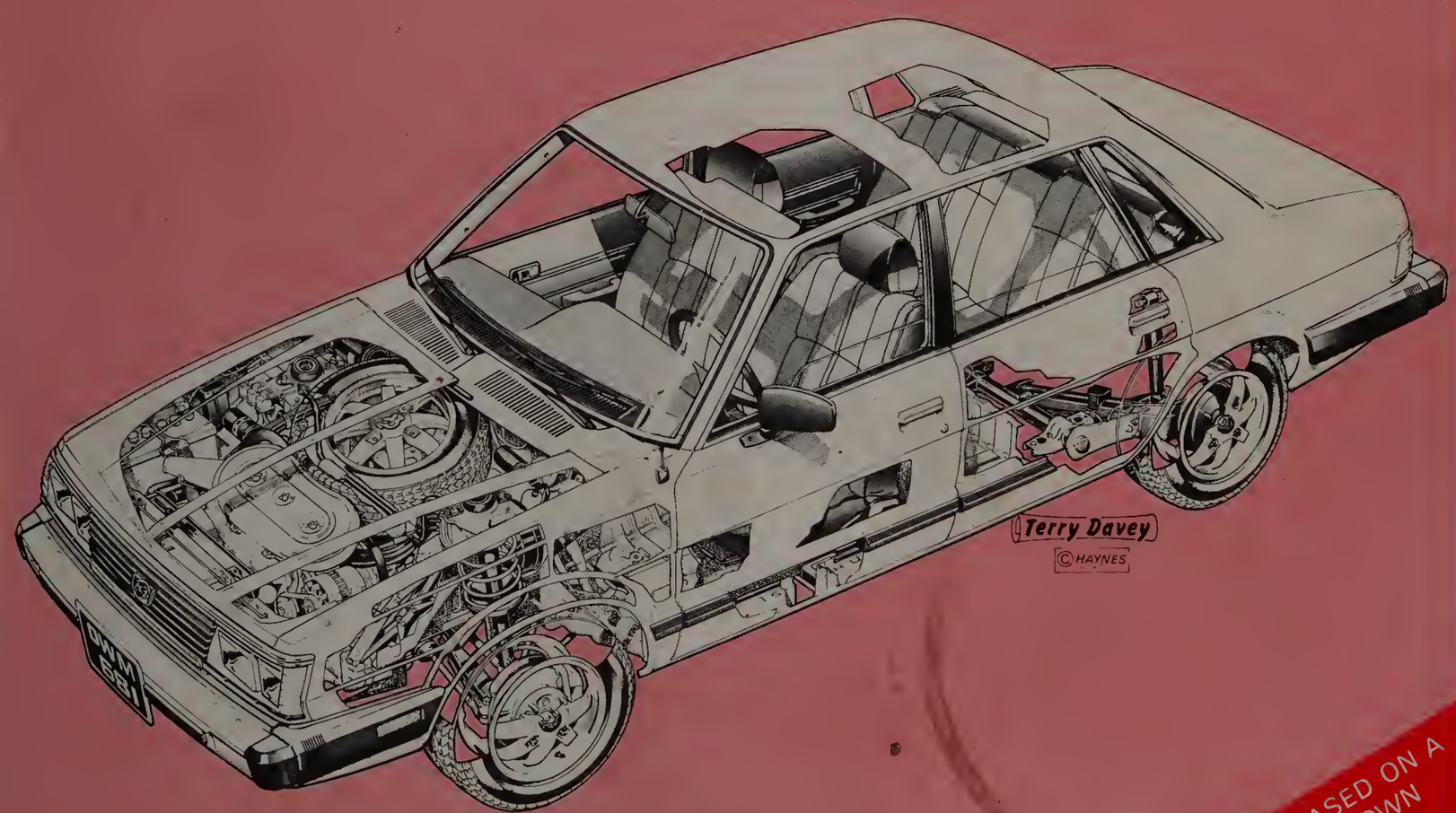
SUBARU 1600 & 1800

1980 thru 1988

Haynes®

681

Owners Workshop Manual



EVERY MANUAL BASED ON A COMPLETE TEARDOWN AND REBUILD

Subaru Owners Workshop Manual

by Larry Holt
and John H Haynes
Member of the Guild of Motoring Writers

Models covered

All models with 1600 cc and 1800 cc engines, automatic and 4 & 5-speed manual transmissions, two-wheel and four-wheel drive

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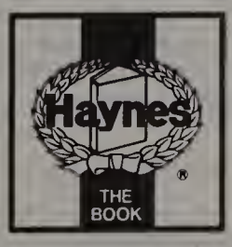

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The Champion Sparking Plug Company provided the illustrations of spark plug conditions.

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 get it done by a dealer service department or a repair shop; it provides information and procedures for routine maintenance and servicing; and it offers diagnostic and repair procedures to follow when trouble occurs.

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

Using the manual

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

The two types of illustrations used (figures and photographs), are referenced by a number preceding their captions. Figure reference numbers denote Chapter and numerical sequence in the Chapter; i.e. Fig. 12.4 means Chapter 12, figure number 4. Figure captions are followed by a Section number which ties the figure to a specific portion of the text. All photographs apply to the Chapter in which they appear, and the reference number pinpoints the pertinent Section and paragraph; i.e. 3.2 means Section 3, paragraph 2.

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

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

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

Introduction to the Subaru

The Subaru line of vehicles, manufactured by Fuji Heavy Industries Ltd. of Japan, is one of the most versatile of all vehicles currently available.

Although Subaru models have been available in both the US and UK for a number of years, this OWM is involved with only those vehicles produced in 1980 and later. Models built prior to 1980 are the subject of another Haynes manual.

Subaru vehicles can be purchased in a number of forms and trim levels. In North America the most popular versions include 2-door and 4-door hatchbacks, station wagons and the unique pick-up truck called the Brat. The UK has a similar line of saloons, hardtop coupes and the MV pick-up truck.

One feature which helps to separate Subaru from other vehicle manufacturers is the use of four-wheel drive (4WD), available on most models. Subaru is the worldwide innovator in 4WD passenger cars.

As mentioned above, in addition to body form, Subarus can be purchased in a variety of trim levels with many options. Optional equipment includes items such as a digital display instrument panel and the revolutionary Hill-holder device which prevents the vehicle from rolling backward when accelerating from a stop on a hill.

Contents

The Subaru GL wagon (foreground) and DL wagon (background) (North American models shown)

The Subaru hatchback models (North American models shown)

The Subaru 1600 GLF Saloon (UK version shown)

The Subaru pick-up truck known as the Brat in North America and as the MV in the UK (MV shown)

General dimensions

Length (overall)

Hatchback (DL-2WD)	156.9 in (3985 mm)
Hatchback (GL-2WD)	157.9 in (4010 mm)
Hatchback (All 4WD)	157.3 in (3995 mm)
Sedan and hardtop (DL)	167.3 in (4250 mm)
Sedan and hardtop (GL)	168.1 in (4270 mm)
Station wagon (DL-2WD)	168.5 in (4280 mm)
Station wagon (GL-2WD)	169.3 in (4300 mm)
Station wagon (All 4WD)	168.7 in (4285 mm)
Pick-up truck	174.2 in (4425 mm)

Width (overall)

Hatchback (DL-2WD)	63.4 in (1610 mm)
Hatchback (GL-2WD)	63.6 in (1615 mm)
Hatchback (All 4WD)	63.8 in (1620 mm)
Sedan and hardtop (DL)	63.4 in (1610 mm)
Sedan and hardtop (GL)	63.6 in (1615 mm)
Station wagon (DL-2WD)	63.4 in (1610 mm)
Station wagon (GL-2WD)	63.6 in (1615 mm)
Station wagon (All 4WD)	63.8 in (1620 mm)
Pick-up truck	64.4 in (1635 mm)

Height (overall)

Hatchback (2WD)	53.7 in (1365 mm)
Hatchback (4WD)	55.7 in (1415 mm)
Sedan	53.7 in (1365 mm)
Hardtop	53.1 in (1350 mm)
Station wagon (2WD)	54.7 in (1390 mm)
Station wagon (4WD)	56.9 in (1445 mm)
Pick-up truck	56.9 in (1445 mm)

Wheelbase

Hatchback (2WD)	93.7 in (2380 mm)
Hatchback (4WD)	93.3 in (2370 mm)
Sedan and hardtop	96.9 in (2460 mm)
Station wagon (2WD)	96.7 in (2455 mm)
Station wagon (4WD)	96.3 in (2445 mm)
Pick-up truck	96.3 in (2445 mm)

Track

	Front	Rear
Hatchback (2WD)	52.4 in (1330 mm)	53.0 in (1345 mm)
Hatchback (4WD)	52.6 in (1335 mm)	53.9 in (1370 mm)
Sedan and hardtop	52.4 in (1330 mm)	53.0 in (1345 mm)
Station wagon (2WD)	52.5 in (1325 mm)	53.0 in (1345 mm)
Station wagon (4WD)	52.6 in (1335 mm)	53.7 in (1365 mm)
Pick-up truck	52.6 in (1335 mm)	53.7 in (1365 mm)

Turning circle

Hatchback	15.5 ft (4.7 m)
All others	15.8 ft (4.8 m)

Curb weight

Hatchback (DL-2WD)	2060 lb (934 kg)
Hatchback (GL-2WD)	2120 lb (962 kg)
Hatchback (4WD)	2235 lb (1014 kg)
Sedan (DL)	2130 lb (966 kg)
Sedan (GL)	2190 lb (993 kg)
Hardtop (DL)	2110 lb (957 kg)
Hardtop (GL)	2180 lb (989 kg)
Station wagon (DL-2WD)	2250 lb (1021 kg)
Station wagon (GL-2WD)	2310 lb (1048 kg)
Station wagon (DL-4WD)	2365 lb (1072 kg)
Station wagon (GL-4WD)	2405 lb (1091 kg)
Pick-up truck (DL)	2175 lb (987 kg)
Pick-up truck (GL)	2245 lb (1018 kg)

Use of English

As this book has been written in America, it uses the appropriate American component names, phrases, and spelling. Some of these differ from those used in the U.K. Normally, these cause no difficulty, but to make sure, a glossary is printed below. In ordering replacement parts remember the parts list may use some of these words:

American	English	American	English
Antenna	Aerial	Freeway, turnpike etc	Motorway
Gas pedal	Accelerator	License plate	Number plate
Stabilizer or sway bar	Anti-roll bar	Kerosene	Paraffin
Hood	Bonnet (engine cover)	Gasoline (gas)	Petrol
Trunk	Boot (luggage compartment)	Gas tank	Petrol tank
Firewall	Bulkhead	'Pinging'	'Pinking'
Valve lifter or tappet	Cam follower or tappet	Driveshaft	Propeller shaft
Carburetor	Carburettor	Quarter window	Quarter light
Latch	Catch	Recap	Retread
Barrel	Choke/venturi	Back-up	Reverse
Snap-ring	Circlip	Valve cover	Rocker cover
Lash	Clearance	Sedan	Saloon
Ring gear (of differential)	Crownwheel	Frozen	Seized
Rotor/disc	Disc (brake)	Side marker lights	Side indicator lights
Pitman arm	Drop arm	Parking light	Side light
Convertible	Drop head coupe	Muffler	Silencer
Generator (DC)	Dynamo	Wrench	Spanner
Ground	Earth (electrical)	Rocker panel	Sill panel (beneath doors)
Prussian blue	Engineer's blue	Lock (for valve spring retainer)	Split cotter (for valve spring cap)
Station wagon	Estate car	Cotter pin	Split pin
Header	Exhaust manifold	Spindle arm	Steering arm
Troubleshooting	Fault finding/diagnosis	Oil pan	Sump
Float bowl	Float chamber	Tang; lock	Tab washer
Lash	Free-play	Valve lifter	Tappet
Coast	Freewheel	Throw-out bearing	Thrust bearing
Piston pin or wrist pin	Gudgeon pin	High	Top gear
Shift	Gearchange	Tie rod (or connecting rod)	Trackrod (of steering)
Transmission	Gearbox	Secondary shoe	Trailing shoe (of brake)
Axleshaft	Halfshaft	Whole drive line	Transmission
Parking brake	Handbrake	Tire	Tyre
Soft top	Hood	Panel wagon/van	Van
Heat riser	Hot spot	Vise	Vice
Turn signal	Indicator	Lug nut	Wheel nut
Dome lamp	Interior light	Windshield	Windscreen
Countershaft	Layshaft (of gearbox)	Fender	Wing/mudguard
Primary shoe	Leading shoe (of brake)		
Latches	Locks		

Miscellaneous points

An 'oil seal', is also fitted to components lubricated by grease!

A 'shock absorber' is a 'damper', it damps out bouncing and absorbs shocks of bump impact. Both names are correct, and both are used haphazardly.

Note that British drum brakes are different from the Bendix type that is common in America, so different descriptive names result. The shoe end farthest from the hydraulic wheel cylinder is on a pivot; interconnection between the shoes, as on Bendix brakes, is most uncommon. Therefore the phrase 'Primary' or 'Secondary' shoe does not apply. A shoe is said to be 'Leading' or 'Trailing'. A 'Leading' shoe is one on which a point on the drum, as it rotates forward, reaches the shoe at the end worked by the hydraulic cylinder before the anchor end. The opposite is a 'Trailing' shoe and this one has no self servo from the wrapping effect of the rotating drum.

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:

Authorized dealer parts department: This is the best source for parts which are peculiar to your vehicle and not generally available elsewhere (i.e. major engine parts, transmission parts, trim pieces, etc.). It is also the only place you should buy parts if your vehicle is still under warranty, as non-factory parts may invalidate the warranty. To be sure of obtaining the correct parts, have your vehicle's engine and chassis numbers available and, if possible, take the old parts along for positive identification.

Retail auto parts stores: Good auto parts stores will stock frequently needed components which wear out relatively fast (i.e. 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 (i.e. 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 your home.

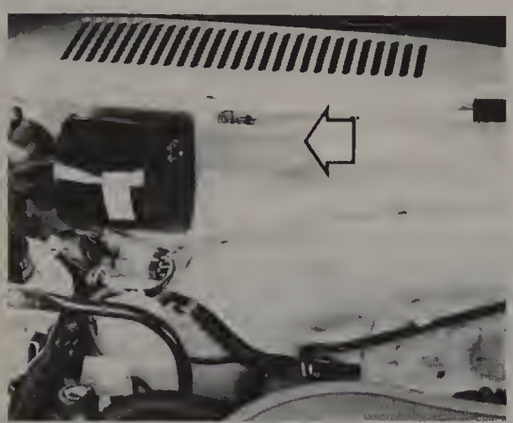
Vehicle identification numbers

The Vehicle Identification Number (VIN) is located in two different places. It is stamped on the firewall of the engine compartment (photo) and on most models is also on a plate fastened to the dash on the driver's side (photo).

The engine serial number is stamped on the right side of the engine crankcase, near the front (photo). The transmission serial number label is attached to the right upper surface of the main case of the manual transmission (photo) or the converter housing of the automatic transmission.

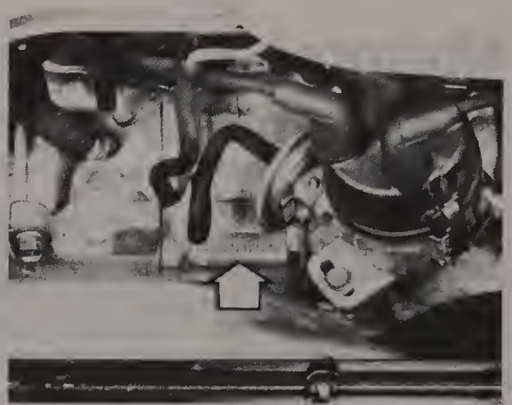
Other important vehicle labels which may be included are the Safety Certification plate, found on the driver's side door pillar (photo) and the Vehicle Color Code label, stuck on the top radiator crossmember, near the hood latch (photo).

An Emissions Control Information label is supplied with all North America models. It is attached to the underside of the hood. It contains information concerning certification, vacuum connections and high altitude settings (photo). For California vehicles, there is an Emission Data label found on the driver's side of the dash.

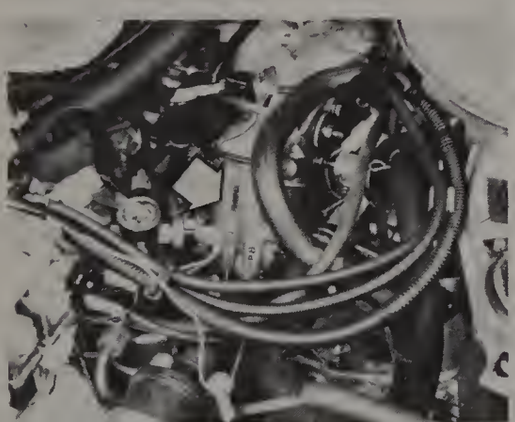


Vehicle Identification Number (VIN) engine compartment location

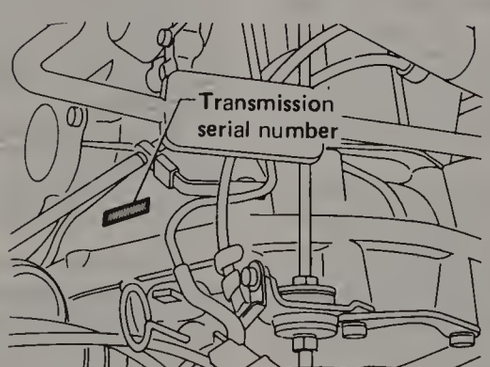
Vehicle Identification Number (VIN) driver's side dash location



The engine serial number (arrow) is stamped into the right side of the crankcase, near the front

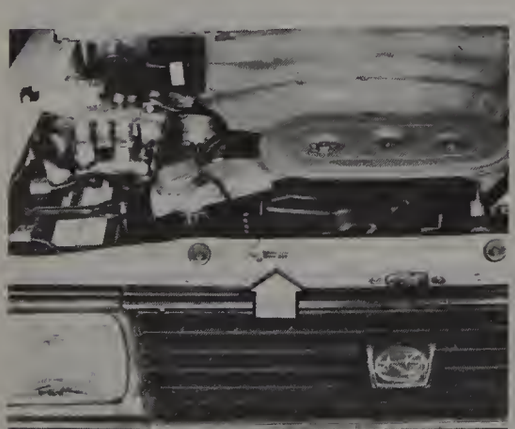


Manual transmission serial number location (arrow)

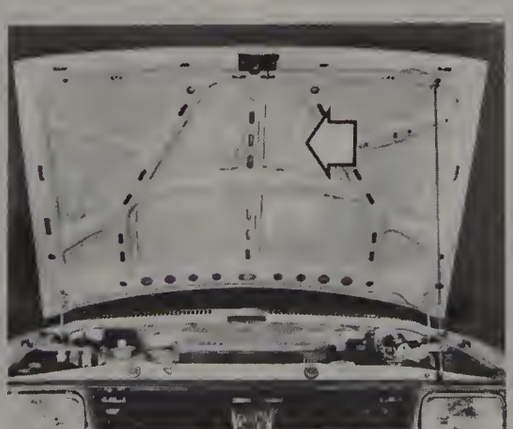


Automatic transmission serial number location

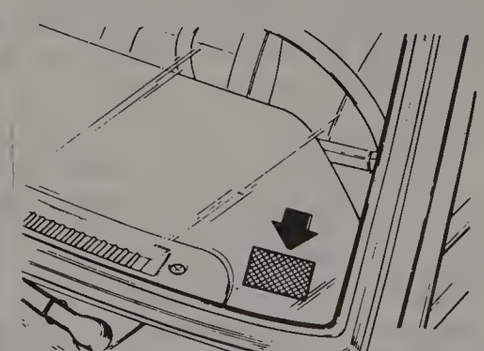
Safety Certification plate location (arrow) on driver's side door pillar



Vehicle Color Code label location (arrow)



The Emission Control Information label (arrow) is attached to the underside of the hood



The Emissions Data label (California vehicles only) is attached to the driver's side of the dash, near the VIN

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 lock washer, 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 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 repair of threaded holes that have been stripped out).

Flat washers and lock washers, when removed from an assembly should always be replaced exactly as removed. Replace damaged washers with new ones. Always use a flat washer between a lock washer and 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., English 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 $\frac{1}{2} - 13 \times 1$ bolt is $\frac{1}{2}$ 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 measured 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, 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. 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.

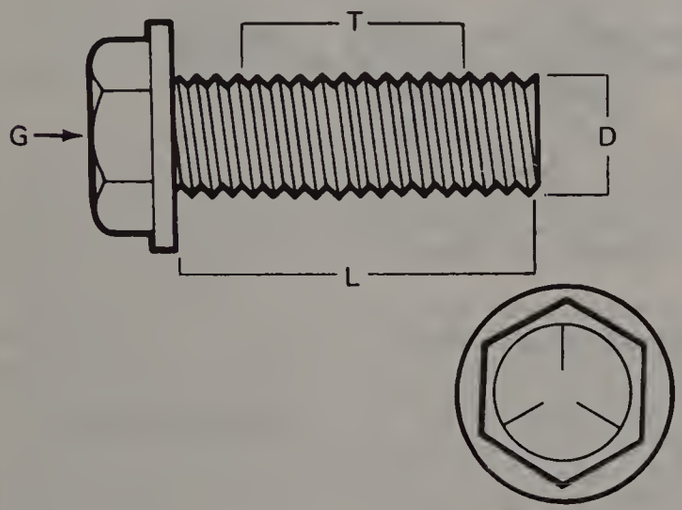
It should be noted that many fasteners, especially Grades 0 through 2, have no distinguishing marks on them. When such is the case, the only way to determine whether it is standard or metric is to measure the thread pitch or compare it to a known fastener of the same size.

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

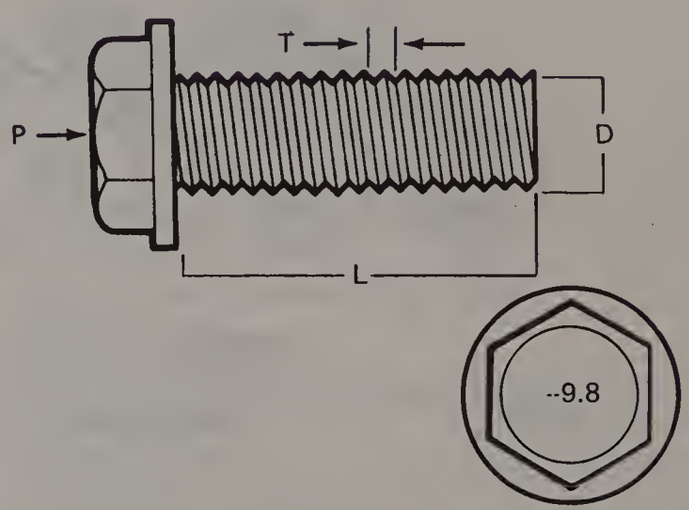
Most threaded fasteners should be tightened to a specific torque value (torque is basically a twisting force). Over-tightening the fastener can weaken it and lead to eventual breakage, while under-tightening can cause it to eventually come loose. Bolts, screws and studs, depending on the materials they 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. As was previously mentioned, the sizes and grade of a fastener determine the amount of torque that can safely be applied to it. The figures listed here are approximate for Grade 2 and Grade 3 fasteners (higher grades can tolerate higher torque values).

	Ft-lb	Nm
Metric thread sizes		
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) bolt dimensions/grade marks

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



Metric bolt dimensions/grade marks

P – Property class (bolt strength)
L – Length (in millimeters)
T – Thread pitch (distance between threads; in millimeters)
D – Nominal diameter (in millimeters)

Fasteners laid out in a pattern (i.e. cylinder head bolts, oil pan bolts, differential cover bolts, etc.) must be loosened and tightened in a definite 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 they all have been tightened to the proper torque value. To loosen and remove them 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 simple sketches or take instant photos of components before removal.

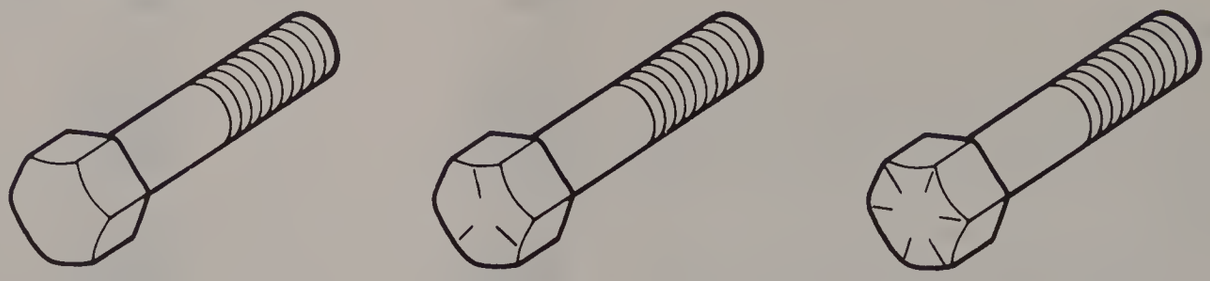
When removing fasteners from an assembly, keep track of their locations. Sometimes threading a bolt back in a part or putting the washers and nut back on a stud can prevent mixups later. If nuts and bolts cannot be returned to their original locations, they should be kept in a compartmented box or a 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's a good idea to identify them with numbered pieces of masking tape so that they can be easily reconnected.

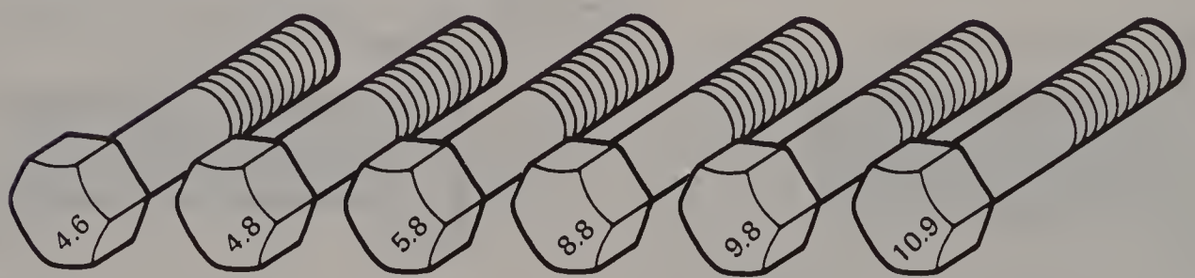
Gasket sealing surfaces

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-faced 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



Grade 1 or 2 | Grade 5 | Grade 8



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

Grade	Identification
Hex Nut Grade 5	3 Dots
Hex Nut Grade 8	6 Dots

Standard hex nut strength markings

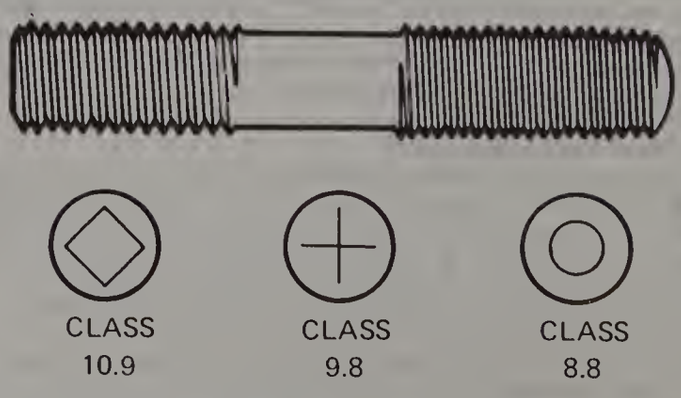
Class	Identification
Hex Nut Property Class 9	9 Arabic 9
Hex Nut Property Class 10	10 Arabic 10

Metric hex nut strength markings

be easily damaged. With any particularly stubborn part, always recheck to see 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 that 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



Metric stud strength markings

thick enough to fill scratches will have to be used upon reassembly of the components. For most applications, a non-drying (or semi-drying) gasket sealer should be used.

Hose removal tips

Caution: *If the vehicle is equipped with air conditioning, do not disconnect any of the a/c hoses without first having the system de-pressurized by a dealer service department or air conditioning specialist.*

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

As the 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 its 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 re-use 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, if any, the initial investment might seem high, but when compared to the spiraling costs of professional auto maintenance and repair, it is a wise one.

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 and 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 his confidence and experience grow, he 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 he feels 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 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-ended ones, they offer the advantages of both types of wrench.

Combination wrench set ($\frac{1}{4}$ in to 1 in or 6 mm to 19 mm)
Adjustable wrench – 8 in
Spark plug wrench (with rubber insert)
Spark plug gap adjusting tool
Feeler gauge set
Brake bleeder wrench
Standard screwdriver ($\frac{5}{16}$ in x 6 in)
Phillips screwdriver (No. 2 x 6 in)
Combination pliers – 6 in
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
Jack stands (2)
Drain pan

Note: *If basic tune-ups are going to be a part of routine maintenance, it will be necessary to purchase a good quality stroboscopic timing light and a combination tachometer/dwell meter. Although they are included in the list of Special tools, they are 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 $\frac{1}{2}$ in drive over the $\frac{3}{8}$ in drive. Although the larger drive is bulky and more expensive, it has the capability of accepting a very wide range of large sockets (ideally, the mechanic would have a $\frac{3}{8}$ in drive set and a $\frac{1}{2}$ in drive set).

Socket set(s)
Reversible ratchet
Extension – 10 in
Universal joint
Torque wrench (same size drive as sockets)
Ballpeen hammer – 8 oz
Soft-faced hammer (plastic/rubber)
Standard screwdriver ($\frac{1}{4}$ in x 6 in)
Standard screwdriver (stubby – $\frac{5}{16}$ in)
Phillips screwdriver (No.3 x 8 in)
Phillips screwdriver (stubby – No.2)
Pliers – vise grip
Pliers – lineman's
Pliers – needle nose
Pliers – spring clip (internal and external)
Cold chisel – $\frac{1}{2}$ in
Scriber
Scraper (made from flattened copper tubing)
Center punch
Pin punches ($\frac{1}{16}$, $\frac{1}{8}$, $\frac{3}{16}$ in)
Steel rule/straightedge – 12 in
Allen wrench set ($\frac{1}{8}$ to $\frac{3}{8}$ in or 4 mm to 10 mm)
A selection of files
Wire brush (large)
Jack stands (second set)
Jack (scissor or hydraulic type)

Note: *Another tool which is often useful is an electric drill motor with a chuck capacity of $\frac{3}{8}$ in (and a set of good quality drill bits).*

Special tools

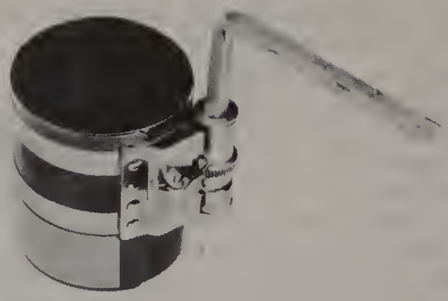
The tools in this list include those which are not used regularly, are expensive to buy, or which need to be used in accordance with their manufacturer's instructions. Unless these tools will be used frequently, it is not very economical to purchase many of them. A consideration would be to split the 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 contains only those tools and instruments widely available to the public, and not those special tools produced by vehicle manufacturers for distribution to dealer service departments. Occasionally, references to the manufacturer's special tools are included in the text of this manual. Generally, an alternate 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, a repair shop or an automotive machine 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
Micrometer(s) and/or dial calipers
Hydraulic lifter removal tool
Balljoint separator

Valve spring compressor

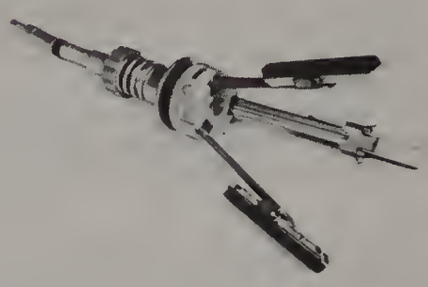
Piston ring groove cleaning tool



Piston ring compressor

Piston ring removal/installation tool

Cylinder ridge reamer



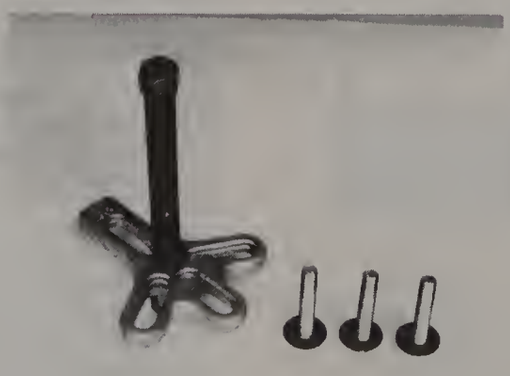
Cylinder surfacing hone

Cylinder bore gauge

Micrometer set

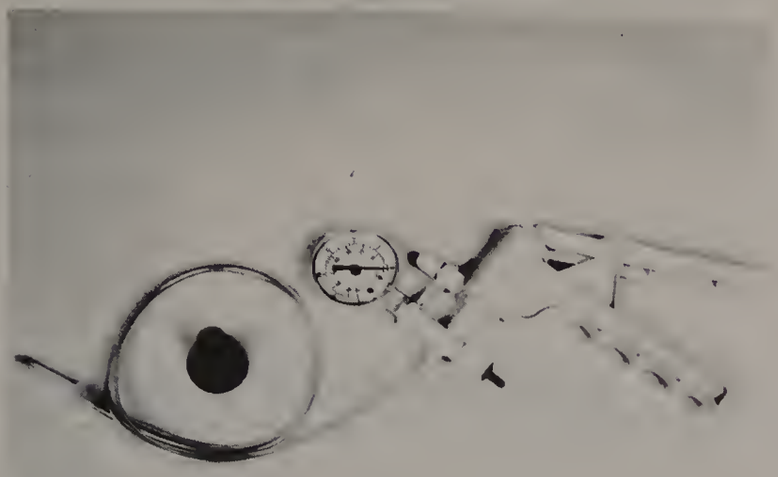
Dial caliper

Hydraulic lifter removal tool



Universal type puller

Dial indicator set



Hand operated vacuum pump

Brake shoe spring tool

Universal-type puller
Impact screwdriver
Dial indicator set
Stroboscopic timing light (inductive pickup)
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 couple 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 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 in a clean and 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 don'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, 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 transmission during normal maintenance or repairs, present a disposal problem. To avoid pouring oil on the ground or into the sewage system, simply pour the used fluids into large containers, seal them with caps and deliver them to a local recycling center or disposal facility. 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 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.

Automotive chemicals and lubricants

A number of automotive chemicals and lubricants are available for use in 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.

Contact point/spark plug cleaner is a solvent used to clean oily film and dirt from points, grime from electrical connectors and oil deposits from spark plugs. It is oil free and leaves no residue. It can also be used to remove gum and varnish from carburetor jets and other orifices.

Carburetor cleaner is similar to contact point/spark plug cleaner but it is a stronger solvent and may leave a slight oily residue. It is not recommended for cleaning electrical components or connections.

Brake system cleaner is used to remove grease or brake fluid from brake system components where clean surfaces are absolutely necessary and petroleum-based solvents cannot be used. It also leaves no residue.

Silicone-based lubricants are used to protect rubber parts such as hoses, weatherstripping and grommets and are used as lubricants for hinges and locks.

Multi-purpose grease is an all-purpose lubricant used whenever grease is more practical than a liquid lubricant such as oil. Some multi-purpose grease is white and specially formulated to be more resistant to water than ordinary grease.

Bearing grease/wheel bearing grease is a heavy grease used where increased loads and friction are encountered (i.e. wheel bearings, universal joints, etc.).

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, which is a 'dry' type lubricant.

Gear oil (sometimes called gear lube) is a specially designed oil used in differentials, manual transmissions and transfer cases, as well as other areas where high friction, high temperature lubrication is required. It is available in a number of viscosities (weights) for various applications.

Motor oil, of course, is the lubricant specially formulated for use in the engine. It normally contains a wide variety of additives to prevent corrosion and reduce foaming and wear. Motor oil comes in various weights (viscosity ratings) of from 5 to 80. The recommended weight of the oil depends on the seasonal 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.

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

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

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

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

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

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

Solvents are used alone or in combination with degreasers to clean parts and assemblies during repair and overhaul. The home mechanic should use only solvents that are non-flammable and that do not produce irritating fumes.

Gasket sealing compounds may be used in conjunction with gaskets, to improve their sealing capabilities, or alone, to seal metal-to-metal joints. Many gaskets can withstand extreme heat, some are impervious to gasoline and lubricants, while others are capable of filling and sealing large cavities. Depending on the intended use, gasket sealers either dry hard or stay relatively soft and pliable. They are usually applied by hand, with a brush, or are sprayed on the gasket sealing surfaces.

Thread cement is an adhesive locking compound that prevents threaded fasteners from loosening because of vibration. It is available in a variety of types for different applications.

Moisture dispersants are usually sprays that can be used to dry out electrical components such as the distributor, fuse block and wiring connectors. Some types can also be used as a treatment for rubber and as a lubricant for hinges, cables and locks.

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 or polish. Some polishes utilize a chemical or abrasive cleaner to help remove the top layer of oxidized (dull) paint in 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.

Jacking and towing

Jacking

The jack supplied with the vehicle should only be used for raising the vehicle for changing a tire or placing jack stands under the frame. *Under no circumstances should work be performed beneath the vehicle or the engine started while this jack is being used as the only means of support.*

All vehicles are supplied with a lug wrench and a scissors-type jack which fits into notches in the vertical rocker panel flange nearest to the wheel being changed.

The vehicle should be on level ground with the wheels blocked and the transmission in Park (automatic) or Reverse (manual).

Pry off the hub cap (if equipped) using the tapered end of the lug wrench. Loosen the lug nuts one-half turn and leave them in place until the wheel is raised off the ground.

Place the jack under the side of the vehicle in the appropriate jacking notch. Use the supplied wrench or handle to turn the jackscrew clockwise until the wheel is raised off the ground. Remove the lug nuts, pull off the wheel and replace it with the spare.

With the beveled side in, replace the lug nuts and tighten them until snug. Lower the vehicle by turning the jackscrew counterclockwise. Remove the jack and tighten the nuts in a crisscross pattern. Replace the hubcap by placing it into position and using the heel of your hand or a rubber mallet to seat it.

Jacking point (front)

Towing

The vehicle can be towed with all four wheels on the ground, as long as speeds do not exceed 20 mph (30 kmh) and the distance is not over six miles (10 km). Towing hooks are located at the front and the rear of the vehicle (photo).

For distances exceeding six miles, towing equipment specifically designed for this purpose must be used and should be attached to the main structural members of the vehicle, not the bumper or brackets.

While towing, the parking brake should be fully released and the transmission should be in Neutral. The steering must be unlocked (ignition switch in the Off position). Remember that power steering and power brakes will not work with the engine off.

Avoid towing another vehicle with your front towing hooks and never use the tie-down tabs for towing.

Safety is a major consideration when towing and all applicable state and local laws must be obeyed. A safety chain system must be used for all towing.

Jacking point (rear)

Towing hooks (arrows) are located at the front and rear of the vehicle

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 the battery. The battery normally gives 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. Do not charge at an excessive rate or the battery may burst.

Take care when adding water 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.

Troubleshooting

Contents

This section provides an easy-reference guide to the more common faults which may occur during the operation of your vehicle. These faults and their probable causes are grouped under their respective systems, i.e. Engine, Cooling system, etc., and also refer to the Chapter and/or Section which deals with the problem.

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

Finally, always get clear in your mind why a problem has occurred and take steps to ensure that it doesn't happen again. If the electrical system fails because of a poor connection, check all other connections in the system to make sure that they don't fail as well; if a particular fuse continues to blow, find out why – don't just go on replacing fuses. Remember, failure of a small component can often be indicative of potential failure or incorrect functioning of a more important component or system.

Engine

1 Engine will not rotate when attempting to start

1 Battery terminal connection loose or corroded. Check the cable terminals at the battery; tighten or remove corrosion as necessary.
2 Battery discharged or faulty. If the cable connections are clean and tight at the battery posts, turn the key to the On position and switch on the headlights and/or windshield wipers. If these fail to function, the battery is discharged.
3 Automatic transmission not fully engaged in Park.
4 Broken, loose or disconnected wiring in the starting circuit. Inspect all wiring and connectors at the battery, starter solenoid (at lower left side of engine) and ignition switch (on steering column).
5 Starter motor pinion jammed on flywheel ring gear. If manual transmission, place in gear and rock the vehicle to manually turn the engine. Remove starter (Chapter 5) and inspect pinion and flywheel at earliest convenience.
6 Starter solenoid faulty (Chapter 5).
7 Starter motor faulty (Chapter 5).
8 Ignition switch faulty (Chapter 10).

2 Engine rotates but will not start

1 Fuel tank empty.
2 Battery discharged (engine rotates slowly). Check the operation of electrical components as described in previous Section (Chapter 5).
3 Battery terminal connections loose or corroded. See previous Section.
4 Carburetor flooded and/or fuel level in carburetor incorrect. This will usually be accompanied by a strong fuel odor from under the hood. Wait a few minutes, depress the accelerator pedal all the way to the floor and attempt to start the engine.
5 Choke control inoperative (Chapter 4).
6 Fuel not reaching carburetor. With ignition switch in Off position, open hood, remove the top plate of air cleaner assembly and observe the top of the carburetor (manually move choke plate back if necessary). Have an assistant depress the accelerator pedal fully and make sure that fuel spurts into carburetor. If not, check fuel filter (Chapter 1), fuel lines and fuel pump (Chapter 4).
7 Excessive moisture on, or damage to, ignition components (Chapter 5).
8 Worn, faulty or incorrectly adjusted breaker points or spark plugs (Chapter 1).
9 Broken, loose or disconnected wiring in the starting circuit (see previous Section).
10 Distributor loose, causing ignition timing to change. Turn the distributor as necessary to start the engine, then set ignition timing as soon as possible (Chapter 1).
11 Ignition condenser faulty (Chapter 5).
12 Broken, loose or disconnected wires at the ignition coil or distributor, or faulty coil (Chapter 5).

3 Starter motor operates without rotating engine

1 Starter pinion sticking. Remove the starter (Chapter 5) and inspect.
2 Starter pinion or engine flywheel teeth worn or broken. Remove the starter to inspect.

4 Engine hard to start when cold

1 Battery discharged or low. Check as described in Section 1.
2 Choke control inoperative or out of adjustment (Chapter 4).
3 Carburetor flooded (see Section 2).
4 Fuel supply not reaching the carburetor (see Section 2).
5 Carburetor worn and in need of overhauling (Chapter 4).

5 Engine hard to start when hot

1 Choke sticking in the closed position (Chapter 1).
2 Carburetor flooded (see Section 2).
3 Air filter in need of replacement (Chapter 1).
4 Fuel not reaching the carburetor (see Section 2).

6 Starter motor noisy or excessively rough in engagement

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

7 Engine starts but stops immediately

1 Loose or faulty electrical connections at distributor, coil or alternator.
2 Insufficient fuel reaching the carburetor. Disconnect the fuel line at the carburetor. Place a container under the disconnected fuel line. Observe the flow of fuel from the line. If little or none at all, check for blockage in the lines and/or replace the fuel pump (Chapter 4).
3 Vacuum leak at the gasket surfaces of the intake manifold and/or carburetor. Make sure that all mounting bolts (nuts) are tightened securely and that all vacuum hoses connected to the carburetor and manifold are positioned properly and in good condition.
4 Faulty ignition ballast resistor (Chapter 5).

8 Engine 'lopes' while idling or idles erratically

1 Vacuum leakage. Check mounting bolts (nuts) at the carburetor and intake manifold for tightness. Check that all vacuum hoses are connected and in good condition. Use a stethoscope or a length of fuel hose held against your ear to listen for vacuum leaks while the engine is running. A hissing sound will be heard. A soapy water solution will also detect leaks. Check the carburetor and intake manifold gasket surfaces.
2 Leaking EGR valve or plugged PCV valve (Chapter 6).
3 Air cleaner clogged and in need of replacement (Chapter 1).
4 Fuel pump not delivering sufficient fuel to the carburetor (see Section 7).
5 Carburetor out of adjustment (Chapter 1).
6 Leaking head gasket. If this is suspected, take the vehicle to a repair shop or dealer where it can be pressure checked without the need to remove the head.
7 Timing gears worn and in need of replacement (Chapter 2).
8 Camshaft lobes worn, necessitating the removal of the camshaft for inspection (Chapter 2).

9 Engine misses at idle speed

1 Spark plugs faulty or not gapped properly (Chapter 1).
2 Faulty spark plug wires (Chapter 1).
3 Carburetor choke not operating properly (Chapter 1).
4 Sticking or faulty emissions systems (see Chapter 6).
5 Clogged fuel filter and/or foreign matter in fuel. Remove the fuel

filter (Chapter 1) and inspect.
6 Vacuum leaks at carburetor, intake manifold or hose connections. Check as described in Section 8.
7 Incorrect speed or idle mixture (Chapter 1).
8 Incorrect ignition timing (Chapter 1).
9 Uneven or low cylinder compression. Check compression as described in Chapter 1.

10 Engine misses throughout driving range

1 Fuel filter clogged and/or impurities in the fuel system (Chapter 1). Also check fuel output at the carburetor (see Section 7).
2 Faulty or incorrectly gapped spark plugs (Chapter 1).
3 Incorrectly set ignition timing (Chapter 1).
4 Check for a cracked distributor cap, disconnected distributor wires or damage to the ignition system components (Chapter 5).
5 Leaking spark plug wires (Chapter 1).
6 Emission system components faulty (Chapter 6).
7 Low or uneven cylinder compression pressures. Check compression as described in Chapter 1.
8 Vacuum leaks at carburetor, intake manifold or vacuum hoses (see Section 8).
9 Faulty breaker points or condenser (Chapter 1).

11 Engine stalls

1 Carburetor idle speed incorrectly set (Chapter 1).
2 Fuel filter clogged and/or water and impurities in the fuel system (Chapter 1).
3 Choke improperly adjusted or sticking (Chapter 4).
4 Distributor components damp, points out of adjustment or damage to distributor cap, rotor, etc. (Chapter 1).
5 Emission system components faulty (Chapter 6).
6 Faulty or incorrectly gapped spark plugs (Chapter 1). Also check spark plug wires (Chapter 1).
7 Vacuum leak at the carburetor, intake manifold or vacuum hoses. Check as described in Section 8.
8 Valve clearance incorrectly set (Chapter 1).

12 Engine lacks power

1 Incorrect ignition timing (Chapter 1).
2 Excessive play in distributor shaft. At the same time check for worn or misadjusted contact points, faulty distributor cap, wires, etc. (Chapter 1).
3 Faulty or incorrectly gapped spark plugs (Chapter 1).
4 Carburetor not adjusted properly or excessively worn (Chapter 4).
5 Weak coil or condenser (Chapter 5).
6 Brakes or Hill-holder binding (Chapter 9).
7 Automatic transmission fluid level incorrect, causing slippage (Chapter 1).
8 Manual transmission clutch slipping (Chapter 8).
9 Fuel filter clogged and/or impurities in the fuel system (Chapter 1).
10 Emission control system not functioning properly (Chapter 6).
11 Use of sub-standard fuel. Fill tank with proper octane fuel.
12 Low or uneven cylinder compression pressures. Test with compression tester, which will also detect leaking valves and/or blown head gasket (Chapter 1).

13 Engine backfires

1 Emission system not functioning properly (Chapter 6).
2 Ignition timing incorrect (Chapter 1).
3 Carburetor in need of adjustment or worn excessively (Chapter 4).
4 Vacuum leak at carburetor, intake manifold or vacuum hoses. Check as described in Section 8.
5 Valve clearance incorrectly set, and/or valves sticking (Chapter 1).

14 Pinging or knocking engine sounds during hard acceleration or uphill

1 Incorrect grade of fuel. Fill tank with fuel of the proper octane rating.
2 Ignition timing incorrect (Chapter 1).
3 Carburetor in need of adjustment (Chapter 4).
4 Improper spark plugs. Check plug type with that specified on label located inside engine compartment. Also check plugs and wires for damage (Chapter 1).
5 Worn or damaged distributor components (Chapter 5).
6 Faulty emission system (Chapter 6).
7 Vacuum leak (check as described in Section 8).

15 Engine 'diesels' (continues to run) after switching off

1 Idle speed too fast (Chapter 1).
2 Electrical solenoid(s) at side of carburetor not functioning properly (not all models, see Chapter 6).
3 Ignition timing incorrectly adjusted (Chapter 1).
4 Air cleaner baffle not operating properly (Chapter 1).
5 Excessive engine operating temperatures. Probable causes of this are malfunctioning thermostat, clogged radiator, faulty water pump (see Chapter 3).

Engine electrical system

16 Battery will not hold a charge

1 Alternator drivebelt defective or not adjusted properly (Chapter 1).
2 Electrolyte level too low or too weak (Chapter 1).
3 Battery terminals loose or corroded (Chapter 1).
4 Alternator not charging properly (Chapter 5).
5 Loose, broken or faulty wiring in the charging circuit (Chapter 5).
6 Short in vehicle circuitry causing a continual drain on battery.
7 Battery defective internally.

17 Charge light fails to go out

1 Fault in alternator or charging circuit (Chapter 5).
2 Alternator drivebelt defective or not properly adjusted (Chapter 1).

18 Charge light fails to come on when key is turned on

1 Warning light bulb faulty (Chapter 10).
2 Alternator faulty (Chapter 5).
3 Fault in the printed circuit, dash wiring or bulb holder (Chapter 10).

Engine fuel system

19 Excessive fuel consumption

1 Dirty or choked air filter element (Chapter 1).
2 Incorrectly set ignition timing (Chapter 1).
3 Choke sticking or improperly adjusted (Chapter 1).
4 Emission system not functioning properly (Chapter 6).
5 Carburetor idle speed and/or mixture not adjusted properly (Chapter 1).
6 Carburetor internal parts are excessively worn or damaged (Chapter 4).
7 Low tire pressure or incorrect tire size (Chapter 1).

20 Fuel leakage and/or fuel odor

1 Leak in a fuel feed or vent line (Chapter 4).
2 Tank overfilled. Fill only to automatic shut-off.
3 ECS canister faulty (Chapter 1).
4 Vapor leaks from system lines (Chapter 4).

5 Carburetor internal parts excessively worn or out of adjustment (Chapter 4).

Engine cooling system

21 Overheating

1 Insufficient coolant in system (Chapter 1).
2 Radiator core blocked or radiator grille dirty and restricted (Chapter 3).
3 Thermostat faulty (Chapter 3).
4 Electric cooling fan inoperative (Chapter 3).
5 Radiator cap not maintaining proper pressure. Have cap pressure tested by gas station or repair shop.
6 Ignition timing incorrect (Chapter 1).

22 Overcooling

1 Thermostat faulty (Chapter 3).
2 Inaccurate temperature gauge or sensing unit (Chapter 10).

23 External coolant leakage

1 Deteriorated or damaged hoses. Loose clamps at hose connections (Chapter 1).
2 Water pump seals defective. If this is the case, water will drip from the 'weep' hole in the water pump body (Chapter 3).
3 Leakage from radiator core or header tank. This will require the radiator to be professionally repaired (see Chapter 3 for removal procedures).
4 Engine drain plugs or water jacket freeze plugs leaking (see Chapters 1 and 3).

24 Internal coolant leakage

Note: *Internal coolant leaks can usually be detected by examining the oil. Check the dipstick and inside of rocker arm covers for water deposits and an oil consistency like that of a milkshake.*
1 Faulty cylinder head gasket. Have the system pressure-tested or remove the cylinder head (Chapter 2) and inspect.
2 Cracked cylinder bore or cylinder head. Dismantle engine and inspect (Chapter 2).

25 Coolant loss

1 Overfilling system (Chapter 1).
2 Coolant boiling due to overheating (see causes in Section 21).
3 Internal or external leakage (see Sections 23 and 24).
4 Faulty radiator cap. Have the cap pressure tested.

26 Poor coolant circulation

1 Inoperative water pump. A quick test is to pinch the top radiator hose closed with your hand while the engine is idling, then let it loose. You should feel a surge of coolant if the pump is working properly (Chapter 3).
2 Restriction in cooling system. Drain, flush and refill the system (Chapter 1). If it appears necessary, remove the radiator (Chapter 3) and have it reverse-flushed or professionally cleaned.
3 Water pump drivebelt defective or out of adjustment (Chapter 1).
4 Thermostat sticking (Chapter 3).

Clutch

27 Fails to release (pedal pressed to the floor – shift lever does not move freely in and out of gear)

1 Improper free play adjustment (Chapter 1).
2 Clutch disc warped, bent or excessively damaged (Chapter 8).

28 Clutch slips (engine speed increase with no increase in vehicle speed)

1 Clutch cable in need of adjustment (Chapter 1).
2 Clutch disc oil soaked or facing worn. Remove disc (Chapter 8) and inspect.
3 Clutch disc not seated. It may take 30 or 40 normal starts for a new disc to seat.

29 Grabbing (chattering) on take-up

1 Oil on clutch disc. Remove disc (Chapter 8) and inspect. Correct any leakage source.
2 Worn or loose engine or transmission mounts. These units may move slightly when clutch is released. Inspect mounts and bolts.
3 Worn splines on clutch disc. Remove clutch components (Chapter 8) and inspect.
4 Warped pressure plate or flywheel. Remove clutch components and inspect.

30 Squeal or rumble with clutch fully engaged (pedal released)

1 Improper adjustment; no free play (Chapter 1).
2 Release bearing binding on transmission bearing retainer. Remove clutch components (Chapter 8) and check bearing. Remove any burrs or nicks, clean and relubricate before reinstallation.
3 Weak pedal return spring. Replace the spring.

31 Squeal or rumble with clutch fully disengaged (pedal depressed)

1 Worn, faulty or broken release bearing (Chapter 8).
2 Worn or broken pressure plate springs (or diaphragm fingers) (Chapter 8).

32 Clutch pedal stays on floor when disengaged

1 Bind in cable or release bearing. Inspect cable or remove clutch components as necessary.
2 Clutch pressure plate weak or broken. Remove and inspect clutch pressure plate (Chapter 8).

Manual transmission

Note: *All the Sections referred to here are contained within Chapter 7 unless noted.*

33 Noisy in Neutral with engine running

1 Mainshaft bearing worn.
2 Damaged pinion shaft bearing.

34 Noisy in all gears

1 Any of the above causes, and/or:
2 Insufficient lubricant (see checking procedures in Chapter 1).

35 Noisy in one particular gear

1 Worn, damaged or chipped gear teeth for that particular gear.
2 Worn or damaged synchronizer for that particular gear.

36 Slips out of high gear

1 Transmission mounting bolts loose.
2 Shift mechanism not working freely.
3 Damaged pilot bearing.
4 Dirt between transmission housing and engine or misalignment of transmission.
5 Worn or improperly adjusted linkage.

37 Difficulty in engaging gears

1 Clutch not releasing (see clutch adjustment, Chapter 1).
2 Loose, damaged or maladjusted shift linkage. Make a thorough inspection, replacing parts as necessary. Adjust as described in Chapter 8.

38 Oil leakage

1 Excessive amount of lubricant in transmission (see Chapter 1 for correct checking procedures). Drain lubricant as required.
2 Drive axle oil seals defective.
3 Rear oil seal or speedometer oil seal in need of replacement.

Automatic transmission

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

39 Fluid leakage

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

a) Fluid pan: tighten mounting bolts and/or replace pan gasket as necessary (see Chapter 7)
b) Rear cover: tighten bolts and/or replace oil seal as necessary (Chapter 7)
c) Filler pipe: replace the rubber oil seal where pipe enters transmission case
d) Transmission fluid cooler lines: tighten connectors where lines enter transmission case and/or replace lines
e) Vent pipe: transmission over-filled and/or water in fluid (see checking procedures, Chapter 1)
f) Speedometer connector: replace the O-ring where speedometer cable enters transmission case

40 General shift mechanism problems

Chapter 7 deals with checking and adjusting the shift linkage on automatic transmissions. Common problems which may be attributed to out-of-adjustment linkage are:

a) Engine-starting in gears other than P (Park) or N (Neutral)
b) Indicator pointing to a gear other than the one the transmission is actually in
c) Vehicle will not hold firm when in P (Park) position

41 Transmission will not downshift with the accelerator pedal pressed to the floor

1 Disconnected or damaged vacuum hose between intake manifold and vacuum diaphragm on transmission.
2 Faulty vacuum control diaphragm.

42 Engine will start in gears other than P (Park) or N (Neutral)

Chapter 7 deals with checking the Neutral switch used with automatic transmissions.

43 Transmission slips, shifts rough, is noisy or has no drive in forward or reverse gears

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

Driveshaft (4WD vehicles)

44 Leakage of fluid at front of driveshaft

Defective transmission rear oil seal. See Chapter 7 for replacing procedures. While this is done, check the splined yoke for burrs or a rough condition which may be damaging the seal. If found, these can be dressed with crocus cloth or a fine whetstone.

45 Knock or clunk when the transmission is under initial load (just after transmission is put into gear)

1 Loose or disconnected rear suspension components. Check all mounting bolts and bushings (Chapters 1 and 11).
2 Loose driveshaft bolts. Inspect all bolts and nuts and tighten to the specified torque.
3 Worn or damaged universal joint bearings. Replace bearings (Chapter 8).
4 Worn sleeve yoke and mainshaft splines (Chapter 8).

46 Metallic grating sound consistent with vehicle speed

Pronounced wear in the universal joint bearings. Replace bearings (Chapter 8).

47 Vibration

Note: *Before it can be assumed that the driveshaft is at fault, make sure the tires are perfectly balanced and perform the following test.*
1 Install a tachometer inside the vehicle to monitor engine speed as it is driven. Drive the vehicle and note the engine speed at which the vibration (roughness) is most pronounced. Now shift the transmission to a different gear and bring the engine speed to the same point.
2 If the vibration occurs at the same engine speed (rpm) regardless of which gear the transmission is in, the driveshaft is NOT at fault since the driveshaft speed varies.
3 If the vibration decreases or is eliminated when the transmission is in a different gear at the same engine speed, refer to the following probable causes.
4 Bent or dented driveshaft. Inspect and replace as necessary (Chapter 8).
5 Undercoating or built-up dirt, etc. on the driveshaft. Clean the shaft thoroughly and test.
6 Worn universal joint bearings (Chapter 8).

Front differential

48 Gear noise when driving

If noise increases as vehicle speed increases, it may be due to insufficient gear oil (Chapter 1), incorrect gear engagement or damaged gears. Remove the transmission/differential unit and have it checked and repaired by a Subaru dealer service department.

49 Gear noise when coasting

Damaged gears caused by bearings and shims that are worn or out of adjustment (see Section 48).

50 Bearing noise

Usually caused by cracked, broken or otherwise damaged bearings (see Section 48).

51 Noise when turning

Damaged or worn differential side gear, pinion gear or pinion shaft (see Section 48).

Rear differential (4WD vehicles)

52 Oil leakage

1 Worn, scratched or incorrectly installed pinion seal or axleshaft oil seal.
2 Scored or excessively worn sliding surface of companion flange.
3 Clogged breather.
4 Loose side bearing retainer bolts or damaged O-ring (Chapter 8).
5 Loose rear cover attaching bolts or damaged gasket.
6 Loose oil fill or drain plug.

53 Noise when starting or shifting gears

1 Excessive gear backlash.
2 Insufficient bearing preload.
3 Loose drive pinion nut.
4 Loose side bearing retainer bolts (see Chapter 8).

54 Noise when turning

1 Damaged or worn side gears or bearings.
2 Broken or seized spider gear shaft.
3 Excessively worn side gear thrust washer.
4 Broken teeth on differential hypoid gears.

Axleshafts

55 Clicking noise in turns

Worn or damaged outboard CV joint. Check for cut or damaged boots. Repair as necessary (Chapter 8).

56 Knock or clunk when accelerating after coasting

Worn or damaged inboard joint. Check for cut or damaged boots. Repair as necessary (Chapter 8).

57 Shudder or vibration during acceleration

1 Excessive joint angle. Check and correct as necessary (Chapter 8).
2 Worn or damaged inboard or outboard joints. Repair or replace as necessary (Chapter 8).
3 Sticking inboard joint assembly. Correct or replace as necessary (Chapter 8).

Brakes

Note: *Before assuming that a brake problem exists, make sure that the tires are in good condition and inflated properly (see Chapter 1), the front end alignment is correct (see Chapter 11) and that the vehicle is not loaded with weight in an unequal manner.*

58 Vehicle pulls to one side during braking

1 Defective, damaged or oil-contaminated disc pad on one side. Inspect as described in Chapter 1. Refer to Chapter 9 if replacement is required.
2 Excessive wear of brake pad material or disc on one side. Inspect and correct as necessary.
3 Loose or disconnected front suspension components. Inspect and tighten all bolts to the specified torque (Chapter 11).
4 Defective caliper assembly. Remove caliper and inspect for stuck piston or damage (Chapter 9).

59 Noise (high-pitched squeal without brake applied)

Front brake pads worn out. This noise comes from the wear sensor or pad backing plate rubbing against the disc. Replace pads with new ones immediately (Chapter 9).

60 Excessive brake pedal travel

1 Partial brake system failure. Inspect entire system (Chapter 1) and correct as required.
2 Insufficient fluid in master cylinder. Check (Chapter 1), add fluid and bleed system if necessary (Chapter 9).
3 Rear brakes not adjusting properly. Make a series of starts and stops while the vehicle is in Reverse. If this does not correct the situation, remove drums and inspect self-adjusters (Chapter 9).

61 Brake pedal feels spongy when depressed

1 Air in hydraulic lines. Bleed the brake system (Chapter 9).
2 Faulty flexible hoses. Inspect all system hoses and lines. Replace parts as necessary.
3 Master cylinder mount loose. Inspect master cylinder bolts (nuts) and tighten to the specified torque.
4 Master cylinder faulty (Chapter 9).

62 Excessive effort required to stop vehicle

1 Power brake booster not operating properly (Chapter 9).
2 Excessively worn linings or pads. Inspect and replace if necessary (Chapter 1).
3 One or more caliper pistons (front wheels) or wheel cylinders (rear wheels) seized. Inspect and rebuild as required (Chapter 9).
4 Brake linings or pads contaminated with oil or grease. Inspect and replace as required (Chapter 1).
5 New pads or linings installed and not yet seated. It will take a while for the new material to seat against the drum (or rotor).

63 Pedal travels to floor with little resistance

Little or no fluid in the master cylinder reservoir (caused by leaking wheel cylinder(s), leaking caliper piston(s), loose, damaged or disconnected brake lines). Inspect entire system and correct as necessary.

64 Brake pedal pulsates during brake application

1 Wheel bearings not adjusted properly or in need of replacement (Chapter 1).
2 Caliper not sliding properly due to improper installation or obstructions. Remove and inspect (Chapter 9).
3 Rotor not within specifications. Remove the rotor (Chapter 9) and check for excessive lateral run-out and parallelism. Have the rotor machined or replace it with a new one.
4 Out-of-round rear brake drums. Remove the drums (Chapter 9) and have them machined, or replace them.

65 Hill-holder fails to hold

1 Incline of hill may be too gentle to activate holder.
2 Pressure holder valve in need of adjustment (Chapter 9).

Suspension and steering

66 Excessive tire wear (not specific to one area)

1 Incorrect tire pressures (Chapter 1).
2 Tires out of balance. Have professionally balanced.
3 Wheel damaged. Inspect and replace as necessary.
4 Suspension or steering components excessively worn (Chapter 1).

67 Excessive tire wear on outside edge

1 Inflation pressures not correct (Chapter 1).
2 Excessive speed on turns.
3 Front end alignment incorrect (excessive toe-in). Have professionally aligned (Chapter 11).
4 Suspension arm bent or twisted.

68 Excessive tire wear on inside edge

1 Inflation pressures incorrect (Chapter 1).
2 Front end alignment incorrect (toe-out). Have professionally aligned (Chapter 11).
3 Loose or damaged steering components (Chapter 1).

69 Tire tread worn in one place

1 Tires out of balance. Balance tires professionally.
2 Damaged or buckled wheel. Inspect and replace if necessary.
3 Defective tire.

70 General vibration at highway speeds

1 Out-of-balance front wheels or tires. Have them professionally balanced.
2 Front or rear wheel bearings loose or worn. Check (Chapter 1) and replace as necessary (Chapter 11).
3 Defective tire or wheel. Have them checked and replaced if necessary.

71 Noise – whether coasting or in drive

1 Road noise. No corrective procedures available.
2 Tire noise. Inspect tires and tire pressures (Chapter 1).
3 Front wheel bearings loose, worn or damaged. Check (Chapter 1) and replace if necessary (Chapter 11).
4 Lack of lubrication in the balljoints or tie-rod ends (Chapter 1).
5 Damaged shock absorbers or mounts (Chapter 1).
6 Loose road wheel lug nuts. Check and tighten as necessary (Chapter 11).

72 Vehicle pulls to one side

1 Tire pressures uneven (Chapter 1).
2 Defective tire (Chapter 1).
3 Excessive wear in suspension or steering components (Chapter 1).
4 Front end in need of alignment (Chapter 11).
5 Front brakes dragging. Inspect brakes as described in Chapter 1.

73 Shimmy, shake or vibration

1 Tire or wheel out of balance or out of round. Have professionally balanced.
2 Loose or worn wheel bearings (Chapter 1). Replace as necessary (Chapter 11).
3 Shock absorbers and/or suspension components worn or damaged (Chapter 11).

74 Excessive pitching and/or rolling around corners or during braking

1 Defective shock absorbers. Replace as a set (Chapter 11).
2 Broken or weak coil springs and/or suspension components. Inspect as described in Chapter 11.

75 Excessively stiff steering

1 Lack of fluid in power steering fluid reservoir (Chapter 1).
2 Incorrect tire pressures (Chapter 1).
3 Lack of lubrication at balljoints (Chapter 1).
4 Front end out of alignment.
5 Rack and pinion out of adjustment or lacking lubrication.
6 See also Section 77.

76 Excessive play in steering

1 Loose wheel bearings (Chapter 1).
2 Excessive wear in suspension or steering components (Chapter 1).
3 Rack and pinion out of adjustment (Chapter 11).

77 Lack of power assistance

1 Steering pump drivebelt faulty, broken or not adjusted properly (Chapter 1).
2 Fluid level low (Chapter 1).
3 Hoses or lines restricting the flow. Inspect and replace parts as necessary.
4 Air in power steering system. Bleed system (Chapter 11).

Chapter 1 Tune-up and routine maintenance

Refer to Chapter 13 for specifications and information applicable to 1984 thru 1988 models

Contents

Specifications

Recommended lubricants, fluids and capacities

Engine oil type	Grade SE
Engine oil viscosity	
0° to 30°F (–18° to 0°C)	10W-30
30° to 60°F (0° to 16°C)	10W-40 or 20W-40
60° to 90°F (16° to 32°C)	10W-50 or 20W-50
Engine oil capacity	
1600 cc engine	3.7 qt (3.5 liters)
1800 cc engine	4.2 qt (4.0 liters)
Coolant	
Type	Ethylene glycol
Capacity	
1600 cc engine	5.6 qt (5.3 liters)
1800 cc engine	5.8 qt (5.5 liters)
Radiator only	2.0 qt (1.9 liters)
Brake fluid type	DOT 3
Manual transmission and differential lubricant type/viscosity	
–30° to 90°F (–34° to 32°C)	GL-5, 80W
–30° to above 90°F (–34° to above 32°C)	GL-5, 85W
30° to above 90°F (0° to above 32°C)	GL-5, 90W
Automatic transmission fluid type	ATF Dexron
Power steering fluid type	ATF Dexron

Radiator cap opening pressure ..... 13 ± 1.4 psi (88 ± 10 KPa)

Drivebelt deflection (tension)

Alternator and water pump	0.51 to 0.55 in (13 to 14 mm)
Power steering pump	0.59 to 0.79 in (15 to 20 mm)
Air conditioner	0.47 to 0.59 in (12 to 15 mm)

Engine idle speed

USA models	
1980	
Hatchback STD, DL, Sedan DL and Hardtop DL	800 ± 50 rpm
All others	900 ± 50 rpm
1981	
California	900 ± 50 rpm
All others	850 ± 50 rpm
1982 and 1983	
Automatic transmission	800 ± 100 rpm
Manual transmission	700 ± 100 rpm
UK models	800 ± 50 rpm

Ignition system

Spark plug type	
USA models	
NGK	BPR6ES-11
ND	W20EPR-U11
Champion	RN9YC-4
UK models	
NGK	BP6ES
ND	W20EP
Hitachi	L45PW
Spark plug gap	
1980 USA models and all UK models	0.028 to 0.035 in (0.7 to 0.9 mm)
1981 through 1983 USA models	0.039 to 0.043 in (1.0 to 1.1 mm)
Breaker point gap	0.018 to 0.022 in (0.45 to 0.55 mm)
Dwell angle	49° to 55°
Ignition timing	See Emission Control Information label
Firing order	1-3-2-4

Battery electrolyte specific gravity at 68°F (20°C)

Full charge	1.280
¾ charge	1.250
½ charge	1.220
¼ charge	1.190

Brakes

Front disc brake pad thickness (including metal backing plate)	
Standard	0.59 in (15 mm)
Service limit	0.295 in (7.5 mm)
Disc thickness (solid disc)	
Standard	0.492 in (12.5 mm)
Service limit	0.390 in (10 mm)
Disc thickness (vented disc)	
Standard	0.710 in (18 mm)
Service limit	0.610 in (15.5 mm)
Maximum disc runout	0.0039 in (0.10 mm)
Rear brake shoe lining thickness (including metal plate)	
Standard	0.200 in (5 mm)
Service limit	0.059 in (1.5 mm)
Brake drum inside diameter	
Standard	7.09 in (180 mm)
Service limit	7.17 in (182 mm)
Parking brake lever stroke	3 to 4 notches

Compression pressure

1980 US models	156 psi
1981 through 1983 US models	170 to 175 psi
1600 cc UK models	156 psi
1800 cc UK models	164 psi

Valve clearances (engine COLD)

Intake	0.010 in (0.25 mm)
Exhaust	0.014 in (0.35 mm)

Pedal free play

Accelerator pedal	0 to 0.20 in (0 to 5 mm)
Clutch pedal	0.5 to 0.8 in (13 to 20 mm)
Brake pedal	0.20 to 0.43 in (5 to 11 mm)

Torque specifications

	Ft-lb	Nm
Engine oil drain plug	18	25
Spark plug	13 to 17	18 to 24
Valve locknut	10 to 13	14 to 18

	Ft-lb	Nm
Rocker arm cover bolt	2 to 3	3 to 4
PCV valve	17 to 20	23 to 26
Cylinder head nut/bolt	47	64
Intake manifold bolt	13 to 16	18 to 22
Manual transmission drain plug	33	44
Automatic transmission drain plug	18	25
Automatic transmission differential drain plug	18	25
Idler pulley lock bolt	14 to 22	20 to 29
Tension pulley bracket bolt	17 to 29	24 to 39
Wheel lug nut	58 to 72	78 to 98

1 Introduction to routine maintenance

This Chapter was designed to help the home mechanic maintain his (or her) vehicle for peak performance, economy, safety and long life.

On the following pages you will find a maintenance schedule along with Sections which deal specifically with each item on the schedule. Included are visual checks, adjustments and item replacements.

Servicing your vehicle using the time/mileage maintenance schedule and the sequenced Sections will give you a planned program of maintenance. Keep in mind that it is a full plan, and maintaining only a few items at the specified intervals will not give you the same results.

You will find as you service your vehicle that many of the procedures can, and should be grouped together, due to the nature of the job at hand. Examples of this are as follows:

If the vehicle is fully raised for a chassis inspection, this is the ideal time for the following checks: manual transmission fluid, exhaust system, suspension, steering and the fuel system.

If the tires and wheels are removed, as during a routine tire rotation, go ahead and check the brakes and wheel bearings at the same time.

If you must borrow or rent a torque wrench, it is a good idea to service the spark plugs and/or repack (or replace) the wheel bearings all in the same day to save time and money.

The first step of this or any maintenance plan is to prepare yourself before the actual work begins. Read through the appropriate Sections for all work that is to be performed before you begin. Gather together all necessary parts and tools. If it appears you could have a problem during a particular job, don't hesitate to ask advice from your local parts man or dealer service department.

2 Tune-up sequence

The term 'tune-up' is loosely used for any general operation that puts the engine back in its proper running condition. A tune-up is not a specific operation, but rather a combination of individual operations, such as replacing the spark plugs, adjusting the idle speed, setting the ignition timing, etc.

If, from the time the vehicle is new, the routine maintenance schedule (Section 3) is followed closely and frequent checks are made of fluid levels and high wear items, as suggested throughout this manual, the engine will be kept in relatively good running condition and the need for additional tune-ups will be minimized.

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

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

Minor tune-up

Clean, inspect and test battery (Sec 27)
Check all engine-related fluids (Sec 4)
Test engine compression (Sec 41)
Check and adjust drivebelts (Sec 11)
Replace spark plugs (Sec 18)
Inspect distributor cap and rotor (Sec 19)
Replace breaker points (Sec 49)
Check/adjust breaker point gap and dwell (Sec 49)
Inspect spark plug and coil wires (Sec 19)
Check and adjust idle speed (Sec 17)
Check and adjust timing (Sec 20)
Check and adjust fuel/air mixture (Sec 17)
Replace fuel filter (Sec 15)
Replace PCV valve (Sec 23)
Adjust valve clearances (Sec 42)
Check cooling system (Sec 9)

Major tune-up

(the above operations and those listed below)
Check vacuum advance system (Chapter 5)
Check EGR system (Chapter 6)
Test alternator and regulator (Chapter 5)
Test ignition system (Chapter 5)
Test charging system (Chapter 5)
Check fuel system (Chapter 4)

3 Routine maintenance intervals

Note: *The following maintenance intervals are recommended by the manufacturer. In the interest of vehicle longevity, we recommend shorter intervals on certain operations such as fluid, lubricant and filter replacements. Please note that the following schedule is divided into sections indicating specific odometer readings and time periods from when the vehicle was new. If the vehicle was purchased second-hand, every effort should be made to obtain maintenance history from the original owner.*

At 1000 miles (1600 Km)

Check intake and exhaust valve clearances (Sec 42)
Adjust drivebelts (Sec 11)
Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Retighten cylinder head nuts and intake manifold bolts (Sec 47)
Check engine idle speed (Sec 17)
Check fuel/air mixture (UK only) (Sec 17)
Check ignition timing (UK only) (Sec 20)
Inspect brake system for leaks and damage (Sec 28)
Adjust clutch pedal and cable (Sec 43)
Adjust Hill-holder components (Sec 33)
Inspect power steering and suspension systems (Sec 34)
Tighten wheel lug nuts (Sec 47)

At 6000 miles (10 000 Km) or 6 months

Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check and adjust contact breaker points and lubricate point cam (UK only) (Sec 49)
Check automatic transmission differential oil (Sec 5)
Inspect disc brake pad and disc (Sec 31)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)

At 12 000 miles (20 000 Km) or 12 months

Check intake and exhaust valve clearances (Sec 42)
Inspect drivebelts (Sec 11)

Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check engine coolant (Sec 4)
Check idle speed and fuel/air mixture (UK only) (Sec 17)
Check choke operation (Sec 16)
Replace fuel filter (Sec 15)
Inspect the air cleaner and PCV filter elements (UK only) (Sec 14)
Check and adjust the ignition timing (UK only) (Sec 20)
Replace the contact breaker points and condenser (UK only) (Sec 49)
Check the distributor cap and rotor (UK only) (Sec 19)
Replace the spark plugs (UK only) (Sec 18)
Check the EGR system (Chapter 6)
Check manual transmission oil (Sec 5)
Check automatic transmission fluid (Sec 5)
Check automatic transmission differential oil (Sec 5)
Check rear differential oil (Sec 5)
Inspect disc brake pad and disc (Sec 31)
Inspect brake system for leaks and damage (Sec 28)
Inspect parking brake and cable (Sec 28)
Check brake vacuum booster operation (Sec 30)
Lubricate front disc caliper (Sec 29)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)
Inspect suspension system (Sec 34)
Tighten wheel lug nuts (Sec 47)
Lubricate door, hood and trunk lid hinges and locks (Sec 48)

At 18 000 miles (30 000 Km) or 18 months

Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check and adjust contact breaker points and lubricate point cam (UK only) (Sec 49)
Check automatic transmission differential oil (Sec 5)
Inspect disc brake pad and disc (Sec 31)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)

At 24 000 miles (40 000 Km) or 24 months

Check intake and exhaust valve clearances (Sec 42)
Inspect drivebelts (Sec 11)
Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Replace engine coolant (Sec 6)
Inspect cooling system (Sec 9)
Check idle speed and fuel/air mixture (UK only) (Sec 17)
Lubricate choke mechanism (Sec 16)
Replace fuel filter (Sec 15)
Inspect fuel and evaporative emission system hoses (Sec 13)
Replace air cleaner and PCV filter elements (Sec 14)
Check and adjust ignition timing (UK only) (Sec 20)
Replace spark plugs (UK only) (Sec 18)
Replace the contact breaker points and condenser (UK only) (Sec 49)
Check the distributor cap and rotor (UK only) (Sec 19)
Check the EGR system (Sec 25)
Replace the PCV valve (Sec 23)
Replace manual transmission oil (Sec 6)
Replace automatic transmission fluid (Sec 6)
Replace automatic transmission differential oil (Sec 6)
Inspect disc brake pad and disc (Sec 31)
Inspect drum brake shoes and drum (Sec 32)
Inspect brake system for leaks and damage (Sec 28)
Inspect parking brake and cable (Sec 28)
Replace brake cylinder cups and seals (Sec 29)
Check brake vacuum booster operation (Sec 30)
Lubricate front disc caliper (Sec 29)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)
Inspect suspension system (Sec 34)
Check grease in front and rear wheel bearings (Sec 35)
Check wheel alignment (Sec 39)
Tighten wheel lug nuts (Sec 47)
Check headlight aim (Sec 45)
Lubricate door, hood and trunk lid hinges and locks (Sec 48)

At 30 000 miles (50 000 Km) or 30 months

Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check and adjust contact breaker points and lubricate point cam (UK only) (Sec 49)
Check automatic transmission differential oil (Sec 5)
Replace spark plugs (Sec 18)
Inspect disc brake pad and disc (Sec 31)
Inspect clutch cable pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)

At 36 000 miles (60 000 Km) or 36 months

Check intake and exhaust valve clearances (Sec 42)
Inspect drivebelts (Sec 11)
Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check engine coolant (Sec 4)
Check idle speed and fuel/air mixture (UK only) (Sec 17)
Check choke operation (Sec 16)
Replace fuel filter (Sec 15)
Inspect the air cleaner and PCV filter elements (UK only) (Sec 14)
Check and adjust the ignition timing (UK only) (Sec 20)
Replace the contact breaker points and condenser (UK only) (Sec 49)
Check the distributor cap and rotor (UK only) (Sec 19)
Replace the spark plugs (UK only) (Sec 18)
Check the EGR system (Sec 25)
Check manual transmission oil (Sec 5)
Check automatic transmission fluid (Sec 5)
Check automatic transmission differential oil (Sec 5)
Check rear differential oil (Sec 5)
Inspect disc brake pad and disc (Sec 31)
Inspect brake system for leaks and damage (Sec 28)
Inspect parking brake and cable (Sec 28)
Check brake vacuum booster operation (Sec 30)
Lubricate front disc caliper (Sec 29)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)
Inspect power steering system (Sec 34)
Inspect suspension system (Sec 34)
Tighten wheel lug nuts (Sec 47)
Lubricate door, hood and trunk lid hinges and locks (Sec 48)

At 42 000 miles (70 000 Km) or 42 months

Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check and adjust contact breaker points and lubricate point cam (UK only) (Sec 49)
Check automatic transmission differential oil (Sec 5)
Inspect disc brake pads and disc (Sec 31)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)

At 48 000 miles (80 000 Km) or 48 months

Check intake and exhaust valve clearances (Sec 42)
Inspect drivebelts (Sec 11)
Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Replace engine coolant (Sec 6)
Replace the power steering fluid (Sec 7)
Inspect cooling system (Sec 9)

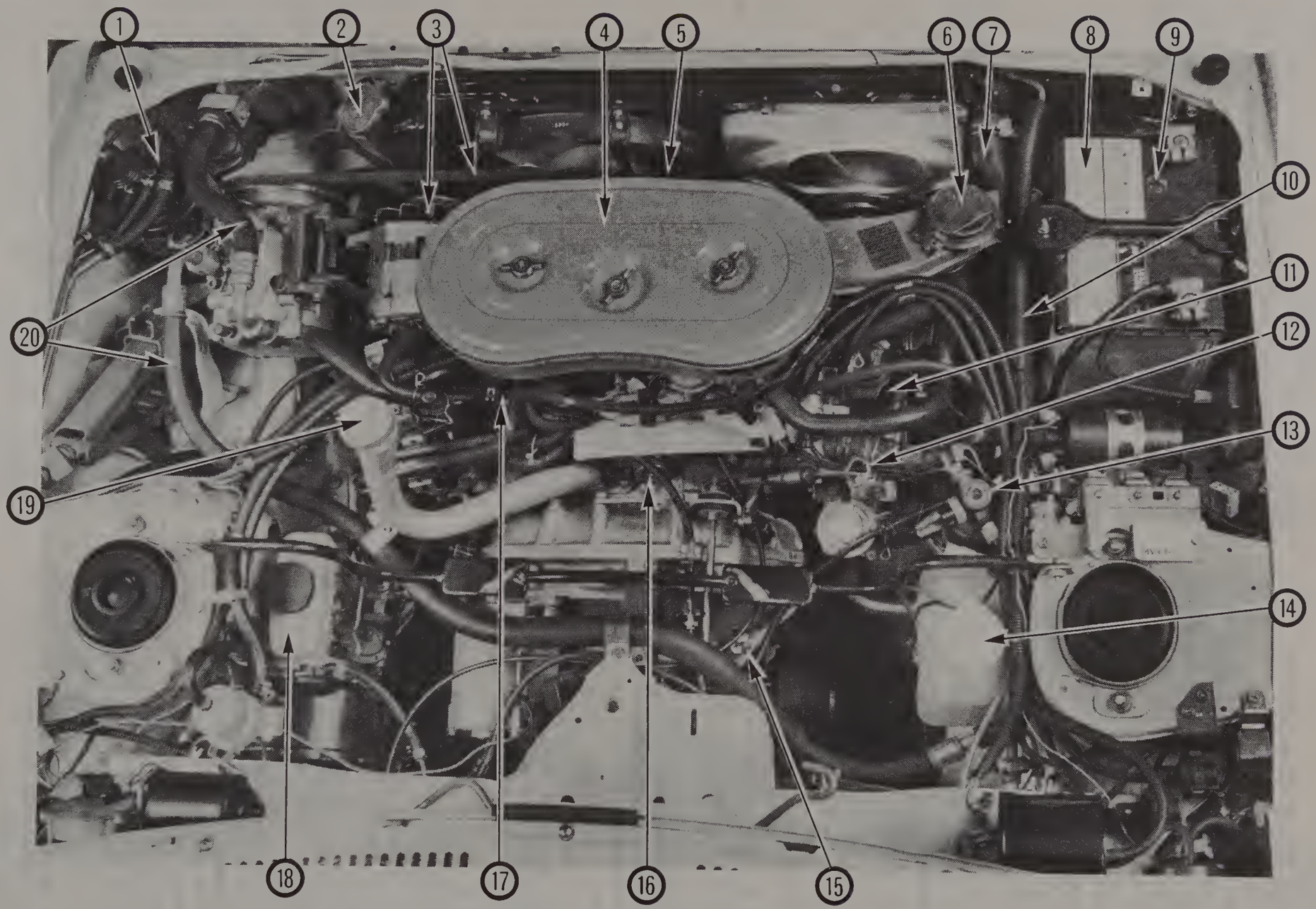


Fig. 1.1 Engine compartment component layout (typical)

1 *ECS canister*
2 *Radiator cap*
3 *Drivebelts*
4 *Air cleaner housing*
5 *Distributor (under air cleaner)*
6 *Hot air intake system baffle motor*
7 *Upper radiator hose*
8 *Battery*
9 *Built-in hydrometer (not all models)*
10 *Air conditioner line*
11 *Spark plug wire(s)*
12 *Engine oil level dipstick*
13 *Air conditioning system sight glass*
14 *Windshield washer fluid reservoir*
15 *Manual transmission and differential oil level dipstick*
16 *EGR valve*
17 *Purge check valve*
18 *Brake fluid reservoir*
19 *Oil filler cap and tube*
20 *Air conditioner hoses*

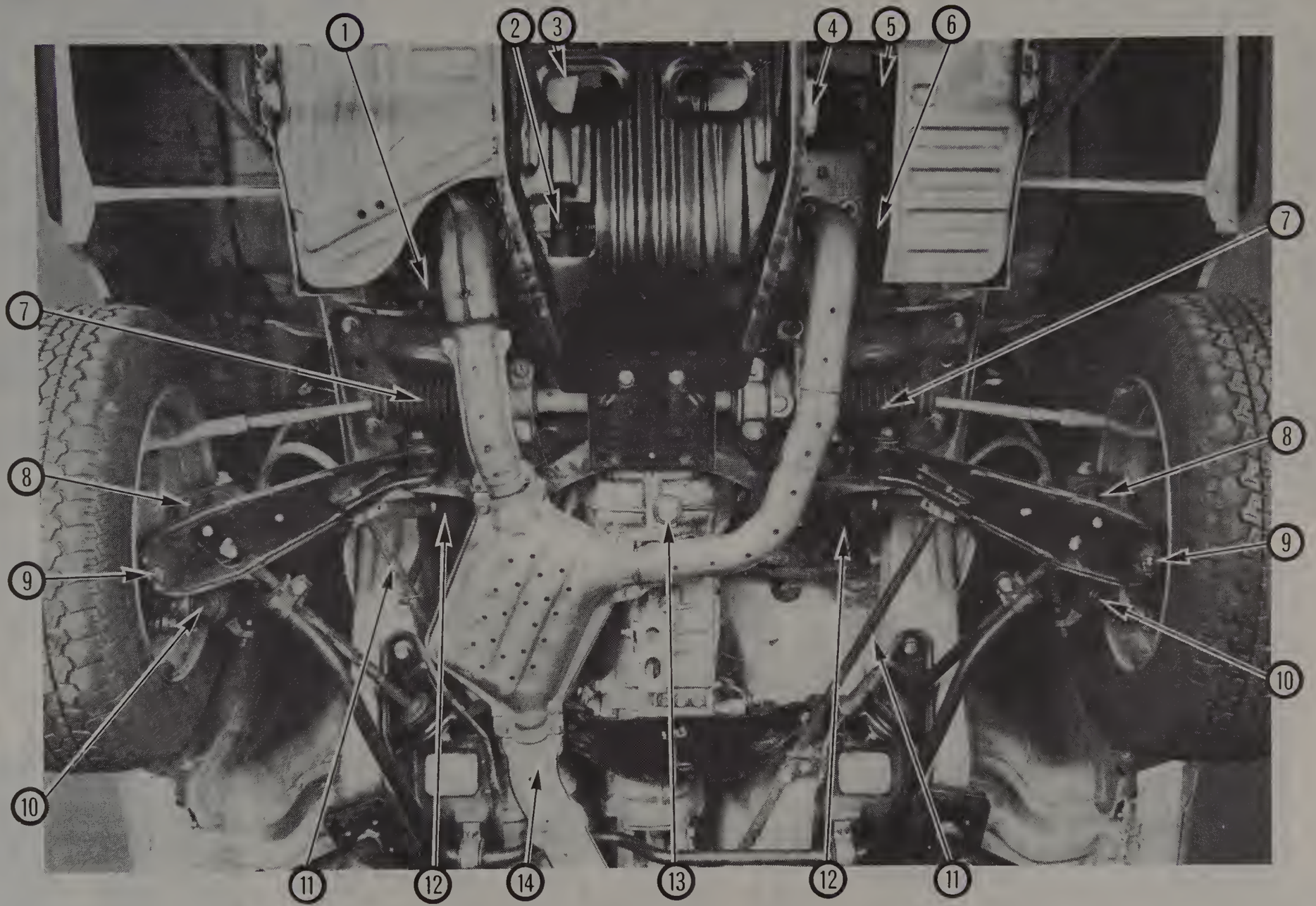


Fig. 1.2 Engine compartment bottom side (typical)

1 *Rocker arm cover (right)*
2 *Engine oil drain plug*
3 *Skidplate (4WD vehicles)*
4 *Oil filter*
5 *Lower radiator hose*
6 *Rocker arm cover (left)*
7 *Steering gearbox rubber boots*
8 *Axleshaft outer boots*
9 *Suspension balljoints*
10 *Hill-holder mechanism*
11 *Hill-holder cable*
12 *Axleshaft inner boots*
13 *Manual transmission/ differential lubricant drain plug*
14 *Exhaust pipe*

Check idle speed and fuel/air mixture (UK only) (Sec 17)
Lubricate choke mechanism (Sec 16)
Replace fuel filter (Sec 15)
Inspect fuel and evaporative system hoses (Sec 13)
Replace air cleaner and PCV filter elements (Sec 14)
Check and adjust ignition timing (UK only) (Sec 20)
Replace the spark plugs (UK only) (Sec 18)
Replace the contact breaker points and condenser (UK only) (Sec 49)
Check the distributor cap and rotor (UK only) (Sec 19)
Check the EGR system (Sec 25)
Replace the PCV valve (Sec 23)
Replace manual transmission oil (Sec 6)
Replace automatic transmission fluid (Sec 6)
Replace automatic transmission differential oil (Sec 6)
Replace rear differential oil (Sec 6)
Replace brake fluid (Sec 7)
Inspect disc brake pad and disc (Sec 31)
Inspect drum brake shoes and drum (Sec 32)
Inspect brake system for leaks and damage (Sec 28)
Inspect parking brake and cable (Sec 28)
Replace brake cylinder cups and seals (Sec 29)
Lubricate front disc caliper (Sec 29)
Check brake vacuum booster operation (Sec 30)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)
Inspect suspension system (Sec 34)
Check grease in front and rear wheel bearings (Sec 35)
Check wheel alignment (Sec 39)
Tighten wheel lug nuts (Sec 47)
Check headlight aim (Sec 45)
Lubricate door, hood and trunk lid hinges and locks (Sec 48)

At 54 000 miles (90 000 Km) or 54 months

Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check and adjust contact breaker points and lubricate point cam (UK only) (Sec 49)
Check automatic transmission differential oil (Sec 5)
Inspect disc brake pads and disc (Sec 31)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)

At 60 000 miles (100 000 Km) or 60 months

Check intake and exhaust valve clearances (Sec 42)
Inspect drivebelts (Sec 11)
Change engine oil (Sec 8)
Replace engine oil filter (Sec 8)
Check engine coolant (Sec 4)
Check idle speed and fuel/air mixture (UK only) (Sec 17)
Check choke operation (Sec 16)
Replace fuel filter (Sec 15)
Inspect the air cleaner and PCV filter elements (UK only) (Sec 14)
Check and adjust the ignition timing (UK only) (Sec 20)
Replace the contact breaker points and condenser (UK only) (Sec 49)
Check the distributor cap and rotor (UK only) (Sec 19)
Replace the spark plugs (Sec 18)
Check the EGR system (Sec 25)
Check manual transmission oil (Sec 5)
Check automatic transmission fluid (Sec 5)
Check automatic transmission differential oil (Sec 5)
Check rear differential oil (Sec 5)
Replace brake fluid (Sec 7)
Inspect disc brake pad and disc (Sec 31)
Inspect brake system for leaks and damage (Sec 28)
Inspect parking brake and cable (Sec 28)
Check brake vacuum booster operation (Sec 30)
Lubricate front disc caliper (Sec 29)
Inspect clutch pedal and cable (Sec 43)
Inspect Hill-holder components (Sec 33)
Inspect steering and axle boots (Sec 36)
Inspect power steering system (Sec 34)
Tighten wheel lug nuts (Sec 47)
Lubricate door, hood and trunk lid hinges and locks (Sec 48)

Severe operating conditions

Severe operating conditions are defined as:

Frequent short trips or long periods of idling
Driving at sustained high speeds during hot weather (over 90°F, +32°C)
Towing a trailer for long distances
Driving in temperatures below 10°F (–12°C) for 60 or more days
Driving 2000 miles (3200 km) or more per month
Driving on dusty roads

If the vehicle has been operated under severe conditions, follow these maintenance intervals:

Change engine oil and filter every 2000 miles (3200 km) or two months
Clean and regap the spark plugs every 6000 miles (9600 km)
Drain and refill the automatic transmission every 22 500 miles (36 000 km) if the vehicle is driven 2000 or more miles per month
Change the air and fuel filters more frequently

4 Fluid levels – check (weekly)

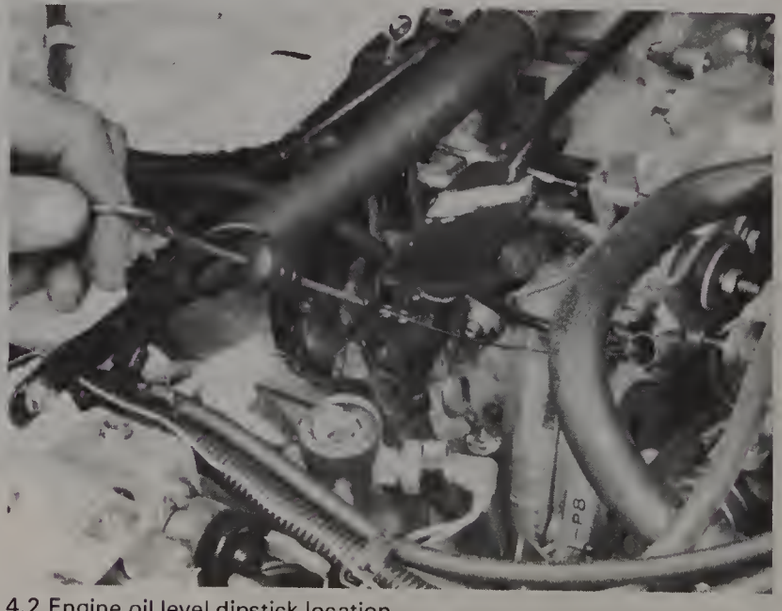
1 There are a number of components on a vehicle which rely on the use of fluids to perform their job. Through the normal operation of the vehicle, these fluids are used up and must be replenished before damage occurs. See *Recommended lubricants and fluids* at the front of this Chapter for the specific fluid to be used when adding is required. When checking fluid levels, it is important to have the vehicle on a level surface.

Engine oil

2 The engine oil level is checked with a dipstick (photo), which is located at the side of the engine block. This dipstick travels through a tube and into the oil pan at the bottom of the engine.

3 The oil level should be checked preferably before the vehicle has been driven, or about 15 minutes after the engine has been shut off. If the oil is checked immediately after driving the vehicle, some of the oil will remain in the upper engine components, thus giving an inaccurate reading on the dipstick.

4 Pull the dipstick from its tube and wipe all the oil from the end with a clean rag. Insert the clean dipstick all the way back into the oil pan and pull it out again. Observe the oil at the end of the dipstick. At its highest point, the level should be between the upper and lower marks.



4.2 Engine oil level dipstick location

5 It takes approximately 1 quart of oil to raise the level from the lower mark to the upper mark on the dipstick. Do not allow the level to drop below the lower mark, as this may cause engine damage due to oil starvation. On the other hand, do not overfill the engine by adding oil above the upper mark, as this may result in oil-fouled spark plugs, oil leaks or oil seal failures.
6 Oil is added to the engine after removing a twist-off cap located on the oil filler tube. An oil can spout or funnel will reduce spills as the oil is poured in.
7 Checking the oil level can also be an important preventative maintenance step. If you find the oil level dropping abnormally, it is an indication of oil leakage or internal engine wear which should be corrected. If there are water droplets in the oil, or if it is milky looking, this also indicates component failure and the engine should be checked immediately. The condition of the oil can also be checked along with the level. With the dipstick removed from the engine, take your thumb and index finger and wipe the oil up the dipstick, looking for small dirt particles or engine filings which will cling to the dipstick. This is an indication that the oil should be drained and fresh oil added (Section 8).

Coolant

8 The coolant level should be checked by removing the radiator cap (photo). *However, the cap should not under any circumstances be removed while the system is hot, as escaping steam could cause serious injury.* Wait until the engine has completely cooled, then wrap a thick cloth around the cap and turn it to its first stop. If any steam escapes from the cap, allow the engine to cool further, then remove the cap and check the level in the radiator. It should be no more than 0.4 in (10 mm) below the level plate.
9 If only a small amount of coolant is required to bring the system up to the proper level, regular water can be used. However, to maintain the proper antifreeze/water mixture in the system, both should be mixed together to replenish a low level. High-quality antifreeze offering protection to −20°F should be mixed with water in the proportion specified on the container. Do not allow antifreeze to come into contact with your skin or painted surfaces of the car. Flush contacted areas immediately with plenty of water. **Caution**: *Antifreeze can be fatal to children and pets. They like it because it is sweet. Just a few licks can cause death. Wipe up garage floor and drip pan coolant drippings immediately. Keep antifreeze containers covered. Repair leaks in your cooling system immediately.*
10 As the coolant level is checked, observe the condition of the coolant. It should be relatively clear. If the fluid is brown or a rust color, this is an indication that the system should be drained, flushed and refilled (Sec 6).
11 If the cooling system requires repeated additions to keep the proper level, have the radiator cap checked for proper sealing ability. Also check for leaks in the system (cracked hoses. loose hose connections, leaking gaskets, etc) (Sec 9).

Windshield washer solvent

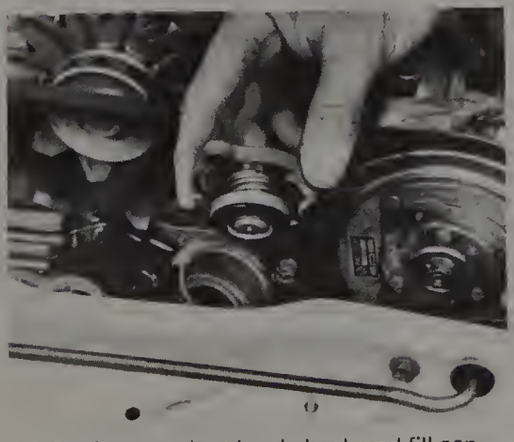
12 The fluid for the windshield washer system is located in a plastic reservoir (photo). The level inside the reservoir should be maintained at the top of the reservoir.
13 A good quality washer solvent should be added to the reservoir whenever replenishing is required. Do not use plain water alone in this system, especially in cold climates where the water could freeze.

Battery electrolyte

Caution *There are certain precautions to be taken when working on or near the battery: a) Never expose a battery to open flame or sparks which could ignite the hydrogen gas given off by it: b) Wear protective clothing and eye protection to reduce the possibility of the corrosive sulfuric acid solution inside the battery harming you (if the fluid is splashed or spilled, flush the contacted area immediately with plenty of water); c) Remove all metal jewelry which could contact the positive terminal and another grounded metal source, thus causing a short circuit; d) Always keep batteries and battery acid out of the reach of children.*
14 Vehicles equipped with 'Freedom' or maintenance-free batteries require no maintenance as the battery case is sealed and has no removable caps for adding water. If a maintenance-type battery is installed, the caps on the top of the battery should be removed periodically to check for a low water level. This check will be more critical during the warm summer months. Some batteries can be checked without removing the caps (see Section 27 for more detailed electrolyte level checking procedures).
15 Remove each of the caps and add distilled water to bring the level of each cell up to the split ring in the filler opening.
16 At the same time the battery water level is checked, the overall condition of the battery and its related components should be inspected. Again, refer to Section 27.

Brake fluid

17 The brake fluid reservoir is located at the side of the engine compartment, just above the fender well (photo).
18 Check that the brake fluid level is between the upper and lower level marks on the reservoir. If it is low, you will have to add brake fluid to bring it up to the proper level.
19 Before removing the cap on the reservoir, use a clean rag to clean all dirt and grease from around the cap area. If any foreign matter enters the reservoir with the cap removed, blockage in the brake system lines can occur. Also, make sure all painted surfaces around the reservoir are covered, as brake fluid will ruin paint.
20 Carefully lift the cap off the cylinder and set it aside, taking care not to set it on a painted surface.
21 Carefully pour the specified brake fluid into the reservoir to bring it up to the proper level. Be careful not to spill the fluid on painted surfaces. Be sure the specified fluid is used, as mixing different types of brake fluid can cause damage to the system (see *Recommended lubricants and fluids* or your owner's manual). **Note**: *Change the brake fluid every two years (24 000 miles) as described in Section 7.*
22 At this time, the fluid and reservoir can be inspected for contamination. If rust deposits, dirt particles or water droplets are seen in the fluid, the system should be dismantled, drained and refilled with fresh fluid.
23 Reinstall the reservoir cap. Make sure it is properly seated to prevent fluid leakage and/or system pressure loss.
24 The brake fluid in the reservoir will drop slightly as the brake shoes or pads at each wheel wear down during normal operation. If it requires repeated replenishing to keep it at the proper level, this is an indication of leakage in the brake system which should be corrected immediately (Section 28).



4.8 Radiator coolant level check and fill cap

4.12 Windshield washer fluid reservoir

4.17 Brake fluid reservoir

25 If upon checking the reservoir fluid level you discover it empty or nearly empty, the system should be bled (Chapter 9). When the fluid level gets low, air can enter the system and should be removed by bleeding the brakes.

Power steering fluid

26 Unlike manual steering, the power steering system relies on fluid which may, over a period of time, require replenishing.
27 The reservoir for the power steering pump is located near the front of the engine, on the right side.
28 The power steering fluid level should be checked only after the vehicle has been driven, with the fluid at operating temperature. The front wheels should be pointed straight ahead.
29 With the engine shut off, use a rag to clean the reservoir cap and the areas around the cap. This will help to prevent foreign material from falling into the reservoir when the cap is removed.
30 Twist off the reservoir cap which has a built-in dipstick attached to it. Pull off the cap and clean off the fluid at the bottom of the dipstick with a clean rag. Now reinstall the dipstick/cap assembly to get a fluid level reading. Remove the dipstick/cap and observe the fluid level. It should be at the upper mark on the HOT side of the dipstick.
31 If additional fluid is required, pour the specified lubricant directly into the reservoir using a funnel to prevent spills.
32 If the reservoir requires frequent fluid additions, all power steering hoses, hose connections, the power steering pump and the steering box should be carefully checked for leaks.

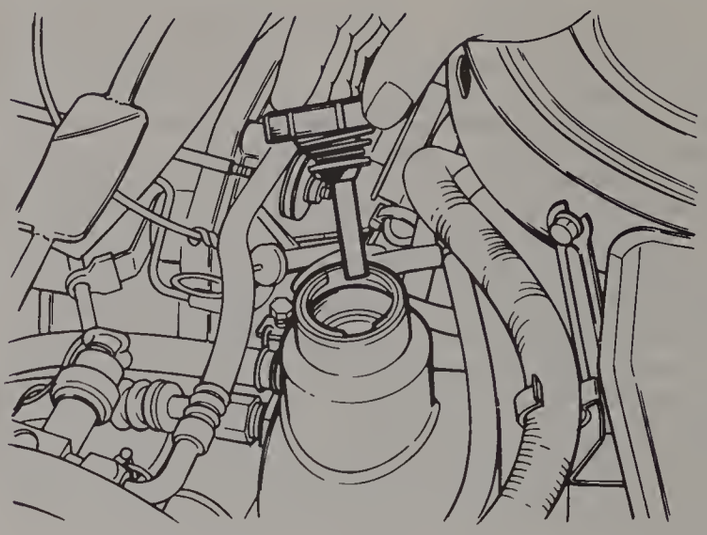


Fig. 1.3 Checking the power steering reservoir fluid level (Sec 4)

5 Fluid levels – check (every 6 months)

Automatic transmission fluids

1 The fluid inside the transmission must be at normal operating temperature to get an accurate reading on the dipstick. This is done by driving the vehicle for several miles, making frequent starts and stops to allow the transmission to shift through all gears.
2 Park the vehicle on a level surface. With the parking brake engaged and the engine idling, select each gear momentarily, ending with the selector lever in the Park position.
3 Remove the transmission dipstick (located on the left side, near the rear of the engine) and wipe all the fluid from the end of the dipstick with a clean rag.
4 Push the dipstick back into the transmission until the cap seats firmly on the dipstick tube. Now remove the dipstick again and observe the fluid on the end. The highest point of fluid should be between the Full mark and $\frac{1}{4}$ inch below the Full mark.
5 If the fluid is at or below the Add mark, add sufficient fluid to raise the level to the Full mark. One pint of fluid will raise the level from Add to Full. Fluid should be added directly into the dipstick guide tube, using a funnel to prevent spills.
6 It is important to note that the transmission must not be overfilled. Under no circumstances should the fluid level be above the Full mark on the dipstick, as this could cause internal damage to the transmission. The best way to prevent overfilling is to add fluid a little at a time, driving the vehicle and checking the level between additions.
7 Use only the transmission fluid specified by the manufacturer. This information can be found in the *Recommended lubricants and fluids* section of the Specifications for this Chapter.
8 The condition of the fluid should also be checked along with the level. If the fluid at the end of the dipstick is a dark reddish-brown color, or if the fluid has a 'burnt' smell, the transmission fluid should be replaced. If you are in doubt about the condition of the fluid, purchase some new fluid and compare the two for color and smell.

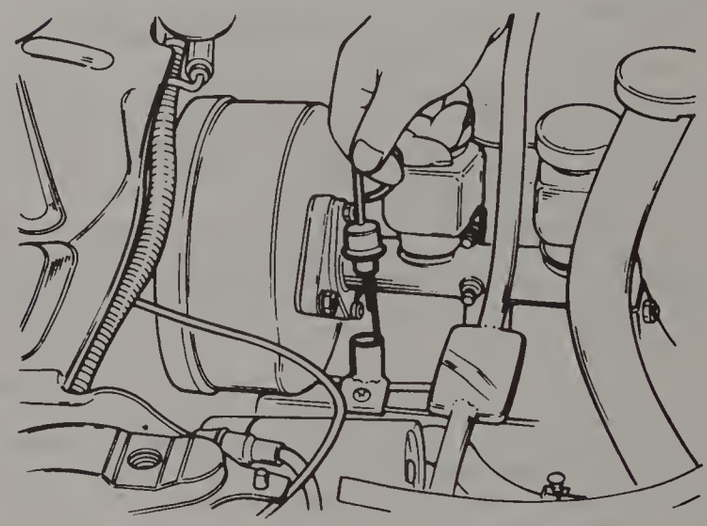


Fig. 1.4 Checking the automatic transmission fluid level (Sec 5)

Automatic transmission differential lubricant

9 The differential lubricant in vehicles equipped with an automatic transmission is checked by removing a dipstick located at the rear of the engine. The level should be checked with the engine cold.
10 Remove the spare tire, pull out the dipstick, wipe it off with a clean rag and reinsert it in the tube. Pull it out again and note the oil level on the end. It should be between the marks.
11 If the level is below the lower mark, add the specified gear oil through the dipstick tube to bring the oil level up to the upper mark (do not overfill). Use a small funnel to prevent spills.
12 Reinstall the dipstick and make sure it is seated in the tube.

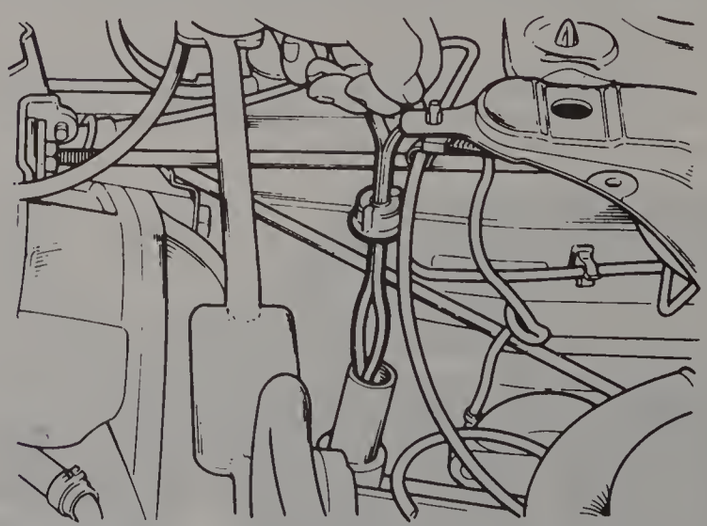
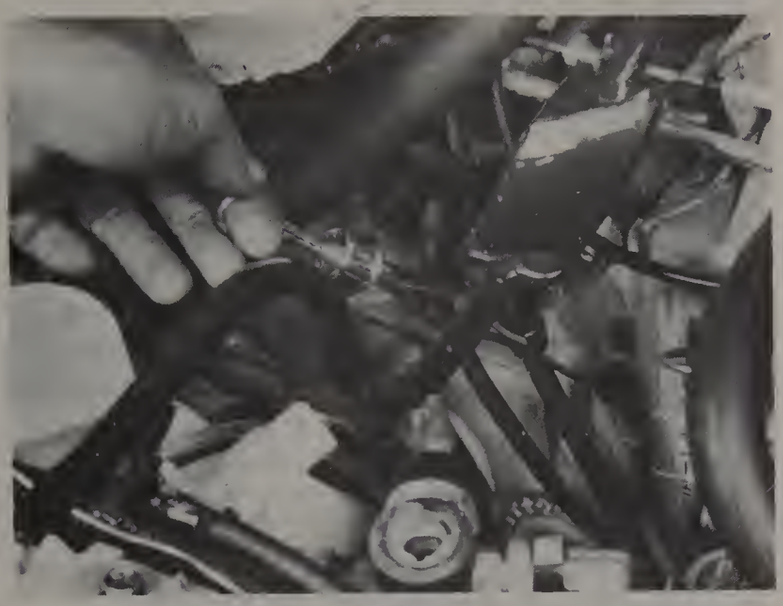


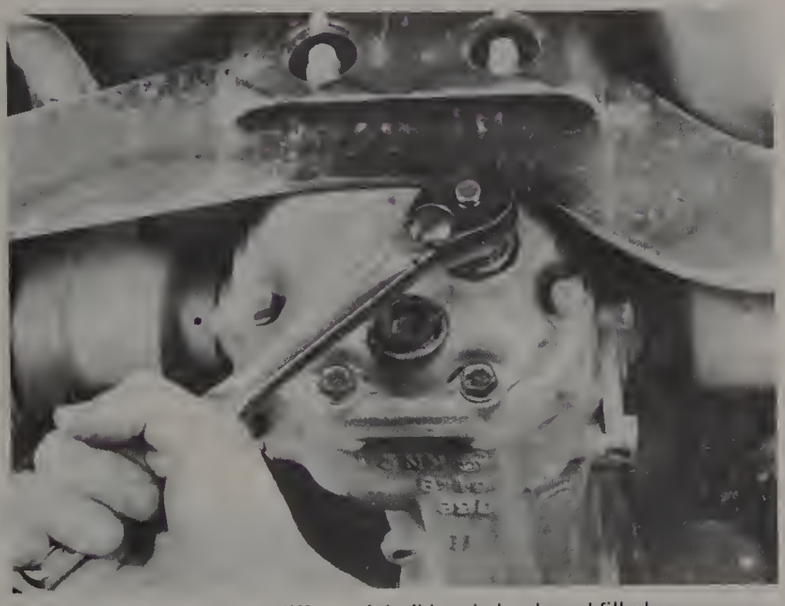
Fig. 1.5 Automatic transmission differential oil level dipstick location (Sec 5)

Manual transmission and differential lubricant

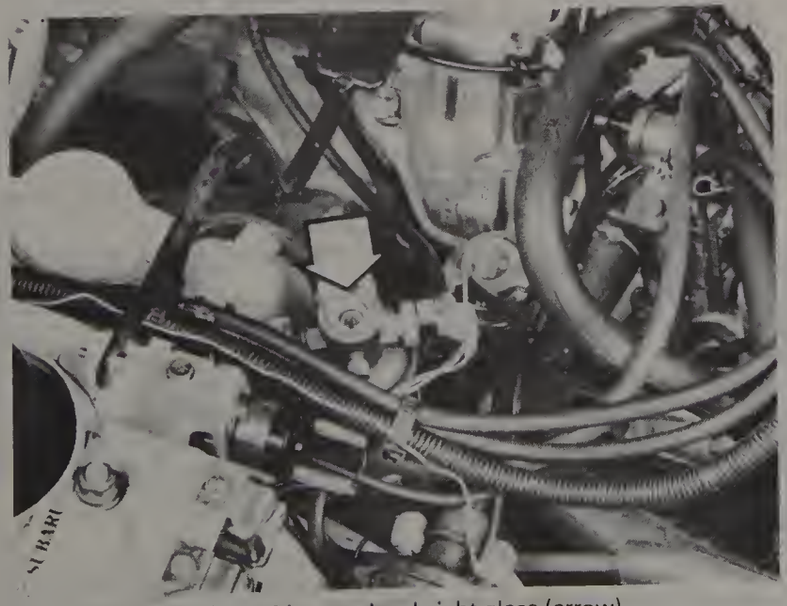
13 The transmission/differential lubricant level is checked by removing a dipstick (photo) which is located on the right side of the engine compartment.
14 The correct oil level to maintain is shown on the stick.
15 If additional oil is needed, use a small funnel and add it at the dipstick tube.



5.13 Manual transmission oil level dipstick



5.16 Removing the rear differential oil level check and fill plug



5.22 Air conditioning refrigerant level sight glass (arrow)

Rear differential lubricant (4WD)

16 The rear axle has an inspection and fill plug (photo) which must be removed to check the fluid level.
17 Remove the plug which is located at the rear of the differential. Use your little finger to reach inside the differential housing to feel the level of the fluid. It should be at the bottom of the plug hole.
18 If this is not the case, add the proper lubricant through the plug hole. A syringe or a small funnel can be used for this. Make certain the correct lubricant is used.
19 Tighten the plug securely and check for leaks after the first few miles of driving.

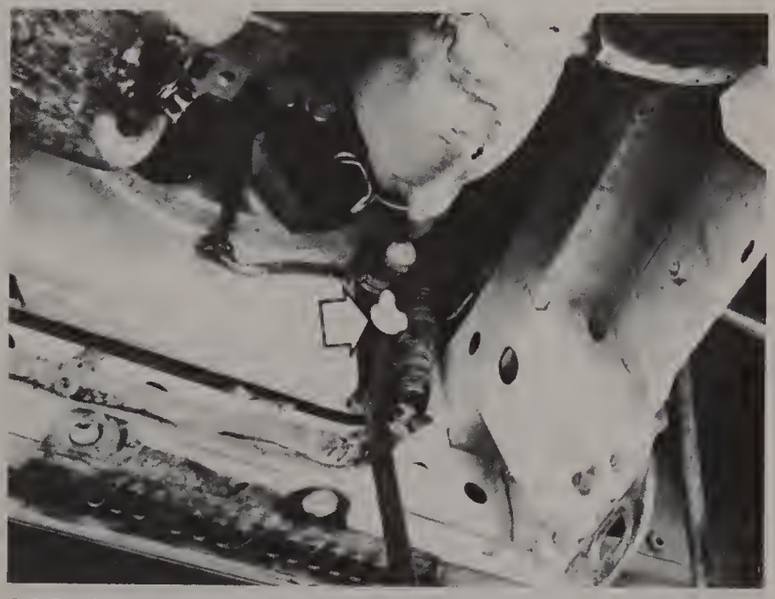
Air conditioning system refrigerant and oil

20 It is important to have the correct amount of oil in the refrigerant system. Too little oil gives inadequate lubrication and can cause the compressor to fail. Too much oil will increase the discharge air temperature.
21 Before the compressor oil level can be checked, the system must be discharged. **Caution**: *Do not attempt to do this yourself; the refrigerant can cause serious injuries and respiratory irritation. Take your vehicle to a qualified service center or dealer service department to have the oil level checked.*
22 You can check the refrigerant level of the air conditioning system. The receiver-dryer has a sight gauge on it (photo).
23 A continuous flow of bubbles means that the level is very low and refrigerant must be added.
24 Bubbles seen at one-to-two second intervals mean that the level is insufficient.
25 Bubbles seen only when engine speed is raised and lowered mean the level is sufficient.
26 No bubbles at any time indicate there is too much refrigerant and some should be discharged.

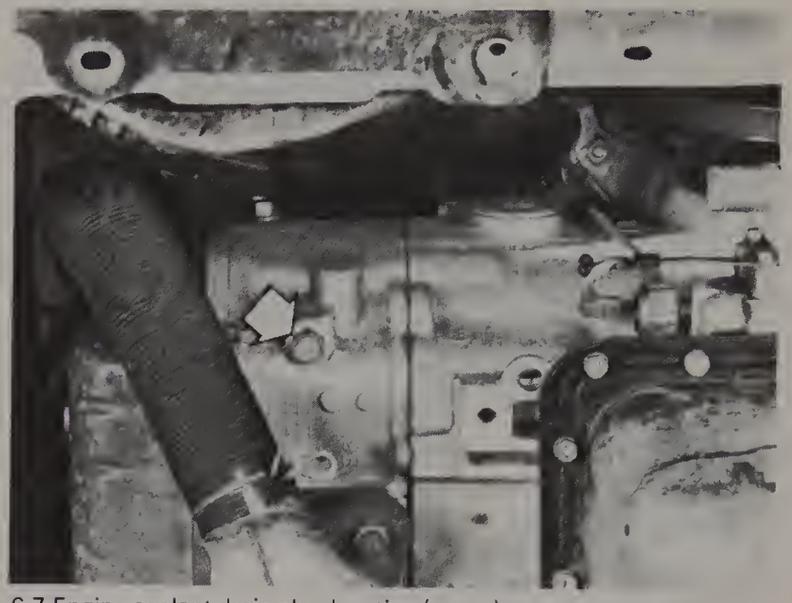
6 Fluid changes (every 24 months)

Coolant

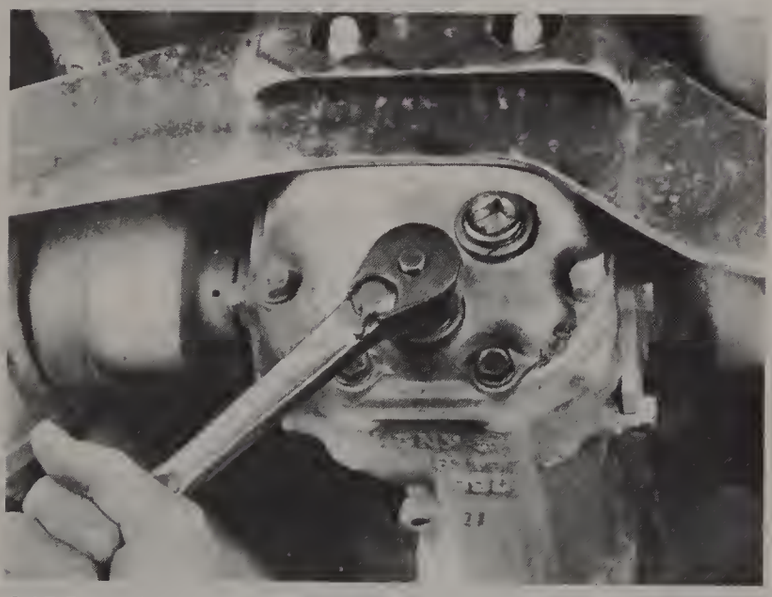
1 Periodically, the cooling system should be drained, flushed and refilled to replenish the antifreeze mixture and prevent formation of rust and corrosion which can impair the performance of the cooling system and ultimately cause engine damage.
2 At the same time the cooling system is serviced, all hoses and the radiator cap should be inspected and replaced if faulty (see Section 9).
3 Since antifreeze is a poisonous solution, be careful not to spill any of the coolant mixture on the vehicle's paint or your own skin. If this happens, rinse immediately with plenty of clear water. Also, consult your local authorities about the dumping of antifreeze before draining the cooling system. In many areas reclamation centers have been set up to collect automobile oil and drained antifreeze/water mixtures rather than allowing these liquids to be added to the sewage system.
4 With the engine cold, remove the radiator cap.
5 Move a large container under the radiator to catch the coolant mixture as it is drained.
6 Drain the radiator by opening the drain petcock (photo), at the bottom.
7 Remove the engine coolant drain plugs from both cylinder heads (photo). This will allow the coolant to drain from the engine itself.
8 Place a cold water hose (a common garden hose is fine) in the radiator filler neck at the top of the radiator and flush the system until the water runs clear at all drain points.
9 In severe cases of contamination or clogging of the radiator, remove it (see Chapter 3) and reverse flush it. This involves simply inserting the hose in the bottom radiator outlet to allow the clear water to run against the normal flow, draining through the top. A radiator repair shop should be consulted if further cleaning or repair is necessary.
10 Where the coolant is regularly drained and the system refilled with the correct antifreeze/inhibitor mixture there should be no need to use chemical cleaners or descalers.
11 To refill the system, install the drain plugs securely in the engine. Special thread sealing tape (available at auto parts stores) should be used on the drain plugs.
12 Fill the radiator to the level plate.
13 Run the engine until normal operating temperature is reached and



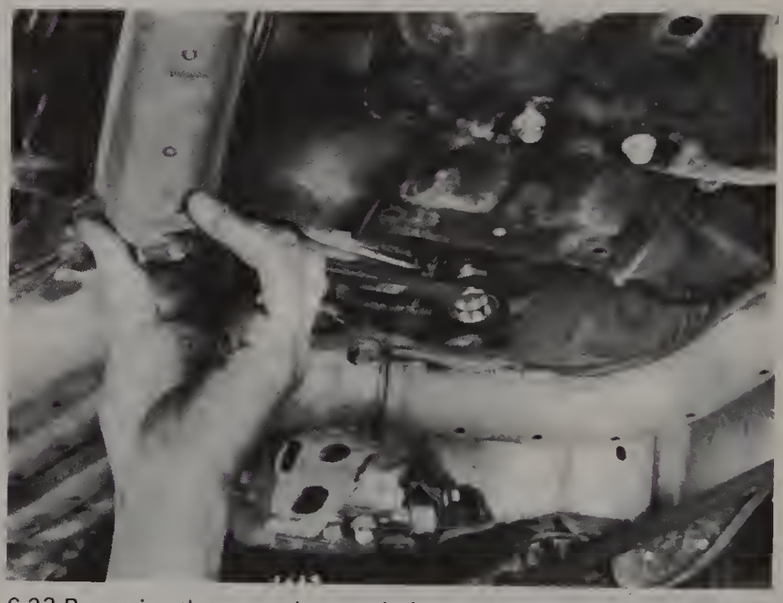
6.6 Radiator coolant drain petcock location (arrow)



6.7 Engine coolant drain plug location (arrow)



6.17 Removing the rear differential drain plug



6.23 Removing the manual transmission drain plug

with the engine idling, add coolant up to the correct level (see Section 4). Install the radiator cap.

14 Always refill the system with a mixture of high quality ethylene glycol-based antifreeze and water in the proportion called for on the antifreeze container or in your owner's manual. Chapter 3 also contains information on antifreeze mixtures.

15 Keep a close watch on the coolant level and the various cooling system hoses during the first few miles of driving. Tighten the hose clamps and/or add more coolant mixture as necessary.

Rear differential lubricant (4WD)

16 The vehicle should be driven for a few minutes before draining the rear axle. This practice will tend to warm up the lubricant and ensure complete drainage.

17 Move a drain pan, rags, newspapers, and tools under the rear of the vehicle. With the drain pan under the differential, remove the drain plug (photo) from the rear of the housing. While the oil is draining, remove the inspection plug.

18 After the oil has drained completely, wipe the area around the drain hole with a clean rag and install the drain plug.

19 Fill the housing (through the inspection hole) with the recommended lubricant until the level is even with the bottom of the inspection hole. Install the inspection plug.

20 After driving the vehicle, check for leaks at the drain and inspection plugs.

21 When the job is complete, check for metal filings or chips in the drained fluid, which indicates that the differential should be thoroughly inspected and repaired (see Chapter 8 for more information).

Manual transmission and differential lubricant

22 Move a drain pan (at least five pint capacity), rags, newspapers and a 21 mm wrench under the center of the vehicle.

23 With the drain pan under the transmission, use the wrench to loosen the drain plug (photo).

24 Once loosened, carefully unscrew it with your fingers until you can remove it from the transmission case.

25 Allow all of the oil to drain into the pan. Then, replace the drain plug and tighten it securely.

26 Now remove the transmission oil level dipstick. Using a hand pump, syringe or funnel, fill the transmission with the correct amount and grade of fluid (see *Recommended lubricants and fluids),* until the level is correct.

Automatic transmission fluid

27 At the specified time or mileage intervals, the transmission fluid should be changed to ensure trouble-free transmission operation.

28 Before draining, purchase the specified transmission fluid (see *Recommended lubricants and fluids).*

29 Tools necessary for this job include jackstands to support the vehicle in a raised position, a wrench to remove the drain plug, a drain pan capable of holding at least eight pints, newspapers and clean rags.
30 The fluid should be drained immediately after the vehicle has been driven. This will remove any built-up sediment better than if the fluid were cold. Because of this, it may be wise to wear protective gloves (fluid temperature can exceed 350°F (177°C) in a hot transmission).
31 After the vehicle has been driven to warm up the fluid, raise the vehicle and place it on jackstands for access underneath. Make sure it is firmly supported.
32 Move the necessary equipment under the vehicle, being careful not to touch any of the hot exhaust components.
33 Place the drain pan under the transmission pan and remove the drain plug.
34 Allow the fluid to drain completely, then reinstall the plug (use a new plug gasket, if necessary) and tighten it securely.
35 Lower the vehicle off the jackstands.
36 Open the hood and remove the transmission fluid dipstick from its guide tube.
37 Since fluid volume is difficult to measure, it is best to add a little fluid at a time, continually checking the level with the dipstick. Allow the fluid time to drain into the transmission. Add fluid through the dipstick tube (use a funnel to prevent spills) until the level just registers on the end of the dipstick.
38 With the selector lever in Park, apply the parking brake and start the engine without depressing the accelerator pedal (if possible). Do not race the engine at a high speed, run at slow idle only.
39 Depress the brake pedal and shift the transmission through each gear. Place the selector back into Park and check the level on the dipstick (Section 5). Look under the vehicle for leaks around the transmission drain plug.
40 Add more fluid through the dipstick tube until the level is correct.

Automatic transmission differential lubricant

41 The differential used in automatic transmission equipped vehicles can be drained by removing the plug from the side of the differential case (it is located just in front of the automatic transmission drain plug).
42 Follow the instructions in Paragraphs 22 through 26 above and note that the differential must be filled with gear oil, *not* automatic transmission fluid. Refer to *Recommended lubricants and fluids* for the gear oil type.

7 Fluid changes (every 48 months)

Power steering fluid

1 Before beginning this maintenance operation, make sure you have purchased enough new power steering fluid of the recommended type (see *Recommended lubricants and fluids*) to refill the system. You will also need two jackstands, a drain pan, some newspapers and clean rags and common hand tools.
2 Raise the front of the vehicle and support it securely on jackstands. The front wheels must be free to turn from side-to-side, so locate the jackstands accordingly.
3 Disconnect both tube fittings on the front of the gearbox tube.
4 Attach vinyl tubes to the ports of the gearbox and to the pipe fittings. Let the tubes hang down into a pan.
5 Slowly turn the steering wheel from lock-to-lock several times. This will ensure complete drainage of the system.
6 Once the system has drained completely, reconnect the tubes and tighten the fittings.
7 Fill the reservoir to within $\frac{1}{4}$ inch of the top with new power steering fluid of the recommended type. Turn the steering wheel slowly from lock-to-lock until bubbles no longer appear in the tank and the fluid level stabilizes.
8 Start the engine, allow it to idle and turn the steering wheel from lock-to-lock several times. Check the fluid level and add more as necessary.
9 Repeat the procedures until the level in the reservoir stabilizes, then check the fluid level by referring to Section 4.
10 Lower the vehicle and test drive it, then check for leaks at the reservoir hose connections. Recheck the fluid level.

Brake fluid

Caution: *Brake fluid is corrosive to paint. If it is spilled, wipe it up immediately and flush with water.*
11 Since brake fluid absorbs moisture and becomes contaminated in other ways while in use, the system should be periodically drained, flushed and refilled with new fluid.
12 Before draining the old fluid, make sure you purchase at least twice as much fluid as the capacity of the reservoir and that it is the recommended type (see *Recommended lubricants and fluids*). Also, obtain enough clear vinyl hose (sized to fit the bleeder nipples) to cut into four separate two-foot lengths. You will also need four containers of one quart capacity.
13 Remove the reservoir cap and siphon or dip out as much old fluid as you can. Place the nylon tubes on each of the four wheel bleeder screws and place the tubes in the containers.
14 An assistant would be helpful at this point. Refill the brake reservoir with new brake fluid and open all of the bleeder screws. Now, have your assistant pump the brakes while you add new brake fluid to the reservoir.
15 Keep the reservoir fluid up to the lower level mark. This will keep air entering the system to a minimum, which will simplify the bleeding procedure later on.
16 Periodically check the drain containers during this period to see when all of the old fluid is out of the system. You can usually tell the old fluid from the new. **Note:** *Have your assistant stop pumping the brake pedal as you do this check.*
17 When you feel that the system is completely flushed, retighten the bleeder screws, fill the reservoir and put the reservoir cap back on.
18 Finally, bleed the system according to the procedure in Chapter 9.

Air conditioning refrigerant

19 The air conditioning system refrigerant can be purged and refilled.
Caution: *Do not attempt to do this yourself; the refrigerant used is pressurized and can cause serious injuries and respiratory irritation.*
20 Leave any draining/refilling of the air conditioning system to a professional who knows the dangers and how to avoid them with the right equipment.

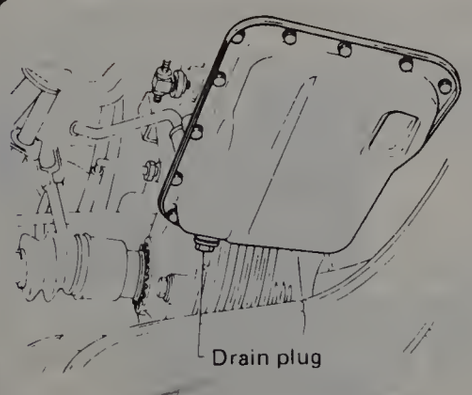


Fig. 1.6 Automatic transmission fluid drain plug location (Sec 6)

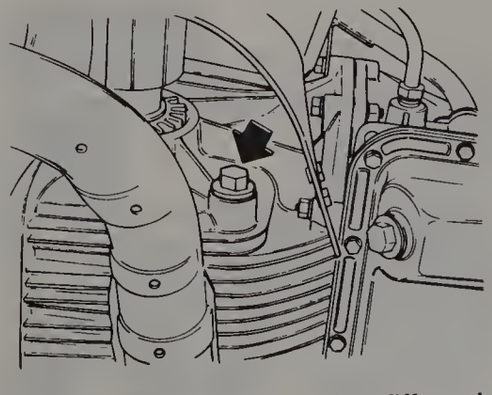


Fig. 1.7 Automatic transmission differential oil drain plug (arrow) (Sec 6)

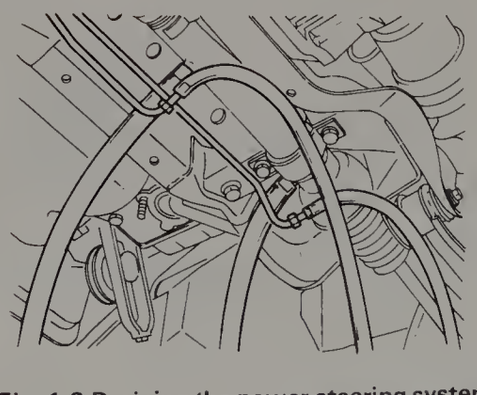


Fig. 1.8 Draining the power steering system (Sec 7)

8 Engine oil and oil filter – change

1 Frequent oil changes may be the best form of preventative maintenance available to the home mechanic. When engine oil is old, it gets diluted and contaminated, which ultimately leads to premature engine wear.
2 Although some sources recommend oil filter changes every other oil change, we feel that the minimal cost of an oil filter and the relative ease with which it is installed dictate that a new filter be used whenever the oil is changed.
3 The tools necessary for a normal oil and filter change are a wrench to fit the drain plug at the bottom of the oil pan, an oil filter wrench to remove the oil filter, a container with at least a six-quart capacity to drain the old oil into, and a funnel or oil can spout to help pour fresh oil into the engine.
4 In addition, you should have plenty of clean rags and newspapers handy to mop up any spills. Access to the underside of the vehicle is greatly improved if it can be lifted on a hoist, driven onto ramps or supported by jackstands. Do not work under a vehicle which is supported only by a bumper, hydraulic or scissors-type jack.
5 If this is your first oil change on the vehicle, it is a good idea to crawl underneath and familiarize yourself with the locations of the oil drain plug and the oil filter. Since the engine and exhaust components will be warm during the actual work, it is a good idea to figure out any potential problems before the vehicle and its accessories are hot.
6 Allow the engine to warm up to normal operating temperature. If new oil or any tools are needed, use this warm-up time to gather together everything necessary for the job. The correct type of oil to buy for your application can be found in *Recommended lubricants and fluids* in the front of this Chapter.
7 With the engine oil warm (warm engine oil will drain better and more built-up sludge will be removed with the oil), raise the vehicle for access beneath. Make sure it is firmly supported. If jackstands are used, they should be placed towards the front of the frame rails which run the length of the vehicle.
8 Move all necessary tools, rags and newspapers under the vehicle. Position the drain pan under the drain plug. Keep in mind that the oil will initially flow from the pan with some force, so position the pan accordingly. On 4WD vehicles, remove the center skidplate.
9 Being careful not to touch any of the hot exhaust pipe components, use the wrench to remove the drain plug near the bottom of the oil pan. Depending on how hot the oil has become, you may want to wear gloves while unscrewing the plug the final few turns.
10 Allow the old oil to drain into the pan. It may be necessary to move the pan farther under the engine as the oil flow reduces to a trickle.
11 After all the oil has drained, clean the drain plug thoroughly with a clean rag. Small metal filings may cling to this plug, which would immediately contaminate the new oil.
12 Clean the area around the drain plug opening and reinstall the drain plug. Tighten the plug securely with your wrench according to the specified torque.
13 Move the drain pan into position under the oil filter.
14 Now use the filter wrench to loosen the oil filter. Chain or metal band-type filter wrenches may distort the filter canister, but don't worry too much about this as the filter will be discarded anyway.
15 Sometimes the oil filter is on so tight it cannot be loosened, or is inaccessible with a filter wrench. As a last resort, you can punch a metal bar or long screwdriver directly through the bottom of the canister and use this as a T-bar to turn the filter. If this must be done, be prepared for oil to spurt out of the canister as it is punctured.
16 Completely unscrew the old filter (photo). Empty the old oil inside the filter into the drain pan.
17 Compare the old filter with the new one to make sure they are of the same type.
18 Use a clean rag to remove all oil, dirt and sludge from the area where the oil filter mounts to the engine. Check the old filter to make sure the rubber gasket is not stuck to the engine mounting surface. If the gasket is stuck to the engine (use a flashlight if necessary) remove it.
19 Smear a light coat of fresh oil onto the rubber seal of the new oil filter.
20 Attach the new filter to the engine following the tightening directions printed on the filter canister or packing box. Most filter manufacturers recommend against using a filter wrench due to possible overtightening and damage to the canister or the rubber seal.
21 Remove all tools, rags, etc., from under the vehicle, being careful not to spill the oil in the drain pan. Lower the vehicle off its support stands.
22 Move to the engine compartment and locate the oil filler cap near the rear of the engine.
23 If an oil can spout is used, push the spout into the top of the oil can and pour the fresh oil through the filler opening (photo). A funnel placed in the opening may also be used.
24 Pour about three quarts of fresh oil into the engine. Wait a few minutes to allow the oil to drain to the pan, then check the level on the oil dipstick (see Section 4 if necessary). If the oil level is at or near the lower mark, start the engine and allow the new oil to circulate.
25 Run the engine for only about a minute and then shut it off. Immediately look under the vehicle and check for leaks at the oil pan drain plug and around the filter. If either is leaking, retighten and recheck them.
26 With the new oil circulated and the filter now completely full, recheck the level on the dipstick and add enough oil to bring the level to the upper mark on the dipstick.
27 During the first few trips after an oil change, make it a point to check frequently for leaks and proper oil level.
28 The old oil drained from the engine cannot be reused in its present state and should be disposed of. Oil reclamation centers, auto repair shops and gas stations will normally accept the oil, which can be refined and used again. After the oil has cooled, it can be drained into a suitable container (capped plastic jugs, topped bottles, milk cartons, etc.) for transport to one of these disposal sites.

9 Cooling system – checks

1 Many major engine failures can be attributed to a faulty cooling system. If the vehicle is equipped with an automatic transmission, the cooling system also plays an important role in prolonging transmission life.
2 The cooling system should be checked with the engine cold. Do this before the vehicle is driven for the day or after it has been shut off for at least three hours.

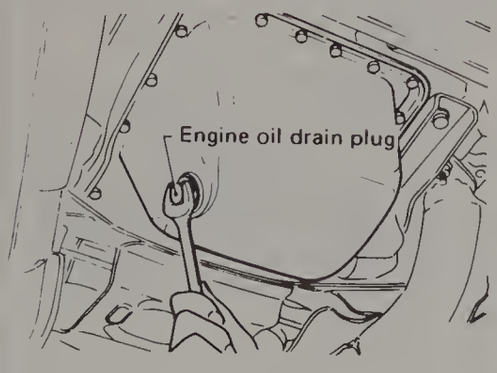
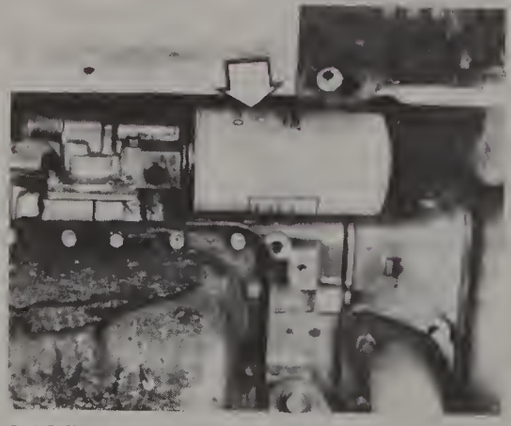


Fig. 1.9 Removing the engine oil drain plug (Sec 8)



8.16 Engine oil filter location (arrow)

8.23 Add oil to the engine through the filler tube

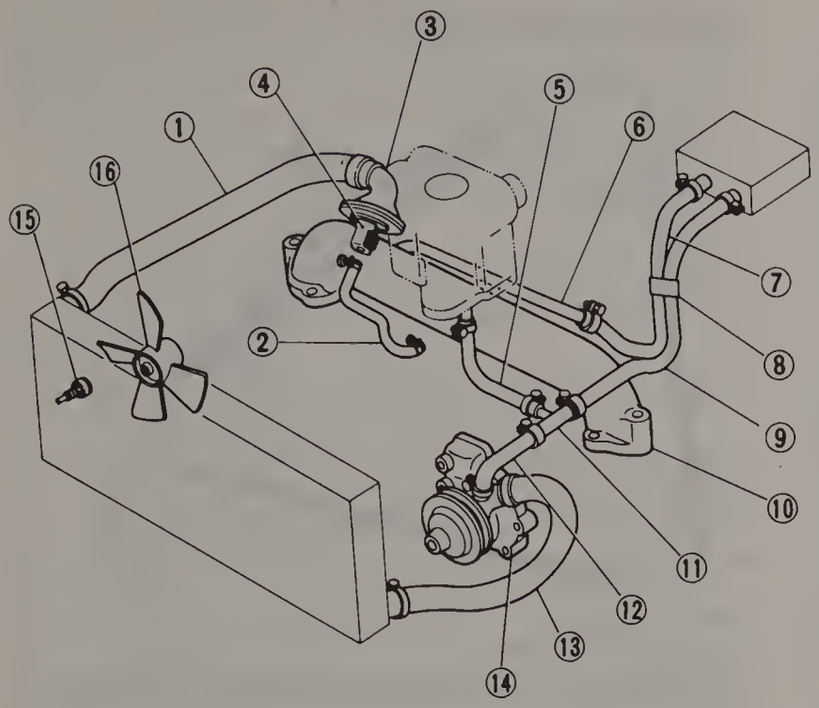


Fig. 1.10 Engine cooling system components (Sec 9)

1 *Radiator inlet hose*
2 *Bypass hose*
3 *Thermostat cover*
4 *Thermostat*
5 *Bypass hose*
6 *Bypass pipe*
7 *Bypass hose*
8 *Three-way valve*
9 *Bypass hose*
10 *Intake manifold*
11 *Bypass pipe*
12 *Bypass hose*
13 *Radiator outlet hose*
14 *Water pump*
15 *Thermo switch*
16 *Electric cooling fan*

3 Remove the radiator cap and thoroughly clean the cap (inside and out) with clean water. Also clean the filler neck on the radiator. All traces of corrosion should be removed.
4 Carefully check the upper and lower radiator hoses along with the smaller diameter heater hoses. Inspect each hose along its entire length, replacing any hose which is cracked, swollen or shows signs of deterioration. Cracks may become more apparent if the hose is squeezed.
5 Also make sure that all hose connections are tight. A leak in the cooling system will usually show up as white or rust-colored deposits on the areas adjoining the leak.
6 Use compressed air or a soft brush to remove bugs, leaves, etc., from the front of the radiator or air conditioning condenser. Be careful not to damage the delicate cooling fins, or cut yourself on the sharp fins.
7 Inspect the radiator cap valve and spring for deterioration or broken packing. Also check the valve opening pressure and compare it with the Specifications. If necessary, replace the cap with a new one.
8 Have the cooling system pressure checked and compare the results with the Specifications at the front of this Chapter.
9 To remove and check the thermostat, see Chapter 3.
10 Make sure the electric cooling fans operate when the temperature of the coolant reaches the specified range. Refer to Chapter 3 for more information.

10 Flexible hoses – check and replacement

Caution: *Replacement of air conditioner hoses should be left to a dealer or air conditioning specialist who can depressurize the system and perform the work safely.*

1 The high temperatures present under the hood can cause deterioration of the numerous rubber and plastic hoses.
2 Periodic inspection should be made for cracks, loose clamps and leaks because some of the hoses are part of the emissions system and can affect the engine's performance.
3 Remove the air cleaner if necessary and trace the entire length of each hose. Squeeze the hose to check for cracks and look for swelling, discoloration and leaks.
4 If the vehicle has considerable mileage or one or more of the hoses is suspect, it is a good idea to replace all of the hoses at one time.
5 Measure the length and inside diameter of each hose and obtain and cut the replacements to size. As original equipment hose clamps are often good for only one or two uses, it is a good idea to replace them with screw-type clamps.
6 Replace each hose one at a time to eliminate the possibility of confusion. Hoses attached to the heater and radiator contain coolant so newspapers or rags should be kept handy to catch the spills when they are disconnected.
7 After installation, run the engine until up to operating temperature, shut it off and check for leaks. After the engine has cooled, retighten all of the screw-type clamps

11 Drivebelts – adjustment and replacement

1 The drivebelts, or V-belts as they are sometimes called, at the front of the engine play an important role in the overall operation of the vehicle and its components. Due to their function and material make-up, the belts are prone to failure after a period of time and should be inspected and adjusted periodically to prevent major engine damage.
2 The number of belts used on a particular vehicle depends on the accessories installed. Drivebelts are used to turn the alternator, power steering pump, water pump and air conditioning compressor. Depending on the pulley arrangement, a single belt may be used for more than one of these components.
3 With the engine off, open the hood and locate the various belts at the front of the engine. Using your fingers (and a flashlight if necessary), move along the belts checking for cracks or separation of the plies. Also check for fraying and for glazing which gives the belt a shiny appearance. Both sides of the belts should be inspected, which means you will have to twist the belt to check the underside.
4 The tension of each belt is checked by pulling or pushing on the belt at a distance halfway between the pulleys. Apply approximately 22 lbs of force and see how much the belt moves (deflects). Refer to the Specifications for the amount of deflection allowed for each belt.
5 If it is necessary to adjust the belt tension, either to make the belt tighter or looser, it is done by moving the belt-driven accessory on its bracket.
6 For each component there will usually be an adjustment or strap bolt and a pivot bolt. Both bolts must be loosened slightly to enable you to move the component.
7 After the two bolts have been loosened, move the component away from the engine (to tighten the belt) or toward the engine (to loosen the belt). Hold the accessory in this position and check the belt tension. If it is correct, tighten the two bolts until snug, then recheck the tension. If it is alright, completely tighten the two bolts.
8 It will often be necessary to use some sort of pry bar to move the accessory while the belt is adjusted. If this must be done to gain the proper leverage, be very careful not to damage the component being moved, or the part being pried against.
9 The power steering pump belt is adjusted by loosening the idler pulley lock bolt and turning the adjusting bolt out (be sure to retighten the lock bolt).
10 The air conditioning drivebelt is adjusted by loosening the tension pulley mounting bolts. Move the tension pulley bracket until the correct belt tension is achieved, then tighten the lower mounting bolt, followed by the upper mounting bolt.

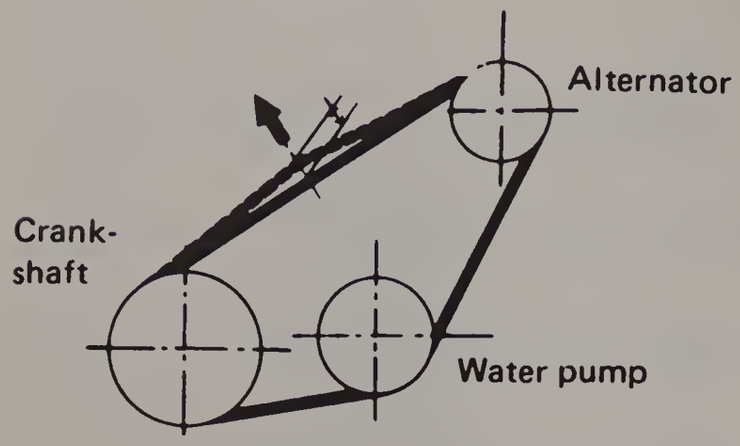


Fig. 1.11 Alternator drivebelt tension check (Sec 11)

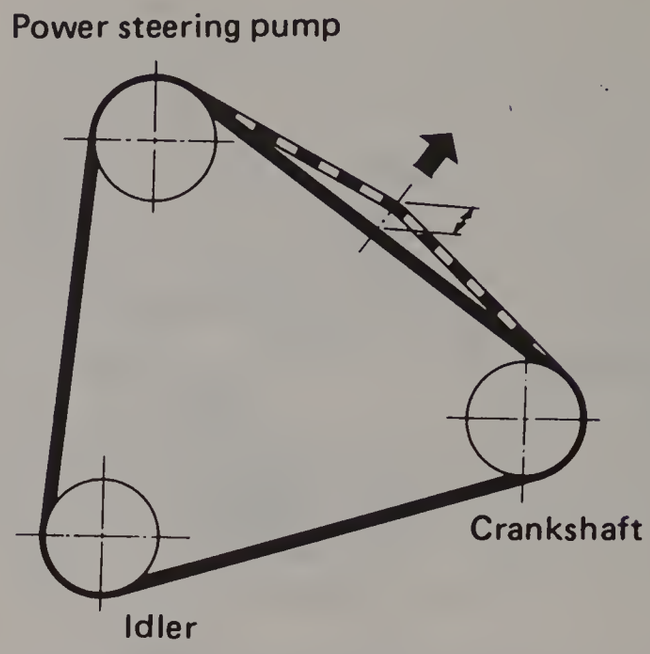


Fig. 1.12 Power steering pump drivebelt tension check (Sec 11)

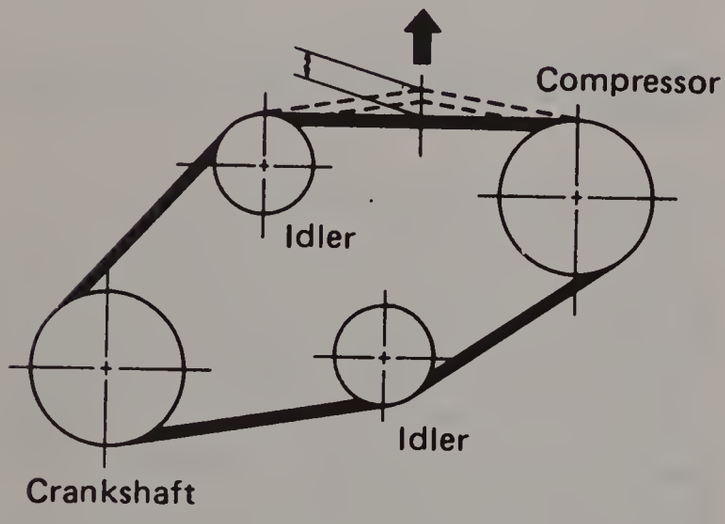


Fig. 1.13 Air conditioning compressor drivebelt tension check (Sec 11)

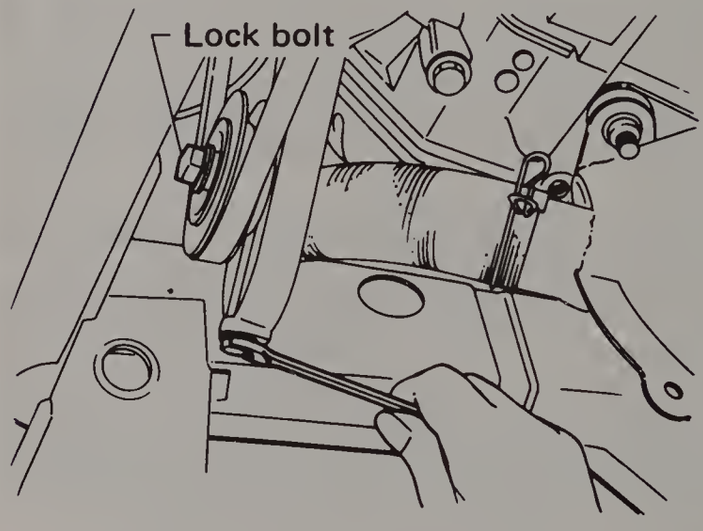


Fig. 1.14 Adjusting the power steering pump drivebelt tension (Sec 11)

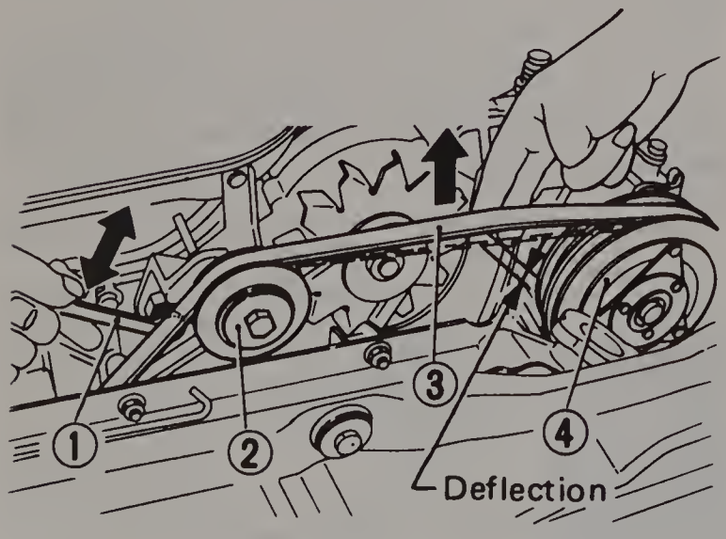


Fig. 1.15 Air conditioning compressor drivebelt tension adjustment (Sec 11)

1 *Wrench (on tension pulley mounting bolt)*
2 *Tension pulley*
3 *Drivebelt*
4 *Compressor*

12 Air conditioning system – checks

1 The following maintenance steps should be performed on a regular basis to ensure that the air conditioner continues to operate at peak efficiency.

a) Check the tension of the compressor drivebelt and adjust it if necessary. Refer to Section 11.
b) Visually inspect the condition of the hoses, checking for cracks, hardening and other deterioration. **Note:** *Do not replace the hoses without first having the system discharged.*
c) Make sure that the fins of the condenser are not covered with foreign material, such as leaves or bugs. A soft brush and compressed air can be used to remove them.

2 The compressor should be run for about 10 minutes at least once every month. This is especially important to remember during the winter months because long-term non-use can cause hardening of the internal seals.

3 Due to the complexity of the air conditioning system and the special equipment required to effectively work on it, accurate trouble-shooting and repair of the system cannot be expected of the home mechanic and should be left to a professional. In any case, due to the toxic nature of the refrigerant, prior to disconnecting any part of the

system, the vehicle should be taken to a dealer or other qualified shop to have the system discharged. If the system should lose its cooling action, some causes can be diagnosed by the home mechanic. Look for other symptoms of trouble such as those in the following list. In all cases, it's a good idea to have the system serviced by a professional.

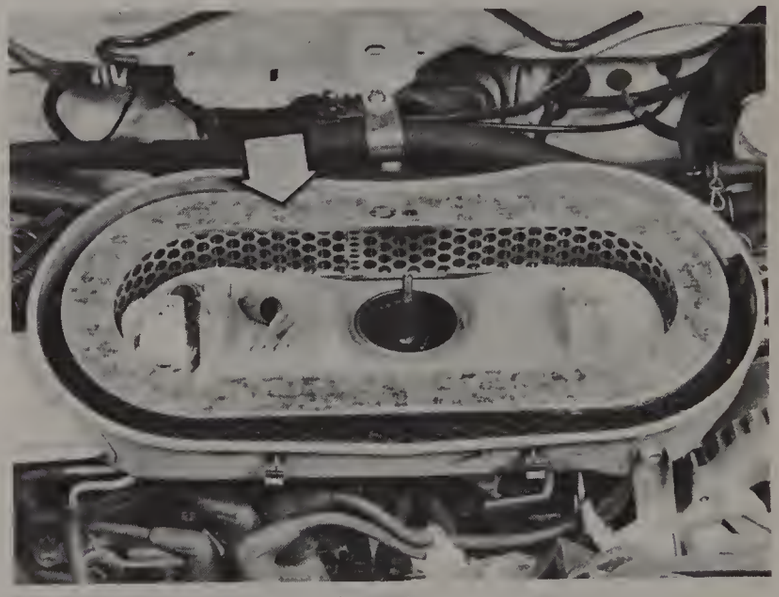
a) If bubbles appear in the sight glass (located at the top of the receiver drier), this is an indication of either a small refrigerant leak or air in the refrigerant. If air is in the refrigerant, the receiver drier is probably defective and should be replaced.
b) If the view glass takes on a mist-like appearance or contains many bubbles, this indicates a large refrigerant leak. In such a case, do not operate the compressor at all until the fault has been corrected.
c) Sweating or frosting of the expansion valve inlet indicates that the expansion valve is clogged or defective. It should be cleaned or replaced as necessary.
d) Sweating or frosting of the suction line (which runs between the suction throttle valve and the compressor) indicates that the expansion valve is stuck open or defective. It should be corrected or replaced as necessary.
e) Frosting on the evaporator indicates a defective suction throttle valve, requiring replacement of the valve.
f) Frosting of the high pressure liquid line (which runs between the condenser, receiver drier and expansion valve) indicates that either the drier or the high pressure line is restricted. The line will have to be cleared or the receiver drier replaced.
g) The combination of bubbles in the sight glass, a very hot suction line and, possibly, overheating of the engine is an indication that either the condenser is not operating properly or the refrigerant is overcharged. Check the drivebelt tension and adjust if necessary. Check for foreign matter covering the fins of the condenser and clean it if necessary. Also check for proper operation of the cooling system. If no fault can be found in these checks, the condenser may have to be replaced.

13 Fuel system – checks

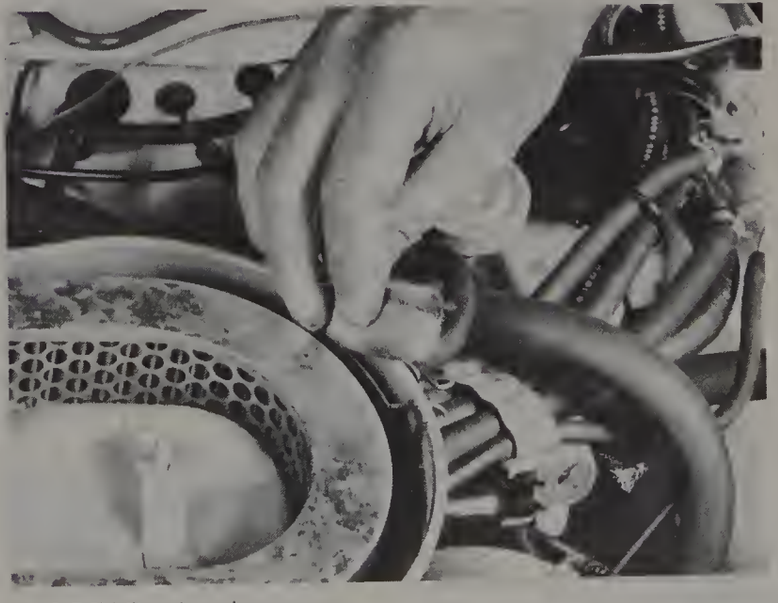
1 There are certain precautions to be taken when inspecting or servicing the fuel system components. Work in a well ventilated area and do not allow open flames (cigarettes, appliance pilot lights, etc.,) to get near the work area. Mop up any spills immediately and do not store fuel-soaked rags where they could ignite.
2 The fuel system is under some amount of pressure, so if any fuel lines are disconnected for servicing, be prepared to catch the fuel as it spurts out. Plug all disconnected fuel lines immediately after disconnection to prevent the tank from emptying itself.
3 The fuel system is most easily checked with the vehicle raised on a hoist where the components under the vehicle are readily visible and accessible.
4 If the smell of gasoline is noted while driving, or after the vehicle has sat in the sun, the system should be thoroughly inspected immediately.
5 Remove the gas filler cap and check for damage, corrosion and a proper sealing imprint on the gasket. The filler cap is also equipped with a vacuum-type relief valve. Relief valve failure may be caused by deteriorated packing or it could be clogged or damaged. Replace the cap with a new one if necessary.
6 With the vehicle raised, inspect the gas tank and filler neck for punctures, cracks and other damage. The connection between the filler neck and the tank is especially critical. Sometimes a rubber filler neck will leak due to loose clamps or deteriorated rubber; problems a home mechanic can usually rectify.
7 Do not under any circumstances try to repair a fuel tank yourself (except rubber components) unless you have considerable experience. A welding torch or any open flames can easily cause the fuel vapors to explode if the proper precautions are not taken.
8 Carefully check all rubber hoses and metal lines leading away from the fuel tank. Check for loose connections, deteriorated hose, crimped lines and damage of any kind. Follow these lines up to the front of the vehicle, carefully inspecting them all the way. Repair or replace damaged sections as necessary.
9 The fuel filter is a cartridge type, which can be replaced easily. Remove the filter and replace it with a new one at the recommended intervals (Section 15).

14 Air cleaner and PCV filters – check and replacement

1 At the specified intervals, the air filter and PCV filter should be replaced with new ones. A thorough program of preventative maintenance would call for the air filter to be inspected periodically between changes.
2 The filters are located inside the air cleaner housing (photo) on the top of the engine. To remove the filters, unscrew the wing nuts at the top of the air cleaner and lift off the top plate.
3 While the top plate is off, be careful not to drop anything down into the carburetor.
4 Lift the air filter out of the housing.
5 To check the air filter, hold it up to strong sunlight, or place a flashlight or droplight on the inside of the ring-shaped filter. If you can see light coming through the paper element, the filter is all right. Check all the way round the filter. A filter not completely clogged with dirt and dust can also be cleaned with compressed air. Before doing this, gently tap the filter against the palm of your hand to remove the bulk of the larger particles.
6 Wipe the inside of the air cleaner housing with a rag.
7 Place the old filter (if in good condition) or the new filter (if specified interval has elapsed) back into the air cleaner housing. Make sure it seats properly in the bottom of the housing.
8 The PCV filter can be treated in the same manner as the air cleaner filter. It is also located in the air cleaner housing (photo).



14.2 Air cleaner filter location (arrow)



14.8 PCV filter location

15 Fuel filter – replacement

1 The fuel filter is located in front of the fuel tank and is accessible from under the vehicle. **Note:** *Some earlier model vehicles have the fuel filter in the engine compartment. Do not confuse it with the fuel separator.* When changing the fuel filter, the fuel tank must be empty or you must somehow clamp off the hose leading to the fuel tank in order to prevent fuel from leaking out when the hoses are disconnected.
2 Jack up the rear of the vehicle and support it on jackstands. Be sure to block the front wheels to prevent rolling. Gather all necessary tools and some rags, as well as the fuel filter, before getting under the vehicle. Since you will be working around gasoline, make sure that there are no bare light bulbs or open flames nearby.
3 Release and slide back the hose clamps at the fuel filter inlet and outlet. Pull the fuel filter out of the spring-type mounting bracket and disconnect both hoses. 4WD vehicles have a fuel filter which is mounted on a plate that is attached to the vehicle with three bolts. If access to the hose clamps is restricted, remove the bolts and pull the plate down to remove them (photo). Be prepared to catch some gasoline in a rag when the hoses are disconnected and take care not to get any gasoline in your eyes. Pull the hose clamps off the hoses and discard them.

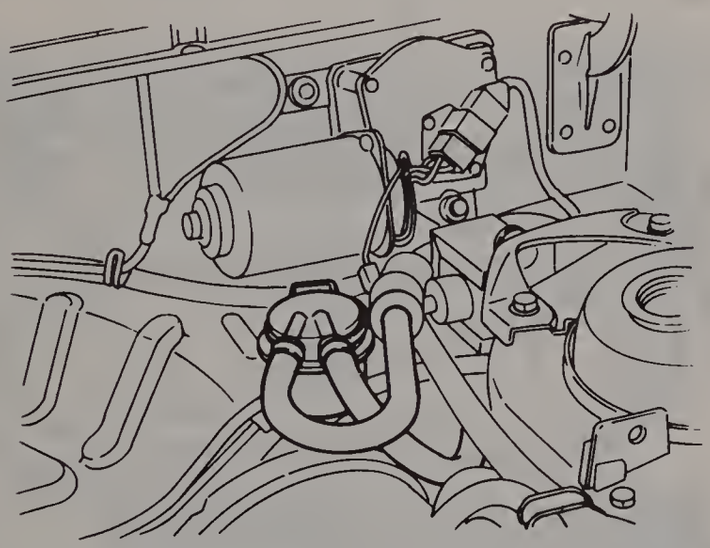
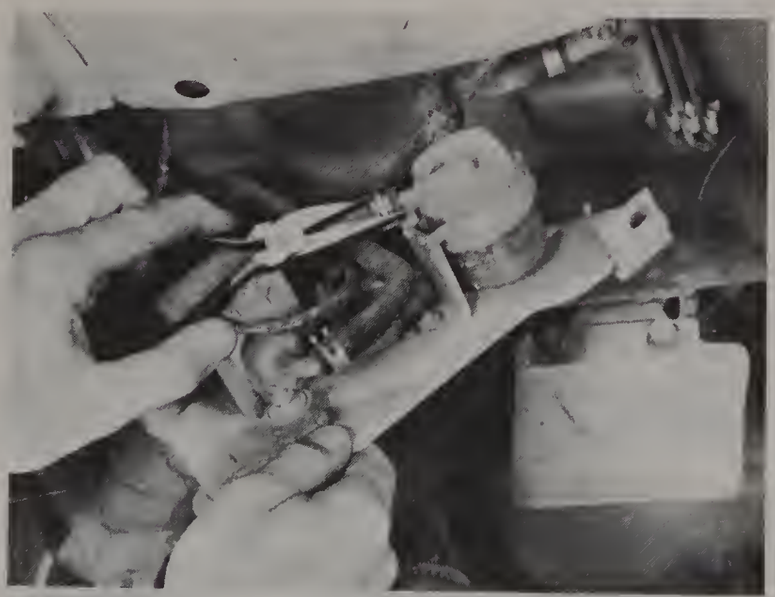


Fig. 1.16 Fuel filter location in engine compartment (older models) (Sec 15)



15.3 Removing the fuel hoses from the fuel filter (newer models shown)

4 Slide new hose clamps onto both hoses. Connect the hoses to the new filter, taking care that the fuel inlet and outlet spigots are in the proper position. Install the hose clamps on both hoses approximately $\frac{1}{4}$ inch back from the hose ends.
5 Push the fuel filter back into the mounting bracket. Check to make sure that it is held securely and that the hoses are not kinked.
6 Start the vehicle and check for leaks.

16 Automatic choke – check, adjustment and lubrication

1 The choke only operates when the engine is cold, so this check should be performed before the vehicle has been started for the day.
2 Open the hood and remove the top plate of the air cleaner assembly. Place the top plate and wing nuts aside, out of the way of moving engine components.
3 Look at the top of the carburetor at the center of the air cleaner housing. You will notice a flat plate at the carburetor opening.
4 Have an assistant press the accelerator pedal to the floor once. The plate should close completely. Start the engine while you observe the plate at the carburetor. **Warning:** *Do not position your face directly over the carburetor, as the engine could backfire, causing serious burns.* When the engine starts, the choke plate should open slightly.
5 Allow the engine to continue running at an idle speed. As the engine warms up to operating temperature, the plate should slowly open, allowing more air to enter through the top of the carburetor.
6 After a few minutes, the choke plate should be completely open to the vertical position.
7 You will notice that the engine speed corresponds with the plate opening. With the plate fully closed, the engine should run at a fast idle speed. As the plate opens, the engine speed will decrease.
8 If during the above checks a fault is detected, refer to Chapter 4 for specific information on adjusting and servicing the choke components.
9 Lubricate all the moving parts of the choke linkage with oil. This will keep them from binding.

17 Idle speed and fuel/air mixture – check and adjustment

Idle speed

Note: *Make sure the valve clearances are correct before adjusting the idle speed.*

1 Engine idle speed is the speed at which the engine operates when no accelerator pedal pressure is applied. This speed is critical to the performance of the engine itself, as well as many engine sub-systems.
2 A hand-held tachometer must be used when adjusting idle speed to get an accurate reading. The exact hook-up for these meters varies

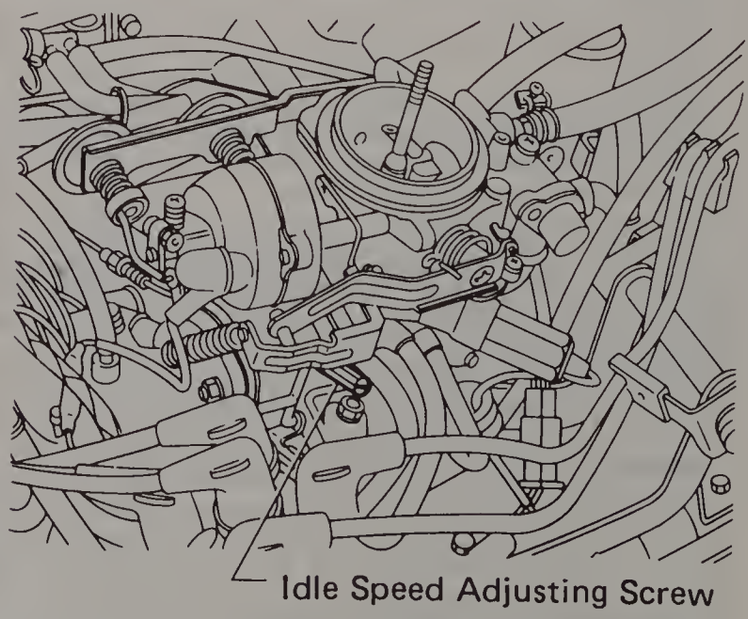


Fig. 1.17 Idle speed adjusting screw location (typical) (Sec 17)

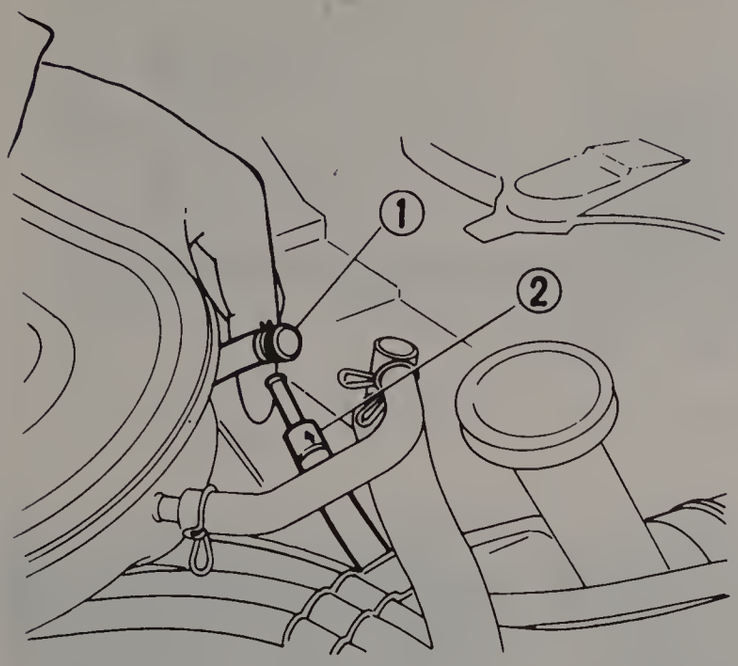


Fig. 1.18 On USA models, disconnect the hose (1) from the purge check valve (2) and plug the hose (Sec 17)

with the manufacturer, so follow the particular directions included.
3 Basically, for most applications, the idle speed is set by turning an adjustment screw located at the side of the carburetor (turning the screw changes the position of the throttle valve in the carburetor).
4 Once you have found the idle speed screw, experiment with different length screwdrivers until the adjustments can be easily made, without coming into contact with hot or moving engine components.
5 On US models, disconnect the purge hose from the purge check valve and plug the hose leading to the intake manifold.
6 Make sure the parking brake is firmly set and the wheels blocked to prevent the vehicle from rolling. Vehicles with an automatic transmission should have the selector lever in Park or Neutral.
7 For all applications, the engine must be completely warmed-up to operating temperature, which will automatically render the choke fast idle inoperative.
8 Turn the idle speed screw in or out, as required, until the idle speed listed in the Specifications is obtained.

Fuel/air mixture

9 Since accurate adjustment of the fuel/air mixture requires special tools and test equipment, it must be done by a Subaru dealer service department.

18 Spark plugs – check and replacement

1 The spark plugs are located on both sides of the engine and are easily accessible for servicing.
2 In most cases, the tools necessary for a spark plug replacement job include a plug wrench or spark plug socket which fits onto a ratchet wrench (this special socket will be insulated inside to protect the porcelain spark plug insulator) and a wire type feeler gauge to check and adjust the spark plug gap.
3 The best procedure to follow when replacing the spark plugs is to purchase the new spark plugs beforehand, adjust them to the proper gap and then replace each plug one at a time. When buying the new spark plugs it is important to obtain the correct plugs for your specific engine. This information can be found in the Specifications at the front of this Chapter, on the tune-up decal located under the hood of your vehicle or in the owner's manual. If differences exist between these sources, purchase the spark plug type specified on the tune-up decal as it was printed for your specific engine.
4 With the new spark plugs at hand, allow the engine to thoroughly cool before attempting the removal. During this cooling time, each of the new spark plugs can be inspected for defects and the gap can be checked.
5 The gap is checked by inserting the proper thickness gauge between the electrodes at the tip of the plug. The gap between these electrodes should be the same as that given in the Specifications or on the tune-up decal. The wire should just touch each of the electrodes. If the gap is incorrect, use the notched adjuster on the feeler gauge body to bend the curved side electrode slightly until the proper gap is achieved. Also, at this time check for cracks in the spark plug body, indicating the spark plug should not be used. If the side electrode is not exactly over the center one, use the notched adjuster to align the two.
6 Cover the fenders of the vehicle to prevent damage to the exterior paint.
7 With the engine cool, remove the spark plug wire from one spark plug. Do this by grabbing the boot at the end of the wire, not the wire itself. Sometimes it is necessary to use a twisting motion while the boot and plug wire are pulled free. Using a wire removal tool is the easiest and safest method.
8 If compressed air is available, use it to blow any dirt or foreign material away from the spark plug area. A common bicycle pump will also work. The idea here is to eliminate the possibility of material falling into the engine cylinder as the spark plug is removed.
9 Now place the spark plug wrench or socket over the plug and remove it from the engine by turning in a counterclockwise motion.
10 Compare the spark plug with the color photos in this Chapter to get an indication of the overall running condition of the engine.
11 Carefully insert one of the new plugs into the spark plug hole and tighten it by hand. Since the cylinder heads on the engine are aluminum, you must be especially careful not to cross-thread the spark plug in the hole. If resistance is felt as you thread the spark plug in by hand, back it out and start again. *Do not, under any circumstances, force the spark plug into the hole with a wrench or socket.*
12 Finally, tighten the spark plug with the wrench or socket. It is a good idea to use a torque wrench for this to ensure the plug is seated correctly. The correct torque figure is given in the Specifications.
13 Before pushing the spark plug wire onto the end of the plug, inspect it following the procedures outlined in Section 19.
14 Attach the plug wire to the new spark plug, again using a twisting motion on the boot until it is firmly seated on the spark plug.
15 Follow the above procedures for the remaining spark plugs, replacing them one at a time to prevent mixing up the spark plug wires.

19 Spark plug wires and distributor cap – check and replacement

1 The spark plug wires should be checked at the recommended intervals and whenever new spark plugs are installed in the engine.
2 The wires should be inspected one at a time to prevent mixing up the order, which is essential for proper engine operation.
3 Disconnect the number one plug wire from the spark plug. A removal tool can be used for this purpose or you can grab the rubber boot, twist slightly and pull the wire free. Do not pull on the wire itself, only on the rubber boot.
4 Inspect inside the boot for corrosion, which will look like a white crusty powder. Push the wire and boot back onto the end of the spark plug. It should be a tight fit on the plug end. If it is not, remove the wire and use pliers to carefully crimp the metal connector inside the wire boot until it fits securely on the end of the spark plug.
5 Using a clean rag, wipe the entire length of the wire to remove any built-up dirt and grease. Once the wire is clean, check for burns, cracks and other damage. Do not bend the wire, since the conductor might break.
6 Disconnect the wire from the distibutor. Again, pull only on the rubber boot. Check for corrosion and a tight fit in the same manner as the spark plug end. Replace the wire in the distributor.
7 Check the remaining spark plug wires, making sure they are securely fastened at the distributor and spark plug when the check is complete.
8 If new spark plug wires are required, purchase a set for your specific engine model. Wire sets are available pre-cut, with the rubber boots already installed. Remove and replace the wires one at a time to avoid mix ups in the firing order.
9 Check the distributor cap and rotor for wear. Look for cracks, carbon tracks, and worn, burned or loose contacts. **Note**: *On some models a special coating (silicone grease or cuprous oxide powder) is applied to the tip of the rotor. Do not wipe off the grease or file the*

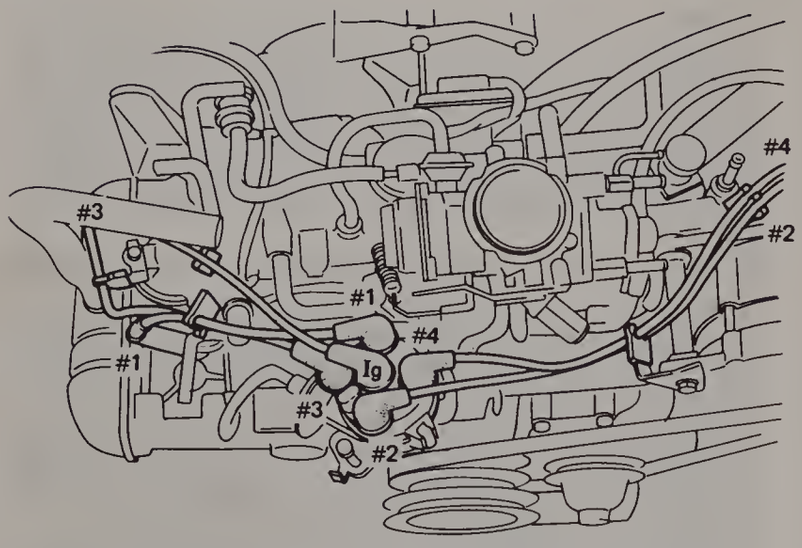


Fig. 1.19 Spark plug wire routing and cylinder numbers (Sec 19)

oxide coating. Replace the cap and rotor with new parts if defects are found. It is common practice to install a new cap and rotor whenever new spark plug wires are installed.

20 Ignition timing – check and adjustment

1 All vehicles are equipped with an Emission Control Information label on the underside of the hood. It lists important ignition timing specifications and procedures to be followed which are specific to the vehicle. Information on the label supersedes the information given in this Section. The label should be followed if information on it is different from that given here.
2 At the specified intervals, when the distributor or breaker points have been removed or a change made in the fuel type, the ignition timing must be checked and adjusted if necessary.
3 Before attempting to check the timing, make sure that the engine is at operating temperature and that the transmission is in Neutral (or Park) with the parking brake set. Turn off the air conditioner and lights. Make sure the idle speed is as specified, then disconnect the distributor vacuum hose and plug it.
4 Connect a timing light in accordance with the manufacturer's instructions. Generally, the light will be connected to the battery terminals and to the number one spark plug in some fashion. The number one spark plug is the one closest to the front of the engine on the right-hand side.
5 Locate the timing mark access hole on the right side of the flywheel housing. Remove the rubber cover.
6 Center the timing marks on the flywheel in the access hole in the flywheel housing. To do this, attach a wrench or socket to the large bolt at the front of the crankshaft and turn the engine over slowly by hand. **Caution**: *Make sure the ignition switch is Off as the crankshaft is being turned.*
7 Use chalk or white paint to highlight the groove in the flywheel that corresponds to the ignition timing specification for your particular engine. Each groove (line) on the flywheel equals 2°. The O indicates Top Dead Center (TDC), the A stands for After Top Dead Center and the B stands for Before Top Dead Center (BTDC). For example, if your ignition timing specification is 8° BTDC, mark the fourth groove on the B side of O (TDC).
8 Make sure that the wiring for the timing light is clear of all moving engine parts, then start the engine.
9 Point the flashing timing light at the timing marks. Again, be careful not to come in contact with moving parts of the engine. The specified mark should appear stationary and be lined up opposite the pointer. If the mark is in alignment with the pointer, the timing is correct. If they are not aligned, turn off the engine.
10 Loosen the bolt at the base of the distributor just enough to enable you to turn the distributor slightly (see Chapter 5 for further details if necessary).
11 Restart the engine and slowly turn the distributor until the timing mark is aligned with the pointer.
12 Shut off the engine and tighten the locknut. Be careful not to disturb the distributor position.
13 Start the engine and recheck the timing to make sure the mark did not shift when you tightened the distributor bolt.
14 Disconnect the timing light and remove any tools from under the hood. Drive the vehicle and listen for pinging noises. These will be most noticeable when the engine is hot and under load (climbing a hill, accelerating from a stop). If the engine is pinging, the ignition timing is too far advanced (Before Top Dead Center). Reconnect the timing light and turn the distributor to move the pointer one or two degrees closer to the O on the timing tab. Road test the vehicle again.
15 To keep the pinging at a minimum and allow vehicle operation at the specified timing setting, it is a good idea to use gasoline of the same octane rating at all times. Switching fuel brands and octane levels can decrease performance and economy and possibly damage the engine.

21 Vacuum hose and connection – checks

1 Check for damage and leaks in the rubber hoses and connections.
2 Inspect the surface of the hoses for heat and mechanical damage. Hard and brittle rubber, cracks, tears, cuts, abrasions and excessive swelling indicate deterioration of the rubber.
3 If any of these symptoms are present, replace the hoses or connections with new ones.
4 There is a vacuum hose routing diagram on the underside of the hood. Use it to locate the hoses.

22 Hot air intake system – check

1 Some Subaru models are equipped with a thermostatically controlled air cleaner which directs air to the carburetor from different locations depending upon the engine temperature.
2 This is a simple visual check; however, if access is tight, a small mirror may have to be used.
3 Open the hood and locate the baffle inside the air cleaner assembly. It will be located inside the long snorkel of the air cleaner (photo). Make sure that the flexible air ducts are securely attached and undamaged.
4 If there is a flexible air duct attached to the end of the snorkel, leading to an area behind the grille, disconnect it at the snorkel. This will enable you to look through the end of the snorkel and see the baffle inside.
5 The testing must be done when the engine and outside air are cold (below 72°F). Start the engine and look through the snorkel at the baffle, which should move to a closed position. With the baffle closed, air cannot enter through the end of the snorkel, but instead enters the air cleaner through the duct attached to the exhaust manifold.
6 As the engine warms up to operating temperature, the baffle should open to allow air through the snorkel end. Depending on ambient temperature, this may take 10 to 15 minutes. To speed up this check you can reconnect the snorkel air duct, drive the vehicle and then check to see if the baffle is completely open.
7 If the hot air intake system is not operating properly, see Chapter 6 for more information.

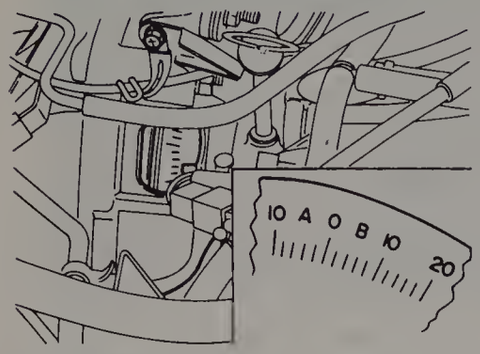


Fig. 1.20 Ignition timing mark location (Sec 20)

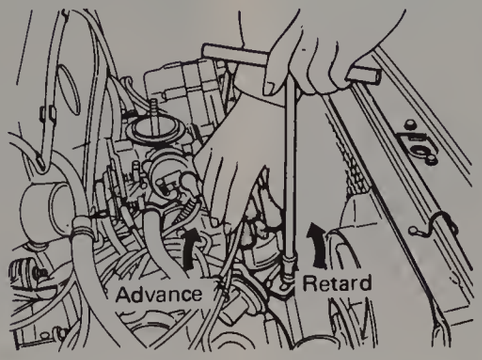
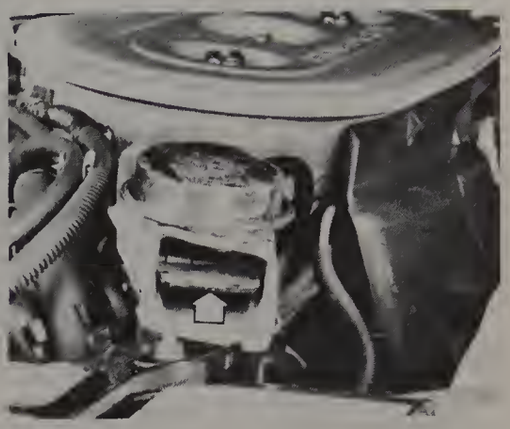
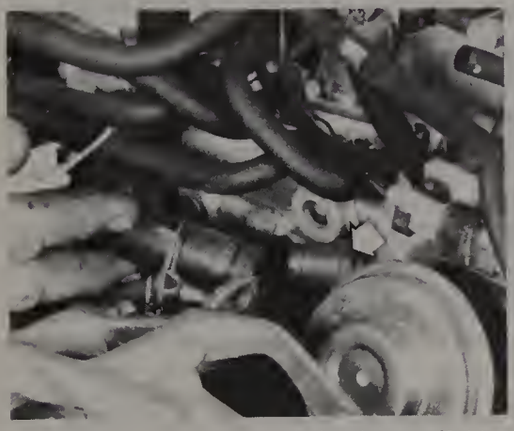


Fig. 1.21 Ignition timing adjustment (Sec 20)

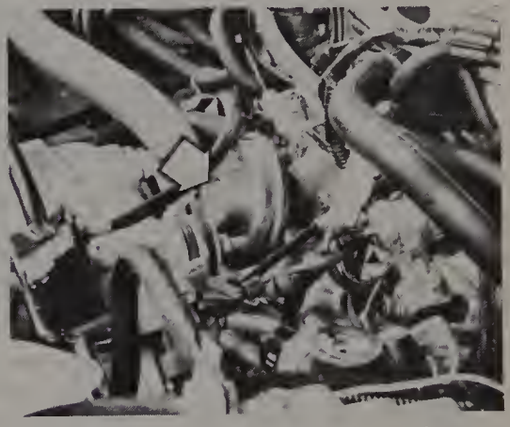


22.3 Hot air intake baffle location (arrow)



23.2 PCV valve location in intake manifold (arrow)

24.3 ECS canister location in the engine compartment



25.1 EGR valve location in the engine compartment (arrow)

23 PCV valve – check and replacement

1 The PCV valve is located on the rear of the intake manifold. It is connected to a rubber hose, which is in turn connected to the rocker arm cover and the air cleaner housing.

2 To check the valve with the engine running, remove the hose from the valve (photo) and place your finger over the valve opening. With the engine idling, a strong vacuum should be felt at the valve. When you increase the engine speed, the vacuum should diminish. The valve can also be checked (after it is removed) by shaking it. If a rattling sound is heard, the valve is good.

3 Check the PCV hoses for leaks and make sure they are not clogged. Check the oil filler cap gasket for damage and see if the cap fits tightly on the filler tube.

4 When purchasing a replacement PCV valve, make sure it is the proper type.

5 Loosen the clamp that secures the hose to the PCV valve and disconnect the hose from the valve.

6 Unscrew the valve from the manifold. Compare the old valve with the new one to make sure they are the same.

7 Thread the new valve into the manifold, tighten it securely and connect the hose to it. More information on the PCV system can be found in Chapter 6.

24 ECS canister – check and replacement

1 The function of the ECS emissions system is to draw fuel vapors from the tank and carburetor, store them in a charcoal-filled canister, and then burn them during normal engine operation.

2 The charcoal canister should be replaced if the filter is clogged. If, however, a fuel odor is detected, the canister and system hoses should be inspected immediately (Chapter 6).

3 The canister is located at the left front side of the engine compartment (photo). It has three or four hoses attached to the top.

4 Loosen and slide back the hose clamps on the three hoses and pull the hoses off the canister. Loosen the spring type clamp at the rear of the canister and lift the canister out of its holder. Examine the filter in the bottom of the canister.

5 If the filter is clogged, place a new canister into position in the holder, tighten the spring-type clamp and replace the hoses and hose clamps.

6 The ECS system is explained in more detail in Chapter 6.

25 EGR valve – check

1 The EGR system is used to reduce oxides of nitrogen in the exhaust system by recirculating exhaust gas back into the combustion chambers. The EGR valve, which is the main component in the system, is located on the back side of the intake manifold (photo).

2 To check the EGR valve, start the engine (it must be completely cool) and run it at idle speed.

3 Touch the underside of the EGR valve diaphragm while increasing the engine speed from idle to approximately 3500 rpm.

4 If the diaphragm or stem moves, the valve is working properly. If it does not move, refer to Chapter 6 for additional checks of the EGR system.

26 Exhaust system – checks

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

2 Check the pipes and connections for signs of leakage and/or corrosion indicating a potential failure. Make sure that all brackets and hangers are in good condition and tight.

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

body putty.

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

5 This is also an ideal time to check the running condition of the engine by inspecting inside the very end of the tailpipe. The exhaust deposits here are an indication of engine state of tune. If the pipe is black and sooty, or coated with white deposits, the engine is in need of a tune-up (including a thorough carburetor inspection and adjustment).

27 Battery – check and maintenance

1 **Warning**: *Certain precautions must be followed when checking or servicing the battery. Hydrogen gas, which is highly flammable, is always present in the battery cells so keep lighted tobacco and any other open flames or sparks away from the battery. The electrolyte inside the battery is actually dilute sulfuric acid, which can be hazardous to your skin and cause injury if splashed in the eyes (it is a good idea to wear eye protection). It will also ruin clothes and painted surfaces.*

2 Check the battery for cracks and evidence of electrolyte leakage.

3 To check the electrolyte level in the battery, remove all vent caps (photo). If the battery water level is low, add distilled water until the level is above the cell plates. There is an indicator in each cell to help you judge when enough water has been added. Do not overfill. **Note**: *Some models are equipped with maintenance-free batteries, which have no provision (or need) for adding water. Also, some models are equipped with translucent batteries so the electrolyte level can be observed without removing any vent caps. On these batteries the level should be between the upper and lower lines.*

4 Periodically check the specific gravity of the electrolyte with a hydrometer. This is especially important during cold weather. If the reading is below the specification, the battery should be recharged. Maintenance-free batteries have a built-in hydrometer (photo), which indicates the battery state-of-charge.

5 Check the tightness of the battery cable clamps to ensure good electrical connections. If corrosion is evident, remove the cables from the battery terminals (a puller may be required), clean them with a battery terminal brush, then reinstall them (photos). Corrosion can be kept to a minimum by applying a layer of petroleum jelly or grease to the terminals and cable clamps after they are assembled.

6 Inspect the entire length of each battery cable for corrosion, cracks and frayed conductors.

7 Check that the rubber protector over the positive terminal is not torn or missing. It should completely cover the terminal.

8 Make sure that the battery is securely mounted, but do not overtighten the clamp bolts.

9 The battery case and caps should be kept clean and dry. If corrosion is evident, clean the battery as explained in Step 12.

10 If the vehicle is not being used for an extended period, disconnect the battery cables and have it charged approximately every six weeks.

11 Corrosion on the battery hold-down components and inner fender panels can be removed by washing with a solution of water and baking soda. Once the area has been thoroughly cleaned, rinse it with clean water.

12 Corrosion on the battery case and terminals can also be removed with a solution of water and baking soda and a stiff brush. Be careful that none of the solution is splashed into your eyes or onto your skin (wear protective gloves). Do not allow any of the baking soda and water solution to get into the battery cells. Rinse the battery thoroughly once it is clean.

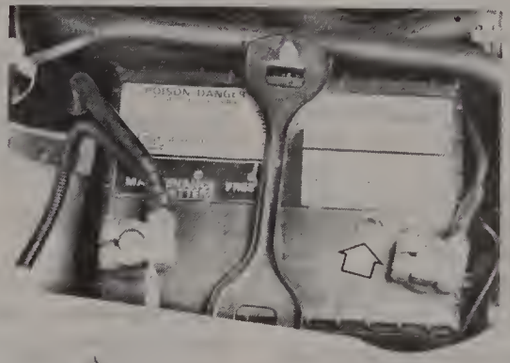
13 Metal parts of the vehicle which have been damaged by spilled battery acid should be painted with a zinc-based primer and paint. Do this only after the area has been thoroughly cleaned and dried.

28 Brake system – checks

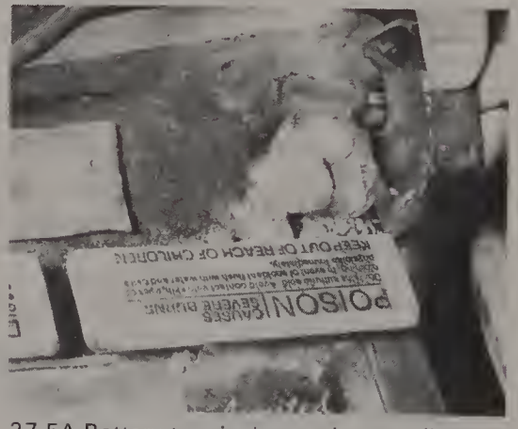
1 The brakes should be inspected every time the wheels are removed or whenever a defect is suspected.

2 Indications of a potential brake system defect are: the vehicle pulls

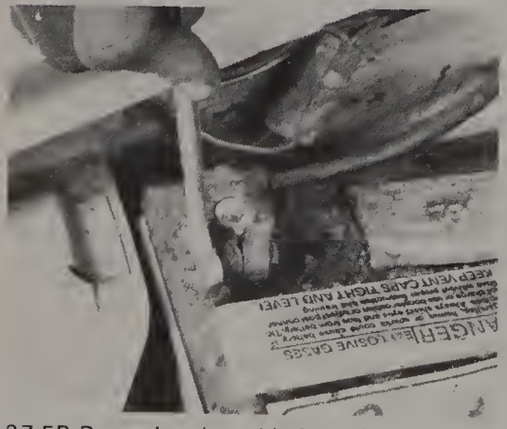
27.3 Remove the vent caps (if equipped) to check the battery electrolyte level



27.4 Maintenance-free batteries have a built-in hydrometer (arrow) to indicate battery state-of-charge

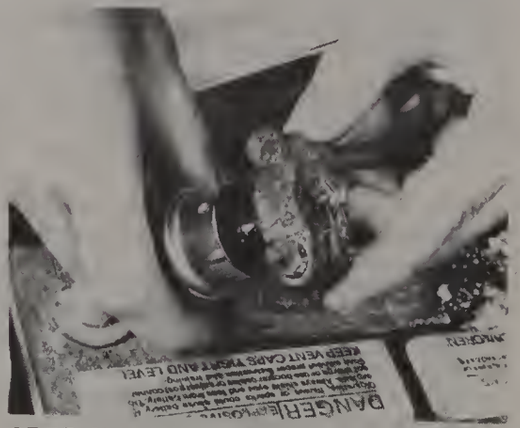


27.5A Battery terminal corrosion usually appears as a white fluffy powder



27.5B Removing the cable from the battery post (always remove the ground cable first and hook it up last)

27.5C Cleaning the battery post with a special tool



27.5D Cleaning the battery cable clamp

Measuring plug gap. A feeler gauge of the correct size (see ignition system specifications) should have a slight 'drag' when slid between the electrodes. Adjust gap if necessary

Adjusting plug gap. The plug gap is adjusted by bending the earth electrode inwards, or outwards, as necessary until the correct clearance is obtained. Note the use of the correct tool

Normal. Grey-brown deposits, lightly coated core nose. Gap increasing by around 0.001 in (0.025 mm) per 1000 miles (1600 km). Plugs ideally suited to engine, and engine in good condition

Carbon fouling. Dry, black, sooty deposits. Will cause weak spark and eventually misfire. Fault: over-rich fuel mixture. Check: carburettor mixture settings, float level and jet sizes; choke operation and cleanliness of air filter. Plugs can be re-used after cleaning

Oil fouling. Wet, oily deposits. Will cause weak spark and eventually misfire. Fault: worn bores/piston rings or valve guides; sometimes occurs (temporarily) during running-in period. Plugs can be re-used after thorough cleaning

Overheating. Electrodes have glazed appearance, core nose very white – few deposits. Fault: plug overheating. Check: plug value, ignition timing, fuel octane rating (too low) and fuel mixture (too weak). Discard plugs and cure fault immediately

Electrode damage. Electrodes burned away; core nose has burned, glazed appearance. Fault: pre-ignition. Check: as for 'Overheating' but may be more severe. Discard plugs and remedy fault before piston or valve damage occurs

Split core nose (may appear initially as a crack). Damage is self-evident, but cracks will only show after cleaning. Fault: pre-ignition or wrong gap-setting technique. Check: ignition timing, cooling system, fuel octane rating (too low) and fuel mixture (too weak). Discard plugs, rectify fault immediately

to one side when the brake pedal is applied; squealing noises coming from the brakes when they are applied; excessive brake pedal travel; spongy brake pedal feel; pulsating pedal; leakage of brake fluid, usually seen on the inside of the tire or wheel.

Hoses and brake lines

3 Visually check all flexible hoses and rigid lines in the brake system. Look for cracked rubber, bent or pinched metal tubes and leaks at the connections. If any item needs to be replaced, refer to the appropriate Section in Chapter 9.

Brake pedal

4 Physically check for smooth pedal movement and a firm feel. Check the pedal free play (the distance it moves before initial resistance is felt) and compare it to the Specifications. If it is incorrect, refer to Chapter 9.

5 Apply normal pressure to the brake pedal. If it feels spongy or gradually moves closer to the floorboard, refer to the bleeding procedure in Chapter 9.

Parking brake

6 The easiest way to check the operation of the parking brake is to park the vehicle on a steep hill, with the parking brake set and the transmission in Neutral. If the parking brake cannot prevent the vehicle from rolling, it is in need of adjustment (see Chapter 9).

7 Visually check the cable for any crimped areas or bends along its length and frayed edges. If these conditions exist, see Chapter 9 for replacement.

Brake vacuum booster

8 For an easy on-vehicle check of your vacuum booster, refer to the appropriate Section in Chapter 9.

29 Brake system – overhaul and lubrication

1 The manufacturer recommends replacing the rubber dust seals and the piston cups in the master cylinder and the rear wheel cylinders every 24 000 miles (40 000 km). However, a thorough check of the brake system will tell you when this is actually needed for your vehicle.

2 To replace the seals and cups of these components, refer to the appropriate Sections in Chapter 9.

3 The parking brake lever (front disc brakes) must be thoroughly repacked with NIGLUBE RX-2 (Subaru no. 725191040 or 003606000). Remove the lever cap ring and then remove the rubber cap. Remove as much old grease as you can from the cap and around the lever itself.

4 Pack grease into the lever and spindle area so the cap will be filled when installed. Be sure to apply grease to the inside of the cap and also to the lip of the cap and the groove it fits into on the caliper body. Don't forget to install the cap ring.

5 The other areas of the calipers to be greased are the guide pin and the lock pin. To do this the caliper must be removed from your vehicle by referring to the appropriate Section in Chapter 9.

6 Apply silicone compound (Subaru no. 725191050 or 003606010) to the areas shown in the accompanying illustration. Make sure that all of the old grease is removed first.

30 Brake vacuum booster – check

To check the vacuum booster, refer to the appropriate Section in Chapter 9.

31 Disc brake pad and disc – checks

1 Disc brakes can be checked visually without the need to remove any parts except the wheels. Most later models come equipped with a 'wear sensor' attached to the inner pad. This is usually a small bent piece of metal which is visible from the inboard side of the caliper. When the pads wear to the danger point, this metal sensor rubs against the disc and makes a screeching sound.

2 Block the rear wheels, raise the front of the vehicle and place it on jackstands.

3 Now visible is the disc brake caliper which contains the pads. There is an inner and an outer brake pad. Both should be inspected.

4 Inspect the pad thicknesses by looking through the cutout inspection port in the caliper body. If the pad thickness is below the specified limit, the pads should be replaced with new ones.

5 The brake pad lining is bonded or riveted to a metal backing plate. This metal plate *must be included* in the measurement.

6 Since it will be difficult to measure the exact thickness of the pad, you may have to remove it for further inspection or replacement. To do this, refer to the appropriate Section in Chapter 9.

7 Also check the condition of the disc. Check for scoring, gouging and burnt spots on the disc surface.

8 Refer to Section 5 in Chapter 9 and check the disc runout and thickness. If the disc is worn abnormally, it can be removed and resurfaced as long as the thickness is kept within the allowable limits listed in the Specifications.

9 If the disc must be removed or replaced, refer to the appropriate Section in Chapter 9.

32 Drum brake shoes and drum – checks

1 Drum brakes can be visually checked without the need to remove any parts except the wheels and the drums. To remove the brake drums, refer to the appropriate Section in Chapter 9.

2 Block the front wheels, raise the rear of the vehicle and place it on jackstands.

3 Now visible is the brake backing plate to which the shoes are attached. There is a leading (front) and a trailing (rear) shoe. Both should be inspected.

4 When inspecting the shoes, carefully brush away any accumulations of dirt and dust. **Warning:** *Do not blow this dust out with compressed air. Do not inhale the dust as it contains asbestos and is harmful to your health.*

5 Measure the thickness of the brake shoes. If they are below the specified limit, the shoes should be replaced with new ones.

6 The brake lining is bonded or riveted to a metal backing plate. This metal plate *must be included* in the measurement.

7 Since it may be difficult to measure the exact thickness of the shoes, you may have to remove them for further inspection or

Fig. 1.22 Checking brake pedal free play (Sec 28)

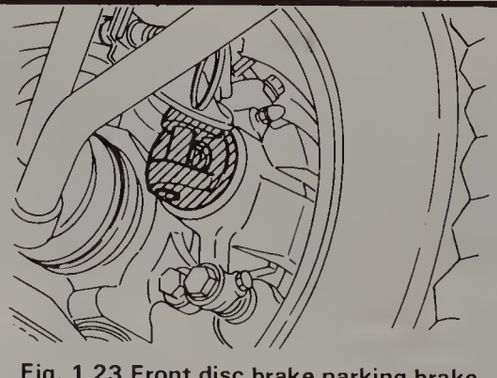


Fig. 1.23 Front disc brake parking brake lever lubrication point (shaded area) (Sec 29)

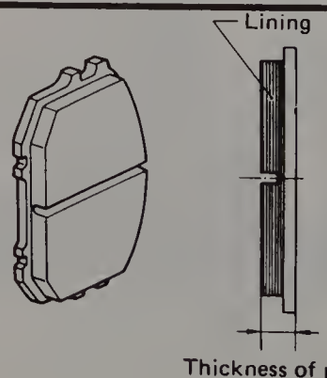


Fig. 1.24 Disc brake pad thickness measurement (Sec 31)

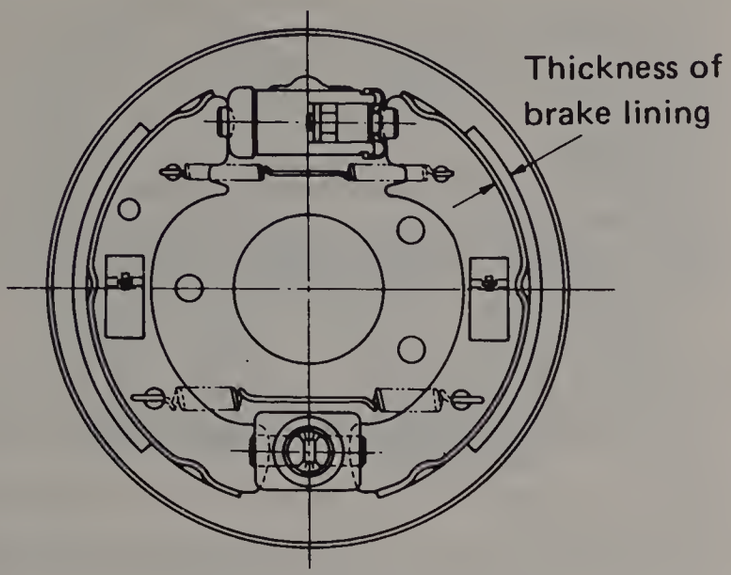


Fig. 1.25 Drum brake shoe thickness measurement (Sec 32)

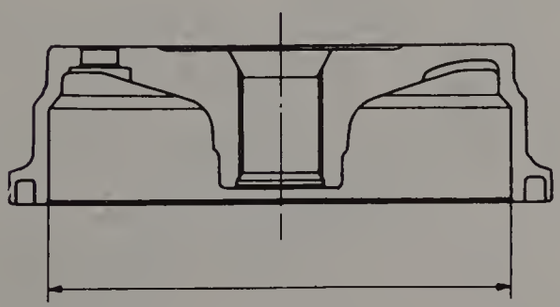


Fig. 1.26 Brake drum inside diameter measurement (Sec 32)

replacement. To do this, refer to the appropriate Section in Chapter 9.
8 Also check the condition of the brake drum. Check for scoring, gouging and burnt spots on the drum's inner surface.
9 Check the drum thickness and measure the inside diameter. If the drum is worn abnormally, it can be resurfaced as long as it is kept within the allowable limits listed in the Specifications.

33 Hill-holder components – check

1 The best way to check the Pressure Holding Valve (PHV) is to drive the vehicle to a hill of three degrees or steeper and check its operation.
2 Stop on the hill, push in the clutch and see if the valve holds the vehicle in position. If it does not hold, it most likely needs to be adjusted (see Chapter 9).
3 Also, check the rubber boots on the cable for deterioration and check the cable for damage and corrosion. Check the return spring for damage and make sure that the valve lever operates smoothly. Replacement and adjustment procedures can be found in Chapter 9.

34 Suspension and steering system – checks

1 Whenever the front of the vehicle is raised for service, it is a good idea to visually check the suspension and steering components for wear.
2 Indications of a fault in these systems are: excessive play in the steering wheel before the front wheels react; excessive sway around corners or body movement over rough roads; binding at some point as the steering wheel is turned.
3 Before the vehicle is raised for inspection, test the shock absorbers by pushing down to rock the vehicle at each corner. If you push the vehicle down and it does not come back to a level position within one or two bounces, the shocks are worn and must be replaced. As this is done, check for squeaks and strange noises from the suspension components. Information on shock absorber and suspension components can be found in Chapter 11.
4 Now, raise the front end of the vehicle and support it firmly on jack-stands placed under the frame rails. Because of the work to be done, make sure the vehicle cannot fall from the stands.
5 Grab the top and bottom of the front tire with your hands and rock the tire/wheel on its spindle. If there is movement of more than 0.059 inch, the wheel bearings should be serviced (see Section 35).
6 Crawl under the vehicle and check for loose bolts, broken or disconnected parts and deteriorated rubber bushings on all suspension and steering components. Look for grease or fluid leaking from around the steering box. Check the power steering hoses and their connections for leaks. Check the balljoints for wear.
7 Have an assistant turn the steering wheel from side-to-side and check the steering components for free movement, chafing or binding. If the steering does not react with the movement of the steering wheel, try to determine where the slack is located.
8 Check for balljoint deflection by squeezing the balljoint with channel-lock pliers.

35 Front/rear wheel bearings – check and repacking

1 The front wheel bearings cannot be checked or repacked except by a dealer service department. Refer to the appropriate Section in Chapter 11 for more information.
2 The rear wheel bearings on 2WD vehicles can be checked, repacked and adjusted by referring to the appropriate Section in Chapter 11.

36 Steering and axle rubber boots – check

1 The rubber boots to be most concerned about are the steering gearbox boots and the front and rear axle CV boots.
2 Check these boots frequently for deterioration, cracks and holes. Replace the boots with new ones if any of these faults are noticed.
3 To replace the steering gearbox boots, refer to the appropriate Section in Chapter 11.
4 To replace the axle shaft boots, refer to the appropriate Section in Chapter 8.

37 Tire wear and tire pressure – checks

1 Periodically inspecting the tires can not only prevent you from being stranded with a flat tire, but can also give you clues as to possible problems with the steering and suspension systems before major damage occurs.
2 Proper tire inflation adds miles to the life of the tires, allows the vehicle to achieve maximum gas mileage and contributes to overall riding comfort.
3 When inspecting the tire, first check the wear on the tread. Irregularities in the tread pattern (cupping, flat spots, more wear on one side than the other) are indications of front end alignment and/or balance problems. If any of these conditions are found, you should take the vehicle to a wheel alignment shop to correct the problem.
4 Also check the tread area for cuts or punctures. Many times a nail or tack will imbed itself into the tire tread and yet the tire will hold its air pressure for a short time. In most cases, a repair shop or gas station can repair the punctured tire.
5 It is also important to check the sidewalls of the tire, both inside and outside. Check for deteriorated, cut or punctured rubber. Also inspect the inboard side of the tires for signs of brake fluid leakage, indicating a brake inspection is needed immediately (Section 28).
6 Incorrect tire pressure cannot be determined merely by looking at the tire. This is especially true for radial tires. A tire pressure gauge must be used. If you do not already have a reliable gauge, it is a good idea to purchase one and keep it in the glove box. Built-in pressure gauges at gas stations are often unreliable.
7 Always check tire inflation when the tires are cold. Cold, in this case, means that the vehicle has not been driven more than one mile after sitting for three hours or more. It is normal for the pressure to increase 4 to 8 pounds or more when the tires are hot.

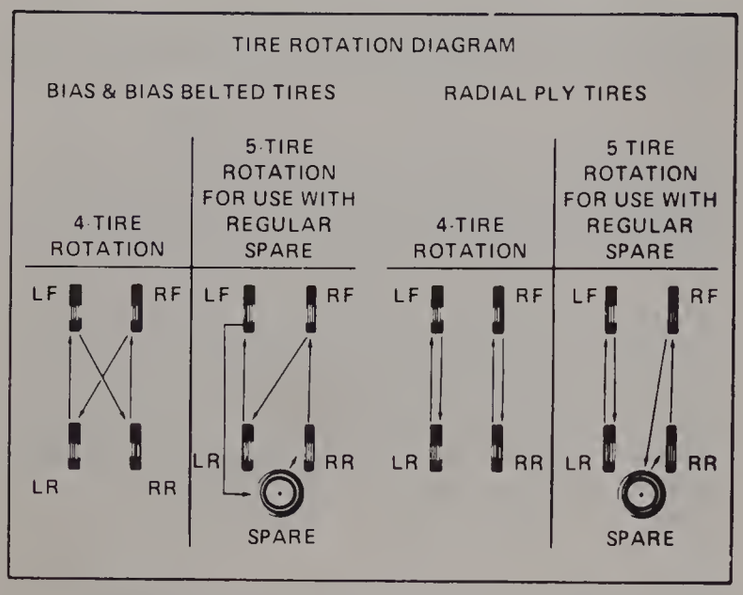


Fig. 1.27 Tire rotation diagram (Sec 38)

8 Unscrew the valve cap protruding from the wheel and firmly press the gauge onto the valve stem. Observe the reading on the gauge and check this figure against the recommended tire pressure for your vehicle.

9 Check all tires and add air as necessary to bring all tires up to the recommended pressure levels. Do not forget the spare tire. Be sure to reinstall the valve caps, which will keep dirt and moisture out of the valve core mechanism.

38 Tire rotation

1 The tires should be rotated at the specified intervals and whenever uneven wear is noticed. Since the vehicle will be raised and the tires removed anyway, this is a good time to check the brakes (Section 28) and/or repack the wheel bearings (Section 35). Read over these sections if this is to be done at the same time.

2 The location for each tire in the rotation sequence depends on the type of tire used on your vehicle. Tire type can be determined by reading the raised printing on the sidewall of the tire.

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

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

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

39 Front wheel alignment – check

Note: *Since wheel alignment and testing equipment is generally out of the reach of the home mechanic, this Section is intended only to familiarize the reader with the basic terms used and procedures followed during a typical wheel alignment job. In the event that your vehicle needs a wheel alignment check or adjustment, we recommend that the work be done by a reputable front-end alignment and repair shop.*

The three basic checks made when aligning a vehicle's front end are toe-in, caster and camber.

Toe-in is the amount the front wheels are angled in relationship to the centerline of the vehicle. For example, in a vehicle with zero toe-in, the distance measured between the front edges of the wheels is the same as the distance measured between the rear edges of the wheels. The wheels are running parallel with the centerline of the vehicle. This distance between the front edges of the wheels and the rear edges of the wheels should be within the Specifications. Toe-in is adjusted by lengthening or shortening the tie-rods. Incorrect toe-in will cause tires to wear improperly by making them 'scrub' against the road surface.

