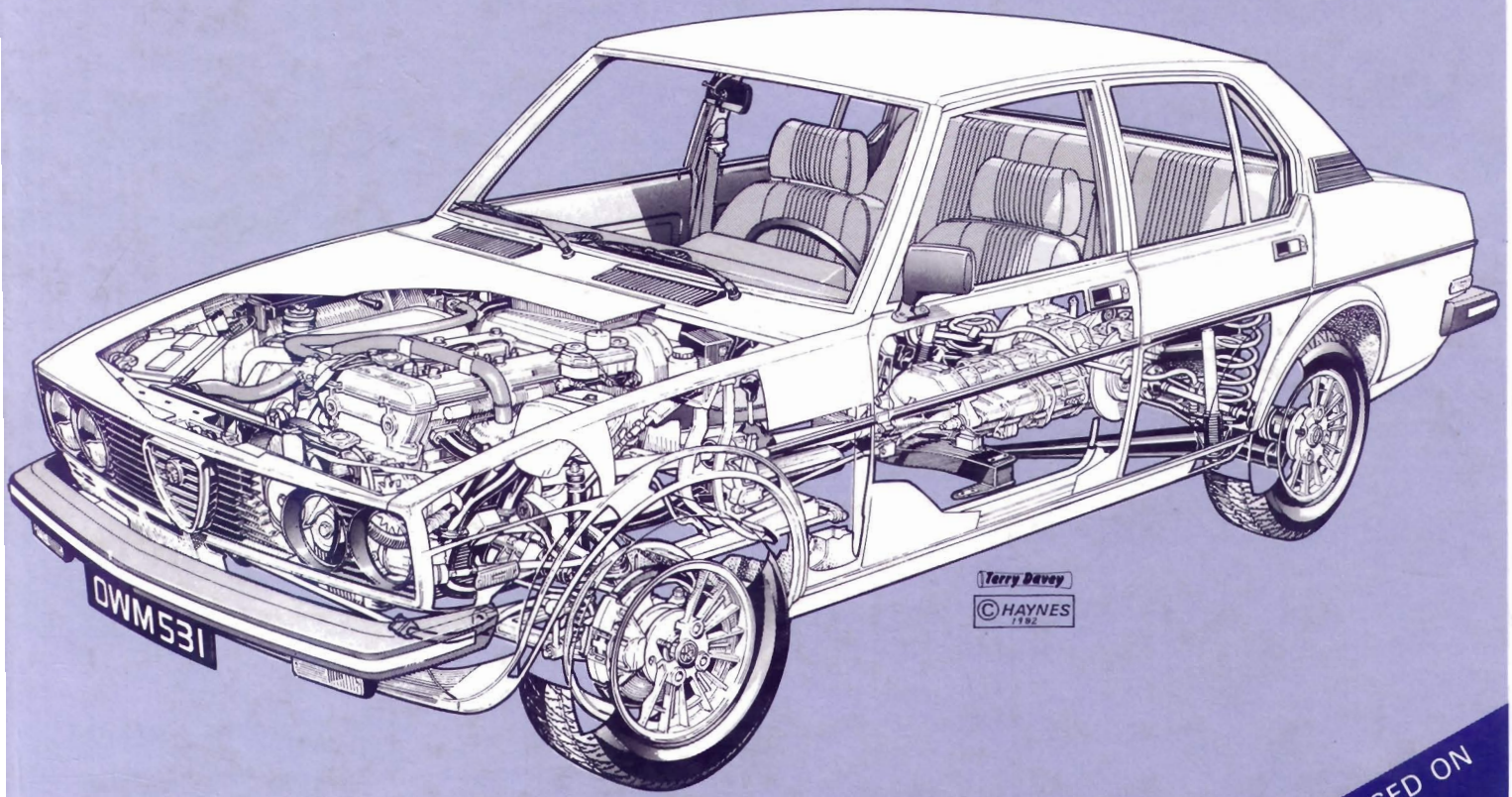
ALFA ROMEO ALFETTA

1973 to 1987 □ All models inc. GTV
1570 cc □ 1779 cc □ 1962 cc

Haynes®

THE BOOK

Owners Workshop Manual



EVERY MANUAL BASED ON A STRIPDOWN AND REBUILD

Alfa Romeo Owners Workshop Manual

Peter G Strasman

Models covered
All Alfa Romeo Alfetta Saloon and Coupe models, including GTV
1570 cc, 1779 cc & 1962 cc

Does not fully cover additional features of special/limited edition variants
Does not cover 2.5 litre GTV-6

ISBN 1 85010 448 4

Printed in England *(531-9S3)*

AB

Haynes Publishing Group
Sparkford Nr Yeovil
Somerset BA22 7JJ England

Haynes Publications, Inc
861 Lawrence Drive
Newbury Park
California 91320 USA

British Library Cataloguing in Publication Data

Strasman, Peter G. *1923–*
Alfa Romeo Alfetta owners workshop manual.
1. Cars. Maintenance & repair – Amateurs' manuals
I. Title
629.28'722
ISBN 1-85010-448-4

Acknowledgements

Thanks are due to Alfa Romeo (GB) Limited for the provision of technical information and for the use of certain illustrations. Castrol Limited supplied lubrication data, the Champion Sparking Plug Company supplied the illustrations showing the various spark plug conditions, and Sykes-Pickavant Ltd provided some of the workshop tools. Special thanks are due to all those people at Sparkford who helped in the production of this manual.

About this manual

Its aim

The aim 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 should you choose to get it done by a garage), provide information on routine maintenance and servicing, and give a logical course of action and diagnosis when random faults occur. However, it is hoped that you will use the manual by tackling the work yourself. On simpler jobs it may even be quicker than booking the car into a garage and going there twice, to leave and collect it. Perhaps most important, a lot of money can be saved by avoiding the costs a garage must charge to cover its labour and overheads.

The manual has drawings and descriptions to show the function of the various components so that their layout can be understood. Then the tasks are described and photographed in a step-by-step sequence so that even a novice can do the work.

Its arrangement

The manual is divided into thirteen Chapters, each covering a logical sub-division of the vehicle. The Chapters are each divided into Sections, numbered with single figures, eg 5; and the Sections into paragraphs (or sub-sections), with decimal numbers following on from the Section they are in, eg 5.1, 5.2 5.3 etc.

It is freely illustrated, especially in those parts where there is a detailed sequence of operations to be carried out. There are two forms of illustration: figures and photographs. The figures are numbered in sequence with decimal numbers, according to their position in the Chapter – eg Fig. 6.4 is the fourth drawing/illustration in Chapter 6. Photographs carry the same number (either individually or in related groups) as the Section or sub-section to which they relate.

There is an alphabetical index at the back of the manual as well as a contents list at the front. Each Chapter is also preceded by its own individual contents list.

References to the 'left' or 'right' of the vehicle are in the sense of a person in the driver's seat facing forwards.

Unless otherwise stated, nuts and bolts are removed by turning anti-clockwise, and tightened by turning clockwise.

Vehicle manufacturers continually make changes to specifications and recommendations, and these, when notified, are incorporated into our manuals at the earliest opportunity.

Whilst every care is taken to ensure that the information in this manual is correct, no liability can be accepted by the authors or publishers for loss, damage or injury caused by any errors in, or omissions from, the information given.

Introduction to the Alfetta

This may be the car for the owner who wants something a little different in the way of styling and performance. Both the Saloon and the Coupe provide good roadholding and excellent braking, combined with a high level of comfort and finish.

The home mechanic should be aware however that lack of working space makes some servicing operations and the removal of major assemblies difficult and time-consuming.

A few special tools are required for some of the more intricate jobs, and there is an addiction to the use of pop rivets for fixing many components which are usually expected to be retained with bolts and nuts to facilitate removal.

Other than these points, the cars present no real problems for the enthusiast who has the time necessary to keep the standard of maintenance up to the specified level.

Spare parts are generally available from stock from agents, but may be considered expensive by comparison with similar production models from other manufacturers.

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Alfetta 1.8 Saloon

Alfetta GT 1.6 Coupe

Alfetta GTV Strada Coupe

Alfetta GTV 2.0 Coupe

General dimensions and weights

Saloon and Sport Sedan

Dimensions

Overall length (with standard bumpers)	4385 mm (172.6 in)
Overall length (with impact-absorbing bumpers)	4500 mm (177.2 in)
Overall width	1640 mm (64.6 in)
Overall height	1430 mm (56.3 in)
Ground clearance	152.4 mm (6.0 in)
Wheelbase	2510 mm (98.82 in)
Front track	1366 mm (53.78 in)
Rear track	1358 mm (53.46 in)

Weights

Kerb weight (full tank):	
Except N. America	1060 kg (2337 lb)
N. America without impact-absorbing bumpers	1200 kg (2645 lb)
N. America with impact-absorbing bumpers	1297 kg (2860 lb)
Maximum towing weight	1200 kg (2645 lb)

Coupe and Sprint Veloce

Dimensions

Overall length	4345 mm (171.1 in)
Overall width	1660 mm (65.4 in)
Overall height	1330 mm (52.4 in)
Ground clearance	152.4 mm (6.0 in)
Wheelbase	2400 mm (94.49 in)
Front track	1360 mm (53.54 in)
Rear track	1358 mm (53.46 in)

Weights

Kerb weight (full tank)	1232 kg (2710 lb)
Maximum towing weight	800 kg (1763 lb)

Use of English

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

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

Buying spare parts and vehicle identification numbers

Buying spare parts

Spare parts are available from many sources, for example: Alfa Romeo garages, other garages and accessory shops, and motor factors. Our advice regarding spare part sources is as follows.:

Officially appointed Alfa Romeo garages – This is the best source of parts which are peculiar to your vehicle and are otherwise not generally available (eg complete cylinder heads, internal gearbox components, badges, interior trim etc). It is also the only place at which you should buy parts if your car is still under warranty – non-Alfa Romeo components may invalidate the warranty. To be sure of obtaining the correct parts it will always be necessary to give the storeman your car's engine and chassis number, and if possible, to take the 'old' part along for positive identification. Remember that many parts are available on a factory exchange scheme – any parts returned should always be clean! It obviously makes good sense to go straight to the specialists on your car for this type of part for they are best equipped to supply you.

Other garages and accessory shops – These are often very good places to buy materials and components needed for the maintenance of your car (eg oil filters, spark plugs, bulbs, drivebelts, oils and greases, touch-up paint, filler paste etc). They also sell general accessories, usually have convenient opening hours, charge lower prices and can often be found not far from home.

Motor factors – Good factors will stock all of the more important components which wear out relatively quickly (eg clutch components, pistons, valves, exhaust system, brake cylinders/pipes/hoses/seals and pads etc). Motor factors will often provide new or reconditioned components on a part exchange basis – this can save a considerable amount of money.

Vehicle identification numbers

It is most important to identify the vehicle accurately when ordering spare parts or asking for information.

A quantity of identification numbers and labels are affixed to the car as shown in the diagram, but it is emphasised that only on North American vehicles are those marked * to be found.

The engine number is stamped on the engine casing on the left-hand side (photo).

Engine number next to flywheel

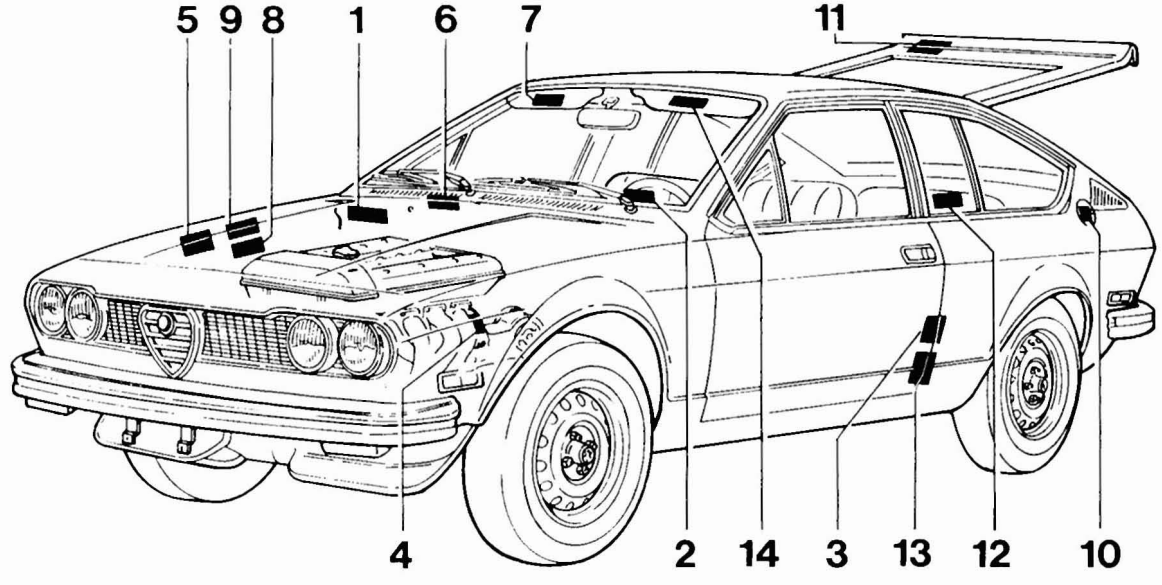


Plate and sticker locations

1 *Vehicle identification number – engine compartment*
2* *VIN – top of facia panel*
3* *DOT certification*
4 *Engine number*
5* *Exhaust emission data*
6* *Load/seating capacity*
7 *Running-in data*
8 *Lubrication data*
9 *Spark plug data*
10 *Fuel requirement*
11 *Paint code*
12 *Exhaust emission level during production*
13* *Air pollution compliance certificate*
14* *Catalytic converter overheat warning*
* *North America only*

Tools and working facilities

Introduction

A selection of good tools is a fundamental requirement for anyone contemplating the maintenance and repair of a motor vehicle. For the owner who does not possess any, their purchase will prove a considerable expense, offsetting some of the savings made by doing-it-yourself. However, provided that the tools purchased meet the relevant national safety standards and are of good quality, they will last for many years and prove an extremely worthwhile investment.

To help the average owner to decide which tools are needed to carry out the various tasks detailed in this manual, we have compiled three lists of tools under the following headings: *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 and confine himself to the simpler jobs around the vehicle. Then, as his confidence and experience grow, he can undertake more difficult tasks, buying extra tools as, and when, they are needed. In this way, a *Maintenance and minor repair* tool kit can be built-up into a *Repair and overhaul* tool kit over a considerable period of time without any major cash outlays. The experienced do-it-yourselfer will have a tool kit good enough for most repair and overhaul procedures and will add tools from the *Special* category when he feels the expense is justified by the amount of use to which these tools will be put.

It is obviously not possible to cover the subject of tools fully here. For those who wish to learn more about tools and their use there is a book entitled *How to Choose and Use Car Tools* available from the publishers of this manual.

Maintenance and minor repair tool kit

The tools given in this list should be considered as a minimum requirement if routine maintenance, servicing and minor repair operations are to be undertaken. We recommend the purchase of combination spanners (ring one end, open-ended the other); although more expensive than open-ended ones, they do give the advantages of both types of spanner.

Combination spanners - 10, 11, 12, 13, 14 & 17 mm
Adjustable spanner - 9 inch
Spark plug spanner (with rubber insert)
Spark plug gap adjustment tool
Set of feeler gauges
Brake bleed nipple spanner
Screwdriver - 4 in long x $\frac{1}{4}$ in dia (flat blade)
Screwdriver - 4 in long x $\frac{1}{4}$ in dia (cross blade)
Combination pliers - 6 inch
Hacksaw (junior)
Tyre pump
Tyre pressure gauge
Oil can
Fine emery cloth (1 sheet)
Wire brush (small)
Funnel (medium size)

Repair and overhaul tool kit

These tools are virtually essential for anyone undertaking any major repairs to a motor vehicle, and are additional to those given in the *Maintenance and minor repair* list. Included in this list is a comprehensive set of sockets. Although these are expensive they will be found invaluable as they are so versatile - particularly if various drives are included in the set. We recommend the $\frac{1}{2}$ in square-drive type, as this can be used with most proprietary torque wrenches. If you cannot afford a socket set, even bought piecemeal, then inexpensive tubular box spanners are a useful alternative.

The tools in this list will occasionally need to be supplemented by tools from the *Special* list.

Sockets (or box spanners) to cover range in previous list
Reversible ratchet drive (for use with sockets)
Extension piece, 10 inch (for use with sockets)
Universal joint (for use with sockets)
Torque wrench (for use with sockets)
'Mole' wrench - 8 inch
Ball pein hammer
Soft-faced hammer, plastic or rubber
Screwdriver - 6 in long x $\frac{5}{16}$ in dia (flat blade)
Screwdriver - 2 in long x $\frac{5}{16}$ in square (flat blade)
Screwdriver - $1\frac{1}{2}$ in long x $\frac{1}{4}$ in dia (cross blade)
Screwdriver - 3 in long x $\frac{1}{8}$ in dia (electricians)
Pliers - electricians side cutters
Pliers - needle nosed
Pliers - circlip (internal and external)
Cold chisel - $\frac{1}{2}$ inch
Scriber
Scraper
Centre punch
Pin punch
Hacksaw
Valve grinding tool
Steel rule/straight-edge
Allen keys
Selection of files
Wire brush (large)
Axle-stands
Jack (strong scissor or hydraulic type)

Special tools

The tools in this list are those which are not used regularly, are expensive to buy, or which need to be used in accordance with their manufacturers' instructions. Unless relatively difficult mechanical jobs are undertaken frequently, it will not be economic to buy many of these tools. Where this is the case, you could consider clubbing together with friends (or joining a motorists' club) to make a joint purchase, or borrowing the tools against a deposit from a local garage or tool hire specialist.

The following list contains only those tools and instruments freely available to the public, and not those special tools produced by the vehicle manufacturer specifically for its dealer network. You will find occasional references to these manufacturers' special tools in the text of this manual. Generally, an alternative method of doing the job without the vehicle manufacturers' special tool is given. However, sometimes, there is no alternative to using them. Where this is the case and the relevant tool cannot be bought or borrowed, you will have to entrust the work to a franchised garage.

Valve spring compressor (where applicable)
Piston ring compressor
Balljoint separator
Universal hub/bearing puller
Impact screwdriver
Micrometer and/or vernier gauge
Dial gauge
Stroboscopic timing light
Dwell angle meter/tachometer
Universal electrical multi-meter
Cylinder compression gauge
Lifting tackle
Trolley jack
Light with extension lead

Buying tools

For practically all tools, a tool factor is the best source since he will have a very comprehensive range compared with the average garage or accessory shop. Having said that, accessory shops often offer excellent quality tools at discount prices, so it pays to shop around.

There are plenty of good tools around at reasonable prices, but always aim to purchase items which meet the relevant national safety standards. If in doubt, ask the proprietor or manager of the shop for advice before making a purchase.

Care and maintenance of tools

Having purchased a reasonable tool kit, it is necessary to keep the tools in a clean serviceable condition. After use, always wipe off any dirt, grease and metal particles using a clean, dry cloth, before putting the tools away. Never leave them lying around after they have been used. A simple tool rack on the garage or workshop wall, for items such as screwdrivers and pliers is a good idea. Store all normal wrenches and sockets in a metal box. Any measuring instruments, gauges, meters, etc, must be carefully stored where they cannot be damaged or become rusty.

Take a little care when tools are used. Hammer heads inevitably become marked and screwdrivers lose the keen edge on their blades from time to time. A little timely attention with emery cloth or a file will soon restore items like this to a good serviceable finish.

Working facilities

Not to be forgotten when discussing tools, is the workshop itself. If anything more than routine maintenance is to be carried out, some form of suitable working area becomes essential.

It is appreciated that many an owner mechanic is forced by circumstances to remove an engine or similar item, without the benefit of a garage or workshop. Having done this, any repairs should always be done under the cover of a roof.

Wherever possible, any dismantling should be done on a clean, flat workbench or table at a suitable working height.

Any workbench needs a vice: one with a jaw opening of 4 in (100 mm) is suitable for most jobs. As mentioned previously, some clean dry storage space is also required for tools, as well as for lubricants, cleaning fluids, touch-up paints and so on, which become necessary.

Another item which may be required, and which has a much more general usage, is an electric drill with a chuck capacity of at least $\frac{5}{16}$ in (8 mm). This, together with a good range of twist drills, is virtually essential for fitting accessories such as mirrors and reversing lights.

Last, but not least, always keep a supply of old newspapers and clean, lint-free rags available, and try to keep any working area as clean as possible.

Spanner jaw gap comparison table

Jaw gap (in)	Spanner size
0.250	$\frac{1}{4}$ in AF
0.276	7 mm
0.313	$\frac{5}{16}$ in AF
0.315	8 mm
0.344	$\frac{11}{32}$ in AF; $\frac{1}{8}$ in Whitworth
0.354	9 mm
0.375	$\frac{3}{8}$ in AF
0.394	10 mm
0.433	11 mm
0.438	$\frac{7}{16}$ in AF
0.445	$\frac{3}{16}$ in Whitworth; $\frac{1}{4}$ in BSF
0.472	12 mm
0.500	$\frac{1}{2}$ in AF
0.512	13 mm
0.525	$\frac{1}{4}$ in Whitworth; $\frac{5}{16}$ in BSF
0.551	14 mm
0.563	$\frac{9}{16}$ in AF
0.591	15 mm
0.600	$\frac{5}{16}$ in Whitworth; $\frac{3}{8}$ in BSF
0.625	$\frac{5}{8}$ in AF
0.630	16 mm
0.669	17 mm
0.686	$\frac{11}{16}$ in AF
0.709	18 mm
0.710	$\frac{3}{8}$ in Whitworth; $\frac{7}{16}$ in BSF
0.748	19 mm
0.750	$\frac{3}{4}$ in AF
0.813	$\frac{13}{16}$ in AF
0.820	$\frac{7}{16}$ in Whitworth; $\frac{1}{2}$ in BSF
0.866	22 mm
0.875	$\frac{7}{8}$ in AF
0.920	$\frac{1}{2}$ in Whitworth; $\frac{9}{16}$ in BSF
0.938	$\frac{15}{16}$ in AF
0.945	24 mm
1.000	1 in AF
1.010	$\frac{9}{16}$ in Whitworth; $\frac{5}{8}$ in BSF
1.024	26 mm
1.063	$1\frac{1}{16}$ in AF; 27 mm
1.100	$\frac{5}{8}$ in Whitworth; $\frac{11}{16}$ in BSF
1.125	$1\frac{1}{8}$ in AF
1.181	30 mm
1.200	$\frac{11}{16}$ in Whitworth; $\frac{3}{4}$ in BSF
1.250	$1\frac{1}{4}$ in AF
1.260	32 mm
1.300	$\frac{3}{4}$ in Whitworth; $\frac{7}{8}$ in BSF
1.313	$1\frac{5}{16}$ in AF
1.390	$\frac{13}{16}$ in Whitworth; $\frac{15}{16}$ in BSF
1.417	36 mm
1.438	$1\frac{7}{16}$ in AF
1.480	$\frac{7}{8}$ in Whitworth; 1 in BSF
1.500	$1\frac{1}{2}$ in AF
1.575	40 mm; $\frac{15}{16}$ in Whitworth
1.614	41 mm
1.625	$1\frac{5}{8}$ in AF
1.670	1 in Whitworth; $1\frac{1}{8}$ in BSF
1.688	$1\frac{11}{16}$ in AF
1.811	46 mm
1.813	$1\frac{13}{16}$ in AF
1.860	$1\frac{1}{8}$ in Whitworth; $1\frac{1}{4}$ in BSF
1.875	$1\frac{7}{8}$ in AF
1.969	50 mm
2.000	2 in AF
2.050	$1\frac{1}{4}$ in Whitworth; $1\frac{3}{8}$ in BSF
2.165	55 mm
2.362	60 mm

Wheel changing, jacking and towing

Wheel changing

Before raising the car for this operation, the nuts on the roadwheel concerned should be slackened using either the brace located within the engine compartment or luggage area according to model, or by using a socket spanner and knuckle bar.

If the jack supplied with the car is being used, remove it from its securing clips, hold it in a vertical position and engage its spigot in the lifting hole under the body sill which is nearest to the wheel being removed (photo).

Before proceeding any further, check that the handbrake is fully applied and then chock both sides of the wheels on the opposite side of the car.

Operate the jack until the wheel being removed is clear of the ground, remove the nuts and then the roadwheel. The spare wheel is located beneath the luggage compartment floor (photo).

Refitting is a reversal of removal, but do not attempt to fully tighten the wheel nuts until the car has been lowered to the ground.

Jacking

The jack supplied with the car should only be used for emergency wheel changing as just described, unless safety stands are used to supplement it.

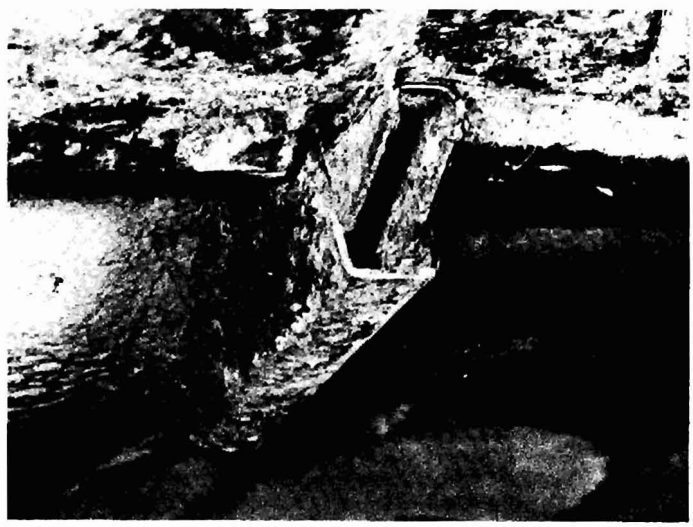
For all repair and maintenance work use preferably a trolley jack, or a hydraulic or screw type bottle jack. All jacks should be supplemented with safety stands placed under reinforced parts of the underbody.

To raise the front end, place the jack under the towing hook or under the suspension lower wishbone arms.

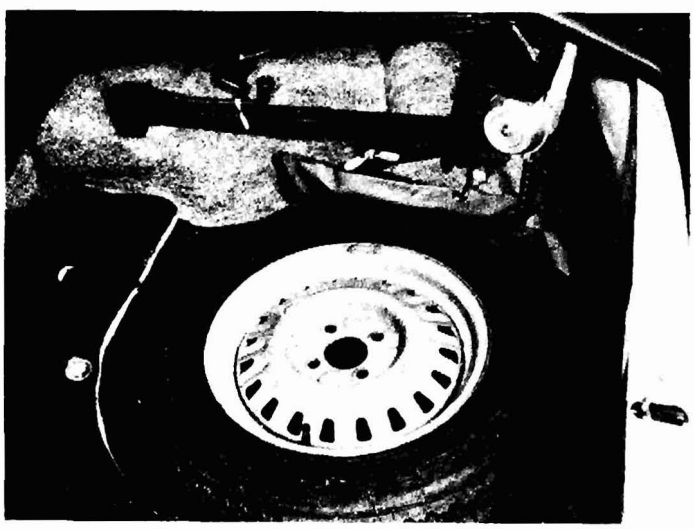
To raise the rear of the car, place the jack under the rear axle tube or suspension front crossmember, or under the sill jacking points.

Towing

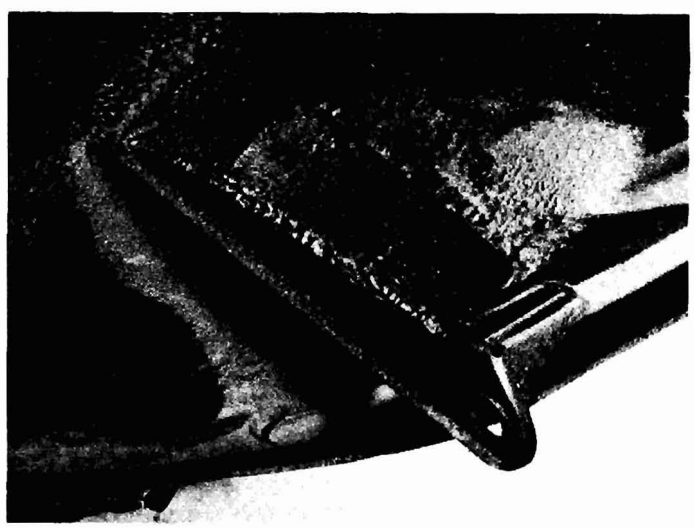
Use the combined towing/jacking hook at the front of the car, or the bracket below the rear body panel (photo). Observe appropriate safety precautions and any applicable regulations when towing. Remember that servo assistance will not be available if the engine is not running, and make sure that the steering is unlocked.



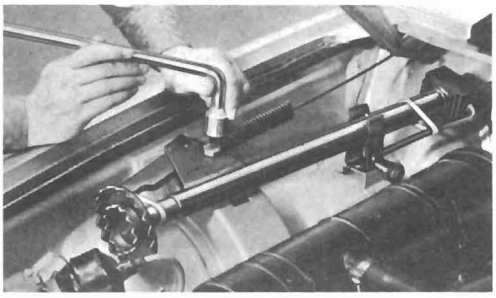
Sill jacking point



Spare wheel and jack location (Coupe)

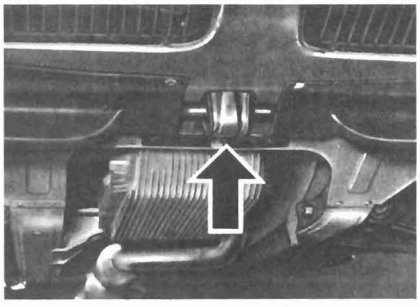


Rear towing hook (Coupe)

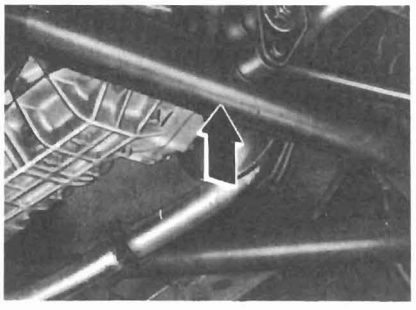


Jack and wheelbrace location (Saloon)

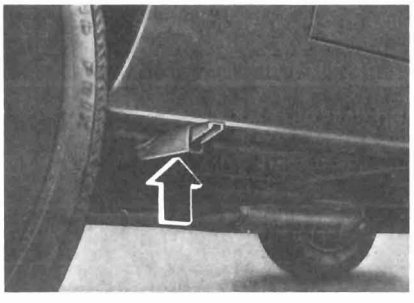
Spare wheel location (Saloon)



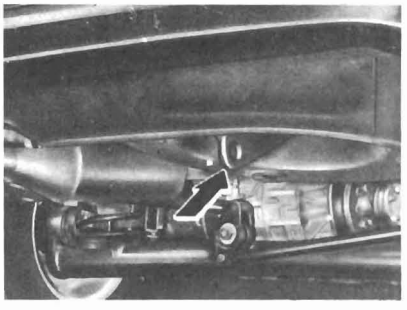
Front end jacking/towing hook (arrowed)



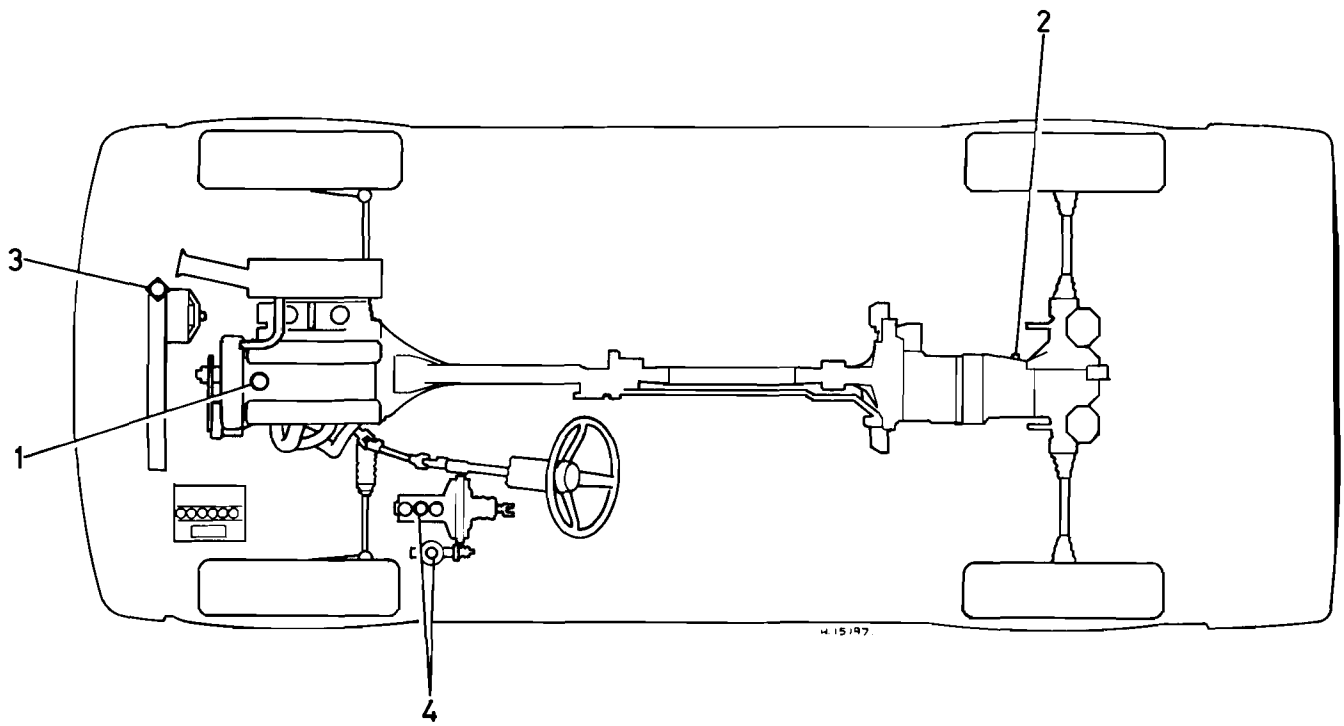
Jacking point on rear axle tube (arrowed)



Sill jacking point (arrowed)



Rear towing hook (arrowed)



Recommended lubricants and fluids

Component or system	Lubricant type or specification
1 **Engine**	Multigrade engine oil SAE 10W/50
2 **Transmission**	SAE 80W/90 gear oil*
3 **Cooling system**	Antifreeze to BS 3151 or 3152
4 **Brake and clutch hydraulic systems**	Hydraulic fluid to SAE J1703C, FMVSS 116 or DOT 3

**This is as specified by Alfa Romeo. Other sources recommend the use of an EP oil.*

Safety first!

Professional motor mechanics are trained in safe working procedures. However enthusiastic you may be about getting on with the job in hand, do take the time to ensure that your safety is not put at risk. A moment's lack of attention can result in an accident, as can failure to observe certain elementary precautions.

There will always be new ways of having accidents, and the following points do not pretend to be a comprehensive list of all dangers; they are intended rather 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 single jack when working underneath the vehicle. Always use reliable additional means of support, such as axle stands, securely placed under a part of the vehicle that you know will not give way.

DON'T attempt to loosen or tighten high-torque nuts (e.g. wheel hub nuts) while the vehicle is on a jack; it may be pulled off.

DON'T start the engine without first ascertaining that the transmission is in neutral (or 'Park' where applicable) and the parking brake applied.

DON'T suddenly remove the filler cap from a hot cooling system – cover it with a cloth and release the pressure gradually first, or you may get scalded by escaping coolant.

DON'T attempt to drain oil until you are sure it has cooled sufficiently to avoid scalding you.

DON'T grasp any part of the engine, exhaust or catalytic converter without first ascertaining that it is sufficiently cool to avoid burning you.

DON'T allow brake fluid or antifreeze to contact vehicle paintwork.

DON'T syphon toxic liquids such as fuel, brake fluid or antifreeze by mouth, or allow them to remain on your skin.

DON'T inhale dust – it may be injurious to health (see *Asbestos* below).

DON'T allow any spilt oil or grease to remain on the floor – wipe it up straight away, before someone slips on it.

DON'T use ill-fitting spanners or other tools which may slip and cause injury.

DON'T attempt to lift a heavy component which may be beyond your capability – get assistance.

DON'T rush to finish a job, or take unverified short cuts.

DON'T allow children or animals in or around an unattended vehicle.

DO wear eye protection when using power tools such as drill, sander, bench grinder etc, and when working under the vehicle.

DO use a barrier cream on your hands prior to undertaking dirty jobs – it will protect your skin from infection as well as making the dirt easier to remove afterwards; but make sure your hands aren't left slippery. Note that long-term contact with used engine oil can be a health hazard.

DO keep loose clothing (cuffs, tie etc) and long hair well out of the way of moving mechanical parts.

DO remove rings, wristwatch etc, before working on the vehicle – especially the electrical system.

DO ensure that any lifting tackle used has a safe working load rating adequate for the job.

DO keep your work area tidy – it is only too easy to fall over articles left lying around.

DO get someone to check periodically that all is well, when working alone on the vehicle.

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

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

IF, in spite of following these precautions, you are unfortunate enough to injure yourself, seek medical attention as soon as possible.

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 petrol (gasoline) is highly flammable. Never smoke, or have any kind of naked flame around, when working on the vehicle. But the risk does not end there – a spark caused by an electrical short-circuit, by two metal surfaces contacting each other, by careless use of tools, or even by static electricity built up in your body under certain conditions, can ignite petrol vapour, which in a confined space is highly explosive.

Always disconnect the battery earth (ground) terminal before working on any part of the fuel or electrical system, and never risk spilling fuel on to a hot engine or exhaust.

It is recommended that a fire extinguisher of a type suitable for fuel and electrical fires is kept handy in the garage or workplace at all times. Never try to extinguish a fuel or electrical fire with water.

Note: *Any reference to a 'torch' appearing in this manual should always be taken to mean a hand-held battery-operated electric lamp or flashlight. It does NOT mean a welding/gas torch or blowlamp.*

Fumes

Certain fumes are highly toxic and can quickly cause unconsciousness and even death if inhaled to any extent. Petrol (gasoline) vapour comes into this category, as do the vapours from certain solvents such as trichloroethylene. 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 carefully. Never use materials from unmarked containers – they may give off poisonous vapours.

Never run the engine of a motor vehicle 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 workplace.

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

The battery

Never cause a spark, or allow a naked light, near the vehicle's battery. It will normally be giving off a certain amount of hydrogen gas, which is highly explosive.

Always disconnect the battery earth (ground) terminal before working on the fuel or electrical systems.

If possible, loosen the filler plugs 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 topping up and when carrying the battery. The acid electrolyte, even when diluted, is very corrosive and should not be allowed to contact the eyes or skin.

If you ever need to prepare electrolyte yourself, always add the acid slowly to the water, and never the other way round. Protect against splashes by wearing rubber gloves and goggles.

When jump starting a car using a booster battery, for negative earth (ground) vehicles, connect the jump leads in the following sequence: First connect one jump lead between the positive (+) terminals of the two batteries. Then connect the other jump lead first to the negative (–) terminal of the booster battery, and then to a good earthing (ground) point on the vehicle to be started, at least 18 in (45 cm) from the battery if possible. Ensure that hands and jump leads are clear of any moving parts, and that the two vehicles do not touch. Disconnect the leads in the reverse order.

Mains electricity and electrical equipment

When using an electric power tool, inspection light etc, always ensure that the appliance is correctly connected to its plug and that, where necessary, it is properly earthed (grounded). Do not use such appliances in damp conditions and, again, beware of creating a spark or applying excessive heat in the vicinity of fuel or fuel vapour. Also ensure that the appliances meet the relevant national safety standards.

Ignition HT voltage

A severe electric shock can result from touching certain parts of the ignition system, such as the HT leads, when the engine is running or being cranked, particularly if components are damp or the insulation is defective. Where an electronic ignition system is fitted, the HT voltage is much higher and could prove fatal.

Routine maintenance

Maintenance is essential both for safety and for obtaining the best in terms of performance and economy from your vehicle. Over the years, the need for periodic lubrication – oiling, greasing, and so on – has been drastically reduced, and this has led some owners to think that the various components either no longer exist or will last forever. This is a serious delusion. It follows, therefore, that the largest initial element of maintenance is visual examination.

The following routine maintenance summary is based on the manufacturer's recommendation, but is supplemented by certain checks which the author feels will add up to improved reliability and an increase of component life.

If you cover a low annual mileage, maintenance tasks should be carried out on the basis of time elapsed rather than mileage elapsed.

At weekly intervals, or before a long journey

- Check engine oil level and top up if necessary (photos)
- Check coolant level and top up if necessary
- Check battery electrolyte level and top up if necessary (photo)
- Check washer fluid level and top up if necessary
- Check brake fluid reservoir level. Top up if necessary and investigate for leaks (photo)
- Check clutch fluid reservoir level and top up if necessary
- Check tyre pressures (photo)
- Check operation of all lights, particularly indicators and stop-lamps

At first 1000 miles (1600 km) – new cars only

- Avail yourself of dealer free service

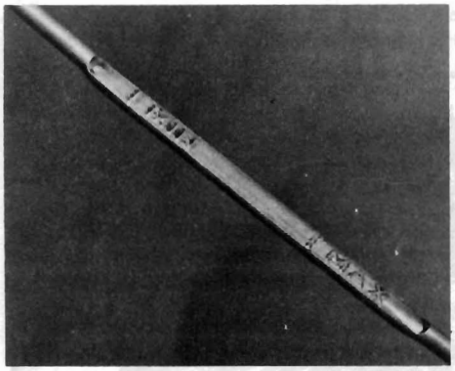
Every 5000 miles (8000 km) or six months, whichever occurs first

- Change engine oil and renew filter
- Check brake pads for wear, renew as necessary
- Adjust timing chain tension
- Inspect tyres for wear or damage
- Clean air pump filter (emission control systems)
- Clean air cleaner elements
- Clean spark plugs
- Check distributor contact points, renew if badly pitted, then check dwell angle and timing
- Check brake flexible hoses and pipelines for leaks or damage

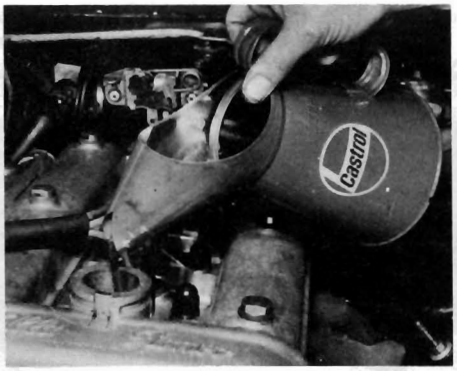
Every 10 000 miles (16 000 km) or annually

In addition to the work specified for the previous service interval

- Renew fuel filter elements
- Change injection pump oil filter (fuel injection system)
- Check cooling system for leaks and condition of hoses



Engine oil dipstick. Quantity of oil to raise level from MIN to MAX is about 4 pints (2 litres)

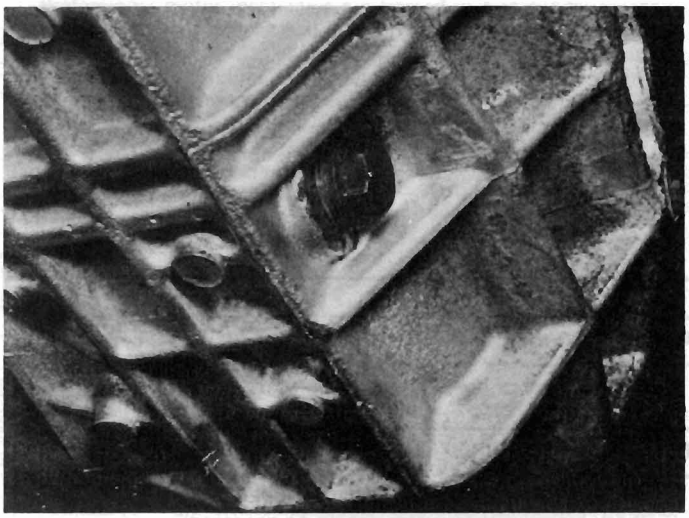


Topping up the engine oil

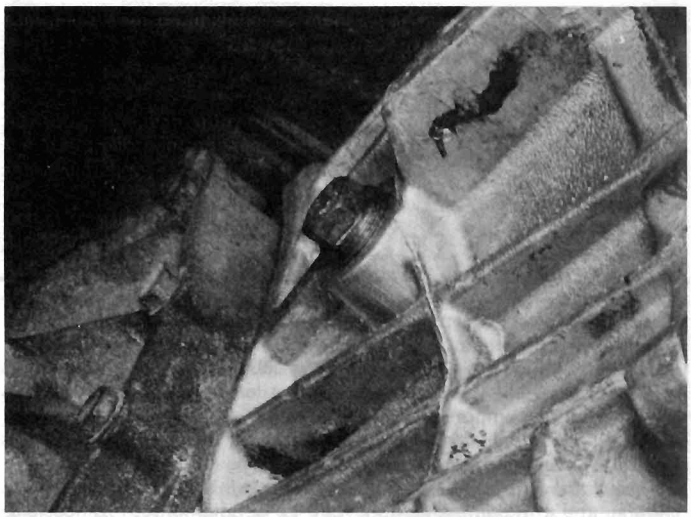
Topping up the battery

Topping up the brake fluid reservoir

Checking a tyre pressure



Transmission drain plug



Transmission filler/level plug

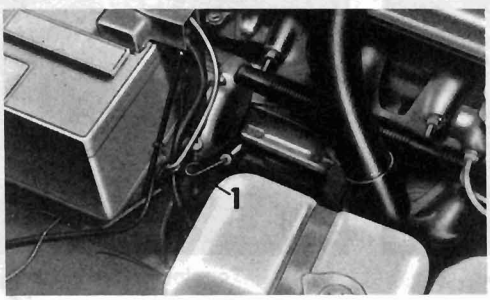
Lubricate hinges and controls
Check tightness of propeller shaft bolts
Check tightness of all steering and suspension bolts and nuts
Check condition of steering rack bellows
Check condition of balljoint gaiters, and check for wear in balljoints
Check front hub adjustment
Check engine idle speed and mixture adjustment

Every 15 000 miles (24 000 km) or 18 months, whichever occurs first

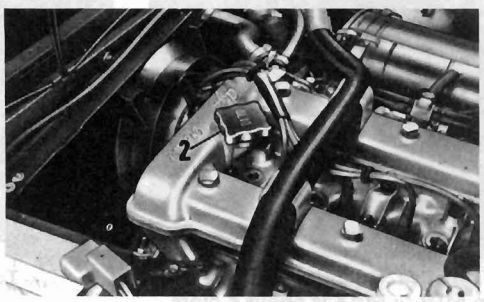
In addition to the work specified for the previous service intervals
Change transmission oil (photos)
Check tension and condition of alternator drivebelt
Check tightness of cylinder head nuts
Check valve clearances
Renew spark plugs
Clean crankcase ventilation system components
Check effectiveness of fuel filler cap seal and system connections (fuel evaporative control system)
Clean throttle throats (fuel injection system)
Renew air pump filter element (emission control system)
Renew engine air cleaner elements
Renew contact breaker points and check dwell angle
Check and adjust ignition timing
Check and adjust idle speed and exhaust emission level
Clean carburettor jets

Every two years (regardless of mileage)

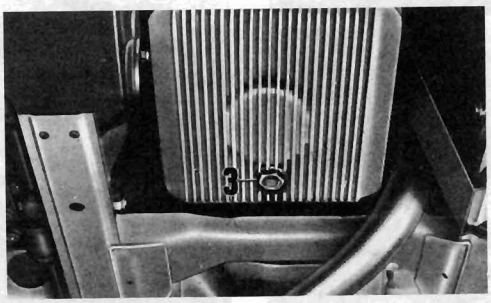
Renew fluid in brake and clutch hydraulic systems
Renew engine coolant (preferably in autumn)



Engine oil dipstick (1)



Engine oil filler cap (2)



Engine sump drain plug (3)

Fault diagnosis

Introduction

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

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

The pages which follow here are intended to help in cases of failure to start or breakdown on the road. There is also a Fault Diagnosis Section at the end of each Chapter which should be consulted if the preliminary checks prove unfruitful. Whatever the fault, certain basic principles apply. These are as follows:

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

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

Cure the disease, not the symptom. Substituting a flat battery with a fully charged one will get you off the hard shoulder, but if the underlying cause is not attended to, the new battery will go the same way. Similarly, changing oil-fouled spark plugs for a new set will get you moving again, but remember that the reason for the fouling (if it wasn't simply an incorrect grade of plug) will have to be established and corrected.

