MERCEDES-BENZ 190

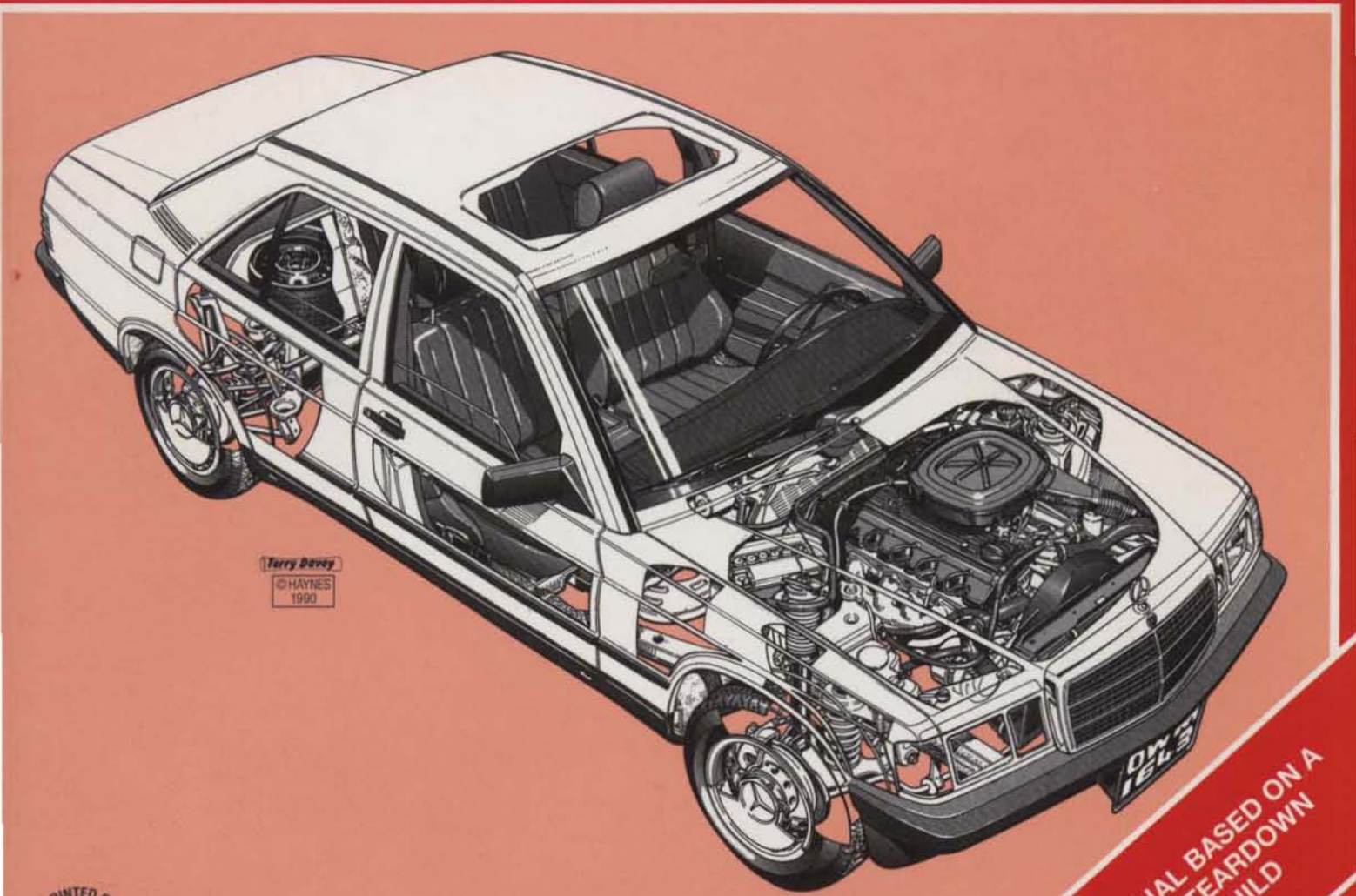
1984 thru 1988

Four-cylinder gasoline engine models

63015 (1643)

Haynes

Automotive Repair Manual



PRINTED ON RECYCLED PAPER

EVERY MANUAL BASED ON A COMPLETE TEARDOWN AND REBUILD

Mercedes-Benz 190 Automotive Repair Manual

by John S Mead, Bob Henderson and John H Haynes
Member of the Guild of Motoring Writers

Models covered:
All Mercedes-Benz 190 four-cylinder gasoline-engine models
1984 through 1988
Does not cover diesel engine or 190E 2.6 models

(11Z3 – 63015)
(1643)

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Mercedes-Benz 190

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.

We hope you 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 doing 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's necessary to refer to another Chapter, the reference will be given as Chapter and Section number. 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.

References to the left or right side of the vehicle assume you are sitting in the driver's seat, facing forward.

Even though we have prepared this manual with extreme care, 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 procedure easier to understand.

CAUTION

A **Caution** provides a special procedure or special steps which must be taken while completing the procedure where the **Caution** is found. Not heeding a **Caution** can result in damage to the assembly being worked on.

WARNING

A **Warning** provides a special procedure or special steps which must be taken while completing the procedure where the **Warning** is found. Not heeding a **Warning** can result in personal injury.

Introduction to the Mercedes-Benz 190

The Mercedes-Benz 190 was introduced in North America in 1984. The innovative new model heralded a departure from traditional Mercedes thinking, and marked the first venture into the medium-sized sedan market by one of the world's most respected manufacturers of large quality cars.

The models covered by this manual feature traditional, solid, practical Mercedes design and engineering, with new advances in automotive technology, foremost among them being the meticulous attention to ride quality and handling. This has been achieved by further refining the proven MacPherson strut front suspension arrangement, used extensively by other manufacturers but not previously by Mercedes, and combining this with a new multi-link independent rear suspension.

The model range is not extensive, offering just one body style, but with a choice of engines and options to enhance the package. The cars covered by this manual are all four door sedans powered by a four cylinder overhead camshaft fuel injected engine. The engine is mounted longitudinally, and drives the rear wheels through a five-speed manual or four-speed automatic transmission.

General dimensions, weights and capacities

Dimensions

Overall length	4420 mm (174.1 in)
Overall width	1678 mm (66.1 in)
Overall height	1390 mm (54.8 in)
Wheelbase	665 mm (105.0 in)
Front track	1437 mm (56.6 in)
Rear track	1418 mm (55.9 in)

Weights

Curb weight	1140 kg (2513.7 lb)
Gross vehicle weight	1640 kg (3616.2 lb)
Maximum roof rack load	100 kg (200.5 lb)
Maximum luggage compartment load	100 kg (220.5 lb)

Capacities (approximate)

Engine oil	
Total capacity	
2.3L engine	5.0 liters (5.2 qts)
2.3-16 engine	5.5 liters (5.8 qts)
Refill with filter change	
2.3L engine	4.5 liters (4.7 qts)
2.3-16 engine	5.0 liters (5.2 qts)
Cooling system (including heater)	
2.3L engine	8.5 liters (2.25 gals)
2.3-16 engine	8.0 liters (2.0 gals)
Fuel tank	55 litres (14.5 gals)
Manual transmission	1.5 litres (1.6 qts)
Automatic transmission	
Total capacity	7.1 liters (7.5 qts)
Drain and refill	6.0 liters (6.3 qts)

Vehicle identification numbers

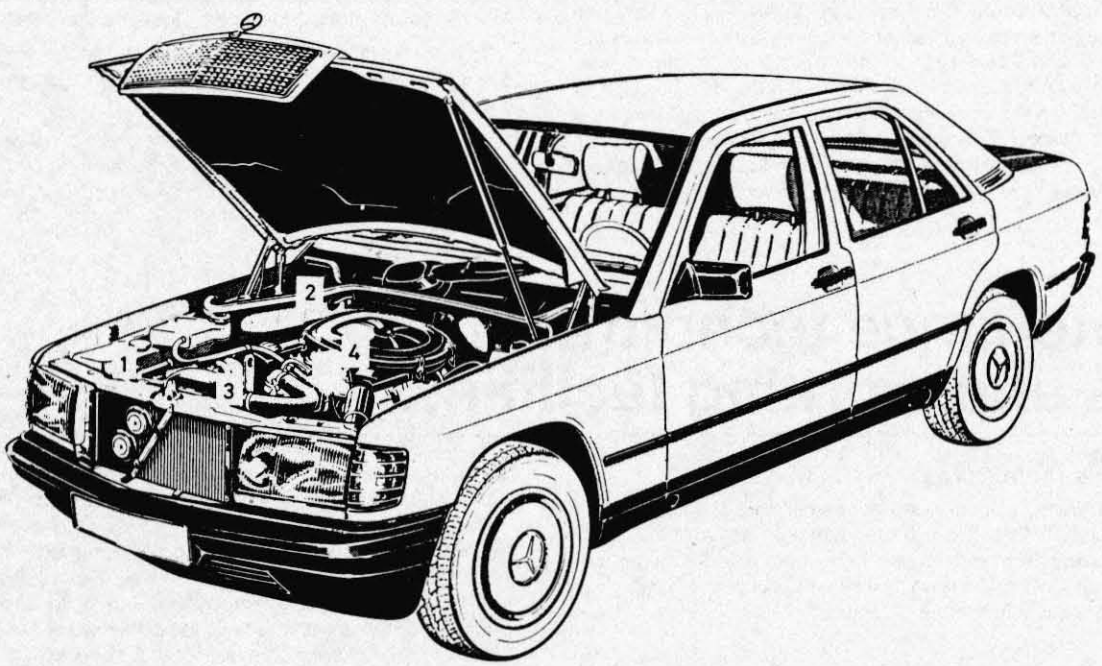
Modifications are a continuing and unpublicized process in vehicle manufacturing. Since replacement parts manuals and lists are compiled on a numerical basis, the individual vehicle numbers are essential for correct identification of the component required.

The **vehicle identification plate (see illustration)** is located on the front body panel, just to the right of the radiator.

The **chassis number** is stamped on the engine compartment inner bulkhead on the right-hand side.

The **body and paint code numbers** are located on the left side of the front body panel.

The **engine number** is stamped on the cylinder block below the intake manifold.



Vehicle identification number locations

1 Vehicle identification plate
2 Chassis number
3 Body and paint code numbers
4 Engine number

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.

Fastener sizes

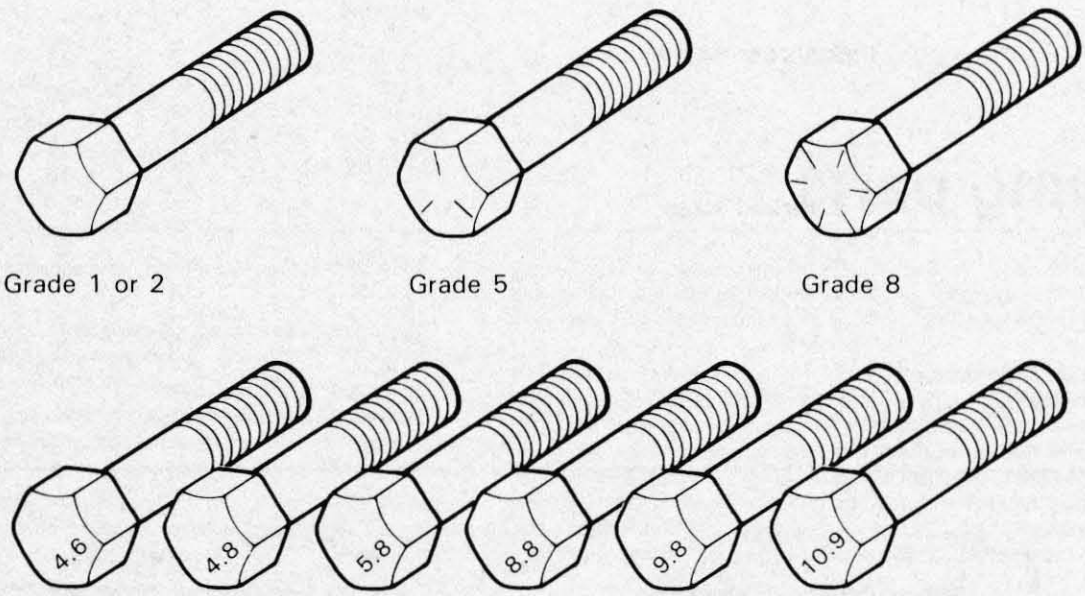
For a number of reasons, automobile manufacturers are making wider and wider use of metric fasteners. Therefore, it is important to be able to tell the difference between standard (sometimes called U.S. or SAE) and metric hardware, since they cannot be interchanged.

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 M12 – 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.

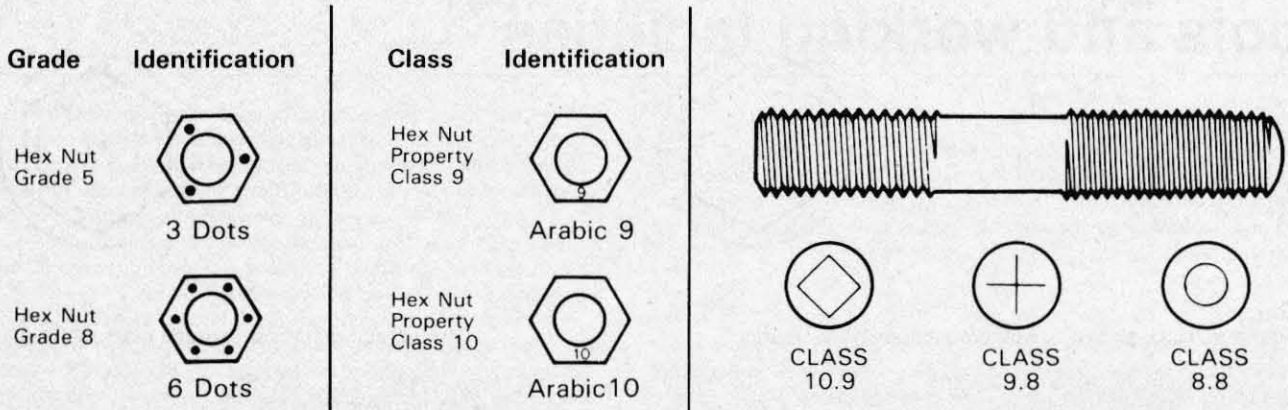
In addition to the differences in diameter, thread pitch and length, metric and standard bolts can also be distinguished by examining the bolt heads. To begin with, the distance across the flats on a standard bolt head is measured in inches, while the same dimension on a metric bolt is sized in millimeters (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), while smaller studs carry a geometric code to denote grade.



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



Standard hex nut strength markings

Metric hex nut strength markings

Metric stud length markings

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.

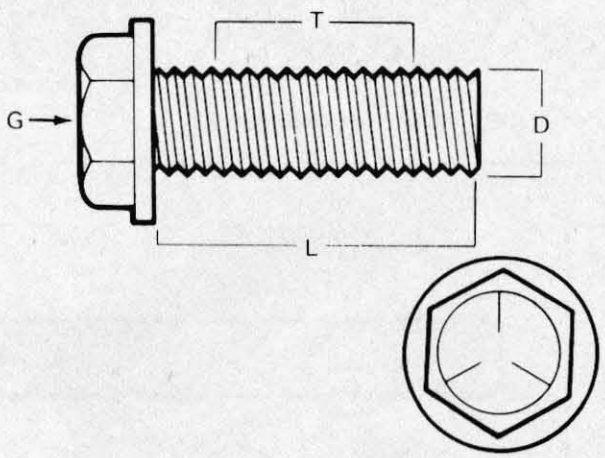
Standard fasteners are often referred to as SAE, as opposed to metric. However, it should be noted that SAE technically refers to a non-metric *fine thread* fastener only. Coarse thread non-metric fasteners are referred to as USS sizes.

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

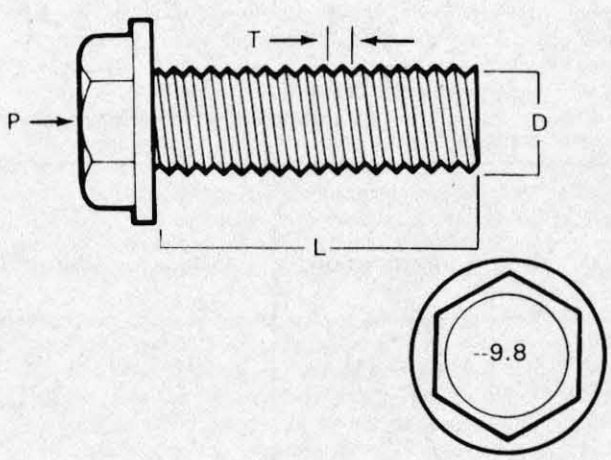
Most threaded fasteners should be tightened to a specific torque value (torque is the twisting force applied to a threaded component such as a nut or bolt). Overtightening the fastener can weaken it and cause it to break, while undertightening can cause it to eventually come loose. Bolts, screws and 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

Metric thread sizes	Ft-lbs	Nm
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	17 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
5/16 – 24	14 to 20	19 to 27
3/8 – 16	22 to 32	30 to 43
3/8 – 24	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 length)
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

applied to it. The figures listed here are approximate 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 a service station.*

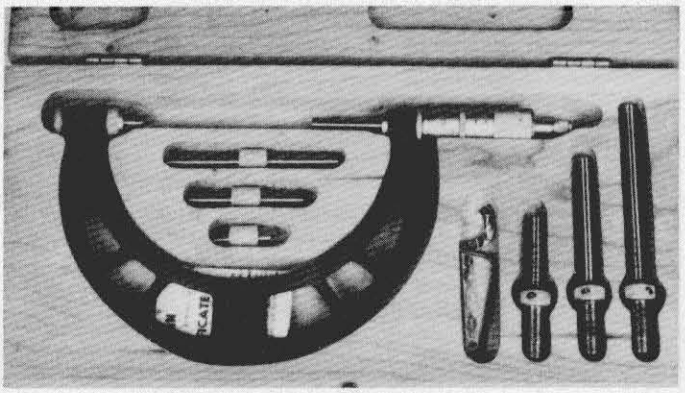
Hose removal precautions closely parallel gasket removal precautions. Avoid scratching or gouging the surface that the hose mates against or the connection may leak. This is especially true for radiator hoses. Because of various chemical reactions, the rubber in hoses can bond itself to the metal spigot 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.

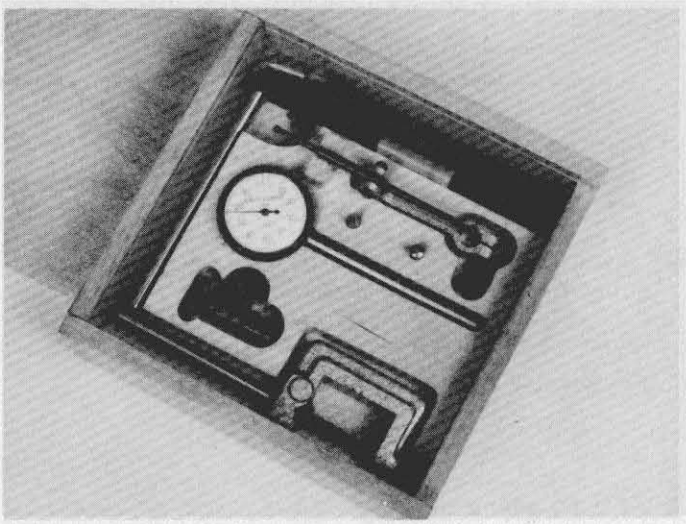
If a hose clamp is broken or damaged, do not reuse it. Wire-type clamps usually weaken with age, so it is a good idea to replace them with screw-type clamps whenever a hose is removed.

Tools

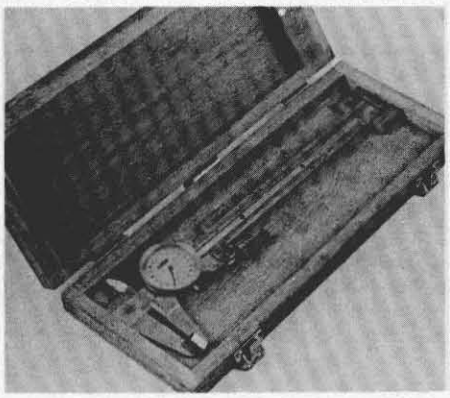
A selection of good tools is a basic requirement for anyone who plans to maintain and repair his or her own vehicle. For the owner who has few tools, the initial investment might seem high, but when compared to the spiraling costs of professional auto maintenance and repair, it is a wise one.



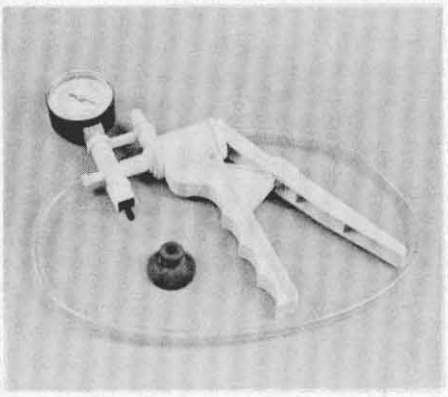
Micrometer set



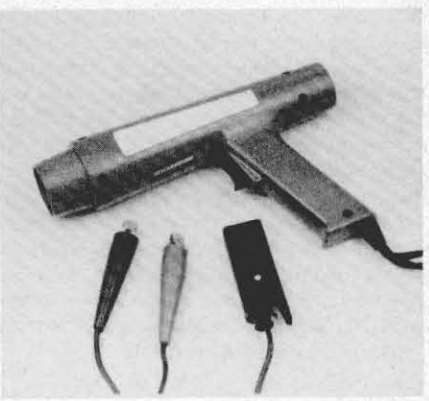
Dial indicator set



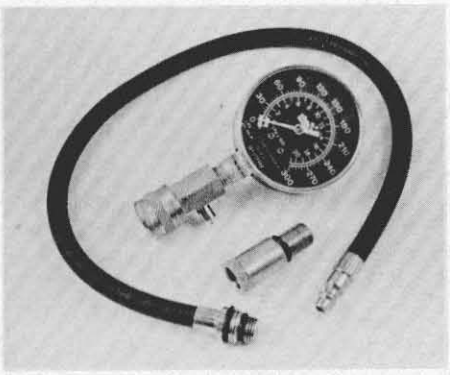
Dial caliper



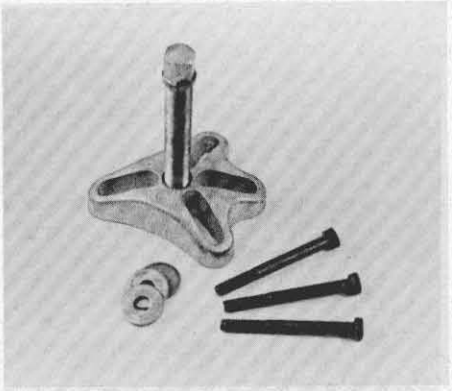
Hand-operated vacuum pump



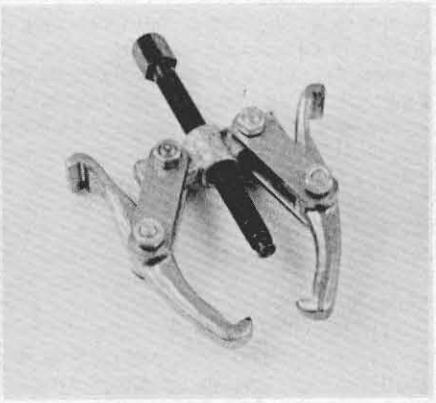
Timing light



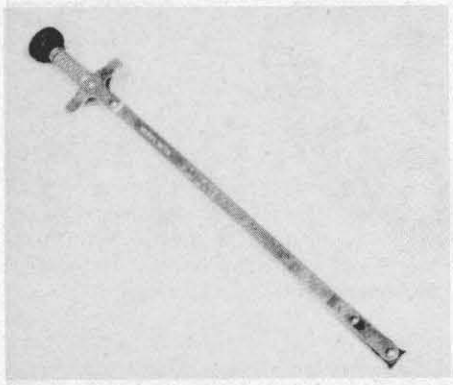
Compression gauge with spark plug hole adapter



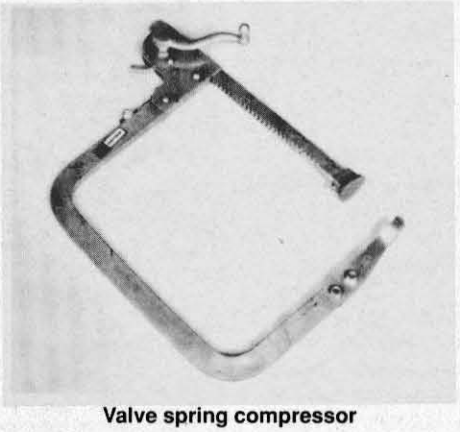
Damper/steering wheel puller



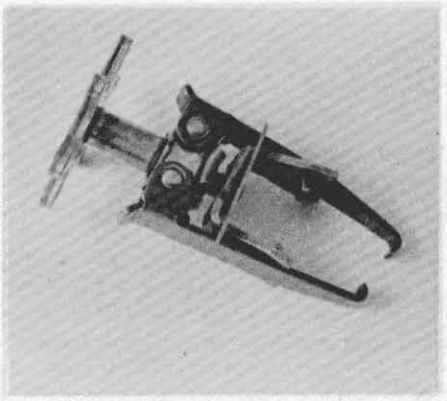
General purpose puller



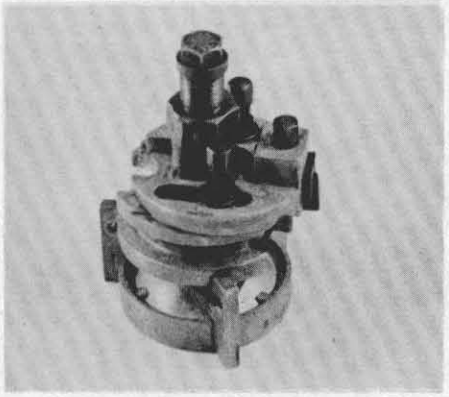
Hydraulic lifter removal tool



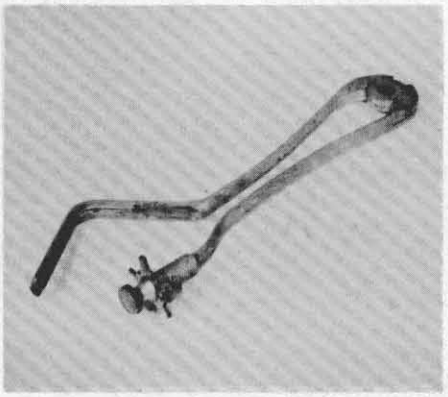
Valve spring compressor



Valve spring compressor



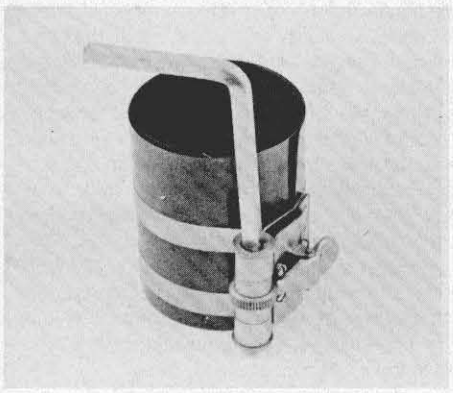
Ridge reamer



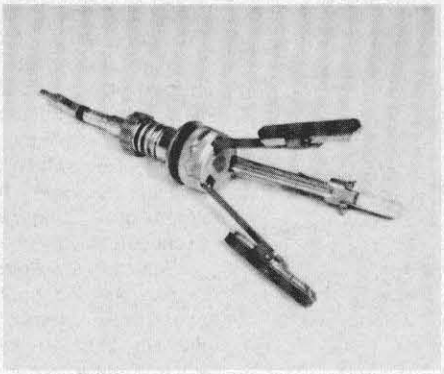
Piston ring groove cleaning tool



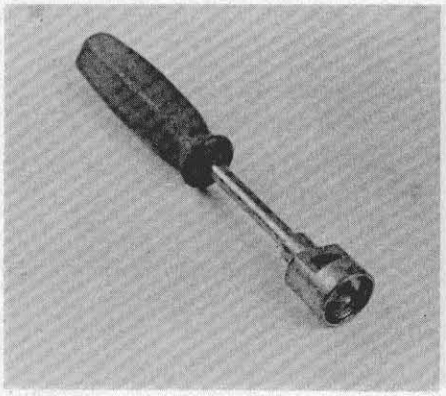
Ring removal/installation tool



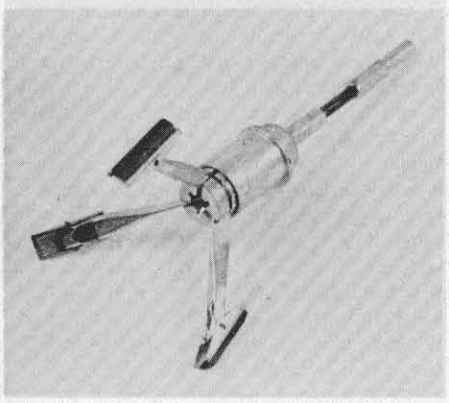
Ring compressor



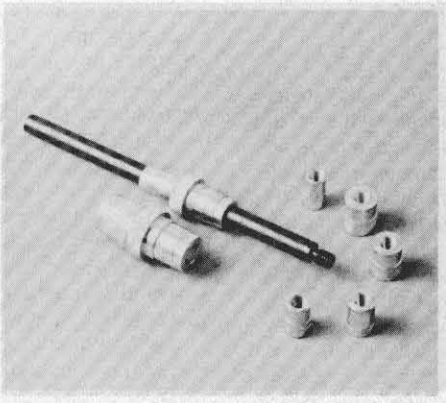
Cylinder hone



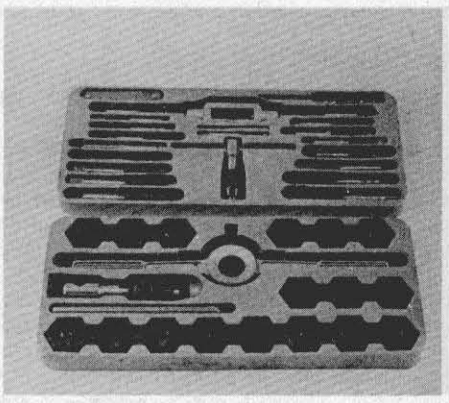
Brake hold-down spring tool



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 (5/16-inch x 6 inch)
Phillips screwdriver (No. 2 x 6 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 – 10 inch
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. 3 x 8 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 included 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 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.

Jacking, towing and tire changing

Jacking and tire changing

To change a tire, first remove the spare tire and jack, which are located under the luggage compartment floor. If the tire is being changed at the side of the road, remove the hazard warning triangle from the trunk lid and set this up on the road to face oncoming traffic. Firmly apply the parking brake and engage 1st gear, or move the selector lever to P if the vehicle is equipped with an automatic transmission. Chock the wheel diagonally opposite the one being changed.

Using both hands, pull off the wheel cover (if equipped) or carefully pry it off with a screwdriver **(see illustrations)**. Loosen the wheel lug bolts with the tool provided, but do not remove them at this stage.

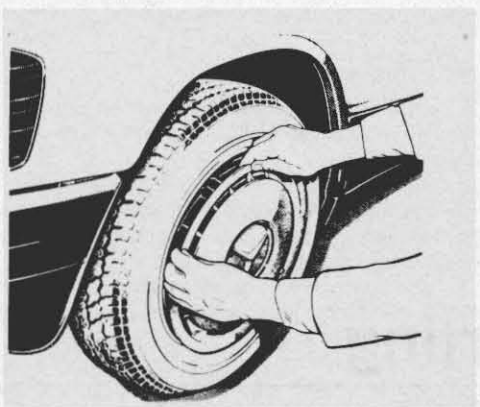
Withdraw the protective cap out of the jack engagement point on the sill, which is located just in front of the rear wheel or just behind the front wheel. Insert the jack into the hole, and position it so it is vertical, as viewed from the side **(see illustration)**. Raise the car until the wheel is off the ground, then remove the wheel lug bolts and pull off the wheel. Position the wheel on the hub, insert the wheel lug bolts and lightly tighten them. Lower the car, install the protective cap, then tighten the wheel lug bolts evenly in a criss-cross pattern. Install the wheel cover and stow the tools and the tire in the luggage compartment. Don't forget to retrieve the warning triangle.

When jacking up the car with a floor jack, position the jack beneath a sturdy part of the vehicle underbody, such as the reinforced chassis sections behind the front wheels, and in front of the rear wheels, or the crossmember under the engine. Do not position the jack under the oil pan, or any of the suspension or steering components. Once the vehicle is raised, support it securely on jackstands. Never work under, around, or near a raised car unless it is adequately supported in at least two places.

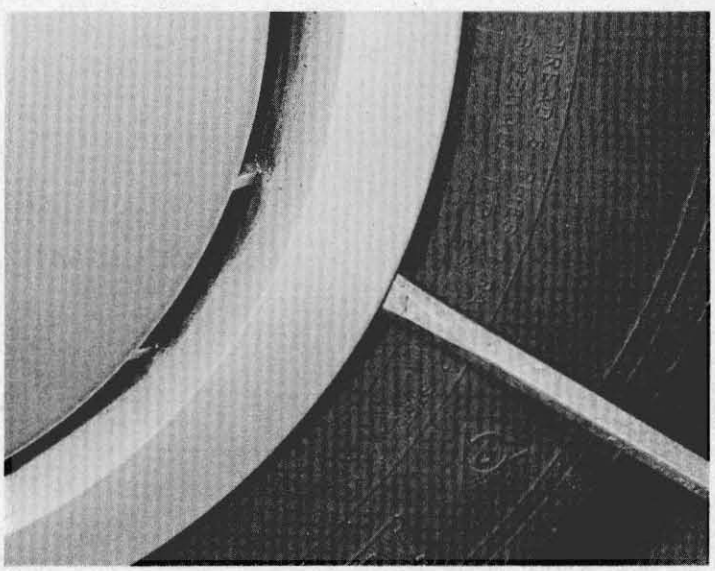
Towing

Towing eyes are located at the front and rear of the vehicle for attachment of a tow-chain. The rear towing eye is below the bumper on the right-hand side, and the front towing eye is behind a detachable flap under the bumper on the right-hand side also **(see illustration)**. Always unlock the steering if the vehicle is being towed, and remember that the power brake booster is inoperative if the engine is not running.

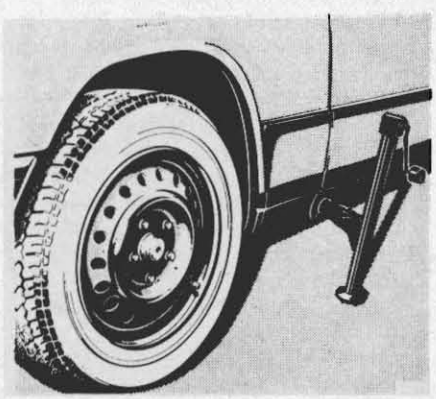
If the vehicle is equipped with an automatic transmission, the selector lever must be in the N position when being towed. With the rear wheels on the ground, the maximum towing distance should not exceed 74 miles (120 km), and the towing speed must be kept down to a maximum of 30 mph (50 kph). Whenever possible, a trailer should be used for transporting automatic transmission models, particularly if transmission damage is suspected.



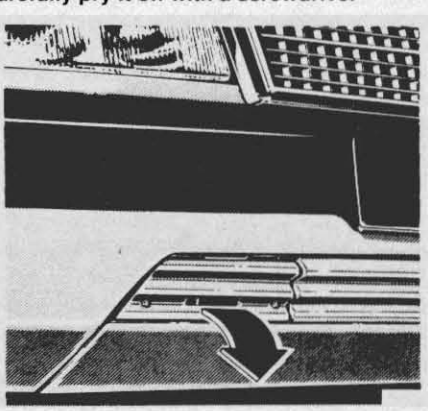
Pull off the wheel cover using both hands



If the wheel cover is difficult to remove by hand, carefully pry it off with a screwdriver



Vehicle jack inserted in one of the front lifting holes



Pull out the flap for access to the front towing eye

Booster battery (jump) starting

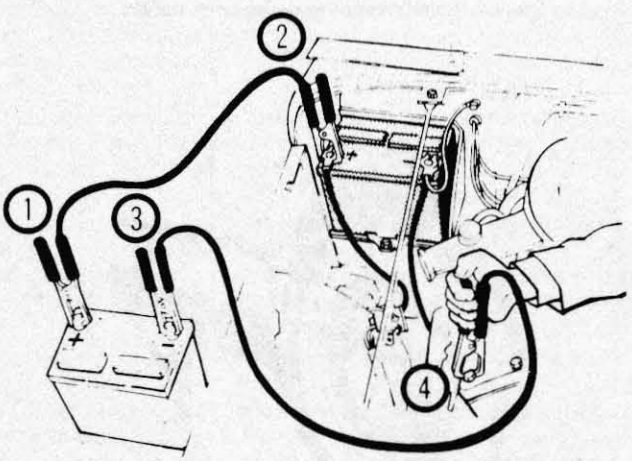
Observe these precautions when using a booster battery to start a vehicle:

a) Before connecting the booster battery, make sure the ignition switch is in the Off position.
b) Turn off the lights, heater and other electrical loads.
c) Your eyes should be shielded. Safety goggles are a good idea.
d) Make sure the booster battery is the same voltage as the dead one in the vehicle.
e) The two vehicles MUST NOT TOUCH each other!
f) Make sure the transmission is in Neutral (manual) or Park (automatic).
g) If the booster battery is not a maintenance-free type, remove the vent caps and lay a cloth over the vent holes.

Connect the red 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 **(see illustration)**. Make sure the cable will not come into contact with the fan, drivebelts or other moving parts of the engine.

Start the engine using the booster battery, then, with the engine running at idle speed, disconnect the jumper cables in the reverse order of connection.



Make the booster battery cable connections in the numerical order shown (note that the negative cable of the booster battery is NOT attached to the negative terminal of the dead battery)

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. They are 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 transmissions 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 molybdenum 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 to +190-degrees 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 electronic ignition modules where it is essential that heat is 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 exhaust 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 may be removed later. High-strength locking compound is for large nuts, bolts and studs which aren't removed 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, fuel injection 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 contain 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 so 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. Some 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 maintenancefree 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

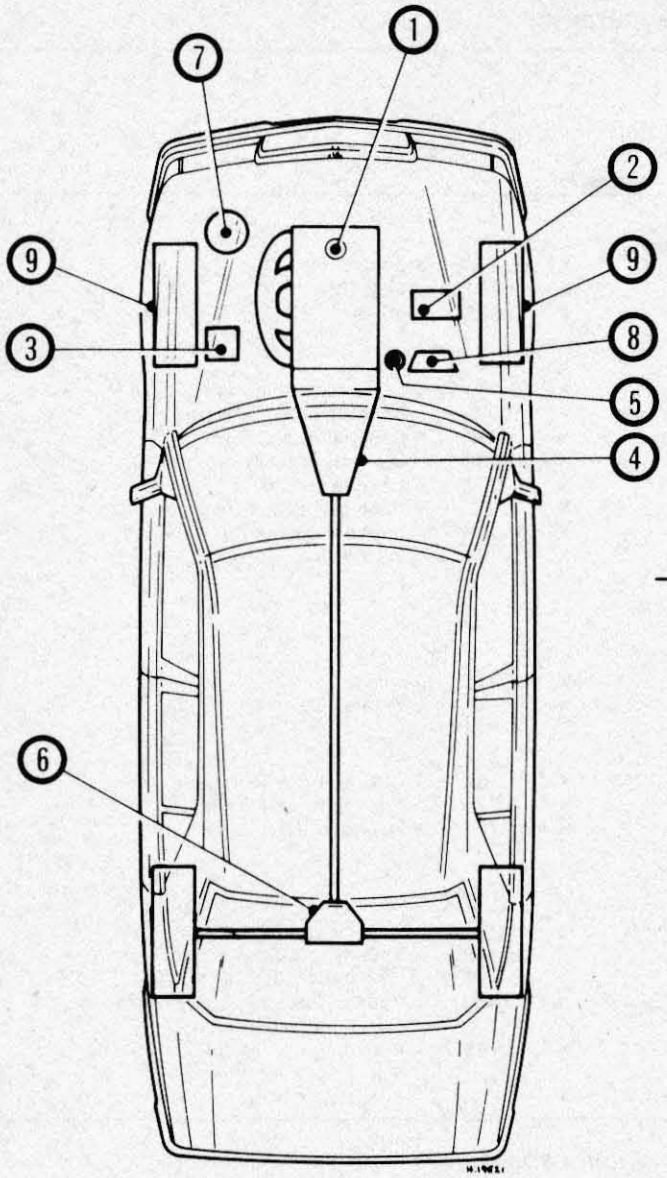
Length (distance)						
Inches (in)	X	25.4	= Millimetres (mm)	X	0.0394	= Inches (in)
Feet (ft)	X	0.305	= Metres (m)	X	3.281	= Feet (ft)
Miles	X	1.609	= Kilometres (km)	X	0.621	= Miles
Volume (capacity)						
Cubic inches (cu in; in^3)	X	16.387	= Cubic centimetres (cc; cm^3)	X	0.061	= Cubic inches (cu 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)	X	1.201	= US quarts (US qt)	X	0.833	= Imperial quarts (Imp qt)
US quarts (US qt)	X	0.946	= Litres (l)	X	1.057	= US quarts (US qt)
Imperial gallons (Imp gal)	X	4.546	= Litres (l)	X	0.22	= Imperial gallons (Imp gal)
Imperial gallons (Imp gal)	X	1.201	= US gallons (US gal)	X	0.833	= Imperial gallons (Imp gal)
US gallons (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)	X	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)	X	0.068	= Atmospheres (atm)	X	14.696	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)
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)
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)
Kilopascals (kPa)	X	0.01	= Kilograms-force per square centimetre (kgf/cm^2; kg/cm^2)	X	98.1	= Kilopascals (kPa)
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)	X	0.425	= Kilometres per litre (km/l)	X	2.352	= Miles per gallon, US (mpg)

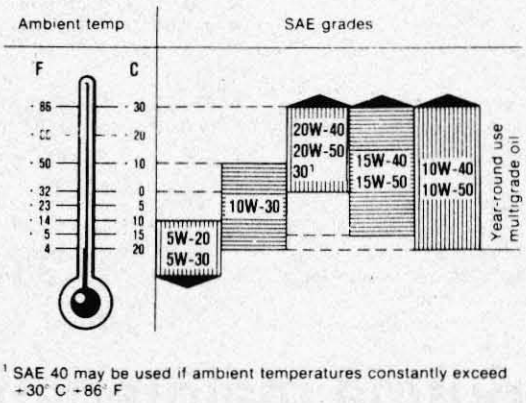
Temperature

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 (l/100km), where mpg (Imperial) x l/100 km = 282 and mpg (US) x l/100 km = 235*





[1] SAE 40 may be used if ambient temperatures constantly exceed +30° C +86° F

Engine oil viscosity chart

Recommended lubricants and fluids

	Component or system	Lubricant type/specification
1	**Engine**	See accompanying chart
2	**Cooling system**	50/50 mixture of ethylene glycol-based antifreeze and water
3	**Brake/clutch hydraulic systems**	DOT 4 brake fluid
4	**Manual transmission**	Dexron II ATF
5	**Automatic transmission**	Dexron II ATF
6	**Differential**	Hypoid gear oil, viscosity SAE 90 EP
7	**Power steering fluid reservoir**	Dexron II ATF
8	**Windshield washer fluid reservoir**	Water mixed with Mercedes-Benz windshield detergent or equivalent
9	**Front wheel bearings**	High-temperature disc brake wheel bearing grease

Routine maintenance

Maintenance is essential for ensuring safety, and desirable for the purpose of getting the best in terms of performance and economy from your car. Over the years the need for periodic lubrication has been greatly reduced if not totally eliminated. This has unfortunately tended to lead some owners to think that because no such action is required, the items either no longer exist, or will last forever. This is certainly not the case; it is essential to perform regular visual examinations as comprehensively as possible in order to spot any possible defects at an early stage before they develop into major expensive repairs, or dangerous operating conditions.

The following service schedules are a list of the maintenance requirements and the intervals at which they should be carried out, as recommended by the manufacturer. Where applicable these procedures are covered in greater detail throughout this Manual, near the beginning of each Chapter.

Every 250 miles (400 km) or weekly

Engine, cooling system, suspension and brakes

Check the engine oil level and add if necessary
Check the coolant level and add if necessary
Check the fluid level in the power steering reservoir, and add if necessary
Check the brake fluid level in the master cylinder reservoir, and add if necessary

Lights and wipers

Check the operation of the horn, all the lights and the wipers and washers – adjust washer aim if necessary
Check and if necessary top up the washer reservoir

Tires

Check the tire pressures, including the spare, and adjust if necessary.
Visually examine the tread depth; look for wear and damage

Every 6,000 miles (10,000 km) or 6 months – whichever comes first

Engine (Chapter 1)

Replace the engine oil and filter

Fuel and exhaust systems (Chapter 3)

Check the operation of the accelerator cable and linkage and lubricate the pivot and contact areas

Manual transmission (Chapter 6)

Check the level and if necessary add the specified lubricant

Differential and driveshafts (Chapter 8)

Check and if necessary top up the differential lubricant level

Every 12,000 miles (20,000 km) or 12 months – whichever comes first

In addition to the items in the weekly and 6000 mile (10,000 km) services, carry out the following:

Engine (Chapter 1)

Check and if necessary adjust the valve clearances (where applicable)
Visually check the engine for oil leaks and note the security and condition of all related components and accessories

Cooling system (Chapter 2)

Check the hoses, hose clamps and visible gaskets for leaks and signs of corrosion or deterioration

Fuel and exhaust systems (Chapter 3)

Visually check the fuel lines and hoses for security, chafing, leaks and corrosion
Check and if necessary adjust the engine idle speed and fuel/air mixture
Check the exhaust system for corrosion, leaks and security and the tightness of all mounting bolts

Ignition system (Chapter 4)

Replace the spark plugs
Clean and check the condition of the distributor cap, spark plug wires and other ignition-related wiring
Check and if necessary adjust the ignition timing

Clutch (Chapter 5)

Check the operation of the clutch and clutch pedal

Manual transmission (Chapter 6)

Visually check for oil leaks around the gaskets and oil seals
Change the transmission lubricant

Automatic transmission (Chapter 6)

Check and if necessary add transmission fluid
Visually check for oil leaks around the gaskets and oil seals, and check the condition and security of the fluid cooler hoses and fittings

Driveshaft (Chapter 7)

Check the condition of the driveshaft flexible rubber couplings, center support bearing and universal joint

Differential and driveaxles (Chapter 8)

Drain and refill the differential with fresh lubricant
Check the differential for leaks
Check the condition of the driveaxle constant velocity joints

Brakes (Chapter 9)

Check the brake pads for wear and the condition of the discs
Drain the brake hydraulic system and refill with fresh fluid
Check the brake lines, hoses and fittings for corrosion and leakage
Check the operation of the parking brake and lubricate the exposed cables and linkages. Adjust if required.

Suspension and steering systems (Chapter 10)

Adjust the front wheel bearings
Check and if necessary adjust, or replace, the power steering pump drivebelt
Check the front suspension struts and rear shock absorbers for fluid leakage and efficiency of operation
Check the condition and security of all suspension and steering linkages and mounts
Inspect the wheels for damage and check the tightness of the wheel lug bolts

Body (Chapter 11)

Lubricate the locks and hinges (except the steering lock)
Check and if necessary adjust, or replace, the air conditioning compressor drivebelt

Electrical system (Chapter 12)

Check and if necessary add water to the battery
Check and if necessary adjust, or replace, the alternator drivebelt
Check the condition and security of all accessible wiring connectors, harnesses, retaining clips, washer hoses and connections
Check the operation of all electrical equipment and accessories
Check the condition of the wiper blades and replace if necessary
Clean the battery terminals

Every 36,000 miles (60,000 km) or three years – whichever comes first

In addition to the items listed in the previous services, perform the following:

Cooling system (Chapter 2)

Drain and flush the cooling system and refill with fresh coolant

Fuel and exhaust systems (Chapter 3)

Replace the air cleaner element
Replace the fuel filter

Clutch (Chapter 5)

Check the clutch plate for wear

Automatic transmission (Chapter 6)

Change the automatic transmission fluid

Troubleshooting

Introduction

The vehicle owner who does his or her own maintenance according to the recommended maintenance schedules should not have to use this section of the manual very often. Modern component reliability is such that, provided those items subject to wear or deterioration are inspected or replaced at the specified intervals, sudden failure is comparatively rare. Faults do not usually just happen as a result of sudden failure, but develop over a period of time. Major mechanical failures in particular are usually preceded by characteristic symptoms over hundreds or even thousands of miles. Those components which do occasionally fail without warning are often small and easily carried in the vehicle.

With any troubleshooting, the first step is to decide where to begin diagnosis. Sometimes this is obvious, but on other occasions a little detective work will be necessary. The owner who makes half a dozen haphazard adjustments or replacements may be successful in curing a problem (or its symptoms), but he will be none the wiser if the fault recurs and he may well have spent more time and money than was necessary. A calm and logical approach will be found to be more satisfactory in the long run. Always take into account any warning signs or abnormalities that may have been noticed in the period preceding the fault – power loss, high or low gauge readings, unusual noises or smells, etc – and remember that failure of components such as fuses or spark plugs are usually indications of some underlying fault.

The pages which follow here are intended to help in cases of failure to start or a breakdown on the road. There is also a Troubleshooting Section at the end of each Chapter which should be consulted if the preliminary checks don't find the problem. Whatever the condition, certain basic principles apply. These are as follows:

Verify the problem. This is simply a matter of being sure that you know what the symptoms are before starting work. This is particularly important if you are investigating a fault for someone else who may not have described it very accurately.

Don't overlook the obvious. For example, if the vehicle won't start, make sure there is gas in the tank! (Don't take anyone else's word on this particular point, and don't trust the fuel gauge either.) If an electrical problem is indicated, look for loose or broken wires before digging out the test gear.

Cure the disease, not the symptom. Substituting a dead battery with a fully charged one will get you going again, but if the cause is not attended to, the new battery will soon go dead, too. Similarly, changing oil-fouled spark plugs for a new set will get you moving again, but remember that the reason for the fouling will have to be established and corrected.

Don't take anything for granted. Particularly, don't forget that a "new" component may itself be defective, and don't leave components out of a troubleshooting sequence just because they are new or recently installed. When you do finally diagnose a difficult problem, you'll probably realize that all the evidence was there from the start.

Electrical malfunctions

Electrical problems can be more puzzling than straightforward mechanical failures, but they are no less susceptible to logical analysis if the basic principles of operation are understood. Vehicle electrical wiring exists in extremely unfavorable conditions – heat, vibration and chemical attack – and the first things to look for are loose or corroded connections and broken or chafed wires, especially where the wires pass through holes in the bodywork or are subject to vibration.

All metal-bodied vehicles in current production have one pole of the battery grounded (connected to the vehicle bodywork), and in nearly all modern vehicles it is the negative (-) terminal. The various electrical components – motors, bulb holders etc – are also connected to ground, either by means of a wire or directly by their mountings. Electric current flows through the component and then back to the battery via the bodywork. If the component mounting is loose or corroded, or if a good path back to the battery is not available, the circuit will be incomplete and malfunction will result. The engine and/or transmission are also earthed by means of flexible metal straps to the body or subframe; if these straps are loose or missing, starter motor, generator and ignition trouble may result.

Assuming all of the grounds to be satisfactory, electrical malfunctions will be due either to component failure or to defects in the current supply. Individual components are dealt with in Chapter 12. If supply wires are broken or cracked internally this results in an open-circuit, and the easiest way to check for this is to bypass the suspect wire temporarily with a length of wire having an alligator clip or suitable connector at each end. Alternatively, a 12V test lamp can be used to verify the presence of supply voltage at various points along the wire and the break can then be isolated.

If a bare portion of a live wire touches the bodywork or other grounded metal part, the electricity will take the path of least resistance back to the battery – this is known as a short-circuit. Hopefully a short-circuit will blow a fuse, but otherwise it may cause burning of the insulation (and possibly further short-circuits) or even a fire. This is why you should never bypass persistently blowing fuses with aluminum foil or wire.

Spare parts and tool kit

Most vehicles are supplied only with sufficient tools for tire changing; the *Maintenance and minor repair tool kit* detailed in *Tools and working facilities*, with the addition of a hammer, is probably sufficient for those repairs that most motorists would consider attempting at the roadside. In addition, a few items which can be installed without too much trouble in the event of a breakdown should be carried. Experience and available space will modify the list below, but the following may save having to call on professional assistance:

Spark plugs, clean and correctly gapped
Spark plug wire – long enough to reach the plug furthest from the distributor
Distributor cap and rotor
Drivebelt(s) – emergency type may suffice
Spare fuses
Set of light bulbs
Radiator sealer and hose bandage
Exhaust bandage
Roll of insulating tape
Mechanic's wire
Electrical wire
Flashlight
Test light
Battery jumper cables
Tow rope
Ignition waterproofing aerosol
Quart of engine oil
Sealed can of brake fluid
Hose clamps
Tube of gasket sealant

If spare fuel is carried, a can designed for this purpose should be used to minimize risks of leakage and collision damage.

When traveling long distances it may be advisable to carry additional spare parts which, even if you can't install them yourself, could save you from having to wait while parts are obtained. The items below may be worth considering:

Throttle cables
Cylinder head gasket
Alternator brushes
Fuel pump repair kit
Tire valve core

Engine will not start

Engine fails to turn when starter operated

Dead battery (recharge, use jumper cables, or push start)
Battery terminals loose or corroded
Battery ground to body defective
Engine ground strap loose or broken
Starter motor (or solenoid) wiring loose or broken
Automatic transmission selector in wrong position, or inhibitor switch faulty
Ignition/starter switch defective
Major mechanical failure (seizure)
Starter or solenoid internal fault (see Chapter 12)

Starter motor turns engine slowly

Partially discharged battery (recharge, use jumper cables, or push start)
Battery terminals loose or corroded
Battery ground to body defective
Engine ground strap loose
Starter motor (or solenoid) wiring loose
Starter motor internal fault (see Chapter 12)

Starter motor spins without turning engine

Discharged battery
Starter motor pinion sticking on sleeve
Flywheel gear teeth damaged or worn
Starter motor mounting bolts loose

Engine turns normally but fails to start

Damp or dirty spark plug wires and distributor cap (crank engine and check for spark)
No fuel in tank
Cold start injector faulty
Fouled or incorrectly gapped spark plugs (remove, clean and regap)
Other ignition system fault (see Chapter 4)
Other fuel system fault (see Chapter 3)
Poor compression (see Chapter 1)
Major mechanical failure

Engine fires but will not run

Malfunctioning cold start valve
Air leaks at intake manifold
Fuel starvation (see Chapter 3)
Other ignition fault (see Chapter 4)

Engine cuts out and will not restart

Engine cuts out suddenly – ignition fault

Loose or disconnected ignition system primary wires
Wet spark plug wires or distributor cap
Coil failure (check for spark)
Other ignition fault (see Chapter 4)

Engine misfires before cutting out – fuel fault

Fuel tank empty
Fuel pump defective or filter blocked (check for delivery)
Fuel tank filler vent blocked (suction will be evident on releasing cap)
Other fuel system fault (see Chapter 4)

Engine cuts out – other causes

Serious overheating
Major mechanical failure

Engine overheats

Ignition (no-charge) warning light illuminated

Loose or broken drivebelt – adjust or replace (see Chapter 12)

Ignition warning light not illuminated

Coolant loss due to internal or external leakage (see Chapter 12)
Thermostat defective
Low oil level
Brakes binding
Radiator clogged externally or internally
Cooling fan not operating correctly
Engine water jackets clogged

Ignition timing incorrect or automatic advance malfunctioning

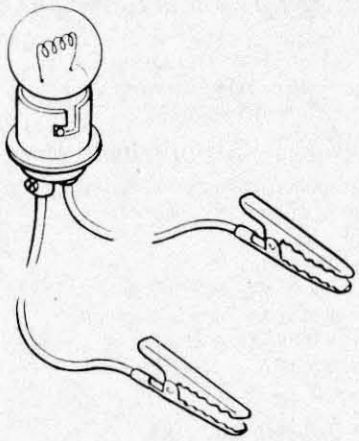
Mixture too weak

Note: *Do not add cold water to an overheated engine or damage may result.*

Low engine oil pressure

Gauge reads low or warning light illuminated with engine running

Oil level low or incorrect grade oil



A simple test light is useful for diagnosing electrical problems

Defective gauge or sender unit
Wire to sender unit grounded
Engine overheating
Oil filter clogged or bypass valve defective
Oil pressure relief valve defective
Oil pick-up strainer clogged
Oil pump worn or loose
Worn main or connecting rod bearings

Note: *Low oil pressure in a high-mileage engine at idle is not necessarily a cause for concern. Sudden pressure loss at speed is far more significant.*

In any event, check the gauge or warning light sender before condemning the engine.

Engine noises

Pre-ignition (pinging) during acceleration

Incorrect grade of fuel
Ignition timing incorrect
Distributor faulty or worn
Worn or mis-adjusted fuel injection system (where applicable)
Excessive carbon build-up in engine

Whistling or wheezing noises

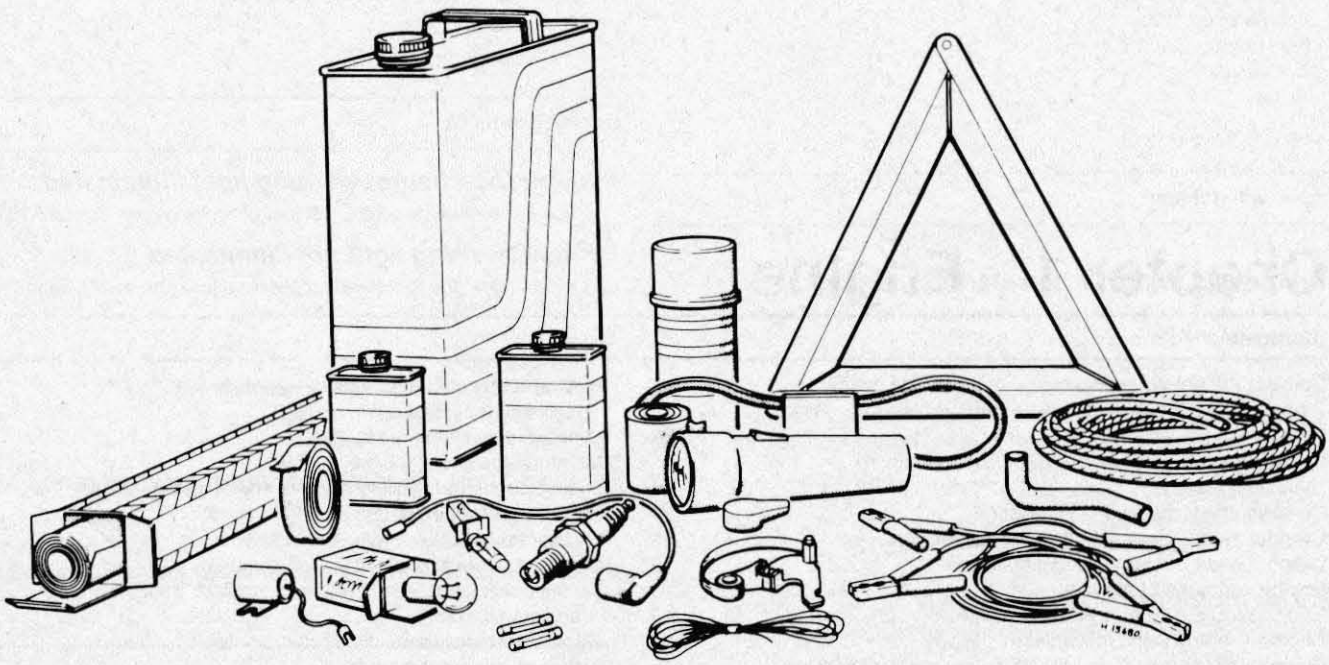
Leaking vacuum hose
Leaking manifold gasket
Blown head gasket

Tapping or rattling

Incorrect valve clearances
Worn valve gear
Worn timing chain or belt
Broken piston ring (ticking noise)

Knocking or thumping

Worn drivebelt
Peripheral component fault (alternator, water pump etc)
Worn connecting rod bearings (regular heavy knocking, perhaps less under load)
Worn main bearings (rumbling and knocking, perhaps worsening under load) piston slap (most noticeable when cold)



Carrying a few spare parts can save you a long walk

Chapter 1 Engine

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Specifications

General

Engine type	Four cylinder in-line, overhead camshaft(s)
Engine codes	
1984	102.961
1985 through 1988	102.985
1986, 1987 2.3-16 valve	102.983
Capacity	2299 cc
Bore	95.50 mm (3.76 in)
Stroke	80.25 mm (3.16 in)
Compression ratios	
Engine code 102.961	8.0:1
Engine code 102.985	9.0:1
Engine code 102.983	9.7:1
Compression pressures (all engines)	145 to 174 psi
Minimum acceptable compression pressure	123 psi
Maximum compression difference between cylinders	21 psi
Firing order	1-3-4-2 (No 1 at timing cover end)

Cylinder block

Material	Cast iron
Number of main bearings	5
Cylinder bore diameter	
Standard	95.498 to 95.528 mm (3.762 to 3.763 in)
1st oversize (0.5 mm)	95.998 to 96.028 mm (3.782 to 3.783 in)
2nd oversize (1.0 mm)	96.498 to 96.528 mm (3.802 to 3.803 in)
Maximum acceptable cylinder bore ovality	0.10 mm (0.0039 in)
Maximum acceptable cylinder bore taper	0.05 mm (0.0019 in)
Cylinder block height	292.45 to 292.55 mm (11.523 to 11.526 in)
Minimum acceptable height after machining	292.35 mm (11.519 in)
Maximum acceptable gasket face distortion	
At cylinder head face	0.03 mm (0.0012 in)
At oil pan face	0.04 mm (0.0016 in)

Crankshaft

Main bearing journal diameter	
Standard	57.935 to 57.965 mm (2.283 to 2.284 in) in six grades
1st undersize (0.25 mm)	57.705 to 57.715 mm (2.2736 to 2.2740 in)
2nd undersize (0.50 mm)	57.455 to 57.465 mm (2.2637 to 2.2641 in)
3rd undersize (0.75 mm)	57.205 to 57.215 mm (2.2539 to 2.2543 in)
4th undersize (1.0 mm)	56.955 to 56.965 mm (2.2440 to 2.2444 in)
Main bearing running clearance	0.025 to 0.070 mm (0.0010 to 0.0028 in)
Connecting rod bearing journal diameter	
Standard	47.955 to 47.965 mm (1.889 to 1.890 in)
1st undersize (0.25 mm)	47.705 to 47.715 mm (1.8796 to 1.8800 in)
2nd undersize (0.50 mm)	47.455 to 47.465 mm (1.8697 to 1.8701 in)
3rd undersize (0.75 mm)	47.205 to 47.215 mm (1.8599 to 1.8603 in)
4th undersize (1.0 mm)	46.955 to 46.965 mm (1.8500 to 1.8504 in)
Connecting rod bearing running clearance	0.030 to 0.070 mm (0.0012 to 0.0028 in)
Crankshaft endplay	0.12 to 0.30 mm (0.005 to 0.012 in)
Crankshaft thrust washer thicknesses	2.15, 2.20, 2.25, 2.35 and 2.40 mm (0.085, 0.087, 0.089, 0.093 and 0.095 in)
Minimum acceptable diameter of connecting rod cap studs or bolts	
Caps retained by studs and nuts	8.0 mm (0.315 in) at stud stepped down portion
Caps retained by bolts	7.1 mm (0.280 in) at bolt stepped down portion

Flywheel and torque converter driveplate

Minimum acceptable diameter of retaining stretch bolts	8.0 mm (0.315 in) at bolt stepped down portion
Maximum acceptable length of retaining stretch bolts	22.5 mm (0.887 in)

Pistons and piston rings

Piston diameter	
Standard	95.468 to 95.502 mm (3.761 to 3.762 in) in three classes
1st oversize (0.5 mm)	95.968 to 96.002 mm (3.781 to 3.782 in) in three classes
2nd oversize (1.0 mm)	96.468 to 96.502 mm (3.801 to 3.802 in) in three classes

Pistons and piston rings (continued)

Piston-to-bore clearance	0.016 to 0.040 mm (0.0006 to 0.0016 in)
Piston ring-to-groove clearance	
Top ring	0.050 to 0.15 mm (0.0020 to 0.0059 in)
Second ring	0.010 to 0.10 mm (0.0004 to 0.0039 in)
Oil control ring	0.010 to 0.10 mm (0.0004 to 0.0039 in)
Piston ring end gaps	
Top ring	0.30 to 1.0 mm (0.0118 to 0.0394 in)
Second ring	0.25 to 0.8 mm (0.0099 to 0.0315 in)
Oil control ring	0.25 to 0.8 mm (0.0099 to 0.0315 in)
Piston pin clearance in piston at 21-degrees C (70-degrees F)	0.002 to 0.012 mm (0.0001 to 0.0005 in)
Piston pin fit in connecting rod	
Pre-January 1984 engines	0.007 to 0.018 mm (0.0003 to 0.0007 in) clearance at 21-degrees C (70-degrees F)
Post-January 1984 engines	Interference fit at 21-degrees C (70-degrees F)

Camshaft

Number of bearings	5
Bearing journal diameter	
Standard	31.934 to 31.950 mm (1.2582 to 1.2588 in)
Oversize	32.434 to 32.450 mm (1.2779 to 1.2785 in)
Camshaft bearing running clearance	0.050 to 0.11 mm (0.0020 to 0.0043 in)
Camshaft endplay	0.07 to 0.18 mm (0.0028 to 0.0071 in)

Cylinder head

Material	Aluminium alloy
Cylinder head height	98.4 to 98.5 mm (3.877 to 3.881 in)
Minimum acceptable height after machining	97.8 mm (3.853 in)
Maximum acceptable longitudinal distortion	0.15 mm (0.006 in)
Maximum acceptable transverse distortion	0.05 mm (0.002 in)
Camshaft bearing bore diameter	
Standard	32.025 to 32.050 mm (1.2608 to 1.2618 in)
Oversize	32.500 to 32.525 mm (1.2805 to 1.2815 in)
Maximum acceptable camshaft bore ovality	0.012 mm (0.0005 in)
Valve seat angle	45-degrees
Valve seat width	
Intake	1.8 to 2.5 mm (0.07 to 0.10 in)
Exhaust	1.5 to 2.5 mm (0.06 to 0.10 in)
Seat cutter correction angle	
Upper	15-degrees
Lower	60-degrees
Valve guide length	
Eight-valve engines	
Intake	46.0 mm (1.81 in)
Exhaust	51.0 mm (2.01 in)
16-valve engines	
Intake	45.5 mm (1.79 in)
Exhaust	42.9 mm (1.69 in)
Valve guide internal diameter	
Eight-valve engines	
Intake	8.000 to 8.015 mm (0.3152 to 0.3158 in)
Exhaust	9.000 to 9.015 mm (0.3546 to 0.3552 in)
16-valve engines	
Intake	7.000 to 7.015 mm (0.2758 to 0.2763 in)
Exhaust	8.000 to 8.015 mm (0.3152 to 0.3158 in)
Maximum acceptable cylinder head stretch bolt length	
Eight-valve engines	122.0 mm (4.807 in)
16-valve engines	113.0 mm (4.452 in)

Valves – general

Type	
Inlet valve	Solid
Exhaust valve	Hollow, sodium filled

Valve clearances	
Early 1984 models (engine code 102.961) and 16-valve models (engine code 102.983)	
Intake (cold)	0.15 mm (0.006 in)
Exhaust (cold)	0.30 mm (0.012 in)
Intake (hot)	0.20 mm (0.008 in)
Exhaust (hot)	0.35 mm (0.014 in)

(Note: *On 16-valve models, a measurement of 0.05 mm (0.002 in) greater or less than the specified clearance is permissible)*

1985 through 1988 eight-valve models (engine code 102.985)	Self-adjusting
Intake valve (eight-valve engines)	
Length	114.70 to 115.10 mm (4.519 to 4.535 in)
Stem diameter	7.955 to 7.970 mm (0.3134 to 0.3140 in)
Valve stem-to-guide clearance	0.03 to 0.045 mm (0.0012 to 0.0018 in)
Valve seat angle	45-degrees
Exhaust valve (eight-valve engines)	
Length	115.60 to 116.00 mm (4.555 to 4.570 in)
Stem diameter	8.938 to 8.960 mm (0.352 to 0.353 in)
Valve stem-to-guide clearance	0.040 to 0.055 mm (0.0016 to 0.0022 in)
Valve seat angle	45-degrees

Intake valve (16-valve engine)

Length	111.65 mm (4.400 in)
Stem diameter	6.97 mm (0.274 in)
Valve stem-to-guide clearance	0.03 to 0.045 mm (0.0012 to 0.0018 in)
Valve seat angle	45-degrees

Exhaust valve

Length	111.5 mm (4.393 in)
Stem diameter	7.96 mm (0.3136 in)
Valve stem-to-guide clearance	0.040 to 0.055 mm (0.0016 to 0.0022 in)
Valve seat angle	45-degrees

Lubrication

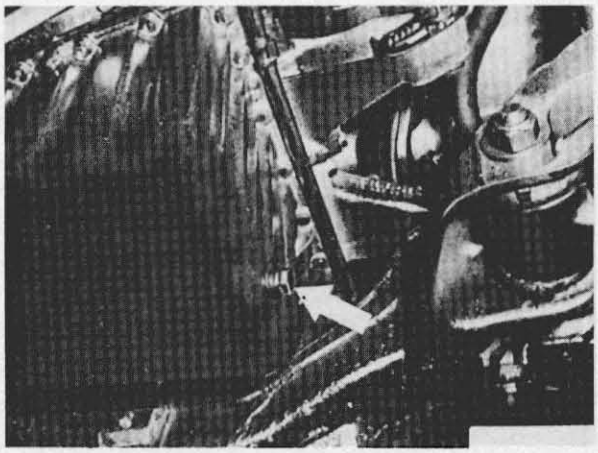
Oil pump type	Gear type, driven by crankshaft
Relief valve opening pressure	65.2 psi)
Lubricant type	See *Recommended lubricants and fluids* at the front of this manual
Lubricant capacity	See *General dimensions, weights and capacities* at the front of this manual

Torque Specifications

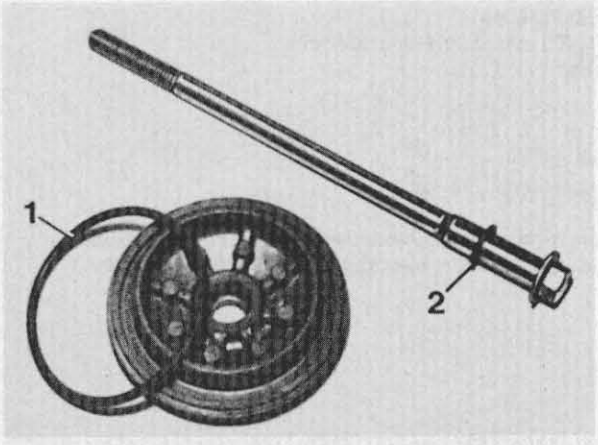
	Ft-lbs
Camshaft cover bolts	11
Camshaft bearing bracket bolts	15
Camshaft sprocket bolt	59
Timing chain tensioner retaining nut	52
Cylinder head retaining bolts (M12)	
Stage 1	52
Stage 2	Tighten further by 90-degrees
Stage 3	Tighten further by 90-degrees
Cylinder head front bolts (M8)	18
Crankshaft pulley and vibration damper retaining bolt	221
Timing cover retaining bolts	17
Oil pan retaining bolts	7
Oil pan drain plug	22
Oil pump cover bolts	7
Oil pick-up tube-to-pump cover	7
Oil pick-up tube-to-main bearing cap	7
Intermediate shaft retaining plate bolt	4
Oil pressure relief valve plug	22
Connecting rod bearing retaining nuts	
Stage 1	30 to 37
Stage 2	Tighten further by 90- to 100-degrees
Connecting rod bearing cap retaining bolts	
Stage 1	22
Stage 2	Tighten further by 90- to 100-degrees
Main bearing cap bolts	66
Crankshaft rear oil seal carrier	7

Torque Specifications (continued)

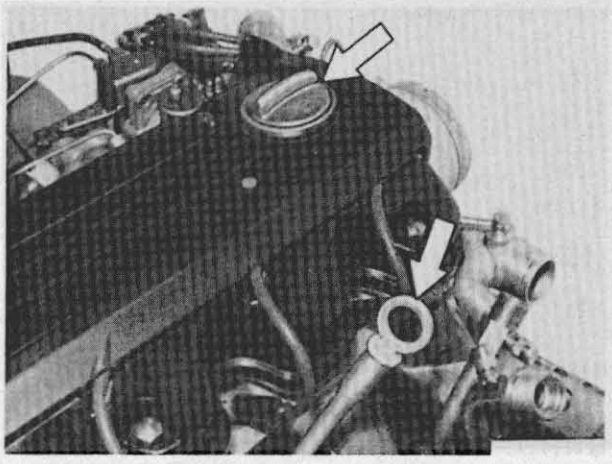
	Ft-lbs
Flywheel or torque converter driveplate bolts	
Stage 1	22 to 30
Stage 2	Tighten further by 90 to 100-degrees
Engine mounting bracket-to-mount	37
Engine mount-to-crossmember	30



2.3 Oil drain plug location on the left-hand side of the oil pan



2.9 On cars with a cartridge type oil filter, replace the sealing ring on the housing cover (1) and retaining bolt (2)



2.13 Oil filler cap and dipstick locations

1 General information

The engine is of four-cylinder in-line single or dual overhead camshaft type, of 2299 cc displacement, and mounted conventionally at the front of the car.

The crankshaft is supported in five main bearings within the cast iron cylinder block. Crankshaft endplay is controlled by thrust washers, located on either side of the center main bearing.

The forged steel connecting rods are attached to the crankshaft by horizontally split connecting rod bearings, and to the pistons by fully floating piston, or "wrist" pins on early models, or by interference-fit piston pins from early 1984 on. The aluminum alloy pistons are equipped with three piston rings; two compression and one oil control.

The camshaft(s) is (are) driven by a single-row chain from the crankshaft sprocket. The chain also drives the intermediate shaft, which is used to drive the distributor

The camshaft(s) is/are supported in five bearings (each) in the aluminum alloy cylinder head, and actuates the valves via rocker arms. The rocker arms installed on early engines incorporate conventional adjusting screws and locknuts for valve clearance (tappet) adjustment, but from October 1984 on, a compact, self-adjusting hydraulic tappet assembly is installed to each rocker arm at the valve stem end.

The engine has a full-flow lubrication system from a gear-type oil pump, located in the timing cover and driven directly by the crankshaft. The oil filter is of the cartridge type on early models, or canister type on later models, and is located on the left-hand side of the engine at the rear.

2 Maintenance and inspection

Refer to illustrations 2.3, 2.9 and 2.13

1 At the intervals given in the *Routine Maintenance* section at the beginning of this manual, carry out the following maintenance operations on the engine.

2 Visually inspect the engine joint faces, gaskets and seals for any sign of water or oil leaks. Pay particular attention to the areas around the camshaft cover, cylinder head, timing cover and oil pan-to-cylinder block mating areas. Repair any leaks by referring to the appropriate Sections of this Chapter.

3 Place a suitable container beneath the oil drain plug on the left-hand side of the oil pan **(see illustration)**.

4 Remove the drain plug and allow the oil to drain. Inspect the condition of the drain plug sealing washer and replace it, if necessary. Install and tighten the plug after draining.

5 Move the container to the rear of the engine beneath the oil filter.

6 On early models with a cartridge type filter, unscrew the central retaining bolt and remove the bolt and filter housing cover.

7 Lift out and discard the old filter and remove any oil remaining in the housing using a suction gun or poultry baster.

8 Wipe clean the inside of the housing and insert the new filter cartridge.

9 Replace the sealing rings on the housing cover and central retaining bolt **(see illustration)**. Place the cover in position, install the bolt and tighten to the specified torque.

10 On later models with a canister type filter, loosen the filter using a strap wrench or filter removal tool, then unscrew it from the engine and discard.

11 Wipe the face of the filter housing flange with a rag, then lubricate the seal on the new filter with clean engine oil.

12 Screw the filter into position and tighten it firmly by hand only, do not use any tools.

13 Remove the filler cap on the camshaft cover and fill the engine, using the correct grade of oil, until the level is up to the upper mark on the dipstick **(see illustration)**. Install the cap.
14 Start the engine and run it for a few minutes while checking for leaks around the filter. Switch it off and re-check the level on the dipstick, adding more oil if required.
15 On pre-October 1984 models, check the valve clearances as described in Section 5.

3 Major operations possible with the engine in the vehicle

The following work can be carried out without having to remove the engine:

a) Valve clearances – adjustment
b) Camshaft – removal and installation
c) Cylinder head – removal and installation, disassembly and reassembly
d) Timing chain – replacement
e) Engine mounts – removal and installation
f) Oil filter and filter housing – removal and installation

4 Major operations requiring engine removal

The following work can only be carried out after removal of the engine from the vehicle:

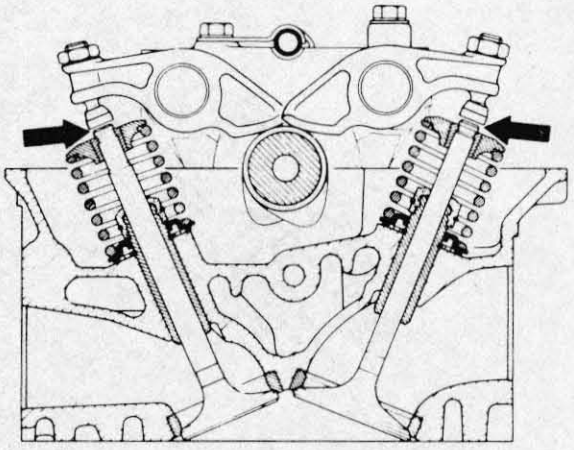
a) Oil pan – removal and installation
b) Timing cover – removal and installation
c) Timing chain components and intermediate shaft – removal and installation
d) Oil pump – disassembly and reassembly
e) Flywheel or driveplate – removal and installation (these can also be replaced by removing the transmission)
f) Connecting rod and piston assemblies – removal and installation
g) Crankshaft – removal and installation

5 Valve clearances (eight-valve engines) – check and adjustment

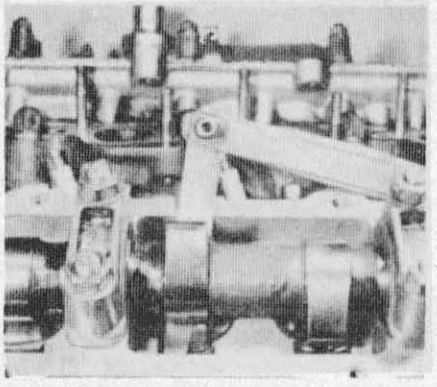
Refer to illustration 5.7

Note: *Valve clearance adjustment is only necessary on engines without hydraulic tappets, manufactured up to October 1984. Checking and adjustment may be carried out with the engine cold or warm.*

1 Remove the air cleaner as described in Chapter 3.
2 Pull off the spark plug wires at the spark plugs and release the two distributor cap retaining clamps using a screwdriver.
3 On fuel injected models, disconnect the idle speed air distributor hose on the side of the camshaft cover.
4 Remove the retaining bolts and remove the camshaft cover, complete with spark plug wires and distributor cap. On models with air conditioning, unscrew the refrigerant suction line bracket on the front of the cylinder head, and move the suction line slightly to allow the distributor cap to be pulled through. *Don't disconnect any air conditioning lines.*
5 Disconnect the primary wiring electrical connector at the ignition system electronic switching unit (refer to Chapter 4).
6 Using a 27 mm socket or wrench, turn the engine by means of the crankshaft pulley bolt, in the normal direction of rotation (clockwise when viewed from the front), until the cam lobes for No. 1 cylinder intake and exhaust valves are pointing down, away from the rocker arms.
7 Using the proper thickness feeler gauge (see this Chapter's Specifications for the clearance value), check that the gauge is a tight sliding fit between the valve stem and rocker arm **(see illustration)**. Note that the intake valves are on the fuel injection system side of the cylinder head, the exhaust valves are on the exhaust manifold side, and the clearances are different for both.
8 If adjustment is required, loosen the locknut, turn the rocker arm adjusting screw until the correct clearance is obtained, then tighten the locknut while holding the adjusting screw.
9 When both the valves for No. 1 cylinder have been adjusted, turn the crankshaft until the cam lobes for the next pair of valves (No. 2 cylinder) are pointing downwards, and adjust these valves in the same way. Repeat the procedure for cylinders 3 and 4.
10 On completion, install the camshaft cover using a new gasket if the original shows any sign of deterioration. Tighten the camshaft cover retaining bolts to the specified torque. Reconnect the air hose.
11 Reconnect the spark plug wires in the correct sequence and install the distributor cap. Secure the refrigerant suction line bracket where applicable.
12 Connect the primary wiring electrical connector to the switching unit, then install the air cleaner as described in Chapter 3.



5.7 Check the valve clearances between the valve stems and rocker arms with the cam lobes pointing down



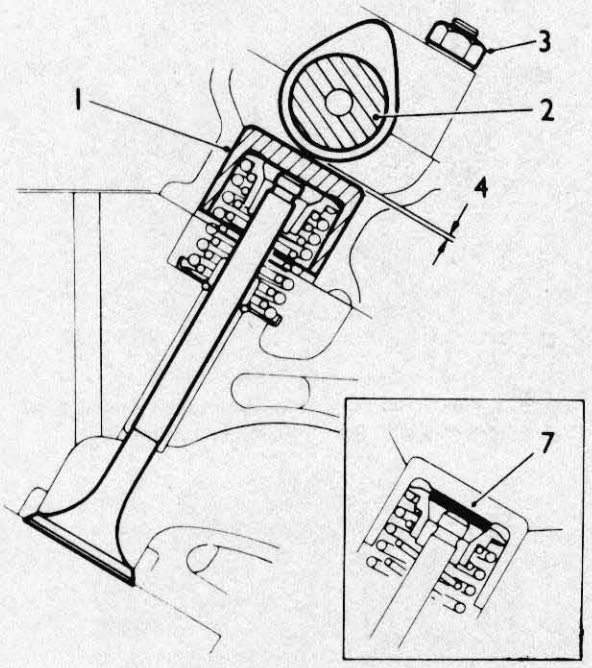
6.3a On 16-valve engines, check the clearance between the base circle of the camshaft lobe and the cam follower

6 Valve clearances (16-valve engines) – check and adjustment

Refer to illustrations 6.3a and 6.3b

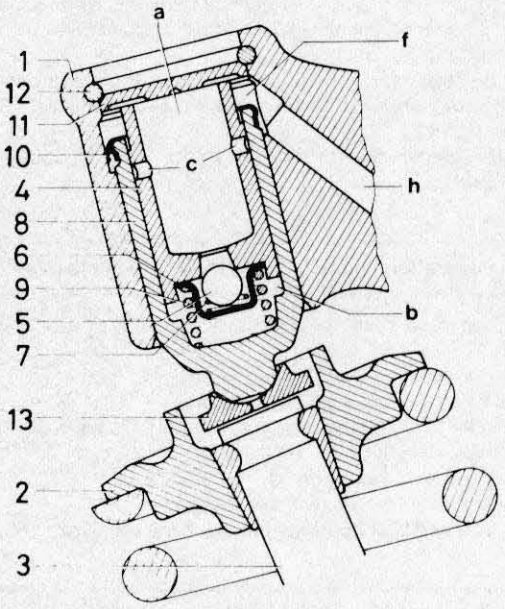
1 Disconnect the cable from the negative terminal of the battery.
2 Remove the camshaft cover by removing the three screws that secure the spark plug wire channel cover, then remove the channel cover, disconnect the spark plug wires and set the wires aside. Loosen the hose clamp and disconnect the breather hose from the rear of the camshaft cover, remove the camshaft cover nuts and lift the cover from the cylinder head. If the cover sticks to the head, gently tap against the corners using a rubber or plastic mallet to break it loose – DON'T pry it off.
3 Using a feeler gauge, measure the clearance of each valve between

1



6.3b Sectional view of the valve and cam

1	*Cam follower*	*4*	*Clearance*
2	*Camshaft*	*5*	*Cam follower and adjustment shim (darkened portion)*
3	*Camshaft bearing cap nut*		



7.1 Sectional view of the hydraulic tappet elements

1	*Rocker arm*	*10*	*Closing cap*
2	*Valve spring cap*	*11*	*Upper retaining washer*
3	*Valve*	*12*	*Snap-ring*
4	*Plunger*	*13*	*Tappet contact seat*
5	*Ball valve*	*a*	*Supply chamber*
6	*Ball guide*	*b*	*Operating chamber*
7	*Ball valve spring*	*c*	*Return bores*
8	*Guide sleeve*	*f*	*Annular duct*
9	*Compression spring*	*h*	*Oil duct*

the base circle of the cam (the part opposite the lobe) and the cam follower **(see illustrations)**. To bring the camshafts into the proper positions for checking the clearances, rotate the engine by turning the crankshaft with a wrench positioned on the crankshaft pulley bolt. Record each measurement and compare your readings with the clearance values listed in this Chapter's Specifications.

4 If a clearance is not as specified, remove the camshaft (or camshafts, as the case may be) from above the particular valve that is out of adjustment (see Section 9). Remove the cam follower – a strong magnet or a suction cup will help you to pull the follower out of its bore. **Caution:** *DO NOT rotate the engine while a camshaft is removed.*

5 Detach the adjusting shim from the underside of the follower. Wipe the oil from the shim with a clean rag and note the thickness stamped into the shim. If the stamping isn't visible, measure the thickness of the shim with a micrometer. Use the following example to determine what shim sizes are needed to correct the clearances that are currently out of the specified range:

	Intake valve	**Exhaust valve**
Specified clearance	0.10 to 0.20 mm	0.25 to 0.35 mm
Measured clearance:	0.06 mm	0.40 mm
Insert a shim:	0.10 mm THINNER	0.10 mm THICKER

6 The shims are available in 0.05 mm increments. **Note:** *Through careful analysis of shim sizes needed to bring the clearances within the specified range, it's often possible to simply move a shim that has to come out anyway to another follower requiring a shim of that particular size, which will reduce the number of shims that must be purchased. Also, keep a record of the shim sizes installed to make the next valve adjustment easier.*

7 Install each shim with the numbered side against the follower, coat the follower with engine oil and reinstall it into its bore in the cylinder head.

8 When all of the clearances have been set, reinstall the camshaft(s) and recheck the clearances.

9 Install the camshaft cover and reconnect the cable to the negative terminal of the battery.

7 Hydraulic tappets (eight-valve engines) – description, removal and installation

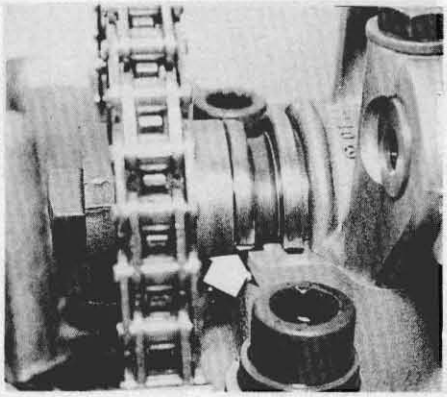
Refer to illustration 7.1

Description

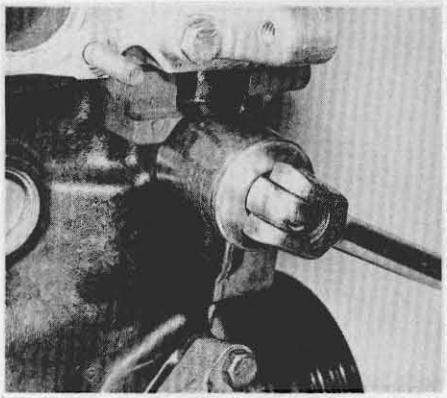
1 On engines manufactured from October 1984 on, hydraulic tappet mechanisms incorporated in each rocker arm were installed, to reduce valve train noise and eliminate the need for periodic valve clearance adjustment **(see illustration)**. The tappets operate as follows:

2 When the engine is stopped and the tappet element is under load from the cam lobe, oil is displaced from the operating chamber through the clearance between the plunger and guide sleeve walls and into the supply chamber via the return bores. This allows the element to completely retract.

3 When the engine is started and the cam lobe moves past the rocker arm, the load on the plunger is removed, and the compression spring pushes the plunger upward until the rocker arm again contacts the cam lobe. As this happens, a vacuum is created in the operating chamber which draws the ball valve off its seat and allows oil from the supply chamber to fill the operating chamber. As the cam lobe starts to move the rocker arm, the ball valve closes, the plunger is placed under load and the oil in the operating chamber creates a hydraulic lock within the element. The element, now in a solid condition, opens the valve as the cam lobe rotates, and actuates the rocker arm.



8.6 Camshaft TDC mark (arrow) aligned with the edge of the cylinder head



8.8A Unscrew the timing chain cover tensioner retaining nut, located on the right front of the cylinder block



8.8B Remove the tensioner spring and sealing ring

4 The oil supply for the hydraulic element is supplied from the main oil gallery and into a hole in the rocker arm. From here it passes to the supply chamber through slots in the upper retaining washer.

Removal

5 To remove the hydraulic tappets, first remove the relevant camshaft bearing bracket complete with rocker arms (see Section 8).

6 Remove the element from the rocker arm by pushing it down from above with a suitable mandrel or punch. Withdraw the element and upper retaining washer from the underside of the rocker arm.

Installation

7 Before installing, the unit must be filled with engine oil. To do this, hold the element vertically and fill the supply chamber with oil. Using a thin piece of wire inserted down through the supply chamber, push the ball valve off its seat so that oil can enter the operating chamber. At the same time, push the plunger upwards to its stop. Repeat this two or three times until no more oil can be added.

8 Still holding the element in a vertical position, insert the upper retaining washer into the rocker arm, with the oil slots toward the element, then insert the element into the rocker arm. Push it up into contact with the snap ring. The camshaft bearing bracket can now be installed.

9 The design and construction of the hydraulic tappet element is such that the amount of free play, or clearance, that it can cope with is limited. This is mainly due to the small, compact size of the unit. To keep this clearance to a minimum and to within the operating tolerances of the unit, the upper retaining washer is available in a number of thicknesses.

10 Under normal operating conditions, the hydraulic tappet element will automatically adjust to take up the clearance between the rocker arm and valve stem, and no problems will occur.

11 If, however, after replacement of the camshaft, rocker arms, valves, or any of the hydraulic elements themselves, the valve train becomes noisy in operation, it is possible that the operating clearance has now become more than the element can cope with. In this case, it will be necessary to change the upper retaining washer for one of a different thickness.

12 To determine the required thickness of washer requires the use of a Mercedes-Benz special clamping fixture and dial gauge, and the work should be performed by a dealer service department or other repair shop if problems of this nature are experienced.

8 Camshaft (eight-valve engines) – removal and installation

Refer to illustrations 8.6, 8.8a, 8.8b, 8.9a, 8.9b, 8.10, 8.11, 8.14a, 8.14b, 8.15 and 8.18

Removal

1 Disconnect the cable from the negative terminal of the battery. Remove the air cleaner as described in Chapter 3, and the alternator as described in Chapter 12.

2 Pull off the spark plug wires at the spark plugs, and release the two distributor cap retaining clamps using a screwdriver.

3 Disconnect the idle speed air distributor hose on the side of the camshaft cover.

4 Remove the retaining bolts and remove the camshaft cover, complete with spark plug wires and distributor cap. On cars with air conditioning, unscrew the refrigerant suction line bracket on the front of the cylinder head, and move the suction line slightly to allow the distributor cap to be pulled through.

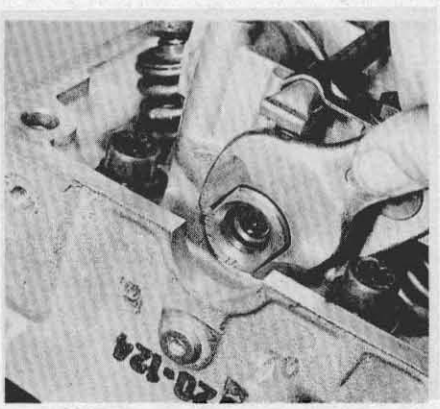
5 Disconnect the primary wiring electrical connector at the ignition system electronic switching unit (see Chapter 4).

6 Using a 27 mm socket or wrench, turn the engine by the crankshaft pulley bolt, in the normal direction of rotation, until the following conditions are obtained: the pointer on the timing cover aligns with the TDC mark on the crankshaft pulley, the distributor rotor tip points towards the notch in the rim of the distributor body and, more importantly, the mark on the camshaft flange aligns with the edge of the cylinder head **(see illustration)**. The engine is now positioned with No. 1 piston at Top Dead Center (TDC) on compression.

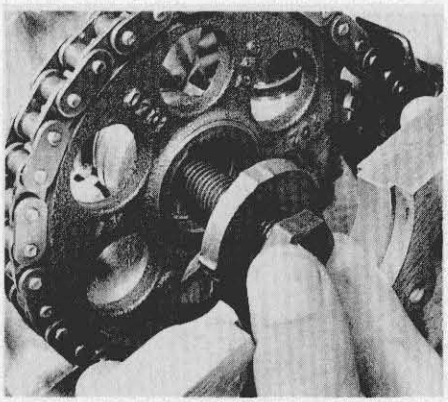
7 Using quick-drying white paint, make a reference mark on the camshaft sprocket and an adjacent link on the timing chain to aid in installation.

8 Unscrew the timing chain tensioner retaining nut on the right-hand side of the cylinder block **(see illustration)**, and remove the spring and sealing ring **(see illustration)**. **Note:** *The nut is under considerable tension from the spring, so be prepared for it to fly off when it reaches the end of the threads.*

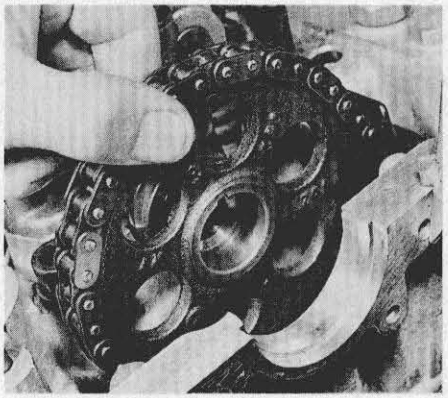
9 Remove the bolt and thrust washer securing the sprocket to the camshaft. The camshaft can be held with a 24 mm open-ended wrench on the two flats at the rear, to prevent it from turning as the bolt is removed **(see illustrations)**.



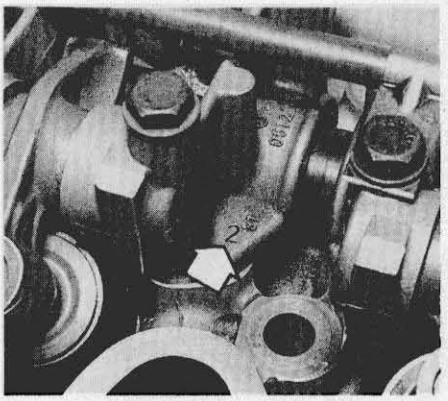
8.9a Hold the camshaft with a wrench on the flats at the end of the shaft . . .



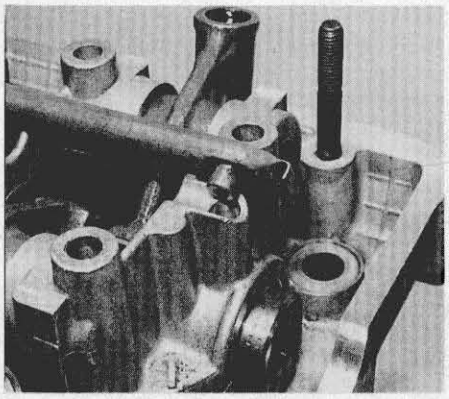
8.9b . . . then loosen and remove the camshaft sprocket bolt



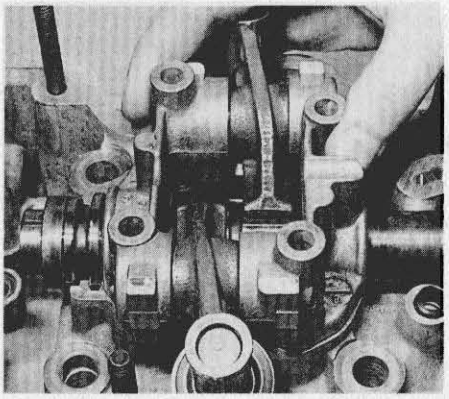
8.10 Remove the sprocket from the camshaft and chain



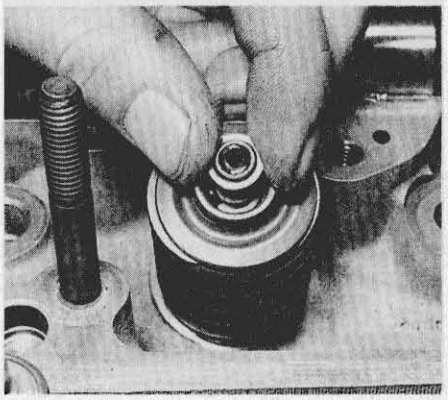
8.11 Camshaft bearing bracket identification numbers (arrow)



8.14A Detach the oil spray pipe



8.14B With the oil spray pipe removed, the bearing brackets and rocker arms can be removed



8.15 Remove the tappet contact seat from the valve stem

10 Pull the sprocket off the camshaft **(see illustration)** and suspend it with a piece of wire, keeping tension on the chain at all times.

11 Check that the rocker arm and camshaft bearing brackets are each numbered on their right-hand side according to their respective cylinder **(see illustration)** from front to rear, 1 to 4 respectively. A corresponding mark is cast in the cylinder head beneath the camshaft. If any of the brackets are not marked, apply marks using a small file or punch marks. The brackets must not be mixed up after removal.

12 On early engines having valve clearance adjusting screws in the rocker arms, loosen the locknuts and unscrew the adjusting nuts as far as possible.

13 Loosen the rocker arm and camshaft bearing bracket retaining bolts a little at a time (to prevent distorting the camshaft), noting the location of the oil spray pipe retaining clips.

14 Withdraw the oil spray pipe, then remove the four bearing bracket assemblies **(see illustrations)**. If they are stuck, lightly tap them free with a plastic mallet.

15 On engines with hydraulic tappets, remove the tappet contact seat from the top of each valve stem **(see illustration)**, and keep them strictly in order in a compartmented box marked for each valve.

16 Lift the camshaft upwards and out of its bearings in the cylinder head.

17 Perform a careful inspection of the components as described in Section 26.

Installation

18 Lubricate the camshaft and its bearings with engine oil and place the camshaft in the cylinder head. Turn the camshaft so that the mark on the flange is aligned with the edge of the cylinder head as was done prior to removal **(see illustration 8.6)**.

19 On engines with hydraulic tappets, place each tappet contact seat in position on its respective valve stem.

20 Install each bearing bracket in the correct numbered order so that the identification numbers are on the right-hand (exhaust manifold) side, and the mounting surface for the oil spray pipe is towards the rear.

21 Locate the oil spray pipe over the bearing brackets, ensuring that the oil pick-up holes are over the oil holes in the bearing brackets.

22 Install the bearing bracket (and oil spray pipe) retaining bolts, and tighten the bolts a little at a time, in a diagonal sequence, to the specified torque.

23 Check that the engine and camshaft are still positioned at TDC as previously described, then engage the camshaft sprocket with the camshaft, making sure the previously applied reference marks on the chain and sprocket are still in line with each other (if the sprocket was properly suspended, with tension on the chain, the marks will still be in alignment).

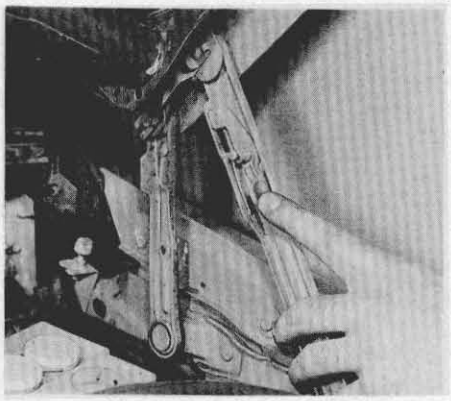
24 Install the sprocket bolt and thrust washer, hold the camshaft at the rear machined flats and tighten the sprocket bolt to the specified torque.

25 Install the chain tensioner spring, sealing ring and nut, then tighten the nut to the specified torque.

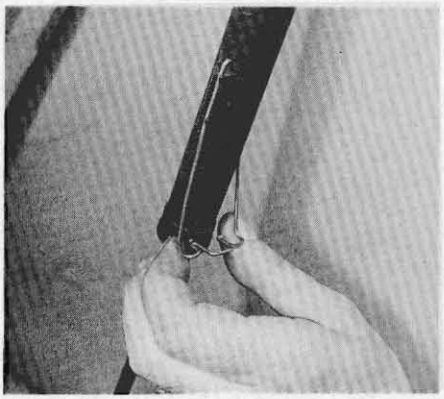
26 Turn the engine through two complete revolutions of the crankshaft, return it to the TDC position, and make sure the mark on the camshaft flange is aligned with the edge of the cylinder head. If not, it is likely that the sprocket has been installed one tooth out in relation to the chain position. If so, remove the sprocket, re-position it and check the marks again.

27 On engines without hydraulic tappets, refer to Section 5 and adjust the valve clearances.

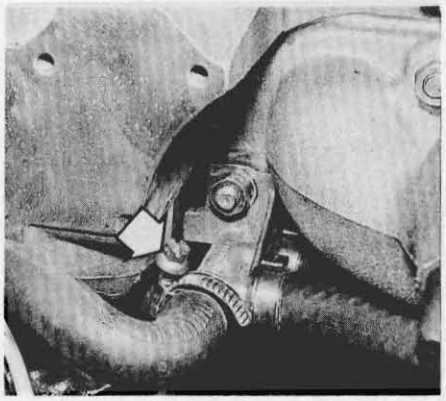
28 Install the camshaft cover, using a new gasket if necessary, and tighten the retaining bolts to the specified torque. Reconnect the air hose.



10.2A Raise the hood to the vertical position by pressing the hinge lever . . .



10.2B . . . and releasing the strut spring



10.5A Disconnect the coolant hose at the front pipe junction (arrow)

29 Install the spark plug wires to the spark plugs and install the distributor cap.
30 Connect the primary wiring electrical connector to the ignition switching unit.
31 Install the air cleaner as described in Chapter 3, and the alternator as described in Chapter 12.

9 Camshaft(s) (16-valve engines) – removal and installation

Removal

1 Set the number one piston at Top Dead Center (TDC) on the compression stroke (the pointer on the front cover will be pointing to the TDC mark on the crankshaft pulley and the distributor rotor tip will be pointing to the area on the distributor body that corresponds with the No. 1 tower on the distributor cap).
2 Disconnect the cable from the negative terminal of the battery.
3 Remove the camshaft cover following the procedure in Section 6, Step 2. Check again that the engine is at TDC No. 1 – this can be confirmed by noting where the 2 mm hole in each camshaft sprocket is positioned. If they are aligned opposite each other, toward the center of the cylinder head, the engine is in the correct position.
4 Using white paint (typists' correction fluid works well), mark the relationship of the sprockets to the timing chain.
5 Unscrew the timing chain tensioner nut from the right hand side of the engine block.
6 Mark the relationship of the camshafts to the camshaft sprockets. Remove the four sprocket-to-camshaft bolts from each sprocket, being very careful not to drop any of the fasteners down into the front cover. Hold the camshafts with a wrench to prevent them from turning as the bolts are loosened.
7 Using a plastic hammer, gently knock the camshafts toward the rear, disengaging them from the sprockets.
8 Loosen all of the camshaft bearing cap retaining bolts, with the exception of the two forward bearing caps which retain the sprockets, a little at a time. When all the spring pressure is off the camshafts, remove the bolts and bearing caps. Store the caps in order – they must be reinstalled in their original positions.
9 Remove the camshafts and inspect them as described in Section 26.
10 If it is necessary to remove the camshaft sprockets, mark the relationship of the sprockets to the chain, remove the two forward bearing caps and remove the sprockets. **Caution:** *Keep tension on the timing chain at all times – don't let it drop.*

Installation

11 Oil the camshaft bearing saddles in the head and carefully lay the camshafts into position, lining up the previously applied matchmarks with the marks on the cam sprockets. **Note:** *The holes in the shafts and sprockets are drilled non-symmetrically, so they will only fit together one way.*
12 Oil the bearing caps and install them to their respective saddles. Install the bolts and tighten them a little at a time, alternatively, to the torque listed in this Chapter's Specifications.
13 Slide the camshafts forward to engage them with the sprockets.
14 Apply a little thread locking compound to the sprocket-to-camshaft bolts and install them, tightening them to the torque listed in this Chapter's Specifications, while holding the camshafts with a wrench to prevent them from turning.
15 Install the chain tensioner bolt and tighten it to the torque listed in this Chapter's Specifications.

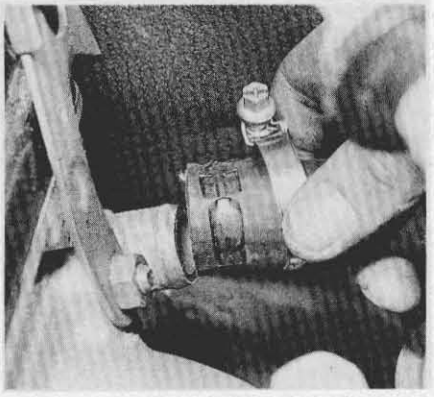
10 Cylinder head – removal and installation

Note: *The cylinder head must only be removed when the engine is cold.*

Removal

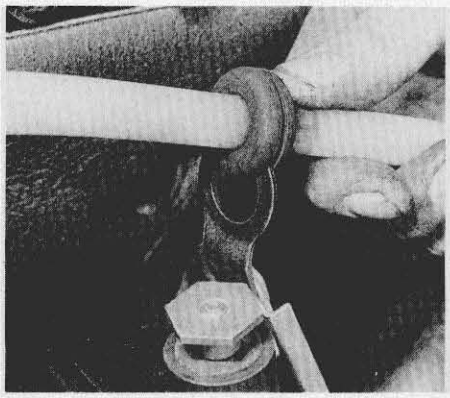
Refer to illustrations 10.2a, 10.2b, 10.5a, 10.5b, 10.6, 10.7, 10.10, 10.12, 10.15, 10.27a, 10.27b, 10.27c, 10.29a, 10.29b, 10.29c and 10.32

1 Position the number one piston at Top Dead Center (see Section 8 or 9). Disconnect the cable from the negative terminal of the battery.
2 Raise the hood to its vertical position by pressing the lever on the hinge and releasing the safety spring on the support strut. Push the hood up until the hinge locking catch engages **(see illustrations)**.
3 Remove the air cleaner as described in Chapter 3.
4 Drain the cooling system as described in Chapter 2.
5 Disconnect the coolant hoses at the front and rear of the cylinder head **(see illustrations)**.

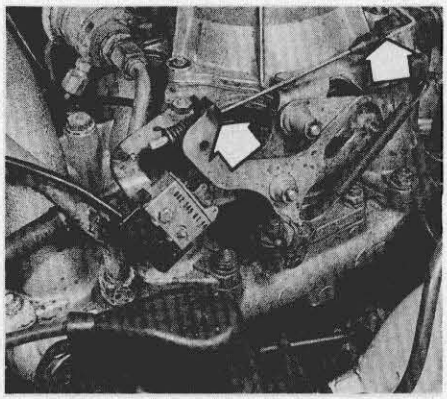


10.5B Also disconnect the hose at the rear of the cylinder head

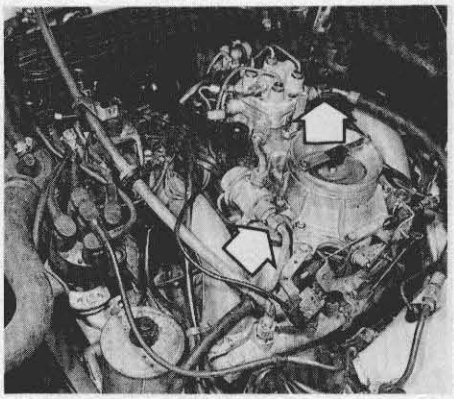
1



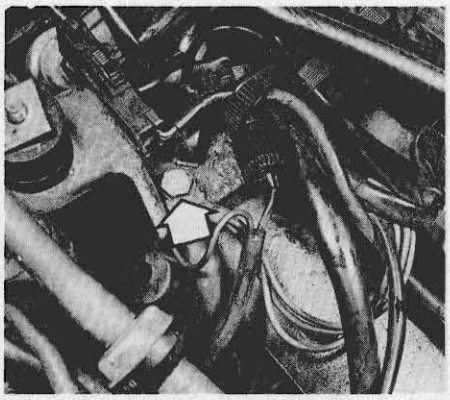
10.6 Release the brake booster vacuum hose at the support bracket



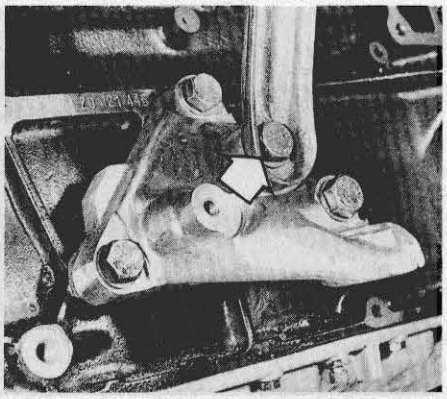
10.7 Accelerator cable attachments at the guide lever and support bracket (arrows)



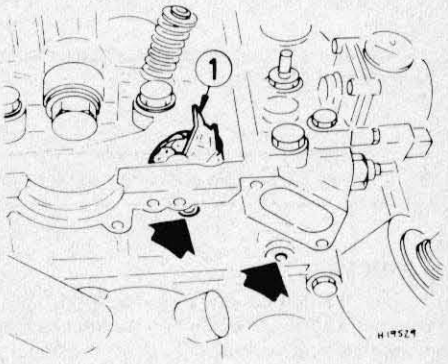
10.10 Fuel hose connections at the fuel distributor and fuel pressure regulator (arrows)



10.12 Intake manifold ground connection



10.15 Remove the manifold support bracket bolt (arrow)



10.27a Timing chain slide rail (1) and retaining bearing bolts (arrows)

6 Detach the brake servo vacuum hose from its bracket on the intake manifold and move the hose clear **(see illustration)**.

7 Disconnect the accelerator cable end from the linkage guide lever by releasing the square retainer and slipping the cable out of the lever slot. Compress the legs of the outer cable retainer, and pull the cable up and out of the support bracket **(see illustration)**.

8 On automatic transmission models, disconnect the control pressure cable from the guide lever, using the procedure described in Chapter 6.

9 Disconnect the linkage return spring at the guide lever.

10 Disconnect the fuel hoses at the fuel distributor and fuel pressure regulator **(see illustration)**. Place rags around the fitting nuts to catch the escaping fuel as the fitting is loosened.

11 Disconnect the electrical connectors at the cold start valve, electromagnetic pressure actuator on the side of the fuel distributor, airflow sensor, throttle valve housing, auxiliary air device, coolant temperature sensor, and at the thermal switches and wiring connectors on the cylinder head. Identify each connector with a label, or make notes to aid installation.

12 Disconnect the wires at the main ground connection on the intake manifold bracket **(see illustration)**.

13 Detach the idle air distributor hose from the side of the camshaft cover.

14 Disconnect any remaining wiring or vacuum hose connections likely to impede cylinder head removal, release the clips and ties, and move the wiring harness clear.

15 Remove the bolts and remove the intake manifold support strut **(see illustration)**.

16 Detach the air conditioning hoses from their brackets on the front of the cylinder head.

17 Remove the nut securing the engine oil dipstick tube clip to the manifold. Pull out the dipstick and and plug the dipstick tube.

18 On automatic transmission equipped models, remove the bolt securing the dipstick tube to the rear of the cylinder head.

19 Remove the exhaust pipe-to-manifold nuts or bolts.

20 Remove the thermostat housing as described in Chapter 2.

21 Remove the alternator as described in Chapter 12.

22 Remove the serpentine drivebelt by loosening the bolt in the center of the belt tensioner and turning the tensioner nut counterclockwise. Unbolt the hydraulic pump from the right front of the cylinder head and secure it out of the way. Don't disconnect the hoses (vehicles with level control only).

23 Remove the camshaft cover (see Section 6 or 8).

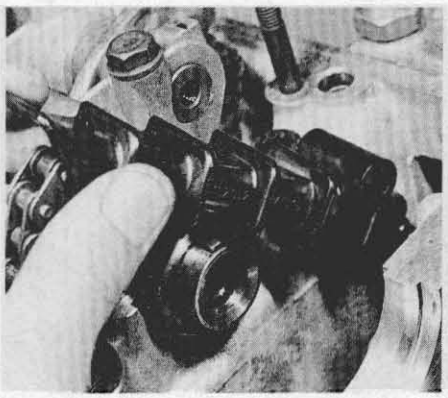
24 On 16-valve models, remove the camshafts (see Section 9).

25 On 16-valve models, remove the nuts securing the chain tensioner upper slide rail, remove the two circlips and drive out the two guide pins, then remove the rail.

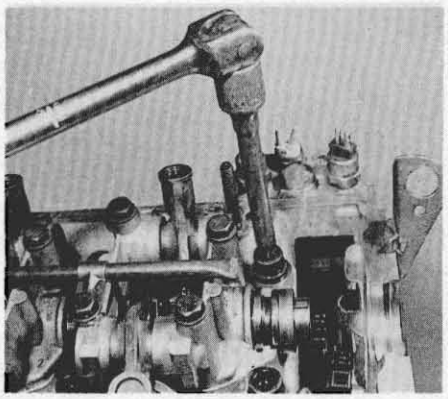
26 On 16-valve models, remove the two forward bearing caps, work the timing chain off the sprockets and remove them, but be sure to keep tension on the chain so it doesn't fall off the crankshaft sprocket. This can be accomplished by twisting a length of mechanics wire through two of the links on the chain (one on each side) and attaching the other end of the wire to another component outside of the cylinder head. When the head is lifted from the cylinder block, have an assistant hold these wires and reach under the head to grab the chain, continuing to keep it taut.



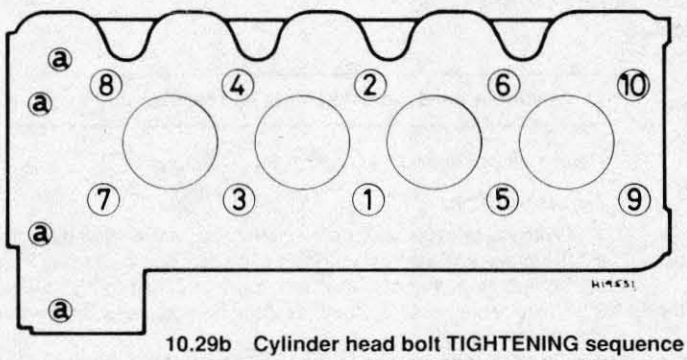
10.27b Use a puller and slide hammer arrangement to remove the slide rail bearing bolts



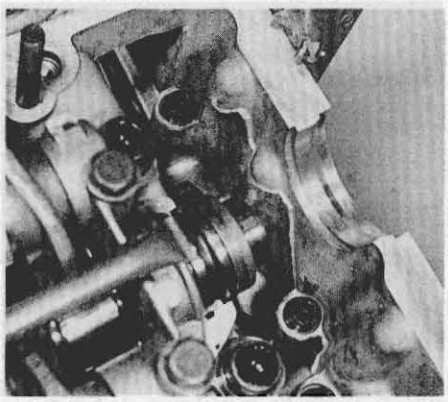
10.27c When both bearing bolts have been removed, lift the slide rail from the timing chain and head



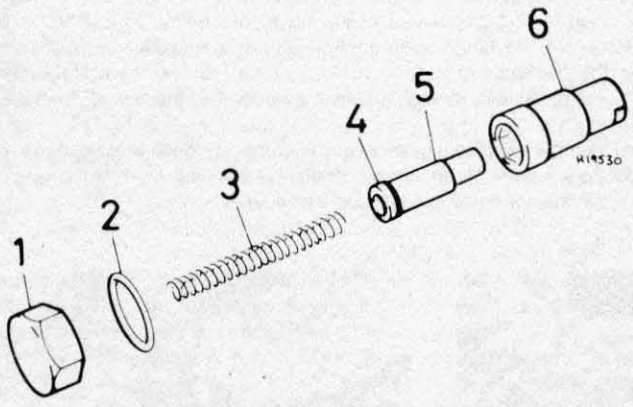
10.29a Use the proper tool (a 12-point internal drive socket), not an Allen wrench, when loosening (or tightening) the head bolts



10.29b Cylinder head bolt TIGHTENING sequence – when loosening the bolts, use the reverse of this sequence



10.29c Also remove the four additional front bolts (the two center bolts are shown here)



10.32 Exploded view of the timing chain tensioner

1 Retaining nut
2 Sealing ring
3 Spring
4 Detent ring
5 Tensioner plunger
6 Tensioner body

27 On eight-valve models it is now necessary to pull out the two bearing bolts in the front of the cylinder head which support the timing chain slide rail **(see illustration)**. Thread an M6 bolt and washer into the bearing bolt, attach a slide hammer and puller to the bolt and pull the bearing bolt from its bore **(see illustration)**. Repeat this procedure to the other bolt and remove the slide rail **(see illustration)**.

28 Make sure all wiring, hoses, brackets and other attachments likely to impede cylinder head removal are disconnected and positioned out of the way.

29 Using a 12-point internal driver, loosen the cylinder head bolts, a little at a time, in the reverse order of the tightening sequence **(see illustrations)**. Also, remove the smaller bolts securing the front of the cylinder head to the timing cover and cylinder block **(see illustration)**.

30 The cylinder head, complete with manifolds, can now be lifted from the block. If it's stuck, tap against a sturdy part of the casting or use the manifolds for additional leverage. Don't pry between the head and the block, as this would damage the mating faces. Due to the considerable weight of the cylinder head with the manifolds attached, the help of an assistant will be necessary to lift it off. Alternatively, an engine hoist can be used, with the lifting chains attached to the brackets on the cylinder head.

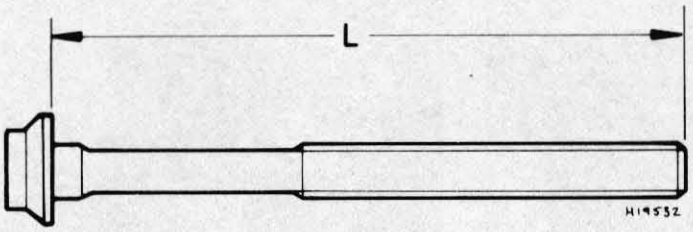
31 Remove the cylinder head gasket. Clean the surface of the block, removing all traces of old gasket material.

32 Remove the timing chain tensioner plunger from the tensioner body and inspect it, replacing the assembly if it appears worn or damaged **(see illustration)**.

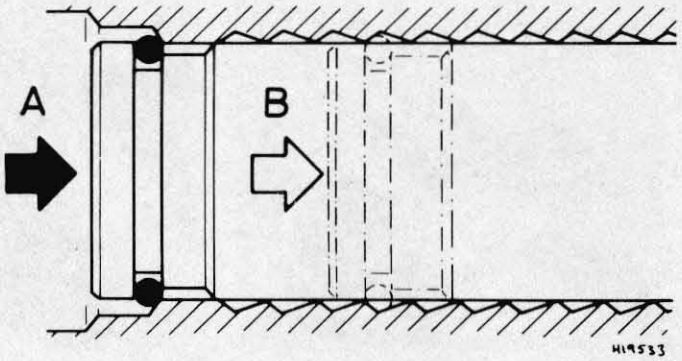
Installation

Refer to illustrations 10.34 and 10.40

33 Check the cylinder head bolt holes in the block to make sure they are free of oil, water, dirt or old gasket material. If they are dirty, run an appropriately-sized tap down them to clean the threads.



10.34 Cylinder head bolt length measuring points



10.40 Timing chain tensioner plunger assembly positions

A Initial detent when installing plunger
B Direction of plunger removal from tensioner body

34 Measure the length of the cylinder head bolts, from the underside of the bolt heads to the end of the bolt **(see illustration)**. Compare your measurements with the maximum bolt length listed in this Chapter's Specifications. If the bolts have stretched past the maximum allowable length, they must be replaced.

35 Place a new cylinder head gasket onto the block, then carefully lower the head onto the gasket.

36 Install the head bolts, finger tight only at this time.

37 Tighten the bolts in the proper sequence **(see illustration 10.29b)** in three stages, as follows. First, tighten them to the value listed in the Specifications Section. Second, tighten each bolt, in the correct sequence, an additional 90-degrees (1/4-turn). Third, tighten the bolts another 90-degrees, again in the correct sequence.

38 Install the smaller bolts in the front of the head and tighten them to the torque listed in this Chapter's Specifications.

39 On eight-valve engines, install the timing chain slide rail with the open side toward the head, hold it in position with a narrow punch inserted through the upper bolt hole. Apply sealant to the bearing bolts, install the lower bolt and tap it into place. Remove the punch and install the upper bolt in the same way.

40 Insert the timing chain tensioner plunger into the tensioner body, up to the first detent **(see illustration)**.

41 On 16-valve engines, install the camshafts. On all models, install the camshaft sprocket(s), timing chain and tensioner.

42 The remainder of installation is the reverse of the removal procedure. When assembly is complete, check the throttle cable adjustment (see Chapter 3). On models equipped with automatic transmissions, check the control pressure cable adjustment (see Chapter 6). Refill the cooling system (see Chapter 2).

11 Cylinder head – disassembly and reassembly

Refer to illustrations 11.4, 11.5, 11.6a, 11.6b and 11.9

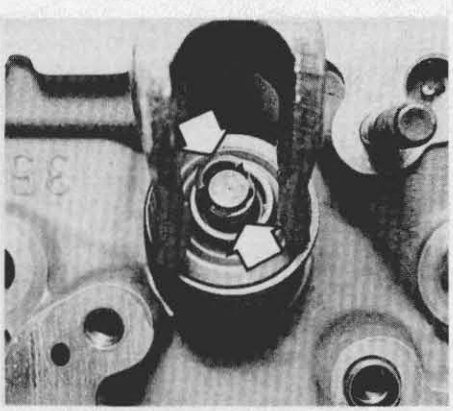
Disassembly

1 With the cylinder head on the bench, begin disassembling by removing the intake and exhaust manifolds as described in Chapter 3. Leave all the components that are attached to the manifold in place, disconnect their hose or electrical connections at the cylinder head, and remove them with the manifold.

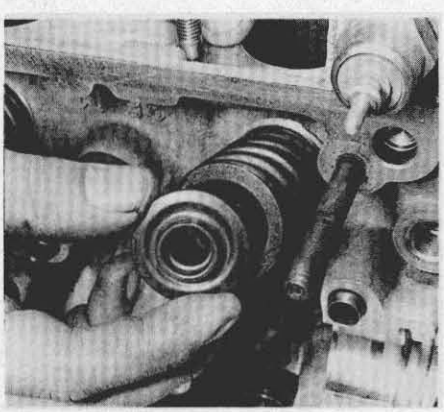
2 Remove the camshaft from the cylinder head as described in Section 8 (eight-valve engines).

3 Have ready a cardboard box with eight holes (eight-valve engines) or sixteen holes (16-valve engines) punched in it, into which each valve can be inserted as it is removed, or have a set of labelled containers, so that each valve and its associated parts can be identified and kept separate. Number the board or containers No. 1 intake, No. 1 exhaust, No. 2 intake, No. 2 exhaust, etc, noting that No. 1 cylinder is at the timing chain end of the engine.

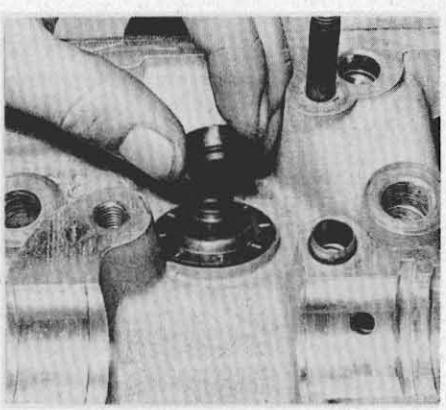
4 Using a valve spring compressor, compress each valve spring in turn until the keepers can be removed **(see illustration)**. Take out the keepers, release the spring compressor and remove it.



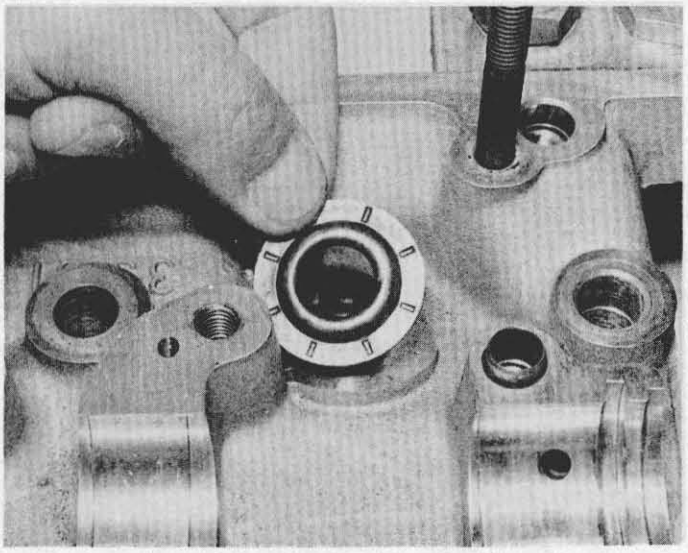
11.4 Compress the valve spring and remove the split keepers



11.5 Remove the spring retainer



11.6a Remove the valve stem oil seal . .



11.6b . . . and the spring seat

5 Remove the spring retainer, valve spring (or springs on certain models), followed by the valve **(see illustration)**.
6 Pry off the valve stem oil seal then remove the spring seat **(see illustrations)**.
7 Perform a careful inspection of the components as described in Section 26, and decarbonize the cylinder head and valves as described in Section 27.

Reassembly

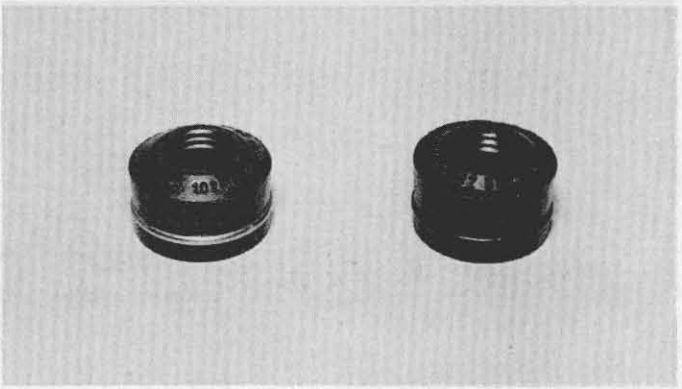
8 Begin reassembly by placing the spring seat for the first valve over the guide, so that the raised center portion of the spring seat is uppermost.
9 Place the appropriate new valve stem oil seal over the valve guide, and push it fully into place. Note that the exhaust valve stem oil seal is identified by its bright galvanized wire ring, while the intake seal has a black ring **(see illustration)**.
10 Liberally lubricate the valve stem and oil seal, then carefully insert the valve, taking care not to damage the oil seal as it is pushed through.
11 Place the spring over the valve stem, followed by the spring retainer. On engines with double valve springs, the close coils must be towards the cylinder head.
12 Compress the spring and insert the keepers, ensuring that they seat correctly in the valve stem groove.
13 Release and remove the compressor, then tap the top of the valve stem sharply with a soft-faced mallet to seat the components.
14 Install the remaining valves in the same way, then install the camshaft as described in Section 8 (eight-valve engines) and the manifolds as described in Chapter 3.

12 Timing chain – replacement

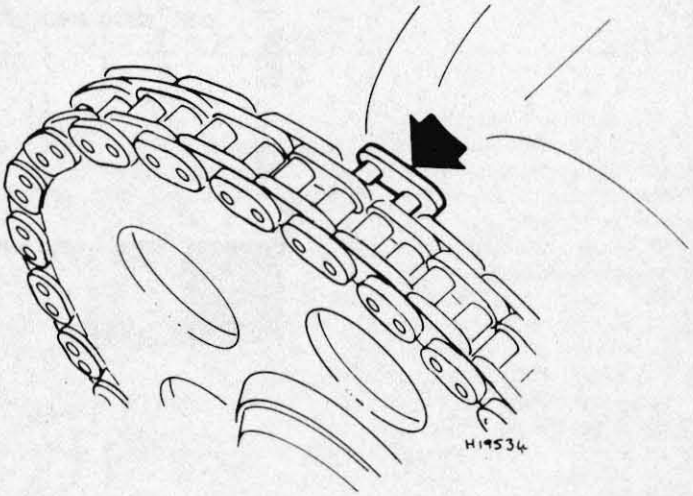
Refer to illustrations 12.11 and 12.15

Note: *The timing chain itself can be replaced with the engine in the car, but removal and installation of the timing cover, lower slide rails or tensioning rail can only be carried out with the engine removed. Replacement of the timing chain using the following procedure requires the use of a portable electric grinder to cut through one of the chain links. Ensure that such a tool is available, as well as a new chain and new connecting link before proceeding.*

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the air cleaner (see Chapter 3).
3 Remove the camshaft cover (see Section 5 or 6).
4 Remove the spark plugs.

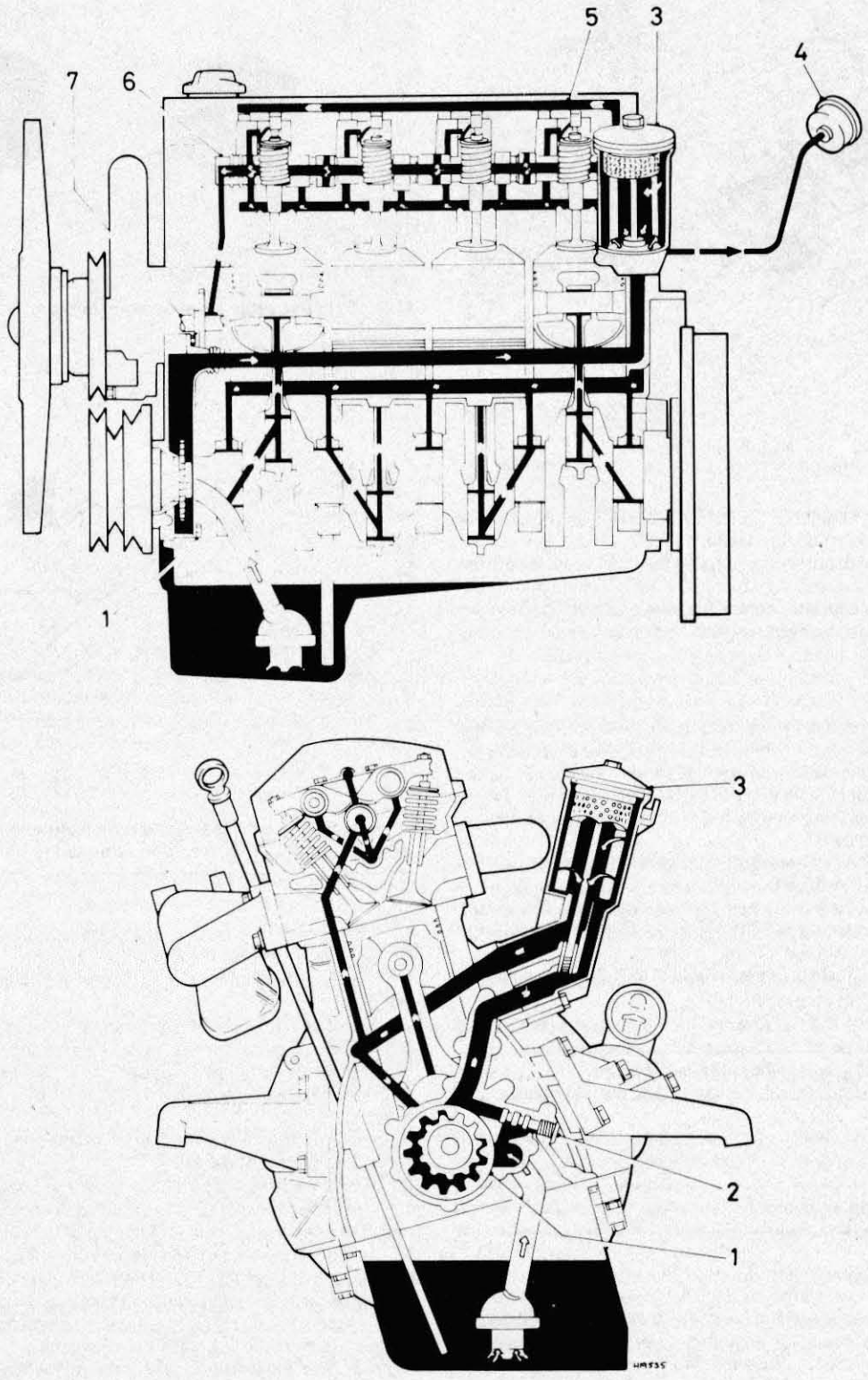


11.9 Exhaust valve stem oil seal (left) and intake stem seal (right)



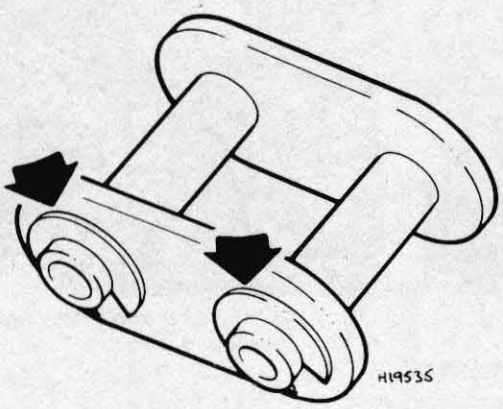
12.11 Grind off the peened pins from one of the timing chain links, then remove the link

5 Disconnect the primary wiring electrical connector at the ignition system electronic switching unit (see Chapter 4).
6 Remove the alternator as described in Chapter 12 (eight-valve models only).
7 Unscrew the timing chain tensioner retaining nut on the right-hand side of the cylinder block, and remove the spring and sealing ring (see illustrations 8.8a and 8.8b). **Caution:** *The nut is under considerable tension from the spring, so be prepared for it to fly off when it reaches the end of the threads.*
8 Using a large Allen wrench, unscrew the chain tensioner body and remove it from the cylinder block.
9 Remove the plunger from the tensioner body.
10 Cover the camshaft(s) and the chain opening in the timing cover with rags, but keep the rags clear of the top of the camshaft sprocket.
11 Using the grinder, grind off the protruding legs of one of the chain links on the top of the sprocket. On 16-valve engines, make sure the link you grind off is on the exhaust camshaft sprocket, as near to the outside edge of the cylinder head as possible (this will make installation of the new chain easier). Remove the link plate, then push the link out of the chain toward the rear **(see illustration)**. Clean the metal filings from the sprockets, chain and surrounding area. Remove the rags.
12 Using the new link, connect one end of the new timing chain to the tail end of the old chain, in such a way that as the engine is turned, the new chain will be drawn down, around the sprockets and guides, then up the other side. Ensure that the new chain is connected so that the link heads are toward the rear, and the peened over ends of the link legs are towards the front.



14.1 General views of the engine lubrication circuit

1 *Oil pump*
2 *Pressure relief valve*
3 *Oil filter (cartridge type shown)*
4 *Oil pressure switch*
5 *Oil spray pipe*
6 *Camshaft*
7 *Intermediate shaft*

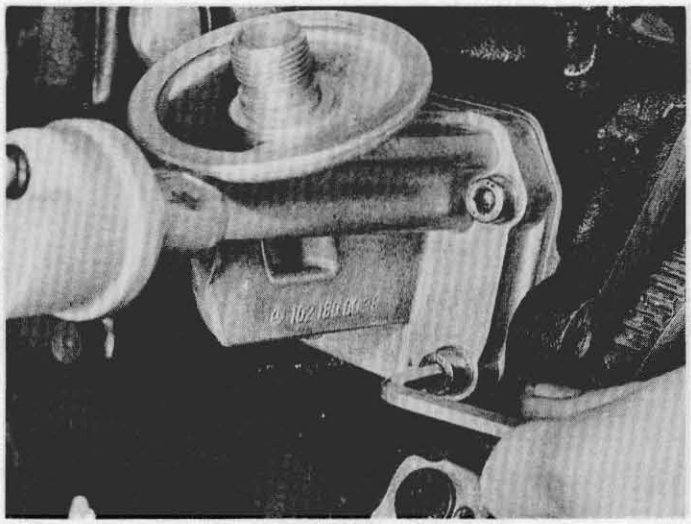


12.15 Retaining circlips (arrows) used to secure new link

13 Using a 27 mm socket on the crankshaft pulley bolt, slowly rotate the crankshaft in the normal direction of rotation. Keep the links of the new chain engaged with the camshaft sprocket as it is pulled through (otherwise the timing will be lost) and pull up on the old chain to prevent it from dropping off the crankshaft sprocket, or jamming in the guides.
14 When the end of the new chain appears, remove the link and disconnect it from the old chain. Place the new chain on the camshaft sprocket and join the two ends with the connecting link, inserted from the rear.
15 Fit the link plate and lock the link, using the two small circlips supplied, by inserting them into the link pin grooves **(see illustration)**.
16 Set the engine at the TDC position for No. 1 piston, and check that all the timing marks align as described in Section 8 (eight-valve engines) or Section 9 (16-valve engines).
17 Insert the timing chain tensioner plunger into the tensioner body, up to detent "A" **(see illustration 10.40)**.
18 Install the tensioner body to the cylinder block and tighten it securely.
19 Install the tensioner spring, sealing ring and retaining nut, tightening the nut to the torque listed in this Chapter's Specifications.
20 The remainder of installation is the reverse of the removal procedure.

13 Engine mounts – removal and installation

1 Raise the front of the vehicle and support it securely on jackstands.
2 Support the engine under the oil pan using a floor jack and a wood block.
3 From above, remove the central bolt securing the mount to the bracket on the cylinder block. If working on the right-hand mount, remove the protective shield.
4 Raise the engine slightly until the cylinder block bracket is clear of the mount.
5 Working through the access hole in the crossmember from below, remove the socket-headed bolt securing the mount to the crossmember, and remove the mount.
6 The mounts are not interchangeable from side to side, and are therefore color-coded by means of a colored dot on the mounting body. The left-hand mount is identified by a red dot, and the right-hand mount by a green dot.
7 Installation is the reverse sequence of removal, but make sure the lug on the mount engages with the slot on the cylinder block bracket when positioning it.



15.3 Unscrew the oil filter housing bolts using an Allen wrench

14 Lubrication system – description

Refer to illustration 14.1

The oil pump draws oil from the oil pan through a pick-up tube, and then supplies pressurized oil through a feed duct through the cylinder block to the oil filter at the rear of the engine **(see illustration)**. Should the pressure exceed a predetermined value, the oil pressure relief valve in the timing cover is opened against spring pressure, and some of the oil is diverted back to the suction side of the pump.

The full-flow oil filter is of the cartridge type on early models, and throw-away canister type on later models. Contained within the filter housing are non-return valves, which prevent the oil draining back to the oil pan when the engine is stopped.

Filtered oil passes out of the housing and into the oil gallery in the block, where one branch diverts it to the main bearings in the crankcase. Oil at the main bearings enters passages in the crankshaft, which supply the connecting rod bearings, and pistons via squirt holes in the connecting rods. Another branch from the oil gallery supplies oil to operate the plunger in the timing chain tensioner.

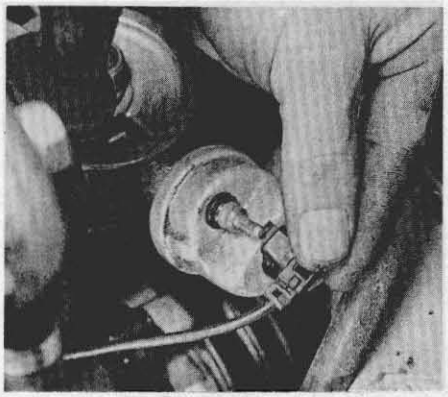
Oil supplied to the cylinder head passes through the hollow camshaft to lubricate the bearing journals, and also through passages in the rocker shafts and rocker arms (eight-valve engines only) to spray onto the cam lobes. Additional spray lubrication of the camshaft is provided by the longitudinal oil pipe over the camshaft and rocker arms.

From the cylinder head, oil flows through galleries to the front of the engine to lubricate the intermediate shaft and distributor shaft, the chain and gears. Passages in the cylinder head and block allow the oil to return under gravity to the oil pan.

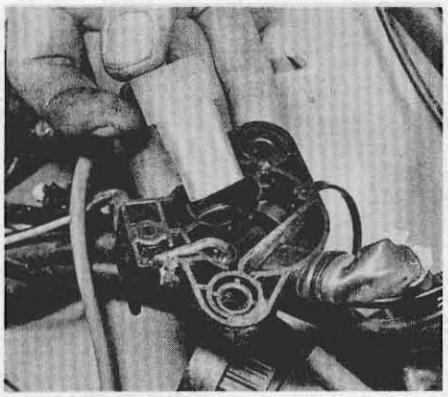
15 Oil filter housing – removal and installation

Refer to illustration 15.3

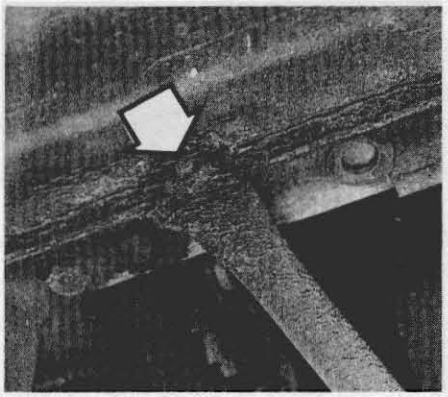
1 Drain the engine oil and remove the oil filter as described in Section 2.
2 Disconnect the electrical connector at the oil pressure switch.
3 Using an Allen wrench, unscrew the socket-headed retaining bolts and remove the filter housing and gasket **(see illustration)**.
4 Clean the housing and cylinder block mating surfaces thoroughly, and install the housing using the reverse sequence of removal.
5 Install a new filter and refill the engine with oil.



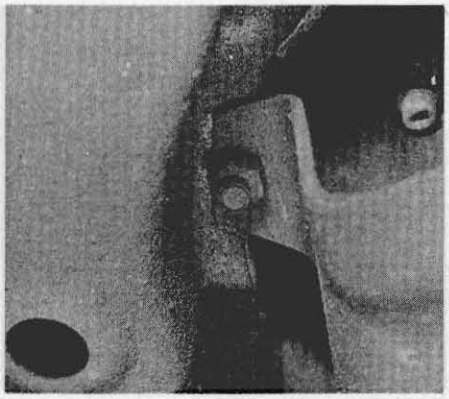
17.14 Disconnect the electrical connector from the oil pressure switch



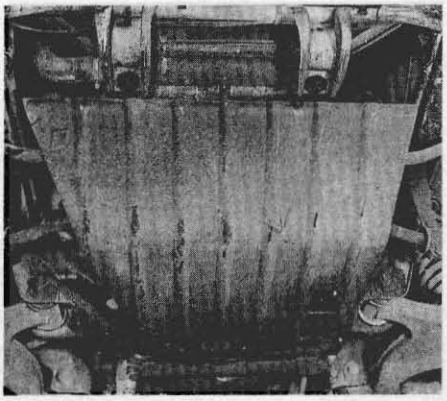
17.16 Disconnect the electrical connector at the rear of the diagnostic socket



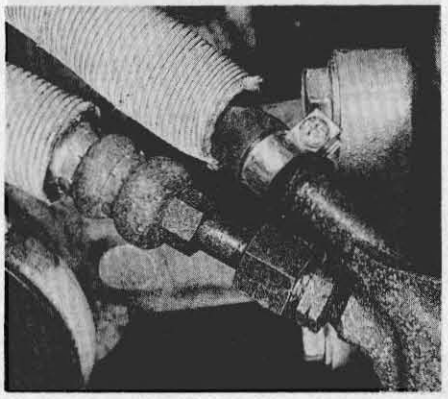
17.20a Unbolt the undertray front support (arrow) . . .



17.20b . . . and rear flange attachment . . .



17.20c . . . then remove the undertray



17.23 Disconnect the power steering hoses at the lower right-hand connections

16 Engine – method of removal

The engine must be removed complete with the transmission, and is lifted up and out of the engine compartment from above.

17 Engine – removal and installation

Refer to illustrations 17.14, 17.16, 17.20a, 17.20b, 17.20c, 17.23, 17.24 and 17.32

Removal

1 Disconnect the battery negative terminal.

2 Raise the hood to its vertical position by pressing the catch on the left-hand hinge and releasing the safety wire spring on the support strut. Push the hood up until the hinge locking catch engages (see illustrations 10.2a and 10.2b).

3 Remove the air cleaner as described in Chapter 3.

4 Drain the cooling system and remove the radiator as described in Chapter 2.

5 On cars equipped with air conditioning, remove the air conditioning compressor drivebelt. Unbolt the air conditioning compressor and move it clear of the engine, but without disconnecting any of the hoses. It may be necessary to remove other components to allow the hoses to clear depending on model, options, and type of system used.

6 Unscrew the filler cap on the power steering pump reservoir and remove the fluid, using a large syringe such as a suction gun or poultry baster. Install the filler cap when the reservoir has been emptied.

7 Disconnect the accelerator cable end from the linkage guide lever by releasing the square retainer and slipping the cable out of the lever slot. Compress the legs of the outer cable retainer and pull the cable up and out of the support bracket **(see illustration 10.7)**.

8 Remove the power brake booster vacuum hose banjo bolt or fitting nut on the intake manifold. Recover the two sealing washers where a banjo fitting is used.

9 Release the booster vacuum hose from the support bracket at the rear of the cylinder head.

10 Disconnect the radiator top hose at the water pump and the expansion tank hose at the thermostat housing.

11 Disconnect the right-hand heater hose at the water pump outlet, and the left-hand hose at the rear of the cylinder head.

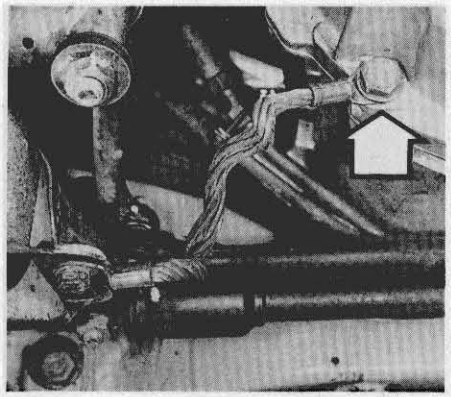
12 On vehicles equipped with level control, unbolt the hydraulic pump from the right side of the cylinder head and position it out of the way, wiring it to the inner fender panel if necessary.

13 Disconnect the fuel hoses at the fuel distributor and fuel pressure regulator. Place rags around the fitting nuts to catch the escaping fuel as the fitting is loosened. Cover the fittings after removal.

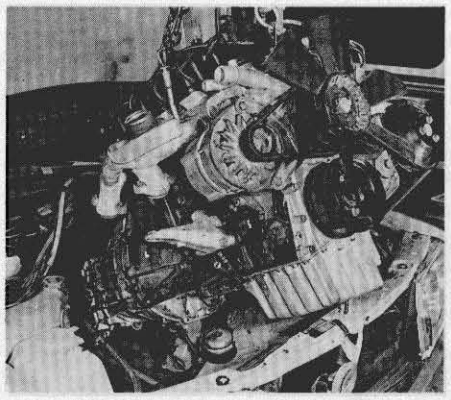
14 Make a careful note of all the wiring and hose connections that affect engine removal, or preferably attach labels to the wires and hoses, then disconnect them. These will include the connections at the following components:

Cold start valve, electromagnetic pressure actuator, airflow sensor, throttle valve housing, auxiliary air device, coolant temperature sensor and cylinder head thermal switches, oil pan oil level sensor, alternator, starter motor, oil pressure switch **(see illustration)** and the coil wire.

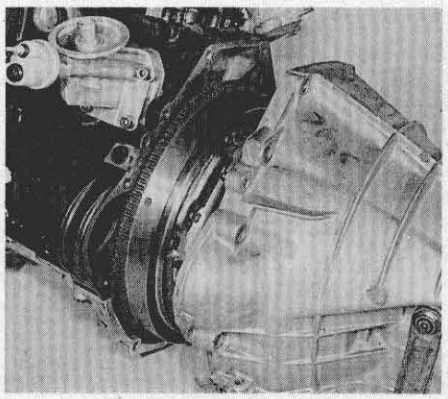
15 Disconnect the two electrical connectors at the ignition system electronic switching unit.



17.24 Disconnect the engine ground strap (arrow)



17.32 Remove the engine and transmission at a 45-degree angle



18.4 Pull the transmission straight back off the engine, until the input shaft is clear of the clutch (manual transmission models)

16 Remove the screws securing the diagnostic socket to the inner fender panel and disconnect the electrical connector from the rear of the socket **(see illustration)**.
17 Remove the bolt securing the wiring harness support bracket to the mounting bracket on the intake manifold adjacent to the oil filter.
18 Release the wiring and cables from the various ties and cable clamps and move all the disconnected wiring clear of the engine.
19 Raise the vehicle and support it securely on jackstands.
20 On cars equipped with an engine undertray, remove the front support strut nuts and bolts and the rear flange nuts and bolts and remove the undertray **(see illustrations)**.
21 On early models, unbolt the mounts and remove the engine front shock absorber.
22 Remove the flange nuts or bolts and separate the exhaust pipes at the manifold.
23 Loosen the hose clamp and remove the fitting nut to release the power steering hoses at the connections on the lower right-hand side of the engine **(see illustration)**. Plug the hoses and pipe fittings after removal.
24 Remove the nut and bolt and remove the engine ground strap at the bellhousing **(see illustration)**.
25 Remove the driveshaft (see Chapter 7).
28 Remove the bolts securing the engine mount brackets to the mounts. Remove the shield on the right-hand mount.
29 Attach an engine hoist to the engine lifting brackets at the front and rear of the cylinder head. Position the chains so the engine and transmission will adopt a 45-degree angle as they are removed.
30 Make a final check that all wiring, pipes, hoses and attachments likely to impede engine removal are disconnected and positioned aside.
31 Raise the lifting gear to just take the weight of the engine, then remove the jack from under the transmission.
32 Slowly and carefully raise the unit and when sufficient clearance exists, swing it over the front body panel and out of the engine compartment **(see illustration)**.
33 Lower the engine and transmission to the ground, or position them on a bench ready for separation.

Installation

34 Installation is the reverse of the removal procedure, bearing in mind the following points.

a) Ensure that the lugs on the engine mounts engage with the slot on the mounting brackets as the engine is lowered into place.
b) Attach the transmission, the driveshaft, and the adjacent components, using the procedures described in Chapter 6 and 7.
c) On manual transmission models, bleed the clutch hydraulic system as described in Chapter 5.
d) On automatic transmission models, fill the transmission with fluid and adjust the control pressure cable as described in Chapter 6.
e) On cars equipped with air conditioning, install the air conditioning compressor drivebelt as described in Chapter 11 or 12 as applicable, after installing the compressor.
f) Refill the power steering pump reservoir with the specified fluid as described in Chapter 10.
g) Fill the cooling system as described in Chapter 2.

18 Engine – separation from and attachment to transmission

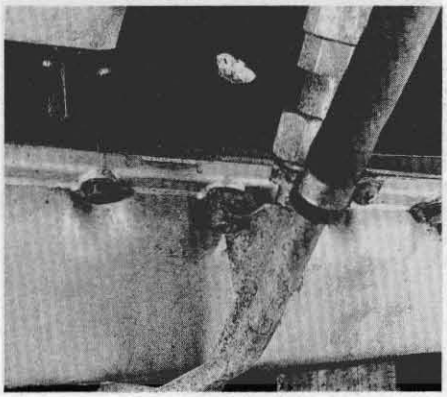
Refer to illustration 18.4

Manual transmission models

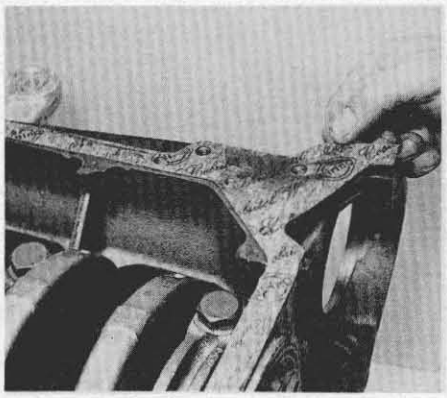
1 With the engine and transmission removed from the vehicle and resting on a workbench or the floor, remove the starter (see Chapter 12).
2 Remove the clutch slave cylinder (see Chapter 5).
3 Unscrew all the transmission-to-engine bolts, noting the location of any cable support brackets and the engine ground strap.
4 Slide the transmission off the locating dowels **(see illustration)**, keeping it level until the input shaft is clear of the clutch assembly.
5 Attachment is the reverse of separation, but be sure to lightly lubricate the input shaft splines with grease (don't overdo it though, as the grease could fly off and contaminate the clutch disc lining.

Automatic transmission models

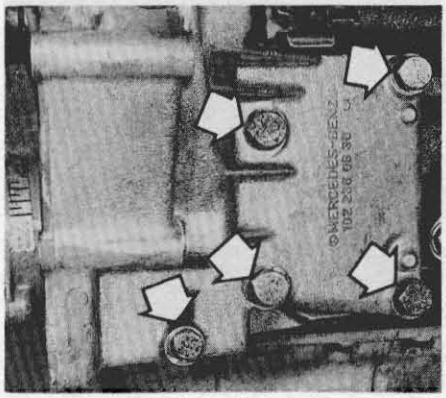
6 With the engine and transmission removed from the vehicle, position the assembly to provide access to the underside of the converter housing (some wood blocks might be helpful).
7 Remove the rubber grommet from the front face of the converter housing under the engine oil pan. Mark the relationship of the torque converter to the driveplate using a sharp scribe or a marking pen.
8 Using a large socket, turn the crankshaft until each pair of torque converter retaining bolts (there are six bolts altogether) become accessible through the converter housing opening. Remove the first two bolts, turn the crankshaft and repeat the procedure for the remaining bolts.
9 Disconnect the transmission dipstick tube at the rear of the cylinder head.
10 Disconnect the fluid cooler pipe support clips along their entire length, so the pipes can be removed with the transmission.
11 Remove the starter motor (see Chapter 12).
12 Remove the transmission-to-engine bolts, noting the location of any cable support brackets and the engine ground strap, if this hasn't already been removed.
13 Pull the transmission squarely off the engine dowels, making sure the torque converter stays on the transmission as it is removed.
14 Attachment is the reverse of separation, but lightly lubricate the torque converter stub shaft if the converter has been removed.



19.3 Power steering pipe support bracket attachment at the oil pan



19.7 When installing the oil pan gasket, make sure all the holes line up



20.5a Power steering pump mounting bracket bolts on the side of the cylinder block (arrows) . . .

19 Oil pan – removal and installation

Refer to illustrations 19.3 and 19.7

Removal

1 Remove the engine from the vehicle (see Section 17).

2 Unscrew the oil pan drain plug and allow the oil to drain into a suitable container, then reinstall the plug. Use a new sealing washer on the drain plug if the original is damaged.

3 Unbolt the power steering line support bracket and move the lines out of the way **(see illustration)**.

4 Remove the bolts securing the oil pan to the crankcase, timing cover and bellhousing (if the transmission is still attached).

5 Remove the oil pan, tapping on its corners with a soft-faced mallet if it is stuck. Don't pry between the oil pan and the block, as this will mar the mating surfaces.

6 Remove all traces of the old gasket from the pan and block. Clean the oil pan thoroughly inside and out with solvent, then wipe it dry.

Installation

7 Apply a thin coat of gasket sealant to both sides of the new gasket, position the gasket **(see illustration)** and install the pan. Install the bolts.

8 Tighten the bolts in a criss-cross pattern, a little at a time, to the torque listed in this Chapter's Specifications.

1 Remove the engine from the vehicle as described in Section 17.

20 Timing cover – removal and installation

Removal

Refer to illustrations 20.5a, 20.5b, 20.7, 20.9a, 20.9b, 20.10, 20.11, 20.13a, 20.13b and 20.13c

2 Remove the water pump as described in Chapter 2, the distributor as described in Chapter 4, and the power steering pump as described in Chapter 10.

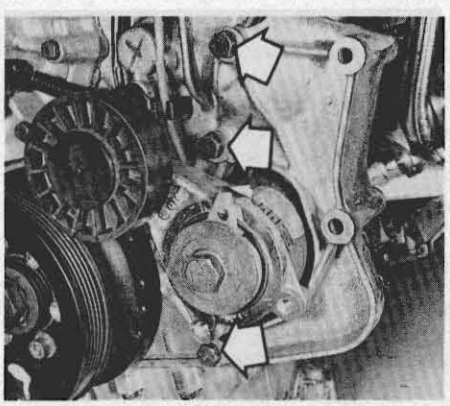
3 Remove the cylinder head as described in Section 11, and the oil pan as described in Section 19.

4 On pre-October 1984 models, remove the bolts securing the power steering pump mounting bracket to the side of the cylinder head and remove the bracket.