Camber and caster are the angles at which the wheel and suspension upright are inclined to the vertical. Camber is the angle of the wheel in the lateral (side-to-side) plane, while caster is the angle of the wheel and upright in the longitudinal (fore-and-aft) plane. Camber angle affects the amount of tire tread which contacts the road and compensates for change in the suspension geometry when the vehicle is traveling around curves or over an undulating surface. Caster angle affects the self-centering action of the steering, which governs straight-line stability. Camber and caster cannot be adjusted on these vehicles.

40 Accelerator pedal – check and adjustment

1 Check the accelerator pedal free play by operating the pedal with your hand.

2 Refer to the Specifications and compare them to the measurements that you obtain.

3 If the accelerator pedal needs adjustment, make the adjustments by turning the nut connecting the accelerator cable to the carburetor.

41 Cylinder compression check

1 A compression check will tell you what mechanical condition the engine is in. Specifically, it can tell you if the compression is down due to leakage caused by worn piston rings, defective valves and seats or a blown head gasket.

2 Begin by cleaning the area around the spark plugs before you remove them. This will keep dirt from falling into the cylinders while you are performing the compression test.

3 Remove the coil high-tension lead from the distributor and ground it on the engine block. Block the throttle and choke valves wide open.

4 With the compression gauge in the number one cylinder's spark plug hole, crank the engine over at least four compression strokes and observe the gauge. The compression should build up quickly in a healthy engine. Low compression on the first stroke, followed by gradually increasing pressure on successive strokes, indicates worn piston rings. A low compression reading on the first stroke, which does not build up during successive strokes, indicates leaking valves or a defective head gasket. Record the highest gauge reading obtained.

5 Repeat the procedure for the remaining cylinders and compare the results to the Specifications. All cylinders should be within 15 psi of each other.

6 Pour a couple of teaspoons of engine oil (a squirt can works great for this) into each cylinder, through the spark plug hole, and repeat the test.

7 If the compression increases after the oil is added, the piston rings are definitely worn. If the compression does not increase significantly, the leakage is occurring at the valves or head gasket.

8 If two adjacent cylinders have equally low compression, there is a strong possibility that the head gasket between them is blown. The appearance of coolant in the combustion chambers or the crankcase would verify this condition.

9 If the compression is higher than normal, the combustion chambers are probably coated with carbon deposits. If that is the case, the cylinder heads should be removed and decarbonized.

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

42 Valve clearance – check and adjustment

Note: *It is not necessary to adjust the valve clearances on vehicles that are equipped with hydraulic lifters.*

1 To check and adjust the valve clearances, the engine must be cold with the coolant temperature between 68 and 104°F (20 and 40°C).

2 Remove the rocker arm cover from the engine.

3 Position the number one piston at top dead center (TDC) on the compression stroke. To do this, remove all of the spark plugs from the engine, then locate the number one cylinder spark plug wire and trace

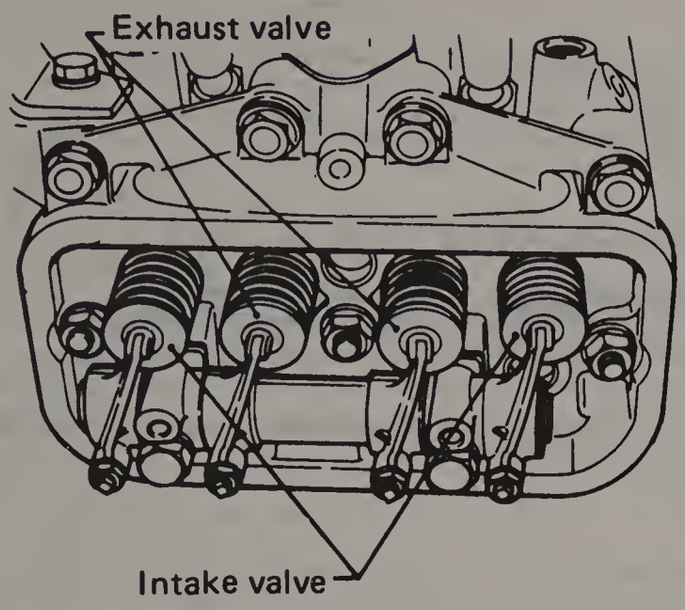


Fig. 1.28 Valve locations (Sec 42)

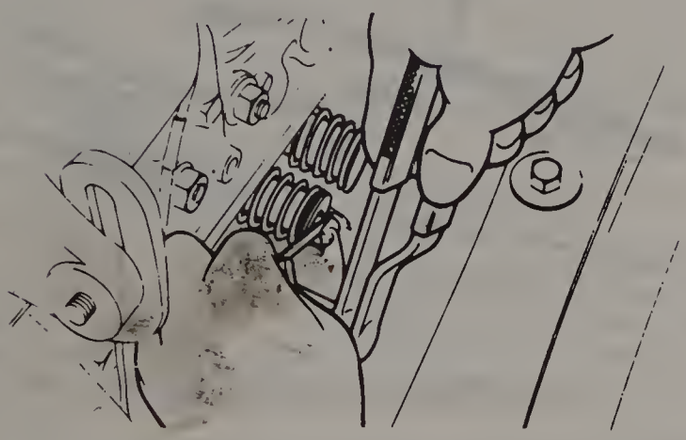


Fig. 1.29 Adjusting valve clearances (Sec 42)

it back to the distributor. Write a number 1 on the distributor body directly below the terminal where the number one spark plug wire attaches to the distributor cap. Do this for the other three cylinders (using numbers 2, 3 and 4) as well, then remove the cap and wires from the distributor.

4 Slip a wrench or socket over the large bolt at the front of the crankshaft and slowly turn it in a clockwise direction until the O on the flywheel is aligned with the pointer. The rotor should now be pointing directly at the mark you made on the distributor body. If it is not, turn the crankshaft one more complete revolution (360°) in a clockwise direction. If the rotor is now pointing at the mark on the distributor body, then the number one piston is at TDC on the compression stroke and the valve clearances can be checked and adjusted.

5 Insert an appropriate size feeler gauge between the valve stem and the rocker arm. Be sure to use the correct feeler gauge; intake and exhaust valves require different clearances for proper engine operation. If the feeler gauge fits between the valve and rocker arm with a slight drag, then the clearance is correct and no adjustment is required.

6 If the feeler gauge will not fit between the valve and rocker arm, or if it is loose, loosen the adjusting screw locknut and carefully tighten or loosen the adjusting screw until you can feel a slight drag on the feeler gauge as it is withdrawn from between the valve stem and rocker arm.

7 Hold the adjusting screw with a wrench, to keep it from turning, and tighten the locknut securely. Recheck the clearance to make sure it hasn't changed.

8 The valves in the remaining cylinders can now be checked. It is essential to adjust cylinder 3 next, followed by 2 and finally 4. Before checking clearances, bring each cylinder (in order) to TDC by turning the crankshaft 180° in a clockwise direction. Verify TDC by checking that the distributor rotor is pointing to the appropriate cylinder number you previously made on the distributor body.

9 Install the rocker arm covers (use new gaskets) and tighten the mounting bolts evenly and securely.

10 Install the distributor cap and spark plugs, then hook up the spark plug wires and the various hoses and vacuum lines.

11 Start the engine and check for oil leakage between the rocker arm covers and the cylinder heads.

43 Clutch pedal and cable – check and adjustment

1 If equipped with a manual transmission, it is important to have the clutch pedal free play correctly adjusted.

2 Clutch pedal free play is the distance the clutch pedal moves before the mechanical linkage actually begins to disengage the clutch disc from the flywheel and pressure plate.

3 To check the free play, slowly depress the clutch pedal until the resistance offered by the clutch release mechanism is felt. The pedal will suddenly become much more difficult to move.

4 Measure the distance the clutch pedal has traveled and compare it to the Specifications. If adjustment is required, raise the vehicle and set it securely on jackstands for access to the adjuster on the clutch release lever. Loosen the locknut and turn the adjusting nut, as required, until the specified free play is obtained, then tighten the locknut.

5 Clutch cables take a lot of abuse and should be inspected periodically.

6 Check the cable for ease of movement, frayed edges along its

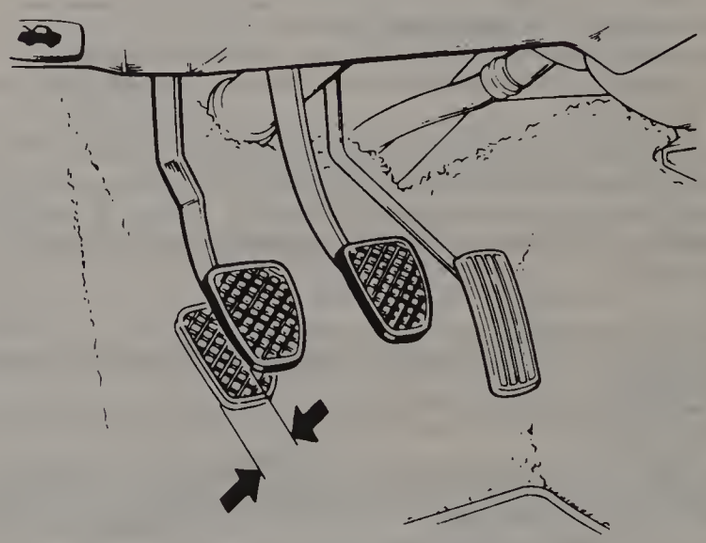


Fig. 1.30 Checking clutch pedal freeplay (Sec 43)

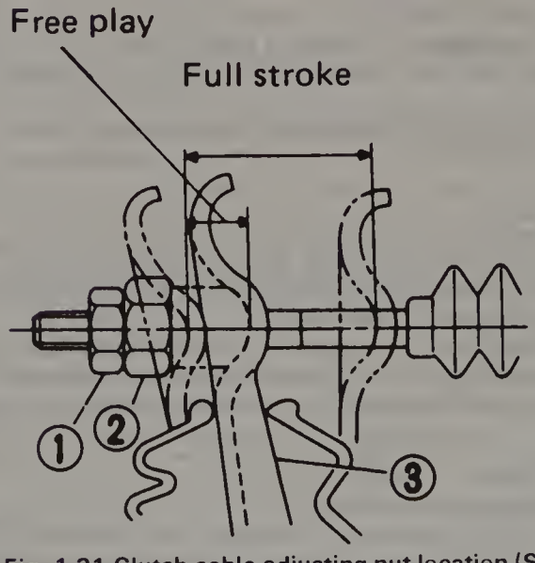


Fig. 1.31 Clutch cable adjusting nut location (Sec 43)

1 Locknut
2 Adjusting nut
3 Release fork

entire length and any crimped or bent sections.
7 Replace the cable, if necessary, by referring to Chapter 8. If the cable does not need to be replaced, wipe some grease on the exposed metal to keep it from deteriorating.

44 Universal joints (4WD) – check

1 Universal joint problems are usually caused by worn or damaged needle bearings. These problems are revealed as vibration in the driveline or clunking noises when the transmission is put in Drive or the clutch is released. In extreme cases they are caused by lack of lubrication. If this happens, you will hear metallic squeaks and, ultimately, grinding and shrieking sounds as the bearings are destroyed.
2 It is easy to check the needle bearings for wear and damage with the driveshaft in place on the vehicle. To check the rear universal joint, turn the driveshaft with one hand and hold the differential end yoke with the other. Any movement between the two is an indication of wear. The front universal joint can be checked by holding the front driveshaft with one hand and the sleeve yoke in the transfer case with the other. Any movement here indicates the need for universal joint repair. Lifting up on the driveshaft will also indicate whether there is play in the universal joints.
3 If they are worn or damaged, the universal joints will have to be disassembled and the bearings replaced with new ones. Read over the procedure carefully before beginning (Chapter 8).

45 Headlights – check and adjustment

1 Headlight adjustment is achieved using the two adjusting screws on each light unit.
2 Because of the regulations which are in force in different areas, it is not possible to give specific adjustment instructions.
3 Any adjustments which are made should be regarded only as an interim measure and the alignment should be checked as soon as possible by a Subaru dealer or service station with optical alignment equipment.

46 Window wiper and washer components – check and blade replacement

Wiper arms

1 Visually check the position of the wiper blades on the windshield. If they do not compare with the accompanying illustration or if they seem to hang over the edge of the window weatherstripping, adjust the arms by referring to Chapter 10.

Washer jets

2 Turn the washer system on and visually check where the fluid first contacts the windshield. If it does not touch directly in the center of the glass, adjust the spray nozzle with pliers until the desired effect is achieved.
3 If the amount of fluid coming out of the jets is insufficient, check for low (see Section 5) or frozen fluid and kinks in the supply hoses.

Wiper blades

4 Pour water on the windshield, turn the wiper blades on and visually check how the windshield is cleaned off. If it is not wiped clean, check the windshield and blades for wax or dirt build-up and the blades for deterioration or deformation.
5 If the blades must be replaced with new ones, refer to the accompanying illustration, pull up on the arm lever and pull the blade out. Install the new blades by simply pushing them into the holes.

47 Vehicle fastener – checks

1 Since nuts, bolts, screws, etc., may eventually work loose as a result of vibration and shock, it is a good idea to periodically check and tighten them to avoid damage to and possible loss of components.
2 Chassis parts that should be carefully checked include front and rear suspension components and steering and brake system parts.

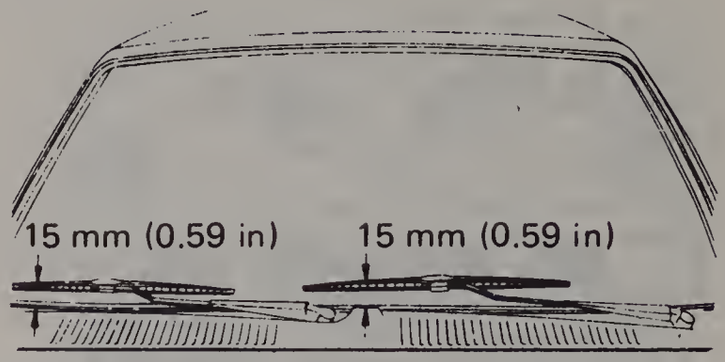


Fig. 1.32 Correct position of wiper blades on windshield (Sec 46)

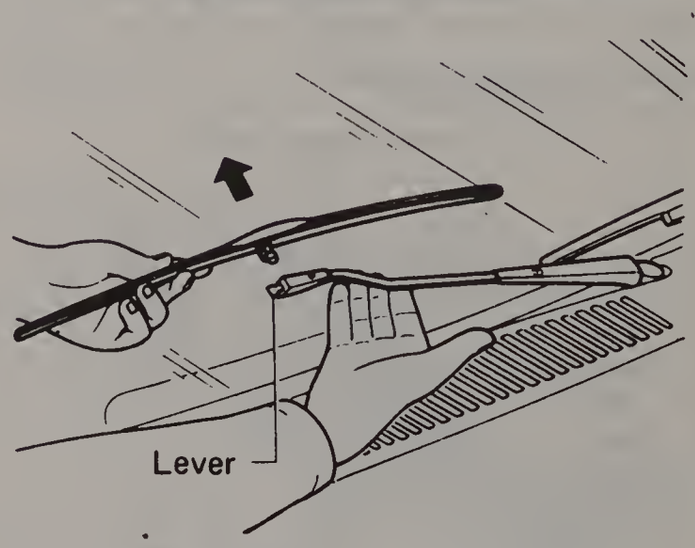


Fig. 1.33 Replacing a wiper blade (Sec 46)

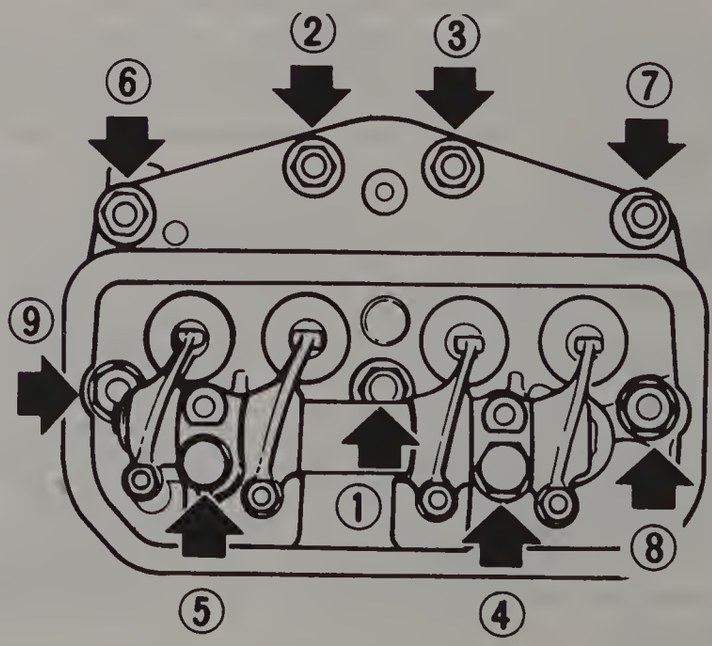


Fig. 1.34 Tightening sequence for cylinder head nuts and bolts (Sec 47)

3 Body parts that may loosen in time include seats and seat belt systems, doors and hood components.
4 Check the operation of all hinges and locks.
5 Check and tighten the cylinder head, the wheel lug nuts and the manifold bolts according to the Torque specifications.

48 Vehicle chassis lubrication

1 A grease gun and a cartridge filled with grease are usually the only pieces of equipment necessary to lubricate the chassis components. Occasionally, on later model vehicles, plugs will be installed rather than grease fittings, in which case grease fittings will have to be purchased and installed.
2 Look under the vehicle to see if grease fittings or solid plugs are installed. If there are plugs, remove them with the correct wrench and buy grease fittings which will thread into the component. A dealer or auto parts store will be able to find replacement fittings. Straight, as well as angled, fittings are available for easy access.
3 For easier access under the vehicle, raise the vehicle with a jack and place jackstands under the frame. Make sure it is firmly supported by the stands.
4 Before you do any greasing, force a little of the grease out of the nozzle to remove any dirt from the end of the gun. Wipe the nozzle clean with a rag.
5 With the grease gun and plenty of clean rags, crawl under the vehicle to begin lubricating the components.
6 Wipe the grease fitting nipple clean and push the nozzle firmly over the fitting nipples. Squeeze the trigger on the grease gun to force grease into the component. The balljoints should be lubricated until the rubber reservoir is firm to the touch. Do not pump too much grease into these fittings as this could rupture the reservoir. For all other suspension and steering fittings, continue pumping grease into the nipple until the grease seeps out of the joint between the two components. If the grease seeps out around the grease gun nozzle, the nipple is clogged or the nozzle is not fully seated around the fitting nipple. Resecure the gun nozzle to the fitting and try again. If necessary, replace the fitting.
7 Wipe the excess grease from the components and the grease fitting. Follow these procedures for the remaining fittings.
8 Check the universal joints on the driveshaft; some have fittings, some are factory sealed. About two pumps is all that is required for grease type universal joints. While you are under the vehicle, clean and lubricate the parking brake cable along with its cable guides and levers. This can be done by smearing some of the chassis grease onto the cable and its related parts with your fingers.
9 Lower the vehicle to the ground for the remaining body lubrication process.
10 Open the hood and smear a little chassis grease on the hood latch mechanism. If the hood has an inside release, have an assistant pull the release knob from inside the vehicle as you lubricate the cable at the latch.
11 Lubricate all the hinges (door, hood, etc.) with a few drops of light engine oil to keep them in proper working order.
12 Finally, the key lock cylinders can be lubricated with spray-on graphite which is available at auto parts stores.

49 Contact breaker points/condenser – removal, installation and adjustment (UK models only)

1 Although the contact points can be cleaned and dressed with a fine-cut file, it may be a false economy for the home mechanic to attempt this. Due to the inaccessibility of the distributor components, it is more practical to replace the contact points with new ones during tune-ups.
2 The contact point set and condenser are replaced as a set. Point alignment and spring tension are factory set and should require no further adjustment.
3 Whenever contact point replacement is required. It is a good idea to use magnetized tools to prevent screws or nuts from falling down into the distributor body (which means that distributor disassembly will be required to retrieve them).

Contact point removal and installation

4 Remove the distributor cap by releasing the spring-type latches.
5 With both latches disengaged from the distributor cap, position the cap (with the spark plug wires still attached) out of the way. Use a length of wire or string if necessary.
6 Remove the rotor, which is now visible at the top of the distributor shaft (the rotor is a push fit on the shaft and can simply be lifted away).
7 Loosen the two screws which secure the contact point set to the breaker plate. Do not completely remove these screws, as most point sets have slots at these locations. Slide the point set off the breaker plate.

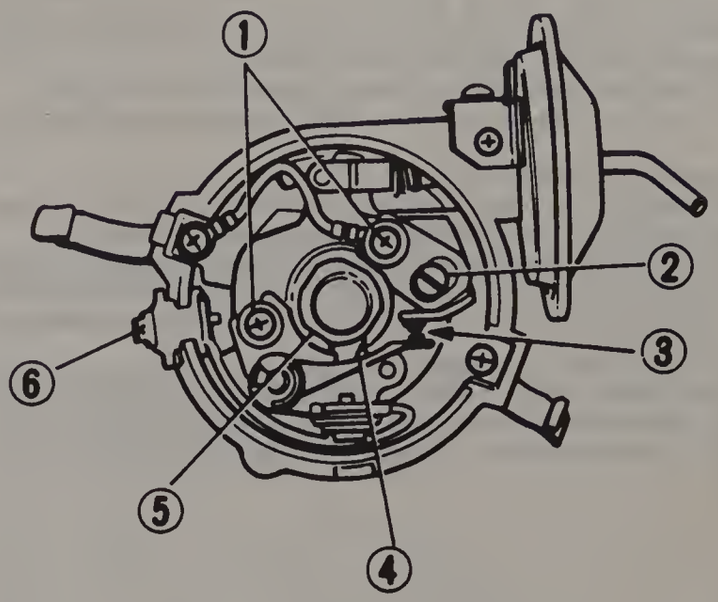


Fig. 1.35 Contact breaker points (UK models only) (Sec 49)

1 Mounting screws
2 Adjusting screw
3 Contacts
4 Rubbing block
5 Point cam
6 Distributor body primary terminal

8 Disconnect the primary wire lead at the contact point set or the distributor body terminal connection. This wire may be attached with a small nut (which should be loosened, but not removed) or a small screw.
9 Disconnect the condenser wire from the distributor body. The condenser can now be removed from the side of the distributor. Loosen the mounting strap screw and slide the condenser out of the bracket, or completely remove the condenser and strap, depending on the exact mounting arrangement.
10 Before installing the new points and condenser, clean all old lubricant, dirt, etc. from the breaker plate and the point cam surface of the distributor shaft.
11 Lubricate the point cam with the grease supplied with the new points (do not use multi-purpose grease).
12 Place the new condenser in position and tighten the retaining screw.
13 Slide the new contact point set onto the breaker plate and tighten the two mounting screws finger-tight.
14 Connect the primary wire lead to the new point assembly or the distributor body terminal. Make sure the lead is positioned the same as it was during removal.
15 Although the gap between the contact points will be adjusted when the dwell angle is adjusted, it is a good idea to set the initial gap to start the engine. With the points in position and the mounting screws snug, but not completely tight, make sure that the point rubbing block is resting on one of the lobes of the cam. To move the cam, turn the crankshaft by placing a wrench over the large bolt at the front of the crankshaft.
16 With the rubbing block on a cam lobe (points fully open), place a blade-type feeler gauge between the contacts. The gap should be as specified. If it is not correct, use a screwdriver to turn the adjusting screw, which will open and close the gap. When the gap is correct, tighten the mounting screws securely.
17 Before installing the rotor, inspect it for cracks and damage. Carefully check the condition of the metal contact at the top of the rotor for excessive burning or pitting. If in doubt as to its condition, replace it with a new one (see Section 19).
18 Install the rotor. It is keyed to fit on the shaft one way. Make sure it is firmly seated.

19 Before installing the distributor cap, inspect it for cracks and damage. Closely examine the contacts on the inside of the cap for excessive corrosion. Slight scoring is normal. If in doubt as to the quality of the cap, replace it with a new one.
20 Install the distributor cap, locking the two latches into place.
21 Start the engine and check the dwell angle and the ignition timing.

Dwell angle adjustment

22 Whenever new contact points are installed or the original points are cleaned, the dwell angle should be checked and adjusted.
23 Setting the dwell angle is actually very easy; however, a dwell meter must be used for precise adjustment. Combination tach/dwell meters are common tune-up instruments which can be purchased at a reasonable cost.
24 Connect the dwell meter according to the manufacturer's instructions. Usually one lead is attached to the primary wire at the distributor and the other lead is attached to a good ground on the engine. Make sure the engine selector switch is in the correct position.
25 Start the engine and allow it to idle until it has reached normal operating temperature. The engine must be warm to achieve an accurate reading.
26 Note the dwell meter reading. If it is within the specified range, shut off the engine and disconnect the meter. If it is not within the specified range, shut off the engine and remove the distributor cap and rotor.
27 Loosen the breaker point mounting screws slightly, then turn the adjusting screw to change the point gap (dwell). Increasing the point gap will *decrease* the dwell reading, while decreasing the point gap will *increase* the dwell reading.
28 Tighten the point mounting screws, then install the rotor and distributor cap and recheck the dwell.
29 Repeat the procedure until the dwell reading is within the specified range. **Note**: *Try to obtain a dwell setting that is toward the lower end of the specified range. Then, as the points wear (which increases dwell), the dwell will remain within the specified range for a longer period of time.*

Chapter 2 Engine

Refer to Chapter 13 for specifications and information applicable to the overhead cam (OHC) engine

Contents

Specifications

General

Bore and stroke	
1600 cc engine	3.62 x 2.36 in (92 x 60 mm)
1800 cc engine	3.62 x 2.64 in (92 x 67 mm)
Displacement	
1600 cc engine	97 cu in (1595 cc)
1800 cc engine	109 cu in (1781 cc)
Oil pressure at 2500 engine rpm	57 psi
Valve clearances	See Chapter 1

Cylinder head

Head gasket surface warpage limit	0.002 in (0.05 mm)
Head gasket surface resurfacing limit	0.020 in (0.5 mm)
Valve seat angle	45°
Valve seat width	
Intake	0.028 to 0.051 in (0.7 to 1.3 mm)
Exhaust	0.039 to 0.071 in (1.0 to 1.8 mm)
Valve guide inside diameter	0.3150 to 0.3156 in (8.000 to 8.015 mm)
Valve guide protrusion (1980 through 1982)	
Intake	0.689 to 0.709 in (17.5 to 18.0 mm)
Exhaust	0.886 to 0.906 in (22.5 to 23.0 mm)
Valve guide protrusion (1983 only)	
Intake	0.689 to 0.728 in (17.5 to 18.5 mm)
Exhaust	0.886 to 0.925 in (22.5 to 23.5 mm)

Valves

Valve face angle	45° +0.50 −0.00
Margin width (standard)	
Intake	0.039 in (1 mm)
Exhaust	0.051 in (1.3 mm)

Margin width (service limit)	
Intake	0.020 in (0.5 mm)
Exhaust	0.031 in (0.8 mm)
Stem diameter	
Intake	0.3130 to 0.3136 in (7.950 to 7.965 mm)
Exhaust	0.3128 to 0.3134 in (7.945 to 7.960 mm)
Valve stem-to-guide clearance (standard)	
Intake	0.0014 to 0.0026 in (0.035 to 0.065 mm)
Exhaust	0.0016 to 0.0028 in (0.040 to 0.070 mm)
Valve stem-to-guide clearance (service limit)	
Intake	0.0059 in (0.15 mm)
Exhaust	0.0059 in (0.15 mm)

Valve springs (solid lifters)

Free length	
Inner spring	1.921 in (48.8 mm)
Outer spring	1.783 in (45.3 mm)
Compressed height	
Inner spring	
19.0 to 22.1 lb	1.476 in (37.5 mm)
41.7 to 48.3 lb	1.122 in (28.5 mm)
Outer spring	
32.9 to 38.1 lb	1.555 in (39.5 mm)
112.5 to 127.9 lb	1.201 in (30.5 mm)
Out-of-square limit	
Inner spring	0.083 in (2.1 mm)
Outer spring	0.079 in (2.0 mm)

Valve springs (hydraulic lifters)

Free length	
Inner spring	2.087 in (53.0 mm)
Outer spring	1.909 in (48.5 mm)
Compressed height	
Inner spring	
26.0 to 30.0 lb	1.476 in (37.5 mm)
45.2 to 51.8 lb	1.181 in (30.0 mm)
Outer spring	
51.4 to 58.9 lb	1.555 in (39.5 mm)
116.6 to 134.7 lb	1.260 in (32.0 mm)
Out-of-square limit	
Inner spring	0.091 in (2.3 mm)
Outer spring	0.083 in (2.1 mm)

Rocker arms

Bore diameter	0.7093 to 0.7100 in (18.016 to 18.034 mm)
Shaft diameter	0.7080 to 0.7088 in (17.982 to 18.003 mm)
Rocker arm-to-shaft clearance	0.0005 to 0.0020 in (0.013 to 0.052 mm)

Valve lifters (solid)

Lifter diameter	0.8248 to 0.8256 in (20.949 to 20.970 mm)
Lifter bore diameter	0.8268 to 0.8276 in (21.000 to 21.021 mm)
Lifter-to-bore clearance	
Standard	0.0012 to 0.0028 in (0.030 to 0.072 mm)
Service limit	0.004 in (0.100 mm)

Valve lifters (hydraulic)

Lifter diameter	0.8248 to 0.8255 in (20.950 to 20.968 mm)
Lifter bore diameter	0.8263 to 0.8283 in (20.988 to 21.040 mm)
Lifter-to-bore clearance	
Standard	0.0008 to 0.0035 in (0.020 to 0.090 mm)
Service limit	0.0039 in (0.100 mm)

Pushrods

Runout	0.016 in (0.4 mm) or less

Cylinder bores

Diameter	3.6214 to 3.6226 in (91.985 to 92.015 mm)
Taper limit	0.002 in (0.05 mm)
Out-of-round limit	0.002 in (0.05 mm)
Maximum increase in diameter (boring and honing)	0.0197 in (0.5 mm)
Maximum difference in diameter between cylinders	0.002 in (0.05 mm)
Cylinder-to-piston clearance	
Standard	0.0004 to 0.0016 in (0.010 to 0.040 mm)
Service limit	0.0024 in (0.06 mm)

Pistons and rings

Piston diameter (std.)	3.6205 to 3.6216 in (91.960 to 91.990 mm)
Piston pin diameter	0.8265 to 0.8268 in (20.992 to 21.000 mm)
Piston pin bore diameter	0.8267 to 0.8271 in (20.999 to 21.009 mm)
Piston pin-to-bore clearance	0.0002 to 0.0004 in (0.004 to 0.010 mm)
Piston ring end gap	
Top and second rings	0.0079 to 0.0591 in (0.20 to 1.50 mm)
Oil ring side rails	0.0079 to 0.0787 in (0.20 to 2.0 mm)
Piston ring-to-groove clearance	
Top ring	
Standard	0.0016 to 0.0031 in (0.04 to 0.08 mm)
Service limit	0.0059 in (0.15 mm)
Second ring	
Standard	0.0012 to 0.0028 in (0.03 to 0.07 mm)
Service limit	0.0059 in (0.15 mm)
Oil ring	0

Connecting rods

Bend/twist limit (per 3.94 in/100 mm)	0.0039 in (0.10 mm)
Side clearance	
Standard	0.0028 to 0.0130 in (0.070 to 0.330 mm)
Service limit	0.016 in (0.4 mm)
Piston pin bushing bore diameter	
1980 through 1982	0.8268 to 0.8292 in (21.000 to 21.061 mm)
1983	0.8268 to 0.8274 in (21.000 to 21.016 mm)
Piston pin-to-rod bore clearance	
1980 and 1981	0.0002 to 0.0016 in (0.005 to 0.040 mm)
1982 and 1983	0 to 0.0009 in (0 to 0.022 mm)

Crankshaft and bearings

Main bearing journal diameter (std.)	
1800 cc engine	1.7715 to 1.7720 in (44.995 to 45.010 mm)
1600 cc engine	
Front/rear journals	1.9668 to 1.9673 in (49.957 to 49.970 mm)
Center journal	1.9673 to 1.9678 in (49.970 to 49.982 mm)
Connecting rod bearing journal diameter (std.)	1.7715 to 1.7720 in (44.995 to 45.010 mm)
Bearing journal taper limit	0.0028 in (0.07 mm)
Bearing journal out-of-round limit	0.0012 in (0.03 mm)
Bearing journal regrind limit	0.0098 in (0.25 mm)
Crankshaft runout limit	0.0014 in (0.035 mm)
Crankshaft endplay	
Standard	
1980 and 1981	0.0016 to 0.0054 in (0.040 to 0.137 mm)
1982 and 1983	0.0004 to 0.0037 in (0.010 to 0.095 mm)
Service limit	0.0118 in (0.3 mm)
Main bearing oil clearance	
Standard (1800 cc engine)	
Center bearing	0.0004 to 0.0010 in (0.010 to 0.025 mm)
Front/rear bearings	0.0004 to 0.0012 in (0.010 to 0.030 mm)
Standard (1600 cc engine)	
Center bearing	0.0004 to 0.0012 in (0.010 to 0.030 mm)
Front/rear bearings	0.0004 to 0.0014 in (0.010 to 0.035 mm)
Service limit	
Center bearing	0.0018 in (0.045 mm)
Front/rear bearings	0.0022 in (0.055 mm)
Connecting rod bearing oil clearance	
Standard	0.0008 to 0.0028 in (0.020 to 0.070 mm)
Service limit	0.0039 in (0.10 mm)

Camshaft

Runout limit	0.002 in (0.05 mm)
Thrust clearance	
Standard	0.0008 to 0.0035 in (0.020 to 0.090 mm)
Service limit	0.008 in (0.2 mm)
Cam lobe height	
With solid lifters	
Standard	1.2693 to 1.2732 in (32.24 to 32.34 mm)
Wear limit	0.0059 in (0.15 mm)
With hydraulic lifters	
Standard	1.4134 to 1.4173 in (35.90 to 36.00 mm)
Wear limit	0.0059 in (0.15 mm)
Camshaft bearing journal diameter	
Front/center journals	
1800 cc engine	1.2582 to 1.2589 in (31.959 to 31.975 mm)
1600 cc engine	1.0220 to 1.0226 in (25.959 to 25.975 mm)
Rear journal	1.4157 to 1.4163 in (35.959 to 35.975 mm)

Camshaft bearing bore diameter (in crankcase)	
Front/center bores	
1800 cc engine	1.2598 to 1.2605 in (32.00 to 32.018 mm)
1600 cc engine	1.0236 to 1.0243 in (26.00 to 26.018 mm)
Rear bore	1.4173 to 1.4180 in (36.00 to 36.018 mm)
Camshaft bearing oil clearance	
Standard	0.0010 to 0.0023 in (0.025 to 0.059 mm)
Service limit	0.0039 in (0.100 mm)
Camshaft gear axial runout limit	0.0098 in (0.25 mm)
Camshaft gear-to-crankshaft gear backlash	
Standard	0.0004 to 0.0020 in (0.010 to 0.050 mm)
Service limit	0.0039 in (0.10 mm)

Crankcase

Mating surface warpage limit	0.002 in (0.05 mm)
Stud protrusion from crankcase surface	
1600 cc engine	3.563 to 3.642 in (90.5 to 92.5 mm)
1800 cc engine	3.602 to 3.681 in (91.5 to 93.5 mm)

Oil pump

Drivegear outside diameter	1.1693 to 1.1709 in (29.70 to 29.74 mm)
Rotor outside diameter	1.5957 to 1.5968 in (40.53 to 40.56 mm)
Drivegear tip-to-rotor tip clearance	
Standard	0.0008 to 0.0047 in (0.02 to 0.12 mm)
Service limit	0.008 in (0.2 mm)
Rotor/gear-to-case side clearance	
Standard	0.0012 to 0.0051 in (0.03 to 0.13 mm)
Rotor-to-case radial clearance	
Standard	0.0059 to 0.0083 in (0.15 to 0.21 mm)
Service limit	0.0098 in (0.25 mm)
Relief valve spring free length	1.854 in (47.1 mm)
Bypass valve spring free length	
1800 cc engine	1.461 in (37.1 mm)
1600 cc engine	1.602 in (40.7 mm)

Torque specifications

	Ft-lb	Nm
Oil pressure sensing unit	16 to 20	22 to 27
Engine-to-transmission bolts	34 to 40	46 to 54
Engine mount-to-crossmember nut	14 to 25	20 to 33
Front exhaust pipe-to-engine	18 to 25	25 to 34
Pitching stopper nut	7 to 13	10 to 18
Connecting rod nut	29 to 31	39 to 42
Crankcase bolts and nuts		
6 mm	3.3 to 4.0	4.4 to 5.4
8 mm	17 to 20	23 to 26
10 mm	29 to 35	39 to 47
Crankcase service hole plugs	46 to 56	62 to 76
Oil strainer mounting bolt	17 to 20	23 to 26
Large crankcase studs	25 to 33	34 to 44
Cylinder head bolts/nuts		
1st step	22	29
2nd step	43	59
3rd step	47	64
Flywheel/driveplate housing-to-engine bolts	14 to 20	20 to 27
Oil pan bolts	3.3 to 4.0	4.4 to 5.4
Flywheel-to-crankshaft bolts	30 to 33	41 to 45
Driveplate-to-crankshaft bolts	36 to 39	49 to 53
Crankshaft pulley bolt	47 to 54	64 to 74
Intake manifold bolts	13 to 16	18 to 22

1 General information

The 1600 cc and 1800 cc engines are of horizontally opposed, four cylinder, overhead valve configuration. The larger engine is used primarily in the four-wheel drive vehicles.

The crankcase is made of aluminum and can be separated into right and left sections. The cylinder heads are also aluminum while the crankshaft is made of steel and supported by three main bearings.

The aluminum pistons are the slipper type with two compression rings and one combination-type oil control ring. The camshaft is short, with four cam lobes operating the intake and exhaust valves on both sides. The camshaft is directly supported in the crankcase at three places *without* the use of replaceable bearings.

The engine oil pump is driven directly by the camshaft and is mounted on the outside of the crankcase, making inspection and maintenance easy.

2 Engine overhaul – general information

1 It is not always easy to determine when, or if, an engine should be completely overhauled, as a number of factors must be considered.

2 High mileage is not necessarily an indication that an overhaul is needed, while low mileage, on the other hand, does not preclude the need for an overhaul. Frequency of servicing is probably the single most important consideration. An engine that has regular (and frequent) oil and filter changes, as well as other required maintenance,

will most likely give many thousands of miles of reliable service. Conversely, a neglected engine may require an overhaul very early in its life.

3 Excessive oil consumption is an indication that piston rings and/or valve guides are in need of attention (make sure that oil leaks are not responsible before deciding that the rings and guides are bad). Have a cylinder compression or leak-down test performed by an experienced tune-up mechanic to determine for certain the extent of the work required.

4 If the engine is making obvious 'knocking' or rumbling noises, the connecting rod and/or main bearings are probably at fault. Check the oil pressure with a reliable gauge installed in place of the pressure sending unit. If it is extremely low, the bearings and/or pump may be worn out.

5 Loss of power, rough running, excessive valve train noise and high fuel consumption rates may also point to the need for an overhaul (especially if they are all present at the same time). If a complete tune-up does not remedy the situation, major mechanical work is the only solution.

6 An engine overhaul generally involves restoring the internal parts to the specifications of a new engine. During an overhaul, the piston rings are replaced and the cylinder walls are reconditioned (rebored and/or honed). If a rebore is done, then new pistons are also required. The main and connecting rod bearings are replaced with new ones and, if necessary, the crankshaft may be reground to restore the journals. Generally, the valves, pushrods and lifters are serviced as well, since they are usually in less-than-perfect condition at this point. While the engine is being overhauled, other components such as the fuel system, the distributor, the starter and the alternator can be rebuilt also. The end result should be a like-new engine that will give as many trouble-free miles as the original.

7 Before beginning the engine overhaul, read through the entire procedure to familiarize yourself with the scope and requirements of the job. Overhauling an engine is not that difficult, but it is time-consuming. Plan on the vehicle being tied up for a minimum of two weeks, especially if parts must be taken to an automotive machine shop for repair or reconditioning. Check on availability of parts and make sure that any necessary special tools and equipment are obtained in advance. Most work can be done with typical shop hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be replaced. Often a reputable automotive machine shop will handle the inspection of parts and offer advice concerning reconditioning and replacement. **Note:** *Always wait until the engine has been completely disassembled and all components (especially the engine crankcases) have been inspected before deciding what service and repair operations must be performed by an automotive machine shop. Since the condition of the cylinders will be a major factor to consider when determining whether to overhaul the original engine or buy a rebuilt one, never purchase parts or have machine work done on other components until the crankcases have been thoroughly inspected.* As a general rule, time is the primary cost of an overhaul, so it doesn't pay to install worn or sub-standard parts.

8 As a final note, to ensure maxiumum life and minimum trouble from a rebuilt engine, everything must be assembled with care in a spotlessly clean environment.

3 Engine – disassembly and reassembly sequence

1 To completely disassemble the engine, remove the following items in the order given:

Engine external components (Section 5)
Oil pump (Section 8)
Oil pan (Section 10)
Oil strainer/pick-up tube
Cylinder head and valve train components (Section 12)
Pistons (Section 18)
Separate the crankcases (Section 19)
Crankshaft and connecting rods (Section 20)
Camshaft and valve lifters (Section 21)

2 Engine reassembly is basically the reverse of disassembly. Install the following components in the order given:

Camshaft and valve lifters (Section 21)
Crankshaft and connecting rods (Section 29)
Rejoin the crankcases (Section 31)
Pistons (Section 33)
Cylinder head and valve train components (Section 17)
Oil strainer/pick-up tube
Oil pan (Section 10)
Oil pump (Section 8)
Engine external components (Section 34)

4 Engine – removal

Note: *The engine must be removed as a separate unit with the transmission left in place in the vehicle. Do not attempt to remove the transmission with the engine.*

1 Before starting this procedure, some method of lifting the engine must be devised. Ideally, a small crane mounted on wheels should be rented or borrowed. These are readily available and easy to use. An alternative would be to suspend a chain fall or cable hoist from the garage rafters or a framework fabricated from large timbers. Regardless of which type of hoist support is utilized, it must be strong enough to support the full weight of the engine. Do not take chances or cut corners here, as serious injury and damage to the engine and vehicle could result.

2 The following sequence of operations does not necessarily need to be performed in the order given. It is, rather, a checklist of everything that must be disconnected or removed before the engine can be lifted out of the vehicle. It is very important that all linkages, electrical wiring, hoses and cables be removed or disconnected before attempting to lift the engine clear of the vehicle, so double-check everything thoroughly. **Caution:** *If the vehicle is equipped with air conditioning, have the lines disconnected by an automotive air conditioning mechanic. Do not attempt to do this at home, as serious injury or damage could result.*

3 Scribe (or mark with paint) the location of the hood hinge brackets on the hood (to ensure proper alignment of the hood during reinstallation). Loosen and remove the bolts attaching the hood to the brackets and lift the hood carefully away from the vehicle (with the help of an assistant).

4 Remove the splash shields (photo) from the underside of the engine.

5 Remove the spare tire and support bracket.

6 Disconnect both cables from the battery (negative first, then positive).

7 Refer to Chapter 1 and drain the entire cooling system (including the engine), then remove the lower radiator hose.

8 Unplug the automatic transmission cooling fan connector (if applicable).

9 Disconnect the hoses and wiring from the air cleaner and remove the air cleaner assembly. **Note:** *Plug the carburetor opening to keep dirt out.*

10 Disconnect the upper radiator hose from the top of the radiator (photo) and the thermostat housing.

11 Unplug the engine cooling fan and the coolant temperature sensing unit electrical connectors. These connectors are located at the front of the battery.

12 Disconnect the cooling fan ground cable (photo) attached to the radiator shroud above the engine cooling fan.

13 Remove both upper radiator mount bolts (photo) and the transmission fluid cooler lines (if applicable), then lift the radiator out of the engine compartment.

14 Remove the air conditioning compressor hoses (photo) (if applicable).

15 Remove the air conditioning compressor drivebelt by loosening the tensioner pulley adjustment bolt (photo).

16 Disconnect the air conditioning compressor clutch wire.

17 Remove the air conditioning compressor mounting bolts (photo).

18 Remove the air conditioning compressor.

19 Disconnect the wires from the rear of the alternator.

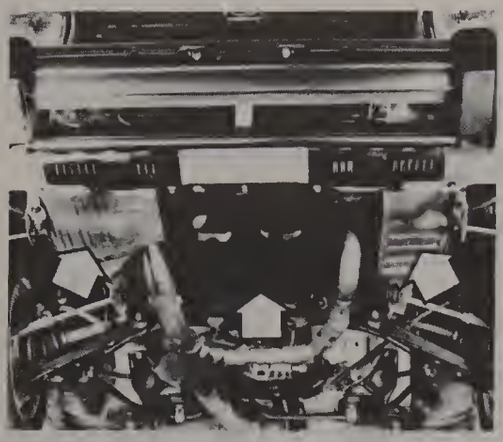
20 Loosen the alternator pivot and adjustments bolts, then remove the alternator drivebelt. Remove the alternator bolts and lift out the alternator.

21 Remove the air cleaner pre-heat transfer tube.

22 Remove the ground cable from the upper right-hand corner of the cylinder head.

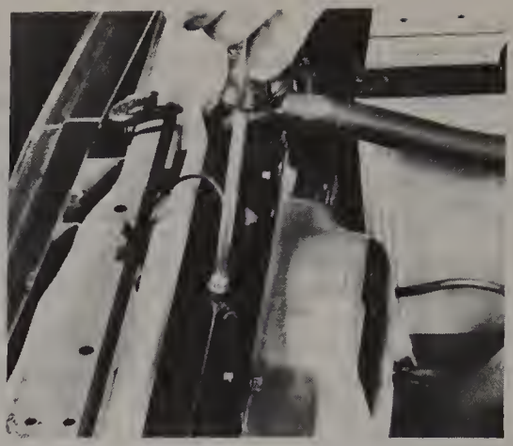
23 Disconnect the distributor high tension wire from the coil (photo).

24 Tag and remove the two wires attached to the positive (+) and

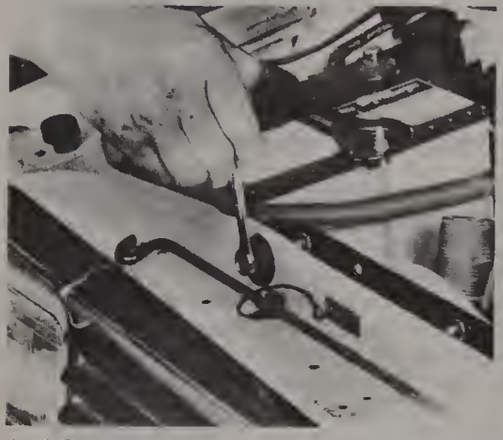


4.4 The splash shields (arrows) must be removed to gain access to the underside of the engine

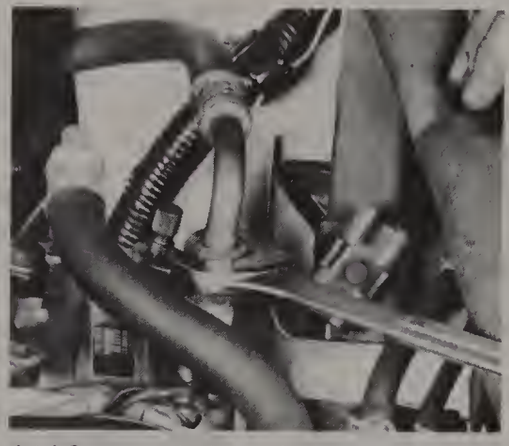
4.10 Loosening the upper radiator hose clamp



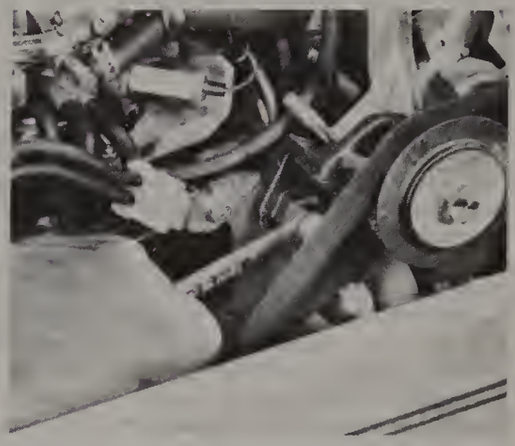
4.12 Removing the cooling fan ground wire screw



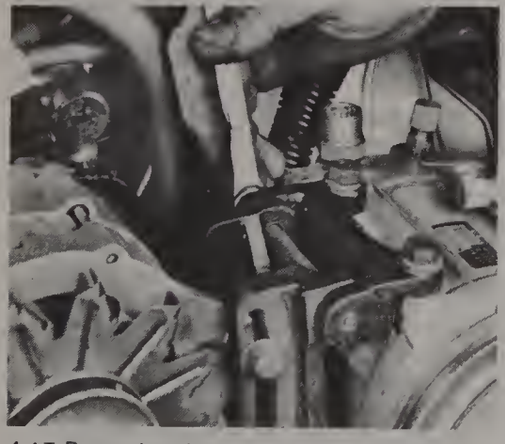
4.13 The radiator is held in place with bolts at the top



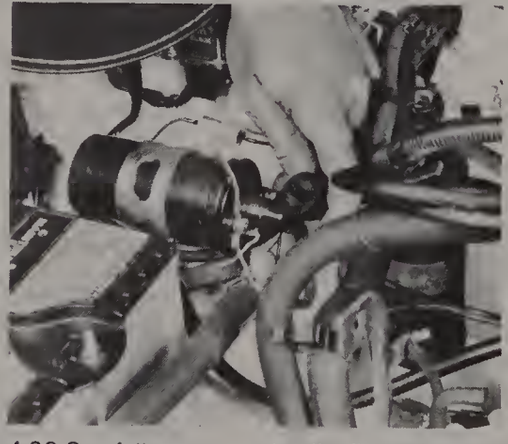
4.14 Separate the hoses from the air conditioning compressor only after you have had the system evacuated



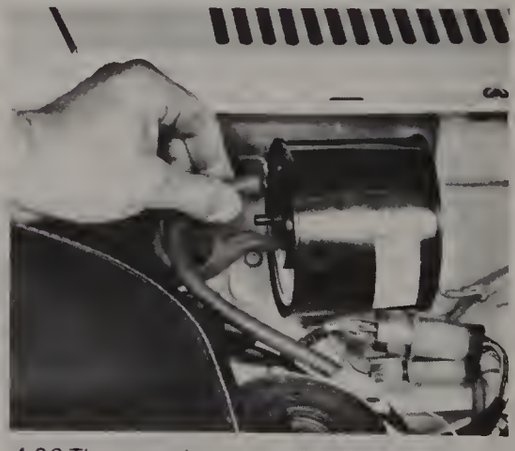
4.15 Loosening the air conditioning compressor drivebelt tensioner bolt



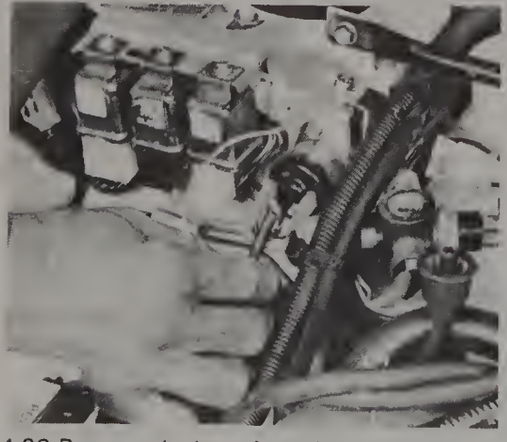
4.17 Removing the compressor mounting bolts



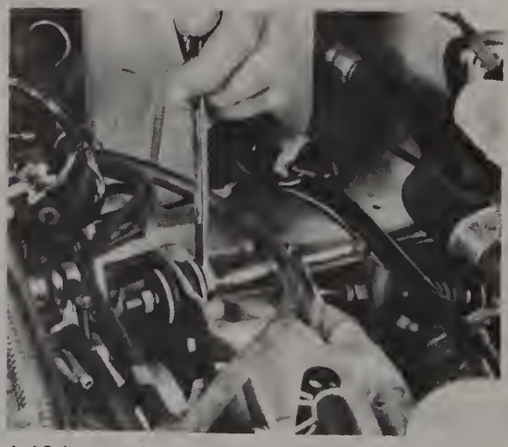
4.23 Carefully separate the distributor high tension wire from the coil



4.26 The upper hose must be disconnected from the vacuum canister



4.29 Remove the hose from the vacuum solenoid



4.40 Loosening the pitching stopper rod nuts

4.45 Separating the front exhaust pipe from the engine flange

negative (-) terminals of the coil. When doing this, make sure you reconnect to the coil any wires not attached directly to the engine.
25 Disconnect the wires from the starter motor. Remove the starter motor mounting bolts and remove the starter motor from the engine.
26 Disconnect the vacuum hose from the upper port of the vacuum canister (photo) and the T-fitting located just to the rear of the windshield washer filler.
27 Disconnect the vacuum line from the T-fitting located just forward of the vacuum canister.
28 Unplug the two electrical connectors just below the vacuum canister.
29 Disconnect the vacuum hose from the solenoid (photo).
30 Disconnect the capacitor electrical lead from the positive battery cable stand-off bracket located just below the thermostat housing (not all models).
31 Disconnect the throttle cable from the manifold bracket and the carburetor throttle shaft pulley.
32 Disconnect the Hill-holder cable from the clutch lever on the bellhousing bracket (manual transmission). Disconnect the clutch return spring.
33 Disconnect the air conditioning hose bracket from the oil fill tube bracket (if applicable).
34 Disconnect the heater hoses at the bellhousing/transmission parting line.
35 Remove the hose bracket directly in front of the oil fill tube.
36 Disconnect the miscellaneous hoses coupled directly to the carburetor. **Note:** *You may want to label these hoses in some manner to eliminate confusion during installation.*
37 There is no need to remove the carburetor at this time. If you must remove it for overhaul, refer to Chapter 4.
38 Disconnect the vacuum hose from the left end of the intake manifold.
39 Disconnect the Hill-holder cable just outboard of the heater hose from the heater hose bracket (if applicable).
40 Remove the engine pitching stopper rod (photo). Remove the spark plug wire bracket from the top front of the engine so the chain does not damage it as the engine is removed.
41 If vehicle is equipped with power steering, refer to Chapter 11 and remove the power steering pump. Remove the pump bracket as well.
42 Raise the front of the vehicle and support it on jackstands. Block the rear wheels to keep the vehicle from rolling.
43 Remove the Hot Air Intake system duct from the heat stove on the exhaust pipe (not all models).
44 Disconnect the electrical lead from the oxygen sensor (not all models).
45 Detach the front exhaust pipe from the head pipe flanges on each cylinder head (photo).
46 Separate the front exhaust pipe from the rear pipe and the frame hangers (photo), then remove the front exhaust pipe.
47 If your vehicle is equipped with an automatic transmission, remove the cover from the timing mark hole and turn the crankshaft until one of the driveplate-to-torque converter bolts is visible in the hole. Remove the bolt (be careful not to drop it into the housing). Turn the crankshaft and repeat the procedure for the remaining bolts.
48 *Remove* the two upper engine-to-transmission mounting bolts and *loosen* the two lower engine-to-transmission mounting nuts.
49 Remove the front engine mount retaining nuts (photo).
50 Attach the engine hoist chain or cables to the engine lifting hooks, then support the transmission with an hydraulic floor jack.
51 Take the slack out of the hoist chain or cables, then remove the two lower engine-to-transmission mounting nuts.
52 Before proceeding, make sure that *all* wires, hoses, lines and brackets have been disconnected.
53 Very carefully lift the engine until the front engine mount studs clear the crossmember, then slowly move the engine forward and up (photo). Be very careful not to allow the engine to strike or catch on the engine compartment components or the body as it is being removed.

5 External engine components – removal

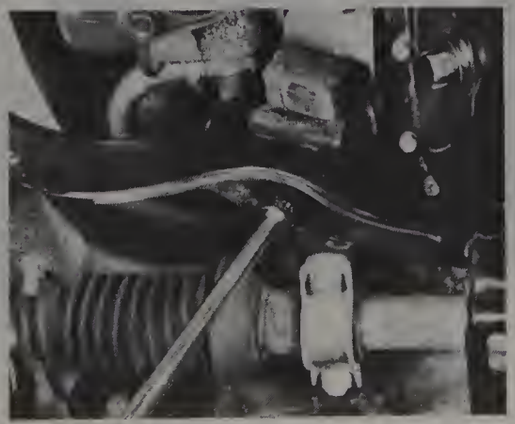
Refer to Figs. 2.1 through 2.4

1 Remove the clutch cover and disc by referring to Chapter 8. Remove the large bolt, then separate the pulley from the front of the crankshaft. Remove the flywheel (manual transmission) or the converter driveplate (automatic transmission) from the engine.
2 Remove the compressor/alternator bracket (photo).
3 Remove the hoses from the rocker arm covers.
4 Disconnect the hose from the water pump (photo), then remove the mounting bolts and separate the pump from the engine.
5 Disconnect the plug wire separators from the associated brackets.
6 Remove the spark plug wires from the plugs, then remove the plug wires and the distributor cap and cap seal from the distributor. Remove the rotor.
7 Remove the spark plugs from the engine (photo).
8 Disconnect the distributor primary wire(s), then remove the screw and separate the clamp and harness from the distributor (photo).
9 Remove the vacuum advance diaphragm hose, then refer to Chapter 5 and remove the distributor from the engine.
10 Disconnect the oil pressure sensing unit wire. Remove the sensing unit (photo).
11 Remove the coolant transfer hose (from the thermostat housing) from the fitting directly below the carburetor.
12 Disconnect the right-hand rocker arm cover vent hose.
13 Remove the rubber hose and the air supply tube from the air injection system Air Suction valve. Remove the flexible hose.
14 Remove the two flexible hoses and holder. Disconnect the vacuum sensing line from the air injection system air suction valve.
15 Remove the EGR supply tube.
16 Remove the oil fill tube and bracket (photo).
17 Remove the hose assembly from the PCV valve (photo).
18 Refer to the appropriate Section and remove the intake manifold.
Note: *Do not remove the carburetor, hoses and other components from the manifold unless replacement or overhaul is necessary. The carburetor removal procedure can be found in Chapter 4.*

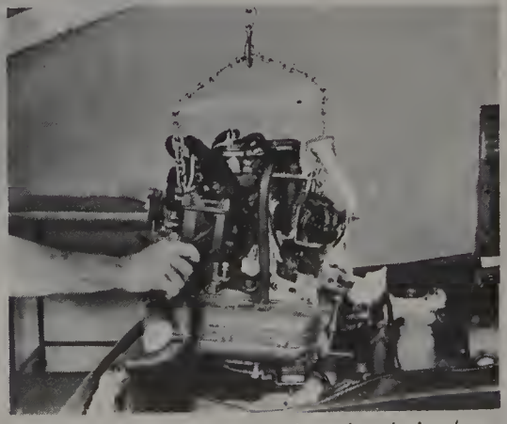
6 Intake manifold – removal and installation

1 In order to remove the intake manifold from the engine, a number of components have to be disconnected.

4.46 Removing the exhaust pipe frame hanger bolts



4.49 The front engine mounts are bolted to the crossmember



4.53 When raising the engine, the chains (or cables) must be directed straight up to avoid damaging the carburetor

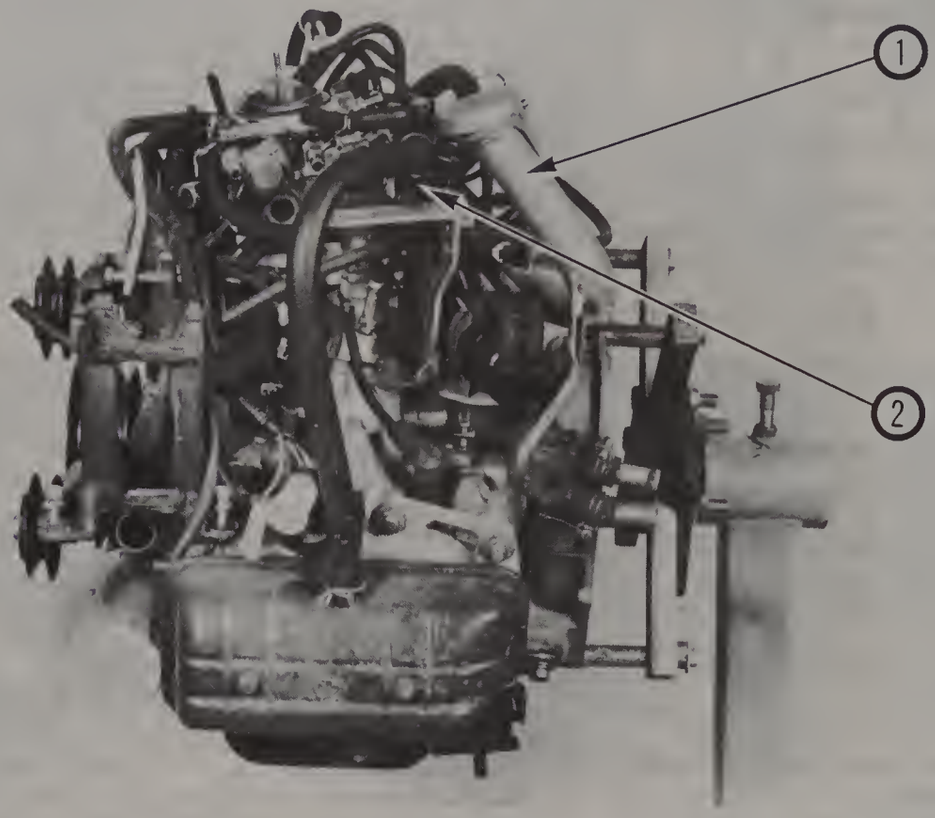


Fig. 2.1 Engine – left side view

1 Oil fill tube
2 PCV valve hose assembly

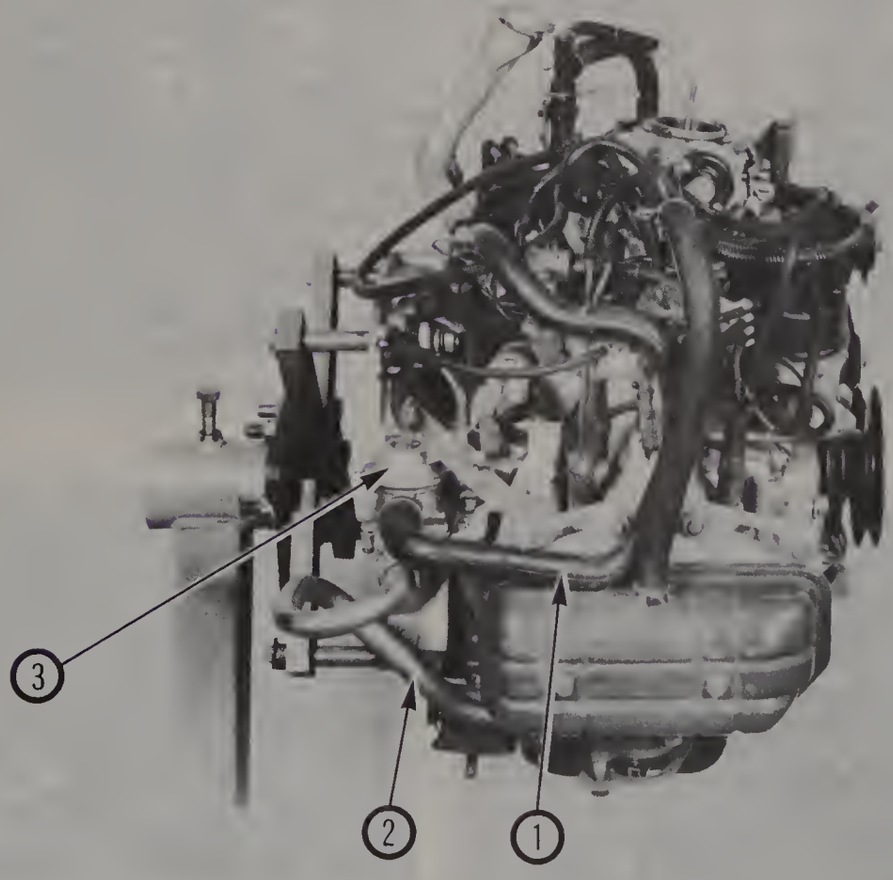


Fig. 2.2 Engine – right side view

1 Air Suction valve rubber hose
2 Air Suction valve air supply tube
3 Air Suction valve

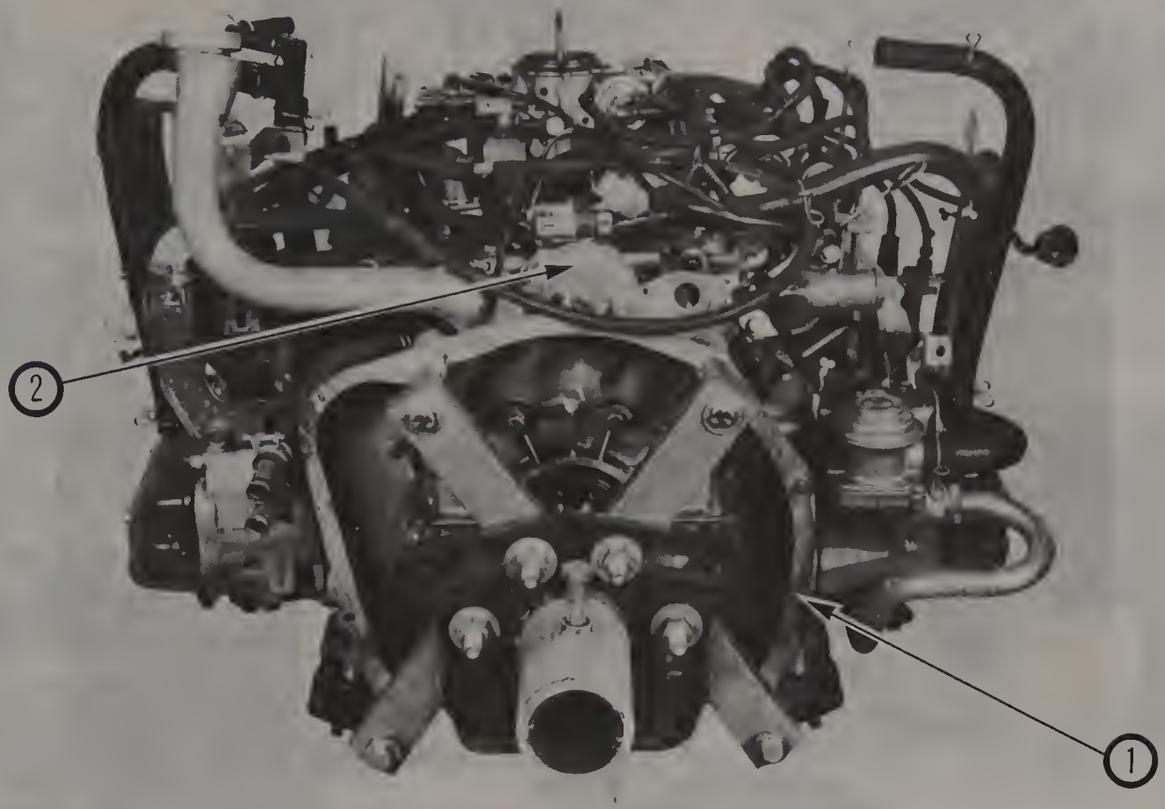


Fig. 2.3 Engine – rear view

1 Flywheel/driveplate housing
2 EGR valve

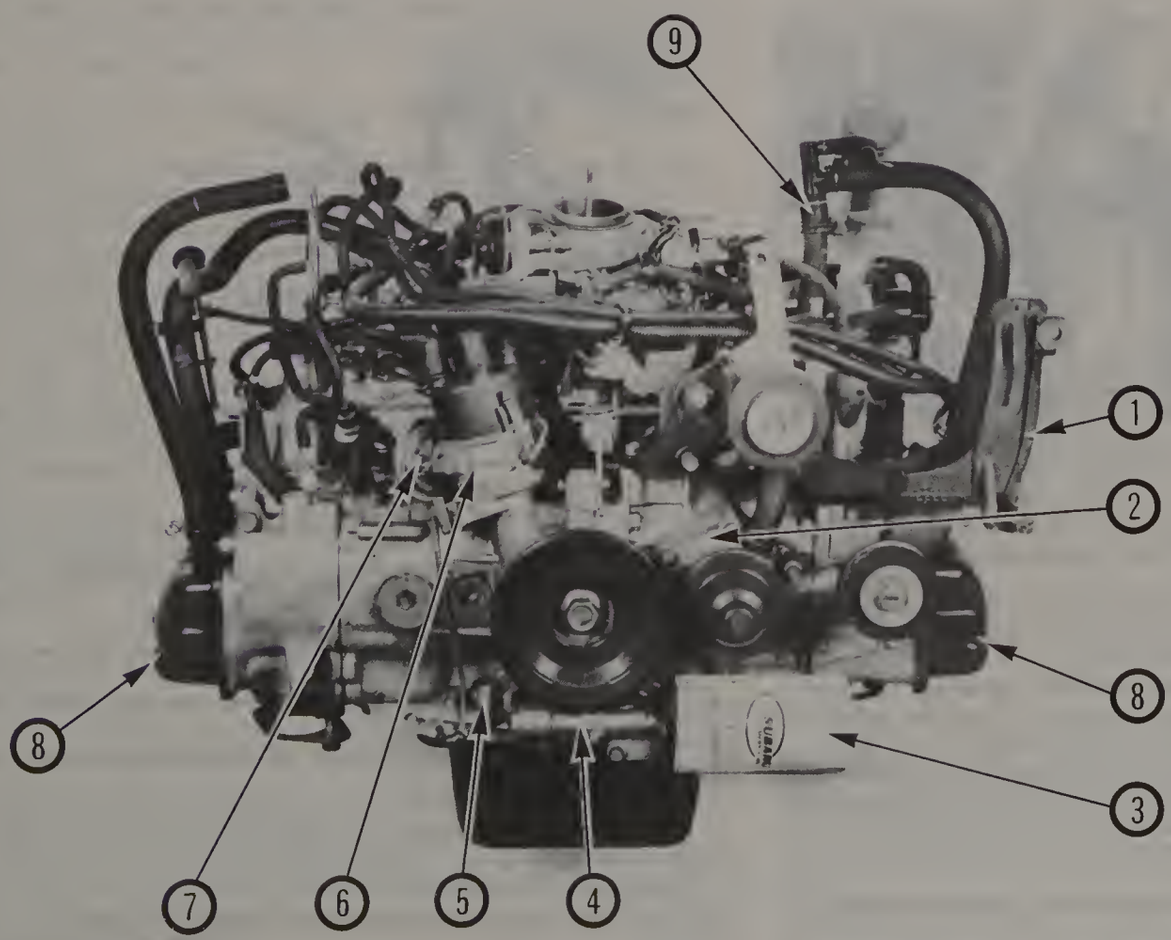
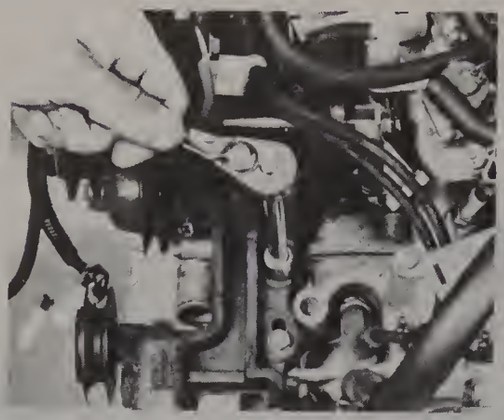
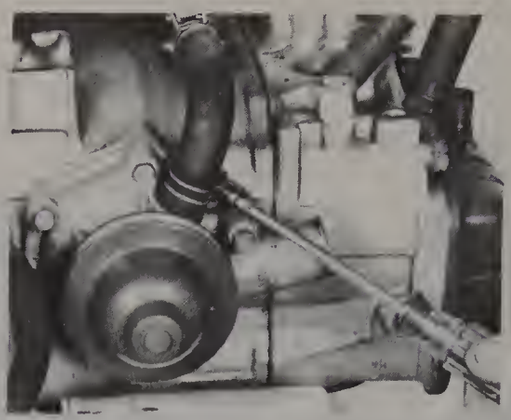


Fig. 2.4 Engine – Front view

1 Air conditioning compressor/alternator bracket
2 Water pump
3 Oil filter
4 Oil pump
5 Oil pressure sensing unit
6 Distributor
7 Vacuum advance unit
8 Rocker arm cover(s)
9 PCV valve hose assembly

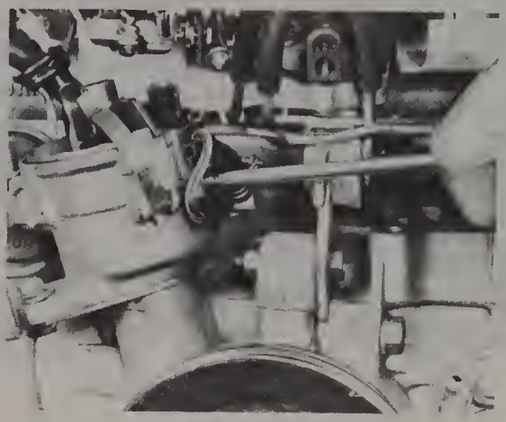


5.2 Removing the air conditioning compressor/alternator mounting bracket bolts

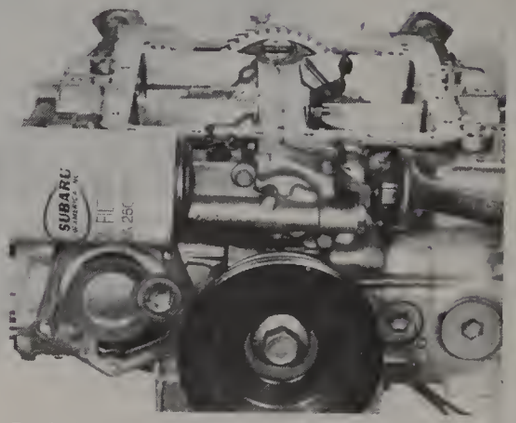


5.4 Disconnecting the water pump coolant hose clamp

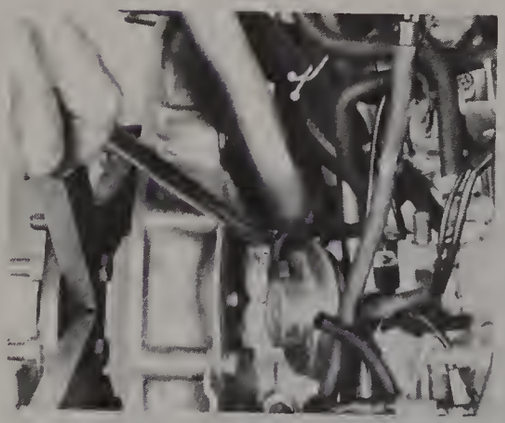
5.7 Removing the spark plugs



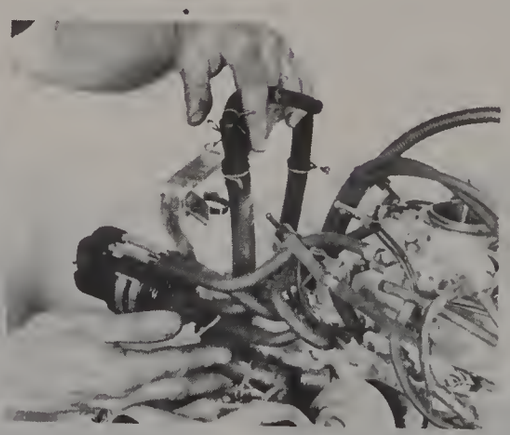
5.8 Separating the wire harness from the distributor



5.10 Removing the oil pressure sensing unit

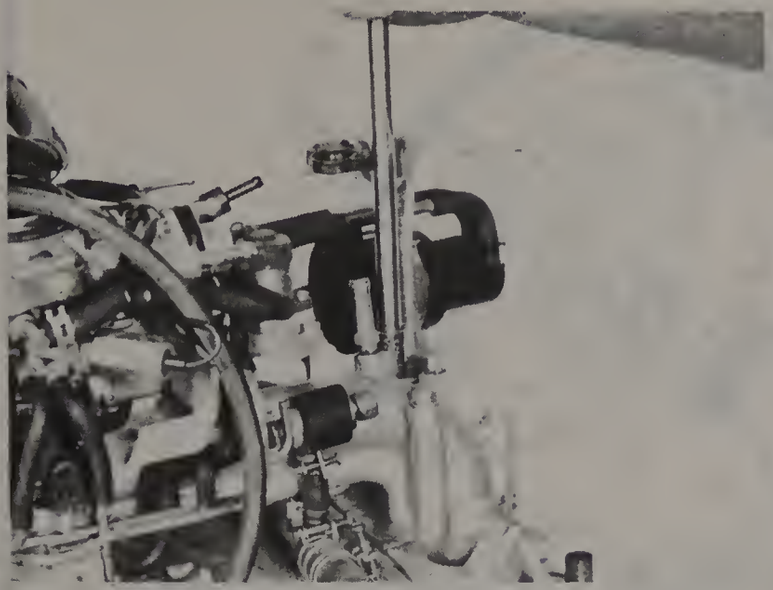


5.16 Removing the oil fill tube and bracket



5.17 Separate the hose assembly from the PCV valve on the intake manifold

2 Disconnect the cables from the battery (negative first, then positive).
3 Remove the spare tire and support bracket.
4 Disconnect all of the hoses and wires from the air cleaner assembly.
5 Remove the air cleaner assembly from the top of the carburetor. **Note**: *Plug the carburetor opening to prevent dirt from entering the carburetor throat.*
6 Disconnect the fuel delivery and return hoses from the carburetor.
7 Disconnect the vacuum hose, the carburetor vent hose and the purge hose from the evaporation pipe.
8 Disconnect the brake booster vacuum hose from the intake manifold.
9 Disconnect the kick-down solenoid vacuum hose from the vacuum pipe (automatic transmission).
10 Disconnect the spark plug wires from the plugs and the high-tension wire leading to the distributor cap from the ignition coil.
11 Disconnect the accelerator cable from the carburetor.
12 Disconnect the coolant hose to the thermostat housing from the top of the radiator.
13 Disconnect the thermoswitch electrical connector.
14 Remove the carburetor protector on the back side of the carburetor (if applicable).
15 Disconnect the vacuum hose and the lead wire from the distributor.
16 Remove the EGR valve pipe cover and disconnect the pipe from the EGR valve.
17 Disconnect the ASV pipe from the Air Suction valve.
18 Disconnect the oil pressure switch/gauge and the thermoswitch electrical connectors.
19 Disconnect the hose from the PCV valve.
20 Disconnect the coolant bypass hoses and the heater hose from the manifold.
21 Remove the intake manifold mounting bolts (photo) and carefully lift the manifold off of the engine. **Note**: *As you lift the manifold, check for any hoses or wires that may still be connected.*



6.21 Loosen the intake manifold mounting bolts a little at a time in a criss-cross pattern

22 To install the manifold, follow this procedure in reverse paying attention to the following.
23 Always use new gaskets when installing the manifold. **Note:** *Make sure that both the engine and the manifold mounting surfaces are thoroughly clean.*
24 Check all vacuum and other hoses for cracks and damage at this time. Replace them with new ones if necessary.
25 When installing the accelerator cable, make the cable adjustments by referring to Chapter 1.
26 Make sure that the mounting bolts are tightened according to the Torque specifications.

7 Clutch and flywheel/driveplate – removal and installation

Refer to Figs. 2.5 and 2.6

1 Remove the clutch disc and clutch cover assembly by referring to Chapter 8.
2 Remove the attaching bolts and separate the flywheel/driveplate from the crankshaft. **Note:** *Insert a large screwdriver, pry bar or alignment punch through the timing mark hole in the housing and one of the holes in the flywheel/driveplate to keep it from turning as the bolts are loosened.*
3 Remove the O-ring installed between the flywheel or driveplate and the crankshaft.
4 Attach the O-ring to the end of the crankshaft.
5 Apply liquid gasket sealer to the bolt threads. Hold the flywheel/driveplate in position and install the bolts in the end of the crankshaft. On automatic transmission models, align the small hole in the driveplate with the mark on the backplate before installing the bolts.
6 While holding the flywheel/driveplate so that it doesn't turn, tighten the bolts (using a crisscross pattern) to the specified torque.
7 Install the clutch disc and clutch cover assembly as described in Chapter 8.

8 Oil pump – removal and installation

1 The oil pump is located on the bottom-front of the engine. It is easily accessible from underneath the vehicle.
2 Remove the engine oil drain plug by referring to Chapter 1 and completely drain the oil from the engine.
3 Raise the front of the vehicle and place it on jackstands.
4 Remove the oil pump from the engine by removing the mounting bolts. **Note:** *Be prepared for some oil to spill at this time.* You can remove the oil filter from the pump before or after the pump is removed from the engine.
5 When installing the oil pump always use a new gasket. **Note:** *Make sure that the engine and pump mounting surfaces are clean.*
6 Install the oil pump on the engine with the mounting bolts. Make sure that the bolts are tightened evenly and securely.
7 Install a new oil filter and add new oil to the engine by referring to Chapter 1.

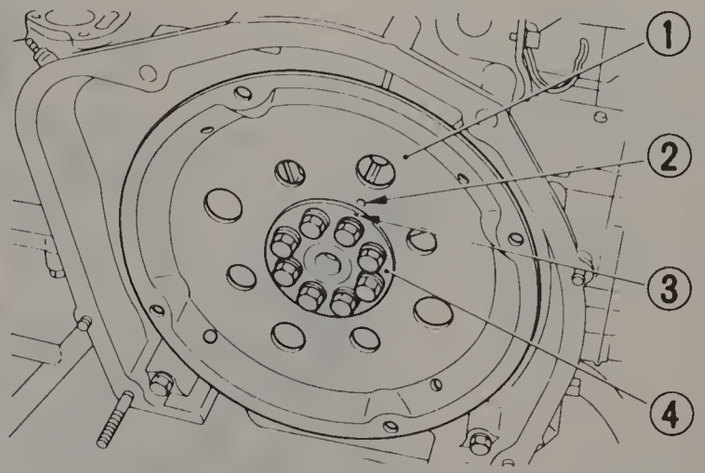


Fig. 2.5 When installing the driveplate (automatic transmission vehicles), be sure to line up the back plate properly (Sec 7)

1 Converter drive plate
2 Hole
3 Mark
4 Back plate

9 Oil pump – disassembly, inspection and reassembly

Refer to Figs. 2.7 through 2.11

Disassembly

1 Remove the oil filter from the oil pump if not already done. **Note:** *Be prepared for some oil to spill.*
2 Remove the screws and separate the pump body holder from the oil pump body.
3 Remove the drivegear, the rotor and the rubber O-ring from the pump.
4 Remove the O-ring, the bypass valve spring and the ball from the pump.
5 Remove the oil pressure sensing unit/switch and plugs from the pump.
6 Now, remove the relief valve plug, the washers, the spring and the relief valve from the pump body.

Inspection

7 Clean all of the parts in a suitable solvent and check the following. **Note:** *Always replace the O-rings and gaskets with new ones.*
8 Measure the outside diameter of the drivegear and the rotor and compare with the Specifications.
9 Using a feeler gauge, measure the tip-to-tip clearance between the drivegear and the rotor. **Note:** *To do this, place both components back into the pump housing.* Refer to the accompanying illustration.
10 Measure the side clearance between the pump case face, the rotor and the drivegear.
11 Measure the radial clearance between the pump case interior and the rotor.
12 Carefully check the interior surface of the pump case and the exterior surfaces of the drivegear and the rotor for score marks and damage.
13 Check the relief valve for seat condition and damage.
14 Check both valve springs for damage and deterioration.
15 Check the pump shaft hole in the pump holder for wear and the holder surface for cracks and damage.
16 Check the pump case for clogged oil passages, case cracks and damage.
17 If the specifications are not met or if there is damage to any of the components, replace the pump with a new one.

Reassembly

18 If everything checks out, reassemble the pump components in the

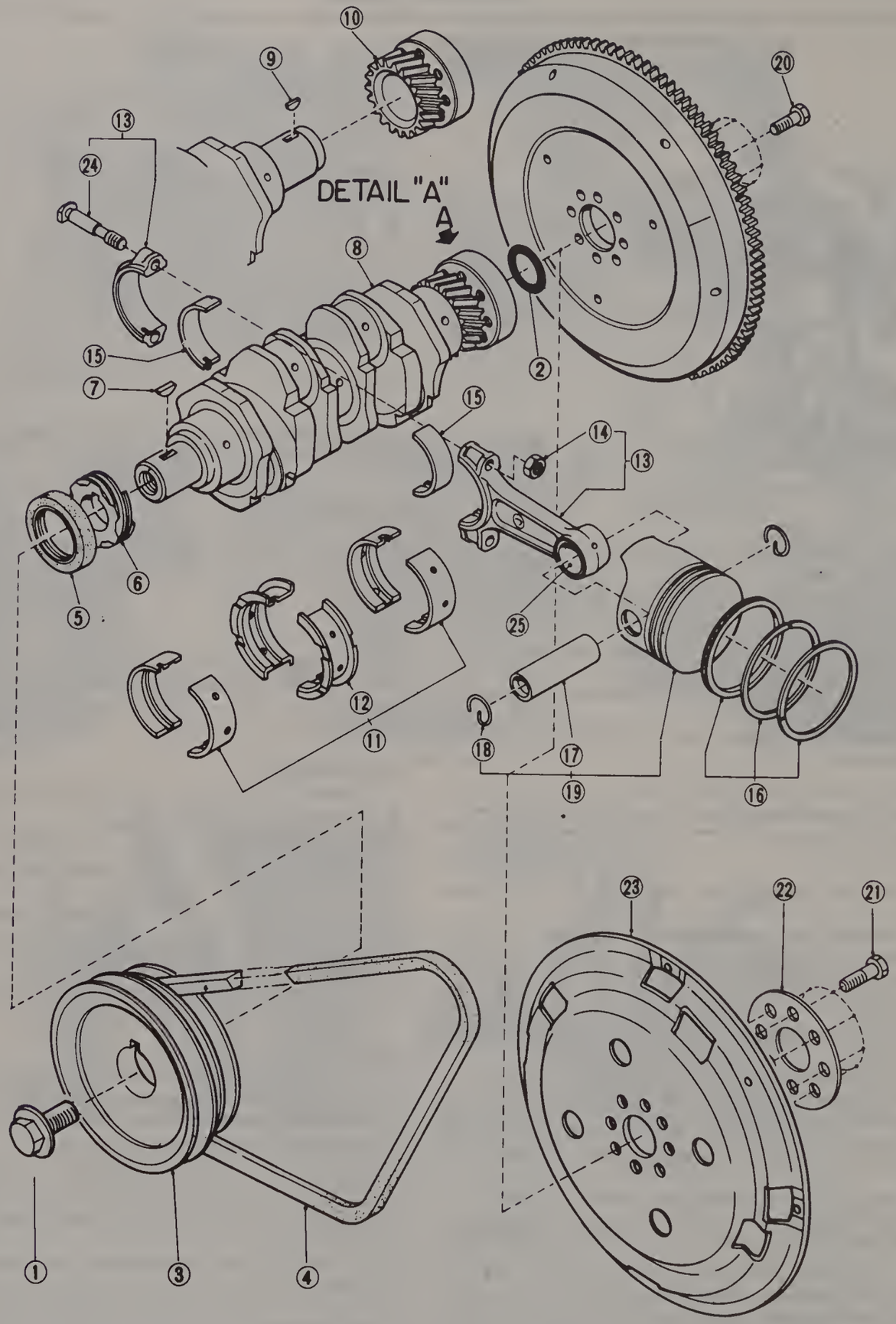


Fig. 2.6 Crankshaft, bearings, connecting rods, pistons and flywheel/driveplate components – exploded view

1 *Bolt*
2 *O-ring*
3 *Crankshaft pulley*
4 *Drivebelt*
5 *Front oil seal*
6 *Distributor drive gear*
7 *Woodruff key*
8 *Crankshaft*
9 *Woodruff key*
10 *Crankshaft gear*
11 *Crankshaft main bearing set*
12 *Center (thrust) bearing set*
13 *Connecting rod and cap*
14 *Nut*
15 *Connecting rod bearing set*
16 *Piston ring set*
17 *Piston pin*
18 *Circlip*
19 *Piston components*
20 *Bolt (MT)*
21 *Bolt (AT)*
22 *Converter back plate (AT)*
23 *Converter driveplate (AT)*
24 *Connecting rod bolt*
25 *Connecting rod bushing*

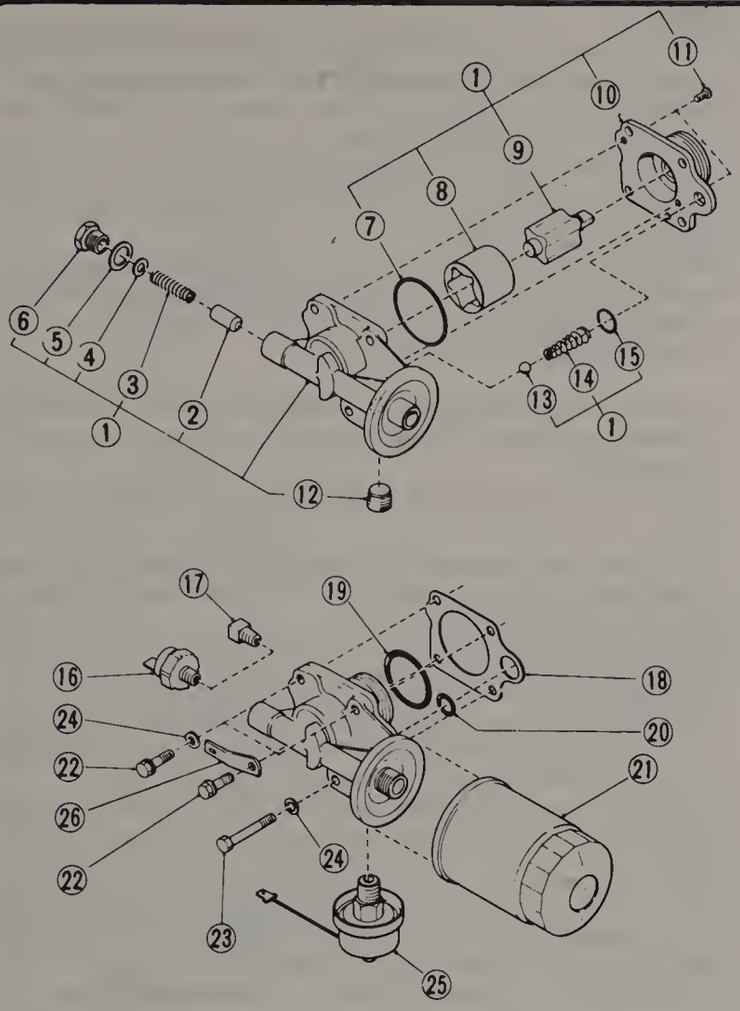


Fig. 2.7 Oil pump components (1800 cc engine) – exploded view (Sec 9)

1 Oil pump assembly
2 Oil relief valve
3 Relief valve spring
4 Washer
5 Washer
6 Plug
7 O-ring
8 Oil pump rotor
9 Oil pump drive gear
10 Oil pump body holder
11 Pan head screw
12 Plug (models without pressure gauge)
13 Ball
14 Bypass valve spring
15 O-ring
16 Oil pressure switch (models without pressure gauge)
17 Plug (models with pressure gauge)
18 Oil pump body gasket
19 O-ring
20 O-ring
21 Oil filter
22 Bolt
23 Bolt
24 Washer
25 Oil pressure gauge (models with pressure gauge)
26 Stay

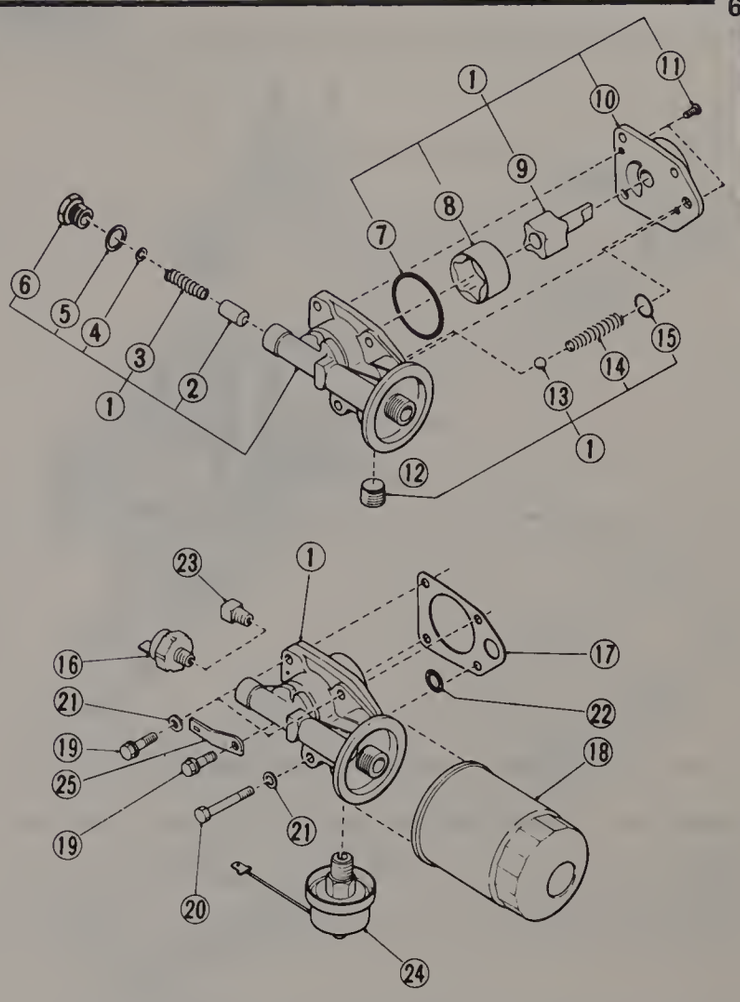


Fig. 2.8 Oil pump components (1600 cc engine) – exploded view (Sec 9)

1 Oil pump assembly
2 Oil relief valve
3 Relief valve spring
4 Washer
5 Washer
6 Plug
7 O-ring
8 Oil pump rotor
9 Oil pump drive gear
10 Oil pump body holder
11 Pan head screw
12 Plug (models without pressure gauge)
13 Ball
14 Bypass valve spring
15 O-ring
16 Oil pressure switch (models without pressure gauge)
17 Oil pump body gasket
18 Oil filter
19 Bolt
20 Bolt
21 Washer
22 O-ring
23 Plug (models with pressure gauge)
24 Oil pressure gauge (models with pressure gauge)
25 Stay

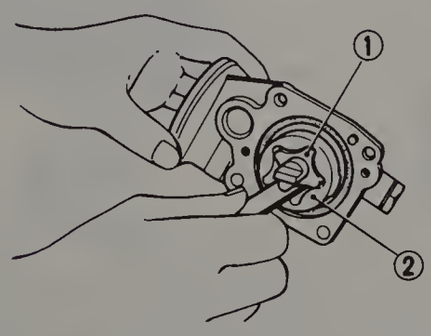


Fig. 2.9 Checking drive gear-to-rotor tip clearance with a feeler gauge (Sec 9)

1 Drive gear
2 Rotor

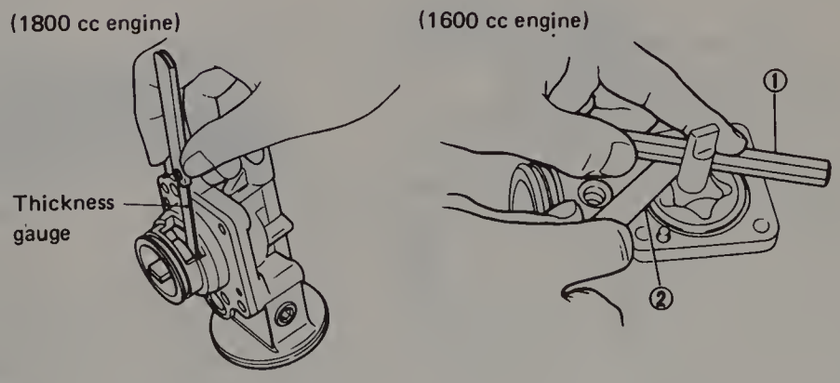


Fig. 2.10 Measuring rotor-to-case and gear-to-case clearance (Sec 9)

1 Straightedge
2 Feeler gauge

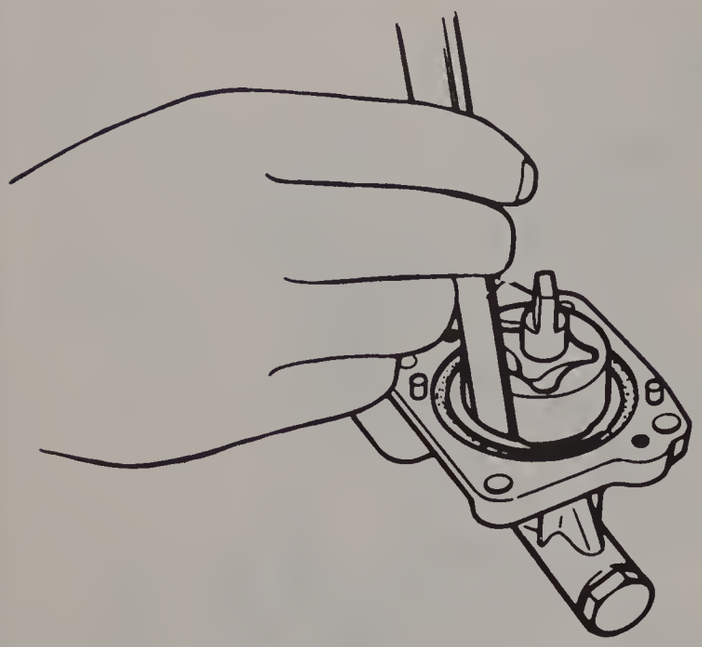


Fig. 2.11 Checking rotor-to-case radial clearance (Sec 9)

reverse order of disassembly. **Note:** *Be sure to use new O-rings and gaskets.*
19 You can install a new oil filter now or wait until the pump is mounted on the engine.
20 Make sure the screws holding the pump body holder to the pump body are tight.

10 Oil pan and strainer – removal and installation

1 Remove the bolts securing the oil pan to the engine.
2 Tap on the pan with a soft-faced hammer, to break the gasket seal, and lift the oil pan off the engine.
3 Using a gasket scraper, scrape off all traces of the old gasket from the crankcases, the flywheel/driveplate housing and the oil pan. Be especially careful not to nick or gouge the gasket sealing surfaces of the crankcases (they are made of aluminium and are quite soft).
4 Clean the oil pan with solvent and dry it thoroughly. Check the gasket sealing surfaces for distortion.
5 Remove the oil strainer mounting bolt, then carefully tap the strainer mounting flange to remove it from the crankcase hole. *Do not remove the bracket from the strainer.*

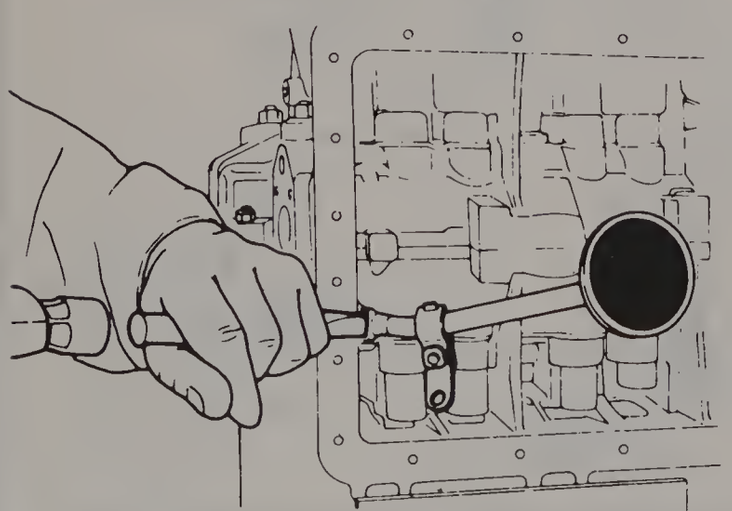


Fig. 2.12 Removing the oil strainer from the crankcase with a hammer and cold chisel (Sec 10)

6 Use a new O-ring when installing the strainer and tap only on the mounting flange to seat the pipe in the crankcase hole. Install the bolt and tighten it to the specified torque.
7 Before installing the oil pan, apply a thin coat of RTV-type gasket sealer to the crankcase gasket sealing surfaces. Lay a new oil pan gasket in place and carefully apply a coat of gasket sealer to the exposed side of the gasket.
8 Gently lay the oil pan in place (do not disturb the gasket) and install the bolts. Start with the bolts closest to the center of the pan and tighten them to the specified torque using a crisscross pattern. *Do not overtighten them or leakage may occur.*

11 Rocker arm assemblies and pushrods – removal, inspection and installation

Refer to Figs. 2.13 and 2.14

1 The rocker arm assemblies are removed during the cylinder head removal procedure (refer to Section 12). The pushrods can simply be slipped out of the crankcase.
2 **Note:** *Pay special attention to the installed direction of the rocker arm shaft, the position of the spring washers, the difference between the rocker arms and the R mark on the right-hand spacer.*
3 Refer to the accompanying illustration. Remove the snap-ring (photo) and slide the parts off the shaft, taking care not to mix them up, so they can be reinstalled in the same order.
4 Examine the rocker arm shaft (photo) and bushings for wear. If the rocker arm surface that contacts the valve stem is worn considerably, replace the rocker arm with a new one. If it is worn slightly in a stepped shape it can be corrected on a valve refacing machine. If the rocker arm bushing has to be replaced it requires special tools and should be left to your Subaru dealer or an automotive machine shop. Check the adjuster buckets and the pushrod ends for wear.
5 Oil the parts and reassemble them on their respective shafts in the original order.
6 Check the pushrods to make sure they are straight (photo). Clean the oil holes thoroughly.
7 The pushrods and rocker arm assemblies are installed during the cylinder head installation procedure (Section 12).

12 Cylinder heads – removal

Refer to Fig. 2.16
1 Remove the spark plugs and the rocker arm cover bolts (photo), then separate the rocker arm covers from the cylinder heads. You may have to tap on the covers with a soft-faced hammer to break the gasket seal. Remove the rocker arm cover gaskets.
2 Loosen the locknuts (photo) and back off the valve adjusting screws on the rocker arms.
3 Remove the large bolts (photo) and lift the rocker arm shaft assemblies away from the cylinder heads.
4 Remove the pushrods. Label them 'No. 1 cylinder exhaust', 'No. 1 cylinder intake', etc so they can be reinstalled in their original locations.
5 Loosen the cylinder head nuts (photo) in three or four steps following the sequence shown in the accompanying illustration.
6 Remove the cylinder heads and the old gaskets. **Note:** *Do not pry between the cylinder heads and the crankcase, as damage to the gasket sealing surfaces may result.* Instead use a soft-faced hammer to tap the heads and break the gasket seal.

13 Cylinder heads – disassembly

1 Cylinder head disassembly involves removal of the intake and exhaust valves and their related components.
2 Before the valves are removed, arrange to label and store them, along with their related components, so they can be kept separate and reinstalled in the same valve guides they were removed from.
3 Compress the valve spring on the first valve with a spring compressor, then remove the keepers and the retainer from the valve assembly. Carefully release the valve spring compressor and remove the springs, the seal, the spring seat and the valve from the head. If the valve binds in the guide (won't pull through), push it back into the head

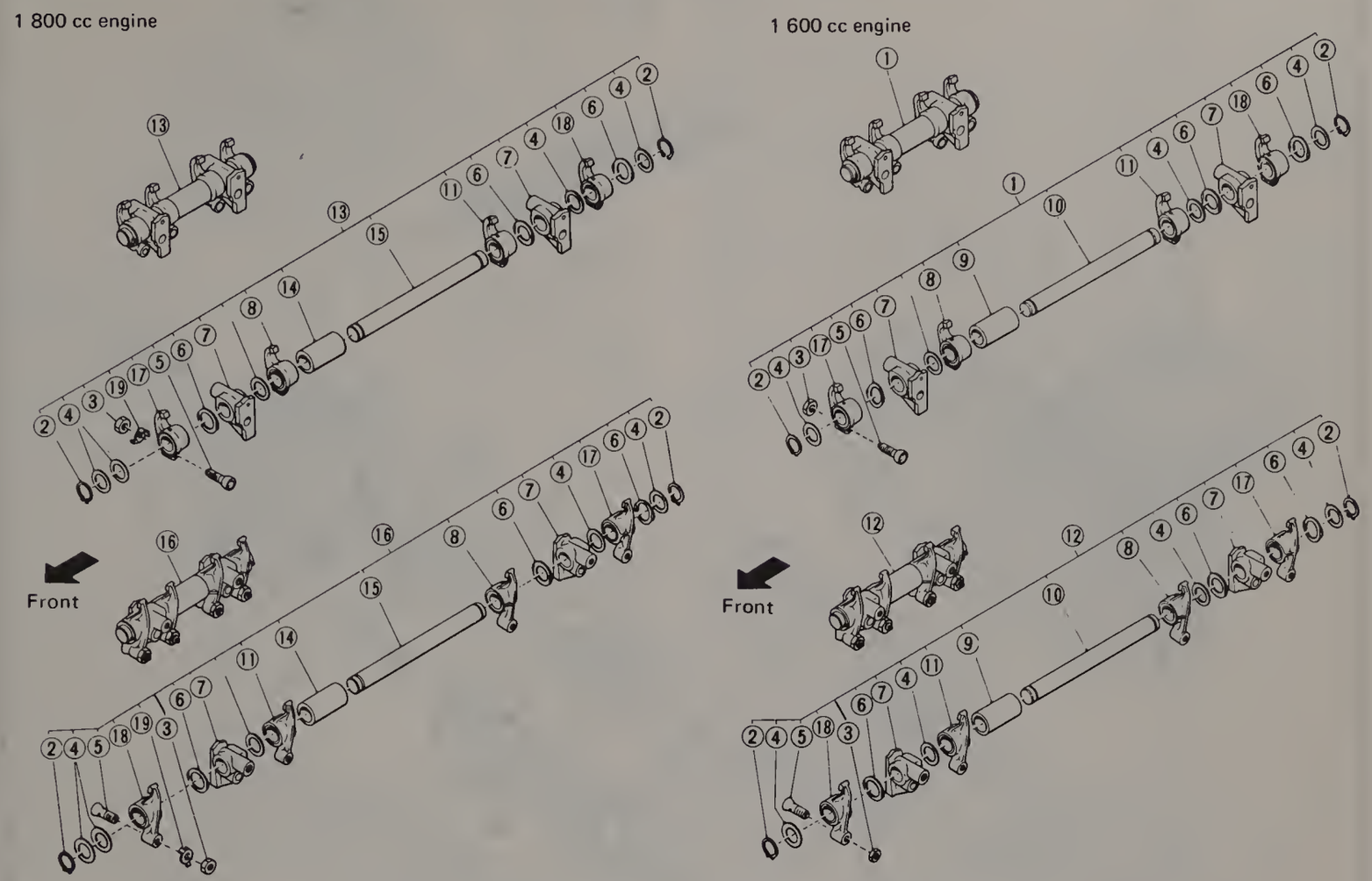


Fig. 2.13 Rocker arm shaft components – exploded view (Sec 11)

1 *Rocker arm assembly (right-hand)*
2 *Snap-ring*
3 *Nut*
4 *Washer*
5 *Valve adjusting screw*
6 *Shaft spring washer*
7 *Shaft supporter*
8 *Rocker arm*
9 *Rocker shaft spacer*
10 *Rocker arm shaft*
11 *Rocker arm*
12 *Rocker arm assembly (left-hand)*
13 *Rocker arm assembly (right-hand)*
14 *Rocker shaft spacer*
15 *Rocker arm shaft*
16 *Rocker arm assembly (left-hand)*
17 *Rocker arm*
18 *Rocker arm*
19 *Lock washer (only for hydraulic valve lifter)*

11.3 Removing the snap-ring from the rocker arm shaft

11.4 Look for wear on the rocker arm shaft

11.6 The pushrods should be checked with a dial indicator to see if they are straight

and deburr the area around the keeper groove with a fine file or whetstone.

4 Repeat the procedure for the remaining valves. Remember to keep all the parts for each valve in order so they can be reinstalled in the same locations.

5 Once the valves have been removed and safely stored, the head should be thoroughly cleaned and inspected. If a complete engine overhaul is being done, finish the engine disassembly procedures before beginning the cylinder head cleaning and inspection process.

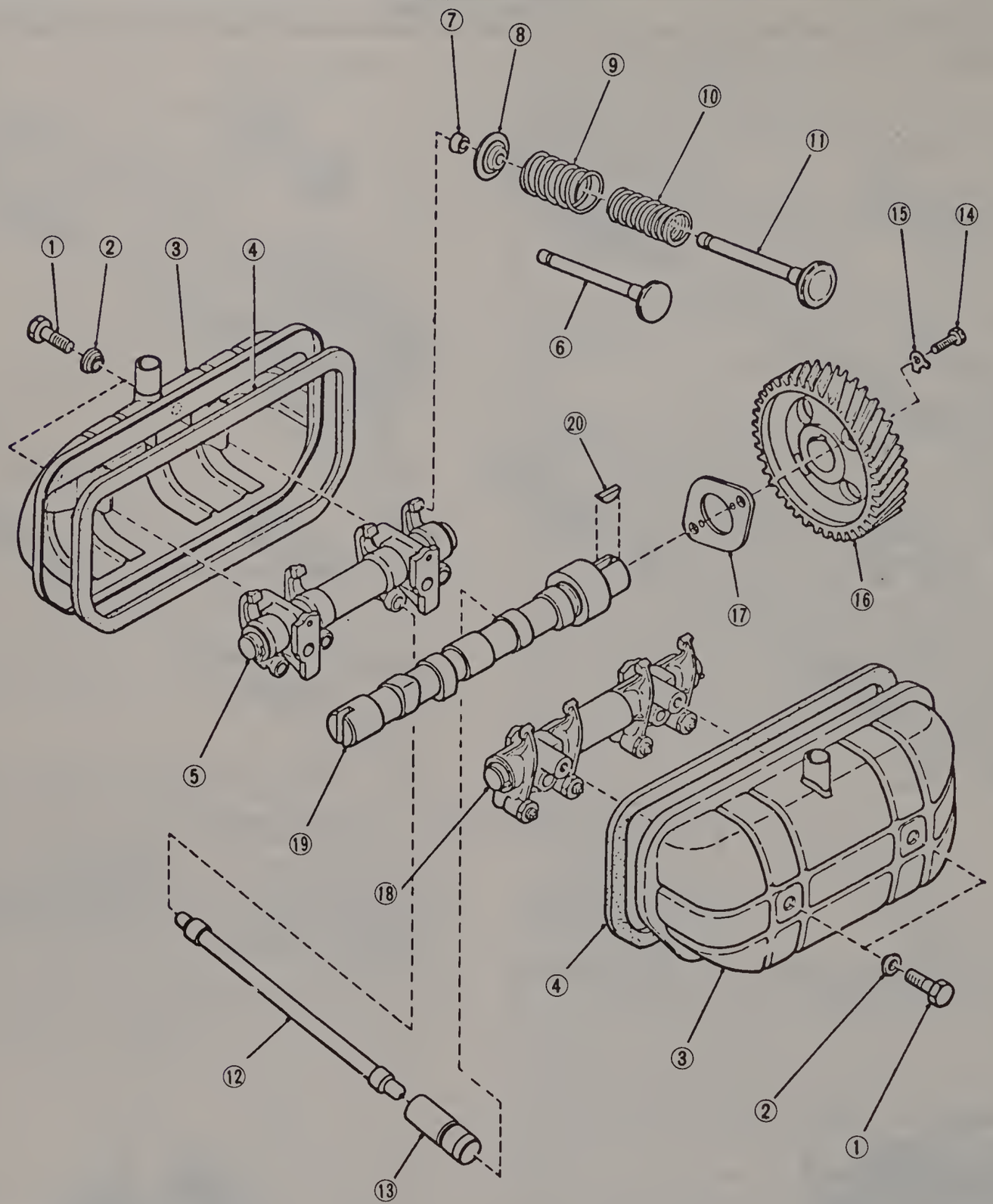


Fig. 2.14 Camshaft and valve train components – exploded view (Sec 12)

1 *Bolt*
2 *Rocker arm cover seal washer*
3 *Rocker arm cover*
4 *Rocker arm cover gasket*
5 *Rocker arm assembly (right-hand)*
6 *Exhaust valve*
7 *Keepers*
8 *Valve spring retainer*
9 *Valve spring (outer)*
10 *Valve spring (inner)*
11 *Intake valve*
12 *Pushrod*
13 *Valve lifter*
14 *Bolt*
15 *Lock washer*
16 *Camshaft gear*
17 *Camshaft plate*
18 *Rocker arm assembly (left-hand)*
19 *Camshaft*
20 *Woodruff key*

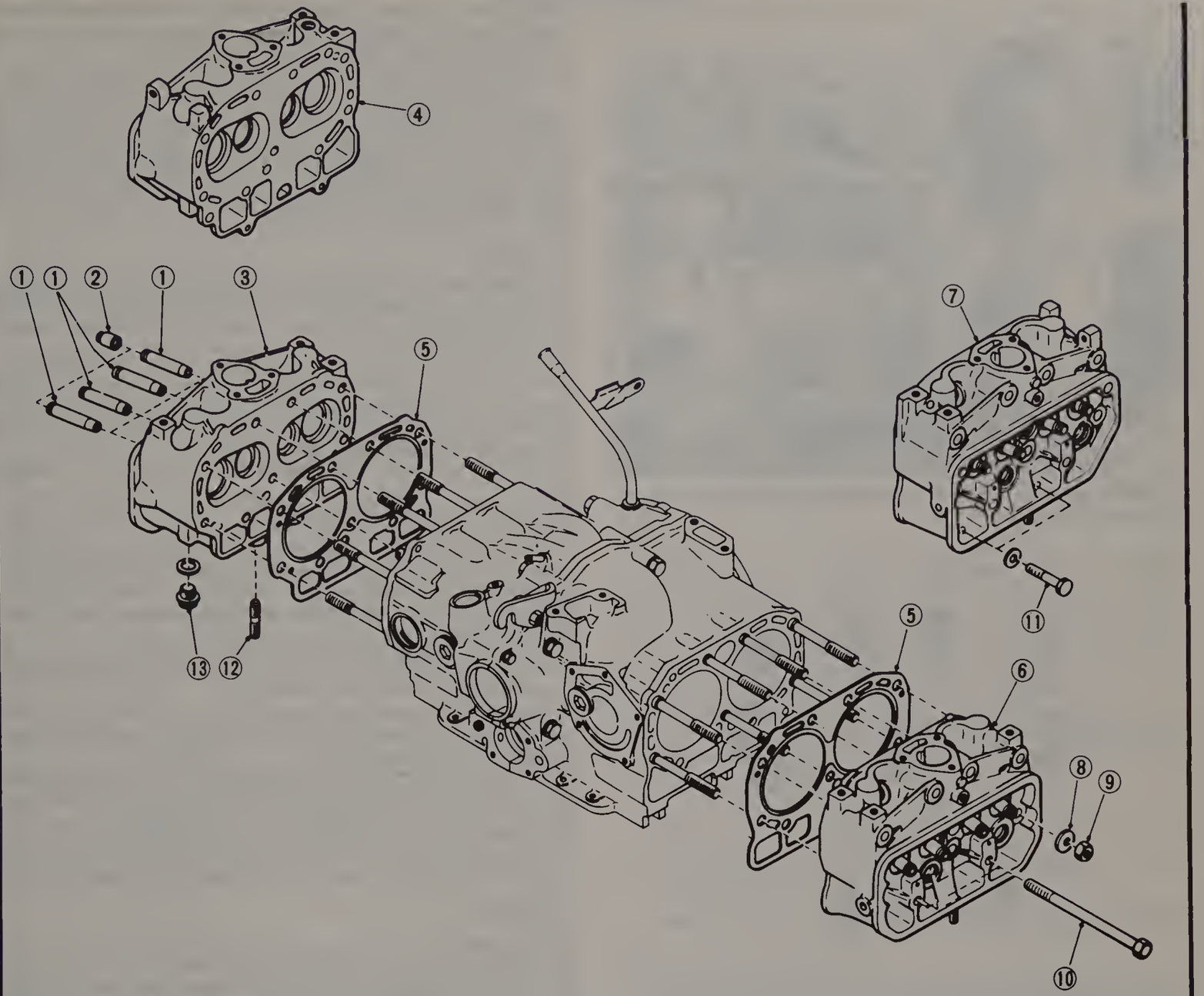
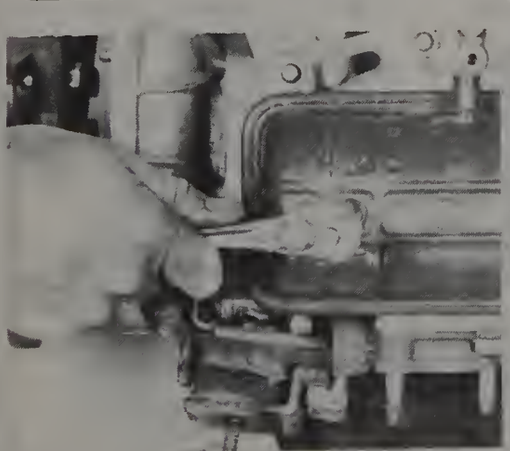
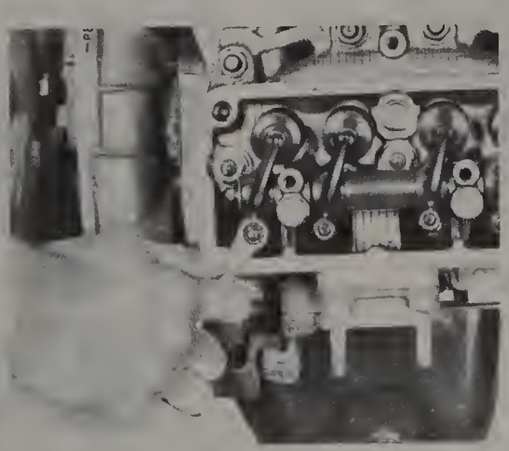


Fig. 2.15 Cylinder head components – exploded view (Sec 12)

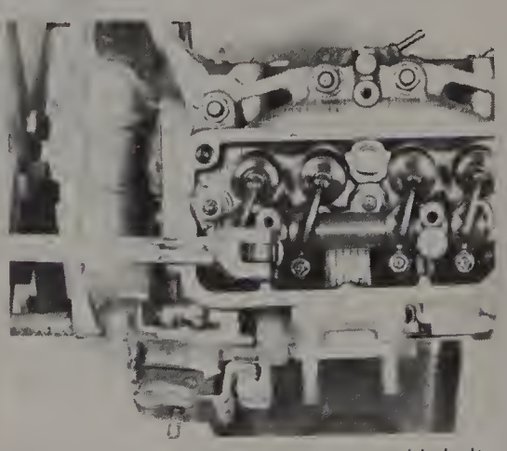
1 *Valve guide*
2 *Oil seal*
3 *Cylinder head (1600 cc)*
4 *Cylinder head (1800 cc)*
5 *Cylinder head gasket*
6 *Cylinder head (1600 cc)*
7 *Cylinder head (1800 cc)*
8 *Washer*
9 *Nut*
10 *Bolt (11 x 162 x 34 mm)*
11 *Bolt (6 x 66 x 16 mm)*
12 *Stud*
13 *Plug and washer*



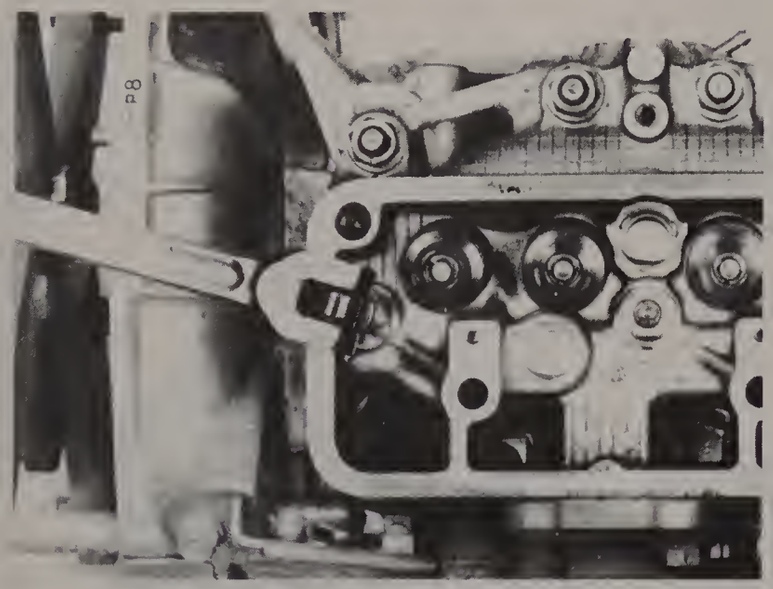
12.1 Removing the rocker arm cover bolts



12.2 Back off the valve adjusting screws before loosening the rocker arm assembly bolts



12.3 Removing the rocker arm assembly bolts



12.5 When loosening the cylinder head bolts, be sure to follow the correct sequence

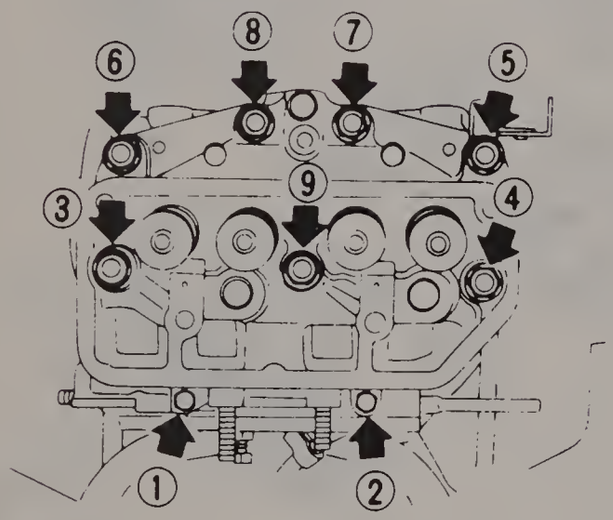


Fig. 2.16 Cylinder head bolt/nut *loosening* sequence (Sec 12)

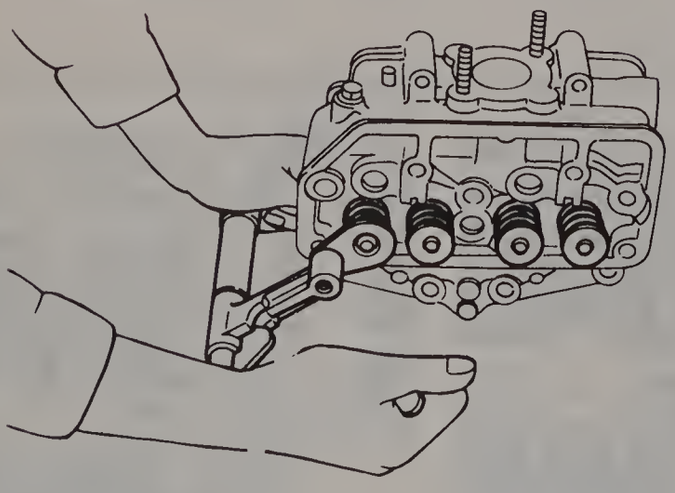


Fig. 2.17 A valve spring compressor is required to remove the valves (Sec 13)

14 Cylinder heads – cleaning and inspection

1 Thorough cleaning of the cylinder head and related valve train components, followed by a detailed inspection, will enable you to decide how much valve service work must be done during the engine overhaul. **Note:** *Decarbonizing chemicals are available and may prove very useful when cleaning cylinder heads and valve train components. They are very caustic and should be used with caution. Be sure to follow the directions on the container.*

Cleaning

2 Scrape away any traces of old gasket material and sealing compound from the head gasket, the intake manifold and the exhaust pipe sealing surfaces. Work slowly and do not nick or gouge the soft aluminium of the head.

3 Carefully scrape all carbon deposits out of the combustion chamber areas. A hand-held wire brush or a piece of fine emery cloth can be used once the majority of deposits have been scraped away. Do not use a wire brush mounted in a drill motor, as the head material is soft and can be eroded away by the wire brush.

4 Remove any scale that may be built up around the coolant passages.

5 Run a stiff wire brush through the oil holes to remove any sludge deposits that may have formed in them.

6 It is a good idea to run an appropriate size tap into each of the threaded holes to remove any corrosion or thread sealant that may be present. Be very careful when cleaning aluminium threads; they can be damaged easily with a tap. If compressed air is available, use it to clear the holes of debris produced by this operation.

7 Clean the exhaust pipe stud threads in a similar manner with an appropriate size die. Clean the rocker arm assembly bolt holes and the cylinder head stud holes with a wire brush.

8 Next, clean the cylinder head with solvent and dry it thoroughly. Compressed air will speed the drying process and ensure that all holes and recessed areas are clean.

9 Clean all the valve springs, keepers, retainers and spring seats with solvent and dry them thoroughly. Do the parts from one valve at a time, so that no mixing of parts between valves occurs.

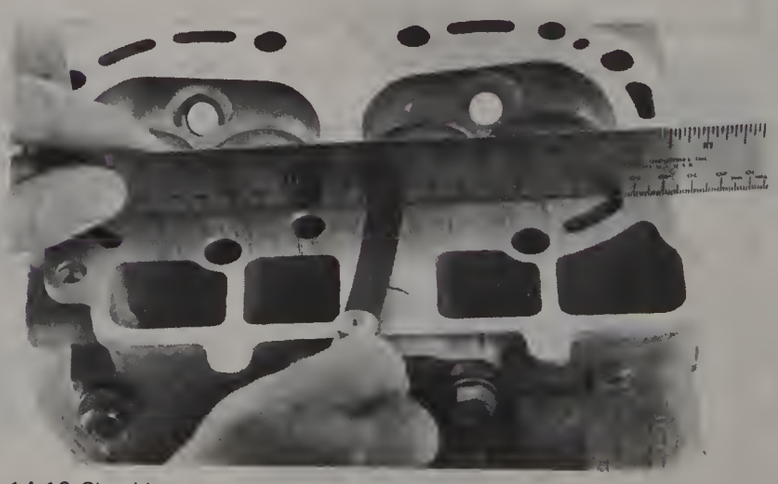
10 Scrape off any heavy deposits that may have formed on the valves, then use a motorized wire brush to remove deposits from the valve heads and stems. Again, make sure the valves do not get mixed up.

Inspection

Cylinder head

11 Inspect the head very carefully for cracks, evidence of coolant leakage and other damage. If cracks are found, a new head is in order.

12 Using a straightedge and feeler gauge, check the head gasket mating surfaces for warpage (photo). Lay the straightedge lengthwise, across the head and diagonally (corner-to-corner) and try to slip a



14.12 Checking the cylinder head gasket mating surface for warpage with a straightedge and feeler gauge

0.002 in (0.05 mm) feeler gauge under it at each location. If the feeler gauge can be inserted between the head and the straightedge, the head is warped. If the head is warped, it must be resurfaced at an automotive machine shop or replaced with a new one.

13 Examine the valve seats in each of the combustion chambers. If they are pitted, cracked or burned, the head will require valve service that is beyond the scope of the home mechanic.

14 Measure the inside diameters of the valve guides (at both ends and the center of the guide) with a small hole gauge and 0-to-1 inch micrometer. Record the measurements for future reference. These measurements, along with the valve stem diameter measurements, will enable you to compute the valve stem-to-guide clearance. This clearance, when compared to the Specifications, will be one factor that will determine the extent of the valve service work required. The guides are measured at the ends and at the center to determine if they are worn in a bell-mouth pattern (more wear at the ends). If they are, guide reconditioning or replacement is an absolute must.

Valves

15 Carefully inspect each valve face for cracks, pits and burned spots. Check the valve stem and neck for cracks. Rotate the valve and check for any obvious indication that it is bent. Check the end of the stem for pits and excessive wear. The presence of any of the above conditions indicates a need for valve service by a professional.

16 Measure the width of the valve margin (on each valve) and compare it to the Specifications. Any valve with a margin narrower than specified will have to be replaced with a new one.

17 Measure the valve stem diameter. By subtracting the stem diameter from the valve guide diameter, the valve stem-to-guide clearance is obtained. Compare the results to the Specifications. If the stem-to-guide clearance is greater than specified, the guides will have to be reconditioned or replaced and new valves may have to be installed, depending on the condition of the old ones.

Valve components

18 Check each valve spring for wear (on the ends) and pits. Measure the free length and compare it to the Specifications. Any springs that are shorter than specified have sagged and should not be reused. Stand the spring on a flat surface and check it for squareness. Have the vehicle spring tension checked by an automotive machine shop.

19 Check the spring retainers and keepers for obvious wear and cracks. Any questionable parts should not be reused, as extensive damage will occur in the event of failure during engine operation.

15 Valves – servicing

1 Because of the complex nature of the job and the special tools and equipment required, servicing of the valves, the valve seats and the valve guides (commonly known as a 'valve job') is best left to a professional.

2 The home mechanic can remove and disassemble the head, do the initial cleaning and inspection, then reassemble and deliver the head to a dealer service department or a reputable automotive machine shop for the actual valve servicing.

3 The dealer service department, or automotive machine shop, will remove the valves and springs, recondition or replace the valves and valve seats, recondition or replace the valve guides, check and replace the valve springs, retainers and keepers (as necessary), replace the valve seals with new ones, reassemble the valve components and make sure the installed spring height is correct. The cylinder head gasket surface will also be resurfaced if it is warped.

4 After the valve job has been performed by a professional, the head will be in like-new condition. When the head is returned, be sure to clean it again, very thoroughly (before installation on the engine), to remove any metal particles and abrasive grit that may still be present from the valve service or head resurfacing operations. Use compressed air, if available, to blow out all the oil holes and passages.

16 Cylinder heads – reassembly

Refer to Figs. 2.18 and 2.19

1 Regardless of whether or not the heads were sent to an automotive machine shop for valve servicing, make sure they are clean before beginning reassembly. If the heads were sent out for valve servicing, the valves and related components will already be in place.

2 Lay all the spring seats in position, then install new seals on the intake valve guides. Lubricate the outside of the guides and press the seals over them, with an appropriate size deep socket, until the tops of the seals are the specified distance from the spring seat surface (see the accompanying illustration). Be careful not to cock or deform the seals as they are installed or they may not contact the valve stems properly.

3 Next, install the valves (taking care not to damage the new seals), the springs, the retainers and the keepers. **Note:** *The springs must be installed with the paint mark next to the retainer and the tightly wound coil end next to the head.* Coat the valve stems with clean multi-purpose grease (or engine assembly lube) before slipping them into the guides. When compressing the springs with the valve spring compressor, do not let the retainers contact the valve guide seals.

4 Repeat the procedure for the remaining head.

5 Support the heads (one at a time) on wood blocks so the valves cannot contact the workbench top and very gently tap each of the valve stem ends with a soft-faced hammer. This will help seat the keepers in their grooves.

17 Cylinder heads – installation

Refer to Fig. 2.20

1 Clean the gasket mating surfaces of the cylinder heads and crankcase with lacquer thinner or acetone (they must be clean and oil-free).

2 Position the engine on a workbench with the left side up.

3 Apply a thin, even coat of head gasket sealant (Three Bond 1201 or Dow Corning 92-024) to *both sides* of the new head gasket. then lay it in place.

4 Install the cylinder head and lubricate the stud threads with engine oil. Install the nuts and tighten them finger-tight.

5 Slip the pushrods into place, then install the rocker arm assemblies. Make sure the pushrods are seated in the lifters and the adjuster buckets. Install the bolts and tighten them finger-tight.

6 Tighten the nuts and bolts to the specified torque. Follow the sequence shown in the accompanying illustration and work up to the final torque in three steps.

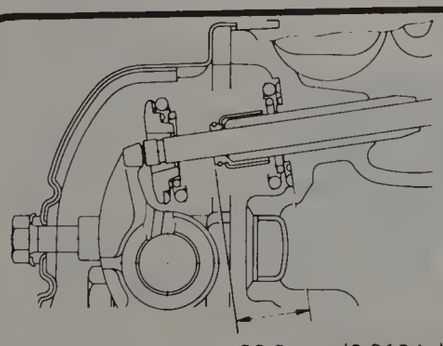


Fig. 2.18 The valve seals must be pressed onto the guides until they are the specified distance from the spring seat (Sec 16)

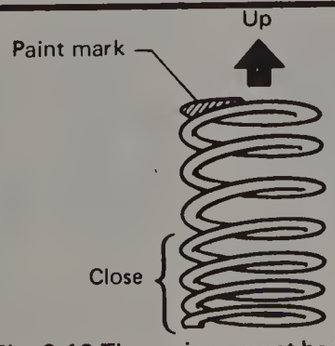


Fig. 2.19 The springs must be installed with the paint mark next to the retainer and the closely wound coils next to the head (Sec 16)

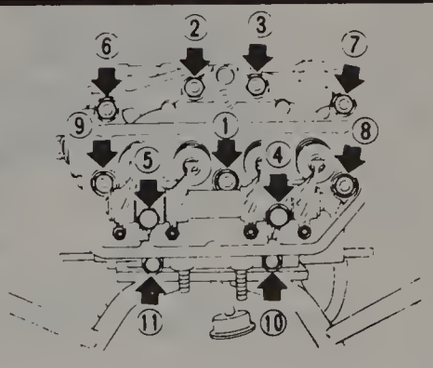


Fig. 2.20 Cylinder head bolt/nut *tightening* sequence (Sec 17)

7 Repeat the procedure for the remaining head.

18 Pistons – removal

Note: *Check for the presence of a wear ridge at the top of each cylinder. If a ridge has formed, it must be machined out before the pistons are removed. Special ridge reaming tools are available at tool and auto parts stores (follow the directions supplied with the tool).*

1 Temporarily install the crankshaft pulley bolt in the crankshaft front end so you can turn the crankshaft.

2 To remove the piston pin circlips from the rear pistons, position each piston at bottom dead center by turning the crankshaft, then insert needle-nose pliers through the rear service holes and remove the circlips.

3 Remove the piston pins, using a length of heavy gauge wire with the end bent over to pull the pins out through the rear service holes.

4 Remove the crankcase plugs from the front service holes with a 14 mm Allen wrench, then remove the circlips and piston pins from the front pistons as described in paragraphs 2 and 3.

5 Keep the pistons and pins together and mark the pistons so they can be reinstalled in their original locations.

6 Leave the pistons in the bores until the crankcases are separated, then push them out.

7 The pistons can be removed without separating the crankcases as follows:

(a) Turn the crankshaft very slowly until the connecting rods push the pistons out slightly.

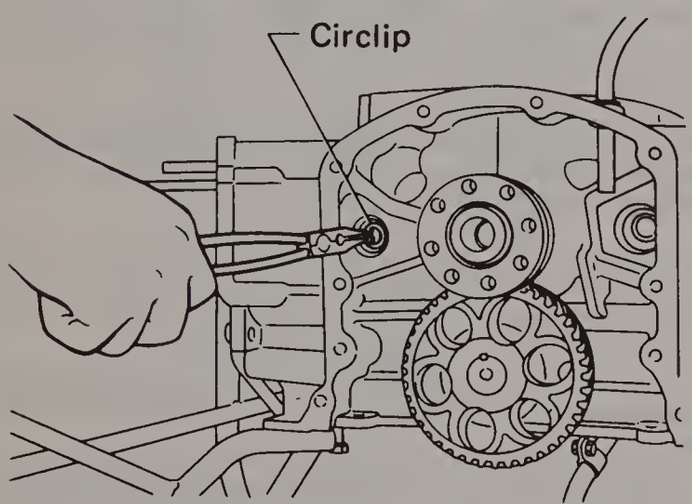


Fig. 2.21 Removing the piston pin circlip (Sec 18)

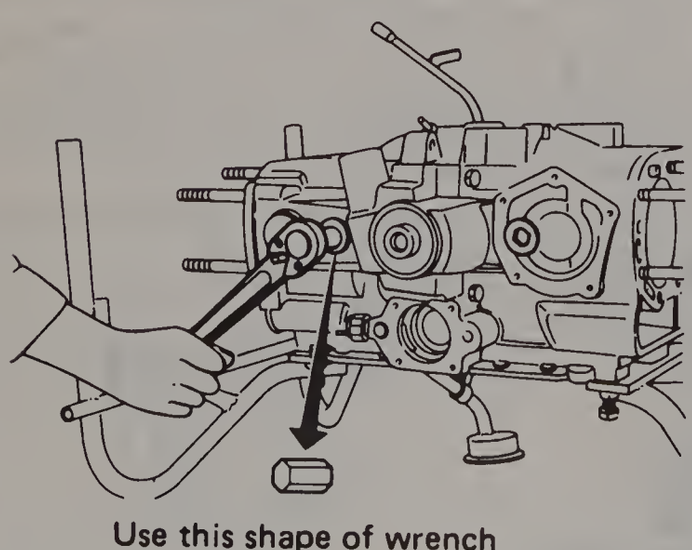


Fig. 2.22 Removing the service hole plugs from the front of the crankcase (Sec 18)

(b) Insert the piston pins into the connecting rods (through the service holes), then turn the crankshaft until the pistons protrude from the bores.

(c) Pull the pistons out.

19 Separating the crankcases

Refer to Figs. 2.23 and 2.24

1 In order to separate the crankcases, the oil pan, cylinder heads, pistons and flywheel/driveplate must be removed first.

2 Remove the bolt securing the oil dipstick tube and pitching stopper bracket. Remove the stiffener mounting bolts (4WD vehicles only).

3 Remove the bolts, then separate the flywheel/driveplate housing from the crankcases.

4 Using a dial indicator set-up, check the backlash between the camshaft and crankshaft gears. If it is greater than specified, have the gears replaced with new ones at a Subaru dealer or automotive machine shop after the crankshaft and camshaft are removed.

5 Bend back the lockplate tabs, then remove the cam plate mounting bolts (work through the holes in the gear).

6 Use sections of rubber hose or soft wire (photo) to hold the lifters in position.

7 Position the engine on a workbench with the left side (cylinders two and four) facing down, then remove the nuts and bolts holding the crankcase sections together.

8 Pull the camshaft to the rear as far as possible, then pull straight up on the right crankcase to separate the two sections. You may have to tap the right crankcase section with a soft-faced hammer to break the gasket seal.

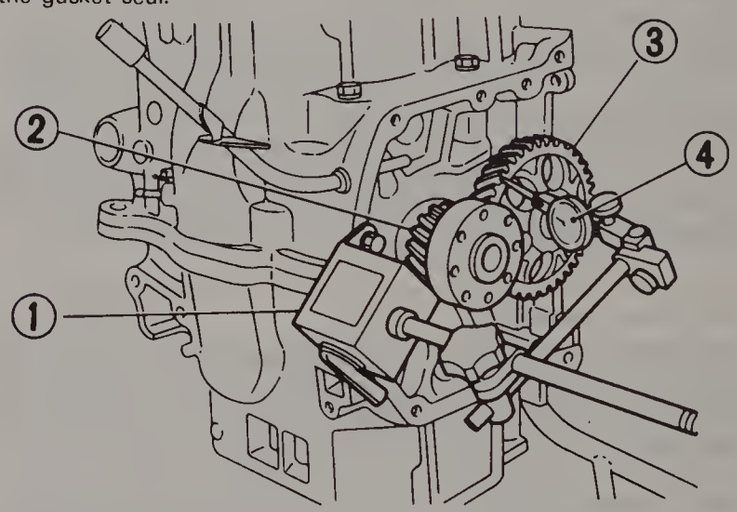


Fig. 2.23 Checking backlash between the crankshaft and camshaft gears (Sec 19)

1 Magnetic base
2 Crankshaft gear
3 Camshaft gear
4 Dial indicator

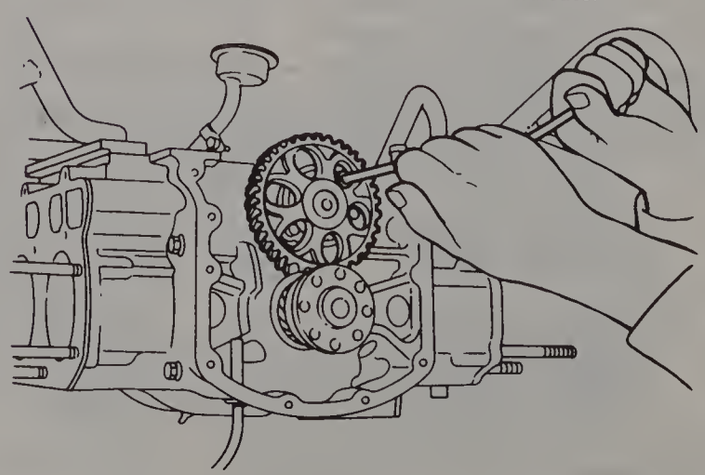
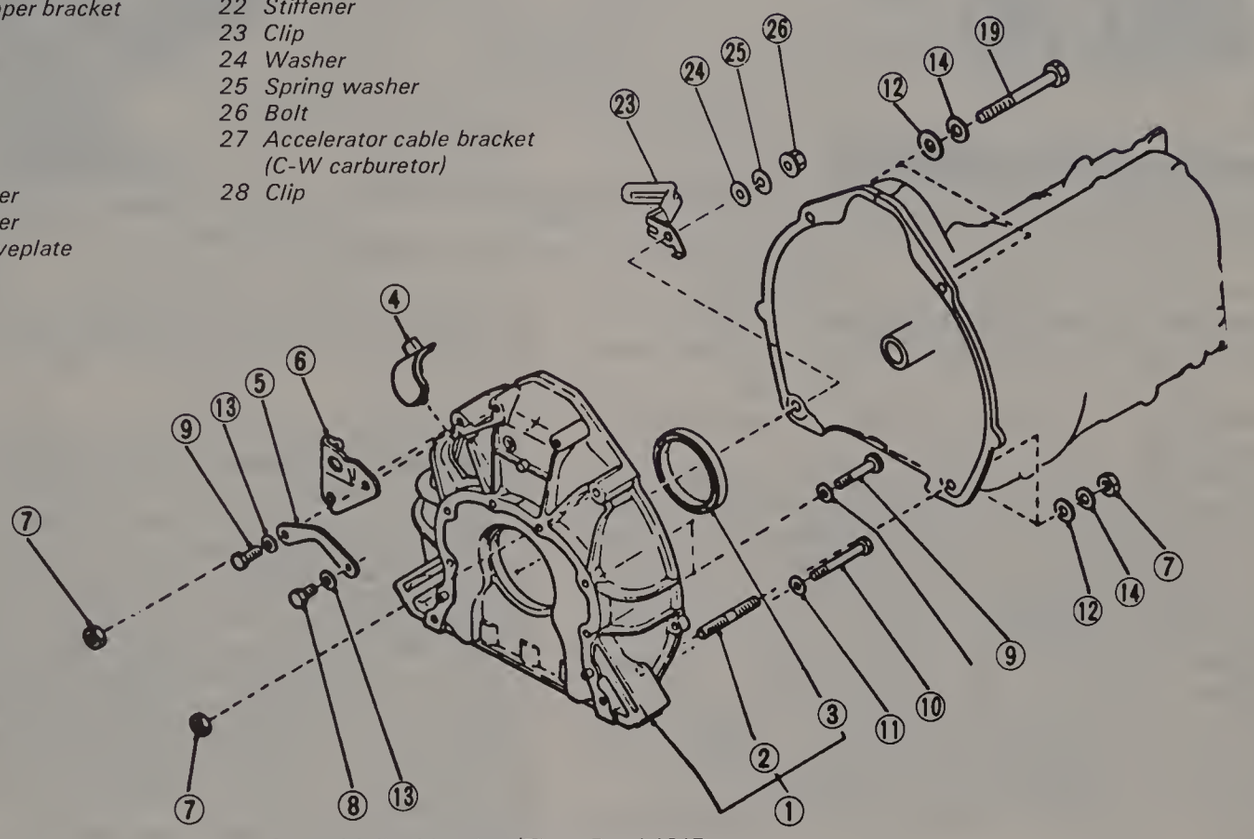


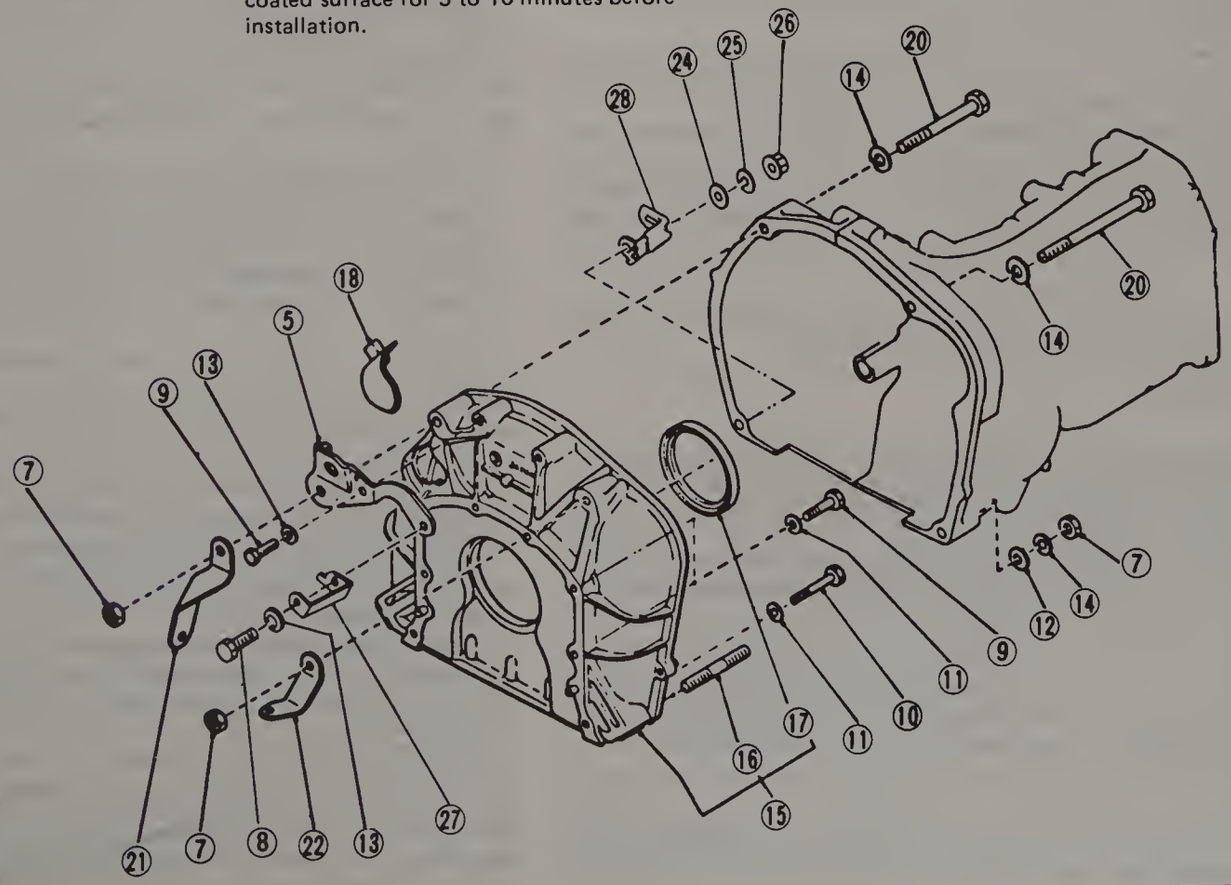
Fig. 2.24 Removing the cam plate mounting bolts (Sec 19)

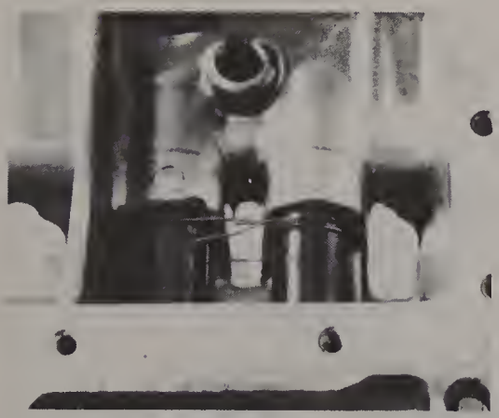
Fig. 2.25 Flywheel/driveplate housing components – exploded view (1600 cc engine – top; 1800 cc engine – bottom) (Sec 19)

1 *Flywheel driveplate housing*
2 *Stud*
3 *Oil seal (70 x 87 x 8.5 mm)*
4 *Timing hole plug*
5 *Crankcase rear hanger*
6 *Pitching stopper bracket*
7 *Nut*
8 *Bolt*
9 *Bolt*
10 *Bolt*
11 *Washer*
12 *Washer*
13 *Spring washer*
14 *Spring washer*
15 *Flywheel/driveplate housing*
16 *Stud*
17 *Oil seal (76 x 93 x 10 mm)*
18 *Timing hole plug*
19 *Bolt*
20 *Bolt*
21 *Stiffener*
22 *Stiffener*
23 *Clip*
24 *Washer*
25 *Spring washer*
26 *Bolt*
27 *Accelerator cable bracket (C-W carburetor)*
28 *Clip*



Coat with liquid gasket (Three Bond 1215 or equivalent) on mating surface and dry the coated surface for 5 to 10 minutes before installation.





19.6 Hold the lifters in position with wire before separating the crankcase sections

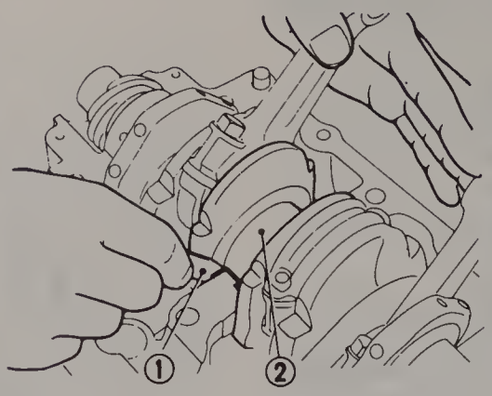
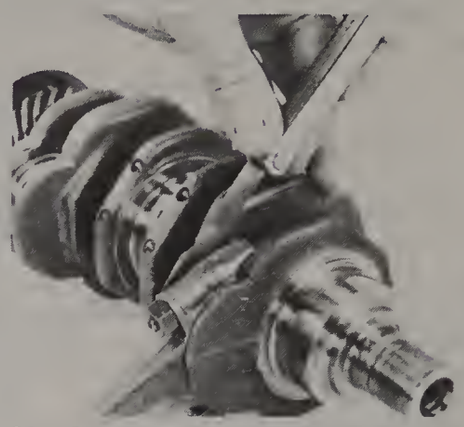


Fig. 2.26 Checking crankshaft end play (Sec 20)

1 Feeler gauge 2 Center main bearing journal



22.1 Checking the connecting rod side clearance

20 Crankshaft and main bearings – removal

Refer to Figs. 2.5 and 2.6

1 Separate the crankcases (Section 19) and remove the front crankshaft oil seal.
2 Before lifting out the crankshaft/connecting rod assembly, check the crankshaft end play. Gently pry or push the crankshaft all the way to the rear of the engine. Slip feeler gauges between the crankshaft and the thrust face of the center main bearing to determine the clearance (which is equivalent to crankshaft end play). If the end play is greater than the specified limit, new main bearings *must* be installed when the engine is reassembled.
3 Carefully lift out the crankshaft and store it where it will not fall or get damaged.
4 Remove the main bearings from the cases and store them in containers marked 'front/left', 'front/right', etc so they can be reinstalled in their original locations (if they are reused).
5 Main bearing inspection is covered in Section 24.
6 Refer to Section 22 to remove the connecting rods from the crankshaft.

21 Camshaft and lifters – removal

1 Separate the crankcases (Section 19) and remove the crankshaft/connecting rod assembly (Section 20).
2 Carefully lift out the camshaft and gear and store it where it will not fall or get damaged.
3 Remove the wires or pieces of rubber hose holding the lifters in place, then slip the lifters out of their bores. Store them in paper bags or cardboard boxes marked 'No 1 cylinder intake', 'No 1 cylinder exhaust', etc so they will be reinstalled in their original locations.

22 Connecting rods and bearings – removal

Refer to Fig. 2.6

1 Before removing the connecting rods from the crankshaft, check the side clearance with a feeler gauge (photo). If the side clearance is greater than specified, new connecting rods will be required for engine reassembly.
2 Using a center punch and hammer, carefully mark the connecting rods and the caps so they can be reinstalled in the same position on the same crankshaft journal. Mark the rod and cap at the front of the crankshaft with one dot, the second rod and cap with two dots and so on (both the rods and caps must be marked since they are going to be separated). Loosen the cap nuts on one connecting rod in three steps, carefully lift off the cap and bearing insert, then carefully remove the rod and remaining bearing insert from the crankshaft journal. Temporarily reassemble the rod, the bearing and the cap to prevent mixing up parts.
3 Repeat the procedure for the remaining connecting rods. Be very careful not to nick or scratch the crankshaft journals with the rod bolts.
4 Without mixing them up, clean the parts with solvent and dry them thoroughly. Make sure the oil holes are clear.
5 Refer to Section 25 for the connecting rod inspection procedures.

23 Crankcases and cylinder bores – cleaning and inspection

1 After the crankcases have been separated and the crankshaft, camshaft and lifters removed, the crankcases should be cleaned thoroughly with new solvent and dried with compressed air. All oil passages should be blown out with compressed air and all traces of old gasket sealant should be removed from the mating surfaces. **Caution:** *Be very careful not to nick or gouge the crankcase mating surfaces or leaks will result.* The threaded holes in the cases must be clean to ensure accurate torque readings during reassembly. Run the proper size tap into each of the holes to remove any rust, corrosion, thread sealant or sludge and to restore any damaged threads. If possible, use compressed air to clear the holes of debris produced by this operation.
2 Visually check the cases and cylinders for cracks, rust and corrosion. Look for stripped threads in the threaded holes. It is also a good idea to have the components checked for hidden cracks by an automotive machine shop that has the special equipment to do this type of work. If defects are found, have the cases repaired, if possible, or replaced. Make sure the cylinder head studs are straight and tight and check the exposed threads for damage. If new studs are required, take the crankcases to a dealer service department or automotive machine shop.
3 Using a straightedge and feeler gauges, check the cylinder head gasket mating surface of the crankcases for warpage. Lay the straightedge lengthwise, across the case and corner-to-corner and try to slip a 0.002 inch (0.05 mm) feeler gauge under it at several points in each position. If necessary, an automotive machine shop will make this check for you and resurface the block if warpage exceeds the service limit.
4 Check the cylinder bores for scuffing and scoring.
5 Using the appropriate precision measuring tools, measure each cylinder's diameter at the top (just under the upper limit of the top piston ring's travel), center and bottom of the cylinder bore, parallel to the crankshaft axis (photo). Next, measure each cylinder's diameter at the same three locations across the crankshaft axis. Compare the results to the Specifications. If the cylinder walls are badly scuffed or scored, or if they are out-of-round or tapered beyond the limits given in the Specifications, have the cylinders rebored and honed at an automotive machine shop. If a rebore is done, oversize pistons and rings will be required as well.
6 If the cylinders are in reasonably good condition and not worn to the outside of the limits, and if the piston-to-cylinder clearances can be maintained properly, then they do not have to be rebored; honing is all that is necessary.
7 To perform the honing operation, you will need the proper size flexible hone (with fine stones), plenty of light oil or honing oil, some rags and an electric drill motor. Mount the hone in the drill motor, compress the stones and slip the hose into the first cylinder. Lubricate the cylinder thoroughly, turn on the drill and move the hone up and down in the cylinder at a pace which will produce a fine crosshatch

1 800 cc engine

1 600 cc engine

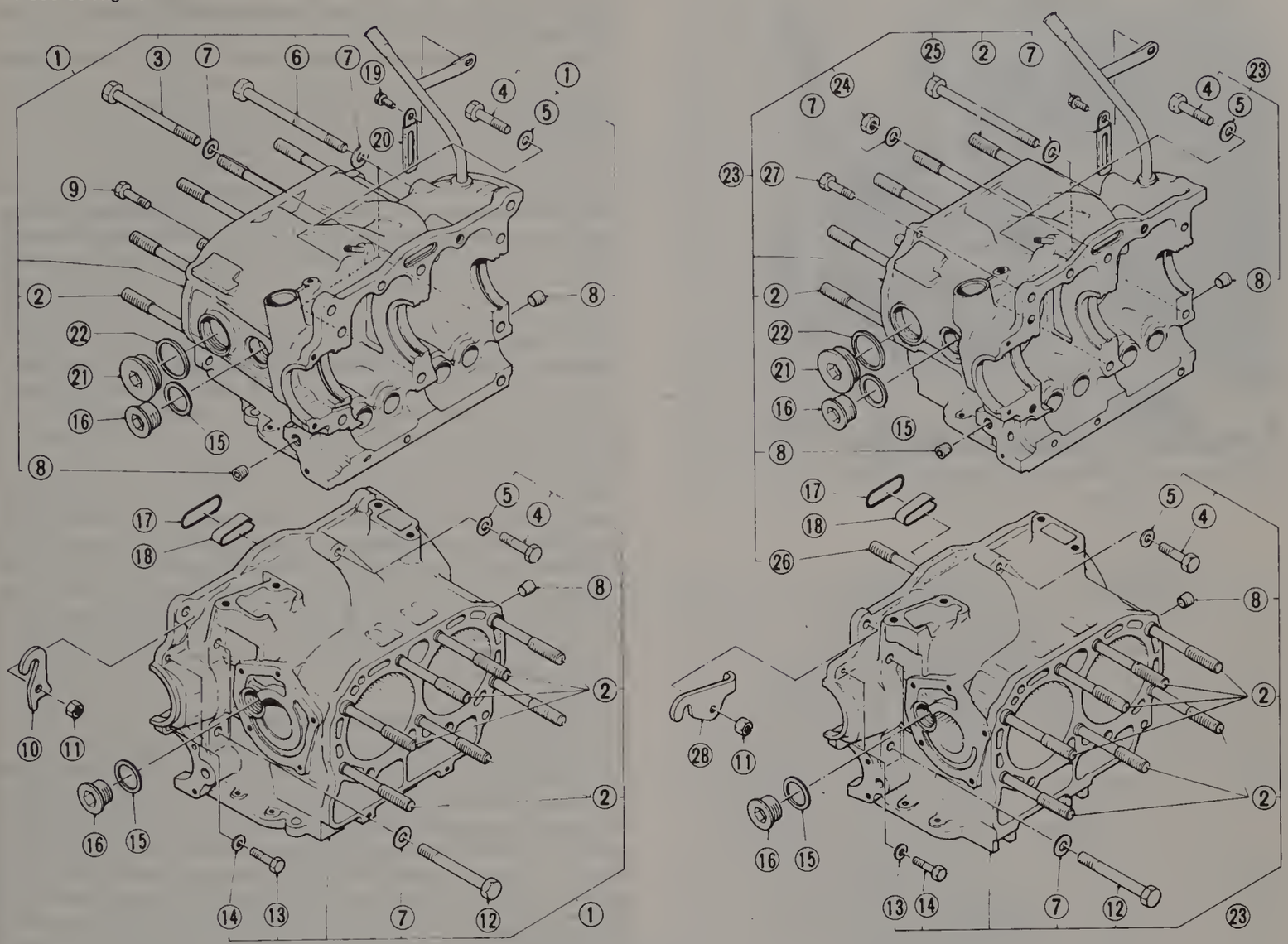


Fig. 2.27 Crankcase components – exploded view

1 *Crankcase assembly*
2 *Stud bolt*
3 *Bolt (10 x 108 x 28 mm)*
4 *Bolt*
5 *Washer*
6 *Bolt (10 x 145 x 28 mm)*
7 *Washer (10.5 x 18 x 2 mm)*
8 *Main gallery plug*
9 *Bolt*
10 *Crankcase front hanger*
11 *Nut*
12 *Bolt (10 x 70 x 28 mm)*
13 *Bolt*
14 *Washer*
15 *Gasket (26.2 x 31.5 x 1 mm)*
16 *Crankcase plug*
17 *Crankcase O-ring*
18 *Back up ring*
19 *Bolt and washer (6 x 13 x 13 mm)*
20 *Clip*
21 *Crankcase plug*
22 *Gasket (36.2 x 44 x 1 mm)*
23 *Crankcase assembly*
24 *Nut (10 x 8 mm)*
25 *Bolt 10 x 135 x 28 mm)*
26 *Stud bolt (10 x 120 x 26 mm)*
27 *Bolt*
28 *Crankcase hanger*

pattern on the cylinder walls (with the crosshatch lines intersecting at approximately a 60° angle). Be sure to use plenty of lubricant and do not take off any more material than is absolutely necessary to produce the desired finish. Do not withdraw the hone from the cylinder while it is running. Instead, shut off the drill and continue moving the hone up and down in the cylinder until it comes to a complete stop, then compress the stones and withdraw the hone. Wipe the oil out of the cylinder and repeat the procedure for the remaining cylinders. Remember, do not remove too much material from the cylinder wall. If you do not have the tools or do not desire to perform the honing operation, most automotive machine shops will do it for a reasonable fee.

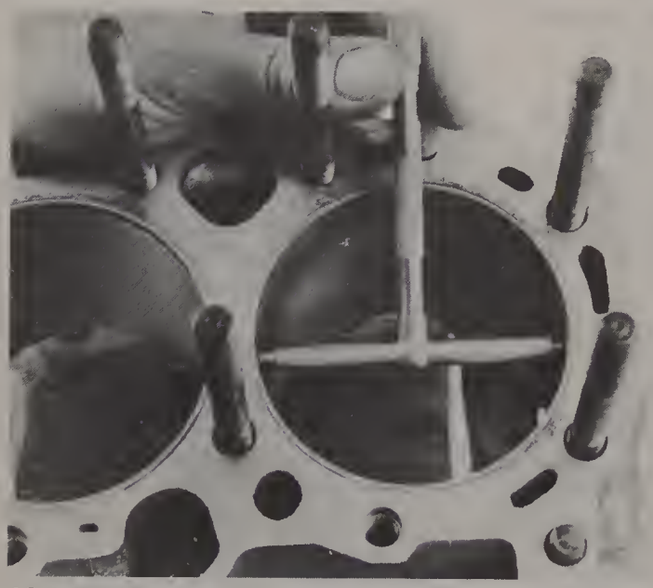
8 After the honing job is complete, chamfer the top edges of the cylinder bores with a small file. Wrap masking tap around the end of the file to avoid scratching or nicking the cylinder walls during the chamfering operation.

9 Next, the crankcases and bores must be thoroughly washed with warm soapy water to remove all traces of the abrasive grit produced during the honing operation. Be sure to run a brush through all oil holes and flush them with running water. After rinsing, dry the cases thoroughly and apply a coat of light rust preventative oil to the cylinder bores.

24 Main and connecting rod bearings – inspection

1 Even though the main and connecting rod bearings should be replaced with new ones during the engine overhaul, the old bearings should be retained for close examination, as they may reveal valuable information about the condition of the engine.

2 Bearing failure occurs mainly because of lack of lubrication, the presence of dirt or other foreign particles, overloading the engine



23.5 Checking the cylinder diameter with a telescoping gauge (the gauge is then measured with a micrometer)

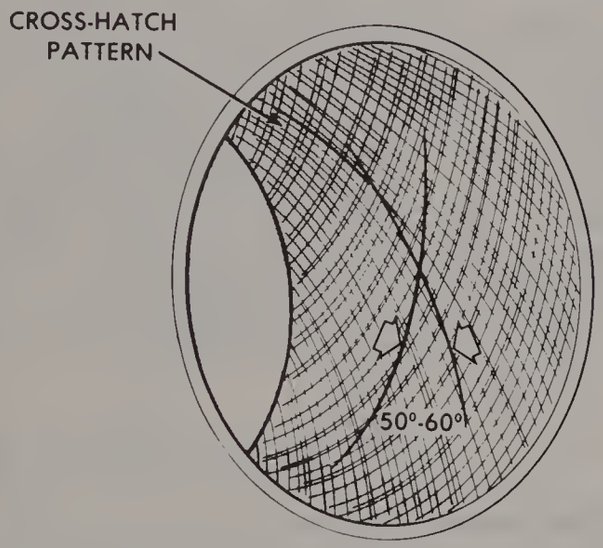


Fig. 2.28 The cylinder hone should leave a crosshatch pattern with the lines intersecting at approximately a 60 degree angle (Sec 23)

25.3 Measuring a connecting rod journal diameter with a micrometer

and/or corrosion. Regardless of the cause of bearing failure, it must be corrected before the engine is reassembled to prevent it from happening again.

3 When examining the bearings, remove them from the engine block, the main bearing caps, the connecting rods and the rod caps and lay them out on a clean surface in the same general position as their location in the engine. This will enable you to match any noted bearing problems with the corresponding crankshaft journal.

4 Dirt and other foreign particles get into the engine in a variety of ways. It may be left in the engine during assembly, or it may pass through filters or breathers. It may get into the oil, and from there into the bearings. Metal chips from machining operations and normal engine wear are often present. Abrasives are sometimes left in engine components after reconditioning, especially when parts are not thoroughly cleaned using the proper cleaning methods. Whatever the source, these foreign objects often end up embedded in the soft bearing material and are easily recognized. Large particles will not embed in the bearing and will score or gouge the bearing and shaft. The best prevention for this cause of bearing failure is to clean all parts thoroughly and keep everything spotlessly clean during engine assembly. Frequent and regular changes of engine oil, and oil filters, is also recommended.

5 Lack of lubrication (or lubrication breakdown) has a number of interrelated causes. Excessive heat (which thins the oil), overloading (which squeezes the oil from the bearing face) and oil leakage or throw-off (from excessive bearing clearances, worn oil pumps or high engine speeds) all contribute to lubrication breakdown. Blocked oil passages, which usually are the result of misaligned oil holes in a bearing shell, will also oil-starve a bearing and destroy it. When lack of lubrication is the cause of bearing failure, the bearing material is wiped or extruded from the steel backing of the bearing. Temperatures may increase to the point where the steel backing turns blue from overheating.

6 Driving habits can have a definite effect on bearing life. Full throttle low-speed operation (or 'lugging' the engine) puts very high loads on bearings, which tends to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatique failure). Eventually the bearing material will loosen in pieces and tear away from the steel backing. Short-trip driving leads to corrosion of bearings, as insufficient engine heat is produced to drive off the condensed water and corrosive gases produced. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings the acid attacks and corrodes the bearing material.

7 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight-fitting bearings, which leave insufficient bearing oil clearance, result in oil starvation. Dirt or foreign particles trapped behind a bearing insert result in high spots on the bearing which lead to failure.

25 Crankshaft and connecting rods – inspection

Crankshaft

1 Clean the crankshaft with solvent (be sure to clean the oil holes with a stiff brush and flush them with solvent) and dry it thoroughly. Check the main and connecting rod bearing journals for uneven wear, scoring, pitting and cracks. Check the remainder of the crankshaft for cracks and damage.

2 Refer to Section 24 and examine the main bearing inserts. If they are scored, badly scuffed, discolored from excessive heat or appear to have been seized, new bearings must be installed.

3 Using an appropriate size micrometer, measure and record the diameter of the main and connecting rod journals (photo) and compare the results to the Specifications. By measuring the diameter at a number of points around the journal's circumference, you will be able to determine whether or not the journal is worn out-of-round. Take the measurement at each end of the journal, near the crank throws, to determine whether the journal is tapered.

4 If the crankshaft journals are damaged, tapered, out-of-round or worn beyond the limits given in the Specifications, have the crankshaft reground by a reputable automotive machine shop. Be sure to use the correct undersize bearing inserts if the crankshaft is reconditioned.

5 Check the crankshaft runout with a dial indicator. This measurement requires a special jig (or V-blocks) so it may have to be done by an automotive machine shop.

Connecting rods

6 Check the connecting rods for cracks and other obvious damage. Inspect the thrust surfaces on both sides of the big ends. If they are worn, scored or otherwise damaged, new connecting rods will be required.

7 Refer to Section 24 and examine the connecting rod bearing inserts. If they are scored, badly scuffed or appear to have been seized, new bearings must be installed. Always replace the bearings in all connecting rods as a set. If they are badly damaged, inspect the crankshaft journals as well. Evidence of extreme heat, such as discoloration, indicates that lubrication failure has occurred. Be sure to thoroughly check the oil pump and oil pressure relief valve as well as all oil holes and passages before reassembling the engine.

8 If the bearings and journals appear to be in good condition, check the oil clearances as follows:

9 Remove the connecting rod caps from the rods. Remove the bearing inserts (make sure they do not get mixed up) and wipe the bearing surfaces of the rods and caps with a clean, lint-free cloth. *They must be spotlessly clean.*

10 Clean the upper bearing inserts, then lay them in place in the connecting rods. Make sure that the tab on each bearing fits into the recess in the rod. Do not hammer the bearing inserts into place and be very careful not to nick or gouge the bearing surfaces. *Do not lubricate the bearings at this time.*

11 Clean the other bearing inserts and install them in the rod caps. Again, make sure the tab on each bearing fits into the recess in the cap and do not apply any lubricant. It is critically important to ensure that the mating surfaces of the bearings and connecting rods are perfectly clean and oil free when they are assembled.

12 Clean the number one connecting rod journal on the crankshaft and the bearing face in the rod, then slip the rod into place on the crankshaft journal. Make sure the mark on the rod is facing the front of the crankshaft.

13 Trim a piece of type HPG-1 Plastigage so that it is slightly shorter than the width of the connecting rod bearing and lay it in place on the rod journal, parallel with the journal axis.

14 Clean the connecting rod cap bearing face and gently install the rod cap in place. Make sure the mating mark on the cap is on the same side as the mark on the connecting rod. Install the rod bolts and nuts and tighten them to the specified torque, working up to it in three steps. Refer to the accompanying exploded view illustration to ensure correct installation of the rod bolts. Also, there is very little clearance between the connecting rod and the nuts so you may have to grind a taper on the lower edge of the socket until it fits completely over the nut without binding between the nut and the rod. Failure to do this may result in inaccurate torque readings. **Note**: *Do not rotate the connecting rod or move the crankshaft at any time during this operation.*

15 Remove the rod cap, being very careful not to disturb the Plastigage. Compare the width of the crushed Plastigage to the scale printed on the Plastigage container to obtain the oil clearance. Compare the results to the Specifications to make sure the clearance is correct. If the clearance is not correct, make sure that no dirt or oil was between the bearing inserts and the connecting rod or cap when the clearance was measured. Repeat the procedure for the remaining connecting rods.

16 An alternative method of checking the connecting rod bearing oil clearances requires a telescoping gauge (or inside micrometer) and a 1-to-2 inch micrometer. Assemble the connecting rods and caps (with the bearing inserts) and tighten the nuts as described in Step 13. Use the telescoping gauge and micrometer to determine the diameter of the connecting rod big end bore. Subtract the diameter of the corresponding crankshaft journal (obtained in Step 2) from the diameter of the connecting rod bore – the result is the oil clearance.

17 As a general rule, bearings are replaced as a matter of course whenever the engine is disassembled, but if the clearances are within the specified limits, the original bearings can be reinstalled when the engine is assembled. However, it should be noted that if the clearances are within the specified limits, but very close to the high side of the limits, it would be wise to go ahead and replace the bearings with new ones, since the engine is already apart.

18 If the oil clearances are excessive, or if the bearings are damaged, new bearings *must* be installed.

19 Measure the piston pin outside diameter and the connecting rod bushing inside diameter with a telescoping gauge and a 0-to-1 inch micrometer (photo). Subtract the two measurements to obtain the piston pin-to-connecting rod clearance. If it is greater than specified, the rod bushing must be replaced with a new one. Check the remaining rods and pins in the same manner, but do not mix up the parts. If the rod bushings require replacement, take the connecting rods to a reputable automotive machine shop. The machine shop will also check the rods to see if they are bent or twisted.

26 Camshaft and lifters – inspection

Camshaft

1 Inspect the cam bearing surfaces of the crankcases. Look for score marks, deep scratches and evidence of galling.

2 Check the camshaft lobes for heat discoloration (blue appearance), score marks, chipped areas and flat spots. Measure the height of each lobe (photo) and compare the results to the Specifications. Have the camshaft and gear runout checked by a dealer service department or an automotive machine shop. If damage or excessive wear is evident, the camshaft must be replaced with a new one. **Note**: *If the camshaft is replaced, replace all of the lifters with new ones as well.*

3 Using a feeler gauge, measure the thrust clearance between the front bearing journal and the plate (photo). If it exceeds the specified limit, have the plate replaced with a new one by a Subaru dealer service department or an automotive machine shop.

4 Check the camshaft gear teeth for cracks, abnormal wear and other damage. If necessary, have the gear replaced by a Subaru dealer service department or an automotive machine shop.

5 Next, check the camshaft bearing oil clearances. Clean the camshafts and the bearing surfaces in the crankcases with a clean, lint-free cloth, then lay the cam in place in the left-hand section of the crankcase. **Note**: *Refer to Section 29 and check the crankshaft main bearing oil clearance at the same time.*

6 Cut three strips of Plastigage (type HPG-1) and lay one piece on each of the cam bearing journals, parallel with the camshaft centerline.

7 Very carefully lay the remaining crankcase section in place (be careful not to disturb the Plastigage) and install the bolts. Tighten the bolts to the specified torque in four steps, following the sequence shown in the accompanying illustration. *During this procedure do not rotate the camshaft.*

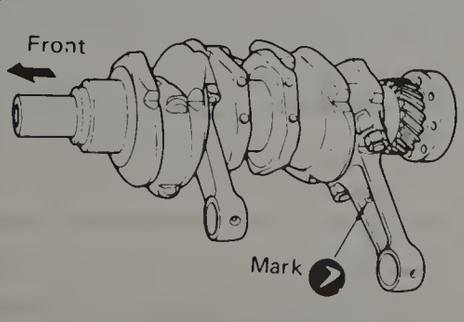


Fig. 2.29 The connecting rods must be installed with the mark facing the front of the crankshaft (Sec 25)

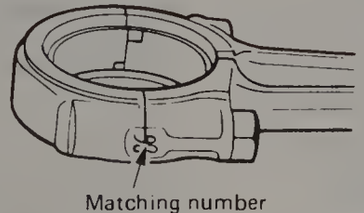


Fig. 2.30 The connecting rods may be marked with a number (which will help to match the rods and caps correctly) (Sec 25)

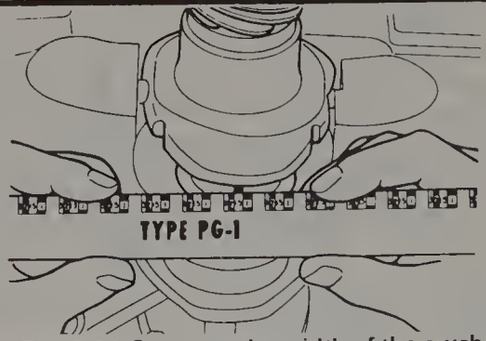
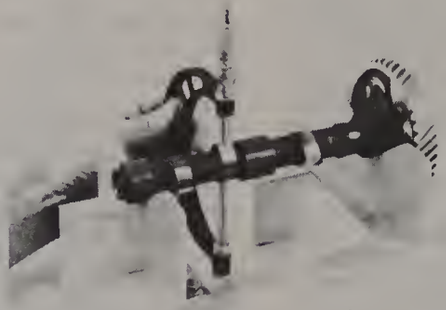


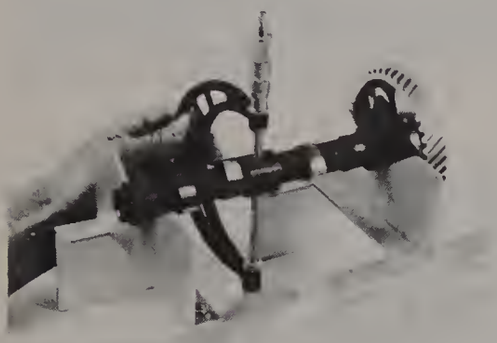
Fig. 2.31 Compare the width of the crushed Plastigage to the scale printed on the container to obtain the connecting rod bearing oil clearance (Sec 25)

25.19 The connecting rod bushing inside diameter can be determined with a telescoping gauge and micrometer



26.2 Measuring camshaft lobe height

26.3 Measuring camshaft thrust clearance with a feeler gauge



26.9 Measuring camshaft bearing journal diameter with a micrometer

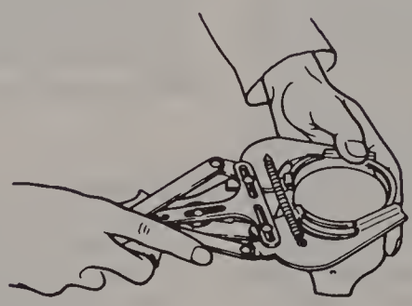
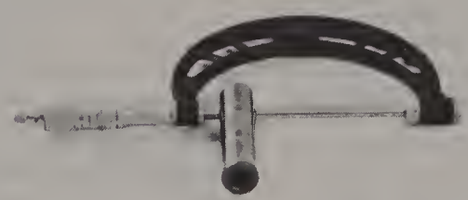


Fig. 2.32 Removing the piston rings (note the special tool being used) (Sec 27)

27.10 Measuring piston ring-to-groove clearance with a feeler gauge

27.11 Measuring piston diameter



27.12A Measuring piston pin diameter

27.12B A telescoping gauge is used to determine the piston pin bore size

8 Loosen and remove the bolts (again, in four steps) then very carefully lift off the crankcase section.

9 To obtain the oil clearance, compare the crushed Plastigage (at its widest point) on each journal to the scale printed on the Plastigage container. Compare the results to the Specifications. If the oil clearance is greater than specified, measure each cam bearing journal diameter with a micrometer (photo). If the journal diameters are less than the specified limit, replace the camshaft with a new one and recheck the oil clearance. If the clearance is still too great, replace the crankcases with new parts (consult your Subaru dealer first).

Lifters

10 Check the lifters and bores for score marks, deep scratches and evidence of galling.

11 Check the camshaft lobe contact area of each lifter for abnormal or excessive wear and pitting.

12 Measure the outside diameter of each lifter and the inside diameter of each lifter bore in the crankcases. Subtract the lifter diameters from the corresponding bore diameter to obtain the lifter-to-bore clearances. If they are greater than specified, new lifters and possibly new crankcases will be required. Consult your Subaru dealer before purchasing parts.

13 If your engine is equipped with hydraulic lifters, have them checked for proper operation by a Subaru dealer service department or an automotive machine shop.

27 Pistons – inspection

1 Before the inspection process can be carried out, the pistons must be cleaned and the old piston rings removed from the pistons.

2 Using a piston ring installation tool, carefully remove the rings from the pistons. Do not nick or gouge the pistons in the process.

3 Scrape all traces of carbon from the top (or crown) of the piston. A hand-held wire brush or a piece of fine emery cloth can be used once

the majority of the deposits have been scraped away. Do not, under any circumstances, use a wire brush mounted in a drill motor to remove deposits from the pistons. The piston material is soft and will be eroded away by the wire brush.

4 Use a piston ring groove cleaning tool to remove any carbon deposits from the ring grooves. If a tool is not available, a piece broken off the old ring will do the job. Be very careful to remove only the carbon deposits. Do not remove any metal and do not nick or scratch the sides of the ring grooves.

5 Once the deposits have been removed, clean the pistons with solvent and dry them thoroughly. Make sure that the oil return slots in the back sides of the oil ring grooves are clear.

6 If the pistons are not damaged or worn excessively, and if the cylinders are not rebored, new pistons will not be necessary. Normal piston wear appears as even vertical wear on the piston thrust surfaces and slight looseness of the top ring in its groove. New piston rings, on the other hand, should always be used when an engine is rebuilt.

7 Carefully inspect each piston for cracks around the skirt, at the pin bosses and at the ring lands.

8 Look for scoring and scuffing (on the thrust faces of the skirt), holes (in the piston crown) and burned areas (at the edge of the crown). If the skirts are scored or scuffed, the engine may have been suffering from overheating and/or abnormal combustion, which caused excessively high operating temperatures. The cooling and lubrication systems should be checked thoroughly. A hole in the piston crown, an extreme to be sure, is an indication that abnormal combustion (preignition) was occurring. Burned areas at the edge of the piston crown are usually evidence of spark knock (detonation). If any of the above problems exist, the causes must be corrected or the damage will occur again.

9 Corrosion of the piston (evidenced by pitting) indicates that coolant is leaking into the combustion chambers and/or the crankcase. Again, the cause must be corrected or the problem may persist in the rebuilt engine.

10 Measure the piston ring-to-groove clearances by laying a new piston ring in each ring groove and slipping a feeler gauge in beside it (photo). Check the clearance at three or four locations around the groove. Be sure to use the correct ring for each groove; they are different. If the clearances are greater than specified, new pistons will have to be used and the cylinder rebored to accept them.

11 Check the piston-to-bore clearances by measuring the cylinder bores (see Section 23) and the piston diameter (photo). Make sure that the pistons and bores are correctly matched. Measure the pistons across the skirt, on the thrust faces (at 90° angle to the piston pin), about 1 in up from the bottom of the skirt. Subtract the piston diameter from the corresponding bore diameter to obtain the clearance. If *any* are greater than specified, the cylinders will have to be rebored and new pistons and rings installed.

12 Measure the piston pin outside diameter (photo) and the pin bore inside diameter (photo). Subtract the two measurements to obtain the piston-to-piston pin clearance. If it is greater than specified, new pistons and possibly new pins must be installed.

13 Refer to Section 32 and install the rings on the pistons.

28 Connecting rods and bearings – installation and oil clearance check

1 Once the crankshaft and rods have been cleaned and inspected and the decision has been made concerning bearing replacement, the connecting rods can be reinstalled on the crankshaft. **Note:** *If new bearings are being used, check the oil clearances as described in Section 25 before final installation of the connecting rods. If the clearances are within the specified limits, proceed with the installation. Never assume that the clearances are correct even though new bearings are involved.*

2 Make sure the bearing faces are perfectly clean, then apply a uniform layer of clean grease (preferably molybdenum disulfide) or engine assembly lube to the bearing faces. The tab on each bearing must be engaged in the recess in the cap or rod.

3 Clean the number one rod journal on the crankshaft, then slip the number one rod into place. *Make sure the mark on the rod is facing the front of the crankshaft.*

4 Gently install the rod cap in place. Make sure the mating mark on the cap is on the same side as the mark on the connecting rod. Install the rod bolts and nuts and tighten them to the specified torque, working up to it in three steps. Refer to the accompanying exploded view illustration to ensure correct installation of the rod bolts. Also, there is very little clearance between the connecting rod and the nuts so you may have to grind a taper on the lower edge of the socket until it fits completely over the nut without binding between the nut and the rod. Failure to do this may result in inaccurate torque readings.

5 Repeat the procedure for the remaining rods; do not mix up the rods and caps and do not install the rods backwards.

6 After the connecting rods have been installed, rotate them by hand and check for any obvious binding.

7 As a final step, the connecting rod big end side clearances must be rechecked. Slide each connecting rod to one side of the journal and slip a feeler gauge between the side of each connecting rod and the crankshaft throw. Be sure to compare the measured clearances to the Specifications to make sure they are correct.

29 Crankshaft and main bearings – installation and oil clearance check

Refer to Figs. 2.33 through 2.35

1 Before installation of the crankshaft, the main bearing oil clearances must be checked. **Note:** *The camshaft bearing oil clearances should be checked at the same time (refer to Section 26 for details):*

2 Position the left crankcase section on a workbench with the bearing saddles facing up. Wipe the main bearing surfaces of the crankcases with a clean lint-free cloth. *They must be kept spotlessly clean.*

3 Clean the back sides of the main bearing inserts and lay one bearing half in each main bearing saddle in the crankcase on the workbench and the other bearing half from each set in the corresponding location in the remaining crankcase section. Make sure the tab on the bearing insert fits into the recess in the crankcase. Do not hammer the bearing into place and do not nick or gouge the bearing faces. No lubrication should be used at this time.

4 Clean the faces of the bearings in the crankcases and the crankshaft main bearing journals with a clean, lint-free cloth. Once you are certain that the crankshaft is clean, carefully lay it in position in the crankcase section on the workbench.

5 Trim three pieces of type HPG-1 Plastigage so that they are slightly shorter than the width of the main bearings and place one piece on each crankshaft main bearing journal, parallel with the journal axis.

6 Clean the faces of the bearings in the right crankcase, then carefully lay it in position. Do not disturb the Plastigage.

7 Install the crankcase bolts. Following the sequence shown in the accompanying illustration, tighten them in three steps to the specified torque. *Do not rotate the crankshaft at any time during this operation.*

8 Remove the bolts and carefully lift off the right crankcase section. Do not disturb the Plastigage or rotate the crankshaft.

9 Compare the width of the crushed Plastigage on each journal to the scale printed on the Plastigage container to obtain the main

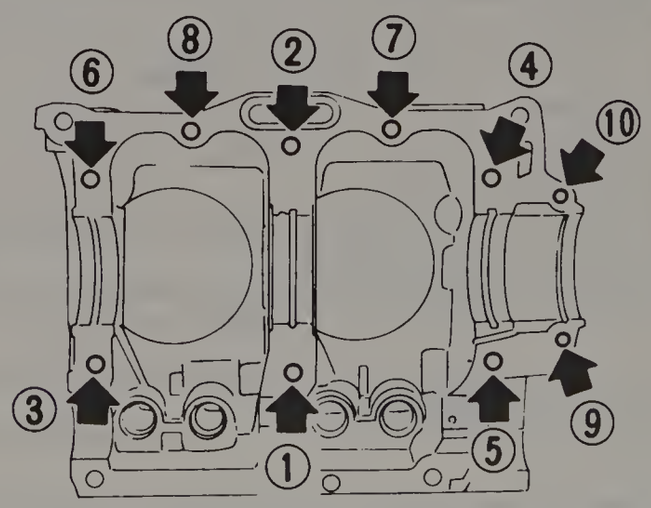


Fig. 2.33 Crankcase bolt tightening sequence (Sec 29)

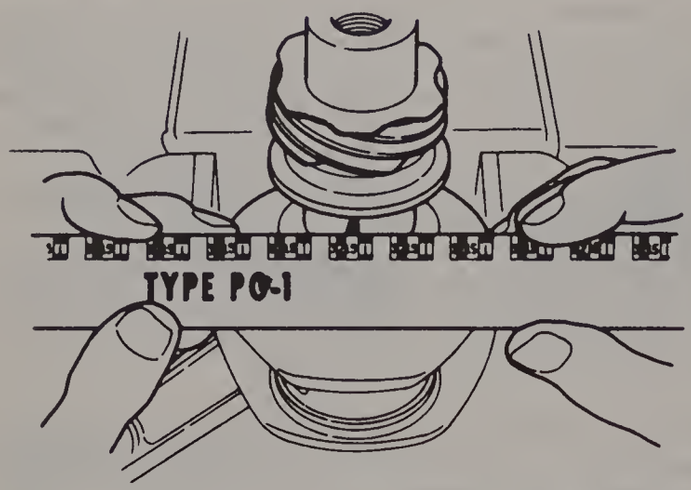


Fig. 2.34 Compare the width of the crushed Plastigage to the scale printed on the container to obtain the main bearing oil clearance (Sec 29)

bearing oil clearances. Check the Specifications to make sure they are correct.

10 If the clearance is not correct, double-check to make sure that you have the right size bearing inserts. Also, recheck the crankshaft main bearing journal diameters and make sure that no dirt or oil was between the bearing inserts and the main bearing caps or the block when the clearance was measured.

11 Be sure to remove all traces of the Plastigage from the bearing faces and/or journals. To prevent damage to the bearing surfaces, use a wood or plastic tool.

12 Carefully lift the crankshaft out of the case. Clean the bearing faces, then apply a thin layer of clean, high-quality multi-purpose grease or engine assembly lube (preferably one containing molybdenum disulfide) to each of the bearing faces in both crankcase sections (photo). Be sure to coat the thrust bearing faces as well.

13 Refer to Section 30 and install the camshaft and lifters before final installation of the crankshaft.

14 Install the Woodruff key and distributor drive gear at the front of the crankshaft (photo) (if they were removed).

15 Carefully lay the crankshaft in the left crankcase section. Make sure the connecting rods are directed into the cylinder bores.

16 Turn the camshaft and crankshaft independently until the punch mark in the cam gear can be seen through the large chamfered bolt hole in the crankshaft gear (see the accompanying illustration).

17 Refer to Section 31 and rejoin the two crankcase sections.

30 Camshaft and lifters – installation

1 The camshaft and lifters must be in position before the crankcases are rejoined (Section 31).

2 Make sure the camshaft bearing oil clearance (Section 26) has been checked before final installation of the camshaft and rejoining of the crankcases.

3 Lubricate the lifters with engine assembly lube or molybdenum disulfide grease, then slip them into the bores and retain them with wire or pieces of rubber hose.

4 Lubricate the camshaft bearing journals and lobes, then position the camshaft in the left crankcase section (the one containing cylinders numbered two [2] and four [4]).

5 Refer to the appropriate Sections and install the crankshaft/connecting rod assembly and rejoin the crankcases.

31 Rejoining the crankcases

Refer to Fig. 2.33

1 Clean the mating surfaces with lacquer thinner or acetone (they must be clean and oil-free).

2 Refer to the appropriate Sections and install the camshaft, lifters and crankshaft/connecting rod assembly.

29.12 Apply engine assembly lube to the main bearings before installing the crankshaft

29.14 Installing the distributor drive gear on the front of the crankshaft

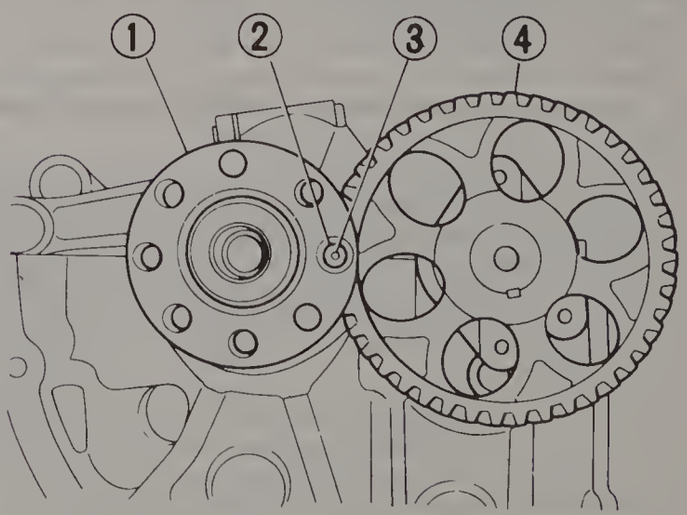


Fig. 2.35 Correct camshaft gear-to-crankshaft gear mesh (Sec 29)

1 Crankshaft gear
2 Hole with large chamfer
3 Punch mark
4 Camshaft gear

3 Install the O-ring and backup ring (photo) in the left crankcase section.
4 Apply a thin layer of liquid gasket sealer (Fuji Bond C or equivalent) to the crankcase mating surfaces.
5 Carefully lower the right crankcase section into position on the left crankcase and install the nuts and bolts. Tighten them to the specified torque in three steps. Be sure to use the sequence shown in the accompanying illustration.
6 Install a new oil seal in the flywheel/driveplate housing, then lubricate the seal lip with engine oil. Apply liquid gasket sealer to the mating surfaces and attach the housing to the crankcase. Tighten the bolts in a criss-cross pattern to the specified torque.
7 Install a new front oil seal. Lubricate the outer edge and carefully drive it in with a hammer and block of wood until it is flush with the crankcase.
8 Lubricate the seal lip, then install the crankshaft pulley. Do not tighten the pulley bolt until the flywheel/driveplate is in place.
9 The remainder of the procedure is basically the reverse of the separation procedure. Be sure to tighten the crankshaft pulley mounting bolt.

32 Piston rings – installation

Refer to Figs. 2.37 through 2.39

1 Before installing the new piston rings, the ring end gaps must be checked. It is assumed that the ring-to-groove clearances (Section 27) have already been checked.
2 Lay out the pistons and the new ring sets so the rings will be matched with the same piston and cylinder during the end gap measurement and engine reassembly.
3 Insert the top (number one) ring into the first cylinder and square it up with the cylinder walls by pushing it in with the top of the piston. The ring should be near the bottom of the cylinder at the lower limit of ring travel. To measure the end gap, slip a feeler gauge between the ends of the ring (photo). Compare the measurement to the Specifications.
4 If the gap is larger or smaller than specified, double-check to make sure that you have the correct rings before proceeding.
5 If the gap is too small, it must be enlarged or the ring ends may come in contact with each other during engine operation, which can cause serious damage to the engine. The end gap can be increased by filing the ring ends very carefully with a fine file. Mount the file in a vise equipped with soft jaws, slip the ring over the file so that the ends contact the file face and slowly move the ring to remove material from the ends. When performing this operation, file only from the outside in.
6 Excess end gap is not critical unless it is greater than 0.060 in (1.50 mm). Again, double-check to make sure you have the correct rings for your engine.
7 Repeat the procedure for each ring that will be installed in the first cylinder and for each ring in the remaining cylinders. Remember to keep rings, pistons and cylinders matched up.
8 Once the ring end gaps have been checked/corrected, the rings can be installed on the pistons.
9 The oil control ring (lowest one on the piston) is installed first. It is composed of three separate components. Slip the oil ring spacer into the groove with the end gap approximately 180° from the stopper pin. Install the upper side rail. Do not use a piston ring installation tool on the oil ring side rails, as they may be damaged. Instead, place one end of the side rail into the groove between the spacer and the ring land, hold it firmly in place and slide a finger around the piston while pushing the rail into the groove. Next, install the lower side rail in the same manner.
10 After the three oil ring components have been installed, check to make sure that the upper and lower rail end gaps are positioned exactly as shown in the accompanying illustration.
11 The number two (middle) ring is installed next. It can be readily distinguished from the top ring by its cross section shape, lack of chrome plating on the face and the fact that it is thicker than the top ring.
12 Use a piston ring installation tool and *make sure that the identification mark is facing up,* then fit the ring into the middle groove on the piston. Do not expand the ring any more than is necessary to slide it over the piston.

31.3 Don't forget the O-ring and backup ring

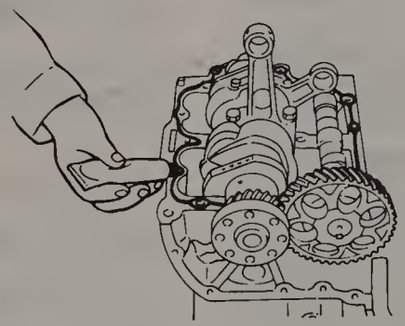
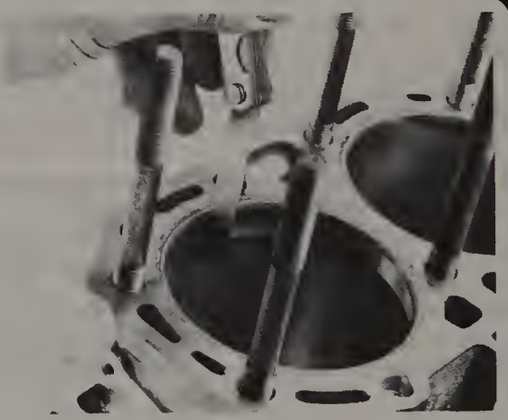


Fig. 2.36 Be sure to apply a thin layer of the specified liquid gasket sealer to the crankcase mating surfaces before rejoining them (Sec 31)



32.3 Checking piston ring end gap with a feeler gauge

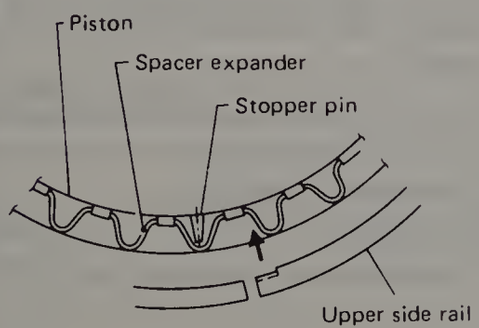


Fig. 2.37 Installation details for *Nippon* oil rings (Sec 32)

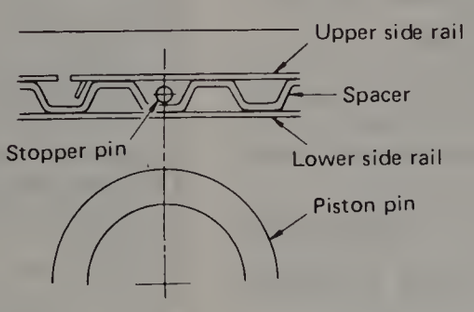


Fig. 2.38 Installation details for *Riken* oil rings (Sec 32)

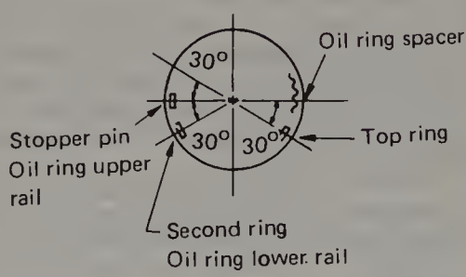


Fig. 2.39 Be sure to position the piston ring gaps exactly as shown before installing the pistons (Sec 32)

13 Finally, install the number one (top) ring in the same manner. *Make sure the identifying mark is facing up.*
14 Repeat the procedure for the remaining pistons and rings. Be careful not to confuse the number one and number two rings.

33 Pistons – installation

Refer to Figs. 2.40 and 2.41

Note: *When the pistons are installed, the stopper pins that keep the oil ring spacer expanders from moving must face away from the piston pin service holes (see the accompanying illustrations).*
1 Position the engine on a workbench with the left side (cylinders two and four) facing *down.*
2 Install the inner circlip (stopper pin side of the piston) in the number two (2) piston pin hole groove. Rotate the circlip until the circlip pigtail points toward the *top* of the piston (see the accompanying illustration).
3 Make sure the ring end gaps are positioned correctly, then lubricate the skirt and rings with clean engine oil. Install a piston ring compressor on the piston. Leave the skirt protruding about $\frac{1}{4}$ inch to guide the piston into the cylinder. The rings must be compressed as far as possible.
4 Carefully turn the crankshaft until the number two (2) connecting rod is at bottom dead center. At this point the rod should be as close to vertical as possible.
5 Gently guide the piston skirt into the number two (2) cylinder. Make sure the stopper pin is facing *away* from the service hole. Tap the exposed edge of the ring compressor so that it is contacting the crankcase around its entire circumference.
6 Carefully tap on the top of the piston with a soft-faced hammer. The piston rings may try to pop out of the ring compressor just before entering the cylinder bore, so keep some pressure on the ring compressor. Work slowly, and if any resistance is felt as the piston rings enter the cylinder, stop immediately. Find out what is hanging up and fix it before proceeding. Do not, for any reason, force the piston into the cylinder, as you will break a ring and/or the piston.
7 Push the piston in until the service hole, the piston pin bore and the small end of the connecting rod are all aligned.
8 Lubricate the pin with clean engine oil, then slip it through the service hole into the piston and connecting rod. *If resistance is felt, do not force the pin.* Instead, check to make sure the pin bore and connecting rod are aligned.
9 Install the outer circlip in the pin hole groove and rotate it until the pigtail points toward the top of the piston.
10 Repeat the procedure for the number four (4) piston.
11 Turn the engine upside-down (cylinders one and three should be facing *down)* and repeat the procedure for pistons one and three.
12 Make sure the aluminum washers are in place, then apply gasket sealer to the threads and install the service hole plugs in the front of the crankcase. Tighten them to the specified torque.

34 External engine components – installation

1 Carefully place the intake manifold (with the carburetor) on the engine and bolt it into place with the mounting bolts.
2 Attach the hose assembly to the PCV valve.
3 Install the oil fill tube and bracket on the engine.
4 Attach the EGR supply tube to the EGR valve.
5 Connect the vacuum sensing line to the air injection system air suction valve. Install the two flexible hoses and the holder.
6 Attach the rubber hose and the air supply tube to the air injection system air suction valve.
7 Reconnect the right hand rocker arm cover vent hose.
8 Connect the coolant transfer hose (from the thermostat housing) to the fitting directly below the carburetor.
9 Install the oil pressure sensing unit and connect the electrical connector to it.
10 Refer to Chapter 5 and install the distributor. Install the vacuum advance diaphragm hose.
11 Attach the clamp and harness to the distributor and connect the distributor primary wire(s).
12 Install the spark plugs.
13 Install the rotor, the distributor cap and the cap seal on the distributor.

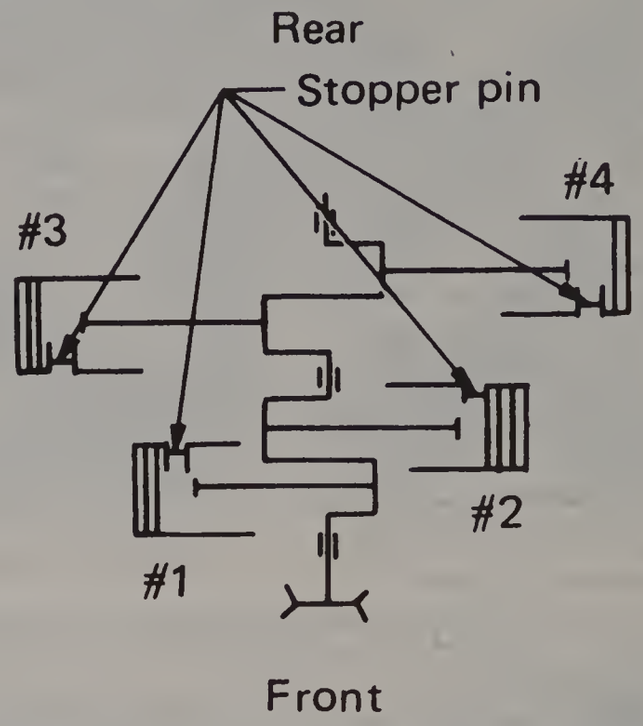


Fig. 2.40 The oil ring spacer stopper pins must face *in* when the pistons are installed (Sec 33)

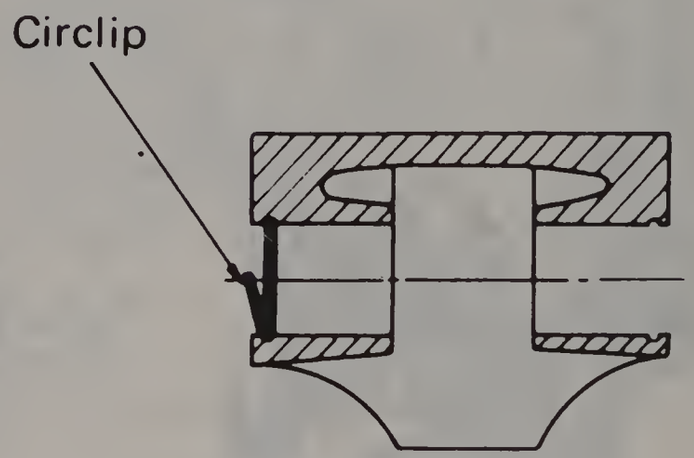


Fig. 2.41 The circlip pigtail must point toward the top of the piston (Sec 33)

14 Attach the spark plug wires to the distributor cap and the individual spark plugs. **Note:** *Refer to Chapter 1 for the correct plug wire installation (firing order).*
15 Attach the plug wire separators to their associated brackets.
16 Install the water pump by referring to Chapter 3. Connect the hose to the water pump.
17 Attach the hoses to the rocker arm covers.
18 Install the compressor/alternator bracket.
19 Install the flywheel (manual transmission) or the converter driveplate (automatic transmission).
20 Install the clutch cover and disc (if applicable) by referring to Chapter 8.

35 Engine – installation

1 Apply grease to the splines of the transmission mainshaft (manual transmission equipped vehicles only).
2 Slowly and carefully raise the engine with the hoist and then lower

it into the engine compartment while you tip the rear of the engine down towards the transmission.
3 Align the engine crankshaft with the transmission mainshaft.
4 Attach the engine to the transmission as follows:

Manual transmission

a) Turn the crankshaft pulley until the mainshaft is aligned with the clutch disc at the splines.

Automatic transmission

b) Jack the vehicle up until the front wheels are slightly off the ground.
c) Turn the crankshaft pulley until one mounting bolt hole in the converter driveplate is centered in the timing mark hole.
d) Turn the steering wheel until the mounting holes are aligned and then install the mounting bolt. Do this for each of the mounting bolts, but do not tighten the bolts until they are all installed. **Note**: *Be careful not to drop the bolts into the converter housing.*

5 Now, attach the engine to the transmission by installing the upper and then the lower engine-to-transmission mounting bolts.
6 Make sure that the engine is properly aligned with the transmission. Tighten the bolts to the specified torque.
7 Lower the jack supporting the transmission and remove it from under the vehicle. Position the engine rubber mounts in place.
8 Lower the engine completely and remove the hoist from the area.
9 Raise the vehicle sufficiently to work underneath it and support it with jackstands.
10 Securely tighten all of the engine mounting nuts and bolts according to the Torque specifications.
11 Install the front exhaust pipe by referring to Chapter 4.
12 Now, lower the vehicle and install the engine pitching stopper as follows:

a) Attach the pitching stopper rod to the bracket on the engine, then tighten it at the body end.
b) Tighten the rear nut on the pitching stopper so that 0.031 to 0.047 in (0.8 to 1.2 mm) clearance is maintained between the rubber cushion and the washer.
c) Attach a wrench to the rear nut on the engine side of the pitching stopper to prevent it from turning and tighten the front nut securely.

13 Attach the clutch cable (manual transmission) to the clutch release lever and adjust it by referring to Chapter 1.
14 Attach the Hill-holder cable (manual transmission) to the clutch release fork and adjust it by referring to Chapter 9.
15 Attach the Hot Air Intake system duct to the heat stove on the exhaust pipe.
16 If your vehicle has power steering, install the power steering pump by referring to Chapter 11.
17 Attach the spark plug wire bracket to the top of the engine and connect the vacuum hose to the left end of the intake manifold.
18 Connect the miscellaneous hoses to the carburetor.
19 Install the hose bracket directly in front of the oil fill tube.
20 Connect the heater hoses at the bellhousing/transmission parting line.
21 Connect the air conditioning hose bracket to the oil fill tube bracket (if applicable).
22 Connect the throttle cable to the manifold bracket and the carburetor throttle shaft pulley. Adjust the throttle cable by referring to Chapter 1.
23 Connect the capacitor electrical lead to the positive battery cable stand-off bracket located just below the thermostat housing (not all models).
24 Connect the vacuum hose to the solenoid.
25 Connect the two electrical connectors just below the vacuum canister.
26 Connect the vacuum line to the T-fitting located just forward of the vacuum canister.
27 Connect the vacuum hose to the upper port of the vacuum canister and the T-fitting located just to the rear of the windshield washer filler.
28 Install the starter motor by referring to Chapter 5. Connect the wires to the starter motor.
29 Attach the two tagged wires to the positive and negative terminals of the ignition coil.
30 Connect the high tension wire from the distributor to the coil.
31 Attach the ground cable to the upper right-hand corner of the cylinder head.
32 Install the air cleaner pre-heat transfer tube.
33 Install the alternator and the alternator drivebelt.
34 Connect the wires to the rear of the alternator.
35 Install the air conditioner compressor (if applicable).
36 Install the air conditioner compressor clutch wire, the compressor drivebelt and the air conditioning hoses.
37 Install the radiator and both upper radiator mounts.
38 Connect the transmission fluid cooler lines (if applicable).
39 Connect the ground cable to the radiator shroud above the engine cooling fan.
40 Reconnect the engine cooling fan and the coolant temperature sensing unit electrical connectors.
41 Attach the upper radiator hose to the top of the radiator and the thermostat housing.
42 Reconnect the hoses and wiring to the air cleaner assembly and install the air cleaner filter and cover.
43 Reconnect the automatic transmission cooling fan electrical connector (if applicable).
44 Install the lower radiator hose and reconnect the cables to both battery terminals (positive first, then negative).
45 Install the spare tire support bracket and the spare tire in the vehicle.
46 Attach the splash shields to the underside of the vehicle.
47 Inspect the whole engine compartment and make sure that there are no hoses or wires that were missed and not hooked up.
48 Make sure that all mounting hardware is tight.
49 Refer to Chapter 1 and adjust the engine drivebelts.
50 Refer to Chapter 1 and fill the engine and transmission with the correct quantity and type of lubrication called for in the Specifications.
51 Make sure that the radiator is filled with coolant.

36 Initial start-up and break-in after overhaul

1 Once the engine has been properly installed in the vehicle, double-check the engine oil and coolant levels.
2 With the spark plugs out of the engine and the coil high-tension lead grounded to the engine block, crank the engine over until oil pressure registers on the gauge.
3 Install the spark plugs, hook up the plug wires and the coil high-tension lead.
4 Start the engine. It may take a few moments, but the engine should start without a great deal of effort.
5 As soon as the engine starts, it should be set at a fast idle (to ensure proper oil circulation) and allowed to warm up to normal operating temperature. While the engine is warming up, make a thorough check for oil and coolant leaks.
6 After the engine reaches normal operating temperature, let it run for about 10 minutes then shut it off. After it has cooled down completely, remove the rocker arm covers, retorque the head nuts and check the valve clearances.
7 Install the rocker arm covers and recheck the engine oil and coolant levels. Also, check the ignition timing and the engine idle speed (refer to Chapter 1) and make any necessary adjustments.
8 Drive the vehicle to an area with minimum traffic, accelerate at full throttle from 30 to 50 mph, then allow the vehicle to slow to 30 mph with the throttle closed. Repeat the procedure 10 or 12 times. This will load the piston rings and cause them to seat properly against the cylinder walls. Check again for oil and coolant leaks.
9 Drive the vehicle gently for the first 500 miles (no sustained high speeds) and keep a constant check on the oil level. It is not unusual for an engine to use oil during the break-in period.
10 At approximately 500 to 600 miles, change the oil and filter and recheck the valve clearances.
11 For the next few hundred miles, drive the vehicle normally. Do not pamper it or abuse it.
12 After 2000 miles, change the oil and filter again and consider the engine fully broken in.

Chapter 3 Cooling, heating and air conditioning systems

Refer to Chapter 13 for information applicable to 1984 thru 1988 models

Contents

Specifications

Coolant

Type	See Chapter 1
Capacity	See Chapter 1

Thermostat (standard)

Starts to open	
US models	190°F (88°C) approx.
UK models	185°F (85°C) approx.
Fully open (all models)	208°F (98°C)

Water pump drivebelt tension	See Chapter 1

1 General information

On all models, a single cross-flow type radiator equipped with an electric motor-driven fan is employed. With this system, cooling ability at idling speed, and warm-up characteristics, are improved.