Don't take anything for granted. Particularly, don't forget that a 'new' component may itself be defective (especially if it's been rattling round in the boot for months), and don't leave components out of a fault diagnosis sequence just because they are new or recently fitted. When you do finally diagnose a difficult fault, you'll probably realise that all the evidence was there from the start.

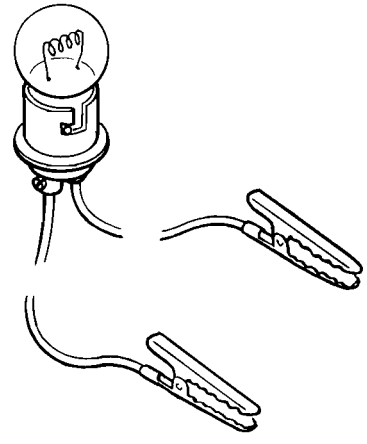
Electrical faults

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

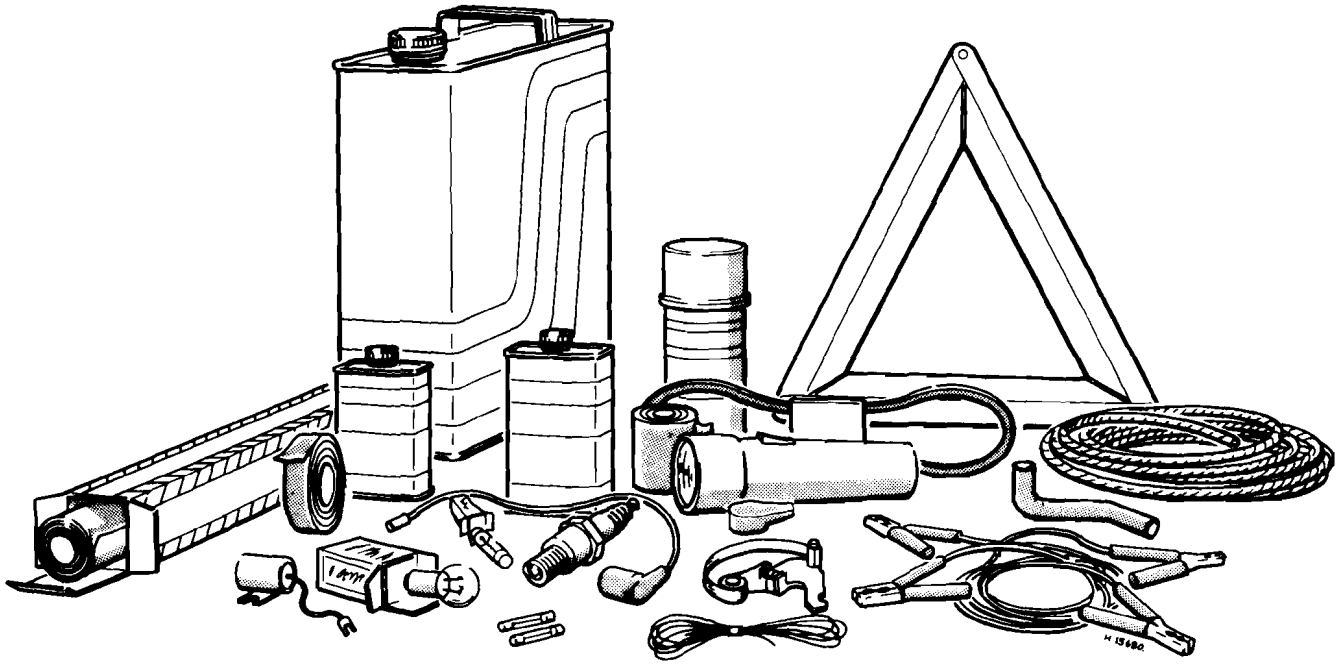
All metal-bodied cars in current production have one pole of the battery 'earthed', ie connected to the car bodywork, and in nearly all modern cars it is the negative (–) terminal. The various electrical components – motors, bulb holders etc – are also connected to earth, either by means of a lead or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

Assuming the earth return to be satisfactory, electrical faults will be due either to component malfunction or to defects in the current supply. Individual components are dealt with in Chapter 9. If supply wires are broken or cracked internally this results in an open-circuit, and the easiest way to check for this is to bypass the suspect wire temporarily with a length of wire having a crocodile clip or suitable connector at each end. Alternatively, a 12V test lamp can be used to verify the presence of supply voltage at various points along the wire and the break can be thus isolated.

If a bare portion of a live wire touches the car bodywork or other earthed metal part the electricity will take the low-resistance path thus formed back to the battery: this is known as a short-circuit. Hopefully a short-circuit will blow a fuse, but otherwise it may cause burning of the insulation (and possibly further short-circuits) or even a fire. This is why it is inadvisable to bypass persistently blowing fuses with silver foil or wire.



A simple test lamp is useful for tracing electrical faults



Carrying a few spares can save you a long walk!

Spares and tool kit

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

Spark plugs, clean and correctly gapped
HT lead and plug cap – long enough to reach the plug furthest from the distributor
Distributor rotor, condenser and contact breaker points
Drivebelt(s) – emergency type may suffice
Spare fuses
Set of principal light bulbs
Tin of radiator sealer and hose bandage
Exhaust bandage
Roll of insulating tape
Length of soft iron wire
Length of electrical flex
Torch or inspection lamp (can double as test lamp)
Battery jump leads
Tow-rope
Ignition waterproofing aerosol
Litre of engine oil
Sealed can of hydraulic fluid
Tyre valve core

If spare fuel is carried, a can designed for the purpose should be used to minimise risks of leakage and collision damage. A first aid kit and a warning triangle, whilst not at present compulsory in the UK, are obviously sensible items to carry in addition to the above.

When touring abroad it may be advisable to carry additional spares which, even if you cannot fit them yourself, could save having to wait while parts are obtained. The items below may be worth considering:

Throttle cable
Cylinder head gasket
Alternator brushes

One of the motoring organisations will be able to advise on availability of fuel etc in foreign countries.

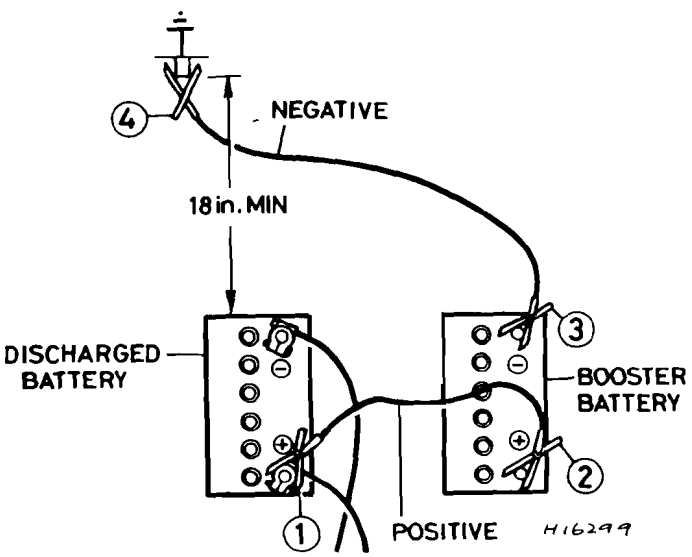
Engine will not start

Engine fails to turn when starter operates

Flat battery (recharge, use jump leads, or push start)
Battery terminals loose or corroded
Battery earth to body defective
Engine earth strap loose or broken
Starter motor (or solenoid) wiring loose or broken
Ignition/starter switch faulty
Major mechanical failure (seizure) or long disuse (piston rings rusted to bores)
Starter or solenoid internal fault (see Chapter 9)

Starter motor turns engine slowly

Partially discharged battery (recharge, use jump leads, or push start)
Battery terminals loose or corroded
Battery earth to body defective

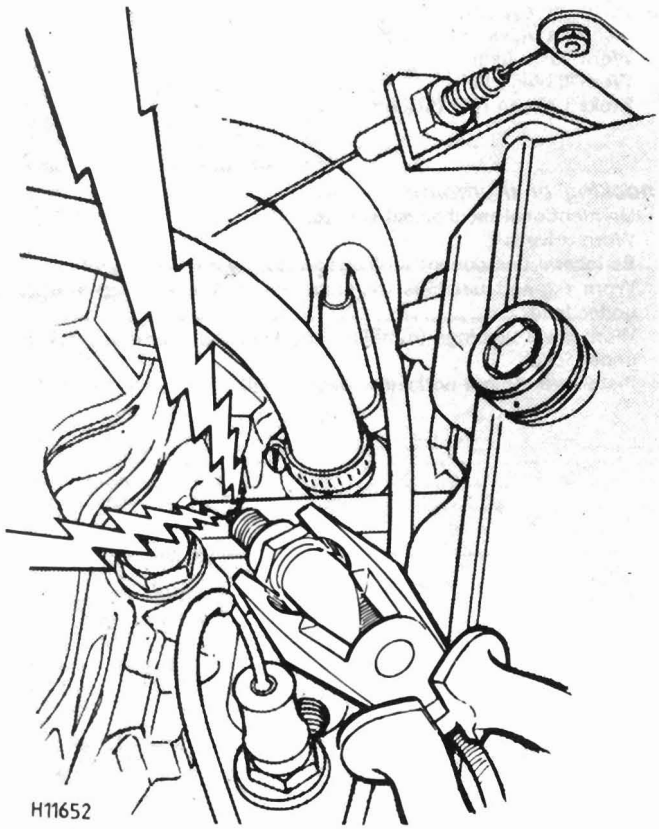


Jump start lead connections for negative earth vehicles – connect leads in order shown

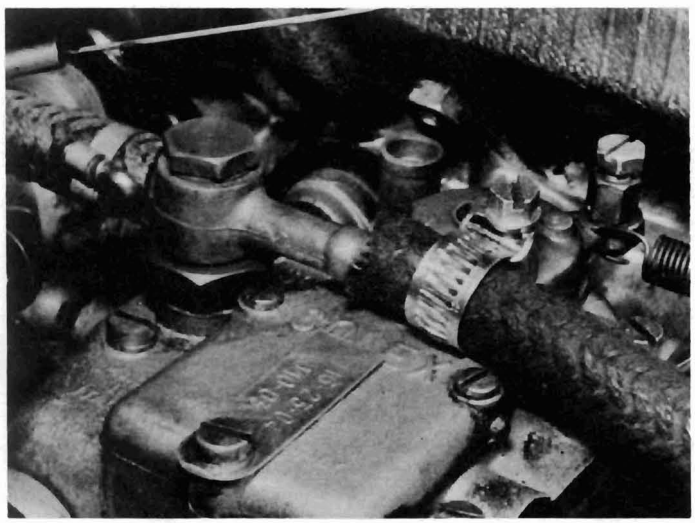
Engine earth strap loose
Starter motor (or solenoid) wiring loose
Starter motor internal fault (see Chapter 9)

Starter motor spins without turning engine
Flywheel gear teeth damaged or worn
Starter motor mounting bolts loose

Engine turns normally but fails to start
Damp or dirty HT leads and distributor cap (crank engine and check for spark)
Dirty or incorrectly gapped contact breaker points
No fuel in tank (check for delivery at carburettor) (photo)
Excessive choke (hot engine) or insufficient choke (cold engine)



Crank engine and check for spark. Note use of insulated tool



On carburettor models, remove fuel pipe and check for fuel delivery

Fouled or incorrectly gapped spark plugs (remove, clean and regap)
Other ignition system fault (see Chapter 4)
Other fuel system fault (see Chapter 3)
Poor compression (see Chapter 1)
Major mechanical failure (eg camshaft drive)

Engine fires but will not run
Insufficient choke (cold engine)
Air leaks at carburettor or inlet manifold
Fuel starvation (see Chapter 3)
Ballast resistor defective, or other ignition fault (see Chapter 4)

Engine cuts out and will not restart

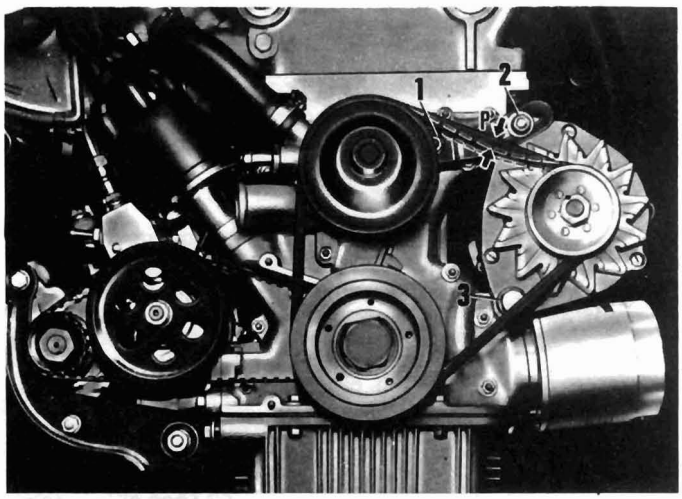
Engine cuts out suddenly – ignition fault
Loose or disconnected LT wires
Wet HT leads or distributor cap (after traversing water splash)
Coil or condenser failure (check for spark)
Other ignition fault (see Chapter 6).

Engine misfires before cutting out – fuel fault
Fuel tank empty
Fuel pump defective or filter blocked (check for delivery)
Fuel tank filler vent blocked (suction will be evident on releasing cap)
Carburettor needle valve sticking
Carburettor jets blocked (fuel contaminated)
Fuel injection system faults (see Chapter 3)

Engine cuts out – other causes
Serious overheating
Major mechanical failure (eg camshaft drive)

Engine overheats

Ignition (no-charge) warning light illuminated
Slack or broken drivebelt – retension or renew (Chapter 2)



A slack drivebelt can cause battery charging or overheating problems. Fuel injection model is shown here

1 Link joint
2 Link clamp nut
3 Alternator pivot bolt
P Deflection

Ignition warning light not illuminated
Coolant loss due to internal or external leakage (see Chapter 2)
Thermostat defective
Low oil level
Brakes binding
Radiator clogged externally or internally
Electric cooling fan not operating correctly

Engine waterways clogged
Ignition timing incorrect or automatic advance malfunctioning
Mixture too weak

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

Low engine oil pressure

Gauge reads low or warning light illuminated with engine running

Oil level low or oil of incorrect grade
Defective gauge or sender unit
Wire to sender unit earthed
Engine overheating
Oil filter clogged or bypass valve defective
Oil pressure relief valve defective
Oil pick-up strainer clogged
Oil pump worn or mountings loose
Worn main or big-end bearings

Note: *Low oil pressure in a high-mileage engine at tickover is not necessarily a cause for concern. Sudden pressure loss at speed is far more significant. In any event, check the gauge or warning light sender before condemning the engine!*

Engine noises

Pre-ignition (pinking) on acceleration

Incorrect grade of fuel
Ignition timing incorrect
Distributor faulty or worn
Worn or maladjusted carburettor, incorrectly adjusted fuel inspection system
Excessive carbon build-up in engine

Whistling or wheezing noises

Leaking vacuum hose
Leaking carburettor or manifold gasket
Blowing head gasket

Tapping or rattling

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

Knocking or thumping

Unintentional mechanical contact
Worn drivebelt
Peripheral component fault (generator, water pump etc)
Worn big-end bearings (regulator heavy knocking, perhaps less under load)
Worn main bearings (rumbling and knocking, perhaps worsening under load)
Piston slap (most noticeable when cold)

Chapter 1 Engine

For modifications, and information applicable to later models, see Supplement at end of manual

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Specifications

General

Engine type	4-cylinder, in-line, twin overhead camshaft		
	1.6 l	**1.8 l**	**2.0 l**
Bore	78.0 mm (3.07 in)	80.0 mm (3.15 in)	84.0 mm (3.31 in)
Stroke	82.0 mm (3.23 in)	88.5 mm (3.48 in)	88.5 mm (3.48 in)
Displacement	1570 cc (95.8 cu in)	1799 cc (108.5 cu in)	1962 cc (119.7 cu in)
Power (DIN)	109 bhp (80.1 kW) at 5600 rpm	122 bhp (91 kW) at 5300 rpm	130 bhp (96.9 kW) at 5400 rpm
Torque	142 Nm (104 lbf ft) at 4300 rpm	167 Nm (123 lbf ft) at 4400 rpm	171 Nm (126 lbf ft) at 4000 rpm
Compression ratio	9.0 : 1	9.5 : 1	9.0 : 1
Firing order	1 – 3 – 4 – 2 (No 1 at timing chain end)		

Cylinder block

Material	Light alloy with iron liners

Cylinder liners

Diameter – 1.6 l engine:	
Class A (blue)	77.985 to 77.994 mm (3.0703 to 3.0706 in)
Class B (pink)	77.995 to 78.004 mm (3.0707 to 3.0710 in)
Class C (green)	78.005 to 78.014 mm (3.0711 to 3.0714 in)
Diameter – 1.8 l engine:	
Class A (blue)	79.985 to 79.994 mm (3.1490 to 3.1494 in)
Class B (pink)	79.995 to 80.004 mm (3.1494 to 3.1498 in)
Class C (green)	80.005 to 80.014 mm (3.1498 to 3.1502 in)
Diameter – 2.0 l engine:	
Class A (blue)	83.985 to 83.994 mm (3.3065 to 3.3069 in)
Class B (pink)	83.995 to 84.004 mm (3.3069 to 3.3072 in)
Class C (green)	84.005 to 84.014 mm (3.3073 to 3.3076 in)
Clearance between liner and piston:	
New	0.030 to 0.050 mm (0.0012 to 0.0020 in)
Wear limit	0.150 mm (0.0060 in)
Liner out-of-round or taper limit:	
New liner	0.01 mm (0.0004 in)
Used liner	0.05 mm (0.002 in)
Liner projection above block	0.01 to 0.06 mm (0.0004 to 0.0024 in)

Crankshaft

Main bearing journal diameter:	
1.6 l:	
Standard	59.960 to 59.973 mm (2.3606 to 2.3611 in)
Undersize (1)	59.706 to 59.719 mm (2.3506 to 2.3511 in)
Undersize (2)	59.452 to 59.465 mm (2.3406 to 2.3411 in)
1.8 l and 2.0 l:	
Standard (red)	59.961 to 59.971 mm (2.3607 to 2.3611 in)
Undersize (blue)	59.951 to 59.961 mm (2.3603 to 2.3607 in)

Crankpin diameter:	
1.6 l:	
Standard	49.987 to 50.000 mm (1.9680 to 1.9685 in)
Undersize (1)	49.733 to 49.746 mm (1.9580 to 1.9585 in)
Undersize (2)	49.479 to 49.492 mm (1.9480 to 1.9485 in)
1.8 l and 2.0 l:	
Standard (red)	49.988 to 49.998 mm (1.9680 to 1.9684 in)
Undersize (blue)	49.978 to 49.988 mm (1.9676 to 1.9680 in)
Crankshaft endfloat:	
1.6 l	0.076 to 0.264 mm (0.0030 to 0.0104 in)
1.8 l and 2.0 l	0.080 to 0.264 mm (0.0031 to 0.0104 in)
Main bearing running clearance:	
1.6 l	0.014 to 0.058 mm (0.0006 to 0.0023 in)
1.8 l and 2.0 l	0.026 to 0.067 mm (0.0010 to 0.0026 in)
Big-end bearing running clearance:	
1.6 l	0.025 to 0.064 mm (0.0010 to 0.0025 in)
1.8 l and 2.0 l	0.021 to 0.058 mm (0.0008 to 0.0023 in)

Connecting rods

1.6 l:	
Length between centres	147.955 to 148.045 mm (5.8250 to 5.8285 in)
Internal diameter of small-end bush	22.005 to 22.015 mm (0.8663 to 0.8667 in)
Endfloat	0.020 to 0.30 mm (0.0079 to 0.0118 in)
1.8 l and 2.0 l:	
Length between centres	156.950 to 157.050 mm (6.1791 to 6.1831 in)
Internal diameter of small-end bush	22.005 to 22.015 mm (0.8663 to 0.8667 in)
Endfloat	0.20 to 0.30 mm (0.0079 to 0.0118 in)

Gudgeon pins

Pin diameter:	
Black mark	21.994 to 21.997 mm (0.8659 to 0.8660 in)
White mark	21.997 to 22.000 mm (0.8660 to 0.8661 in)
Running clearance in connecting rod:	
Black mark	0.008 to 0.021 mm (0.0003 to 0.0008 in)
White mark	0.005 to 0.017 mm (0.0002 to 0.0007 in)
Running clearance in piston:	
Black mark	0.003 to 0.008 mm (0.00012 to 0.00032 in)
White mark	0.003 to 0.007 mm (0.00012 to 0.00028 in)

Pistons

Diameter 1.6 l:	
Grade A (blue)	77.920 to 77.930 mm (3.0677 to 3.0681 in)
Grade B (pink)	77.931 to 77.940 mm (3.0681 to 3.0685 in)
Grade C (green)	77.940 to 77.950 mm (3.0685 to 3.0689 in)
Diameter 1.8 l:	
Grade A (blue)	79.945 to 79.955 mm (3.1474 to 3.1478 in)
Grade B (pink)	79.955 to 79.965 mm (3.1478 to 3.1482 in)
Grade C (green)	79.966 to 79.975 mm (3.1482 to 3.1486 in)
Diameter 2.0 l:	
Grade A (blue)	83.935 to 83.945 mm (3.3045 to 3.3049 in)
Grade B (pink)	83.945 to 83.955 mm (3.3049 to 3.3053 in)
Grade C (green)	83.955 to 83.965 mm (3.3053 to 3.3057 in)
Piston ring-to-groove clearance:	
1.6 l:	
Top compression ring	0.045 to 0.072 mm (0.0018 to 0.0029 in)
Second compression ring	0.035 to 0.062 mm (0.0014 to 0.0024 in)
Oil control ring	0.025 to 0.052 mm (0.0010 to 0.0020 in)
1.8 l and 2.0 l:	
Top and second compression ring	0.035 to 0.067 mm (0.0014 to 0.0026 in)
Oil control ring	0.025 to 0.057 mm (0.0010 to 0.0022 in)
Piston ring end gap:	
Compression (all models)	0.300 to 0.450 mm (0.0118 to 0.0177 in)

Cylinder head

Material	Light alloy
Maximum permissible distortion:	
Bottom face	0.05 mm (0.0020 in)
Out-of-parallel between both faces	0.087 mm (0.0034 in)
Camshaft journal diameter	26.959 to 26.980 mm (1.0614 to 1.0622 in)
Bearing running clearance	0.020 to 0.074 mm (0.0008 to 0.0029 in)
Camshaft endfloat	0.065 to 0.182 mm (0.0026 to 0.0072 in)
Cam follower diameter:	
Standard	34.973 to 34.989 mm (1.3769 to 1.3775 in)
Oversize	35.173 to 35.189 mm (1.3848 to 1.3854 in)

Cam follower bore diameter in cylinder head:	
Standard	35.000 to 35.025 mm (1.3780 to 1.3789 in)
Oversize	35.200 to 35.225 mm (1.3858 to 1.3868 in)
Cam follower running clearance	0.011 to 0.052 mm (0.0004 to 0.0020 in)

Timing chain tensioner

Spring free length	99.0 mm (3.9 in)

Valves

Head diameter – 1.6 l and 1.8 l*:	
Inlet	41.00 to 41.20 mm (1.6140 to 1.6219 in)
Exhaust	37.00 to 37.20 mm (1.4570 to 1.4649 in)
Head diameter – 2.0 l*:	
Inlet	43.47 to 43.67 mm (1.7114 to 1.7193 in)
Exhaust	39.47 to 39.67 mm (1.5540 to 1.5618 in)
Stem diameter*:	
Inlet	8.960 to 8.987 mm (0.3523 to 0.3535 in)
Exhaust	8.935 to 8.960 mm (0.3515 to 0.3523 in)
Overall length*:	
Inlet	106.903 to 107.157 mm (4.208 to 4.219 in)
Exhaust	106.173 to 106.427 mm (4.180 to 4.190 in)

**May vary according to manufacturer*

Valve guides

Outside diameter	14.033 to 14.044 mm (0.5525 to 0.5529 in)
Inside diameter	9.00 to 9.015 mm (0.3543 to 0.3549 in)
Guide projection from cylinder head:	
Inlet	13.30 to 13.50 mm (0.5236 to 0.5315 in)
Exhaust	16.30 to 16.50 mm (0.6417 to 0.6496 in)
Stem-to-guide clearance:	
Inlet	0.013 to 0.043 mm (0.0005 to 0.0017 in)
Exhaust	0.040 to 0.080 in (0.0016 to 0.0031 in)

Valve seats

Insert diameter (1.6 l and 1.8 l):	
Inlet (standard)	42.597 to 42.632 mm (1.6770 to 1.6780 in)
Inlet (oversize)	42.897 to 42.932 mm (1.6889 to 1.6895 in)
Exhaust (standard)	38.597 to 38.632 mm (1.5196 to 1.5210 in)
Exhaust (oversize)	38.897 to 38.932 mm (1.5314 to 1.5325 in)
Insert diameter (2.0 l):	
Inlet (standard)	45.065 to 45.10 mm (1.7745 to 1.7759 in)
Inlet (oversize)	45.365 to 45.40 mm (1.7864 to 1.7877 in)
Exhaust (standard)	41.065 to 41.10 mm (1.6165 to 1.6179 in)
Exhaust (oversize)	41.365 to 41.40 mm (1.6285 to 1.6299 in)

Valve spring free length

Inner	46.50 to 47.35 mm (1.831 to 1.864 in)
Outer	51.30 to 52.80 mm (2.020 to 2.079 in)

Valve clearance

Inlet	0.40 to 0.45 mm (0.016 to 0.018 in)
Exhaust	0.45 to 0.50 mm (0.018 to 0.020 in)

Valve timing

1.6 l models:

	Engine no. 016.00*000001* on	Engine no. 016.00*016001 + on
Inlet valve opens (BTDC)	43° 30′	40° 34′
Inlet valve closes (ABDC)	67° 30′	64° 34′
Exhaust valve opens (BBDC)	69° 50′	63° 54′
Exhaust valve closes (ATDC)	27° 50′	27° 54′

1.8 l models:

	Engine no. 016.08*00001* on	Engine no. 016.08*S00001	Engine no. 016.08*X00001* +
Inlet valve opens (BTDC)	48°	45°	40° 34′
Inlet valve closes (ABDC)	67°	70°	64° 34′
Exhaust valve opens (BBDC)	69° 20′	69° 20′	63° 54′
Exhaust valve closes (ATDC)	32° 20′	32° 20′	27° 54′

2.0 l models (engine no. 016.25):

Inlet valve opens (BTDC)	40° 34′
Inlet valve closes (ABDC)	64° 34′
Exhaust valve opens (BBDC)	63° 54′
Exhaust valve closes (ATDC)	27° 54′

Lubrication system

Oil pressure (hot):	
At idle	0.5 to 1.0 kgf/cm² (7.1 to 14.2 lbf/in²)
At full speed	3.5 to 5.0 kgf/cm² (49.8 to 71.1 lbf/in²)
Oil capacity with filter change	6.6 litres (11.6 Imp pints, 6.7 US quarts)

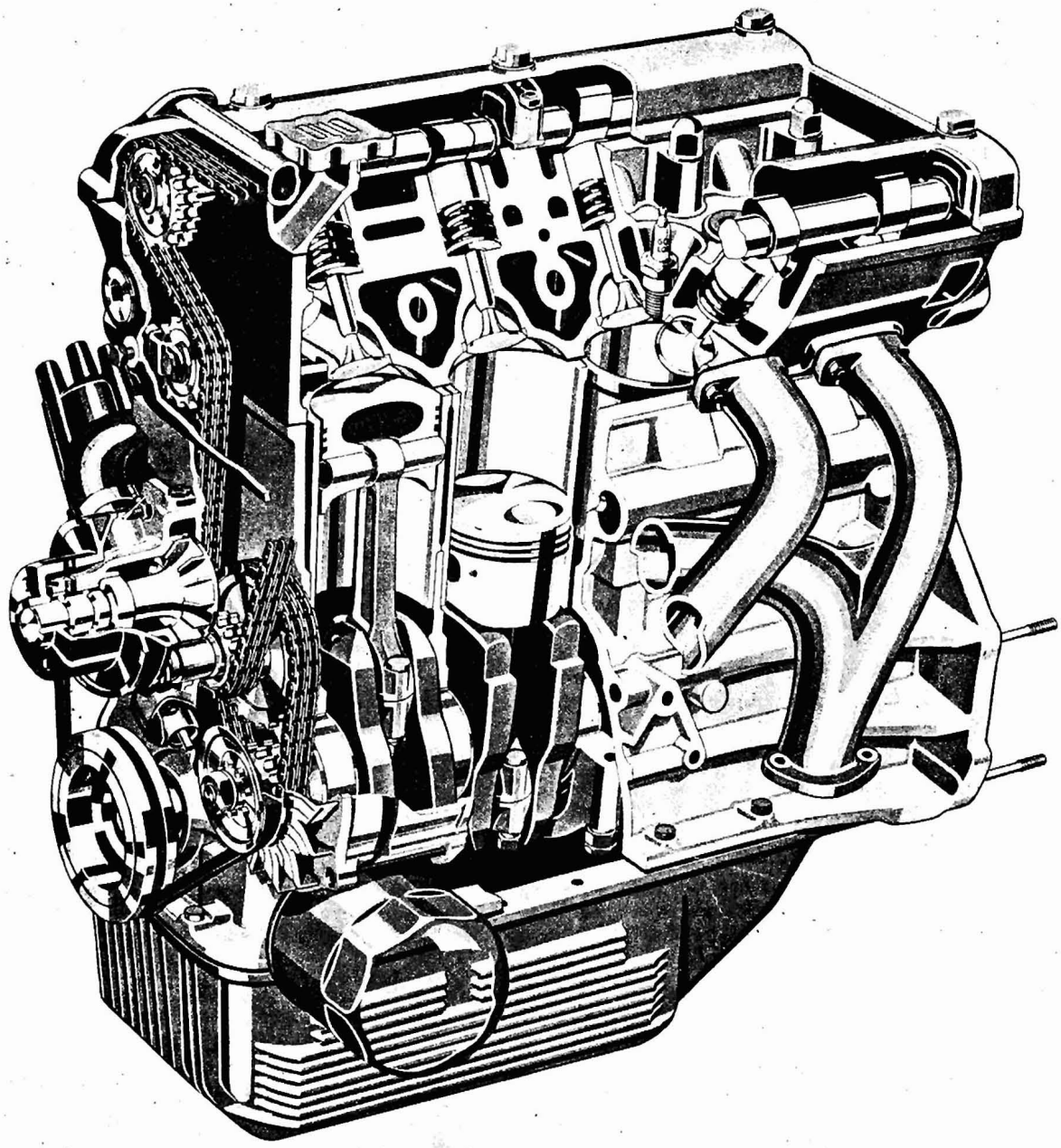


Fig. 1.1 Cutaway view of engine (Sec 1)

Torque wrench settings	Nm	lbf ft
Main bearing cap nuts	48	35
Flywheel bolts	112	82
Connecting rod cap bolts	50	37
Crankshaft damper/pulley nut	196	144
Cylinder head nuts (1.6 and 2.0 litre):		
Cold (Stage 1)	78	58
Hot (Stage 2)	82	61
Cold (Stage 3) – see text	87	64
Cylinder head nuts (1.8 litre):		
Cold (Stage 1)	72	53
Hot (Stage 2)	75	55
Cold (Stage 3) see text	77	57
Camshaft cover nuts	18	13
Spark plugs	34	25
Camshaft bearing cap nuts	21	15
Engine oil drain plug	76	56

1 Description

The engine on all models is of light alloy, four-cylinder, twin overhead camshaft type.

Although all engines are of similar construction, their different capacities are obtained by varying the bore and stroke (see Specifications).

The combustion chambers are hemispherical in design. Sodium-cooled exhaust valves are used.

The crankshaft is supported in 5 main bearings, and a torsional damper is fitted at its front end.

Light alloy pistons run in cast iron 'wet' cylinder liners, and the gudgeon pin is a running fit both in the connecting rod bronze bush and in the piston.

The valve gear is operated by chains and the valves are directly operated from the camshaft lobes. Valve clearance adjustment is accomplished by shims.

Lubrication is by means of a gear type oil pump mounted inside the crankcase front cover. The pump is driven by gears from the crankshaft and draws oil from a light alloy sump. A pressure relief valve is incorporated in the pump and a disposable type oil filter is screwed onto the front left-hand side of the crankcase.

The operations described in this Chapter are based upon carburettor type engines, with European standard emission control equipment. For North American versions with a fuel injection system and full emission control equipment, differences in the operations described will occur for such work as cylinder head and engine removal. On cars so equipped, refer to Chapter 3 and disconnect these special system components as work progresses, ignoring any reference to carburettors and mechanically-operated fuel pump. The items concerned will include removal of the air pump, the fuel injection pump and air cleaner. Disconnection of the air injectors, the fuel injectors, vacuum pipes and electrical leads, also the link rods from the fuel injection control unit, will also be necessary.

Warning

On models equipped with air conditioning, if the operations to be carried out are likely to be prevented by obstruction of the various system components, have the system discharged by your dealer before commencing operations. The refrigerant fluid is Freon 12, and although harmless under normal conditions, contact with the eyes or skin must be avoided. If Freon comes into contact with a naked flame then a poisonous gas will be generated.

Where a component such as the compressor or the condenser, if unbolted, cannot be moved aside within the limits of any flexible connecting pipes to avoid obstructing the overhaul operations, then the system must be discharged by your dealer or a competent refrigeration engineer and the system recharged on completion of the work.

It is essential to completely evacuate the system before recharging. The necessary vacuum equipment to do this is only likely to be held by your dealer or refrigeration engineer.

System connections must not be left open, as the entry of moist air will harm the components and affect operation and performance of the units.

2 Major operations possible – engine in car

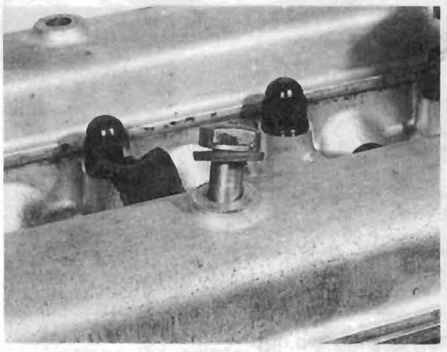
1 Most operations can be carried out without the necessity of removing the engine from the car. These include removal and refitting of the following:

Camshafts
Cylinder head
Timing gear
Sump pan
Oil pump
Flywheel and crankshaft rear oil seal
Pistons and connecting rods
Cylinder liners

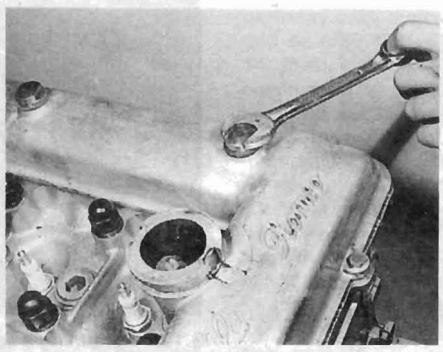
2 Attention to the crankshaft and main bearings will require removal of the engine.

3 Camshafts – removal and refitting

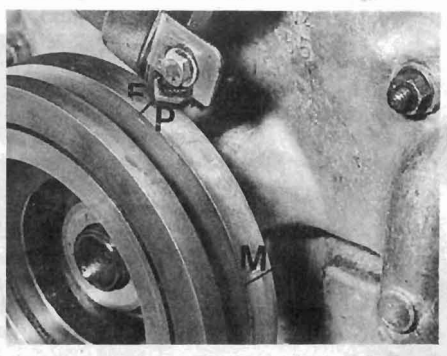
1 Disconnect the battery.
2 Disconnect the crankcase vent hose from the camshaft cover.
3 Unbolt and remove the camshaft cover. The securing bolts are of special head design and in the absence of the adaptor (A 50180), use a close fitting open-ended spanner to unscrew them (photos).
4 Using a socket on the crankshaft pulley nut, turn the crankshaft until No 1 piston is at TDC on its compression stroke. This setting can be established when the detachable link is located on the top run of the chain and the camshaft alignment marks are opposite their matching marks on the bearing caps. The F/P mark on the crankshaft pulley will also be in line with the pointer on the front face of the engine (photo).
5 Slacken the chain tensioner mounting bolt and push the tensioner against the pressure of its spring so that it is away from the chain, then retighten the bolt.
6 Pass a piece of wire through the chain at each side of the detachable link and remove the link, at the same time holding the wires to prevent the chain from sliding into the engine. Tie the ends of the wires to suitable anchorage points.
7 From this point on, **do not** rotate the crankshaft, or the timing will be upset and damage to pistons and valves could occur.
8 Mark the location of the camshaft bearing caps and unbolt and remove them.
9 Lift out the camshafts, taking care to identify them as to intake or exhaust sides.
10 The cam followers and valve clearance adjustment shims may be removed if required, but this should only be needed if the valve clearances are being checked and adjusted as described in Section 13.
11 Commence refitting by oiling the camshaft bearings and placing the camshafts in them (photo).
12 Turn the camshafts so that No 1 camshaft lobes point outwards and check that No 1 piston is still at TDC. Failure to observe this will cause the valve heads to dig into the piston crowns as the camshafts are bolted down.
13 Fit the bearing caps to their correct locations so that their oilways point inwards. Tighten the cap nuts evenly to the specified torque (photos).



3.3a Camshaft cover bolt



3.3b Unscrewing a camshaft cover bolt



3.4 Crankshaft pulley marks

14 Turn the camshafts if necessary to align their journal/cap marks.
15 Reconnect the chain, fitting the link at the top run (photos). The closed end of the detachable link must point in the direction of rotation.
16 Release the chain tensioner locking bolt and allow the spring to move the tensioner against the chain. Retighten the bolt.
17 Where necessary, further chain adjustment may be carried out as described in Section 5.
18 Fit the camshaft cover using a new gasket and semi-circular sealing plug (photos).
19 Reconnect the vent hose to the cover.
20 Reconnect the battery.

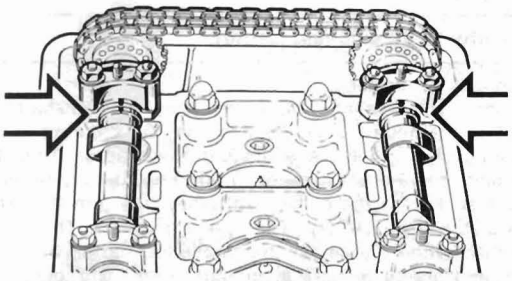


Fig. 1.2 Camshaft alignment marks (Sec 3)

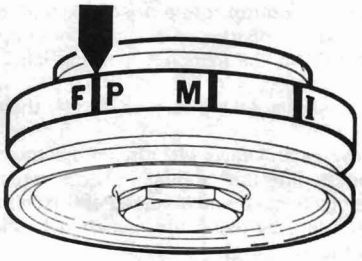


Fig. 1.3 Crankshaft damper timing marks (Sec 3)

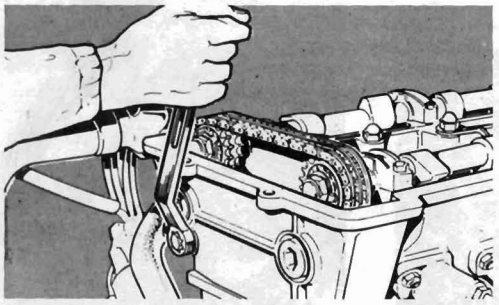
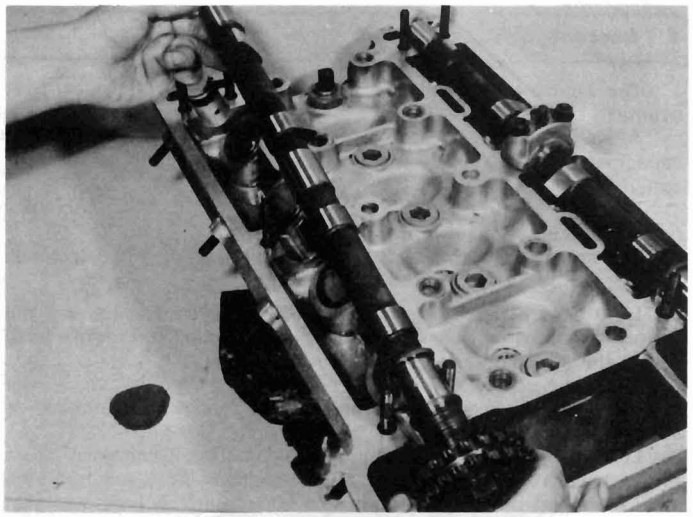
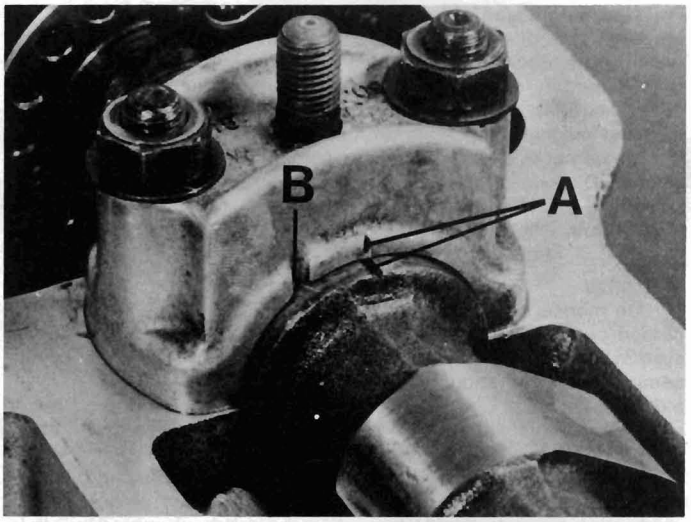


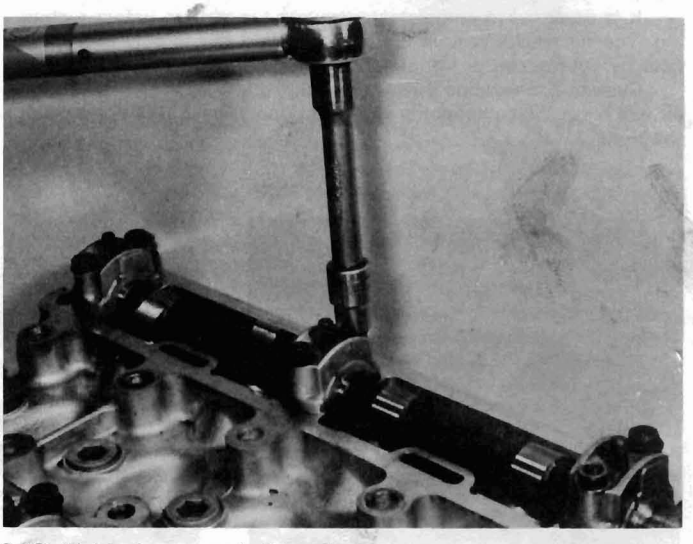
Fig. 1.4 Releasing the chain tensioner locking bolt (Sec 3)



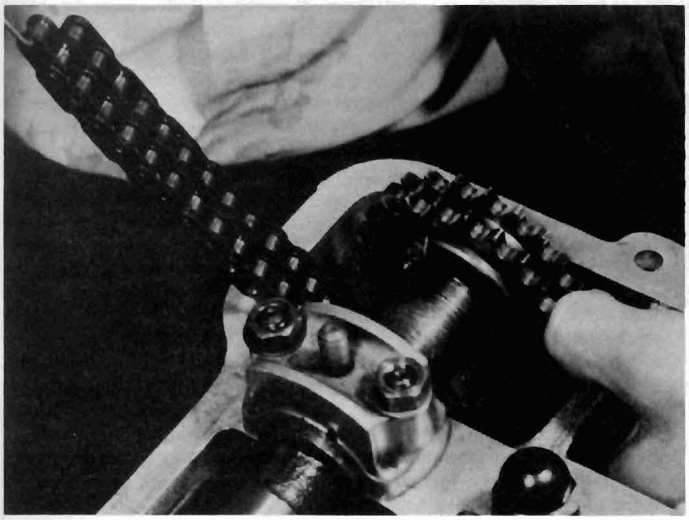
3.11 Refitting a camshaft



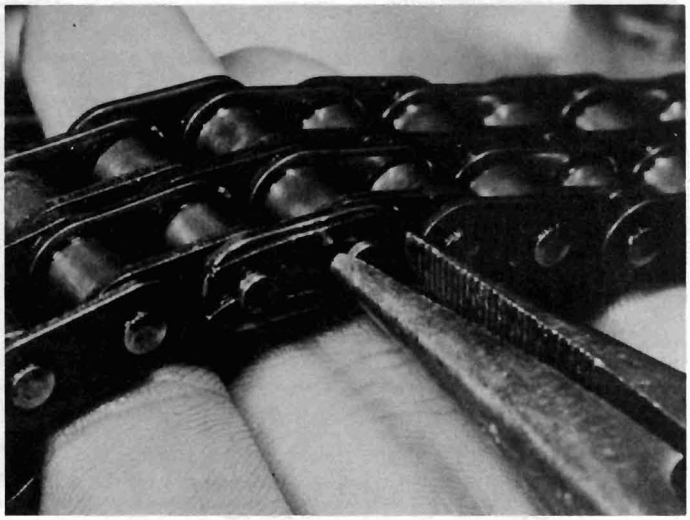
3.13a Camshaft alignment marks (A) and oilway (B)



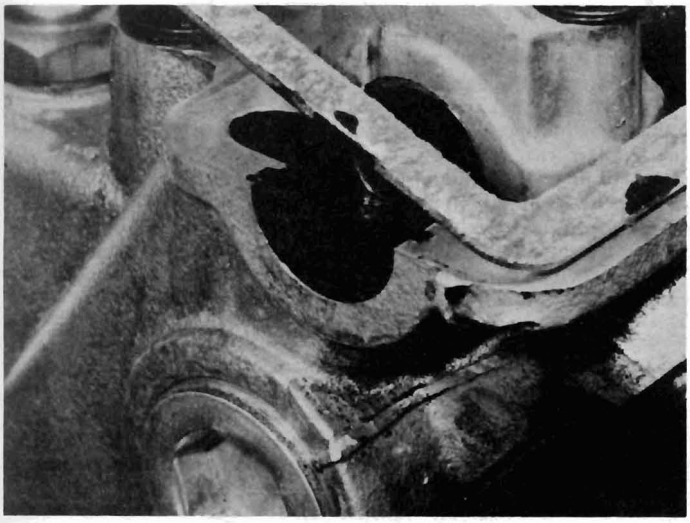
3.13b Tightening a camshaft bearing cap nut



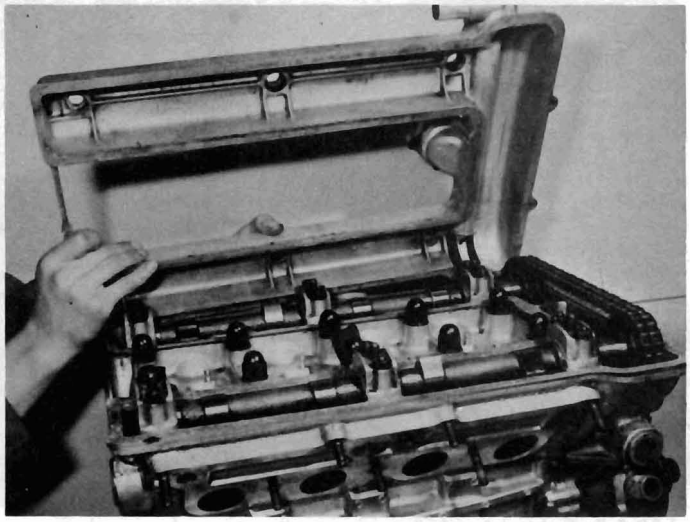
3.15a Connecting the timing chain



3.15b Chain connecting link



3.18a Camshaft cover gasket and sealing plug



3.18b Refitting the camshaft cover

4 Cylinder head – removal and refitting

On cars equipped with air conditioning, refer to the warning in Section 1.