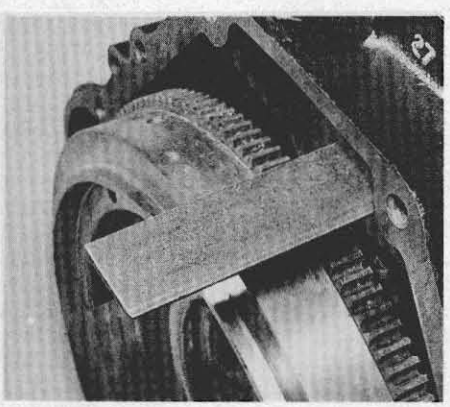
5 On models manufactured from October 1984 on, remove the five bolts securing the power steering pump mounting bracket and drivebelt tensioner assembly to the cylinder block, and the three bolts and nuts securing it to the timing cover **(see illustrations)**. If a shock absorber for the tensioner is also installed as part of this assembly, remove the additional mounts and brackets and remove the shock absorber and the mounting bracket/tensioner together.

6 Remove any other brackets which are attached to, or impeding removal of, the timing cover.

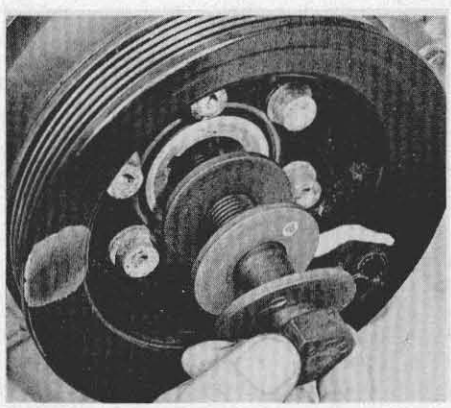
7 Lock the crankshaft by placing an angle-iron strip or similar alternative between the flywheel teeth and the side of the cylinder block **(see illustration)**.



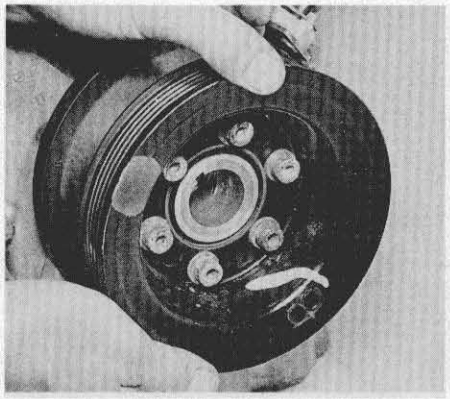
20.5b . . . and on the timing cover (arrows)



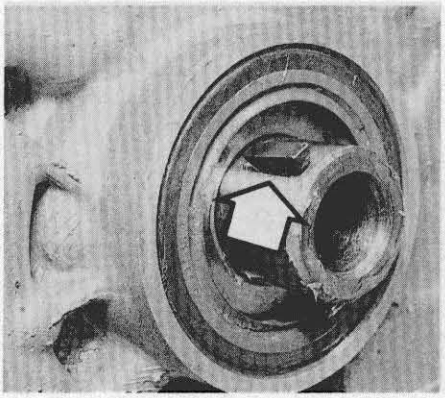
20.7 Use a strip of angle-iron to lock the ring gear teeth



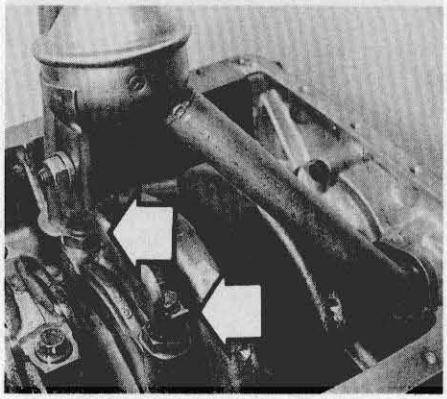
20.9a Remove the crankshaft pulley and vibration damper bolt and spring washers . . .



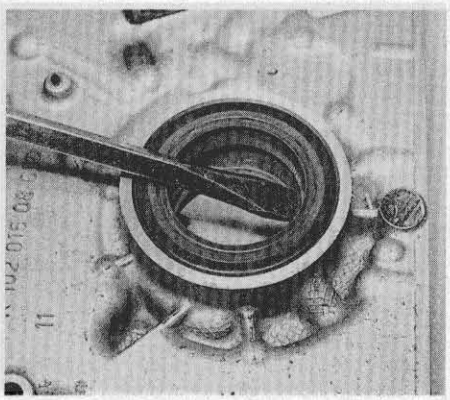
20.9b . . . and remove the pulley and damper assembly



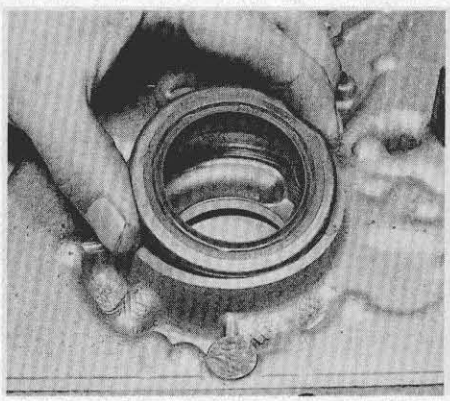
20.10 Remove the crankshaft Woodruff key (arrow) – you'll probably have to tap it out with a hammer and punch



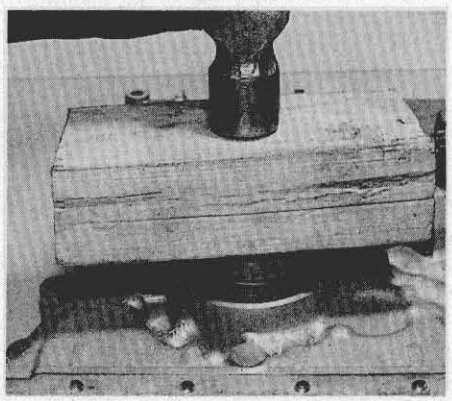
20.11 Oil pick-up tube bracket attachments to the main bearing cap bolts (arrows)



20.13a Pry out the old front oil seal from the timing cover



20.13b Install the new seal in its bore



20.13c Drive the new seal into place using a wood block and the old seal as a driver

8 With the crankshaft locked and an assistant supporting the engine, remove the crankshaft pulley retaining bolt using a 27 mm socket. This bolt is extremely tight, and considerable effort will be needed to loosen it.

9 Remove the bolt and the spring cups behind the bolt head, then withdraw the vibration damper or hub, and the pulley as an assembly **(see illustrations)**.

10 Remove the Woodruff key from the front of the crankshaft **(see illustration)**.

11 Remove the two bolts securing the oil pick-up tube support bracket to the main bearing cap **(see illustration)**.

12 Unscrew the bolts securing the timing cover to the engine, remove the cover from its dowels complete with the oil pick-up tube, and the spacer ring on the front of the crankshaft. It may be necessary to use a little judicious levering if the spacing ring is tight on the crankshaft. Be extremely careful not to scratch the crankshaft.

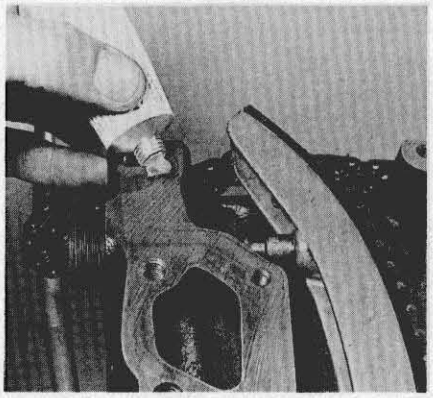
13 The crankshaft front oil seal in the timing cover should be replaced as a matter of course. Pry out the old seal using a screwdriver, then place the new seal in position and tap it in using a hammer, wood block and the old seal **(see illustrations)**.

14 Remove all traces of old gasket from the cylinder block and timing cover mating faces. Note that during manufacture, the timing cover is assembled using a sealant compound and a gasket is not used. Gaskets are supplied for repairs in service, but it is acceptable to use an RTV sealant as an alternative.

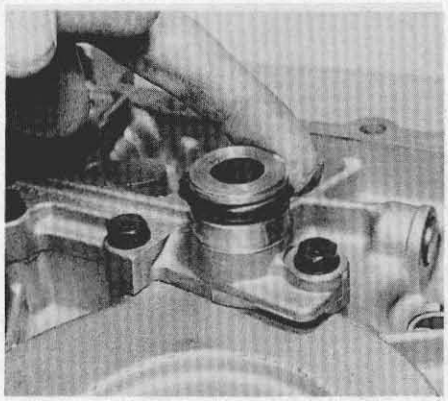
Installation

Refer to illustrations 20.15, 20.16a, 20.16b and 20.20

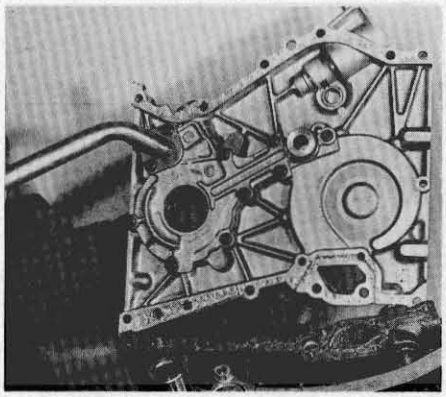
15 Place the new gaskets in position or apply a bead of RTV sealant to the cylinder block mating face **(see illustration)**.



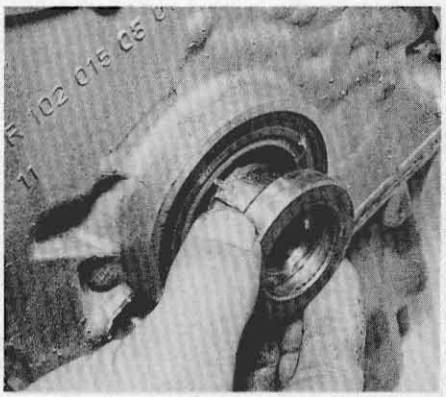
20.15 Apply a thin coat of RTV sealant to the timing cover mating face on the cylinder block



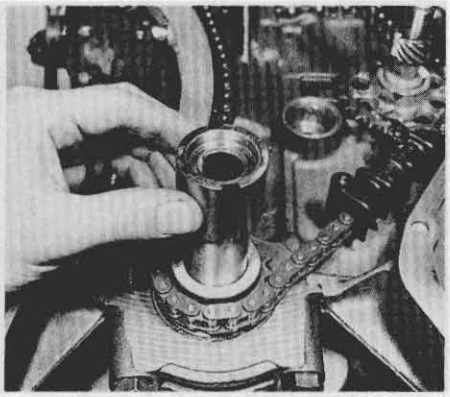
20.16a Lubricate the oil supply line O-ring . . .



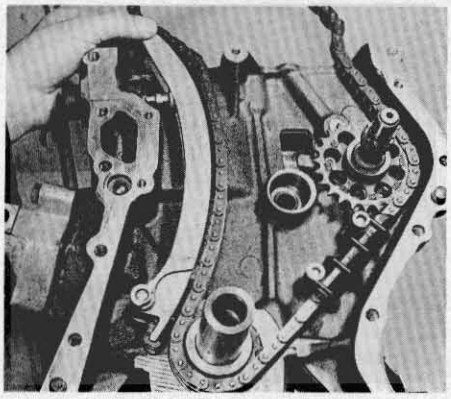
20.16b . . . and install the timing cover



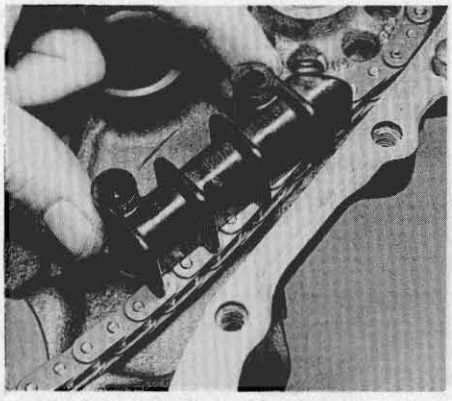
20.20 Install the crankshaft spacer ring



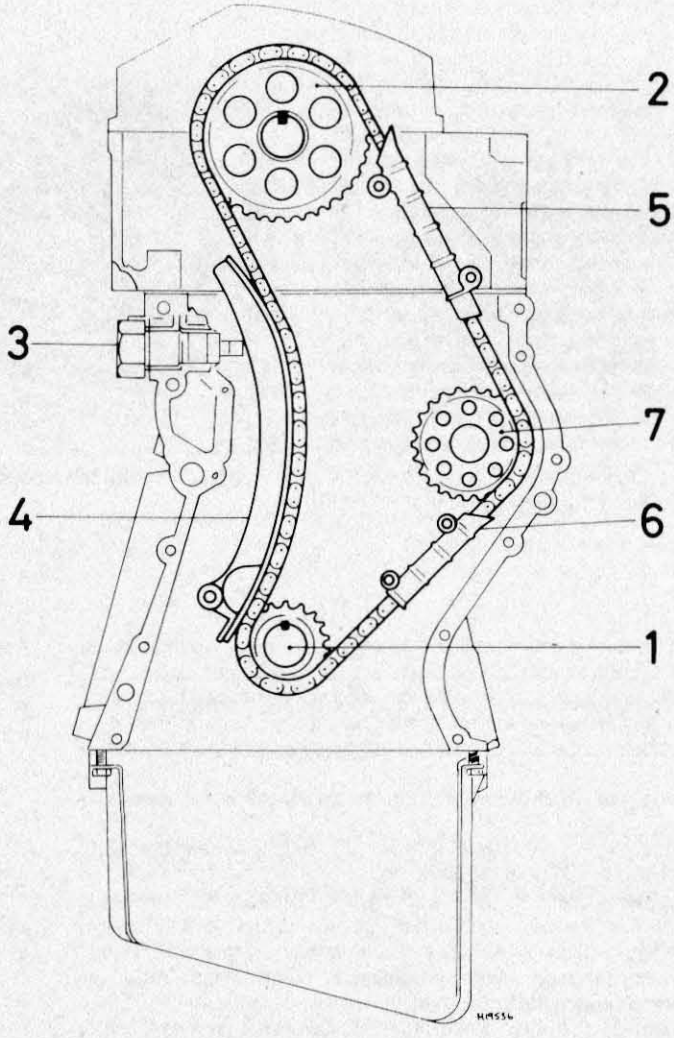
21.2 Withdraw the oil pump drive collar



21.3b Lift out the tensioning rail . . .

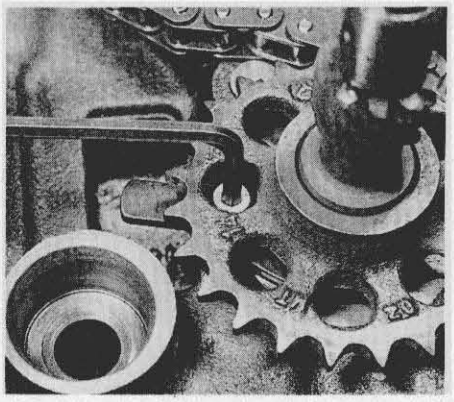


21.3c . . . followed by the slide rail

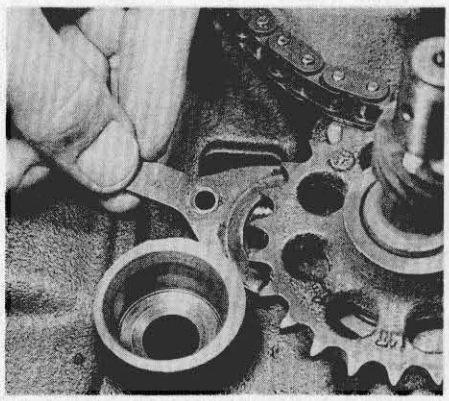


21.3a Layout of the timing chain and components (eight-valve engine shown)

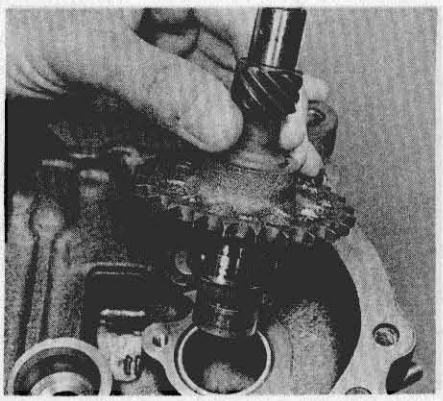
1 *Crankshaft sprocket*
2 *Camshaft sprocket*
3 *Timing chain tensioner*
4 *Tensioning rail*
5 *Slide rail*
6 *Slide rail*
7 *Intermediate gear*



21.4 Remove the intermediate shaft retaining plate bolt



21.5 Remove the retaining plate



21.6 Removing the intermediate shaft

16 Lubricate the oil supply line O-ring on the inside of the timing cover, then place the timing cover in position **(see illustrations)**.
17 Install the timing cover retaining bolts which are not used to secure any other components, and tighten them finger-tight only at this stage.
18 Install the two bolts securing the oil pick-up tube to the main bearing cap, and tighten them to the specified torque.
19 Install the water pump (Chapter 2), alternator (Chapter 12), power steering pump bracket, and any other brackets, clamps or attachments which are also retained by the timing cover bolts. Now tighten the bolts in a diagonal sequence, a little at a time, to the specified torque.
20 Install the spacer ring to the crankshaft **(see illustration)**, then tap the Woodruff key into its groove.
21 Clean the oil seal bearing surface on the crankshaft pulley, then lubricate this surface thoroughly with engine oil.
22 Install the pulley assembly, spring cups and retaining bolt, noting that the raised side of all three spring cups face the bolt head.
23 Lock the crankshaft using the same procedure as for removal, and tighten the retaining bolt to the specified torque.
24 Install the oil pan as described in Section 19 and the cylinder head as described in Sections 11.
25 Install the distributor as described in Chapter 4, and the power steering pump as described in Chapter 10.
26 Install the engine (see Section 17). Check all the fluid levels, adding if necessary.

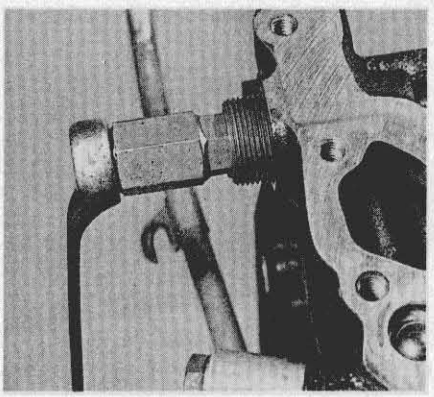
21 Timing chain components and intermediate shaft – removal and installation

Refer to illustrations 21.2, 21.3a, 21.3b, 21.3c, 21.4, 21.5, 21.6 and 21.7

Note: *This procedure was performed and photographed on an eight-valve engine, but also applies to the 16-valve engine. If you are working on a 16-valve model, simply ignore the Steps which do not apply.*

Removal

1 Remove the timing cover as described in Section 20.
2 Remove the oil pump drive collar from the end of the crankshaft **(see illustration)**.
3 Lift out the tensioning rail, followed by the slide rail **(see illustrations)**.
4 Using an Allen wrench, remove the intermediate shaft retaining plate bolt, inserting the Allen wrench through one of the sprocket holes **(see illustration)** (eight-valve engines). On 16-valve engines, remove the plug and sealing ring from the intermediate shaft. Hold the gear and slide the shaft out, then remove the gear.
5 Remove the bolt and withdraw the retaining plate **(see illustration)**.

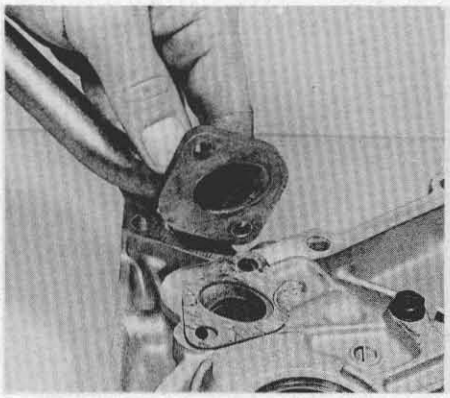


21.7 Unscrew the timing chain tensioner body

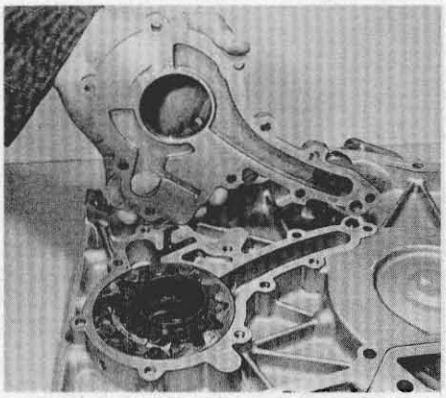
6 Lift the intermediate shaft out of its bearing, slip off the chain and remove the shaft **(see illustration)**.
7 Using a large Allen wrench or hexagonal adaptor, unscrew the timing chain tensioner body from its location **(see illustration)**.
8 If required, the timing chain sprocket on the crankshaft can be removed using two screwdrivers positioned on either side, as levers. Remove the Woodruff key after removing the sprocket.
9 Carry out a careful inspection of the components as described in Section 26, and obtain new parts as necessary.

Installation

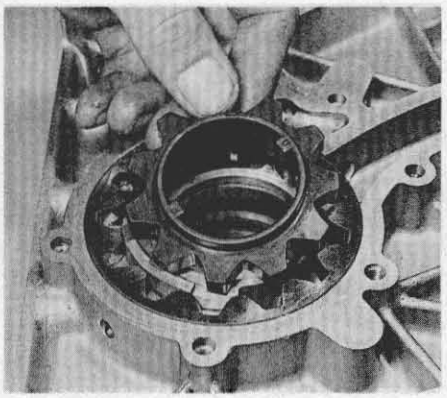
10 If removed, install the Woodruff key and the sprocket to the crankshaft.
11 Lubricate the intermediate shaft bearing with engine oil, place the timing chain over the intermediate shaft sprocket and place the shaft in its bearing.
12 Install the intermediate shaft retaining plate and its retaining bolt.
13 Engage the timing chain over the crankshaft sprocket, then place the tensioning rail and slide rail over their locating pegs.
14 Push out the timing chain tensioner plunger from the tensioner body and insert the plunger up to detent "A" **(see illustration 10.40)**.
15 Install the tensioner body and tighten it securely.
16 Install the oil pump drive collar to the crankshaft.
17 Pull the timing chain up so that it roughly adopts its normal running position, and keep it in this position during the engine reassembly procedure.
18 Install the timing cover as described in Section 20.



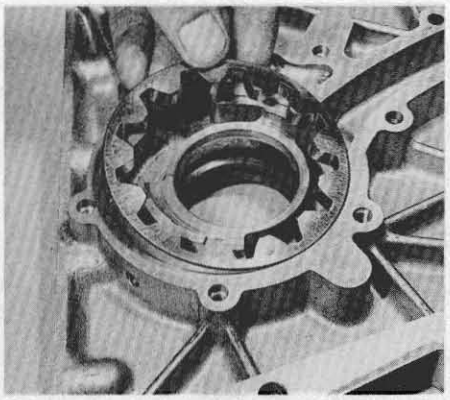
22.2 Remove the oil pick-up tube



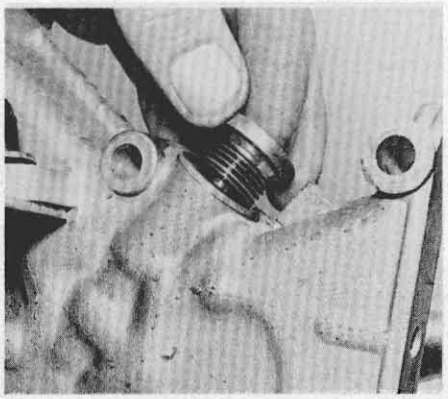
22.3 Lift off the oil pump cover



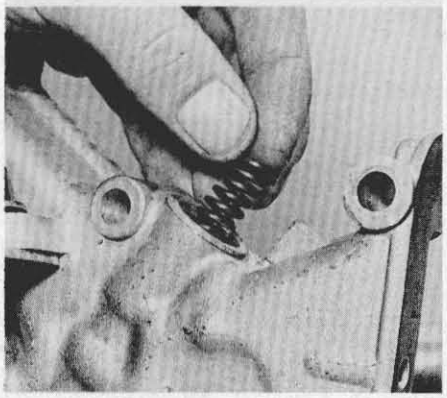
22.4a Remove the oil pump inner rotor . . .



22.4b . . . and outer rotor



22.5a Unscrew the oil pressure relief valve plug



22.5b Remove the tension spring

22 Oil pump – disassembly and reassembly

Refer to illustrations 22.2, 22.3, 22.4a, 22.4b, 22.5a, 22.5b, 22.5c, 22.10 and 22.12

Disassembly

1 Remove the timing cover as described in Section 19.

2 Remove the bolts securing the oil pick-up tube to the oil pump cover, and remove the tube and gasket **(see illustration)**.

3 Remove the bolts and lift off the oil pump cover **(see illustration)**.

4 Withdraw the pump inner and outer rotors **(see illustrations)**.

5 Unscrew the oil pressure relief valve plug on the side of the timing cover and withdraw the tension spring, valve and sealing ring **(see illustrations)**.

6 Carry out a careful inspection of the pump components as described in Section 26, and obtain new parts as necessary.

Reassembly

7 Ensure that the timing cover, oil pump components and mating surfaces are thoroughly clean and dry.

8 Install the pump inner and outer rotors, then pack the spaces between the rotor teeth with petroleum jelly. This will ensure the pump is primed adequately, so oil pressure will develop quickly when the engine is initially started.

9 Install the pump cover and secure with the retaining bolts tightened to the specified torque.

10 Place a new pick-up tube gasket on the pump cover so the rounded offset edge of the gasket is towards the top of the timing cover **(see illustration)**.

11 Install the pick-up tube and secure with the two bolts tightened to the specified torque.

12 Replace the O-ring on the oil gallery supply line outlet **(see illustration)**.

13 Install the pressure relief valve into its bore after lubricating it thoroughly, then install the tension spring and valve plug.

23 Flywheel or torque converter driveplate – removal and installation

1 Remove the engine as described in Section 17, then separate the gearbox or automatic transmission as described in Section 18. Alternatively, the work can be performed with the engine in the vehicle, but with the transmission removed as described in Chapter 6.

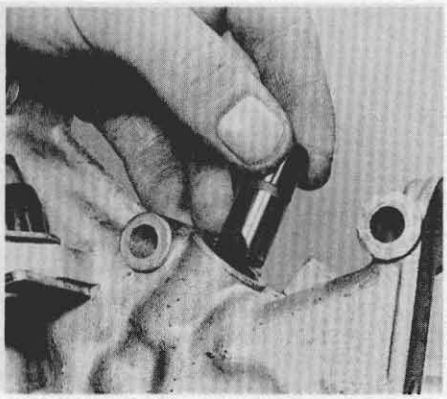
2 On manual transmission models, remove the clutch assembly as described in Chapter 5.

3 Working in a diagonal sequence, one at a time, loosen the bolts securing the flywheel or driveplate to the crankshaft. The crankshaft can be prevented from turning as the bolts are loosened using a strip of angle-iron or something similar between the ring gear teeth and the side of the cylinder block **(see illustration 20.7)**.

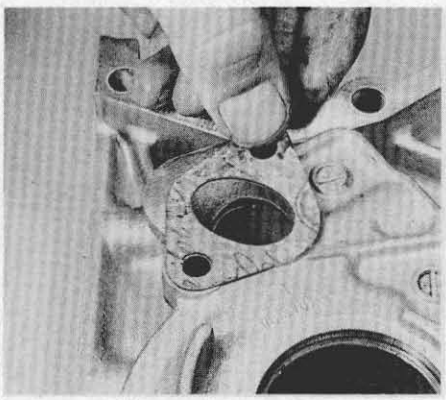
4 With all the bolts loose, unscrew them completely and remove the flywheel or driveplate and spacers (if present).

5 Perform a careful component inspection as described in Section 26.

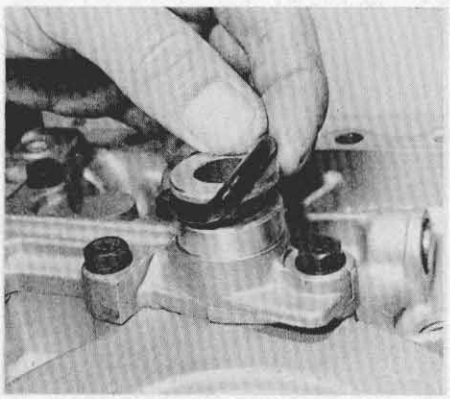
6 Before installing, the length of the stretch-type retaining bolts and the diameter of the stepped down portion must be measured and the dimensions compared with those given in the Specifications. Replace the bolts if the dimensions are outside the tolerance range.



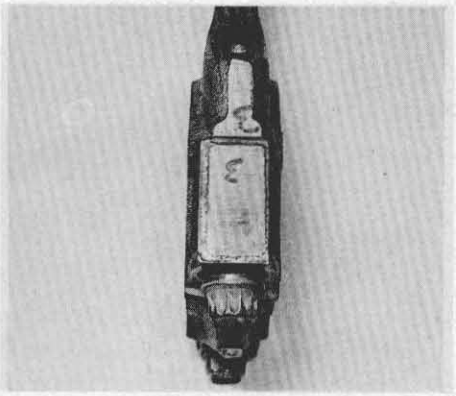
22.5c Pull out the pressure relief valve



22.10 Position the pick-up tube gasket with the rounded offset edge towards the top of the timing cover



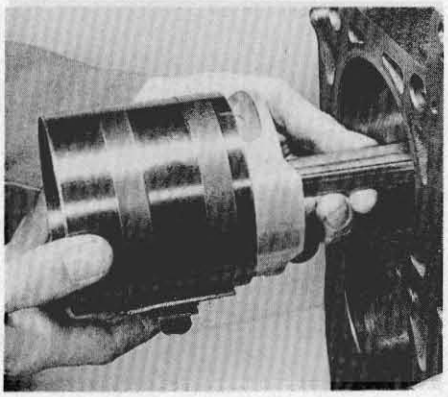
22.12 Replace the oil supply pipe O-ring



24.3 Identification numbers on the connecting rod and cap sides



24.4 Remove the connecting rod cap and bearing shell



24.11a With a piston ring compressor in place, guide the piston and connecting rod into its bore

7 Place the flywheel or driveplate on the crankshaft with the unused hole in each aligned. Where spacers are fitted, these must be positioned one on each side of the driveplate.
8 Install the bolts and tighten them progressively and in a diagonal sequence to the specified 1st stage torque setting, while holding the crankshaft as before.
9 Tighten each retaining bolt using a breaker bar, not a torque wrench, by a further 90-degrees.
10 On manual transmission models, install the clutch assembly as described in Chapter 5.
11 Reconnect and install the engine and transmission as described in Sections 18 and 17 respectively, or install the transmission as described in Chapter 6, as applicable.

24 Connecting rod and piston assemblies – removal and installation

Removal

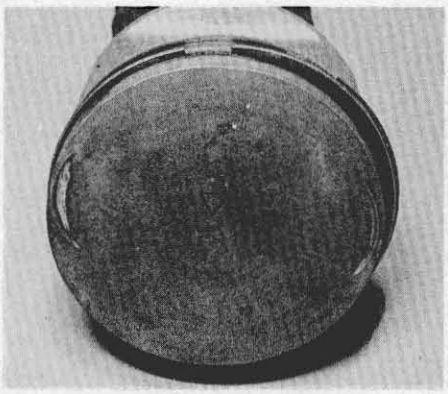
Refer to illustrations 24.3 and 24.4

1 Remove the engine from the vehicle as described in Section 17, then remove the cylinder head and the oil pan as described in Section 10 and 19 respectively.
2 Turn the crankshaft so that No. 1 piston is at the bottom of its bore. While turning the crankshaft, keep tension on the timing chain so that it does not jam in the slide rails or become disengaged from the crankshaft sprocket.
3 Check that marks or numbers identifying each connecting rod and bearing cap in relation to its cylinder are visible on the side of the rod and cap **(see illustration)**. If no form of identification can be seen, mark each rod and cap with a center punch accordingly.
4 Remove the bearing cap retaining nuts (or bolts on later models) and remove the cap and bearing shell **(see illustration)**. Tap the cap from side to side if necessary to free it from the connecting rod.
5 Using the handle of a hammer, push the piston and connecting rod out of the top of the cylinder. Keep the bearing shells in position in the connecting rod and cap, and loosely install the cap to the rod.
6 Repeat these operations to remove the remaining piston and connecting rod assemblies.
7 Removal of the pistons and piston rings, and inspection of the components, is covered in Section 26.

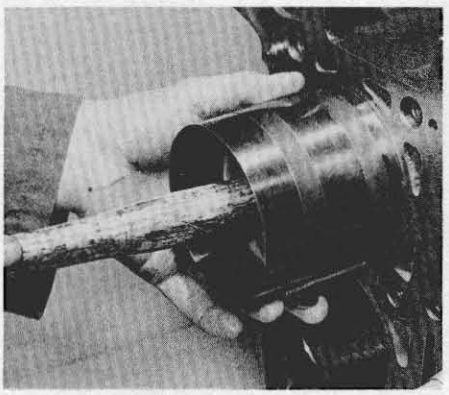
Installation

Refer to illustrations 24.11a, 24.11b and 24.12

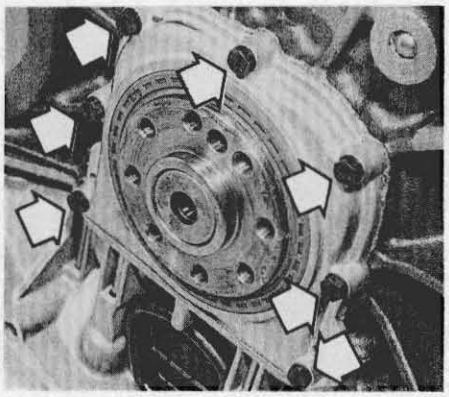
8 Starting with the assembly for No. 1 cylinder, space the piston ring gaps so that they are all at 120-degrees to each other, then thoroughly lubricate the piston, rings and cylinder bore with engine oil.
9 Turn the crankshaft so that the No. 1 journal is at its lowest position. Remove the bearing cap from the connecting rod if it's still in place.
10 Dip the top of the piston in clean engine oil, submerging the rings. Take the piston out of the oil and install a piston ring compressor over the rings, tightening it securely.
11 Liberally lubricate the cylinder bore with clean engine oil. Introduce the assembly into the cylinder bore, with the arrow or triangular mark pointing towards the timing chain end of the engine **(see illustrations)**.



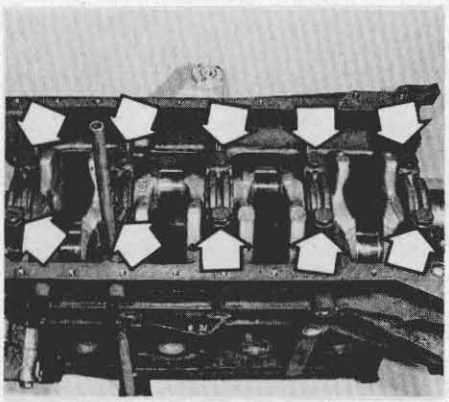
24.11b The directional mark on the top of the piston must point towards the timing chain end of the engine



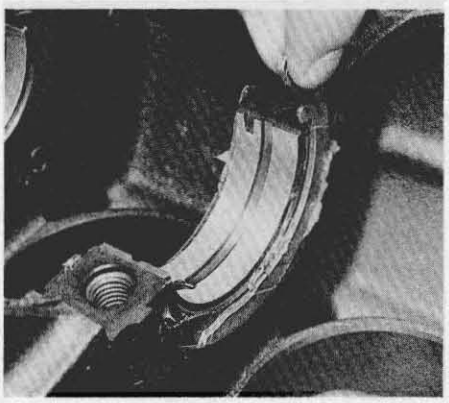
24.12 Carefully tap the piston down into the bore with a hammer handle



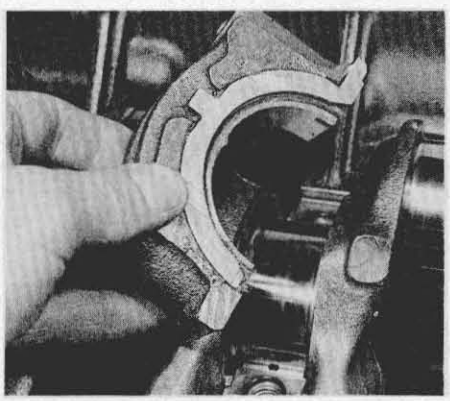
25.2 Crankshaft rear oil seal carrier bolts (arrows)



25.4 Remove the main bearing cap retaining bolts (arrows)



25.9 Install the upper thrust washers with the oil grooves facing out



25.11 Lower thrust washers engaged with the bearing cap notches

12 Tap the piston down into its bore until it is fully inserted in the cylinder **(see illustration)**.

13 Guide the connecting rod, with the bearing shell in place, onto the crankshaft journal while still tapping the piston down.

14 Lubricate the bearing journal thoroughly, then install the cap to the rod, making sure the numbers line up. Also, the bearing shell locating notches on the connecting rod and bearing cap must be on the same side of the crankshaft journal when the cap is installed.

15 Install the cap retaining nuts or bolts. Tighten them initially to the stage 1 torque setting, then to the stage 2 torque angle, as given in the Specifications. Use a breaker bar, not a torque wrench, for the angle tightening.

16 Repeat these operations to install the remaining piston and connecting rod assemblies.

17 On completion, install the oil pan and cylinder head as described in Sections 19 and 10, then install the engine to the car as described in Section 17.

25 Crankshaft – removal and installation

Removal

Refer to illustrations 25.2 and 25.4

1 Remove the engine from the car, separate it from the transmission, then remove the cylinder head, oil pan, timing cover and chain components, flywheel or torque converter driveplate, and the connecting rod and piston assemblies as previously described.

2 Remove the seven bolts and remove the crankshaft rear oil seal carrier and seal from the rear of the block **(see illustration)**.

3 Check that the main bearing caps are numbered 1 to 5 from the timing chain end, and if not, file some small notches on the edge of each cap to identify it accordingly.

4 Remove the bolts securing each main bearing cap to the crankcase **(see illustration)**, and remove the caps complete with the lower main bearing shell. Remove the two thrust washers at the center main bearing.

5 When all the bearing caps have been removed, lift out the crankshaft.

6 Remove the upper main bearing shells from the crankcase, together with the two upper thrust washers, and place the bearings with their respective caps.

7 Perform a careful inspection of the crankshaft, bearings and cylinder block, as described in Section 26.

Installation

Refer to illustrations 25.9, 25.11, 25.14, 25.15 and 25.17

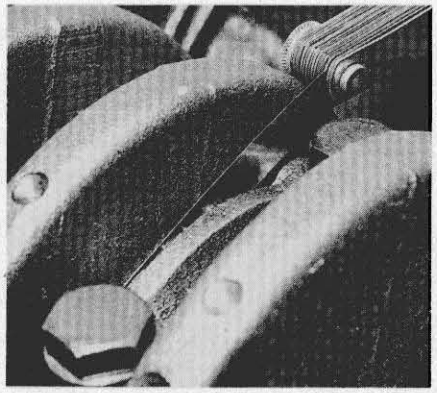
8 Begin installation by placing the bearing shell upper halves in their respective locations.

9 Stick the thrust washer upper halves to each side of the center bearing, using a little grease, and so that the oil grooves are facing outwards, towards the crankshaft **(see illustration)**. The thrust washer upper halves are the ones without the locating tags.

10 Thoroughly lubricate the bearing shells and crankshaft journals, then lower the crankshaft into position.

11 Install the lower bearing shell and the two remaining thrust washers to the center main bearing cap, so that the tags on the thrust washers engage with the cap notches, and the oil grooves are facing outwards **(see illustration)**.

12 Fit the cap to the center bearing journal, so that the bearing shell locating notches in the cap and crankcase are on the same side of the bearing journal. The cap is slightly offset to one side, so it should be impossible to install it the wrong way.



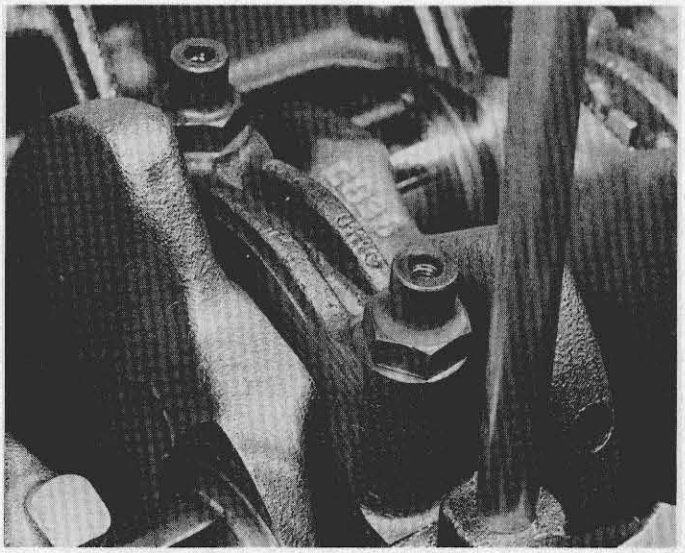
25.14 Checking crankshaft endplay with a feeler gauge

13 Install the remaining bolts and tighten them to the specified torque.
14 Using a dial gauge, or feeler gauges between the thrust washers and the side of the crankshaft, check the crankshaft endplay **(see illustration)**. If new standard size thrust washers have been installed, the endplay should be within the tolerance range given in the Specifications. If the endplay is excessive, oversize thrust washers are available.
15 Install the remaining bearing shells and caps in the same way, noting that the special threaded bolts used to secure the oil pump pick-up tube are installed in the No. 2 bearing cap **(see illustration)**.
16 Replace the crankshaft rear oil seal by prying it out of the carrier using a screwdriver, then carefully tapping in a new seal using a hammer and large block of wood.
17 Lubricate the oil seal lips with multi-purpose grease, and apply RTV sealant to the carrier mating face **(see illustration)**.
18 Carefully place the seal over the crankshaft, then install and tighten the carrier retaining bolts.
19 The remainder of installation is the reverse of removal.

26 Component inspection

Refer to illustrations 26.3, 26.20, 26.21, 26.23, 26.33, 26.45a, 26.45b

1 Clean all components using paraffin or a water-soluble solvent, then dry them with a lint-free rag.

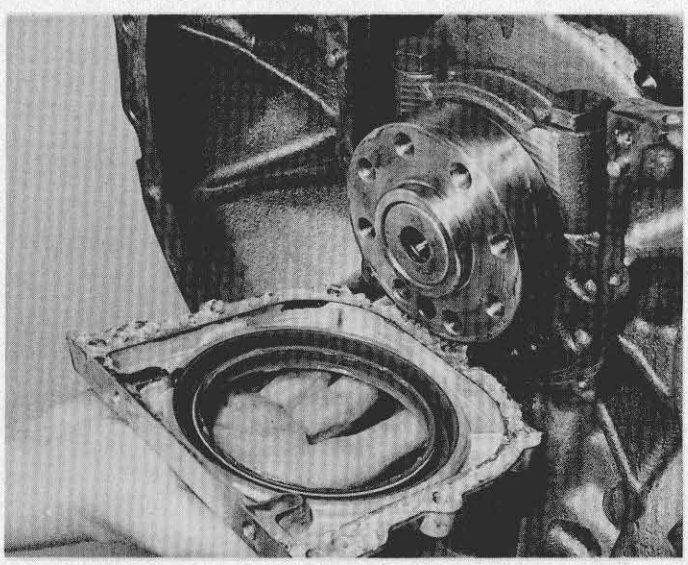


25.15 The special internally-threaded bolts are installed to the No. 2 main bearing cap

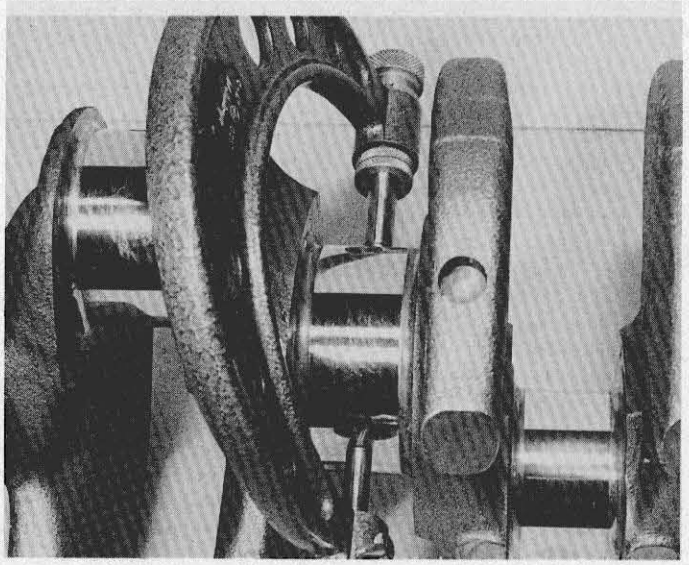
2 Carefully examine each part as described in the following paragraphs, and with reference to the Specifications for dimensions, clearances, and tolerances etc. Replace any parts that are worn, damaged, or in any way suspect. Replace main and connecting rod bearing shells as a matter of course, unless you know that they have had little wear and are in perfect condition.

Crankshaft, main and connecting rod bearings

3 Examine the bearing surfaces of the crankshaft for scoring or grooving and, using a micrometer, check each main and big-end journal for ovality **(see illustration)**. If the journals are scored, or if their size is outside the specified limits, the crankshaft will have to be reground and undersize bearing shells installed.
4 Crankshaft regrinding must be performed by an automotive machine shop, who will normally supply the matching main and connecting rod bearing shells.
5 If the crankshaft is in a satisfactory condition, new bearing shells and thrust washers should be obtained as a matter of course.



25.17 Apply a thin coat of RTV sealant and install the rear oil seal carrier



26.3 Check the main bearing journal size with a micrometer

Cylinder block and crankcase

6 The cylinder bores must be examined for taper, ovality, scoring and scratches. Start by examining the top of the bores. If these are worn, a slight ridge will be found which marks the top of the piston ring travel. If the wear is excessive, the engine will have had a high oil consumption rate, accompanied by blue smoke from the exhaust.

7 Using an internal micrometer, measure the bore diameter just below the ridge, then halfway down the bore, then at the bottom of the bore, which is not subject to wear. Take these measurements in a longitudinal direction (in line with the crankshaft), then in a transverse direction. Compare the measurements with the figures in the Specifications for bore diameter, taper and ovality. If the wear is excessive, it will be necessary to have the cylinder rebored and oversize pistons installed.

8 If new pistons are being installed to old bores, it is essential to roughen the bore walls slightly, using a cylinder hone, to remove the glaze from the cylinder walls and enable the new piston rings to bed in properly.

9 Thoroughly examine the crankcase and cylinder block for cracks and damage, and use a piece of wire to probe all oilways and waterways to ensure they are unobstructed.

10 The diameter of the main bearing bores with the bearing shells in place should be measured, so that the main bearing journal running clearances can be determined.

11 Install the bearing shells to the crankcase and bearing caps, install the caps in their correct positions, then install and fully tighten the retaining bolts. Measure the internal diameter of each bearing, then measure the diameters of the respective journals on the crankshaft. Subtract the journal diameter from the bearing diameters to give the running clearance. If it is excessive, new bearing shells are required.

Piston and connecting rod assemblies

12 On cars manufactured prior to October 1984, the pistons are retained by fully floating piston pins, which are retained by circlips. These can be easily removed, as described below, should it be necessary to replace the pistons or connecting rods. On later models, however, the piston pins are an interference fit in the connecting rods. If the pistons or connecting rods on these engines are to be replaced, it will be necessary to have this work carried out by a Mercedes-Benz dealer service department or other repair shop, who will have the necessary special tools.

13 To remove the fully floating piston pins, extract the circlips in the piston grooves, support the piston and gently tap out the piston pin using a soft metal drift. Before separating the piston and connecting rod, make a note of which side the bearing locating notch in the connecting rod is positioned on, in relation to the direction of travel arrow on the piston crown. This relationship must be maintained on reassembly.

14 To remove the piston rings, expand them carefully, starting with the top ring, and slide them up and off. The use of a piston ring expander is recommended.

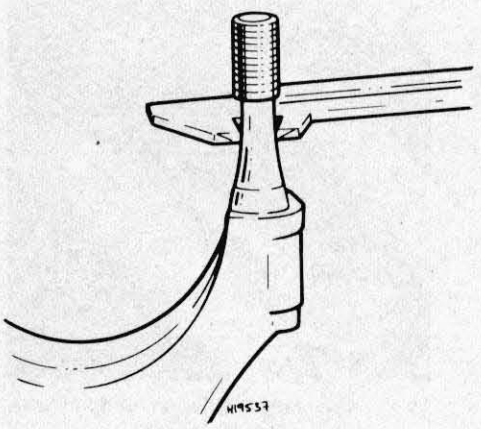
15 Ensure that the ring grooves in the piston are free of carbon by cleaning them using an old ring, break the ring in half to do this. Carefully remove the carbon from the piston crown using a scraper.

16 Check the piston for signs of excessive scuffing on the skirt or other signs of wear. Measure the piston diameter using a micrometer, and compare the figure with that given in the Specifications. The standard cylinder bore and piston sizes are divided into three classes which are identified 0, 1 and 2. This identification number is stamped on the cylinder lock face adjacent to the cylinder, and should also appear on the piston crown. A similar three-class size arrangement is also used for the oversize reboring dimensions. To maintain the correct piston-to-bore clearances the piston and its respective cylinder bore must always be of the same class.

17 Check the piston ring grooves in the piston for wear by placing the edge of the ring in the groove and viewing it end-on. Wear will be obvious if the ring can be moved up and down, but a more accurate check can be made using a feeler gauge between the ring and the top face of the groove. Also check for wear ridges in the rings themselves.

18 Check the connecting rods for any signs of obvious distortion, and check the fit of the fully floating piston pin in the bushing.

19 The diameter of the connecting rod bearing bores should also be checked to determine the bearing running clearances, and is carried out in the same way as for the main bearings described in paragraphs 10 and 11.

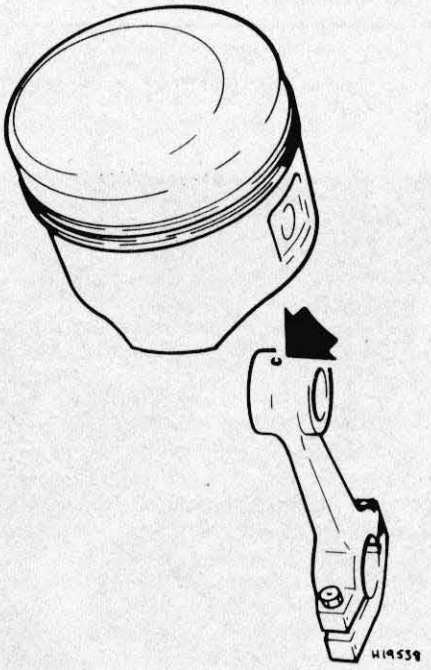


26.20 Checking connecting rod stud width – if the width is less than specified, replace both studs on the connecting rod

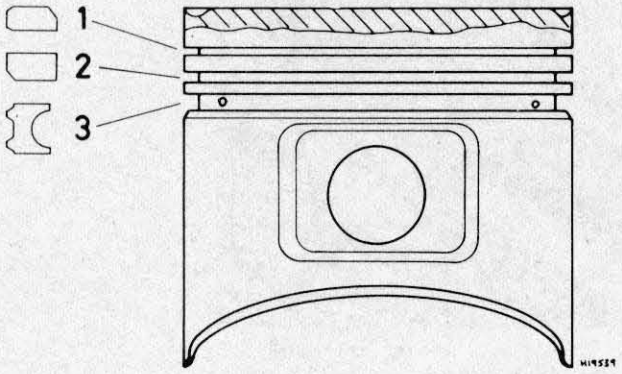
20 Finally, measure the width of the studs or bolts, used to secure the connecting rod bearing cap, at the stepped down portion in the center of the stud or bolt **(see illustration)**. If this dimension is less than shown in the Specifications, then the studs or bolts have stretched excessively and must be replaced.

21 Install the pistons to the connecting rods so that the bearing notch in the rod is on the correct side in relation to the piston arrow, as noted during removal. As a double check, the offset of the oil hole in the top of the rod must be towards the timing chain end of the engine **(see illustration)**.

22 Push in the piston pin by hand and secure with new circlips, located fully in the piston grooves.

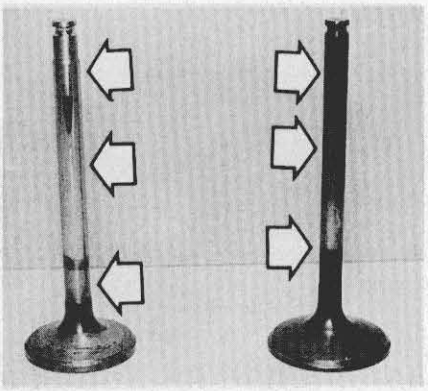


26.21 The hole in the top of the connecting rod must be offset towards the timing chain end of the engine when installing the piston



26.23 Piston ring identification

1 Top compression ring
2 Second compression ring
3 Oil control ring



26.33 Measure the exhaust valve (left) and intake valve (right) stem diameters at the points indicated

23 Carefully install the new rings to the pistons **(see illustration)**, starting with the oil control ring, using a piston ring expander as for removal. The words TOP on the rings must be towards the top of the piston. When all the rings are in place, space out their ends at 120-degrees to each other.

Timing cover, gears, chain and intermediate shaft

24 Examine all the teeth on the camshaft, crankshaft and intermediate shaft sprockets. If these teeth are "hooked" in appearance, replace the sprockets.

25 Examine the timing chain for wear ridges on the rollers, or looseness of the rivets or side plates. If it has been in operation for a considerable time, or if when held horizontally (rollers vertical) it takes on a deeply bowed appearance, replace the chain.

26 Check the slide rails, tensioning rail and tensioner for obvious signs of wear or damage, and replace as necessary.

27 Check the distributor drivegear on the intermediate shaft, and check the fit of the shaft in its bushings. Replace the intermediate shaft if worn. If the shaft bushings require replacement, this work will have to be performed by a Mercedes-Benz dealer service department or other repair shop.

28 Check the timing cover for cracks or damage, and replace as necessary.

Oil pump

29 Check for scoring or wear ridges on the pump inner and outer rotors, rotor teeth, pump cover and the pump casing formed in the timing cover. If the rotors are worn, these can be replaced as a rotor set. If the pump casing or pump cover are worn, it will be necessary to obtain a new timing cover.

Flywheel or torque converter driveplate

30 Examine the flywheel for scoring or grooving of the clutch face, and for wear or chipping of the ring gear teeth. If the clutch face is scored, the flywheel should be replaced. If the ring gear is worn or damaged it may be replaced separately, but this is a job best left to a Mercedes-Benz dealer service department or other repair shop. The temperature to which the ring gear must be heated for installation is critical, and if not done accurately, the hardness of the teeth will be destroyed.

31 Check the torque converter driveplate carefully for signs of distortion, or any hairline cracks around the bolt holes or radiating outwards from the center.

Cylinder head and valves

32 Before carrying out any examination, the cylinder head and valves should be completely decarbonized as described in Section 27.

33 Check each valve carefully for any obvious signs of wear or damage. If the valve appears initially satisfactory, measure the stem diameter at several points using a micrometer **(see illustration)**. If the diameter is less than specified, replace the valve. Check the valve head for excessive pitting, or a concave appearance of the valve seat. Minor pitting can be removed when grinding in the valve but if the pitting is deep or the seat is concave then the valve should be machined to restore the seat condition, or if severe, replaced.

34 Check the condition of the valve seat in the cylinder head in the same way as for the valve. Light pitting can be removed by grinding-in, but if the seat condition is poor, it should be recut using valve seat cutting tools. If the seat is severely damaged beyond reclamation, the seat insert can be removed and a new one installed. This work and any major seat reconditioning should be left to a Mercedes-Benz dealer service department or other repair shop.

35 Place each valve in turn in its guide so that approximately one-third of its length enters. Rock the valve from side to side. If there is any more than a very slight movement, the valve guides are worn and will have to be replaced by a dealer.

36 Measure the valve spring length and replace the springs if the length is less than specified. It is advisable to replace the springs as a matter of course if major reconditioning work is being carried out on the cylinder head.

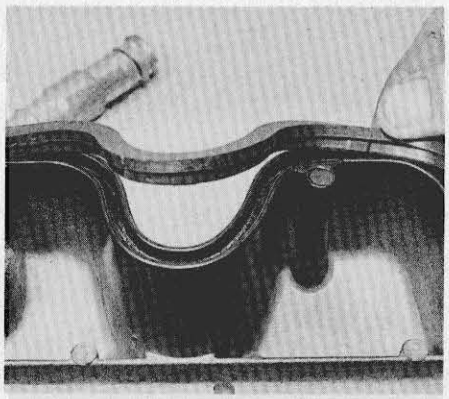
37 Check the condition of the cylinder head itself, paying particular attention to the camshaft bearing journals and the head mating face. If the journals are scored, or if the mating face has been damaged by corrosion to a serious level, reconditioning by machining operations can be carried out, but the advice of a dealer should be sought.

38 Measure the length of the cylinder head bolts **(see illustration 10.34)**. These stretch-type bolts must be replaced if their length exceeds the specified dimension.

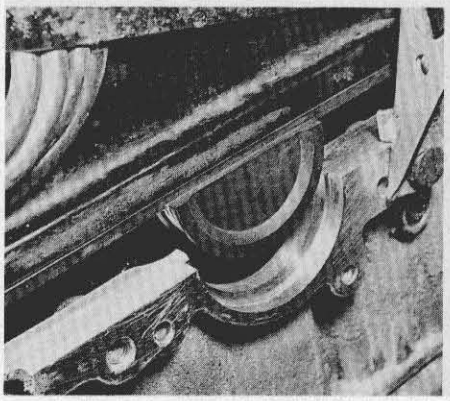
Camshaft(s), rocker arms (eight-valve engines) and cam followers (16-valve engines)

39 Examine the camshaft bearings and the cam lobes for any sign of scoring, wear grooves or pitting and if apparent replace the camshaft. Any damage of this nature may have been caused by a blocked oil passage either in the cylinder head, rocker assemblies or the oil spray pipe, and carefully examination should be carried out to determine the cause. If the camshaft is replaced, all the rocker arms or cam followers must be replaced at the same time.

40 With the camshaft bearing brackets removed, the rocker arms can be removed from the brackets after drawing out the short rocker shaft. Ideally the manufacturer's tool, which is a slide hammer that screws into the end of the shaft, should be used. An alternative method is to screw in a suitable long bolt and washer, then strike the washer with a hammer away from the bearing bracket to force out the shaft. The rocker can now be withdrawn.



26.45a Ensure that the camshaft cover gasket engages in the cover recess . . .



26.45b . . . and the half-round projection engages with the cylinder head opening

41 Check for wear of the rocker arm to camshaft contact pad, check the fit of the rocker on its shaft, and check the condition of the adjusting screw end on engines without hydraulic tappets. Replace any of these components that show signs of wear.

42 When installing the rocker arms and rocker shafts, ensure that the shaft is positioned with the groove for the retaining bolt aligned with the bolt hole in the bearing bracket.

Oil seals and gaskets

43 Replace the oil seals in the timing cover and crankshaft rear oil seal carrier, whenever these components are removed, as a matter of course. The seals are removed by prying them out with a screwdriver and tapping in the new seal squarely using a hammer and block of wood. The seals must be installed so that their open side is towards the engine. Lubricate the oil seal lips with multi-purpose grease prior to installing the oil seal carrier or timing cover.

44 Replace all gaskets either individually, or in a top or bottom overhaul set, if major repair work is being undertaken. Also replace any O-rings unless their condition is perfect after inspection.

45 When installing a new camshaft cover gasket, ensure that it locates in the camshaft cover recess around the cover edge **(see illustration)**. On later engines, a half-round projection engages with the opening on the cylinder head, and is incorporated in the gasket **(see illustration)**. On earlier engines, there was a corresponding half-round opening in the camshaft cover, and the resulting hole was sealed by a separate circular rubber sealing disc. This disc should be inspected and replaced at the same time as the camshaft cover gasket on engines so equipped.

26 Cylinder head and pistons – decarbonizing

1 With the cylinder head removed as described in Section 10, the carbon deposits should be removed from the combustion surfaces using a blunt scraper. Take great care as the head is made of an aluminum alloy construction, and avoid the use of a rotary (power-driven) wire brush.

2 Where a more thorough job is to be carried out, the cylinder head should be disassembled, as described in Section 11, so that the valves may be ground in, and the ports and combustion spaces cleaned and blown out after the manifolds have been removed.

3 Before grinding-in a valve, remove the carbon and deposits completely from its head and stem. With an intake valve this is usually quite easy, simply a case of scraping off the soft carbon with a blunt knife and finishing with a wire brush. With an exhaust valve, the deposits are very much harder and those on the valve head may need to be removed with coarse sandpaper. A woodworking chisel is a useful tool to remove the worst of the valve head deposits.

4 Make sure that the valve heads are very clean, otherwise the rubber suction cup grinding tool will not stick during the grinding-in operations.

5 Before starting to grind in a valve, support the cylinder head so there is sufficient clearance under it for the valve stem to project fully without being obstructed, otherwise the valve will not seat properly during grinding.

6 Take the first valve and apply a little coarse grinding paste to the bevelled edge of the valve head. Insert the valve into its guide and apply the suction grinding tool to its head. Rotate the tool between the palms of the hands in a back-and-forth rotary movement until the gritty action of the grinding-in process disappears. Repeat the operation with fine paste and then wipe away all traces of grinding paste and examine the seat and bevelled edge of the valve. A matte silver mating band should be observed on both components, without any sign of black spots. If some spots do remain, repeat the grinding-in process until they have disappeared. On completion, wipe away all traces of grinding paste using solvent and a rag.

7 Repeat the operation on the remaining valves, taking care not to mix them up.

8 An important part of the decarbonizing process is to remove the carbon deposits from the piston crowns. To do this (engine in vehicle), turn the crankshaft (be sure to hold tension on the timing chain to keep it from falling off the crankshaft sprocket) so two pistons are at the top of their stroke, then press some grease between the pistons and the cylinder walls. This will prevent carbon particles falling down into the piston ring grooves. Plug the other two bores with rags.

9 Cover the oilways and coolant passages with masking tape and then, using a blunt scraper, remove all the carbon from the piston crowns. Be very careful not to gouge the piston or scratch the cylinder bore.

10 Rotate the crankshaft 180-degrees (again supporting the timing chain) to bring the other two pistons to TDC and repeat the operations.

11 Wipe away the circles of grease and carbon from the cylinder bores.

12 Clean the top surface of the cylinder block by careful scraping.

27 Troubleshooting – engine

Symptom	Reason(s)
Engine fails to turn over when starter operated	Discharged or defective battery Dirty or loose battery cables Defective starter solenoid or switch Defective starter motor Engine ground strap disconnected

27 Troubleshooting – engine

Symptom	Reason(s)
Engine turns over but will not start	Coil wire disconnected Ignition primary wiring disconnected or broken Electronic ignition system fault Fuel tank empty Fuel pump faulty Other fuel system defect
Engine idles erratically	Incorrectly adjusted fuel injection system Intake manifold leak Leaking cylinder head gasket Worn camshaft lobes Incorrect valve clearances or faulty hydraulic tappet element Disconnected vacuum or air hoses Incorrect valve timing Incorrect ignition timing Uneven cylinder compressions Ignition system fault
Engine misfires	Incorrect spark plug gaps or faulty plug Faulty electronic ignition system component Distributor cap cracked or tracking Uneven cylinder compressions Leaking cylinder head gasket Incorrect valve clearances or faulty hydraulic tappet element Incorrectly adjusted fuel injection system
Excessive oil consumption	Worn pistons and cylinder bores Valve guides or valve stem oil seals worn Oil leakage from gaskets or oil seals
Engine backfires	Incorrectly adjusted fuel injection system Ignition timing incorrect Valve timing incorrect Intake manifold leak Sticking valve
Engine lacks power	Ignition timing incorrect Valve timing incorrect Low cylinder compression Excessive carbon buildup in engine Valve clearances incorrect or hydraulic tappet element faulty
Unusual noises from engine	Worn valve gear or incorrect adjustment (noisy tapping from camshaft cover) Worn timing chain, tensioner or slide rail(s) (rattling from timing cover) Worn connecting rod bearings (regular metallic knocking) Worn main bearings (harsh rumbling and vibration on overrun) Worn or incorrectly adjusted drivebelt(s) (screeching or whine from the front of the engine)

Chapter 2 Cooling system

Contents

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Cooling system – draining 3
Cooling system – filling 5
Cooling system – flushing 4
Electromagnetic fan and fan coupling – removal and installation 10
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Thermostat housing – removal and installation 9
Troubleshooting – cooling system 13
Water pump – removal and installation 11

Specifications

System type	Pressurized pump-assisted thermo-syphon, with front–mounted radiator and electromagnetic cooling fan
Thermostat	
Type	Twin valve, wax pellet operated
Opening temperature	85 to 89-degrees C (185 to 192-degrees F)
Expansion tank pressure cap	
Pressure cap code number	120
Release pressure	17.4 psi
System capacity (including heater)	
2.3L engine	8.5 liters (2.25 gals)
2.3-16 engine	8.0 liters (2.0 gals)

Antifreeze

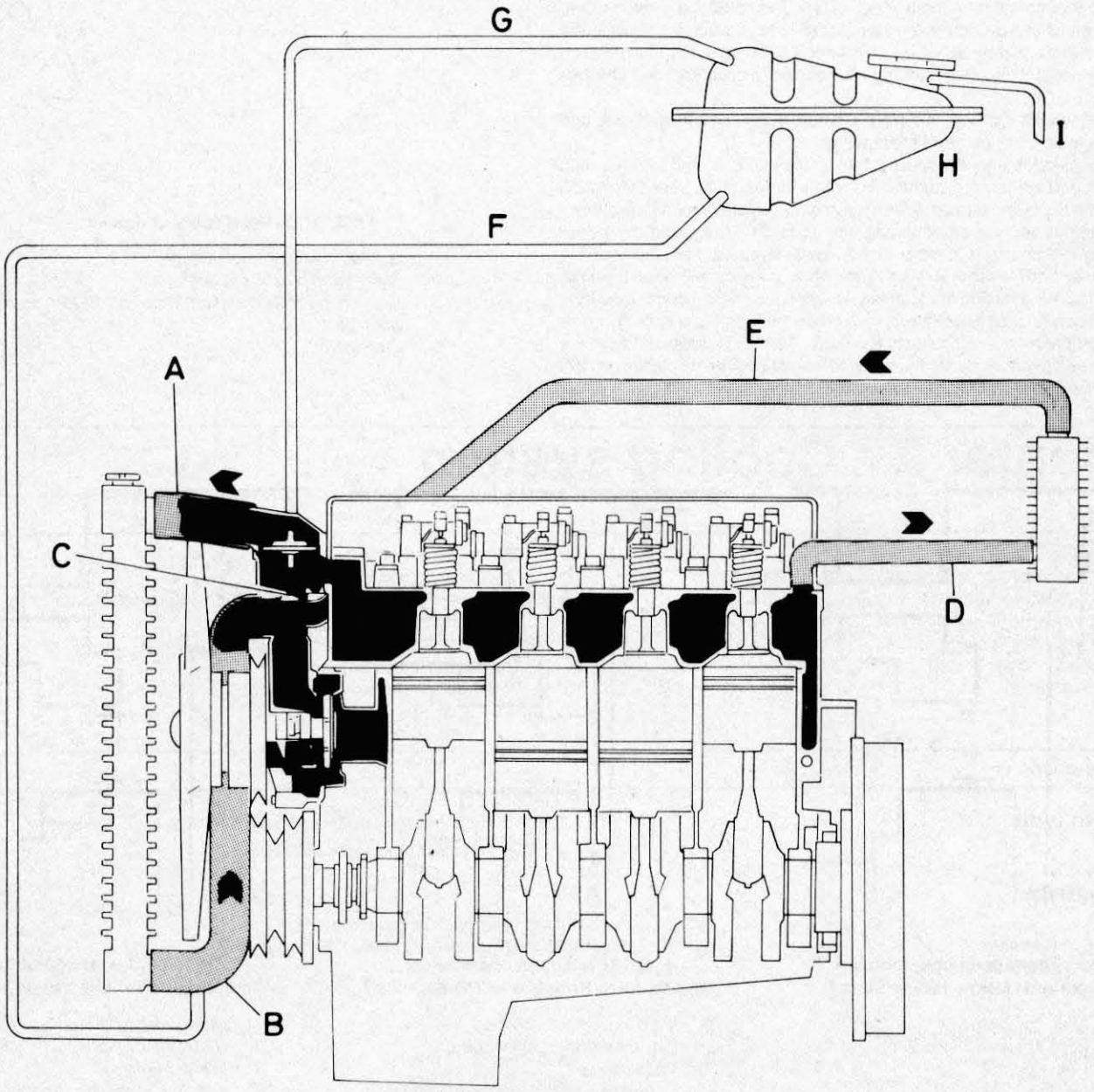
Mixing quantities of antifreeze and water for protection to:	**Antifreeze**	**Water**
–30-degrees C (–22-degrees F)	3.75 liter (4.0 qts)	4.75 liter (5.0 qts)
–40-degrees C (–40-degrees F)	4.50 liter (5.5 qts)	4.0 liter (4.2 qts)

Electromagnetic cooling fan

Operating temperature	100-degrees C (212-degrees F)

Torque specifications

	Ft-lbs
Water pump-to-timing cover	7
Cooling fan-to-pump spindle	18
Fan pulley-to-pump spindle	7
Electromagnetic fan coupling body retaining bolts	7
Thermostat housing cover bolts	7
Alternator mounting bracket bolts	33
Cylinder block drain plug	22



1.1 Sectional view of the cooling system

A From thermostat housing to radiator
B From radiator to water pump
C Bypass line from thermostat housing to water pump
D Coolant flow to heater
E Coolant return from heater
F From expansion tank to water pump
G From thermostat housing to expansion tank
H Expansion tank
I Overflow hose

1 General information

Refer to illustrations 1.1, 1.2, 1.3a, 1.3b and 1.3c

These vehicles employ a pressurized engine cooling system with thermostatically controlled coolant circulation. The system comprises a water pump, thermostat, electromagnetic cooling fan, expansion tank and the associated hoses **(see illustration on previous page)**.

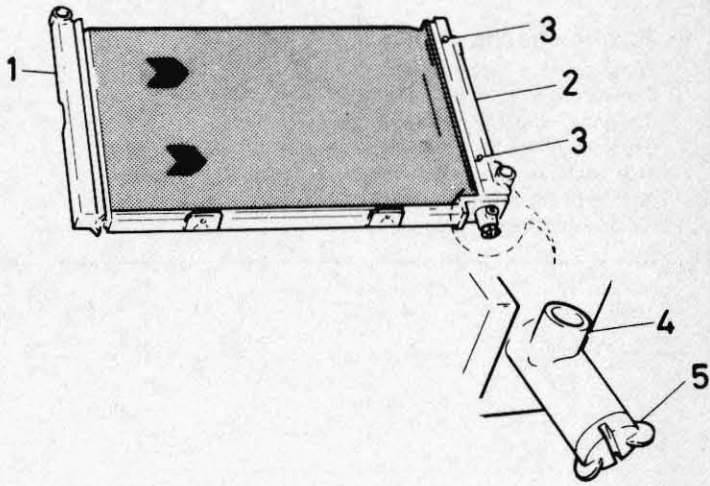
The radiator is an aluminum alloy crossflow type with plastic coolant compartments at each side **(see illustration)**. On some models, the tanks are mounted on the top and bottom. On cars equipped with automatic transmissions, a transmission fluid cooler is incorporated in the right-hand side coolant compartment.

The thermostat is of the twin-valve type incorporating a main valve, which opens at a predetermined temperature to allow coolant flow to the radiator, and a bypass valve, which is open when the main valve is closed to allow coolant circulation through the engine and heater **(see illustrations)**.

The impeller-type water pump is located on the front of the engine and is belt-driven from the crankshaft pulley.

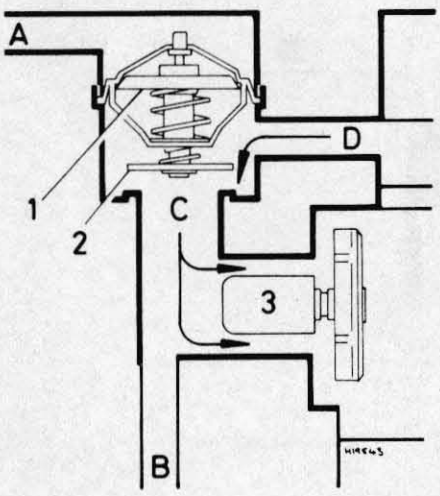
The electromagnetic cooling fan is mounted on the water pump spindle, and operates in conjunction with a temperature-sensitive switch located in the cylinder head. When the engine coolant reaches a predetermined temperature, the electromagnetic coupling is energized and the fan is rigidly locked to the pump pulley. At lower temperatures, the coupling is released and the fan is allowed to freewheel, turning only under the influence of bearing friction or incoming air when the car is moving forwards.

The plastic expansion tank is located on the right-hand side of the engine compartment, and collects the coolant which is displaced from the system as it expands due to the rise in temperature The displaced coolant is returned to the radiator as the system cools.



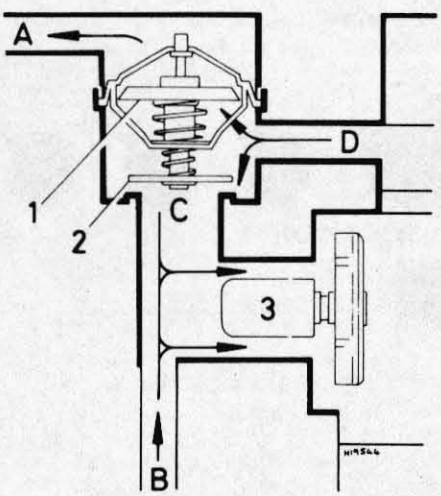
1.2 Crossflow radiator details

1 Left-hand plastic coolant tank
2 Right-hand plastic coolant tank
3 Fluid cooler fittings (automatic transmission models)
4 Drain plug outlet
5 Drain plug



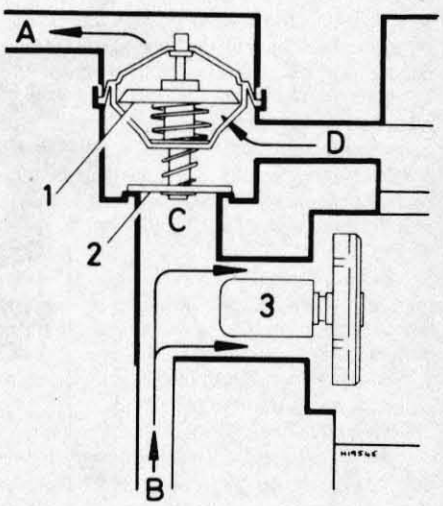
1.3a Thermostat operation at temperatures below 188-degrees F

1 Main valve closed
2 Bypass valve fully open
3 Water pump
A No flow to radiator
B No return flow from radiator
C Coolant flow from open bypass valve
D Coolant return from engine to bypass valve



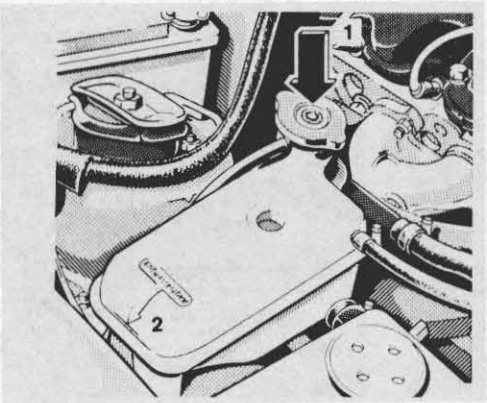
1.3b Thermostat operation at temperatures from 188 to 215-degrees F

1 Main valve partially open
2 Bypass valve partially open
3 Water pump
A Partial flow to radiator from engine
B Partial return flow from radiator to pump
C Coolant flow from partially open bypass valve to pump
D Coolant return from engine through main and bypass valve



1.3c Thermostat operation at temperatures above 215-degrees F

1 Main valve fully open
2 Bypass valve closed
3 Water pump
A Full flow to radiator from engine
B Return flow from radiator to pump
C No flow through bypass valve
D Coolant return from engine through main valve



2.1 Expansion tank pressure cap (1) and coolant level marking (2)

2 Maintenance and inspection

Refer to illustration 2.1

1 At weekly intervals, check the coolant level in the system when the engine is cold by viewing the coolant in the expansion tank on the right-hand side of the engine compartment **(see illustration)**. The level is correct when the coolant is up to the indicated mark on the side of the tank. If the engine is hot, the level will be slightly above the indicated mark.

2 If adding coolant is necessary, wait until the engine is cold, then turn the pressure cap on the expansion tank counterclockwise until it reaches the first stop. Wait until any pressure remaining in the system is released then push the cap down, turn it counterclockwise to the second stop and lift it off. **Warning:** *DO NOT attempt to remove the pressure cap when the engine is hot, as there is a very great risk of scalding.*

3 Add a mixture of water and antifreeze (see Section 6) through the expansion tank filler neck until the coolant is up to the level mark. Install the cap by turning it clockwise as far as it will go.

4 With a sealed-type cooling system, the addition of coolant should only be necessary at very infrequent intervals. If this is not the case, and frequent topping-up is required, it is likely there is a leak in the system. Check all hoses and joint faces for any signs of staining or actual wetness, and repair if necessary. If no leaks can be found, it is advisable to have the system pressure tested, as this will often reveal a small leak not previously visible.

5 At the intervals given in *Routine Maintenance* at the beginning of this manual, carefully inspect all hoses, hose clamps, radiator and visible joint gaskets for cracks, corrosion, deterioration or leakage. Replace any components that are suspect.

6 Check the condition of the water pump and alternator drivebelt, replace the belt and/or adjust its tension as necessary. These procedures are covered in Chapter 12 of this manual.

7 At the (less frequent) service intervals given, drain, flush and refill the cooling system using fresh antifreeze as described in Sections 3, 4 and 5 respectively.

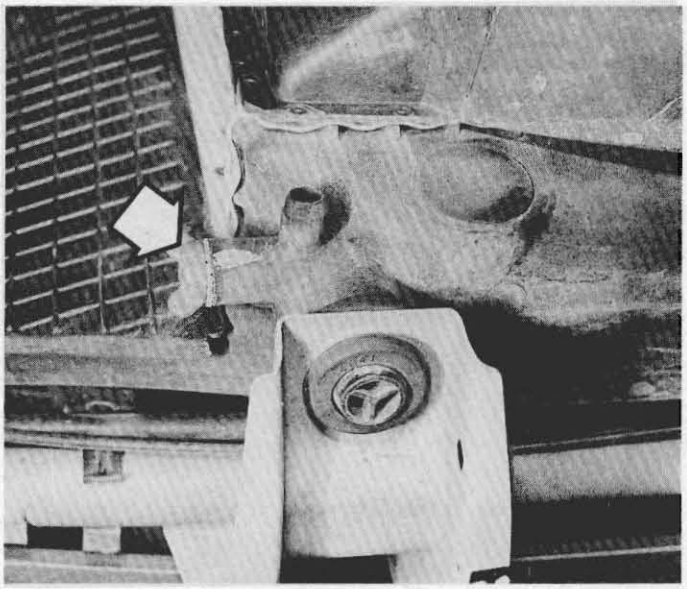
3 Cooling system – draining

Refer to illustrations 3.3 and 3.5

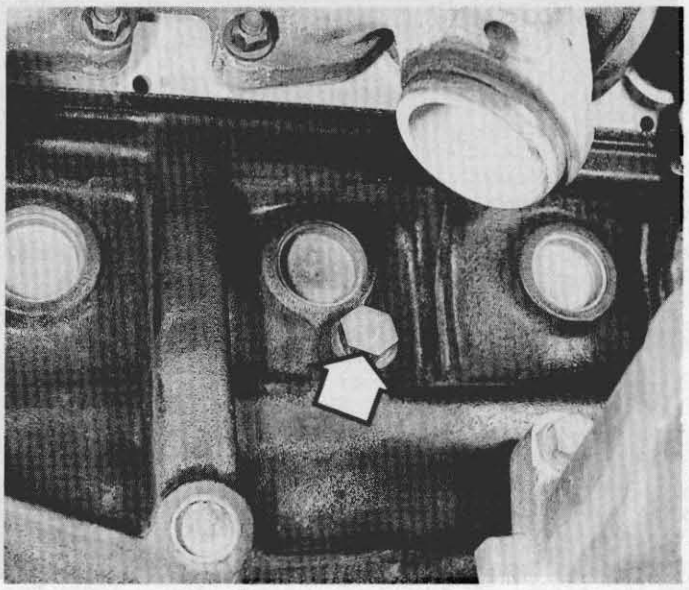
Warning: *Wait until the engine is cold before starting this procedure. Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Rinse off spills immediately with plenty of water. NEVER leave antifreeze lying around in an open container or in a puddle in the driveway or on the garage floor. Children and pets are attracted by it's sweet smell. Antifreeze is fatal if ingested.*

1 Remove the expansion tank pressure cap.

2 Place a suitable container beneath the right-hand side of the radiator.



3.3 Loosen the drain valve (arrow) and allow the coolant to drain



3.5 Cylinder block drain plug location (arrow)

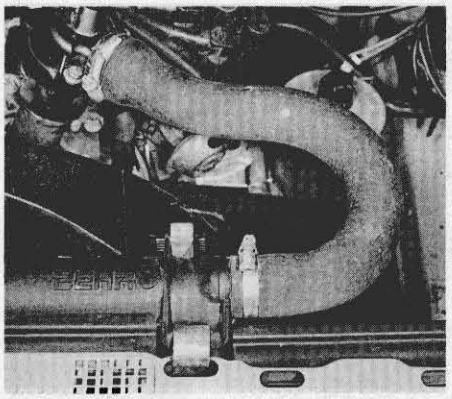
3 Unscrew the radiator drain plug **(see illustration)** and allow the coolant to drain into the container. Tighten the drain plug when all the coolant has drained.

4 Position the container beneath the right-hand side of the engine beneath the exhaust manifold.

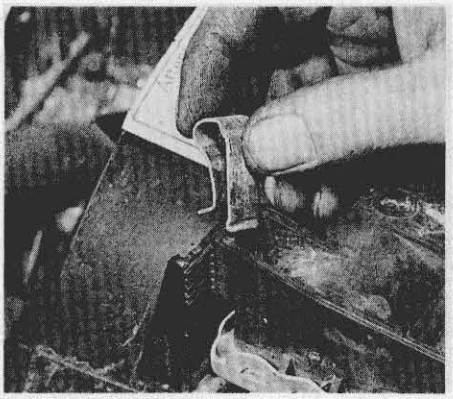
5 Unscrew and remove the cylinder block drain plug **(see illustration)** and allow the remaining coolant in the engine to drain into the container. install the drain plug on completion.

4 Cooling system – flushing

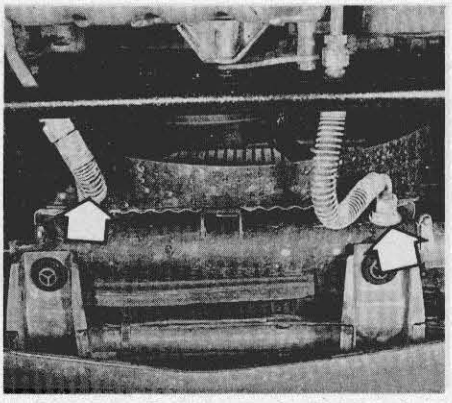
1 With time, the cooling system may gradually lose its efficiency as the radiator core becomes choked with rust, scale deposits from the water and other deposits. This is more likely to occur if the specified concentration of antifreeze has not been maintained in the system, or if the antifreeze has not been replaced at the recommended intervals.



7.2 Radiator top hose attachments at radiator and thermostat housing cover



7.3 Remove the fan shroud retaining spring clips



7.4 Automatic transmission fluid cooler line fittings

2 To flush the system, first drain the coolant as described in the previous Section.
3 Refer to Section 8 and remove the thermostat, then install the thermostat housing cover.
4 Set the heater controls to the maximum heat position.
5 Fill the cooling system through the expansion tank using clean water only, until the water is up to the full level indicated on the side of the tank.
6 Leave the expansion tank pressure cap off, and run the engine at a fast idle until the temperature gauge moves off its stop to the first mark on the gauge (approximately 140 to 158-degrees F). Add water to maintain the correct level in the tank during this time if necessary.
7 Install the expansion tank pressure cap and continue running the engine until the temperature reaches 212-degrees F, and then for a further five minutes thereafter.
8 Shut it off and allow the engine to cool to approximately 122-degrees F.
9 Drain the system once more, but take care as the water will be hot and the system may still be under pressure.
10 Repeat this flushing procedure until only clean water, free from rust and sediment, drains from the system.
11 On completion install the thermostat as described in Section 8, then fill the system as described in Section 5.
12 The use of chemical cleaners should only be necessary as a last resort in cases of severe contamination. Before using any form of de-scaling or de-rusting additives, the advice of a Mercedes-Benz dealer should be sought as to their effectiveness and compatibility with the metals in the system. The regular replacement of antifreeze should prevent excessive contamination of the system.

5 Cooling system – filling

Warning: *Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Rinse off spills immediately with plenty of water. NEVER leave antifreeze lying around in an open container or in a puddle in the driveway or on the garage floor. Children and pets are attracted by it's sweet smell. Antifreeze is fatal if ingested.*

1 Ensure that the heater controls are set to the maximum heat position, then slowly fill the system through the expansion tank, with the appropriate mixture of water and antifreeze, until the level is up to the full mark on the side of the tank.
2 Leave the expansion tank pressure cap off, and run the engine at a fast idle until the temperature gauge needle moves off its stop to the first mark (approximately 140 to 158-degrees F). Add coolant to maintain the correct level in the tank during this time if necessary.
3 Install the expansion tank pressure cap and continue to run the engine, increasing the speed periodically, until the temperature reaches approximately 194 to 212-degrees F.
4 Switch the engine off and allow it to cool. When cold recheck the coolant level and top up if necessary.

6 Antifreeze mixture – general information

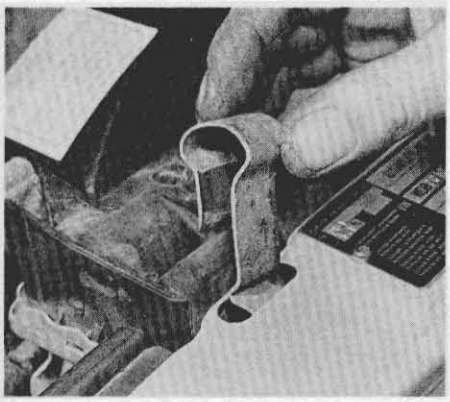
Warning: *Do not allow antifreeze to come in contact with your skin or painted surfaces of the vehicle. Rinse off spills immediately with plenty of water. NEVER leave antifreeze lying around in an open container or in a puddle in the driveway or on the garage floor. Children and pets are attracted by it's sweet smell. Antifreeze is fatal if ingested.*

1 The coolant used in the cooling system consists of a mixture of water and antifreeze to provide protection against freezing, protection against corrosion and also to raise the boiling point of the coolant.
2 For adequate corrosion protection, the proportion of antifreeze to water must never drop below 33-percent, which also provides antifreeze protection down to -4-degrees F, nor should it exceed 55-percent, which provides protection from freezing down to -49-degrees F, otherwise the heat dissipation properties of the coolant will be impaired.
3 The ideal quantities of antifreeze and water which should be maintained in the system at all times are shown in the Specifications.
4 The antifreeze should be replaced at the intervals given in *Routine Maintenance*, at which time the system should be completely drained and flushed, and all hoses checked for condition and security.
5 Always use an ethylene glycol-based antifreeze which is suitable for use in mixed metal cooling systems.
6 After filling with antifreeze, a label should be attached to the radiator stating the type and concentration of antifreeze used, and the date installed. Any subsequent topping-up should be made with the same type and concentration of antifreeze.
7 Do not use engine antifreeze in the windshields washer system, as it will cause damage to the vehicle's paint. Windshield washer antifreeze is available at most auto parts stores.

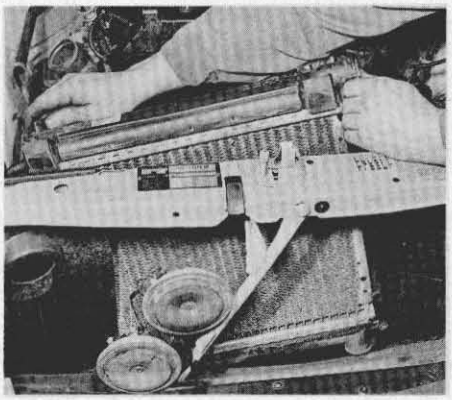
7 Radiator – removal, inspection, cleaning and installation

Refer to illustrations 7.2, 7.3, 7.4, 7.5, 7.6a, 7.6b and 7.8

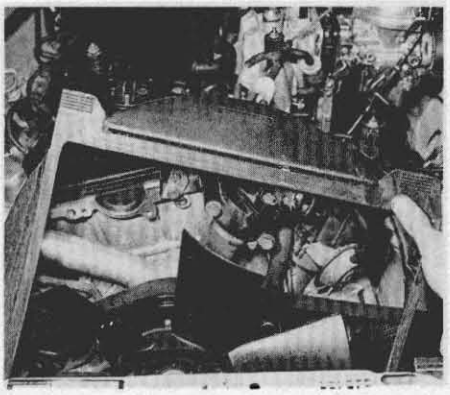
1 Disconnect the cable from the negative terminal of the battery.
2 Refer to Section 3 and drain the cooling system. Loosen the hose clamps and disconnect the top and bottom hoses at the radiator **(see illustration)**.
3 Carefully pry out the retaining spring clips securing the top of the fan shroud to the radiator **(see illustration)**. Disengage the shroud from the radiator and place it over the fan blades.
4 On automatic transmission models, unscrew the transmission fluid cooler line fittings **(see illustration)** using a flare nut wrench and a backup wrench to prevent the fitting from turning in the radiator tank. Carefully withdraw and plug the lines.
5 Carefully pry out the retaining spring clips securing the top of the radiator to the body panel **(see illustration)**.
6 Lift the radiator upwards to disengage the lower mounting lugs and remove it from the car, followed by the fan shroud **(see illustrations)**.



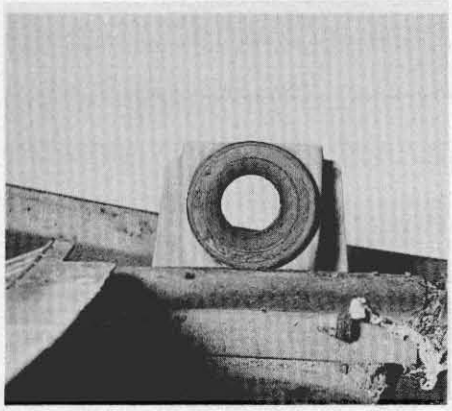
7.5 Remove the radiator retaining spring clips



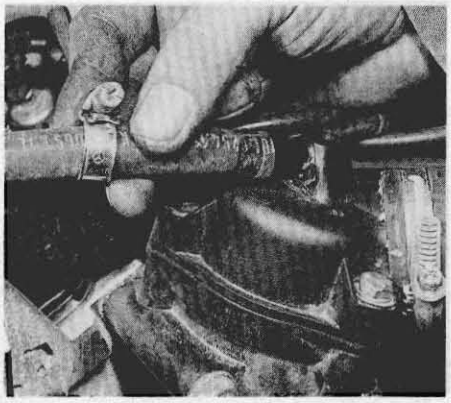
7.6a Lift out the radiator, being careful not to damage the cooling fins



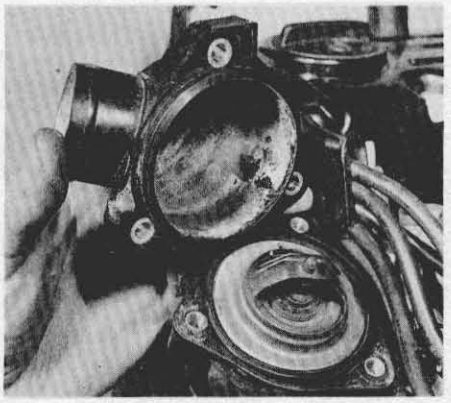
7.6b Maneuver the fan shroud out, taking care not to damage the condenser



7.8 Radiator lower mounting lug grommet – replace these if they are deteriorated



8.6 Disconnect the expansion tank hose from the thermostat housing cover



8.7a Lift off the thermostat housing cover

2

7 Carefully examine the radiator for signs of leaks, corrosion of the alloy core, or damage to the plastic side, top or bottom tanks. Should the radiator require attention, this work should be left to a specialist due to the nature of its construction. Clean the radiator core of flies, small leaves or other debris by brushing or hosing. Check the condition of all hoses, clamps, mounts and retaining spring clips and replace as necessary.

8 Installing the radiator is the reverse sequence to removal, but ensure that the lower mounting lugs properly engage with their rubber grommets **(see illustration)**. Fill the cooling system as described in Section 5 after installing, and on automatic transmission models, check the transmission fluid level as described in Chapter 6.

8 Thermostat – check and replacement

Refer to illustrations 8.6, 8.7a, 8.7b and 8.8

***Warning:** Do not remove the radiator cap, drain the coolant or replace the thermostat until the engine has cooled completely.*

Check

1 Before assuming the thermostat is to blame for a cooling system problem, check the coolant level, drivebelt tension and temperature gauge operation.

2 If the engine seems to be taking a long time to warm up (based on heater output or temperature gauge operation), the thermostat is probably stuck open. Replace the thermostat with a new one.

3 If the engine runs hot, use your hand to check the temperature of the upper radiator hose. If the hose isn't hot, but the engine is, the thermostat is probably stuck closed, preventing the coolant inside the engine from escaping to the radiator. Replace the thermostat.

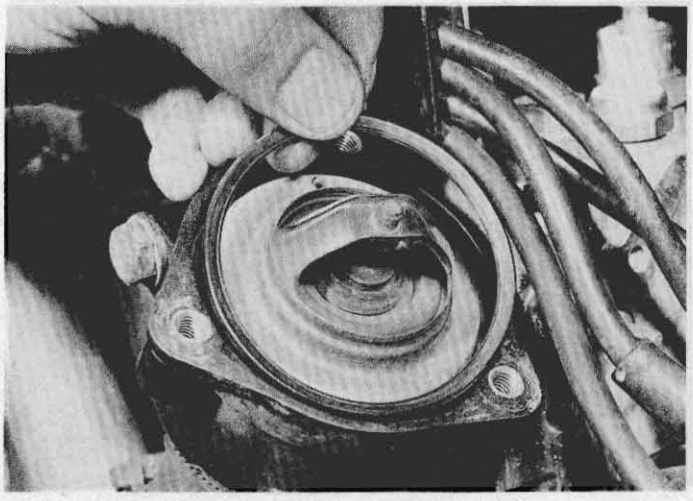
4 If the radiator hose is hot, it means that the coolant is flowing and the thermostat is open. Consult the *Troubleshooting* section at the end of this Chapter for cooling system diagnosis.

Replacement

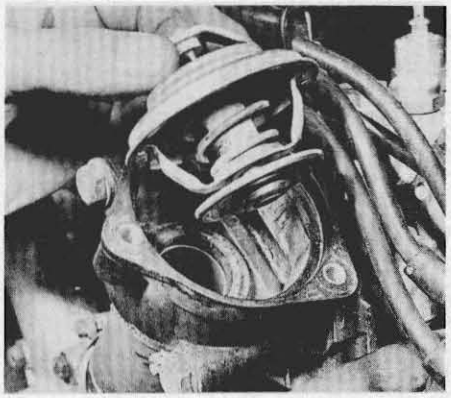
5 Refer to Section 3 and drain approximately 2.0 quarts of coolant from the radiator.

6 Loosen the hose clamps and remove the radiator top hose and expansion tank hose from the thermostat housing cover **(see illustration)**.

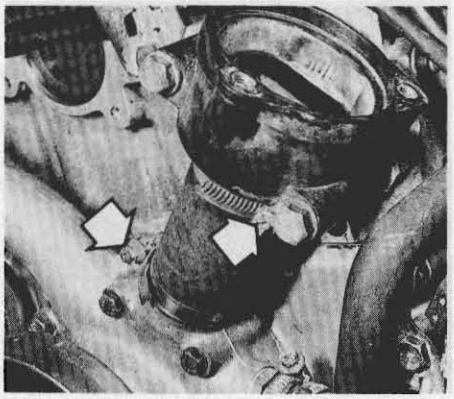
7 Unscrew the three bolts and lift off the cover, followed by the O-ring seal **(see illustrations)**.



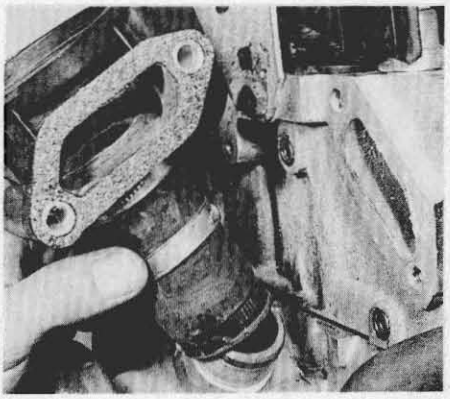
8.7b Remove the O-ring



8.8 Pull the thermostat from the housing



9.2 Bypass hose retaining clamps (arrows)



9.3 Remove the thermostat housing with a twisting motion to break the bond between the hose and outlet

8 Lift the thermostat from the housing **(see illustration)**.
9 Installing the thermostat is the reverse sequence of removal, but be sure to replace the O-ring seal. Tighten the thermostat housing cover retaining bolts to the specified torque and fill up the cooling system on completion.

9 Thermostat housing – removal and installation

Refer to illustrations 9.2 and 9.3

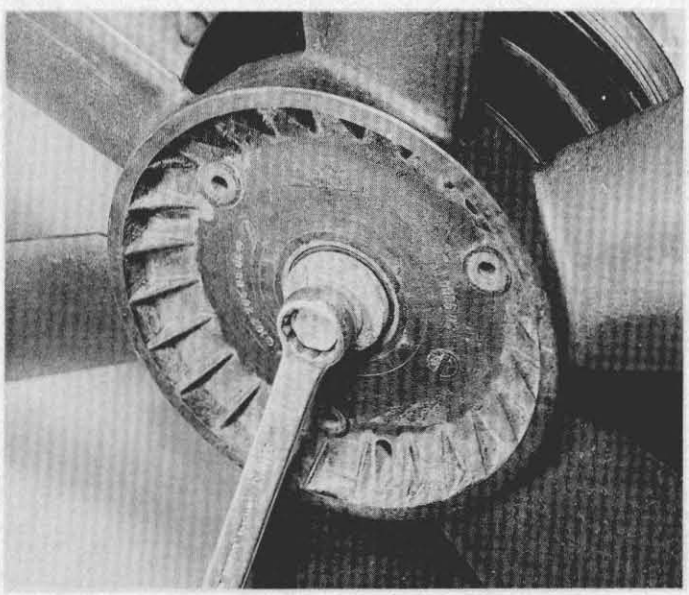
1 Remove the thermostat as described in Section 8.
2 Loosen the hose clamp securing the bypass hose to the water pump **(see illustration)**.
3 Remove the two housing retaining bolts, and remove the housing from the water pump and cylinder head **(see illustration)**.
4 Scrape away all traces of old gasket from the cylinder head and housing mating faces. Check the condition of the bypass hose and hose clamps, and obtain replacements if necessary together with a new gasket.
5 Smear the gasket with RTV sealant and place it in position on the housing.
6 Position the housing and bypass hose in place, then install and tighten the bolts and secure the hose with the clamp.
7 Install the thermostat as described in Section 8.

10 Electromagnetic fan and fan coupling – removal and installation

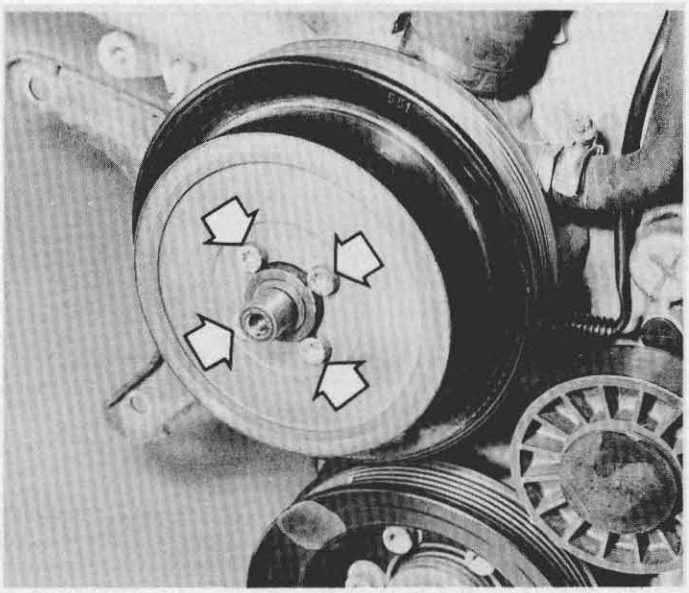
Refer to illustrations 10.4, 10.5, 10.6a, 10.6b, 10.7 and 10.8

Removal

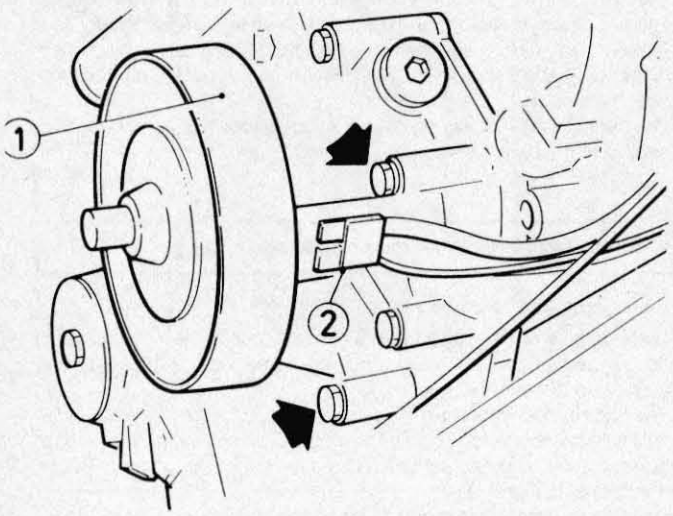
1 Disconnect the cable from the negative terminal of the battery.
2 Refer to Section 7 of this Chapter and remove the radiator. Refer to Chapter 3 and remove the air cleaner.
3 Refer to Chapter 12 and release the drivebelt from the alternator and water pump pulleys.
4 Remove the center retaining bolt securing the fan to the pump spindle **(see illustration)**, and remove the fan.
5 Remove the four socket-headed bolts securing the pulley to the water pump spindle **(see illustration)** and remove the pulley.
6 On pre-October 1984 models with multiple drivebelts, remove the three bolts securing the fan coupling body to the water pump and pump bracket **(see illustrations)**. Pull off the coupling, disconnect the electrical connector, and remove the unit from the engine.
7 On post-October 1984 models with a single drivebelt arrangement, unscrew the bolts at the rear of the coupling body securing it to the mounting plate. Slide the coupling forward, disconnect the electrical connector and remove the unit from the engine **(see illustration)**.



10.4 Unscrew the fan center retaining bolt

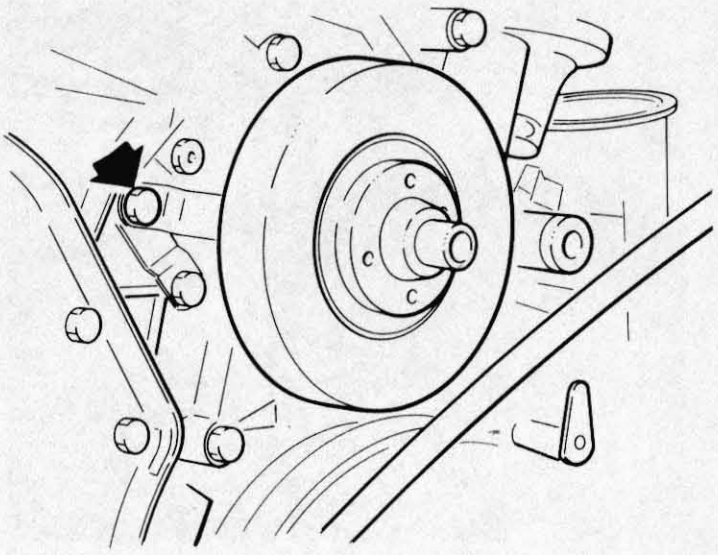


10.5 Water pump pulley retaining bolts (arrows)

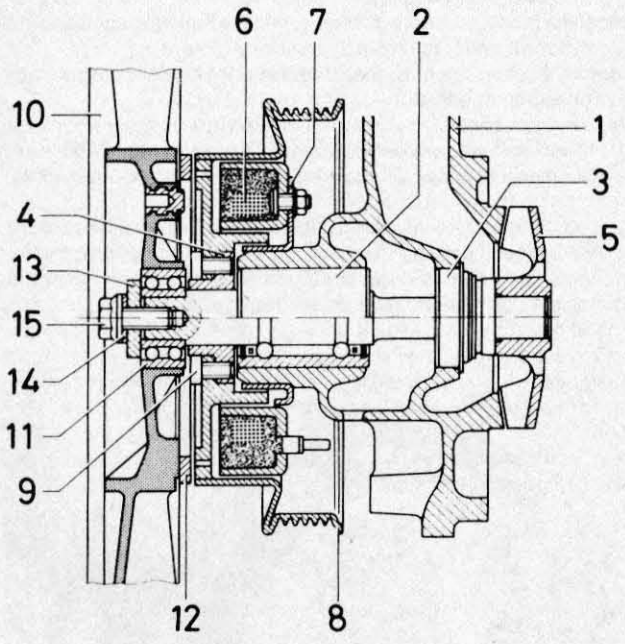


10.6a Electromagnetic fan coupling body retaining bolts on left-hand side (arrow) – pre-October 1984 models

1 Fan coupling body 2 Electrical connector



10.6b Electromagnetic fan coupling body-to-bracket retaining bolt (arrow) – pre-October 1984 models



10.7 Sectional view of the electromagnetic cooling fan assembly installed on post-October 1984 models

1 Water pump body
2 Pump bearing
3 Sealing ring
4 Pump spindle flange
5 Impeller
6 Solenoid body
7 Solenoid body carrier
8 Puller
9 Retaining bolts
10 Fan
11 Ball bearing
12 Armature
13 Spacer
14 Dished washer
15 Fan retaining bolt

Installation

8 Installation is the reverse sequence of removal. Ensure that the arrangement of washers on the fan retaining bolt is correct **(see illustration)** and tighten all retaining bolts to the torque values listed in this Chapter's Specifications.

9 Install and adjust the drivebelt (see Chapter 12), install the air cleaner (see Chapter 3) and the radiator (see Section 7), then fill the cooling system (see Section 5). Reconnect the battery cable.

2

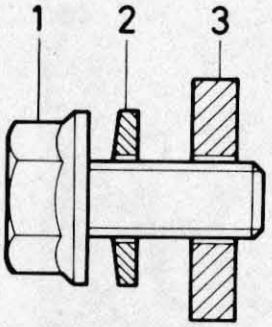
11 Water pump – removal and installation

Refer to illustrations 11.3, 11.5, 11.6 and 11.8

Removal

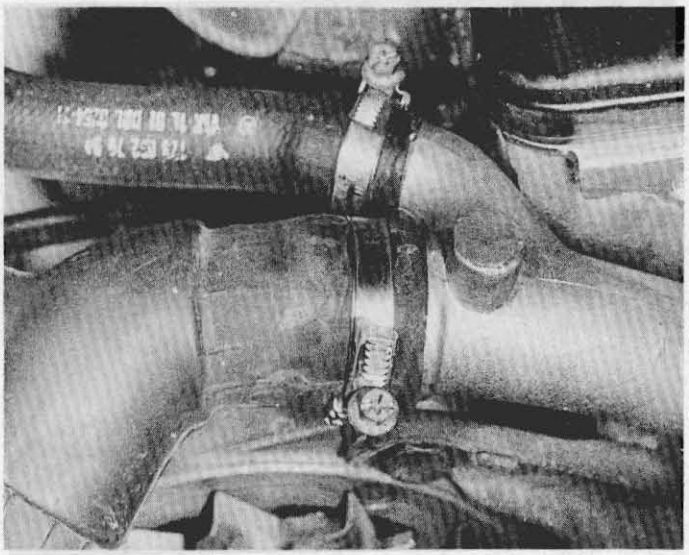
1 Refer to Section 10 and perform the operations described in paragraphs 1 to 7.

2 Remove the thermostat housing as described in Section 9.



10.8 Fan retaining bolt washer and spacer arrangement

1 Fan retaining bolt
2 Dished washer
3 Spacer



11.3 Radiator and heater hose connections at the water pump

3 Loosen the clamps and disconnect the radiator bottom hose and heater return hose at the water pump **(see illustration)**.
4 Loosen the clamp and disconnect the coolant auxiliary hose on the left-hand side of the pump body.
5 Remove the alternator as described in Chapter 12, then unscrew the three bolts securing the alternator mounting bracket to the water pump **(see illustration)**. Remove the bracket.
6 Unscrew the remaining bolts securing the water pump to the timing cover and remove the pump **(see illustration)**. Make a note of the retaining bolt locations, as there are a number of different lengths used.

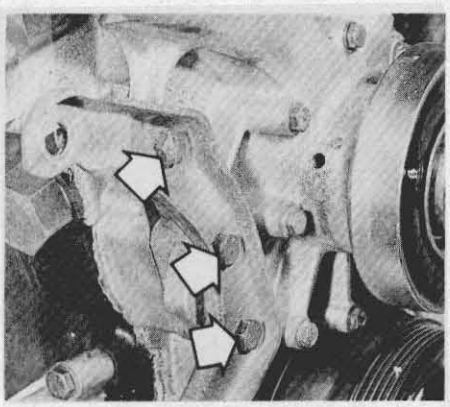
Installation

7 Clean away all traces of gasket material and sealant from the mating surfaces prior to installing the pump.
8 Smear a new gasket with RTV sealant, and place it on the timing cover **(see illustration)**. Note that during manufacture, the water pump-to-timing cover joint is sealed with a non-hardening silicone sealant, and a gasket is not used. In some instances, service replacement pumps may be supplied without a gasket, in which case a silicone sealant may be used again if a gasket cannot be obtained separately.
9 Place the pump in position, install the retaining bolts and tighten to the specified torque.
10 Install the alternator mounting bracket and the alternator.
11 If previously removed, install the electromagnetic fan coupling and secure with the three bolts.
12 Reconnect the coolant hoses and install the thermostat housing (see Section 9).
13 Install the water pump pulley and secure with the four socket-headed bolts.
14 Place the fan over the pulley, install the retaining bolt with the washer arranged as shown in illustration 10.8, and tighten to the specified torque.
15 Install and adjust the drivebelt (see Chapter 12), install the air cleaner (see Chapter 3) and the radiator (see Section 7), then fill the cooling system (see Section 5).
16 Reconnect the fan coupling electrical connector (where applicable), and secure to the loom using new cable ties.

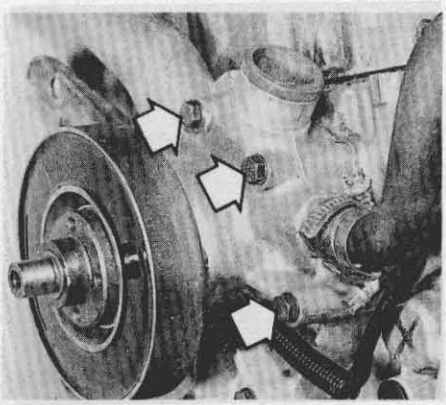
12 Coolant level indicator – description and testing

Refer to illustrations 12.4 and 12.7

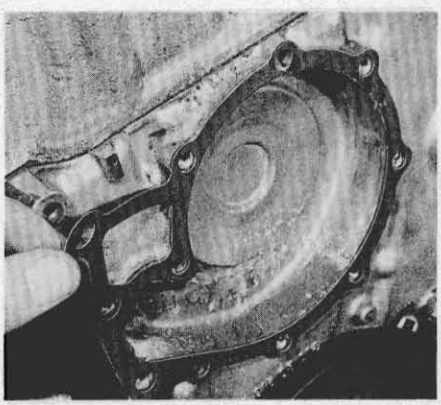
1 Later models are equipped with a dynamic coolant level indicator to monitor the coolant level in the expansion tank, and provide visual warning to the driver in the event of coolant loss or low coolant level.
2 The level sensor located in the expansion tank has a float which rises and falls with coolant level. Should the level fall below minimum, the float actuates the sensor contacts which causes a warning lamp bulb in the instrument panel to illuminate.
3 Should the warning lamp fail to illuminate when the coolant level falls below minimum, or if it is illuminated even when the level is correct, the circuit can be checked as follows.
4 Disconnect the electrical connector from the level sensor in the expansion tank **(see illustration)**.
5 Connect an ohmmeter across the two sensor terminals and note the resistance. With the coolant level correct, the ohmmeter reading should be infinity. With the level below minimum, the reading should be approximately 5.0 ohms.
6 If the readings are not as given above, replace the sensor. To do this, first drain the coolant in the expansion tank by removing the return hose at the base of the tank. Make sure, however, that the engine is cold, and the pressure in the system is released by removing the pressure cap.
7 Extract the retaining circlip **(see illustration)** and withdraw the sensor and O-ring from the tank.
8 Install the new sensor and O-ring, noting that the unequal-sized lugs allow it to be inserted one way only. Secure the sensor with the circlip, connect the electrical connector and expansion tank hose, then top up the system.
9 If the ohmmeter readings were satisfactory, then the fault lies in the warning indicator or the wiring. To check the indicator, remove the instrument panel as described in Chapter 12 and connect the ohmmeter between terminal 12 of the instrument panel 15 terminal electrical connector, and a good ground. If the reading on the ohmmeter is infinity, then the warning indicator is faulty and should be replaced. If the reading is less than infinity, there is a wiring fault between the sensor and warning indicator, which should be investigated by a Mercedes-Benz dealer or other repair shop.
10 Remove the ohmmeter and install the instrument panel as described in Chapter 12 on completion.



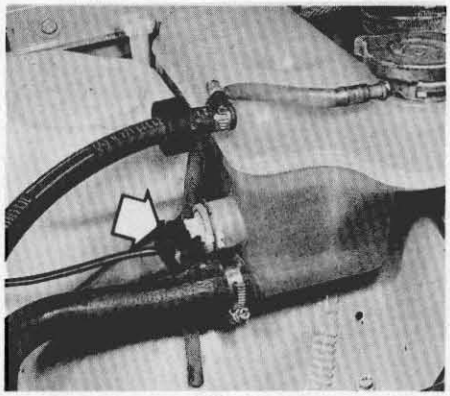
11.5 Alternator mounting bracket retaining bolts



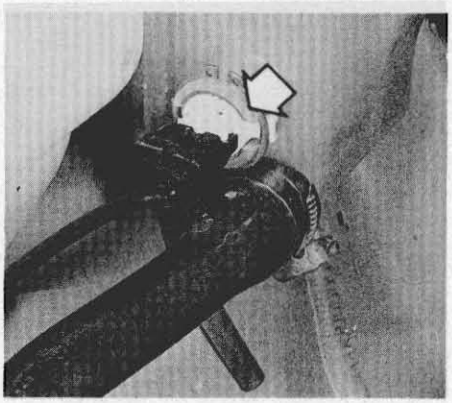
11.6 Water pump retaining bolts (arrows) on left-hand side



11.8 Coat the new gasket with RTV sealant and stick it to the timing cover



12.4 Coolant level sensor electrical connector (arrow)



12.7 Coolant level sensor retaining circlip (arrow)

13 Troubleshooting – cooling system

Symptom	Reason(s)
Overheating	Low coolant level (this may be the result of overheating for other reason) Drivebelt slipping or broken Radiator blockage (internal or external) Thermostat defective Faulty electromagnetic fan coupling or thermal switch Expansion tank pressure cap faulty Ignition system fault Fuel system fault Blown cylinder head gasket Brakes binding
Overcooling	Thermostat defective
Coolant loss – external	Loose hose clamps Deteriorated hoses Radiator core leaking Heater core leaking Expansion tank pressure cap faulty Boiling due to overheating Water pump or thermostat housing joint leakage Core plug leakage
Coolant loss – internal	Cylinder head gasket blown Cylinder head cracked or warped Cylinder block cracked
Corrosion	Incorrect antifreeze mixture or incorrect type of antifreeze Combustion gases contaminating coolant (indicating blown head gasket, cracked cylinder head or block) Infrequent draining or flushing

Chapter 3 Fuel and exhaust system

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Specifications

General

System type	Bosch CIS-E electronically-controlled continuous injection system
System pressure	76.8 to 79.7 psi

Fuel pump

Delivery quantity (minimum)	1.0 liter (1.05 qts) in 40 seconds

Fuel injectors

Opening pressure	
With new injectors	50.7 to 59.4 psi
With used injectors	43.5 psi minimum
Idle speed	750 to 850 rpm
Idle mixture CO content	0.5 to 1.5%
Fuel tank capacity	55 liters (14.5 US gals) including 7.5 liters (1.98 US gals) reserve

Torque specifications

	Ft-lbs
Fuel gauge sending unit cap nut	29
Air flow sensor rubber mount nuts	7
Air guide housing to air flow sensor	7
Exhaust pipe-to-exhaust manifold	15
Exhaust system flange joint	15

1 General information

The fuel system on the vehicles covered by this manual consists of an upright, centrally-mounted fuel tank, electrically-operated fuel pump and Bosch CIS-E electronically-controlled fuel injection system.

The air cleaner is of the conventional dry filter type, containing a disposable paper element.

The exhaust system is made up of two sections; the front section contains a resonator and twin downpipes from the manifold, while the rear section contains the two silencers. The system is suspended on rubber mountings, and bolted via a flange joint to the cast iron manifold at the front.

Warning: *Many of the procedures in this Chapter require the removal of fuel lines and connections which may result in some fuel spillage. Before carrying out any operation on the fuel system refer to the precautions given in Safety First! at the beginning of this Manual and follow them implicitly. Gasoline is a highly dangerous and volatile liquid and the precautions necessary when handling it cannot be overstressed.*

2 Maintenance and inspection

1 At the intervals given in Routine Maintenance at the beginning of this manual, carry out the following service operations on the fuel system.

2 With the car raised on a vehicle lift or securely supported on jackstands, carefully inspect the fuel lines, hoses and unions for chafing, leaks and corrosion. Replace any pipes that are severely pitted with corrosion or in any way damaged. Replace any hoses that show signs of cracking or other deterioration.

3 Check the exhaust system flange bolts for tightness and check the system for leaks and security (see Section 25).

4 Inside the engine compartment, check the security of ail fuel hose attachments and inspect the fuel hoses and vacuum hoses for kinks, chafing and deterioration.

5 Replace the air cleaner element as described in Section 3.

6 Replace the fuel filter (see Section 10).

7 Check the operation of the accelerator linkage, and lubricate the linkage and cable with a few drops of engine oil.

3 Air cleaner and element – removal and installation

Refer to illustrations 3.1, 3.2, 3.7a, 3.7b, 3.7c, 3.8 and 3.9

3

Removal

1 Remove the nuts securing the air cleaner cover to the body **(see illustration)**.

2 Spring back the retaining clips **(see illustration)** and lift off the cover complete with air cleaner element.

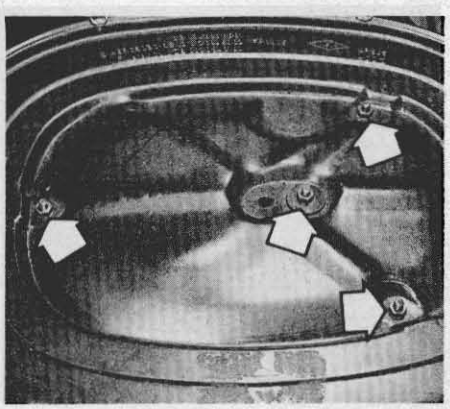
3 Remove the element from the cover.

4 Wipe out the inside of the air cleaner body and the cover.

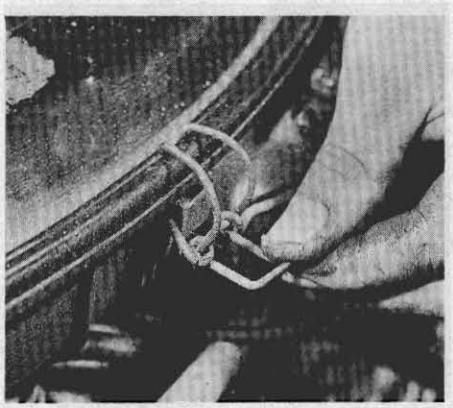
5 Place a new element in the cover and install the cover to the air cleaner body. Secure with the clips and retaining nuts.

6 To remove the complete air cleaner assembly, first remove the cover and element as previously described.

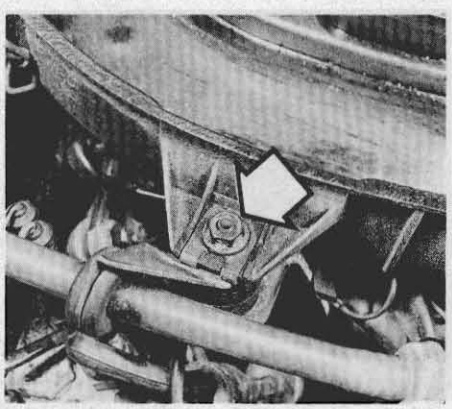
7 Remove the nuts securing the air cleaner body to the camshaft cover and the support brackets **(see illustrations)**.



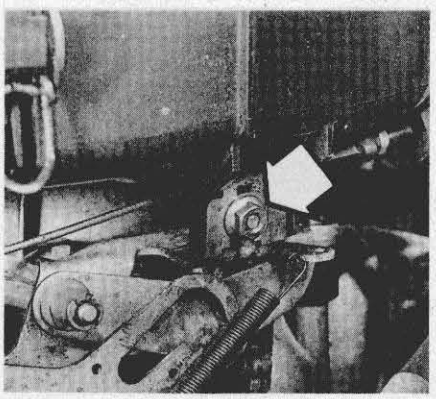
3.1 Remove the air cleaner cover retaining nuts (arrows)



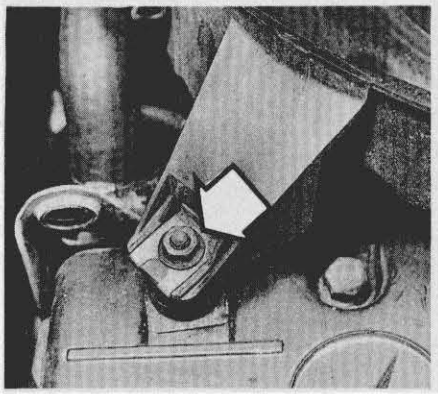
3.2 Unlatch the hold-down clips and lift the air cleaner cover off



3.7a The air cleaner housing front retaining nut



3.7b Air cleaner housing center nut



3.7c Air cleaner housing rear mounting nut

8 Pull out the air intake duct and lift the air cleaner off the airflow sensor **(see illustration)**.
9 Disconnect the engine breather hose from the base of the air cleaner, and remove the unit from the car **(see illustration)**.

Installation

10 Installation is the reverse of removal, but make sure the sealing ring locates squarely over the airflow sensor.

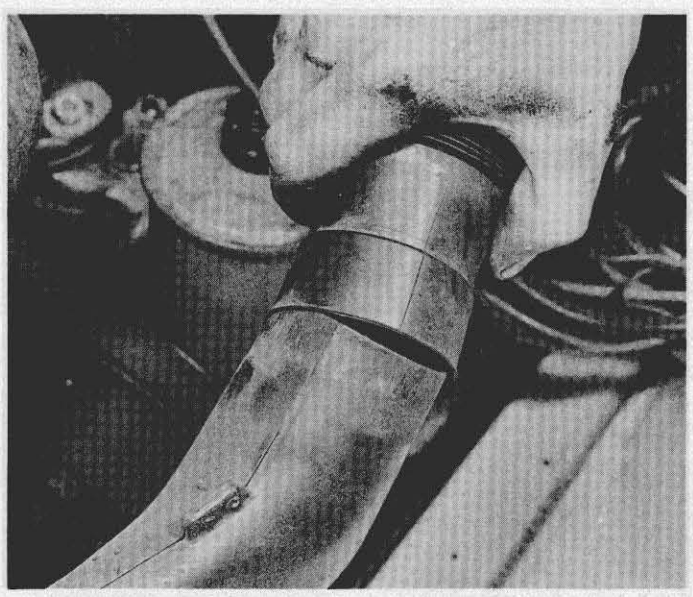
4 Fuel tank – removal and installation

Refer to illustrations 4.6a, 4.6b, 4.7 and 4.8

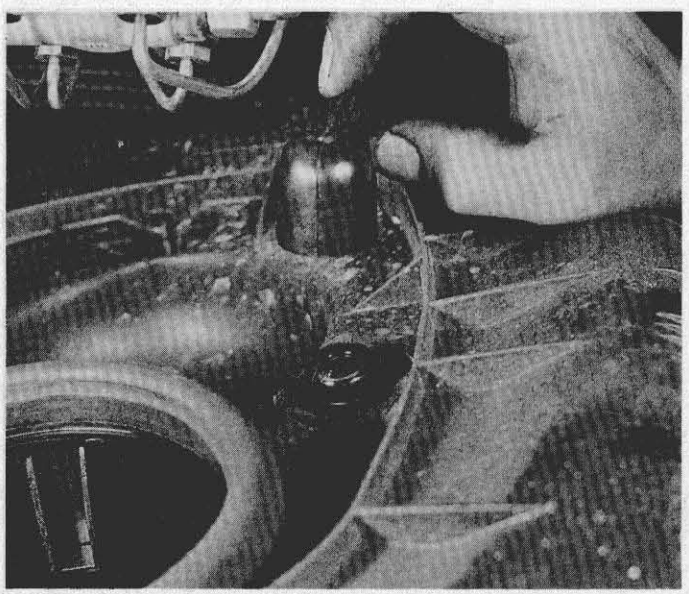
Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

Removal

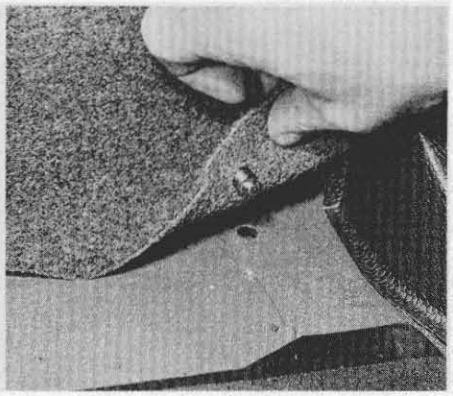
1 Removal of the fuel tank should be undertaken when the tank is almost empty, as a drain plug is not provided. Alternatively use a syphon or hand pump to remove the fuel, but ensure that this, and the fuel tank removal operations, are carried out in a well-ventilated area. **Warning:** *Never start the siphoning action with your mouth!*
2 Raise the rear of the vehicle and support it on jackstands. Do not position the car over an inspection pit.
3 Disconnect the cable from the negative terminal of the battery.
4 From under the car, disconnect the fuel supply and return hoses and the vent hose from the tank outlets. Plug the hoses and outlets after removal.
5 Remove the large rubber grommet from the fuel tank outlets.
6 From within the luggage compartment, remove the floor carpet then release the tank lining panel retainers, first at the bottom, then along the top and sides of the panel **(see illustrations)**. Remove the panel from the luggage compartment.
7 Disconnect the fuel gauge sending unit electrical connector on the upper right-hand side of the tank **(see illustration)**, and release the wiring from the cable clips.
8 Unscrew the fuel tank retaining nuts **(see illustration)**, lift the tank slightly, and pull out the drain hose.



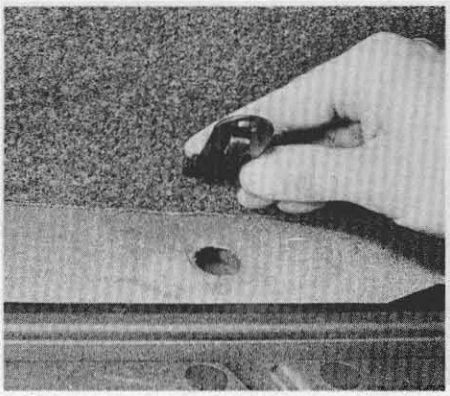
3.8 Detach the air intake duct



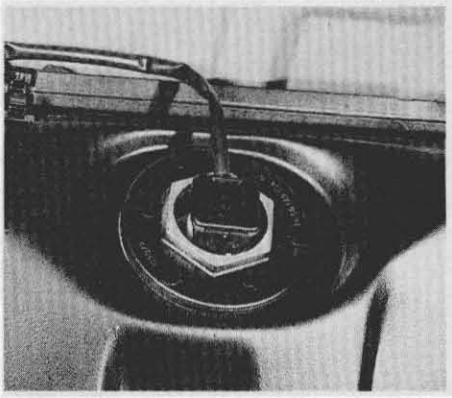
3.9 Lift up the air cleaner and disconnect the breather hose



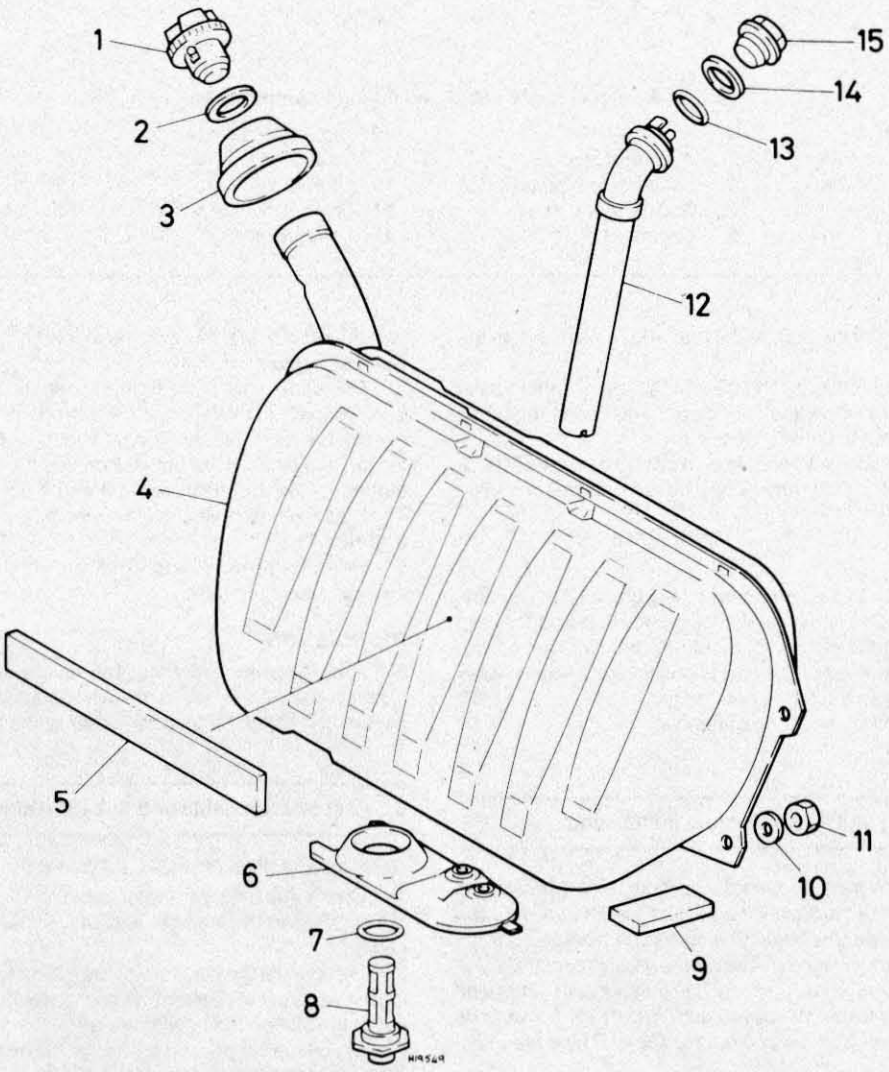
4.6a Pull out the fuel tank carpet fasteners . . .



4.6b . . . and remove the clips

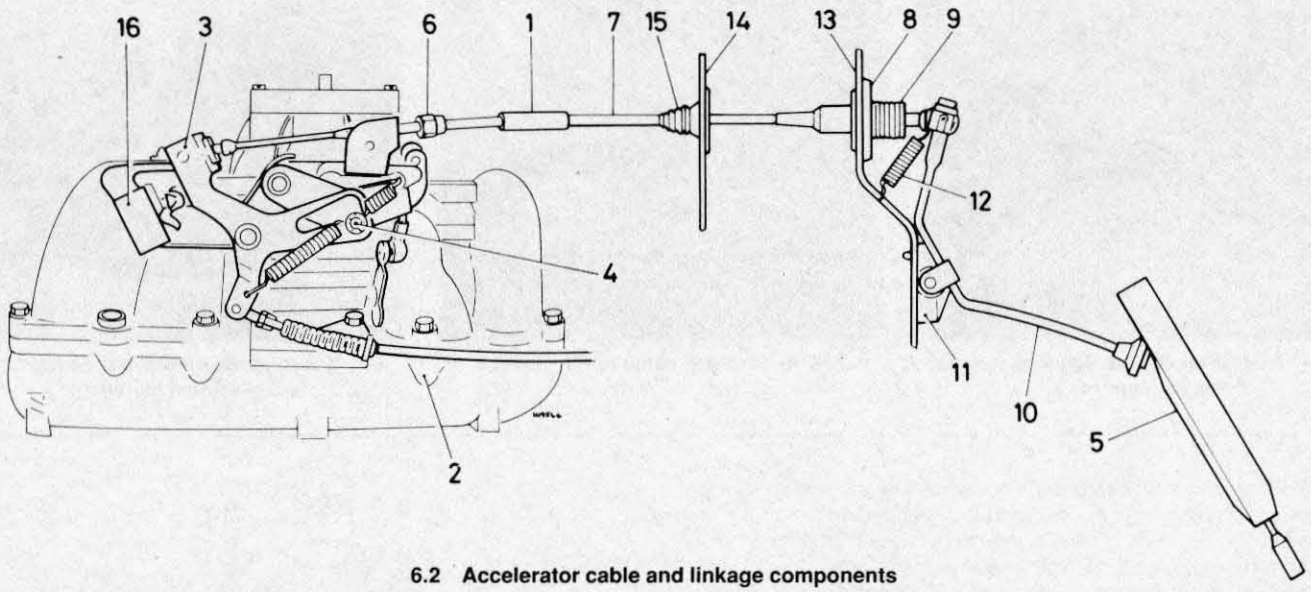


4.7 Disconnect the fuel gauge sending unit electrical connector



4.8 Fuel tank and related components

1	*Filler cap*	5	*Rear damping pad*	9	*Bottom damping pad*	13	*Sealing O-ring*
2	*Sealing ring*	6	*Closing grommet*	10	*Washer*	14	*Sealing O-ring*
3	*Sealing sleeve*	7	*Filter seal*	11	*Nut*	15	*Sending unit cap nut*
4	*Fuel tank*	8	*Filter*	12	*Fuel gauge sending unit*		



6.2 Accelerator cable and linkage components

1 *Anti-chafing collar*
2 *Control pressure cable (automatic transmission models)*
3 *Guide lever*
4 *Roller*
5 *Accelerator pedal*
6 *Full throttle stop adjuster*
7 *Accelerator cable*
8 *Grommet*
9 *Idle speed end stop adjuster*
10 *Pedal arm*
11 *Pedal pivot bracket*
12 *Return spring*
13 *Firewall*
14 *Inner firewall*
15 *Grommet*
16 *Microswitch*

9 Lift the tank up for clearance, then to the rear and remove it from the luggage compartment.
10 With the tank removed, unscrew the filter at the supply hose outlet and remove it from the tank. Blow the filter clean, and check the mesh screen for damage. Replace the filter if necessary.
11 If the tank is corroded or leaks, it should be repaired by specialists, or replaced. **Warning:** *Do not, under any circumstances, solder or weld a fuel tank.*

Installation

12 Before installing, screw in the filter using a new gasket if necessary, and tighten securely. Also check that the damping pads at the bottom and rear faces of the tank are in place and secure. Attach them with adhesive if necessary, ensuring that the rear face pad is positioned approximately 190.0 mm (7.5 in) down from the tank upper edge.
13 Installation is the reverse sequence of removal.

5 Fuel gauge sending unit – removal and installation

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

Removal

1 The fuel gauge sending unit is located on the upper right-hand side of the fuel tank, and can be removed and installed from within the luggage compartment with the tank in place. Before removal it is necessary to remove 8 liters (2.5 gals) of fuel from the tank (assuming it is full), by siphon or hand pump. **Warning:** *Never start the siphoning action with your mouth!. Ensure that this and the following operations are carried out in a well-ventilated area.*
2 Disconnect the cable from the negative terminal of the battery.
3 From within the luggage compartment, remove the floor carpet then release the fuel tank lining panel retainers, first at the bottom, then along the top and sides of the panel. Remove the panel from the luggage compartment **(see illustrations 4.6a and 4.6b)**.
4 Disconnect the electrical connector from the sending unit **(see illustration 4.7).**
5 Unscrew the retaining cap nut and withdraw the sending unit up and to the rear, out of the tank.

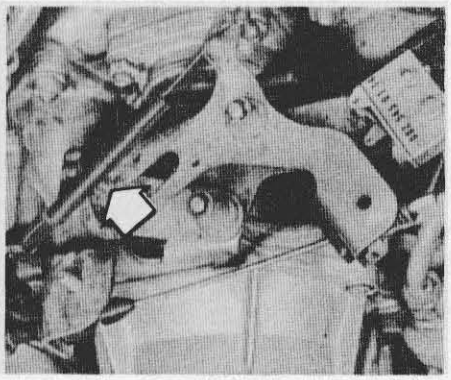
Installation

6 Installation is the reverse of removal, but replace both sealing O-rings on the cap nut if they are in any way damaged. Ensure that the lug on the sender unit flange faces downwards when the unit is installed.

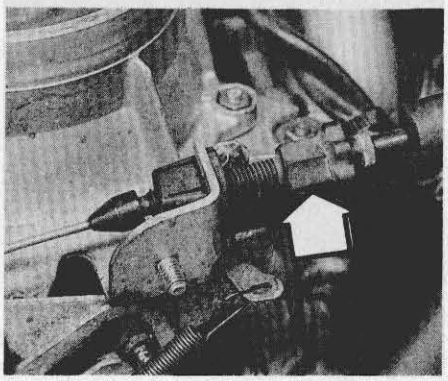
6 Accelerator cable and linkage – adjustment

Refer to illustrations 6.2, 6.4, 6.7 and 6.9

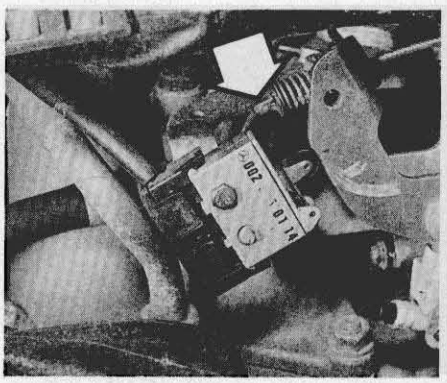
1 Check that the accelerator cable and linkage operate smoothly without stiffness in the linkage, and with no trace of binding or kinks in the cable.
2 Disconnect the accelerator cable end from the guide lever by releasing the square retainer from the lever **(see illustration)**. Now slip the cable out of the slot on the side of the lever.
3 Pry off the connecting lever from the guide lever ball socket. The connecting lever is the adjustable thin flat lever, connecting the guide lever on the main linkage with the throttle lever below on the throttle valve housing.
4 Move the guide lever until the roller rests against the idle speed end stop **(see illustration)**. With the linkage in this position, adjust the length of the connecting lever if necessary, so that it can be installed, free of tension, to the guide lever ball socket.
5 Reconnect the accelerator cable and connecting lever to the guide lever.



6.4 Linkage roller (arrow) against idle speed end stop



6.7 Accelerator cable full throttle stop adjuster (arrow)



6.9 Accelerator cable stop fitting (arrow)

6 Have an assistant depress the accelerator pedal fully on cars with manual transmission, or down as far as the kickdown switch on cars with automatic transmission. Do not actuate the kickdown switch.

7 The throttle lever on the throttle valve housing should now be in contact with the full throttle stop. Turn the cable adjuster **(see illustration)** as required to achieve this.

8 Release the accelerator pedal and allow the linkage to return to the idle position, with the roller resting against the guide lever idle speed end stop.

9 In this position, the stop fitting on the end of the accelerator cable should be in contact with the compression spring with no free play **(see illustration)**. If this is not the case, turn the adjuster at the accelerator pedal end of the cable, which is accessible from inside the car, until the adjustment is correct.

10 Refer to Chapter 6, and adjust the control pressure cable on cars equipped with automatic transmission.

7 Accelerator cable – removal and installation

Removal

1 Disconnect the accelerator cable end from the guide lever by releasing the square retainer from the lever. Now slip the cable out of the slot on the side of the lever.

2 Compress the two legs of the outer cable retainer, and pull the cable up and out of the support bracket.

3 From inside the car, extract the retaining circlip and remove the cable end from the accelerator pedal shaft.

4 Release the cable from the firewall and pull it through into the engine compartment.

5 Remove the grommet in the inner firewall and the retaining clips along the cable length.

6 Remove the cable from the car.

Installation

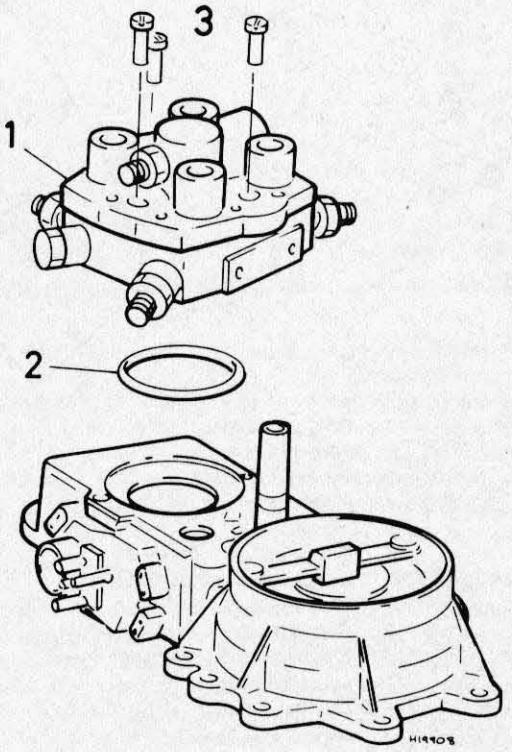
7 Installation is the reverse of removal, but adjust the cable as described in Section 6.

8 Fuel injection system – description and operation

Refer to illustrations 8.1a, 8.1b and 8.1c

The fuel injection system on these vehicles is of the continuous injection type and supplies a precisely controlled quantity of atomized fuel to each cylinder under all operating conditions **(see illustrations)**.

The main components of the system are listed below, together with a brief description of their operation, as follows:



8.1a Fuel distributor attachment details

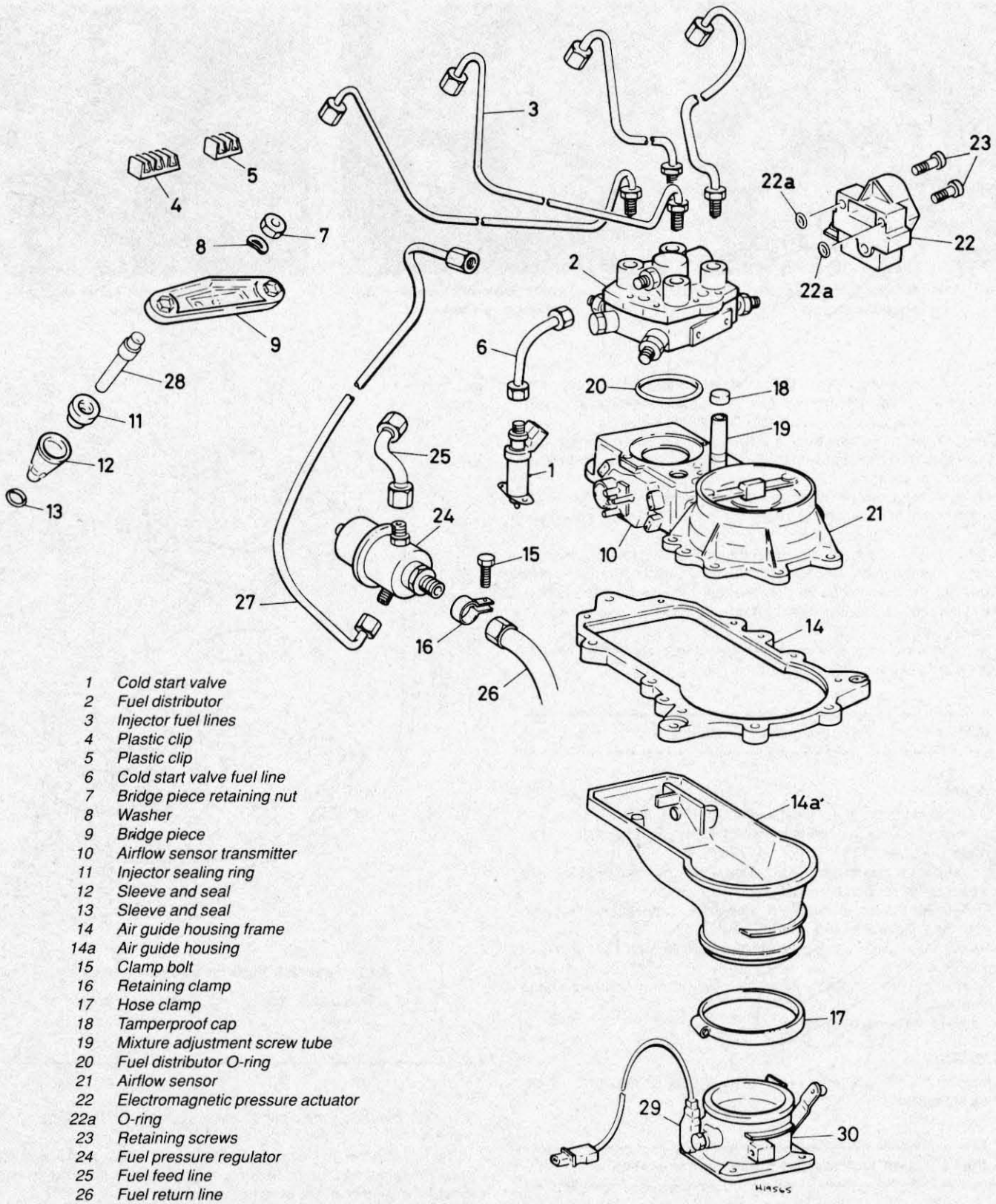
1 Fuel distributor
2 O-ring
3 Retaining screws

The *fuel tank* is located behind a panel at the front of the luggage compartment.

The *fuel pump* is an electric, roller cell type. A pressure relief valve is incorporated in the pump to prevent excessive pressure build-up in the event of a restriction in the fuel lines.

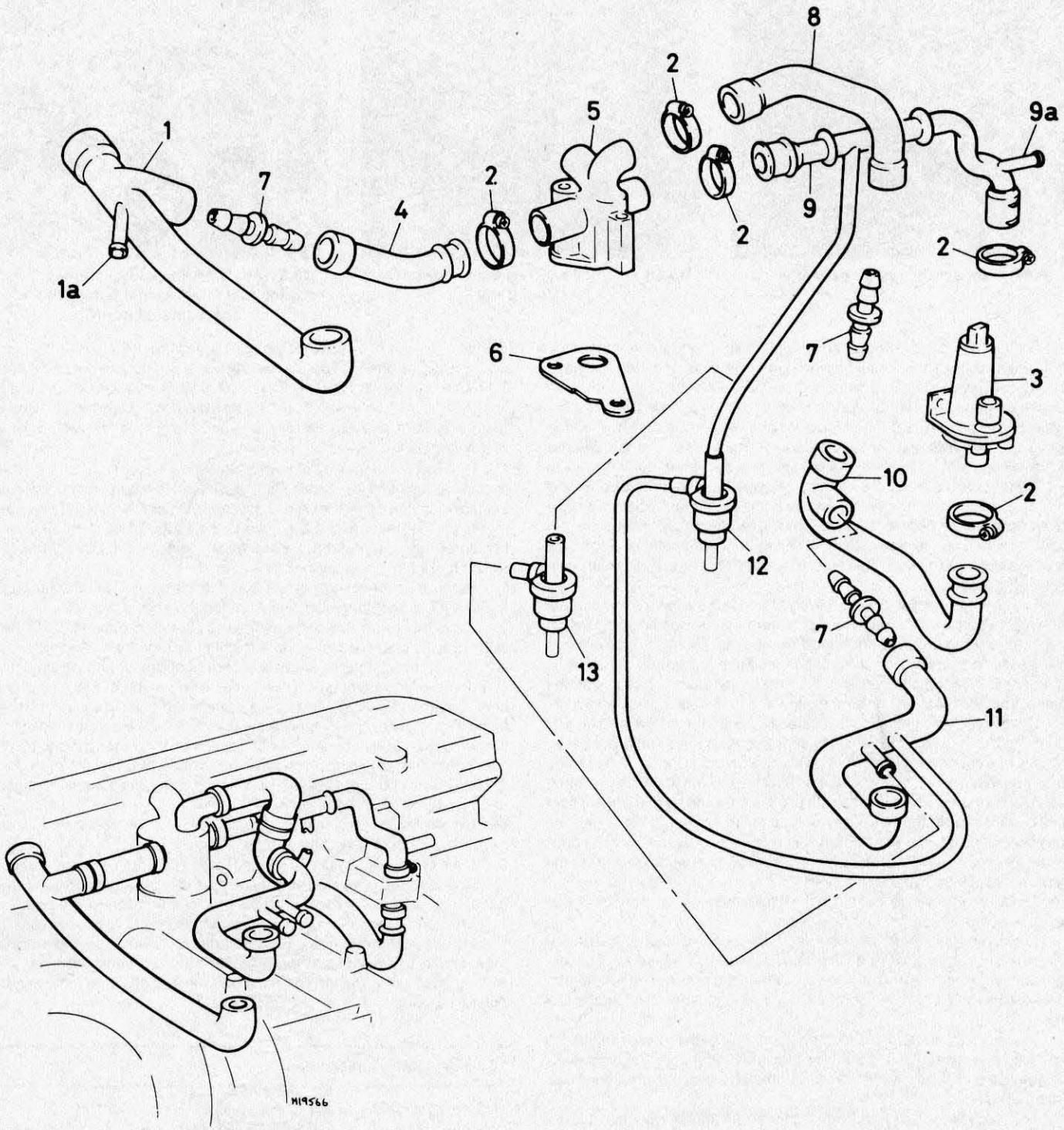
The *fuel accumulator* has two functions, (i) to dampen the pulsation of the fuel flow generated by the pump, and (ii) to maintain fuel pressure after the engine has been switched off. This prevents a vapor lock developing with consequent hot starting problems.

The *fuel filter* incorporates two paper filter elements to ensure that the fuel reaching the injection system components is completely free from dirt.



1 *Cold start valve*
2 *Fuel distributor*
3 *Injector fuel lines*
4 *Plastic clip*
5 *Plastic clip*
6 *Cold start valve fuel line*
7 *Bridge piece retaining nut*
8 *Washer*
9 *Bridge piece*
10 *Airflow sensor transmitter*
11 *Injector sealing ring*
12 *Sleeve and seal*
13 *Sleeve and seal*
14 *Air guide housing frame*
14a *Air guide housing*
15 *Clamp bolt*
16 *Retaining clamp*
17 *Hose clamp*
18 *Tamperproof cap*
19 *Mixture adjustment screw tube*
20 *Fuel distributor O-ring*
21 *Airflow sensor*
22 *Electromagnetic pressure actuator*
22a *O-ring*
23 *Retaining screws*
24 *Fuel pressure regulator*
25 *Fuel feed line*
26 *Fuel return line*
27 *Regulator to fuel distributor fuel line*
28 *Fuel injector*
29 *Throttle valve switch*
30 *Throttle valve housing*

8.1b Exploded view of the fuel injector and airflow sensor assembly components

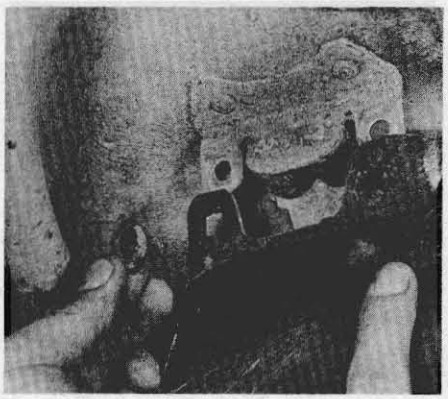


8.1c Exploded view of the fuel injection air and vacuum hose arrangement

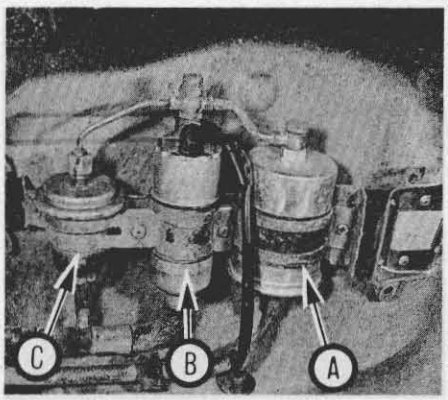
1	*Shaped hose*	*4*	*Shaped hose*	*9*	*Shaped hose*	*12*	*Bypass valve for automatic transmission*
1a	*Take-off to fuel pressure regulator*	*5*	*Idle speed air distributor*	*9a*	*Take-off to automatic transmission*	*13*	*Bypass valve for air conditioning compressor*
2	*Hose clamp*	*6*	*Gasket*	*10*	*Shaped hose*		
3	*Auxiliary air device*	*7*	*Spacing element*	*11*	*Shaped hose*		
		8	*Shaped hose*				



10.4a Pull out the center expander . . .



10.4b . . . followed by the plastic cover retainer body



10.6 Fuel line and wiring connections at the fuel filter (A) fuel pump (B) and fuel accumulator (C)

The *fuel distributor/airflow sensor assembly.* The fuel distributor controls the quantity of fuel being delivered to the engine, ensuring that each cylinder receives the same amount. The airflow sensor incorporates an air sensor plate and control plunger. The air sensor plate is located in the main airstream between the air cleaner and the throttle butterfly. During idling, the airflow lifts the sensor plate which in turn raises a control plunger which allows fuel to flow past the plunger and out of the metering slits to the injector valves. Increases in engine speed cause increased airflow which raises the control plunger and so admits more fuel. All mixture corrections are controlled electronically, by the electromagnetic pressure actuator, located on the side of the fuel distributor. The pressure actuator is directly controlled by a variable electric current, delivered by the fuel injection control module.

The *fuel injection control module* is located in the engine compartment behind the battery, and receives inputs from the various engine sensors concerning temperature, engine load, throttle movement, throttle position and starter actuation. This information modifies a program stored in its memory so that the electromagnetic pressure actuator, on receiving the signal from the module, can alter the mixture to suit all engine conditions.

The throttle valve housing is located beneath the airflow sensor, and contains the throttle plate, which is operated from the throttle linkage by means of a connecting lever. A throttle valve switch is located on the side of the housing, which sends inputs on throttle position to the control module. During manufacture, the throttle plate is adjusted so that it is fractionally open, to avoid the possibility of it jamming shut, and it must not be re-positioned. Idle speed adjustment is provided for by means of a screw in the idle speed air distributor which, according to its setting, restricts the airflow through air bypass channels.

The *fuel injectors* are located in the intake manifold, and are designed to open at a pre-determined fuel pressure.

The *fuel pressure regulator* is a vacuum-operated mechanical device which maintains the pressure differential between the intake manifold depression and the system fuel pressure. When the pressure differential increases beyond a certain figure, excess fuel is diverted back to the fuel tank.

The *auxiliary air device* is located at the rear of the intake manifold. It consists of a pivoted plate, bi-metal strip and heater coil. The purpose of this device is to supply an increased volume of fuel/air mixture during cold idling conditions.

The *cold start valve* system consists of an electrically operated injector and a thermotime switch. Its purpose is to spray fuel into the manifold to assist cold starting, the thermotime switch regulating the amount of fuel injected.

9 Fuel injection system – precautions and general repair information

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

1 Due to the complexity of the fuel injection system and the need for special gauges and Mercedes-Benz dedicated test equipment, any work should be limited to the operations described in this Chapter. Other adjustments and system checks are beyond the scope of most readers, and should be left to a Mercedes-Benz dealer service department or other Bosch fuel injection specialists.

2 Before disconnecting any fuel lines, fittings or components, thoroughly clean the component or connection and the adjacent area.

3 Place any removed components on a clean surface and cover them with a plastic sheet or paper. Do not use fluffy rags for cleaning.