When the coolant temperature is below 190°F (88°C) coolant flows only through the bypass, thus shortening the warm-up time. When the coolant temperature exceeds 190°F (88°C) the thermostat opens and the coolant circulates through the radiator.

When the coolant temperature exceeds 208°F (98°C) the thermoswitch operates to start the electric fan. This forced air cooling maintains the coolant temperature between 190°F (88°C) and 208°F (98°C).

On models equipped with an automatic transmission, an oil cooler is built into the radiator to cool the automatic transmission fluid. Heated oil circulating through the torque converter returns to the oil cooler and is cooled by the coolant, thus maintaining the oil at an adequate temperature.

The heater serves as a converter. As the engine warms, coolant is circulated to absorb the heat given off by the engine. The heated coolant passes into the heater core which in turn combines heated air and fresh air which is released into the vehicle interior by operation of the heater controls. The heater can also be used as a defroster by operating the lever which directs heated air into the defrost nozzle.

If an air conditioning unit is installed, do not attempt to service any of the air conditioning components. Have this work done by your dealer. If accidentally discharged, refrigerant can cause severe burns and may also result in damage to the air conditioning system.

2 Thermostat – check and replacement

Refer to Figs. 3.1 and 3.2

1 The thermostat is located at the rear of the manifold on the right side of the engine. The thermostat allows for quick warm-ups and governs the normal operating temperature of the engine.

2 If the thermostat is functioning properly, the temperature gauge should rise to the normal operating temperature quickly and then stay there, only rising above the normal position occasionally when the engine gets unusually hot. If the engine does not rise to normal operating temperature quickly, or if it overheats, the thermostat should be removed and checked or replaced.

3 The engine must be cool when removal is performed.

4 Place a suitable container under the radiator and drain some of the coolant into the container by opening the radiator drain valve.

5 Loosen and slide back the hose clamp, then pull the upper radiator hose off the thermostat housing cover.

6 Remove the bolts and lift off the housing cover. You may have to tap the cover with a soft-faced hammer to break the gasket seal.

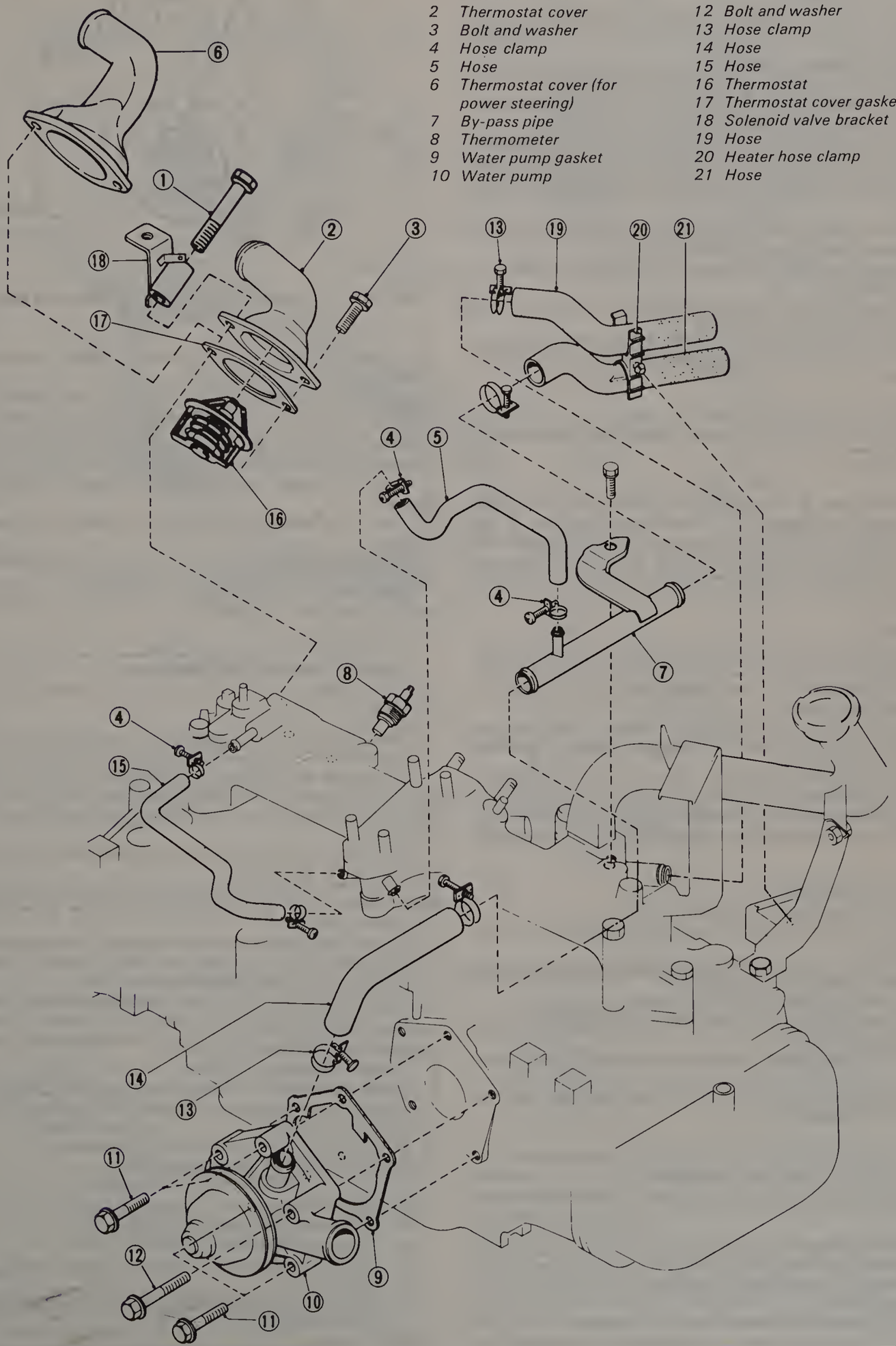
7 After the cover has been removed, note how the thermostat is installed and lift it out. If it is open when it is removed, it is defective and must be replaced with a new one.

8 To check the thermostat, submerge it in a container of water along with a thermometer. The thermostat should be suspended so it does not touch the container.

9 Gradually heat the water in the container with a hotplate or stove and check the temperature when the thermostat first starts to open.

Fig. 3.1 Thermostat and water pump components – exploded view

1 *Bolt and washer*
2 *Thermostat cover*
3 *Bolt and washer*
4 *Hose clamp*
5 *Hose*
6 *Thermostat cover (for power steering)*
7 *By-pass pipe*
8 *Thermometer*
9 *Water pump gasket*
10 *Water pump*
11 *Bolt and washer*
12 *Bolt and washer*
13 *Hose clamp*
14 *Hose*
15 *Hose*
16 *Thermostat*
17 *Thermostat cover gasket*
18 *Solenoid valve bracket*
19 *Hose*
20 *Heater hose clamp*
21 *Hose*



10 Continue heating the water and check the temperature when the thermostat is fully open.
11 Lift the fully open thermostat out of the water and allow it to cool.
12 Compare the opening temperature and the fully open temperature to the Specifications.
13 If these Specifications are not met, or if the thermostat does not open while the water is heated, replace it with a new one.
14 Scrape all traces of the old gasket from the thermostat housing and cover. Do not nick or gouge the gasket sealing surfaces.
15 To install the thermostat, lay it in place in the housing with the proper end facing up. Each thermostat has a breather, which must face out. Examine yours carefully before installing it. Make sure that the thermostat flange is properly seated in the recessed area of the housing.
16 Apply a thin, even layer of RTV-type gasket sealer to both sides of a new gasket and lay it in place on the housing.
17 Next, carefully position the housing cover, install the bolts and tighten them securely.
18 Slip the upper radiator hose onto the housing cover spigot, install the hose clamp and tighten it securely.
19 Pour the drained coolant back into the radiator. Start the engine and check for leaks around the thermostat housing and the upper radiator hose.

3 Cooling fans and motors – check, removal and installation

Refer to Fig. 3.3

1 All vehicles have a thermostatically controlled fan and motor assembly which is actuated by a thermo-switch installed in the radiator. Vehicles with air conditioning have an additional fan and motor assembly installed behind the core of the transmission oil cooler. If the engine overheats because the cooling fan(s) fail to operate, check the motor as described in this Section.

Motor check

2 To check the fan motor for proper operation, unplug the electrical connector and attach jumper wires to the two terminals in the connector half attached to the motor. *Make sure the jumper wires are not contacting each other.*
3 Connect the opposite ends of the jumper wires to the battery posts and see if the fan operates. **Caution**: *Keep your hands and the wires away from the cooling fan.*
4 If the motor operates, check the system wires and connections and have the thermoswitch checked by a dealer service department. If the motor does not operate it should be replaced with a new one (check with your dealer about the possibility of brush replacement first).

Removal and installation

5 Disconnect the fan motor electrical connector.
6 Remove the fan motor shroud (with motor attached) from the radiator frame.
7 Remove the fan motor mounting bolts from the shroud and then remove the fan motor along with the fan.
8 If the motor is not working, replace it with a new one.
9 Remove the fan from the old motor and attach it to the new motor with the fan mounting nut.
10 Install the motor on the fan shroud and the shroud on the radiator frame.
11 Connect the electrical connector to the motor and make sure that all of the mounting hardware is tight.

4 Water pump – removal and installation

Refer to Fig. 3.1

1 To replace the water pump, first drain the coolant out of the radiator by referring to the appropriate Section in Chapter 1.
2 Next, disconnect the radiator outlet hose and the bypass hose from the water pump.
3 Release the tension and remove the pump drivebelt.
4 Remove the bolts, then separate the water pump and gasket from the engine. You may have to tap the pump gently with a soft-faced hammer to break the gasket seal.

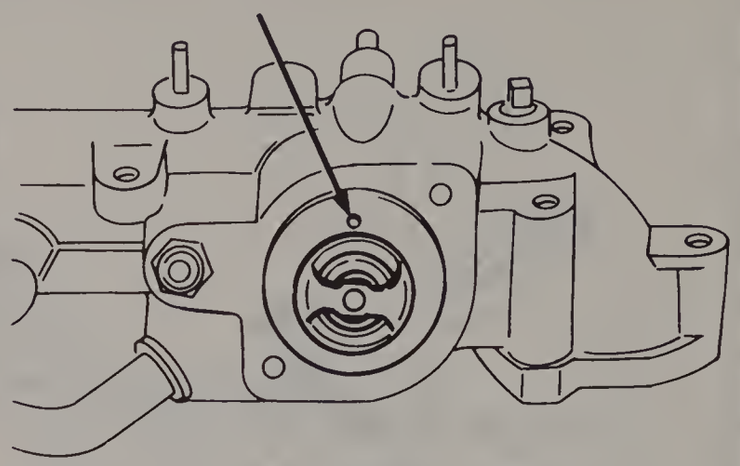


Fig. 3.2 The breather (arrow) must be up when the thermostat is installed (Sec 2)

5 Scrape all traces of the old gasket and gasket sealer off of the engine. Do not nick or gouge the gasket sealing surfaces.
6 Coat both sides of a new gasket with RTV-type gasket sealer, then install the new pump. Be sure to line up the bolt holes in the pump body and the gasket before placing the pump in position on the engine.
7 Install the pump mounting bolts and tighten them evenly and securely.
8 Attach the hoses to the pump and tighten the hose clamps securely.
9 Install the pump drivebelt and make the proper adjustments by referring to the appropriate Section in Chapter 1.
10 Refill the cooling system with coolant, start the engine and check for leaks and abnormal noises.

5 Radiator – removal and installation

Refer to Fig. 3.3

1 Drain the coolant out of the radiator by referring to Chapter 1.
2 Disconnect the radiator hoses by loosening the hose clamps.
3 On vehicles with automatic transmissions, disconnect the hoses from the oil cooler in the radiator. **Note**: *Be prepared to catch any transmission fluid that may run out of these hoses when they are disconnected.*
4 Disconnect the fan motor wiring connector, the thermoswitch wire and the radiator ground wire.
5 Remove the cooling fan and shroud from the radiator (Section 3). **Note**: *Vehicles with air conditioning also have an additional fan assembly to remove.*
6 Remove the radiator mounting bolts and remove the radiator by lifting it up and out of the engine compartment. Radiator service and repair should be left to a reputable radiator shop.
7 Install the radiator in the engine compartment with its mounting bolts and tighten them securely. **Note**: *There is a pin on the radiator that aligns it with the vehicle body. Make sure that the radiator is in alignment before tightening the bolts.*
8 Reconnect the electrical wires.
9 Attach the hoses to the radiator and tighten the clamps securely.
10 On vehicles with automatic transmissions, attach the hoses to the oil cooler in the radiator.
11 Install one or both cooling fans on the radiator.
12 Tighten the radiator drain plug securely.
13 Fill the radiator with coolant as follows:

a) Set the heater lever to the Hot position.
b) Fill the radiator completely with coolant.
c) Close the radiator cap tightly.
d) Start the engine and let it idle a few minutes until the radiator becomes hot.
e) Stop the engine and check the level. If it has decreased, fill it to the level plate.

14 Check for leaks around each of the coolant hose attaching points.

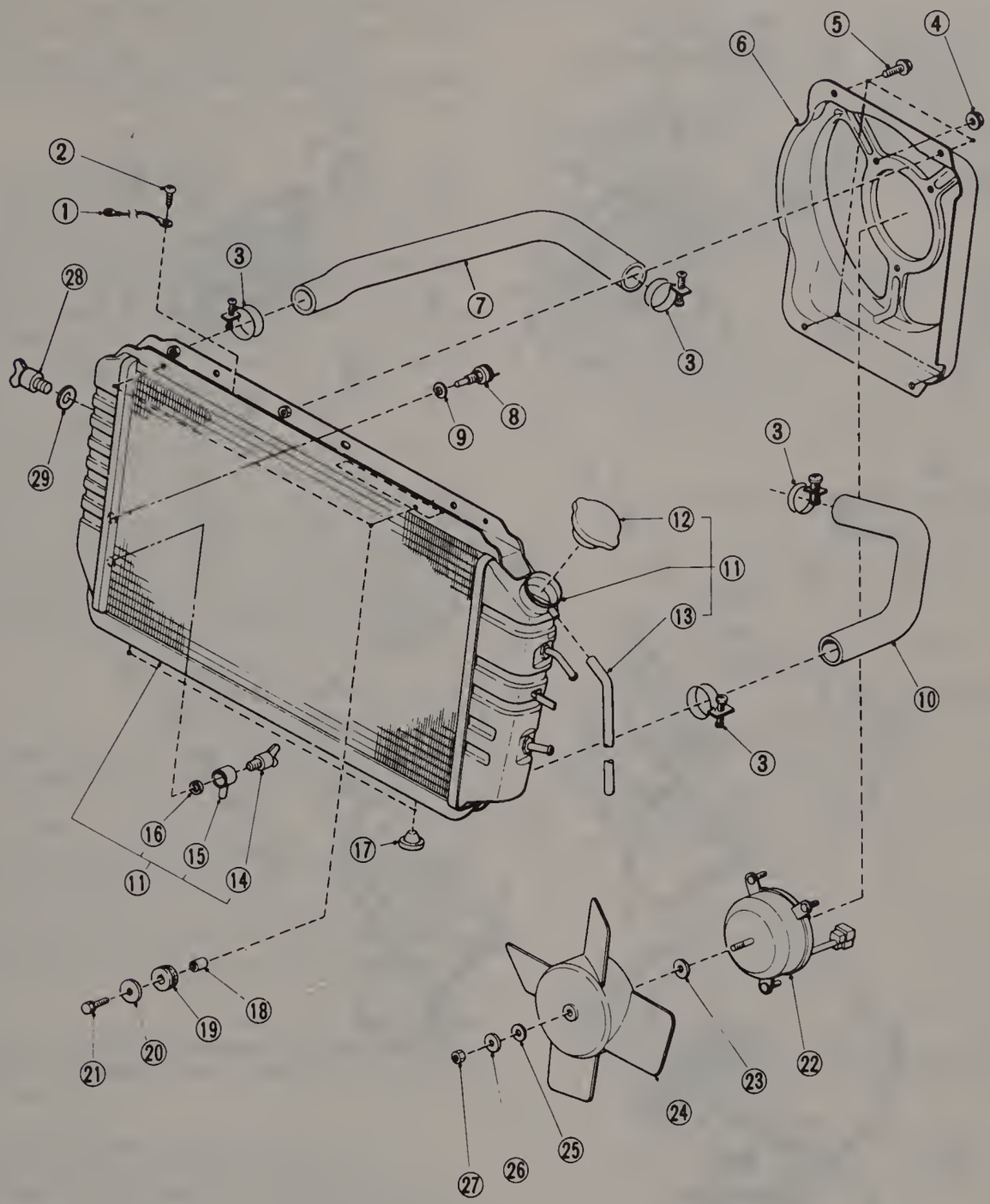


Fig. 3.3 Fan/motor and radiator components – exploded view (Sec 3)

1 *Ground*
2 *Tapping screw*
3 *Hose clamp*
4 *Flange nut*
5 *Flange bolt*
6 *Shroud*
7 *Radiator inlet hose*
8 *Thermo switch*
9 *Packing*
10 *Radiator outlet hose*
11 *Radiator*
12 *Radiator cap*
13 *Overflow tube*
14 *Drain plug*
15 *Drain*
16 *Packing*
17 *Cushion*
18 *Spacer*
19 *Grommet*
20 *Washer*
21 *Bolt and washer*
22 *Motor*
23 *Washer*
24 *Fan*
25 *Fan washer*
26 *Washer*
27 *Nut*
28 *Plug (AT only)*
29 *Gasket*

6 Heater controls – check

Note: *If any of the heater controls need adjustment after checking them, refer to the procedure within the next section.*

Mode lever

1 Start the engine and set the temperature control dial to the Cold position. Set the fresh air ventilation control lever to the Off position.
2 With the fan switch on the fourth step, and the mode lever in the AC position (if applicable), outside air should be directed into the compartment only through the center and side air ducts.
3 If air is directed through the lower outlet or the defroster nozzle, the mode lever should be adjusted until the air directed through these ports is at a minimum.
4 With the fan switch on the fourth step and the mode lever in the Heat position, outside air should be directed into the compartment only through the lower air ducts and the defroster nozzle.
5 If air is directed through the center or side outlets, the mode lever should be adjusted until the air directed through these ports is at a minimum.

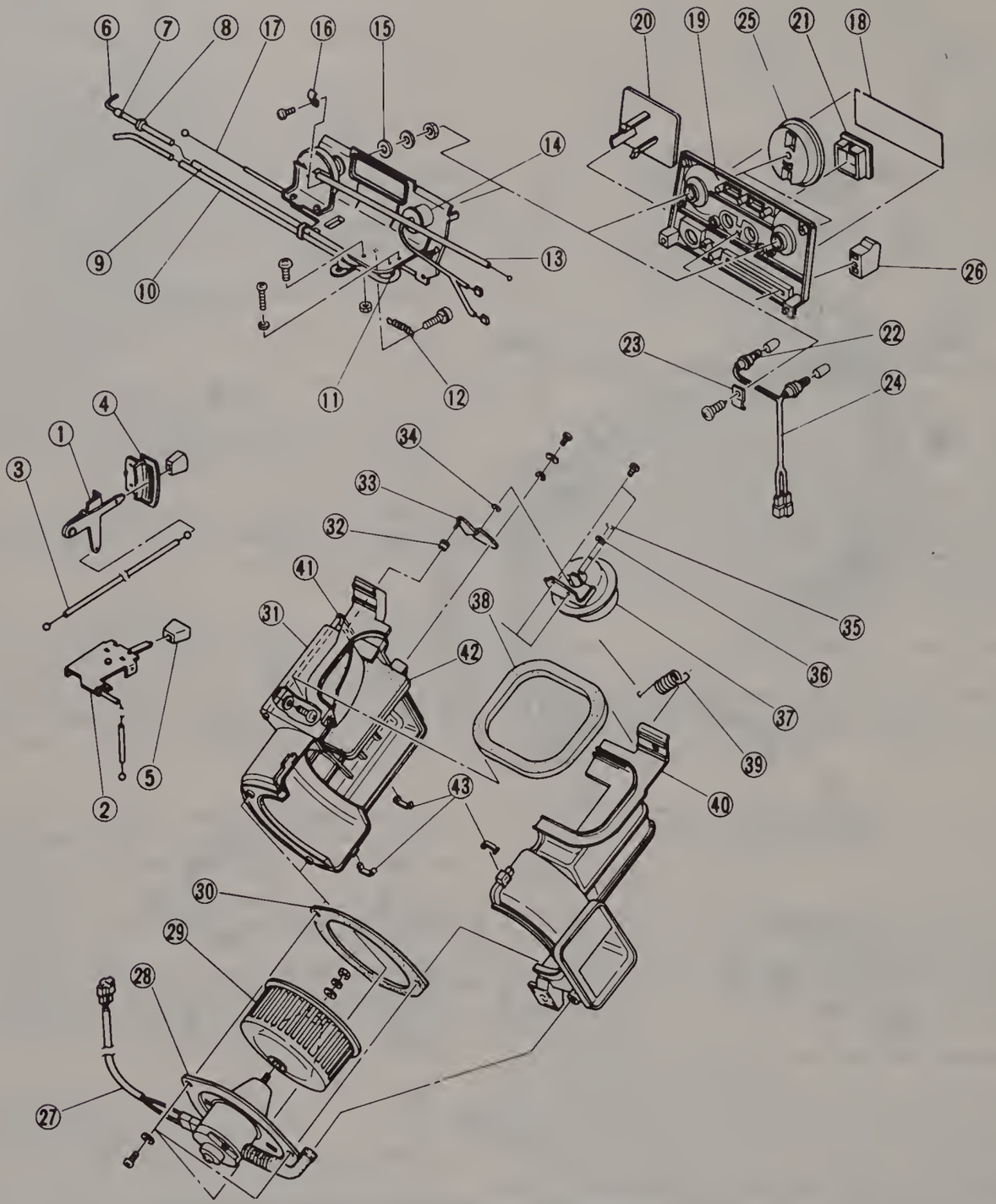


Fig. 3.4 Heater control and blower components – exploded view (Sec 7)

1 *Fresh air ventilation lever (standard type)*
2 *Fresh air ventilation lever (multi type)*
3 *Ventilation cable*
4 *Ventilation grille*
5 *Ventilation knob*
6 *Vacuum pipe*
7 *Vacuum hose*
8 *Check valve*
9 *Vacuum hose*
10 *Vacuum hose*
11 *Vacuum switch*
12 *Spring*
13 *Temperature control cable*
14 *Fan switch*
15 *Bushing*
16 *Cable clamp*
17 *Mode control cable*
18 *Plate*
19 *Panel*
20 *Cigarette lighter cap*
21 *Rear defogger switch*
22 *Bulbs*
23 *Cord clamp*
24 *Cord assembly*
25 *Fan and temperature control knobs*
26 *Mode lever knob*
27 *Harness*
28 *Motor assembly*
29 *Blower*
30 *Packing*
31 *Blower case*
32 *Bushing*
33 *Intake shutter lever*
34 *Spacer*
35 *Clip*
36 *Bushing*
37 *Actuator*
38 *Packing*
39 *Intake shutter return spring*
40 *Blower case*
41 *Intake shutter shaft*
42 *Intake shutter*
43 *Springs*

6 With the fan switch on the fourth step and the mode lever in the Def position, outside air should be directed into the compartment only through the defroster nozzle.
7 If air is directed through the lower, center or side outlets, the mode lever should be adjusted until the air directed through these ports is at a minimum.

Temperature control dial

8 To check the temperature control dial, check for correct outlet air temperature. Start the engine and let it warm up for 10 minutes. Set the fresh air ventilation lever to the Off position.
9 Set the mode lever to the Heat position, the fan switch at the first step and the temperature control dial to the Cold position.
10 Measure the air temperature coming out of the lower outlet of the heater unit with a thermometer. Hold the thermometer in place for a few minutes; the temperature should not vary more than 5 degrees from the outside temperature.
11 If the temperature variance is more than 5 degrees, adjust the control system of the water cock.
12 Set the mode lever to the Def position, the fan switch at the fourth step and the temperature control dial to the Hot position.
13 Measure the air temperature coming out of the defroster nozzle with a thermometer. Hold the thermometer in place for a few minutes and check the reading. Defroster nozzle temperature directly corresponds with the outside temperature in that the warmer the temperature outside of the vehicle, the warmer the defroster nozzle temperature. The following example will illustrate this and will also give you something to shoot for as far as the correct temperature.

Outside air	Defroster nozzle air
-4°F (-20°C)	*122°F (50°C) or more*
32°F (0°C)	*140°F (60°C) or more*

14 If your temperature readings do not correspond with the information given, adjust the control system of the water cock.

Fresh air ventilation lever

15 Check the ventilation lever for air leakage. Set the mode lever to the Circ position, the fan switch in the Off position and the ventilation lever to the Off position.
16 Outside air should be directed through the center outlet only. If air is directed through any other outlet around the console, the ventilation lever should be adjusted until the air directed through these ports is at a minimum.

7 Heater controls – removal, installation and adjustment

Refer to Figs. 3.4 through 3.11

Removal

1 Disconnect the ground cable from the battery.
2 Remove the radio/console box from the vehicle interior.
3 Remove the heater control panel from the instrument panel.
4 Disconnect the cables for the temperature control, the mode control and the center ventilation control from the heater unit. Refer to the accompanying illustration.
5 Remove the control assembly and disconnect the electrical wiring and the vacuum hoses.

Installation

6 To install the heater controls, follow the removal procedure in reverse. To correctly install the individual cables, proceed as follows. **Note**: *Connect the cables before installing the heater control panel in the instrument panel.*

Adjustment

7 To connect the mode lever cable, set the mode lever to the Circ position. Set the mode lever linkage at the heater unit to the Circ position (pull lever B up and back). Refer to the accompanying illustration.
8 After connecting the mode lever cable to lever B, connect the cable to the cable clamp while pulling the cable up and back. Refer to the accompanying illustration and maintain the distance that is specified.
9 To connect the temperature control cable, set the temperature control dial to the Cold position. Set the temperature control linkage at

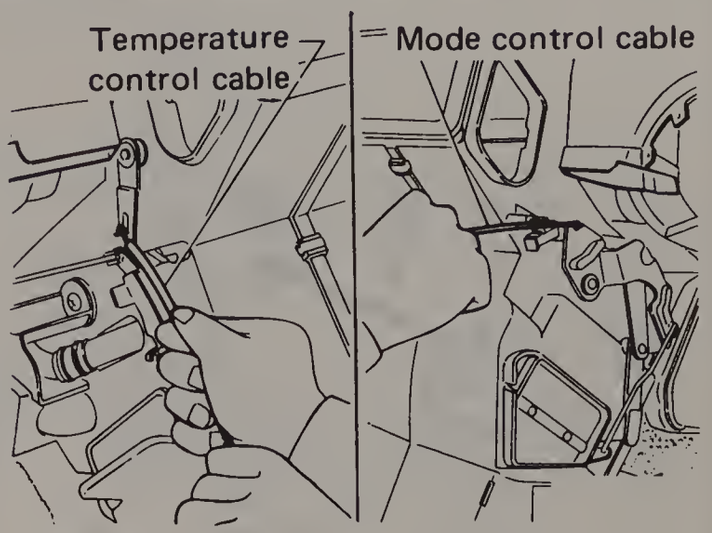


Fig. 3.5 Heater control cable connections (Sec 7)

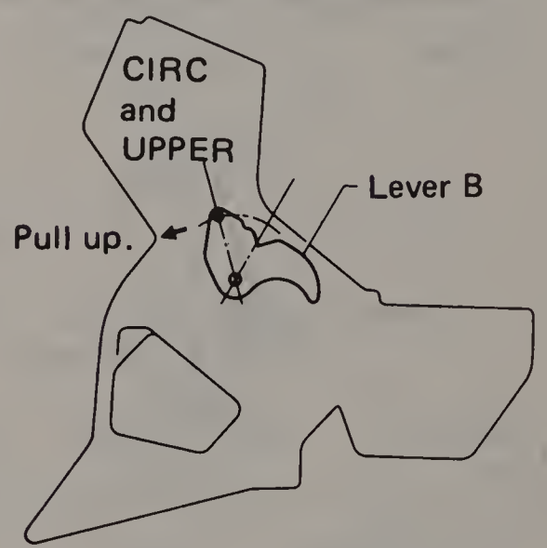


Fig. 3.6 Mode control lever setting (Sec 7)

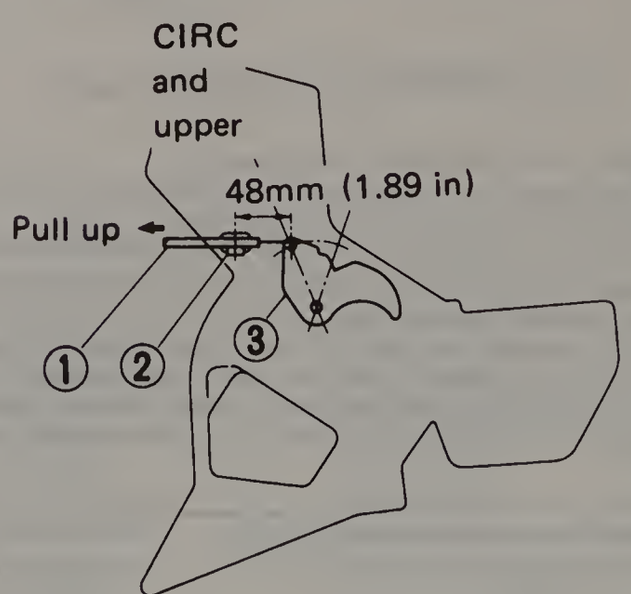


Fig. 3.7 Mode control cable connection (Sec 7)

1 Cable
2 Clamp
3 Lever B

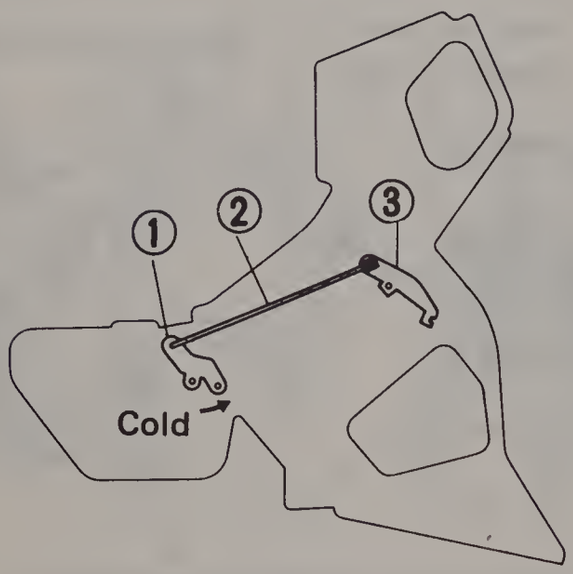


Fig. 3.8 Temperature control lever setting (Sec 7)

1 Lever E
2 Rod
3 Lever A

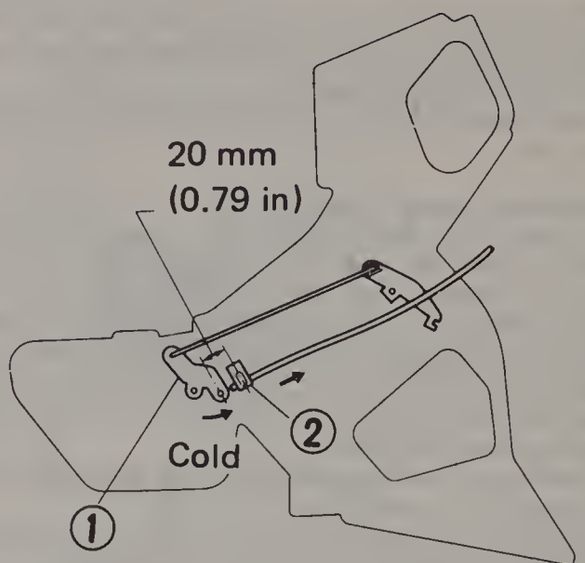


Fig. 3.9 Temperature control cable connection (Sec 7)

1 Lever E
2 Clamp

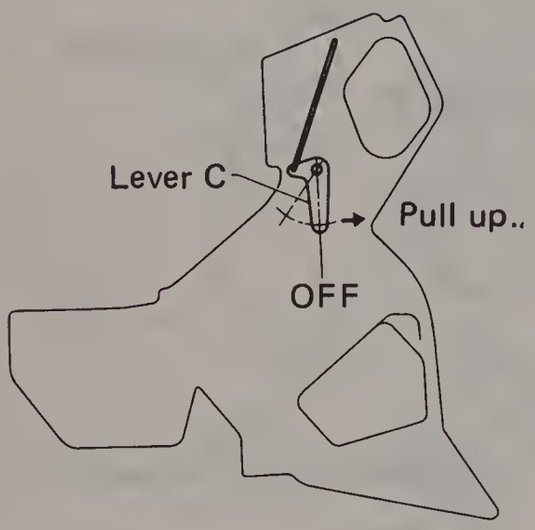


Fig. 3.10 Ventilation control lever setting (Sec 7)

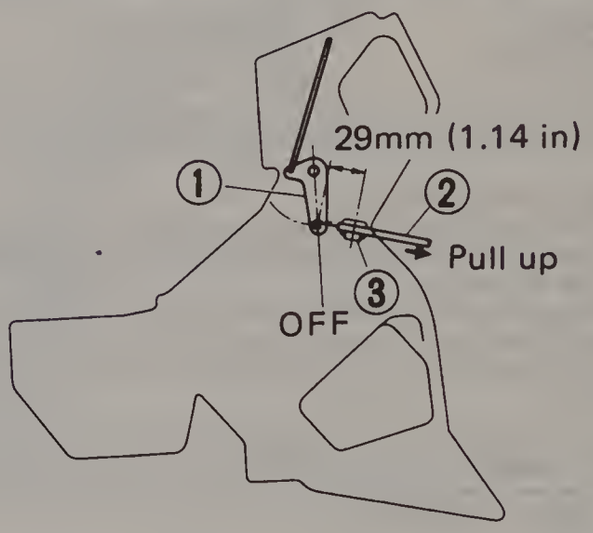


Fig. 3.11 Ventilation control cable connection (Sec 7)

1 Lever C
2 Cable
3 Clamp

the heater to the Cold position (pull E lever up).
10 After connecting the temperature control cable to lever E, connect the cable to the clamp while pulling the cable up. Refer to the accompanying illustration and maintain the distance that is specified.
11 To connect the fresh air ventilation control cable, set the ventilation lever to the Off position. Set the ventilation control linkage at the heater unit to the Off position (pull lever C up and back).
12 After connecting the ventilation control cable to lever C, connect the cable to the clamp while pulling the cable up and back. Refer to the accompanying illustration and maintain the distance that is specified.
13 To check the heater controls, refer to the previous Section in this Chapter.

8 Heater unit – removal and installation

Refer to Fig. 3.12

Removal

1 Disconnect the ground cable from the battery.
2 Remove the radiator drain plug and drain the coolant from the radiator.
3 Disconnect both the inlet and the outlet hoses from the heater pipe.
4 Remove the heater hose grommet from the firewall.
5 Remove the radio box or the console box from the vehicle.
6 Remove the luggage shelf in the instrument panel.
7 Detach the heater duct between the heater unit and the blower assembly.
8 Remove both of the defroster nozzles.
9 Remove the bolts on the upper part of the heater unit, lift the heater unit and take it out backwards.
10 Remove the water valve and disconnect the rod between the left and right defroster shutters.
11 Separate the heater unit into two parts, left and right.
12 Remove the heater core and the shutters.

Installation

13 Attach the heater core and the shutters to the heater cases.
14 Join the two halves of the heater case and secure them with the spring clips.
15 Connect the rod between the left and right defroster shutters with the clamp and attach the water valve.

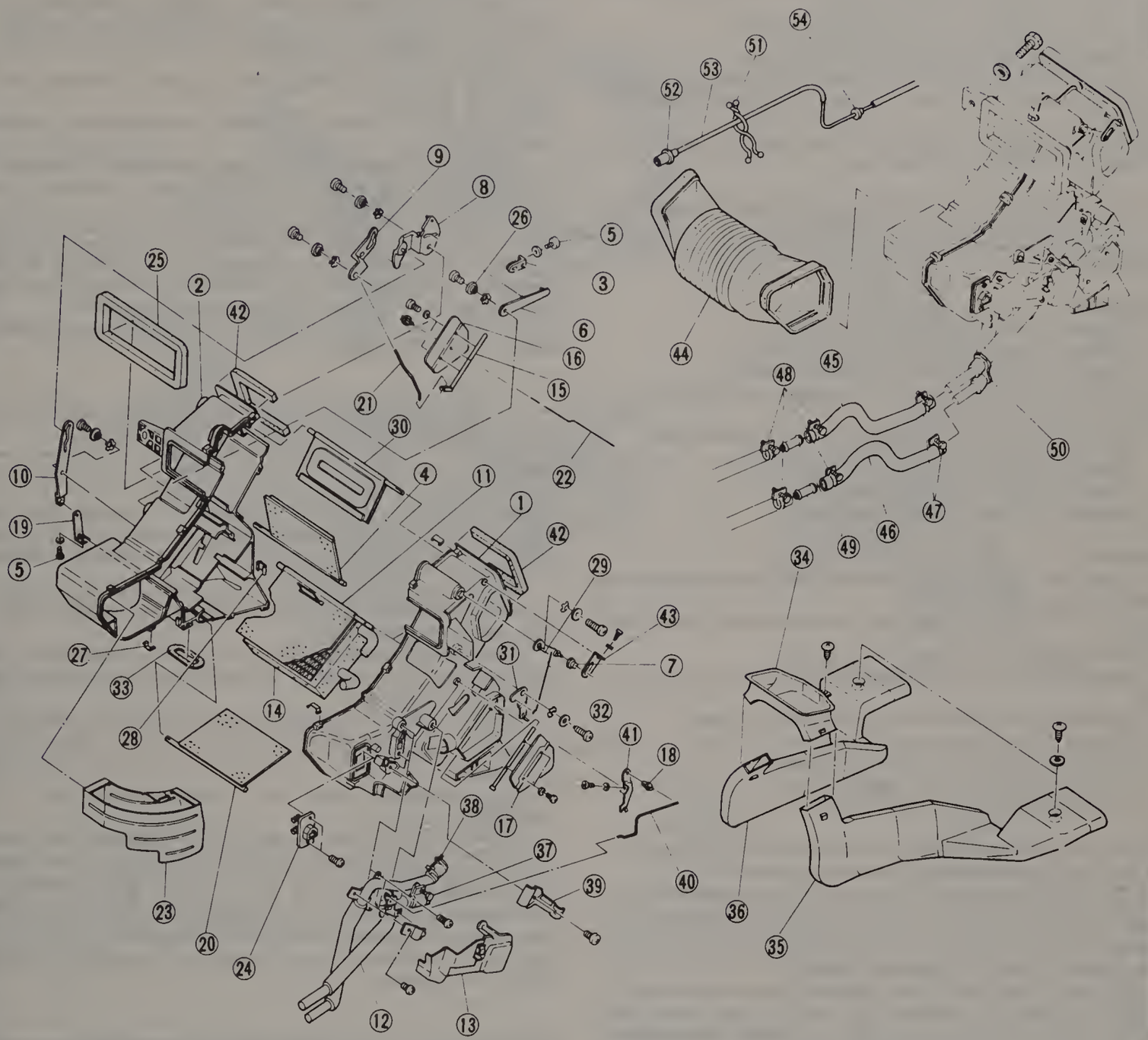


Fig. 3.12 Heater unit and duct components – exploded view (Sec 8)

1 *Heater case*
2 *Heater case*
3 *Upper lever*
4 *Upper shutter*
5 *Screw*
6 *Upper link*
7 *Bushing*
8 *Mode lever*
9 *Defroster link*
10 *Lower link*
11 *Air mixing shutter*
12 *Heater valve*
13 *Protector*
14 *Heater core*
15 *Defroster shaft*
16 *Defroster shutter*
17 *Defroster shutter*
18 *Rod clamp*
19 *Lower lever*
20 *Lower shutter*
21 *Defroster rod*
22 *Defroster shutter shaft*
23 *Guide*
24 *Resistor*
25 *Intake packing*
26 *Shaft bushing*
27 *Hold spring*
28 *Hold spring*
29 *Ventilation link*
30 *Ventilation shutter*
31 *Ventilation link*
32 *Ventilation rod*
33 *Cushion*
34 *Lower duct*
35 *Rear duct (LH)*
36 *Rear duct (RH)*
37 *Hose clamp*
38 *Hose clamp*
39 *Hose bracket*
40 *Heater cock rod*
41 *Air mixing lever*
42 *Ventilation packing*
43 *Ventilation lever*
44 *Heater duct*
45 *Heater inlet hose*
46 *Heater outlet hose*
47 *Hose clamp*
48 *Hose clamp*
49 *Connector*
50 *Heater hose grommet*
51 *Clip*
52 *Vacuum connector*
53 *Vacuum hose*
54 *Vacuum hose grommet*

16 Install the heater unit in the vehicle.
17 Install the defroster nozzle and attach the heater ducts between the heater unit and the blower assembly.
18 Install the luggage shelf in the instrument panel.
19 Attach the radio box or the console box.
20 Install the heater hose grommet in the firewall.
21 Connect both the inlet and the outlet hoses to the heater pipe.
22 Fill the radiator with coolant and connect the ground cable to the battery.
23 Start the vehicle and operate the heater controls. Check for any leakage around the hose connections.

9 Heater blower – removal and installation

Refer to Fig. 3.4

Removal

1 Disconnect the ground cable from the battery.
2 Remove the luggage shelf and the glove box.
3 Detach the heater duct from the blower assembly.
4 Set the heater lever to the Circ position and disconnect the vacuum hose from the actuator.
5 Disconnect the electrical connector from the blower motor.
6 Remove the actuator from the blower assembly.
7 Remove the blower assembly from the vehicle.
8 Detach the blower from the motor.
9 Separate the blower case into two halves.

Installation

10 Attach the springs and the intake shutter return spring to the blower case.
11 Attach the blower to the motor and install them in the blower case.
12 Install the blower assembly in the vehicle.
13 Install the actuator on the blower assembly with the screws and clip.
14 Connect the electrical connector for the blower motor.
15 Connect the vacuum hose to the actuator.
16 Attach the heater duct to the blower assembly.
17 Install the glove box in the luggage shelf.
18 Connect the ground cable to the battery.

10 Air conditioner servicing – general information

Caution: *Before performing any work on individual components, the system must be evacuated by an air conditioning technician. Do not attempt to do this yourself; the refrigerant used in the system can cause serious injuries and respiratory irritation.*

Because of the special tools, equipment and skills required to service air conditioning systems and the difference between the various systems that may be installed on vehicles, air conditioner servicing cannot be covered in this manual. We will cover component removal, as the home mechanic may realize a substantial savings in repair costs if he removes components himself, takes them to a professional for repair and/or replaces them with new ones.

Problems in the air conditioning system should be diagnosed and the system refrigerant evacuated by an air conditioning technician before component removal/replacement is attempted. Once the new or reconditioned component has been installed, the system should then be charged and checked by an air conditioning technician.

Before indiscriminately removing air conditioning system components, get more than one estimate or repair cost from reputable air conditioning service centers. You may find it to be cheaper and less trouble to let the entire operation be performed by someone else.

Refer to Chapter 1 for additional information and checks.

11 Air conditioner compressor – removal and installation

Refer to Figs. 3.13 and 3.14

Caution: *Before removing the compressor, the system must be evacuated by an air conditioning technician. Do not attempt to do this yourself; the refrigerant used in the system can cause serious injuries and respiratory irritation.*

1 The air conditioner compressor is mounted at the front of the engine on the left side and is driven by a belt from the crankshaft.
2 Before removing the compressor, the system must be evacuated by an air conditioning technician.
3 Loosen the drivebelt tensioner pulley and slip the drivebelt off the compressor clutch pulley.
4 Loosen the hose clamps and remove the hoses from the compressor.
5 Unplug the air conditioner compressor clutch electrical connector.
6 Remove the bolts attaching the compressor to the brackets and the compressor can be lifted out of the vehicle.
7 Installation is basically the reverse of removal. Lubricate the inside of the hoses and the outside of the fittings with refrigerant oil before installing the hoses. Be sure to carefully seat the hoses on the compressor fittings and install the hose clamps securely. Locate the hoses at least 0.79 in (20 mm) away from the compressor.
8 The belt must be correctly tensioned for proper air conditioner operation. Refer to Chapter 1.

12 Air conditioner condenser – removal and installation

Refer to Fig. 3.13

Caution: *Before removing the condenser, the system must be evacuated by an air conditioning technician. Do not attempt to do this yourself; the refrigerant used in the system can cause serious injuries and respiratory irritation.*

1 The air conditioner condenser is mounted in front of the radiator.
2 Before removing the condenser, the system must be evacuated by an air conditioning technician.
3 Loosen the hose clamps and remove the hoses leading from the compressor and receiver/dryer to the condenser. Do not remove the hoses from the condenser.
4 Remove the grille (by referring to Chapter 12) and the lower stay.
5 Remove the bolts attaching the condenser to the radiator. Carefully lift the condenser out of the vehicle; do not bend the cooling fins or coil.
6 Loosen the hose clamps and remove the hoses from the condenser.
7 Installation is the reverse of removal. When installing the hoses, lubricate the inside surfaces of the hoses and the outside of the fittings with refrigerant oil. Be sure to install the hoses on the condenser before mounting the condenser in the vehicle. Support the hose fittings against a solid surface, such as a workbench, when pushing the hoses onto them. This will prevent bending of the fittings or the coils, which could cause leaks. Be sure to locate the clamps properly and tighten them securely.

13 Air conditioner receiver/dryer – removal and installation

Refer to Fig. 3.13

Caution: *Before removing the receiver/dryer, the system must be evacuated by an air conditioning technician. Do not attempt to do this yourself; the refrigerant used in the system can cause serious injuries and respiratory irritation.*

1 The receiver/dryer, which acts as a reservoir for the refrigerant, is the canister-shaped object mounted on the right fender well in the engine compartment.
2 Before removing the receiver/dryer, the system must be evacuated by an air conditioning technician.
3 Detach the windshield washer tank from its mounting bracket and place it to the side.
4 Disconnect the wiring from the low-pressure switch.
5 Remove both tubes from the receiver/dryer.
6 Loosen the clamp and pull up on the receiver/dryer to remove it from its mount.
7 When installing the receiver/dryer, lubricate the inside surfaces of the tubes and the outside of the fittings with refrigerant oil. Be sure the tubes are properly installed and securely tightened.

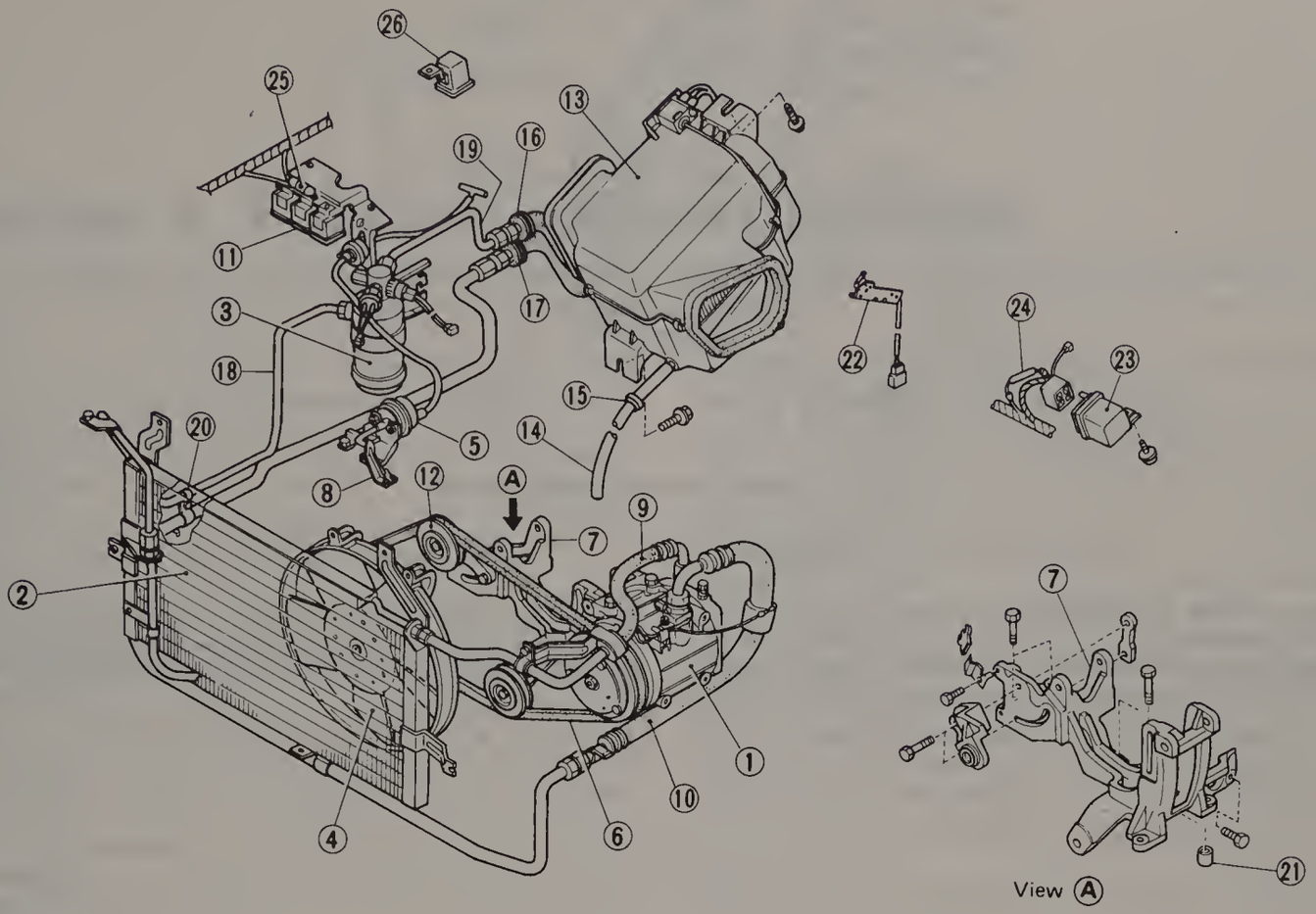


Fig. 3.13 Air conditioning components

1 Compressor
2 Condenser
3 Receiver/drier
4 Condenser cooling fan
5 Actuator
6 Belt
7 Compressor bracket
8 Lever
9 Pipe and hose
10 Pipe and hose
11 Relay
12 Tension pulley
13 Evaporator
14 Drain hose
15 Grommet
16 Grommet
17 Grommet
18 Pipe
19 Pipe
20 Clamp
21 Spacer
22 Micro switch
23 Relay
24 Fuse
25 Fuse
26 Relay

14 Air conditioner evaporator – removal and installation

Refer to Figs. 3.13 and 3.14

Caution: *Before removing the evaporator, the system must be evacuated by an air conditioning technician. Do not attempt to do this yourself; the refrigerant used in the system can cause serious injuries and respiratory irritation.*

1 The air conditioner evaporator is combined with the heater assembly and is mounted under the right side of the vehicle instrument panel.

2 Before removing the evaporator, the system must be evacuated by an air conditioning technician.

3 Disconnect the negative terminal of the battery.

4 Disconnect the discharge and suction pipes from the evaporator. Remove the grommets from the pipes.

5 Remove the following parts in order:

Instrument panel lid
Front shelf
Lower duct
Blower

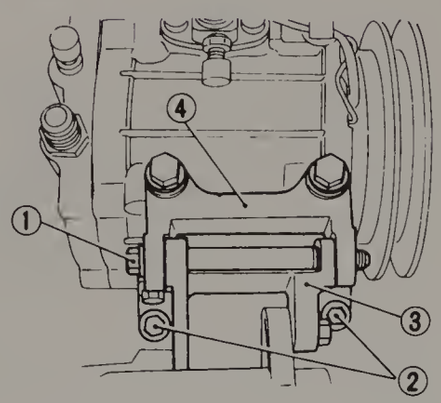


Fig. 3.14 Compressor mounts and hardware (Sec 11)

1 Upper bolt
2 Lower bolts
3 Bracket (compressor)
4 Bracket (upper)

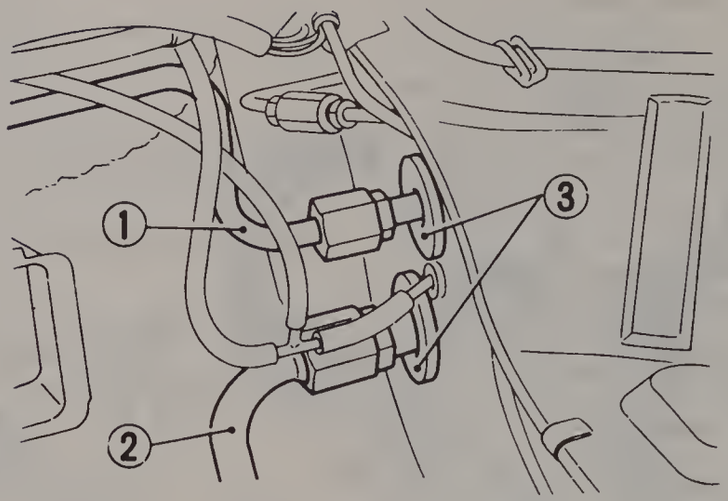


Fig. 3.15 Evaporator line location (Sec 14)

1 Discharge line
2 Suction line
3 Grommet

6 Loosen the bolts and disconnect the drain pipe connection. Remove the evaporator.

7 Installation is basically the reverse of removal. Be sure to position the plastic ducts before slipping the evaporator into place. When installing the tubes, lubricate the inside surfaces and the outside of the fittings with refrigerant oil. The pipes must be positioned properly and tightened securely. Do not forget to install the drain pipe.

Chapter 4 Fuel and exhaust systems

Refer to Chapter 13 for specifications and information applicable to 1984 thru 1988 models

Contents

Specifications

Carburetors

UK Hitachi – 1600 cc	
Throttle bore size	1.02 in (26 mm)
Main jets	
Primary	No. 98
Secondary	No. 143
Main air bleed	
Primary	No. 70
Secondary	No. 80
Slow jets	
Primary	No. 41
Secondary	No. 60
Slow air bleed	
Primary	No. 160
Secondary	No. 150
Secondary throttle valve (refer to Fig. 4.7)	
G2 clearance	0.240 in (6.1 mm)
Opening angle	48°
Choke valve closed angle	16°
Fast idle opening (refer to Fig. 4.5)	
G1 clearance	0.051 in (1.3 mm)
Opening angle	17°
Float level (refer to Fig. 4.9)	
H clearance	0.413 in (10.5 mm)
L clearance	0.051 to 0.067 in (1.3 to 1.7 mm)
UK Hitachi – 1800 cc	
Throttle bore size	1.10 in (28 mm)
Main jets	
Primary	No. 114
Secondary	No. 170
Main air bleed	
Primary	No. 65
Secondary	No. 100
Slow jets	
Primary	No. 42
Secondary	No. 130
Slow air bleed	
Primary	No. 170
Secondary	0

Secondary throttle valve (refer to Fig. 4.7)		
G2 clearance	0.252 in (6.4 mm)	
Opening angle	47°	
Choke valve closed angle	16°	
Fast idle opening (refer to Fig. 4.5)		
G1 clearance	0.0606 in (1.54 mm)	
Opening angle	18.5°	
Float level (refer to Fig. 4.9)		
H clearance	0.413 in (10.5 mm)	
L clearance	0.051 to 0.067 in (1.3 to 1.7 mm)	
US Hitachi – 1980		
Throttle bore size		
Primary	1.02 in (26 mm)	
Secondary	1.18 in (30 mm)	
Main jets	**Primary**	**Secondary**
California	No. 113	No. 145
49-States amd Canada (A/T)	No. 111	No. 145
49-States and Canada (M/T)	No. 114	No. 145
Main air bleed	**Primary**	**Secondary**
California	No. 95	No. 80
49-States and Canada (A/T)	No. 95	No. 80
49-States and Canada (M/T)	No. 75	No. 80
Slow jets	**Primary**	**Secondary**
California (A/T)	No. 54	No. 70
California (M/T)	No. 52	No. 70
49-States and Canada (A/T)	No. 54	No. 70
49-States and Canada (M/T)	No. 48	No. 70
Slow air bleed	**Primary**	**Secondary**
California	No. 160	No. 100
49-States and Canada (A/T)	No. 160	No. 100
49-States and Canada (M/T)	No. 160	No. 80
Secondary throttle valve (California) (refer to Fig. 4.8)		
G2 clearance	0.236 in (6.0 mm)	
Opening angle	47°	
Secondary throttle valve (49-States and Canada) (refer to Fig. 4.8)		
G2 clearance	0.236 in (6.0 mm)	
Opening angle	48°	
Choke valve closed angle	16°	
Fast idle opening (California – M/T) (refer to Fig. 4.6)		
G1 clearance	0.0516 in (1.31 mm)	
Opening angle	17°	
Fast idle opening (California – A/T) (refer to Fig. 4.6)		
G1 clearance	0.0602 in (1.53 mm)	
Opening angle	19°	
Fast idle opening (49-States and Canada – A/T) (refer to Fig. 4.6)		
G1 clearance	0.0602 in (1.53 mm)	
Opening angle	19°	
Fast idle opening (49-States and Canada – M/T) (refer to Fig. 4.6)		
G1 clearance	0.0413 in (1.05 mm)	
Opening angle	14°	
Float level (refer to Fig. 4.9)		
H clearance	0.413 in (10.5 mm)	
L clearance	0.051 to 0.067 in (1.3 to 1.7 mm)	
US Hitachi – 1981		
Throttle bore size		
Primary	1.02 in (26 mm)	
Secondary	1.18 in (30 mm)	
Main jets		
Primary	No. 110	
Secondary	No. 150	
Main air bleed		
Primary	No. 60	
Secondary	No. 80	
Slow jets		
Primary	No. 43	
Secondary	No. 80	
Slow air bleed		
Primary	No. 100	
Secondary	No. 90	
Secondary throttle valve (refer to Fig. 4.8)		
G2 clearance	0.236 in (6.0 mm)	
Opening angle	49°	
Choke valve closed angle	16°	
Fast idle opening (1600 cc) (refer to Fig. 4.6)		
G1 clearance	0.046 in (1.17 mm)	
Opening angle	17°	

Fast idle opening (1800 cc) (refer to Fig. 4.6)		
G1 clearance	0.054 in (1.38 mm)	
Opening angle	19°	
Float level (refer to Fig. 4.9)		
H clearance	0.413 in (10.5 mm)	
L clearance	0.051 to 0.067 in (1.3 to 1.7 mm)	
US Hitachi – 1982		
Throttle bore size		
Primary	1.02 in (26 mm)	
Secondary	1.18 in (30 mm)	
Main jets	**Primary**	**Secondary**
1600 cc – M/T	No. 116	No. 145
1800 cc – M/T	No. 114	No. 145
1800 cc – A/T	No. 116	No. 145
Main air bleed		
Primary	No. 60	
Secondary	No. 80	
Slow jet		
Primary	No. 43	
Secondary	No. 80	
Slow air bleed		
Primary	No. 150	
Secondary	No. 50	
Secondary throttle valve (refer to Fig. 4.8)		
G2 clearance	0.236 in (6.0 mm)	
Opening angle	49°	
Choke valve closed angle	16°	
Fast idle opening (1600 cc) (refer to Fig. 4.6)		
G1 clearance	0.039 in (0.98 mm)	
Opening angle	15°	
Fast idle opening (1800 cc – M/T) (refer to Fig. 4.6)		
G1 clearance	0.048 in (1.22 mm)	
Opening angle	17.5°	
Fast idle opening (1800 cc – A/T) (refer to Fig. 4.6)		
G1 clearance	0.052 in (1.33 mm)	
Opening angle	18.5°	
Float level (refer to Fig. 4.9)		
H clearance	0.413 in (10.5 mm)	
L clearance	0.051 to 0.067 in (1.3 to 1.7 mm)	
US Hitachi – 1983		
Throttle bore size		
Primary	1.02 in (26 mm)	
Secondary	1.18 in (30 mm)	
Main jets	**Primary**	**Secondary**
California (1600 cc)	No. 116	No. 145
California (1800 cc)	No. 114	No. 145
49-States (2WD)	No. 114	No. 145
Canada and 4WD 49-States (M/T)	No. 109	No. 140
Canada and 4WD 49-States (A/T)	No. 109	No. 145
Main air bleed	**Primary**	**Secondary**
California and 2WD 49-States	No. 60	No. 80
Canada and 4WD 49-States	No. 70	No. 80
Slow jets		
Primary	No. 43	
Secondary	No. 80	
Slow air bleed	**Primary**	**Secondary**
California and 2WD 49-States	No. 150	No. 50
Canada and 4WD 49-States (M/T)	No. 160	No. 90
Canada and 4WD 49-States (A/T)	No. 150	No. 90
Secondary throttle valve (refer to Fig. 4.8)		
G2 clearance	0.236 in (6.0 mm)	
Opening angle	49°	
Choke valve closed angle	16°	
Fast idle opening (1600 cc) (refer to Fig. 4.6)		
G1 clearance	0.0386 in (0.98 mm)	
Opening angle	15°	
Fast idle opening (1800 cc – M/T) (refer to Fig. 4.6)		
G1 clearance	0.0480 in (1.22 mm)	
Opening angle	17.5°	
Fast idle opening (1800 cc – A/T) (refer to Fig. 4.6)		
G1 clearance	0.0528 in (1.34 mm)	
Opening angle	18.5°	
Float level (refer to Fig. 4.9)		
H clearance	0.433 to 0.453 in (11.0 to 11.5 mm)	
L clearance	0.051 to 0.067 in (1.3 to 1.7 mm)	

US Carter/Weber – 1982	
Throttle bore size	1.44 in (36.5 mm)
Main metering jet	0.092 in (2.34 mm)
Main well bleed	0.023 in (0.57 mm)
Low speed jet	0.028 in (0.70 mm)
Bypass bleed	0.049 in (1.25 mm)
Choke valve closed angle	15°
Float level	0.6701 in (17.02 mm)
US Carter/Weber – 1983	
Throttle bore size	1.437 in (36.5 mm)
Main metering jet	0.0921 in (2.34 mm)
Main well bleed	0.0224 in (0.57 mm)
Low speed jet	0.0276 in (0.70 mm)
Bypass bleed	0.0492 in (1.25 mm)
Choke valve closed angle	15°
Float level	0.6701 in (17.02 mm)

Fuel pump

1980 (UK and US)	
Discharge pressure	1.8 to 2.6 psi (12.8 to 17.7 kPa)
Discharge volume	6.6 gal/hr (25 l/hr)
Current	Less than 0.8 Amps
Starting voltage	Less than 8 Volts
1982 and 1983 (UK)	
Discharge pressure	
2WD	1.84 to 2.56 psi (12.75 to 17.65 kPa)
4WD	1.35 to 2.07 psi (9.32 to 14.22 kPa)
Discharge volume	6.6 gal/hr (25 l/hr)
Current	Less than 0.8 Amps
Starting voltage	Less than 8 Volts
1981 through 1983 (US)	
Discharge pressure	1.35 to 2.06 psi (9.32 to 14.22 kPa)
Discharge volume	7.4 gal/hr (28 l/hr)
Current	Less than 1.5 Amps
Starting voltage	Less than 8 Volts

Torque specifications

	Ft-lb	Nm
Intake manifold bolts	13 to 16	18 to 22
Banjo bolt (C/W carb.)	25 to 30	34 to 40
Fuel tank drain bolt	8.7	12
Fuel level sensing unit	18.1	25
Fuel tank mounting bolt	10.1	14
Front exhaust pipe-to-manifold	19 to 22	25 to 29
Front exhaust hanger-to-frame	7 to 13	10 to 18
Tailpipe hanger-to-frame	10 to 16	14 to 22
Oxygen sensor	16 to 22	22 to 29
Tailpipe-to-rear exhaust pipe	31 to 38	42 to 52
Front exhaust pipe-to-rear exhaust pipe	31 to 38	42 to 52

1 General information

The carburetors installed on all Subaru engines are of the downdraft two barrel type, which are capable of supplying the correct air-fuel mixture under all operating conditions. Both the primary and secondary venturi are provided with a throttle valve.

The primary side of the carburetor consists of the main, acceleration, and choke system. During normal driving the primary side satisfies all the requirements for the carburetor. The primary low-speed system is an economizer type which provides smooth acceleration and deceleration during light-load driving. It also provides stable idling speed.

The carburetors are provided with a coasting bypass valve system for controlling exhaust emissions during deceleration.

Icing of the throttle bore is prevented by utilizing hot coolant to preheat the throttle chamber.

The fuel system consists of a fuel tank at the rear of the vehicle, an electrically operated fuel pump mounted under the vehicle or in the engine compartment and a disposable type fuel filter. The pump draws gasoline from the tank and delivers it to the carburetor. The gasoline level in the carburetor is controlled by a float operated needle valve. Gasoline flows past the needle valve until the float rises to a predetermined level and closes the needle valve. The fuel pump then free wheels under slight back pressure until the gasoline level drops in the carburetor float chamber and the needle valve opens.

The exhaust system consists of a tailpipe, the muffler, a rear exhaust pipe and a front exhaust pipe.

The catalytic converter and oxygen sensor are mounted in the front exhaust pipe. These items will be explained in Chapter 6.

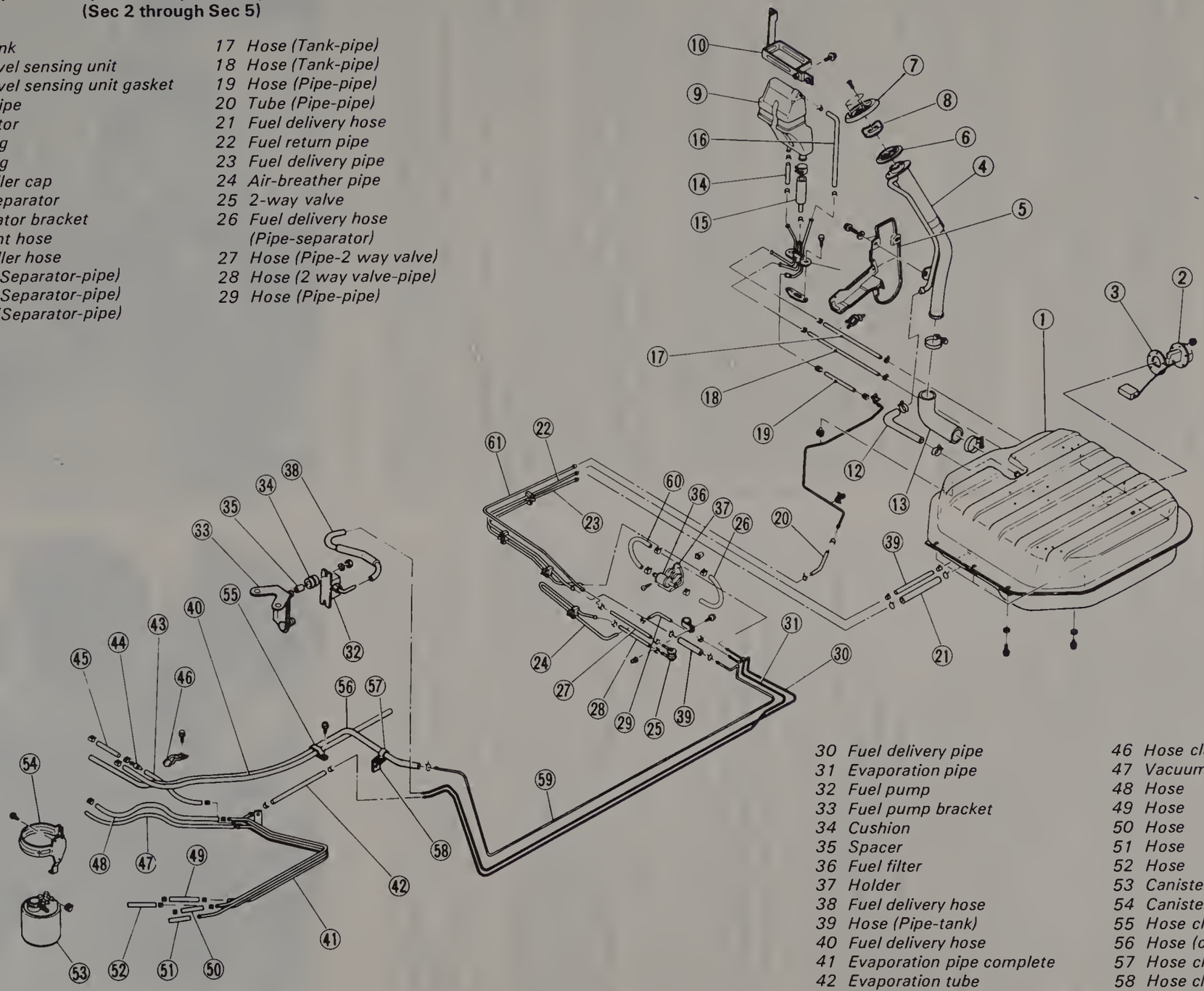
2 Fuel separator – removal and installation

Refer to Fig. 4.1

Sedan and hardtop

1 Remove the rear quarter trim and the backrest of the rear seat.
2 Remove the fuel separator mounting screw on the inside of the vehicle and the screws holding it in place in the trunk area.
3 Disconnect the air breather hoses under the floor.
4 Bend the joining portion of the cover and protector toward the front and then the rear while you remove the separator from the floor.
5 Remove the screw that secures the band to the separator, then disconnect the hose between the separator and the pipe.
6 Remove the separator by expanding the band. **Note:** *Be careful not to damage the separator nozzle.*
7 To install the separator, connect the hoses between the separator and the pipe and install the band on the separator.
8 Connect the air breather hoses to the pipe under the floor.
9 Install the separator on the vehicle with the cover and the protector.
10 Make sure that all of the mounting screws are tight.
11 Install the rear quarter trim and the rear seat backrest.

Fig. 4.1 Typical fuel system component layout – exploded view (Sec 2 through Sec 5)



1 Fuel tank
2 Fuel level sensing unit
3 Fuel level sensing unit gasket
4 Filler pipe
5 Protector
6 Packing
7 Packing
8 Fuel filler cap
9 Fuel separator
10 Separator bracket
12 Air-vent hose
13 Fuel filler hose
14 Hose (Separator-pipe)
15 Hose (Separator-pipe)
16 Hose (Separator-pipe)
17 Hose (Tank-pipe)
18 Hose (Tank-pipe)
19 Hose (Pipe-pipe)
20 Tube (Pipe-pipe)
21 Fuel delivery hose
22 Fuel return pipe
23 Fuel delivery pipe
24 Air-breather pipe
25 2-way valve
26 Fuel delivery hose (Pipe-separator)
27 Hose (Pipe-2 way valve)
28 Hose (2 way valve-pipe)
29 Hose (Pipe-pipe)
30 Fuel delivery pipe
31 Evaporation pipe
32 Fuel pump
33 Fuel pump bracket
34 Cushion
35 Spacer
36 Fuel filter
37 Holder
38 Fuel delivery hose
39 Hose (Pipe-tank)
40 Fuel delivery hose
41 Evaporation pipe complete
42 Evaporation tube
43 Purge hose
44 Check valve
45 Purge hose
46 Hose clamp
47 Vacuum hose
48 Hose
49 Hose
50 Hose
51 Hose
52 Hose
53 Canister (US only)
54 Canister bracket
55 Hose clamp
56 Hose (carb-pipe)
57 Hose clamp
58 Hose clamp bracket
59 Fuel return pipe
60 Hose (Separator-pipe)
61 Air-breather pipe

Hatchback

12 Remove the rear trim and the rear quarter trim.
13 Disconnect the hoses from the separator.
14 Remove the separator from the vehicle.
15 Remove the screw securing the band to the separator and remove the separator by expanding the band. **Note:** *Be careful not to damage the separator nozzle.*
16 Disconnect the air breather hoses under the floor.
17 Remove the screws securing the pipe assembly to the floor and pull the pipe assembly out while inclining it to the rear. **Note:** *Be careful not to damage the pipe ends.*
18 To install the separator, attach the pipe assembly with the screws.
19 Connect the air breather hoses to the pipe assembly under the floor.
20 Install the band on the separator with the screw.
21 Install the separator in position with the mounting screws.
22 Connect the hoses to the separator.
23 Make sure that all of the mounting screws are tight.
24 Install the rear trim and the rear quarter trim.

Station wagon

25 Detach the rear trim and the rear quarter trim.
26 Remove the separator from the rear quarter panel.
27 Disconnect the hoses from the separator.
28 Remove the screw securing the band to the separator and take out the separator by expanding the band.
29 To install the separator, install the band on the separator with the screw.
30 Connect the hoses to the separator with the clips.
31 Install the separator on the rear panel with the mounting screws.
32 Make sure that all mounting screws are tight.
33 Attach the rear trim and rear quarter trim.

Pick-up truck

34 Remove the rear side panel cover from the right side of the cargo space.
35 Remove the separator from the back side of the rear panel and pull it out through the side panel hole.
36 Disconnect the hoses from the separator.
37 Remove the screw securing the band to the separator and take out the separator by expanding the band.
38 To install the separator, install the band on the separator with the screw.
39 Connect the hoses to the separator with the clips.
40 Install the separator on the back side of the rear panel with the mounting screws.
41 Make sure that all of the mounting screws are tight.
42 Install the rear side panel cover.

3 Vapor separator (1982 and 1983) – check and replacement

1 The vapor separator is located in the engine compartment on the left side, near the brake master cylinder.
2 To remove the separator, release the clamps (photo) and remove the hoses.
3 Pull the separator from the holder.
4 Inspect the separator for foreign material and water. If you find water, turn the separator upside-down and shake it until the water drains out.
5 The separator cannot be taken apart. If you find a great deal of foreign material, which may affect the performance of the vehicle, replace it with a new one.
6 Installation is the reverse of removal.

4 Fuel pump – removal and installation

Refer to Fig. 4.1

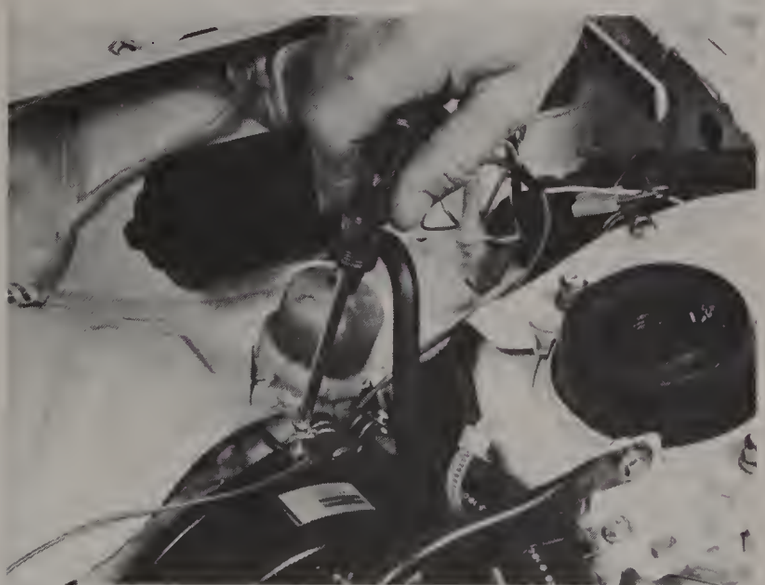
1 If, after removing and inspecting the fuel pump, it is found to be working improperly, replace the pump with a new one.

1980 and 1981 vehicles

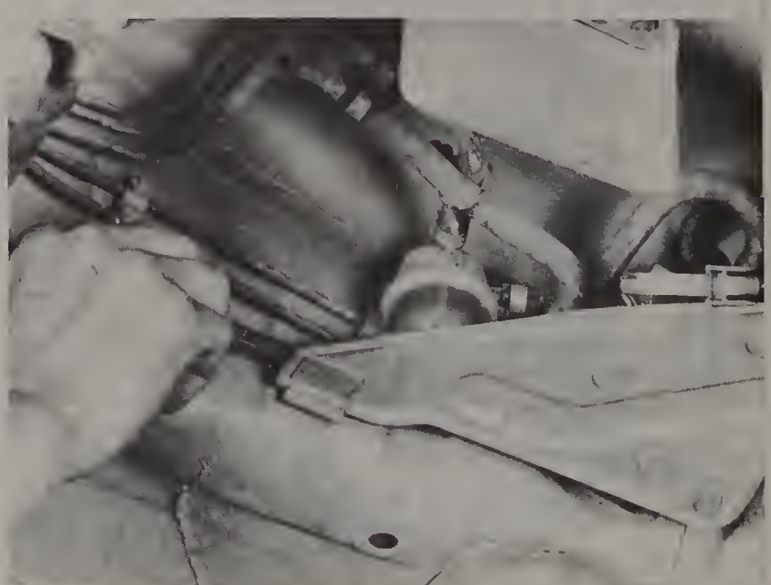
2 The pump is located in the engine compartment near the fuel filter.
3 Disconnect the wiring harness from the pump.
4 Remove the pump bracket and pump from the suspension bracket by removing the mounting screws.
5 Remove the pump from its bracket by removing the bolts.
6 Disconnect the hoses from the pump.
7 Install the fuel pump and connect the hose from the filter to the lower pipe and the other hose to the upper pipe of the pump.

1982 and 1983 vehicles

8 The fuel pump is located under the rear of the vehicle and near the fuel filter. It is hidden and protected by a splash shield (photo).
9 Locate the pump fuel inlet hose and pinch it off to keep fuel from leaking when it is disconnected.
10 Disconnect the electric wiring harness.
11 Release the clamps and disconnect the fuel delivery hoses from the pipe assembly.
12 Remove the screws and take out the pump mounting bracket along with the fuel pump.
13 Remove the nuts and detach the pump from the bracket.
14 Disconnect the fuel delivery hoses from the pump.
15 Install the fuel pump and reconnect the delivery hoses to the pump and the pipe assembly. Reconnect the electric wiring to the pump.



3.2 Removing the hose clamps from the vapor separator (1982 and 1983)



4.8 In order to gain access to the fuel pump on 1982 and 1983 vehicles, the splash shield must be detached

5 Fuel tank – removal, repair and installation

Refer to Fig. 4.1

1 Disconnect the ground cable from the negative terminal of the battery.
2 Raise the vehicle and place it on jackstands.
3 Remove the right rear wheel.
4 Disconnect the wiring harness to the fuel level sensing unit.
5 Remove the fuel drain bolt and drain the fuel into a suitable container. **Warning:** *Gasoline is extremely flammable and extra precautions must be taken when working on the fuel system. Do not smoke and do not allow open flames or bare light bulbs near the vehicle. Also, do not perform this operation in a garage containing appliances that operate on natural gas.*
6 Remove the bolts and the fuel filler pipe protector.
7 Disconnect the clamps and the fuel filler hose from the fuel tank.
8 Disconnect the air-vent hose from the air-vent pipe.
9 Disconnect the air-breather hoses from the air-breather pipes by removing the clamps.
10 Disconnect the fuel delivery hose, the return hose and the air-breather tube from the fuel tank.
11 Now, remove only the front mounting bolts of the tank.
12 Support the fuel tank and remove the rear tank mounting bolts.
13 Remove the fuel tank from the vehicle by pulling it down and towards the rear.
14 Remove the fuel tank gauge unit (it is held in place with five screws).
15 Turn the tank over and empty out any remaining fuel.
16 If repair work must be done on the fuel tank that does not involve any heat or flame, the tank can be satisfactorily cleaned by running hot water into it and letting it overflow out the top for at least five minutes. **This method, however, does not remove gas vapors**.
17 If repair work involving heat or flame is necessary, have it done by an experienced professional. The following, more thorough procedures should be used to remove all fuel and vapors from the tank for transportation to a repair shop.
18 Fill the tank completely with tap water, agitate vigorously and drain.
19 Add a gasoline emulsifying agent to the tank according to the manufacturer's instructions, refill with water, agitate approximately 10 minutes and drain.
20 Flush to overflowing once again with water for several minutes and drain.
21 The tank is now ready for safe transportation.
22 Under no circumstances should anyone perform repair work involving heat or flame without first carrying out the above procedures.
23 If the tank is rusted, extremely dirty or damaged, replace it with a new one or a used one in good condition.
24 Install the fuel tank in the vehicle. Tighten the mounting bolts according to the Torque specifications.
25 Attach the filler hose to the tank until it stops and then fasten it with the clip.
26 Install the air-vent and air-breather hoses.
27 Connect the fuel delivey hose, the return hose and the air-breather tube.
28 Install the filler tube protector and the rear tire.
29 Fill the fuel tank with fuel and check for leakage.
30 Connect the fuel level sensing unit wiring and attach the ground cable to the negative terminal of the battery.

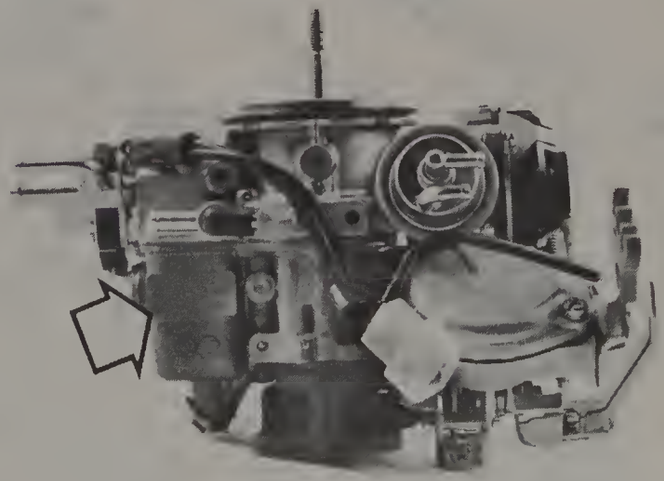
6 Carburetor servicing and identification – general information

1 A thorough road test and check of carburetor adjustments should be done before any major carburetor service. Specifications for some adjustments are listed on the vehicle Emission Control Information label found in the engine compartment.
2 Some performance complaints directed at the carburetor are actually a result of loose, misadjusted or malfunctioning engine or electrical components. Others develop when vacuum hoses leak, are disconnected or are incorrectly routed. The proper approach to analyzing carburetor problems should include a routine check of the following areas.
3 Inspect all vacuum hoses and actuators for leaks and proper installation (see Chapter 6. *Emissions control systems).*
4 Tighten the intake manifold nuts and carburetor mounting nuts evenly and securely.
5 Perform a cylinder compression test (Chapter 1).
6 Clean or replace the spark plugs as necessary.
7 Check the spark plug wires, distributor cap, rotor and contact breaker points (where applicable) (refer to Chapter 1).
8 Inspect the ignition primary wires and check the vacuum advance operation. Replace any defective parts.
9 Check the ignition timing with the vacuum advance line disconnected and plugged.
10 Set the carburetor idle speed as described in Chapter 1.
11 Inspect the heat control baffle in the air cleaner for proper operation (refer to Chapter 1).
12 Remove the carburetor air filter element and blow out any dirt with compressed air. If the filter is extremely dirty, replace it with a new one.
13 Inspect the crankcase ventilation system (see Chapter 6).
14 Carburetor problems usually show up as flooding, hard starting, stalling, severe backfiring, poor acceleration and lack of response to idle mixture screw adjustments. A carburetor that is leaking fuel and/or covered with wet-looking deposits definitely needs attention.
15 Diagnosing carburetor problems may require that the engine be started and run with the air cleaner removed. While running the engine without the air cleaner it is possible that it could backfire. A backfiring situation is likely to occur if the carburetor is malfunctioning, but removal of the air cleaner alone can lean the air/fuel mixture enough to produce an engine backfire.
16 Once it is determined that the carburetor is indeed at fault, it should be disassembled, cleaned and reassembled using new parts where necessary. Before dismantling the carburetor, make sure you have the correct carburetor rebuild kit, which will include all necessary gaskets and internal parts, carburetor cleaning solvent and some means of blowing out all the internal passages of the carburetor. To do the job properly, you will also need a clean place to work and plenty of time and patience.
17 Before purchasing a carburetor rebuild kit, locate the model number of your carburetor and record it. *The number is printed on a flat surface on the end of the float chamber (photo).* You will also have to refer to the model number to determine the manufacturer and make the adjustments required after reassembly of the carburetor. **Note:** *Carburetors with a DC model number prefix were manufactured by Hitachi, while carburetors with a TYF model number prefix were manufactured by Carter/Weber.*

7 Carburetor – removal and installation

1 Remove the air cleaner assembly.
2 Disconnect the following hoses:

The fuel inlet hose



6.17 Carburetor model number (arrow) location (Hitachi shown)

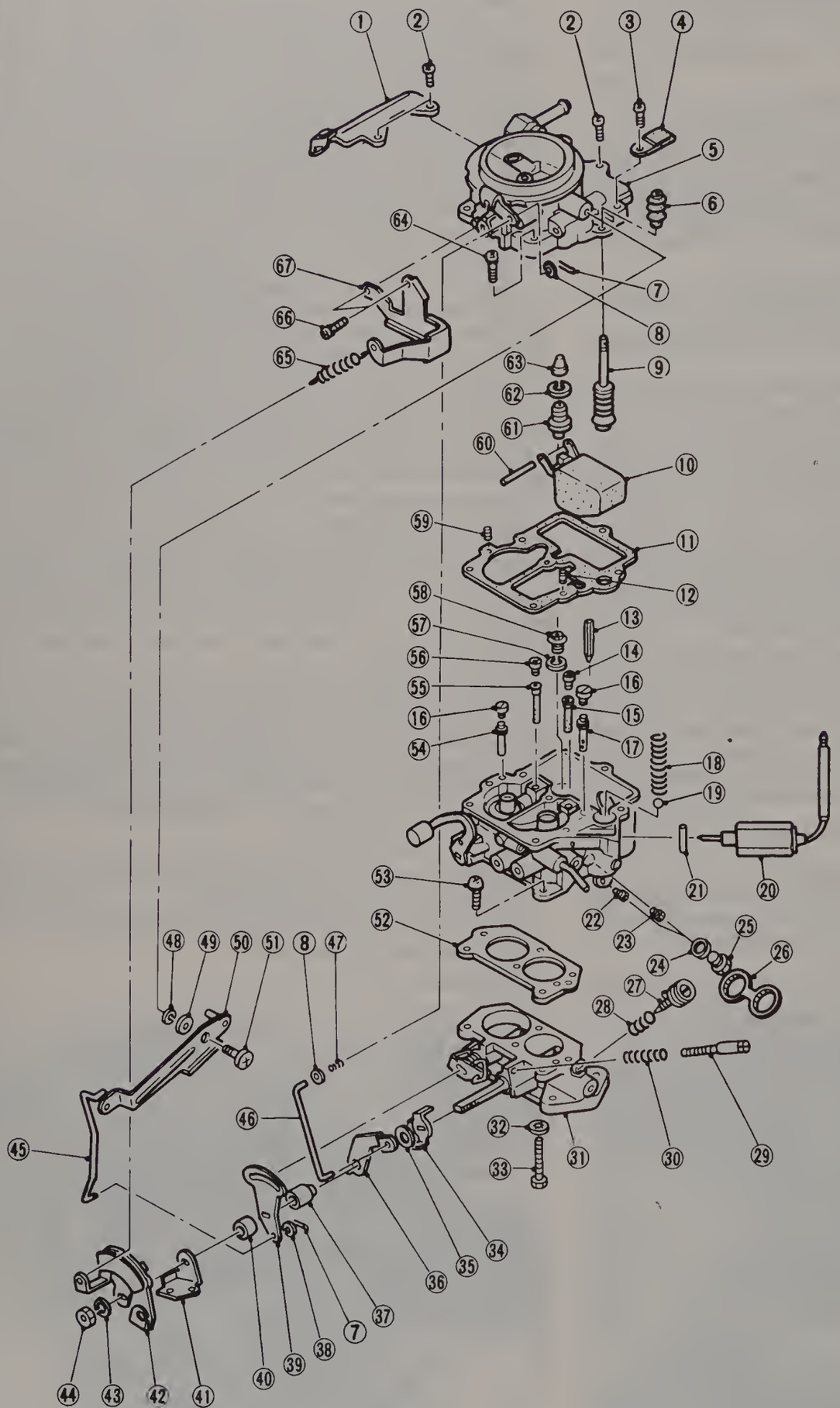


Fig. 4.2 Carburetor components (UK Hitachi) – exploded view (Sec 8)

1 *Choke wire hanger*
2 *Screw and washer*
3 *Screw and washer*
4 *Lead wire holder*
5 *Choke chamber*
6 *Pump cover*
7 *Cotter pin*
8 *Washer*
9 *Piston*
10 *Float*
11 *Float chamber gasket*
12 *Primary slow air bleed*
13 *Injector weight*
14 *Primary main air bleed*
15 *Primary emulsion tube*
16 *Plug*
17 *Primary slow jet*
18 *Piston return spring*
19 *Ball*
20 *Anti-dieseling switch*
21 *Washer*
22 *Secondary main jet*
23 *Primary main jet*
24 *Washer*
25 *Float chamber plug*
26 *Lock plate*
27 *Idle fuel/air mixture*
28 *Spring*
29 *Idle speed adjusting screw*
30 *Spring*
31 *Throttle chamber*
32 *Washer*
33 *Screw*
34 *Adjusting lever*
35 *Washer*
36 *Starting lever*
37 *Sleeve*
38 *Washer*
39 *Connecting lever*
40 *Collar*
41 *FICD lever*
42 *Throttle lever*
43 *Spring washer*
44 *Nut*
45 *Pump connecting rod*
46 *Choke connecting rod*
47 *Spring*
48 *Spring washer*
49 *Washer*
50 *Pump lever*
51 *Shaft*
52 *Insulator*
53 *Screw and washer*
54 *Secondary slow jet*
55 *Secondary emulsion tube*
56 *Secondary main air bleed*
57 *Washer*
58 *Power valve*
59 *Secondary slow air bleed*
60 *Float shaft*
61 *Needle valve*
62 *Washer*
63 *Filter*
64 *Screw and washer*
65 *Throttle return spring*
66 *Screw and washer*
67 *Spring hanger*

The fuel return hose
The carburetor air vent hose
The main diaphragm vacuum hose
The distributor vacuum advance hose
The EGR vacuum hose
The retard vacuum hose (if applicable)

3 Disconnect the following duty solenoid valve hose (if applicable):

The slow duty solenoid valve hose
The main duty solenoid valve hose

4 Disconnect the main diaphragm hose and the secondary main air bleed hose (if applicable).
5 Disconnect the duty solenoid valve connector clamp (if applicable).
6 Disconnect the wiring harness connector.
7 Disconnect the accelerator cable from the throttle lever.
8 Remove the mounting nuts which hold the carburetor to the intake manifold and remove the carburetor. **Note:** *After you remove the carburetor, place a clean cloth over the intake manifold opening to keep dirt out of the engine.*
9 Installation is the reverse of removal, but the following points should be noted:

a) By filling the carburetor bowl with fuel, the initial start-up will be easier and cause less drain on the battery.
b) Always replace gaskets with new ones.
c) Idle speed and mixture settings should be checked and adjusted if necessary (Chapter 1).

8 Carburetor (UK Hitachi) – disassembly, inspection and reassembly

Refer to Figs. 4.2 and 4.3

Note: *Make sure that you have the correct rebuild kit for your carburetor by checking the model number on the carburetor body and consulting with your Subaru dealer. The 1600 cc and 1800 cc engines are both covered in this procedure with the differences noted in the text.*
1 Use the proper size wrenches and screwdrivers to remove the various nuts and screws. Be careful not to create any burrs or other damage.
2 As you remove parts from the carburetor, place them on a clean surface in the order that they were removed. This will save you a lot of problems when reassembling the carburetor.
3 Use solvent and compressed air to clean the jets and fuel passages. Never use a wire or cloth.

Disassembly

4 Remove the throttle return spring.
5 Remove the accelerator pump lever, the pump lever shaft, the spring (1600 cc), the washer and the spring washer.
6 Remove the choke connecting rod, the washers, the spring and the cotter pin attached. **Note:** *Leave the pump connecting rod as it is.*
7 Remove the choke chamber together with the choke wire hanger, the clip(s) and the gasket.
8 Remove the piston return spring, the ball and the injector weight. **Note:** *Since the choke chamber is installed with the float, take care not to damage the float.*
9 Disconnect the hose from the secondary diaphragm and remove the diaphragm (1800 cc).
10 Separate the float chamber from the throttle chamber. **Note:** *Be careful not to damage the longest screw, since it has a vacuum passage hole for the power valve.*
11 Remove the accelerator pump piston and the pump cover.
12 Remove the float shaft and the float.
13 Remove the needle valve. Be careful not to lose the small washer.
14 Remove the primary and secondary slow air bleeds (1600 cc).
15 Remove the spring hanger.
16 Remove the primary and secondary main air bleeds and emulsion tubes (1600 cc).
17 Remove the primary and secondary main air bleeds (1800 cc).
18 Remove the primary and secondary slow jets (1600 cc).
19 Remove the plug, the secondary slow air bleed and the primary and secondary slow jets (1800 cc).
20 Remove the coasting bypass plug, the jet and the air bleed (1800 cc).
21 Remove the lock plate, the float chamber drain plugs, the primary and secondary main jets. Be careful not to lose the small washers.
22 Remove the servo diaphragm (1800 cc).
23 Remove the anti-dieseling switch. Be careful not to lose the small washer.
24 Remove the power valve. Be careful not to lose the small washer.
25 Remove the idle speed adjusting screw and the spring.
26 Remove the idle fuel/air mixture adjusting screw and the spring.
27 Remove the parts from the throttle valve shaft.

Inspection

28 Clean all of the parts with solvent. Make sure that all of the small passages are open.

Choke chamber

29 Inspect the air horn. Check for cracks, damaged mating surfaces, damaged threads and excessive wear of the choke valve shaft contact areas.
30 Inspect the air horn. Check for deformation and rust.
31 Inspect the choke valve shaft. Check for wear and distortion.
32 Inspect the power piston. Check for smooth operation.
33 Inspect the float. Check for deformation, damage to the seat and stopper and wear of the float shaft hole.

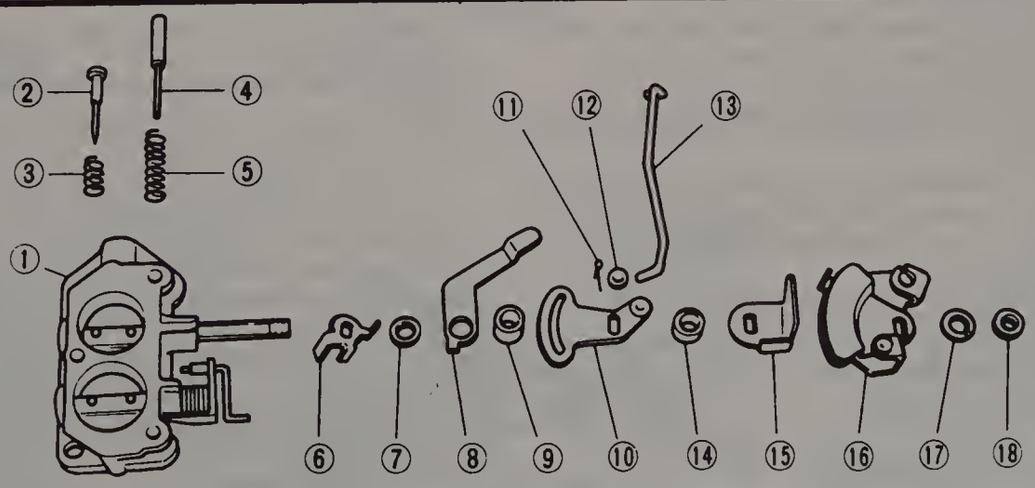


Fig. 4.3 Throttle valve shaft components – exploded view (Sec 8)

1 *Throttle chamber*
2 *Idle fuel/air mixture adjusting screw*
3 *Spring*
4 *Idle speed adjusting screw*
5 *Spring*
6 *Adjusting lever*
7 *Washer*
8 *Starting lever*
9 *Sleeve*
10 *Connecting lever*
11 *Cotter pin*
12 *Washer*
13 *Pump connecting rod*
14 *Collar*
15 *FICD lever*
16 *Throttle lever*
17 *Spring washer*
18 *Nut*

34 Inspect the needle valve. Check for damage and correct contact with the valve seat.
35 Inspect the filter. Check for deformation and damage.
36 Inspect the air bleed. Check for damaged threads and groove.
37 Inspect the choke spring. Check for rust and deterioration.
38 Inspect the accelerator pump cover. Check for cracks and damage.

Float chamber

39 Inspect the float chamber body. Check for cracks, damaged mating surfaces, damaged threads, wear of the auxiliary shaft hole and wear of the accelerator pump cylinder.
40 Inspect the injector weight. Check for damage and proper contact against the seat.
41 Inspect the ball. Check for damage and distortion.
42 Inspect the piston return spring. Check for rust and deformation.
43 Inspect the jet. Check for damaged threads and groove.
44 Inspect the emulsion tube. Check for deformation.
45 Inspect the accelerator pump piston. Check for damage and wear.
46 Inspect the power valve. Check for correct operation and any damage to the threads and the groove. Check the servo diaphragm (1800 cc) and O-ring for damage. Make sure the diaphragm operates by applying vacuum to the port. When vacuum is applied, the shaft should retract.

Throttle chamber

47 Inspect the chamber body. Check for cracks, damaged mating surfaces, wear of the throttle valve shaft hole and damaged threads.
48 Inspect the throttle valve. Check for deformation.
49 Inspect the throttle valve shaft. Check for wear, distortion and thread damage.
50 Inspect the idle mixture adjusting screw. Check for damage on the tip of the screw.
51 Inspect the springs. Check for deformation and rust.

Miscellaneous items

52 Inspect the washers. Check for deformation.
53 Inspect the linkages. Check for wear of each moving part and rust.
54 Inspect the fuel and air passages to make sure they are open.
55 If any parts are rusted, deformed, scratched or cracked, replace them with new ones.

Reassembly

56 Replace the gaskets, the lockplate and the cotter pins with new ones.
57 Install the spring hanger.
58 Install the primary and secondary slow air bleeds (1600 cc).
59 Install the needle valve and filter with its washer.
60 Install the float and the float shaft. Adjust the float by referring to the appropriate Section in this Chapter. **Note:** *Be sure to connect the needle valve to the float.*
61 Install the accelerator pump piston and the pump cover.
62 Install the power valve with its washer.
63 Install the anti-dieseling switch with its washer.
64 Install the servo diaphragm with the O-ring (1800 cc).
65 Install the primary and secondary main jets and the float chamber drain plugs with the washers. Install the lock plate.
66 Install the coasting bypass jet, air bleed and plug (1800 cc).
67 Install the primary and secondary slow jets and plugs (1600 cc).
68 Install the primary and secondary slow jets, plug and secondary slow air bleed (1800 cc).
69 Install the primary and secondary main air bleeds (1800 cc). **Note:** *The emulsion tubes are separable (1600 cc).*
70 Refer to the accompanying illustration and install the parts on the throttle valve shaft.
71 Install the idle fuel/air mixture adjusting screw and spring.
72 Install the idle speed adjusting screw and spring.
73 Position the float and throttle chamber together with the insulator and gaskets between them (1800 cc). **Note:** *The insulator and gaskets are all one piece (1600 cc)*
74 Insert the end of the main return spring in the groove of the float chamber.
75 Install the secondary diaphragm and clip with the E-ring (1800 cc).
76 Install and connect the vacuum hose to the diaphragm (1800 cc).
77 Install the injector weight, ball and pump return spring.
78 Install the choke chamber together with the choke wire hanger, clip(s) and gasket.
79 Install the choke connecting rod with the washers, the spring and the cotter pin.
80 Connect the accelerator pump connecting rod to the pump lever, then install the pump lever with the lever shaft, the spring (1600 cc), the washer and the spring washer.
81 Install the throttle return spring.
82 Finally, make sure that all of the linkages work properly and freely and that all mounting hardware is tight.

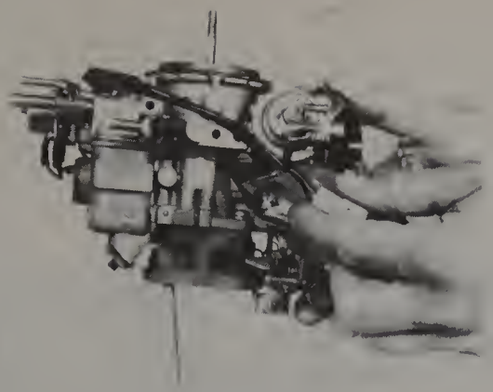
9 Carburetor (US Hitachi) – disassembly, inspection and reassembly

Refer to Fig. 4.4

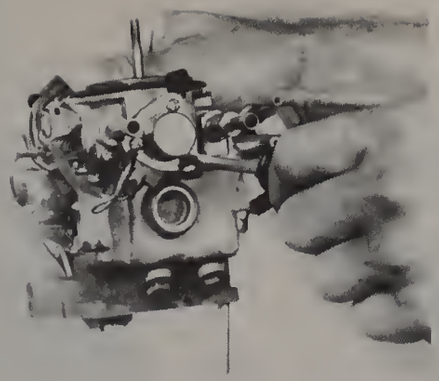
Note: *Make sure that you have the correct rebuild kit for your carburetor by checking the model number on the carburetor body and consulting with your Subaru dealer.*
1 Use the proper size wrenches and screwdrivers to remove the various nuts and screws. Be careful not to create any burrs or other damage.
2 As you remove parts from the carburetor, place them on a clean surface in the order that they were removed. This will save you a lot of problems when reassembling the carburetor.
3 Use clean solvent and compressed air to clean the jets and fuel passages. Never use a wire brush or cloth.

Disassembly

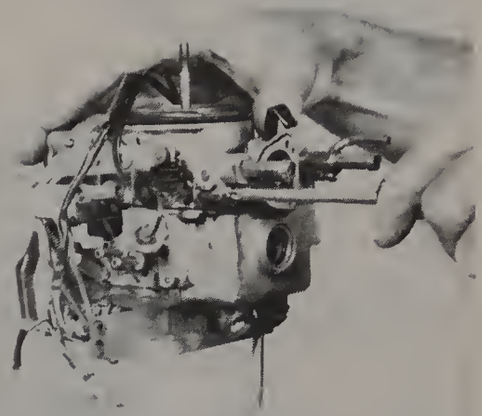
4 Remove the wiring harness from the clips (photo).
5 Remove the vent solenoid valve cover (photo). **Note:** *The mounting screw at the 8:30 position retains a ground strap to the solenoid. Lay the cover to the side because it is still attached to the harness.*
6 Remove the vent solenoid valve housing (photo). When disassembling the vent solenoid valve (photo), check the rubber diaphragm and stopper for deterioration and cracks and replace these parts with new ones if necessary.
7 Remove the upper air horn-to-air cleaner rubber gasket.
8 Remove the solenoid valve (photo).
9 Disconnect the throttle valve return spring.
10 Remove the choke heater housing cover. **Note:** *In order to remove the cover, the metal rivets must be filed or drilled out (photo).*
11 Remove the screws retaining the choke plate to the choke shaft (photo). **Note:** *These screws are extremely tight and are difficult to remove.*
12 Remove the mounting screws from the choke housing (photo).
13 Remove the cotter pin and washer from the fast idle rod and disconnect the rod from the choke housing (photo).
14 Remove the screw from the choke pull-off mechanism (photo).
15 Remove the choke housing from the carburetor (photo).
16 Remove the spring and the mounting screws for the choke pull-off bracket (photo).
17 Remove the accelerator pump lever screw (photo). The lever is spring loaded.
18 Remove the screws and separate the choke chamber from the float chamber assembly (photo).
19 Remove the accelerator pump and rubber boot from the float chamber.
20 Remove the float pivot pin and the float from the float chamber.
21 Remove the needle valve and seat (photo).
22 Remove the gasket from the choke chamber. Be sure to replace it with a new one during reassembly.
23 Remove the accelerator pump return spring.
24 Remove the snap-ring from the rod connected to the secondary throttle actuator diaphragm. Be careful not to lose the snap-ring.
25 Remove the secondary throttle actuator diaphragm (photo).
26 Prepare to remove the jets from the float chamber. Take a good look at the top of the float chamber and draw a simple diagram of the chamber and the positions of the jets in relationship to each other. Lay the diagram on a flat surface and as you remove the jets, place them on their respective positions on the diagram. This procedure will be a lot of help during reassembly.
27 Now, remove the secondary slow jet, the secondary air bleed, the primary air bleed and then the primary slow jet. **Note:** *The slow jets are covered with plugs.*
28 Remove the accelerator pump injector weight and the power jet (photo).
29 Remove the main jet access plugs from the float chamber after removing the lockplates (photo).



9.4 Remove the wiring harness from the clips

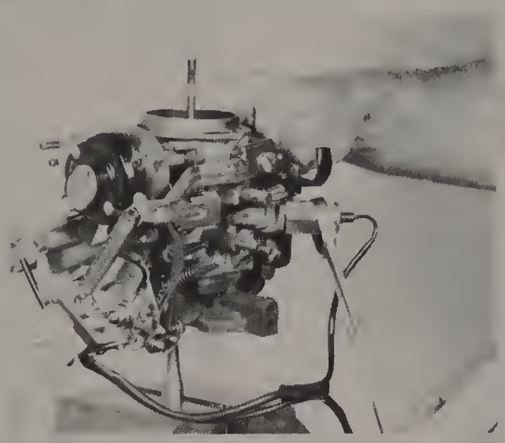


9.5 Remove the vent solenoid valve cover



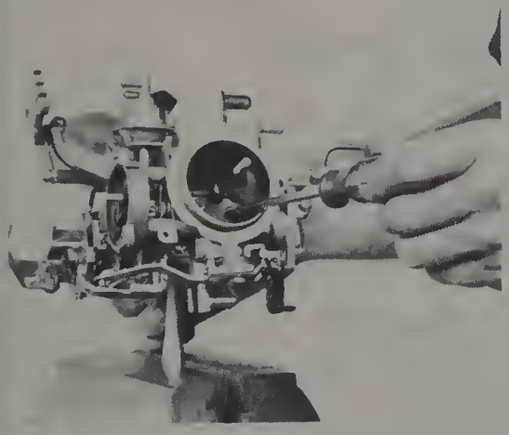
9.6A Remove the vent solenoid valve housing

9.6B Check the vent solenoid valve parts for wear and damage

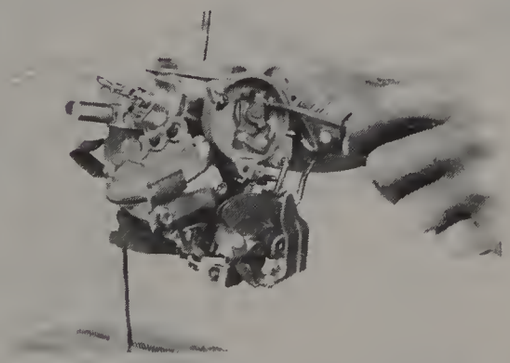


9.8 Remove the solenoid valve

9.10 File the metal rivets off in order to remove the choke housing cover

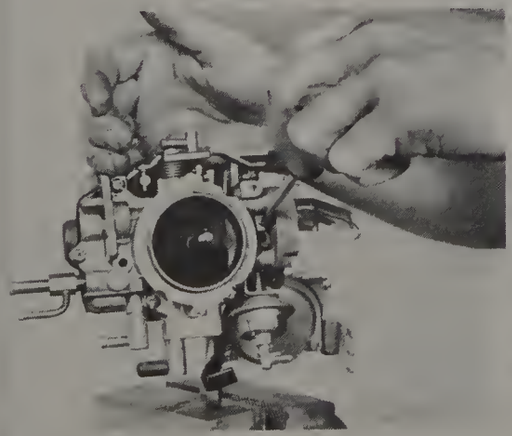


9.11 Remove the screws retaining the choke plate to the choke shaft

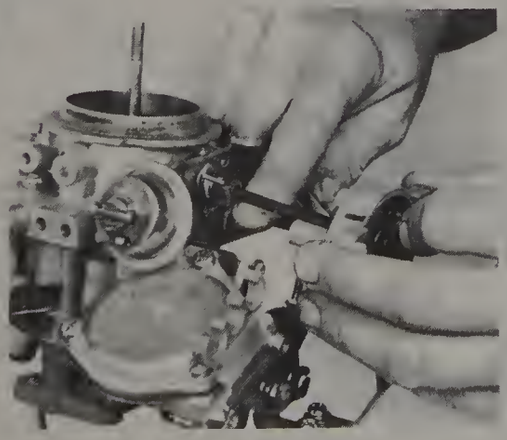


9.12 Remove the screws mounting the choke housing

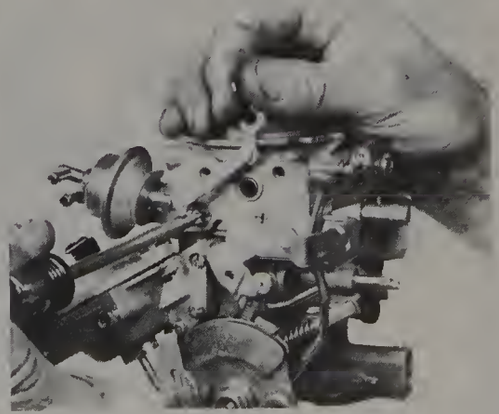
9.13 Remove the cotter pin and washer from the fast idle rod attached to the choke housing



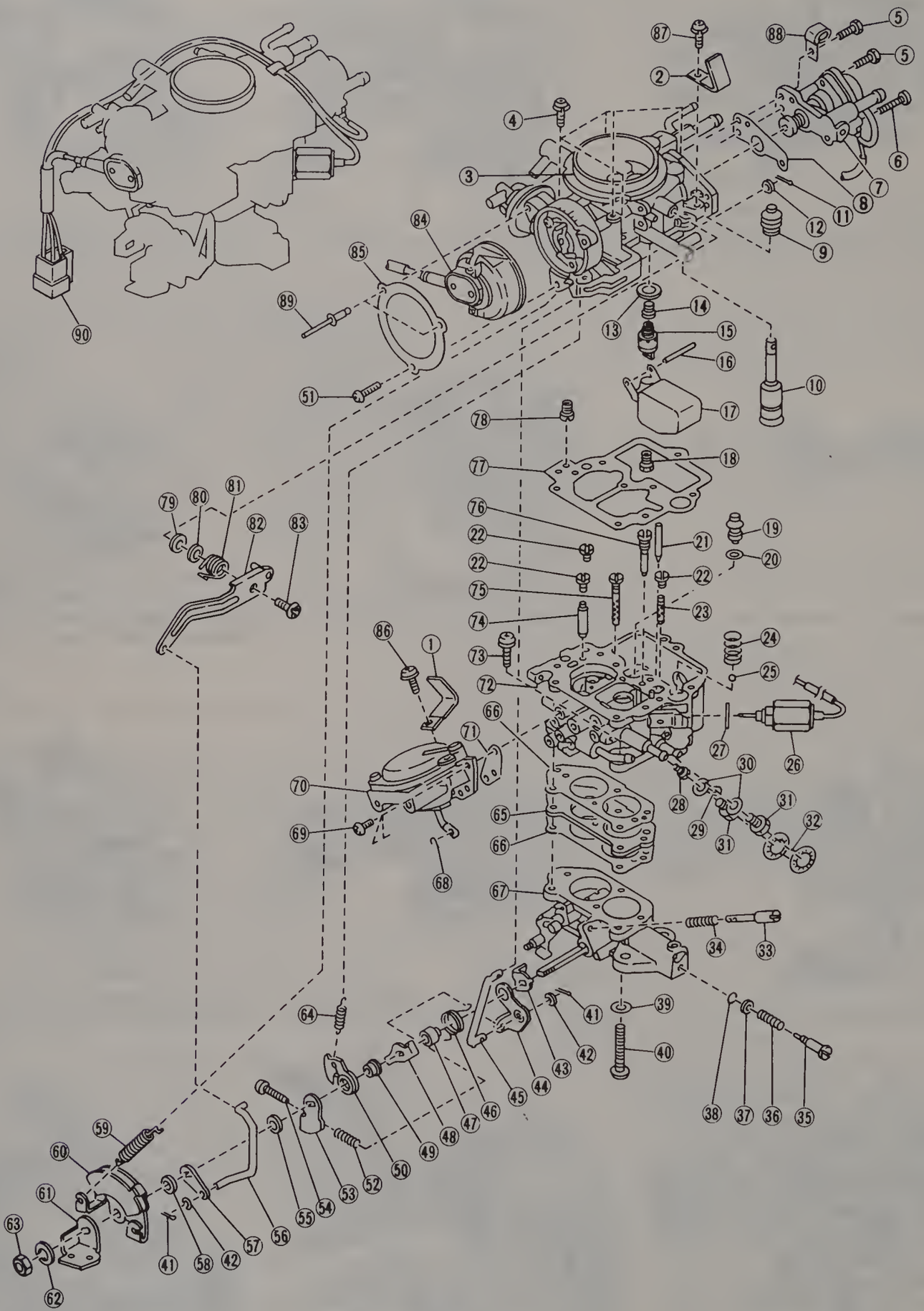
9.14 Remove the screw from the choke pull-off mechanism



9.15 Remove the choke housing from the carburetor



9.16 Remove the choke pull-off bracket screws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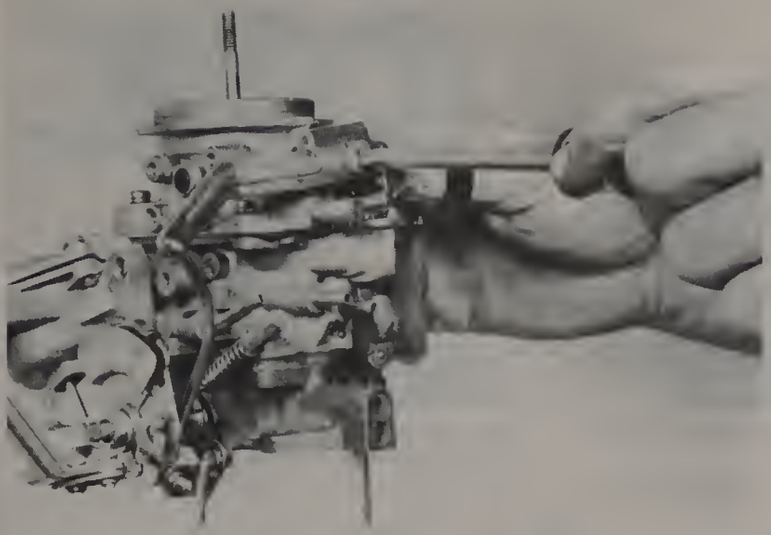
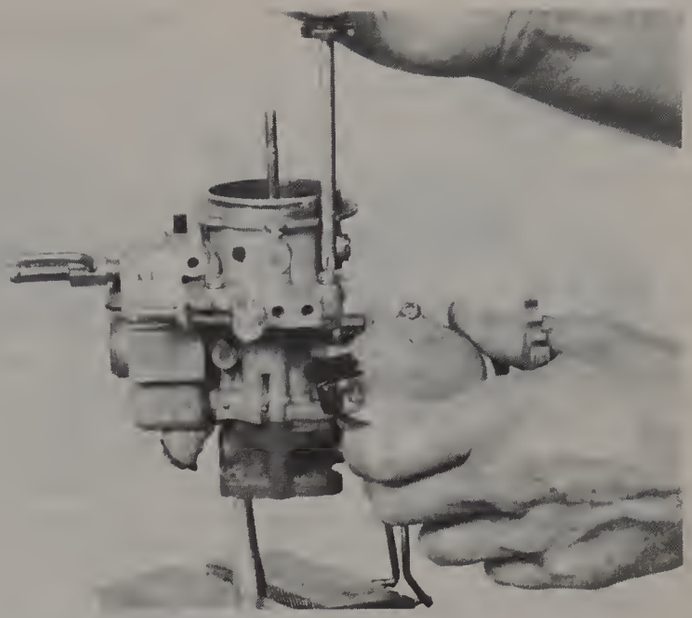


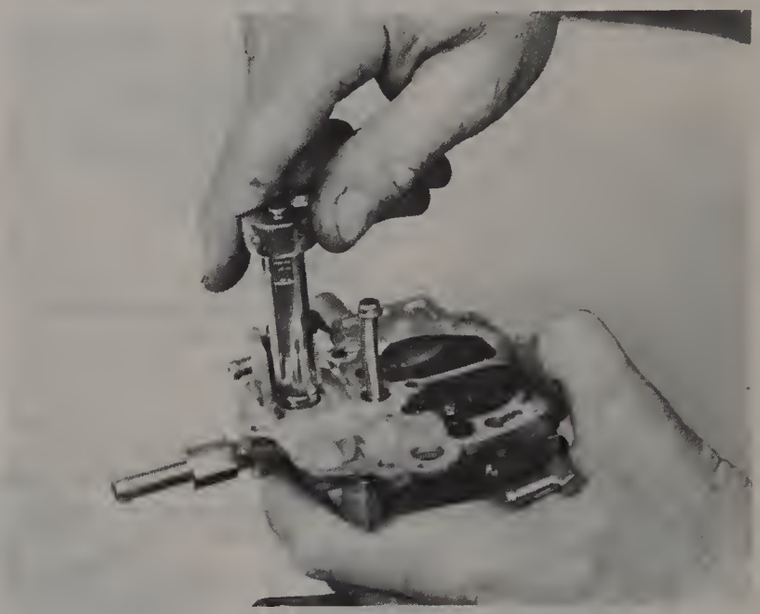
9.17 Remove the accelerator pump lever screw



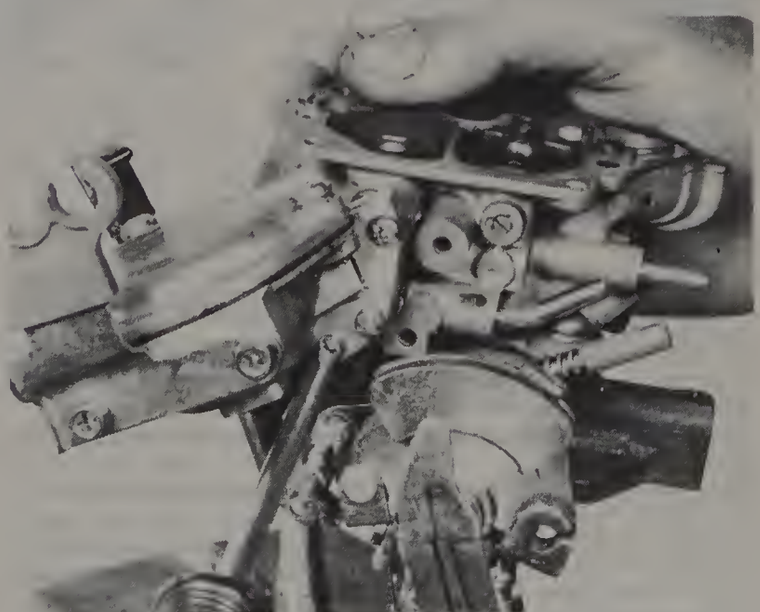
9.18 Remove the choke chamber mounting screws and separate it from the float chamber assembly

Fig. 4.4 Carburetor components (US Hitachi) – exploded view (Sec 9)

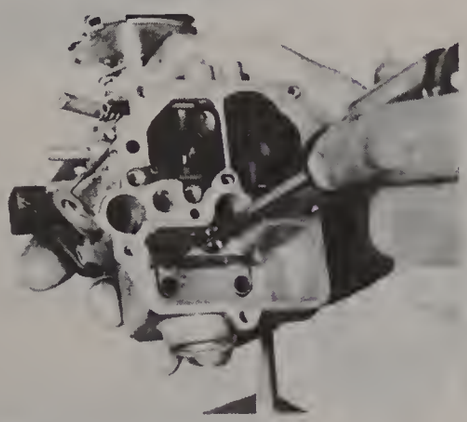
1 *Wire clip*
2 *Wire clip*
3 *Choke chamber*
4 *Screw and washer*
5 *Screw and washer*
6 *Screw*
7 *Vent solenoid valve*
8 *Gasket*
9 *Pump rubber boot*
10 *Piston*
11 *Cotter pin*
12 *Washer*
13 *Washer*
14 *Filter*
15 *Needle valve*
16 *Float pivot pin*
17 *Float*
18 *Primary slow air bleed*
19 *Power jet*
20 *Washer*
21 *Injector weight*
22 *Plug*
23 *Primary slow jet*
24 *Piston return spring*
25 *Ball*
26 *Solenoid valve*
27 *Washer*
28 *Secondary main jet*
29 *Primary main jet*
30 *Washer*
31 *Float chamber plug*
32 *Lockplate*
33 *Idle speed screw*
34 *Spring*
35 *Idle mixture screw*
36 *Spring*
37 *Washer*
38 *O-ring*
39 *Washer*
40 *Screw*
41 *Cotter pin*
42 *Washer*
43 *Adjust plate*
44 *Fast idle lever*
45 *Fast idle rod*
46 *Spring*
47 *Sleeve*
48 *Connecting lever*
49 *Sleeve*
50 *Return plate*
51 *Screw and washer*
52 *Idle adjust spring*
53 *Fast idle lever*
54 *Screw*
55 *Washer*
56 *Pump connecting rod*
57 *Connecting lever*
58 *Collar*
59 *Throttle return spring*
60 *Throttle lever*
61 *FICD lever*
62 *Spring washer*
63 *Nut*
64 *Return spring*
65 *Insulator*
66 *Gasket*
67 *Throttle chamber*
68 *E-ring*
69 *Screw and washer*
70 *Secondary throttle actuator*
71 *Gasket*
72 *Float chamber*
73 *Screw and washer*
74 *Secondary slow jet*
75 *Secondary main air bleed*
76 *Primary main air bleed*
77 *Gasket*
78 *Secondary slow air bleed*
79 *Spring washer*
80 *Washer*
81 *Pump lever spring*
82 *Pump lever*
83 *Pump lever shaft*
84 *Choke housing*
85 *Choke cover*
86 *Screw and washer*
87 *Screw and washer*
88 *Lead wire holder*
89 *Blind rivet*
90 *Connector*



9.21 Remove the needle valve seat from the choke chamber

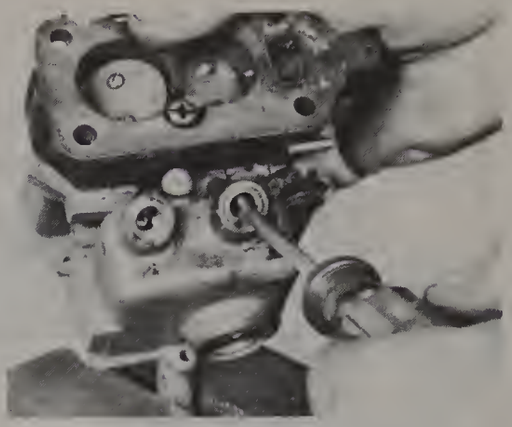


9.25 Remove the secondary throttle actuator diaphragm



9.28 Remove the power jet and washer

9.29 Remove the main jet plug lockplates, then unscrew the plugs

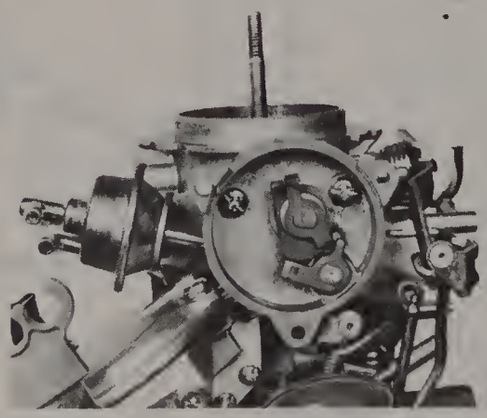


9.30 Remove the main jets from the float chamber with a large screwdriver

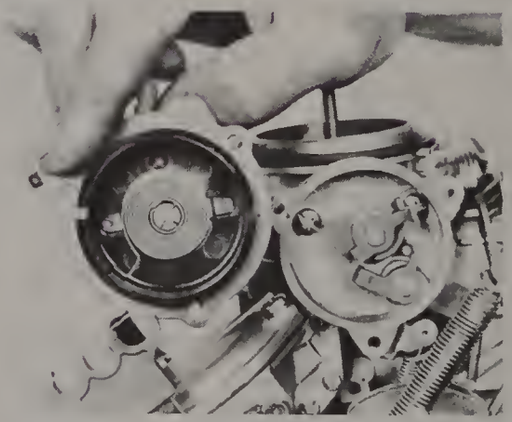
9.32 Remove the screw holding the throttle chamber to the float chamber

9.36 The throttle chamber with the idle mixture screw and lock pin

9.78 Install a new gasket on the secondary throttle actuator diaphragm while keeping the vacuum delivery hole clear (arrow)



9.89 Inspect the choke linkages to make sure they are positioned correctly (photo shows choke in the open position)



9.94 Install the choke housing cover by aligning the housing pin with the cover slot

30 Remove the plugs and the main jets (photo) from the float chamber.
31 Remove the check ball from the accelerator pump cavity by turning the float chamber upside-down. **Note:** *This ball may be plastic or metal; do not lose it.*
32 Remove the large screw that holds the throttle chamber to the float chamber (photo). **Note:** *This screw has a hole in the center so don't get it confused with other screws.*
33 Remove the remaining screws holding the throttle chamber to the float chamber.
34 Separate the throttle chamber from the float chamber and remove the gasket. Replace the gasket with a new one during reassembly.
35 The throttle chamber needs no further disassembly. Make sure that everything is cleaned thoroughly and then apply light machine oil to the moving parts.
36 Remove the idle mixture screw lock pin from the throttle chamber (photo).
37 While you count the revolutions, turn the idle mixture screw in until it lightly contacts the seat. Record the number of revolutions required to seat it (you will have to refer to it during reassembly).
38 Remove the idle mixture screw, the spring, the seal retainer washer and then the seal.

Inspection

39 Clean all of the parts with solvent. Make sure that all of the small passages are open.

Choke chamber

40 Inspect the air horn. Check for cracks, damaged mating surfaces, damaged threads and excessive wear of the choke valve shaft contact areas.
41 Inspect the choke valve. Check for deformation and rust.
42 Inspect the choke valve shaft. Check for wear and distortion.
43 Inspect the power piston. Check for smooth operation.
44 Inspect the float. Check for deformation, damage to the seat and stopper and wear of the float shaft hole.
45 Inspect the needle valve. Check for damage and correct contact

with the valve seat.
46 Inspect the filter. Check for deformation and damage.
47 Inspect the air bleed. Check for damaged threads and groove.
48 Inspect the choke spring. Check for rust and deterioration.
49 Inspect the accelerator pump cover. Check for cracks and damage.

Float chamber

50 Inspect the float chamber body. Check for cracks, damaged mating surfaces, damaged threads, wear of the auxiliary valve shaft hole and wear of the accelerator pump cylinder.
51 Inspect the injector weight. Check for damage and proper contact against the seat.
52 Inspect the ball. Check for damage and distortion.
53 Inspect the piston return spring. Check for rust and deformation.
54 Inspect the jet. Check for damaged threads and groove.
55 Inspect the emulsion tube. Check for deformation.
56 Inspect the accelerator pump piston. Check for damage and wear.
57 Inspect the power valve. Check for correct operation and any damage to the threads and the groove.
58 Inspect the vent solenoid valve diaphragm and O-ring. Check for correct operation and damage to the rubber seat and O-ring. Also, check that the diaphragm is working by applying a small amount of vacuum to the valve.

Throttle chamber

59 Inspect the chamber body. Check for cracks, damaged mating surfaces, wear of the throttle valve shaft hole and damaged threads.
60 Inspect the throttle valve. Check for deformation.
61 Inspect the throttle valve shaft. Check for wear, distortion and thread damage.
62 Inspect the idle mixture adjusting screw. Check for damage on the tip of the screw.
63 Inspect the springs. Check for deformation and rust.

Miscellaneous items

64 Inspect the washers. Check for deformation.
65 Inspect the linkages. Check for wear of each moving part and rust.
66 Inspect the fuel and air passages to make sure they are open.
67 If any parts are rusted, deformed, scratched or cracked, replace them with new ones.

Reassembly

68 Replace the gaskets, the lockplate and the cotter pins with new ones.
69 Install the idle mixture screw seal, the seal retainer and the idle mixture screw spring.
70 Install the idle mixture screw. Turn it in until it lightly comes in contact with the seat. Then, turn it back out the same number of turns recorded when it was removed.
71 Attach the throttle chamber to the float chamber. Make sure that the mounting screws are tight.
72 Install the primary and secondary main jets. **Note**: *These jets should screw in easily, do not force them or thread damage could occur.*
73 Install both main jet plugs. Make sure that new metal washers are used and that the plugs are tight before installing the lockplate.
74 Install the power jet using a new washer.
75 Install the accelerator check ball and return spring. **Note**: *Make sure that the spring is inserted with the check ball retainer (on the spring end) going in first.*
76 Install the accelerator pump injector weight.
77 Install the secondary jet and plug, the secondary air bleed, the primary air bleed and the primary slow jet and plug.
78 Install the secondary throttle actuator diaphragm. **Note**: *The shortest screw must be inserted in the recessed hole.* Install a new gasket and make sure that the vacuum delivery hole is clear (photo). Attach the diaphragm actuator linkage to the secondary throttle shaft lever before mounting the diaphragm.
79 Install the float needle valve and seat in the choke chamber. Use a new sealing ring.
80 Install the float in position in the choke chamber with the float pivot pin.
81 Refer to the appropriate Section in this Chapter to make the float adjustments.
82 Lightly lubricate the accelerator pump cavity.
83 Prepare to attach the choke chamber to the float chamber. **Note**: *As you install the choke chamber, make sure that the float pivot pin is centered and that the accelerator pump spring engages the pump shaft.*
84 Install the choke chamber making sure that the bracket is attached to the screw that is closest to the vent solenoid housing flange. **Note**: *Two of the screws are longer than the others. Make sure that the longest ones are installed in the deepest flanges in the choke chamber,* Install all of the screws part way and move the chamber around to position it correctly. Push down on the accelerator pump shaft a few times to make sure that everything is seated properly. Tighten the mounting screws in a criss-cross fashion.
85 Install the accelerator pump return linkage. Loosely install the pivot (mounting) screw. Attach the lever to the linkage rod and then engage the accelerator pump plunger with the linkage pin.
86 Now engage the accelerator pump lever return spring. To install the spring, engage the lug on the choke chamber body first and then attach it to the lever.
87 Install the choke pull-off bracket by first engaging its return spring with the linkage. The linkage is down on the primary throttle shaft.
88 Install the choke housing and shaft on the float chamber. To do this, install the choke shaft about half-way into the choke chamber, then attach the choke lever to the linkage.
89 Install the choke housing screws loosely. When installing the housing, refer to the photo and make sure that the choke linkages are positioned correctly.
90 Connect the choke linkage with the cotter pin and washer.
91 Install the butterfly valves with their mounting screws in the choke chamber throat.
92 Attach the primary throttle return spring to the choke pull-off bracket and the primary throttle lever.
93 Install the solenoid valve using a new washer.
94 Install the choke housing cover making sure that the alignment pin on the housing fits into the slot on the cover (photo). **Note**: *Be sure to engage the bi-metal spring with the choke linkage.*
95 Install the original mounting screw in the bottom of the choke housing. Install new machine screws and nuts in place of the metal rivets that were removed.
96 Install a new gasket on the vent solenoid valve and attach the valve to the choke chamber.
97 Finally, attach the wiring harness to the clips at the various locations on the carburetor.
98 Adjust the carburetor by referring to the appropriate Sections in this Chapter.

10 Fast idle opening (Hitachi) – check and adjustment

Refer to Figs. 4.5 and 4.6

UK vehicles

1 Keep the choke valve fully closed.
2 Measure the clearance (G1) between the primary throttle valve and the inner wall of the throttle chamber.
3 Compare your measurement with the Specifications.
4 To adjust the clearance, bend the adjustment lever until the choke valve is fully closed and the G1 clearance is as specified.

US vehicles

5 With the choke valve fully closed, and the top of the cam adjusting lever resting on the highest step of the fast idle cam, measure the G1 clearance (see accompanying illustration).
6 Compare your measurement with the Specifications and adjust it with the fast idle adjusting screw if necessary.

11 Secondary throttle valve (Hitachi) – check and adjustment

Refer to Figs. 4.7 and 4.8

1 The primary and secondary throttle valves are interlocked so that the secondary valve starts to open when the primary valve is opened to a certain degree.
2 Move the primary valve slightly until the secondary valve just begins to open.
3 Measure the opened angle of the primary valve and the G2 clearance (see accompanying illustration).
4 Compare your measurements to the Specifications.
5 To make an adjustment, carefully bend the connecting rod (UK models) or the adjust plate (US models) until the G2 clearance is as specified.

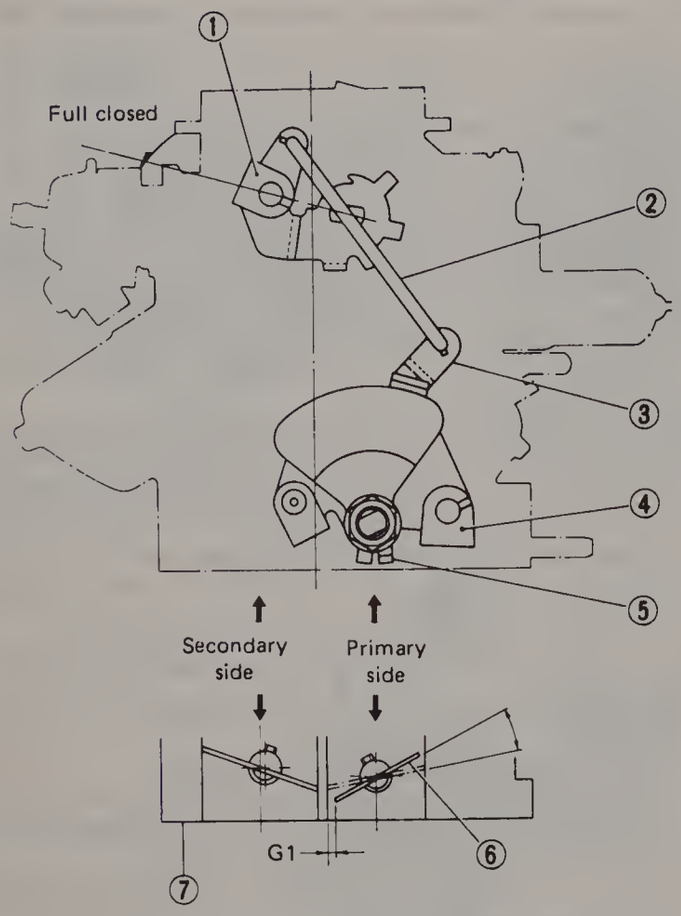


Fig. 4.5 Fast idle opening adjustment (UK – Hitachi) (Sec 10)

1 *Choke lever*
2 *Choke lever*
3 *Choke connecting lever*
4 *Throttle lever*
5 *Adjust lever*
6 *Primary throttle valve*
7 *Throttle chamber*

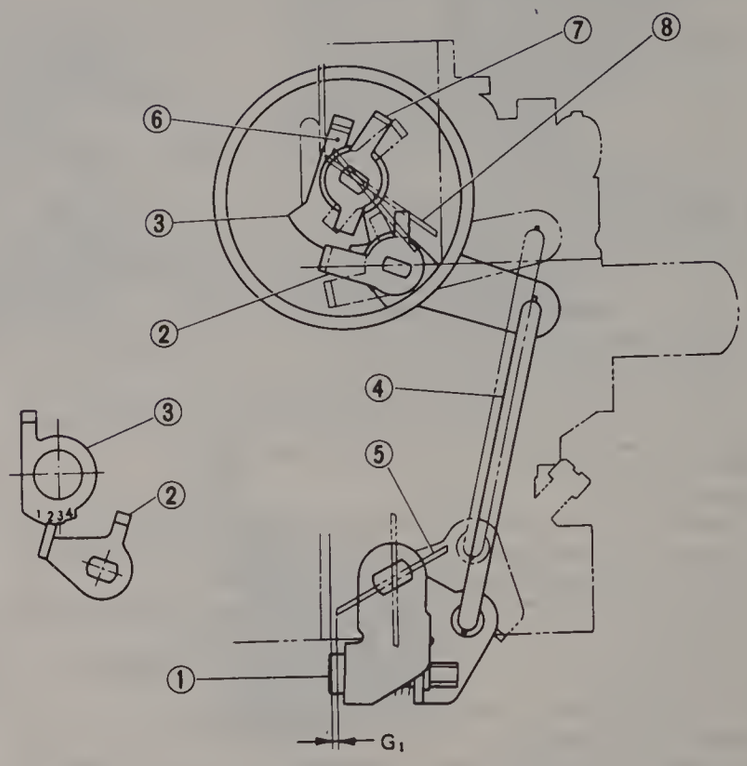


Fig. 4.6 Fast idle opening adjustment (US – Hitachi) (Sec 10)

1 *Fast idle adjusting screw*
2 *Cam adjusting lever*
3 *Fast idle cam*
4 *Cam connecting rod*
5 *Throttle valve*
6 *Bend this pawl to adjust choke valve opening angle*
7 *Choke lever*
8 *Choke valve*

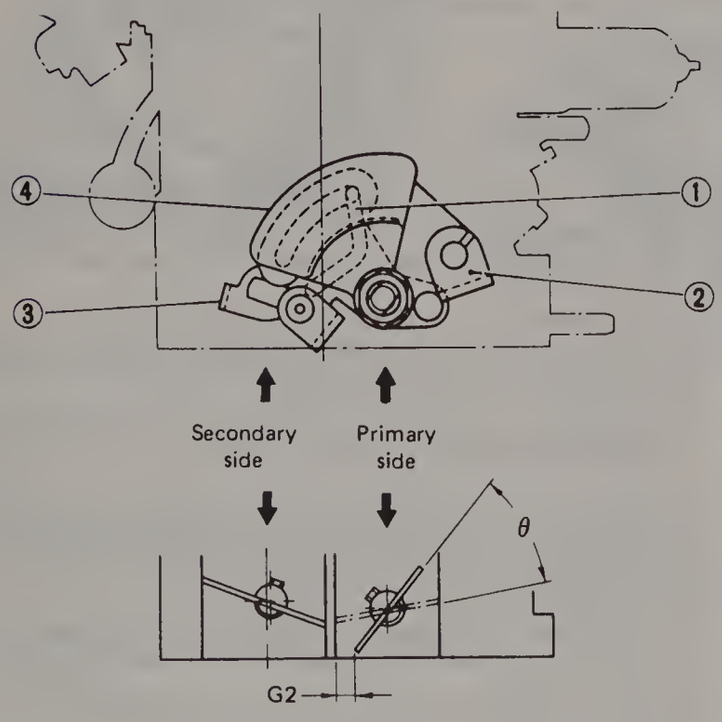


Fig. 4.7 Secondary throttle valve adjustment (UK Hitachi) (Sec 11)

1 *Connecting rod*
2 *Throttle lever*
3 *Connecting lever (secondary)*
4 *Connecting lever (primary)*

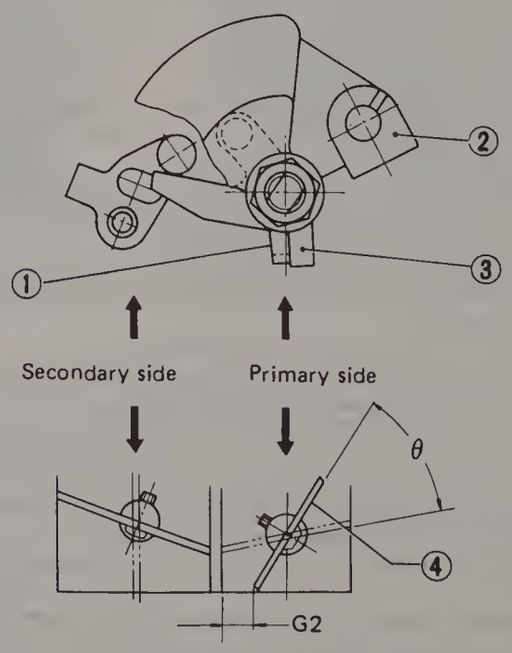


Fig. 4.8 Secondary throttle valve adjustment (US Hitachi) (Sec 11)

1 *Adjust plate*
2 *Throttle lever*
3 *Return plate*
4 *Primary throttle valve*

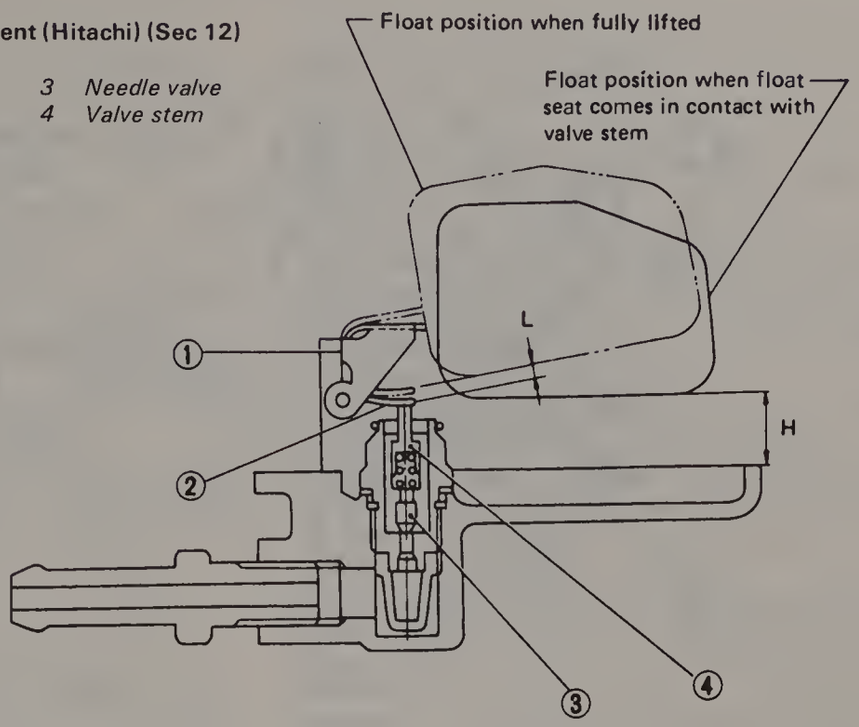


Fig. 4.9 Float level adjustment (Hitachi) (Sec 12)

1 Float stopper
2 Float seat
3 Needle valve
4 Valve stem

12 Float level (Hitachi) – check and adjustment

Refer to Fig. 4.9

1 With the choke chamber removed, turn it upside down.
2 Measure the clearance (H) when the float seat comes in contact with the valve stem (see the accompanying illustration).
3 Compare your measurement with the Specifications.
4 To adjust the clearance, bend the float seat slightly until the specifications are met.
5 Measure the clearance (L) with the float fully lifted to its stopping point.
6 Compare your measurement with the Specifications.
7 To adjust the clearance, bend the float stopper slightly until the specifications are met.

13 Carburetor (US Carter/Weber) – disassembly, inspection and reassembly

Refer to Fig. 4.10

Note: *Make sure that you have the correct rebuild kit for your carburetor by checking the model number of the carburetor body and consulting with your Subaru dealer.*

1 Use the proper size wrenches and screwdrivers to remove the various nuts and screws. Be careful not to create any burrs or other damage.
2 As you remove parts from the carburettor, place them on a clean surface in the order that they were removed. This will save you a lot of problems when reassembling the carburetor.
3 Use clean solvent and compressed air to clean the jets and fuel passages. Never use a wire or cloth.

Disassembly

4 Remove the choke vacuum hose.
5 Remove the outer and inner fuel line clamps.
6 Remove the banjo lock and the banjo fuel bolt.
7 Remove the banjo fuel line assembly and gaskets.
8 Remove the idle stop solenoid.
9 Remove the fuel line bracket.
10 Remove the feedback solenoid and gasket.
11 Remove the bowl vent solenoid and gasket.
12 Remove the bowl vent armature and the spring from the bowl vent solenoid.
13 Remove the connector rod.
14 Remove the air horn by removing the screws.
15 Remove the float by pulling out the float hinge pin.
16 Remove the air horn gasket.
17 Remove the fuel inlet needle pin, the needle pin spring and the needle.
18 Remove the needle seat, the gasket and the filter. Remove the metering rod and the accelerator pump.
19 Remove the lifter link, the metering rod and the spring.
20 Remove the pump hose and the main jet.
21 Remove the pump housing assembly.
22 Remove the pump discharge check ball and the weight.
23 Separate the body from the flange by removing the screws.
24 Remove the flange gasket and the tamper-proof pin.
25 Remove the idle mixture screw and spring.

Inspection

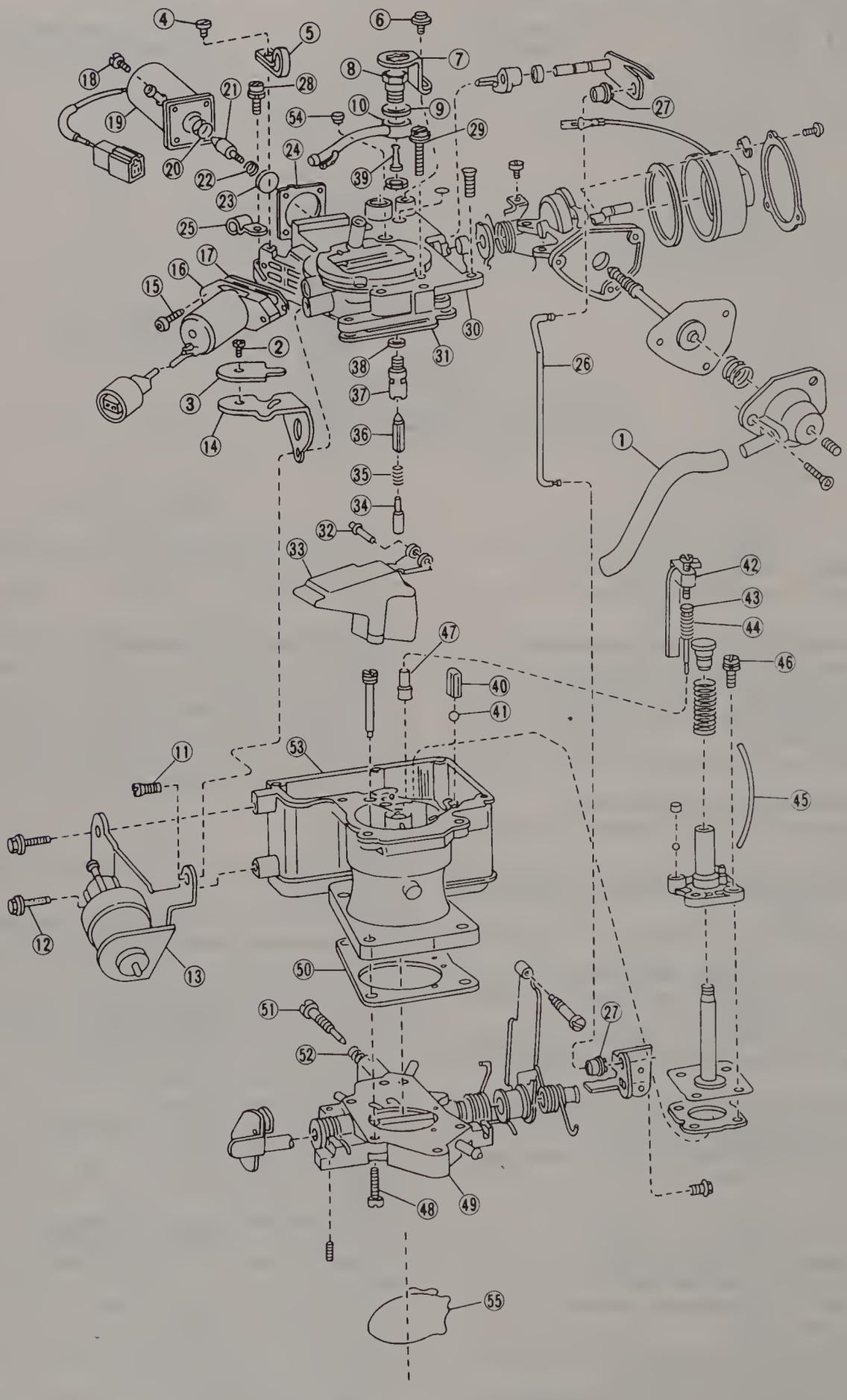
26 Clean all of the parts with clean solvent. Make sure that all of the small passages are free of dirt.

Air horn

27 Inspect the air horn. Check for cracks, damaged mating surfaces, damaged threads and excessive wear of the choke valve shaft contact areas.
28 Inspect the choke valve. Check for deformation and rust.
29 Inspect the choke valve shaft. Check for wear and distortion.
30 Inspect the countershaft. Check for abnormal wear.
31 Inspect the float. Check for deformation, damage to the seat and stopper and wear of the float hinge pin hole.
32 Inspect the fuel inlet needle valve. Check for damage and the correct contact against the seat.
33 Inspect the filter. Check for deformation and damage.
34 Inspect the choke break diaphragm. Check for damage and cracks.
35 Inspect the choke coil.
36 Inspect the accelerator pump cam. Check for cracks, wear and damage.
37 Inspect the modulation bushings and spring. Check for excessive wear and make sure that the parts move freely.
38 Inspect the fast idle cam bushing. Check for excessive wear.

Main body

39 Inspect the body casting. Check for cracks, damaged mating surfaces and damaged threads.
40 Inspect the accelerator discharge weight. Check for damage and wear.
41 Inspect the ball. Check for damage.
42 Inspect the pump and metering rod springs. Check for rust and deformation.
43 Inspect the main jet. Check for damaged threads.
44 Inspect the low speed jet tube. Check for deformation.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45 Inspect the accelerator pump seal and delivery hose. Check for damage and wear.
46 Inspect the lifter link. Check for abnormal wear and warpage.
47 Inspect the accelerator pump diaphragm. Check for correct operation and damage to the rubber seat. Also, check that the diaphragm is working by applying a small amount of vacuum to the pump.

Throttle flange

48 Inspect the flange body. Check for cracks, damaged mating surfaces, wear of the throttle valve shaft hole and damaged threads.
49 Inspect the throttle valve. Check for deformation.
50 Inspect the throttle valve shaft. Check for wear, distortion and thread damage.
51 Inspect the idle mixture adjusting screw. Check for damage on the tip of the screw.
52 Inspect the springs. Check for deformation and rust.

Miscellaneous items

53 Inspect the washers. Check for deformation and damage.
54 Inspect the linkages. Check for wear of each moving part and rust.
55 Inspect the fuel and air passages to make sure they are open.
56 If any parts are rusted, deformed, scratched or cracked, replace them with new ones.

Reassembly

57 Replace the gaskets with new ones.
58 Install the idle mixture screw and spring in the flange.
59 Position the flange on the body casting with the gasket between them and install and tighten the screws.
60 Install the pump housing assembly and the pump hose.
61 Install the main jet.
62 Install the lifter link, the metering rod and the spring.
63 Install the pump discharge check ball and weight.
64 Install the fuel inlet needle seat with the fuel filter and washer.

Fig. 4.10 Carburetor components (Carter/Weber) – exploded view (Sec 13)

1 *Choke vacuum hose*
2 *Fuel line clamp screw (outer)*
3 *Fuel line clamp (outer)*
4 *Fuel line clamp screw (inner)*
5 *Fuel line clamp (inner)*
6 *Banjo lock screw*
7 *Banjo lock*
8 *Banjo fuel bolt*
9 *Banjo gasket*
10 *Banjo fuel line*
11 *Fuel line bracket attaching screw*
12 *Idle stop solenoid attaching screw*
13 *Idle stop solenoid*
14 *Fuel line bracket*
15 *Feedback solenoid attaching screw*
16 *Feedback solenoid*
17 *Feedback solenoid gasket*
18 *Bowl vent solenoid attaching screw*
19 *Bowl vent solenoid*
20 *Bowl vent armature spring*
21 *Bowl vent armature*
22 *Bowl vent armature spring retainer*
23 *Bowl vent valve*
24 *Bowl vent gasket*
25 *Wire support(s)*
26 *Connector rod*
27 *Connector rod bushing*
28 *Air horn attaching screw (short)*
29 *Air horn attaching screw (long)*
30 *Air horn*
31 *Air horn gasket*
32 *Float hinge pin*
33 *Float*
34 *Fuel inlet needle pin*
35 *Fuel inlet needle pin spring*
36 *Fuel inlet needle*
37 *Fuel inlet needle seat*
38 *Fuel inlet needle seat gasket*
39 *Fuel inlet filter*
40 *Pump discharge weight*
41 *Pump discharge check ball*
42 *Lifter link*
43 *Metering rod*
44 *Metering rod spring*
45 *Pump delivery hose*
46 *Pump assembly attaching screw*
47 *Main jet*
48 *Flange attaching screws*
49 *Flange*
50 *Flange gasket*
51 *Idle mixture adjusting screw*
52 *Idle mixture screw spring*
53 *Main body*
54 *Metering rod adjustment hole plug*
55 *Flange O-ring*

65 Install the fuel inlet needle with the spring and the needle pin.
66 Install the float. Check the float adjustment by referring to the appropriate Section in this Chapter.
67 Install the air horn gasket on the air horn.
68 Position the air horn on the body casting and install and tighten the screws.
69 Install the connector rod and the rod bushings.
70 Put the bowl vent armature, the spring retainer and the valve together.
71 Put the spring and bowl vent armature into the bowl vent solenoid.
72 Install the bowl vent solenoid assembly with the gasket.
73 Install the feedback solenoid with the gasket.
74 Install the idle stop solenoid with the fuel line bracket.
75 Position the banjo gasket, the banjo fuel line assembly and the second banjo gasket on the air horn.
76 Put the banjo bolt on the fuel line assembly and tighten it lightly.
77 Install the outer and inner fuel line clamps.
78 Now, tighten the banjo bolt to the specified torque.
79 Install the banjo lock and the choke vacuum hose.
80 Make sure that all of the linkages operate correctly and smoothly.
81 Make the final adjustments by referring to the appropriate Sections in this Chapter.

14 Fast idle (Carter/Weber) – check and adjustment

Refer to Fig. 4.11

Note: *Before you attempt to adjust the fast idle, make sure that the engine idle speed and the idle mixture have been adjusted properly by referring to the appropriate Section in Chapter 1.*

1 Warm up the engine a few minutes to make sure that the automatic choke is fully open. Hook up a tachometer according to the manufacturer's instructions.
2 Engage the fast idle lever with the 3rd cam step.
3 Turn the fast idle adjusting screw until the idle speed is 2000 rpm.

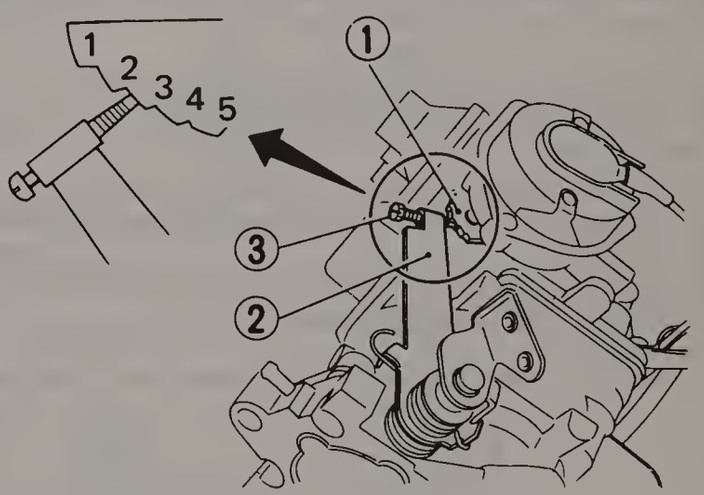


Fig. 4.11 Fast idle adjustment (Carter/Weber) (Sec 14)

1 *Cam*
2 *Fast idle lever*
3 *Fast idle adjusting screw*

15 Float level (Carter/Weber) – check and adjustment

Refer to Fig. 4.12

1 Turn the air horn upside-down to check the float.
2 Measure the distance shown in the accompanying illustration and compare it to the Specifications.
3 If an adjustment is required, bend portion A until the distance is correct.
4 After this check, turn the air horn right-side-up to lower the float.
5 Measure the distance from the lower surface of the air horn to the top end of the float.
6 The measurement should be 1.50 in (38 mm) or more.
7 If an adjustment is required, bend portion B until the distance is

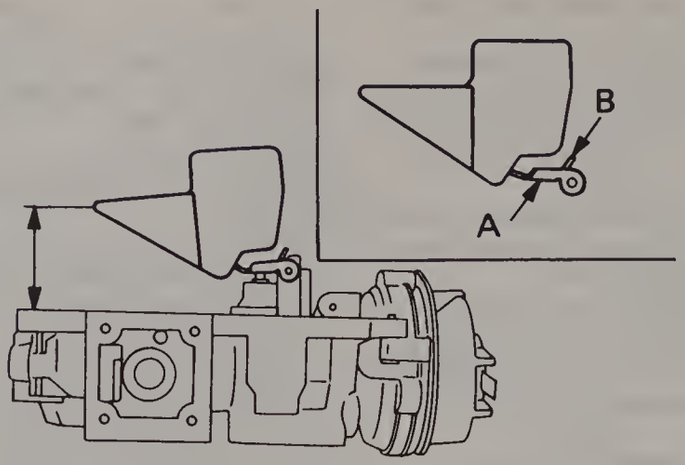


Fig. 4.12 Float level adjustment (Carter/Weber) (Sec 15)

correct. **Note**: *The fuel inlet needle must be free while adjusting the distance. Recheck the first measurement after this adjustment.*

16 Muffler and tailpipe – removal and installation

Refer to Fig. 4.13

1 The tailpipe is actually part of the muffler assembly.
2 Remove the bolts and nuts which connect the muffler to the rear exhaust pipe. **Note**: *If these nuts are rusted, soak them with a penetrating oil before attempting to remove them.*
3 Remove the muffler by disconnecting it from the rubber cushions.
4 Installation is basically the reverse of removal. **Note**: *Be sure to install new mounting nuts and bolts.* Replace the gasket between the muffler and the exhaust pipe with a new one.

17 Exhaust pipe (front) – removal and installation

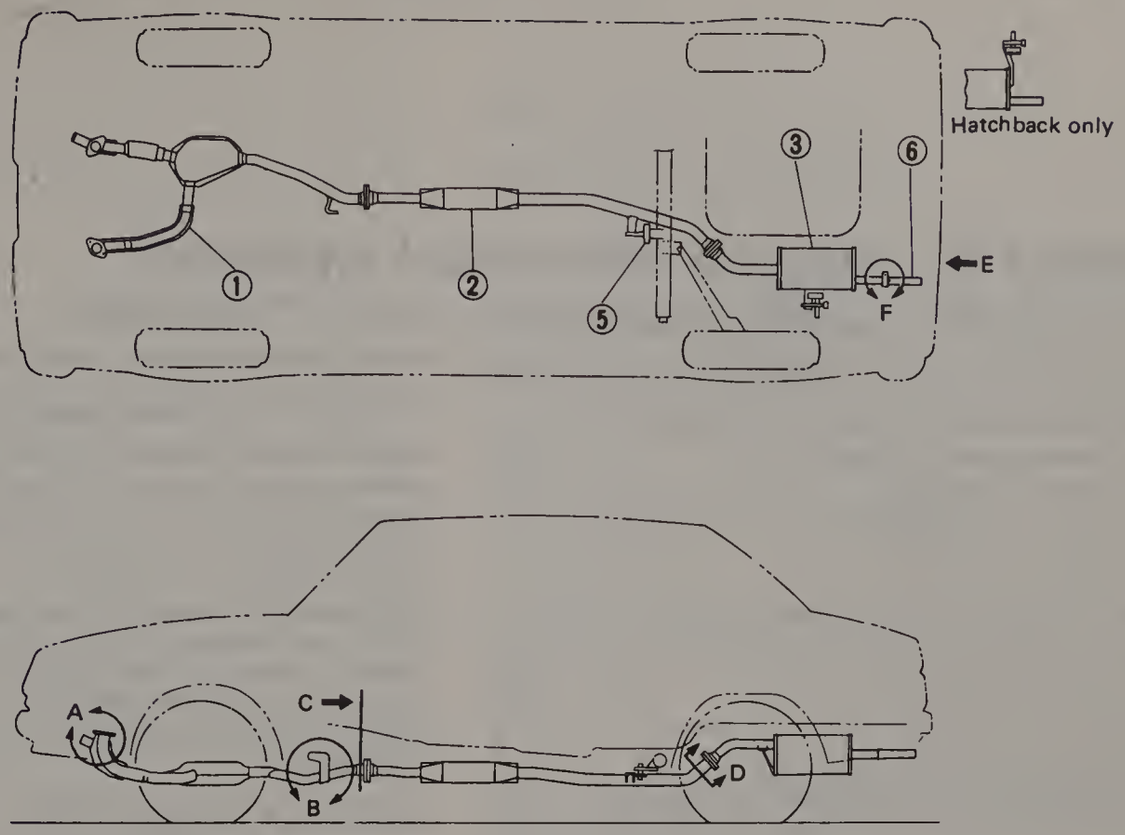
Refer to Fig. 4.13

1 The catalytic converter is built into the front exhaust pipe.
2 Take the cap off the oxygen sensor located at the top-front of the exhaust pipe.
3 Remove the hot air intake hose and the heat shield from the exhaust pipe.
4 Loosen the nuts holding the exhaust pipe to the exhaust ports of the engine.
5 Remove the bolts holding the front exhaust pipe to the rear exhaust pipe. **Note**: *If these bolts are rusted, soak them with penetrating oil before removing them.*
6 Remove the bolt which secures the exhaust pipe to the bracket under the vehicle.
7 Support the front exhaust pipe with your hand and remove the pipe-to-engine mounting bolts.
8 Remove the exhaust pipe from the vehicle. **Note**: *Be careful not to strike or otherwise damage the oxygen sensor.*
9 Installation is the reverse of the removal procedure. **Note**: *Be sure to install new mounting bolts.* Replace the gaskets with new ones, making sure that the gaskets between the exhaust pipe and the engine are installed with the flat surface towards the engine.
10 Make sure that all of the mounting hardware is tightened according to the Torque specifications.

18 Exhaust pipe (rear) – removal and installation

Refer to Fig. 4.13

1 Remove the bolts and nuts holding the rear exhaust pipe to the front exhaust pipe and to the tailpipe. **Note**: *If the nuts and bolts are rusted, soak them with penetrating oil before attempting to remove them.*
2 Disconnect the exhaust pipe from the rubber cushion and remove the pipe from the vehicle.
3 Installation is the reverse of removal. **Note**: *Be sure to install new nuts and bolts.* Replace the gaskets with new ones.
4 Make sure that all of the mounting hardware is tightened according to the Torque specifications.



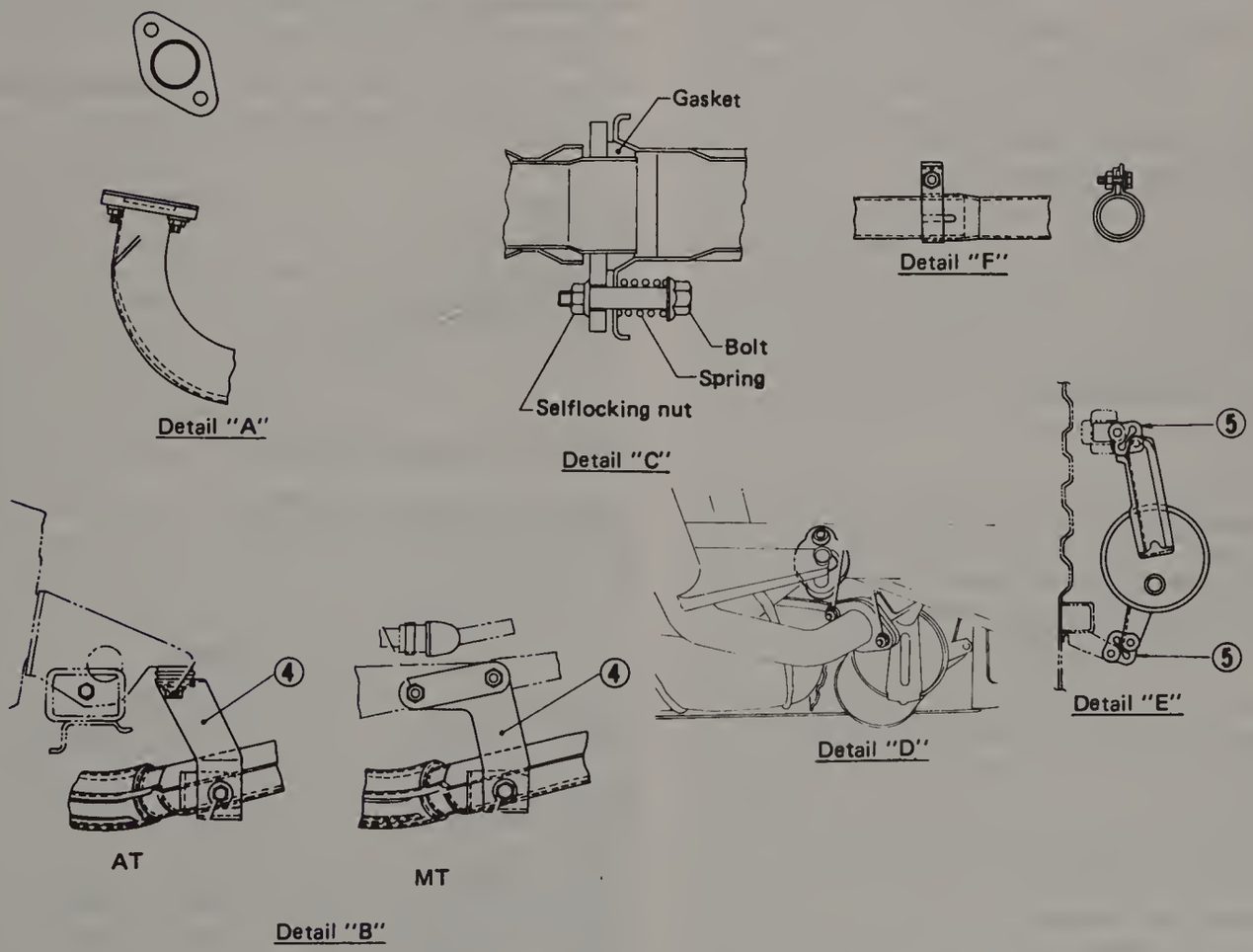


Fig. 4.13 Exhaust system components (Sec 16)

1 *Front exhaust pipe*
2 *Rear exhaust pipe*
3 *Muffler*
4 *Bracket*
5 *Cushion*
6 *Tail pipe cutter*

Chapter 5 Engine electrical systems

Refer to Chapter 13 for specifications applicable to 1984 thru 1988 models

Contents

Specifications

Ignition system (breaker point)

Point gap	See Chapter 1
Dwell	See Chapter 1
Ignition coil resistance	
Primary	1.35 to 1.65 ohms
Secondary	6.5 to 12.5 K ohms
Distributor shaft end play	0.039 in (1.0 mm) maximum

Ignition system (electronic)

Distributor air gap	
ND distributor	0.008 to 0.016 in (0.2 to 0.4 mm)
Hitachi distributor	
1980	0.012 to 0.016 in (0.3 to 0.4 mm)
1981 through 1983	0.012 to 0.020 in (0.3 to 0.5 mm)
Pick-up coil resistance	
ND distributor	130 to 190 ohms
Hitachi distributor	600 to 850 ohms

Ignition coil resistance (USA models)

	ND	Hitachi
1980		
Primary	1.33 to 1.63 ohms	1.17 to 1.43 ohms
Secondary	12600 to 15400 ohms	7800 to 11600 ohms
1981		
Primary	1.06 to 1.30 ohms	1.04 to 1.27 ohms
Secondary	12150 to 14850 ohms	7360 to 11040 ohms
1982 and 1983		
Primary	1.13 to 1.38 ohms	1.04 to 1.27 ohms
Secondary	10795 to 14605 ohms	7360 to 11040 ohms

Ignition coil resistance (UK models)	
Primary	1.035 to 1.265 ohms
Secondary	7098 to 9603 ohms
Distributor shaft end play (ND distributor)	
1980 and 1981	0.006 to 0.019 in (0.15 to 0.5 mm)
1982 and 1983	0.0039 to 0.0118 in (0.1 to 0.3 mm)

Charging system

Battery electrolyte specific gravity	See Chapter 1
Drivebelt tension	See Chapter 1

Voltage regulator settings (external regulator)	
Standard core gap	
Voltage coil	0.024 to 0.039 in (0.6 to 1.0 mm)
Charge relay	0.031 to 0.039 in (0.8 to 1.0 mm)
Standard point gap	
Voltage coil	0.014 to 0.018 in (0.35 to 0.45 mm)
Charge relay	0.016 to 0.024 in (0.4 to 0.6 mm)

1 General information

The ignition, starting and charging systems are all part of what is commonly known as the engine electrical system. Their functions and components are often interrelated.

The ignition system is designed to ignite the fuel/air charge entering the cylinders at just the right moment. It does so by producing a high-voltage electrical spark between the electrodes of the spark plugs. The timing of the spark (when it occurs in the engine cycle) is automatically varied to meet the requirements of engine load and speed.

The ignition system consists of a switch, an ignition coil, a distributor, an electronic control unit and the spark plugs and wires.

The starting system consists of a switch, a solenoid, a starter motor, the battery cables and wiring and the battery.

The charging system consists of the alternator, a voltage regulator and the connecting wires.

2 Booster battery (jump) starting procedure

1 If the vehicle will not start because the starter does not operate or barely turns over, suspect a discharged battery. Remove and clean the battery cables (see Chapter 1), reconnect them and try to start the engine again. If the headlights do not work, or dim when the starter is operated, or the radio does not work, the problem is a dead battery. If the lights shine brightly when the starter is operated, the problem is in the starter motor or its wiring.

2 A vehicle with a dead battery can usually be started using a set of jumper cables and a second vehicle that is operating. Make sure both vehicles have 12-volt batteries (which have six filler holes; 6-volt batteries have three filler holes). Your eyes should be shielded; safety goggles are a good idea. Before connecting the batteries, make sure that the ignition switch is in the Off position.

3 If possible, bring both vehicles nose-to-nose and open the hoods. Position the vehicles so the batteries are as close to one another as possible. **Do not allow the vehicles to touch.**

4 Set both parking brakes. Put manual transmissions in Neutral and automatics in Park.

5 Remove the vent caps (if equipped) from both batteries and allow any built-up gases to escape. Cover the vent holes with clean rags.

6 Determine which of the battery posts in each vehicle is the positive terminal. The positive post is generally larger than the negative post; it may be marked with a plus sign (+) or Pos.

7 Attach the *red* jumper cable to the positive terminals of both batteries (first to the good battery and then to the dead one).

8 The other battery post in each vehicle is the negative one. If the posts have different diameters, the negative one will be smaller. It may be marked with a minus sign (-) or Neg.

9 Attach one end of the *black* cable to the negative terminal of the *good* battery. Attach the other end to a good ground on the *dead* vehicle, such as an unpainted bolt or flange on the engine or chassis.

10 Make sure all hands and cables are clear of the fans and other moving parts on both vehicles. Then, start the engine of the vehicle with the good battery and have an assistant accelerate it moderately.

11 Attempt to start the second engine. If it will not start, check for additional problems in the ignition and fuel systems.

12 If the 'dead' engine now starts, keep it running and carefully remove the cables in the opposite order in which they were attached *(black* cable from the dead vehicle, then from the good one; *red* cable from the dead vehicle, then from the good one).

13 Replace the vent caps and discard the rags.

14 Drive the formerly stalled vehicle for at least 30 minutes to recharge its battery. If this problem recurs, refer to Chapter 1 or replace the battery with a new one.

3 Ignition system (breaker point) – on vehicle test

Note: *You will need a multimeter for some of the following tests.*

1 Some problems you may run into with a defective ignition system include poor engine performance due to incorrect ignition timing or misfiring and hard engine starting due to defective ignition components.

2 The last problem is the most difficult to find the cause of and correct. The first thing to check is the spark.

Secondary circuit

3 Disconnect the wire from one of the spark plugs and remove the plug from the engine. Reattach the wire securely to the plug and hold it against the engine while an assistant operates the starter. Do this with each plug.

4 If all of the spark plugs fired, the ignition system is operating properly.

5 If *none* of the plugs fired, proceed to Step 6. If *some* of the plugs fired, check the condition of the plugs and set the gaps. Replace them with new ones (as a set) if necessary. If replacing the plugs makes no difference, proceed to Step 6.

6 Pull the high tension wire (distributor-to-ignition coil) out of the distributor cap. Hold the wire approximately $\frac{1}{4}$ in (6 mm) from the engine while an assistant operates the starter.

7 If a bright blue spark occurs, check the condition of the distributor cap, the rotor and the plug wires. Replace them with new parts if necessary.

8 If no spark is produced, check the condition of the high tension wire between the distributor cap and ignition coil. Replace it with a new one if necessary.

9 If replacing the high tension wire made no difference, check the ignition coil cap for cracks and carbon tracks and ensure the primary wire connections are clean and tight. Also, check the resistance in the primary and secondary coils and compare the readings with the Specifications. Replace the coil with a new one if necessary.

10 If everything checks out to this point and/or replacing the ignition coil made no improvements, check the primary circuit.

Primary circuit

11 Locate the wire lead at the primary terminal on the distributor body. Turn the ignition switch to the On position and measure the voltage at the terminal. It should be battery voltage (12 volts).

12 If you measured 12 volts, proceed to Steps 13 and 14. If you did not measure 12 volts, proceed to Step 15.

13 Check the distributor breaker points. Clean and adjust them or replace them with new ones (Chapter 1). **Note:** *Whenever you replace the points, also replace the condenser.*

14 If replacing the points and condenser made no improvements, remove and check the internal wire lead (distributor primary terminal-to-breaker points) for an open or short. Replace it with a new one if necessary.

15 Disconnect the primary terminal wire lead on the distributor body and turn the ignition switch to the On position. Measure the voltage at the negative (-) terminal of the ignition coil. It should be battery voltage.

16 If you measured 12 volts, check the wire between the negative terminal of the coil and the primary terminal of the distributor for an open or short. Repair or replace it with a new one if necessary.

17 If you did not measure 12 volts, measure the voltage at the positive (+) terminal of the ignition coil. It should be battery voltage.

18 If you measured 12 volts at the positive terminal, replace the coil with a new one.

19 If you did not measure 12 volts, measure the voltage at both ends of the coil external resistor. It should be battery voltage.

20 If you measured 12 volts at both ends, check the wiring harness

from the resistor to the positive (+) terminal of the coil for a broken wire. Repair or replace it with a new one if necessary.
21 If you did not measure 12 volts at either end, check the wiring harness from the battery to the resistor, the connector, the ignition switch and the fuse. Repair or replace components as needed.
22 If you measured 12 volts at one end only, disconnect the wire from the resistor terminal where no voltage existed and measure the voltage of the resistor. It should be battery voltage.
23 If you measured 12 volts, check the wiring harness from the resistor to the ignition coil for a short circuit. Repair or replace it with a new one if necessary.
24 If you did not measure 12 volts, replace the resistor with a new one.
25 Make sure that all of the connections are secure and all mounting hardware is tight.

4 Electronic ignition system (2WD – 1980 and 1981) – on vehicle test

Note: *You will need a multimeter for some of the following tests.*
1 Some problems you may run into with a defective ignition system include poor engine performance due to incorrect ignition timing or misfiring and hard engine starting due to defective ignition components.
2 The last problem is the most difficult to find the cause of and correct. The first thing to check is the spark.

Secondary circuit
3 To check the secondary ignition circuit, follow the procedure outlined in Steps 3 through 10 of Section 3 in this Chapter.

Primary circuit
4 Turn the ignition switch to the On position. Measure the voltage at both ends of the ignition coil resistor. One end of the resistor should measure battery voltage (12 volts) and the other end should measure half of that (6 volts).
5 If you do measure 12 and 6 volts, proceed to Step 18. If you do not measure 12 and 6 volts, proceed to Step 6, 7 or 10 as indicated.
6 If you did not measure any voltage at either end of the resistor, check the wiring harness, the connector, the ignition switch and the fuse, between the battery and the resistor, for broken wires, and short circuits. Repair or replace the defective item with a new one if necessary.
7 If you measured voltage at only one end of the resistor, turn the ignition switch to the On position. Disconnect the wire lead from the resistor terminal that measured no voltage. Check the resistor terminal for voltage.
8 If you still measure no voltage, replace the resistor with a new one.
9 If you now measure voltage, check the wiring harness between the resistor and the positive terminal of the ignition coil for a short circuit. Repair or replace the wire with a new one if necessary.
10 If voltage exists (Step 4) but the readings are not 6 and 12 volts, turn the ignition switch to the On position. Check the voltage at the negative terminal of the ignition coil. It should be battery voltage.
11 If you did not measure 12 volts, proceed to Step 15. If you did measure 12 volts, proceed to Step 12.
12 Turn the ignition switch to the Off position. Measure the resistance between a good ground and the ignition control unit.
13 If you measured 0.5 ohms or more, check the ground circuit for the control unit (make sure the connections are clean and tight).
14 If you measured less than 0.5 ohms, refer to the appropriate Section in this Chapter and check the ignition control unit.
15 With the ignition switch in the On position, check the voltage at the positive terminal of the ignition coil. It should be battery voltage.
16 If you did measure 12 volts, check the wiring harness between the resistor and the positive terminal of the coil for a broken wire or a bad connection. Repair or replace the wire with a new one if necessary.
17 If you did not measure 12 volts, replace the ignition coil with a new one.
18 With the ignition switch in the On position, measure the voltage at the negative terminal of the ignition coil.
19 If you measured no voltage or it reads less than 0.5 volts, proceed to Step 20. If you measured 0.5 volts, proceed to Step 22.
20 Check the wiring harness from the negative terminal of the coil for a short circuit or a loose wire at the coil. Tighten the wire connection if necessary.
21 If you still have a problem, refer to the appropriate Section in this Chapter and check the ignition control unit.
22 Turn the ignition switch to the Off position. Disconnect the distributor three wire connector and measure the resistance between the (distributor side) No. 1 (pink) and No. 2 (white) wire terminals. It should be between 130 and 190 ohms.
23 If the resistance is not within this range, replace the pick-up coil with a new one.
24 If the resistance is within this range, make sure the ignition switch is in the Off position, then check the air gap (Section 9) and compare your measurements to the Specifications.
25 If the air gap does not agree with the Specifications, adjust the gap.
26 If the gap does agree with the Specifications, refer to the appropriate Section in this Chapter and check the ignition control unit.

5 Electronic ignition system (4WD – 1980 and 1981) – on vehicle test

Note: *You will need a multimeter for some of the following tests.*
1 Some problems you may run into with a defective ignition system include poor engine performance due to incorrect ignition timing or misfiring and hard engine starting due to defective ignition components.
2 The last problem is the most difficult to find the cause of and correct. The first thing to check is the spark.

Secondary circuit
3 To check the secondary ignition circuit, follow the procedure outlined in Steps 3 through 10 of Section 3 in this Chapter.

Primary circuit
4 Turn the ignition switch to the On position. Check the voltage at the negative terminal of the ignition coil. It should be battery voltage (12 volts).
5 If you did measure 12 volts, proceed to Step 13. If you did not measure 12 volts, proceed to Step 6.
6 With the ignition switch in the On position, measure the voltage at the coil positive terminal. It should be battery voltage.
7 If you did not measure 12 volts, check the wiring between the ignition switch, the positive terminal of the coil, the wiring to the battery and the fuse for a broken wire or a bad connection. Repair or replace the wire with a new one if necessary.
8 If you did measure 12 volts, disconnect the wire lead from the negative terminal of the coil to the control unit. With the ignition switch in the On position, measure the voltage at the coil negative terminal. The voltage should be equal to battery voltage.
9 If you did measure 12 volts, replace the defective control unit with a new one. If you did not measure 12 volts, proceed to Step 10.
10 If you have a tachometer, disconnect the wire lead to the tachometer and turn the ignition switch to the On position. Check the voltage at the negative terminal of the coil. It should be battery voltage.
11 If you did not measure 12 volts, replace the ignition control unit with a new one.
12 If you did measure 12 volts, check the wiring from the negative terminal of the coil to the tachometer for a short circuit or a broken wire. Repair or replace the wire with a new one if necessary.
13 Turn the ignition switch to the Off position. Disconnect the two wire connector and measure the resistance between the connector terminals (distributor side).
14 If the resistance measured was not between 600 and 850 ohms, replace the pick-up coil with a new one.
15 If you measured between 600 and 850 ohms, measure the resistance between a good ground and the ignition control unit.
16 If you measured 0.5 ohms or more, check the ground connection and make sure it is clean and tight.
17 If you measured less than 0.5 ohms, make sure the ignition switch is in the Off position and check the air gap (Section 9). Compare your measurement to the Specifications and if it is outside the Specifications, adjust the gap.
18 If the measurement was within the Specifications, refer to the appropriate Section in this Chapter and check the ignition control unit.

6 Electronic ignition system (1982 and 1983) – on vehicle test

Note: *You will need a multimeter for some of the following tests.*

1 Some problems you may run into with a defective ignition system include poor engine performance due to incorrect ignition timing or misfiring and hard engine starting due to defective ignition components.

2 The last problem is the most difficult to find the cause of and correct. The first thing to check is the spark.

Secondary circuit

3 Pull the high tension wire (distributor-to-ignition coil) out of the distributor cap. Hold the wire approximately $\frac{1}{4}$ in (6 mm) from the engine while an assistant operates the starter.

4 If a spark occurs, proceed to Step 8. If no spark occurs proceed to Step 5.

5 Check the condition of the high tension wire. Replace it with a new one if necessary.

6 If replacing the high tension wire made no difference, check the ignition coil cap for cracks and carbon tracks. Also, check the resistance in the primary and secondary coils and compare the readings to the Specifications. Replace it with a new one if necessary.

7 If replacing the ignition coil made no improvement, check the primary circuit by proceeding to Step 13.

8 Reinstall the high tension wire in the distributor and disconnect the wire from one of the spark plugs. Attach the plug wire to a new spark plug and hold it against the engine while an assistant operates the starter. Do this with each plug wire.

9 If the plug fired each time, proceed to Step 12. If not, proceed to Steps 10 and 11.

10 Check the distributor cap and rotor (Chapter 1). Replace them with new parts if necessary.

11 Check the spark plug wires as described in Chapter 1. Replace them with new ones if necessary.

12 Remove the old plugs from the engine and check the gap and the condition of each plug. Replace them (as a set) with new ones if necessary.

Primary circuit

13 Turn the ignition switch to the On position. Measure the voltage at the negative (-) terminal of the ignition coil. It should be approximately battery voltage (12 volts).

14 If you measured 12 volts, proceed to Step 23. If you did not measure 12 volts, proceed to Steps 15 through 22.

15 Measure the voltage at the positive (+) terminal of the coil. It should be approximately battery voltage.

16 If you measured 12 volts, proceed to Steps 18 through 22. If you did not measure 12 volts, proceed to Step 17.

17 Check the power supply harness, the fuse and the noise suppressor condenser for open and short circuits. Repair or replace them with new ones if necessary.

18 Turn the ignition switch to the Off position. Disconnect the distributor wire from the negative terminal of the coil. Turn the ignition switch to the On position and measure the voltage at the negative coil terminal. It should be approximately battery voltage.

19 If you measured 12 volts, proceed to Step 20. If you did not measure 12 volts, proceed to Steps 21 and 22.

20 You have a faulty control unit or a short/open circuit in the wire between the control unit and the distributor. Repair or replace them with new ones if necessary.

21 Disconnect the tachometer wire from the negative coil terminal. Turn the ignition switch to the On position and measure the voltage at the negative terminal of the coil. It should be approximately battery voltage.

22 If you did not measure 12 volts, replace the ignition coil with a new one. If you did measure 12 volts, check the tachometer circuit for a short.

23 Turn the ignition switch to the Off position. Check the air gap (Section 9) and compare it to the Specifications.

24 If the gap does not agree with the Specifications, adjust it.

25 If the gap is within the specified limits, disconnect all of the wires from the terminals of the coil. Check the resistance of the primary coil and compare it to the Specifications.

26 If the resistance does not agree with the Specifications, replace the coil with a new one.

27 If the resistance is within the specified limit, refer to Step 20.

28 Make sure that all of the connections are secure and that all mounting hardware is tight.

7 Ignition coil – check and replacement

1 Mark the wires and terminals with pieces of numbered tape, then remove the primary wires and high-tension wire from the coil.

2 Remove the coil from its mount, clean the outer case and check it for cracks and other damage.

3 Clean the primary coil terminals and check the coil tower terminal for corrosion. Clean it with a wire brush if any corrosion is found.

4 Check the primary coil resistance by attaching the leads of an ohmmeter to the positive and negative primary terminals. Compare the measured resistance to the Specifications.

5 Check the secondary coil resistance by hooking one of the ohmmeter leads to one of the primary terminals and the other ohmmeter lead to the high-tension coil tower terminal. Compare the measured resistance to the Specifications.

6 If the measured resistances are not as specified, the coil is probably defective and should be replaced with a new one.

7 It is essential for proper ignition system operation that all coil terminals and wire leads be kept clean and dry.

8 Install the coil in the vehicle and hook up the wires.

8 Ignition control unit (external) – check and replacement

Note: *You will need a battery of between 1 and 6 volts and some jumper wires to perform this test.*

1 With the ignition switch in the Off position, disconnect the two wire (2WD) or the three wire (4WD) connector.

2 Disconnect the high tension wire that runs between the distributor and the ignition coil from the distributor.

3 Turn the ignition switch to the On position and have an assistant hold the high tension wire approximately $\frac{1}{4}$ in (6 mm) from the engine.

4 Attach wires to the extra battery (not the vehicle battery) and intermittently apply voltage to the following terminals of the connector leading to the control unit in the distributor.

2WD vehicle – No. 1 (pink) and No. 2 (white)
4WD vehicle – No. 1 (red) and No. 2 (blue)

5 If sparks jump from the high tension wire as the small voltage is applied, the ignition system should be considered good.

6 If sparks do not jump from the wire, replace the ignition control unit with a new one.

9 Distributor air gap – adjustment

Refer to Figs. 5.1 and 5.2

1 Remove the distributor cap and the rotor. Leave the wires attached to the distributor cap but position it out of the way.

2 Use a wrench on the large bolt at the front of the crankshaft and turn the engine over until the distance between the reluctor tangs and the pick-up coil core (or stator) is at its minimum.

3 Measure this distance with a feeler gauge and compare it with the Specifications.

4 Any adjustments can be made by loosening the mounting screws and repositioning the coil (or stator) until the specified gap is achieved.

5 Make sure that the mounting screws are tight and then recheck the gap to make sure that it did not change.

6 Install the rotor and the distributor cap.

10 Distributor – removal and installation

1 Disconnect the negative battery cable from the battery. Unplug the wiring harness from the distributor (or remove the primary wire lead) and remove the distributor cap.

2 Disconnect the vacuum hose from the vacuum advance unit on the distributor.

3 Pull the spark plug wires off the spark plugs. Pull only on the rubber boot or damage to the spark plug wire could result.

4 Remove the spark plugs and the timing mark access hole cover,

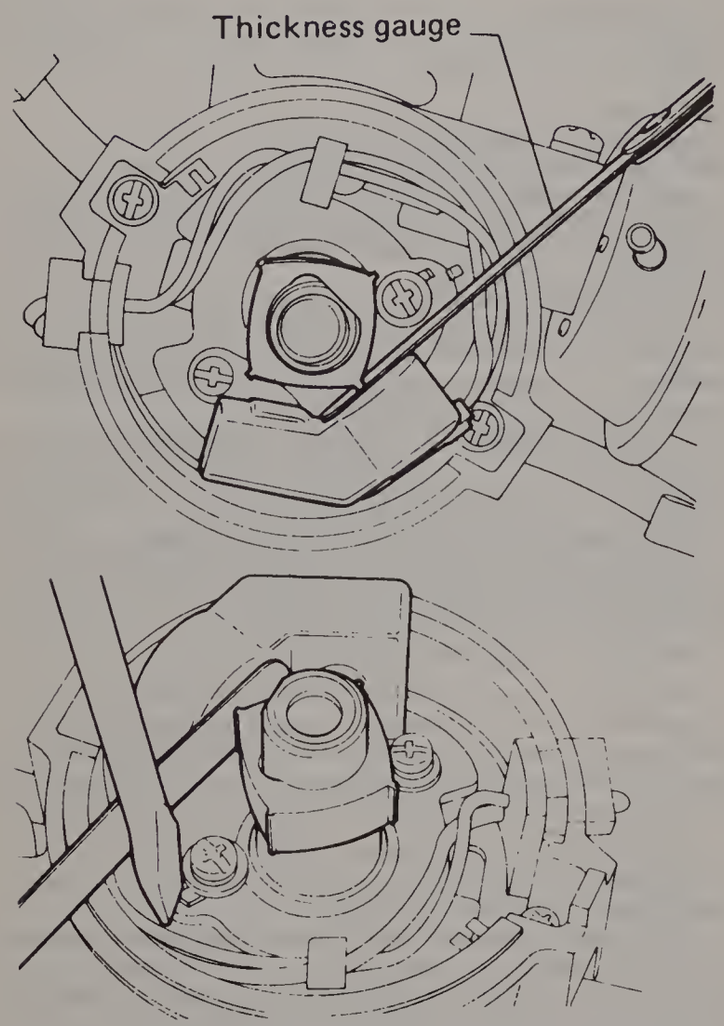


Fig. 5.1 Adjusting the pick-up coil air gap (ND and early Hitachi) (Sec 9)

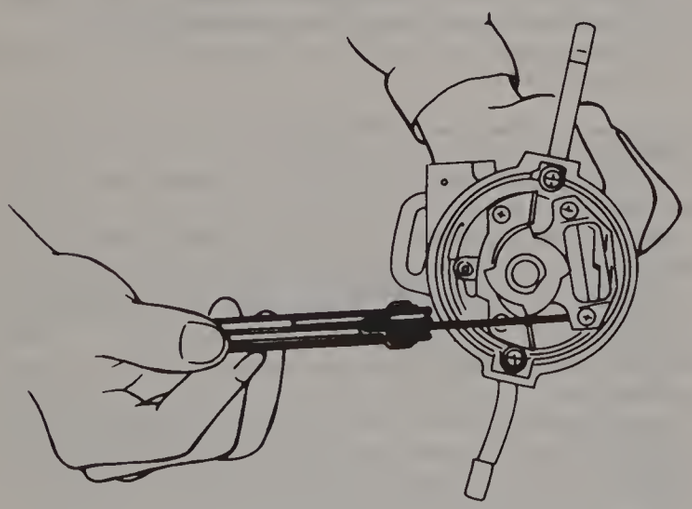


Fig. 5.2 Adjusting the stator air gap (late Hitachi) (Sec 9)

then place your thumb over the No. 1 spark plug hole and turn the crankshaft in a clockwise direction (looking at it from the front) until you can feel the compression pressure in the No. 1 cylinder. Continue to slowly turn the crankshaft until the flywheel notch in the pointer lines up with the O on the flywheel housing. At this point, the No. 1 piston is at TDC on the compression stroke.

5 Mark the distributor body directly opposite and in-line with the rotor terminal. Scribe a line across the distributor hold-down flange and the engine as well.

6 Remove the distributor hold-down bolt and pull straight out on the distributor. Remove the O-ring.

7 Do not allow the engine to be cranked until the distributor has been reinstalled.

8 To install the distributor, position the rotor opposite the mark on the distributor body and align the marks on the hold down flange and engine. As the distributor is slipped into place, the shaft may rotate slightly as the gears engage. With the scribed lines on the hold down flange and engine perfectly aligned, the rotor should point directly at the mark made during removal. If it does not, the drivegear may be one tooth off. Make sure the distributor is completely seated, then install the bolt and tighten it finger tight.

9 Replace the spark plugs and install the plug wires.

10 Install the distributor cap, plug in the distributor wiring harness (or connect the primary wire lead) and connect the vacuum hose to the vacuum advance unit.

11 Connect the negative battery cable to the battery and check the ignition timing as described in Chapter 1. Don't forget to tighten the distributor hold-down bolt securely when finished.

11 Distributor (breaker point) – disassembly and reassembly

Refer to Figs. 5.3 and 5.4

1 Remove the distributor cap, rotor, dust cover and dust cover packing (if equipped).

2 Loosen the screw and remove the terminal and terminal insulator.

3 Remove the two mounting screws and lift out the contact points.

4 Remove the circlip, mounting screw, condenser and vacuum advance unit.

5 Remove the two screws securing the contact point breaker plate and lift out the plate. Remove the advance springs (take care not to open the spring end too wide).

6 Remove the point cam securing screw and remove the cam from the distributor shaft.

7 Drill the end of the drivegear roll pin, to remove the staking, then tap out the pin and remove the gear from the shaft.

8 Pull the shaft from the housing and remove the washers and advance weights.

9 Clean all the disassembled parts and inspect them for damage and wear. Check the diaphragm of the vacuum advance unit by applying a vacuum to the port; the plunger should retract and remain in as long

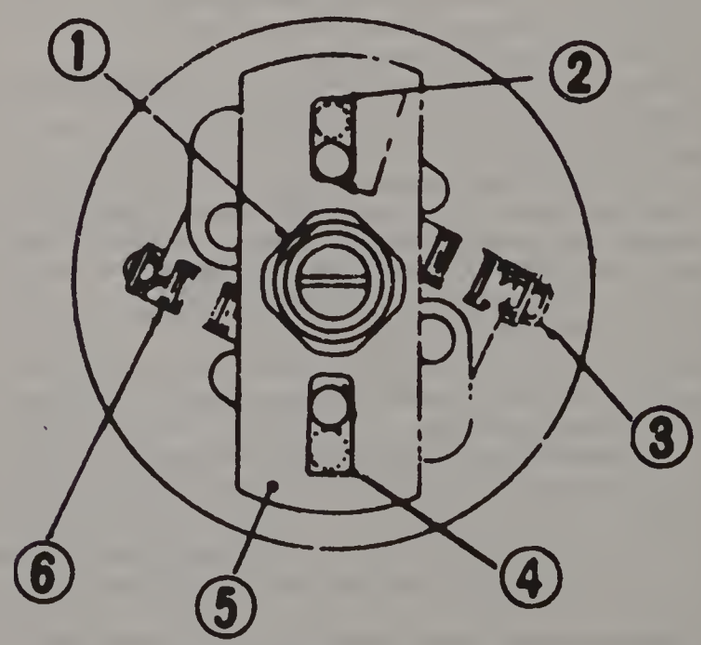


Fig. 5.3 Cam and advance spring component positions – breaker point distributor (Sec 11)

1 Locating notch
2 Short square hole
3 Spring (oblong hook)
4 Long square hole
5 Cam plate
6 Spring (round hook)

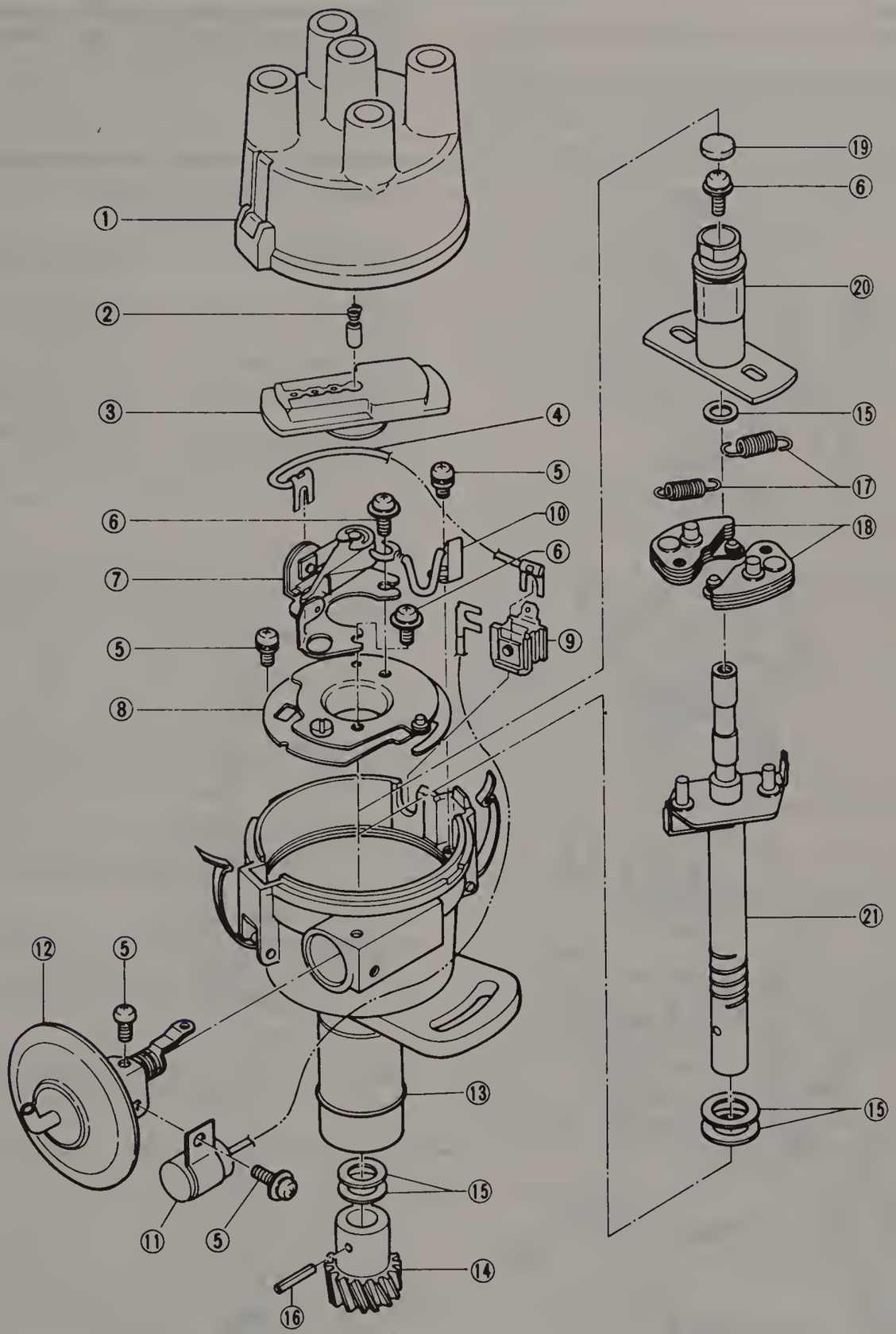


Fig. 5.4 Distributor components (breaker points) – exploded view (Sec 11)

1 *Distributor cap*
2 *Carbon contact*
3 *Rotor*
4 *Wire lead*
5 *Screw*
6 *Contact point mounting screw*
7 *Contact point set*
8 *Contact point breaker plate*
9 *Terminal*
10 *Ground wire*
11 *Condenser*
12 *Vacuum advance unit*
13 *O-ring*
14 *Drive gear*
15 *Washer*
16 *Roll pin*
17 *Advance spring*
18 *Advance weight*
19 *Packing*
20 *Point cam*
21 *Distributor shaft*

as vacuum is applied.

10 Refer to Section 19 in Chapter 1 and inspect the distributor cap and rotor.

11 Reassembly is the reverse of disassembly. Be sure to lubricate the advance weight pivots and the distributor shaft before installing them. Check the shaft end play. If it is excessive, thicker washers must be used.

12 After assembly, check the operation of the mechanical advance by holding the gear and turning the rotor. When the rotor is released it must return freely to its original position.

13 Refer to Section 49 in Chapter 1 and install a new set of points after the distributor is in place on the engine.

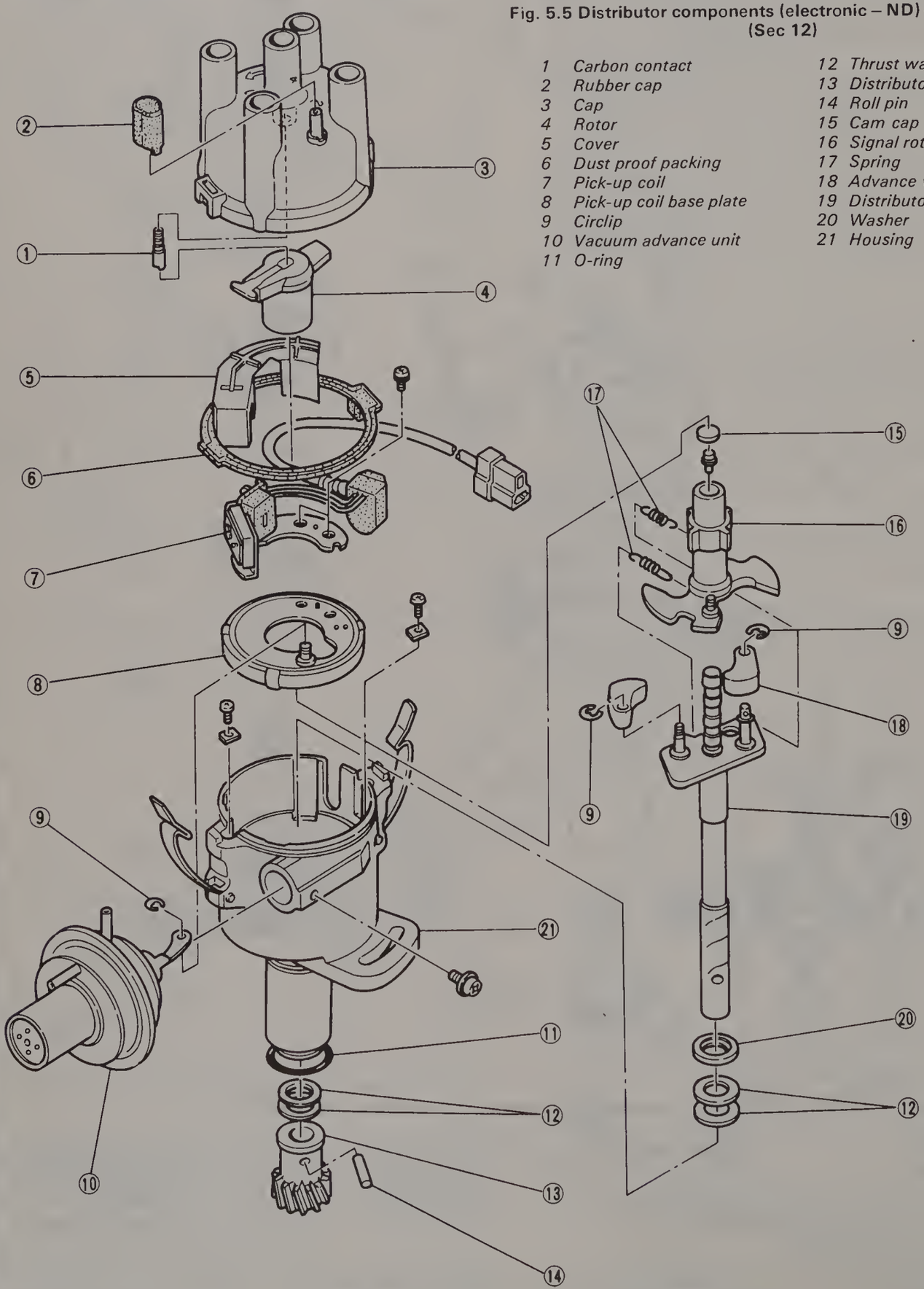


Fig. 5.5 Distributor components (electronic – ND) – exploded view (Sec 12)

1 *Carbon contact*
2 *Rubber cap*
3 *Cap*
4 *Rotor*
5 *Cover*
6 *Dust proof packing*
7 *Pick-up coil*
8 *Pick-up coil base plate*
9 *Circlip*
10 *Vacuum advance unit*
11 *O-ring*
12 *Thrust washer*
13 *Distributor drive gear*
14 *Roll pin*
15 *Cam cap*
16 *Signal rotor*
17 *Spring*
18 *Advance weight*
19 *Distributor shaft*
20 *Washer*
21 *Housing*

12 Distributor (electronic – ND) – disassembly and reassembly

Refer to Fig. 5.5

1 Remove the cap, rotor, cover and dust proof packing.
2 Remove the pick-up coil mounting screws and remove the coil. Remove the vacuum advance unit circlip and mounting screw, pull on the vacuum unit and turn it clockwise about 90° to remove it.
3 Remove the two screws and lift the pick-up base out of the housing.
4 Drill the end of the drive gear roll pin to remove the staking (if applicable) then tap out the pin and remove the gear and thrust washers.
5 Remove the distributor shaft from the housing and detach the governor springs with long nosed pliers. Take care not to open the spring end too wide.
6 Disassemble the advance weights by removing the circlips. Remove the cam cap and screw, then remove the advance cam and signal rotor from the shaft.
7 Clean all the disassembled parts and check for damage and wear. Check the diaphragm in the vacuum advance unit and the cap and rotor as described for the breaker type distributor (Section 11).
8 Assembly is the reverse of disassembly. However, pay attention to the following:

a) When rejoining the signal rotor and distributor shaft, make sure the 15.5 (early models) or the 11.0 (later models) stamped into the signal rotor cam plate is visible through the hole in the shaft flange. Lubricate the inside of the signal rotor before slipping it over the shaft (use high melting point grease if available).
b) Lubricate the distributor shaft before installing it in the housing.
c) Make sure the shaft end play is as specified. If not, different size thrust washers should be installed.
d) When installing the pick-up coil base plate, align the clips with the grooves in the housing.
e) Adjust the air gap (Section 9).

9 After assembly, check the operation of the mechanical advance by holding the gear and turning the rotor. When the rotor is released it must return freely to its original position.

13 Distributor (electronic – Hitachi) – disassembly and reassembly

Refer to Figs. 5.6 through 5.9

Early models

1 Remove the cap and rotor.
2 Remove the clamp holding the leads on the inside and outside of the housing and the pick-up coil securing screws and lift out the pick-up coil.
3 Remove the vacuum advance unit.
4 Drive out the pin securing the gear, then remove the gear and thrust washer.
5 Remove the securing screws and withdraw the reluctor and shaft assembly.
6 Remove the cap from the end of the reluctor, then remove the screw and separate the reluctor from the distributor shaft.
7 Mark the parts so they can be reinstalled in the same positions, then separate the advance weights and springs from the shaft.
8 Clean all the disassembled parts and check for damage and wear. Check the diaphragm in the vacuum advance unit and the cap and rotor as described in Section 11.
9 Reassembly is the reverse of disassembly. When installing the advance weights and springs, refer to Fig. 5.3. When installing the gear, align the flat on the reluctor assembly with pole piece B on the pick-up coil, then align mark A on the gear with the notch in the lower end of the housing and install the roll pin (see Fig. 5.6).
10 Refer to Section 9 and adjust the air gap.
11 Check the mechanical advance as described in Section 12, Step 9.

Late models

12 Remove the cap and rotor.
13 Disconnect the wires from the control unit terminals and separate the wires from the housing by removing the clamp screw.
14 Remove the screws and separate the vacuum advance unit from the distributor.
15 Remove the screws and separate the magnet and stator from the pick-up coil plate.
16 Using two screwdrivers as levers, very carefully pry the reluctor off the shaft.
17 Remove the screws and separate the pick-up coil and control unit from the pick-up coil plate.
18 Drive out the roll pin and separate the gear and thrust washers from the shaft.
19 Remove the screws and separate the pick-up coil plate and shaft from the housing.
20 Lift off the pick-up coil plate, then remove the packing and screw from the upper end of the shaft and separate the reluctor shaft from the distributor shaft.
21 Mark the parts to ensure correct installation, then remove the advance weights and springs.
22 Clean all the disassembled parts and check for damage and wear. Check the diaphragm in the vacuum advance unit and the cap and rotor as described in Section 11.
23 Reassembly is the reverse of disassembly. When installing the pick-up coil plate, align the notch in the plate with the groove in the housing before tightening the screws (see accompanying illustration). When installing the gear, align the flat on the reluctor shaft opposite the notch in the pick-up coil plate, then align mark A on the gear with the notch in the lower end of the housing and install the roll pin (see Fig. 5.7).
24 Refer to Section 9 and adjust the air gap.
25 Check the mechanical advance as described in Section 12, Step 9.