1 Drain the cooling system as described in Chapter 2, then allow then engine to cool completely before releasing the cylinder head nuts, otherwise distortion to the head may occur. If the coolant is required for further use, retain it in a closed container.

2 Disconnect the battery.

3 Disconnect the radiator and heater hoses from the cylinder head.

4 Disconnect the brake servo vacuum pipe from the intake manifold and the vent hose from the camshaft cover.

5 Remove the air cleaner and disconnect the control linkage from the carburettor as described in Chapter 3.

6 Disconnect the hoses from the fuel pump and plug their open ends to prevent loss of fuel.

7 Working under the car, disconnect the exhaust system front bracket.

8 Unbolt the exhaust downpipes from the manifold pipe flanges.

9 Carry out the operations described in paragraphs 3 to 7 of Section 3.

10 Unscrew and remove the spark plugs.

11 Unscrew the cylinder head nuts, half a turn at a time in diagonal sequence, working from the centre nuts towards each end of the head.

12 Remove the engine lifting bracket and also extract the two screws which connect the front cover to the head (photo).

13 Lift off the cylinder head, complete with manifolds and carburettors. Use the exhaust manifold to 'rock' the head off its studs if it is tight or stuck. In extreme cases, when all else fails, a special tool is available (A20146) to withdraw it (Fig. 1.29). Something similar can be made up from scrap materials using a bolt to screw into the plug holes. Make sure that the cylinder head domed nuts are only screwed part-way onto their studs if a tool has to be used. Remove the gasket, and six oil passage O-rings.

14 If the engine overhaul operations will require rotation of the crankshaft, then the cylinder liners must be clamped down to prevent breakage of their base seals. A special tool (A 20117) is available for the purpose, but something similar can be made up from scrap material using distance pieces on the cylinder head studs and screwing on the nuts.

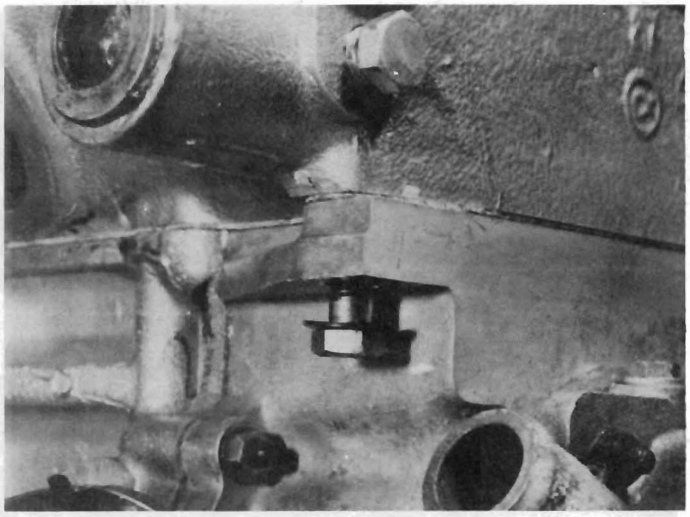
15 With the head on the bench, remove the carburettors (Chapter 3).

16 If necessary, unbolt the manifolds and remove them.

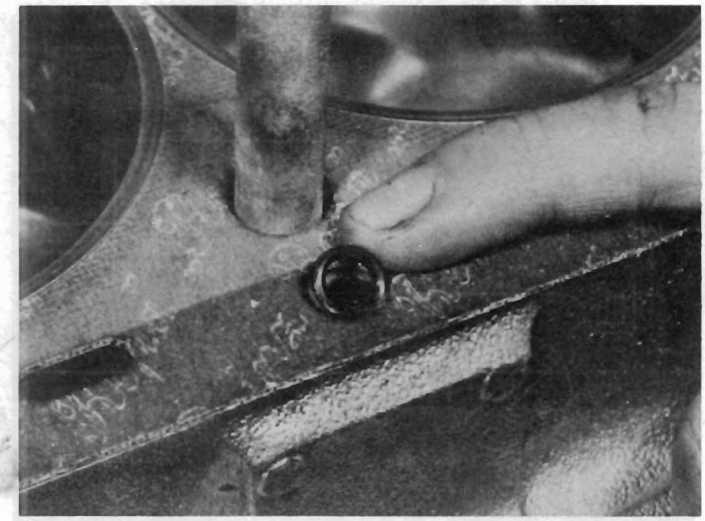
17 When complete decarbonising is required, refer to Section 13. If it is not, remove all loose carbon and ensure that the mating surfaces of the head and block are scrupulously clean.

18 If they were removed, refit the manifolds and carburettors using new gaskets.

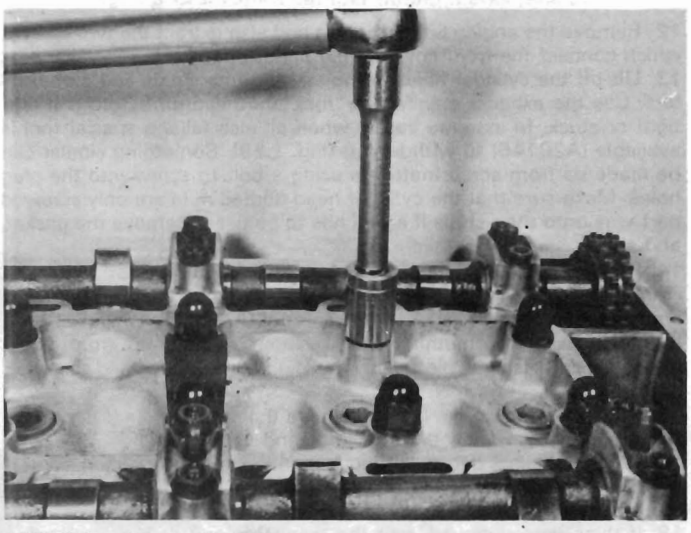
19 Locate a new gasket on the cylinder block. Make sure that the



4.12 Bolt connecting front cover to cylinder head



4.20 Cylinder block/head oil passage sealing ring

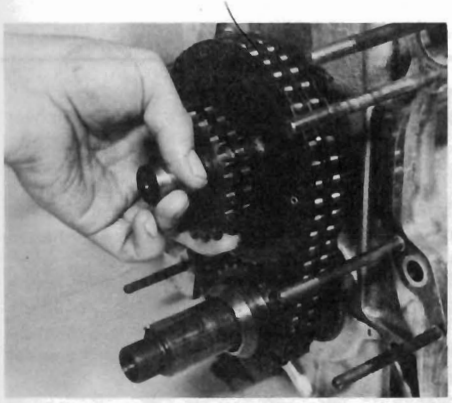


4.24 Tightening a cylinder head nut

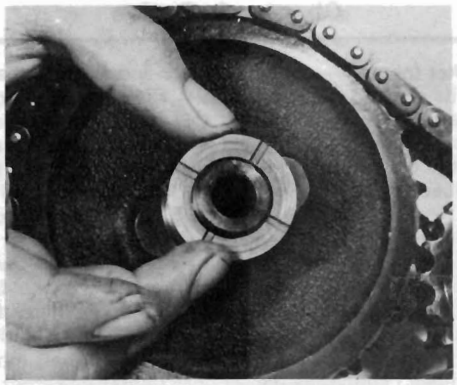
gasket is the correct way up by comparing all the oilways and coolant passage cut-outs for alignment. Refit the cylinder head positioning dowels.
20 Fit the oil passage sealing rings (photo).
21 Turn the camshafts so that their front bearing cap and journal marks are in alignment, with the No 1 camshaft lobes pointing outwards. Failure to do this will cause the valve heads to dig into the piston crowns as the cylinder head is bolted down. Check that No 1 piston is still at TDC.
22 Lower the cylinder head carefully into position over the studs, pulling the wires to draw the chains through the cut-out in the head.
23 Apply grease to the threads of the studs, fit the washers and screw on the nuts finger tight, making sure that the engine lifting bracket is under the centre two nuts.
24 Tighten the nuts to the Stage 1 specified torque following the sequence in Fig. 1.5 (photo).
25 Check that the camshaft marks are still correctly aligned and reconnect the timing chain, using the link at the top run of the chain.
26 Release the chain tensioner locking bolt and allow the spring to move the tensioner against the chain. Retighten the bolt.
27 Where necessary, further chain adjustment may be carried out as described in Section 5.
28 Screw in the spark plugs and refit the camshaft cover using a new gasket. Refit the bolts securing the front cover to the cylinder head.
29 Reconnect the exhaust pipe and front bracket.
30 Reconnect the fuel pipe and carburettor control linkage.
31 Refit the air cleaner and connect the camshaft cover vent hose.
32 Reconnect the heater and coolant hoses, also the servo vacuum hose.
33 Reconnect the battery.
34 Fill the cooling system.
35 Start the engine, and run the car until normal operating temperature is reached. Now further tighten the cylinder head nuts (without unscrewing them) to the Stage 2 specified torque.
36 Recheck the timing chain tension as described in Section 5.
37 After the car has covered about 600 miles (1000 km) the nuts should be retorqued. Following the original tightening sequence (Fig. 1.5), slacken each nut, lubricate the washer and nut, and retighten to the Stage 3 torque. Repeat with the next nut in the sequence.

5 Timing gear – removal and refitting

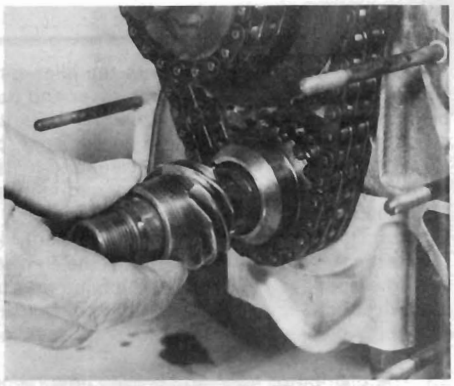
1 Drain the cooling system and remove the radiator as described in Chapter 2. On cars equipped with an air conditioning system, refer to the warning in Section 1.
2 Remove the alternator (Chapter 9).
3 Remove the sump pan as described in Section 6.
4 Remove the fuel pump and pushrod as described in Chapter 3.
5 Remove the cylinder head as described in the preceding Section.
6 Clamp the cylinder liners as described in Section 4.
7 Unscrew the crankshaft pulley nut. To prevent the crankshaft rotating, either select fifth gear and apply the handbrake fully, or remove the starter motor and jam the flywheel ring gear with a suitable tool. If the nut is really tight, the last method is recommended.
8 Remove the crankshaft damper/pulley.
9 Remove the coolant pump (refer to Chapter 2).
10 Remove the engine front cover complete with distributor and oil pump. The oil slinger from the front end of the crankshaft will drop out as the cover is withdrawn. If the front cover jams and will not pull off, reach down inside the cover with a long screwdriver and straighten the oil slinger, which has probably twisted on the crankshaft and is causing the jamming.
11 Mark both chains with quick-drying paint to indicate the original direction of travel. If new chains are being fitted, this operation can be ignored.
12 Withdraw the upper chains and crankshaft oil pump gear.
13 Pull off the lower chain complete with sprockets.
14 Carry out the examination and renovation procedure as detailed in Section 14.
15 Engage the sprockets within the primary (lower) chain and install the complete assembly to the front of the engine. Make sure that the thrust washer is in position on the idler sprocket (photos).
16 Push the oil pump/distributor drivegear onto the front end of the crankshaft (photo).



5.15a Installing primary chain and sprockets



5.15b Idler sprocket thrust washer



5.16 Fitting oil pump/distributor drivegear

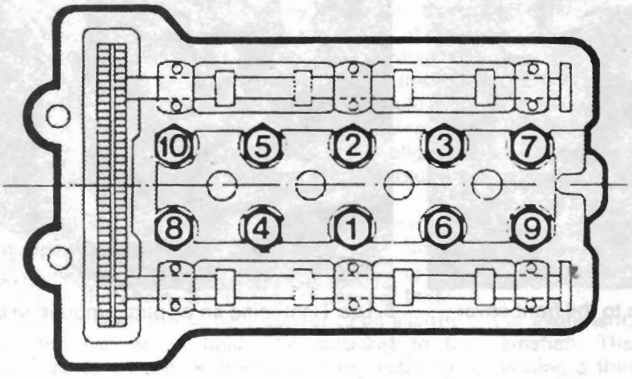


Fig. 1.5 Cylinder head nuts tightening sequence (Sec 4)

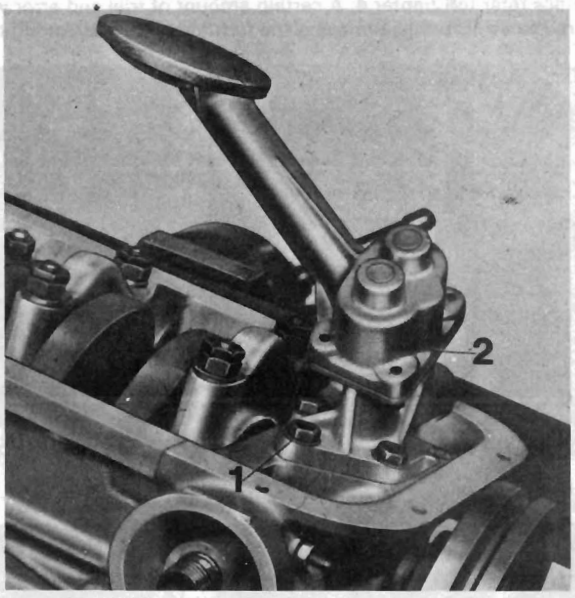


Fig. 1.6 Oil pump installed (Sec 5)

1 Mounting bolt *2 Pump body*

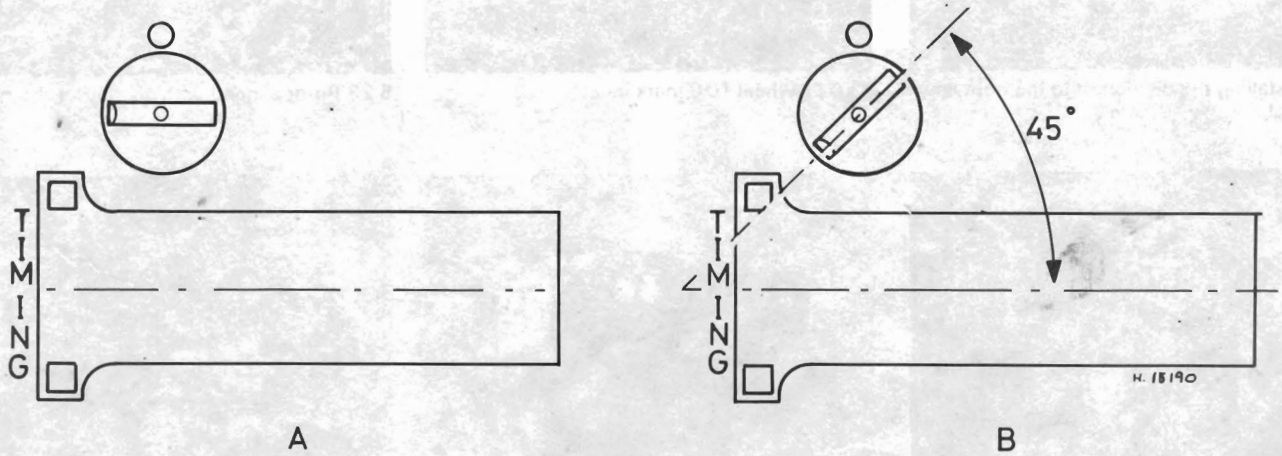
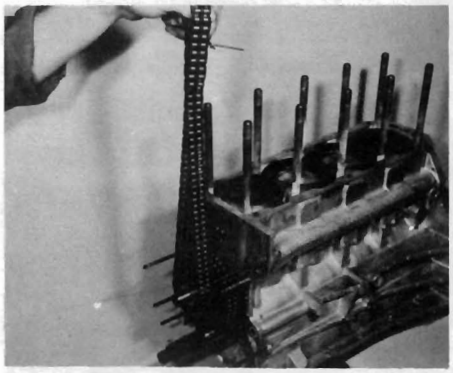
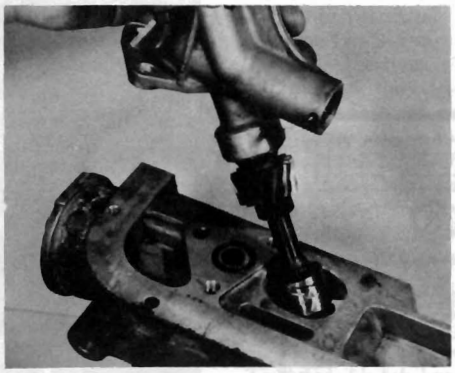


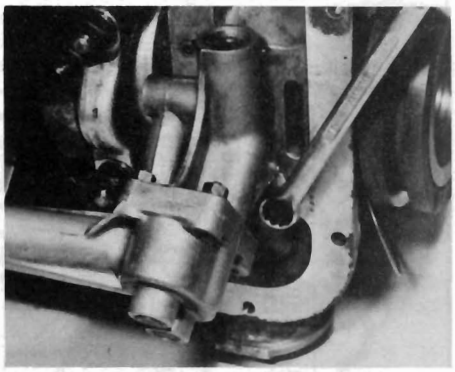
Fig. 1.7 Distributor rotor setting (No 1 at TDC) (Sec 5)

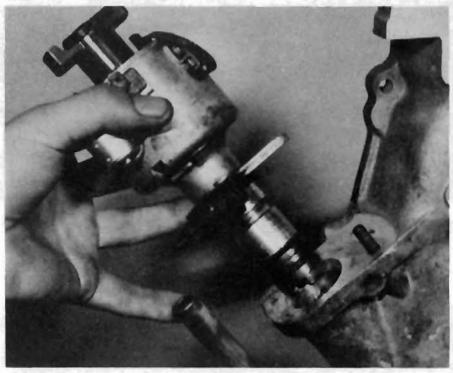
A Marelli *B Bosch*

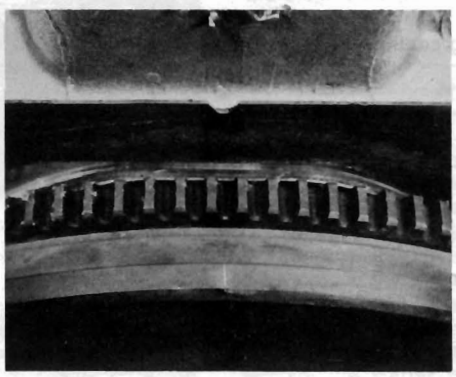
17 Engage the upper chain with the idler sprocket (photo).
18 Fit the oil pump to the front cover and turn its shaft to check for binding. If it binds, release the pump bolts and give the pump mounting flange a sharp tap to centralise it (photos).
19 Fit the distributor O-ring oil seal and install the distributor to the front cover so that the rotor is aligned as described in the following paragraphs (photo).
20 Turn the crankshaft to bring Nos 1 and 4 pistons to TDC. When this setting is correct, the mark on the flywheel will be in alignment with the notch at the top of the engine rear plate (photo).
21 Stick the O-ring seal to the front cover, using a dab of thick grease.
22 Apply grease to the front cover oil seal lips and locate new cover gaskets.
23 The distributor rotor arm should now be positioned so that as the cover assembly is installed, and the drivegears mesh, the arm will take up a final position either parallel to the engine centre line (Marelli distributors) or at an angle of 45° to it (Bosch distributors) (photo). For more details refer to Chapter 4. A certain amount of trial and error will be required to achieve this, removing the front cover, repositioning the rotor and refitting the cover again.
24 Offer the front cover to its studs, but only just engage the cover with the top two studs and allow it to hang on them.
25 Hold the crankshaft oil slinger with a pair of long-nosed pliers and pass it down inside the front cover until it can be placed on the front end of the crankshaft. Make sure that the front cover is pushed on sufficiently far to ensure that the gear on the oil pump drive is located behind the oil slinger (photo).
26 Pass a thin screwdriver between the crankshaft and the lips of the oil seal and rotate the oil slinger until its keyway aligns with the Woodruff key. Push the front cover fully home, the cover will take the oil slinger with it until the slinger is up against the oil pump drivegear on the crankshaft (photos).
27 Tighten the front cover bolts.
28 Fit the coolant pump (refer to Chapter 2).
29 Fit the crankshaft damper/pulley and tighten the nut to the specified torque while the flywheel ring gear is jammed. Bend up the lockplate (photos).
30 Check that Nos 1 and 4 pistons are still at TDC and remove the

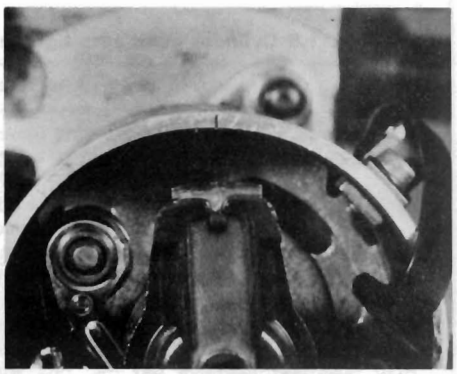

5.17 Engaging the timing upper chain with the sprocket

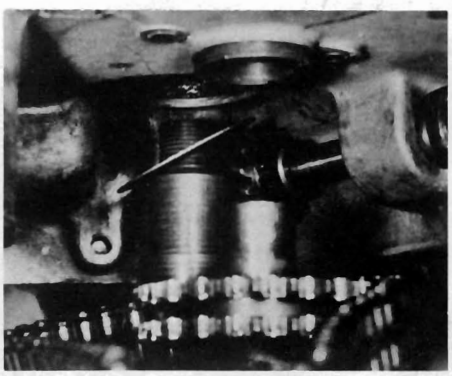

5.18a Fitting the oil pump to the front cover

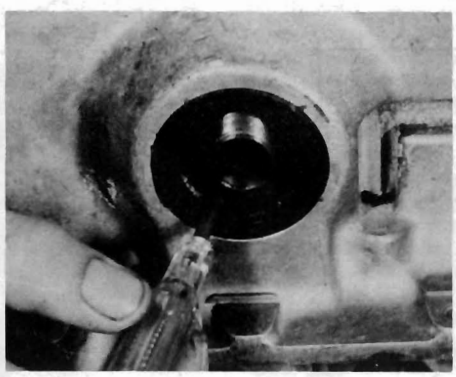

5.18b Tightening an oil pump mounting bolt

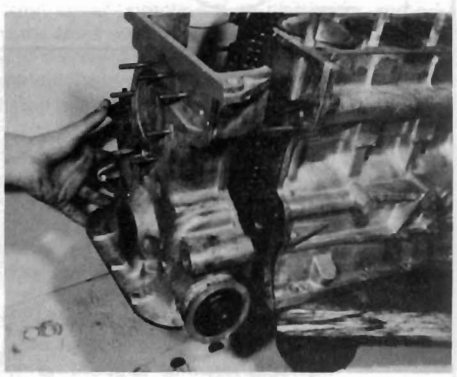

5.19 Installing the distributor to the front cover

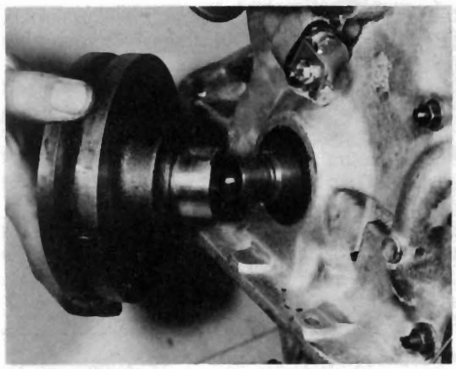

5.20 Flywheel TDC mark


5.23 Rotor aligned with distributor rim mark

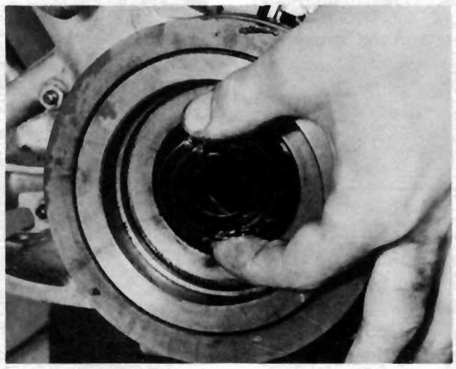

5.25 Oil slinger on front end of crankshaft


5.26a Turning the oil slinger to align with the crankshaft key

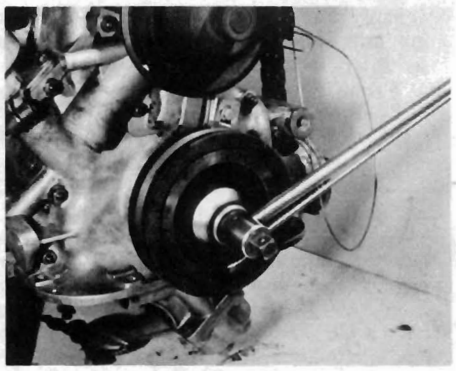

5.26b Installing the front cover



5.29a Fitting the crankshaft damper/pulley



5.29b Crankshaft pulley nut lockplate



5.29c Tightening the crankshaft pulley nut

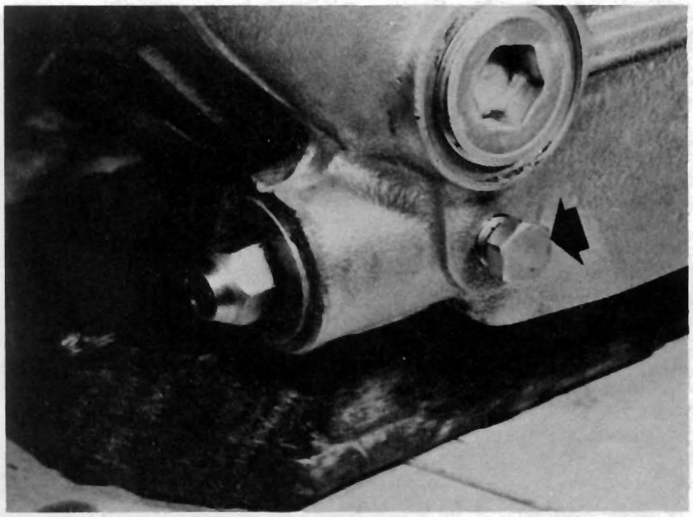
cylinder liner clamps.
31 Fit the cylinder head as described in Section 4 and the sump pan (Section 6).
32 Engage the upper chain with the camshaft and tensioner sprockets. Reconnect the chain between the two camshaft sprockets.
33 Tension the chain. Do this by releasing the locking bolt and pushing the tensioner against the pressure of its spring. Once the freedom of the tensioner to slide has been verified, allow the tensioner to exert pressure on the chain and retighten the locking bolt (photo).
34 A further check of the valve timing should now be carried out. With the camshaft journal and bearing housing marks in alignment, and the F/P mark on the crankshaft pulley aligned with the pointer, turn the crankshaft through two complete revolutions and recheck the marks.
35 Start the engine and run it to normal operating temperature, then hold its speed at a steady 1000 to 1200 rpm. Now slightly release the tensioner locking bolt to allow the tensioner to take up any residual slackness in the chain. Retighten the locking bolt.
36 If the camshaft marks now appear to be slightly out of alignment, release the nut which holds the sprocket to the camshaft. The camshaft sprocket can be prevented from rotating by passing a thin rod through one of the holes in the sprocket.
37 Extract the split pin from the small castellated nut on the sprocket, unscrew the nut and remove the bolt.
38 Again prevent the sprocket from rotating and turn the camshaft so that the sprocket mounting flange moves relative to its sprocket, until the sprocket/flange marks are in alignment. The camshaft can be turned using a pair of grips on the non-machined surface of the camshaft.
39 Refit the small camshaft flange-to-sprocket bolt, noting that it will now only pass through a different offset hole as the alignment has been altered.
40 Fit and tighten the castellated nut and insert a new split pin (photo).
41 Repeat the adjustment on the opposite sprocket.

6 Sump pan – removal and refitting

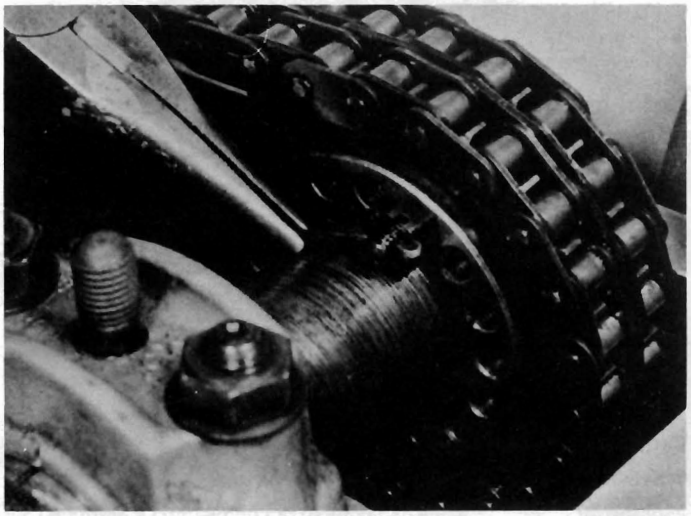
1 Drain the engine oil into a suitable container.
2 Refit the drain plug and tighten it.
3 Unscrew and remove the sump pan securing screws and lift the pan from the crankcase. Note the screws attaching the sump to the front cover.
4 When refitting, use a new gasket and tighten the screws in an alternate, diagonal sequence.

7 Oil pump – removal and refitting

1 The oil pump is bolted to the inside of the engine front cover and is accessible after first withdrawing the sump pan as described in the preceding Section.
2 Unbolt and remove the oil pump.
3 Before installing the oil pump, first turn the crankshaft to bring No 1 piston to TDC on its compression stroke. To make sure that it is the compression stroke, either remove No 1 spark plug and place a finger over the hole to feel the compression being generated, or if the cam cover is removed, check that the front cam lobes are both facing outwards. Continue turning the crankshaft until the pulley/front cover timing marks are in alignment.
4 Set the distributor rotor arm so that it is slightly in advance of No 1 contact in the distributor cap (distributor shaft turns clockwise).
5 Turn the oil pump driveshaft until the groove in the end of the shaft is aligned ready to engage with the dog on the end of the distributor shaft. Push the pump into position so that the oil pump driven gear meshes with the crankshaft drivegear. Check that the alignment of the rotor arm with No 1 contact is correct; if not,



5.33 Chain tensioner lockbolt (arrowed)



5.40 Fitting a split pin to the camshaft sprocket castellated nut

withdraw the pump and repeat the operations, having repositioned the rotor arm and the oil pump driveshaft to allow for the movement associated with the meshing of the gears.
6 Screw in the pump mounting bolts.
7 Refit the sump and fill with oil.
8 Check the ignition timing (see Chapter 4).

8 Flywheel – removal and refitting

1 Although in theory, the engine flywheel housing should be able to be removed once the starter motor (Chapter 9) and propeller shaft (Chapter 7) have been withdrawn, it is usual to find that the projection of the weld flange on the engine compartment rear bulkhead is so large that the housing cannot be moved far enough to the rear to clear the flywheel studs.
2 It is recommended therefore that the engine is either removed, or at least its mountings disconnected and the power unit slid forward, in order to be able to remove the flywheel housing and to give access to the starter ring gear and rear main bearing.
3 Once the engine has been removed or at least slid forward, carry out the following operations.
4 Unbolt the engine rear mounting and then unbolt the flywheel housing and withdraw it from the engine.

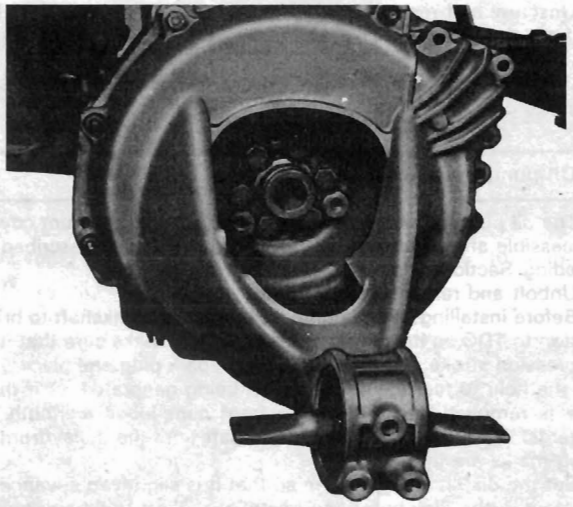


Fig. 1.8 Flywheel housing and rear mounting (Sec 8)

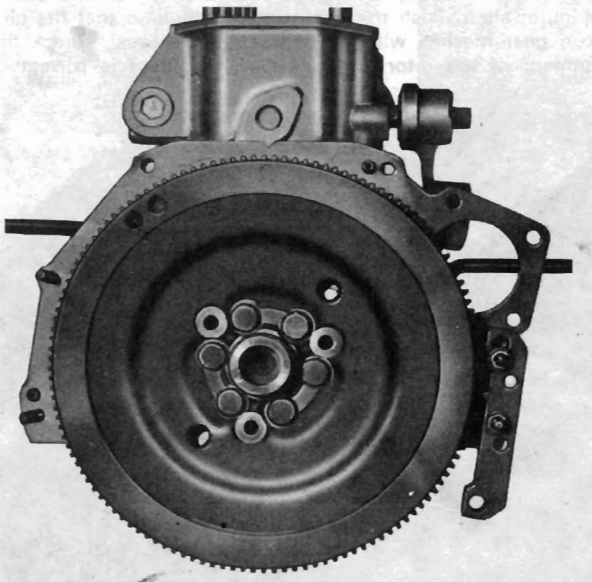


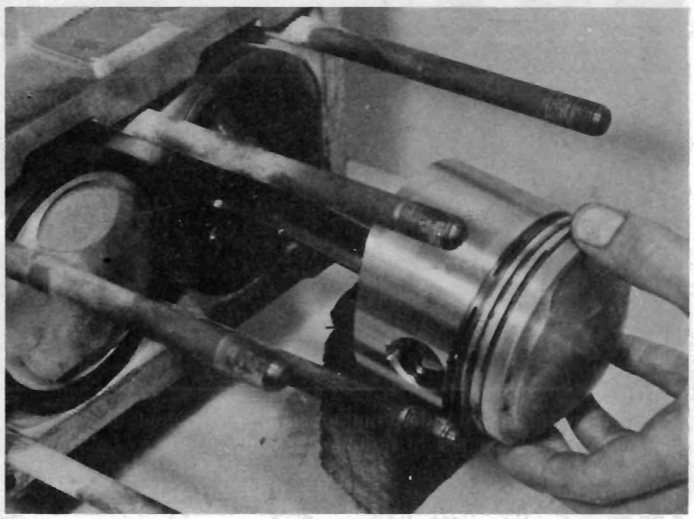
Fig. 1.9 Flywheel jammed with typical lockplate (Sec 8)

VOLANO BLOCCARE

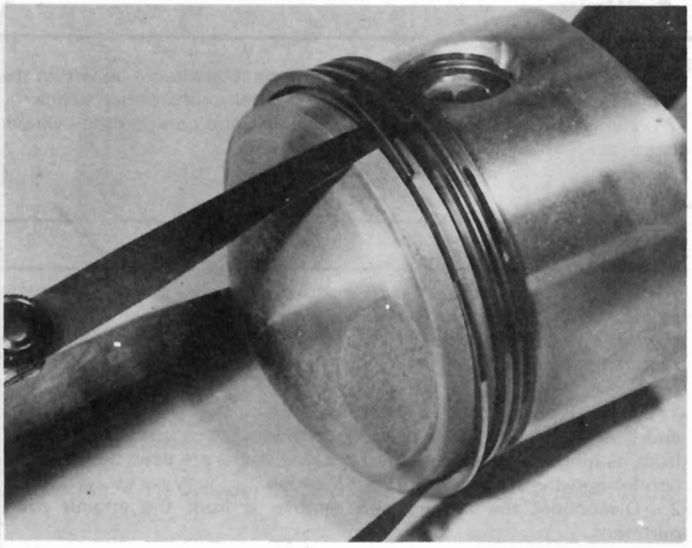
5 Examine the flywheel for alignment marks. If none is evident, mark the position of the flywheel in relation to the crankshaft mounting flange.
6 Flatten the locktabs on the flywheel bolts and then unscrew and remove the bolts. In order to prevent the flywheel rotating, jam the teeth of the flywheel starter ring gear with a suitable tool or plate.
7 Lift the flywheel from its mounting flange.
8 If the crankshaft rear oil seal has been leaking, it may be prised out and a new one tapped into position using a piece of tubing.
9 Refitting is a reversal of removal. Align the marks made at dismantling and apply thread locking compound to the threads of the bolts, which should be clean and dry. Tighten to the specified torque.

9 Pistons and connecting rods – removal and refitting

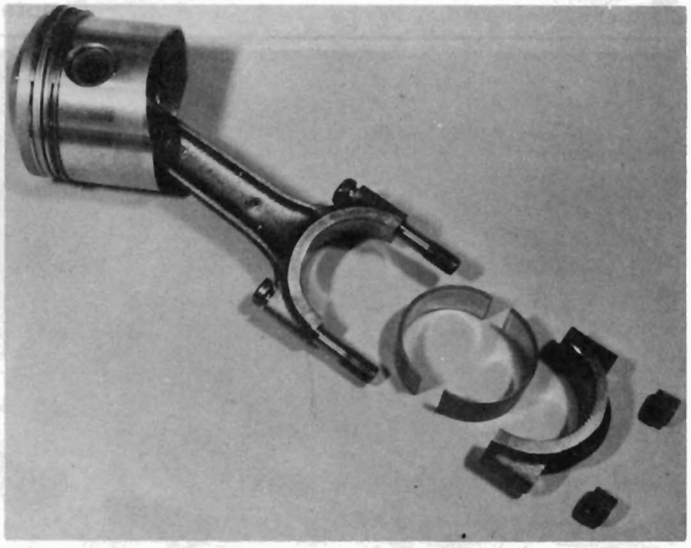
1 Refer to Section 4 and remove the cylinder head.
2 Fit clamps to retain the cylinder liners in the block (see Section 4). The clamp must not foul the cylinder bores.
3 Remove the sump pan (Section 6).
4 Check the big-end caps and connecting rods for identification marks, which will indicate their position in the block and also which way round they are installed. If no marks are visible, mark the caps and rods at adjacent points using a punch or a file and note to which side of the engine the marks face, this should be the oil filter side.
5 Check the top of the bores for a wear ridge. This can easily be detected with the fingernail; if evident, the ridge should be removed by very careful scraping, otherwise the piston rings will break as the piston is pushed out of the bore. Take great care not to score the cylinder bores when removing the wear ridge.
6 Unscrew the big-end cap nuts and take off the caps complete with bearing lower shells.
7 Withdraw each piston/connecting rod from the top of the block by pushing the rod upwards (photo).
8 If the bearing shells are to be used again, tape them to their respective cap or rod.
9 The piston can be removed from its rod by extracting the gudgeon pin circlips and pushing out the pin, which is a sliding fit in both rod and piston.
10 Remove the piston rings by sliding two or three feeler blades round behind the top ring and sliding the ring off upwards using a twisting motion (photo).
11 Refit the piston rings by reversing the removal operations. Make sure that the word 'TOP' on the rings is uppermost.
12 If the piston was separated from its rod, reconnect it and fit new circlips. Correct alignment of piston to connecting rod is vital. The arrow on the piston crown should point towards the exhaust side of the engine, and the rod big-end should be offset towards main bearings 2 and 4 when the assembly is installed in its cylinder liner (photo).
13 Oil the rings liberally and fit a piston ring clamp to the first piston. Oil the bores and the crankpins.



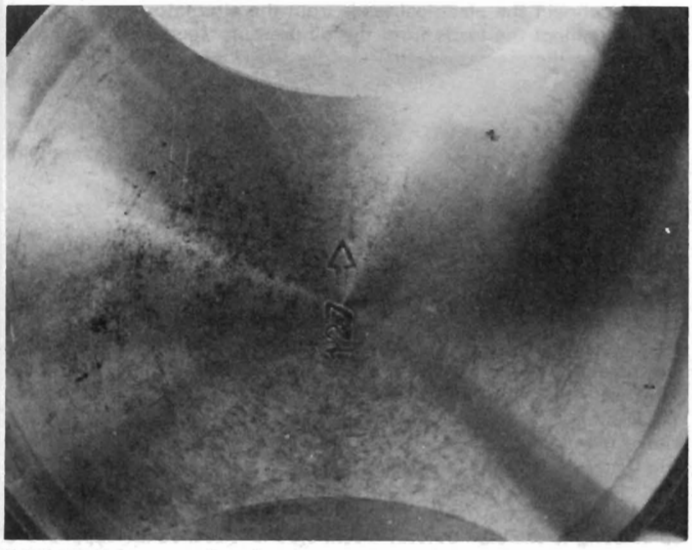
9.7 Removing a piston/connecting rod assembly



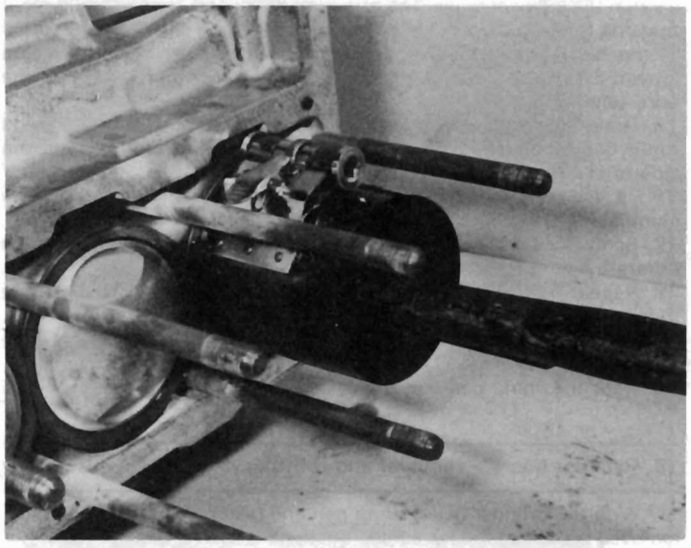
9.10 Removing the piston rings



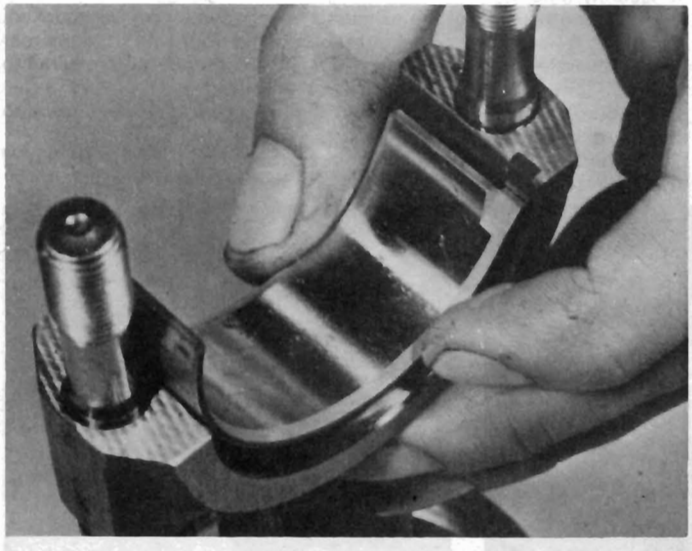
9.12 Piston/connecting rod components



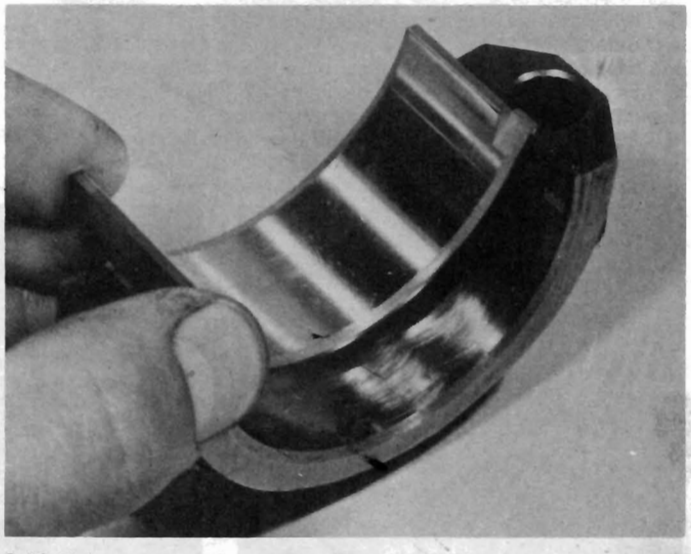
9.14a Piston crown directional arrow



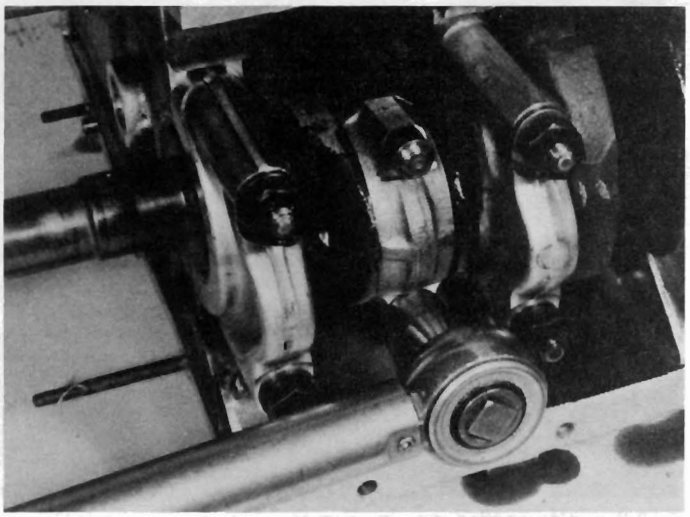
9.14b Installing a piston/connecting rod



9.15 Fitting a connecting rod bearing shell



9.16 Fitting a connecting rod bearing cap shell



9.17 Tightening a connecting rod big-end cap nut

14 Enter the connecting rod into the cylinder bore, taking care not to scratch the cylinder walls. The arrow on the piston crown should point towards the exhaust side. With the clamp resting squarely on the top of the block, apply the wooden handle of a hammer to the piston crown. Strike the head of the hammer and drive the piston into the bore (photos).
15 Draw the rod downwards, fit the bearing shell and connect the rod to the crankshaft, making sure that the identification numbers face the side of the engine originally noted (photo).
16 Fit the cap complete with shell, again making sure that the identification numbers are adjacent to those on the rod (photo).
17 Screw on the nuts and tighten them to the specified torque (photo).
18 Repeat the operations on the remaining three pistons/connecting rods.
19 The shells on No 4 rod and cap have their chamfer towards the flywheel.
20 Refit the sump pan and the cylinder head.