4 The system operates under pressure at all times, and care must be taken when disconnecting any fuel lines under pressure. Place an absorbent rag around the fuel line to be disconnected and slowly unscrew the fitting. Discard the rag safely once the pressure has been released and no further fuel escapes. If more than one union on a component is to be disconnected, the remaining unions will not normally be under pressure once the first one is undone. Always work with the cable disconnected from the negative terminal of the battery.

5 Never start the engine when the battery is not firmly connected, and never disconnect the battery with the engine running.

6 If the battery is to be fast-charged from an external source, it should be completely disconnected from the vehicle electrical system. If this is not done, there is a risk of damage to the fuel injection control module.

7 The control module must be removed from the car if temperatures are likely to exceed 80-degrees C (176-degrees F) as would be experienced, for example, in a paint spray oven, or if any electric welding is being performed on the car. The ignition must be switched off when removing the control module.

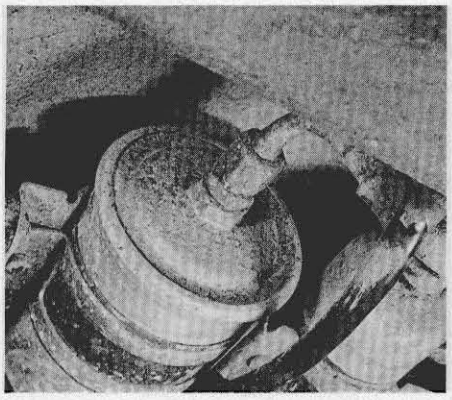
10 Fuel filter – replacement

Refer to illustrations 10.4a, 10.4b, 10.6, 10.7, 10.8 and 10.9

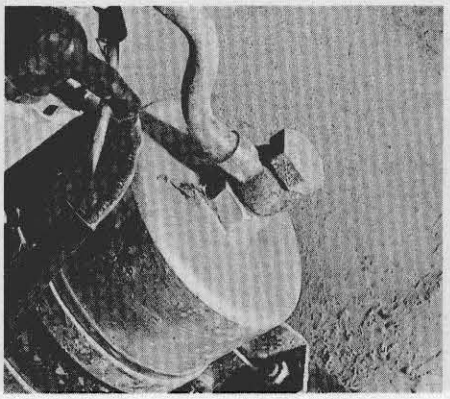
Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

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

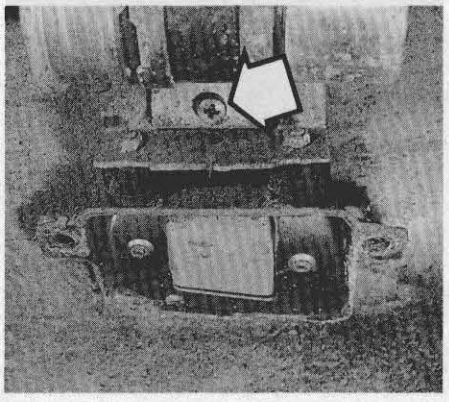
2 Release any excess pressure in the fuel tank by removing the filler cap.



10.7 Fuel filter outlet fitting



10.8 Filter connecting pipe banjo fitting bolt



10.9 Filter retaining strap screw

3 Jack up the rear of the car and support it on jackstands. Block the front wheels so the car doesn't roll off the stands.
4 Remove the plastic cover over the fuel filter, pump and accumulator assembly. To do this, unscrew the retaining bolts or if plastic fasteners are used, unscrew the center expander, then withdraw the retainer body **(see illustrations)**.
5 Using brake hose clamps or small C-clamps, pinch the two fuel hoses to prevent excessive fuel spillage.
6 Clean the area around the fuel hose fittings at both ends of the filter **(see illustration)**.
7 Place a container beneath the filter to catch any escaping fuel, then unscrew the fuel outlet fitting on the left end of the filter **(see illustration)**. Detach the union and hose from the filter.
8 Unscrew the connecting pipe banjo union bolt, remove the bolt and the sealing washers **(see illustration)**.
9 Loosen the retaining strap screw **(see illustration)**, swing the strap down and remove the filter.
10 Installation is the reverse of removal. Ensure that the retaining strap locates on the filter plastic sleeve only, and does not make metal-to-metal contact with the filter body. Use new sealing washers at the banjo fitting.

11 Fuel pump – removal and installation

Refer to illustration 11.4

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

Removal

1 Refer to Section 10 and perform Steps 1 through 5.
2 Clean the area around the fuel hose unions at both ends of the pump.
3 Place a container beneath the fuel pump to catch any escaping fuel, then loosen the clamp on the fuel feed hose. Disconnect the hose from the pump.
4 Unscrew the connecting pipe banjo fitting bolt, remove the bolt and the sealing washers **(see illustration)**.
5 Disconnect the electrical connectors at the pump terminals.
6 Remove the two retaining strap screws, remove the strap and withdraw the pump.

Installation

7 Installation is the reverse sequence to removal. Ensure that the retaining strap locates on the pump plastic sleeve only, and does not make metal-to-metal contact with the pump body. Position the pump with the electrical terminals in line vertically before securing the strap. Use new sealing washers on the banjo fitting.

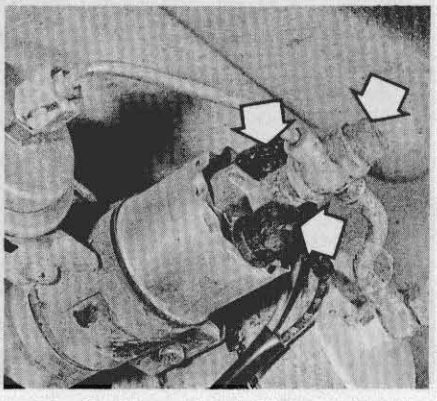
12 Fuel accumulator – removal and installation

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

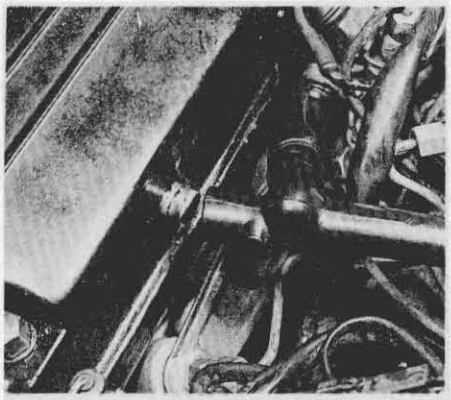
1 Proceed as described in Section 10, Steps 1 to 5.
2 Clean the area around the fuel hose unions at both ends of the fuel accumulator.
3 Place a container beneath the accumulator to catch any escaping fuel, then loosen the clamp on the fuel hose. Disconnect the hose from the accumulator.
4 Unscrew the fuel pipe fitting nut at the other end of the accumulator.
5 Remove the retaining strap screw, remove the strap and withdraw the accumulator.
6 Installation is the reverse of removal.

13 Idle speed and mixture – adjustment

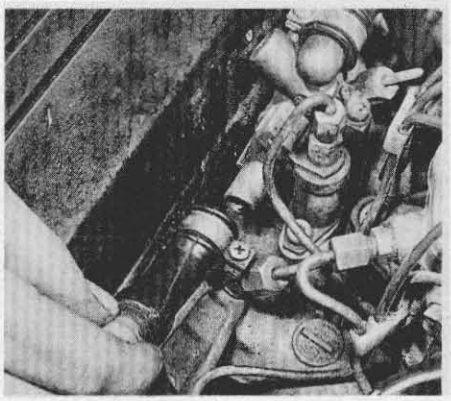
Note: *The idle speed is electronically controlled and cannot be adjusted. If the idle speed is erratic, the advice of a Mercedes-Benz dealer should be sought.*



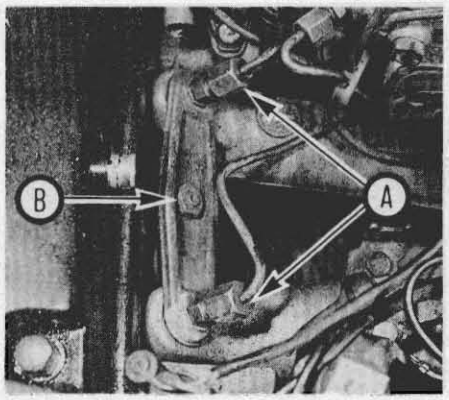
11.4 Fuel pump banjo fitting bolt and electrical connectors



14.2a Disconnect the shaped hoses at the camshaft cover . . .



14.2b . . . and idle speed air distributor



14.3 Fuel line fitting nuts (A) and injector bridge piece nut (B)

14 Fuel injectors – removal and installation

Refer to illustrations 14.2a, 14.2b and 14.3

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

1 Remove the air cleaner as described in Section 3.

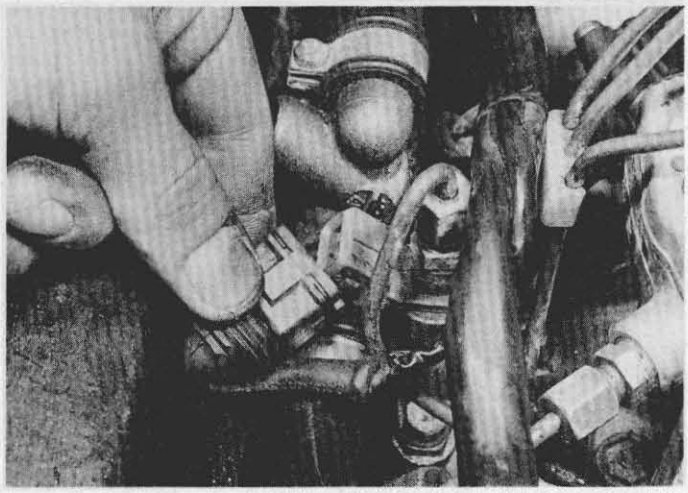
2 Loosen the clamps and disconnect the shaped hoses at the camshaft cover and idle speed air distributor as necessary for access **(see illustrations)**.

3 Unscrew the fuel line fitting nuts at the injectors and at the fuel distributor, and move the fuel lines to one side **(see illustration)**. Hold the injector body with a second wrench when unscrewing the union nuts.

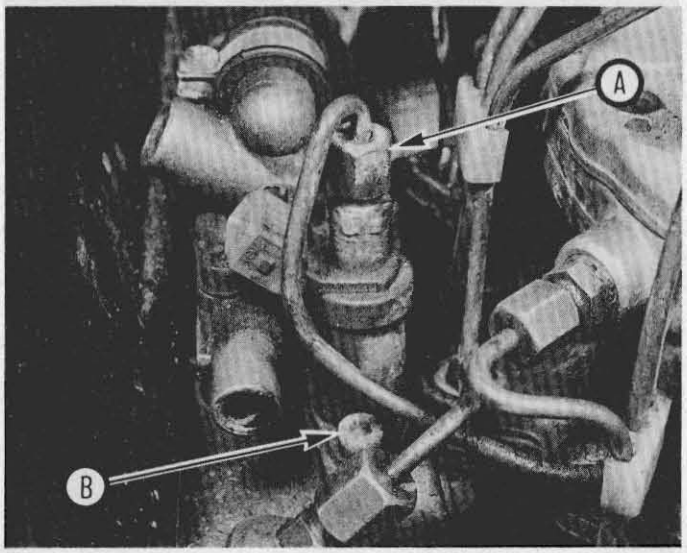
4 Unscrew the central nut and remove the retaining bridge piece securing each pair of injectors.

5 Pull out the injector(s) from the manifold.

6 Installation is the reverse of removal, but replace the rubber sealing rings if they have deteriorated in any way.



15.2 Disconnecting the cold start valve electrical connector



15.3 Cold start valve fuel line fitting (A) and front retaining bolt (B)

15 Cold start valve – removal and installation

Refer to illustrations 15.2 and 15.3

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

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

2 Disconnect the electrical connector at the cold start valve, which is located between the 2nd and 3rd fuel injector **(see illustration)**.

3 Unscrew the fuel line fitting nut and detach the fuel line **(see illustration)**.

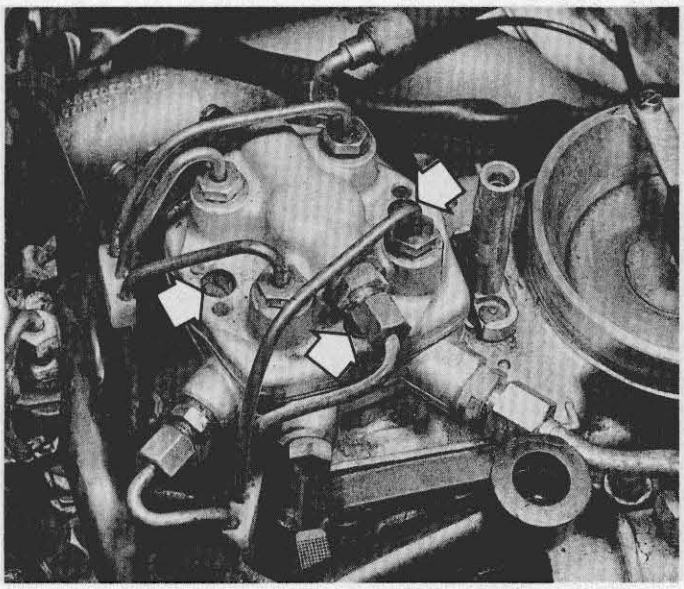
4 Remove the two socket-headed bolts and pull the valve from the manifold.

5 Installation is the reverse of removal, but be sure to check for fuel leakage after the job is complete.

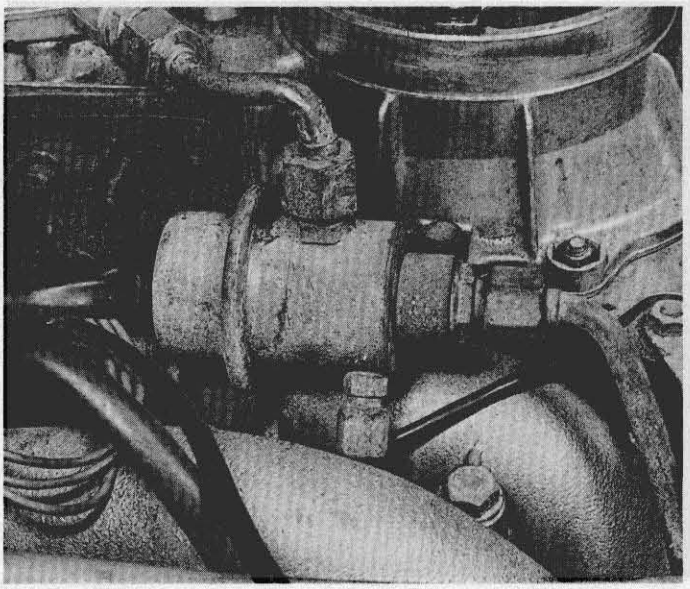
16 Fuel distributor – removal and installation

Refer to illustration 16.6

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dry-*



16.6 Fuel distributor retaining screws



17.2 Fuel pressure regulator location and connections

er) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.

Removal

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the air cleaner as described in Section 3.
3 Unscrew the fuel line fitting nuts for the four fuel injectors at the fuel distributor, and at the injectors. Ensure that the injector body is held with a second wrench as the union nuts are undone. Detach the fuel lines from the fuel distributor.
4 Also unscrew the fitting nuts for the cold start valve, pressure regulator and fuel supply line at the fuel distributor.
5 Disconnect the electrical connector from the electromagnetic pressure actuator on the side of the fuel distributor.
6 Unscrew the three retaining screws on top of the unit, turn it from side to side while pulling it up, then remove the unit from the airflow sensor **(see illustration)**. Remove the sealing O-ring.

Installation

7 Installation is the reverse sequence of removal, but use a new O-ring seal. Check for any signs of leaks on completion.

17 Fuel pressure regulator – removal and installation

Refer to illustration 17.2

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

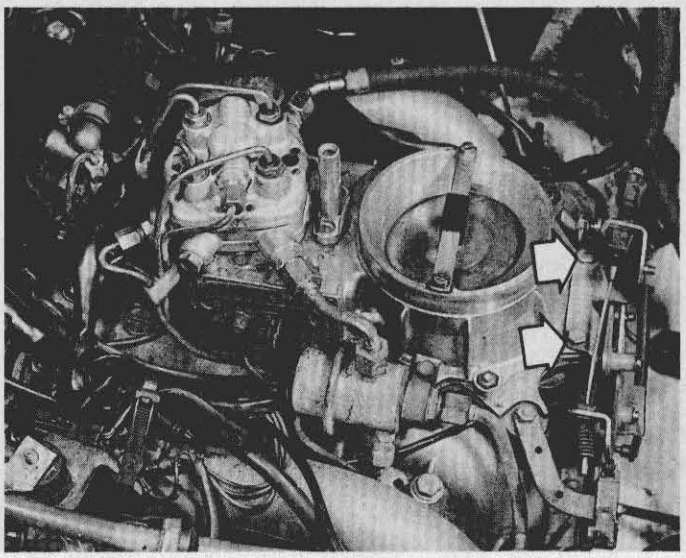
1 Disconnect the cable from the negative terminal of the battery. Remove the air cleaner as described in Section 3.
2 Unscrew the three fuel line fitting nuts at the regulator located on the side of the airflow sensor **(see illustration)**.
3 Disconnect the vacuum hose at the rear of the regulator.
4 Unscrew the clamp bolt and remove the unit from the airflow sensor.
5 Installation is the reverse sequence of removal. Be sure to check for leaks after the job has been completed.

18 Airflow sensor – removal and installation

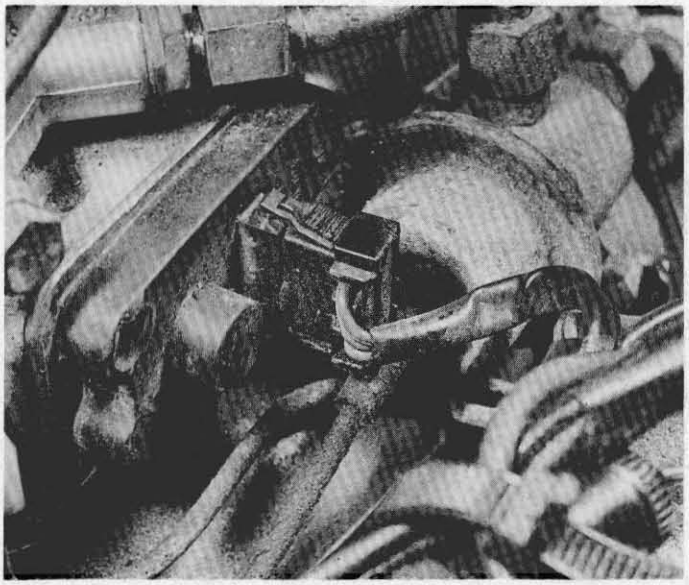
Refer to illustrations 18.2, 18.3, 18.4 and 18.5

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

1 Remove the fuel distributor as described in Section 16 and the fuel pressure regulator as described in Section 17.
2 Unscrew the two bolts and move the throttle linkage bracket aside **(see illustration)**.



18.2 Throttle linkage bracket retaining bolts (arrows)



18.3 Airflow sensor electrical connector

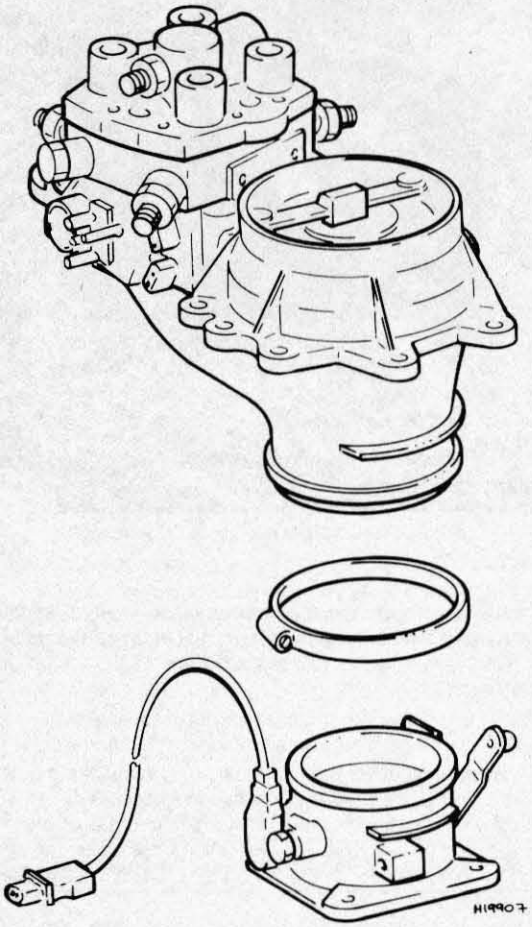
3 Disconnect the electric electrical connector at the airflow sensor transmitter **(see illustration)**.
4 Loosen the hose clamp on the rubber connecting sleeve between the airflow sensor and the throttle valve housing below **(see illustration)**.
5 Unscrew the nuts securing the airflow sensor to its rubber mountings. Lift off the brackets under the nuts at the throttle linkage end **(see illustration)**.
6 Lift the unit up, disconnect the idle speed air hose, and remove the airflow sensor from the car.
7 With the unit removed, the rubber air guide housing and its frame can be removed if required after undoing the retaining nuts.
8 Installation is the reverse of removal.

19 Throttle valve housing – removal and installation

Refer to illustration 19.11

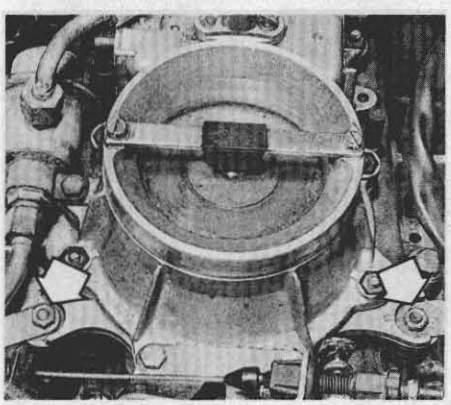
Removal

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the air cleaner as described in Section 3.
3 Unscrew the two bolts and move the throttle linkage bracket on the air-flow sensor aside **(see illustration 18.2).**
4 Disconnect the linkage return spring on the throttle valve housing and the linkage connecting rod.

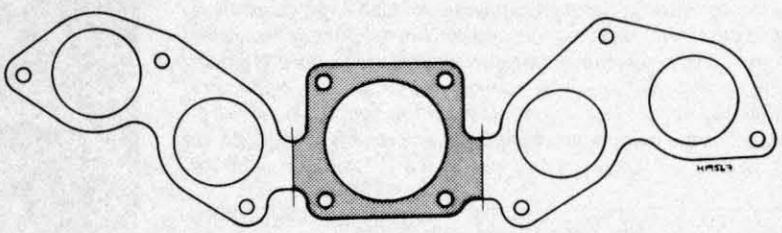


18.4 Throttle valve housing attachment details

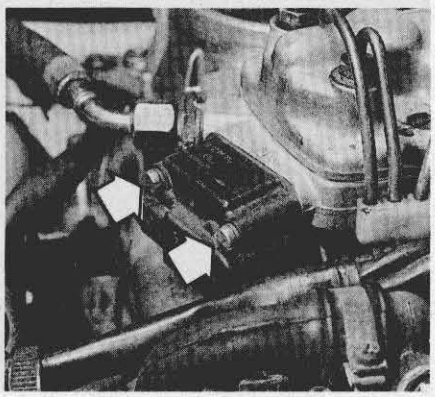
5 Disconnect the vacuum hose at the throttle valve housing, and unplug the throttle valve switch electrical connector at the harness connection.
6 Remove the nuts securing the housing to the intake manifold.
7 Loosen the hose clamp on the rubber connecting sleeve between the throttle valve housing and airflow sensor **(see illustration 18.4).**



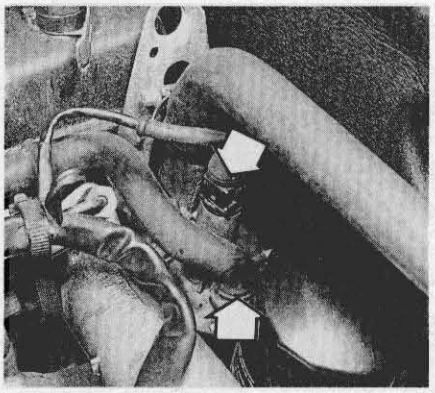
18.5 Airflow sensor-to-rubber mount retaining nuts (arrows)



19.11 Cut the intake manifold gasket and remove the center portion after removing the throttle valve housing



20.5 Electromagnetic pressure actuator retaining screws (arrows)



21.2 Electrical connector and air hose at the auxiliary air device

8 Remove the two nuts securing the airflow sensor to its rubber mounts at the throttle linkage end.
9 Unscrew the fuel return hose fitting nut at the rear of the fuel pressure regulator.
10 Lift the airflow sensor up until sufficient clearance exists to enable the throttle valve housing to be removed.
11 Cut the intake manifold gasket at the throttle valve housing contact area, and remove the center part of the gasket **(see illustration)**.

Installation

12 Installation is the reverse of removal, but use a new manifold gasket. Cut the gasket so that just the center portion for the throttle valve housing is used.

20 Electromagnetic pressure actuator – removal and installation

Refer to illustration 20.5

Warning: *Gasoline is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance (such as a water heater or clothes dryer) with a pilot light is present. If you spill any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a Class B type fire extinguisher on hand.*

Removal

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the air cleaner as described in Section 3.
3 Disconnect the electrical connector from the pressure actuator, which is located on the side of the fuel distributor.
4 Reduce the fuel pressure by loosening the fuel line fitting on the pipe between the cold start valve and the fuel distributor at the fuel distributor end. Use an absorbent rag. Tighten the fitting after releasing the pressure.
5 Remove the two retaining screws and pull out the pressure actuator from the fuel distributor **(see illustration)**. Remove the two O-ring seals.

Installation

6 Installation is the reverse of removal, but use new O-ring seals.

21 Auxiliary air device – removal and installation

Refer to illustration 21.2

1 Disconnect the cable from the negative terminal of the battery.
2 Disconnect the electrical connector and the air hoses at the auxiliary air device, which is located at the rear of the intake manifold, adjacent to the engine compartment firewall **(see illustration)**.
3 Unscrew the retaining bolts and lift the unit away.
4 Installation is the reverse of removal.

22 Fuel injection control module – removal and installation

Refer to illustration 22.4

Removal

1 The fuel injection control module is located in the engine compartment in the space behind the battery.
2 Remove the battery as described in Chapter 12.
3 On cars equipped with ABS brakes, remove the braking system control unit as described in Chapter 9.
4 Pull the control unit up and out of its location **(see illustration)**.

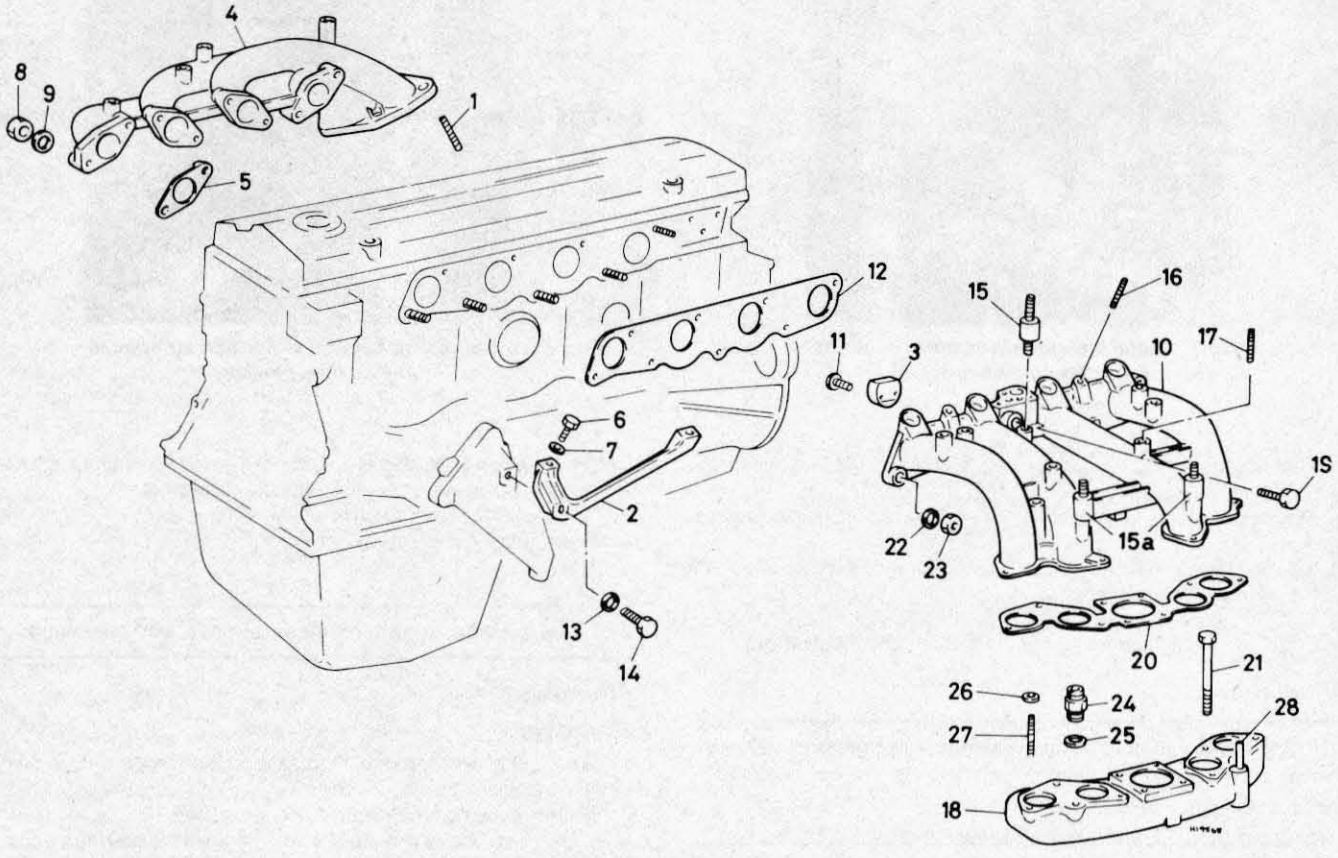


22.4 Fuel injection control module location in the compartment behind the battery

5 Disconnect the electrical connector by depressing the spring tag at the cable end, lift the plug up at the cable end, then disengage the tab at the other end.

Installation

6 Installation is the reverse of removal, but ensure that the electrical connector engages with an audible click from the spring tag.



23.9 Intake and exhaust manifold details

1	*Stud*	9	*Washer*	15a	*Airflow sensor outer rubber mounts*	22	*Washer*
2	*Support strut*	10	*Intake manifold upper half*	16	*Stud*	23	*Nut*
3	*Closing cover*	11	*Rivet*	17	*Stud*	24	*Adaptor*
4	*Exhaust manifold*	12	*Gasket*	18	*Intake manifold lower half*	25	*Sealing ring*
5	*Gasket*	13	*Washer*	19	*Bolt*	26	*Washer*
6	*Bolt*	14	*Bolt*	20	*Gasket*	27	*Stud*
7	*Washer*	15	*Airflow sensor inner rubber mount*	21	*Bolt*	28	*Vacuum connection*
8	*Nut*						

23 Intake manifold – removal and installation

Refer to illustration 23.9

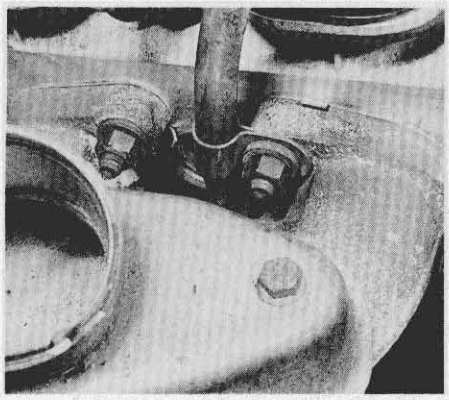
1 Disconnect the battery negative terminal.
2 Remove the fuel injectors as described in Section 14.
3 Remove the cold start valve as described in Section 15.
4 Remove the airflow sensor as described in Section 18.
5 Remove the throttle valve housing as described in Section 19.
6 Disconnect the air hoses at the idle speed air distributor.
7 Unscrew the fitting nut and remove the brake booster vacuum hose. Release the hose from its support bracket.
8 Disconnect the remaining electrical connectors and vacuum hoses from their attachments and cable clips, after making a careful note of the location of each.
9 Unscrew the bolts and remove the support strut from beneath the manifold **(see illustration)**.
10 Remove the retaining nuts and one bolt securing the manifold to the cylinder head, withdraw the manifold from the studs, and remove the gasket.
11 If required, the manifold upper and lower halves can be separated after removing the retaining nuts and bolts.
12 Installation is the reverse of the removal procedure. Use new gaskets and install the manifold components with reference to the relevant Sections.

24 Exhaust manifold – removal and installation

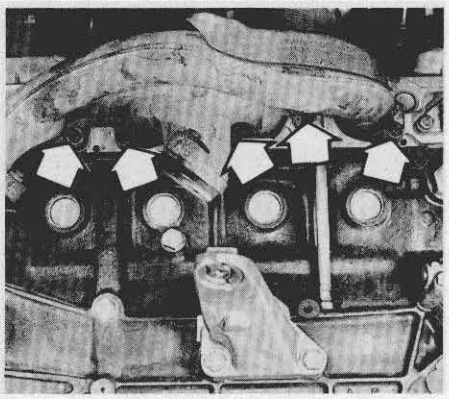
Refer to illustrations 24.7a and 24.7b

Removal

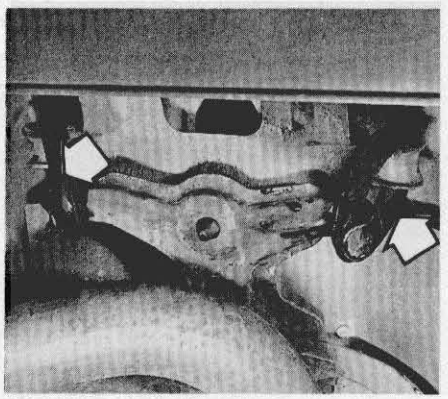
1 Jack up the front of the car and support it on jackstands. Apply the parking brake and block the rear wheels.
2 Loosen the U-bolt nuts securing the exhaust downpipe to the transmission-mounted support bracket.
3 Remove the nuts securing the support bracket to the transmission, and move the bracket clear.
4 Support the exhaust downpipe with a jack.
5 Remove the bolts securing the downpipes to the manifold, and lower the jack to separate the joints. Recover the flange gasket(s).
6 Refer to Section 3 and remove the air cleaner.



24.7a Dipstick tube attachment at the exhaust manifold



24.7b Exhaust manifold lower retaining nuts (arrows)



25.1a If the exhaust system hangers show signs of cracking or other deterioration, replace them

7 Remove the nuts securing the manifold to the cylinder head, noting the location of the engine oil dipstick tube support clip **(see illustrations)**.
8 Withdraw the manifold from the cylinder head studs and remove the gaskets.

Installation

9 Installation is the reverse of the removal procedure, but ensure that new gaskets are used, with the raised beads on the sheet metal sections towards the manifold.

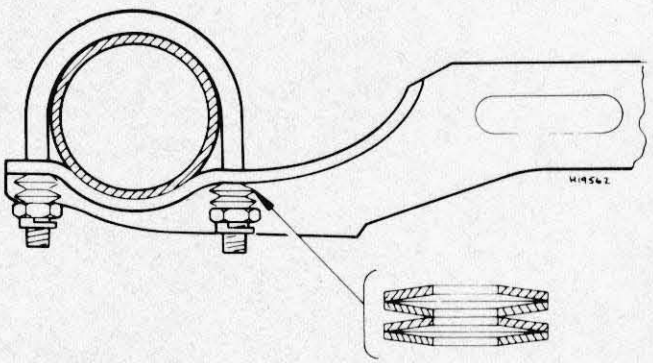
25 Exhaust system servicing – general information

Refer to illustrations 25.1a and 25.1b

Warning: *Inspection and repair of exhaust system components should be done only after enough time has elapsed after driving the vehicle to allow the system components to cool completely. Also, when working under the vehicle, make sure it is securely supported on jackstands.*

1 The exhaust system consists of the exhaust manifold(s), the catalytic converter, the muffler, the tailpipe and all connecting pipes, brackets, hangers and clamps. The exhaust system is attached to the body with mounting brackets and rubber hangers **(see illustrations)**. If any of the parts are improperly installed, excessive noise and vibration will be transmitted to the body.
2 Conduct regular inspections of the exhaust system to keep it safe and quiet. Look for any damaged or bent parts, open seams, holes, loose co nections, excessive corrosion or other defects which could allow exhaust fumes to enter the vehicle. Deteriorated exhaust system components should not be repaired; they should be replaced with new parts.
3 If the exhaust system components are extremely corroded or rusted together, welding equipment will probably be required to remove them. The convenient way to accomplish this is to have a muffler repair shop remove the corroded sections with a cutting torch. If, however, you want to save money by doing it yourself (and you don't have a welding outfit with a cutting torch), simply cut off the old components with a hacksaw. If you have compressed air, special pneumatic cutting chisels can also be used. Also, most auto parts stores carry special exhaust system tubing cutters at a reasonable price. If you do decide to tackle the job at home, be sure to wear safety goggles to protect your eyes from metal chips and rust, and work gloves to protect your hands.
4 Here are some simple guidelines to follow when repairing the exhaust system:

a) Work from the back to the front when removing exhaust system components.



25.1b Exhaust support bracket U-bolt washer arrangement

b) Apply penetrating oil to the exhaust system component fasteners to make them easier to remove.
c) Use new gaskets, hangers and clamps when installing exhaust systems components.
d) Apply anti-seize compound to the threads of all exhaust system fasteners during reassembly.
e) Be sure to allow sufficient clearance between newly installed parts and all points on the underbody to avoid overheating the floor pan and possibly damaging the interior carpet and insulation. Pay particularly close attention to the catalytic converter and heat shield.

26 Troubleshooting – fuel injection system

Due to the need for special test equipment to perform even the most routine troubleshooting procedure, any malfunction related to the fuel injection system should be diagnosed by a Mercedes-Benz dealer service department or other Bosch fuel injection specialist. Before doing this, however, make sure the problem is not being caused by a disconnected or damaged hose, loose or disconnected electrical connector, clogged air filter or fuel filter, or by some other simple fault that may be obvious under close visual inspection.

Chapter 4 Ignition system

Contents

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Specifications

General

System type	Constant energy transistorized electronic ignition

Distributor

Type	Bosch electronic, breakerless
Rotor rotation	Clockwise
Firing order	1-3-4-2 (No. 1 at crankshaft pulley end)
Dwell angle range	7 to 34-degrees (checked at the screw terminal on the side of the diagnosis socket)

Coil

Type	Bosch
Primary resistance	0.5 to 0.9 ohm
Secondary resistance	6.0 to 16.0 K ohms

Ignition timing

At idle (unless otherwise indicated), with vacuum hose disconnected:	
1984 (engine code 102.961)	5 to 11-degrees BTDC at 3500 rpm
1985 to 1988 (engine code 102.985)	8 to 12-degrees BTDC
1986 and 1987 16-valve models (engine code 102.983)	14 to 18-degrees BTDC
Centrifugal advance check – at	
4500 rpm, with vacuum hose disconnected	31 to 33-degrees BTDC
Vacuum advance check (total advance) – at	
4500 rpm, with vacuum hose connected	40 to 44-degrees BTDC

Spark plugs

Type	Bosch H7DC, Beru 14k-7DU, Champion BN9Y or SN9YC
Electrode gap	0.8 mm (0.032 in)

Torque specifications

	Ft-lbs
Spark plugs	15

1 General information

All models covered by this manual are equipped with a constant-energy electronic ignition system. The system is made up of the battery, coil, distributor, electronic switching unit, spark plugs and the associated cables and wiring.

The system is divided into two circuits, primary and secondary. The secondary circuit is similar to that of a conventional ignition system, and consists of the secondary coil windings, distributor cap, rotor, spark plugs and spark plug wires. The primary circuit consists of the battery, ignition switch, primary coil windings and a pulse generator operating in conjunction with the electronic switching unit. The pulse generator is located in the distributor, and employs a permanent magnet, pick-up coil and trigger wheel (reluctor). The unit essentially performs the same function as the contact breaker points in a conventional system.

When the ignition switch is on, the ignition primary circuit is energized. As the distributor shaft rotates, the reluctor, which is a four-spoked disc mounted on the distributor shaft, changes the magnetic field created by the permanent magnets in which it rotates. Each time the magnetic field is interrupted, a voltage, sensed by the pick-up coil, is induced. This is sent to the electronic switching unit, which on receipt of the signal pulse, switches off the ignition coil primary current. The magnetic field in the coil collapses, and a high voltage is induced in the coil secondary windings which is conducted to the spark plug via the rotor, distributor cap and spark plug wires. A timing circuit in the electronic switching unit turns on the coil current again after the magnetic field has collapsed, and the process continues for each power stroke of the engine.

The distributor is equipped with centrifugal and vacuum advance mechanisms, to control the ignition timing according to engine speed and load, respectively.

Additional ignition advance, controlled by a check valve and thermovalve, is used to improve driving characteristics during the warm-up period. When the engine is cold, the thermovalve is closed and vacuum from the intake manifold acts on the distributor vacuum unit via the check valve. The check valve maintains the vacuum and the ignition timing is advanced by a further 8 to 12-degrees in addition to normal centrifugal advance. When the engine coolant reaches a pre-determined temperature, the thermovalve opens and the vacuum is exhausted to the throttle valve housing. The vacuum unit now provides ignition advance conventionally according to throttle position and engine load.

2 Maintenance and inspection

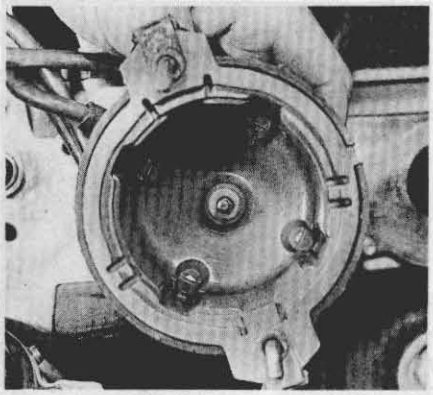
Refer to illustration 2.4

1 At the intervals specified in Routine Maintenance at the beginning of this manual, check the condition and security of all leads and wiring associated with the ignition system. Make sure that no chafing is occurring on any of the wires, and that all connections are secure, clean and free of corrosion. Pay particular attention to the spark plug and coil wires, which should be carefully inspected for any sign of corrosion on their end terminals which if evident, should be carefully cleaned off.

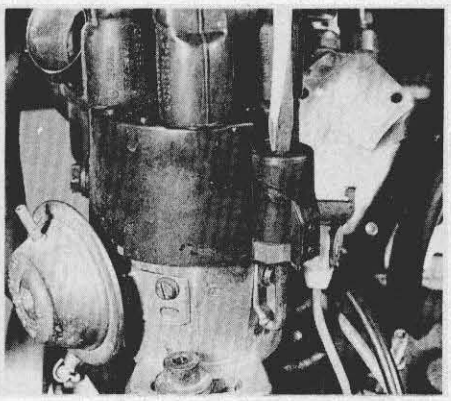
2 Replace the spark plugs as described in Section 9. If the spark plugs have been replaced within the service interval, clean them and reset the electrode gap also as described in Section 9.

3 Using the procedures given in Section 6, check and, if necessary, adjust the ignition timing.

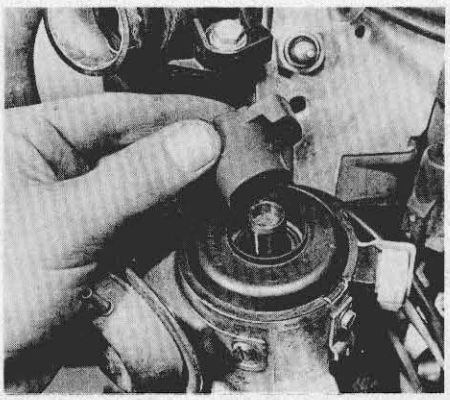
4 Although not a specified service requirement, it is advisable to periodically remove the distributor cap and clean it inside and out with a dry lint-free rag. Examine the terminals inside the cap. If they appear badly burnt or pitted, the cap should be replaced. Also check that the carbon brush in the center of the cap is free to move and protrudes from its holder **(see illustration)**.



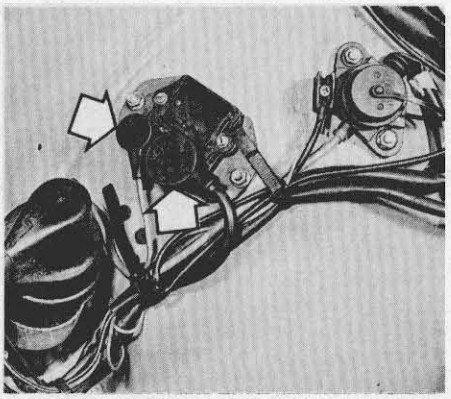
2.4 Check the condition of the carbon brush and terminals inside the distributor cap



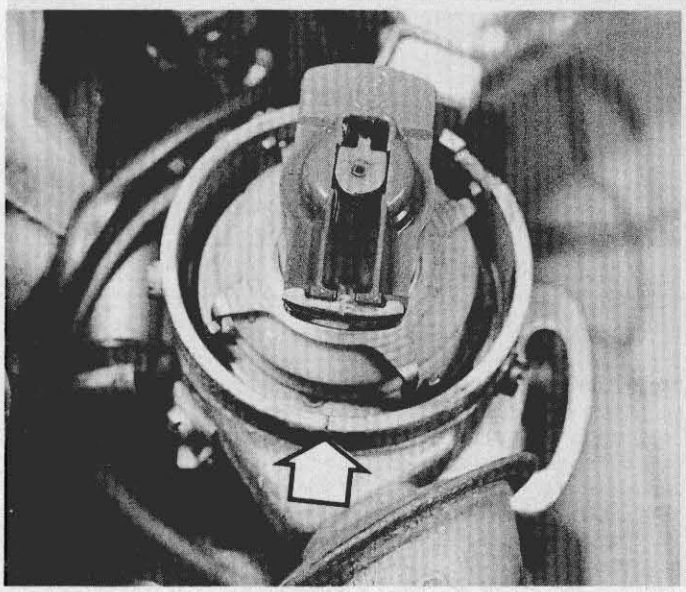
4.1 Release the distributor cap clamps by turning them 90-degrees



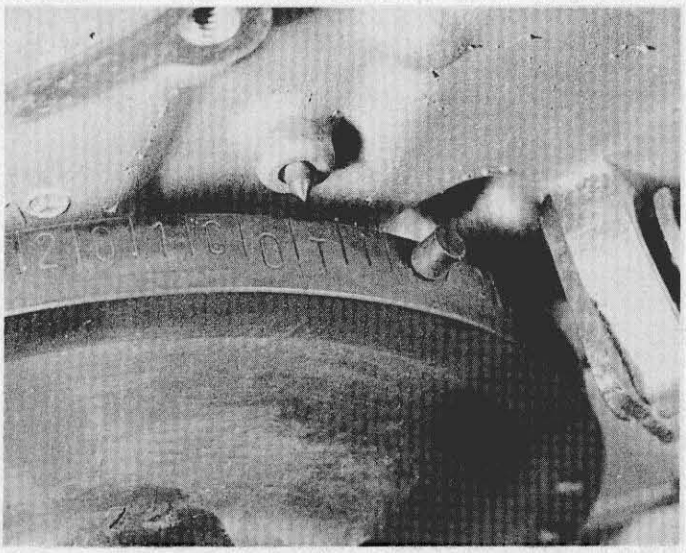
4.2 Pull off the rotor then remove the dust shield



4.3 Electrical connectors (arrows) at the electronic switching unit



4.6a Rotor tip pointing toward notch (arrow) in distributor body rim



4.6b Timing cover pointer aligned with TDC mark on vibration damper

3 Ignition system – precautions

1 When working on the electronic ignition system, the following precautions must be strictly observed to prevent damage to the electronic components and to avoid the risk of personal injury.

2 The voltages produced are considerably higher than those produced by a conventional system. Extreme care must be taken if work is being done with the ignition switched on, and it is recommended that persons fitted with a cardiac pacemaker should not work on the system.

3 The ignition must be switched off before any ignition wiring, including spark plug wires or test equipment wiring, is disconnected or connected.

4 If for any reason the engine is to be turned over without starting (for example, when checking valve clearances or cylinder compressions) either by hand or at starter motor speed, switch off the ignition and disconnect the primary electrical connector at the electronic switching unit (smaller of the two plugs, and having the green wire).

5 Do not run the engine with any ignition wiring or spark plug wires disconnected. For this reason, it is not permissible to pull off a spark plug wire with the engine running, or to check for a spark between the end of a disconnected spark plug wire or coil wire and ground with the engine running or cranking on the starter.

6 When using a timing light to check ignition timing, the only timing light type allowable is an inductive pickup type (one which receives its trigger signal from an clamp around the spark plug wire). Do not use a timing light that requires the spark plug wire to be disconnected and plugged into an adaptor. When using an instrument with an inductive clamp, connect the clamp to the spark plug wire as near to the distributor as possible.

7 Do not connect any test instruments such as a tachometer or dwell meter, or any other form of instrument or device, between terminals 1 and 15 on the ignition coil. If any test instrument is being used which cannot be plugged directly into the diagnostic socket, consult a Mercedes-Benz dealer as to its compatibility and correct method of connection.

4 Distributor – removal and installation

Refer to illustrations 4.1, 4.2, 4.3, 4.6a, 4.6b and 4.8

Removal

1 Using a screwdriver, release the two distributor cap clamps by pushing and turning the screw head through 90-degrees **(see illustration)**.

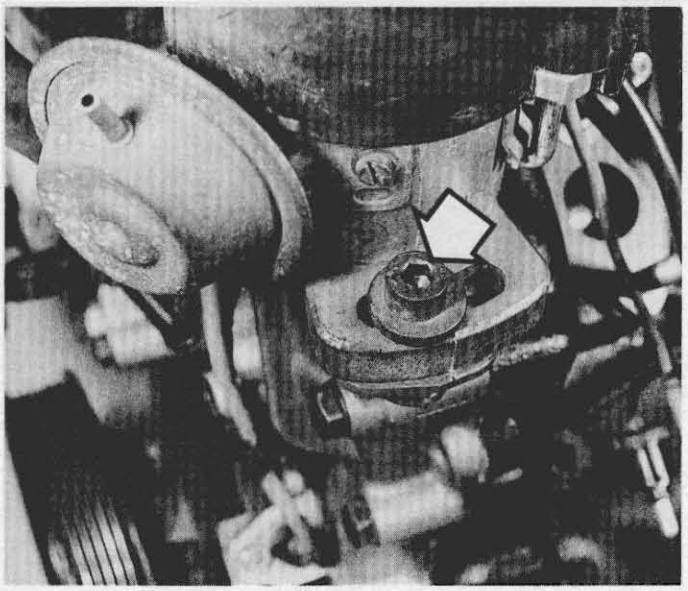
2 Remove the rotor and shield **(see illustration)** then install the rotor.

3 Disconnect the two electrical connectors at the electronic switching unit on the inner fender panel **(see illustration)**. Also remove any cable ties retaining the distributor primary wire to the wiring loom.

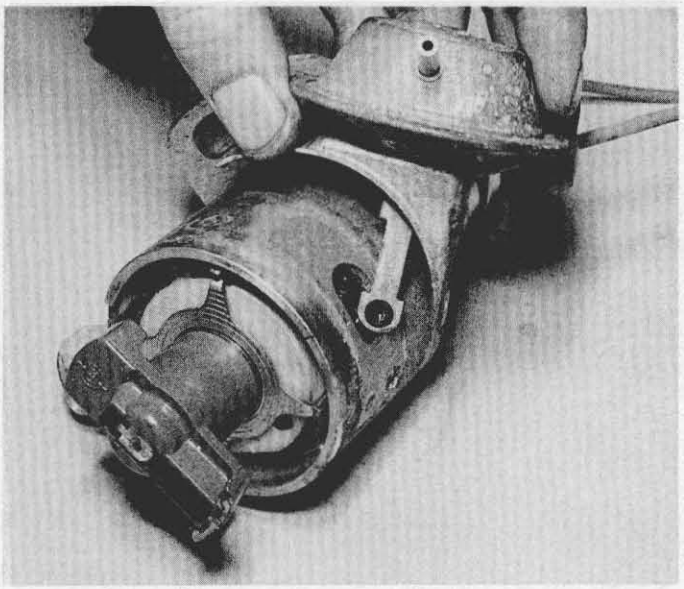
4 Disconnect the hose from the distributor vacuum unit.

5 Pull off the spark plug wire and remove No. 1 cylinder spark plug (nearest the front of the engine).

6 Using a socket and breaker bar on the crankshaft pulley bolt, turn the



4.8 Distributor retaining bolt (arrow)



5.6 Removing the distributor vacuum unit

engine over in the normal direction of rotation until the following conditions are present:

a) Compression can be felt building up in No. 1 cylinder if a finger is placed over the spark plug hole as the engine is turned
b) The rotor tip is pointing towards the notch in the distributor body rim **(see illustration)**
c) The pointer on the timing cover is aligned with the TDC mark on the scale on the crankshaft pulley vibration damper **(see illustration)** The engine is now positioned with No. 1 piston at Top Dead Center (TDC) on compression.

7 As a further aid to installing, scribe a line across the distributor body base and the timing cover.

8 Using an Allen wrench, unscrew the bolt securing the base of the distributor and slowly lift the unit out of its location **(see illustration)**. As the distributor is removed, note that the rotor turns clockwise as the driving gears disengage. Mark this new position of the rotor tip on the distributor body.

Installation

9 Before installing, make sure the engine is still positioned with No. 1 piston at TDC as described in Step 6.

10 Position the rotor tip so it is pointing towards the mark made on the distributor body after removal, and hold the distributor over the engine with the elongated mounting slot over the mounting bolt hole.

11 Insert the distributor fully, noting that the rotor tip should move counterclockwise and point towards the notch in the rim, with the line scribed on the distributor body base and timing cover also aligned.

12 Install the retaining bolt, spark plug and wire, shield, rotor and distributor cap, then reconnect the wiring.

13 Adjust the ignition timing as described in Section 6.

5 Distributor vacuum advance unit – removal and installation

Refer to illustration 5.6

1 Apart from the distributor cap and rotor, the only other distributor component which is available separately is the vacuum advance unit. The unit can be replaced without having to remove the distributor from the engine, although the accompanying photo shows the unit removed for clarity.

2 Release the two clamp screws and lift off the distributor cap.

3 Remove the rotor and shield.

4 Disconnect the hose from the vacuum unit.

5 Remove the two screws securing the vacuum unit to the distributor body.

6 Disengage the vacuum unit arm from the baseplate, and remove the unit from the distributor **(see illustration)**.

7 Installation is the reverse of removal.

6 Ignition timing – adjustment

Note: *Before checking the ignition timing, ensure the fuel injection system adjustments are correct, and the valve clearances (where applicable) and spark plug gaps are correctly set. A suitable timing light will be required for the following operations (see Section 3). On later models having a single drivebelt for the belt driven components, access to the timing marks is extremely limited due to the close proximity of the fan, drivebelt and the various pulleys. Exercise extreme caution when handling the timing light in this area.*

1 Turn the crankshaft using a socket on the pulley bolt until the timing marks on the pulley vibration damper are accessible. Before turning the crankshaft, disconnect the primary electrical connector at the electronic switching unit (the smaller of the two plugs, having the green wire) **(see illustration 4.3).**

2 Refer to the Specifications for the ignition timing setting at idle, then using a dab of quick-drying white paint, highlight this valve on the vibration damper scale. Also highlight the timing cover pointer above the vibration damper.

3 Reconnect the primary electrical connector at the electronic switching unit and disconnect the vacuum hose at the distributor vacuum unit.

4 Start the engine and point the timing light at the scale on the vibration damper. With the engine idling, the highlighted mark and pointer will appear stationary and, if the timing is correct, will be in alignment.

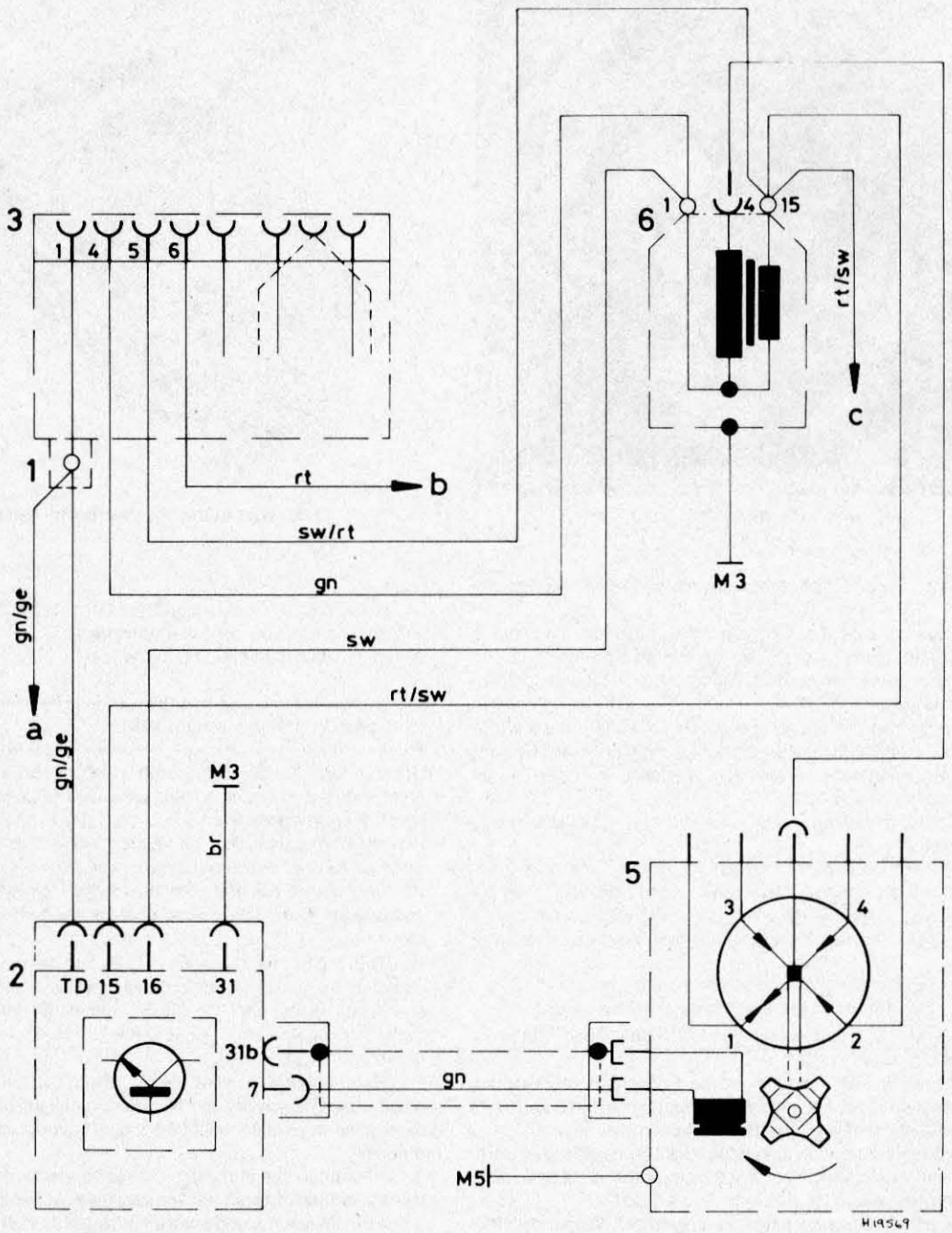
5 If adjustment is necessary, loosen the distributor retaining bolt and move the distributor body as necessary until the mark and pointer align. Tighten the retaining bolt and re-check the setting.

6 If required, the operation of the distributor centrifugal and vacuum advance mechanisms can be checked as follows.

7 Refer to the Specifications for the centrifugal advance check figure and the corresponding engine speed.

8 Have an assistant run the engine at the specified speed with reference to the tachometer in the car.

9 Point the timing light at the vibration damper scale again, and this time the specified advance check figure on the damper scale should be aligned with the pointer. If this is not the case, or if the mark appears to "jump" erratically, then the mechanism is worn or otherwise faulty and a new distributor will be required.

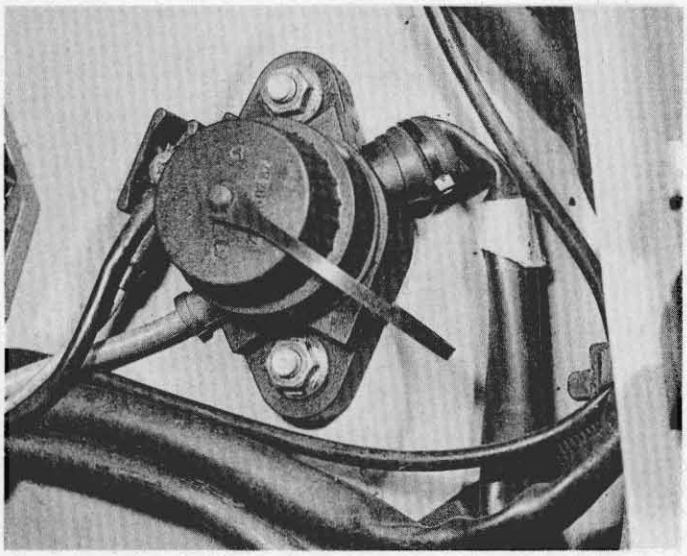


7.3b Electronic ignition system wiring diagram

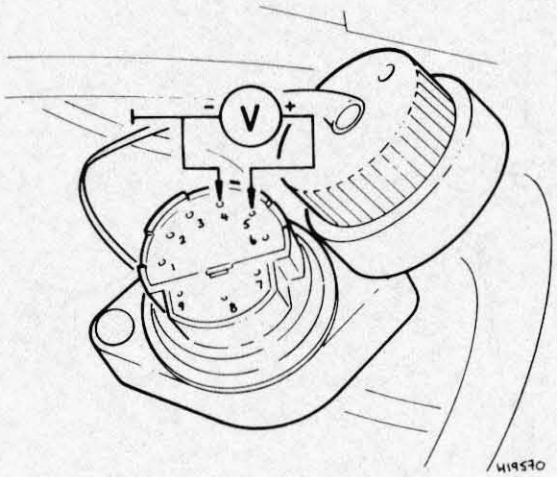
1 *Diagnosis socket terminal TD*
2 *Electronic switching unit*
3 *Diagnosis socket*
4 *Not used*
5 *Distributor*
6 *Ignition coil*
a *To idle speed shut-off valve relay/tachometer*
b *Central electric system coupler S jack 11*
c *Central electric system coupler S jack 4*

Color code

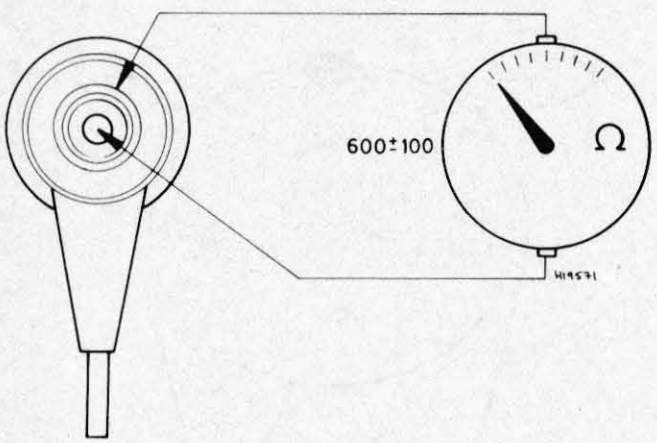
br = brown
ge = yellow
gn = green
rt = red
sw = black



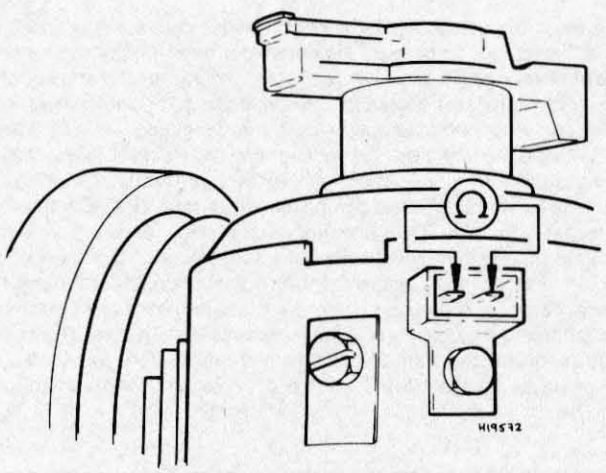
7.3a Diagnosis socket location on inner fender panel



7.4 Checking the voltage between terminals 4 and 5 of the diagnosis socket



7.7a Checking resistance at the primary wiring electrical connector of the electronic switching unit



7.7b Checking resistance at the distributor terminals

10 Similarly, the vacuum advance mechanism can be checked by running the engine at the specified speed and reconnecting the vacuum hose. As this is done, the specified vacuum advance check figure on the damper scale should align with the pointer. If this is not the case the vacuum unit is faulty and should be replaced.

11 On completion of the checks, switch off the engine and disconnect the timing light.

7 Ignition system – check

Refer to illustrations 7.3a, 7.3b, 7.4, 7.7a, 7.7b and 7.8

1 If a problem develops in the ignition system, the following test procedure can be used to isolate the fault and the component concerned. To perform these tests a high impedance voltmeter, ohmmeter and dwell meter will be needed.

2 First check that the battery terminals are clean and secure, and that the battery is fully charged and supplying the correct system voltage (see Chapter 12).

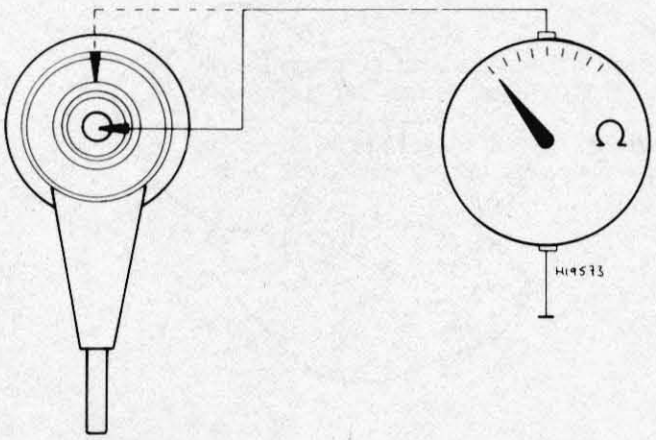
3 Unscrew the cap on the diagnosis socket **(see illustration)** and connect the voltmeter between terminal 5 of the socket and ground **(see illustration)**. Switch on the ignition and check that battery voltage is present, then switch off the ignition. If the reading is less than battery voltage, there is a break in the supply voltage from the ignition switch or other wiring problem.

4 Connect the voltmeter between terminals 4 and 5 of the diagnosis socket **(see illustration)**. With the ignition switched on, there should be no reading on the voltmeter. Switch off the ignition. If a reading of 0.1 volts or greater was indicated, the electronic switching unit is faulty and must be replaced. This may also have caused excessive heat build-up, and internal damage to the ignition coil and this component should also be checked as described in Section 8.

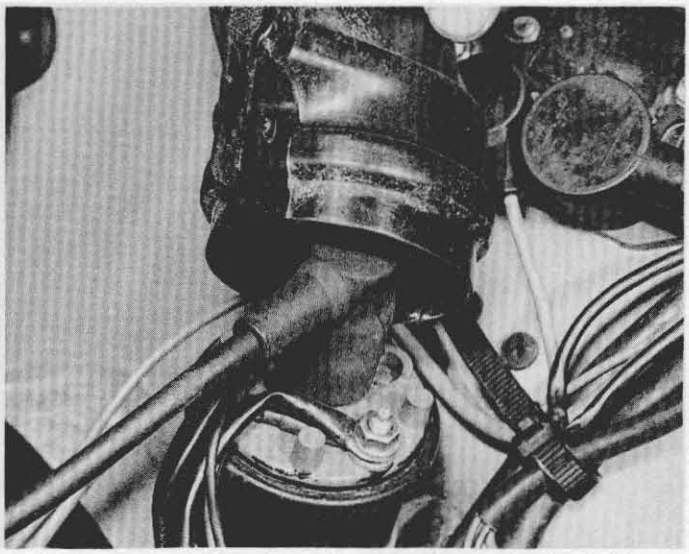
5 Connect a dwell meter to the diagnosis socket terminals in accordance with the maker's instructions, or to terminal TD, which is the external screw terminal on the side of the diagnosis socket.

6 With the engine cranking, check that the dwell angle falls within the range given in the Specifications. If the dwell angle is greater than the value specified, replace the electronic switching unit. If the dwell angle is correct, or if there was no reading on the dwell meter, proceed to the next test, but first switch off the ignition and disconnect the meter.

7 Disconnect the primary electrical connector at the electronic switching unit (the smaller of the two plugs, and having the green wire). Connect the ohmmeter between the center terminal (7) and the outer screening (3) **(see illustration)**. The resistance should be between 500 and 700 ohms.



7.8 Checking resistance between the electrical connector terminals of the distributor primary wire and ground



8.3a Remove the cover over the ignition coil terminals

If this value is not obtained, disconnect the electrical connector on the side of the distributor and connect the ohmmeter between the two terminals **(see illustration)**. This resistance should be between 500 and 700 ohms also. If not, replace the distributor. If the values obtained are correct, install the electrical connector to the distributor and proceed to the next test.

8 With the primary electrical connector at the electronic switching unit still disconnected, connect the ohmmeter between terminal 3 and ground, then between terminal 7 and ground **(see illustration)**. The resistance in each case should be 200 k ohms or greater. If these values are not obtained, disconnect the electrical connector at the distributor once more and connect the ohmmeter between one of the terminals and ground. If the resistance is now 200 k ohms or more, replace the green wire between the distributor and switching unit. If the resistance is still not as specified, replace the distributor. If the values obtained initially were correct, the system is in order and the wiring can be reconnected and the test instruments removed.

8 Ignition coil – check, removal and installation

Refer to illustrations 8.3a and 8.3b

1 The ignition coil is mounted on the inner fender panel in the left-hand side of the engine compartment.

2 If the coil is suspected to be malfunctioning, the following checks can be made.

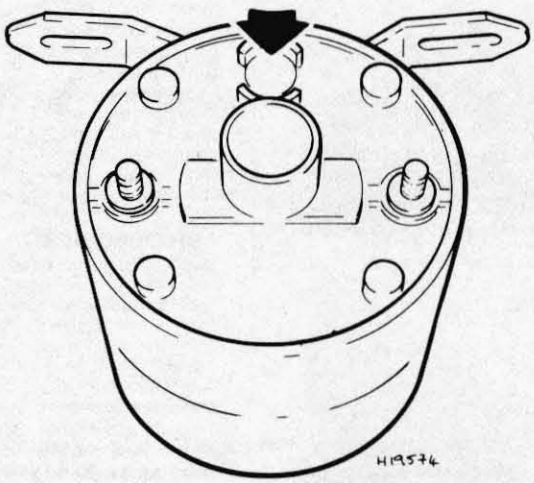
3 Remove the protective plastic cover over the coil terminals **(see illustration)**, and locate the small round plug located on the coil face behind the center terminal **(see illustration)**. If there has been excessive heat build-up in the coil caused by a fault in the ignition system circuitry, any of the components, or the coil itself, this plug will pop out. In this case the coil must be replaced, but before doing this it is necessary to determine the nature of the fault and repair it, otherwise the new coil will be damaged also.

4 To check the coil primary resistance, connect an ohmmeter between the two primary terminals (1 and 15). The resistance should be as given in the Specifications.

5 To check the secondary resistance, connect the ohmmeter between terminal 1 and the center terminal (4). Again the resistance should be as specified.

6 If the correct resistance values are not obtained, the coil must be replaced. Only an identical Mercedes-Benz ignition coil may be installed. If any other type is used, irreparable damage may be caused to the ignition system.

7 To remove the coil disconnect the coil secondary wire from the center terminal and unscrew the primary terminal nuts. Disconnect the primary wires from the terminal studs after identifying their color and location for installing.



8.3b Ignition coil over-pressure safety plug (arrow)

8 Unscrew the mounting bracket bolts and remove the coil from the vehicle.

9 Installation is the reverse of removal.

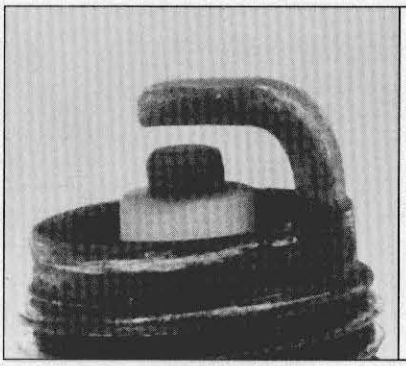
9 Spark plugs and spark plug wires – general information

Refer to illustrations 9.2, 9.10a and 9.10b

1 The correct functioning of the spark plugs is vital for the proper running and efficiency of the engine. The spark plugs should be replaced at the intervals given in Routine Maintenance at the beginning of this manual. If misfiring, hesitation or poor starting is experienced within the service period, the spark plugs should be removed, cleaned and re-gapped.

2 To remove the plugs, first pull off the spark plug wires by gripping the insulator portion, not the wire itself **(see illustration)**. The insulator is a tight fit over the plug, and a sharp pull is required. Using a spark plug

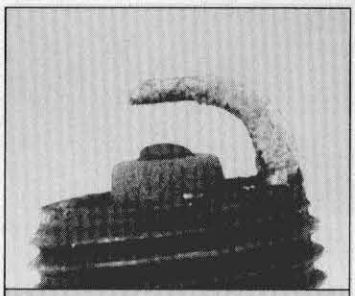
Common spark plug conditions



NORMAL

Symptoms: Brown to grayish-tan color and slight electrode wear. Correct heat range for engine and operating conditions.

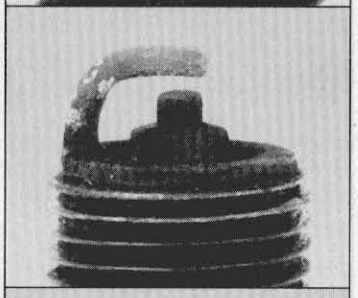
Recommendation: When new spark plugs are installed, replace with plugs of the same heat range.



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.

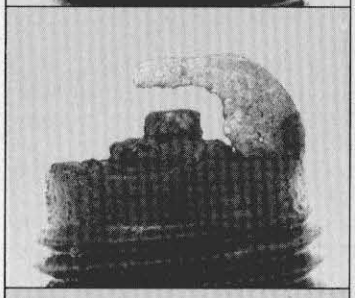
Recommendation: Plugs have been left in the engine too long. Replace with new plugs of the same heat range. Follow the recommended maintenance schedule.



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.

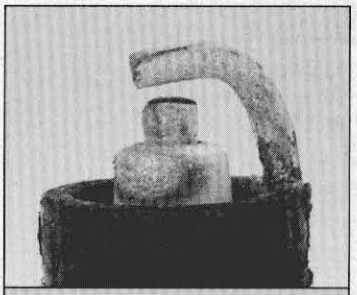
Recommendation: Correct the mechanical condition with necessary repairs and install new plugs.



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.

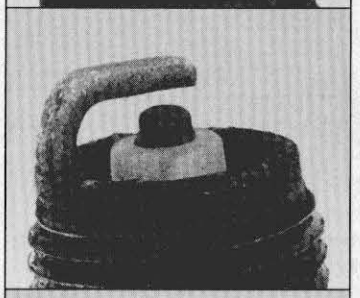
Recommendation: Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, intake manifold vacuum leaks, sticking valves and insufficient engine cooling.



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.

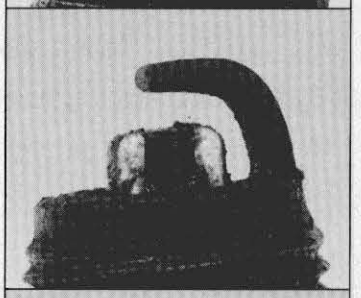
Recommendation: Check for the correct plug heat range, over-advanced ignition timing, lean fuel mixture, insufficient engine cooling and lack of lubrication.



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.

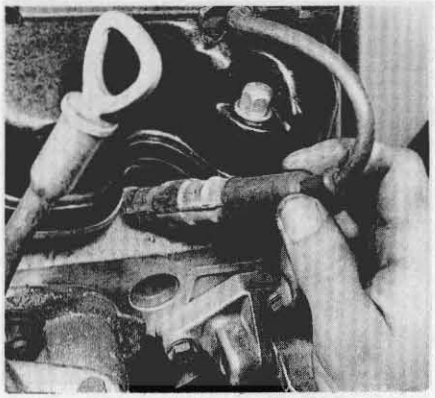
Recommendation: Make sure the fuel anti-knock values meet engine requirements. Use care when setting the gaps on new plugs. Avoid lugging the engine.



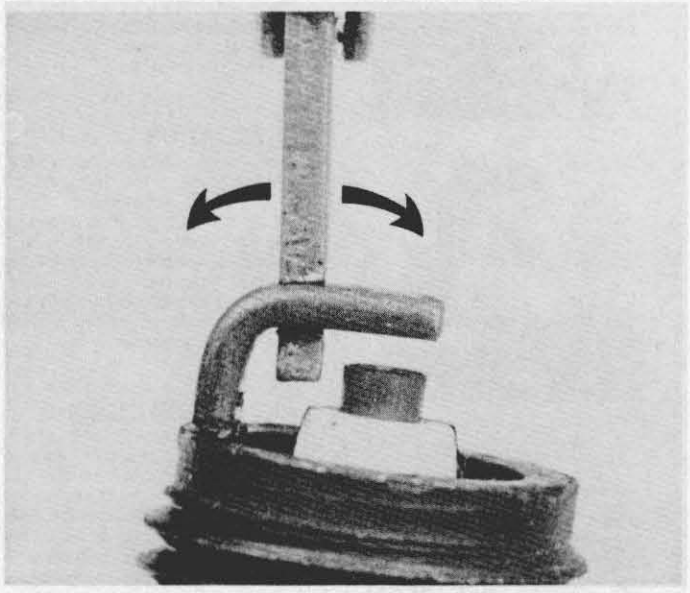
MECHANICAL DAMAGE

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.



9.2 When removing a spark plug wire from the spark plug, grasp the boot, not the wire



9.10b 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

wrench or suitable deep socket and extension bar, unscrew the plugs and remove them from their recesses in the cylinder head.

3 Examination of the spark plugs will give a good indication of the condition of the engine.

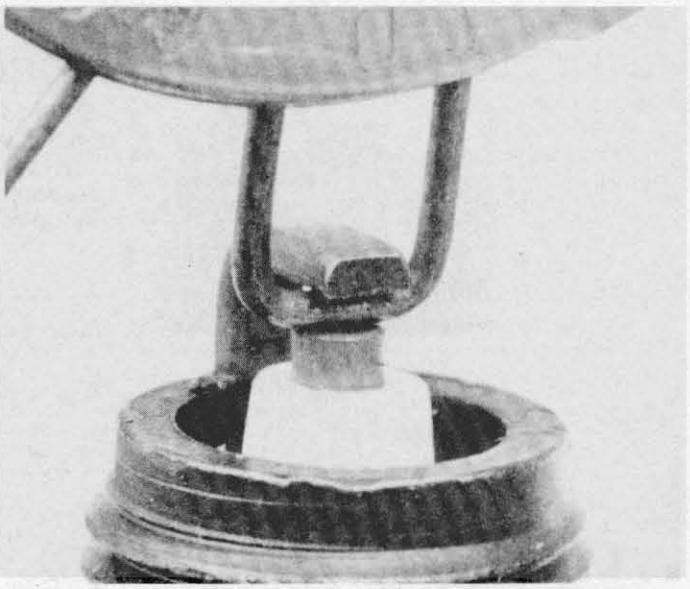
4 If the insulator nose of the spark plug is clean and white, with no deposits, this is indicative of a lean fuel mixture, or too hot a plug (a hot plug transfers heat away from the electrode slowly – a cold plug transfers heat away quickly).

5 If the top and insulator nose is covered with hard black-looking deposits, then this is indicative that the mixture is too rich. Should the plug be black and oily, then it is likely that the engine is fairly worn, and/or the mixture being too rich.

6 If the insulator nose is covered with light tan to grayish brown deposits, the mixture is correct, and it is likely that the engine is in good condition.

7 If there are any traces of long brown tapering stains on the outside of the white portion of the plug, the plug will have to be replaced, as this shows there is a faulty joint between the plug body and the insulator and compression is being allowed to leak out.

8 Plugs should preferably be cleaned by a sand-blasting machine, which will free them from carbon better than cleaning by hand. Some machines will also test the condition of the plugs under compression. Any plug that fails to spark at the recommended pressure should be replaced.



9.10a The 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

9 The spark plug gap is of considerable importance, because if it is either too large or too small the size of the spark and its efficiency will be seriously impaired. The spark plug gap should be set to the figures given in the Specifications.

10 To set it, measure the gap with a feeler gauge and then bend open, or close, the outer plug electrode until the correct gap is achieved **(see illustrations)**. The center electrode should never be bent as this may crack the insulation and cause plug failure.

11 To install the plugs, ensure that the thread is clean and dry and then screw each plug in by hand. Tighten the plugs to the specified torque. If a torque wrench is not available tighten them hand tight onto their seating and then tighten further by approximately 1/8 of a turn.

12 When installing the spark plug wires, make sure that they are pushed completely over the spark plug and into the cylinder head recess.

13 The plug wires themselves require no routine maintenance other than being kept clean and wiped over regularly. Should it be necessary to replace any of the wires, it is recommended that they be changed as a complete set. To do this, carefully pry off the plastic covers that retain them within the camshaft cover. Disconnect each wire, one at a time, from the spark plug and distributor cap, then install a new wire of the same length. With all the new wires in place, install the covers ensuring that each wire locates in its correct groove, corresponding to the cylinder numbering stamped on the plastic covers.

10 Troubleshooting – ignition system

Warning: *When carrying out troubleshooting tests or any checks on the ignition system, do not disconnect any wiring (including spark plug wires) when the engine is running or the ignition is switched on.*

1 There are two distinct symptoms of ignition system problems. Either the engine will not start or fire, or it starts with difficulty and does not run normally.

2 If the starter motor spins the engine satisfactorily, there is adequate fuel supply and yet the engine will not start, the fault is likely to be in the primary side.

3 If the engine starts but does not run satisfactorily, it is more likely to be a secondary circuit fault.

Engine fails to start

4 If the starter motor spins the engine satisfactorily, but the engine does not start, first check that the fuel supply to the engine is in order, with reference to Chapter 3.

5 Check for obvious signs of broken or disconnected wires or electrical connectors, particularly those to the coil, distributor and electronic switching unit, and for damp distributor cap and spark plug wires.

6 If all the above is in order follow the test procedure described in Section 7.

Engine starts but misfires

7 Bad starting and intermittent misfiring can be caused by a primary circuit malfunction, such as an intermittent connection of either the distributor, coil or electronic switching unit wiring connections or plugs.

8 If these are satisfactory, look for signs of tracking or burning inside the distributor cap, then check the cap carbon brush, rotor, spark plug wires, spark plug boots and plug insulators.

9 If the engine misfires regularly, it indicates that the fault is in one particular cylinder. This can often be confirmed by removing the spark plugs and checking to see if any are badly sooted or even wet with fuel, indicating that particular plug is not firing. If this is the case, clean and test, or replace, the spark plug, and run the engine again. If the problem persists, remove the spark plug wire and substitute it with one known to be satisfactory. If this clears the fault, replace the spark plug wires as a set. If the condition is not cured, check once again for tracking in the distributor cap. If these tests fail to cure the problem, there may be an internal engine problem on that cylinder, such as low cylinder compression.

10 If the misfire is of a more irregular nature, the test procedures described in Section 7 should be followed.

Chapter 5 Clutch

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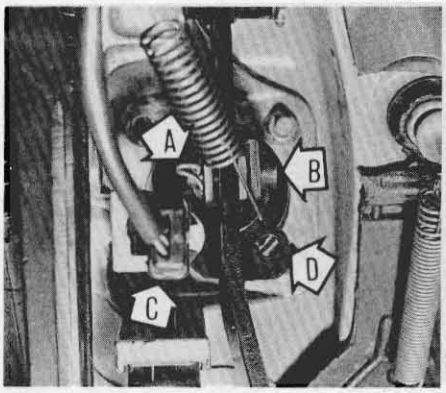
Specifications

Type	Single dry plate, diaphragm spring with hydraulic operation
Driven plate	
Friction lining thickness (new)	3.6 to 3.8 mm (0.14 to 0.15 in)
Friction lining thickness (minimum)	1.6 mm (0.06 in)
Maximum run-out	0.5 mm (0.02 in)
Pressure plate	
Maximum wear of diaphragm spring fingers	0.3 mm (0.01 in)
Hydraulic fluid	
Type	DOT 4 brake fluid
Torque specifications	**Ft-lbs**
Pressure plate-to-flywheel	18
Pedal bracket assembly-to-firewall	15

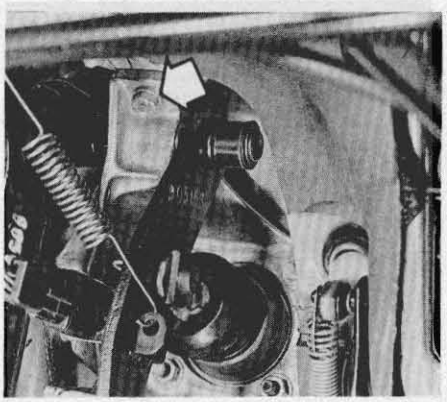
1 General information

All manual transmission models are equipped with a single dry plate diaphragm spring clutch. The unit consists of a steel cover which is bolted to the flywheel and contains the pressure plate and diaphragm spring.

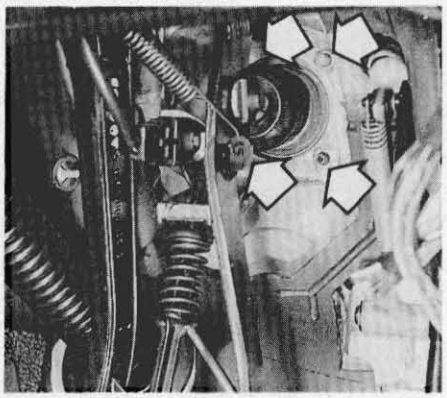
The clutch driven plate is free to slide along the splined transmission input shaft, and is held in position between the flywheel and the pressure plate by the pressure of the diaphragm spring. Friction lining material is riveted to the driven plate, which has a spring-cushioned hub to absorb transmission shocks and help ensure a smooth engagement.



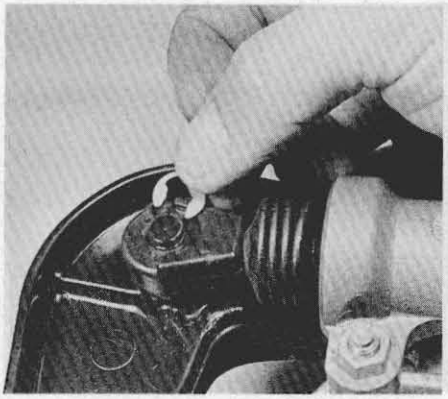
2.7 Brake booster pushrod retaining clip (A), clevis pin (B), brake light switch electrical connector (C) and pedal return spring attachment (D)



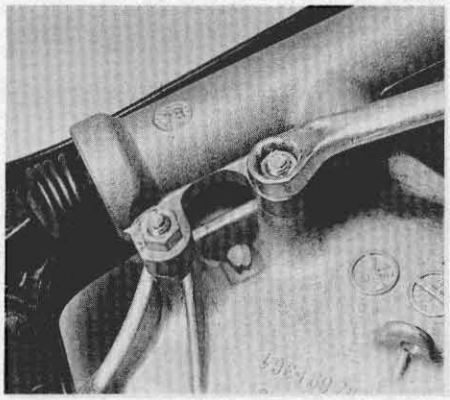
2.9 Pedal bracket upper retaining bolt (arrow)



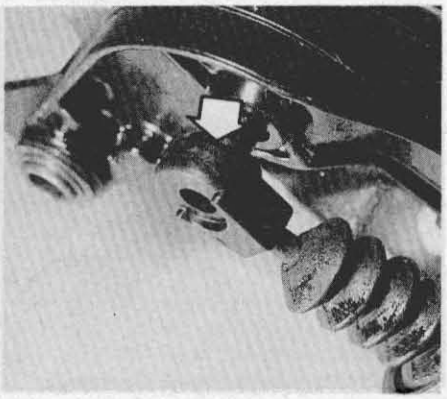
2.10 Pedal bracket and brake booster retaining nuts (arrow)



2.14 Remove the pushrod-to-pedal retaining circlip



2.15 Remove the master cylinder retaining nuts



2.16 Install the pushrod eye with the flanged side (arrow) towards the pedal

The clutch is operated hydraulically by a master and slave cylinder. The master cylinder is located inside the car, and is attached to the clutch pedal mounting bracket assembly. The slave cylinder is bolted to the transmission bellhousing, and actuates the clutch by means of a pushrod, release fork and release bearing. Hydraulic fluid for the system is provided by a combined brake and clutch hydraulic fluid reservoir, located on the brake master cylinder.

The clutch is self-adjusting for wear of the driven plate linings, and apart from periodically checking the fluid level in the master cylinder, the system is entirely maintenance-free.

2 Clutch master cylinder -- removal and installation

Refer to illustrations 2.7, 2.9, 2.10, 2.14, 2.15 and 2.16

The clutch master cylinder is located inside the car, attached to the clutch and brake pedal mounting bracket. Hydraulic fluid for the unit is supplied by a flexible rubber hose from the brake master cylinder reservoir in the engine compartment.

Removal

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

2 Remove the cover below the steering column to gain access to the master cylinder and pedal assembly.

3 Remove the floor carpet and cover the floor beneath the pedals to protect against hydraulic fluid spillage.

4 To reduce hydraulic fluid loss, draw off a quantity of fluid from the appropriate chamber of the brake master cylinder reservoir, using a clean syringe, until the fluid level is below that of the supply hose outlet.

5 Disconnect the brake pedal return spring at the brake pedal end.

6 Disconnect the electrical connector from the brake light switch on the pedal bracket.

7 Remove the retaining clip and withdraw the brake booster pushrod clevis pin **(see illustration)**.

8 Unscrew the hydraulic line fitting on the end of the clutch master cylinder, and carefully detach the line. Plug the line and master cylinder orifice to prevent the entry of dirt and to minimize fluid loss.

9 Remove the upper bolt securing the pedal bracket assembly to the firewall **(see illustration)**.

10 Unscrew the four nuts securing the pedal bracket assembly and brake booster to the firewall **(see illustration)**.

11 Disconnect the master cylinder fluid supply hose from the side of the brake master cylinder reservoir in the engine compartment. Push the hose a little way through the firewall, but not all the way.

12 Remove the pedal bracket assembly from the booster studs, and as soon as sufficient clearance exists, disconnect the fluid supply hose from the clutch master cylinder by pulling out the elbow connector.

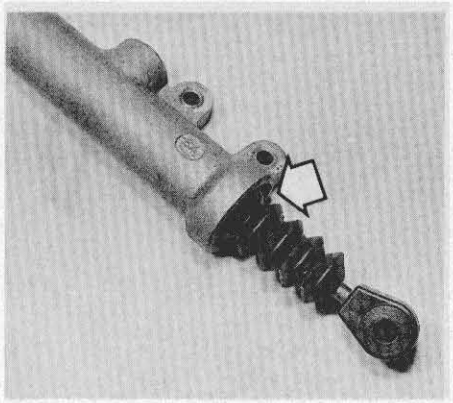
13 Remove the pedal bracket assembly from the car.

14 With the assembly removed, extract the retaining clip securing the master cylinder pushrod to the clutch pedal **(see illustration)**.

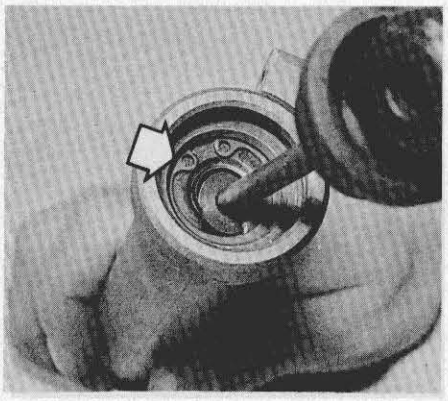
15 Unscrew the cylinder retaining nuts and remove the unit from the pedal bracket and pedal **(see illustration)**.

Installation

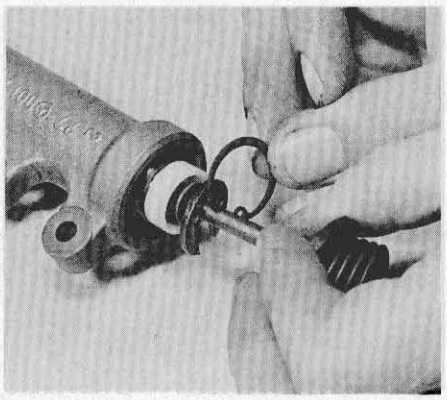
16 Installation is the reverse sequence of removal, but ensure that the master cylinder pushrod eye is installed with the flanged side towards the pedal **(see illustration)**. Bleed the clutch hydraulic system on completion, as described in Section 9.



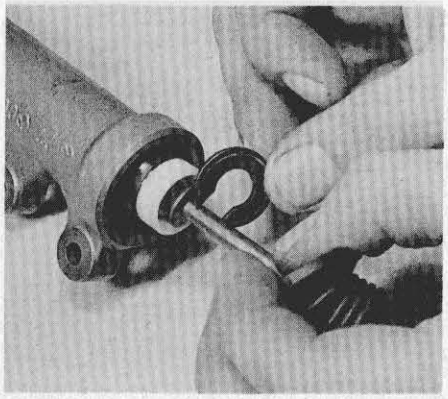
3.2a Ease the pushrod dust cover away from the cylinder body (arrow) . . .



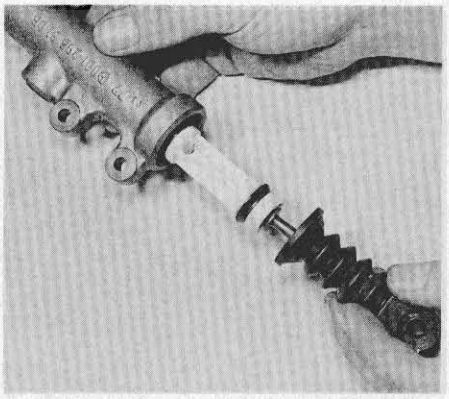
3.2b . . . to provide access to the circlip (arrow)



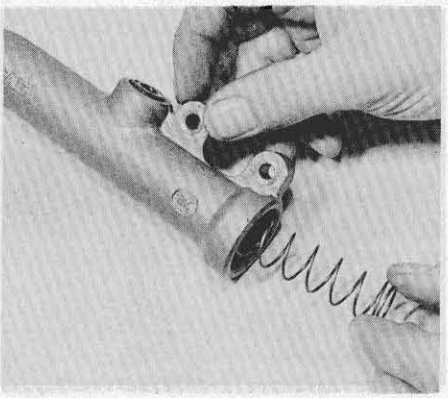
3.3a Remove the pushrod circlip



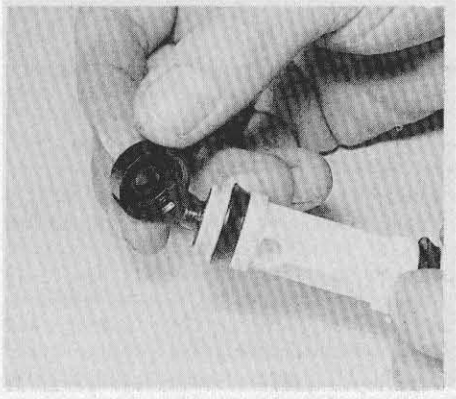
3.3b Remove the retaining washer



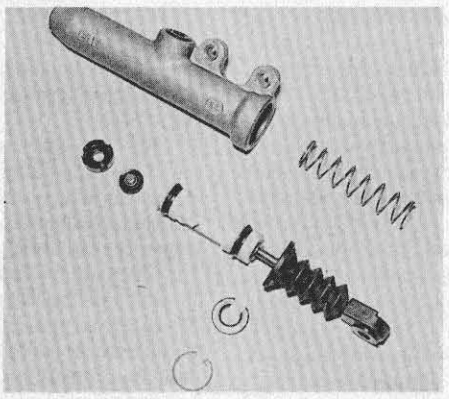
3.4a Pull out the pushrod and piston assembly



3.4b Remove the piston spring



3.5 Remove the end cap and check valve from the piston



3.6 Clutch master cylinder components



4.2 Unscrew the slave cylinder rigid line-to-flexible hose fitting

3 Clutch master cylinder – overhaul

Refer to illustrations 3.2a, 3.2b, 3.3a, 3.3b, 3.4a, 3.4b, 3.5 and 3.6

1 Remove the master cylinder from the car as described in Section 2.

2 Ease the dust cover on the pushrod away from the cylinder body to provide access to the circlip **(see illustrations)**.

3 Using circlip pliers, extract the circlip, then remove the retaining washer **(see illustrations)**.

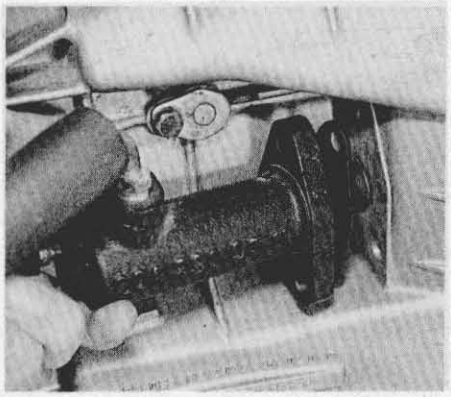
4 Remove the pushrod and piston assembly from the cylinder bore, followed by the piston spring **(see illustrations)**.

5 Remove the end cap and check valve from the end of the piston **(see illustration)**.

6 Wash all the parts in clean hydraulic fluid, then lay them out for inspection **(see illustration)**.

7 Examine the cylinder bore and piston carefully for signs of scoring or wear ridges. If these are apparent, replace the complete master cylinder. If the condition of the components appears satisfactory, a new set of rubber seals must be obtained. Never re-use the old seals.

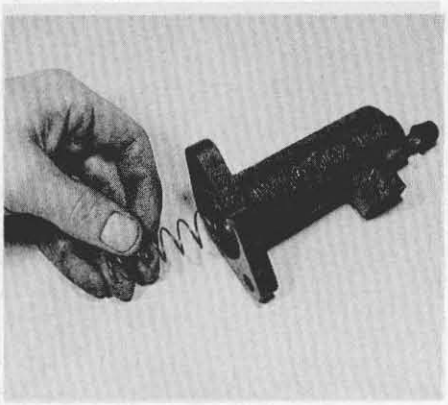
8 Remove the old seals from the piston, and carefully install the new ones using the fingers only, and liberal quantities of clean brake fluid. Ensure that the sealing lip edge of each seal is facing the spring end of the piston.



4.3 Removing the slave cylinder from the transmission bellhousing



5.3a Pull out the slave cylinder piston . . .



5.3b . . . followed by the spring

9 Lubricate the cylinder bore and the piston with brake fluid, then insert the spring into the bore.
10 Place the check valve and end cap on the piston, and carefully insert the piston into the cylinder bore. Take care not to damage the seal lips.
11 Install the retaining washer over the pushrod, followed by the circlip.
12 Push the piston down the bore slightly and engage the circlip in its groove. Ensure that it is fully seated.
13 Slide the dust cover into position and locate its end under the edge of the cylinder.
14 The master cylinder can now be installed as described in Section 2.

4 Clutch slave cylinder – removal and installation

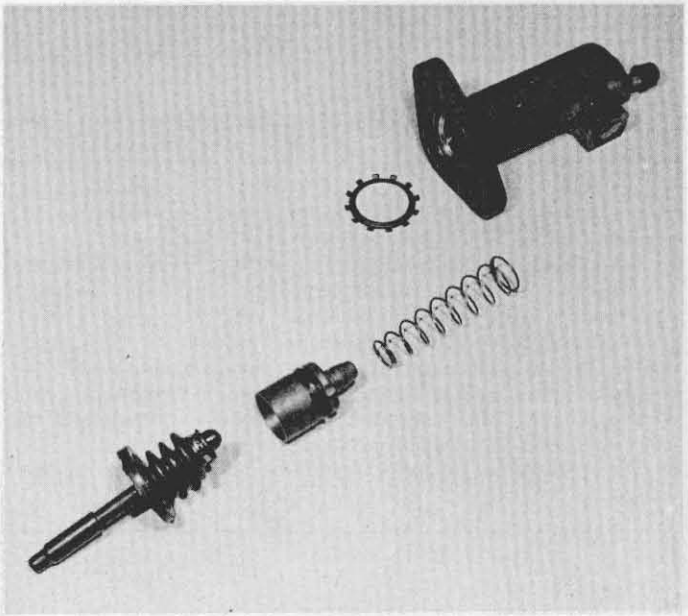
Refer to illustrations 4.2 and 4.3

1 Raise the front of the vehicle and support it securely on jackstands.
2 Unscrew the rigid line-to-flexible hose fitting at the connection located on the right-hand side of the transmission tunnel **(see illustration)**. Place a suitable container beneath the bracket to catch the escaping fluid as the fitting is loosened. Plug both the pipe and hose after separation to prevent further loss of fluid and contamination.
3 Unscrew the two bolts securing the slave cylinder to the bellhousing, and pull out the cylinder complete with pushrod, shim and flexible hose **(see illustration)**.
4 To install the cylinder, place the shim in position with the grooved side towards the bellhousing.
5 Guide the cylinder and pushrod into the bellhousing, making sure that the pushrod engages with the spherical recess in the clutch release fork.
6 Install and tighten the two retaining bolts, then reconnect the hose fitting.
7 Bleed the clutch hydraulic system as described in Section 9.

5 Clutch slave cylinder – overhaul

Refer to illustrations 5.3a, 5.3b and 5.4

1 Remove the slave cylinder as described in Section 4.
2 Using a screwdriver, carefully hook out the notched retaining ring and withdraw the pushrod assembly.
3 Tap the cylinder on a block of wood if necessary to release the piston, then remove the piston and spring **(see illustrations)**.
4 Wash all the parts in clean brake fluid, then lay them out for inspection **(see illustration)**.
5 Examine the cylinder bore and piston carefully for signs of scoring or wear ridges. If these are apparent, replace the complete slave cylinder. If the condition of the components appears satisfactory, a repair kit containing new rubber seals should be obtained. Never re-use the old seals.



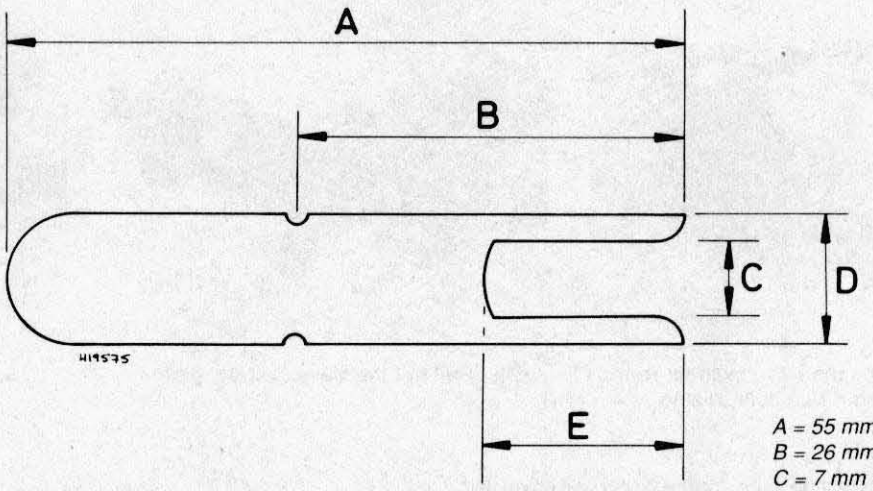
5.4 Clutch slave cylinder components

6 Remove the old seal from the piston, and install the new one using the fingers only, and liberal quantities of clean brake fluid. Ensure that the sealing lip edge is towards the spring end of the piston.
7 Lubricate the cylinder bore and insert the spring, with the larger coils toward the bottom of the cylinder.
8 Carefully insert the piston, engaging the protruding end into the center of the spring.
9 Install a new dust cover to the pushrod if necessary, and insert the pushrod assembly into the cylinder. The dust cover end of the pushrod faces the piston.
10 Press a new retaining ring into place and push it in firmly to secure the pushrod assembly.
11 The slave cylinder can now be installed as described in Section 4.

6 Clutch driven plate – on-vehicle check

Refer to illustrations 6.1, 6.4a and 6.4b

1 The vehicles covered by this manual have a provision for checking the wear of the driven plate friction linings without having to remove the transmission or clutch assembly from the car. The check is carried out from below at the clutch slave cylinder, and requires the use of a checking



6.1 Clutch wear checking gauge*

**Gauge fabricated from tin or a strip of scrap material, not more than 0.75 mm (0.03 in) thick*

gauge, which can easily be made from a thin strip of scrap metal or tin plate **(see illustration)**.

2 Raise the front of the vehicle and support it securely on jackstands.

3 Insert the forked end of the gauge into the machined slot between the slave cylinder flange and the bellhousing.

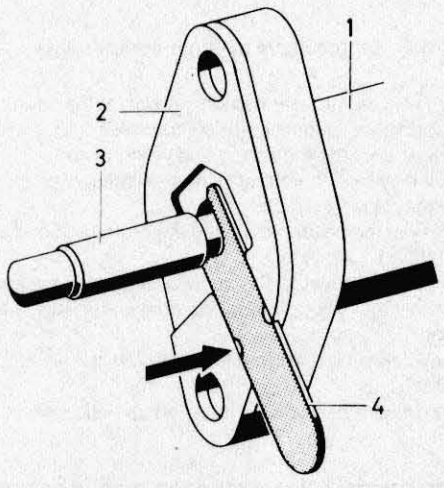
4 Push the gauge in until the forked end contacts the slave cylinder pushrod. If the two notches on the checking gauge are not visible, the driven plate linings are in a satisfactory condition **(see illustrations)**. If the two notches are visible, the driven plate linings have reached their wear limit, and the clutch assembly must be replaced (see Section 7).

5 After carrying out the check, remove the gauge and lower the car to the ground.

7 Clutch components – removal, inspection and installation

Refer to illustrations 7.3, 7.7, 7.10, 7.11 and 7.13

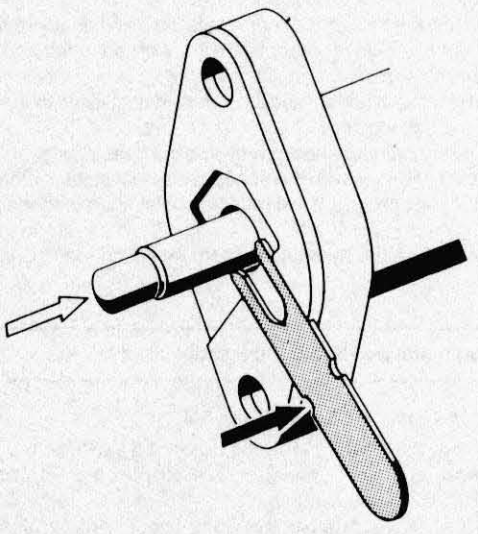
Warning: *Dust created by clutch wear and deposited on clutch components may contain asbestos, which is a health hazard. DO NOT blow it out with compressed air or inhale any of it. DO NOT use gasoline or petroleum-based solvents to clean off the dust. Brake system cleaner should be used to flush the dust into a drain pan. After the clutch components are wiped clean with rags, dispose of the contaminated rags and cleaner in a sealed, marked container.*



6.4a Checking clutch wear – clutch driven plate linings in good condition

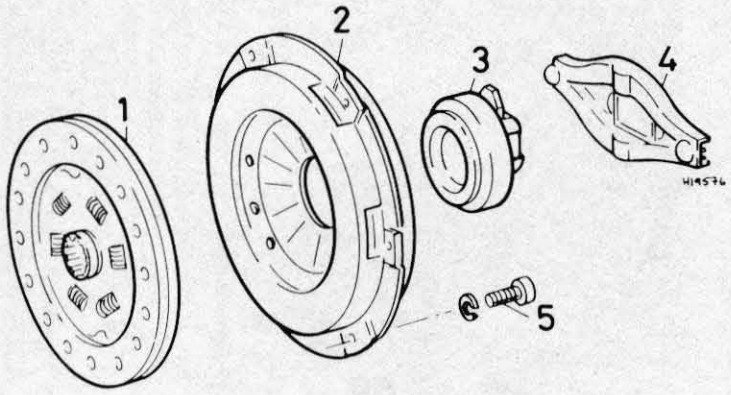
1 *Slave cylinder*
2 *Slave cylinder shim*
3 *Pushrod*
4 *Checking gauge*

Arrow indicating notches on gauge not visible



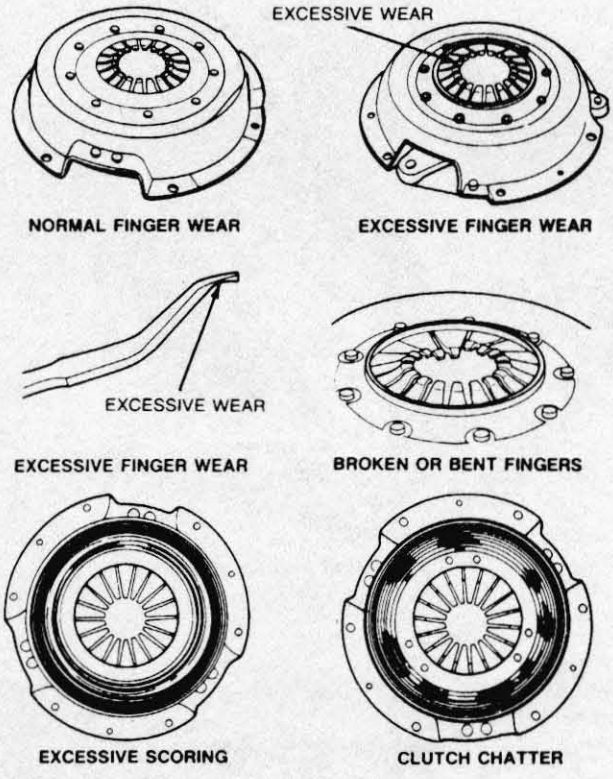
6.4b Checking clutch wear – driven plate linings worn

Light arrow – Pushrod movement as wear takes place
Dark arrow – Notches on gauge visible



7.3 Clutch assembly and release bearing components

1 Driven plate
2 Cover assembly
3 Release bearing
4 Release fork
5 Cover bolt



7.7 Replace the pressure plate if excessive wear is noted

Removal

1 Remove the transmission as described in Chapter 6.

2 In a diagonal sequence, half a turn at a time, loosen the bolts securing the clutch pressure plate to the flywheel.

3 When all the bolts are loose, remove them, then ease the pressure plate off the locating dowels **(see illustration)**. Be prepared to catch the driven plate, which will drop out as the pressure plate is removed.

Inspection

4 With the clutch assembly removed, clean the parts with brake system cleaner, making sure the dust is not inhaled.

5 Check the clutch driven plate linings for signs of oil contamination, cracks and insecure retaining rivets. Check that the linings have not worn down to, or below the minimum thickness as given in the Specifications. Also check that the torsion springs are not broken or loose, and that the splines do not exhibit wear ridges. Check the fit of the driven plate hub on the gearbox input shaft splines, ensuring that the hub slides smoothly along the shaft with no sign of binding, and with minimal radial clearance between the input shaft and driven plate hub. **Note:** *The relatively low cost of the clutch components compared to the time and trouble spent gaining access to them warrants their replacement any time the engine or transmission is removed, unless they are new or in near perfect condition.*

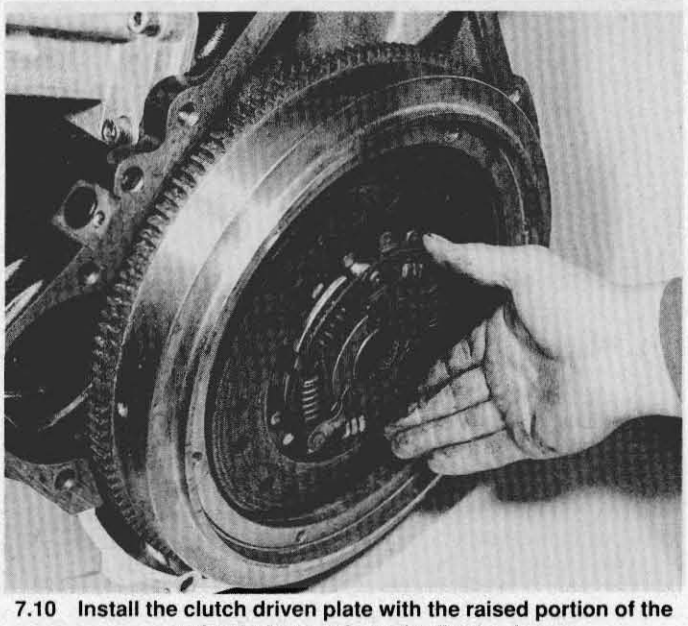
6 Inspect the flywheel for cracks, heat checking, grooves and other obvious defects. If the imperfections are slight, a machine shop can machine the surface flat and smooth, which is highly recommended regardless of surface appearance. Refer to Chapter 1 for the flywheel removal and installation procedure.

7 Check the machined surfaces and and the diaphragm spring fingers of the of the pressure plate **(see illustration)**. If the surface is grooved or otherwise damaged, replace the pressure plate. Also check for obvious damage, distortion, cracking, etc. Light glazing can be removed with sandpaper or emery cloth. If a new pressure plate is required, new and factory-rebuilt units are available.

8 Check the release bearing as described in Section 8.

Installation

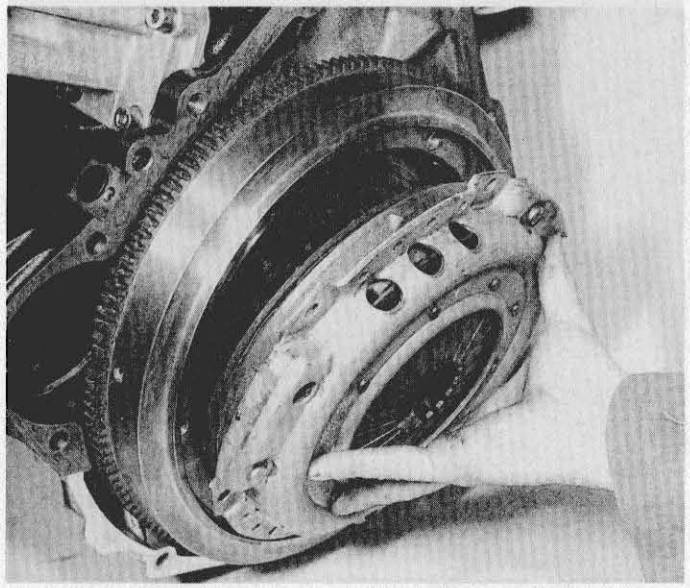
9 Ensure that all the parts are clean, free of oil and grease, and are in a good condition before reassembling. If a new pressure plate is being installed, wipe off the protective grease coating with brake system cleaner.



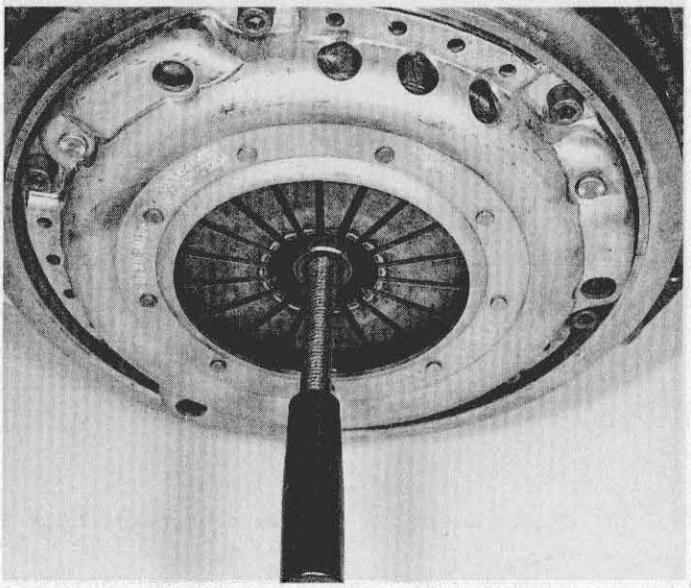
7.10 Install the clutch driven plate with the raised portion of the spring hub away from the flywheel

10 To install the clutch assembly, place the driven plate in position with the raised portion of the spring hub facing away from the flywheel **(see illustration)**.

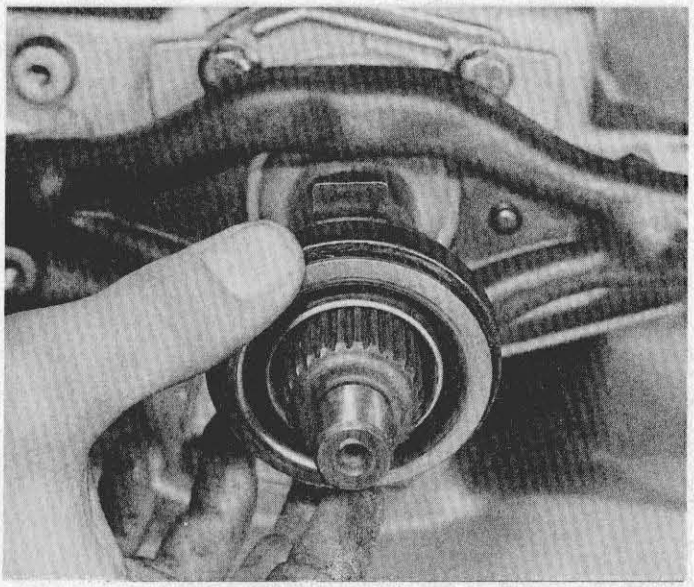
11 Hold the plate in place and install the pressure plate loosely on the dowels. Install the retaining bolts and tighten them finger tight so that the



7.11 Install the pressure plate



7.13 Using a clutch aligning tool to center the clutch plate



8.2 Turn the release bearing 90-degrees to detach it from the release fork

driven plate is gripped, but can still be moved **(see illustration)**.

12 The driven plate must now be aligned so that when the engine and transmission are mated, the input shaft splines will pass through the splines in the driven plate hub and engage with the pilot bearing in the end of the crankshaft.

13 Alignment of the driven plate can be carried out in one of three ways; either by obtaining the manufacturer's centering tool, by obtaining a universal clutch aligning tool **(see illustration)**, which can be purchased from most auto parts stores or rented from an equipment rental yard, or by aligning the driven plate visually as described below.

14 Insert a round bar through the center of the driven plate hub so that the bar rests in the pilot bearing in the center of the crankshaft. Moving the bar sideways or up and down will move the driven plate in whichever direction is necessary to achieve centralization. With the bar removed, view the driven plate hub in relation to the hole in the end of the crankshaft and the circle created by the ends of the diaphragm spring fingers. When the hub appears exactly in the center, it is aligned.

15 Tighten the pressure plate retaining bolts gradually, and in a diagonal sequence, to the torque listed in this Chapter's Specifications.

16 Install the transmission as described in Chapter 6.

8 Clutch release bearing – removal, inspection and installation

Refer to illustrations 8.2, 8.3, 8.5 and 8.6

1 Remove the transmission as described in Chapter 6.

2 Rotate the release bearing to disengage it from the release fork, and slide the bearing off the front cover sleeve over the input shaft **(see illustration)**.

3 Move the end of the release fork nearest to the clutch slave cylinder away from the slave cylinder pushrod, then slide the fork sideways to disengage it from the pivot ball pin **(see illustration)**. Remove the fork from the bellhousing.

4 Check the release bearing for smoothness of operation when spun and replace it if there is any harshness or roughness. Also check that the bearing is free to slide on the input shaft guide sleeve, but without excessive radial clearance.

5 Before installing, lubricate the guide sleeve **(see illustration)**, pivot ball pin, slave cylinder pushrod, and all the points on the release fork which contact the release bearing, with a light coat of molybdenum disulphide grease.

6 Install the release fork by engaging its end with the pivot ball pin so that the spring clip locates around the rear of the pin **(see illustration)**. Move the other end of the fork towards the transmission so the slave cylinder pushrod rests in the ball shaped cut-out in the fork.

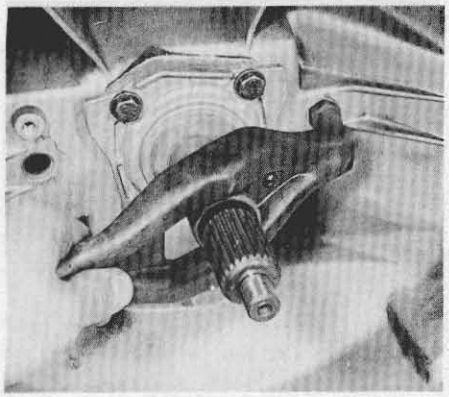
7 Slide the release bearing onto the guide sleeve and rotate the bearing so it engages with the cut-outs in the fork.

8 Install the transmission as described in Chapter 6.

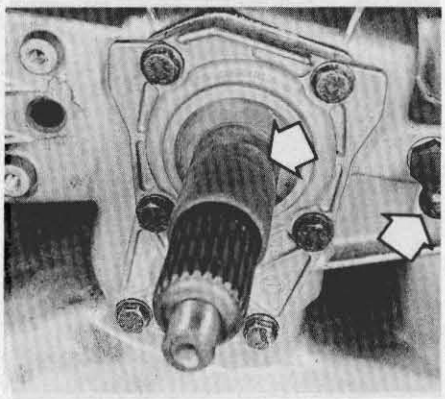
9 Clutch hydraulic system – bleeding

Refer to illustrations 9.6 and 9.7

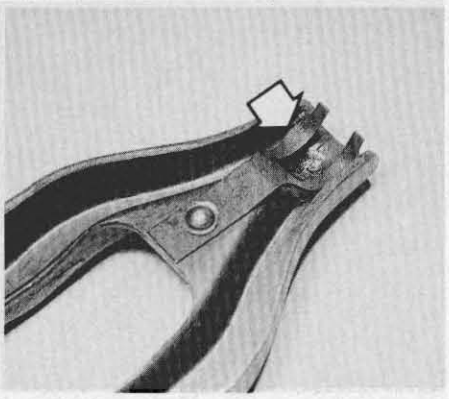
1 If any part of the hydraulic system is disassembled, or if air has acci-



8.3 Pull the release fork out and slide the end off the pivot ball



8.5 Lubricate the guide sleeve and pivot ball pin (arrows) before installing the release fork and bearing



8.6 Make sure the release fork spring clip (arrow) engages around the rear of the pivot ball pin

dentally entered the system, the system will have to be bled. The presenceof air is characterized by the pedal having a "spongy" feel (which lessens if the pedal is pumped a few times) and it results in difficulty in changing gear.

2 The design of the clutch hydraulic system does not allow bleeding to be carried out using the conventional method of pumping the clutch pedal. Instead, bleeding is carried out by utilizing the hydraulic pressure of the vehicle brake system to force the air out of the clutch hydraulic system.

3 To bleed the system, loosen the right front wheel lug nuts, raise the front of the vehicle and support it securely on jackstands. Remove the wheel.

4 Check the fluid level in the combined brake and clutch fluid reservoir on top of the brake master cylinder, and top up to the maximum level if necessary using the specified type of brake fluid. Observe the fluid level during the bleeding operation and keep the reservoir topped up.

5 Obtain a length of rubber or plastic tubing which is long enough to reach from the right front brake caliper to the clutch slave cylinder on the side of the transmission, and which is a snug fit on the brake caliper and slave cylinder bleed screws. The help of an assistant will also be required for the following operations.

6 Connect one end of the tube to the brake caliper bleed screw, and open the bleed screw approximately half a turn **(see illustration)**. Have your assistant slowly depress the brake pedal until the tube is full of fluid free from air bubbles. Close the bleed screw then have your assistant release the brake pedal.

7 Connect the free end of the tube to the slave cylinder bleed screw, then open both bleed screws approximately half a turn **(see illustration)**.

8 Have your assistant depress the brake pedal fully, close the brake caliper bleed screw while the pedal is depressed, then allow the pedal to be released. Open the bleed screw again and repeat the procedure until fluid free from air bubbles is being returned to the reservoir. Make sure that the brake caliper bleed screw is closed each time before the pedal is released, and keep the fluid level in the reservoir topped up as necessary during the bleeding operation.

9 On completion, close both bleed screws and check the operation of the clutch pedal. If it still has a "spongy" feel, further bleeding is required. When the actuation of the pedal produces a firm, positive feel, the system is free of air. Finally, remove the tube, install the wheel and lower the car to the ground.

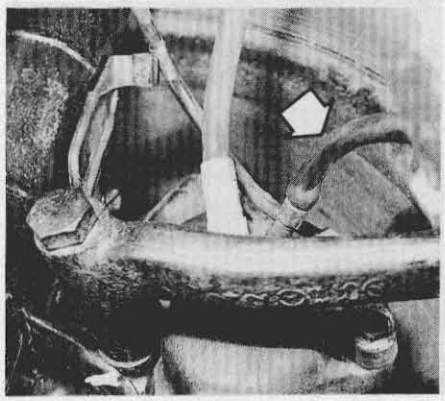
10 Clutch and brake pedals – removal and installation

Refer to illustrations 10.2, 10.3a, 10.3b and 10.4

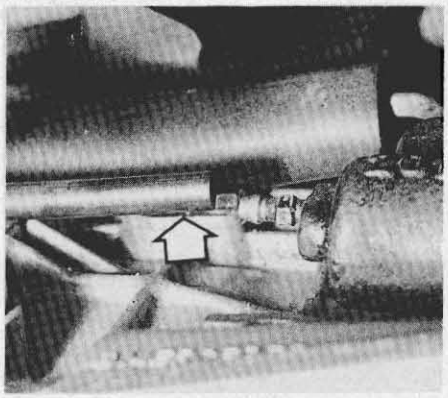
1 Remove the pedal bracket assembly from the car as described in Section 2, Steps 1 to 14.

2 With the assembly on the bench, remove the brake light switch by unscrewing the outer locknut or, on later models, by pushing the switch down and turning it 90-degrees **(see illustration)**.

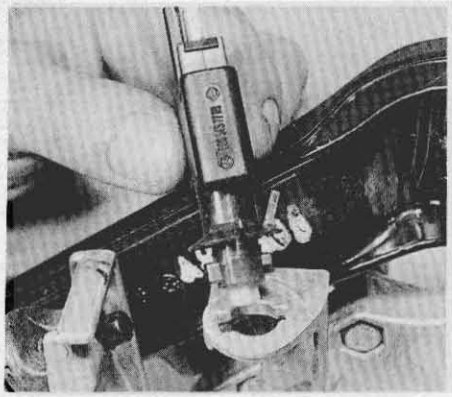
3 Lift the clutch pedal up until the end of the off-center spring can be re-



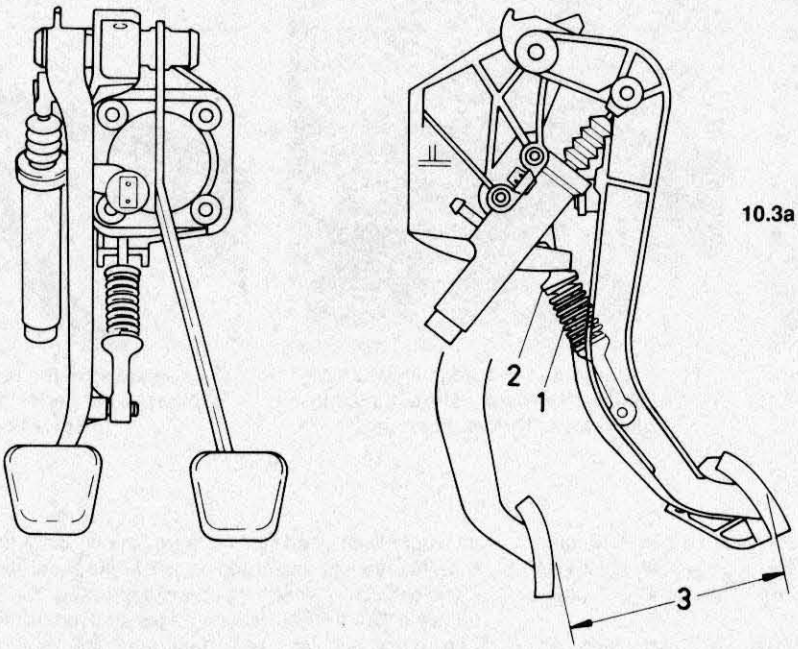
9.6 Bleed tube (arrow) connected to the brake caliper bleed screw



9.7 Connect the other end of the tube (arrow) to the slave cylinder bleed screw



10.2 Turn the brake light switch 90-degrees to disengage the retaining tangs from the bracket



10.3a Clutch and brake pedal bracket assembly

1 Off-center spring
2 Spring end
3 Pedal travel

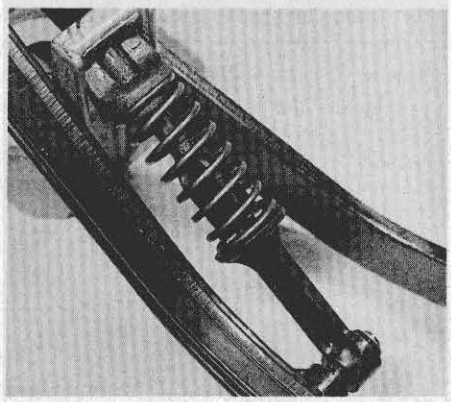
leased from the pedal bracket **(see illustration)**. Now remove the off-center spring leg from the stud on the clutch pedal **(see illustration)**.

4 Using circlip pliers, extract the circlip securing the clutch pedal to the pivot shaft **(see illustration)**. Remove the washer and slide the pedal off the shaft.

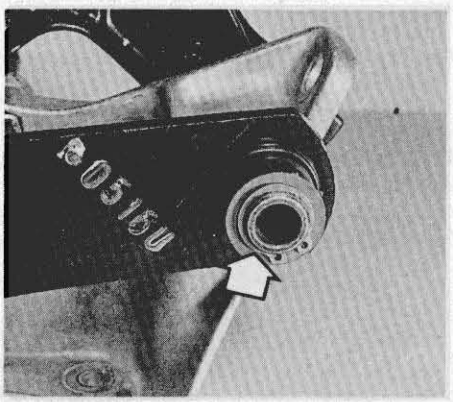
5 Repeat Step 4 for the brake pedal if this is to be removed also.

6 Check the condition of the pedal bushing, and replace it if it's worn or damaged. The bushing is removed by knocking it out with a suitable tube or drift. Tap in the new bush so its flange is towards the pedal bracket.

7 Lubricate the pedal shaft with molybdenum disulphide grease and install the pedal(s) using the reverse sequence of removal. Install the pedal bracket assembly to the car as described in Section 2.



10.3b Lift the clutch pedal up to release the off-center spring end



10.4 Clutch and brake pedal retaining circlip (arrow)

11 Troubleshooting – clutch

Symptom	Reason(s)
Clutch chatter	Oil or grease contamination of clutch friction linings Worn friction linings Excessive clutch driven plate runout Driven plate sticking on input shaft splines Weak or broken pressure plate or diaphragm spring

Troubleshooting (continued)

Symptom	Reason(s)
Clutch slip	Friction linings worn or contaminated with grease or oil Weak or broken diaphragm spring Clutch drag (failure to disengage) Driven plate sticking on input shaft splines Driven plate sticking to flywheel Input shaft seized in pilot bearing Air in clutch hydraulic system
Noise when depressing clutch pedal	Dry or worn release bearing Dry clutch pedal shaft bushings

Chapter 6 Transmission

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Specifications

Part A: Manual transmission

Type	Five forward speeds and reverse with synchromesh on all forward speeds
Identification codes	
190 E 2.3	717.412
190 E 2.3-16	717.410
Ratios	
1st	3.91 : 1
2nd	2.17 : 1
3rd	1.37 : 1
4th	1.00 : 1
5th	0.77 : 1
Reverse	4.27 : 1
Lubrication	
Transmission lubricant	Dexron II ATF
Lubricant capacity	1.5 liters (1.6 qts)
Synchromesh ring wear limit	1.0 mm (0.039 in)

Torque specifications	Ft-lbs (unless otherwise indicated)
Transmission crossmember retaining bolts	33
Driveshaft clamping nut	22 to 30
Center support bearing to underbody	18
Driveshaft flexible rubber coupling bolts	33
Transmission front cover bolts	15
Transmission flange collar nut	118
Transmission rear cover/intermediate plate retaining bolts:	
Bolts stamped 8.8	15
Bolts stamped 10.9	21
Pivot pin plate retaining bolts	72 in-lbs
Reverse shaft locating bolt	15
Locking cage retaining bolts	72 in-lbs
Shift lever retaining bolts	18
Gearshift locking lever nut	15
Reverse lever bearing pin nut	15
Oil drain and filler plugs	44
Gear lever remote control assembly retaining bolts	48 in-lbs

Part B: Automatic transmission

Type	Four-speed fully automatic with planetary gearsets,three element torque converter and standard or economy program selection
Identification codes	
190 E 2.3	722.408
190 E 2.3-16	722.410
Ratios	
1st	4.25 : 1
2nd	2.40 : 1
3rd	1.48 : 1
4th	1.00 : 1
Reverse	5.14 : 1
Lubrication	
Transmission lubricant	Dexron II ATF
Lubricant capacity	
Total capacity	7.1 liters (7.5 qts)
Drain and refill (including torque converter)	6.0 liters (6.3 qts)

Torque specifications	Ft-lbs (unless otherwise indicated)
Transmission crossmember retaining bolts	33
Driveshaft clamping nut	22 to 30
Center support bearing to underbody	18
Driveshaft flexible rubber coupling bolts	33
Transmission-to-engine retaining bolts:	
M10 bolts	41
M12 bolts	48
Torque converter-to-drive plate bolts	31
Oil pan and torque converter drain plugs	10
Oil pan retaining bolts	72 in-lbs
Selector lever assembly retaining bolts	48 in-lbs

Part A: Manual transmission

1 General information

The manual transmission on the the vehicles covered by this manual is of Mercedes-Benz manufacture, and has five forward gears and one reverse gear. Synchromesh gear engagement is used on all forward gears, and a standstill synchronizing system is also used on reverse gear for smooth engagement, providing the car is at rest.

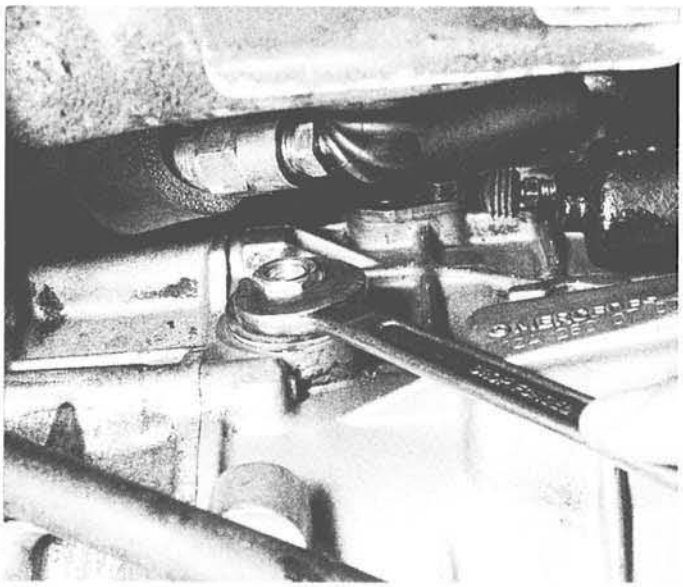
The transmission comprises a main light alloy case with integral bellhousing, an intermediate plate and a rear cover. Housed within the case are the input shaft, mainshaft and layshaft assemblies, which carry constant mesh gear clusters, and are supported on plain and tapered roller bearings. Additionally, the front of the input shaft is supported in a needle roller bearing located in the end of the engine crankshaft. The synchromesh gear engagement is by baulk rings, which act under the movement of the synchro unit sliding sleeves. Gear selection is by means of a floor-mounted lever connected to the transmission shift levers by three shift rods.

2 Maintenance and inspection

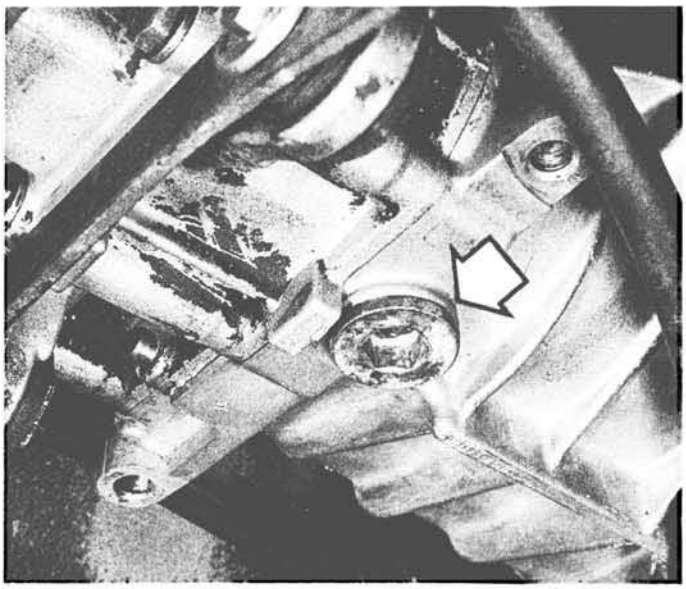
Refer to illustrations 2.3 and 2.4

1 At the intervals given in *Routine Maintenance* at the beginning of this manual, carry out the following service operations on the transmission.

2 Carefully inspect the transmission joint faces and oil seals for signs of damage, deterioration, or oil leakage.



2.3 Using a long nut and a wrench to remove the transmission filler/level plug



2.4 Manual transmission drain plug location (arrow)

3 Check and, if necessary, add the specified lubricant to the transmission. The filler/level plug is located on the right-hand side of the case, and if the correct size Allen wrench is not available, the plug can be unscrewed using a suitable long nut and wrench **(see illustration)**. Automatic transmission fluid is used in the transmission (see the Specifications at the beginning of this Chapter), and the level is correct if the fluid just runs out of the hole when the plug is removed.

4 At the intervals specified, the fluid should be replaced. Drain the transmission by removing the plug at the base of the case **(see illustration)**. After draining, reinstall and tighten the plug, then fill the transmission as previously described.

5 At periodic intervals, a check should be made of the condition and security of the gear linkage shift rods, shift levers and the shift lever bushings.

3 Manual transmission – removal and installation

Refer to illustration 3.4a, 3.4b, 3.5, 3.8, 3.9, 3.15, 3.16 and 3.18

Removal

1 Raise the front of the vehicle and support it securely on jackstands. Apply the handbrake firmly.

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

3 Remove the full-length engine undertray, on cars so equipped, if this is likely to impede access to the transmission.

4 Unscrew the nuts and remove the bolts and washers securing the exhaust system support bracket to the rear of the transmission **(see illustrations)**.

5 Unscrew the U-clamp nuts securing the exhaust to the bracket and remove the bracket **(see illustration)**.

6 Disconnect the exhaust system rubber hangers, lower the system by 150 to 250 mm (6 to 10 in), and support it in this position using wire or rope.

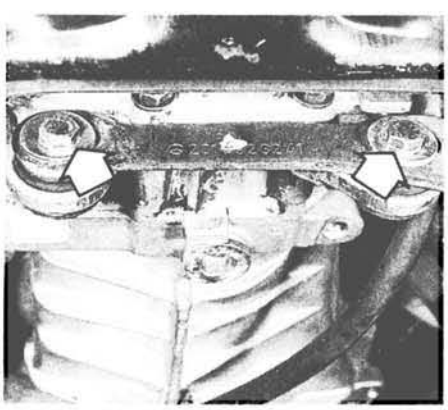
7 Support the transmission on a floor jack, preferably one equipped with a transmission holding fixture.

8 Unscrew the two bolts each side securing the transmission crossmember to the chassis rails **(see illustration)**.

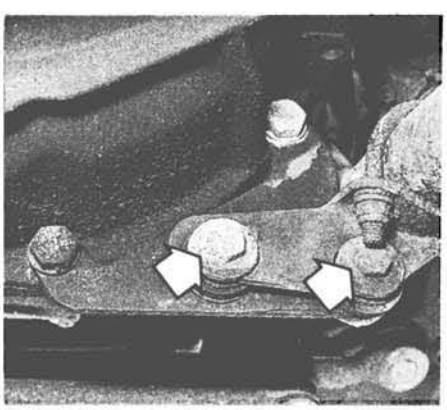
9 Unscrew the nut securing the transmission rubber mount to the transmission and remove the crossmember **(see illustration)**.

10 Unscrew the four bolts and remove the exhaust heat shield over the front silencer.

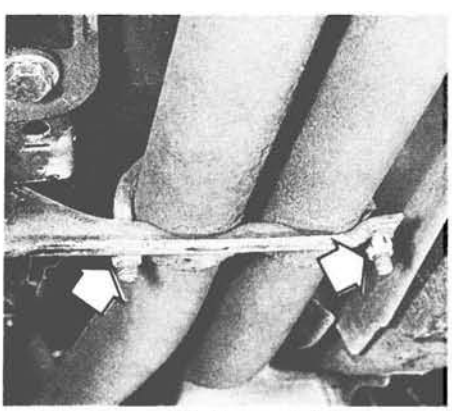
11 Remove the three nuts and bolts securing the driveshaft front flexible rubber coupling to the transmission flange. To do this, unscrew the bolts using a socket and extension bar while holding the nuts from behind with a wrench. **Note:** *Further information on this and the following driveshaft procedure will be found in Chapter 7.*



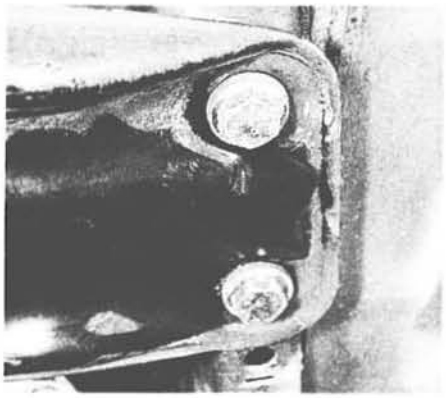
3.4a Exhaust system support bracket bolts – early models (arrows)



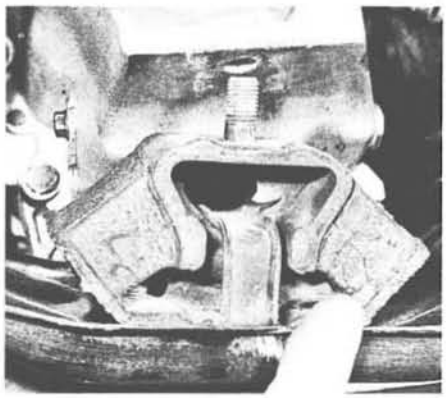
3.4b Exhaust system support bracket bolts – later models (arrows)



3.5 Exhaust U-clamp retaining nuts (arrows)



3.8 Transmission crossmember right side retaining bolts



3.9 Remove the crossmember complete with the rubber mount



3.15 Removing the speedometer cable

12 Using a 41 mm open-ended wrench, loosen the driveshaft clamping nut approximately two turns while using a second wrench to prevent the driveshaft turning.

13 Loosen the two bolts securing the center support bearing to the underbody.

14 Slide the driveshaft front section towards the rear as far as the support bearing and clamping nut will allow. If the flexible coupling is tight on the transmission flange, insert a bar or large screwdriver through the bolt holes and move it up and down to release the locating sleeves from their recesses in the flange. Tie the driveshaft up out of the way when it is clear.

15 Unscrew the speedometer cable clamp bolt on the right-hand side of the transmission and pull out the cable **(see illustration)**.

16 Release the speedometer cable clips from the brackets below and on the left-hand side of the transmission, and move the cable to one side **(see illustration)**.

17 Unscrew the clutch fluid pipe-to-flexible hose fitting on the right-hand side of the transmission, and separate the hose from the pipe (see Chapter 5). Plug or tape over the two fittings to minimize fluid loss and prevent the entry of contaminants.

18 Remove the retaining clips and detach the shift rods from the three shift levers on the transmission **(see illustration)**.

19 Unscrew the bolts securing the starter motor to the engine and bellhousing, noting the location of the cable clip bracket behind the lower bolt head. Pull out the starter and move it aside.

20 Position a second jack and wood block beneath and in contact with the engine oil pan at the rear.

21 Unscrew all the bolts securing the transmission bellhousing to the engine, noting the location of the engine ground strap on the left side bolt beneath the starter motor lower bolt.

22 Place a piece of sheet metal or similar protective material over the firewall insulation at the rear of the engine, so the insulation is not damaged by the cylinder head when the engine is lowered.

23 While holding the transmission in place, slowly lower the two jacks until sufficient clearance exists to allow withdrawal of the transmission.

24 Pull the transmission squarely away from the engine after detaching it from the locating dowels. A screwdriver can be used to carefully pry the transmission bellhousing from the engine.

25 As soon as the transmission is free of the dowels, turn it to the left and continue pulling it squarely to the rear until the input shaft is fully out of the clutch driven plate hub. Now lower the transmission at the rear and remove it from under the car.

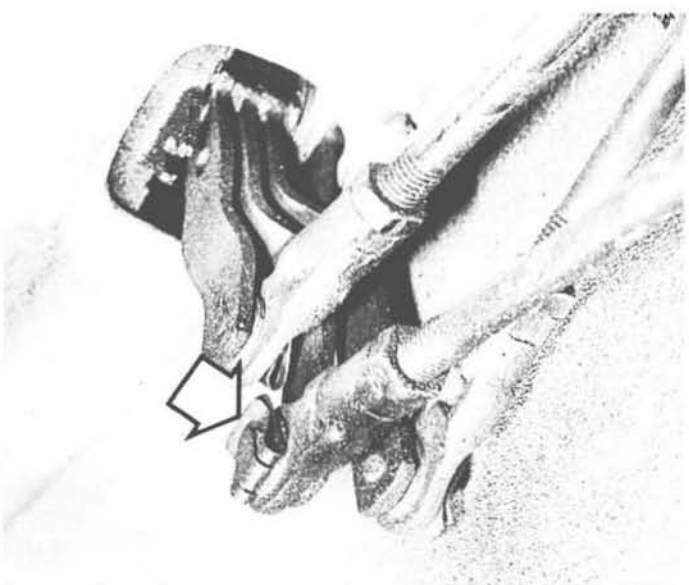
Installation

26 Installing the transmission is the reverse sequence to removal, keeping in mind the following points:

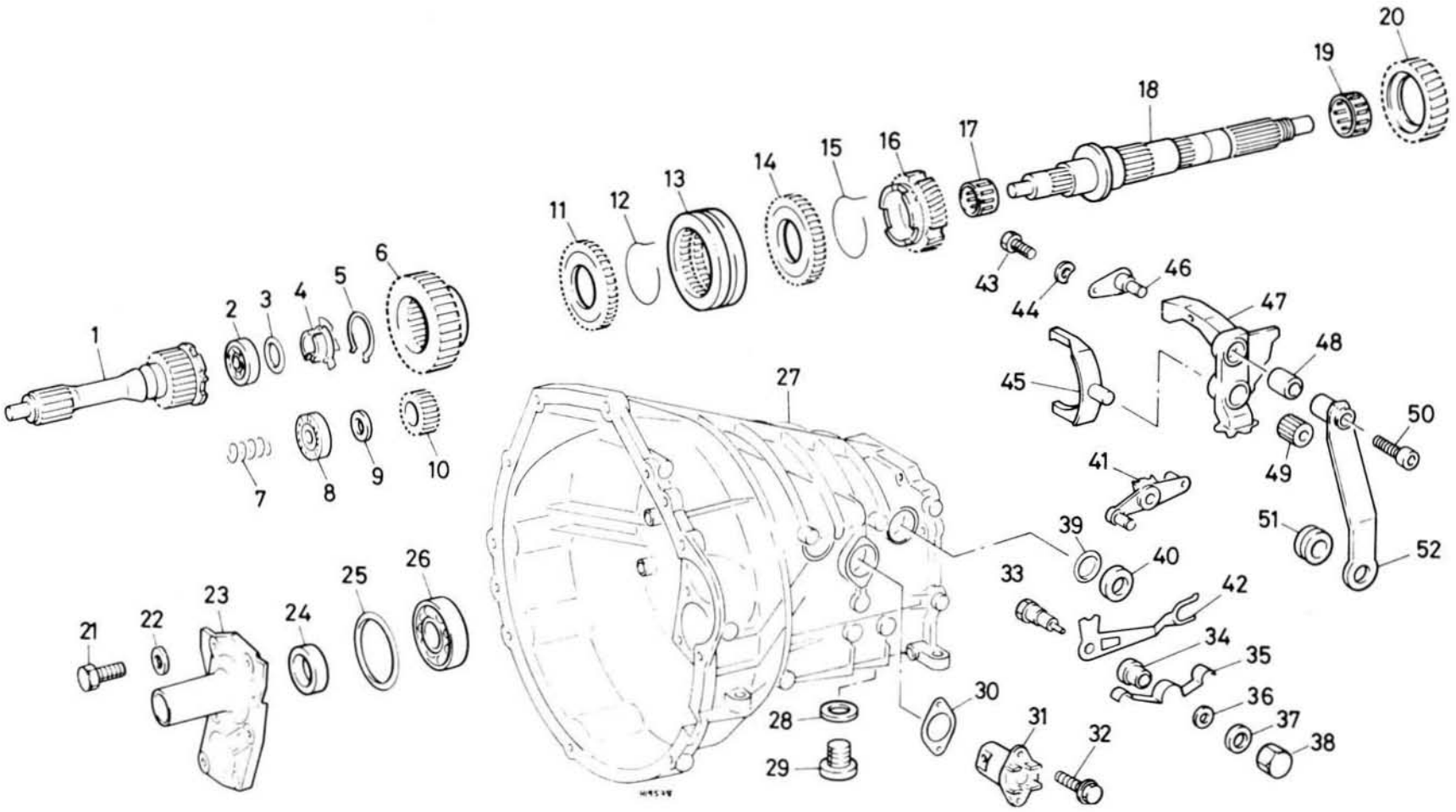
a) Lubricate the transmission input shaft splines with a thin film of molybdenum disulphide grease prior to installing



3.16 Detach the speedometer cable clips from the brackets

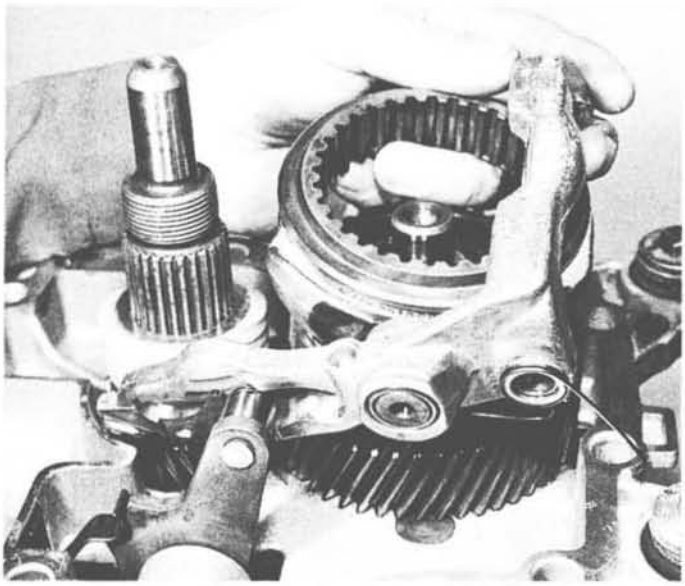


3.18 Extract the retaining clip (arrow) from each shift rod, then separate the rods from the lever pins

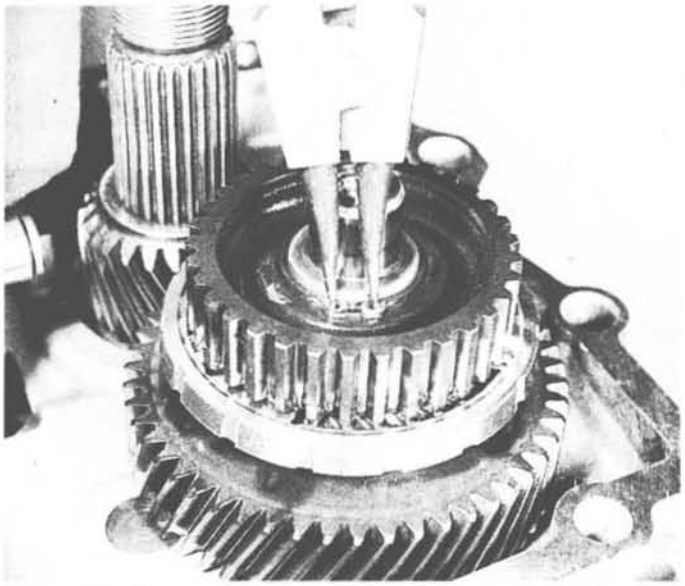


5.2a Exploded view of the transmission case, shift mechanism, input shaft and mainshaft front components

1	*Input shaft*	14	*Synchro ring*	27	*transmission case*	40	*O-ring cover*
2	*Tapered roller bearing*	15	*Annular spring*	28	*Washer*	41	*Shift arm*
3	*Washer*	16	*3rd gear*	29	*Drain plug*	42	*Locking lever*
4	*Oil slinger*	17	*3rd gear needle roller bearing*	30	*Gasket*	43	*Bolt*
5	*Locking ring*	18	*Mainshaft*	31	*Locking cage*	44	*Washer*
6	*3rd/4th gear synchro hub*	19	*2nd gear needle roller bearing*	32	*Bolt*	45	*3rd/4th shift fork*
7	*Preload spring*	20	*2nd gear*	33	*Locking lever bearing bolt*	46	*Pivot pin plate*
8	*Roller thrust bearing*	21	*Bolt*	34	*Collar*	47	*3rd/4th shift mechanism*
9	*Washer*	22	*Washer*	35	*Detent leaf spring*	48	*Spacing sleeve*
10	*Needle roller bearing*	23	*Front cover*	36	*Washer*	49	*Shift fork bearing*
11	*Synchro ring*	24	*Input shaft oil seal*	37	*Spacer*	50	*Bolt*
12	*Annular spring*	25	*Spacer washer*	38	*Collar nut*	51	*Shift lever bush*
13	*3rd/4th gear synchro sleeve*	26	*Input shaft tapered roller bearing*	39	*O-ring*	52	*3rd/4th shift lever*



5.7 Pull off the 5th gear synchro sleeve and shift mechanism as an assembly



5.9 Remove the retaining circlip from the layshaft

b) When installing tightening the upper bellhousing bolts, avoid dislodging the brake line which runs over the transmission tunnel from its retaining clip. Ensure that there is a clearance between the brake pipe and transmission after installation
c) When connecting the driveshaft, tighten the clamping nut after attaching the front flexible coupling and securing the center support bearing
d) Bleed the clutch hydraulic system as described in Chapter 5
e) Refill or top up the transmission fluid in the transmission with reference to Section 2

4 Manual transmission overhaul – general information and precautions

Disassembling the transmission into its major assemblies is reasonably straightforward, and can be performed without the use of special tools. This will allow an initial assessment of any wear or damage to be carried out, and a decision can then be made as to the best course of action to take. The factors influencing that decision are firstly that transmission parts are very expensive, and there can often be a problem with availability. Secondly, bear in mind that if further disassembling to be undertaken, it will be necessary to have access to a press or hydraulic gear puller, together with a set of suitable mandrels. Also, if any of the tapered roller bearing assemblies, the transmission cases or the shafts require replacement, the running clearances and endplays will have to be adjusted, and this can really only be performed successfully by a dealer service department or transmission repair shop with special tools and a large assortment of selective spacing washers for this purpose. It is worth seeking the advice of a dealer concerning this before proceeding with extensive disassembling of the transmission. One final note of caution; it is not advisable to undertake extensive disassembly or overhaul unless you have some previous transmission experience, or know somebody who has and is willing to help. Taking all these points into consideration, it may be more economical or practical to consider obtaining an exchange reconditioned transmission, or perform the removal, disassembly and reassembly work yourself, but with the help of a dealer to remove and install the bearings and set up the clearances.

Whichever course of action is taken, read through all the procedures first so you know what to expect, and if and when a special tool or alternative will be needed. It must be pointed out at this stage that undocumented changes are sometimes made to the design and specification of vehicle systems, particularly in the engine and transmission areas. Therefore some transmission components may differ slightly from those shown in the photographs and described in the text. This should not present any problems, providing a logical approach is adopted, and if necessary, suitable notes taken as an aid to reassembly.

Before starting any work on the transmission, drain the transmission fluid from the unit by unscrewing the drain plug on the bottom of the case, then clean the exterior with solvent.