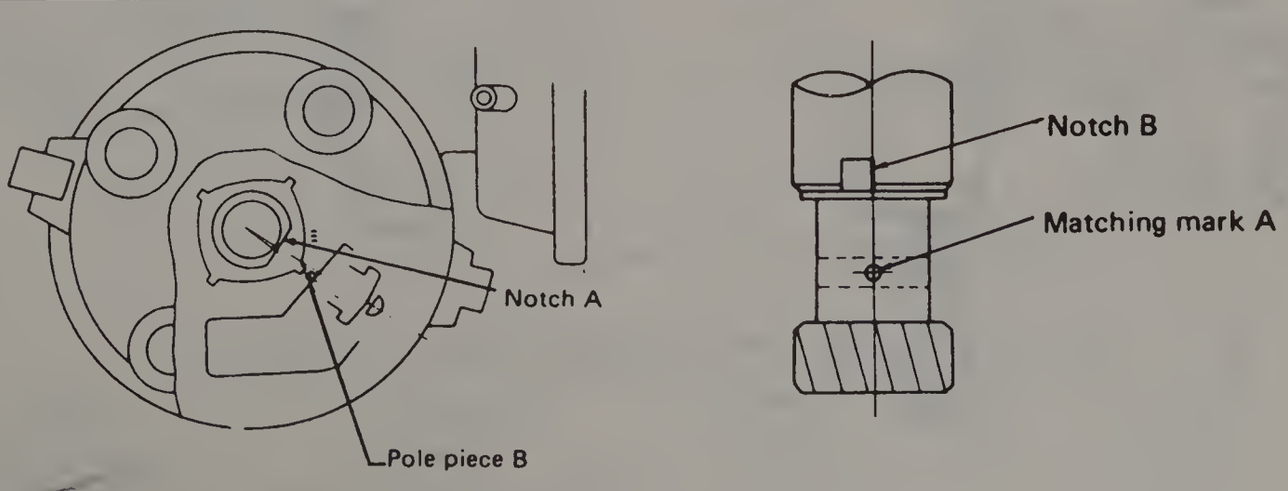
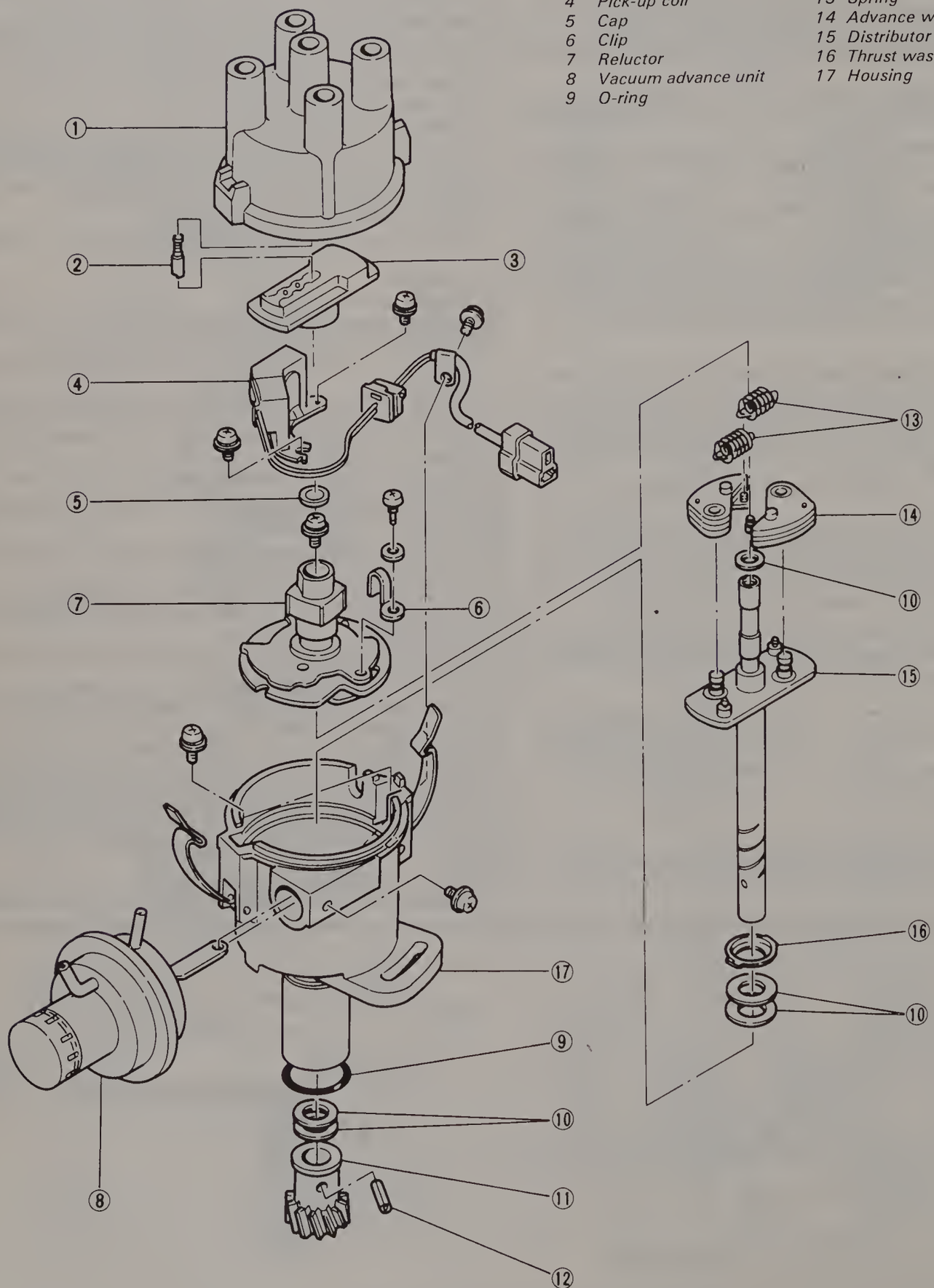


Fig. 5.6 Correct distributor gear installation (Sec 13)

Fig. 5.7 Distributor components (electronic – early Hitachi) – exploded view (Sec 13)

1 *Cap*
2 *Carbon contact*
3 *Rotor*
4 *Pick-up coil*
5 *Cap*
6 *Clip*
7 *Reluctor*
8 *Vacuum advance unit*
9 *O-ring*
10 *Thrust washer*
11 *Distributor drive gear*
12 *Roll pin*
13 *Spring*
14 *Advance weight*
15 *Distributor shaft*
16 *Thrust washer*
17 *Housing*



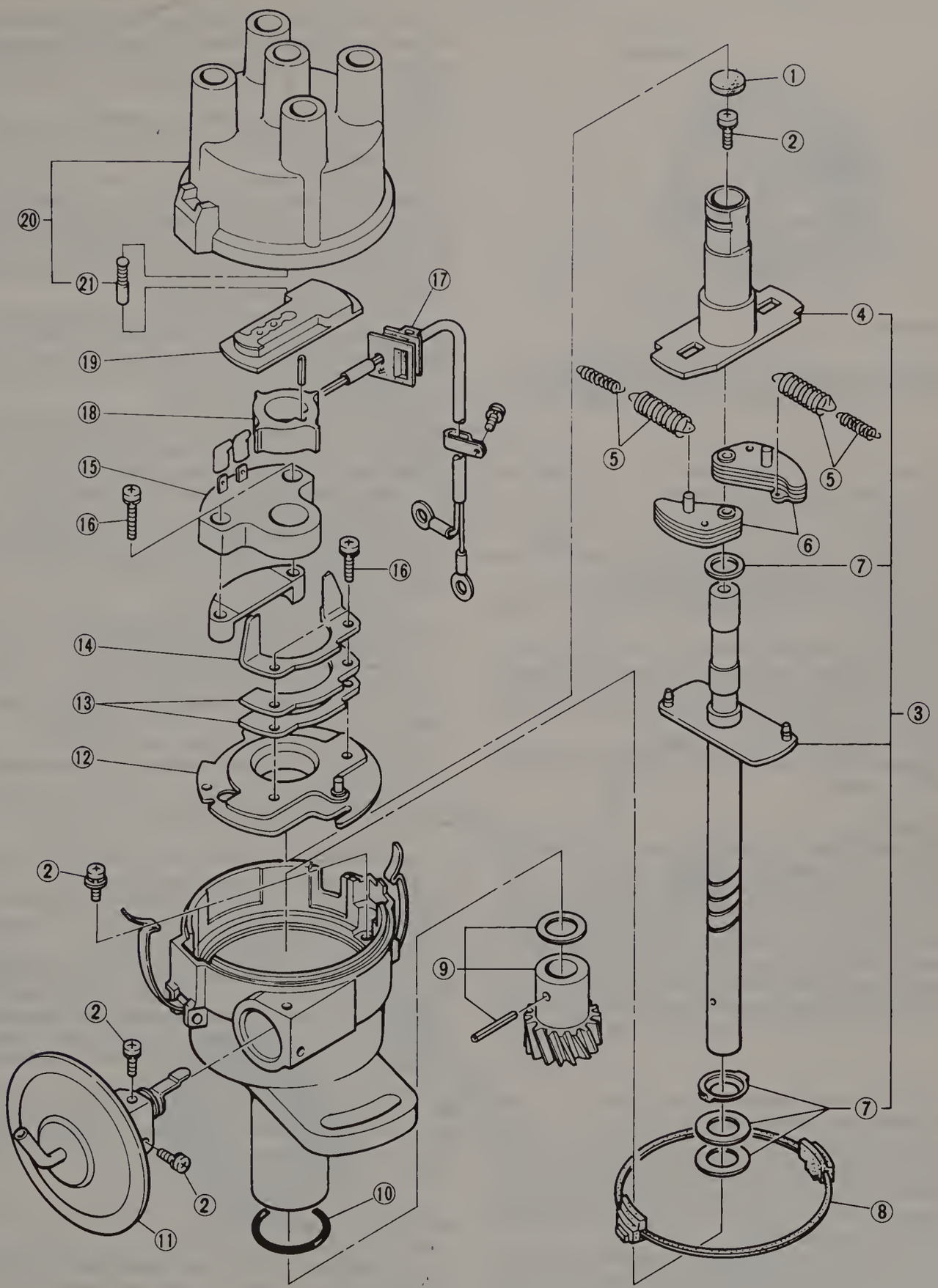


Fig. 5.8 Distributor components (electronic – late Hitachi) – exploded view (Sec 13)

1 *Packing*
2 *Screw*
3 *Shaft assembly*
4 *Reluctor shaft*
5 *Spring*
6 *Advance weight*
7 *Thrust washer*
8 *Packing*
9 *Gear*
10 *O-ring*
11 *Vacuum advance unit*
12 *Pick-up coil plate*
13 *Magnet*
14 *Stator*
15 *Pick-up coil and control unit*
16 *Screw*
17 *Wires*
18 *Reluctor*
19 *Rotor*
20 *Cap*
21 *Carbon contact*

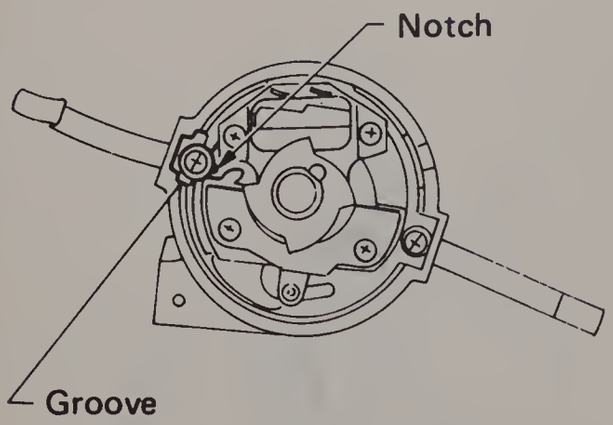


Fig. 5.9 Make sure the notch in the pick-up coil plate is aligned with the groove in the housing (late Hitachi) (Sec 13)

14 Distributor advance mechanism – check

Mechanical advance

1 Refer to Chapter 1, *Ignition timing-adjustment,* and hook up a timing light as if you were adjusting the ignition timing.
2 With the engine running at idle speed and the timing light properly connected, remove the vacuum hose from the vacuum advance control unit on the distributor.
3 Remove the timing mark cover, and observe the timing marks on the flywheel. Slowly accelerate the engine. The O mark on the flywheel should appear to move smoothly in the direction away from the stationary pointer. Then when the engine is slowed down, the mark should return to its original position.
4 If the above conditions are not met, the advance mechanism inside the distributor should be checked for seized weights, broken springs and other problems.

Vacuum advance

5 Refer to Chapter 1, *Ignition timing-adjustment,* and hook up a timing light as if you were adjusting the ignition timing.
6 Start the engine and set it at approximately 2500 rpm.
7 Remove the timing mark cover and observe the timing marks on the flywheel. Remove the vacuum hose from the vacuum advance control unit on the distributor. When the hose is removed, the O mark on the flywheel should appear to move closer to the stationary pointer. When the hose is reconnected, the mark should move away again.
8 If reconnecting the vacuum hose produces an abrupt increase in advance, or none at all, the vacuum advance control unit is probably defective.

15 Starting system – on vehicle test

Note: *In order for the starting system to operate, the battery must be in a fully charged condition and the transmission must be in Neutral or Park. If the battery is not fully charged, or if the neutral safety switch is faulty, recharge the battery or make any necessary repairs before trying to diagnose the starting system.*

1 If the starter does not turn, switch on the headlights and turn the key to Start. If the headlights did not come on, or if they dim or go out when the key is turned to Start, the battery (see note above) or cable connections are at fault. If the headlights remain bright, but the starter does not crank the engine, there is an open circuit somewhere in the system (some possible locations are the ignition switch and connections, the starter motor brushes or the solenoid). If the solenoid clicks once when the key is turned to Start, the battery and cable connections should be checked. *It should be noted that a jammed starter drive, defective starter motor, engine mechanical problems and extremely low outside temperatures can affect the starting system operation, but the previously mentioned possible problems are the most common.*
2 The most likely cause of starting system problems (and one that is very easy to fix) is loose, corroded or defective battery cables and cable connections. They should be checked carefully and systematically and cleaned, tightened or replaced (see Chapter 1 for battery maintenance).
3 Also, check the wiring and connections between the solenoid and the ignition switch. Look for broken wires, burned insulation and loose or dirty connections.
4 If a voltmeter is available, it can be used very effectively to check voltage drops through the circuit's wiring and connections. The first check should be a cranking voltage test (if the starter motor will operate at all). Hook the voltmeter positive lead (red) to the positive post of the battery and the negative lead (black) to the negative post. Crank the engine and note the voltmeter reading. If it is less than nine volts, the battery is not fully charged.
5 Next, attach the meter leads to the battery positive post and the solenoid battery terminal, then turn the key to Start and note the voltmeter reading. It should be extremely low (approx. 0.2 volts or less). If not, there is excessive resistance (such as a loose or dirty connection) in that part of the circuit.
6 Repeat the test with the voltmeter leads attached to the negative battery post and the starter motor housing and with the leads attached to the solenoid battery and motor terminals. Remember, a high voltage reading means excessive resistance in that part of the circuit. Each wire and connector can be checked in the same way.
7 If the voltage drop tests do not produce conclusive results and if you know the battery is good, then it is very likely that the starter motor is defective. It should be replaced with a new or rebuilt unit (refer to the appropriate Section in this Chapter for removal and installation procedures).

16 Starter motor – removal and installation

1 Remove the spare wheel.
2 Disconnect the ground lead from the negative terminal of the battery.
3 Disconnect the leads from the starter.
4 Remove the nuts securing the starter to the transmission and pull out the starter.
5 Installation is the reverse of the removal sequence. Make sure that the contact surfaces of the mounting faces are clean.

17 Alternator safety – general information

1 When servicing the charging system, do not short across or ground any of the terminals on the alternator.
2 Never reverse the battery cables, even for an instant, as the reverse polarity current flow will damage the diodes in the alternator. Also, to prevent damage to the diodes, the alternator leads (and battery cables) should be disconnected whenever arc welding is being done on the vehicle. Never start the engine with a battery charger connected and always disconnect the battery cables from the battery before hooking up a charger.
3 Overhaul of the alternator requires experience with electrical tools and test equipment and the need for replacement parts, which are sometimes difficult to obtain. Therefore, it is in the best interest of the home mechanic to replace the alternator with a new or rebuilt unit if problems develop.

18 Charging system – check

1 If a malfunction occurs in the charging circuit, do not immediately assume that the alternator is causing the problem. First check the following items:

a) The battery cables where they connect to the battery (make sure the connections are clean and tight).
b) The battery electrolyte specific gravity. If it is low, charge the battery.
c) Check the external alternator wiring and connections (they must be in good condition).
d) Check the drivebelt condition and tension (see Chapter 1). Check the alternator mount bolts for tightness.
e) Run the engine and check the alternator for abnormal noise.

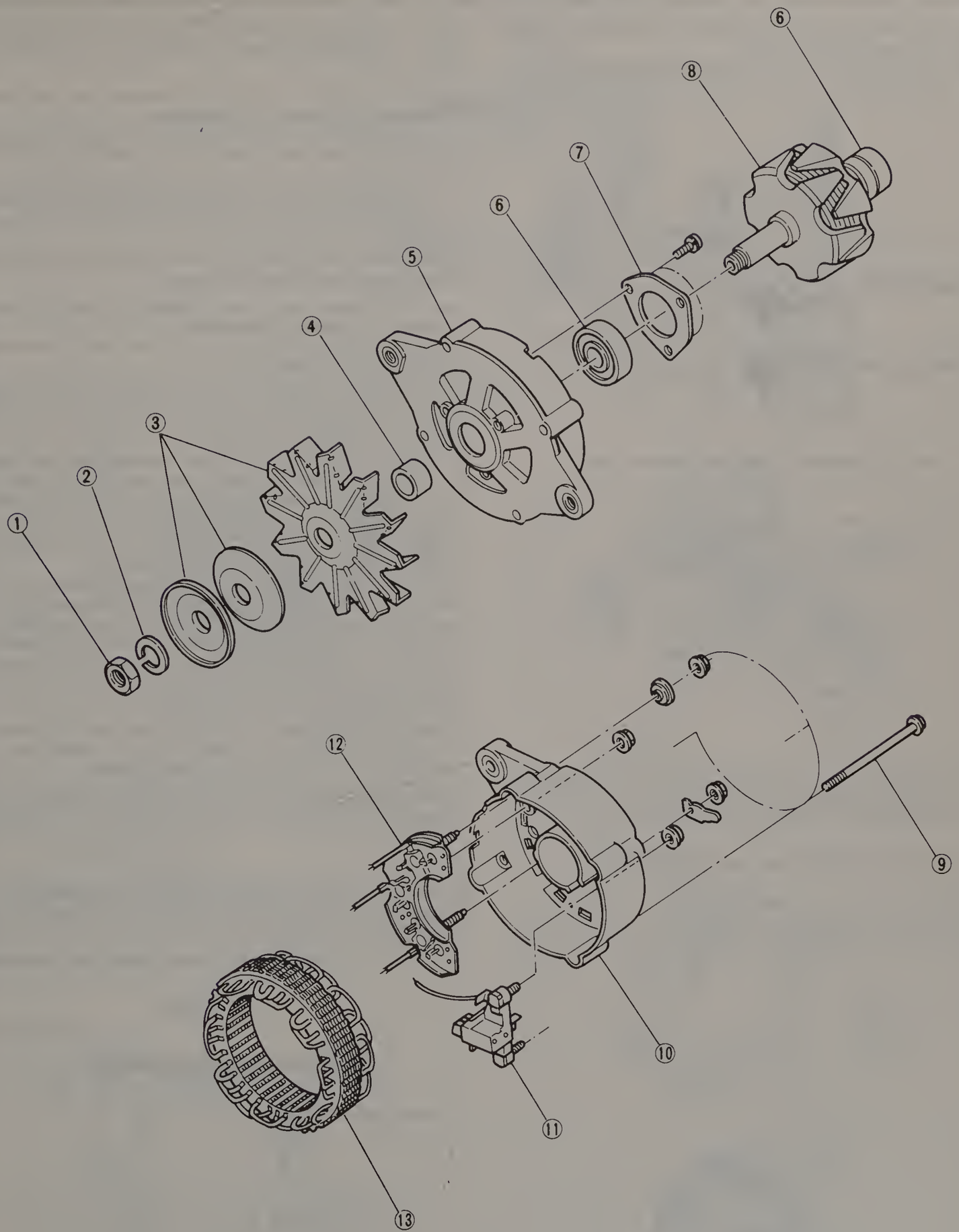


Fig. 5.10 Alternator components (typical) – exploded view (Sec 20)

1 Nut	*5 Front cover*	*8 Rotor*	*11 Brush holder*
2 Lock washer	*6 Ball bearing*	*9 Through bolt*	*12 Diode*
3 Pulley	*7 Retainer*	*10 Rear cover*	*13 Stator*
4 Spacer			

2 Using a voltmeter, check the battery voltage with the engine off. It should be approximately 12 volts.
3 Start the engine and check the battery voltage again. It should now be approximately 14 to 15 volts. If it does not rise when the engine is started or if it exceeds 15 volts, have the charging system checked further by a dealer service department or a reputable repair shop.

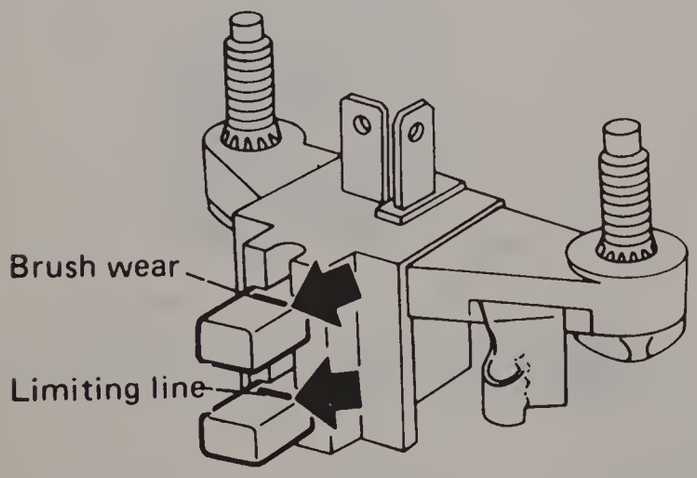


Fig. 5.11 Alternator brush wear limit line (Sec 20)

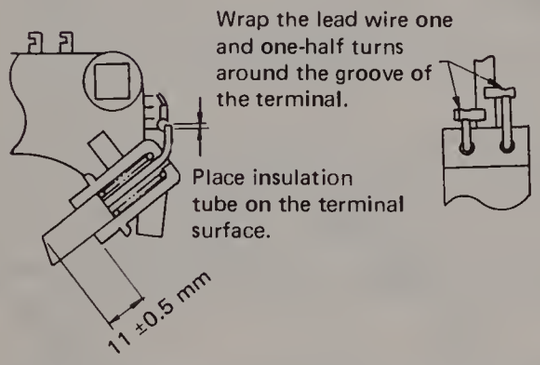


Fig. 5.12 Make sure the new brushes extend beyond the holder as shown (models with integral regulator) (Sec 20)

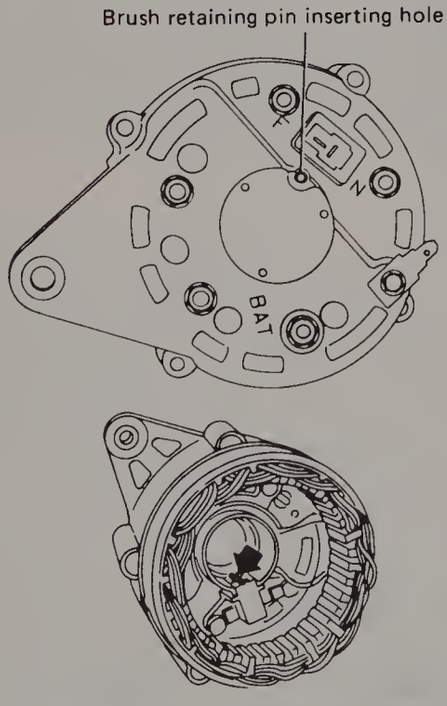


Fig. 5.13 A piece of wire inserted through the hole in the cover will hold the brushes in the retracted position as the alternator is reassembled (Sec 20)

19 Alternator – removal and installation

1 Disconnect the ground cable from the negative terminal of the battery.
2 Disconnect the wiring from the rear of the alternator.
3 Remove the adjusting bolt, loosen the pivot bolt and remove the drivebelt from the pulley. Remove the pivot bolt and lift out the alternator.
4 Installation is the reverse of the removal sequence. Adjust the drivebelt tension by referring to Chapter 1.

20 Alternator brushes – replacement

Refer to Figs. 5.10 through 5.13

1 To replace the brushes, remove the through bolts and carefully separate the rear cover and the stator from the front cover and rotor. Insert a screwdriver into the slots in the front cover and rotate the screwdriver to pry the stator free.
2 Remove the nuts and insulators from the rear cover, then separate the cover from the stator to expose the brush holder. If the brushes are worn to the limit line (see accompanying illustration), they should be replaced with new ones. **Note:** *Models with external mechanical voltage regulators must have the brushes and brush holder replaced as an assembly. Models with a built-in, solid state voltage regulator can have the brushes replaced by unsoldering the leads.*
3 Carefully and quickly unsolder the leads and remove the old brushes and springs from the brush holder. Do not apply any more heat than is absolutely necessary, as the diodes may be ruined.
4 Install the new brushes and springs (one at a time) and solder the leads, leaving the proper amount of brush exposed. Make sure that the curvature of the brush matches the contour of the slip ring it will contact. Check the brushes to make sure they move smoothly in the holder, then cut off the excess lead wires.
5 Reattach the rear cover to the stator, then push the brushes into the holder and insert a piece of wire through the access hole in the cover to hold the brushes in their retracted position.
6 Carefully join the rear cover and the stator to the front cover and rotor. Install the through bolts and tighten them evenly and securely. Withdraw the wire from the rear cover and check for smooth operation of the rotor.

21 Voltage regulator (external) – check and replacement

Refer to Figs. 5.14 through 5.17

1 In order to check the regulator it has to be removed from the side

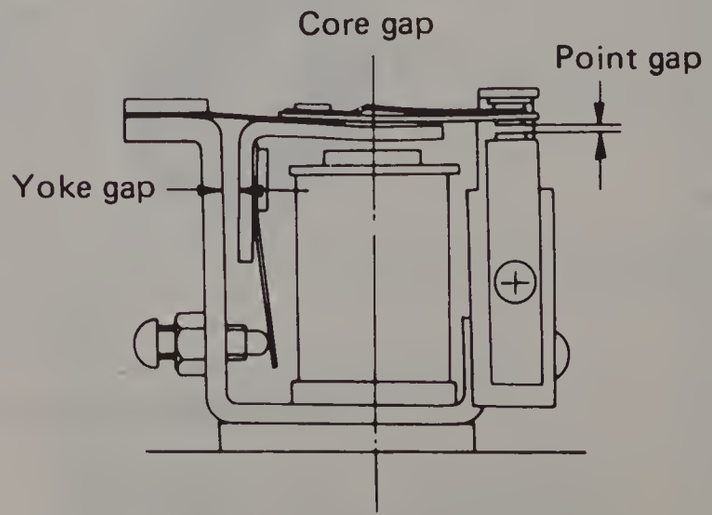


Fig. 5.14 Voltage coil core gap and point gap measurement (Sec 21)

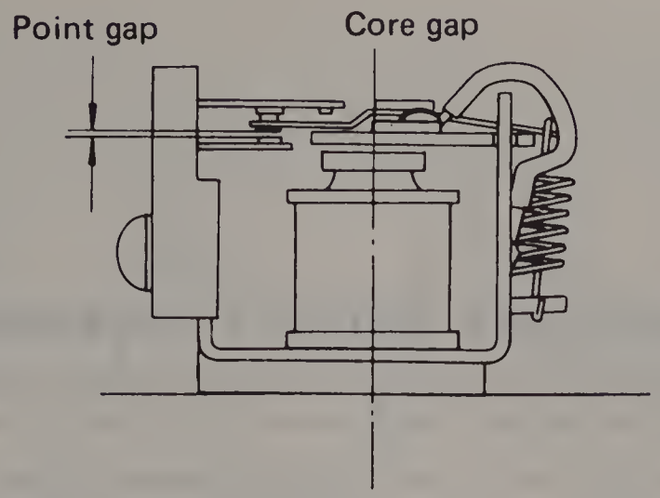


Fig. 5.15 Charge relay core gap and point gap measurement (Sec 21)

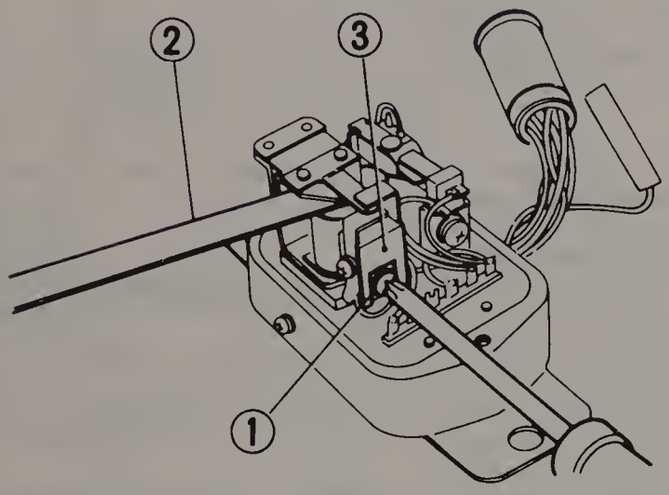


Fig. 5.16 Adjustment of the voltage coil core gap (Sec 21)

1 Adjusting screw
2 Thickness gauge
3 Contact set

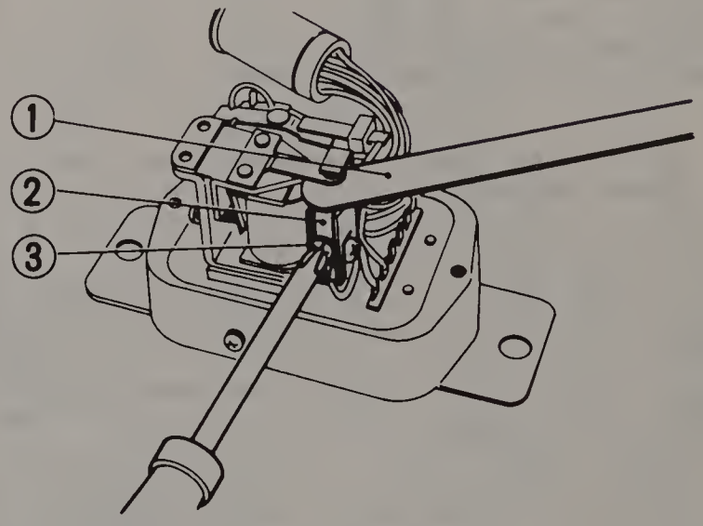


Fig. 5.17 Adjustment of the voltage coil point gap (Sec 21)

1 Thickness gauge
2 Upper contact
3 Adjusting screw

wall of the engine compartment (near the battery).

2 Remove the cover mounting screws and the cover from the regulator. Inspect the points and polish them lightly with emery cloth if they are burnt or dirty. Replace the voltage regulator with a new one if the cores or the points are damaged in any way.

3 Use a feeler gauge and measure the core gap first, followed by the point gap (for both the voltage coil and the charge relay). Compare your measurements with the Specifications and adjust them if necessary.

Chapter 6 Emissions control systems

Refer to Chapter 13 for information applicable to 1984 thru 1988 models

Contents

1 General information

Refer to Figs. 6.1 through 6.4

To prevent pollution of the atmosphere, a number of emissions control systems are required. The combination of systems used depends on the year in which the vehicle was manufactured and the locality to which it was orginally delivered.

The Sections in this Chapter include general descriptions, checking procedures (where possible) and component replacement procedures (where applicable) for each of the systems.

Before assuming that an emissions control system is malfunctioning, check the fuel and ignition systems carefully. In some cases, special tools and equipment, as well as specialized training, are required to accurately diagnose the causes of a rough running or difficult to start engine. If checking and servicing become too difficult, or if a procedure is beyond the scope of the home mechanic, consult your Subaru dealer service department.

This does not mean, however, that all the emissions control systems are difficult to maintain or repair. You can quickly and easily perform many checks and most (if not all) of the regular maintenance at home with common tune-up and hand tools. **Note**: *The most frequent cause of emissions control system problems is simply a loose or broken vacuum hose or wiring connection. Therefore, always check hose and wiring connections first.*

Pay close attention to any special precautions outlined in this Chapter (particularly those concerning the catalytic converter). Also be aware that the illustrations and/or descriptions of the various systems may not be *exactly* like yours due to manufacturing changes and refinements for the various geographic areas.

2 Positive Crankcase Ventilation (PCV) system

General description

This system is designed to reduce hydrocarbon emissions (HC) by routing blow-by gases (fuel/air mixture that escapes from the combustion chamber past the piston rings into the crankcase) from the crankcase to the intake manifold and combustion chamber where they are burned during engine operation.

The system is very simple and consists of rubber hoses and a small replaceable metering valve (PCV valve).

Checking and component replacement

Checking, cleaning and replacement of the PCV system components is a routine maintenance procedure. Refer to Chapter 1 for details.

3 Catalytic converter

General description

The catalytic converter provides for the oxidizing of hydrocarbons and carbon monoxide in the exhaust system, which reduces the levels of these pollutants in the exhaust.

The catalyst cannot be replaced independently, as the catalyst and front exhaust pipe are an assembly.

The catalytic converter requires the use of unleaded fuel only. Leaded fuel will destroy the effectiveness of the catalyst as an emissions control device.

Under normal operating conditions, the catalytic converter will not require maintenance. However, it is important to keep the engine properly tuned. If the engine is not properly tuned, engine misfiring may cause overheating of the catalyst, which may damage the converter or other vehicle components. Heat damage can also occur during diagnostic testing if spark plug wires are removed and the engine is allowed to idle for a prolonged period of time. **Note**: *If large amounts of unburned gasoline enter the catalyst, it may overheat and cause a fire. Always observe the following precautions:*

Use only unleaded fuel
Avoid prolonged idling
Do not prolong engine compression checks
Do not run the engine with a nearly empty fuel tank
Avoid coasting with the ignition turned off
Do not dispose of a used catalytic converter along with oily or fuel soaked rags

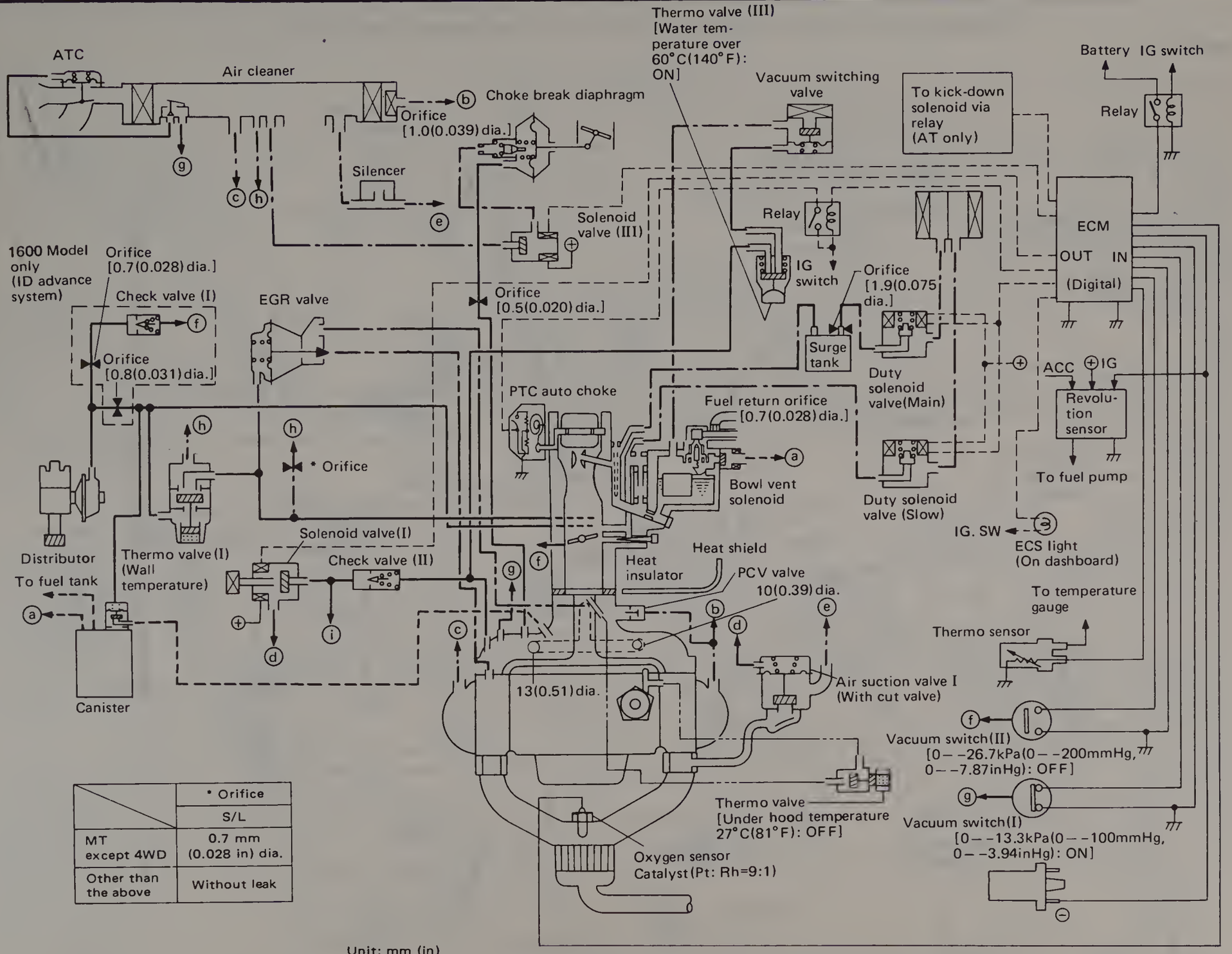
The converter is located in the exhaust system and closely resembles a muffler. It is mounted just past the exhaust manifold, and is a part of the front exhaust pipe.

Checking

1 The catalytic converter requires little if any maintenance and servicing at regular intervals. However, the system should be inspected whenever the vehicle is raised on a lift or if the exhaust system is checked or serviced.

2 Check all connections in the exhaust pipe assembly for looseness and damage. Also check all the clamps for damage, cracks, or missing fasteners. Check the rubber hangers for cracks.

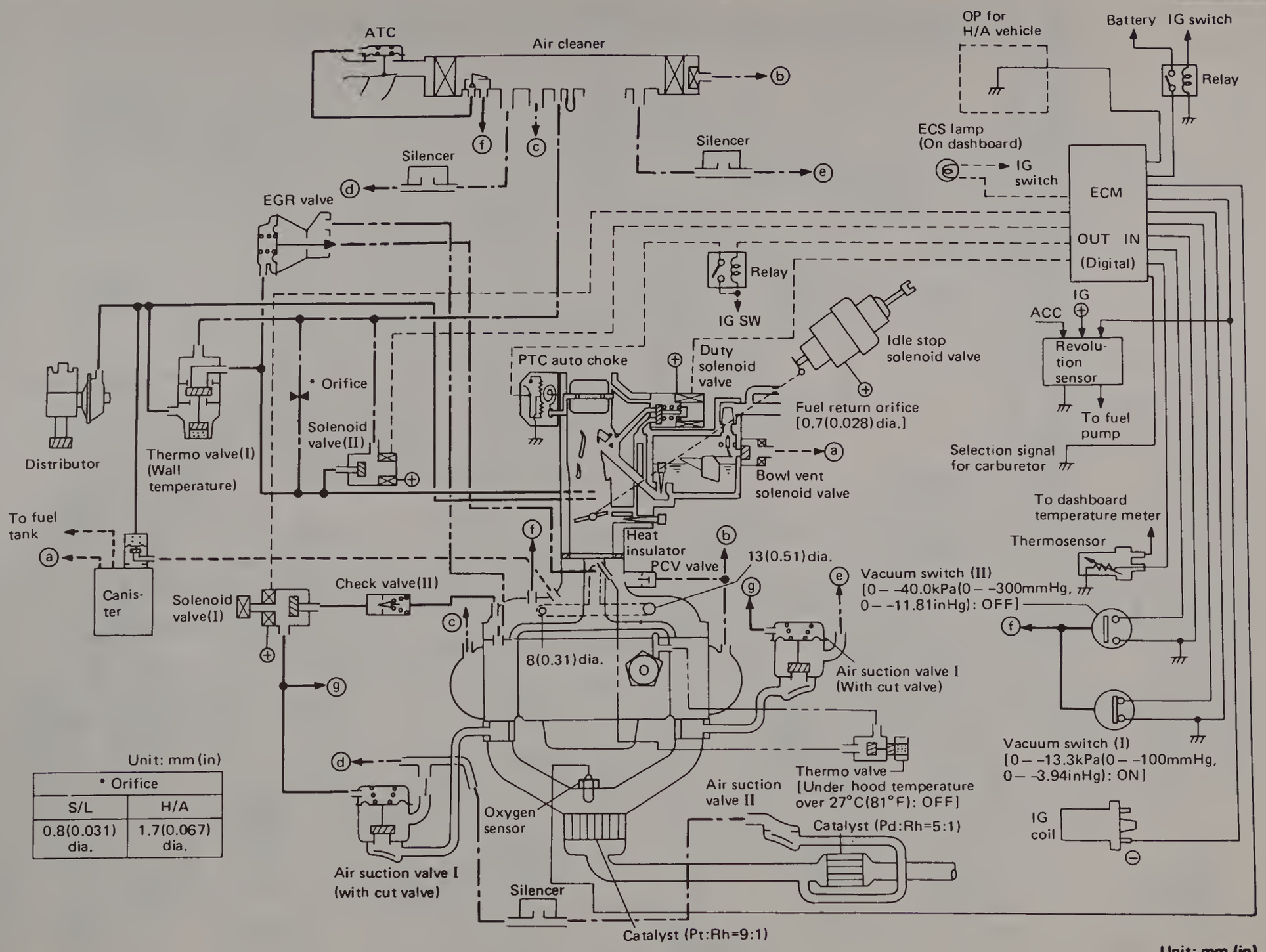
3 The converter itself should be checked for damage and dents (maximum $\frac{3}{4}$ in deep) which could affect its performance and/or be hazardous to your health. At the same time the converter is inspected, check the metal protecter plate under it as well as the heat insulator above it for damage and loose fasteners.



	* Orifice
	S/L
MT except 4WD	0.7 mm (0.028 in) dia.
Other than the above	Without leak

Unit: mm (in)

Fig. 6.1 Emissions control component diagram for vehicles with Hitachi carburetors – typical (1983 shown)



Unit: mm (in)

* Orifice	
S/L	H/A
0.8(0.031) dia.	1.7(0.067) dia.

Unit: mm (in)

Fig. 6.2 Emissions control component diagram for vehicles with Carter/Weber carburetors – typical (1983 shown)

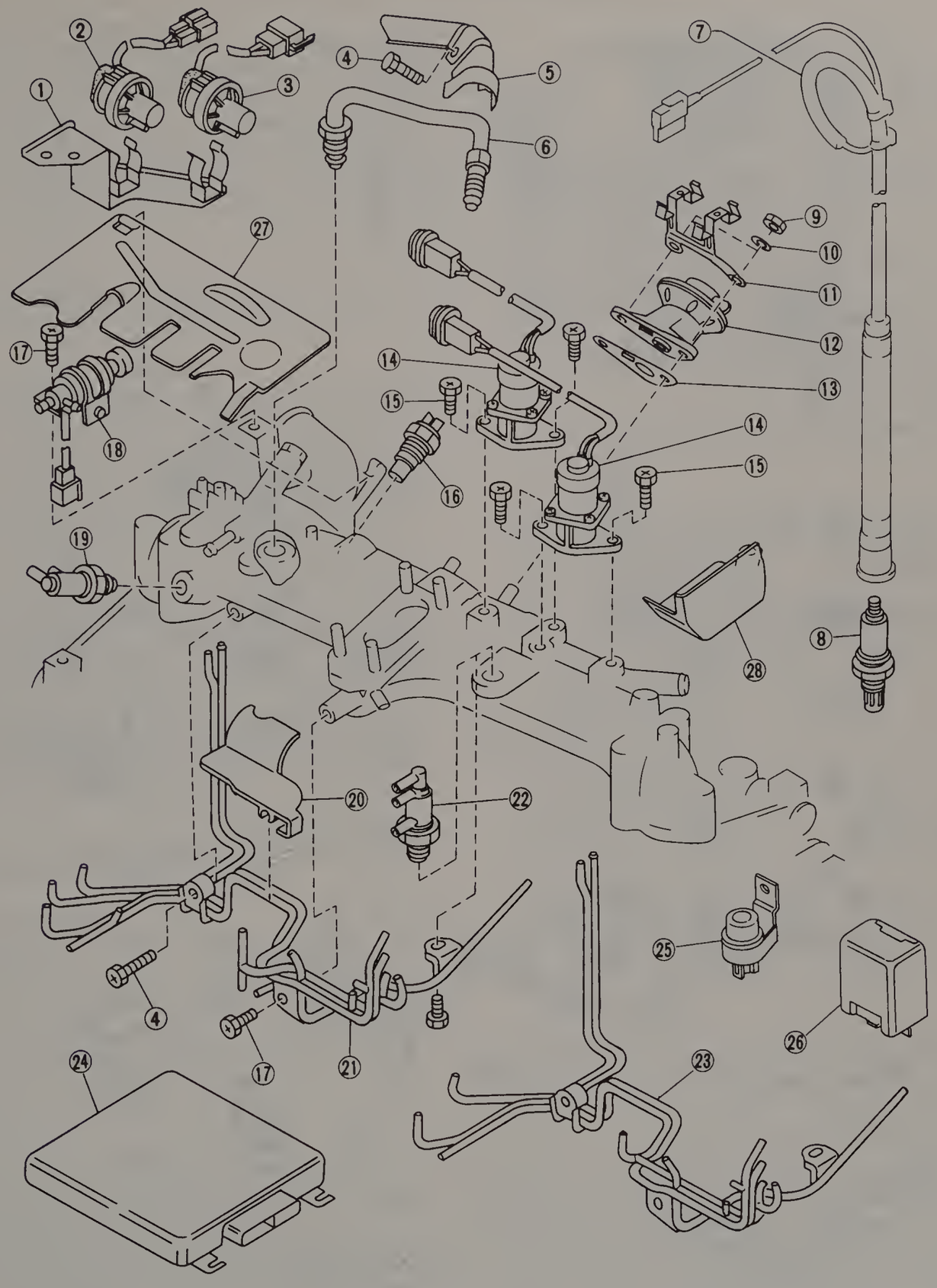


Fig. 6.3 Emission control components for vehicles with Hitachi carburetors – exploded view (typical – 1983 shown)

1 *Bracket*
2 *Vacuum switch I*
3 *Vacuum switch II*
4 *Bolt and washer*
5 *EGR pipe cover*
6 *EGR pipe*
7 *Oxygen sensor harness*
8 *Oxygen sensor*
9 *Nut*
10 *Washer*
11 *Clamp*
12 *EGR valve*
13 *Gasket*
14 *Duty solenoid valve*
15 *Bolt and washer*
16 *Thermosensor*
17 *Bolt and washer*
18 *Solenoid valve I*
19 *Thermo vacuum valve II*
20 *Carburetor protector 3*
21 *Vacuum pipe compl. (except 4WD and AT)*
22 *Thermo vacuum valve I*
23 *Vacuum pipe compl. (4WD and AT)*
24 *Electronic control module*
25 *Ignition relay*
26 *Revolution sensor*
27 *Carburetor protector*
28 *Carburetor protector 2*

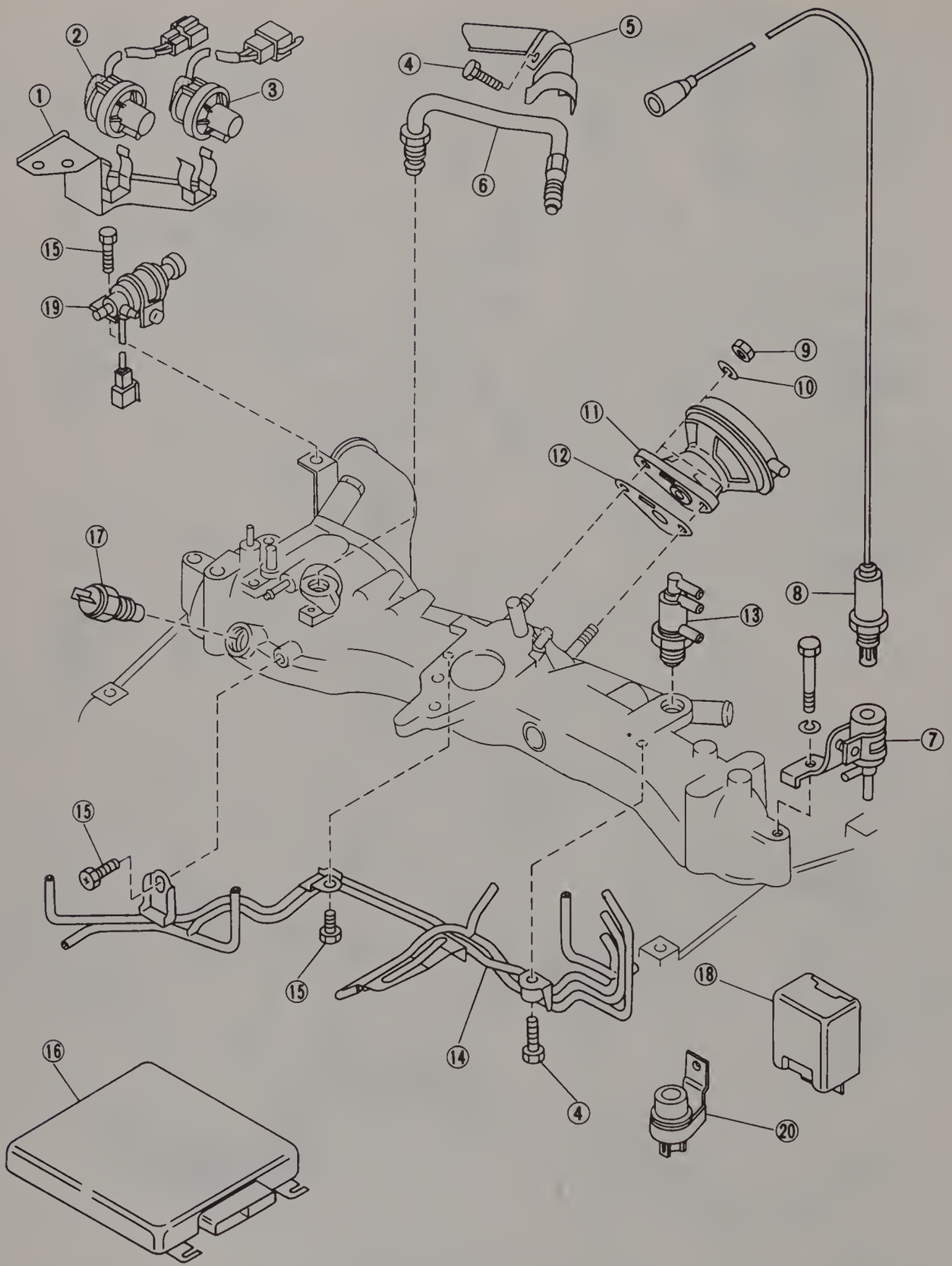


Fig. 6.4 Emissions control components for vehicles with Carter/Weber carburetors – exploded view (typical – 1983 shown)

1 *Bracket*
2 *Vacuum switch I*
3 *Vacuum switch II*
4 *Bolt and washer*
5 *EGR pipe cover*
6 *EGR pipe*
7 *Solenoid valve II*
8 *Oxygen sensor*
9 *Nut*
10 *Washer*
11 *EGR valve*
12 *Gasket*
13 *Thermo vacuum valve I*
14 *Vacuum pipe CP*
15 *Bolt and washer*
16 *Electronic control module*
17 *Thermosensor*
18 *Revolution sensor*
19 *Solenoid valve I*
20 *Ignition relay*

Component replacement

4 Do not attempt to remove the catalytic converter until the complete exhaust system is cool. Raise the vehicle and support it securely on jackstands. Apply some penetrating oil to the clamp bolts and allow it to soak in.
5 Remove the bolts and the rubber hangers, then remove the front exhaust pipe. Remove the old gaskets if they are stuck to the pipes.
6 Installation of the converter is the reverse of removal. Use new exhaust pipe gaskets and tighten the clamp bolts to the specified torque. Replace the rubber hangers with new ones if the originals are deteriorated.

4 Evaporative Control System (ECS)

Refer to Fig. 6.5

General description

This system is designed to prevent the escape of fuel vapors from the carburetor and the fuel tank, which would normally enter the atmosphere and contribute to hydrocarbon (HC) emissions.

An ECS canister is at work in this system. The purge control valve on the canister is controlled by the carburetor vacuum. The fuel vapor from the fuel tank is stored in the canister. When the engine is started, the valve on the canister is opened and the vapor in the canister is sucked into the intake manifold.

The two-way valve located in the fuel vapor line consists of a pressure valve designed to open when the fuel tank internal pressure has increased over the normal pressure. It also has a vacuum valve which opens when a vacuum has been produced in the fuel tank.

The fuel separator tank temporarily accomodates an increased volume of gasoline caused by expansion at high ambient temperatures. It also prevents liquid fuel from entering the vapor line during extreme cornering of the vehicle.

The fuel filler cap is equipped with a relief valve to prevent the escape of fuel vapors into the atmosphere. If the pressure in the tank drops below the specified negative pressure, the valve will open to adjust the pressure.

Checking

1 There are no checks for the fuel separator tank or the fuel two-way valve. Refer to Chapter 1 for checking the canister.

Component replacement

2 Replace all rubber hoses leading to the canister at the time of canister replacement.
3 Replace the canister by referring to Chapter 1.
4 Replace the fuel separator by referring to Chapter 4.

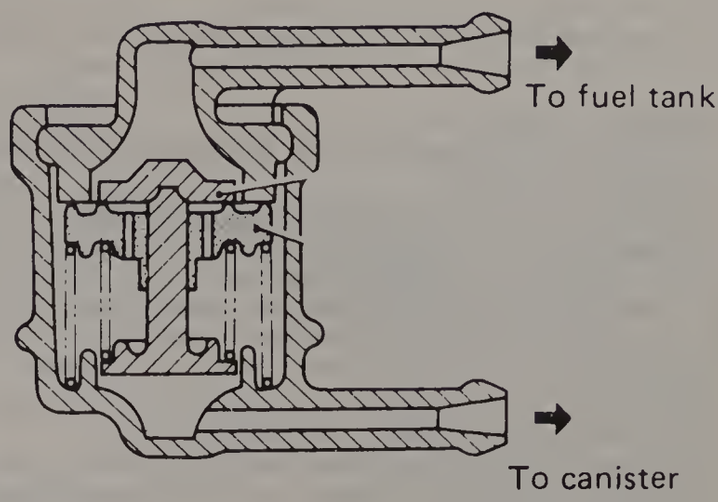


Fig. 6.5 ECS system two-way valve (Sec 4)

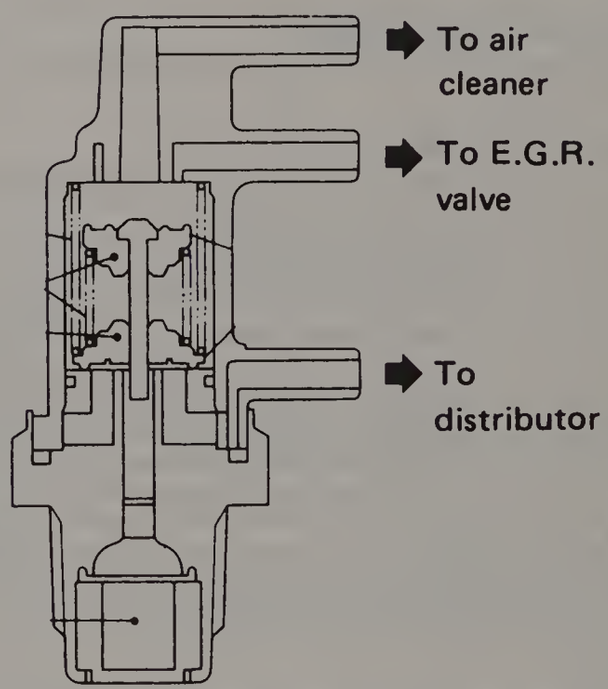


Fig. 6.6 Thermo vacuum valve for the EGR system, the air induction system and the ignition control system (Sec 5)

5 Exhaust Gas Recirculation (EGR) system

Refer to Fig. 6.6

General description

Subaru vehicles utilize an Exhaust Gas Recirculation system (EGR) to reduce oxides of nitrogen in the exhaust.

The EGR valve, located on the intake manifold directly behind the carburetor, is the main component of the system.

The stringent oxides of nitrogen emissions standards require high rates of EGR flow, which adversely affects driveability of the vehicle. To solve this problem, it is necessary to increase EGR flow during high load vehicle operation and decrease EGR flow to improve driveability during low load operation.

The EGR valve opens in response to engine load. Part of the exhaust gas flows into the cylinders through the intake manifold.

The vacuum signal to control the EGR valve is taken care of by a portion of the throttle valve after being modulated with atmospheric pressure through thermo vacuum valve I. On 49-State 2WD vehicles, the vacuum signal is modulated further by solenoid valve II.

Checking

1 To check the EGR system properly, you will need a hand-held vacuum pump.
2 Check all vacuum hoses for cracks and correct installation.
3 Start the engine (it must be completely cool) and run it at idle speed.
4 Touch the underside of the EGR valve diaphragm and increase the engine speed to 3000 to 3500 rpm. No movement of the diaphragm should be felt. If it does move, check the thermo valve and replace it with a new one if necessary.
5 Allow the engine to warm up for eight minutes or more.
6 Again touch the diaphragm and increase the engine speed to the same rpm. This time the diaphragm should move. If it does not, apply a 7.87 in Hg (200 mm Hg) vacuum to the valve with the hand pump. If it still does not move, replace the EGR valve with a new one.
7 To check the thermo vacuum valve, connect separate sections of hose to the air cleaner and EGR valve ports and plug the port to the distributor.
8 Blow into one of the hoses and see if the valve opens at 86°F (30°C) and closes at 104°F (40°C) and above. **Note:** *Start the engine from cold and attach a thermometer next to the thermo valve to determine when the coolant reaches the specified temperatures.*
9 Now plug the air cleaner port and attach the hoses to the EGR valve and distributor ports.
10 Blow into one of the hoses and see if the valve opens at 68°F

(20°C) and closes at 50°F (10°C) and below.
11 If these specifications are not met, replace the valve with a new one. Check the solenoid valve by referring to Section 8, Step 3.

Component replacement

12 The EGR valve is attached to the lower part of the intake manifold, directly behind the carburetor.
13 Mark the vacuum hoses and fittings with pieces of numbered tape, then disconnect the vacuum hoses from the EGR valve.
14 Remove the bolts attaching the EGR valve to the intake manifold and the valve can be lifted away. You may have to tap gently on the EGR valve body with a soft-faced hammer to break the gasket seal.
15 When installing the EGR valve, use a new gasket and tighten the mounting bolts evenly and securely. Also, be sure to install the vacuum hoses properly.
16 The thermal valve is located just in front of the carburetor and is threaded into the coolant passage in the intake manifold.
17 Removal of the thermal valve is quite simple. Pull off the vacuum hoses that are connected to the thermal valve fittings, then unscrew the valve from the manifold.
18 When installing the thermal valve, be sure to use thread-sealing tape on the threads.

6 Air injection system (1980)

Refer to Fig. 6.7

General description

The air injection system reduces HC and CO emissions during low-speed, light-load engine operation by supplying secondary air into the exhaust manifold. A feature of the system is that it automatically controls the amount of air to be supplied.

The operation principle is based on a utilization of the negative pressure caused by exhaust gas pulsation and intake manifold pressure during valve overlap period. The gas pressure in each exhaust port is transmitted to the air suction valve through the secondary air port and an air suction pipe. When the pressure transmitted is negative, the reed of the air suction valve is opened towards the valve stopper and at the same time, fresh air is drawn from the clean side of the air cleaner, through the air suction hose and silencer, into the exhaust port. On the other hand, when positive pressure reaches the air suction valve the reed is immediately closed to prevent the flow of exhaust gas. The fresh air sucked in is mainly used for oxidation of HC and CO in the exhaust passage and partly for fuel combustion in the cylinders.

The main components of the air injection system are the air suction valve and the secondary air cleaner.

Checking

1 With the engine running, remove the hose connected to the secondary air cleaner. Check the vacuum generated at the opening of the hose by plugging it with your finger or hand. If there is not a significant amount of vacuum present, check the hose for air or oil leaks. If no leaks are detected, the air suction valve should be replaced with a new one.
2 The air suction valve is made up of a reed valve. Check the reed valve for cracks.
3 Check the rubber seat part of the valve body for shrinkage, cracks and deformation.
4 Make sure that the contacting surfaces of the reed valve and the reed valve stopper are smooth.
5 The clearance between the reed valve and the rubber seat must be less than 0.008 in (0.2 mm) at the tip of the reed valve.
6 If the clearance is more than specified, disassemble the air suction valve and wash the valve body and the reed valve with solvent.
7 If, after cleaning, the clearance still exceeds the specified limit replace the reed valve or air suction valve as necessary.

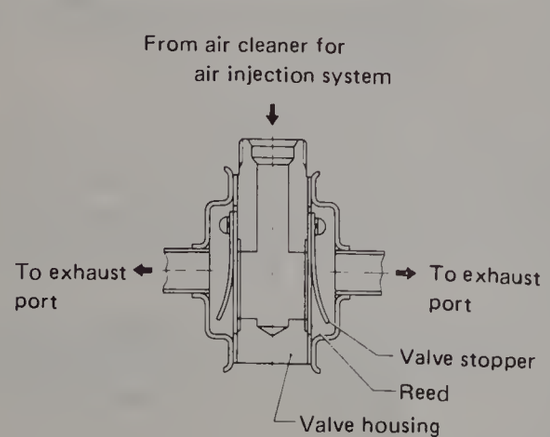


Fig. 6.7 Air suction valve for air injection system (1980) (Sec 6)

Component replacement

8 Disconnect the air suction valve from the air suction pipes leading to the exhaust manifolds and the air suction hose coming from the air cleaner. Position the new part and attach the hoses and pipes.

7 Air induction system (1981)

Refer to Fig. 6.6

General description

This system reduces CO emissions by introducing air from the air cleaner to the intake manifold through the thermo vacuum valve. This function is performed during the choke valve operation so the fuel/air ratio shifts slightly toward 'lean'.

Checking

1 Check the hoses for cracks, kinks and correct installation.
2 Remove the thermo valve from the intake manifold and attach hoses to the ports. Submerge the valve in a pan of water. Blow into the valve while heating the water on a stove or hotplate and check to see if the valve opens at 64°F (18°C) to 114°F (45°C) and closes at 50°F (10°C) or below and 130°F (54°C) or above.
3 If the valve does not meet the specifications, replace it with a new one.

Component replacement

4 Mark the hoses, then remove them from the valve.
5 Remove the valve from the intake manifold with a wrench, then thread the new one into the manifold, tighten it securely and hook up the hoses.

8 Air Injection (AI) system (1982 and 1983)

Refer to Figs. 6.8 and 6.9

General description

The AI system's purpose is to promote oxidation of hydrocarbons (HC) and carbon monoxide (CO) while the engine is cold.

The components of this system are the air suction valves (ASV), the silencers, the air suction pipe, the air induction hose, the air cleaner, a thermosensor, a solenoid valve, a check valve and the electronic control module (ECM).

The operating principle of the AI system is that the exhaust gas pulsation is transmitted to the air suction valve through the air suction pipe. When the negative pulsation pressure is transferred to the ASV, the reeds of the valve are opened and simultaneously fresh air from the air cleaner is sucked into the exhaust passage. When the positive pressure reaches the ASV, the reeds are closed to prevent the reverse flow of exhaust gas.

The AI system is controlled by both the coolant temperature sensed by the thermosensor and time governed by the ECM. When the coolant temperature is sensed by the thermosensor to be below 95°F (35°C), the ECM gives a command to open the intake manifold vacuum passage of the solenoid valve for a period of 123 seconds. This action causes the cutoff valve to be opened by the diaphragm vacuum actuator to operate the ASV.

Under such driving conditions as wide-open-throttle acceleration, the check valve closes the vacuum circuit to confine the vacuum to hold the cutoff valve open for that period.

After this period, the ECM gives a command to close the vacuum passage of the solenoid valve and open the atmospheric pressure

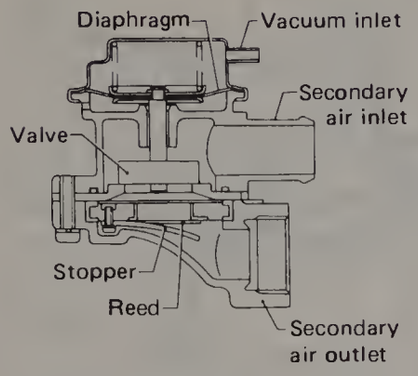


Fig. 6.8 Air suction valve for Air Injection (AI) system (Sec 8)

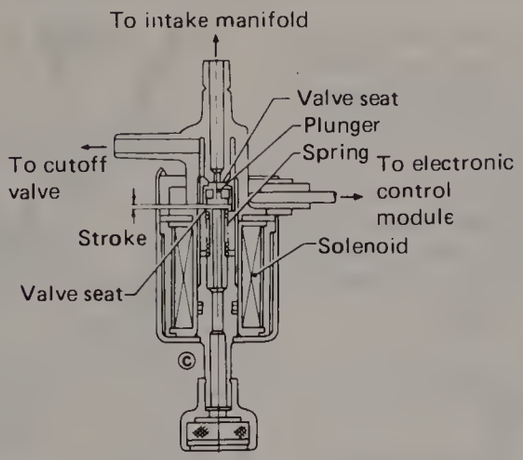


Fig. 6.9 Solenoid valve for Air Injection (AI) system (Sec 8)

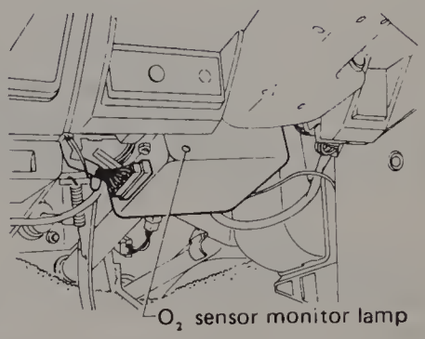


Fig. 6.10 ECM location under the dash – ECC system and Air injection (A1) system (Sec 8)

passage. The vacuum in the vacuum chamber of the cutoff valve leaves through the solenoid valve, whereby the cutoff valve is closed and deactivates the ASV.

Checking

1 To check the ASV, apply a vacuum to the vacuum inlet pipe and determine if the valve operates normally. Air should flow from the secondary air inlet out the secondary air outlet, but not in the reverse direction. Disassemble the ASV and check the reed valve gasket for damage and cracks.

2 Clean the reed valve with solvent and check the assembly for cracks and dents in the reed valve seat. Check for a cracked or broken point of the reed valve. Check for a rusty stopper.

3 To check the solenoid valve, use an ohmmeter and check the resistance between the plus (+) and minus (–) terminals to see if it is 32.7 to 39.9 ohms. Check the resistance between the plus or minus terminal and the valve body to see if it is 1 Mohm or more. Check the vacuum passage for opening and closing operation while applying the battery voltage to the terminals. If any of these checks fail, replace the valve with a new one.

Component replacement

4 To repair or replace the Air Suction Valve, remove the mounting bolts from the bracket. Separate the valve by removing the housing bolts. Disconnect the air suction pipe from the valve housing.

5 To replace the air suction pipe, disconnect it from the ASV housing and the ASV spacer.

6 The silencer can be replaced by disconnecting the rubber hoses leading to the ports.

7 The solenoid valve can be removed or replaced by disconnecting the electrical connector and unbolting it from the mounting bracket.

8 The thermosensor is removed by disconnecting the electrical connector and unscrewing the sensor from the intake manifold.

9 The Electronic Control Module is located under the instrument panel and can be removed by disconnecting the electrical connectors and removing the mounting bolts. Refer to Chapter 10 to remove some of the instrument panel components.

9 Coasting bypass system (1980 and 1981)

Refer to Fig. 6.11

General description

The purpose of the coasting bypass system is to control HC emissions by supplying an appropriate quantity of air and fuel mixture through a bypass passage to improve the combustion in the cylinders during deceleration.

The system consists of a vacuum control valve and a servo diaphragm.

While a vehicle is decelerating a vacuum occurs in the intake manifold due to the primary throttle valve being closed. When the vacuum reaches the servo diaphragm of the carburetor, it forces a bypass valve in the carburetor to open. Air is injected into the carburetor through the air horn, thereby changing the appropriate air/fuel mixture to lean it out.

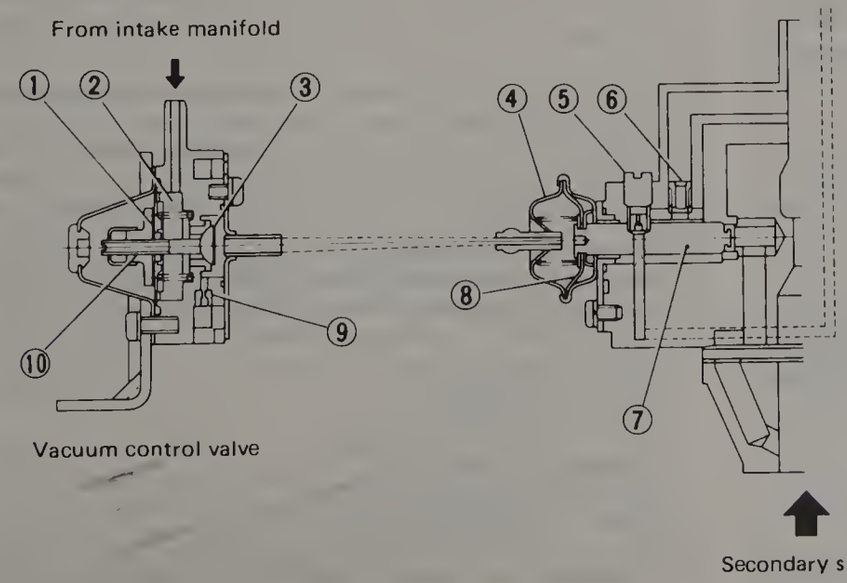


Fig. 6.11 Coasting bypass system (Sec 9)

1 *Diaphragm*
2 *Chamber A*
3 *Chamber B*
4 *Servo diaphragm*
5 *Bypass jet*
6 *Bypass air bleed*
7 *Bypass valve*
8 *Diaphragm*
9 *Orifice*
10 *Poppet valve*

Checking

1 To check the vacuum control valve, remove the vacuum hoses from the valve and install a separate hose to the intake manifold port. Apply a vacuum to the hose and feel the vacuum at the open port. If the vacuum you feel is as strong as the vacuum being applied or if there is no vacuum at all, replace the valve with a new one. There should be less vacuum than what is being applied.

2 To check the servo diaphragm, remove it from the carburetor. Attach a separate hose to the outside port and apply a vacuum. If the bypass valve retracts and is held in place while the vacuum is applied, the valve is working properly. If the valve does not move or does not stay in while the vacuum is applied, replace it with a new one.

Component replacement

3 To replace the vacuum control valve, remove and label the vacuum hoses and remove the mounting hardware holding it in place on its bracket.

4 To replace the servo diaphragm, simply remove the mounting screws retaining it to the carburetor.

10 Electronic Controlled Carburetor (ECC) system (1981 through 1983)

General description

The ECC system monitors the catalytic converter by means of the oxygen sensor and the Electronic Control Module (ECM). The HC, CO and NOx in the exhaust gases vary with the fuel/air ratio and the ECM maintains a balance of these concentrations in order to obtain a high purification efficiency.

The ECC system is made up of the oxygen sensor, the ECM, a duty solenoid and the carburetor.

These components compose a feedback system to control the fuel/air mixture ratio during engine operation by supplying a measured amount of air into the air bleeds of the carburetor. To avoid feedback during certain driving conditions, vacuum switches, a thermosensor and an engine speed sensing circuit come into play.

Checking

1 The ECC system checking is beyond the scope of the home mechanic because of the need for special test and diagnostic equipment. Take the vehicle to a Subaru dealer.

Component replacement

2 To replace the vacuum switches, disconnect the connectors and pull the switch out of the retaining bracket.

3 To replace the thermosensor, pull off the electrical connector and remove the sensor with a wrench.

4 To replace the oxygen sensor, pull the connector off and use a special wrench (499990100) to remove the sensor from the catalytic converter. If it is difficult to remove the sensor, reconnect the connector and run the engine until the exhaust pipe is warm – **do not** run the engine with the sensor wiring disconnected. Before installing the new oxygen sensor, apply an anti-seize compound to the threads, which will allow easier removal in the future. Be careful to apply the anti-seize to the threaded portion only.

5 To replace the ECM, refer to Section 8, Step 9.

11 Ignition control system

Refer to Fig. 6.6

General description

The ignition control system is aimed at reducing the HC, CO and NOx emissions through all of the engine operating conditions. Actual ignition timing is controlled by the combination of a mechanical centrifugal advance unit and a vacuum advance unit in the distributor.

The main components of the ignition control system are the distributor and a thermo vacuum valve.

Checking

1 To check the distributor advance mechanism refer to the appropriate Section in Chapter 5.

2 To check the thermo vacuum valve, refer to Step 8 of the EGR system Section.

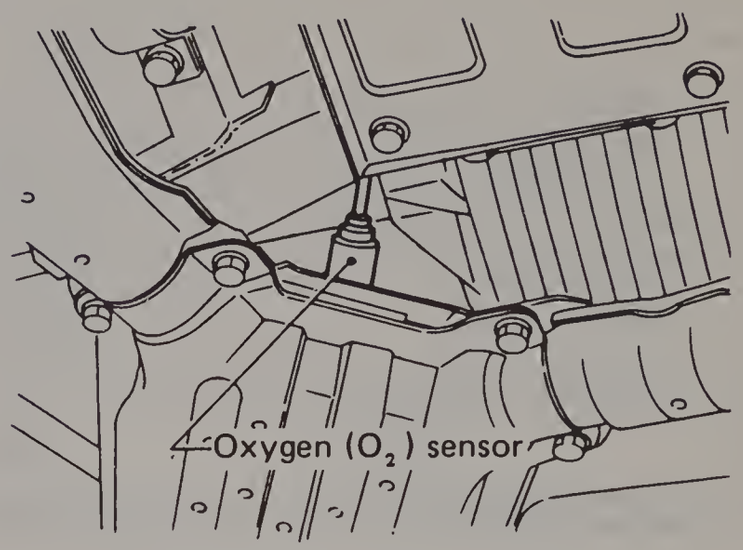


Fig. 6.12 Oxygen sensor location (Sec 10)

Component replacement

3 To replace or overhaul the distributor, refer to the appropriate Section in Chapter 5.

4 Replace the thermo vacuum valve by labeling the vacuum hoses and then removing the valve from the intake manifold.

12 Secondary throttle valve system

Refer to Figs. 6.13 through 6.15

General description

The secondary throttle valve of the carburetor is designed to introduce atmospheric pressure into the negative pressure side of its diaphragm. Therefore, opening of the valve can be restricted for a definite period of time after starting the engine at low temperatures. This is done not only to reduce CO emissions, but also to enhance the driveability of the vehicle in cold weather.

The components of the secondary throttle valve system include the carburetor secondary diaphragm, the solenoid switch, a timer and a thermoswitch.

Checking

1 To check the solenoid valve you need an ohmmeter. See if the resistance between the plus (+) and minus (–) terminals of the valve is 32.7 to 39.9 ohms. If it checks out, measure the resistance between the plus or minus terminal and the valve body. It should be 1 Mohm or more. If that checks out too, apply battery voltage to the terminals and check the opening and closing operation of the vacuum passage. If any of these checks produce different results, replace the valve with a new one.

2 To check the timer, construct a circuit like the one shown in the accompanying illustration. Apply battery voltage to terminals 1 and 2. You should read the same voltage at terminals 2 and 3 until four minutes and five seconds of time elapses. If you still measure battery voltage after the specified time period, replace the timer with a new one.

3 To check the thermoswitch, remove the switch from the vehicle and place it in a pan of water. Use a continuity tester and check the switch to see if it opens and closes at the following temperatures as the water is heated on a stove or hotplate:

Manual transmission
Open – 104°F (40°C) or over
Closed – 88°F (31°C) or below
Automatic transmission
Open – 114°F (45°C) or over
Closed – 97°F (36°C) or below

If the switch does not meet these specifications, replace it with a new one.

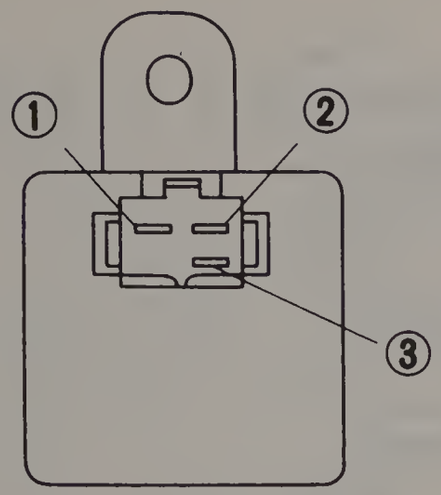


Fig. 6.13 Timer terminal identification (manual transmission) for secondary throttle valve system (Sec 12)

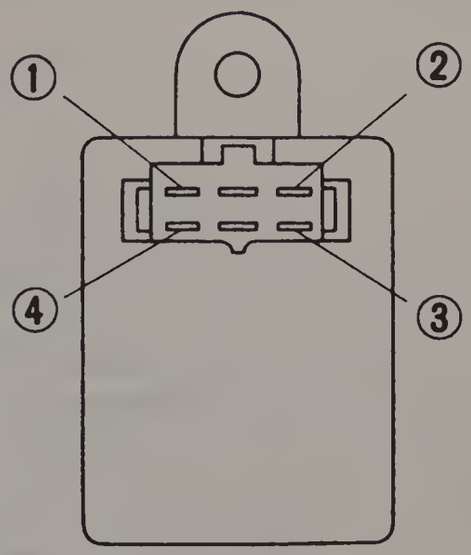


Fig. 6.14 Timer terminal identification (automatic transmission) for secondary throttle valve and shift-up control systems (Sec 12 and 13)

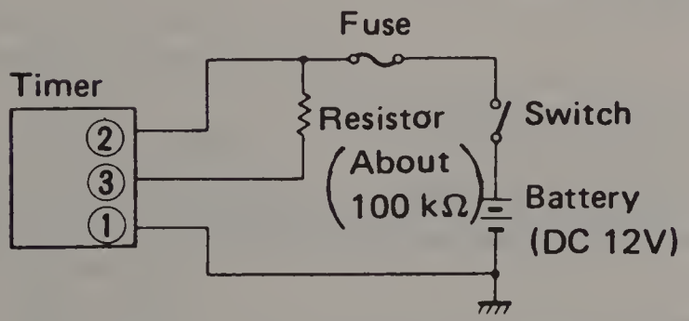


Fig. 6.15 Circuit construction to check the timer on the secondary throttle valve system (Sec 12)

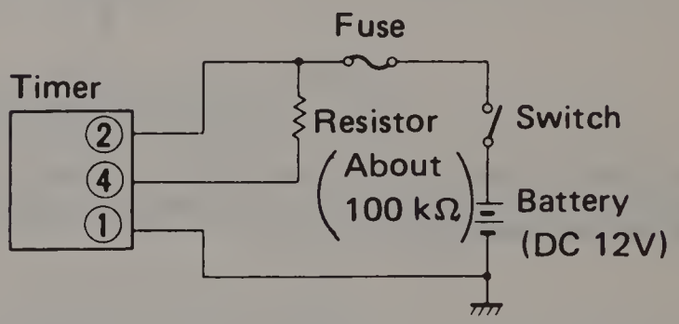


Fig. 6.16 Circuit construction to check the timer on the shift-up control system (Sec 13)

Component replacement

4 To replace the timer, pull the electrical connector off and remove the timer mounting hardware.
5 To replace the solenoid valve, pull the vacuum hoses off and mark them along with the solenoid ports.
6 To replace the thermoswitch, pull the connectors off, mark them and then remove the switch.

13 Shift-up control system

Refer to Figs. 6.14 and 6.16

General description

The shift-up control system is provided on automatic transmission vehicles only. It is used to reduce CO emissions due to rapid warm-up.

When the coolant temperature is lower than the thermoswitch calls for, the transmission is kept in a kick-down status until the temperature rises.

The components of the system are a solenoid valve, a timer and a thermoswitch.

Checking

1 To check the timer, construct a circuit like the one shown in the accompanying illustration. Apply battery voltage to terminals 1 and 2 and after a time lapse of 65 seconds, there should be no voltage at terminals 2 and 4. If there is, replace the timer with a new one.
2 To check the thermoswitch, refer to Step 3 of the Secondary throttle valve system Section.

Component replacement

3 To replace the solenoid valve, refer to Section 8.
4 To replace the thermoswitch, refer to Section 12.
5 To replace the timer, remove the electrical connector and the mounting hardware.

14 Anti-backfire system (1983)

Refer to Fig. 6.17

General description

During rapid deceleration, the fuel/air mixture becomes heavily concentrated for a short period of time. As the vacuum in the intake manifold increases, it causes the fuel residue on the inside wall of the manifold to vaporize and to enter the combustion chamber.

The anti-backfire system prevents this heavy concentration from occurring by introducing air into the intake manifold during this time. This action prevents afterburning in the exhaust system.

The main components of this system are the anti-afterburning valve (AAV), the intake manifold and the EGR valve.

Checking

1 Check the air passage hose for leaks and looseness and replace it with a new one if necessary.
2 Check the vacuum line for leaks and looseness. Disconnect the vacuum hose from the AAV and then run the engine. If air is not sucked into the hose the AAV is defective and should be replaced with a new one.
3 To check the AAV, hold a piece of paper under the AAV and run

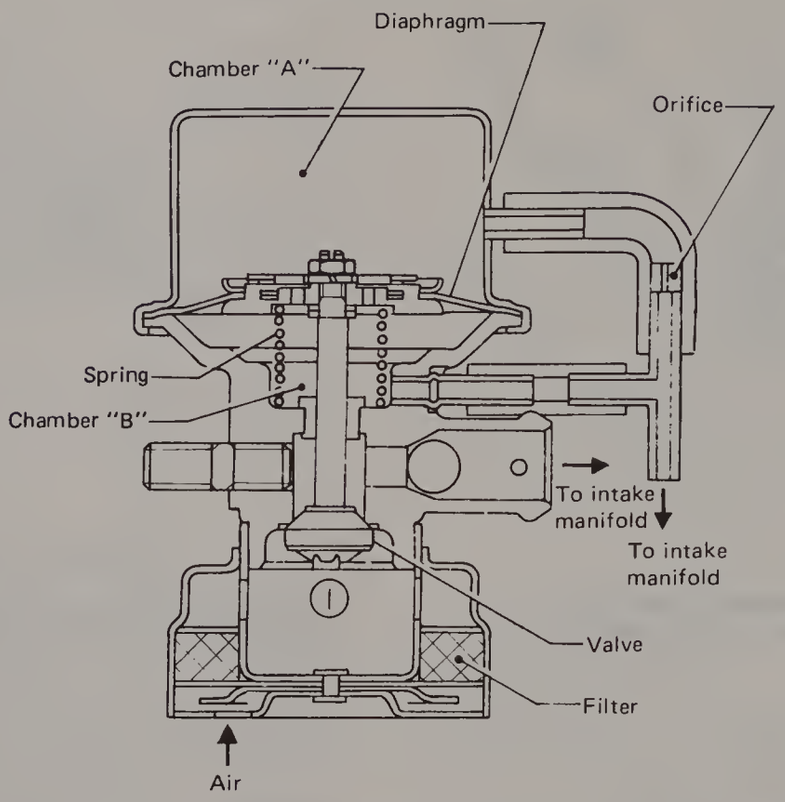


Fig. 6.17 AAV for the Anti-backfire system (1983) (Sec 14)

the engine up to 3000 rpm. Then, close the throttle valve quickly. If the paper is not immediately drawn up at this time, the AAV is defective and should be replaced with a new one.

Component replacement

4 Remove the AAV by disconnecting the hoses from it and then removing the valve from the intake manifold.

Chapter 7 Transmissions

Refer to Chapter 13 for information applicable to 1984 thru 1988 models

Contents

Specifications

Manual transmission

Drive pinion-to-crown gear backlash	
1600 cc	0.004 to 0.0071 in (0.1 to 0.18 mm)
1800 cc	0.0051 to 0.0071 in (0.13 to 0.18 mm)
Differential pinion shaft-to-axle spindle tip clearance	0 to 0.008 in (0 to 0.2 mm)
Mainshaft axial direction play	0 to 0.0020 in (0 to 0.05 mm)
Input shaft axial direction play	0 to 0.0031 in (0 to 0.08 mm)
Reverse idler gear-to-case clearance	0.059 to 0.118 in (1.5 to 3.0 mm)
Reverse shift lever washer-to-case clearance	0 to 0.020 in (0 to 0.5 mm)
Shift rail clearances (all)	
1600 cc (2WD)	0.012 to 0.063 in (0.3 to 1.6 mm)
1800 cc (2WD)	0.012 to 0.063 in (0.3 to 1.6 mm)
1800 cc (4WD)	0.012 to 0.083 in (0.3 to 2.1 mm)
Reverse accent shaft clearance	0.0020 to 0.016 in (0.05 to 0.4 mm)
Rear cover plate selection	
Bearing protrusion	**Plate thickness**
0.138 to 0.140 in (3.5 to 3.63 mm)	0.197 in (5.0 mm)
0.133 to 0.138 in (3.37 to 3.50 mm)	0.202 in (5.13 mm)
Pitching stopper cushion-to-washer clearance	0.031 to 0.047 in (0.8 to 1.2 mm)

Torque specifications

	Ft-lb	Nm
Shifter rod-to-joint bolt	9 to 13	12 to 15
Shifter stay-to-engine rear mount	9 to 13	12 to 15
Cushion rubber mount nut	9 to 17	12 to 23
Shifter knob jam nut	3	5
Shifter selector arm nut	7 to 13	10 to 15
Drive pinion locknut	58	78
Crown gear-to-case bolt	42 to 49	57 to 67
Back-up light switch	12 to 14	16 to 20
Reverse accent shaft plug	23 to 27	31 to 37
Reverse accent spring plug	6.5 to 8.0	9 to 11
Rear driveshaft locknut	54 to 62	73 to 84
Shifter rail plug	13.4 to 15.6	18.1 to 21.1
Drive pinion bearing flange bolt	20 to 24	26 to 32
Holder lock plate	16 to 20	22 to 27
Transmission cover bolts	16 to 20	22 to 27
5th drive gear locknut	58	78
Reverse shifter fork rail plug	14.5	21
Reverse return spring plug	25	34
Transfer case mount bolt	19	25
Rear case-to-transfer case bolts	27	37
Transfer case cover bolts	13.4 to 15.6	18.1 to 21.1
Crossmember rubber cushion nuts	25 to 35	34 to 47
Crossmember mounting nuts	14 to 19	20 to 25
Front exhaust pipe-to-engine nuts	19 to 22	25 to 29
Front exhaust pipe-to-rear exhaust pipe bolts	31 to 38	42 to 52
Engine-to-transmission hardware	34 to 40	46 to 54
Torque converter mounting bolt	17 to 20	23 to 26

1 General information

The manual transmission is a four- or five-speed fully synchronized type with a sliding mesh Reverse gear. Because of the front engine and front wheel drive system, the differential is joined with the transmission and is housed in the same aluminium casing which also serves as the clutch housing. The case can be split into two halves which are connected together by means of through bolts.

The manual transmissions and differentials are lubricated by the same oil, and have one filler/dipstick port and one drain plug. The automatic transmission utilizes two filler dipsticks, two drain plugs and two different lubricants (one for the transmission and one for the differential).

The transmission gearshift is of a remote control, floor-shift type. It consists of a hand lever, a linkage connecting the hand lever to the transmission, and a bracket assembly which supports the linkage.

A transfer case for rear-wheel drive for 4WD models is incorporated on the rear cover. The transfer case is provided with rear axleshafts for transmitting drive to the rear wheels through the driveshaft and rear differential. The rear wheels rotate with the drive pinion at a gear ratio of 1 : 1, while the rear axleshaft is equipped with a claw clutch for four-wheel drive shifting. The claw clutch employs a conventional type synchromesh system to ensure that there is no damage to the gears when shifting to four-wheel drive while the vehicle is in motion.

Since hypoid gears are used for the final reduction, the gear oil must contain extreme-pressure additives. Always use the correct hypoid gear oil.

2 High/Low shift linkage (4WD) – adjustment note

If you ever run into a problem where there is no power being transmitted to the axle shafts when you select FWD or 4WD, the High/Low shift linkage must be adjusted. Take your vehicle to a Subaru dealer to have the adjustments done.

3 Planning major manual transmission work

1 Before beginning transmission disassembly, read through the entire procedure to familiarize yourself with the scope and requirements of the job.

2 One of the biggest problems a beginner will face when dismantling an assembly as complex as a transmission is trying to remember exactly where each part came from. To help alleviate this problem, it may be helpful to draw your own simple diagram or take instant photos during the disassembly process. Laying each part out in the order in which it was removed and tagging parts may also be useful.

3 Try to anticipate which parts may have to be replaced and have them available before beginning. Regardless of broken or badly worn components, there are certain items which must be replaced as a matter of course when the transmission is reassembled. These include gaskets, snap-rings, oil seals and sometimes bearings. You will also need some multi-purpose grease and some RTV-type gasket sealer to properly reassemble the transmission.

4 Cleanliness is extremely important when working on a precision piece of equipment such as a transmission. The work area should be kept as clean and free of dirt and dust as possible. Also, adequate space should be available to lay out the various parts as they are removed.

4 Shifter (manual transmission) – removal and installation

Refer to Figs. 7.1 through 7.4

2WD vehicles

1 Remove the gearshift lever knob and the front exhaust pipe and cover.

2 Remove the Neutral set spring and the stay front end from the engine rear mounting bracket.

3 Remove the rod front end from the joint and the cushion rubber from the underside of the body.

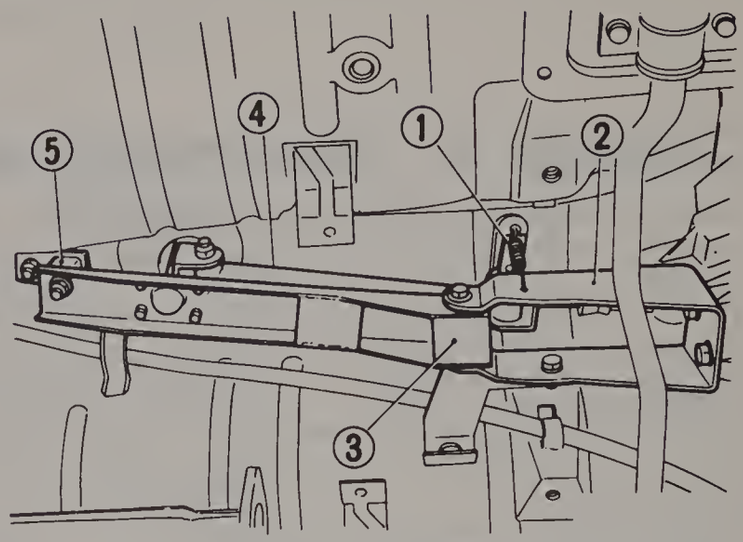


Fig. 7.1 2WD shifter (under vehicle) component location (Sec 4)

1 Neutral set spring
2 Engine rear mount bracket
3 Stay
4 Rod
5 Cushion rubber

4 Now remove the shifter assembly by pulling it down.

5 Connect the rod to the joint from the right side.

6 Connect the stay to the engine rear mounting bracket.

7 Connect the cushion rubber to the body.

8 Install the Neutral set spring, the front exhaust pipe and cover, then the shifter lever knob.

9 Make sure that all of the mounting hardware is tight.

4WD vehicles

10 Remove the gearshift lever knob and the front exhaust pipe and cover.

11 Remove the plastic shift lever covers from around the levers.

12 Remove the nut connecting rod A to rod B.

13 Remove the 4WD selector lever mounting plate bolts and lift out the lever assembly. Remove the screws and lift off the shift lever plate and boot.

14 Disconnect the Neutral set spring and separate rod A from the transfer rail or bracket. **Note:** *Be careful not to lose the bushings (if equipped) when doing this.*

15 Disconnect the shift lever from the transmission lever.

16 Now, remove the shifter assembly by pulling it up.

17 Attach the shift lever to the transmission lever.

18 Install the Neutral set spring and then attach rod A to the transfer rail or bracket. **Note:** *Make sure that the bushings are installed correctly (if so equipped).*

19 Insert the shift lever into the boot, then attach the boot and plate to the body (make sure rod A protrudes through the boot) and tighten the screws.

20 Install the jam nut and knob on the shift lever.

21 Connect rod A to rod B with the nut while holding rod A with a wrench.

22 Attach the 4WD selector lever mounting to the body. Make sure that the transfer rail is set at the forward position. **Note:** *Use a 0.3 in (8 mm) diameter rod to align the selector lever notch with the hole in the plate, then remove the pin.*

23 Install the shift lever covers.

5 Manual transmission – removal

Refer to Fig. 7.5

Note: *Due to the complexity of the transmission and the unavailability of a number of special tools, it is recommended that the home mechanic take the transmission to a Subaru dealer to have it overhauled.*

1 Open the hood and hold it securely in place with the hood stay that is provided. Remove the spare tire and the spare tire support.

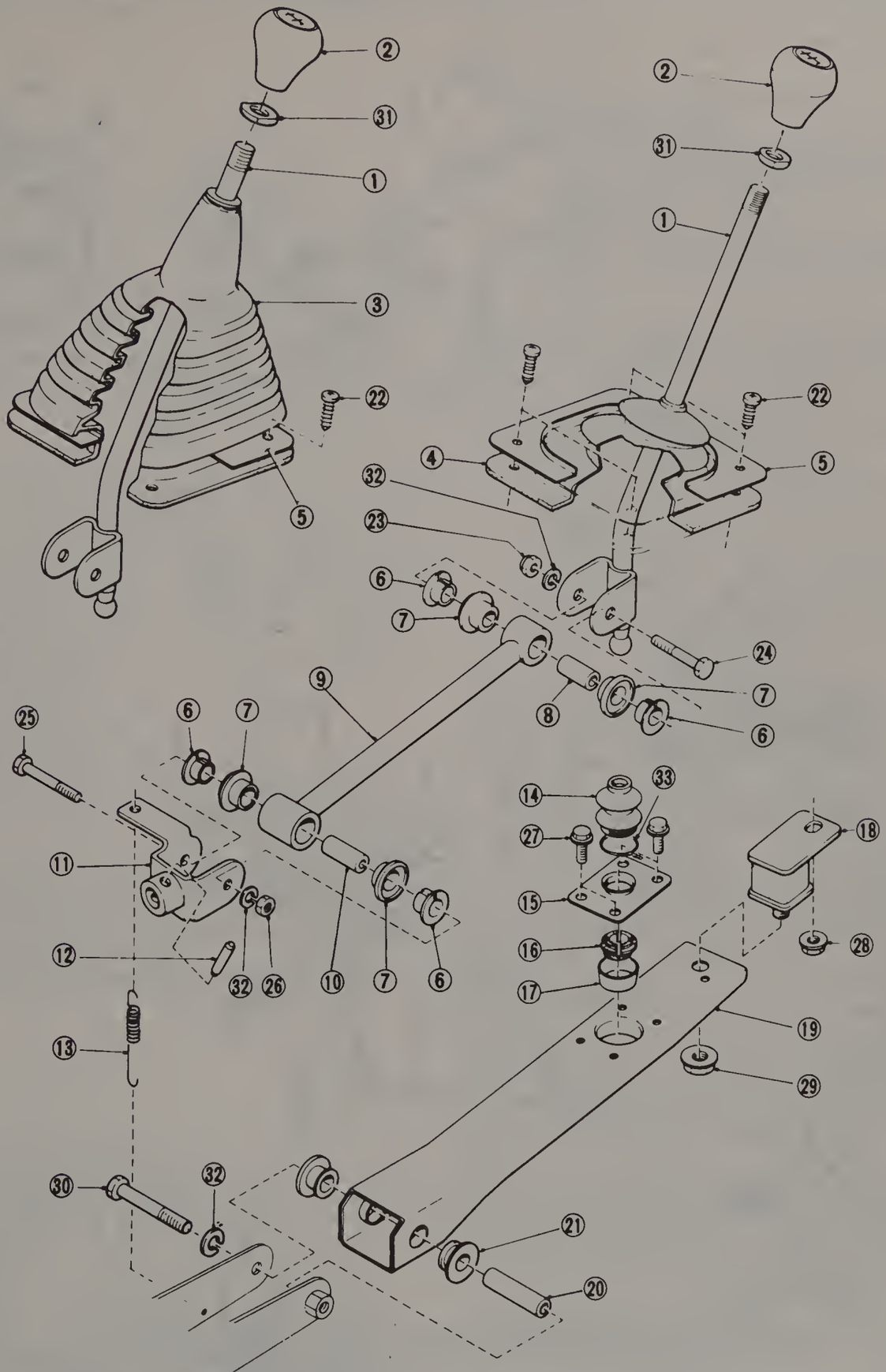


Fig. 7.2 Manual transmission shifter components (2WD) – exploded view (Sec 4)

1 Lever
2 Knob
3 Boot
4 Boot
5 Plate
6 Bushing (resin)
7 Bushing (rubber)
8 Spacer
9 Rod
10 Spacer
11 Joint
12 Spring pin
13 Neutral set spring
14 Dust seal
15 Plate
16 Bushing
17 Cushion
18 Cushion rubber
19 Stay
20 Spacer
21 Bushing (rubber)
22 Screw
23 Nut
24 Bolt
25 Bolt
26 Nut
27 Flange bolt
28 Flange nut
29 Flange nut
30 Bolt
31 Nut
32 Spring washer
33 Lock ring

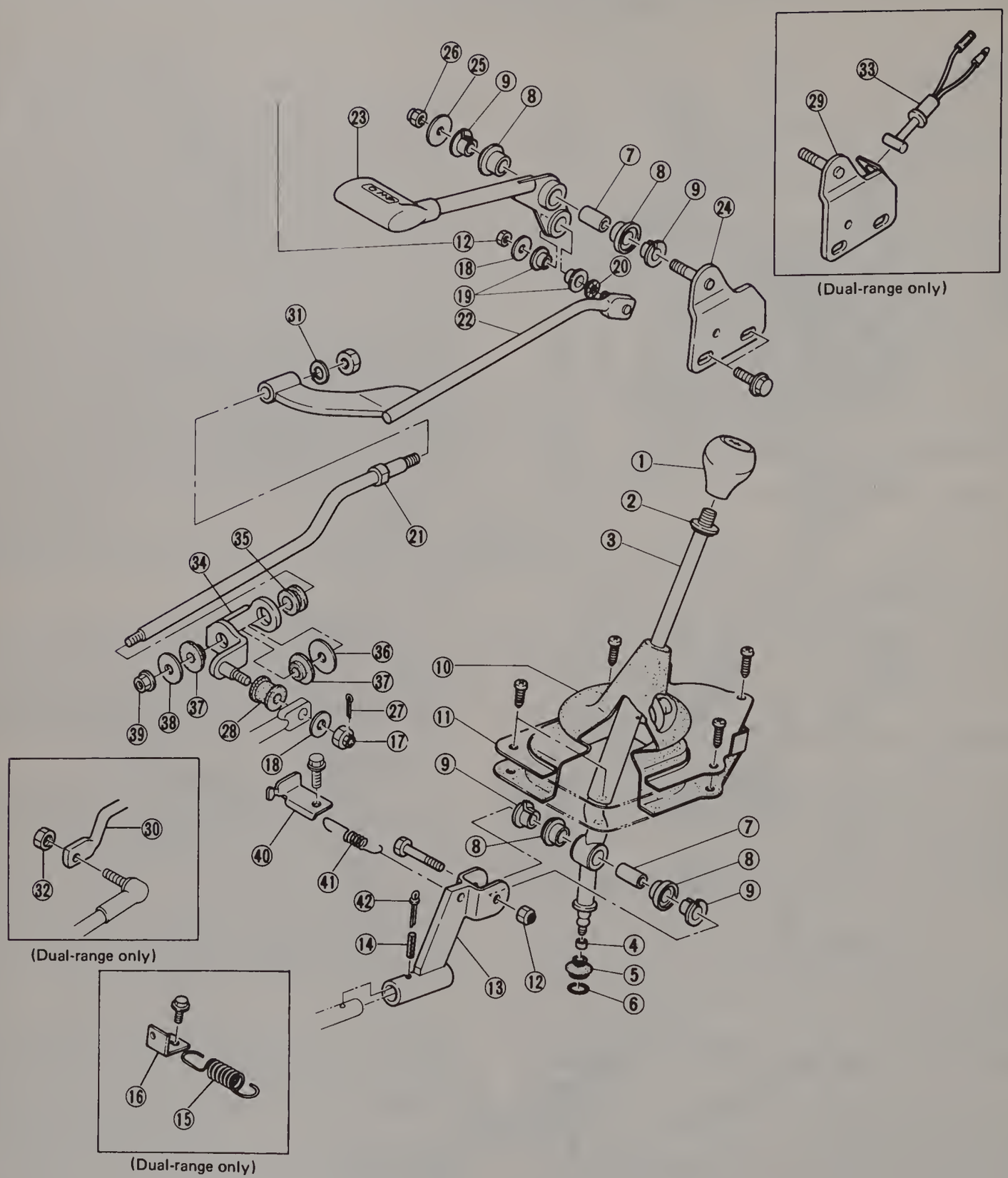


Fig. 7.3 Manual transmission shifter components (4WD) – exploded view (Sec 4)

1 *Knob*
2 *Nut*
3 *Shift lever*
4 *Bushing (rubber)*
5 *Dust seal*
6 *Clip*
7 *Spacer*
8 *Bushing (rubber)*
9 *Bushing (resin)*
10 *Boot*
11 *Plate*
12 *Nut*
13 *Transmission lever*
14 *Spring pin*
15 *Neutral set spring*
16 *Bracket*
17 *Nut*
18 *Washer*
19 *Bushing (resin)*
20 *Wave washer*
21 *Rod A*
22 *Rod B*
23 *4WD selector lever*
24 *Mounting plate*
25 *Washer*
26 *Nut*
27 *Cotter pin*
28 *Bushing (rubber)*
29 *Plate*
30 *Rod A*
31 *Spring washer*
32 *Nut*
33 *Switch*
34 *Transfer rail bracket*
35 *Bushing B*
36 *Washer*
37 *Bushing A*
38 *Washer*
39 *Nut*
40 *Bracket*
41 *Neutral set spring*
42 *Cotter pin*

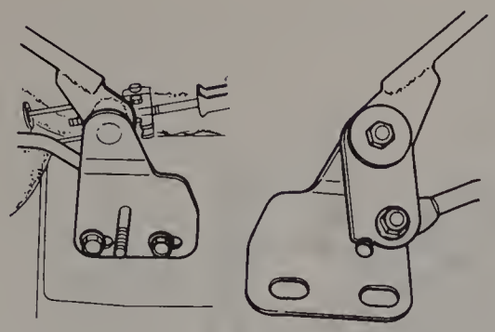


Fig. 7.4 Use an 8 mm bolt or drill bit to align the notch in the selector lever with the hole in the mounting plate (Sec 4)

2 Disconnect the negative (-) battery cable.
3 Disconnect the clutch cable as follows:

a) Remove the clutch cable return spring.
b) Remove both the jam nut and the adjusting nut from the clutch cable end.
c) Unfasten the clip which holds the outer cable in place.
d) Detach the rubber boot from the cable end.

4 Disconnect the speedometer cable from the transmission and unfasten the clip on the cable.
5 Disconnect the following electrical wiring connections:

Back-up light switch connector
Ground cable on the vehicle body
Starter wiring harness

Note: *Do not disconnect the battery cable from the starter.*
6 Remove the starter motor (with battery cable) and hang it on the firewall.
7 Remove the upper bolts which hold the engine to the transmission; loosen the lower nuts but do not remove them.
8 Now, loosen the nut which holds the engine pitching stopper to the transmission side and back it off about $\frac{3}{8}$ inch. Tighten the stopper nut on the engine side an equal amount.
9 Tilt the engine backwards slightly in order to aid in the removal of the transmission.

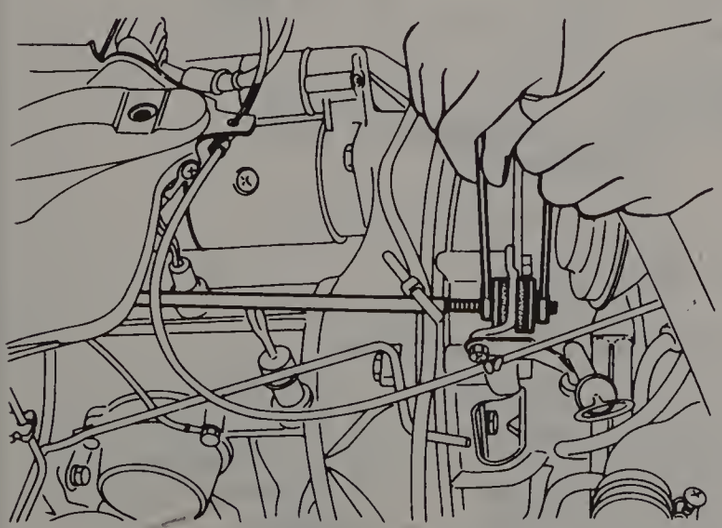


Fig. 7.5 Loosen and reposition the nuts on the engine pitching stopper (Sec 5)

10 *On 4WD vehicles,* separate the 4WD selector and gearshift system as follows:

a) Remove the parking brake cover and tray.
b) Remove the rod cover.
c) Set the drive selector lever in the 4WD position.
d) Remove the nut connecting rod B to rod A (see Fig. 7.3).
e) Separate rod B and the drive selector lever from the plate by removing the nuts.
f) Remove the boot mounting screws
g) Remove the bolt connecting the gearshift lever to the transmission lever and pull up on the gearshift lever and the boot.

11 Disconnect the oxygen sensor and unclamp it.
12 Block the rear wheels, raise the front of the vehicle and place jackstands in the front notches of the side rocker panels.
13 Remove the front exhaust pipe assembly as follows:

a) Disconnect the hot air intake tube.
b) Loosen the nuts which hold the exhaust pipe assembly to the exhaust flanges of the engine.
c) Remove the bolts which secure the front exhaust pipe to the rear exhaust pipe.
d) Remove the bolts which hold the front exhaust pipe to the hanger on the body.
e) Whilst supporting the front exhaust pipe assembly, remove the nuts from the exhaust flanges of the engine and remove the exhaust assembly. **Note:** *Be careful not to strike the oxygen sensor against anything during the removal of the pipe.*

14 *On 4WD vehicles,* remove the driveshaft from the vehicle by referring to the appropriate Section in Chapter 8.
15 Disconnect the gearshift and drive selector linkage system by referring to the appropriate Section in this Chapter.
16 Remove the stabilizer bar by referring to the appropriate Section in Chapter 11.
17 Disconnect both suspension arms where they connect to the crossmember by referring to the appropriate Section in Chapter 11. Lower the suspension arms.
18 Drive the spring pins out of both front axles where they connect to the transmission. Push the wheels to the outside of the vehicle and disconnect the axles from the transmission spindles.
19 Unfasten the clamp on the left side of the parking brake cable in order to remove the crossmember.
20 Remove the nuts which secure the left and right transmission mount rubber cushions.
21 Securely support the transmission by placing a floor jack underneath it.
22 Remove the front crossmember by referring to the appropriate Section in Chapter 11.
23 Now, remove the nuts holding the engine to the transmission.
24 Carefully move the transmission away from the engine making sure that the transmission mainshaft no longer interferes with the engine.
25 Lower the jack and the transmission making sure that it does not come into contact with any adjacent parts on the way down.
26 Since the transmission is separated from the engine, it would be a good time to check the clutch components and replace any parts if necessary. To do this, refer to the appropriate Section in Chapter 8.

6 Transmission (4-speed – 2WD) – overhaul

Refer to Figs. 7.6 through 7.20

Disassembly

General

1 Remove the clutch release fork and release bearing holder as described in Chapter 8.
2 Remove the securing nuts and take off the transmission cover. Remove the bolts retaining the drive pinion.
3 Wrap vinyl tape around the splines of the driveshafts from the oil seal to the end of the shaft. This is to prevent damage to the oil seals as the case is separated into two parts. This is important if you are separating the case of a newly assembled transmission for any reason. In the case of transmissions which have been in use for some time, it

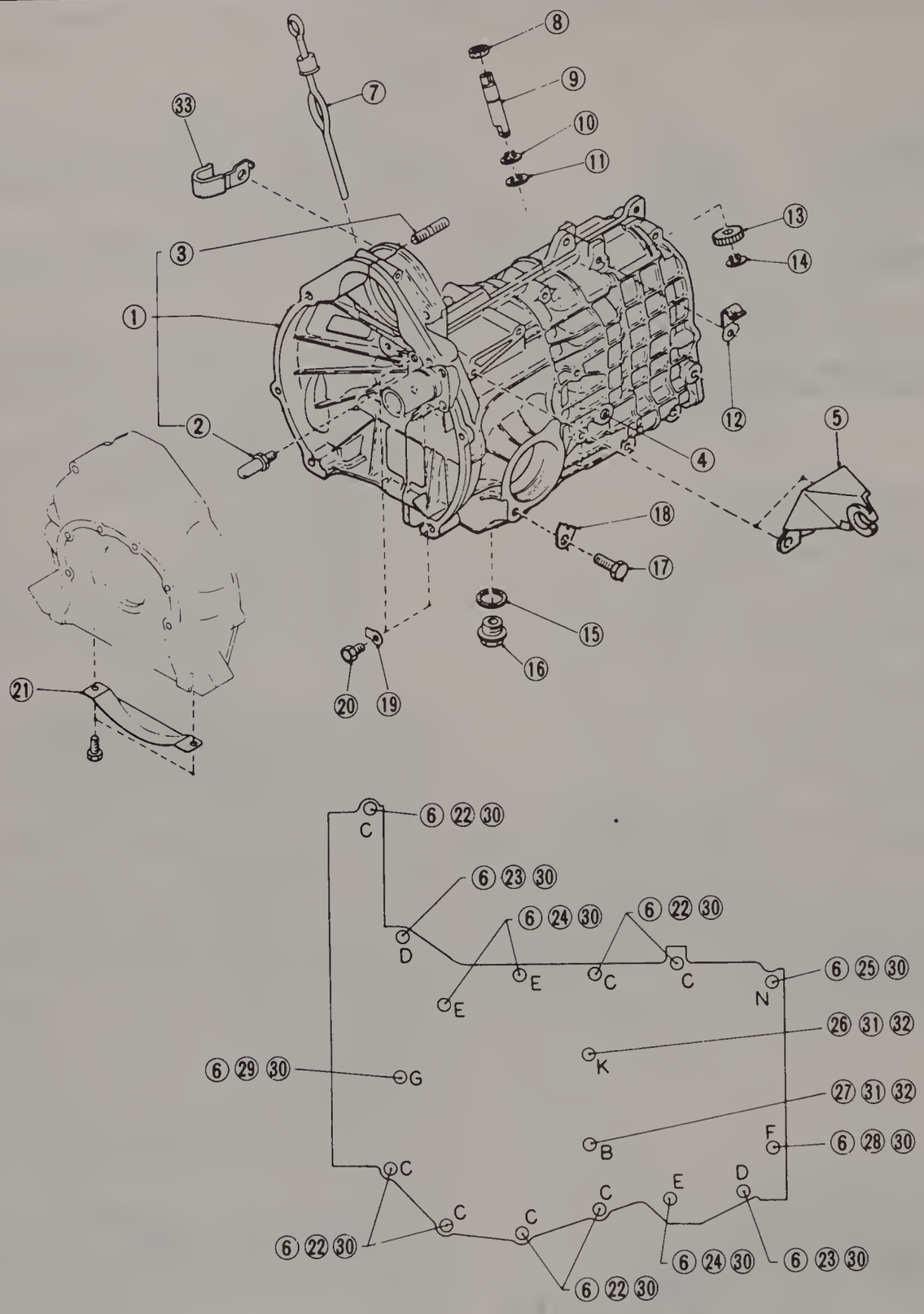


Fig. 7.6 Transmission main case (1600 cc engine) components – exploded view

1 *Main case assembly*
2 *Pivot*
3 *Stud*
4 *Straight pin*
5 *Clutch cable bracket*
6 *Nut*
7 *Oil gauge*
8 *Oil seal*
9 *Speedometer shaft*
10 *Snap-ring*
11 *Washer*
12 *Back-up light clip*
13 *Speedometer driven gear*
14 *Snap-ring*
15 *Gasket*
16 *Drain plug*
17 *Bolt*
18 *Oil seal holder lock plate*
19 *Release spring bracket*
20 *Bolt*
21 *Clutch housing cover*
22 *Bolt (8 x 62 x 18 mm)*
23 *Bolt (8 x 110 x 18 mm)*
24 *Bolt (8 x 130 x 22 mm)*
25 *Bolt (8 x 119 x 18 mm)*
26 *Bolt (10 x 152 x 18 mm)*
27 *Bolt (10 x 168 x 18 mm)*
28 *Bolt (8 x 152 x 18 mm)*
29 *Bolt (8 x 168 x 18 mm)*
30 *Washer*
31 *Washer*
32 *Nut*
33 *Oxygen sensor harness clip*

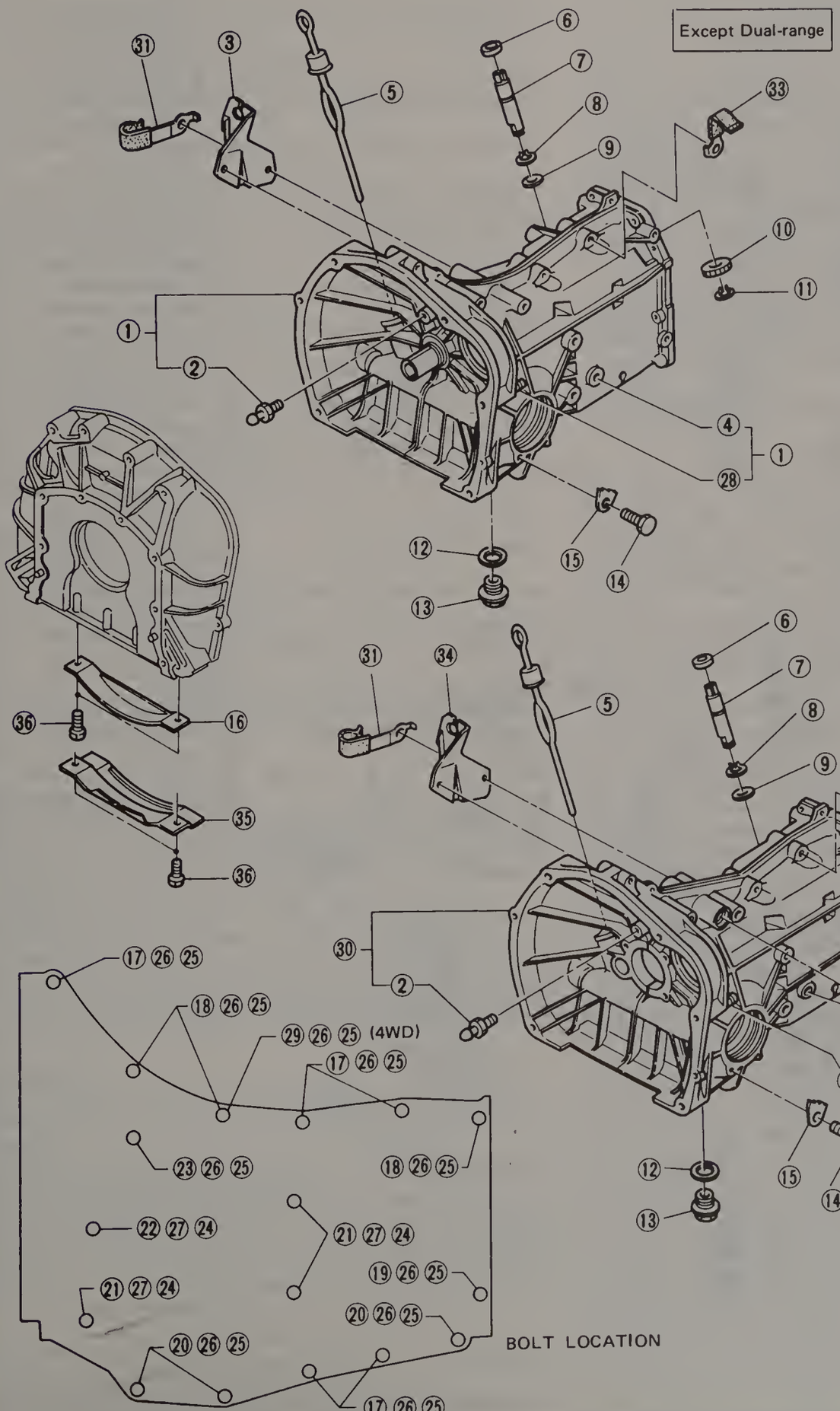


Fig. 7.7 Transmission main case (1800 cc engine) components – exploded view

1 *Main case assembly*
2 *Pivot*
3 *Clutch cable bracket*
4 *Straight pin*
5 *Oil gauge complete*
6 *Oil seal*
7 *Speedometer shaft*
8 *Snap-ring*
9 *Washer*
10 *Speedometer driven gear*
11 *Snap-ring*
12 *Gasket*
13 *Oil drain plug*
14 *Bolt*
15 *Lock plate*
16 *Clutch housing cover*
17 *Bolt (8 x 62 x 18 mm)*
18 *Bolt (8 x 130 x 22 mm)*
19 *Bolt (8 x 168 x 18mm)*
20 *Bolt (8 x 110 x 18 mm)*
21 *Bolt (10 x 168 x 18 mm)*
22 *Bolt (10 x 198 x 18 mm)*
23 *Bolt (8 x 152 x 18 mm)*
24 *Washer*
25 *Washer*
26 *Nut*
27 *Nut*
28 *Stud*
29 *Bolt (8 x 119 x 18 mm)*
30 *Main case assembly (dual-range)*
31 *Oxygen sensor harness clip*
32 *Oil seal*
33 *Back-up light clip*
34 *Clutch cable bracket (dual-range)*
35 *Clutch housing cover (4WD)*
36 *Bolt*

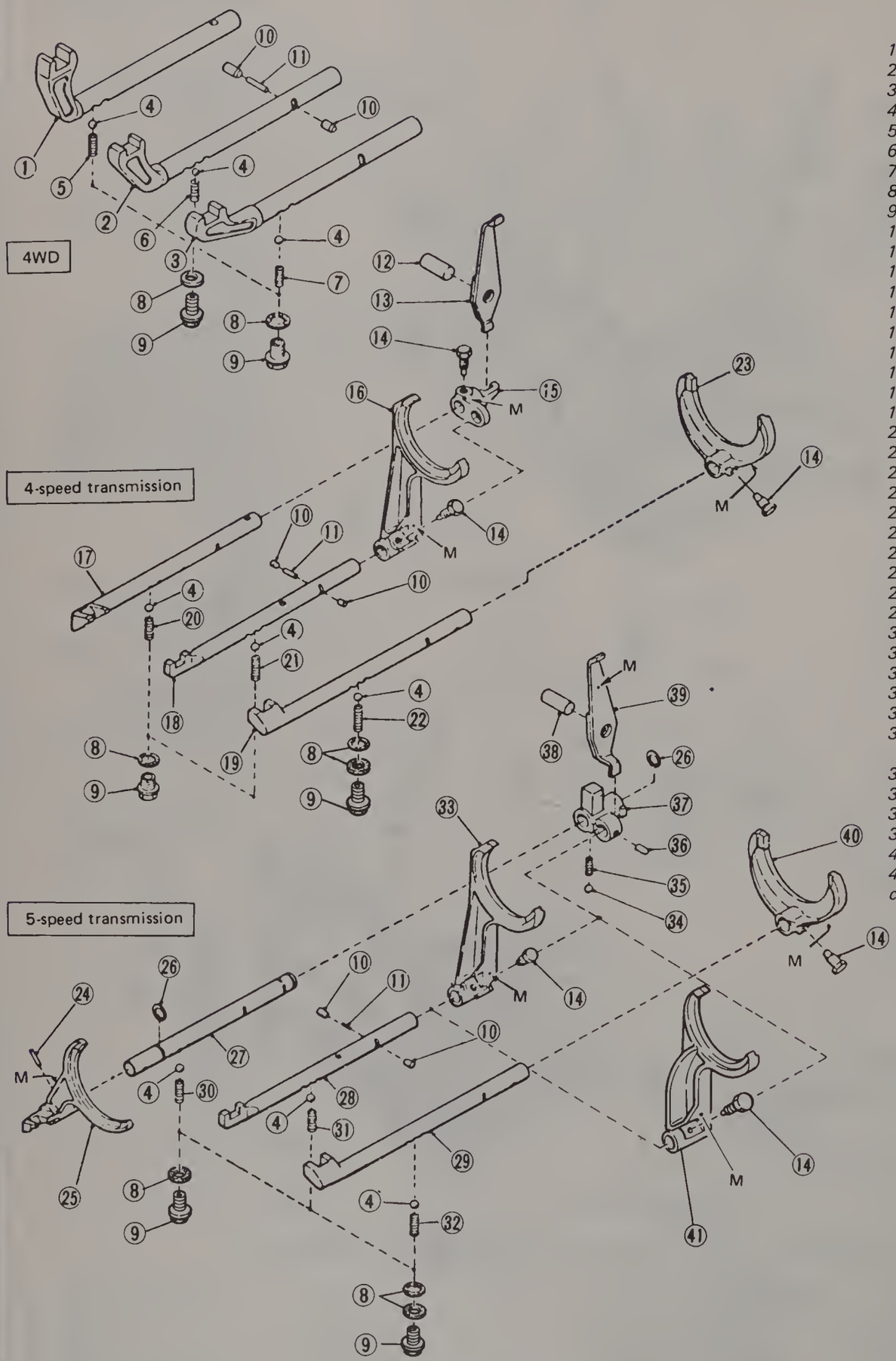


Fig. 7.8 Shifter fork and rail components – exploded view

1 *Reverse shifter rail*
2 *3rd-4th shifter rail*
3 *1st-2nd shifter rail*
4 *7.144 ball*
5 *Shifter fork spring*
6 *Shifter fork spring*
7 *Shifter fork spring*
8 *Aluminum gasket*
9 *Plug*
10 *5.56 x 10.1 plunger*
11 *3 x 11.9 plunger*
12 *Straight pin*
13 *Reverse lever complete*
14 *Shifter fork set screw*
15 *Reverse shifter arm*
16 *3rd-4th shifter fork*
17 *Reverse shifter rail*
18 *3rd-4th shifter rail*
19 *1st-2nd shifter rail*
20 *Shifter fork spring*
21 *Shifter fork spring*
22 *Shifter fork spring*
23 *1st-2nd shifter fork*
24 *Spring pin*
25 *5th shifter fork*
26 *Snap-ring*
27 *Reverse shifter rail*
28 *3rd-4th shifter rail*
29 *1st-2nd shifter rail*
30 *Shifter fork spring*
31 *Shifter fork spring*
32 *Shifter fork spring*
33 *3rd-4th shifter fork*
34 *5.556 ball*
35 *Reverse shifter arm spring*
36 *5.56 x 10.1 plunger*
37 *Reverse shifter arm*
38 *Straight pin*
39 *Reverse lever complete*
40 *1st-2nd shifter fork*
41 *3rd-4th shifter fork (1800 cc)*

is recommended that new seals be installed at reassembly.
4 Remove the bolts clamping the transmission case together and separate the case into the right half and left half. The case will easily separate if the two areas around the knock pins (dowels) are tapped with a plastic hammer.
5 Lift out the drive pinion. If necessary, pry it up using a screwdriver against a block of wood. Remove the shims from the drive pinion to prevent them from being damaged.
6 Remove the transmission mainshaft.
7 Remove the differential assembly. Take care not to interchange the right-hand and left-hand sides of the roller bearing outer race. Identify them with labels.
8 Remove the shifter rail spring plugs and collect the springs and balls.
9 Unscrew the shifter fork set screws and remove the shifter forks for 4th/3rd and 1st/2nd gears as well as the shifter fork rails. When pulling out a rail, keep the other rails in the Neutral position and take care not to drop the shifter rail plungers. To remove the 4th/3rd rail, turn it 90° and then pull it out.
10 Unscrew the shifter fork securing set screw and remove the Reverse shifter rail arm and shifter rail.
11 Unscrew the attaching bolts from the transmission case then remove the oil seal holder lock plate and the driveshaft oil seal holder from each half of the transmission case. Remove the O-rings from the oil seal holders.
12 Remove the circlip retaining the speedometer driven gear and pull the gear out. Then remove the speedometer shaft by tapping it out using a drift. The oil seal will come out with the shaft.
13 Pull out the knock pin and then remove the Reverse idler gearshaft, Reverse idler gear and the shift lever.

Mainshaft
14 Secure the mainshaft in a vise with soft jaws to prevent damage to the gears.
15 Remove the snap-ring. Discard the snap-ring and always fit a new one at reassembly.
16 Remove the ball bearing, mainshaft collar, 4th drivegear, synchronizer hub, 4th drivegear bushing and 3rd drivegear with a press.
17 The 3rd drivegear bushing should be left on the shaft if it is in good condition. If it requires replacing, cut a groove on it with a grinder and drive it off with a chisel. Once it has moved a little it can be removed with a press.

Drive pinion
18 Using soft jaws to prevent damage to the gears, hold the 4th/3rd gears in a vise and remove the locknut after relieving the staking. The gears should be supported after removing the locknut, to prevent the ball bearings from dropping out, because some of the bearings are not a press fit on the drive pinion.
19 Remove the ball bearing and 4th/3rd driven gears using a press and then take off the 2nd driven gear and needle bearing.
20 Remove the 1st driven gear, the needle bearing race, the synchronizer hub and the needle bearing with a press. Remove the key from the drive pinion shaft before removing the needle bearing race.
21 Using the press, remove the needle bearing race, the drive pinion spacer and the roller bearing.

Differential
22 Remove the right and left-hand snap-rings and withdraw the axle spindles. Identify the shafts so that they can be installed in the same positions.
23 Straighten the crown gear lockwasher, unscrew the securing bolts and lift the crown gear out of the case.
24 Drive out the differential pinion shaft retaining pin toward the crown gear position with a pin punch. Pull out the differential pinion shaft and remove the differential pinions, the side gears and the washers.
25 Do not remove the roller bearings unless they are defective. If they have to be replaced, use a puller to remove the bearings.

Rear case
26 Unscrew and remove the back-up light switch and then remove the Reverse accent spring, ball and straight pin.
27 Remove the plug in the upper part of the cover and then take out the Reverse accent shaft and Reverse return spring.

Inspection
28 Clean all the parts thoroughly with solvent and dry them with compressed air.
29 Check all the bearings for cracked, pitted or worn balls. Examine the bearing cages for damage and corrosion. Lubricate the bearings with gear oil and turn them to see if the rotation is smooth or if unusual noises are emitted. The pinion end bearing rotation may be felt to be a little heavier than the others as preloading is applied to this bearing.
30 Replace any gears having cracked or damaged teeth, excessive wear or pitted tooth surfaces. Replace if the cone bearing synchronizer ring is rough or damaged.
31 Replace the synchronizer ring and hub if the contacting surface of the synchronizer hub insert is worn in steps or excessively worn. Replace the ring if the inner surface or tooth surface is damaged or unevenly worn. Replace the ring if the clearance between the surfaces of ring and cone facing each other is very small when the ring is forced against the cone of the gear.
32 Check the gearshift rails for wear or damage. If slightly bent, straighten them. Replace the forks if damaged or worn.
33 Examine the differential gears for excessive or uneven wear, pitted tooth surfaces or cracked teeth. If the crown gear is defective it must be replaced as a matched set with the drive pinion. Examine the axle driveshaft journals and splines for wear and damage, and replace as necessary.
34 Replace all oil seals and gaskets. Before reassembly, lubricate all parts with gear oil.

Reassembly
Rear case
35 Install the backup light switch with the aluminium gasket and tighten it securely.
36 Install the Reverse return spring, the Reverse accent shaft and the plug with the aluminium gasket. Tighten the plug to the specified torque.
37 Install the balls, the Reverse accent springs and the plug with an aluminium gasket. Tighten the plug to the specified torque. **Note:** *Make sure that the lower spring is red and the upper one is yellow.*
Differential
38 Install the differential side gears and the differential pinions together with the washers in the differential case and then insert the differential pinion shaft.
39 Using a dial indicator gauge, measure the backlash between the gears and pinions and adjust by using the appropriate thickness of washers. The correct backlash can be found in the Specifications.
40 Align the differential pinion shaft with the holes in the case. Insert the locking pin from the crown wheel side and, using a pin punch, drive the pin in until it is just below the level of the case and then stake the case to retain the pin.
41 Install the roller bearings on the case with a press. If installing the same bearings, make sure they are installed in the correct location and matched to the outer races.
42 Install the crown gear on the case and secure it with the lockwashers and bolts. Tighten the bolts to the specified torque and then bend over the lockwashers.
43 Install the axle driveshaft and secure it with snap-rings. Measure the clearance between the differential pinion shaft and the end of the axle spindles. Adjust, if necessary, by selecting the correct thickness of snap-ring. The correct clearance can be found in the Specifications.
Drive pinion
44 Install the roller bearing and then the drive pinion spacer, using a press.
45 Assemble the synchronizer inserts, the Reverse driven gear and the springs on the synchronizer hub. Make sure that the spring cut-ends are 120° apart and the Reverse driven gear with its toothed side, and the hub having the smaller boss, are facing in the same direction.
46 Press on the needle bearing race. Install the needle bearing, the 1st driven gear and the assembled synchronizer rings and hub. Ensure that the synchronizer ring groove is in line with the inserts.
47 Press on the needle bearing race and install the 2nd driven gear. Insert the key into the groove on the pinion.
48 Press on the 3rd/4th driven gear and then the ball bearing. Some ball bearings may be installed without having to press them on but this does not affect their operation.
49 Install the drive pinion lockwasher and locknut. Tighten the

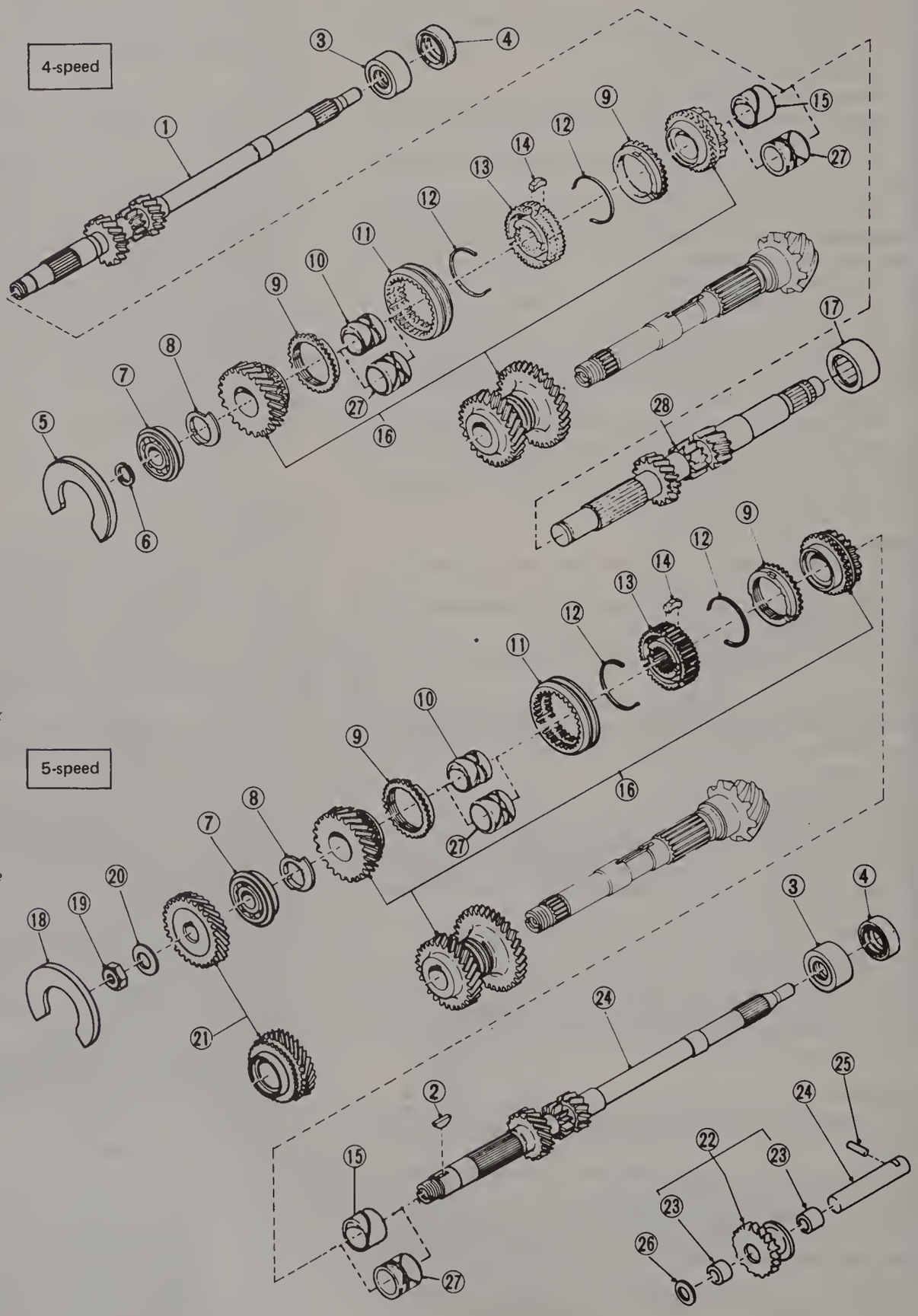


Fig. 7.9 Manual transmission mainshaft components – exploded view

1 *Mainshaft*
2 *Woodruff key*
3 *Needle bearing (22 x 42 x 20 mm)*
4 *Oil seal (20 x 40 x 10 mm)*
5 *Main shaft rear plate*
6 *Snap-ring (outer)*
7 *Ball bearing (22 x 58 x 25 mm)*
8 *4th drive gear thrust plate*
9 *Synchronizer ring*
10 *4th drive gear bushing*
11 *Synchronizer sleeve*
12 *Synchronizer hub spring*
13 *Synchronizer hub*
14 *Synchronizer hub insert*
15 *3rd drive gear bushing*
16 *4th-3rd gear set*
17 *Needle bearing*
18 *Mainshaft rear plate*
19 *Locknut*
20 *Lock washer*
21 *5th gear set*
22 *Reverse idler gear*
23 *Reverse idler gear bushing*
24 *Reverse idler gear shaft*
25 *Knock pin*
26 *Washer*
27 *3rd-4th drive gear bushing*
28 *Transmission mainshaft (4WD)*

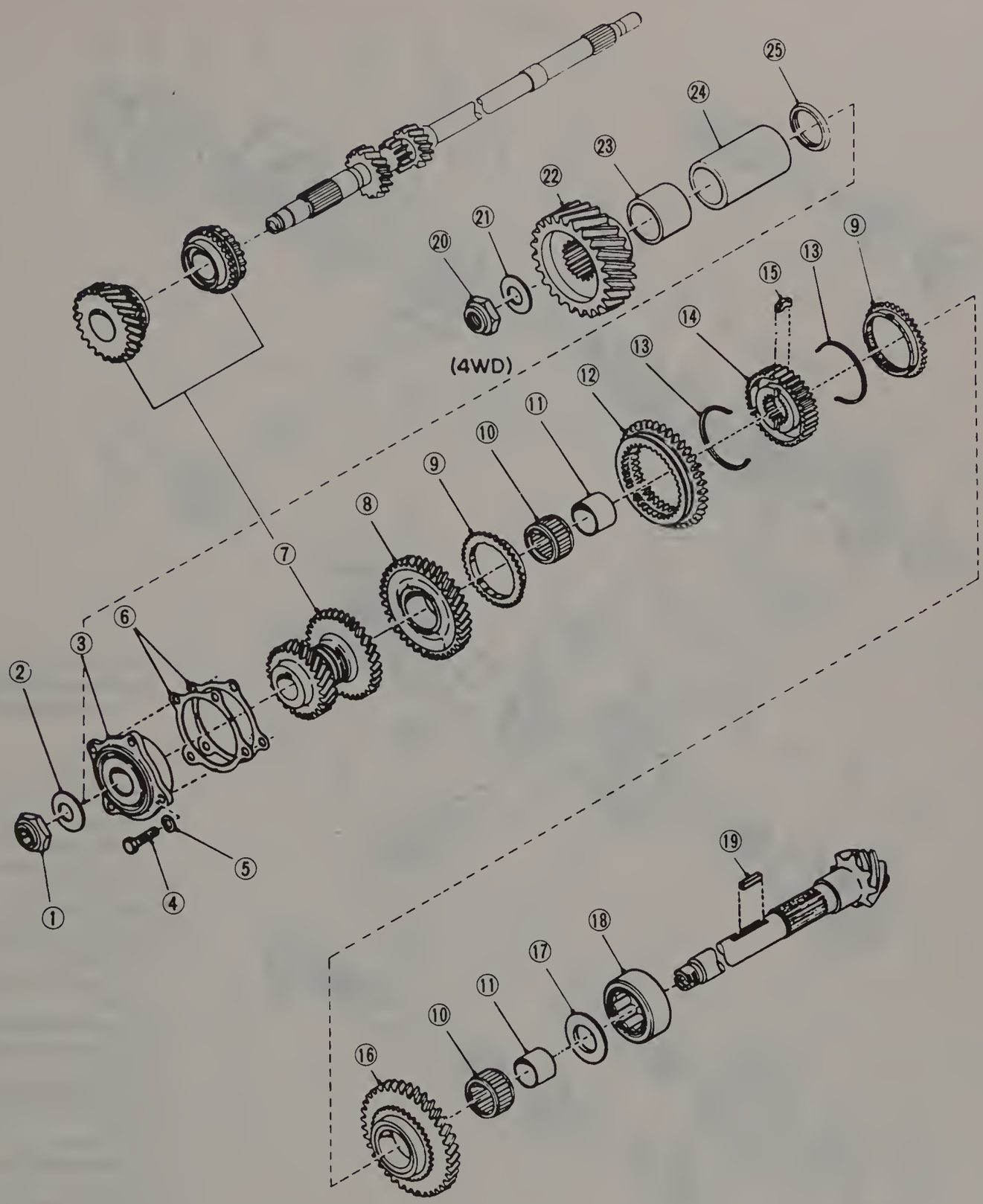


Fig. 7.10 Drive pinion components (4-speed and 4WD) – exploded view

1 Locknut
2 Lock washer
3 Ball bearing (25 x 70 x 30 mm)
4 Bolt (8 x 28 x 23 mm)
5 Spring washer
6 Drive pinion shim
7 4th-3rd gear set
8 2nd driven gear
9 1st-2nd synchronizer ring
10 Needle bearing (37 x 42 x 23.8 mm)
11 1st-2nd needle bearing race
12 Reverse driven gear
13 1st-2nd synchronizer spring
14 1st-2nd synchronizer hub
15 1st-2nd synchronizer insert
16 1st driven gear
17 1st driven gear thrust plate
18 Roller bearing (37.5 x 67 x 22 mm)
19 Key
20 Locknut
21 Lockwasher
22 Transfer drive gear
23 Transfer needle bearing race
24 Drive pinion collar
25 Washer

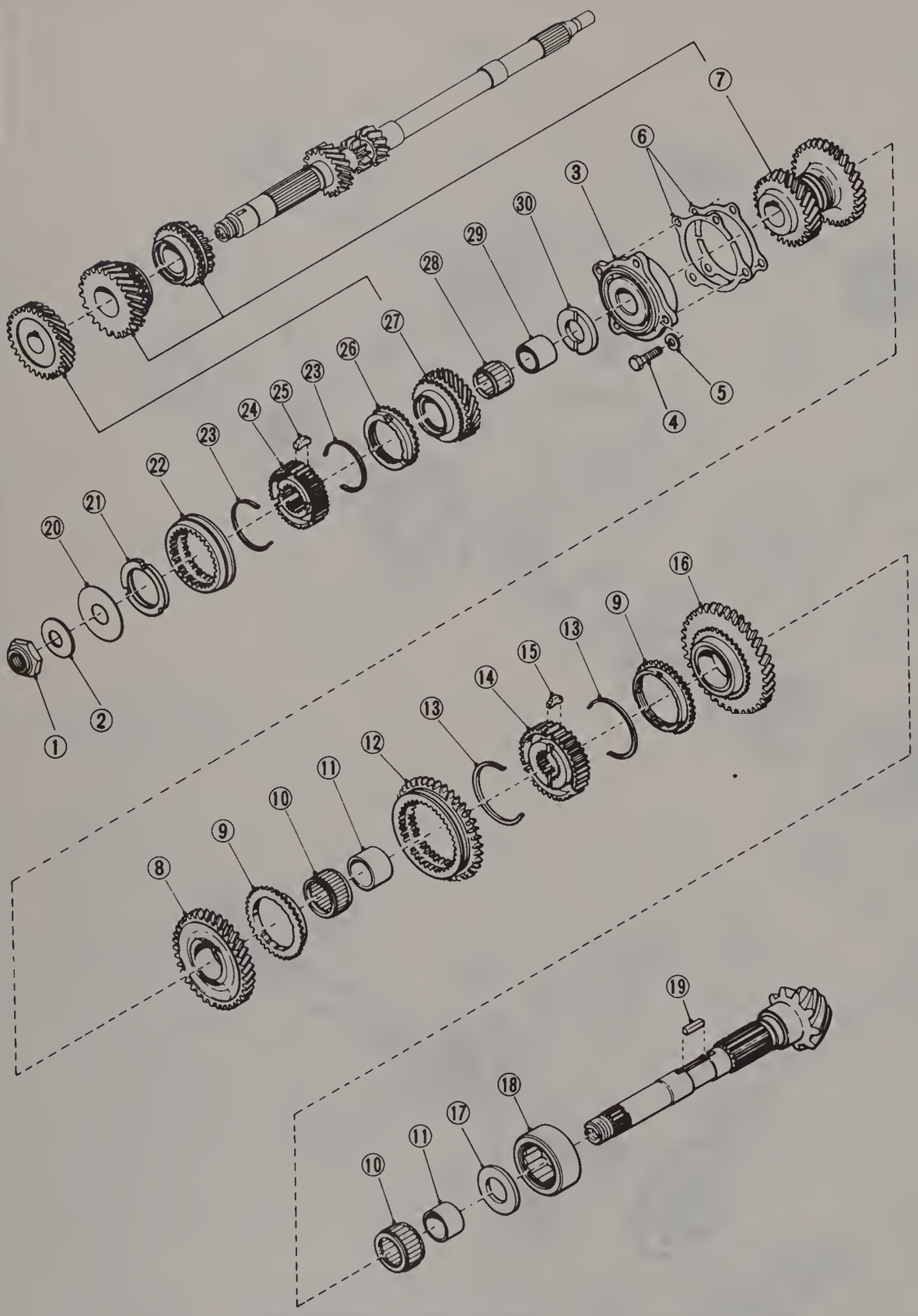


Fig. 7.11 Drive pinion components (5-speed) – exploded view

1 *Locknut*
2 *Lockwasher*
3 *Ball bearing (25 x 70 x 30 mm)*
4 *Bolt (8 x 28 x 23 mm)*
5 *Spring washer*
6 *Drive pinion shim*
7 *4th/3rd gear set*
8 *2nd driven gear*
9 *1st-2nd synchronizer ring*
10 *Needle bearing (37 x 42 x 23.8 mm)*
11 *1st-2nd needle bearing race*
12 *Reverse driven gear*
13 *1st-2nd synchronizer spring*
14 *1st-2nd synchronizer hub*
15 *1st-2nd synchronizer insert*
16 *1st driven gear*
17 *1st driven gear thrust plate*
18 *Roller bearing (37.5 x 67 x 22 mm)*
19 *Key*
20 *Insert stopper plate*
21 *Insert guide*
22 *Synchronizer sleeve*
23 *Synchronizer hub spring*
24 *Synchronizer hub*
25 *Synchronizer hub insert*
26 *Synchronizer ring*
27 *5th gear set*
28 *Needle bearing (29 x 33 x 23.8 mm)*
29 *5th needle bearing race*
30 *5th driven gear thrust plate*

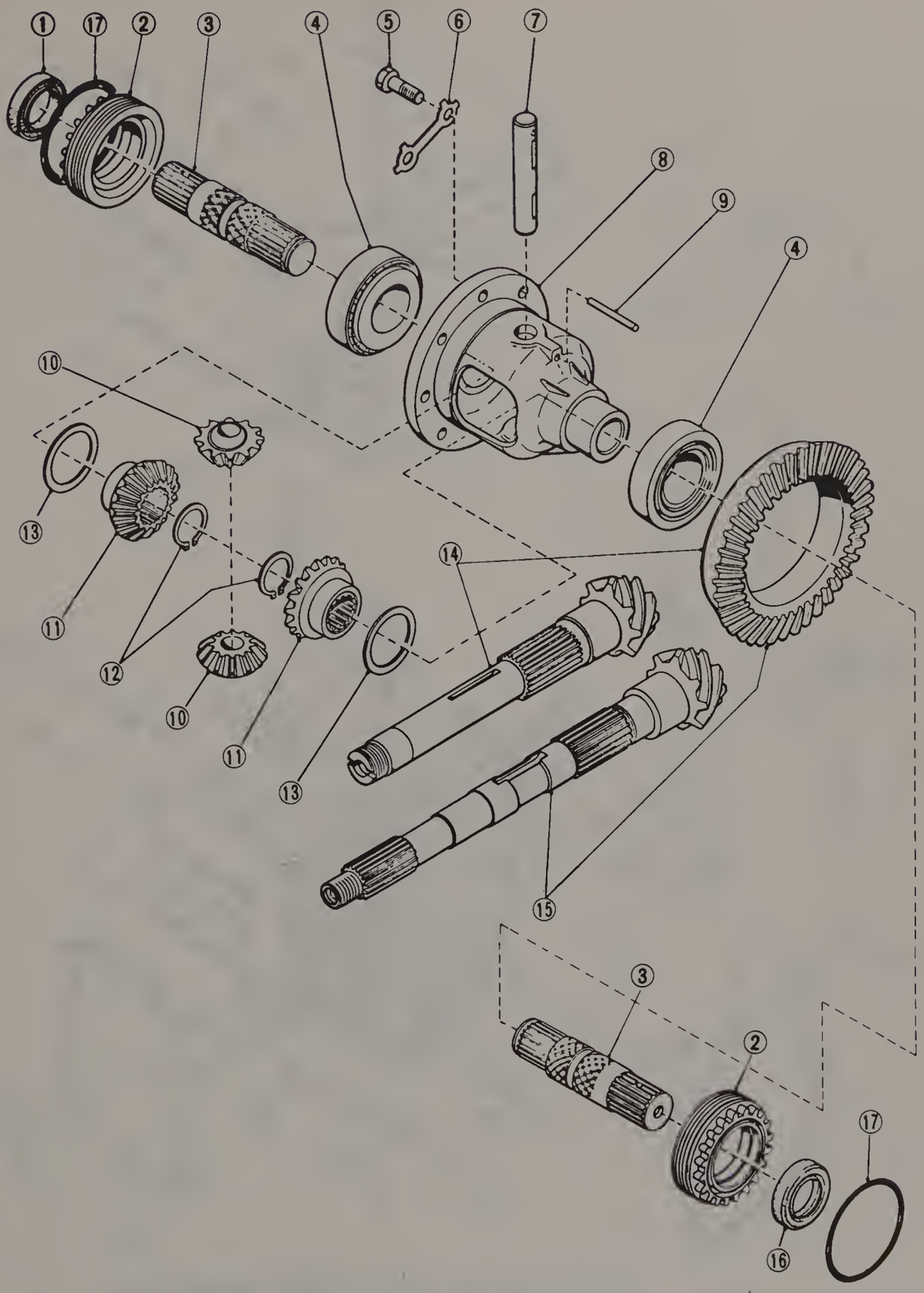


Fig. 7.12 Transmission/differential components – exploded view

1 *Oil seal*
2 *Axle shaft oil seal holder*
3 *Axle driveshaft*
4 *Roller bearing*
5 *Bolt*
6 *Crown gear lock washer (1600 cc only)*
7 *Differential pinion shaft*
8 *Differential case*
9 *Straight pin*
10 *Differential pinion*
11 *Differential side gear*
12 *Snap-ring*
13 *Washer*
14 *Pinion and crown gear set (4-speed and 5-speed)*
15 *Pinion and crown gear set (4WD)*
16 *Oil seal*
17 *O-ring*

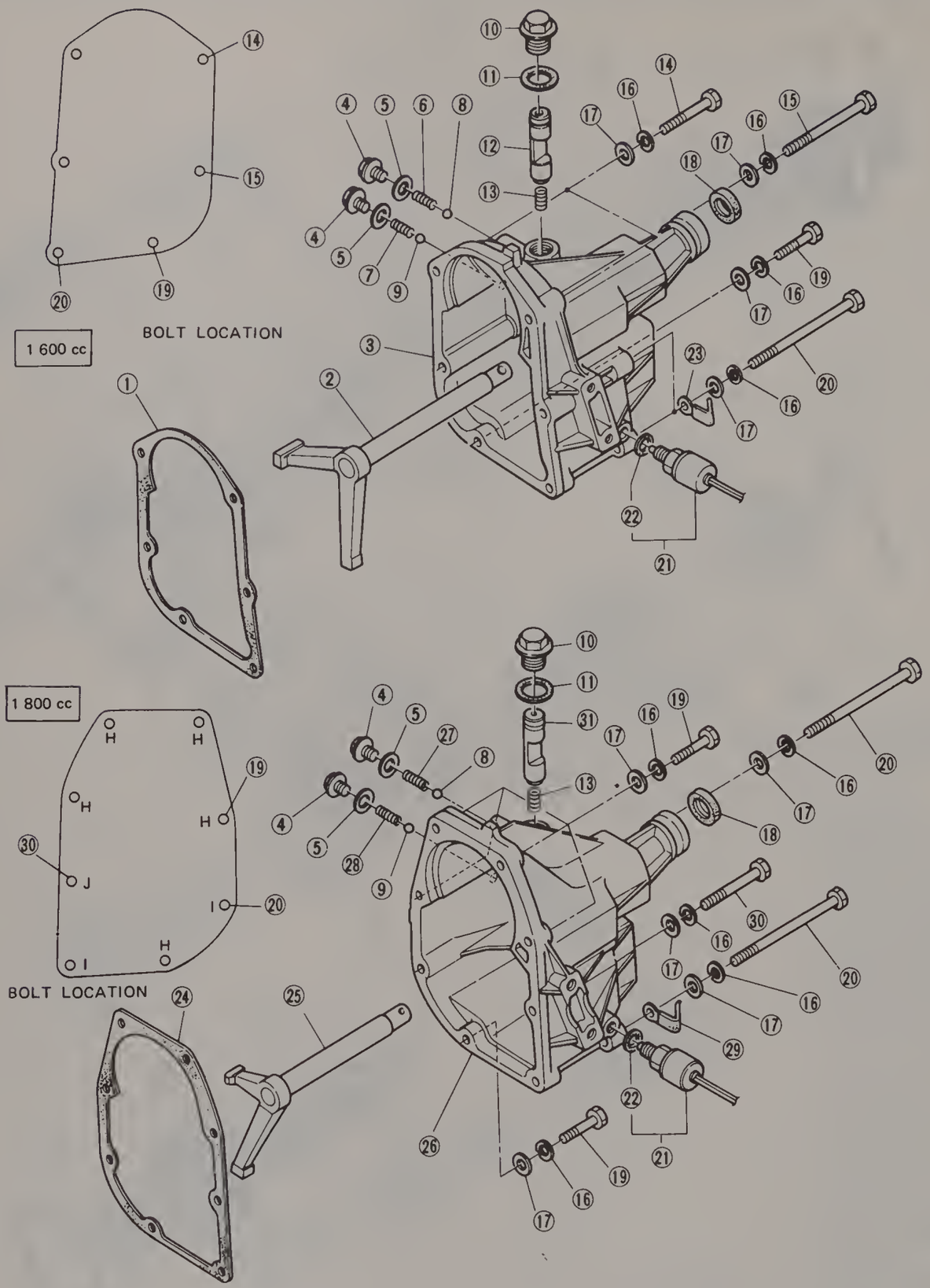


Fig. 7.13 Rear case components (2WD) – exploded view

1 *Main case rear gasket (1600 cc)*
2 *Shifter arm*
3 *Rear case (1600 cc)*
4 *Filler*
5 *Aluminum gasket*
6 *Shifter fork rail spring*
7 *Shifter fork rail spring*
8 *Ball*
9 *Ball*
10 *Plug*
11 *Aluminum gasket*
12 *Reverse accent shaft*
13 *Reverse return spring*
14 *Bolt (8 x 55 x 18 mm)*
15 *Bolt (8 x 93 x 18 mm)*
16 *Spring washer*
17 *Washer*
18 *Oil seal*
19 *Bolt (8 x 38 x 18 mm)*
20 *Bolt (8 x 119 x 18 mm)*
21 *Back-up light switch*
22 *Gasket*
23 *Back-up light wire clip*
24 *Main case rear gasket (1800 cc)*
25 *Shifter arm (1800 cc)*
26 *Rear case (1800 cc)*
27 *Shifter fork rail spring*
28 *Shifter fork rail spring*
29 *Back-up light wire clip*
30 *Bolt (8 x 65 x 20 mm)*
31 *Reverse accent shaft (1800 cc)*

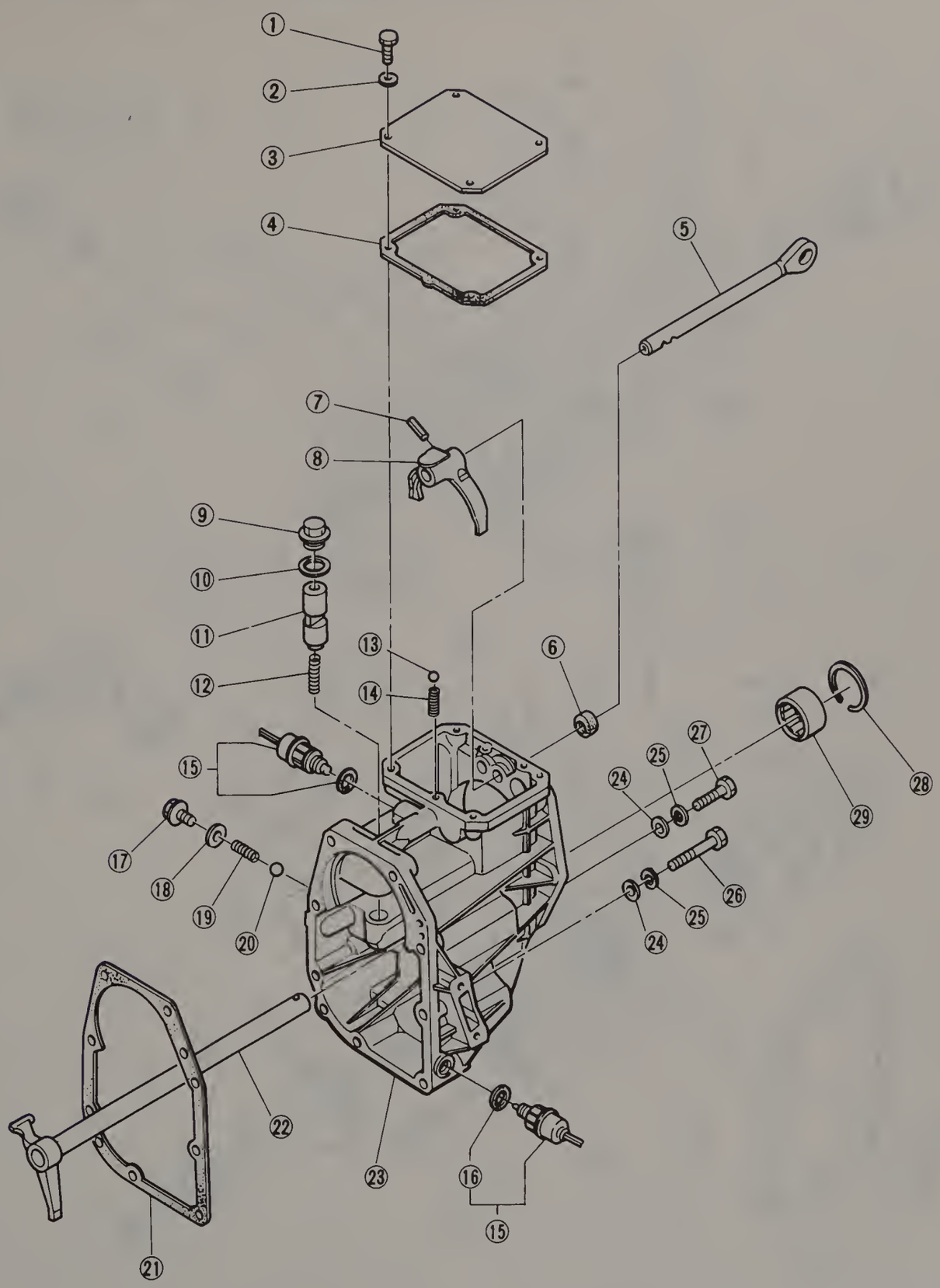


Fig. 7.14 Transfer case components (4WD) – exploded view

1 *Bolt*
2 *Spring washer*
3 *Transfer case cover*
4 *Transfer cover gasket*
5 *Transfer rail*
6 *Oil seal*
7 *Straight pin*
8 *Transfer shifter fork*
9 *Plug*
10 *Gasket*
11 *Reverse accent shaft*
12 *Reverse return spring*
13 *Ball*
14 *Shifter fork rail spring*
15 *Back-up light switch*
16 *Aluminum gasket*
17 *Filler*
18 *Aluminum gasket*
19 *Reverse accent spring*
20 *Ball*
21 *Transmission gasket*
22 *Shifter arm*
23 *Transfer case*
24 *Washer*
25 *Spring washer*
26 *Bolt*
27 *Bolt*
28 *Snap-ring*
29 *Needle bearing*

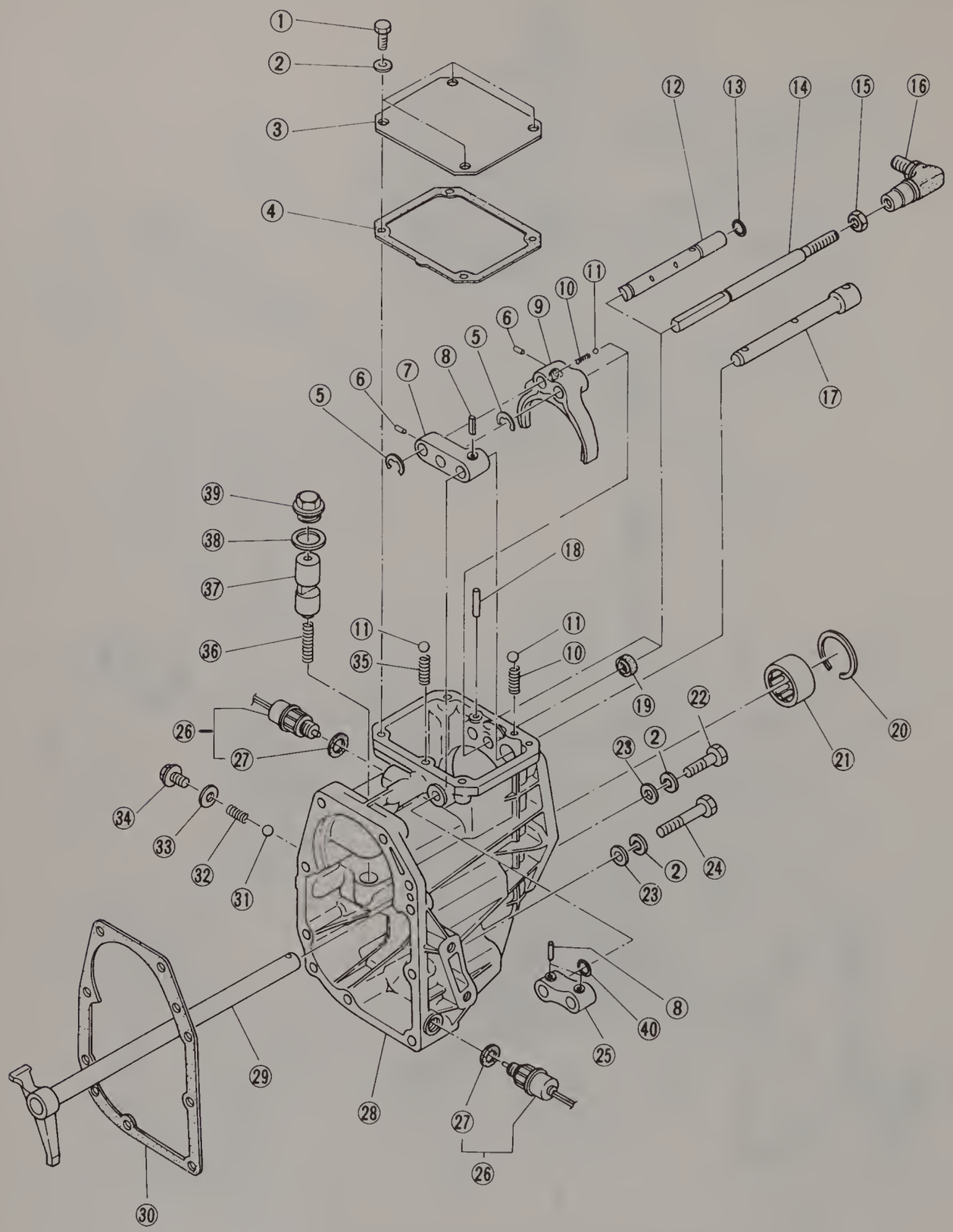


Fig. 7.15 Transfer case components (4WD dual-range) – exploded view

1 *Bolt*
2 *Spring washer*
3 *Transfer case cover*
4 *Transfer cover gasket*
5 *Clip*
6 *Plunger*
7 *High-Low shifter arm*
8 *Straight pin*
9 *Transfer shifter fork*
10 *Spring*
11 *Ball*
12 *Interlock rail*
13 *O-ring*
14 *Transfer rail*
15 *Nut*
16 *Transfer ball joint assembly*
17 *High-Low shifter rail*
18 *Knock pin*
19 *Oil seal*
20 *Snap-ring*
21 *Needle bearing*
22 *Bolt (8 x 38 x 18 mm)*
23 *Washer*
24 *Bolt (8 x 65 x 20 mm)*
25 *Rod arm*
26 *Back-up light switch*
27 *Gasket*
28 *Transfer case unit*
29 *Shifter arm complete*
30 *Main case rear gasket*
31 *Ball*
32 *Reverse accent spring*
33 *Gasket*
34 *Filler*
35 *Shifter fork spring*
36 *Reverse return spring*
37 *Reverse accent shaft*
38 *Gasket*
39 *Plug*
40 *O-ring*

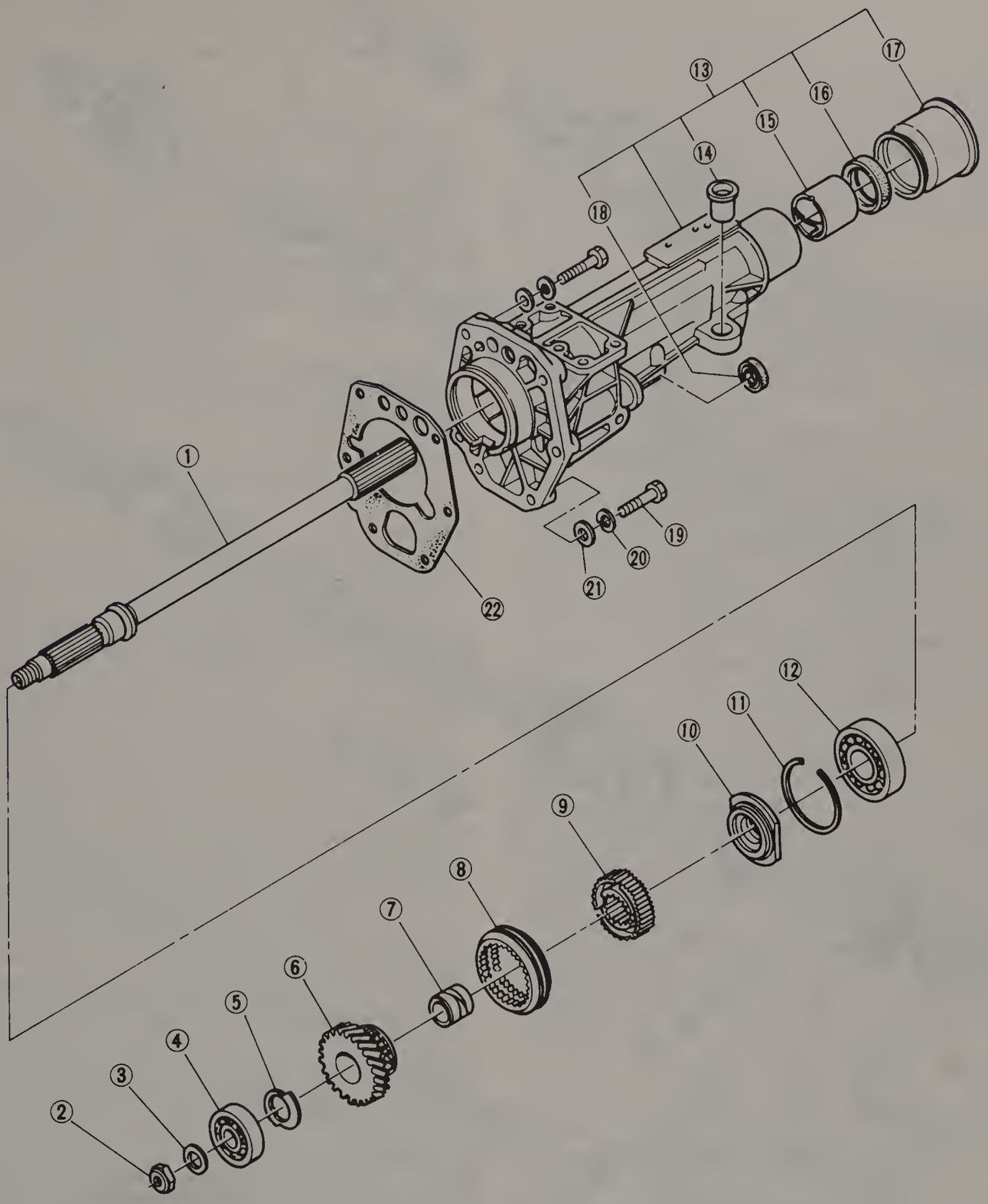


Fig. 7.16 Extension components (4WD) – exploded view

1 *Rear driveshaft*
2 *Locknut*
3 *Lock washer*
4 *Ball bearing*
5 *4th driven gear thrust plate*
6 *Transfer driven gear*
7 *Bushing*
8 *Synchronizer sleeve*
9 *Synchronizer hub*
10 *Rear drive spacer*
11 *Snap-ring*
12 *Ball bearing*
13 *Extension*
14 *Change rod bushing*
15 *Bushing*
16 *Oil seal*
17 *Extension dust cover*
18 *Oil seal*
19 *Bolt*
20 *Spring washer*
21 *Washer*
22 *Transfer rear gasket*

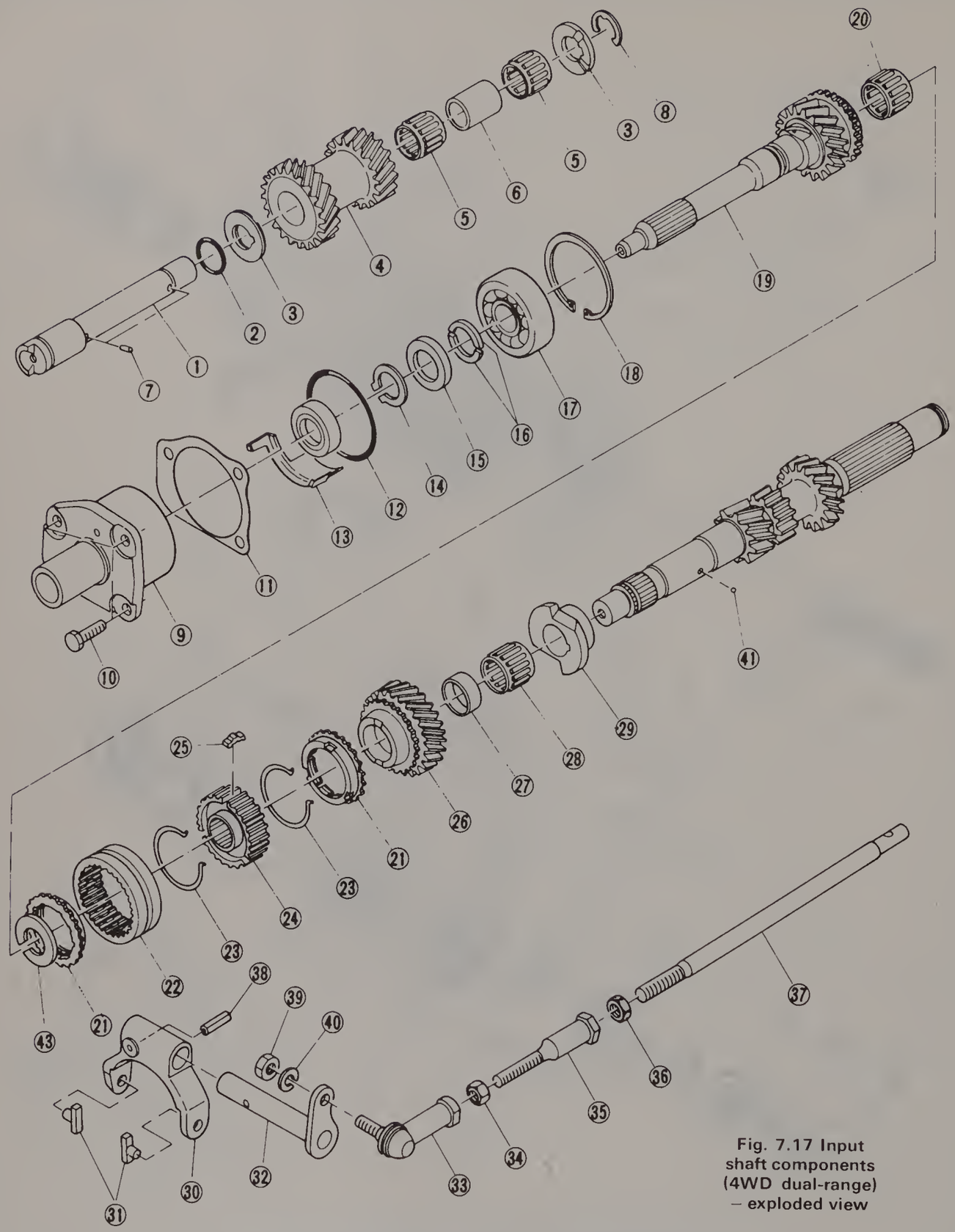


Fig. 7.17 Input shaft components (4WD dual-range) – exploded view

1 Counter gear shaft
2 O-ring
3 Counter gear washer
4 Counter gear
5 Needle bearing
6 Counter gear collar
7 Knock pin
8 Clip
9 Input shaft holder
10 Bolt
11 Input shaft shim
12 O-ring
13 Oil guide
14 Snap-ring
15 Input shaft retainer
16 Input shaft cotter
17 Ball bearing (22 x 56 x 16)
18 Snap-ring
19 Input shaft
20 Needle bearing
21 High-Low synchronizer ring
22 High-Low synchronizer sleeve
23 Spring
24 High-Low synchronizer hub
25 High-Low synchronizer insert
26 Input low gear
27 Input low gear collar
28 Needle bearing
29 Input low gear spacer
30 High-Low shifter fork
31 Piece
32 High-Low shifter lever
33 Rod ball joint assembly
34 Nut
35 Rod adjust screw
36 Nut (left-hand thread)
37 High-Low shifter rod
38 Spring pin
39 Nut
40 Spring washer
41 3.9688 ball
42 Oil seal (22 x 40 x 10)
43 Snap-ring

locknut to the specified torque and lock the nut by staking it in two places.
50 Make adjustments to the drive pinion by referring to the appropriate Section in this Chapter.

Mainshaft
51 Press on the 3rd drivegear bushing, if it was removed during disassembly.
52 Assemble the synchronizer inserts, the synchronizer sleeve and the synchronizer springs on the hub so that the spring cut-ends are 120° apart. The synchronizer hub is installed with the end of the spline having the narrower tooth width on the 3rd gear side. **Note**: *There are two kinds of inserts. The short one is for the 3rd/4th synchronizer, while the longer one is for the 1st/2nd synchronizer.*
53 Install the 3rd drivegear and the assembled synchronizer ring and hub. It may be necessary to use a press.
54 Press on the 4th drivegear bushing.
55 Install the 4th drivegear, the synchronizer ring and the transmission mainshaft collar, taking care to align the insert with the synchronizer ring groove. Match the oil groove end of the 4th drivegear bushing with the large notch of the mainshaft collar.
56 Press on the ball bearing.
57 Install a new snap-ring. Select the snap-ring which will achieve the correct axial play called for in the Specifications.

General
58 Install new oil seals into the axle oil seal holders, then screw the holders into the transmission (the one marked R to the right-hand half and the one marked L to the left-hand half of the case) as far as the end of the thread but not fully into their final positions.
59 Install the outer snap-ring and washer onto the speedometer shaft and insert them in the case. Install the speedometer driven gear on the shaft and retain with the snap-ring. Drive in the speedometer oil seal, using a socket wrench as a drift.
60 Install the Reverse shift lever into the left-hand case, the Reverse idler gear and shaft and secure it in position with a lock pin.
61 Position the Reverse shifter rail arm to the end of the Reverse shifter lever. Install the shifter rail and tighten the shifter fork set screw. Insert the fork rail ball and springs in the case and then install the gasket and plug.
62 When installing the Reverse shifter rail arm, check that the clearance between the Reverse idler gear and the wall of the case complies with the Specifications. Three different shifter rail arms are available, marked 1, 'no mark' and 3. Number 1 reduces the clearance, 'no mark' is the standard and 3 increases the clearance.
63 Install the 1st/2nd gear shifter plunger in the hole in the case.
64 Install the needle bearing on the mainshaft and place the mainshaft assembly in the case, ensuring that the hole in the needle bearing outer race is located on the dowel pin.
65 Wrap the splines of the right- and left-hand axle driveshafts with tape, to prevent damage to the oil seals, and install the differential unit into the case.
66 Install the shims, selected in the previous Section, on the drive pinion and install the drive pinion assembly in position in the case. Make sure that the hole in the roller bearing outer race is located on the dowel.
67 Insert the plunger, install the 3rd/4th gear fork on the shifter rail, then install the rail in the case and tighten the setscrew.
68 Insert the 1st/2nd gear shifter rail plunger in the hole in the case and install the shifter fork and rail. Tighten the setscrews. Insert the shifter rail springs and balls in the case, then install the gaskets and plugs. Tighten the plugs to the torque specifications.
69 Install the mainshaft oil seal, locate it against the face of the case. When installing the right-hand case, be careful not to let the oil seal tilt and get damaged.
70 Remove all grease or oil from the joint faces of both halves of the case. Apply liquid gasket sealant to the mating faces and install the right-hand case on the left-hand.
71 Remove the outer race of the roller bearing in the right-hand case and align the case so that the drive pinion is not caught in between. Check that the speedometer gear is in mesh. If not, turn the speedometer shaft with a screwdriver. Install the outer race of the roller bearing in the right-hand case.
72 Attach the clutch cable bracket and back-up light lead clip to the case. Install case joining bolts and tighten them to the specified torque. Follow the illustrated pattern to avoid warping the cases.
73 Install the drive pinion bearing flange to the case with the securing bolts tightened to the specified torque.
74 To adjust the preload on the roller bearings, a handle for turning the mainshaft and a special preloading weight (Subaru 39978 0104) is required. With the left-hand case at the bottom, place the bearing holder weight on the outer race of the bearing in the right-hand case. Screw the axle shaft oil seal holder into the left-hand case. Engage the 4th gear and while turning the mainshaft, screw the holder in until a slight resistance is felt. This is the contact point of the crown gear and drive pinion. Remove the weight and screw in the driveshaft holder on the upper side and stop at the point where a slight resistance is felt. At this point the backlash between the crown gear and drive pinion is zero.
75 Install the driveshaft holder lock plate. Loosen the holder at the bottom by $1\frac{1}{2}$ notches of the lock plate and screw in the holder at the top by the same amount to obtain a nominal backlash (see Specifications). The notch of the lock plate moves by half a notch if the plate is turned upside down. Screw the holder in, at the top, by $\frac{1}{2}$ to 1 notch in order to apply preload to the taper roller bearing. Temporarily tighten both lock plates and index mark both the holders and lock plates for later readjustment.
76 Turn the mainshaft a number of times and then insert the probe of a dial indicator gauge, suitably mounted, through the drain plug hole, so that it contacts the tooth surface at right angles. Check whether the backlash is as specified according to the masking on the crown gear. To reduce the backlash, loosen the holder in the upper (right-hand half) case and screw in the holder on the lower (left-hand half) case by the same amount. To increase the backlash, loosen the holder in the bottom (left-hand) case and screw in the holder on the upper (right-hand) case to the same amount.
77 After checking the backlash, note the index marks on the holder lock plate and holder (both sides) then loosen the driveshaft holder until the O-ring groove appears. Install the O-ring and screw the holder back into the same position. Tighten the holder lock plates and remove the vinyl tape from the axle driveshafts. Torque the lock plates to the Specifications.
78 Install the Reverse return spring, accent shaft, aluminium washer and plug in the transmission cover. Also the ball, pin, spring, aluminium washer and back-up light switch. Tighten the plug and the switch to the torque Specifications.
79 When installing the transmission cover, determine the thickness of the cover required. Measure the ball bearing protrusion with a depth gauge at the point shown in the illustration. A should be within the clearance range, shown in the Specifications. If not, use the plate thickness indicated.
80 Install the shifter arm in the transmission cover and bolt the cover to the case. Tighten the bolts to the Specifications.
81 Install the clutch release bearing holder and release fork as described in Chapter 8.
82 Install the transmission by referring to the appropriate Section in this Chapter.

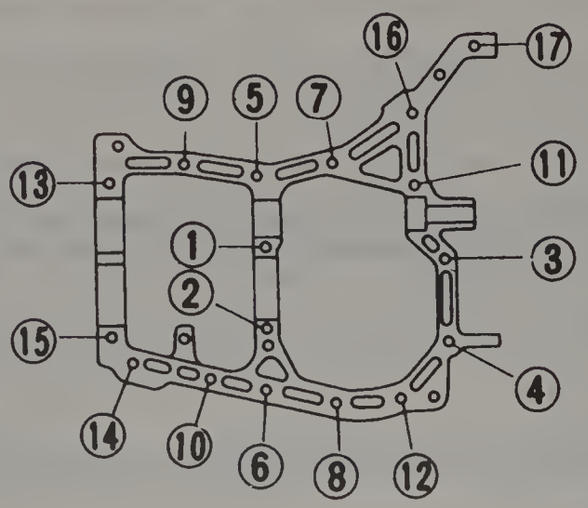


Fig. 7.18 Transmission case bolt tightening sequence

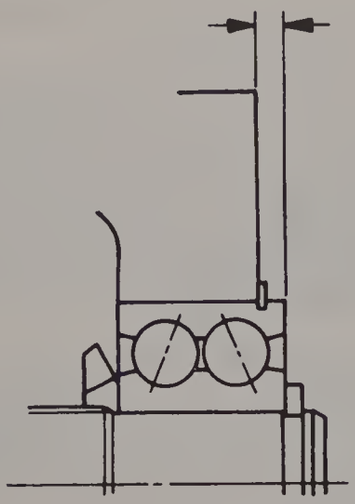


Fig. 7.19 Measure the ball bearing protrusion beyond the transmission main case as shown

7 Transmission (4-speed – 4WD) – overhaul

Refer to Figs. 7.6 through 7.20

Disassembly

General

1 Remove the securing bolts and lift off the top cover.
2 Drive out the straight pin with a pin punch, pull out the Reverse shifter rail and remove the shifter fork, ball and spring. When pulling out the rail be careful that the ball does not fly out and get lost.
3 Undo the bolts and remove the rear case, if necessary, tap it with a plastic hammer to free it.
4 Release the staking on the drive pinion locknut. Engage two gears at once, to lock the shaft from turning, and remove the drive pinion locknut. Withdraw the rear shaft drivegear from the drive pinion.
5 Remove the securing nuts and take off the transfer case. If necessary, tap it with a plastic hammer to free it from the main case. Remove the needle bearing, collar and washer from the drive pinion.
6 Release the staking on the rear driveshaft locknut and remove the locknut and washer. Remove the ball bearing, spacer and rear shaft-driven gear using a press.
7 Remove the synchronizer sleeve, hub and spacer from the rear driveshaft.
8 Remove the inner snap-ring from the case with a screwdriver and drive the rear shaft out of the case with a soft metal drift.
9 Using a press, remove the ball bearing from the rear driveshaft.
10 Take the O-ring out of the shifter arm and then remove the shifter arm.
11 Remove the back-up light switch from the transfer case assembly and then take out the Reverse accent spring ball and pin.
12 Remove the plug from the case and take out the Reverse accent shaft and Reverse turn spring.
13 Drive the needle bearing out of the transfer case with a soft metal drift.
14 Remove the rear extension oil seal from the rear case assembly.
15 Refer to Section 6, paragraphs 1 through 13, to finish the general disassembly procedure.

Mainshaft

16 Refer to Section 6, paragraphs 14 through 17, to disassemble the mainshaft.

Drive pinion

17 Refer to Section 6, paragraphs 18 through 21, to disassemble the drive pinion.

Differential

18 Refer to Section 6, paragraphs 22 through 25, to disassemble the differential.

Transfer case

19 Remove the shifter arm.
20 Remove the Reverse accent spring, filler, the gasket, the spring and the ball.
21 Remove the Reverse accent shaft plug, the gasket, the shaft and the Reverse return spring.
22 Remove the snap-ring with a screwdriver and drive out the needle bearing with an aluminium rod.
23 Remove the back-up light switch.

Extension

24 Remove the snap-ring from the extension with a screwdriver.
25 Punch out the rear driveshaft with a hammer and an aluminium rod.
26 Remove the rear driveshaft locknut after the staked portions of the nut are raised.
27 Remove the following parts from the driveshaft:

Ball bearing
Thrust plate
Transfer driven gear
Bushing
Sleeve and hub
Spacer
Ball bearing

Input shaft (dual range)

28 Remove the oil guide and the input shaft holder shim.
29 Wrap tape around the splines of the input shaft to protect the splines.
30 Remove the snap-ring from the shaft.
31 Remove the input shaft by tapping the shaft end with a plastic hammer while holding the shaft holder.
32 Remove the outer snap-ring, the input shaft retainer and the input shaft cotter pin.
33 Remove the ball bearing.

Inspection

34 If there is excessive wear or scoring of the rear extension case bushing, it must be replaced. To remove the bushing, cut it with a hacksaw blade and pull it out toward the rear. When pressing in the rear bushing, ensure that the oil hole lines up with the groove in the casing. The bushing should be reamer finished to 1.38 to 1.3815 in (35 to 35.039 mm).
35 Refer to Section 6, paragraphs 28 through 34 to finish the rest of the inspection procedure.

Reassembly

Input shaft (dual range)

36 Install the ball bearing onto the input shaft. **Note:** *Before pressing the bearing into place, insert the snap-ring between the input shaft gear and the ball bearing.*
37 Install the input shaft cotter, the input shaft retainer and the outer snap-ring onto the input shaft. **Note:** *Install the correct input shaft cotter to allow for the correct play in the axle direction.* The cotter thickness and the correct play in the axial direction is found in the Specifications.
38 Install the oil seal into the input shaft holder.
39 Install the input shaft into the holder by tapping it lightly with your hand.
40 Install the inner snap-ring into the holder with a pliers. **Note:** *Select a suitable snap-ring so that the play in the axial direction is held.* The correct play in the axial direction is given in the Specifications.
41 Install a new O-ring and oil guide onto the input shaft holder.

Extension

42 Install the ball bearing onto the rear driveshaft.
43 Drive the rear driveshaft into the extension with a plastic hammer.
44 Install the snap-ring to the groove on the inside of the extension.
45 Install the rear guide spacer, the synchronizer hub and the sleeve onto the rear driveshaft.
46 Install the transfer driven gear bushing onto the rear driveshaft.
47 Install the transfer driven gear and thrust plate onto the rear driveshaft.
48 Install the ball bearing onto the rear driveshaft.
49 Install the rear driveshaft lock washer and locknut and tighten

them to the specified torque.
50 After tightening the locknut, stake the nut at four different places.

Transfer case
51 Install the needle bearing into the transfer case with a press and install the snap-ring.
52 Install the Reverse return spring, the Reverse accent shaft and the plug with the aluminium gasket. Tighten the plug according to the Torque specifications.
53 Install the ball, the Reverse accent spring and the plug with the aluminium gasket. Tighten the plug to the specified torque.
54 Install the back-up light switch with the aluminium gasket and tighten the switch according to the Torque specifications.
55 Install a new oil seal in the transfer case. **Note:** *Make sure that the oil seal is flush and does not protrude from the case surface.*

Differential
56 Refer to Section 6, paragraphs 38 through 43, to reassemble the differential.

Drive pinion
57 Refer to Section 6, paragraphs 44 through 48, to start the drive pinion reassembly.
58 Assemble the drive pinion by installing the ball bearing, the washer, the collar needle bearing, the rear shaft drivegear, the lockwasher and the locknut. Do not stake the locknut at this time.
59 Make adjustments to the pinion by referring to the appropriate Section in this Chapter.

Mainshaft
60 Refer to Section 6, paragraphs 51 through 57, to reassemble the mainshaft.

General
61 Refer to Section 6, paragraphs 58 through 77, to start the general reassembly.
62 Remove the locknut, lockwasher and rear shaft drivegear from the drive pinion.
63 Press the needle bearing in the transfer case with the marked side of the bearing flush with the case.
64 Insert the Reverse return spring and accent shaft into the transfer case, then install the adjusting aluminium washer and the plug, tightened to the Torque specifications.
65 Install the ball, Reverse accent spring, pin, aluminium washer and back-up light switch, tightened to the Torque specifications.
66 Install the shifter arm on the transfer case.
67 Press the rear ball bearing onto the rear driveshaft, then drive the shaft into the rear transfer case and install the snap-ring in the groove in the case.
68 Assemble the synchronizer inserts, synchronizer sleeve and synchronizer springs on the synchronizer hub, so that the smallest spline is on the rear drive spacer side.
69 Install the rear drive spacer, synchronizer hub assembly, rear shaft drive gear sleeve, synchronizer ring, rear shaft driven gear and transmission mainshaft spacer to the rear driveshaft.
70 Press the ball bearing onto the rear driveshaft. Install the lockwasher and locknut. Tighten the locknut to the Torque specifications and stake it in four places.
71 Determine the thickness of the cover plate required to accommodate the bearings of the transfer case as described in Section 6.
72 Install the washer, drive pinion collar and needle bearing race on the above pinion.
73 Install the transfer case to the main transmission unit using a new gasket, and tighten the securing nuts to the specified torque.
74 Install the rear shaft drivegear, lockwasher and locknut on the drive pinion. Tighten the locknut to the specified torque.
75 Install a new O-ring into the groove in the shifter arm.
76 Ensure all the parts are well lubricated with gear oil. Use a new gasket and install the rear case to the transfer case. Be careful not to damage the shifter arm O-ring. Before tightening each bolt, make sure that the shifter arm moves smoothly. Tighten the bolts to the specified torque.
77 Install the shifter fork, insert the shifter fork rail spring and the ball (coated with grease to make it stick) in the transfer case and then install the shifter fork rail. Drive in the straight pin. After the pin has been installed, check the operation of the shifter fork rail.
78 Use a new gasket and install the top cover on the transfer case and secure it with four bolts. Tighten the bolts to the specified torque.
79 Install the clutch release bearing holder and release fork as described in Chapter 8.
80 Install the transmission by referring to the appropriate Section in this Chapter.

8 Transmission (5-speed) – overhaul

Refer to Figs. 7.6 through 7.20

Disassembly

General
1 Remove the clutch release fork and release bearing holder as described in Chapter 8. Remove the securing nuts and take off the transmission cover.
2 Drive out the spring pin on the 5th gear shifter fork with a pin punch. Relieve the staking on the pinion shaft nut.
3 Engage two gears at once to lock the mainshaft from turning and remove the pinion shaft nut.
4 Remove the synchronizer hub and 5th gear shifter fork.
5 Remove the 5th driven gear, needle bearing inner race, needle bearing and drive pinion spacer. Remove the bolts securing the pinion assembly to the transmission case.
6 Refer to Section 6, paragraphs 1 through 9 and 11 through 13 to finish the general disassembly procedure.
7 To remove the Reverse idler gearshaft, take out the lock pin, then remove the shaft, Reverse idler gear and Reverse shifter lever. Remove the outer snap-ring and take off the shifter rail arm from the Reverse shifter rail, then collect the ball and spring.

Mainshaft
8 Secure the mainshaft in a vise with soft jaws to prevent damaging the gear teeth.
9 Relieve the staking and remove the locknut.
10 Using a press, remove the 5th drive gear. Remove the Woodruff key.
11 Press off the ball bearing and 4th driven gear.
12 Disassemble the synchronizer hub, 3rd drivegear and 4th drive gear bushing.
13 To eliminate backlash noise of the 1st and 2nd gears, sub-gears are used on the 1st and 2nd driven gears. Remove the outer snap-ring, 1st driven gear washer and spring, and 2nd driven gear spring. Use snap-ring pliers to remove the snap-rings.
14 Refer to Section 6, paragraphs 14 through 17, to finish the mainshaft disassembly.

Drive pinion
15 Refer to Section 6, paragraphs 18 through 21, to disassemble the drive pinion.

Differential
16 Refer to Section 6, paragraphs 22 through 25, to disassemble the differential.

Rear case
17 Refer to Section 6, paragraphs 26 and 27, to disassemble the rear case.

Inspection

18 Inspect the 1st/2nd gear spring for broken, damaged or excessively worn tooth surfaces. Replace if a tooth is damaged. Install the gear and rotate it with your finger, replace it if it rotates too lightly. Check that the clearance between the driven gear and sub-gear is between 0.004 to 0.020 in (0.1 to 0.5 mm). Replace if necessary.
19 Refer to Section 6, paragraphs 28 through 34, to finish the rest of the inspection procedure.

Reassembly

Rear case
20 Refer to Section 6, paragraphs 35 through 37, to reassemble the rear case.

Differential
21 Refer to Section 6, paragraphs 38 through 43, to reassemble the differential.

Drive pinion

22 Refer to Section 6, paragraphs 44 through 48, to reassemble the drive pinion.
23 Install the spacer, needle bearing race, needle bearing, 5th driven gear, synchronizer stoppers, lockwasher and locknuts in this order. Tighten the locknut to the specified torque.
24 Make adjustments to the drive pinion by referring to the appropriate Section in this Chapter.
25 Do not stake the pinion locknut at this time.

Mainshaft

26 Except for the assembly of the 1st/2nd driven gears, follow the instructions in Section 6, paragraphs 51 through 55. For assembly of 1st/2nd gears, install the gear springs (sub-gears) and washers to the 1st and 2nd gears and then install the retaining snap-rings.
27 Press on the ball bearing. Install the Woodruff key, 5th drive gear, lockwasher and locknut. Stake the locknut after tightening it to the Torque specifications.

General

28 Refer to Section 6, paragraphs 58 and 59 to start the general reassembly procedure.
29 Put the 1st/2nd shifter rail spring and ball in the Reverse shifter rail arm then install the Reverse shifter rail. Install the outer snap-ring.
30 Install the Reverse shifter fork rail spring, ball and gasket in the left-hand casing then install and tighten the plug to the Torque specifications.
31 When installing the Reverse shift lever, check that the gap between the Reverse idler gear and casing wall is 0.06 to 0.118 in (1.5 to 3.0 mm). Adjustments are made by selecting one of three different Reverse shift levers available. After installing the Reverse shift lever, set it to the Neutral position and install a suitable washer so that the gap between the washer and the case wall is 0 to 0.02 in (0 to 0.5 mm).
32 Put the 1st/2nd gear shift rail plungers into the hole in the case and the Reverse shifter rail arm. Insert the correct plunger.
33 Install the mainshaft assembly in the left-hand half of the transmission.
34 Insert the 3rd/4th shifter rail plunger and install the shifter fork and shifter fork rail, then tighten the setscrew.
35 Install the pinion drive assembly, with previously selected shims, on the case.
36 Insert the 1st/2nd shifter rail plunger into the hole in the case and install the 1st/2nd gear shifter fork and rail, then tighten the setscrew.
37 Push the shifter rail spring and ball in the case and install the gasket and plug. Tighten the plug to the Torque specifications.
38 Now, refer to Section 6, paragraphs 72 through 77, for further component installation procedures.
39 Undo the drive pinion locknut and remove the lockwasher, stoppers, and synchronizer hub.
40 Install the 5th gear shifter fork to reverse shifter rail with a spring pin and assemble the synchronizer hub, stoppers and drive pinion lockwasher.
41 Install the drive pinion locknut, engage two gears to lock the mainshaft from turning, then tighten the drive pinion locknut to the Torque specifications.
42 Select the transmission cover thickness as described in Section 6, paragraph 79.
43 Install the rear cover assembly and tighten the attaching bolts to the specified torque.
44 Install the clutch release bearing holder and release fork as described in Chapter 8.

9 Drive pinion shim adjustment

Refer to Fig. 7.20

1 The drive pinion has to be adjusted in relation to the crown gear of the differential unit, as they are a matched set. The match marks on the drive pinion and crown gear are shown in the accompanying illustration. The first digits on the drive pinion end face are the match number for the first digit number on the crown gear. The second number on the crown gear indicates the backlash value in millimeters (1600: 899914100 or 1800: 499917100).
2 A special gauge is required. Adjust the gauge by loosening the bolts and setting the scale so that it indicates 0.5 when the plate end and the scale are on the same level.
3 Place the drive pinion in the left-hand case, without shims, and secure it with the bolts tightened to 22 ft lb (29 Nm). Position the gauge by placing the pins of the gauge in the dowel holes of the transmission case.
4 Slide the gauge scale with your fingertips and read the value at the point where it matches with the end face of the drive pinion. The thickness of shim required is determined by adding the value indicated on the drive pinion to the value indicated on the gauge (add if the figure on the drive pinion is prefixed by a plus (+) sign and subtract if prefixed by a minus (-) sign). Select one to three shims from the range of shims available to obtain the required thickness.

10 Manual transmission – installation

1 Support the transmission on the floor jack then raise it into alignment with the engine. Apply a coat of grease to the mainshaft splines.
2 Attach the transmission to the engine with the nuts and bolts. **Note:** *If the mainshaft is hard to align with the engine, simultaneously turn the left and right transmission driveshafts until the mainshaft splines engage with the engine.* Temporarily tighten the mounting hardware.
3 Install the center crossmember onto the vehicle as follows.

a) Align the left and right rubber cushion guides for the transmission mounts with the guides of the crossmember.
b) Temporarily hold the crossmember in place on the vehicle with the mounting hardware.
c) Tighten the rubber cushion mounting nuts to the specified torque.

4 Now, tighten the crossmember mounting nuts to the specified torque.
5 Remove the jack from the transmission and clamp the parking brake cable to the body.
6 Align the axle shafts and the spring pinholes with the axle spindles of the transmission. Install the spring pins.
7 Refer to the appropriate Sections in Chapter 11 and install the suspension arms and the stabilizer bar. **Note:** *Remember not to torque-tighten the suspension hardware until the vehicle is on the ground.*
8 Install the gearshift lever assembly by referring to the appropriate Section in this Chapter.
9 *On 4WD vehicles* install the driveshaft to the rear differential and the transmission by referring to the appropriate Section in Chapter 8.
10 Install the front exhaust pipe assembly as follows:

a) Position the exhaust pipe on the hanger bracket and secure it in place.
b) Install new gaskets in the exhaust flanges of the engine and temporarily tighten the mounting nuts.
c) Temporarily tighten the front and rear of the exhaust pipe after installing new gaskets.
d) After making sure that the exhaust system is installed correctly, tighten all of the mounting hardware securely.

11 Attach the oxygen sensor harness to the sensor, connect the hot air intake tube and lower the vehicle to the ground.
12 Now, tighten the transmission-to-engine mounting nuts and bolts to the specified torque. Install the starter motor.
13 Adjust the pitching stopper as follows:

Fig. 7.20 Drive pinion and crown gear match mark locations (Sec 9)

a) Loosen the nut of the stopper (on the engine side) until it is free to move.
b) Tighten the rear nut (on transmission side) until the rubber cushion-to-washer clearance is within the Specifications.
c) Attach a wrench to the rear nut and tighten the front nut securely.

14 Connect the speedometer cable to the transmission and tighten it securely with your fingers. Then, using a pliers, tighten it about 30 degrees more.
15 Route the speedometer cable underneath the pitching stopper (along with the battery cable) and clamp it to the pitching stopper.
16 Reconnect the following wiring harnesses:

Back-up light switch
Ground cable on the vehicle body
Starter wiring harness

17 Connect the clutch cable and adjust the free play by referring to the appropriate Section in Chapter 1.
18 *On 4WD vehicles,* connect the 4WD selector and the gearshift system to the transmission by referring to the appropriate Section in this Chapter.
19 Connect the battery ground cable to the battery.
20 Add fluid to the transmission by referring to the appropriate Section in Chapter 1.
21 Start the engine and check the exhaust system for any leaks or noise.
22 Check the clutch for smooth operation.
23 Check the shift levers for smooth operation.
24 Install the spare tire support and the spare tire.

11 Automatic transmission – road test

Automatic transmission malfunctions may be caused by four general conditions: poor engine performance, improper adjustments, hydraulic malfunctions and mechanical malfunctions. Diagnosis of these problems should always begin with a check of the easily repaired items: fluid level and condition, shift linkage adjustment and throttle linkage adjustment. Next, perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, additional diagnosis should be done by a Subaru dealer service department or a reputable automotive or transmission repair shop.

12 Automotive transmission overhaul – general note

Due to the complexity of the clutches and the hydraulic control system and because of the special tools and expertise required to perform an automatic transmission overhaul, it should not be undertaken by the home mechanic.

If the transmission requires major repair work, it should be left to an authorized dealer service department or a reputable automotive or transmission repair shop specializing in this type of work.

13 Shifter (automatic transmission) – removal, installation and Neutral switch check

Refer to Fig. 7.21

1 Remove the shifter grip and then the parking brake cover along with the console box.
2 Disconnect all of the electrical wiring harnesses.
3 Set the selector lever to the N position and then remove the shifter assembly mounting screws and plate.
4 Disconnect the rod from the transmission selector arm (under the vehicle) by removing the outer nut.
5 Now attach the rod to the transmission selector arm. Insert the connector from the transmission side.
6 Install the selector lever assembly by first applying butyl rubber tape to the edge of the lever access hole. Attach the assembly mounting plate to the body and tighten the screws.
7 Adjust the shift linkage by referring to the appropriate Section.
8 Reconnect the electrical wiring harnesses.
9 Check the Neutral safety switch operation as follows.
10 The engine can only be started in the N or P positions.
11 The reverse lights work only when the selector is in the R position.
12 There must be no position between P and N where the reverse lights work and the engine can be started at the same time. If necessary, loosen the bolt and move the switch slightly.
13 Install the console box and the parking brake cover making sure that the mounting screws are tight.

14 Shift linkage (automatic transmission) – adjustment

Refer to Figs. 7.22 through 7.24

1 Set the selector lever to the N position.
2 Set the transmission selector arm (under the vehicle) to the N position by moving the connector of the arm to align with the cast boss on the transmission. Refer to the accompanying illustration.
3 Now adjust the connection of the rod with the selector arm. Do this by pushing the rod lightly with your fingers while turning nut A until it is the indicated distance from the connector (1982 and 1983 models) or until it contacts the connector lightly (1980 and 1981 models).
4 Hold nut A with a wrench and then tighten nut B until it contacts the connector.
5 Confirm that the selector lever operates smoothly.

15 Automatic transmission – removal

1 Open the hood and hold it securely in place with the hood stay that is provided. Remove the spare tire and the spare tire support.
2 Disconnect the negative (-) battery cable.
3 Disconnect the diaphragm vacuum hose.
4 Disconnect the speedometer cable from the transmission and unfasten the clip on the cable.
5 Disconnect the following electrical wiring connections:

Back-up light switch connector
Ground cable on the vehicle body
Starter wiring harness
Note: *Do not disconnect the battery cable from the starter.*

6 Remove the starter motor (with battery cable) and hang it from the firewall.
7 Remove the bolts connecting the torque converter to the driveplate through the timing hole. **Note:** *Be careful not to drop the bolts into the converter housing.*
8 Disconnect the oil cooler hose from the transmission. Plug the hose to prevent fluid from running out.
9 Remove the upper bolts which hold the engine to the transmission; loosen the lower nuts but do not remove them.
10 Now, loosen the nut which holds the engine pitching stopper to the transmission side and back it off about $\frac{3}{8}$ inch. Tighten the stopper nut on the engine side an equal amount.
11 Tilt the engine backwards slightly in order to aid in the removal of the transmission.
12 Disconnect the oxygen sensor and unclamp it.
13 Block the rear wheels, raise the front of the vehicle and place jackstands in the front notches of the side rocker panel.
14 Remove the front exhaust pipe assembly as follows:

a) Disconnect the hot air intake tube
b) Loosen the nuts which hold the exhaust pipe assembly to the exhaust flanges of the engine.
c) Remove the bolts which secure the front exhaust pipe to the rear exhaust pipe.
d) Remove the bolts which hold the front exhaust pipe to the hanger on the body.
e) While supporting the front exhaust pipe assembly, remove the nuts from the exhaust flanges of the engine and remove the exhaust assembly. **Note:** *Be careful not to strike the oxygen sensor against anything during the removal of the pipe.*

15 *On 4WD vehicles,* remove the driveshaft from the vehicle by referring to the appropriate Section in Chapter 8.
16 Disconnect the gearshift and drive selector linkage system from the vehicle by referring to the appropriate Section in this Chapter.

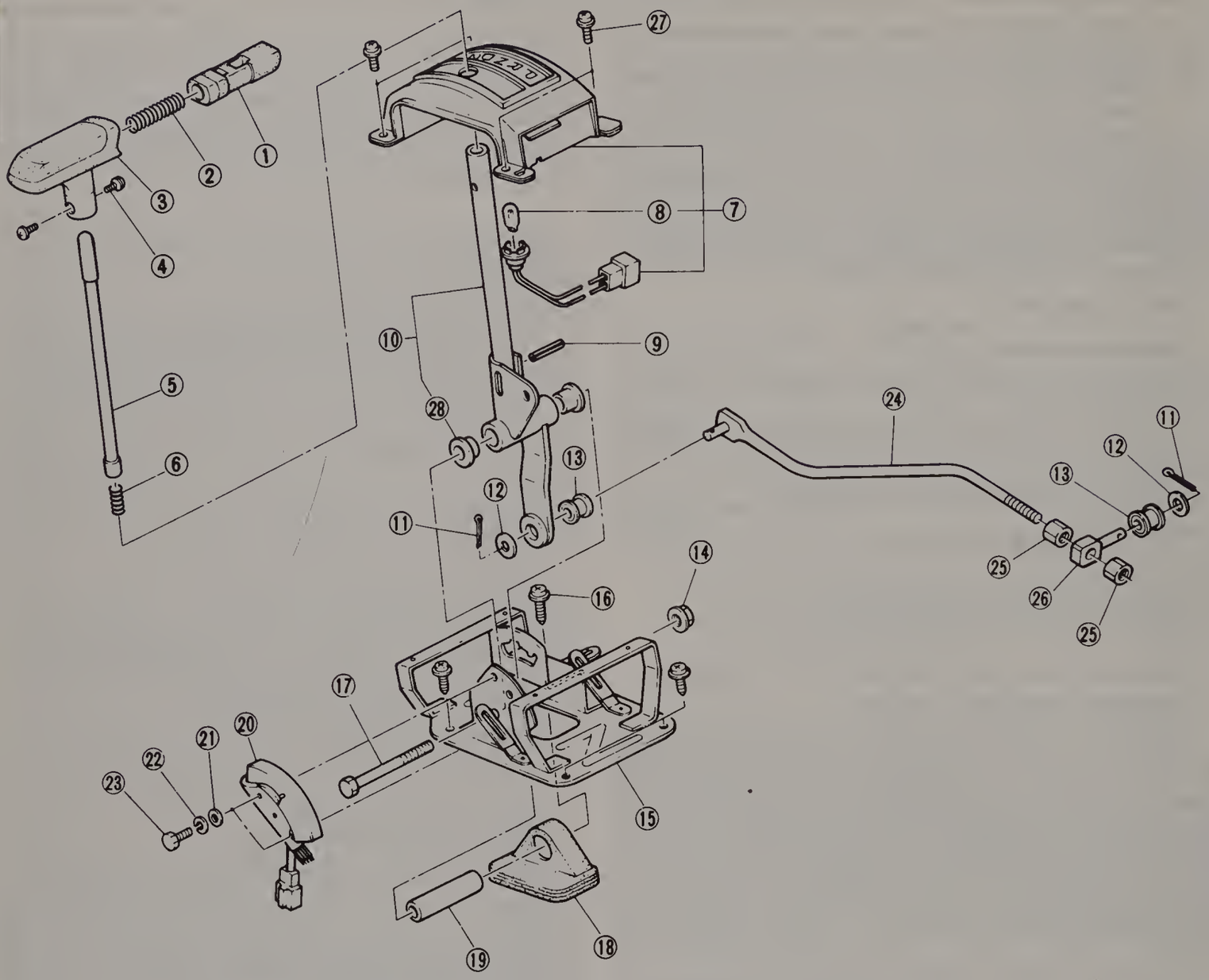


Fig. 7.21 Automatic transmission shifter components – exploded view (Sec 13)

1 Button	8 Bulb	15 Plate	22 Spring washer
2 Spring	9 Spring pin	16 Screw	23 Bolt
3 Grip	10 Selector lever	17 Bolt	24 Rod
4 Screw and washer	11 Cotter pin	18 Boot	25 Nut
5 Lever rod	12 Washer	19 Spacer	26 Connector
6 Spring	13 Bushing	20 Neutral safety switch	27 Flange screw
7 Indicator assembly	14 Flange nut	21 Washer	28 Bushing

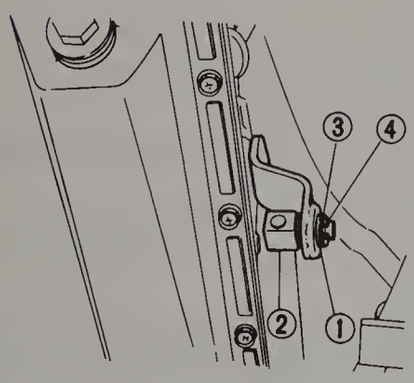


Fig. 7.22 Automatic shifter-to-transmission connector components (Sec 14)

1 Bushing
2 Connector
3 Washer
4 Cotter pin

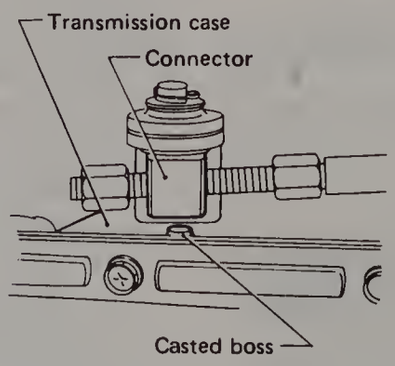


Fig. 7.23 Set the selector arm to the N position where the center of the connector is aligned with the cast boss on the transmission case (Sec 14)

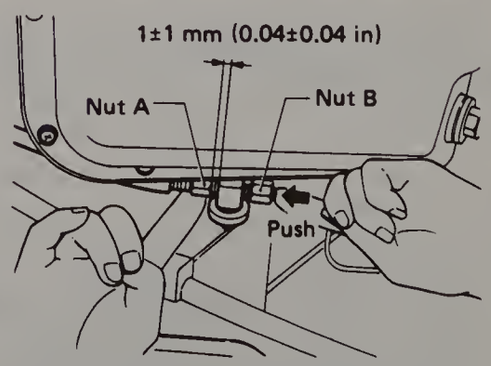


Fig. 7.24 1982 and 1983 models require clearance between nut A and the connector (Sec 14)

17 Remove the stabilizer bar by referring to the appropriate Section in Chapter 11.
18 Disconnect both suspension arms where they connect to the crossmember by referring to the appropriate Section in Chapter 11. Lower the suspension arms.
19 Drive the spring pins out of both front axles where they connect to the transmission. Push the wheels to the outside of the vehicle and disconnect the axles from the transmission spindles.
20 Unfasten the clamp on the left side of the parking brake cable in order to remove the crossmember.
21 Remove the nuts which secure the left and right transmission mount rubber cushions.
22 Securely support the transmission by placing a floor jack underneath it.
23 Remove the front crossmember by referring to the appropriate Section in Chapter 11.
24 Now, remove the nuts holding the engine to the transmission.
25 Carefully move the transmission away from the engine.
26 Lower the jack with the transmission, making sure that it does not come into contact with any adjacent parts on the way down.

16 Automatic transmission – installation

1 Support the transmission on the floor jack then raise it into alignment with the engine.
2 Attach the transmission to the engine with the nuts and bolts. **Note:** *If the shaft is hard to align with the engine, simultaneously turn the left and right transmission driveshafts until the shaft engages with the engine.* Temporarily tighten the mounting hardware.
3 Install the center crossmember onto the vehicle as follows.

a) Align the left and right rubber cushion guides for the transmission mounts with the guides of the crossmember.
b) Temporarily hold the crossmember in place on the vehicle with the mounting hardware.
c) Tighten the rubber cushion mounting nuts to the specified torque.

4 Now, tighten the crossmember mounting nuts to the specified torque.
5 Remove the jack from the transmission and clamp the parking brake cable to the body.
6 Align the axle shafts and the spring pinholes with the axle spindles of the transmission. Install the spring pins.
7 Refer to the appropriate Sections in Chapter 11 and install the suspension arms and the stabilizer bar on the vehicle. **Note:** *Remember not to torque-tighten the suspension hardware until the vehicle is on the ground.*
8 Install the gearshift lever assembly by referring to the appropriate Section in this Chapter.
9 *On 4WD vehicles,* attach the driveshaft to the rear differential and the transmission by referring to the appropriate Section in Chapter 8.
10 Connect the cooler hose.
11 Install the front exhaust pipe assembly as follows:

a) Position the exhaust pipe on the hanger bracket and secure it in place.
b) Install new gaskets in the exhaust flanges of the engine and temporarily tighten the mounting nuts.
c) Temporarily tighten the front and rear of the exhaust pipe after installing new gaskets.
d) After making sure that the exhaust system is installed correctly, tighten all of the mounting hardware.

12 Attach the oxygen sensor harness to the sensor, connect the hot air intake tube and lower the vehicle to the ground.
13 Now, tighten the transmission-to-engine mounting nuts and bolts to the specified torque. Install the starter motor.
14 Install the torque converter and driveplate as follows:

a) Using a jack, raise the body slightly.
b) Using a wrench, turn the crankshaft until one of the driveplate mounting holes is brought to the center of the timing hole.
c) Rotate the wheel until the holes on the torque converter and driveplate are properly aligned. Then install the bolts.
d) Turn the engine with a wrench and securely tighten all four retaining bolts – one bolt at a time for each turn – to retain the torque converter and driveplate.

15 Adjust the pitching stopper as follows:

a) Loosen the nut of the stopper (on the engine side) until it is free to move.
b) Tighten the rear nut (on transmission side) until the rubber cushion-to-washer clearance is within the Specifications.
c) Attach a wrench to the rear nut and tighten the front nut securely.

16 Connect the speedometer cable to the transmission and tighten it securely with your fingers. Then, using a pliers, tighten it about 30 degrees more.
17 Route the speedometer cable underneath the pitching stopper (along with the battery cable) and clamp it to the pitching stopper.
18 Reconnect the following wiring harnesses:

Back-up light switch
Ground cable on the body
Starter wiring harness

19 Connect the diaphragm vacuum hose.
20 Connect the battery ground cable.
21 Add fluid to the transmission (if necessary) by referring to the appropriate Section in Chapter 1.
22 Start the engine and check the exhaust system for any leaks or noise.
23 Check the selector lever for smooth operation.
24 Install the spare tire support and the spare tire.