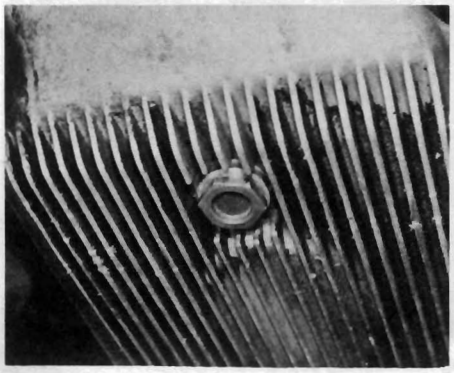
10 Cylinder liners – removal and refitting

1 With the cylinder head, sump pan and pistons/connecting rods all removed as described in earlier Sections, remove the cylinder liner clamps.
2 If the liners are to be used again, mark their position in the block with regard both to sequence and to alignment. Quick-drying paint is best used for this.
3 Withdraw the liners from the cylinder block.
4 Before refitting the liners, clean away all the old sealing rings from the base of the liners and the liner base recess in the block.
5 Fit the new sealing rings to the liners and install the liners, having applied engine oil to inner and outer surfaces.
6 Fit the liner retaining clamps and then measure the projection of each liner above the top surface of the cylinder block. Ideally a dial gauge should be used or this, but a straight-edge and feeler blades will provide an acceptable alternative. The projection should be within the limits given in the Specifications. If not, seek professional advice.
7 Refit the pistons/connecting rods, the sump pan and the cylinder head, all as described in earlier Sections.

11 Engine – removal

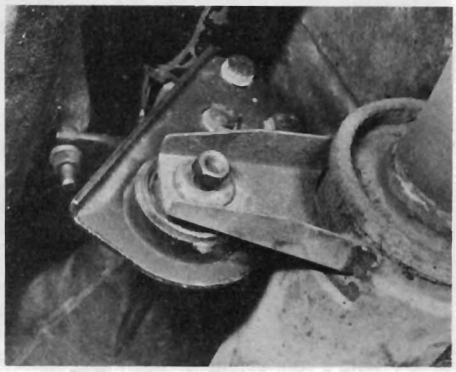
If your car is equipped with air conditioning, refer to the warning in Section 1. If your car is equipped with fuel injection or emission control equipment, refer to Chapter 3 for alternative disconnection requirements in comparison with the carburettor engine described here.

1 Open the bonnet, disconnect the engine compartment lamp wires and washer tube and with the help of an assistant, unbolt the bonnet from its hinges and lift it away. If packing shims are used between the bonnet and the hinges, note their location.
2 Disconnect the battery and remove it from the engine compartment.
3 Drain the cooling system by disconnecting the radiator bottom hose and unscrewing the cylinder block drain plug as described in Chapter 2.
4 Remove the air cleaner and intake duct.
5 Disconnect the electrical leads from the alternator.
6 Disconnect the leads from the oil pressure sender, and from the electric fan thermostatic switch on the radiator.
7 Refer to Chapter 2 and remove the radiator complete with shroud and electric fan.
8 Unclip the cover and cap from the distributor, disconnect the HT leads from the spark plugs and coil, and remove the cap complete with leads.
9 Disconnect the LT lead from the distributor.
10 Disconnect the leads from the starter motor.
11 Disconnect the fuel inlet pipe from the fuel filter, also the pipe between the filter and the pump.
12 Disconnect the heater hose from the coolant pump.
13 Disconnect the fuel inlet hose from the carburettor.
14 Disconnect the throttle control linkage balljoint at the bellcrank just below the intake manifold.
15 Disconnect the choke cable from the carburettor choke levers.
16 Disconnect the vacuum servo hose and the heater hose from the intake manifold.
17 Disconnect the tachometer drive cable from the coolant pump by unscrewing the knurled ring. Not all models have a cable drive tachometer – some have an electronic type, with an electric wire connecting to the distributor. Disconnect the wire instead if applicable.
18 Disconnect the lead from the coolant temperature switch which is screwed into the cylinder head.
19 Drain the engine oil, refit the drain plug to the sump and tighten it securely (photo).
20 The front section of the exhaust system should now be removed. To do this, release the clamp and separate the front pipe from the rear pipe. A liberal application of releasing fluid will probably be required to free the components.
21 Prise off the suspension rubber ring securing the exhaust pipe to the gearbox crossmember.
22 Unbolt the flexible mounting and disconnect the front section of the exhaust pipe (photos).



11.19 Sump drain plug

11.22a Exhaust section clamp



11.22b Exhaust flexible mounting

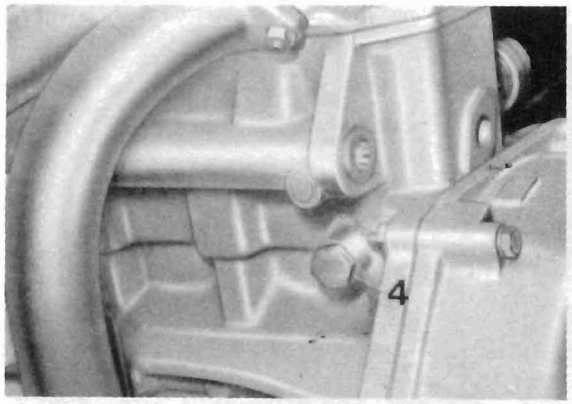


Fig. 1.10 Cylinder block coolant drain plug (4) (Sec 11)

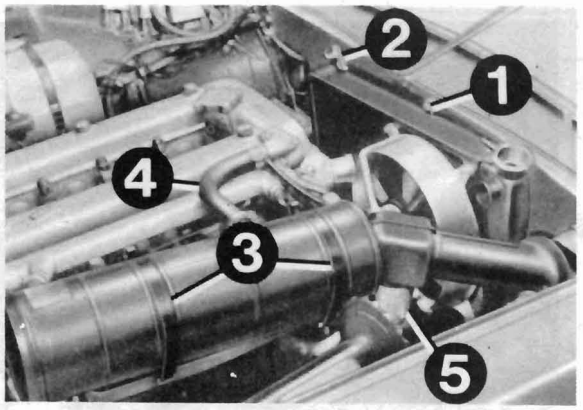


Fig. 1.11 Disconnection points (Sec 11)

1 *Radiator fixing screw*
2 *Bracket*
3 *Air cleaner clamps*
4 *Crankcase vent hose*
5 *Warm air duct*

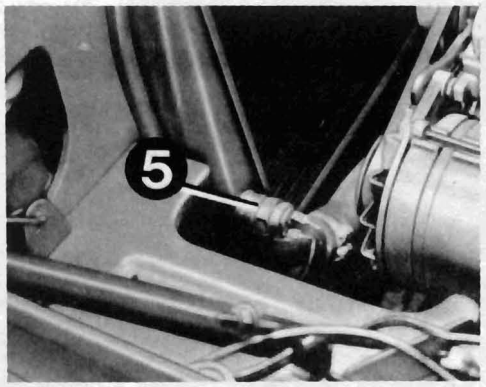


Fig. 1.12 Radiator fan thermostatic switch (5) (Sec 11)

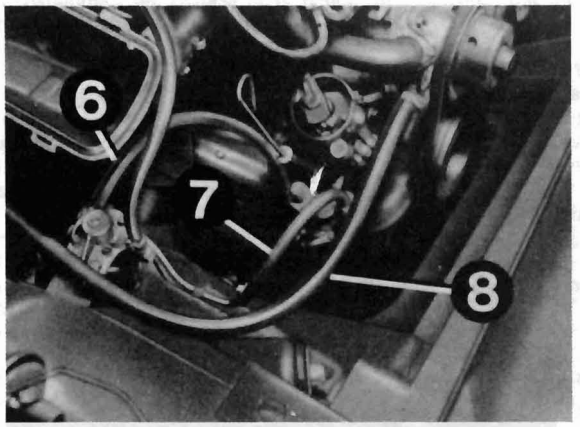


Fig. 1.13 Fuel and heater hoses (Sec 11)

6 *Filter inlet*
7 *Pump inlet*
8 *Heater coolant return*

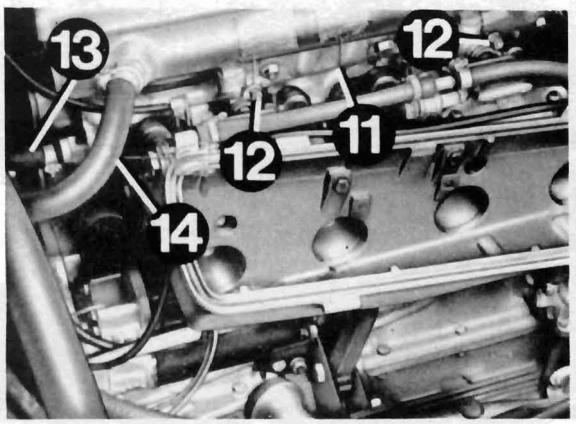


Fig. 1.14 Brake servo and heater hoses (Sec 11)

11 *Choke control cable*
12 *Carburettor choke levers*
13 *Brake servo vacuum line*
14 *Heater coolant flow*

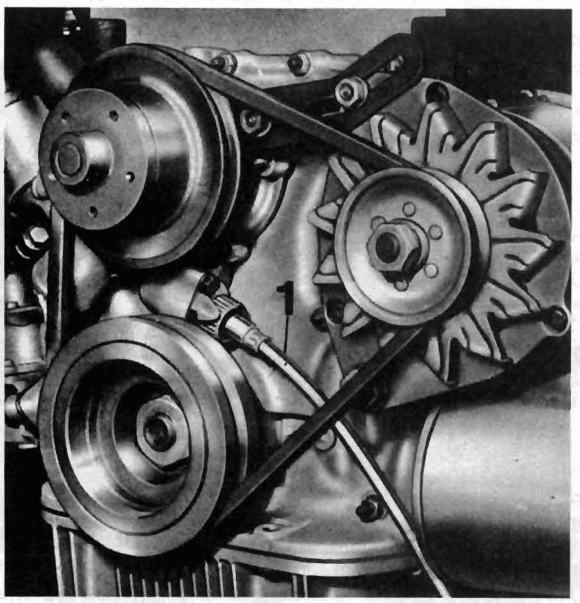


Fig. 1.15 Tachometer drive connection (1) at coolant pump (Sec 11)

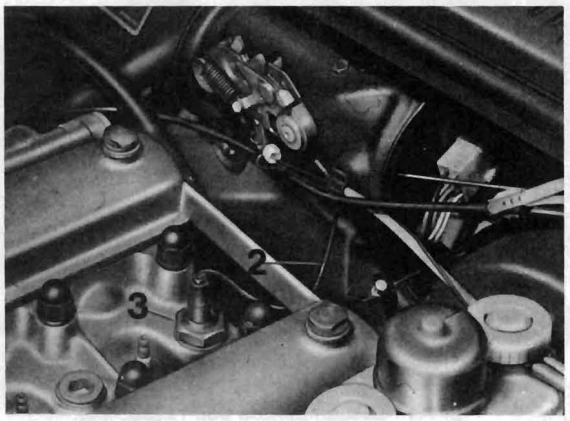


Fig. 1.16 Connecting lead (2) and coolant temperature switch (3) (Sec 11)

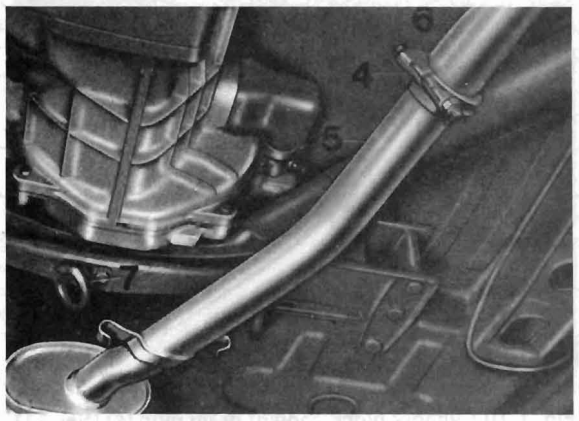


Fig. 1.17 Exhaust pipe connection (Sec 11)

4 Clamp
5 Front sectio..
6 Rear section
7 Suspension ring

Fig. 1.18 Exhaust front section flexible mounting (Sec 11)

8 Exhaust expansion box
9 Flexible mounting

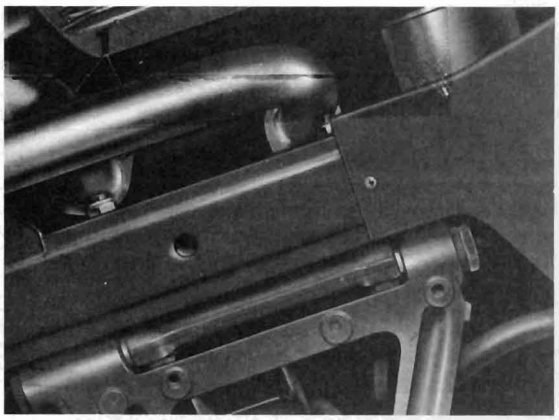


Fig. 1.19 Exhaust downpipe (1) attachment to manifolds (Sec 11)

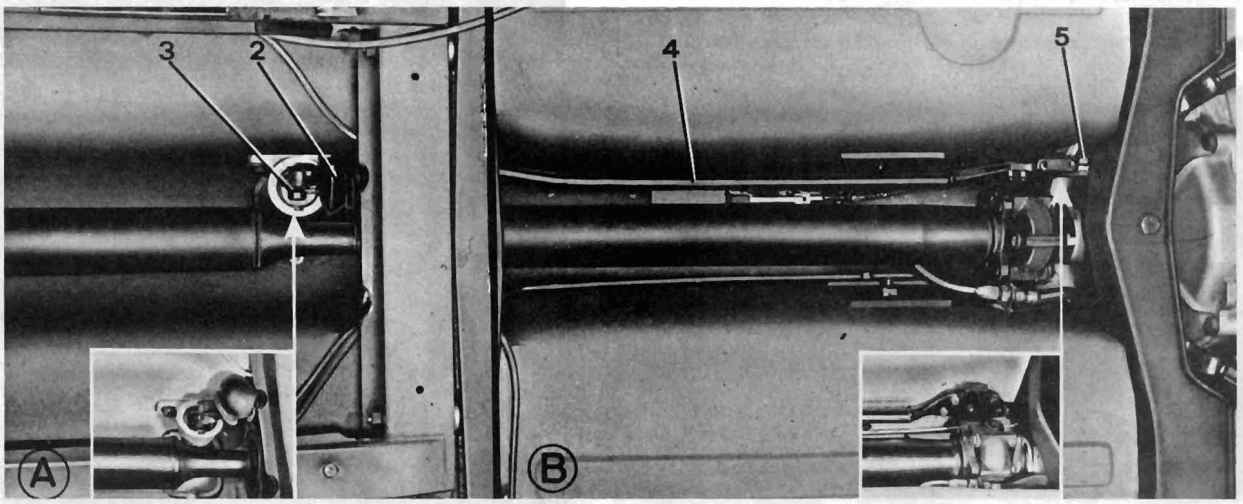


Fig. 1.20A Gear lever connection to link rod (Sec 11)

2 Dust-excluding boot
3 Fixing screw

Fig. 1.20B Selector link rod connection at transmission (Sec 11)

4 Link rod
5 Rod fixing bolt to transmission selector lever

23 Unbolt the exhaust downpipes from the manifold and withdraw the exhaust front section from the car.
24 Still working under the car, pull back the dust-excluding bellows from the gearchange lever support.
25 Disconnect the link rod from the gear lever by removing the screw and washer.
26 Working at the opposite end of the link rod, unscrew the nuts and bolts and disconnect the link rod from the selector lever of the transmission.
27 Refer to Chapter 5 and remove the propeller shaft.
28 Disconnect the earth strap which runs between the flywheel housing and the mounting.
29 Attach a hoist to the engine and take its weight.
30 Unscrew and remove the flywheel housing nuts and bolts.
31 Disconnect the flywheel housing flexible mounting from the body studs. Retain the spacer collars from the studs.
32 Unbolt and remove the small cover plate from the lower front face of the flywheel housing.
33 From the exhaust side of the engine, remove the heat shield from the engine mounting.
34 Unscrew the upper nuts which secure the engine mountings to the body side-members.
35 With the weight of the engine still taken on the hoist, unscrew the lower screws which hold the mountings to the wing inner panels.
36 Pull the engine forwards to clear the flywheel housing and lift the engine out of the engine compartment.

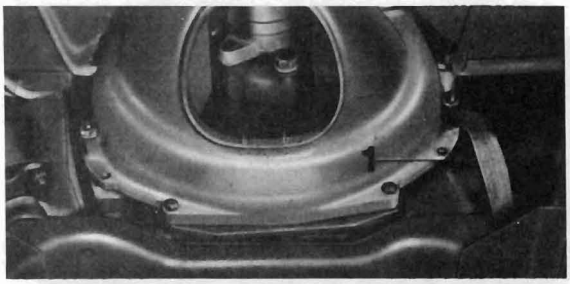


Fig. 1.21 Flywheel housing earth strap (1) (Sec 11)

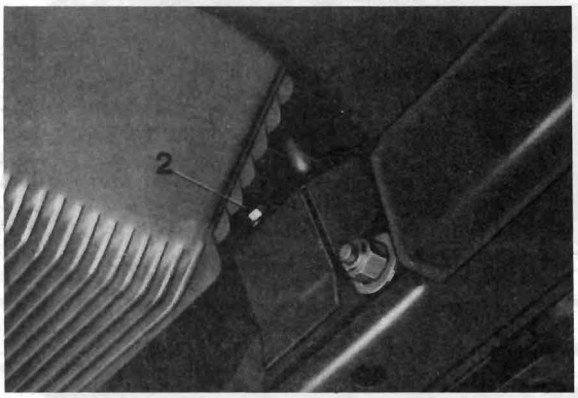


Fig. 1.22 Body side-member engine mounting bolts (2) (Sec 11)

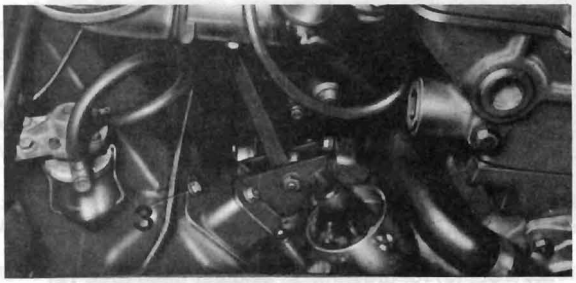


Fig. 1.23 Wing panel engine mounting bolts (3) (Sec 11)

12 Engine – complete overhaul

1 With the engine removed, first clean away all external dirt and grease using paraffin or a water-soluble solvent and a stiff brush.
2 Support the engine on a strong bench or trestle, or if these are not available, on a sheet of plywood or hardboard on the floor.
3 Remove the carburettor support strut.
4 Unbolt and remove the starter motor.
5 Unbolt and remove the engine mounting from the intake manifold side of the engine.
6 Remove the hot air collecting device and bracket.
7 Unbolt and remove the exhaust manifolds and gaskets.
8 Unbolt and remove the engine mounting from the exhaust manifold side of the engine.
9 Release the distributor clamp plate nut and withdraw the distributor. Do not unscrew the clamp plate pinch-bolt.
10 Unscrew and remove the spark plug.
11 Release the alternator mounting and adjuster link bolts, push the alternator in towards the engine and slip the drivebelt from the pulleys.
12 Remove the alternator mounting bolts and remove the unit from the engine.
13 Disconnect the bypass hose which runs between the thermostat housing and the coolant pump.
14 Withdraw the engine oil dipstick.
15 Unscrew the oil filter cartridge and discard it. A removal tool will be required for this or if one is not available, drive a large screwdriver through the filter casing at the end furthest from the engine and use this as a lever to unscrew the filter. Be prepared for some oil spillage.
16 Detach the throttle rods and unbolt and remove the carburettor assemblies.
17 Unbolt the cover from the thermostat housing and withdraw it complete with thermostat and O-ring.
18 Unbolt and remove the intake manifold.
19 Unbolt and remove the fuel pump from the engine front cover, retaining the insulator block and pushrod.
20 Unscrew and remove the oil pressure switch.
21 Unscrew and remove the coolant temperature switch.
22 Unbolt and remove the camshaft cover, not forgetting the two screws at the front which attach it to the flange of the cylinder head.
23 Using a socket spanner on the crankshaft pulley nut, turn the crankshaft until the connecting link on the timing chain is located between the camshaft sprockets and the camshaft reference marks (journal to cap) are in alignment.
24 Release the chain tensioner setscrew, depress the top run of the chain to counteract the spring tension of the tensioner and then retighten the tensioner screw.
25 Remove the chain connecting link and slip the chain from the sprockets, then withdraw it from the engine. If the chain is to be used again, mark it for its direction of running.
26 Unscrew the cylinder head nuts, starting at the centre two and working towards each end of the head. Remove the engine lifting bracket then lift off the head.
27 If the head is stuck, pour releasing fluid around the studs and refit the exhaust manifold for leverage using a rocking action. In extreme cases, when all else fails, a special tool in available (A20146) to withdraw it (Fig. 1.29). Something similar can be made up from scrap materials using a bolt to screw into the plug holes. Make sure that the cylinder head domed nuts are only screwed part-way onto their studs if a tool has to be used.
28 If the cylinder liners are not to be removed, fit liner clamps now (see Section 4).
29 Turn the engine on its side and unbolt and remove the sump pan. Peel off the gasket.
30 Unbolt and remove the oil pump and its sealing ring.
31 Check the connecting rods and big-end caps for alignment and sequence numbers. If necessary, mark them with a punch or file at adjacent points. Remember to which side of the engine the marks should face (oil filter side).
32 Unscrew the big-end nuts and remove the caps. If the caps are tight, tap them off with a plastic-faced hammer. Keep the bearing shells with their caps or rods if they are to be used again.
33 Jam the flywheel starter ring gear with a suitable tool or plate bolted to the engine rear flange.
34 Flatten the lockplate tab and unscrew the crankshaft damper/pulley nut. Remove the damper.

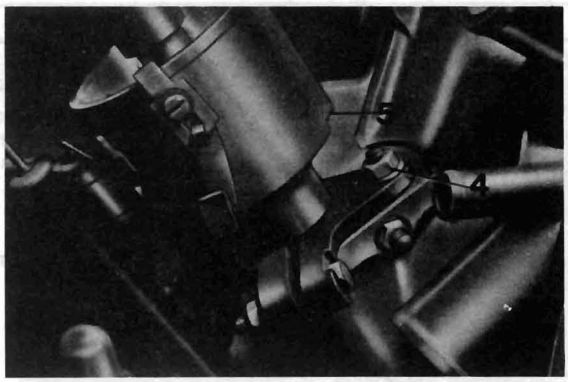


Fig. 1.24 Distributor fixing clamp (Sec 12)

4 Clamp plate nut *5 Distributor body*

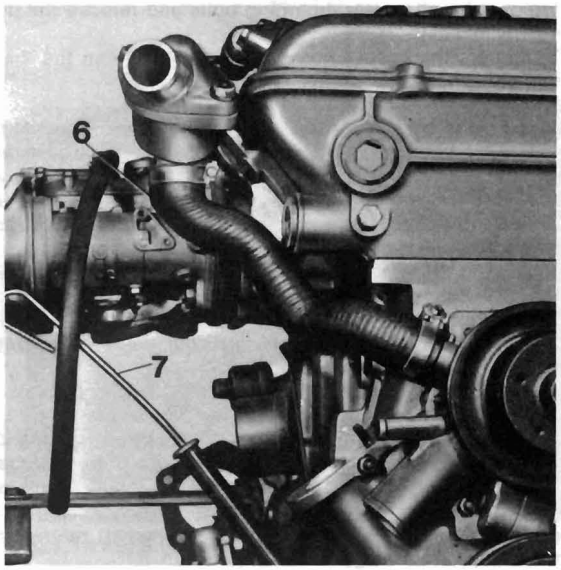


Fig. 1.26 Coolant bypass hose (6) and engine oil dipstick (7) (Sec 12)

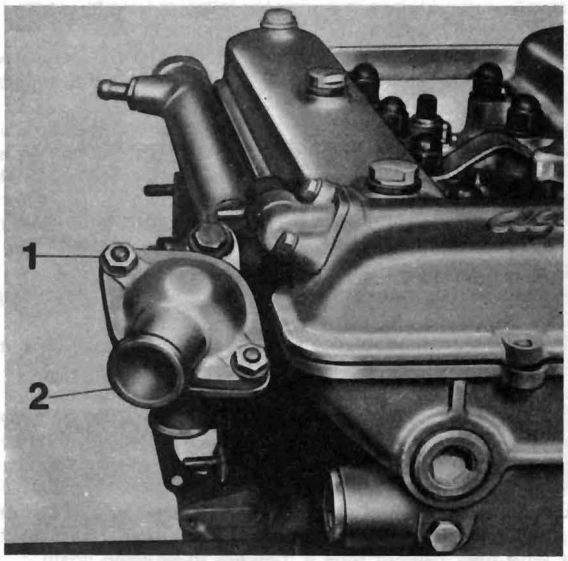


Fig. 1.28 Thermostat housing (Sec 12)

1 Fixing nuts *2 Cover*

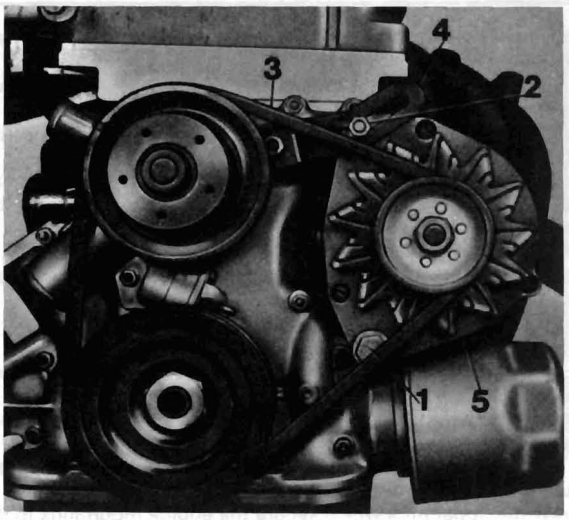


Fig. 1.25 Alternator mountings (Sec 12)

1 Lower pivot bolt
2 Adjustment link nut
3 Drivebelt
4 Adjuster link
5 Alternator

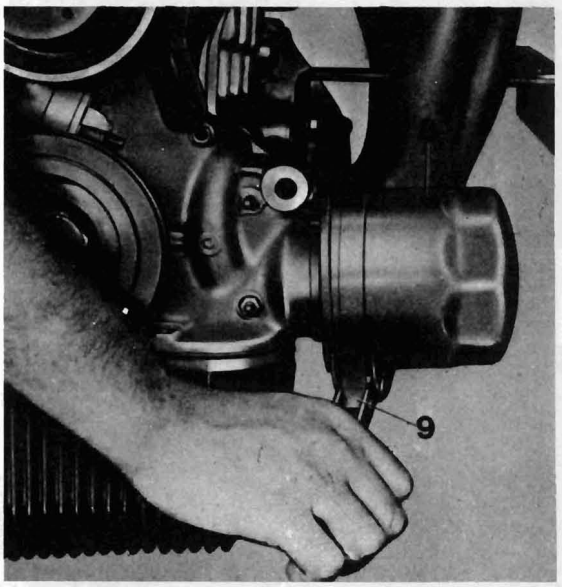


Fig. 1.27 Removing the oil filter (Sec 12)

8 Oil filter *9 Removal tool*

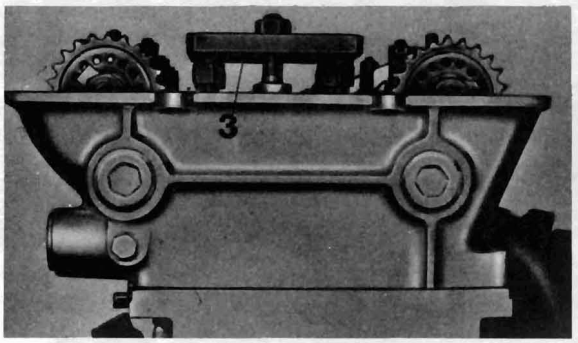


Fig. 1.29 Tool (3) for drawing off cylinder head (Sec 12)

35 Unbolt and remove the coolant pump.
36 Unbolt and remove the engine front cover together with gaskets and sealing ring. The crankshaft oil slinger will drop out as the front cover is withdrawn.
37 Pull off the primary chain and gears as an assembly. Mark the chain for running direction if it is to be used again.
38 With the flywheel again jammed, mark its position in relation to the crankshaft assembly mounting flange, unscrew the fixing bolts and remove it.
39 Unbolt and remove the rear cover plate and its gasket. Remove the engine rear plate.
40 Unscrew and remove the locknuts from the studs on the main bearing caps, then unscrew and remove the bearing cap nuts. The rear cap nuts are secured with lockplates.
41 Take off the main bearing caps. If they are tight, tap them off carefully with a plastic-faced hammer. Note that the caps are numbered 1 to 5 from the front of the engine, and that semi-circular thrust washers are located at the centre cap. If the bearing shells are to be used again, keep them identified as to their original position in cap or crankcase.

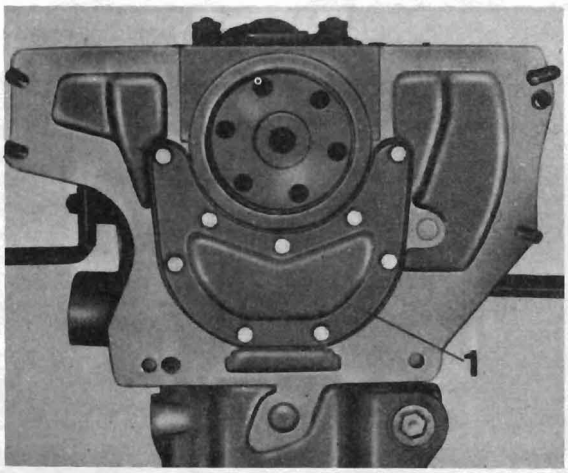


Fig. 1.30 Engine rear cover plate (1) (Sec 12)

13 Cylinder head – dismantling, servicing and reassembly

Dismantling

1 Identify the camshaft bearing caps and then unbolt and remove them.
2 Withdraw the camshafts.
3 To remove the sprocket from a camshaft, extract the split pin and unscrew the bolt. In order to prevent the camshaft from turning, use a pin wrench or similar engaged in the holes at the rear of the sprocket mounting boss.
4 Unscrew the nut which holds the sprocket to the camshaft.
5 Pull off the sprocket and mounting boss and extract the Woodruff key.
6 Keeping them in their installed positions (use a box with divisions), take out each of the cam followers together with valve adjusting shim.
7 Using a suitable compressor, compress the first valve spring and extract the split collets. Slowly release the compressor and remove it.
8 Take off the spring retainer, the double valve springs and the oil seals from the intake valve guides (photo).
9 Remove the spring lower seats and any shims and withdraw the valve from the cylinder head.
10 Keep the valves and their components in strict order and repeat the removal operations on the remaining valves.

Decarbonisation

11 With the cylinder head dismantled, remove all carbon deposits from the combustion surfaces and valve heads.
12 Take care not to damage the alloy surfaces of the head and use a rotary wire brush with discretion. An essential part of the de carbonising process is to remove the carbon from the piston crowns. Again take care not to damage the surfaces of the pistons, and mask oil and coolant passages to prevent the carbon from dropping into them.

Valves and guides

13 Insert each valve in turn into its guide. If the valve tends to rock due to excessive stem-to-guide clearance, then new valves and guides will be required. This is a job for your dealer or motor engineer, as the guides must be reamed on completion and the seats recut to ensure concentricity.
14 Examine the valve seats and valve head bevelled edge for signs of burning. If small black spots are visible without any sign of severe burning, the valves may be ground in. To do this first raise the cylinder head on two blocks of wood, then take the first valve and after having oiled its stem, insert it into its guide. Fit a suction type valve grinding tool to the head of the valve, then partially withdraw the valve and apply a little coarse valve grinding paste to the valve seat. Rotate the tool between the palms of the hands without applying pressure downwards. Once the grinding action loses its gritty feeling, lift the valve, turn it through 180° and continue grinding. When this last action loses its effectiveness for redistributing the grinding paste, withdraw the valve, apply some fine paste and repeat the grinding process. Finally withdraw the valve, wipe away all trace of paste and examine the ground surfaces. If black spots are still visible, repeat the grinding until a clean frosty grey band appears on both the valve head and seat. A single drop of paraffin applied to the paste on the seat about halfway through the grinding-in process will speed up the work. Do not apply more, or paste may be washed into the valve guide with damaging results.
15 Where the valves or valve seats are severely burned or eroded, new valves will be required and new seats must be fitted – the latter is a job for your dealer.
16 Keep the valves in order so that they will be refitted to the seats into which they were ground. Wash away all traces of grinding paste using a cloth soaked in paraffin.
17 Renew the intake valve stem oil seals.

Valve springs and camshafts

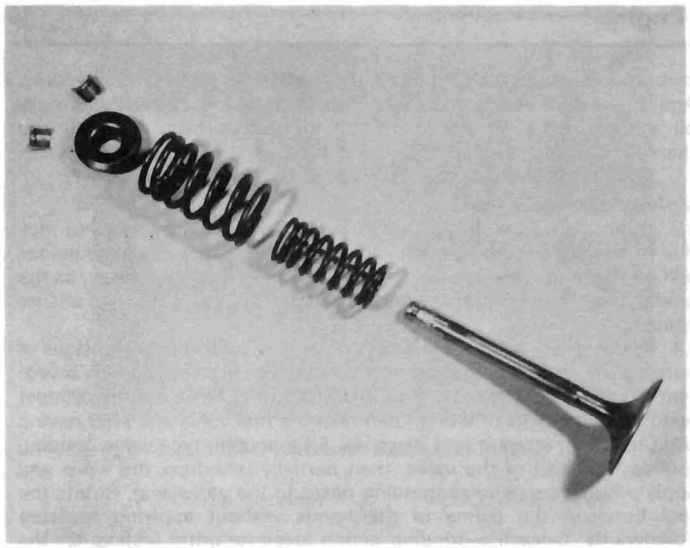
18 If the engine has covered 64 000 km (40 000 miles) or more, renew the valve springs.
19 Check the camshafts for worn journals, bearings, cam lobes and sprocket teeth. Examine the contact faces of the cam followers for wear. Renew if evident.

Cylinder head

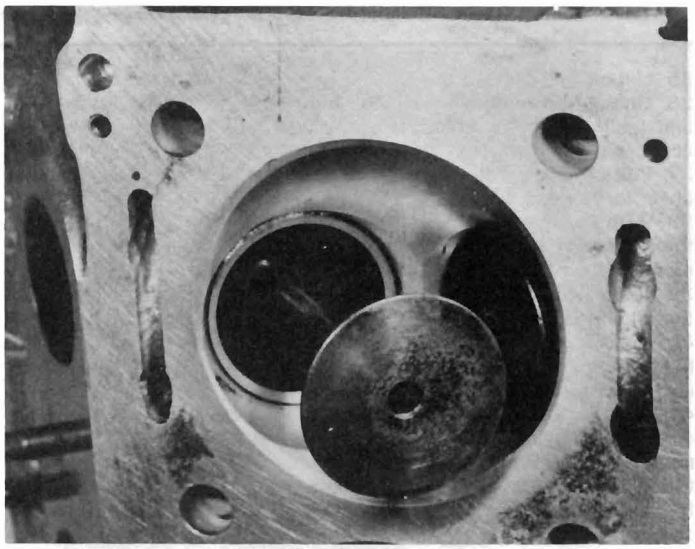
20 If there is reason to suspect that the cylinder head mating surface is out of true, this should be measured using a straight edge, or a piece of plate glass and feeler blades. If it is out of permitted tolerance, it may be possible to have the face re-finished – see your dealer. At the same time, examine the head for cracks or stripped plug threads. The latter can be remedied by the use of thread inserts – another job for your dealer.

Reassembly

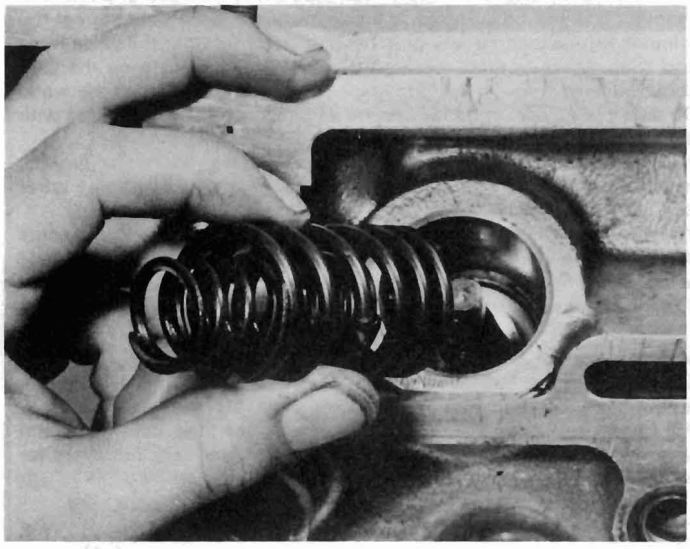
21 Commence reassembly by installing the valves, the seats and shims and the double valve springs (closer coils to cylinder head). Fit the valve spring retainer, compress the springs and fit the split collets into the groove in the stem. Slowly release the compressor and remove it (photos).
22 Repeat the operations on the remaining valves and then tap the end of each valve stem with a plastic-faced hammer to settle the components, but before doing this, make sure that the head is supported at its ends on two blocks of wood to permit the valve heads to move as the stem is struck.
23 Fit the original shim and the cam follower to each valve (photos).
24 Install the camshafts, making sure that the bearing caps are returned to their original numbered locations and that their oilways are inboard.
25 Fit the bearing cap nuts and tighten to the specified torque.
26 The valve clearances must now be checked. If the valves have been ground in or new valves fitted, it is very unlikely that the clearances will be within the specified tolerance, and the adjustment shims will have to be changed.
27 Turn the camshafts to bring a cam lobe heel (base circle) squarely



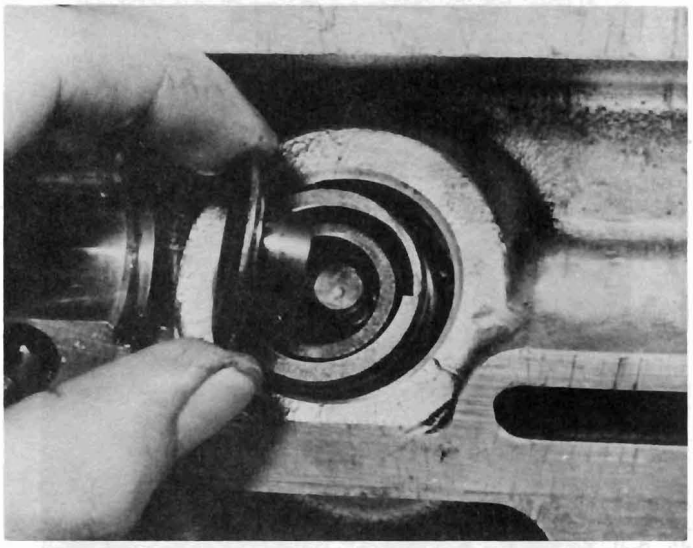
13.8 Valve components



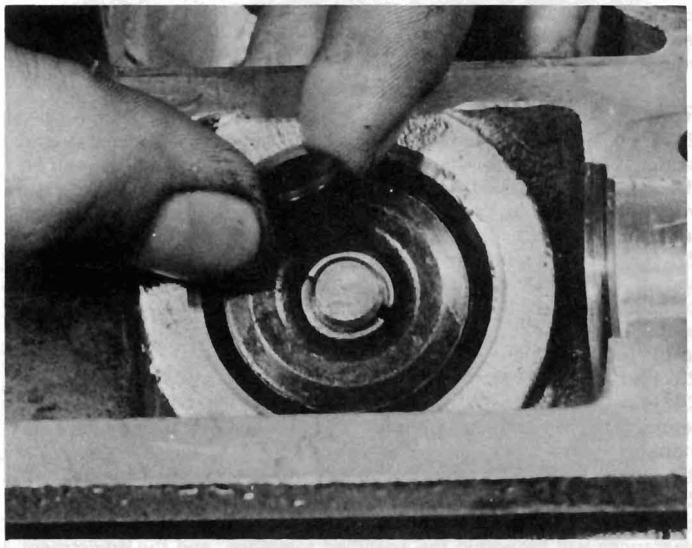
13.21a Inserting a valve into its guide



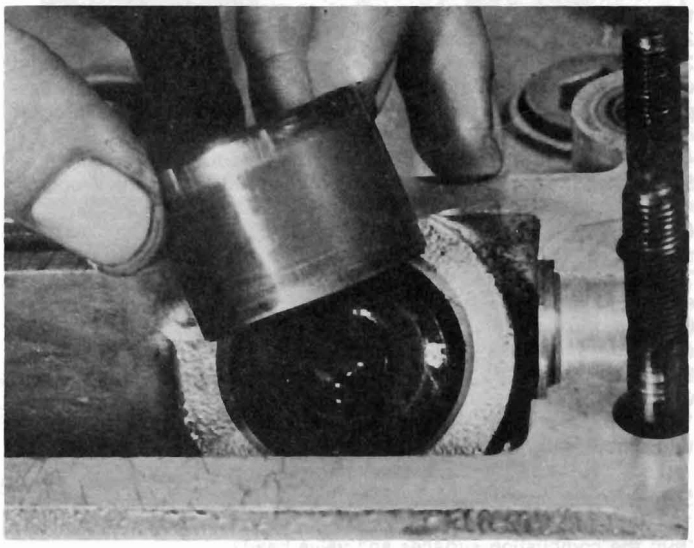
13.21b Fitting valve springs



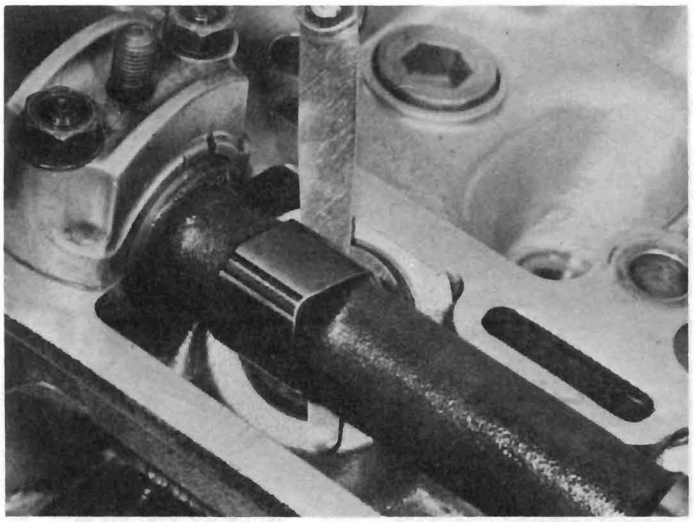
13.21c Fitting a valve spring retainer



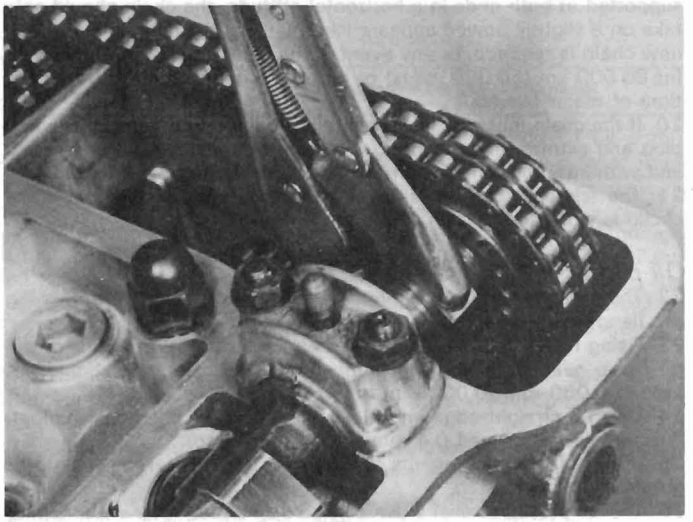
13.23a Fitting a valve clearance shim



13.23b Fitting a cam follower



13.27a Checking a valve clearance



13.27b Method of turning the camshaft

onto the cam follower. Using a feeler blade, check the clearance between the cam and the surface of the cam follower. Turn the camshafts as necessary to check each clearance as described (photos).
28 Viewing from the timing chain end of the engine, the valve locations are as follows:

Intake valves	–	*left-hand bank*
Exhaust valves	–	*right-hand bank*

29 The correct clearances are given in the Specifications.
30 If the clearances are incorrect, record them for their respective valves and then remove the camshafts.
31 Take off the first cam follower and measure the thickness of the shim. Use a micrometer for this. By simple calculation, it can be established what thickness the new shim must be to provide the desired clearance. Shims are available in thicknesses of 1.3 to 3.5 mm (0.05 to 0.14 in) in graduations of 0.25 mm (0.010 in). In practice, it is often possible to interchange some of the existing shims to provide the new required clearances.
32 Fit the selected shims, cam followers and camshafts, and recheck the clearances.
33 Fit the camshaft sprockets and the chain tensioner.