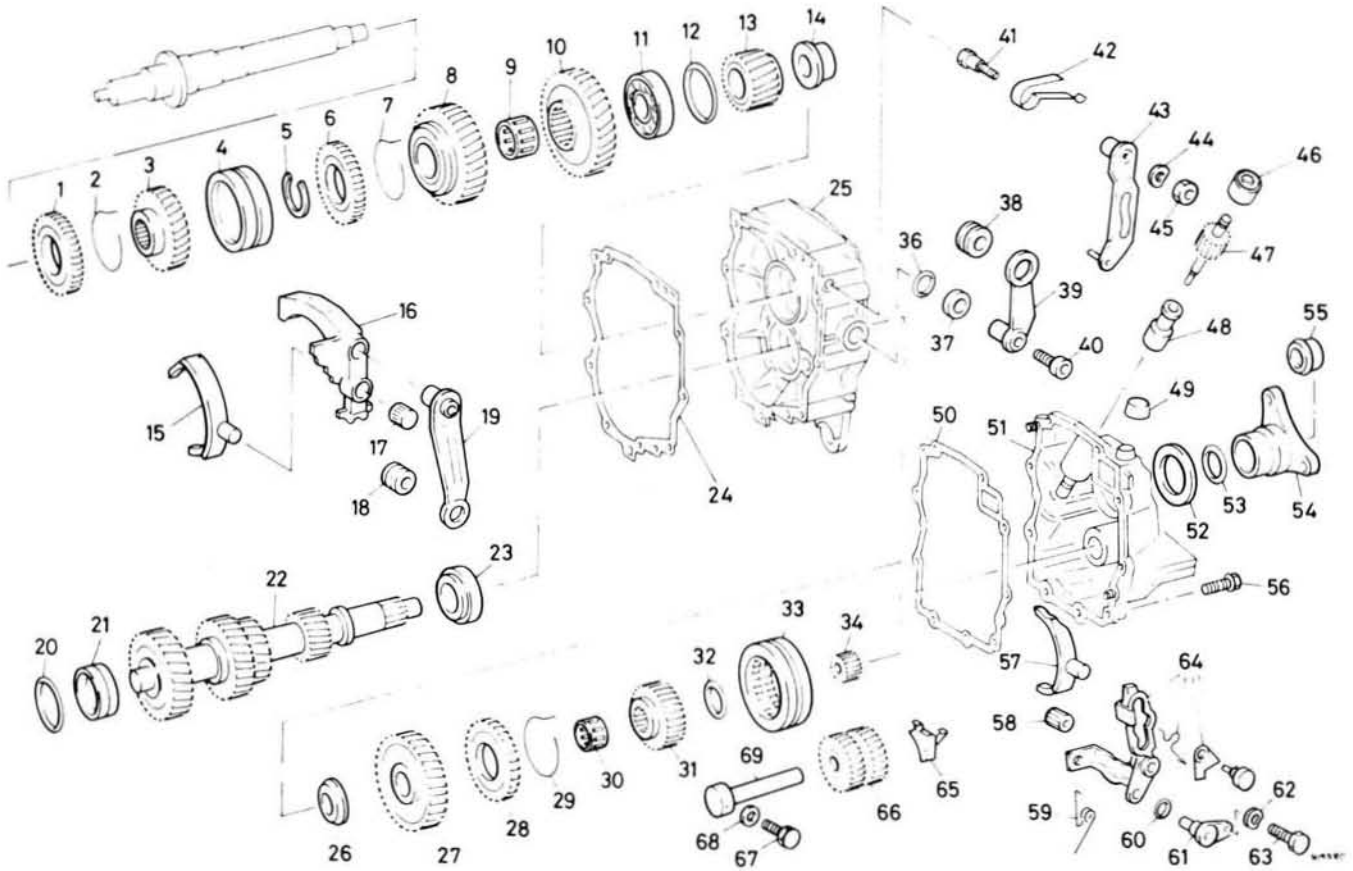
Make sure that an uncluttered working area is available with some small trays ready to store the various parts. Keep all related components together and, where applicable, in their installed direction. Attach labels to the parts as they are removed if there is any likelihood of confusion on reassembly.

Before reassembing, all the components must be spotlessly clean and should be lubricated with the specified type of automatic transmission fluid as they are installed.

5 Manual transmission – disassembling into major components

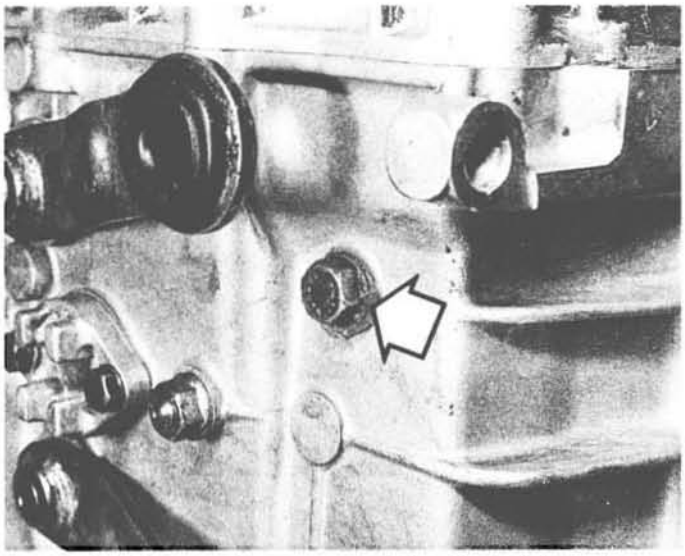
Refer to illustrations 5.2a, 5.2b, 5.7, 5.9, 5.12, 5.14a, 5.14b, 5.15, 5.18 and 5.19

1 Remove the transmission from the car as described in Section 3, then remove the clutch release bearing, release fork and slave cylinder as described in Chapter 5.
2 Using a screwdriver or small punch, knock back the staked portion of the nut securing the transmission flange collar to the mainshaft **(see illustrations)**.
3 Using a socket and breaker bar, unscrew the collar nut, noting that a new nut must be obtained prior to reassembly. To stop the flange from turning as the nut is removed, wedge a small socket or similar item between one of the flange arms and a sturdy part of the case.
4 Remove the transmission flange from the mainshaft, together with any spacing washers that may be present. If the flange is stuck, use a gear puller to pull it off – don't attempt to knock it off with a hammer.
5 On each side of the transmission rear cover, remove the retaining bolt and pull out the pivot pin plates that support the 5th gearshift mechanism. Recover the O-rings from the pivot pins.
6 Unscrew the bolts securing the rear cover and remove the cover and gasket from the transmission.
7 Pull off the 5th gear synchro sleeve and shift mechanism as an assembly from the 5th gear synchro hub **(see illustration)**.
8 Remove the speedometer drive gear from the mainshaft.
9 Using circlip pliers, extract the retaining circlip from the end of the layshaft **(see illustration)**.

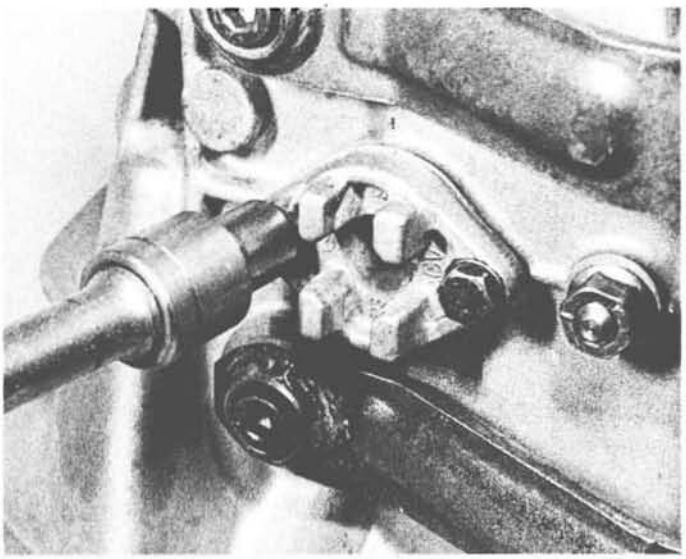


5.2b Exploded view of the rear cover, intermediate plate, layshaft and mainshaft rear components

1	*2nd gear*	19	*1st/2nd shift lever*	36	*O-ring*	53	*Thrustwasher*
2	*Annular spring*	20	*Spacer washer*	37	*O-ring cover*	54	*Transmission flange*
3	*1st/2nd gear synchro hub*	21	*Tapered roller bearing*	38	*Shift lever bush*	55	*Collar nut*
4	*1st/2nd gear synchro sleeve*	22	*Layshaft*	39	*5th/reverse shift lever*	56	*Bolt*
5	*Locking ring*	23	*Tapered roller bearing*	40	*Bolt*	57	*5th gear shift fork*
6	*Synchro ring*	24	*Gasket*	41	*Reverse lever bearing pin*	58	*Shift fork bearing*
7	*Annular spring*	25	*Intermediate plate*	42	*Detent leaf spring*	59	*Shift mechanism spring*
8	*1st gear*	26	*Thrustwasher*	43	*Reverse lever*	60	*O-ring*
9	*1st gear needle roller bearing*	27	*5th gear on layshaft*	44	*Washer*	61	*Pivot pin plate*
10	*Reverse gear*	28	*Synchro ring*	45	*Nut*	62	*Washer*
11	*Tapered roller bearing*	29	*Annular spring*	46	*Closing cover*	63	*Bolt*
12	*Spacer washer*	30	*5th gear needle roller bearing*	47	*Speedometer driven gear*	64	*5th gearshift mechanism*
13	*5th speed driving gear*	31	*5th gear synchro hub*	48	*Sealing ring*	65	*Cover*
14	*Speedometer drivegear*	32	*Circlip*	49	*Cap*	66	*Reverse sliding gear*
15	*1st/2nd shift fork*	33	*5th gear synchro sleeve*	50	*Gasket*	67	*Reverse shaft locating bolt*
16	*1st/2nd shift mechanism*	34	*Needle roller bearing*	51	*Rear cover*	68	*Washer*
17	*Shift fork bearing*	35	*Not used*	52	*Oil seal*	69	*Reverse shaft*
18	*Shift lever bush*						



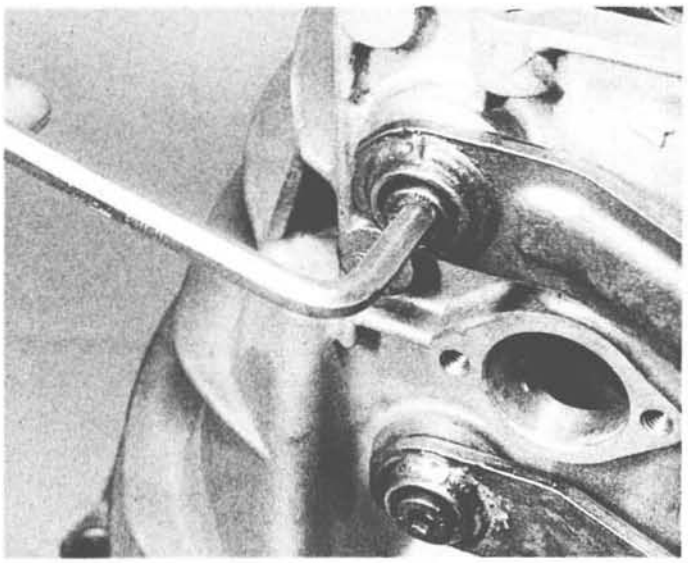
5.12 Remove the reverse shaft locating bolt (arrow)



5.14a Remove the two bolts . . .



5.14b . . . and remove the locking cage



5.15 Remove the 1st/2nd gearshift lever Allen-head bolt

6

10 Remove the 5th gear synchro hub, followed by the 5th gear and synchro ring, from the layshaft.

11 Remove the 5th gear needle roller bearing and the thrustwasher.

12 Remove the reverse shaft locating bolt from the left-hand side of the transmission case **(see illustration)**.

13 Carefully lift the intermediate plate up and off the case. Remove the gasket.

14 Remove the two bolts and withdraw the locking cage from the left-hand side of the case. Recover the gasket **(see illustrations)**.

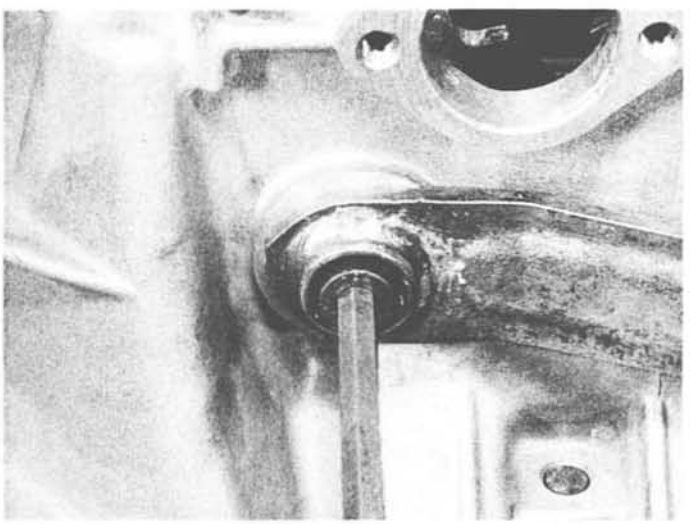
15 Using an Allen wrench, unscrew the 1st/2nd gearshift lever bolt and remove the shift lever **(see illustration)**.

16 Unscrew the retaining bolt and pull out the pivot pin plate that supports the 1st/2nd gearshift mechanism. Recover the gasket behind the plate.

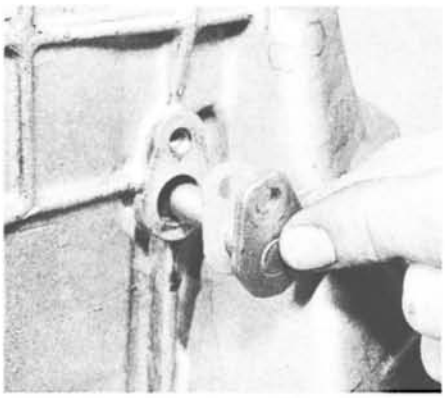
17 Lift the mainshaft and layshaft slightly, tip the layshaft away from the mainshaft and remove the mainshaft assembly from the case.

18 Using an Allen wrench, unscrew the 3rd/4th gearshift lever bolt and remove the shift lever **(see illustration)**.

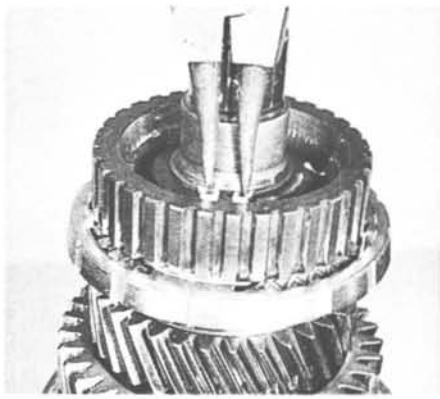
19 Unscrew the retaining bolt and pull out the pivot pin plate that supports the 3rd/4th gearshift mechanism. Remove the gasket behind the plate **(see illustration)**



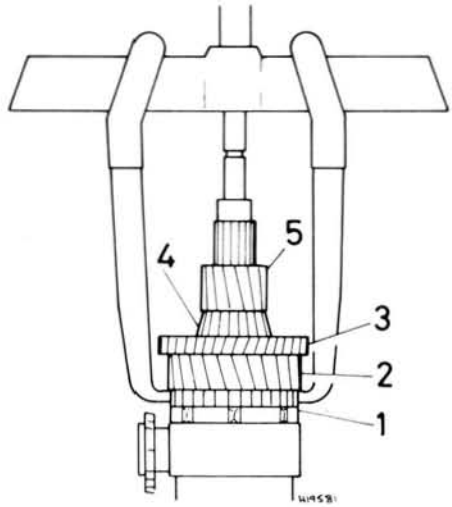
5.18 Remove the 3rd/4th gear shift lever Allen-head bolt



5.19 Removing the 3rd/4th gearshift mechanism pivot pin plate and gasket

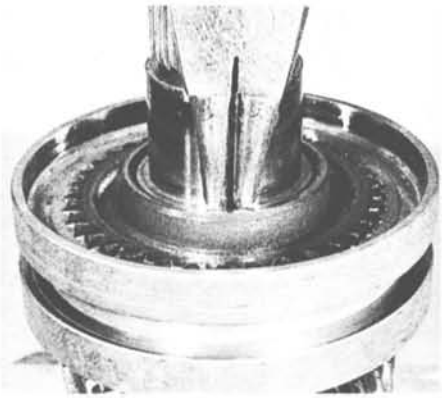


6.2 Extract the circlip from the mainshaft

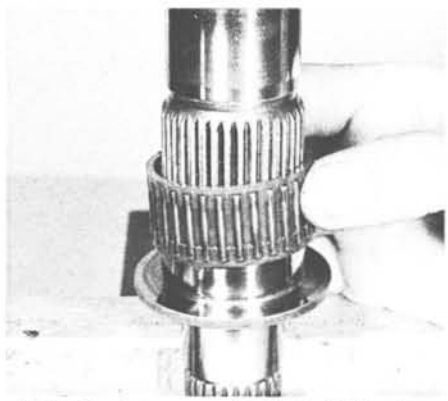


6.6 Using a puller to remove the mainshaft gears

1 Synchro ring
2 1st gear
3 Reverse gear
4 Tapered roller bearing
5 5th speed driving gear



6.8 Extract the 1st/2nd gear synchro hub locking ring



6.12 Begin reassembly by installing the 2nd gear needle roller bearing

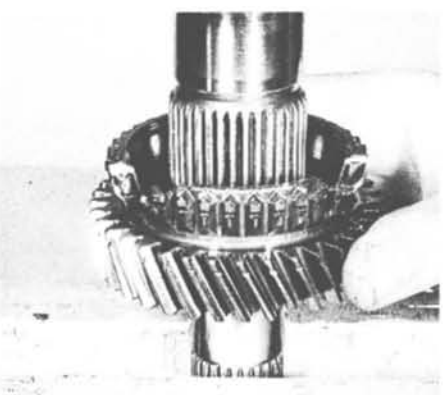
20 Withdraw the 3rd/4th gear synchro sleeve and shift mechanism from the input shaft while lifting the layshaft slightly for clearance.
21 Remove the layshaft from the case.
22 Pull out the input shaft with 4th gear synchro ring from the case.
23 Remove the needle roller bearing from the center of the input shaft and, where present, the preload spring, roller thrust bearing and washers.

6 Mainshaft – disassembly and reassembly

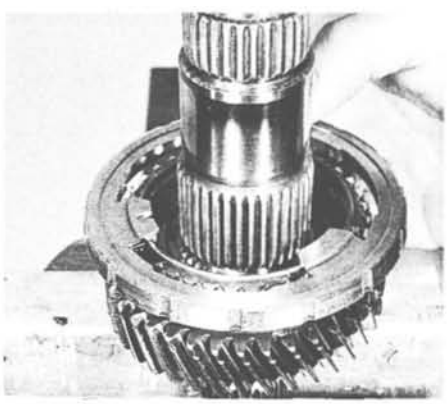
Disassembly

Refer to illustrations 6.2, 6.6 and 6.8

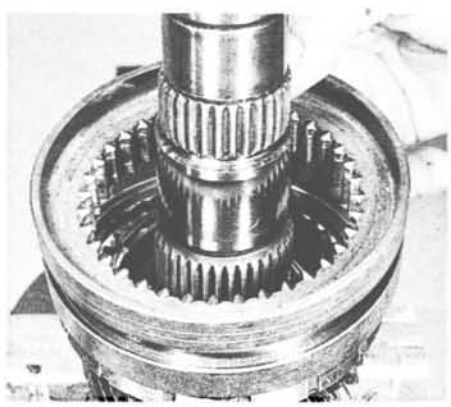
1 Clamp the rear of the mainshaft in a vice. Make sure the vise jaws are padded with wood or thick rags to prevent damage to the shaft.
2 Remove the retaining circlip from the input shaft end of the mainshaft **(see illustration)**.
3 Slide off the 3rd/4th gear synchro hub, followed by 3rd gear and the 3rd gear synchro ring.
4 Remove the 3rd gear needle roller bearing.
5 Turn the mainshaft over so the gears on the rear of the shaft are at the top, and support the shaft in the vice.
6 Using a puller with its legs located behind the 1st gear, draw off 1st gear, reverse gear, the mainshaft tapered roller bearing and the 5th speed driving gear together **(see illustration)**.
7 Remove the 1st gear synchro ring and 1st gear needle roller bearing.
8 Remove the locking ring securing the 1st/2nd gear synchro hub to the mainshaft **(see illustration)**.



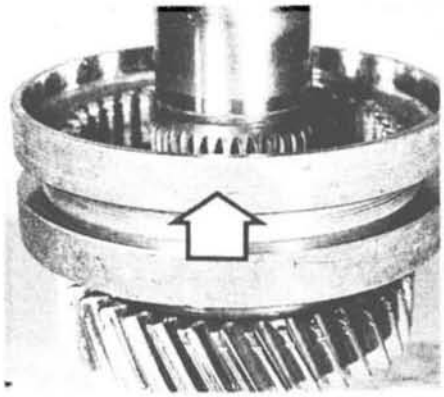
6.13a Install 2nd gear over the needle roller bearing . . .



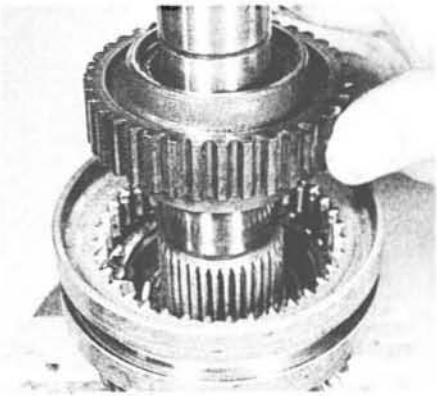
6.13b . . . then place the synchro ring on the gear



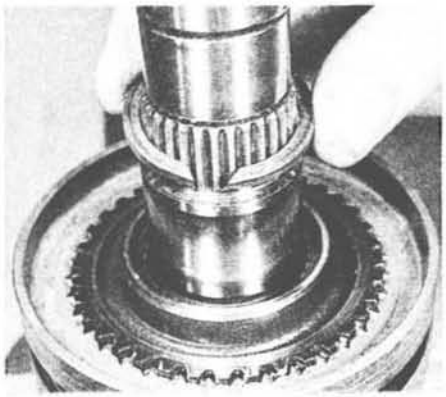
6.14a Install the 1st/2nd gear synchro sleeve . . .



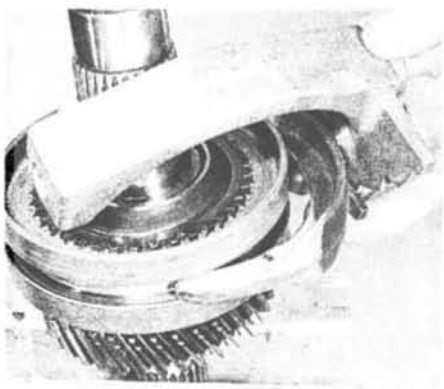
6.14b . . . so that the side with the machined grooves (arrow) faces away from 2nd gear



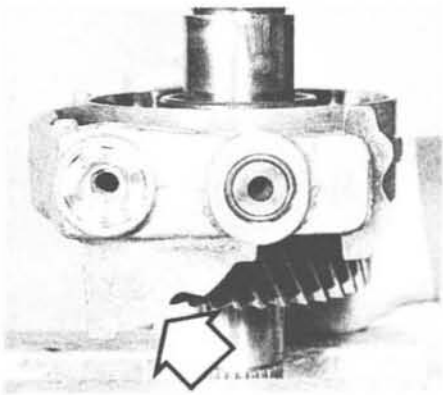
6.15 Install the 1st/2nd gear synchro hub with the wider flange toward 2nd gear



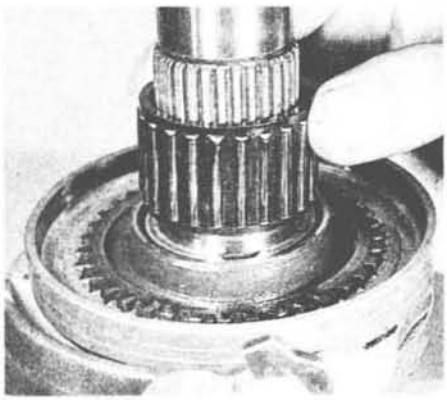
6.16 Secure the synchro hub with the locking ring – make sure the locking ring seats fully in its groove



6.17a Install the 1st/2nd shift mechanism to the sleeve . . .



6.17b . . . with the detent grooves (arrow) toward 2nd gear



6.18 Place the 1st gear needle roller bearing on the mainshaft

9 Slide off the 1st/2nd synchro sleeve, hub and shift mechanism as an assembly.

10 Remove the 2nd gear synchro ring, followed by 2nd gear and the needle roller bearing from the mainshaft.

11 With the mainshaft now disassembled, carefully check the mainshaft components as described in Section 11, and obtain any new parts as necessary.

Reassembly

Refer to illustrations 6.12 through 6.24b

12 Begin reassembly by placing the 2nd gear needle roller bearing in position on the mainshaft **(see illustration)**.

13 Lower 2nd gear over the needle roller bearing, then place the synchro ring on the gear **(see illustrations)**. Ensure that the synchro ring lugs engage with the slots in the gear and the annular spring locates in the gear groove.

14 Place the 1st/2nd synchro sleeve on the mainshaft and over the synchro ring so that the side with the two machined grooves faces away from 2nd gear **(see illustrations)**.

15 Slide on the 1st/2nd synchro hub, through the sleeve and with the wider hub flange towards 2nd gear **(see illustration)**.

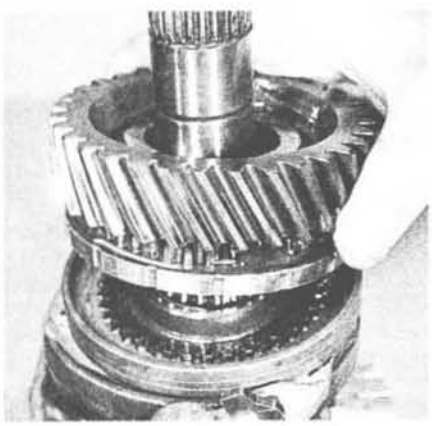
16 Secure the synchro hub with the locking ring, making sure it seats in its groove completely **(see illustration)**.

17 Turn the fork of the 1st/2nd shift mechanism through 90-degrees in relation to the mechanism body, and engage the fork with the groove in the 1st/2nd synchro sleeve **(see illustration)**. When in position, the detent grooves in the mechanism body must be towards 2nd gear **(see illustration)**.

18 Place the 1st gear needle roller bearing on the mainshaft **(see illustration)**.

19 Install 1st gear together with the synchro ring to the mainshaft **(see illustration)**, ensuring that the synchro ring lugs engage with the slots in the gear, and the annular spring locates in the gear groove.

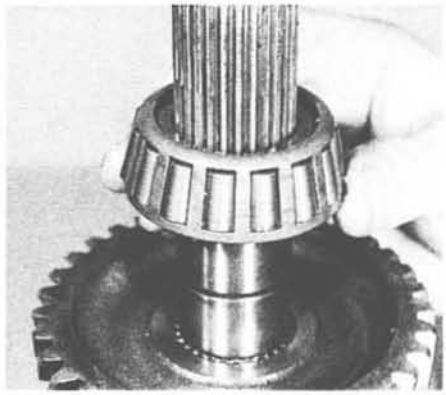
20 Install reverse gear to the mainshaft, followed by the tapered roller



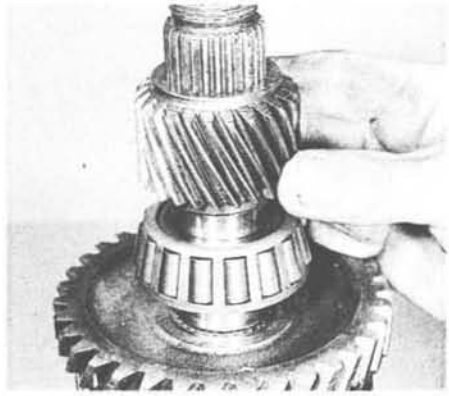
6.19 Install 1st gear together with the synchro ring



6.20a Install reverse gear . . .



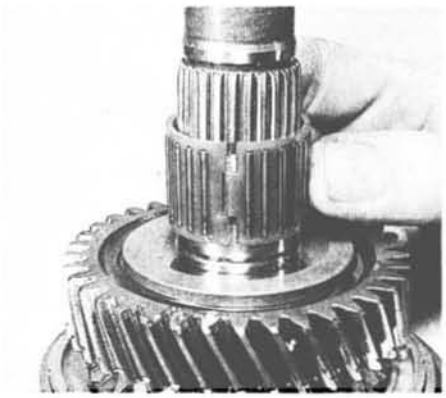
6.20b . . . the tapered roller bearing . . .



6.20c . . . and the 5th gear speed driving gear



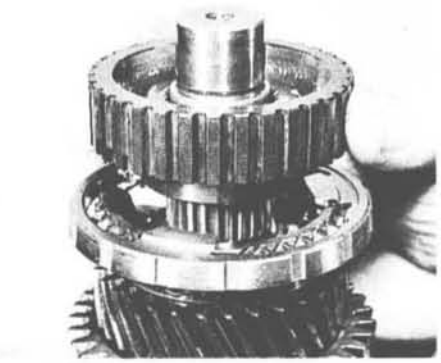
6.21 Using a hydraulic puller arrangement to press the gear and bearing onto the shaft



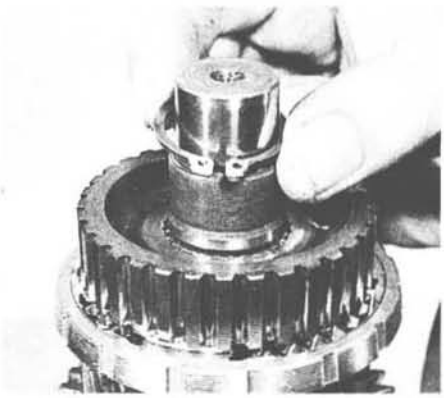
6.22 Install the 3rd gear needle roller bearing to the other end of the mainshaft



6.23 Place the 3rd gear synchro ring over the bearing



6.24a Install the 3rd/4th gear synchro hub . . .



6.24b . . . and secure with the circlip



8.1 Tapered roller bearing locations (arrows) on the layshaft

bearing and the 5th speed driving gear **(see illustrations)**. Note that the wider collar of the 5th speed gear faces the bearing.

21 Using a press or hydraulic puller and suitable mandrels, press the 5th speed gear and tapered roller bearing into place **(see illustration)**.

22 At the other end of the mainshaft, place the 3rd gear needle roller bearing in position **(see illustration)**.

23 Install the 3rd gear and synchro ring with the synchro ring lugs engaged with the slots in the gear, and the annular spring located in the gear groove **(see illustration)**.

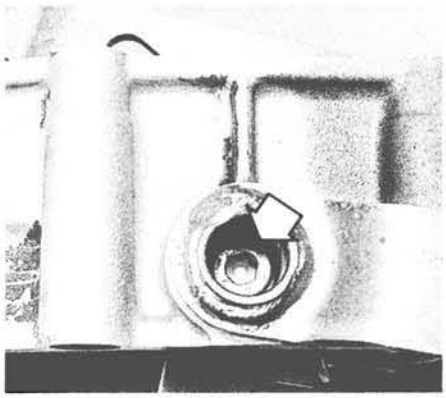
24 Install the 3rd/4th synchro hub and secure with the retaining circlip **(see illustrations)**. Ensure that the circlip seats fully in its groove.

7 Input shaft – disassembly and reassembly

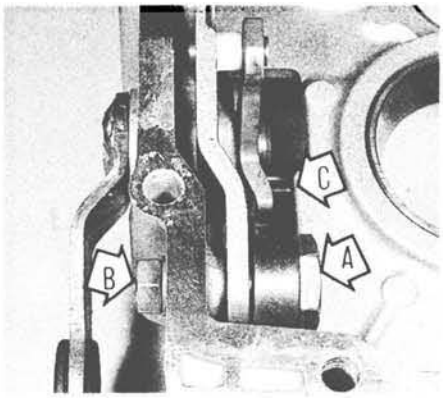
1 Essentially, disassembly of the input shaft is performed as part of the transmission main disassembling procedure, and only the tapered roller bearing will now be left in place.

2 If it is necessary to remove the bearing, this can only be done using a press or hydraulic puller with suitable mandrels. The new bearing is then installed in the same way.

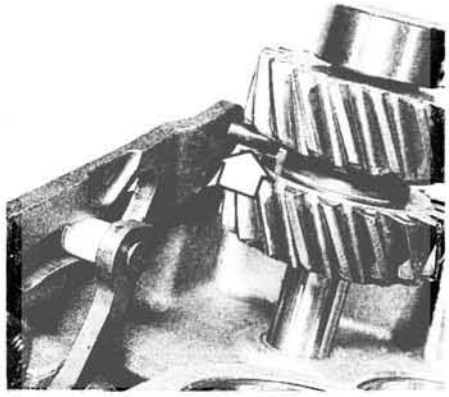
3 Further reassembly of the input shaft is covered in later procedures in this Chapter.



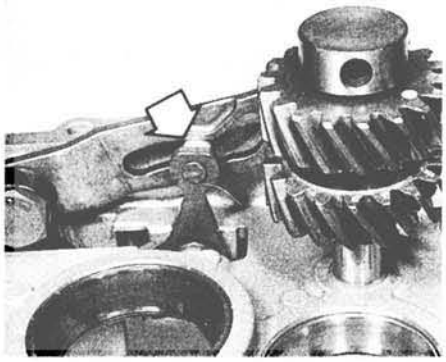
9.1 Remove the 5th/reverse shift lever retaining bolt (arrow)



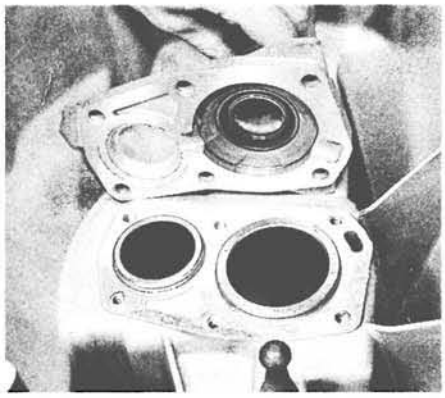
9.2 Reverse lever bearing pin (A), retaining nut (B), and detent leaf spring (C)



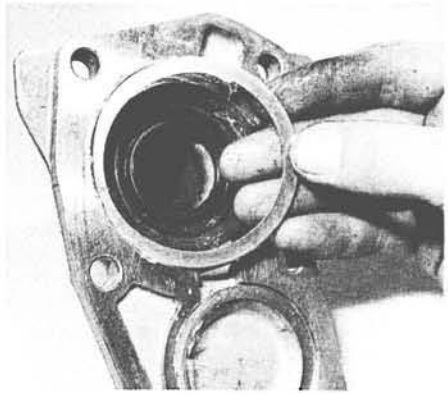
9.9 Reverse lever peg (arrow) engaged with reverse sliding gear



9.10 Shift arm end engaged with reverse lever slot (arrow)



10.1a Remove the front cover from the case . . .



10.1b . . . and remove the spacing washers

8 Layshaft – disassembly and reassembly

Refer to illustration 8.1

1 Disassembly and reassembly of the layshaft is limited to replacement, if necessary, of the tapered roller bearing at each end **(see illustration)**.

2 To do this, the bearings must be removed using a press or hydraulic puller together with suitable mandrels. New bearings are then pressed on in the same way.

9 Intermediate plate – disassembly and reassembly

Disassembly

Refer to illustrations 9.1 and 9.2

1 Using an Allen wrench, unscrew the bolt securing the 5th/reverse shift lever to the shift arm inside the intermediate plate **(see illustration)**. Withdraw the shift lever and the shift arm.

2 Unscrew the nut and remove the reverse lever bearing pin, together with the detent leaf spring **(see illustration)**. Remove the reverse lever.

3 Support the intermediate plate, and drive out the reverse shaft together with the reverse sliding gear.

4 Remove the shift lever O-ring cover and the O-ring.

5 If the mainshaft and layshaft tapered roller bearing outer races are to be replaced, remove the outer races by tapping them out to the inside of the intermediate plate using a brass drift. Recover any spacing washers that may be present behind the outer races.

Reassembly

Refer to illustrations 9.9 and 9.10

6 With any new parts obtained as necessary, install the outer races, together with their spacing washers (if any were present) by tapping them carefully and squarely into position.

7 Install a new O-ring and O-ring cover to the shift lever bore.

8 With the sliding gear in place, attach the reverse shaft to the transmission case using the reverse shaft locating bolt. Lay the intermediate plate on the case in its installed position so the reverse shaft enters its intermediate plate bore. Tap the plate down fully, then remove the locating bolt. Remove the intermediate plate complete with reverse shaft and sliding gear. Now tap the shaft into place until its end is flush with the intermediate plate face.

9 Engage the reverse lever peg with the reverse sliding gear, then install the bearing pin and detent leaf spring **(see illustration)**. Secure the bearing pin with the retaining nut.

10 Locate the shift arm end in the elongated slot in the the reverse lever **(see illustration)**.

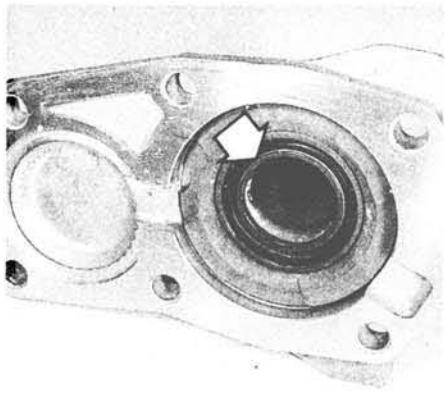
11 Insert the shift lever into its bore and engage the end of the lever with the shift arm. Secure the lever with the Allen-head retaining bolt.

10 Manual transmission case and rear cover – disassembly and reassembly

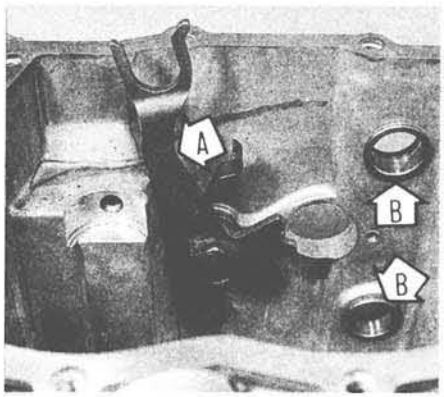
Disassembly

Refer to illustrations 10.1a, 10.1b and 10.2

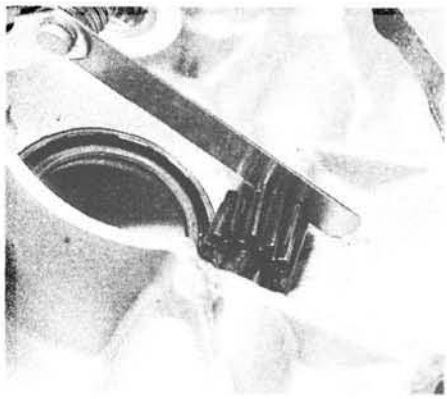
1 Unscrew the six bolts and remove the front cover from within the transmission case bellhousing **(see illustration)**. Remove the spacing washers from the bearing seats in the cover **(see illustration)**.



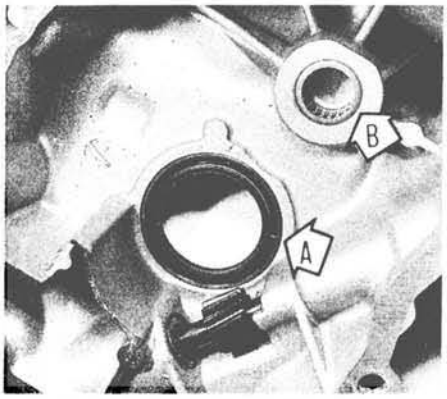
10.2 Input shaft oil seal location (arrow) in front cover



10.7 Locking lever assembly (A) and shift lever O-ring seals (B) in the transmission case



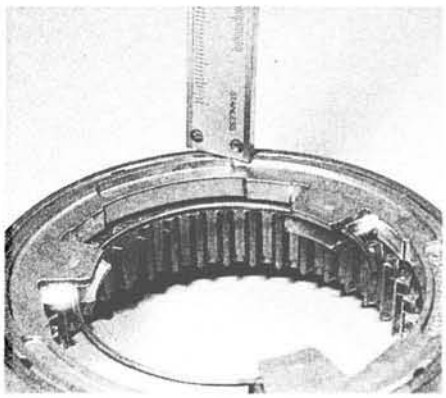
10.11 Using feeler gauges to check the speedometer driven gear clearance



10.12 Mainshaft oil seal (A) and needle roller bearing (B) in the rear cover



11.4 Check the condition of the synchro ring and annular spring (arrow)



11.5 Using a vernier caliper to check synchro ring wear

2 The input shaft oil seal in the front cover should be replaced as a matter of course **(see illustration)**. To do this pry out the old seal using a screwdriver, and squarely tap in a new seal using a suitable mandrel.

3 Liberally grease the sealing lips of the new seal and also the open area within the seal itself.

4 If this work is being carried out in conjunction with transmission overhaul, do not install the front cover at this stage.

Reassembly

Refer to illustrations 10.7, 10.11 and 10.12

5 If the front cover was removed only for replacement of the oil seal, clean the cover and case mating surfaces and apply RTV sealant to the cover face.

6 Place the spacing washers in position and install the cover to the case. Apply thread sealer to the retaining bolts, then install and tighten them to the specified torque.

7 Check the condition of the locking lever and detent leaf spring in the transmission case, and replace these components if necessary. Also replace the two O-ring seals for the shift levers in the side of the case **(see illustration)**.

8 If the input shaft and layshaft tapered roller bearings are to be replaced, remove the two outer races by tapping them out of the case using a brass drift. Install the two new outer races by carefully and squarely tapping them into place so that they protrude towards the front cover by approximately 5.0 mm (0.2 in).

9 Check the condition of the speedometer driven gear in the rear cover for signs of damage or wear of the teeth.

10 To replace the driven gear, tap out the closing cover using a thin punch from within the rear cover then pull out the gear.

11 Install the new gear, and tap in the closing cover until there is a clearance of 5.0 mm (0.2 in) between the gear and the register in the case **(see illustration)**.

12 Replace the rear cover mainshaft oil seal as a matter of course **(see illustration)** using the same procedure as for the front cover oil seal (paragraphs 2 and 3).

13 Replacement of the needle roller bearing in the rear cover requires the use of a special extractor tool, and if necessary this work should be performed by a Mercedes-Benz dealer or other repair shop.

11 Gears, synchro units and shift mechanism – inspection and overhaul

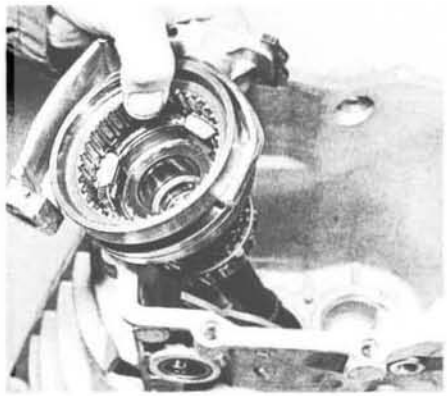
Refer to illustrations 11.4 and 11.5

1 With the mainshaft and input shaft disassembled, examine the shafts and gears for signs of pitting, scoring, wear ridges or chipped teeth. Check the fit of the gears on the shafts, and ensure that there is no lateral free play.

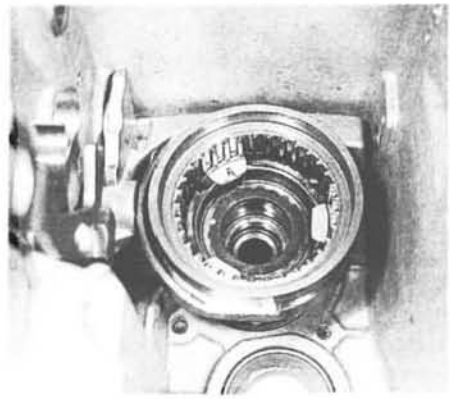
2 Check the smoothness of the bearings and check for any signs of scoring on the rollers, outer races or shafts.



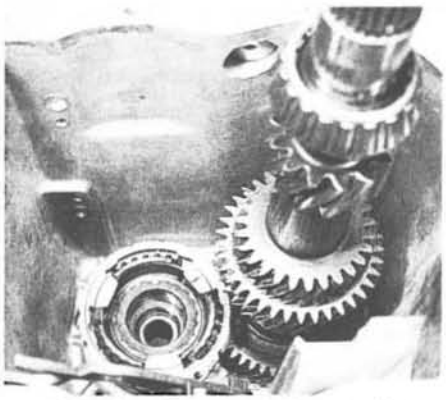
12.1 Install the spacer washers in the front cover



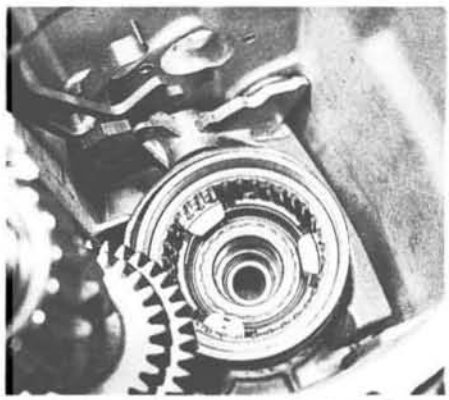
12.4a Install the input shaft assembly to the case, complete with synchro sleeve and shift mechanism



12.4b Input shaft assembly in position



12.5a Install the layshaft assembly while temporarily removing the sleeve and shift mechanism from the input shaft



12.5b As the gears mesh, place the sleeve and shift mechanism back on the input shaft



12.6a If equipped, place the preload spring in the input shaft bore . . .

6

3 Check the fit of the selector mechanism forks in their respective grooves in the synchro sleeves. Also check for wear ridges in the fork ends.

4 Examine each synchro ring for evidence of cracks, and check that the annular spring is not broken or distorted **(see illustration)**.

5 Place the synchro rings, one at a time, in position on their respective sleeves. Using a depth gauge (or the end of a vernier caliper), measure the distance between the face of the ring and the edge of the sleeve at three points around the circumference **(see illustration)**. If the measured dimension is greater than 1.0 mm (0.039 in), replace the synchro ring.

6 Obtain any new parts as necessary prior to reassembly.

12 Manual transmission – reassembly

Refer to illustrations 12.1 and 12.4a through 12.30

Note: *If, during overhaul, it was necessary to replace any of the tapered roller bearings, the transmission case or intermediate plate, or the mainshaft, input shaft or layshaft themselves, the transmission running clearances must be checked and if necessary adjusted. This is performed by accurate measurement and the substitution of the selective spacing washers behind the bearing outer races in the front cover. It is recommended that the transmission major assemblies be taken to a Mercedes-Benz dealer service department or a transmission specialist to have this work done. These clearances will not normally be affected if only the gears, synchro units or any other components not mentioned above have been replaced.*

1 Begin reassembly by placing the selected spacer washers in their respective recesses in the transmission case front cover **(see illustration)**. Use a little grease to hold the washers in place.

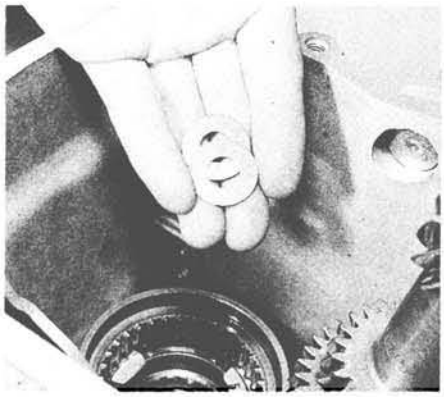
2 Ensure that the mating surfaces are clean and dry, then apply RTV sealant to the cover face.

3 Install the cover and secure with the six retaining bolts, after first applying a thread sealer to the bolt threads. Tighten the bolts to the specified torque.

4 Install the input shaft with synchro sleeve and shift mechanism **(see illustrations)**.

5 Install the layshaft assembly to the transmission case. To do this, it is necessary to lift off the synchro sleeve and shift mechanism from the input shaft, guide the layshaft into its bearing race slightly, while at the same time placing the sleeve and shift mechanism back on the input shaft **(see illustrations)**.

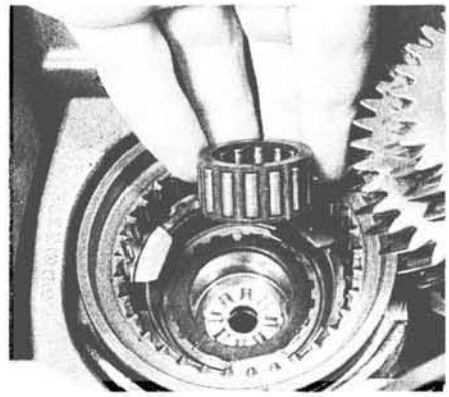
6 On models so equipped, install the preload spring, washers and roller thrust bearing to the input shaft bore **(see illustrations)**.



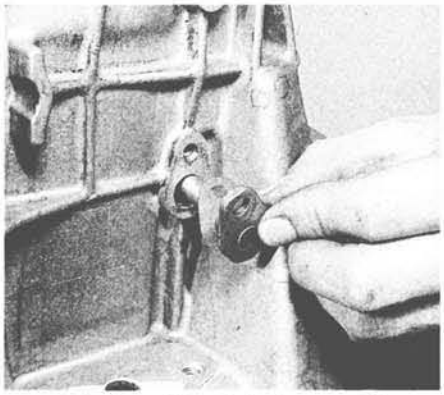
12.6b ... followed by the washers ...



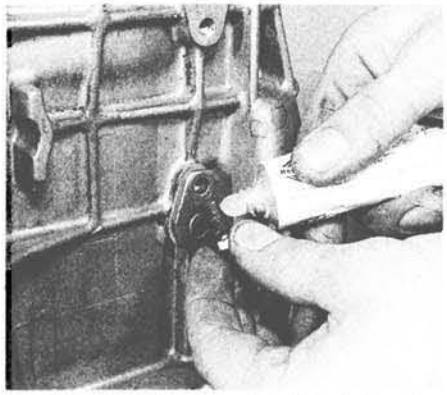
12.6c ... and roller thrust bearing



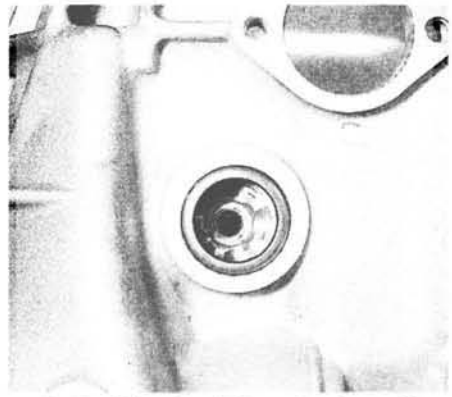
12.7 Install the mainshaft support bearing to the input shaft



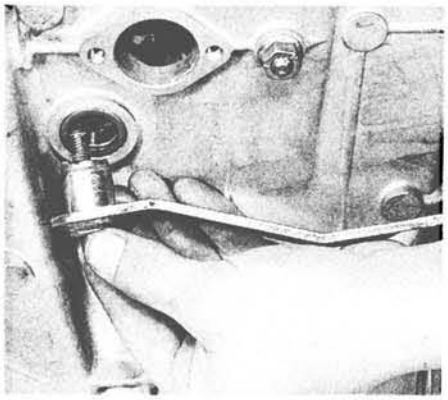
12.8 Install the 3rd/4th gearshift mechanism pivot pin plate and gasket



12.9 Coat the threads of the bolt with sealant and install it to the pivot pin plate



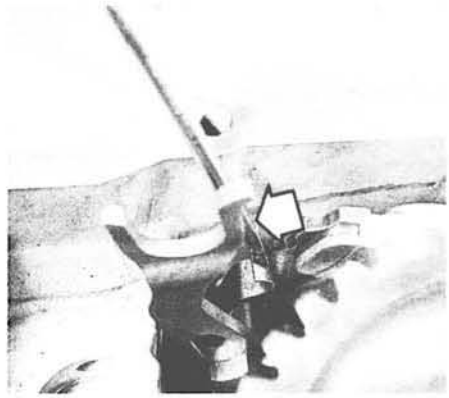
12.10 Align the shift mechanism with the shift lever bore



12.11 Install the 3rd/4th gearshift lever



12.12a Locate the mainshaft assembly in position ...



12.12b ... while easing back the detent leaf spring with a screwdriver (arrow)

7 Install the mainshaft support needle roller bearing to the center of the input shaft **(see illustration)**.

8 Using a new gasket, install the 3rd/4th gearshift mechanism pivot pin plate, while manipulating the shift mechanism to align the pivot pin hole **(see illustration)**.

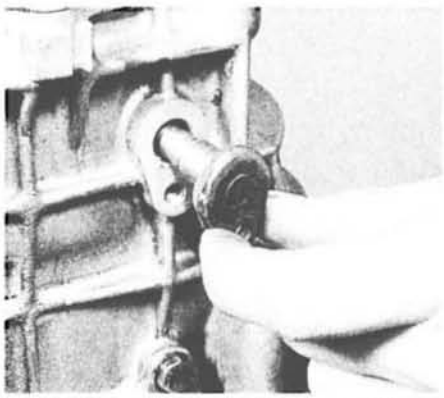
9 Apply a thread sealer to the retaining bolt, then install and tighten the bolt to the specified torque **(see illustration)**.

10 On the other side of the case, align the shift mechanism with the shift lever bore in the case **(see illustration)**.

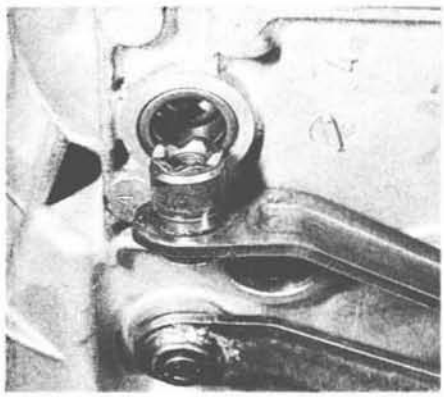
11 Install the 3rd/4th gearshift lever, engage the formed end in the lever with that in the shift mechanism, and install the retaining bolt **(see illustration)**. Tighten the bolt to the specified torque.

12 Place the mainshaft assembly in position on the input shaft **(see illustration)**. As the mainshaft is inserted, it will be necessary to lift and rotate the layshaft to allow the gears to engage. It will also be necessary to ease back the shift lever detent leaf spring with a screwdriver to allow the detents on the 1st/2nd shift mechanism to clear the spring **(see illustration)**. The help of an assistant is useful here.

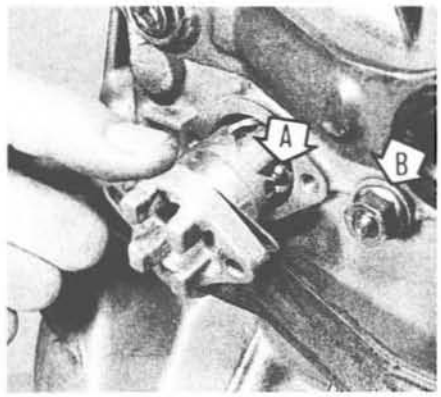
13 With the mainshaft in place, fit the 1st/2nd shift mechanism pivot pin plate with a new gasket, and secure with the retaining bolt tightened to the



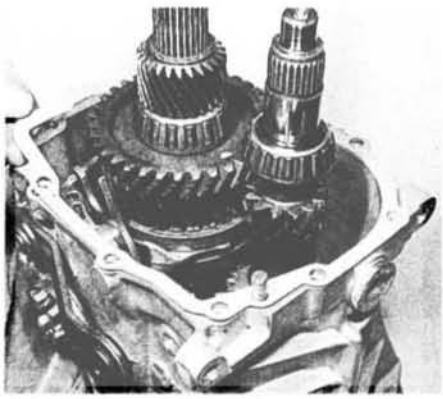
12.13 Install the 1st/2nd gearshift mechanism pivot pin plate



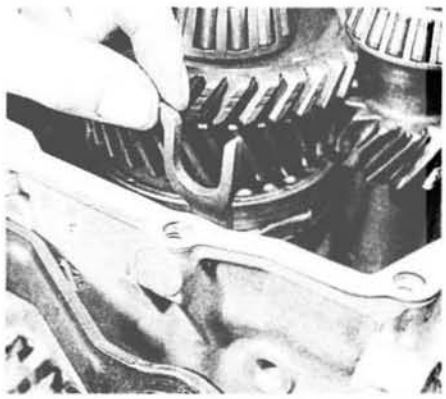
12.14 Install the 1st/2nd gearshift lever



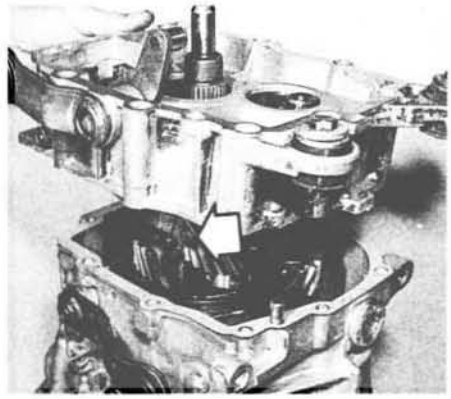
12.15 Insert the locking cage so that one ball (A) points towards the collar nut (B)



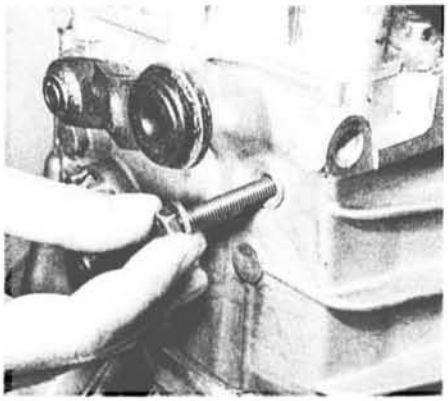
12.16 Place a new intermediate plate gasket on the case



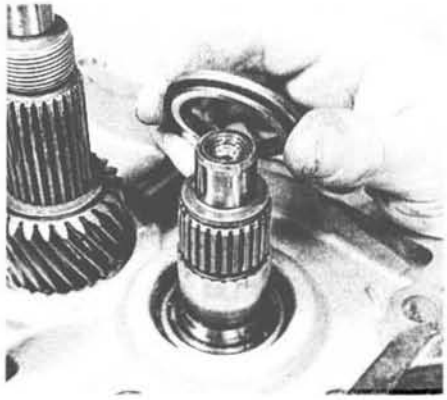
12.17 Move the locking lever to an upright position . . .



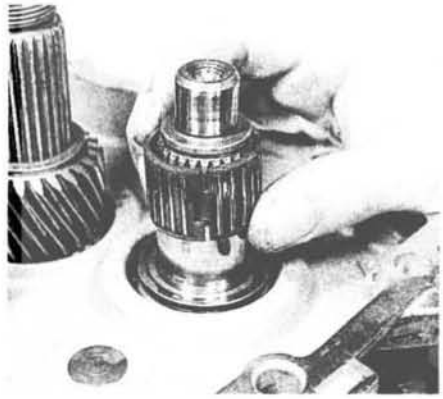
12.18 . . . so that it engages the shift lever (arrow) as the intermediate plate is installed



12.19 Install the reverse shaft locating bolt



12.20 Place the thrust washer on the layshaft



12.21a Install the needle roller bearing over the end of the layshaft

specified torque **(see illustration)**.

14 Install the 1st/2nd gearshift lever and secure with the retaining bolt tightened to the specified torque **(see illustration)**.

15 Using a new gasket, insert the locking cage into the transmission case in such a manner that one ball points down toward the collar nut **(see illustration)**. Install the two retaining bolts and tighten to the specified torque.

16 Install a new intermediate plate gasket on the transmission case **(see illustration)**.

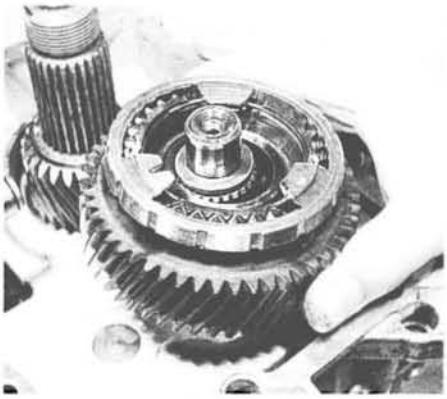
17 Move the locking lever in the transmission case to an upright position, ready to accept the shift lever in the intermediate plate **(see illustration)**.

18 Carefully position the intermediate plate on the case, while guiding the shafts into their bearing races, and the shift arm into the locking lever **(see illustration)**. Tap the intermediate plate down using a soft mallet until it is fully seated on the transmission case.

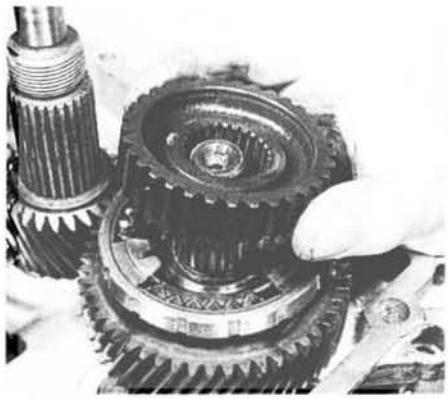
19 Insert the reverse shaft locating bolt into the case and tighten it to the specified torque **(see illustration)**.

20 Place the thrustwasher on the layshaft with the flanged side towards the bearing **(see illustration)**.

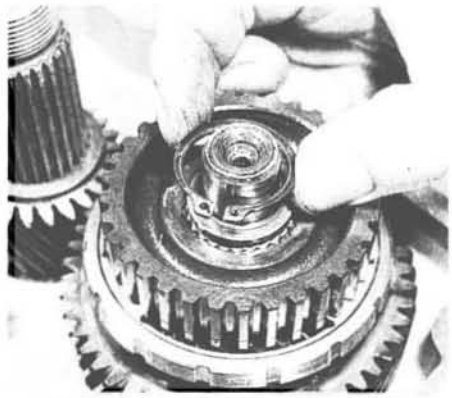
21 Install the needle roller bearing, followed by the 5th gear **(see illustra-**



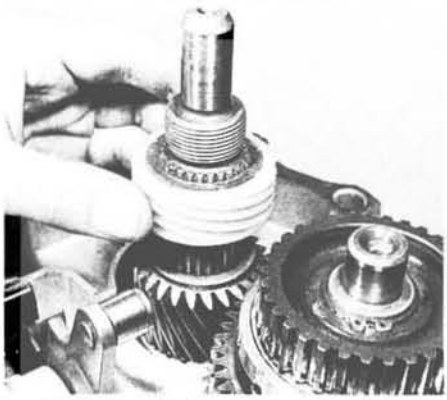
12.21b Install 5th gear and its synchro ring on to the layshaft



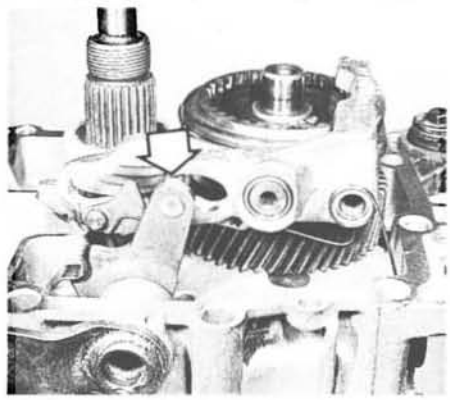
12.22 Install the synchro hub over the 5th gear and synchro ring assembly



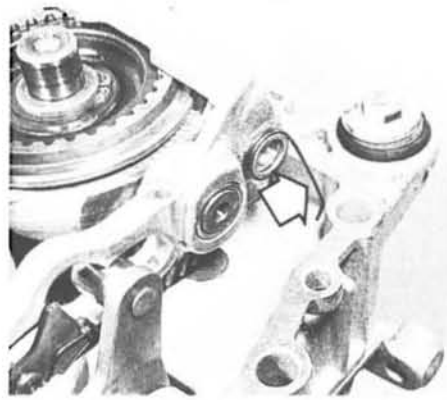
12.23 Secure the synchro hub with the circlip



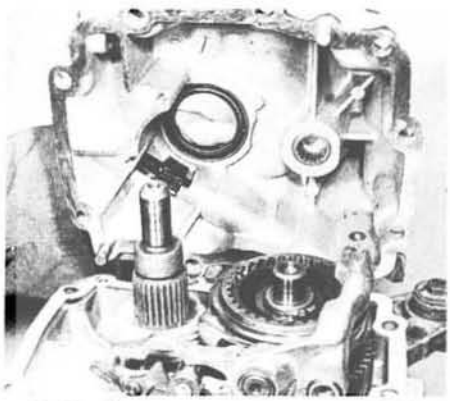
12.24 Install the speedometer drive gear with the flat side to the rear



12.25a Install the synchro sleeve and shift mechanism with the shift arm (arrow) engaged . . .



12.25b . . . and the spring end (arrow) against the side of the intermediate plate



12.26 Place a new rear cover gasket in position and install the rear cover



12.27 Install the pivot pin plates on each side



12.29a Install the spacing washer over the end of the output shaft

tions).

22 Lay the 5th gear synchro hub over the layshaft splines **(see illustration)** and tap it into place.

23 Secure the synchro hub using the retaining circlip, ensuring that the circlip seats completely in its groove **(see illustration)**.

24 Slip the speedometer drivegear onto the mainshaft, so the flat side is towards the rear **(see illustration)**.

25 Install the 5th gear synchro sleeve and shift mechanism as an assembly, ensuring that the shift mechanism engages with the shift arm, and the spring end locates against the side of the intermediate plate **(see illustrations)**.

26 Install a new rear cover gasket on the intermediate plate, then install the rear cover **(see illustration)**.

27 Using new O-rings, install the pivot pin plates on each side of the rear cover that support the 5th gear shift mechanism **(see illustration)**. Secure the pivot pin plates with the retaining bolts, tightened to the specified torque.

28 Install the rear cover and intermediate plate retaining bolts and tighten to the specified torque.

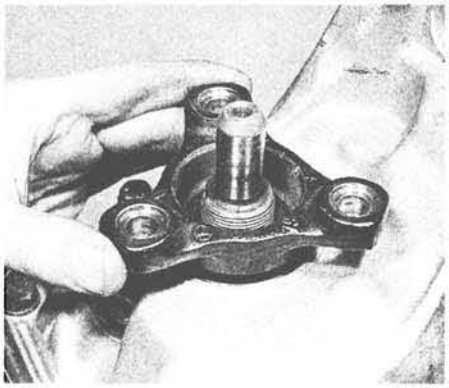
29 Install the spacing washer (where fitted), followed by the transmission flange **(see illustrations)**.

30 Screw on a new collar nut and tighten the it to the specified torque. To stop the flange turning as the nut is tightened, wedge a small socket or similar item between one of the flange arms and a sturdy part of the case **(see illustration)**.

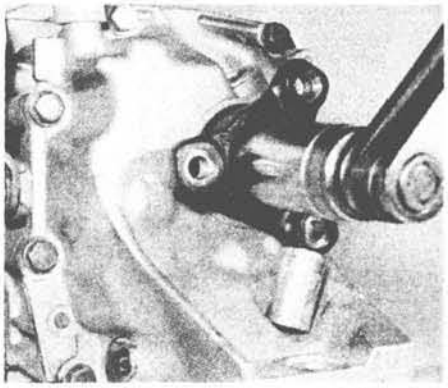
31 Using a small punch, stake the collar of the nut into the groove in the mainshaft after tightening.

32 Install the clutch release bearing, release fork and slave cylinder as described in Chapter 5.

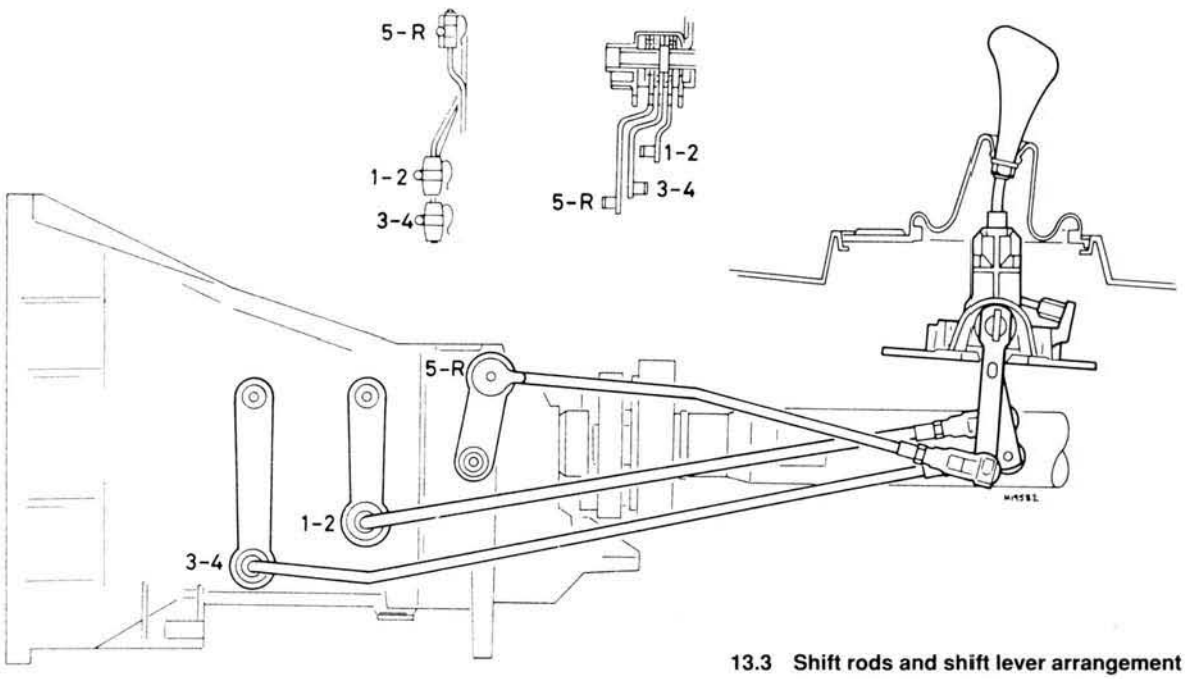
33 The transmission can now be installed as described in Section 3.



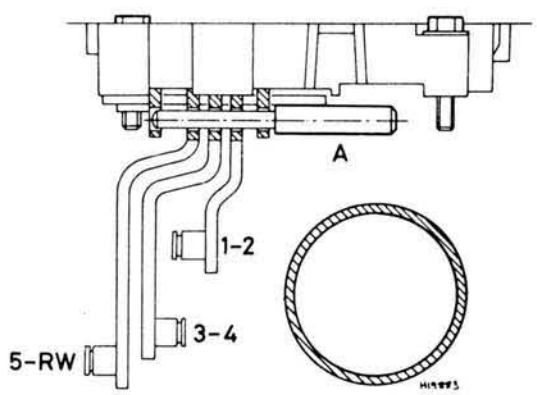
12.29b Install the transmission flange



12.30 Tighten the flange nut while using a socket to stop the flange from turning



13.3 Shift rods and shift lever arrangement



13.4 Using a pin punch (A) to lock the shift levers for adjustment purposes

13 Gearshift linkage – adjustment

Refer to illustrations 13.3 and 13.4

1 Raise the front of the vehicle and support it securely on jackstands.

2 Place the gear lever in neutral.

3 From under the car, remove the retaining clips and detach the shift rods from the three transmission shift levers **(see illustration)**.

4 Lock the three shift levers in the neutral position by inserting a screwdriver, small punch or metal rod, having a diameter of 5.9 mm (0.23 in) and a length of approximately 40.0 mm (1.6 in), through the holes in the shift levers provided for this purpose **(see illustration)**.

5 The shift rod ends should now just slip onto the pins of the shift levers. If adjustment is necessary, loosen the locknuts and adjust the length of each rod as required by turning the end fitting. Tighten the locknuts after adjustment.

6 Remove the locking tab and install the shift rods to the shift levers. Secure each rod with its retaining clip.

7 Lower the car to the ground and check the operation of the linkage with the engine running.

14 Gear lever and remote control assembly – removal and installation

Removal

1 Jack up the front of the car and support it on axle stands.
2 From under the car, extract the retaining clips and detach the shift rods from the three gear lever remote control shift levers.
3 From inside the car, remove the cover on the center console for access to the remote control assembly (refer to Chapter 11 if necessary).
4 Unclip the reverse light switch from the remote control housing.
5 Remove the four bolts securing the housing to the floor and remove the assembly from inside the car.

Installation

6 Installation is the reverse sequence of removal. Tighten the retaining bolts to the specified torque, then check the linkage adjustment as described in Section 13 before lowering the car to the ground.

15 Troubleshooting – manual transmission

Symptom	Reason(s)
Grinding noise when shifting	Clutch not disengaging completely (see Chapter 5) Worn synchro rings
Jumps out of gear	Weak or broken detent spring Worn synchro unit or shift mechanism Excessive running clearances in transmission
Noisy operation	Worn bearing or gears
Difficult engagement of gears	Clutch not disengaging completely (see Chapter 5) Worn synchro unit or shift mechanism Incorrect gear linkage adjustment Pilot bearing in crankshaft worn or seized

PART B: AUTOMATIC TRANSMISSION

16 General information

Refer to illustration 16.1

The Mercedes-Benz four-speed automatic transmission comprises two basic systems: the torque converter, which takes the place of the conventional clutch, and a torque/speed-responsive hydraulically-operated epicyclic transmission **(see illustration)**.

The transmission also incorporates a program selector switch, which enables the unit to operate in Standard or Economy mode. In Standard mode, the transmission operates normally for maximum utilization of engine power according to load and throttle position. In Economy mode, the vehicle starts from rest with the transmission in 2nd gear, and up- and down-shifts occur at lower driving and engine speeds for quieter, comfort-orientated driving. The Economy mode is automatically switched off under full throttle (kickdown) conditions.

Because of the need for special test equipment, the complexity of some of the parts, and the need for absolute cleanliness when servicing automatic transmissions, the amount which the owner can do is limited, but those operations which can reasonably be carried out are detailed in the following Sections.

17 Maintenance and inspection

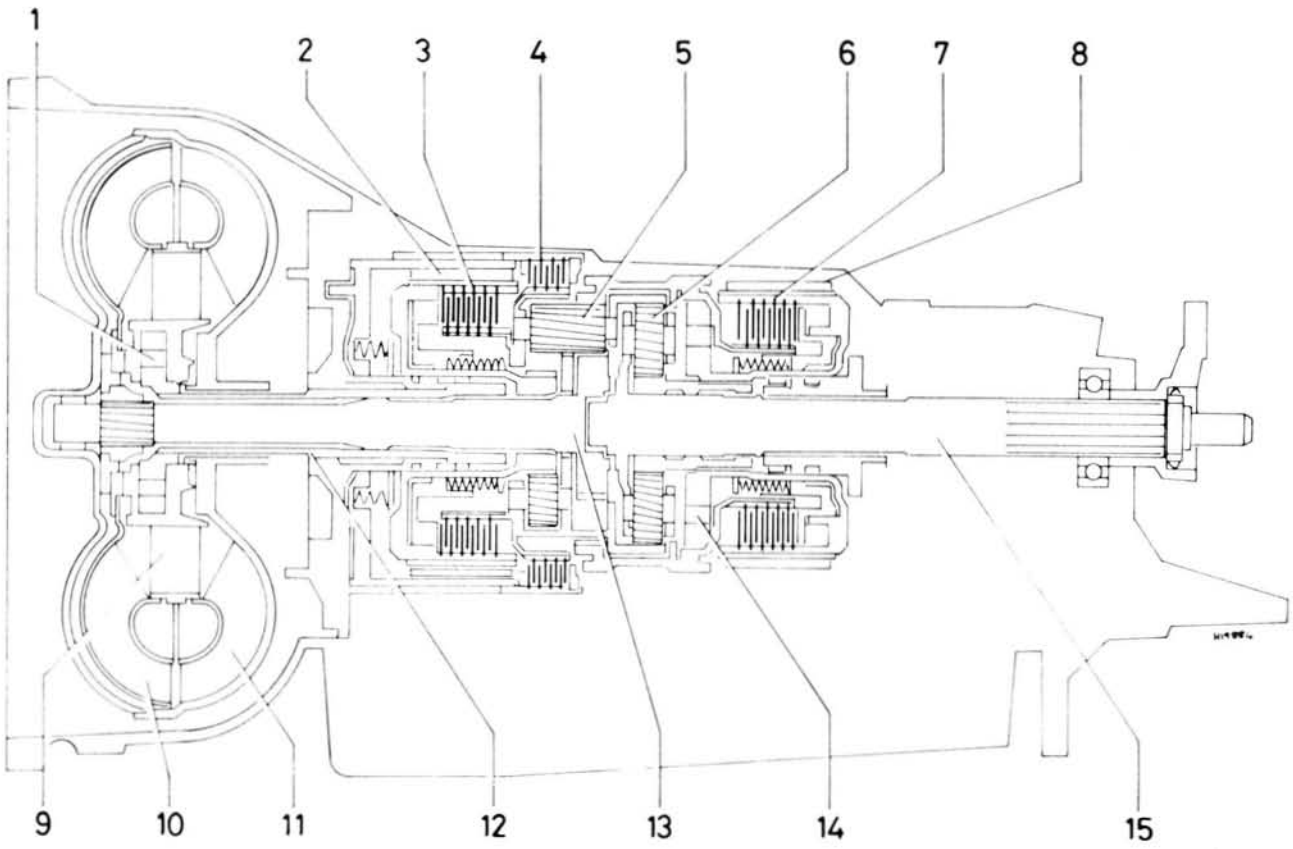
Refer to illustrations 17.3a and 17.3b

1 At the intervals specified in Routine Maintenance, the automatic transmission fluid level should be checked and if necessary topped up using the following procedures.
2 The fluid level should be checked when the transmission is at normal operating temperature.
3 Park the car on level ground, with the engine idling and the selector lever in the "P" (park) position. Lift up the locking catch on the transmission fluid dipstick which is located at the right rear of the engine compartment **(see illustration)**. Pull out the dipstick, wipe it on a clean rag, re-insert it fully, pull it out it once more and check the fluid level. With the transmission at normal operating temperature, the level should be up to the upper ("max") mark on the dipstick **(see illustration)**.
4 If topping-up is required, pour the required quantity of the specified fluid into the dipstick tube. Take care not to overfill the transmission, noting that the difference between the upper and lower marks on the dipstick is 0.3 liter (0.32 qt).
5 After adding fluid, move the selector lever through all the gear positions, pausing a few seconds in each position, then return the lever to "P". Recheck the level once more and top up if necessary.
6 On completion, secure the dipstick in its tube by pressing down the locking catch.
7 Draining and refilling of the automatic transmission fluid should be carried out at the intervals specified in *Routine Maintenance*, using the procedure given in Section 18.

18 Automatic transmission fluid – change

Refer to illustrations 18.6, 18.7 and 18.9

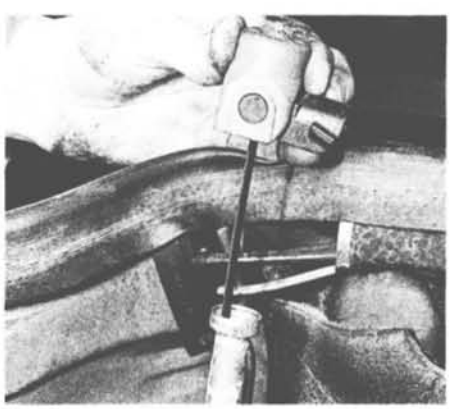
1 This job should not be attempted unless clean, dust-free conditions can be achieved.
2 Raise the front and rear of the vehicle and support it securely on jackstands and rear, but ensure that it stays level.
3 Remove the full-length engine undertray, on cars so equipped, to provide access around the transmission oil pan.
4 Place the selector lever in the "P" (park) position.
5 Clean the transmission oil pan, particularly around the drain plug, pan-to-transmission retaining bolts and the pan-to-transmission joint edge.
6 Unscrew the transmission drain plug **(see illustration)** using an Allen wrench, and allow the oil to drain into a suitable container. Reinstall the drain plug when all the oil has drained.



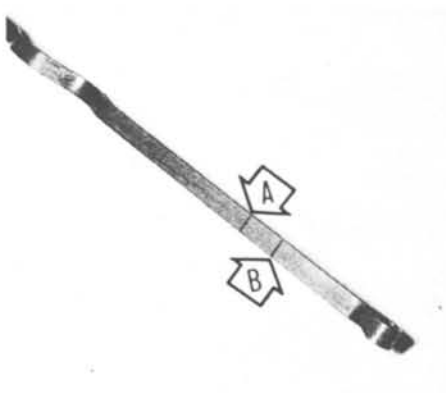
16.1 Details of the Mercedes-Benz four-speed automatic transmission and torque converter

1 *One-way converter clutch*
2 *Brake band B1*
3 *Clutch K1*
4 *Multiple disc brake B3*
5 *Front planetary gear set*
6 *Rear planetary gear set*
7 *Clutch K2*
8 *Brake band B2*
9 *Impeller*
10 *Torque converter (turbine wheel)*
11 *Pump wheel*
12 *Stator shaft*
13 *Input shaft*
14 *One-way shift clutch F*
15 *Output shaft*

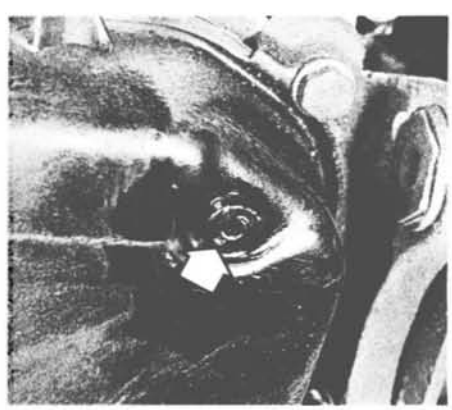
6



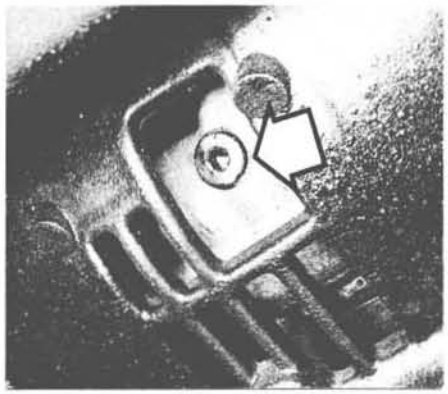
17.3a Lift up the locking catch and pull out the transmission fluid dipstick



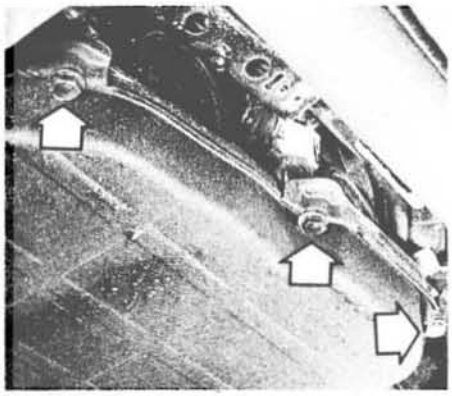
17.3b "Max" mark (A) and "min" mark (B) on the dipstick



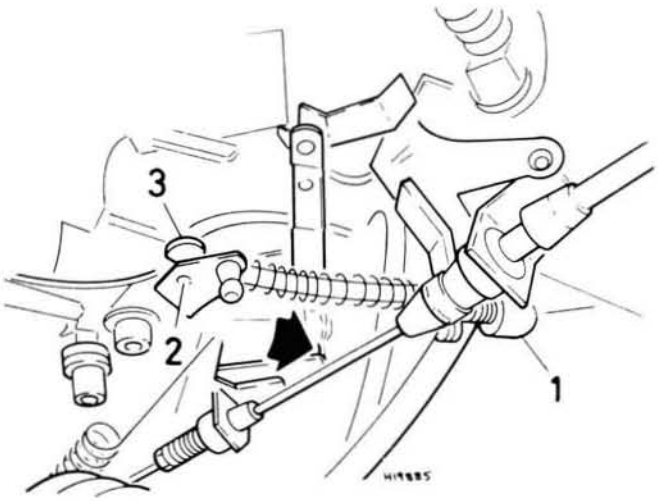
18.6 Transmission drain plug location (arrow)



18.7 Torque converter drain plug (arrow) accessible through the converter housing opening



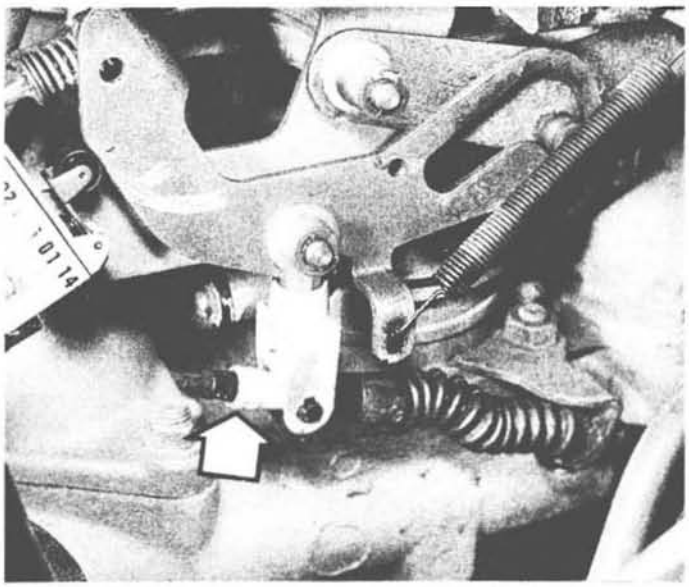
18.9 Transmission oil pan right-hand side retaining bolts (arrows)



19.1 Control pressure cable adjustment on early engines

1 Cable adjuster
2 Ball socket on linkage
3 Cable end

Arrow indicates inner cable pushed back into outer cable



19.5 Control pressure cable serrated adjusting nut (arrow)

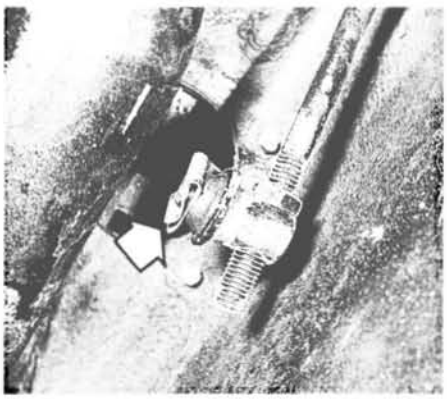
7 Turn the engine until the torque converter drain plug is accessible through the opening in the bottom of the converter housing **(see illustration)**.
8 Unscrew the drain plug and allow the oil to drain into the container. Reinstall the plug after draining.
9 Unscrew the oil pan retaining bolts **(see illustration)**, remove the clamp plates and withdraw the oil pan from the transmission. Tap the pan gently with a soft mallet if it is stuck. Recover the rubber seal.
10 Remove the screws and remove the filter screen.
11 Before installing, thoroughly clean the oil pan inside and out, and dry with a lint-free cloth.
12 Install a new filter screen and secure with the retaining screws.
13 Place the oil pan in position and install the retaining bolts and clamp plates. Tighten the retaining bolts to the specified torque.
14 Where applicable, install the engine undertray.
15 Lower the car to the ground, then fill the transmission initially with approximately 4.0 liters (4.3 qts) of the specified fluid, through the dipstick tube.
16 Start the engine and allow it to idle with the selector lever in the "P" (park) position.
17 Continue adding fluid until the level is 12.0 mm (0.47 in) below the lower ("min") mark on the dipstick.
18 Move the selector lever through all the gear positions, pausing a few seconds in each position, then return the lever to the "P" position.
19 Repeat Step 18 if topping-up is necessary.
20 Take the car for a short drive to bring the engine and transmission to normal operating temperature. Recheck the fluid level with the transmission warmed up, and this time, top-up if necessary to bring the level up to the upper ("max") mark on the dipstick.
21 On completion, switch off and secure the dipstick into its tube by pressing down the locking catch.

19 Control pressure cable – adjustment

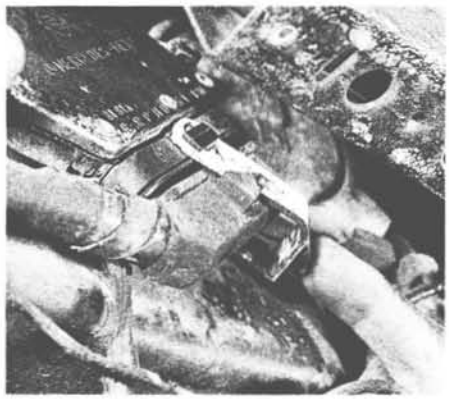
Refer to illustrations 19.1 and 19.5

Engines up to October 1984

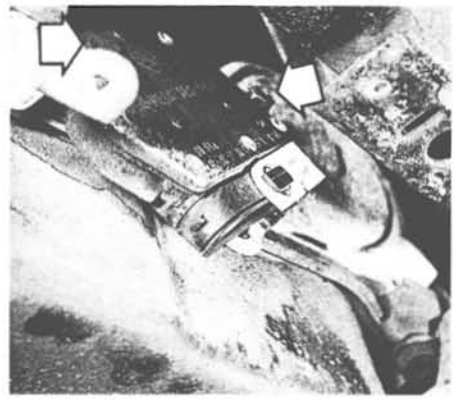
1 Disconnect the control pressure cable end from the ball socket on the throttle linkage **(see illustration)**.
2 Push the inner cable back into its outer cable (push it towards the transmission), then pull it out again until slight resistance is felt.
3 At the point where resistance is just felt, it should be possible to fit the cable end back onto the ball socket. If the cable is too long or too short to achieve this, turn the outer cable adjuster as necessary.



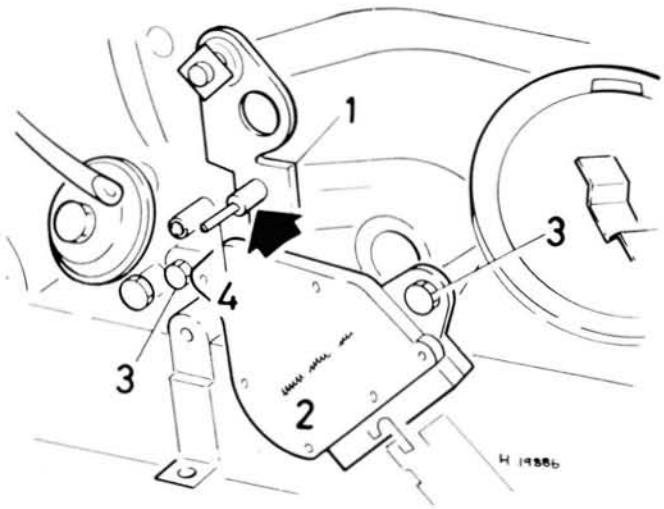
20.3 Extract the selector rod spring clip (arrow) then separate the rod from the selector lever



20.9 Push the electrical connector locking clip up to release the plug

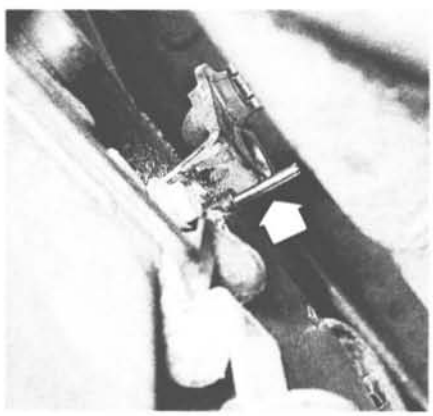


20.10 Starter inhibitor switch retaining bolt locations (arrows)



20.12a Starter inhibitor switch adjustment

1 Gear selector arm
2 Starter inhibitor switch
3 Retaining bolts
4 Drill bit inserted in operating peg (arrow)



20.12b Cotter pin (arrow) inserted through starter/inhibitor switch operating peg

4 When the adjustment is correct, push the cable end firmly into place on its ball socket.

Engines from October 1984 on

5 Screw in the serrated adjusting nut **(see illustration)** adjacent to the cable bracket, until there is approximately 1.0 mm (0.039 in) freeplay at the crush nipple on the spacing sleeve.

6 Now unscrew the adjusting nut until the tip of the indicator pointer is above the groove in the adjusting nut.

20 Starter inhibitor switch – removal, installation and adjustment

Removal

Refer to illustrations 20.3, 20.9 and 20.10

1 Raise the front and rear of the vehicle and support it securely on jackstands.

2 Place the selector lever in the "N" (neutral) position.

3 From under the car, extract the spring clip and disconnect the selector rod from the selector lever **(see illustration)**.

4 Disconnect the exhaust system rear mounts, lower the system as far as possible without subjecting it to excessive strain, and support it using a length of wire.

5 Position a jack beneath the transmission crossmember and take the weight of the transmission.

6 Remove the two bolts each side securing the transmission crossmember to the chassis rails.

7 Lower the transmission just enough to provide access to the starter inhibitor switch on the left side of the transmission case.

8 Disconnect the speedometer cable clip from the support bracket on the side of the transmission.

9 Release the electrical connector locking clip by pushing it up **(see illustration)** then disconnect it from the starter inhibitor switch.

10 Unscrew the two retaining bolts and remove the starter inhibitor switch from the transmission **(see illustration)**.

Installation

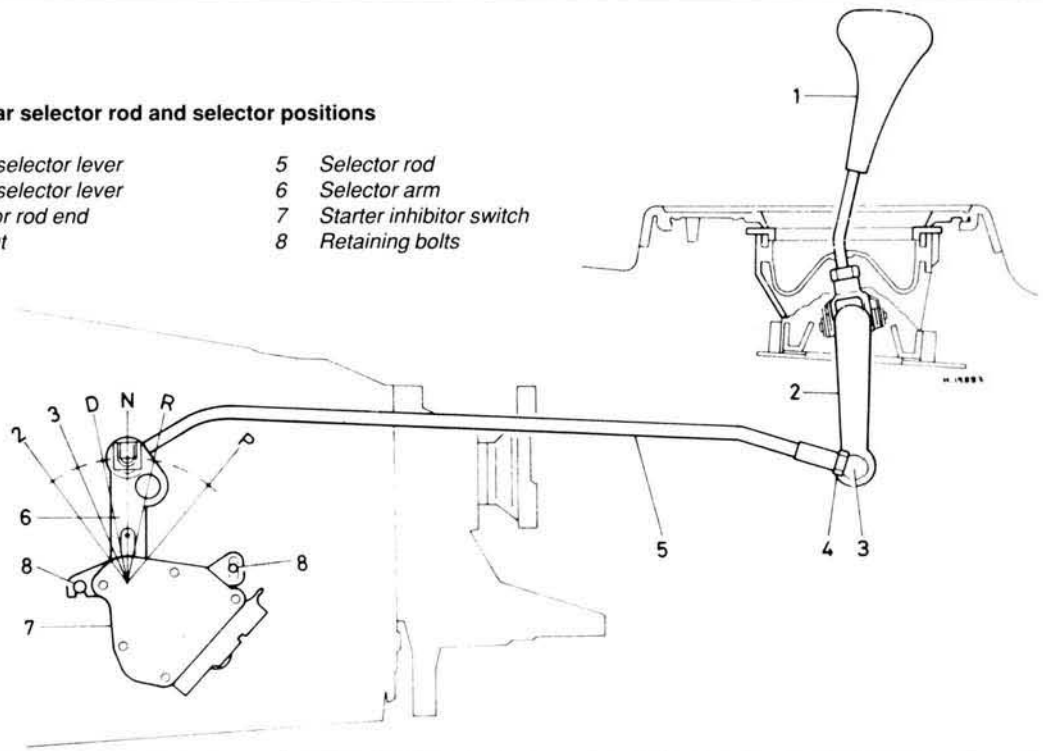
11 To install the switch, place it in position on the transmission, ensuring that the operating peg enters the gear selector arm opening. Install the two retaining bolts but do not tighten at this stage.

Adjustment

Refer to illustrations 20.12a and 20.12b

12 Insert a 4.0 mm (0.16 in) diameter drill bit, or cotter pin of similar size, through the operating peg bore to lock the inhibitor switch and selector arm **(see illustrations)**. Now tighten the switch retaining bolts, then remove the drill bit or cotter pin.

13 Reconnect the electrical connector and slip the locking clip down to secure.



21.3 Gear selector rod and selector positions

1 Upper selector lever
2 Lower selector lever
3 Selector rod end
4 Locknut
5 Selector rod
6 Selector arm
7 Starter inhibitor switch
8 Retaining bolts

14 Raise the transmission on the jack, install the crossmember bolts and tighten them securely.
15 Reconnect the exhaust system to its mounts.
16 Reconnect the speedometer cable retaining clip.
17 Reconnect the selector rod to the selector lever.
18 Lower the car to the ground and check the operation of the starter inhibitor switch.

21 Gear selector rod – adjustment

Refer to illustration 21.3

1 Raise the front of the vehicle and support it securely on jackstands.
2 Place the selector lever in the "N" (neutral) position.
3 From under the car, extract the spring clip and disconnect the selector rod from the selector lever **(see illustration)**.
4 Ensure that the selector arm on the side of the transmission is in the "N" position **(see illustration 21.3)**.
5 Loosen the locknut on the selector rod. Now adjust the rod length by turning the end fitting until there is approximately 1.0 mm (0.039 in) clearance between the selector lever and the "N" stop on the selector gate with the rod connected.
6 When the adjustment is correct, secure the selector rod with the spring clip, tighten the locknut, and lower the car to the ground.

22 Gear selector lever assembly – removal and installation

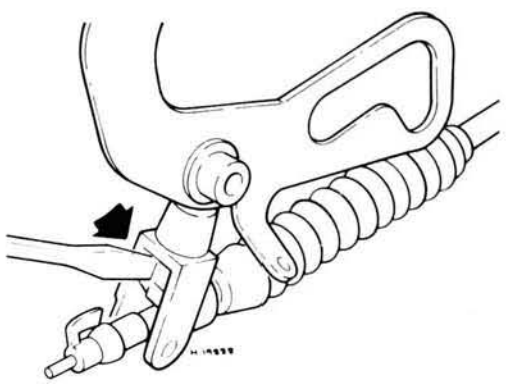
1 Raise the front of the vehicle and support it securely on jackstands.
2 From under the car, remove the retaining clip and detach the selector rod from the lower selector lever.
3 From inside the car, remove the cover on the center console for access to the selector assembly (refer to Chapter 11 if necessary).
4 Remove the four bolts securing the selector assembly to the floor, detach the wiring and cable clips and remove the assembly from the car. Remove the rubber seal at the base of the unit.
5 Installation is the reverse of removal.

23 Automatic transmission – removal and installation

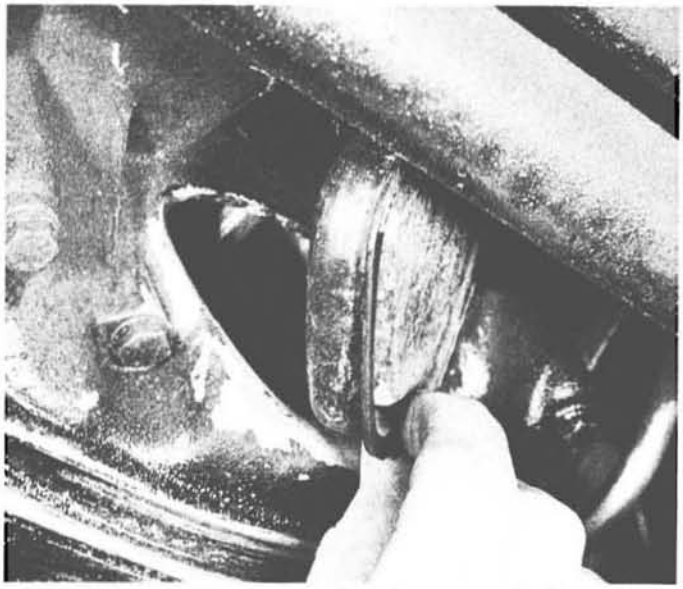
Refer to illustrations 23.5, 23.7, 23.8, 23.9, 23.14, 23.20, 23.21, 23.27, 23.28a, 23.28b and 23.32

Removal

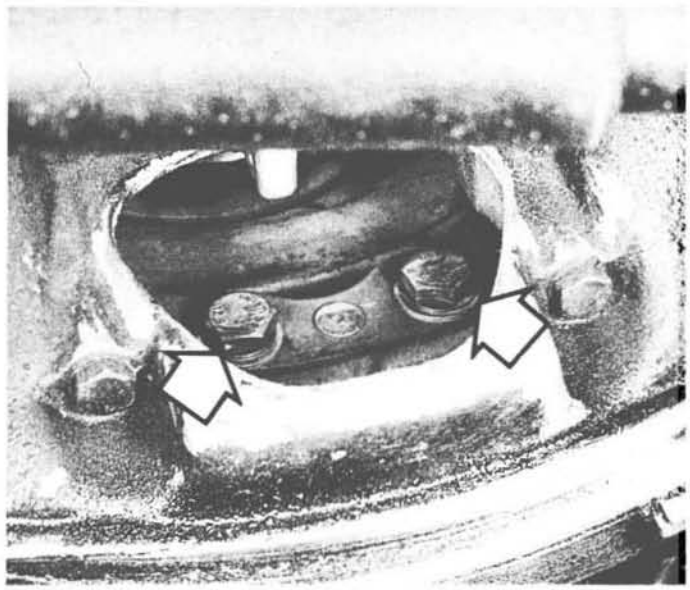
1 Raise the vehicle and support it securely on jackstands.
2 Disconnect the cable from the negative terminal of the battery.
3 Disconnect the transmission fluid dipstick tube at the rear of the cylinder head and on the camshaft cover.
4 On models up to October 1984, disconnect the control pressure cable end from the ball socket on the throttle linkage. Release the outer cable from the support bracket and move the cable clear.
5 On models from October 1984 and on, disconnect the control pressure cable end by prying the support fixture apart using a screwdriver **(see illustration)**, then withdrawing the cable end. Release the outer cable from the support bracket and move the cable clear.



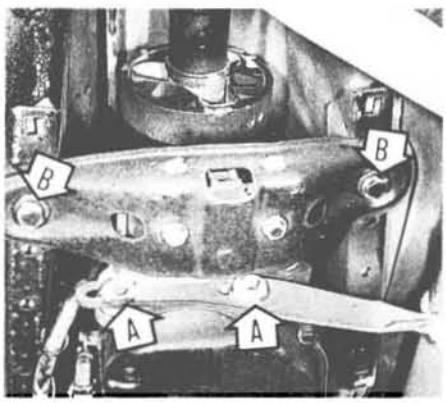
23.5 Disconnecting the control pressure cable by using a screwdriver to pry apart the support fixture (arrow)



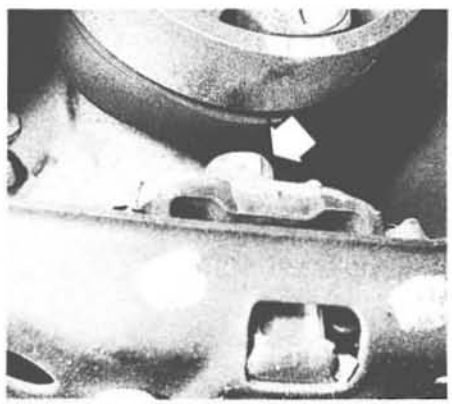
23.7 Remove the converter housing grommet – it may be necessary to pry it out with a screwdriver



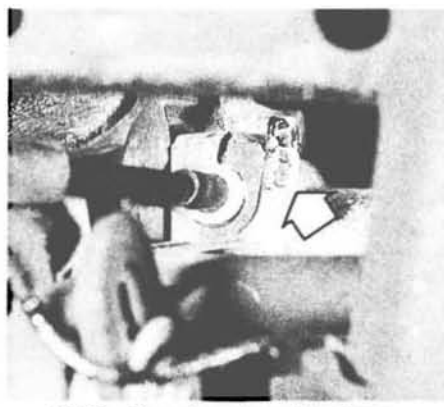
23.8 The torque converter-to-driveplate bolts are accessible through the opening in the converter housing – two of six bolts shown



23.9 Exhaust system support bracket bolts (A) and crossmember retaining bolts (B)



23.14 Crossmember rubber mounting-to-transmission retaining nut (arrow)



23.20 Speedometer cable clamp bolt (arrow)

6

6 Refer to Section 18 and drain the automatic transmission fluid from the oil pan and torque converter.

7 Remove the rubber grommet from the front face of the converter housing **(see illustration)**.

8 Turn the engine until each pair of torque converter retaining bolts (from a total of six) becomes accessible through the converter housing opening **(see illustration)**. Remove the two bolts then repeat the procedure for the remaining bolts.

9 Remove the nuts, bolts and washers securing the exhaust system support bracket to the rear of the transmission **(see illustration)**.

10 Remove the U-clamp nuts securing the exhaust to the bracket, and remove the bracket.

11 Disconnect the exhaust system rubber ring mounts, lower the system by 150 to 250 mm (6 to 10 in) and support it in this position using wire or rope.

12 Support the transmission on a jack beneath the oil pan, using a block of wood to protect the pan.

13 Remove the two bolts each side securing the transmission crossmember to the chassis rails.

14 Remove the nut securing the crossmember rubber mounting to the transmission and remove the crossmember **(see illustration)**.

15 Unscrew the four bolts and remove the exhaust heat shield over the front silencer.

16 Remove the three nuts and bolts securing the driveshaft front flexible rubber coupling to the transmission flange. To do this, unscrew the bolts using a socket and extension bar while holding the nuts from behind with a wrench. **Note:** *Further information on this and the following driveshaft procedures will be found in Chapter 7.*

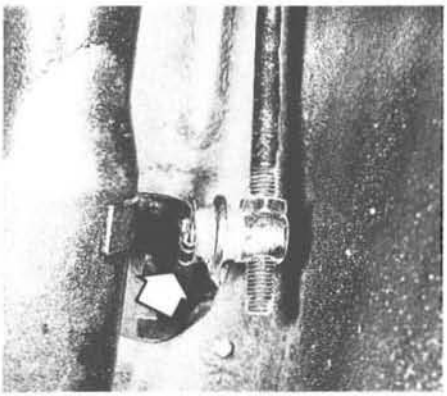
17 Using a 41 mm open-ended wrench, loosen the driveshaft clamping nut approximately two turns, while using a second wrench to prevent the driveshaft from turning.

18 Loosen the two bolts securing the center support bearing to the underbody.

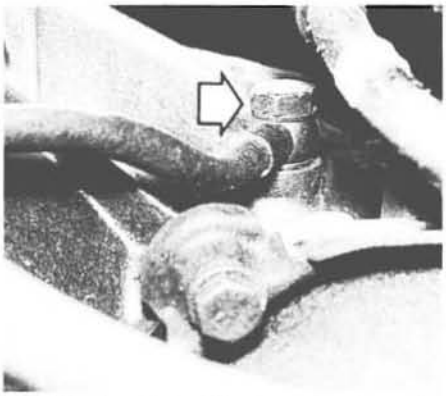
19 Slide the driveshaft front section towards the rear as far as the support bearing and clamping nut will allow. If the flexible coupling is tight on the transmission flange, insert a bar or large screwdriver through the bolt holes, and move it up and down to release the locating sleeves from their recesses in the flange. Tie the driveshaft up out of the way when it is clear.

20 Remove the speedometer cable clamp bolt **(see illustration)** and withdraw the cable from the transmission. Release the cable clip from the support bracket and move the cable to one side.

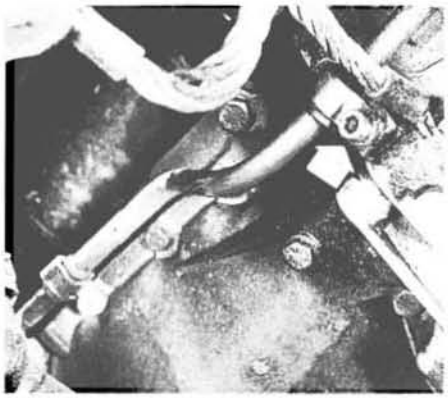
21 Extract the retaining clip and remove the selector rod end fitting from



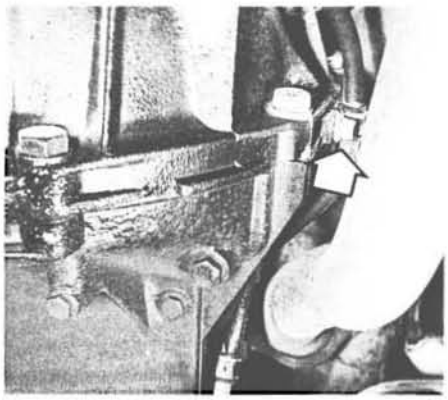
23.21 Selector rod-to-lever retaining clip (arrow)



23.27 Location of the transmission oil cooler pipe on the left side (arrow) – be sure to replace the sealing washers upon installation



23.28a Remove the pipe support clip on the left side (arrow) . . .



23.28b . . . and right side of the converter housing (arrow)



23.32 Engine ground strap attachment at the transmission

the selector lever **(see illustration)**.

22 Disconnect the cable for the kickdown solenoid valve at the rear of the

23 Lower the transmission slightly to provide access to the starter inhibitor switch on the left-hand side.

transmission.

24 Release the electrical connector locking clip by pushing it upwards, then disconnect the wiring plug from the starter inhibitor switch.

25 Disconnect the vacuum pipe at the vacuum control unit adjacent to the starter inhibitor switch.

26 Unscrew the Allen-head bolt and pull out the transmission fluid dipstick tube. Remove the tube from the car.

27 Unscrew the oil cooler pipe banjo fittings on each side of the transmission **(see illustration)** and recover the sealing washers. Cover the unions after removal to prevent the entry of dirt.

28 Remove the Allen-head bolts securing the oil cooler pipe support clips on each side of the converter housing **(see illustrations)** and remove the clips. Position the pipes clear of the transmission.

29 Remove the bolts securing the starter motor to the engine and converter housing, pull out the starter and move it aside.

30 Position a second jack beneath and in contact with the engine oil pan at the rear. Place a block of wood on the jack head to act as a cushion.

31 Place a piece of sheet metal or similar protective material over the firewall insulation at the rear of the engine, so that the insulation is not damaged by the cylinder head when the engine is tipped back.

32 Remove all the bolts securing the transmission to the engine, noting the location of the engine ground strap on the lower left side **(see illustration)**.

33 While holding the transmission in place, slowly lower the two jacks until sufficient clearance exists to allow the transmission to be pulled to the rear.

34 Carefully pry the transmission off the locating dowels using a screwdriver between the converter housing and the transmission, then remove the transmission complete with torque converter from the engine.

35 Carefully lower the jack and remove the unit from under the vehicle.

Installation

36 Installing the transmission is the reverse sequence of removal, bearing in mind the following points:

a) Lightly lubricate the torque converter stub shaft prior to installing
b) When connecting the driveshaft, tighten the clamping nut after attaching the front flexible coupling and securing the center support bearing
c) Use new sealing washers when installing the oil cooler pipe banjo fittings
d) Refill the transmission with the specified fluid using the procedure given in Section 18

24 Troubleshooting – automatic transmission

1 Before the automatic transmission is removed for repair of a suspected malfunction, it is imperative that the cause be traced and confirmed. To do this requires specialist experience and various tools and gauges not normally found in the home mechanic's workshop.

2 If any problem arises that cannot be cured by attention to the fluid level and the adjustments described in this Chapter, take the vehicle to a Mercedes-Benz dealer service department or transmission specialist for diagnosis and repair.

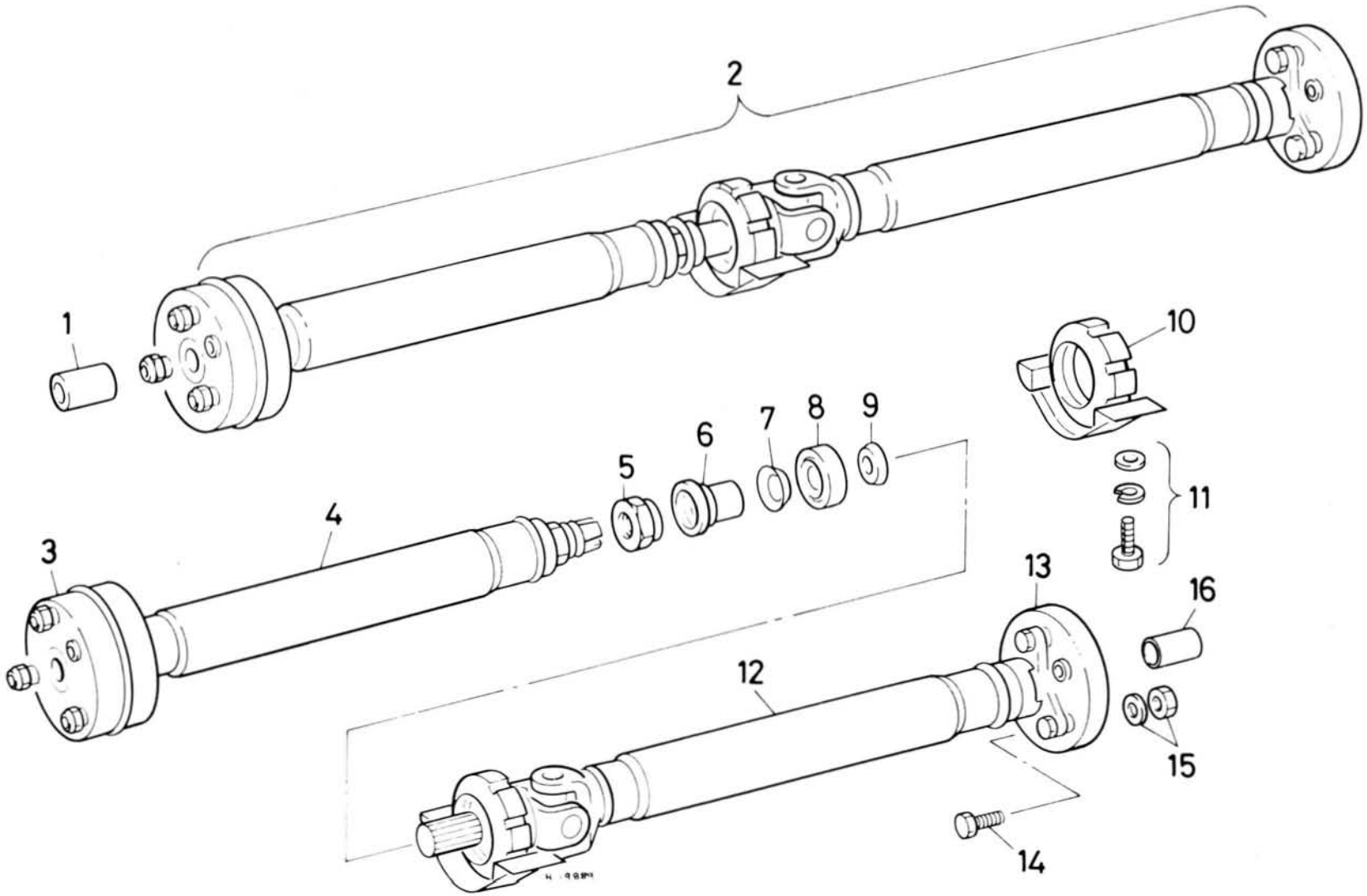
Chapter 7 Driveshaft

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Driveshaft centering sleeves – removal and installation 6
Driveshaft – removal and installation 3
Flexible rubber couplings and vibration damper – removal and installation 4
General information 1
Maintenance and inspection 2
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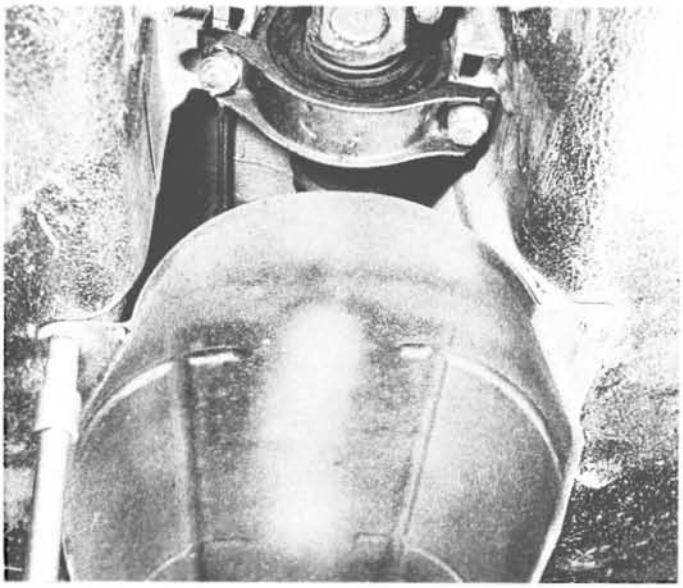
Specifications

Type	Two-piece tubular steel driveshaft with front and rear flexible rubber couplings, single universal joint and center support bearing
Centering sleeves	
Protrusion, front	33.0 mm (1.30 in)
Protrusion, rear	24.0 mm (0.95 in)
Torque specifications	**Ft-lbs**
Flexible rubber coupling mounting bolts	33
Center support bearing-to-underbody	18
Driveshaft clamping nut	22 to 30

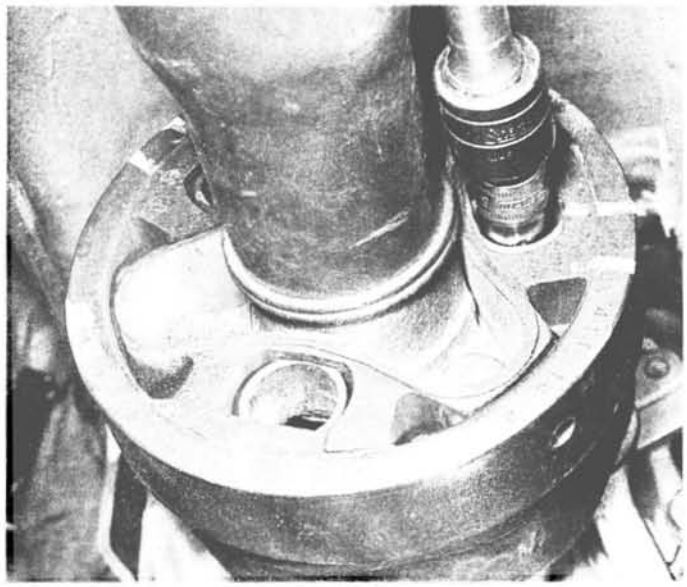


1.1 Exploded view of the driveshaft components

1 *Front centering sleeve*
2 *Driveshaft assembly*
3 *Front flexible rubber coupling and vibration damper*
4 *Driveshaft front section*
5 *Clamping nut*
6 *Rubber boot*
7 *Front protective cap*
8 *Ball bearing*
9 *Rear protective cap*
10 *Center support bearing rubber mounting*
11 *Retaining bolt and washers*
12 *Driveshaft rear section*
13 *Rear flexible rubber coupling*
14 *Retaining bolt*
15 *Nut and washer*
16 *Rear centering sleeve*



3.2 Unscrew the four bolts and remove the exhaust heat shield



3.3 Remove the front coupling and vibration damper retaining bolts

1 General information

Refer to illustration 1.1

Power is transmitted from the transmission to the differential by means of a two-piece tubular steel driveshaft **(see illustration)**. The driveshaft is attached at each end through flexible rubber couplings, and is supported at the center by a rubber-mounted ball bearing. A vibration damper, located at the transmission end of the shaft, works in conjunction with the rubber couplings to eliminate transmission shocks and harmonically-induced vibrations. A universal joint located just to the rear of the center bearing allows for slight movement of the driveshaft and transmission on their mounts. The front and rear sections of the driveshaft are joined by a sliding spline, which is locked by a clamping nut once the driveshaft is installed in the car.

2 Maintenance and inspection

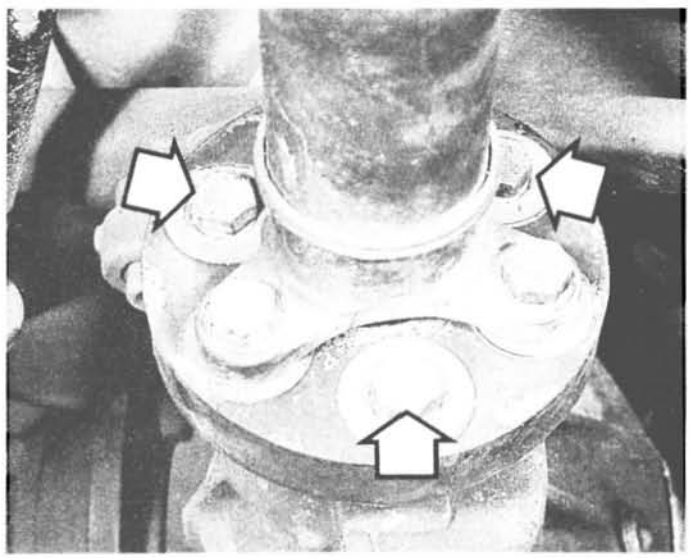
1 At the intervals specified in *Routine Maintenance* at the beginning of this manual, raise the vehicle and support it securely on jackstands so the driveshaft can be inspected over its entire length.

2 Check the two flexible rubber couplings at each end of the shaft carefully for signs of cracks, splits, deformation, or any signs of swelling of the rubber due to oil contamination. Should any of these conditions be apparent, replace the coupling as described in Section 4.

3 At the center of the shaft, check the condition of the center support bearing and its rubber mount. Examine the rubber for cracks, splits, oil contamination or other damage, and the bearing for obvious signs of excessive free play. Wear of the bearing may not be obvious visually, but may be indicated by a rumble from the center of the car, consistent with road speed, when the car is driven. Should replacement of the bearing be necessary, refer to Section 5.

4 Check the condition of the universal joint by holding both driveshaft sections and turning them in opposite directions. Any wear will appear as movement between the two yokes. Also check for signs of red rust deposits around the universal joint spider and the two yokes. This indicates that the joint is dry of lubricant, and in an advanced state of wear. Should the joint be worn, a new driveshaft rear section must be obtained as the joint cannot be repaired.

5 Finally check the driveshaft over its entire length for any other sign of damage, distortion or wear.



3.4 Rear flexible coupling-to-differential flange retaining bolts (arrows)

7

3 Driveshaft – removal and installation

Refer to illustrations 3.2, 3.3, 3.4, 3.5, 3.7, 3.8, 3.10, 3.11a, 3.11b and 3.13

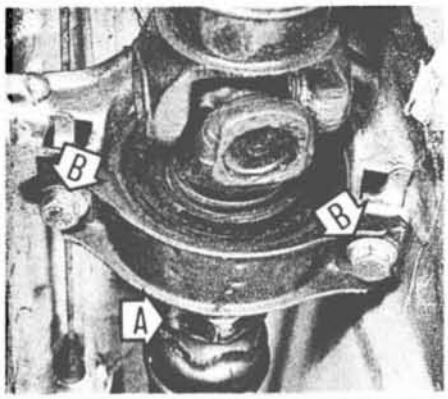
Removal

1 Raise the vehicle and support it securely on jackstands.

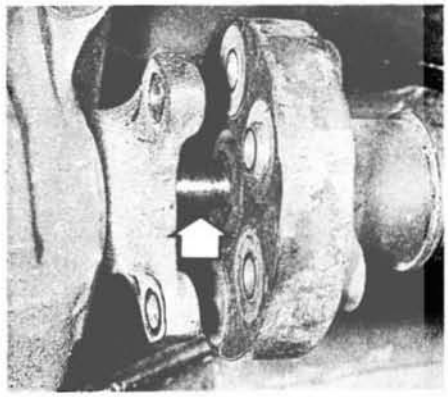
2 Unscrew the four bolts and remove the exhaust heat shield over the front muffler **(see illustration)**.

3 Remove the three nuts and bolts securing the front flexible rubber coupling to the transmission flange. To do this, unscrew the bolts using a socket and ratchet while holding the nuts from behind with a wrench **(see illustration)**. Clearance for the wrench is extremely limited, and if problems are encountered, support the transmission on a jack and remove the transmission crossmember. This will provide increased working clearance.

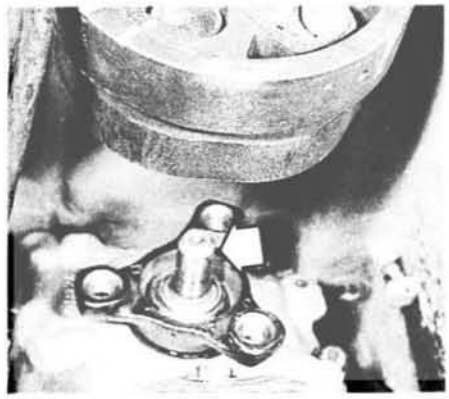
4 At the rear, remove the three nuts and bolts securing the flexible rubber coupling to the differential flange **(see illustration)**.



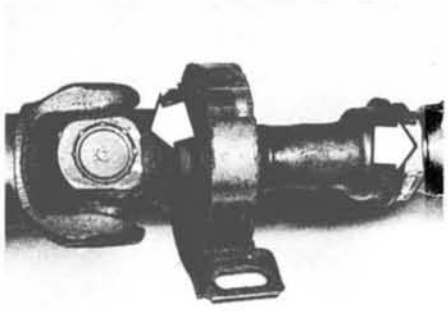
3.5 Driveshaft clamping nut (A) and center support bearing retaining bolts (B)



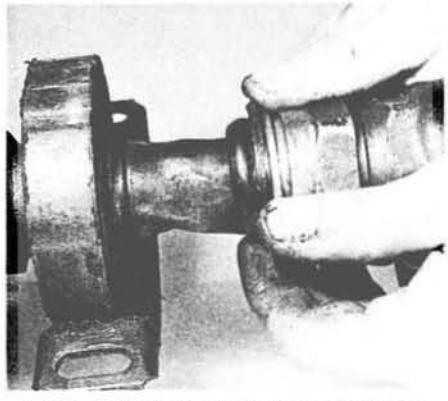
3.7 Slide the driveshaft rear section forwards to clear the differential flange centering stub (arrow)



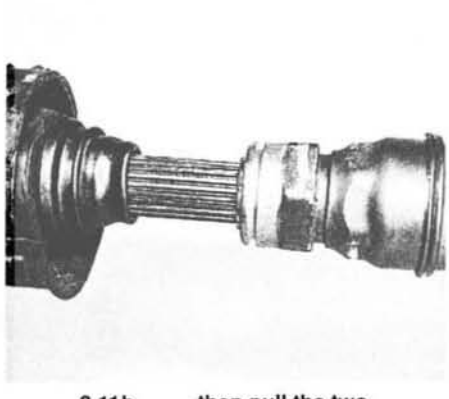
3.8 Front section clear of transmission flange centering stub (arrow)



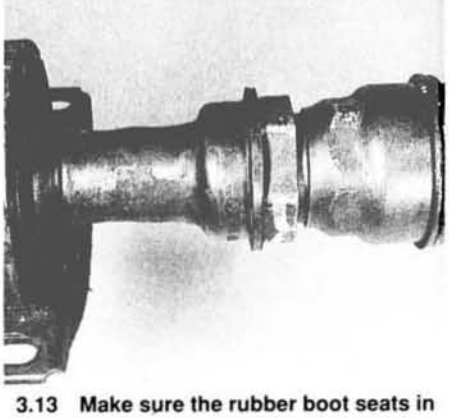
3.10 Alignment marks made on driveshaft front and rear sections (arrows)



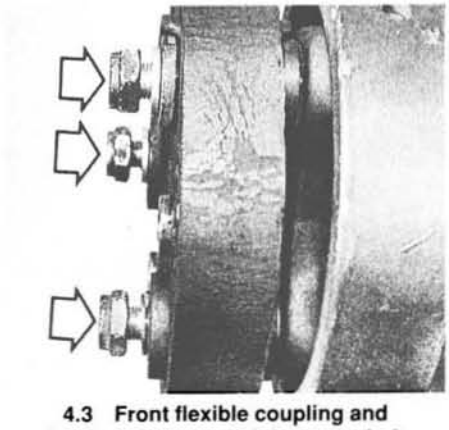
3.11a Detach the rubber boot from the clamping nut groove . . .



3.11b . . . then pull the two sections apart



3.13 Make sure the rubber boot seats in its groove correctly on reassembly



4.3 Front flexible coupling and vibration damper retaining nuts, bolts and washers (arrows)



4.6a Install the vibration damper – make sure the marks are in alignment

5 Using a 41 mm open-ended wrench, loosen the driveshaft clamping nut approximately two turns, while using a second wrench to prevent the driveshaft from turning **(see illustration)**. When standing under the car looking towards the rear, the nut is turned clockwise to loosen.

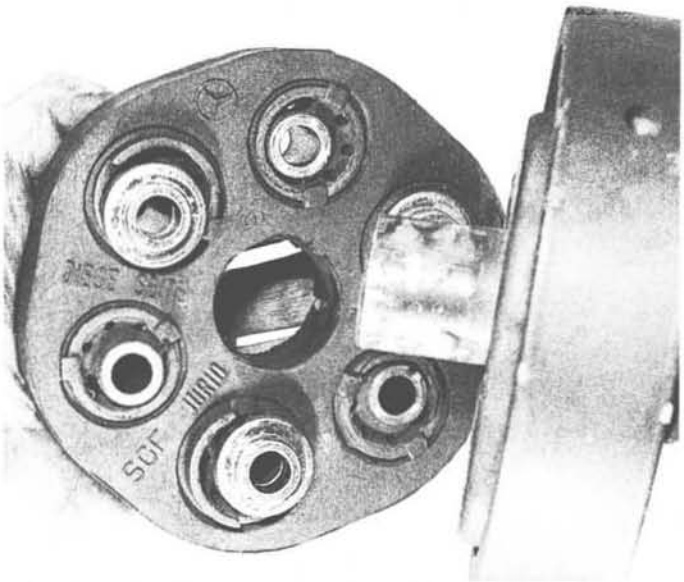
6 Remove the two bolts securing the center support bearing to the underbody.

7 Slide the driveshaft rear section forwards until it is clear of the centering stub on the differential flange **(see illustration)**.

8 Slide the driveshaft front section to the rear until it clears the transmission flange centering stub **(see illustration)**. If the flexible coupling is tight on the transmission flange, insert a bar or screwdriver through the bolt holes and move it up and down to separate the locating sleeves from their recesses in the flange.

9 With the driveshaft free at both ends, lower it at the rear and remove it towards the rear from under the car. Hold both front and rear sections together during removal otherwise they will come apart at the clamping nut splines.

10 If the two driveshaft sections are to be separated after removal, check



4.6b Install the flexible coupling with the wording facing the damper (where applicable)



5.3 Slide the rubber boot off the driveshaft splines

that some form of alignment marks are visible to ensure correct reassembly. These should be in the form of two humps on the rear section yoke, and a corresponding single hump on the front section just forward of the clamping nut. If no marks are apparent, make your own using dabs of white paint **(see illustration)**.

11 With both sections marked, the sections can be separated if required by detaching the rubber boot from the clamping nut groove and pulling the sections apart **(see illustrations)**.

Installation

12 Before reassembling, liberally lubricate the centering sleeve cavities at each end of the driveshaft, and also the rear section splines (if separated), with molybdenum disulphide grease.

13 Reconnect the two shaft sections, if previously separated, and slip the rubber boot into the clamping nut groove **(see illustration)**. Do not tighten the clamping nut at this stage.

14 Engage the driveshaft front and rear sections with the centering stubs on the transmission and differential. Install the two bolts securing the center bearing to the underbody, but leave the bolts finger-tight only at this stage.

15 Secure the front and rear flexible rubber couplings to their respective flanges, tightening the retaining bolts to the specified torque. Install the transmission crossmember if previously removed for access.

16 Using the two open-ended wrenches, securely tighten the driveshaft clamping nut.

17 Tighten the driveshaft center bearing bolts to the specified torque, install the exhaust shield, and lower the car to the ground.

4 Flexible rubber couplings and vibration damper – removal and installation

Refer to illustrations 4.3, 4.6a and 4.6b

Front coupling and vibration damper

1 Remove the driveshaft from the car as described in Section 3.

2 Mark the vibration damper in relation to the three-arm flange of the driveshaft, and also to the flexible coupling, before separating these components.

3 Using a socket and wrench in the same way as for removal of the driveshaft, unscrew the three nuts and remove the bolts and washers securing the coupling and damper to the driveshaft **(see illustration)**.

4 Remove the flexible rubber coupling, followed by the vibration damper, from the driveshaft flange.

5 Check the condition of the flexible coupling and replace it if there is any sign of cracking, splits, or deformation of the rubber particularly around the retaining bolt locating sleeves.

6 Install the vibration damper **(see illustration)**, ensuring that the previously-made marks are aligned, followed by the flexible rubber coupling. On certain models, special couplings are used, which are identifiable by having off-center retaining bolt locating sleeves. This type of coupling must be fitted with the wording "DIESE SEITE ZUR GELENKWELLE" (this side towards driveshaft) facing the vibration damper **(see illustration)**.

7 Install the mounting bolts, washers and nuts, with the bolt heads toward the driveshaft, and tighten to the specified torque.

8 Install the driveshaft as described in Section 3.

Rear coupling

9 Remove the driveshaft as described in Section 3.

10 Unscrew the three nuts, bolts and washers securing the coupling to the driveshaft flange and remove the coupling.

11 Check the condition of the flexible coupling and replace it if there is any sign of cracking, splits, or deformation of the rubber, particularly around the retaining bolt locating sleeves.

12 Install the new coupling and secure with the three bolts, nuts and washers. Ensure that the bolt heads are towards the driveshaft, and tighten to the specified torque.

13 Install the driveshaft as described in Section 3.

5 Center support bearing – removal and installation

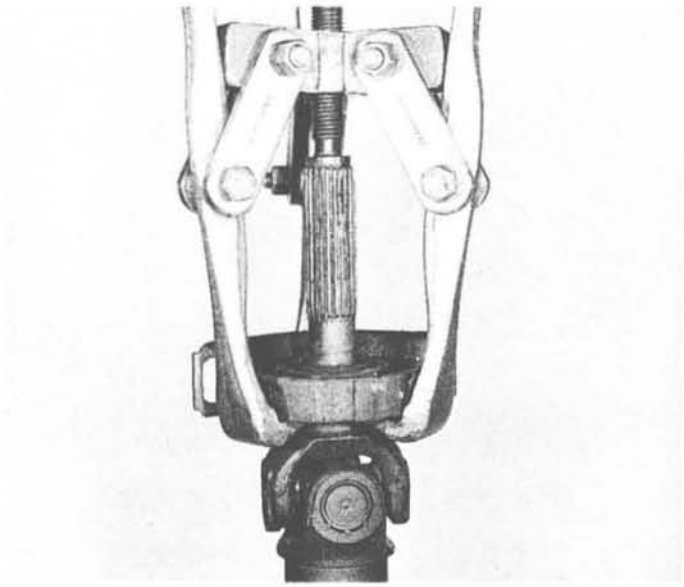
Refer to illustrations 5.3, 5.4 and 5.6

Removal

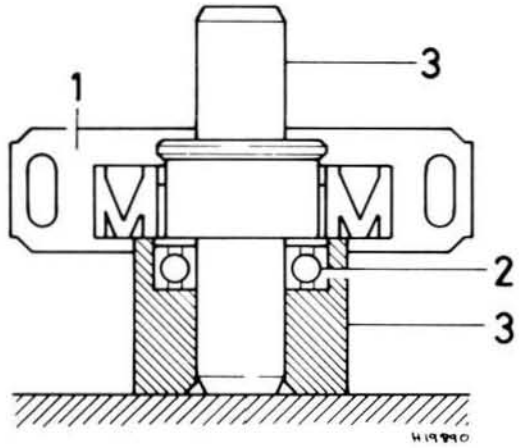
1 Remove the driveshaft and separate the front and rear sections as described in Section 3.

2 Securely clamp the driveshaft rear section in a vise with the support bearing at the top.

3 Slide the rubber boot off the driveshaft splines **(see illustration)**.



5.4 Remove the center support bearing assembly using a puller



5.6 Removing the center support bearing from the rubber mount

1 Rubber mount
2 Ball bearing
3 Mandrel for removing bearing and socket or tube to support rubber mount

4 Using a two- or three-jaw puller, pull the center support bearing assembly off the driveshaft yoke **(see illustration)**.

5 Pry off the rear protective cap still in position on the driveshaft yoke. Lift off the front protective cap from the support bearing assembly.

6 If the ball bearing or rubber mount are to be replaced, place the assembly on a tube or large socket of suitable diameter to contact the inner circumference of the rubber mount. Using a mandrel in contact with the bearing outer race, drive the bearing out of the mount **(see illustration)**.

Installation

7 Assemble the new bearing and/or mounting using the reverse of the dismantling procedure, ensuring that the bearing seats fully against the flange in the mounting.

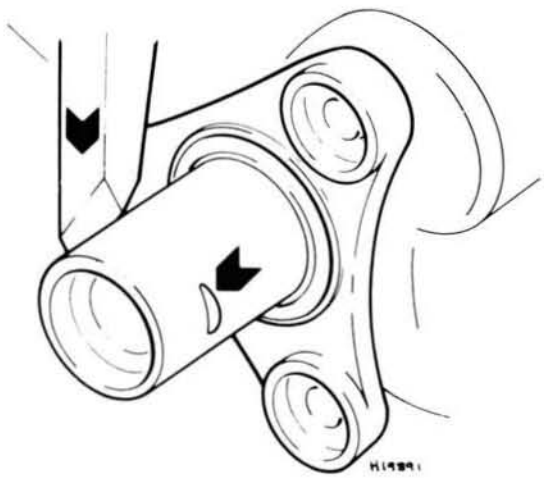
8 Install the rear protective cap to the driveshaft yoke.

9 Place the support bearing assembly over the splines on the yoke, and drive it on completely using a tube in contact with the ball bearing inner race. Make sure that the support bearing assembly is installed facing the correct direction. The bearing is offset to one side of the rubber mount, and this offset side must be facing towards the driveshaft universal joint.

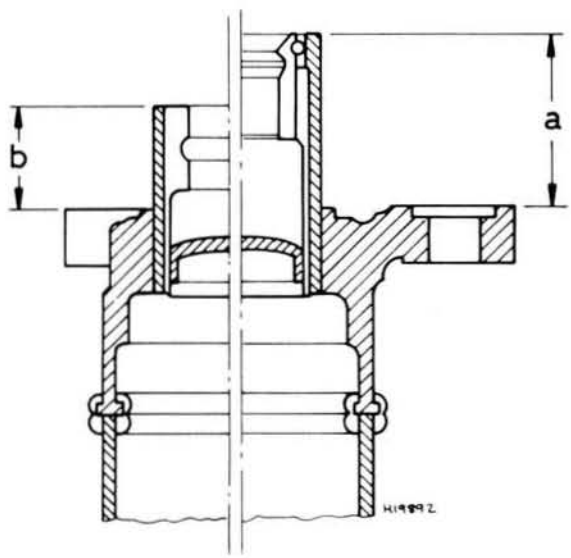
10 Tap on a new front protective cap until it contacts the bearing inner race.

11 Install the rubber boot, ensuring that the small end locates correctly.

12 The two driveshaft sections can now be reconnected and installed as described in Section 3.



6.5 Using a flat chisel for removal of a centering sleeve



6.6 Measure the centering sleeve protrusion at the points indicated

a Protrusion at front *b Protrusion at rear*

6 Driveshaft centering sleeves – removal and installation

Refer to illustrations 6.5 and 6.6

Removal

1 In the event of wear or damage to the sealing lip in the driveshaft front or rear section centering sleeves, which locate over the centering stubs in the transmission and differential flanges, the centering sleeves can be replaced as follows.
2 Remove the driveshaft as described in Section 3.
3 Refer to Section 4 and remove the front flexible rubber coupling and vibration damper, if the front centering sleeve is to be replaced, or the rear flexible coupling if the rear sleeve is to be replaced.
4 Securely mount the front or rear driveshaft section in a vise, as applicable.
5 Knock the centering sleeve uniformly out of the driveshaft using a hammer and flat chisel **(see illustration)**.

Installation

6 Protect the end of the new centering sleeve with a block of wood, and tap it into place in the driveshaft. When installed, the sleeve must protrude by the amount given in the Specifications **(see illustration)**.
7 Fill the inside of the centering sleeve with approximately 6 grams of molybdenum disulphide grease, then install the rubber coupling and where applicable, the vibration damper as described in Section 4.
8 The driveshaft can now be installed as described in Section 3.

Troubleshooting – driveshaft

Symptom	Reason(s)
Vibration	Worn front or rear flexible couplings Flexible rubber coupling mounting bolts loose Worn center support bearing Driveshaft front and rear sections incorrectly assembled Vibration damper incorrectly installed Worn universal joint
"Clunk" on acceleration and deceleration	Worn front or rear flexible couplings Flexible rubber coupling mounting bolts loose Worn universal joint Worn front-to-rear section connecting splines, or clamping nut loose
Rumbling noise	Worn center support bearing Worn universal joint

Chapter 8 Differential and driveaxles

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Differential drive flange oil seal – replacement ... 4
Driveaxle – removal and installation ... 5
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Inner constant velocity joint – disassembly, inspection and reassembly ... 7
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Troubleshooting – differential and driveaxles ... 8

Specifications

Differential

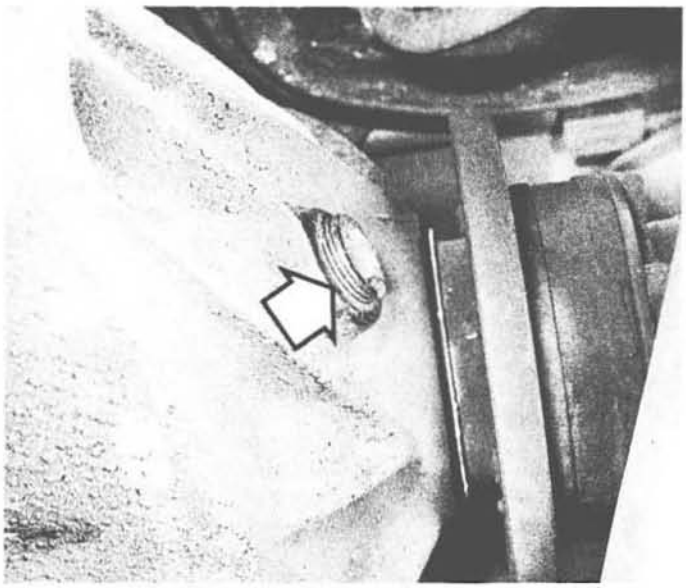
Type	Hypoid bevel gear
Lubricant type	Hypoid gear oil, viscosity SAE 90 EP
Lubricant capacity	0.7 liter (0.74 qt)
Differential ratio	3.23:1
Drive flange locking ring thicknesses	1.20 to 1.80 mm (0.047 to 0.071 in) in 0.05 mm (0.002 in) increments

Driveaxles

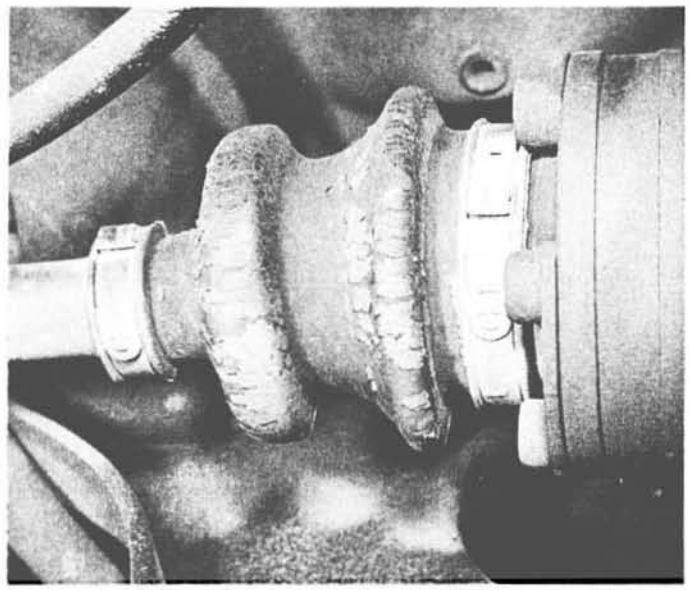
Type	Solid steel with inner and outer constant velocity joints

Torque specifications

	Ft-lbs
Differential housing rear retaining bolts	37
Differential housing front retaining nut and bolt	33
Differential housing rear cover bolts	33
Driveshaft center support bearing bolts	18
Driveshaft flexible coupling to pinion flange	33
Driveshaft clamping nut	26
Inner constant velocity joint to differential drive flange	52
Driveaxle retaining collar nut	207 to 236



2.3 Differential oil filler/level plug (arrow)



2.5 Check the condition of the constant velocity joint rubber boots – look for damage and deterioration

1 General information

The conventional hypoid differential assembly is bolted to a subframe at the rear of the car, which is in turn attached to the underbody by means of rubber-cushioned mounts.

Power from the driveshaft is taken to the bevel pinion and transmitted to the crownwheel and differential unit, which together form the differential assembly. A drive flange on each side, splined to the differential side gears, allows the power to be transmitted to the driveaxles and then to the rear wheels.

The solid steel driveaxles each contain two ball and cage type constant velocity joints, one at each end. The inner joint is bolted to the differential drive flange, and the outer joint is splined to the rear hub flange.

The procedures given in this Chapter relating to the differential assembly are limited to those considered feasible for the average owner to carry out. Due to the need for special tools, jigs, fixtures and expertise, it is not recommended that the owner attempt to either remove, disassemble or make adjustments to, the differential unit itself. This work should be entrusted to a Mercedes-Benz dealer service department or other repair shop.

Removal of the driveaxle assemblies is straightforward but repair is limited to replacement of the rubber boots and inner constant velocity joints, these being the only parts available separately. The outer joint is supplied as part of a complete driveshaft assembly.

2 Maintenance and inspection

Refer to illustrations 2.3, 2.5 and 2.7

1 At the intervals specified in *Routine Maintenance* at the beginning of this manual, carry out the following service operations on the differential and driveaxles.

2 Jack up the rear of the car and support it on axle stands.

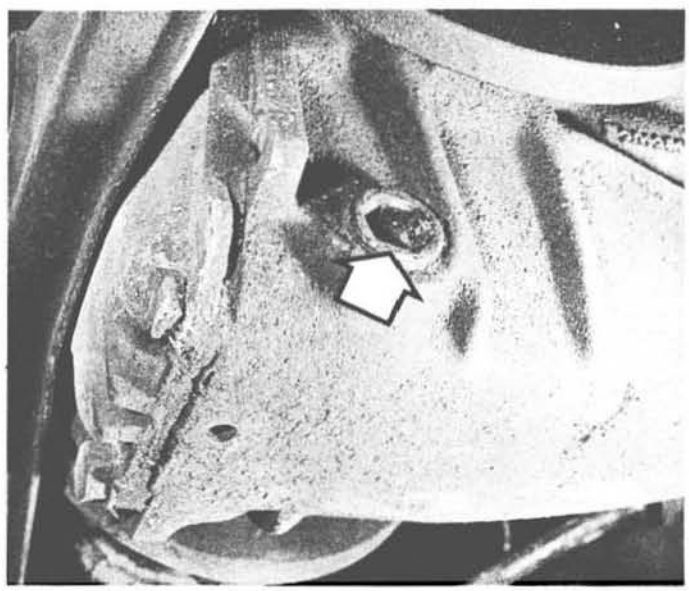
3 Wipe the area around the filler/level plug on the left-hand side of the differential case, unscrew the plug using a 14 mm Allen wrench, and check that the oil level is up to the plug opening. Top up if required using the specified lubricant, then install the plug **(see illustration)**.

4 Check for signs of oil leakage around the drive flange and pinion shaft oil seals, and check the condition and security of all components and attachments within the differential area.

5 Turn each driveaxle slowly, and carefully inspect the condition of the rubber boots on the inner and outer constant velocity joints. If any are split, they must be replaced immediately as described in Section 6 **(see illustration)**.

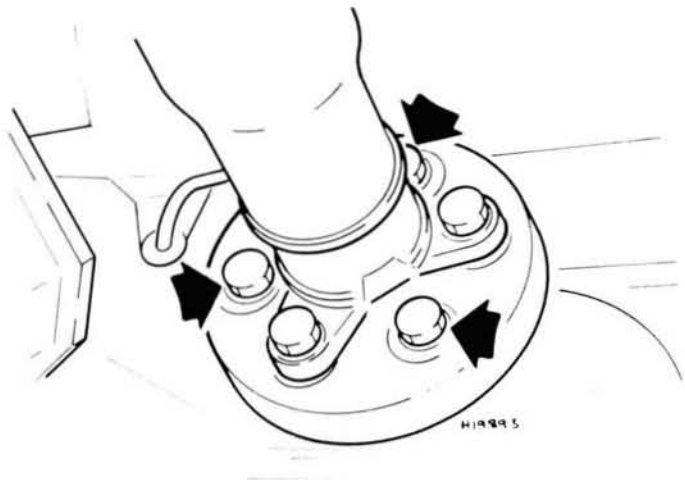
6 Check for wear in the outer constant velocity joints by holding the wheel and attempting to turn the driveaxle. Any excessive movement of the driveaxle indicates wear in the joint. Check the inner constant velocity joint in a similar way, but hold the differential drive flange while attempting to turn the driveaxle. If the joints are suspect, remove the driveaxle from the car and carry out a careful inspection as described in later Sections of this Chapter.

7 At the specified intervals, drain and refill the differential with fresh lubricant. Unscrew the drain plug at the bottom of the differential housing and allow the oil to drain into a suitable container **(see illustration)**. When the oil has drained, clean and install the drain plug, and refill the differential with the specified grade of lubricant through the filler/level plug on the left-hand side of the differential case.

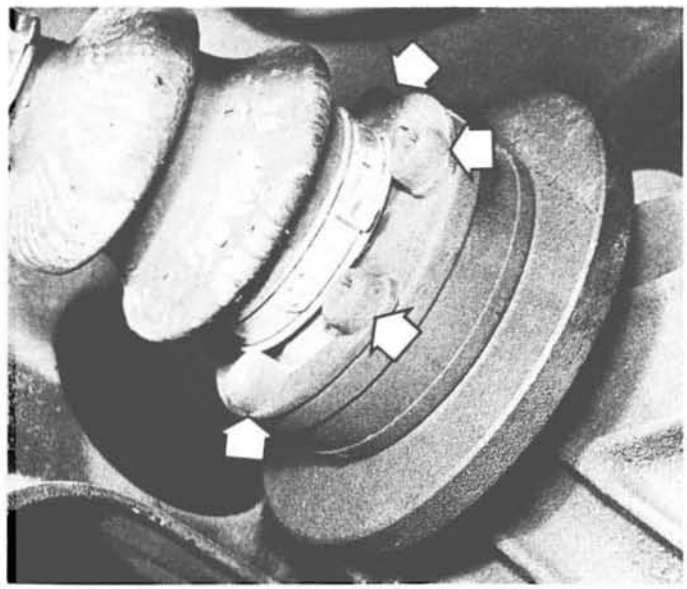


2.7 Location of the differential drain plug (arrow)

8



3.6 Driveshaft rear flexible coupling-to-differential flange retaining bolts (arrows)



3.8 Inner constant velocity joint retaining bolts (arrow)

3 Differential assembly – removal and installation

Refer to illustrations 3.6, 3.8, 3.11 and 3.12

Removal

1 Raise the rear of the vehicle and support it securely on jackstands.

2 On cars equipped with ABS brakes, unscrew the drain plug at the bottom of the differential housing using a 14 mm Allen wrench, and allow the oil to drain into a container **(see illustration 2.7)**. Unscrew the Allen-head bolt and remove the rpm sensor from the side of the housing. Cover the probe end of the sensor after removal to protect it from damage. When all the oil has drained, install the drain plug.

3 Remove the heat shield over the exhaust system center section.

4 Using a 41 mm open-ended wrench, loosen the driveshaft clamping nut, located just to the rear of the center support bearing, approximately two turns. Use a second wrench to hold the driveshaft stationary as the clamping nut is loosened (see Chapter 7 if necessary).

5 Remove the two screws securing the driveshaft center support bearing to the underbody.

6 Remove the three nuts and remove the bolts securing the driveshaft rear flexible coupling to the differential pinion flange **(see illustration)**.

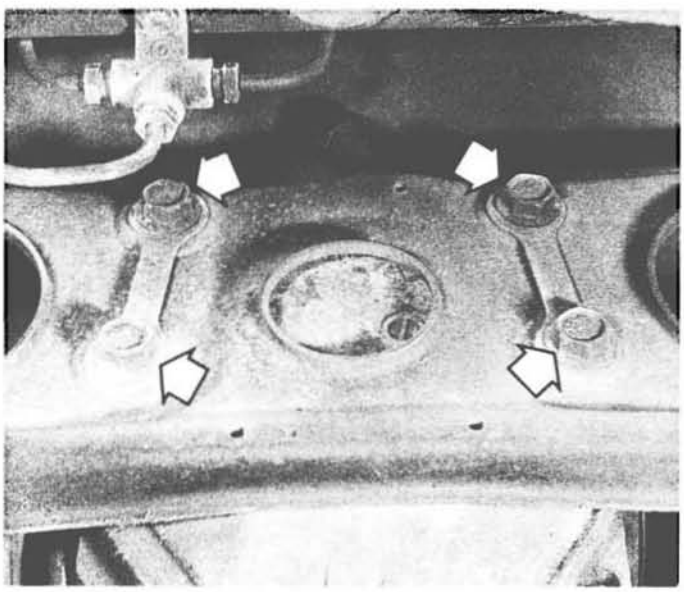
7 Push the driveshaft forwards as far as it will go to disengage the pinion flange centering sleeve. Move the disconnected driveshaft to the side and support it using a length of wire tied to the parking brake cable.

8 Using a 12-point internal spline wrench, unscrew the bolts securing both driveaxle inner constant velocity joints to the differential drive flanges. Remove the bolts and locking plates **(see illustration)**.

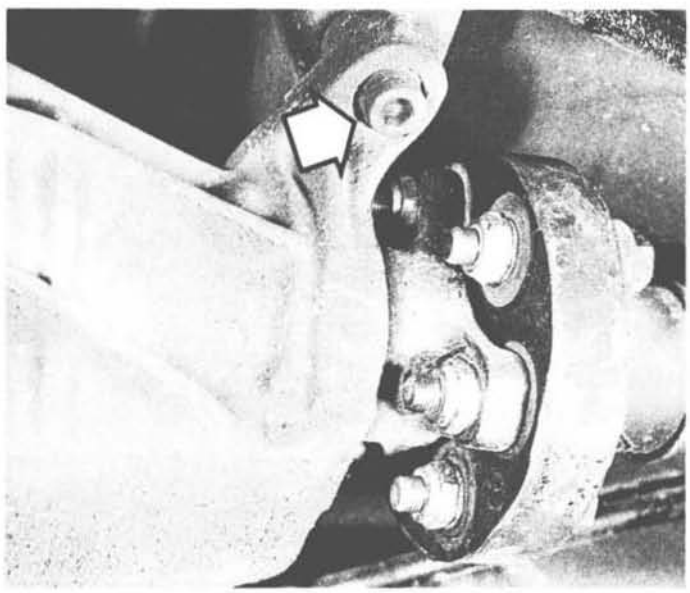
9 Push the driveaxles outwards to clear the drive flanges and tie them up, using a length of wire, to the rear suspension camber strut.

10 Support the differential housing with a floor jack.

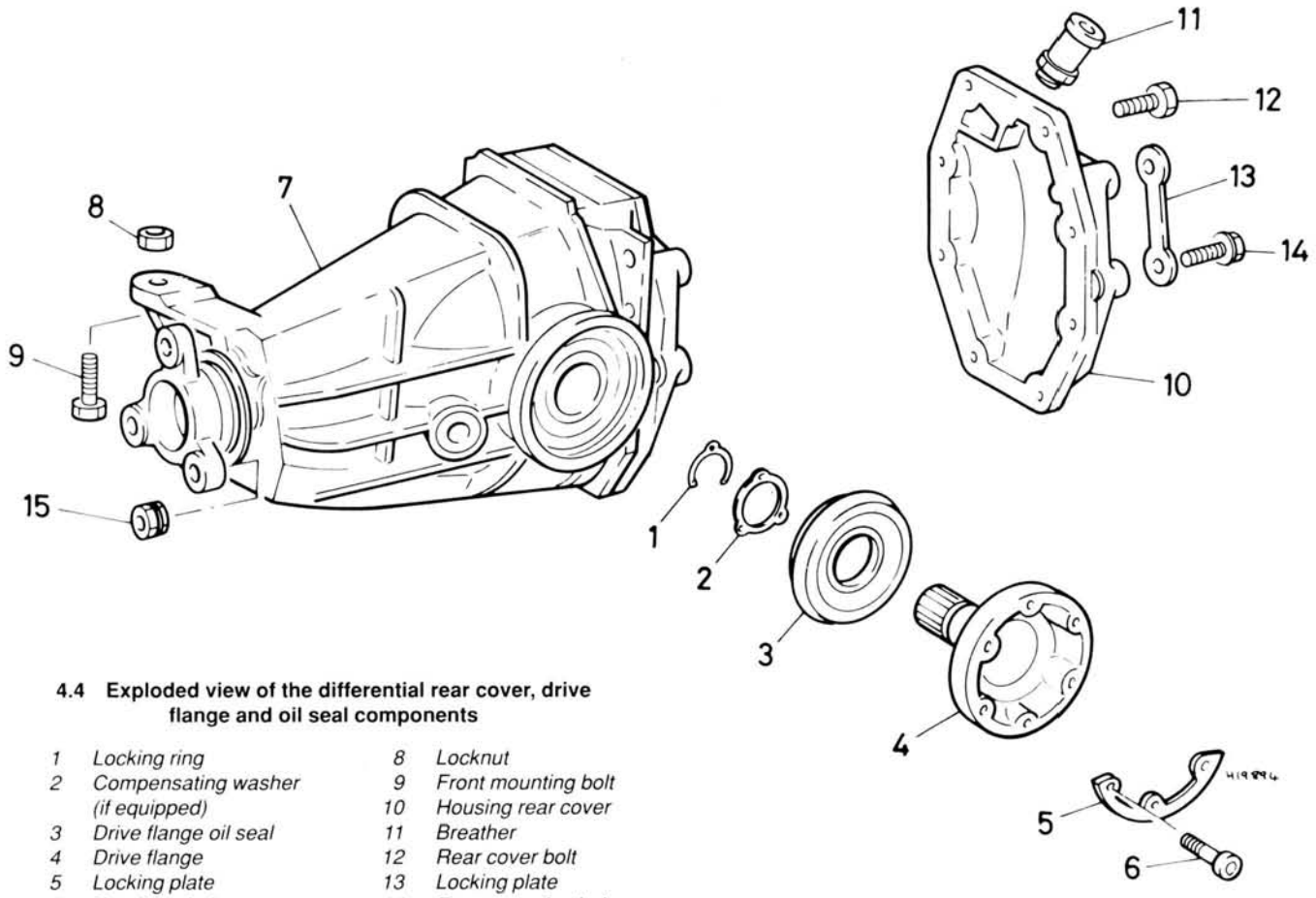
11 Unscrew the bolts at the rear securing the differential housing to the subframe, and remove the bolts together with the locking plates **(see illustration)**.