Chapter 8 Driveline

Contents

Specifications

Clutch

Disc facing wear	
Rivet head standard depth	0.055 in (1.4 mm)
Rivet head depth limit	0.012 in (0.3 mm)
Disc runout limit	0.028 in (0.7 mm)

Driveshaft (4WD)

Tube runout limit	0.024 in (0.6 mm)
U-joint axial play	0.0008 in (0.02 mm) or less

Axleshaft (4WD)

Free play in axial direction	
Standard	0.0024 in (0.06 mm)
Limit	0.0039 in (0.10 mm)
Free play at drum periphery	
Standard	0.0035 in (0.09 mm)
Limit	0.0059 in (0.15 mm)

Rear differential (4WD)

Front and rear bearing preload	
New bearing	4.4 to 6.4 lb (2.0 to 2.9 Kg)
Used bearing	1.87 to 3.75 lb (0.85 to 1.7 Kg)
Side gear clearance	0.004 to 0.008 in
Drive gear-to-pinion backlash	0.0039 to 0.0079 in (0.10 to 0.20 mm)
Drive gear runout limit	0.0020 in (0.05 mm)
Drive pinion turning resistance	0.9 to 5.2 in-lb (1 to 6 Kg)

Torque specifications

	Ft-lb	Nm
Driveshaft yoke-to-companion flange bolt	13 to 18	18 to 25
Side bearing retainer bolt	6.5 to 8.7	9 to 12
Differential rear cover bolt	14 to 19	19 to 25
Differential mounting nut	51 to 58	69 to 78
Clutch cover mounting bolt	10.5 to 12.7	14.2 to 17.2

1 General information

Power is transmitted to the front wheel by two axleshafts which are carried by steering knuckle arms attached to the bottom of the shock absorber struts. Each shaft is supported on two ball bearings, mounted back-to-back with a spacer in between and is splined to the wheel hub.

A Constant Velocity Joint (CVJ), at the outer end of the axle shaft and a Double Offset Joint (DOJ) at the inner end, ensures a smooth drive to the front and rear wheels.

The front wheel toe-in must be checked after completion of repair work on the front wheels and axle shafts.

On vehicles with 4WD, the drive is transmitted by driveshaft, with two maintenance-free universal joints, to the rear axle differential.

The clutch is a single dry plate type and is cable operated from the clutch pedal. The clutch release bearing is permanently sealed and no additional lubrication is required.

2 Clutch cable – replacement

Refer to Fig. 8.1

1 If you find that you need to replace your clutch cable with a new one, refer to the accompanying illustration and locate both ends of the cable.

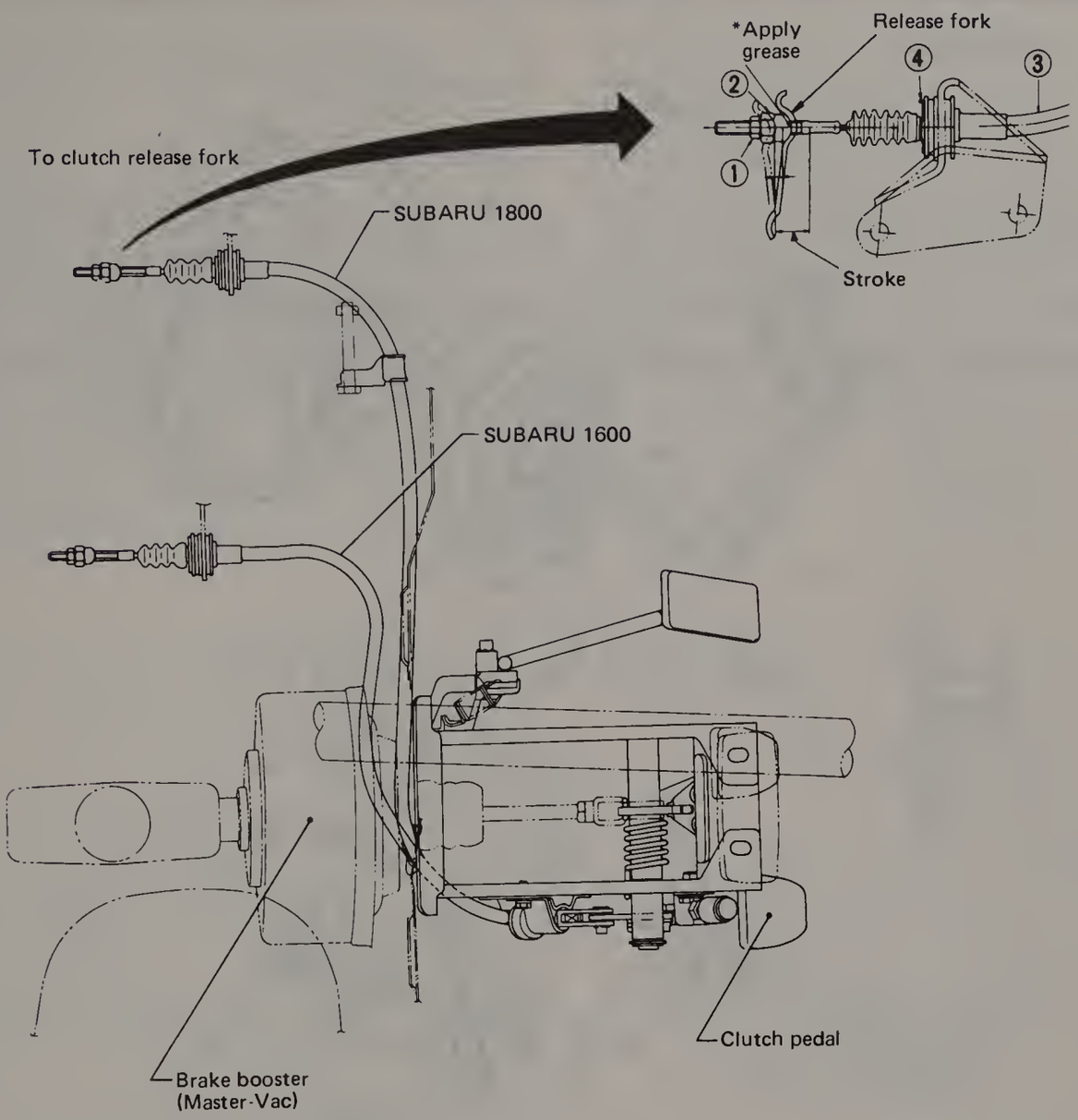


Fig. 8.1 Clutch cable location in the engine compartment (Sec 2)

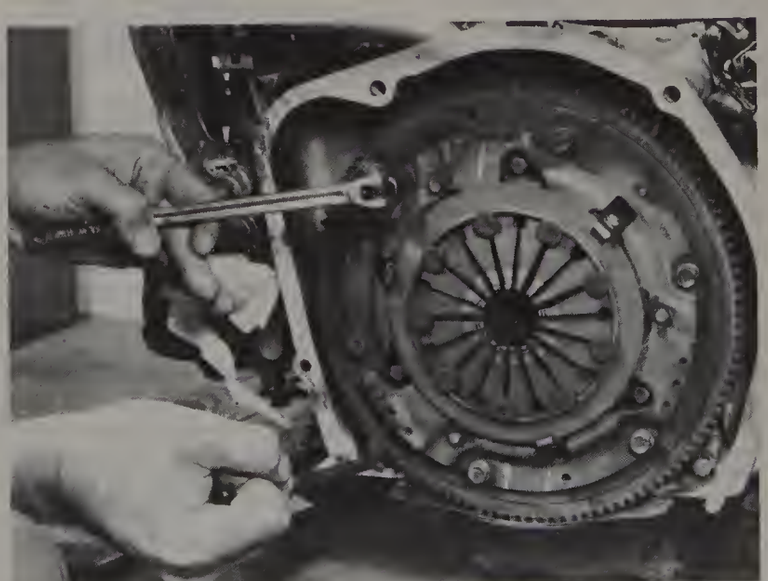
1 Jam nut 2 Adjusting nut 3 Clutch cable 4 Cable clip

2 Disconnect the cable from the engine by removing the jam nut and the adjusting nut from the release fork.
3 Remove the cotter pin from the clevis pin connected to the clutch pedal.
4 Pull the cable (from the engine compartment) through the rubber grommet in the firewall.
5 Install the new cable by inserting the correct end through the grommet and into the passenger compartment.
6 Attach the cable to the clutch pedal with the clevis pin and the cotter pin.
7 Attach the cable to the release fork using the adjusting nut and lock it in place with the jam nut after it has been correctly adjusted.
8 To adjust the clutch, refer to Chapter 1.

3 Clutch cover and disc – removal and installation

Refer to Fig. 8.2

1 To remove the cover and the dist you have to first remove the transmission from the vehicle. To do this, refer to the appropriate Section in Chapter 7.
2 Hold the flywheel with a large screwdriver and loosen the cover assembly bolts (photo). Do this in a diagonal sequence so the diaphragm spring pressure is released evenly. Do not remove any



3.2 Remove the clutch cover mounting bolts as you hold the flywheel with a large screwdriver

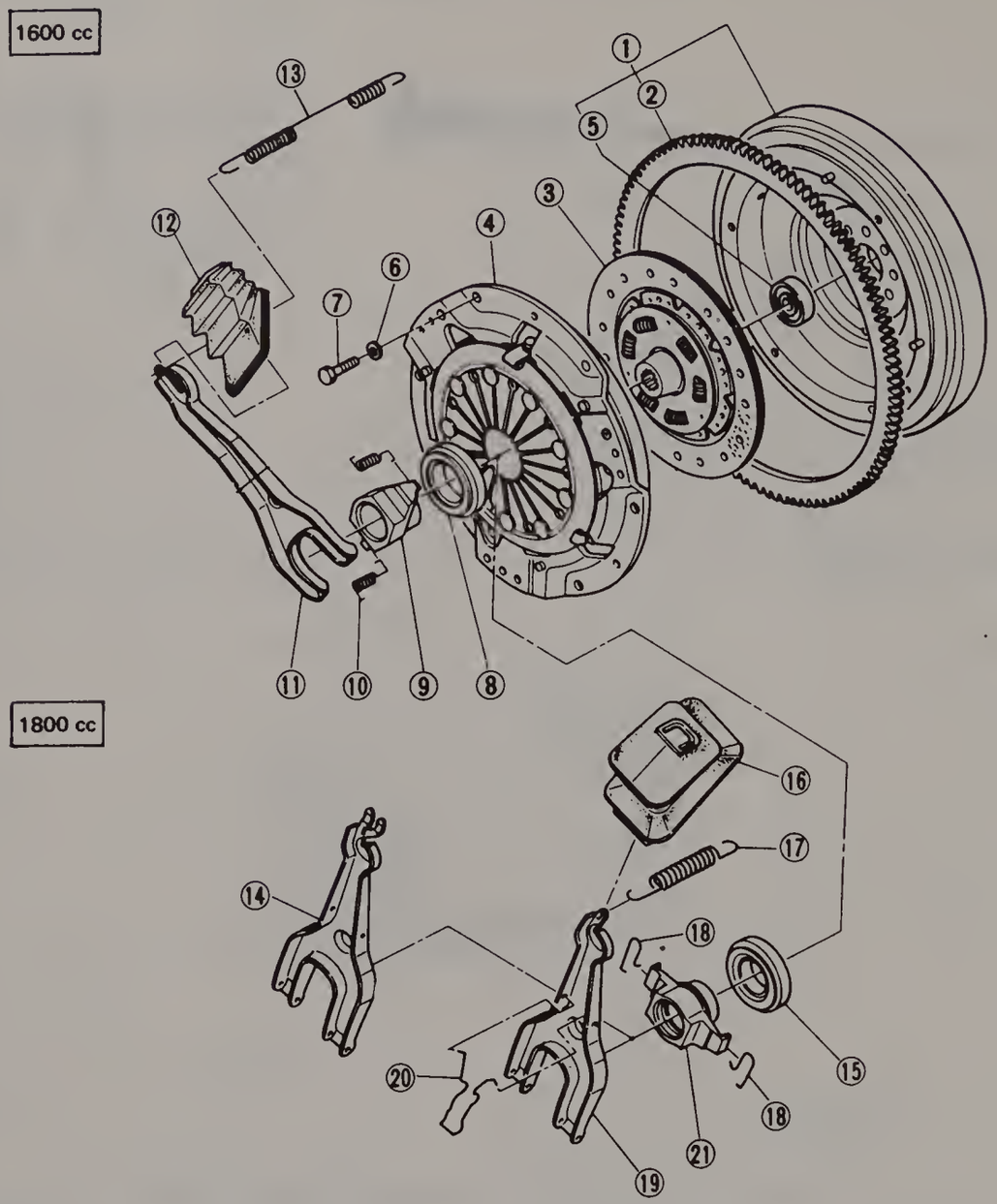


Fig. 8.2 Clutch components – exploded view (Sec 3)

1 *Flywheel*
2 *Ring gear*
3 *Clutch disc*
4 *Clutch cover*
5 *Ball bearing*
6 *Spring washer*
7 *Bolt*
8 *Release bearing*
9 *Bearing holder*
10 *Spring*
11 *Release fork*
12 *Rubber boot*
13 *Spring*
14 *Release fork (for (Hill-holder)*
15 *Release bearing*
16 *Rubber boot*
17 *Spring*
18 *Retaining clip*
19 *Release fork*
20 *Retainer spring*
21 *Bearing holder*

mounting bolts from the cover until all of the bolts are loosened.

3 Now remove the bolts, the clutch cover and the clutch disc. **Note**: *Make sure that you do not get any grease or oil on the disc or it will have to be replaced with a new one.*

4 Inspect the disc facing for wear and oil contamination. Check the rivet head depth and compare it to the Specifications. Replace the disc with a new one if it is damaged or worn.

5 Examine the friction faces of the flywheel and clutch pressure plate for abnormal wear and scoring due to the rivets popping through. If there is scoring, have the plate resurfaced or replace it with a new one. Inspect the release bearing as described in the following Section.

6 Do not disassemble the cover or the disc.

7 **Note**: *When attaching the clutch cover to the flywheel, position the clutch cover so that there is a gap of 120 degrees or more between O marks on the flywheel and clutch cover.* Attach the clutch disc and then the cover to the engine using a clutch alignment tool. Install the mounting bolts snug with your fingers, then tighten them in a diagonal sequence to the specified torque.

8 Install the transmission in the vehicle by referring to the appropriate Section in Chapter 7.

4 Clutch release bearing/mechanism – removal and installation

Refer to Fig. 8.2

1 To remove the release bearing and mechanism, the transmission must be removed from the vehicle. To do this, refer to the appropriate Section in Chapter 7.

2 Remove the rubber sealing boot from the release fork.

3 Remove the release bearing retaining clips (or springs) from the bearing holder.

4 Remove the bearing and holder from the shaft.

5 Inspect the bearing. If it feels sloppy or does not turn freely, replace the holder and bearing (as a unit) with a new one.
6 Pull the release fork away from the transmission and remove the fork return spring.
7 Remove the release fork from the transmission.
8 Replace any of the retaining or return springs with new ones if they are deformed.
9 Before installation, apply a light coat of grease to the inner groove of the bearing holder, the contact surface of the fork and pivot, the contact surface of the fork and holder and then on the transmission mainshaft and splines.
10 Install the release fork, making sure that it is positioned correctly on its pivot and held there with its return spring.
11 Install the release bearing with the holder closest to the transmission.
12 Install the retaining clips (or springs) correctly.
13 Install the transmission in the vehicle by referring to the appropriate Section in Chapter 7.

5 Driveshaft (4WD) – removal and installation

Refer to Fig. 8.3

1 First, raise and support the vehicle on jackstands.

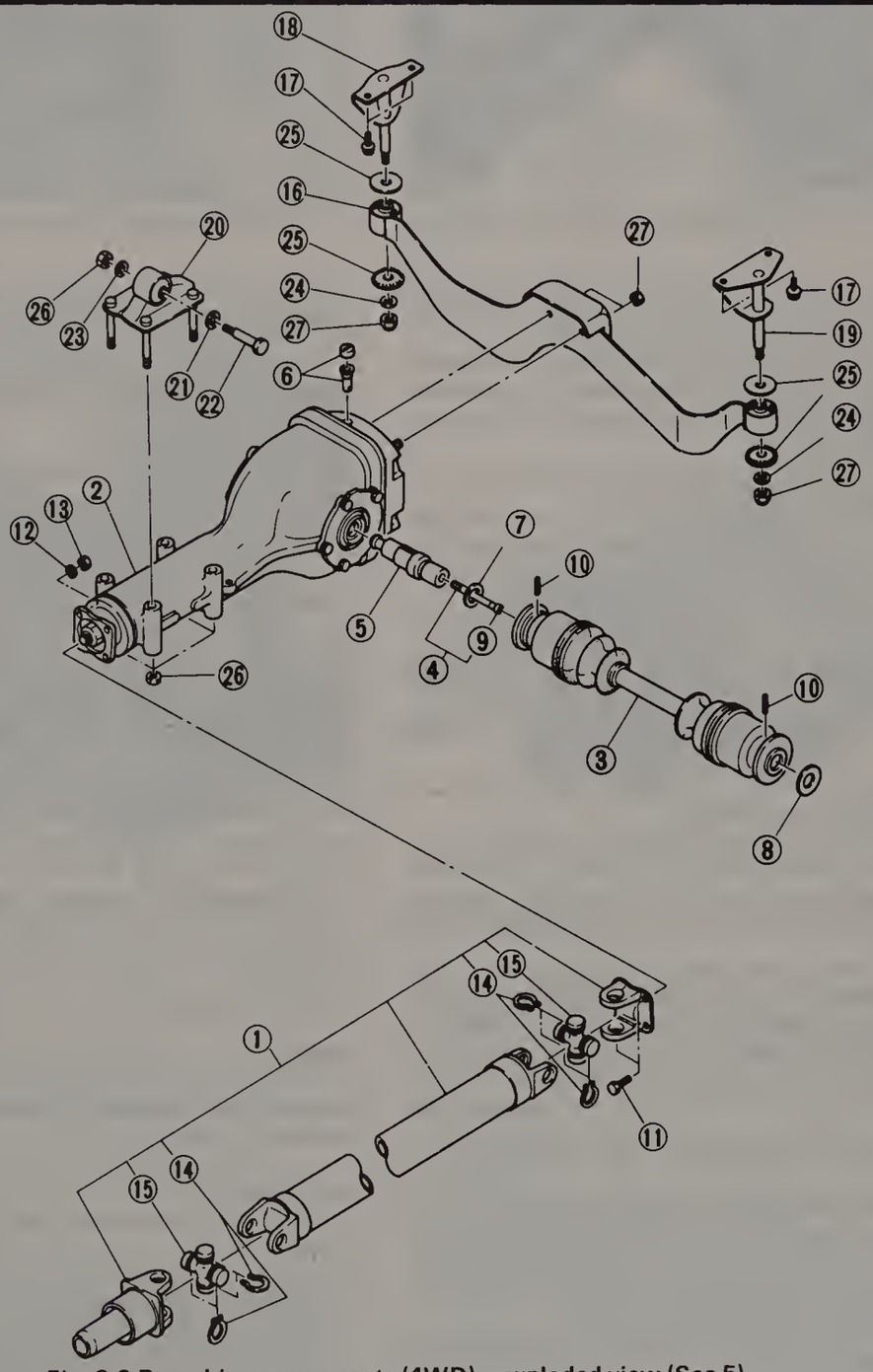


Fig. 8.3 Rear drive components (4WD) – exploded view (Sec 5)

1 *Driveshaft assembly*
2 *Differential assembly*
3 *Axleshaft assembly*
4 *Bolt*
5 *Axle spindle*
6 *Breather cap*
7 *Packing*
8 *Packing*
9 *O-ring*
10 *Spring pin*
11 *Bolt*
12 *Spring washer*
13 *Nut*
14 *Snap-ring*
15 *Universal joint cross assembly*
16 *Differential mount assembly*
17 *Bolt*
18 *Bracket (RH)*
19 *Bracket (LH)*
20 *Bracket assembly*
21 *Washer*
22 *Differential mount bolt*
23 *Washer*
24 *Washer*
25 *Stopper*
26 *Locknut*
27 *Locknut*

5.2 Remove the nuts and bolts holding the differential yoke to the companion flange

7.3 Use a slender punch to remove the spring pins from the axleshafts

2 Place match marks on the differential yoke and the companion flange of the differential assembly. Remove the bolts and nuts holding the input yoke and the companion flange together (photo).
3 Remove the driveshaft from the vehicle by pulling the transmission output yoke out of the transmission. **Note:** *Be prepared to cap the rear of the transmission as soon as the driveshaft is removed, because some transmission fluid will drain out.*
4 If you removed the driveshaft in order to replace the universal joints, refer to the following Section in this Chapter.
5 Install the transmission end of the driveshaft first. Unplug the rear of the transmission and carefully slide the output yoke into the transmission. **Note:** *Be careful not to damage the seal or the splines of the transmission output shaft.*
6 Now, align the match marks of the input yoke and the companion flange. Reconnect the flange and the yoke with the mounting hardware and make sure it is tightened according to the Torque specifications.
7 Lower the vehicle to the ground.

6 Universal joints (4WD) – replacement

1 In order to replace the universal joints, you have to remove the driveshaft from the vehicle. To do this, refer to the previous Section.
2 Remove the snap-rings from the ends of the universal joint cross with a screwdriver.
3 Remove the bearing race from the yoke by tapping the yoke with a hammer. **Note:** *If the bearing race is stubborn, place a socket (the same size as the race) on the outside of the race and carefully drive the race through the yoke with a hammer.*
4 Remove the yoke from the journal end of the driveshaft. Finish removing the rest of the universal joint cross from the yoke and the journal.
5 Make sure that the needle bearings of the cross are packed with grease.
6 Carefully install the new cross (with the needle bearings inside of the races) into the yoke and then the yoke with the cross into the driveshaft journal. **Note:** *A good way to install the bearing races is to use a socket with the same size outside diameter as the races and press them into place between the jaws of a large vise.*
7 After the universal joint is completely assembled, pivot it with your hands in a number of different directions to see if it operates smoothly.
8 Install the driveshaft on the vehicle.

7 Axleshafts – removal and installation

Refer to Fig. 8.3

Front

1 Because of the special tools required (which are usually not available to the home mechanic), disassembly of the front axle from the steering knuckle should be performed by a dealer service department.
2 To remove and install the front axle and steering knuckle as an assembly, refer to the appropriate Section in Chapter 11.

Rear (4WD)

3 To remove the rear axleshaft, use a slender punch and tap out the spring pins holding the axleshaft in position (photo). Pull the axleshaft ends off the splined shafts of the rear differential and the wheels.
4 To install the axle assembly, use a new spring pin and drive the pin into the hole of the axle. **Note:** *Make sure that the holes in the axle spindle and the åxleshaft are in alignment before you install the spring pin.*

8 Axleshaft boots – replacement

Refer to Fig. 8.4

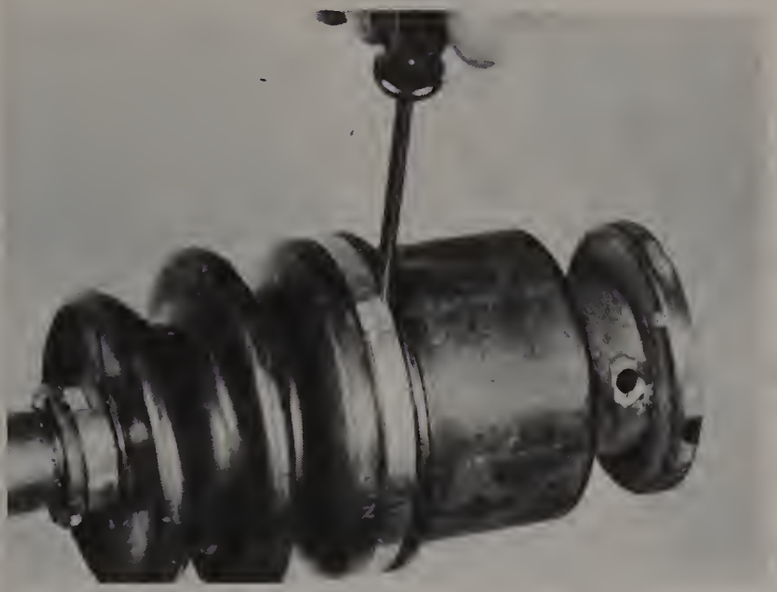
Note: *The construction of the front and rear Constant Velocity (CV) joints is the same. In some auto parts stores you can purchase a boot replacement kit which allows you to replace only the boots, while the axleshafts are still in place, on the vehicle. If you decide to use this type of kit, follow the manufacturer's instructions carefully. These boot replacement kits are not available through Subaru dealers, nor are they recommended by Subaru. Otherwise, the axleshafts have to be removed from the vehicle.*

Front

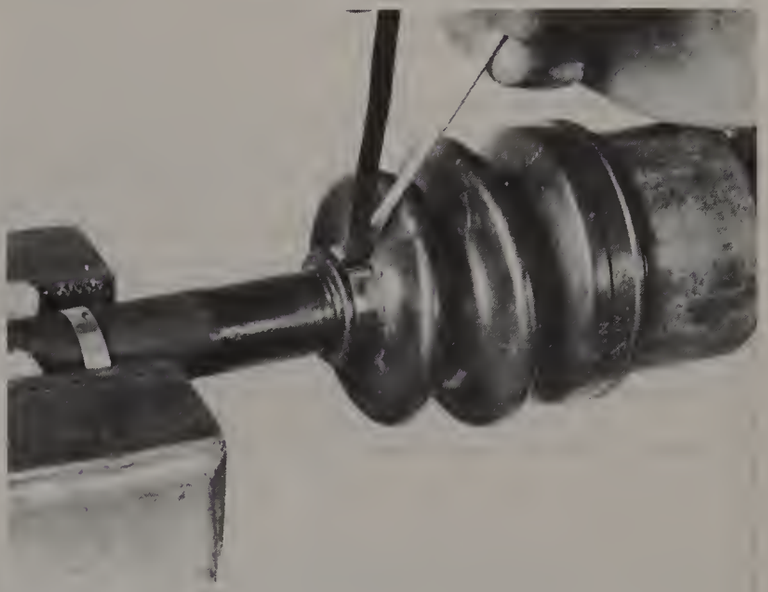
1 In order to replace the boots, the axleshaft and steering knuckle assembly must be removed together by referring to the appropriate Section in Chapter 11.

Rear (4WD)

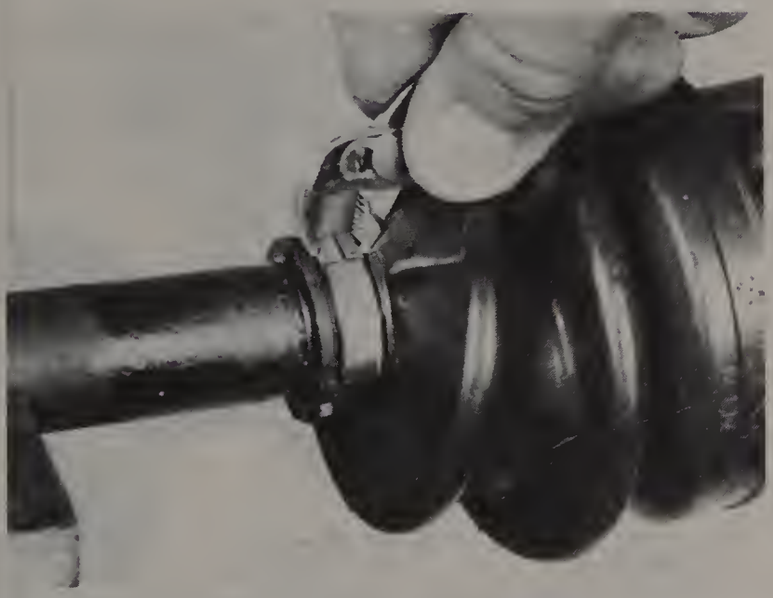
2 To remove the axle assembly, refer to the previous Section in this Chapter.
3 Remove the metal bands on the large and small ends of the CV boot by using a small screwdriver and prying apart the locking tangs of the bands (photo).
4 In order to fully remove the boots from the axle shaft, refer to the next Section in this Chapter and disassemble the axleshaft assembly.
5 Remove the old boot from the axle by sliding it off. Install the new boot in the opposite manner.
6 After the new boots have been installed on the axle and the axle reassembled and packed in grease, you can pack the inside of the new boots with grease.
7 Place the metal bands around the small and large ends of the boot and lock them into place.
8 To do this, insert the end of the band into the slot that is provided on the band and pull it as tight as you can without pinching the boot.



8.3 Remove the metal bands on the axle boots by prying open the locking tabs



8.9 Wrap the metal bands tightly around the boot and bend them into place



8.11 Cut off the excess metal band, fold under the locking tabs and bend the locking tabs into position

8.12 Use a small screwdriver and carefully place the baffle plate around the boot

9 Place the end of a screwdriver on the edge of the band and bend the band up to form a crease (photo).
10 Use a metal cutter and cut the band to within $\frac{1}{8}$ inch of the locking tabs.
11 Now, open the locking tabs slightly and insert the $\frac{1}{8}$ inch excess under the locking tabs. Squeeze the tabs together and make sure they are tight and flat (photo).
12 Using a small screwdriver, carefully place the rubber baffle plate around the large end of the boot (photo).
13 Install the axle assembly on the vehicle.

9 Axleshafts – disassembly and reassembly

Refer to Fig. 8.4

Front

1 Because of the special tools required (which are usually not available to the home mechanic), disassembly of the axle from the steering knuckle should be performed by a dealer service department. **Note:** *It would be to your advantage to have additional work done at this time. Have the wheel bearings checked, repacked or replaced and adjusted. Have the rubber boots replaced and the Constant Velocity (CV) joints checked and repacked on the axle assembly. In doing this, you may save yourself a lot of time and money in the future.*
2 In order to remove the axle and steering knuckle assembly, refer to the appropriate Section in Chapter 11.

Rear (4WD)

3 To remove the axle assembly, refer to the appropriate Section in this Chapter.
4 Remove the metal bands from around the ends of the boots by referring to Section 9 in this Chapter.
5 Remove the circlip on the inside of the CV outer bearing race with a screwdriver (photo).
6 Remove the CV bearing outer race from the axleshaft assembly.
7 Wipe away any excess grease from the bearing balls and cage. Using a small screwdriver, carefully pry the balls out of the cage (photo).
8 Remove the cage from the bearing inner race by slightly turning it to one side or the other and moving it toward the rubber boot.
9 Remove the bearing inner race retaining ring from the end of the axleshaft (photo). Remove the race from the shaft.
10 Now you can pull the bearing cage and boot off the shaft.
11 Clean and inspect the parts for any abnormal wear. Replace them with new ones if necessary. **Note:** *If any of the bearing parts need to be replaced, they must be replaced as a matched set.*
12 Install the new boot and pack it with grease. Install the bearing

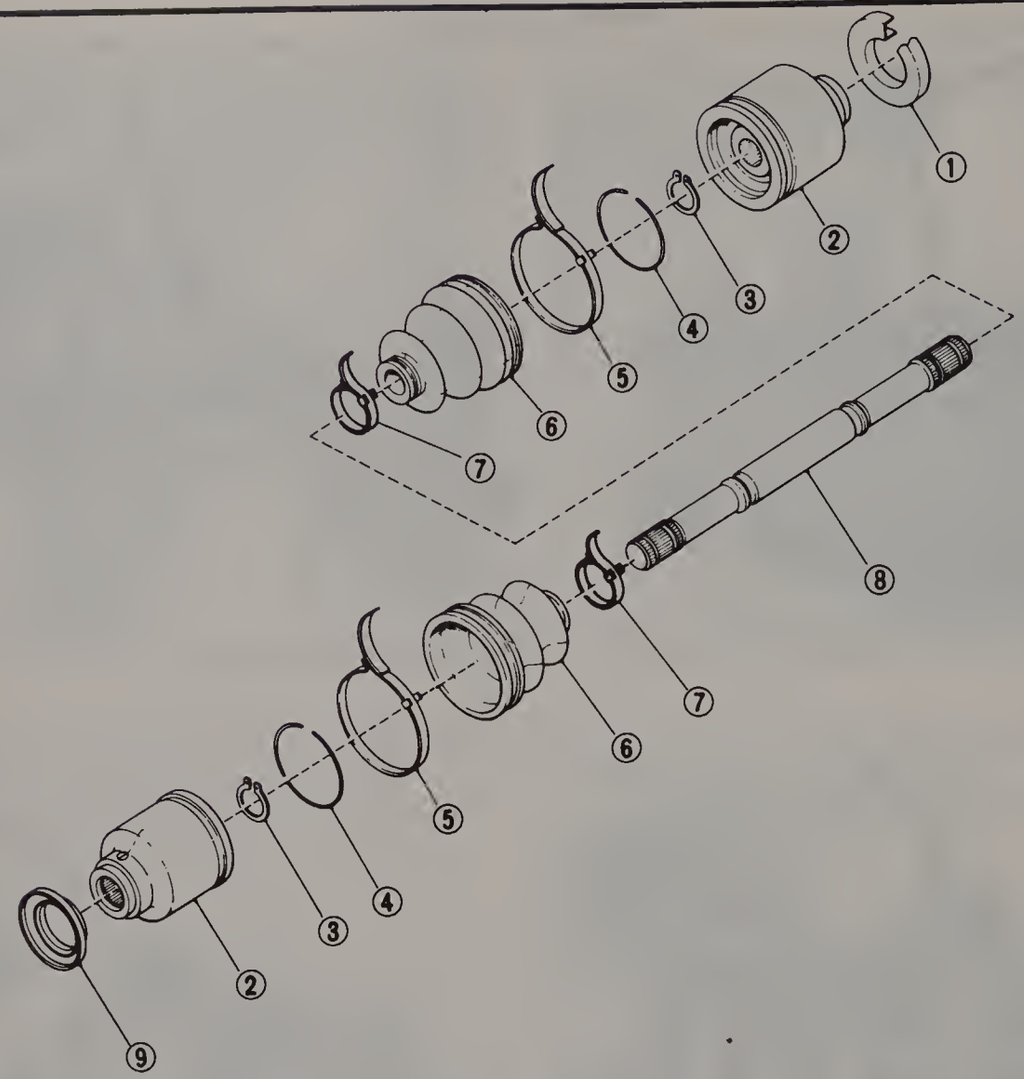
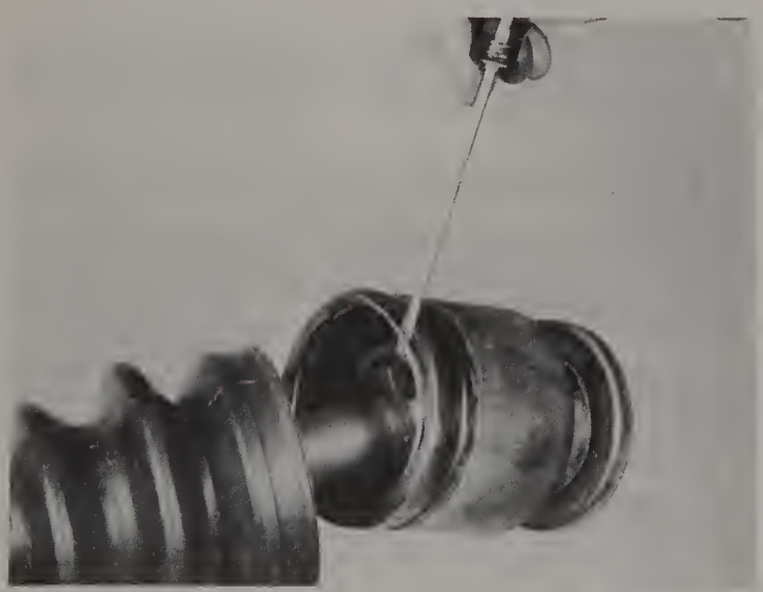
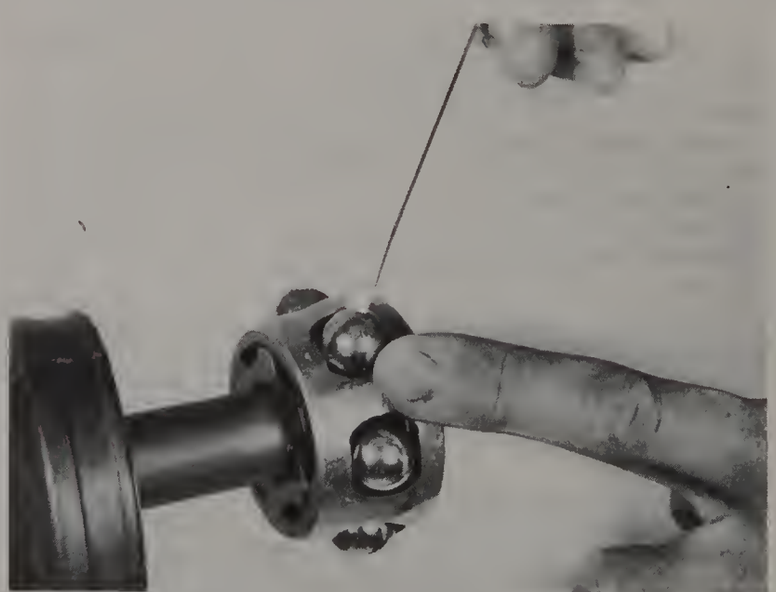


Fig. 8.4 Rear axleshaft components – exploded view (Sec 9)

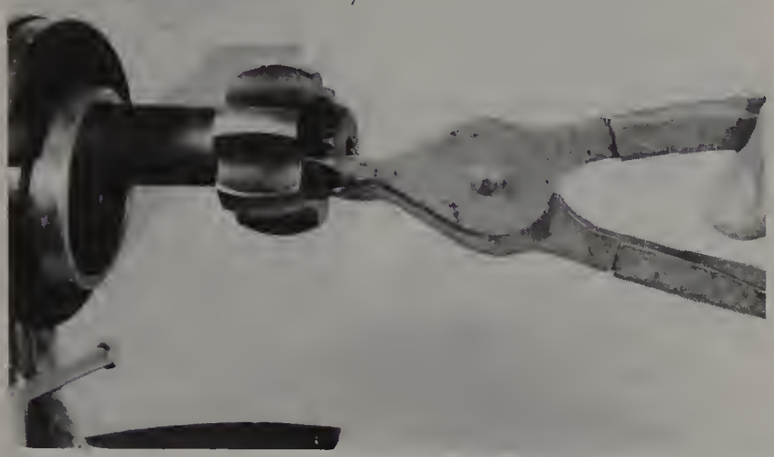
1	*Baffle plate*	*3*	*Retaining ring*	*6*	*Boot*	*8*	*Axleshaft*
2	*Constant Velocity (CV) joint*	*4*	*Circlip*	*7*	*Metal band*	*9*	*Baffle plate*
		5	*Metal band*				



9.5 Remove the circlip from the inside of the outer bearing race

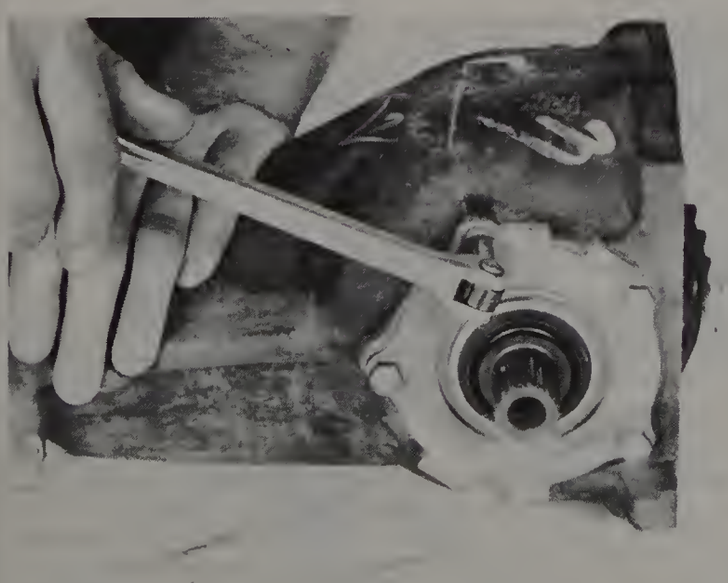


9.7 Use a small screwdriver and carefully pry the balls out of the bearing cage



9.9 Remove the retaining ring from the end of the axleshaft

9.16 Pack the bearings full of grease making sure it flows out of the openings



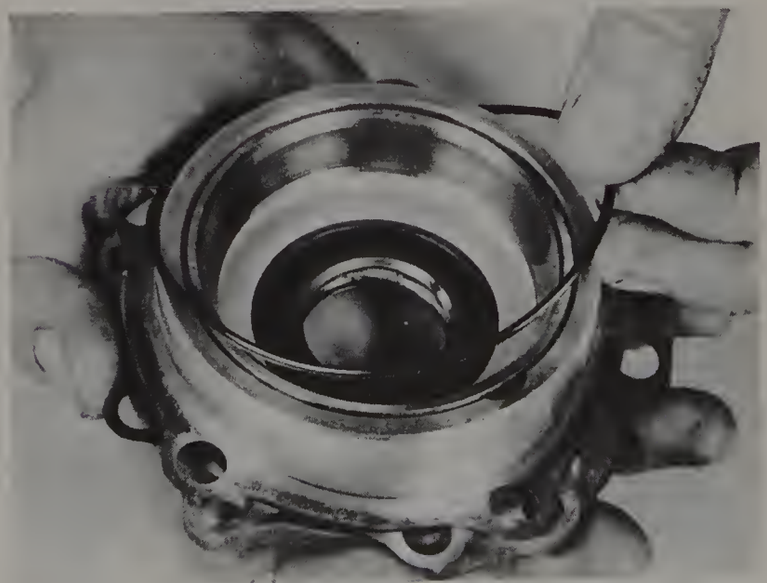
10.5 Remove the side bearing retainer bolts

cage with the smaller diameter end toward the boot.
13 Install the bearing inner race and the retaining ring that holds it onto the axleshaft.
14 Now, turn the bearing cage slightly and place it around the bearing inner race. **Note**: *Make sure that the slots in the cage line up with recesses of the inner race.*
15 Install the bearing balls into the bearing cage by pushing them into place with your fingers.
16 You must carefully pack these bearings with grease. To do this, push grease into ALL of the openings on both sides of the bearing (photo). Make sure that the grease fills in all of the cavities and is squeezed out around the bearing balls.
17 Apply a large quantity of grease to the inside of the bearing outer race. Install the outer race onto the shaft and around the bearing.
18 Install the circlip into the groove that is inside the outer race. Be sure that it is installed correctly.
19 Now add a large quantity of grease to the open area of the bearing assembly.
20 Install the rubber CV boots by referring to Section 8 in this Chapter.

10 Rear differential seals (4WD) – replacement

Refer to Fig. 8.5

1 **Note**: *Due to the special tools required (which usually are not available to the home mechanic), you should take the differential to a dealer service department to have the front seal replaced.* The side oil seals can be replaced with the differential still in the vehicle, even though this procedure shows it being done with the differential removed.
2 Block the front wheels, raise the rear of the vehicle and support it securely on jack stands.
3 Drain all of the lubricant out of the differential. Refer to Chapter 1 for the drain, fill and check plug locations.
4 Remove the rear axles from the vehicle by referring to the appropriate Section in this Chapter.
5 Remove the side bearing retainer mounting bolts (photo), the side bearing spacer and the bearing retainer. Make a note of the retainer notch position. **Note**: *When you remove the retainer from the differential, be careful not to move any of the internal parts that may disturb the bearing preload.*
6 With the retainer removed, replace the retainer O-ring (photo) with a new one. Also remove the metal shims.
7 To remove the oil seal from the retainer, place the retainer on two blocks of wood as shown. Now, using a socket with the same outside diameter as the outside diameter of the seal, drive the seal out of the retainer (photo).
8 To install a new seal, use the same socket and one block of wood and carefully drive the new seal into position (photo). **Note**: *Make sure*



10.6 Replace the retainer O-ring with a new one

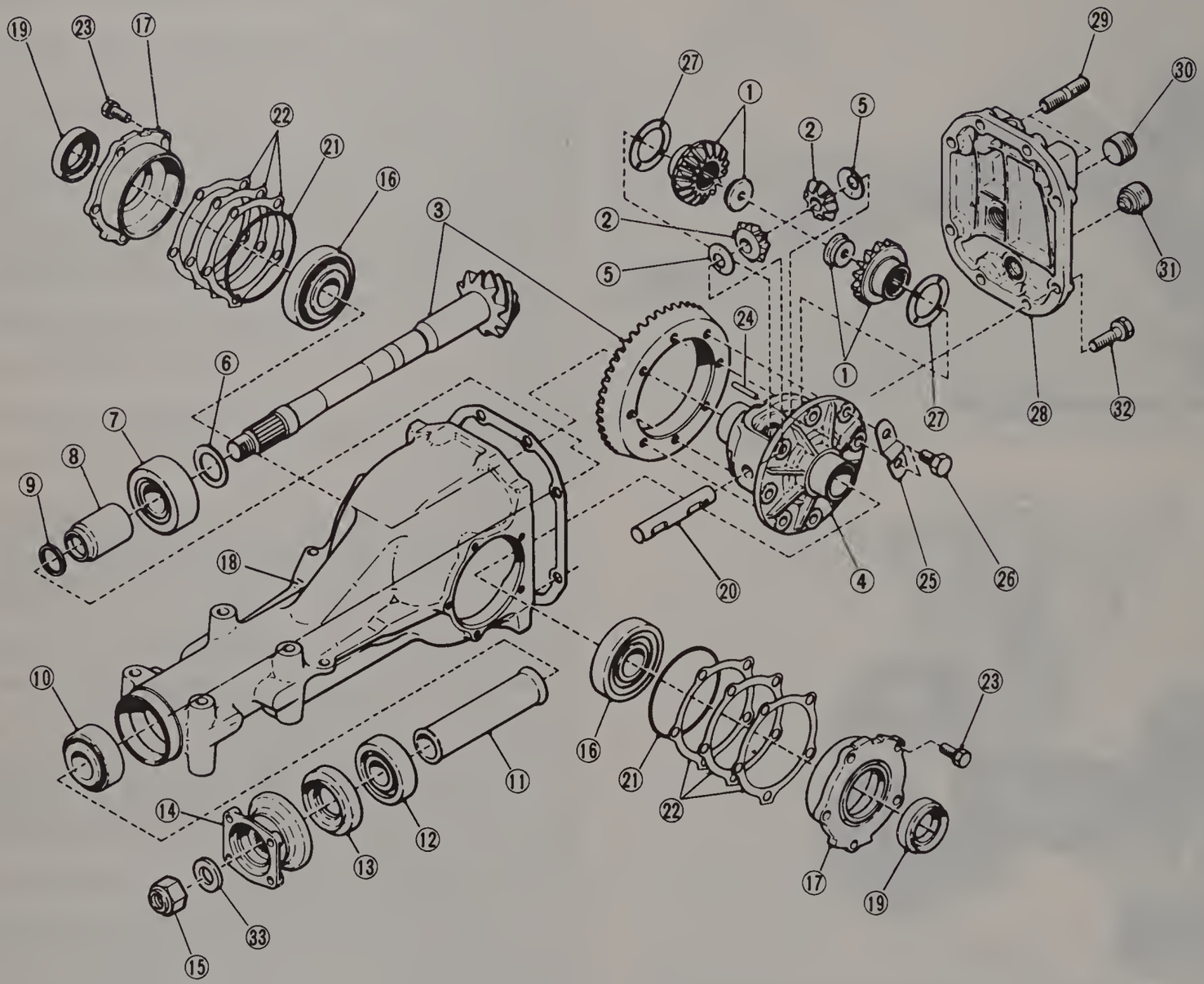


Fig. 8.5 Rear differential components (4WD) – exploded view (Sec 10)

1 *Side gear*
2 *Pinion gear*
3 *Crown gear set*
4 *Differential carrier*
5 *Gear washer*
6 *Height adjusting washer*
7 *Rear bearing*
8 *Preload adjusting spacer*
9 *Preload adjusting washer*
10 *Front bearing*
11 *Spacer*
12 *Pilot bearing*
13 *Front oil seal*
14 *Companion flange*
15 *Drive pinion nut*
16 *Side bearing*
17 *Bearing retainer*
18 *Differential case*
19 *Side oil seal*
20 *Spyder gear shaft*
21 *Bearing retainer O-ring*
22 *Bearing retainer shim*
23 *Bolt*
24 *Pinion shaft lock pin*
25 *Lockplate*
26 *Bolt*
27 *Thrust washer*
28 *Rear cover*
29 *Stud bolt*
30 *Plug*
31 *Plug*
32 *Bolt*
33 *Washer (not all models/ years)*

that the seal is installed just flush with the surface of the retainer.

9 Install the metal shims. If using new shims, they must be the same thicknesses as the ones that were removed. Install the new O-ring on the retainer.

10 Now, install the bearing retainer onto the differential, making sure that the notch is in the same place as when it was removed (photo).

11 Install the bearing retainer bolts and tighten them according to the Torque specifications. Install the side bearing spacer.

12 Install the rear axles back in the vehicle, then refer to Chapter 1 and add the specified type and quantity of lubricant to the differential.

13 Drive the vehicle, then check for leaks around the seals and retainers.

11 Rear differential (4WD) – removal and installation

Refer to Fig. 8.3.

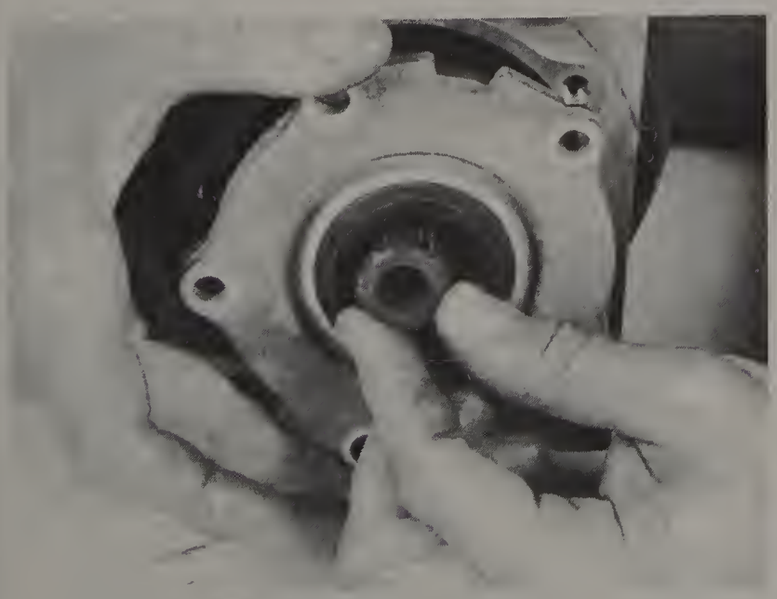
Note: *The side oil seals can be replaced with the differential still in the vehicle by referring to the previous Section in this Chapter.*

1 Block the front wheels and raise the rear of the vehicle. Support it securely on jack stands. Even though it is not absolutely necessary, it may be a good idea to drain the lubricant from the differential (see Chapter 1).

2 Remove the axle assemblies and driveshaft by referring to the appropriate Sections in this Chapter.

10.7 Use a socket to drive the old oil seal out of the retainer

10.8 Carefully install the new seal flush with the retainer



10.10 Install the side bearing retainer with the notch in the upper position

3 Support the rear of the differential with a jack and remove the mounting nuts holding the rear of the differential to the mount assembly.
4 Now remove the mounting nuts holding the front of the differential to the mounting bracket.
5 Carefully lower the differential and remove it from under the vehicle. **Note:** *Disassembly is not recommended because the tools required are not available to the home mechanic. For repair, take the differential to a dealer service department (or consider replacing it with a new or rebuilt unit).*
6 With the differential removed from the vehicle, now would be a good time to check or replace the rubber mounts on the brackets. To do this, refer to Section 13 in this Chapter.
7 Position the differential back on the jack and place it in position to mount it in the vehicle.
8 Install the rear mounting nuts loosely. Now, install the front mounting nuts. Tighten all of the differential mounting hardware according to the Torque specifications.
9 Install the axleshafts and the driveshaft.
10 Remove the jack and lower the vehicle to the ground.
11 If it was drained, fill the differential with new lubricant according to the Specifications in Chapter 1.

12 Rear differential rubber mounts (4WD) – replacement

Refer to Fig. 8.3

1 Remove the differential by referring to the previous Section in this Chapter.

Front bracket

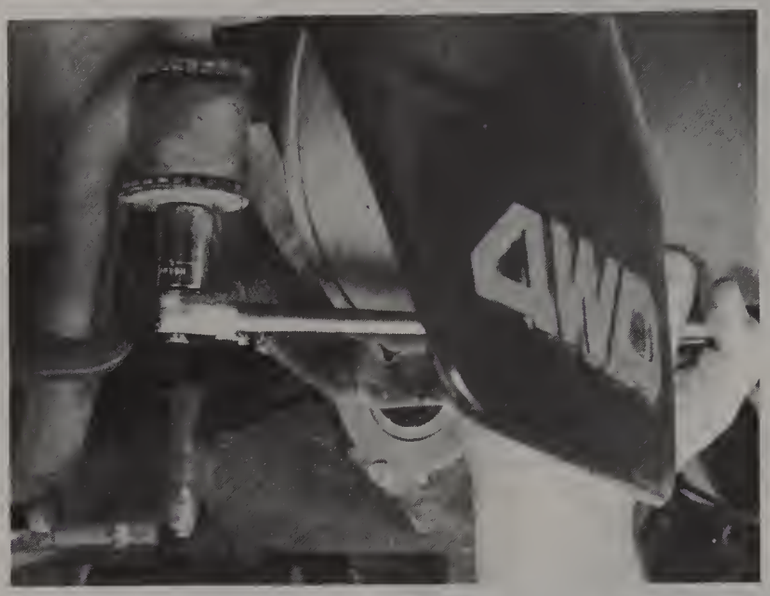
2 Remove the bolt and nut holding the bracket to the underside of the vehicle (photo).
3 The old rubber bushing must be pressed out and the new one pressed in. To do this, use two blocks of wood and a socket the same size as the bushing.
4 Place the blocks on one side of the bracket and the socket on the other side with everything between the jaws of a large vise. As you turn the vise handle, the bushing will be forced out.
5 Use approximately the same procedure to install the new bushing.
6 Install the bracket back on the vehicle and make sure that the mounting hardware is tight.

Rear mount

7 Remove both nuts holding the mount assembly to the left and right hand brackets (photo).
8 Remove the mount from the vehicle. Place each end into the jaws of a large vise with two blocks of wood on one side of the bushing and a socket the same size as the bushing on the other side.
9 As you turn the handle of the vise, the bushing will be forced out.

12.2 Remove the front bracket mounting bolt

Install the new bushings in approximately the same way.
10 Install the rear mount back on the vehicle and make sure that the mounting hardware is tight.
11 Install the differential assembly.



12.7 Remove the rear bracket assembly mounting nuts

Chapter 9 Brakes

Refer to Chapter 13 for specifications applicable to 1984 thru 1988 models

Contents

Specifications

Front brake

Type	Disc
Adjusting mechanism	Automatic
Pad thickness (includes metal backing plate)	
Standard	0.591 in (15 mm)
Service limit	0.295 in (7.5 mm)
Disc rotor thickness	
Standard	0.492 in (12.5 mm)
Service limit	0.394 in (10 mm)
Disc rotor runout limit	0.0039 in (0.10 mm)

Rear brake

Type	Drum
Adjusting mechanism	Manual
Shoe lining thickness	
Standard	0.200 in (5 mm)
Service limit	0.059 in (1.5 mm)
Drum inside diameter (all except UK MV model)	
Standard	7.09 in (180 mm)
Service limit	7.17 in (182 mm)
Drum inside diameter (UK MV model)	
Standard	8.00 in (203.2 mm)
Service limit	8.08 in (205.2 mm)

Brake booster

Brake fluid pressure without engine running	
At pedal force of 33 lb (15 kg)	57 psi (392 kpa)
At pedal force of 66 lb (30 kg)	370 psi (2550 kpa)
Pressure with engine running and vacuum at 19.69 in Hg (66.7 kpa)	
At pedal force of 33 lb (15 kg)	498 psi (3432 kpa)
At pedal force of 66 lb (30 kg)	853 psi (5884 kpa)

Torque specifications

	Ft-lb	Nm
Caliper body mounting bolt	36 to 51	48 to 68
Caliper support mounting bolt	36 to 51	49 to 69
Brake hose/cable union bolt	11 to 15	15 to 21
Backing plate mounting bolt	34 to 43	46 to 58
Master cylinder check valve cap	18 to 25	25 to 34
Master cylinder stopper screw	1.1 to 2.2	1.5 to 2.9
Master cylinder mounting nut	7 to 12	10 to 16
Brake wheel cylinder mounting nut	5.8 to 7.2	8 to 10
Brake booster-to-firewall	9 to 17	13 to 23
Parking brake bracket bolt	7 to 10	10 to 14
Cable mounting bracket bolt	4.7 to 6.9	6.4 to 9.3
Caliper lock pin	33 to 54	45 to 72
Axle castle nut	145	196

1 General information

The brake system is four-wheel, hydraulically operated, with disc brakes on the front and drum brakes on the rear. This system is assisted by a vacuum booster.

The vacuum booster is located between the master cylinder and the brake pedal. Its main advantage is that more braking effort is achieved with less pedal effort.

The hydraulic system is a dual circuit layout with a primary and secondary circuit. The primary circuit serves the front right and the rear left brakes while the secondary circuit serves the front left and the rear right brakes. The purpose of this type of system is that if one circuit should fail, the other circuit will provide temporary braking effort.

The parking brake is a front-wheel, mechanically operated type. The parking brake lever is connected to the front brakes by cables with an equalizer to ensure an equal application of the brake to both wheels.

Later models feature a Hill-holder device for manual transmissions only. This device is connected to the clutch fork and is mechanically activated when the clutch is pushed in. The advantage is that it activates the brakes on a steep incline so that the clutch does not wear out and also makes it easier to start the vehicle in motion when on a hill.

MV (pick-up) models sold in the UK and Europe feature a number of changes to the brake system. The rear brakes are slightly larger in diameter and adjust automatically. A load sensing valve is incorporated into the hydraulic system to monitor load condition and then balance front-to-rear braking force as required.

2 Brake pedal – adjustment

Refer to Fig. 9.1

1 First, refer to the appropriate Section in Chapter 1 and check the brake pedal feel.

2 Pedal height and free play are the only adjustments that may be required. Brake pedal height, or the distance from the floorboard to the pedal, should only need adjusting if the brake light switch is replaced or adjusted. If and when the brake pedal height is changed, the free play should also be checked and adjusted as necessary.

3 To adjust the pedal height, unplug the electrical connector in the wiring harness coming from the brake light switch. Loosen the jam nut and turn the brake light switch until the specified pedal height is obtained.

4 Tighten the jam nut, plug in the electrical connector and check the brake lights for proper operation. They should come on when the brake pedal is depressed. and go out when it is released.

5 Check the pedal free play (the distance the pedal travels before actuating the piston in the power brake unit) and compare it to the Specifications.

6 If an adjustment is necessary, loosen the jam nut on the power brake pushrod (at the yoke that attaches the rod to the pedal) and turn the pushrod (pliers may be necessary) until the proper amount of free play is obtained. Tighten the jam nut securely.

7 Depress the pedal as far as possible and make sure that the pedal-to-floorboard clearance is as specified. If the pedal has an excessively long stroke, check the brake shoe lining-to-drum clearance (Section 14).

3 Parking brake – adjustment

Refer to Figs. 9.2 and 9.3.

1 Before attempting to adjust the parking brake, make sure that all of the air has been bled out of the system and that the rear brakes have been adjusted properly. To do this, refer to the appropriate Sections in this Chapter.

2 Forcibly pull the parking brake lever back three to five times.

3 Count how many clicks the brake lever travels before it becomes fully engaged. The correct number should be three or four clicks. If it exceeds this, the parking brake should be adjusted as follows.

4 Remove the parking brake cover screws, followed by the cover itself.

5 To adjust the cable, unlock the jam nut from the adjuster nut on the end of the cable. Now, turn the adjuster nut in the direction that will tighten the cable.

6 It will be a trial-by-error method of adjustment, depending on how much the cable was out of adjustment. Operate the parking brake lever again and count how many clicks it takes to fully operate the brakes. Repeat this procedure until it maintains the correct adjustment.

7 After the adjustment is made, tighten the jam nut against the adjuster nut and lubricate any exposed cable with oil.

8 If it is impossible to reach the correct adjustment, it means that the cable is stretched beyond adjustment and needs to be replaced with a new one. To do this, refer to the appropriate Section in this Chapter.

9 Install the parking brake cover and tighten its mounting screws.

4 Parking brake cable – replacement

Refer to Figs. 9.2 and 9.3

Removal

1 If you find that your parking brake cable needs to be replaced, jack

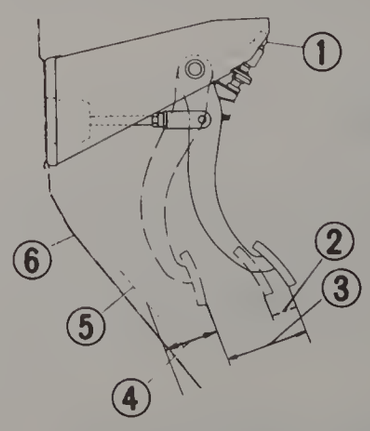


Fig. 9.1 Brake pedal clearances (Sec 2)

1 Stoplight switch
2 Pedal free play
3 Pedal stroke
4 Pedal clearance
5 Floor mat
6 Firewall

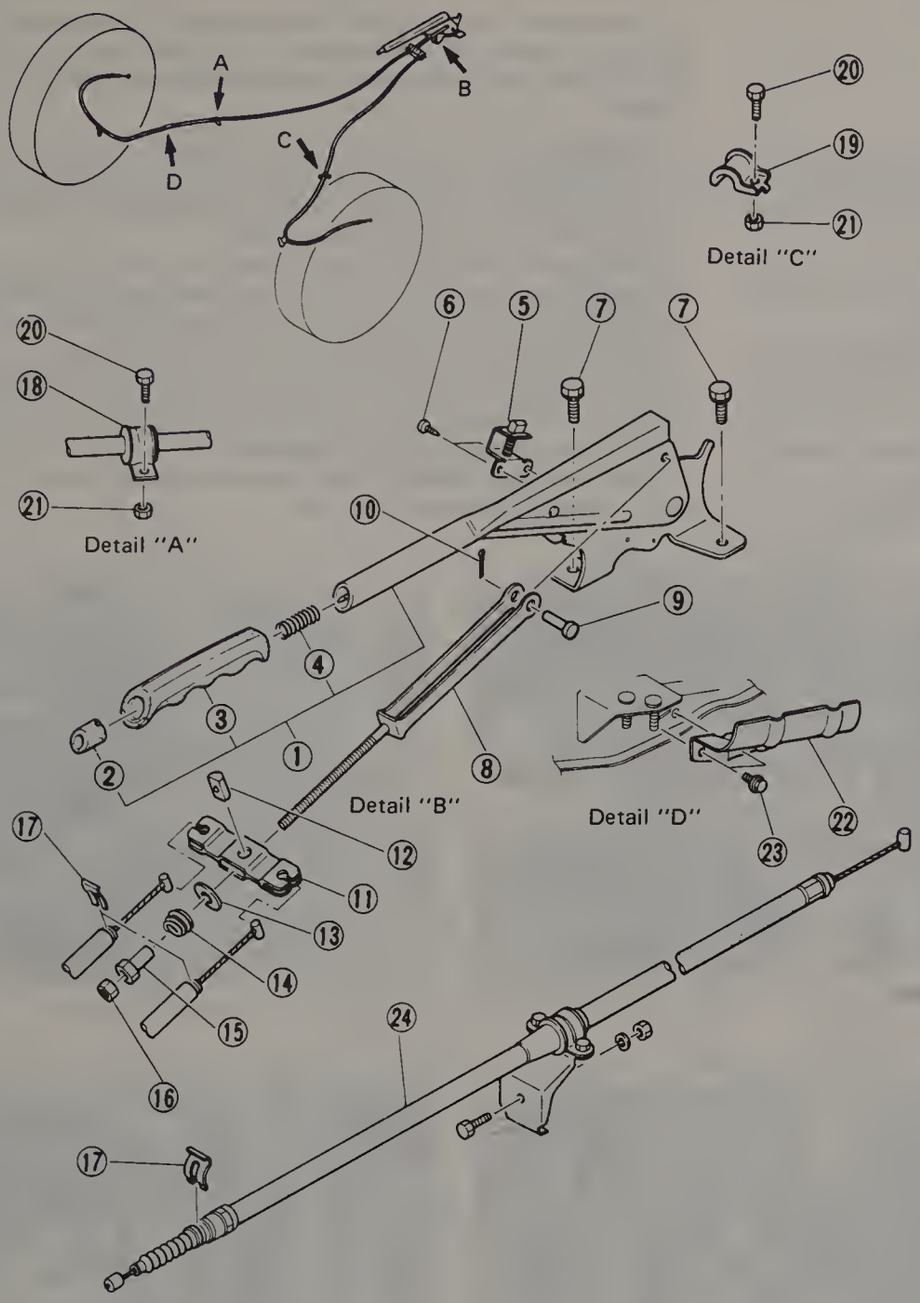


Fig. 9.2 Parking brake components – exploded view (Sec 3)

1 Brake lever assembly
2 Lever button
3 Lever grip
4 Lever spring
5 Lever switch
6 Switch mounting screw
7 Brake mounting bolt
8 Brake rod
9 Clevis pin
10 Cotter pin
11 Equalizer
12 Brake pin
13 Washer
14 Brake spring
15 Adjuster nut
16 Jam nut
17 Cable clamp
18 Clamp
19 Clamp
20 Clamp bolt
21 Clamp nut
22 Cable cover
23 Cover bolt
24 Cable assembly

up the front of your vehicle and place it on jack stands according to the *Jacking and towing* procedures at the front of this book.

2 Remove the front wheels and then the parking brake cover inside the vehicle.

3 Loosen the jam nut on the cable equalizer and then loosen the adjuster nut.

4 Disconnect both cable ends from the equalizer and then remove the clamps holding the cable to the vehicle body.

5 Remove the clips holding the cables to the disc brake supports and then remove the cables.

Installation

6 Now, replace the cables with new ones in the reverse order of their removal.

7 Adjust the new cables according to the adjustment procedure in this Chapter.

8 To help lengthen the life of your cables, coat their entire length with a good oil.

9 After the proper adjustment has been made, tighten the jam nut up against the adjuster nut to keep it from loosening.

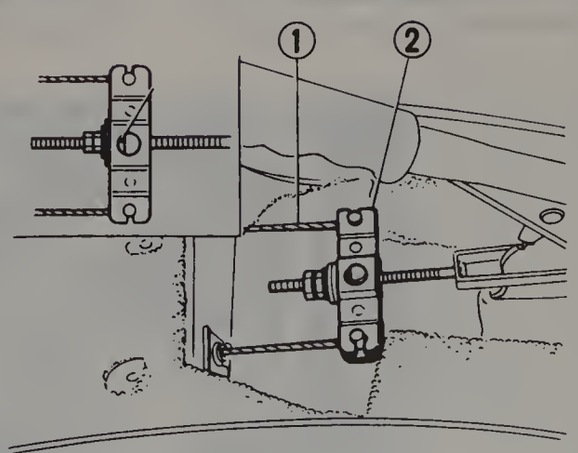


Fig. 9.3 Parking brake adjustment equalizer (Sec 3)

1 Parking brake cable *2 Equalizer*

5 Disc pads (front) – replacement

Refer to Fig. 9.4

Removal

1 Before attempting to replace the pads, measure them to see if they need to be replaced by referring to the appropriate Section in Chapter 1. Make sure you have the correct pad replacements for your vehicle.

2 Block the rear wheels and then raise the front of your vehicle according to the *Jacking and towing* procedures near the front of this book.

3 Completely release the parking brake lever and remove the front wheel. **Note:** *It is recommended that you complete one side of the vehicle at a time, leaving the other side assembled for use as a guide should difficulty be encountered.*

4 Remove the cable clamp (photo) holding the parking brake cable in place.

5 Now, disconnect the parking brake cable from its lever (photo) and pull it through the holder and out of the way.

6 Remove the disc caliper lock pin (photo) and place it to the side. **Note:** *Some models are equipped with a small bolt that locks the pin in place. This small bolt must be removed before the lock pin is unscrewed.*

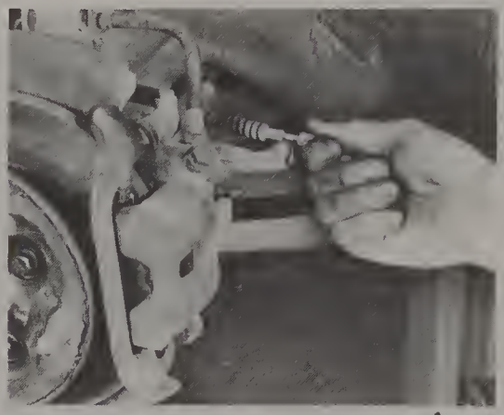
7 Before performing the following step, have a piece of stiff wire or a straightened coat hanger ready and accessible. Pull up on the disc caliper assembly and swivel it to the top as far as it will go (photo). Then, using the wire, attach it to the front shock absorber to keep it in this position and out of the way (photo).

8 Now, carefully remove the inner brake pad (photo) and then the outer pad (photo) from the pad support and retaining clips. **Note:** *Do not touch or push on the brake pedal after the pads have been removed. Also, do not disconnect the brake line for this procedure.*

9 Remove the pad shim (photo) from the outer pad and inspect it for wear or warpage. Replace it with a new one if necessary. Remove all of the pad's retaining clips and inspect them for wear or breakage. Replace them with new ones if necessary.

10 If necessary, the pads can now be thoroughly inspected and the lining thickness accurately measured.

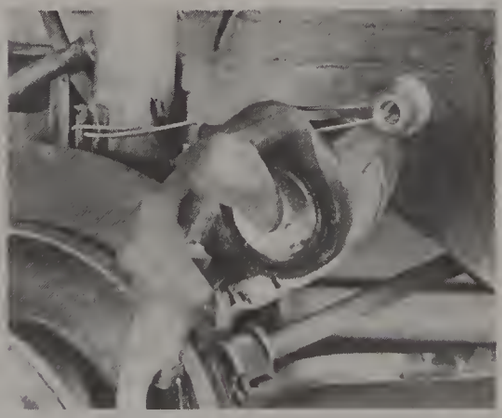
5.4 Remove the clamp holding the parking brake cable in place



5.5 Disconnect the parking brake cable from the lever

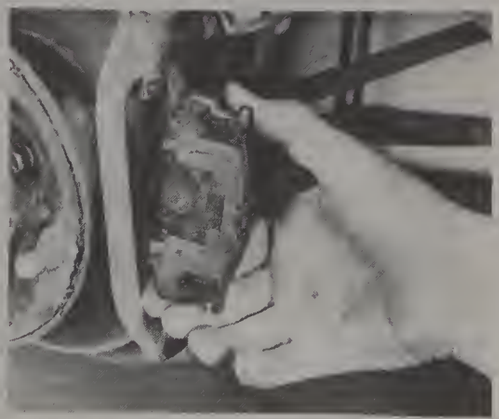
5.6 Remove the disc caliper lock pin

5.7A Swivel the caliper assembly up and ...



5.7B ... secure it to the front shock absorber

5.8A Remove the inside brake pad, then ...



5.8B ... the outside brake pad

5.9 Remove the shim from the outer pad

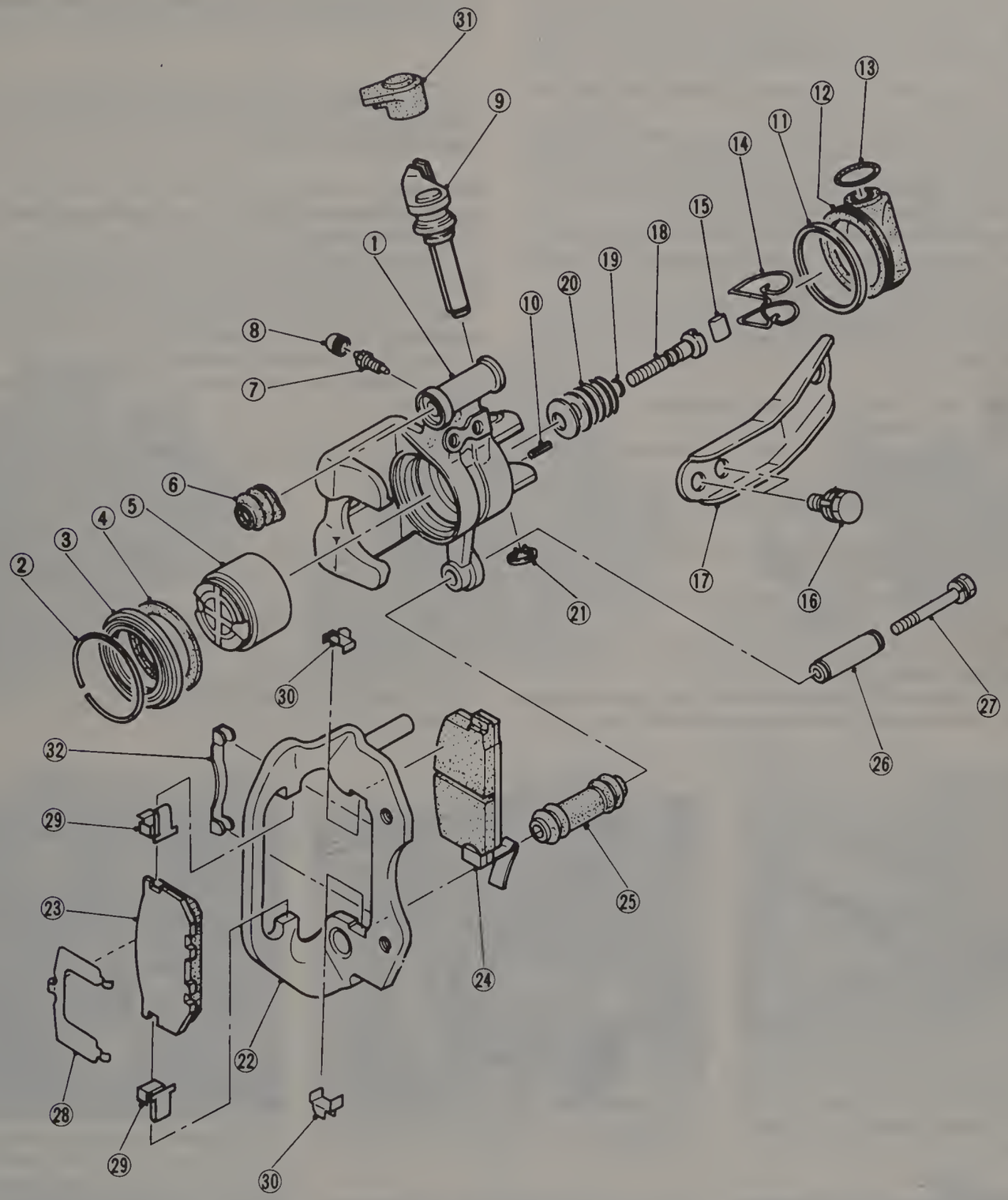


Fig. 9.4 Front disc brake components – exploded view (Sec 5)

1 *Caliper body*
2 *Piston boot retaining ring*
3 *Piston boot*
4 *Inner piston seal*
5 *Piston*
6 *Guide pin boot*
7 *Bleeder screw*
8 *Bleeder cap*
9 *Lever and shaft*
10 *Spring pin*
11 *Cap ring*
12 *Lever cap*
13 *Cap spring*
14 *Return spring*
15 *Connecting link*
16 *Bolt assembly*
17 *Bracket*
18 *Spindle*
19 *O-ring*
20 *Conical springs*
21 *Snap-ring*
22 *Pad support*
23 *Outer pad*
24 *Inner pad*
25 *Lock pin boot*
26 *Sleeve*
27 *Lock pin*
28 *Pad shim*
29 *Outer pad clip*
30 *Inner pad clip*
31 *Upper lever cap*
32 *Inner pad clip*

Installation

11 Before you install the new pads, using the special tool 925590000 or a similar tool (photo), turn in the disc brake piston. Turn in the piston by turning in a clockwise direction until it will not turn anymore.
12 If the face of the cylinder does not line up as shown (photo), turn the cylinder back out until it does line up.
13 Inspect the disc rotor for abnormal scoring and measure the thickness (photo) at three or four different points around the rotor. If the rotor has worn thin (see Specifications) it will have to be replaced with a new one. Slight imperfections will require the rotor to be removed and resurfaced at a machine shop.
14 Measure the disc runout both on the outside face and the inside face (photo) of the rotor. Compare with the Specifications and replace the rotor with a new one if necessary.
15 Install the new inside pad by inserting the bottom of the pad into its retaining clip while pressing it down and into the top retaining clip.
16 Install the shim to the outside pad and then install the new outside pad by compressing the bottom clip with your thumb and inserting the pad into its retaining clips.
17 Unhook the wire holding the caliper assembly to the shock absorber and lower it down and onto the new pads.
18 Make sure that the raised pin, on the back side of the inner pad, engages the notches of the piston face.
19 Install the lock pin (photo) through the caliper assembly and then into the caliper support. Tighten the lock pin according to the Torque specifications.
20 Reconnect the parking brake cable. Perform the same procedure on the remaining side, if not already done.
21 Install the wheels and lower the vehicle to the ground. Tighten the lug nuts according to the Torque specifications.
22 Depress the brake pedal several times with a normal braking force. This will adjust the correct clearance of the cylinder to the pads and will also adjust the parking brake.
23 Check the parking brake lever and confirm that it becomes fully engaged in three to four clicks. If not, adjust as described previously in this Chapter.
24 If the brake pedal feels 'spongy' when depressed, you may need to bleed the brake system as described elsewhere in this Chapter.

6 Disc calipers (front) – removal and installation

Refer to Fig. 9.4

Removal

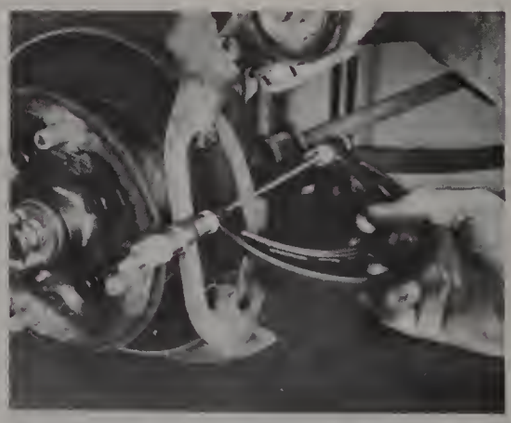
1 Initially follow the instructions in the previous Section and remove the disc brake pads.
2 Be prepared with a small container and some rags to catch any spilled brake fluid and then loosen and remove the union bolt of the brake line hose where it connects to the caliper. Place the hose up and out of the way. **Note:** *Do not let any brake fluid spill on any brake components (ie, pads or disc rotor).*
3 Remove the disc caliper assembly (photo) by carefully sliding it off its pivot. The disc pad support does not have to be removed during this procedure.
4 Thoroughly clean the outside of the caliper assembly with brake fluid or brake cleaning solution. Place the caliper assembly on a suitable workbench and prepare to disassemble it by referring to the following Section.

Installation

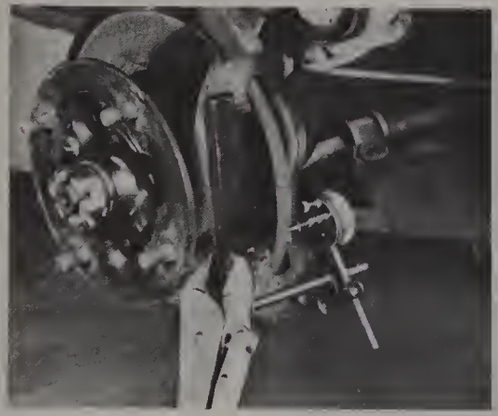
5 Before installing the caliper assembly back onto the caliper support, apply Niglube RX-2 (725191040 or 003606000) to the caliper mounting pivot.
6 Install the caliper assembly onto the vehicle and reconnect the brake line to the caliper. Make sure that the union bolt is tightened to proper Torque specifications.
7 Finish installing the remaining brake parts by referring to the previous Section. The brake system must be bled of all air; see the appropriate Section in this Chapter.

5.11 Use a tool similar to this to turn in the brake cylinder

5.12 Make sure the brake piston head lines up in this manner



5.13 Measure the thickness of the disc rotor and compare it to the Specifications



5.14 Check the disc runout on *both* sides with a dial indicator

5.19 Install the disc caliper lock pin

6.3 Remove the disc caliper assembly by sliding it in, off the pivot

7 Disc calipers (front) – disassembly and reassembly

Refer to Figs. 9.4 through 9.7

Disassembly

1 Before beginning, thoroughly clean the outside of the caliper assembly with brake fluid or brake cleaning solution before you disassemble it. Also, obtain the proper rebuild kit which will contain all the necessary replacement parts.

2 Remove the piston boot retaining ring (photo) with a small screwdriver. Remove the piston boot (photo) and discard it. A new boot will be supplied in the rebuild kit to be used upon reassembly.

3 The piston must now be removed. Sometimes this can be achieved by tapping on the caliper housing with a soft-faced hammer. Usually, compressed air inserted into the brake fluid inlet will be necessary to dislodge the piston. **Note:** *When removing the cylinder with compressed air, the force is powerful enough to damage the face of the cylinder, so place a rag or cloth between the cylinder face and the caliper assembly (photo).*

4 Remove the guide pin boot (photo) from the caliper assembly by evenly tapping both metal tabs that hold the boot in place with a hammer and a chisel. Discard the boot as a new one should be supplied in the rebuild kit.

5 Remove the inner piston rubber seal (photo) with a small screwdriver.

Caution: *Make sure that you do this carefully so that you do not scratch the inner cylinder walls.*

6 Completely remove the upper (rubber) lever cap (photo) from the parking brake lever. Remove the main (rubber) lever cap ring (photo), and then place the main lever cap out of the way by turning it inside out and to the side.

7 Remove the snap ring holding the lever in position.

8 To disassemble the rest of the caliper assembly, you will need a special puller (tool 925471000) or make a tool as shown in the accompanying photo. **Note:** *Dimensions are as follows: outside*

7.2A Remove the cylinder boot retaining ring

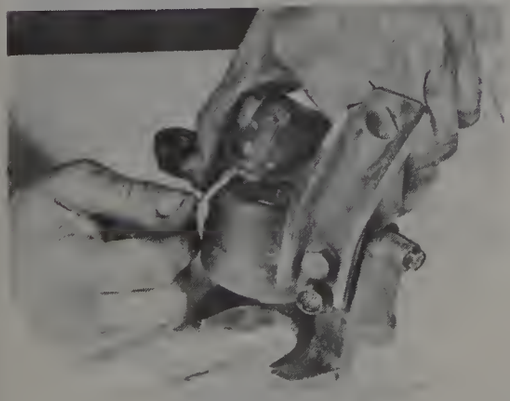
7.2B Remove the cylinder boot

7.3 Removing the piston from the caliper assembly (note the rag, which acts as a cushion)

7.4 Remove the guide pin boot and metal retainer

7.5 Remove the rubber seal from the inner cylinder

7.6A Remove the upper parking brake lever cap



7.6B Remove the main lever cap ring

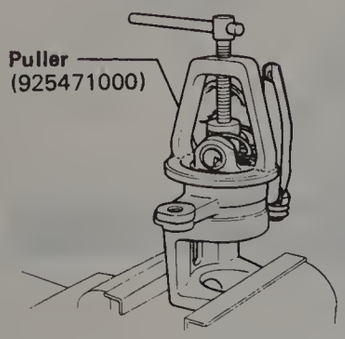


Fig. 9.5 The special tool needed to remove the lever and spindle (Sec 7)

7.8 A special tool is needed to compress the conical spring washers (see text for dimensions)

diameter – 1.06 in (26.9 mm), inside diameter – 0.8125 in (20.6 mm), total height – 1.50 in (38.1 mm), notch depth – 1.25 in (31.7 mm) and notch width – 0.62 in (15.7 mm)

9 Insert the caliper assembly into a vise as shown (photo) and compress the conical springs in order to remove the lever.

10 Carefully and slowly remove the lever (photo) from the assembly. Remove the assembly from the vise.

11 Remove the connecting link (photo) and the return spring (photo) from the caliper assembly.

12 Pull the spindle, with the conical washers, out of the caliper assembly.

13 Remove the springs and the O-ring from the spindle.

14 Inspect all parts for wear, scoring, damage or any deformation and replace any bad parts with new ones.

15 Clean all parts thoroughly with clean brake fluid before reassembly. See the following Section for seal replacements on the pad support which should be done at the same time as caliper overhaul.

Reassembly

16 Apply silicone compound (725191040 or 003606000) to the new rubber O-ring that goes on the spindle. Also apply silicone to the O-ring groove of the spindle and to the area inside the caliper assembly where it comes in contact with the O-ring.

17 Install the new O-ring (photo) to the spindle. Be careful and roll the O-ring onto the spindle slowly so that you do not damage it.

18 Install the conical spring washers as shown in the illustration. Install the springs (one at a time) applying a thick mixture of Niglube RX-2 between each of the springs.

19 Apply a thin coat of clean brake fluid to the interior cylinder walls of the caliper assembly. Then, apply a coat of silicone to the groove inside the cylinder.

20 Apply silicone to the complete exterior of the rubber seal which mounts into the groove of the cylinder wall. Carefully install the rubber seal into this groove.

21 Install the cylinder piston into the caliper assembly. To do this, start the back side of the piston into the caliper assembly and then carefully push (squeeze) the piston into place with your fingers (photo).

22 Install the spindle (with the conical washers attached) into the caliper assembly. **Note:** *Make sure the groove on top of the spindle is in line with the holes that retain the lever shaft.*

23 Apply plenty of Niglube RX-2 to the top of the spindle. This will also help hold the connecting link and spring in place.

24 Install the connecting link as shown (photo), with the large round end facing down. Place the spring in position over the spindle (it only fits one way).

25 Place the caliper assembly in a vise and, using your special tool, compress the conical springs and spindle until you can install the lever handle. **Note:** *Apply a heavy coat of Niglube RX-2 to the lever shaft before you install it.*

26 When you have the lever handle installed correctly, install the retaining snap-ring (photo) on the end of the lever shaft. Fully pack the interior of the main lever handle boot with Niglube RX-2 and then position the boot as you install the cap ring.

27 Install a new guide pin boot by using a socket with the same inside diameter as the outside diameter of the new rubber boot. Place the boot (and its metal retainer) into position.

28 Install the upper lever rubber boot onto the lever handle.

29 Install the caliper assembly onto the vehicle by referring to the previous Section.

8 Pad/caliper support (front) – removal and installation

Refer to Fig. 9.4

Removal

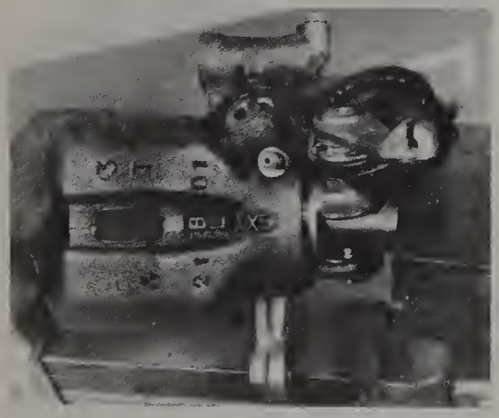
Note: *Make sure you have the right rebuild parts for your vehicle.*

1 In order to remove the caliper support, the pads and the caliper assembly must be removed. To do this, refer to the appropriate Sections in this Chapter.

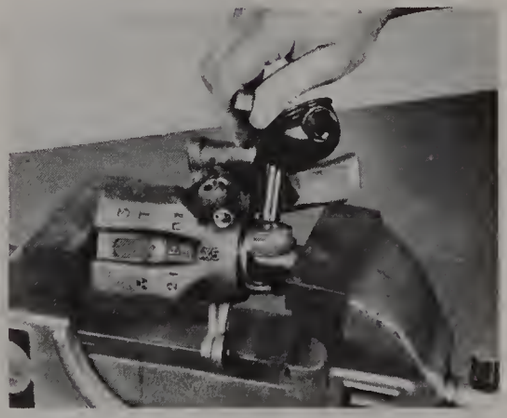
2 Remove the support mounting bolts (photo) and then remove the support from the vehicle.

3 The only repair that can be done to the support is the replacement of its rubber boot and neoprene seal.

4 To do this, remove the boot retaining ring (photo) with a



7.9 Place the caliper assembly in a vise to compress the conical springs and remove the lever



7.10 Remove the parking brake lever

7.11A Remove the connecting link and ...

7.11B ... the return spring from the caliper body

7.17 Install the new O-ring on the spindle

7.21 Install the cylinder piston with your fingers

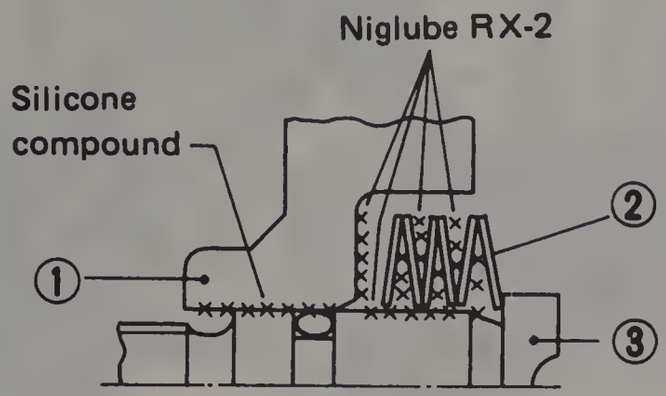


Fig. 9.6 Correct places to apply special lubricants (Sec 7)

1 *Caliper body*
2 *Conical washers*
3 *Spindle*

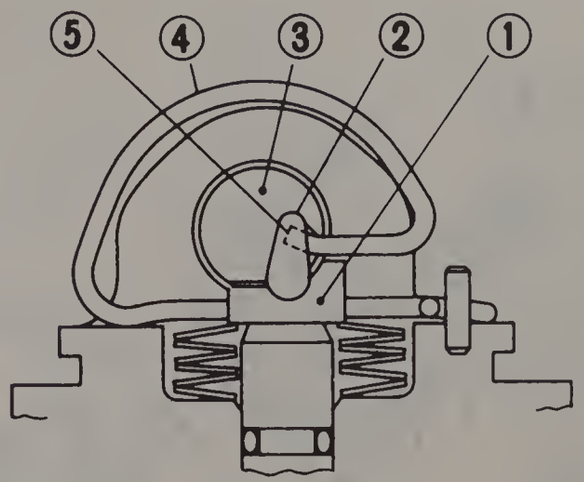
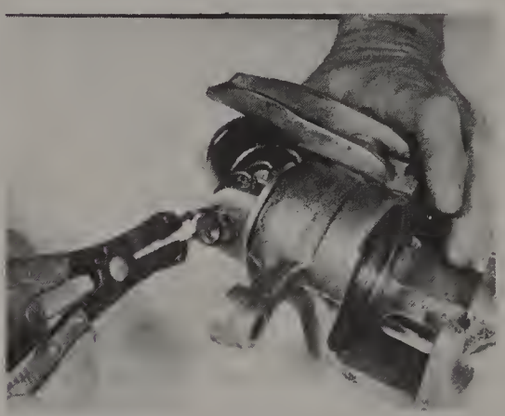


Fig. 9.7 Correct installation of parking brake lever and components (Sec 7)

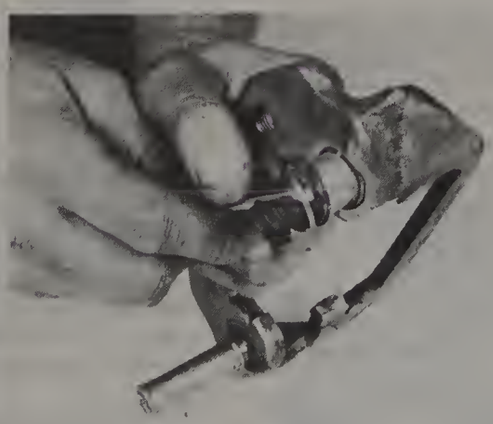
1 *Spindle*
2 *Connecting link*
3 *Lever and shaft*
4 *Return spring*
5 *Hooked portion of return spring*

7.24 Install the connecting link with the large round end down



7.26 Install the retaining ring onto the end of the parking brake lever shaft

8.2 Remove the caliper support mounting bolts



8.4 Remove the boot retaining ring and the rubber boot

8.5 Remove the neoprene seal

screwdriver. Then remove the boot from the sleeve.
5 Inside the sleeve there is a neoprene seal which can be pried out with a small screwdriver (photo).
6 Replace the boot and seal with new ones.

Installation

7 Install the new seal into the sleeve and then the rubber boot onto the outside of the sleeve. Install the boot retaining ring.
8 Install the support to the vehicle with its mounting bolts. Make sure that the bolts are tightened to the Torque specifications.
9 Install the remaining brake parts by referring to the appropriate Sections in this Chapter.

9 Disc rotor (front) – removal and installation

Refer to Fig. 9.8

Removal

1 In order to remove the rotor, the pads, the caliper assembly and the caliper support must be removed. To do this, refer to the previous Sections in this Chapter.
2 With a screwdriver or a pair of pliers, bend the ends of the axle nut cotter pin until they are straight. Remove the cotter pin.
3 Install the wheel back onto the axle with two (diagonally installed)

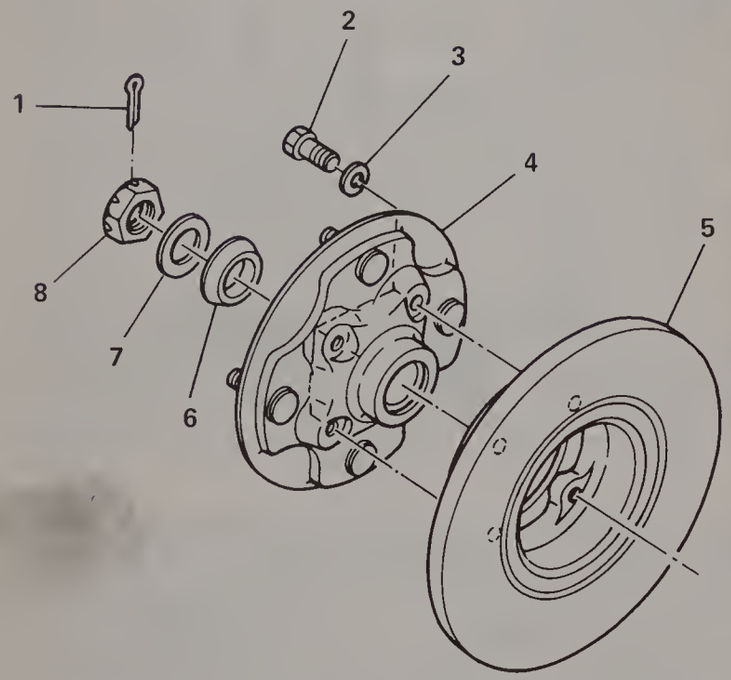


Fig. 9.8 Front disc rotor components – exploded view (Sec 9)

1	*Cotter pin*	5	*Disc rotor*
2	*Bolt*	6	*Conical spacer*
3	*Washer*	7	*Washer*
4	*Hub*	8	*Axle nut*

wheel lug nuts. Tighten the nuts, lower the vehicle to the ground and then loosen (but do not remove) the axle nut.

4 Raise the vehicle, loosen and remove the wheel nuts and then remove the wheel.

5 Install a puller to the back side of the hub as shown (photo). Remove the hub and rotor assembly, along with the washer and conical spacer, from the axle (photo).

6 To separate the rotor from the hub, remove the rotor mounting bolts.

Installation

7 Check the thickness of the rotor at several different locations around its outside diameter and compare with the specifications. If the rotor is not within the specifications given, replace it with a new one. If it is within the specifications, you can have it turned to eliminate any deep scoring or out-of-roundness.

8 Install the rotor to the hub and then install the hub assembly onto the vehicle with the axle nut. Make sure that the mounting hardware is tightened according to the Torque specifications.

9 Install the wheel back onto the vehicle (with the two lug nuts as before). Lower to the ground and then tighten the axle nut to the Torque specifications. **Note**: *Further tighten the axle nut until the next available hole (in the axle shaft) lines up with a slot in the axle nut.*

10 Install a new cotter pin through the axle nut and bend its ends around the nut.

11 Remove the wheel and finish installing the rest of the brake parts by referring to the appropriate Sections in this Chapter.

10 Brake drum (rear) – removal and installation

Refer to Fig. 9.9

2WD vehicles

Removal

Note: *Before beginning, obtain the new oil seals and O-rings which will be required upon reassembly.*

1 Use a thin screwdriver and pry off the axle grease cap.

2 Pry open the locking tang of the axle lock washer until the washer is flat. Remove the axle nut, the locking washer and the lock plate from the axle. To ease the loosening of the axle nut, install the wheel and two (diagonally installed) lug nuts. Lower the vehicle to the ground and loosen the axle nut.

3 Raise the vehicle and remove the lug nuts and the wheel. Carefully remove the brake drum together with the outer bearing. **Caution**: *As you remove the drum, the outer and inner bearing races may come off. Try not to drop them.*

4 Remove the oil seal and replace it with a new one upon installation.

5 Remove the inner bearing and the spacer with a puller.

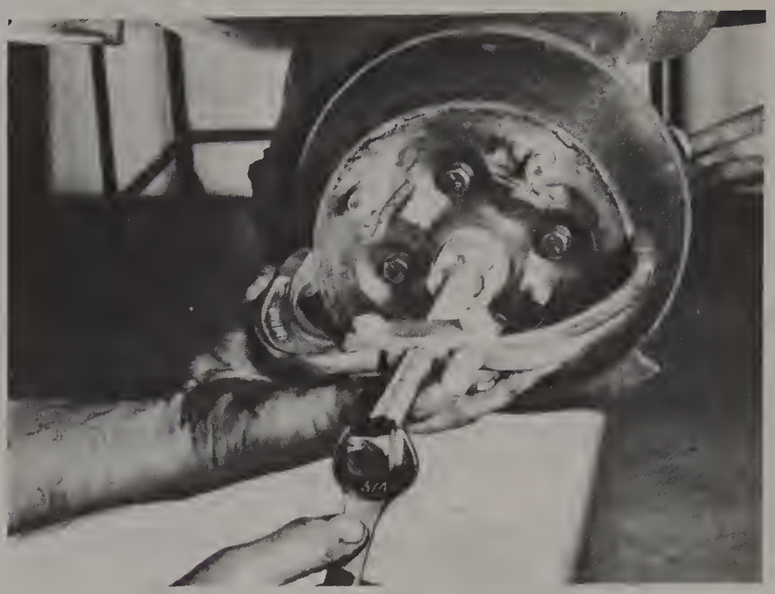
Installation

6 Upon installation, begin by thoroughly cleaning the bearings in a suitable solvent. Carefully inspect each for broken or damaged rollers, scoring of the races or any other visible damage. They should spin freely in your hand.

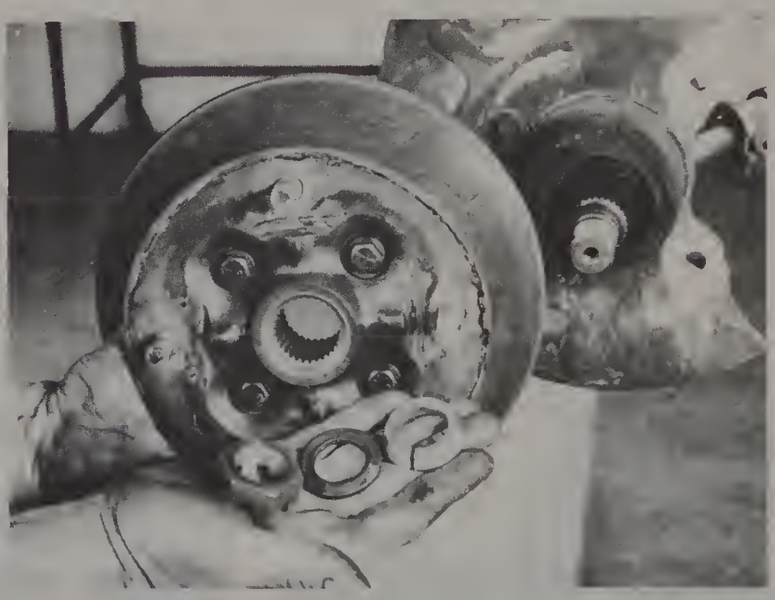
7 Completely pack the bearings with a high-quality wheel-bearing grease, working the grease fully into the bearing roller surfaces.

8 Install the inner bearing and spacer (with a new O-ring), followed by a new oil seal.

9 If one or both of the bearing races came out of the brake drum, apply a locking compound (available at auto parts stores) to the outside of the races and also to the area in the drum where the races will be mounted.



9.5A Attach a puller to the hub to remove the hub and rotor assembly



9.5B Remove the hub and rotor along with the related parts

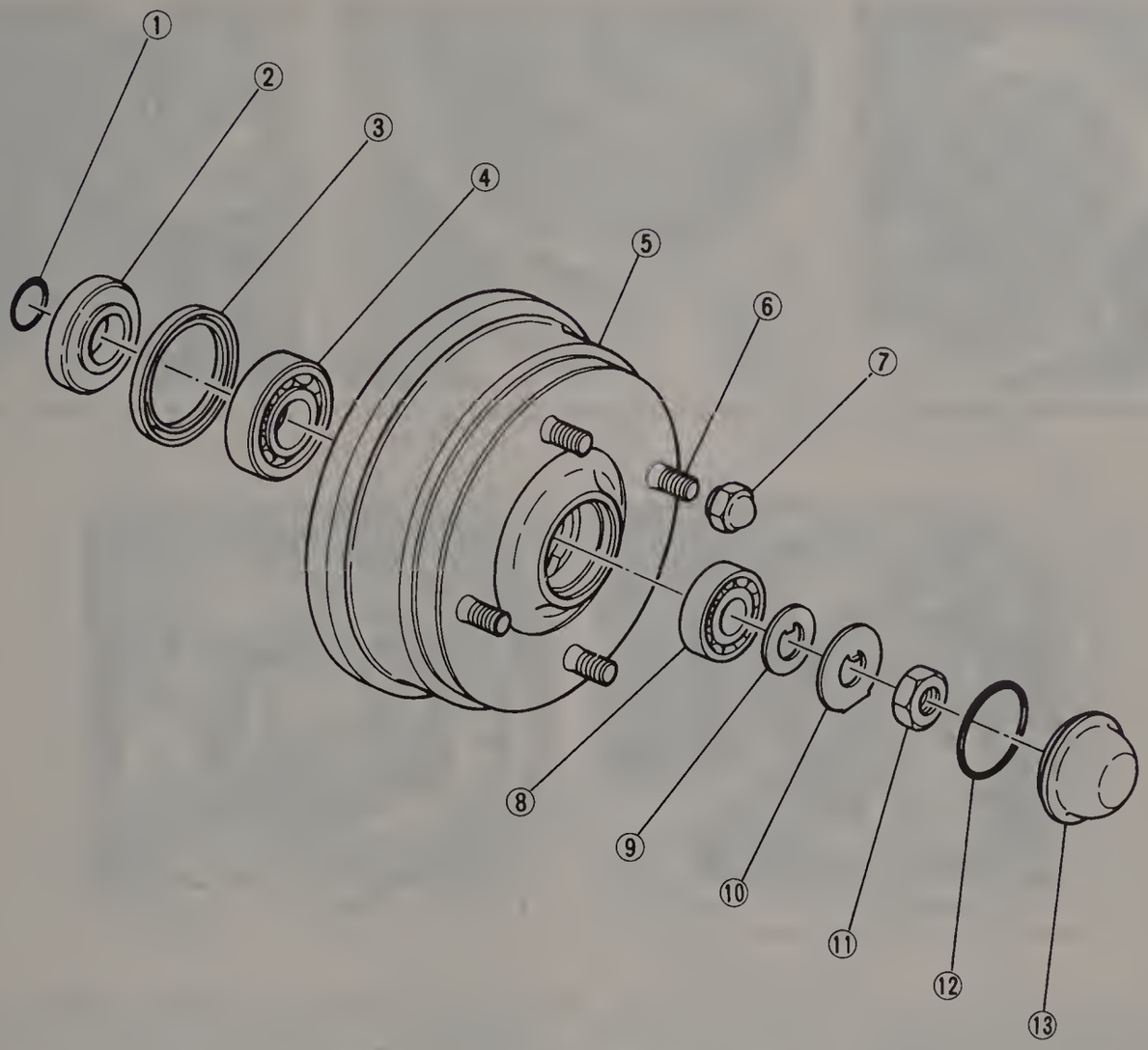


Fig. 9.9 2WD brake drum components – exploded view (Sec 10)

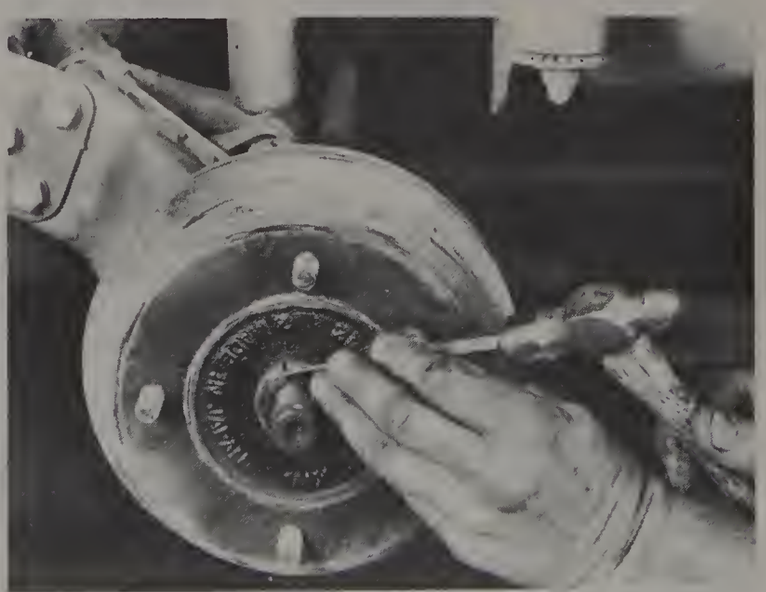
1 O-ring	*5 Drum*	*8 Outer bearing*	*11 Axle nut*
2 Seal spacer	*6 Wheel stud*	*9 Lock plate*	*12 O-ring*
3 Oil seal	*7 Lug nut*	*10 Lock washer*	*13 Grease cap*
4 Inner bearing			

10 Completely pack the interior (between both bearing races) of the brake drum with wheel bearing grease. Install the drum onto the axle.
11 Install the outer bearing, the lock plate, the locking washer and then the axle nut (in that order) onto the axle. A new lock plate and locking washer should be used upon installation.
12 The rear wheel bearing pre-load must be set using a specific procedure. To do this, refer to the appropriate Section in Chapter 11.
13 After the pre-load has been established, install a new cotter pin and bend the ends around the axle nut.
14 Install a new O-ring, followed by the grease cap, onto the axle.

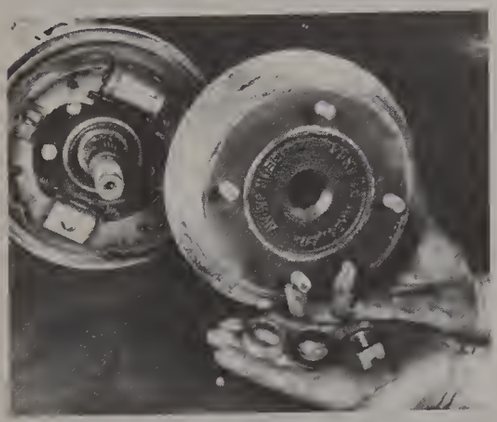
4WD vehicles

Removal

15 Straighten the ends of the axle cotter pin with a screwdriver or a pair of pliers. Remove the cotter pin.
16 Install the wheel back onto the vehicle with two (diagonally installed) lug nuts. Tighten the nuts, lower the vehicle to the ground and loosen the axle nut.
17 Raise the vehicle and remove the nuts and the wheel. Back-off the axle nut about half-way but, do not remove it. Use a cold chisel or punch and loosen the conical spacer as shown (photo). The drum can now be pulled loose.
18 Remove the axle nut, the washer, the conical spacer and then the brake drum (photo).



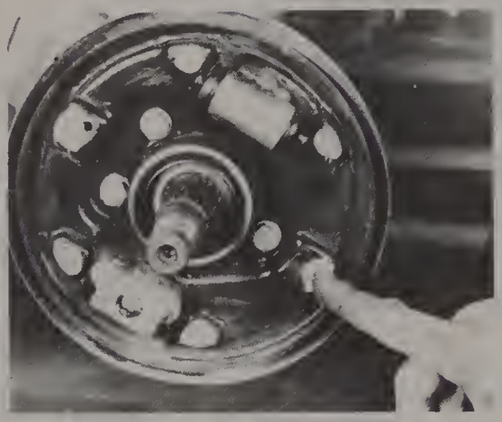
10.17 Loosen the conical spacer



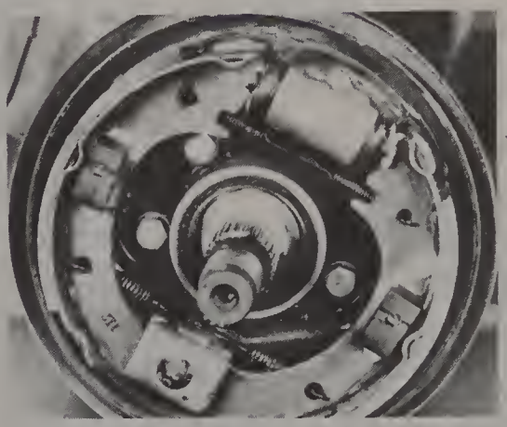
10.18 Remove the brake drum and related parts

11.4 Back-off the adjuster screw completely

11.6 Remove the shoes with the springs



11.11 Apply high-temperature grease to the raised areas of the backing plate



11.13 Correctly assembled rear brake

Installation

19 Install the brake drum, the conical spacer, the washer and then the axle nut by referring to the illustration.

20 Tighten the axle nut to the specified torque and then a little more in order to line up the hole (in the axle shaft) with a slot in the axle nut.

21 Install a new cotter pin and bend its ends around the axle nut.

11 Drum shoe replacement – all models except UK MV (pick-up)

Refer to Fig. 9.10

Removal

Note: *Make sure you have the correct shoe replacements for your vehicle.*

1 Block the front wheels and then raise the rear of the vehicle according to the *Jacking and Towing* procedures near the front of this book.

2 Completely release the parking brake lever and then remove the rear wheel.

Note: *It is advisable to complete the entire replacement procedure on one side of the vehicle at a time, leaving the other side intact to look at if trouble is encountered.*

3 Refer to the appropriate Section in this Chapter to remove the rear brake drum.

4 Go to the back side of the brake backing plate and completely back off the adjuster screw (photo) by turning it in a counterclockwise direction.

5 Remove the shoe hold-down springs by using a pair of pliers to compress them until you can turn the hold-down pin (at the center of the spring) and disengage it from the spring.

6 Grab both brake shoes with your hands (photo), pull them apart and remove them (together with the return springs) from the brake backing plate.

7 Place the brake shoe assembly on a bench. Remove the return springs from the shoes and clean them in clean brake fluid and wipe them dry.

8 Before reassembly, carefully inspect the wheel cylinder components for signs of leakage. Any fluid on the brake components or around the wheel cylinder piston boots indicates that the wheel cylinder should be removed and overhauled; otherwise the replacement brake shoes will be ruined.

9 Inspect the brake drum for abnormal scoring and measure the drum inside diameter at three or four different points. Imperfections in the drum surface can, and should, be removed by machining at a competent automotive machine shop. If, by machining and/or wear, the drum inside diameter becomes excessive, the drum will have to be replaced with a new one.

10 Reassemble the springs onto the new brake shoes. Remember that the heavier spring connects the bottom of the shoes.

Installation

11 Apply a good-quality, high-temperature grease to the raised areas of the backing plate that the shoes ride on (photo).

12 Install the shoe and spring assembly to the backing plate by slightly pulling the shoes apart and inserting the tops and bottoms of the shoes into their appropriate slots of the wheel cylinder and the adjuster mechanism.

13 Install the shoe hold-down springs by compressing them and turning the hold-down pins until they engage the springs. Refer to the photo for the correct brake component reassembly.

14 Install the brake drum by referring to the appropriate Section in this Chapter.

12 Drum shoe adjuster (all models except UK MV pick-up) – removal and installation

Refer to Fig. 9.10

Removal

1 In order to remove the adjuster, you first have to remove the brake drum and the brake shoes. To do this, refer to the appropriate Sections in this Chapter.

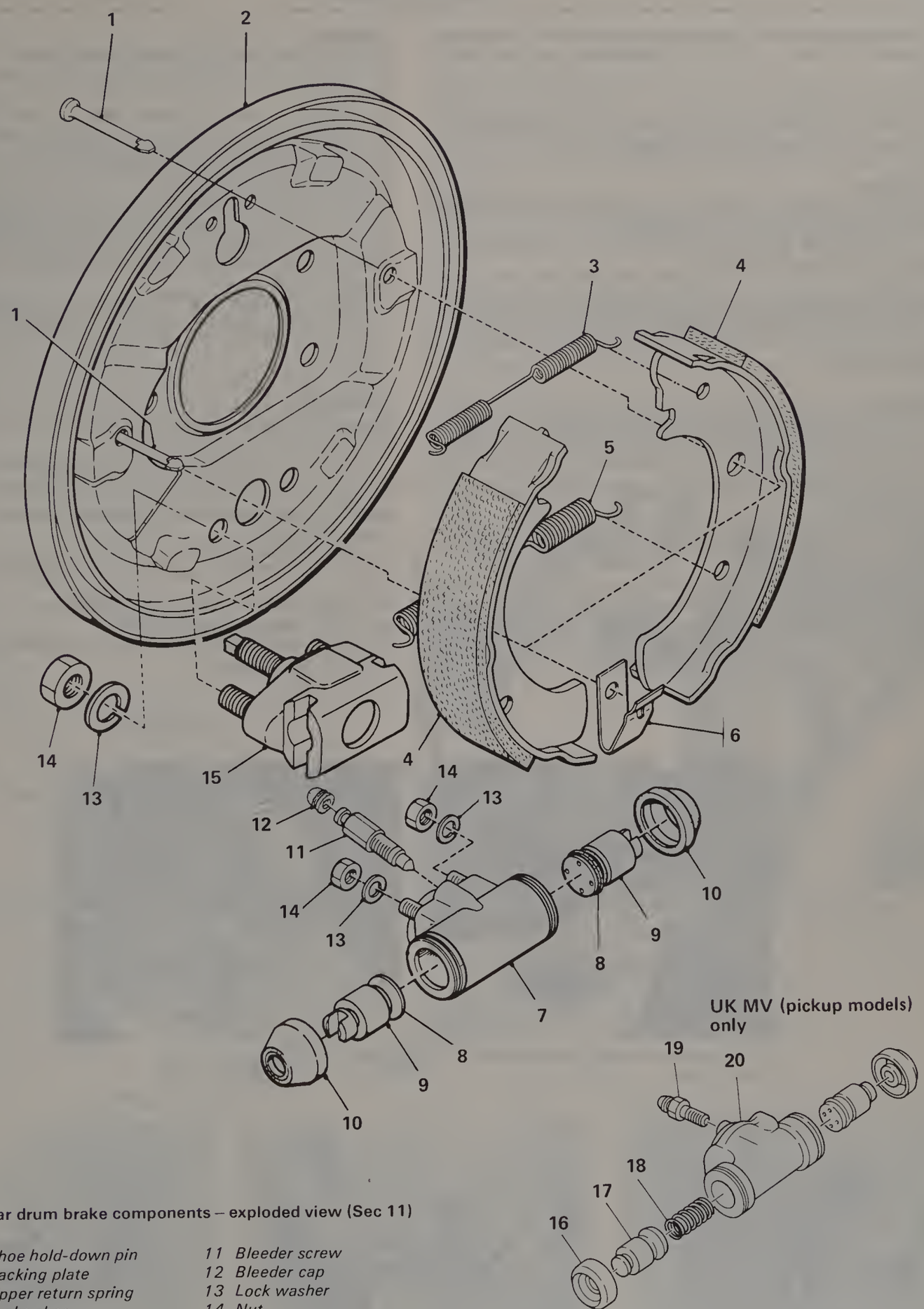


Fig. 9.10 Rear drum brake components – exploded view (Sec 11)

1 *Shoe hold-down pin*
2 *Backing plate*
3 *Upper return spring*
4 *Brake shoe*
5 *Lower return spring*
6 *Shoe hold-down spring*
7 *Wheel cylinder*
8 *Piston cup*
9 *Piston*
10 *Piston boot*
11 *Bleeder screw*
12 *Bleeder cap*
13 *Lock washer*
14 *Nut*
15 *Adjuster*
16 *Piston boot*
17 *Piston*
18 *Piston spring*
19 *Bleeder valve*
20 *Wheel cylinder*

2 Remove the mounting nuts and lock washers from the adjuster mechanism. Remove the adjuster (photo) from the brake backing plate.
3 The adjuster mechanism cannot be disassembled. The best thing you can do is to clean it thoroughly in a good cleaning solvent using a long bristle brush and then pack it with grease. Work the adjuster a few times to make sure it operates correctly.

Installation

4 Install the adjuster onto the backing plate with the lock washers and nuts. Tighten the mounting nuts securely.
5 Install the rest of the brake components by referring to the appropriate Sections in this Chapter.

13 Wheel cylinder (rear) – removal, overhaul and installation

Refer to Fig. 9.10

Removal

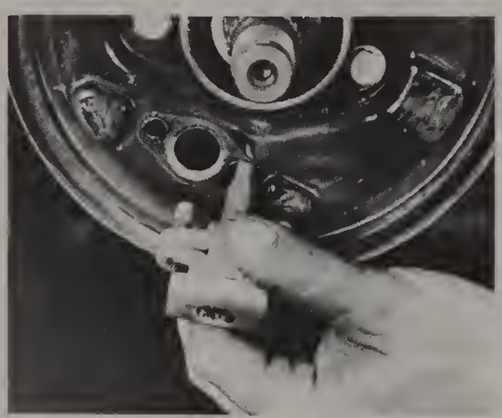
Note: *Make sure you have the correct rebuild parts for your vehicle.*
1 In order to remove and overhaul the wheel cylinder, the drum and the shoes must be removed. To do this, refer to the appropriate Sections in this Chapter.
2 Loosen (but do not remove) the brake line (photo) going to the wheel cylinder.
3 Loosen (but do not remove) the mounting nuts holding the wheel cylinder to the brake backing plate. UK MV (pick-up) models have bolts.
4 With a rag handy to catch any spilled fluid, disconnect the brake line and plug it with the rubber (air bleeder) cap or a clean object.
5 Remove the cylinder mounting nuts and then remove the cylinder from the vehicle.
6 Place the cylinder on a workbench and prepare to disassemble it.

Overhaul

7 Remove the brake line bleeder valve (photo).
8 Remove both rubber boots (photo) and replace them with new ones.
9 Carefully remove both pistons (together with rubber cups) from the wheel cylinder. MV (pick-up) models produced for the UK and Europe feature a spring between the pistons.
10 Clean all of the cylinder parts with clean brake fluid. Do not use petroleum-based solvents.
11 Check the wheel cylinder bore for wear, scoring, pitting and rust. If the bore is worn, pitted, scored or rusted, it can be honed slightly to restore it to reusable condition. Be sure to use the appropriate size hone. If a hone is not available, or if the damage is slight, polish the bore with crocus cloth.
12 Upon reassembly coat all parts with clean brake fluid.
13 Refer to the photo for the correct installation of the new rubber cups onto the pistons. Replace the cups with new ones.

Installation

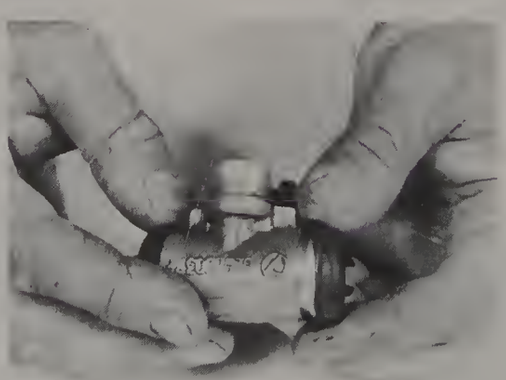
14 Install the pistons correctly and then the new rubber boots onto the cylinder. Refer to the illustration.
15 After making sure there are no obstructions in the passage, install the bleeder valve. Make sure the valve is tight.
16 Install the wheel cylinder to the backing plate with its mounting hardware. Make sure the nuts (or bolts) are tightened according to the Torque Specifications.
17 Unplug the brake line and reconnect it to the back of the cylinder. Make sure the fitting is tight. Return the rubber cap to the bleeder valve.
18 Install the rest of the brake components by referring to the appropriate Sections in this Chapter.
19 Bleed the air from the brake system by referring to the appropriate Section in this Chapter.



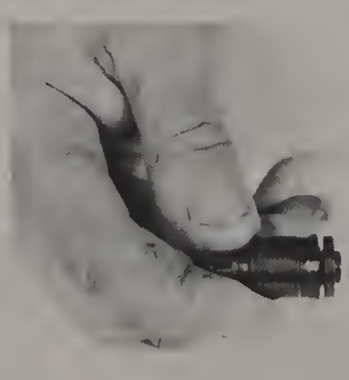
12.2 Remove the adjuster from the brake backing plate

13.2 Loosen the brake line fitting

13.7 Remove the bleeder valve and clean it with new brake fluid



13.8 Remove both rubber boots



13.13 Install new rubber caps on the pistons

14 Drum shoe clearance adjustment – all models except UK MV (pick-up)

Refer to Fig. 9.11

1 Whenever your rear brakes need to be adjusted, this is the only means to do the adjustment, because the adjuster mechanism is manual. Make sure you check the front disc pad and the rear drum shoe thicknesses, as well as to bleed all the air from the system, before assuming that the brakes need adjusting.
2 The front wheels must be blocked and the rear of your vehicle raised according to the *Jacking and towing* procedures near the front of this manual.
3 Tighten the adjuster screw in a clockwise direction until the brake drum refuses to rotate.
4 Now, back off the adjuster screw (counterclockwise direction) 180 degrees.
Note: *As you turned in the adjuster screw, you may have noticed that the screw clicks. Two of these clicks are approximately 180 degrees.*
5 Now, check to see if the brake drum rotates freely. If not, back off a click at a time (no more than an additional two) until the drum rotates freely.
6 Make sure that you do this to both rear wheels.
7 Lower the vehicle and remove the front wheel blocks. Road test the vehicle for proper operation.

15 Master cylinder – removal and installation

Removal

Note: *Make sure you have the correct rebuild parts for your vehicle before beginning. Place old rags underneath the master cylinder prior to removal for catching fluid which may damage painted surfaces if spilled.*
1 Drain the brake system by placing nylon tubes on all of the bleeder valves to drain into individual containers. Open all of the valves and let them gravity-drain into the containers (do not reuse this brake fluid).
2 Disconnect the electrical connector (photo) for the brake fluid level indicator.
3 Disconnect the nuts holding the brake tubes to the bottom of the master cylinder.
4 Remove the nuts connecting the cylinder to the brake vacuum booster. Place the hose clamp up and out of your way.
5 Wrap the master cylinder in rags. Now, carefully remove the cylinder by pulling it up and out of the vehicle.

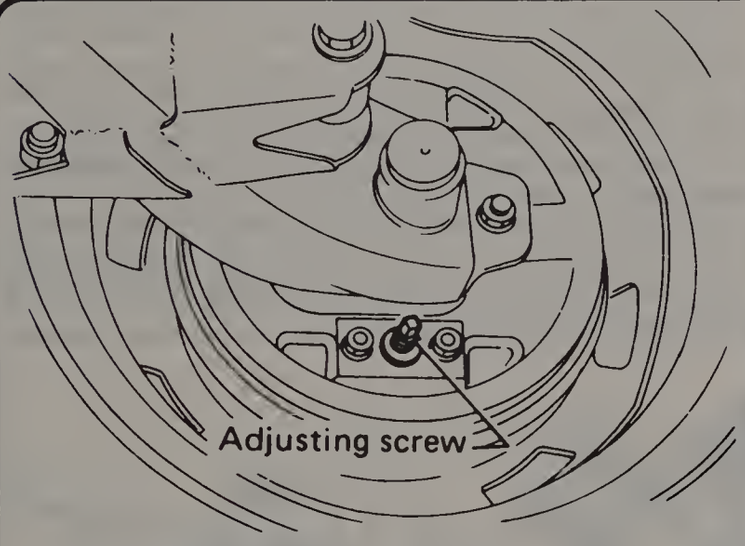
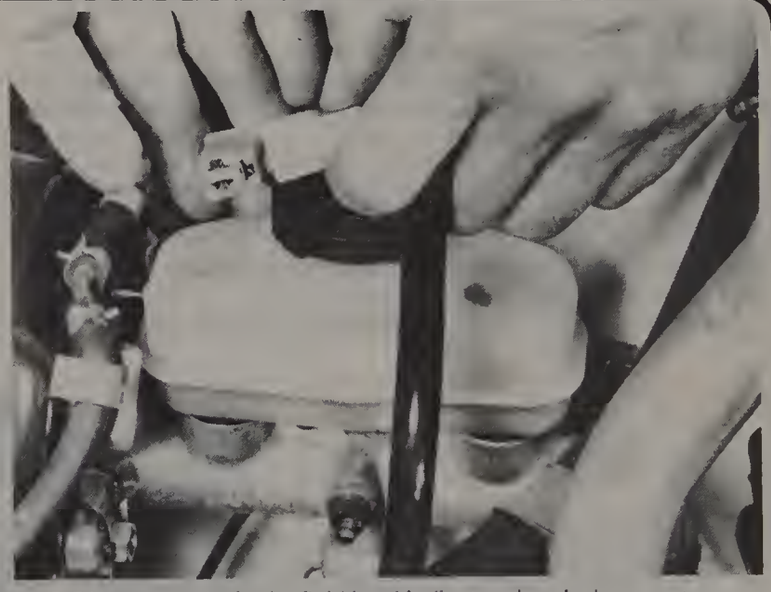


Fig. 9.11 Shoe clearance adjusting screw (Sec 14)



15.2 Disconnect the brake fluid level indicator electrical connector

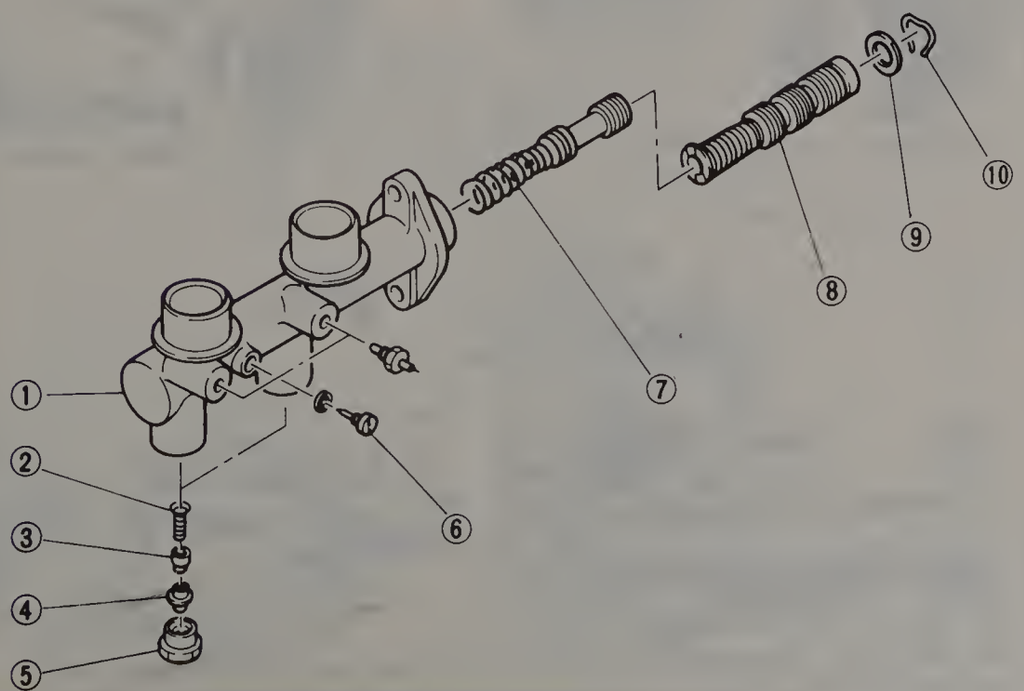


Fig. 9.12 Master cylinder components – exploded view (Sec 15)

1 *Master cylinder*
2 *Check valve spring (all except UK MV models)*
3 *Check valve (all except UK MV models)*
4 *Tube seat*
5 *Check valve cap*
6 *Stopper screw*
7 *Secondary piston assembly*
8 *Primary piston assembly*
9 *Stopper washer (all except UK MV models)*
10 *Stopper ring (all except UK MV models)*

Installation

6 Install the cylinder onto the brake vacuum booster. Make sure to torque-tighten the mounting nuts according to the Torque specifications.
7 Install the hose clamp to the brake booster.
8 Connect the brake tubes with the nuts to the bottom of the cylinder. Make sure they are connected correctly.
9 Connect the electrical connector for the fluid level indicator. Make sure all of the connections are tight.
10 Bleed the brake system according to the procedure given in this Chapter.

16 Master cylinder – disassembly and reassembly

Refer to Figs. 9.12 and 9.13

Disassembly

Note: *Make sure that you have the correct rebuild parts for your vehicle.*
1 Remove the stopper screw while pushing in on the primary piston with a screwdriver (photo).
2 Using the same screwdriver, push the primary piston into the cylinder and remove the stopper ring and washer or snap-ring (UK MV pick-up models) (photo).
3 Remove the primary piston assembly (photo) and the secondary piston assembly (photo). **Note:** *Do not disassemble either piston assembly. When replacing the rubber cups, they have to be replaced with the pistons as a complete assembly.*
4 The check valve assemblies (if equipped) can be removed and disassembled after removing the valve caps (photo). Check the valve for any foreign objects that may clog it and then clean it out.
5 Remove the bleed valves (photo) so that the cylinder can be thoroughly cleaned with alcohol or brake fluid. Do not use petroleum-based solvents.
6 Inspect the inside walls of the cylinder for any abnormal scoring or other damage. Replace the cylinder with a new one if these conditions are found.

Reassembly

7 After coating with clean brake fluid, install the piston assemblies (secondary first) into the cylinder body. Refer to the cross-section illustration in order to assemble the cylinder correctly. **Note:** *Be careful not to damage the cylinder walls when you install the piston assemblies.*
8 Install the check valve and related components (photo) into the bottom of the cylinder.
9 Install the stopper ring and components (or snap-ring) while pushing it on the primary piston with a screwdriver.
10 Install the stopper screw while pushing the primary piston in with a screwdriver.
11 Make sure all items are tightened according to the Torque specifications.

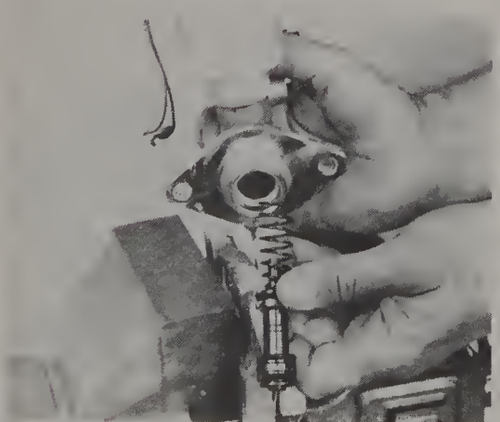
17 Brake booster – on-vehicle check

1 The following procedure is a manual check to find out if your booster unit is functioning properly. **Note:** *It is not designed to pinpoint the exact location of a problem, but is sufficient to attain a general knowledge of its condition. You can also remove the unit and have it checked on a brake booster tester at your dealer service department.*
2 To check the air tightness, start the engine and let it run for one to two minutes (no more), then shut it off.
3 Pump the brake pedal several times. If the pedal depresses farther than normal the first time but gradually rises to a normal position the second and third time, it is in good condition.
4 If there is no change in the pedal height when it is depressed the second and third time, it is defective. **Note:** *If you suspect that your booster is defective because of its performance, first inspect the vacuum lines and the sealing parts and replace them if they are bad, then repeat the procedure.*

16.1 Remove the piston stopper screw

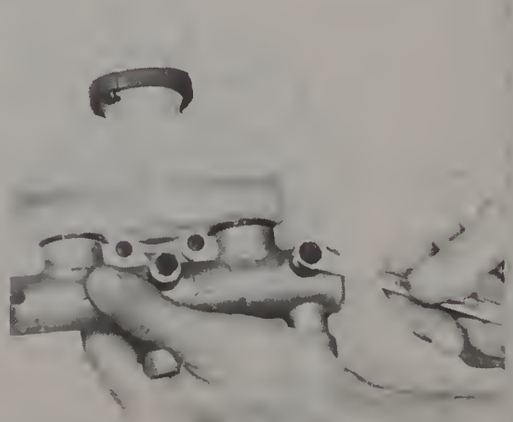
16.2 Remove the piston stopper ring

16.3A Remove the primary piston assembly



16.3B Remove the secondary piston assembly

16.4 Remove the check valve caps and then the check valve assemblies



16.5 Remove both of the bleeder valves

16.8 Install the check valve and spring

5 With the engine stopped, pump the brake pedal several times (with even pressure) and then keep it depressed.
6 With the pedal still depressed, start the engine. If the pedal goes down slightly, the booster is in good condition.
7 If there is no change in pedal height, it is defective.
8 With the engine running, check the air tightness under a load by depressing the brake pedal. Now, while keeping the pedal depressed, stop the engine.
9 Hold the pedal depressed for 30 seconds. If the pedal height does not change, it is in good condition. If it rises, the booster is defective.

18 Brake booster – removal and installation

Refer to Fig. 9.13

Removal

1 If you find that the booster is defective, it is not recommended that you overhaul it. Because of its complexity and the special tools needed to do the job, it is best to let your dealer service department overhaul it for you, or obtain a factory-rebuilt/new replacement unit.
2 However, you can remove it yourself by following the procedure outlined here:
3 Remove the brake master cylinder by referring to the appropriate Section in this Chapter. Disconnect the vacuum hose from the booster unit.
4 Working on the inside of your vehicle, remove the pedal return spring, the cotter pin, the push rod clevis pin and the four booster nuts, then remove the booster from the vehicle.

Installation

5 To install the booster, reverse the removal procedure.
6 Install new seals to both sides of the engine firewall before installing the booster unit onto your vehicle.
7 Bleed the brake system according to the bleeding procedure found in this Chapter.

19 Hill-holder cable – replacement

Refer to Fig. 9.14

Removal

1 Loosen and remove the jam nut from the end of the Hill-holder cable.
2 Then loosen the adjuster nut (photo) for the Hill-holder cable enough to release it from the clutch release fork.

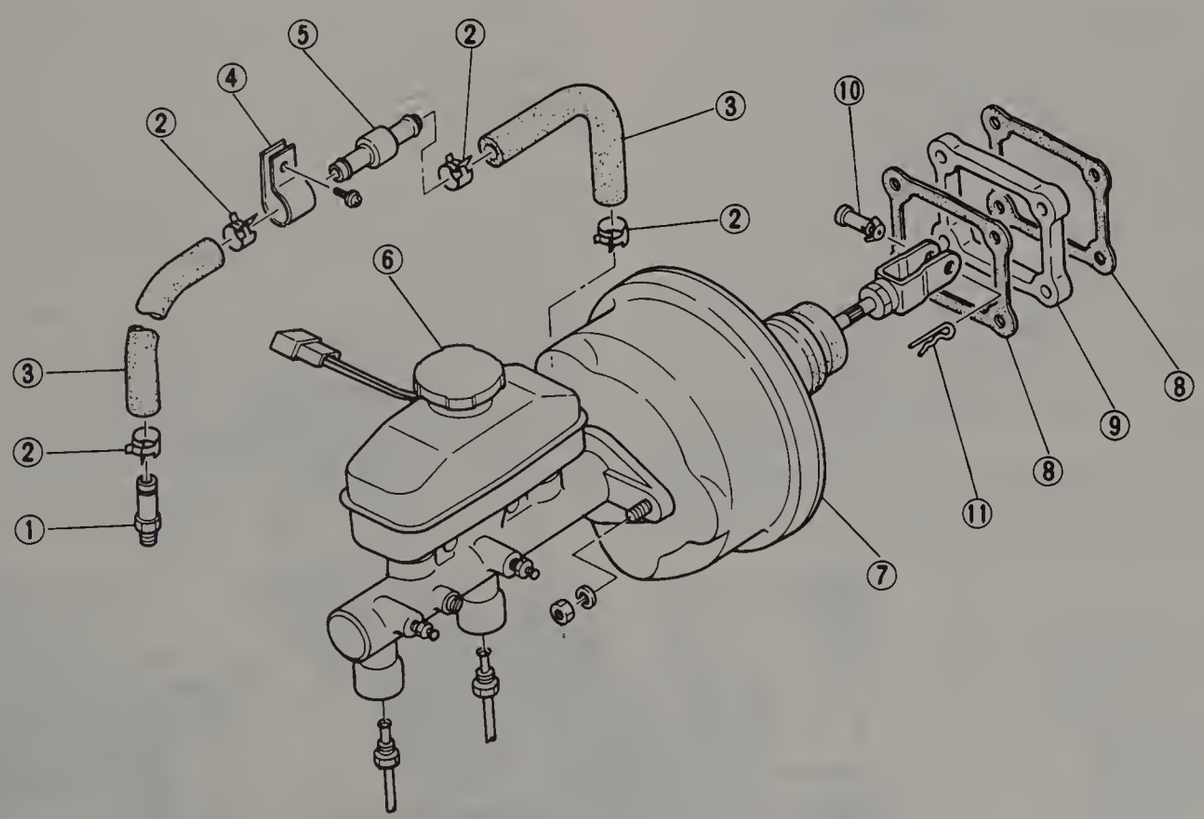


Fig. 9.13 Brake booster components – exploded view (Sec 18)

1 Vacuum hose joint bolt
2 Clip
3 Vacuum hose
4 Clamp
5 Check valve
6 Master cylinder assembly
7 Brake booster
8 Seal
9 Spacer
10 Clevis pin
11 Snap-ring

19.2 Loosen the adjuster nut

3 Pull the end of the cable out of the clutch release fork and then remove the clip which secures the cable in place on the engine bracket.
4 Remove the clip holding the cable to the lever assembly on the Hill-holder valve.
5 Remove the cable end from the Hill-holder valve.
6 Remove any clamps holding the cable in place along its length and then remove and replace the cable with a new one.

Installation

7 Make sure that the cable is installed correctly at both ends. Do not tighten the adjusting nut at the clutch fork until the adjustment has been made.
8 Adjust the Hill-holder cable by referring to the appropriate Section in this Chapter.

20 Hill-holder valve – removal and installation

Refer to Fig. 9.14

Removal

1 Place old rags underneath the master cylinder and the Hill-holder valve prior to removal for catching fluid which may damage painted surfaces. Drain the brake fluid from the reservoir on the primary side of the master cylinder (front section). Open the valve, with a nylon tube attached to it, and let it drain into a container by gravity.
2 When the fluid is drained, disconnect the Hill-holder cable at both the clutch fork end and the Hill-holder valve end. Do this by referring to the cable replacement Section in this Chapter.
3 Disconnect the brake tube fittings (top, bottom and rear) from the valve.
4 Remove the mounting bolts holding the Hill-holder valve in place and also remove the 3-way connector from the valve bracket.

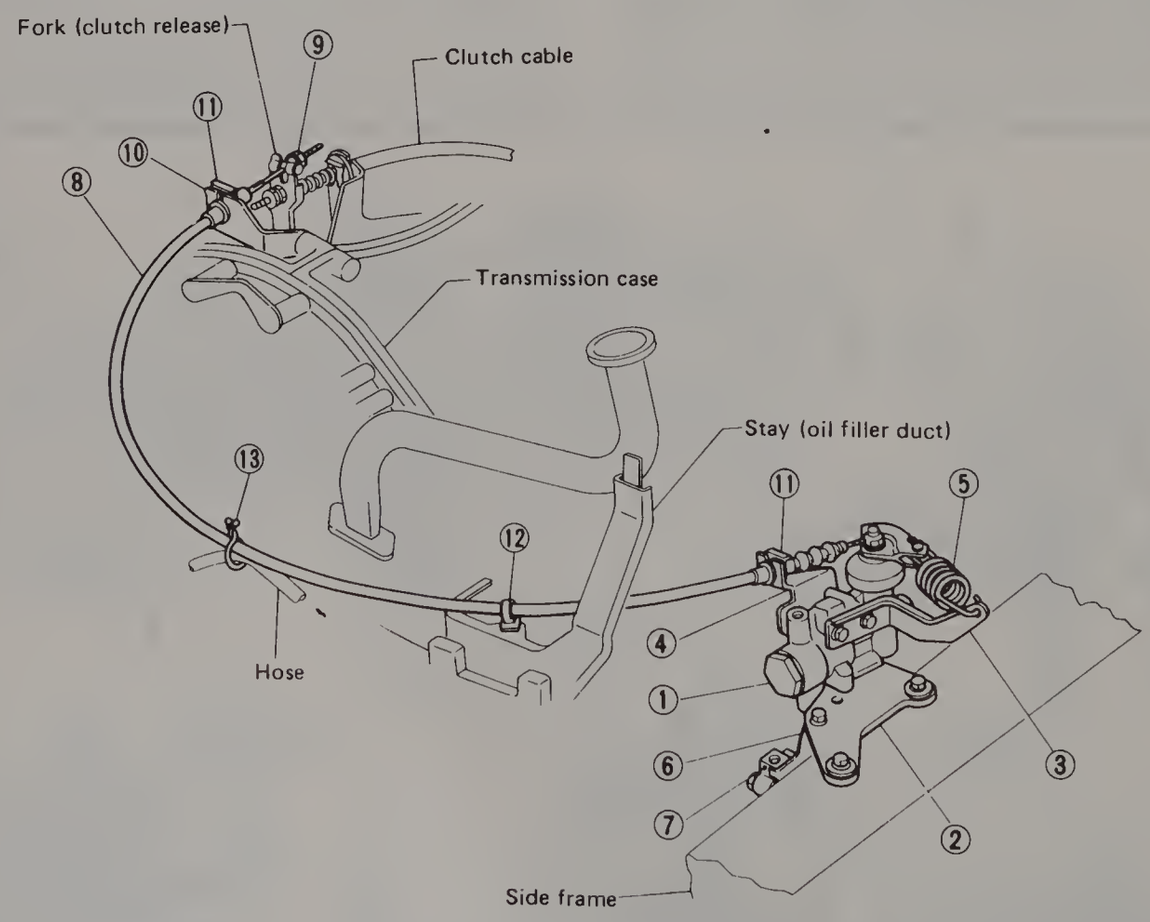


Fig. 9.14 Hill-holder components – installed view (Sec 19)

1 *Hill-holder valve*
2 *Bracket*
3 *Spring hook*
4 *Cable stay*
5 *Return spring*
6 *Bracket*
7 *3-way connector*
8 *Hill-holder cable*
9 *Adjuster nut*
10 *Cable bracket*
11 *Clamp*
12 *Clip*
13 *Clip*

Installation

5 The Hill-holder valve cannot be disassembled; a new one will have to replace it.
6 Check the return spring to see if it is worn out or damaged. Replace it with a new one if necessary.
7 One way of inspecting the valve is to rotate it back and forth in your hands. If the sound of a rolling ball is heard, then the valve itself is probably good.
8 Apply a good-quality, lithium-based grease to all of the moving parts of the valve mechanism. Work the lever a few times to make sure it is working correctly and to loosen it up.
9 When replacing the valve with a new one, refer to the accompanying photo and illustration to install the parts from the old valve correctly.
10 Install the valve to the frame of your vehicle (photo) and then the 3-way connector to the valve bracket. Tighten all of the mounting hardware securely.
11 Install all of the brake tubes to their correct positions and make sure they are tight.
12 Now, install both cable ends but do not tighten the jam nut on the clutch fork. Refer to the Hill-holder adjustment Section in this Chapter.
13 Bleed all of the air from the system by referring to the appropriate Section in this Chapter.

21 Hill-holder – adjustment

Refer to Figs. 9.14 and 9.15.

1 The first thing you have to do before adjusting the Hill-holder device is to check the clutch adjustment. If the clutch is out of adjustment, refer to the appropriate Section in Chapter 1. The clutch and Hill-holder valve work hand in hand – when one is engaged, the other one is not engaged.
2 In order to adjust the Hill-holder, you need a hill of 3 degrees or steeper. From the factory, the valve does not engage on a hill that is less than 3 degrees.
3 Refer to the illustration given to see where the adjustment nuts are located. **Note**: *Whenever turning the Hill-holder adjusting nut, hold the cable with a pair of pliers to keep it from turning.*
4 When you find a suitable hill to test the Hill-holder valve, start the vehicle up the hill, stop, and then push on the clutch. If the vehicle starts to move backward, the cable should be adjusted tighter. Tighten the adjusting nut on the cable.
5 Follow this procedure until the desired affect is achieved, but do not over-tighten the cable.
6 Since the valve is connected directly to the master cylinder, your brakes are what actually hold your vehicle in place when the valve is actuated.
7 If you find that your brakes will not allow your vehicle to move very easily, it may be because the Hill-holder cable is adjusted too tightly. Take your vehicle to a 3-degree or steeper hill and loosen the cable adjuster nut until the desired effect is achieved.
8 If you ever find that the brakes will not release your vehicle at all, check to see if the Hill-holder return spring is broken. If this is true, remove the Hill-holder cable adjusting nuts, disconnect the cable from the clutch fork and manually move the Hill-holder valve lever back until the brake releases on your vehicle.
9 Replace the Hill-holder mechanism immediately by referring to the appropriate Section in this Chapter.
10 If you want to change the angle that the Hill-holder is activated, you can insert thin shims between its mounting bracket and the side frame of the vehicle.

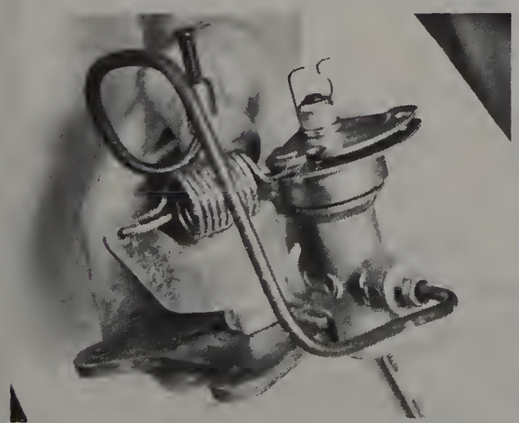
a) Insert shim under rear of valve – takes a steeper hill to activate the valve.
b) Insert shim under front of valve – activates the valve on a hill of less than 3 degrees.

Note: *Use only Subaru-approved shims and never add more than two shims to the valve.*

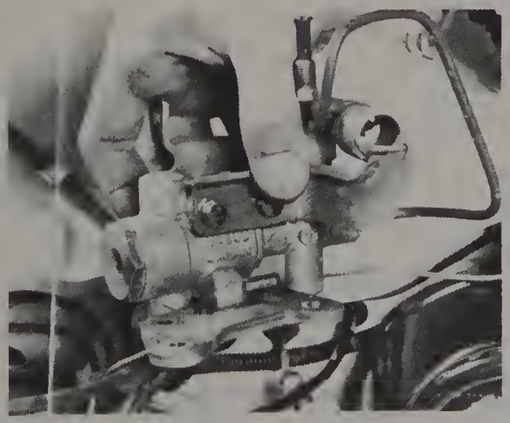
22 Brake system air bleeding procedure

See Chapter 1 for additional instructions and illustrations

1 If the brake system has air in it, operation of the brake pedal will be spongy and imprecise. Air can enter the brake system whenever any part of the system is dismantled or if the fluid level in the master cylinder reservoir runs low. Air can also leak into the system through a fault too slight to allow fluid to leak out. In this case, it indicates that a general overhaul of the brake system is required.
2 To bleed the brakes, you will need an assistant to pump the brake pedal, a supply of new brake fluid, an empty glass jar, a plastic or vinyl tube which will fit over the bleed nipple, and a wrench for the bleeder screw.
3 There are five or six locations at which the brake system is bled: the master cylinder; the front caliper assemblies; and the rear brake wheel cylinders. MV pick-up models purchased in the UK or Europe have a bleeder valve at the GLSV (see Section 24).
4 Check the fluid level at the master cylinder reservoir. Add fluid, if necessary, to bring the level up to the Full mark. Use only the recommended brake fluid, and do not mix different types. Never use fluid from a container that has been standing uncapped. You will have to check the fluid level in the master reservoir often during the bleeding procedure. If the level drops too far, air will enter the system through the master cylinder.
5 Raise the vehicle and set it securely on jackstands.
6 Remove the bleeder screw cap from the wheel cylinder or caliper assembly that is being bled. If more than one wheel must be bled, start with the primary circuit first and then the secondary circuit. **Note:** *Only if you disassembled the master cylinder will the master cylinder have to also be bled. In this case, bleed the primary circuit (rear bleed screw) first, and then the secondary circuit (front bleed screw) of the master cylinder* **before** *the individual wheels are bled. If equipped with the load-sensing system (see Section 24), the GLSV should be bled after the master cylinder.*
7 Attach one end of the clear plastic or vinyl tube to the bleeder screw nipple and place the other end in the glass or plastic jar submerged in a small amount of clean brake fluid.
8 Loosen the bleeder screw slightly, then tighten it to the point where it is snug yet easily loosened.
9 Have the assistant pump the brake several times and hold it in the fully depressed position.
10 With the pressure on the brake pedal, open the bleeder screw approximately one-half turn. As the brake fluid is flowing through the tube and into the jar, tighten the bleeder screw. Again, pump the brake



20.9 Correctly assembled Hill-holder valve



20.10 Attach the valve to the vehicle frame

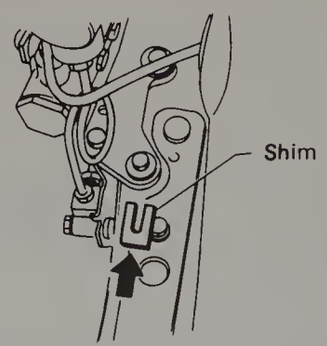


Fig. 9.15 Location of the Hill-holder adjustment shim placement (Sec 21)

pedal, hold it in the fully depressed position, and loosen the bleeder screw momentarily. Do not allow the brake pedal to be released with the bleeder screw in the open position.

11 Repeat the procedure until no air bubbles are visible in the brake fluid flowing through the tube. Be sure to check the brake fluid level in the master cylinder reservoir while performing the bleeding operation.

12 Fully tighten the bleeder screw, remove the plastic or vinyl tube and install the bleeder screw cap.

13 Follow the same procedure to bleed the other wheel cylinder or caliper assemblies.

14 To bleed a master cylinder not equipped with bleeder valves, have the assistant pump and hold the brake pedal. Momentarily loosen the brake line fittings, one at a time, where they attach to the master cylinder. Any air in the master cylinder will escape when the fittings are loosened. Brake fluid will damage painted surfaces, so use paper towels or rags to cover and protect the areas around the master cylinder.

15 Check the brake fluid level in the master cylinder to make sure it is adequate, then test drive the vehicle and check for proper brake operation.

23 Drum shoe replacement – UK MV (pick-up) models

See Figs. 9.16 through 9.18

Note: *The following procedure applies only to those vehicles equipped with 8-inch drums and self-adjusting brake linings.*

Removal

1 Block the front wheels and then raise the rear of the vehicle according to the *Jacking and towing* procedures near the front of this manual.

2 Completely release the parking brake lever and remove the rear wheels and brake drums. **Note:** *It is advisable to complete the entire replacement procedure on one side of the vehicle at a time, leaving the other side intact to look at if trouble is encountered.*

3 Working through the rear service hole, use a screwdriver to release

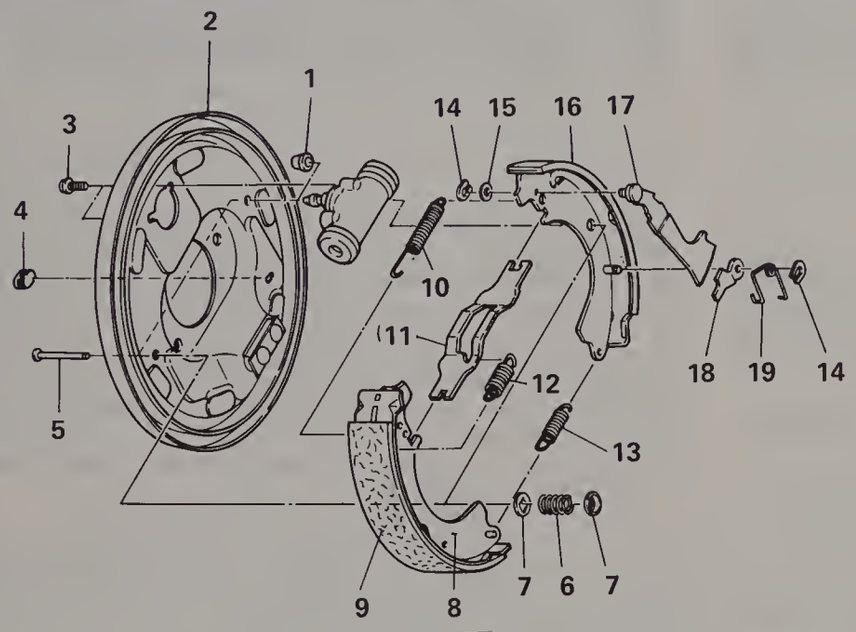


Fig. 9.16 Rear brake components for MV (Pick-up) models sold in the UK and Europe (Sec 23)

1 Bleeder cap
2 Back plate
3 Bolt and washer
4 Service hole cover
5 Shoe hold-down pin
6 Shoe hold-down spring
7 Shoe hold-down seat
8 Brake shoe assembly (leading)
9 Brake lining
10 Shoe return spring (upper)
11 Strut
12 Automatic adjusting spring
13 Shoe return spring (lower)
14 Retainer
15 Spring washer
16 Brake shoe assembly (trailing)
17 Adjusting lever
18 Adjusting latch
19 Return spring

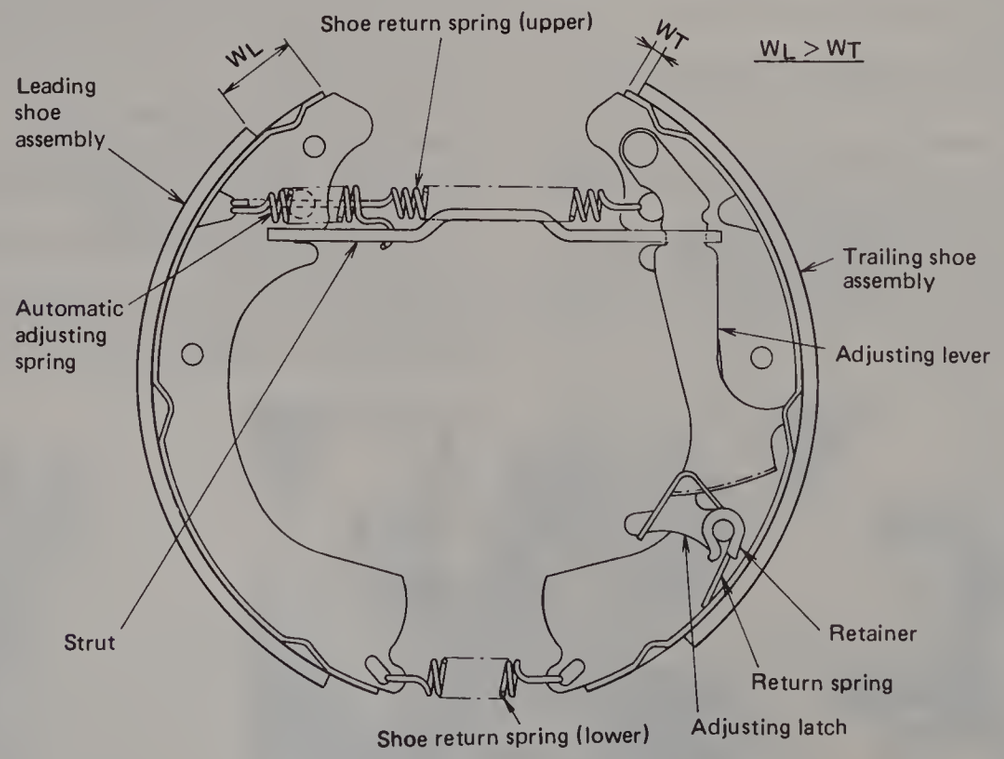


Fig. 9.17 Self-adjusting brake components (Sec 23)

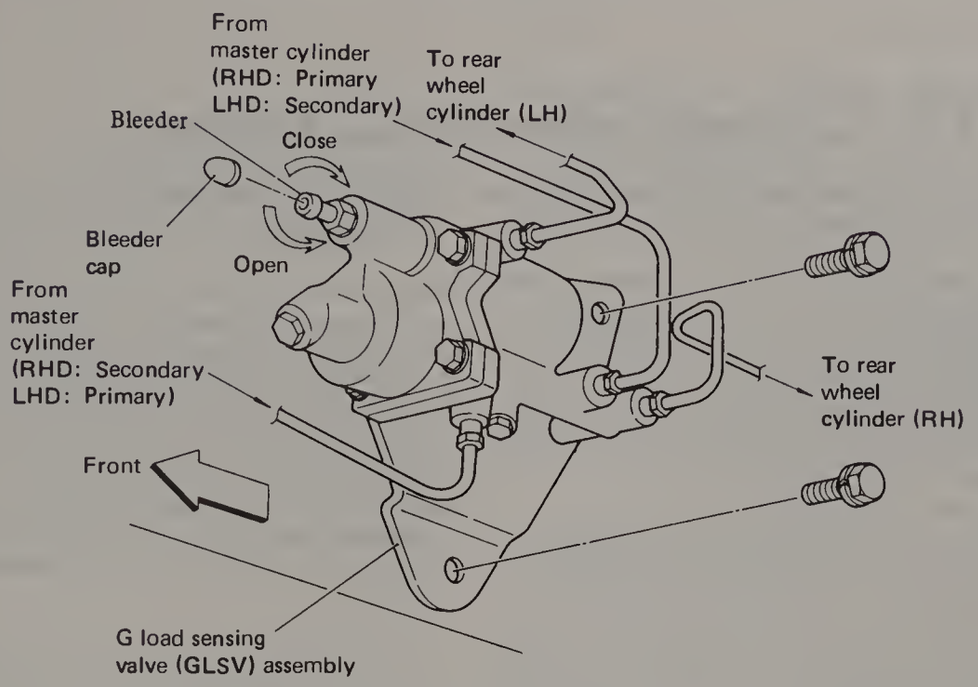


Fig. 9.18 The GLSV which is fitted to some UK and European MV models (Sec 24)

the engagement between the adjusting latch and the adjusting lever.
4 Remove the shoe hold-down springs by using a pair of pliers to compress the spring until you can turn the hold-down pin (at the center of the spring) and disengage it from the spring.
5 Move the adjusting lever toward the axle shaft (with a screwdriver) and expand both of the shoes. Pull downward on both shoes and remove them from the back plate.
6 On the workbench, remove the lower shoe return spring.
7 Move the adjusting latch to the fully released position, put the shoes in their original positions and disconnect the upper shoe return spring.
8 Disengage the adjusting latch from the adjusting lever.
9 While turning the strut, detach it from the leading shoe.
10 Remove the retainers and disconnect the adjusting latch and adjusting lever from the trailing shoe.
11 Inspect all parts for wear or damage (see Section 11). Note that the inner diameter of the brake drum is greater than that of other models (see Specifications).

Installation

12 Apply a high-quality white grease to the raised areas of the back plate.
13 Install the adjusting latch and adjusting lever to the trailing shoe and use pliers to lock the retainers firmly. Make sure the leading and trailing shoes are not confused; see the accompanying figures.
14 Install the strut and return springs (upper and lower).
15 While moving the adjusting lever toward the axle shaft, depress the adjusting latch and move the shoes into position.
16 Install the shoe hold-down springs.
17 Perform the same steps to the other side brake assembly.
18 Install the brake drums and bleed the system of all air which may have entered (see appropriate Sections in this Chapter).
Note: *The shoe-to-drum clearance will be adjusted automatically by depressing the brake pedal several times.*

24 G-Load-Sensing Valve (GLSV) – replacement

Refer to Fig. 9.18

Note: *The following does not pertain to all vehicles.*
1 The GLSV cannot be disassembled for repair. If a fault occurs in the load-sensing system, the valve should be replaced as a complete unit.
2 Gather together paper towels or rags (to catch any spilled fluid) and plastic caps for the brake line ends. For additional working space, raise and support the vehicle firmly.
3 Disconnect the various brake lines at the GLSV. A flare nut wrench, which wraps around the flare nuts, will prevent rounding off the flats. Plug or cover the ends of each brake line to prevent excess drainage and contamination.
4 Remove the two bolts which secure the GLSV and remove the valve assembly.
5 Install the replacement GLSV and tighten the bolts securely.
6 After connecting the brake lines, bleed the entire system (including the GLSV) of air by referring to Section 22.

Chapter 10 Chassis electrical system

Refer to Chapter 13 for specifications applicable to 1984 thru 1988 models

Contents

Specifications

Battery electrolyte specific gravity	See Chapter 1
Coolant temperature sensing unit resistance	
At 122°F (50°C)	153.9 ohms
At 187°F (86°C)	51.9 ohms
At 239°F (115°C)	23.6 ohms
Light bulb replacements	
Combination meter	**Size**
Low fuel indicator	12V/3.4W
Charge indicator	12V/1.4W or 3.4W
Oil pressure indicator	12V/1.4W
High-beam indicator	12V/1.4W
Brake fluid level warning	12V/1.4W
Door ajar warning	12V/1.4W
Seat belt warning	12V/1.4W
Rear gate ajar warning	12V/1.4W
Stoplight warning	12V/1.4W
Parking brake warning	12V/1.4W
Four-wheel-drive indicator	12V/1.4W or 3.4W
Turn signal indicator	12V/1.4W or 3.4W
Meter illumination	12V/1.4W or 3.4W
Dimmer	
High beam	12V/75W
Low beam	12V/50W
Headlight	
Standard	12V/60 over 50W
DL model	12V/65 over 55W
GL model	12V/50 and 35 over 35W
Front combination light	
Turn signal	12V/27W
Parking	12V/3.8W or 8W
Side marker light	
Front	12V/3.8W
Rear	12V/3.8W or 8W
Rear combination light	
Stop	12V/27W
Tail	12V/8W
Turn signal	12V/27W
Back-up	12V/27W
License plate	12V/3.8W or 8W
Interior dome	12V/8W
Ashtray	12V/1.4W
Automatic transmission position indicator	12V/3.4W
Cigarette lighter	12V/1.4W
Rear window defogger indicator	12V/1.4W
Vanity mirror	12V/3.4W
Trunk dome	12V/5W

Torque specifications

	Ft-lb	Nm
Window wiper arm nut	3.3 to 5.4	4.4 to 7.4

1 General information

The electrical system is a 12-volt type and the major components comprise a 12-volt battery, of which the negative terminal is grounded; an alternator, which is belt driven from a pulley on the front of the crankshaft, and a starter motor, which is mounted on the flywheel housing.

The battery supplies the power required to operate the starter motor, which places a heavy demand on it. The battery also provides the current for the ignition, lighting and other electrical circuits, and provides a reserve of electricity when the current consumed by the electrical equipment exceeds that being produced by the alternator. It is kept fully charged by the alternator, the output of which is controlled by the voltage regulator.

When installing electrical accessories on vehicles with a negative ground system it is important, if they contain diodes or transistors, that they are properly connected, otherwise serious damage may be caused to the components concerned.

Wiring diagrams for each model can be found at the end of this Chapter.

2 Electrical troubleshooting – general information

A typical electrical circuit consists of an electrical component, any switches, relays, motors, etc. related to that component and the wiring and connectors that connect the component to both the battery and the chassis. To aid in locating a problem in any electrical circuit, wiring diagrams for each model are included at the end of this Chapter.

Before tackling any troublesome electrical circuit, first study the appropriate diagrams to get a complete understanding of what makes up that individual circuit. Trouble spots, for instance, can often be narrowed down by noting if other components related to that circuit are operating properly or not. If several components or circuits fail at one time, chances are the problem lies in the fuse or ground connection, as several circuits often are routed through the same fuse and ground connections.

Electrical problems often stem from simple causes, such as loose or corroded connections, a blown fuse or melted fusible link. Prior to any electrical troubleshooting, always visually check the condition of the fuse, wires and connections of the problem circuit.

If testing instruments are going to be utilized, use the diagrams to plan ahead of time when you will make the necessary connections in order to accurately pinpoint the trouble spot.

The basic tools needed for electrical troubleshooting include a circuit tester or voltmeter (a 12-volt bulb with a set of test leads can also be used), a continuity tester (which includes a bulb, battery and set of test leads) and a jumper wire, preferably with a circuit breaker incorporated, which can be used to bypass electrical components.

Voltage checks should be performed if a circuit is not functioning properly. Connect one lead of a circuit tester to either the negative battery terminal or a known good ground. Connect the other lead to a connector in the circuit being tested, preferably nearest to the battery or fuse. If the bulb of the tester goes on, voltage is reaching that point (which means the part of the circuit between that connector and the battery is problem free). Continue checking along the entire circuit in the same fashion. When you reach a point where no voltage is present, the problem lies between there and the last good test point. Most of the time the problem is due to a loose connection. *Keep in mind that some circuits receive voltage only when the ignition key is in the Accessory or Run position.*

A method of finding shorts in a circuit is to remove the fuse and connect a test light or voltmeter in its place to the fuse terminals. There should be no load in the circuit. Move the wiring harness from side to side while watching the test light. If the bulb goes on, there is a short to ground somewhere in that area, probably where insulation has rubbed off a wire. The same test can be performed on other components of the circuit, including the switch.

A ground check should be done to see if a component is grounded properly. Disconnect the battery and connect one lead of a self-powered test light such as a continuity tester to a known good ground. Connect the other lead to the wire or ground connection being tested. If the bulb goes on, the ground is good. If the bulb does not go on, the ground is not good.

A continuity check is performed to see if a circuit, section of circuit or individual component is passing electricity through it properly. Disconnect the battery, and connect one lead of a self-powered test light such as a continuity tester to one end of the circuit being tested and the other lead to the other end of the circuit. If the bulb goes on, there is continuity, which means the circuit is passing electricity through it properly. Switches can be checked in the same way.

Remember that all electrical circuits are composed basically of electricity running from the battery, through the wires, switches, relays, etc. to the electrical component (light bulb, motor, etc.). From there it is run to the car body (ground) where it is passed back to the battery. Any electrical problem is basically an interruption in the flow of electricity to and from the battery.

3 Battery charging procedure

1 As was mentioned before, if the battery's specific gravity is below the specified amount, the battery must be recharged.

2 If the battery is to remain in the vehicle during charging, disconnect the cables from the battery to prevent damage to the electrical system.

3 When batteries are being charged, hydrogen gas, which is very explosive and flammable, is produced. **Warning:** *Do not smoke or allow an open flame near a charging or a recently charged battery. Also, do not plug in the battery charger until the connections have been made at the battery posts.*

4 The average time necessary to charge a battery at the normal rate is from 12 to 16 hours (sometimes longer). Always charge the battery slowly. A quick charge or boost charge is hard on a battery and will shorten its life. Use a battery charger that is rated at no more than six (6) amperes.

5 Remove all of the vent caps (if so equipped) and cover the vent holes with a clean cloth to prevent the spattering of electrolyte. If your vehicle is equipped with a maintenance-free battery, make sure the vent is clear. Hook the battery charger leads to the battery posts (positive to positive, negative to negative), then plug in the charger. Make sure it is set at 12 volts if you have a selector switch.

6 Watch the battery closely during charging to make sure that it does not overheat (the electrolyte temperature must not exceed 100°F).

7 The battery can be considered fully charged when it is gassing freely and there is no increase in specific gravity during three successive readings taken at hourly intervals.

8 Overheating of the battery during charging at normal charging rates, excessive gassing and continual low specific gravity readings are an indication that the battery should be replaced with a new one.

4 Fuses and fusible links – general information

Refer to Figs. 10.1 and 10.2

Fuses

The electrical circuits of the vehicle are protected by a combination of fuses and fusible links.

The fuse box is located in the instrument panel on the left side of the vehicle. Access to the fuses is achieved by simply pulling down or sliding the cover.

Each of the fuses is designed to protect a specific circuit, as identified on the fuse cover. Spare fuses are included in the fuse box cover.

If an electrical component has failed, your first check should be the fuse. A fuse which has "blown" can be readily identified by inspecting the metal element inside the housing. If this element is broken, the fuse is inoperable and should be replaced with a new one. Fuses are replaced by simply pulling out the old one and pushing in the new one.

It is important that the correct fuse be installed. The different electrical circuits need varying amounts of protection, indicated by the amperage rating on the fuse. A fuse with too low a rating will blow prematurely, while a fuse with too high a rating may not blow soon

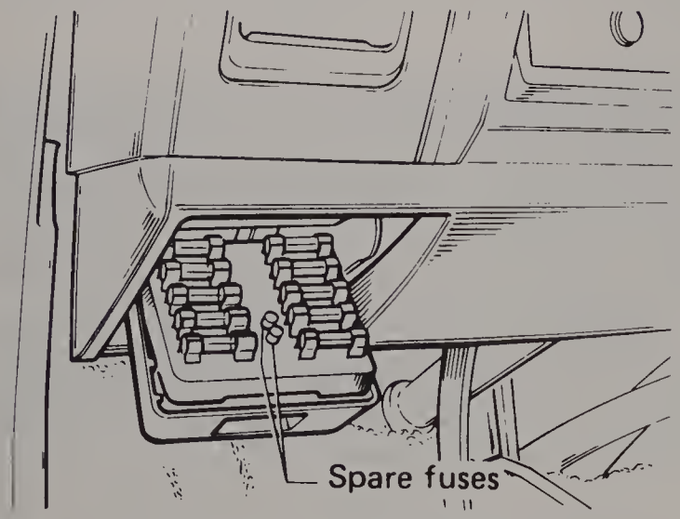


Fig. 10.1 Typical fuse location (Sec 4)

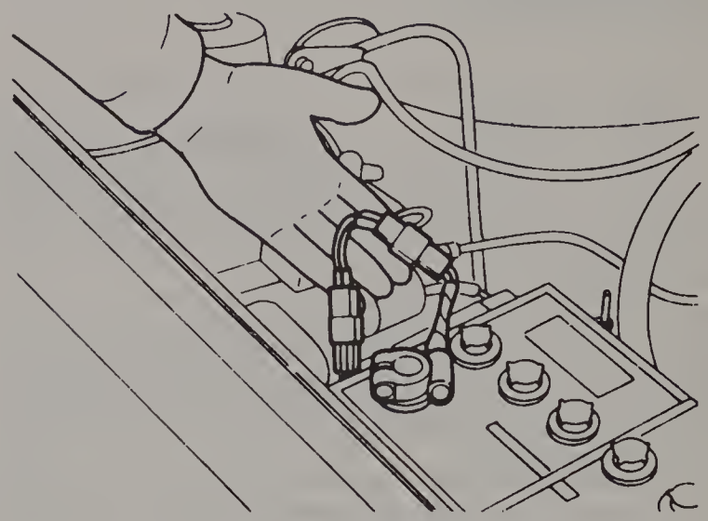


Fig. 10.2 Fusible link location (Sec 4)

enough to avoid serious damage to other components or the wiring.

At no time should the fuse be bypassed with metal or foil. Serious damage to the electrical system could result.

If the replacement fuse immediately fails, do not replace it with another until the cause of the problem is isolated and corrected. In most cases this will be a short circuit in the wiring caused by a broken or deteriorated wire.

Fusible links

In addition to fuses, the wiring system incorporates a fusible link for overload protection. This link is used for circuits which are not ordinarily fused.

The fusible link is located near the positive battery terminal and is easily removed by unplugging the connectors at either end.

If an electrical failure occurs in one of the circuits covered by the fusible link, the link should be the first item you check. If the link is melted, the entire fusible link should be replaced, but only after checking and correcting the electrical fault that caused it.

5 Relays and flasher units – general information

Refer to Figs. 10.21 and 10.22

Relays

The various electrical relays are grouped together either in the engine compartment or under the dash for convenience in the event of needed replacement.

The main relay bracket in the engine compartment is located on the right side, and has the windshield washer reservoir attached to its outer mounting case.

If a faulty relay is suspected, it can be removed and tested by a reputable dealer or other qualified shop. Defective relays must be replaced as a unit.

Flasher units

Small canister-shaped flasher units are incorporated into the electrical circuits for the directional signals and hazard warning lights.

When the units are functioning properly an audible click can be heard with the circuit in operation. If the turn signals fail on one side only and the flasher unit cannot be heard, a faulty bulb is indicated. If the flasher unit can be heard, a short in the wiring is indicated.

If the turn signal fails on both sides, the fault may be due to a blown fuse, faulty flasher unit or switch, or a broken or loose connection. If the fuse has blown, check the wiring for a short before installing a new fuse.

The hazard warning lights are checked in the same manner as Paragraph 3 above.

Both the turn signal and hazard warning flasher units are located on a single bracket underneath the dash on the driver's side (see accompanying illustration).

When replacing either of these flasher units it is important to buy a replacement of the same capacity. Check the new flasher against the old one to be assured of the proper replacement.

6 Combination meter (conventional) – repair

Refer to Figs. 10.3 through 10.5

1 Disconnect the cable from the negative terminal of the battery.
2 Remove the bolts holding the steering column in place and lower it to a resting position.
3 Remove the screws holding the combination meter visor in place and remove the visor.
4 Remove the mounting screws of the combination switch panel.
5 Disconnect the switch wiring and then remove the switch panel.
6 Now remove the screws mounting the combination meter to the instrument panel (photo).
7 Disconnect the wires and the speedometer cable attached to the meter, then remove the meter.
8 To replace any of the gauges, clock or meters, the adjustment knobs (photo), the meter glass and the window plate must be removed.
9 Refer to the illustrations for the correct mounting nuts and bolts (photo) for the gauges and meters.
10 To replace any of the indicator lights, just locate which bulbs you want to replace and twist the old bulbs out and the new ones in.
11 When installing the combination meter, make sure that all of the electrical wiring and the speedometer cable is hooked up correctly to the combination meter and the combination switch panel.
12 Make sure that all of the mounting hardware is tight.

7 Combination meter (digital) – repair

Refer to Fig. 10.6

1 The digital combination meter can be removed by referring to the previous Section in this Chapter.
2 Repair or replacement of any components is beyond the scope of the home mechanic. Remove them and take them to a dealer service department if repair is required.

8 Speedometer cable – replacement

1 Disconnect the speedometer cable from the transmission.
2 Disconnect the other end of the cable from the speedometer by pulling on the end of the cable coupling and pulling the cable out of the speedometer.
3 Loosen the cable securing clip, remove the grommet and pull the cable into the engine compartment.
4 When installing the speedometer cable, make sure that it remains relatively straight with no kinking.

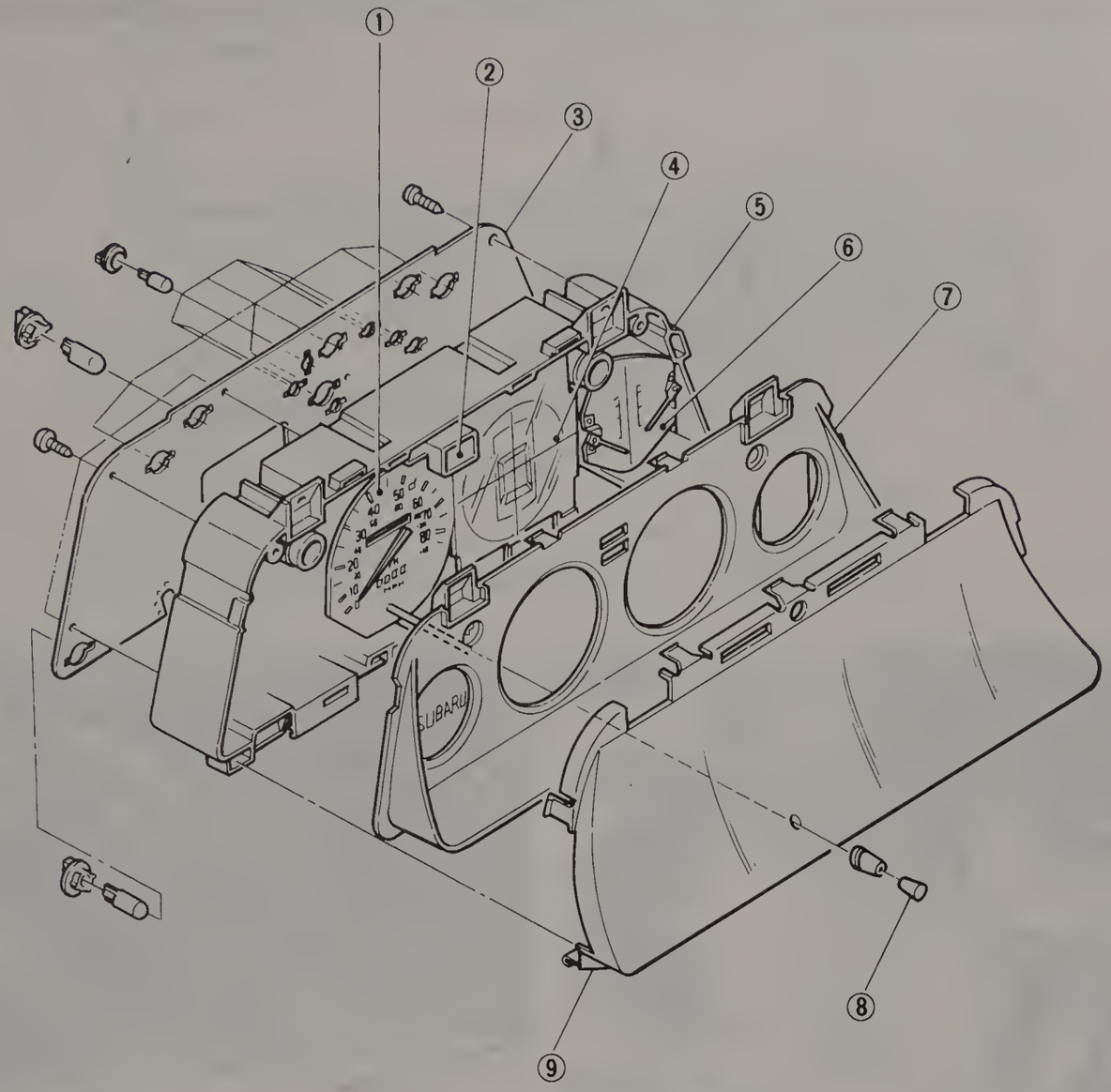


Fig. 10.3 Conventional combination meter components – exploded view (Sec 6)

1 *Speedometer*
2 *Oil pressure light*
3 *Printed circuit board*
4 *Graphic monitor*
5 *Meter case*
6 *Fuel and coolant temperature gauges*
7 *Window plate*
8 *Reset knob*

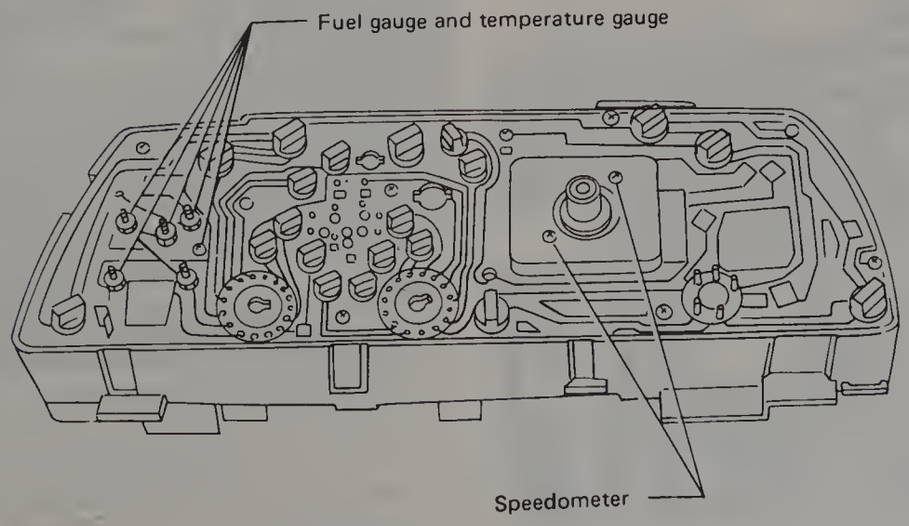


Fig. 10.4 DL model gauge mounting positions and hardware (Sec 6)

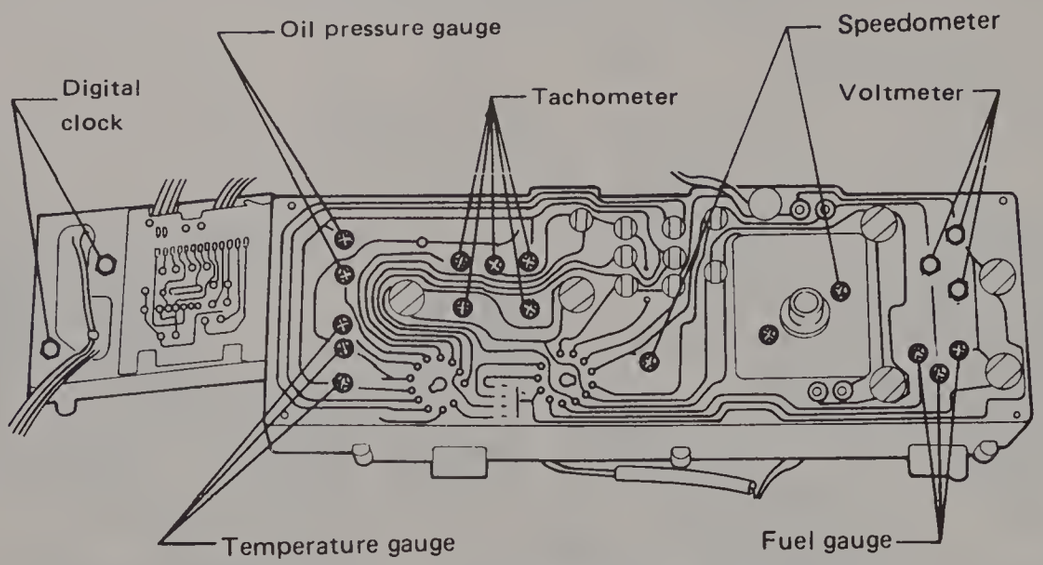
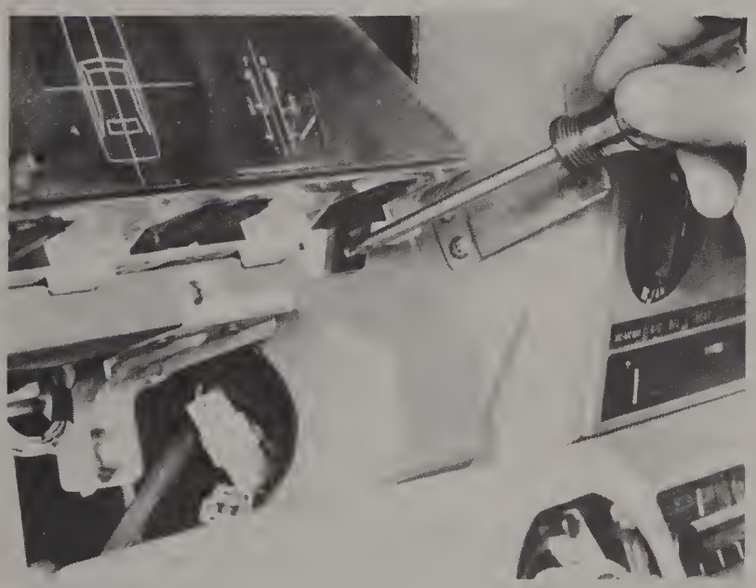
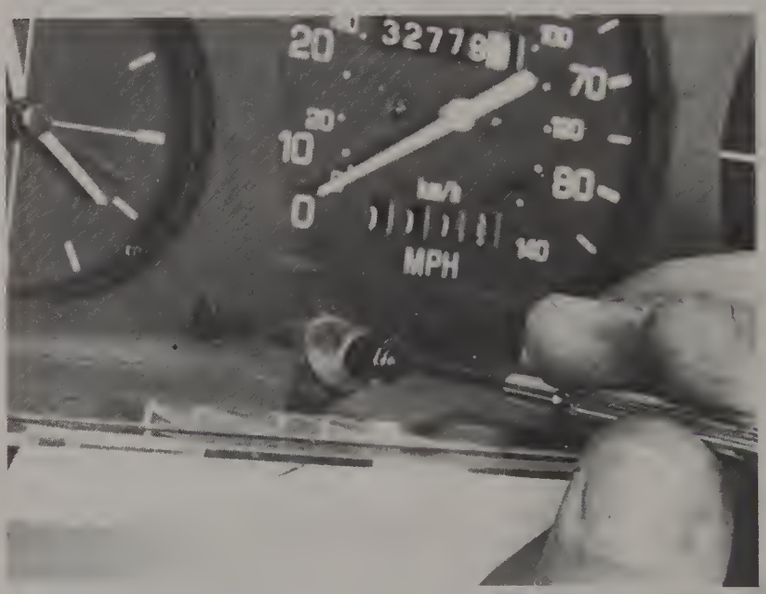


Fig. 10.5 GL model mounting positions and hardware (Sec 6)



6.6 Remove the screws holding the combination meter to the instrument panel



6.8 Remove the adjustment knobs to gain access to the meter interior

6.9 Remove the gauge and meter mounting nuts in order to remove them from the meter

9 Interior switches – removal and installation

Note: *Always disconnect the negative battery cable before doing any electrical work.*

Column combination switch

1 Remove the steering wheel by referring to the appropriate Section in Chapter 11.
2 Remove the steering column mounting bolts and pull the column down.
3 Remove the screws holding the steering column covers in place and remove the covers (photo).
4 Now disconnect the wires to the switch and pull the switch off the column. Replace it with a new one.
5 When installing the switch, make sure you reconnect the switch wiring correctly. Install the column covers and the steering column itself, then install the steering wheel.
6 Make sure that all of the mounting hardware is tight.

Ignition switch

7 The ignition switch is tamper-proof. If it must be replaced, take the vehicle to a dealer service department.

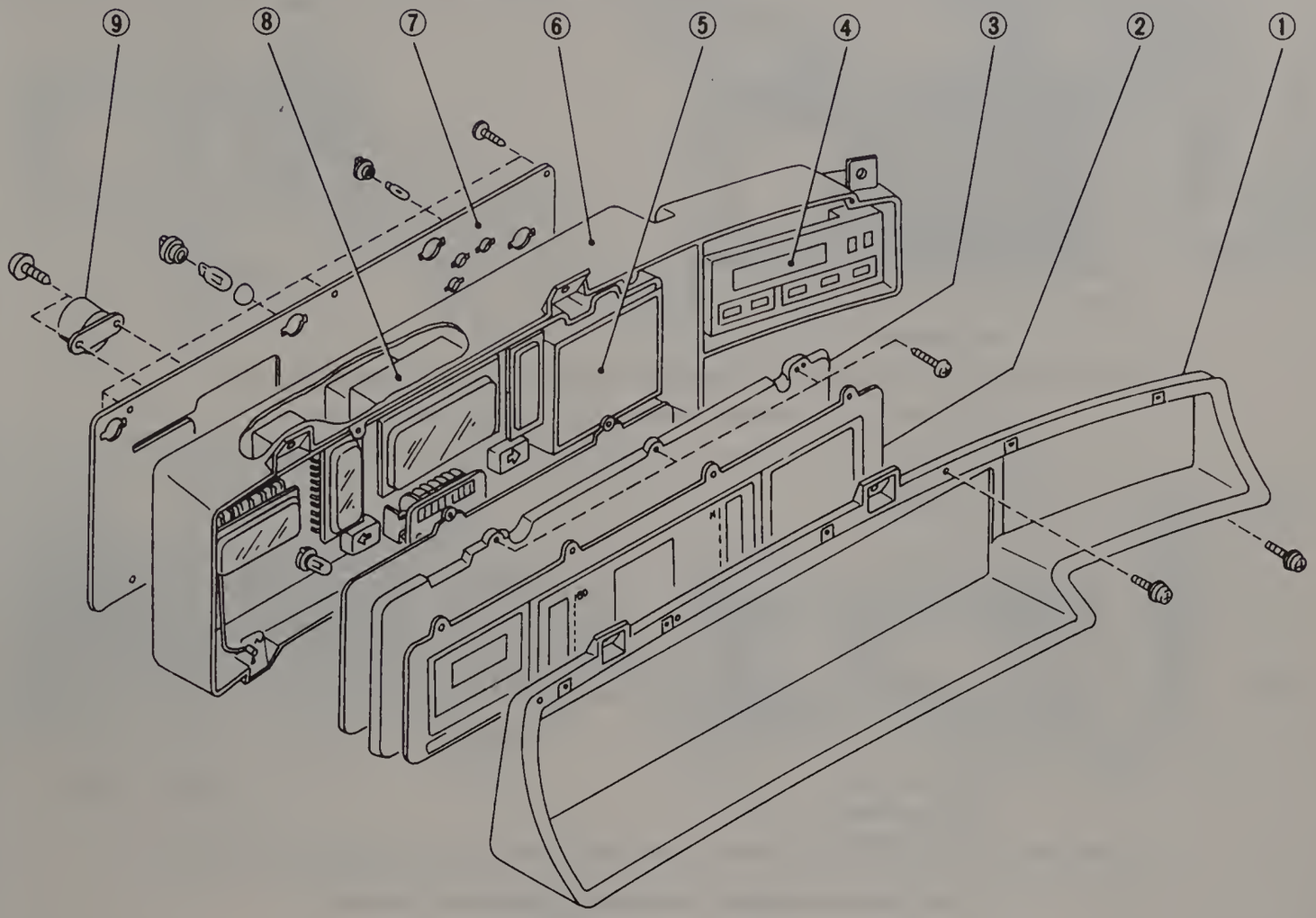
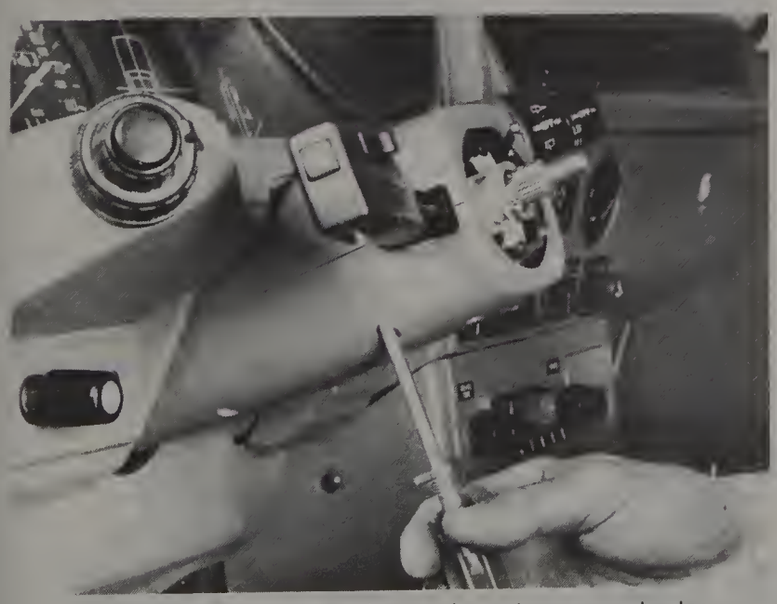


Fig. 10.6 Digital combination meter components – exploded view (Sec 7)

1 Visor
2 Window plate
3 Glass
4 Trip computer
5 Graphic monitor
6 Meter case
7 Printed circuit board
8 Speedometer
9 Buzzer



9.3 Remove the screws holding the steering column cover in place

9.11 Remove the nut holding the lighting switch to the panel

Lighting switches

8 To remove the lighting switches, first remove the screws holding the combination meter visor in place and then remove the visor.
9 Now remove the screws holding the lighting switch panel in place.
10 Disconnect the wiring to both switches and remove the panel.
11 Replace the switches by pulling off the front knobs and removing the nut holding the switches in place (photo).
12 When installing the switches, make sure that the wiring is reconnected correctly and that all mounting hardware is tight.

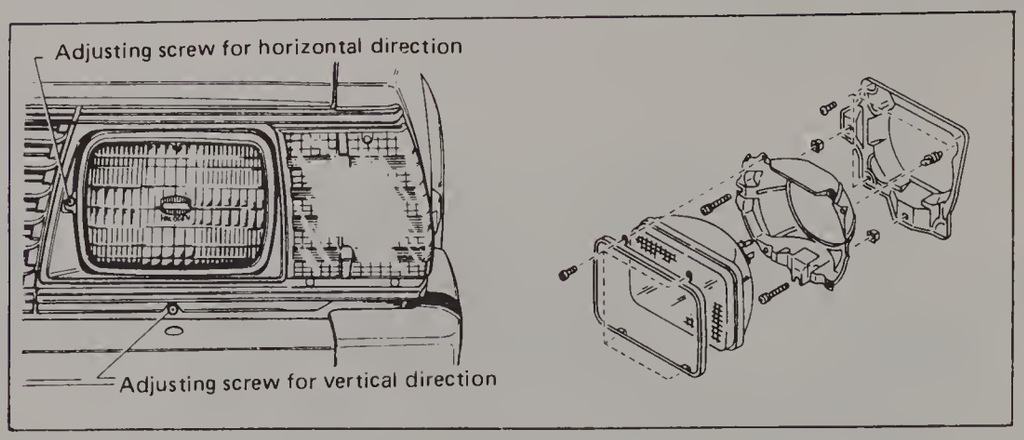


Fig. 10.7 Typical single headlight components – exploded view (Sec 10)

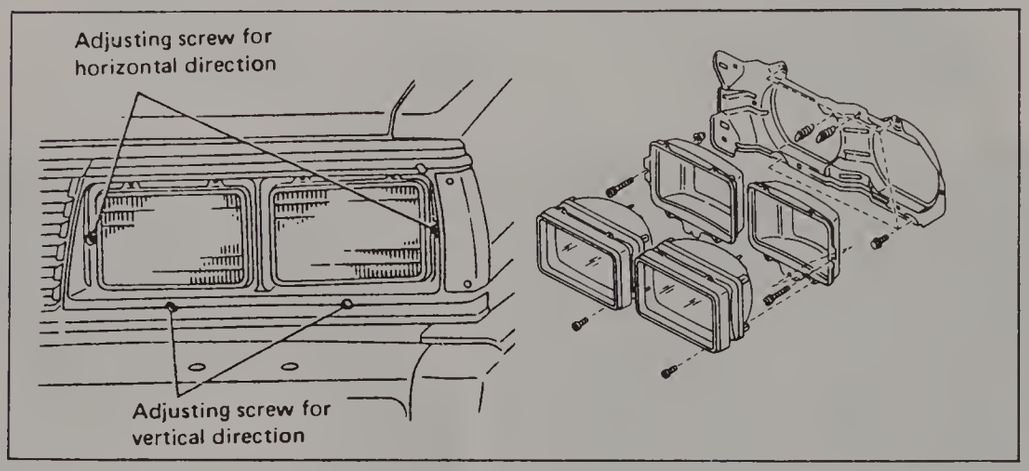


Fig. 10.8 Dual headlight components – exploded view (Sec 10)

10 Headlights – replacement

Refer to Figs. 10.7 and 10.8

1 First you have to remove the front grille by referring to the appropriate Section in Chapter 12.
2 Now remove the front combination light/headlight grille mounting screws.
3 Carefully pull the combination light and grille away from the vehicle. To help gain some working room, you may have to remove one or both of the light bulb sockets from the casing.
4 Remove the headlight retaining ring screws and the retaining ring.
5 Carefully pull the headlight out and away from the vehicle and disconnect the electrical connector.
6 Installation is basically the reverse of the removal procedure.
7 Make sure that the headlight connector is secure and that all of the mounting screws are tight.
8 Also, be sure that the replacement headlight is the correct one for your vehicle by referring to the Specifications at the front of this Chapter.

11 Exterior lights – replacement

Refer to Figs. 10.9 through 10.15

1 If any of the exterior lights fail to work and need to be replaced, it is an easy job to remove their respective lenses and bolts.
2 Refer to the illustrations for your particular vehicle. Remove the mounting screws that hold the lens in place and then replace the burned out bulb with a new one. To remove any of the bulbs, push in on the bulb while turning it counterclockwise. To install the bulb, push in on it while turning it clockwise.
3 Make sure that you tighten all of the lens mounting screws while being careful not to strip out the threads.

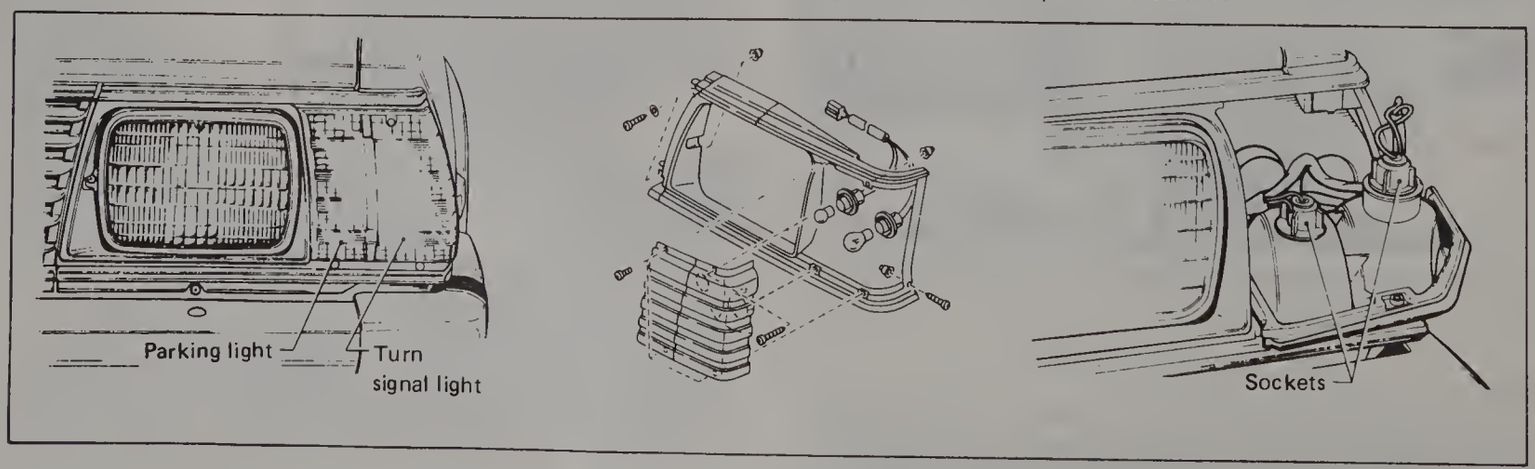


Fig. 10.9 Typical front combination light components – exploded view (Sec 11)

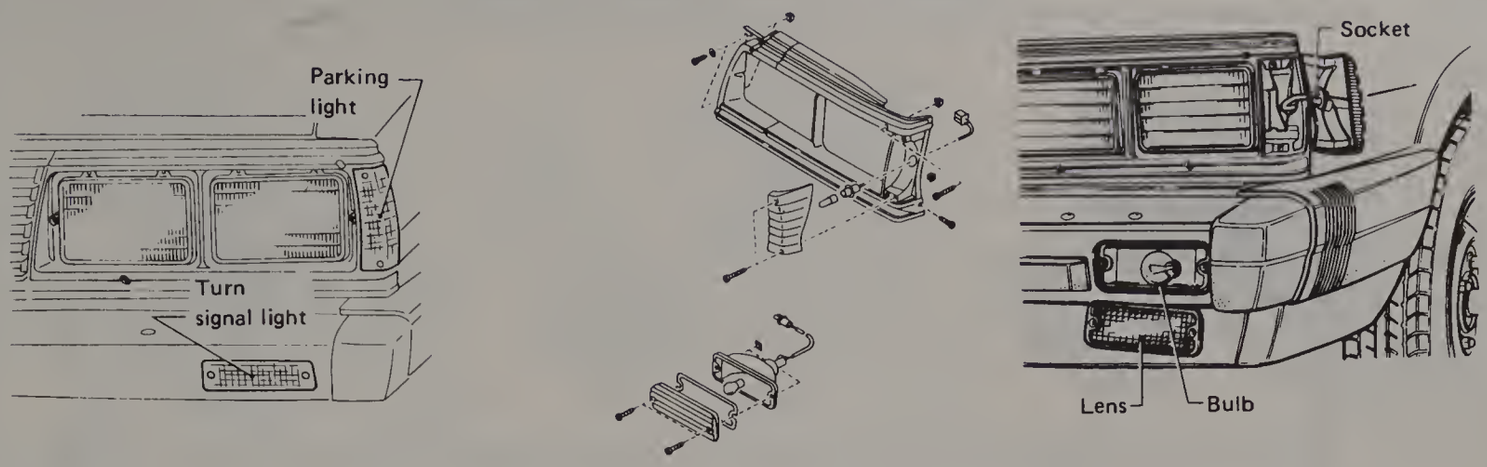


Fig. 10.10 Parking and turn signal light components (dual headlights) – exploded view (Sec 11)

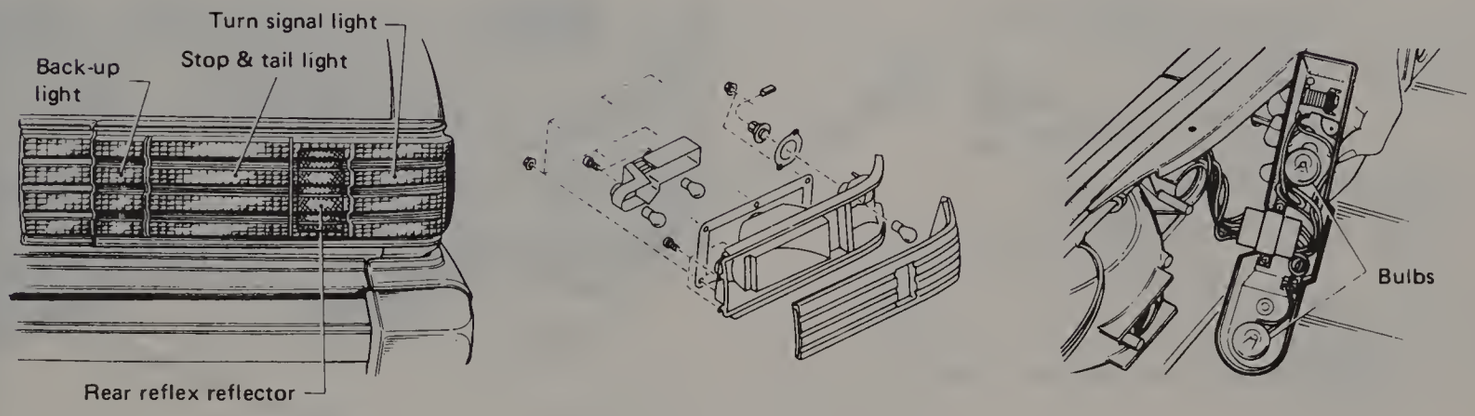


Fig. 10.11 Rear combination light components (sedan, hardtop and hatchback) – exploded view (Sec 11)

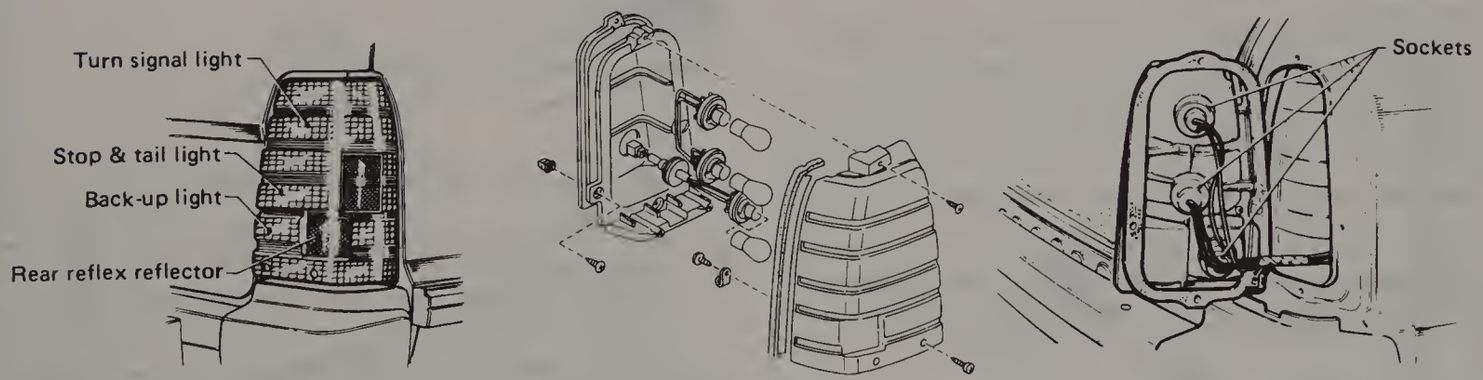


Fig. 10.12 Rear combination light components (station wagon and pick-up truck) – exploded view (Sec 11)

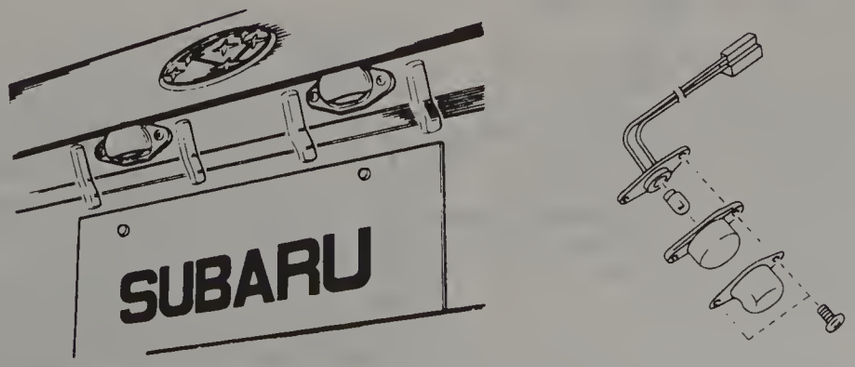


Fig. 10.13 License plate light components (hatchback and station wagon) – exploded view (Sec 11)

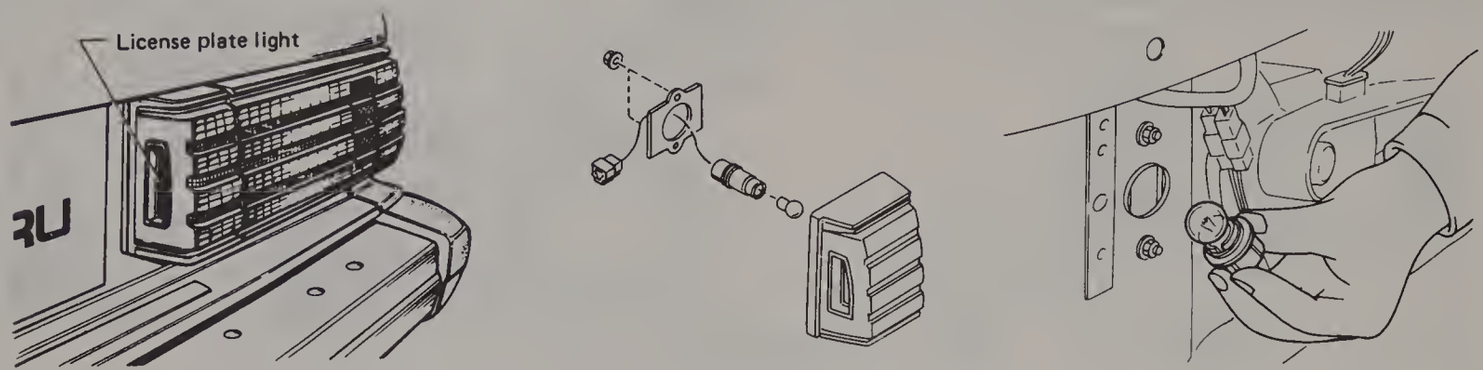


Fig. 10.14 License plate light components (sedan, hardtop and pick-up truck) – exploded view (Sec 11)

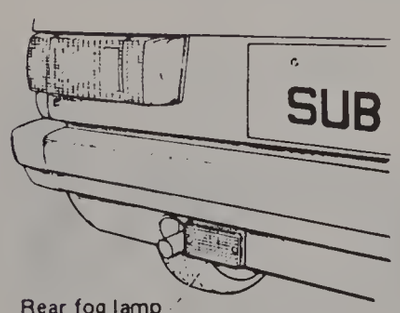


Fig. 10.15 Rear fog lamp (UK only) – (Sec 11)

12 Interior lights – replacement

1 If any of the interior lights fail to work and need to be replaced, it is an easy job to remove their respective lenses and bulbs.
2 Refer to the illustrations for your particular vehicle. Remove the lens (which snaps into place) and then replace the burned out bulb. To replace the bulbs, pull the old bulb out of its electric clip and push the new bulb in.
3 Make sure that the lens is correctly snapped back into position.