14 Engine components – examination and renovation

If the engine has been partially or completely dismantled, every component should be closely examined for wear or damage. Never refit a worn or suspect component.

Crankcase, cylinder block, mountings

1 Check for cracks, stripped threads and blocked oilways or coolant passages. Oilway plugs can be removed if necessary and the passages probed with wire.
2 Due to the fact that 'wet' cylinder liners are used on this engine, reboring as such will never be required. Bore wear is overcome by fitting new liners which are supplied with matching pistons, rings and liner base seals. Provided bore wear is not too severe, special proprietary oil control piston ring sets may be installed to extend the life of the existing piston/cylinder liners before renewal becomes absolutely essential. Install these rings strictly in accordance with the manufacturer's instructions.
3 If the engine mountings have lost their flexibility, renew the rubber component.
4 Fractures to the casting may be repaired by a specialist welder, or by a 'cold' repair offered by some companies using interlocking threaded plugs.

Crankshaft and main bearings

5 The original bearing shells are colour coded. If new standard shells are being fitted, match the shell colours to the colours adjacent to the bearing seats. Always fit new shells unless the old ones are known to be in perfect condition – to do otherwise is false economy.
6 If the crankshaft has worn or is scored and is to be reground, the engine reconditioner will supply shells of suitable undersize to match the regrind size.
7 Ensure that the crankshaft oilway dowel plugs are secure. If not, seek professional advice.

Pistons, connecting rods and big-end bearings

8 As already described, new pistons will normally be supplied with new liners. The pistons and liners are colour coded.
9 Gudgeon pins are marked with a black or white dot to match a corresponding dot on the piston boss.
10 The gudgeon pin is a sliding fit in both connecting rod and piston and is retained by circlips. Worn small-end bushes should be renewed by your dealer. When connecting the piston and rod, make sure that when installed in its liner, the big-end of the rod is offset towards the intermediate main bearing caps (Nos 2 and 4) when the arrow on the piston crown points towards the exhaust manifold side of the engine.
11 Always remove any trace of carbon from the piston ring grooves using a piece of broken ring. Protect your fingers when doing this – piston rings are sharp!
12 Before fitting the rings, test the compression rings for correct end gap by pushing them squarely down the bores and checking with a feeler gauge. If the gap is below the specified limit carefully grind the end of the ring.
13 Fit the rings to the pistons by sliding them down from the top using two or three feeler blades as slides. Stagger the end gaps at 120° to each other to minimise gas blow-by. Check the piston ring-to-groove clearance.

Flywheel

14 Examine the starter ring gear. If the teeth are chipped or worn, a new gear will have to be fitted. To do this, the old ring should be carefully split between two teeth and removed, but not before noting to which side the chamfer is located.
15 Heat the new ring gear to between 120° and 140°C (248° and 284°F). This should be obtainable in a domestic oven. While it is warming up, the flywheel can be placed in a refrigerator or deep freeze. Remove the ring and tap it squarely onto its flywheel register. Allow it to cool naturally, do not quench with water.
16 If worn, the propeller shaft pilot bearing in the centre of the flywheel may be removed using a press or by carefully driving it out.

Timing gears and chains

17 Examine the sprocket teeth for wear or hooked appearance. Renew a worn gear.
18 If the idler gear is slack in its bushes, new bushes should be fitted, but as they must be reamed to give a bore diameter of between 20.637 and 20.698 mm (0.812 and 0.815 in), this is a job best left to your dealer.
19 Inspect the primary and secondary chains for wear. If the chain is

supported at both ends in a horizontal attitude, the chain should only take on a slightly bowed appearance. Anything more will prove that a new chain is required. In any event, if the chains have been in service for 80 000 km (50 000 miles) or more, it is worth renewing them at time of major overhaul.

20 If the chain tensioner is suspected of being worn, remove the end plug and extract the coil spring. Release the tensioner locking screw and withdraw the tensioner from inside the front cover (photos).

21 The sprocket can be removed from the tensioner spindle if the circlip is extracted (photo).

Oil pump

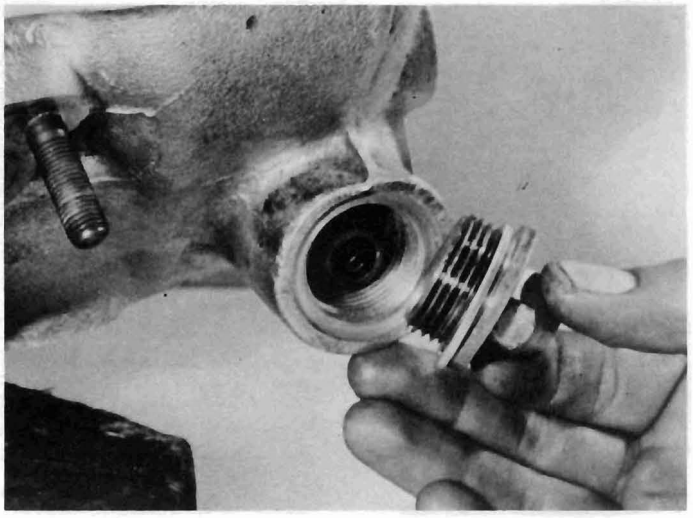
22 The two halves of the oil pump should be separated by unscrewing the flange nuts (photos).

23 Using feeler gauges, check the clearance between the tips of the oil pump gear teeth and the pump body. The clearance should not exceed 0.060 mm (0.0024 in) (photo).

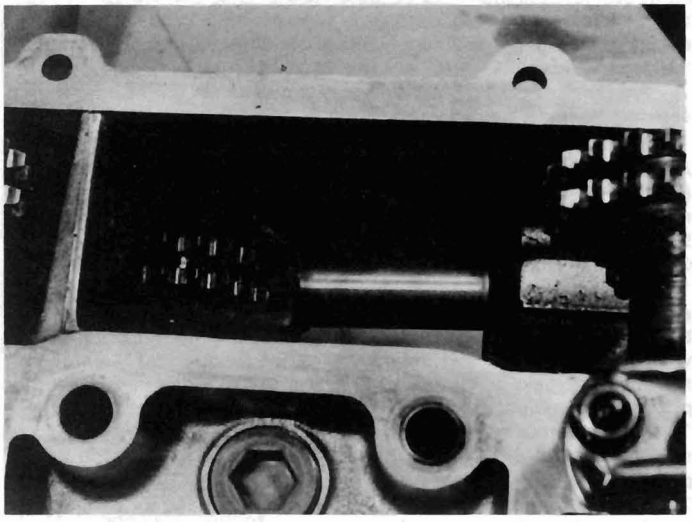
24 Using a straight-edge and feeler blades, check the gear endfloat. This should not exceed 0.4 mm (0.016 in) (photo).

25 If any of the components are worn or damaged, renew them or obtain a new pump.

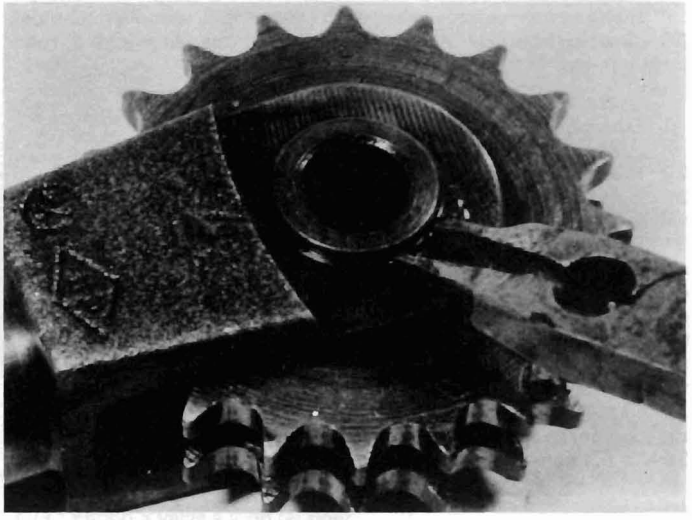
26 The oil pressure relief valve can be dismantled after withdrawing the split pin from its cap, but a broken spring would be the only item



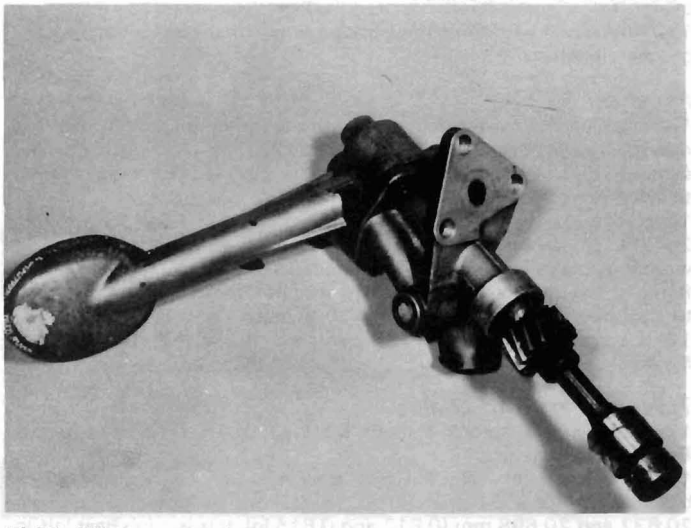
14.20a Chain tensioner end plug



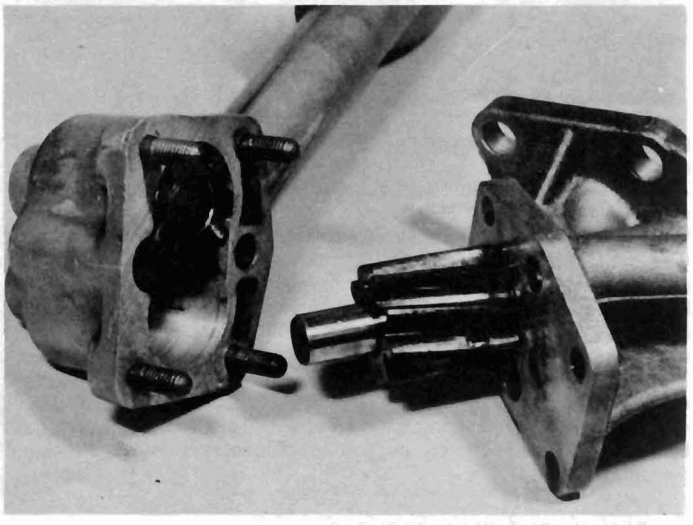
14.20b Removing the chain tensioner



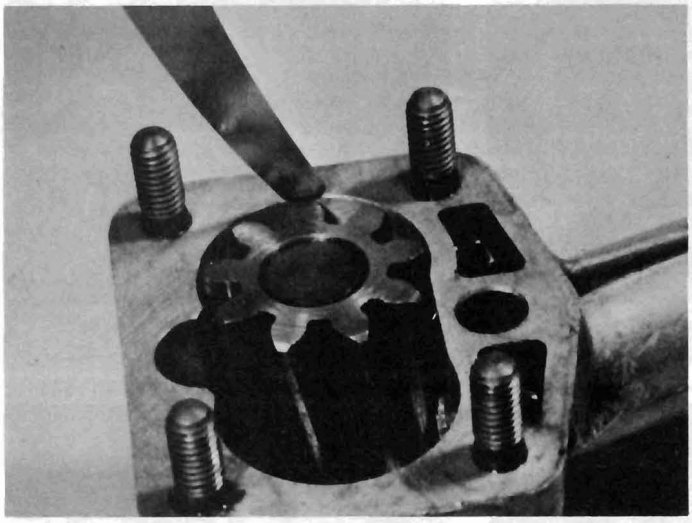
14.21 Removing the chain tensioner sprocket circlip



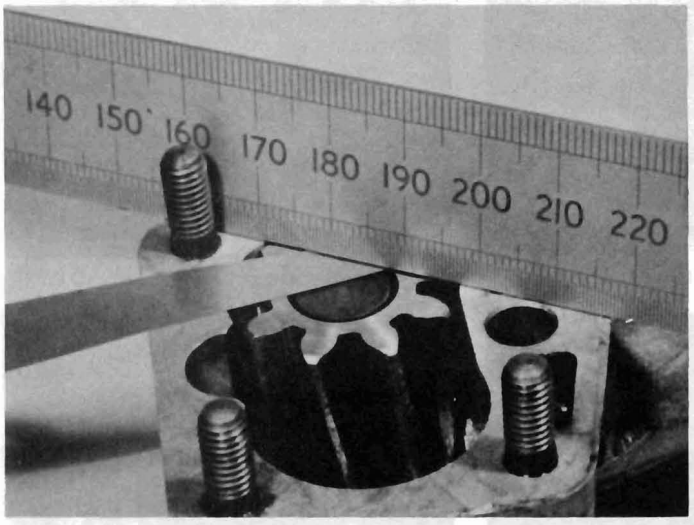
14.22a Oil pump complete



14.22b Oil pump sections separated



14.23 Checking oil pump gear clearance



14.24 Checking oil pump gear endfloat

likely to require renewal and if this had happened, the immediate loss of oil pressure would have long since been noticed!

Oil seals

27 Always renew the engine oil seals as a matter of routine. These include the crankshaft front and rear seals and the rear main bearing sealing strips. Cut the latter flush with the cylinder block after fitting.

15 Crankcase ventilation system – description and maintenance

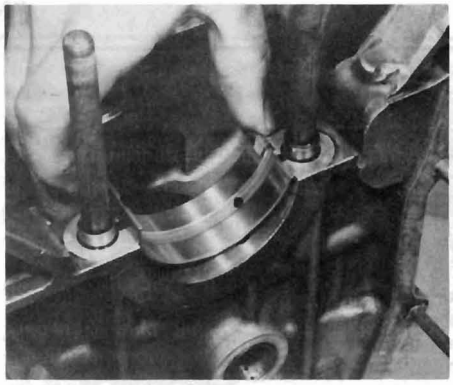
1 All models are equipped with a crankcase ventilation system.
2 The system is basically a method of extracting oil and fuel vapours out of the camshaft cover and into the air cleaner, where they are drawn into the combustion chambers and are burned during the normal engine combustion processes.
3 The vapours occur through gas passing the piston rings into the engine crankcase (blow-by), and vapour occurring generally throughout the engine due to raising the temperature of the engine oil when the engine is operating.
4 The system has an inbuilt control arrangement to regulate gas flow both at wide throttle openings and at idle.
5 An oil separator is located in the hose. The gases pass to the air cleaner under wide throttle conditions; at small throttle openings or at idle they pass to intake ducts downstream of the throttle valve plates.
6 Oil residues in the separator are returned to the sump.
7 Maintenance consists of keeping the hoses and separator clean by flushing them through with paraffin, and checking that the hose connections are tight.

16 Lubrication system and oil pressure sender – general

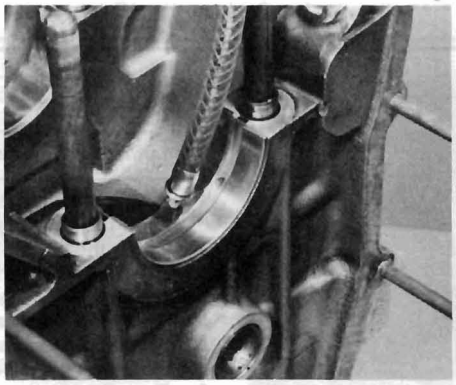
1 The lubrication system is based upon a gear-driven oil pump bolted to the inside face of the engine front cover. Drive is taken from a gear on the nose of the idler sprocket.
2 Oil from the sump is drawn into the pump through a pick-up screen, where it is pressurised by the pump gears and directed through a full-flow type oil filter screwed into the crankcase, and through all the oil galleries and passages to the bearings and friction surfaces. The cylinder bores are splash lubricated by the crankshaft counterweights.
3 The oil pump incorporates a pressure regulating valve to maintain the engine oil pressure at the specified level.
4 The oil filter should be renewed at the intervals specified in Routine Maintenance. The use of a strap or chain wrench will facilitate removal.
5 Always grease the rubber sealing ring of the new filter before screwing it on hand tight only. Never use a tool to tighten it.
6 The oil pressure sender can be renewed without the need to remove the carburettors. A suitable open-ended spanner with the end cranked 90° will be needed.

17 Engine – rebuilding RICOSTRUIRE il motore

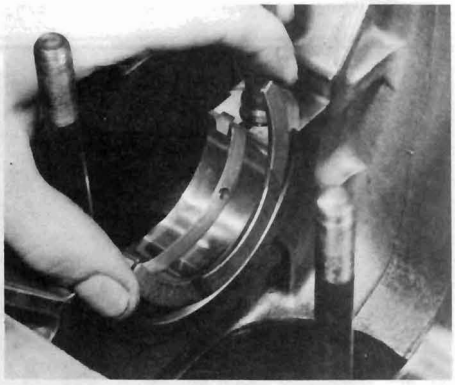
1 Before starting work, make sure that everything is clean, including the working surface on which the engine is resting.
2 Have ready a complete set of engine overhaul gaskets, new lockplates and a tube of jointing compound.
3 As assembly progresses, oil each component liberally with engine oil to prevent any dry friction surfaces.
4 Make sure that all bolt threads are clean and rust free, having wire brushed them where necessary.
5 A torque wrench will be required for those bolt and nut settings listed in the Specifications. Where a torque is not specified, remember that the engine is constructed of soft alloy, so use reasonable force only when tightening. Remember that a leaking flange joint can be rectified, whereas a stripped bolt or stud hole is a much more difficult problem even if a thread insert service can be located.
6 If the oil gallery plugs have been removed, screw in the new plugs and stake them in position.
7 Stand the engine upside-down, wipe the main bearing shell seats and the backs of the shells clean, and fit them into the crankcase (photo).
8 Oil the shells liberally and then use grease to stick the semi-circular thrust washers into position in the crankcase so that the oil grooves are visible (photos).
9 Lower the crankshaft into position (photo).
10 Fit the main bearing caps complete with bearing shells. Note the positioning number on the cap. As a check on which way round to fit them, the notches in the shells should be towards the intake side of the engine. Make sure that the lower sections of the thrust washers are located at the centre cap (photos).
11 Apply engine oil to the main bearing stud threads, use new locknuts and tighten the nuts to the specified torque. The rear bearing cap nuts are secured with locking plates and this cap should not be fitted until the rear oil seal is correctly positioned, the sealing strips inserted in their grooves and any projecting material cut off flush with the surface of the cylinder block (photos).
12 Apply grease to the oil seal lips, fit the rear main bearing cap and tighten the nuts to the specified torque. Bend up the lockplate tabs (photo).
13 Fit the rear bearing cover plate with a new gasket and then locate the engine rear plate on its dowels (photos).
14 Fit the flywheel, complete with pilot bush. Make sure that the marks observed or made at dismantling are in alignment, then screw in the mounting bolts, which should have thread locking compound applied to their clean, dry threads. Tighten the bolts to the specified torque (photo).
15 Install the cylinder liners, complete with base seals, having lubricated their bores and outer surfaces with engine oil. Refer to Section 10 for details of liner alignment. Fit liner clamps (photo).
16 Fit the connecting rods and pistons as described in Sections 9 and 14.



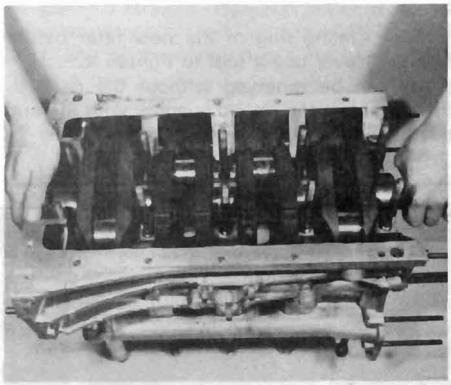
17.7 Fitting a main bearing shell



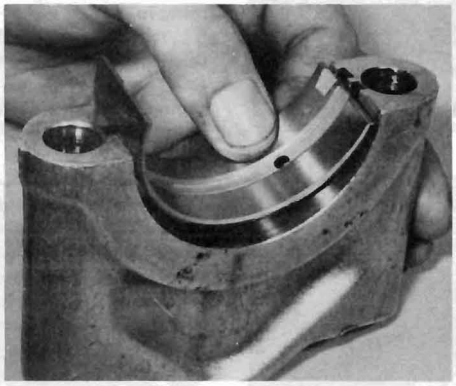
17.8a Oiling the main bearing shells



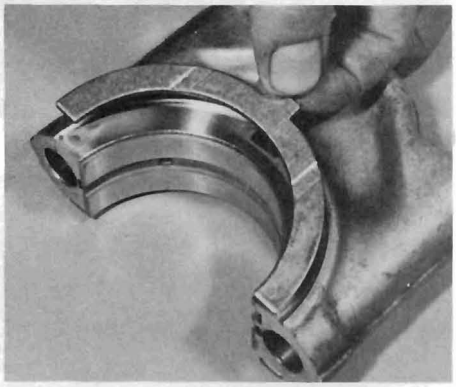
17.8b Fitting a crankshaft thrust washer



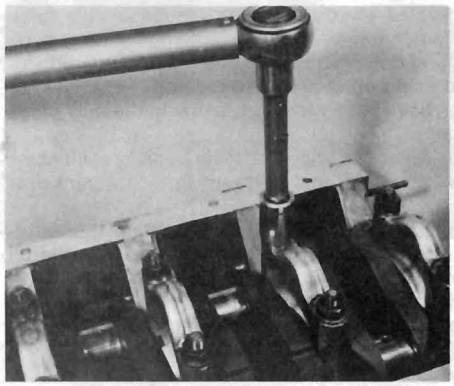
17.9 Installing the crankshaft



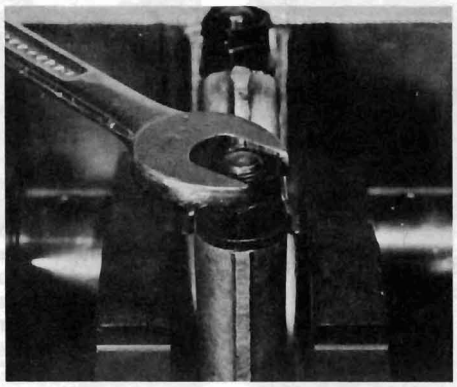
17.10a Fitting a main bearing cap shell



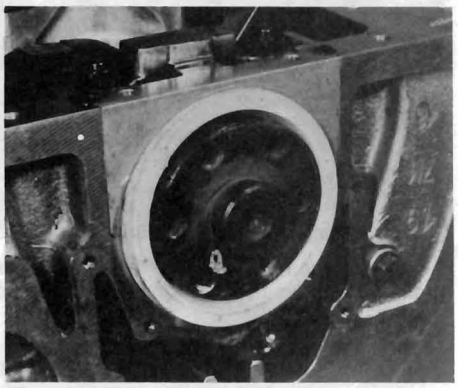
17.10b Crankshaft thrust washer in main bearing cap



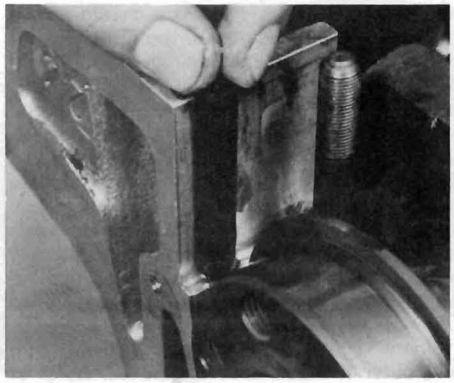
17.11a Tightening a main bearing cap nut



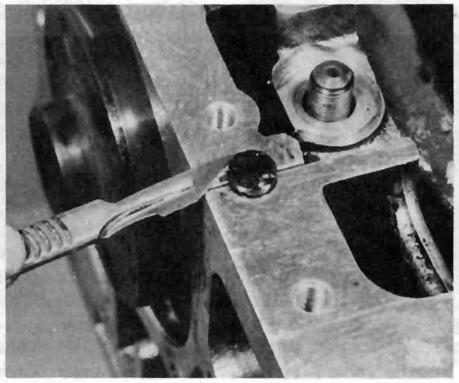
17.11b Tightening a main bearing cap locknut



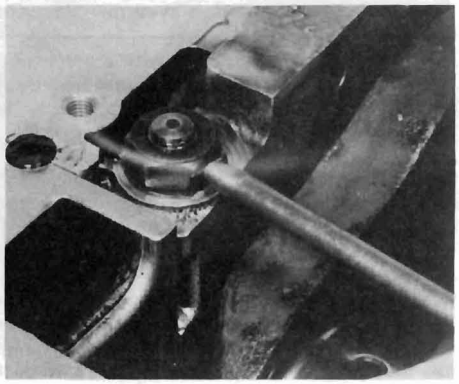
17.11c Crankshaft rear oil seal



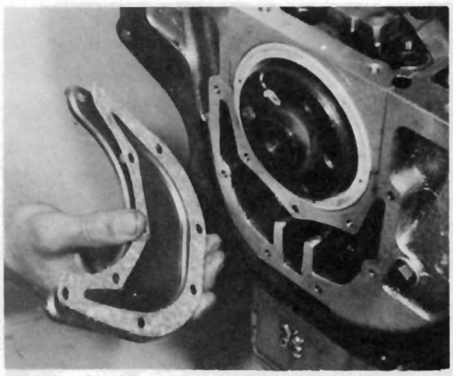
17.11d Crankshaft rear bearing sealing strips



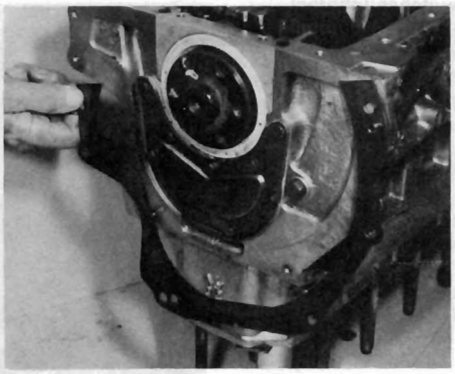
17.11e Cutting a rear bearing sealing strip flush



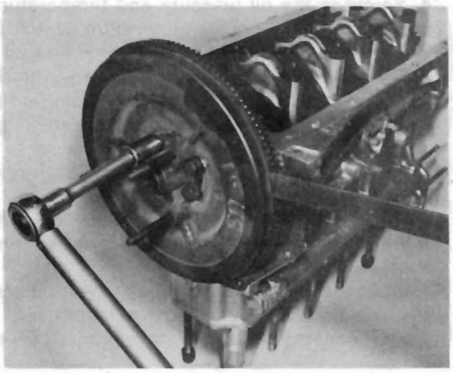
17.12 Locking a rear bearing cap nut



17.13a Fitting the rear bearing cover plate and gasket

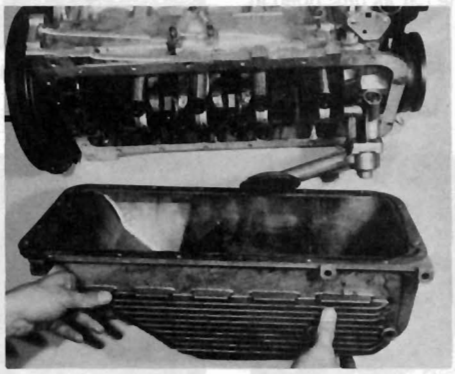


17.13b Locating the engine rear plate

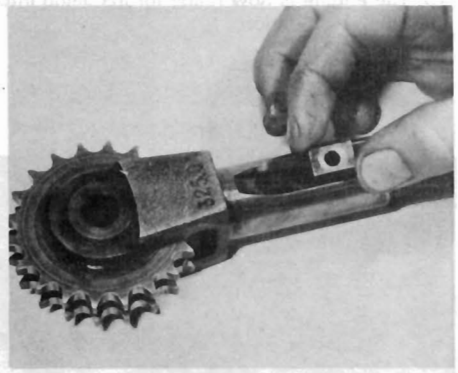


17.14 Tightening the flywheel bolts. Note bar used to lock flywheel

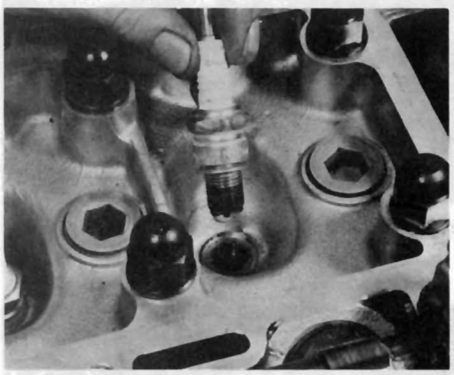
17.15 Cylinder liner clamp made up from sockets



17.21 Fitting the engine sump pan

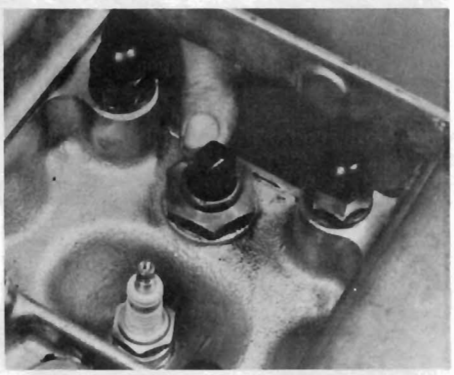


17.25 Chain tensioner lockbolt slide



17.30 Fitting a spark plug

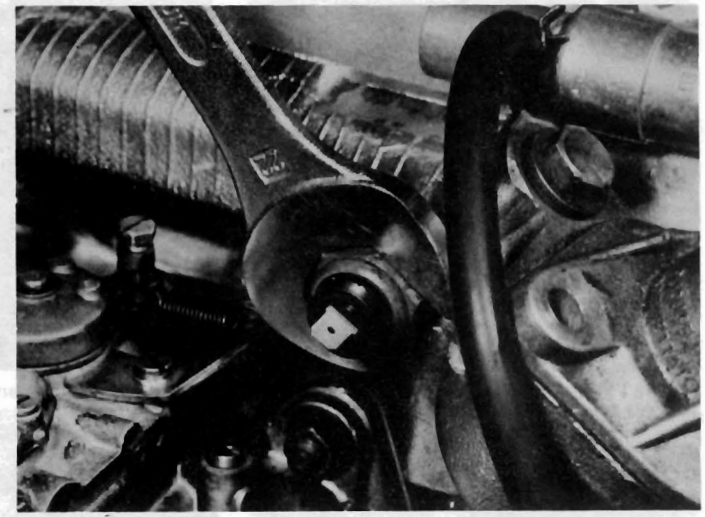
17.34a Fitting the oil pressure sender



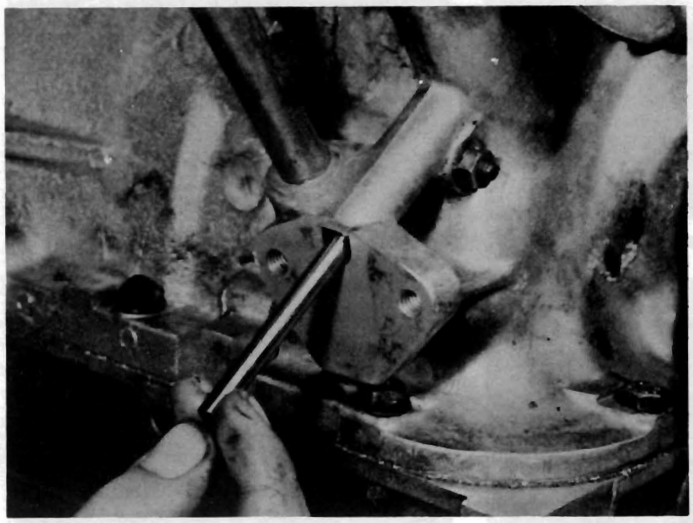
17.34b Oil temperature switch

17 Fit the thrust washer to the face of the timing chain idler sprocket, using thick grease to retain it.
18 Install the timing gears, the front cover complete with oil pump and the distributor, all as described in Section 5.
19 Using a new gasket, fit the coolant pump to the engine front cover. Remember that the alternator adjuster link must be fitted to the coolant pump thicker stud.
20 Fit the damper/pulley to the front end of the crankshaft, tighten the fixing nut to the specified torque and lock by bending up the tab of a new lockplate.
21 Fit the sump using a new gasket. Tighten the bolts evenly in diagonal sequence to avoid distortion (photo).
22 Check that No 1 piston is at TDC and check that the camshafts have their alignment marks opposite to each other.
23 Remove the cylinder liner clamps and fit a new cylinder head gasket and oil passage seals.
24 Fit the cylinder head as described in Section 4, pulling the wires to draw the two ends of the timing chain through the cut-out in the head. Drape the ends of the chains over the rims of the cut-out.
25 Fit the chain tensioner, making sure that the locking bolt engages in the tensioner clamp slide, and retain the tensioner in its fully retracted position (photo).
26 Remember to fit the engine lifting bracket to the centre studs of the cylinder head.
27 Engage the chain with the camshaft and chain tensioner sprockets.
28 Reconnect the two ends of the chain with the link located at the top run.
29 Release the chain tensioner lockbolt. When the chain is seen to be tensioned, tighten the bolt.
30 Fit the spark plugs (photo).
31 Oil the camshafts liberally, fit new gaskets and then bolt on the camshaft covers.
32 If not already installed at time of fitting the cylinder head, bolt on the intake manifold using new gaskets.
33 Again using new gaskets, bolt the carburettors to the intake manifold. Note the earth strap running between the manifold and carburettor.

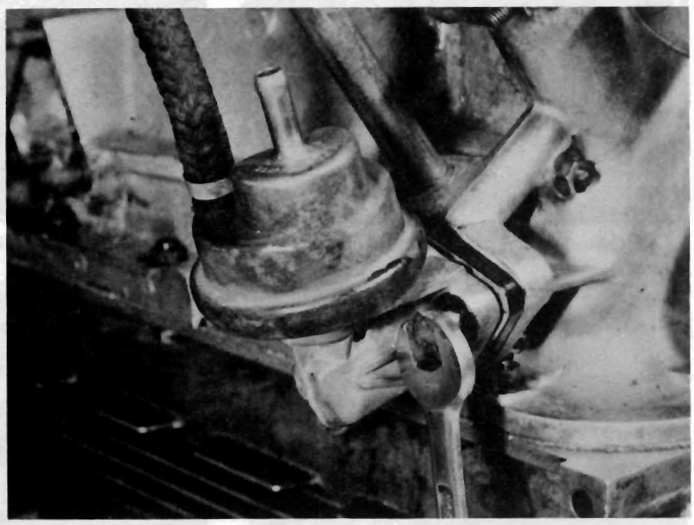
34 Screw in the oil pressure and temperature switches (photos).
35 Screw in the coolant temprature switch (photo).
36 Place a new gasket on either side of the fuel pump flange insulating block, insert the fuel pump pushrod into the cylinder block, locate the insulator and bolt on the fuel pump (photos).
37 Fit the thermostat/cover assembly, making sure that a new sealing ring is located in the groove in the cover.
38 Screw on a new oil filter (hand tight) (photo).
39 Refit the engine oil dipstick (photo).
40 Reconnect the bypass hose (thermostat housing to pump).
41 Refit the alternator and the drivebelt, and tension the belt (see Chapter 2).
42 Refit the engine mountings to the crankcase, noting that the one marked N goes on the exhaust manifold side. The hot air collector for the air cleaner goes under the mounting on the intake manifold side (photos).
43 Bolt on the exhaust manifolds using new metal gaskets (photos).
44 Fit the carburettor support strut to the right-hand engine mounting bracket (photos).
45 The engine is now ready for installing into the car as described in the following Section.



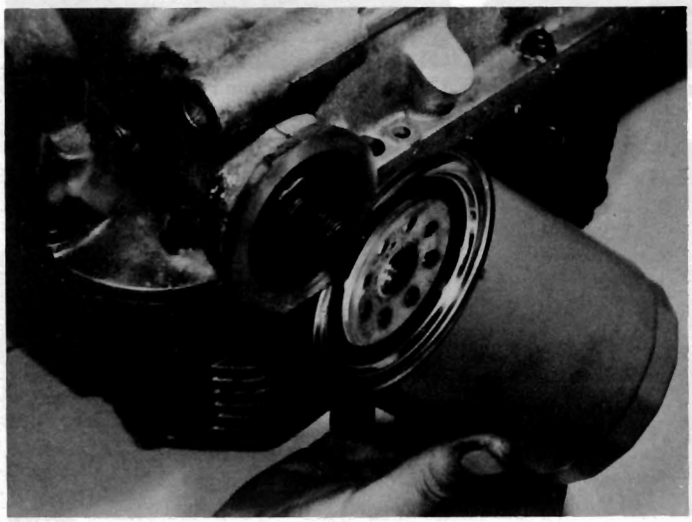
17.35 Fitting the coolant temperature sender



17.36a Fitting the fuel pump pushrod

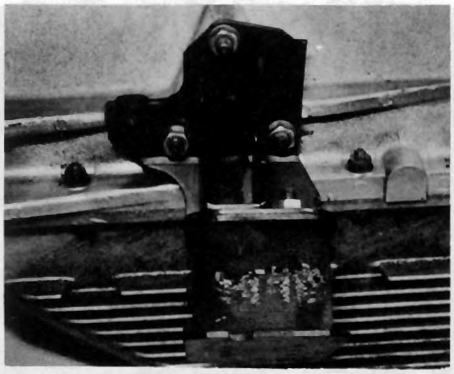


17.36b Bolting on the fuel pump

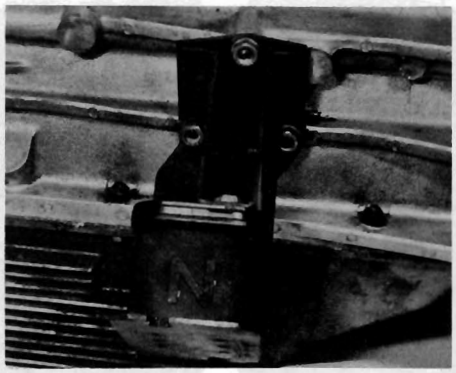


17.38 Fitting the oil filter

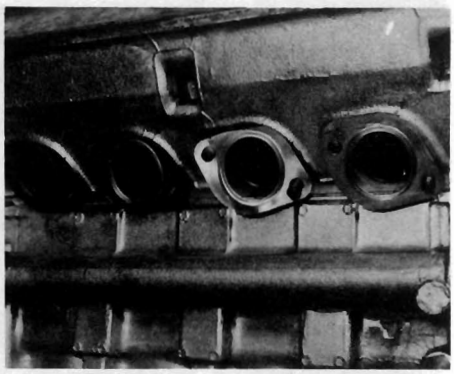
17.39 Fitting the engine oil dipstick



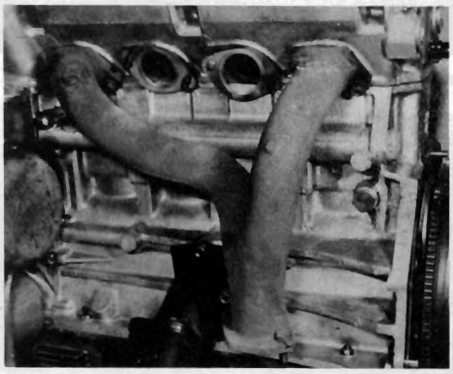
17.42a Engine mounting (RH) – hot air collector plate not fitted for clarity



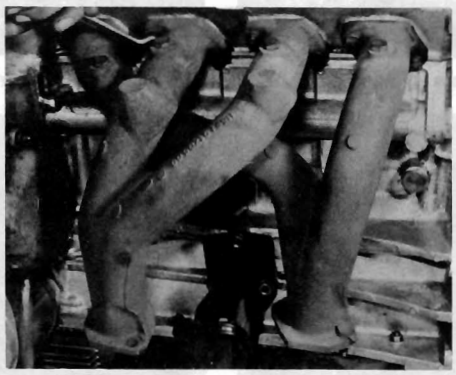
17.42b Engine mounting (LH)



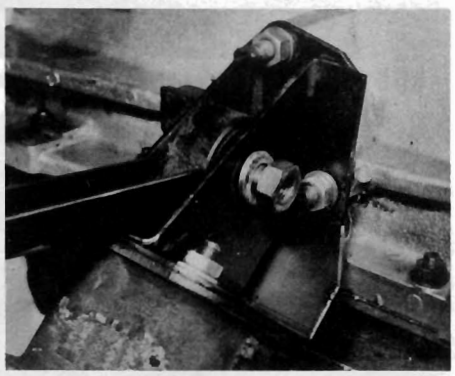
17.43a Exhaust manifold gaskets



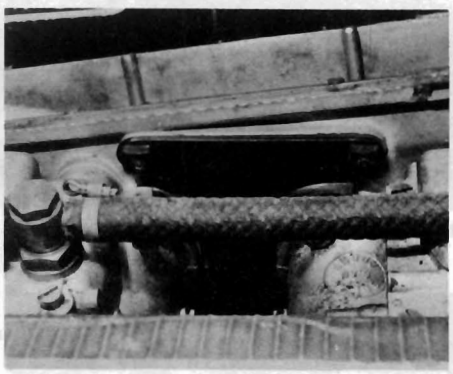
17.43b Exhaust manifold section in position



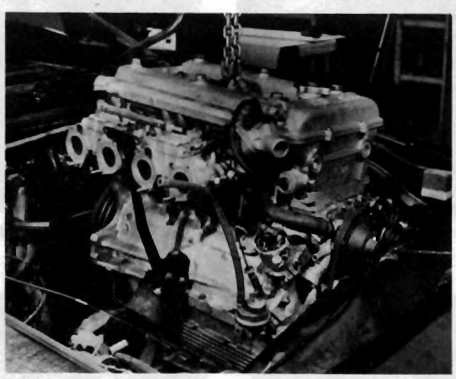
17.43c Exhaust manifold complete



17.44a Fitting carburettor support strut (hot air collector plate not fitted for clarity)



17.44b Carburettor support strut at upper end

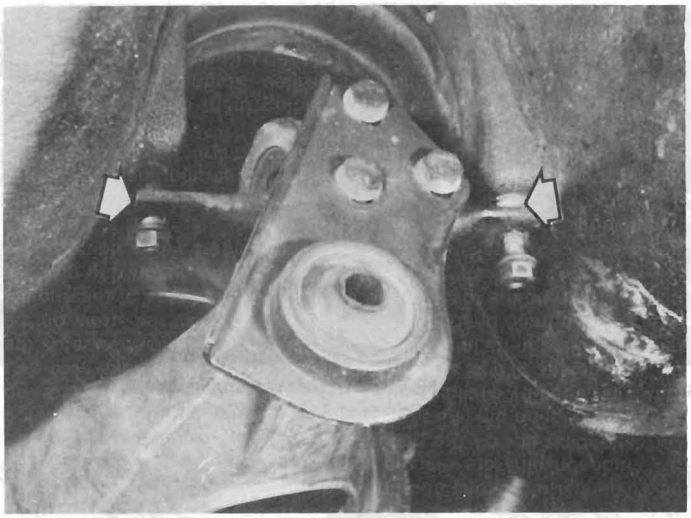


18.4 Installing the engine

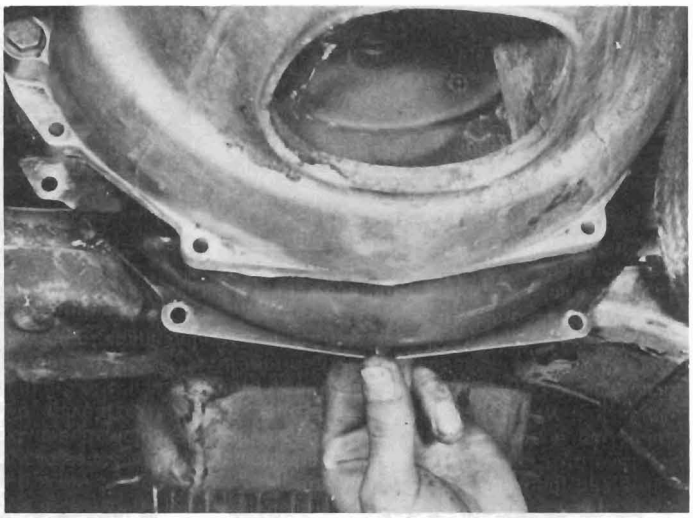
18.5 Earth strap (flywheel housing to body)

18 Engine – installation

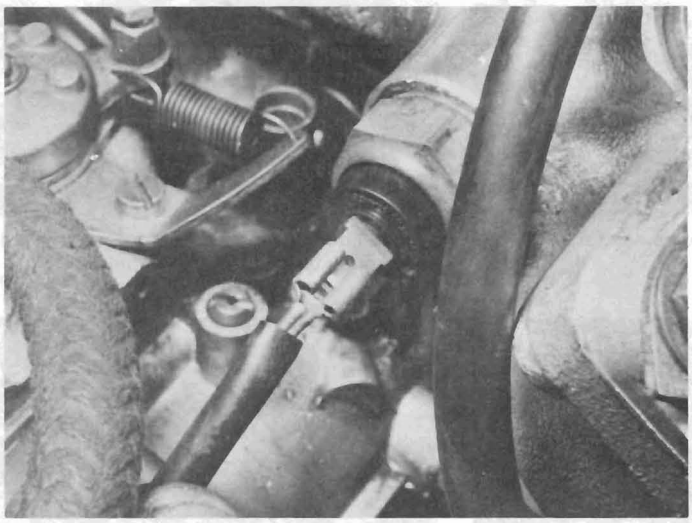
1 If the flywheel housing was removed from the engine compartment after the engine was lifted out, it should be refitted to rest on the steering rack housing before installing the engine.
2 Do not connect the flywheel housing flexible mounting to the body at this stage.
3 Make sure that the two uppermost flywheel housing bolts are in position, complete with their starter motor wiring harness retaining clips, before lowering the engine into place. The proximity of the engine compartment rear bulkhead makes their fitting virtually impossible once the engine is mated with the flywheel housing.
4 Attach the engine lifting hoist to the engine lifting brackets. Manoeuvre the engine over the engine compartment and then lower it carefully downwards until the flywheel housing studs can be slipped under the top rim of the flywheel housing (photo).
5 Push the engine rearwards to fully engage the flywheel housing and to engage the engine mountings on the wing panel studs. Bolt the flywheel housing to the engine, remembering to connect the body earthing strap (photo).
6 Connect the flywheel housing rear flexible mounting to the body studs, making sure that the spacer collars are on the studs. These are very important to maintain the correct propeller shaft running clearance (photo).
7 Remove the engine hoist. Refit the flywheel housing front plate (photo).
8 Refer to Chapter 5 and refit the propeller shaft.
9 Reconnect the gear lever selector link rod, and refit the dust-excluding bellows to the gearchange lever support.
10 Refit the heat shield to the left-hand engine mounting and then bolt up the exhaust front section.