3.11 Differential housing-to-subframe rear retaining bolts (arrows)



3.12 Differential housing-to-subframe front retaining bolt (arrow)



4.4 Exploded view of the differential rear cover, drive flange and oil seal components

1	*Locking ring*	8	*Locknut*
2	*Compensating washer (if equipped)*	9	*Front mounting bolt*
3	*Drive flange oil seal*	10	*Housing rear cover*
4	*Drive flange*	11	*Breather*
5	*Locking plate*	12	*Rear cover bolt*
6	*Retaining bolt*	13	*Locking plate*
7	*Differential housing*	14	*Rear mounting bolt*
		15	*Locknut*

12 Unscrew the nut and remove the Allen-head bolt securing the housing to the subframe at the front **(see illustration)**.
13 Lower the jack and remove the differential housing from under the vehicle.

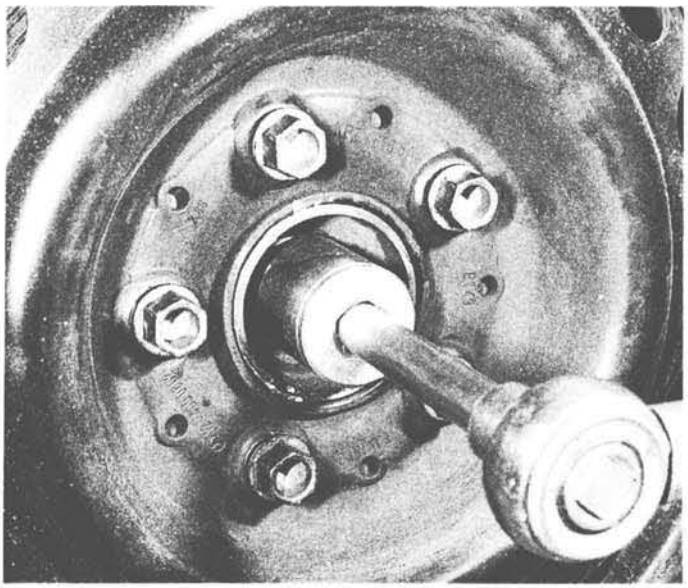
Installation

14 To install the unit, position it centrally within the subframe and install the front retaining bolt and nut finger-tight.
15 Install the four rear retaining bolts and locking plates and tighten them to the specified torque. Now tighten the front nut and bolt to the specified torque also.
16 Engage the driveshaft over the pinion flange centering sleeve, and secure the flexible coupling to the pinion flange with the three nuts and bolts.
17 Install the two center support bearing retaining bolts, but tighten them finger-tight only at this stage.
18 With the driveshaft in position, tighten the clamping nut, then fully tighten the center bearing retaining bolts to the torque listed in the Chapter 7 Specifications.
19 Install the exhaust heat shield.
20 Lightly lubricate the driveaxle inner constant velocity joint-to-differential drive flange bolt threads with oil, install the bolts and locking plates, and tighten them to the specified torque.
21 On cars with ABS brakes, install the rpm sender and secure with the retaining bolt, after first removing any metallic particles which may have collected on the sensor magnetic probe.
22 Unscrew the housing filler/level plug and refill or top up the differential oil to the level of the plug hole, using the specified lubricant. Install the plug and tighten it securely.

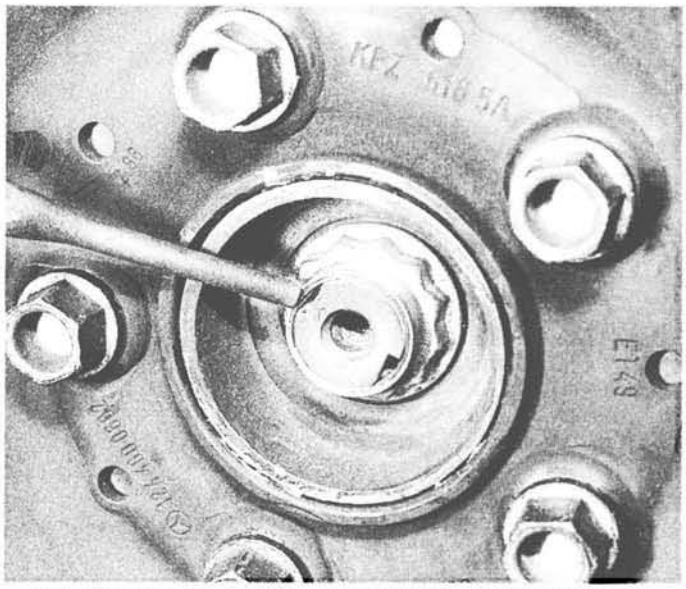
4 Differential drive flange oil seal – replacement

Refer to illustration 4.4

1 Drain the lubricant from the differential (see Section 2).
2 Remove the differential from the vehicle (see Section 3).
3 Wipe away all traces of dirt from the housing in the region of the rear cover and the drive flange being worked on.
4 Unscrew the retaining bolts and remove the housing rear cover **(see illustration)**.
5 Using pliers or a hooked tool, pull the locking ring from the groove in the inner end of the drive flange that protrudes through the differential side gear **(see illustration 4.4).**
6 Remove the drive flange from the side gear and housing.
7 Using a screwdriver, pry the oil seal from its recess in the side of the housing.
8 Before installing the new seal, check the running surface of the drive flange for scoring or wear ridges and replace this component also, if necessary.
9 Lubricate the new seal with the specified differential oil and place it in position in the housing. Using a large socket, tube or a seal driver, tap the seal fully into place. Take care not to damage the face of the seal during installation.



5.2 Unscrew the driveaxle collar nut with the weight of the car on its wheels

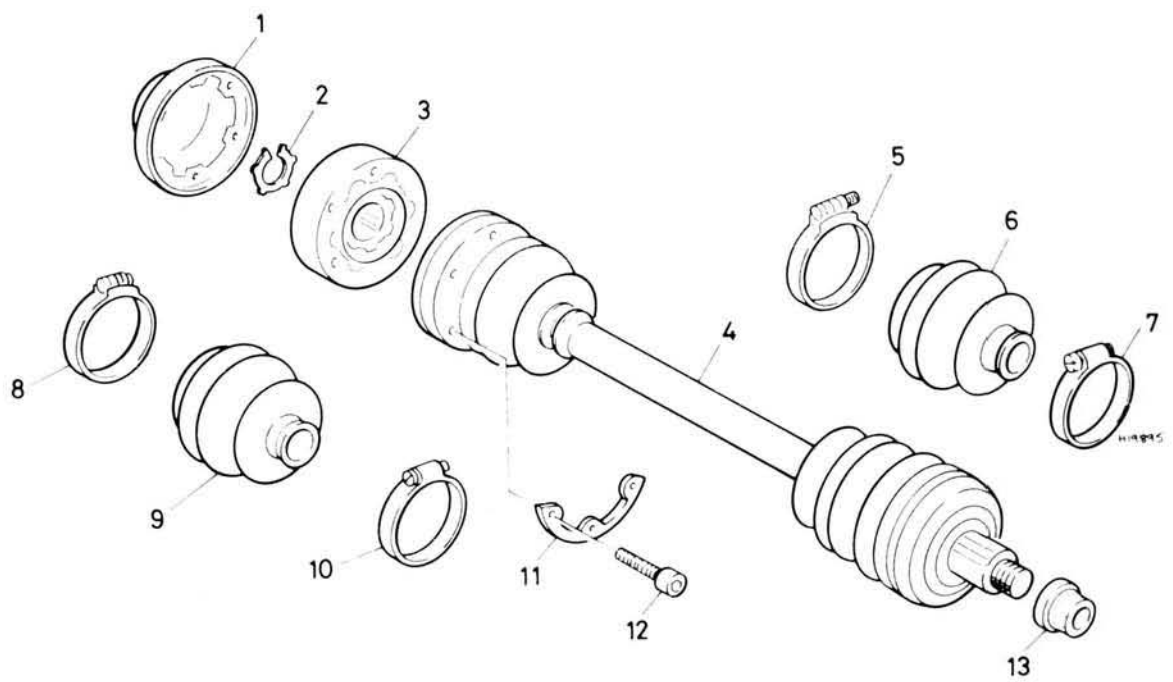


5.8 Peen the edge of the collar nut to the stubshaft groove after tightening

10 Lubricate the running surface of the drive flange and carefully insert it through the seal and sun gear.

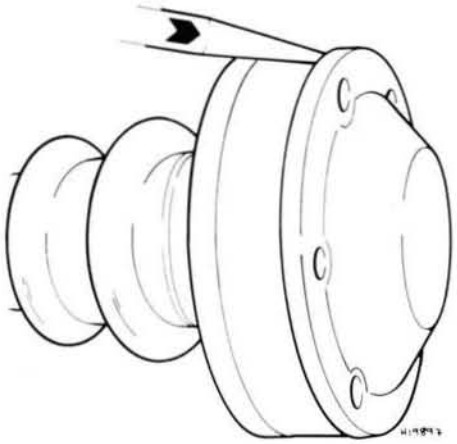
11 Install the locking ring and check that there is no noticeable end play of the drive flange. It should just be possible to turn the locking ring in its groove when in position. If this condition cannot be achieved, replace the locking ring with a slightly thinner or thicker one from the range available. Note that the original ring should also be replaced if it was at all damaged during removal.

12 Thoroughly clean the rear cover and the sealing face of the housing, then apply RTV sealant to the cover contact face.

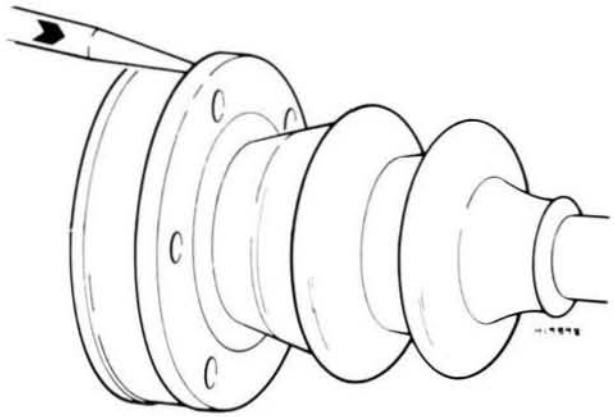


6.2 Exploded view of the driveaxle rubber boots and inner constant velocity joint

1 *End cover*
2 *Circlip*
3 *Constant velocity joint*
4 *Driveaxle assembly*
5 *Retaining clamp*
6 *Outer joint rubber boot*
7 *Retaining clamp*
8 *Retaining clamp*
9 *Inner joint rubber boot*
10 *Retaining clamp*
11 *Locking plate*
12 *Retaining bolt*
13 *Driveaxle collar nut*



6.3 Tap the constant velocity joint end cover off with a hammer and punch



6.4 Removing the rubber boot retaining cap

13 Install the rear cover and secure with the retaining bolts tightened to the specified torque.
14 Install the differential as described in Section 3.

5 Driveaxle – removal and installation

Refer to illustrations 5.2 and 5.8

Note: *Removal and installation of the driveaxle retaining collar nut requires the use of a 30 mm socket and a torque wrench capable of recording up to 250 Ft-lbs. Ensure that these tools are available before proceeding.*

Removal

1 With the car on the ground, remove the rear wheelcover and using a small punch or thin screwdriver, knock back the staking securing the driveaxle retaining collar nut to the stub shaft.
2 Using a 30 mm socket and long bar, unscrew the collar nut **(see illustration)**. Note that a new nut must be used when installing the driveaxle.
3 Loosen the rear wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands.
4 Using a 12-point internal spline wrench, unscrew the bolts securing the driveaxle inner constant velocity joint to the differential drive flange. Remove the bolts and locking plates.
5 Push the inner constant velocity joint outwards, and swivel the driveaxle upwards to clear the drive flange.
6 It should now be possible to push or gently tap the outer constant velocity joint out of the rear hub flange using a brass or plastic mallet. If the joint is tight however, it is advisable to use a suitable puller.
7 With the outer joint free, push the driveaxle down at its inner end and remove it from under the car.

Installation

8 Installation is the reverse of removal, bearing in mind the following points:

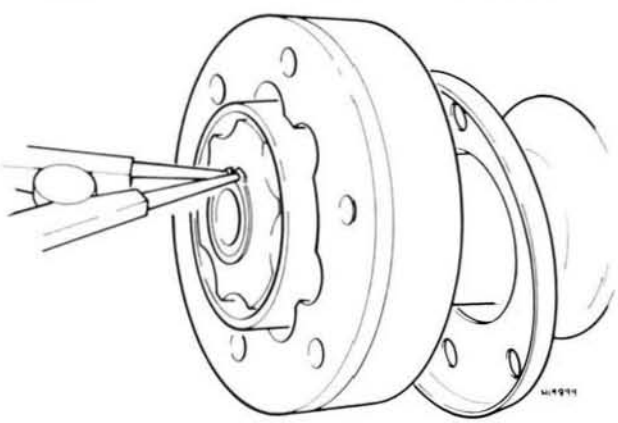
a) Lubricate the threads of the inner constant velocity joint retaining bolts with a little light oil before installing and tighten them to the specified torque
b) Lightly tighten the new driveaxle retaining collar nut initially, then lower the car and tighten the nut fully to the specified torque with the car on the ground. Do not attempt to achieve this very high torque setting with the car suspended as there is a very great risk of tipping the vehicle off the stands
c) After tightening the collar nut, peen the edge of the collar into the stubshaft groove using a small punch **(see illustration)**

6 Constant velocity joint rubber boots – removal and installation

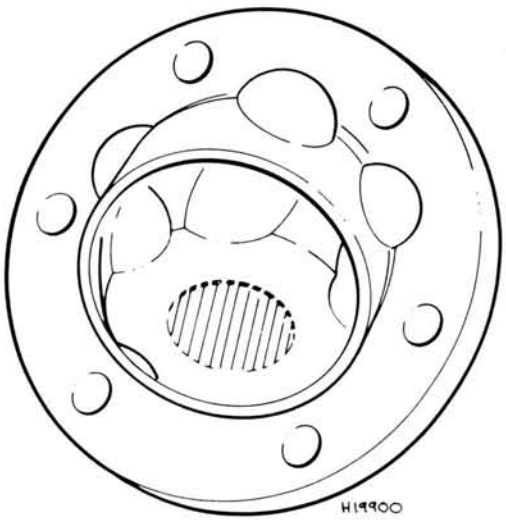
Refer to illustrations 6.2, 6.3, 6.4 and 6.5

Removal

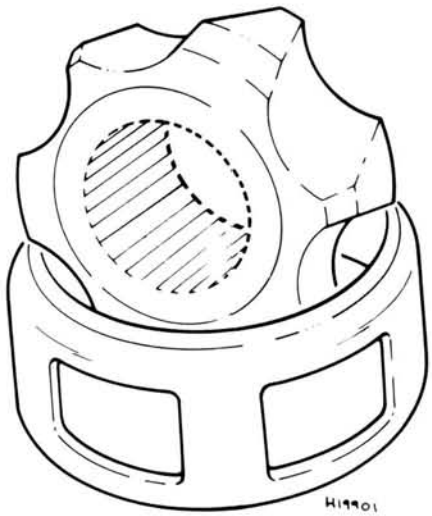
1 Remove the driveaxle as described in Section 5.
2 Working on the inner constant velocity joint, loosen the rubber boot retaining clamp screws and remove both retaining clamps **(see illustration)**. If crimped type clamps are used, cut them off with a pair of cutting pliers.
3 Using a drift punch, carefully tap the end cover off the joint outer member. Take care to avoid damaging the end cover **(see illustration)**.
4 Similarly tap the rubber boot retaining cap off the joint outer member **(see illustration)**, and slide the rubber boot and cap down the driveaxle. Take care to avoid damaging the cap.
5 Wipe away the grease from the outer face of the constant velocity joint, and extract the circlip retaining the joint inner member to the driveaxle **(see illustration)**.



6.5 Remove the inner race retaining circlip with a pair of circlip pliers



7.4 Tilt the inner race and cage assembly in the outer race far enough to remove the balls from the cage



7.6 Tilt the inner race 90-degrees and rotate it out of the cage

6 Support the inner face of the joint inner member in a vise and drive out the driveaxle using a hammer and soft metal drift.
7 Remove the rubber boot and retaining cap from the driveaxle.
8 If the outer constant velocity joint rubber boot requires replacement, remove the retaining clamps, detach the boot from the joint and slide it off the shaft.

Installation

9 Obtain a rubber boot repair kit for each joint as required, which contains a new rubber boot, two new clamps and a quantity of special lubricating grease.
10 Wipe the grease from the constant velocity joint components with a rag. Feel the grease – if it contains any grit, proceed to disassemble the joint and clean and inspect it following the procedure described in Section 7. If the grease is clean, wipe away as much as you can, without using any solvent (as this would contaminate the grease that can't be removed with the rag).
11 If the rubber boot on the outer joint is being replaced, lubricate the joint thoroughly, using 100 grams of the special grease. Smear some grease onto the end of the driveaxle and slide on the boot. Fill the boot with the remainder of the grease and locate it in place over the joint. Secure the boot with the new clamps, ensuring that the screw heads of both clips are together and in line (see also paragraph 18).
12 Slide the inner joint rubber boot and retaining cap onto the driveaxle, then securely mount the driveaxle in a vise.
13 Drive the inner constant velocity joint fully into position, using a mandrel or suitable tube in contact with the joint inner member. Do not strike or apply force to any other part of the joint assembly.
14 Install the retaining circlip.
15 Lubricate the joint thoroughly using 100 grams of the special grease, filling the rubber boot with any surplus.
16 Apply RTV sealant to the rubber boot retaining cap contact face on the joint outer member.
17 Locate the rubber boot and retaining cap in position, ensuring that the cap fits snugly against the joint.
18 Secure the rubber boot with new clamps, ensuring that the screw heads (if screw type clamps are being used) of both clamps are together and on the opposite side of the driveaxle from those securing the outer joint rubber boot. If crimped type clamps are being used, engage one of the slots in the clamp end over the small tag, ensuring that the clamp is as tight as possible. Fully tighten the clamp by squeezing the raised portion with clamp crimping pliers.
19 Apply RTV sealant to the end cover contact face on the joint outer member and tap the end cover into position.
20 Install the driveaxle as described in Section 5.

7 Inner constant velocity joint – disassembly, inspection and reassembly

Refer to illustrations 7.4 and 7.6

Disassembly

1 Refer to Section 6 and carry out the operations described in Steps 1 through 7.
2 With the constant velocity joint on the bench, wipe away as much of the grease as possible at this stage.
3 Mark the relationship of the inner race, ball cage and outer race to each other so these components can be installed in their original position on reassembly.
4 Swivel the inner member and ball cage and remove the balls, one at a time, from their tracks **(see illustration)**.
5 With the balls removed, withdraw the inner race and ball cage together from the outer race.
6 Swivel the inner race 90-degrees and remove it from the ball cage **(see illustration)**.

Inspection

7 Thoroughly clean all the parts and lay them out for inspection.
8 Check the running surfaces of the balls, ball cage and the tracks of the inner and outer races for pitting, scoring or evidence of wear. If any of them are damaged, replace the complete constant velocity joint. If only light running traces and smooth spots are apparent, the joint can be re-used.

Reassembly

9 Begin reassembly by holding the inner race at 90-degrees to the ball cage, insert the race and turn it to its assembled position.
10 Align the previously-made mark on the inner race and ball cage, then

insert one of the balls into its track.
11 Introduce this assembly into the outer race, ensuring the marks made prior to disassembly are all in line.
12 Swivel the inner race and ball cage as necessary and insert each ball, one at a time.
13 The assembled joint can now be installed to the driveaxle using a new rubber boot, retaining clips and quantity of special grease as described in Section 6.

8 Troubleshooting – differential and driveaxles

Symptom	Reason(s)
Vibration	Wear in constant velocity joints Damaged or distorted driveaxle Wheels out of balance Driveshaft out of balance (see Chapter 7)
Noise	Insufficient lubricant in differential Worn differential noise
"Clunk" on acceleration or deceleration	Loose driveaxle collar nut or flange bolts Wear in constant velocity joints Excessive backlash due to wear in differential gears
Oil leakage	Faulty pinion or differential flange oil seals Poor seal of rear cover to differential housing

Chapter 9 Brakes

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Specifications

System type	Power-assisted front-to-rear split dual circuit hydraulic, with front and rear disc brakes and cable-operated handbrake. Anti-lock braking system optionally available
Brake fluid type	DOT 4 brake fluid

Front brakes

Type	Disc with single piston floating calipers
Make	Girling or Teves
Disc thickness	
Solid discs	
New	11.0 mm (0.43 in)
Wear limit	9.0 mm (0.35 in)
Vented discs	
New	22.0 mm (0.867 in)
Wear limit	19.4 mm (0.764 in)
Minimum disc thickness after machining	
Solid discs	9.5 mm (0.37 in)
Vented discs	20.0 mm (0.788 in)
Maximum disc run-out	0.12 mm (0.005 in)
Brake pad friction material	
Thickness new	12.0 mm (0.47 in)
Wear limit	3.5 mm (0.14 in)

Rear brakes

Type	Disc with twin-piston fixed calipers
Make	Teves
Disc thickness	
New	9.0 mm (0.35 in)
Wear limit	7.3 mm (0.29 in)
Minimum disc thickness after machining	7.6 mm (0.30 in)
Maximum disc run-out	0.15 mm (0.006 in)
Brake pad friction material	
Thickness new	9.0 mm (0.35 in)
Wear limit	2.0 mm (0.08 in)

Handbrake

Type	Cable-operated brake shoes with drum machined in rear disc hub
Drum diameter	163.8 to 164.2 mm (6.45 to 6.47 in)
Brake shoe friction material	
Thickness new	2.65 mm (0.10 in)
Wear limit	1.0 mm (0.04 in)

Master cylinder

Make	Girling, Bendix or Teves

Torque specifications

	Ft-lbs
Front caliper guide pin bolts	26
Front caliper carrier-to-steering knuckle	85
Rear caliper-to-hub carrier bolts	37
Master cylinder to brake booster	15
Brake booster-to-firewall	15
Booster vacuum hose fitting	22
Wheel speed sensor retaining bolts (ABS)	16

1 General information

The brake system is of the power-assisted, dual circuit hydraulic type, incorporating disc brakes at the front and rear. A front-to-rear split dual circuit hydraulic system is used, whereby one hydraulic circuit operates the front brakes and a separate hydraulic circuit operates the rear brakes from a tandem master cylinder. Under normal conditions both circuits operate in unison; however, in the event of hydraulic failure in one circuit, full braking force will still be available at two wheels.

The front brakes are operated by single piston floating type calipers, while at the rear, twin piston fixed type calipers are employed.

A cable-operated handbrake provides an independent mechanical means of rear brake application. The handbrake system utilizes two small brake shoes for each rear wheel, which contact a brake drum machined in the hub of each rear brake disc when the handbrake is applied.

Power assistance for the brake system is provided by a vacuum-operated power booster unit, mounted in-line with the brake master cylinder on the engine compartment firewall.

An anti-lock braking system (ABS) is available as an option on all models. Further information on this system will be found in the relevant Sections of this Chapter.

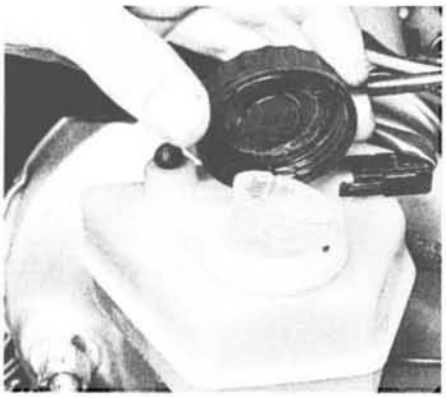
2 Maintenance and inspection

Refer to illustrations 2.2 and 2.3

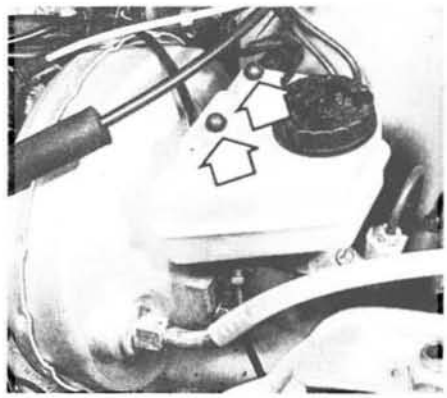
1 At the intervals given in *Routine Maintenance* at the beginning of this manual, the following service operations should be carried out on the brake system components.

2 Check that the brake fluid level in the master cylinder reservoir is

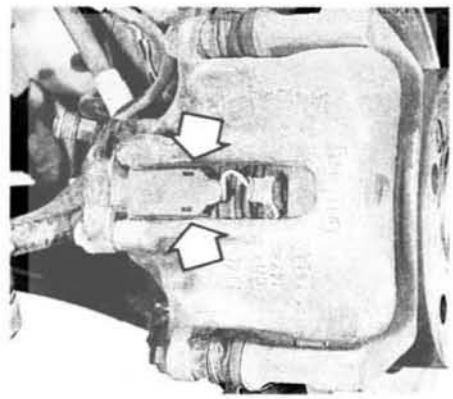
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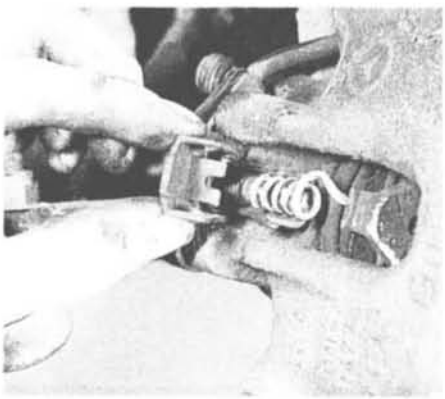
2.2 Periodically clean the fluid strainer in the reservoir



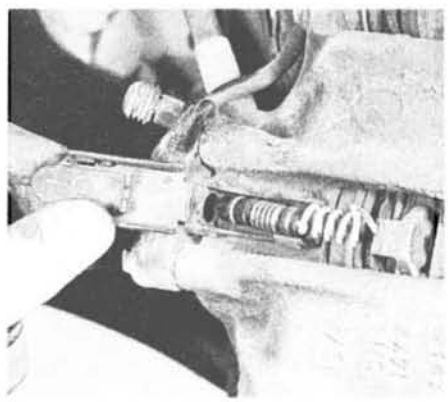
2.3 Low brake fluid warning light test buttons (arrows)



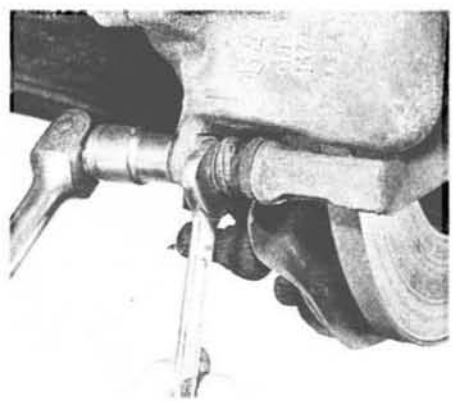
3.3 Insert a screwdriver into the slots (arrows) and pry the plastic cover up, one side at a time



3.4a Lift up the plastic cover . . .



3.4b . . . and unplug the sensor electrical connector



3.5a Hold the caliper guide pin with a wrench while loosening the guide pin bolt

maintained between the MAX and MIN marks on the side of the reservoir. If necessary, add the specified fluid until the level is up to the MAX mark. Periodically check the strainer in the reservoir filler neck for any signs of foreign matter **(see illustration)**. If necessary remove the strainer, clean it in fresh brake fluid, blow it out and reinstall it.

3 The function of the low brake fluid warning light on the instrument panel can be checked by depressing the test buttons on top of the master cylinder reservoir **(see illustration)**. With the ignition switched on, the light should illuminate when each button is depressed in turn.

4 Check the condition and thickness of the front and rear disc pads as described in Sections 3 and 7, and the condition of the discs themselves as described in Sections 6 and 10.

5 Check the hydraulic brake lines and hoses for signs of corrosion, pitting or damage. At the same time check the condition of the handbrake cables, lubricate the exposed cables and linkages and, if necessary, adjust the handbrake as described in Section 11.

6 It is recommended by the manufacturers that the brake fluid is replaced once a year, preferably in the spring, as described in Section 21.

3 Front brake pads – check and replacement

Refer to illustrations 3.3, 3.4a, 3.4b, 3.5a, 3.5b and 3.7

Warning: *Disc brake pads must be replaced on both front wheels at the same time – never replace the pads on only one wheel. Also, the dust created by the brake linings may contain asbestos, which is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake cleaner only!*

Note: *When servicing the disc brakes, use only high quality, nationally recognized brand name pads.*

1 Loosen the front wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Apply the hand brake. Remove the front wheels.

2 Thoroughly clean the caliper with brake system cleaner and allow it to dry – NEVER blow the dust off with compressed air.

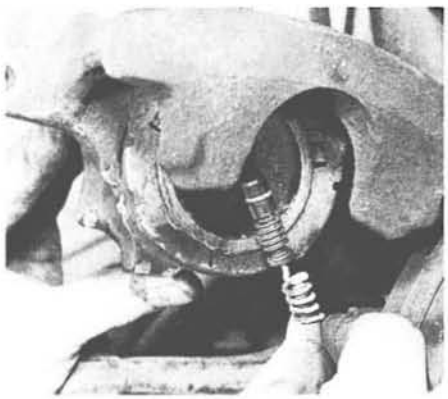
3 Carefully pry up the plastic cover over the brake pad wear sensor by inserting a small screwdriver in the two slots and releasing the lugs **(see illustration)**.

4 Lift up the plastic cover and unplug the wear sensor cable from its electrical connector **(see illustrations)**.

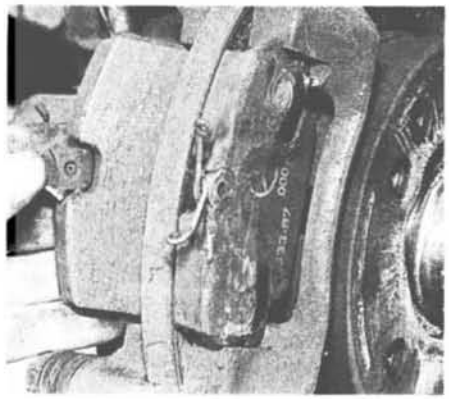
5 On 1985 and later models, which have the front flexible brake hose support bracket located on top of the coil spring turret, unscrew the caliper lower guide pin bolt while holding the guide pin with a wrench **(see illustrations)**. Pivot the caliper up, taking care not to damage the wear sensor, and secure the raised caliper using string or wire attached to the spring.

6 On pre-1985 models, remove the upper guide pin bolt and allow the caliper to pivot down.

7 Lift out the inner and outer brake pads from their locations in the carrier bracket **(see illustration)**.



3.5b Pivot the caliper up for access to the brake pads



3.7 Slide the brake pads from the caliper carrier

8 Rotate the brake disc by hand and scrape away any rust and scale. Carefully inspect the entire surface of the disc, and if there are any signs of cracks, deep scoring or severe abrasions the disc must be machined or replaced (see Section 6). Also inspect the caliper for signs of fluid leaks around the piston, corrosion or other damage. If leaks or damage are apparent, replace or overhaul the caliper as described in Section 5.

9 Check the brake pad friction material for wear, cracks, oil or fluid contamination, or other damage. If either of the pads is worn down to the minimum thickness as given in the Specifications, is contaminated, or in anyway suspect, replace all four front brake pads as a complete set. The pads should also be replaced if the wear sensor connector or the wire is damaged or chafed.

10 If new pads are to be installed, depress the caliper piston back into its bore using a C-clamp. While doing this, check to make sure the brake fluid does not overflow from the master cylinder reservoir, and if necessary, use a clean syringe to extract some fluid. **Note:** *Brake fluid is poisonous, and no attempt should be made to siphon the fluid by mouth.*

11 Install the pads in the carrier, noting that the inner pad carries the brake pad wear sensor.

12 Swing the caliper into position, install the guide pin bolt and tighten it to the specified torque.

13 Coil up the wear sensor wire and insert the end into the electrical connector. Close the plastic cover to secure the sensor.

14 Depress the brake pedal several times to bring the piston into contact with the pads.

15 Repeat the procedure to the other front brake.

16 Install the wheels and lower the vehicle to the ground. Check and if necessary add brake fluid to the master cylinder.

17 If new pads have been installed, bed them in by braking gently from approximately 50 to 25 mph a few times, allowing the brakes to cool each time. Avoid heavy braking or panic stops if possible for the first 50 miles.

4 Front brake caliper – removal and installation

Refer to illustrations 4.6 and 4.7

Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!*

Removal

1 Loosen the wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Apply the hand brake. Remove the wheel.

2 Clean the area around the flexible brake hose-to-rigid line fitting under the fenderwell, and loosen the fitting sufficiently to allow the hose to swivel in its support bracket. Unscrew the brake hose from the caliper. Plug the end of the brake line to prevent excessive fluid loss and the entry of contaminants.

3 Carefully pry up the plastic cover over the disc pad wear sensor on the caliper by inserting a small screwdriver in the two slots and releasing the lugs.

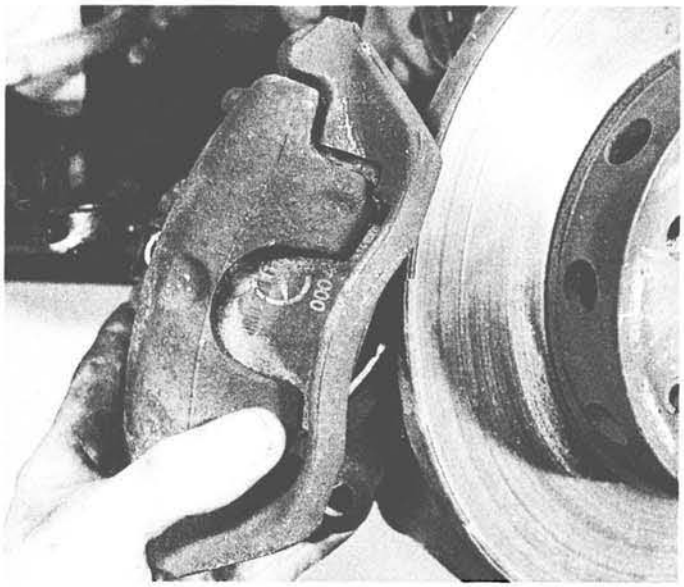
4 Lift up the plastic cover and withdraw the wear sensor cable end from its location in the electrical connector **(see illustrations 3.4a and 3.4b)**.

5 Unscrew the retaining bolt and remove the wear sensor electrical connector from the caliper body.

6 Remove two bolts securing the brake caliper carrier bracket to the steering knuckle **(see illustration)**. **Caution:** *The carrier retaining bolts are of the encapsulated type, and incorporate a thread locking compound which is activated when the bolt is installed and tightened. The compound is ineffective after removal of the bolt and new bolts must be obtained prior to installing the caliper.*



4.6 Lower mounting bolt of the caliper carrier (arrow)



4.7 Lift the caliper off the disc

7 Slide the caliper assembly off the disc **(see illustration)** and remove it from the car.

Installation

8 To install the caliper, slide it over the disc and align the bolt holes with those in the steering knuckle.

9 Install the two new encapsulated bolts and tighten them to the specified torque.

10 Secure the pad wear sensor electrical connector to the caliper, then coil up the sensor wire and insert the connector into the plug. Close the plastic cover to secure the sensor.

11 Connect the flexible brake hose to the caliper and tighten it securely.

12 Engage the other end of the hose in its bracket, making sure it isn't twisted or kinked, and will not contact any suspension or wheel components under steering or suspension travel. Hold the hose in this position and tighten the rigid brake line fitting.

13 Refer to Section 21 and bleed the front brake hydraulic circuit, then install the wheel and lower the car to the ground.

5 Front brake caliper – overhaul

Refer to illustrations 5.8a, 5.8b, 5.9 and 5.10

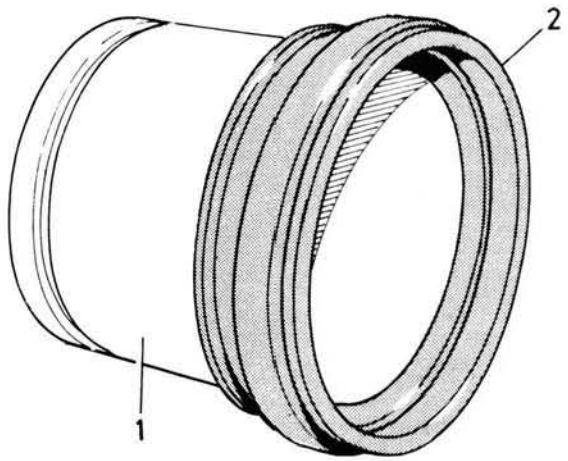
Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner or clean brake fluid only!*

Note: *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's decided to rebuild the calipers, make sure a rebuild kit is available before proceeding. Always rebuild the calipers in pairs – never rebuild just one of them.*

1 Remove the caliper as described in Section 4.

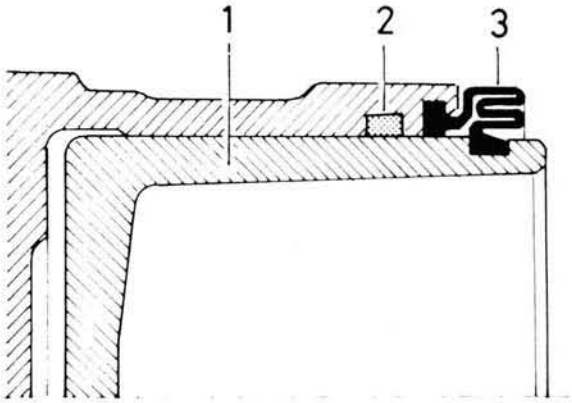
2 Unscrew the two guide pin bolts and remove the caliper from the carrier bracket.

3 Remove the heat shielding plate from the piston, place some rags between the piston and caliper frame, then using a foot pump held against the brake hose fitting, ease the piston out of the cylinder. **Warning:** *Don't place your fingers between the piston and caliper frame – the piston may come out with some force.*



5.8a Correct positioning of the dust boot over the end of the caliper piston prior to installation

1 Piston 2 Dust boot



5.8b Sectional view of front brake caliper showing piston seal and dust boot arrangement

1 Piston 3 Dust boot
2 Piston seal

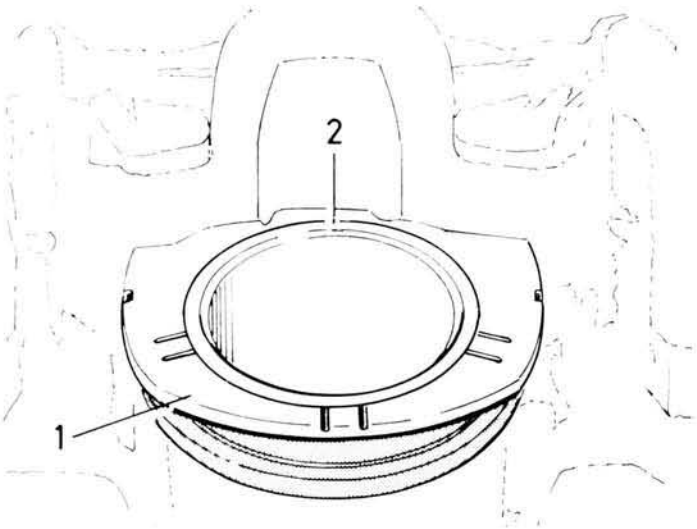
4 Remove the dust boot from the piston and carefully remove the piston seal from the cylinder bore groove using a plastic or wood tool, to prevent damage to the bore (a pencil will do the job).

5 Wipe the components with a clean rag, and inspect the piston and caliper bore for signs of scuffing or corrosion. Light corrosion deposits on the piston can be removed with a soft brass wire brush, and in the caliper bore with fine emery paper. However if the components are heavily corroded or pitted the caliper should be replaced.

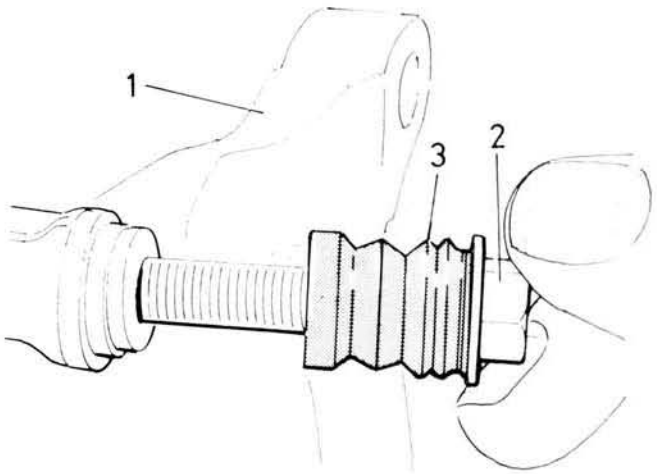
6 If the caliper is in good condition, clean the components in brake cleaner or brake fluid and dry with compressed air (if available) or a clean lint-free cloth. Also obtain a caliper repair kit for reassembly.

7 Thoroughly lubricate the piston surface, cylinder bore and the seals with clean brake fluid, then carefully install the piston seal in the groove in the caliper bore.

8 Position the dust cover over the innermost end of the piston so that the caliper bore sealing lip protrudes beyond the base of the piston **(see illustration)**. Using a blunt instrument if necessary, engage the sealing lip of the dust cover with the groove of the caliper. Now push the piston into



5.9 Correct positioning of the heat shielding plate (1) over piston (2)



5.10 Caliper guide pin details

1 Carrier bracket
2 Guide pin
3 Dust boot

the bore until the other sealing lip of the dust cover can be engaged with the groove of the piston, then push the piston fully into its bore. Ease the piston out again slightly and make sure that the dust cover lip is correctly seated in the piston groove **(see illustration)**.

9 Install the heat shielding plate, ensuring that the locating tags engage in the piston upper groove **(see illustration)**.

10 Lift the brake pads off the carrier bracket, then detach the dust boots and remove the two guide pins **(see illustration)**.

11 Clean the carrier bracket, guide pins and the guide pin bores. Inspect the guide pins and the carrier bracket for signs of damage and replace if necessary.

12 If the components are in good condition, lubricate the guide pins with a high melting-point brake grease, then install the pins and dust boots to the carrier bracket. Use new dust boots if the originals show any signs of deterioration.

13 Place the brake pads in the carrier with the pad containing the wear sensor on the inside (nearest to the center of the car with the carrier installed).

14 Position the caliper assembly over the pads, install the guide pin bolts and tighten them to the specified torque.

15 Install the caliper as described in Section 4.

6 Front brake disc – inspection, removal and installation

Refer to illustrations 6.4, 6.6 and 6.7

Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!*

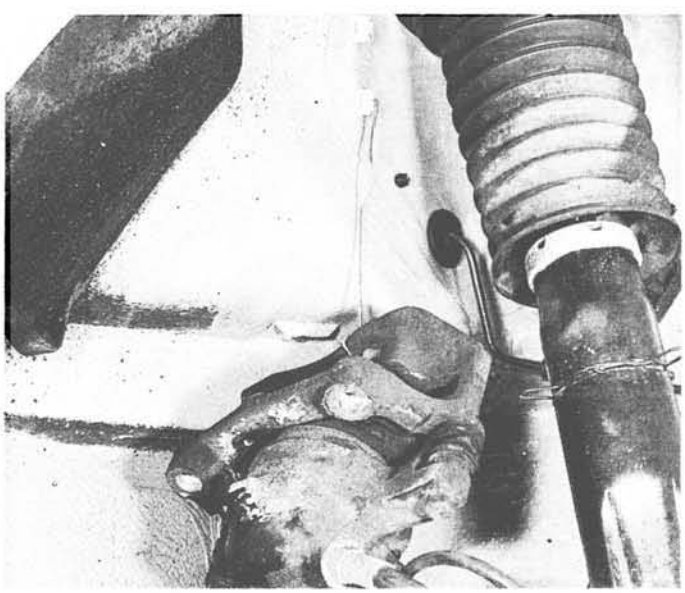
1 Loosen the wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Apply the hand brake. Remove the wheel.

2 Detach the pad wear sensor wire from the cable clip on the suspension strut.

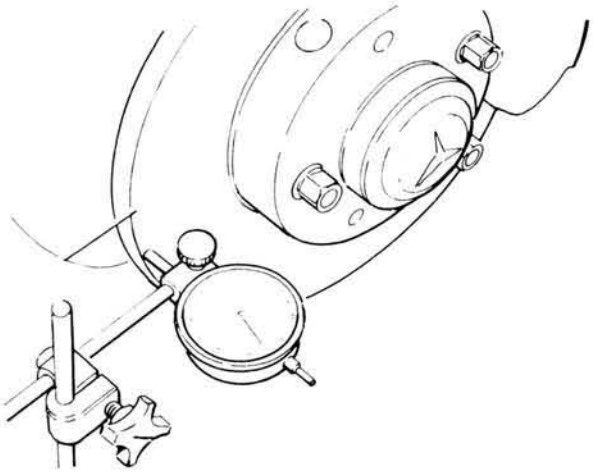
3 Remove the two bolts securing the brake caliper carrier bracket to the steering knuckle. **Note:** *The carrier retaining bolts are of the encapsulated type, and incorporate a thread locking compound which is activated when the bolt is tightened. The compound is ineffective after removal and new bolts must therefore be obtained prior to installing the caliper.*

4 Slide the caliper assembly, complete with pads, off the disc and suspend it from a convenient place in the fenderwell **(see illustration)**. Do not let the caliper hang unsupported from the brake hose.

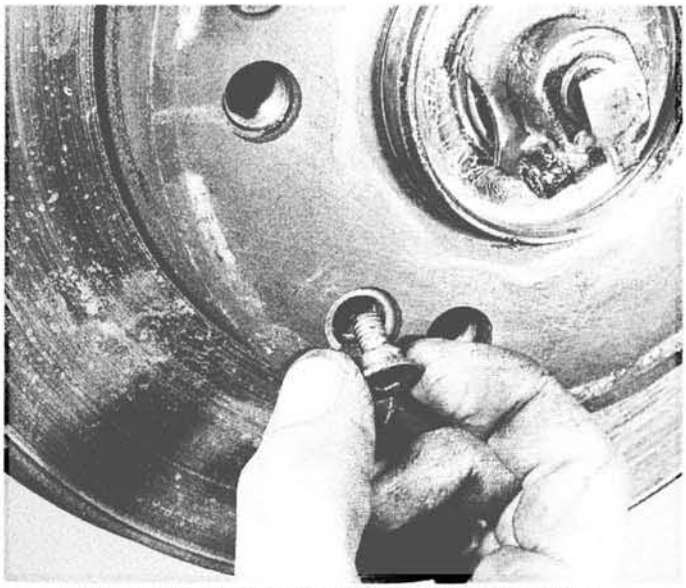
5 Rotate the disc and examine it for cracks, deep scoring or grooving. Light scoring is normal, but if excessive the disc should be removed and machined by a Mercedes-Benz dealer or other repair shop, providing that the machining operation will not reduce the disc to below the minimum specified thickness.



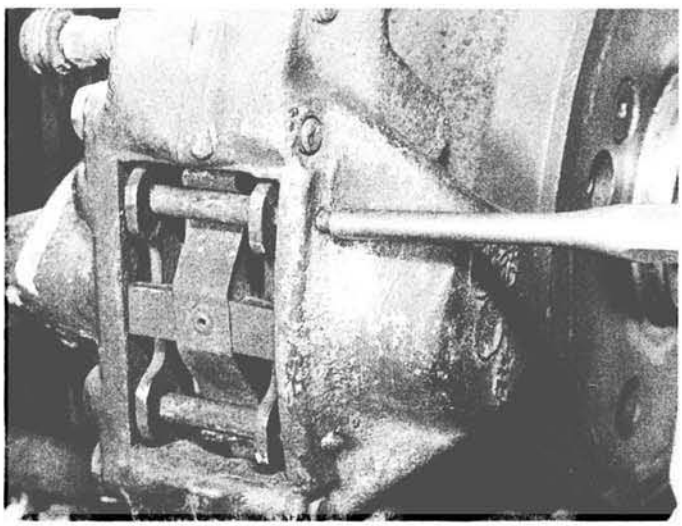
6.4 Suspend the caliper from a convenient place in the fenderwell



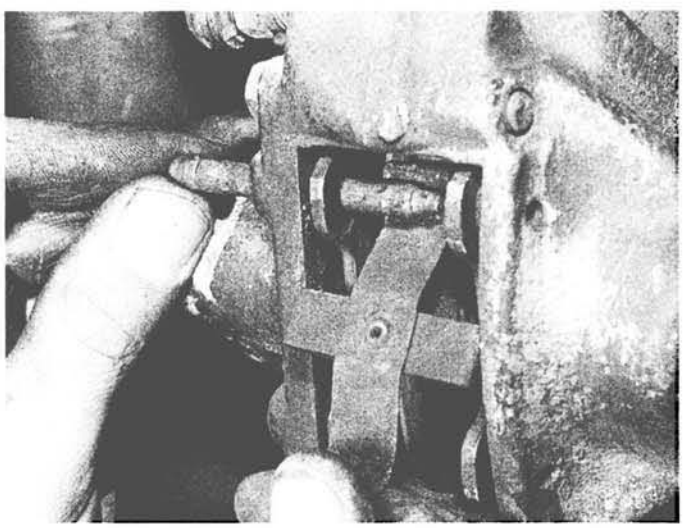
6.6 Use a dial indicator to check disc runout – if the reading exceeds the specified allowable runout limit, the disc will have to be machined or replaced



6.7 The front brake disc is held to the hub with an Allen-head screw



7.3a Knock out the rear disc pad retaining pins



7.3b Remove the cross spring

6 If brake pedal pulsation has been experienced, check the disc thickness at various points using a micrometer, and also check the disc run-out using a dial gauge if available **(see illustration)**. ***Note:*** *Brake pedal pulsation may also be caused by incorrectly adjusted front wheel bearings.*

7 To remove the disc, unscrew the Allen-head retaining screw and slide the disc from the locating dowels **(see illustration)**.

8 Before installing the disc, remove all traces of rust or any burrs that may be evident on the hub flange or on the inside of the disc hub. Note also that new discs are supplied with a coating of nitro-cellulose paint to protect against corrosion, and this must be removed with brake system cleaner before installing.

9 Locate the disc over the dowels, then install and tighten the retaining screw.

10 Place the caliper over the disc and install the two new encapsulated retaining bolts, tightening them to the specified torque.

11 Install the wheel and lower the car to the ground.

7 Rear brake pads – check and replacement

Refer to illustrations 7.3a, 7.3b, 7.4 and 7.8

Warning: *Disc brake pads must be replaced on both rear wheels at the same time – never replace the pads on only one wheel. Also, the dust created by the brake linings may contain asbestos, which is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake cleaner only!*

Note: *When servicing the disc brakes, use only high quality, nationally recognized brand name pads.*

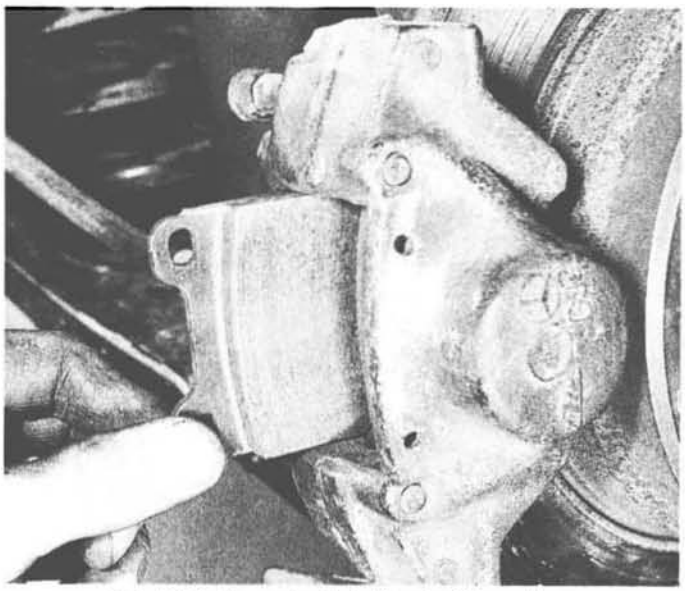
1 Loosen the rear wheel lug bolts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels. Remove the wheels.

2 Thoroughly clean the caliper with brake system cleaner and allow it to dry – NEVER blow the dust off with compressed air.

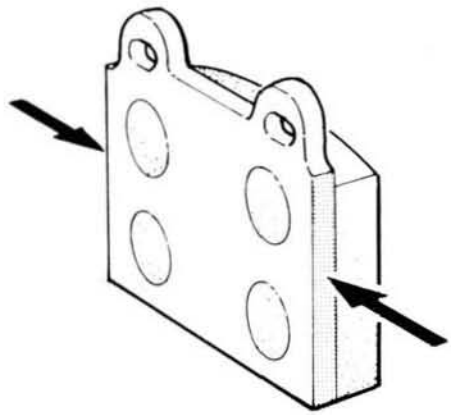
3 Using a hammer and punch, knock out the two pad retaining pins and remove the cross spring **(see illustrations)**.

4 Slide the two brake pads from the caliper **(see illustration)**.

5 Rotate the brake disc by hand and scrape away any rust and scale. Carefully inspect the entire surface of the disc and if there are any signs of



7.4 Slide the pads straight out of the caliper



7.8 Lubricate the edges of the rear brake pad backing plates with high-temperature grease before installing them

cracks, deep scoring or severe abrasions the disc must be machined or replaced (see Section 10). Also inspect the caliper for signs of fluid leaks around the pistons, corrosion or other damage. If leaks or damage are apparent, overhaul the caliper as described in Section 9. If the pads were tight in the caliper and hard to remove, scrape away the corrosion which will have caused this along the inner surfaces of the caliper contacted by the edges of the pad backing plates.

6 Check the brake pad friction material for wear, cracks, oil or fluid contamination, or other damage. If either of the pads is worn down to the minimum thickness as given in the Specifications, is contaminated, or in any way suspect, replace all four pads as a complete set.

7 If new pads are to be installed, push the caliper pistons back into their bores using a C-clamp or small piece of wood as a lever. While doing this, check that brake fluid will not overflow from the master cylinder reservoir, and if necessary use a clean syringe to extract some fluid. **Note:** *Brake fluid is poisonous, and no attempt should be made to siphon the fluid by mouth.*

8 Lubricate the edges of the pad backing plates with a high melting-point brake grease and slide the pads into position in the caliper **(see illustration)**. Take care not to allow any grease to come into contact with the pad friction material.

9 Position the cross spring over the pads, then tap in the upper and lower retaining pins.

10 Depress the brake pedal several times to bring the pistons into contact with the pads.

11 Repeat the operations on the other rear brake.

12 Install the wheels and lower the car to the ground. Check and if necessary add brake fluid to the master cylinder reservoir.

13 If new pads have been installed, allow them to bed in by braking gently from approximately 50 to 25 mph a few times, allowing the brakes to cool each time. Avoid heavy braking or panic stops if possible for the first 20 to 50 miles.

8 Rear brake caliper – removal and installation

Refer to illustrations 8.3a and 8.3b

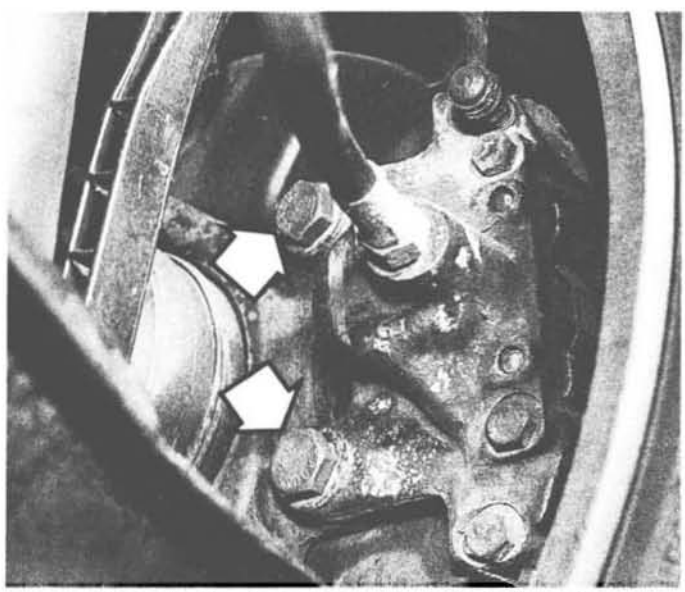
Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!*

Removal

1 Loosen the rear wheel lug bolts, raise the rear of the vehicle and support it securely on jackstands. Remove the wheel.

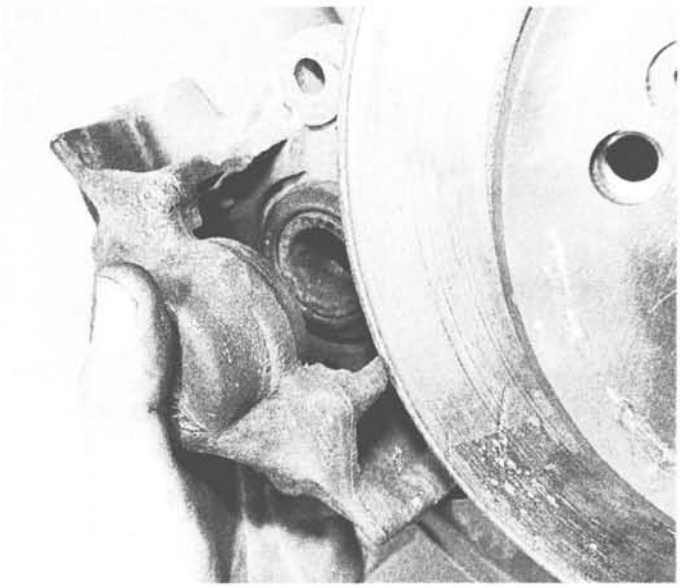
2 Clean the area around the flexible brake hose-to-rigid line fitting under the fenderwell, and loosen the fitting sufficiently to allow the hose to swivel in its support bracket. Unscrew the brake hose from the caliper. Plug the end of the brake line to prevent excessive fluid loss and the entry of contaminants.

3 Remove the two bolts securing the caliper to the rear hub carrier and slide the caliper off the disc **(see illustrations)**.

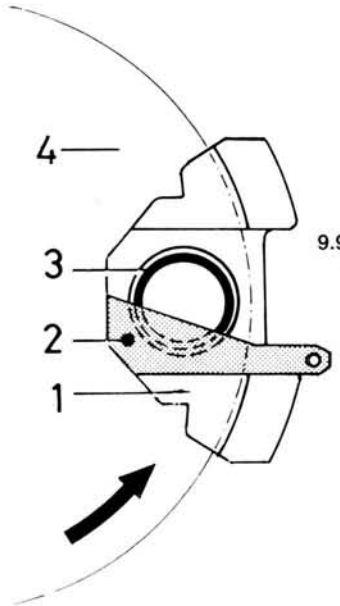


8.3a Rear brake caliper mounting bolts (arrow)

9



8.3b Remove the caliper from the disc, then support it with a piece of wire – don't let it hang by the hose



9.9a Correct positioning of the piston in rear brake caliper

1 Caliper
2 Optional special tool for positioning machined contact face of piston
3 Piston
4 Disc arrow indicates rotational direction of disc

Installation

4 **Note:** *The caliper retaining bolts are of the encapsulated type, and incorporate a thread locking compound which is activated when the bolt is tightened. The compound is ineffective after removal of the bolt, so new bolts must be obtained prior to installing the caliper.* To install the caliper, slide it over the disc, align the mounting bolt holes and install two new encapsulated bolts. Tighten the bolts to the specified torque.

5 Install the flexible brake hose to the caliper and tighten it securely.

6 Engage the other end of the hose in its bracket, ensuring that the hose is not twisted or kinked. Hold the hose in this position and tighten the rigid brake line fitting.

7 Refer to Section 21 and bleed the rear brake hydraulic circuit, then install the wheel and lower the car to the ground.

9 Rear brake caliper – overhaul

Refer to illustrations 9.9a, 9.9b and 9.10

Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner or clean brake fluid only!*

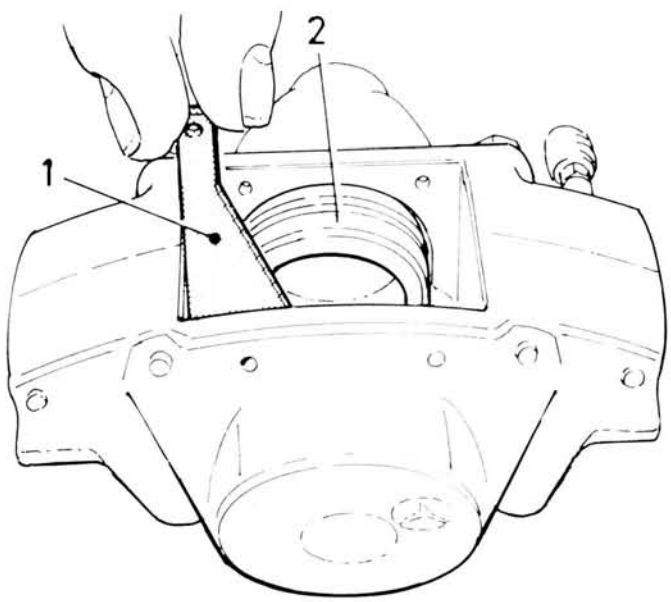
Note: *If an overhaul is indicated (usually because of fluid leakage) explore all options before beginning the job. New and factory rebuilt calipers are available on an exchange basis, which makes this job quite easy. If it's decided to rebuild the calipers, make sure a rebuild kit is available before proceeding. Always rebuild the calipers in pairs – never rebuild just one of them.*

1 Remove the brake pads from the caliper as described in Section 7 then remove the caliper from the car as described in Section 8.

2 Using a small screwdriver, hook the two piston dust boots out of their locations in the caliper body grooves.

3 Using a small piece of wood and a C-clamp, retain one of the pistons in place, while blowing out the other piston using a foot pump held against the brake hose fitting on the side of the caliper.

4 With the first piston removed, seal off the caliper bore using the C-clamp and a flat piece of wood, then blow out the second piston in the same way.

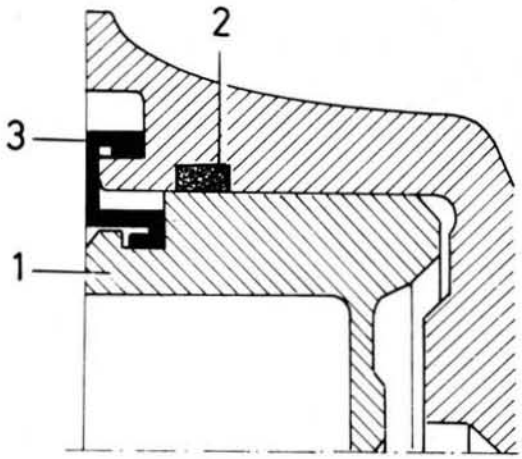


9.9b Using Mercedes tool (1) to position piston (2) in rear caliper

5 Remove the dust boots from the pistons, and remove the two piston seals from the caliper bore grooves using a wood or plastic tool (a pencil will work).

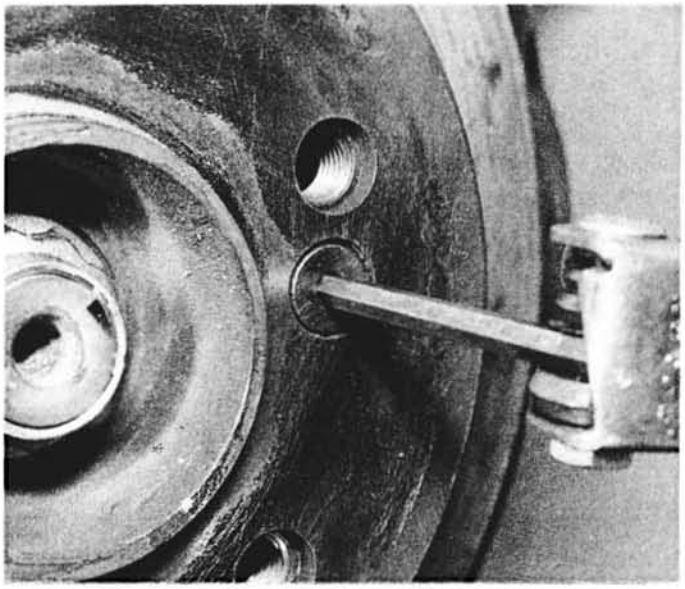
6 Wipe the components with a clean rag and inspect the pistons and caliper bores for signs of scuffing or corrosion. Light corrosion deposits on the pistons can be removed with a soft brass wire brush, and in the caliper bores with fine emery paper. However, if the components are heavily corroded or pitted, the caliper should be replaced.

7 If the caliper is in good condition, clean the components with brake system cleaner or clean brake fluid and dry with compressed air (if available) or a clean lint-free cloth. Also obtain a caliper repair kit.



9.10 Sectional view of rear brake caliper showing piston seal and dust boot arrangement

1 Piston
2 Piston seal
3 Dust boot



10.6 Remove the rear disc retaining screw using an Allen wrench

8 Thoroughly lubricate the piston surface, cylinder bore and the seals with clean brake fluid, then carefully install the piston seals in the grooves in the caliper bore.

9 Carefully install the pistons to their respective caliper bores. Note that part of the pad contact face of each piston has been machined away, with the purpose of causing the pad to tip slightly under the action of the piston, thus reducing the possibility of disc pad squeal. With the caliper in its installed position, the machined portion of each piston must face forwards at approximately 30-degrees from horizontal **(see illustrations)**. Set each piston in this position as it is inserted into its bore.

10 Engage the inner circumference of the new dust boots into their grooves in the pistons, push the pistons fully into their bores, then engage the outer circumference of the boots in their caliper grooves. Push the dust boots fully into place **(see illustration)**.

11 Install the caliper as described in Section 8 then install the brake pads (Section 7) before bleeding the rear brake circuit (Section 21).

10 Rear brake disc – inspection, removal and installation

Refer to illustration 10.6

Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!*

1 Loosen the wheel lug bolts, raise the rear of the vehicle and support it securely on jackstands. Remove the wheel.

2 Remove the two bolts securing the brake caliper to the rear hub carrier. **Note:** *The caliper retaining bolts are of the encapsulated type, and incorporate a thread locking compound which is activated when the bolt is tightened. The compound is ineffective after removal, so new bolts must be obtained prior to installing the caliper.*

3 Slide the caliper assembly, complete with pads, off the disc and suspend it from the coil spring using string or wire. Do not let the caliper hang unsupported from the brake hose.

4 Rotate the disc and examine it for cracks, deep scoring or grooving. Light scoring is normal, but if excessive the disc should be removed and machined by a Mercedes-Benz dealer service department or other repair shop, providing that the machining operation will not reduce the disc to below the minimum specified thickness.

5 If brake pedal pulsation has been experienced, check the thickness of the disc at various points using a micrometer, and also check the disc runout using a dial gauge if available **(see illustration 6.6).**

6 To remove the disc, make sure that the handbrake is not applied, then unscrew the Allen-head retaining screw **(see illustration)**.

7 Pull the disc from the locating dowel and remove it from the car. If the disc is tight, tap it from behind using a plastic mallet.

8 With the disc removed, check that the handbrake shoe linings are not excessively worn and that the inner circumference of the disc hub, which acts as the handbrake drum, is in good condition.

9 Before installing the disc, remove all traces of rust or any burrs that may be evident on the hub flange or on the inside of the disc hub. Note also that new discs are supplied with a coating of nitro-cellulose paint to protect against corrosion, and this must be removed with brake system cleaner before installing.

10 Lightly lubricate the inner face of the disc hub at the wheel hub contact areas with a high melting-point brake grease, as an aid to future removal. Take care not to allow the grease to contaminate the disc face or brake drum.

11 Locate the disc over the hub and secure with the retaining screw, where applicable.

12 Place the caliper over the disc and install the two new encapsulated bolts. Tighten the bolts to the specified torque.

13 Install the wheel and lower the car to the ground.

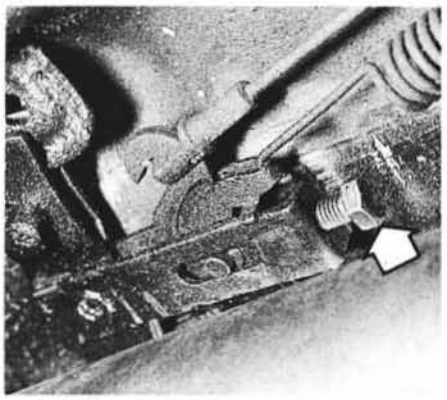
11 Handbrake – adjustment

Refer to illustrations 11.4, 11.6a and 11.6b

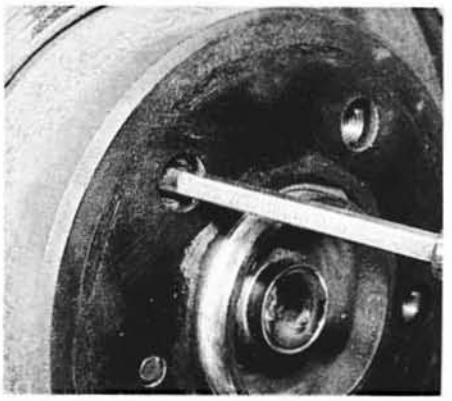
1 Adjustment of the handbrake should normally only be necessary after removal and installing of any of the handbrake components, or to compensate for wear of the handbrake shoe linings (which will be minimal) or slight stretch of the cables.

2 If the handbrake lever can be pulled up by more than two notches of the ratchet without obtaining a braking effect, proceed as follows.

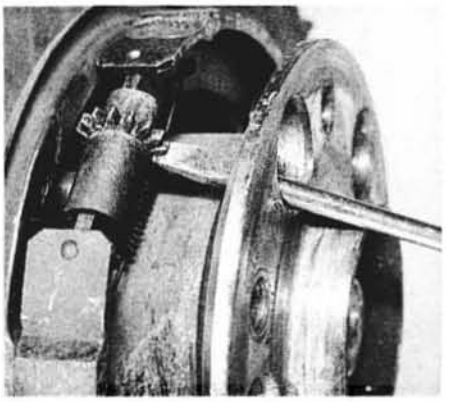
3 Remove one lug bolt from each rear wheel. Raise the rear of the vehicle and support it securely on jackstands. Block the front wheels.



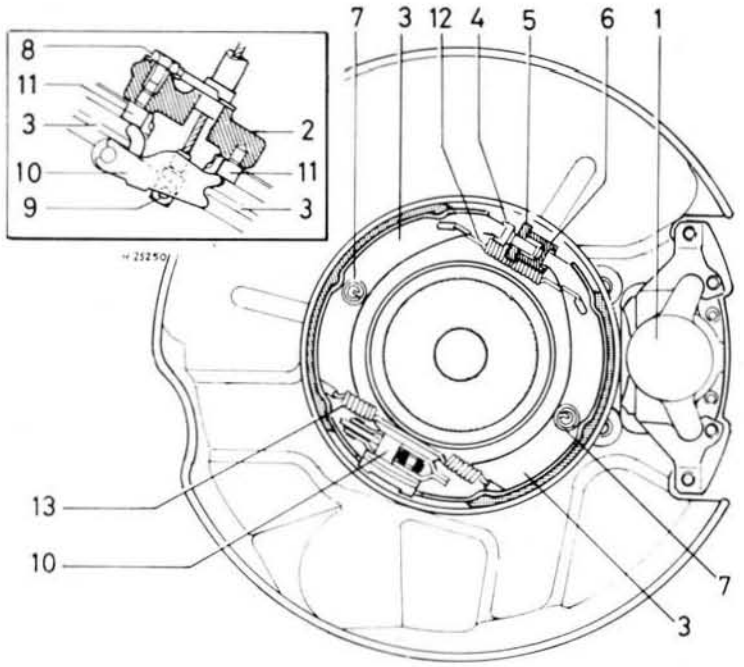
11.4 Handbrake adjusting bolt (arrow) on compensating mechanism



11.6a Turning the handbrake shoe adjusting wheel using a screwdriver through a wheel bolt hole

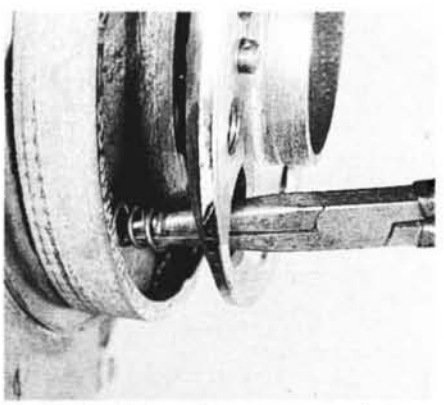


11.6b Handbrake shoe adjusting wheel shown with disc removed for clarity

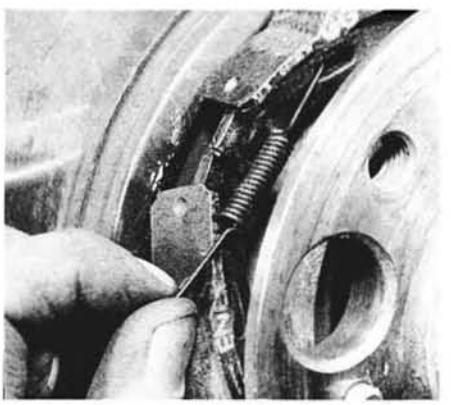


12.2a Layout of the left side handbrake shoe and expander mechanism components

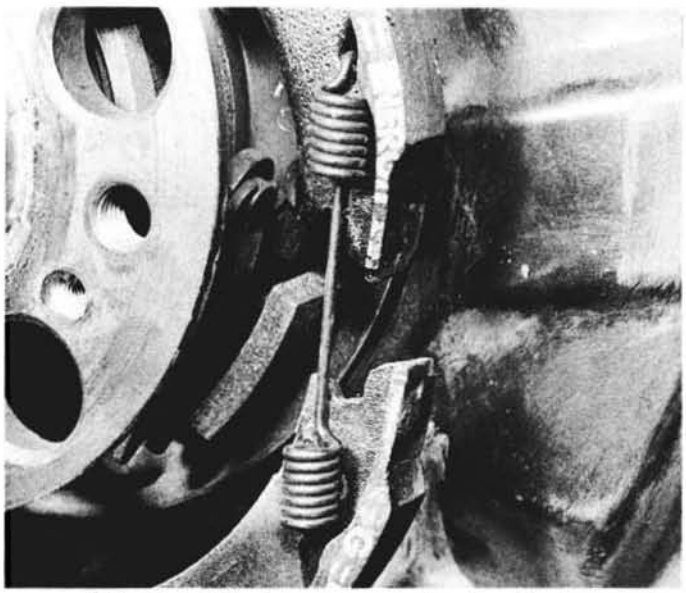
1 *Brake caliper*
2 *Rear hub carrier*
3 *Handbrake shoes*
4 *Thrust piece*
5 *Adjusting wheel*
6 *Reaction member*
7 *Handbrake shoe hold-down spring*
8 *Handbrake cable retaining bolt*
9 *Handbrake cable-to-expander mechanism pin*
10 *Expander mechanism link*
11 *Supporting bolt*
12 *Upper return spring*
13 *Lower return spring*



12.2b Using pliers to remove the handbrake shoe hold-down spring



12.4 Disconnect the handbrake shoe upper return spring



12.5 Detach the lower return spring from the two handbrake shoes

4 Release the handbrake fully, then from under the car, loosen the handbrake adjusting bolt on the compensating mechanism **(see illustration)** until both the cables are slack.
5 Turn the right rear wheel until the hole from which the wheel bolt was removed is positioned to the rear, at approximately 45-degrees from horizontal.
6 Insert a screwdriver through the bolt hole, and engage the toothed adjusting wheel of the handbrake shoe adjuster **(see illustrations)**.
7 Turn the adjusting wheel using the screwdriver until the shoes are in firm contact with the drum and the wheel can no longer be turned. On the right-hand brake, the screwdriver handle should be moved in a downwards direction to expand the handbrake shoes.
8 Now back off the adjusting wheel just enough to allow the wheel to turn freely without dragging.
9 Repeat paragraphs 5 to 8 on the left-hand side, but in this case move the screwdriver handle in an upwards direction to expand the handbrake shoes.
10 Tighten the handbrake adjusting bolt on the compensating mechanism just enough to remove the slack from the cables.
11 Operate the handbrake lever quickly two or three times, then make further adjustments at the adjusting bolt until both wheels are locked after two clicks of the handbrake lever ratchet. Make sure however that both wheels are free to turn when the handbrake is released.
12 On completion, install the lug bolts and wheel trim then lower the car to the ground.

12 Handbrake shoes – removal and installation

Refer to illustrations 12.2a, 12.2b, 12.4, 12.5 and 12.12

Warning: *Dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air, and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use brake system cleaner only!*

Removal

1 Remove the rear brake discs as described in Section 10.
2 Before removing any of the brake components, remove all traces of brake dust with brake cleaner. Using a pair of needle-nose pliers inserted through one of the holes in the hub flange, depress the brake shoe hold-down spring, turn it 90-degrees to release it from the backplate and remove the spring **(see illustrations)**. Remove the other shoe hold-down spring in the same way.
3 Lift the brake shoe upper ends out of their locations in the adjusting wheel mechanism and remove the adjusting wheel.
4 Disconnect the upper return spring from both brake shoes and remove the spring **(see illustration)**.
5 Lift the other end of the brake shoes out of the expander mechanism, disconnect the lower return spring **(see illustration)** and remove the two brake shoes.
6 Push out the pin securing the handbrake cable to the expander mechanism and remove the expander from the backplate.
7 Examine the components for wear, damage or lack of free movement and replace any that are suspect. Replace the shoes if the linings are worn down to the specified minimum or show any sign of oil, grease or fluid contamination.



12.12 Handbrake shoe lower return spring large hooked end (arrow)

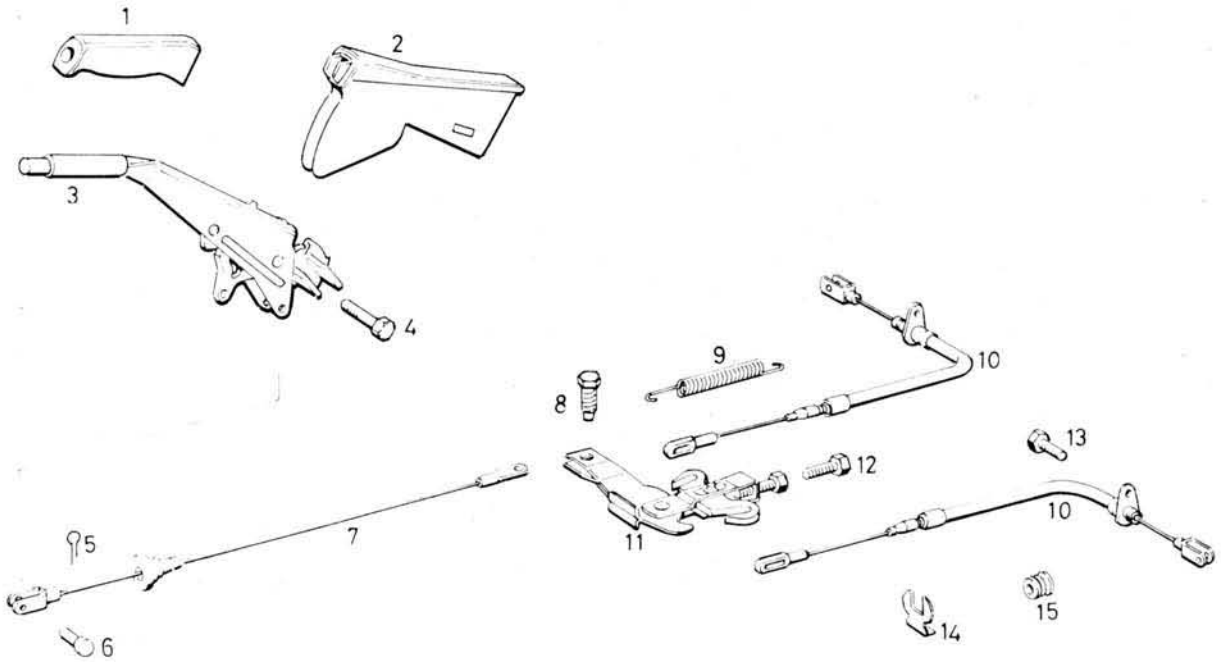
Installation

8 Lightly lubricate the sliding surfaces of the expander mechanism and the threads of the adjusting wheel with a high melting-point brake grease.
9 Install the expander to the backplate and secure to the handbrake cable with the retaining pin.
10 Place the shoes in position on the backplate and connect the upper return spring to the slots in the brake shoe webs.
11 Set the adjusting wheel in the minimum adjustment position, spread the brake shoe ends and insert the adjusting wheel mechanism so that the adjusting wheel is towards the front of the car.
12 Insert the small hooked end of the lower return spring to the lower brake shoe and the large hooked end to the upper shoe **(see illustration)**.
13 Spread the brake shoe ends and insert them into their locations in the expander mechanism.
14 Install the hold-down springs to both brake shoes by depressing and turning each spring 90-degrees. Ensure that the springs are correctly connected to the backplate.
15 Install the rear brake discs as described in Section 10 then adjust the handbrake as described in Section 11.

13 Handbrake lever – removal and installation

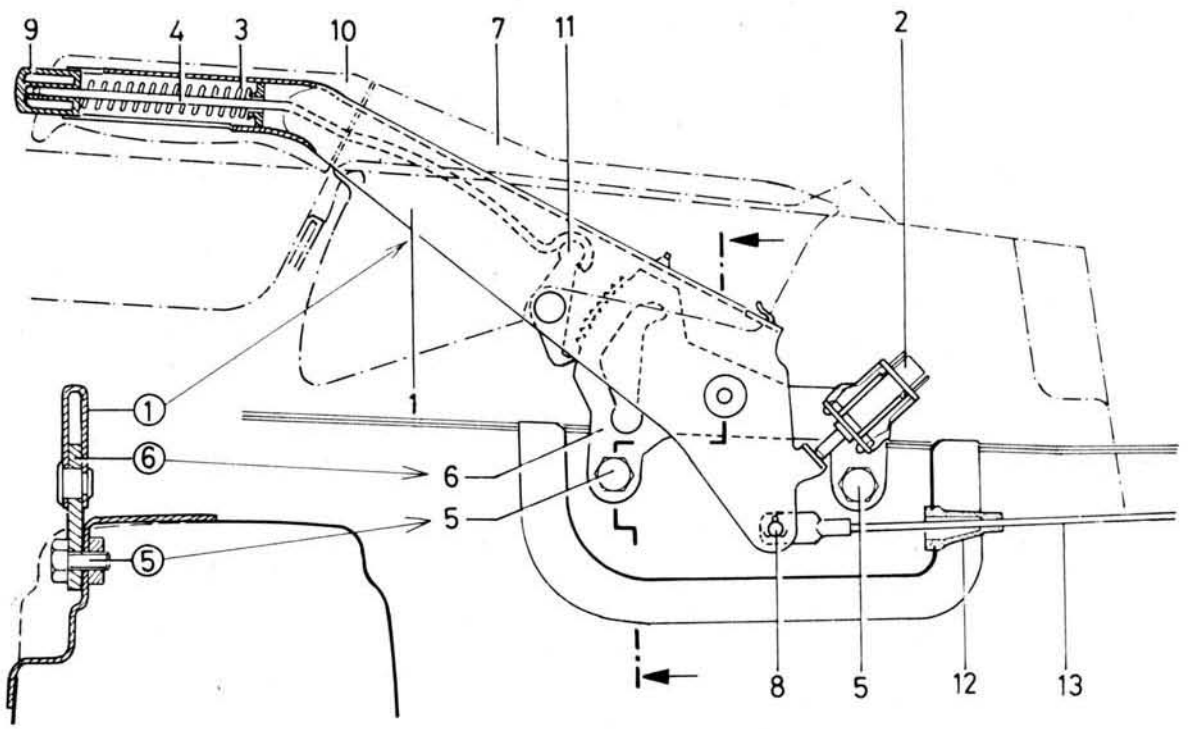
Refer to illustrations 13.2 and 13.4

1 Raise the rear of the vehicle and support it securely on jackstands. Block the front wheels.
2 From under the car disconnect the return spring at the handbrake cable compensating mechanism **(see illustration on next page)**.
3 Refer to Chapter 11 and remove the center console.
4 Release the warning light switch from the handbrake lever bracket **(see illustration on next page)**.
5 Remove the two bolts securing the lever assembly to the floor and lift up the lever.
6 Extract the retaining circlip and remove the clevis pin securing the front handbrake cable to the lever.



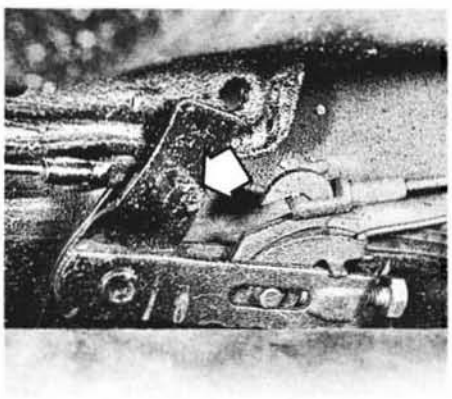
13.2 Handbrake lever and cable arrangement

1	*Lever grip*	5	*Retaining circlip*	9	*Return spring*	13	*Rear cable retaining bolt*
2	*Lever cover*	6	*Clevis pin*	10	*Rear cables*	14	*Support bracket clip*
3	*Lever assembly*	7	*Front cable*	11	*Compensating mechanism*	15	*Grommet*
4	*Lever retaining bolt*	8	*Front cable retaining bolt*	12	*Adjusting bolt*		

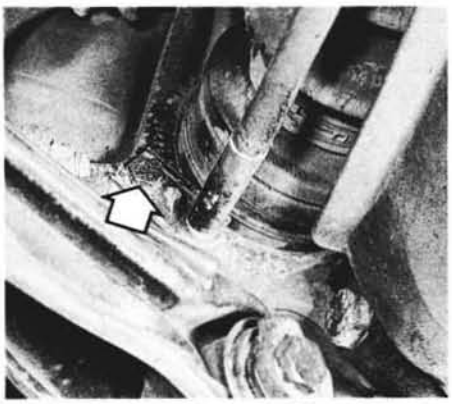


13.4 Handbrake lever attachment details

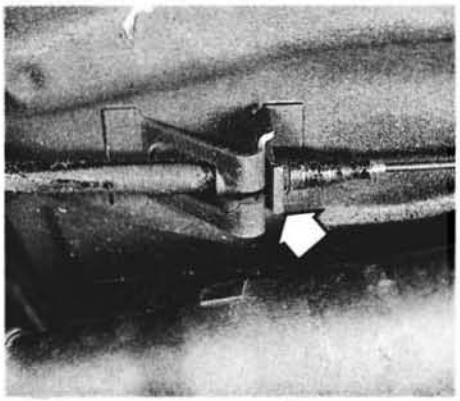
1	*Handbrake lever*	5	*Retaining bolt*	8	*Clevis pin*	11	*Pawl*
2	*Warning light switch*	6	*Lever bracket*	9	*Push button*	12	*Grommet*
3	*Return spring*	7	*Lever cover*	10	*Lever grip*	13	*Front handbrake cable*
4	*Lever operating rod*						



14.2 Handbrake front cable-to-intermediate lever retaining bolt (arrow)



14.6 Handbrake rear cable-to-hub carrier retaining bolt (arrow)



14.12 Handbrake rear cable-to-support bracket retaining clip (arrow)

7 Remove the lever assembly from inside the car.
8 Installation is the reverse of removal. Check and if necessary adjust the handbrake as described in Section 11 on completion.

14 Handbrake cables – removal and installation

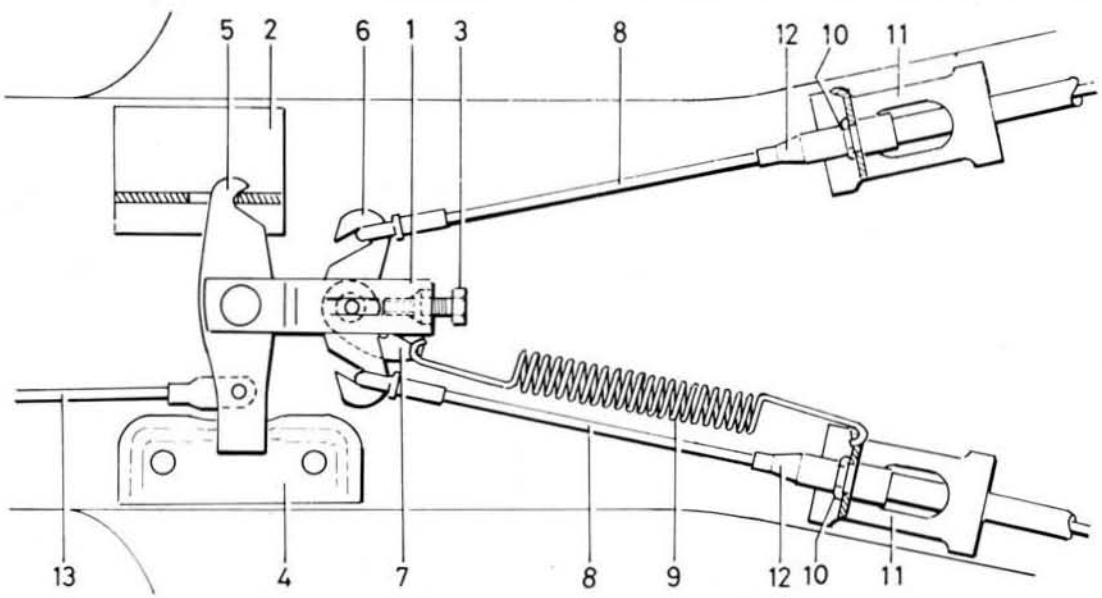
Refer to illustrations 14.2, 14.6, 14.7 and 14.12

Front cable

1 Remove the handbrake lever as described in Section 13.
2 Remove the bolt securing the front cable to the intermediate lever on the compensating mechanism under the car **(see illustration)**.
3 Pull the cable through the grommet on the underbody and remove the cable from under the car.
4 Installation is the reverse of removal. Check and if necessary adjust the handbrake as described in Section 11 on completion.

Rear cables

5 Remove the handbrake shoes on the relevant side as described in Section 12.
6 Remove the bolt securing the handbrake cable to the rear hub carrier **(see illustration)** and withdraw the cable.
7 Disconnect the compensating mechanism return spring at the cable support bracket **(see illustration)**.
8 Loosen the handbrake adjusting bolt fully **(see illustration 11.4).**
9 Remove the bolt securing the front cable to the intermediate lever on the compensating mechanism **(see illustration 14.2).**
10 Withdraw the hooked end of the intermediate lever from its locating bracket.
11 Disconnect the rear cable eye from the compensating lever.
12 Extract the retaining spring clip and withdraw the rear cable from its support bracket **(see illustration)** and guides.
13 Remove the cable from under the car.
14 Installation is the reverse of removal.

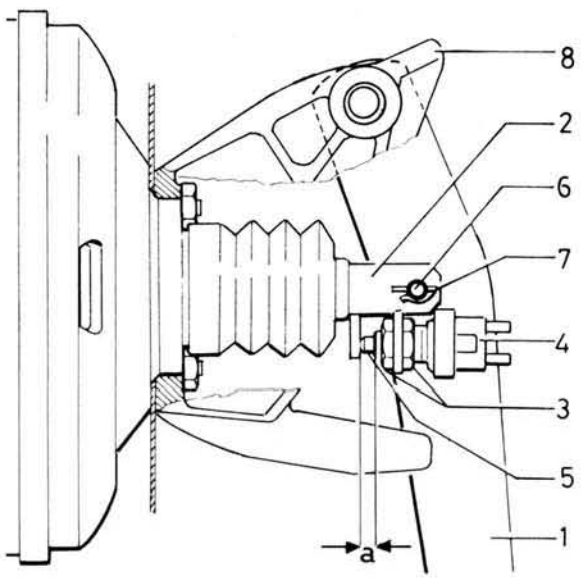


14.7 Handbrake cable and compensating mechanism

1 *Adjusting bracket*
2 *Locating bracket*
3 *Adjusting bolt*
4 *Guide bracket*
5 *Intermediate lever*
6 *Compensating lever*
7 *Spring clip*
8 *Rear cables*
9 *Return spring*
10 *Retaining clip*
11 *Support bracket*
12 *Grommet*
13 *Front cable*

15 Brake pedal – removal and installation

The brake and clutch pedals share a common bracket and pivot shaft assembly. Removal and installation procedures for both pedals are given in Chapter 5.



16.3 Brake light switch attachment details

1	*Brake pedal*	5	*Plunger*
2	*Brake booster pushrod*	6	*Clevis pin*
3	*Adjusting locknuts*	7	*Retaining clip*
4	*Brake light switch (adjustable type)*	8	*Pedal bracket*

a = 3 to 20 mm (0.12 to 0.78 in)

16 Brake light switch – adjustment, removal and installation

Refer to illustrations 16.3 and 16.5

1 The brake lights are operated by a mechanical switch located on the brake pedal mounting bracket. The switch should activate the brake lights after a pedal movement of 3 to 20 mm (0.12 to 0.78 in).

2 If adjustment is necessary, remove the trim panel under the dash on the driver's side for access to the switch.

3 If the switch is provided with two locknuts for adjustment, loosen both locknuts and reposition the switch in its bracket as necessary **(see illustration)**. Tighten the locknuts and check the brake light operation. Repeat this procedure until the lights illuminate within the specified range of pedal travel.

4 If the switch does not incorporate adjusting locknuts, then it will be necessary to bend the contact plate on the brake pedal slightly if the brake lights do not illuminate within the specified range of pedal travel.

5 To remove the switch, disconnect the electrical connector **(see illustration)**, then unscrew the inner locknut, or depress and turn the switch body 90-degrees according to the type of switch installed.

6 Installation is the reverse of removal.

17 Master cylinder – removal and installation

Refer to illustrations 17.4 and 17.6

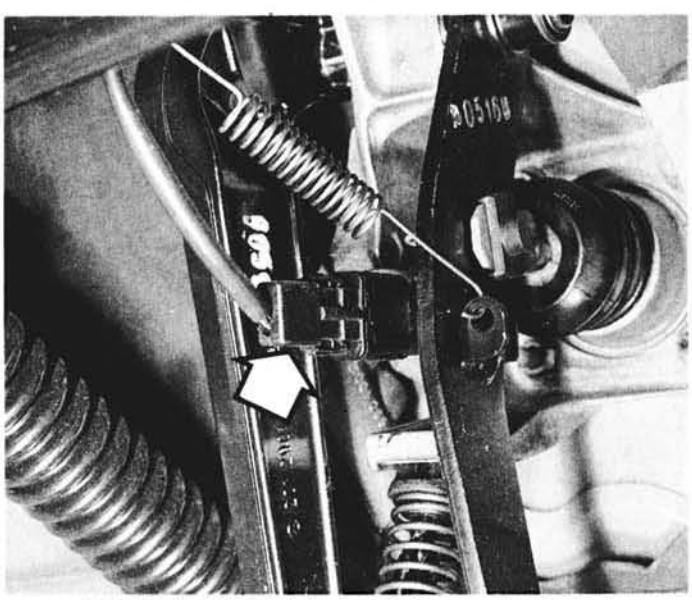
Removal

1 Remove the master cylinder reservoir filler cap, place a piece of thin polyethylene sheeting over the filler neck and install the cap. This will minimize brake fluid lost during subsequent operations.

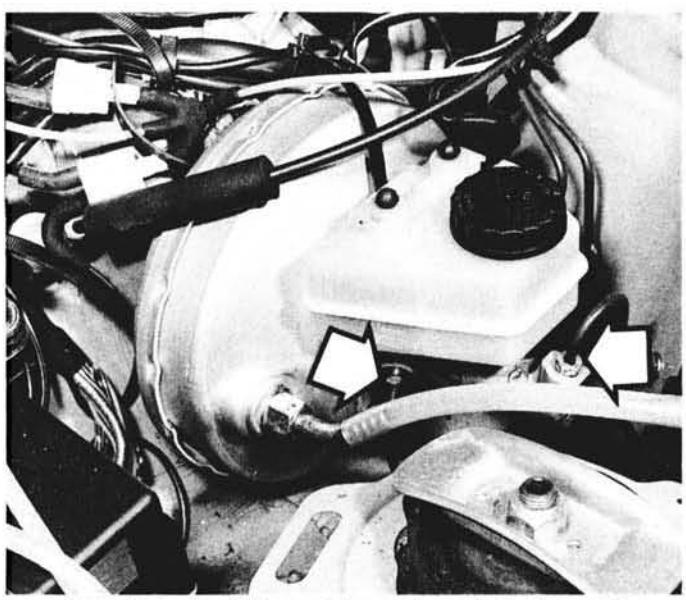
2 Using a small screwdriver, release the retaining lugs on the fluid level warning light electrical connector and disconnect the plug from the reservoir.

3 On manual transmission models, disconnect the clutch master cylinder fluid supply hose from the side of the reservoir. Plug or cap the outlet in the reservoir and the hose end as soon as the hose is detached.

4 Unscrew the fitting nuts and detach the two brake line ends from the master cylinder body **(see illustration)**. Plug or cap the cylinder openings and line ends after removal. Carefully ease the brake line at the front of the cylinder slightly to one side to provide clearance for removal of the master cylinder.



16.5 Brake light switch electrical connector (arrow)



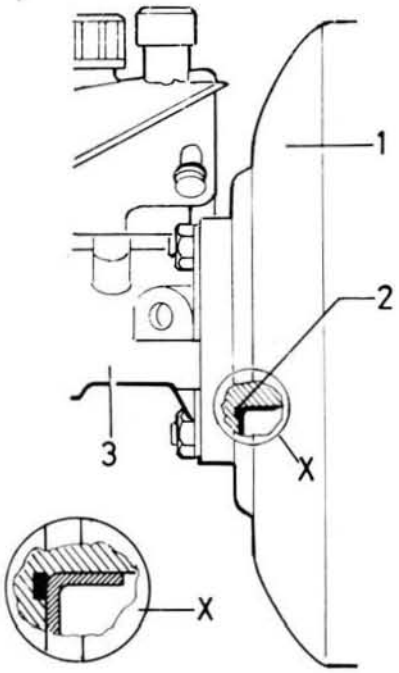
17.4 Brake line fittings at the master cylinder (arrows)

5 Remove the two nuts securing the master cylinder to the brake booster and pull the cylinder squarely off the studs. Do not tilt or twist the cylinder as it is removed, otherwise the lugs securing the pushrod in the booster may be damaged.

6 Recover the master cylinder-to-brake booster sealing ring, noting that the sealing ring must be replaced prior to installation **(see illustration)**.

Installation

7 Installation is the reverse of the removal sequence. Ensure that the sealing ring is correctly located in its groove in the cylinder body, and bleed the brake hydraulic system as described in Section 21 after completion.



17.6 Master cylinder sealing ring details

1 Brake booster unit
2 Sealing ring
3 Master cylinder

18 Master cylinder – overhaul

Refer to illustrations 18.3 and 18.9

Note: *Before deciding to overhaul the master cylinder, investigate the availability and cost of a new and factory rebuilt unit and also the availability of a rebuild kit.*

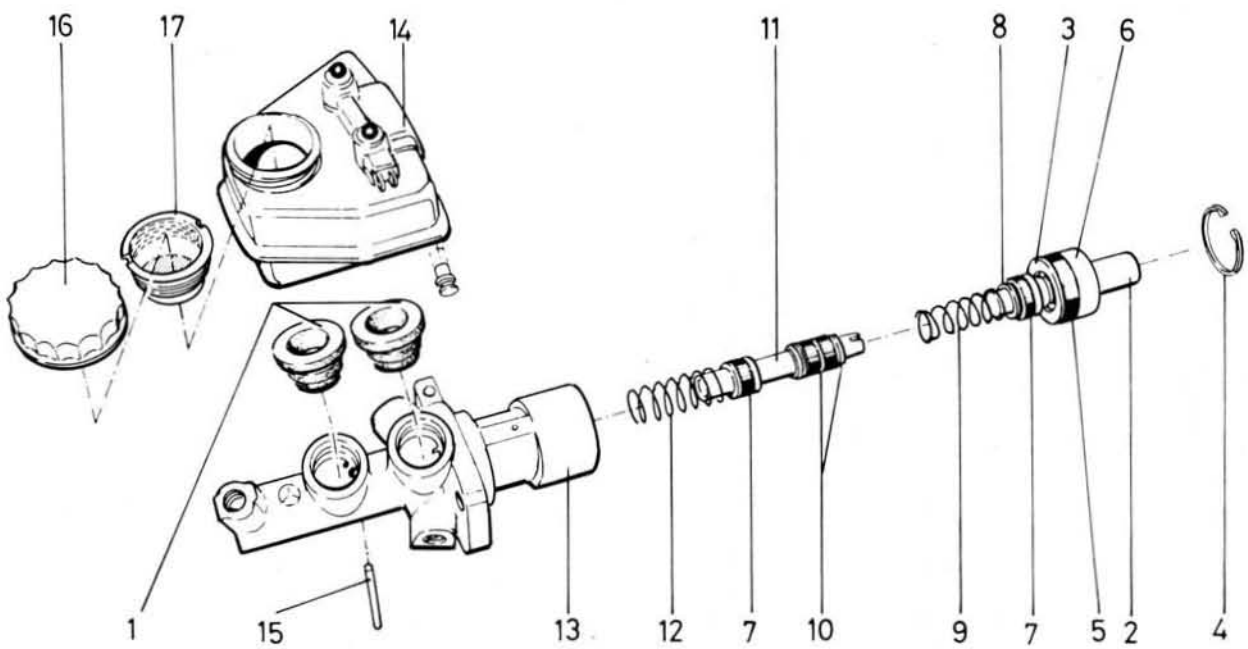
1 Remove the master cylinder as described in Section 17.

2 Remove the reservoir filler cap and pour the brake fluid into a container.

3 Carefully pry the reservoir out of the two rubber seals, then withdraw the seals from the cylinder ports **(see illustration)**.

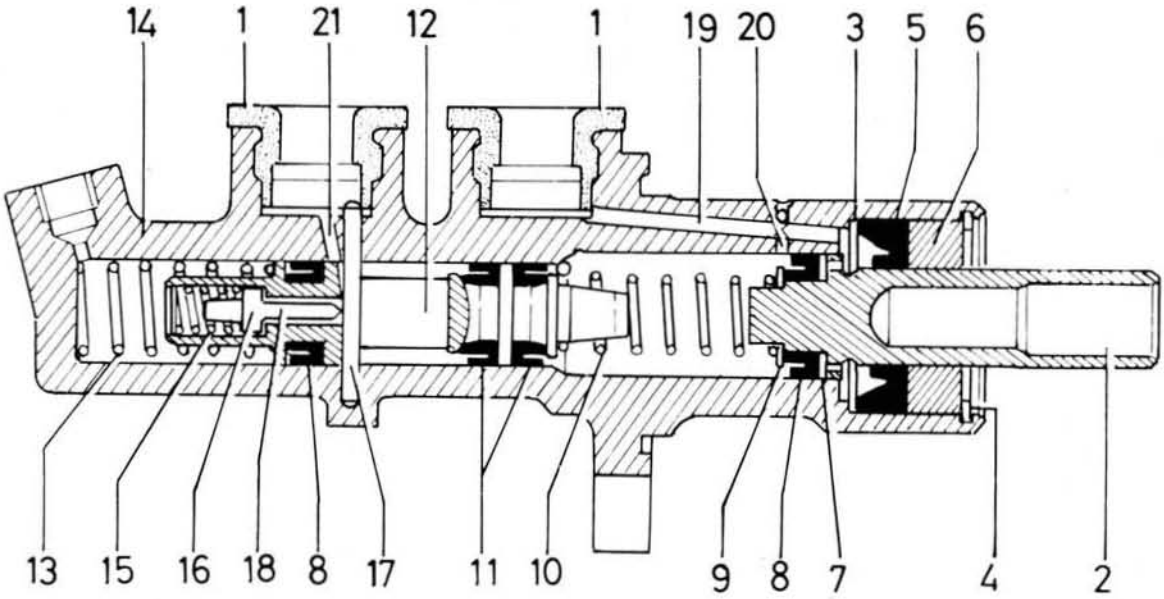
4 Push the piston in slightly and extract the cylinder pin from the reservoir front port using needle-nose pliers.

5 Maintain pressure on the piston, and extract the piston retaining circlip from the end of the master cylinder bore using circlip pliers. If equipped, remove the washer and O-ring seal from the cylinder.



18.3 Exploded view of the Bendix master cylinder components – Girling and Teves units similar

1 Reservoir seals
2 Outer piston
3 Washer
4 Circlip
5 Secondary seal
6 Bush
7 Piston seal
8 Supporting ring
9 Compression spring
10 Separating sleeve
11 Inner piston
12 Compression spring
13 Cylinder body
14 Reservoir
15 Cylinder pin
16 Filler cap
17 Strainer

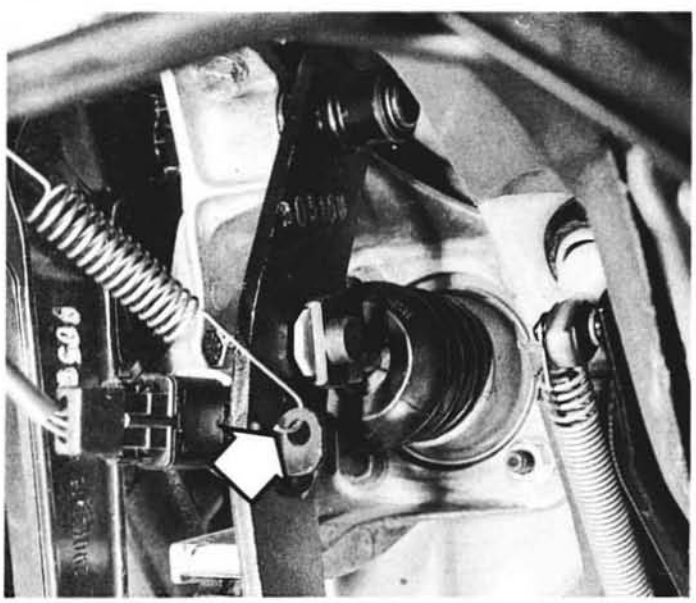


18.9 Sectional view of the Bendix master cylinder – Girling and Teves units similar

1 *Reservoir seals*
2 *Outer piston*
3 *Washer*
4 *Circlip*
5 *Secondary seal*
6 *Bushing*
7 *Filling disc*
8 *Piston seal*
9 *Supporting ring*
10 *Compression spring*
11 *Separating sleeve*
12 *Inner piston*
13 *Compression spring*
14 *Cylinder body*
15 *Valve spring*
16 *Valve seal*
17 *Cylinder pin*
18 *Valve pin*
19 *Filling bore*
20 *Compensating bore*
21 *Filling and compensating bore*

6 Withdraw the two piston assemblies, together with their seals and springs, from the cylinder bore. Tap the end of the cylinder on a block of wood if necessary to eject the inner piston.

7 Examine the master cylinder bore for signs of scoring, wear ridges or corrosion, and if evident replace the complete master cylinder assembly. If the cylinder body is satisfactory, obtain a repair kit which consists of new pistons with their seals in place, and new O-rings and circlips as applicable.



19.4 Brake pedal return spring attachment (arrow)

8 Prior to reassembly, clean the cylinder body thoroughly in brake fluid and dry with a clean lint-free cloth.

9 Lubricate the cylinder bore thoroughly with clean brake fluid and insert the inner piston and spring assembly **(see illustration)**. The guide slot on the piston must remain vertical during installation. If necessary, turn the piston by means of a screwdriver engaged with the notch in the piston end.

10 Using a Phillips screwdriver or a punch, push the piston in against spring pressure and install the cylinder pin, chamfered end first, through the reservoir port. The pin must not protrude by more than 2.0 to 3.0 mm (0.07 to 0.12 in).

11 Introduce the second piston into the cylinder bore, install the O-ring and washer (where applicable), then push the piston down and install the retaining circlip.

12 Lubricate the reservoir seals and install them in the cylinder ports.

13 Insert one of the reservoir outlets into its seal, push down and engage the second outlet. Ensure that the reservoir outlets are fully engaged with their respective seals and the reservoir is sitting squarely.

14 The assembled master cylinder can now be installed to the car as described in Section 17.

19 Power brake booster – removal and installation

Refer to illustration 19.4

1 Remove the master cylinder as described in Section 17.

2 Unscrew the fitting nut and remove the vacuum hose from the front face of the brake booster.

3 Remove the trim panel under the dash on the driver's side.

4 Disconnect the brake pedal return spring at the pedal **(see illustration)**.

5 Pull out the retaining clip, then pull out the clevis pin securing the booster pushrod to the brake pedal.

6 Unscrew the four nuts securing the booster to the firewall and pedal bracket, then remove the booster from the engine compartment.
7 Installation is the reverse of the removal procedure.

20 Brake lines and hoses – removal and installation

1 Before removing a brake line or hose, unscrew the master cylinder reservoir filler cap, place a piece of thin polyethylene sheeting over the filler neck and install the cap. This will minimize brake fluid loss during subsequent operations.
2 To remove a rigid brake line, unscrew the fitting nuts at each end, detach the pipe from its retaining clips and withdraw the pipe from the car. Installation is the reverse of removal. **Warning:** *Don't use copper tubing for any brake system components. Prefabricated steel brake line, with the tube ends already flared and fittings installed, is available at auto parts stores and dealer parts departments.*
3 To remove a flexible brake hose, unscrew the fitting nut securing the rigid brake line to the end of the flexible hose, while holding the hose end stationary. Remove the retaining clip and detach the hose from its bracket. Unscrew the other end of the hose from the brake caliper, release any retaining clips and remove the hose from the car. Installation is the reverse of removal.
4 Bleed the brake hydraulic system as described in Section 21 after installing a rigid line or flexible hose, and whenever a line or hose fitting is disconnected.

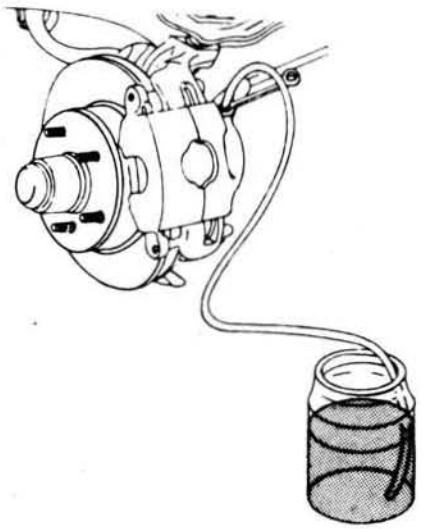
21 Brake system bleeding

Refer to illustration 21.8

Warning: *Wear eye protection when bleeding the brake system. If the fluid comes in contact with your eyes, immediately rinse them with water and seek medical attention.*

Note: *Bleeding the hydraulic system is necessary to remove any air that manages to find its way into the system when it's been opened during removal and installation of a hose, line, caliper or master cylinder.*

1 It will probably 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 or wheel cylinder 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 Remove any residual vacuum from the brake power booster by applying the brake several times with the engine off.
5 Remove the master cylinder reservoir cap and fill the reservoir with brake fluid. Reinstall the cap. **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 bubbles into the master cylinder.*
6 Have an assistant on hand, as well as a supply of new brake fluid, a clear container partially filled with clean brake fluid, 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.
7 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.
8 Place one end of the tubing over the bleeder valve and submerge the other end in brake fluid in the container **(see illustration)**.
9 Have the assistant pump the brakes slowly a few times to get pressure in the system, then hold the pedal firmly depressed.
10 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.



21.8 When bleeding the brakes, a hose is connected to the bleeder valve and then submerged in brake fluid – air will be seen as bubbles in the hose and container

11 Repeat Steps 9 and 10 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.
12 Never use old brake fluid. It contains moisture which will deteriorate the brake system components.
13 Refill the master cylinder with fluid at the end of the operation.
14 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.*

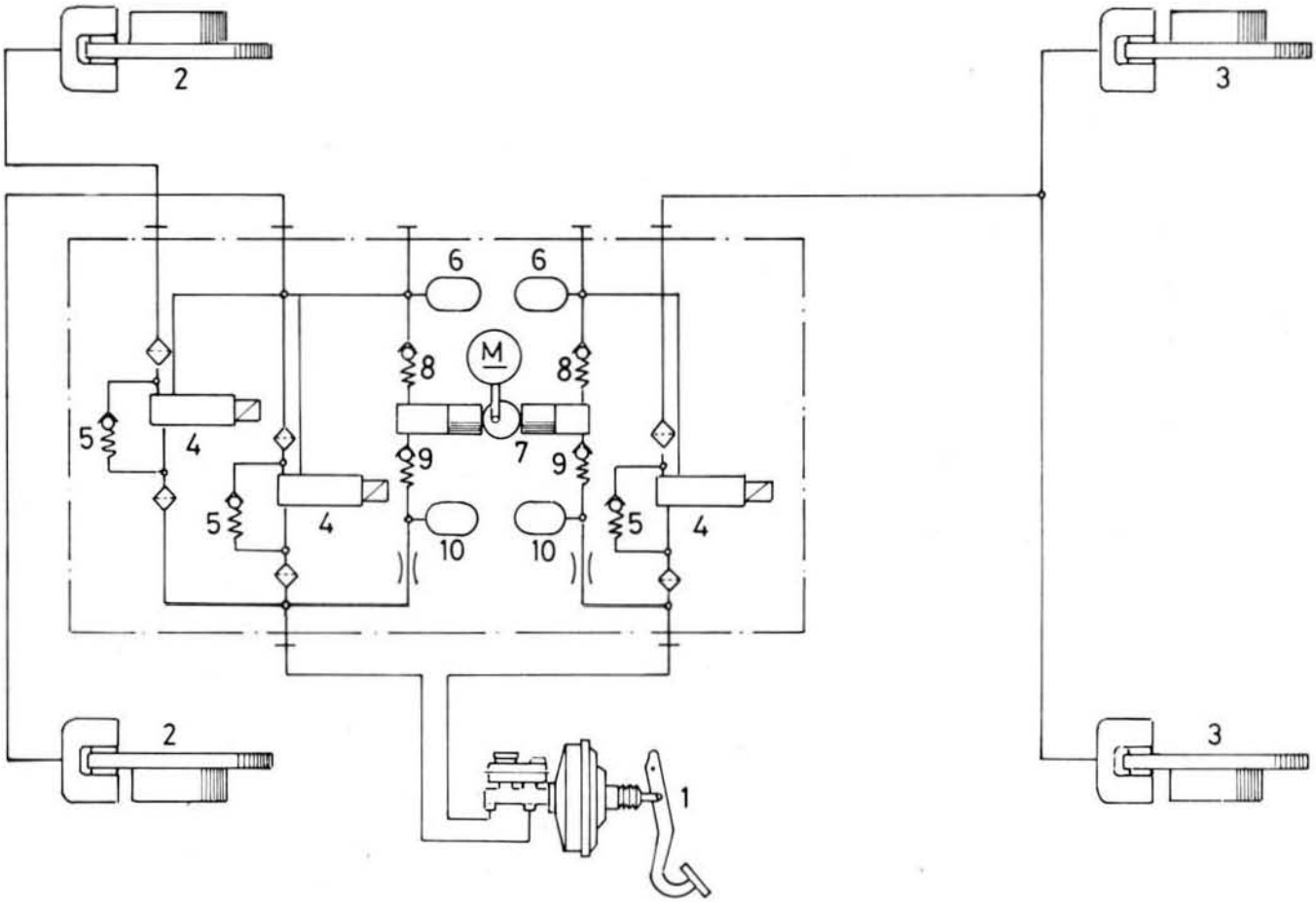
22 Anti-lock braking system – general information

Refer to illustration 22.1

Mercedes-Benz 190 models covered by this manual are available with an anti-lock braking system (ABS) as an option. The system is used in conjunction with the normal braking system to provide greater stability, improved steering control and shorter stopping distances under adverse braking conditions **(see illustration on next page)**.

The wheels are provided with wheel speed sensors which monitor the wheel rotational speed. A separate sensor is used for each front wheel, while at the rear a single sensor monitors the speed of both rear wheels. The sensors consist of a magnetic core and coil and are mounted at a predetermined distance from a toothed rotor. The rotors for the front wheels are machined into the front wheel hubs, with the sensors mounted on the steering knuckles. At the rear, the rotor is pressed onto the differential pinion with the sensor located in the side of the differential housing. When each rotor turns it alters the magnetic field of the sensor, thus inducing an alternating voltage, the frequency of which varies according to wheel speed.

Signals from the wheel speed sensors are sent to an electronic control unit which can accurately determine whether a wheel is accelerating or decelerating in relation to a reference value. Information from the electronic control unit is sent to the hydraulic modulator, which contains three solenoids, one for each front wheel and one for both rear wheels. The solenoids each operate one inlet and one exhaust valve, and all work independently of each other in three distinct phases.



22.1 Schematic view of the anti-lock braking system

1	*Brake master cylinder*	*4*	*Solenoid valves*	*6*	*Pump reservoir*	*8*	*Solenoid inlet valves*
2	*Front brakes*	*5*	*Check valve*	*7*	*Return pump*	*9*	*Solenoid exhaust valves*
3	*Rear brakes*					*10*	*Silencers*

Pressure build-up phase: The solenoid inlet valves are open, and brake pressure from the master cylinder is applied directly to the brake calipers.

Constant pressure phase: The solenoid inlet and exhaust valves are closed and brake pressure at the calipers is maintained at a constant level even though master cylinder pressure may increase.

Pressure reduction phase: The solenoid inlet valve is closed to prevent further brake pressure reaching the caliper and, in addition, the exhaust valve is open to reduce existing pressure and release the brake. Fluid is returned to the master cylinder in this phase via the return pump in the hydraulic modulator.

The braking cycle for one wheel is therefore as follows, and will be the same for each front brake or both rear brakes, although independently.

Wheel rotational speed is measured by the wheel speed sensors and processed by the electronic control unit. By comparing the signals received from each wheel the control unit can determine a reference speed, and detect any variation from this speed, which would indicate a locking brake. Should a lock-up condition be detected, the control unit initiates the constant pressure phase and no further increase in brake pressure is applied to the affected brake. If the lock-up condition is still detected the pressure reduction phase is initiated to allow the wheel to turn. The control unit returns to the constant pressure phase until the wheel rotational speed exceeds a predetermined value, then the cycle repeats with the control unit re-initiating the pressure build-up phase. This control cycle is continuously and rapidly repeated until the brake pedal is released or the car comes to a stop.

Additional circuitry within the electronic control unit monitors the functioning of the system and informs the driver of any fault condition by means of a warning light. Should a fault occur, the system switches off allowing normal braking, without ABS, to continue.

23 Anti-lock braking system – precautions

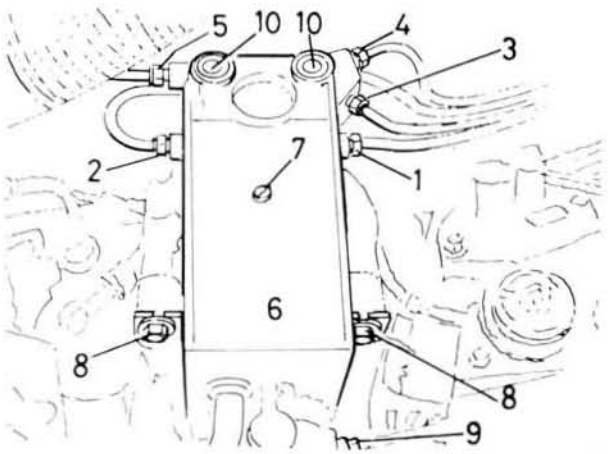
Due to the complex nature of the anti-lock braking system the following precautions must be observed when performing maintenance and repair work on cars so equipped.

1 Whenever the battery cables are disconnected, ensure that the clamps are securely tightened when installing.

2 Disconnect the electronic control unit electrical connector before using any electric welding equipment on the car.

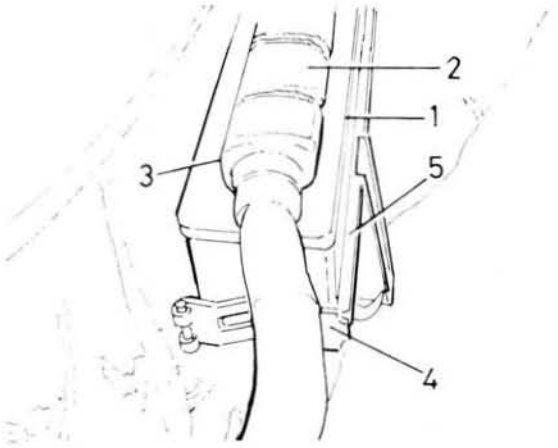
3 Ensure that the negative cable is disconnected from the battery before removing the hydraulic modulator.

4 Avoid subjecting the electronic control unit to prolonged high temperatures such as those experienced in a paint spray oven. Maximum acceptable temperatures are 95-degrees C (203-degrees F) for very short



24.4 Connections and attachments at the hydraulic modulator – anti-lock braking system

1 to 5 Brake line connections
6 Modulator cover
7 Cover retaining screw
8 Mounting nuts
9 Ground strap
10 Valve plugs – Do not unscrew



24.9 Electronic control unit attachments – anti-lock braking system

1 Electronic control unit
2 Wiring plug
3 Spring clip
4 Mounting bracket retainer
5 Mounting bracket

periods or 85-degrees C (185-degrees F) for up to two hours.

5 After any general maintenance or simple repair operation such as brake pad replacement, brake disc replacement, handbrake cable adjustment or replacement, or any work not directly involving the ABS components, road test the car and check that the ABS warning light does not come on when the vehicle reaches a speed of 4 mph (6 kph). If the warning light illuminates, there is a problem in the system and the advice of a Mercedes-Benz dealer service department should be sought.

6 If any of the ABS components are removed, installed, replaced or in any way disturbed, the operation of the system must be checked by a Mercedes-Benz dealer on completion.

24 Anti-lock braking system components – removal and installation

Note: *Before proceeding, refer to Section 23.*

Hydraulic modulator

Refer to illustration 24.4

1 The hydraulic modulator is located at the front left-hand side of the engine compartment.

2 To remove the modulator control relays, disconnect the cable from the negative terminal of the battery, then remove the screw and lift off the modulator cover. Remove the relays by pulling them straight up out of their locations. The large relay controls the return pump operation, and the small relay controls the solenoid valve operation. Installation is the reverse of removal.

3 To remove the complete modulator unit, first disconnect the cable from the negative terminal of the battery, then remove the screw and lift off the modulator cover.

4 Mark each brake line at the modulator to aid identification when installing **(see illustration)**. Unscrew the line fittings and carefully pull the brake lines away from the modulator. Immediately plug the pipe ends and modulator orifices to minimize brake fluid loss and the entry of contaminants.

5 Disconnect the ground strap from the return pump motor.

6 Release the mounting bracket spring clamp and lift the unit from its mounting bracket.

7 Pull back on the electrical connector spring clip and detach the electrical connector. Do not attempt to disassemble the modulator, as it is a sealed unit and no repairs are possible.

8 Installation is the reverse of removal. Bleed the brake hydraulic system as described in Section 21, then have the ABS operation checked by a Mercedes-Benz dealer.

Electronic control unit

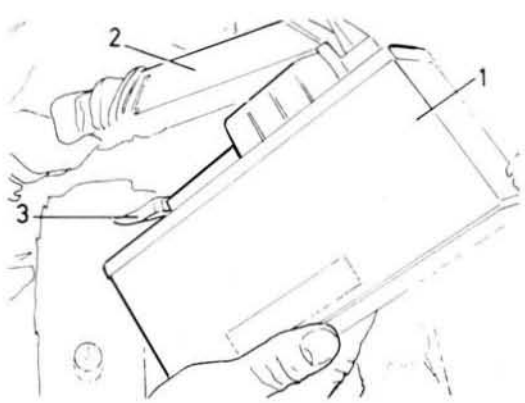
Refer to illustrations 24.9 and 24.12

9 The electronic control unit is located in the engine compartment, behind the battery **(see illustration)**.

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

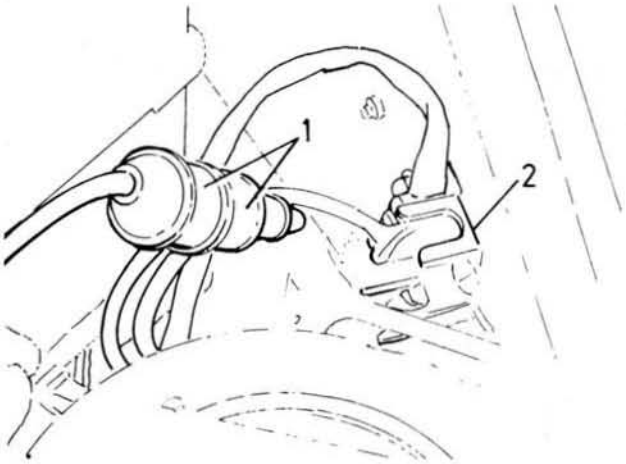
11 Release the mounting bracket retainer and lift the control unit from its bracket.

12 Disconnect the control unit electrical connector by depressing the spring clip at the cable end, lift the plug up at the cable end, then disengage the tab at the other end **(see illustration)**.



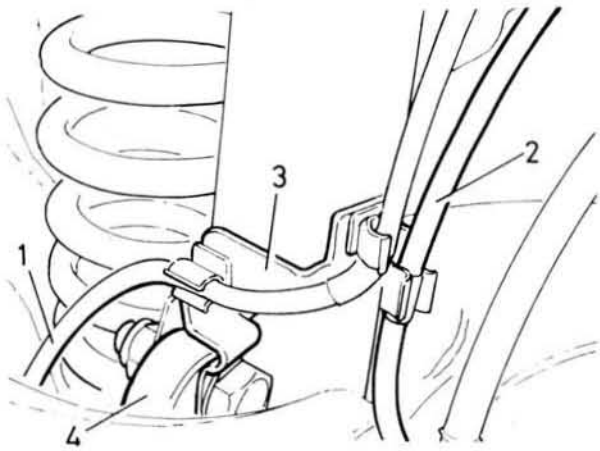
24.12 Electronic control unit electrical connector removal – anti-lock braking system

1 Electronic control unit
2 Electrical connector
3 Spring clip



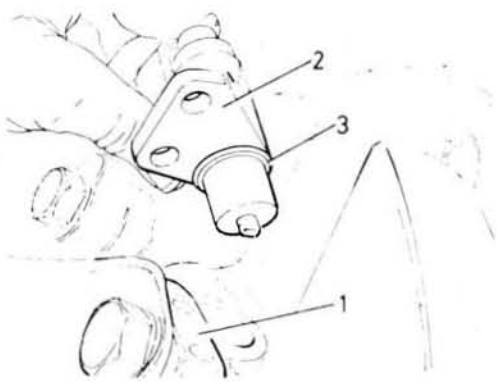
24.17 Location of the front wheel speed sensor electrical connector – anti-lock braking system

1 Electrical connector
2 Holder in engine compartment



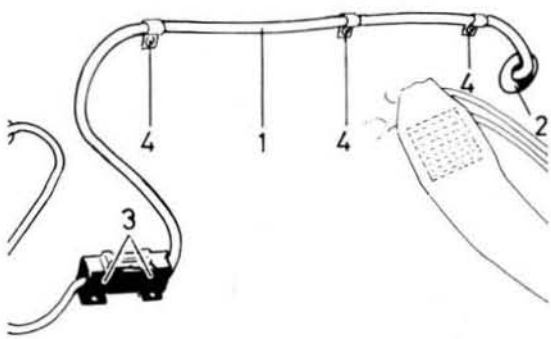
24.19 Wheel speed sensor wiring clips on the strut/steering knuckle – anti-lock braking system

1 Wiring to wheel speed sensor
2 Wiring to brake pad wear sensor
3 Cable clip bracket
4 Steering knuckle



24.20 Front wheel speed sensor mounting details – anti-lock braking system

1 Steering knuckle
2 Wheel speed sensor
3 Rubber grommet on sensor body



24.25 Rear wheel speed sensor wiring attachments under rear seat – anti-lock braking system

1 Wiring
2 Grommet
3 Electrical connector and holder
4 Clip retaining screws

13 Installation is the reverse of removal, but ensure that the electrical connector engages with an audible click from the spring clip.
14 Have the ABS operation checked by a Mercedes-Benz dealer on completion.

Front wheel speed sensors

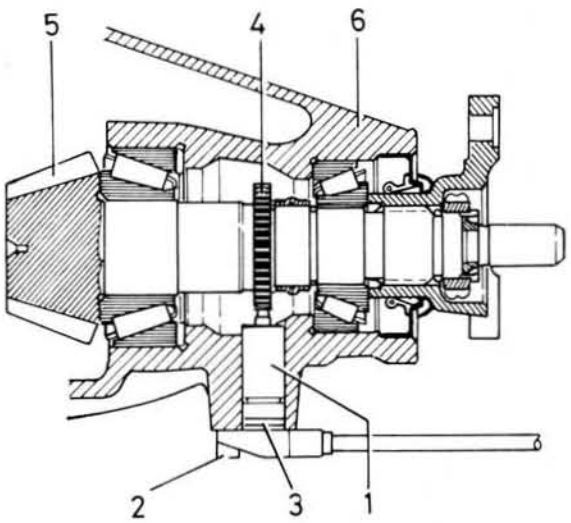
Refer to illustrations 24.17, 24.19 and 24.20

15 Disconnect the cable from the negative terminal of the battery.
16 Loosen the wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Remove the wheel.
17 Detach the speed sensor electrical connector from its holder in the engine compartment adjacent to the suspension strut mounting turret **(see illustration)**. Disconnect the wiring at the connector.
18 Release the wiring from its support bracket under the fenderwell, and pull the wiring and grommet through from the engine compartment.
19 Detach the wiring from the clips on the steering knuckle and suspension strut **(see illustration)**.
20 Using an Allen wrench, unscrew the two bolts and remove the wheel speed sensor from the steering knuckle **(see illustration)**. Remove the rubber grommet from the sensor body.
21 Installation is the reverse of removal. Ensure that there are no metal chips on the sensor probe, and that the rubber grommet is in place prior to mounting.
22 Have the ABS operation checked by a Mercedes-Benz dealer on completion.

Rear wheel speed sensor

Refer to illustrations 24.25 and 24.28

23 Disconnect the cable from the negative terminal of the battery.
24 Remove the rear seat cushion and backrest, referring to Chapter 11 if necessary.
25 Detach the wiring from the holder bracket under the rear seat, and disconnect the wiring at the connector **(see illustration)**. Slacken the clip screws and release the wiring from the clips in the rear seat area.



24.28 Sectional view of the rear wheel speed sensor in the differential housing – anti-lock braking system

1 Wheel speed sensor
2 Retaining bolt
3 O-ring
4 Toothed rotor
5 Differential pinion
6 Differential housing

26 Raise the rear of the vehicle and support it securely on jackstands.
27 From under the car, pry out the grommets in the car floor and rear subframe, then pull the wiring down and out of the car.
28 Using an Allen wrench, unscrew the retaining bolt and remove the wheel speed sensor from the differential housing **(see illustration)**.
29 Installation is the reverse of removal, but ensure that there are no metal chips on the sensor probe. Replace the O-ring seal on the sensor body if it is in any way damaged.
30 Have the ABS operation checked by a Mercedes-Benz dealer on completion.

25 Troubleshooting – brake system

Note: *Troubleshooting the anti-lock braking system should be left to a Mercedes-Benz dealer service department due to the need for special test equipment and expertise.*

Symptom	Reason(s)
Excessive pedal travel	Air in hydraulic system Defective master cylinder
Brake pedal feels spongy	Air in hydraulic system Defective master cylinder
Brake pedal pulsation	Excessive runout of brake discs Caliper mounting bolts loose Incorrectly adjusted front wheel bearings Worn caliper guide pins Wear in suspension or steering components
Excessive pedal pressure required to stop car	Faulty power brake booster Caliper piston(s) seized Brake pads contaminated or excessively worn Incorrect grade of brake pads installed Primary or secondary hydraulic circuit failure
Vehicle pulls to one side when brakes are applied	Brake pads contaminated or excessively worn Caliper piston seized Brake pads replaced on one side only Tire, steering or suspension problem (see Chapter 10)
Brakes binding	Caliper piston(s) seized Handbrake incorrectly adjusted Handbrake cable or mechanism seized Defective master cylinder Defective brake hose

Chapter 10 Suspension and steering systems

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Specifications

Front suspension

Type	Independent, with MacPherson struts and separate coil springs, control arms and an anti-roll bar
Wheel bearing (hub) endplay	0.01 to 0.02 mm (0.0004 to 0.0008 in)
Wheel bearing lubricant	NLGI No. 2 EP high temperature wheel bearing grease

Rear suspension

Type	Independent, with multiple locating struts, coil springs, telescopic shock absorbers and anti-roll bar

Steering

Type	Power-assisted, recirculating ball
Power steering fluid	Dexron II ATF
Power steering reservoir capacity	0.6 liter (0.63 qt)

Front wheel alignment

Toe setting	0-degrees 20' ± 10' (2.5 ± 1.0 mm) toe-in
Camber	0-degrees + 10' - 20'
Maximum camber variation between sides	0-degrees 20'
Caster	10-degrees 30' ± 30'
Maximum caster variation between sides	0-degrees 30'

Rear wheel alignment

Toe setting	0-degrees 25' + 10 (3.0 + 1.0 mm) - 5' - 0.5
Camber	-1-degree 30' (at curb weight, vehicle level)
Track angle variation per wheel at 60 mm (2.36 in) suspension travel	0-degrees 05' + 0' toe out - 10'

Wheels

Type	Pressed steel or light alloy
Size	
Early models	5J x 14
Later models	6J x 15

Tires

Tire sizes		
Early models with 14 in wheels	175/70 R14 84 H	
Later models with 15 in wheels	185/65 R15 87 H	
Tire pressures	**Front**	**Rear**
Normally laden:		
175/70 R14 84H	29 psi	32 psi
185/65 R15 87H	29 psi	32 psi
Fully loaded:		
175/70 R14 84H	32 psi	36 psi
185/65 R15 87H	32 psi	36 psi

Torque specifications

	Ft-lbs
Front suspension	
Disc caliper carrier bracket-to-steering knuckle	85
Suspension strut-to-steering knuckle lower bolts	81
Suspension strut-to-steering knuckle upper nut and bolt	55
Steering knuckle-to-control arm balljoint pinch-bolt and nut	92
Steering arm-to-steering knuckle bolts	59
Suspension strut upper mount-to-body	15
Suspension strut rod-to-upper mount	44
Front control arm inner mounting bolts	89
Anti-roll bar clamp nuts	15
Rear suspension	
Rear subframe front and rear mounting bolts	52
Camber strut-to-rear subframe	52
Camber strut-to-hub carrier	30
Pulling strut inner mount	52
Pulling strut-to-hub carrier	30
Pushing strut-to-rear subframe	52
Pushing strut-to-hub carrier	33
Track rod-to-rear subframe	52
Track rod-to-hub carrier	26
Rear disc caliper-to-hub carrier	37
Spring support arm inner mounting bolt	52
Spring support arm-to-hub carrier	89
Anti-roll bar-to-spring support arm	89
Anti-roll bar clamp retaining nuts	15
Shock absorber lower mounting bolt	33
Driveaxle retaining collar nut	207 to 236

Torque specifications (continued)

	Ft-lbs
Steering	
Steering wheel retaining bolt	59
Steering flexible coupling pinch-bolts	18
Steering column mounting bolts	15
Power steering gear-to-chassis member bolts	55
Tie-rod and drag link balljoint retaining nuts	26
Steering damper retaining nuts	37
Power steering pump pulley bolts	22
Power steering pump mounting bolts	18
Steering idler arm retaining nut	70
Wheels	
Wheel bolts	81

1 General information

Refer to illustrations 1.1 and 1.2

The independent front suspension is of the MacPherson strut type, incorporating single-tube telescopic damper (shock absorber) struts and separately-mounted coil springs, located inboard and to the front of each strut. Lower control arms provide lateral and longitudinal location of each strut assembly, and an anti-roll bar is used to minimize body roll **(see illustration)**.

The independent rear suspension is of a unique multi-link arrangement, which comprises four individual upper and lower links for lateral control, and a track rod to control fore-and-aft movement. Coil springs and telescopic shock absorbers are used in conjunction with an anti-roll bar, and the complete rear suspension assembly, including the differential, is mounted on a subframe attached to the vehicle underbody **(see illustration)**.

The steering system is of the recirculating ball type, incorporating tie-rods, drag link, idler arm and steering damper. Power-assistance is standard on most models.

2 Maintenance and inspection

Refer to illustration 2.10

1 At the intervals given in *Routine Maintenance* at the beginning of this manual, a thorough inspection of all suspension and steering components should be performed, using the following procedures as a guide.

Front suspension and steering

2 Raise the front of the vehicle and support it securely on jackstands.

3 Perform a careful visual inspection of the steering gear, power steering pump and the fluid lines, hoses and fittings for signs of leaks, chafing of the pipes and hoses, or insecure components. Repair any problems found, referring to the relevant Sections of this Chapter.

4 Inspect the condition of the dust boots on the control arm, track rod and drag link balljoints. The dust boots can be replaced separately, if necessary. However, if the dust boots have been damaged for some time, water and dirt will have entered the joint, causing rapid wear. If this is the case, replacement of the track rod or control arm balljoints, or the complete drag link, will be necessary.

5 Check and if necessary adjust the front wheel bearing play, using the procedure described in Section 3.

6 With the front wheel bearings correctly adjusted, grasp the wheel at the 12 o'clock and 6 o'clock positions, and try to rock it. Very slight freeplay should be felt, but if the movement is appreciable, there is likely to be wear in the control arm balljoint or control arm inner mounts. Replace the control arm balljoint if worn, or the inner bushings if the wear is in this area (see Sections 10 and 9).

7 Now grasp the wheel at the 9 o'clock and 3 o'clock positions, and try to rock it as before. Once again, slight movement only should be felt. If the movement is excessive, further investigation is required in the area of the track rod or drag link balljoints, or the idler assembly. Replace any worn components as described in the appropriate Sections of this Chapter.

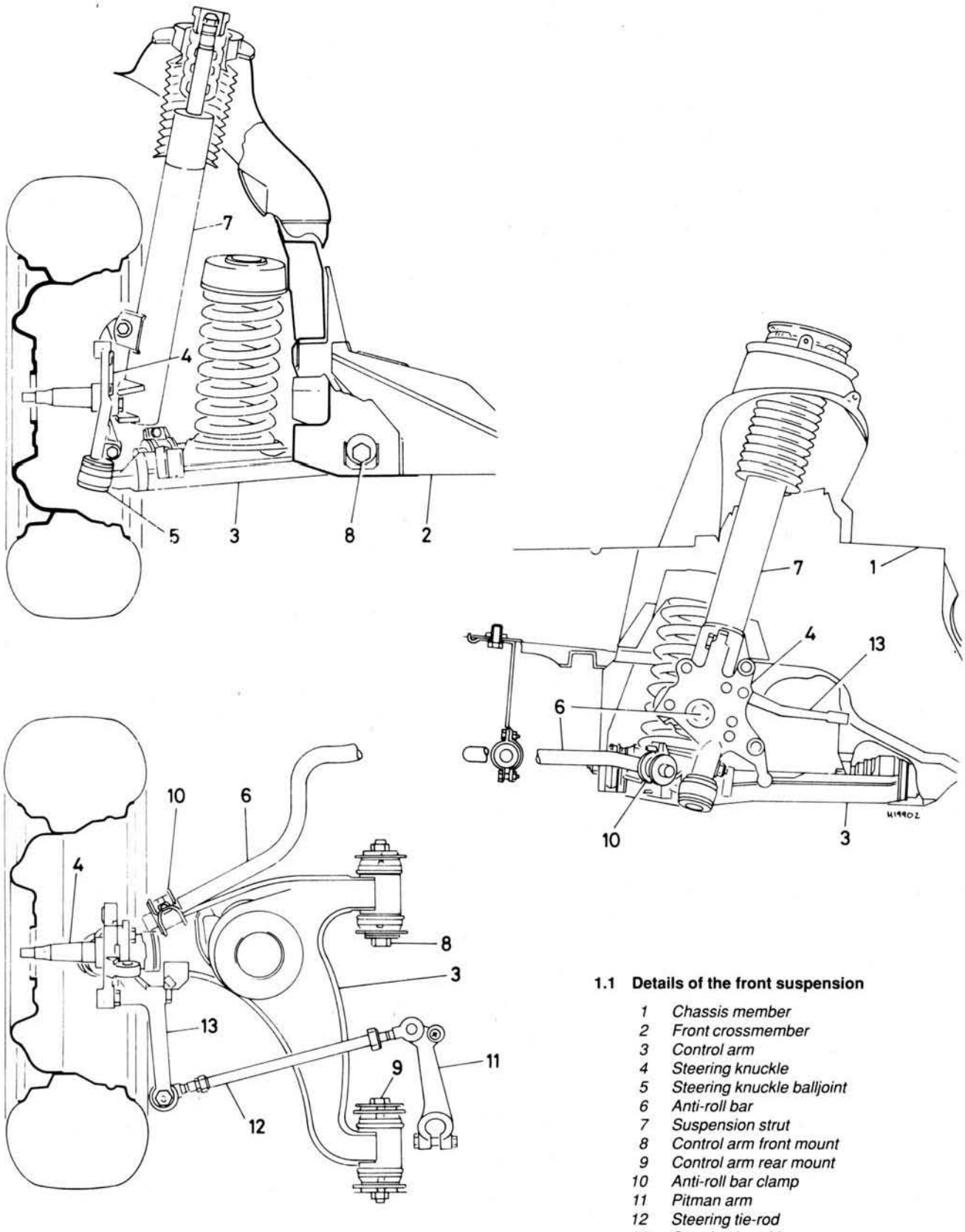
8 Using a large screwdriver or pry bar as a lever, check for wear in the anti-roll bar mounts and control arm inner bushings by carefully levering against these components. Some movement is to be expected, as the mountings are made of rubber, but excessive wear should be obvious. Replace any bushings that are worn.

9 With the car standing on its wheels, have an assistant turn the steering wheel back and forth about one-eighth of a turn each way. With recirculating ball type steering there may be some lost movement between the steering wheel and the wheels, but this should be minimal. If the freeplay is excessive, closely observe the joints and mounts previously described, but in addition check the steering column couplings for wear, and also the steering gear itself. Any wear should be visually apparent, and must be repaired as described in the appropriate Sections of this Chapter.

10 Check the fluid in the power steering pump reservoir by unscrewing the cap nut, lifting off the cover and observing the fluid level **(see illustration)**. If the car has just been driven and is at normal operating temperature, the fluid should be up to the punched or cast mark on the reservoir (approximately 20.0 mm/0.78 in) below the rim. If the fluid is cold, the level should be approximately 6.0 to 8.0 mm (0.23 to 0.31 in) below this mark. If the fluid is low, add the specified fluid to the reservoir until the level is correct, then install the cover and cap nut.

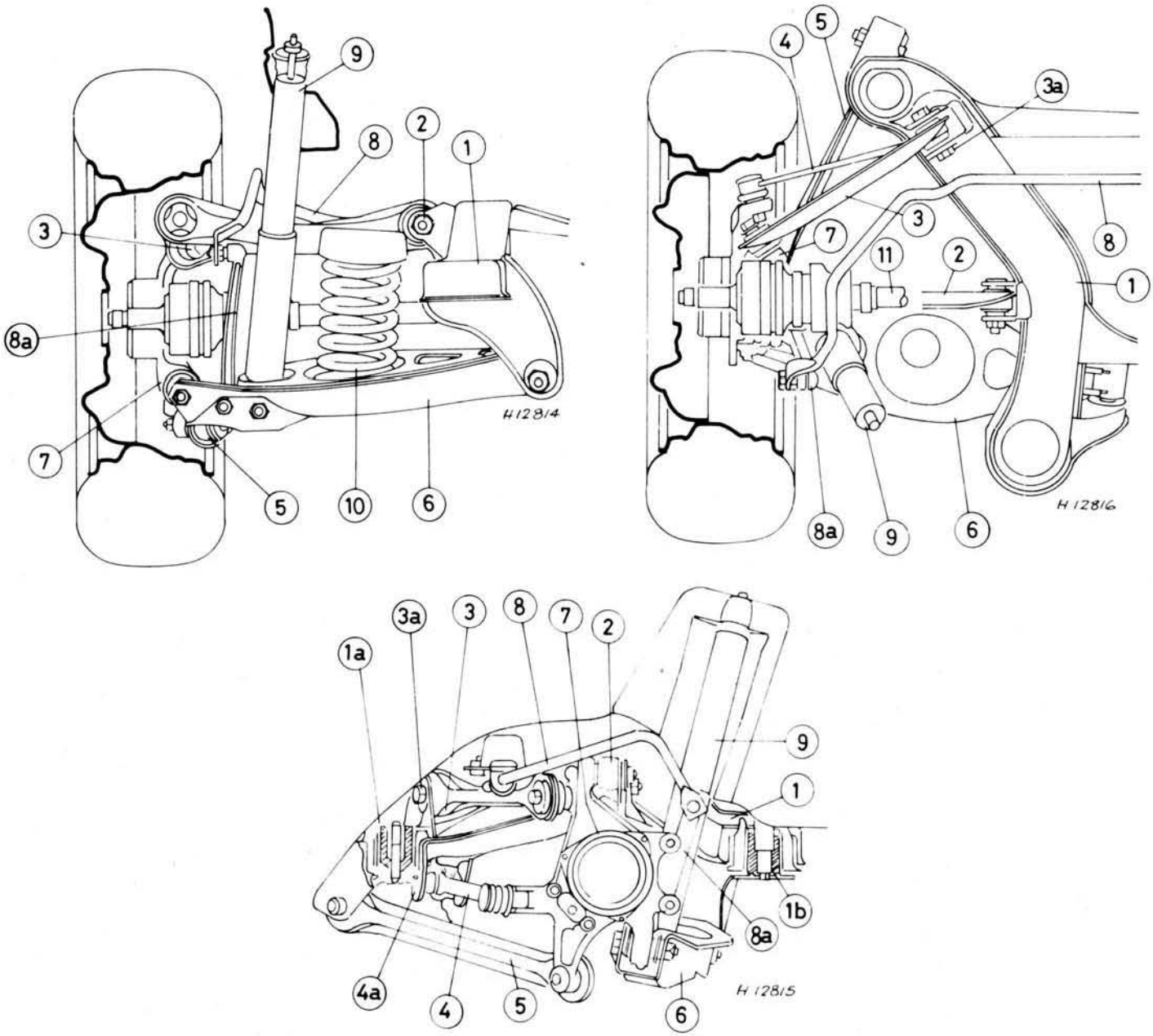


2.10 The fluid level should be up to the punched or cast mark on the reservoir



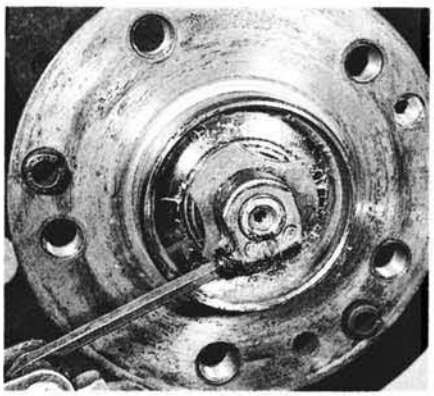
1.1 Details of the front suspension

1 *Chassis member*
2 *Front crossmember*
3 *Control arm*
4 *Steering knuckle*
5 *Steering knuckle balljoint*
6 *Anti-roll bar*
7 *Suspension strut*
8 *Control arm front mount*
9 *Control arm rear mount*
10 *Anti-roll bar clamp*
11 *Pitman arm*
12 *Steering tie-rod*
13 *Steering knuckle arm*



1.2 Details of the rear suspension

1	*Rear subframe*	*3*	*Pulling strut*	*6*	*Spring support arm*	*9*	*Shock absorber*
1a	*Subframe front mount*	*4*	*Track rod*	*7*	*Rear hub carrier*	*10*	*Coil spring*
1b	*Subframe rear mount*	*4a*	*Track rod inner mount*	*8*	*Anti-roll bar*	*11*	*Driveaxle*
2	*Camber strut*	*5*	*Pushing strut*	*8a*	*Anti-roll bar connecting link*		



3.5 Loosen the retaining nut clamp bolt before attempting to turn the hub nut

11 Check the condition, and if necessary adjust the tension, of the power steering pump drivebelt as described in Section 30 on cars with multiple drivebelts, or in Chapter 12 for later models with a single drivebelt arrangement.

Rear suspension

12 Raise the rear of the vehicle and support it securely on jackstands.
13 Visually inspect the rear suspension components, attachments and linkages for any visible sign of wear or damage.
14 Grasp the wheel at the 12 o'clock and 6 o'clock positions and try to rock it. Any excess movement here indicates worn hub bearings or wear in the suspension arm bushings.

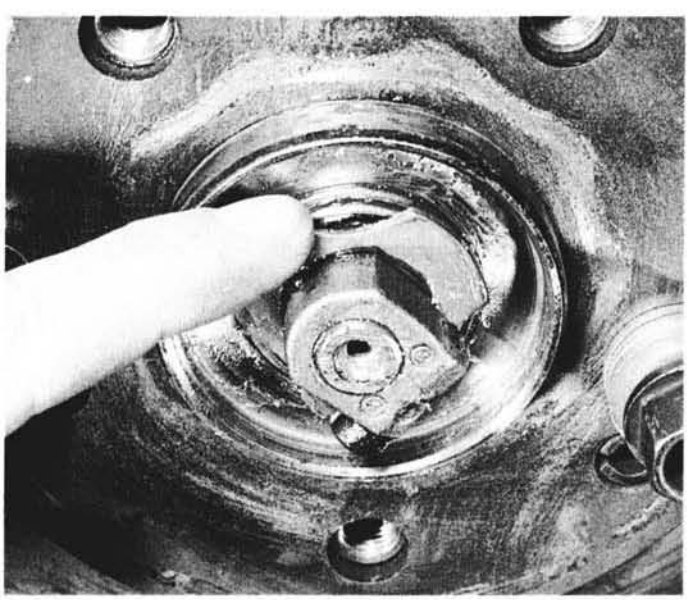
Wheels and tires

15 Carefully inspect each tire, including the spare, for signs of uneven wear, lumps, bulges or damage to the sidewalls or tread face. Refer to Section 36 for further details.
16 Check the condition of the wheel rims for distortion, damage or excessive run-out. Also make sure that the balance weights are secure, with no obvious signs that any are missing. Check the torque of the wheel bolts and check the tire pressures.
17 The efficiency of the shock absorbers may be checked by bouncing the car at each corner. Generally speaking, the body will return to its normal position and stop after being depressed. If it rises and returns on a rebound, the shock absorber is probably worn out. Examine also the shock absorber upper and lower mounts for any sign of wear, and the body and piston areas for signs of fluid leakage. Replacement procedures are contained in Sections 6 and 21 for the front and rear units respectively.

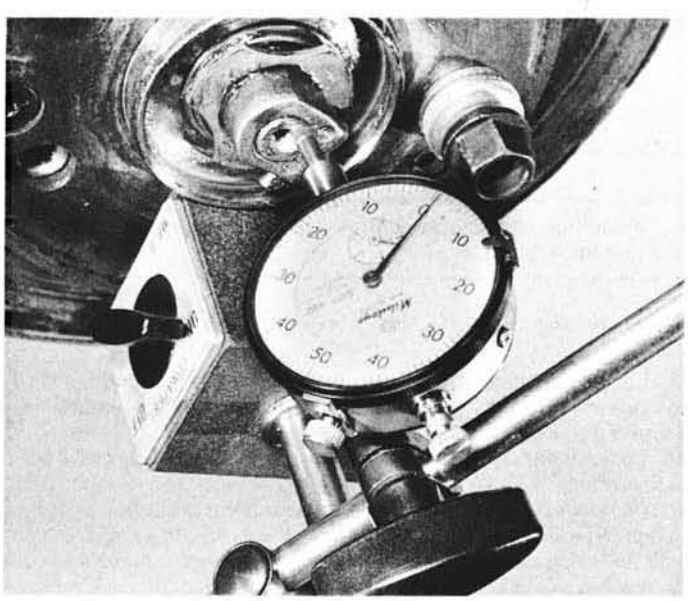
3 Front wheel bearings – adjustment

Refer to illustrations 3.5, 3.8 and 3.9

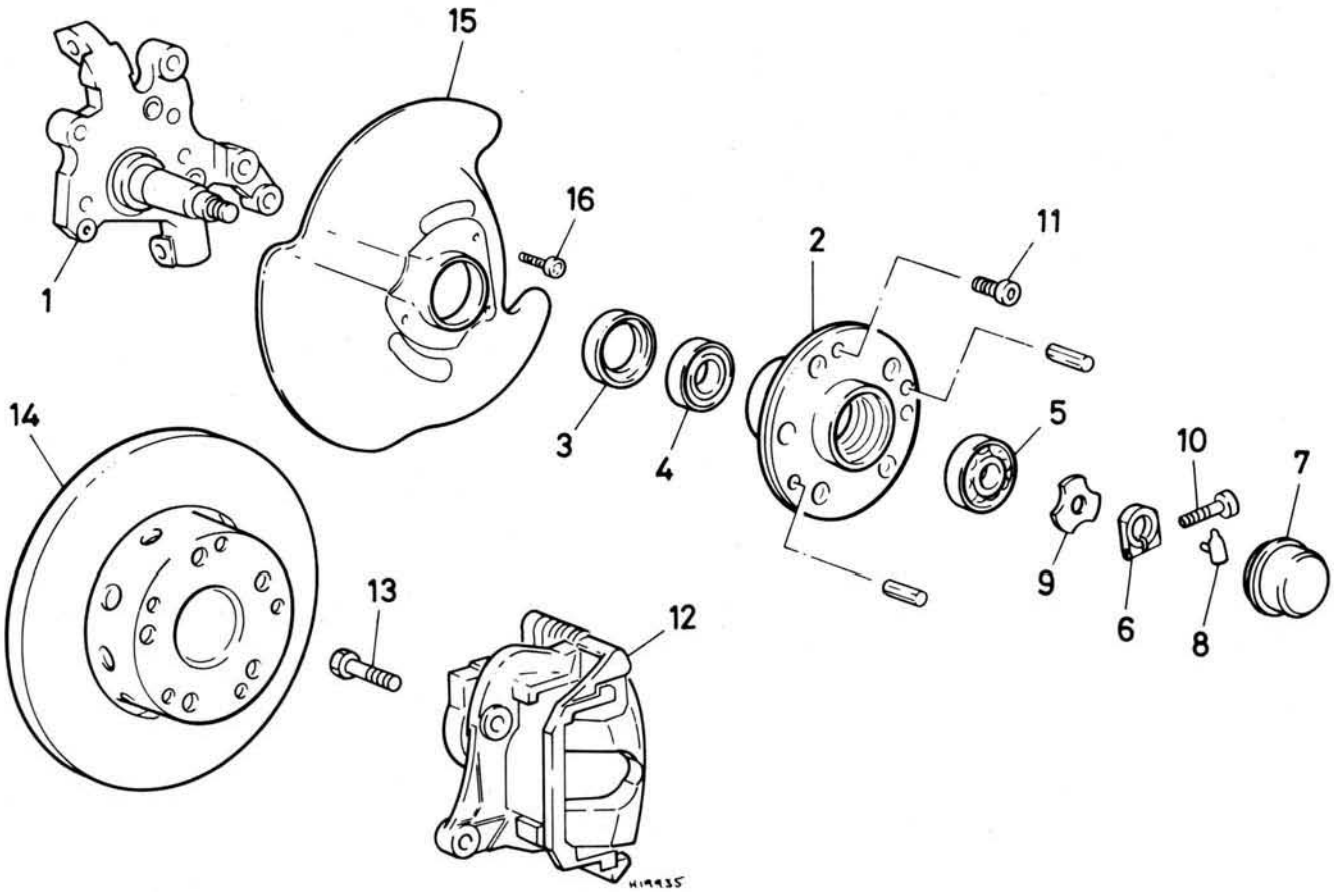
1 Loosen the wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheel.
2 Install two of the wheel bolts (with washers under their heads) into diagonally opposite wheel bolt holes, and tighten them snugly to keep the disc firmly clamped to the hub.
3 Using a small punch or blunt chisel, carefully tap off the hub cap.
4 Refer to Chapter 9 and remove the front disc pads.
5 Loosen the clamp bolt on the hub retaining nut using an Allen wrench **(see illustration)**, until the retaining nut is free to turn.
6 Tighten the retaining nut while turning the hub until the hub just becomes difficult to turn.
7 Loosen the retaining nut by approximately one-third of a turn, then strike the end of the hub spindle with a soft-faced mallet to relieve the tension on the bearing.
8 The hub endplay, as given in the Specifications, should now be approximately correct. To check this, grasp the disc at two opposite points and pull it in and out. It should be just possible to detect the slightest trace of movement as this is done. Also, if the adjustment is correct, it should just be possible to turn the thrust washer behind the hub retaining nut smoothly with one finger and with minimal force **(see illustration)**.
9 If a dial indicator is available, mount the indicator stand on the front face of the hub, with the probe in contact with the end of the spindle. Zero the scale, then pull the disc in and out as previously described. The hub endplay will be shown accurately on the gauge **(see illustration)**.
10 Repeat the adjustment procedure until the specified hub endplay is obtained, then lock the retaining nut by tightening the clamp bolt.
11 Remove the lug bolts, then install the brake pads as described in Chapter 9.
12 Install the wheel and lower the car to the ground.