13 Window wiper arms – removal, installation and adjustment

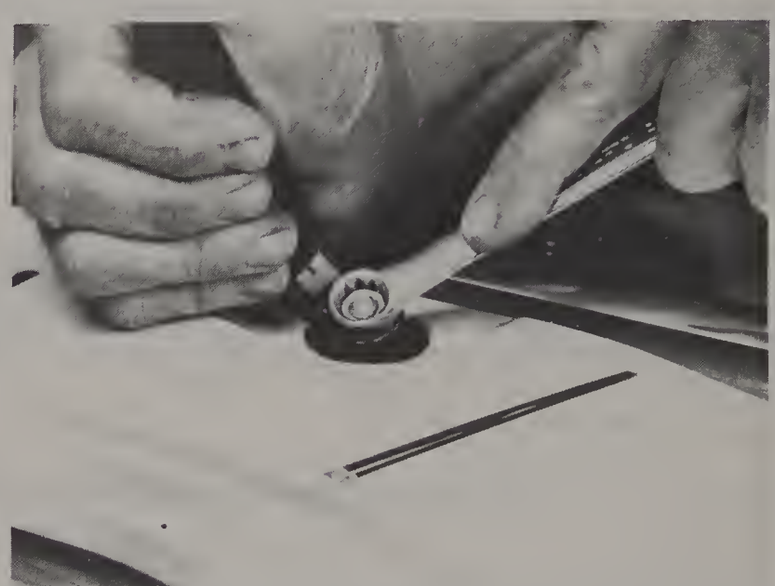
Refer to Figs. 10.16 and 10.17

Front wiper arm

1 To remove the wiper arm, you have to first remove the plastic cap covering the mounting nut by lifting up on it.
2 Remove the wiper arm mounting nut (photo).
3 Remove the arm by carefully pulling straight up on it to keep from damaging the interlocking splines of the arm and the motor shaft.
4 Installation is the reverse of removal.
5 Be careful not to damage the arm and shaft splines by forcing the arm on. **Note:** *The driver's side arm has a Red marker on it and the passenger side does not. Do not interchange them.*
6 To adjust the wiper arm for the correct position on the window, the wiper switch has to be in the Off position. Measure the distance between the wiper blades and the window molding. The distance should be 0.59 in (15 mm). Make the adjustment, if necessary, by removing the arm and repositioning it on the splined shafts.
7 After the correct adjustment has been made, make sure that the arm mounting nut is tightened to the specified torque.

Rear wiper arm

8 The removal and installation of the rear arm is exactly like the front arm. Refer to the beginning of this Section.
9 Remove the plastic mounting nut cover and then the mounting nut.



13.2 Remove the wiper arm mounting nut

10 Refer to Chapter 1 for the rear arm adjustment.

14 Window wiper motors – check and replacement

Refer to Figs. 10.16 and 10.17

1 In order to remove and replace the window wiper motors, the wiper arms must be removed first. To do this, refer to the previous Section in this Chapter.
2 Also, the hood cowl panel will have to be removed by referring to the appropriate Section in Chapter 12.
3 Now, you can begin removing the wiper motor.

Front wiper motor

4 Disconnect the negative cable from the battery and place it to the side. Disconnect the electrical connection to the wiper motor.
5 The wiper arm/motor linkage will have to be removed from the motor shaft. To do this, use a 16 mm socket. Push the socket down onto the plastic retainer (photo) and it will push the tabs on the retainer in. Lift the wiper linkage up and away from the motor shaft. Do the same thing to the opposite end of the wiper linkage and then remove the linkage from the vehicle.
6 Remove the retaining nut from the wiper end of the remaining wiper linkage (photo). Remove the linkage from the motor shaft and place it aside without dismantling the other end.
7 Remove the motor mounting bolts (photo) and then remove the motor from the vehicle.
8 To check the wiper motor, use jumper wires to connect the motor terminals to the vehicle's battery.
9 If the motor works correctly, you may have a problem in the

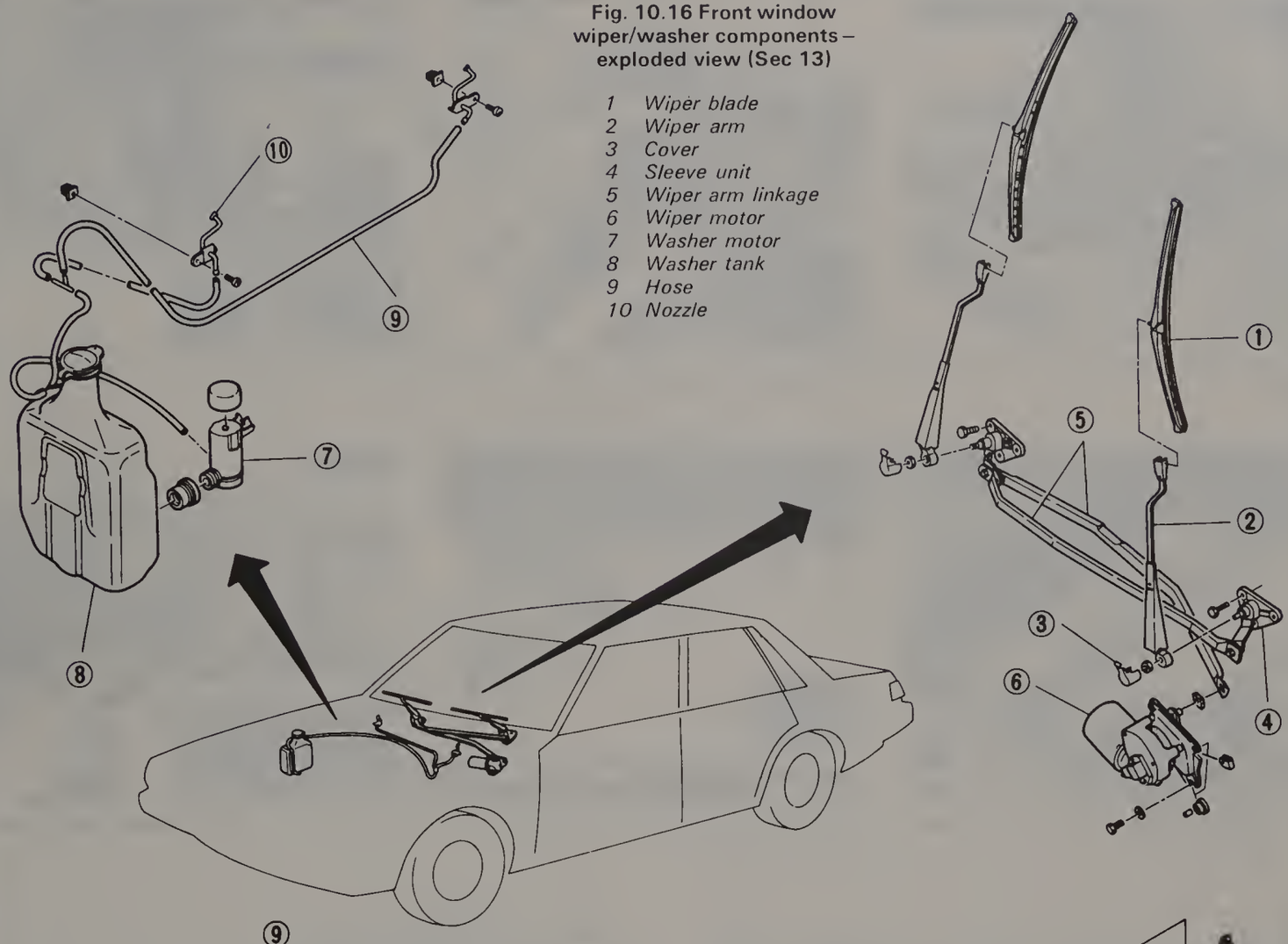


Fig. 10.16 Front window wiper/washer components – exploded view (Sec 13)

1 *Wiper blade*
2 *Wiper arm*
3 *Cover*
4 *Sleeve unit*
5 *Wiper arm linkage*
6 *Wiper motor*
7 *Washer motor*
8 *Washer tank*
9 *Hose*
10 *Nozzle*

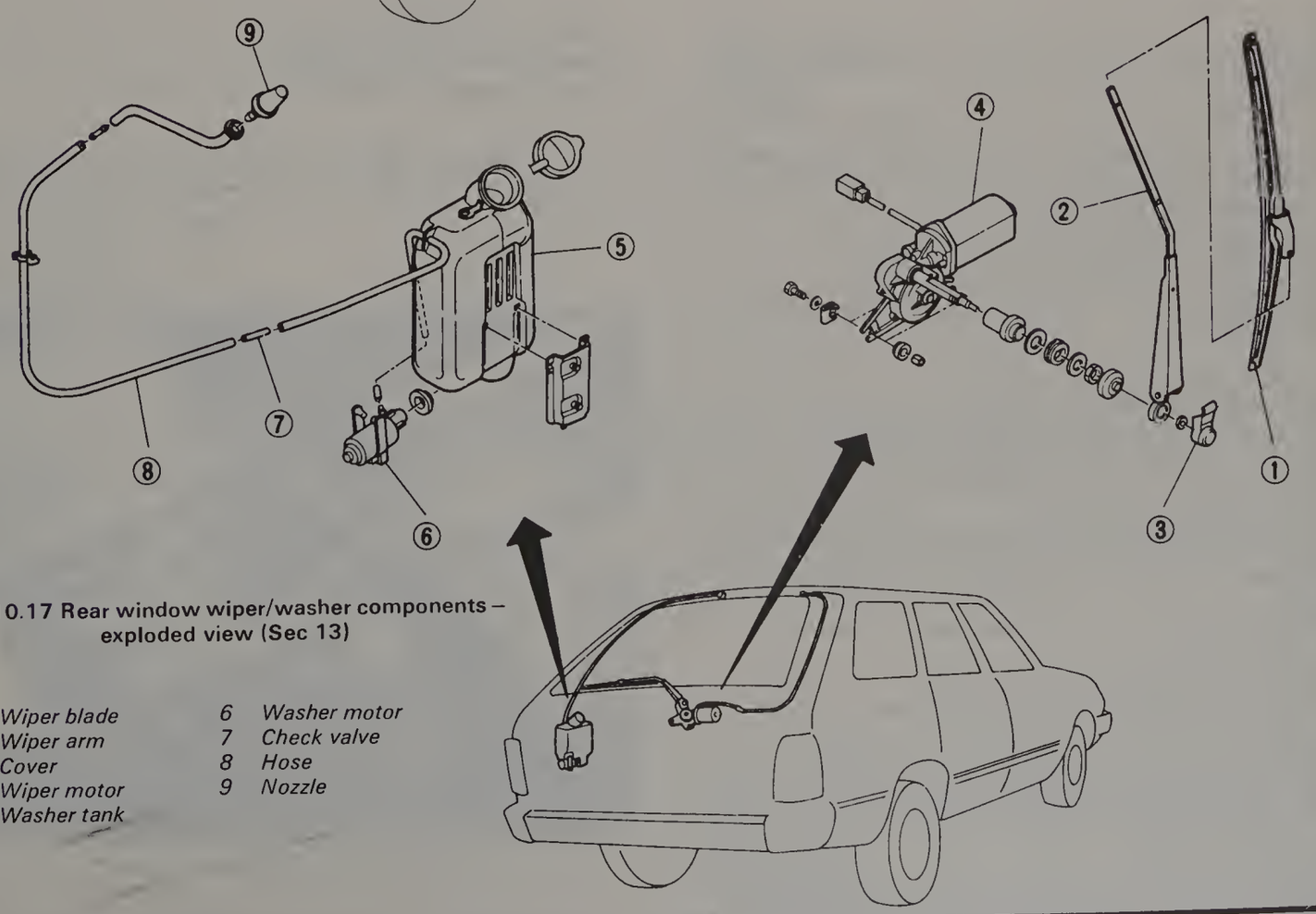
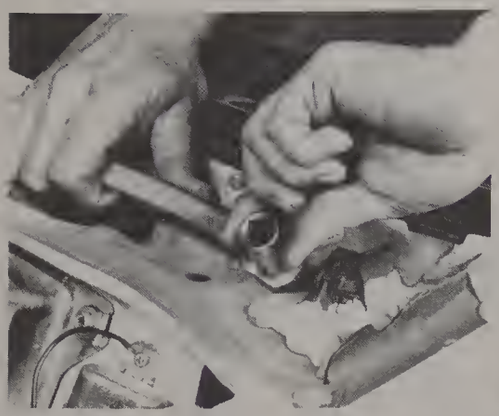
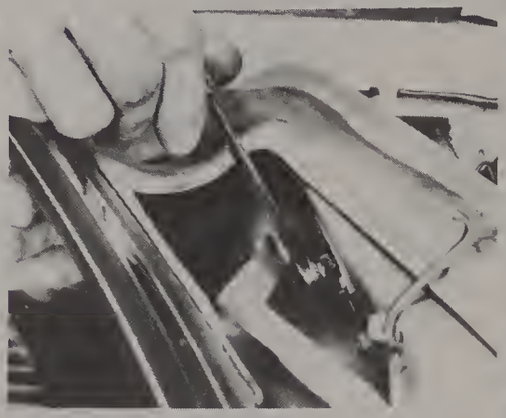


Fig. 10.17 Rear window wiper/washer components – exploded view (Sec 13)

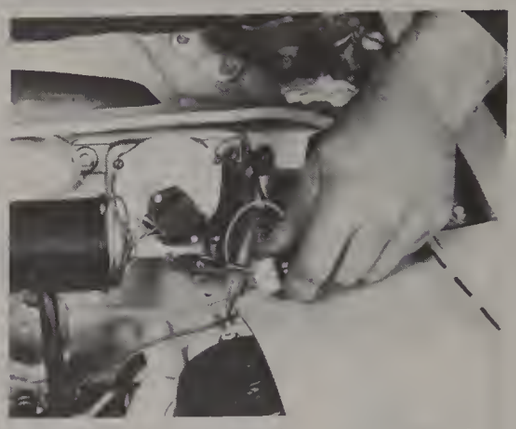
1 *Wiper blade*
2 *Wiper arm*
3 *Cover*
4 *Wiper motor*
5 *Washer tank*
6 *Washer motor*
7 *Check valve*
8 *Hose*
9 *Nozzle*



14.5 Use a socket to remove the wiper arm linkage

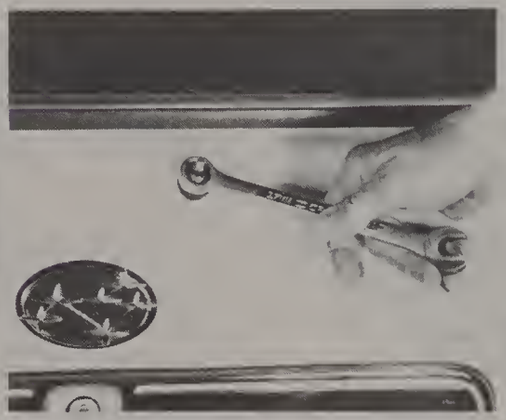


14.6 Remove the retaining nut from the wiper linkage connected to the wiper motor

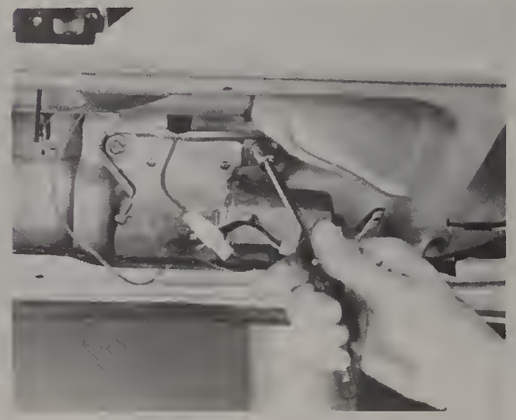


14.7 Remove the front wiper motor mounting bolts

14.12 Make sure that the wiper arm linkages are installed correctly



14.18 Remove the second rear wiper arm mounting nut



14.19 Remove the rear wiper motor mounting nuts

switch. Replace the switch by referring to the appropriate Section in this Chapter.

10 If the motor does not work correctly, replace the unit with a new one.

11 Installation is basically the reverse of the removal procedure.

12 Install the wiper motor with its mounting hardware. Install the wiper linkages by pushing them onto their correct position. Make sure they are installed correctly (photo).

13 Make sure all mounting hardware is tight. Connect the motor electrical connector and the negative battery cable.

14 Install the cowl panel and then the wiper arms by referring to the appropriate Sections.

Rear wiper motor

15 To remove or replace the wiper motor, refer to the previous Section in this Chapter to remove the wiper arm.

16 You will also have to remove the rear gate trim panel and disconnect the wiper motor connectors. To do this, refer to the appropriate Section in Chapter 12.

17 Disconnect the negative battery cable and place it to the side.

18 Now, after removing the top wiper arm mounting nut, there is a plastic cushion and then a second mounting nut (photo) that must be removed.

19 Remove the motor mounting nuts (photo) and then remove the motor from the gate.

20 To check the motor, refer to paragraph 8.

21 If the motor works correctly, you may have a problem in the switch. Check the switch by referring to the appropriate Section in this Chapter.

22 If the motor does not work correctly, replace it with a new one.

23 Installation is basically the reverse of the removal procedure.

24 Install the wiper motor with its mounting hardware. Make sure that all hardware is tight.

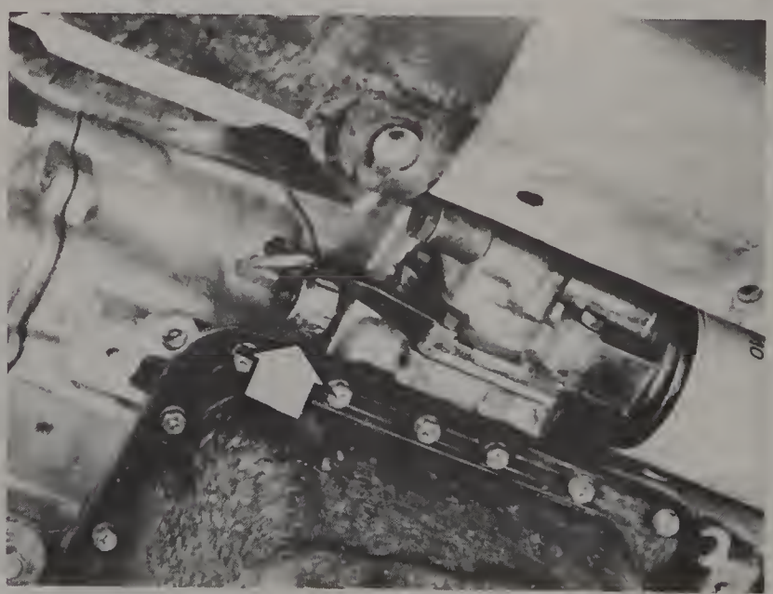
25 Connect the electrical leads and then the negative battery cable.

26 Install the wiper arm by referring to the appropriate Section.

15 Engine sensing units – check

Refer to Fig. 10.18

1 An oil pressure switch is used on vehicles with oil pressure indicator lights. The switch is located on the oil pump (photo). If the oil



15.1 Engine oil pressure sending unit location (arrow)

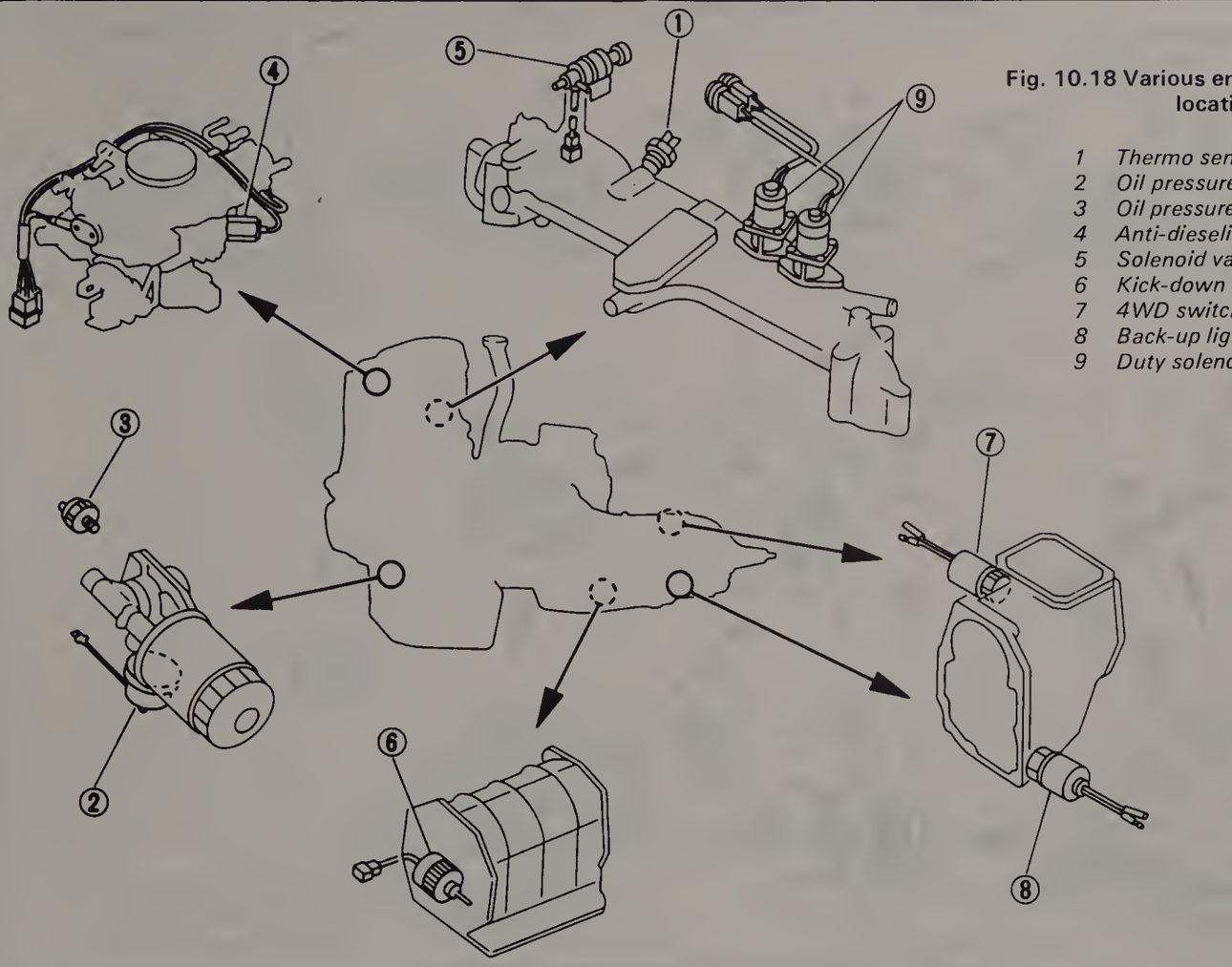


Fig. 10.18 Various engine electrical unit locations

1 *Thermo sensor*
2 *Oil pressure unit*
3 *Oil pressure switch*
4 *Anti-dieseling switch*
5 *Solenoid valve*
6 *Kick-down switch (A/T)*
7 *4WD switch (dual range)*
8 *Back-up light switch*
9 *Duty solenoid valve*

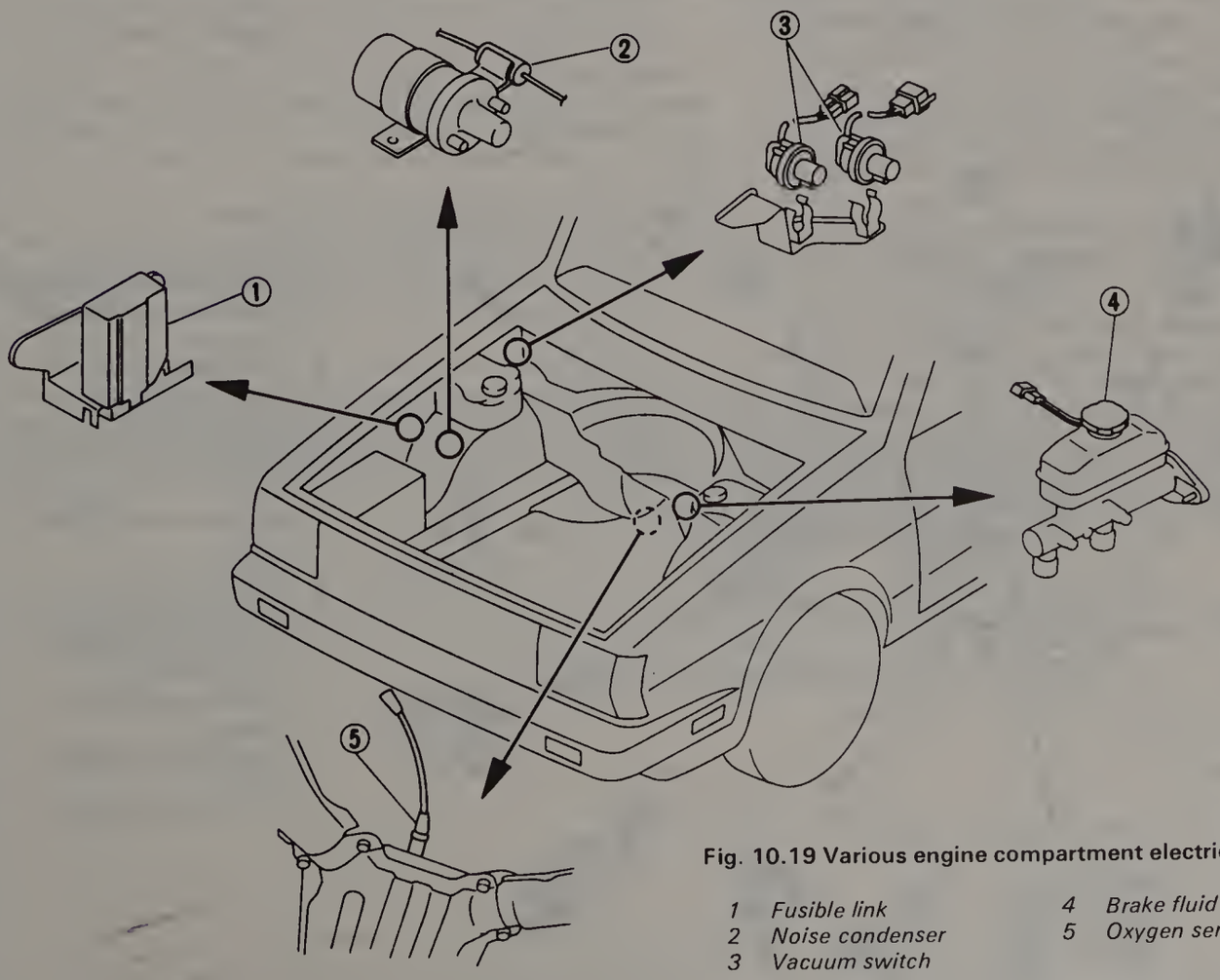


Fig. 10.19 Various engine compartment electrical unit locations

1 *Fusible link*
2 *Noise condenser*
3 *Vacuum switch*
4 *Brake fluid level sensor*
5 *Oxygen sensor*

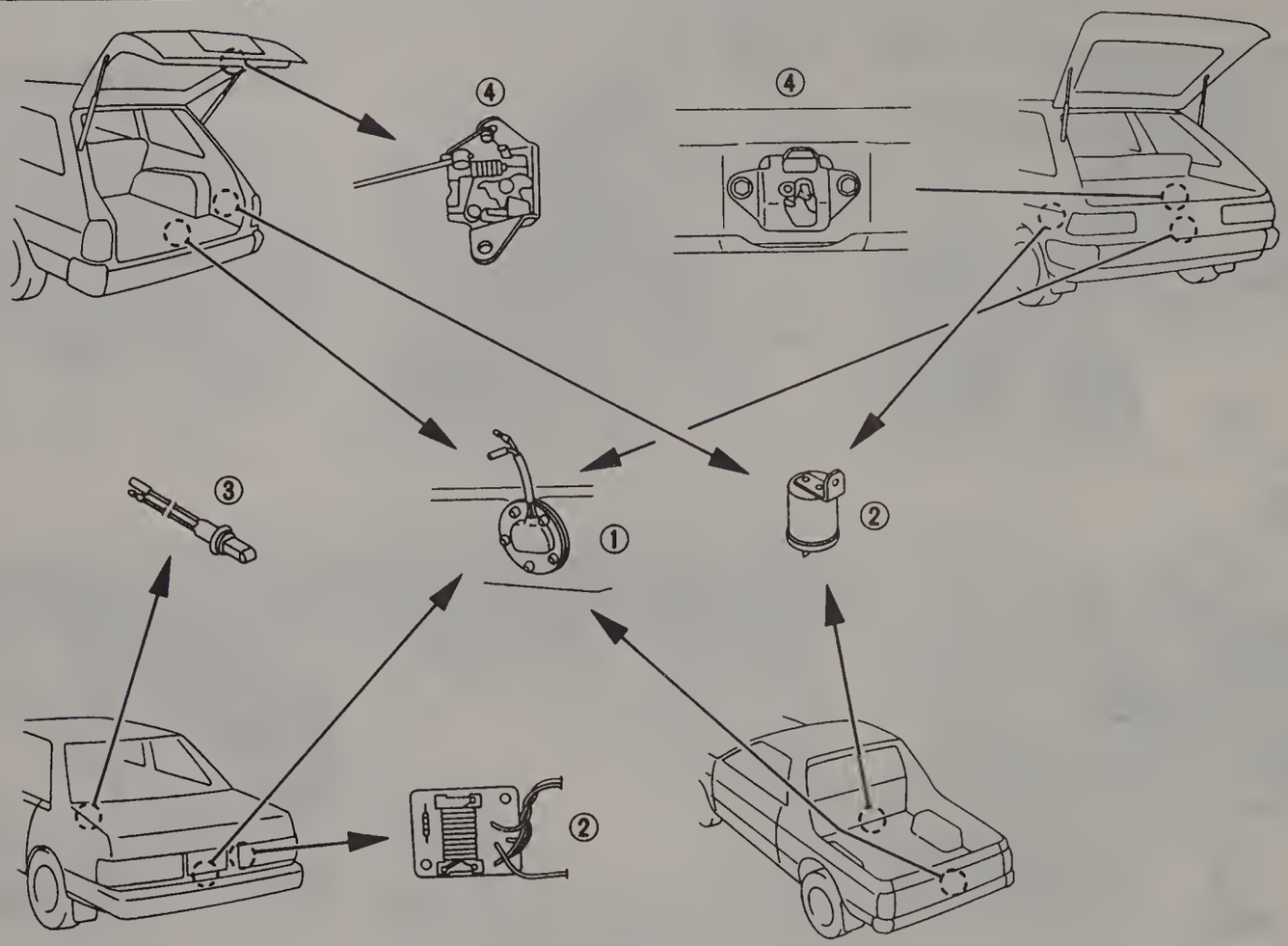


Fig. 10.20 Various rear vehicle electrical unit locations

1 Fuel level sensing unit *2 Stoplight checker* *3 Trunk switch* *4 Rear gate switch*

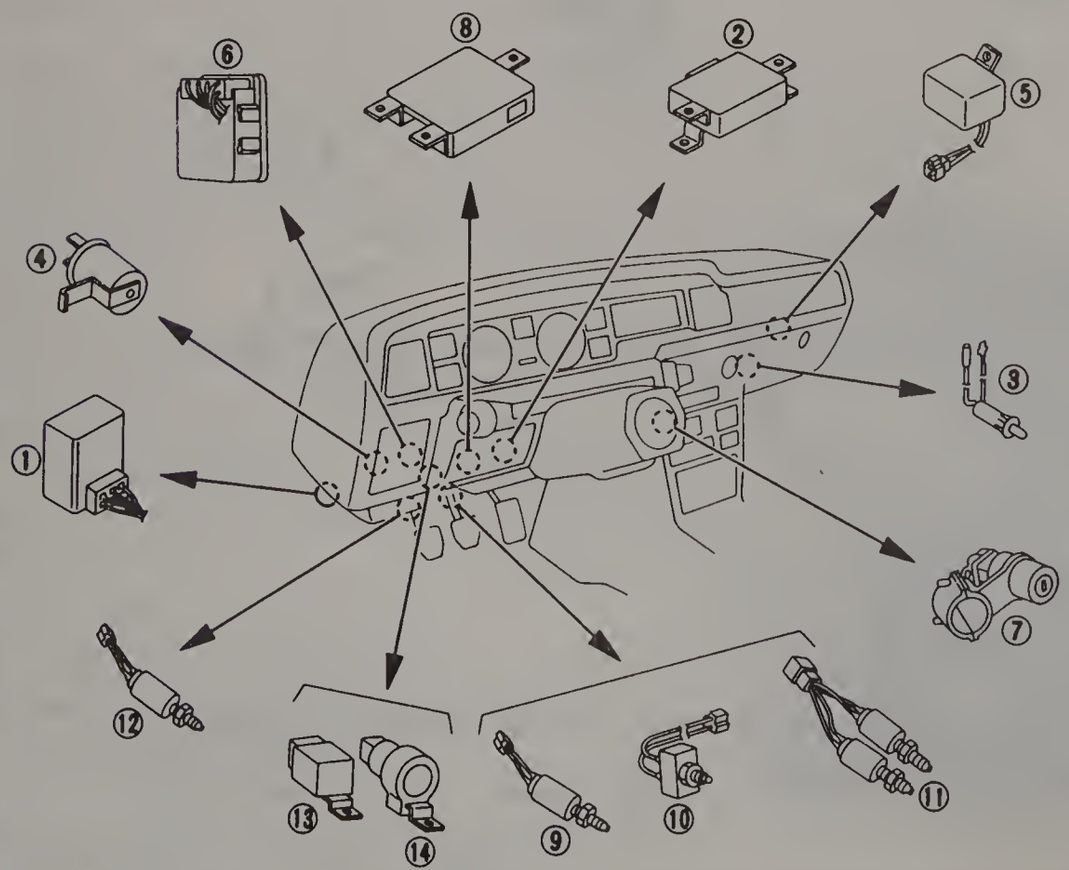


Fig. 10.21 Various under-dash electrical unit locations

1 Fuel pump control unit
2 Cruise control unit
3 Glove box switch
4 Intermittent wiper unit
5 Chime
6 Timer
7 Ignition and key warning unit
8 ECM
9 Stoplight switch
10 Kick-down switch (A/T)
11 Stop and brake switch (cruise control)
12 Clutch switch (cruise control)
13 Turn signal and hazard flasher
14 Kick-down relay (A/T)

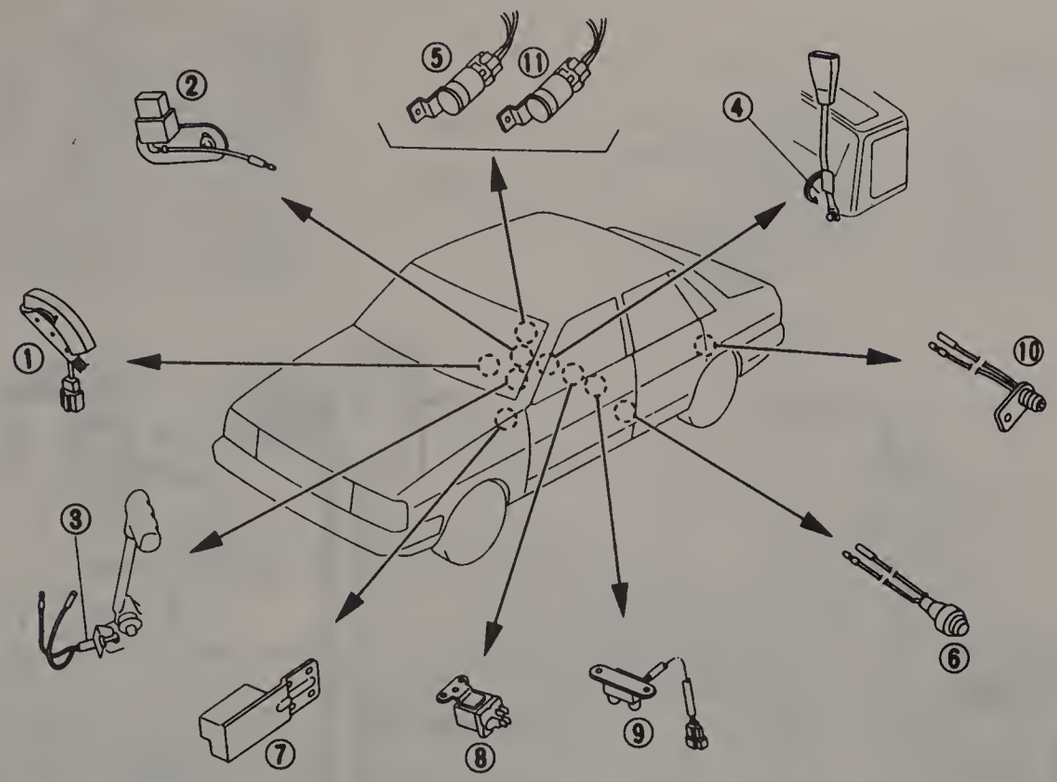


Fig. 10.22 Various interior electrical unit locations

1 *Inhibitor switch*
2 *Parking brake switch*
3 *4WD switch (dual range)*
4 *Seat belt switch*
5 *Ignition relay*
6 *Door switch (front)*
7 *Power window control unit*
8 *Power window relay*
9 *Power window breaker*
10 *Door switch (rear)*
11 *Automatic choke relay*

warning light does not operate, check the engine oil level first, then look for a damaged or disconnected wire.

2 To test the switch, connect an ohmmeter between the switch terminal and a good ground. The switch should make contact (continuity) when the ignition switch is On and the engine is not running. When the engine is running, the switch should break the circuit (no continuity). The operating pressure for the switch is over 4 psi.

3 If the coolant temperature gauge does not operate properly, but the engine does not overheat, remove the coolant temperature unit sensing from the intake manifold (be careful not to drop or strike it).

4 Attach one ohmmeter lead to each sensing unit wire terminal, then immerse the inner end of the sensing unit in a pan of heated water, along with a thermometer.

5 Check the resistance with the water at approximately 122°F, 187°F and 239°F (50, 86 and 115°C) and compare the results to the resistance figures in the Specifications (50, 86 and 115°C). If the readings are not as indicated, replace the sending unit with a new one.

6 When reinstalling the sending unit, apply sealant to the threads to prevent leaks.

16 Horn – check and adjustment

1 The horn is mounted in the engine compartment. On some models, two horns are used (a high tone and a low tone).

2 If the horn does not operate, check the fuse. If the fuse is in good condition make sure that there is current at the horn connections using a test light. If not, examine the wiring and switch contacts.

17 Rear window defogger – check and repair

1 Turn the defogger switch on.

2 Use a voltmeter and check each heating line at the center for voltage. A normal reading is about 6 volts.

3 If any of your readings fluctuate between 0 and 12 volts, that particular wire is broken or has a poor connection.

4 To find the exact portion of the line that is faulty, move the meter lead along the line until you notice an abrupt change in the reading.

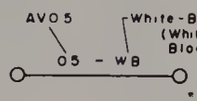
5 You can have that portion of the bad line repaired by taking your vehicle to an authorized Subaru dealer. This will preclude having to replace the whole window.

See overleaf for Wiring Diagrams

Wiring code used

	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	0.60 (0.24)	8.4
AV8	0.37 (0.15)	5.9
AV3	0.24 (0.09)	3.4
AV2	0.19 (0.07)	2.5
AV1.25	0.15 (0.06)	1.9
AV0.85	0.12 (0.05)	1.5
AV0.5	0.10 (0.04)	1.1

Example of the circuit indication



Color code of electric wires

W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Brock	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow - Blue	GL	Green - Blue	BR	Black - Red

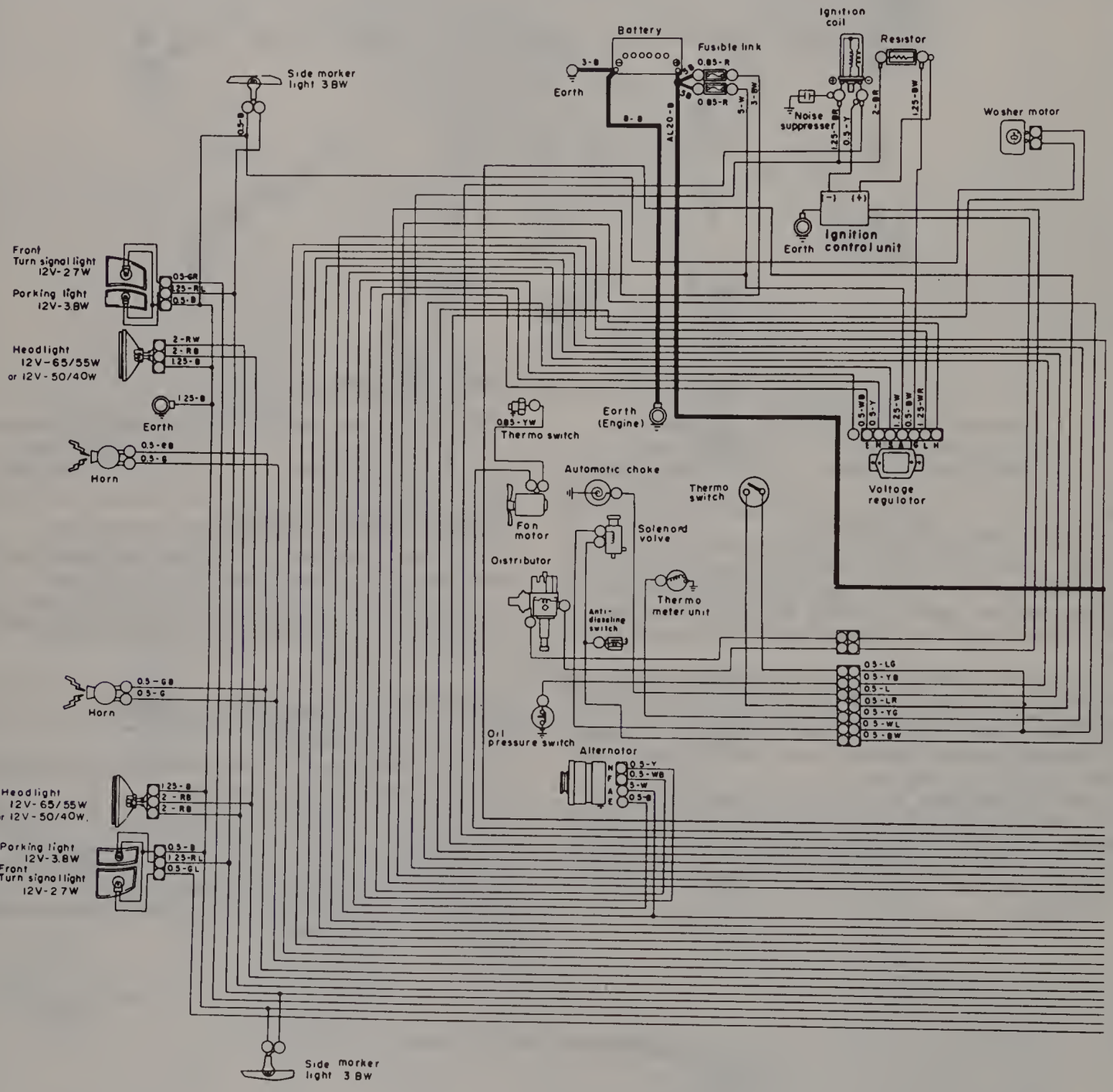


Fig. 10.23 1980/1981 North American models – 1 of 8

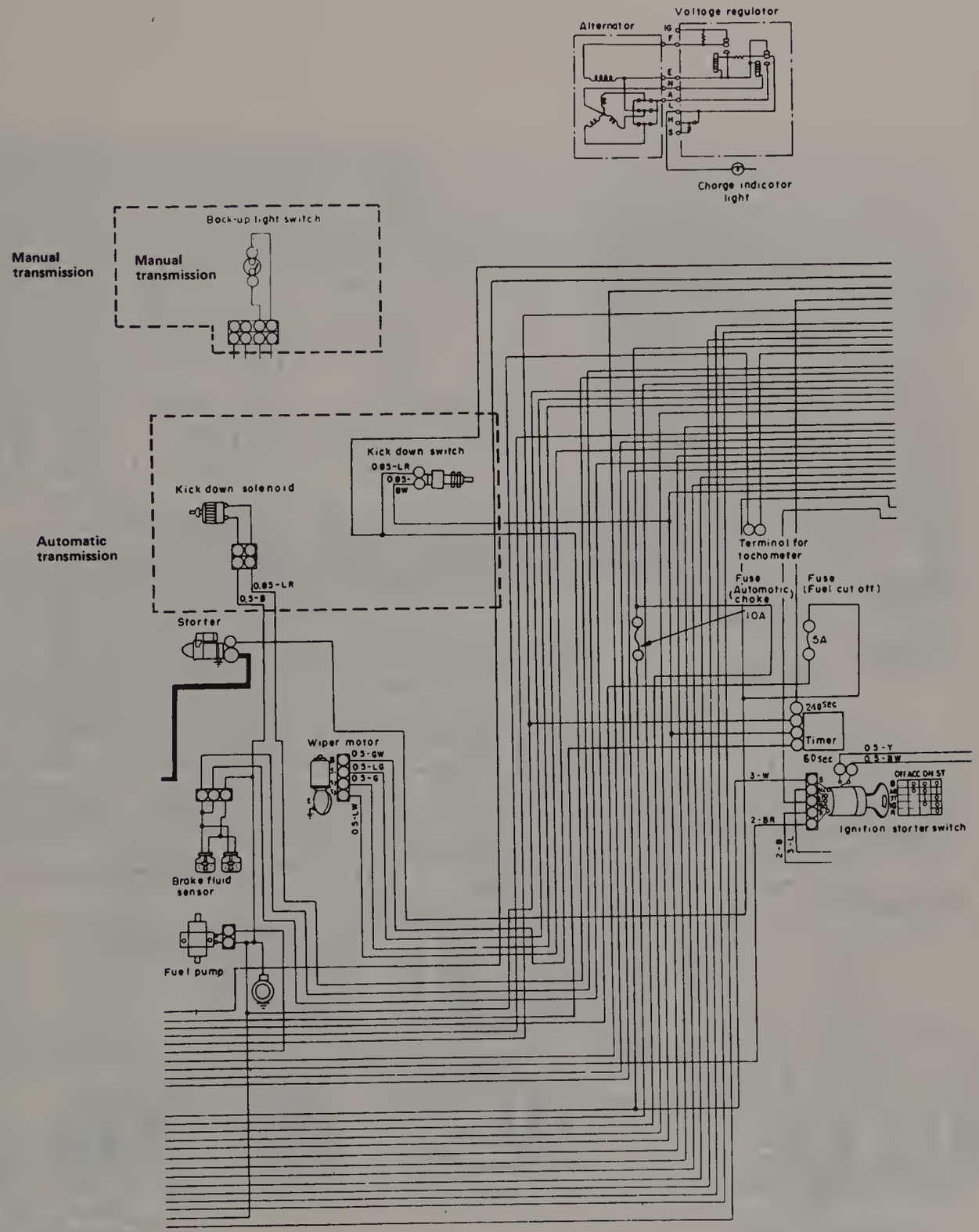


Fig. 10.24 1980/1981 North American models – 2 of 8

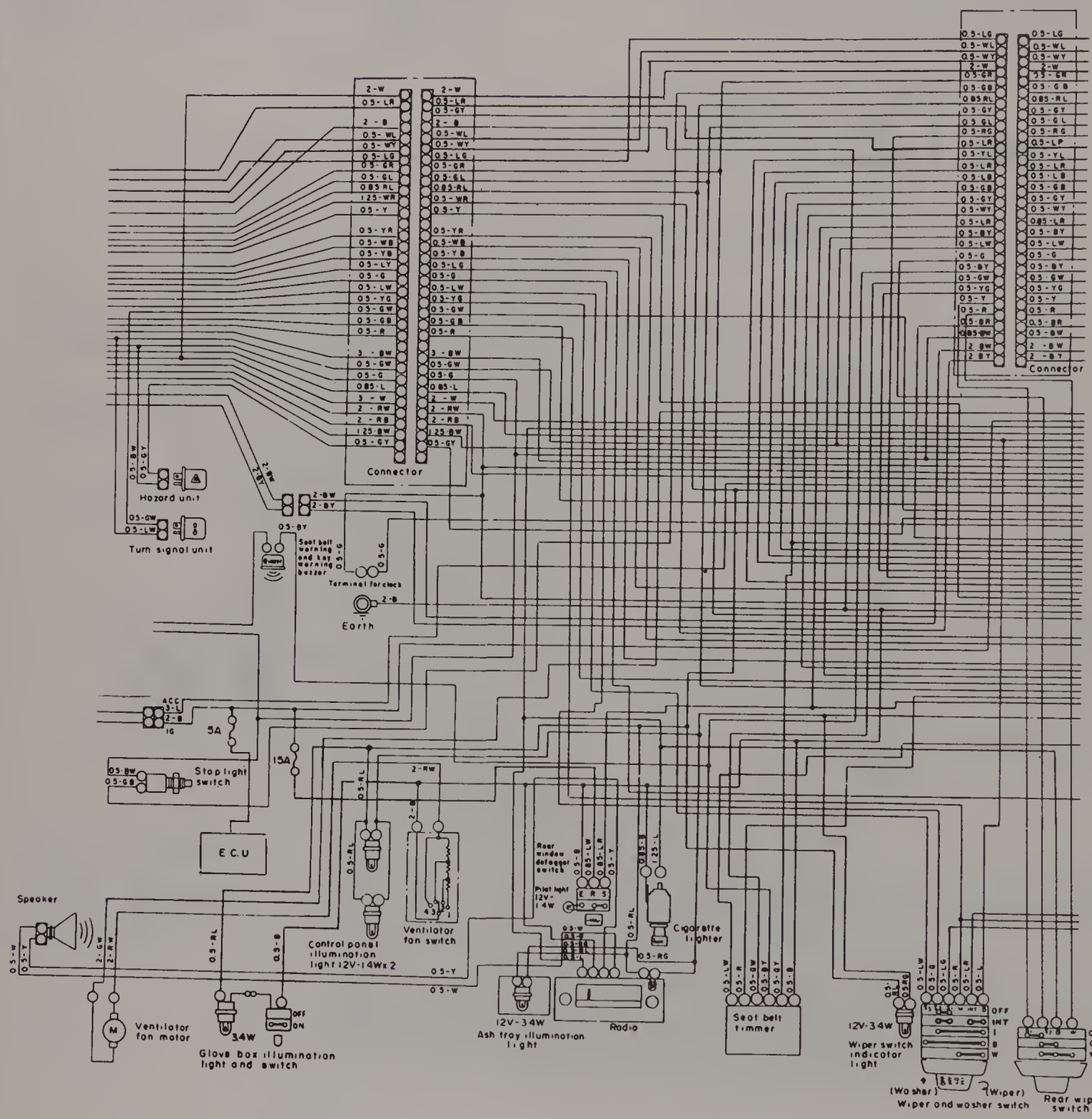


Fig. 10.25 1980/1981 North American models – 3 of 8

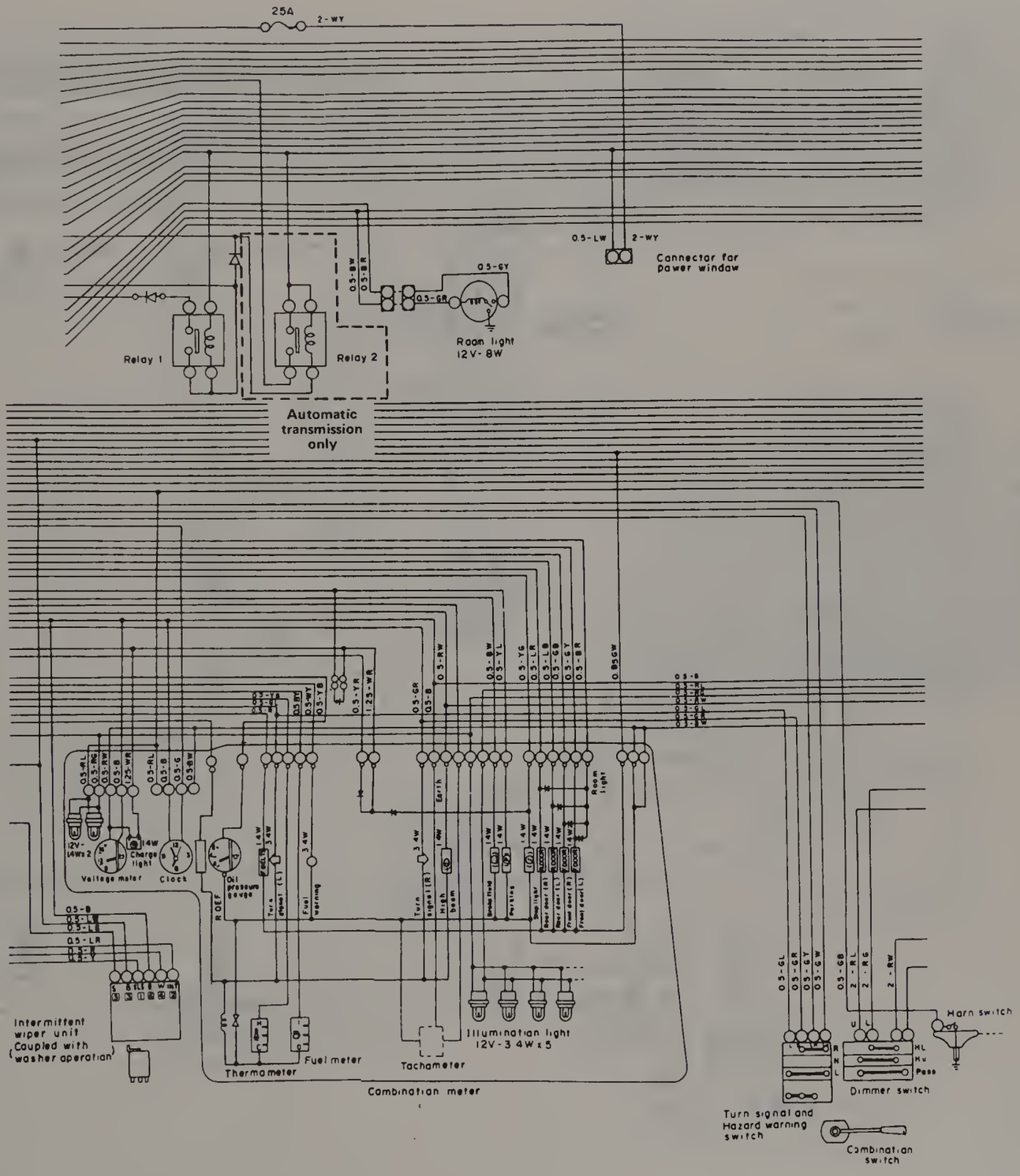


Fig. 10.26 1980/1981 North American models – 4 of 8

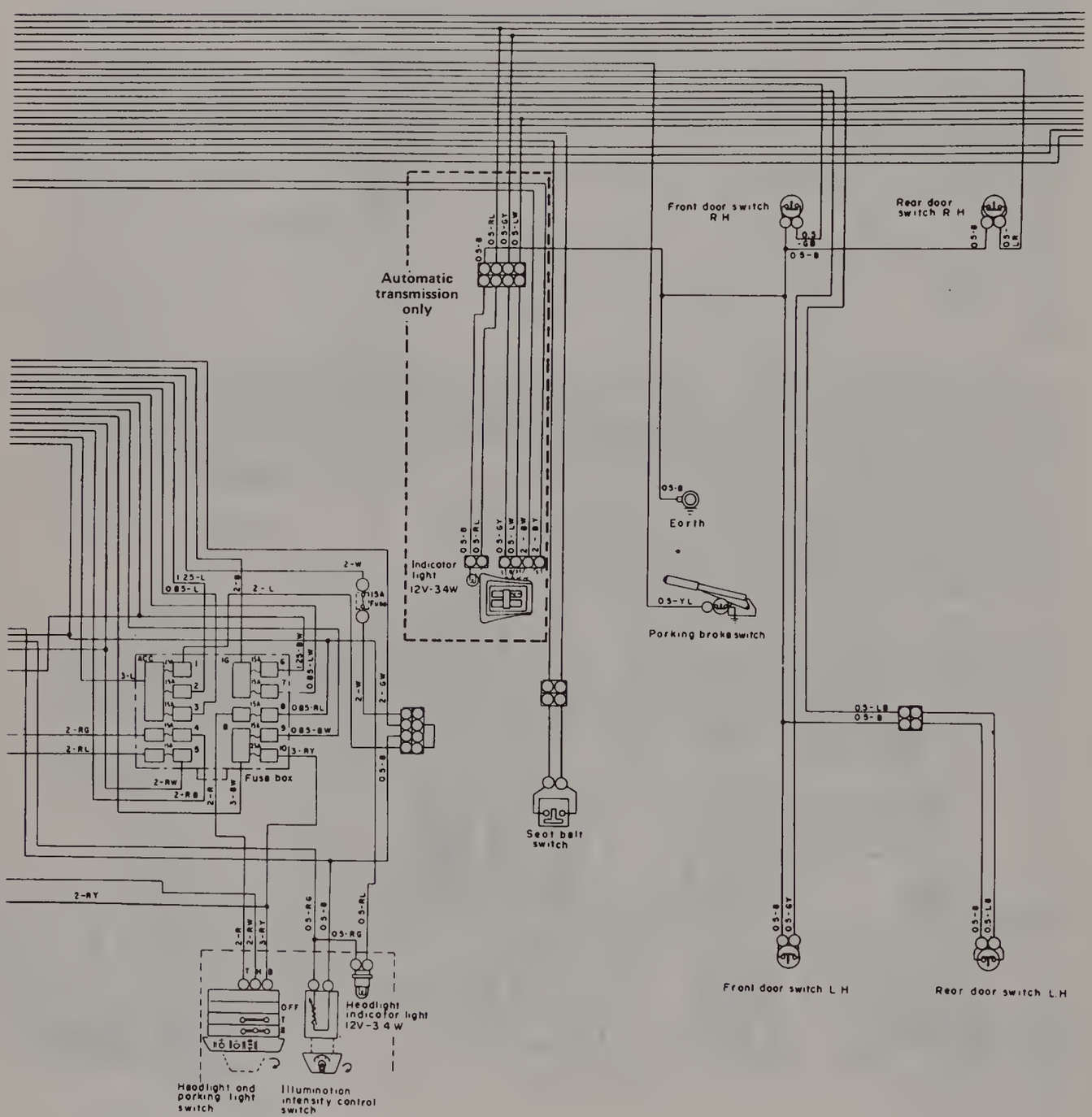
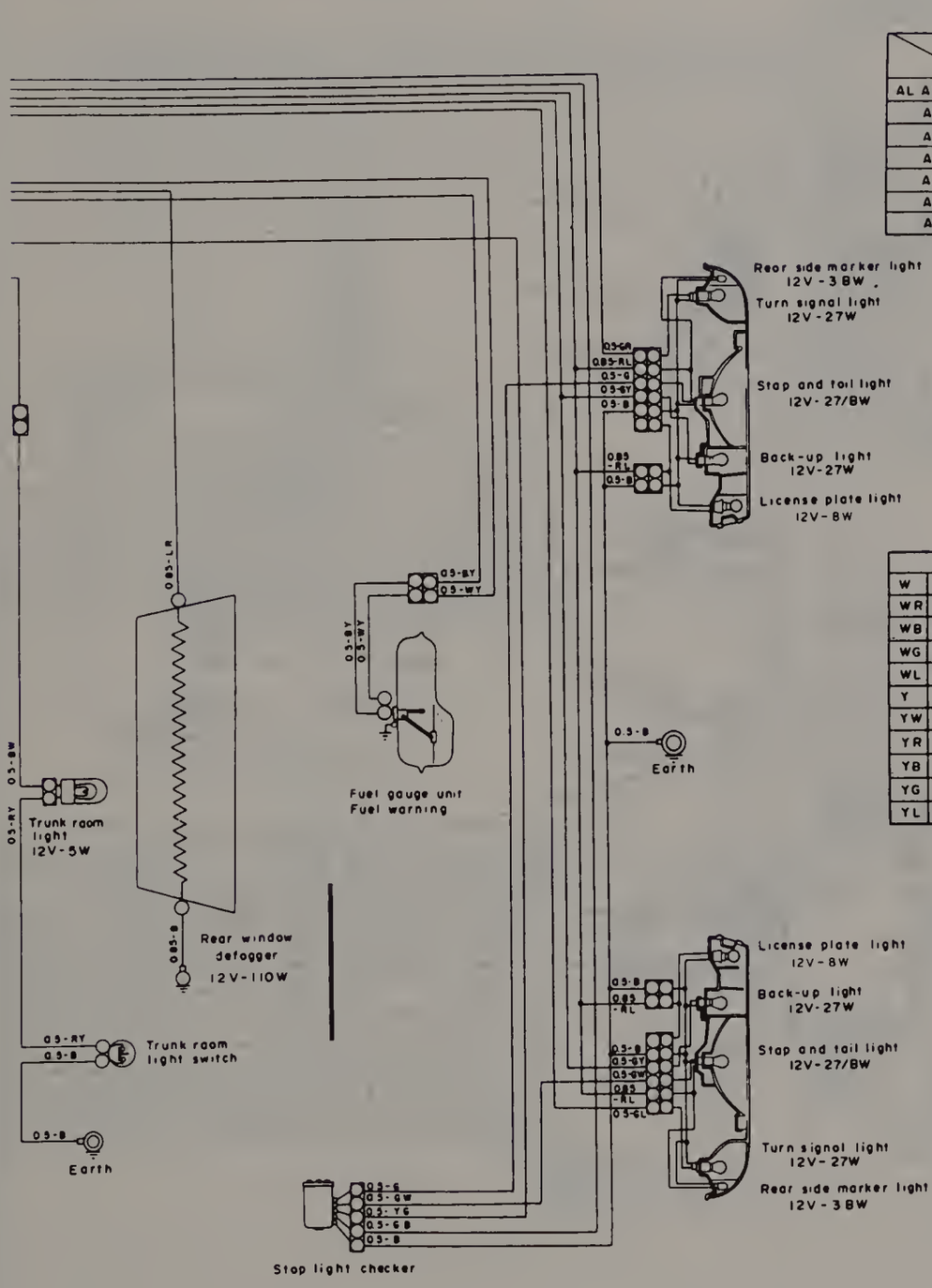


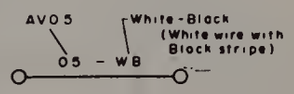
Fig. 10.27 1980/1981 North American models – 5 of 8



Wiring code used

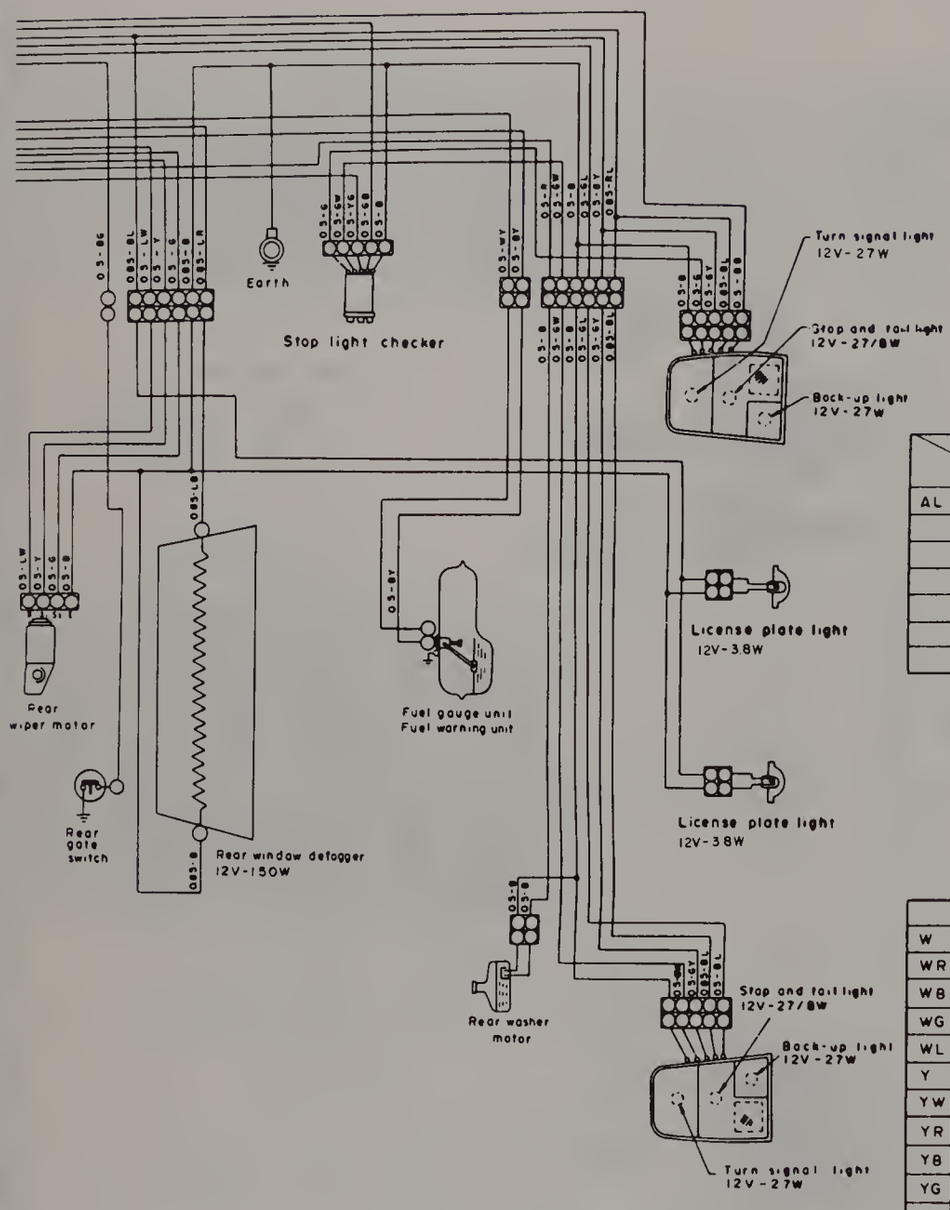
	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	0.60 (0.24)	8.4
AV8	0.37 (0.15)	5.9
AV3	0.24 (0.09)	3.4
AV2	0.19 (0.07)	2.5
AVI 25	0.15 (0.06)	1.9
AV0.85	0.12 (0.05)	1.5
AV0.5	0.10 (0.04)	1.1

Example of the circuit indication



Color code of electric wires					
W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Brack	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow - Blue	GL	Green - Blue	BR	Black - Red

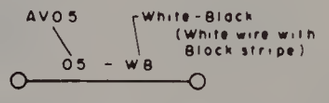
Fig. 10.28 1980/1981 North American models – 6 of 8 – (rear components on Sedan and Hardtop)



Wiring code used

	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	0.60 (0.24)	8.4
AV8	0.37 (0.15)	5.9
AV3	0.24 (0.09)	3.4
AV2	0.19 (0.07)	2.5
AVI 25	0.15 (0.06)	1.9
AV085	0.12 (0.05)	1.5
AV05	0.10 (0.04)	1.1

Example of the circuit indication



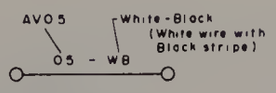
Color code of electric wires					
W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Brack	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow - Blue	GL	Green - Blue	BR	Black - Red

Fig. 10.29 1980/1981 North American models – 7 of 8 – (rear components on Station wagon)

Wiring code used

	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	0.60 (0.024)	8.4
AV8	0.37 (0.015)	5.9
AV3	0.24 (0.009)	3.4
AV2	0.19 (0.007)	2.5
AV125	0.15 (0.006)	1.9
AV085	0.12 (0.005)	1.5
AV05	0.10 (0.004)	1.1

Example of the circuit indication



Color code of electric wires					
W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Brack	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow - Blue	GL	Green - Blue	BR	Black - Red

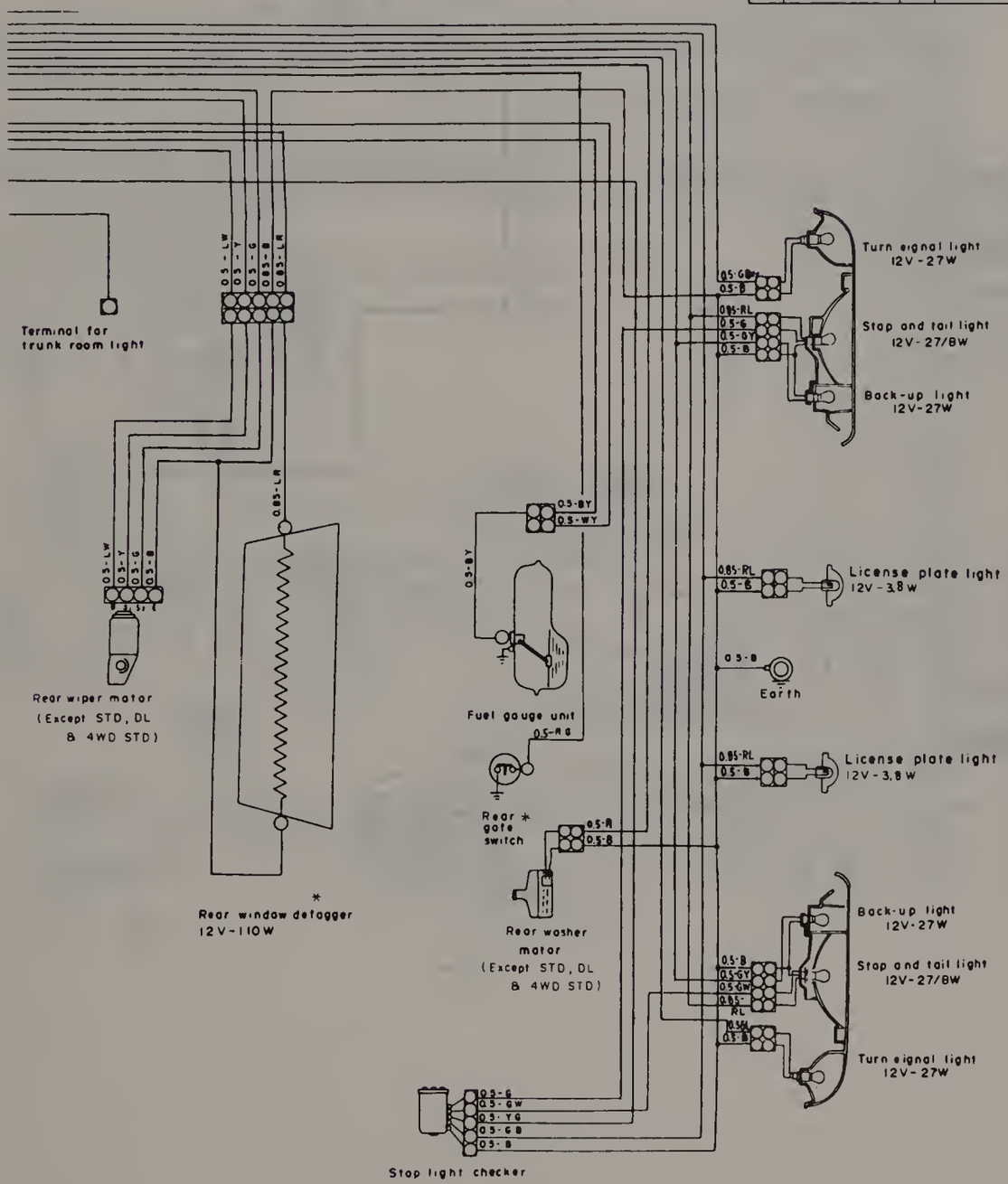


Fig. 10.30 1980/1981 North American models – 8 of 8 – (rear components on Hatchback)

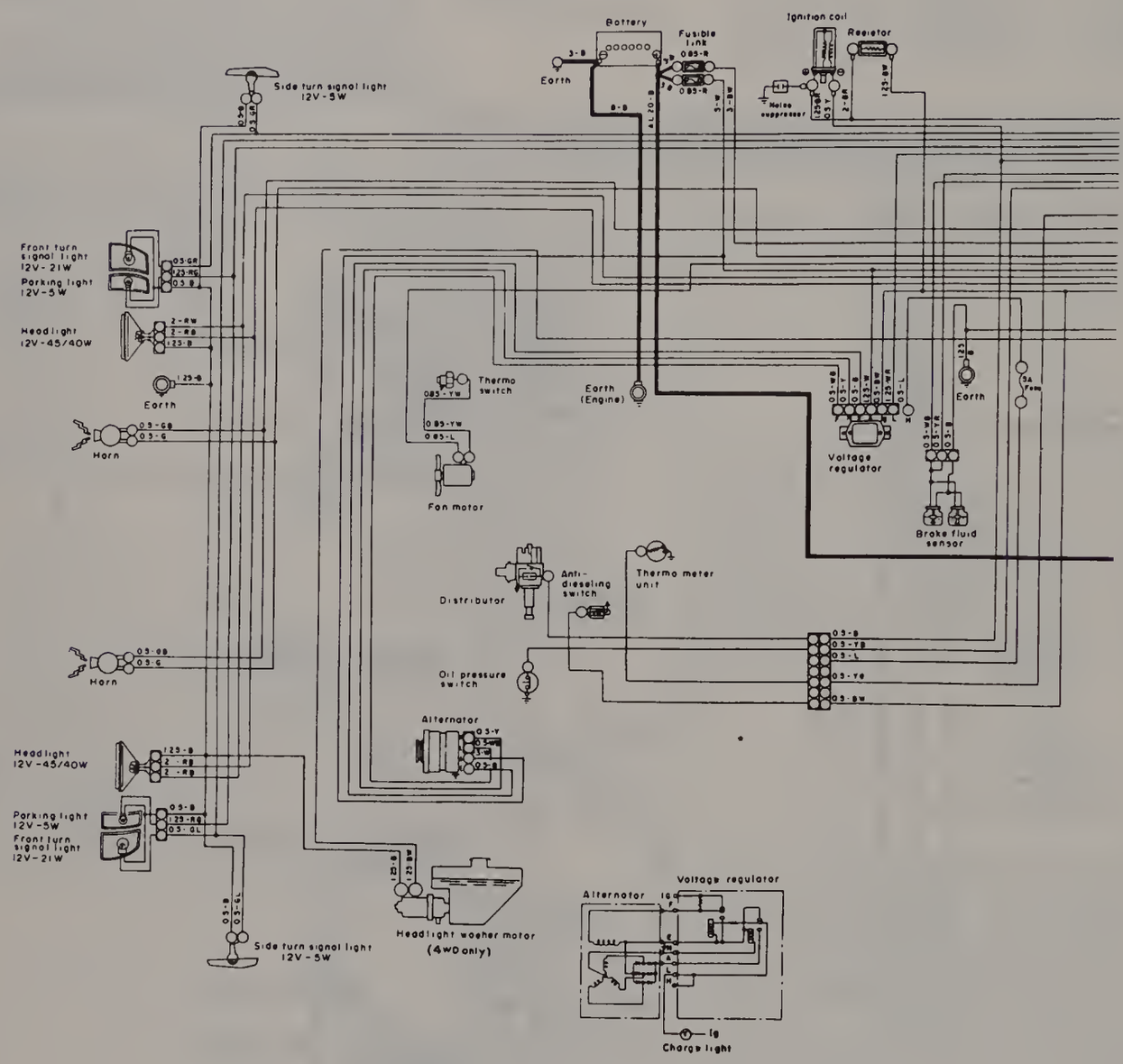


Fig. 10.31 1980/1981 UK models (right-hand drive) – 1 of 6

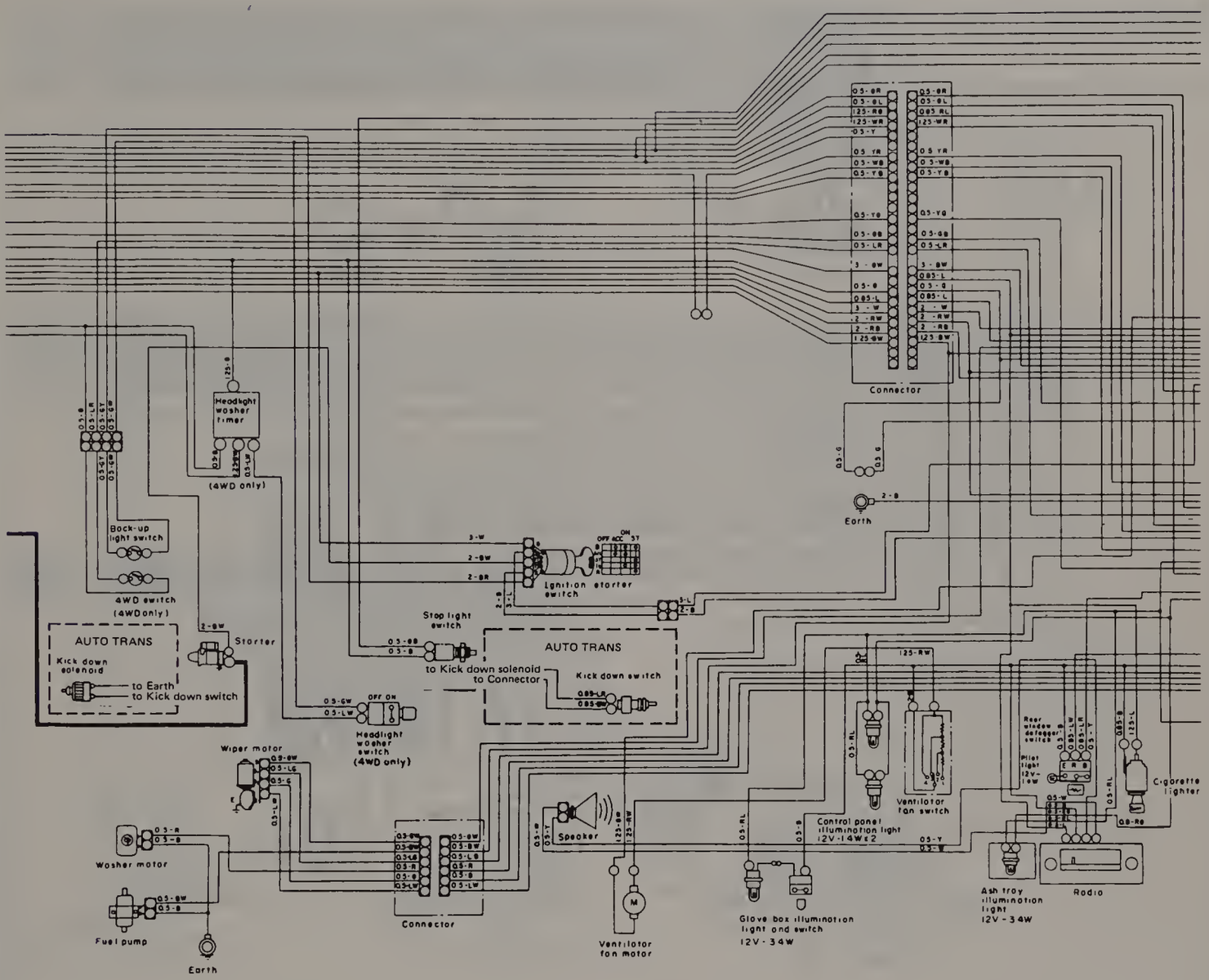


Fig. 10.32 1980/1981 UK models (right-hand drive) – 2 of 6

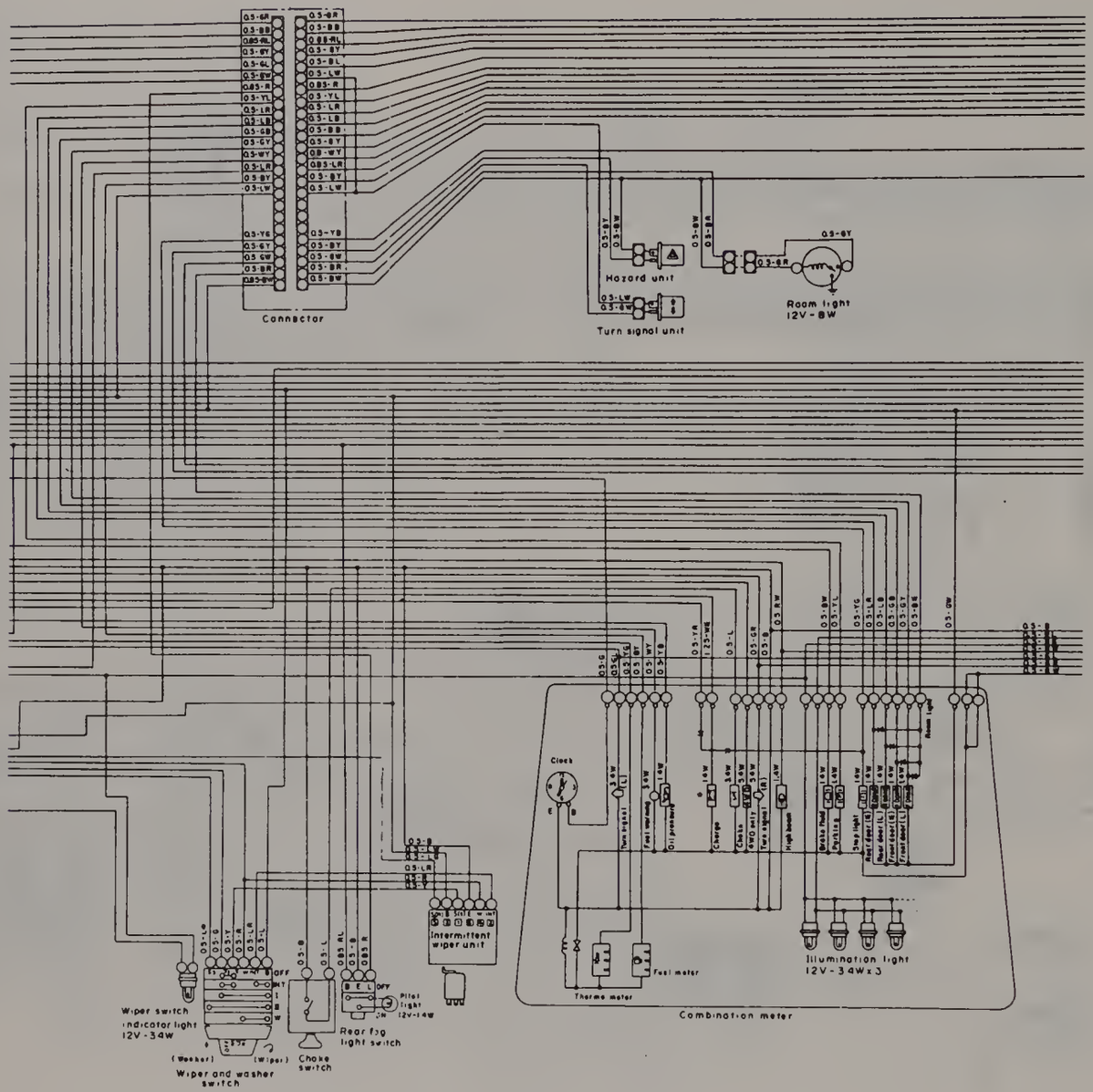


Fig. 10.33 1980/1981 UK models (right-hand drive) – 3 of 6

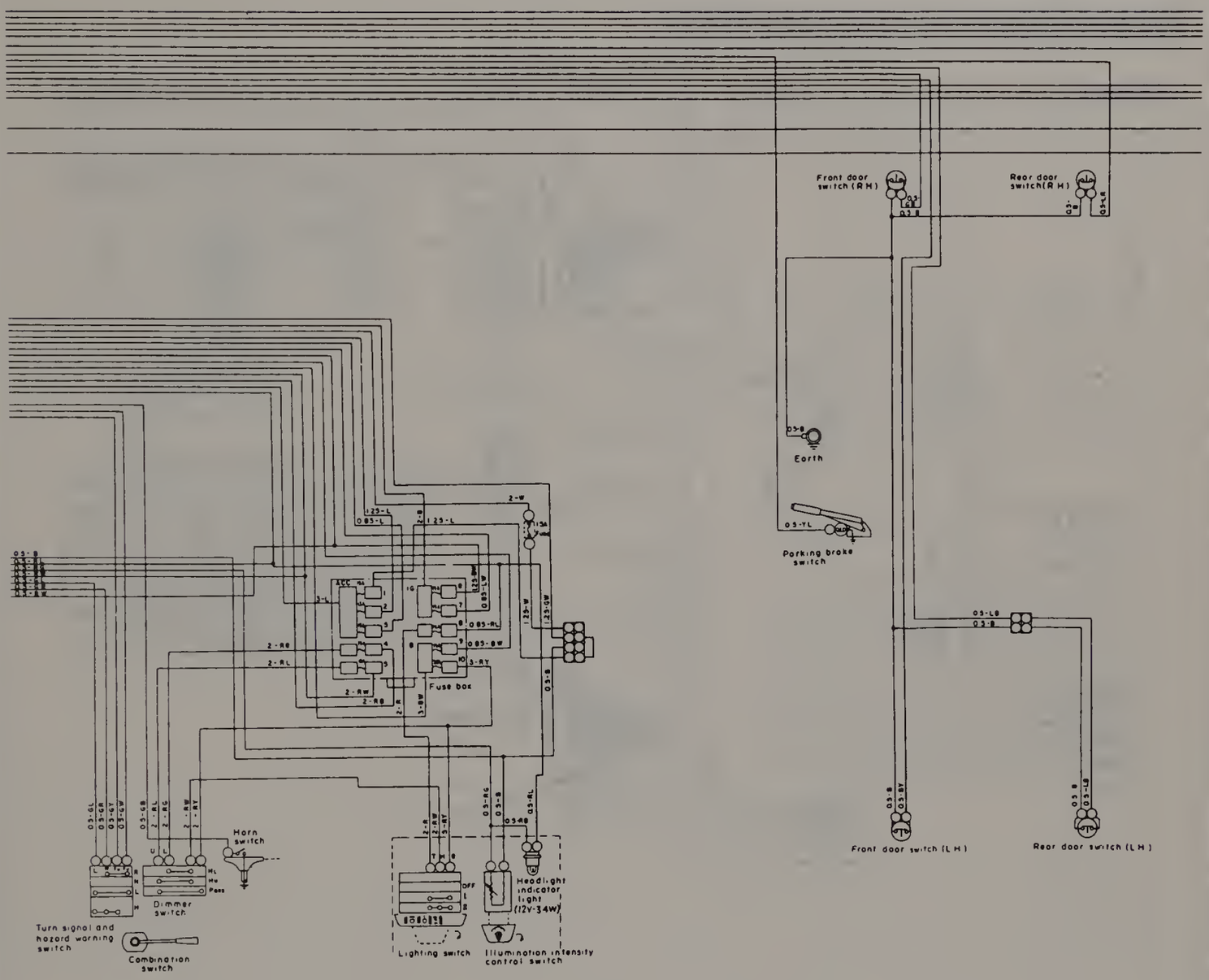
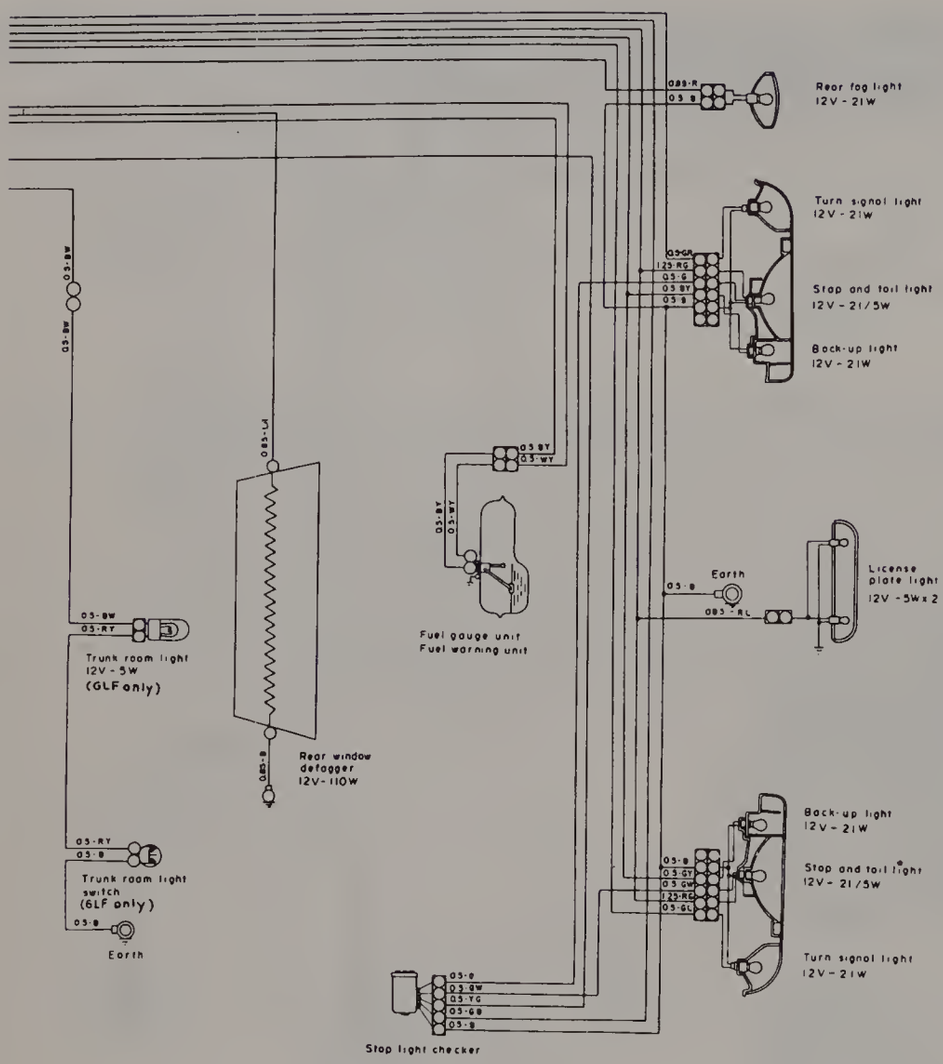


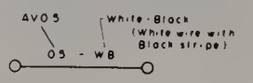
Fig. 10.34 1980/1981 UK models (right-hand drive) – 4 of 6



Wiring code used

	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	0.60 (0.024)	8.4
AV8	0.37 (0.015)	5.9
AV3	0.24 (0.009)	3.4
AV2	0.19 (0.007)	2.5
AV1.25	0.15 (0.006)	1.9
AV0.85	0.12 (0.005)	1.5
AV0.5	0.10 (0.004)	1.1

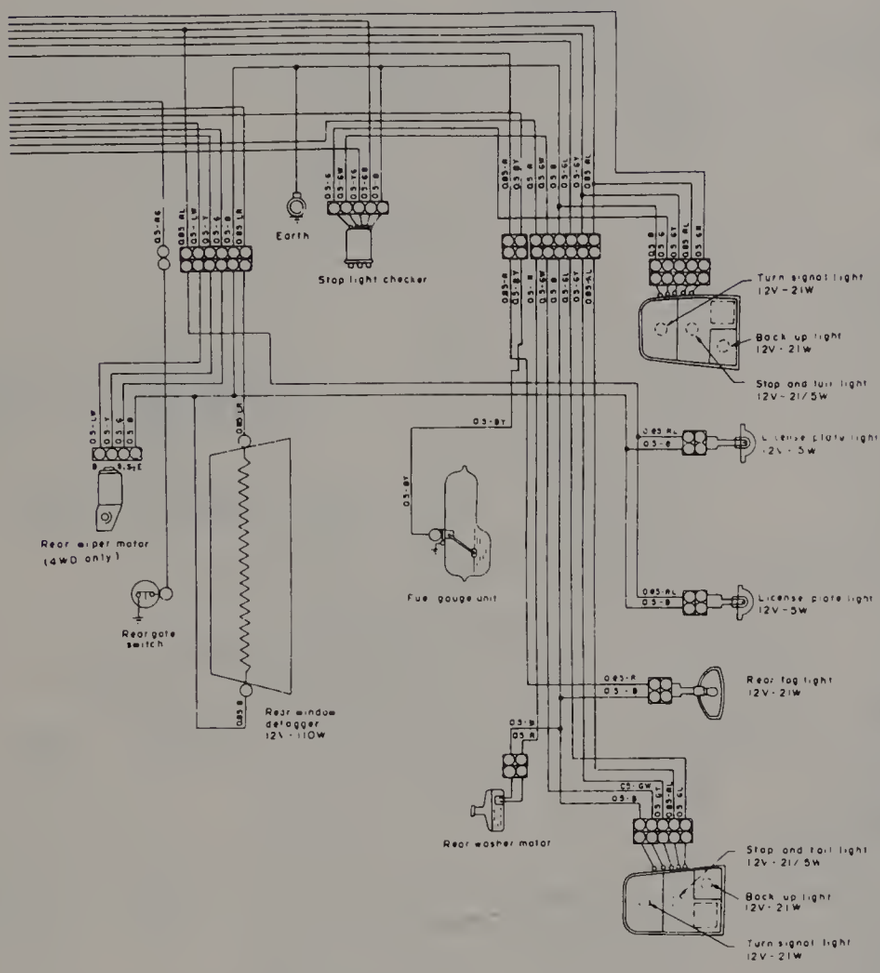
Example of the circuit indication



Color code of electric wires

W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Black	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow - Blue	GL	Green - Blue	BR	Black - Red

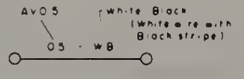
Fig. 10.35 1980/1981 UK models – 5 of 6 – (right-hand drive) – (rear components on all except Station wagon)



Wiring code used

	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	0.60 (0.024)	8.4
AV8	0.37 (0.015)	5.9
AV3	0.24 (0.009)	3.4
AV2	0.19 (0.007)	2.5
AVI.25	0.15 (0.006)	1.9
AV0.85	0.12 (0.005)	1.5
AV0.5	0.10 (0.004)	1.1

Example of the circuit indication



Color code of electric wires

W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Black	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow Blue	GL	Green - Blue	BR	Black Red

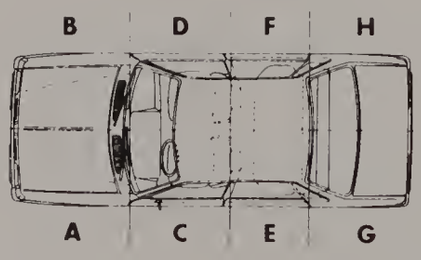
Fig. 10.36 1980/1981 UK models (right-hand drive) – 6 of 6 (rear components on Station wagon)

		Component	• Section	Location	Remark
Connector	*1	CONNECTOR	C	In instrument panel	for clock
	*2	CONNECTOR	O	In instrument panel	For power window
Fuse	*3	FUSE (20A)	B	In front of strut mount tower	for condenser of A/C
		FUSE (20A)	C	In instrument panel	for blower relay of A/C
Relay	*4	AIR CONDITIONER RELAY	B	In front of strut mount tower	for A/C
	*5	CONDENSER FAN REALY	B	In front of strut mount tower	for A/C
	*6	HEADLIGHT RELAY	B	In front of strut mount tower	for A/C
	*7	IGNITION RELAY	O	Under front passenger's seat	
	*8	LIGHTING RELAY	B	In front of strut mount tower	
		RELAY	O	Under front passenger's seat	for center lamp
		RELAY	C	Under driver's seat	for power window
Switch	*9	ANTI-DIESELING SWITCH	A	Beside carburetor	
		CLUTCH SWITCH	C	On pedal bracket	for cruise control
		4WD SWITCH	Between A & B or C & D	On transmission or select lever	

		Component	• Section	Location	Remark
Switch	*11	INHIBITOR SWITCH	Between C & O	In AT selector cover	
	*12	KEY WARNING SWITCH	C	In ignition starter switch	
		LO SWITCH	Between A & B	On transmission	
		OIL PRESSURE SWITCH	Between A & B	On engine	
	*13	PARKING BRAKE SWITCH	Between C & D	On parking brake lever	
	*14	SEAT BELT SWITCH	C	In driver's seat belt buckle	
	*15	STOP LIGHT SWITCH	C	On pedal bracket	
		STOP & BRAKE SWITCH	C	On pedal bracket	for cruise control
	*16	THERMO SWITCH	B	On radiator	
	*17	VACUUM SWITCH (I)	B	On bulkhead	
	*18	VACUUM SWITCH (II)	B	On bulkhead	
Unit		CRUISE CONTROL UNIT	C	In instrument panel	
		CONTROL UNIT	C	In instrument panel	for power window
		CONTROL UNIT	B	In front of strut mount tower	for center lamp

		Component	• Section	Location	Remark
Unit	*19	FUEL GAUGE UNIT	Between G & H	On fuel tank	
	*20	FUEL WARNING UNIT	Between G & H	On fuel tank	
	*21	HAZARD UNIT	C	In instrument panel	
	*22	INTERMITTENT WIPER UNIT	C	In instrument panel	
	*23	OIL PRESSURE GAUGE UNIT	Between A & B	On engine	
	*24	TEMPERATURE GAUGE UNIT	B	On intake manifold	
	*25	TURN SIGNAL UNIT	C	In instrument panel	
Others	*26	ECM	C	Under steering column	
	*27	KICK-DOWN SOLENOID	B	On transmission	
	*28	O_2 SENSOR	B	On exhaust manifold	
	*29	SEAT BELT & WARNING CHIME	O	In instrument panel	
	*30	SEAT BELT TIMER	C	In instrument panel	

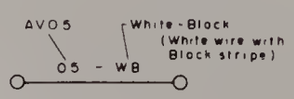
• Lettering (A,B,C ... H) shows locating section of each component in the following illustration



Wiring code used

	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	0.60 (0.024)	8.4
AV8	0.37 (0.015)	5.9
AV3	0.24 (0.009)	3.4
AV2	0.19 (0.007)	2.5
AV1.25	0.15 (0.006)	1.9
AV0.85	0.12 (0.005)	1.5
AV0.5	0.10 (0.004)	1.1

Example of the circuit indication



Color code of electric wires					
W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Black	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow - Blue	GL	Green - Blue	BR	Black - Red

Fig. 10.37 1982/1983 North American models – Key to Figs. 10.38 to 10.43

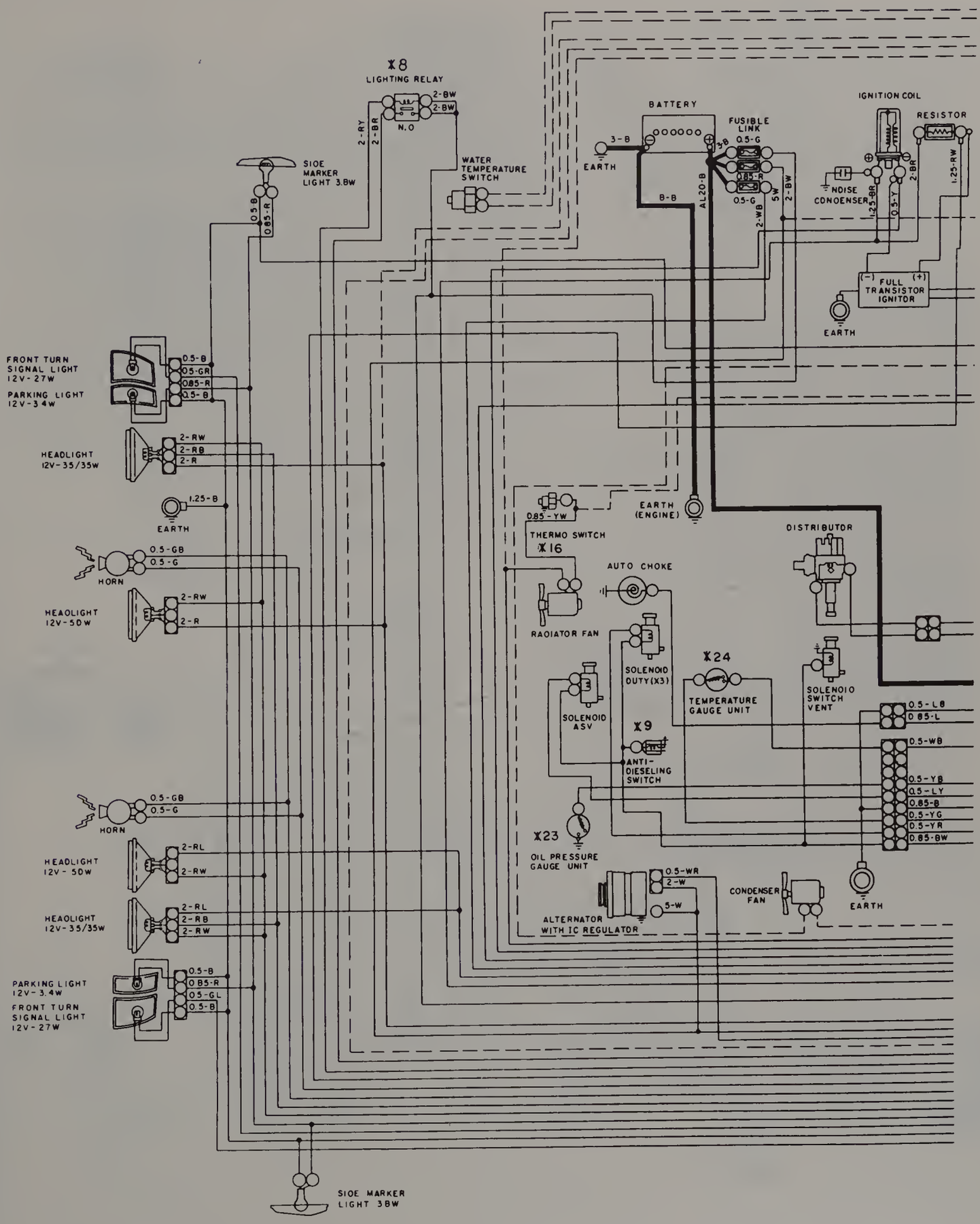


Fig. 10.38 1982/1983 North American models – 1 of 6

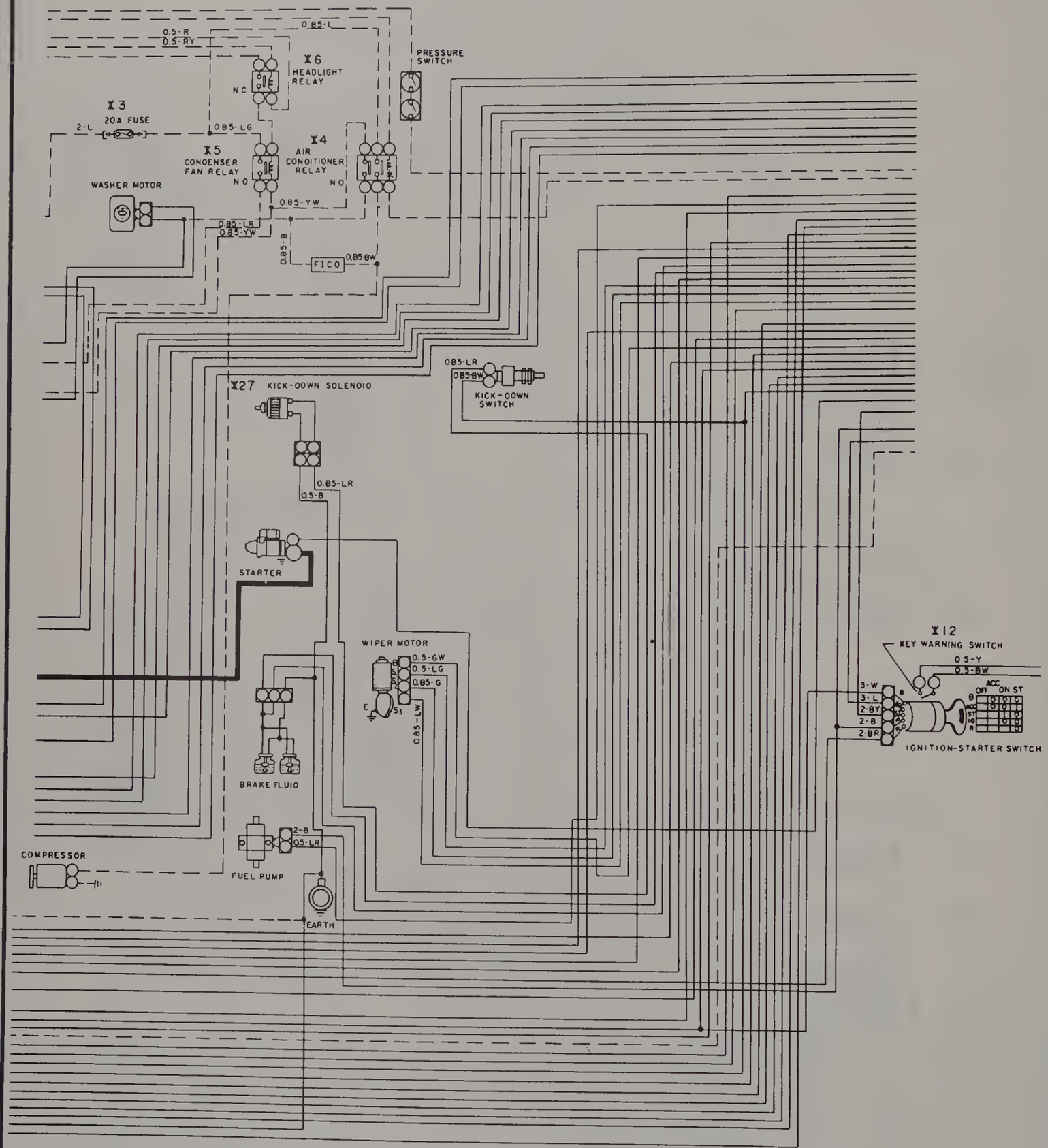


Fig. 10.39 1982/1983 North American models – 2 of 6

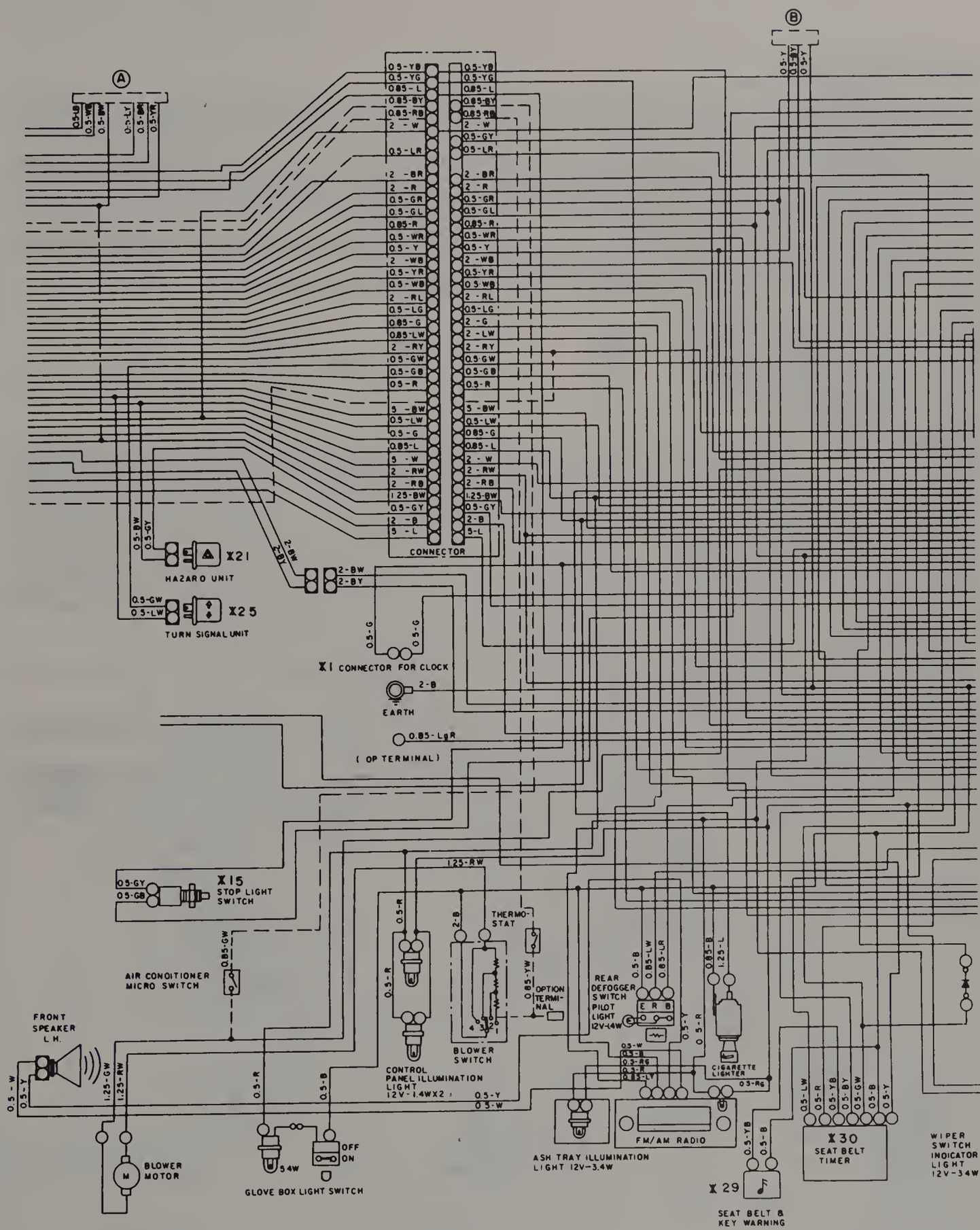


Fig. 10.40 1982/1983 North American models – 3 of 6

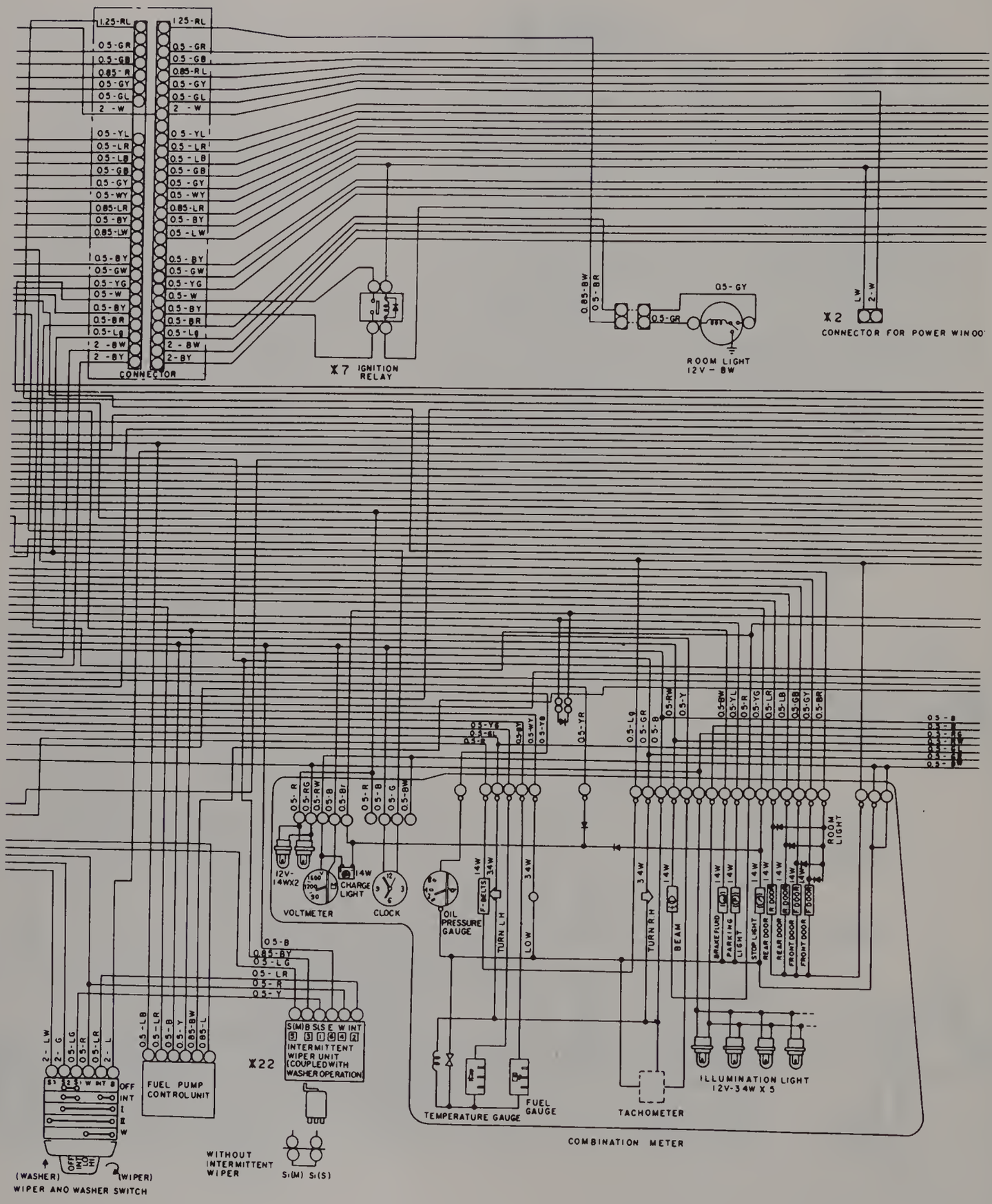


Fig. 10.41 1982/1983 North American models – 4 of 6

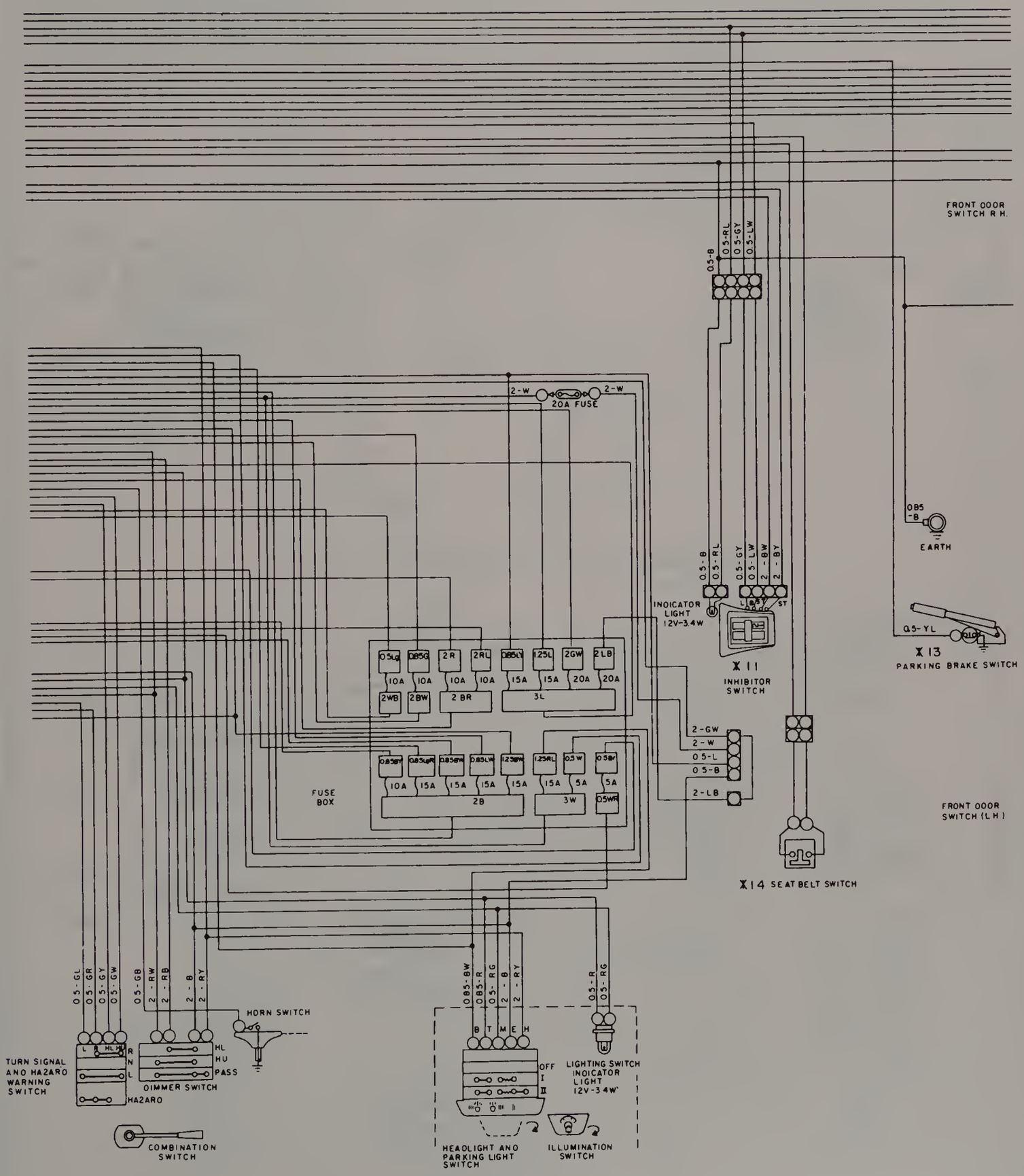
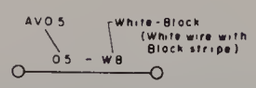


Fig. 10.42 1982/1983 North American models – 5 of 6

Wiring code used

	Outer diameter of conductor mm (in)	Allowable current (A)
AL AV20	60 (0.24)	8.4
AV8	37 (0.15)	5.9
AV3	24 (0.09)	3.4
AV2	19 (0.07)	2.5
AV1.25	15 (0.06)	1.9
AV0.85	12 (0.05)	1.5
AV0.5	10 (0.04)	1.1

Example of the circuit indication



Color code of electric wires					
W	White	R	Red	GB	Green - Black
WR	White - Red	RW	Red - White	L	Blue
WB	White - Black	RB	Red - Brack	LW	Blue - White
WG	White - Green	RG	Red - Green	LR	Blue - Red
WL	White - Blue	RL	Red - Blue	LY	Blue - Yellow
Y	Yellow	RY	Red - Yellow	LG	Blue - Green
YW	Yellow - White	G	Green	LB	Blue - Black
YR	Yellow - Red	GW	Green - White	B	Black
YB	Yellow - Black	GY	Green - Yellow	BW	Black - White
YG	Yellow - Green	GR	Green - Red	BY	Black - Yellow
YL	Yellow - Blue	GL	Green - Blue	BR	Black - Red

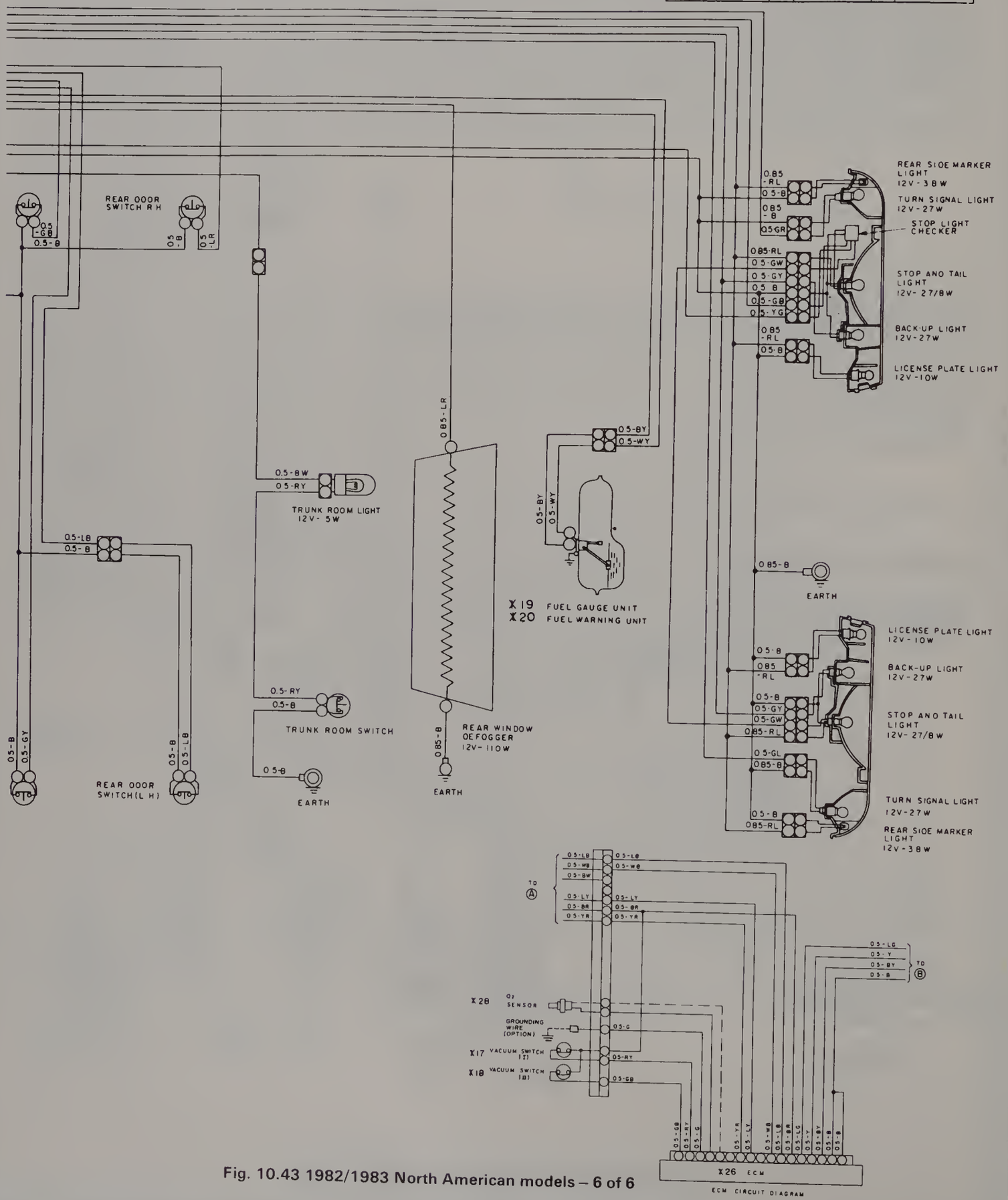


Fig. 10.43 1982/1983 North American models – 6 of 6

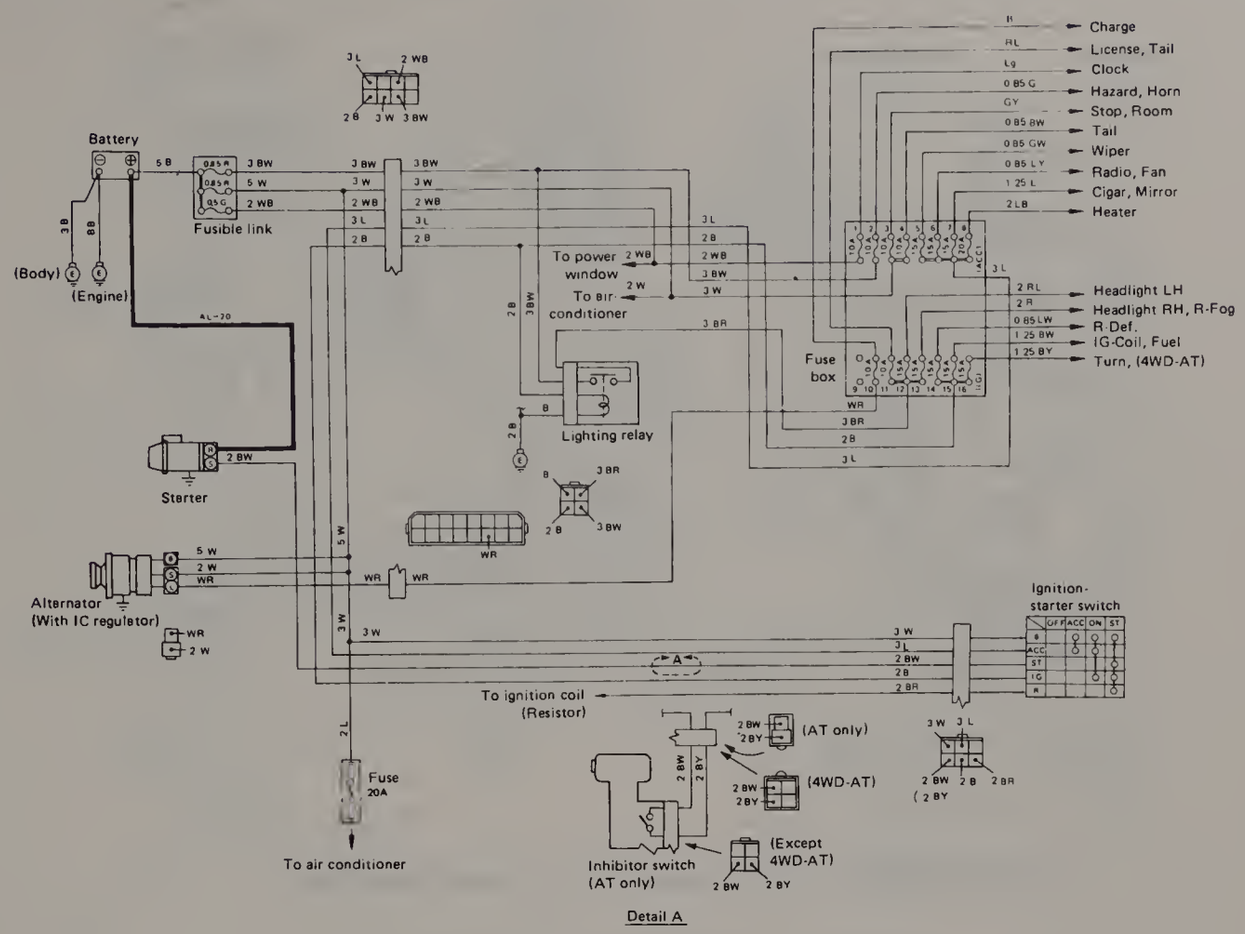


Fig. 10.44 1982/1983 UK models (1 of 16) – engine electrical

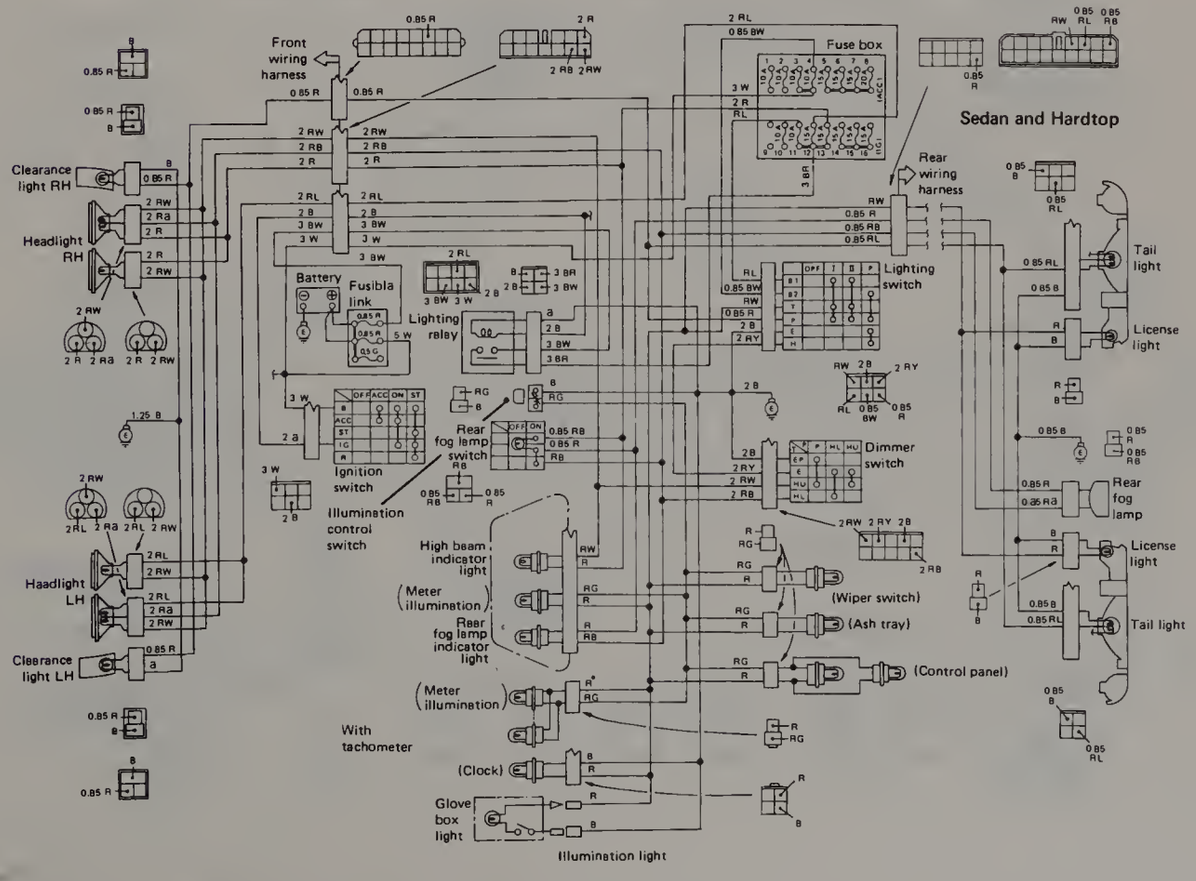


Fig. 10.45 1982/1983 UK models (2 of 16) – lighting

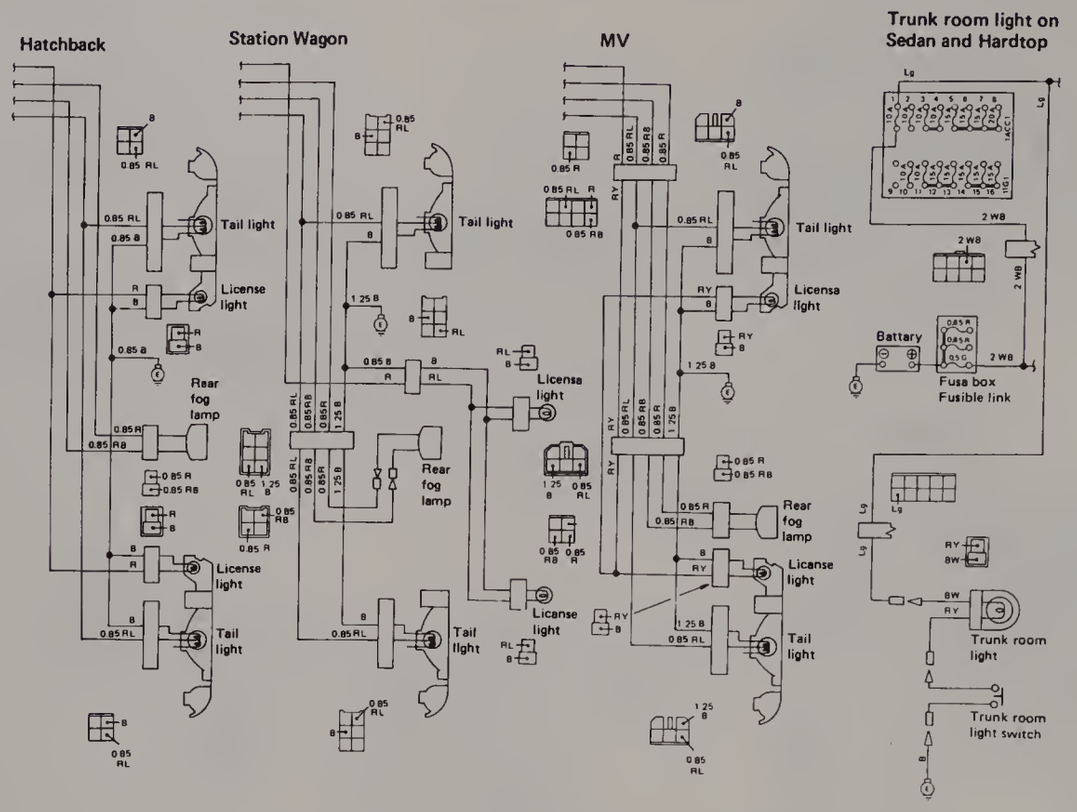


Fig. 10.46 1982/1983 UK models (3 of 16) – lighting (continued)

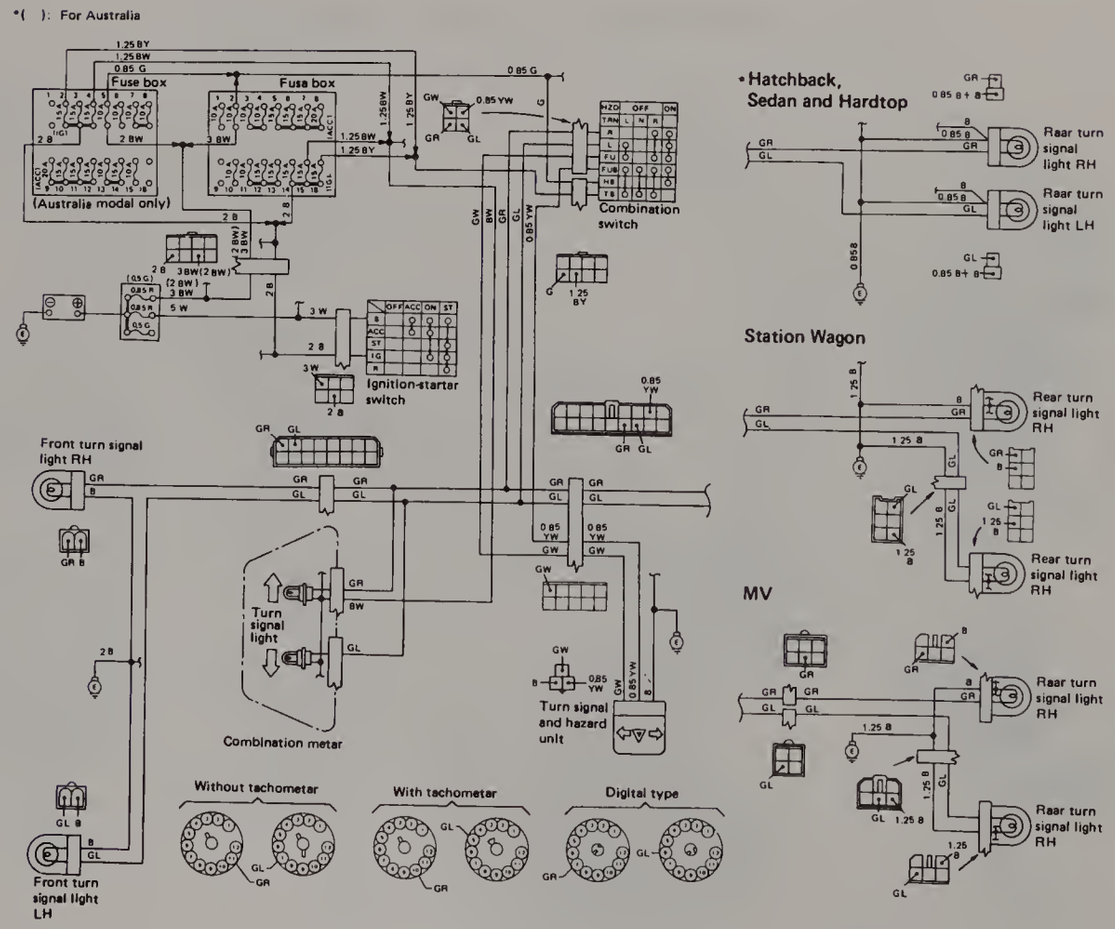


Fig. 10.47 1982/1983 UK models (4 of 16) – turn signal and hazard warning systems

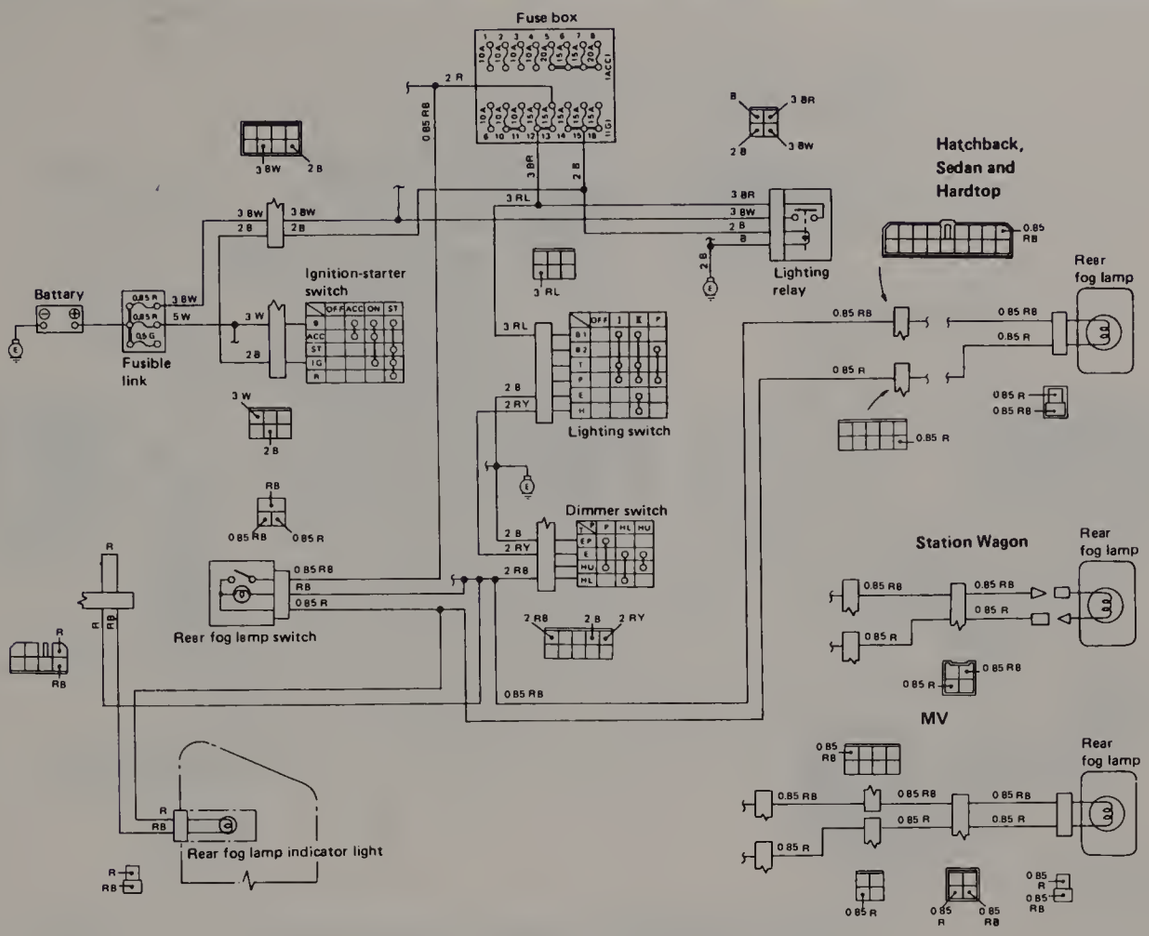


Fig. 10.48 1982/1983 UK models (5 of 16) – rear fog lamps

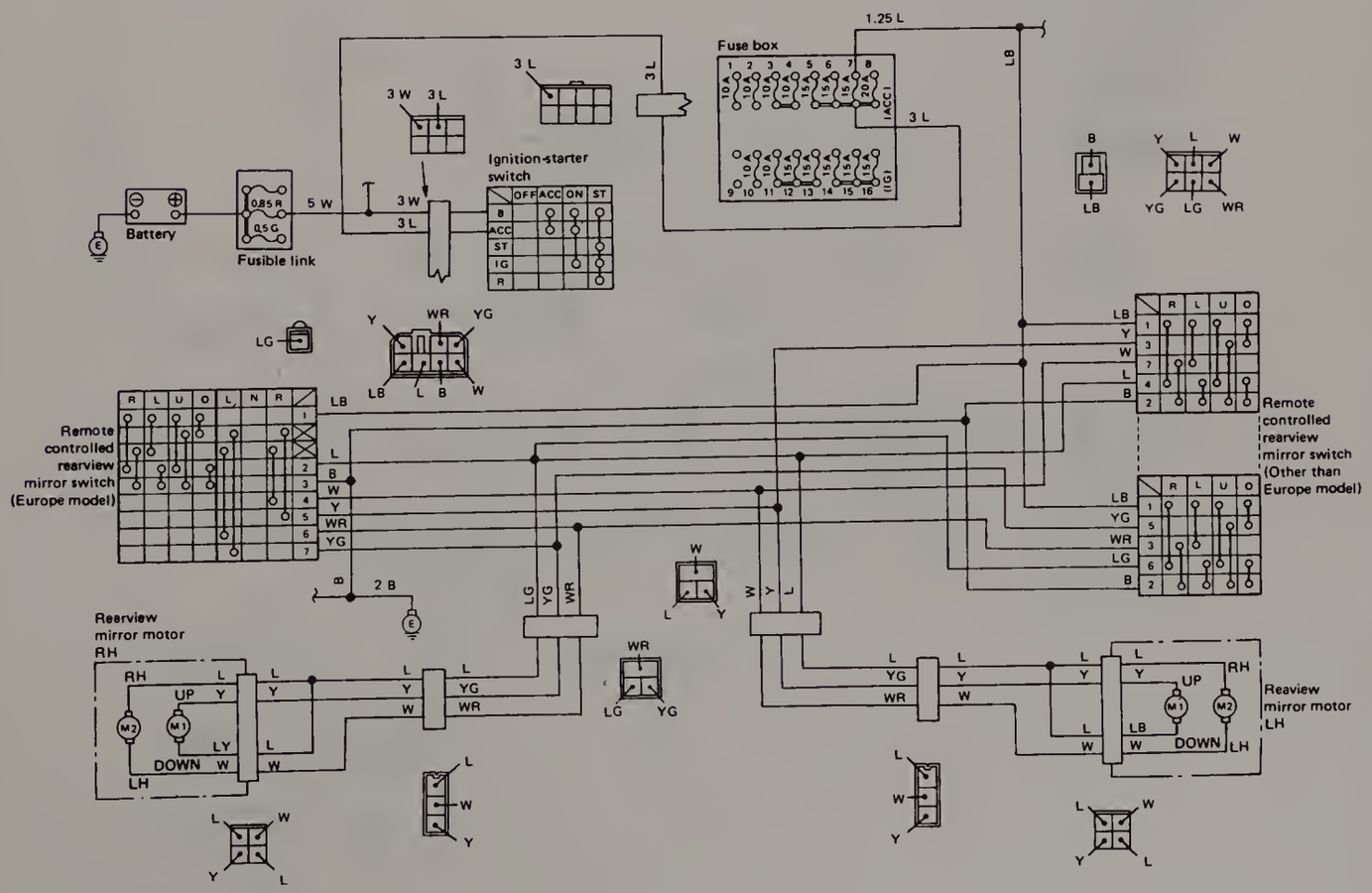


Fig. 10.49 1982/1983 UK models (6 of 16) – rear view mirrors

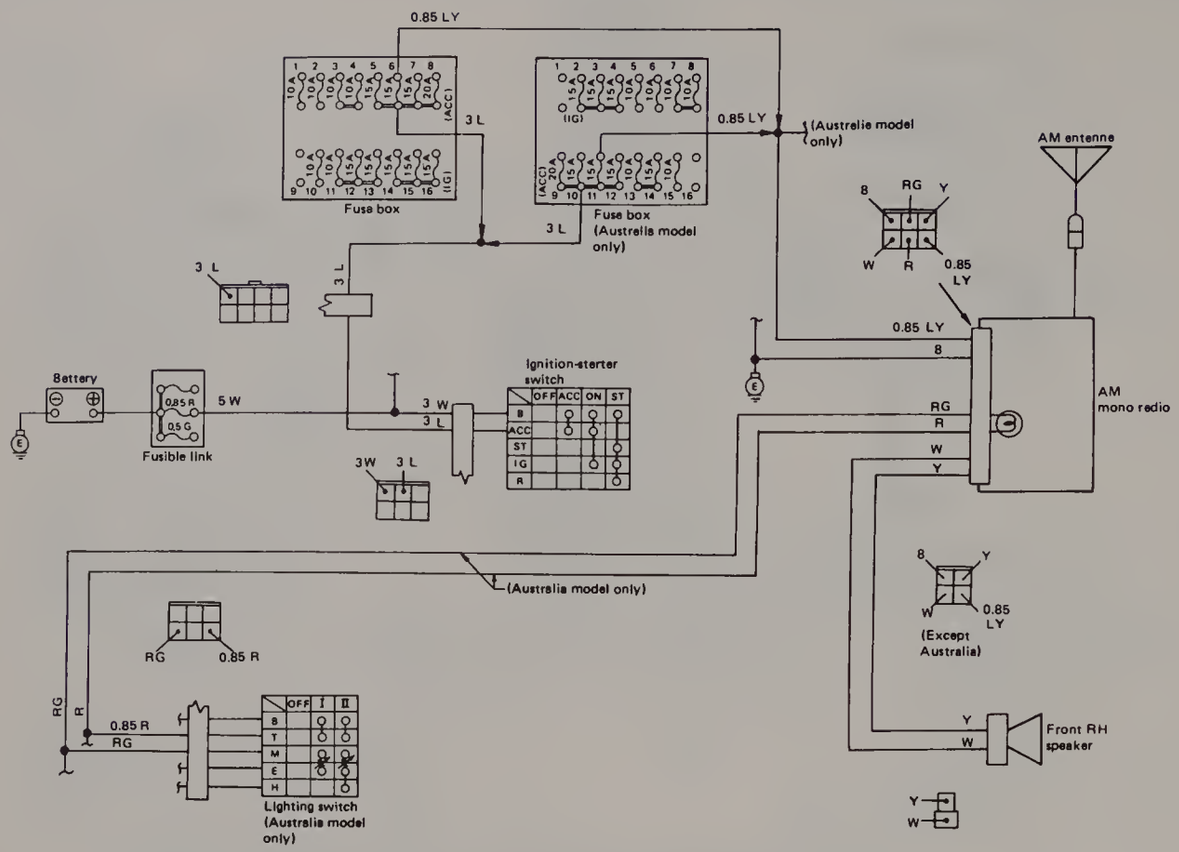


Fig. 10.50 1982/1983 UK models (7 of 16) – AM radio

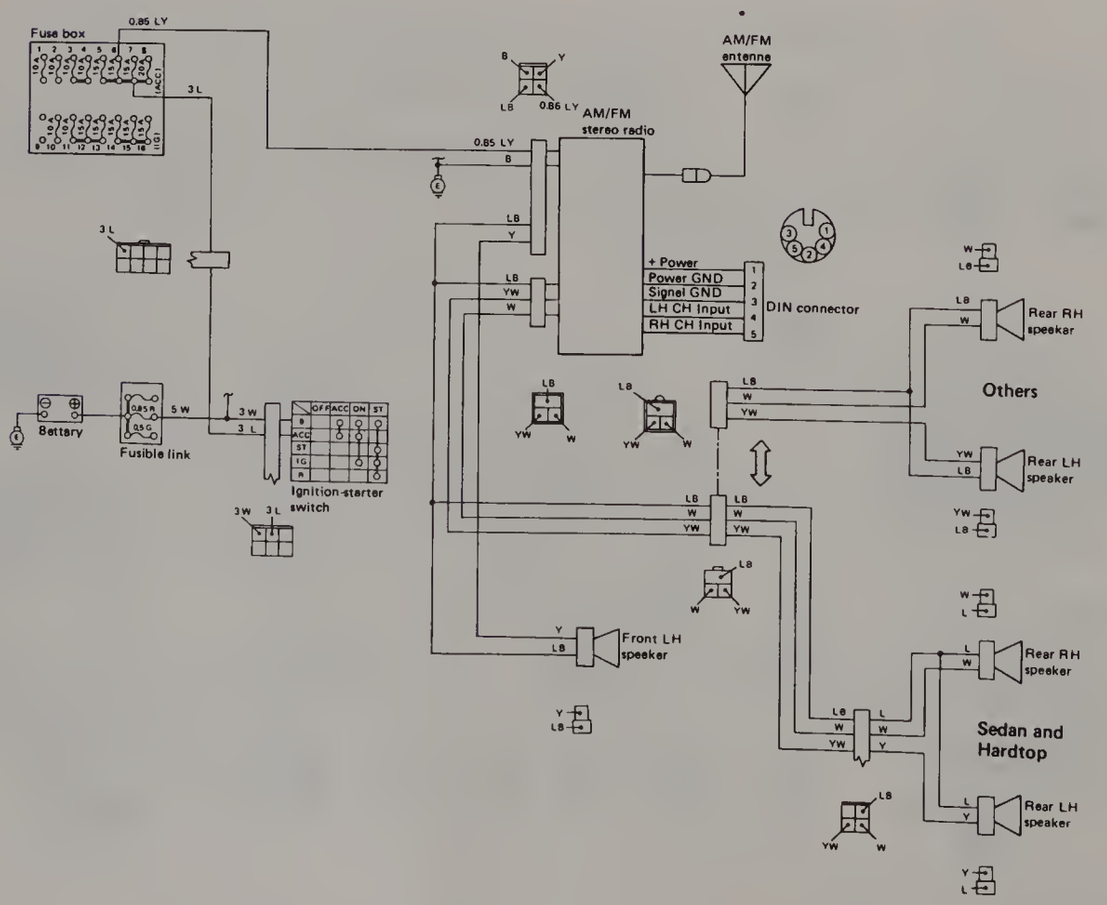


Fig. 10.51 1982/1983 UK models (8 of 16) – AM/FM radio

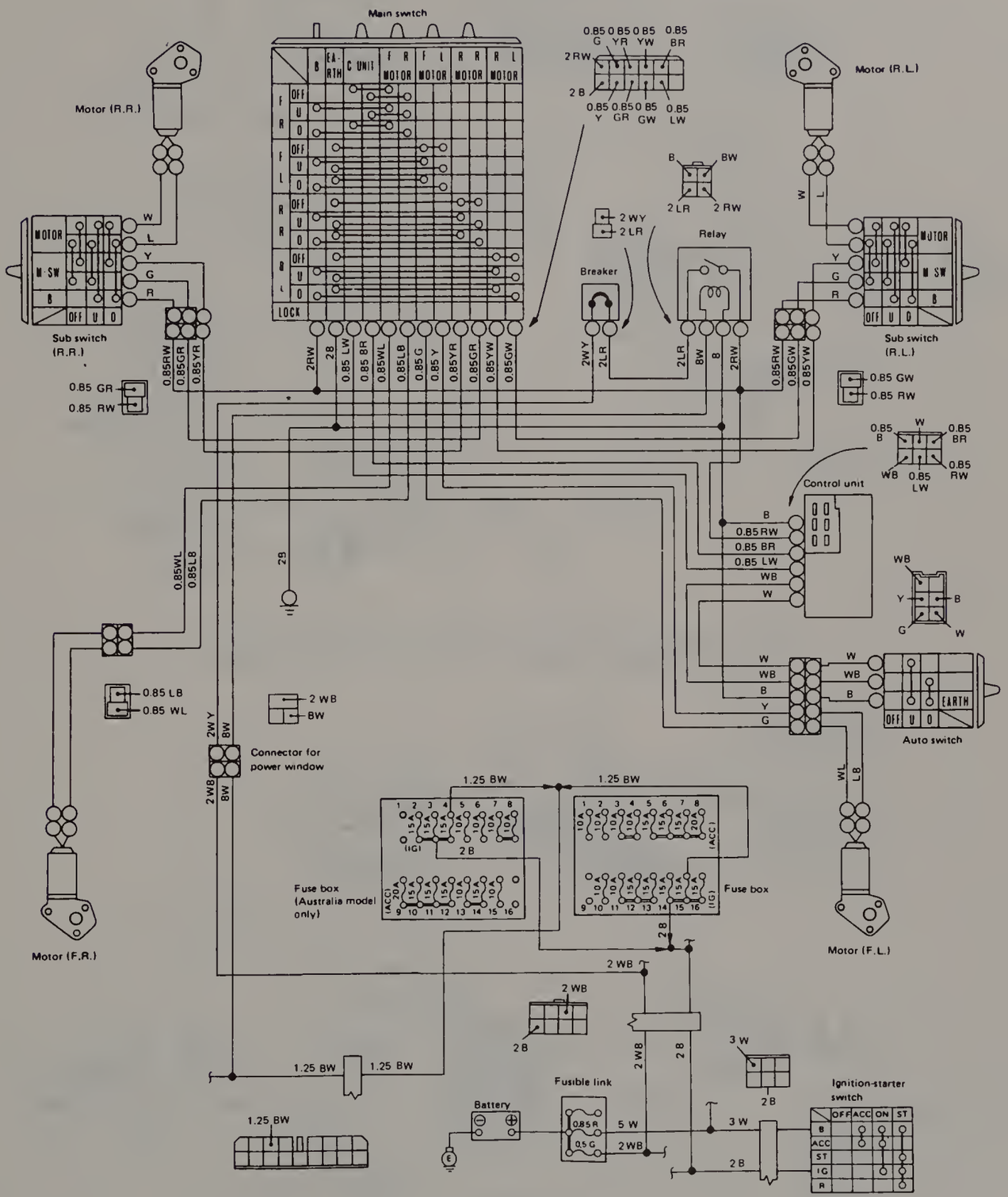


Fig. 10.52 1982/1983 UK models (9 of 16) – power windows

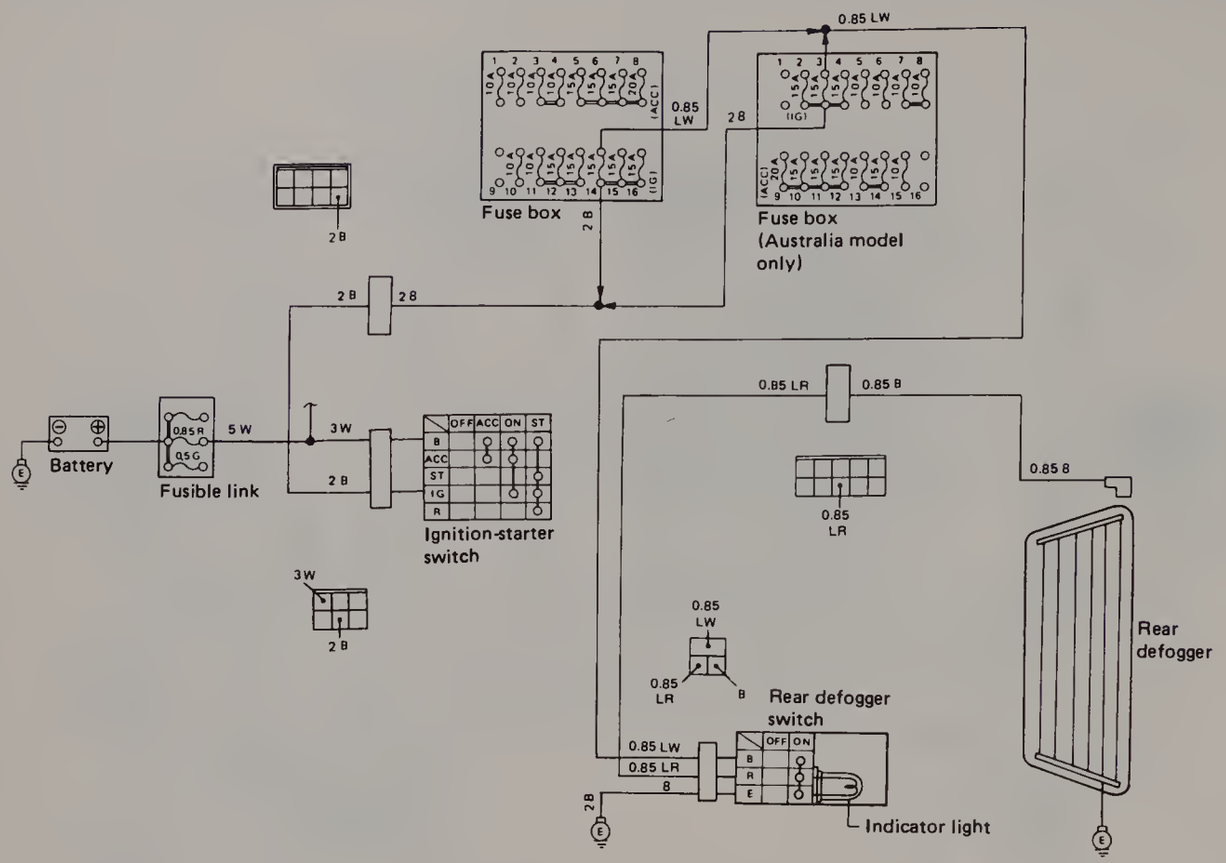


Fig. 10.53 1982/1983 UK models (10 of 16) – rear window defogger

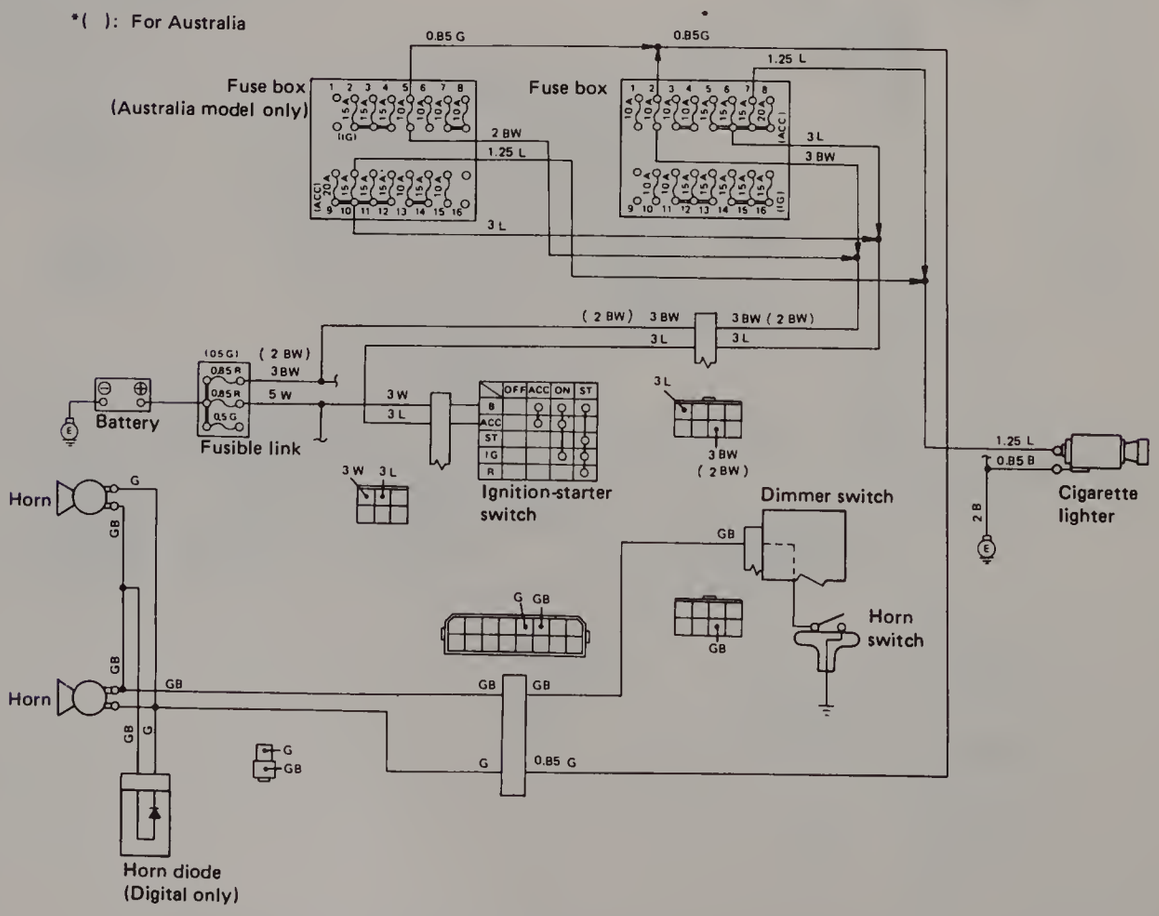


Fig. 10.54 1982/1983 UK models (11 of 16) – cigarette lighter and horn

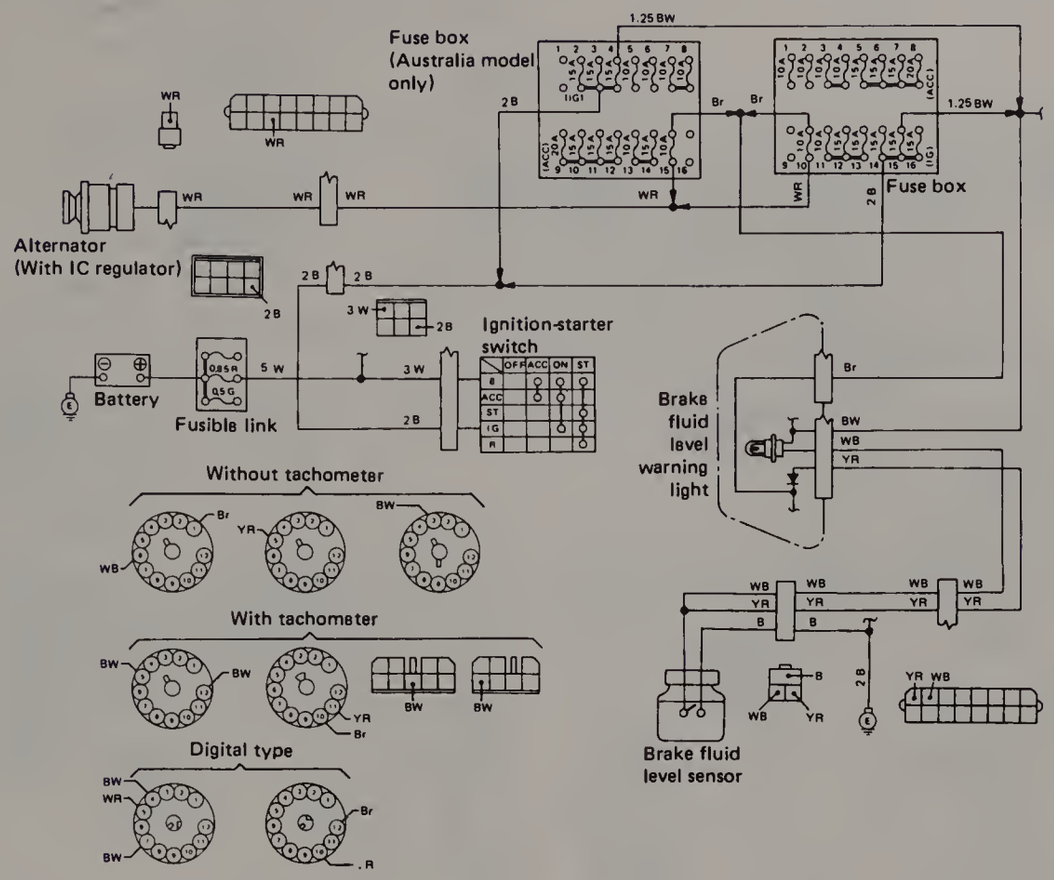


Fig. 10.55 1982/1983 UK models (12 of 16) – brake fluid level warning

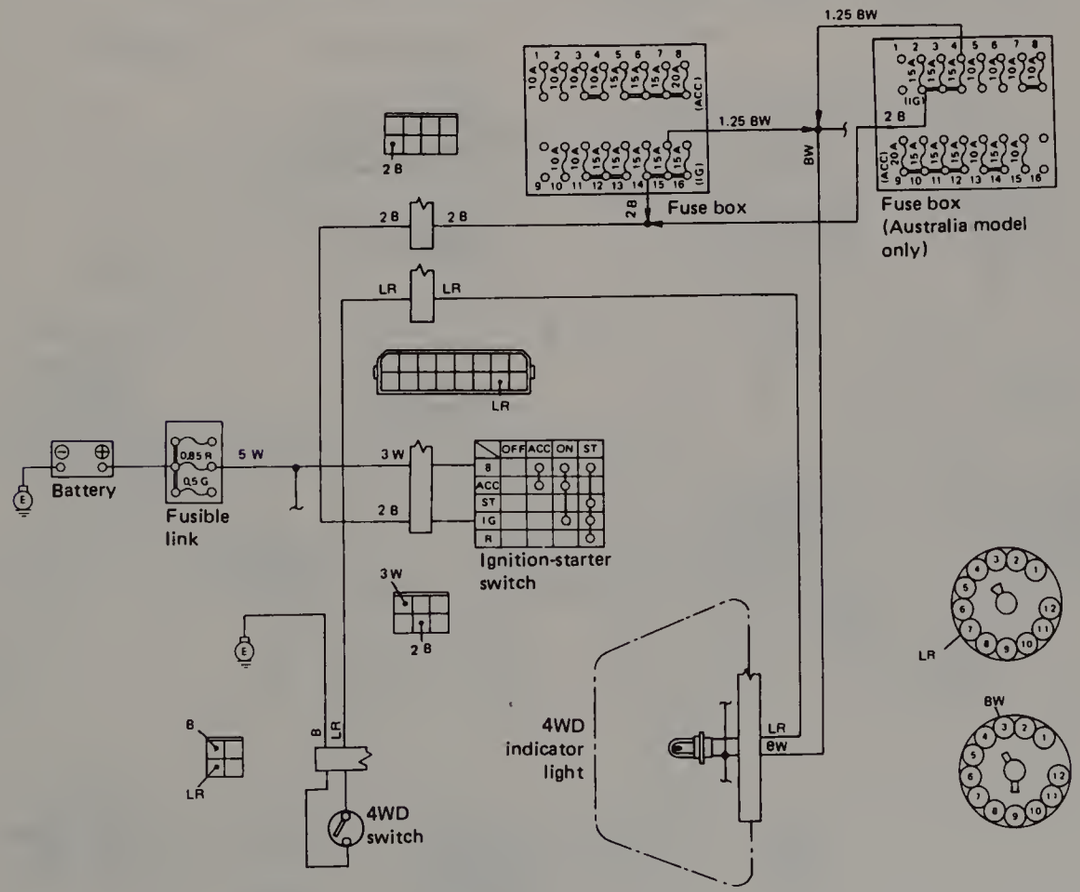


Fig. 10.56 1982/1983 UK models (13 of 16) – 4WD system

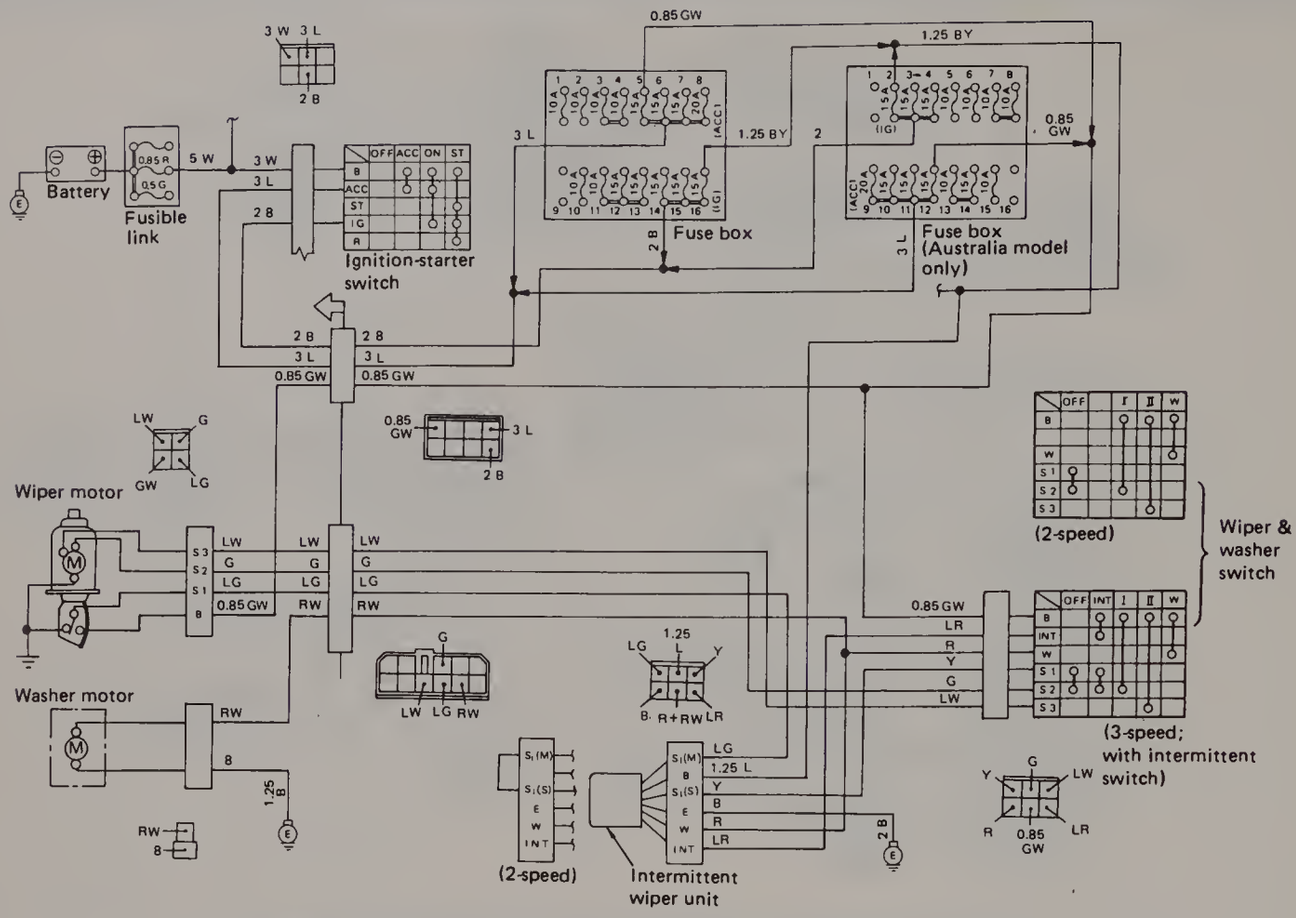


Fig. 10.57 1982/1983 UK models (14 of 16) – windshield washer/wiper systems

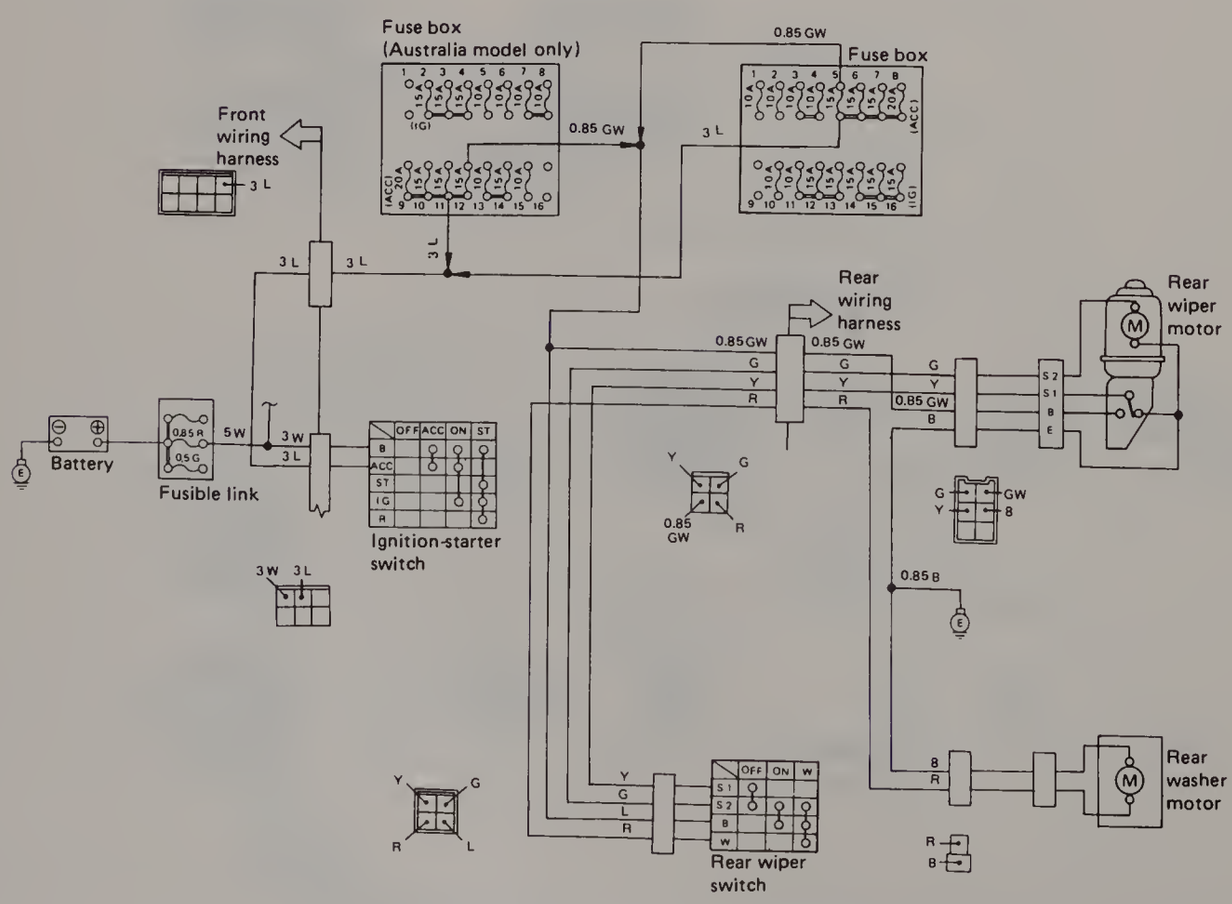


Fig. 10.58 1982/1983 UK models (15 of 16) – rear window washer/wiper systems

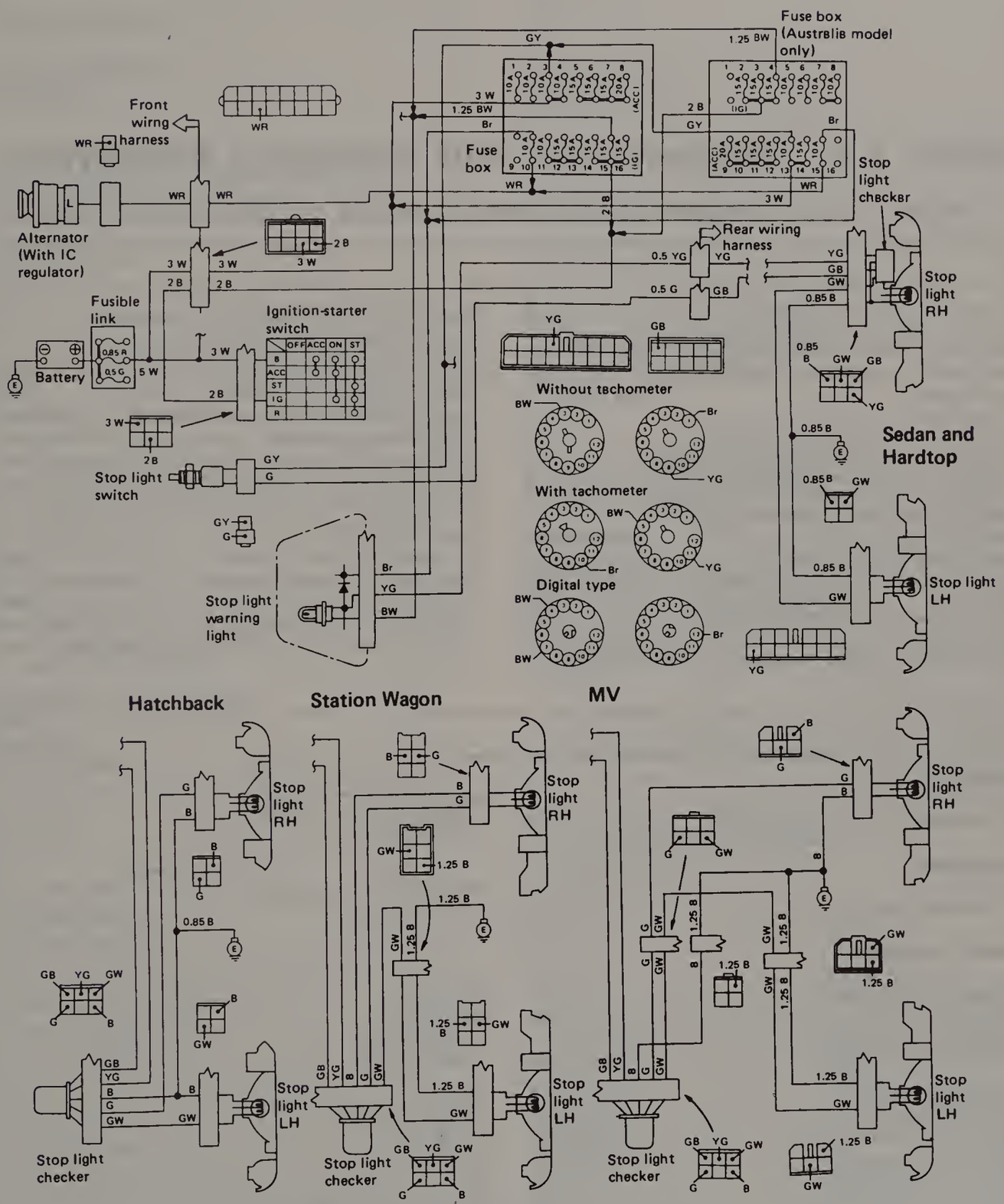


Fig. 10.59 1982/1983 UK models (16 of 16) – stoplights

Chapter 11 Suspension and steering systems

Refer to Chapter 13 for specifications and information applicable to 1984 thru 1988 models

Contents

Specifications

Front suspension

Type	MacPherson strut, independent
Coil spring free length	12.56 in (319 mm)

Rear suspension

Type	Semi-trailing arm, independent
Torsion bar spring diameter	0.83 in (21 mm)

Front wheel alignment

Camber	
Station wagon (2WD)	1° to 2°30′
All other 2WD	45′ to 2°15′
4WD (1980 through 1982)	1°40′ to 3°20′
4WD (1983)	1°40′ to 3°10′
Caster	
Station wagon (2WD)	-50′ to 40′
All other 2WD	-1°10 to 20′
Hatchback (4WD)	-1°15′ to 15′
All other 4WD	-1°25′ to 5′
Toe-in (1980 and 1981)	
All 2WD	0.08 to 0.31 in (2 to 8 mm)
All 4WD	0.24 to 0.47 in (6 to 12 mm)
Toe-in (1982)	
All 2WD	0.04 ± 0.04 in (1 ± 1 mm)
All 4WD	0.08 ± 0.04 in (2 ± 1 mm)
Toe-in (1983)	
All 2WD	0.04 ± 0.04 in (1 ± 1 mm)
All 4WD	OUT 0.20 ± 0.04 in (OUT 5 ± 1 mm)

Rear wheel alignment

Camber	
Station wagon and Brat (4WD)	-25′ to 1°05′
All others (2WD and 4WD)	-45′ to 45′
Toe-in (all models)	-0.12 to 0.12 in (-3 to 3 mm)

Steering system

Minimum turning radius	
Hatchback	15.4 ft (4.7 m)
All others	15.7 ft (4.8 m)
Steering wheel turns (lock-to-lock)	3.8

Manual steering gearbox

Rack shaft bend limit	0.004 in (0.1 mm)
Pinion free play limit	0.012 in (0.3 mm)

Power steering gearbox

Turning resistance (maximum) at straight-ahead position	
Within 1.18 in (30 mm) from rack center	1.39 lb (0.63 kg)
Within 6.89 in (175 mm) from rack center	1.90 lb (0.86 kg)

Power steering pump

Relief pressure	782 psi (5394 kpa)
Pulley shaft play	
Radial	0.008 in (0.2 mm) or less
Axial	0.012 in (0.3 mm) or less
Regular pressure	142 psi (981 kpa) or less
Working pressure	668 to 853 psi (4609 to 5884 kpa)

Ground clearance – North American models

Front (standard)	
Hatchback (std)	10.43 to 11.42 in (265 to 290 mm)
Hatchback (GL)	10.63 to 11.61 in (270 to 295 mm)
Wagon and pick-up (DL)	10.43 to 11.42 in (265 to 290 mm)
Wagon and pick-up (GL)	10.63 to 11.61 in (270 to 295 mm)
Maximum additional height (all)	0.98 in (25 mm)
Rear (standard)	
Hatchback (std)	12.60 to 13.39 in (320 to 340 mm)
Hatchback (GL)	12.80 to 13.58 in (325 to 345 mm)
Wagon and pick-up (DL)	13.19 to 13.98 in (335 to 355 mm)
Wagon and pick-up (GL)	13.39 to 14.17 in (340 to 360 mm)
Maximum additional height (all)	1.18 in (30 mm)

Ground clearance – UK models

Front (standard)	
Hatchback/Sedan	10.43 to 11.42 in (265 to 290 mm)
Station wagon/pick-up	10.63 to 11.61 in (270 to 295 mm)
Maximum additional height (all)	0.98 in (25 mm)
Rear (standard)	
Hatchback/sedan	12.60 to 13.39 in (320 to 340 mm)
Station wagon	13.19 to 13.98 in (335 to 355 mm)
Pick-up	13.58 to 14.37 in (345 to 365 mm)
Maximum additional height (all)	1.18 in (30 mm)

Torque specifications

	Ft/lb	Nm
Front shock top mounting nut	22 to 29	29 to 39
Wheel lug nut	58 to 72	78 to 98
Front shock bottom mounting bolt	22 to 29	29 to 39
Suspension arm-to-ball stud nut	29	39
Rear shock bottom mounting bolt	65 to 87	88 to 118
Rear shock top mounting bolt	65 to 94	88 to 127
Rear crossmember mounting bolt	87 to 108	118 to 147
Wheel bearing nut	145	196
Tie-rod balljoint nut	43 to 51	59 to 69
Idler pulley lock bolt	18 to 25	25 to 34
Front shock cartridge assembly nut	43 to 54	59 to 74
Leading rod mounting bolt	27 to 31	36 to 42
Suspension arm-to-front crossmember	43 to 51	59 to 69
Stabilizer bar bracket bolt	13 to 23	18 to 31
Brake hose bracket bolt	9 to 13	12 to 18
Front crossmember-to-frame nut	59 to 71	80 to 96
Outer arm-to-inner arm bolt	87 to 108	118 to 147
Steering gearbox mounting bolt	33 to 40	44 to 54
Tie-rod to gearbox	58	78
Tie-rod balljoint to tie-rod jam nut	58 to 65	78 to 88
Power steering pump mounting bolt	33 to 40	44 to 54
Idler pulley bracket bolt	18 to 25	25 to 34
Front shock mount-to-piston rod nut	43 to 54	59 to 74
Rear crossmember lock bolt	23 to 29	31 to 39
Rear crossmember-to-engine mount	14 to 24	19 to 32
Power steering U-joint bolt	16 to 19	22 to 25
Steering wheel nut	21 to 29	28 to 40

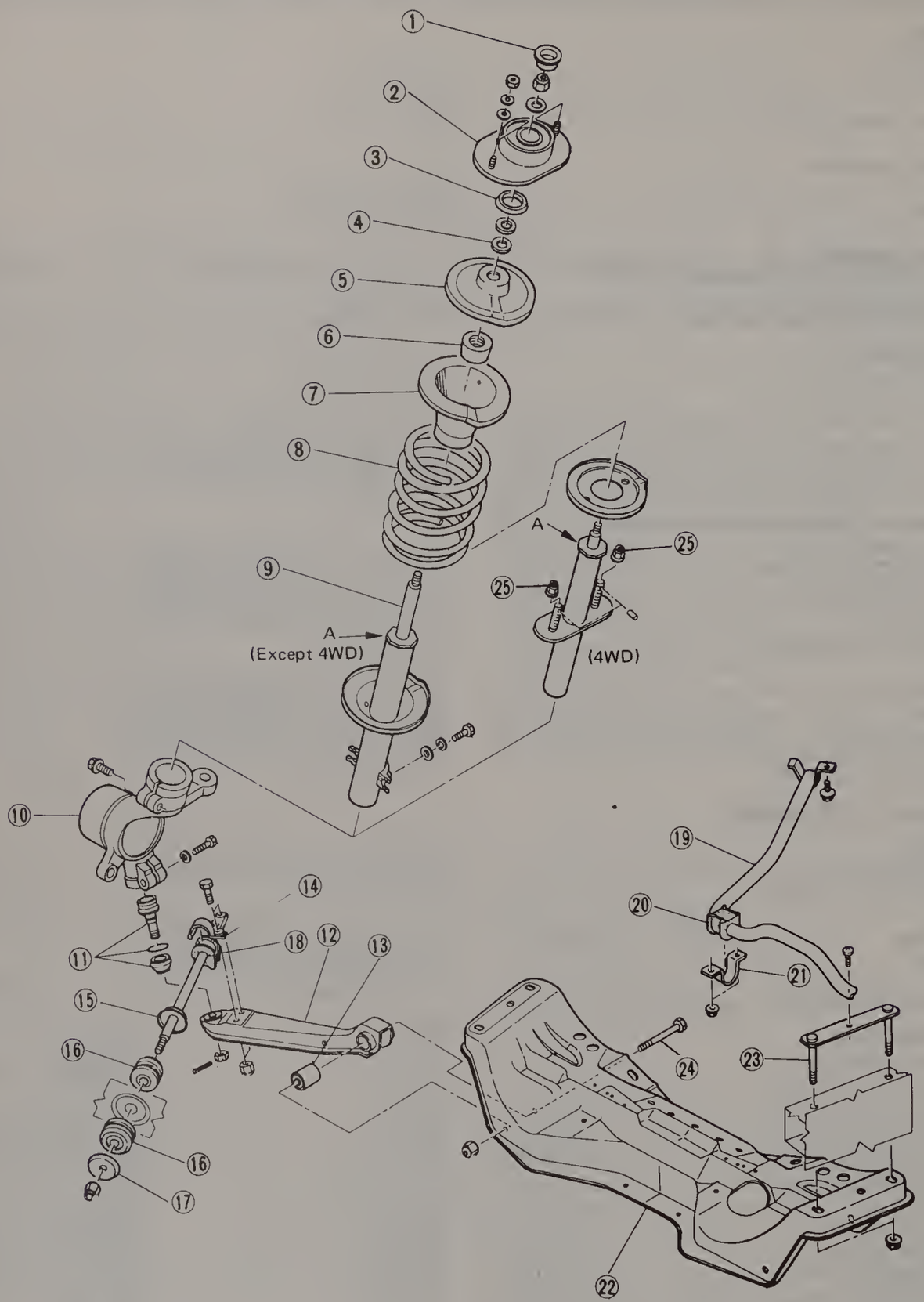


Fig. 11.1 Front suspension components – exploded view

1 *Cap*
2 *Strut mount*
3 *Oil seal*
4 *Thrust washer*
5 *Spring seat*
6 *Helper*
7 *Dust cover*
8 *Coil spring*
9 *Damper strut (cartridge)*
10 *Steering knuckle*
11 *Balljoint*
12 *Suspension arm*
13 *Rubber bushing*
14 *Stabilizer front bracket*
15 *Leading rod*
16 *Bushing*
17 *Plate*
18 *Stabilizer front bushing*
19 *Stabilizer bar*
20 *Stabilizer rear bushing*
21 *Stabilizer rear bracket*
22 *Crossmember*
23 *Plate*
24 *Suspension arm mounting bolt*
25 *Posture adjusting nuts*

1 General information

Suspension

The front suspension consists of MacPherson strut type shock absorbers. These consist of independent struts with cylindrical, double-acting shocks and coil springs mounted on the control arms. The upper end of each strut is secured to the wheel apron, while the lower end is retained by a knuckle housing bolted to the hub.

The control arms have a maintenance-free balljoint riveted at the outer end with the inner end bolted to the crossmember through rubber cushions.

The stabilizer bar is bolted to the floor of the body and the ends are fastened to the control arms with bushings.

The leading rod is welded at one end to the control arm and the balljoint is bolted to the control arm instead of being riveted. The ends of the stabilizer bar are connected to the leading rods through rubber bushings.

The rear suspension is a semi-trailing arm type consisting of a torsion bar set-up and double-acting shock absorbers.

Steering

All models contain a simple and reliable rack and pinion type of steering system.

The steering wheel is splined to the shaft, which is connected to the gearbox pinion by use of a universal joint, a torque rod and a flexible rubber coupling. The collapsible steering column prevents the steering from being driven toward the driver in the event of a front-end collision. The pinion teeth mesh with the teeth machined into the rack so that rotation of the pinion moves the rack from one side of the housing to the other. Backlash is automatically adjusted to zero, therefore no maintenance is required.

Located at each end of the rack are tie-rods. These rods are installed with balljoints which provide for the adjustment of the front wheel toe-in. The tie-rods are connected to the steering knuckle arms.

A steering lock mechanism is incorporated in the ignition starter switch. The ignition key cannot be pulled out of the switch except in the 'steering locked' position.

Note: *2WD stands for two-wheel drive, while 4WD stands for four-wheel drive.*

2 Shock absorber assembly (front) – removal and installation

Refer to Figs. 11.1 and 11.2

Removal

1 Before removing your shock absorbers, apply penetrating oil to the area where the bottom of the strut mounts in the top of the steering knuckle. Make sure you have the correct replacement shock absorbers for your vehicle. Loosen, but do not remove, the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches).

2 Remove both wheels and detach the clips holding the flexible brake line to the shock absorber strut.

3 Remove the mounting bolts holding the bottom of the strut to the steering knuckle (photo). Now, grab the knuckle with your hands and turn it back and forth (photo) as you push down on the knuckle. This will allow the knuckle to free itself from the strut. **Note**: *You may have to pry the top of the knuckle apart.*

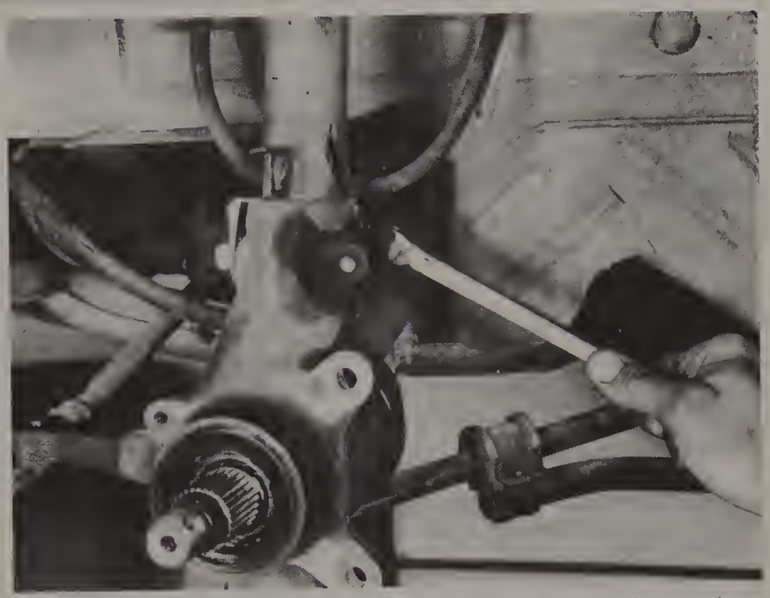
4 When the strut releases itself from the knuckle, allow the knuckle to rest in its lowered position. Now, go working within the engine compartment, remove the mounting nuts holding the top of the strut in position (photo).

5 Remove the strut assembly from vehicle and refer to Section 3 for cartridge removal and installation procedures. An alternative would be to take it to a dealer or repair shop where the strut cartridge can be safely replaced with a new one.

Installation

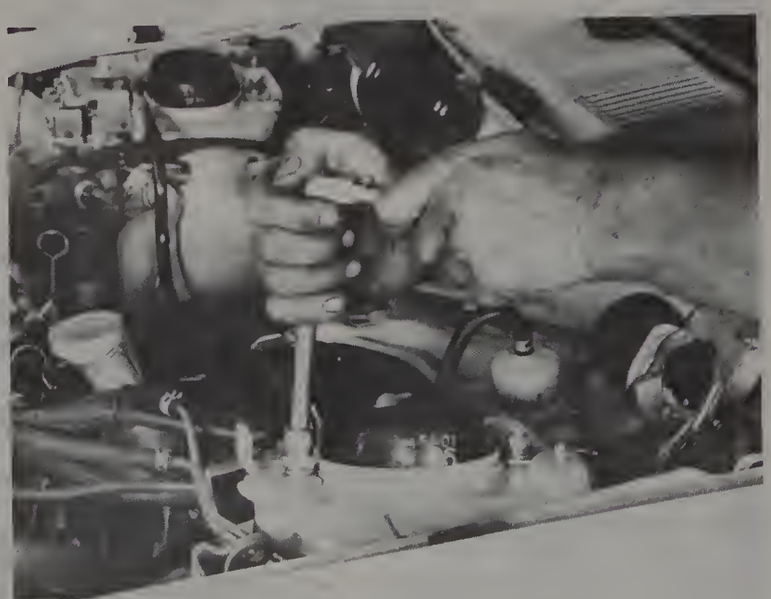
6 Attach the new strut assembly to the vehicle at the top first. Refer to the accompanying illustration and make sure that you install it correctly.

7 Attach the mounting nuts to the top of the strut but do not tighten them. Place a jack under the steering knuckle and use the jack to



2.3A Remove the bolts holding the bottom of the strut to the steering knuckle

2.3B Grasp the knuckle and twist back-and-forth while pushing down on it



2.4 Remove the top strut mounting bolts

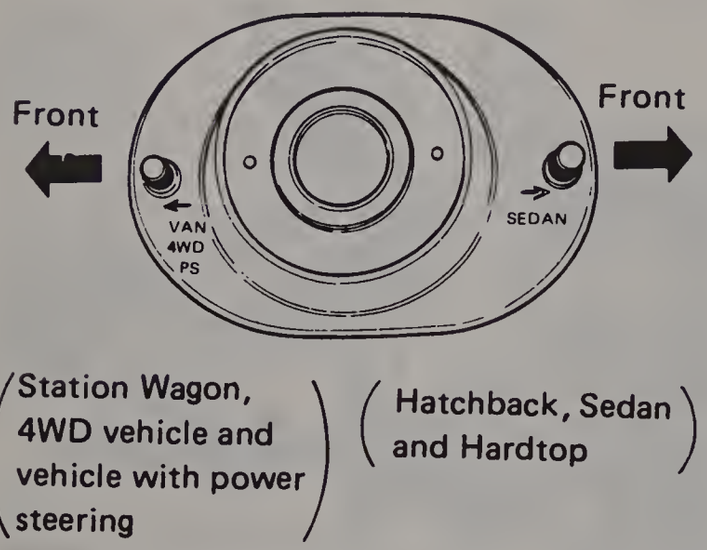


Fig. 11.2 Correct installation of the top shock mount (Sec 2)

slowly raise the knuckle into position until it is engaged with the bottom of the strut.
8 Install the mounting bolts at the bottom of the strut and tighten them according to the Torque specifications.
9 Attach the flexible brake hose to the strut with the clip. Install the wheel with the lug nuts.
10 Lower the vehicle to the ground and tighten the wheel lug nuts as well as the top strut mounting nuts according to the Torque specifications.

3 Shock absorber cartridge (front) – replacement

Refer to Figs. 11.1 through 11.5

Removal

1 If you find that your shock absorber is defective, it is recommended that you only replace the cartridge and not disassemble it. Remove the shock assembly by referring to the appropriate Section in this Chapter. **Caution**: *To remove the cartridge from the shock assembly you will need a spring compressor, which you may be able to rent from a parts store. Be extremely careful when compressing the spring and follow the instructions included with the tool.*
2 Attach the spring compressor to the shock assembly.
3 Compress the spring until the cartridge floats freely. Remove the cartridge mounting nut on top of the assembly. This self-locking nut should be replaced with a new one on reassembly.
4 Now, remove the strut mount, the oil seal and thrust washer, the spring seat, the helper and the dust cover from the shock assembly.
5 Carefully release the tension on the coil spring. Remove the tool, attach it to the new cartridge and install the spring.

Installation

6 Inspect any of the parts that you removed for damage or deterioration. Replace any defective parts with new ones, if necessary.
7 Make sure that the coil spring is installed properly by referring to the illustration given.
8 Install the compressor and compress the spring until there is enough room to install the remaining parts.
9 Extend the piston rod to its maximum stroke and install the dust cover, the upper spring seat and the thrust washer. **Note:** *Install the ground surface of the washer facing the lip side of the oil seal.*
10 Now, install the oil seal and washer assembly over the thrust washer. **Note:** *Install this assembly with the oil seal lip facing the upper spring seat.*
11 Install the strut mount and the new self-locking mounting nut.
12 Slowly and carefully remove the spring compressor from the assembly and then tighten the mounting nut to the specified torque.
13 Install the shock absorber on your vehicle.

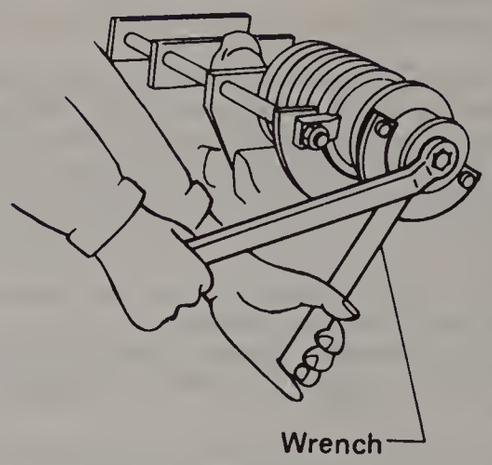


Fig. 11.3 Mount the shock assembly in a vise and hold it in a horizontal position (Sec 3)

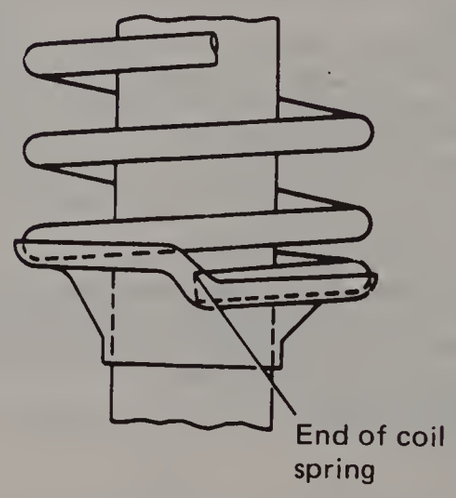


Fig. 11.4 Correct installation of the coil spring on the new shock strut cartridge (Sec 3)

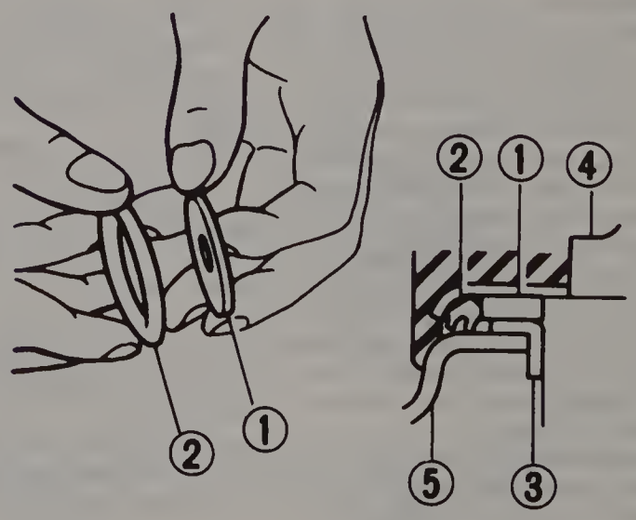


Fig. 11.5 Correct installation of the strut oil seal and thrust washer (Sec 3)

1 *Washer*
2 *Oil seal*
3 *Thrust washer*
4 *Piston rod*
5 *Upper spring seat*

4 Stabilizer bar (front) – removal and installation

Refer to Fig. 11.1

Removal

1 First, loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 Remove the bolts mounting the stabilizer bar (photo) to the leading rod.
3 Remove the bracket that holds the front bushing in place. Remove the stabilizer front bushing.
4 Pull the front of the stabilizer bar down. Now, remove the stabilizer rear bracket mounting bolts (photo).
5 Remove the rear brackets and bushings from the stabilizer bar and remove the bar from the vehicle.

Installation

6 Check the bushings for cracks or deterioration. Inspect the stabilizer bar for cracks in the curved portions and deformation. Replace any parts, if necessary, with new ones.
7 Install the stabilizer bar, the front and rear bushings and the brackets with the mounting hardware.
8 Do not completely tighten the mounting bolts until you install the wheels and lower the vehicle to the ground.
9 Now tighten the bolts according to the Torque specifications.

5 Leading rod (front) – removal and installation

Refer to Fig. 11.1

Removal

1 First, loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 Remove the nut holding the rear of the leading rod to the frame (photo). Remove the leading rod bushing and metal retaining plate.
3 Now, remove the bolts mounting the front of the leading rod to the suspension arm (photo). Remove the leading rod from the vehicle.
4 Remove the remaining bushing from the rod.
5 Check the bushings for cracks or deterioration. Inspect the leading rod for cracks and deformation. Replace any parts, if necessary, with new ones.

Installation

6 Install the leading rod, the metal retainer and the bushings with the mounting hardware.
7 Do not completely tighten the mounting hardware until you install the wheels and lower the vehicle to the ground.
8 Now, tighten the hardware according to the Torque specifications.

6 Suspension arm (front) – removal and installation

Refer to Fig. 11.1

Removal

1 First, loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 Remove the parking brake cable bracket from the suspension arm.
3 Straighten the tangs on the suspension arm balljoint cotter pin and remove the cotter pin.
4 Loosen the balljoint mounting nut about halfway and then attach a puller to the balljoint (photo) in order to break it loose from the suspension arm.
5 Remove the mounting bolts holding the front of the leading rod to the suspension arm.
6 Now remove the rear mounting bolt holding the suspension arm to the frame (photo). Remove the arm from the vehicle.
7 Check the bushings for cracks or deterioration. Inspect the suspension arm for cracks and deformations. Replace any parts, if

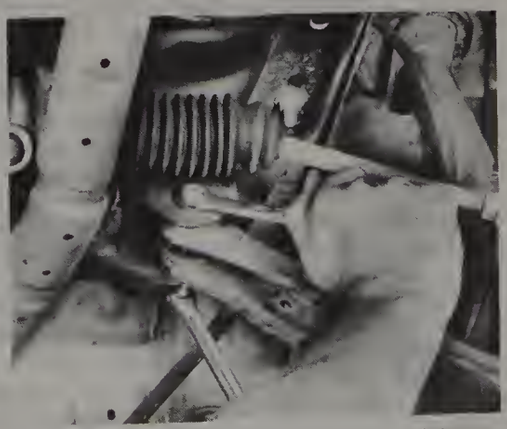
4.2 Remove the bolts holding the stabilizer bar to the leading rod

4.4 Remove the stabilizer bar rear mounting bolts

5.2 Remove the nut holding the rear of the leading rod to the frame

5.3 Remove the bolts holding the front of the leading rod to the suspension arm

6.4 Attach a puller to the balljoint and remove the balljoint from the steering knuckle



6.6 Remove the bolt holding the rear of the suspension arm to the frame

necessary, with new ones.

Installation

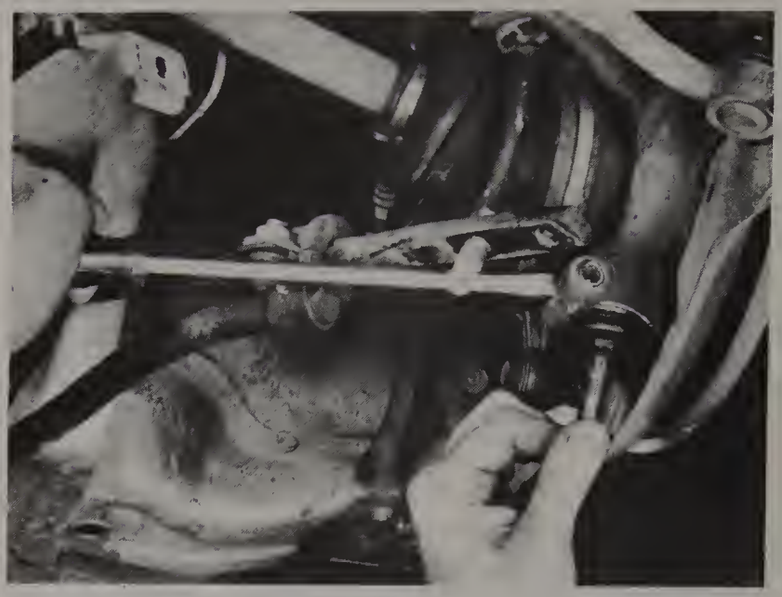
8 Install the bushings in the arm and install the arm on the vehicle with its mounting hardware.
9 Do not completely tighten the mounting hardware until you install the wheels and lower the vehicle to the ground.
10 Now, tighten the hardware to the Torque specifications.

7 Balljoint (front) – removal and installation

Refer to Fig. 11.1

Removal

1 Loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 First, you have to disconnect the suspension arm from the balljoint by referring to Section 6 in this Chapter.
3 Remove the bolt holding the balljoint in place in the bottom of the steering knuckle.
4 Now, use a large screwdriver and pry open the slot in the steering knuckle (photo) in order to remove the balljoint.
5 Remove the balljoint by installing the castle nut part of the way onto its threads and pulling on it.
6 Remove the boot ring (photo) from the balljoint. Now remove the rubber boot from the joint.
7 Inspect the boot for cracks or deterioration. Check the balljoint for rust, pitting and abnormal wear. Replace any parts, if necessary, with new ones.



7.4 Use a screwdriver to pry open the slot in order to remove the balljoint

7.6 Remove the boot ring from the balljoint

Installation

8 Apply wheel bearing grease to the balljoint and pack the inside of the rubber boot. Also apply a thin coat of oil to the part of the balljoint that fits into the steering knuckle.
9 Install the balljoint into the knuckle and tighten its mounting bolt according to the Torque specifications.
10 Refer to Section 6 in this Chapter and attach the suspension arm to the balljoint.

8 Crossmember (front) – removal and installation

Refer to Fig. 11.1

Removal

1 Loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 Remove the spare tire. Remove the complete air cleaner assembly from the carburetor. **Note:** *Lay a clean cloth over the opening in the carburetor so that foreign objects do not enter it.*
3 Remove the pitching stopper rod by referring to the appropriate Section in Chapter 2.
4 Remove the parking brake cable bracket from the suspension arm.
5 Remove the cotter pin and castle nut from the steering tie-rod balljoint connected to the steering knuckle. Disconnect the balljoint from the knuckle by referring to Section 6 in this Chapter.
6 Remove the front exhaust pipe by referring to the appropriate Section in Chapter 4.
7 Remove the suspension arms from the crossmember by referring to the appropriate Section in this Chapter.
8 Disconnect the steering torque rod from the steering pinion shaft by referring to the appropriate Section in this Chapter.
9 Using a chain block and engine hoist, raise the engine about 0.400 in (10 mm).
10 Support the bottom of the crossmember with a jack and remove its mounting nuts. Slowly lower the crossmember (with steering gearbox installed) with the jack.
11 Refer to the appropriate Section in this Chapter to remove the steering gearbox from the crossmember.
12 Inspect the crossmember for cracks and deformation and replace it, if necessary, with a new one. Check any mounting rubber or cushions for cracks and deterioration and replace, if necessary, with new ones.

Installation

13 Refer to the appropriate Sections in this Chapter to install the steering box, the steering torque rod, the suspension arms and the tie-rod balljoint.
14 Refer to the appropriate Section in Chapter 4 to install the exhaust pipe and in Chapter 2 to install and adjust the engine pitching stopper rod.
15 Tighten all mounting hardware to the specified torque.

9 Steering knuckle and axleshaft (front) – removal and installation

Refer to Figs. 11.1 and 11.6

Removal

1 First, loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 Refer to the appropriate Sections in Chapter 9 and remove the disc calipers, the pads, the pad supports and the hub/rotor assembly.
3 Remove the brake backing plate (photo).
4 Refer to the appropriate Sections in this Chapter and remove the steering tie-rod balljoint and the crossmember from the knuckle.
5 Remove the spring pin from the transmission side of the axleshaft

9.3 Remove the bolts holding the backing plate to the steering knuckle

9.7 Remove the steering knuckle and axleshaft as an assembly

using a slender punch and a hammer.
6 Remove the shock absorber strut from the knuckle by referring to Section 2 in this Chapter.
7 Now, remove the steering knuckle (with the axleshaft installed) from the vehicle (photo).
8 The suspension arm balljoint can be serviced at this time by referring to the appropriate Section in this Chapter.
9 Because of the special tools required (which are not available to the home mechanic), disassembly of the axle from the steering knuckle should be performed by a dealer service department. **Note:** *It would be to your advantage to have some other work done at this time. Have the wheel bearings checked, repacked or replaced and adjusted. Have the rubber boots replaced and the Constant Velocity (CV) joints repacked on the axle assembly. In doing this, you may save yourself a lot of time and money in the future.*

Installation

10 Install the steering knuckle and axle assembly back onto your vehicle by installing the spring pin in the axleshaft.
11 Install all of the parts that you removed from the knuckle by referring to the appropriate Sections and Chapters.
12 Make sure that all mounting hardware is tightened according to the Torque specifications.

10 Wheel bearings – check, repacking and adjustment

Refer to Figs. 11.6 through 11.8

Front

1 Because of the special tools required (which are not available to the home mechanic), disassembly of the axle from the steering knuckle should be performed by a dealer service department. **Note:** *It would be to your advantage to have some other work done at this time. Have the wheel bearings checked, repacked or replaced and adjusted. Have the rubber boots replaced and the Constant Velocity (CV) joints repacked on the axle assembly. In doing this, you may save yourself a lot of time and money in the future.*
2 To remove the knuckle and axleshaft assembly, refer to the appropriate Section in this Chapter.

Rear

3 Remove the rear brake drum by referring to the appropriate Section in Chapter 9.
4 Check the bearings for grease. Make sure that they are packed full of grease.
5 If they do not have a lot of grease around them, clean the bearings thoroughly with solvent, and dry them with compressed air. Check for any scoring or burned spots.
6 Pack them with wheel bearing grease and install them by referring to the appropriate Section in Chapter 9.
7 Tighten the axle nut to 36 ft-lb (49 Nm) and then back it off slightly. Turn the drum back and forth a few times to make sure that the bearings seat properly.
8 Make sure that the drum turns easily and smoothly. Bend the locking washer into place. Install a new O-ring on the grease cap, then install the grease cap with a soft-faced hammer.

11 Shock absorber (rear) – replacement

Refer to Fig. 11.9

Removal

Note: *Make sure that you have the correct replacement shocks for your vehicle.*
1 First, loosen the wheel lug nuts. Block the front wheels, raise the rear of the vehicle and place it on jackstands (position them in the rear rocker panel notches). Remove both rear wheels.
2 Support the suspension inner arm with a floor jack to aid in the installation.
3 Remove the upper shock absorber mounting bolts (photo), and then remove the lower mounting bolt (photo).
4 Remove the shock absorber from the vehicle.

Installation

5 Attach the shock absorber to the vehicle. Use the jack to raise or lower the suspension arm for connection.
6 Make sure that the mounting hardware is tightened according to the Torque specifications. Repeat the procedure for the remaining shock absorber.
7 Install the wheels and lower the vehicle to the ground.