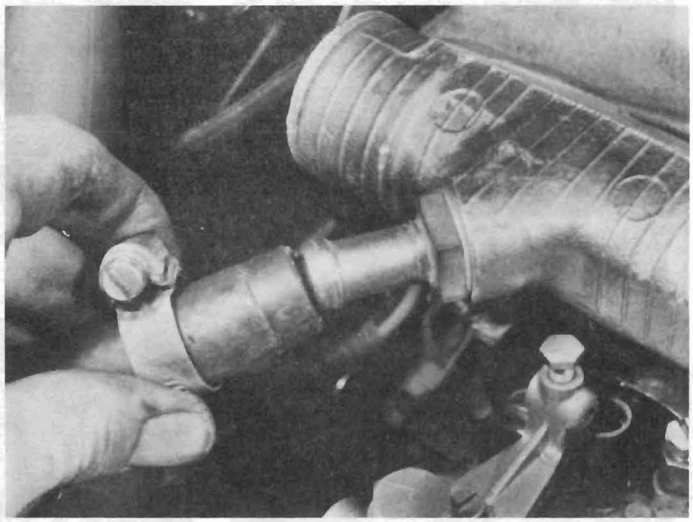
18.6 Flywheel housing flexible mounting – spacers arrowed



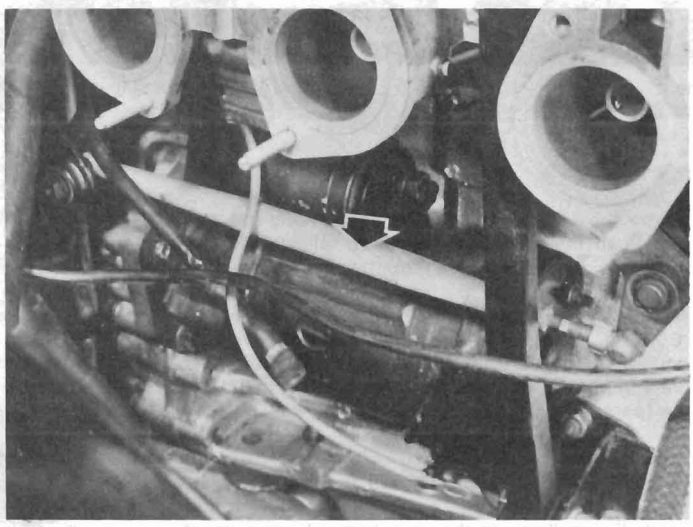
18.7 Fitting the flywheel housing front plate



18.11 Connecting the lead to the coolant temperature switch

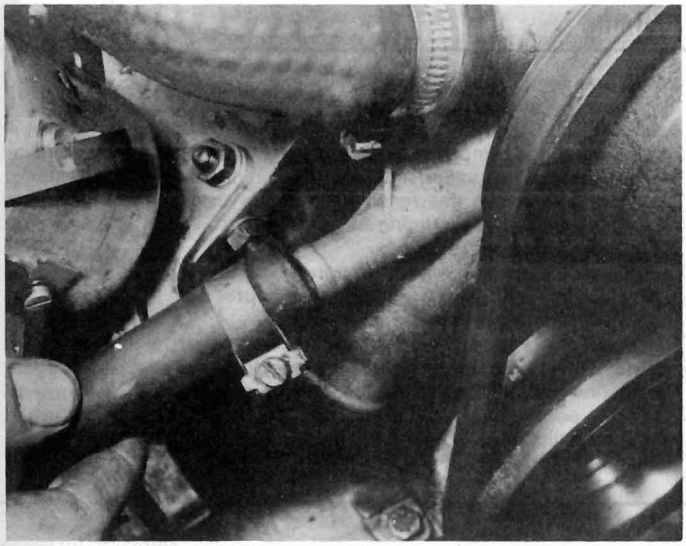


18.13 Connecting the heater hose to the inlet manifold

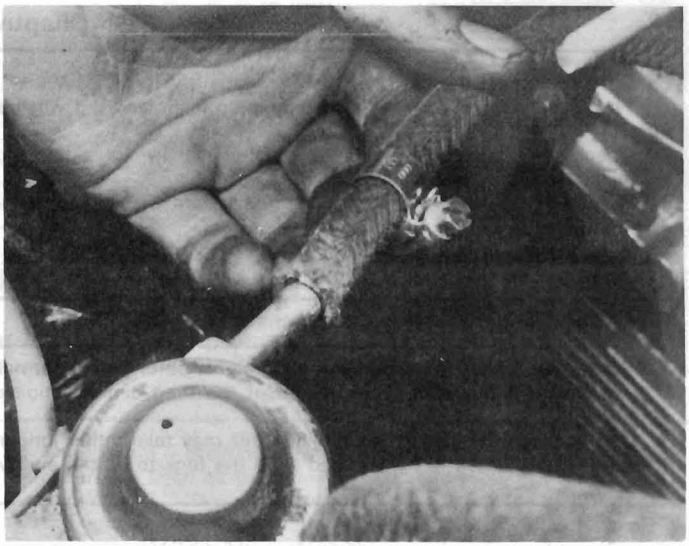


18.14 Main carburettor control link rod (arrowed)

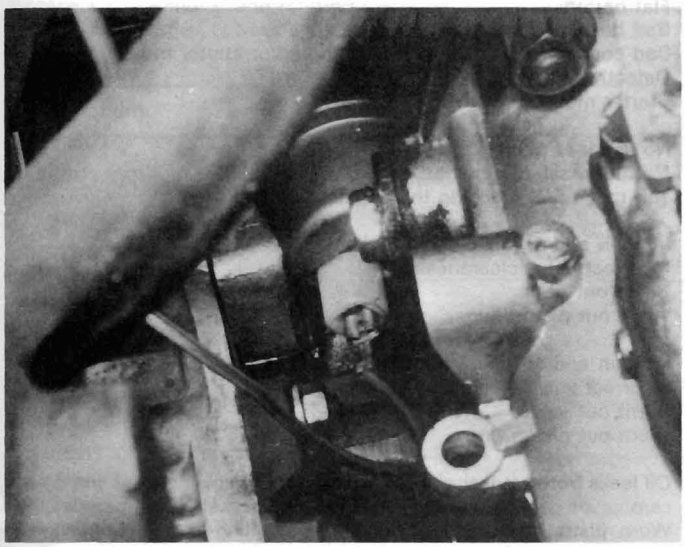
11 Reconnect the lead to the coolant temperature switch (photo).
12 Connect the tachometer drive cable to the coolant pump (earlier models only).
13 Connect the brake vacuum servo hose and the heater hose to the intake manifold (photo).
14 Connect the choke cables and the carburettor control linkage (photo).
15 Connect the fuel inlet hose to the carburettor.
16 Connect the heater hose to the coolant pump (photo).
17 Connect the fuel inlet pipe between the filter and the pump, also the pipe to the fuel filter (photo).
18 Connect the starter motor leads.
19 Connect the LT lead to the distributor.
20 Fit the distributor cap and connect the spark plug and coil HT leads. Fit the distributor weatherproof cover and clip.
21 Refit the radiator complete with shroud and electric fan.
22 Connect the leads to the oil pressure switch and temperature switch (photos).
23 Connect the leads to the thermostatic switch in the radiator which controls the electric fan (photo).
24 Connect the alternator leads, and the hoses to the crankcase breather oil separator (photo).
25 Fit the air cleaner and air intake.
26 Fill the cooling system as described in Chapter 2.
27 Refill the engine with oil.



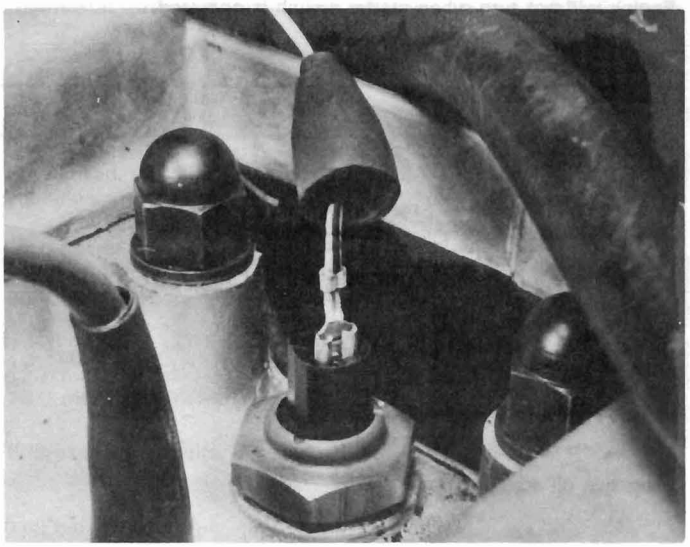
18.16 Connecting the heater hose to the coolant pump



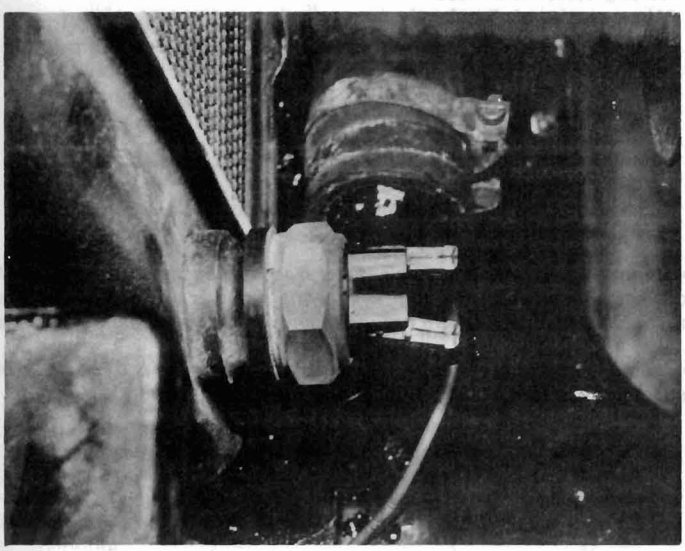
18.17 Connecting the fuel inlet hose to the filter



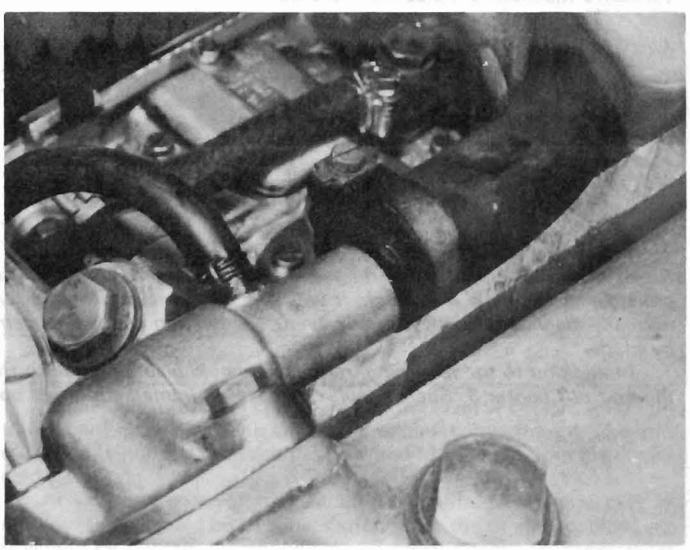
18.22a Oil pressure sender lead



18.22b Oil temperature switch lead



18.23 Radiator fan switch and leads



18.24 Crankcase breather hose and oil separator

28 Fit and connect the battery.
29 Fit the bonnet, reconnect the engine lamp leads and the washer tube.
30 Check all connections, nuts and bolts visually for tightness, especially hose connections for any leaks.
31 Remove tools, rags and any other items from the engine compartment.

19 Engine – initial start-up after overhaul

1 Set the idle speed screws at a slightly higher setting than normal to increase the idle speed. This will offset the drag of new engine components.
2 Use full choke and start the engine. This may take rather longer than usual as fuel has to be pumped from the tank to fill the empty pump and carburettor bowls.
3 Once the engine fires, allow it to run at a fast idle until the choke can be dispensed with and then check for oil and coolant leaks. A certain amount of smoke and odd smells will come from the engine as oil and solvents are vaporised from the engine and exhaust system.
4 Once the engine has reached operating temperature, check the chain tension and valve timing as described in Section 5, paragraphs 34 to 41.
5 Check the ignition timing (Chapter 4).
6 Check the carburettor adjustment (Chapter 3).
7 Check the engine oil and coolant levels.
8 Road test the car. If new internal component have been fitted, treat the engine as a new one and operate at restricted speed and revs for the first few hundred miles. It is beneficial to change the engine oil and filter once the running-in process is complete, to get rid of the small metallic particles which are produced by new components bedding-in with each other.

20 Fault diagnosis – engine

Symptom	Reason(s)
Engine will not turn when starter switch is operated	Flat battery Bad battery connections Bad connections at solenoid switch and/or starter motor Defective solenoid Starter motor defective
Engine turns normally but fails to start	No spark at plugs No fuel reaching engine Too much fuel reaching the engine (flooding)
Engine starts but runs unevenly and misfires	Ignition and/or fuel system faults Incorrect valve clearances Burnt out valve Worn out piston rings
Lack of power	Ignition and/or fuel system faults Incorrect valve clearances or timing Burnt out valves Worn out piston rings
Excessive oil consumption	Oil leaks from crankshaft rear oil seal, timing cover gasket and oil seal, cam cover gasket, oil filter gasket, sump gasket, sump plug washer Worn piston rings or cylinder bores resulting in oil being burnt by engine Worn valve guides and/or defective inlet valve stem seals
Excessive mechanical noise from engine	Wrong valve clearances Worn crankshaft bearings Worn cylinders (piston slap) Slack or worn timing chain and sprockets
Poor idling	Leak in inlet manifold gasket Perforated or leaking PCV connecting pipe Perforated or leaking brake servo pipe
Low oil pressure	Crankshaft oilway dowel plugs loose Faulty oil pressure relief valve

Note: *When investigating starting and uneven running faults, do not be tempted into snap diagnosis. Start from the beginning of the check procedure and follow it through. It will take less time in the long run. Poor performance from an engine in terms if power and economy is not normally diagnosed quickly. In any event, the ignition and fuel systems must be checked first before assuming any further investigation needs to be made.*

In addition to the foregoing, reference should also be made to the fault finding chart for emission control equipment which is to be found at the end of Chapter 3. Such a fault can have an immediate effect upon engine performance.

Chapter 2
Cooling, heating and air conditioning systems

For modifications, and information applicable to later models, see Supplement at end of manual

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Specifications

System type	Pressurised, semi-sealed cooling system with expansion tank; air conditioning optional
Thermostat	
Opening temperature	81° to 85°C (177° to 185°F)
Fully open temperature	96°C (205°F)
Drivebelt deflection	
Coolant pump	12.7 mm (0.5 in)
Air conditioning compressor	10.0 mm (0.4 in)
Coolant capacity	8 litres (14 Imp pints, 8.4 US quarts)
Radiator cap	
Pressure setting	0.69 bar (10 lbf/in²)
Electric cooling fan	
Cut-in temperature	82° to 92°C (180° to 198°F)

Torque wrench settings	**Nm**	**lbf ft**
Coolant pump nuts	22	16
Thermostat cover screws	16	12
Temperature switches	25	18

1 Description

The cooling system is of semi-sealed type and incorporates an expansion tank.

At normal operating temperatures when the coolant expands, excess coolant passes into the expansion tank. When the engine cools down, the coolant is drawn back into the system. This method automatically keeps the cooling system topped up without the need to add coolant.

The radiator is mounted at the front of the car and is of crossflow type. Circulation is assisted by a belt-driven pump mounted on the front of the engine. A take-off for the mechanical tachometer is provided on the coolant pump on some earlier models.

A thermostat fitted in the cylinder head provides the means for quick engine warm-up and maintains the specified engine operating temperature.

An electrically-operated radiator cooling fan is used, being controlled by a thermal switch screwed into the left-hand radiator tank.

The car interior heater is connected to the engine cooling system.

On cars destined for operation in North America, a factory-fitted air conditioner is optionally available. The system incorporates the functions of air conditioner, heater and ventilator in one unit. Section 16 gives further details.

2 Coolant level – checking

1 At the weekly service check, inspect the level of coolant inside the translucent expansion tank within the engine compartment. The level must be maintained between the MIN and MAX levels with the engine cold.

2 At very rare intervals the addition of antifreeze mixture may be required. This should be of similar strength to the original coolant and it should be poured directly into the expansion tank.

3 The need for frequent topping-up can only be due to a leak in the system.

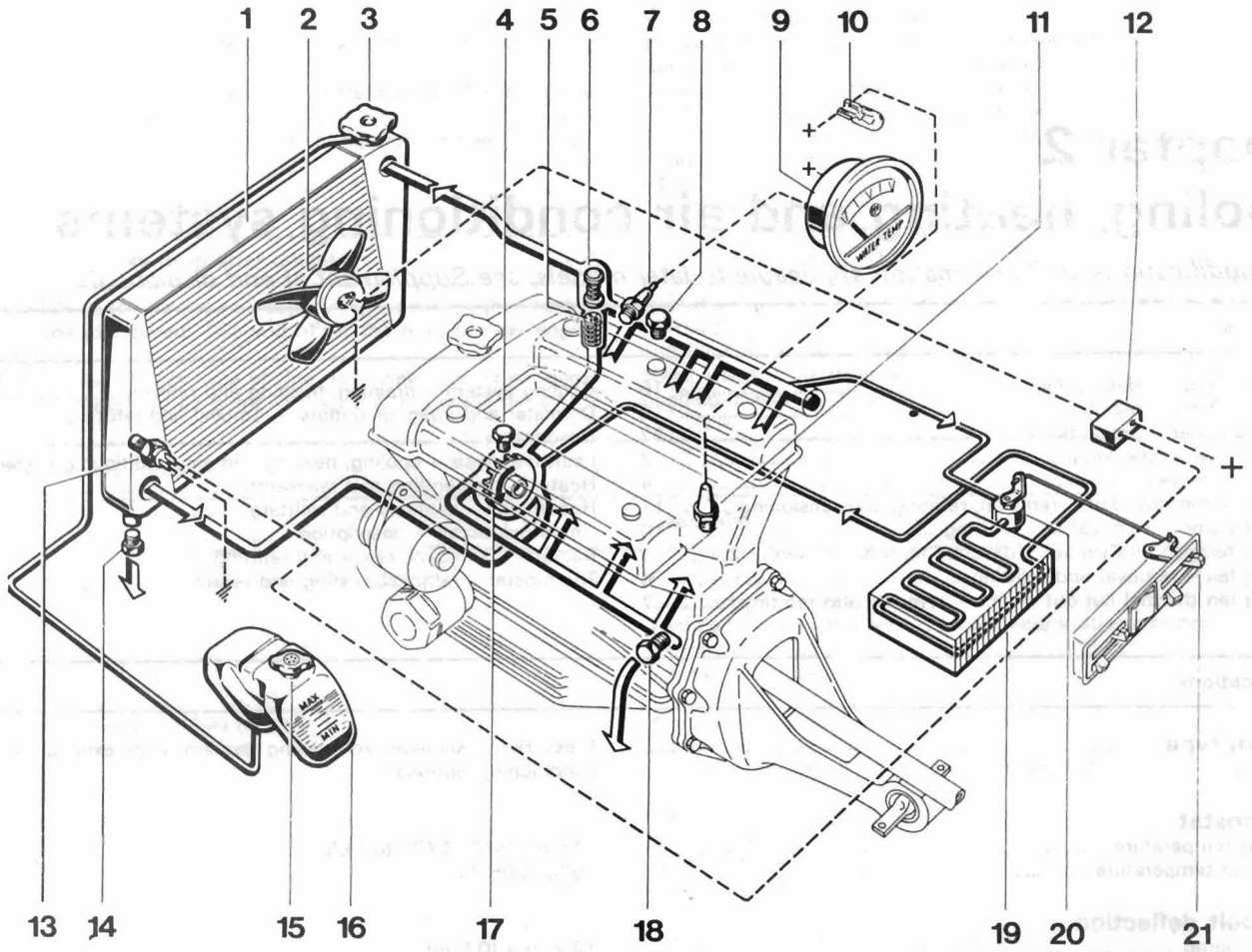


Fig. 2.1 Cooling system layout (Sec 1)

1 *Radiator*
2 *Electric fan*
3 *Radiator cap*
4 *Coolant pump air bleed screw*
5 *Bypass control valve*
6 *Thermostat*
7 *Temperature transmitter*
8 *Manifold air bleed screw*
9 *Coolant temperature gauge*
10 *Coolant temperature warning lamp*
11 *Coolant temperature warning lamp switch*
12 *Electric fan relay*
13 *Electric fan thermostatic switch*
14 *Radiator drain plug*
15 *Expansion tank cap*
16 *Expansion tank*
17 *Coolant pump*
18 *Cylinder block drain plug*
19 *Heater matrix*
20 *Water valve*
21 *Temperature control lever*

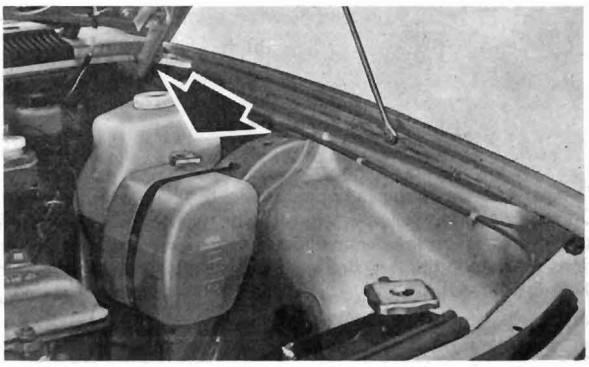
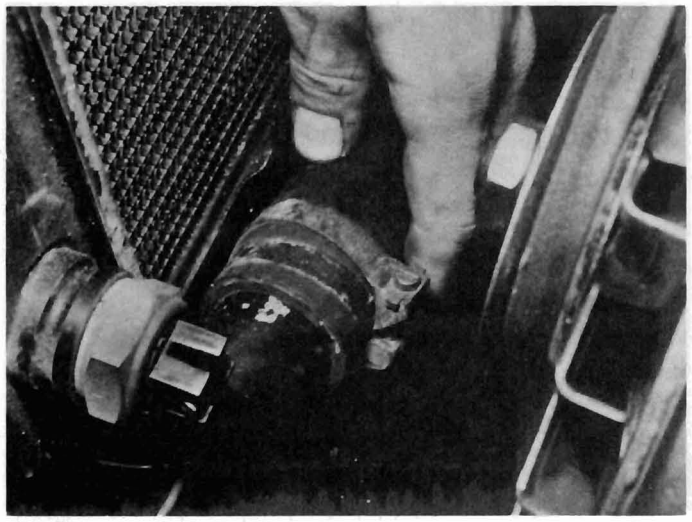


Fig. 2.2 Typical cooling system expansion tank (Sec 2)

3 Cooling system – draining, flushing and refilling

1 Make sure the engine is cold – never release the radiator or expansion tank caps on a hot engine, or you may be scalded.
2 Set the heater control lever to the maximum heat position.
3 Remove the radiator filler cap and the cap from the expansion tank (photo).
4 Disconnect the radiator lower hose and unscrew and remove the plug from the cylinder block and allow the coolant to drain. If the coolant is required for further use, catch it in suitable containers (photo).
5 If the air bleed screw on the thermostat housing is released, this will increase the rate of coolant flow.
6 If the coolant is renewed at the specified intervals (see Section 4), there should be no need to flush the system and new coolant can be poured in straight away. Where coolant renewal has been neglected, flush through until the water runs clear from the drain plugs. If there is a blockage in the radiator it may have to be removed for reverse flushing as described in Section 8.
7 Refit the drain plug and connect the hose.
8 With both bleed screws open (thermostat housing and coolant pump), pour antifreeze mixture into the radiator filler neck until it is seen to escape from the bleed screw on the coolant pump. Close the screw.
9 Continue adding more coolant until it is seen to escape from the bleed screw on the thermostat housing.
10 Start the engine and run it at a fast idle until no more air is heard to escape from the bleed screw, only coolant, and then close the screw.
11 Add more coolant to the radiator until it is absolutely brim full.
12 Pour similar coolant mixture into the expansion tank until it reaches the MAX mark.
13 Fit the radiator and expansion tank filler caps.
14 Run the engine until normal operating temperature is reached, then allow it to cool and top up the expansion tank if necessary.

3.3 Radiator filler cap



3.4 Radiator lower hose

4 Coolant mixtures

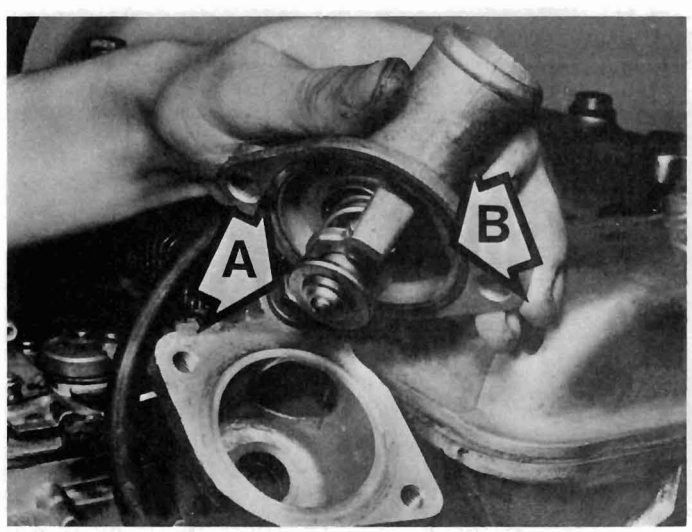
1 Due to the fact that the engine is constructed almost entirely of light alloy, it is essential that plain water is not used in the system, as this would encourage corrosion and make it very difficult to remove the cylinder head from the retaining studs.
2 In cold and temperate climates a 50/50 glycol and water antifreeze mixture should be used to prevent freezing and to minimise corrosion. Inhibitors to combat corrosion and rust are included in all reliable brands of antifreeze.
3 In hot climates where antifreeze is not required, a good quality corrosion inhibitor should always be used in the cooling water in the strength recommended by the manufacturer.
4 Antifreeze mixtures should be renewed at two-yearly intervals. Any topping-up required during this period must be made using mixture of similar strength to the original mixture.

5 Thermostat – removal, testing and refitting

1 Remove the warm air hose from the air cleaner and pull the HT leads from the spark plugs. Drain sufficient coolant (3 litres, 5.3 Imp pints, 3.2 US quarts) to bring the level below the thermostat housing. Disconnect the hose from the thermostat housing.
2 Unscrew the nuts which hold the cover to the thermostat housing. Remove the cover complete with thermostat and O-ring seal (photo).
3 Do not attempt to lever the thermostat out of the cover, the components cannot be separated and are only supplied as an assembly.
4 If the thermostat is suspected of being faulty, suspend the assembly in a container of water and bring the water to boiling point. The valve plate on the thermostat should open at the temperature shown in the Specifications and then continue to open fully. As the thermostat cools, the valve plate should close smoothly.
5 If the thermostat valve plate remains closed or open without moving irrespective of temperature changes, then a new unit must be fitted.
6 Make sure that the new assembly is of the specified type, with the temperature marked on its flange.
7 Refitting is a reversal of removal. Use a new O-ring seal, a gasket is not used.
8 Top up the cooling system (see Section 3).

6 Cooling fan – removal and refitting

1 Disconnect the electrical leads from the fan motor connectors.
2 Unbolt the fan cowl mounting feet from the radiator and carefully withdraw the assembly from the rear face of the radiator.
3 Refitting is a reversal of removal. Do not use undue force when tightening the fan mounting nuts.



5.2 Removing thermostat housing cover. Note thermostat housing bleed screw (A) and O-ring seal (B)

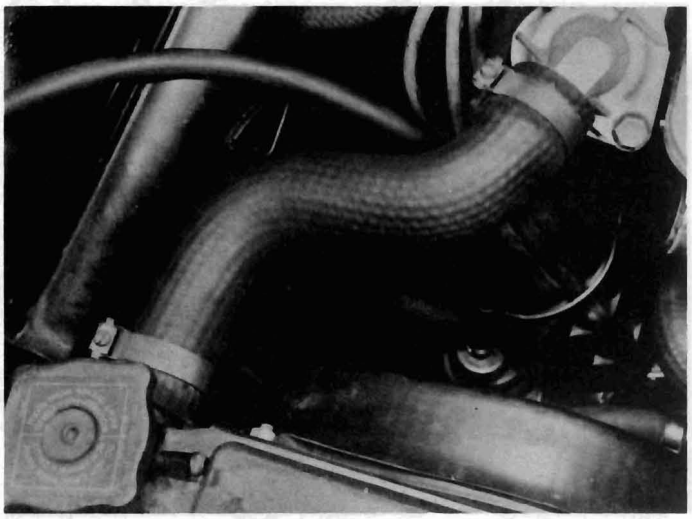
7 Cooling fan thermal cut-out switch – removal and refitting

1 Drain the cooling system as described in Section 3.
2 Disconnect the electrical leads from the thermostatic switch in the base of the left-hand radiator tank.
3 Unscrew the switch and remove it.
4 Refitting is a reversal of removal, but use a new sealing washer.
5 Refill the cooling system as described in Section 3.
6 Note that whilst a defective switch cannot be repaired, it may be bypassed temporarily if necessary so that the cooling fan operates continuously.

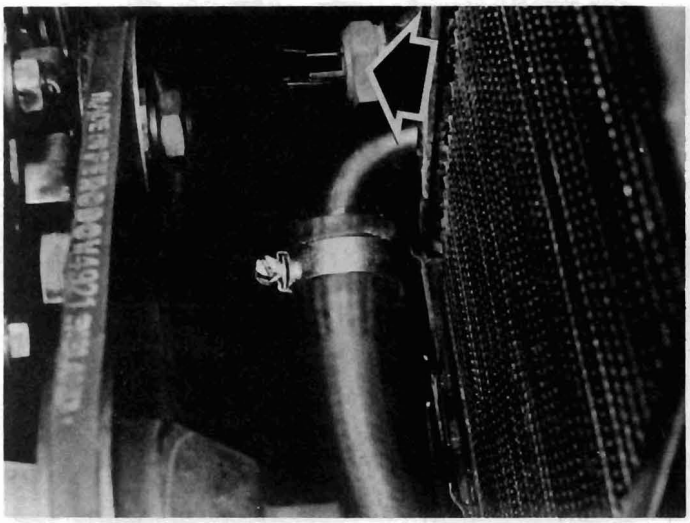
8 Radiator – removal, repair and refitting

1 Drain the cooling system as described in Section 3.
2 From the radiator disconnect the coolant hoses, the expansion tank hose and the leads from the fan thermostatic switch and fan motor (photos).
3 Release the radiator mounting screws and brackets and withdraw the radiator/fan assembly from the engine compartment (photos).
4 Unbolt and remove the fan assembly.

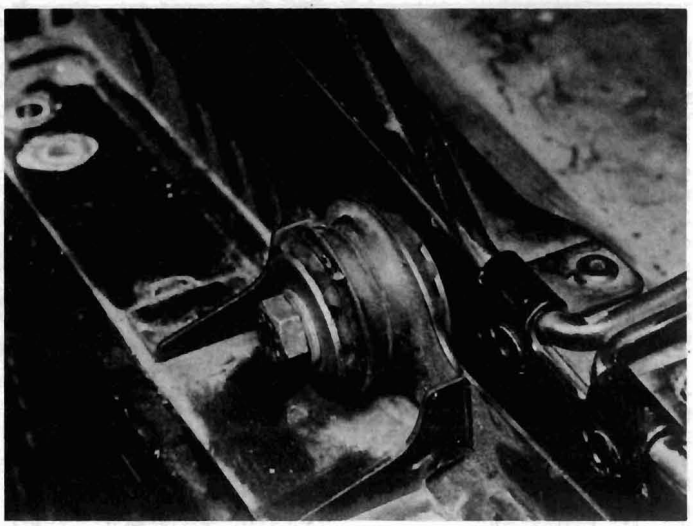
8.2a Expansion tank hose



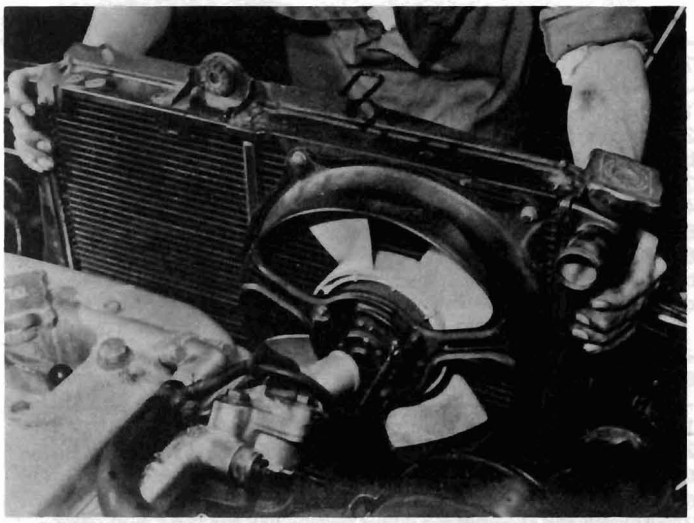
8.2b Radiator top hose



8.2c Radiator fan thermostatic switch (arrowed)



8.3a Radiator upper mounting



8.3b Removing the radiator

5 If the radiator is clogged, try reverse flushing it with a cold water hose. If this fails, use a chemical cleanser strictly in accordance with the manufacturer's instructions.

6 A leaking radiator should preferably be repaired professionally. A small leak can be soldered successfully provided heat travel is restricted so as not to extend the fracture. Alternatively, body filler paste may be used. The use of sealants which are mixed with the coolant is at best a temporary measure and may cause clogging of the fine tubes in the heater matrix.

7 If the radiator is to be renewed, remember to remove the fan switch and the filler cap before parting with the old unit.

8 Check that the seals in the radiator and expansion tank pressure caps are in good order. If there is any doubt as to their correct operation, they can be pressure tested at your service station.

9 Refit the radiator by reversing the removal operations.

10 Fill the cooling system, with reference to Section 3.

9 Coolant temperature sender – description, removal and refitting

1 This sender is screwed into the side of the thermostat housing and is connected to the coolant temperature gauge.

2 A malfunction of the coolant temperature gauge and fuel contents

gauge at the same time may be due to a faulty instrument voltage stabiliser.
3 Where only the coolant temperature gauge shows an incorrect reading, suspect the sender.
4 To remove the sender, first drain the coolant until its level is below the thermostat housing.
5 Unscrew and remove the sender.
6 Refit the new unit by reversing the removal operations. Do not overtighten.
7 Refill the system, with reference to Section 3.

10 Coolant pump – removal and refitting

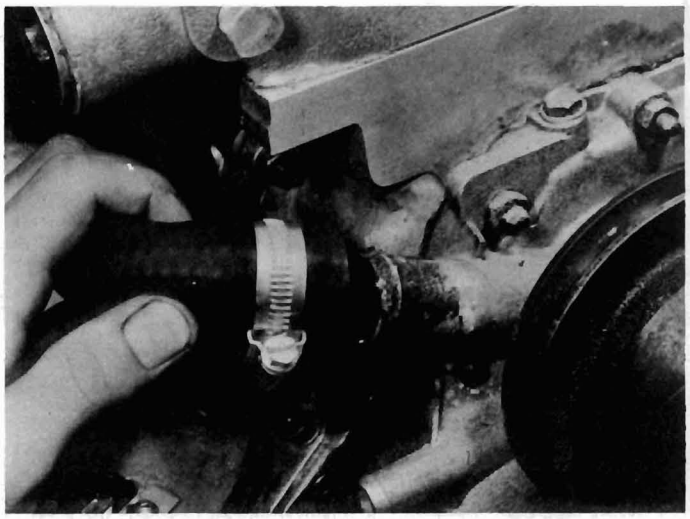
1 Drain the cooling system and disconnect the coolant hoses from the pump (photo).
2 Release the alternator mounting and adjuster link bolts, also the nut at the coolant pump end of the link, and push the alternator in towards the engine. Slip the drivebelt from the pulleys.
3 Disconnect the tachometer drive cable from the coolant pump if so equipped (certain early models).
4 The crankshaft pulley/damper must be removed before the coolant pump can be withdrawn. To do this, either remove the starter motor and jam the flywheel starter ring gear with a large screwdriver or cold chisel, or select a gear and apply the handbrake fully in order to prevent the crankshaft rotating as the nut is unscrewed.
5 Unbolt and remove the coolant pump from the engine front cover. Discard the joint gasket. The belt pulley is a press fit on the pulley hub.
6 A leaking or noisy coolant pump should be replaced by a new unit. Dismantling of a faulty pump is not recommended and it is difficult to obtain the necessary internal spare parts.
7 Refitting is a reversal of removal. Use a new gasket with jointing compound applied to clean mating faces (photos).
8 Fit the crankshaft pulley and tighten its retaining nut to the specified torque.
9 Fit the drivebelt and tension it as described in the next Section.
10 Refill the cooling system as described in Section 3.
11 Reconnect the tachometer drive cable where the car is so equipped.

11 Coolant pump drivebelt – removal, refitting and tensioning

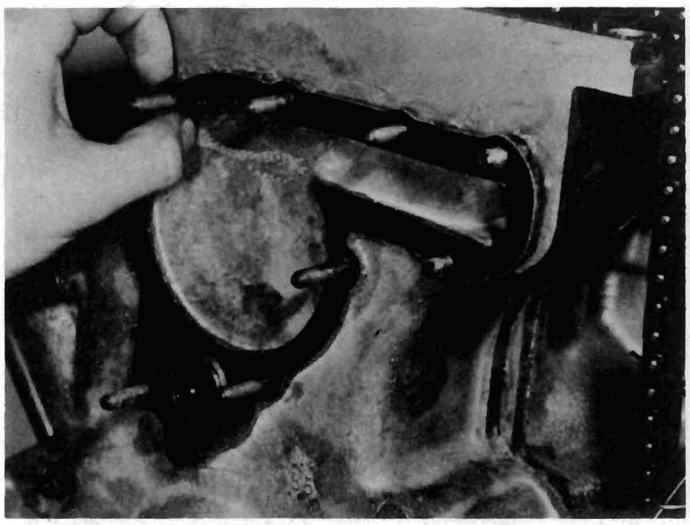
1 At regular intervals, inspect the drivebelt for fraying or cuts, or highly glazed areas denoting a slipping belt. Renew where evident.
2 To remove the belt, release the alternator mounting and adjuster link bolts, also the nut at the coolant pump end of the link, and push the alternator in towards the engine. Slip the belt from the pulleys. If the belt is to be used again, mark its direction of running.
3 Fit the belt by engaging it in the pulley grooves (photo), then pull the alternator away from the engine and partially tighten the mounting bolts so that the alternator swivels stiffly on its mountings. Lever the alternator away to further tension the belt and tighten the link bolt. Only lever on the alternator end frame, not on the body.
4 Check the belt deflection under firm thumb pressure at the mid-point of its longest run. This should be 12.7 mm (0.5 in). If it is not, readjust (photo).
5 When tension is correct, fully tighten the mounting and adjuster link nuts and bolts (photo).

12 Heater/ventilator – description

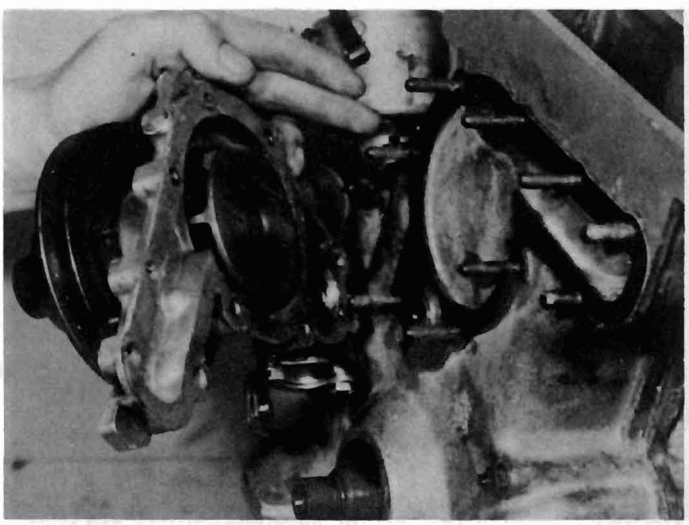
1 The heater provides warm air which is heated by flowing through an engine coolant-heated matrix.
2 Fresh air is provided at facia panel side and lower outlets, or can be mixed with the heated air to be ejected from the heater air grilles.
3 The forward motion of the car usually provides the necessary ram effect for adequate heating or ventilating airflow, but an electric booster 3-speed fan is fitted in conjunction with a facia mounted warning lamp.
4 Temperature and airflow control is by means of a control lever panel mounted on the centre lower part of the facia panel. The fresh air outlets are adjustable for flow and direction.
5 Extraction vents for stale air are fitted in the rear quarter panels of the body (photo).