3.8 The hub bearing adjustment is correct if the thrust washer can just be moved with one finger



3.9 Alternative method of checking the wheel bearing adjustment, using a dial gauge



4.6a Exploded view of the front hub and bearings

1	*Steering knuckle*	6	*Hub retaining nut*	10	*Clamp bolt*	14	*Brake disc*
2	*Front hub*	7	*Hub cap*	11	*Disc retaining screw*	15	*Disc shield*
3	*Hub seal*	8	*Radio interference contact spring*	12	*Brake caliper*	16	*Disc shield retaining bolt*
4	*Inner bearing*	9	*Thrust washer*	13	*Encapsulated bolt for the caliper carrier bracket*		
5	*Outer bearing*						

4 Front hub and wheel bearings – removal, repack and installation

Refer to illustrations 4.6a, 4.6b, 4.7, 4.8, 4.9, 4.10, 4.12, 4.16, 4.19 and 4.20

1 Loosen the wheel lug nuts, raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheel.

2 Detach the brake pad wear sensor wire from the cable clip on the suspension strut.

3 Remove the two bolts securing the brake caliper carrier bracket to the steering knuckle. **Note:** *The carrier retaining bolts are of the encapsulated type, and incorporate a thread locking compound which is activated when the bolt is tightened. The compound is ineffective after removal, so new bolts must be obtained prior to installing the caliper.*

4 Slide the caliper assembly, complete with pads, off the disc and suspend it from a convenient place under the fenderwell using string or wire. Do not let the caliper hang unsupported from the brake hose.

5 Using a small punch or blunt chisel, carefully tap off the hub cap.

6 Unscrew the disc retaining screw using an Allen wrench, and pull the disc from the locating dowels **(see illustrations)**.

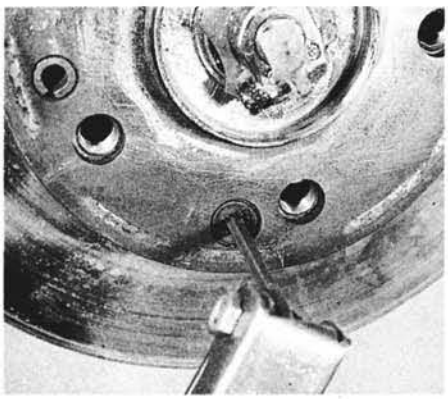
7 Remove the radio interference contact spring from the center of the hub spindle **(see illustration)**.

8 Loosen the hub retaining nut clamp bolt using an Allen wrench **(see illustration 3.5),** then unscrew the nut from the spindle and remove the thrust washer **(see illustration)**.

9 The front hub can now be withdrawn from the spindle, but if it is tight, which is quite likely, it will be necessary to use a two- or three-jawed puller, or a slide hammer **(see illustration)** to remove it. As the hub is removed, the inner bearing and its inner race is likely to come apart and remain on the spindle. If this happens, remove the bearing using a puller with its jaws engaged behind the bearing rollers.

10 With the hub removed, lift out the outer bearing, then turn the hub over and pry out the oil seal using a screwdriver **(see illustration)**.

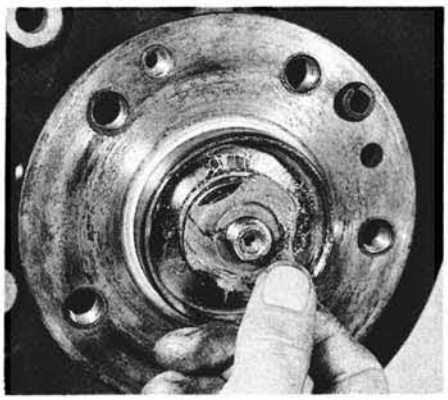
11 Lift out the inner bearing.



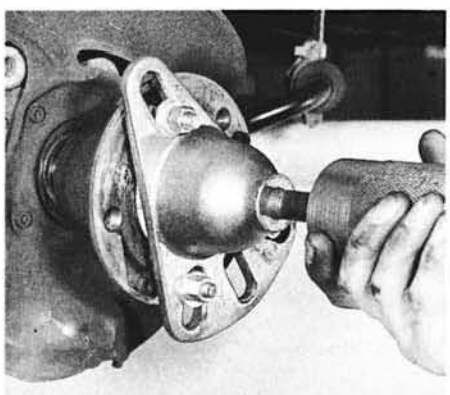
4.6b Remove the Allen-head retaining screw, then slide the disc from the hub



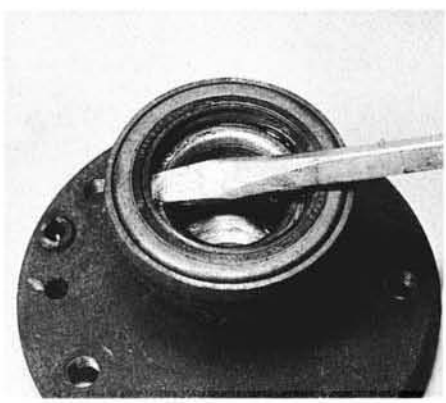
4.7 Remove the radio interference contact spring



4.8 Remove the hub nut and thrust washer



4.9 Use a slide hammer to remove the front hub from the spindle, if necessary



4.10 Pry out the hub seal using a screwdriver



4.12 If the bearings are to be replaced, knock the outer races from the hub using a long drift

12 Wipe the grease from the bearing outer races, and inspect them for scoring, bluing, pitting, cracks or other signs of wear. If they are in need of replacement, knock them out of the hub using a drift inserted through the center of the hub **(see illustration)**.

13 Wipe away the surplus grease from the bearings and hub bore, then clean these components thoroughly with solvent. Dry with a lint-free rag, or compressed air if available. Remove any burrs or score marks from the hub bore using a fine file.

14 Carefully examine the bearing rollers and roller cage for pitting, scoring, cracks or any sign of corrosion. Also check for any damage to the inner bearing caused by removal if it stayed in place on the spindle. Replace the bearings as a pair if at all suspect. It will also be necessary to replace the oil seal, as this will definitely have been damaged during removal.

15 Using the old bearing races or a large socket as a driver, drive the outer races into the hub until they contact their respective shoulders in the hub bore. Ensure that the races are kept square as they are driven in.

16 Use high temperature wheel bearing grease to pack the bearings. Work the grease completely into the bearings, forcing it between the rollers and cage, from the back side **(see illustration)**.

17 Coat the outer race of the inner bearing in the hub with wheel bearing grease. Place the inner bearing in the hub, lubricate the sealing lip and cavity of the new oil seal, and carefully tap the seal into place using a hammer and block of wood.

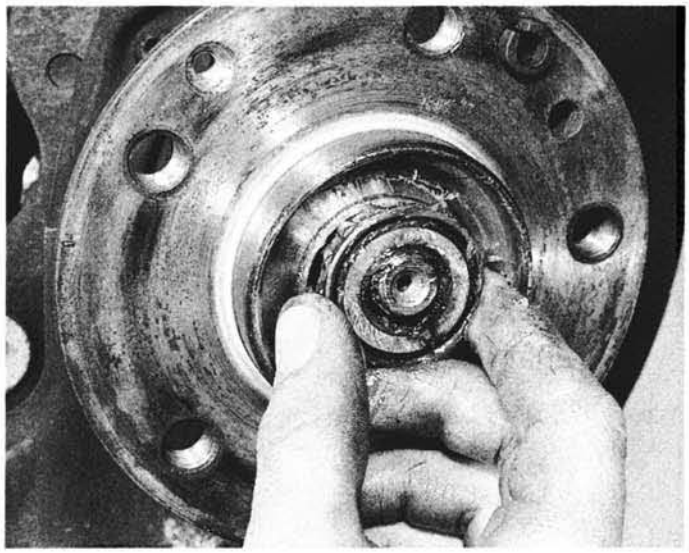
18 Add an additional amount of grease to the space between the bearings in the bore, then place the hub in position over the spindle.



4.16 Work the grease completely into the rollers



4.19 Tap the hub onto the spindle using a large socket or piece of pipe



4.20 Pack the outer bearing with grease and insert it into the hub

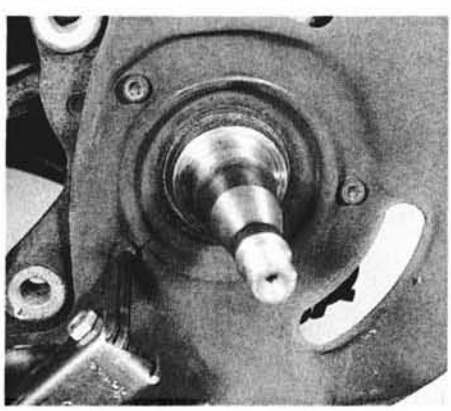
19 Tap the hub into place using a hammer and large socket or piece of pipe **(see illustration)**.
20 Place the outer bearing inner race in the hub **(see illustration)**, followed by the thrust washer and retaining nut. Tighten the retaining nut finger-tight only at this stage.
21 Install the brake disc, ensuring that the disc and hub contact surfaces are clean and dry. Secure the disc with the retaining screw, where applicable.
22 Adjust the front wheel bearings using the procedure described in Section 3.
23 Install the radio interference contact spring, then install the hub cap.
24 Place the caliper over the disc, and secure it with two new encapsulated retaining bolts, tightened to the torque specified in Chapter 9. Install the wear sensor wire to its cable clip.
25 Install the wheel and lower the car to the ground.

5 Steering knuckle – removal and installation

Refer to illustrations 5.4, 5.7a, 5.7b, 5.7c, 5.8, 5.9 and 5.10

Removal

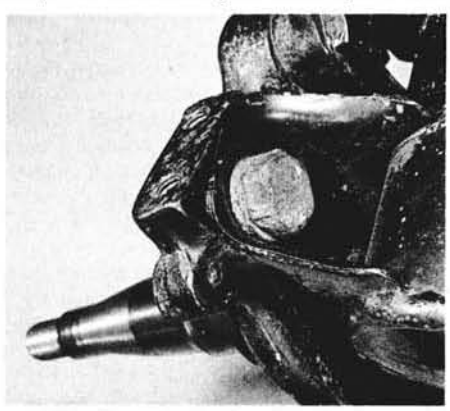
1 Loosen the wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheel.
2 Remove the front hub using the procedure described in Section 4.
3 On cars equipped with ABS brakes, remove the front wheel speed sensor from the steering knuckle, as described in Chapter 9.
4 Using an Allen wrench, unscrew the three bolts securing the disc shield to the steering knuckle, and remove the shield **(see illustration)**.
5 Remove the nut securing the tie-rod end to the steering arm. Separate the joint from the steering arm using a balljoint separator tool (see Section 33).
6 Position a floor jack beneath the control arm and in contact with it. Make sure the jack is secure, as the full force of the coil spring will be taken by the jack when the steering knuckle is removed. It is advisable to retain the spring using coil spring compressors, or loop a length of chain up through the spring and bolt the chain together, for added safety.
7 Remove the two lower bolts securing the suspension strut to the steering knuckle **(see illustrations)**. **Note:** *These two bolts are of the encapsulated type, and incorporate a thread locking compound which is activated when the bolt is tightened. The compound is ineffective after removal, so new bolts must be obtained prior to installing the steering knuckle.*
8 Remove the upper nut and bolt securing the strut to the steering knuckle, and ease the steering knuckle away from the strut **(see illustration)**.
9 Unscrew the nut and remove the pinch bolt securing the steering knuckle to the control arm balljoint **(see illustration)**.
10 Separate the steering knuckle from the balljoint stud and remove it from the car **(see illustration)**. If the knuckle is tight on the balljoint shank



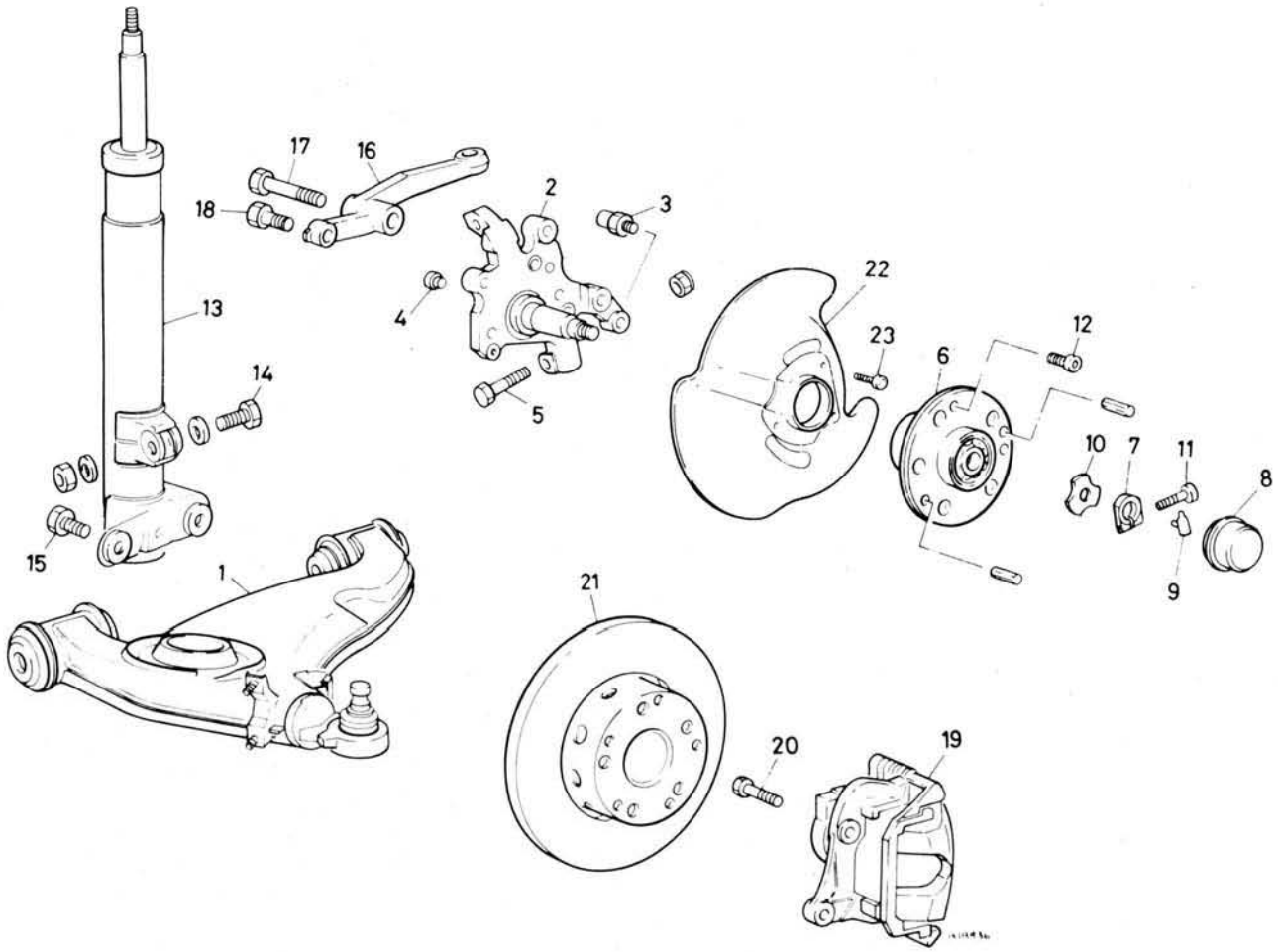
5.4 Remove the disc shield retaining bolts, then lift the shield from the steering knuckle



5.7a Strut-to-steering knuckle lower front bolt

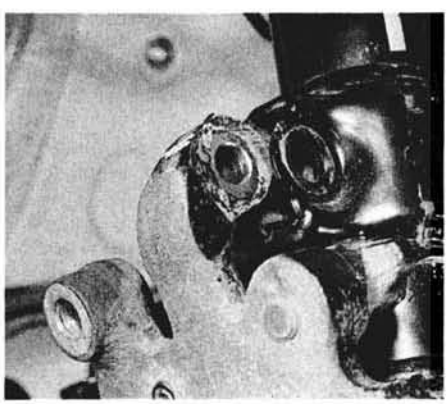


5.7b Strut-to-steering knuckle lower rear bolt



5.7c Exploded view of the steering knuckle, suspension strut and related components

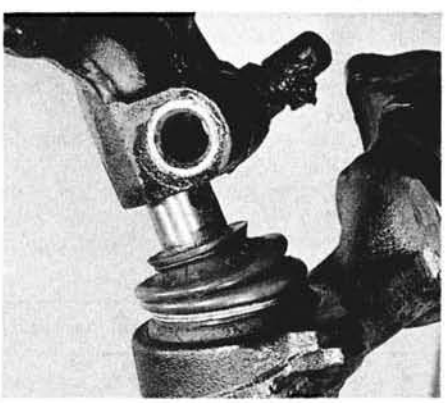
1	*Control arm*	8	*Hub cap*	14	*Strut-to-steering knuckle upper retaining bolt*	19	*Disc caliper*
2	*Steering knuckle*	9	*Radio interference contact spring*	15	*Strut-to-steering knuckle lower retaining bolt*	20	*Caliper carrier bracket encapsulated bolt*
3	*Steering lock stop*	10	*Thrust washer*	16	*Steering knuckle arm*	21	*Disc*
4	*Locating peg*	11	*Clamp bolt*	17	*Arm retaining bolt (long)*	22	*Disc shield*
5	*Steering knuckle pinch bolt*	12	*Disc retaining screw*	18	*Arm retaining bolt (short)*	23	*Disc shield retaining bolt*
6	*Front hub*	13	*Suspension strut*				
7	*Hub retaining nut*						



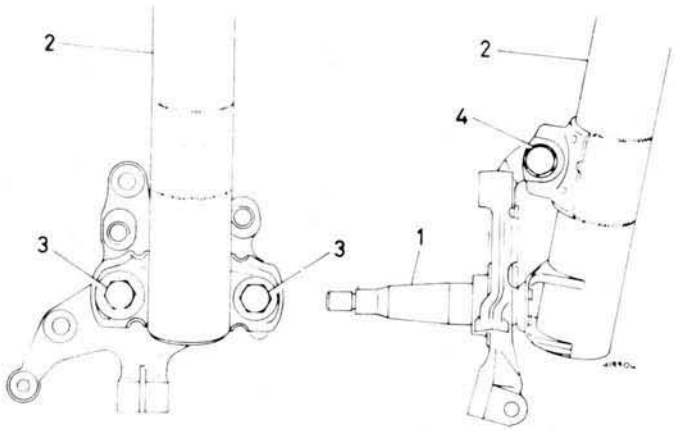
5.8 Remove the upper nut and bolt, then separate the strut from the steering knuckle



5.9 Remove the steering knuckle-to-control arm nut and pinch-bolt



5.10 Withdraw the steering knuckle from the control arm balljoint – if it's stuck, spread the pinch joint gap with a screwdriver



6.4a Suspension strut-to-steering knuckle mounting details

1 Steering knuckle
2 Suspension strut
3 Lower mounting bolts (encapsulated)
4 Upper nut and bolt

due to corrosion, liberally apply penetrating fluid, then spread the knuckle clamp slightly using a pry bar.

11 Check the steering knuckle for any signs of damage or distortion, paying particular attention to the steering arm and the hub spindle areas. Check that the hub bearing oil seal contact area on the spindle is free from rust or wear grooves, and touch up with fine emery paper if necessary. If the contact area is scored or deeply grooved, replace the knuckle. Also check for scoring or damage on the hub bearing inner race contact areas on the spindle. Again, replace the knuckle if these are damaged. The steering arm can be replaced separately after undoing the two bolts if any damage or distortion is evident.

Installation

12 Install the steering knuckle to the control arm balljoint and secure with the pinch-bolt, tightened to the specified torque.

13 Position the steering knuckle against the strut and fit the two new encapsulated bolts, but do not tighten the bolts at this stage.

14 Install the upper knuckle-to-strut retaining bolt and nut, but tighten the nut only lightly at this stage.

15 Now tighten the two encapsulated bolts to the specified torque, followed by the upper nut and bolt.

16 Remove the spring compressors or safety chain (if installed) and the jack from under the control arm.

17 Install the disc shield and secure with the three bolts.

18 Connect the tie-rod balljoint with the steering arm and install the retaining nut. Hold the balljoint stud using an Allen wrench, and tighten the retaining nut.

19 On cars with ABS brakes, install the front wheel speed sensor as described in Chapter 9.

20 Install the front hub, disc and caliper as described in Section 4 and Chapter 9, then adjust the front wheel bearings as described in Section 3.

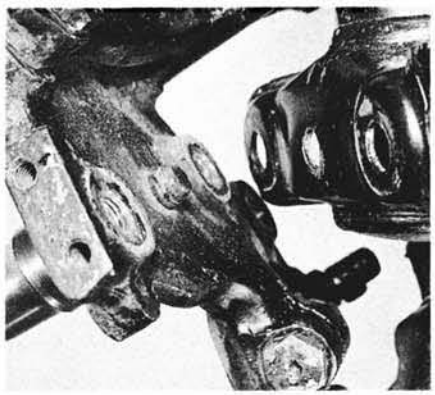
21 Install the wheel and lower the car to the ground.

6 Front suspension strut – removal and installation

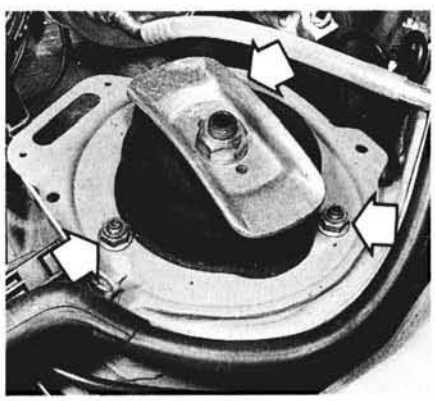
Refer to illustrations 6.4a, 6.4b, 6.6a, 6.6b and 6.7

Removal

1 Loosen the wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheel.



6.4b Removing the suspension strut from the steering knuckle



6.6a Suspension strut upper mounting-to-body turret nuts (arrows)

2 Position a floor jack beneath the control arm and in contact with it. Make sure that the jack is secure, as the full force of the coil spring will be taken by the jack when the suspension strut is removed. It is advisable to retain the spring using coil spring compressors, or loop a length of chain up through the spring and bolt the chain together, for added safety.

3 Remove the two lower bolts securing the suspension strut to the steering knuckle. **Note:** *These two bolts are of the encapsulated type, and incorporate a thread locking compound which is activated when the bolt is tightened. The compound is ineffective after removal, so new bolts must be obtained prior to installing the suspension strut.*

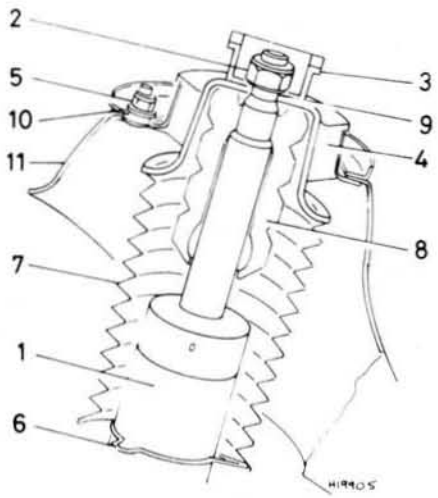
4 Remove the upper nut and bolt securing the strut to the steering knuckle, and ease the knuckle away from the strut **(see illustrations)**.

5 Disconnect any wiring, cables or hoses from their clips on the strut body.

6 From within the engine compartment, remove the three nuts securing the strut upper mount to the body turret **(see illustrations)**, and guide the strut out from under the fenderwell.

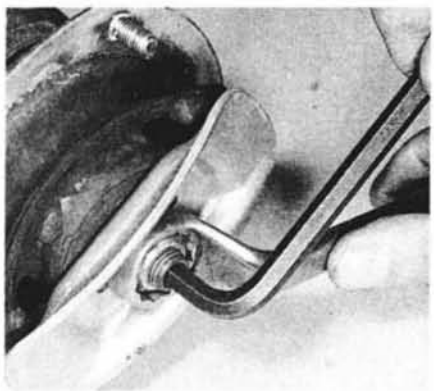
7 If required, the upper mount can be removed by unscrewing the retaining nut while holding the strut rod with an Allen wrench **(see illustration)**. Lift off the upper mount, followed by the dust cover and the rubber bump-stop.

8 Examine the strut for signs of fluid leakage. Check the strut rod for signs of wear or pitting along its entire legnth, and check the strut body for signs of damage. Test the operation of the strut, while holding it in an upright position, by moving the rod through a full stroke, then through short strokes of about half the total spindle travel. In both cases, the resistance felt should be smooth and continuous. If the resistance is jerky or uneven, or if there is any visible sign of wear or damage to the strut, replacement is necessary.



6.6b Suspension strut upper mounting details

1	*Suspension strut*	6	*Dust cover support ring*
2	*Strut rod retaining nut*	7	*Dust cover*
3	*Rebound stop*	8	*Bump stop*
4	*Upper mount*	9	*Washer*
5	*Upper mount retaining nut*	10	*Washer*
		11	*Body turret*



6.7 Hold the strut rod with an Allen wrench and loosen the retaining nut to remove the upper mount

7 Front coil spring – removal and installation

Refer to illustrations 7.3, 7.5, 7.7, 7.9 and 7.10

Removal

1 Loosen the wheel lug bolts, raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheel.

2 Remove the front suspension strut and the steering knuckle. The steering knuckle may remain attached to the strut (remove them as a unit) (see Sections 5 and 6).

3 Using coil spring compressors positioned on either side of the spring, compress the spring evenly until there is no tension on the upper spring seat or control arm **(see illustration)**.

4 Unscrew the two nuts securing the anti-roll bar clamp plate to the control arm. Remove the plate and slide the rubber bushing clear of the mount.

5 Using a large pry bar, lever the control arm down and pull the lower end of the spring from its control arm seat. Pull the spring down, out of its upper mount and remove it from the car **(see illustration)**.

6 If the spring is to be replaced, or left off the car for some time, carefully and evenly loosen the spring compressors and remove them from the spring. Remove the rubber upper mounting cup.

Installation

7 Before installation, compress the spring evenly, ensuring that with the compressors fitted on each side, the lower spring end faces forwards and to the right **(see illustration)**.

8 Install the rubber upper mounting cup over the top of the spring.

Installation

9 Install the bump-stop, dust cover and strut upper mount, and secure the mount with the retaining nut.

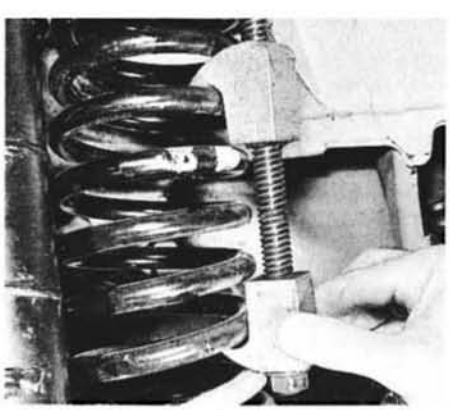
10 Position the strut under the fenderwell and engage the mounting studs with the turret holes. Install and tighten the three upper mount retaining nuts.

11 Install the two new encapsulated bolts securing the lower part of the strut to the steering knuckle, then the upper nut and bolt. Tighten the two lower bolts, followed by the upper nut and bolt, in that order, to the specified torque.

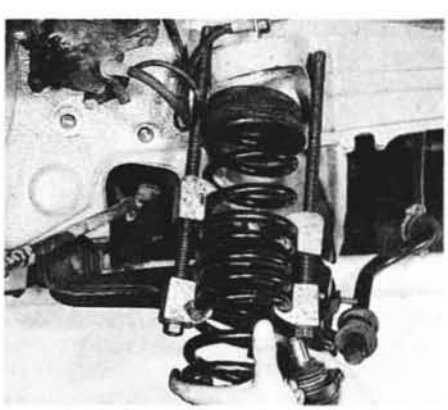
12 Remove the spring compressors or safety chain (if installed) and the jack from under the control arm.

13 Install the wiring, cables or hoses as applicable to the clips on the strut body.

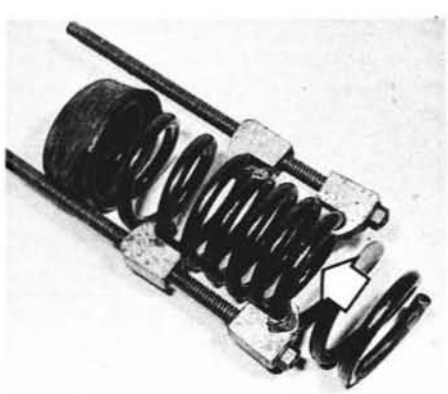
14 Install the wheel and lower the car to the ground.



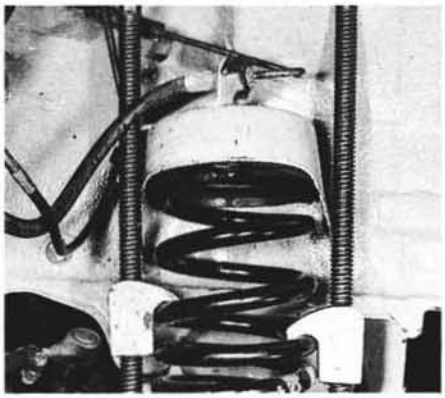
7.3 Using coil spring compressors to compress the spring



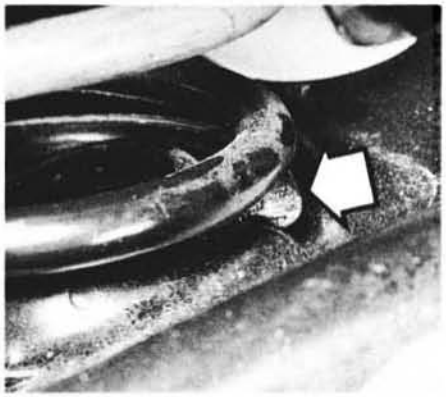
7.5 Front coil spring removal



7.7 When installing, position the spring compressors in relation to the spring end (arrow) as shown



7.9 Locate the spring in its upper seat



7.10 Engage the lower end of the spring with the register in the control arm (arrow)

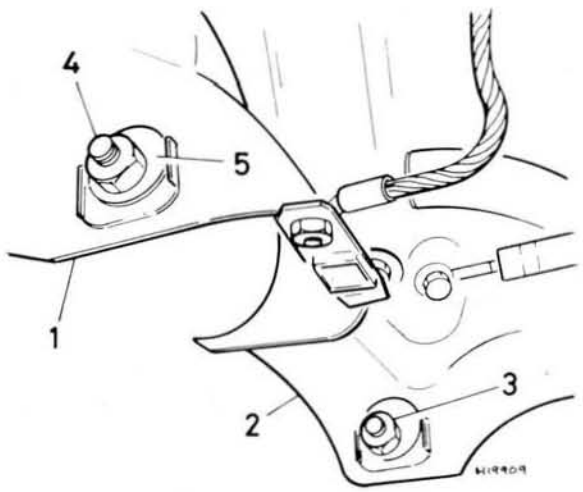
9 Pry the control arm down and push the spring up into its upper mount **(see illustration)**.
10 Engage the lower end of the spring in the control arm with the spring end resting in the depressed portion of the seat **(see illustration)**.
11 Install the suspension strut and steering knuckle. Connect the control arm to the knuckle (see Sections 5 and 6).
12 Remove the spring compressors.
13 Slide the anti-roll bar bushing into its mount, install the clamp plate and secure with the two nuts.
14 On cars equipped with ABS brakes, feed the wiring through the wheel arch and fit the grommet to its location. Reconnect the electrical connector in the engine compartment.
15 Install the brake caliper (see Chapter 9).
16 Connect the tie-rod balljoint to the steering arm (see Section 33).
17 Reconnect the brake pad wear sensor wire to the cable clip on the suspension strut.
18 Install the wheel and lower the car to the ground.

8 Control arm – removal and installation

Refer to illustration 8.5

Removal

1 Loosen the wheel lug nuts, raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheel.
2 Remove the engine undertray on models so equipped.
3 Remove the coil spring (see Section 7).
4 Accurately mark the position of both control arm inner mounting bolts, by drawing a vertical line on the chassis member above and directly in line with the bolt center-line. The control arm inner mounts are adjustable in a lateral plane, for camber and caster angle corrections, by means of an elongated bolt hole and an eccentric pin (mounting bolt). If the existing position of the mounting bolt is marked prior to removal, the settings will not be lost on reassembly.
5 Unscrew the two inner mounting bolt retaining nuts and eccentric washers, then remove both the bolts **(see illustration)**. Tap the bolts out using a small punch if necessary.
6 Using a pry bar, ease the control arm inner mounts out of their locations.
7 With the control arm removed, check it carefully for signs of damage, and check the condition of the inner mounting bushings, balljoint dust boot and the balljoint itself. Should any of these components show signs of wear or damage, replace them using the procedures described in the appropriate sections of this Chapter.

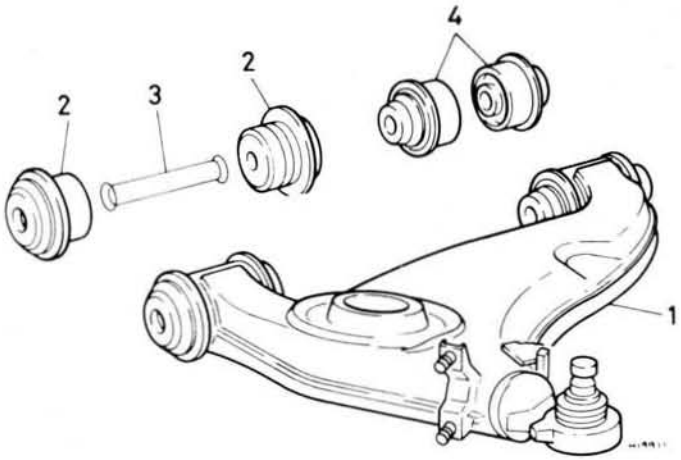


8.5 Front control arm inner mounts

1 Chassis member
2 Crossmember
3 Front mounting eccentric bolt
4 Rear mounting eccentric bolt
5 Eccentric washer

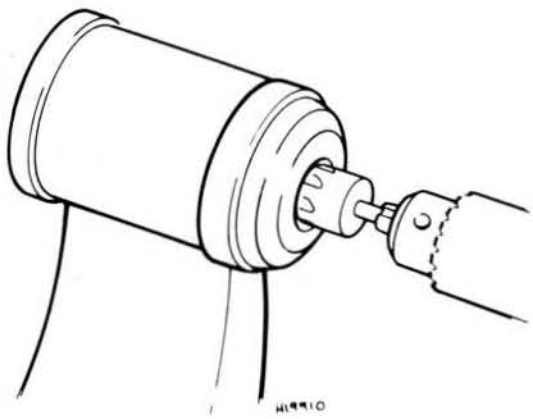
Installation

8 Lubricate the control arm inner mounting bushings with rubber grease, then position the control arm in the chassis member.
9 Insert the mounting bolts with their bolt heads facing each other, followed by the eccentric washers and retaining nuts. Do not tighten the nuts at this stage.
10 Install the coil spring and connect the control arm balljoint to the steering knuckle.
11 Slide the anti-roll bar rubber bushing into position, install the clamp plate and secure with the two nuts.
12 Install thewheel and lower the car to the ground.
13 Roll the car forwards and backwards to settle the suspension.
14 Turn the inner mounting bolts, using a wrench on the bolt heads, until the bolt center-line is positioned in line with the previously-made mark. Hold the bolts in position while tightening the retaining nuts to the specified torque.
15 Install the engine undertray where applicable.
16 If a new control arm has been installed, new bushings installed, or if the bolt positions were not marked prior to removal, have the wheel alignment and steering angles checked by a Mercedes-Benz dealer service department or an alignment shop (see Section 35).



9.3a Front control arm bushings

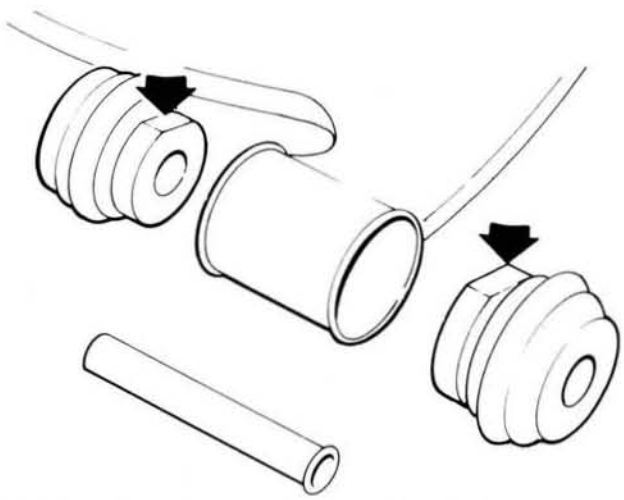
1 Front control arm
2 Front bushing halves
3 Clamping sleeve
4 Rear bushing halves



9.3b Use a drill to remove the flared end on the control arm front bushing clamping sleeve



9.4 Use a punch to knock out the control arm front bushing sleeve



9.7 Control arm front bushings must be installed with their flats (arrows) facing up

9 Control arm bushings – replacement

Refer to illustrations 9.3a, 9.3b, 9.4, 9.7 and 9.13

1 Remove the control arm as described in Section 8.

Front bushing

2 Clamp the control arm securely in a vise, with the front bushing at the top.

3 Using a large drill bit, drill out the flared end of the clamping sleeve in the center of the bushing **(see illustrations)**.

4 Using a punch, knock the clamping sleeve through, and remove it from the other end of the bushing **(see illustration)**.

5 Using a drift against the bushing collar, knock out the two bushing halves from the control arm front mounting.

6 Thoroughly clean the bushing bore in the control arm using fine emery paper, if necessary, to remove any corrosion.

7 Lubricate the two new bushing halves with rubber grease, and place one of them in position on the control arm with the flat on the bushing facing up **(see illustration)**.

8 Using a socket or tube of suitable diameter, press the bushing into the control arm with the aid of the vise.

9 Repeat paragraphs 7 and 8 for the other bushing half.

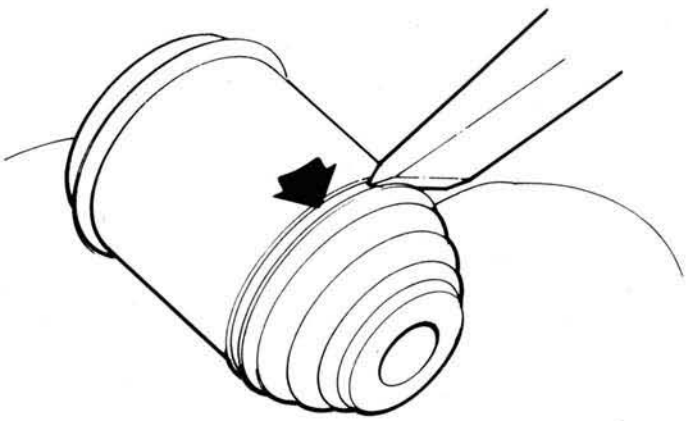
10 Insert a new clamping sleeve through the center of the bushings, then flare the end of the sleeve to secure the bushings. Use a tapered tool for this, such as the shank of a tapered drift.

Rear bushing

11 Clamp the control arm securely in a vise, with the rear mounting facing up.

12 Insert a large screwdriver or metal bar into the center of one of the bushing halves, and move it up and down to help free the bushing from its location.

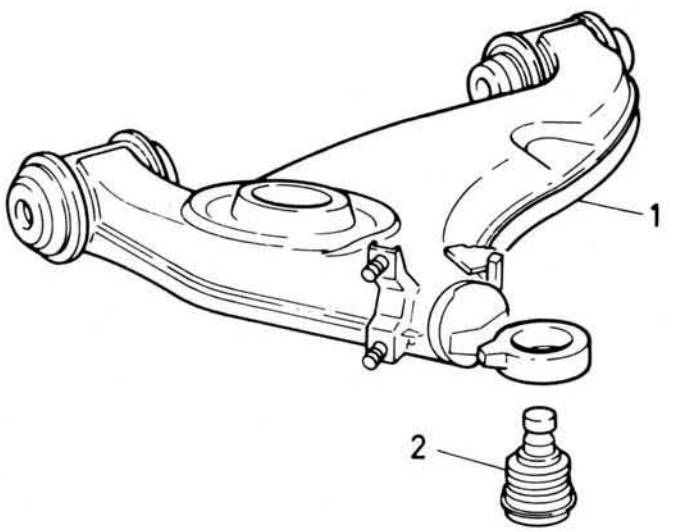
13 Tap out the bushing, using a chisel against the bushing flanged edge



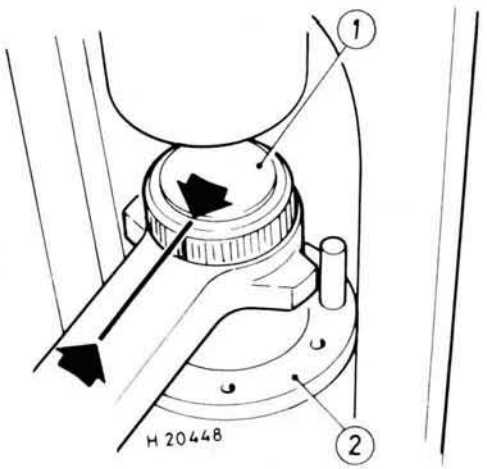
9.13 Use a chisel to knock out the control arm rear bushing



10.2 Use a small screwdriver to pry out the balljoint dust boot retaining clip



10.4a Front control arm (1) and balljoint (2)



10.4b Balljoint groove aligned with center of control arm boss

1 Balljoint 2 Hydraulic puller and adaptor for installing balljoint

Arrows indicate groove and control arm center-line

(see illustration). With the first bushing half removed, tap out the second, using a drift through the control arm bushing bore.

14 Thoroughly clean the bushing bore in the control arm using fine emery paper, if necessary, to remove any corrosion.

15 Position both new bushing halves in the control arm so that the slit in the bushing metal jacket is towards and aligned with the welded seam of the control arm.

16 Draw the bushing halves into place using a long bolt, nut and flat washers.

17 On completion install the control arm as described in Section 8.

10 Control arm balljoint – removal and installation

Refer to illustrations 10.2, 10.4a and 10.4b

Removal

1 Remove the front control arm as described in Section 8.

2 Pry out the retaining wire clips, and remove the dust boot from the balljoint **(see illustration)**.

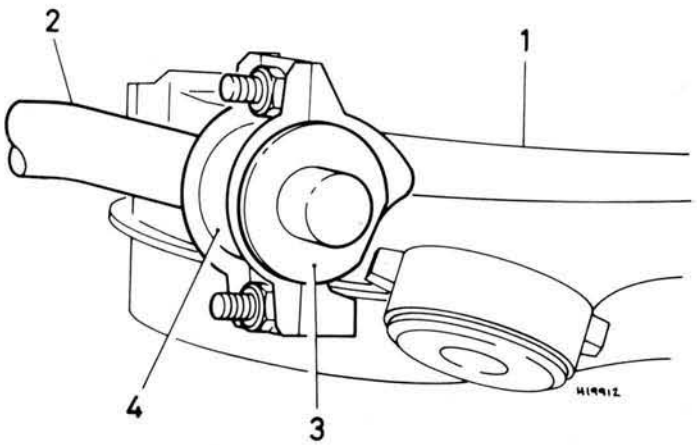
3 The balljoint can now be pressed downwards out of the control arm. It is possible to do this using a sturdy vise with suitable pieces of tubing as distance pieces, and mandrels, but the use of a hydraulic press is preferable. If a press isn't available, it is recommended to take the control arm to a dealer service department or other repair shop, and have them press out the joint and install the new one for you.

Installation

4 Install the new balljoint using the same procedure as for removal, but ensure that the groove on the upper flange of the joint is towards the center of the control arm boss **(see illustrations)**.

5 Place the new dust boot over the balljoint and install the retaining wire clips (see Section 11).

6 Install the control arm as described in Section 8.



12.2 Anti-roll bar mounting clamp details

1 Control arm
2 Anti-roll bar
3 Bushing
4 Clamp plate

11 Balljoint dust boots – replacement

1 The dust boots over the control arm, tie-rod and drag link balljoints can be individually replaced if their condition has deteriorated, or if they have been damaged during a removal and installation operation. Should a damaged dust boot be discovered during routine maintenance, it is likely that water and dirt will have entered the balljoint, causing rapid wear. In this case the affected balljoint or drag link, as applicable, should be replaced.
2 Separate the balljoint stud from its component attachment with reference to the relevant Sections of this Chapter.
3 Remove the two retaining wire clips securing the dust boot to the balljoint housing and stud **(see illustration 10.2).**
4 Remove the dust boot and wipe out the old grease from the joint. Do not clean the joint with any solvents.
5 Pack the joint with molybdenum disulphide grease, then install the new dust boot and secure with the two wire clips. When installing the large clip, place a tube or socket over the dust boot, then slide the clip over the tube or socket and into position.
6 Reconnect the balljoint stud to its component attachment.

12 Front anti-roll bar – removal and installation

Refer to illustrations 12.2 and 12.4

1 Loosen the lug bolts on both front wheels, raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheels.
2 Unscrew the nuts and remove the clamp plates securing the anti-roll bar to both front control arms, and to the mounting brackets on the front chassis members **(see illustration)**.
3 Pull the anti-roll bar forwards and remove it from under the car.
4 If the mounting bushings are deteriorated and in need of replacement, slide them off the ends of the anti-roll bar, then slide on the new bushings after first lubricating them with rubber grease **(see illustration)**.
5 Installation is the reverse of removal.

13 Rear hub carrier – removal and installation

Refer to illustrations 13.5 and 13.6

Removal

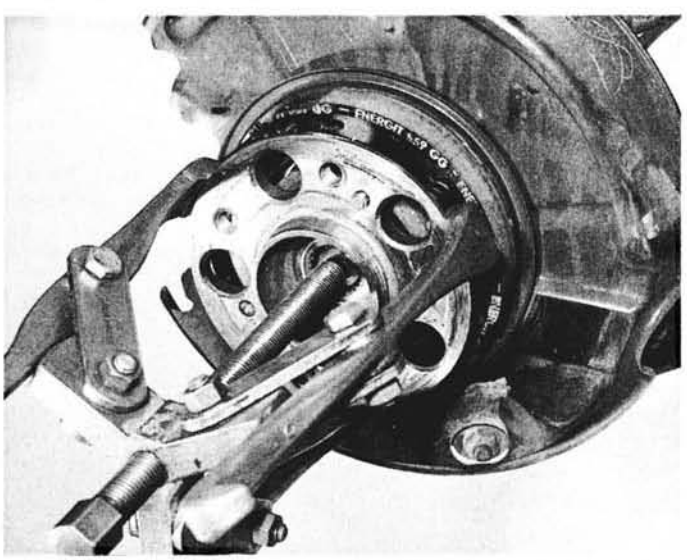
1 Remove the driveaxle hub nut following the procedure described in Chapter 8. Loosen the rear wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels.
2 Remove the rear brake caliper and support it out of the way with a piece of wire (see Chapter 9).
3 Remove the rear brake disc and handbrake shoes (see Chapter 9).
4 Detach the handbrake cable from the rear hub carrier (see Chapter 9 if necessary).
5 Disconnect the camber strut, pulling strut, pushing strut, track rod and spring support arm from the hub carrier, following the procedures outlined in Sections 15 through 19 **(see illustration on next page)**.
6 Push, or gently tap, the stub shaft and outer constant velocity joint out of the hub flange, while at the same time withdrawing the hub carrier assembly from the car. If the constant velocity joint is tight, release it from the hub flange using a puller **(see illustration)**.



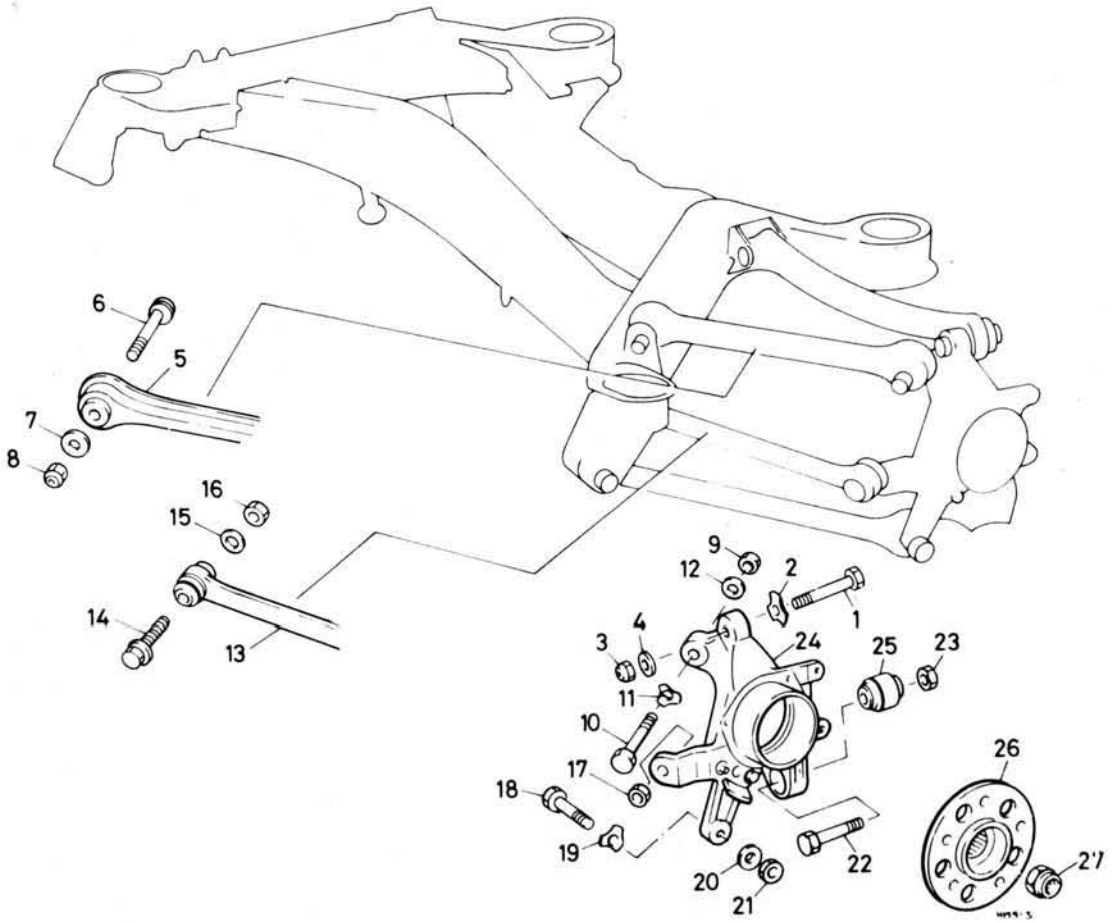
12.4 The anti-roll bar bushing can be slid off the bar – if its old and hardened, cut it off

Installation

7 Installing the hub carrier is the reverse of removal, but bear in mind the following points:
a) Tighten all retaining nuts and bolts to the specified torque.



13.6 Using a puller to separate the driveaxle constant velocity joint from the hub flange



13.5 Rear hub carrier attachment details

1 *Camber strut mounting bolt*
2 *Contour disc*
3 *Retaining nut*
4 *Washer*
5 *Pulling strut*
6 *Pulling strut eccentric mounting bolt*
7 *Eccentric washer*
8 *Retaining nut*
9 *Retaining nut*
10 *Pulling strut mounting bolt*
11 *Contour disc*
12 *Washer*
13 *Track rod*
14 *Track rod eccentric mounting bolt*
15 *Eccentric washer*
16 *Retaining nut*
17 *Retaining nut*
18 *Pushing strut mounting bolt*
19 *Contour disc*
20 *Washer*
21 *Retaining nut*
22 *Spring support arm retaining bolt*
23 *Retaining nut*
24 *Hub carrier*
25 *Spring support arm bushing*
26 *Hub flange*
27 *Driveaxle retaining collar nut*

b) When installing the camber strut and pushing strut, ensure that the contour disc is located behind the retaining bolt head and the washer (where fitted), behind the nut.
c) Before tightening the strut, tie-rod or spring support arm mountings, place a jack beneath the spring support arm and raise the suspension assembly until the driveshaft is horizontal.
d) Use new encapsulated bolts to retain the brake caliper, and a new driveaxle retaining collar nut.
e) Tighten the driveaxle collar nut with the car standing on its wheels, then stake the collar into the stub shaft groove using a small punch.

14 Rear hub bearings – removal and installation

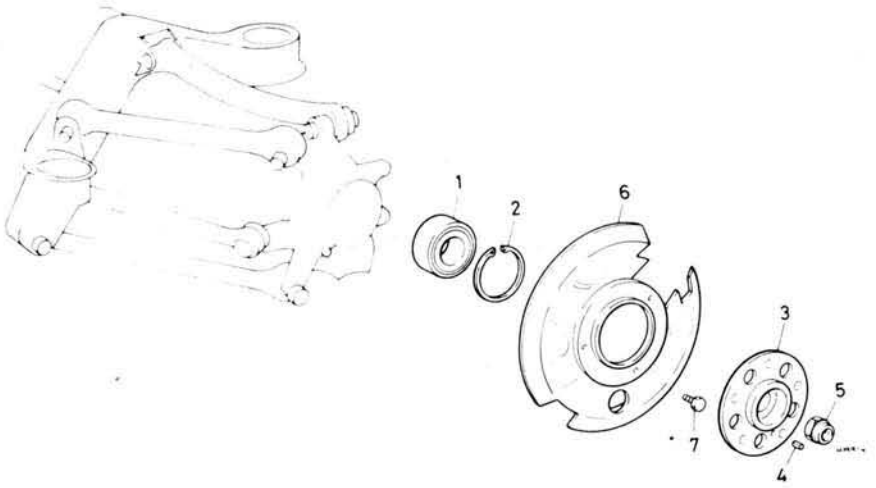
Refer to illustrations 14.5 and 14.11

Removal

1 Remove the rear hub carrier as described in Section 13.
2 Support the hub carrier securely in a vise, and drive out the hub flange using a hammer and drift or suitable tube.
3 As the hub flange is removed, the bearing will come apart and the inner race will then have to be removed from the hub flange. This is best done by obtaining an exhaust system U-clamp which is a snug fit in the inner race ball track. Place the U-clamp in the ball track and locate the legs of a puller behind the clamp. Use a washer or piece of metal over the end of the hub flange as a thrust piece for the puller, and draw off the bearing race.
4 Unscrew the bolts and remove the disc shield from the hub carrier.
5 Using circlip pliers, extract the bearing retaining circlip **(see illustration)**.
6 Place the hub carrier face down in the vise, and drive the bearing down and out of the hub carrier using a hammer and drift.
7 Clean the hub carrier and remove any burrs from the bore using a scraper and emery paper.

Installation

8 Install the new bearing, either by pushing it in between the jaws of the vise, or by using a long bolt, nut and large washers to draw it into the hub carrier bore. Ensure that the bearing is inserted fully into the hub carrier until it contacts the hub carrier shoulder.
9 Install the bearing retaining circlip.
10 Install the disc shield and tighten the bolts securely.



14.5 Rear hub and bearing components

1 *Rear hub bearing*
2 *Circlip*
3 *Hub flange*
4 *Dowel*
5 *Driveaxle retaining collar nut*
6 *Disc shield*
7 *Allen-head bolt*

11 Using a similar method to that used for installing the bearing, install the hub flange, but make sure that the inner race is supported, otherwise it will be pushed out as the hub flange is installed. Illustration 14.11 shows the manufacturer's special tool for this purpose, to give an idea of the arrangement.

12 Install the rear hub carrier to the car as described in Section 13.

15 Camber strut – removal and installation

Refer to illustration 15.2

Removal

1 Loosen the rear wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels. Remove the wheel.

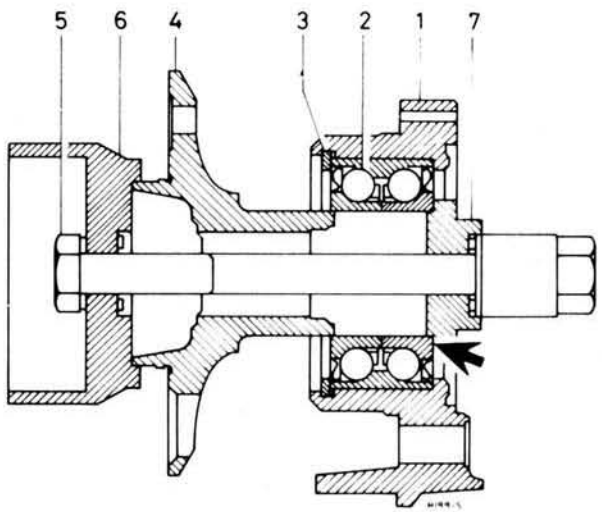
2 Unscrew the nut and remove the bolt securing the inner end of the camber strut to the rear subframe **(see illustration)**.

3 Unscrew the nut and washer, and remove the bolt and contour disc securing the camber strut to the hub carrier.

4 Pry the strut sideways to separate the mounting sleeve from the hub carrier.

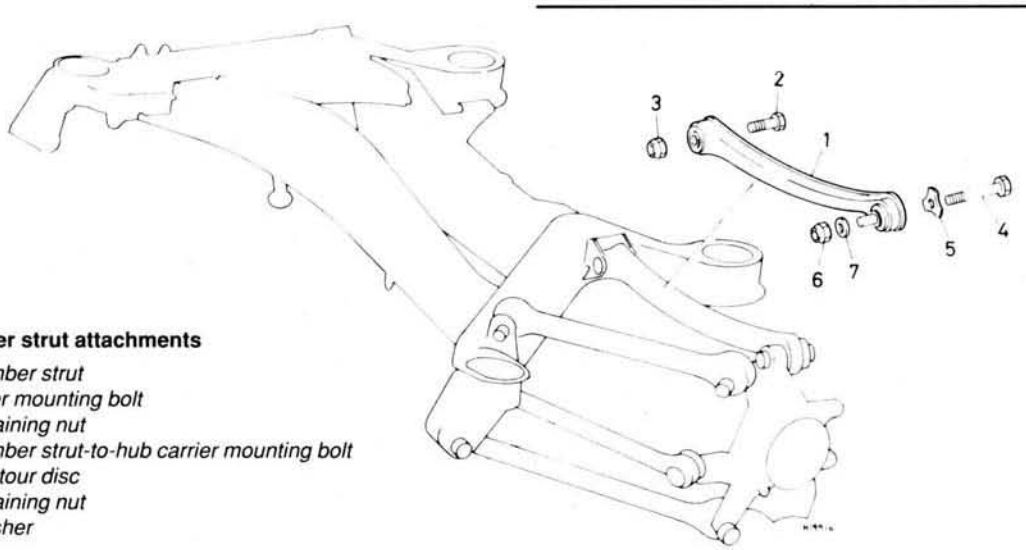
5 Detach the inner end of the camber strut from its location, pull the hub carrier outwards, then remove the strut from the vehicle.

6 Check the camber strut rubber bushings for signs of deterioration and, if apparent, replace the strut. The bushings can't be individually replaced.



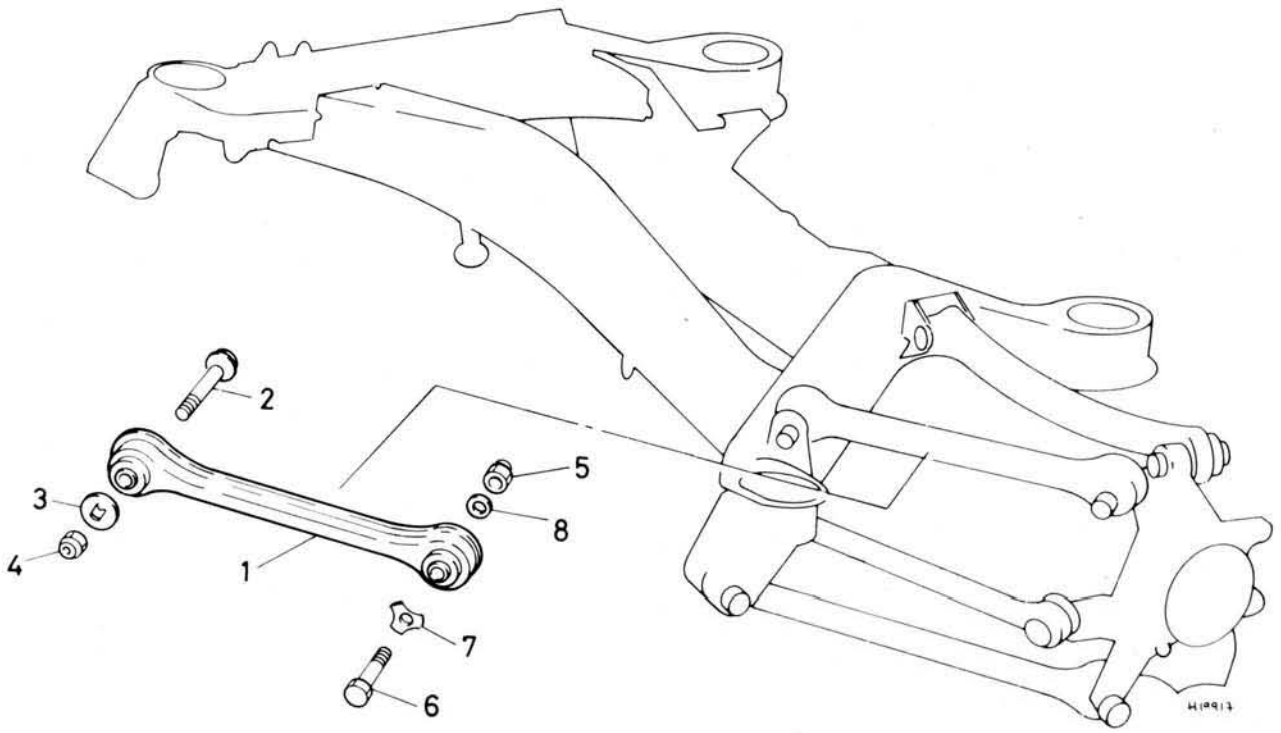
14.11 Manufacturer's special tool for installing rear hub flange

1 *Hub carrier*
2 *Hub bearing*
3 *Circlip*
4 *Hub flange*
5 *Tool through-bolt*
6 *Pressing collar*
7 *Thrust piece in contact with inner race (arrow)*



15.2 Camber strut attachments

1 *Camber strut*
2 *Inner mounting bolt*
3 *Retaining nut*
4 *Camber strut-to-hub carrier mounting bolt*
5 *Contour disc*
6 *Retaining nut*
7 *Washer*



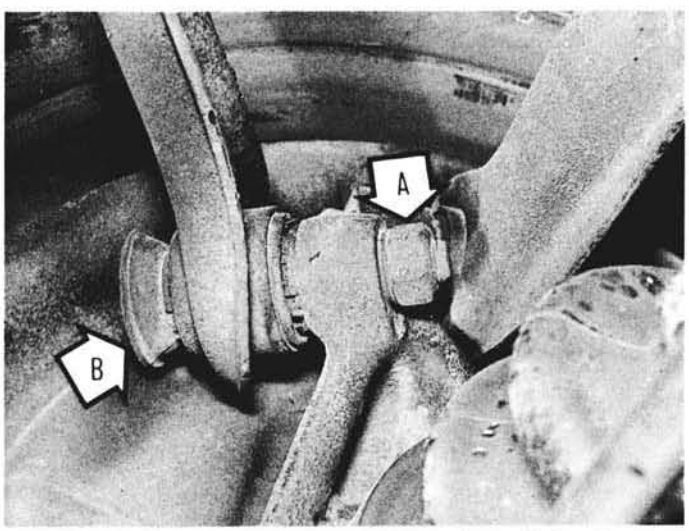
16.2 Pulling strut attachments

1 *Pulling strut*
2 *Eccentric mounting bolt*
3 *Eccentric washer*
4 *Retaining nut*
5 *Retaining nut*
6 *Pulling strut-to-hub carrier mounting bolt*
7 *Contour disc*
8 *Washer*

Installation

7 Installation is the reverse of removal, bearing in mind the following points:

a) Tighten the retaining nuts to the specified torque, but before doing so, raise the rear suspension so the driveaxle is horizontal by means of a jack under the spring support arm.
b) When installing the outer retaining bolt, ensure that the contour disc is located behind the bolt head, and the washer behind the nut.



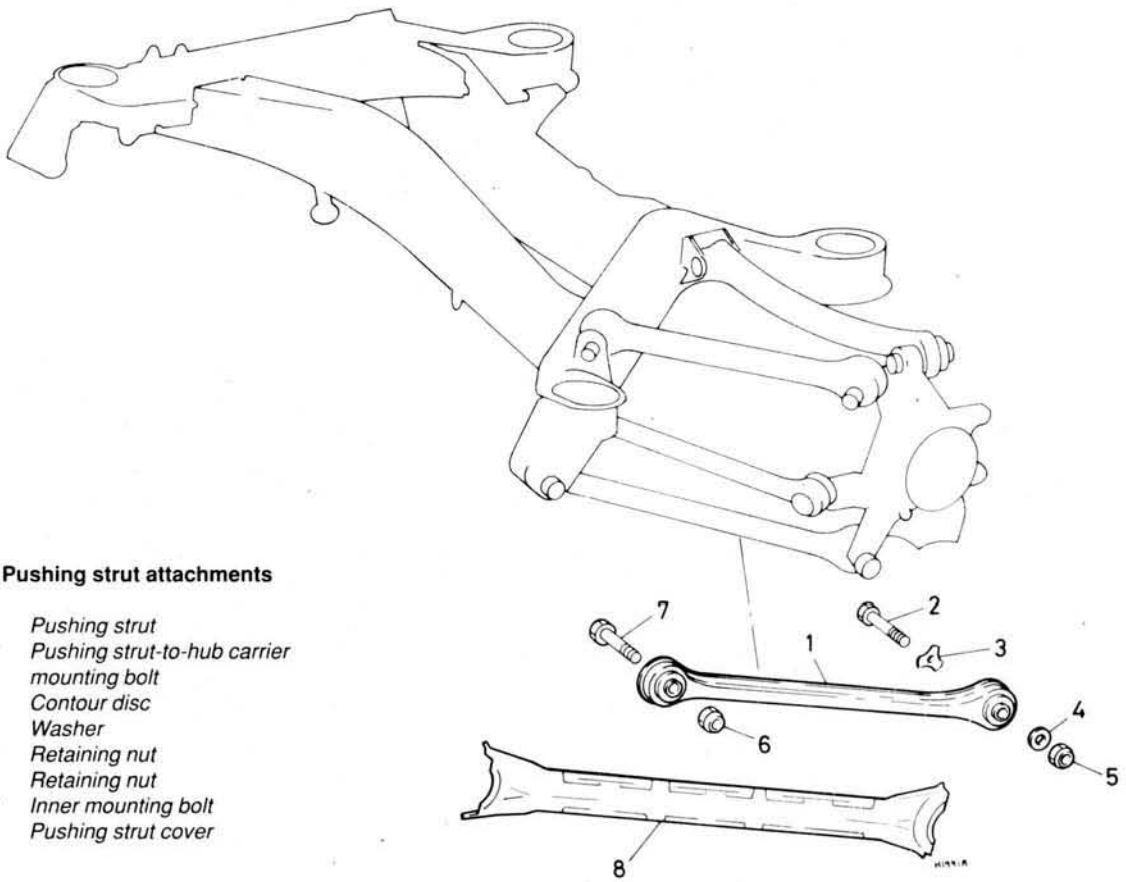
16.4 Pulling strut mounting at hub carrier end, showing retaining nut (A) and contour disc (B)

16 Pulling strut – removal and installation

Refer to illustrations 16.2 and 16.4

1 Loosen the rear wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels. Remove the wheel.
2 Using quick-drying white paint, draw a line across the camber strut inner mounting bolt, eccentric disc and chassis member **(see illustration)**. The pulling strut inner mount is adjustable for suspension angle correction by means of an elongated bolt hole and an eccentric disc formed in the mounting bolt head. If the existing position of the bolt and eccentric disc is marked prior to removal, the settings will not be lost on reassembly.
3 Unscrew the inner mounting nut and eccentric washer, then remove the mounting bolt.
4 At the hub carrier end, unscrew the retaining nut and washer, and remove the bolt and contour disc **(see illustration)**.
5 Pry the pulling strut sideways to detach the mounting sleeve from the hub carrier, then remove the pulling strut from the car.
6 Check the pulling strut bushings for signs of deterioration and, if apparent, replace the strut. The bushings can't be individually replaced.
7 Installation is the reverse of removal, bearing in mind the following points:

a) Tighten the retaining nuts to the specified torque, but before doing so, raise the rear suspension so the driveaxle is horizontal by means of a jack under the spring support arm.
b) Position the inner mounting bolt in line with the markings made prior to removal. If the bolt was not marked, or if any new parts have been installed, the rear wheel alignment must be checked by a Mercedes-Benz dealer service department or alignment shop on completion (see Section 35).
c) Ensure the contour disc is installed behind the outer retaining bolt head, and the washer behind the nut.

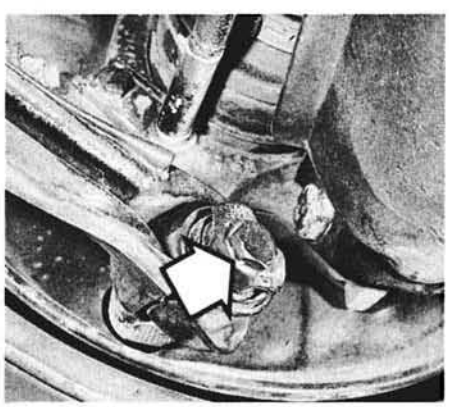


17.2 Pushing strut attachments

1 *Pushing strut*
2 *Pushing strut-to-hub carrier mounting bolt*
3 *Contour disc*
4 *Washer*
5 *Retaining nut*
6 *Retaining nut*
7 *Inner mounting bolt*
8 *Pushing strut cover*



17.3 Pushing strut-to-subframe retaining bolt (arrow)



17.4 Pushing strut-to-hub carrier retaining bolt (arrow) and contour disc

10

17 Pushing strut – removal and installation

Refer to illustrations 17.2, 17.3 and 17.4

Removal

1 Loosen the rear wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels. Remove the wheel.
2 Remove the cover from the side of the pushing strut **(see illustration)**.
3 Unscrew the nut and remove the bolt securing the pushing strut to the rear subframe **(see illustration)**.
4 Unscrew the nut and washer, and remove the bolt and contour disc securing the strut at the hub carrier end **(see illustration)**.
5 Pry the pushing strut sideways to detach the mounting sleeve from the hub carrier, and remove the strut from the car.
6 Check the pushing strut bushings for signs of deterioration and, if apparent, replace the strut. The bushings can't be individually replaced.

Installation

7 Installation is the reverse of removal, bearing in mind the following points:

a) Tighten the retaining nuts to the specified torque but before doing so, raise the rear suspension so the driveaxle is horizontal by means of a jack under the spring support arm.
b) Ensure the contour disc is installed behind the pushing strut-to-hub carrier retaining bolt head with the washer behind the nut.

18 Rear track rod – removal and installation

Refer to illustrations 18.3a, 18.3b and 18.6

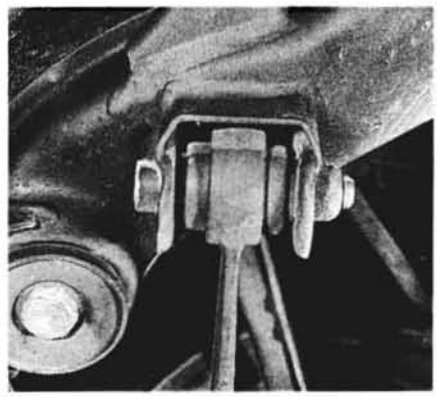
Removal

1 Loosen the rear wheel lug nuts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels. Remove the wheel.
2 Using quick-drying white paint, draw a line across the track rod inner mounting bolt, eccentric disc and subframe member. The track rod inner mount is adjustable for suspension angle correction by means of an elongated bolt hole and an eccentric disc formed in the mounting bolt. If the existing position of the bolt and eccentric disc is marked prior to removal, the settings will not be lost on reassembly.
3 Unscrew the inner mounting nut and eccentric washer, then remove the mounting bolt **(see illustrations)**.
4 At the hub carrier end, remove the nut securing the track rod balljoint, then detach the balljoint from the hub carrier using a balljoint separator tool.
5 Pry the track rod inner mounting bushing out of its location and remove the track rod from the car.
6 If the inner mounting bushing shows signs of deterioration, this can be replaced separately by pulling it out using a long bolt and nut, a small tube of suitable diameter, and packing washers **(see illustration)**. Install the new bushing in the same way until it protrudes by equal amounts on both sides of the track rod.

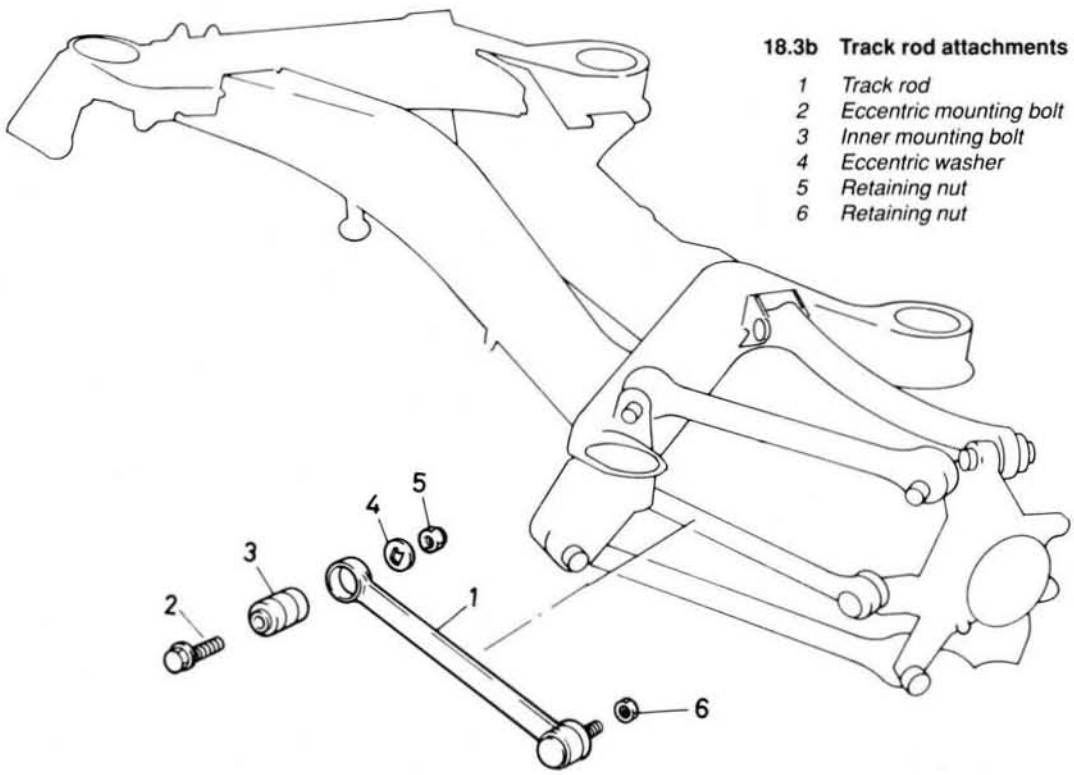
Installation

7 Installation is the reverse of removal, bearing in mind the following points:

a) Position the inner mounting bolt in line with the markings made prior to removal. If the bolt was not marked, or if any new parts have been installed, the rear wheel alignment must be checked by a Mercedes-Benz dealer service department or alignment shop on completion (see Section 35).
b) Tighten the inner mounting nut to the specified torque, but before doing so, raise the rear suspension so the driveaxle is horizontal by means of a jack under the spring support arm.
c) Tighten the track rod balljoint retaining nut to the specified torque, while holding the balljoint stud using an Allen wrench.

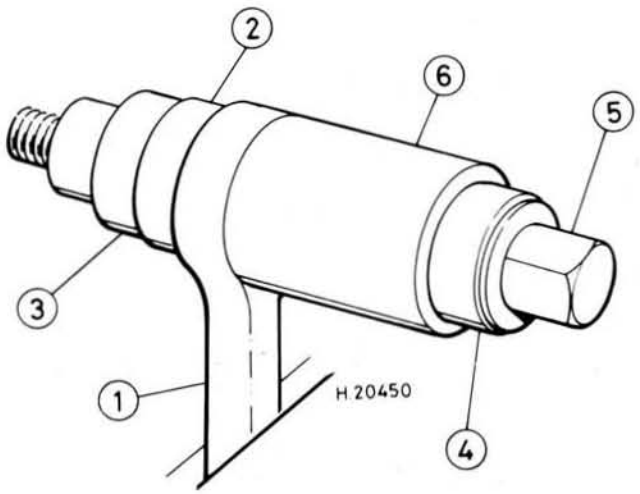


18.3a Track rod inner mounting on rear subframe



18.3b Track rod attachments

1 Track rod
2 Eccentric mounting bolt
3 Inner mounting bolt
4 Eccentric washer
5 Retaining nut
6 Retaining nut



18.6 Track rod bushing removal tool

1 *Track rod*
2 *Bushing*
3 *Thrust piece (packing washers)*
4 *Thrust piece (packing washers)*
5 *Long bolt and nut*
6 *Tube of suitable diameter*

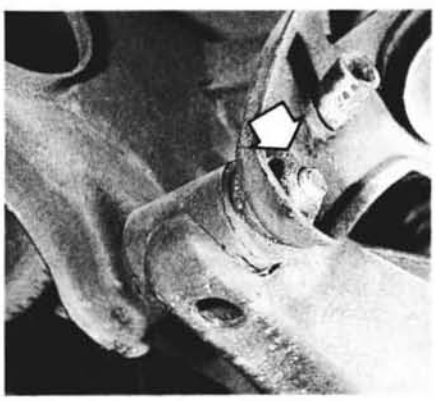
19 Spring support arm – removal and installation

Refer to illustrations 19.4a, 19.4b, 19.6, 19.7, 19.8, 19.9, 19.12a, 19.12b, 19.13a and 19.13b

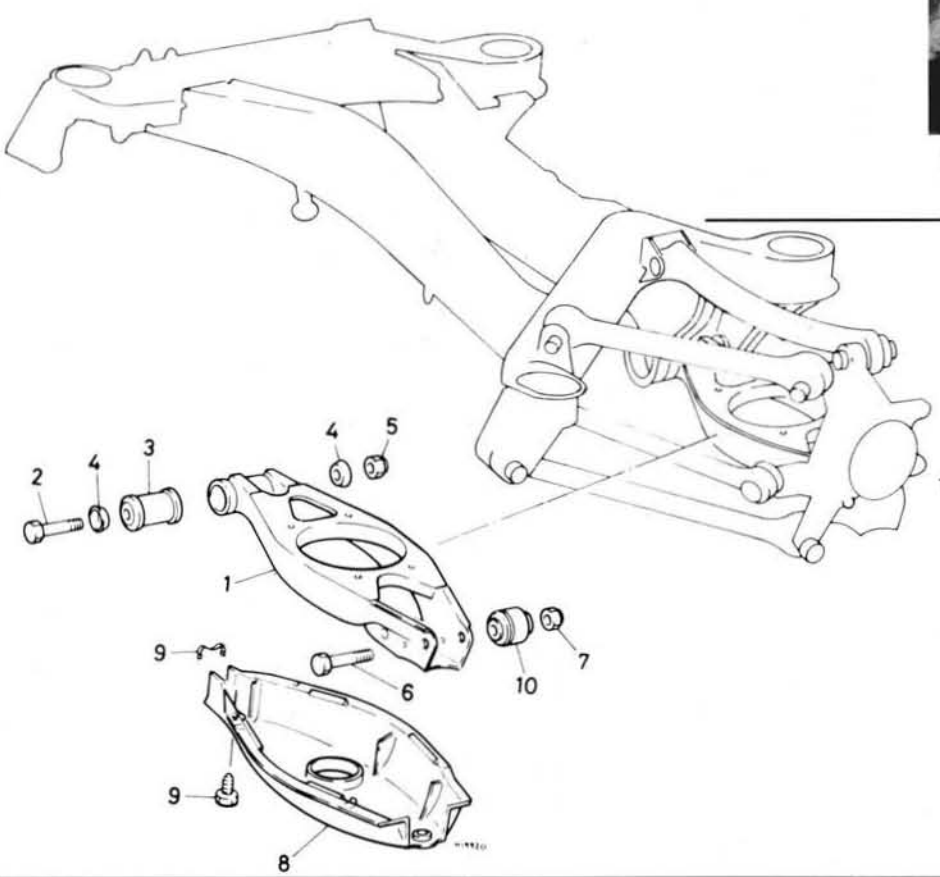
Warning: *For this operation it is recommended that the coil spring is retained using the manufacturer's special tool for this purpose, or some other form of coil spring compressor that can be installed inside the spring through the opening in the support arm. Although it is possible to complete the procedure without such a tool, there is a risk of personal injury if extreme care is not taken. An alternative method is to loop a length of safety chain up through the center of the spring and out the top, then bolt the chain together (be sure to leave enough slack in the chain to allow the coil spring to extend fully) to contain the coil spring in case it "pops" out of the control arm seat.*

Removal

1 Loosen the rear wheel lug bolts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels. Remove the wheel.
2 Refer to Section 21 and remove the rear shock absorber.
3 Unbolt the rear brake caliper from the hub carrier and support it out of the way with a piece of wire (see Chapter 9).
4 Loosen, but do not remove, the spring support arm inner mounting bolt nut **(see illustrations)**.

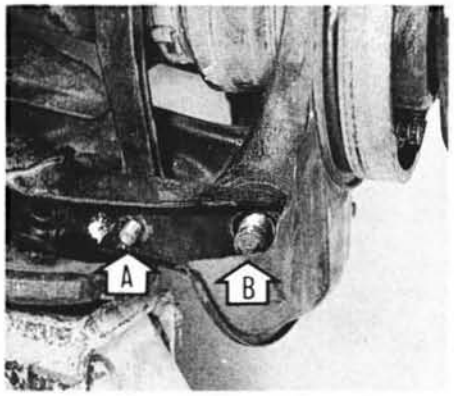


19.4a Loosen the spring support arm inner mounting nut (arrow)

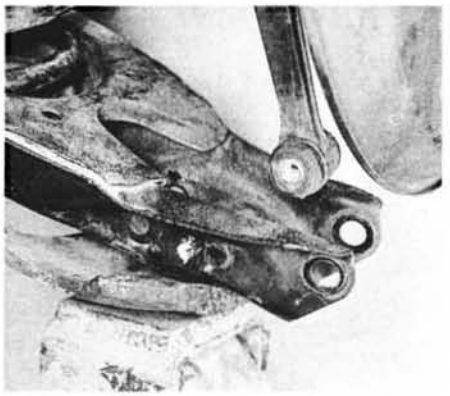


19.4b Spring support arm attachments

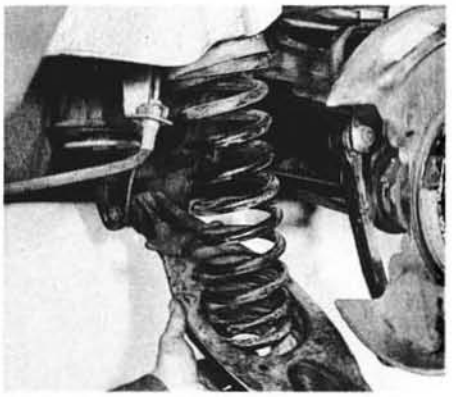
1 *Spring support arm*
2 *Inner mounting bolt*
3 *Inner mounting bushing*
4 *Washer*
5 *Retaining nut*
6 *Support arm-to-hub carrier mounting bolt*
7 *Retaining nut*
8 *Plastic cover*
9 *Cover retaining bolt*
10 *Hub carrier bushing*



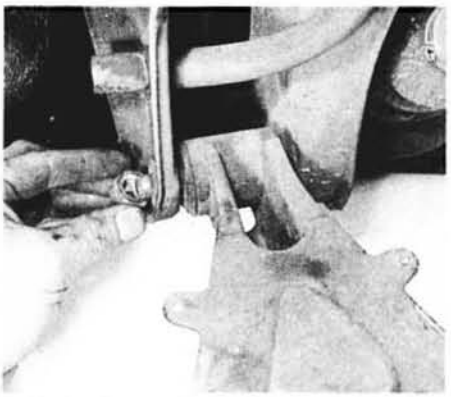
19.6 Remove the nuts from the anti-roll bar (A) and hub carrier (B) retaining bolts



19.7 Remove the bolts and carefully lower the supporting jack



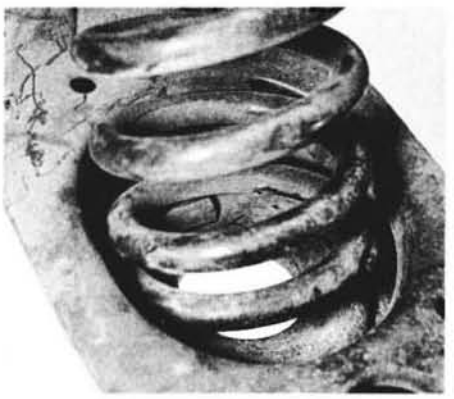
19.8 Remove the coil spring when it is free from tension



19.9 Remove the spring support arm inner mounting nut and bolt



19.12a Install the spring in its upper mount . . .



19.12b . . . and in the spring support arm

5 Install the spring compressor (if used) to the coil spring, and compress the spring until the tension is removed from the spring support arm. If a spring compressor is not used, install a safety chain (see the Warning at the beginning of this Section).

6 With the spring support arm securely supported on a jack, remove the nuts and washers securing the anti-roll bar and hub carrier retaining bolts to the spring support arm **(see illustration)**.

7 Remove the anti-roll bar and hub carrier retaining bolts, then slowly and carefully lower the jack **(see illustration)**.

8 With the spring free of tension, withdraw it from its location in the support arm and subframe **(see illustration)**.

9 Remove the retaining nut, washer and inner mounting bolt **(see illustration)**, and remove the arm from its location.

10 If the inner mount bushing shows signs of deterioration, this can be replaced separately, by pulling it out using a long bolt and nut, a small tube of suitable diameter, and packing washers. Install the new bushing in the same way, after first lubricating it with rubber grease, until it protrudes by equal amounts on both sides of the support arm.

Installation

11 Begin installing by engaging the inner end of the arm in its subframe location. Install the inner mounting bolt and nut, but do not tighten them at this stage.

12 Locate the spring in its subframe mount, and in the recess in the spring support arm **(see illustrations)**. Install the spring compressor or the safety chain.

13 Raise the support arm on the jack until the hub carrier and anti-roll bar mounting holes are aligned with those in the arm, and install the retaining bolts. It may be necessary to lever down on one of the suspension upper struts, using a pry bar, to bring all the bolt holes into alignment **(see illustrations)**.

14 Install the nuts and washers to the hub carrier and anti-roll bar bolts, but do not tighten them at this stage. Remove the spring compressor, if one was used, or the safety chain.

15 Raise the jack further until the driveaxle is horizontal, then tighten all the mounting nuts to the specified torque.

16 Install the brake caliper to the hub carrier and secure with two new encapsulated bolts, tightened to the torque specified in Chapter 9.

17 Install the shock absorber as described in Section 21.

18 Install the wheel and lower the car to the ground.

20 Rear coil spring – removal and installation

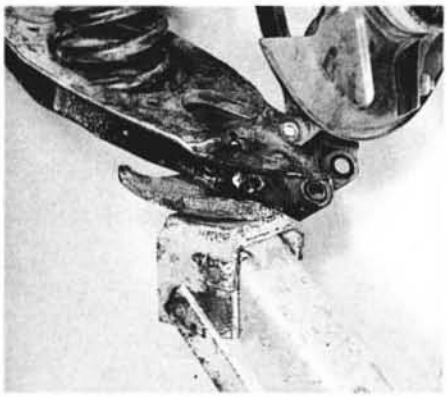
Refer to Section 19, as rear coil spring removal is part of the spring support arm removal and installation procedure.

21 Rear shock absorber – removal and installation

Refer to illustrations 21.2, 21.4, 21.6, 21.7 and 21.8

1 Loosen the wheel lug bolts, raise the rear of the vehicle and support it on jackstands. Block the front wheels. Remove the wheel.

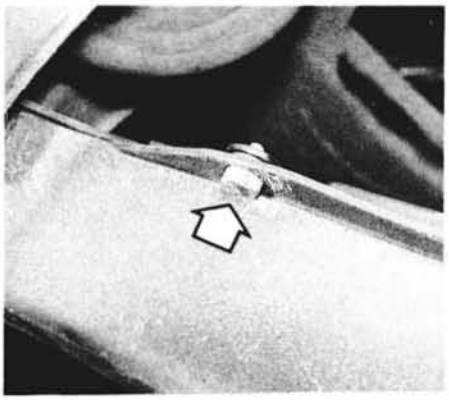
2 Remove the plastic cover over the spring support arm by releasing the retaining clips on early models, or by removing the small bolts **(see illustration)** on later versions.



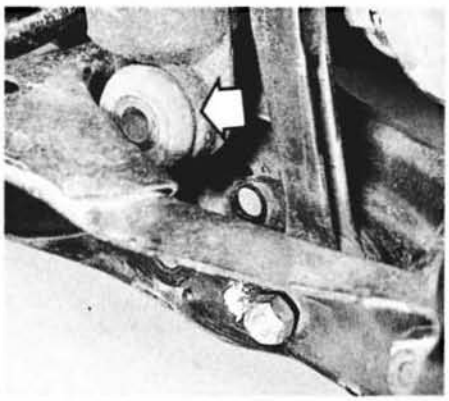
19.13a Raise the supporting jack to align the mounting holes . . .



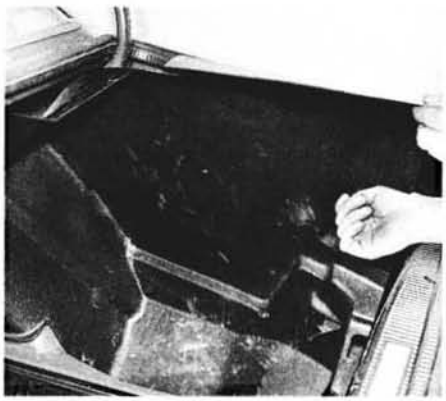
19.13b . . . and lever down using a large pry bar (arrow) if necessary, until the bolts can be installed



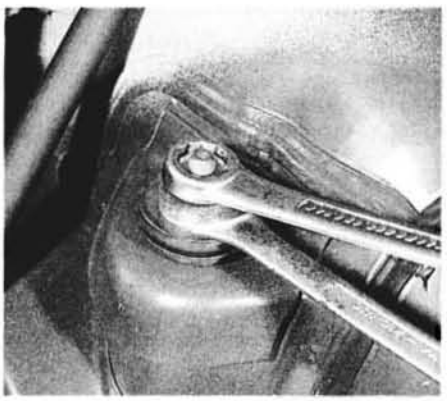
21.2 Spring support arm cover retaining bolt (arrow)



21.4 Push up on the lower end of the shock absorber to separate it from the spring support arm



21.6 Remove the side trim panel in the trunk



21.7 Loosen the shock absorber mounting locknuts



21.8 Remove the nuts, washer, bushing and bushing seat

3 Position a floor jack beneath the spring support arm, and raise the jack slightly to take the tension of the coil spring.

4 Remove the nut and washer, then remove the shock absorber lower mounting bolt from the spring support arm. Ease the shock absorber lower mounting from the arm **(see illustration)**.

5 From inside the trunk, release the retaining buttons and plastic clips securing the vertical trim covering over the fuel tank. This need only be done on the side being worked on, and just sufficiently to fold back the covering for access.

6 Remove the moulded plastic trim panel over the shock absorber **(see illustration)**.

7 Using two wrenches, loosen the shock absorber upper mounting locknuts and remove the upper nut **(see illustration)**.

8 Remove the lower nut, followed by the washer and rubber mount **(see illustration)**.

9 Push the shock absorber down, and remove it from the fenderwell.

10 Test the operation of the shock absorber, while holding it in an upright position, by moving the damper rod through a full stroke, then through short strokes of about half its total travel. In both cases, the resistance felt should be smooth and continuous. If the resistance is jerky or uneven, or if there is any visible sign of wear or damage to the unit, replacement is necessary.

11 Installation is the reverse of removal.

22 Rear anti-roll bar – removal and installation

1 Loosen the rear wheel lug bolts, raise the rear of the vehicle and support it securely on jackstands. Block the front wheels. Remove the wheels.

2 Remove the nuts and bolts securing the anti-roll bar to the spring support arm connecting links on both sides.

3 Remove the two nuts each side securing the mounting clamp plates, and remove both plates.

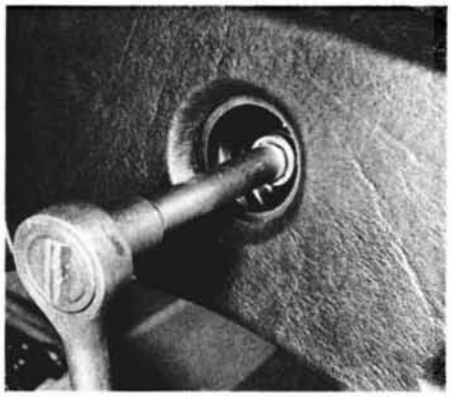
4 Manipulate the anti-roll bar sideways, and remove it from under the right-hand fenderwell.

5 If required, the mounting bushings can be replaced by sliding them off the ends of the bar. Lubricate the new bushings with rubber grease before installing.

6 Installation is the reverse of removal.



23.2 Pry out the steering wheel trim motif



23.3 Remove the retaining bolt with an Allen wrench socket

23 Steering wheel – removal and installation

Refer to illustrations 23.2 and 23.3

1 Set the front wheels in the straight-ahead position.

2 Using a small screwdriver, carefully pry out the trim motif from the center of the steering wheel pad **(see illustration)**.

3 Using an Allen wrench socket and extension, unscrew the steering wheel retaining bolt, with the help of an assistant if necessary to hold the wheel **(see illustration)**.

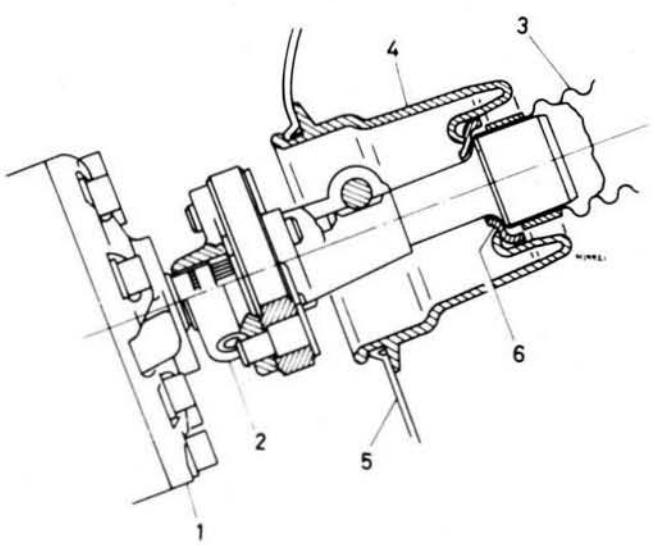
4 Remove the steering wheel from the shaft.

5 Before installing the steering wheel, check if there is a marking line or notch on the end of the steering shaft. If so, ensure that this is uppermost.

6 Position the steering wheel on the shaft with the spokes horizontal, and the slightly-curved spoke at the bottom.

7 Install the retaining bolt and tighten it to the specified torque.

8 Install the trim motif.



24.5 Steering column coupling and rubber guide sleeve details

1 Steering gear
2 Flexible rubber coupling
3 Steering column lower shaft
4 Rubber guide sleeve
5 Floorpan
6 Sealing ring

24 Steering column – removal and installation

Refer to illustrations 24.5, 24.8, 24.10, 24.11, 24.12 and 24.14

Removal

1 Remove the trim panel under the dash on the driver's side.

2 Remove the steering wheel as described in Section 23.

3 Remove the instrument panel as described in Chapter 12.

4 Raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels.

5 From under the car, remove the two Allen-head pinch bolts securing the flexible rubber coupling to the steering gear spindle and steering column lower shaft **(see illustration)**.

6 Slide the rubber coupling off the steering gear spindle.

7 From inside the car, remove the three screws securing the combination switch to the column.

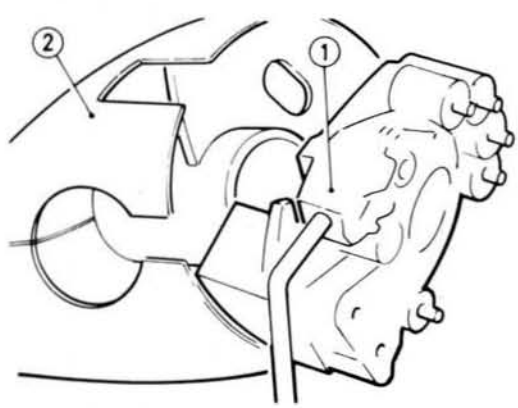
8 Pull off the combination switch and remove the one-piece steering column shroud **(see illustration)**.

9 Remove the complete steering lock assembly as described in Section 26.

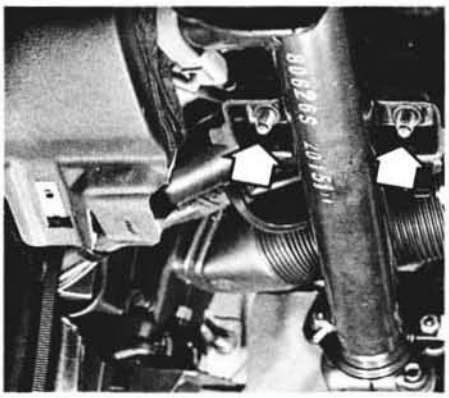
10 Unscrew the two nuts and remove the column upper mounting bolts **(see illustration)**.

11 Unscrew the two nuts and remove the column lower mounting bolts **(see illustration)**.

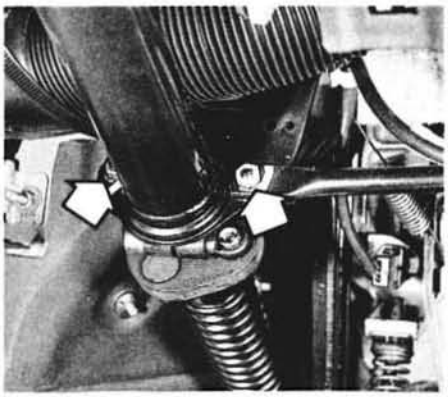
12 Pry the rubber guide sleeve from the floor at the base of the column **(see illustration)**, then remove the column assembly from the car.



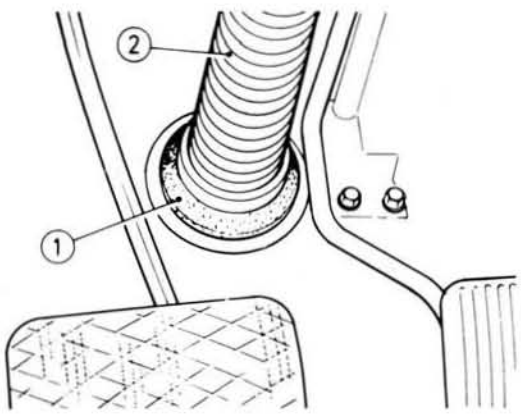
24.8 Removing the combination switch (1) and steering column shroud (2)



24.10 Steering column upper mounting fasteners (arrows)

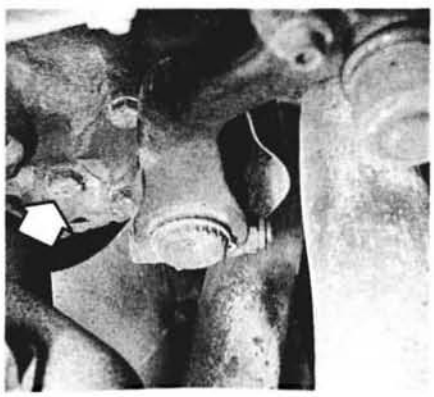


24.11 Steering column lower mounting fasteners (arrows)



24.12 Rubber guide sleeve location

1 *Rubber guide sleeve*
2 *Steering column lower shaft*



24.14 Steering gear centering hole plug bolt (arrow)

13 Check the condition of the flexible rubber coupling on the column lower shaft, and replace the shaft if there is any sign of deterioration of the coupling. The shaft should also be replaced if the corrugated section shows any sign of distortion, damage, or evidence of compression to any of the corrugations.

Installation

14 Before installing the steering column, the steering gear must be centered with the front wheels in the straight-ahead position. To do this, unscrew the hex-head plug from the steering gear adjacent to the Pitman arm **(see illustration)**. Slowly turn the steering gear by means of the steering gear spindle, while viewing through the plug orifice. When a centering hole appears in the piston being viewed through the orifice, the steering is centered. Ideally, the steering gear should be locked in this position by obtaining a suitable long bolt that will screw into the plug orifice, then file a point at the end. This will then engage and lock the piston, preventing any movement of the steering gear.
15 Lubricate the sealing ring at the base of the column lower shaft, and position the column assembly and rubber guide sleeve in the car.
16 Install the column upper and lower mounting bolts and nuts, but don't tighten them yet.
17 Install the steering column lock assembly as described in Section 26.
18 Tighten the column upper and lower mounting bolts to the specified torque.
19 Engage the flexible rubber coupling with the steering gear spindle, then install and tighten the two pinch bolts.
20 From under the car, remove the bolt used to lock the steering gear, and install the plug bolt.
21 Install the steering column shrouds and the combination switch.
22 Slip the rubber guide sleeve into its location in the floor.
23 Install the instrument panel as described in Chapter 12.
24 Install the steering wheel as described in Section 23.
25 Install the trim panel under the dash and lower the car to the ground.

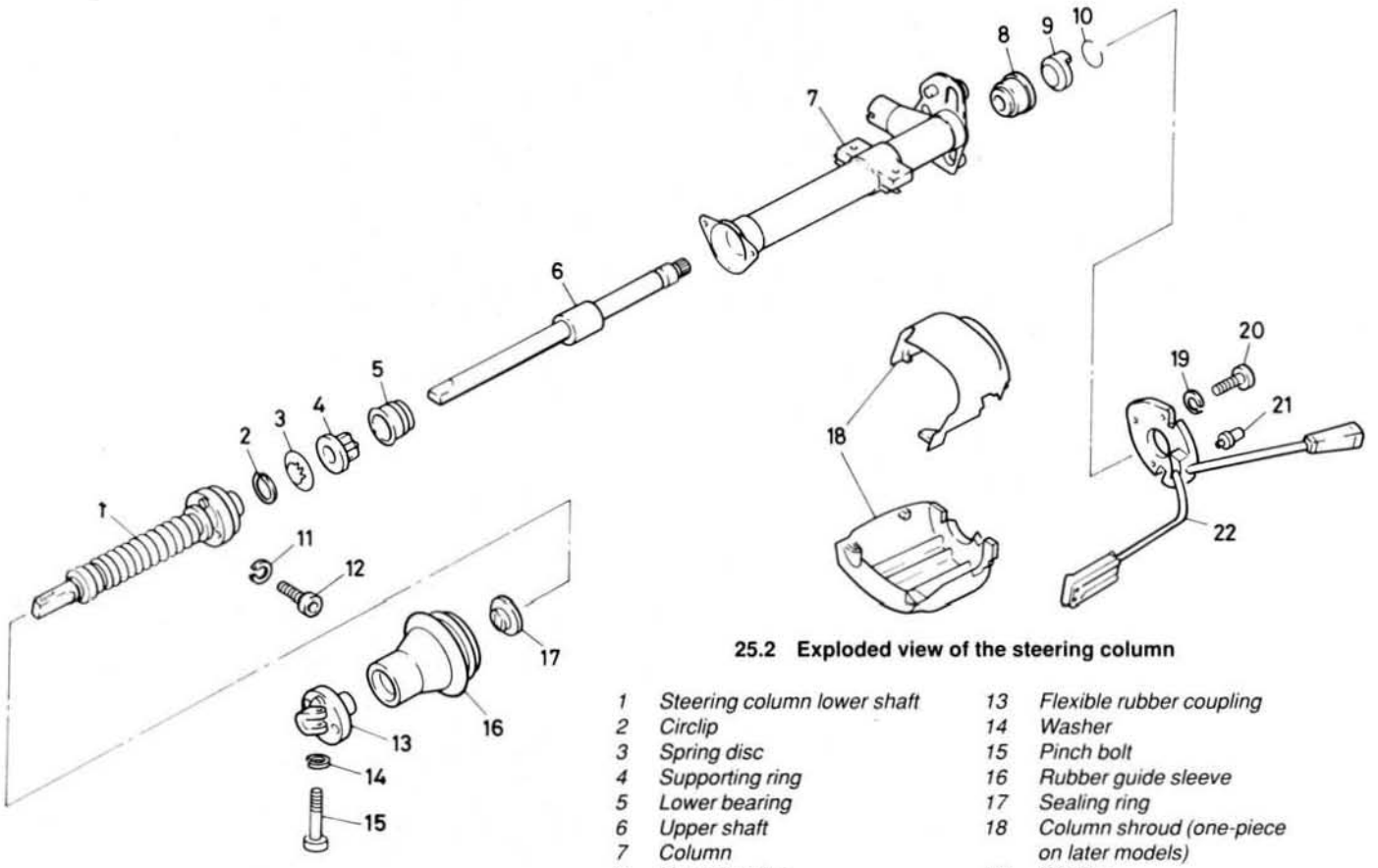
10

25 Steering column – disassembly and reassembly

Refer to illustrations 25.2, 25.4 and 25.6

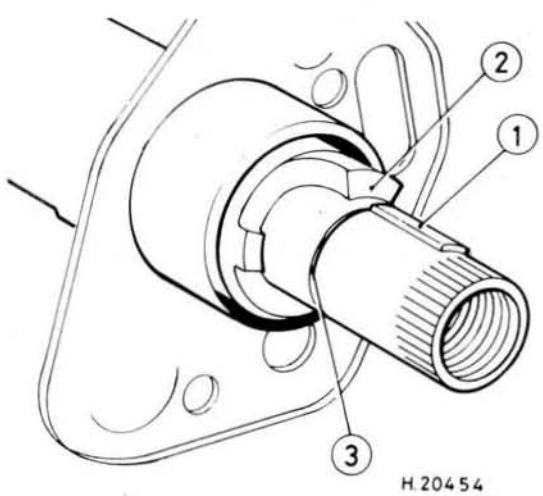
Disassembly

1 Remove the steering column as described in Section 24.
2 With the column assembly on the bench, unscrew the pinch bolt at the upper rubber coupling and separate the column lower shaft from the upper shaft **(see illustration on next page)**.
3 At the base of the upper shaft, extract the circlip and remove the spring disc and supporting ring.



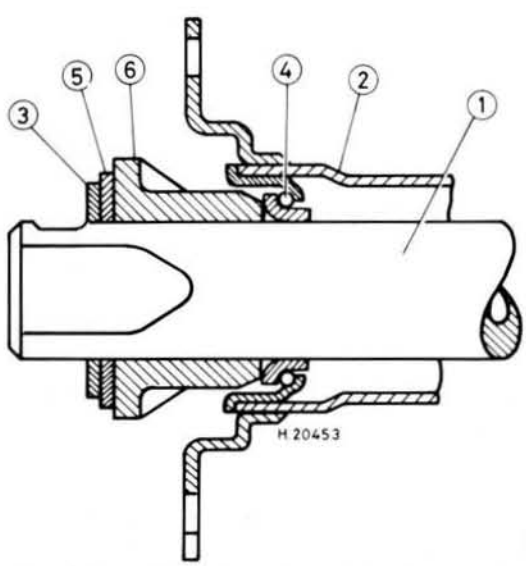
25.2 Exploded view of the steering column

1	*Steering column lower shaft*	13	*Flexible rubber coupling*
2	*Circlip*	14	*Washer*
3	*Spring disc*	15	*Pinch bolt*
4	*Supporting ring*	16	*Rubber guide sleeve*
5	*Lower bearing*	17	*Sealing ring*
6	*Upper shaft*	18	*Column shroud (one-piece on later models)*
7	*Column*	19	*Washer*
8	*Upper bearing*	20	*Combination switch retaining screw*
9	*Support ring*	21	*Horn contact*
10	*Locking ring*	22	*Combination switch*
11	*Washer*		
12	*Pinch bolt*		



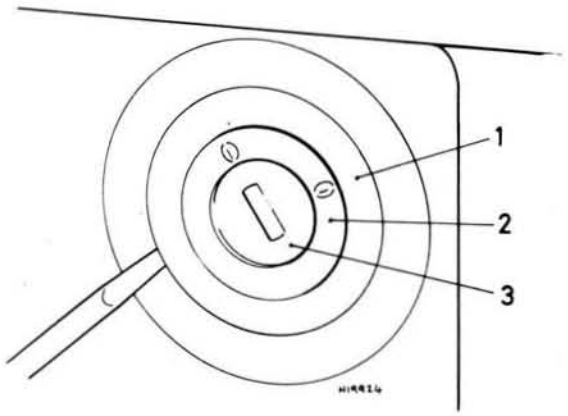
25.4 Steering column upper bearing components

1	*Upper shaft*	3	*Locking ring*
2	*Supporting ring*		



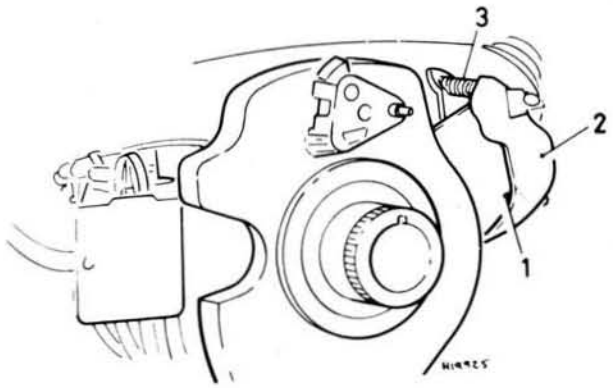
25.6 Sectional view of the column lower bearing components

1	*Upper shaft*	4	*Lower bearing*
2	*Column*	5	*Spring disc*
3	*Circlip*	6	*Supporting ring*



26.6 Use a screwdriver to pry off the ignition switch trim ring

1 Trim ring
2 Lock barrel sleeve
3 Lock barrel



26.11 Steering lock body clamp details

1 Locking pin
2 Clamp
3 Clamp bolt

4 Push the shaft upwards slightly, then push the support ring at the top of the shaft down to allow removal of the locking ring **(see illustration)**. With the locking ring removed, slide off the support ring.
5 Slide the steering shaft down the column, and place a flat piece of metal behind the upper bearing. Firmly push the shaft up, to force the bearing out of the column.
6 Repeat Steps 4 and 5 to remove the lower bearing **(see illustration)**, then remove the shaft from the column.
7 Check all the disassembled parts for wear, and replace as necessary.

Reassembly

8 Using a socket, tube or other suitable mandrel, tap the lower bearing into place in the column.
9 Insert the steering shaft from above into the column, then install the upper bearing using the same technique.
10 Slide the support ring onto the shaft so that its lug engages with the shaft groove.
11 Install the locking ring to the shaft groove.
12 At the base of the upper shaft, install the supporting ring, spring disc and locking ring. Use a tube to push the locking ring down until it enters its groove in the shaft.
13 Install the column lower shaft and secure the coupling with the pinch bolt, tightening it to the specified torque.

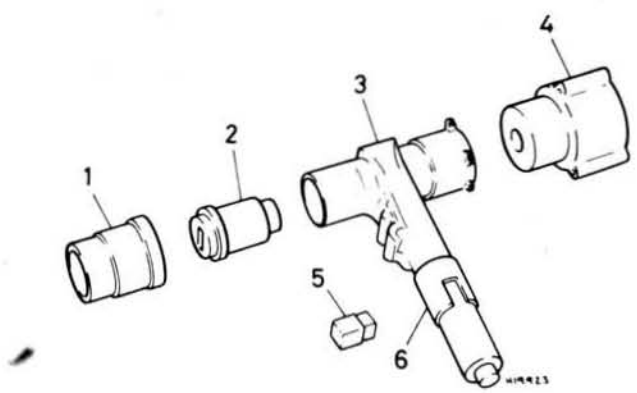
26 Steering lock and ignition switch – removal and installation

1 The steering lock is a three-part assembly made up of the electrical part of the ignition switch, the ignition switch lock barrel, and the mechanical part of the steering lock mechanism. All three parts can be removed and installed separately as follows.

Ignition switch

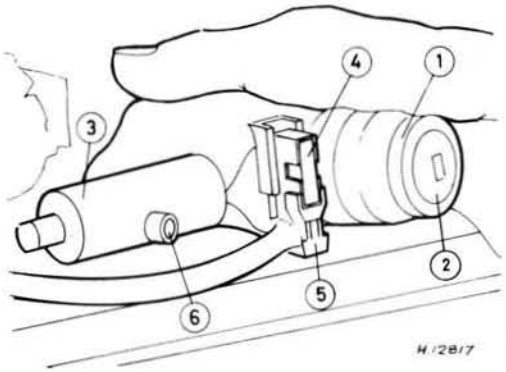
Refer to illustrations 26.6, 26.11, 26.12 and 26.14

2 Disconnect the cable from the negative terminal of the battery.
3 Remove the trim panel under the dash on the driver's side.
4 Refer to Section 23 and remove the steering wheel.
5 Refer to Chapter 12 and remove the instrument panel.
6 Using a small screwdriver, carefully pry off the trim ring around the ignition switch **(see illustration)**.
7 Insert the ignition key and turn the switch to position 'I'.
8 Working through the instrument panel aperture, pull off the electrical connector at the rear of the switch.
9 Remove the three screws securing the combination switch to the steering column.
10 Pull out the combination switch and remove the one-piece steering column shroud.
11 Loosen the bolt to release the clamp around the steering lock body **(see illustration)**.
12 Depress the locking pin located behind the clamp **(see illustration)**, and slightly withdraw the lock body.
13 Remove the ignition key, then swivel the lock body so that it clears the ignition switch hole in the dash. If necessary, remove the dash retaining screw adjacent to the steering column and ease the panel outwards for increased clearance.



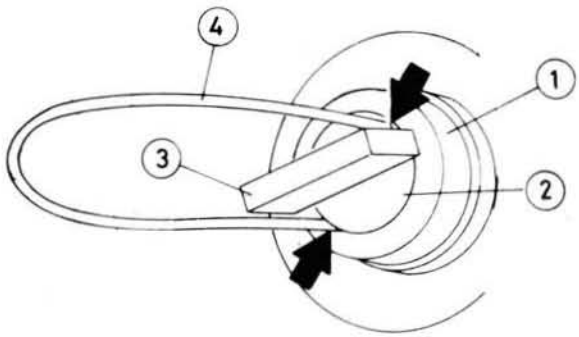
26.12 Exploded view of the steering lock components

1 Lock barrel sleeve
2 Lock barrel
3 Lock body
4 Ignition switch
5 Contact switch
6 Locking pin



26.14 Steering lock assembly removal

1 *Lock barrel sleeve*
2 *Lock barrel*
3 *Steering lock*
4 *Contact switch*
5 *Contact switch electrical connector*
6 *Locking pin*



26.22 Ignition switch lock barrel removal

1 *Lock barrel sleeve*
2 *Lock barrel*
3 *Ignition key in position 1*
4 *Releasing wire*

14 Pull the lock body from the steering column and disconnect the electrical connector at the contact switch **(see illustration)**.
15 Reinsert the ignition key, turn it to position 'I' and remove the contact switch.
16 Unscrew the three screws securing the ignition switch to the rear of the lock body and remove the switch.
17 To install the switch, place it in position on the lock body, ensuring that the tag on the switch engages with the notch in the body. Secure the switch with the three screws.
18 The remainder of the procedure is the reverse of removal. Ensure that the locking pin is depressed as the lock body is installed, and that the pin enters its locating hole. When depressing the pin, and when installing the contact switch and electrical connector, the ignition key must be inserted and turned to position 'I'.

Ignition switch lock barrel

Refer to illustration 26.22

19 Using a small screwdriver, carefully pry off the trim ring around the ignition switch **(see illustration 26.6).**
20 Insert the ignition key and turn the switch to position 'I'.
21 Bend a length of 2.0 mm (0.07 in) diameter wire (a piece of welding rod is ideal) into a U-shape, and file a 60-degree (approximately) chamfer on each end, facing inwards.
22 Insert this wire into the slots on each side of the lock barrel, and push the wire in to compress the detents **(see illustration)**.
23 Pull out the lock barrel using the ignition key.
24 Remove the wire and ignition key, then separate the lock barrel from its sleeve.
25 To install, insert the lock barrel into the steering lock body, with the raised section engaged in the lock body groove.
26 Position the sleeve over the lock barrel with its detent towards the steering column.
27 Insert the ignition key, turn it to position I and push both the lock barrel and cover fully into the steering lock body. **Note:** *The edge of the ignition key must point towards the mark on the cover while installing, indicating that the cover detent is in correct alignment.*
28 Check the lock and lock barrel for correct operation, then install the trim ring.

Steering lock mechanism

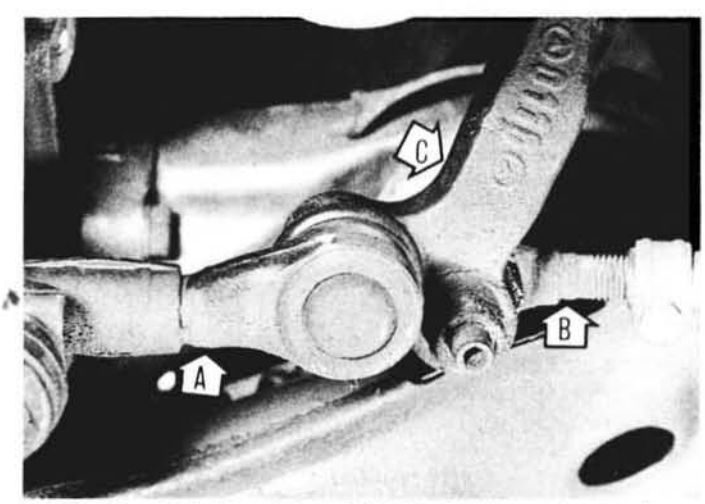
29 Removal of the steering lock mechanism complete is included in the procedures at the beginning of this Section. Carry out Steps 2 to 18, with the exception of paragraph 16.

27 Power steering gear – removal and installation

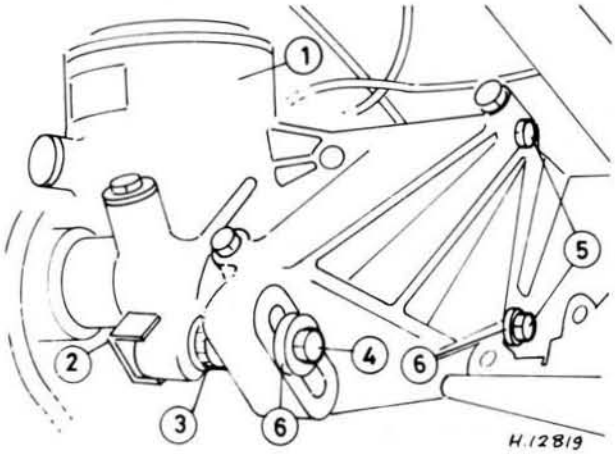
Refer to illustration 27.6

Removal

1 Unscrew the power steering pump reservoir cap nut, lift off the cover and remove the fluid in the reservoir using a clean syringe such as a poultry baster.
2 Unscrew the high-pressure hose and return hose fitting nuts at the steering gear, while using a second wrench to hold the fitting adaptors. Remove the two hoses and plug or tape over their ends, and the adaptors on the steering gear, to prevent excessive fluid spillage and the entry of contaminants.
3 Raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels..
4 Remove the two Allen-head pinch bolts securing the flexible rubber coupling to the steering gear spindle and steering column lower shaft.
5 Slide the rubber coupling up off the steering gear spindle.
6 Remove the two nuts securing the drag link and tie-rod balljoints to the steering gear Pitman arm **(see illustration)**. Detach the balljoints from the arm using a balljoint separator tool.

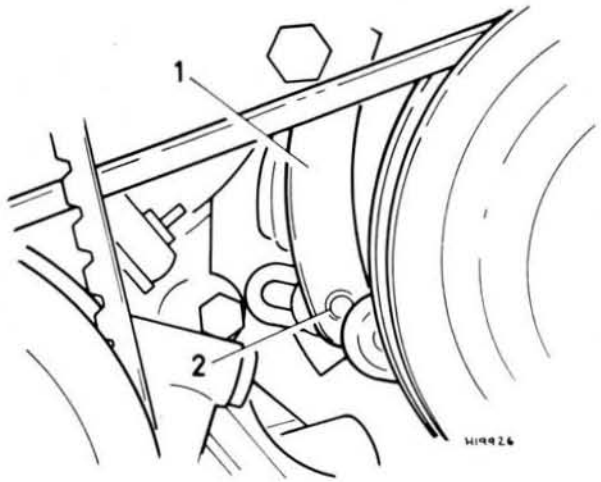


27.6 Drag link (A) and tie-rod (B) attachments at the steering gear Pitman arm (C)



28.6 Power steering pump mounting details

1	*Power steering pump*	4	*Adjuster lockbolt*
2	*Locking nut*	5	*Mounting bolts*
3	*Toothed adjuster*	6	*Washers*



28.10 Power steering pump threaded retaining plate (1) and mounting bolt (2)

7 From under the fenderwell, unscrew the three bolts securing the steering gear to the chassis member.
8 Remove the steering gear from under the car.

Installation

9 Before installing, the steering gear must be centered and locked in the straight-ahead position, using the procedure described in Section 24, Step 14.
10 Place the steering gear in position and secure to the chassis member using three new retaining bolts, tightened to the specified torque.
11 Turn the steering wheel to the straight-ahead position, with the top of the wheel boss horizontal.
12 Slide the flexible rubber coupling onto the steering gear spindle, screw in the two pinch bolts, and tighten them to the specified torque.
13 Remove the bolt used to lock the steering gear and install the plug bolt.
14 Install the drag link and tie-rod balljoints to the Pitman arm, screw on the retaining nuts, and tighten the nuts while holding the balljoint studs with an Allen wrench.
15 Lower the car to the ground.
16 Install the high-pressure and return hoses to the steering gear, and tighten the fittings securely.
17 Fill the power steering pump reservoir with the specified fluid. See *Recommended lubricants and fluids* at the front of this manual.
18 Start the engine and turn the steering wheel several times to full-left, then full-right lock, while keeping the fluid level in the reservoir filled. When the fluid level remains constant, top up finally to the correct level (see Section 2), then install the cover and cap nut.

28 Power steering pump (pre-October 1984 models) – removal and installation

Refer to illustrations 28.6 and 28.10

Note: *The following procedure covers models in which multiple drivebelts are used to drive the engine accessories. On cars with a single drivebelt layout, refer to Section 29.*

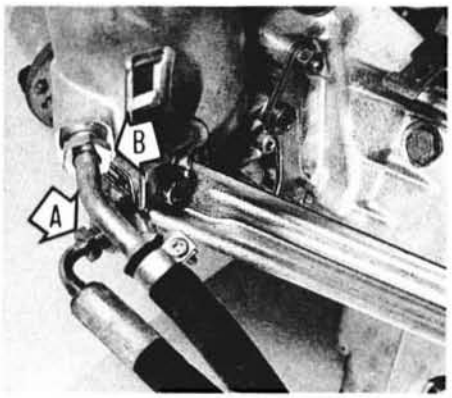
Removal

1 Unscrew the cap nut and lift off the cover on the power steering pump reservoir.
2 Unscrew the nut from the long stud in the center of the reservoir, and remove the pressure spring from the stud.
3 Withdraw the filter cartridge from the reservoir.
4 Using a clean syringe such as a poultry baster, remove the fluid from the reservoir.
5 Unscrew the high-pressure and return hose fittings on the side of the pump and detach them. Plug or tape over the hose ends and pump openings to prevent fluid spillage and the entry of contaminants.
6 At the rear of the pump mounting bracket, loosen the adjuster lockbolt furthest from the engine, and the two mounting bolts nearest to the engine **(see illustration)**.
7 Turn the toothed adjuster bolt using an open-ended wrench to move the pump towards the engine and relieve the tension on the drivebelt.
8 Slip the drivebelt off the pump pulley.
9 Unscrew the three bolts securing the pulley to the pump flange and remove the pulley.
10 Remove the two mounting bolts at the rear of the pump mounting bracket, and recover the threaded retaining plate from the front **(see illustration)**.
11 Remove the adjuster lockbolt from the rear of the pump, and recover the locking nut and toothed adjuster.
12 Remove the pump from the engine.

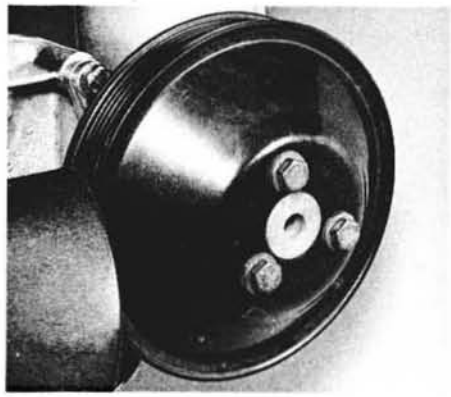
Installation

13 Installation is the reverse sequence of removal, bearing in mind the following points:

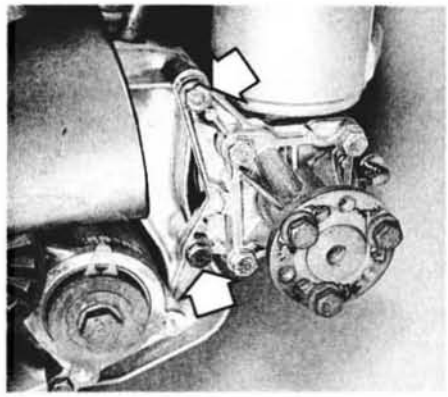
a) With the drivebelt in position, adjust its tension as described in Section 30.
b) When installing the filter cartridge pressure spring and nut, tighten the nut just sufficiently to pre-load the spring.
c) On completion of installation, fill the reservoir with the specified fluid, then start the engine and turn the steering full-left, then full-right lock a few times, topping-up the fluid as necessary. When the fluid level remains constant, fill to the correct level (see Section 2), then install the cover and cap nut.



29.6 High-pressure (A) and return (B) line fittings at the power steering pump



29.8 Power steering pulley-to-pump flange retaining bolts



29.10 Power steering pump-to-mounting bracket bolts (arrows)

29 Power steering pump (October 1984 and later models) – removal and installation

Refer to illustrations 29.6, 29.8 and 29.10

Note: *The following procedure covers models in which a single drivebelt is used to drive the engine accessories. On cars with a multiple drivebelt layout, refer to Section 28.*

Removal

1 For increased working access, remove the air cleaner assembly as described in Chapter 3.
2 Unscrew the cap nut and lift off the cover on the power steering pump reservoir.
3 Unscrew the nut from the long stud in the center of the reservoir, and remove the plastic sleeve and pressure spring from the stud.
4 Remove the filter cartridge from the reservoir.
5 Using a clean syringe such as a poultry baster, remove the fluid from the reservoir.
6 Unscrew the high-pressure and return hose fittings on the side of the pump and detach the pipes **(see illustration)**. Plug or tape over the pipe ends and pump orifices to prevent fluid spillage and the entry of contaminants.
7 Referring to the procedures given in Chapter 12, loosen the drivebelt and remove it from the pump pulley.
8 Unscrew the three bolts and remove the pulley from the pump flange **(see illustration)**.
9 Unscrew the bolt securing the support strut to the rear of the pump, and loosen the bolt securing the strut to the engine. Swivel the strut clear of the pump.
10 Unscrew the two bolts and nuts securing the pump to the mounting bracket, then remove the unit from the engine **(see illustration)**.

Installation

11 Installation is the reverse sequence of removal, bearing in mind the following points:

a) With the drivebelt in position, adjust its tension as described in Chapter 12.
b) When installing the filter cartridge, pressure spring plastic sleeve and nut, tighten the nut just sufficiently to pre-load the spring.
c) On completion of installation, fill the reservoir with the specified fluid, then start the engine and turn the steering to full-left, then full-right lock a few times, adding fluid as necessary. When the fluid level remains constant, fill to the correct level (see Section 2), then install the cover and cap nut.

30 Power steering pump drivebelt – removal, installation and adjustment

Note: *The following procedure covers models in which multiple drivebelts are used to drive the engine ancillaries (up to approximately October 1984). On later cars with a single drivebelt layout, refer to Chapter 12.*

1 At the rear of the power steering pump mounting bracket, loosen the adjuster lockbolt furthest from the engine and the two mounting bolts nearest to the engine **(see illustration 28.6).**
2 Turn the toothed adjuster bolt using an open-ended wrench to move the pump towards the engine, then slip the drivebelt off the pulleys.
3 Examine the belt for cracks, fraying, signs of oil contamination or evidence of the belt bottoming in the vee of the pulleys. Replace the belt if at all suspect.
4 Install the belt over the pulleys, then turn the adjuster bolt until it is just possible to deflect the drivebelt by approximately 12.0 mm (0.5 in) under moderate finger pressure midway between the two pulleys.
5 Tighten the adjuster lockbolt, followed by the two mounting bolts.

31 Steering damper – removal and installation

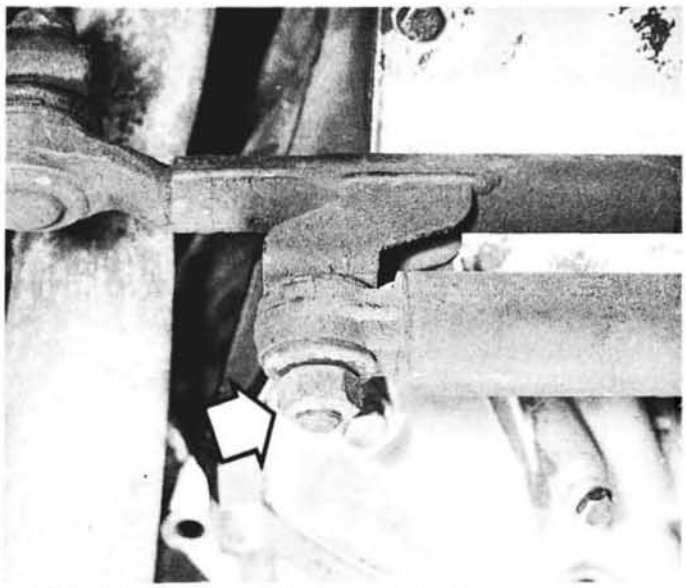
Refer to illustrations 31.2a and 31.2b

1 Raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels.
2 Unscrew the nuts and remove the bolts securing the damper to the drag link and chassis bracket **(see illustrations)**.
3 Remove the damper from the vehicle.
4 Check the operation of the damper by compressing and releasing it through two or three full strokes, then several half strokes. At all times, the resistance felt should be continuous and even. If the resistance is jerky or uneven, or if there is any damage to the damper body or mounting bushings, replace the damper.
5 Installation is the reverse of removal, but note that the piston (large) end of the damper must be installed to the chassis bracket. Tighten the retaining nuts to the specified torque.

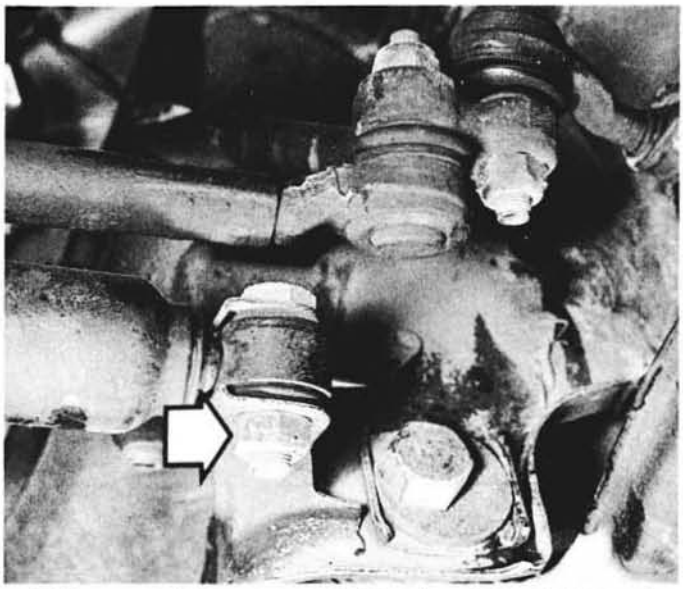
32 Drag link – removal and installation

Removal

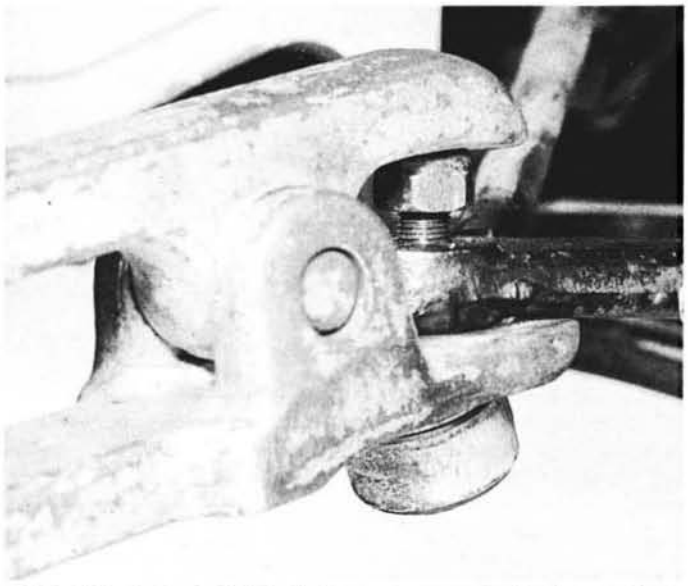
1 Raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels.
2 Remove the nut and bolt securing the steering damper to the drag link.



31.2a Steering damper-to-drag link retaining nut (arrow) . . .



31.2b . . . and damper mount at the chassis bracket (arrow)

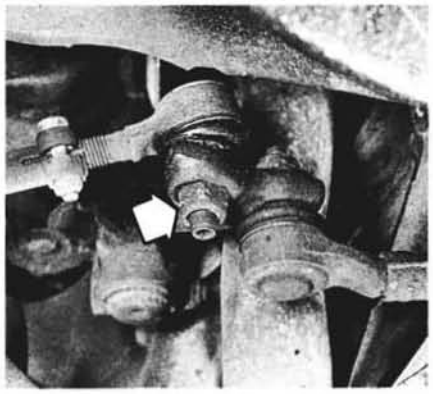


33.2 Detach the balljoint stud using a separator tool – note that the nut hasn't been removed completely – this will prevent the components from separating violently

3 Remove the retaining nuts, and detach the drag link balljoints from the steering gear Pitman arm and the idler arm, using a balljoint separator tool.
4 Remove the drag link from the vehicle.
5 Check the condition of the drag link balljoints, which should be reasonably stiff to move. If they are sloppy or have excessive freeplay, replace the drag link. The drag link should also be replaced if the balljoint dust boots have deteriorated, or are damaged or split. If, however, the damage was caused during removal, the dust boots can be replaced separately as described in Section 11.

Installation

6 Installation is the reverse sequence to removal. Tighten the balljoint retaining nuts to the specified torque while holding the balljoint stud with an Allen wrench.



33.3 Remove the nut (arrow) securing the inner balljoint to the Pitman arm

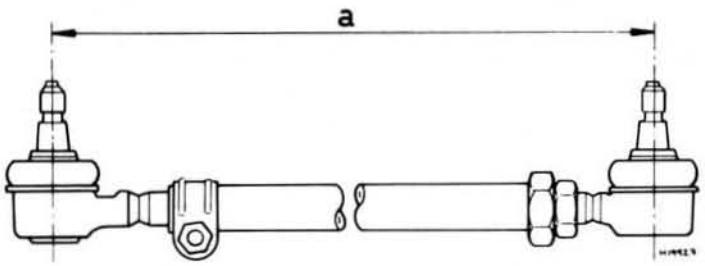
33 Steering tie-rod – removal and installation

Refer to illustrations 33.2, 33.3, 33.7 and 33.10

Removal

1 Loosen the wheel lug bolts, raise the front of the vehicle and dupport it securely on jackstands. Apply the handbrake and block the rear wheels. Remove the wheel.
2 Remove the nut securing the tie-rod outer balljoint to the steering arm, and detach the balljoint using a separator tool **(see illustration)**.
3 Remove the nut securing the tie-rod inner balljoint to the steering gear Pitman arm or idler arm **(see illustration)**. Detach the balljoint using the separator tool.
4 Remove the tie-rod from the car.
5 Check the condition of the tie-rod balljoints, which should be reasonably stiff to move. If they are sloppy or have excess free play, replace the balljoint(s). The balljoint should also be replaced if the dust boot has deteriorated, or is damaged or split. If, however, the damage was caused during removal, the dust boot can be replaced separately as described in Section 11.

10



33.7 Steering track rod installed dimension

a = 333.0 to 337.0 mm (13.12 to 13.28 in)

6 To replace a balljoint, first record the number of exposed threads between the balljoint and tie-rod. If the outer balljoint is being replaced, loosen the two locknuts. If the inner balljoint is being replaced, loosen the clamp nut and bolt. Now grip the tie-rod and unscrew the balljoint.

7 To install the balljoint, first transfer the two locknuts if a new outer joint is being installed, then screw the balljoint into the tie-rod until the same number of threads as noted during removal are showing. If both balljoints are being installed or replaced, set the distance between the ball stud centers **(see illustration)**, and with the same number of exposed threads on each.

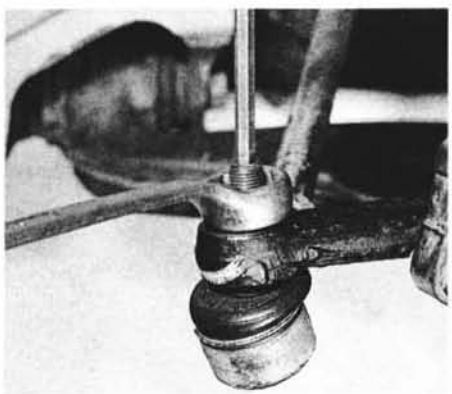
8 Tighten the two locknuts or the clamp nut and bolt as applicable.

Installation

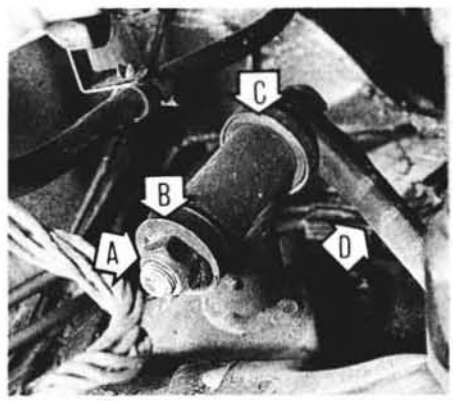
9 Install the tie-rod to the car, with the balljoint containing the two locknuts attached to the steering knuckle arm.

10 Install the locknuts and tighten while holding the ball stud with an Allen wrench **(see illustration)**.

11 Install the wheel and lower the car to the ground.



33.10 Tighten the retaining nut while holding the balljoint stud with an Allen wrench



34.3 Steering idler arm assembly showing the retaining nut (A), sealing washer (B), dust cap (C) and idler arm (D)

12 Check the front wheel alignment as described in Section 35, or have it checked by an alignment shop.

34 Steering idler arm assembly – removal and installation

Refer to illustrations 34.3 and 34.6

Removal

1 Raise the front of the vehicle and support it securely on jackstands. Apply the handbrake and block the rear wheels.

2 Unscrew the retaining nuts and separate the tie-rod and drag link balljoints from the idler arm, using a balljoint separator tool.

3 Unscrew the idler arm retaining nut and remove the sealing washer **(see illustration)**.

4 Withdraw the through-bolt, idler arm and dust cap from the idler bracket, and remove them from the car. Recover any washers, if present, from between the idler arm and dust cap.

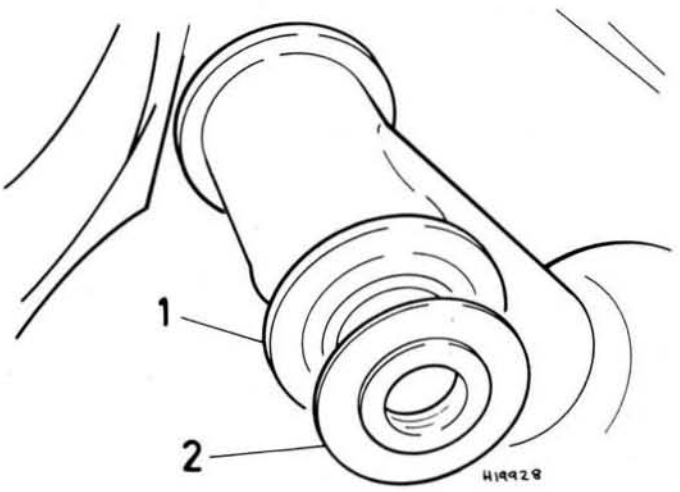
5 If necessary the idler bushings can be replaced as follows.

6 Lift up the sealing lip of the rubber slide bearing using a screwdriver, and remove the slide bushing from the slide bearing **(see illustration)**.

7 The slide bearings can be replaced by pulling them out using a tube of suitable diameter, a long bolt, nut and packing washers. Install the new slide bearings in a similar way.

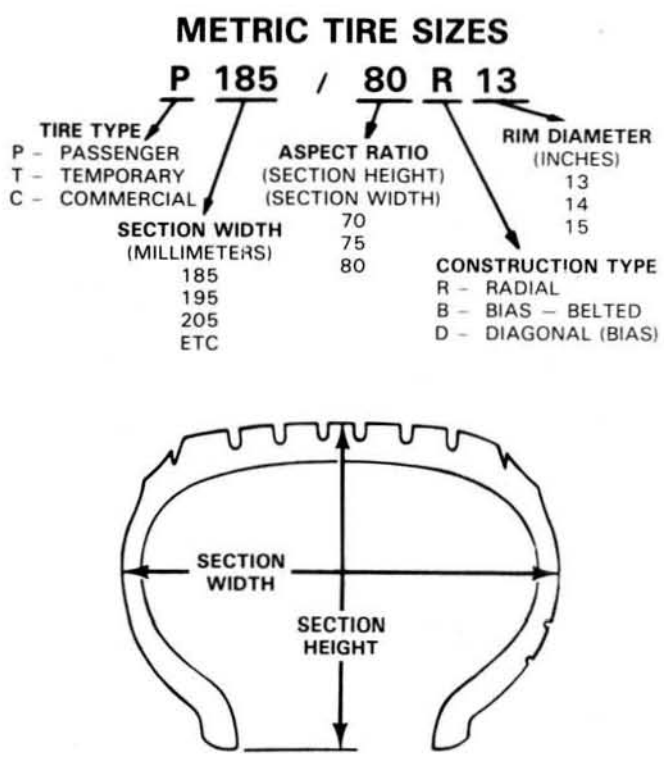
Installation

8 Install the slide bushing to the slide bearing, while lifting up the sealing lip as done during removal.



34.6 Idler assembly bushing replacement

1 Rubber slide bearing *2 Glide bushing*



35.1 Metric tire size code

9 Install the dust cap to the top of the slide bearing assembly, then install the idler arm, through-bolt, and any washers recovered during removal.
10 Install the lower washer and retaining nut, and tighten to the specified torque.
11 Locate the drag link and tie-rod balljoints into the idler arm, install the retaining nuts and tighten while holding the ball studs with an Allen wrench.
12 Lower the car to the ground.

35 Wheels and tires – general information

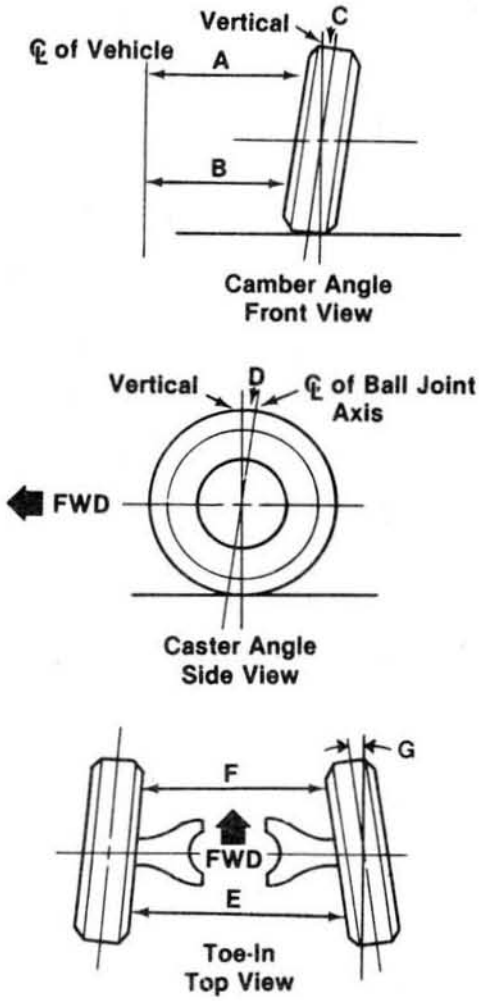
Refer to illustration 35.1

All vehicles covered by this manual are equipped with metric-sized fiberglass or steel belted radial tires **(see illustration)**. Use of other size or type of tires may affect the ride and handling of the vehicle. Don't mix different types of tires, such as radials and bias belted, on the same vehicle as handling may be seriously affected. It's recommended that tires be replaced in pairs on the same axle, but if only one tire is being replaced, be sure it's the same size, structure and tread design as the other.

Because tire pressure has a substantial effrect on handling and wear, the pressure on all tires should be checked at least once a month or before any extended trips.

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 bolts won't stay tight. Wheel repairs that use welding or peening are not recommended.

Tire and wheel balance is important to 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.



36.1 Typical alignment details

A minus B = C (degrees camber)
D = caster (measured in degrees)
E minus F = toe-in (measured in inches)
G = toe-in (expressed in degrees)

36 Wheel alignment – general information

Refer to illustration 36.1

A wheel alignment refers to the adjustments made to the wheels so they are in proper angular relationship to the suspension and the ground. Wheels that are out of proper alignment not only affect steering control, but also increase tire wear. The adjustments normally required are camber, caster and toe-in **(see illustration)**.

Getting the proper wheel alignment is a very exacting process, one in which complicated and expensive machines are necessary to perform the job properly. Because of this, you should have a technician with the proper equipment perform these tasks. We will, however, use this space to give you a basic idea of what is involved with wheel alignment so you can better understand the process and deal intelligently with the shop that does the work.

Toe-in is the turning in of the wheels. The purpose of a toe specification is to ensure parallel rolling of the wheels. In a vehicle with zero toe-in, the distance between the front edges of the wheels will be the same as the distance between the rear edges of the wheels. The actual amount of toe-in is normally only a fraction of an inch. Toe-in adjustment on the front

wheels is controlled by the tie-rod end position on the tie-rod. On the rear wheels, toe-in is adjusted by turning a cam bolt at the inner end of the track rod. Incorrect toe-in will cause the tires to wear improperly by making them scrub against the road surface.

Camber is the tilting of the front wheels from vertical when viewed from the front of the vehicle. When wheels tilt out at the top, the camber is said to be positive (+). When the wheels tilt in at the top of the camber is negative (-). The amount of tilt is measured in degrees from vertical and this measurement is called the camber angle. This angle affects the amount of tire tread which contacts the road and compensates for changes in the suspension geometry when the vehicle is cornering or travelling over undulating surface.

Caster is the tilting of the top of the front steering axis from vertical. A tilt toward the rear is positive caster and a tilt toward the front is negative caster.

On the front wheels, camber and caster are adjusted by turning the inner mounting cam bolts of the control arms. It is not adjustable on the rear wheels.

37 Troubleshooting – suspension and steering

Symptom	Reason(s)
Note: *More detailed troubleshooting procedures on the power steering system requires the use of special test equipment. Apart from the general references listed below, power steering troubleshooting should be performed by a Mercedes dealer service department or other repair shop.*	
Excessive play in steering	Worn steering gear Worn tie-rod or drag link balljoints Worn idler arm bushings Worn control arm balljoint or bushings
Car wanders or pulls to one side	Incorrect wheel alignment Worn tie-rod drag link balljoints Worn control arm balljoint or bushings Uneven tire pressures Defective tire Accident damage (bent suspension or steering component) Dragging brakes
Heavy or stiff steering	Power steering pump drivebelt slipping or broken Incorrect wheel alignment Incorrect tire pressures Seized suspension or steering balljoint Power steering gear or pump intoernal problem Bent steering column or shaft Defective steering damper
Wheel wobble and vibration	Wheels out of balance Wheels damaged Defective tire Defective steering damper Weak shock absorber Front wheel bearings incorrectly adjusted
Excessive tire wear	Incorrect tire pressures Excessive cornering speeds Incorrect wheel alignment Wheels out of balance Defective tire Wear in steering or suspension components

Chapter 11 Body

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1 General information

These models feature a "unibody" layout, 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 repaired or replaced. 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 do-it-yourselfer are included in this Chapter.

2 Body – maintenance

1 The condition of your vehicle's body is very important, because the resale value depends a great deal on it. It's 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 wheel wells, the frame and the engine compartment, are equally important, although they don't require as frequent attention as the rest of the body.

2 Once a year, or every 12,000 miles, it's a good idea to have the underside of the vehicle steam cleaned. All traces of dirt and oil will be removed and the area can then be inspected carefully for rust, damaged brake lines, frayed electrical wires, 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 with a steam cleaner or water soluble degreaser.

4 The wheel wells should be given close attention, since undercoating can peel away and stones and dirt thrown up by the tires can cause the paint to chip and flake, allowing fender 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 about once a week. 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 can wear down the paint.

6 Spots of tar or asphalt thrown up from the road should be removed with a cloth soaked in solvent.

7 Once every six months, wax the body and chrome trim. 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.

2 Leather upholstery requires special care. Stains should be removed with warm water and a very mild soap solution. Use a clean, damp cloth to remove the soap, then wipe again with a dry cloth. Never use alcohol, gasoline, nail polish remover or thinner to clean leather upholstery.

3 After cleaning, regularly treat leather upholstery with a leather wax. Never use car wax on leather upholstery.

4 In areas where the interior of the vehicle is subject to bright sunlight, cover leather seats with a sheet if the vehicle is to be left out for any length of time.

4 Body repair – minor damage

See photo sequence on pages 206 and 207

Repair of 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, aluminum tape, 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 well. 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.

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 the specialized equipment required to do the job properly.

2 If the damage is extensive, the body 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 the 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 Hood – removal and installation

Refer to illustrations 6.2a, 6.2b and 6.6

1 Raise the hood to the vertical position by pressing the catch on the left-hand hinge, releasing the retaining wire clip on the support strut, and pushing the hood up.

2 Remove the retaining clip **(see illustration)** and pull out the support strut from its lower mounting stud **(see illustration on next page)**.

3 Disconnect the windshield washer hose(s) at the check valve on the right-hand side and release the hose clips on the hood hinge.

4 Pull the wiring for the heated washer jets out of the hood cavity adjacent to the jet(s) and disconnect the electrical connector connections.

5 Tie a length of string to the main feed cable and pull the wiring out of the hood cavity from the hinge end. As soon as the end of the string appears, untie it and remove the wire. When installing, tie the cable to the string to draw it back into position.

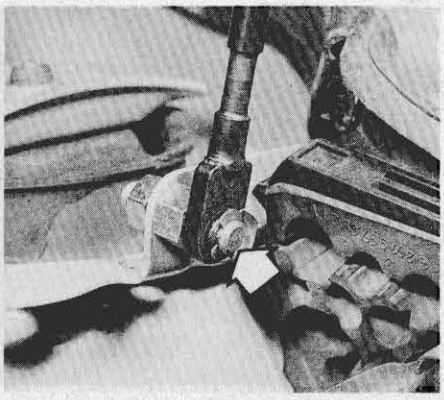
6 Remove the hinge retaining straps by releasing the upper bent-over locking portion from the hinge pin, then pulling the straps up **(see illustration)**.

7 Mark the position of the lower threaded hinge bolts on both sides so that the hood can be installed in its original position.

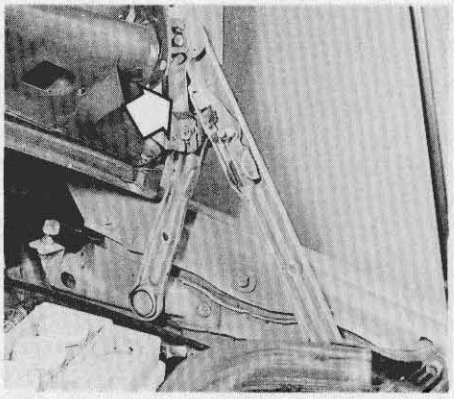
8 With the help of an assistant to support the hood, unscrew the lower retaining nut each on side, remove the hinge bolts and hinge pins and carefully lift off the hood.

9 To install the hood, push the hinge pin and hinge bolt bushings into the hinges, if these came out during removal.

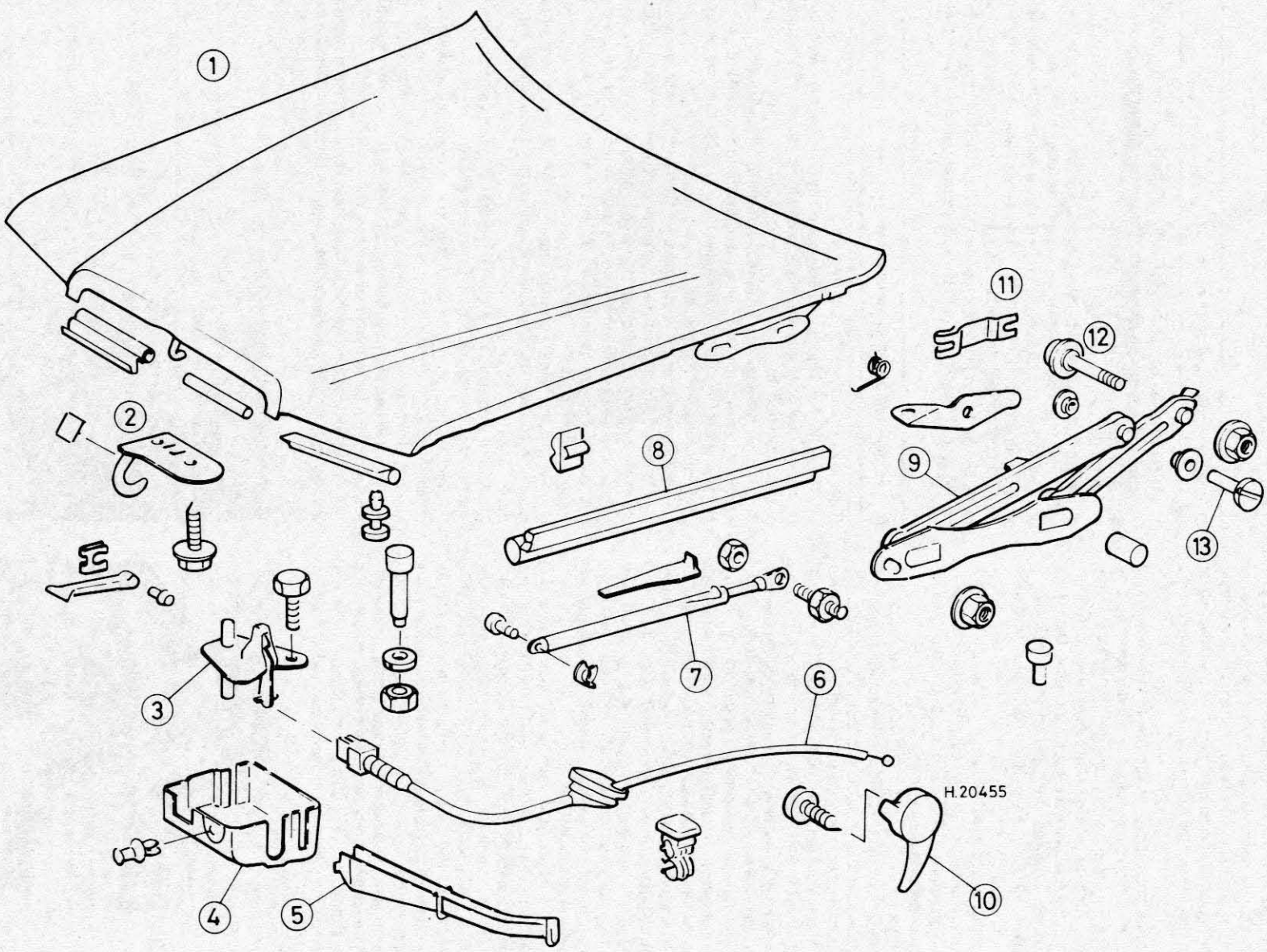
10 Place the hood in position and insert the lower hinge bolt. Turn the bolt until the square collar engages with the rectangular hole in the hinge lever.