12 Inner suspension arm (rear) – removal and installation

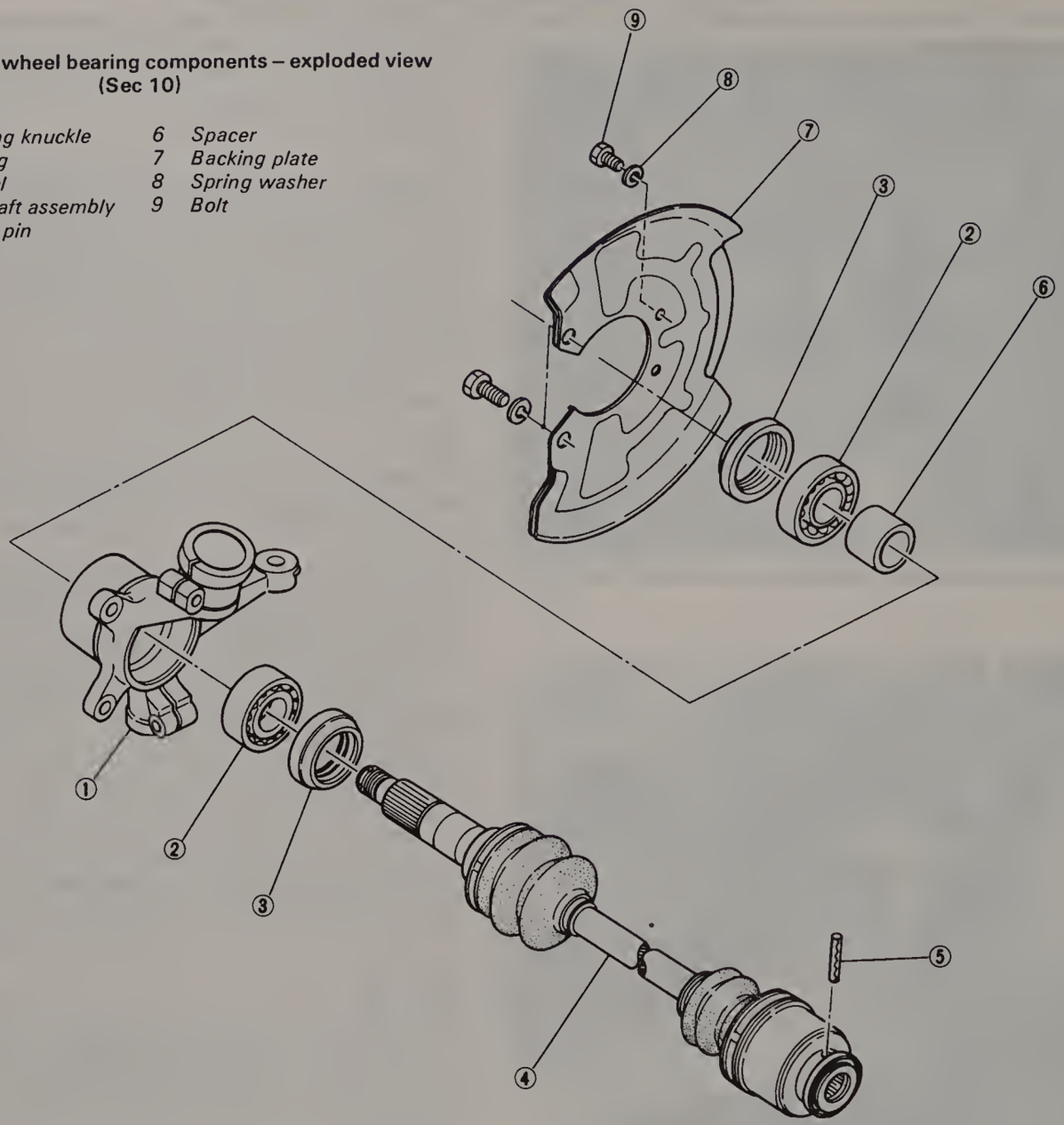
Refer to Fig. 11.9

Removal

1 The inner arm can be removed without having to remove any other suspension parts from your vehicle. **Note:** *The photos show the rear suspension removed.*
2 Refer to the appropriate Section in Chapter 8 and remove the rear driveshaft from the inner arm and the differential on 4WD vehicles.
3 Remove the bolt holding the inner arm and bushing to the crossmember (photo).
4 Remove the bolts holding the inner arm to the outer suspension arm (photo).
5 Remove the inner arm and brake drum assembly from the vehicle.

Fig. 11.6 Front wheel bearing components – exploded view (Sec 10)

1 *Steering knuckle*
2 *Bearing*
3 *Oil seal*
4 *Axleshaft assembly*
5 *Spring pin*
6 *Spacer*
7 *Backing plate*
8 *Spring washer*
9 *Bolt*



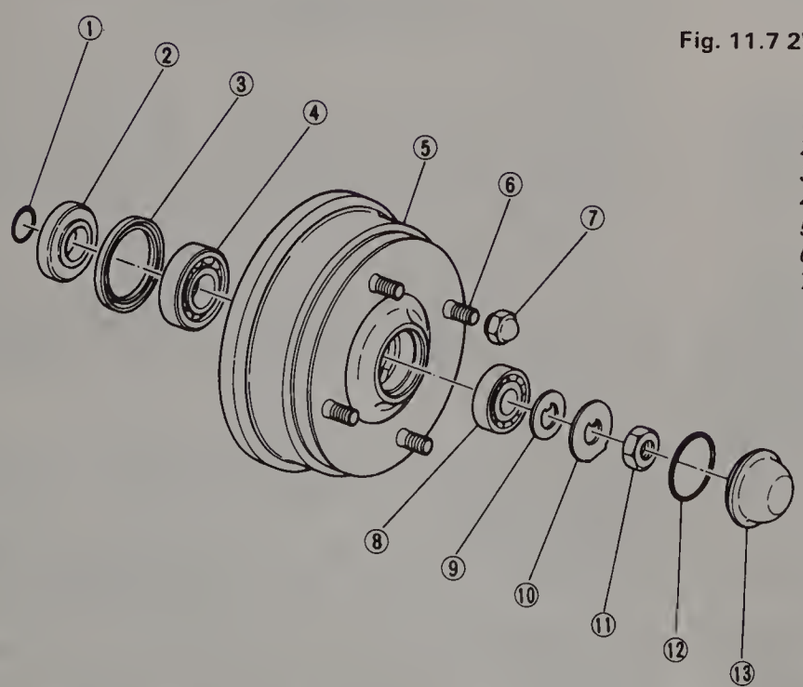


Fig. 11.7 2WD rear wheel bearing components – exploded view (Sec 10)

1 *O-ring*
2 *Spacer*
3 *Oil seal*
4 *Bearing*
5 *Brake drum*
6 *Hub bolt*
7 *Lug nut*
8 *Bearing (outer)*
9 *Lock plate*
10 *Lock washer*
11 *Axle nut*
12 *O-ring*
13 *Grease cap*

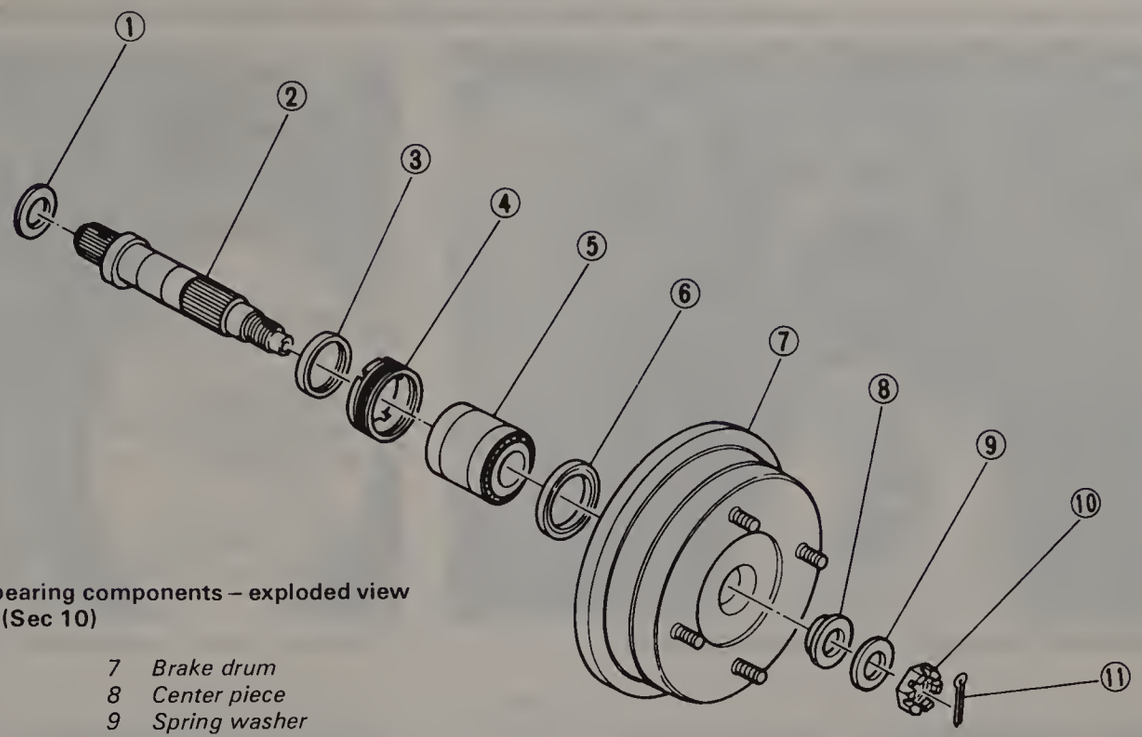
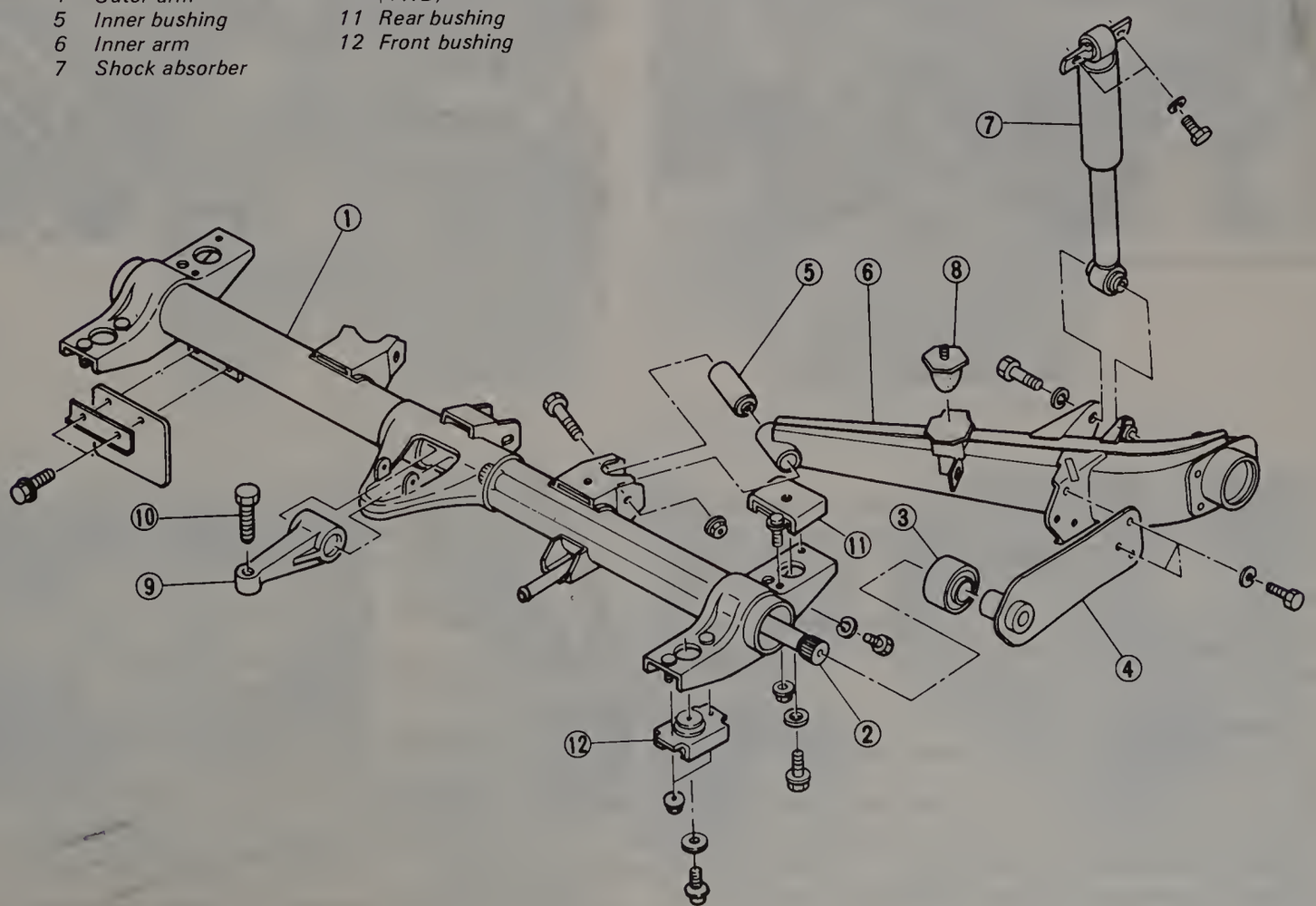


Fig. 11.8 4WD rear wheel bearing components – exploded view (Sec 10)

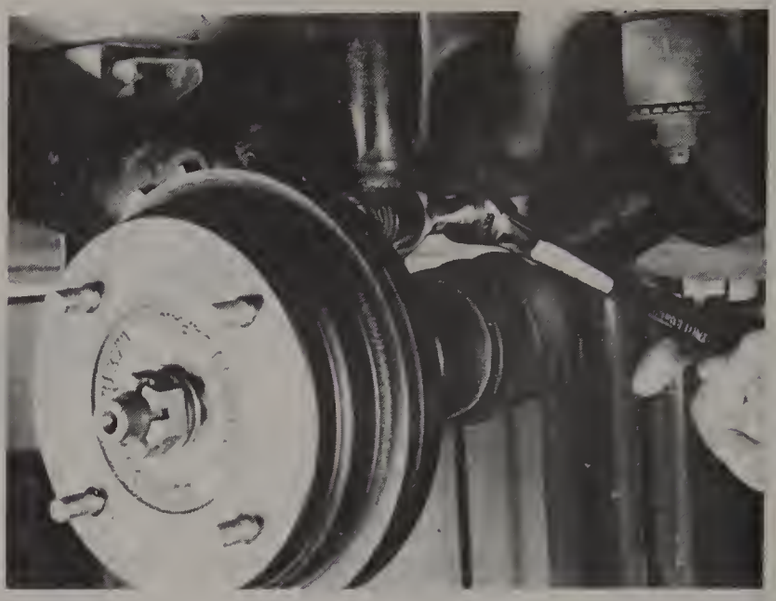
1 *Packing*
2 *Rear spindle*
3 *Inner oil seal*
4 *Ring nut*
5 *Bearing assembly*
6 *Outer oil seal*
7 *Brake drum*
8 *Center piece*
9 *Spring washer*
10 *Axle nut*
11 *Cotter pin*

Fig. 11.9 Rear suspension components – exploded view

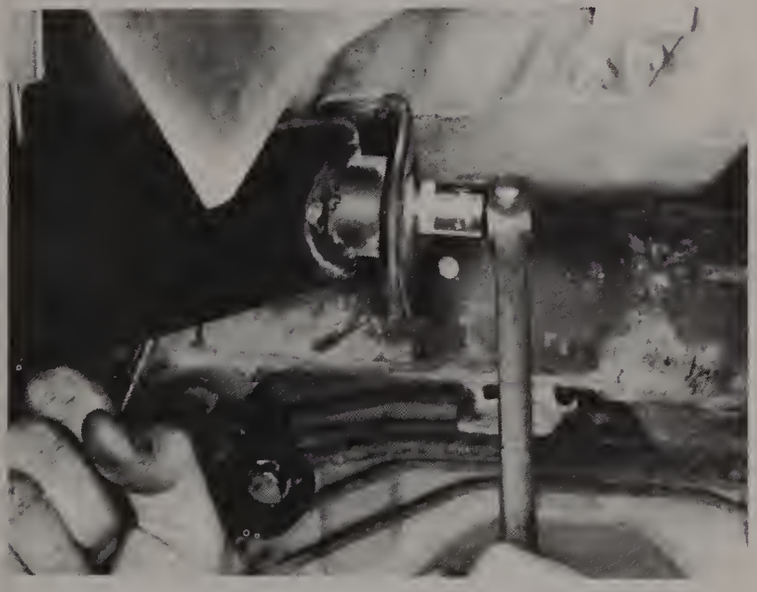
1 *Crossmember*
2 *Torsion bar*
3 *Outer bushing*
4 *Outer arm*
5 *Inner bushing*
6 *Inner arm*
7 *Shock absorber*
8 *Helper (wagon)*
9 *Center arm (4WD)*
10 *Center arm bolt (4WD)*
11 *Rear bushing*
12 *Front bushing*



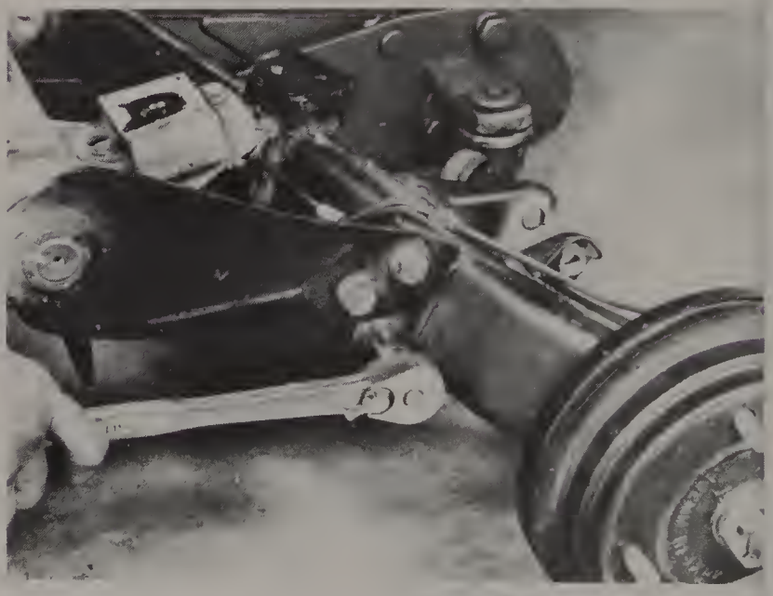
11.3A Remove the upper shock absorber mounting bolts



11.3B Remove the lower shock absorber mounting bolt



12.3 Remove the bolt that holds the inner arm to the crossmember



12.4 Remove the bolts holding the inner arm to the outer arm

6 To replace the inner arm itself, refer to the appropriate Section in Chapter 9 and remove the drum and brake assembly.
7 To replace the inner arm bushing, place the bushing end the arm on a block of wood with a hole in it large enough to accept the bushing.
8 Drive the old bushing out with a socket the same size as the bushing. Install a new bushing by carefully driving it into place with a hammer.

Installation

9 Install the inner arm onto your vehicle without the brake drum assembly attached to it.
10 Install the driveshaft and the brake assembly by referring to the appropriate Chapters.
11 Make sure all of the mounting hardware is tightened according to the Torque specifications.
12 Adjust the rear wheel bearings by referring to the appropriate Section in this Chapter.

13 Crossmember (rear) – removal and installation

Refer to Fig. 11.9

Removal

1 Remove the rear shock absorber by referring to the appropriate Section in this Chapter.

4WD only

2 Refer to the appropriate Section in Chapter 8 and remove the rear axleshafts.
3 Refer to the appropriate Section in Chapter 8 and remove the driveshaft from the vehicle.
4 Now, support the rear differential with a floor jack. Refer to the appropriate Section in Chapter 8 and remove the differential.

2WD and 4WD

5 Refer to the appropriate Section in Chapter 4 and remove the front and rear exhaust pipes.

6 Disconnect the brake line fitting attached to the inner arm.
7 Plug the brake line with the bleeder cap off of the rear brake to keep brake fluid from leaking.
8 Support the crossmember with a floor jack and then remove the mounting bolts (photo).
9 Lower the crossmember assembly with the floor jack and prepare to remove the outer suspension arm and torsion bar.
10 Keep the crossmember on the floor jack to disassemble it.

Installation

11 Attach the crossmember to your vehicle. Make sure the mounting bolts are tightened according to the Torque specifications.
12 Install the shocks, the front and rear exhaust pipes, (on 4WD vehicles the rear differential, the driveshaft and the rear axleshafts) and the rear wheels by referring to the appropriate Sections and Chapters.
13 Make sure that all mounting hardware is tightened according to the Torque specifications.

14 Outer suspension arm (rear) – removal and installation

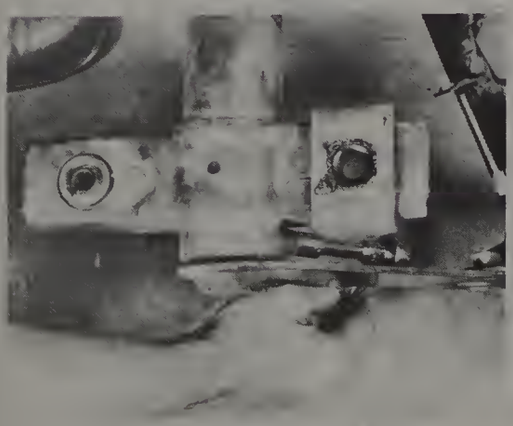
Refer to Fig. 11.9

Removal

1 To remove the outer suspension arm you first have to remove the crossmember from the vehicle. To do this, refer to the appropriate Section in this Chapter.
2 Match mark the torsion bar to the outer arm and the outer arm to the crossmember (photo), so they will be reassembled correctly.
3 Remove the bolts holding the outer arm to the inner arm bracket.
4 Remove the outer bushing locking bolt (photo).
5 Now, remove the outer arm together with the torsion bar from the crossmember.
6 Remove the torsion bar from the outer arm with a gear puller (photo).
7 Inspect and replace the outer bushing if necessary. To remove the bushing, use a puller (photo).

13.8 Remove the bolts holding the crossmember to the frame

14.2 Match mark the torsion bar to the outer arm and then to the crossmember



14.4 Remove the outer bushing locking bolt

14.6 Remove the torsion bar from the outer arm with a puller

14.7 Remove the outer bushing from the outer arm with a puller

8 Apply grease to the exterior of the bushing before installing it.
9 Apply grease to the splines of the torsion bar.

Installation

10 Without disturbing the crossmember, install the outer arm with torsion bar into the crossmember and line up the match marks.
11 Temporarily install the outer bushing locking bolt.
12 Install the crossmember and other associated suspension components by referring to the appropriate Chapters.
13 With everything installed on the vehicle and tightened according to the specified torque, lower the vehicle to the ground. Now tighten the outer bushing locking bolt to the specified torque.

15 Center arm (rear – 4WD) – removal and installation

Refer to Fig. 11.9

Removal

1 First, remove the outer arm and torsion bar assembly by referring to the appropriate Sections in this Chapter.
2 Remove the center arm by removing any mounting bolts holding it in place on the crossmember.

Installation

3 Make sure that grease is applied to the inside of the center arm and also to the splines on both of the torsion bars.
4 Install the center arm onto the crossmember.
5 Install the outer arm and torsion bar assembly.

16 Ground clearance (4WD) – check and adjustment

Refer to Figs. 11.10 and 11.11

1 Before making any check of your vehicle's ground clearance, make sure that the tire pressure is correct and place the vehicle (unloaded)

on a level surface.

Front posture (see Fig. 11.1)

2 Check the clearance by measuring between the flat of the front suspension arm mounting bolt to the ground. Compare with the Specifications.

3 To adjust the clearance, turn both of the adjusting nuts (on both of the struts) the same number of turns. Refer to the accompanying illustrations. A 21-mm wrench is required for these adjusting nuts.

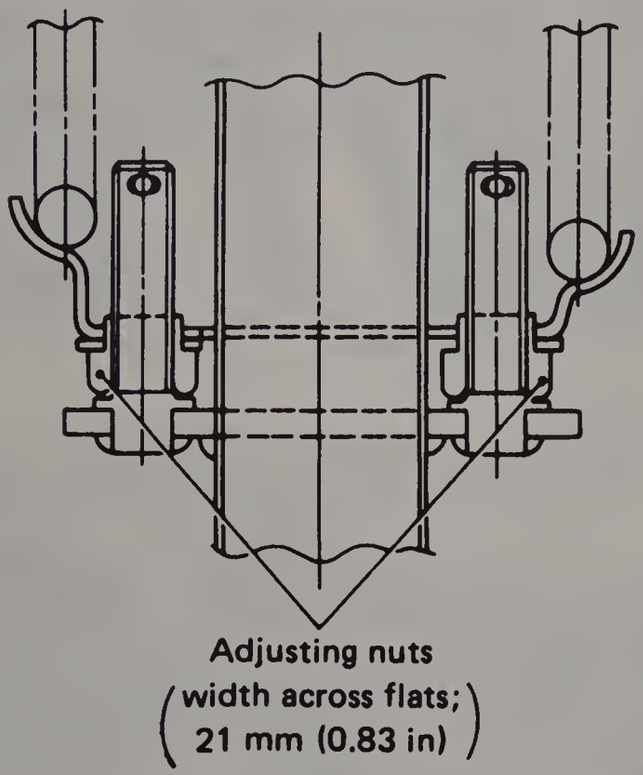


Fig. 11.10 Vehicle front height adjusting bolts (Sec 16)

4 After any adjustments have been made, have the toe-in checked and adjusted.

Rear posture

5 Check the clearance by measuring between the lowest point of the rear crossmember's round section and the ground. Compare with the Specifications.

6 To adjust the clearance, turn the height adjustment bolt on the center arm of the crossmember. A service hole is provided on the floor of the vehicle for access to this bolt.

7 Turning the bolt clockwise increases vehicle height and counter-clockwise decreases height.

17 Steering wheel – removal and installation

Removal

1 **Note:** *A steering wheel puller is not needed for this procedure.* Disconnect the cable from the negative terminal of the battery.

2 Remove the steering wheel pad mounting screws (photo) and then the pad.

3 You can also remove the horn button pads (photo) at this time.

4 Remove the steering wheel-to-column mounting bolt (photo). Remove the steering wheel from the column by pulling straight out.

Installation

5 Install the steering wheel and tighten the mounting nut to the specified torque.

6 Make sure that all of the cover pad mounting screws are tight.

18 Steering gearbox boots – replacement

Refer to Fig. 11.13

Manual gearbox

Removal

1 The boots can be replaced with the steering unit still mounted on your vehicle, even though the photographs show the unit removed from the vehicle. **Note:** *If, by inspecting the boots, it is found that they have holes or tears in them, remove the whole unit from your vehicle so it can be thoroughly cleaned and greased.*

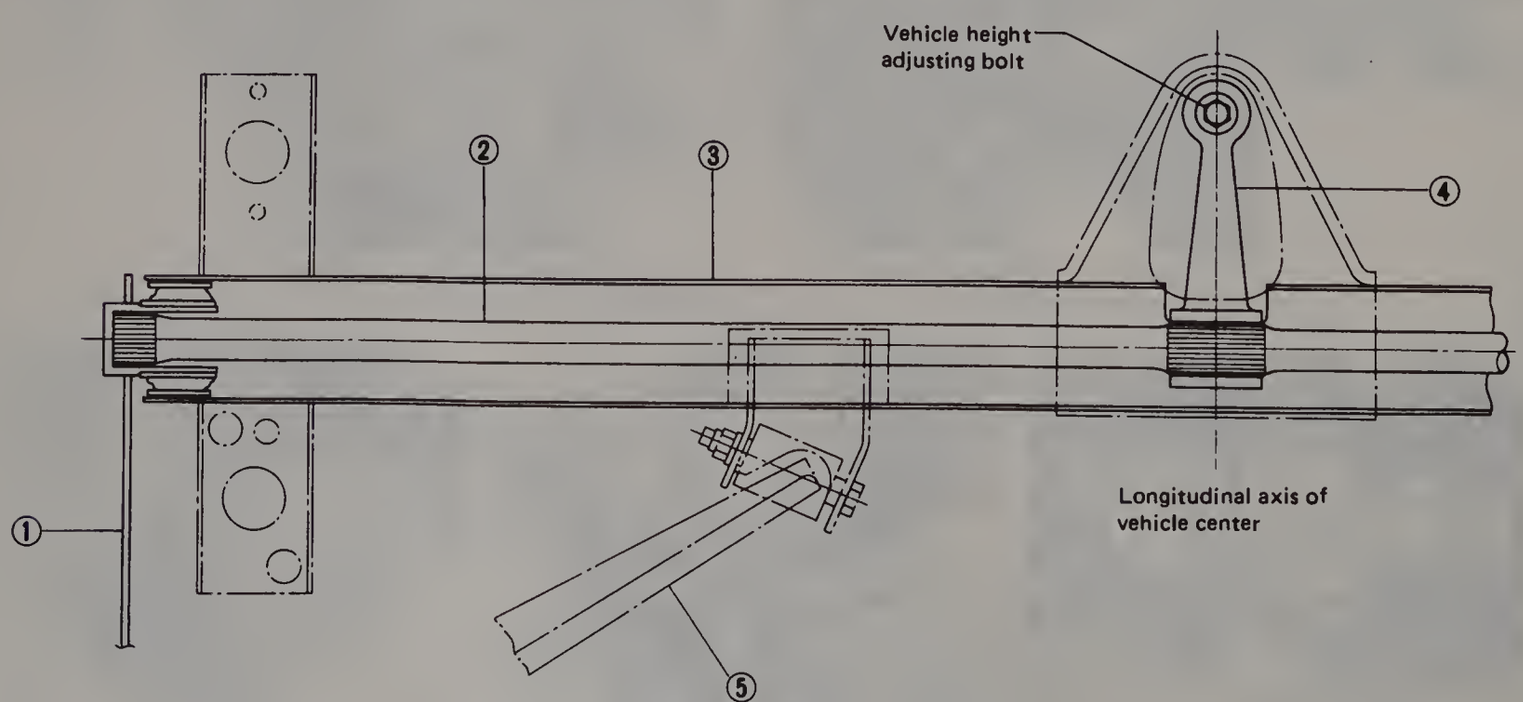


Fig. 11.11 Vehicle rear height adjustment (Sec 16)

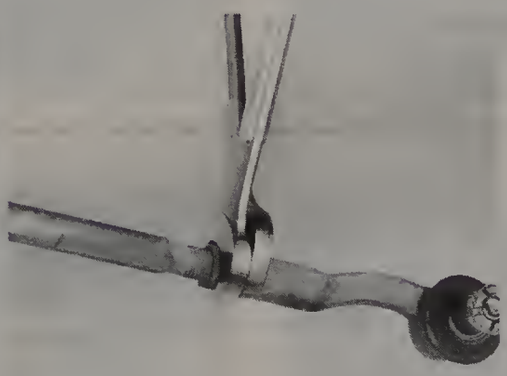
1 Outer arm
2 Torsion bar
3 Crossmember
4 Center arm
5 Inner arm

17.2 Remove the steering wheel pad mounting screws

17.3 You can also remove the horn button pad screws

17.4 Remove the steering wheel-to-column mounting nut

18.4 Remove the tie-rod end boot ring



18.6 Loosen and back the jam nut away from the tie-rod end

18.7 Remove the tie-rod end from the tie-rod

18.8 Remove the small boot retaining spring

18.9 Remove the large boot retaining spring

2 Refer to Section 9 of this Chapter to disconnect the tie-rod ends from the steering knuckle.
3 Remove the splash shield that protects the steering box and is attached to the crossmember.
4 First, remove the boot ring and the rubber boot (photo) from the tie-rod end. Replace the boot with a new one.
5 Clean as much of the old grease from the tie-rod end as possible.
6 **Note**: *Before loosening the jam nut, count and record the number of threads that are visible on the tie-rod. This will allow you to install the tie-rod and jam nut in approximately the same location.* Now, use two wrenches (one on the tie-rod end – the other on the jam nut) and loosen the jam nut (photo) and thread it away from the tie-rod end.
7 Now engage the flat portion of the tie-rod with a wrench and remove the tie-rod end (photo).
8 Remove the small boot retaining spring (photo) from the rubber boot.
9 Now, remove the large boot retaining spring (photo) from the rubber boot.
10 Carefully remove the rubber boot from the tie-rod assembly.

Installation

11 Inspect the boot for deterioration, cracks and holes. Replace it with a new one if necessary.
12 Using the steering wheel, turn the wheel all the way to one side and apply grease to the rack teeth. Turn the wheel in the opposite direction and do the same.
13 Apply grease to both of the tie-rod ends that are connected to the rack.
14 Carefully install the rubber boot and make sure that the indented portions of the boot fit tightly into the slots.
15 Install both boot retaining springs.
16 Fill the threaded cavity of both tie-rod ends with grease prior to installing them onto the tie-rods. As you install them, the grease will be forced through the balljoints and purge the old grease.
17 Install the jam nuts and the tie-rod ends onto the tie-rods. **Note**: *There are identification marks on the tie-rod ends for left and right*

side. Make sure that you do not interchange them.
18 Position the tie-rod ends and the jam nuts according to the number of threads that you counted when they were removed or refer to the accompanying illustration and maintain the given measurement.
19 Tighten the jam nut against the tie-rod end according to the Torque specifications.
20 Install the new rubber boot, filled with grease, onto the tie-rod end. Install its retaining ring.
21 Position the large lip of the rubber boot toward the rubber boot itself as shown in the accompanying illustration.
22 Attach the protective shield to the crossmember. Attach the balljoint ends to the steering knuckle by referring to Section 9 in this Chapter.
23 Make sure that all mounting hardware is tightened according to the Torque specifications.

Power gearbox

24 The procedure for replacing the rubber boots on the power steering gearbox is basically the same as for the manual gearbox.
25 Note that the power gearbox boots have three boot retaining springs instead of two.
26 Also, there is an air vent pipe between the boots on the power gearbox. When removing this pipe from the boots, make sure that it is open (no restrictions) and that it is reinstalled after both boots are in place.

19 Steering gearbox (manual) – removal and installation

Refer to Fig. 11.12

Removal

1 Loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 Straighten the tangs of the cotter pin on the tie-rod end balljoints and then remove it.
3 Remove the castle nut holding the balljoints in place on the steering knuckle (photo).
4 Using a puller (photo), disengage the balljoint from the knuckle.
5 Remove the coupling cover from around the steering coupling (it is attached to the crossmember).
6 Remove the bolts holding the rubber steering coupling to the gearbox pinion (photo).

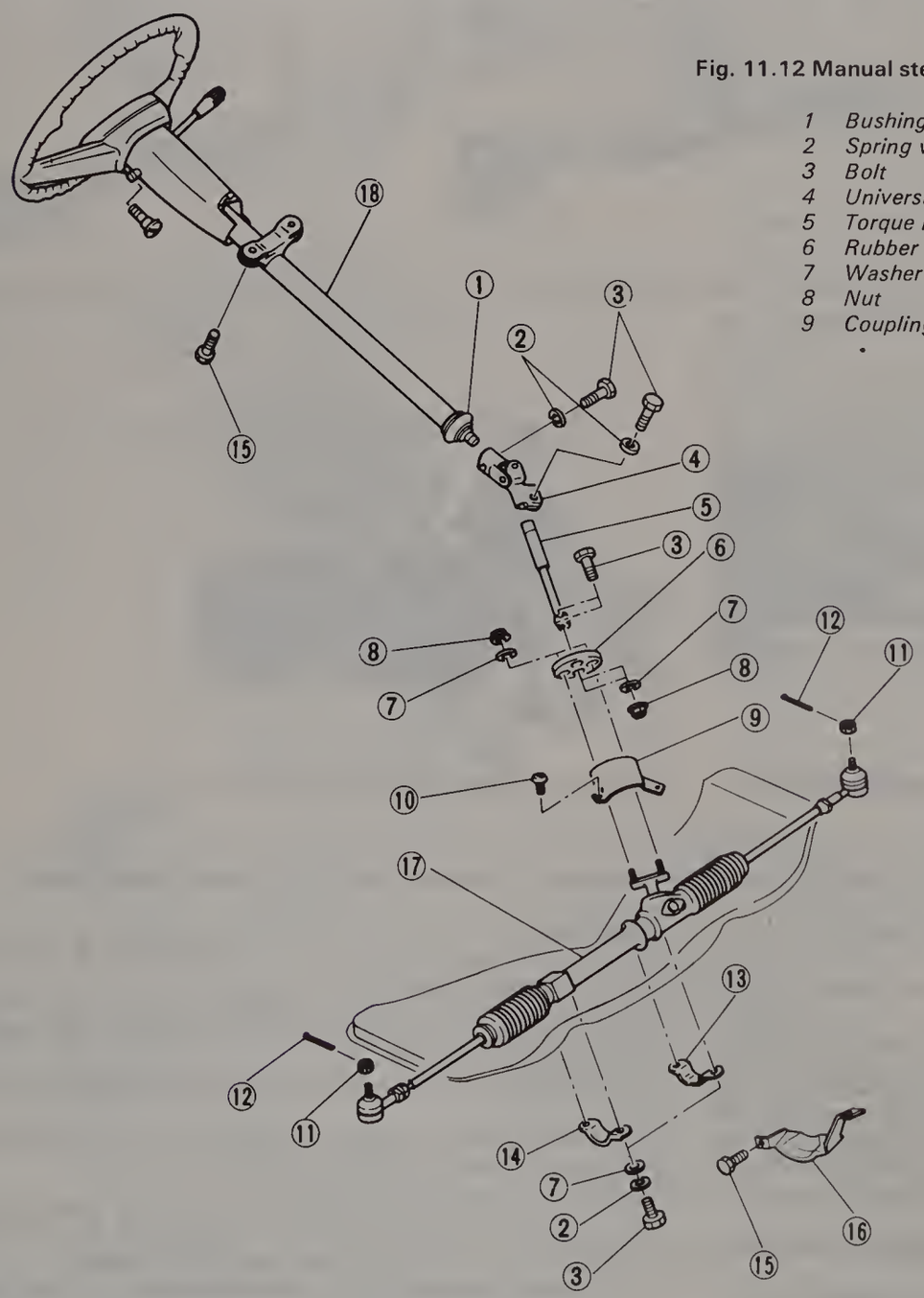
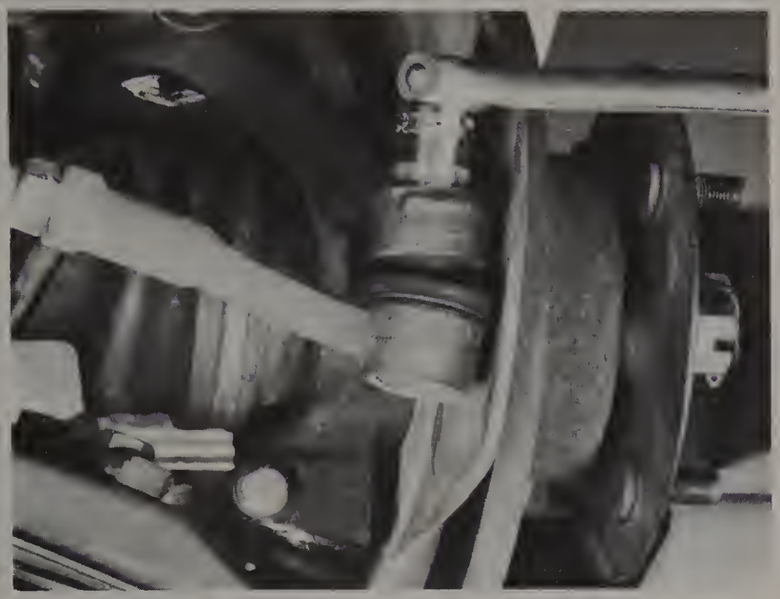
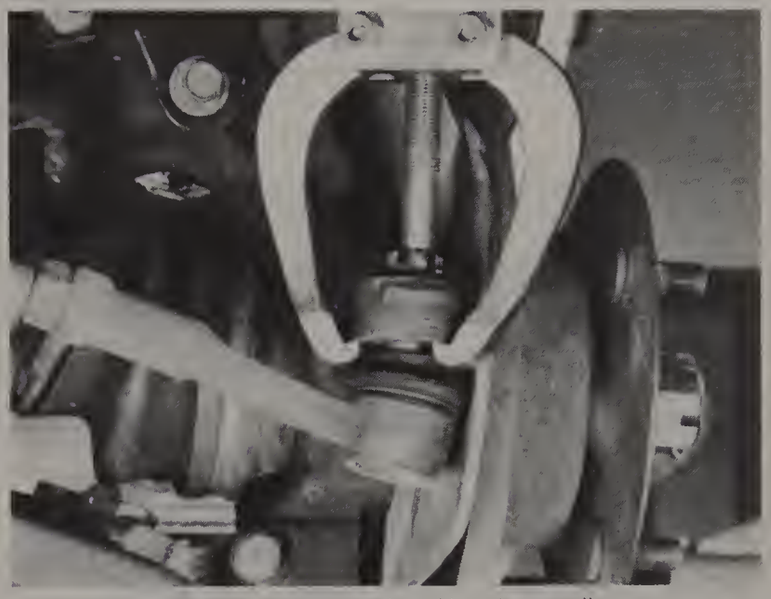


Fig. 11.12 Manual steering system components – exploded view

1	*Bushing*	10	*Screw*
2	*Spring washer*	11	*Castle nut*
3	*Bolt*	12	*Cotter pin*
4	*Universal joint*	13	*Clamp*
5	*Torque rod*	14	*Clamp*
6	*Rubber coupling*	15	*Flange bolt*
7	*Washer*	16	*Protective shield*
8	*Nut*	17	*Gearbox*
9	*Coupling cover*	18	*Shaft assembly*

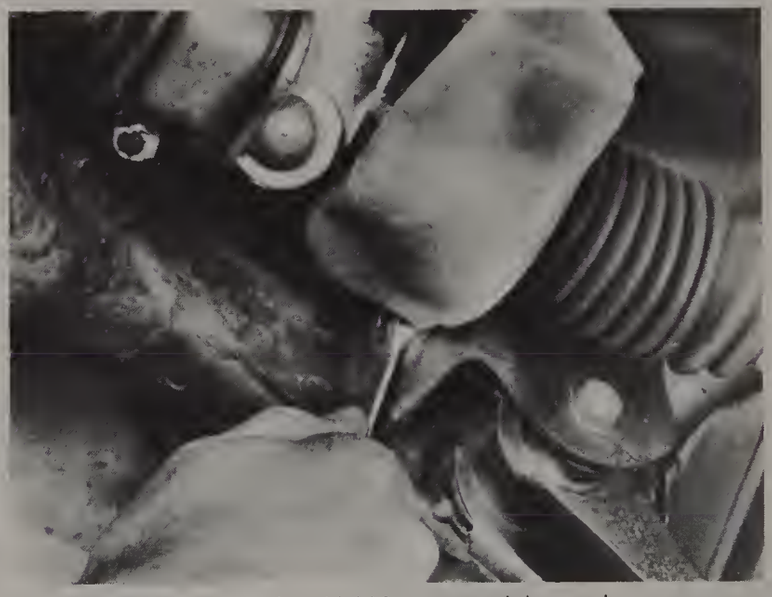


19.3 Remove the castle nut holding the tie-rod to the steering knuckle

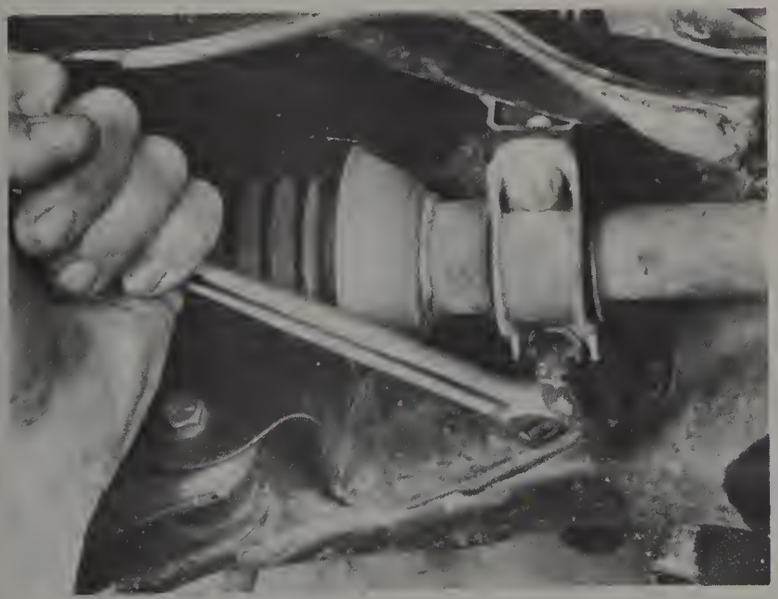


19.4 Remove the balljoint from the knuckle using a puller

19.6 Remove the bolts holding the coupling to the pinion



19.7 Remove the protective shield from around the gearbox



19.8 Remove the bolts holding the gearbox to the frame

7 Remove the protective shield from around the gearbox (photo).
8 Now you can remove the gearbox mounting bolts (photo) as well as the rubber mounts from around the gearbox tube.
9 Carefully remove the steering gearbox assembly from the vehicle.

Installation

10 Carefully install the gearbox assembly in the vehicle.
11 Install the rubber mounts around the gearbox tube. **Note**: *Install the mounts with the slit in the mount facing down.*
12 Install the gearbox mounting clamps and bolts and tighten them according to the Torque specifications.
13 Make sure that the steering wheel is pointed straight ahead. Reconnect the rubber coupling to the gearbox pinion. Make sure that the bolts are tight.
14 Install the coupling cover around the rubber coupling and to the crossmember. Make sure the bolts are tight.
15 Attach the balljoints to the steering knuckles.
16 Install the castle nuts and tighten them according to the Torque specifications.
17 Install new cotter pins in the nuts.
18 Install the front wheels, lower the front of the vehicle and tighten the wheel lug nuts.

20 Steering gearbox (power) – removal and installation

Refer to Fig. 11.17

Removal

1 Loosen the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
2 Straighten the tangs of the cotter pins on the tie-rod end balljoints and then remove them.
3 Remove the castle nuts holding the balljoints in place on the steering knuckles.
4 Using a puller, disengage the balljoints from the knuckles. **Note:** *Refer to Section 19 for photo coverage.*
5 Disconnect the cap from the oxygen sensor and remove the front exhaust pipe.
6 Remove the boot protector that is attached to the crossmember.
7 Remove the power steering fluid from the gearbox. To do this, disconnect the hydraulic lines attached directly to the tube of the gearbox. Attach vinyl hoses to these fittings and plug the ports of the gearbox.
8 Place the other end of the vinyl hoses in a container, start the engine and turn the steering wheel several times from lock-to-lock until the fluid is completely pumped out of the system.
9 Now disconnect the bolts holding the steering universal joint together.
10 Remove all of the hydraulic lines to the steering box control valve.
11 Remove the gearbox mounting bolts and then remove the gearbox from the vehicle.
12 Disassembly of the steering gearbox is not recommended. Refer to Section 21.

Installation

13 Attach the gearbox to the vehicle using the mounting bolts. Make sure you tighten the bolts to the specified torque.
14 Attach the hydraulic lines to the gearbox and the control valve. Make sure they are tight.
15 Install the rubber boot protector on the crossmember.
16 Install the cap on the oxygen sensor.
17 Reconnect the steering universal joint and make sure that the mounting bolts are tightened according to the Torque specifications.
18 Reconnect the rod ends to the steering knuckle. Make sure that the castle nuts are tightened according to the Torque specifications.
19 Install the front wheels. Fill the steering system with the recommended fluid and then check for leaks.
20 Bleed any air from the system by referring to Section 24 of this Chapter.
21 Have the front end alignment checked by a dealer service department.

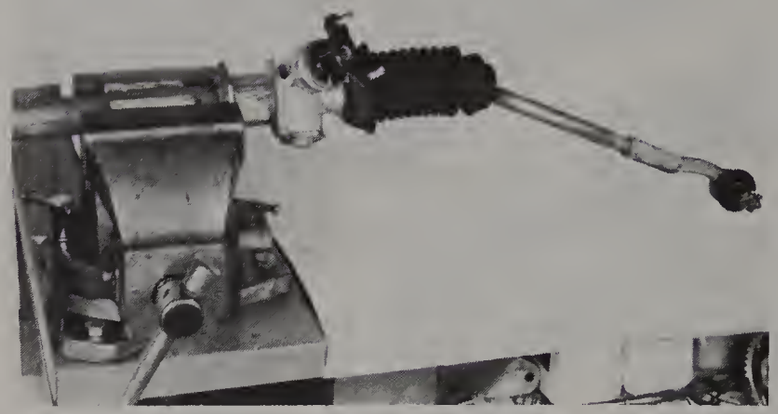
21 Steering gearboxes – disassembly and reassembly

Refer to Figs. 11.13 through 11.15

Manual gearbox

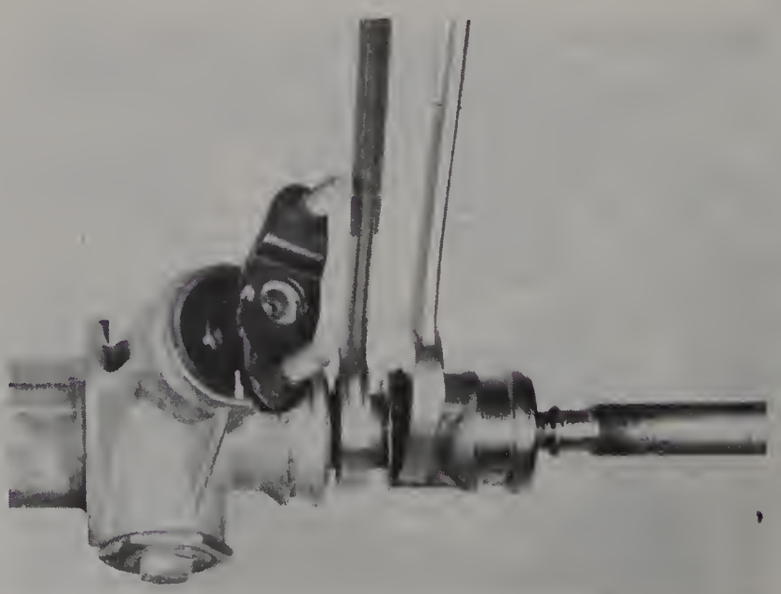
Disassembly

1 Place the gearbox assembly in a vise. To do this safely and effectively, place a block of wood on both sides of the gearbox tube. Make them only thick enough to allow the vise jaws to clamp onto the wood and the flanged boss of the gearbox tube. This will stabilize the gearbox in the vise (photo).
2 Remove the tie-rod ends and the rubber boots by referring to Section 18 in this Chapter.
3 Now you can remove the tie-rods from the rack. To do this, push the tie-rod into the gearbox until it bottoms against the gearbox tube.
4 Use a chisel and hammer and bend the tangs of the lockwasher until the washer is flat (photo).
5 Pull the tie-rod out of the gearbox tube until you can engage the flats on the rack with a wrench. Now engage the flats on the balljoint and remove the tie-rod (photo).
6 Remove the lock washer and replace it with a new one.
7 Remove the adjusting screw locknut (photo). Remove the adjusting screw (photo). Replace the O-ring on the adjusting screw with a new one.



21.1 Mount the gearbox in a vise

21.4 Flatten the tangs on the locking washer with a chisel



21.5 Remove the tie-rod from the racks

(Left-hand drive vehicle)

(Right-hand drive vehicle)

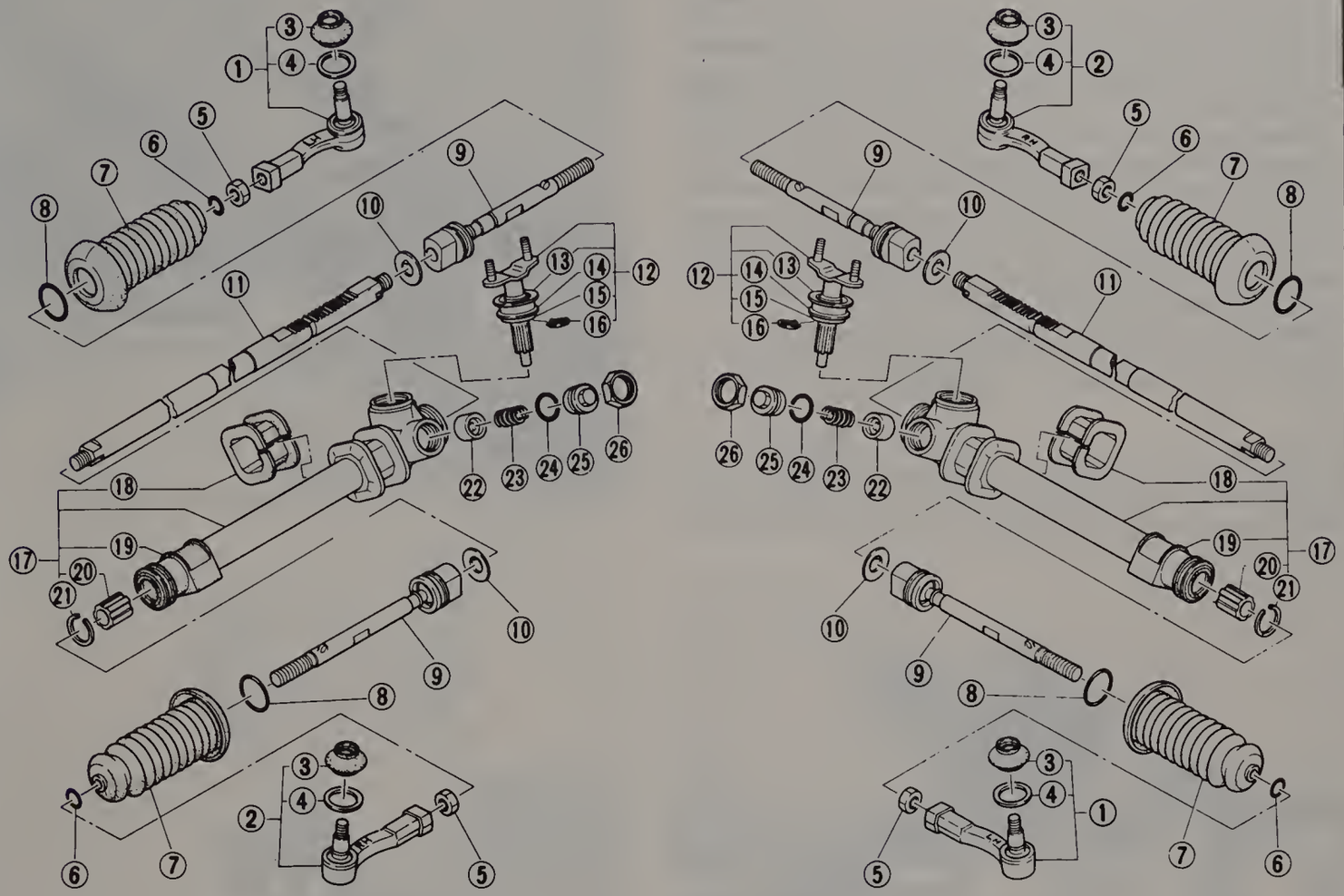
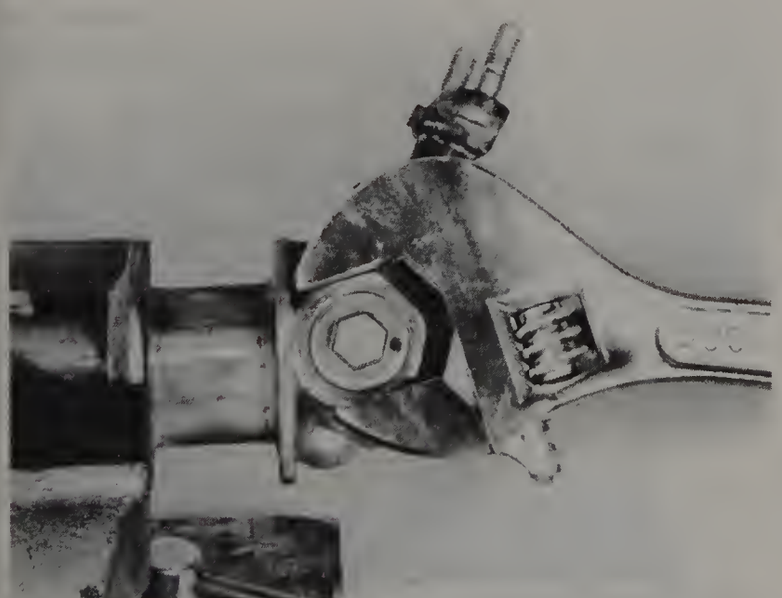
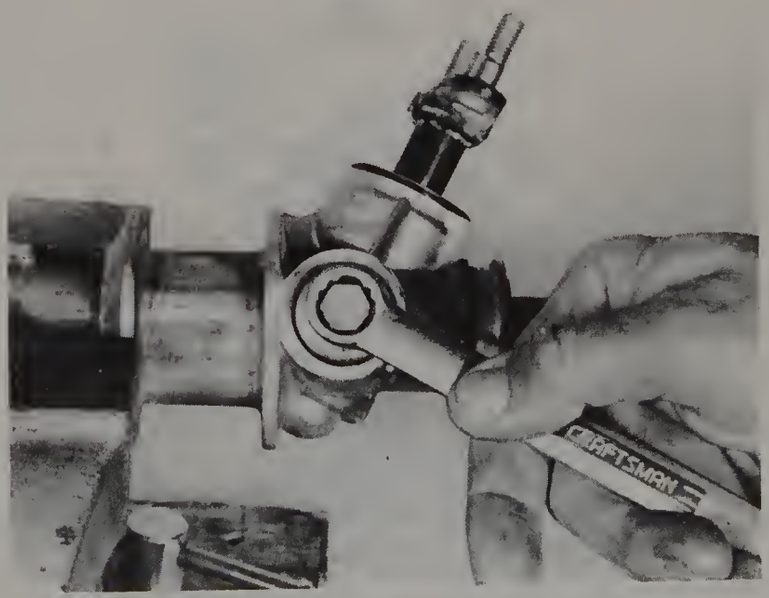


Fig. 11.13 Manual steering gearbox components – exploded view (Sec 21)

1 *Tie-rod end (LH)*
2 *Tie-rod end (RH)*
3 *Dust seal*
4 *Snap-ring*
5 *Nut*
6 *Spring*
7 *Boot*
8 *Spring*
9 *Tie-rod*
10 *Lock washer*
11 *Rack*
12 *Pinion assembly*
13 *Oil seal*
14 *Snap-ring*
15 *Ball bearings*
16 *Snap-ring*
17 *Gearbox*
18 *Adapter*
19 *Adapter*
20 *Bushing*
21 *Clip*
22 *Sleeve*
23 *Spring*
24 *O-ring*
25 *Adjusting screw*
26 *Locknut*



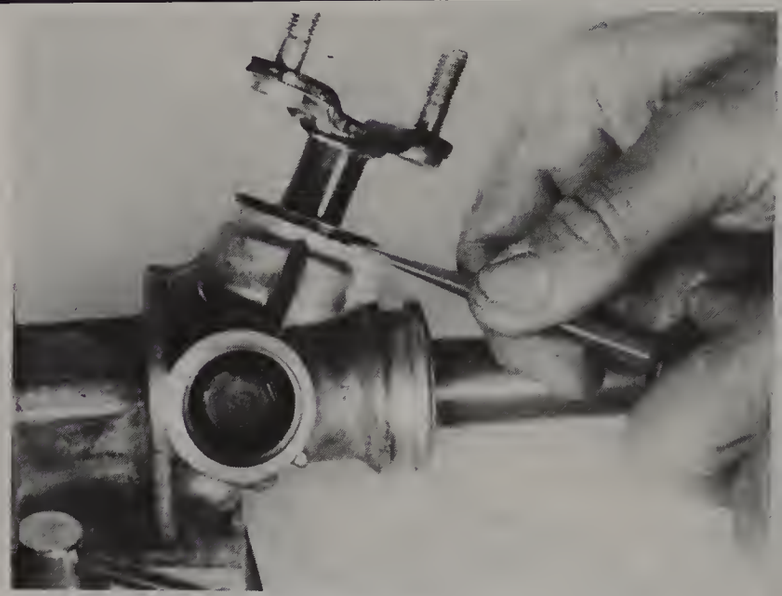
21.7A Remove the adjusting screw locknut ...



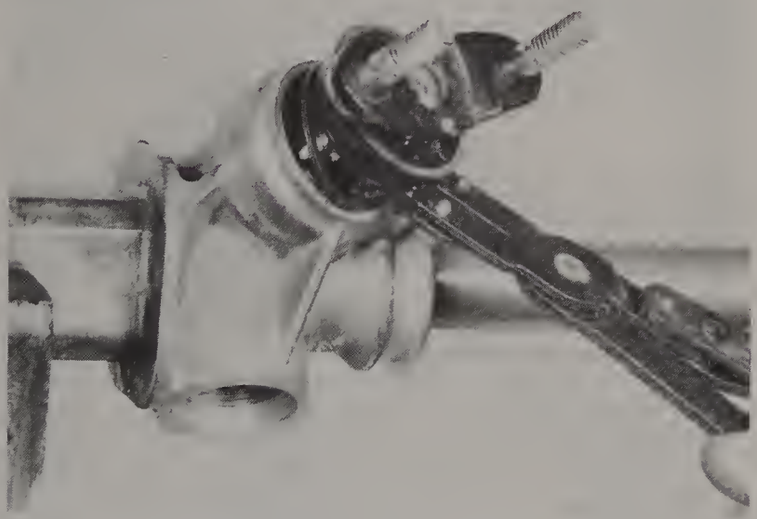
21.7B ... and then remove the adjusting screw

8 Now remove the adjusting screw tension spring and the sleeve from the gearbox. To remove the sleeve, you first have to remove the pinion assembly.
9 Use a screwdriver and carefully pry on the rubber seal of the pinion in order to lift it (photo) and remove the retaining ring.
10 Remove the retaining ring (photo) and then the pinion assembly from the gearbox.
11 Now you can remove the sleeve by pushing on it with a screwdriver until it falls into the gearbox.
12 Remove the rack from the gearbox. **Note:** *There is no reason to remove the opposite tie-rod end from the rack unless you are going to replace it with a new one.*
13 Remove the gearbox tube from the vise and install the pinion assembly in the vise. Do this by installing the pinion-to-steering shaft mounting nuts and clamping onto them with the vise.
14 Remove the pinion bearing retaining ring (photo).
15 Remove the bearing from the pinion using a puller (photo).
16 Remove the rubber seal ring and then remove the seal from the pinion.

Reassembly
17 Install the new pinion rubber seal and its retaining ring.
18 Install the bearing using a deep socket (photo) with the same inside diameter as the outside diameter of the pinion shaft. Install the retaining ring.

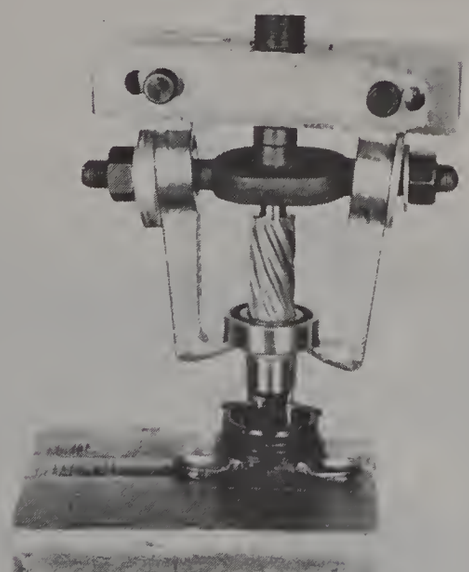


21.9 Use a screwdriver and lift the rubber seal off the pinion

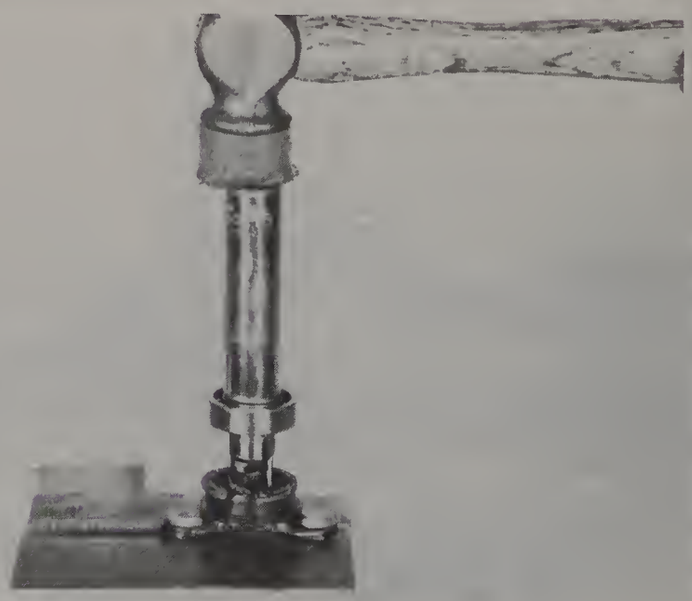


21.10 Remove the retaining ring from the pinion

21.14 Remove the pinion bearing retaining ring



21.15 Remove the bearing from the pinion using a puller



21.18 Install the bearing on the pinion using a deep socket

19 Remove the pinion assembly from the vise and then install the gearbox back into the vise as before.
20 Install the rack into the gearbox after cleaning the old grease off it. **Note:** *Apply clean grease to the rack and install it from the pinion side of the gearbox so that you do not damage the bushing on the other end of the gearbox.*
21 After installing the rack, position it to the dimension from the pinion side of the gearbox as shown in the accommpanying illustration.
22 Fill as much of the cavity where the pinion goes as you can with the specified grease. Install the pinion to the gearbox.
23 When inserting the pinion to mesh with the teeth of the rack, make sure that the pinion flange is inclined in the straight-ahead drive condition as shown in the accompanying illustration. **Note:** *Refer to your vehicle – make sure the steering wheel is in the straight-ahead position – then look at the rubber coupling that connects to the pinion flange.*
24 After you have accomplished this, while maintaining the specified dimension between the rack and the pinion end of the gearbox (photo), install the large retaining ring that holds the pinion to the gearbox.
25 Make sure the retaining ring is seated properly by turning the pinion back and forth. Make sure the seal is installed properly.
26 Now install a dial indicator (photo) and measure the clearance in the parallel direction to the pinion shaft. Compare it to the Specifications. If the clearance is different from the Specifications, the retaining ring may be installed improperly.
27 If everything is correct, install the adjustment sleeve, making sure that it engages the rack correctly. Fill the cavity with grease.
28 Install the spring and then the adjusting screw (with a new O-ring).

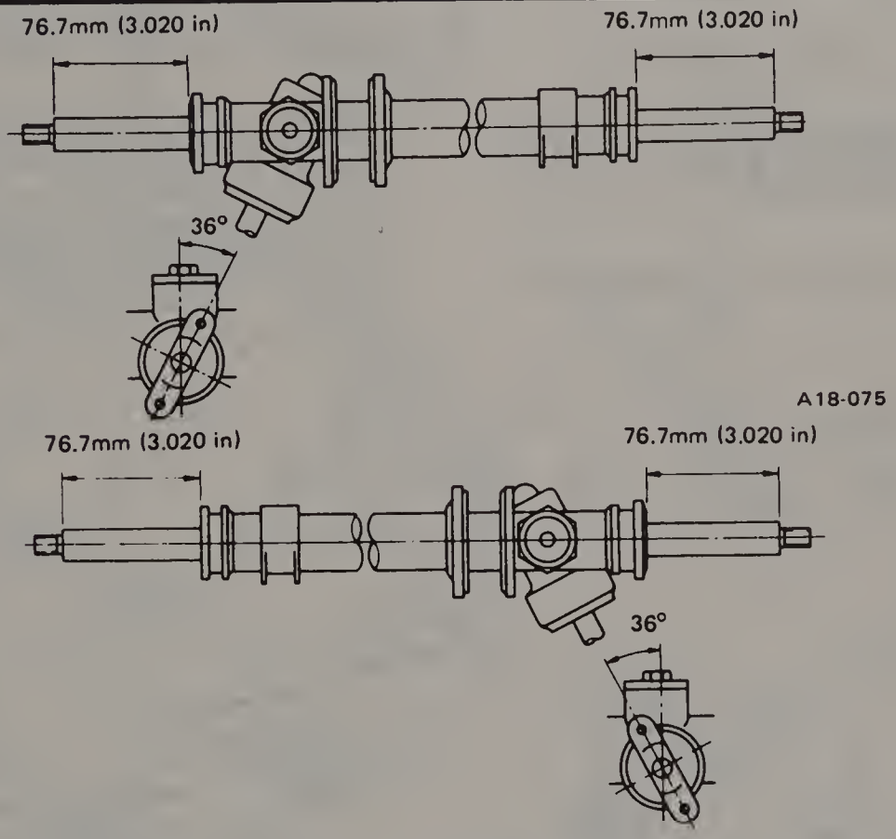
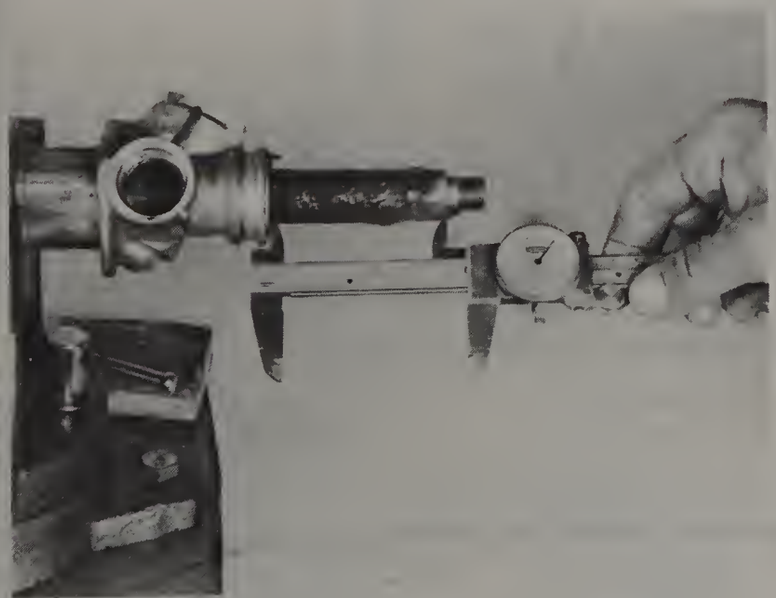
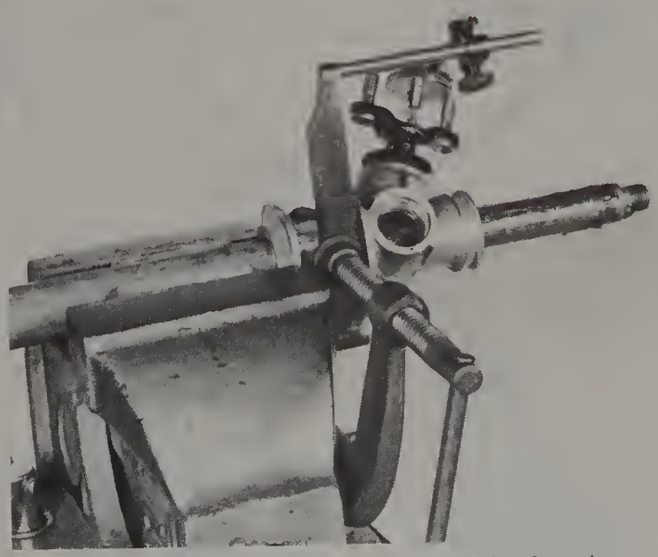


Fig. 11.14 Correct rack-to-gearbox-to-pinion position; left-hand drive (top), right-hand drive (bottom) (Sec 21)



21.24 Maintain this measurement between the rack and the gearbox end during reassembly



21.26 Install a dial indicator and measure pinion free play

Do not completely tighten the screw.
29 The rack-to-pinion backlash must be set now. To do this, turn the adjusting screw in until the effort to turn it increases sharply. At this point, back the screw off about 15 degrees.
30 Hold the adjusting screw with a wrench to keep it from turning, then install the locknut and tighten it securely. **Note:** *Check the engagement of the pinion and rack by turning the pinion by hand. If it turns abnormally hard, back off the adjusting screw a little more.*
31 Install the new lock washer on the rack and then install the tie-rod onto the rack. **Note:** *The ball end of the tie-rod is hollow. Fill the threaded cavity of the balljoint with grease prior to installing it. As you install the balljoint, the grease will be forced through the ball, thereby purging the old grease and adding new grease.*
32 Tighten the rod end as tight as you can and then peen the sides of the lock washer up against the flats of the balljoint.

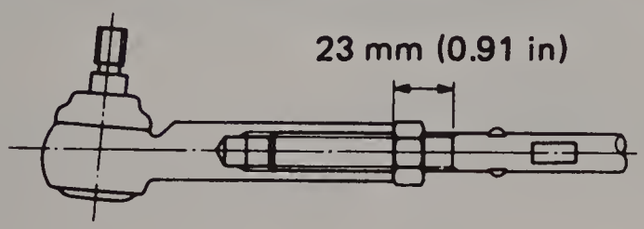


Fig. 11.15 Correct rod end-to-tie-rod position (Sec 21)

33 Refer to Section 18 of this Chapter to install the boots and the rod ends.
34 Refer to Section 19 and install the gearbox in your vehicle.

Power gearbox

35 Because of the special tools needed to do the job, it is recommended that you do not attempt to overhaul your power steering gearbox. Remove it from the vehicle by referring to the appropriate Section in this Chapter, then take it to a dealer service department and have it repaired (or replace it with a new one).

22 Power steering pump – removal and installation

Refer to Figs. 11.16 and 11.17

1 If your power steering pump is found to be defective, it must be replaced with a new one.

Removal

2 First, loose the wheel lug nuts. Block the rear wheels, raise the front of the vehicle and place it on jackstands (position them in the front rocker panel notches). Remove the front wheel(s).
3 Remove the power steering fluid from the system. To do this, disconnect the hydraulic fittings attached directly to the tube of the gearbox. Attach vinyl hoses to these fittings and plug the ports of the gearbox.
4 Place the other end of the vinyl hoses in a container, start the

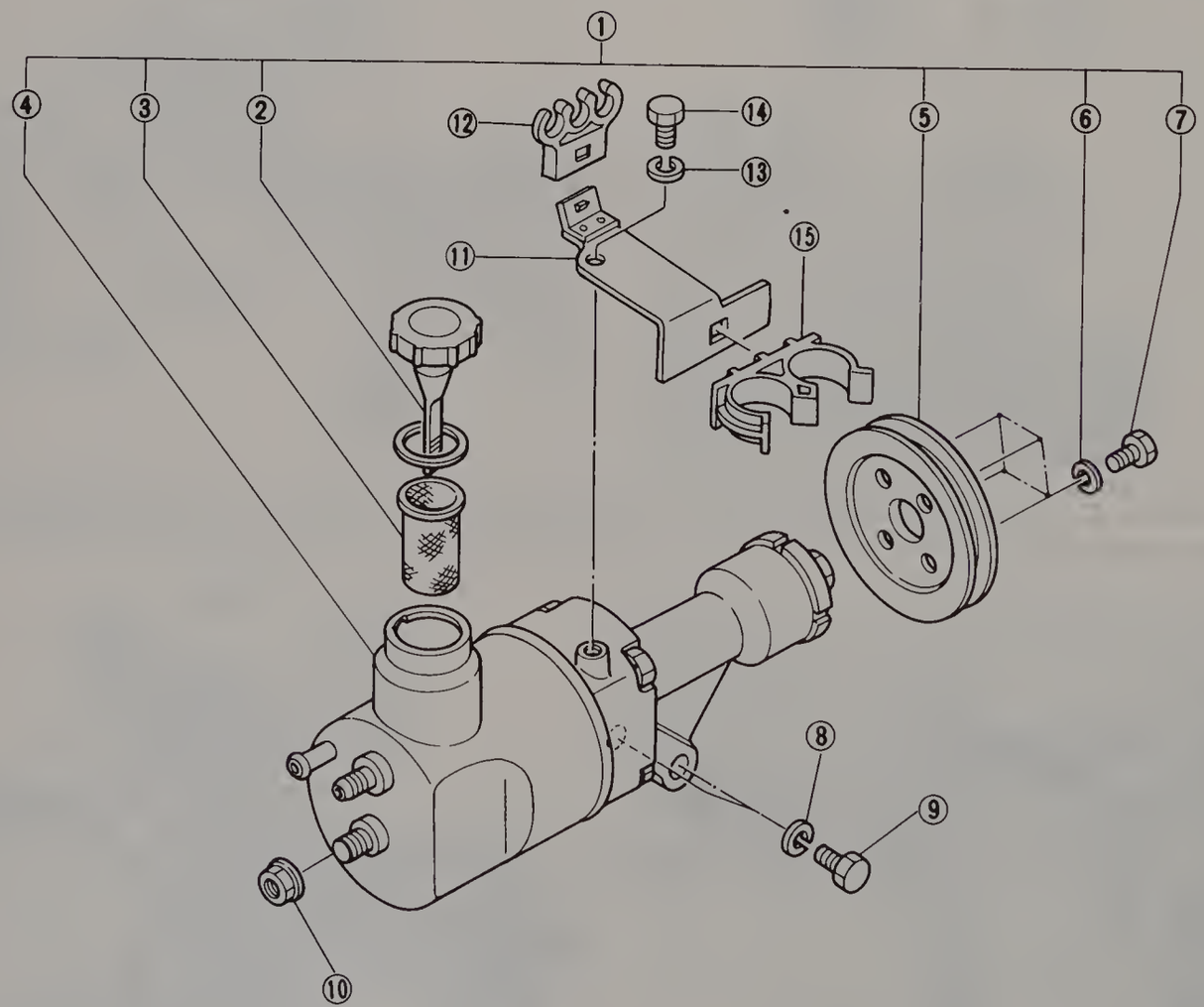


Fig. 11.16 Power steering pump components – exploded view (Sec 22)

1 *Pump assembly*
2 *Cap*
3 *Strainer*
4 *Oil pump*
5 *Pulley*
6 *Spring washer*
7 *Bolt*
8 *Spring washer*
9 *Bolt*
10 *Flange nut*
11 *Stay*
12 *Supporter*
13 *Spring washer*
14 *Bolt*
15 *Hose clamp*

engine and turn the steering wheel from lock to lock several times until the fluid is completely pumped out of the system.

5 Grab the brim of the idler cap with a pliers and remove it.

6 Loosen the lock bolt by turning it about two turns.

7 Turn the adjustment bolt counterclockwise and take out the drivepump belt.

Note: *After turning the adjustment bolt, the idler pulley will move up due to the tension of the drivebelt, which will allow the belt to be removed easily.*

8 Disconnect the hoses to the air cleaner assembly. Remove the air cleaner assembly. **Note:** *Place a rag inside the carburetor after the air cleaner is removed to avoid getting dirt inside.*

9 Remove the hoses on the backside of the power steering pump and plug them to keep dirt out.

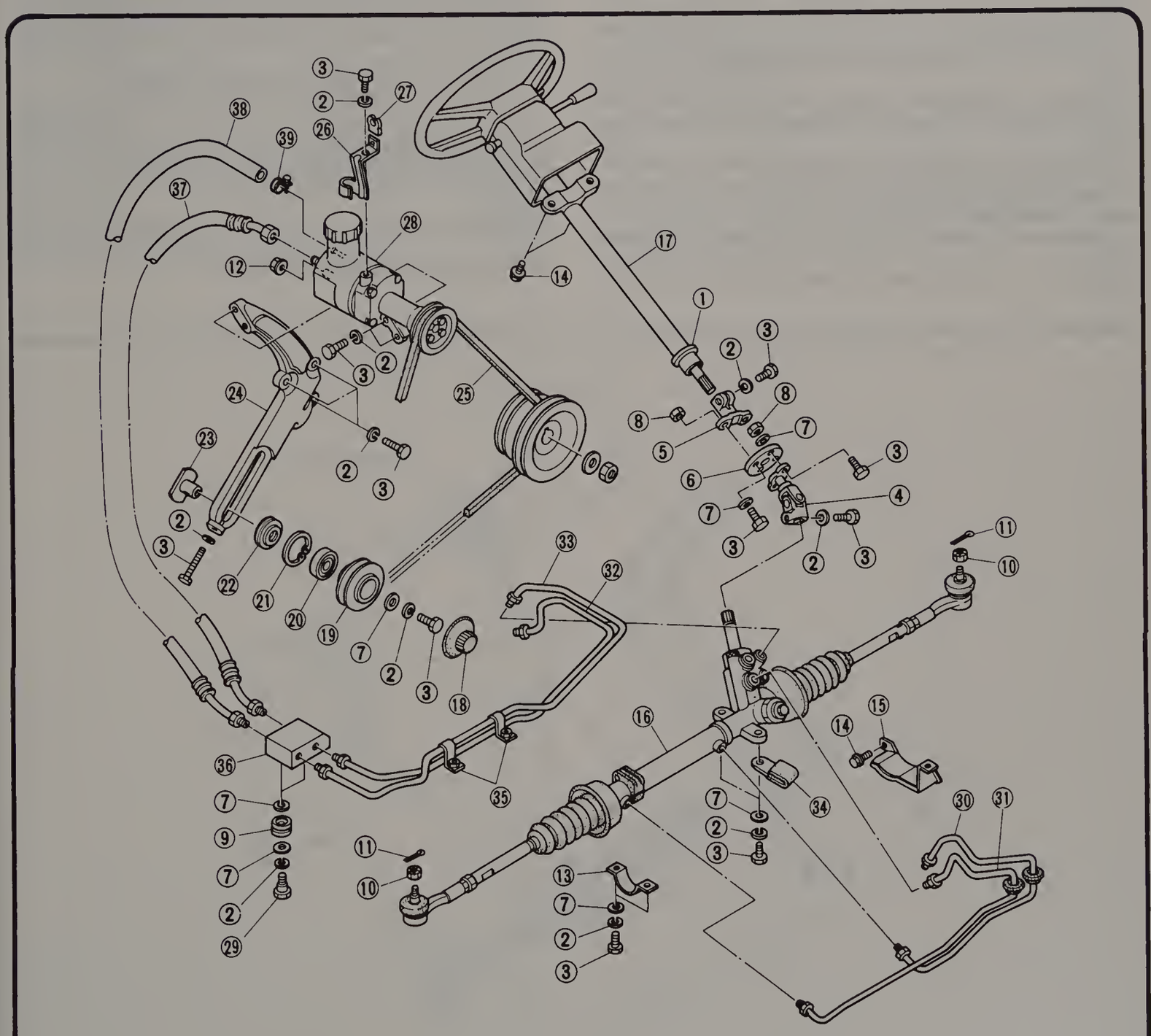


Fig. 11.17 Left-hand drive power steering system components – exploded view

1 *Bushing*
2 *Spring washer*
3 *Bolt*
4 *Universal joint*
5 *Joint*
6 *Rubber coupling*
7 *Washer*
8 *Self-locking nut*
9 *Grommet*
10 *Castle nut*
11 *Cotter pin*
12 *Flange nut*
13 *Clamp*
14 *Flange bolt*
15 *Protector*
16 *Gearbox assembly*
17 *Shaft assembly*
18 *Cap*
19 *Idler pulley*
20 *Ball bearing*
21 *Snap-ring*
22 *Dust seal*
23 *Shaft*
24 *Beltline bracket*
25 *Drivebelt*
26 *Clip*
27 *Supporter*
28 *Oil pump*
29 *Connector bolt*
30 *Line*
31 *Line*
32 *Line*
33 *Line*
34 *Clamp*
35 *Clamp*
36 *Connector*
37 *Pressure hose*
38 *Return hose*
39 *Hose clamp*

10 Remove the oil pump stay by removing its mounting bolts.
11 Remove the mounting bolts holding the pump in position, then lift out the pump.

Installation

12 Install the oil pump and tighten the mounting bolts according to the Torque specifications.
13 Attach the hoses to the oil pump making sure that they are not twisted.
14 Install the pump hose stay and tighten the mounting bolts. Attach the hoses to the stay.
15 Install the air cleaner assembly and its associated hoses and filters.
16 Install the drivebelt and adjust its tension by referring to the appropriate Section in Chapter 1. Install the idler cap in its correct position.
17 Attach the hydraulic lines to the tube of the steering gearbox and make sure that they are tight.
18 Install new power steering fluid and check for any leaks in the system. Tighten fittings if necessary.
19 Make sure that all of the fittings and hose clamps are installed correctly.
20 Bleed any air from the system by referring to Section 24 of this Chapter.

23 Power steering idler pulley – removal and installation

Refer to Figs. 11.17 and 11.18

Removal

1 Grab the brim of the idler cap with pliers and remove it.
2 Loosen the lock bolt by turning it about two turns.
3 Turn the adjustment bolt counterclockwise and take out the drivebelt. **Note:** *After turning the adjustment bolt, the idler pulley will move up due to the tension of the drivebelt, which will allow the belt to be removed easily.*
4 Disconnect the hoses to the air cleaner assembly.
5 Disconnect the air hose and duct connected to the right-hand side rocker cover. Remove the wing nuts holding the air cleaner in place.
6 Remove the bolts on the front of the pump assembly while lifting up the air cleaner air horn slightly.
7 Remove the belt line bracket together with the idler pulley assembly.

Disassembly

8 Now remove the lock and adjustment bolts from the belt line bracket.
9 Push the idler pulley out of the bracket.

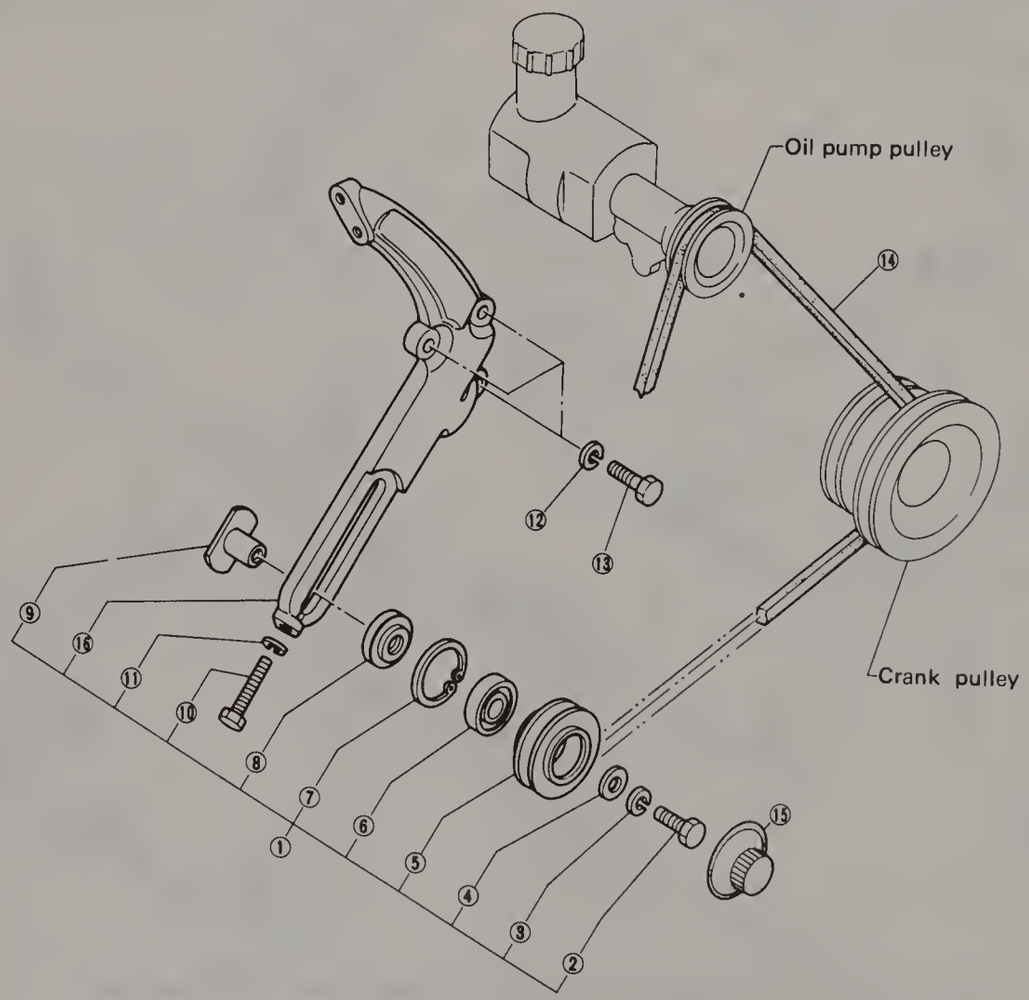


Fig. 11.18 Power steering idler pulley components – exploded view (Sec 23)

1 *Front bracket assembly*
2 *Lock bolt*
3 *Spring washer*
4 *Plain washer*
5 *Idler pulley*
6 *Ball bearing*
7 *Snap-ring*
8 *Dust seal*
9 *Shaft*
10 *Adjustment bolt*
11 *Washer*
12 *Washer*
13 *Bolt*
14 *Drivebelt*
15 *Idler cap*
16 *Beltline bracket*

10 Remove the dust seal and the shaft from the bracket.
11 Remove the snap-ring and then the bearing from the idler pulley.

Reassembly

12 Install the bearing and snap-ring on the idler pulley.
13 Apply grease to both sealing surfaces of the dust seal, install the shaft and the seal on the bracket.
14 Apply grease to the inner surface of the idler pulley and then install the idler pulley.
15 Install the lock bolt in position but do not completely tighten it.
16 Remove any excess grease from between the idler pulley and the belt line bracket.
17 Install the adjustment bolt in the bracket. Insert it only enough to come in contact with the threads of the shaft.

Installation

18 Install the mounting bolts that hold the bracket and the pump in place. Tighten the bracket bolts according to the Torque specifications.
19 Now, tighten the pump mounting bolts according to the Torque specifications.
20 Tighten the wing nuts on the top of the air cleaner assembly. Attach the air duct and hose to the rocker cover.
21 Install the belt and adjust it by referring to the appropriate Section in Chapter 1.
22 Install the idler cap. Start the engine and make sure that no moving parts come in contact with other parts.

24 Power steering system – air bleeding procedure

1 Bleeding air out of the power steering system is accomplished in the following manner. Check the fluid level first and add fluid if necessary.
2 Raise and support the front of the vehicle with jackstands.
3 Turn the steering wheel from lock-to-lock two or three times and recheck the fluid level.
4 Start the engine and let it idle. Turn the steering wheel from lock-to-lock again (two or three times) and recheck the fluid level one more time.
5 Lower the front of the vehicle to the ground. Run the engine and again turn the wheel from lock-to-lock two or three times. Recheck the fluid level. Position the wheels in the straight-ahead position.
6 Bleeding is complete if the fluid level did not rise, from the Full mark, more than 0.200 in (5 mm) and if no foaming is observed when the engine is stopped.

Chapter 12 Bodywork

Contents

Specifications

Torque specifications

	Ft-lb	Nm
Window stopper bolt A	5.1 to 6.5	7 to 9
Window stopper bolt B	3.6 to 5.1	5 to 7
Window adjuster nut	13 to 17	18 to 23
Window regulator mounting bolt	5 to 6	7 to 8
Door hinge bolt	14 to 19	20 to 25
Door striker screw	7 to 10	10 to 14
Door latch screw	2.9 to 4.3	4 to 6
Front and rear glass sash nut	7 to 9	10 to 12
Gate gas stay mounting bolt	4.3 to 6.5	6 to 9
Gate latch bolts	16 to 19	22 to 25
Gate handle nut	5.1 to 7.2	7 to 10
Key lock cylinder set screw	3.6 to 4.3	5 to 6
Gate striker bolt	16 to 19	22 to 25
Gate hinge bolt	9 to 17	13 to 23
Bumper-to-damper mounting nut	35 to 52	47 to 71
Damper-to-frame mounting bolt	12 to 20	16 to 27
Front seat mounting bolt	9 to 17	13 to 23
Rear seat mounting bolt	2.2 to 4.3	3 to 6

1 General information

The body used on the Subaru is of combined body and integral frame construction, having all of the panels welded. The only exception is the front fenders, which are bolted in place.

The different body types that are covered in this book are the sedan, hardtop, hatchback, station wagon and the pick-up truck.

2WD means two-wheel drive, while 4WD means four-wheel drive. 2WD models have energy absorbing bumpers, while the 4WD models are rigid.

Certain components are particularly vulnerable to accident damage and can be unbolted and replaced with new ones. Among these parts are the body molding, bumpers, front fenders, doors/gates, hood/trunk lid and all glass.

2 Body exterior – maintenance

1 The condition of your vehicle's body is of considerable importance as it is on this that the resale value will mainly depend. It is much more difficult to repair neglected bodywork than to replace mechanical components. The hidden portions of the body, such as the wheel arches, fender skirts, frame and engine compartment, are equally important, although obviously not requiring as frequent attention as the exterior paint.

2 Once a year or every 12 000 miles it is a good idea to have the underside of the body steam cleaned. All traces of dirt and oil will have to be removed, and the underside can then be inspected carefully for rust, damaged hydraulic brake lines, frayed electrical wires and similar problems. The front suspension should be greased after completion of this job.

3 At the same time, clean the engine and the engine compartment with a water-soluble cleaner.

4 The fender wells should be given particular attention, since undercoating can easily come away and stones and dirt thrown up from the wheels can soon cause the paint to chip and flake and allow rust to set in. If rust is found, clean down to the bare metal and apply an anti-rust paint.

5 The body should be washed once a week or when dirty.

Thoroughly wet the vehicle to soften the dirt and then wash it down with a soft sponge and plenty of clean water. If the surplus dirt is not washed off very gently, in time it will wear down the paint.

6 Spots of tar thrown up from the road surfaces are best removed with a cloth soaked in a cleaner made especially for this purpose.

7 Once every six months, or more frequently depending on the weather conditions, give the body and chrome trim a thorough wax job. If a chrome cleaner is used to remove rust on any of the vehicle's plated parts, remember that the cleaner can also remove part of the chrome, so use it sparingly.

3 Upholstery and carpets – maintenance

1 Remove the carpets or mats and thoroughly vacuum the interior of the vehicle every three months (more frequently if necessary).

2 Beat out the carpets and vacuum them if they are very dirty. If the upholstery is soiled, apply an upholstery cleaner with a damp sponge and wipe it off with a clean dry cloth.

3 Consult your local dealer or auto parts store for cleaners made especially for newer automative upholstery fabrics. Always test the cleaner in an inconspicuous place.

4 Vinyl trim – maintenance

Vinyl trim should not be cleaned with detergents, caustic soaps or petroleum-based cleaners. Plain soap and water or a mild vinyl cleaner is best for stains. Test a small area for color fastness. Bubbles under the vinyl can be corrected by piercing them with a pin and then working the air out.

5 Hinges and locks – maintenance

Every 3000 miles or 3 months, the door, hood and trunk hinges and locks should be lubricated with a few drops of oil. The door and trunk lid-striker plates should also be given a thin coat of grease to reduce wear and ensure free movement.

6 Body repair – minor damage

Refer to the accompanying color photos which illustrate the following procedures.

Repair of minor scratches

If the scratch is very superficial and does not penetrate to the metal of the body, repair is very simple. Lightly rub the scratch with a fine rubbing compound to remove loose paint from the scratch and to clear the surrounding paint of wax buildup. Rinse the area with clean water.

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.

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 any 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, this filler can be mixed with thinner to provide a very thin paste which is ideal for filling narrow scratches. Before the glaze filler hardens in the scratch, wrap a piece of smooth cotton cloth around the top 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 hollowed. The scratch can now be painted over as described earlier in this Section.

Repair of dents

When deep denting of the vehicle's body has taken place, the first task is to pull the dent out until the area nearly attains its original shape. There is little point in trying to restore the original shape completely as the metal in the damaged area will have stretched on impact and cannot be completely restored to its original contours. It is better to bring the level of the dent up to a point which is about $\frac{1}{8}$ 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.

If the underside of the dent is accessible, it can be hammered out gently from behind using a mallet with a wooden or plastic head. While doing this, hold a block of wood firmly against the metal to absorb the hammer blows and prevent large areas of the metal from being stretched out.

If the dent is in a section of the body which has double layers, or some other factor making it inaccessible from behind, a different technique is in order. 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 removed by pulling on the protruding heads of the screws with a pair of locking pliers.

The next stage of the repair is the removal of the paint from the damaged area and from an inch or so of the surrounding 'sound' metal. This is easily accomplished by using a wire brush or sanding disc 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 really good 'grip' for the filler material. To complete the repair, see the Section on filling and painting.

Repair of rust holes or gashes

Remove all paint from the affected area and from an inch or so of the surrounding 'sound' metal using a sanding disc 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. With the paint removed, you will be able to determine the severity of the corrosion and, therefore, decide whether to replace the whole panel, if possible, or to repair the affected area. New body panels are not as expensive as most people think and it is often quicker and more desirable to install a new panel than to attempt to repair large areas of rust.

Remove all trim pieces from the affected area (except those which will act as a guide to the original shape of the damaged body (ie. headlamp shells, etc.). Then, 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 in to create a slight depression for the filler material.

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.

Before filling can be done, it will be necessary to block the hole in some way. This can be accomplished with sheet metal riveted or screwed into place or by stuffing the hole with wire mesh.

Once the hole is blocked off, the affected area can be filled and painted (see the following Section on filling and painting).

Filling and painting

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 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 maker's instructions on the package, otherwise the filler will set incorrectly.

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 correct 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 filler paste at 20-minute intervals until the level of the filler is just above the surrounding metal.

Once the filler has hardened, excess can be removed using 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.

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 the good paint. Rinse the repair area with clean water until all of the dust produced by the sanding operation is gone.

Spray the entire area with a light coat of primer. This will reveal any imperfections in the surface of the filler. Repair these 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.

The repair area is now ready for painting. Paint spraying must be carried out in warm, dry, windless and dustfree atmosphere. These conditions can be created if you have access to a large indoor working area but if you are forced to work in the open, you will have to pick your day very carefully. If you are working indoors, dousing the floor in the work area with water will help to 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 to 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.

Before spraying, shake the paint can thoroughly, then spray a test area until the 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.

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 using a very fine rubbing compound, blend the edges of the paint into the existing paint. Finally, apply a coat of wax.

7 Body repair – major damage

1 Major damage must be repaired by an auto body/frame repair shop with the necessary welding and hydraulic straightening equipment.

2 If the damage has been serious, it is vital that the frame be checked for correct alignment as the handling of the vehicle will be affected. Other problems, such as excessive tire wear and wear in the transmission and steering may also occur.

8 Windshield glass – removal and installation

Because of the special tools, adhesives and techniques required to properly replace the windshield glass, it should be done by a Subaru dealer's service department or a reputable auto glass shop.

9 Window glass (rear) – removal and installation

1 Because of the special tools, adhesives and techniques required to properly replace the rear window in sedans, hatchbacks and station wagons, it should be done by a Subaru dealer's service department or a reputable auto glass shop.

2 When replacing the sliding glass on the pick-up, position the two pieces of glass in the middle of the sash and slide them into their respective sides. Then, install the sash in the vehicle.

10 Window glass (opening quarter) – removal and installation

Refer to Figs. 12.1 through 12.3 and 12.13

Hatchback

1 To remove the side window, first remove the plastic hinge covers. Open the glass halfway and then remove the mounting screws holding the lock to the body.

2 Remove the mounting screws holding the hinges to the body. Now, carefully grab the window and remove it from the vehicle.

3 If you want to replace the glass and use the original mounts, place the glass on a mat or rug to keep from damaging the finish. Remove the hinges and lock assembly.

4 Install the hinges and lock assembly on the new glass. To engage the nut plate with the hinges or lock, align all of the flats with each other and then install the screws.

5 Do not completely tighten the screws until the correct glass position has been established.

6 You can also replace the weatherstripping at this time. Remove the old weatherstripping and then install the new one by attaching the lower corner to the bottom of the window flange first. Repeat this

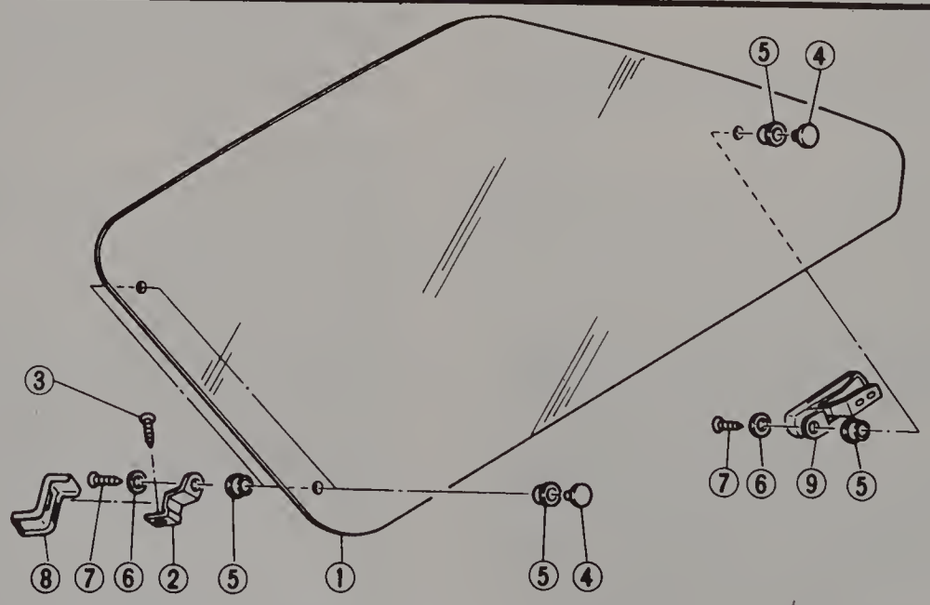


Fig. 12.1 Hatchback side window components – exploded view (Sec 10)

1 *Side window glass*
2 *Hinge plate*
3 *Flange screw*
4 *Nut plate*
5 *Packing*
6 *Rosette*
7 *Screw*
8 *Hinge cover*
9 *Lock*

process at the front upper corner and then the rest of the window.
7 Install the glass by loosely installing the mounting screws.
8 Adjust the glass by shifting it until there is uniform spacing on all sides.
9 Be sure to tighten all of the mounting screws.

Hardtop

10 In order to remove the side window or the window glass regulator, the rear seat and backrest must be removed.
11 To do this, remove the mounting bolts at the front bottom of the rear seat cushion. Lift the front of the cushion slightly and push the rear of the cushion down while you pull the cushion forward and out.
12 Remove the mounting bolts at the bottom of the rear backrest. Now, lift the backrest off of its retainer (on the back side) and pull it out of the vehicle.
13 Remove the seat belt shoulder anchor. Detach and remove the window glass regulator handle, the armrest, the rear pillar trim, the upper trim panel and the lower trim panel. **Note:** *If you need any help with this, refer to the door trim panel removal Section in this Chapter.*
14 Remove the seat belt restrictor, disconnect the electrical connector for the door switch and then remove the moisture-proof sheet.
15 Temporarily attach the glass regulator handle and lower the window all the way down. Remove the mounting screw holding the outer weatherstripping (from the inside). Then, remove the screws holding the grille (from the outside). Lift the grille slightly and then pull out the outer weatherstripping.
16 Close the glass about halfway and then disconnect the glass holder from the regulator arm. **Note:** *Be careful not to drop any mounting hardware inside the body panel.* You might want to stuff some old rags in the panel opening to prevent this.
17 Remove stopper B and the adjuster nuts shown in the accompanying illustration. Do not remove stopper A at this time.

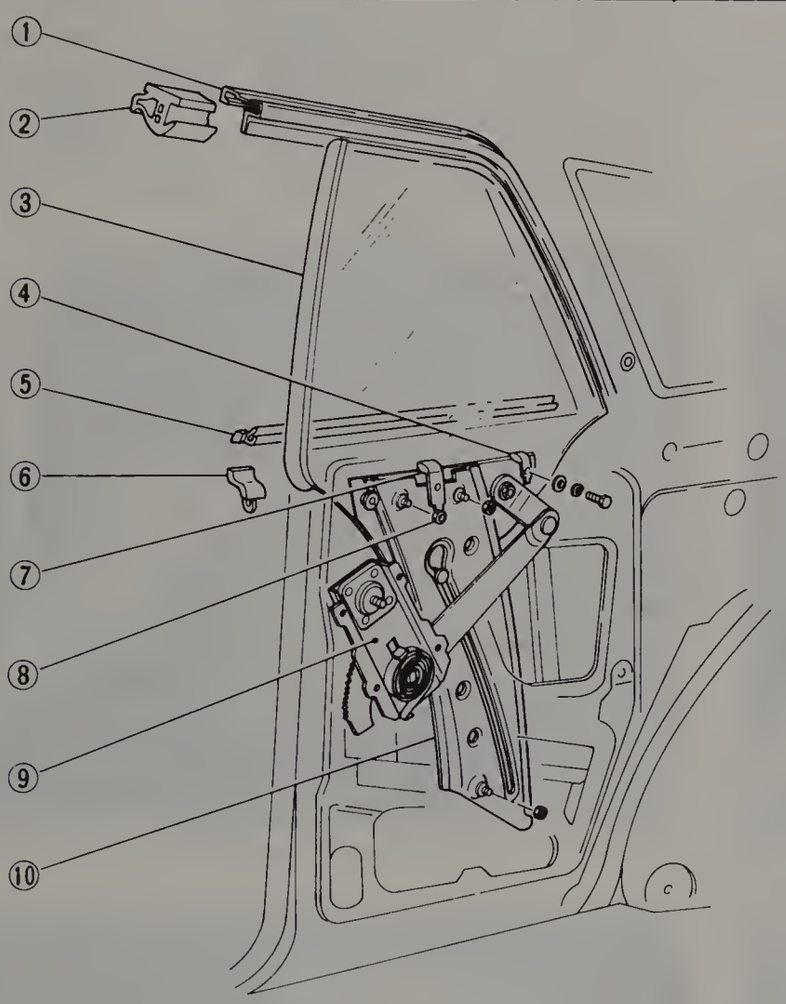


Fig. 12.2 Hardtop side window components – exploded view (Sec 10)

1 Retainer
2 Roof side weatherstrip
3 Side window weatherstrip
4 Stopper B
5 Outer weatherstrip
6 Corner patch
7 Stopper A
8 Adjuster nuts
9 Regulator
10 Guide plate

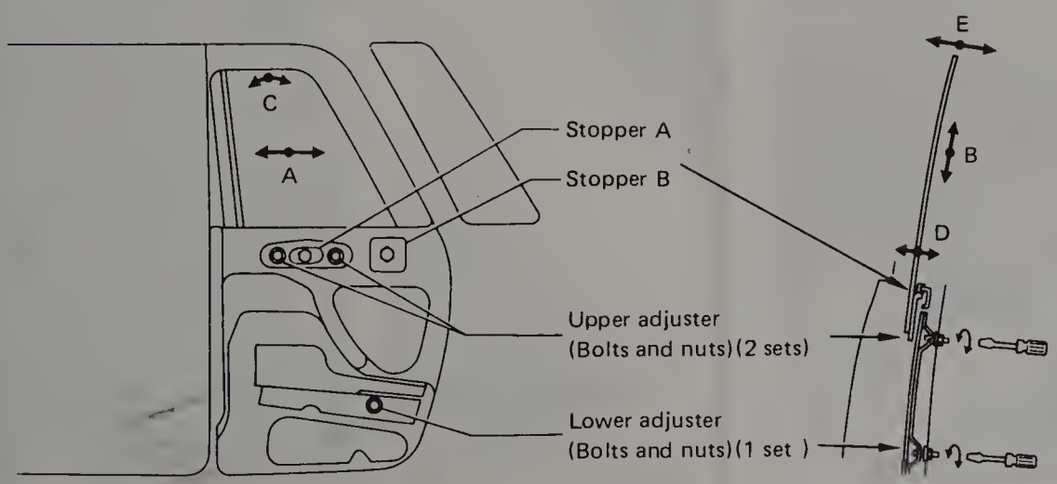


Fig. 12.3 Side window stopper and adjuster locations and adjustment details (Sec 10)

18 To help in the glass removal, lower the regulator arm with the regulator handle.
19 Now, carefully and slowly lift and remove the glass, together with the guide plate, from the vehicle.
20 If they are in good working order, you can use the regulator arm and any mounting hardware on the new window.
21 To remove the glass regulator, remove the bolts holding the regulator in place and then remove the regulator.
22 Installation is basically the reverse of the removal procedure.
23 Adjust the glass by referring to the illustration provided. Loosen the adjuster bolts and reposition the glass for a good fit.

11 Window glass (fixed quarter) – removal and installation

Because of the special tools, adhesives and techniques required to properly replace the non-opening quarter glass, it should be done by a Subaru dealer's service department or a reputable auto glass shop.

12 Door trim panels – removal and installation

Refer to Fig. 12.4

1 The front and rear doors (if applicable) are basically the same. The door trim panel has to be removed to do any work on the interior of the door. To remove the trim panel, first remove the door armrest mounting screws (photo) and then remove the armrest.
2 Remove the window glass regulator handle by pulling out the retainer clip. To do this, use a hooked tool or a fairly stiff wire with a curved hook bent into the end (photo). Push in slightly on the door panel to get a better look at the clip. Remove the plastic protective ring from behind the handle.
3 Now, remove the interior door handle cover by removing its mounting screw (photo). The cover can be removed by pulling the handle slightly toward you and getting your fingers behind the cover and pulling on it.
4 To remove the lower trim panel, insert a screwdriver between the panel and the door and carefully pry the panel away from the door (photo). If there is enough room to slip your fingers in between the panel and the door, do so, and finish removing the panel by slowly pulling on it with your hands.
5 Remove the upper trim panel in the same manner. **Note:** *If your vehicle is equipped with power windows, do not forget to disconnect all electrical connectors.*
6 To gain access to the door interior, the moisture-proof sheet will have to be removed. Start at an upper corner and slowly pull the sheet away from the door with your hands. Be careful not to tear it or disrupt the adhesive any more than you have to.
7 Installation is basically the reverse of the removal procedure.
8 Make sure the moisture-proof sheet is positioned correctly on the door before you press it into place.

12.1 Removing the door armrest screws

12.2 Removing the window regulator handle clip

12.3 Removing the interior door handle cover screw

12.4 Carefully pry the door panels away from the door to remove them

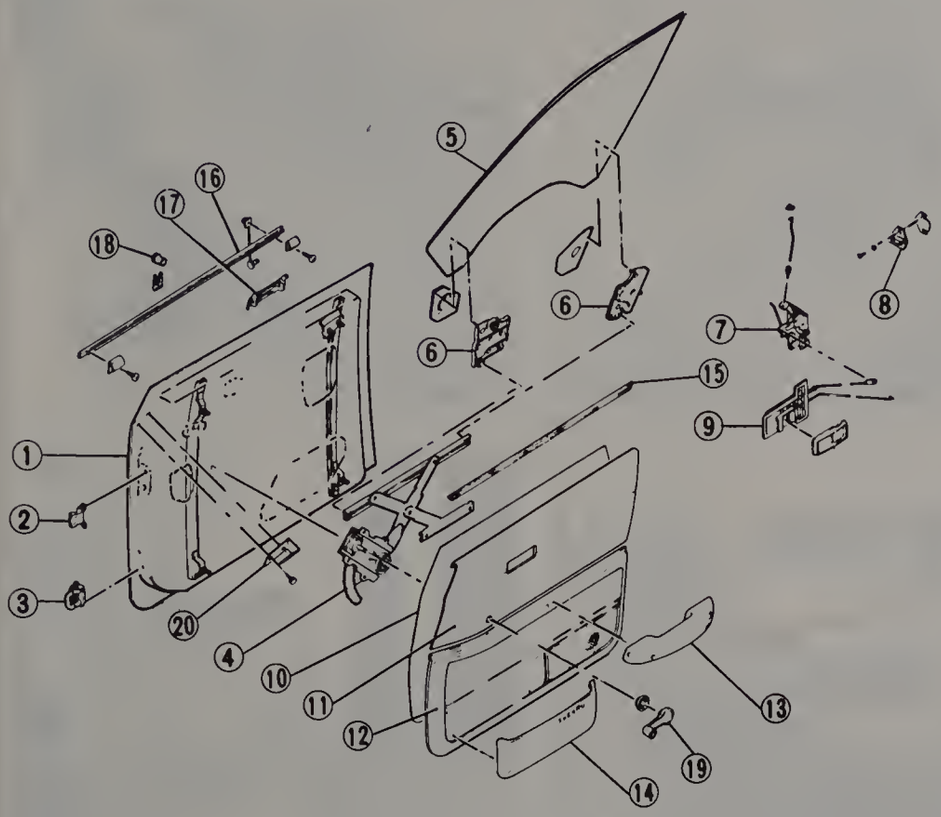


Fig. 12.4 Door components – exploded view (typical) (Sec 12)

1 *Door panel*
2 *Upper hinge*
3 *Lower hinge*
4 *Regulator*
5 *Door glass*
6 *Glass holder*
7 *Door latch*
8 *Door striker*
9 *Interior door handle*
10 *Moisture proof sheet*
11 *Upper trim panel*
12 *Lower trim panel*
13 *Armrest*
14 *Door pocket*
15 *Inner weatherstrip*
16 *Outer weatherstrip*
17 *Door handle*
18 *Key lock cylinder*
19 *Regulator handle*
20 *Hook*

9 Install the door panels, making sure the plastic retaining clips are in their correct holes before you press them into position. **Note:** *Reconnect the power window electrical connectors to the upper panel (if applicable) before you install the lower panel.*
10 Install the handle cover by again pulling out on the handle and inserting the cover into place.
11 Attach the window regulator handle clip to the handle as shown (photo). With the window rolled all the way to the top, place the handle in the four o'clock position and push the handle onto its shaft until it locks into position.
12 Install the armrest and make sure that all mounting screws are tight.

12.11 Attach the clip (arrow) to the regulator handle before installing the handle

13 Door components and window glass – removal and installation

Refer to Figs. 12.4 through 12.11

1 The front and rear doors (if applicable) are basically the same. To remove the door trim panels, refer to the appropriate Section in this Chapter.

Disassembly

Interior door handle assembly

2 Remove the screws and detach the door handle linkage from the door latch linkage (photo).
3 Now, detach the lower linkage from the latch rod holder by using a screwdriver and turning the rod holder toward the bottom of the door.
4 Remove the interior door handle mounting screws (photo) and then the handle assembly.

Key lock cylinder

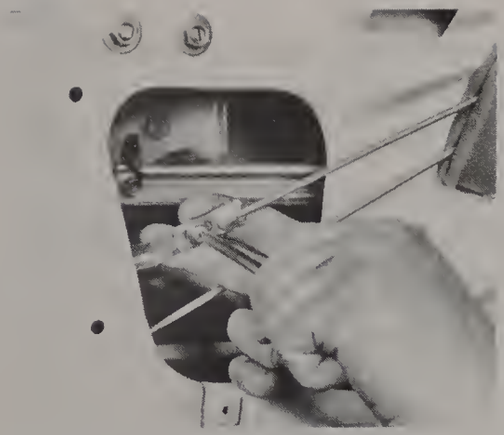
5 To remove the key cylinder, detach the cylinder linkage from the door latch rod holder.
6 Using pliers, remove the retaining clip from the cylinder inside the door (photo).
7 Now you can remove the cylinder from the door (photo).

Door latch assembly

8 If not already done, detach both interior door handle linkages and the key cylinder linkage from the door latch. Refer to the above procedures.
9 Remove the door latch mounting screws (photo).
10 Now, carefully remove the latch assembly by moving it down and out of the lower access hole.

Exterior door handle

11 The door handle can be removed by removing the mounting nuts. Remove the handle from the door (photo).
12 The door handle has a plastic adjusting nut (photo) which is inserted into the door latch and then adjusted for free play (explained during installation).



13.2 Detaching the door handle linkage from the door latch linkage

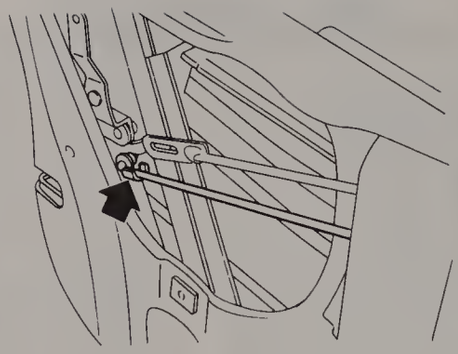
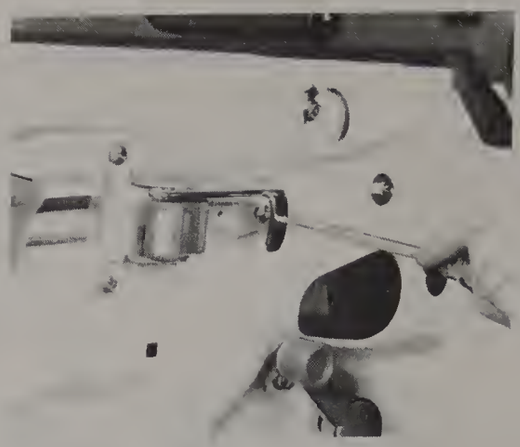
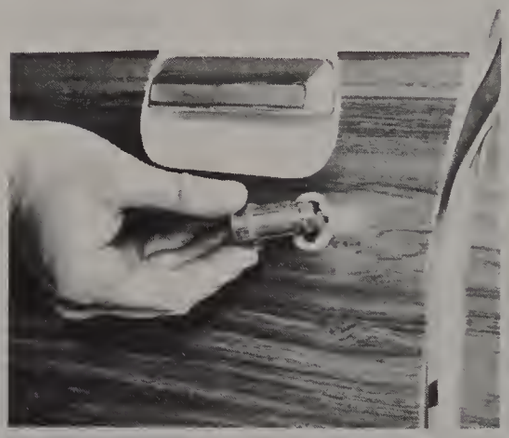


Fig. 12.5 Detach the lower linkage (arrow) from the latch rod holder (Sec 13)



13.4 Removing the interior door handle mounting screws

13.6 Removing the key cylinder retaining clip

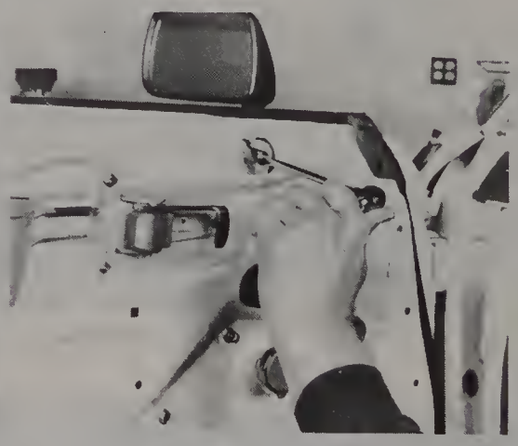


13.7 Removing the key cylinder from the outside of the door

13.9 Removing the door latch mounting screws

13.11 Removing the exterior door handle from the outside

13.12 The exterior door handle adjusting nut (arrow)

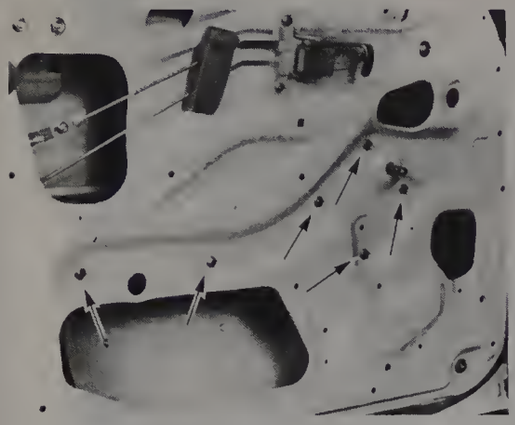


13.13 Remove both upper window stops

13.14 Remove the rubber weather seal

13.15 Remove the upper weatherstripping screws

13.17 Removing the glass mounting screws



13.19 Detach the regulator by removing the regulator baseplate bolts and the regulator channel bolts (arrows)

13.20 Collapse and remove the regulator assembly through the access hole

13.22 Removing the rear view mirror mounting screws

Door window glass

13 To remove the door glass, first remove both upper window stops (photo).

14 Carefully remove the rubber weatherseal by inserting a screwdriver underneath it at the point where it is held in place by plastic retainers (photo). Carefully pry the rubber seal away from the door, but only as far as is necessary for the glass to clear it.

15 Remove the upper weatherstripping molding screws (photo) and then carefully remove the weatherstripping from the door by pulling on it with your hands.

16 Now, slowly position the window glass with the regulator handle until you can see the glass mounting screws through the access holes.

17 Remove the glass mounting screws (photo).

18 Carefully remove the window glass by grabbing the sides with your hands and lifting it out of the door.

Window glass regulator assembly

19 **Note:** *If your vehicle is equipped with power windows, the motor to run the windows is attached to the regulator and is removed with it. Replacement should be as a complete assembly.* Remove the glass regulator by removing the regulator baseplate mounting bolts and the regulator channel mounting bolts (photo).

20 Carefully collapse the regulator assembly to lower, and easily remove, the regulator from the access hole (photo).

Door glass sashes

21 To remove the glass sashes, just remove their mounting nuts and lift them up and out through the glass opening. **Note:** *Mark in some way which sash goes where because they are different.*

Door rear view mirror

22 To remove the rear view mirror, just remove its mounting screws (photo). **Note:** *If your vehicle is equipped with a remote-controlled mirror, the electrical connector will have to be disconnected in order to remove it.*

23 To remove the doors from the vehicle, refer to the appropriate Section in this Chapter.

Reassembly

Door rear view mirror

24 Install the mirror making sure the mounting screws are tight and the electrical connector is connected (if applicable). **Note:** *If your mirror is too tight or loose, it can be adjusted by turning the glass mounting nut inside the mirror casing (prior to installation).*

Door glass sashes

25 Make sure you get the correct sash mounted in the front or rear position. Tighten the nuts according to the Torque specifications.

Window glass regulator assembly

26 Inspect the gear for excessive wear, the spring for cracks and the other components for damage or wear. Repair or replace these parts with new ones if necessary.

27 Lubricate the channels and sliding pins, the spring and the gear thoroughly with a good white grease.

28 When installing the regulator assembly, first install the regulator baseplate mounting bolts and tighten them, then install the channel mounting bolts while making any adjustments necessary to align the channel holes.

29 Make sure all mounting bolts are tightened according to the Torque specifications.

Door window glass

30 Carefully lower the glass into the door and onto the mounting channel. Make sure the glass mounting claws are securely resting on the channel before tightening the mountings screws.

31 You can now adjust the window glass for a good fit.

32 Install both window glass upper stops, but do not tighten them. Loosen the upper adjusting bolt of the front sash (sedan or wagon) or the upper adjusting bolt of the rear sash (hardtop or hatchback). Position them to the center of the elongated slot and temporarily tighten them. Loosen the regulator channel B mounting bolts, position them in the center of the elongated slots and temporarily tighten them.

33 The vertical adjustment is done by shifting the upper glass stops until the dimensions shown in the accompanying illustration are achieved.

34 The inclination adjustment is made by moving the regulator channel B up or down. **Note:** *Make sure that when the adjustment is made, the channel is horizontal and not diagonal.*

35 The backward/forward adjustment is done by shifting the applicable sash (depending on your model vehicle), forward or backward to meet the requirements in the illustration.

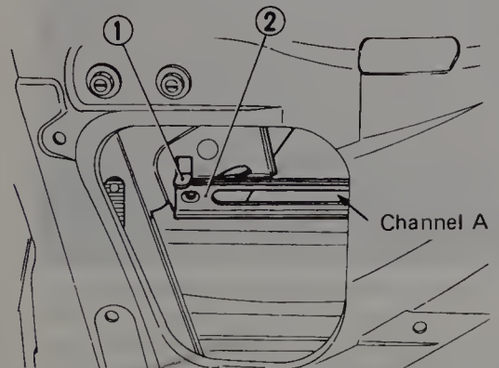


Fig. 12.6 Placing window claw on regulator channel A (Sec 13)

1 Claw 2 Regulator channel A

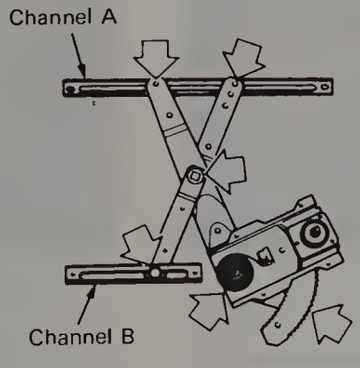


Fig. 12.7 Window regulator and channels (apply grease to areas indicated by arrows) (Sec 13)

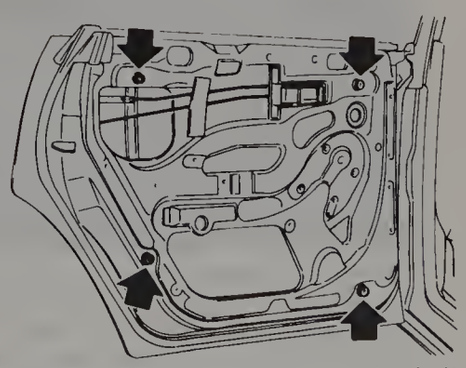


Fig. 12.8 Door glass sash mounting bolts (Sec 13)

This sequence of photographs deals with the repair of the dent and paintwork damage shown in this photo. The procedure will be similar for the repair of a hole. It should be noted that the procedures given here are simplified – more explicit instructions will be found in the text

In the case of a dent the first job – after removing surrounding trim – is to hammer out the dent where access is possible. This will minimise filling. Here, the large dent having been hammered out, the damaged area is being made slightly concave

Now all paint must be removed from the damaged area, by rubbing with coarse abrasive paper. Alternatively, a wire brush or abrasive pad can be used in a power drill. Where the repair area meets good paintwork, the edge of the paintwork should be 'feathered', using a finer grade of abrasive paper

In the case of a hole caused by rusting, all damaged sheet-metal should be cut away before proceeding to this stage. Here, the damaged area is being treated with rust remover and inhibitor before being filled

Mix the body filler according to its manufacturer's instructions. In the case of corrosion damage, it will be necessary to block off any large holes before filling – this can be done with aluminium or plastic mesh, or aluminium tape. Make sure the area is absolutely clean before ...

... applying the filler. Filler should be applied with a flexible applicator, as shown, for best results; the wooden spatula being used for confined areas. Apply thin layers of filler at 20-minute intervals, until the surface of the filler is slightly proud of the surrounding bodywork

Initial shaping can be done with a Surform plane or Dreadnought file. Then, using progressively finer grades of wet-and-dry paper, wrapped around a sanding block, and copious amounts of clean water, rub down the filler until really smooth and flat. Again, feather the edges of adjoining paintwork

The whole repair area can now be sprayed or brush-painted with primer. If spraying, ensure adjoining areas are protected from over-spray. Note that at least one inch of the surrounding sound paintwork should be coated with primer. Primer has a 'thick' consistency, so will find small imperfections

Again, using plenty of water, rub down the primer with a fine grade wet-and-dry paper (400 grade is probably best) until it is really smooth and well blended into the surrounding paintwork. Any remaining imperfections can now be filled by carefully applied knifing stopper paste

When the stopper has hardened, rub down the repair area again before applying the final coat of primer. Before rubbing down this last coat of primer, ensure the repair area is blemish-free – use more stopper if necessary. To ensure that the surface of the primer is really smooth use some finishing compound

The top coat can now be applied. When working out of doors, pick a dry, warm and wind-free day. Ensure surrounding areas are protected from over-spray. Agitate the aerosol thoroughly, then spray the centre of the repair area, working outwards with a circular motion. Apply the paint as several thin coats

After a period of about two weeks, which the paint needs to harden fully, the surface of the repaired area can be 'cut' with a mild cutting compound prior to wax polishing. When carrying out bodywork repairs, remember that the quality of the finished job is proportional to the time and effort expended

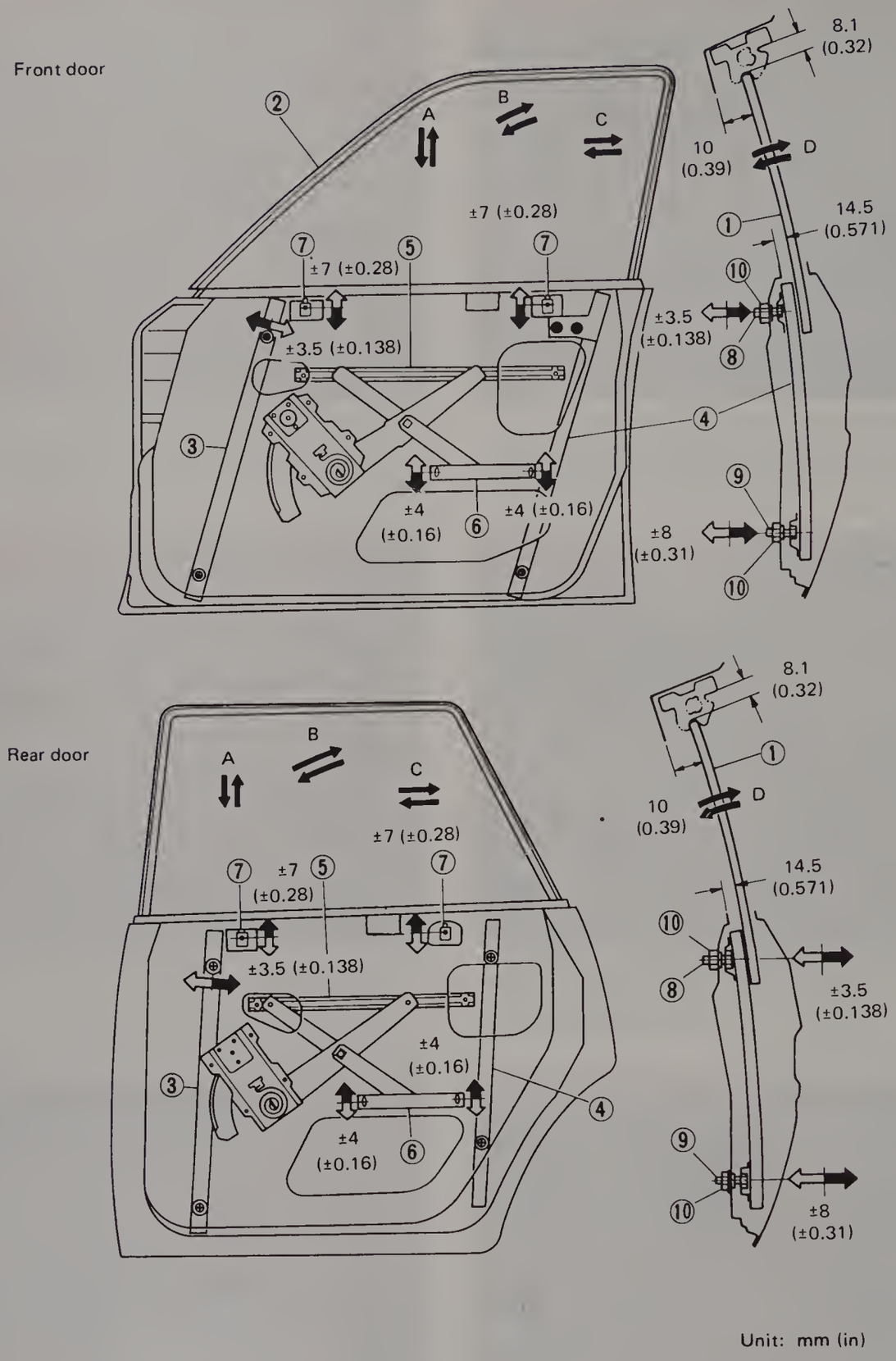


Fig. 12.9 Door glass adjustment details (Sec 13)

A Vertical adjustment
B Inclination adjustment
C Front/back adjustment
D Fitting pressure adjustment

1 Glass
2 Retainer
3 Front sash
4 Rear sash

5 Regulator channel A
6 Regulator channel B
7 Upper stoppers
8 Upper adjuster bolts

9 Lower adjuster bolts
10 Nuts with conical spring washers

36 The glass fitting pressure adjustment is made with both upper sash adjusting bolts. By turning the bolts in or out, the window glass will move toward or away from the weatherstripping for a good seal (photo).
37 Now make sure the window operates smoothly and tighten all mounting hardware according to the Torque specifications.

Exterior door handle

38 Install the door handle, making sure the linkage with the adjuster nut fits into the correct hole in the door latch assembly. Tighten the mounting nuts securely.
39 You can adjust the free play of the handle by turning the adjuster nut up or down accordingly. The free play is how much the handle moves before the linkage activates the latch. It should be 0.020 to 0.039 in (0.5 to 1.0 mm).

Door latch assembly

40 Install the latch assembly and make sure you connect the exterior handle, the key lock cylinder and both of the interior door handle linkages.
41 After installation, make sure the locking mechanism works properly and lubricate any sliding pieces with a good white grease. Tighten the mounting screws according to the Torque specifications.

Key lock cylinder

42 Install the lock cylinder, making sure it is installed in the correct position and that the linkage is correctly connected to the door latch. To check this, refer to the illustration provided.

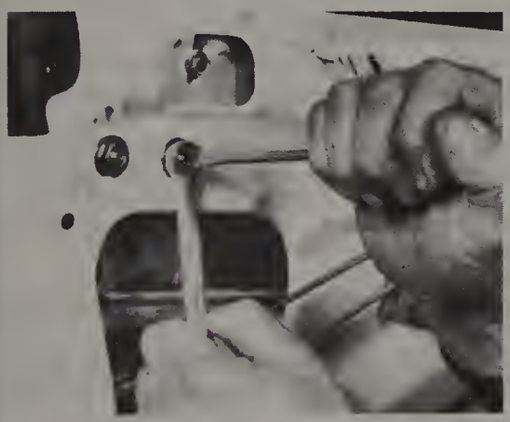
Interior door handle assembly

43 Install the door handle by first connecting the lower linkage to the rod holder of the door latch. Then install the handle assembly to the door with the mounting screws, but do not tighten them.
44 Next, connect the upper linkage to the latch linkage and loosely install the screw (photo).
45 To adjust the door handle, first grab the lower handle linkage with your hand and pull it to the rear until it just comes in contact with the locking stopper. Hold the handle assembly in this position until you tighten the mounting screws.
46 Now grab the latch linkage with your hand and move it to the rear as far as it will go. With your other hand, grab the upper handle linkage and line it up with the latch linkage. Install the screw in this position.
47 Finally, make sure that all of the controls work properly, apply a good white grease to any working parts and tighten all hardware according to the Torque specifications.
48 To install the door panels, refer to the appropriate Section in this Chapter.

14 Doors – removal, installation and adjustment

Refer to Fig. 12.12

1 The front and rear doors (if applicable) can be removed in the same way. The front door must be open during the rear door removal.
2 To remove the door you will need a jack, a block of wood and a rag.
3 Refer to the accompanying illustration and place the rag on top of the block of wood and then place the wood on top of the jack. Place the jack under the outside corner of the door and raise it just enough to make contact with the bottom of the door and stay in place.



13.36 Upper sash adjusting bolts

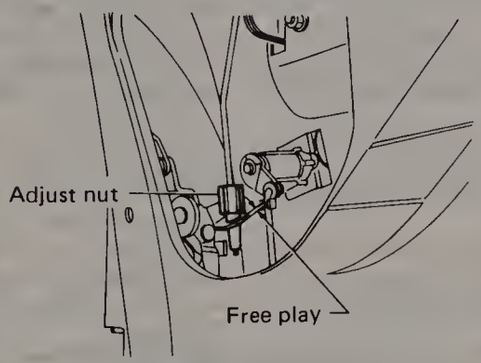


Fig. 12.10 Door handle free play adjusting nut location (Sec 13)

13.44 Connect the upper linkage to the latch linkage and install the screw (do not tighten it at this time)

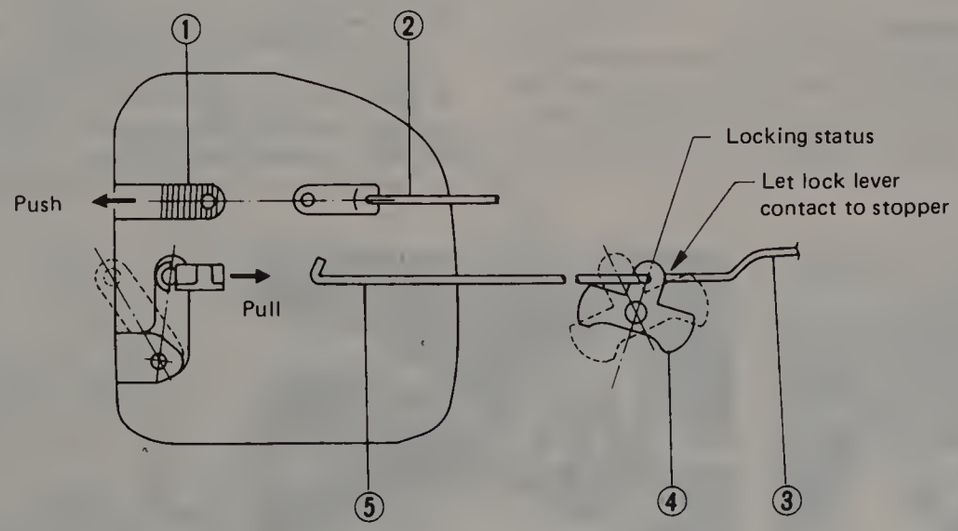


Fig. 12.11 Door latch and lock adjusting details (Sec 13)

1 Connector
2 Rod (upper side)
3 Inner remote bracket
4 Lock lever
5 Rod (lower side)

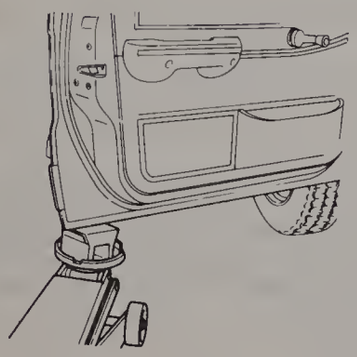
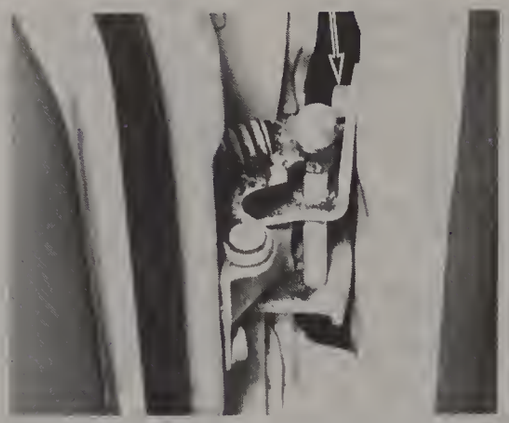


Fig. 12.12 Support the door with a floor jack during removal and installation (Sec 14)



14.8 Adjustments to the door are made with the hinge body mounting bolts (arrow)

14.10 Adjust the closing/locking effectiveness by loosening and moving the striker

4 Remove all but one of each of the door hinge mounting bolts (top and bottom). Now carefully remove the last bolt from the bottom hinge and then the top. Carefully remove the door from the vehicle.
5 If you are replacing the door with a new one and want to use some of the internal parts of the old door, refer to the appropriate Section in this Chapter to remove and install the parts.
6 Installation is basically the reverse of the removal procedure.
7 Install one mounting bolt in each hinge (top and bottom), then install the rest of the mounting bolts. Tighten these bolts according to the Torque specifications.
8 Adjustments can be made using the hinge body (not door) mounting bolts (photo). Loosen the bolts and adjust the door in either a horizontal or a vertical direction, whichever is required to make it fit and close good.
9 Tighten these bolts according to the Torque specifications and lubricate all moving hinge parts with a good white grease.
10 To adjust the closing/locking effectiveness of the door, loosen the door striker (photo) and move it up or down.
11 If the door still does not lock very well (or not at all), you may need to put a spacer behind the striker plate. The size (thickness) of the spacer will depend on how much will be needed to get the door to lock right.
12 After the adjustment is made, tighten the striker mounting screws to the specified torque.

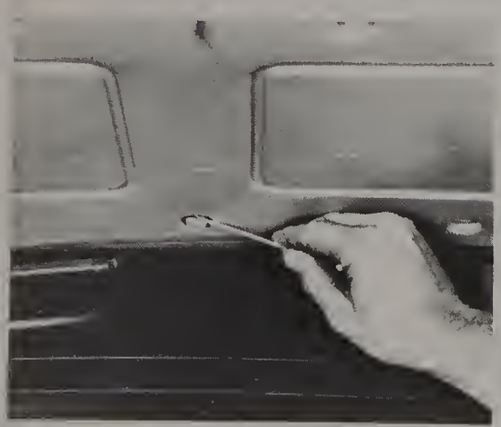
15 Gate (rear) – disassembly and reassembly

Refer to Figs. 12.13 through 12.17

Station wagon and hatchback

1 To gain access to most of the following components, the gate trim panel must be removed. To do thus, use a small screwdriver and carefully remove the plastic retaining clips from the trim panel (photo).
Note: *These clips are tricky and in order to remove them, you have to position the screwdriver between the outside lip and the inside of each clip and pry (photo).*

Window wiper and motor
2 Remove the wiper and motor by referring to the appropriate Section in Chapter 10.
Latch mechanism
3 To remove the latch, first remove the trim panel by referring to the beginning of this Section.
4 Now, disconnect the latch rod from its retainer on the key lock cylinder (photo).
5 Remove the latch mounting bolts (photo) and then remove the latch, together with the latch rod.
6 Installation is the reverse of the removal procedure.
7 Install the latch (photo) and make sure the mounting bolts are tightened to the specified torque. Add some white grease to the latch inner mechanism.
8 To adjust the lock cylinder/latch free play, use a screwdriver and activate the latch by pushing on the latch claw (photo) until it locks into position. Check the free play with a feeler gauge (photo). If it is more than 0.030 in (0.76 mm), disconnect the latch rod from the lock cylinder and turn it (in or out) to achieve the right adjustment.
Outer handle (station wagon)
9 First, remove the trim panel by referring to the beginning of this Section.
10 Disconnect both license plate bulb connectors from the outer handle (photo). Disconnect the latch rod that is connected to the key cylinder.
11 Remove the nuts holding the outer handle to the gate (photo). Then, remove the bolts mounting the handle to the outside of the gate (photo).
12 Carefully remove the handle with the key cylinder and wiring from the gate (photo).
13 The key cylinder can now be removed from the handle by removing its mounting screws (photo).
14 The installation is the reverse of removal.
15 Make sure you connect the license plate bulb connectors and tighten all mounting hardware according to the Torque specifications.
Key lock cylinder (station wagon)
16 To remove the key cylinder you first have to remove the gate outer



15.1A Remove the plastic clips from the rear panel

15.1B Position the screwdriver between the outside and inside lips and pry

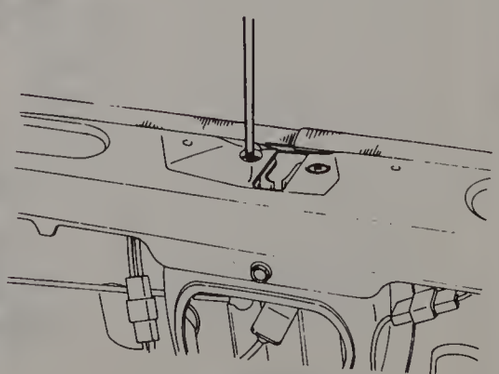


Fig. 12.13 Removing the latch from the hatchback (Sec 15)

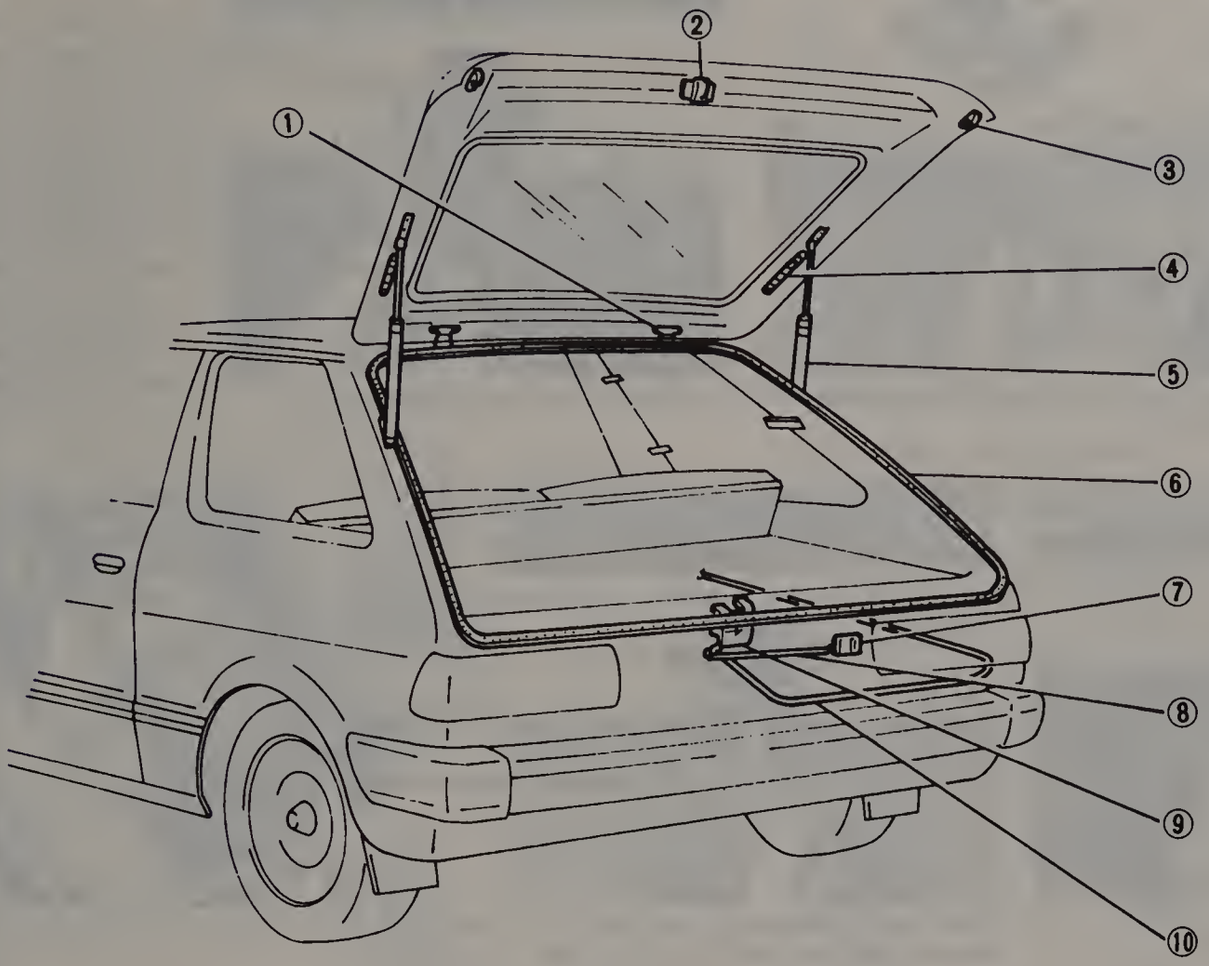


Fig. 12.14 Hatchback rear gate components (Sec 15)

1 *Hinge*
2 *Striker*
3 *Stopper*
4 *Air-vent grille*
5 *Gas stay*
6 *Weatherstrip*
7 *Key cylinder*
8 *Rod*
9 *Latch*
10 *Rear gate opener cable*

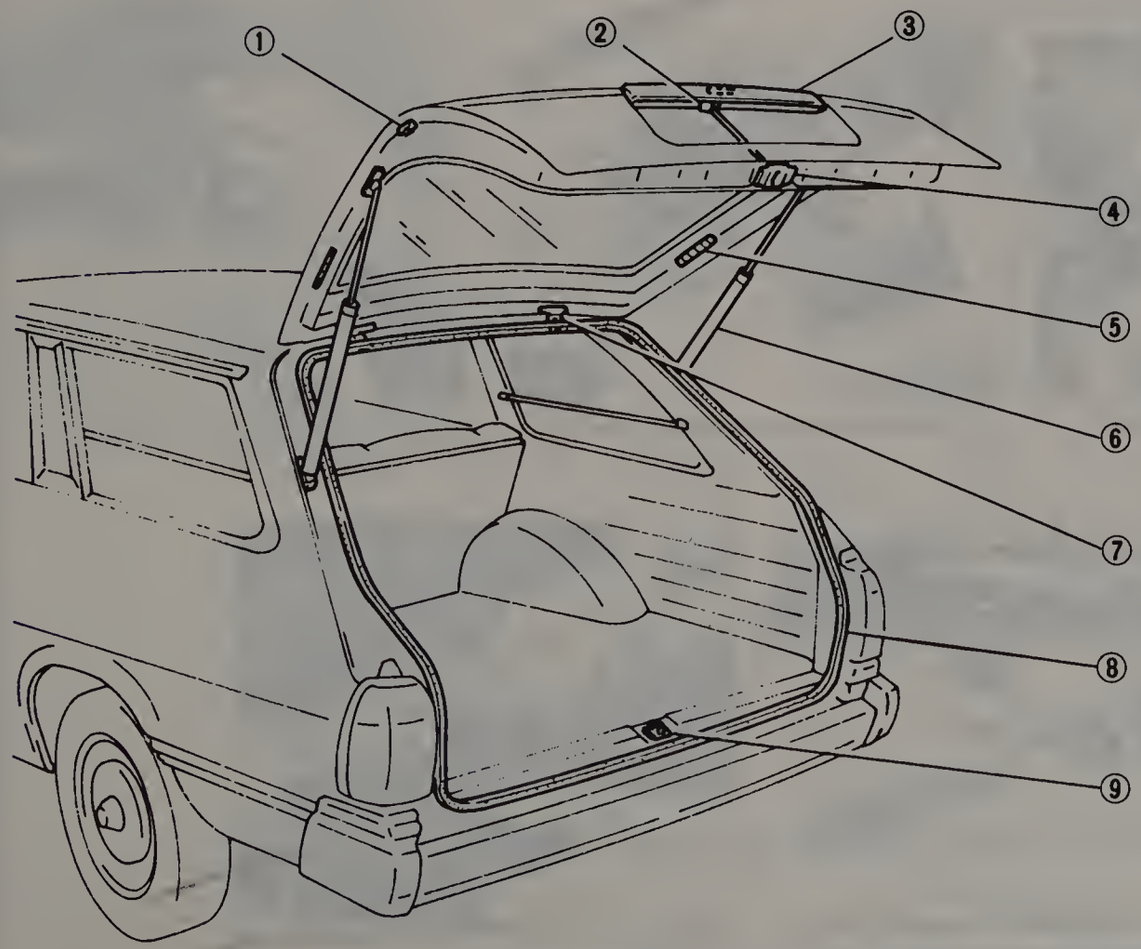
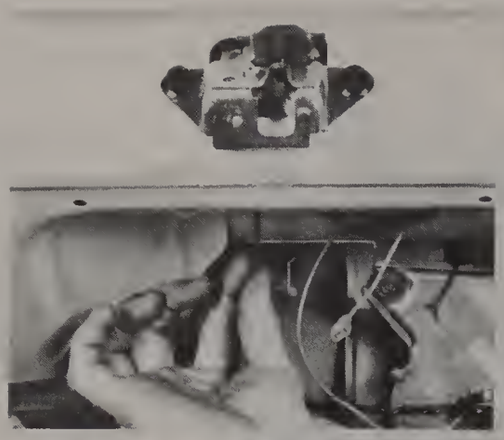


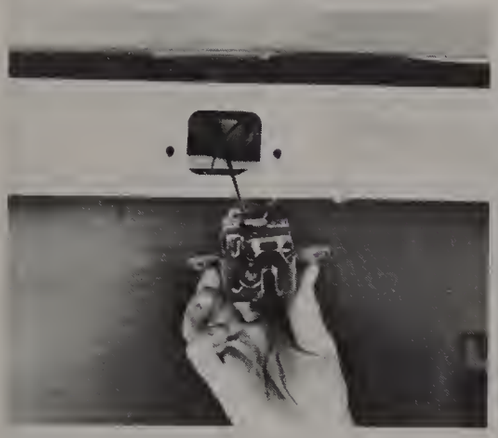
Fig. 12.15 Station wagon rear gate components (Sec 15)

1 *Stopper*
2 *Key cylinder*
3 *Outer handle*
4 *Latch*
5 *Air-vent grille*
6 *Gas stay*
7 *Hinge*
8 *Weatherstrip*
9 *Striker*

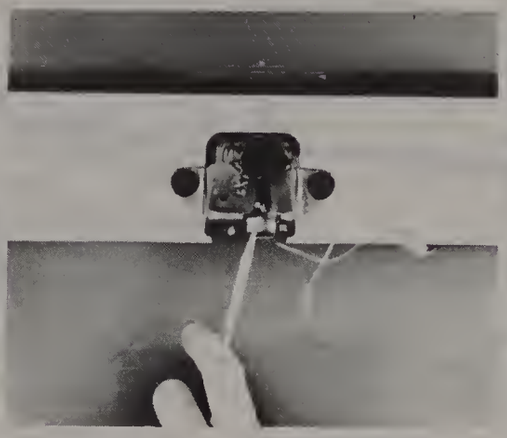


15.4 Disconnect the latch rod from the key cylinder

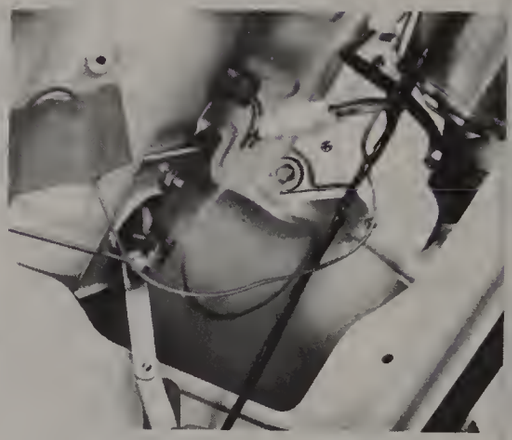
15.5 Remove the latch from the rear gate



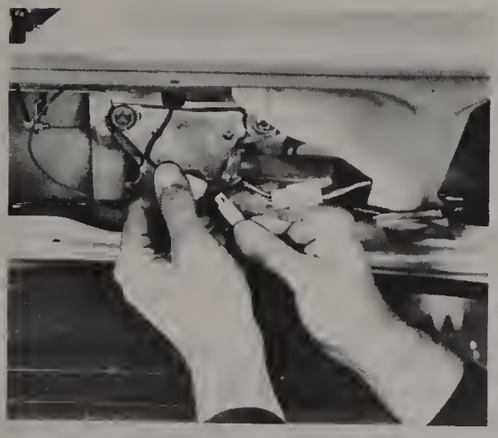
15.7 Install the latch with its rod



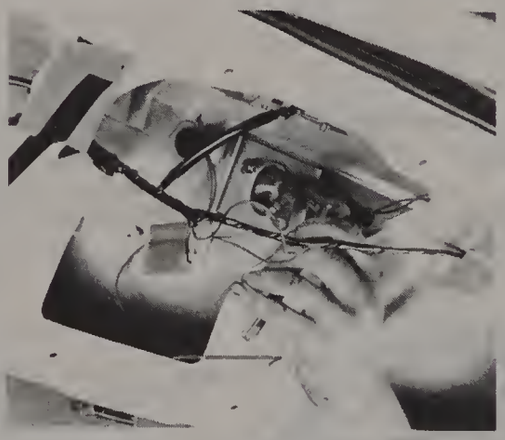
15.8A Activate the lock by pushing the latch claw into the locking position to adjust free play



15.8B Check the latch free play with a feeler gauge

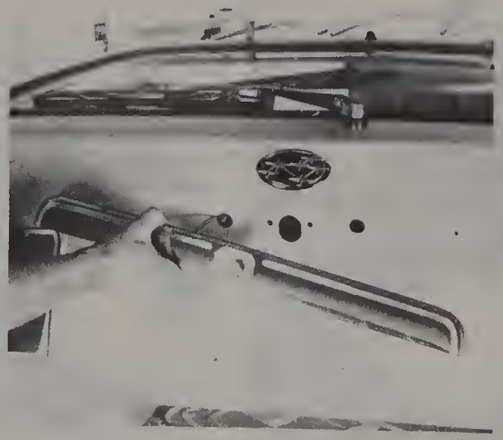


15.10 Disconnect both license plate bulb connectors



15.11A Remove the outer handle inner nuts, then ...

15.11B ... the outer handle outer bolts



15.12 Remove the handle with key cylinder from the gate

15.13 Remove the key cylinder screws

handle. Refer to the appropriate paragraph in this Section.

Key lock cylinder (hatchback)

17 Remove the screws retaining the trim panel to the rear skirt and then remove the panel.

18 Disconnect the rod between the latch and the key cylinder.

19 Remove the spring clip from behind the cylinder and then remove the cylinder from the outside of the vehicle.

20 Installation is the reverse of the removal procedure. Remember to connect the latch rod to the key cylinder. Free play adjustment can be made by referring to the latch mechanism information in this Section.

Pick-up truck

Note: *The illustrations shown are for the years 1982 and 1983. Your gate and procedure will be similar.*

Latch

21 Remove the covers of the rear gate.

22 Remove the screws connecting the rods to the levers.

23 Remove the latch, along with the rod, by removing the bolts.

24 Installation is the reverse of the removal procedure.

25 Position the claw of the latch into the locked position by pushing on the claw with a screwdriver.

26 Now, properly connect the rods to the levers with the screws without pulling on the rods.

27 Check the locking performance of the latch by working the outer handle.

28 Apply white grease to all of the working parts of the latch. Install the rear gate covers and make sure all of the mounting hardware is tight.

Striker

29 Remove the striker by turning it using the hexagon area or the cross-hole.

30 Install a new striker but do not completely tighten it.

31 Carefully close the rear gate until the striker contacts the latch.

32 Check the striker to see if it is positioned in the center of the notch in the latch. If not, move the striker up or down until it is positioned correctly.

33 Add or remove shims to the striker until the clearance between the striker and the claw allows the gate to close correctly and tightly.

16 Gate (rear) – removal, installation and adjustment

Refer to Figs. 12.13 through 12.17

Station wagon and hatchback

1 To start the removal process, the gate trim panel must be removed. To do this, refer to the gate disassembly Section of this Chapter.

2 Now, disconnect both defogger electrical connectors by grabbing and pulling the terminals with your fingers (photo). **Note:** *Never pull the wires themselves.*

3 Disconnect the window wiper connector (photo) and the rear washer hose (photo). Disconnect the washer hose by carefully grabbing it and pulling. **Note:** *If you have a station wagon, also disconnect both license plate bulb connectors.*

4 Remove the rubber wiring harness grommet (photo) and remove

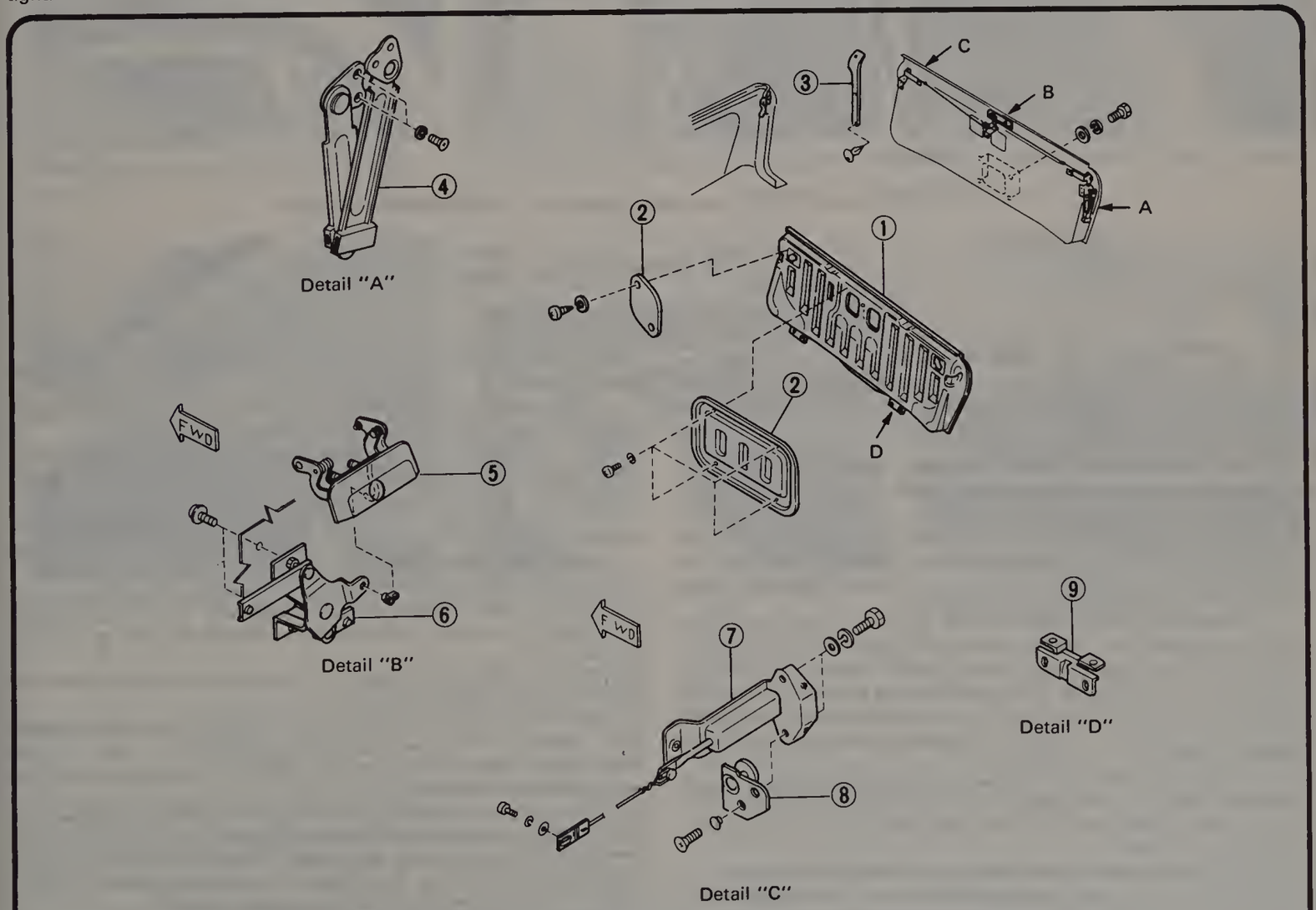


Fig. 12.16 Pick-up truck (1982) rear gate components – exploded view (Sec 15)

1 Rear gate panel	*4 Stay*	*6 Lever assembly*	*8 Stopper*
2 Cover	*5 Outer handle*	*7 Lock assembly*	*9 Hinge*
3 Strip			

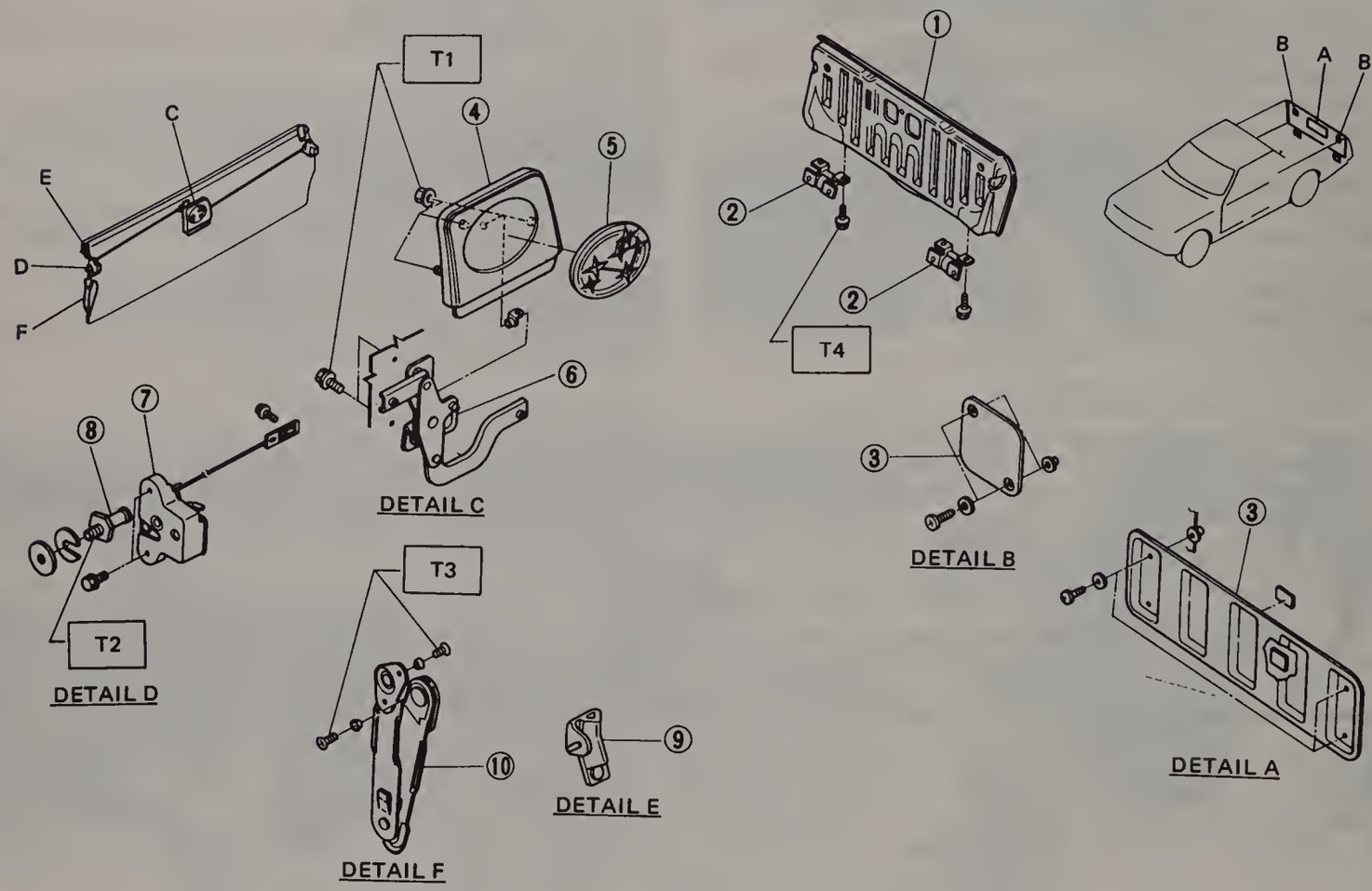


Fig. 12.17 Pick-up truck (1983) rear gate components - exploded view (Sec 15)

1 Rear gate panel	*4 Outer handle*	*7 Latch*	*9 Buffer*
2 Hinge	*5 Ornament*	*8 Striker*	*10 Stay*
3 Cover	*6 Lever*		

the harness from the gate. **Note**: *If you are going to reinstall the original gate, wrap all of the electrical connectors together with tape and attach a length of flexible wire to the end of them. Carefully pull the harness out, remove the attached wire and leave it in the gate to ease the harness installation.*

5 If you are replacing the existing gas stays with new ones, replace only one stay at a time. **Warning**: *Never disassemble a gas stay, it contains high-pressure gases.*

6 As a precaution, a stay which has been replaced with a new one should have a $\frac{1}{8}$-inch hole drilled into it about $\frac{3}{8}$ inch from its base. This will eliminate the possibility of injury to anyone. **Warning**: *When drilling a stay, wear protective eye covering.*

7 To remove the stays, open the rear gate all the way. While the gate is supported by an assistant, remove the gate end of the stay first (photo) and then the body end (photo). **Note**: *Never let the gate be supported by only one stay. When replacing the gas stays, make sure you get the right ones for your vehicle. Gates with a rear window wiper have a white mark on the label, while gates without a window wiper have no markings.*

8 Now, place a heavy cloth between the vehicle body and the top of the gate to prevent paint damage when the gate is removed.

9 Remove the gate side hinge bolts and then carefully remove the gate from the vehicle.

10 Installation is basically the reverse of the removal procedure.

11 If a new gate is to be installed and you want to use some of the parts from the old gate, refer to the gate disassembly Section in this Chapter to remove and install the parts.

12 Install the gate with its mounting bolts and tighten them to the specified torque.

13 To make any adjustments for the fit on the gate, you have to use the gate body hinge nuts. Remove the side rail trim (photo) and some of the clips holding the rear roof headliner in place. **Note**: *Do not remove more headliner clips than is necessary to reach the gate body hinge nuts.*

14 Loosen the hinge nuts (photo) and move the gate in a horizontal or vertical direction to get the gate to close and fit properly.

15 After the adjustments are made, tighten the hinge nuts securely.

16 Install the roof headliner back into position, as well as the side rail trim. Make sure the screws are tight.

17 To adjust the gate for locking/closing abilities, loosen the gate striker bolts (photo) and move the striker horizontally or vertically to achieve a good locking/closing position.

18 If after making adjustments the gate does not lock well (or not at all), you may need to place a spacer underneath the striker. The size (thickness) of the spacer will depend on what it will take to lock the gate properly.

19 After the adjustments, make sure the striker mounting bolts are tightened to the specified torque.

20 Install both stays by mounting the body end first and then the gate end. Tighten the mounting bolts according to the Torque specifications. **Note**: *Have someone assist you in supporting the gate as the stays are installed.*

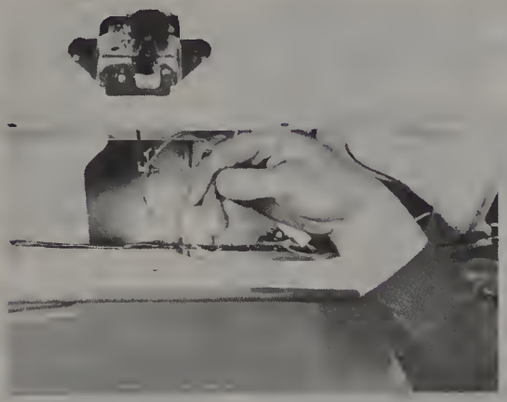
21 Now, reconnect the wiring harness connectors to the flexible wire and carefully maneuver the harness through the access hole and toward the bottom of the gate. Don't forget to attach all of the electrical connectors to their correct components. **Note**: *Station wagons have connectors for the license plate bulbs.*

22 With a small screwdriver, carefully install the washer hose and the wiring harness grommet back into their correct places.

23 Connect the defogger electrical connectors by carefully pushing them on.

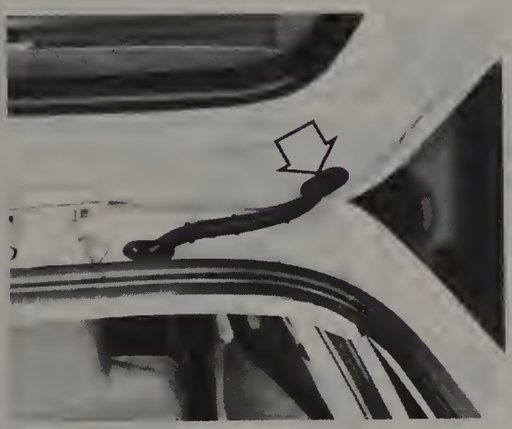
24 Install the trim panel by referring to the gate installation Section in this Chapter.

16.2 Disconnect both defogger connectors



16.3A Disconnect the window wiper connector ...

16.3B ... and the rear washer hose

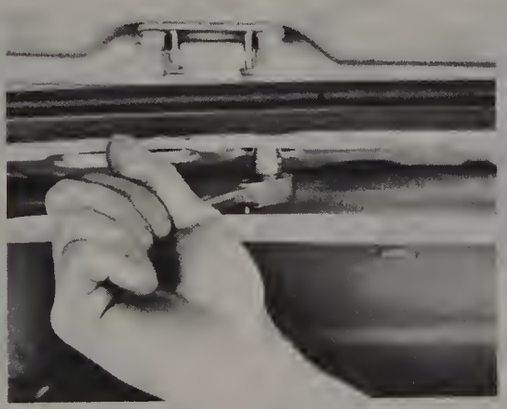


16.4 Remove the wiring harness grommet (arrow)

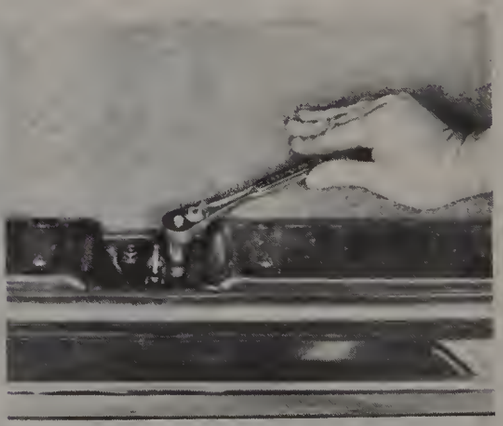
16.7A Remove the top stay mounting bolts first ...

16.7B ... and then the bottom stay mounting bolts

16.13 Remove the side rail trim clips and screws



16.14 Loosening the gate body hinge nuts



16.17 Loosen and move the gate striker to adjust the gate locking action

Pick-up truck

25 The gate removal and installation is fairly easy and straightforward. Open the gate for the removal.

26 Remove the gate body (bed) hinge bolts and then remove the gate.

Note: *Place a heavy cloth between the gate and the body to prevent any paint damage during removal.*

27 If the gate is to be replaced with a new one and you want to use parts off of the old gate, refer to the gate disassembly Section in this Chapter and exhange the parts.

28 Installation is the reverse of removal. Do not totally tighten the hinge bolts in case you have to make adjustments to the gate.

29 To adjust the gate up and down or forward and backward, loosen the gate body hinge bolts and make the necessary adjustments for a good fit.

30 Also, to adjust the gate left and right or up and down, loosen the gate side hinge bolts.

31 When the adjustments have been made, tighten all mounting hardware to the specified torque.

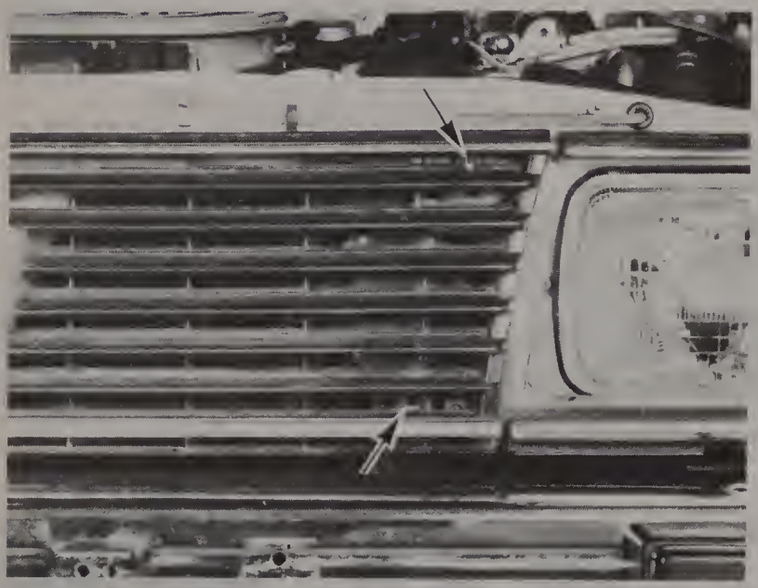
17 Grille (front) – removal and installation

1 Removal of the front grille is fairly straightforward.

2 Remove the mounting screws (photo) and then remove the grille.

3 Installation is the reverse of the removal procedure.

4 Make sure that when you install the mounting screws, you tighten them carefully (not to the point that the threads of the nuts are stripped out).



17.2 Remove the grille mounting screws (arrows)

18 Bumpers – removal and installation

Refer to Figs. 12.18 and 12.19. In order to disassemble the bumpers easily, they should be removed as a complete assembly. They can, however, be disassembled on the vehicle.

Front bumper

1 The best way to start is by removing both side bumpers first. To do this, use a screwdriver and carefully pry off the plastic mounting bolt plugs (photo).

2 Remove the bolts holding the side bumpers to the main bumper (photo) and also to the body of the vehicle (photo).

3 Now, carefully pull the side bumper away from the vehicle and disconnect the side marker electrical connectors (photo). You may have to do this inside the engine compartment, depending on where the connectors are.

4 On 2WD vehicles, remove the bolts mounting the shock dampers to the body. Then carefully remove the main bumper assembly (with dampers) from the vehicle. **Note:** *1982 and 1983 dual-headlight models have the turn signal lights mounted in the bumper. These connectors will have to be disconnected and reconnected prior to removing and installing the main bumper.*

5 On 4WD vehicles, remove the bolts attaching the guard pipe to the lower skirt (photo) and loosen the middle oil pan shield bolt about

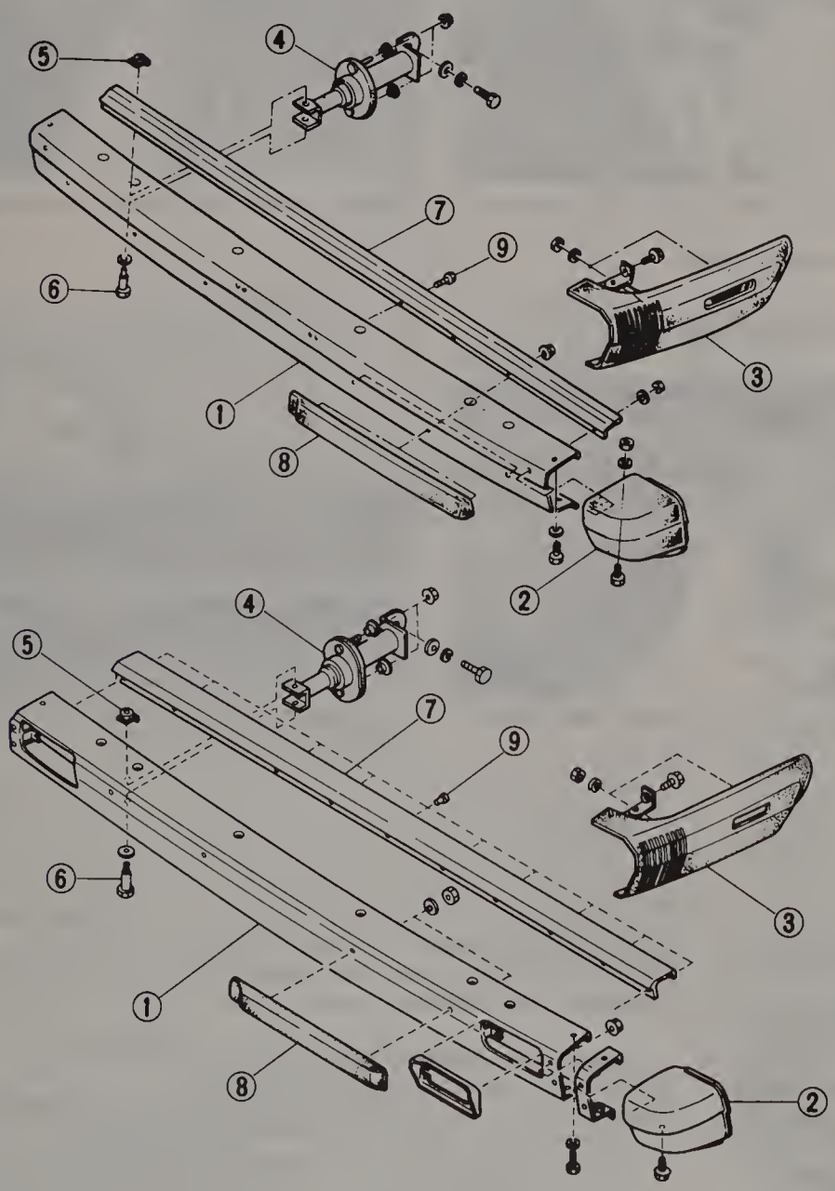
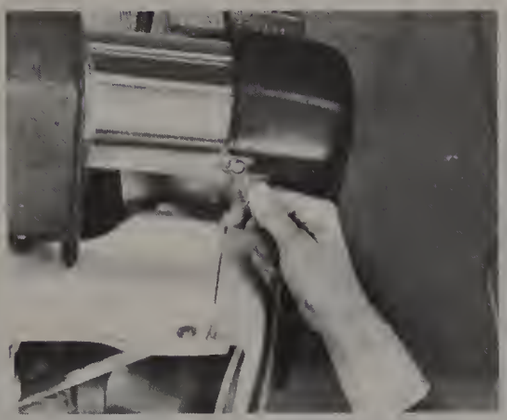


Fig. 12.18 Front bumper components (typical) – exploded view (Sec 18)

1 *Bumper center*
2 *Bumper side*
3 *Bumper side*
4 *Damper assembly*
5 *Stop nut*
6 *Pin*
7 *Front bumper cover*
8 *Bumper protector*
9 *Rivet*

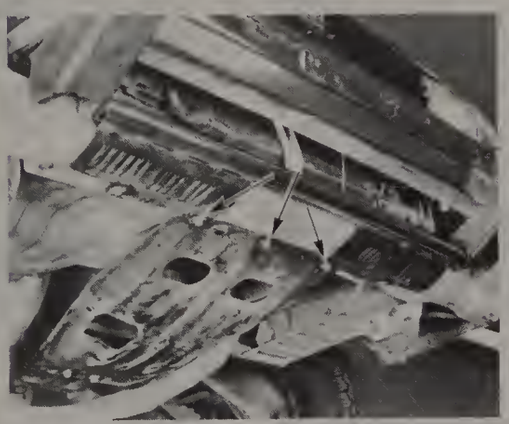
18.1 Pry off the plastic plugs to gain access to the bumper mounting bolts



18.2A Remove the side bumper-to-main bumper bolts

18.2B Remove the side bumper-to-vehicle body bolts

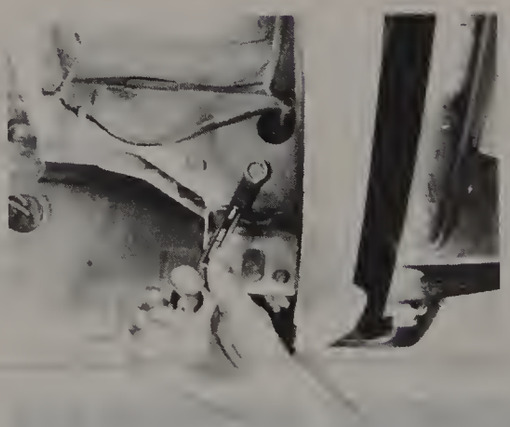
18.3 Disconnect the side marker electrical connectors



18.5A Remove the guard pipe-to-lower skirt bolts (arrows)

18.5B Remove the main bumper stay bolts

18.11 Remove the rear side bumper-to-main bumper bolts



18.12 Remove the main bumper stay bolts

a quarter of the way to ease installation. Remove the main bumper stay mounting bolts (photo) and carefully remove the main bumper assembly from the vehicle.

6 If you are going to replace any individual pieces of the bumper assembly, refer to the appropriate Section in this Chapter for disassembly.

7 Installation is basically the reverse of the removal procedure.

8 Loosely install the bumper assembly onto the vehicle with the mounting bolts. Raise the bumper and make sure the alignment is correct while tightening the mounting bolts. **Note:** *The side bumpers have an alignment pin on the underside. Make sure this pin goes into the hole on the main bumper during installation of the side bumpers.*

9 Don't forget to reconnect the side marker connectors, noting whether to do it before or after you install the side bumpers. **Note:** *Some vehicles have shortened wires.*

10 Make sure all of the mounting bolts are tight, especially the ones specifying a torque.

Rear bumper

11 To remove the rear main bumper assembly, first remove the plastic mounting bolt plugs with a screwdriver. Then remove the side bumper mounting bolts from the main bumper (photo) and from the vehicle body (if applicable).

12 Remove the bumper sides and then loosen and carefully remove the shock damper mounting bolts (2WD) or the main bumper stay mounting bolts (4WD) (photo).

13 Carefully remove the main bumper assembly from the vehicle.

14 You can replace any individual parts on the main bumper assembly by removing the mounting bolts.

15 Installation is basically the reverse of the removal procedure.

16 Loosely install the bumper assembly on the vehicle. Raise the bumper and make sure the alignment is correct while tightening the mounting bolts.

17 The side bumpers have an alignment pin on the underside. Make sure this pin goes into the hole on the main bumper during assembly.

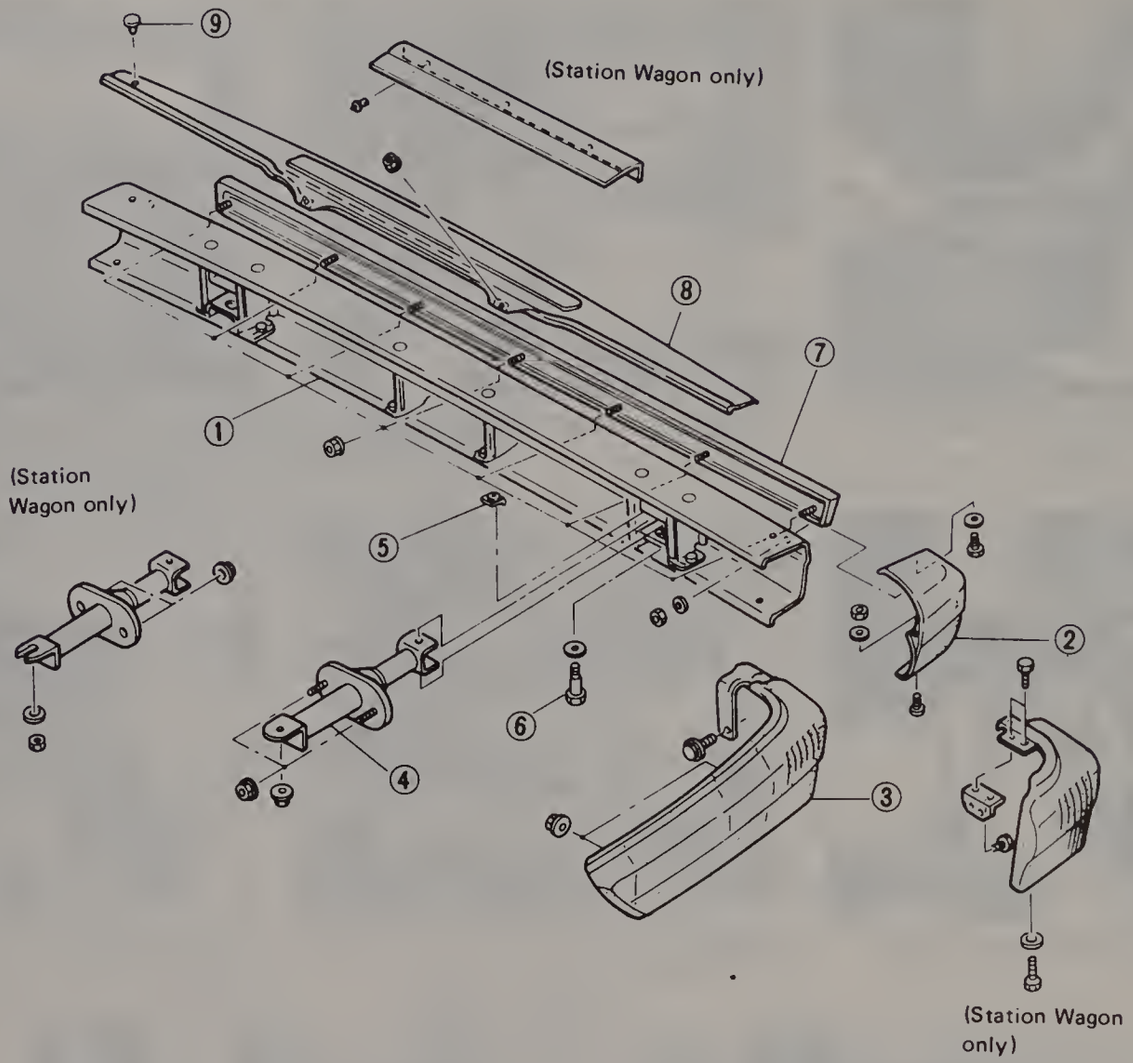
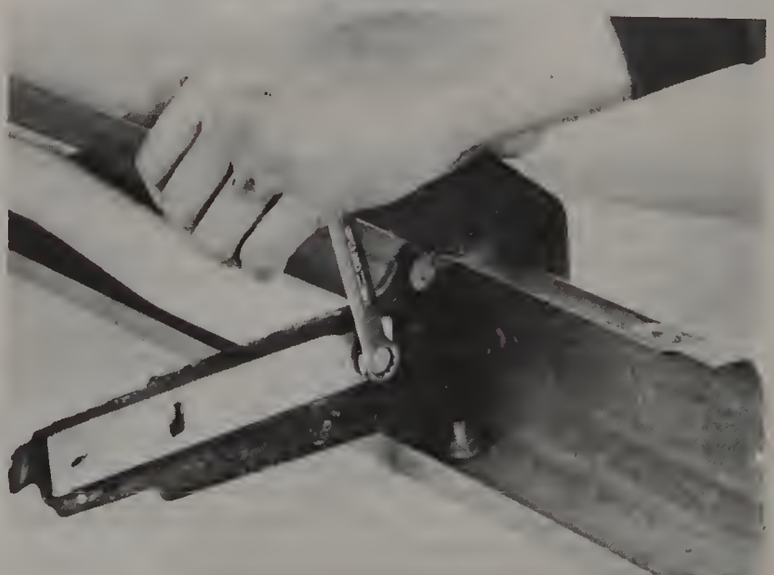


Fig. 12.19 Rear bumper components (typical) – exploded view (Sec 18)

1 *Bumper center*
2 *Bumper side*
3 *Bumper side*
4 *Damper*
5 *Stop nut*
6 *Pin*
7 *Bumper protector*
8 *Bumper cover*
9 *Clip*

19.2 Remove the oil pan shield mounting nuts



19.3 Remove the guard pipe mounting bolts

18 Make sure that all mounting bolts are tightened according to the Torque specifications.

19 Bumpers – disassembly and reassembly

Refer to Figs. 12.18 and 12.19

Front bumper

1 After removing the bumper assembly from your vehicle, you can disassemble it and replace any defective parts.

4WD

2 Remove the oil pan shield mounting nuts and then remove the shield (photo).

3 Remove the guard pipe mounting bolts (photo) and then remove the pipe from the bumper.

4 Now you can remove the bumper stay and the bumper guard by removing the mounting nuts.

2WD

5 Remove the mounting nut pins from the shock dampers and then remove the dampers. **Warning:** *The shock dampers are filled with high-pressure gases. Never try to disassemble them or place them near open flames or other sources of heat.*

6 Now you can remove the bumper protector and the indicator light housing (if equipped) from the bumper by removing the mounting hardware.

7 Reassembly is basically the reverse of the disassembly procedure.

8 Make sure you tighten all of the mounting hardware according to the Torque specifications.

Rear bumpers

9 The rear bumpers are disassembled basically the same way as the front bumpers.

20 Skirt (front) – removal and installation

Refer to Fig. 12.20

1 In order to remove the front skirt, you have to first remove the front bumper and the front grille. To do this, refer to the appropriate

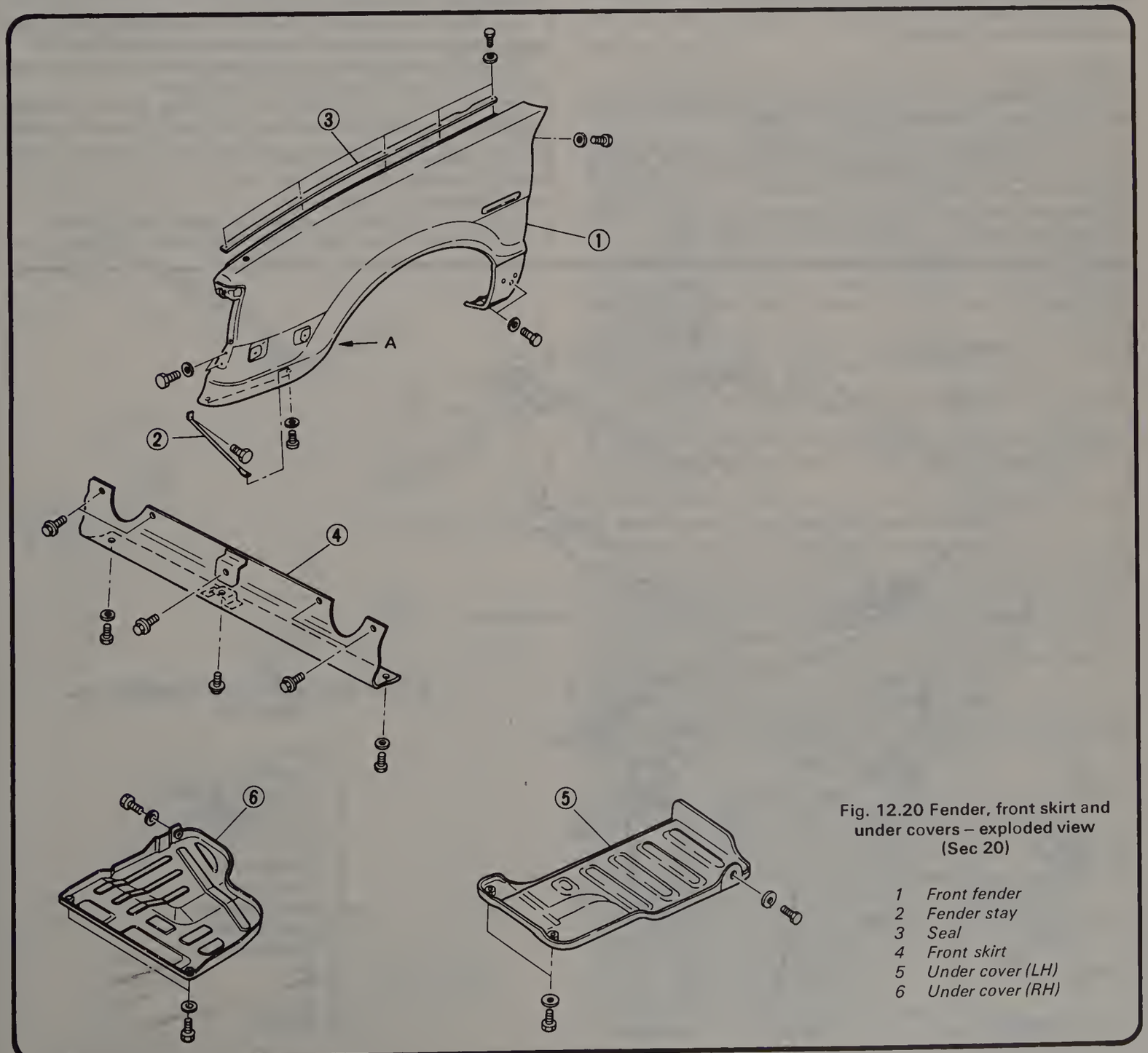


Fig. 12.20 Fender, front skirt and under covers – exploded view (Sec 20)

1 *Front fender*
2 *Fender stay*
3 *Seal*
4 *Front skirt*
5 *Under cover (LH)*
6 *Under cover (RH)*

Sections in this Chapter.
2 Remove the bolts mounting the skirt to the vehicle body, the radiator panel and the front fenders.
3 To remove the skirt, move it to one side or the other, in order to clear the fender, and then pull it forward.
4 Installation is basically the reverse of the removal procedure.
5 Make sure that all mounting bolts are tightened securely.
6 Install the front grille and the front bumper.

21 Hood components – removal and installation

Refer to Fig. 12.21

Striker assembly

1 Remove the striker mounting bolts and then the striker assembly from the hood.
2 Check the striker spring and also the safety lever spring for cracks and replace it if necessary. Also check the operation of the safety lock, apply a good white grease to the hinged parts and operate it a few times to ensure that it is in good working condition.
3 Install the striker assembly on the hood and make sure the mounting bolts are tightened.

Lock assembly

4 Remove the lock mounting bolts and then the lock assembly from the radiator panel. Disconnect the hood release cable.
5 Check the lock spring for cracks and replace it with a new one if necessary. Also check the locking lever for correct operation. Apply a white grease to the lever hinge area and operate it a few times to make sure it works properly.
6 Install the lock assembly on the radiator panel and make sure the mounting bolts are tight. Reconnect the hood release cable.

Hood release cable

7 To remove or replace the cable, you have to first unhook it from the lock assembly, the plastic retainer clips on the radiator panel and the handle under the instrument panel.
8 Install the new cable in the same manner as it was removed.
9 Make sure that the new cable releases the lock assembly correctly. If it does not, adjust its length (by moving it in or out of the metal clamp on the radiator panel) and then crimp it into place with the clamp.

22 Hood – removal, installation and adjustment

Refer to Fig. 12.21

1 To remove and install the hood you will need an assistant. First, place a protective covering on the vehicle directly below the bottom edge of the hood. This will prevent damage to the hood and body if the hood is accidentally dropped.
2 Remove the mounting bolts holding the hood bracket to the hood hinges. **Note:** *Remove these bolts from one side of the hood at a time and then lightly set the corner of the hood down on the covering until the other side of the hood is disconnected.*
3 If the hood was damaged, you may want to remove the hinges and check them for straightness or replace them with new ones.
4 To do this, you first have to remove the hood cowl panel by referring to the appropriate Section in this Chapter.
5 Remove the pin/bolt holding the hinge in place. Remove the hinge by pulling it toward the front of the vehicle and through the rubber plate.
6 If you are replacing the hood with a new one, you may want to use some of the items from the old hood. To do this, refer to the appropriate Section in this Chapter.
7 Installation is basically the reverse of the removal procedure.
8 If you removed the hood hinges, install them and tighten the

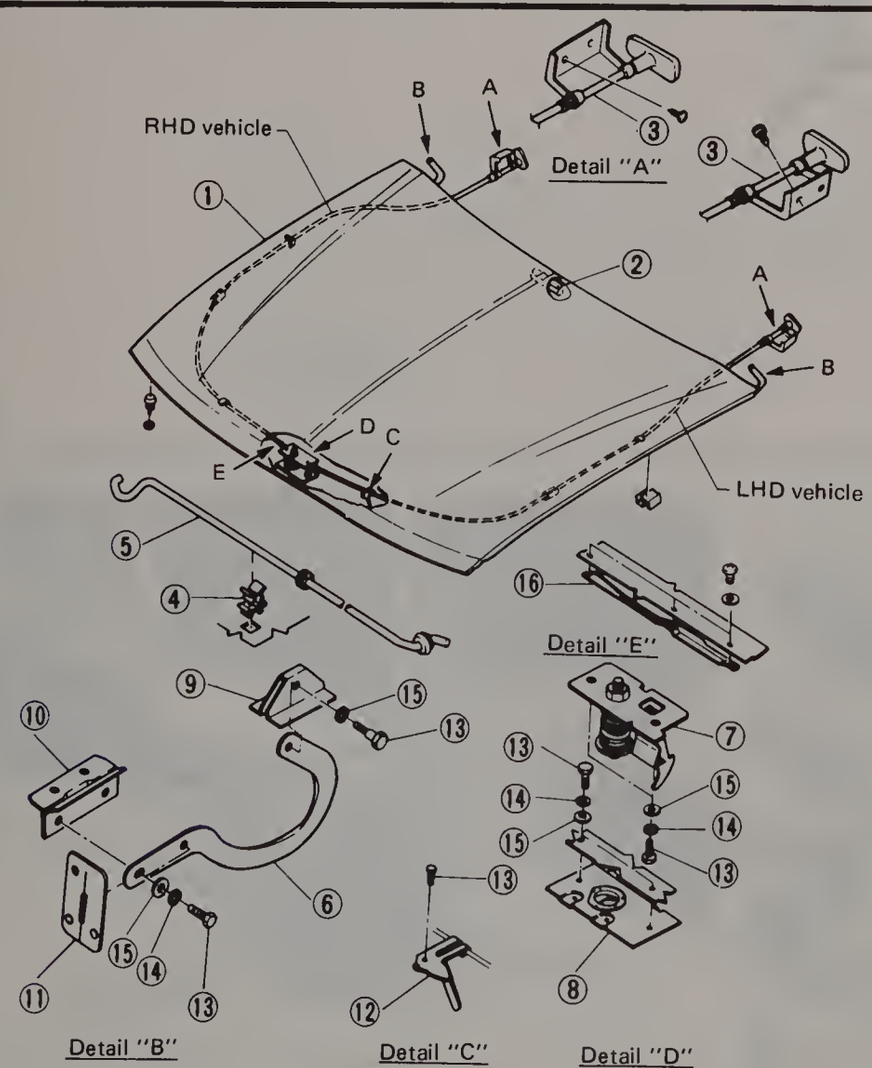


Fig. 12.21 Hood components – exploded view (Sec 21)

1 *Hood*
2 *Grommet*
3 *Hood release cable*
4 *Hood stay clip*
5 *Hood stay*
6 *Hinge*
7 *Striker*
8 *Hood lock*
9 *Hinge bracket*
10 *Hood bracket*
11 *Rubber plate*
12 *Clip*
13 *Bolt*
14 *Spring washer*
15 *Washer*

mounting bolts. Also, install the hood cowl panel.
9 With the help of an assistant, attach the hood brackets to the mounting hinges. **Note:** *When installing the hood, the hood brackets are mounted on the outside of the hood hinges.*
10 To adjust the hood, the mounting bolts have to be loose. Move the hood toward the front or the rear of the vehicle to get a good fit and then tighten the bolts.
11 To adjust the hood in the up/down position, use a screwdriver and loosen/tighten the rubber cushions.
12 Make sure all of the mounting hardware is tight.

23 Trunk lid components – removal and installation

Refer to Fig. 12.22

Lock assembly

1 Remove the lock mounting bolts and then the lock assembly from the trunk lid. Disconnect the trunk lid release cable.
2 Check the lock mechanism for wear and damage and replace it if necessary. Check the operation of the lock and apply white grease to the hinged parts. Operate the lock a few times to ensure that it is in good working condition.
3 Attach the lock assembly to the trunk lid and make sure the mounting bolts are tight. Reconnect the trunk lid release cable.

Striker

4 If the striker needs to be replaced, just remove its mounting screws from the vehicle body. Place shims underneath the striker if it does not allow the lid to close properly. Make sure that the mounting screws are tight.

Trunk lid release cable

5 In order to remove and replace the cable, you must release the cable from the following parts: the lock assembly, the clamp on the right hinge, the interior pull handle and the clips and tape running through the vehicle body. To do this, you will have to remove the rear seats by referring to Section 10 of this Chapter.
6 With the cable removed, check for any kinks or frays, that might have caused them and whether it can be avoided with the new cable. Replace the cable with a new one if necessary.
7 Carefully install the new cable, making sure it does not kink and that it is installed the same way as the old cable.

Trunk lid release handle

8 Remove the handle knob by pulling it forward. Remove the release handle assembly from the crossmember by removing its mounting screws. Disconnect the trunk lid release cable.
9 Check the working condition of the handle assembly and apply white grease to its hinged parts to enable it to work easier.
10 When installing the handle, make sure the mounting screws are tight.

Weatherstripping

11 If you have to replace the trunk weatherstripping, make sure that during installation the ends of the weatherstripping come together at the bottom outside edge of the trunk lid.

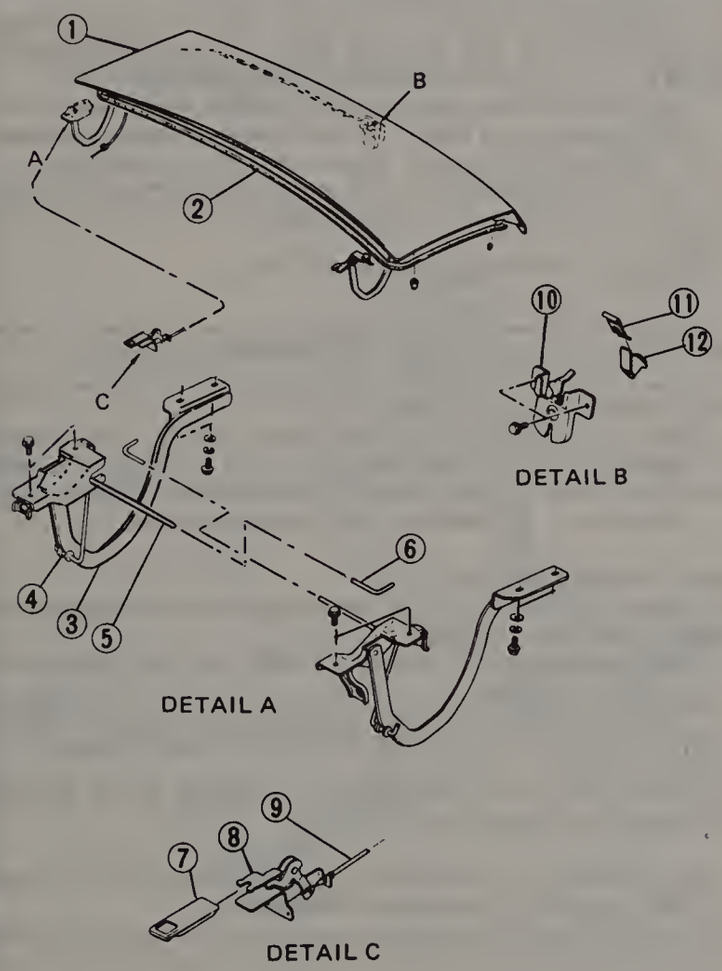


Fig. 12.22 Trunk lid components – exploded view (Sec 23)

1 *Trunk lid*
2 *Weatherstrip*
3 *Hinge*
4 *Roller*
5 *Torsion bar*
6 *Torsion bar*
7 *Trunk opener knob*
8 *Trunk opener handle*
9 *Trunk opener cable*
10 *Lock assembly*
11 *Clip*
12 *Key cylinder*

24 Trunk lid – removal and installation

Refer to Fig. 12.22

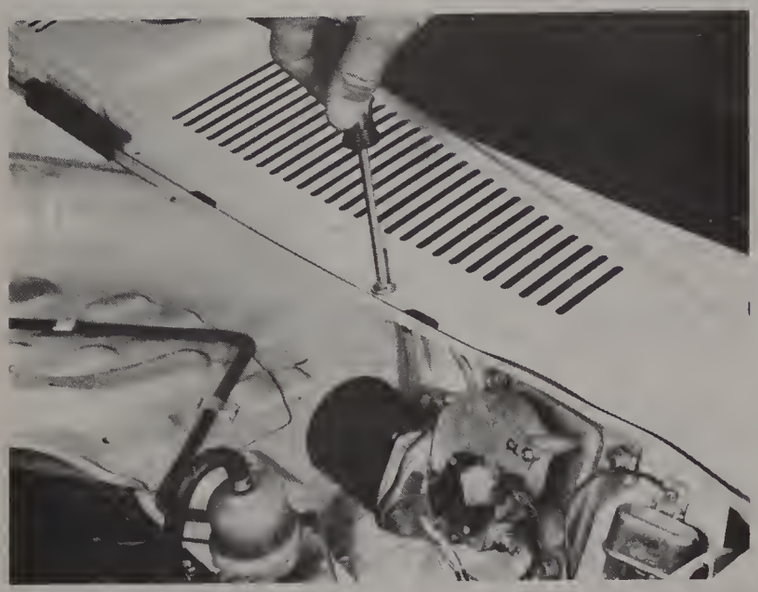
1 To remove and install the trunk lid, you may need the help of an assistant. Carefully remove both torsion bars from the trunk lid. **Note:** *Mark the torsion bars right or left because they are different.* After removing the torsion bars, the trunk lid will no longer hold itself up, so be careful.
2 The trunk lid hinges can be removed at either the trunk lid brackets or the vehicle brackets, depending on the condition they are in and if you want to keep them.
3 Apply white grease to all of the contact areas of the rollers and hinges.
4 Install the torsion bars in the same manner as they were removed.
5 Make sure you tighten all of the mounting bolts securely.

25 Splash board (rear) – removal and installation

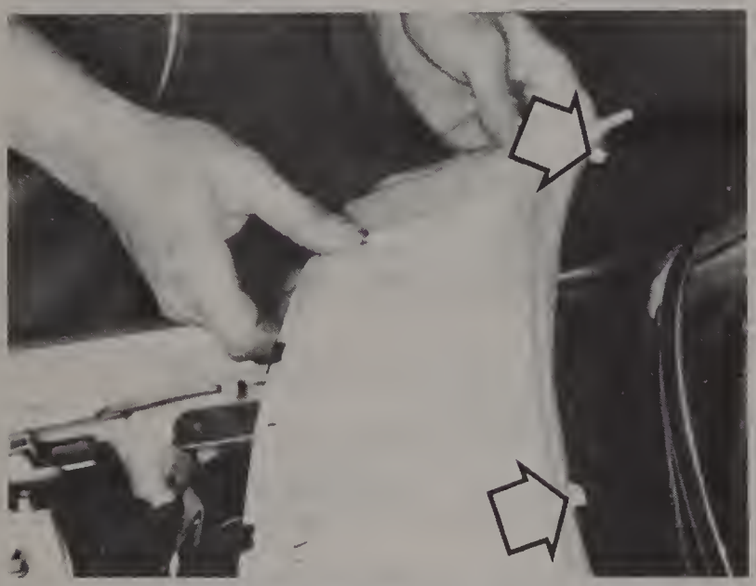
1 The rear splash board consists of two pieces – upper and lower.
2 Remove the bolt that connects the upper board to the lower board.
3 To remove the lower board, carefully pull out the plastic clip from the rear wheel apron and then remove the other mounting bolt from the board.
4 To remove the upper board, remove the mounting hardware and then the board.
5 Installation is the reverse of the removal procedure.
6 When mounting the upper splash board, apply an anti-corrosive sealant to the mounting screws before installation and after they are tightened. **Note:** *Do not over-tighten these mounting screws.*

26 Mud guard (inner fender) – removal and installation

1 To remove either of the mud guards, the related front tire must be removed. Raise the vehicle and place it on jack stands according to the *Jacking and towing* procedures at the front of this book.
2 Remove all of the clips and mounting screws holding the mud guard to the fender. Shift the guard to the inside of the fender and then remove the clips from the fender flange.
3 Inspect all of the mounting clips for damage and replace them with new ones if necessary.
4 Installation is the reverse of the removal procedure.
5 Make sure that all of the mounting hardware is tight, but do not over-tighten the screws.



27.2 Removing the cowl mounting screws



27.4 Make sure the tabs of the cowl are inserted into the slots correctly

27.5 Carefully maneuver the rubber lip to the underside of the cowl with a screwdriver

27 Cowl panel (hood) – removal and installation

1 To remove the cowl, you first have to remove the wiper arms. To do this, refer to the appropriate Section in Chapter 10.
2 Now, remove the cowl mounting screws (photo) and then carefully remove the cowl from the vehicle.
3 Installation is basically the reverse of the removal procedure.
4 When installing the cowl, make sure that all of the tabs are inserted into their slots correctly (photo).
5 The cowl tabs will not fit completely into their slots until the rubber lip along the bottom edge of the windshield is positioned under the cowl panel. To do this, use a small screwdriver and carefully maneuver the rubber lip under the panel as shown (photo).
6 Install the mounting screws and make sure they are tight.
7 Install and adjust the window wiper arms by referring to the appropriate Section in Chapter 10.