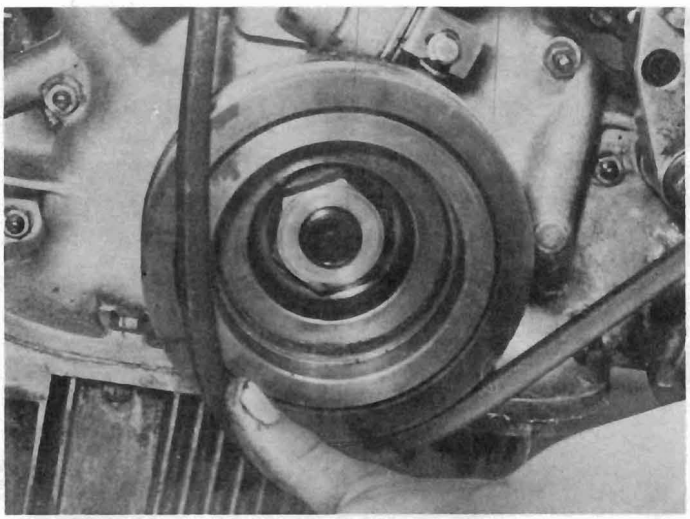
10.1 Disconnecting a hose from the coolant pump



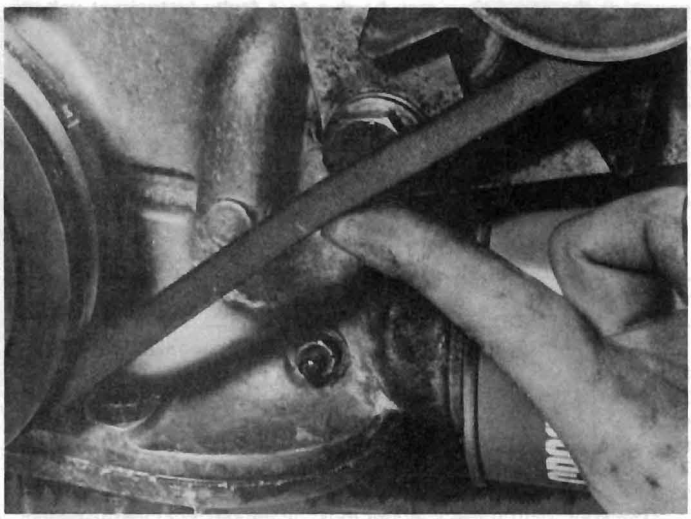
10.7a Locating coolant pump gasket



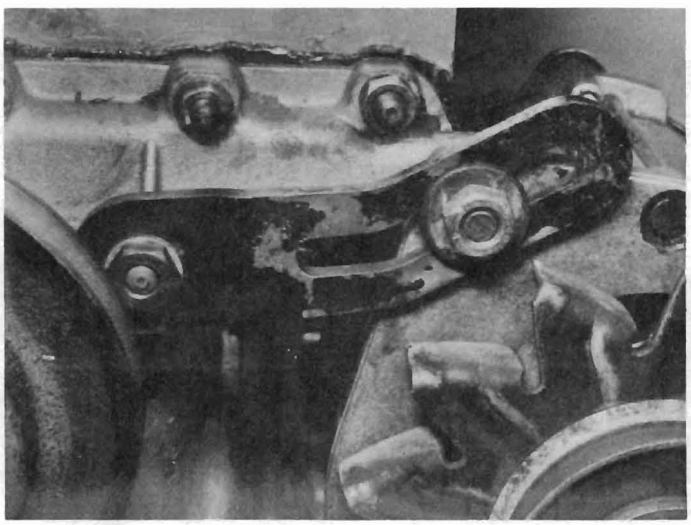
10.7b Fitting the coolant pump



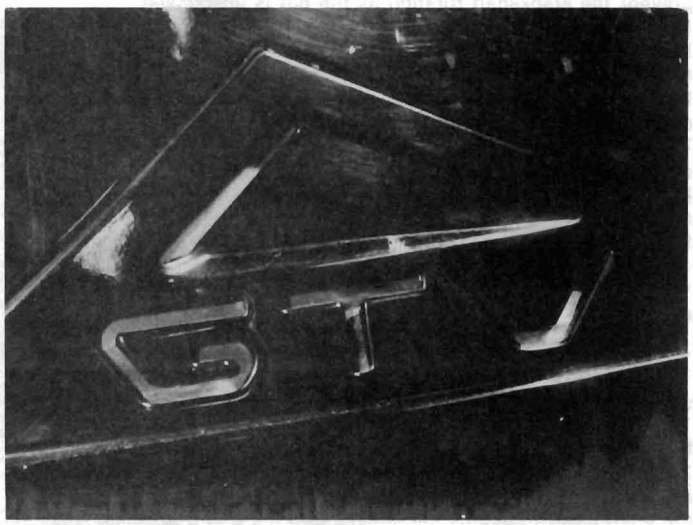
11.3 Engaging V-belt with crankshaft pulley



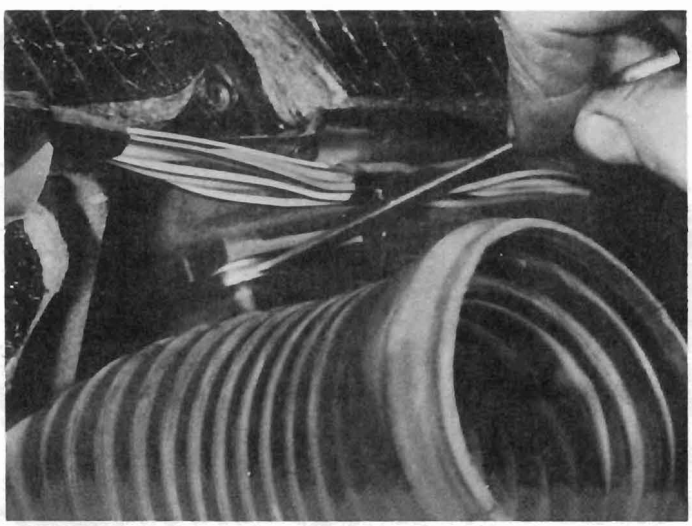
11.4 Checking V-belt tension



11.5 Alternator adjuster link



12.5 Coupe air extraction vent



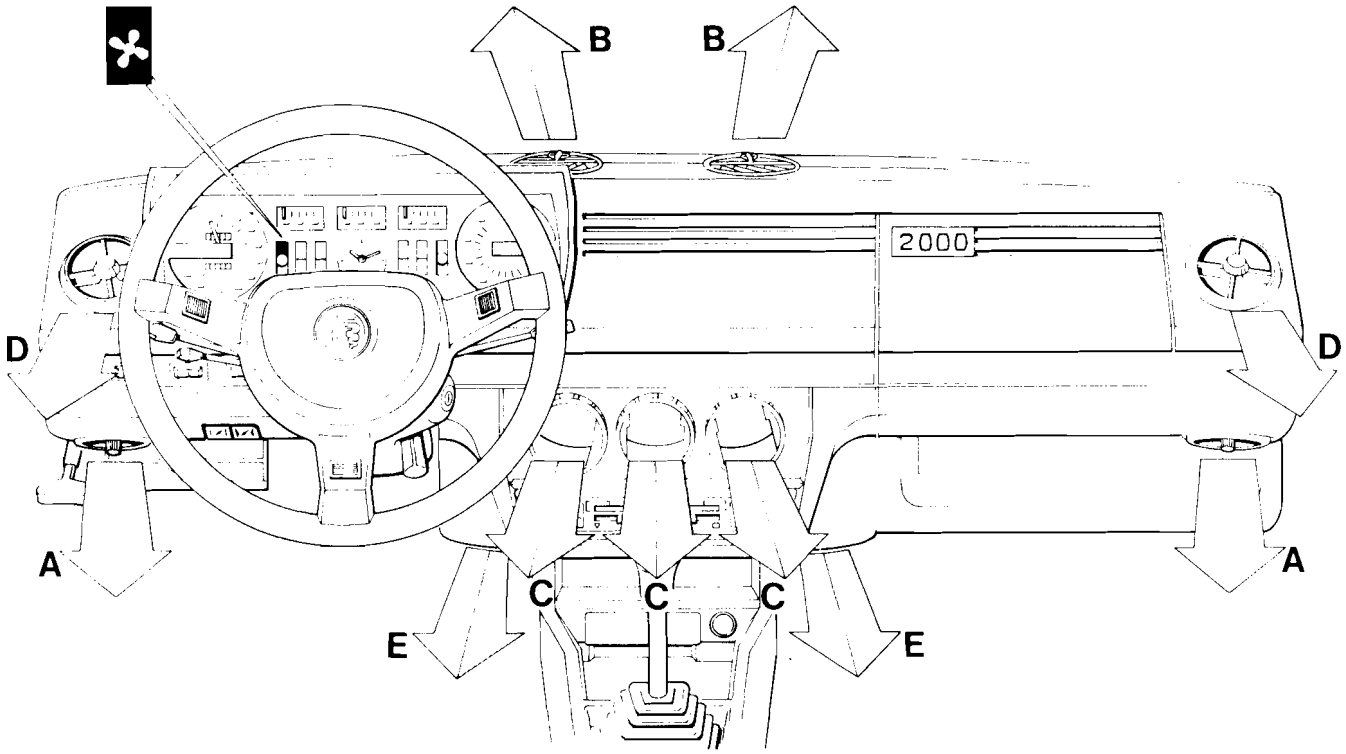
13.4 Unscrewing a heater mounting bolt

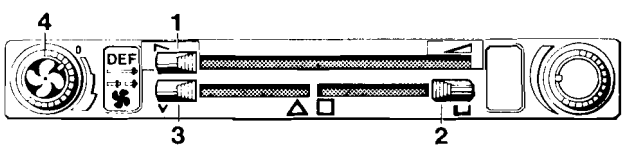
13 Heater unit – removal and refitting

1 Drain the cooling system as described in Section 3.
2 Extract the screw at each end of the heater control panel and release the panel from the facia.
3 Remove the facia panel as described in Chapter 12.
4 Unscrew the heater mounting bolts (photo).
5 Pull the heater towards you until the electrical wiring, the air ducts and the heater coolant hoses can all be disconnected. Take care that coolant does not leak onto the carpet.
6 Refit by reversing the removal operations. Refill the cooling system on completion.

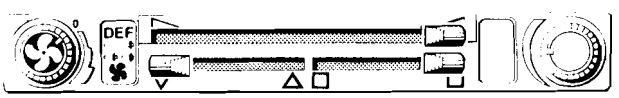
14 Heater – dismantling and reassembly

1 With the heater removed from its location, mark the positions of the control lever rods and cables and disconnect them.
2 Unclip the flange clips and remove the upper section of the heater casing. Remove the matrix.
3 Unclip the lower section of the heater casing and withdraw the blower assembly.
4 The water valve can be renewed if it is stiff to operate or leaking. The matrix can be cleaned if clogged by reverse flushing, or by the use of a chemical cleanser.

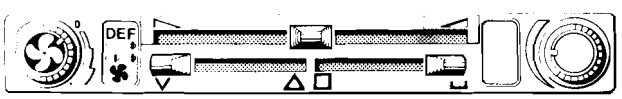




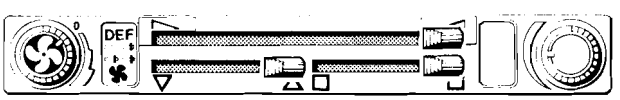
Partial fresh air flow to outlets C and louvres E



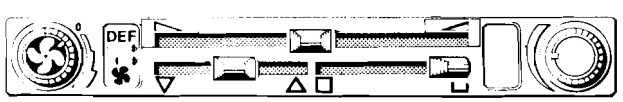
Partial warm air flow to outlets C and louvres E



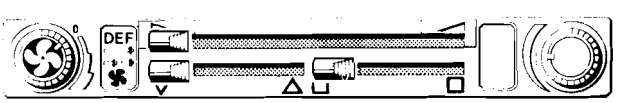
Warm and fresh air blending to outlets C and louvres E



Warm air flow to outlets B (screen demisting) as well as to outlets C



Warm and fresh air blending to outlets B,C and louvres E



Heat & vent system closed

Fig. 2.3 Heater controls and air distribution – LHD shown (Sec 12)

A Fresh air vent
B Heater/demister vents
C Heater outlets
D Fresh air vent
E Heater louvres
1 Temperature control lever
2 Airflow volume control
3 Air deflection lever
4 Blower control switch

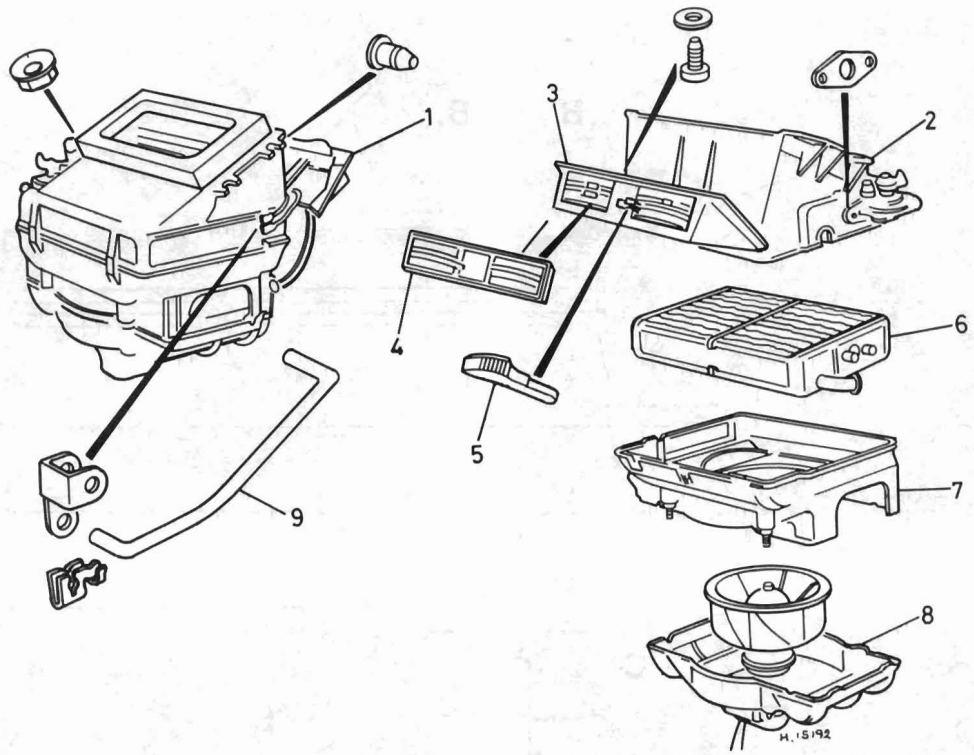


Fig. 2.4 Heater assembly (Sec 14)

1 Heater unit
2 Heater upper casing
3 Control lever panel
4 Escutcheon
5 Control lever
6 Matrix
7 Heater lower casing
8 Heater blower
9 Control rod

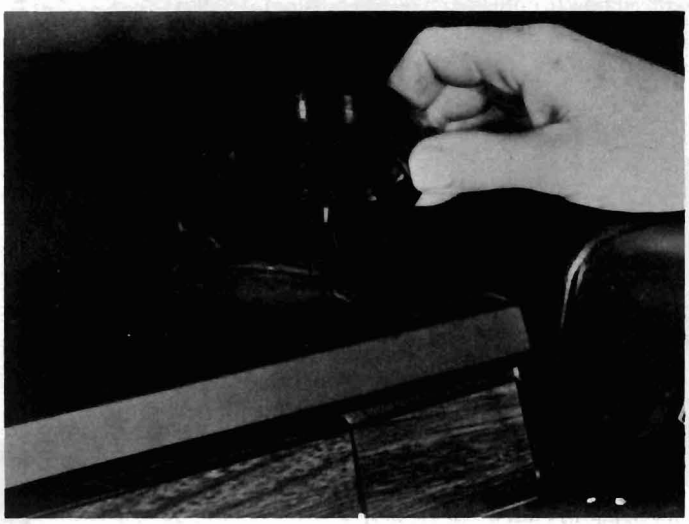
5 Repair of leaks is best left to specialists or preferably by exchanging the matrix for a new or reconditioned one.
6 Reassembly is a reversal of dismantling. Make sure that the casing joint seals are in good condition and reset the control rods and cables to their original positions.

15 Demister and fresh air outlets – removal and refitting

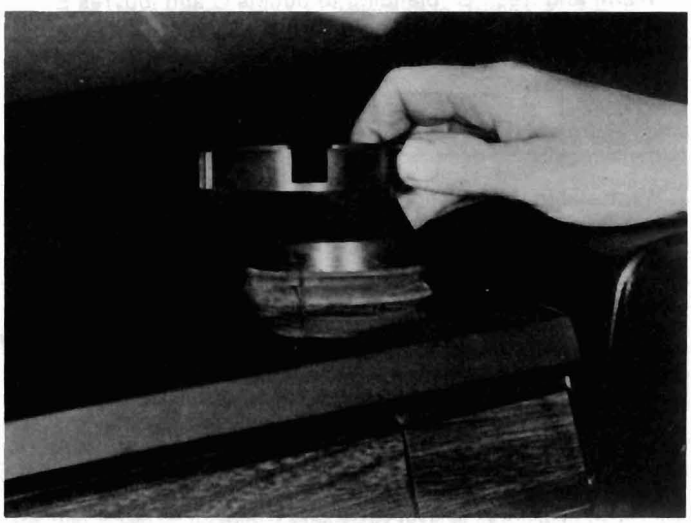
1 The windscreen demister ducts and outlet grilles can be removed if the duct elbows are first unbolted from the heater casing and then the upper duct collars unclipped from the grilles.
2 Remove the grilles from inside the windscreen and the ducts from under the facia panel.
3 The fresh air outlet grilles can be removed by prising them from their seating rings. It is unlikely that the ducts will have to be removed and these are riveted in place (photos).
4 Refitting is a reversal of removal.

16 Air conditioner – description

1 Where an air conditioner is installed, this combines the functions of air conditioning, ventilating, heating and demisting in one unit.



15.3a Removing a fresh air outlet grille



15.3b Removing a fresh air grille seating ring

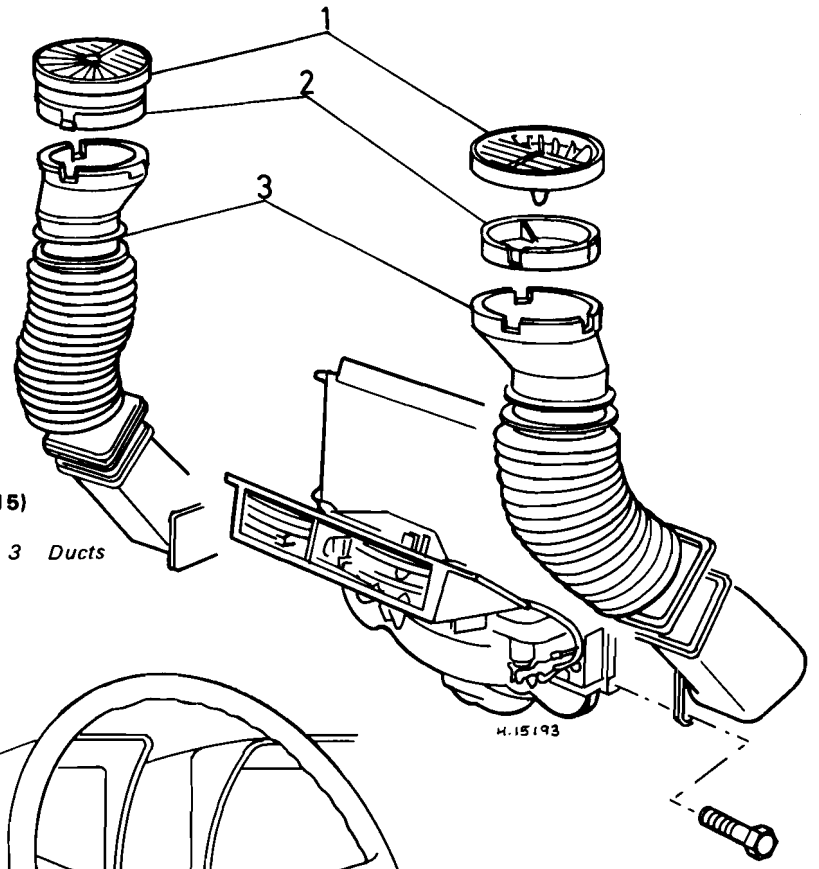


Fig. 2.5 Windscreen demister ducts (Sec 15)

1 Grilles 2 Retaining collars 3 Ducts

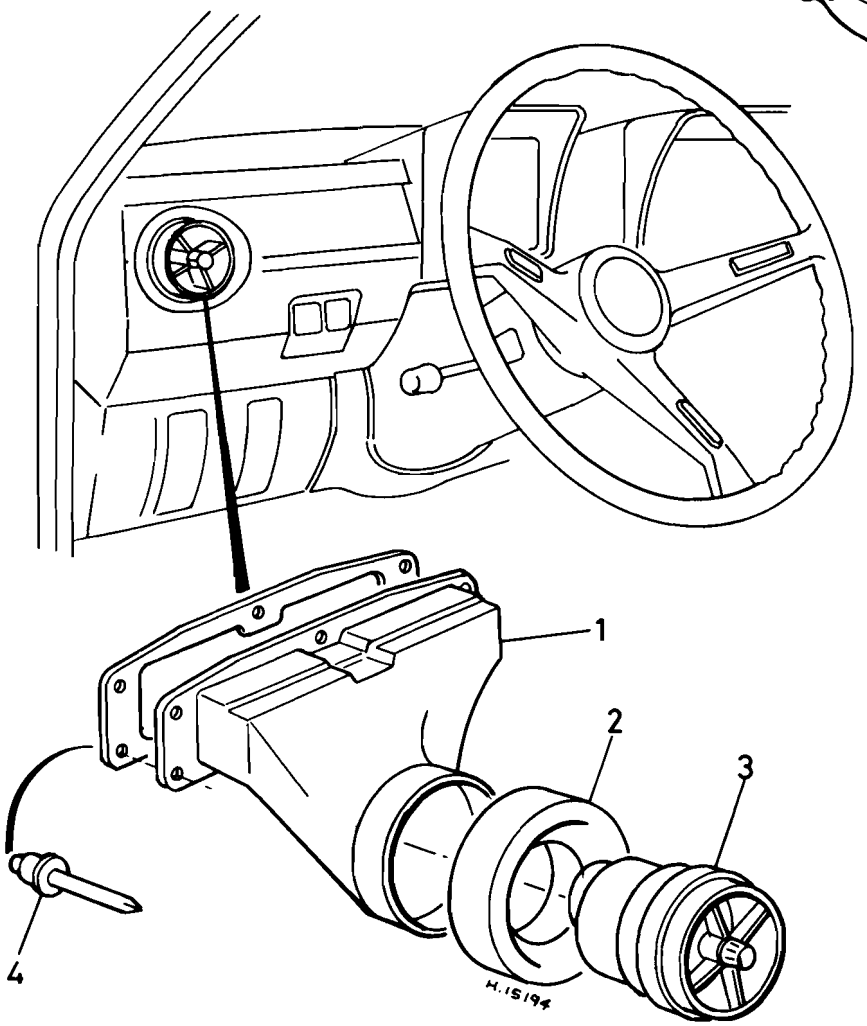


Fig. 2.6 Fresh air outlet (Sec 15)

1 Duct 2 Collar/retainer 3 Grille and flow control 4 Rivet

Air conditioning controls

2 Close the windows and air inlet grilles.
3 Set the heater temperature lever in the closed position.
4 Slide the ventilation lever to INT.
5 Open the vents.
6 Switch the blower control to the desired position.
7 Turn the air conditioner control knob to the required temperature range.

Ventilation controls

8 Check that the air conditioner control is off.
9 The heater temperature lever should be closed and on the blue mark.
10 Slide the lever as required from INT to EXT (maximum outside air intake).

Heating controls

11 Close the air vents.
12 Check that the air conditioner control is off.
13 Move the temperature lever to the desired position between off and maximum.
14 Move the lever from INT to EXT as required.

Demisting controls

15 Set the air outlet grilles to deflect the air for demisting as required.
16 Close the air outlets.
17 Turn on the air conditioner.

17 Air conditioner – precautions

1 On cars equipped with this factory-fitted option, it is most important to observe the following operating precautions.
2 Before attempting to start the engine, make sure that the air conditioner is switched off, otherwise the battery will be overloaded.
3 If the heater temperature lever is moved to the maximum heat position while the air conditioner is operational in an effort to accelerate demisting, never turn the heater system off in advance of switching off the air conditioner.
4 Whenever overhaul of a major nature is being undertaken to the engine, and components of the air conditioning system obstruct the work, never be tempted to disconnect any component or pipeline of the air conditioning refrigeration circuit as the release of fluid might be very dangerous.
5 The refrigerant fluid is Freon 12 and although harmless under normal conditions, contact with eyes or skin must be avoided. If Freon comes in contact with a naked flame then a poisonous gas will be generated.
6 Where a component such as the compressor or the condenser, if unbolted, cannot be moved aside within the limits of any flexible connecting pipes to avoid obstruction, then the system must be discharged by your dealer or a competent refrigeration engineer and recharged on completion of the work.
7 It is essential to completely evacuate the system before recharging. The necessary vacuum equipment to do this is only likely to be held by your dealer.

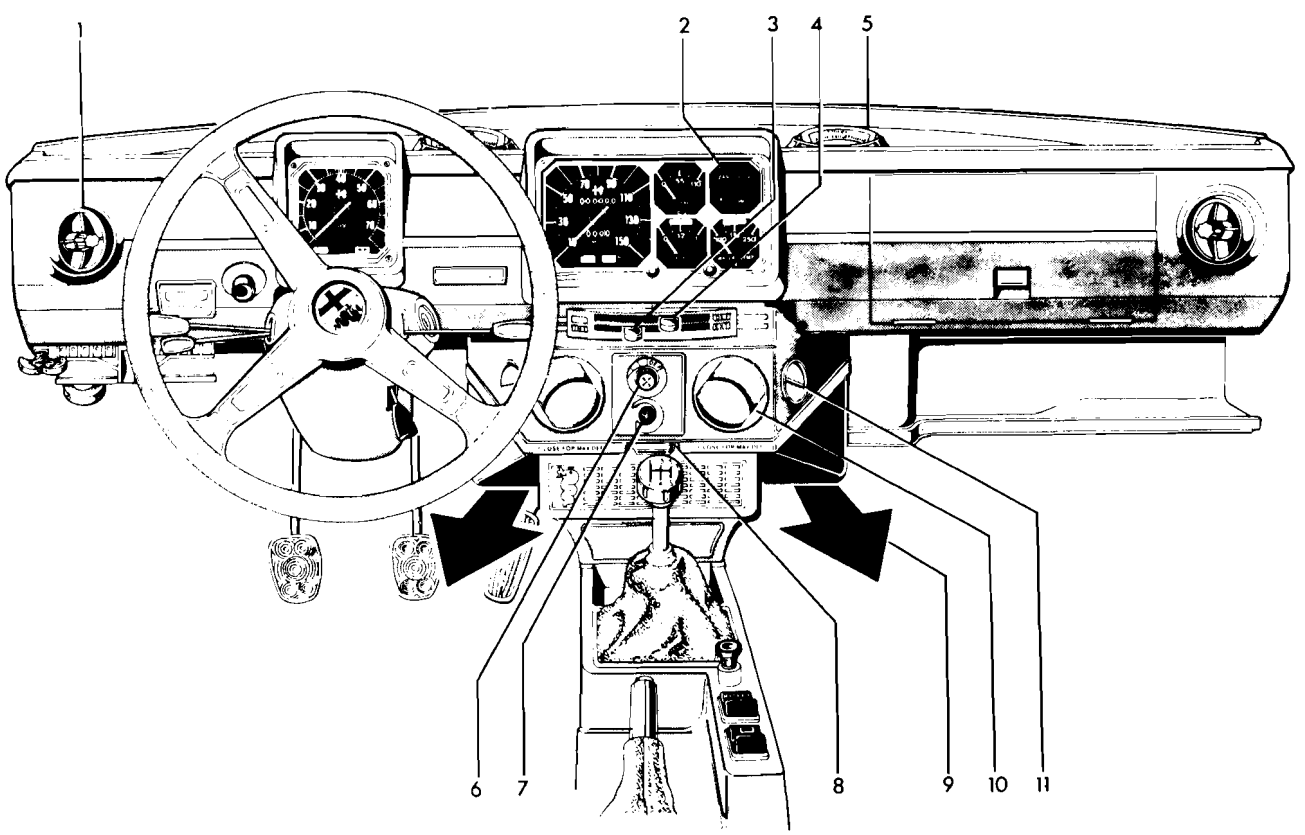


Fig. 2.7 Air conditioner controls (Sec 16)

1 Fresh air vent
2 Blower warning lamp
3 Air control lever
4 Temperature control
5 Demister outlet
6 Blower switch knob
7 Air conditioner control knob
8 Air control lever
9 Base air outlet
10 Adjustable air vent
11 Side air vent

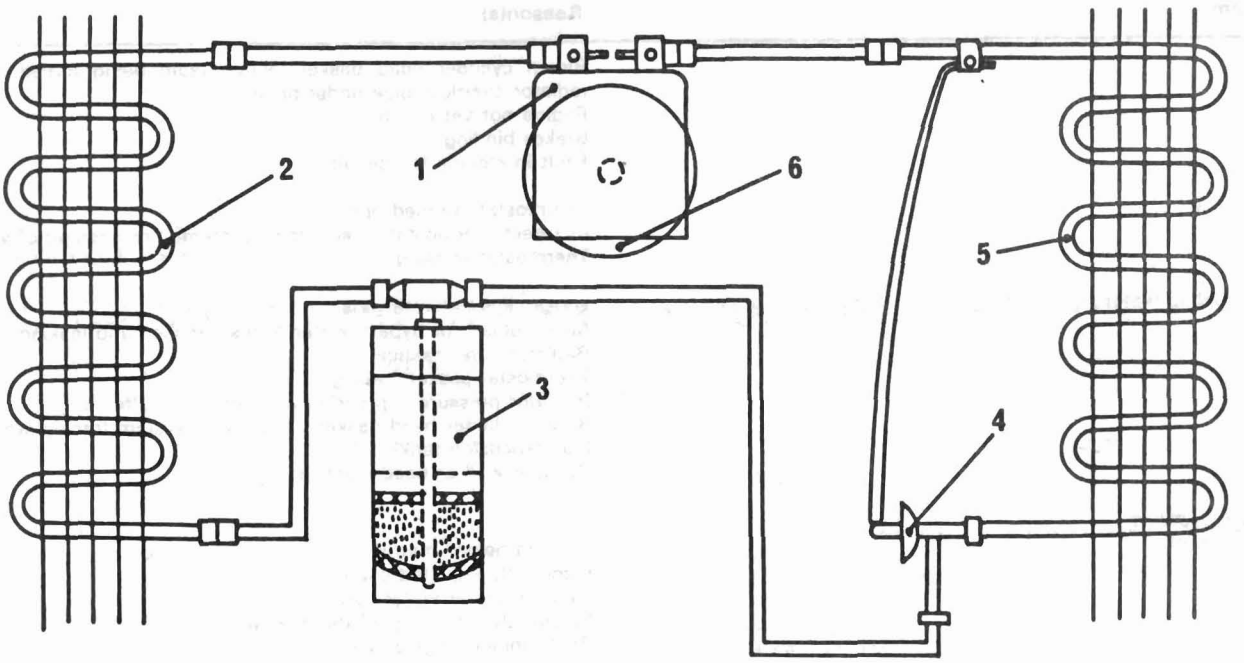


Fig. 2.8 Schematic diagram of air conditioning system (Sec 16)

1 Compressor
2 Condenser
3 Dehydrator
4 Expansion valve
5 Evaporator
6 Magnetic clutch

18 Air conditioner – maintenance

1 Periodically check the tension of the compressor drivebelt. This should be 10.0 mm (0.4 in) when the belt is depressed at the mid-point of its top run using moderate finger pressure.
2 Where adjustment is required, loosen the tensioner pulley mounting bolts, move the pulley as necessary and then retighten the bolts.
3 Periodically, especially at the end of the summer season, clean the condenser of flies and leaves. The condenser is mounted ahead of the radiator. The use of compressed air or a water jet is a suitable way to clean the fins if directed in the reverse direction to normal airflow.
4 Annually, or if the system is not operating efficiently, have your dealer check the refrigerant fluid level through the sight glass provided on the dehydrator.
5 Relays for the air conditioner are located on the fuse block adjacent to those used for certain other electrical accessories, and these should be checked first if a fault occurs (refer to Chapter 9).

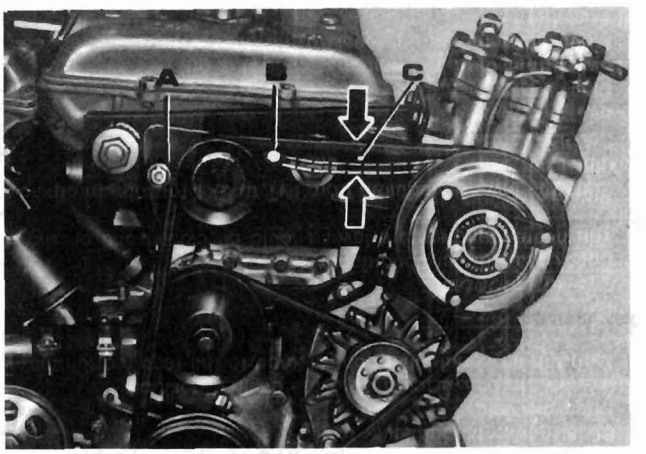


Fig. 2.9 Compressor drivebelt tensioning (Sec 18)

A Tensioner pulley adjuster link nut
B Tensioner pulley pivot bolt
C Deflection

19 Fault diagnosis – cooling, heating and air conditioning systems

Symptom	Reason(s)
Cooling system	
Overheating SURRISCALDAMENTO	Insufficient water in cooling system Pump belt slipping (accompanied by a shrieking noise on rapid engine acceleration) Radiator core blocked or radiator grille restricted Coolant hose collapsed, impeding flow Thermostat not opening properly Ignition advance and retard incorrectly set (accompanied by loss of power, and perhaps, misfiring) Carburettor incorrectly adjusted (mixture too weak) Exhaust system partially blocked Oil level in sump too low

Symptom	Reason(s)
	Blown cylinder head gasket (water/steam being forced down the radiator overflow pipe under pressure) Engine not yet run-in Brakes binding Fault in electric fan circuit
Cool running	Thermostat jammed open Incorrect thermostat fitted allowing premature opening of valve Thermostat missing
Loss of cooling water	Loose clips on water hoses Main coolant or bypass water hoses perished and leaking Radiator core leaking Thermostat gasket leaking Radiator pressure cap spring worn or seal ineffective Blown cylinder head gasket (pressure in system forcing water/steam into expansion tank) Cylinder wall or head cracked
Heating system	
Lack of warmth	Blocked heater matrix Incorrectly adjusted controls Fault in heater water valve Incorrectly rated engine thermostat Cool running engine (see above)
Air conditioner	
Little or no cooling effect	Compressor magnetic clutch not engaging due to: blown fuse defective microswitch defective resistor defective thermistor broken electrical lead Loose compressor drivebelt Defective compressor pump Insufficient refrigerant Defective expansion valve Choked receiver Control levers inoperative
Restricted air ejection	Blower fuse blown Blower motor defective Blower switch or resistor defective
Noisy operation	Dry or worn blower motor bearing Worn compressor Compressor mountings loose Low oil level in compressor Compressor magnetic clutch bearings worn Slack drivebelt Worn idler pulley bearing
Overheating of engine (see cooling system faults)	Condenser fins clogged

Chapter 3
Fuel, exhaust and emission control systems

For modifications, and information applicable to later models, see Supplement at end of manual

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Specifications

Part A: Models with carburettors

System type	Rear-mounted fuel tank, twin dual choke, sidedraught carburettors and mechanically operated fuel pump
Fuel tank capacity	
1.6 and 1.8 models	49 litres (10.8 Imp gals, 12.9 US gals)
2.0 GTV models	56 litres (12.3 Imp gals, 14.8 US gals)
Reserve (all models)	8 litres (1.76 Imp gals, 2.1 US gals)
Fuel grade	UK 4-star (97 octane)
Carburettor calibration (in mm)	
Weber:	
Identification	40 DCOE 72/73 and 40 DCOE 80/81
Venturi	32
Main jet	1.35
Main emulsion tube	F34
Main air metering jet	2.10
Idle jet	0.55
Idle air metering jet	F17
Progression holes	1.20-1.60-1.60-1.50
Choke jet	0.65 F5
Choke air metering jet	2.00
Angled bush for choke mixture	1.00
Accelerator pump jet	0.35
Leak for accelerator pump inlet valve	0.60
Accelerator pump delivery volume (20 strokes each barrel)	3.5 to 4.5 cc
Accelerator pump rod stroke	18.0 mm
Needle valve	1.50

Solex:	
Identification	C40 DDH-8
Venturi	32
Main jet	1.40
Main emulsion tube	2
Main air metering jet	1.59
Idle jet	0.50
Idle emulsion tube	1.30
Choke jet	1.40
Choke air metering jet	6.00
Accelerator pump jet	0.35
Leak for accelerator pump valve	0.60
Accelerator pump delivery volume (20 strokes each barrel)	5.0 to 7.0 cc
Needle valve	1.60
Needle valve washer thickness	1.00
Dellorto:	
Identification	DHLA 40F
Venturi	32
Main jet	1.45
Main emulsion tube	7772-08-28
Main air metering jet	2.10
Idle jet	0.52 to 0.55 according to date of production
Idle air metering jet	2.20
Progression holes	1.2-1.6-1.6-1.5-1.5
Choke jet	0.70 to 0.80 according to date of production
Choke air metering jet	1.50 to 3.00 according to date of production
Choke emulsion tube	7482.3
Accelerator pump jet	0.33
Accelerator pump delivery volume (20 strokes each barrel)	5.0 to 6.0 cc or 7.5 to 9.5 cc according to date of production
Fuel inlet needle valve	1.50

Adjustment data (all carburettors)

Idle speed	850 to 1000 rpm
Fast idle speed	1450 to 1750 rpm
Exhaust gas CO content	4.5% at 850 to 1000 rpm with hot engine, transmission in neutral

Torque wrench settings – carburettor models

	Nm	lbf ft
Carburettor flange nuts	20	15
Intake manifold nuts	22	16
Exhaust manifold nuts	25	18
Exhaust joint clamp bolts	35	26
Fuel pump mounting nuts	20	15

Part B: Models with fuel injection

System type	Alfa Romeo-Spica with belt-driven injection pump and control unit. Inbuilt compensation for altitude, temperature and cold start
Fuel tank capacity	54 litres, (11.8 Imp gals, 14.3 US gals)
Fuel grade*	Unleaded or leaded, minimum grade 2, 91 RON

**Use only unleaded fuel if catalytic converter fitted*

Adjustment data

Idle speed	600 to 800 rpm (transmission in neutral, air conditioner and other accessories off)
Maximum CO level	1.2%
Maximum HC emission	330 ppm

Torque wrench settings (fuel injection models)

	Nm	lbf ft
Fuel injectors	30	22
Fuel injector pipe unions	25	18
Air pump mounting nuts	33	24

PART A: MODELS WITH CARBURETTORS

1 Description

All cars are fitted with a rear-mounted fuel tank, located below the luggage area floor on the left-hand side.

The fuel pump is mechanically operated by a pushrod from an eccentric cam on the oil pump/distributor driveshaft.

A filter is located between the fuel pump and the carburettor.

The air filter is of disposable paper type, and the air cleaner has a control for the admission of cold or warmed air (from the crankcase exterior) according to seasonal conditions.

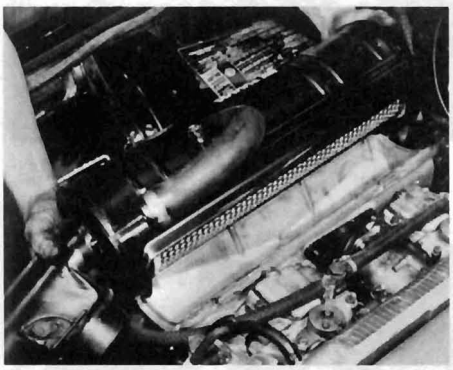
Twin carburettors are installed and these may be of Weber, Dellorto or Solex manufacture.

2 Air cleaner – servicing, removal and refitting

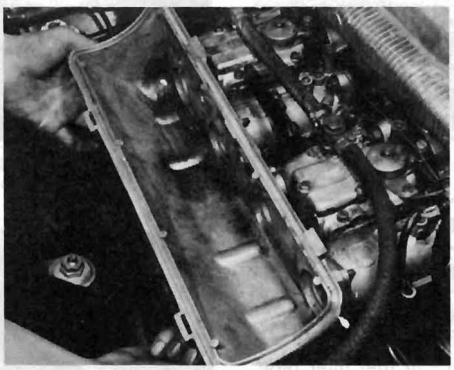
1 At intermediate service intervals, the air cleaner element should be removed and cleaned with compressed air. Release the air cleaner from its light alloy cradle.
2 Raise the casing, slacken the wing nut, take off the cover plate and extract the element (photo).
3 Apply air pressure to the inside surfaces of the element and wipe out the air cleaner casing.
4 Refit the element, the cover plate and wing nut, making sure that the gasket is correctly located.
5 Reconnect the air cleaner fixing straps to the intake manifold.
6 At full service intervals as specified, the element should be discarded and a new one fitted.
7 The air cleaner summer/winter control lever should be placed in position I for preheated air in winter, and in position E for summer operation.
8 The air cleaner can be completely removed after unbolting its light alloy cradle, removing the joint gaskets and detaching its connecting hoses and duct ring (photos).

3 Fuel filter – maintenance

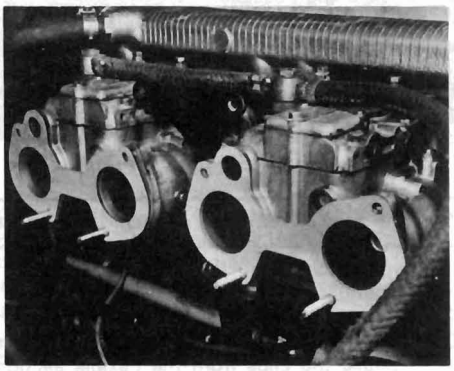
1 At intermediate service intervals, release the bowl from the fuel filter and wipe it out.
2 Refit the bowl, checking the mating of the gasket and sealing washer above the filter element.
3 At full service intervals, the filter element should be removed and



2.2 Removing the air cleaner



2.8a Removing the air cleaner cradle



2.8b Carburettor flange gaskets

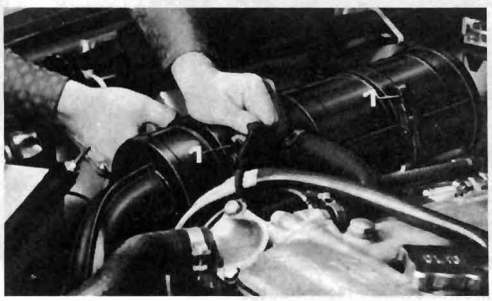


Fig. 3.1 Air cleaner toggle straps (1) (Sec 2)

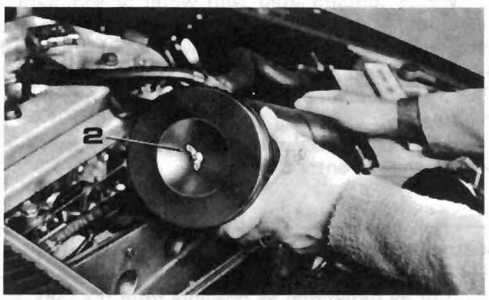


Fig. 3.2 Air cleaner cover wing nut (2) (Sec 2)

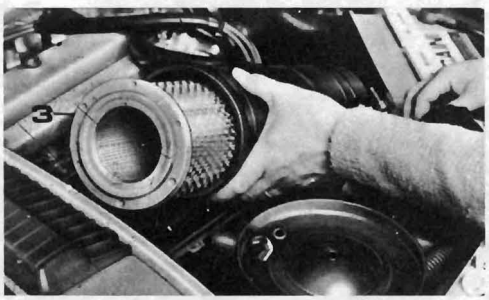


Fig. 3.3 Air cleaner element (3) (Sec 2)

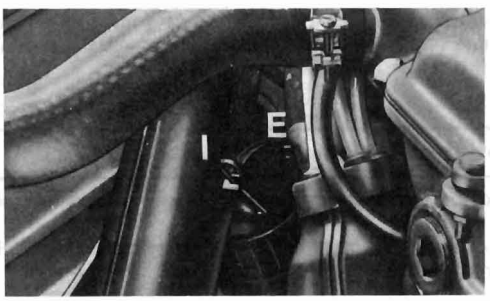
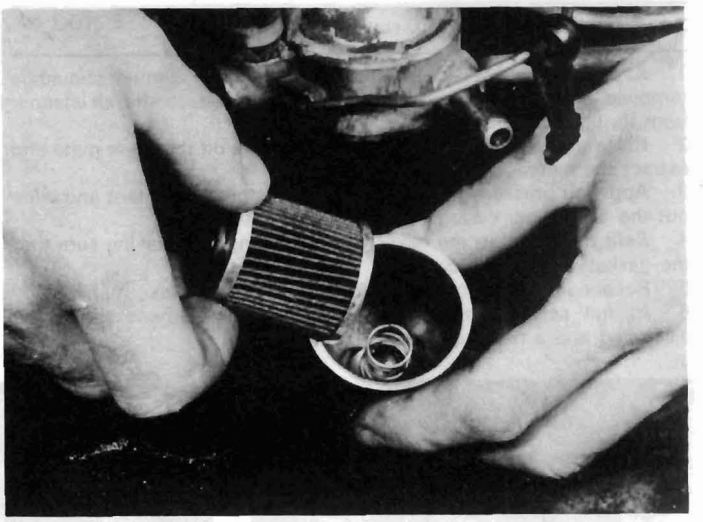


Fig. 3.4 Air cleaner winter (I) and summer (E) control lever (Sec 2)

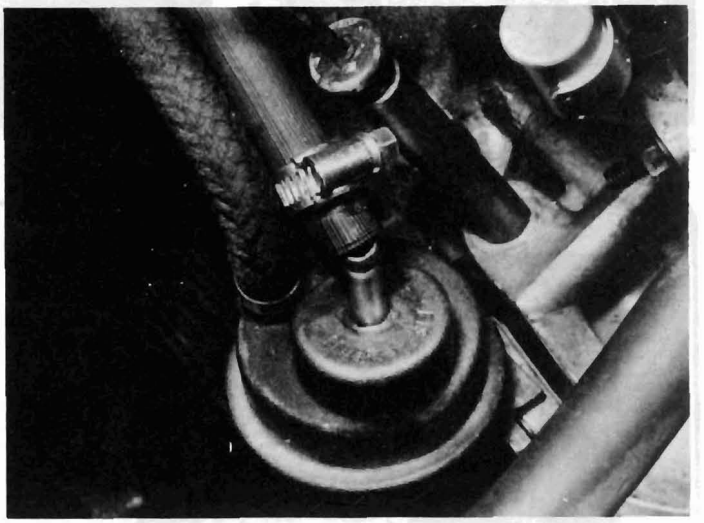
discarded and a new one fitted. Note that the coil spring fits below the filter element (photo).



3.3 Fuel filter element

4 Fuel pump – testing, removal and refitting

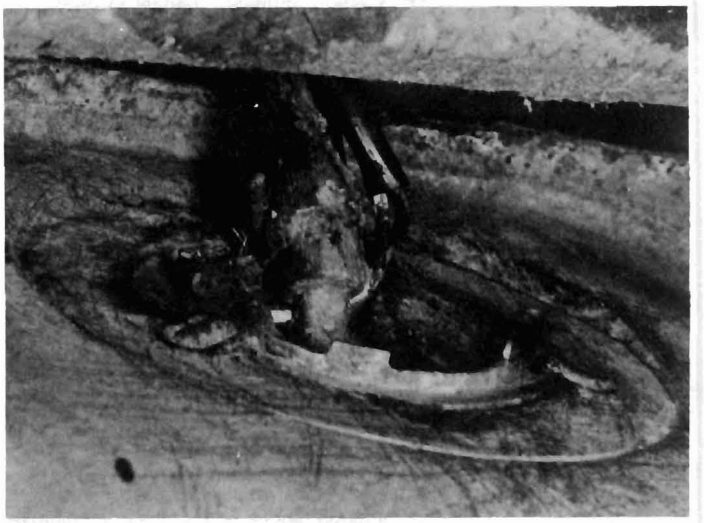
1 In the event of fuel starvation at the carburettor, first check that there is in fact fuel in the tank. If so, test the pump as follows.
2 Disconnect the outlet pipe from the fuel pump (photo).
3 Disconnect the LT wire from the ignition coil to prevent the engine from starting.
4 Operate the starter and have an assistant check for regular well-defined spurts of fuel being ejected from the pump outlet. If this does not happen then the pump is faulty.
5 The fuel pump is a sealed unit and can only be renewed complete, no repair being possible.
6 To remove the pump, disconnect the fuel lines from it and their open ends up as high as possible.
7 Unscrew the mounting nuts and take the pump from the engine front cover. Retain the insulating spacer and extract the pushrod.
8 Refitting is a reversal of removal, but place a new sealing gasket on both sides of the insulating spacer.



4.2 Fuel pump outlet pipe disconnected

5 Fuel tank – removal, servicing and refitting

1 Syphon out as much fuel as possible from the tank and store in a sealed container.
2 Disconnect the leads from the tank sender unit terminals (photo).
3 Disconnect the fuel supply pipe from the tank.
4 Release the clips from the flexible section of the fuel filler pipe (photo).
5 Support the weight of the fuel tank, and unscrew and remove the tank flange securing bolts (photo).
6 Remove the tank from the car.
7 If the tank is contaminated with water or sediment, remove the tank sender unit and pour in some paraffin. Shake vigorously and empty out. Repeat until clean and allow to drain thoroughly.
8 If the tank is leaking, it should be professionally repaired. *Never attempt to weld or solder a fuel tank until it has been thoroughly purged by steaming or boiling out.*
9 Refitting is a reversal of removal. Make sure that the flange joint is well sealed against entry of moisture.