6.2a Hood support strut retaining clip (arrow)



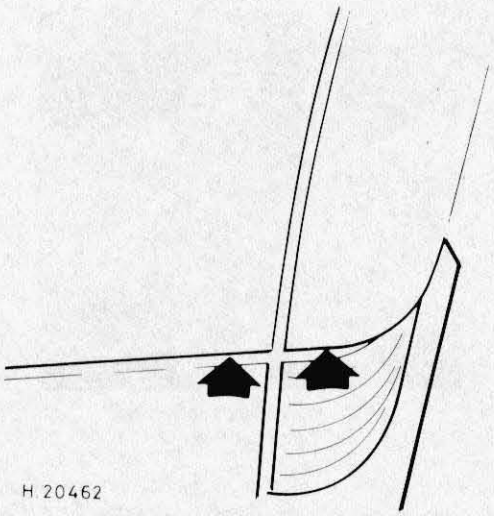
6.6 Hood hinge retaining strap (arrow)



6.2b Hood, hinge and latch assembly main components

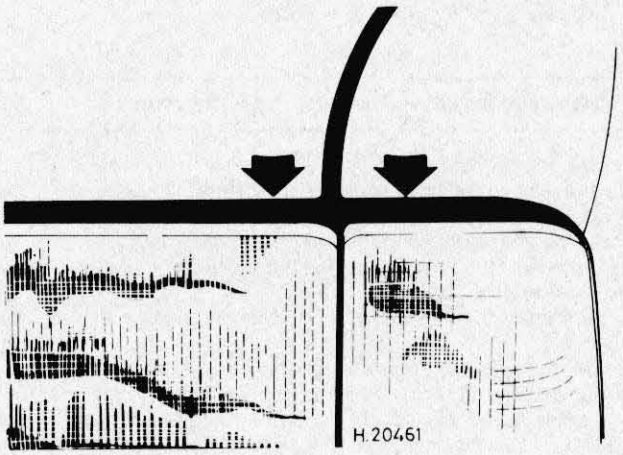
1	*Hood*	4	*Latch cover*	7	*Support strut*	10	*Release handle*
2	*Latch upper plate*	5	*Cover extension*	8	*Hood seal*	11	*Retaining strap*
3	*Hood latch*	6	*Release cable*	9	*Hinge assembly*		

12	*Hinge bolt*
13	*Hinge pin*



7.1a Hood longitudinal adjustment

Front edge of hood aligned with front edge of fender when correct



7.1b Hood height adjustment

Height of hood front edge and front fender identical when correct

11 Insert the upper hinge pin and turn it until the slot in the hinge pin head is horizontal.
12 Install the hinge nut, position the hood so that the previously made marks are aligned, then tighten the nut. Install the hinge retaining strap, then repeat these operations for the hinge on the other side.
13 Tie the washer jet wiring to the drawstring and pull the wires through the hood into place. Reconnect the electrical connector(s).
14 Reconnect the washer hose(s) at the check valve, and secure with new hose clamps to the hood hinge.
15 Locate the support strut on the mounting stud and secure with the retaining clip.
16 Lower the hood and check its fit and alignment. If necessary adjust the hood position as described in Section 7.

7 Hood – adjustment

Refer to illustrations 7.1a, 7.1b and 7.2

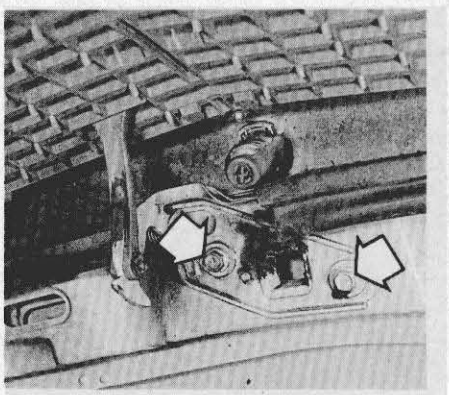
1 With the hood closed, check the gap between the hood and front fenders on both sides (transverse adjustment), the alignment of the front edge of the hood with the front edge of the fender when looking down, **(see illustration)** and the height of the hood front edge and top edge in relation to the fender **(see illustration)**.

Transverse adjustment

2 Open the hood and loosen the two bolts securing the latch upper plate to the hood **(see illustration)**
3 By trial and error, move the upper plate until a gap of approximately 5.0 mm (0.2 in) exists between the hood and the front fenders on each side.

Longitudinal adjustment

4 Remove the hood support strut as described in Section 9.
5 Remove the plastic covering from under the fenderwell, on the side being adjusted, for access to the hood hinge retaining nuts.
6 From inside the engine compartment, loosen the locknut and screw down the hood rubber buffer behind the hinge.
7 Loosen the four hood hinge retaining bolts from under the fenderwell.
8 With the hood closed, position it in such a way that when viewed from the front looking down, the edge of the hood and the edge of the front fender are in alignment.
9 Tighten the hinge nuts with the hood closed and correctly aligned.
10 Install the fenderwell covering and hood support strut, then check the height adjustment.



7.2 Hood latch upper plate retaining bolts (arrows)

Height adjustment

11 From inside the engine compartment, loosen the locknut and screw down the hood rubber buffer behind the hinge.
12 Loosen the nut on the hood-to-hinge lower retaining bolt.
13 By trial and error, move the hood as necessary, tightening the hinge bolt each time until the hood upper edge and front fender edge are aligned.
14 Now raise the rubber buffer a little at a time until the front edge of the hood and the edge of the fender, when viewed from the front, are aligned. Tighten the buffer locknut when adjustment is correct.

8 Hood hinge – removal and installation

1 Remove the hood as described in Section 6.
2 Remove the plastic covering from under the fenderwell for access to the hinge retaining nuts.
3 Remove the four hinge retaining nuts and remove the hinge.
4 Installation is the reverse of removal. Adjust the hood as described in Section 7 after fitting.

9 Hood support strut – removal and installation

1 Open the hood to the vertical position by pressing the catch on the left-hand hinge, releasing the retaining wire clip on the support strut and pushing the hood upwards until the hinge locks.

2 Extract the strut lower retaining clip, unscrew the upper retaining nut and remove the strut.
3 Installation is the reverse of removal.

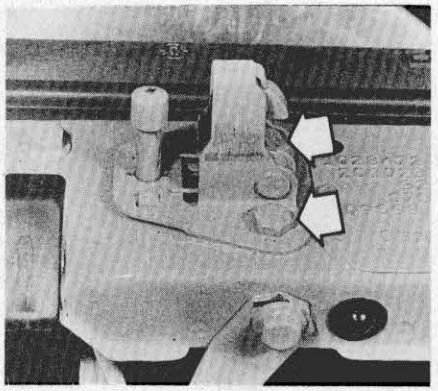
10 Hood release cable – removal and installation

1 Release the locking stud on the front panel adjacent to the support strut and remove the cover under the lock. **Note:** *On cars with air conditioning, unscrew the two screws and move the fan, then release the four upper clips and move the radiator to the rear for access.*
2 Disconnect the release cable at the lock lever and support bracket **(see illustration 6.2b).**
3 From inside the car, remove the cover under the dash on the left-hand side.
4 Remove the screw and the release handle, then disconnect the cable.
5 Push out the rubber grommet at the cable entry point on the firewall.
6 Tie string to the release cable so that as the cable is pulled through the firewall it will pull the string with it.
7 Pull out the cable in a forward direction. When the drawstring appears, untie it and remove the cable from the car.
8 Installation is the reverse of removal – use the string to draw the new cable through the firewall into the car.

11 Hood latch – removal and installation

Refer to illustration 11.3

1 Detach the locking stud on the front panel adjacent to the support strut and remove the cover under the latch. **Note:** *On cars with air conditioning, unscrew the two screws and move the fan, then release the four upper clips and move the radiator to the rear for access.*



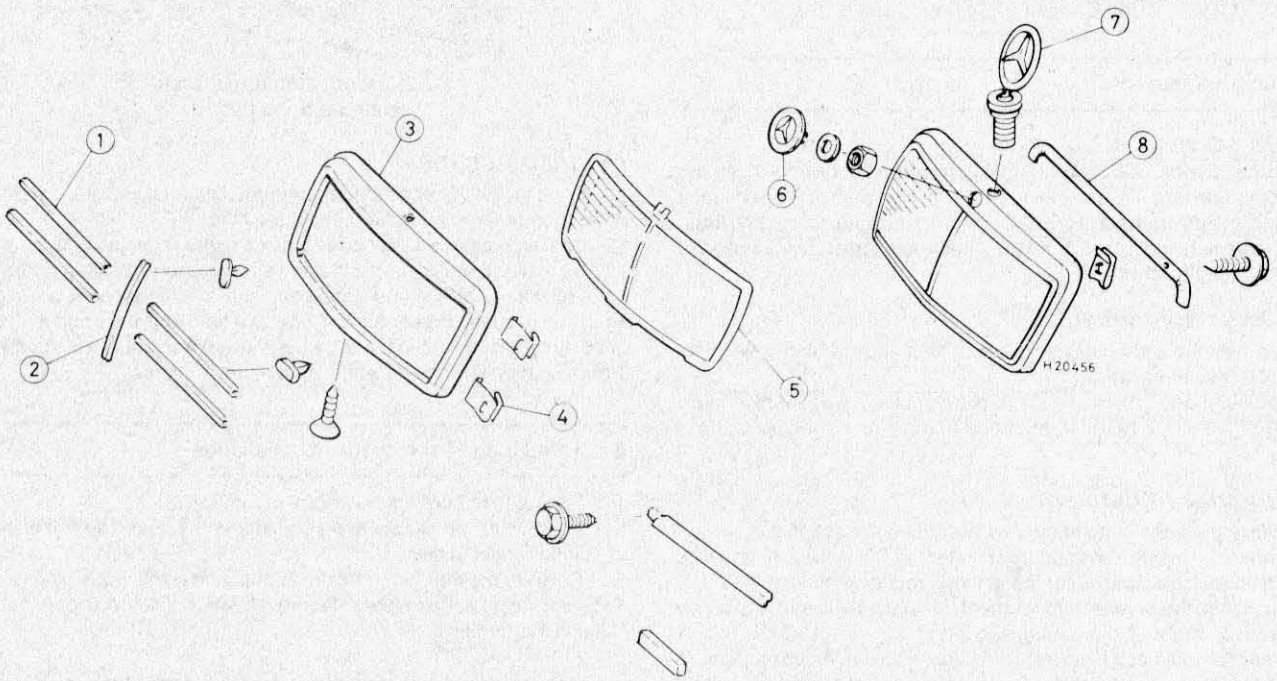
11.3 Hood latch retaining bolts (arrows)

2 Disconnect the release cable at the latch lever and support bracket.
3 Remove the two retaining bolts and remove the latch from the front panel **(see illustration).**
4 Installation is the reverse of removal. Minor adjustment of the closing action can be performed by loosening the front panel support strut lower mounting bolt, and moving the strut and panel up or down slightly as necessary.

12 Radiator grille – removal and installation

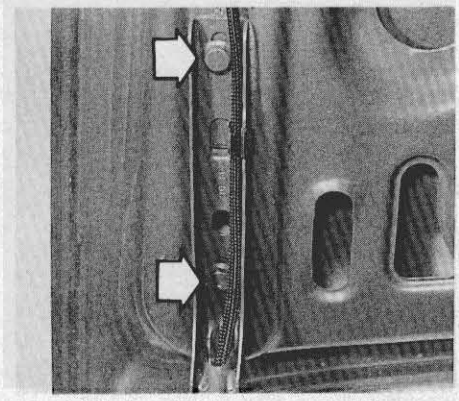
Refer to illustration 12.1

1 Open the hood, and from the inside at the front, unscrew the six retaining bolts **(see illustration).**

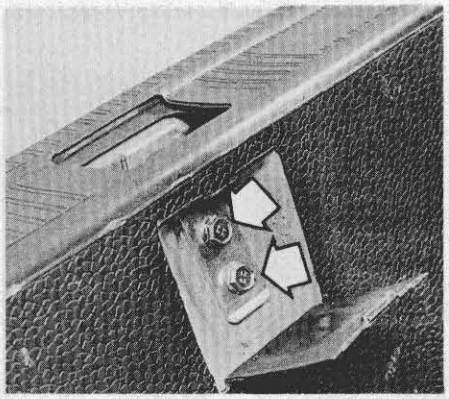


12.1 Radiator grille components and attachments

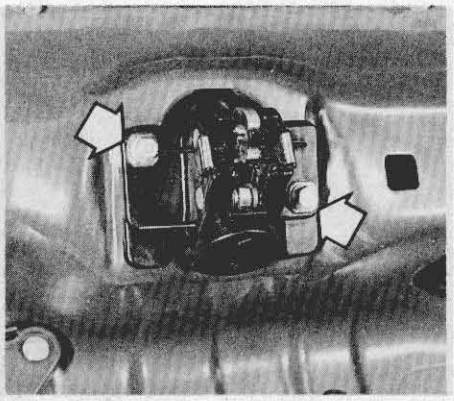
1	*Horizontal bars*	3	*Grille surround*	5	*Grille panel*	7	*Mercedes star*
2	*Vertical bar*	4	*Pin clamps*	6	*Mercedes badge*	8	*Clamp rail*



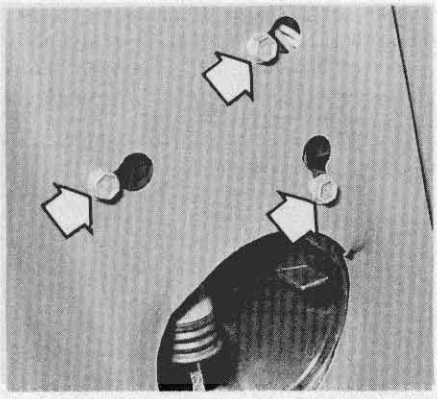
14.5 Trunk lid-to-hinge retaining bolts (arrows)



14.6 Trunk lid striker plate retaining bolts (arrows)



15.1 Remove the bolts (arrows) and pull out the trunk latch



15.2 Central locking solenoid retaining bolts (arrows)

2 Remove the grille surround and grille from the hood.
3 Remove the pin clamps securing the grille to the grille surround on both sides.
4 Remove the lower screw and the upper nut that also retains the Mercedes badge. Remove the badge, then lift the grille out of the grille surround.
5 Installation is the reverse of removal.

13 Mercedes star – removal and installation

1 From the underside of the hood, pull the spring clip down using heavy duty pliers, against considerable spring tension, and turn the clip 90-degrees to the left. Make sure that the spring clip enters into the grooves of the rosette.
2 Pull the star upwards out of the grille surround to remove.
3 Installation is the reverse of removal.

14 Trunk lid – removal and installation

Refer to illustrations 14.5 and 14.6

1 Disconnect the cable from the negative terminal of the battery.
2 Pry out the luggage compartment lamp, disconnect the wiring and remove the lamp.
3 Carefully pull out the wiring harness from the trunk lid cavity.
4 Mark the outline of the hinges on the trunk lid using a pencil.
5 Place some rags beneath the lower corners of the trunk lid and, with the help of an assistant, unscrew the hinge retaining bolts **(see illustration)**. Remove the trunk lid from the car.
6 Installation is the reverse of removal, but align the hinges with the outline marks made prior to removal before tightening the bolts. Adjust the lock striker plate as necessary to achieve satisfactory opening and closing of the trunk lid **(see illustration)**.

15 Trunk lid latch – removal and installation

Refer to illustrations 15.1 and 15.2

1 Open the trunk lid, unscrew the two bolts and remove the latch **(see illustration)**.
2 If the vehicle is equipped with central locking, unscrew the three solenoid retaining screws **(see illustration)** and disconnect the operating rod from the latch prior to removal.
3 To remove the solenoid, disconnect the vacuum hose and withdraw the unit from the trunk lid opening.
4 Installation is the reverse of removal. Adjust the latch striker plate as necessary to achieve satisfactory opening and closing of the trunk lid.

16 Front and rear bumpers – removal and installation

Front bumper

Refer to illustration 16.1

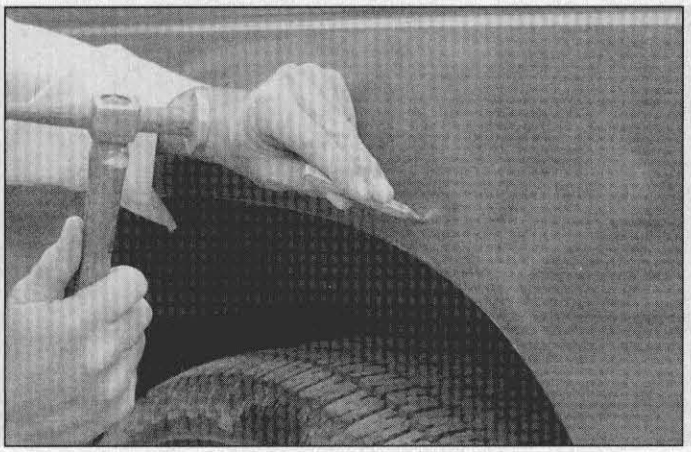
1 Remove the single bolt each side securing the bumper laterally to the side support members **(see illustration on next page)**.
2 Remove the two nuts and remove the washers on each side at the front securing the bumper to the chassis members.
3 Push out the clips along the top edge of the bumper in front of the radiator.
4 Carefully pull the bumper forwards and remove it from the car.
5 Installation is the reverse of removal.

Rear bumper

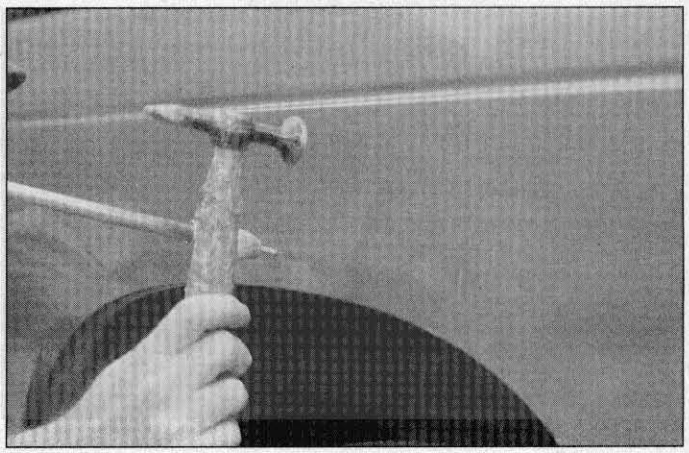
Refer to illustrations 16.6a and 16.6b

6 From inside the luggage compartment, open the flaps in the trim pan-

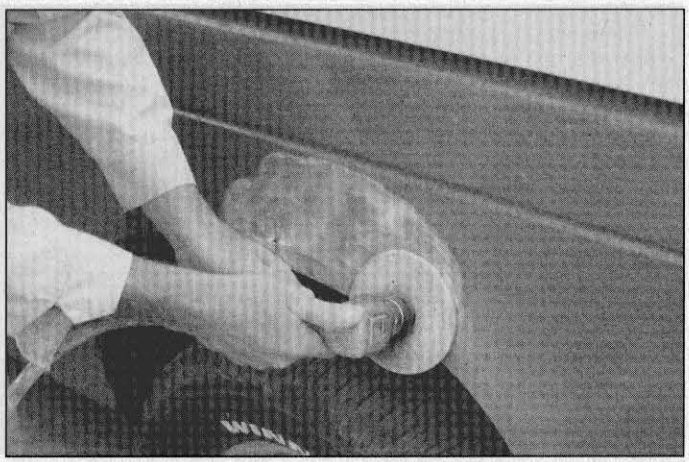
These photos illustrate a method of repairing simple dents. They are intended to supplement *Body repair - minor damage* in this Chapter and should not be used as the sole instructions for body repair on these vehicles.



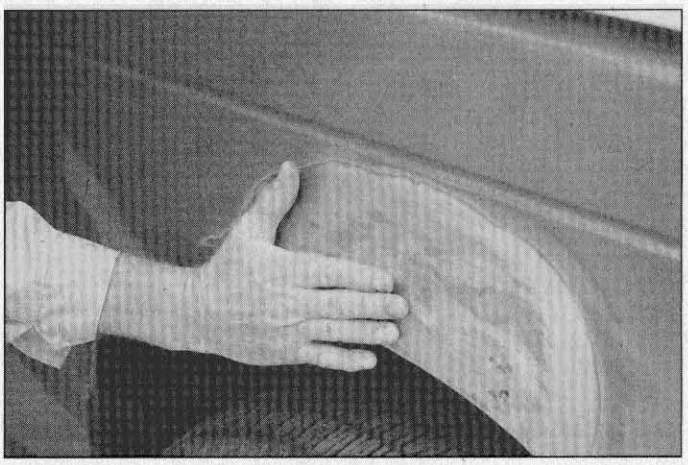
1 If you can't access the backside of the body panel to hammer out the dent, pull it out with a slide-hammer-type dent puller. In the deepest portion of the dent or along the crease line, drill or punch hole(s) at least one inch apart . . .



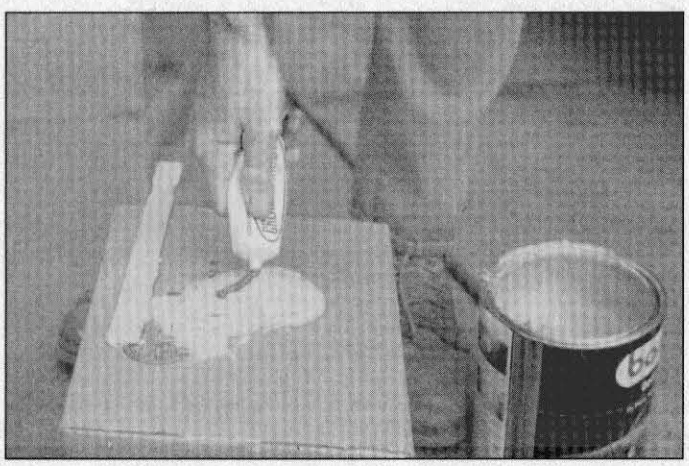
2 . . . then screw the slide-hammer into the hole and operate it. Tap with a hammer near the edge of the dent to help 'pop' the metal back to its original shape. When you're finished, the dent area should be close to its original contour and about 1/8-inch below the surface of the surrounding metal



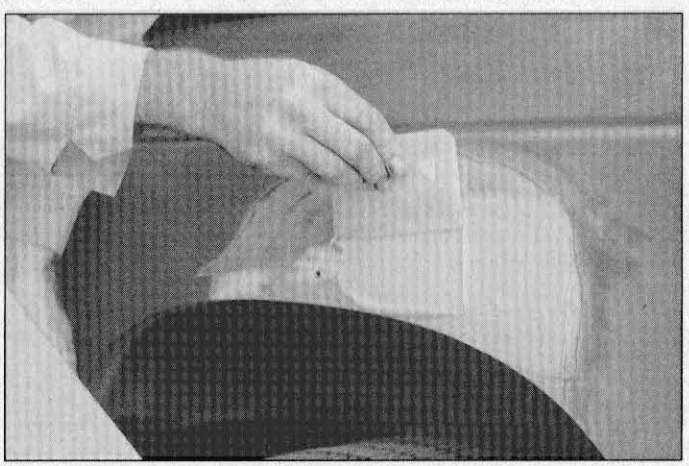
3 Using coarse-grit sandpaper, remove the paint down to the bare metal. Hand sanding works fine, but the disc sander shown here makes the job faster. Use finer (about 320-grit) sandpaper to feather-edge the paint at least one inch around the dent area



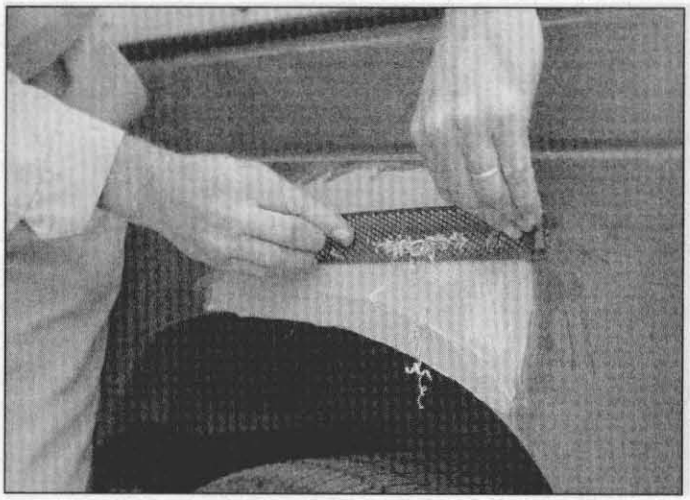
4 When the paint is removed, touch will probably be more helpful than sight for telling if the metal is straight. Hammer down the high spots or raise the low spots as necessary. Clean the repair area with wax/silicone remover



5 Following label instructions, mix up a batch of plastic filler and hardener. The ratio of filler to hardener is critical, and, if you mix it incorrectly, it will either not cure properly or cure too quickly (you won't have time to file and sand it into shape)



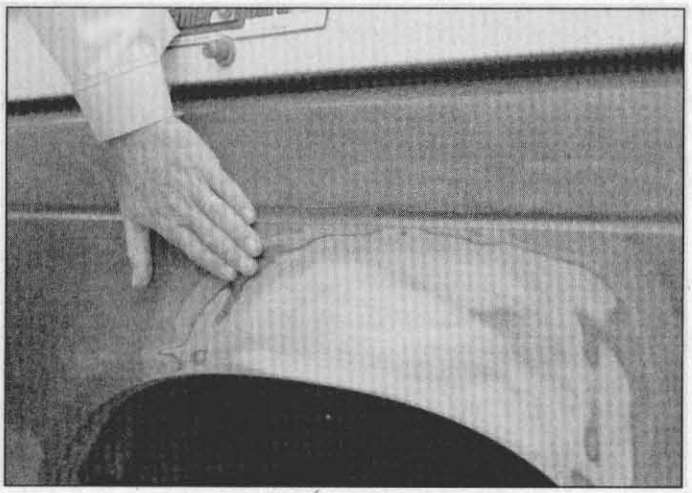
6 Working quickly so the filler doesn't harden, use a plastic applicator to press the body filler firmly into the metal, assuring it bonds completely. Work the filler until it matches the original contour and is slightly above the surrounding metal



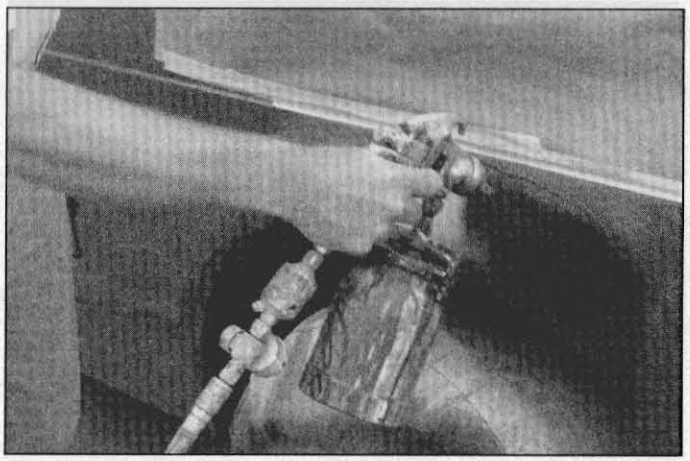
7 Let the filler harden until you can just dent it with your fingernail. Use a body file or Surform tool (shown here) to rough-shape the filler



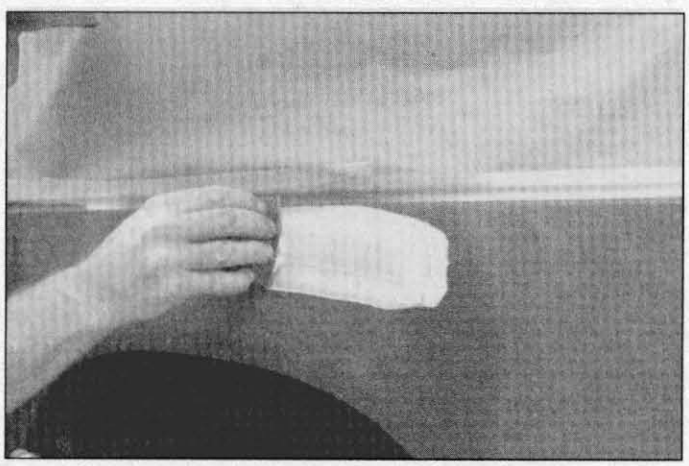
8 Use coarse-grit sandpaper and a sanding board or block to work the filler down until it's smooth and even. Work down to finer grits of sandpaper - always using a board or block - ending up with 360 or 400 grit



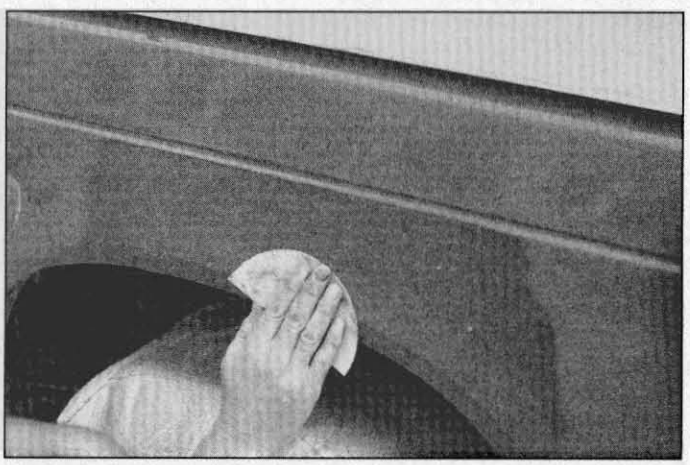
9 You shouldn't be able to feel any ridge at the transition from the filler to the bare metal or from the bare metal to the old paint. As soon as the repair is flat and uniform, remove the dust and mask off the adjacent panels or trim pieces



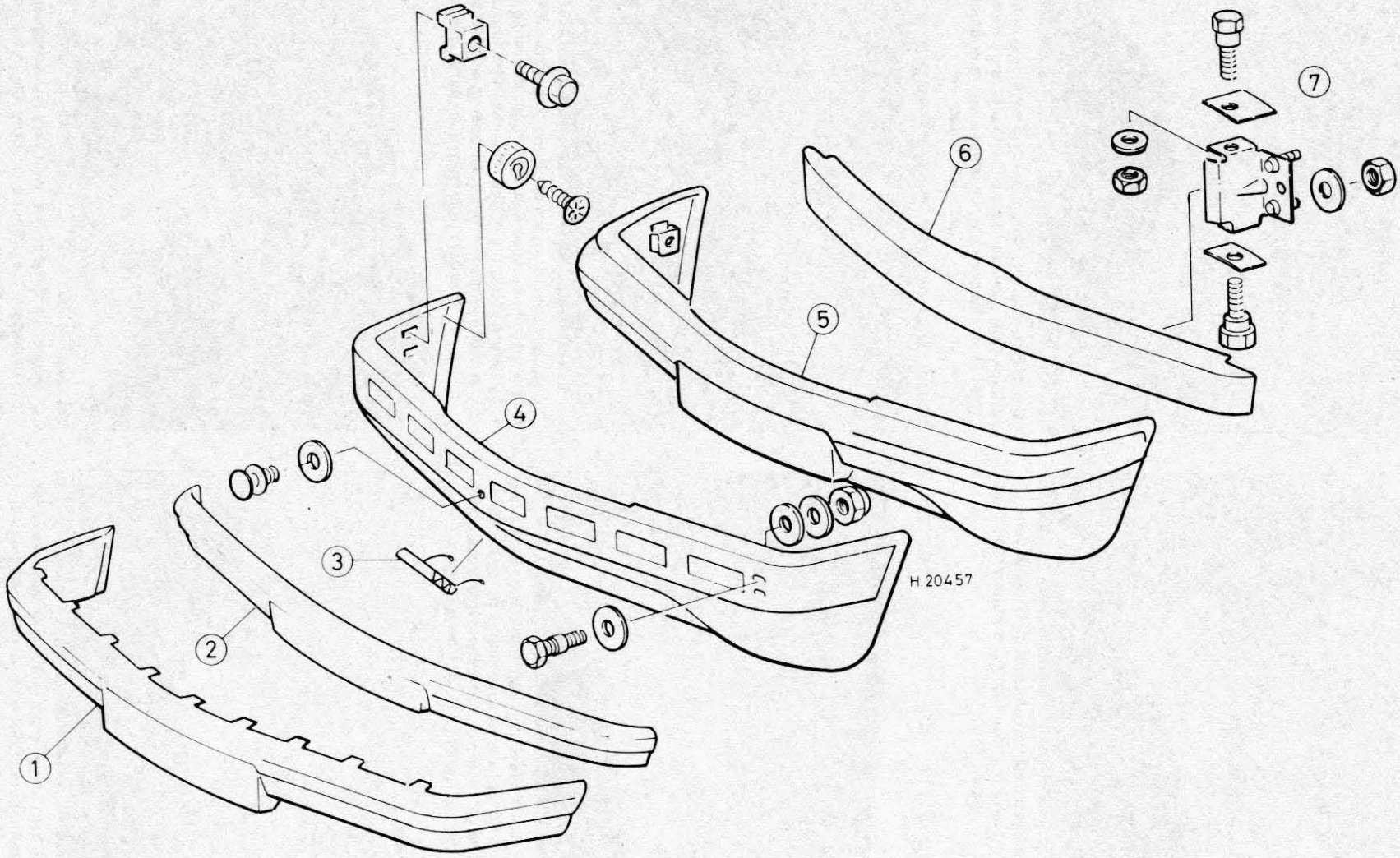
10 Apply several layers of primer to the area. Don't spray the primer on too heavy, so it sags or runs, and make sure each coat is dry before you spray on the next one. A professional-type spray gun is being used here, but aerosol spray primer is available inexpensively from auto parts stores



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

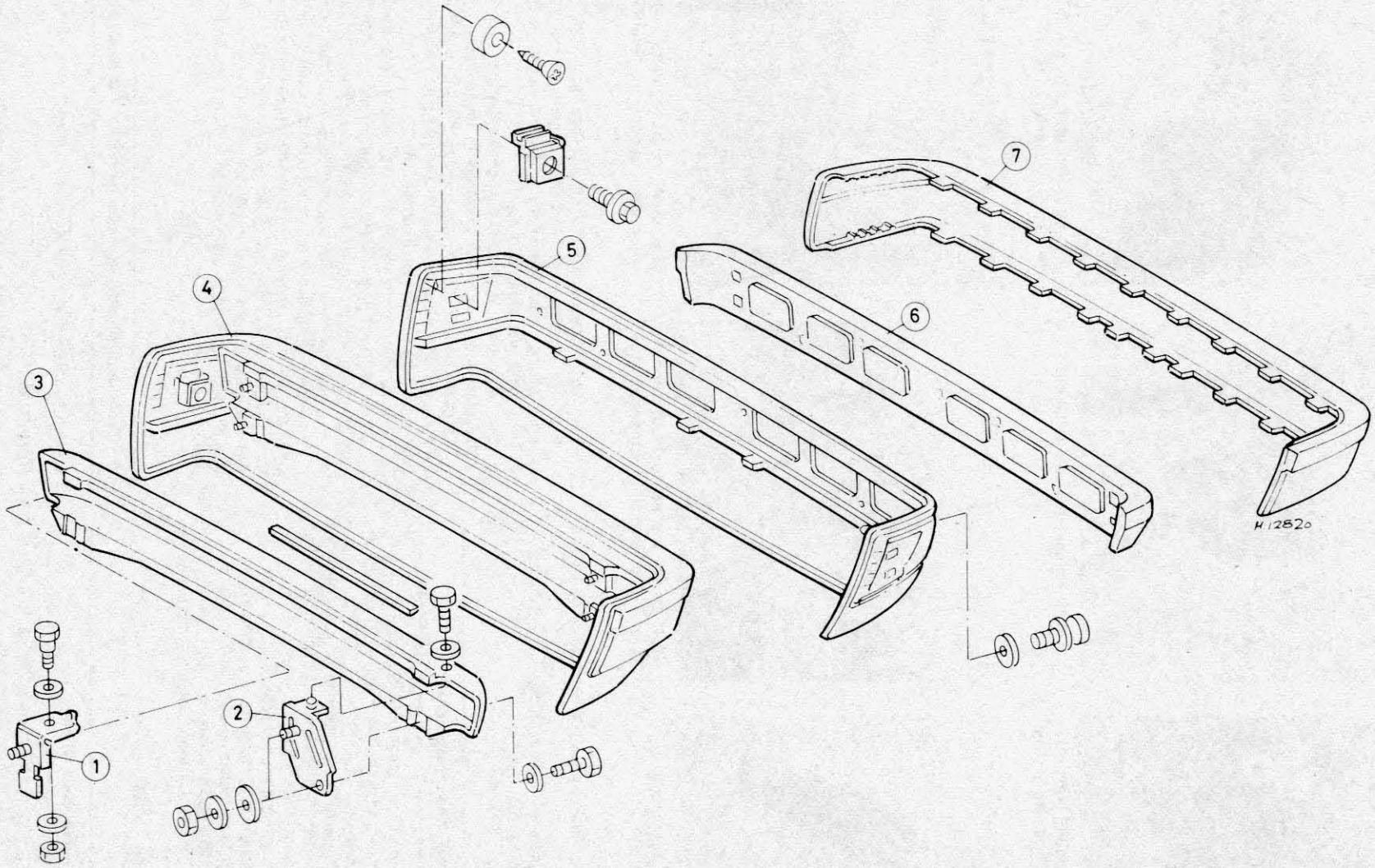


12 Finish sand the primer with very fine sandpaper (400 or 600-grit) to remove the primer overspray. Clean the area with water and allow it to dry. Use a tack rag to remove any dust, then apply the finish coat. Don't attempt to rub out or wax the repair area until the paint has dried completely (at least two weeks)



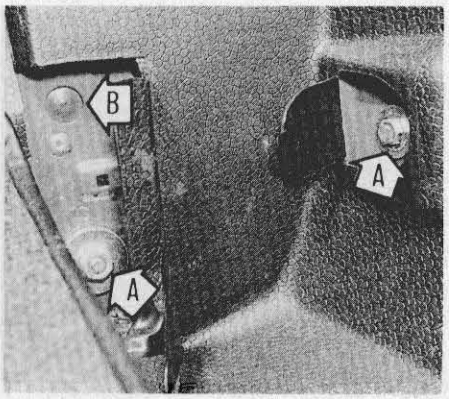
16.1 Front bumper components

1	*Protective strip*	*4*	*Outer trim covering*	*6*	*Stiffener*
2	*Foam member*	*5*	*Inner trim covering*	*7*	*Front holder*
3	*Towing eye cover*				

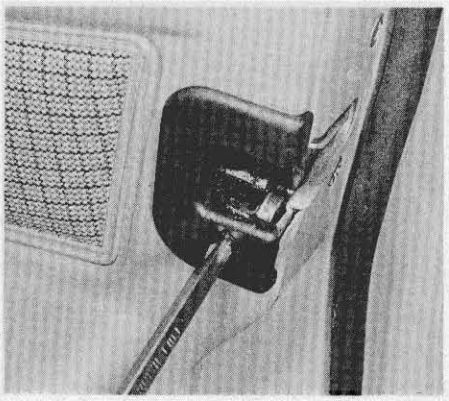


16.6a Rear bumper components

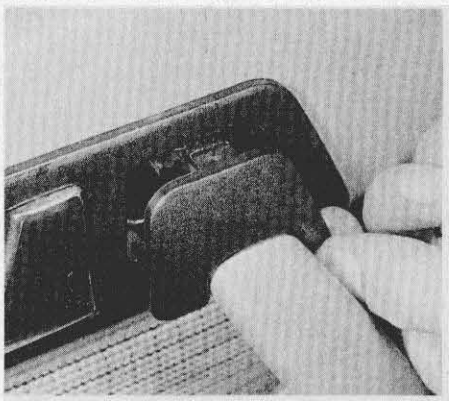
1	*Holder*	*4*	*Inner trim covering*	*6*	*Foam member*
2	*Holder*	*5*	*Outer trim covering*	*7*	*Protective strip*
3	*Stiffener*				



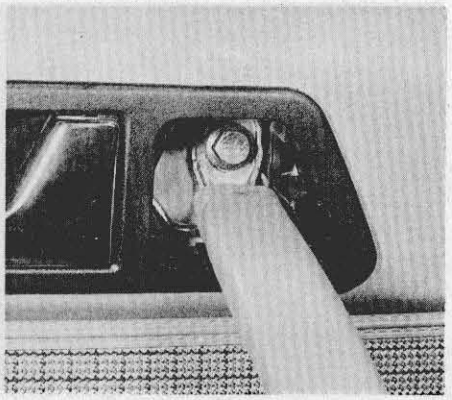
16.6b Rear bumper retaining bolts (A) – additional bolt may be installed at (B)



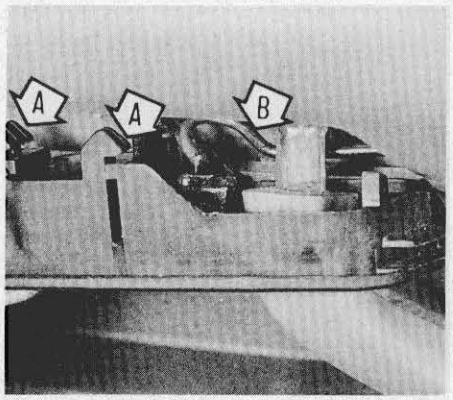
18.1 Remove the door latch trim



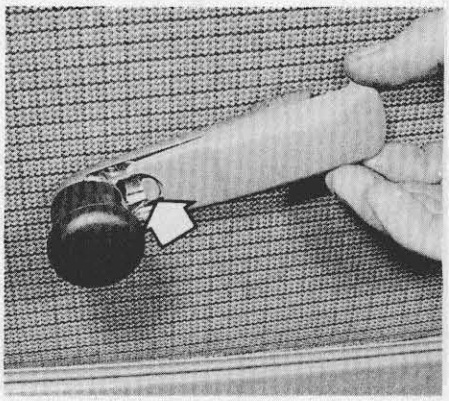
18.2 Pry off the grab handle plastic cover



18.3 Remove the grab handle retaining bolt



18.4 Detach the interior handle hooks (A) and disengage the operating rod (B)



18.6 Remove the regulator handle trim after pressing down the detent (arrow)

els and unscrew the bumper retaining bolts on each side **(see illustrations)**.
7 Carefully pull the bumper to the rear and remove it from the car.
8 Installation is the reverse of removal.

17 Bumpers – disassembly and reassembly

1 The front and rear bumpers consist of a protective strip, foam member, trim covering and stiffener sandwiched together to form an assembly **(see illustration 16.1 or 16.6a).**
2 Remove the side retaining screws at the extreme ends on both sides.
3 Push back the holding straps, top and bottom, in pairs starting from the outside and working towards the center.
4 Remove the protective strip and the foam member.
5 Push back the clips and remove the trim from the stiffener.
6 Push back the detent on the threaded holders on both sides, while at the same time sliding the holder down to remove.
7 Remove the nuts and bolts securing the front holders, and remove the holders.
8 Reassembly is the reverse of disassembly.

18 Door trim panel – removal and installation

Refer to illustrations 18.1, 18.2, 18.3, 18.4, 18.6, 18.7a, 18.7b, 18.8, 18.9 and 18.10

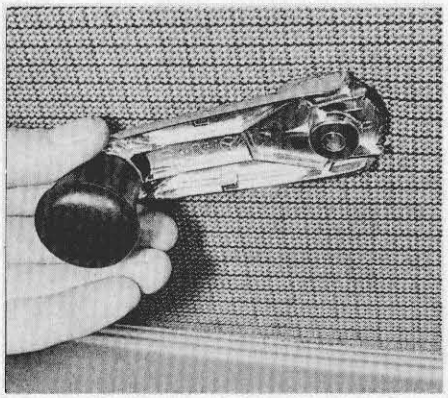
1 Remove the screw and detach the door latch trim **(see illustration)**.
2 Carefully pry off the plastic cover at the top of the grab handle **(see illustration)**.
3 Remove the grab handle retaining bolt **(see illustration)**.
4 Ease the interior release handle out of the trim panel, while at the same time sliding the complete housing forwards to release the internal retaining hooks **(see illustration)**.
5 Disengage the lock operating rod from the rear of the interior release handle, and remove the handle and housing from the door.
6 On cars with manually operated window regulators, slide the regulator handle trim off the handle, after releasing the detent by pressing down with a small screwdriver **(see illustration)**.
7 Remove the regulator handle and the trim disc **(see illustrations)**.
8 Lift the trim panel up to release the hooked retainers at the rear of the panel at the center, bottom and sides **(see illustration)**. When the panel is free, lift it over the interior lock button and remove it from the door.
9 For access to the door internal components, carefully peel back the waterproof sheet and remove it from the door **(see illustration)**.
10 installation is the reverse of removal. When engaging the panel hooked retainers, first engage the longer one at the center of the panel **(see illustration)**, then lift the panel just sufficiently to engage the rest without disengaging the center one.

19 Front door window regulator – removal and installation

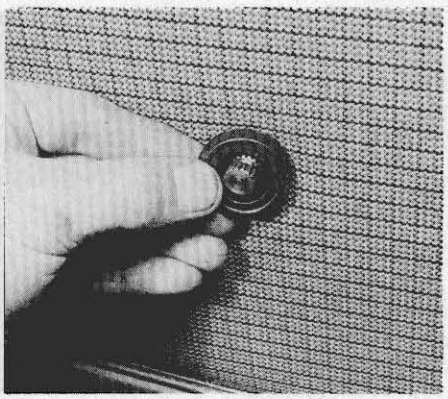
Refer to illustrations 19.2a, 19.2b, 19.3, 19.6, 19.7, 19.8, 19.9a and 19.9b

Removal

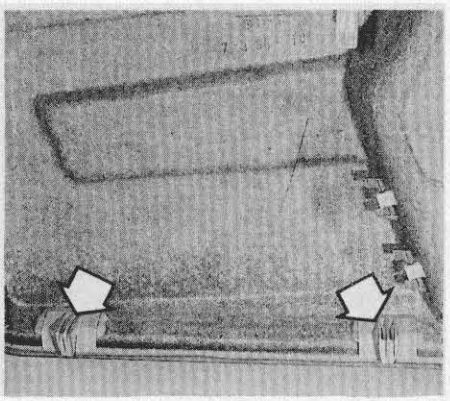
1 Remove the door inner trim panel as described in Section 18.
2 Lower the window until the nut securing the regulator arm to the window regulator channel is accessible through the small opening at the front of the door **(see illustrations)**.



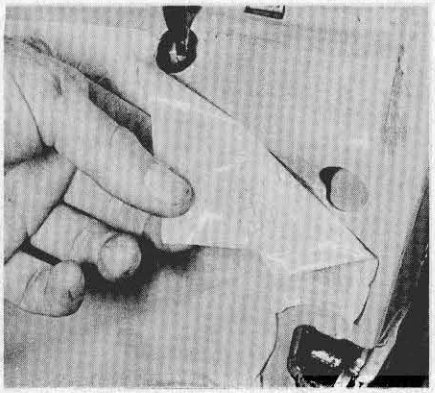
18.7a Withdraw the regulator handle . . .



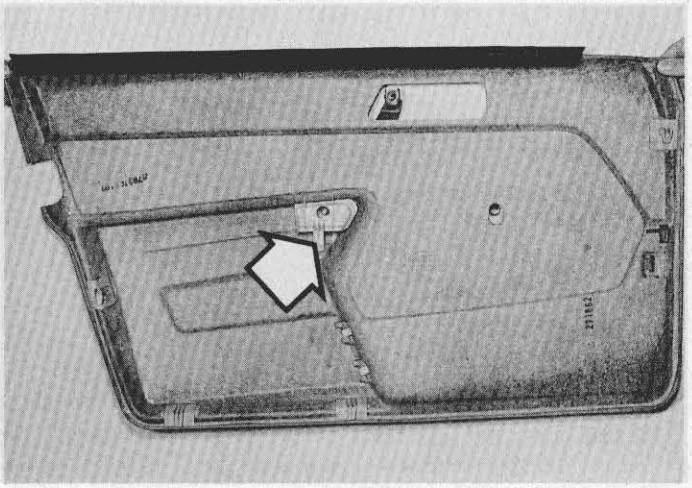
18.7b . . . and the trim disc



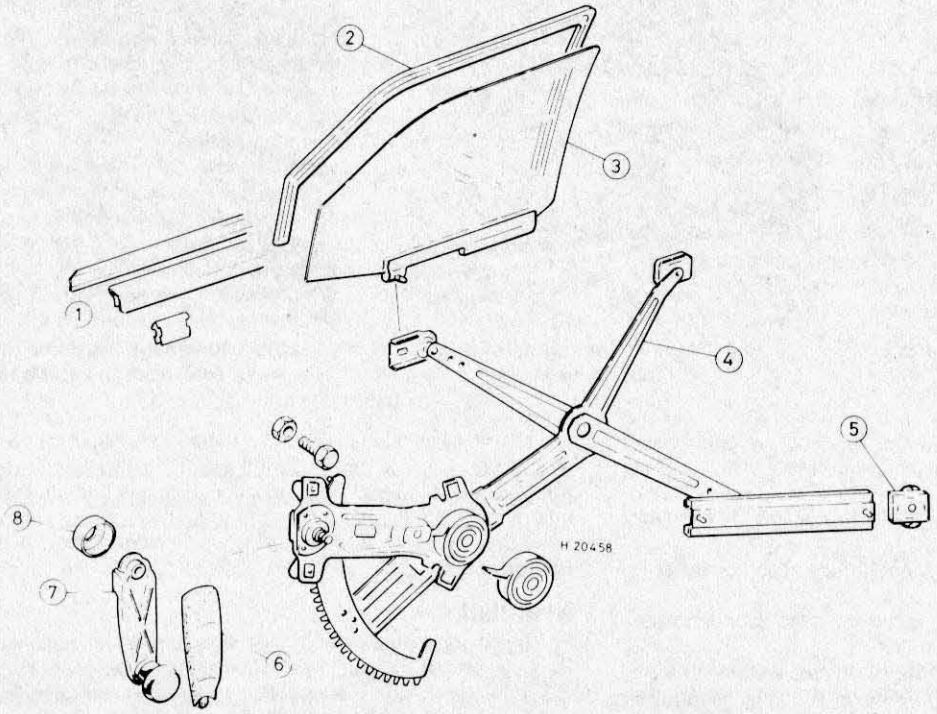
18.8 Door panel lower rear hooked retainers (arrows)



18.9 Carefully peel back the waterproof sheet

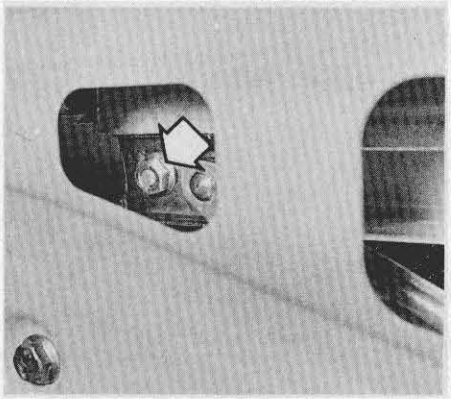


18.10 Engage the center hooked retainer first (arrow) when installing the panel

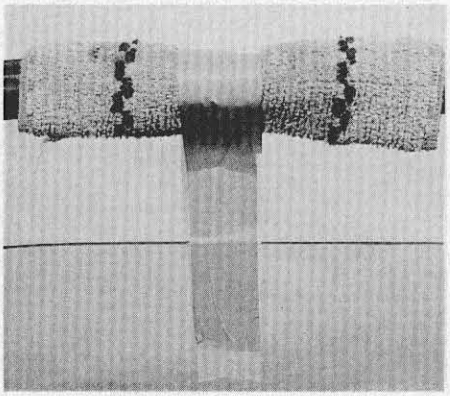


19.2a Front door window and regulator

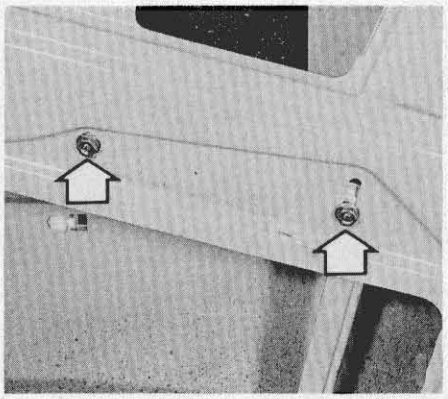
1 *Waist rail inner and outer sealing strips*
2 *Glass channel*
3 *Window glass*
4 *Regulator*
5 *Guide member*
6 *Regulator handle trim*
7 *Regulator handle*
8 *Trim disc*



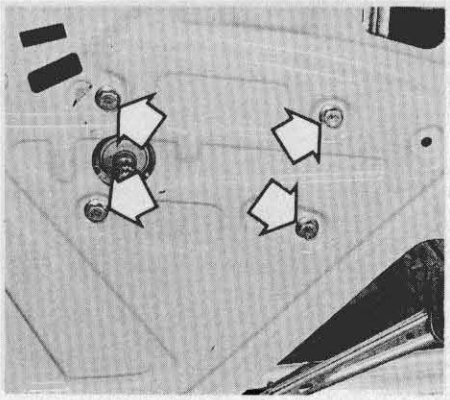
19.2b Remove the regulator arm to regulator channel nut (arrow)



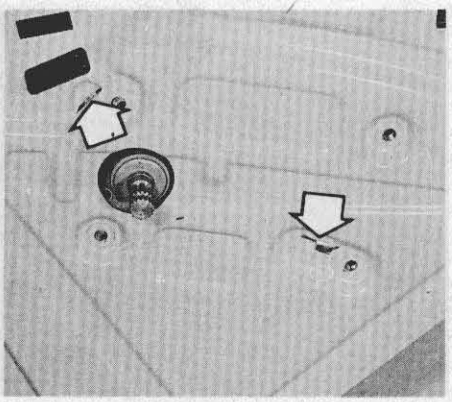
19.3 Using masking tape to support the window – be sure to drape a rag over the weatherstrip so the tape doesn't stick to the rubber



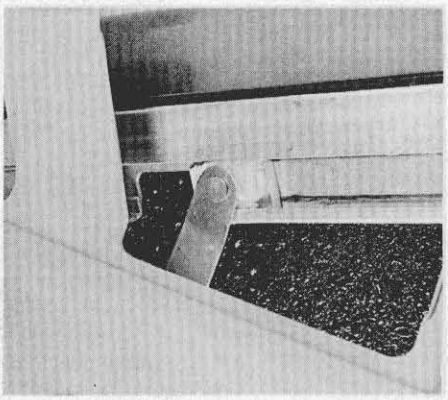
19.6 Remove the guide rail retaining nuts (arrows)



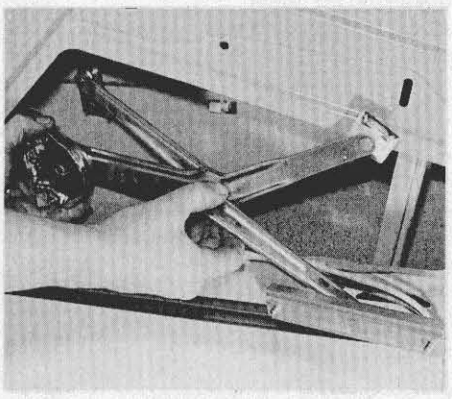
19.7 Remove the four regulator retaining bolts (arrows)



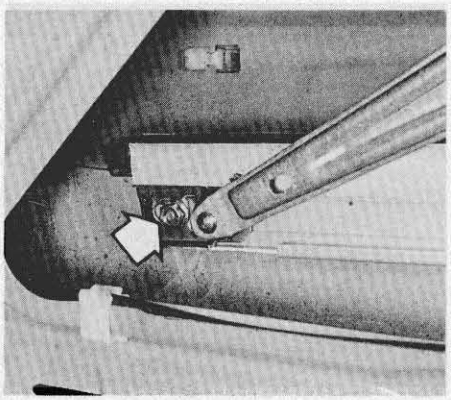
19.8 Release the detents (arrows)



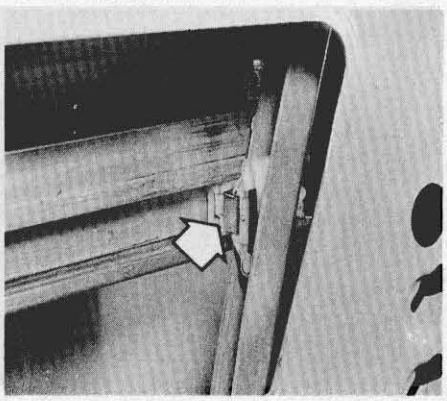
19.9a Disengage the regulator rear arm . . .



19.9b . . . and remove the regulator



20.2 Remove the regulator arm nut (arrow)



20.4 Disengage the guide member (arrow) from the guide rail

3 Support the window in this position either by using a wooden wedge between the window and door, or by using masking tape over the top of the door frame **(see illustration)**.

4 With the window supported, unscrew the regulator arm-to-channel retaining nut.

5 On cars with electric windows, disconnect the electrical connectors at the motor.

6 Remove the two nuts securing the guide rail to the door panel **(see illustration)** and release the rail from the panel.

7 Remove the four bolts **(see illustration)** on cars with manual windows, or three bolts on cars with electric windows, securing the regulator assembly to the door.

8 On cars with manual windows, temporarily install the regulator handle, and turn it as if to lower the window until the two detents **(see illustration)** are swivelled out of their location. Remove the regulator handle.

9 Disengage the regulator rear arm from the regulator channel, and remove the regulator assembly out through the door lower opening **(see illustrations)**.

Installation

10 Installation is the reverse sequence of removal, but only tighten the regulator arm-to-regulator channel nut and the two guide rail nuts finger-tight initially, then adjust the window operation as follows, before installing the trim panel.

11 Wind the window down to the fully-open position.
12 Push the window down and forwards at the front, into the front guide channel, and rearwards at the top into the rear guide channel.
13 With the window held in this position, tighten the regulator arm-to-regulator channel retaining nut.
14 Push the guide rail rear nut down and tighten it, then tighten the guide rail front nut.
15 Check the window operation and install the trim panel as described in Section 18.

20 Front door window glass – removal and installation

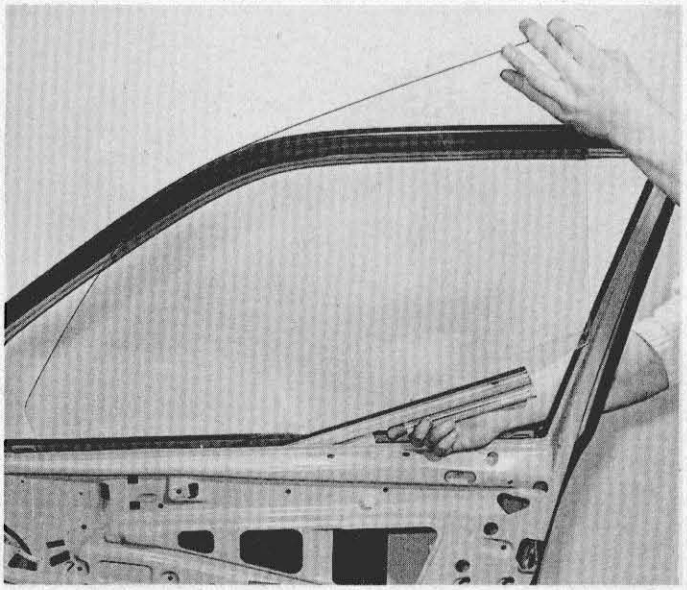
Refer to illustrations 20.2, 20.4 and 20.5

1 Remove the door trim panel as described in Section 18.
2 Lower the window fully, and unscrew the nut securing the regulator arm to the regulator channel at the front **(see illustration)**.
3 Remove the two nuts securing the guide rail to the door panel **(see illustration 19.6).**
4 Disengage the regulator rear arm from the regulator channel, and the guide member from the guide rail **(see illustration)**.
5 Remove the guide member from the regulator channel, then lift the glass up and out, to the inside of the door frame **(see illustration)**.
6 Installation is the reverse of removal, but adjust the regulator as described in Section 19.

21 Rear door window regulator – removal and installation

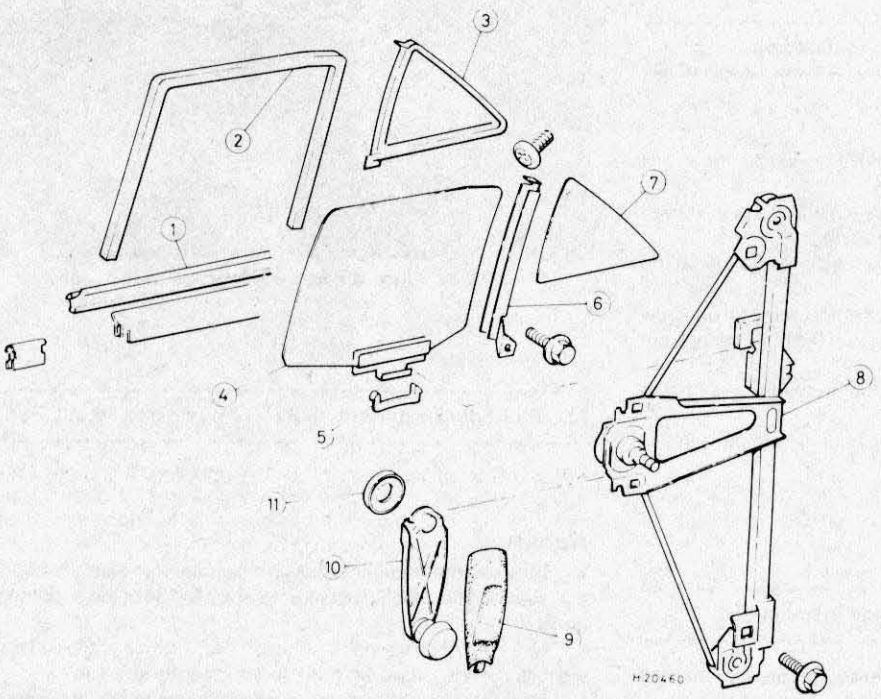
Refer to illustration 21.5

1 Remove the door inner trim panel as described in Section 18.



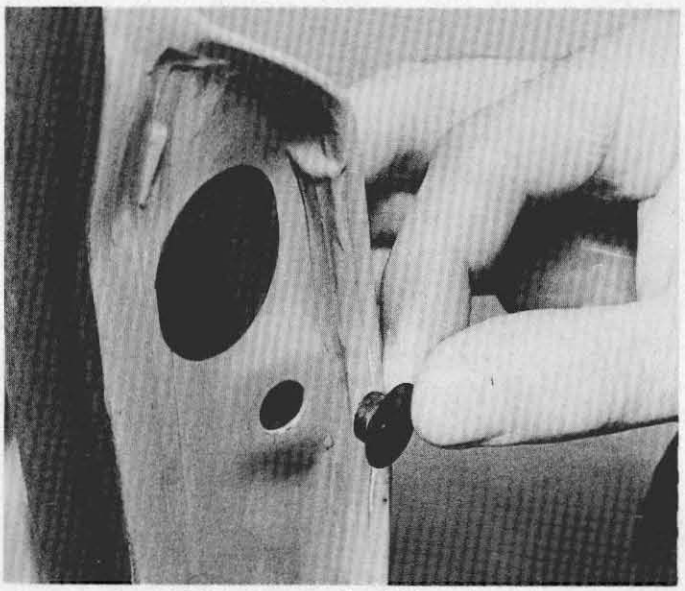
20.5 Remove the glass to the inside of the door frame

2 Open the window until the guide member of the regulator guide rail is accessible through the opening in the top center of the door panel.
3 Support the window in this position either by using a wooden wedge between the window and the door, or by using masking tape over the top of the door frame and onto the glass on the inside and outside.
4 On cars with electric windows, open the electrical connector connection and release the two wires for the window lift motor.
5 Remove the locking clip securing the window glass to the guide member of the regulator guide rail **(see illustration)**.

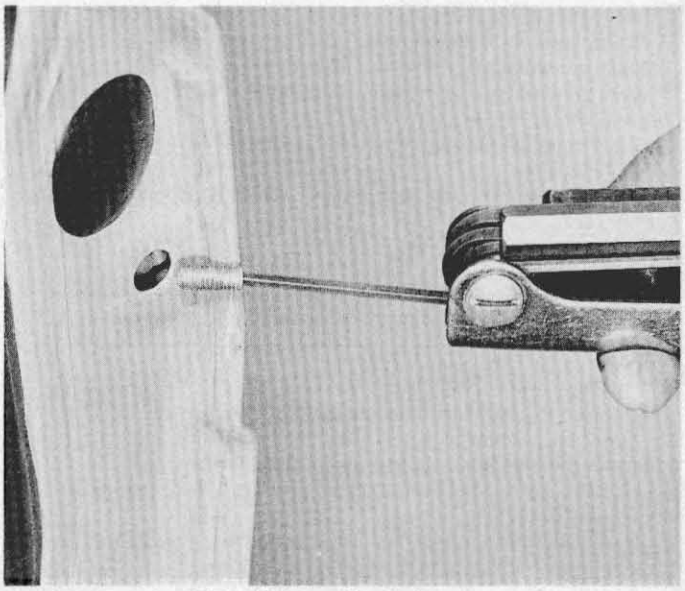


21.5 Rear door window glass and regulator

1 *Waist rail inner and outer sealing strips*
2 *Glass channel*
3 *Quarter window frame*
4 *Window glass*
5 *Locking clip*
6 *Rear guide rail*
7 *Quarter window glass*
8 *Regulator*
9 *Regulator handle trim*
10 *Regulator handle*
11 *Trim disc*



24.2 Remove the closing plug



24.3 Remove the grub screw

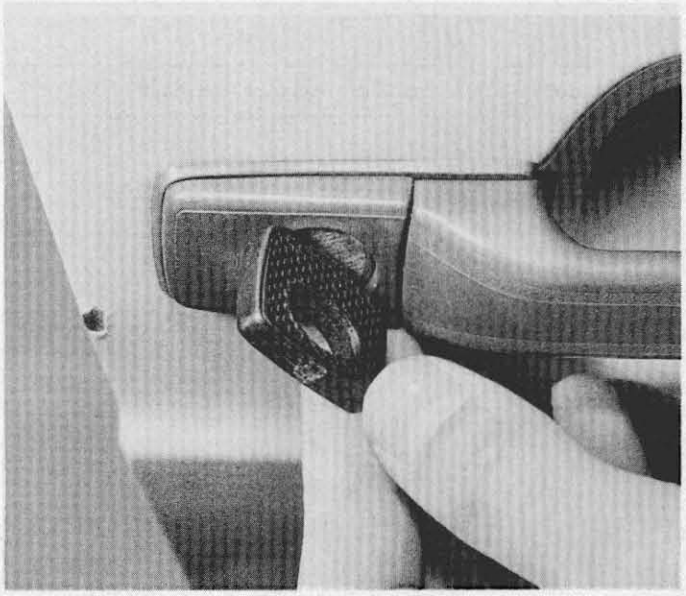
6 Remove the two regulator retaining bolts on manual windows, or the three regulator nuts on electric windows.
7 Remove the regulator guide rail lower retaining bolt.
8 Swivel the regulator to the rear to release the guide member from the channel at the bottom of the window glass.
9 On cars with electric windows, remove the motor electrical connector from the door panel.
10 Maneuver the regulator assembly out of the large opening in the door panel.
11 Installation is the reverse of removal.

22 Rear door window glass – removal and installation

1 Remove the door trim panel as described in Section 18.
2 Lower the window fully.
3 Using a plastic wedge or similar tool, carefully pry up the inner and outer sealing strips at the top of the door panel.
4 Remove the locking clip securing the window glass to the guide member of the regulator guide rail **(see illustration 21.5)**.
5 Move the window glass to the rear to disconnect the channel at the bottom of the glass from the guide member.
6 Pull the flexible guide channel out of the rear guide rail, then unscrew the lower bolt securing the rail to the door panel and the upper screw securing the rail to the door frame.
7 Slide the guide rail down and remove it from one of the door panel openings.
8 Lift the window glass up and remove it, to the inside of the window frame.
9 Installation is the reverse of removal.

23 Rear door quarter window – removal and installation

1 Refer to Section 22 and perform the operations listed in Steps 1 through 7.
2 Pull the quarter window forwards and remove it from the door.
3 Installation is the reverse of removal, but lubricate the quarter window sealing channels with a soapy solution to ease insertion.



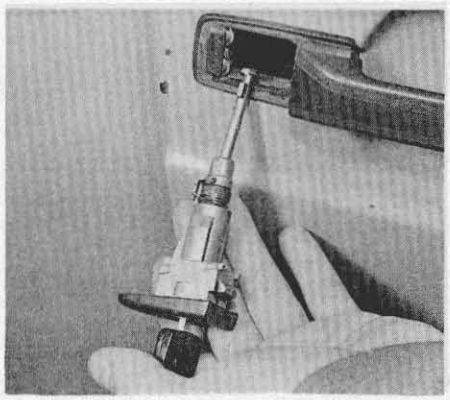
24.4a Turn the key 60-degrees to the rear . . .

24 Front door exterior handle – removal and installation

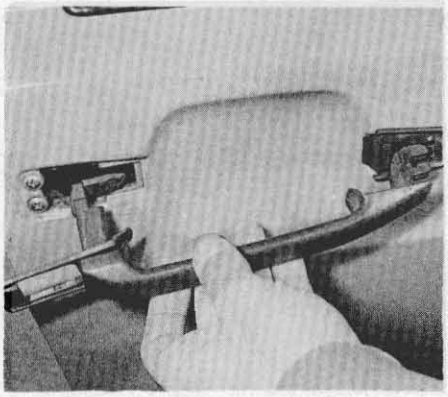
Refer to illustrations 24.2, 24.3, 24.4a, 24.4b, 24.5, 24.6, 24.7a, 24.7b, 24.8a and 24.8b

Removal

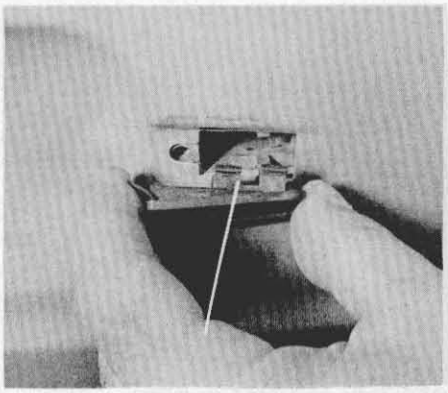
1 Remove the door trim panel as described in Section 18.
2 Remove the closing plug from the rear edge of the door **(see illustration)**.
3 Using an Allen wrench inserted through the closing plug hole, remove the lock cylinder retaining grub screw **(see illustration)**.
4 Insert the key into the door lock cylinder and turn it approximately 60-degrees to the rear **(see illustration)**. At the same time, push the lock cylinder to the rear to disengage the internal tang, and withdraw it from the door handle **(see illustration)**.



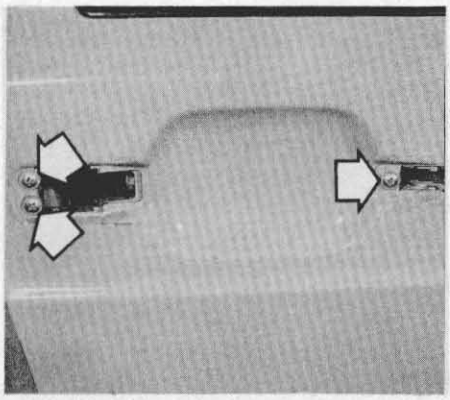
24.4b . . . and remove the lock cylinder



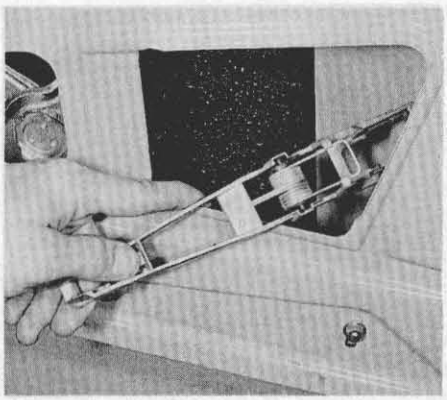
24.5 Remove the exterior handle



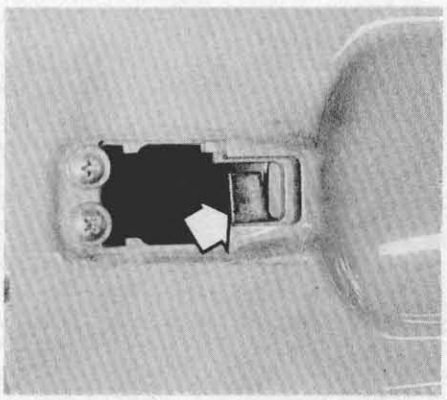
24.6 Remove the rubber escutcheon



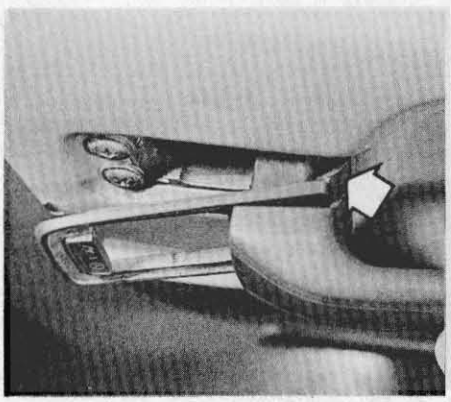
24.7a Remove the mounting bracket screws (arrows) . . .



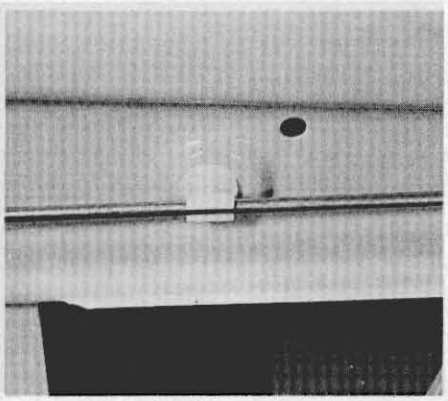
24.7b . . . and remove the mounting bracket



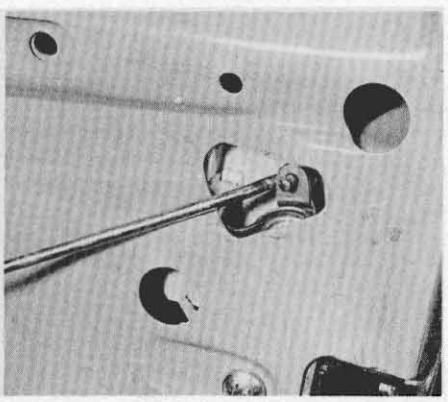
24.8a The exterior handle leg must fit behind the latch lever (arrow) when installing



24.8b The handle escutcheon tag (arrow) locates between the door and bracket



25.2a Detach the connecting rod from the guide



25.2b Remove the rod from the latch lever

5 Push the door exterior handle to the rear, while at the same time pulling it out, then disengage the tangs at the front from the mounting bracket **(see illustration)**.

6 Remove the rubber escutcheon from the handle front location **(see illustration)**.

7 Remove the three mounting bracket retaining screws and remove the mounting bracket from the opening in the inner door panel **(see illustrations)**.

Installation

8 Installation is the reverse of removal. When inserting the handle, ensure that the rear operating leg slides behind the wire spring of the mounting bracket as well as the lock lever, **(see illustration)** then slide the handle forward to secure. The tag on the handle rear rubber escutcheon fits between the door panel and the mounting bracket **(see illustration)**.

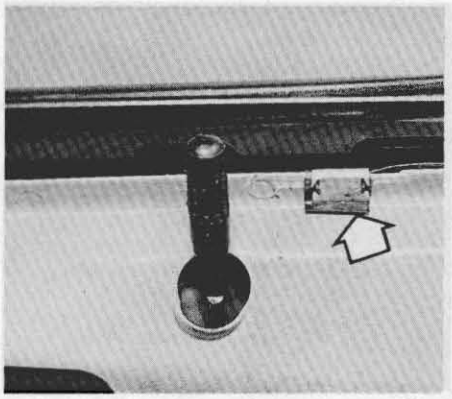
25 Front door latch – removal and installation

Refer to illustrations 25.2a, 25.2b, 25.3a, 25.3b, 25.3c, 25.4, 25.5 and 25.6

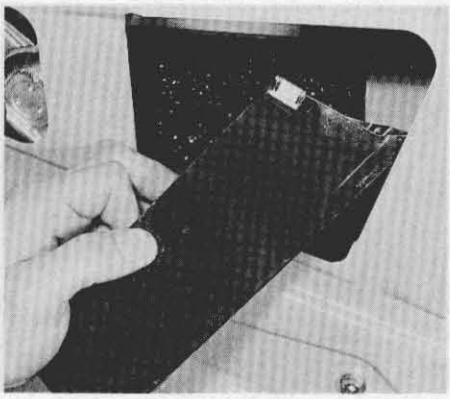
Removal

1 Remove the front door exterior handle as described in Section 24.

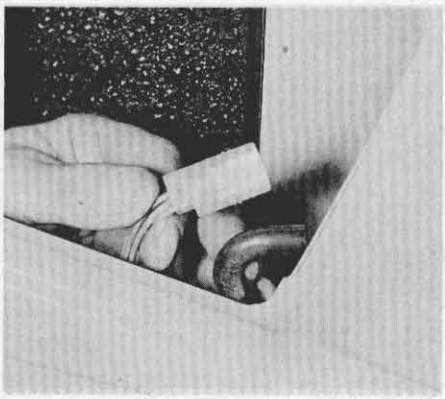
2 Detach the inner door handle connecting rod from the door guide **(see illustration)** then disengage it from the latch lever **(see illustration)**.



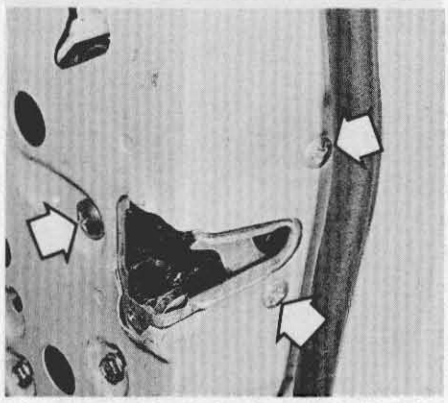
25.3a Pry off the clip (arrow) . . .



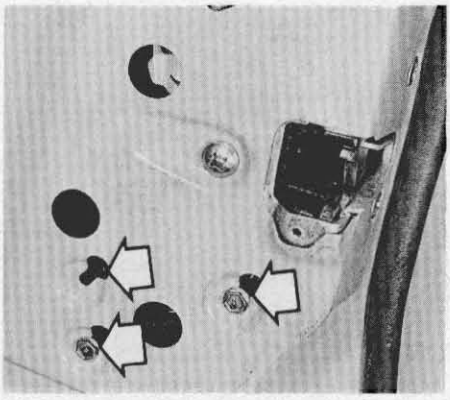
25.3b . . . and remove the water deflector



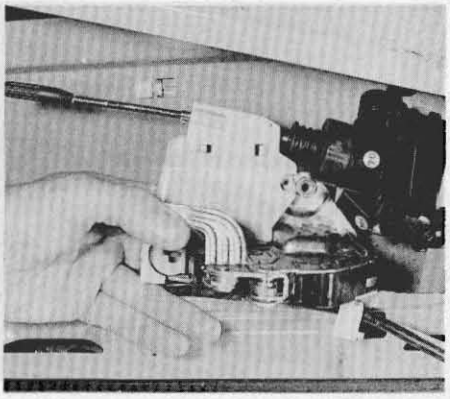
25.3c Disconnect the wiring and vacuum hose at the solenoid



25.4 Remove the door latch retaining screws (arrows) . . .



25.5 . . . and central locking solenoid screws (arrows)



25.6 Remove the latch and solenoid from the door

3 On cars equipped with central locking, detach the retaining clip on the top edge of the door and remove the plastic water deflector from the door opening **(see illustrations)**. Disconnect the wiring and vacuum connections at the central locking solenoid **(see illustration)**.

4 Remove the screws securing the door latch to the door **(see illustration)**.

5 On cars equipped with central locking, remove the screws securing the central locking solenoid to the door **(see illustration)**.

6 Lower the door latch and remove it, complete with central locking solenoid (if equipped), through the door panel opening **(see illustration)**.

Installation

7 Installation is the reverse of removal. When installing the water deflector on cars with central locking, the deflector must slide up behind the window guide channel before clipping onto the top edge of the door.

26 Rear door exterior handle – removal and installation

The procedure is the same as for the front door handle as described in Section 24, except that there is no lock cylinder to remove. Instead, remove the plastic trim covering by pushing it to the rear.

27 Rear door latch – removal and installation

The procedure is the same as for the front door latch as described in Section 25.

28 Door lock solenoids (central locking system) – removal and installation

Refer to illustrations 28.2, 28.3, 28.4a and 28.4b

1 Remove the door latch, complete with solenoid, from the front or rear door as applicable, as described in Section 25 or 27.

2 Carefully pry off the plastic cover over the solenoid and latch connecting levers **(see illustration)**.

3 Push the retaining clip end up, then remove it from the interior lock button rod **(see illustration)**.

4 Detach the interior lock button rod to release the solenoid operating rod, and remove the solenoid **(see illustrations)**.

5 Installation is the reverse of removal.

29 Doors – removal and installation

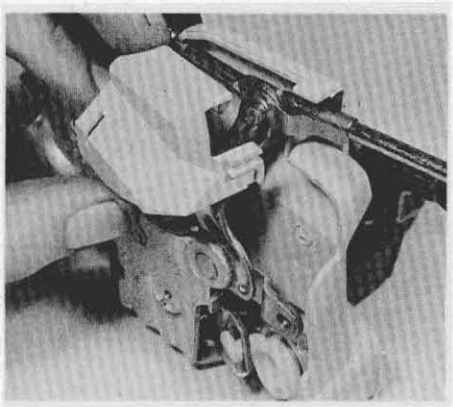
Refer to illustrations 29.2, 29.4a, 29.4b and 29.6

Removal

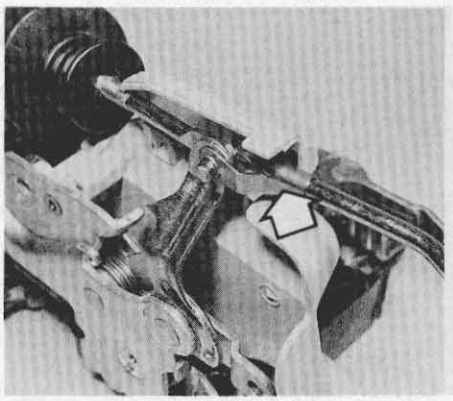
1 On cars equipped with central locking or electric windows, remove the door trim panel as described in Section 18 and disconnect the applicable wiring or vacuum hose connections. Detach the convoluted boot between the door and pillar, and pull the wiring and hoses out of the door.

2 Remove the rubber seal from the door check strap **(see illustration)**, extract the retaining clip and washer, and drive out the check strap pin upwards using a punch.

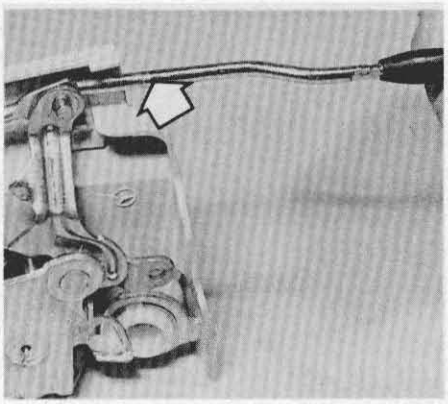
3 Accurately mark the outline of the upper and lower hinge plates on the



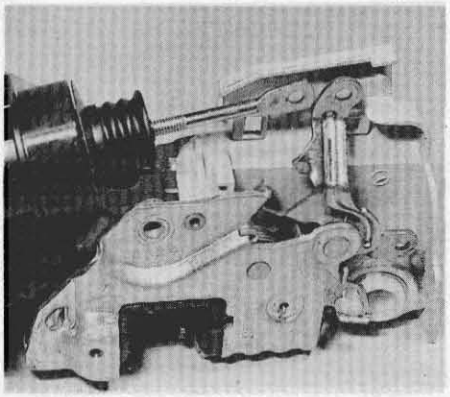
28.2 Pry off the plastic cover



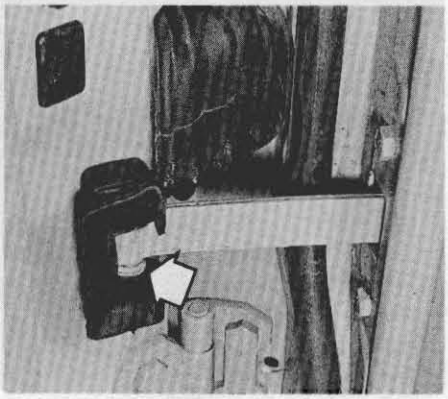
28.3 Remove the retaining clip (arrow)



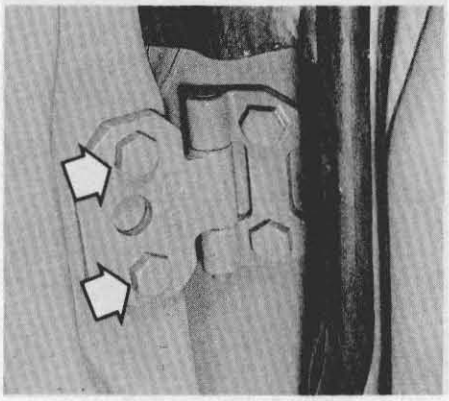
28.4a Remove the lock rod . . .



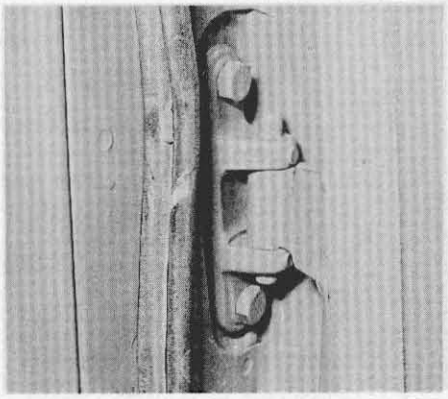
28.4b . . . to free the solenoid operating rod



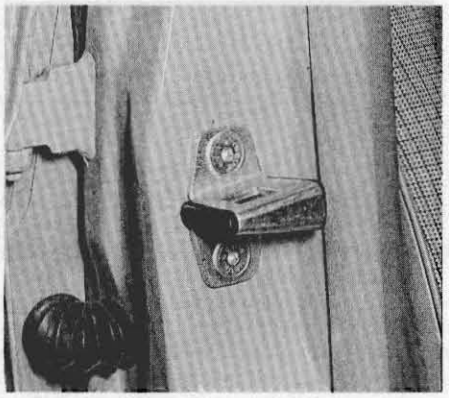
29.2 Remove the rubber seal from the check strap (arrow)



29.4a Hinge plate-to-door pillar bolts for the front door (arrows)



29.4b Hinge plate-to-door pillar bolts for the rear door



29.6 Front door striker plate

pillar using a pencil.

4 With an assistant supporting the door, remove the two upper and two lower bolts securing the hinge plates to the body pillar **(see illustrations)**.

5 Remove the door towards the rear from the car.

Installation

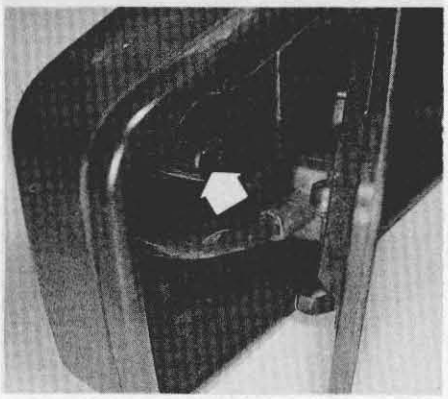
6 Installation is the reverse of removal, but ensure that the hinge plates are aligned with the previously made marks. Adjustments can be made at the hinge plates and at the door striker **(see illustration)** to provide an equal gap all round the door, and to align the contour of the door panel with that of the front fender.

30 Windshield and rear window – removal and installation

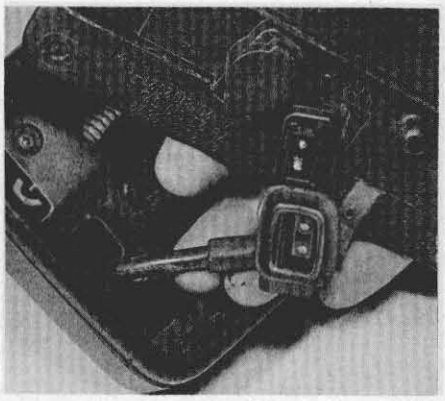
Due to the methods of attachment, and the special equipment required to complete the task successfully, removal and installation of the windshield and rear window should be left to a dealer service department or auto glass replacement specialist.



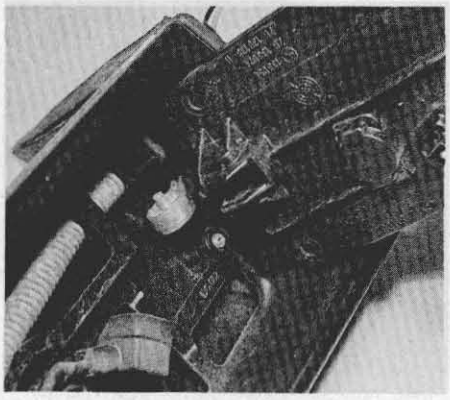
31.1a Pry out the mirror glass using a plastic wedge . . .



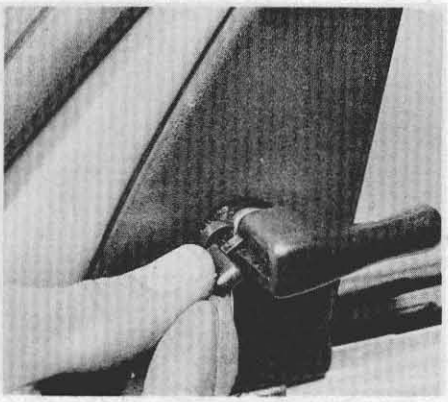
31.1b . . . to release the ball from the socket (arrow)



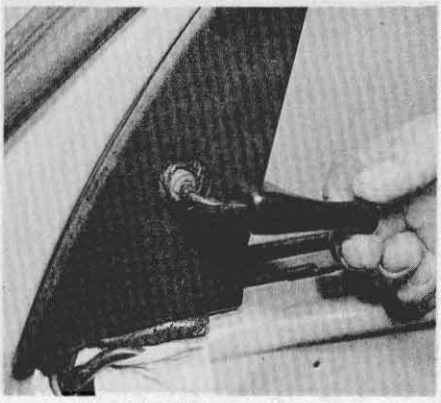
31.2 Disconnect the electrical connector on electrically heated mirrors



31.4 Engage the front of the glass with the adjuster when installing



32.1 Extract the small plastic clip



32.2 Withdraw the lever cover

31 Driver's door mirror glass (manual mirror) – replacement

Refer to illustrations 31.1a, 31.1b, 31.2 and 31.4

1 Using a plastic wedge, very carefully pry the ball on the rear face of the mirror glass out of the plastic socket on the mirror body **(see illustrations)**.

2 If the mirror is electrically heated, disconnect the electrical connector at the rear of the mirror glass **(see illustration)**.

3 Pull the mirror to the rear to disengage the adjuster at the front and remove it from the mirror body.

4 To install the glass, reconnect the electrical connector, where applicable, then engage the front of the glass with the adjuster **(see illustration)**.

5 Engage the ball stud with the socket, then press the glass in the center until the ball fully engages with the socket.

32 Driver's door mirror assembly (manual mirror) – removal and installation

Refer to illustrations 32.1, 32.2, 32.3, 32.4 and 32.5

1 Extract the small plastic clip from the adjustment lever by carefully prying it out with a screwdriver **(see illustration)**.

2 Withdraw the adjustment lever cover **(see illustration)**.

3 Pry off the trim panel at the top, disengage its bottom edge from the door trim panel and remove it **(see illustration)**.

4 If the mirror glass is electrically heated, unplug the electrical connector **(see illustration)**.

5 Remove the three screws **(see illustration)** and remove the mirror assembly from the door.

6 Refitting is the reverse sequence to removal.

33 Driver's door mirror glass (electrically operated mirror) – replacement

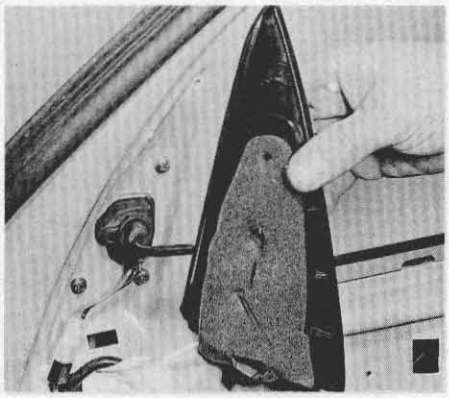
1 Using a plastic wedge, very carefully pry the mirror glass off the three engagement points on the reverse side of the glass **(see illustration 31.1a).**

2 Align the engagement points on the adjusting motor to accept the sockets on the new glass. Align the upper engagement point horizontally and the lateral points vertically.

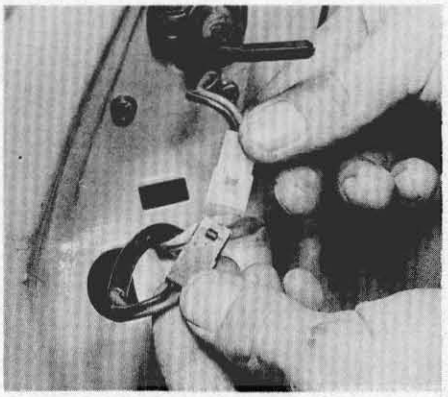
3 Place the glass in position and press it in until it is heard to engage in the three places.

34 Driver's door mirror assembly (electrically operated mirror) – removal and installation

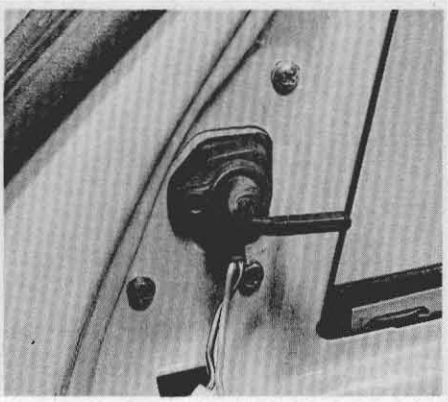
1 Pry off the trim panel for the mirror attachment at the top, disengage its bottom edge from the door trim panel and remove it **(see illustration 32.3).** Remove the foam fabric shim.



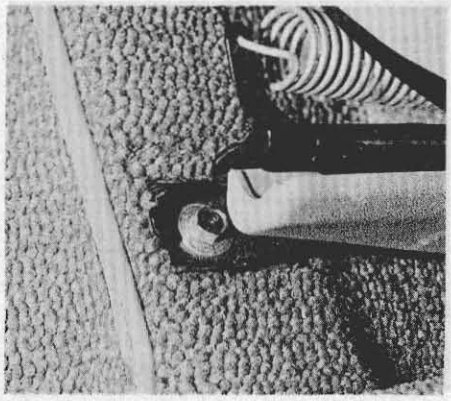
32.3 Remove the trim panel



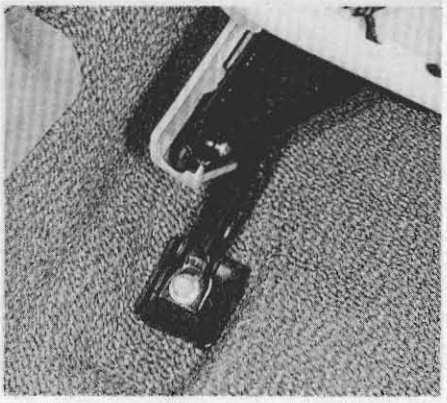
32.4 Disconnect the wiring connector



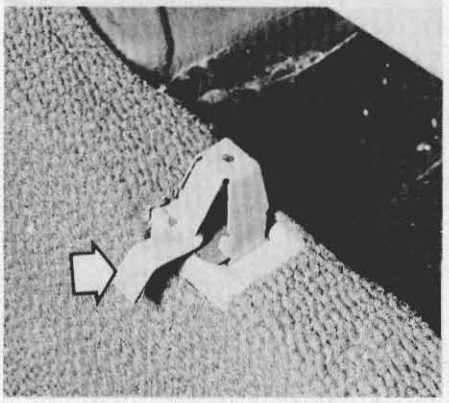
32.5 Remove the three mirror retaining screws



35.2 Remove the seat front guide rail bolts . . .



35.4 . . . and the rear guide rail bolts



36.1 Push in the detent clip (arrow) to release the rear seat bench

2 Unscrew the electrical connector retaining screw and disconnect the connector.
3 Remove the three screws and remove the mirror from the door **(see illustration 32.5).**
4 To remove the adjustment motor, remove the mirror glass as described in Section 33, then remove the three motor retaining screws.
5 Hinge the mirror back and hold it in this position.
6 Turn the electrical connector in a clockwise direction and remove the motor and wiring from the mirror body.
7 Installation is the reverse of removal.

35 Front seats – removal and installation

Refer to illustrations 35.2 and 35.4

Driver's seat

1 Move the driver's seat to the rear and set the height adjuster to its lowest position.
2 Remove the two bolts at the front securing the guide rails to the floor **(see illustration).**
3 Move the driver's seat forward and set the height adjuster to its highest position.
4 Remove the two bolts at the rear securing the guide rails to the floor **(see illustration).**
5 Slightly raise the driver's seat and pull it forward out of the slide rail.
6 Installation is the reverse of removal.

Passenger's seat

7 Move the passenger's seat to the rear and remove both front guide rail retaining bolts.
8 Slide the seat forwards and remove the covers on the guide rails at the rear.
9 Remove the guide rail rear retaining bolts, then pull the seat forwards out of the slide rail.
10 Installation is the reverse of removal.

36 Rear seat – removal and installation

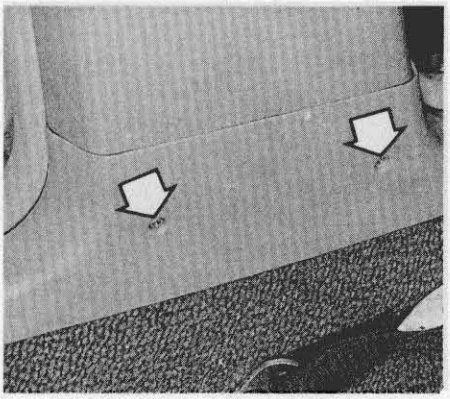
Refer to illustration 36.1

Seat bench

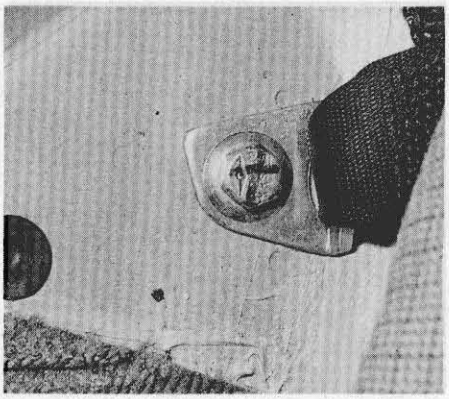
1 Push in the detent clip on the left- and right-hand sides of the seat bench at the bottom **(see illustration)**, while at the same time lifting up the seat bench.
2 Withdraw the seat bench and remove it from the car.
3 Installation is the reverse of removal.

Seat back rest

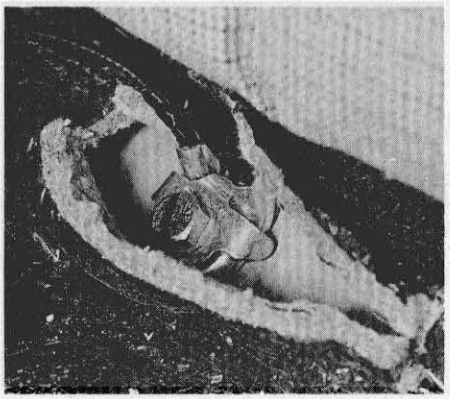
4 Remove the seat bench.
5 Remove the three retaining screws at the bottom of the back seat.
6 Push the backrest up to disengage the four upper tags, then remove the backrest from the car.
7 Installation is the reverse of removal, but ensure that the upper tags engage with their holders.



37.1 Center pillar trim panel screws (arrows)



37.10 Rear seat belt mounting bolt



37.18 Rear seat belt stalk retaining bolt

37 Seat belts – removal and installation

Refer to illustrations 37.1, 37.10 and 37.18

Front belt

1 Remove the two center pillar trim panel lower retaining screws **(see illustration)**.
2 Swivel the seat belt to the rear, remove the cap over the lower mounting bolt by sliding it off the bottom of the belt, then remove the seat belt lower mounting bolt.
3 Carefully pull off the door weatherstrip around the center pillar.
4 Move the center pillar trim down to detach the upper retaining clip, and remove the trim.
5 Remove the seat belt upper guide retaining bolt and the inertia reel retaining bolt, then remove the belt.
6 If the seat belt stalk is also to be removed, first remove the driver's or passenger's seat as applicable, as described in Section 35.
7 Hold the stalk and remove the retaining bolt on the side of the seat. Remove the stalk.
8 Installation is the reverse of removal.

Rear belt

9 Remove the rear seat bench as described in Section 36.
10 Remove the bolt securing the seat belt to the floor **(see illustration)**.
11 Pull off the door weatherstrip around the trim panel on the rear pillar.
12 Carefully pry off the trim panel clips at the front, towards the center of the car.
13 Push the trim panel up and remove it from the rear pillar.
14 Remove the rear seat backrest as described in Section 36.
15 Remove the belt upper guide retaining bolt on the rear pillar.
16 Unclip the sound-deadening material around the rear inertial reel.
17 Remove the inertia reel retaining bolt and remove the seat belt from the car.
18 If the stalk(s) are to be replaced, remove the single bolt, remove the separating plate and remove the stalk **(see illustration)**.
19 Installation is the reverse of removal.

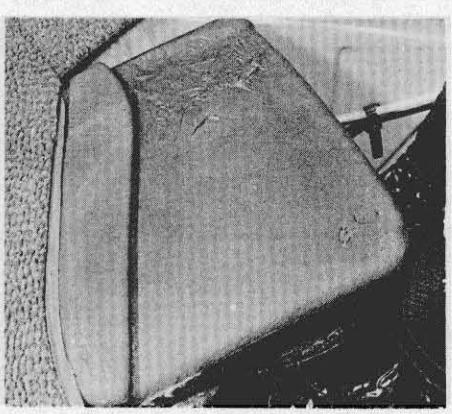
38 Sunroof – general information

1 A sliding sunroof, either mechanically or electrically operated, is available as a factory installed option.
2 Adjustment or repair of the sunroof or its component parts should be left to a dealer service department or other repair shop, as the complexity of the unit and the need for special tools and equipment renders these operations beyond the scope of the average owner.

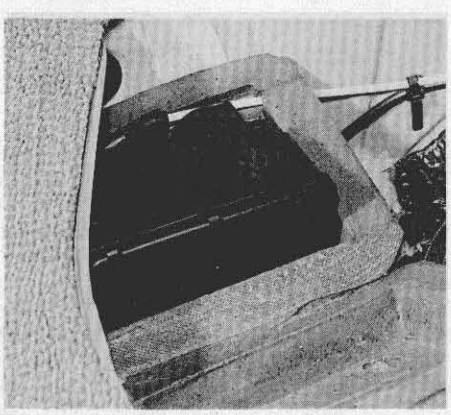
39 Central locking system vacuum pump – removal and installation

Refer to illustrations 39.3a, 39.3b and 39.4

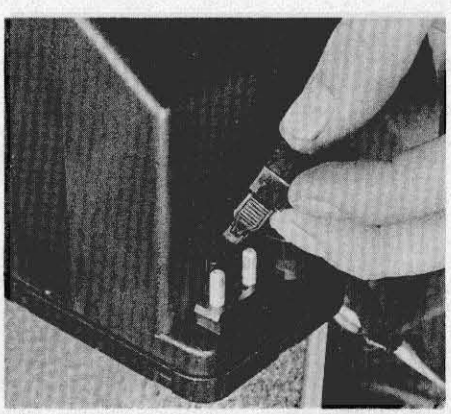
1 Disconnect the cable from the negative terminal of the battery.
2 Remove the rear seat bench as described in Section 36.
3 Lift up the cover on the sound proofing box and lift the unit out of its location **(see illustrations)**.
4 Disconnect the vacuum hoses and electrical connector, and remove the unit from the car **(see illustration)**.
5 Installation is the reverse of removal.



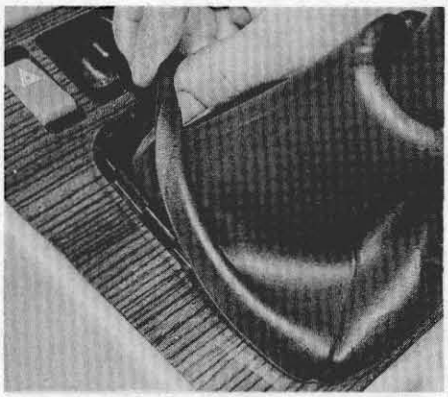
39.3a Lift up the soundproofing box cover . . .



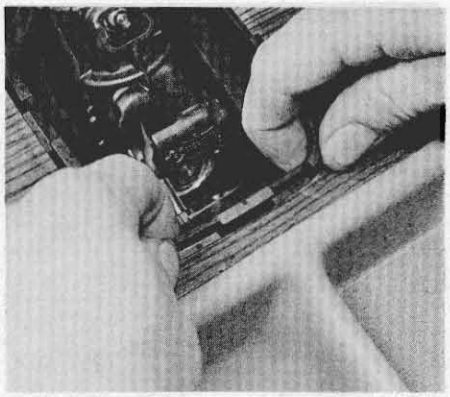
39.3b . . . and take out the vacuum pump



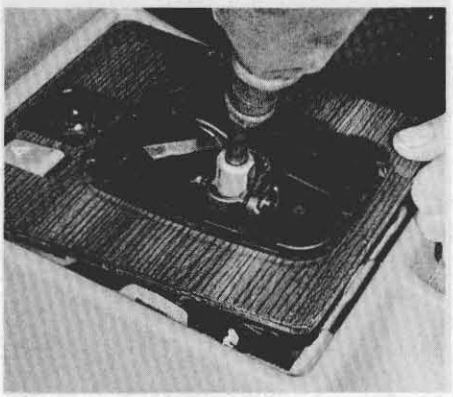
39.4 Disconnect the vacuum hoses and electrical connector



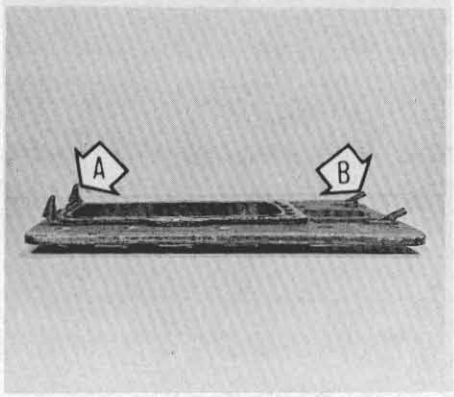
40.1a Detach the shift lever boot



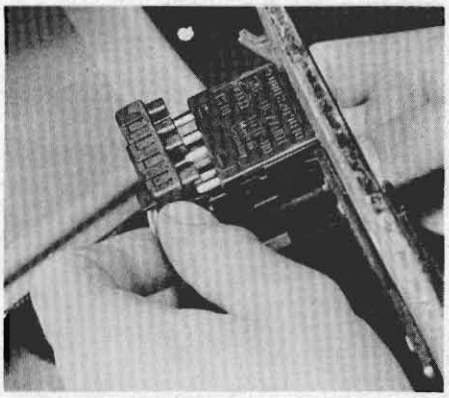
40.1b Lift the console cover at the rear . . .



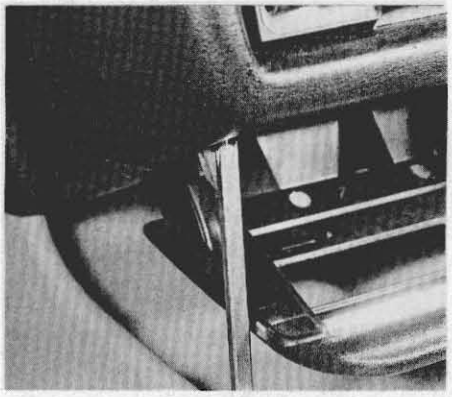
40.1c . . . then slide it to the rear to remove



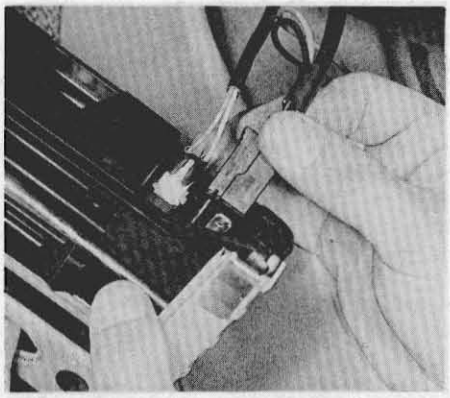
40.1d Console cover rear tags (A) and front lugs (B)



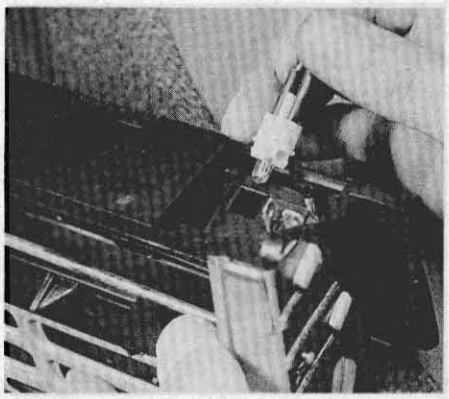
40.3 Disconnect the electrical connectors at the console cover switches



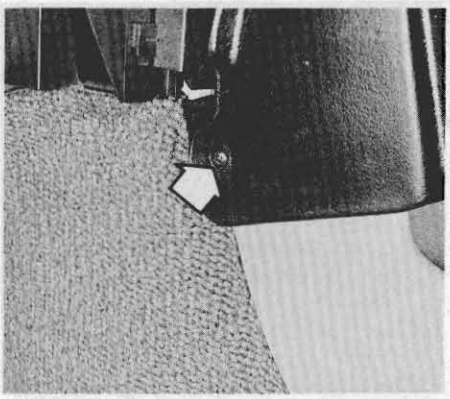
40.5 Remove the front ashtray housing screws



40.6a Disconnect the cigarette lighter electrical connector



40.6b Detach the bulb holder from the ashtray housing



40.8 Remove the side retaining screw (arrow)

40 Center console – removal and installation

Refer to illustrations 40.1a through d, 40.3, 40.5, 40.6a, 40.6b, 40.8, 40.9, 40.11a, 40.11b, 40.12, 40.13, 40.14, 40.15, 40.16a, 40.16b, 40.19a and 40.19b

1 On manual transmission models, release the shift lever boot from the console and slide it up the lever **(see illustration)**. Using your fingers at the rear of the plastic center part of the console cover, lift the cover at the rear, then slide it to the rear and lift it off **(see illustrations)**. The cover is secured by two extremely tight rear tags and two lugs at the front **(see illustration)**.

2 On automatic transmission models, lift the console cover at the rear by means of a plastic wedge inserted in the gap between the selector position plate and the cover. Move the cover to the rear to disengage the two front lugs and lift off.

3 Disconnect the electrical connectors at the console cover switches, after marking their locations, and remove the cover **(see illustration)**.

4 Refer to Chapter 9 and loosen the handbrake adjuster under the car so the lever can be pulled up to the nearly-vertical position.

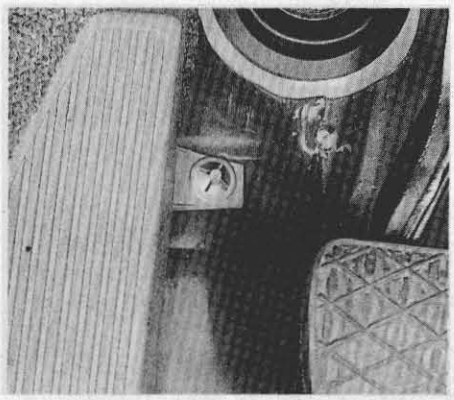
5 Remove the front ashtray, then unscrew the two upper screws securing the ashtray housing to the dash **(see illustration)**.

6 Pull out the ashtray housing, disconnect the wiring and bulb holder and remove the housing **(see illustrations).**

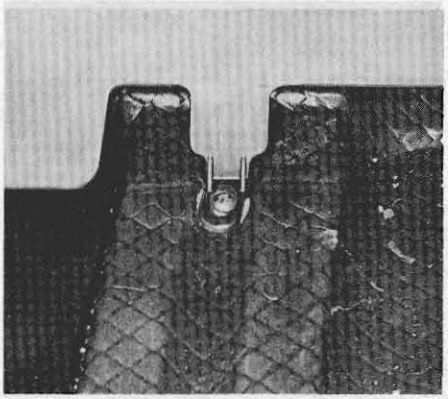
7 Remove the floor mats on both sides from the footwells.

8 Remove the retaining screw on each side securing the dash and console edges **(see illustration)**.

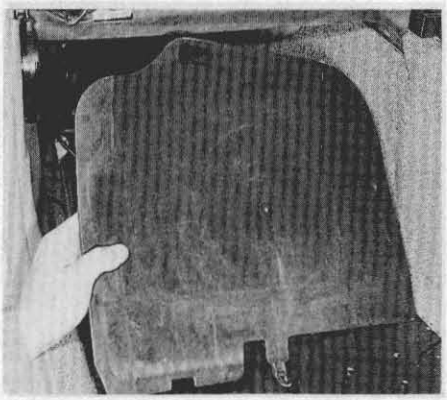
9 Pry off the spire clip and remove the retaining screw, then remove the footrest on the driver's side **(see illustration)**.
10 Remove the front carpets on both sides.
11 On the passenger's side unscrew the lower retaining screw and remove the front kick panel **(see illustrations)**.
12 Remove the central retaining screw and remove the console side cover carpet on both sides **(see illustration)**. On the drivers side the cover carpet is also secured by an additional spire clip.
13 Pull the grip off the handbrake lever and slide it off the front of the lever **(see illustration)**.
14 Pull the handbrake up and remove the lower lever lining **(see illustration)**.
15 Remove the console retaining bolt in front of the shift lever or selector housing **(see illustration)**.
16 Remove the rear ashtray, then remove the ashtray holder by prying up the lower holding clip **(see illustrations)**.



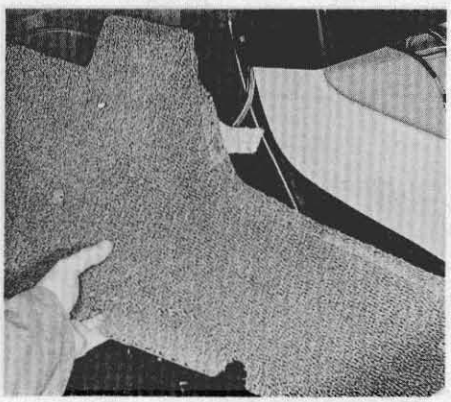
40.9 Pry off the footrest retaining spire clip – if this is done carefully, the clip can be reused



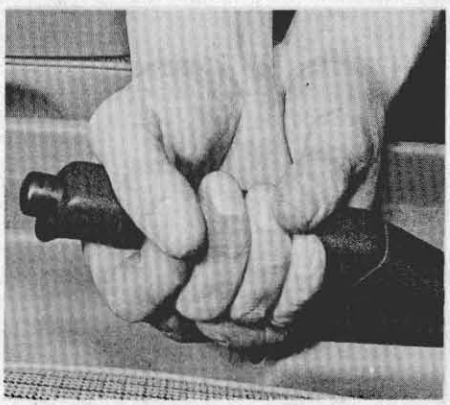
40.11a Remove the kick panel retaining screw



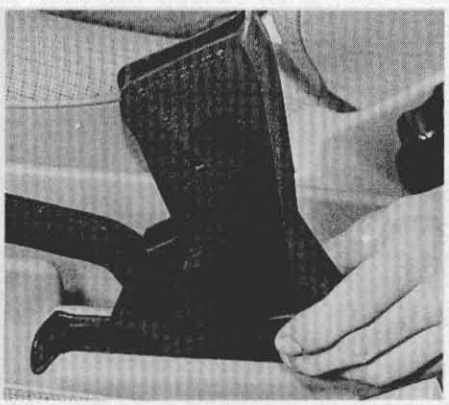
40.11b Remove the kick panel



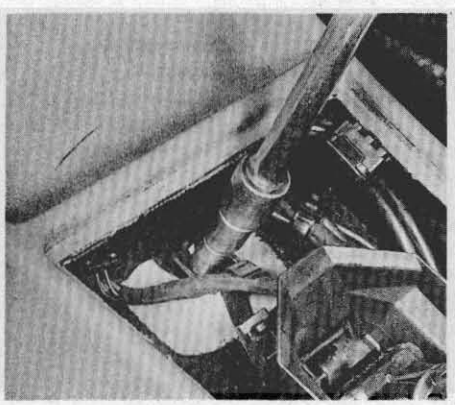
40.12 Remove the console side cover carpets



40.13 Pull off the handbrake lever grip – this may take a considerable amount of effort



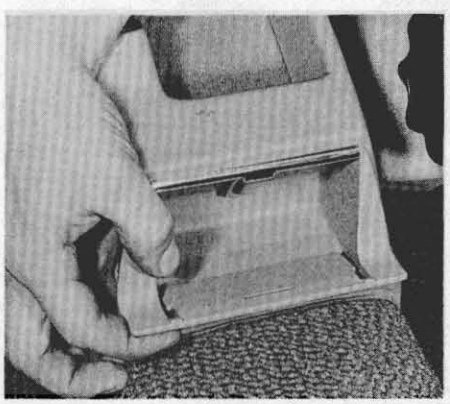
40.14 Remove the handbrake lever lower lining



40.15 Remove the console front retaining bolt

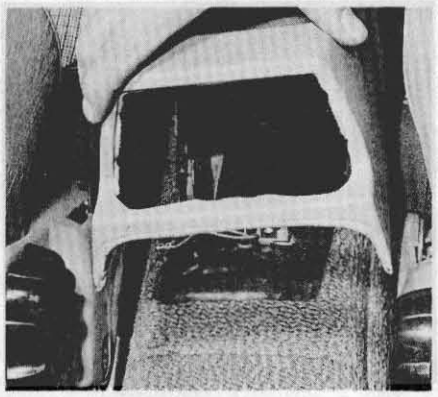


40.16a Remove the rear ashtray

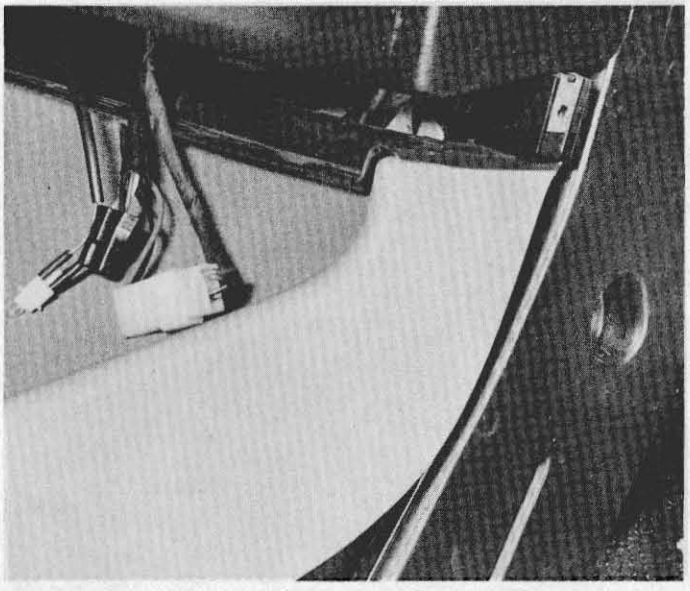


40.16b Remove the ashtray housing

17 Working through the ashtray aperture, remove the console rear retaining bolt.
18 Move both front seats towards the rear, and pull the handbrake lever up as far as it will go.



40.19a Lift up the console at the rear . . .



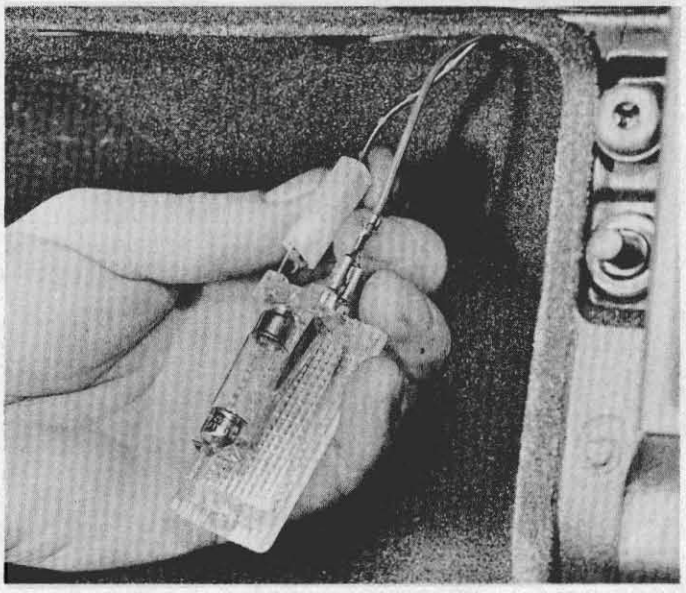
40.19b . . . and pull it down in the front to disengage it

19 Lift the console at the rear, and disengage it from the dash at the front **(see illustrations)**.
20 Lift the console up over the handbrake lever and remove it from the car.
21 Installation is the reverse of removal. Adjust the handbrake as described in Chapter 9 on completion.

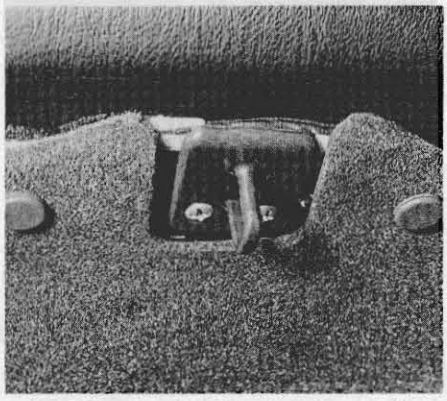
41 Glovebox – removal and installation

Refer to illustrations 41.2, 41.3, 41.4 and 41.5

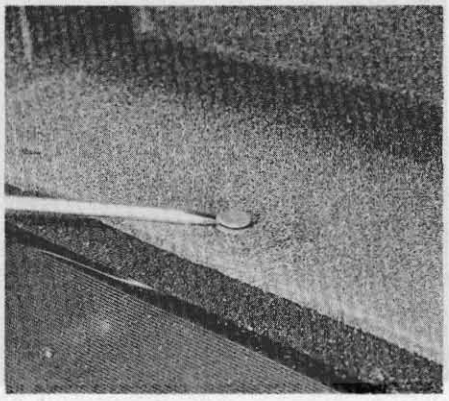
1 Disconnect the cable from the negative terminal of the battery.
2 Pry out the glovebox lamp, disconnect the wiring and remove the lamp **(see illustration)**.
3 Remove the two screws and remove the latch bracket **(see illustration)**.
4 Remove the expanding rivets by prying out the rivet expander with a screwdriver, then remove the expander and rivet body **(see illustration)**.
5 Pull out the glovebox, pull the lamp wiring through the aperture and remove the glovebox from the dash **(see illustration)**.
6 Installation is the reverse of removal.



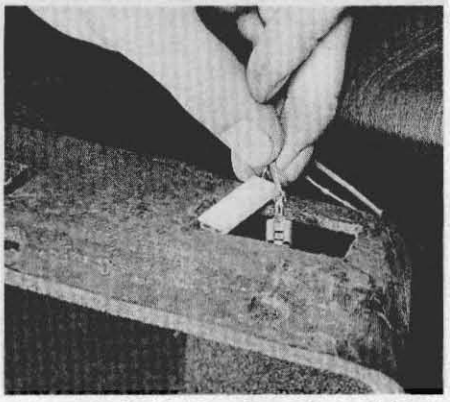
41.2 Remove the glovebox lamp and disconnect the electrical connectors



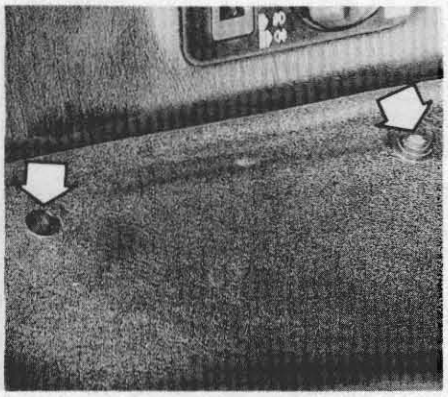
41.3 Remove the latch bracket screws



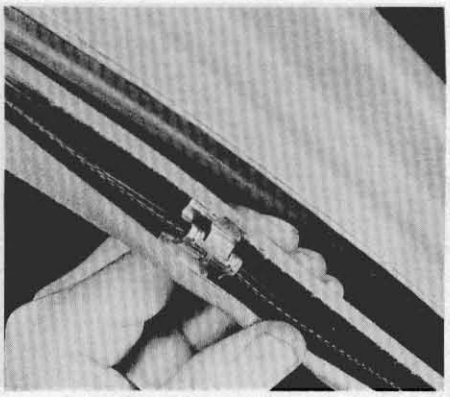
41.4 Pry out the rivet expander, then remove the rivet body



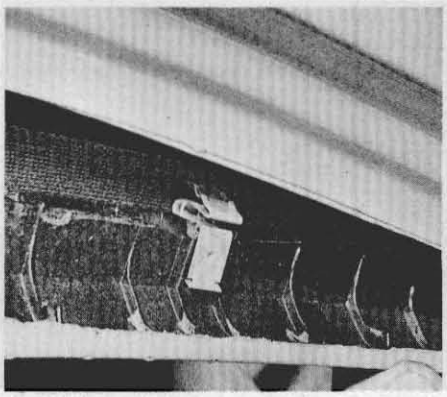
41.5 Pull the wires through the light opening



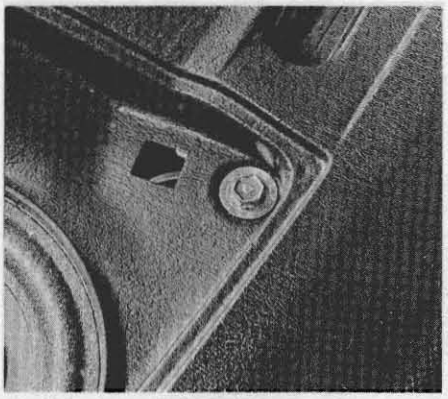
42.3 Pry off the trim caps and remove the screws (arrows)



42.4 Pull away the door seal weatherstrip



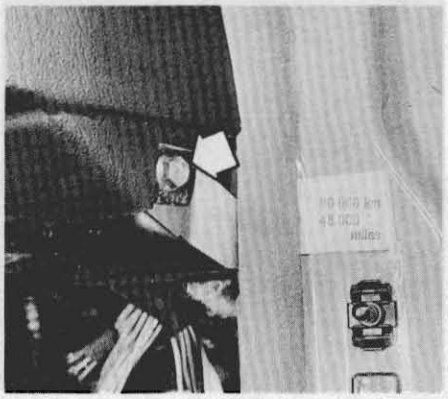
42.5 Remove the front pillar trim panels



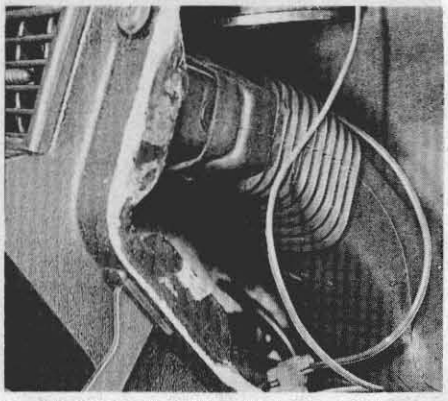
42.7 Remove the upper bolt by the speaker on each side



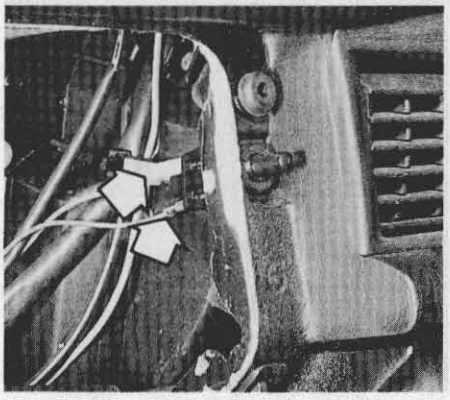
42.8 Remove the light switch retaining nut (arrow)



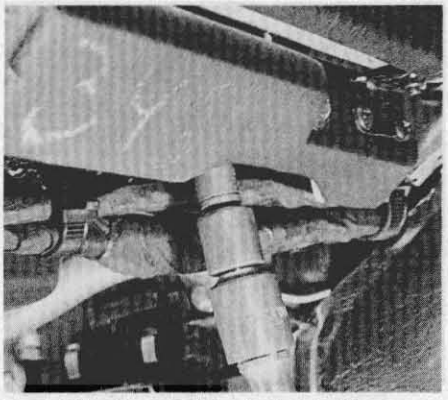
42.11 Remove the dash side retaining bolts on each side (arrow)



42.12 Pull off the air ducts on the side outlets



42.13 Disconnect the glovebox lamp switch wires (arrows)



42.14 Remove the dash-to-stiffener lower bolt

42 Dash panel – removal and installation

Refer to illustrations 42.3, 42.4, 42.5, 42.7, 42.8 and 42.11 through 42.24

1 Remove the instrument panel as described in Chapter 12.

2 Remove the glovebox as described in Section 41.

3 Remove the covers under the dash on both sides. On the driver's side, the cover is retained by four screws and a spire clip, and on the passenger's side, by three screws. Pry off the trim caps for access to the screws **(see illustration)**.

4 Pull away the door weatherstrip on the front body pillar on both sides **(see illustration)**.

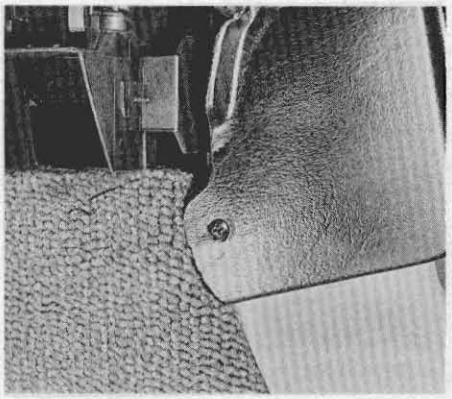
5 Remove both front pillar trim panels by pushing the panel in the area of the retaining clips away from the pillar using a plastic wedge or, if you are very careful, a screwdriver **(see illustration)**.

6 Remove the retaining screw and remove the speaker grille from the top of the dash on both sides.

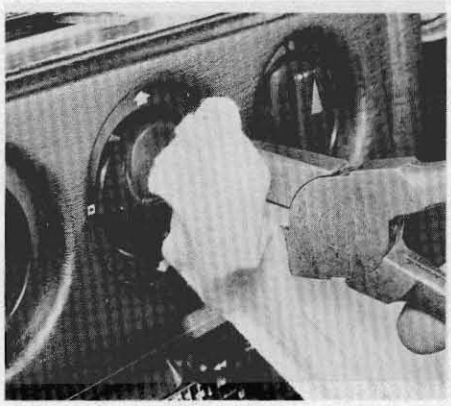
7 Remove the upper retaining bolt on each side adjacent to the speakers **(see illustration)**.

8 Using pliers and a protective cloth, pull off the knob on the light switch, then unscrew the switch retaining nut **(see illustration)**. Disconnect the wiring and remove the switch.

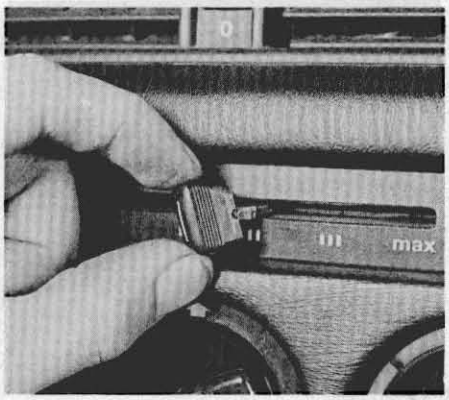
9 Pry out the headlamp beam adjustment rotary switch, disconnect the wiring and vacuum hoses and remove the switch. Take note that the hose attachments are lilac at the top and lilac/yellow at the bottom.



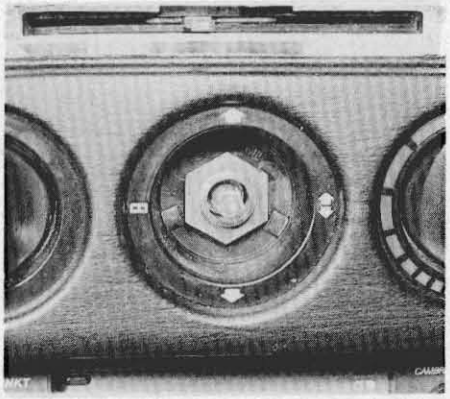
42.15 Remove the side retaining screws



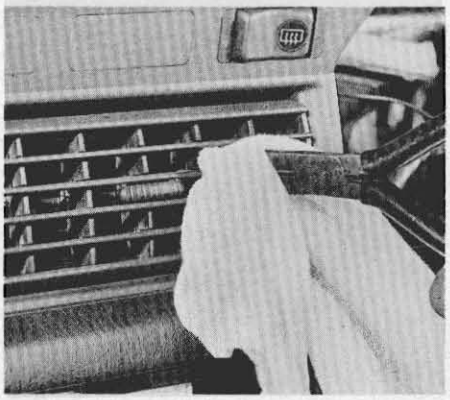
42.16 Pull off the heater control knobs



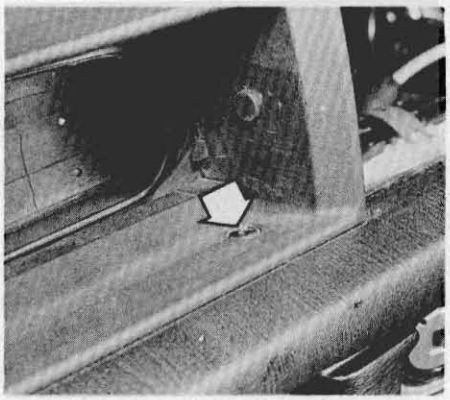
42.17 Pull off the blower control switch knob



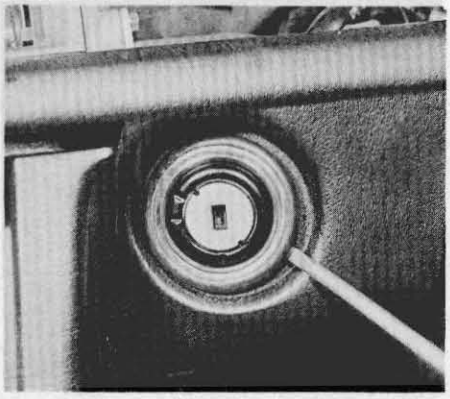
42.18 Remove the nut from each heater control switch



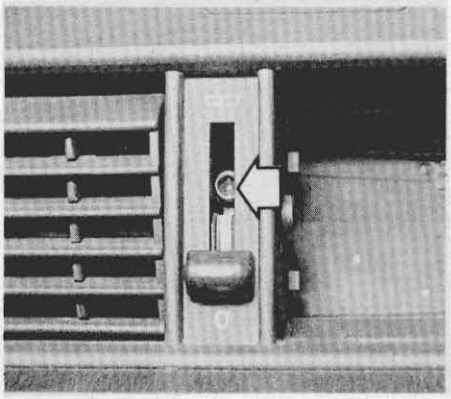
42.19 Pull out the center vent grilles



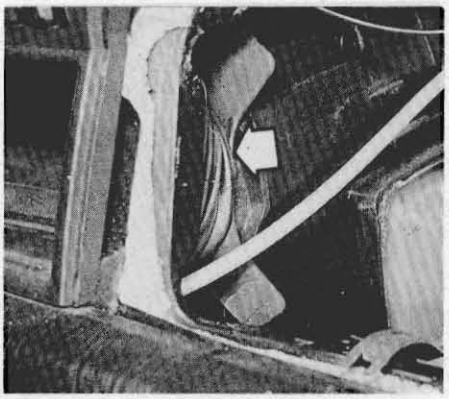
42.20 Remove the screws in the center vent opening (arrows)



42.21 Pry off the ignition switch trim escutcheon



42.22 Remove the bolt (arrow) through the lever slot



42.23 Pull off the center vent air hose (arrow)

10 Pry out the dash upper switches, or push them out from behind, mark the electrical connectors and disconnect them. Remove the switches.

11 Remove the two side retaining bolts, left and right, securing the dash to the body stiffener **(see illustration)**.

12 Pull off the air ducts on the left and right air outlets **(see illustration)**.

13 Identify their locations, then disconnect the wires at the glovebox lamp switch **(see illustration)**.

14 Remove the bolt securing the underside of the dash to the body stiffener **(see illustration)**.

15 Remove the screw securing the dash to the center console on both sides **(see illustration)**.

16 Using pliers and a protective cloth, pull off the three heater control knobs **(see illustration)**.

17 Pull off the blower control switch knob **(see illustration)**.

18 Remove the retaining nuts from the heater controls **(see illustration)**.

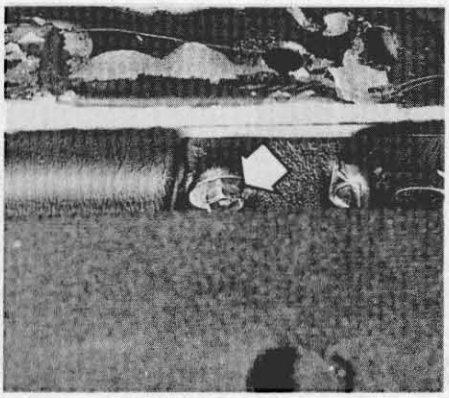
19 Using pliers and a protective cloth, pull out the center vent grilles **(see illustration)**.

20 Remove the screws on each side of the center vent grille openings **(see illustration)**.

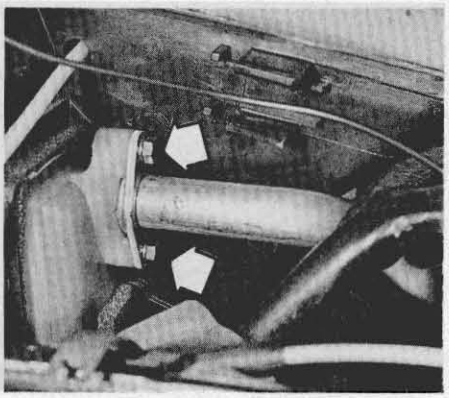
21 Carefully pry off the ignition switch trim surround **(see illustration)**.

22 Close the fresh air flap and remove the bolt, working through the lever slot **(see illustration)**.

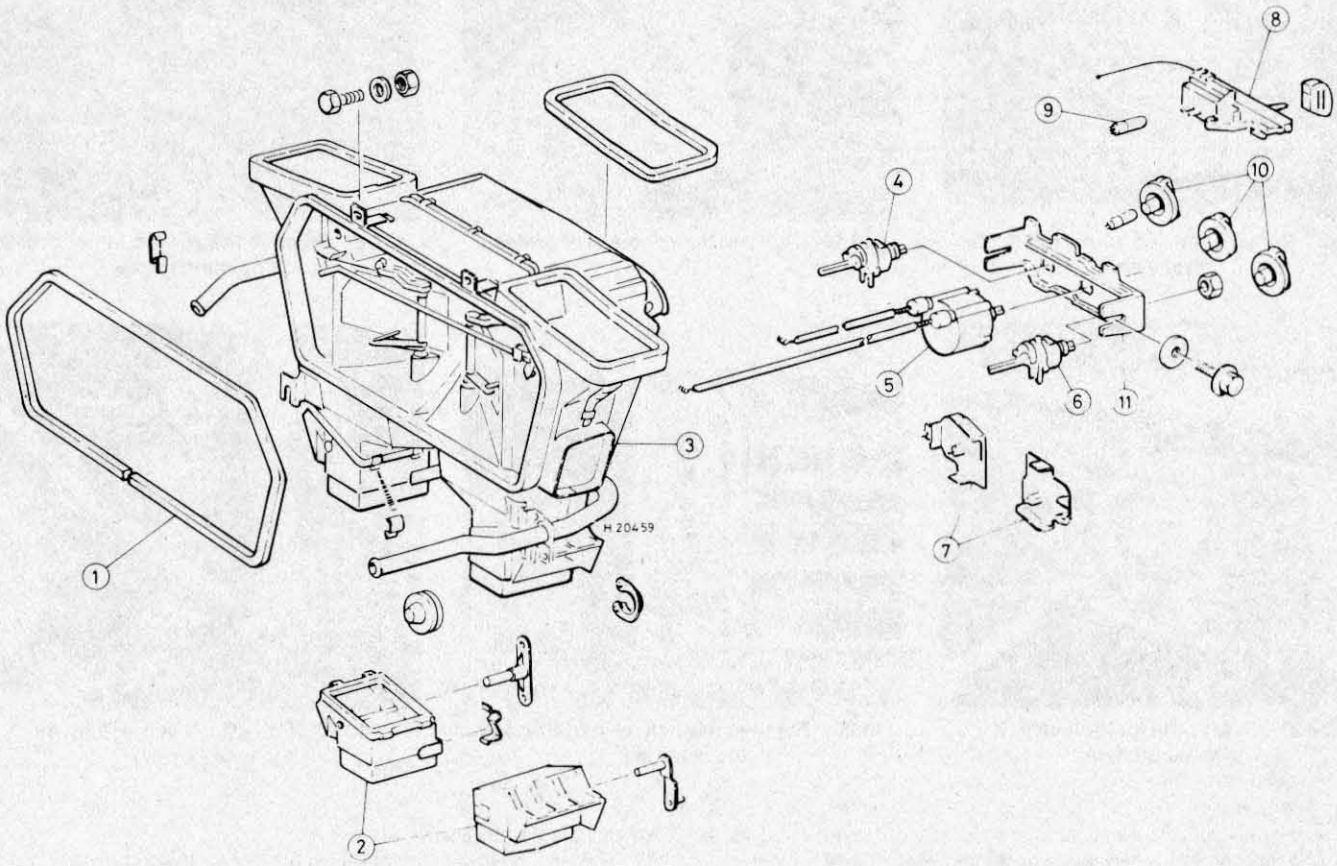
23 Pull the air hose off the rear of the center vent outlets **(see illustra-**



42.24 Remove the bolt behind the glovebox cover (arrow)

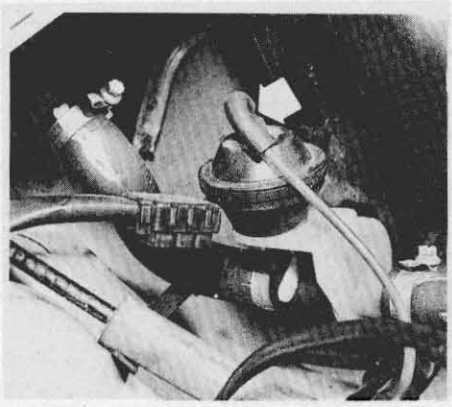


43.9 Remove the return flow pipe bolts (arrows)

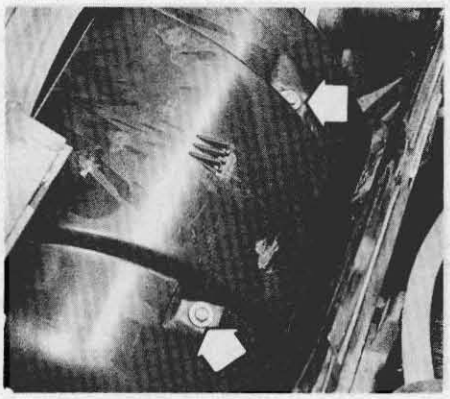


43.16 Heater unit and components

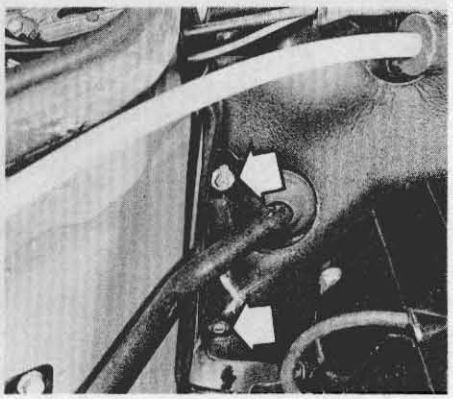
1	*Seal*	4	*Vacuum switch*	7	*Covers*	10	*Switch knobs*
2	*Air outlet*	5	*Air distribution control*	8	*Blower control switch*	11	*Switch bracket*
3	*Heater unit*	6	*Vacuum switch*	9	*Bulb*		



45.2 Disconnect the vacuum hose from the heater valve



45.3 Remove the screws from the blower motor cover (arrows)



45.4 Inner firewall retaining screws (arrows)

tion).
24 Remove the retaining bolt behind the glovebox cover **(see illustration)**, and the inner nut at the bottom right-hand side.
25 Pull out the demister nozzles on the heater box and remove the dash from the car.
26 Installation is the reverse of removal.

43 Heater unit – removal and installation

Refer to illustrations 43.9 and 43.16

Removal

1 Drain the cooling system as described in Chapter 2.
2 Remove the dash as described in Section 42.
3 Release the cable retaining tie on the left-hand side of the heater unit, and remove the screw on the wiring terminal.
4 Disconnect the electrical connector at the rear of the blower motor switch.
5 Disconnect the vacuum lines and illumination bulb wiring at the rear of the heater controls.
6 Place a container beneath the engine, under the area of the heater feed hose at the rear of the cylinder head.
7 Disconnect the heater feed hose at the rear of the cylinder head.
8 Disconnect the heater return hose at the thermostat housing. Using compressed air from a foot pump, blow the residual coolant out of the heater matrix by inserting the foot pump hose into the heater return hose. The coolant will be forced out of the feed hose into the container.
9 Remove the two bolts and separate the return flow pipe at the matrix flange joint **(see illustration)**.
10 Pull off the right-hand air duct at the heater unit below the return flow pipe.
11 Remove the two bolts and separate the feed flow pipe at the matrix flange joint on the other side of the heater.
12 Pull off the left-hand air duct at the heater unit below the feed flow pipe.
13 Force off the feed flow pipe holder at the firewall on the left-hand side.
14 Unscrew the mounting bracket nut below the feed flow pipe holder.
15 Unscrew the right-hand mounting bracket nut below the return flow pipe.
16 Unscrew the two mounting nuts at the top of the heater unit **(see illustration)**.
17 Disconnect the control cable at the blower motor slide switch.
18 Disconnect the control cable at the main air flap on the side of the heater unit.
19 Separate the heater unit from the mounting studs, lift the unit up and remove it from the car.

Installation

20 Installation is the reverse of removal. When connecting the blower control cable, connect and secure the cable at the slide switch, then move the switch to blower position MAX. Connect the control cable end to the main air flap lever, open the main air flap up to its stop, then clip the outer cable into position.
21 On completion, refill the cooling system as described in Chapter 2.

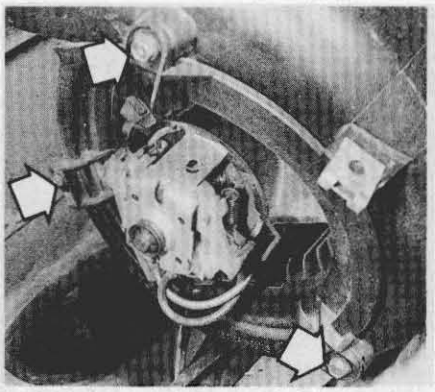
44 Heater core – removal and installation

1 Remove the heater unit as described in Section 43.
2 Remove the screws on the heater unit air intake **(see illustration 43.16)**.
3 Carefully pry off all the retaining clips along the top, on both sides, and on the bottom of the heater unit.
4 Force the connecting linkage out of the left- and right-hand defogger flap arms.
5 Push back the lock on the left-hand defogger flap, while at the same time pulling off the connecting linkage lever.
6 Pull off the gaskets on the left- and right-hand defogger nozzle connections.
7 Push off the connecting levers of the mixed air flaps on the left- and right-hand levers.
8 Pry the left- and right-hand mixed air flap connecting lever ball heads off the ball sockets.
9 Separate the two halves of the heater unit and remove the mixed air flaps.
10 Remove the heater core frame retaining screws, remove the frame and take out the heater core.
11 Installation is the reverse of removal.

45 Heater blower motor – removal and installation

Refer to illustrations 45.2, 45.3, 45.4 and 45.7

1 Remove the air intake cover over the plenum chamber as described in Chapter 12, Section 28.
2 Disconnect the vacuum hose at the heater valve **(see illustration)**.
3 Remove the two screws on the blower motor cover **(see illustration)**.
4 Lift the rubber sealing strip off the inner firewall and remove the two retaining screws on each side **(see illustration)**.
5 Move the firewall up and forward, then remove the blower motor cover.
6 Remove the cable ties and disconnect the blower motor electrical connector.



45.7 Blower motor retaining bolts (arrows)

7 Remove the blower motor retaining bolts and guide the motor sideways out of the housing **(see illustration)**.
8 Installation is the reverse of removal.

46 Heater valve – removal and installation

1 Remove the air intake cover over the plenum chamber as described in Chapter 12, Section 28.
2 Remove the expansion tank pressure cap slowly to release any residual pressure in the cooling system.
3 Disconnect the vacuum hose at the heater valve, located adjacent to the heater blower motor in the plenum chamber **(see illustration 45.2).**
4 Disconnect the coolant hoses and remove the heater valve from its bracket.
5 Installation is the reverse of removal, but note that the side of the valve marked "inlet" must be towards the engine. Top up the cooling system on completion.

47 Air conditioning system – precautions and maintenance

1 Never disconnect any part of the air conditioning system unless the system has been discharged by your Mercedes-Benz dealer, or other repair shop.
2 Where the compressor or condenser obstruct other mechanical operations such as engine removal, unbolt the component and move it to the limit of its flexible hose deflection, but don't disconnect the hoses. If there is still insufficient room to perform the required work, then the system must be discharged before disconnecting and removing the assemblies.
3 If the system has been discharged it will, of course, have to be recharged on completion.
4 Regularly check the condenser fins for clogging with bugs, leaves or other debris. Clean it out with water or compressed air.
5 Check the drivebelt condition and if necessary adjust the belt tension, as described in Section 48.

48 Air conditioning compressor drivebelt – removal, installation and adjustment

Note: *The following procedure covers models in which multiple drivebelts are used to drive the engine accessories (up to approximately October 1984). On later cars with a single drivebelt layout, refer to Chapter 12, Section 6.*

1 See Chapter 12 and remove the alternator drivebelt.
2 See Chapter 10 and remove the power steering pump drivebelt.
3 Loosen the compressor mounting bolt, unscrew the tensioning bolt to move the compressor in towards the engine, and slip the belt off the pulleys.
4 Install a new belt over the pulleys, and tighten the tensioning bolt until it is just possible to deflect the belt by 10.0 mm (0.4 in) under thumb pressure at a point midway between the pulleys. Tighten the mounting bolt when the tension is correct.
5 Install the power steering pump drivebelt (see Chapter 10) and the alternator drivebelt (see Chapter 12).

Chapter 12 Electrical system

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Specifications

System type	12 volt, negative ground
Battery	
Type	12 volt lead-acid 55 or 62 Amp-hours
Alternator	
Rated output	55 Amps
Minimum brush length	5.0 mm (0.20 in)
Starter motor	
Minimum brush length	10.0 mm (0.39 in)
Torque specifications	**Ft-lbs (unless otherwise indicated)**
Alternator pulley retaining nut	
With V-belt pulley	30
With multi-ribbed pulley	48
Drivebelt adjustment pointer lockbolt	55
Wiper motor retaining bolts	48 in-lbs

1 General information

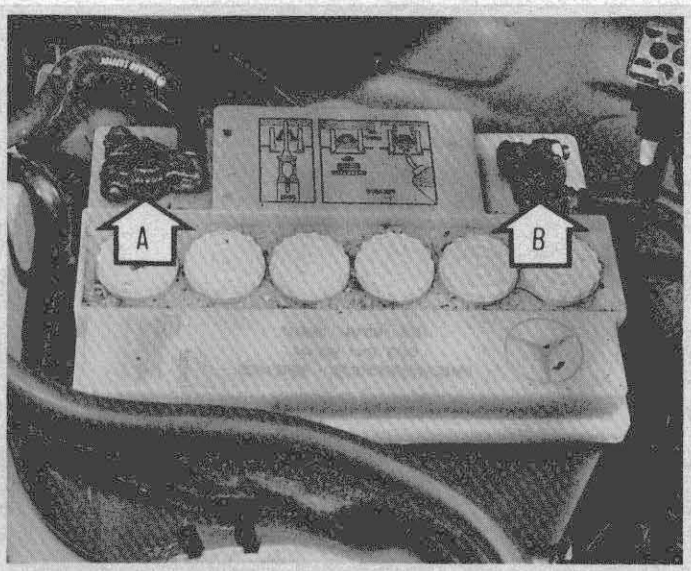
The electrical system is of the 12-volt negative ground type, and consists of a 12-volt battery, alternator, starter motor and related electrical accessories, components and wiring. The battery is charged by an alternator which is belt-driven from the crankshaft pulley. The starter motor is of the pre-engaged type incorporating an integral solenoid.

Further details of the major electrical systems are given in the relevant Sections of this Chapter.

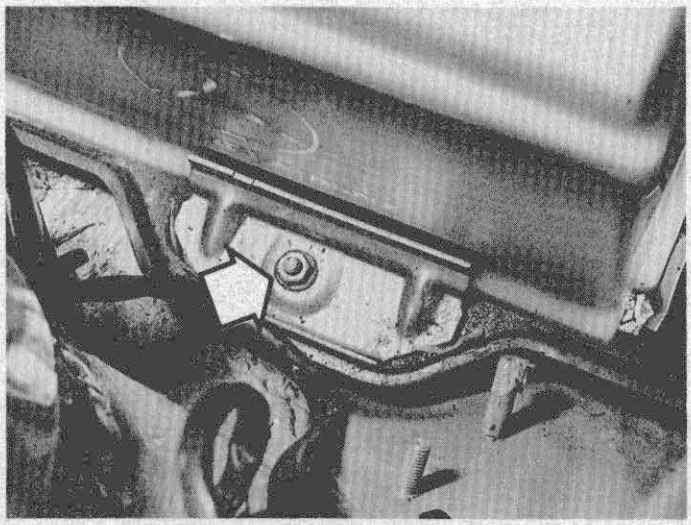
Caution: *Before carrying out any work on the vehicle electrical system, read through the precautions given in Safety First at the beginning of this manual and in Section 2 of this Chapter.*

2 Electrical system – precautions

It is necessary to take extra care when working on the electrical system to avoid damage to semi-conductor devices (diodes and transistors), and to avoid the risk of personal injury. In addition to the precautions given in Safety First at the beginning of this manual, observe the following items when working on the system to avoid the risk of personal injury. In addition to the precautions given in Safety First at the beginning of this manual, observe the following items when working on the system.



4.2 Battery positive terminal (A) and negative terminal (B)



4.4 Battery hold-down clamp nut (arrow)

1 Always remove rings, watches, etc before working on the electrical system. Even with the battery disconnected, capacitive discharge could occur if a component live terminal is grounded through a metal object. This could cause a shock or burn.
2 Do not reverse the battery connections. Components such as the alternator or any other having semi-conductor circuitry could be damaged.
3 If the engine is being started using jumper cables and a booster battery, connect the batteries, positive to positive, and negative to negative. This also applies when connecting a battery charger.
4 Never disconnect the battery terminals or alternator wiring when the engine is running.
5 The battery cables and alternator wiring must be disconnected before performing any electric welding on the car.
6 Never use an ohmmeter of the type incorporating a hand-cranked generator for circuit or continuity testing.
7 Always ensure that the battery negative cable is disconnected when working on the electrical system.