28 Fenders (front) – removal and installation

Refer to Fig. 12.20

1 In order to remove the front fenders, other parts will have to be removed first.
2 Refer to the appropriate Sections in this Chapter and remove the mud guard, the front grille, the front bumper or bumper side and the cowl panel.
3 Also refer to the appropriate Section in Chapter 10 and remove the front combination light and possibly the antenna and bracket (depending on which fender you are removing).
4 Now remove the fender by removing all of the mounting hardware, including the fender stay. **Caution**: *When removing the fender, be careful not to damage the vehicle body with the fender.*
5 Install a new fender sealer. Install the new fender loosely with its mounting hardware and adjust it so there is uniform spacing between it, the hood and the front door. Tighten the mounting hardware.
6 Install all of the items that were removed in order to remove the fender by referring to the appropriate Sections in this Chapter and in Chapter 10.
7 Make sure all mounting hardware is tight.

29 Molding (interior/exterior) – removal and installation

Rear pillar molding (sedan)

1 Remove the upper rear pillar panel from the inside of the vehicle.
2 Remove the nuts through the service holes and take out the rear pillar molding with the rear end of the roof molding in a raised position.
3 Installation is the reverse of the removal procedure.

Roof molding (drip rail)

4 *Hardtop and sedan* – cut off the heads of the rivets holding the roof molding to the front pillar.
5 *Hatchback and station wagon* – Remove the joint between the front and rear moldings.
6 Detach the front and rear moldings (along with the clip) by pulling it with your fingers or screwdriver (with a cloth wrapped around it to protect the finish).
7 Installation of the roof molding on the drip rail is done by depressing it with your hand.

30 Radio console – removal and installation

Refer to Figs. 12.24 and 12.25

4WD

1 Loosen the cord on the 4WD selector boot and remove the panel cover screws and then the cover itself.

All models

2 Remove the parking brake panel cover screws and then remove the cover.
3 Loosen the cord on the shifter lever boot and remove the center

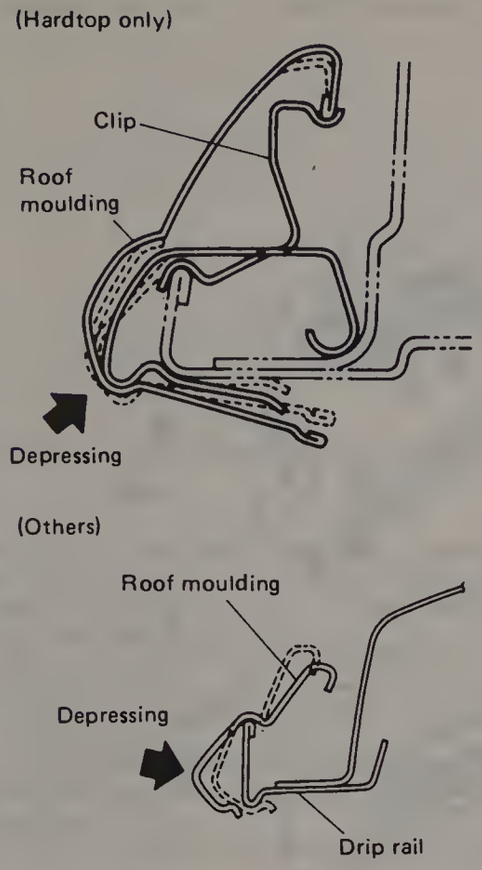


Fig. 12.23 Installing drip rail molding (Sec 29)

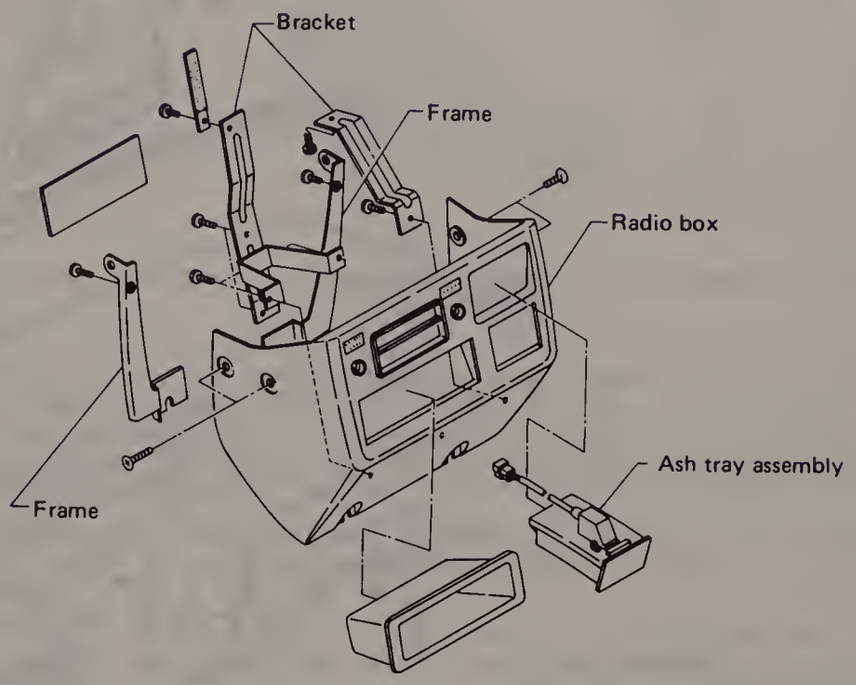


Fig. 12.24 Radio console components (style A) – exploded view (Sec 30)

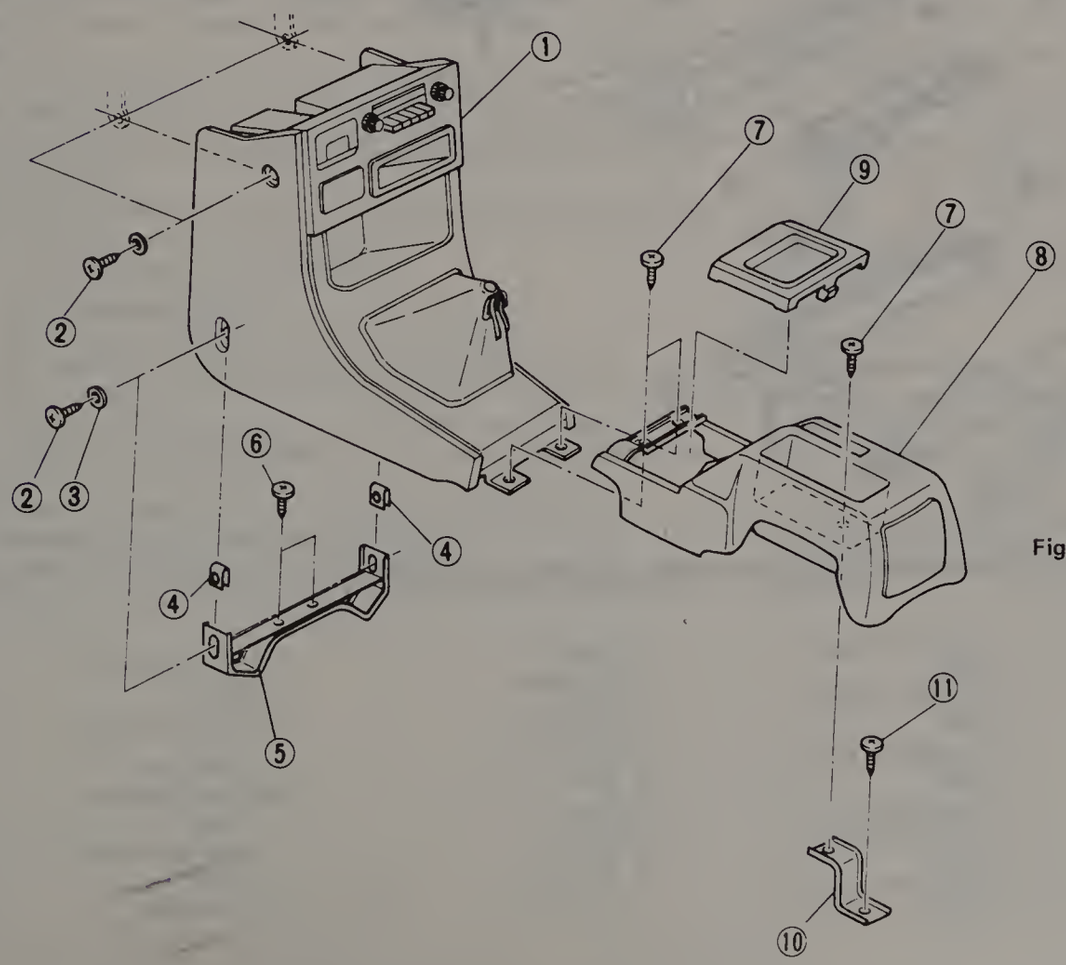


Fig. 12.25 Radio console and parking brake components (style B) – exploded view (Sec 30)

1 *Console box*
2 *Screw*
3 *Washer*
4 *Spring nut*
5 *Bracket*
6 *Screw*
7 *Screw*
8 *Parking brake cover*
9 *Cover tray*
10 *Bracket*
11 *Screw*

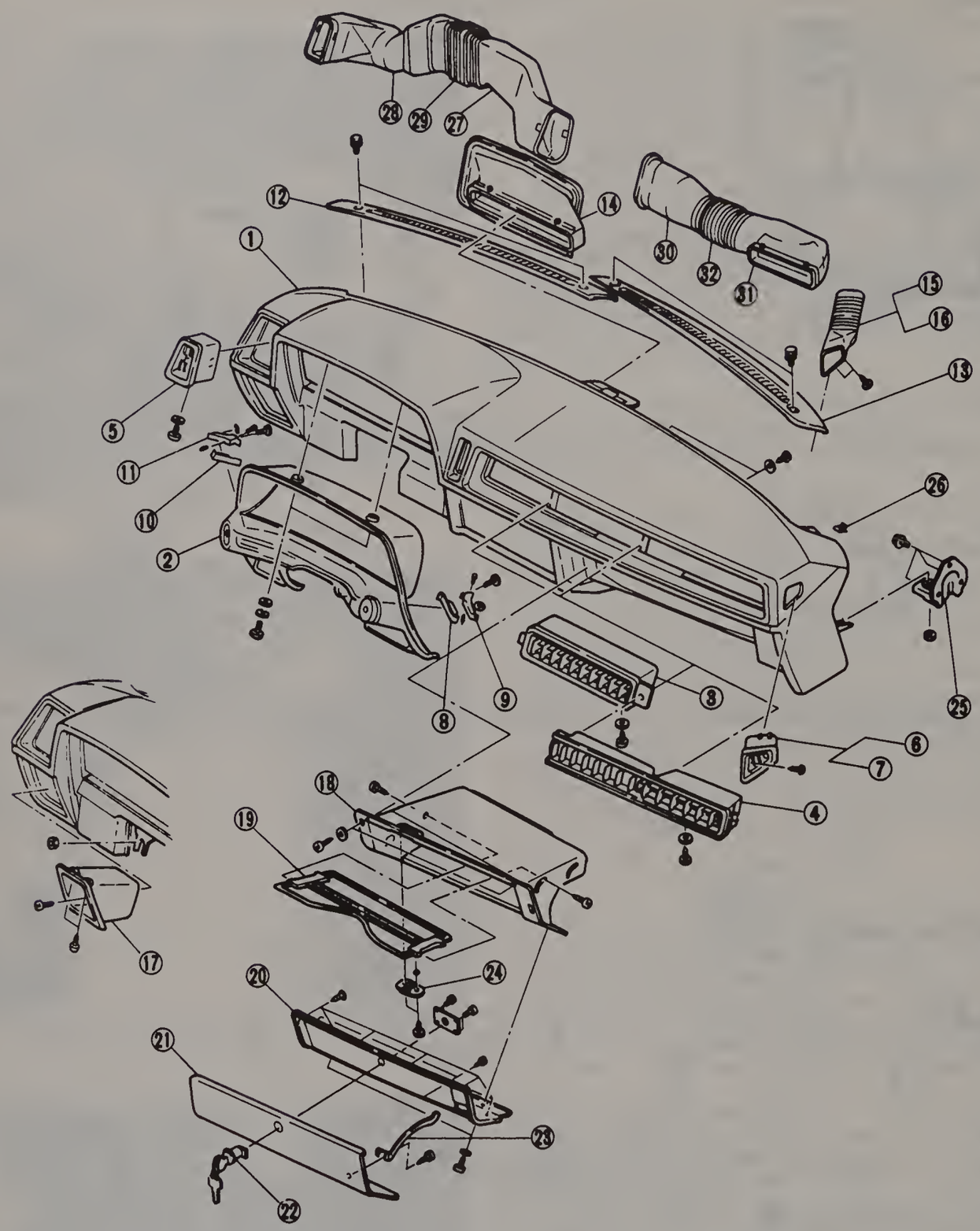


Fig. 12.26 Instrument panel components – exploded view (Sec 31)

1 Instrument panel
2 Visor and switch box
3 Center grille
4 Side grille
5 Side vent grille
6 Side defrost grille (LH)
7 Side defrost grille (RH)
8 Wiper plate
9 Wiper indicator light
10 Lighting plate
11 Lighting indicator light
12 Top defrost grille (LH)
13 Top defrost grille (RH)
14 Center duct
15 Side defrost duct (LH)
16 Side defrost duct (RH)
17 Coin box
18 Glovebox
19 Shelf
20 Trim panel
21 Glovebox lid
22 Lock
23 Stay
24 Striker
25 Bracket
26 Speed nut
27 Side vent duct (LH)
28 Side vent duct (LH)
29 Joint (LH)
30 Side vent duct (RH)
31 Side vent duct (RH)
32 Joint (RH)

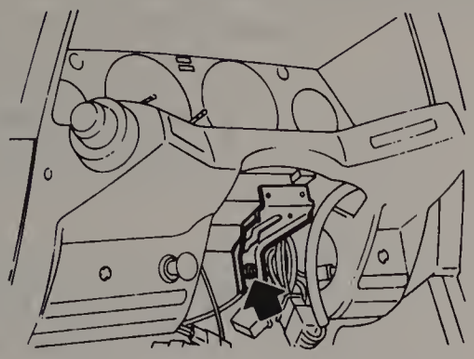


Fig. 12.27 Remove the nut from the combination meter (Sec 31)

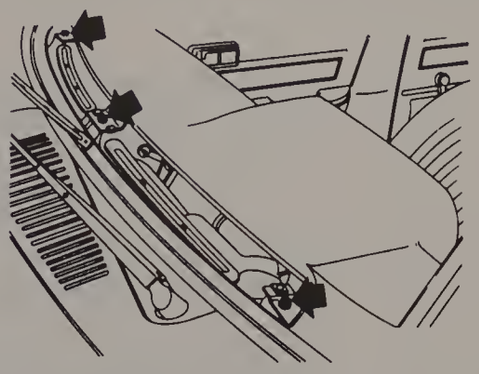


Fig. 12.28 Remove the bolts from the top of the instrument panel (Sec 31)

shelf screws and the shelf. **Note:** *When removing and installing the center shelf, it helps to have the gear shifter in Neutral, the 4WD selector in the 4WD position and the parking brake lever engaged (fully pulled back).*

4 Remove the mounting screws at the bottom of the radio console as well as the mounting screws on the right and left sides.

5 Carefully pull the radio console part way out and disconnect the wiring harness.

6 Installation is basically the reverse of the removal procedure.

7 Place the radio console in its mounting position and connect the wiring harness.

8 Install all of the mounting hardware and make sure it is tight.

31 Instrument panel – removal and installation

Refer to Figs. 12.26 through 12.28

1 **Note:** *Even though the instrument panel can be removed without removing the windshield, it really helps to have the windshield removed.* Remove the parking brake cover by removing the mounting screws.

2 Remove the radio console or the lower console (whichever is applicable) by referring to the appropriate Section in this Chapter.

3 Also, remove the trim panel (containing the fuse box) on the driver's side and the trim panel (containing the glove box) on the passenger side.

4 Remove the bolts that hold the steering column in place. Let the steering column down as far as it will go.

5 Now, disconnect the following items:

The speedometer cable
Any electrical wiring (label wires in some way)
Any cables for the heater controls (label cables)
Any vacuum hoses for the heater controls (label hoses)

6 Remove the nut at the bottom of the combination meter.

7 Remove the instrument panel mounting nuts on both sides of the pillars.

8 Detach the clips and take out both top defroster grilles.

9 Remove the instrument panel mounting nuts at the top of the instrument panel (nearest to the windshield).

10 Detach the defroster ducts and the ventilator ducts on both sides.

11 Now you can remove the instrument panel by lifting it up and toward you (to the rear).

12 Installation is basically the reverse of the removal procedure.

13 When you reinstall the instrument panel, do it carefully and make sure you do not damage any of the wiring harnesses, cables or vacuum hoses.

14 Make sure that all of the mounting hardware is tight and that all of the wires, cables and horns are correctly installed.

32 Heater control panel – removal and installation

1 Remove the radio console by referring to the appropriate Section in this Chapter.

2 Remove the fan switch, the temperature control dial and the heater mode lever knob by simply pulling hard on them with your fingers.

3 Remove the nuts holding the fan switch and the temperature controller in position.

4 Remove the bottom mounting screws holding the control panel in position.

5 Disconnect the electrical wiring (label in some way) for the cigarette lighter, the rear defogger switch and the panel illumination lights.

6 Now you can carefully remove the control panel.

7 Installation is basically the reverse of the removal procedure.

8 Be careful not to damage any of the wiring when you install the panel.

9 Make sure that all of the pieces are put back in their correct places and that all of the mounting hardware is tight.

33 Fuel filler door/key lock – removal and installation

1 To remove the key lock cylinder, open the door and use a needle-nose pliers to pull the clip off the cylinder.

2 Install the key lock in the opposite way it was removed.

3 You can replace/remove the filler door striker or hinge just by removing the mounting screws.

4 Make sure that the door is positioned properly before you tighten the screws.

Chapter 13 Supplement: Revisions and information on 1984 thru 1988 models

Contents

1 Introduction

This Supplement contains specifications and service procedure changes that apply to all Subaru models produced from 1984 through 1988. Also included is information related to previous models that was not available at the time of original publication of this manual.

Where no differences (or very minor differences) exist between 1983 models and later models, no information is given. In those instances, the original material included in Chapters 1 through 12, pertaining to 1983 models, should be used.

2 Specifications

Note: *The specifications listed here include only the items which differ from those listed in Chapters 1 through 12. For information not specifically listed here, refer to the appropriate Chapter.*

Tune-up and routine maintenance

Engine idle speed	Refer to the *Emission Control Information* label in the engine compartment
Spark plug gap	0.039 to 0.043 in (1.0 to 1.1 mm)

Overhead cam (OHC) engine

Cylinder block

Cylinder bore diameter	3.6214 to 3.6226 in (91.985 to 92.015 mm)
Cylinder taper/out-of round limit	0.0020 in (0.05 mm) maximum
Piston diameter	3.6205 to 3.6216 in (91.960 to 91.990 mm)
Piston-to-cylinder clearance	
Standard	0.0004 to 0.0016 in (0.01 to 0.04 mm)
Limit	0.0024 in (0.06 mm)

Cylinder head

Valve guide inside diameter (intake and exhaust)	0.2756 to 0.2762 in (7.000 to 7.015 mm)
Valve guide protrusion (intake and exhaust)	0.689 to 0.728 in (17.5 to 18.5 mm)
Valve stem diameter	
Intake	0.2736 to 0.2742 in (6.950 to 6.965 mm)
Exhaust	0.2734 to 0.2740 in (6.945 to 6.960 mm)
Valve spring free length	
Inner spring	1.980 in (50.3 mm)
Outer spring	2.035 in (51.7 mm)
Valve spring out-of-square limit	
Inner spring	0.087 in (2.2 mm)
Outer spring	0.091 in (2.3 mm)

Crankshaft and bearings

Main journal diameter	
Front	2.1637 to 2.1642 in (54.957 to 54.972 mm)
Center	2.1635 to 2.1642 in (54.954 to 54.972 mm)
Rear	2.1636 to 2.1642 in (54.955 to 54.972 mm)
Crankshaft journal out-of-round limit	0.0012 in (0.03 mm) maximum
Crankshaft journal taper limit	0.0028 in (0.07 mm) maximum
Main bearing oil clearance	
Standard	
Center bearing	0.0003 to 0.0011 in (0.008 to 0.027 mm)
Front/rear bearings	0.0001 to 0.0014 in (0.003 to 0.036 mm)
Service limit	
Center bearing	0.0018 in (0.045 mm)
Front/rear bearings	0.0022 in (0.055 mm)
Connecting rod bearing oil clearance	
Standard	0.0004 to 0.0021 in (0.010 to 0.054 mm)
Service limit	0.0039 in (0.10 mm)
Connecting rod side clearance	0.0028 to 0.013 in (0.07 to 0.33 mm)

Camshaft

Journal diameter	
Front	1.4946 to 1.4953 in (37.964 to 37.980 mm)
Center	1.9080 to 1.9087 in (48.464 to 48.480 mm)
Rear	1.8883 to 1.8890 in (47.964 to 47.980 mm)
Thrust clearance	0.0012 to 0.0102 in (0.030 to 0.260 mm)
Cam lobe height	
Standard	
Carburetor and MPFI turbo	1.560 to 1.5646 in (39.64 to 39.74 mm)
SPFI and MPFI non-turbo	1.5650 to 1.5689 in (39.75 to 39.85 mm)
Service/wear limit (all)	0.0059 in (0.15 mm)

Torque specifications

	Ft-lbs	Nm
Crankshaft pulley bolt	69 to 76	93 to 103
Camshaft sprocket bolts	6.7 to 7.7	9.10 to 10.5
Timing belt idler-to-block bolt	29 to 35	39 to 47
Camshaft support bolts	4.3 to 5.1	5.9 to 6.9
Oil relief plug-to-camshaft case	17 to 20	23 to 26
Camshaft case-to-cylinder head bolts	12.7 to 14.8	17.2 to 20.1
Timing belt tensioner bolts	12.7 to 14.8	17.2 to 20.1
Head bolts		
1st step	22	29
2nd step	43	59
3rd step	47	64
Intake manifold bolts	13 to 16	18 to 22
Block half bolts		
8 mm bolts	17 to 20	23 to 26
10 mm bolts	29 to 35	39 to 47
Cylinder block service hole plugs	46 to 56	62 to 76
Connecting rod nuts	29 to 31	39 to 42
Oil separator cover	3.3 to 4.0	4.4 to 5.4
Oil pan bolts	3.3 to 4.0	4.4 to 5.4
Bellhousing-to-block nuts/bolts	25 to 30	34 to 40
Flywheel/driveplate-to-crankshaft bolts	51 to 55	69 to 75
Pressure plate-to-flywheel bolts	12	16

(Engine specifications continued on next page)

Torque specifications (continued)	Ft-lbs	Nm
Torque converter-to-driveplate bolts	17 to 20	23 to 26
Rocker cover bolts	3.1 to 4.1	4.2 to 5.6
Spark plugs	13 to 17	18 to 24
Oil pressure sender	16 to 20	22 to 27
Knock sensor	16 to 20	22 to 27

Fuel and exhaust systems

Carburetor

Throttle bore size		
Primary	1.10 in (28 mm)	
Secondary	1.26 in (32 mm)	
Main jets	**Primary**	**Secondary**
49-state 2WD and California	No. 115	No. 160
49-state 4WD and Canada		
1985	No. 112	No. 156
1986 on	No. 113	No. 156
Main air bleed		
49-state 2WD and california	No. 60	No. 100
49-state 4WD and Canada	No. 65	No. 100
Slow jets		
49-state 2WD and California	No. 45	No. 135
49-state 4WD and Canada	No. 46	No. 100
Slow air bleed		
49-state 2WD and California		
1985	No. 150	No. 100
1986 on	No. 150	No. 120
49-state 4WD and Canada	No. 160	No. 100
Secondary throttle valve		
49-state 2WD and California		
G2 clearance	0.2752 in (6.99 mm)	
Opening angle	50°	
49-state 4WD and Canada		
G2 clearance	0.2713 in (6.89 mm)	
Opening angle	50°	
Fast idle opening (M/T)		
49-state 2WD and California		
G1 clearance	0.0472 in (1.20 mm)	
Opening angle	15.5°	
49-state 4WD and Canada		
G1 clearance	0.0524 in (1.33 mm)	
Opening angle	17.0°	
Fast idle opening (A/T)		
49-state 2WD and California		
G1 clearance	0.0587 in (1.49 mm)	
Opening angle	18.0°	
49-state 4WD and Canada		
G1 clearance	0.0571 in (1.45 mm)	
Opening angle	18.0°	
Float level		
H clearance	0.453 to 0.492 in (11.5 to 12.5 mm)	
L clearance	0.059 to 0.075 in (1.5 to 1.9 mm)	

Fuel pump

1984 turbo only	
Discharge pressure	43.4 psi (299.1 kPa)
Discharge volume	25.1 gal/hr (95 l/hr)
Current	Less than 4.7 amps
Starting voltage	More than 8 volts
1985 on (all models with carburetor)	
Discharge pressure	2.6 to 3.3 psi (17.7 to 22.6 kPa)
Discharge volume	10.0 gal/hr (38 l/hr)
1985 on (Multi-Point Fuel Injection models)	
Discharge pressure	61 to 71 psi (422 to 490 kPa)
Discharge volume	25.1 gal/hr (95 l/hr)
1986 on (Single-Point Fuel Injection models)	
Discharge pressure	28 to 43 psi (196 to 294 kPa)
Discharge volume	21.1 gal/hr (80 l/hr)

Torque specifications	Ft-lbs	Nm
Fuel and exhaust system		
Throttle chamber/body mounting bolts	13 to 15	18 to 21
Turbocharger		
Oil delivery pipe fitting bolt	10.8 to 13.0	14.7 to 17.7
Cooling pipe fitting bolt	16.0 to 18.0	22 to 25

Engine electrical system

Ignition system (electronic)

Distributor air gap	
ND distributor (MPFI)	0.008 to 0.016 in (0.2 to 0.4 mm)
Hitachi distributor (MPFI turbo)	0.012 to 0.020 in (0.31 to 0.5 mm)
Ignition coil resistance	
Primary	
Hitachi (SPFI)	0.84 to 1.02 ohms
ND (MPFI)	1.13 to 1.38 ohms
Hitachi (MPFI turbo)	0.93 to 1.02 ohms
Secondary	
Hitachi (SPFI)	8000 to 12000 ohms
ND (MPFI)	10795 to 14605 ohms
Hitachi (MPFI turbo)	8000 to 12000 ohms

Brakes

Front brake (1985 on)

Pad thickness (includes metal backing plate)	
Standard	0.709 in (18.0 mm)
Service limit	0.295 in (7.5 mm)
Disc rotor thickness	
Standard	0.71 in (18.0 mm)
Service limit	0.63 in (16.0 mm)
Disc rotor runout limit	0.0039 in (0.10 mm)

Rear brake

Type	Disc
Pad thickness (includes metal backing plate)	
Standard	0.591 in (15.0 mm)
Service limit	0.256 in (6.5 mm)
Disc rotor thickness	
Standard	0.394 in (10.0 mm)
Service limit	0.335 in (8.5 mm)
Disc rotor runout limit	0.0039 in (0.10 mm)

Chassis electrical system

Turbo indicator light bulb type	12V/1.4W
Headlight type (1985 on)	
DL model	12V/50 and 40 over 60W
GL model	12V/65 over 45W

Suspension and steering systems

Suspension

Torsion bar spring diameter (1985 on)	
RX turbo	0.63 in (16 mm)
XT (1986 only)	0.47 in (12 mm)
Air (pneumatic) suspension stabilizer bar diameter	
Front	0.75 in (19 mm)
Rear	0.63 in (16 mm)

Ground clearance

Station wagon (2WD)	
1984 model	11.02 to 11.81 in (280 to 300 mm)
1985 model	8.46 to 9.65 in (215 to 245 mm)
1986 model	8.54 to 9.72 in (217 to 247 mm)
Station wagon (4WD)	
1984 model	13.39 to 14.17 in (340 to 360 mm)
1985 model	10.24 to 11.42 in (260 to 290 mm)
1986 model	10.19 to 11.37 in (259 to 289 mm)
1987 and 1988 models	
Front	9.76 to 11.10 in (248 to 282 mm)
Rear	10.19 to 11.37 in (259 to 289 mm)
Sedan (2WD)	
1984 model	10.24 to 11.02 in (260 to 280 mm)
1985 model	7.68 to 8.86 in (195 to 225 mm)
1986 model	7.75 to 8.93 in (197 to 227 mm)
Sedan (4WD)	
1984 model	12.80 to 13.58 in (325 to 345 mm)
1985 model	9.65 to 10.83 in (245 to 275 mm)
1986 model	9.64 to 10.82 in (245 to 275 mm)
1987 and 1988 models	
Front	9.60 to 11.94 in (244 to 303 mm)
Rear	9.64 to 10.82 in (245 to 275 mm)

Ground clearance (continued)	
1984 turbo model	12.80 to 13.58 in (325 to 345 mm)
Air (pneumatic) suspension model	
1985	8.26 to 10.04 in (210 to 255 mm)
1986 on	8.90 to 10.8 in (226 to 274 mm)
XT model	
2WD	7.20 to 8.38 in (183 to 213 mm)
4WD	9.05 to 10.23 in (230 to 260 mm)
Steering	
Minimum turning radius (1985 on)	
XT	15.9 ft (4.85 m)
All others	15.7 ft (4.8 m)
Manual steering gearbox (1985 on)	
Rack shaft bend limit	0.008 in (0.2 mm)
Power steering gearbox (1985 on)	
Turning resistance at straight-ahead position within 1.18 in (30 mm) from rack center	0.8 ft-lbs (0.11 kg-m)
Power steering pump	
Relief pressure (XT model)	853 to 1067 psi (5884 to 7355 kpa)
Pulley shaft play (1985 on)	
Radial	0.016 in (0.4 mm) or less
Axial	0.035 in (0.9 mm) or less

Torque specifications (air suspension only)	**Ft-lb**	**Nm**
Pressure switch	20 to 30	27 to 41
Solenoid valve assembly bolt	4.0 to 6.9	5.4 to 9.3
Air tank mounting bolts	9 to 17	13 to 23
Insulator bolt	3.6 to 5.8	5 to 8
Compressor bracket bolt	7 to 13	10 to 18
Front air suspension assembly-to-strut nut	38 to 49	51 to 67
Strut mount nut	22 to 29	29 to 39
Rear air suspension assembly strut nut	13 to 19	18 to 25
Rear air suspension assembly jam nut	7 to 14	10 to 20

3 Jacking and towing

Before towing 1988 models equipped with an automatic transmission, the vehicle must be placed in front wheel drive mode. This is done by inserting a spare fuse into the FWD connector inside the engine compartment as shown in Fig. 13.1. If this isn't done, damage to the transfer clutch may occur!

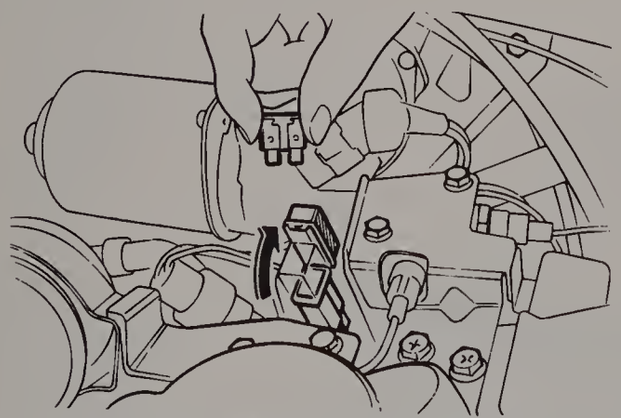


Fig. 13.1 Insert a fuse into the FWD connector before towing 1988 models with an automatic transmission (Sec 3)

4 Tune-up and routine maintenance

Routine maintenance intervals (fuel-injected models)

At 15000 miles (24000 Km) or 15 months

Replace the air filter element with a new one (under extremely dusty conditions, replace it more frequently)

Replace the fuel filter with a new one

At 60000 miles (96000 Km) or 60 months

Replace the timing belt

Air filter check and replacement (fuel-injected models)

Note: *Do not attempt to clean the air filter element. The filter paper is wetted with a special non-flammable, slow-evaporating viscous liquid. It is resistant to cold weather and has a long service life. Dirt adhering to the filter paper forms porous laminations with the viscous liquid, which function as a filtration layer to reduce dust penetration. If the filter paper is cleaned, the filtration layer thus formed will be lost along with the viscous liquid.*

1 The filter element should be replaced with a new one at the recommended intervals.

2 To remove the filter, release the spring clips, detach the upper air filter housing section and lift out the filter element.

3 Position the new element in the housing with the side marked UP visible (Fig. 13.2).

4 Reposition the air filter housing and snap the spring clips into place.

Fuel filter replacement (fuel-injected models)

5 The fuel filter should be replaced with a new one at the specified intervals. The filter on these models is located in the engine compart-

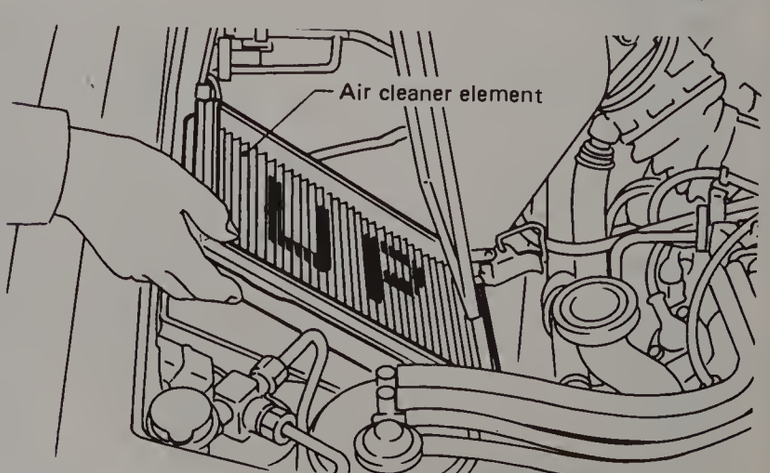


Fig. 13.2 Make sure the air filter element is installed with the marked side facing up (fuel-injected models) (Sec 4)

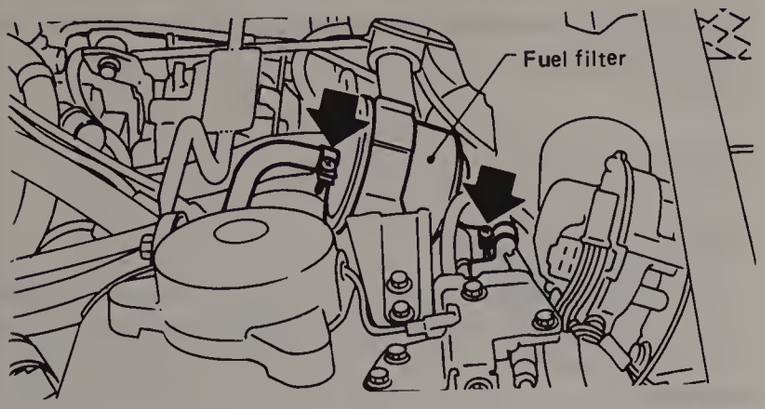


Fig. 13.3 After the new fuel filter is installed, tighten the hose clamps securely and check for leaks with the engine running (Sec 4)

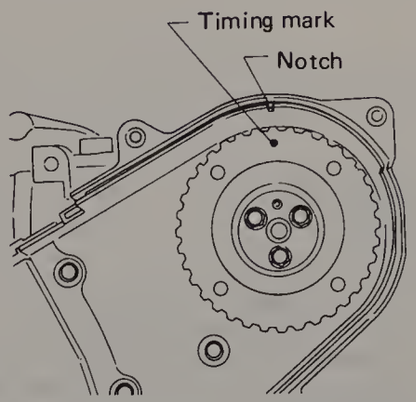


Fig. 13.4 Align the mark on the camshaft sprocket with the notch in the belt cover (Sec 4)

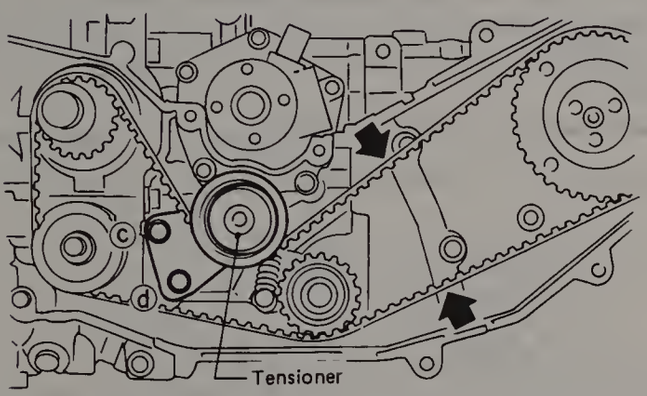


Fig. 13.5 Install the belt over the camshaft sprocket, oil pump sprocket, idler and camshaft sprocket, then check to be sure the tensioner works by squeezing the belt runs together at the points indicated by the arrows (Sec 4)

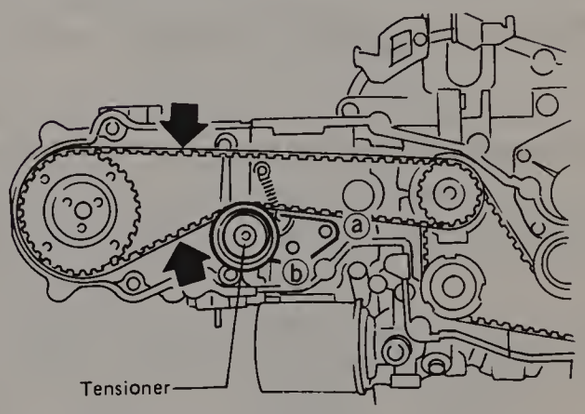


Fig. 13.6 Install the timing belt over the crankshaft and camshaft sprockets and check to be sure the tensioner has removed the slack from the belt by squeezing it at the points shown (arrows) (Sec 4)

ment. **Warning:** *Before disconnecting the hoses and removing the filter, be sure to release the fuel pressure as described in Section 8.*

6 Note how the filter is installed, then loosen the screw on each hose clamp and detach the hoses from the filter.

7 Remove the filter from the holder.

8 Discard the old filter and install the new one. Be sure to tighten the hose clamps, then start the engine and check carefully for leaks at the hose connections (Fig. 13.3).

Timing belt replacement

9 The timing belts (camshaft drivebelts) should be replaced every 60 months or 60000 miles (96000 km), whichever comes first.

Removal

10 Align the center of the three timing lines on the flywheel with the timing mark on the flywheel housing. The crankshaft must not be moved from this position until the procedure is complete.

11 Remove the cooling fan (refer to Chapter 3 if necessary).

12 Loosen the water pump pulley nut until it can be turned by hand.

13 Loosen the two alternator mounting bolts.

14 Remove the drivebelts.

15 Disconnect the oil pressure sender wire harness.

16 Remove the crankshaft pulley.

17 Remove the engine oil dipstick and dipstick tube.

18 On turbocharged models, remove the belt cover plate.

19 Remove the right and left belt covers.

20 Remove the front belt cover.

21 Loosen the bolts securing the tensioner on the number one cylinder side, move the tensioner up to release the belt tension, then retighten the bolts to hold the tensioner in place.

22 Repeat the procedure for the tensioner on the number two cylinder side.

23 Before removing the belts, use chalk to draw arrows on them indicating the normal direction of rotation — the belts must be reinstalled with the same orientation.

24 Remove the timing belt from the number one cylinder side.

25 Remove the crankshaft sprocket.

26 Remove the timing belt from the number two cylinder side.

27 Loosen the upper bolts on the two tensioners.

Installation

28 Check to be sure the center timing mark on the flywheel is still aligned with the timing mark on the flywheel housing.

29 Make sure the alignment mark on the left camshaft sprocket is aligned with the notch on the belt cover (Fig. 13.4).

30 Install the timing belt over the crankshaft sprocket, oil pump sprocket, idler and camshaft sprocket in that sequence.

31 Loosen the lower tensioner bolt and make sure the tensioner applies pressure to the timing belt (Fig. 13.5).

32 Using Subaru special tool no. 498277000 or no. 498497000, lock the crankshaft in position. You must use the special Subaru tool or an aftermarket equivalent to keep the engine from turning over during the belt tensioning procedure.

33 Using a torque wrench, apply 10 to 12 ft-lbs (14 to 16 Nm) *counterclockwise* turning force to the camshaft sprocket. **Note:** *This figure is for a new or used timing belt installation. If a new timing belt is being installed and a new head gasket has been installed, refer to Section 5 in this Chapter for the correct torque figure.*

34 Tighten first the lower, then the upper tensioner bolts to the specified torque.

35 Remove the special tool used to keep the crankshaft from moving, rotate the crankshaft one complete turn clockwise (360°) and reinstall the tool.

36 Install the crankshaft sprocket.

37 Align the timing mark on the *right* camshaft sprocket with the timing mark on the cover.

38 Install the timing belt on the crankshaft and camshaft sprockets (Fig. 13.6).

39 Loosen the lower tensioner bolt and make sure the tensioner is applying pressure to the timing belt.

40 Using a torque wrench, apply 10 to 12 ft-lbs (14 to 16 Nm) *counterclockwise* turning force to the camshaft sprocket.

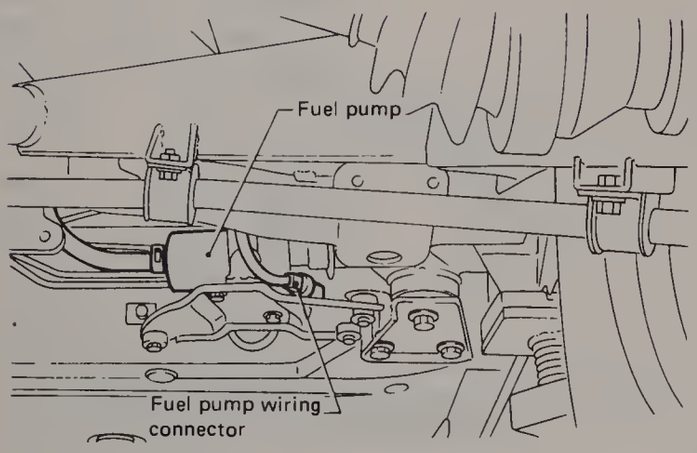


Fig. 13.7 Raise the vehicle and disconnect the fuel pump wiring connector (Sec 5)

41 Tighten first the lower, then the upper tensioner bolts to the specified torque.
42 The remainder of installation is the reverse of the removal procedure.

5 Overhead camshaft (OHC) engine

General information

1 1984 and later models are equipped with a horizontally opposed 4-cylinder engine featuring a belt-driven camshaft mounted above the valves in each head. The procedures included in this Section apply specifically to the OHC engine. For procedures not included here, refer to Chapter 2.

Engine removal and installation

Warning: *Do not attempt to remove any air conditioning components until the system has been depressurized by a qualified professional!*

2 If equipped with fuel injection, raise the vehicle, support it securely on jackstands and disconnect the fuel pump wiring connector (Fig. 13.7).

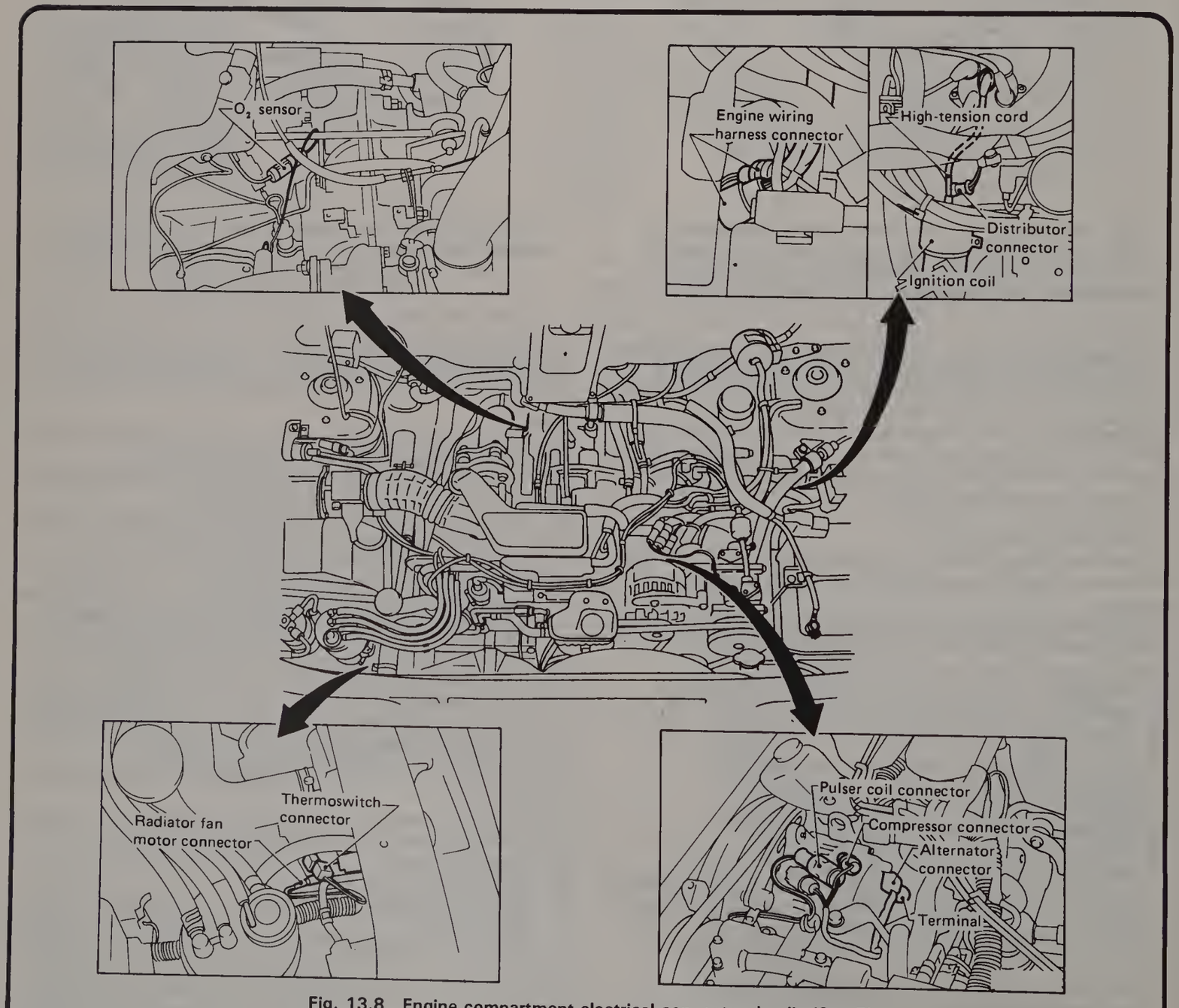


Fig. 13.8 Engine compartment electrical connector details (Sec 5)

3 Lower the vehicle and start the engine. Allow the engine to run until it stops from lack of fuel, then crank it over for approximately 5 seconds.
4 Reconnect the fuel pump wire harness.
5 Drain the coolant from the radiator (Chapter 1).
6 Disconnect the negative cable from the battery and the engine.
7 Remove the spare tire.
8 Remove the spare tire supporter.
9 Disconnect the evaporative canister hoses. Label them if necessary to make sure you can reinstall them in their original locations.
10 Disconnect the fuel delivery, return and evaporation hoses.
11 Disconnect the brake booster vacuum hose.
12 On automatic transmission equipped models, disconnect the diaphragm vacuum hose.
13 On turbocharged models, disconnect the vacuum switch hose and waste gate valve hoses.
14 On models with selective 4WD, disconnect the 4WD vacuum hose.
15 On manual transmission equipped models with full-time 4WD, disconnect the differential lock vacuum hose.
16 Unplug the engine wiring harness connectors, oxygen sensor connector, high tension lead to the ignition coil, distributor-to-crank sensor connector, alternator connector and terminal, air conditioning compressor connector and pulser coil connector, engine ground terminal, radiator fan motor connector and thermoswitch connector (Fig. 13.8).
17 Disconnect the accelerator cable from the engine.
18 If equipped with a manual transmission, disconnect the hill-holder cable (Fig. 13.9).
19 Remove the exhaust system.
20 Remove the air intake boot, upper air cleaner case and element and disconnect the air flow meter connector.
21 Remove the radiator, shroud and fan assembly.
22 Remove the engine drivebelts.
23 With the air conditioning system depressurized, disconnect the air conditioning hoses. **Warning:** *Do not attempt to remove any air conditioning components until the system has been depressurized by a qualified professional!*
24 Remove the power steering pump.
25 Remove the pitching stopper rod.
26 If equipped with an automatic transmission, remove the timing hole plug and remove the four bolts that hold the torque converter to the driveplate (Fig. 13.10). The crankshaft must be turned to bring each of the bolts into position.
27 Remove the bolts that hold the engine mount to the front crossmember.
28 Remove the lower engine-to-transmission nuts (Fig. 13.11).
29 Place a hoist over the engine compartment and attach a lifting chain or cable to the engine.
30 Remove the upper engine-to-transmission nuts and bolts.
31 Support the transmission with a floor jack.
32 Raise the engine slightly, raise the transmission with the floor jack to match, slide the engine forward until it disengages from the transmission, then lift the engine out of the engine compartment.
33 Installation is the reverse of the removal procedure.

Oil pump removal and installation

34 The oil pump can be removed with the engine still installed in the vehicle.
35 Disconnect the negative cable from the battery.
36 Raise the vehicle and support it securely on jackstands.
37 On 4WD vehicles, remove the underguard.
38 Remove the left and right undercovers.
39 On turbocharged models, remove the belt cover plate.
40 Remove the bolts from the lower side of the fan shroud.
41 On air conditioned models, remove the bolts from the lower side of the air conditioning shroud.
42 Lower the vehicle.
43 Disconnect the fan motor electrical connector, remove the upper shroud bolts, remove the canister hoses from the clamp and detach the fan shroud.
44 Remove the air conditioner shroud (if equipped).
45 If equipped with air conditioning, remove the slip fan, pulser assembly and the battery (Fig. 13.12).

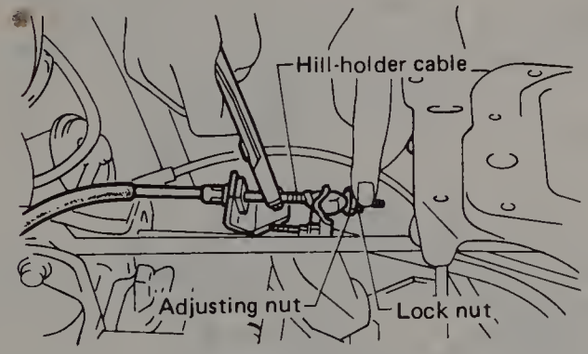


Fig. 13.9 Disconnect the hill-holder cable from the transmission (Sec 5)

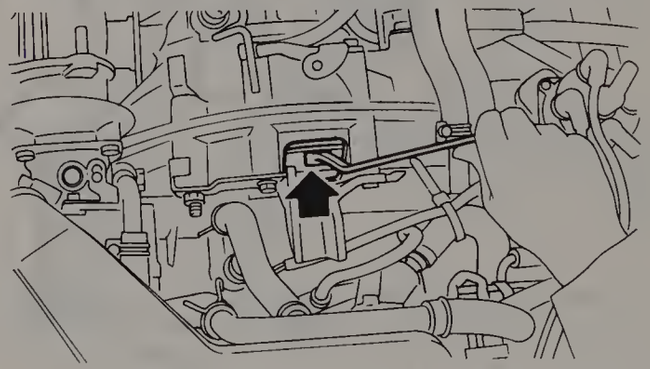


Fig. 13.10 Disconnect the torque converter from the driveplate through the timing mark hole in the bellhousing (Sec 5)

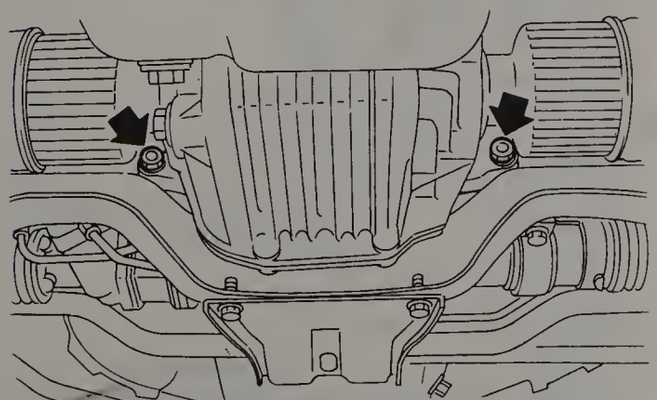


Fig. 13.11 Remove the lower engine-to-transmission nuts (arrows) (Sec 5)

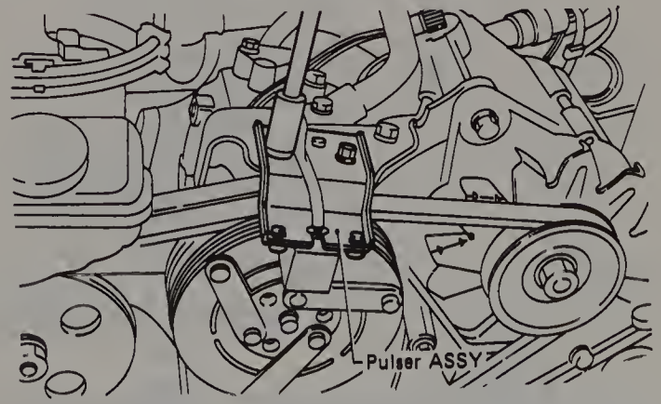


Fig. 13.12 Remove the air conditioning pulser assembly (Sec 5)

46 Remove the alternator and drivebelt.
47 Remove the oil dipstick tube and disconnect the oil pressure sender wire.
48 If equipped with air conditioning, loosen the idler pulley and remove the drivebelt. Remove the pulley, temporarily retighten the pulley nut to prevent the shaft from dropping, then remove the compressor mounting bolts.
49 Put a shop towel or piece of cloth over the battery bracket and position the air conditioning compressor on the cloth.
50 Remove the water pump pulley.
51 Remove the timing belts (see Section 4 in this Chapter).
52 Remove the belt idler.
53 Remove the left camshaft sprocket.
54 Remove the rear belt cover.

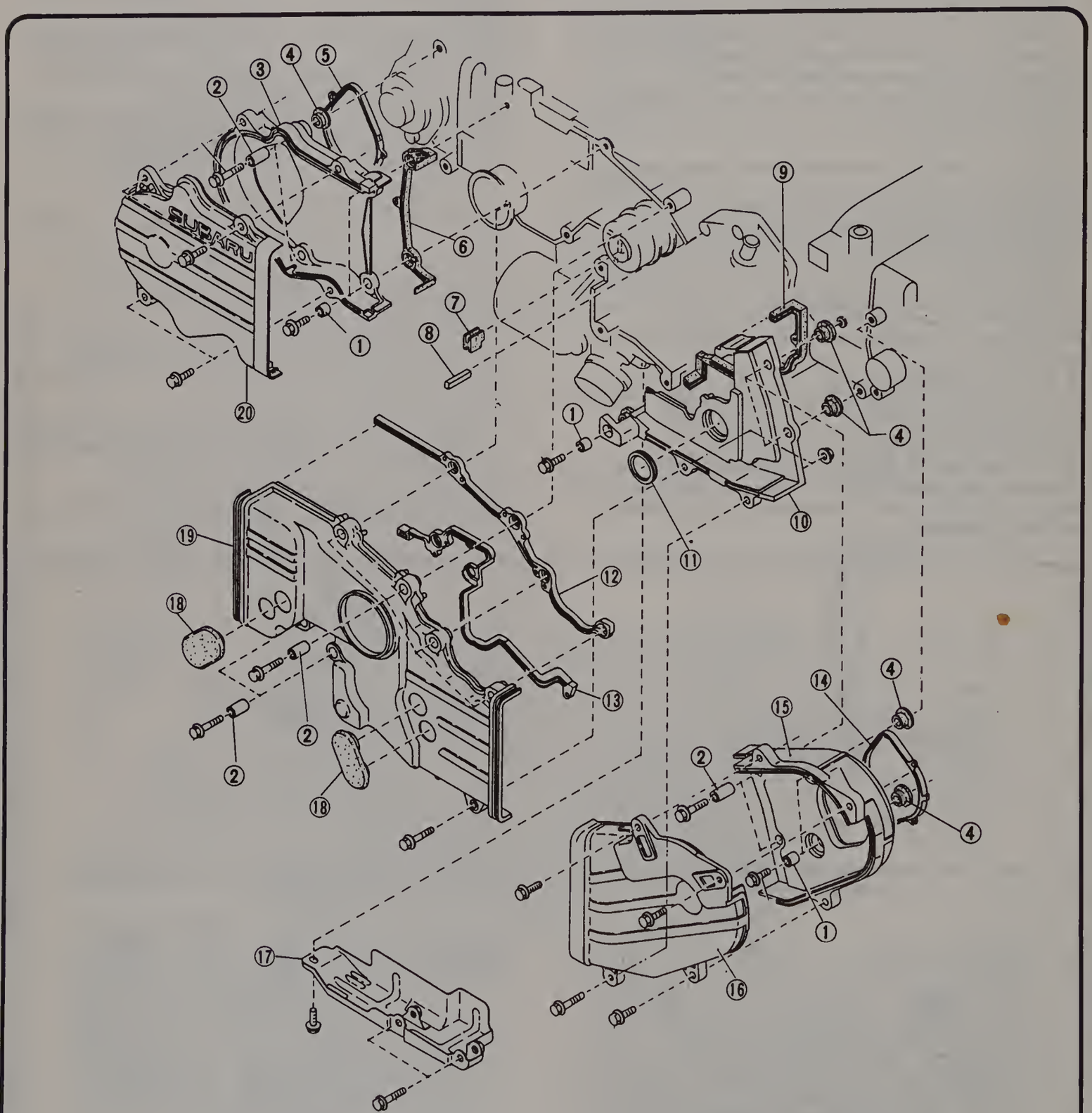


Fig. 13.13 Timing belt covers — exploded view (Sec 5)

1 *Spacer*
2 *Spacer*
3 *Belt cover no. 2 (right)*
4 *Cover mount*
5 *Seal*
6 *Seal*
7 *Seal*
8 *Water pump seal*
9 *Seal*
10 *Belt cover (right rear)*
11 *Seal*
12 *Seal*
13 *Seal*
14 *Seal*
15 *Belt cover no. 2 (left)*
16 *Belt cover (left)*
17 *Belt cover plate*
18 *Belt cover plug*
19 *Belt cover*
20 *Belt cover (right)*

55 Remove the oil pump assembly.
56 Installation is the reverse of the removal procedure. Refer to Section 4 in this Chapter for the timing belt installation and tensioning procedure.

Timing belts and cover assembly removal, check and installation

57 Remove the engine from the vehicle.
58 Turn the crankshaft until the center timing mark on the flywheel is aligned with the timing mark on the bellhousing.
59 Install a Subaru special tool (flywheel or driveplate stopper) to keep the engine from turning over.
60 On turbocharged models, remove the belt cover plate.
61 Remove the belt covers (Fig. 13.13).
62 Remove the timing belts as described in Section 4 of this Chapter.
63 Remove the number two crankshaft sprocket.
64 Using Subaru tensioner wrench no. 499007000, remove both belt tensioners and springs (Fig. 13.14).
65 Remove the belt idler.
66 Using Subaru camshaft sprocket wrench no. 499207000, remove the camshaft sprockets (Fig. 13.15).
67 Remove the inner belt covers.
68 Check the timing belt tensioner and belt idler for smooth rotation. Replace if noise or excessive play is noted.
69 Attach the left no. 3 belt cover seal to the cylinder block.
70 Attach the left belt cover seal, left no. 4 belt cover seal and belt cover mount to the belt cover, then install the assembly on the cylinder block.
71 Attach the left no. 2 belt cover seal and belt cover mounts to belt cover no. 2 and install the assembly on the cylinder head and camshaft case.
72 Attach the right belt cover seal, right no. 2 belt cover seal and belt cover mounts to belt cover no. 2, then install them on the cylinder head and camshaft case.
73 Install the camshaft sprockets. Tighten the bolts in three steps until the specified torque is reached.
74 Attach the tensioner spring to the right tensioner and install the tensioner on the block. Do not tighten the bolts at this time.
75 Attach the tensioner spring to the bolt and tighten bolt "a" in Fig. 13.16, then loosen it 1/2-turn.
76 Push down on the tensioner until it stops, then temporarily tighten bolt "b".
77 Attach the tensioner spring to the left tensioner and install the tensioner on the block. Do not tighten the bolts at this time.
78 Attach the tensioner spring to the bolt and tighten bolt "c" in Fig. 13.17, then loosen it 1/2-turn.
79 Raise the tensioner using Subaru tensioner wrench no. 499007000 until it stops, then temporarily tighten bolt "d".
80 Install the belt idler.
81 Install and tension the timing belts as described in Section 4.
82 The remainder of installation is the reverse of the removal procedure.

Camshaft, valve rocker and valve lash adjuster removal and installation

83 Remove the engine from the vehicle.
84 Remove the timing belt covers and timing belt assembly and sprockets.

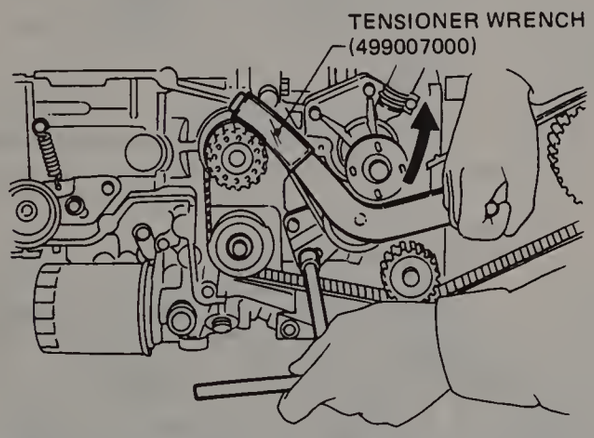


Fig. 13.14 A special wrench is required to remove the belt tensioner and spring (Sec 5)

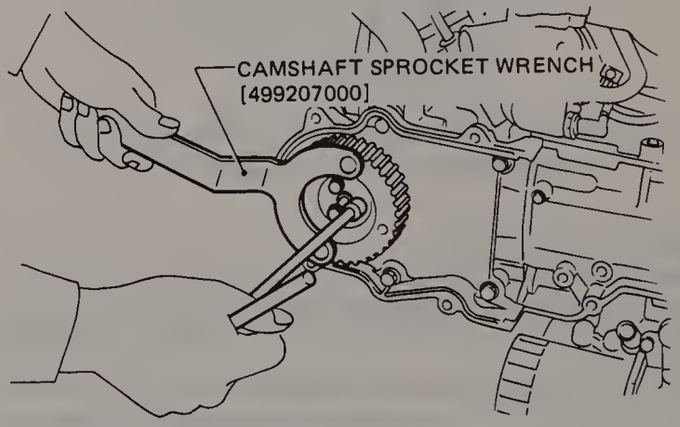


Fig. 13.15 Use a camshaft sprocket wrench to hold the sprocket while removing the bolts (Sec 5)

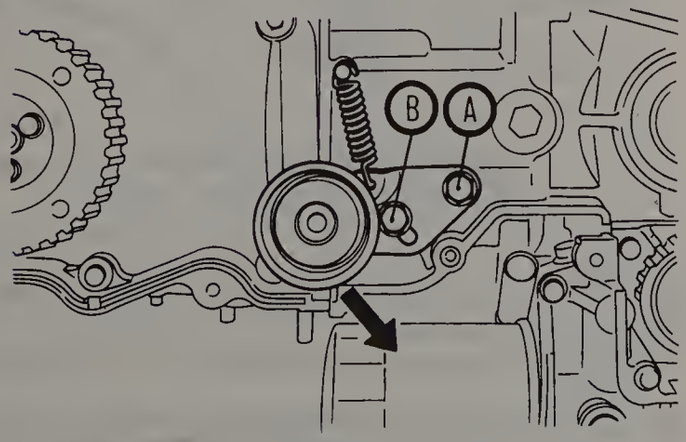


Fig. 13.16 After attaching the spring, tighten bolt "a", then loosen it 1/2-turn (Sec 5)

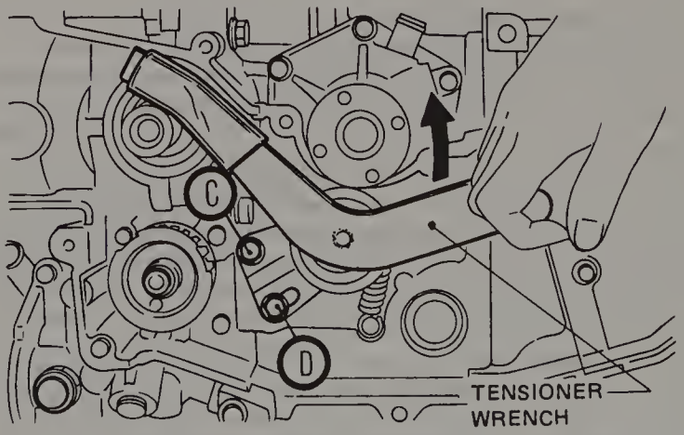


Fig. 13.17 Pull up on the tensioner wrench to position the tensioner, then tighten bolt "c" (Sec 5)

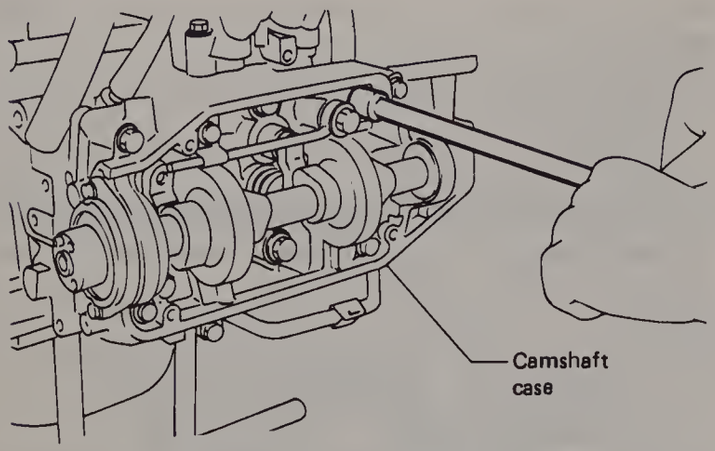


Fig. 13.18 The camshaft case and camshaft come off as an assembly (Sec 5)

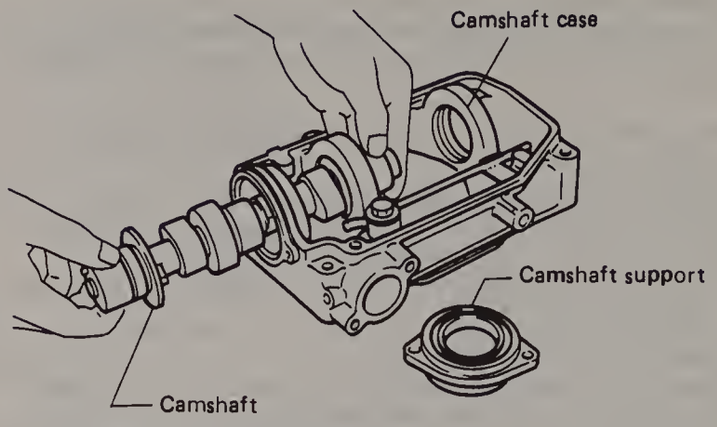


Fig. 13.19 Unbolt the camshaft support and remove the camshaft from the case Sec 5)

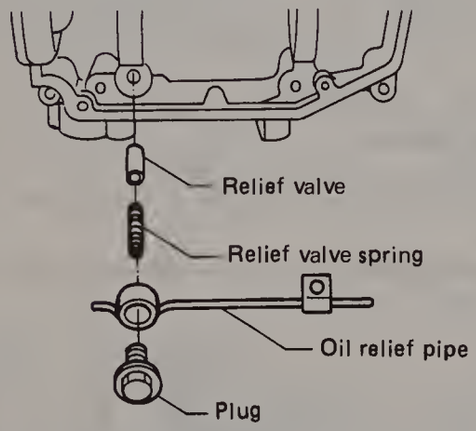


Fig. 13.20 Remove the oil relief plug, oil relief pipe, relief valve spring and relief valve (Sec 5)

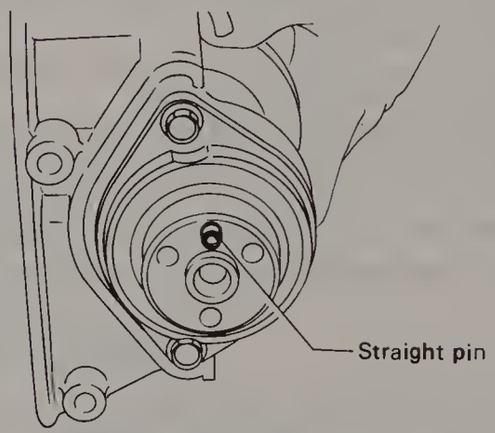


Fig. 13.21 Position the camshaft pin as shown to install the new O-ring (Sec 5)

85 Remove the distributor.
86 Remove the water pipe.
87 Remove the oil filler duct.
88 Remove the PCV hoses from the rocker cover.
89 On turbocharged models, remove the EGR pipe cover, pipe clamps and EGR pipe.
90 Remove the rocker covers and gaskets.
91 Remove the camshaft case, camshaft support and camshaft as a unit (Fig. 13.18).
92 Remove the valve lash adjusters from the head. **Caution:** *Do not lay the adjusters down — keep them upright. Keep the valve rockers and adjusters in order so they can be reinstalled in their original locations.*
93 Remove the camshaft support.
94 Remove the camshaft from the camshaft case (Fig. 13.19).
95 Remove the oil relief plug, then remove the oil relief pipe, relief valve spring and relief valve (Fig. 13.20).
96 Check the camshaft lobes and journals for signs of scuffing and excessive wear.
97 Measure the camshaft journals and replace the camshaft if any journals are under the minimum size given in the Specifications.
98 Measure the camshaft lobe height from the heel of the cam to the highest point of the lobe and replace the camshaft if any of the lobes are under the minimum size given in the Specifications.
99 With the valve lash adjuster held in a vertical position, push the adjuster pivot down quickly.
100 If the pivot goes down more than 0.020-inch (0.5 mm), place the adjuster upright in a container filled with light oil and move the plunger up and down until the depression is less than 0.020-inch.
101 If the valve lash adjuster pivot movement will not reduce to under 0.020-inch, replace the adjuster.
102 Installation is the reverse of the removal procedure, but note the following points.
103 Use heavy grease when installing the valve rockers to keep them from falling off the valve adjusters and valves.

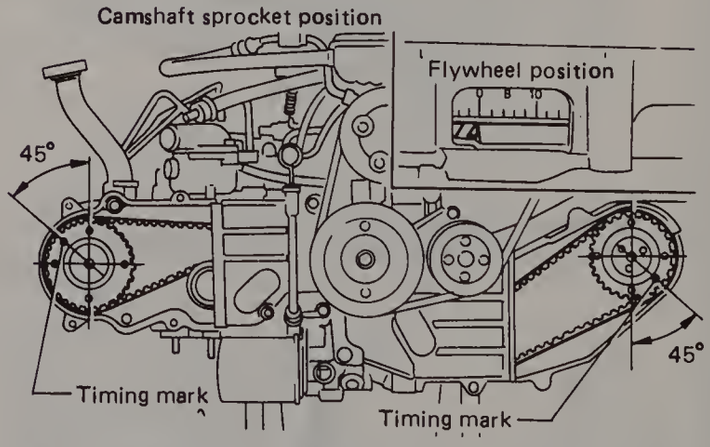


Fig. 13.22 Position the camshaft sprockets as shown here before installing the distributor (Sec 5)

104 Install a new O-ring in the camshaft case by positioning the camshaft with the camshaft pin oriented as shown in Fig. 13.21.
105 To install the distributor:
a) Bring the no. 1 piston to top dead center on the compression stroke.
b) Position the camshaft sprockets as shown in Fig. 13.22.
c) Align the distributor housing match mark with the pinion gear match mark as shown in Fig. 13.23 and install the distributor.

Cylinder head removal and installation

106 Remove the engine from the vehicle.
107 Remove the timing belt covers, timing belts and related parts.

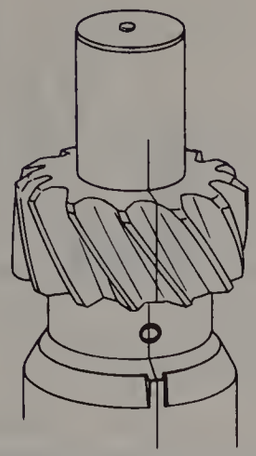


Fig. 13.23 Align the distributor housing and pinion gear marks as shown (Sec 5)

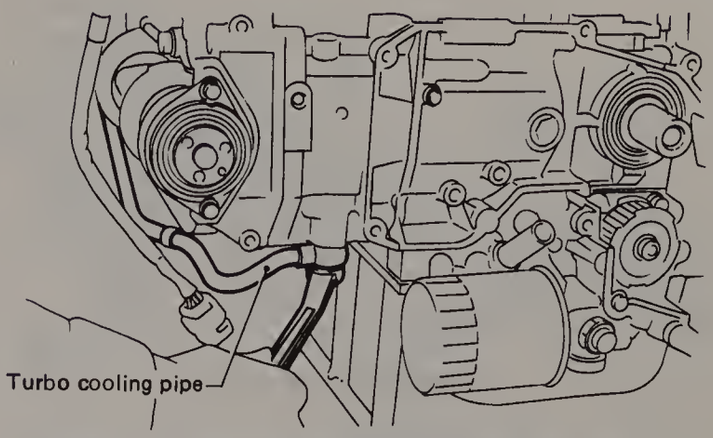


Fig. 13.24 Remove the turbocharger cooling pipe (Sec 5)

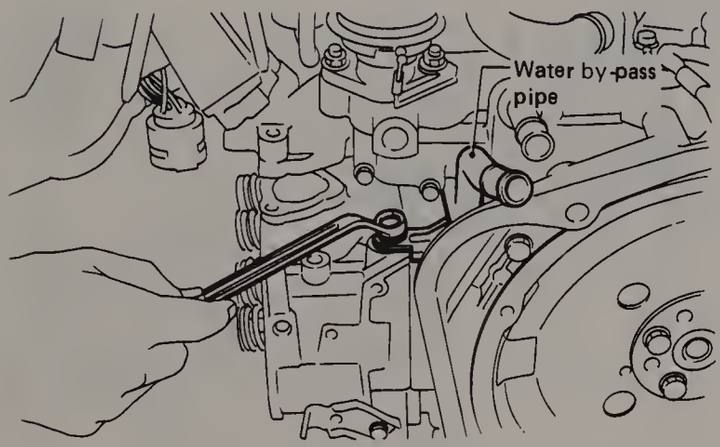


Fig. 13.25 Remove the water bypass hose pipe (Sec 5)

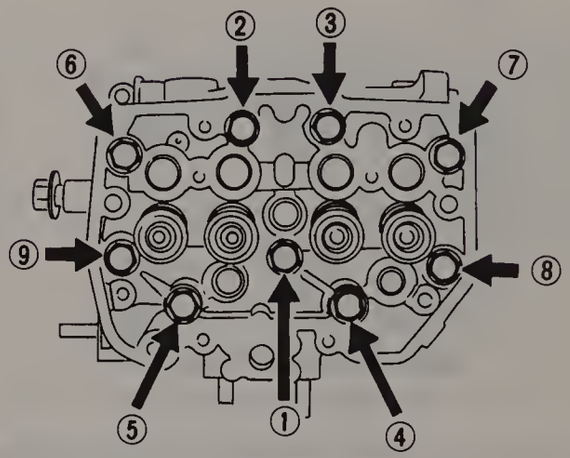


Fig. 13.26 Head bolt tightening sequence (Sec 5)

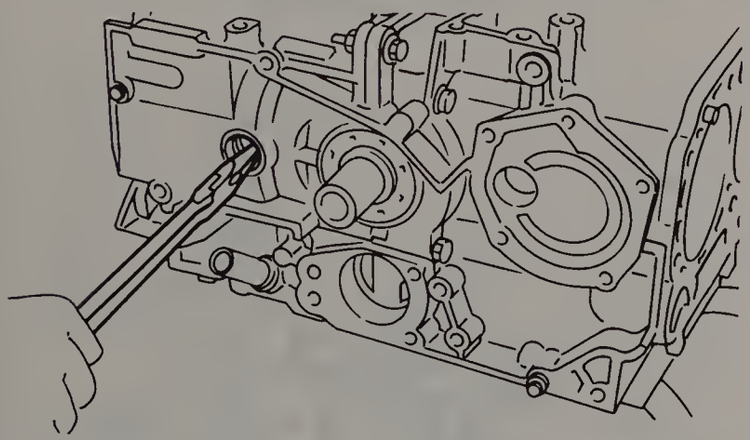


Fig. 13.27 Reach through the service holes to remove the piston pin circlips (Sec 5)

108 On turbocharged models, remove the turbocharger cooling pipe and union screws and gaskets from the cylinder head (Fig. 13.24).
109 Remove the camshaft cases, lash adjusters and related parts.
110 On all except turbocharged models, remove the plug attaching the EGR pipe to the cylinder head.
111 On all models except those with air conditioning, remove the bolts attaching the alternator bracket and the adjusting bar to the cylinder head.
112 Remove the bolts attaching the intake manifold to the cylinder head and lift off the intake manifold.
113 Remove the bolt attaching the water bypass pipe bracket to the cylinder head (Fig. 13.25).
114 Remove the spark plugs.
115 Remove the cylinder heads and gaskets from the block.
116 Installation is the reverse of the removal procedure. Be sure to clean the gasket mating surfaces with lacquer thinner or acetone – they must be clean and oil free when the head is installed. Tighten the head bolts in three steps to the specified torque in the sequence shown in Fig. 13.26.

Cylinder block disassembly and reassembly

117 Remove the engine from the vehicle.
118 Remove the distributor.
119 Remove the EGR pipe cover and EGR pipe.
120 Remove the intake manifold assembly.
121 Remove the power steering pump bracket.
122 Remove the alternator brackets and adjusting bar.
123 On turbocharged models, remove the knock sensor.
124 Remove the air bleed hose, oil filler duct and water pipe.
125 Remove the crankshaft pulley.
126 Remove the water pump pulley and pulley cover.
127 Remove the oil dipstick and dipstick tube.
128 Remove the timing belt cover, timing belt and related parts.
129 Remove the water pump.
130 Remove the oil pump.
131 On manual transmission equipped vehicles, remove the pressure plate and clutch disc.
132 Remove the flywheel or driveplate.
133 Remove the camshaft, valve rockers and lash adjusters.
134 Remove the cylinder heads.
135 Remove the oil pan.
136 Remove the oil strainer and strainer stays.
137 Remove the oil separator cover.
138 Using a 14 mm Allen wrench, remove the service hole plugs from the cylinder block.
139 Turn the crankshaft until the no. 1 and 2 pistons are at top dead center.
140 Reaching through the service hole for the no. 1 and 2 cylinders, remove the piston circlips as shown in Fig. 13.27.

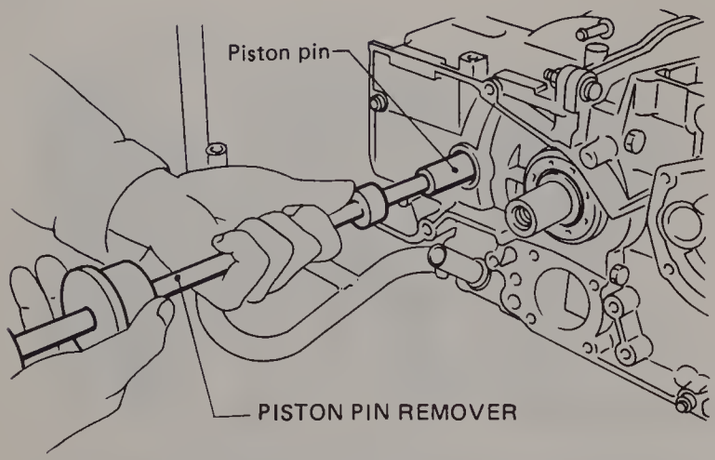


Fig. 13.28 A special tool is required to remove the piston pins (Sec 5)

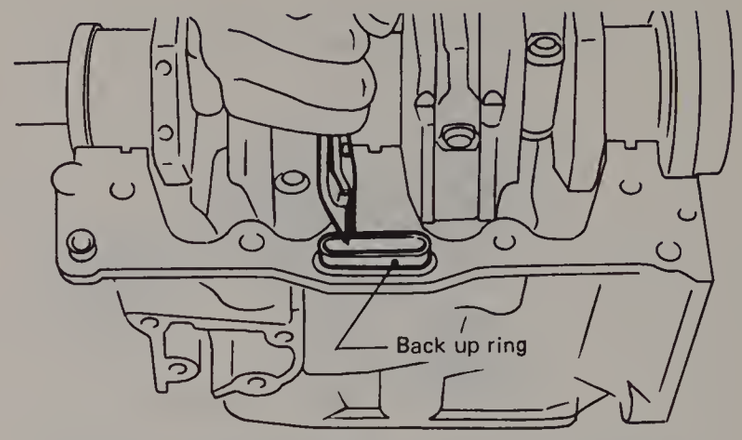


Fig. 13.29 Remove the coolant passage O-ring and back-up ring from the left cylinder block Sec 5)

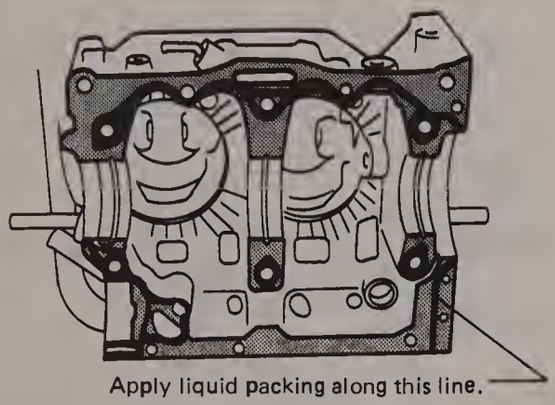


Fig. 13.30 Apply liquid packing to the block mating surface as shown (Sec 5)

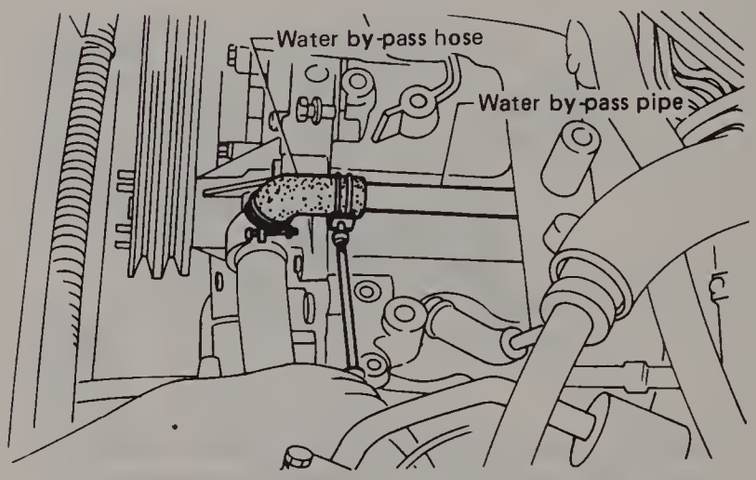


Fig. 13.31 Disconnect the water pump bypass hose from the bypass pipe (Sec 6)

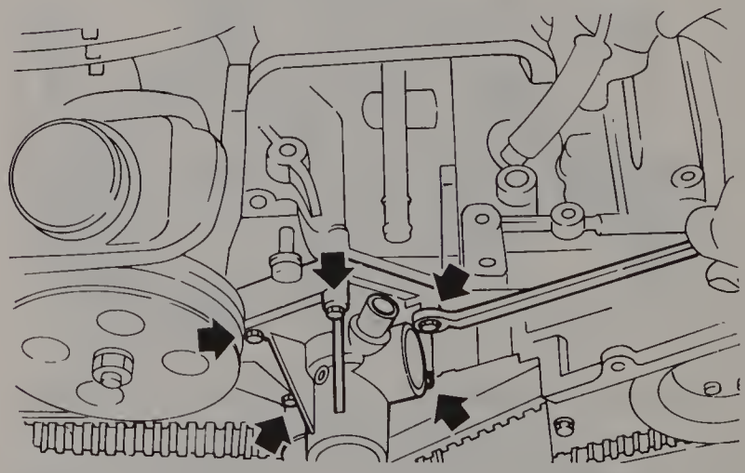


Fig. 13.32 Water pump mounting bolts (arrows) (Sec 6)

141 Using Subaru piston pin remover no. 3990094310, remove the piston pins (Fig. 13.28).
142 Repeat the procedure for pistons no. 3 and 4. Make sure you mark the pistons and pins so they can be returned to their original locations.
143 Remove all the cylinder block bolts except the one under the center journal. Loosen this bolt until it can be turned by hand.
144 Set the block on its side with the no. 1 and 3 cylinders facing up, then remove the remaining bolt and separate the cylinder block halves.
145 Remove the coolant passage O-ring and back-up ring from the left cylinder block (Fig. 13.29).
146 Remove the front and rear crankshaft oil seals.
147 Remove the crankshaft and connecting rods.
148 Using a wooden hammer handle, tap the pistons out of the block.
149 Remove the crankshaft bearings from the block.
150 Measure the cylinder bores at 0.28-inch (7 mm), 1.6-inches (40 mm) and 3-inches (75 mm) from the cylinder head mating surface and compare the diameter, taper and out-of-round measurements to the Specifications.
151 Measure the diameter of the pistons 1.059-inches (26.9 mm) up from the bottom of the skirt and at 90-degrees to the piston pin. Compare the diameter to the Specifications.
152 If the cylinders are worn beyond the specified limit, the block will have to be rebored and oversize pistons installed. If the block measurements are within the limits, but the pistons are worn undersize, the cylinders should be honed and new pistons installed.
153 Reassembly is the reverse of the disassembly procedure. Be sure to apply fluid packing (Three-bond 1215 or equivalent) to the mating surfaces of the cylinder block halves as shown in Fig. 13.30.

Engine mount removal and installation

154 Note that a new design engine mount is used on 1988 model vehicles, as shown in Fig. 13.33. Removal and installation procedures are essentially the same as earlier models.

6 Cooling, heating and air conditioning systems

Water pump removal and installation (OHC engine)

1 The water pump can be removed without removing the engine from the vehicle.
2 Disconnect the negative cable from the battery.
3 Drain the coolant (Chapter 1).
4 Disconnect the upper radiator hose.

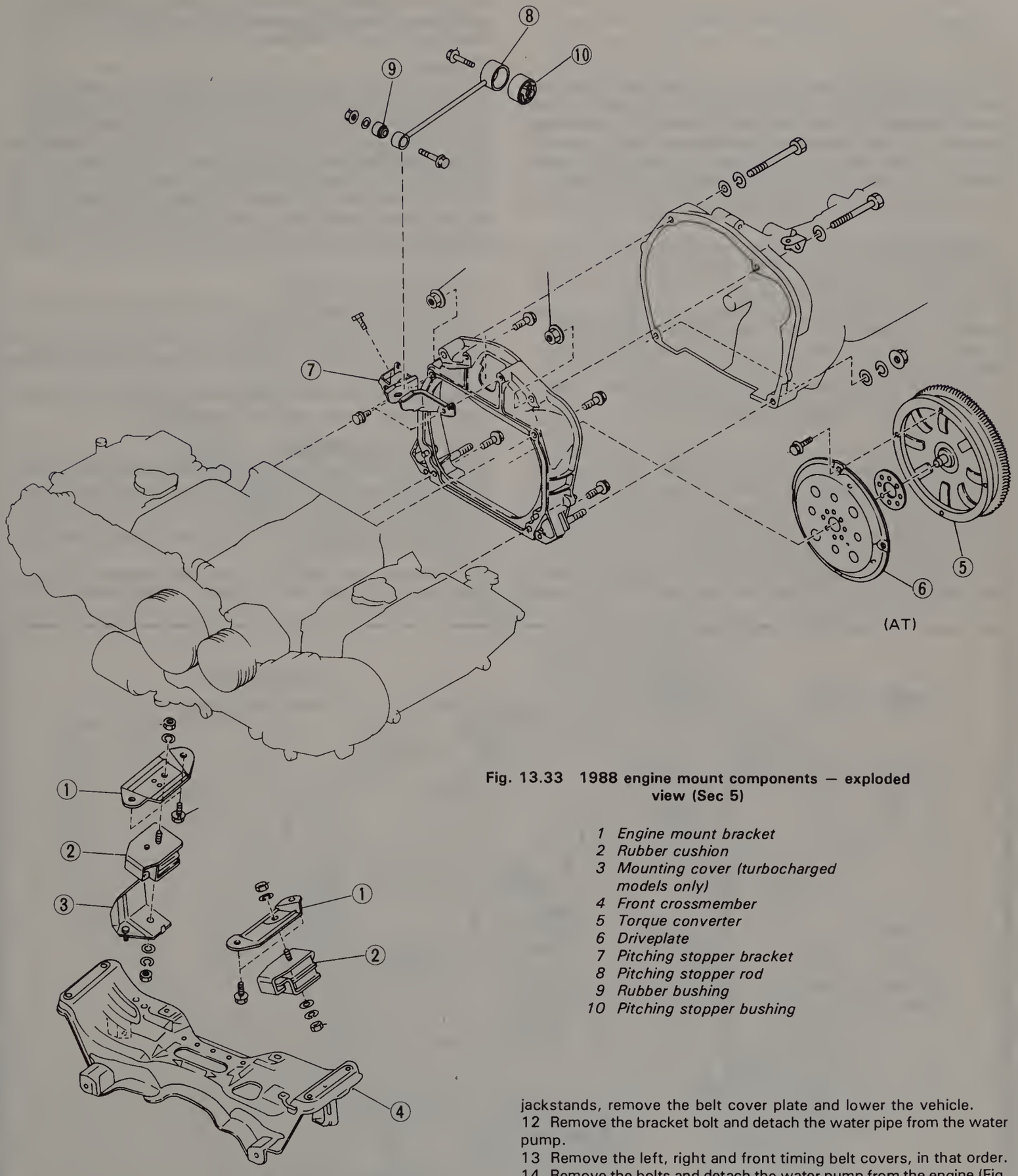


Fig. 13.33 1988 engine mount components — exploded view (Sec 5)

1 Engine mount bracket
2 Rubber cushion
3 Mounting cover (turbocharged models only)
4 Front crossmember
5 Torque converter
6 Driveplate
7 Pitching stopper bracket
8 Pitching stopper rod
9 Rubber bushing
10 Pitching stopper bushing

5 Remove the alternator and drivebelt.
6 Disconnect the water bypass hose from the pipe (Fig. 13.31).
7 Unfasten the clips which hold the oil pressure sender wire harness.
8 Remove the oil dipstick and dipstick tube.
9 Remove the water pump pulley.
10 Remove the crankshaft pulley.
11 On turbocharged models, raise the vehicle, support it securely on jackstands, remove the belt cover plate and lower the vehicle.
12 Remove the bracket bolt and detach the water pipe from the water pump.
13 Remove the left, right and front timing belt covers, in that order.
14 Remove the bolts and detach the water pump from the engine (Fig. 13.32). You may have to tap the pump with a soft-face hammer to break the gasket seal.
15 Using a gasket scraper, remove all traces of old gasket material and sealant from the engine block. Clean the mating surfaces with lacquer thinner or acetone.
16 When installing the new pump, use a new gasket and tighten the bolts in a criss-cross pattern. Work up to the specified torque in three steps.

7 Turbocharger

General information

The turbocharger increases engine power by using an exhaust gas-driven turbine to pressurize the fuel/air mixture as it enters the combustion chamber (Fig. 13.34). The amount of boost (intake manifold pressure) is controlled by the waste gate (exhaust bypass valve). To prevent turbocharging pressure from becoming excessive, the waste gate opens at a predetermined pressure, allowing exhaust gases to bypass the turbocharger and go straight into the exhaust pipe.

Turbine check

1 While a comparatively simple design, the turbocharger is a precision device which can be severely damaged by an interrupted oil or coolant supply and loose or damaged ducting.

2 Due to the special techniques and equipment required, checking and diagnosis of suspected problems should be left to a Subaru dealer service department. The home mechanic can, however, check the connections and linkages for security, damage and other problems.

3 Since each turbocharger has its own distinctive sound, a change in the noise level can be a sign of potential problems.

4 A high-pitched or whistling sound is a symptom of an inlet air or exhaust gas leak.

5 If a screeching sound comes from the vicinity of the turbine, the turbocharger can be removed and the turbine wheel inspected. **Warning**: *All turbine checks must be made with the engine off and cool to the touch or personal injury could result. Operating the turbocharger without all the ducts and filters installed is also dangerous and can result in damage to the turbine wheel blades.*

6 Remove the air intake boot and the turbo inlet duct (see Fig. 13.35). Reach inside the housing and spin the turbine compressor impeller to make sure it turns freely. If it does not, this could be a sign that the cooling oil has sludged or coked from overheating. Push in on the shaft and check for binding. The impeller should rotate freely without binding or rubbing on the housing.

Manifold check

7 Inspect the exhaust manifold for cracks and loose fasteners.

8 Because the turbine wheel rotates at speeds up to 140,000 rpm, severe damage can result from the interruption of coolant or contamination of the oil supply to the turbine bearings. Check for leaks in the coolant and oil inlet lines and obstructions in the oil drain back line, as this can cause severe oil loss through the turbocharger seals. Burned oil on the turbine housing is a sign of oil loss through the seals. **Caution:** *Any time a major engine bearing such as a main, connecting rod or camshaft bearing is replaced, the turbocharger should be flushed with clean oil.*

Waste gate valve check

9 Check the waste gate valve connecting hose for security, cracks and damage. It must not be loose.

10 Disconnect the waste gate valve control hose from the actuator and connect a separate section of hose. Be sure to plug the disconnected control hose.

11 Apply air pressure (9-to-10 psi/59-to-69 kPa) to the hose and see whether the waste gate valve link operates or not.

Removal and installation

12 Disconnect the air intake boot by loosening the hose clamps.

13 Loosen the hose clamps and remove the air intake duct and hoses.

14 Drain the cooling system (Chapter 1), then remove the banjo fitting bolts and detach the turbo cooling lines.

15 Remove the retaining bolts from the heat shields and detach the shields.

16 Remove the banjo fitting bolts, then disconnect the oil inlet line at the turbo. Plug the line end and fitting to prevent the entry of dirt.

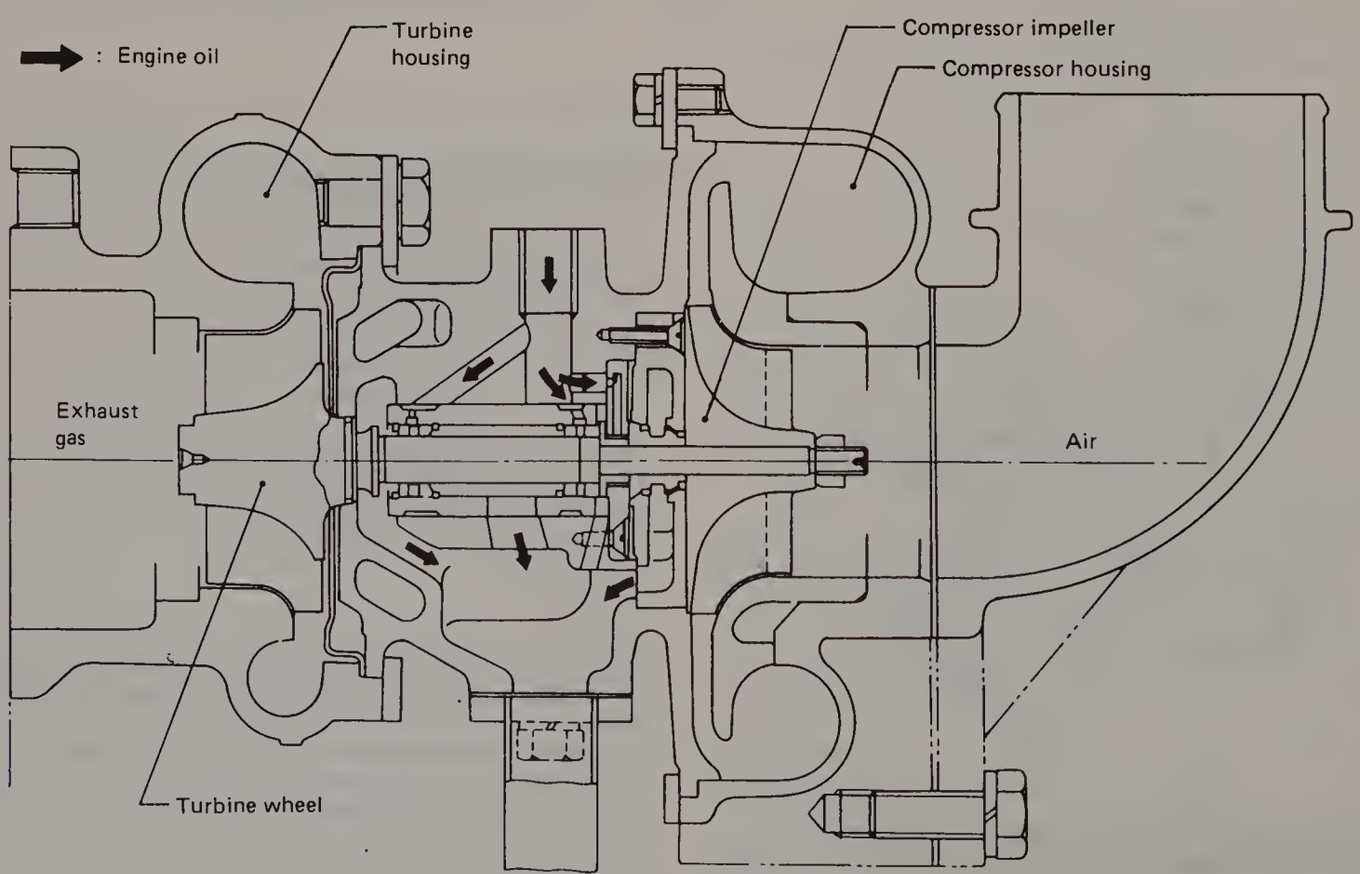


Fig. 13.34 Cross-section view of turbocharger assembly indicating the location of the compressor impeller (Sec 7)

17 Disconnect the oil outlet line by loosening the hose clamps and pulling the hose from the turbocharger and line fittings.
18 Remove the retaining bolts securing the turbo to the exhaust manifold.
19 Separate the turbo from the engine.
20 Clean the turbocharger-to-manifold mating surfaces.
21 Installation is the reverse of the removal procedure. Be sure to use new gaskets where applicable. Also, use new washers on the oil line banjo fitting bolts.
22 Attach the oil inlet line at the lower end first, then fill the line with new, clean engine oil of the recommended type before installing the upper banjo fitting bolt. A squirt-type oil can will make the job relatively easy — just be sure it is clean!

8 Single Point Fuel Injection (SPFI) system

General information

The Single Point Fuel Injection System (SPFI) substitutes a throttle chamber containing one fuel injector for a conventional carburetor. The Engine Control Module (ECM) electronically controls the amount of fuel from the fuel injector and supplies the optimum fuel/air mixture to suit all operating conditions of the engine.

The throttle chamber assembly on the SPFI system is a single bore down-draft type equipped with an injector in the intake passage of the throttle valve. The system contains the injector, a throttle sensor, an

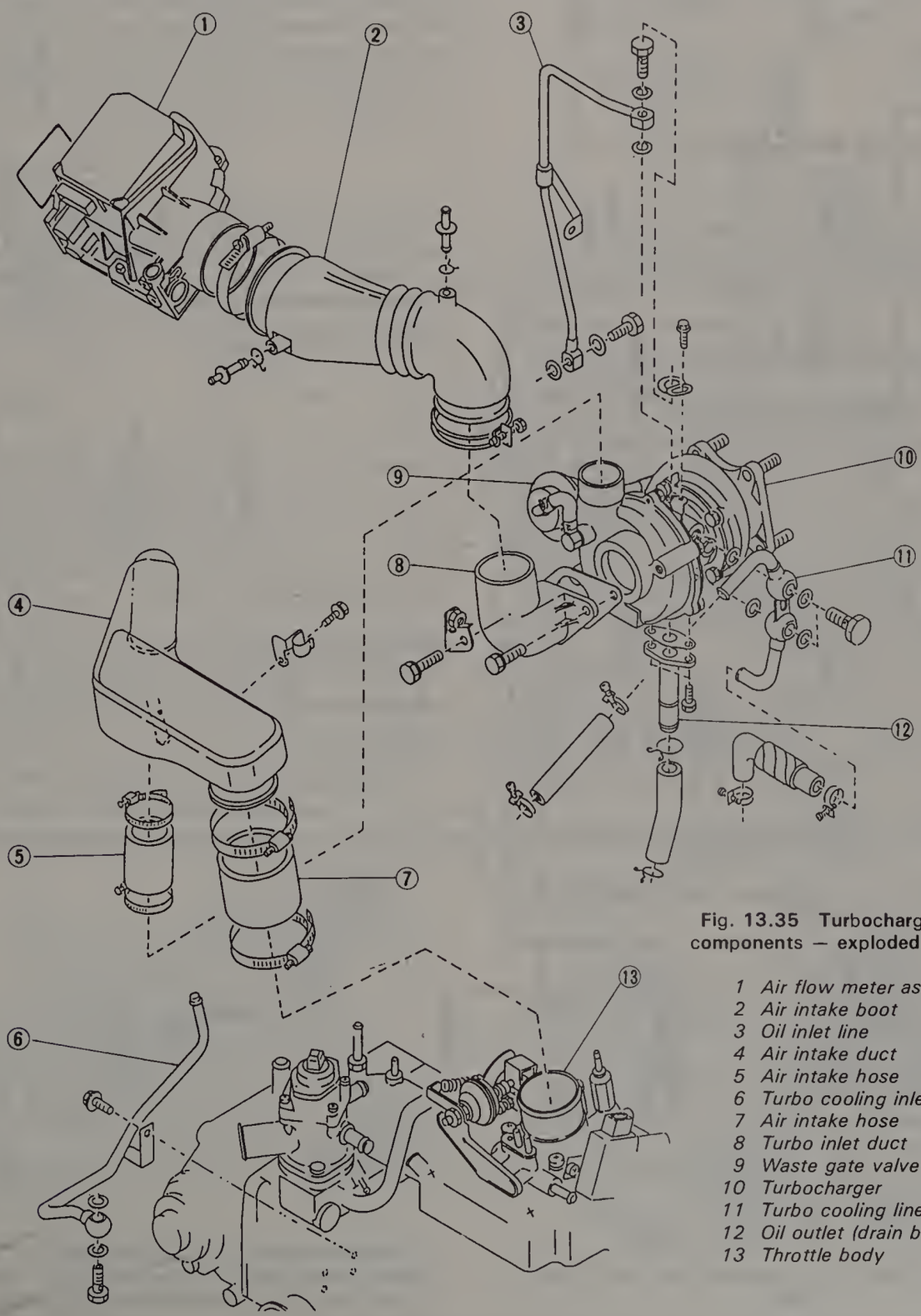


Fig. 13.35 Turbocharger assembly components — exploded view (Sec 7)

1 *Air flow meter assembly*
2 *Air intake boot*
3 *Oil inlet line*
4 *Air intake duct*
5 *Air intake hose*
6 *Turbo cooling inlet line*
7 *Air intake hose*
8 *Turbo inlet duct*
9 *Waste gate valve controller*
10 *Turbocharger*
11 *Turbo cooling line*
12 *Oil outlet (drain back) line*
13 *Throttle body*

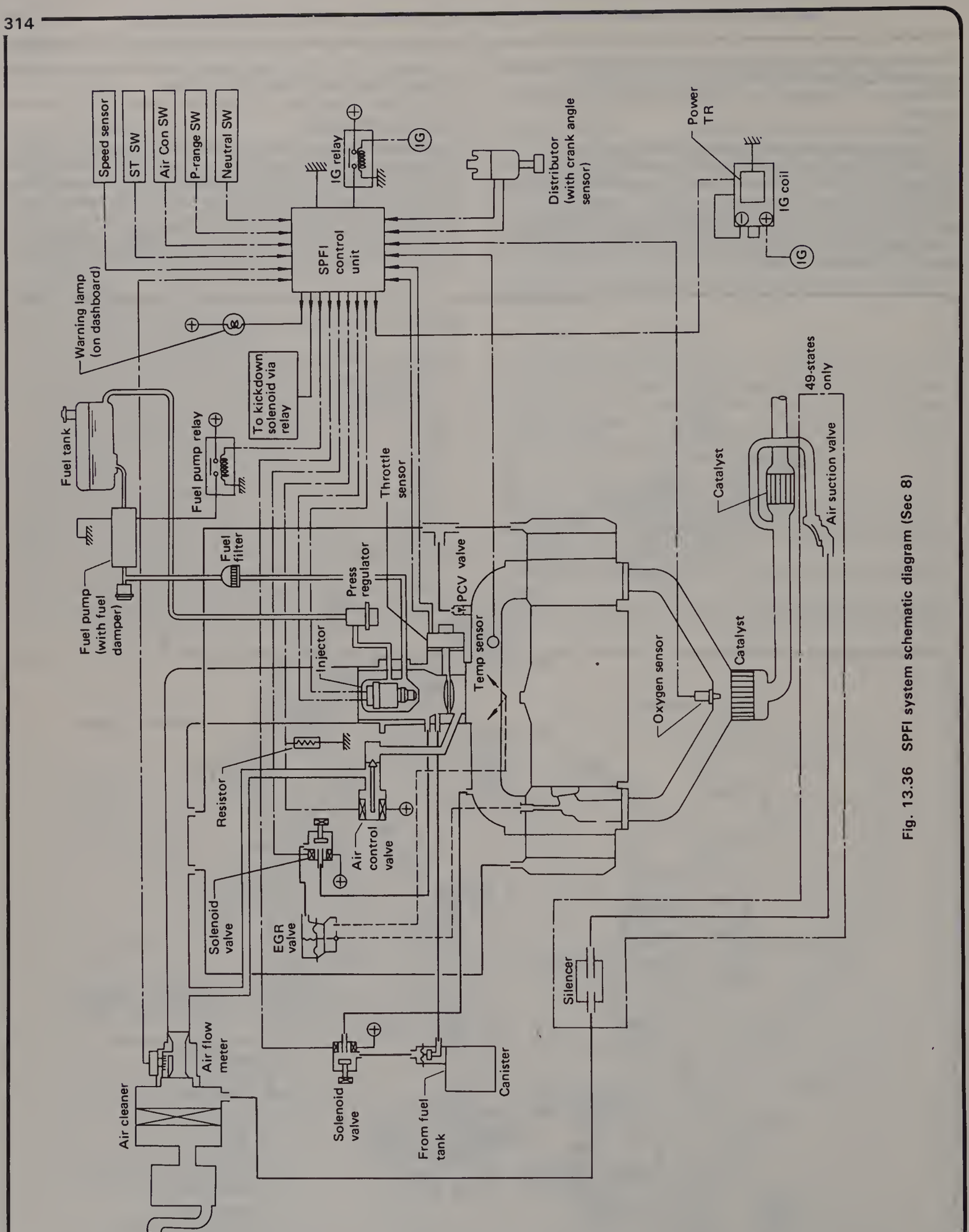


Fig. 13.36 SPFI system schematic diagram (Sec 8)

air control valve and a pressure regulator combined in one body. Fuel is fed from the inlet line into the injector. Fuel also flows around the injector to cool it. The injector is operated by an electronic signal from the SPFI control unit, based on engine speed and load. The pressure regulator regulates fuel pressure and returns excess fuel to the fuel tank through the fuel return line.

To regulate air flow, the SPFI system employs a hot-wire type air flow meter. This meter converts the amount of air taken into the engine into an electric signal by utilizing the heat transfer phenomenon between the incoming air and a heating resistor (hot wire) located in the air intake. This compact metering system, with no moving parts, produces quick response and automatically compensates for high-altitude conditions.

The Electronic Engine Management System controls the ignition as well as the SPFI. The ECM, a major part of this system, has two learning cycles, one for the owner's driving habits and the other for the aging of components. The ECM also has a long-term fault memory and multi-function self-diagnosis function. If the battery is disconnected, part of the ECM memory is erased, which makes it necessary to reteach the computer. This is done by thoroughly warming up the engine and operating the vehicle at part throttle, under stop-and-go conditions and at idle (Fig. 13.36).

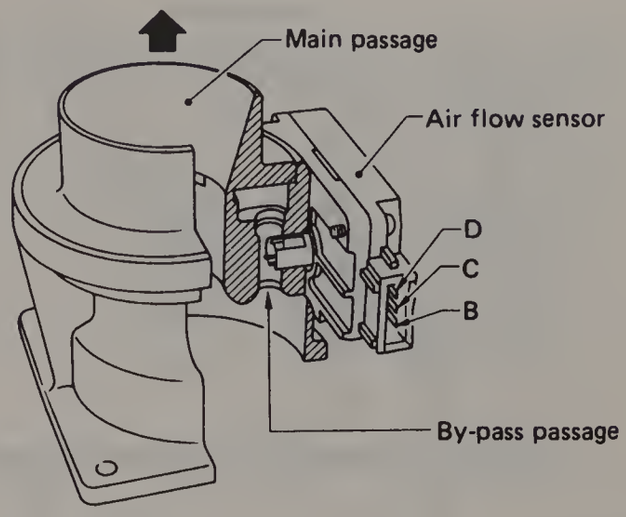


Fig. 13.37 Air flow sensor terminal locations (SPFI) (Sec 8)

Fuel pressure relief

1 Before performing any maintenance or repair procedures that involve the fuel system, the fuel pressure must be relieved as follows. **Warning:** *If the fuel system pressure is not relieved, gasoline could spray out as hoses are detached and get in your eyes or be ignited.*

2 Disconnect the wiring connector at the fuel pump. Crank the engine for more than five seconds. If the engine starts, let it run until it stops. After turning the ignition switch off, reconnect the wiring connector at the fuel pump.

Component checks

Air flow meter

3 Check for leaks and damage in the connection between the air intake boot and air flow meter.

4 Detach the wire harness connector from the air flow meter, then loosen the clamps and separate the air flow meter from the air intake boot and the air cleaner case.

5 Check the exterior of the air flow meter for damage.

6 Check for foreign matter, water and oil in the air passages (especially in the by-pass passage).

7 If no defects are found in the visual checks above, conduct the following test. **Caution:** *Be careful not to short-circuit the power source and do not apply a voltage greater than 12-volts.*

8 Using jumper wires, connect a 12-volt battery to the air flow sensor terminals (positive battery post to terminal B, negative to terminal C) (Fig. 13.37).

9 Connect a voltmeter to terminals C and D and make sure that the voltage is somewhere between 0.1 and 0.5-volts.

10 Blow air into the by-pass passage and see if the voltage changes. If it does not change, the air flow sensor may be defective. Reinstall the air flow meter and be sure to tighten the clamps securely.

Throttle chamber assembly

11 Start the engine and allow it to reach operating temperature.

12 Turn the ignition switch off.

13 Unplug the connector at the throttle sensor.

14 Ensure that the resistance between throttle sensor terminals A and B is zero (0) ohms when the accelerator pedal is released (Fig. 13.38).

15 Reconnect the wire to the throttle sensor.

16 Start the engine again.

17 Turn the air conditioner to off, set the gear select lever to the Neutral or Park position and check the engine idle speed (it should be 700 ± 100 rpm).

18 After ensuring the idle speed is at the specified value, adjust the ignition timing (it should be 20° BTDC at 700 rpm).

19 If the idle speed exceeds 800 rpm, make the following adjustments. **Note:** *Do not turn the IAS (idle adjusting screw) unless adjustment is necessary.*

20 Detach the air control valve connector.

21 Adjust the idle speed to 600 ± 50 rpm by turning the IAS in or out (Fig. 13.39).

22 If the engine idle speed is less than 600 rpm, the connector has a faulty contact or the harness is broken.

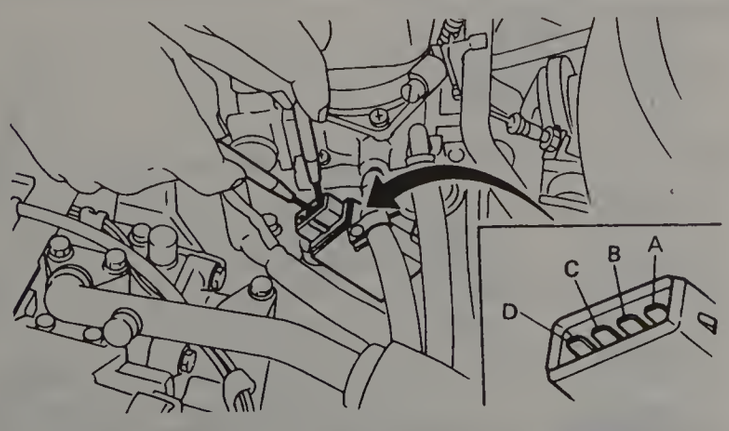


Fig. 13.38 Checking for zero (0) resistance between throttle sensor terminals A and B with the throttle closed (note the terminal locations indicated in the inset) (Sec 8)

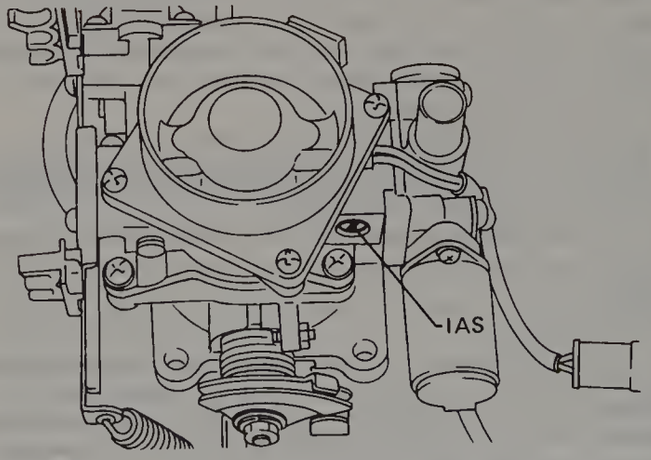


Fig. 13.39 Idle adjustment screw (IAS) location (SPFI) (Sec 8)

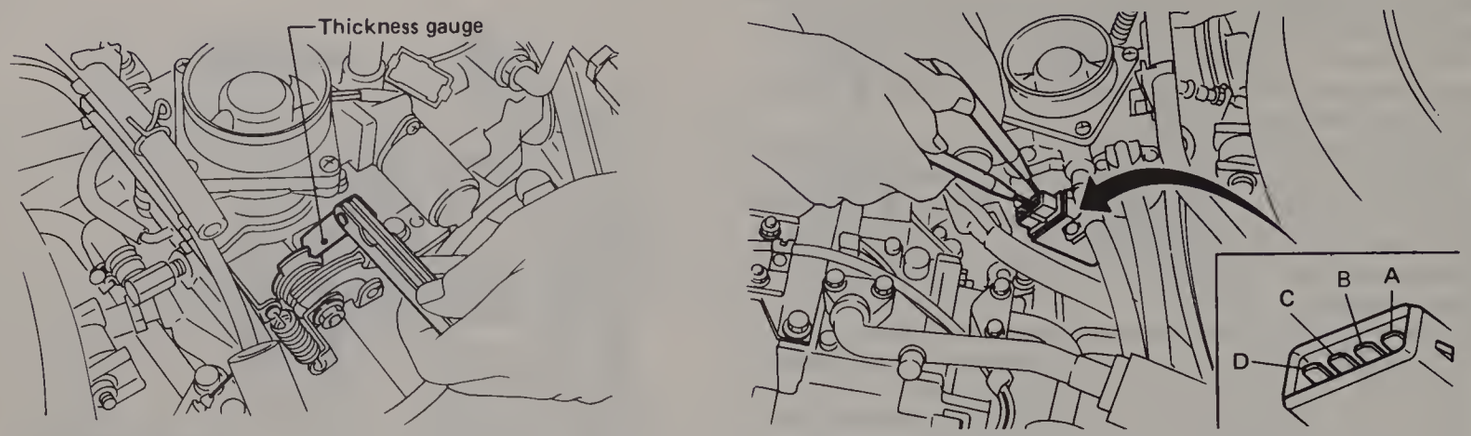


Fig. 13.40 Checking the throttle sensor operation with a feeler gauge and ohmmeter or test light (SPFI) (Sec 8)

Throttle sensor

23 Unplug the throttle sensor connector, then check for continuity between terminals A and B (Fig. 13.40).
24 Make sure there is continuity between terminals A and B when the throttle is fully closed.
25 Make sure there is *No* continuity when the throttle is fully open.
26 Insert a 0.012-inch (0.31 mm) feeler gauge between the throttle chamber stopper screw and the stopper on the throttle shaft. Make sure that continuity exists between terminals A and B.
27 Using a 0.031-inch (0.79 mm) feeler gauge, repeat the continuity check. Make sure that *No* continuity exists between the terminals.
28 If the sensor does not check out as described, loosen the two screws securing the throttle sensor to the throttle chamber and turn the throttle sensor main body until it does. If it cannot be done, replace the throttle sensor with a new one.
29 The resistances between B and D and between B and C change as the throttle valve is opened. A resistance of 3.5 to 6.5 K-ohms should exist between B and D. The resistance between B and C should be less than 1 K-ohm with the throttle valve closed and greater than 2.4 K-ohms with the throttle all the way open.
30 The resistance between B and C should increase continuously when the throttle valve is moved from fully closed to fully open. Conversely, the resistance should decrease continuously as the throttle is moved from open to closed.

Fuel injector

31 Using a stethoscope or a long, thin screwdriver, make sure the injector makes an operating noise (clicking sound) as the engine is running. If the operating noise cannot be heard, check the resistance of the injector as follows.
32 Disconnect the cable from the positive battery terminal.
33 Detach the fuel injector wire harness connector and measure the resistance between the two terminals of the injector. It should be 0.5 to 2 ohms. Measure the resistance between the injector terminals and a good body ground. It should be more than one meg-ohm. If the resistance does not meet this value, the fuel injector may be faulty.
34 **Note:** *When making the following voltage check, the engine must be off and the key must be on.*
35 If it was reconnected, undo the fuel injector connector.
36 Measure the voltage between the terminals in the engine wiring harness side of the fuel injector connector and a good engine ground (Fig. 13.41). It should be 12-volts.
37 If the voltage does not meet this value, the fusible link or harness connector may be faulty. Check and repair the fusible link or harness connector.

Air control valve

38 Unplug the connector to the air control valve while the engine is idling. At this time check to see if the engine speed drops.
39 Make sure that the engine resumes its original speed when the connector is reattached. **Note:** *Unplugging the connector causes a big change in rpm when the engine is cold. However, when the engine is warm, it causes a smaller change or almost no change.*
40 If the engine speed does not change, stop the engine. With the air control valve connnector unplugged, measure the resistance between the connector terminals on the air control valve side. It should be 8.6 to 10.6 ohms. If the resistance is not as specified, replace the air control valve.
41 If the resistance is normal, detach the hose and the electrical connector at the control valve. Apply battery voltage (12-volts) to the terminals on the air control valve side (no polarity), then look through the hose connection to check if the internal valve operates (by applying voltage intermittently). If the valve fails to operate, replace it with a new one.

Pressure regulator

42 The pressure regulator maintains the fuel pressure at 14 psi. **Warning:** *Refer to the fuel pressure relief procedure in this section before proceeding.*
43 Disconnect the fuel hose at the delivery line on the throttle chamber and install a fuel pressure gauge (a T-fitting must be used to enable the pressure to be checked with the fuel hose in place and the engine running).
44 Measure the pressure when the engine is at idle speed. It should be 13 to 17 psi (88 to 118 kPa). If it isn't, the pressure regulator may be faulty.

System removal and installation

45 Unplug the wire connector coming from the air flow meter assembly.
46 Loosen the hose clamps securing the air intake boot and remove the boot (connected to the air flow meter and the throttle chamber assembly) (Fig. 13.42).
47 Loosen and remove the retaining bolts and detach the air cleaner/air flow meter assembly from the chamber.
48 Remove the retaining nuts and remove the chamber assembly from the body.
49 Loosen the hose clamp and detach the air control valve inlet hose

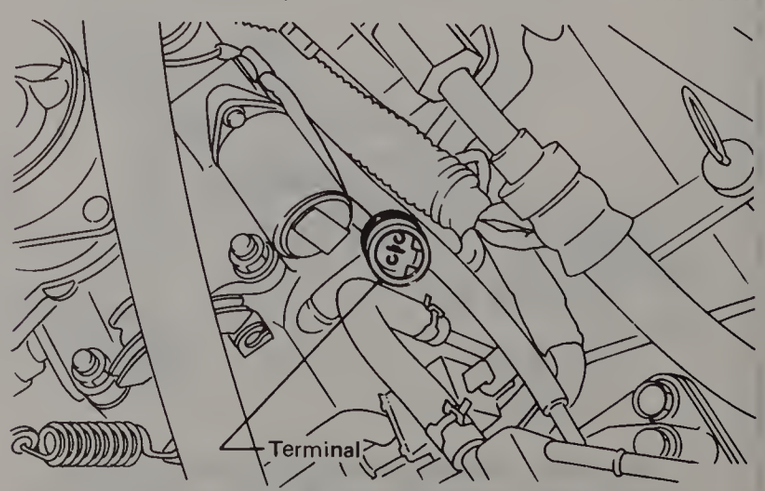


Fig. 13.41 The voltage for the fuel injector should be checked on the wiring harness side of the connector (Sec 8)

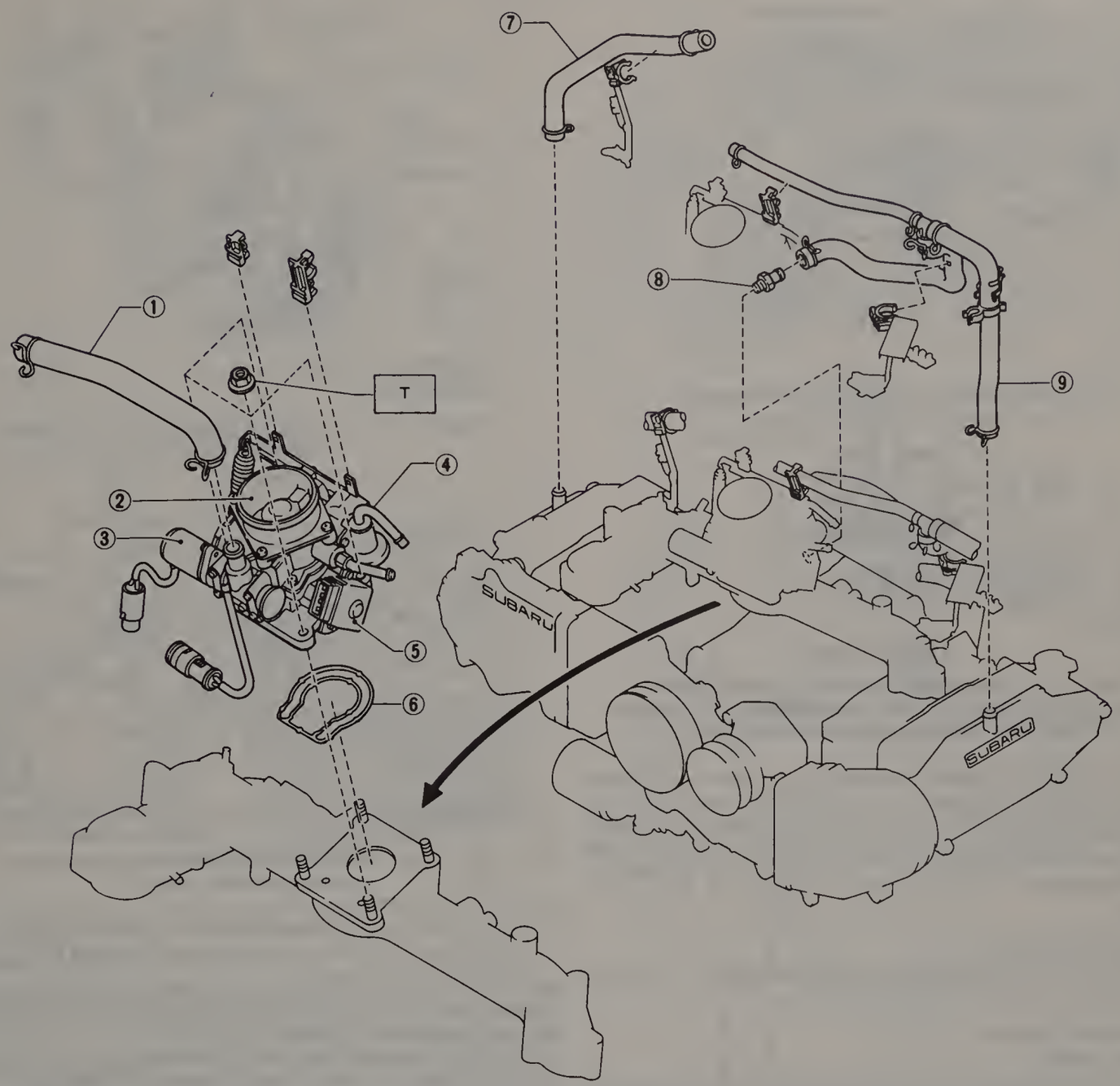


Fig. 13.42 Throttle chamber and related components — exploded view (Sec 8)

1 Air control valve inlet hose
2 Throttle chamber assembly
3 Air control valve
4 Pressure regulator
5 Throttle sensor
6 Gasket
7 PCV hose
8 PCV valve
9 PCV hose

from the valve. Detach the hoses that are clipped to the throttle chamber assembly.

50 Disconnect the throttle sensor wire harness connector. Unplug the air control valve wire harness connector.

51 Open the throttle and detach the cable from the throttle shaft drum.

52 Loosen and remove the bolts and detach the throttle chamber assembly from the intake manifold.

53 Remove all traces of the old gasket from the throttle chamber assembly and the intake manifold with a gasket scraper. Be careful not to nick or gouge the sealing surfaces.

54 Installation is the reverse of this procedure. Be sure to use a new gasket and tighten the throttle chamber mounting bolts in a criss-cross pattern. Work up to the specified torque in three steps to avoid warping the throttle chamber mounting flange.

55 All hose, tube and duct clamps must be tightened securely to avoid air leaks.

9 Multi-Point Fuel Injection (MPFI) system

General information

The Multi-Point Fuel Injection system supplies the optimum fuel/air mixture to the engine for all operating conditions through the use of the latest electronic technology.

With this system, fuel which is kept at a constant pressure is injected into each intake port in the cylinder head. The quantity of fuel injected is controlled by an intermittent injection system where each electro-magnetic injection valve (fuel injector) opens only for a short period of time, depending on the quantity of air required for one cycle of operation. In actual operation, the injection quantity is determined by the duration of an electric pulse applied to the fuel injector, which permits simple, yet highly precise metering of fuel.

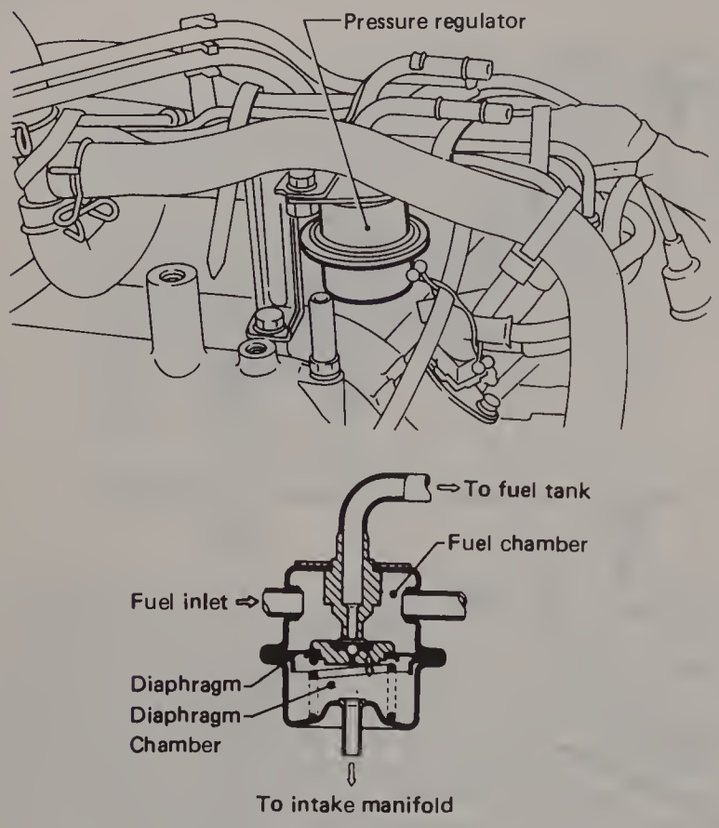


Fig. 13.43 MPFI system pressure regulator location (note that the pressure gauge must be attached to the inlet fitting when checking the fuel pressure) (Sec 9)

All operating conditions of the engine are converted into electric signals for the Engine Management Module to utilize when determining the fuel requirements. This results in additional benefits, such as reduced exhaust emissions, reduced fuel consumption, increased engine output, quick starts and superior warm-up performance in cold weather, since compensation is made for coolant and intake air temperature changes.

Fuel pressure relief

Refer to the fuel pressure relief procedure in Section 8 — it's the same for both types of fuel injection systems.

Component checks

Pressure regulator

Warning: *Before proceeding, refer to the fuel pressure relief procedure in Section 8.*

1 Disconnect the fuel hose at the pressure regulator inlet fitting and install a fuel gauge (a T-fitting and separate section of hose must be used to enable the pressure to be checked with the hose in place and the engine running) (Fig. 13.43).

2 When checking, measure the fuel pressure at idle speed. It should be 26 to 30 psi (177 to 206 kPa). Race the engine and make sure the fuel pressure increases correspondingly.

Fuel injector

3 Using a stethoscope or a long, thin screwdriver, make sure each injector makes an operating noise (clicking sound) with the engine running. If the operating noise cannot be heard on any injector, check for power to the injector as follows.

4 Disconnect the wire harness from the injector, then check the voltage at the terminals on the harness side of the connector (Fig. 13.44). **Note:** *When making this check, the engine must be off. Keep the connectors for the other injectors hooked up.*

5 The voltage should be 12-volts at each terminal. If it isn't, the fusible link or harness connector may be faulty. Check and repair the fusible link or harness connector.

Throttle switch (idle contact)

6 Unplug the throttle switch wiring harness connector at the switch. Using an ohmmeter or self-powered test light, check for continuity between terminals A and C under the following conditions (Fig. 13.45).

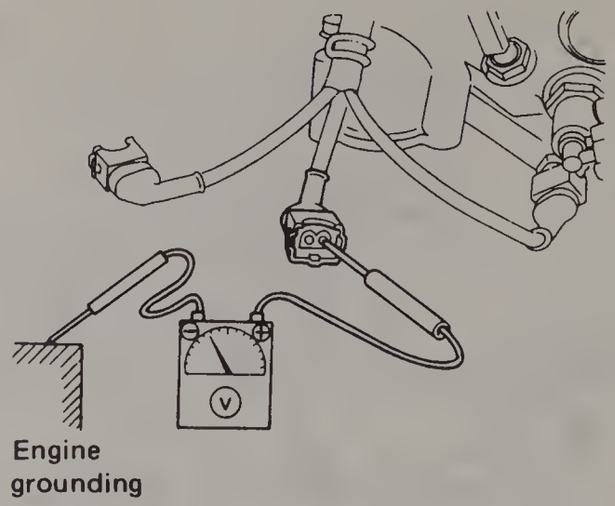


Fig. 13.44 Checking for voltage at the fuel injector connector (Sec 9)

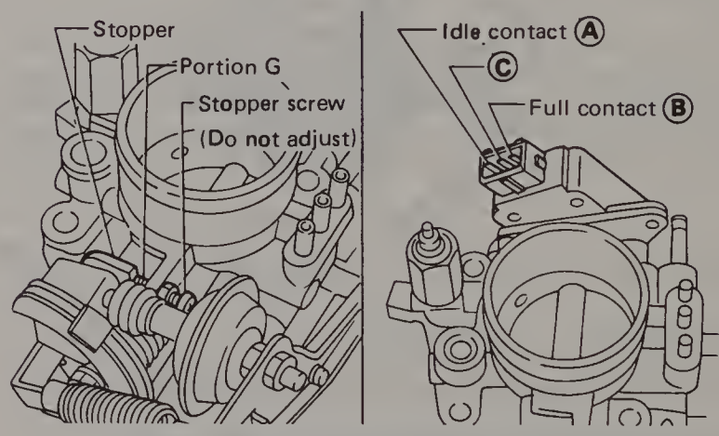


Fig. 13.45 MPFI system throttle switch terminal and stopper locations (Sec 9)

7 Make sure that continuity exists between terminals A and C when the throttle is fully closed.

8 Insert a 0.022-inch (0.55 mm) feeler gauge between the stopper screw of the throttle body and the stopper (portion G). Continuity should exist between terminals A and C.

9 Substitute a 0.036-inch (0.92 mm) feeler gauge and repeat the check. Continuity should *Not* exist between the terminals.

10 If the above standards are not satisfied, loosen the two screws securing the throttle switch to the throttle body and turn the throttle switch until the correct adjustment is obtained.

Throttle switch (full contact)

11 The full contact is turned on when the throttle opens 45° (turbo)/20° (non-turbo) from the position where the idle contact is off. This angle is fixed in the throttle switch and cannot be adjusted. Check for continuity between terminals B and C. Make sure that continuity exists between terminals B and C when the throttle angle is approximately 47° (turbo)/22° (non-turbo) to fully open. **Note:** *Do not attempt to adjust the stopper screw on the throttle body. Adjust the engine idle speed by turning the idle adjust screw on the throttle body.*

Dash pot

12 Warm up the engine sufficiently and make sure that the idle speed is correct.

13 Under a no-load state, turn the throttle lever by hand and increase engine speed until the end of the dash pot is off the throttle cam (Fig. 13.46).

14 Gradually return the throttle lever and read the engine rpm when the throttle cam contacts the end of the dash pot. It should be 2800 to 3400 rpm.

15 If the engine rpm is not within this range, loosen the locknut on the dash pot and turn the dash pot until it is. After adjustment, tighten the locknut securely.

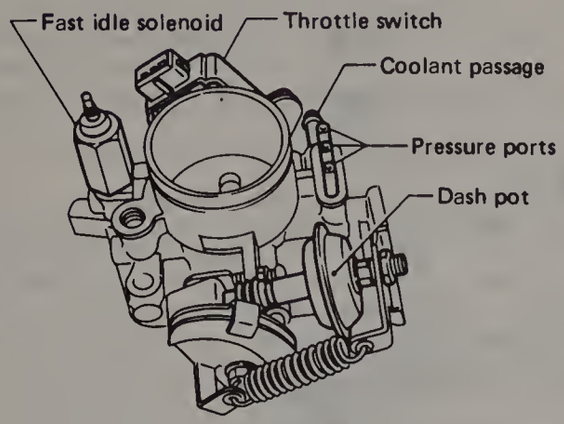


Fig. 13.46 Dash pot location (MPFI system) (Sec 9)

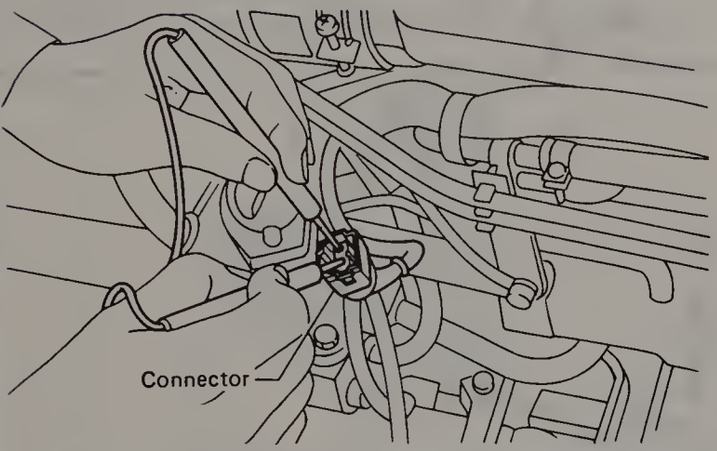


Fig. 13.47 Use a pliers to squeeze the auxiliary air valve hose, but protect it with a rubber pad to avoid causing leaks (Sec 9)

16 After adjustment, race the engine and make sure the engine returns to the specified idle speed as the throttle is released.

Auxiliary air valve

17 Pinch the hose connecting the air intake duct and auxiliary air valve and note how the engine speed changes (Fig. 13.47). When the engine is cold, the idle speed will drop more noticably as the hose is pinched. When it is hot the reduction in speed will be less than 100 rpm.

18 As the engine is started, the auxiliary air valve is heated by the built-in heater and its shutter valve closes gradually. This causes the engine rpm to be lowered gradually until the specified idle speed is reached. If the engine speed will not drop to the idle rpm smoothly, the heater circuit or the heater power supply circuit may be faulty. In this case, check the resistance value of the auxiliary air valve. Unplug the connector at the valve and measure the resistance between the two valve terminals with an ohmmeter. It must be other than zero or infinity.

19 Check the source voltage (Fig. 13.48). Unplug the connector at the auxiliary air valve and check the voltage at the terminals in the harness side of the connector. If the voltage is less than 12-volts, check the harness and the connector.

20 If the source voltage is normal but the engine speed does not change as described in Step 17, the shutter valve in the auxiliary air valve may be sticking closed. The major symptom for this is an engine that stalls easily when it is cold. The shutter valve in the auxiliary air valve may also stick open. The symptom for this is engine rpm does not decrease smoothly during warm-up or the speed remains high. The remedy for both problems is to replace the auxiliary air valve. There is also the possibility of a clogged air passage. The symptoms are the same as for the shutter valve problems. The remedy is to check and clean the air passages and hoses.

Coolant thermosensor

21 Detach the sensor connector and hook the leads of an ohmmeter to the sensor terminals. Start the engine and monitor the changes in

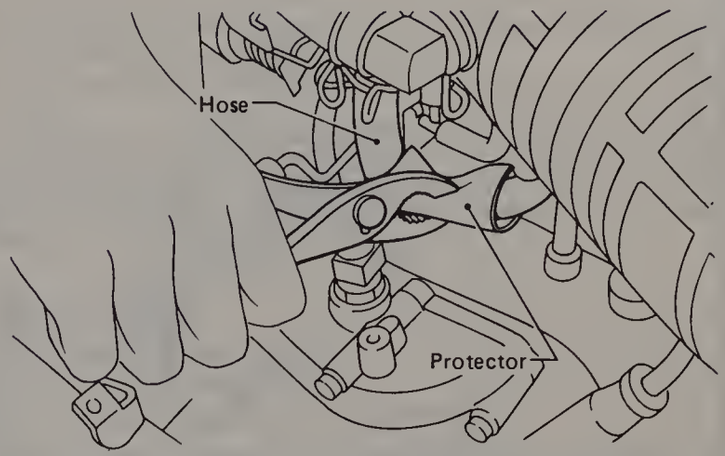
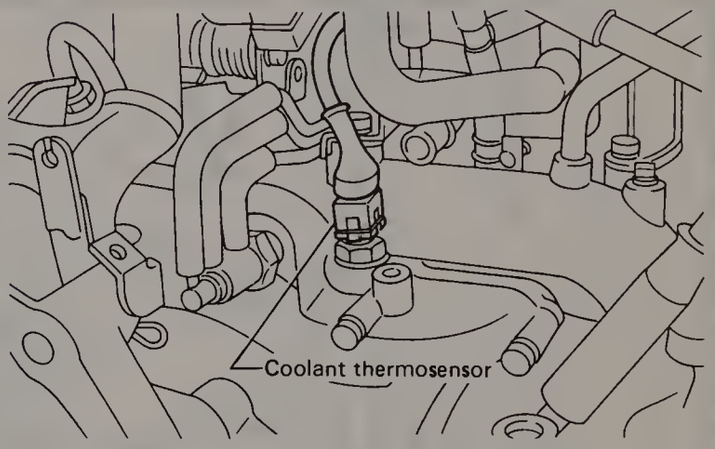


Fig. 13.48 Checking for correct auxiliary air valve source voltage (MPFI system) (Sec 9)



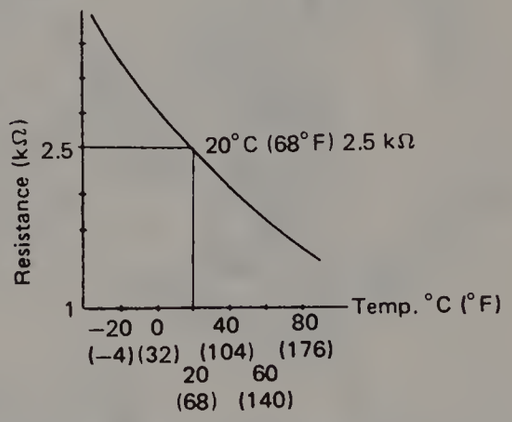


Fig. 13.49 MPFI system coolant thermosensor location (note the graph indicating temperature/resistance relationship) (Sec 9)

coolant temperature and sensor resistance (Fig. 13.49) (a thermometer placed in the radiator filler neck will indicate relative temperature of the coolant). The resistance should change as follows.

Coolant temperature	Resistance
14°F (–10°C)	7 to 11.5 K-ohms
68°F (20°C)	2 to 3 K-ohms
122°F (50°C)	700 to 1000 ohms

22 If the resistance values are much out of these ranges, replace the thermosensor with a new one.

System removal and installation

23 Detach the wiring harness connector from the air flow meter assembly.

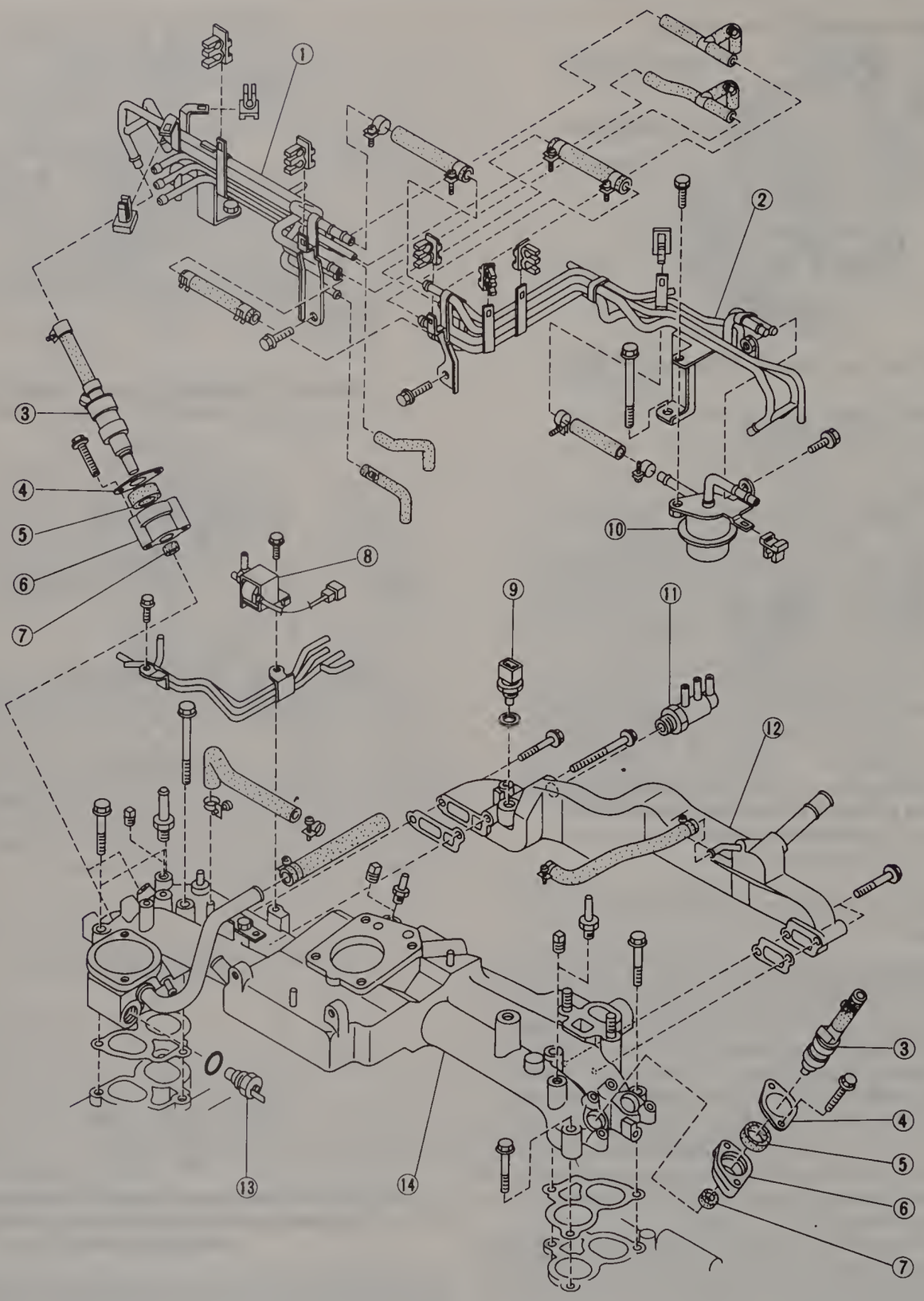


Fig. 13.50 MPFI system fuel line components — exploded view (Sec 9)

1 *Fuel line assembly (right)*
2 *Fuel line assembly (left)*
3 *Fuel injector*
4 *Holder plate*
5 *Insulator*
6 *Holder*
7 *Seal*
8 *EGR solenoid valve*
9 *Coolant thermosensor*
10 *Pressure regulator*
11 *Thermo valve*
12 *Coolant line*
13 *Thermosensor*
14 *Intake manifold*

24 Loosen the hose clamps securing the air intake boot and remove the boot (connecting the throttle body with the air flow meter).
25 Loosen and remove the retaining bolts/nuts and detach the air cleaner assembly from the chamber.
26 Move the air cleaner/air flow meter assembly toward the engine and remove it.
27 Remove the retaining nuts and detach the chamber assembly from the body.
28 Remove the retaining bolts, loosen the hose clamps at the fuel injectors and the fuel line assembly junctions, then remove the right side fuel line assembly (Fig. 13.50).
29 Repeat the procedure for the left side fuel line assembly.
30 Remove the bolts from the holders and detach the fuel injectors.
31 Unplug the wire harness connector(s), loosen the hose clamps and detach the hoses from the throttle body fittings.
32 Loosen and remove the bolts and detach the throttle body assembly from the intake manifold (Fig. 13.51).
33 Remove all traces of the old gasket from the throttle body assembly and the intake manifold with a gasket scraper. Be careful not to nick or gouge the sealing surfaces.
34 Installation is the reverse of this procedure. Be sure to use a new gasket and tighten the throttle body mounting bolts in a criss-cross pattern. Work up to the specified torque in three steps to avoid warping the throttle body mounting flange.
35 All hose, tube and duct clamps must be tightened securely to avoid air leaks.
36 Use new O-rings on the fuel injectors and lubricate them with a small amount of clean gasoline before installing the injectors. Be careful not to damage or distort the O-rings during installation.
37 Start the engine and check carefully for leaks at the fuel hose connections.

10 Emissions control systems

Vacuum hose schematic diagrams

Refer to the accompanying illustrations for schematic diagrams of the emissions control system vacuum hose and wire routing for later model vehicles equipped with carburetors, single-point fuel injection and turbocharged multi-point fuel injection.

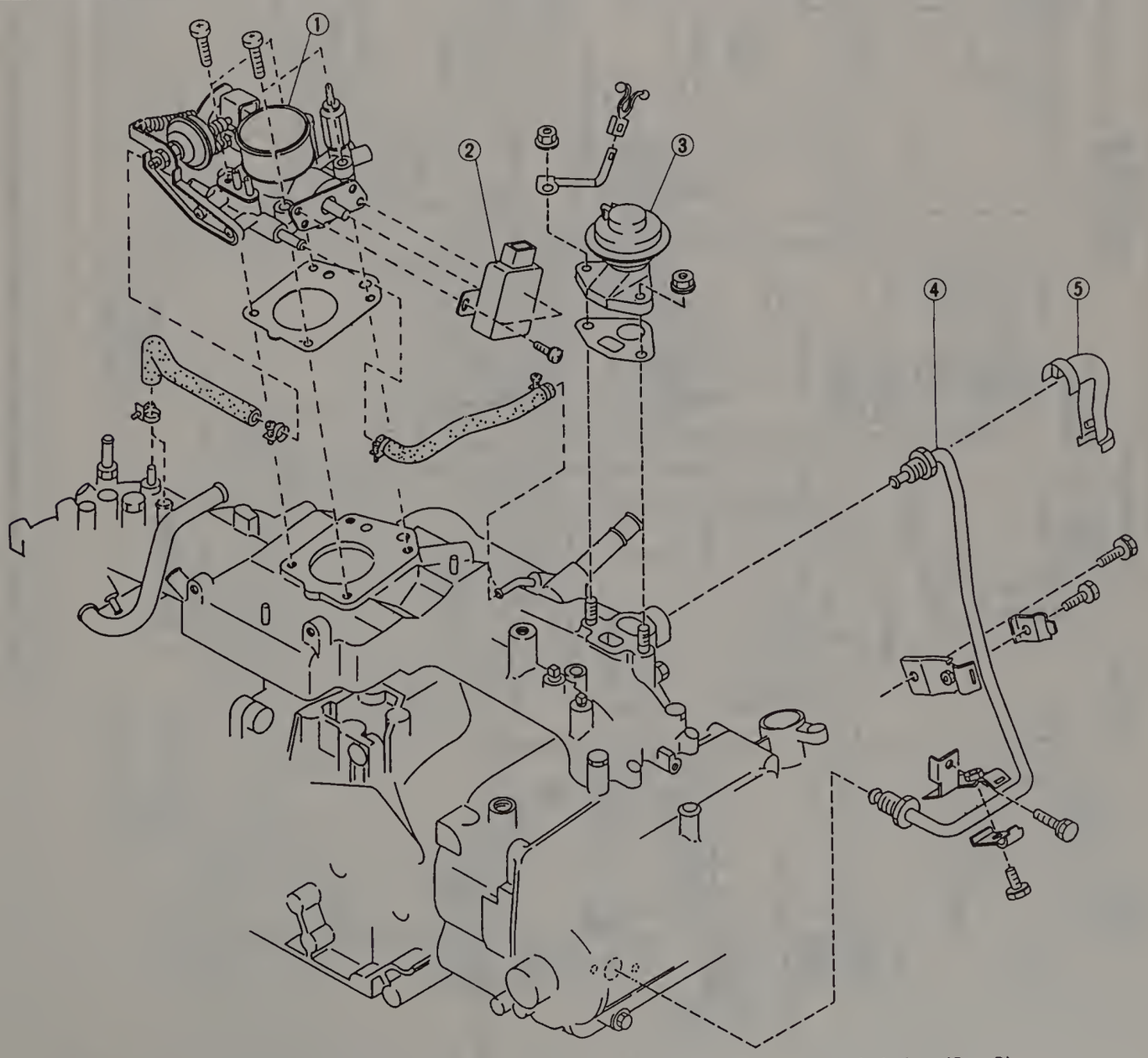


Fig. 13.51 MPFI system throttle body and related components — exploded view (Sec 9)

1 Throttle body assembly
2 Throttle switch
3 EGR valve
4 EGR tube
5 Shield

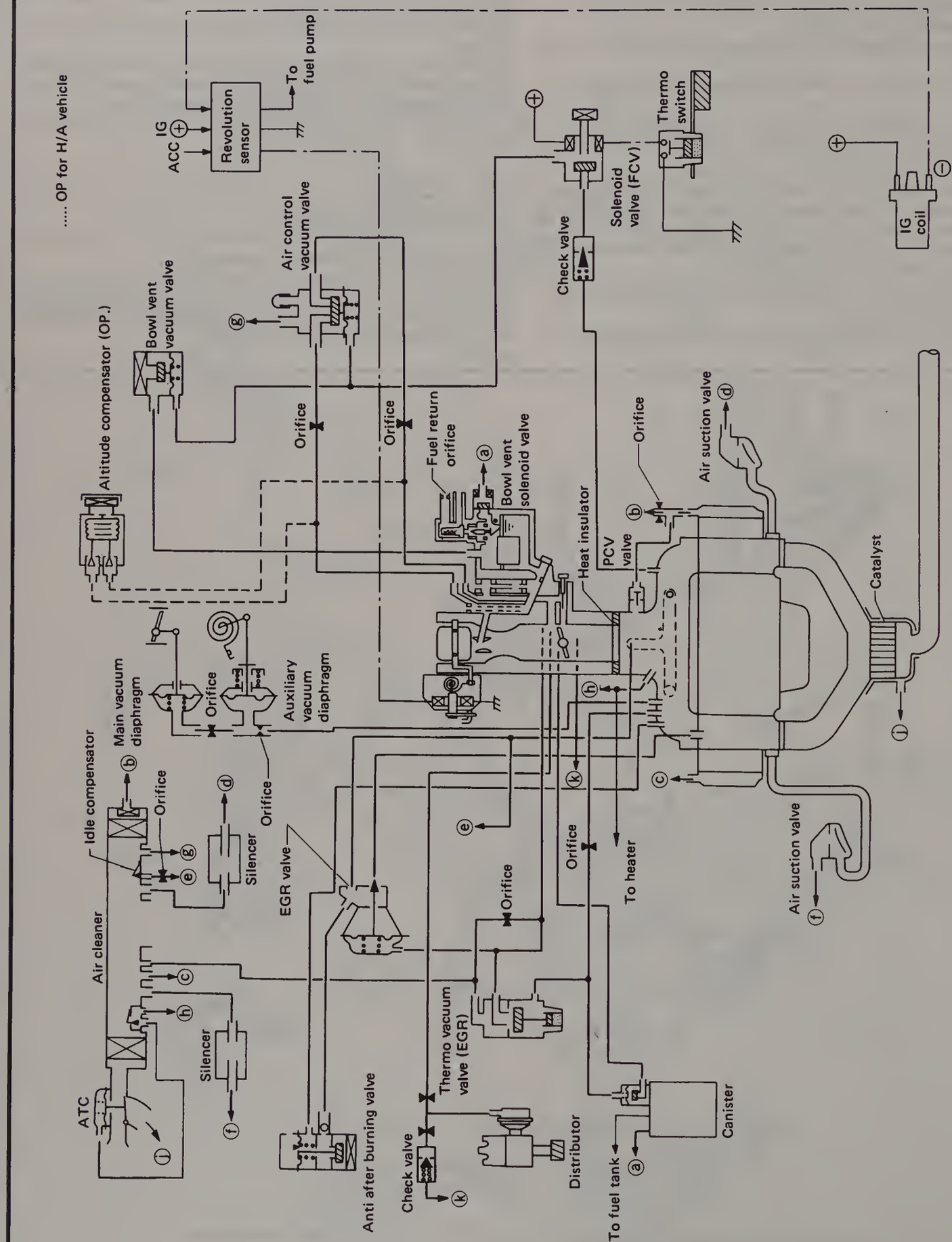


Fig. 13.52 Hose routing diagram for carburetor-equipped vehicles (Sec 10)

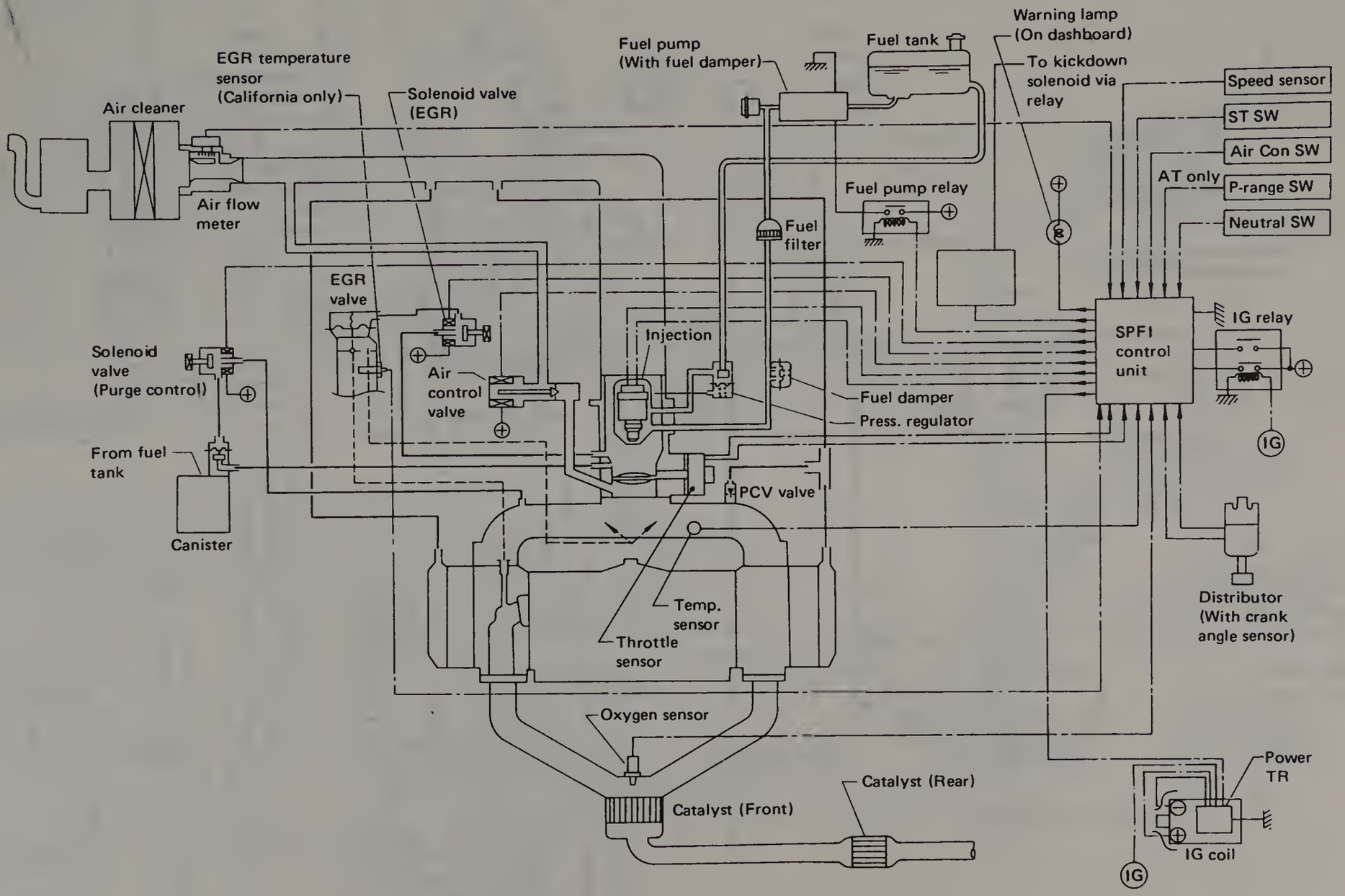


Fig. 13.53 Hose routing diagram for vehicles equipped with SPFI (Sec 10)

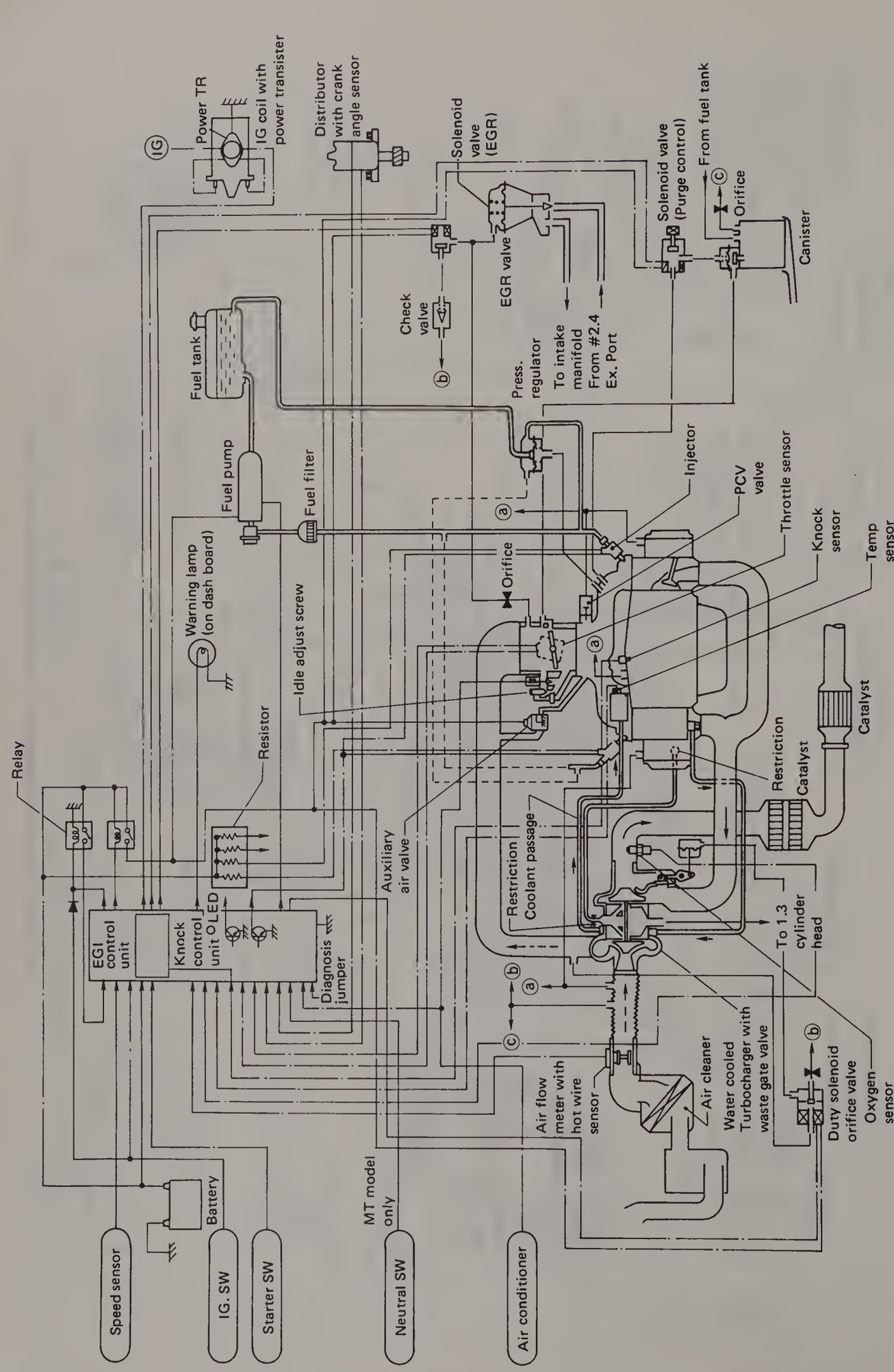


Fig. 13.54 Hose routing diagram for turbocharged vehicles with MPFI (Sec 10)

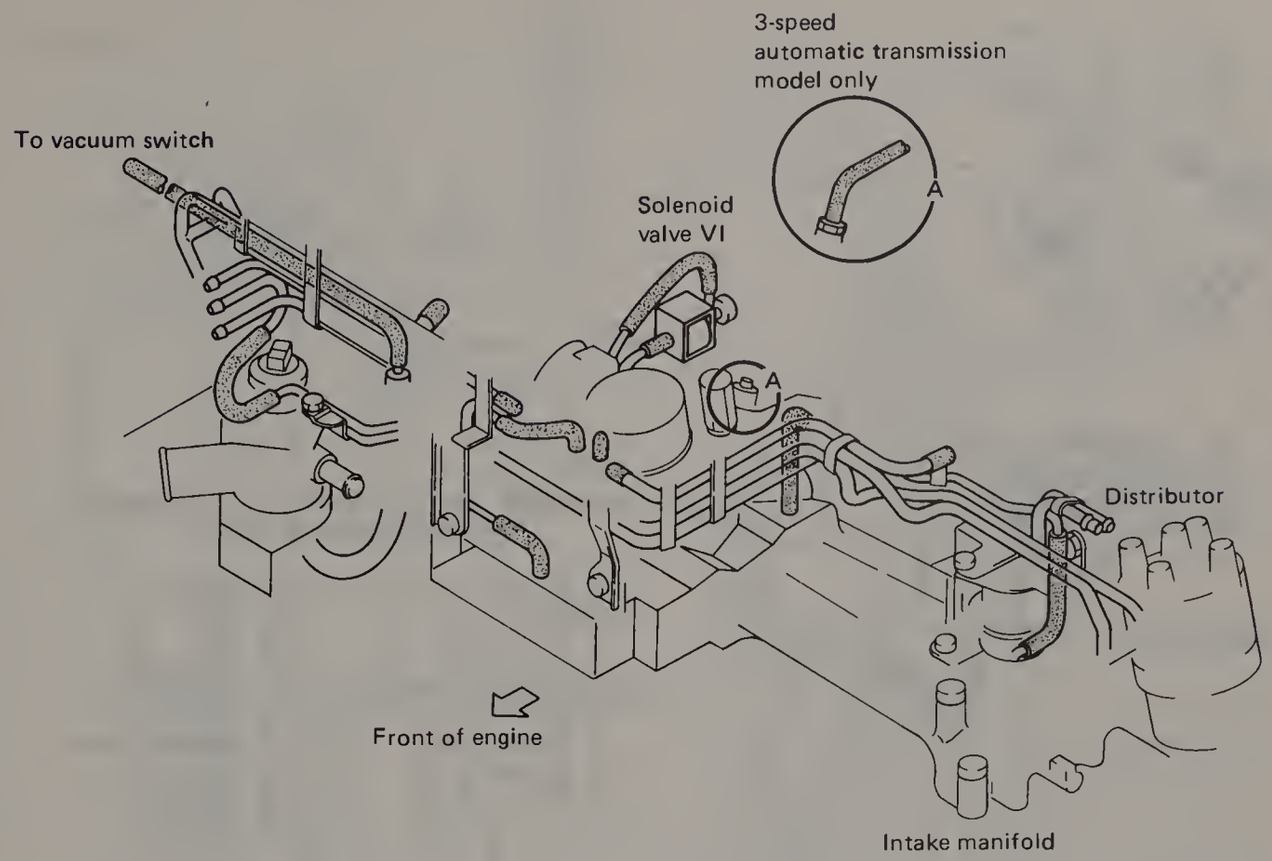


Fig. 13.55 Special hose routing for turbocharged MPFI models produced for sale in California (Sec 10)

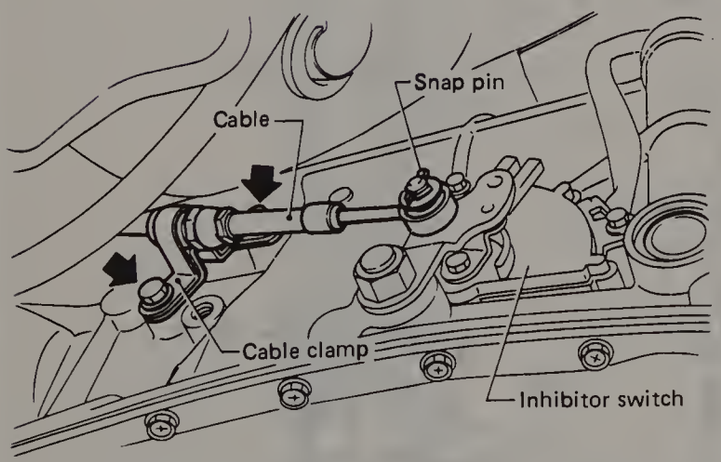


Fig. 13.56 Separate the shifter cable from the transmission lever by removing the snap pin (Sec 11)

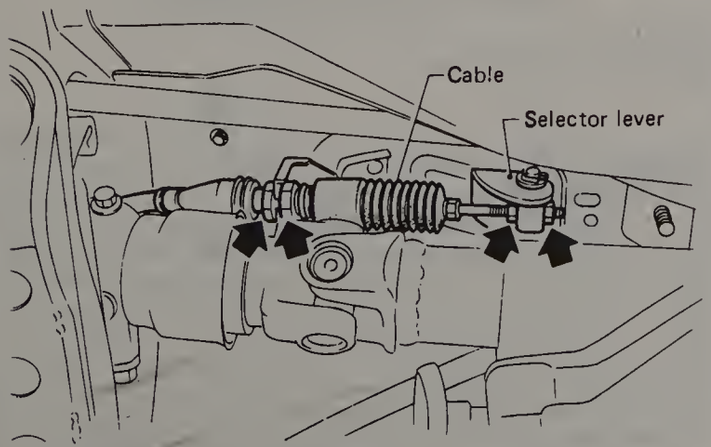


Fig. 13.57 Remove the cable from the selector lever and bracket after loosening the nuts (arrows) (Sec 11)

11 Transmission

Shifter removal and installation (4-speed automatic)

1 A revised shifter mechanism is used on the 4-speed automatic transmission (Fig. 13.58 on next page).
2 Place the transmission in Neutral.
3 Separate the shifter cable from the transmission lever (Fig. 13.56).
4 Remove the cable clamp from the transmission case.
5 Disconnect the cable from the selector lever (Fig. 13.57).
6 Remove the mounting nuts and detach the cable assembly from the bracket.
7 Remove the hand brake cover.
8 Remove the console box.
9 Unplug the light connector and the 1-HOLD switch connector.
10 Remove the select lever.
11 Installation is the reverse of the removal procedure.

12 Chassis electrical system

Wiring diagrams for the overhead cam engine with both single-point and multi-point fuel injection are included at the end of this Supplement.

13 Pneumatic suspension system

General information

Ground clearance can be controlled by operation of the height control switch. There are two levels of ground clearance which can be selected, *Normal* and *High*. The difference in height between high and normal is 1.18 in. (30 mm) for the front and 1.38 in (35 mm) for the rear.

This system also maintains constant ground clearance regardless of vehicle load. To accomplish this, air volume in each air spring is adjusted according to a signal from a vehicle height sensor, which is installed in each rolling diaphragm type air spring.

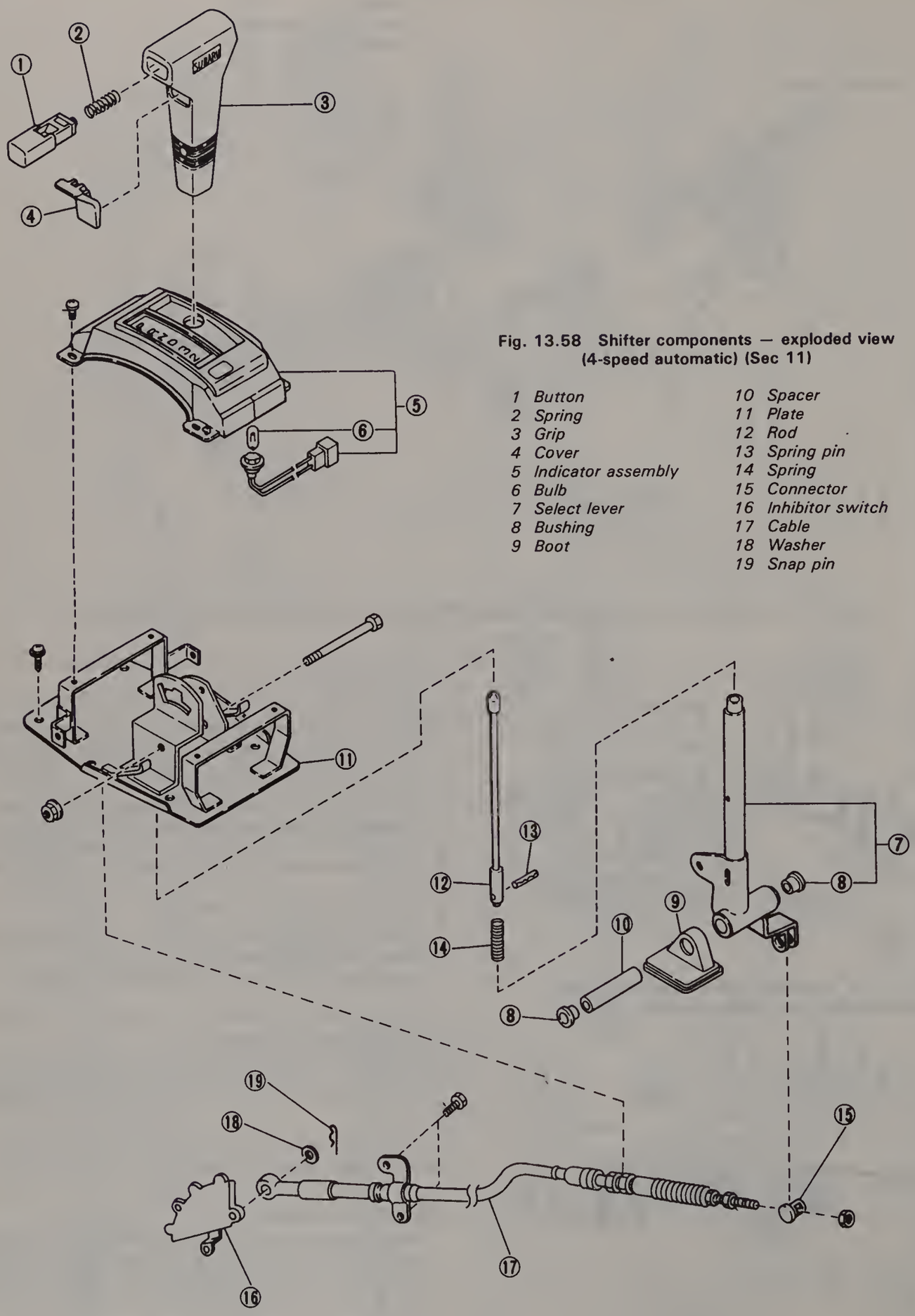


Fig. 13.58 Shifter components — exploded view (4-speed automatic) (Sec 11)

1 Button
2 Spring
3 Grip
4 Cover
5 Indicator assembly
6 Bulb
7 Select lever
8 Bushing
9 Boot
10 Spacer
11 Plate
12 Rod
13 Spring pin
14 Spring
15 Connector
16 Inhibitor switch
17 Cable
18 Washer
19 Snap pin

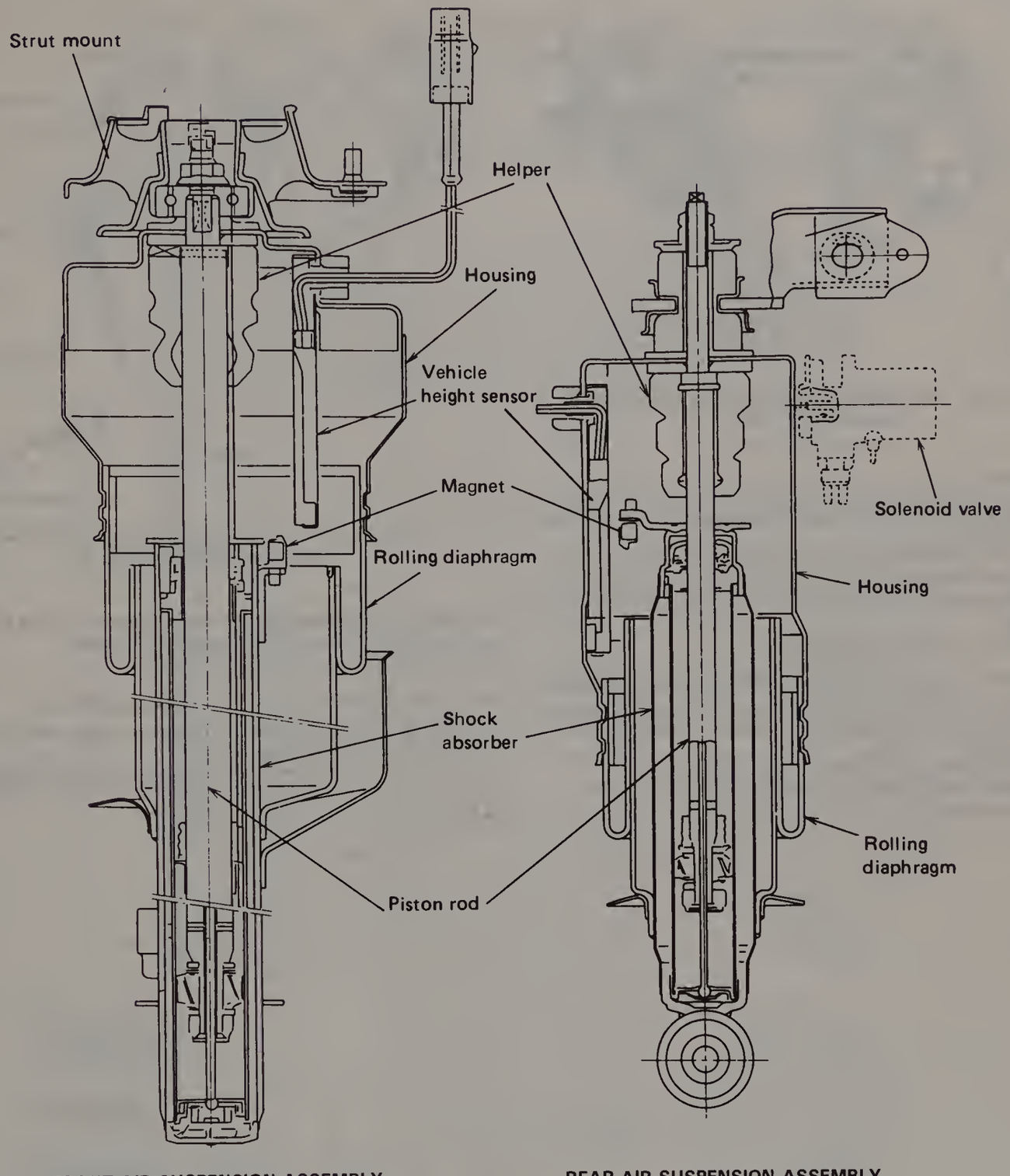


Fig. 13.59 Air suspension system components (Sec 7)

Precautions

1 When working on any part of the suspension system, make sure that the vehicle is in the normal (low) position with the height control switch turned off and disconnect the battery ground cable.

2 When reinstalling components, do not reuse O-rings. Also, be sure not to damage the O-ring contact surfaces (such as the O-ring grooves). Apply grease to all O-rings when reinstalling components.

3 Do not apply an undercoating for local rust prevention to the air bags (rolling diaphragm surface and cylinder surface with which the diaphragm is in rolling contact) or the air compressor. This is because when the damper oil temperature increases, the generated heat melts the undercoating, which may trap dust, dirt and sand resulting in a damaged diaphragm. Undercoating on the air inlet of the compressor can also block the vent (Fig. 13.59).

Front strut assembly removal and installation

4 Raise the front of the vehicle and support it on jackstands. Apply the parking brake to keep the vehicle from rolling, then disconnect the air pipe.

5 Remove the mud guard.

6 Detach the vehicle height sensor harness from the clip.

7 Disconnect the harness coupler. The rest of the procedure is the same as for the removal of a standard type strut assembly (refer to Chapter 11).

8 Installation is the reverse of removal.

Rear shock absorber removal and installation

9 Raise the rear of the vehicle and support it on jackstands. Block the front wheels to keep the vehicle from rolling, then remove the rear

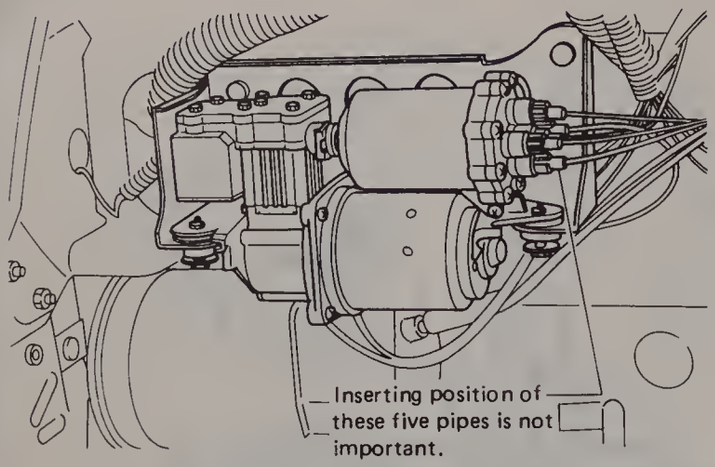


Fig. 13.60 Air suspension system compressor/dryer assembly (Sec 13)

apron protector.
10 Remove the solenoid valve from the rear air suspension assembly.
11 When replacing the solenoid valve, disconnect the air pipe from the solenoid valve.
12 Pull out the vehicle height sensor harness from the access hole in the body and disconnect the harness coupler. The rest of the procedure is the same as for the removal of a standard type shock (refer to Chapter 11).
13 Installation is the reverse of removal.

Compressor and dryer assembly removal and installation

14 Raise the front of the vehicle and support it on jackstands, then apply the parking brake to keep the vehicle from rolling. Remove the left front wheel.
15 Remove the front half portion of the mud guard.
16 Disconnect the five air pipes from the dryer (Fig. 13.60).
17 Remove the coupler.

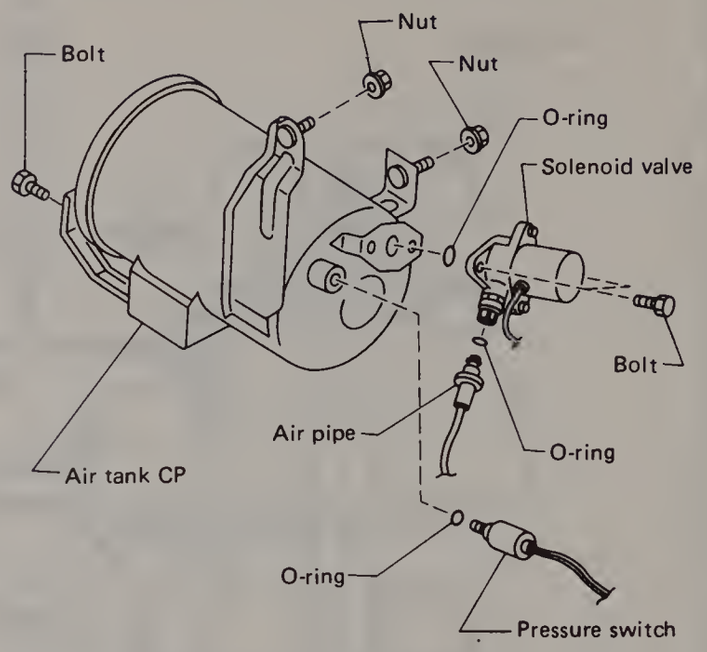
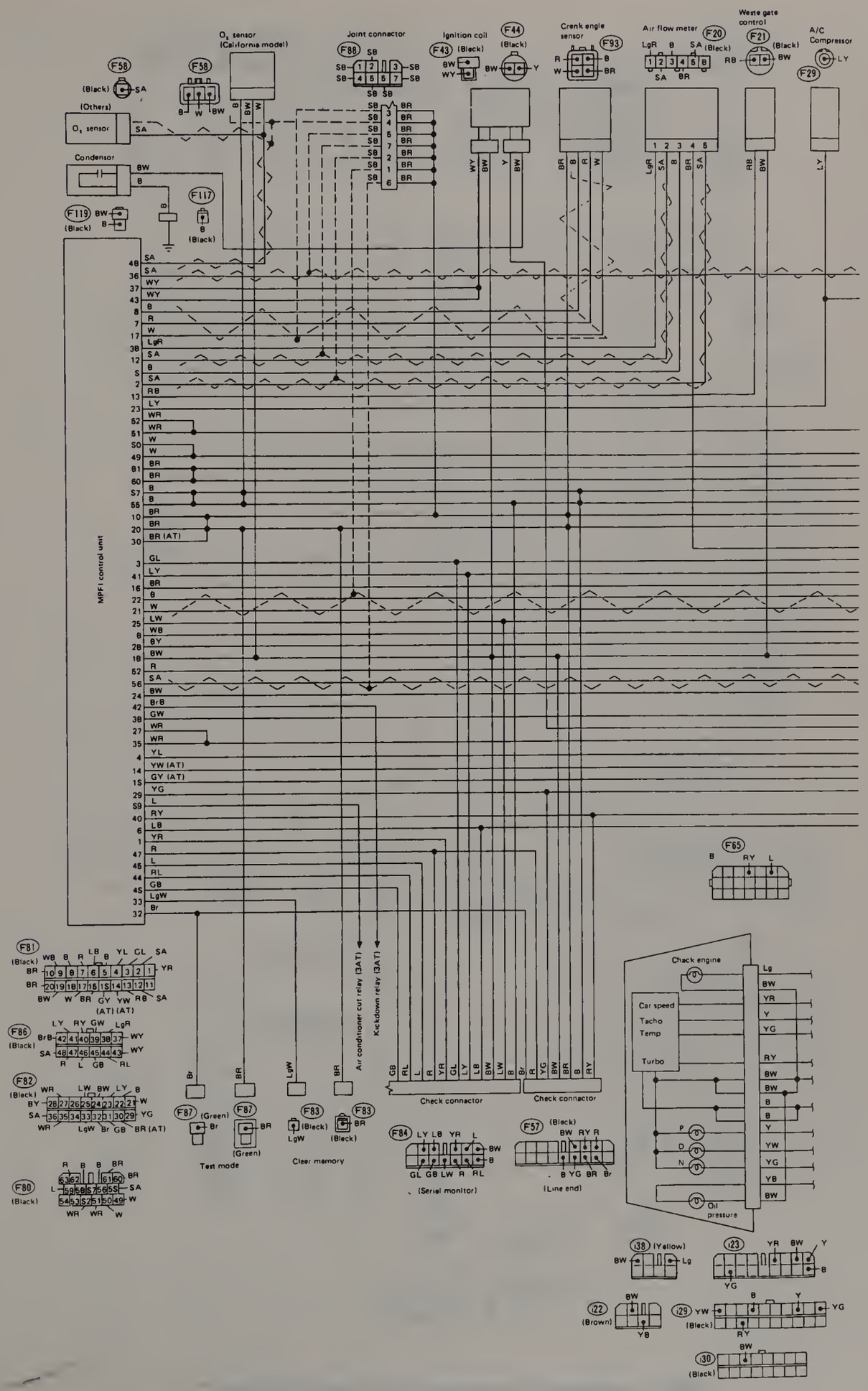


Fig. 13.61 Air suspension system air tank and related components (Sec 13)

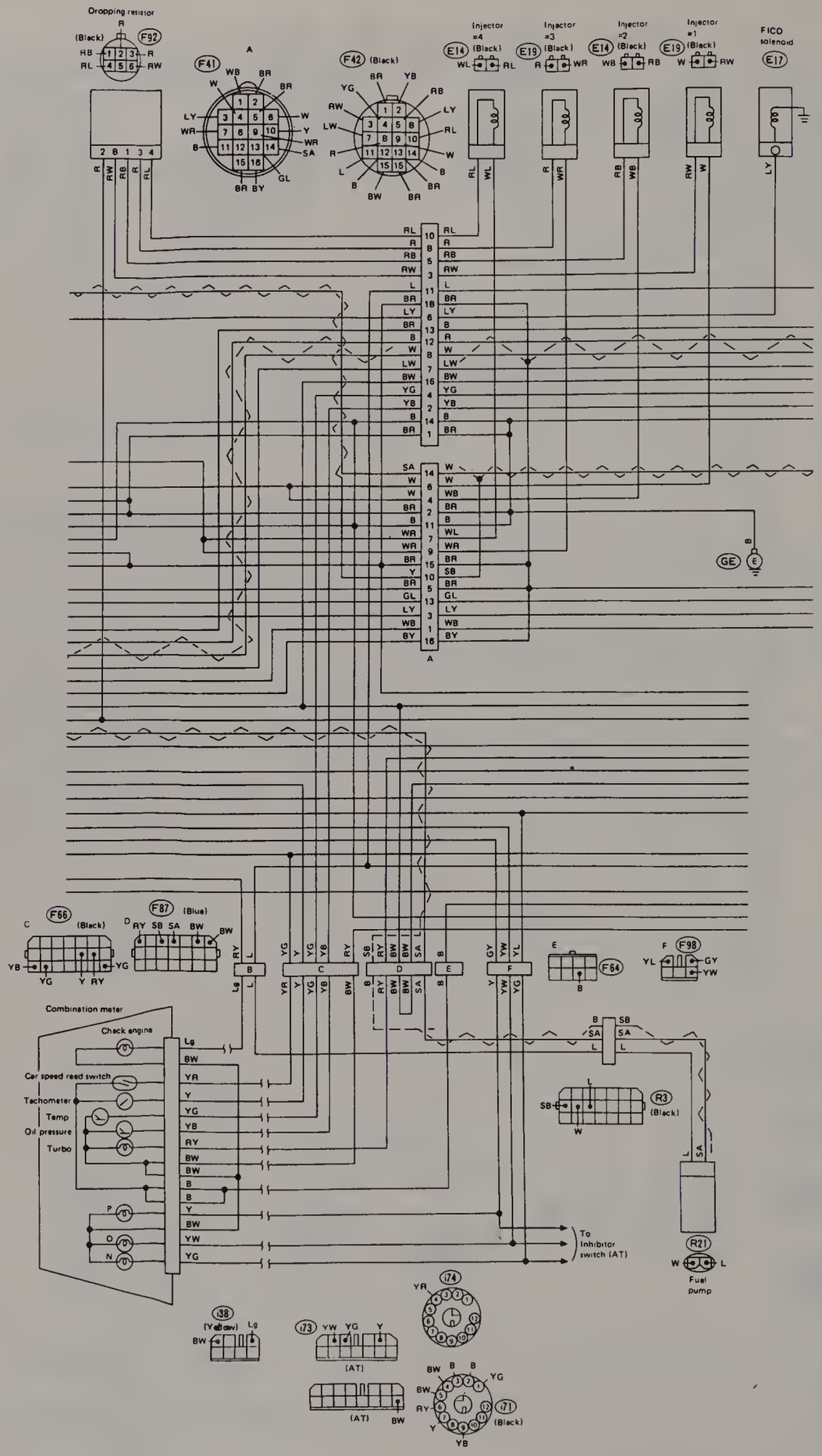
18 Remove the compressor and dryer assembly from the engine compartment after removing the four mounting nuts.
19 Installation is the reverse of removal.

Air tank assembly removal and installation

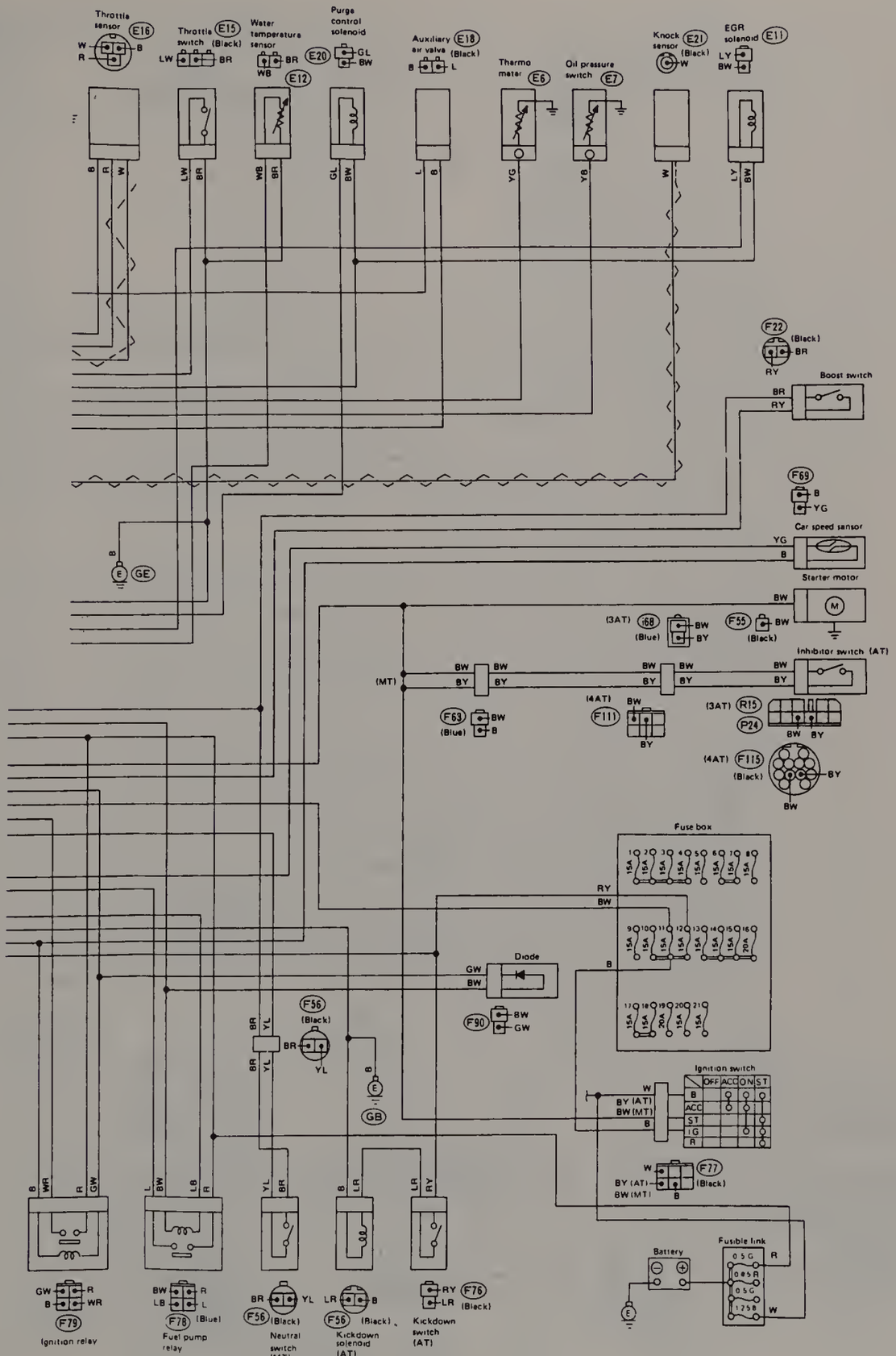
20 Detach the air pipe from the solenoid valve, then remove the solenoid valve coupler (Fig. 13.61).
21 Remove the left hand turn signal from the front bumper.
22 Remove the nuts/bolt and detach the air tank assembly.
23 Installation is the reverse of removal.



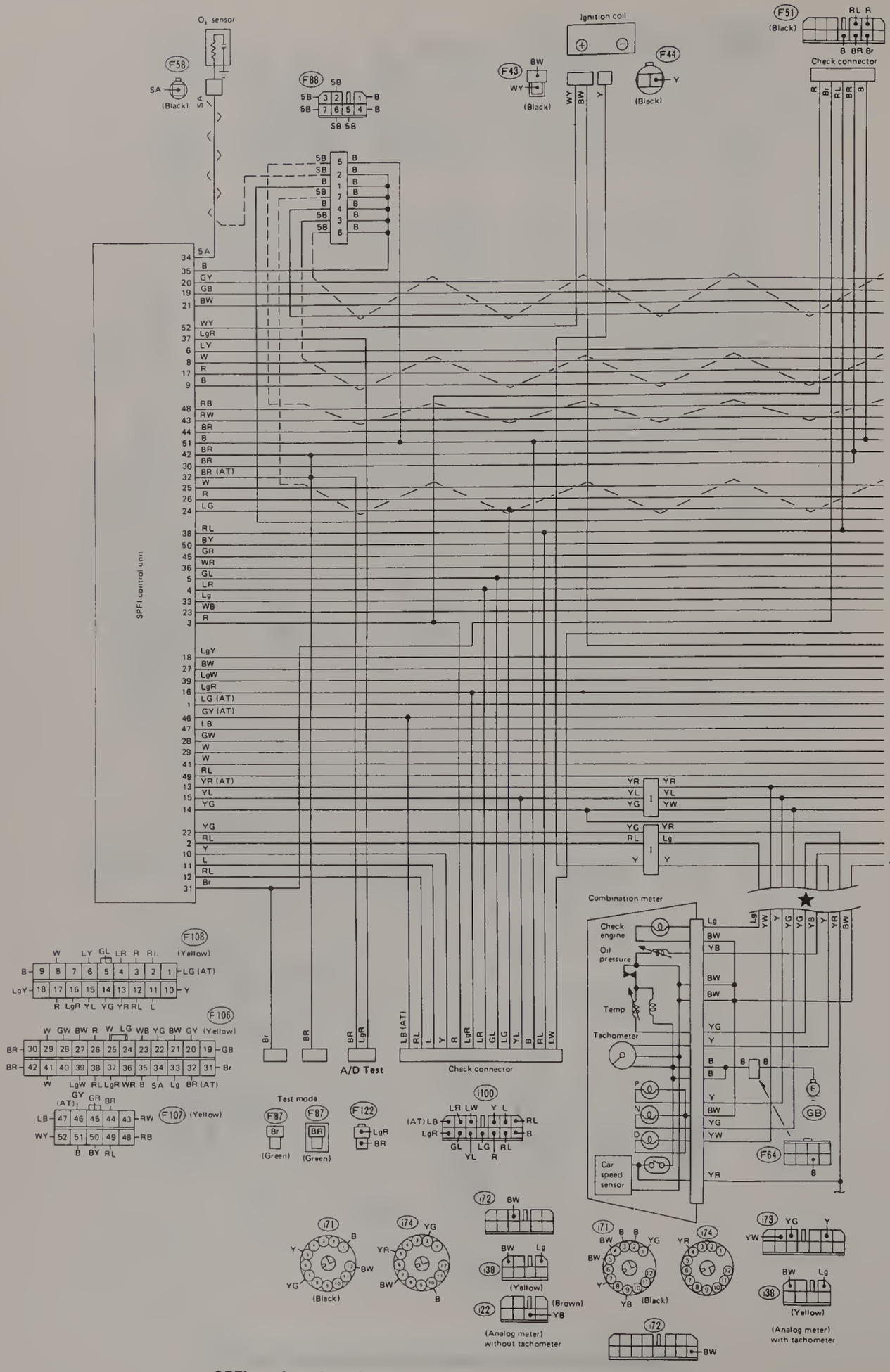
MPFI equipped engine compartment wiring diagram (1 of 3)



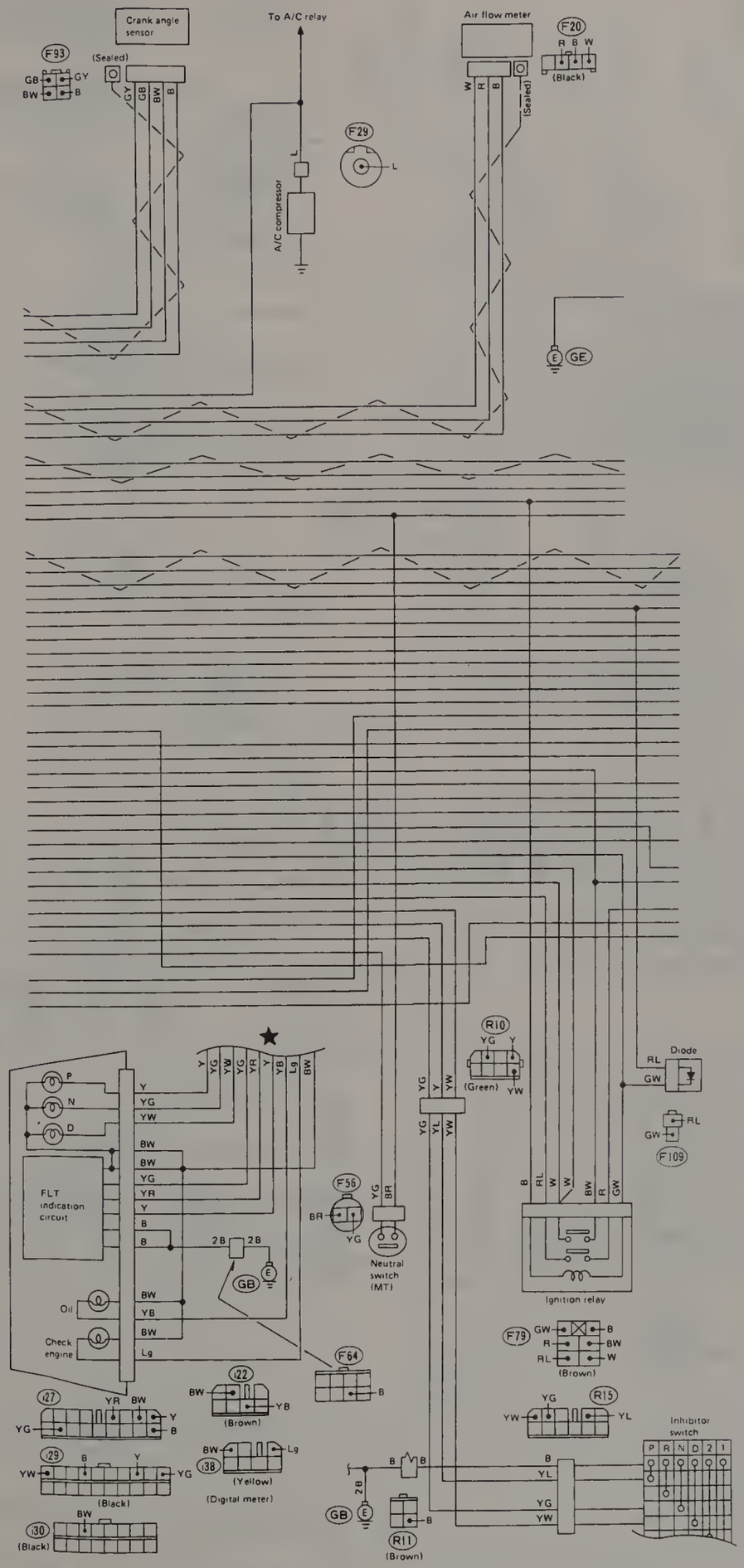
MPFI equipped engine compartment wiring diagram (2 of 3)



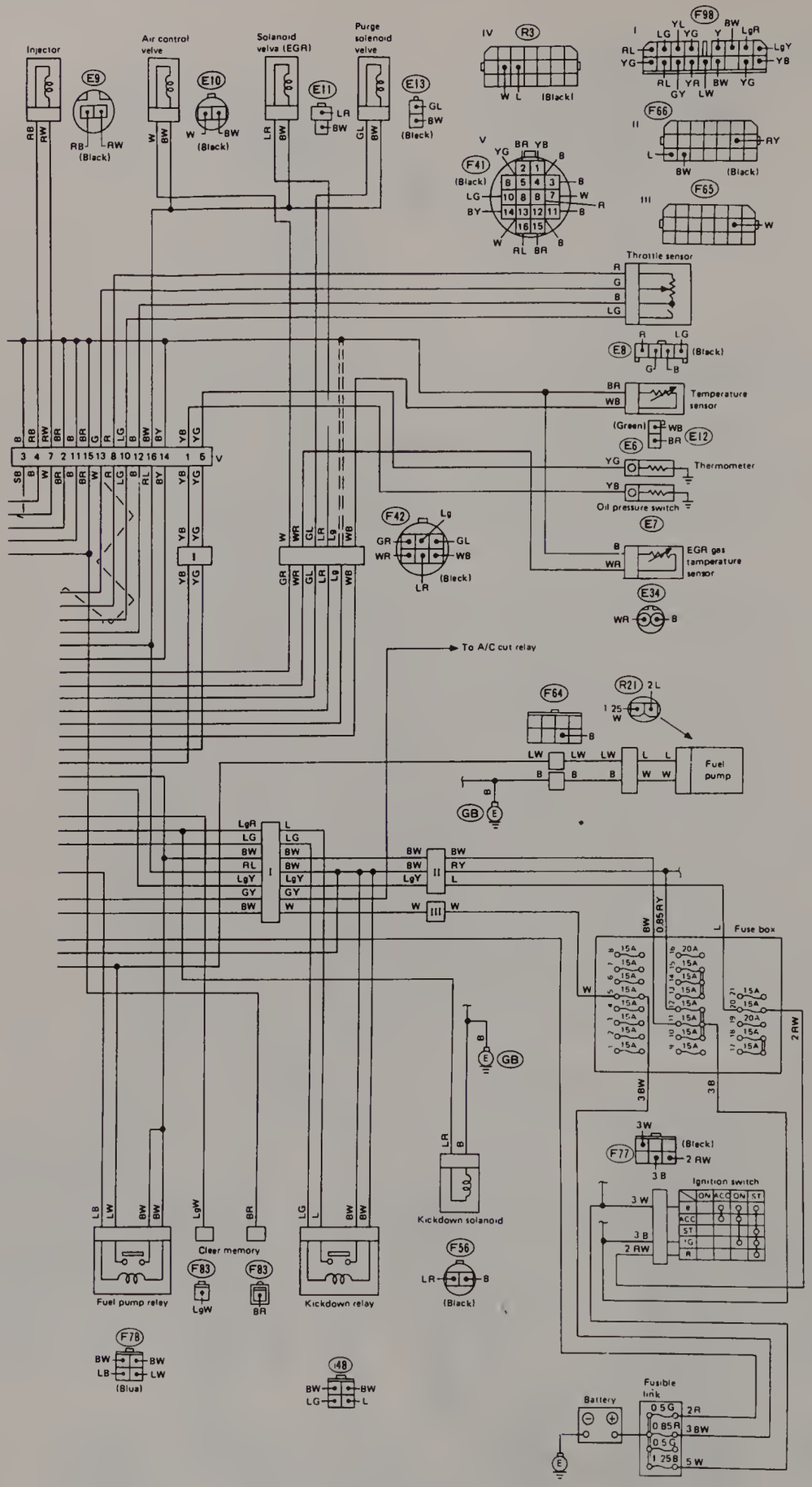
MPFI equipped engine compartment wiring diagram (3 of 3)



SPFI equipped engine compartment wiring diagram (1 of 3)



SPFI equipped engine compartment wiring diagram (2 of 3)



SPFI equipped engine compartment wiring diagram (3 of 3)

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*

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ALFA ROMEO
531 **Alfa Romeo** Sedan & Coupe '73 thru '80

AMC
Jeep CJ — *see JEEP (412)*
694 **Mid-size models,** Concord, Hornet, Gremlin & Spirit '70 thru '83
*934 **(Renault) Alliance & Encore** all models '83 thru '85

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162 **100** all models '69 thru '77
615 **4000** all models '80 thru '87
428 **5000** all models '77 thru '83
*1117 **5000** all models '84 thru '86
207 **Fox** all models '73 thru '79

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Healey Sprite — *see MG Midget Roadster (265)*

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527 **Mini** all models '59 thru '69
*646 **Mini** all models '69 thru '87

BMW
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*632 **528i & 530i** all models '75 thru '80
240 **1500 thru 2002** all models except Turbo '59 thru '77
348 **2500, 2800, 3.0 & Bavaria** all models '69 thru '76

BUICK
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*627 **Mid-size** all rear-drive **Regal & Century** models with V6, V8 and Turbo '74 thru '87
Skyhawk — *see GENERAL MOTORS J-Cars (766)*
552 **Skylark** all X-car models '80 thru '85

CADILLAC
Cimarron — *see GENERAL MOTORS J-Cars (766)*

CAPRI
296 **2000 MK I** Coupe all models '71 thru '75
283 **2300 MK II** Coupe all models '74 thru '78
205 **2600 & 2800** V6 Coupe all models '71 thru '75
375 **2800 Mk II** V6 Coupe all models '75 thru '78
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Cavalier — *see GENERAL MOTORS J-Cars (766)*
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*625 **Chevelle, Malibu & El Camino** all V6 & V8 models '69 thru '86
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*1336 **Corvette** all models '84 thru '87
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319 **Luv Pick-up** all 2WD & 4WD models '72 thru '82
*626 **Monte Carlo** all V6, V8 & Turbo models '70 thru '86
241 **Nova** all V8 models '69 thru '79
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*831 **S-10 & GMC S-15 Pick-ups** all models '82 thru '87
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208 **Vega** all models except Cosworth '70 thru '77

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Laser — *see DODGE Daytona & Chrysler Laser (1140)*

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430 **510** all models '78 thru '81
372 **610** all models '72 thru '76
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359 **Granada & Mercury Monarch** all in-line, 6 cyl & V8 models '75 thru '80
*754 **Ford & Mercury Full-size,** FORD: LTD ('75 thru '82); Custom 500; Country Squire; Crown Victoria, MERCURY: Marquis ('75 thru '82); Gran Marquis; Colony Park, all V8 models '75 thru '84
773 **Ford & Mercury Mid-size** FORD: Torino; Gran Torino; Elite; Ranchero; LTD II; LTD ('83 thru '84); Thunderbird ('75 thru '82), MERCURY: Montego; Comet; Marquis ('83 thru '86); Cougar ('75 thru '82); LINCOLN: Versailles, all 4 cyl, in-line 6 cyl, V6 & V8 models '75 thru '80
*654 **Mustang & Mercury Capri** all in-line models & Turbo '79 thru '87
*558 **Mustang & Mercury Capri** all V6 & V8 models '79 thru '87
*1418 **Tempo & Mercury Topaz** all gasoline models '84 thru '87
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231 **Mustang II** all 4 cyl, V6 & V8 models '74 thru '78
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*344 **Vans** all V8 Econoline models '69 thru '86

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*601 **Prelude CVCC** all models '79 thru '82

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*242 **XJ6** all 6 cyl models '68 thru '86
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533 **Lancia Beta** Sedan, Coupe & HPE all models '76 thru '80

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529 **Diesel** all models '58 thru '80

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*267 **B1600, B1800 & B2000 Pick-ups** '72 thru '84
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096 **RX3** all models '72 thru '76
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698 **350 & 450** Sedan, Coupe & Roadster all models '71 thru '80
697 **Diesel 123 Series** 200D, 220D, 240D, 240TD, 300D, 300CD, 300TD, 4- & 5-cyl incl. Turbo '76 thru '85

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*867 **Firebird** all models '82 thru '87
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*264 **911** all Coupe & Targa models except Turbo '65 thru '85
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097 **12 Saloon & Estate** all models 1289 cc engines '70 thru '80
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598 **18i & Sportwagon** all models '81 thru '86
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*365 **3500 SDI** V8 all models '76 thru '84

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198 **95 & 96** V4 all models '66 thru '75
247 **99** all models including Turbo '69 thru '80
*980 **900** all models including Turbo '79 thru '85

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237 **1100, 1300, 1400 & 1600** all models '71 thru '79
*681 **1600 & 1800** 2WD & 4WD all models '80 thru '86

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229 **Celica** ST, GT & liftback all models '71 thru '78
437 **Celica** all models '78 thru '81
*935 **Celica** all models except front wheel drive and Supra '82 thru '85
680 **Celica Supra** all models '79 thru '81
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361 **Corolla** all models '75 thru '79
*961 **Corolla** all models (rear wheel drive) '80 thru '82
*1025 **Corolla** all models (front wheel drive) 1984
*636 **Corolla Tercel** all models '80 thru '82
230 **Corona & MK II** all 4 cyl sohc models '69 thru '74
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082 **Transporter 1600** all models '68 thru '79
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*270 **240 Series** all models '74 thru '86
400 **260 Series** all models '75 thru '82

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