3 Maintenance and inspection

1 At regular intervals (see Routine Maintenance at the beginning of this manual) perform the following maintenance and inspection operations on the electrical system components.
2 Check the operation of all the electrical equipment, such as the wipers, washers, lights, direction indicators, horn etc. Refer to the appropriate Sections of this Chapter if any components are found to be inoperative.
3 Visually check all accessible wiring connections, harnesses and retaining clips for security, or any signs of chafing or damage. Repair any problems encountered.
4 Check the alternator drivebelt for cracks, fraying or damage. Replace the belt if worn or, if satisfactory, check and adjust the belt tension, as described in Section 6.
5 Check the condition of the wiper blades and if they are cracked or show signs of deterioration, replace them as described in Section 27. Check the operation of the windshield and headlight washers (if installed). Adjust the nozzles using a pin, if necessary.
6 Check the battery terminals, and if there is any sign of corrosion disconnect and clean them thoroughly. Smear the terminals and battery posts with petroleum jelly before installation. If there is any corrosion on the battery tray, remove the battery, clean the deposits and treat the affected metal with an anti-rust preparation. Repaint the tray after treatment.
7 Fill up the washer reservoir and check the security of the pump wires and water hoses.
8 Check the electrolyte level in the battery after unscrewing the cell filler caps. Top up using distilled or de-ionized water as necessary until the water level in the filling chamber no longer drops. Install the filler caps after topping-up.
9 It is advisable to have the headlight aim adjusted using optical beam setting equipment.
10 When performing a road test, check the operation of all the instruments and warning lights, and the operation of the turn signal switch self-cancelling mechanism.

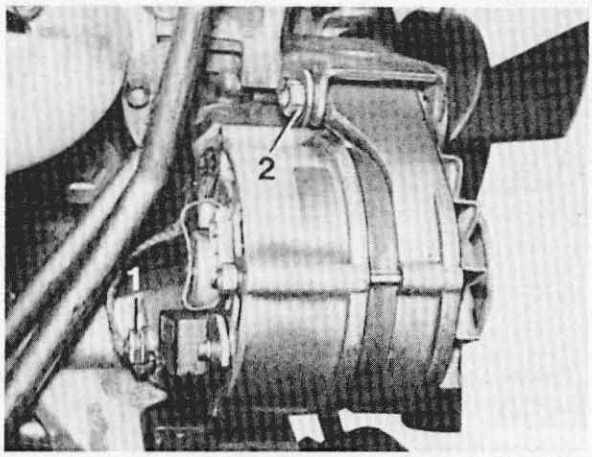
4 Battery – removal and installation

Refer to illustrations 4.2 and 4.4

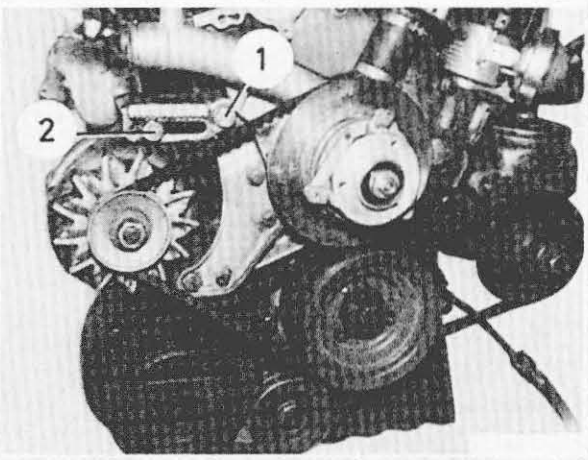
1 The battery is located at the rear of the engine compartment on the left-hand side.
2 Loosen the negative cable clamp **(see illustration)** and disconnect the cable.
3 Loosen the positive cable clamp and disconnect the cable.
4 Unscrew the nut and remove the battery holding clamp **(see illustration)**.
5 Lift the battery out of its location, taking care to keep it upright.
6 Installation is the reverse of removal, but make sure the positive cable is connected first and the negative (ground) terminal last.

5 Battery – charging

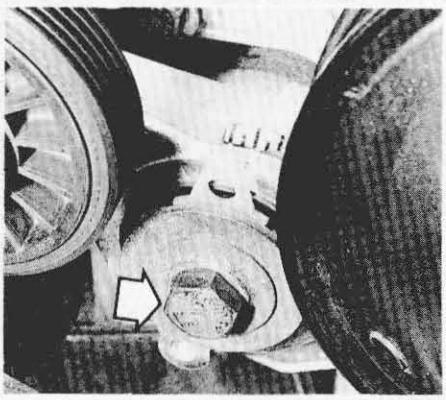
1 Occasionally, it may be necessary to have the battery charged from an external source, such as after long periods of storage, or driving the vehicle on repeated short trips during the winter, when an extra load is placed on the battery.



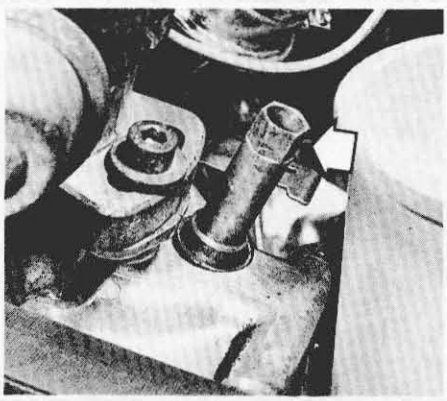
6.2a Alternator upper and lower mounting nuts (1 and 2) – early models



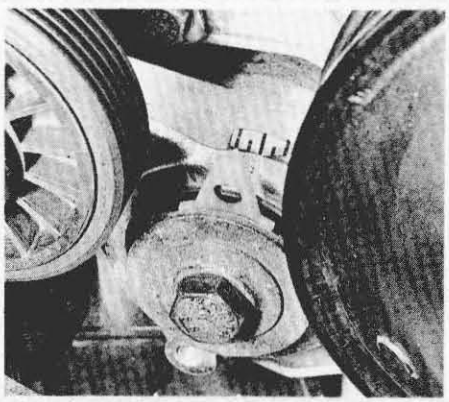
6.2b Alternator adjustment arm bolt (1) and adjuster bolt (2) – early models



6.8 Adjustment pointer lock bolt (arrow)



6.9 Drivebelt tensioning nut (arrow)



6.11 Align the adjustment pointer with the first divisional mark on the scale

2 Ideally, the battery should be charged at a rate of 10-percent of its capacity (example: 6.2 amps for a 62 amp-hour battery) until no further increase in specific gravity or charging voltage occurs over a two hour period. The battery cables must be disconnected while the battery is being charged.

3 A trickle charger, charging at a rate of 1.5 amps, can be safely used overnight.

4 The fast charge, or "boost" type of chargers should not be used as they can cause serious damage to the battery plates through overheating.

6 Alternator drivebelt – removal, installation and adjustment

Engines with multiple drivebelts

Refer to illustrations 6.2a and 6.2b

1 Cars manufactured up to approximately October 1984 are equipped with a number of separate drivebelts to drive the various engine accessories. The following procedure describes the removal, installation and adjustment of the belt used to drive the alternator and water pump. Procedures relating to the other belts are described in the relevant Chapters.

2 To remove the drivebelt, loosen the alternator upper and lower mounting nuts as well as the adjustment arm bolt at its timing cover bracket attachment **(see illustrations)**.

3 Turn the adjuster bolt to move the alternator in toward the engine, then slip the belt off the pulleys.

4 Install the drivebelt over the pulleys then turn the adjuster bolt to tension the belt. The tension is correct when it is just possible to deflect the belt by approximately 12.0 mm (0.5 in) under moderate finger pressure midway along its longest run.

5 Hold the adjuster bolt in this position and tighten the upper and lower mounting nuts, then the adjustment arm bolt, in that order.

6 If the drivebelt has been replaced, recheck the belt tension after running the engine for several minutes.

Engines with single drivebelt

Refer to illustrations 6.8, 6.9, 6.11, 6.12a, 6.12b and 6.13

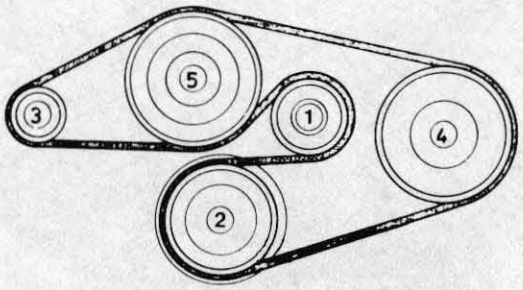
7 Cars manufactured from approximately October 1984 are equipped with a single multi-ribbed poly V-belt to drive all the engine accessories. Removal, inspection, installation and adjustment procedures are as follows.

8 To remove the belt, loosen the adjustment pointer lock bolt on the adjuster mechanism by 1/4 to 1/2 of a turn **(see illustration)**.

9 Turn the tensioning nut **(see illustration)** using a socket or wrench in an counterclockwise direction, until the tensioning roller has retracted sufficiently to allow the belt to be slipped off the pulleys. Remove the belt carefully so the ribs are not damaged by the pulley edges.

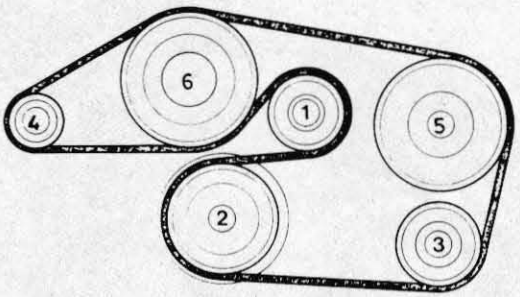
10 With the belt removed, carefully examine its condition and check for rubber lumps or dirt between the ribs, broken or detached ribs, fraying or pulling out of the backing strands, or a pointed upper edge in the ribs. If any of these conditions are evident, replace the drivebelt.

11 Before installing the belt, move the adjustment pointer to the left and align it with the first divisional mark on the tensioning scale **(see illustration)**.



6.12a Drivebelt run diagram for cars with power steering – later models with single drivebelt

1 Tensioning roller
2 Crankshaft
3 Alternator
4 Power steering pump
5 Water pump



6.12b Drivebelt run diagram for cars with power steering and air conditioning – later models with single drivebelt

1 Tensioning roller
2 Crankshaft
3 Refrigerant compressor
4 Alternator
5 Power steering pump
6 Water pump

12 Refer to the accompanying illustrations according to the accessories installed, and slip the drivebelt over the pulleys starting with the tensioning roller **(see illustrations)**.

13 Turn the tensioning nut clockwise until the adjustment pointer is aligned with the appropriate divisional mark as follows:

Cars without power steering – fifth divisional mark
Cars with power steering, or with power steering and air conditioning – seventh divisional mark **(see illustration)**

14 With the belt correctly tensioned, tighten the adjustment pointer lockbolt securely.

7 Alternator – removal and installation

Refer to illustrations 7.3 and 7.5

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

2 Remove the drivebelt as described in the previous Section.

3 Detach the retaining wire clip and disconnect the electrical connector at the rear of the alternator **(see illustration)**.

4 On pre-October 1984 models, remove the upper and lower mounting nuts and remove the bolts, noting the arrangement of the tensioner on the upper bolt **(see illustrations 6.2a and 6.2b).** Remove the alternator from the engine.

5 On post October 1984 models, remove the upper and lower mounting bolts **(see illustration)** and remove the alternator from the engine.

6 Installation is the reverse of removal. Install the drivebelt as described in Section 6.

8 Alternator troubleshooting – general information

Due to the special equipment and expertise required to test or repair an alternator, it is recommended that, if the performance is suspect, the car be taken to an automobile electrician who will have the facilities for such work. Because of this recommendation, information is limited to the inspection and replacement of the brushes. If the alternator output is insufficient, the following points should be checked before seeking further assistance:

a) Check the drivebelt condition and tension
b) Make sure the battery is fully charged
c) Check the ignition warning light bulb, and replace it if it's blown

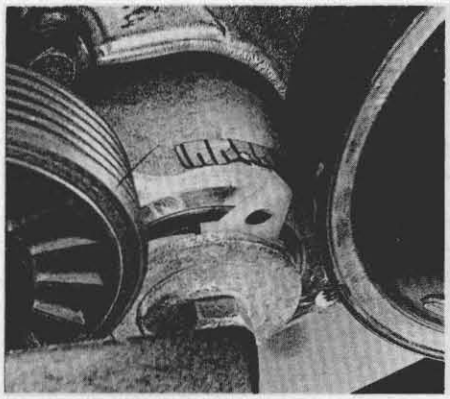
9 Alternator brushes and regulator – replacement

Refer to illustrations 9.2a and 9.2b

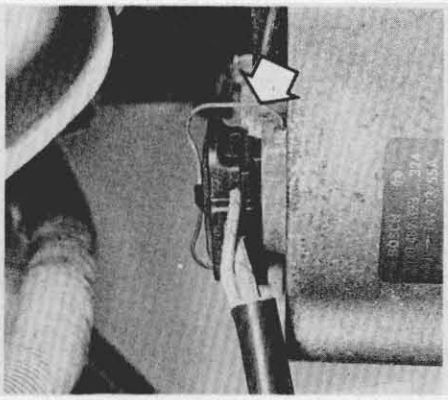
1 Remove the alternator as described in Section 7.

2 Remove the two screws and pull out the brush holder and regulator from the rear of the alternator **(see illustrations)**.

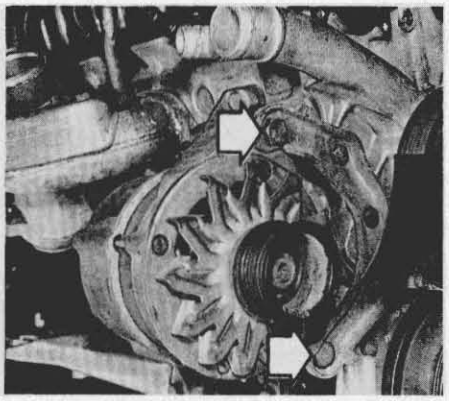
3 Measure the brush length and if less than the specified minimum, re-



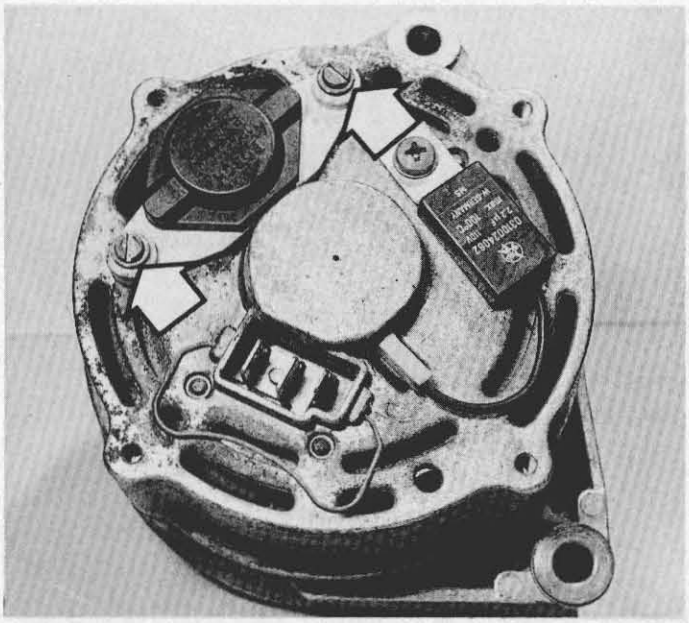
6.13 Adjustment pointer aligned with the seventh divisional mark



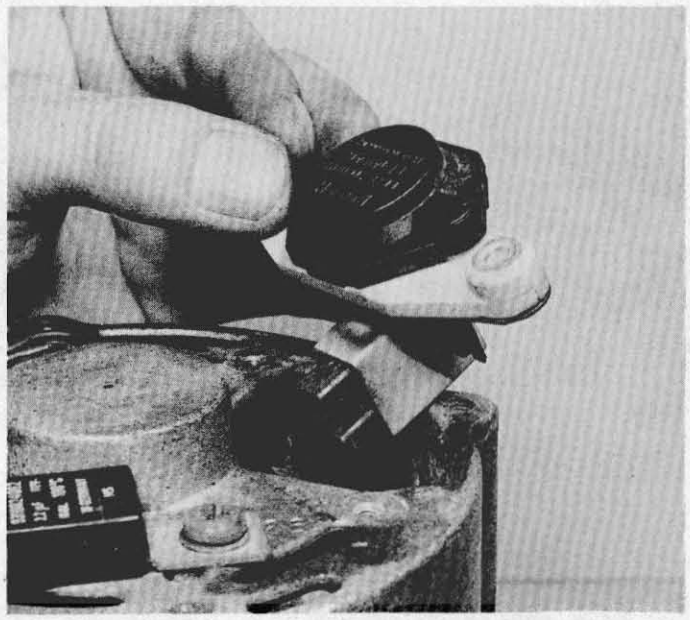
7.3 Detach the alternator electrical connector retaining clip (arrow)



7.5 Alternator retaining bolts (arrows) on later models



9.2a The voltage regulator/brush holder assembly is retained by two screws (arrows)



9.2b Pull the voltage regulator/brush holder out at an angle

place the brush holder and regulator as an assembly.
4 Installation is the reverse of removal.

10 Starter motor – removal and installation

Refer to illustration 10.10

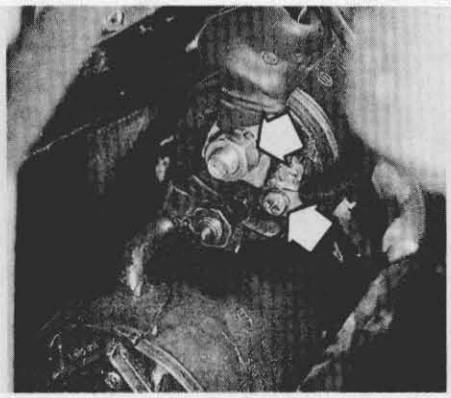
1 Disconnect the cable from the negative terminal of the battery.
2 Raise the front of the vehicle and support it securely on jackstands.
3 Remove the engine undertray on models so equipped.
4 Remove the air cleaner as described in Chapter 3.
5 Remove the two bolts and remove the intake manifold support strut.
6 If equipped, disconnect the electrical connector at the oil level sensor on the side of the oil pan.
7 On starter motors equipped with a rear support bracket, remove the bolts securing the bracket to the cylinder block, and the nuts securing it to the starter, then remove it.
8 Unscrew the bolts securing the starter motor to the bellhousing.
9 Detach the wiring support bracket on the manifold, then turn the steering to provide maximum clearance between the starter motor and the steering drag link.
10 Withdraw the starter slightly, disconnect the wiring at the solenoid **(see illustration)** and remove the starter from under the car.
11 Installation is the reverse of removal.

11 Starter motor – overhaul

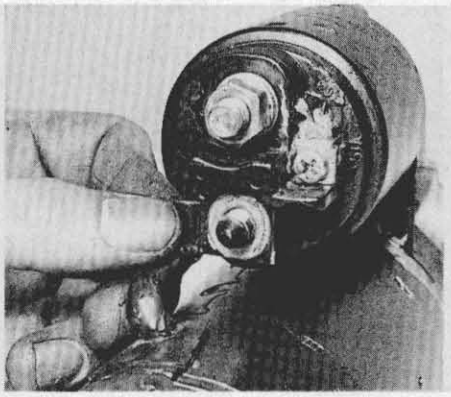
Refer to illustrations 11.3 through 11.10, 11.12a through 11.17c and 11.21

Note: *Two types of starter motor are used on models covered by this manual. Prior to June 1985 a 1.4 kW Bosch pre-engaged unit is used, while on later models a similar Bosch starter is installed but incorporating a reversing gear arrangement at the drive pinion end. The following procedures are applicable to both types but the accompanying illustrations depict the later unit. Also, before disassembling anything, check on the price and availability of a rebuilt starter.*

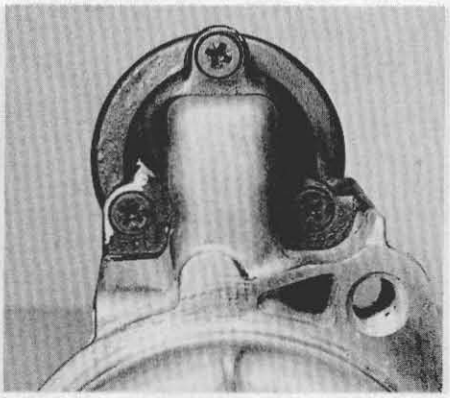
1 Remove the starter motor as described in the previous Section.
2 Mark the housings in relation to each other as an aid to reassembly.
3 Unscrew the nut and disconnect the field wire at the solenoid **(see illustration)**.
4 Remove the three screws and pull off the solenoid body from the drive



10.10 Remove the upper large nut and the screw (arrows) to disconnect the wiring at the starter



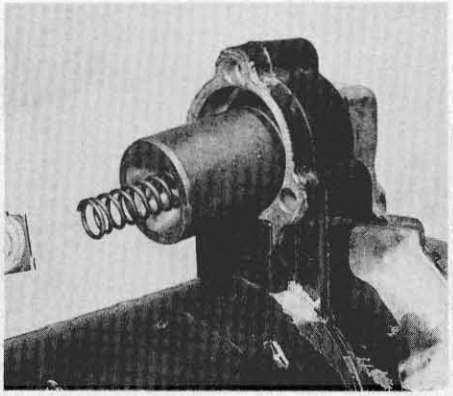
11.3 Disconnect the field wire at the solenoid



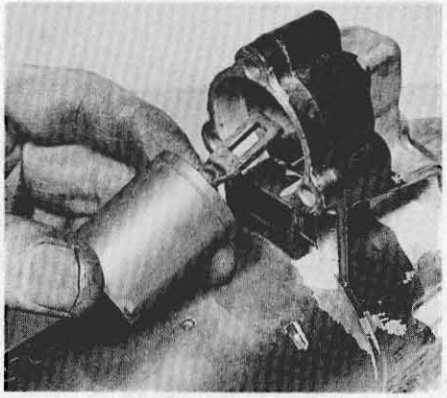
11.4a Remove the three screws . . .



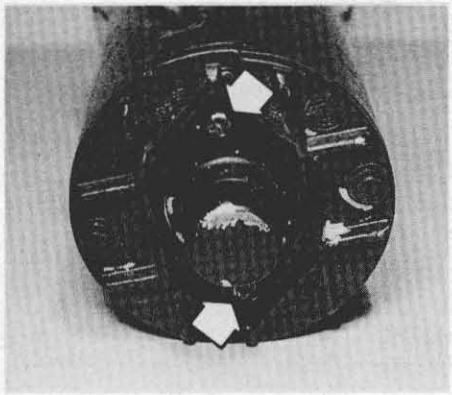
11.4b . . . and pull off the solenoid body



11.5a Remove the plunger spring . . .



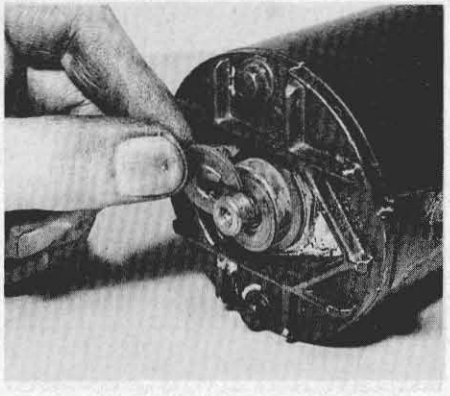
11.5b . . . then unhook and remove the plunger



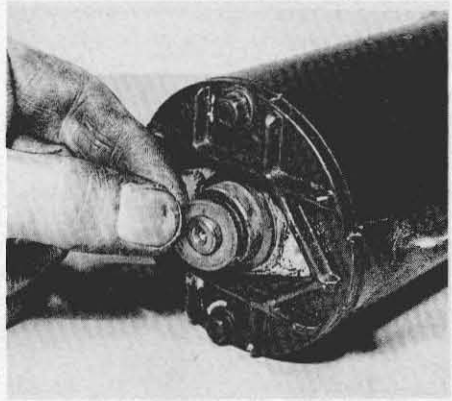
11.6a Remove the two screws (arrows) . . .



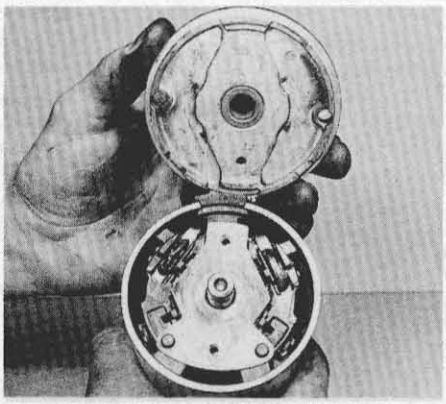
11.6b . . . and take off the end cover



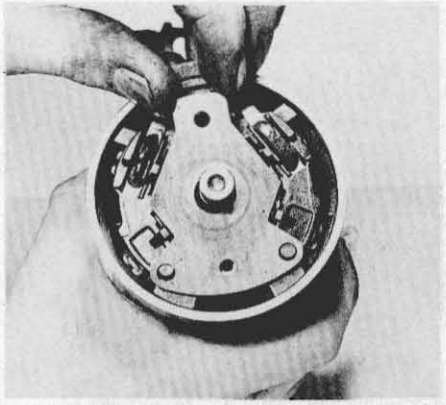
11.7a Extract the armature circlip



11.7b Remove the adjustment shims and count them – make sure the same number of shims are installed when reassembling the starter



11.8a Remove the end plate



11.8b Remove the brush holder support plate

end bracket **(see illustrations)**.

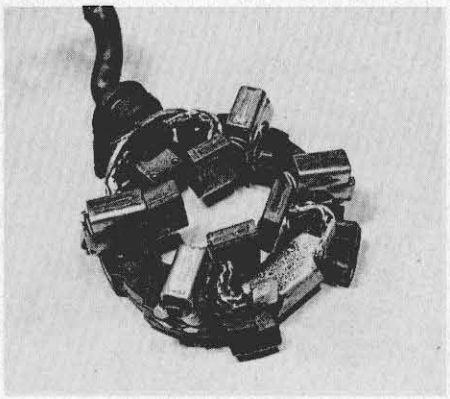
5 Remove the spring, unhook the solenoid plunger from the actuating lever and remove the plunger **(see illustrations)**.

6 Remove the screws and remove the small end cover **(see illustrations)**. Recover the seal (where installed).

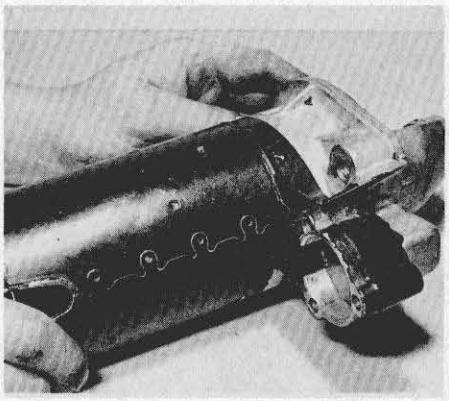
7 Extract the armature circlip and remove the shims **(see illustrations)**. Note the exact number of shims as they determine the shaft end-play.

8 Unscrew the through-bolts and remove the end cover or end plate as applicable **(see illustration)**. Where installed remove the brush holder support plate **(see illustration)**.

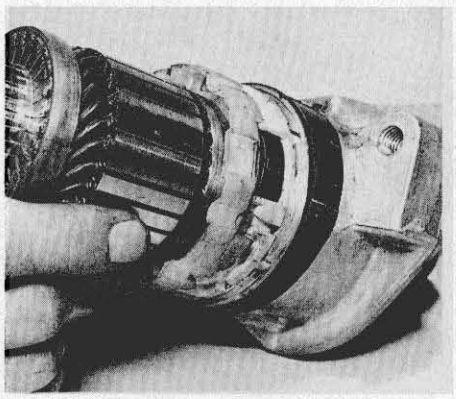
9 Slip the grommet out of the housing and remove the brush holder



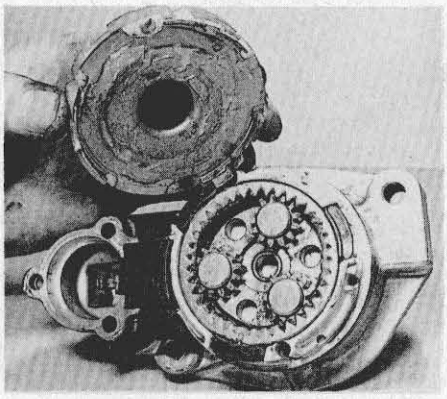
11.9 Remove the brush holder with brushes



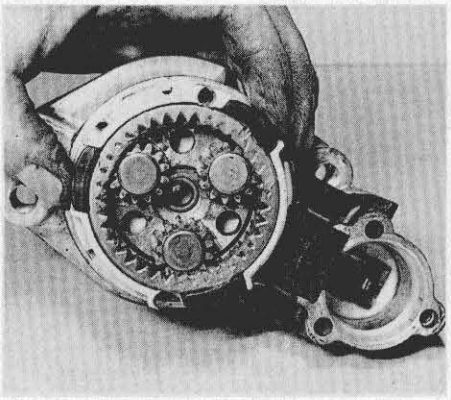
11.10 Remove the drive end bracket and armature



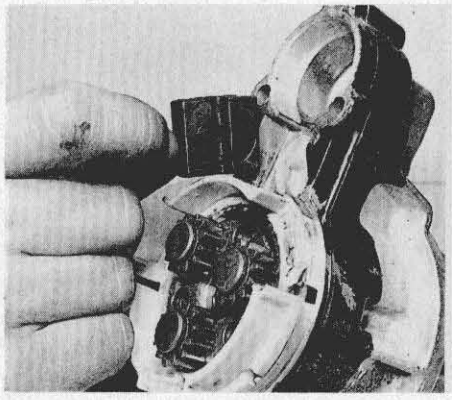
11.12a Pull out the armature



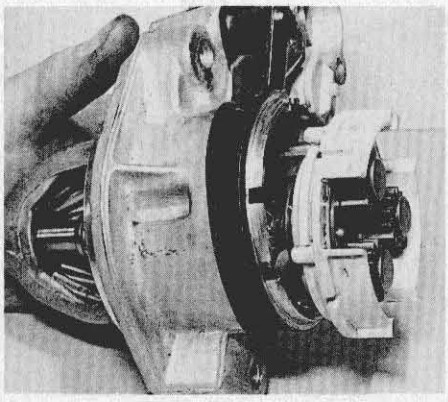
11.12b Remove the reversing gear cover



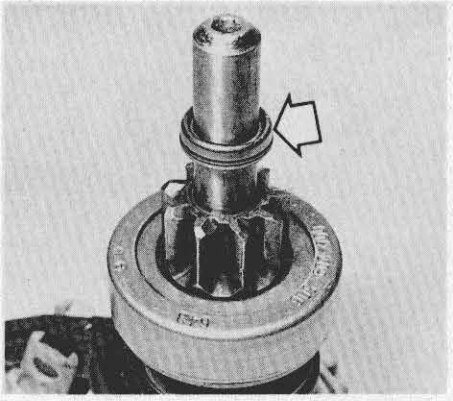
11.12c Lift out the ring gear



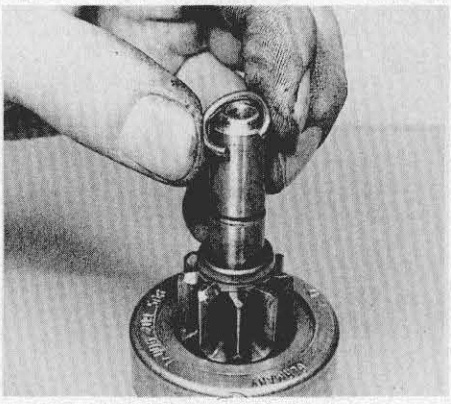
11.12d Extract the actuating lever cover pad



11.12e Remove the reversing gear assembly



11.13 Drive the stop ring (arrow) down the armature



11.14a Remove the circlip . . .

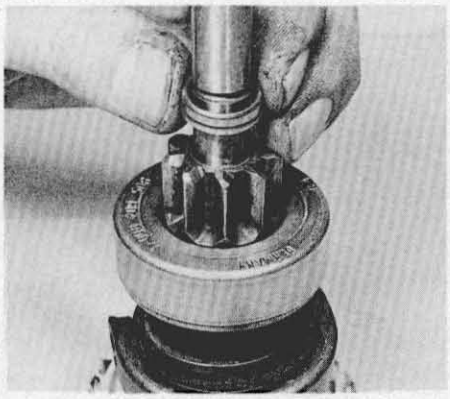
complete with brushes **(see illustration)**.

10 Remove the drive end bracket and armature from the housing **(see illustration)**.

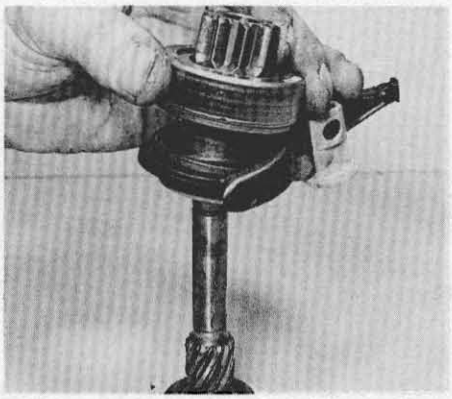
11 On the early type starter motors, pry out the actuating lever cover pad from the drive end bracket and remove the armature and actuating lever.

12 On reversing gear (later) type starters, remove the armature **(see illustration)**, lift off the reversing gear cover and take out the ring gear **(see illustrations)**. Pry out the actuating lever cover pad from the drive end bracket and remove the reversing gear assembly **(see illustrations)** complete with actuating lever.

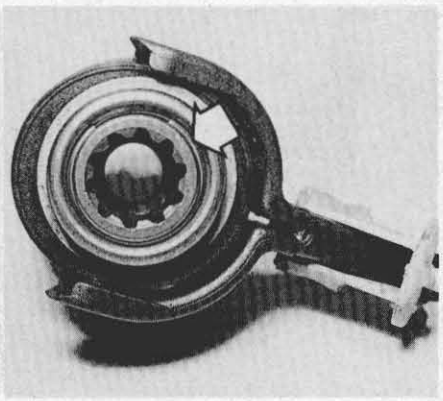
13 Using a metal tube, drive the stop ring down the armature to reveal the retaining circlip **(see illustration)**.



11.14b . . . and stop ring



11.15 Lift off the drive pinion



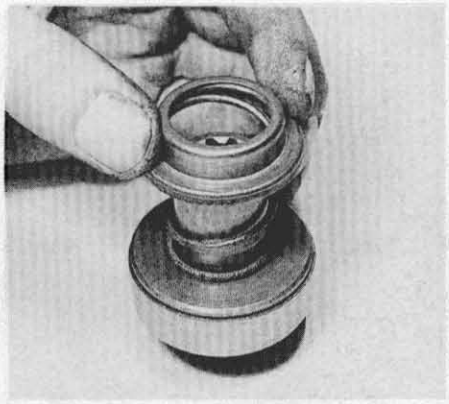
11.16a Remove the drive pinion circlip (arrow)



11.16b Lift off the retaining cap



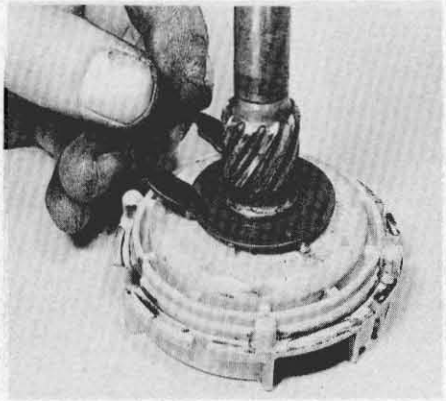
11.16c Remove the actuating lever



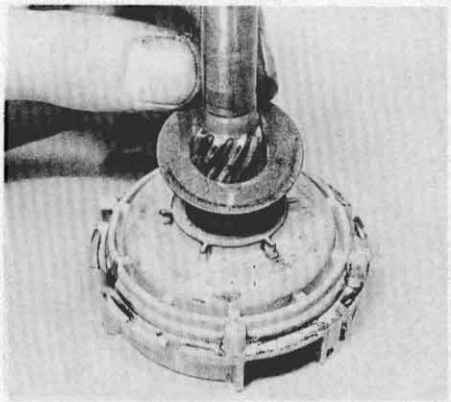
11.16d Lift off the inner cap



11.16e Remove the spring



11.17a Pull out the locking ring . . .



11.17b . . . take off the washer . . .

14 Extract the circlip and remove the stop ring **(see illustrations)**.

15 Pull the drive pinion off the armature or reversing gear shaft **(see illustration)**.

16 Extract the drive pinion circlip and remove the retaining cap, actuating lever, inner cap and spring from the drive pinion **(see illustrations)**.

17 On reversing gear type starters, extract the locking ring, remove the washer, and remove the support plate from the reversing gear shaft **(see illustrations)**.

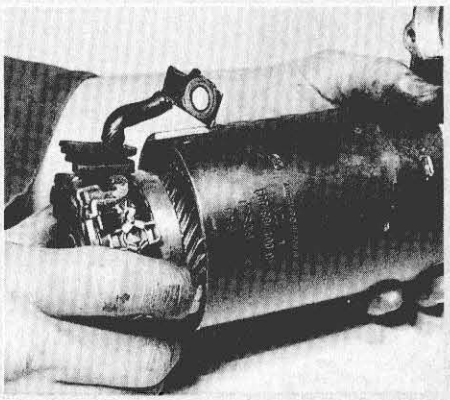
18 Clean all the components in solvent and wipe dry, then examine them for wear and damage. Check the pinion drive for damaged teeth and make sure that the one-way clutch only rotates in one direction. If the shaft bushings are worn they can be removed using a soft metal drift and new bushings installed. However, the new bushings must first be soaked in hot oil for approximately five minutes. Clean the commutator with a rag moistened with solvent. Minor scoring can be removed with fine emery cloth, but deep scoring will necessitate the commutator being turned in a lathe and then being undercut. Commutator refinishing is a job which must be performed by a specialist.

19 On the reversing gear type starter, check the condition of the gear teeth and their fit on the spindles. Also check the fit and condition of the ring gear. Replace the reversing gear as an assembly if wear is detected.

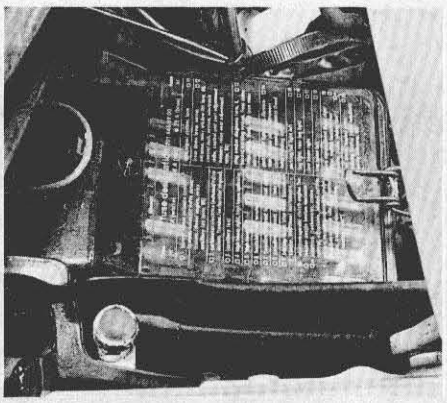
20 Check the condition of the brushes, and replace the brush holder as an assembly if the brushes have worn down to the specified minimum length. To do this on the early units, cut off the copper braid next to the



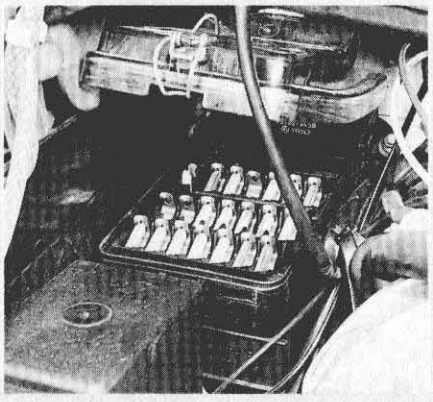
11.17c . . . and remove the support plate



11.21 Install the brushes and holder over the commutator, then install the armature



12.1 The central electrics unit is located at the left rear of the engine compartment



12.2 Lift off the central electrics unit cover

brush holder and solder it to the new holder.

21 Reassembly is the reverse of the disassembly procedure. When installing the brush holder, engage the brushes over the commutator with the armature slightly withdrawn from the housing, then install this assembly to the housing and drive end bracket **(see illustration)**.

12 Fuses and relays – general information

Refer to illustrations 12.1, 12.2, 12.4a, 12.4b and 12.4c

Fuses

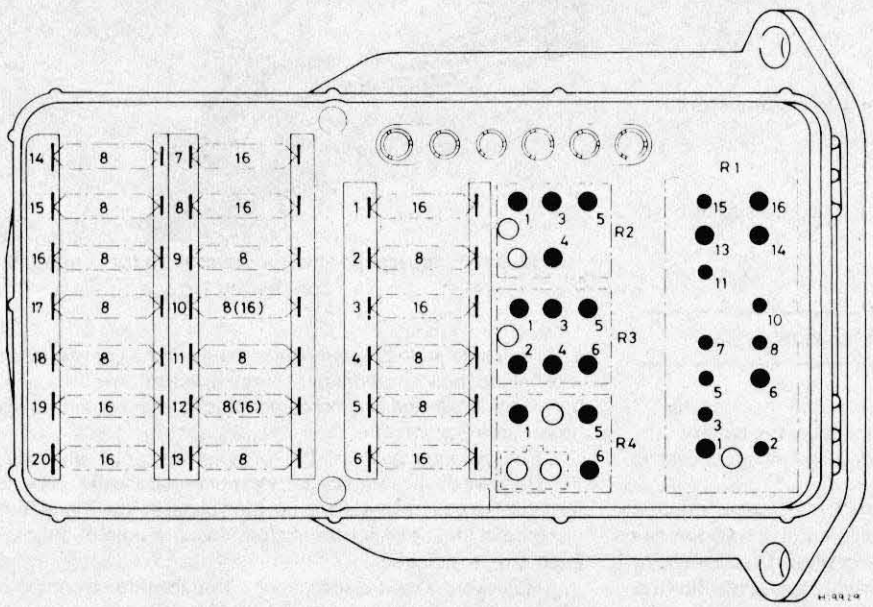
1 The fuses are situated in the central electrics unit, located at the rear of the engine compartment on the right-hand side **(see illustration)**.

2 To gain access to the fuses, lift up the clips at the front and rear of the central electrics unit cover and lift the cover up at the front **(see illustration)**. Squeeze the two legs of the rear clip together to disengage them from the hinge and remove the cover from its location. The fuse locations, current rating and circuits protected are shown on the cover.

3 To replace a blown fuse, withdraw it from its contacts and install a new fuse of an identical rating. Never replace a fuse more than once without finding the cause of the trouble.

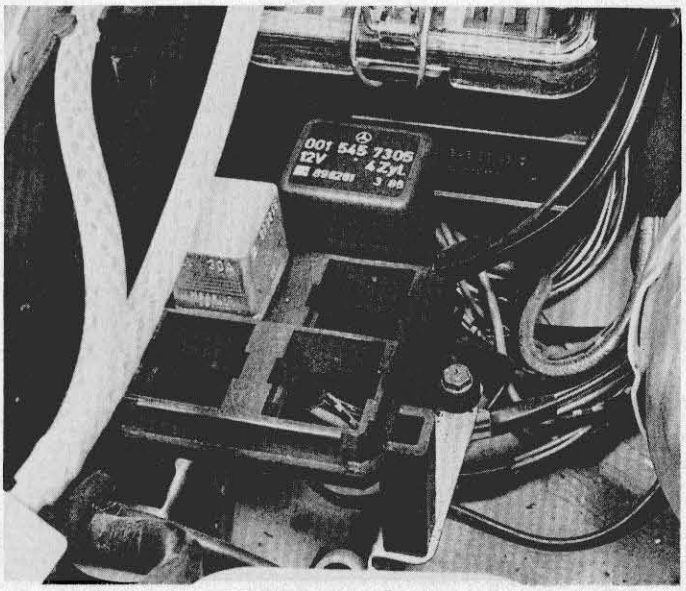
Relays

4 The relays are also located in the central electrics unit behind the fuses, and also in an additional holder situated just to the front of the main unit **(see illustrations)**.

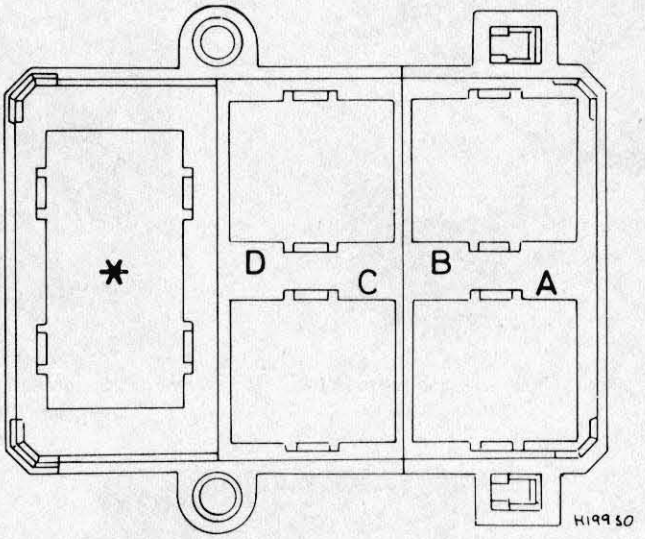


12.4a Relay locations in the central electrics unit

R1 Combination relay (direction indicators, heated rear window, wipers)
R2 Electric window regulator
R3 Air conditioning
R4 Overvoltage protection

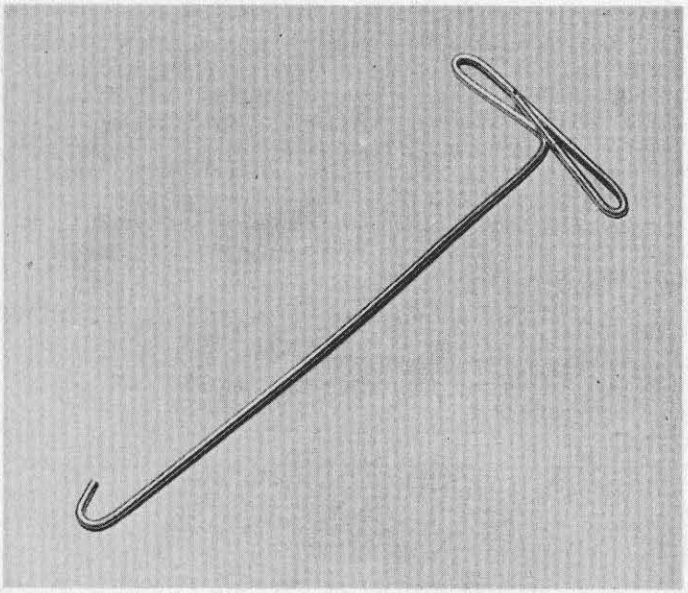


12.4b Additional relay holder location



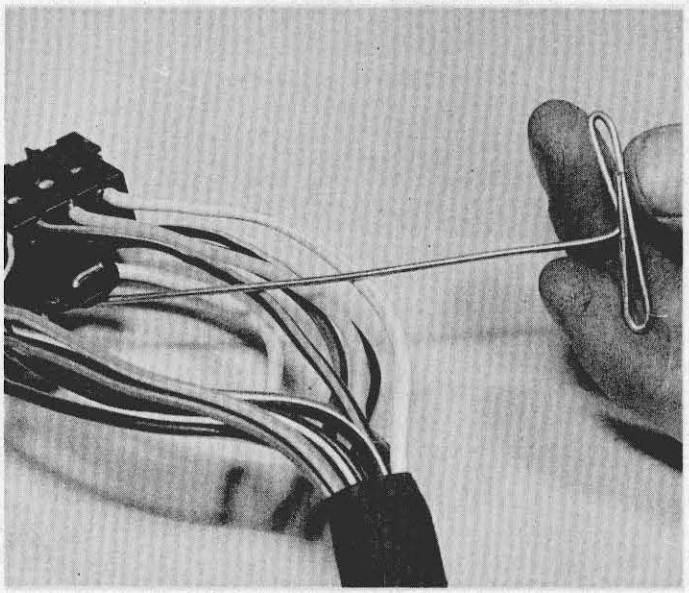
12.4c Relay locations in the additional relay holder

A *Auxiliary heater fuse element*
B *Seat adjustment fuse element*
C *Not used*
D *Headlamp washers and wipers*
** Fuel pump*



13.3a Tool for disconnecting wiring electrical connectors

5 To remove a relay, carefully pull it up from its location. Install by pushing firmly into place.

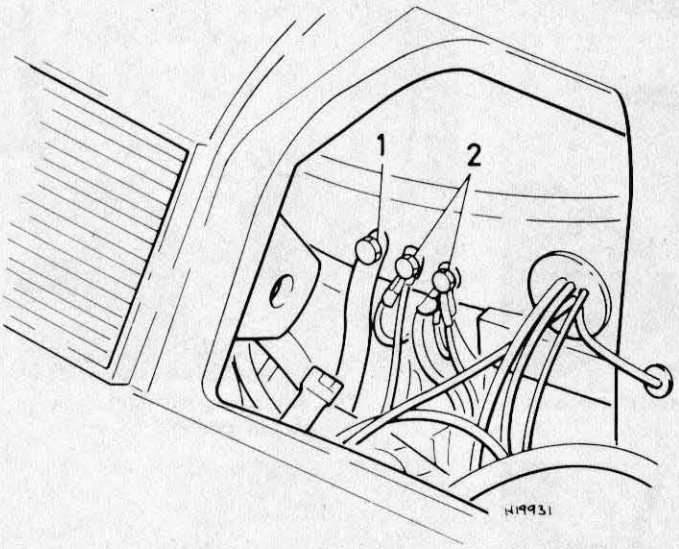


13.3b Electrical connector separation tool engaged with connector tag

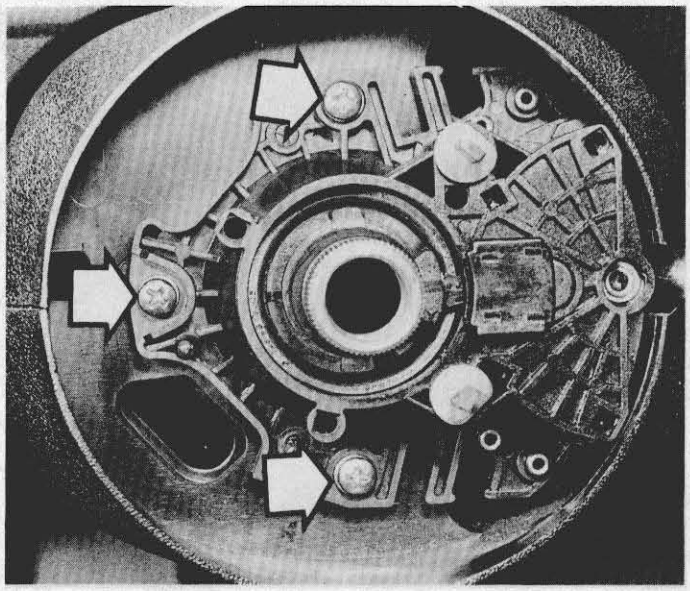
13 Central electrics unit – removal and installation

Refer to illustrations 13.3a, 13.3b and 13.4

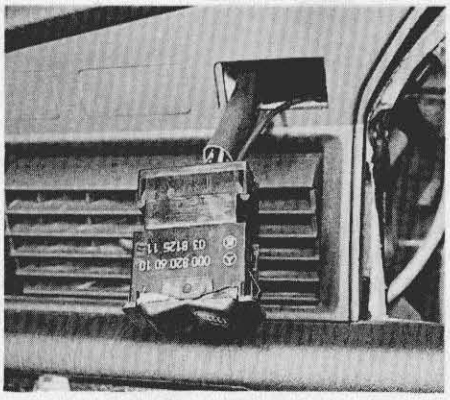
1 Disconnect the cable from the negative terminal of the battery.
2 Remove the cover under the dash on the driver's side for access to the connections on the underside of the unit.
3 Disconnect all the electrical connectors from the underside of the central electrics unit. Each electrical connector is a different shape so they can only be installed one way. If a small hooked piece of wire is used to engage in the tag of each connector, this will make removal easier **(see illustrations)**.
4 Remove the bolts securing the main ground connections to the firewall behind the instrument panel **(see illustration)**.
5 From inside the engine compartment, remove the additional relay holder (see Section 12).
6 Remove the cover over the fuses on the central electrics unit.
7 Remove the two screws and two nuts securing the unit to the firewall.
8 Pull the unit forwards and up, then unscrew the wiring terminals and disconnect the electrical connectors. Make a note of their locations as each wire is removed.
9 Remove the central electric unit from the engine compartment.
10 Installation is the reverse of removal.



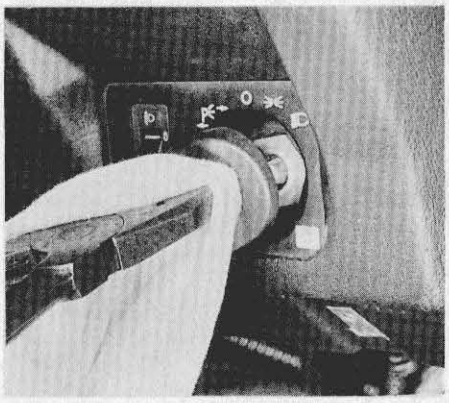
13.4 Main ground connection (1) and additional ground connections (2) behind instrument panel



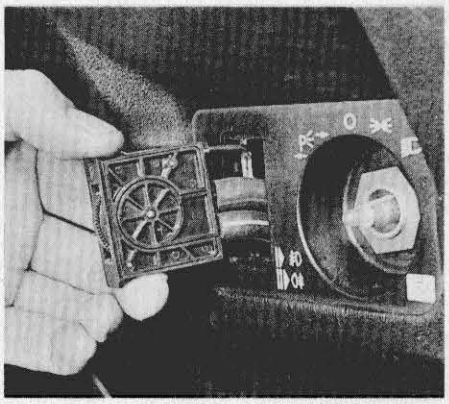
15.4 Combination switch retaining screws (arrows)



16.3 Pry out the switch and disconnect the electrical connector



16.6 Cover the knob with a rag and pull it off with pliers



16.7 Headlight beam control switch removal

14 Ignition switch – removal and installation

Removal and installation of the ignition switch is combined with the steering lock removal and installation procedures as described in Chapter 10.

15 Steering column combination switch – removal and installation

Refer to illustration 15.4

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the cover under the dash on the driver's side.
3 Remove the steering wheel as described in Chapter 10.
4 Remove the three screws securing the combination switch to the steering column **(see illustration)**.
5 Disconnect the combination switch electrical connector from the central electrics unit under the dash. To do this, use a small hooked piece of wire to engage in the tag of the electrical connector, and pull the connector out using the wire **(see illustrations 13.3a and 13.3b).**
6 Lift the combination switch and steering column shroud from the column, then remove the switch and cable from the shroud.
7 Installation is the reverse of removal.

16 Dash panel and center console switches – removal and installation

1 Before removing any switches, disconnect the cable from the negative terminal of the battery, and reconnect it on completion.

Dash switches

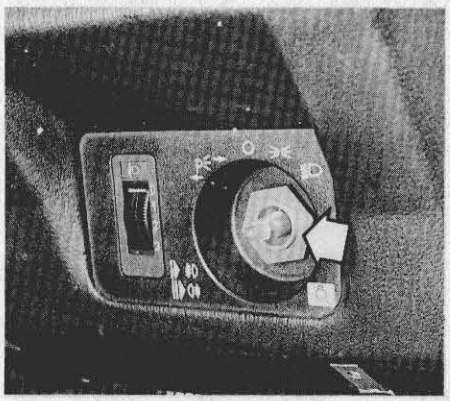
Refer to illustration 16.3

2 To remove the switches on either side of the instrument panel, carefully pry one end of the relevant switch out of its location using a knife blade or thin screwdriver. Protect the dash face as you do this.
3 Remove the complete switch and disconnect the electrical connector at the rear **(see illustration)**.
4 To install, connect the electrical connector and push the switch into position, one end at a time.

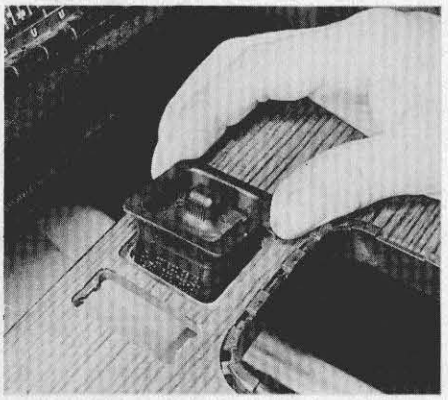
Headlight switch

Refer to illustrations 16.6, 16.7 and 16.8

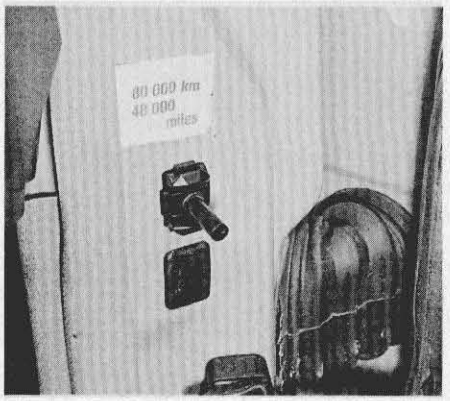
5 Remove the cover under the dash on the driver's side.
6 Using pliers and a protective cloth, carefully pull off the switch knob **(see illustration)**.
7 Using a small screwdriver, pry out the beam control rotary switch **(see illustration)**. Disconnect the vacuum hoses, detach the bulb holder and



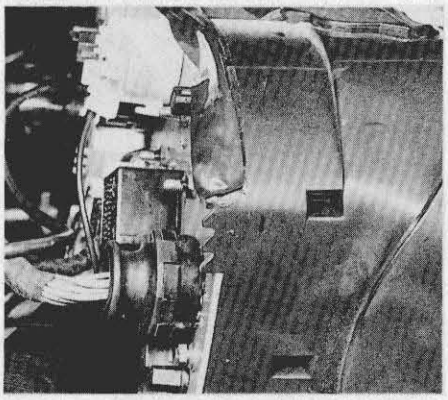
16.8 Headlight switch retaining nut (arrow)



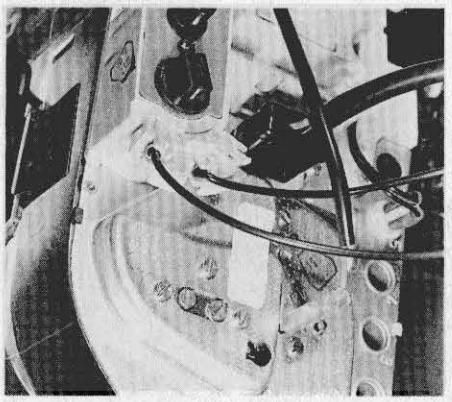
16.10 Center console switch removal



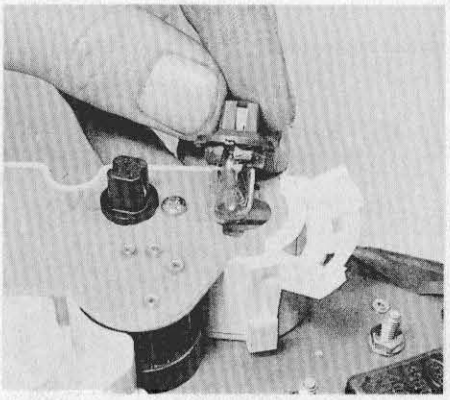
17.2 Door courtesy light switch location



18.7a Disconnect the wiring on the left-hand side . . .



18.7b . . . and right-hand side of the instrument panel



19.2 Twist the bulb holder counterclockwise to remove it

remove the switch.

8 Unscrew the main lighting switch retaining nut **(see illustration)** and remove the switch from behind the dash. Disconnect the electrical connector and remove the switch.

9 Installation is the reverse of removal.

Center console switches

Refer to illustration 16.10

10 Using a small screwdriver, carefully pry the relevant switch from its location **(see illustration)**.

11 Disconnect the electrical connector and remove the switch.

12 Installation is the reverse of removal.

17 Door courtesy light switches – removal and installation

Refer to illustration 17.2

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

2 Carefully pry out the switch **(see illustration)**, disconnect the wiring and remove the switch.

3 Installation is the reverse of removal.

18 Instrument panel – removal and installation

Refer to illustrations 18.7a and 18.7b

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

2 Remove the steering wheel as described in Chapter 10.

3 Remove the cover under the dash on the left-hand side.

4 Working under the dash, detach the air duct to the left-hand vent for access to the rear of the instrument panel.

5 Unscrew the speedometer cable retaining nut and detach the cable from the speedometer head.

6 Push out the instrument panel from the rear to release it from the five retaining spring clips.

7 Make a note of the electrical connectors on the rear of the panel and disconnect them **(see illustrations)**.

8 Remove the panel from the car.

9 Installation is the reverse of removal.

19 Instrument panel components – removal and installation

1 Remove the instrument panel as described in the previous Section.

Panel illumination and warning light bulbs

Refer to illustration 19.2

2 Turn the bulb holders counterclockwise and remove them from the rear of the instrument panel **(see illustration)**.

3 Remove the bulbs by pulling them out of their holders. The warning light bulbs (except for the alternator warning light) are replaced complete with their holders.

4 Install the bulb holders by pushing down and turning clockwise.

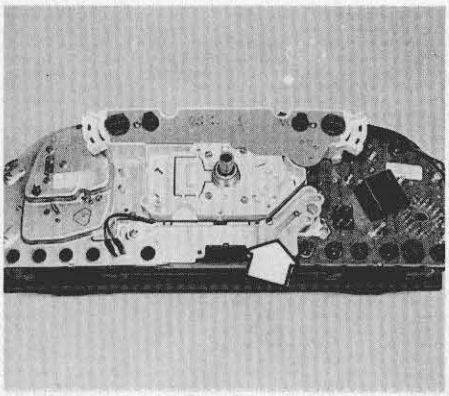
Speedometer

Refer to illustration 19.5

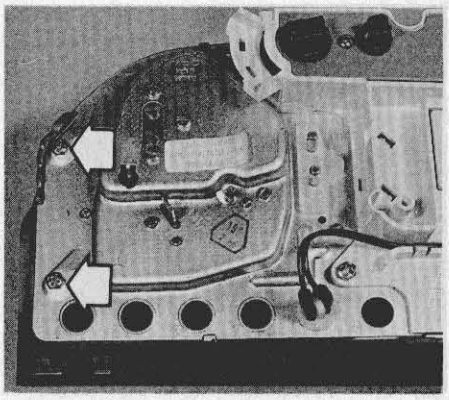
5 Remove the resistance pack adjacent to the rear of the speedometer by pulling it up **(see illustration)**. If it is secured by two screws, remove these first.

6 Remove the four screws securing the speedometer to the rear of the instrument panel.

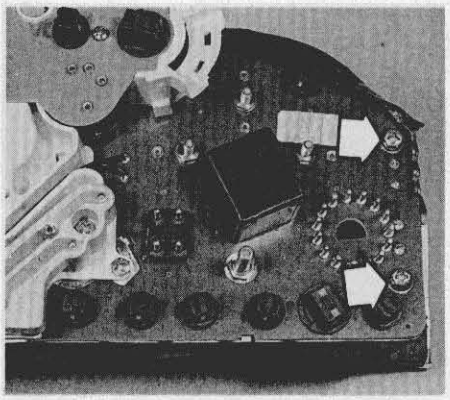
7 Remove the two screws, or release the two clips and pull off the light carrier above the speedometer.



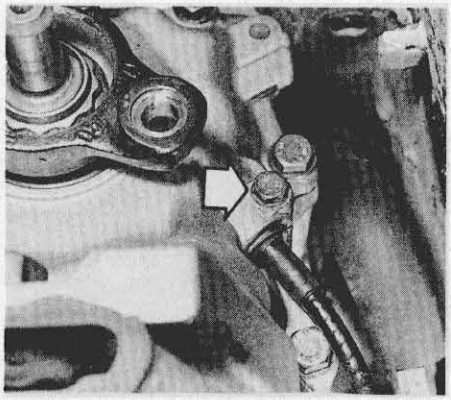
19.5 Instrument resistance pack location (arrow)



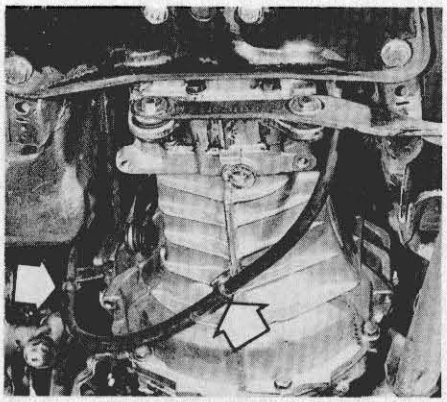
19.12 Tachometer retaining screws (arrows)



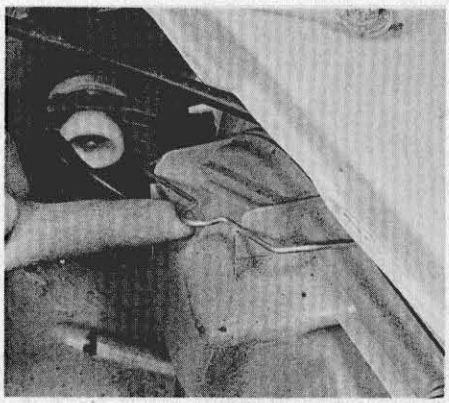
19.15 Gauge cluster retaining screws (arrows)



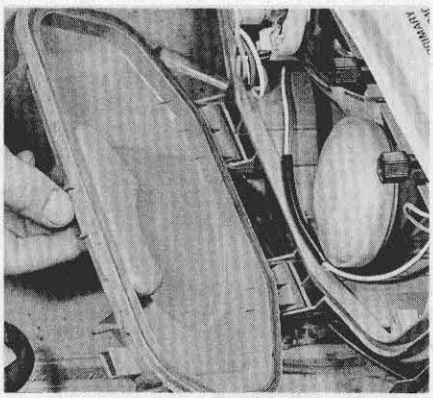
20.7 Remove the speedometer cable retaining bolt (arrow)



20.8 Detach the cable from the transmission support clips (arrow)



21.1a Pull up the headlight cover clips



21.1b Squeeze the headlight bulb retaining clip

8 Where installed, remove the water level indicator bulb and release the wiring adjacent to the speedometer.
9 Remove the speedometer from the instrument panel.
10 Installation is the reverse of removal.

Tachometer

Refer to illustration 19.12

11 Remove the speedometer as previously described.
12 Remove the two additional screws **(see illustration)** and remove the tachometer.
13 Installation is the reverse of removal.

Gauge cluster

Refer to illustration 19.15

14 Remove the speedometer as previously described.
15 Remove the two additional screws **(see illustration)** and remove the gauge cluster.
16 Installation is the reverse of removal.

20 Speedometer cable – removal and installation

Refer to illustrations 20.7 and 20.8

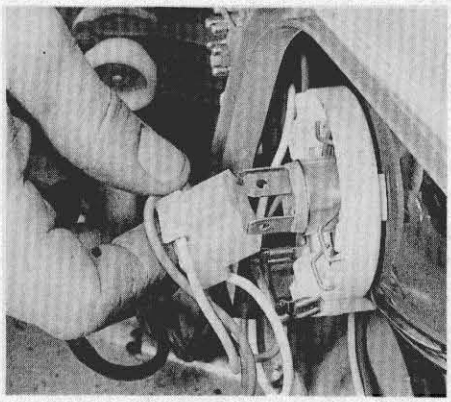
1 Disconnect the cable from the negative terminal of the battery.
2 Remove the cover under the dash on the driver's side.
3 Working under the dash, detach the air duct to the left-hand vent for access to the rear of the instrument panel.
4 Unscrew the speedometer cable retaining nut and detach the cable from the speedometer head.
5 Pull the cable into the engine compartment and detach it from any brackets or support clips.
6 Raise the front of the vehicle and support it securely on jackstands.
7 From under the car, remove the cable retaining bolt on the side of the transmission and remove the cable **(see illustration)**.
8 Detach the cable from the support clips below and to the side of the transmission **(see illustration)** then remove the cable from the car.
9 Installation is the reverse of removal.

21 Bulbs (exterior lights) – replacement

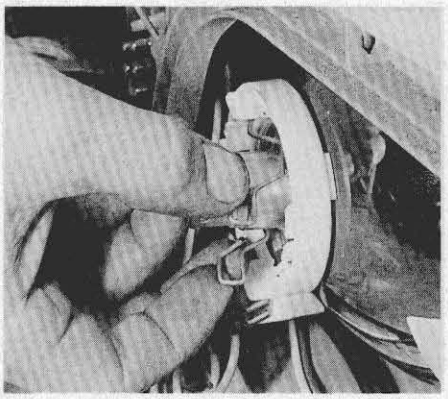
Headlight

Refer to illustrations 21.1a, 21.1b, 21.2a, 21.2b and 21.3

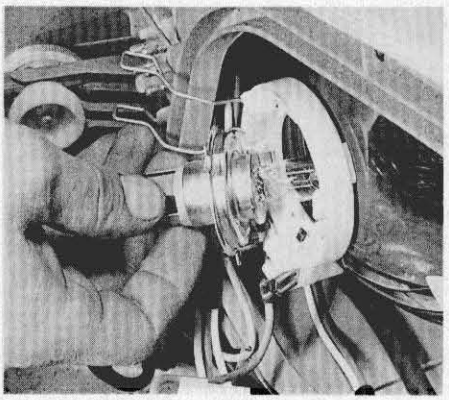
1 From inside the engine compartment, spring up the two light unit cover clips **(see illustration)**, tip the cover back and lift it up to remove **(see illustration)**.



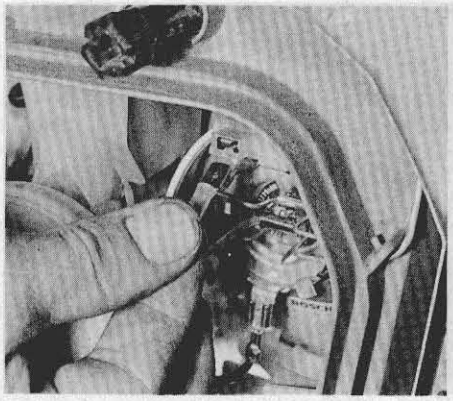
21.2a Disconnect the electrical connector from the headlight



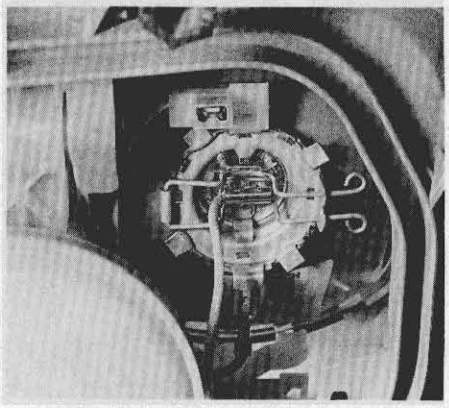
21.2b Squeeze the headlight bulb retaining clip



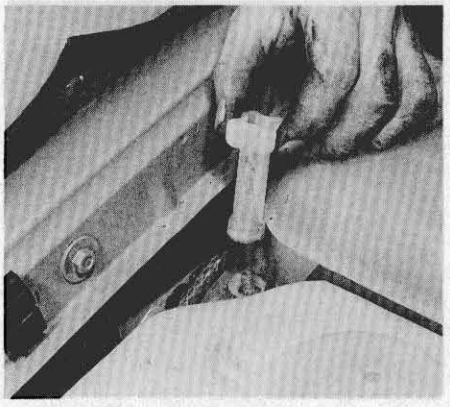
21.3 Remove the bulb from the headlight



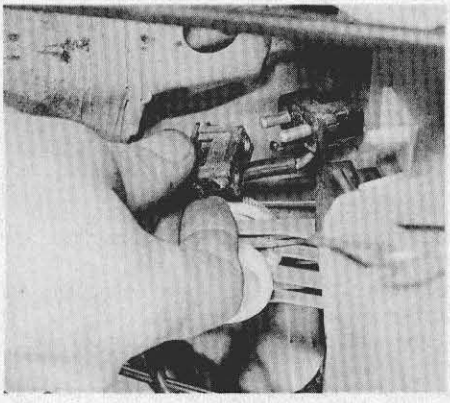
21.10 Disconnect the electrical connector at the foglight



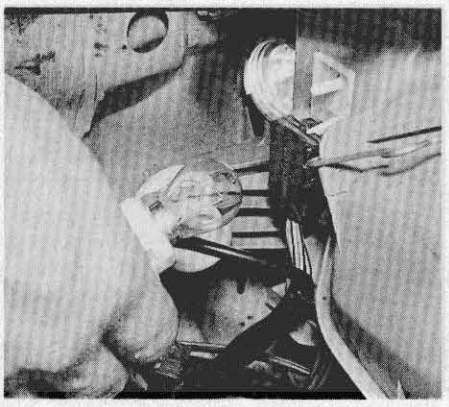
21.11 Squeeze the retaining clip and swing it back to remove the foglight bulb



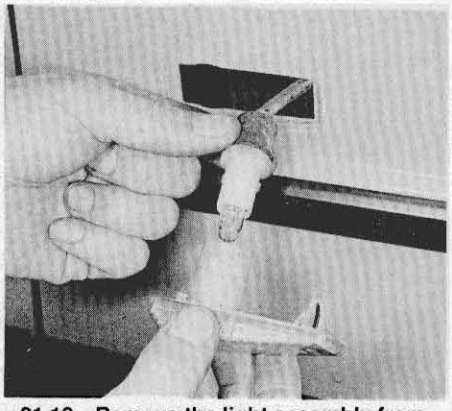
21.14 Remove the washer reservoir cap nut



21.15a Disconnect the turn signal bulb electrical connector



21.15b Twist the bulb holder to remove it from the light housing



21.19 Remove the light assembly from the body for access to the side-mounted turn signal lamp

2 Disconnect the electrical connector **(see illustration)** and release the bulb retaining clip by squeezing the clip arms together and swinging outward **(see illustration)**.

3 Withdraw the bulb from the light unit **(see illustration)**. Take care not to touch the glass with your fingers. If the glass is touched, wipe the bulb with a rag moistened with rubbing alcohol.

4 Installation is the reverse of removal, but ensure that the tags on the bulb plate engage with the recesses in the light unit.

Sidelight

5 Remove the headlight unit cover as described in Step 1.

6 Pull out the sidelight bulb holder, located beneath the headlight bulb.

7 Remove the bulb by turning it slightly counterclockwise.

8 Installation is the reverse of removal.

Foglight

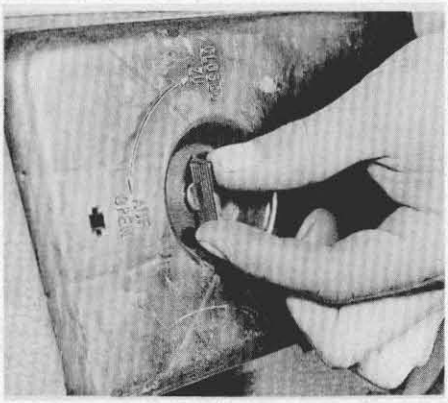
Refer to illustrations 21.10 and 21.11

9 Remove the headlight unit cover as described in Step 1.

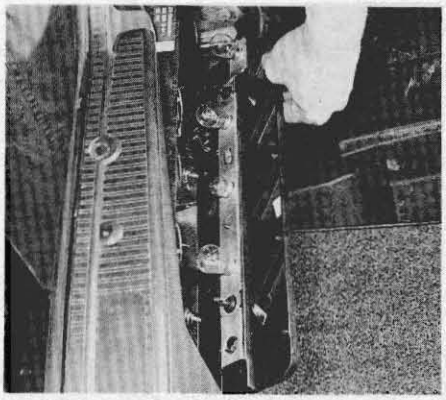
10 Disconnect the bulb electrical connector at the connector **(see illustration)**.

11 Compress the retaining clip arms and swing the clip outwards **(see illustration)**.

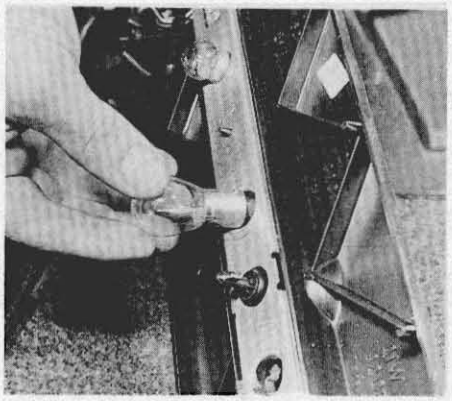
12 Remove the bulb from the light unit, taking care not to touch the glass. Wipe the glass with a rag moistened with rubbing alcohol if the glass is



21.21a Turn the lock catches counterclockwise . . .



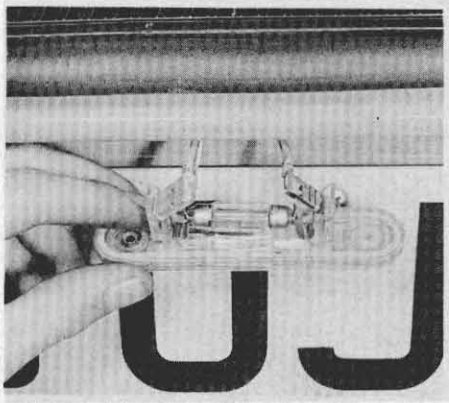
21.21b . . . and remove the rear light bulb carrier



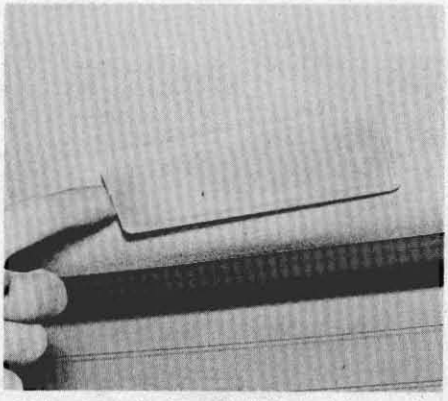
21.22 Remove the relevant bulb from the carrier



21.24a The license plate light is retained by two screws



21.24b The ends of the "festoon" type bulb seat in the dimples in the terminals



22.1a Pry the interior light and lens unit from the headliner

touched.

13 Installation is the reverse of removal.

Front turn signal indicator

Refer to illustrations 21.14, 21.15a and 21.15b

14 If working on the right-hand bulb, disconnect the wiring on the washer reservoir level sensor, unscrew the large plastic cap nut **(see illustration)** and move the reservoir slightly to provide access to the bulb.

15 Disconnect the wiring at the bulb holder, then turn the holder slightly counterclockwise to remove **(see illustrations)**.

16 Turn the bulb slightly counterclockwise to remove it from the holder.

17 Installation is the reverse of removal.

Side turn signal indicator (front)

Refer to illustration 21.19

18 Carefully pry the side turn signal lens unit out of the body side panel, using a screwdriver inserted under the front edge of the unit.

19 Pull out the bulb holder from the lens unit and remove the bulb from the holder **(see illustration)**.

20 Installation is the reverse of removal.

Rear light cluster bulbs

Refer to illustrations 21.21a, 21.21b and 21.22

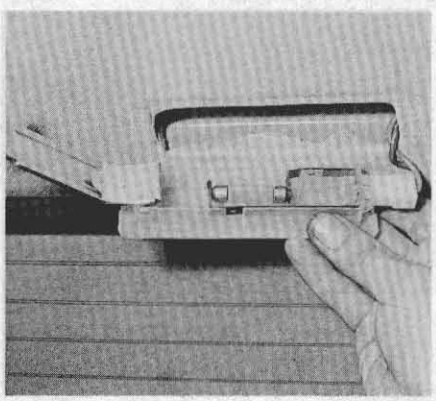
21 From inside the luggage compartment, turn the two lock catches as far as they will go to the left and withdraw the bulb carrier from the light unit **(see illustrations)**.

22 Remove the relevant bulb by turning counterclockwise slightly **(see illustration)**. The bulb numbers and their wattages are shown adjacent to each bulb location.

23 Installation is the reverse of removal.

License plate light

Refer to illustrations 21.24a and 21.24b



22.1b Swing the reflector back to expose the bulb

24 Remove the two retaining bolts and detach the lens unit **(see illustrations)**.

25 Spread the contacts and remove the festoon type bulb.

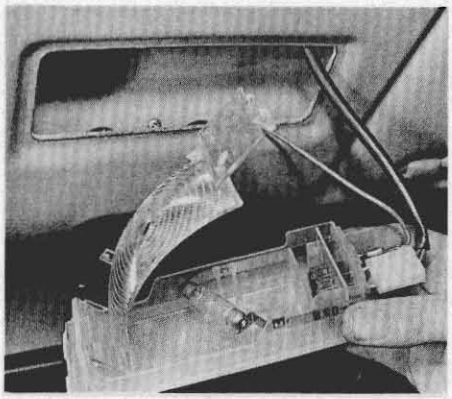
26 Installation is the reverse of removal.

22 Bulbs (interior lights) – replacement

Interior courtesy light

Refer to illustrations 22.1a, 22.1b and 22.1c

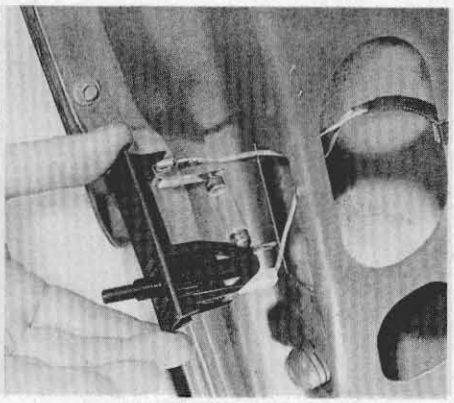
1 Carefully pry out the light and lens unit, then fold back the reflector **(see illustrations)**.



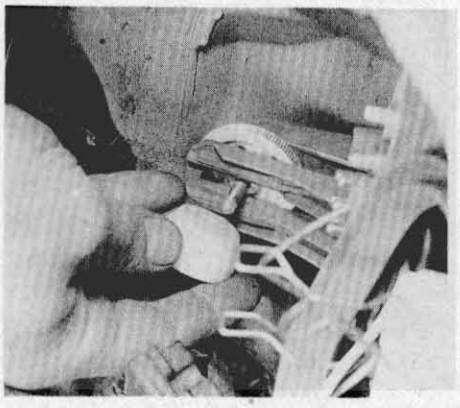
22.1c The front interior light is similar to the rear



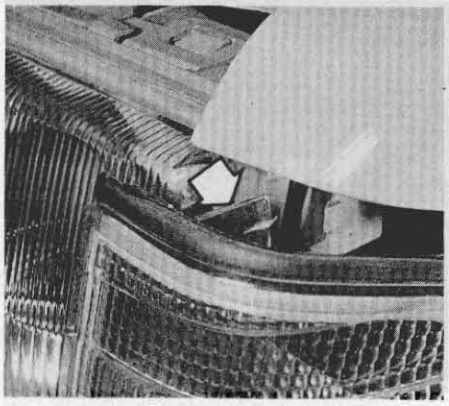
22.7 The glovebox light assembly can be pryed out of the glovebox



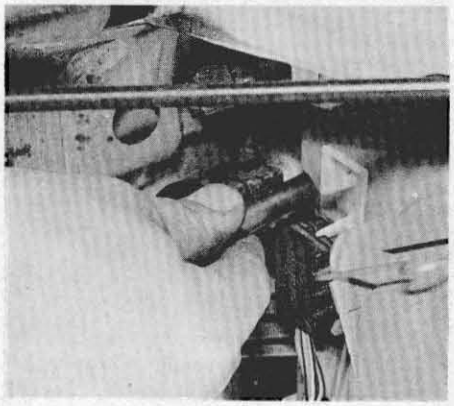
22.10 Remove the luggage compartment light switch and bulb holder for increased clearance



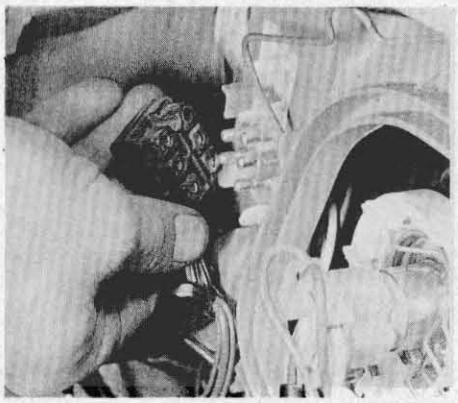
23.3 Unscrew the turn signal light knurled nut



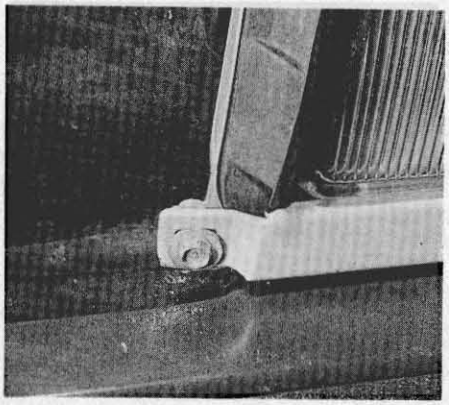
23.4 Turn signal light upper retaining lug (arrow)



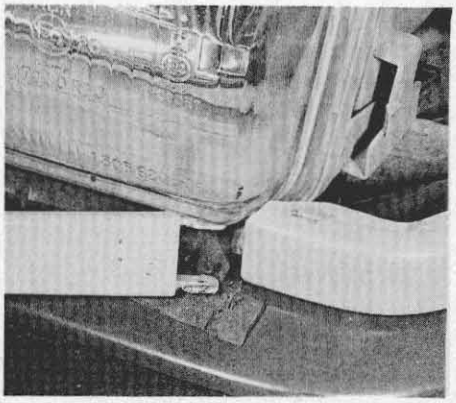
23.6a Disconnect the headlight unit vacuum hose



23.6b Unplug the electrical connector



23.7a Remove the finishing strip retaining bolt . . .



23.7b . . . and disengage the outer end tags

2 Spread the contacts and remove the festoon type bulb.
3 Installation is the reverse of removal.

Sun visor illumination

4 Fold down the sun visor and carefully pry off the cover on the left-hand and right-hand recesses.
5 Spread the contacts and remove the festoon type bulb.
6 Installation is the reverse of removal.

Glovebox light

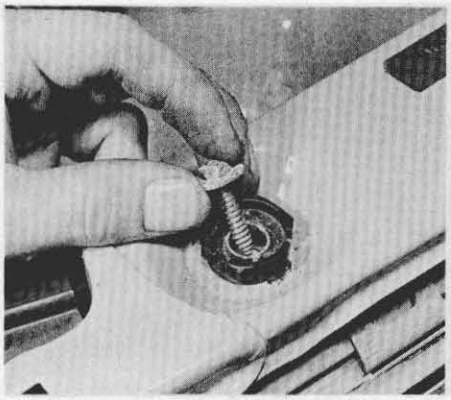
Refer to illustration 22.7

7 Pry the light lens unit out of its location and spread the contacts to remove the festoon type bulb **(see illustration)**.
8 Installation is the reverse of removal.

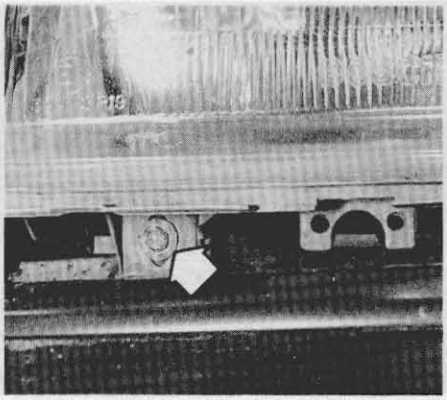
Luggage compartment light

Refer to illustration 22.10

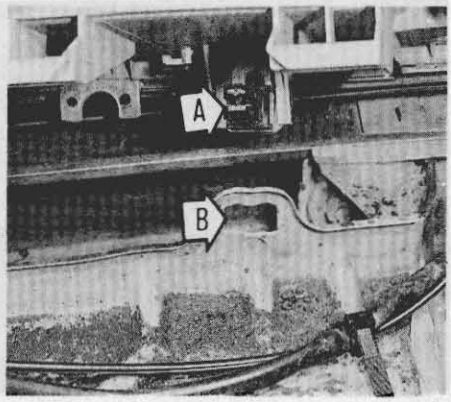
9 Working through the trunk lid opening, spread the contacts and remove the festoon type bulb.
10 For increased working clearance, pull out the switch and bulb holder then remove the bulb **(see illustration)**.



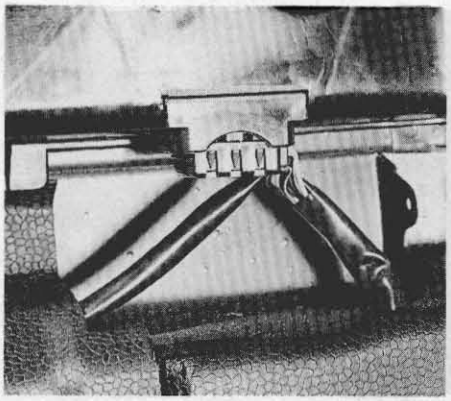
23.8a Remove the upper retaining bolts . . .



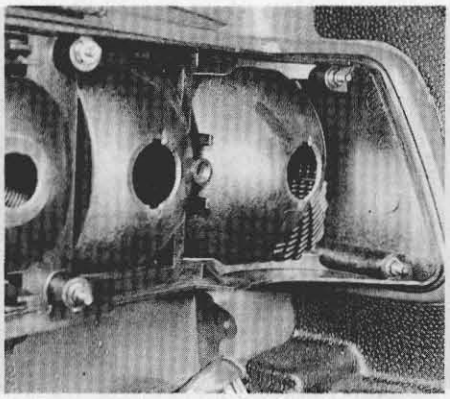
23.8b . . . and single lower bolt (arrow)



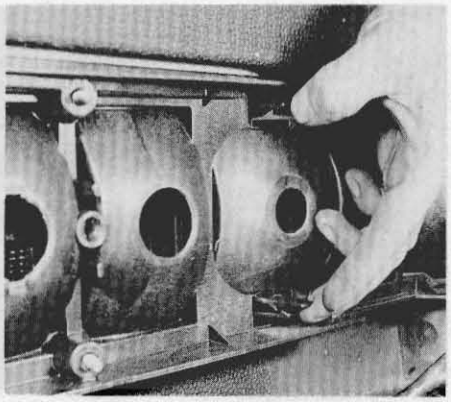
23.9 Ensure that the lower lug (A) enters the slot (B) when installing



23.11a Disconnect the rear light cluster wiring electrical connector



23.11b Remove the six nuts securing the rear light cluster (two of them aren't visible in this photo)



23.12a Depress the two tangs to release the light unit

23 Exterior lights – removal and installation

Front turn signal light

Refer to illustrations 23.3 and 23.4

1 If working on the right-hand unit, disconnect the wiring on the washer reservoir level sensor, unscrew the large plastic cap nut and move the reservoir slightly to provide access.

2 Disconnect the wiring at the rear of the bulb holder.

3 Unscrew the knurled retaining nut **(see illustration)** and pull the light out in a forward direction.

4 Installation is the reverse of removal, but ensure that the two lugs engage with the guides in the headlight unit **(see illustration)**.

Headlight unit

Refer to illustrations 23.6a, 23.6b, 23.7a, 23.7b, 23.8a, 23.8b and 23.9

5 Remove the front direction indicator light as described previously.

6 Disconnect the vacuum hose and the electrical connector at the rear of the light unit **(see illustrations)**.

7 Remove the inner end retaining bolt **(see illustration)** then disengage the finishing strip outer end by sliding it toward the center of the car **(see illustration)**. Remove the strip.

8 Remove the two upper retaining bolts **(see illustration)** and the single lower bolt **(see illustration)**, then remove the unit from its location.

9 Installation is the reverse of removal, but make sure the lower retaining lug engages with the slot in the body **(see illustration)** before installing the lower retaining screw. Tighten the mounts initially finger-tight and make any small corrections to the unit installed position by turning the upper retaining nuts as necessary. Tighten the mounts securely after positioning.

Rear light cluster

Refer to illustrations 23.11a, 23.11b, 23.12a and 23.12b

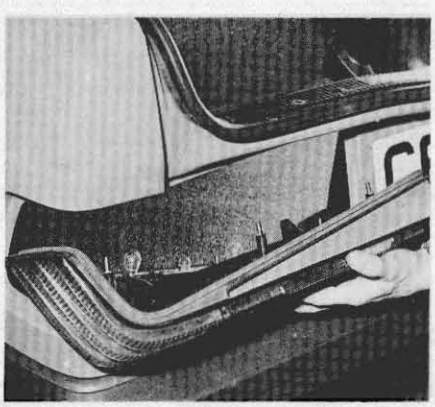
10 From inside the luggage compartment, turn the two lock catches as far as they will go to the left and remove the bulb carrier from the light unit.

11 Disconnect the electrical connector, then remove the six light cluster retaining nuts **(see illustrations)**.

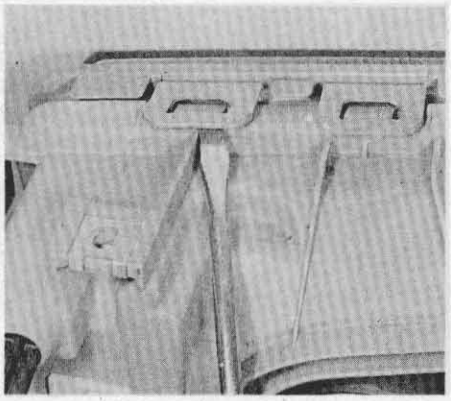
12 Depress the two catches and remove the unit from the outside of the car

(see illustrations).

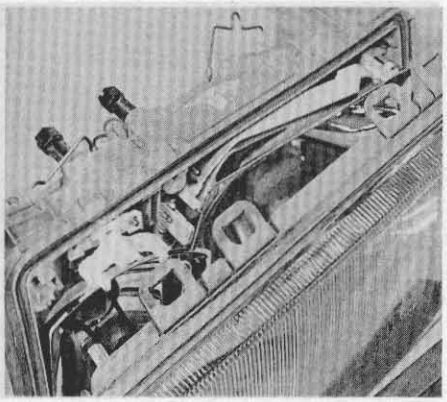
13 Installation is the reverse of removal.



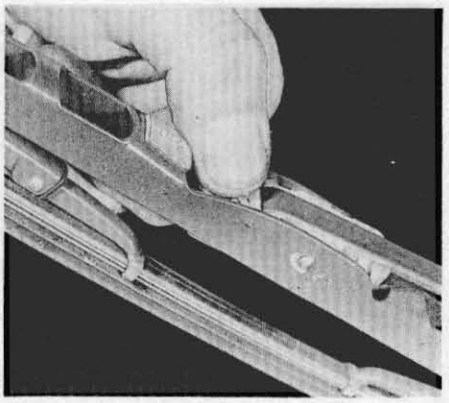
23.12b Remove the light unit from the vehicle



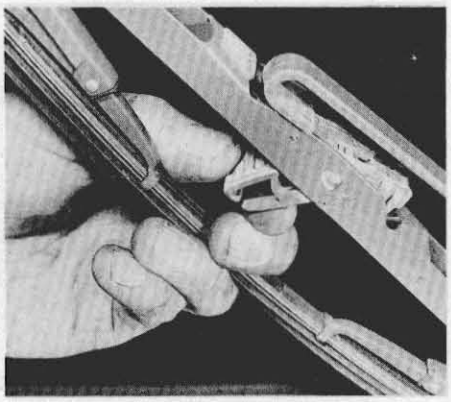
24.2 Carefully pry up the headlight glass retaining tangs



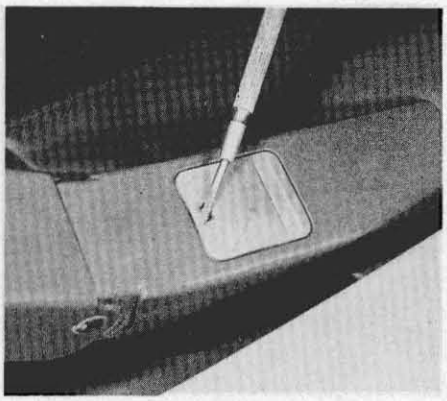
24.3 Separate the headlight glass from the housing



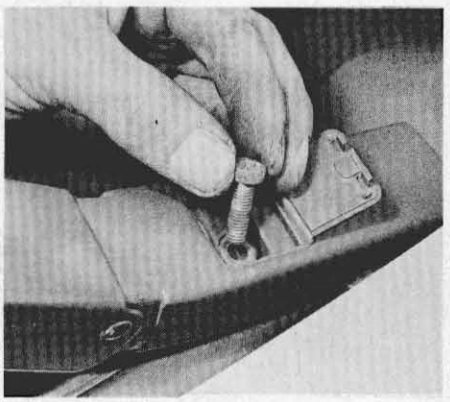
27.6a Depress the plastic clip on the wiper blade



27.6b Lift the blade from the hooked part of the arm



27.11 Pry off the cover with a thin screwdriver



27.12 Remove the wiper arm retaining bolt

24 Headlight glass – removal and installation

Refer to illustrations 24.2 and 24.3

1 Remove the headlight as described in the previous Section.

2 Using a screwdriver, carefully release the eight retaining tags, four on the top and four on the bottom securing the glass to the headlight unit **(see illustration)**.

3 Remove the glass and frame as an assembly **(see illustration)** then pull off the lower rubber seal.

4 Installation is the reverse of removal.

25 Headlights – alignment

1 At periodic intervals the headlight aim should be checked and if necessary adjusted.

2 Due to the light pattern of the lenses, optical beam setting equipment must be used to properly align the aim of the headlights. It is recommended this work is carried out by a Mercedes-Benz dealer service department or other repair shop with the necessary equipment.

26 Headlight height adjustment system – general information

The headlights are equipped with a beam height adjustment system to enable the driver to regulate the beam height from inside the car to compensate for different vehicle loading.

The system is operated by vacuum supplied by the intake manifold and stored in a vacuum reservoir under the left-hand front fenderwell.

The system is controlled by a three position switch adjacent to the lighting switch on the dash. According to switch position, the vacuum supplied to the headlight adjusting unit is regulated. The adjusting unit consists of a diaphragm which is connected to the movable headlight lens by means of a pullrod having a stroke of approximately 3.0 mm (0.12 in). Vacuum applied to the diaphragm causes it to deflect, which in turn moves the pullrod to raise or lower the headlights.

Apart from periodically checking the condition of the vacuum hoses, the system does not require any maintenance or adjustment.

27 Windshield wiper blades and arms – removal and installation

Wiper blades (up to January 1985)

1 Lift the wiper blade and arm from the windshield.

2 Depress the catch on the blade and pull the blade from the end of the arm.

3 Where an auxiliary blade is installed at the base of the arm, extract the retaining clip and washer and remove the auxiliary blade.

4 Installation is the reverse of removal.

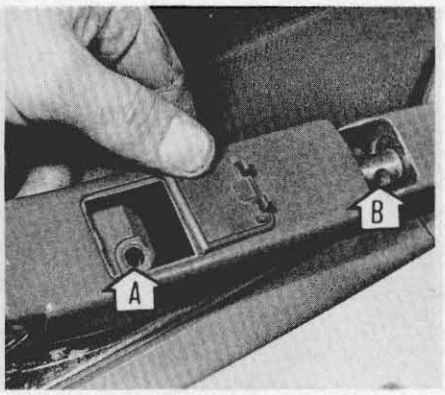
Wiper blades (January 1985 and later)

Refer to illustrations 27.6a and 27.6b

5 Lift the wiper blade and arm from the windshield.

6 Depress the plastic clip and lift the blade from the hooked part of the arm **(see illustrations)**.

7 Insert the blade, then move the clip up to lock it. Release the wiper arm from the raised position by prying the spring catch on the underside of the arm and lower the blade onto the windshield.



27.13 The bolt hole (A) must align with the slot (B) when installing

Wiper arm (up to January 1985)

8 Raise the hood to its vertical position by depressing the catch on the left-hand hinge and releasing the spring clip on the support strut.

9 Hinge back the plastic cover, then unscrew the nut securing the arm to the spindle. Remove the washer and pull off the arm.

10 Installation is the reverse of removal, but ensure that the blade rests on the windshield in the parked position before pushing the arm onto the spindle.

Wiper arm (January 1985 and later)

Refer to illustrations 27.11, 27.12 and 27.13

11 To remove the arm on the panoramic wiper assembly, remove the wiper arm cover using a thin screwdriver and open the cover **(see illustration)**.

12 Remove the wiper arm retaining bolt and detach the arm from the drive mechanism **(see illustration)**.

13 Install the arm onto the drive mechanism and push it up until the arm bolt hole is aligned with the machined slot in the pumping shaft **(see illustration)**.

14 Install the retaining bolt and close the cover.

28 Windshield wiper motor and linkage – removal and installation

Pre-January 1985 models

Refer to illustration 28.3

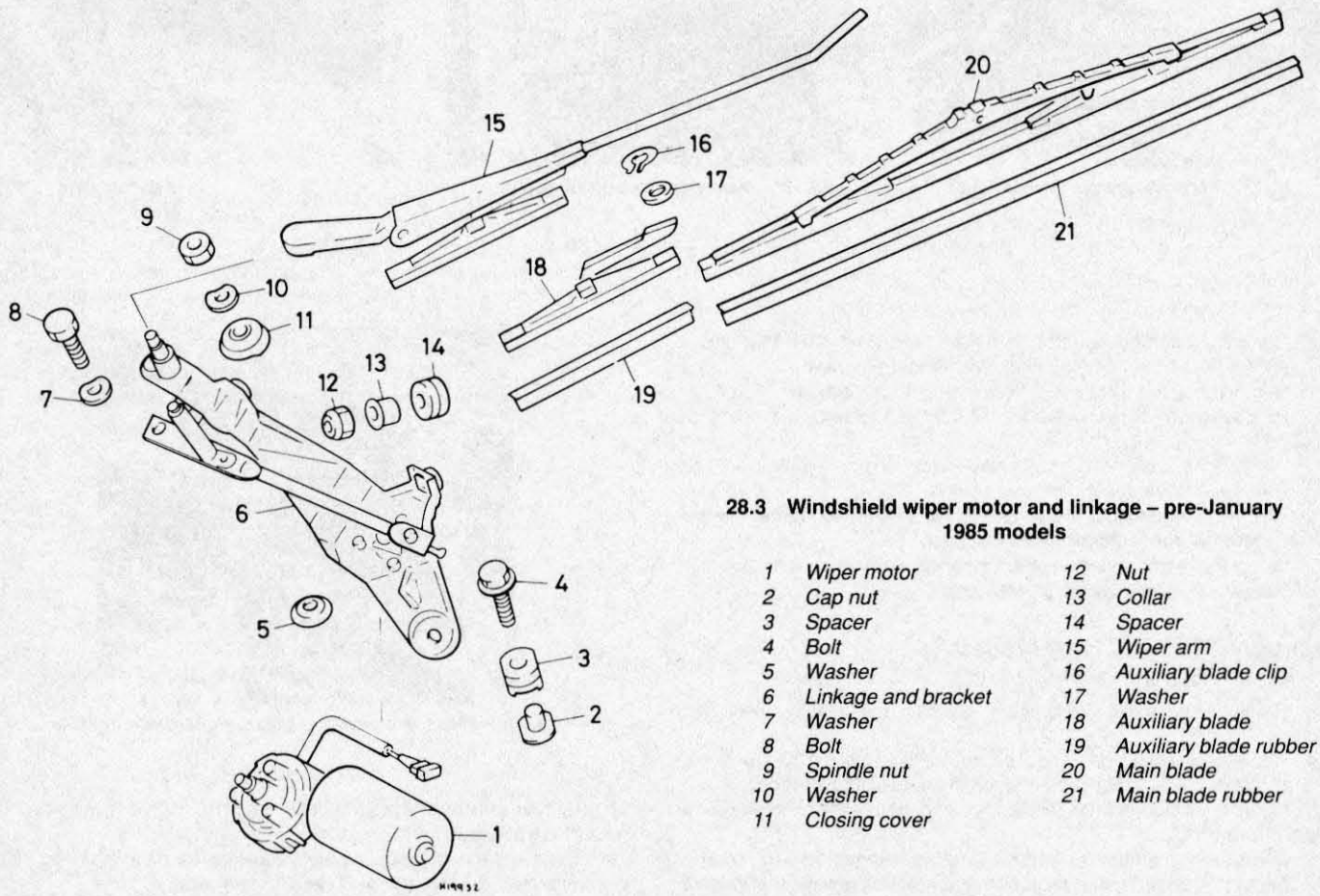
1 Disconnect the cable from the negative terminal of the battery.

2 Remove the wiper arm as described in the previous Section.

3 Pry off the closing cover on the top of the wiper arm spindle **(see illustration)**.

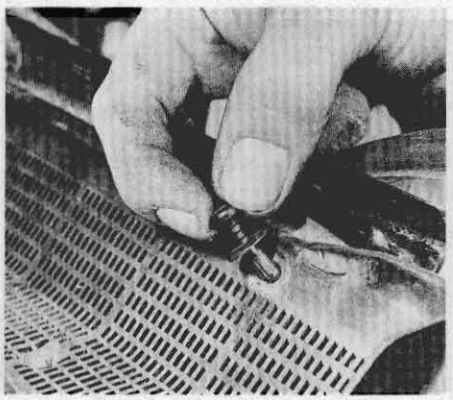
4 Push out the two clips, one each side at the front, securing the air intake cover over the plenum chamber.

5 Lift up the rubber seal to release the front part of the air intake cover.

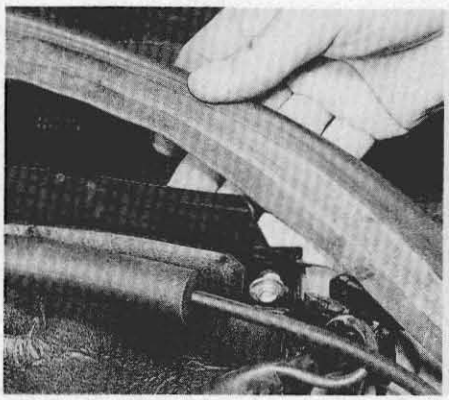


28.3 Windshield wiper motor and linkage – pre-January 1985 models

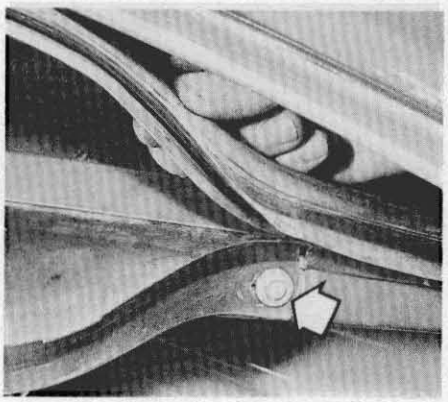
1	*Wiper motor*	12	*Nut*
2	*Cap nut*	13	*Collar*
3	*Spacer*	14	*Spacer*
4	*Bolt*	15	*Wiper arm*
5	*Washer*	16	*Auxiliary blade clip*
6	*Linkage and bracket*	17	*Washer*
7	*Washer*	18	*Auxiliary blade*
8	*Bolt*	19	*Auxiliary blade rubber*
9	*Spindle nut*	20	*Main blade*
10	*Washer*	21	*Main blade rubber*
11	*Closing cover*		



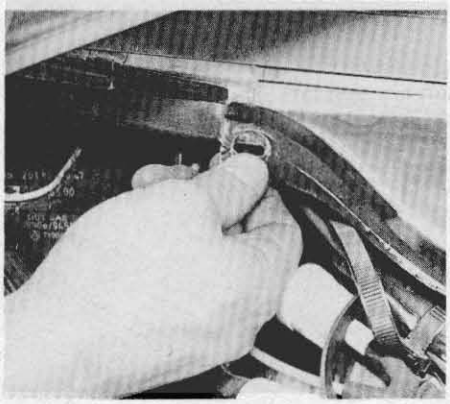
28.14 Remove the air intake cover front screws



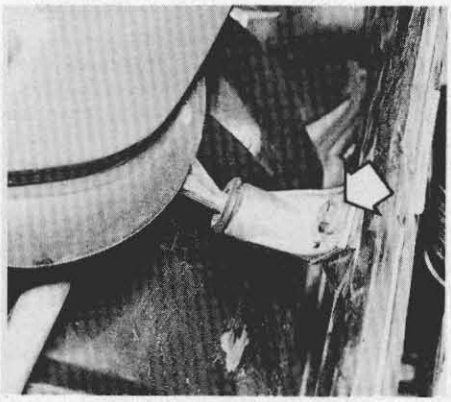
28.15 Lift up the rubber seal



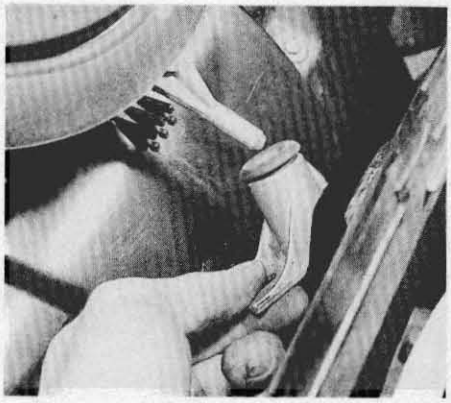
28.16 Lift up the rear rubber seal and remove the screw (arrow) on both sides



28.17 Remove the air intake cover



28.18a Remove the bolt (arrow) . . .



28.18b . . . and detach the support bracket

6 Lift up the rear rubber seal on both sides then remove the two screws, one each side, securing the air intake cover to the firewall.
7 Remove the air intake cover from the plenum chamber.
8 Remove the three rear bolts and one front bolt securing the motor and linkage assembly to the firewall.
9 Remove the cover over the central electrics unit (fusebox) and remove the two retaining nuts and two screws.
10 Lift the central electrics unit up and forward, then disconnect the wiper motor electrical connector from the unit base.
11 Guide the motor and linkage assembly out of its location.
12 Installation is the reverse of removal.

January 1985 and later models

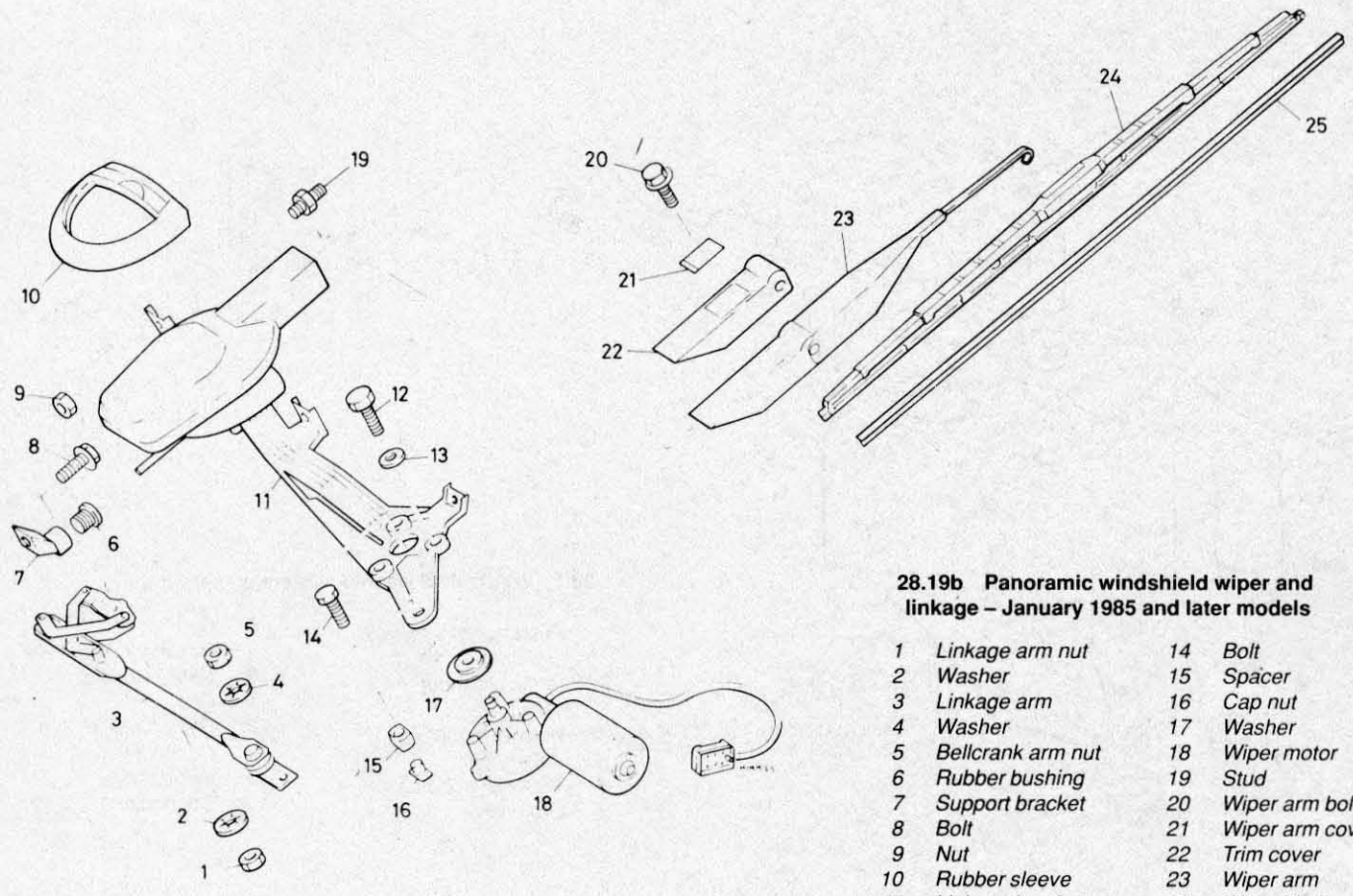
Refer to illustrations 28.14 through 28.20

13 Remove the panoramic wiper arm as described in the previous Section.
14 Remove the two screws and clips, one each side at the front, securing the air intake cover over the plenum chamber **(see illustration)**.
15 Lift up the rubber seal to release the front part of the air intake cover **(see illustration)**.
16 Lift up the rear rubber seal on both sides, then remove the two screws, one each side, securing the air intake cover to the firewall **(see illustration)**.
17 Remove the air intake cover from the plenum chamber **(see illustration)**.



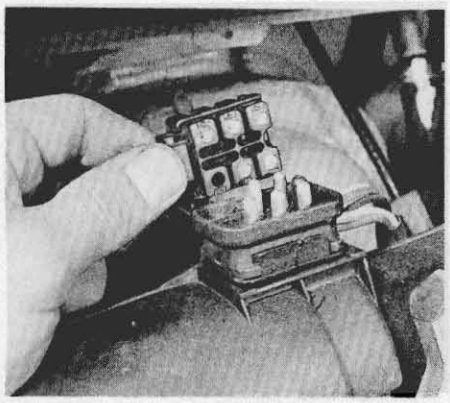
28.19a Pull the assembly into the plenum chamber

18 Remove the bolt and pull the front support bracket off the linkage stud **(see illustrations)**.
19 Remove the bolts securing the linkage to the firewall and pull it forward into the plenum chamber **(see illustrations)**.
20 Disconnect the motor electrical connector and remove the assembly from the car **(see illustration)**.
21 Installation is the reverse of removal.

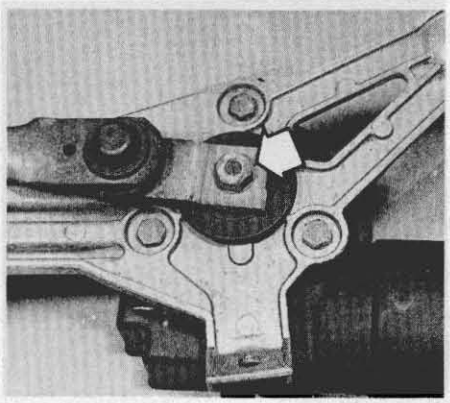


28.19b Panoramic windshield wiper and linkage – January 1985 and later models

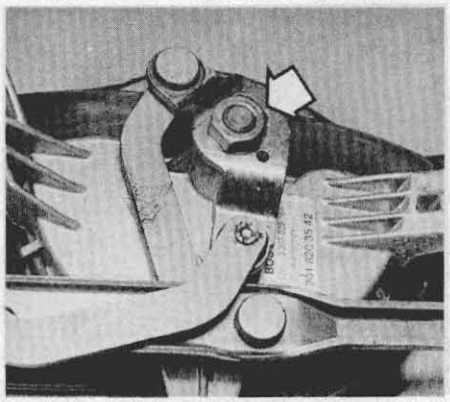
1	*Linkage arm nut*	14	*Bolt*
2	*Washer*	15	*Spacer*
3	*Linkage arm*	16	*Cap nut*
4	*Washer*	17	*Washer*
5	*Bellcrank arm nut*	18	*Wiper motor*
6	*Rubber bushing*	19	*Stud*
7	*Support bracket*	20	*Wiper arm bolt*
8	*Bolt*	21	*Wiper arm cover*
9	*Nut*	22	*Trim cover*
10	*Rubber sleeve*	23	*Wiper arm*
11	*Linkage bracket*	24	*Wiper blade*
12	*Bolt*	25	*Blade rubber*
13	*Washer*		



28.20 Disconnect the motor wiring electrical connector



29.2 Remove the bellcrank arm retaining nut (arrow)



29.4 Linkage arm retaining nut (arrow)

29 Windshield wiper motor – removal and installation

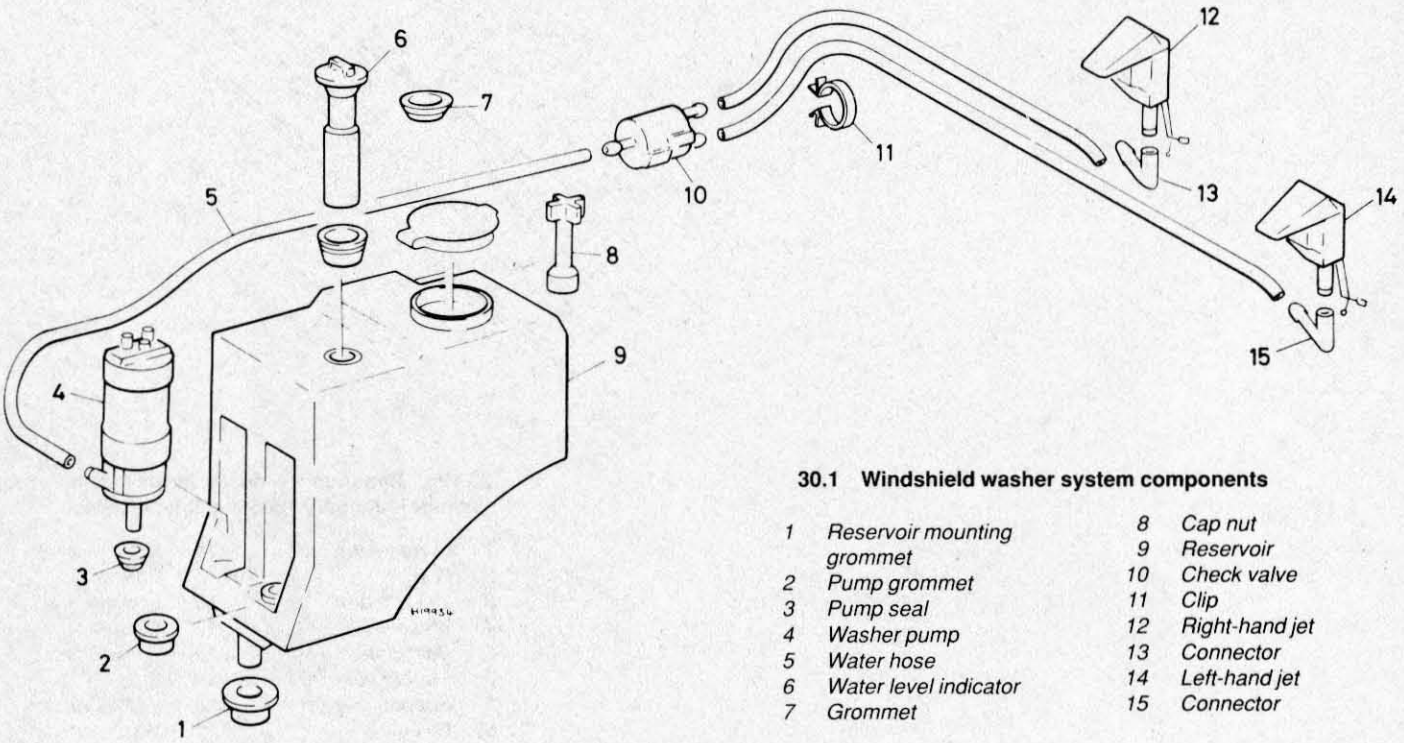
Refer to illustrations 29.2 and 29.4

1 Remove the wiper motor and linkage assembly from the car as described in the previous Section.

2 Unscrew the retaining nut and remove the bellcrank arm from the motor spindle **(see illustration)**.

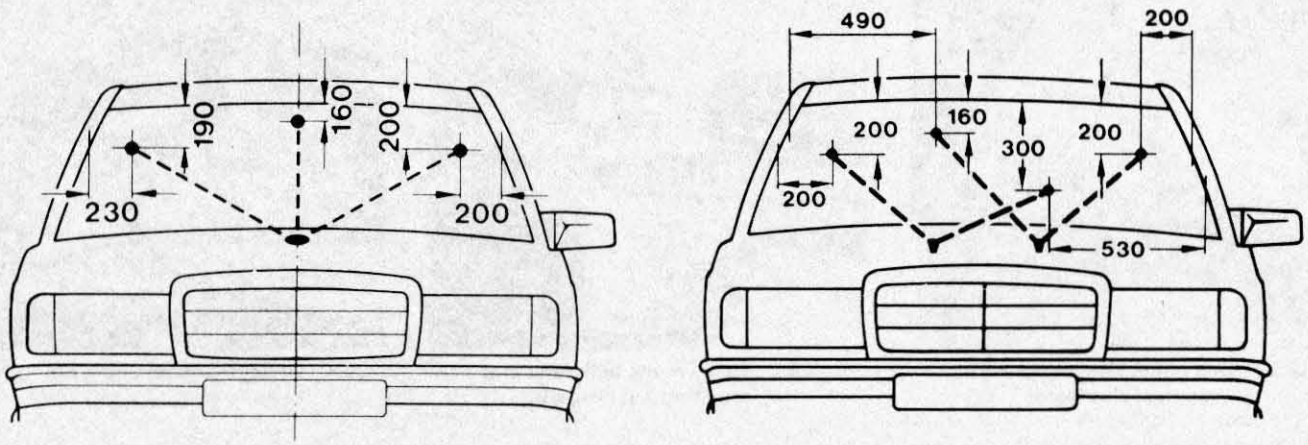
3 Remove the three bolts and remove the motor from the linkage bracket.

4 On the panoramic wiper assembly, the linkage arm can be removed from the wiper arm assembly after removing the nut at the other end **(see illustration)**.



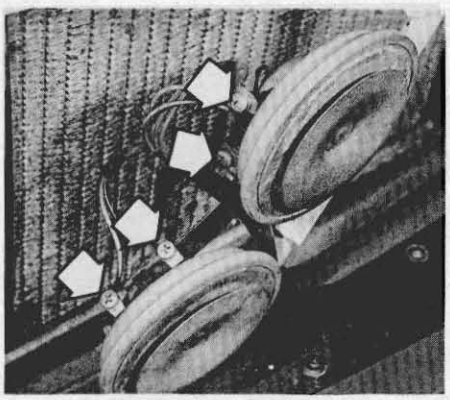
30.1 Windshield washer system components

1	*Reservoir mounting grommet*	8	*Cap nut*
2	*Pump grommet*	9	*Reservoir*
3	*Pump seal*	10	*Check valve*
4	*Washer pump*	11	*Clip*
5	*Water hose*	12	*Right-hand jet*
6	*Water level indicator*	13	*Connector*
7	*Grommet*	14	*Left-hand jet*
		15	*Connector*

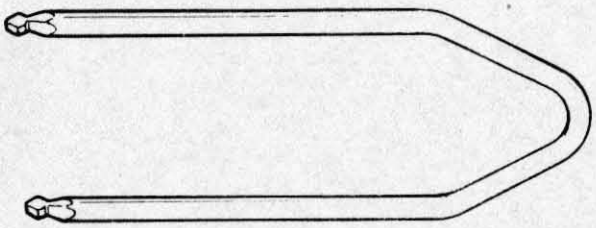


30.9 Windshield washer water contact areas

Left illustration – triple nozzle single jet
Right illustration – double nozzle twin jets
All dimensions in millimeters



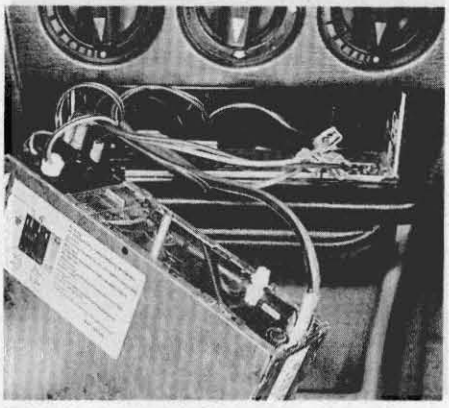
31.2 Horn wiring terminal screws (arrows)



32.2 Radio/cassette player removal tool



32.3 Removing the radio with the removal tools



32.4 Disconnect the wiring at the rear of the radio

5 Installation is the reverse of removal, but with the linkage and motor in the parked position, the bellcrank and linkage must be parallel with each other as the bellcrank is installed to the motor spindle **(see illustration 29.2).**

30 Windshield washer system – removal, installation and adjustment

Refer to illustrations 30.1 and 30.9

1 The windshield washer system consists of a water reservoir located at the right front side of the engine compartment, an electric pump attached to the reservoir and an electrically heated triple nozzle jet located in the center of the hood, or two double nozzle jets located on each side of the hood, on cars equipped with the panoramic windshield wiper. A water level indicator is also installed in the reservoir on later models to inform the driver of low water supply **(see illustration)**.

2 To remove the reservoir, disconnect the wiring and water hoses at the pump and also the electrical connector at the water level indicator, if installed.

3 Unscrew the large plastic cap nut, then lift the reservoir up and out of its location.

4 The pump is a push fit in the reservoir and can be removed by carefully prying it out. The pump is a sealed unit and cannot be repaired.

5 A check valve is located in the water hose alongside the right-hand front suspension strut turret. The valve can be removed after detaching the hoses.

6 To remove the jets, disconnect the water hose and electrical connection from within the opening on the inside of the hood.

7 Push the jet up and remove it from the hood.

8 Install all the components by reversing the removal sequence.

9 Adjust the nozzles using a pin so the water contact areas on the windshield are correct **(see illustration)**.

31 Horns – removal and installation

Refer to illustration 31.2

1 The twin horns are attached to the support strut in front of the radiator, accessible with the hood open.

2 To remove the horns, disconnect the battery negative terminal, then unscrew the wiring terminal screws on each horn. Make a note of the wiring locations on each terminal **(see illustration)**.

3 Remove the horn bracket attachments and remove the horns.

4 Installation is the reverse of removal.

32 Radio/cassette player – removal and installation

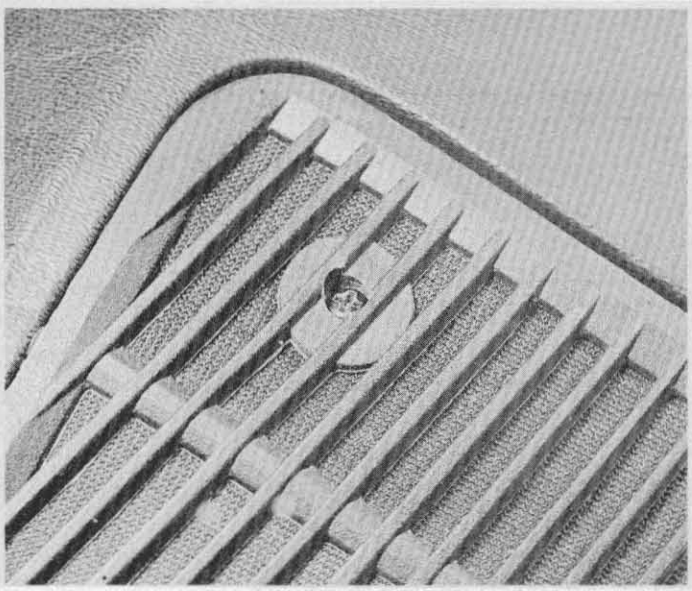
Refer to illustrations 32.2, 32.3 and 32.4

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

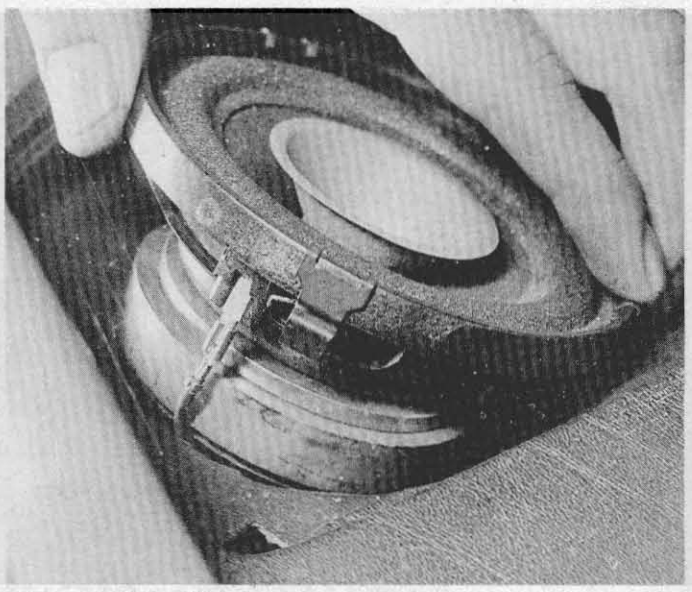
2 According to the type of equipment installed, the method of removal varies slightly. If there are two small holes vertically in line on each side of the radio faceplate, then the unit has a DIN standard attachment and is removed by inserting two special hooked removal tools into these holes to release the internal catches. These special tools may be purchased from radio accessory outlets, or can be made up from thick wire rod such as welding rod **(see illustration)**.

3 Insert the removal tools into the slots until they can be felt to engage with the catches. Now pull the unit forward out of its opening **(see illustration)**.

4 Disconnect the electrical connections and antenna cable at the rear of the radio **(see illustration)** and push the retaining clips in to release the



33.2 Speaker grille retaining screw



33.3 Lift the speaker out and disconnect the electrical connectors

removal tools. Remove the unit from the car.
5 To install, plug in the connectors and push the radio cassette player back into its opening until the clips engage.
6 If the radio faceplate does not have holes for removal tools, the unit is secured in position by means of the ashtray holder mounts.
7 Open the ashtray and remove the screws at the top of the ashtray holder.
8 Lower the ashtray and push the radio out of its opening.
9 Disconnect the electrical connections and antenna cable at the rear and remove the radio from the car.
10 Installation is the reverse of removal.

33 Speakers – removal and installation

Front speakers

Refer to illustrations 33.2 and 33.3

1 The front speakers are located at each side of the dash at the top.
2 Remove the two screws and remove the speaker grille **(see illustration)**.
3 Carefully ease the speaker out of its location **(see illustration)**.
4 Disconnect the wiring and remove the speaker.
5 Installation is the reverse of removal. If two color marks are visible on the speaker rim, these should point towards the rear of the car when the speaker is installed.

Rear speakers

6 Using a short screwdriver, remove the four screws and remove the speaker grille.
7 Remove the speaker retaining screws and lift the speaker from its mount.
8 Disconnect the wiring and remove the speaker.
9 Installation is the reverse of removal.

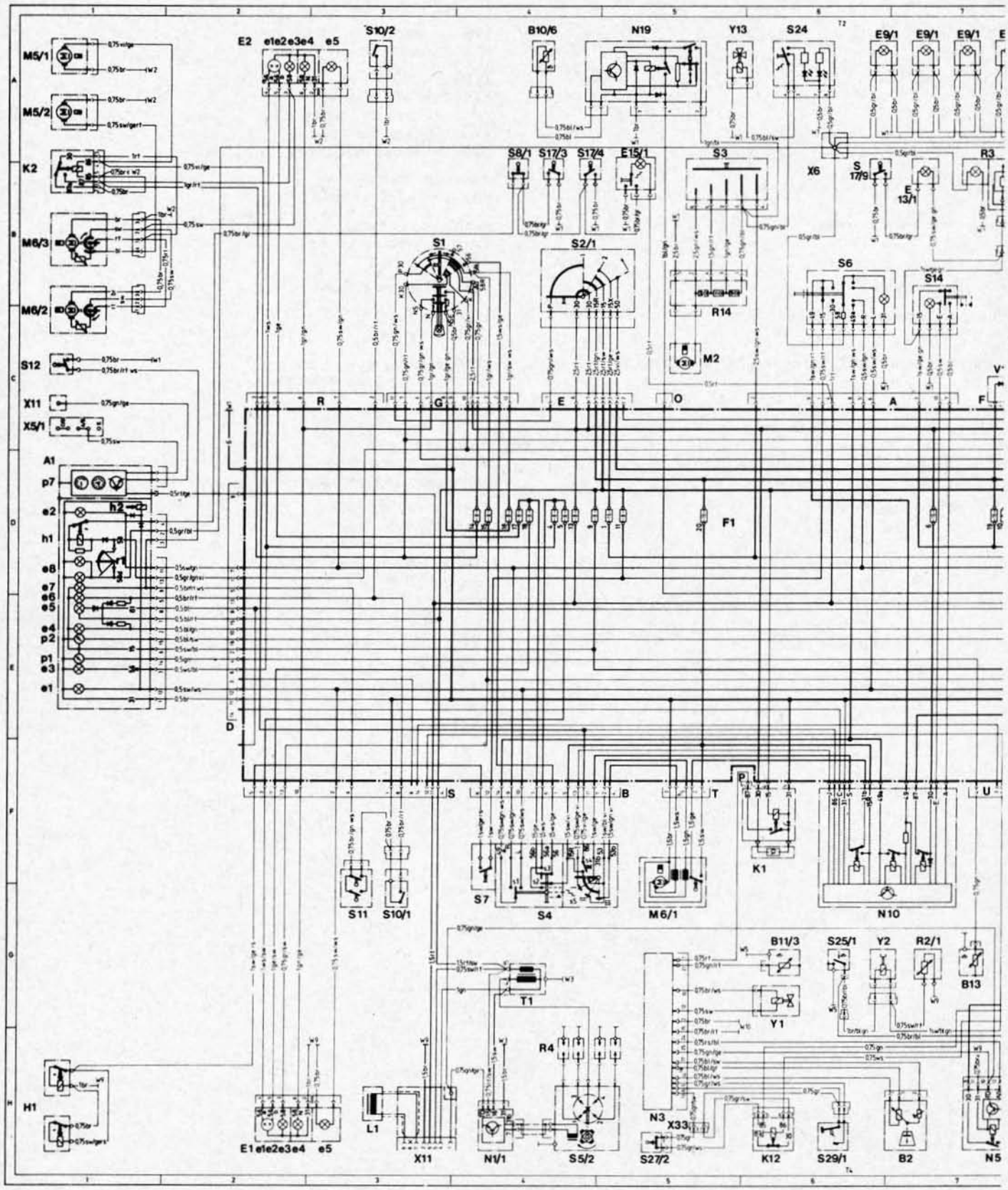
34 Radio antenna – removal and installation

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the inner trim covering on the left side of the luggage compartment.
3 Disconnect the antenna cable, wiring connections and ground strap from the antenna motor.
4 Unscrew the retaining bolts and remove the unit from inside the luggage compartment.
5 Installation is the reverse of removal.

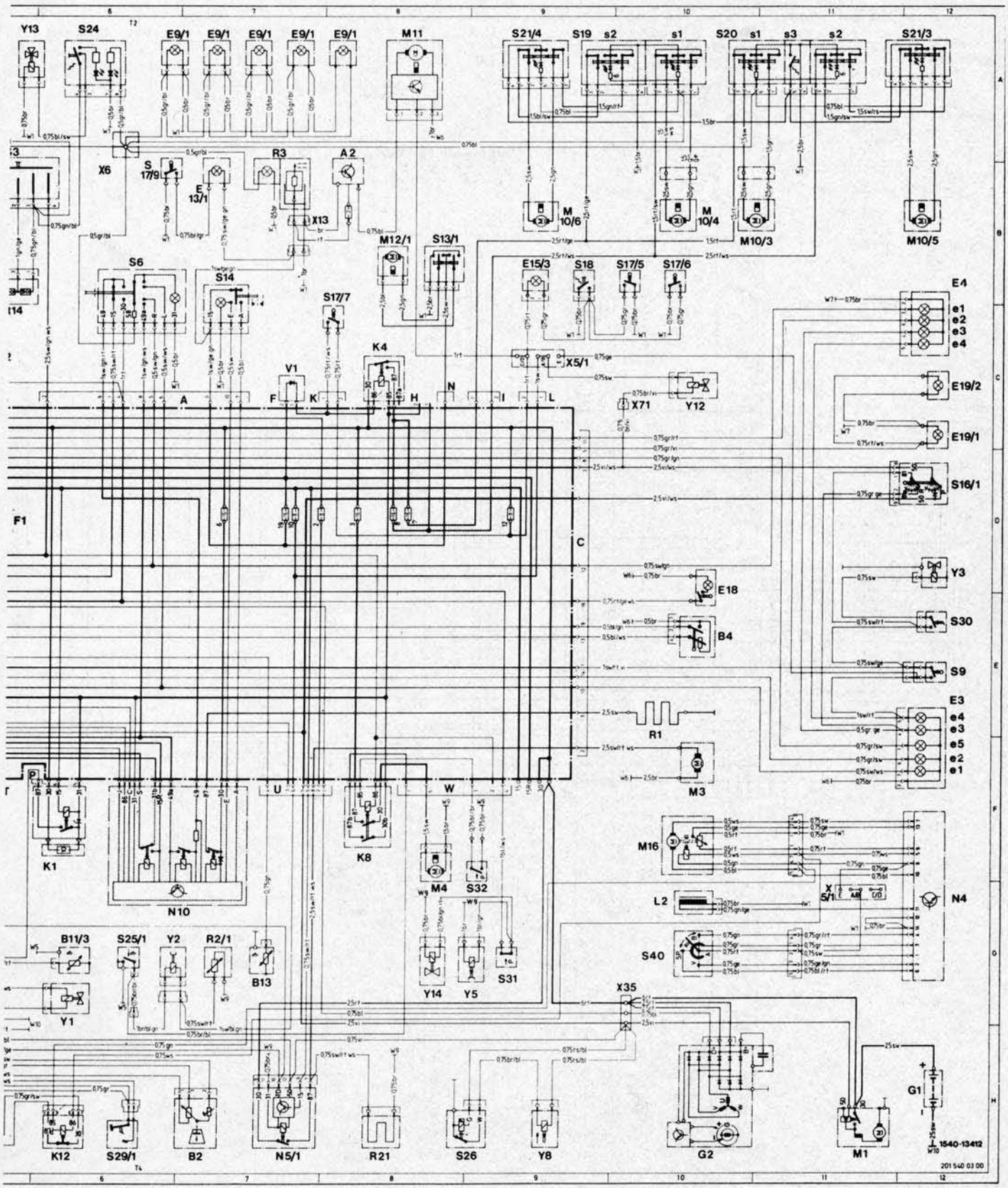
35 Troubleshooting – electrical system

Symptom	Reason(s)
Starter fails to turn engine	Battery discharged or defective Battery cables loose Starter motor wiring loose Starter solenoid defective Starter brushes worn or sticking Starter commutator dirty or worn Starter field coils grounded Starter armature faulty
Starter turns engine very slowly	Battery discharged Starter motor connections loose Starter brushes worn or sticking

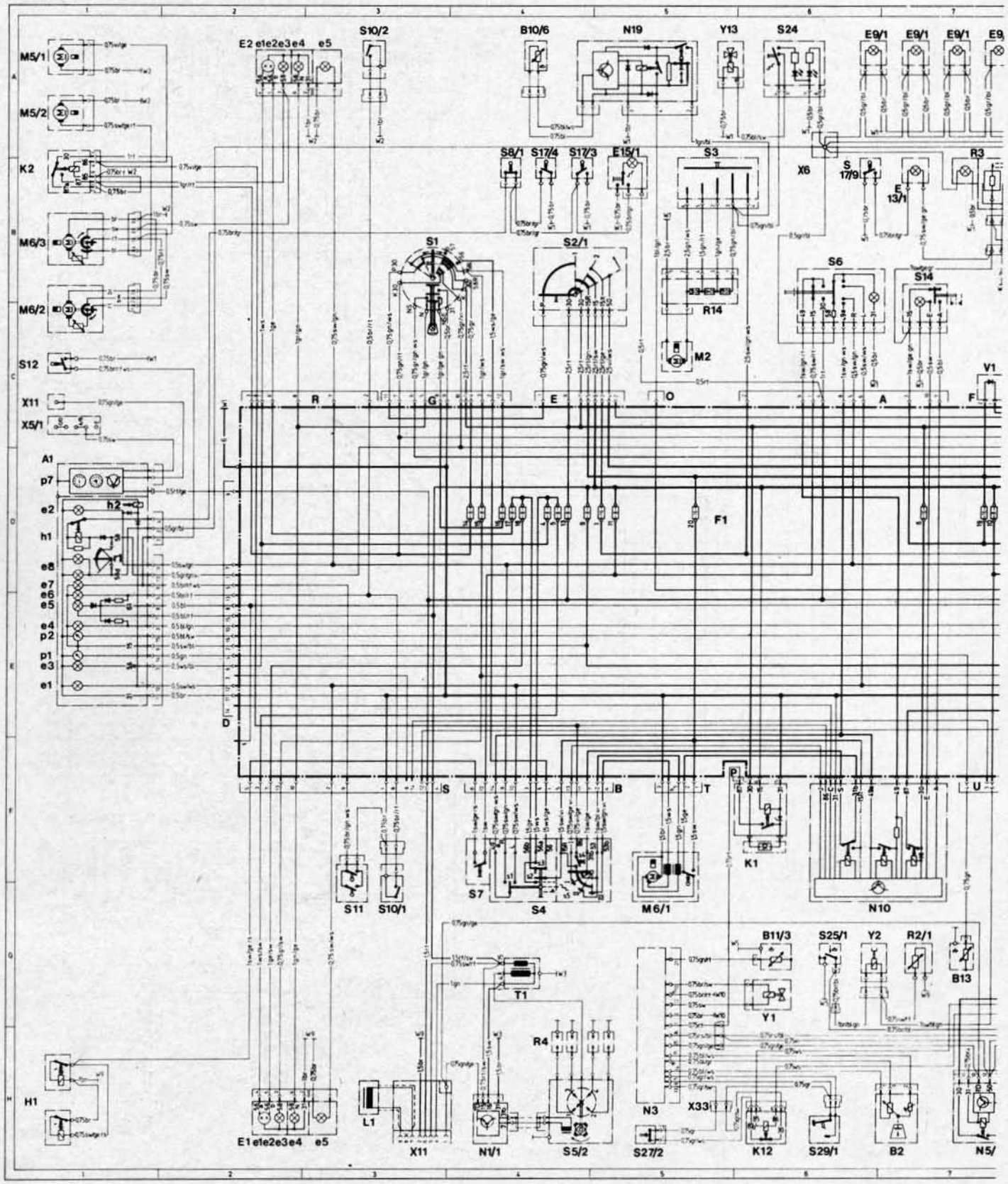
Symptom	Reason(s)
Starter noisy	Pinion or ring gear teeth badly worn Mounting bolts loose
Battery will not hold a charge	Battery defective Electrolyte level too low Alternator drivebelt slipping Alternator or regulator faulty Short in electrical circuit
Ignition light stays on	Alternator defective Alternator drivebelt broken
Ignition light fails to come on	Warning light blown Warning light open circuit Alternator faulty
Instrument readings increase with engine speed	Voltage regulator defective
Fuel or temperature gauge gives no reading	Wiring open circuit Sending unit faulty
Fuel or temperature gauge gives maximumreading always	Wiring short circuit Sending unit or gauge defective
Lights inoperative	Bulb blown Fuse blown Switch defective Wiring open circuit Wiring connection corroded
Failure of component motor	Commutator dirty or burnt Armature defective Brushes sticking or worn Armature shaft bearings seized Field coils faulty Fuse blown Wiring loose or broken
Failure of an individual component	Wiring loose or broken Fuse blown Switch defective Component faulty



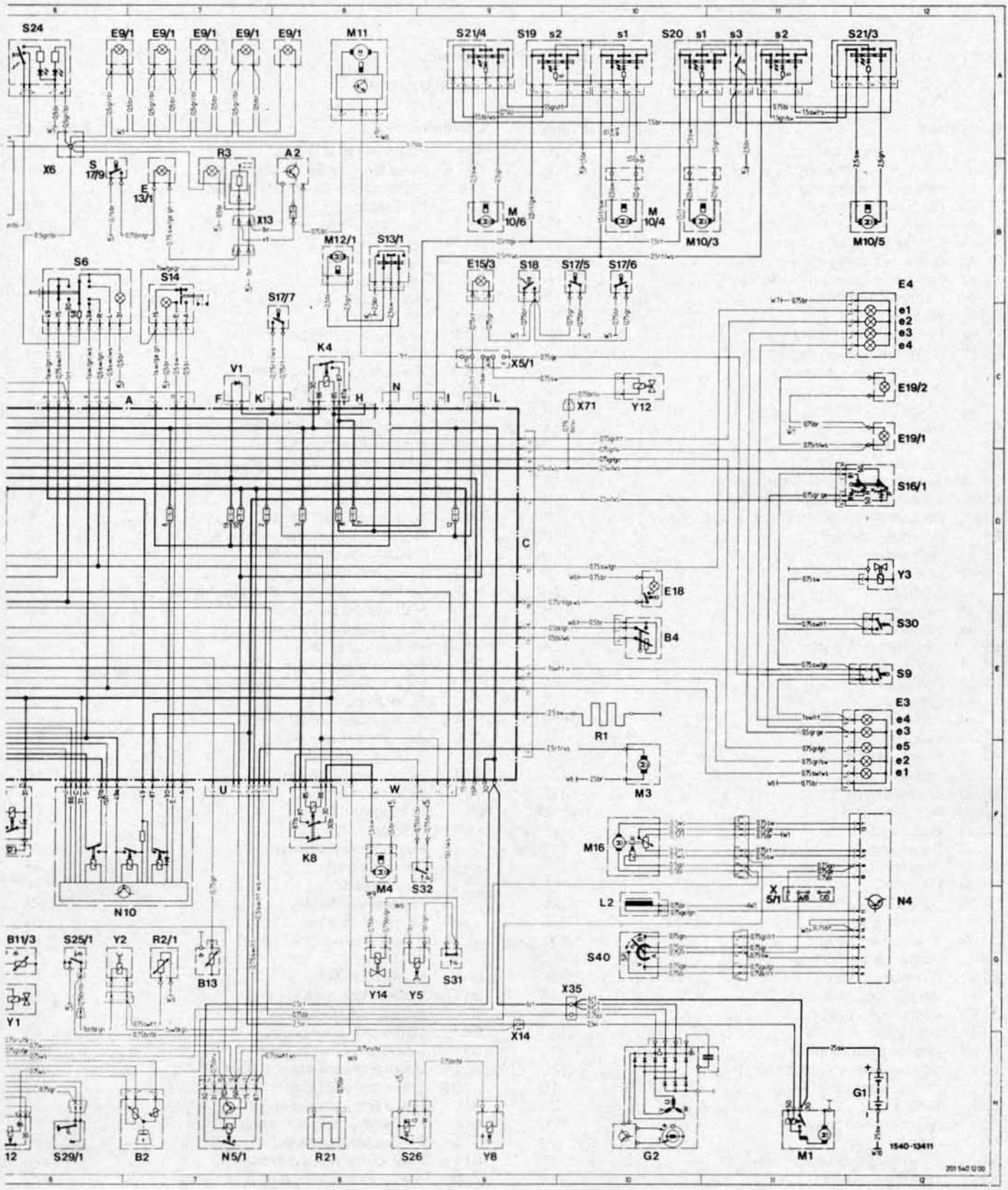
Wiring diagram for 190 E models up to chassis number 000 001-045 803 (1 of 2)



Wiring diagram for 190 E models up to chassis number 000 001-045 803 (2 of 2)



Wiring diagram for 190 E models from chassis number 1A 000 001-153 269999 or 1F 000 001-050 579 (1 of 2)



Wiring diagram for 190 E models from chassis number 1A 000001 153-269 999 or 1F 000 001-050 579 (2 of 2)

Key to wiring diagrams

Not all models are equipped with all items

Component		Location
A1	Instrument cluster	1D
e1	Indicator warning, left	1E
e2	Indicator warning, right	1D
e3	High beam warning	1E
e4	Fuel reserve warning	1E
e5	Charge indicator	1E
e6	Brake pad wear indicator	1E
e7	Brake fluid/handbrake indicator	1D
e8	Instrument lighting	1D
h1	Warning buzzer	1D
h2	Indicator warning buzzer	1D
r1	Instrument lighting rheostat	1D
p1	Coolant temperature gauge	1F
p2	Fuel gauge	1E
p7	Clock/Tachometer	1D
A2	Radio	8A
B2	Air flow meter	7H
B4	Fuel gauge sensor	10E
B10/6	Temperature sensor, evaporator	4A
B11/3	Coolant temperature sensor, KE	6G
B13	Coolant temperature sensor, gauge	7G
E1	Headlight unit, left	2H
e1	High beam	2H
e2	Low beam	2H
e3	Sidelight	2H
e4	Foglight	2H
e5	Indicator	3H
E2	Headlight unit, right	2A
e1	High beam	2A
e2	Low beam	2A
e3	Sidelight	2A
e4	Foglight	2A/3A
e5	Indicator	3A
E3	Rear light unit, left	12E
e1	Indicator	12F
e2	Tail/parking light	12F
e3	Reversing light	12E/12F
e4	Brake light	12E
e5	Rear foglight	12F
E4	Rear light unit, right	12B
e1	Indicator	12C
e2	Tail/parking light	12C
e3	Reversing light	12C
e4	Brake light	12C
E9/1	Heater control lighting	6A to 8C
E13/1	Glovebox light	7B
E15/1	Interior light, front	5A
E15/3	Interior light, rear	9B
E18	Boot light	10D
E19/1	License plate light, left	12C
E19/2	Number plate light, right	12C
F1	Central electrics unit	5D
G1	Battery	12H
G2	Alternator and regulator	10H
H1	Dual-tone horns	1H
K1	Overvoltage protection relay	6F
K2	Headlight cleaning relay	1B

Component		Location
K4	Electric window relay	8C
K8	Relay for auxiliary fan/engine fan	8F
K12	Cruise control deceleration relay	6H
L1	TDC sensor	3H
L2	Road speed sensor	10G
M1	Starter motor	11H
M2	Blower motor	5C
M3	Fuel pump	10F
M4	Auxiliary fan	8G
M5/1	Washer pump	1A
M5/2	Headlight washer pump	1A
M6/1	Wiper motor	5G
M6/2	Wiper motor, headlight, left	1C
M6/3	Wiper motor, headlight, right	1B
M10/3	Window lift motor, front left	10B
M10/4	Window lift motor, front right	10B
M10/5	Window lift motor, rear left	12B
M10/6	Window lift motor, rear right	9B
M11	Power antenna	8A
M12/1	Sunroof motor	8B
M16	Actuator, cruise control	10F
N1/1	Electronic ignition switching unit	4H
N4	Control unit, cruise control	12G
N5/1	Fuel pump relay	7H
N10	Combination relay – indicators, heated rear window, wiper motor	6G
N19	Air conditioning control unit	5A
R1	Heated rear window	10E
R2/1	Washer nozzle heater	7G
R3	Cigar lighter/front ashtray lighting	7A
R4	Spark plugs	4H
R14	Blower motor ballast resistor	5C
R21	Auxiliary air valve heater coil	8H
S1	Rotary light switch	3B
S2/1	Ignition starter switch	4B
S3	Air volume switch	5A
S4	Combination switch	4G
s1	Indicator switch	4F
s2	Headlight flasher switch	4F
s3	Dimmer switch	4F
s4	Washer switch	4F
s5	Wiper speed switch	4G
s5	I Intermittent wipe	4G
s5	II Slow wipe	4G
s5	III Fast wipe	5G
S5/2	Ignition distributor	4H
S6	Hazard flasher switch	6B
S7	Horn contact	4G
S8/1	Lights-on buzzer contact	4A
S9	Stop-light switch	12E
S10/1	Brake pad wear contact, front left	3G
S10/2	Brake pad wear contact, front right	3A
S11	Brake fluid indicator switch	3G
S12	Handbrake indicator switch	1C
S13/1	Electric sunroof switch	8B
S14	Heated rear window switch	7B
S16/1	Starter interlock/back-up light switch	12D

Key to wiring diagrams

Not all models are equipped with all items

Component		Location
S17/3	Door switch, front left	4A
S17/4	Door switch, front right	4A
S17/5	Door switch, rear left	10B
S17/6	Door switch, rear right	10B
S17/7	Door switch, comfort circuit, left	8B
S17/9	Glovebox light switch	6B
S18	Rear interior light switch	9B
S19	Switch group, electric windows, right	9A
s1	Window switch, front right	10A
s2	Window switch, rear right	9A
S20	Switch group, electric windows, left	10A
s1	Window switch, front left	10A
s2	Window switch, rear left	11A
s3	Safety switch, rear electric windows	11A
S21/3	Window switch, rear left	12A
S21/4	Window switch, rear right	6A
S24	Fresh/recirculated air switch	6G
S25/1	Temperature switch, 100-degrees C	6G
S26	Thermotime switch	8H/9H
S27/2	Deceleration microswitch	5H
S29/1	Throttle valve switch, full load	6H
S30	Kickdown switch	12E
S31	Refrigerant compressor switch	9G
S32	Auxiliary fan switch	9G
S40	Cruise control switch	10G
T1	Ignition coil	4G
V1	Comfort circuit diode	7C

Component		Location
W1	Main ground (behind instruments)	
W2	Ground, front right (near light unit)	
W3	Ground, front left wheel arch (ignition coil)	
W4	Ground, front interior light	
W5	Ground, engine	
W6	Ground, boot wheel arch, left	
W7	Ground, boot wheel arch, right	
W9	Ground, front left (near light unit)	
W10	Ground, battery	
X5/1	Interior cable connectors	1C/9C/11G
X6	Cable connector	6B
X11	Diagnostic socket	1C/3H
X13	Cigar lighter connection	7B
X14	Plug connection	9H
X33	Plug connection, KE/cruise control	5H
X35	Cable connector, battery	10G
X71	Plug connection, switchover valve idle speed stabilization	10C
Y1	Electrohydraulic actuator	6G
Y2	Engine fan solenoid	6G
Y3	Switchover valve, automatic transmission	12D
Y5	Refrigerant compressor solenoid	9G
Y8	Starting valve	9H
Y12	Switchover valve, idle speed increase	10C
Y13	Switchover valve, fresh/recirculated air flap	5A
Y14	Switchover valve, idle speed stabilization	8G

Color Codes

bl	Blue	nf	Neutral
br	Brown	rs	Pink
el	Ivory	rt	Red
ge	Yellow	sw	Black
gn	Green	vi	Purple
gr	Grey	ws	White

Wire codes

Example: Wire code 1.5 gr/rt
Basic color – grey
Tracer color – red
Cross-sectional area of wire (wire gauge) = 1.5 mm sq

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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, overadvanced 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, overadvanced ignition timing, lean fuel mixture, insufficient engine cooling and lack of lubrication.

HIGH SPEED GLAZING

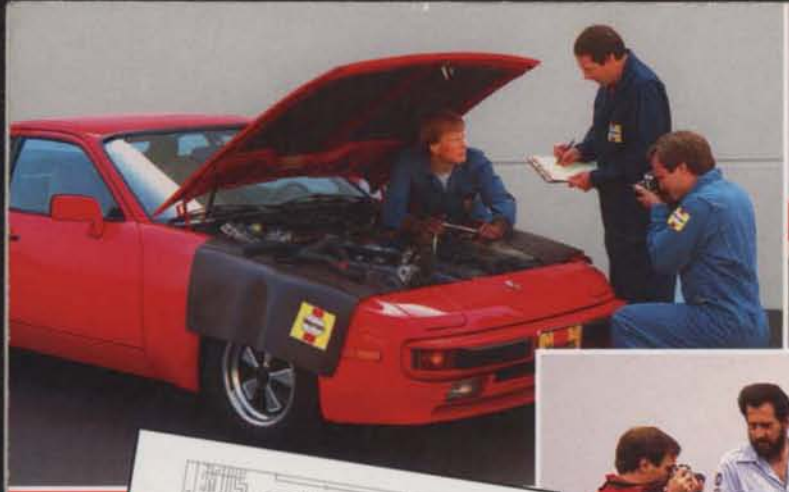
Symptoms: Insulator has yellowish, glazed appearance. Indicates that combustion chamber temperatures have risen suddenly during hard acceleration. Normal deposits melt to form a conductive coating. Causes misfiring at high speeds.
Recommendation: Install new plugs. Consider using a colder plug if driving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







Every manual based on a complete teardown and rebuild!





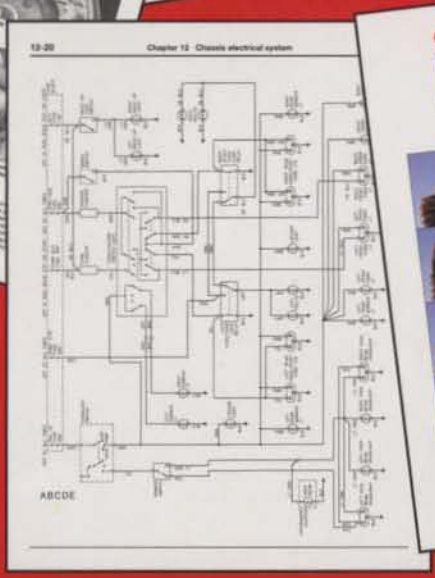
Models covered by this manual:

Mercedes-Benz 190 four-cylinder gasoline engine models 1984 thru 1988

Does not include diesel or 2.6 liter six-cylinder gasoline engine information

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- *Quick and easy troubleshooting sections*
- *Detailed wiring diagrams*
- *Color spark plug diagnosis*







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