5.2 Tank sender unit

6 Tank transmitter unit – removal and refitting

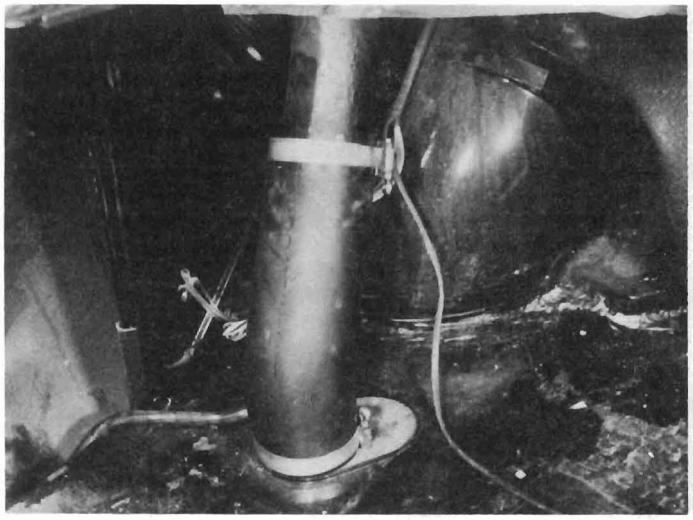
1 Syphon out as much fuel as possible from the tank and store in a closed container.
2 Disconnect the electrical leads and the fuel pipe from the tank transmitter unit, which is located on the face of the tank which is nearest the front of the car.
3 Using a length of flat steel strip, engage it between the tabs on the edge of the tank transmitter cover plate. Unscrew in an anti-clockwise direction.
4 Withdraw the unit carefully, taking care not to damage the float.
5 Refitting is a reversal of removal, but check the sealing ring and renew it if it is not in perfect condition.

7 Carburettors – description

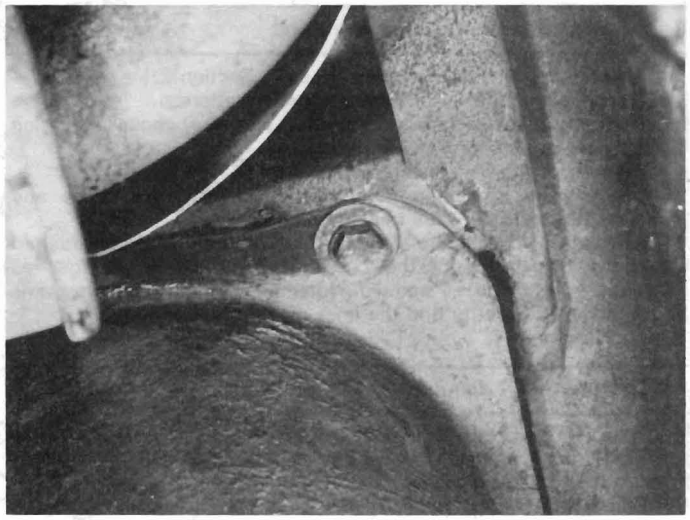
1 The carburettors are in the form of twin dual choke, sidedraught units.
2 One of three makes of carburettor may be installed, all of which are covered in this Chapter.

8 Carburettors – idle speed and mixture adjustment

1 The adjustment for all makes of carburettor is similar. Refer to the appropriate illustration for the exact location of the adjustment screws.
2 Extract the circlip and disconnect the control rod from the lever on the carburettor.



5.4 Fuel tank filler pipe



5.5 Fuel tank mounting bolt

3 Slacken fully the idle speed screw.
4 Slacken the coupling screw and at the same time push the throttle lever upwards until all four carburettor throttle plates are fully closed.
5 Continue to keep the throttle lever pressed upwards while the coupling screw is tightened.
6 Turn the idle speed screw until it just makes contact with the carburettor throttle lever, then give it one further complete turn.
7 Screw in the mixture screws until they just seat and then unscrew them through four complete turns.
8 Connect the control rod to the throttle lever ball, start the engine and bring it to operating temperature. Adjust the idle speed screw to achieve an idle speed within the specified range.
9 Switch off the engine and remove the blanking screws from the vacuum ports.
10 A vacuum gauge (special tool C20014 with adaptor C20015) is available for connection to the parts in order to synchronize the carburettors. Any proprietary 4-bank vacuum gauge set will do.
11 Start the engine and while it is running at a speed of between 800 and 900 rpm, adjust the throttle rod coupling until the vacuum for the 1st and 2nd ducts is equal to that of the 3rd and 4th ducts.
12 If the engine is found to run unevenly, adjust the mixture screws very slightly to obtain a smooth idle.
13 In many operating territories it is essential to have the exhaust emission levels adjusted to bring the CO level within the specified percentage. When it is carried out using an exhaust gas analyser, any weakening of the mixture should be carried out by turning the mixture screws in the smallest amount and equally at each screw.
14 Some later carburettors have tamperproof mixture screws which are adjusted during production. On these units, restrict any adjustment to the coupling and idle speed screws.
15 Where new components have been fitted or it is obvious from performance that the mixture screws must be adjusted, remove the tamperproof caps. Make sure that new ones are fitted on completion of the adjustment, where this is required by law.

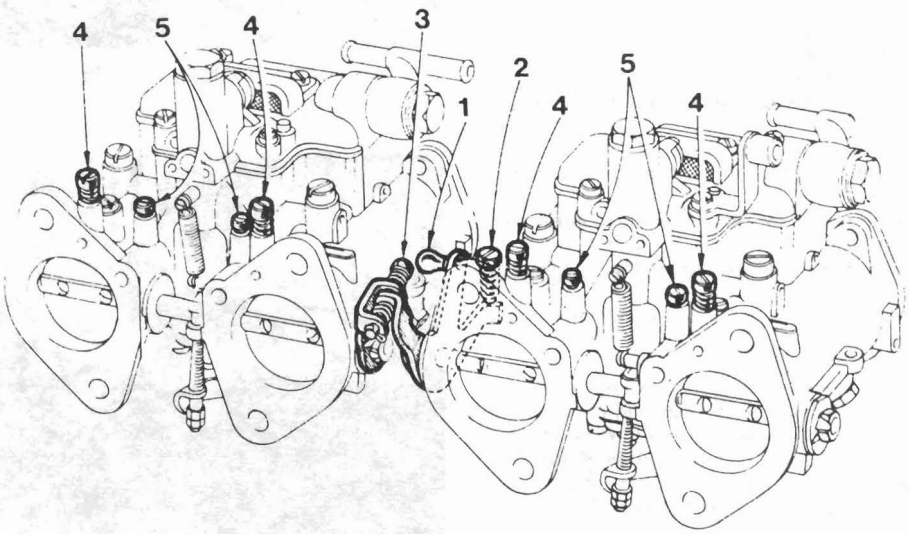


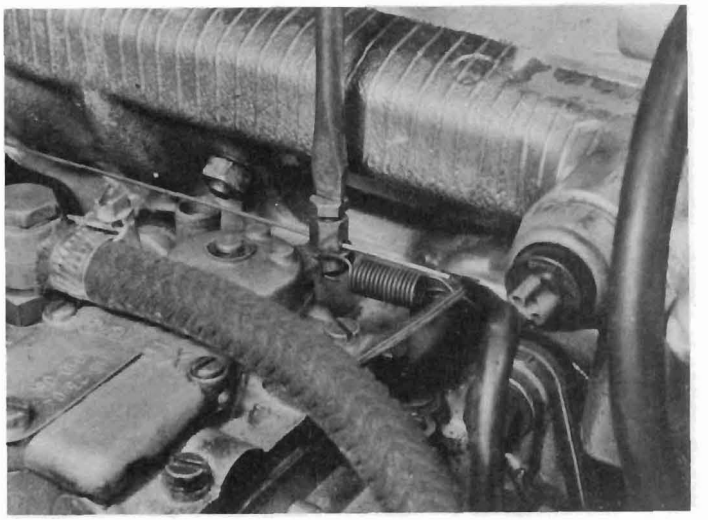
Fig. 3.5 Carburettor adjustment screws (Sec 8)

1 Throttle control rod connecting ball
2 Idle speed screw
3 Coupling screw
4 Idle mixture screws
5 Vacuum port blanking screws

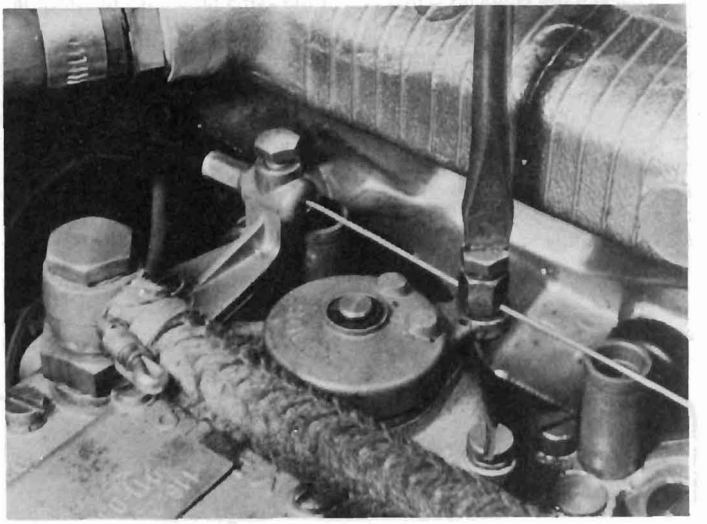
MINIMG

9 Carburettors – removal and refitting

1 Remove the air cleaner as described in Section 2.
2 Disconnect the fuel pipes from the carburettors.
3 Disconnect the accelerator control and the choke operating linkage from the carburettors (photos).
4 Disconnect the distributor vacuum pipe (if fitted).
5 Unscrew the mounting nuts from the carburettor flange and withdraw the units from the intake manifold.
6 Refitting is a reversal of removal, but use new joint gaskets and check the adjustment of the accelerator and choke linkages as described in Sections 14 and 15. Note the earthing strap that runs between the carburettor and the inlet manifold (photo).



9.3a Manual choke cable at front carburettor



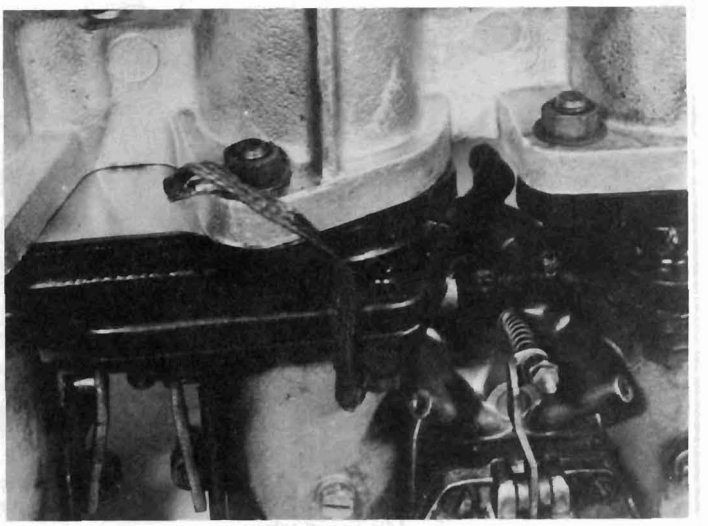
9.3b Manual choke cable at rear carburettor

10 Carburettors – dismantling (general)

1 Complete stripping of the carburettor is seldom required. Usually removal of the top cover, followed by cleaning the bowl and blowing through the jets and passages with compressed air, is sufficient and this can be carried out without removing the carburettor from the engine.
2 A well worn carburettor is often better replaced with a new or factory rebuilt unit, but where the individual components are available, complete overhaul operations are described in the following Sections.
3 When overhauling a carburettor, use only well-fitting screwdrivers and spanners in order to prevent burring and distortion of the jets and other small items.
4 Clean jets and bleed screws only with compressed air (an ordinary foot pump is usually adequate) – never attempt to clear them with wire. A nylon brush bristle is acceptable to clean an obstinate obstruction.

11 Weber carburettor – overhaul

1 With the carburettor removed from the engine, clean away external dirt using a brush and paraffin or petrol.
2 Unscrew and remove the fuel pipe banjo union from the cover.
3 Unscrew the wing nut and remove the jet inspection cover.
4 Unscrew and remove the fuel filter plug and extract the filter screen.
5 Unscrew the carburettor cover securing screws and remove the cover.
6 Remove the float by sliding out the pivot pin.
7 Remove the cover gasket and fuel inlet valve.
8 Remove the plate from the float chamber.
9 Remove the idle jet, carrier and seal.
10 Withdraw the emulsion tubes, the jet carriers and the union air metering jets.
11 Unscrew and remove the main fuel jets.
12 From within the float chamber, remove the accelerator pump inlet valve.
13 Dismantle the accelerator pump by removing the control rod, spring retainer, spring and plunger.
14 Unscrew the plug with washer and withdraw the accelerator pump jet.
15 Remove the plugs, weights and balls so that the accelerator pump outlet valves can be removed.
16 Remove the choke jets.
17 Remove the cover from the choke mechanism, extract the circlip and spring seat and then withdraw the choke valve and its spring.
18 Where necessary, remove the idle speed and idle mixture screws. If the latter are of tamperproof type, avoid disturbing them if possible.
19 Remove the progression hole plugs and the vacuum port plugs.
20 Remove the cover from the base of the float chamber. Peel off the gasket.
21 Take off the accelerator pump housing cover with its gasket.
22 Never attempt to remove the bypass screws from the outside of the carburettor body, and do not attempt to remove the venturis.
23 Clean all jets with air as described in the preceding Section. Wash all components in fuel and examine for wear or damage.
24 If it is suspected that jets or internal components have been changed for ones of incorrect calibration, check against the signs listed in the Specifications.



9.6 Carburettor earth strap

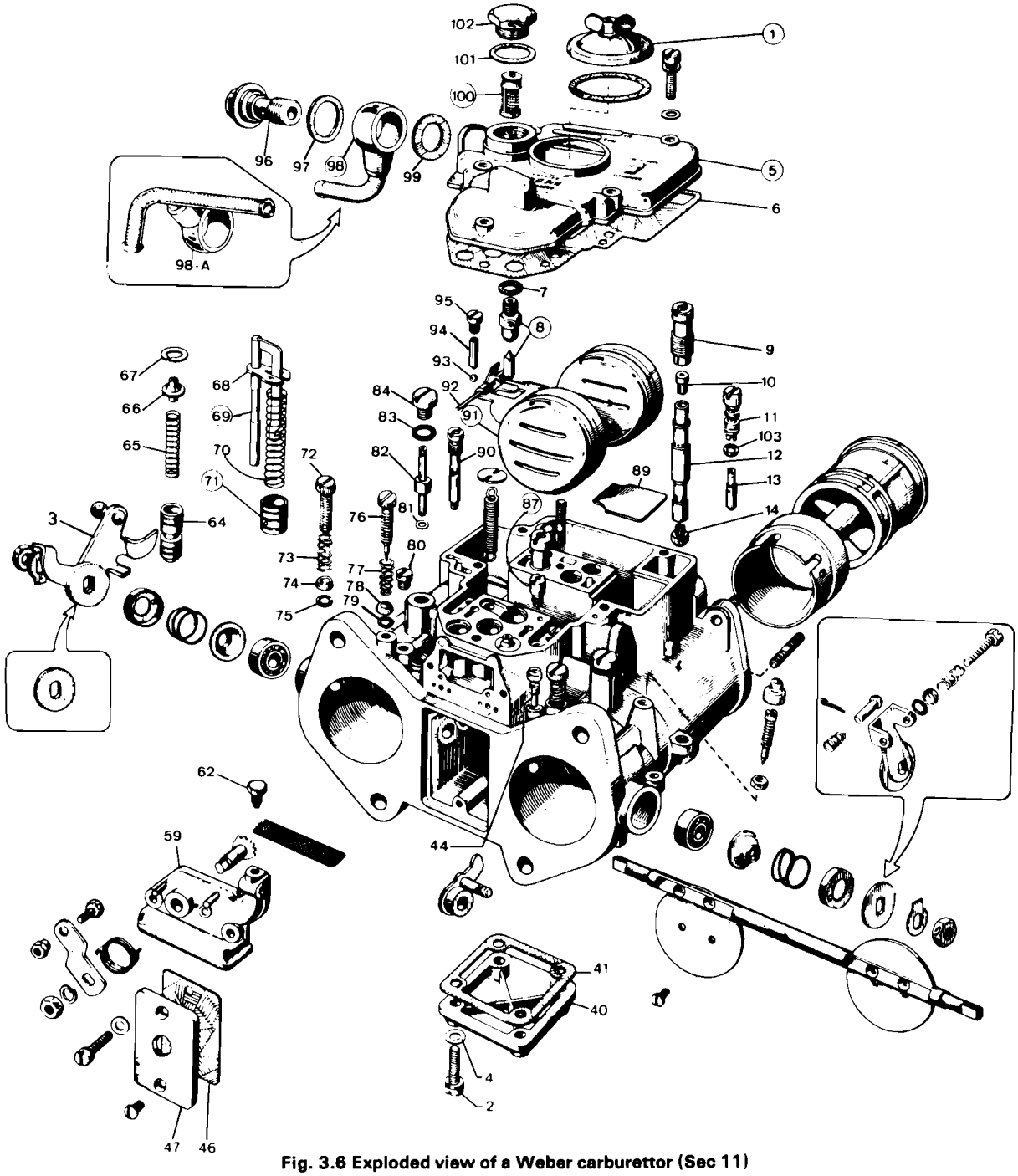


Fig. 3.6 Exploded view of a Weber carburettor (Sec 11)

1 *Jet injection cover*
2 *Fixing screw*
3 *Throttle lever*
4 *Lockwasher*
5 *Top cover*
6 *Gasket*
7 *Sealing washer*
8 *Fuel inlet needle valve*
9 *Jet carrier*
10 *Main air metering jet*
11 *Idle jet carrier*
12 *Emulsion tube*
13 *Idle jet*
14 *Main jet*
40 *Float chamber bottom cover*
41 *Gasket*
44 *Vacuum port plug*
46 *Gasket*
47 *Accelerator pump housing cover*
59 *Choke mechanism cover*
62 *Fixing screw*
64 *Choke valve*
65 *Spring*
66 *Spring seat*
67 *Circlip*
68 *Spring retainer*
69 *Accelerator pump control rod*
70 *Spring*
71 *Plunger*
72 *Idle speed screw*
73 *Spring*
74 *Spring seat*
75 *Seal*
76 *Idle mixture screw*
77 *Spring*
78 *Spring seat*
79 *Seal*
80 *Progression hole plug*
81 *Washer*
82 *Accelerator pump jet*
83 *Washer*
84 *Plug*
87 *Accelerator pump inlet valve*
89 *Float chamber plate*
90 *Choke jet*
91 *Float*
92 *Pivot pin*
93 *Ball*
94 *Weight*
95 *Plug*
96 *Hollow bolt*
98 *Banjo union (rear carburettor)*
98A *Banjo union (front carburettor)*
100 *Filter gauze*
101 *Sealing washer*
102 *Plug*
103 *Seal*

25 Reassembly is a reversal of dismantling, but obtain a repair kit which will contain all the necessary new gaskets and other renewable items.
26 As work progresses, check the float adjustment in the following way. Hold the float chamber cover vertically with a new gasket in position so that the float hangs directly downward.
27 Measure the distance between the nearest point on the float and the surface of the gasket. This should be as shown in Fig. 3.7. Where necessary, slightly bend the float tongue to adjust the dimensions.
28 Adjust the carburettors as described in Section 8 after they have been refitted to the engine.

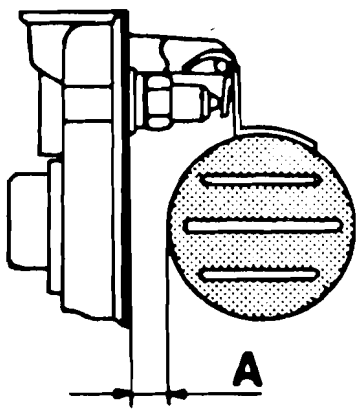


Fig. 3.7 Weber carburettor float adjusting diagram (Sec 11)

A 7.5 mm (0.30 in)

12 Solex carburettor – overhaul

1 With the carburettor removed from the engine, clean away external dirt using a brush and paraffin or petrol.
2 Remove the fuel inlet banjo union and hollow bolt from the carburettor.
3 If the front carburettor is being dismantled, remove the choke valve return spring.
4 Remove the jet inspection cover from the carburettor top cover. Peel off the gasket.
5 Extract the screws and take off the carburettor top cover with gasket.
6 If the front carburettor is being dismantled, remove the choke valve and the return spring bracket. If it is the rear unit which is being dismantled, remove the choke cable conduit bracket.
7 Withdraw the float pivot pin and take out the float.
8 Unscrew the fuel inlet needle valve from the carburettor cover together with its sealing washer.
9 Unscrew and remove the fuel inlet adaptor with its gasket.
10 If necessary, from the carburettor cover remove the circlip, choke valve cover, spring and choke valve.
11 Remove the vacuum port plugs with seals.
12 Now working on the carburettor body, unscrew and remove the main emulsion tubes and the idle jets.
13 Dismantle the accelerator pump outlet valve by removing the plugs, seals, weights and balls.
14 Remove the accelerator pump jets and seals.
15 If necessary, the idle mixture screws and their springs can be removed, but if the screws are fitted with tamperproof caps avoid disturbing them. If they must be removed, make sure that new caps are fitted on completion of overhaul and tuning (see Section 8).
16 The throttle coupling screw may be removed from the front carburettor and the idle speed screw from the rear one.
17 Remove the locknut and nut from the accelerator pump control rod.
18 Extract the accelerator pump screws and remove the pump with gasket. Disconnect the pump control rod as it is removed.
19 Dismantle the pump if necessary after extracting the cover screws and the pump valve and peeling off the flange gasket.
20 The main jet and the choke jet may be unscrewed from the base of the carburettor body.
21 Never attempt to extract the bypass screw from the outside of the carburettor body, and never remove the carburettor venturis.
22 Refer to paragraphs 23, 24 and 25 of Section 11, paying particular attention to the flexible diaphragm of the accelerator pump. Renew it if it has deteriorated, is split or has become hardened.
23 As reassembly progresses, check the float adjustment which controls the fuel level. Measure the projection of the fuel inlet needle valve above the cover flange surface. This should be as shown in Fig. 3.8. If adjustment is required, change the metal sealing washer for one of different thickness. When tightening the inlet valve, make sure that it is tight enough to prevent the fuel bypassing the valve, but not so tight that the threads could strip from the soft metal of the cover.
24 The float arms and tab are non-adjustable and should **not** be bent in an attempt to adjust the float level.
25 The accelerator pump stroke is adjustable, which in turn will alter the volume of fuel ejected. If adjustment is suspect, prime the pump and then give twenty complete strokes. Catch the ejected fuel in a measuring glass and compare the volume received with that given in the Specifications.
26 Adjust the pump rod nut and re-test. Lock the adjuster nut with the locknut on completion.
27 Adjust the carburettors as described in Section 8 after they have been refitted to the engine.

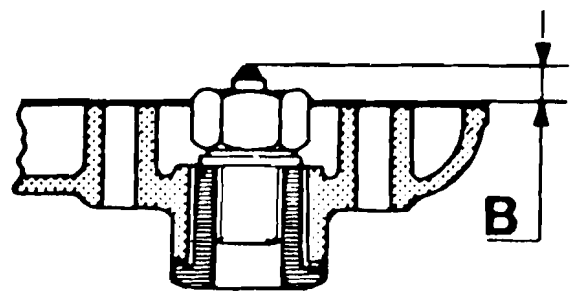


Fig. 3.8 Solex carburettor float adjusting diaphragm (Sec 12)

B 4.4 to 4.6 mm (0.17 to 0.18 in)

13 Dellorto carburettor – overhaul

1 With the carburettor removed from the engine, clean away external dirt using a brush and paraffin or petrol.
2 Unscrew the hollow bolts and remove the fuel banjo union and gauze filter from the top cover.
3 Extract the screws and remove the carburettor inspection cover and gasket from the carburettor topcover.
4 Extract the screws and remove the carburettor top cover with float.
5 If the rear carburettor is being overhauled, disconnect the choke cable bracket.
6 Extract the float pivot pin and remove the float from the top cover.
7 Remove the top cover gasket, the fuel inlet needle valve and its washer.
8 If the choke (cold start) device is to be dismantled, unscrew the nut from the spindle and take off the washer, bush, spring, lever and washer.
9 Unscrew the collar and remove the choke spindle and its washer.
10 Remove the hexagonal plug from the carburettor top cover and extract the spring and valve.
11 Turning your attention to the carburettor body, unscrew and remove the emulsion tubes, main jets and air jets as one assembly.
12 Remove the idle jets with the jet carriers and gaskets.
13 Remove the emulsion tube with choke jet.
14 If necessary, remove the idle mixture screws and springs. If the screws are fitted with tamperproof caps try to avoid removing them but if essential, break off the caps, and remove the screws. Make sure that new caps are fitted after the tuning operations are completed, see Section 8.
15 Remove the plugs from the vacuum ports.
16 Remove the accelerator pump jet plug, withdraw the jet and the seals.
17 Remove the accelerator pump ejector valve which comprises a ball, a plug and a weight.

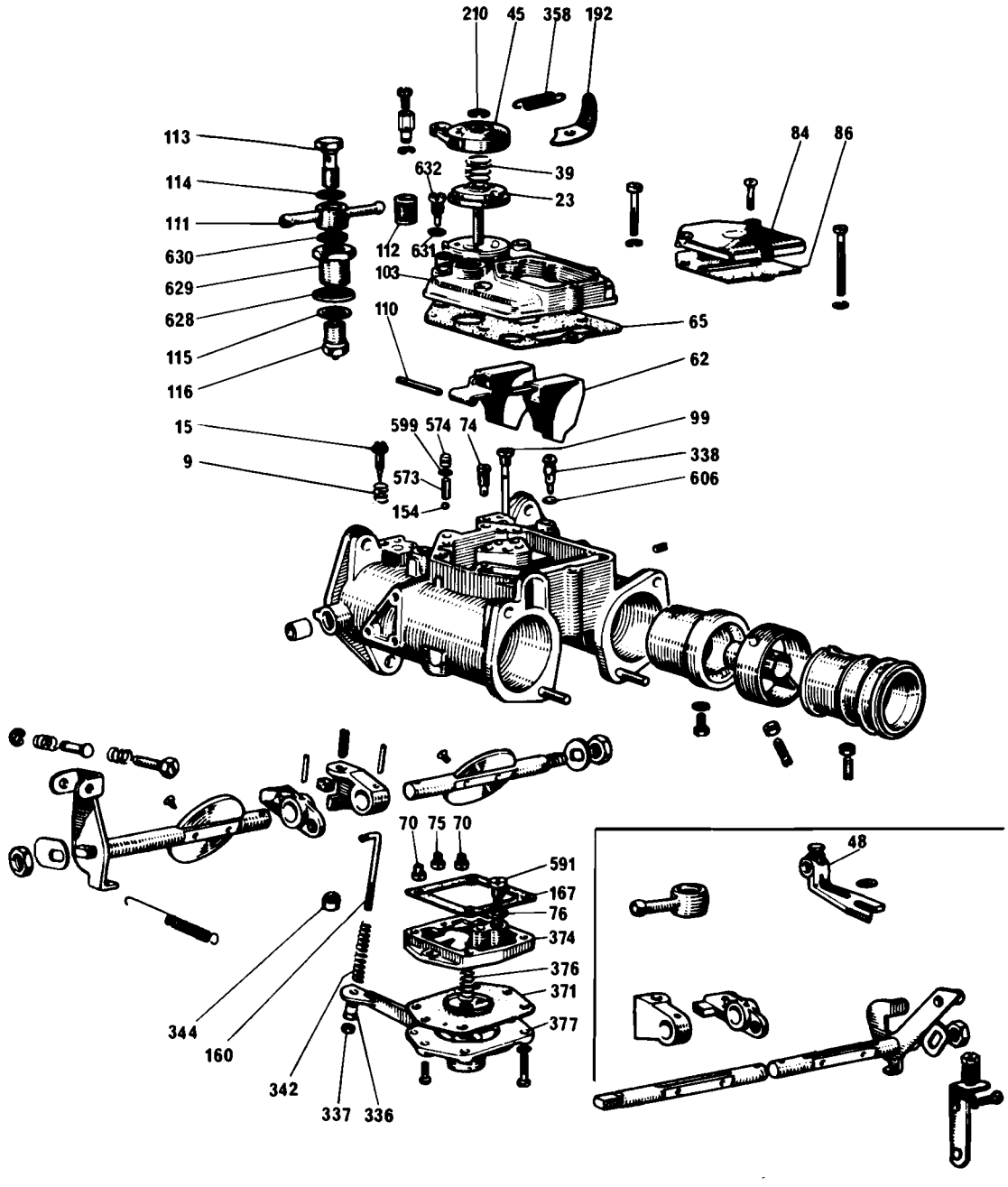


Fig. 3.9 Exploded view of Solex carburettor (Sec 12)

9 Spring
15 Idle mixture screw
23 Choke valve
39 Spring
45 Choke assembly cover
48 Choke outer cable bracket
62 Float
65 Gasket
70 Main jets
74 Idle jet
75 Choke jet
76 Gasket
84 Jet inspection cover
86 Gasket
99 Main emulsion tube
103 Carburettor top cover
110 Pivot pin
111 Banjo union
112 Filter gauze
113 Hollow bolt
114 Seal
115 Sealing washer
116 Fuel inlet needle valve
154 Ball
160 Accelerator pump control rod
167 Gasket
192 Choke valve return spring bracket
210 Circlip
336 Control rod adjuster nut
337 Control rod locknut
338 Accelerator pump jet
342 Spring
344 Bush
358 Choke valve return spring
371 Flexible diaphragm
374 Accelerator pump body
376 Spring
377 Pump cover
571 Accelerator pump valve
573 Weight
574 Plug
599 Seal
606 Seal
628 Gasket
629 Inlet adaptor
630 Seal
631 Seal
632 Vacuum port plug

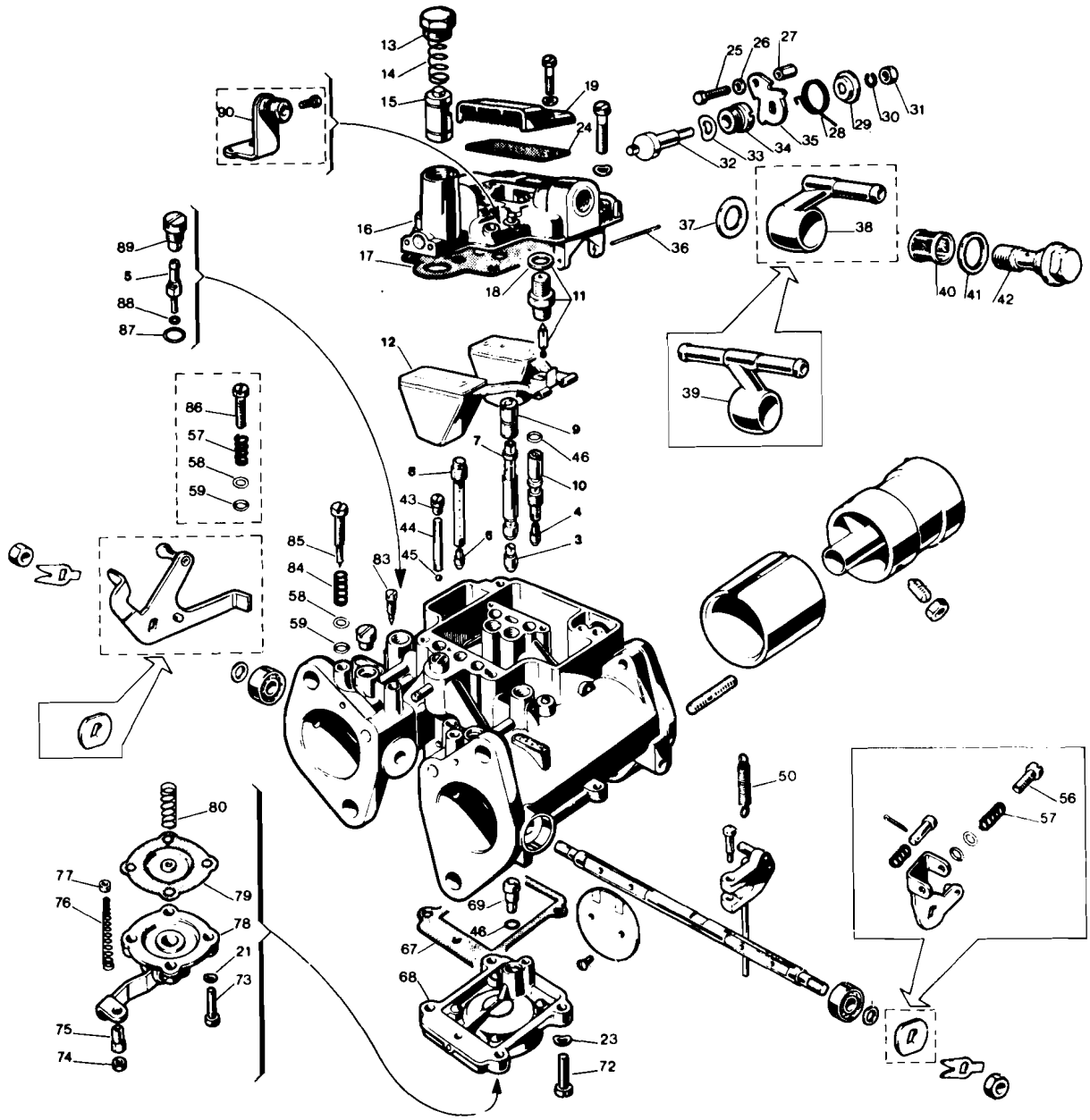
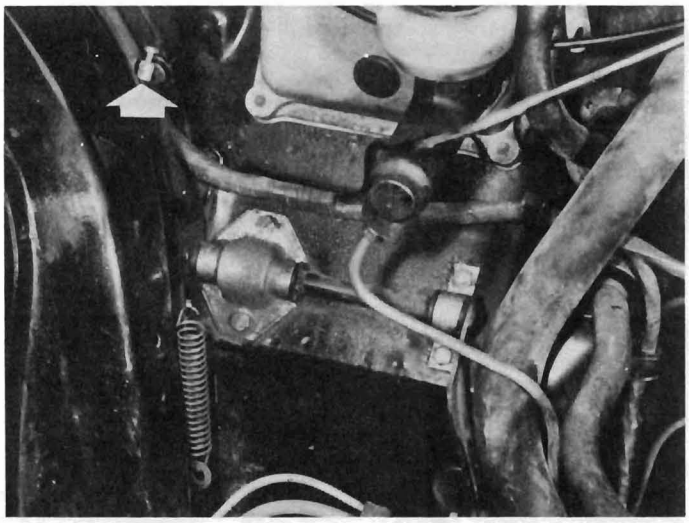


Fig. 3.10 Exploded view of Dellorto carburattor (Sec 13)

3 *Main jet*
4 *Idle jet*
5 *Accelerator pump jet*
6 *Choke jet*
7 *Emulsion tube*
8 *Emulsion tube*
9 *Air jet*
10 *Jet carrier*
11 *Fuel inlet needle valve*
12 *Float*
13 *Plug*
14 *Spring*
15 *Valve*
16 *Fixing screw*
17 *Gasket*
18 *Sealing washer*
19 *Inspection cover*
21 *Washer*
23 *Washer*
24 *Gasket*
25 *Screw*
26 *Washer*
27 *Nut*
28 *Spring*
29 *Bush*
30 *Washer*
31 *Nut*
32 *Choke spindle*
33 *Washer*
34 *Plug*
35 *Choke lever*
36 *Float pivot pin*
37 *Seal*
38 *Banjo unit (rear carburettor)*
39 *Banjo union (front carburettor)*
40 *Filter gauze*
41 *Seal*
42 *Hollow bolt*
43 *Plug*
44 *Weight*
45 *Ball*
46 *Gasket*
50 *Throttle spindle return spring*
56 *Throttle coupling screw*
57 *Spring*
58 *Washer*
59 *Seal*
67 *Gasket*
68 *Accelerator pump*
69 *Pump inlet valve*
72 *Accelerator pump fixing screw*
73 *Cover fixing screw*
74 *Locknut*
75 *Adjuster nut*
76 *Spring*
77 *Bush*
78 *Accelerator pump cover*
79 *Flexible diaphragm*
80 *Spring*
83 *Vacuum port plug*
84 *Spring*
85 *Idle mixture screw*
86 *Idle speed screw*
87 *Seal*
88 *Seal*
89 *Accelerator pump jet plug*
90 *Choke cable bracket*

18 Remove the throttle coupling screw and spring and (from the front carburettor) the throttle spindle ring and washers.
19 Remove the locknut and adjuster nut from the accelerator pump control rod.
20 Remove the mounting screws and take the accelerator pump from the carburettor body. Remove the pump gasket and take the spring and bush from the pump rod.
21 Remove the accelerator pump inlet valve.
22 Take off the pump cover and remove the flexible diaphragm with spring.
23 Unhook and remove the throttle spindle return spring.
24 Never remove the bypass screw from the exterior of the carburettor body, and do not attempt to remove the venturis.
25 Refer to paragraphs 23, 24 and 25 of Section 11 paying particular attention to the flexible diaphragm of the accelerator pump. Renew it if it has deteriorated, is split or has become hardened.
26 As reassembly progresses, check the float setting as shown in Fig. 3.7 except that dimension A should be between 14.5 and 15.0 mm (0.57 and 0.59 in). Where the dimension is not as stated, renew the float.
27 Check and adjust the accelerator pump stroke where necessary as described in Section 12, paragraphs 25 and 26.
28 Adjust the carburettors as described in Section 8 after they have been refitted to the engine.



14.4 Accelerator pedal rod and return spring, showing (arrowed) hand throttle control cable nipple

14 Throttle linkage – adjustment

Accelerator pedal

1 First check that the accelerator pedal stop on the floor projects between 15.0 and 22.0 mm (0.59 and 0.87 in). If necessary, release the locknut and turn the stop as required.
2 Depress the accelerator pedal fully and have an assistant measure the clearance at the carburettor between the throttle control lever and the stop on the carburettor. This should be as shown in Fig. 3.11.
3 Where necessary, release the locknut and turn the link rod in or out.

Hand control

4 Set the throttle hand control in the fully off position. Check that the clearance between the clamp at the end of the cable and the accelerator pedal lever is as shown in Fig. 3.12. Adjust the position of the clamp on the cable if necessary (photo).

15 Choke cable – removal, refitting and adjustment

1 Removal and refitting are relatively straightforward. The cable is secured to the carburettors by screw fittings. The control knob is accessible by reaching behind the dashboard. Adjustment is as follows.
2 Release the inner cable clamp screw at the carburettor.
3 Push the choke control knob fully in and then withdraw it just a fraction.
4 Tighten the cable clamp screw.
5 Now pull the choke knob to the full cold start position and check that the choke operating lever on the carburettor is fully closed against its stop, If not, release the outer cable from its bracket on the carburettor cover and adjust its effective length to correct the choke lever travel. Retighten the outer cable screw.
6 Push the control home again and check that the operating lever is fully off.

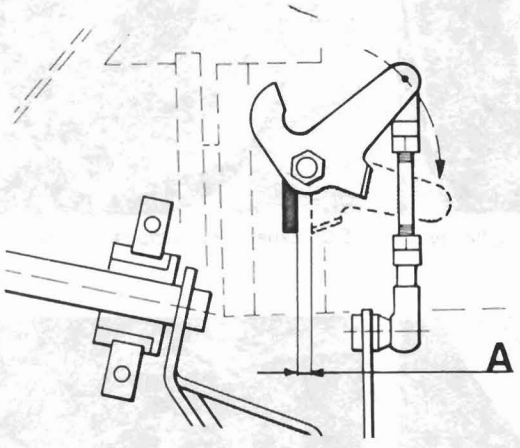


Fig. 3.11 Throttle control clearance at carburettor (Sec 14)

A 1.0 to 2.0 mm (0.04 to 0.08 in)

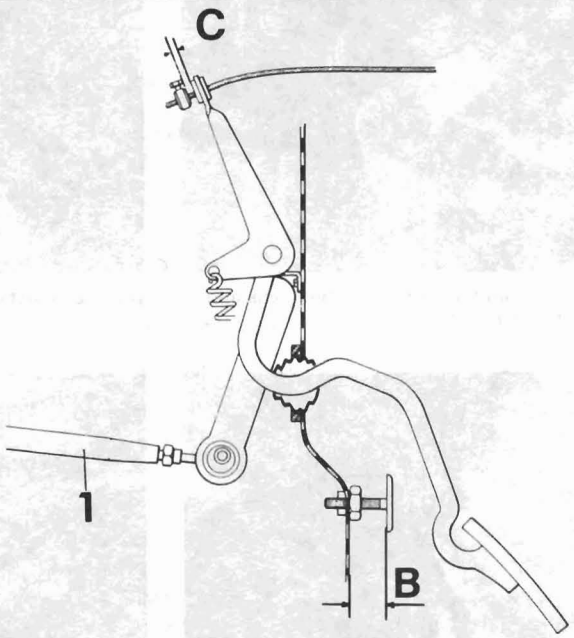
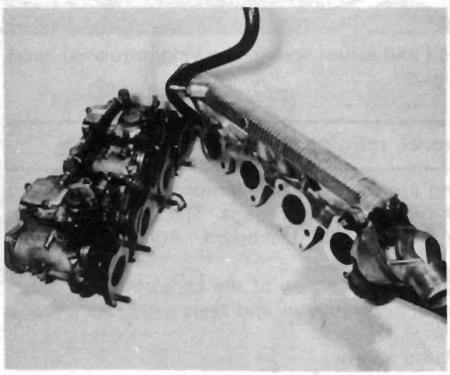


Fig. 3.12 Hand throttle cable stop clearance and accelerator pedal stop projection (Sec 14)

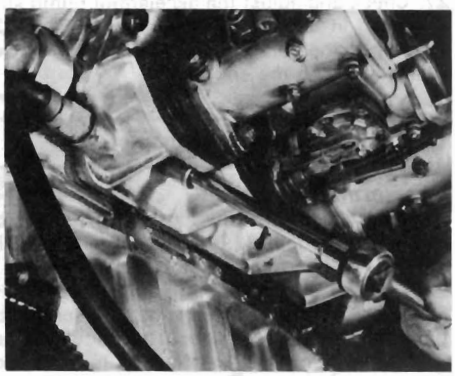
1 Adjustable rod
B 15.0 to 22.0 mm (0.59 to 0.87 in)
C 5.0 to 6.0 mm (0.20 to 0.24 in)

16 Manifolds and exhaust system – description, removal and refitting

1 The exhaust manifold is of multi-branch type, constructed of cast iron.
2 The manifold is secured to the cylinder head with nuts. When refitting the manifold, use new gaskets and tighten the nuts to the specified torque.
3 On the opposite side of the cylinder head is located the light alloy intake manifold. Again, always use new gaskets when installing the manifold and tighten the nuts to the specified torque. Remember the accelerator linkage bellcrank bolted under the manifold (photos).
4 A hot air collector box is fitted to draw air from the proximity of the engine cylinder block during winter running when the control lever on the air cleaner is approximately set.
5 The layout of the exhaust system is similar on all models although the individual components may vary in detail design.
6 The system is supported on flexible mountings and incorporates an expansion box, a sub-silencer, a main silencer and a front and rear pipe section.
7 Examination of the exhaust pipe and silencer at regular intervals is worthwhile as small defects may be repairable when, if left, they will almost certainly require renewal of one of the sections of the system. Also, any leaks, apart from the noise factor, may cause poisonous exhaust gases to get inside the car which can be unpleasant, to say the least, even in mild concentrations. Prolonged inhalation can cause sickness and giddiness, or death.
8 As the sleeve connections and clamps are usually very difficult to separate, it is quicker and easier in the long run to remove the complete system from the car when renewing a section. It can be expensive if another section is damaged when trying to separate a bad section from it.
9 To remove the system, jack up the car at the front and rear and then disconnect the front downpipe from the exhaust manifold (photos).
10 Disconnect all the flexible mountings and withdraw the complete system from below and to the rear of the vehicle (photos).

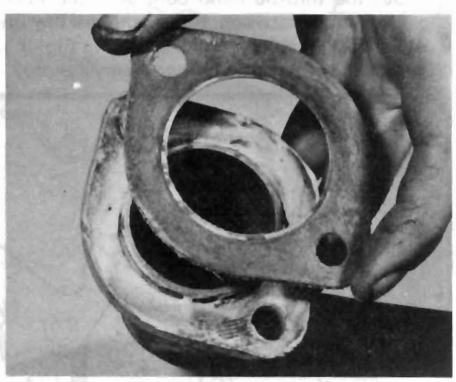

16.3a Inlet manifold and carburettors


16.3b Inlet manifold gasket


16.3c Tightening an inlet manifold lower bolt

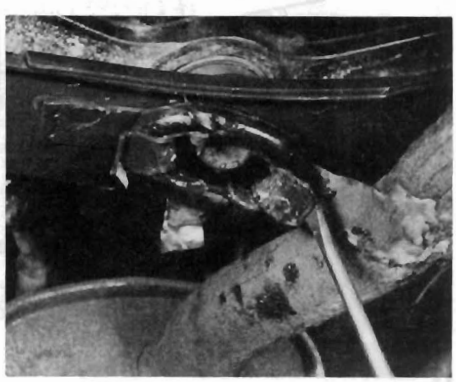

16.3d Accelerator control rod, bellcrank and bracket under inlet manifold


16.9a Exhaust downpipe connecting flange

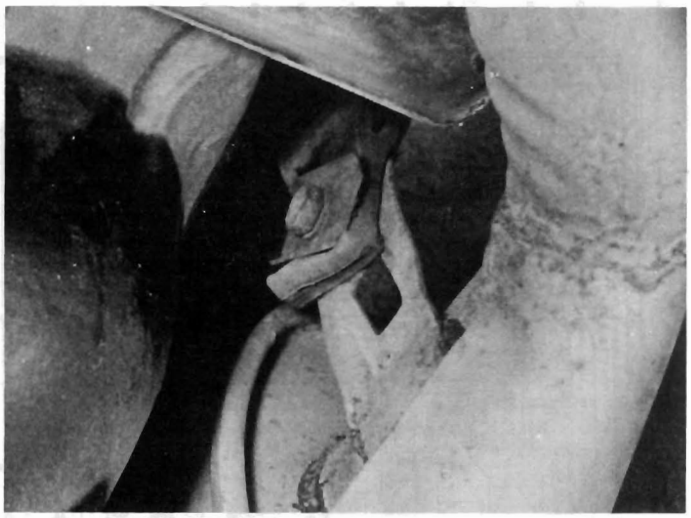

16.9b Exhaust downpipe flange gasket


16.9c Exhaust flexible mounting


16.10a Exhaust pipe suspension rings


16.10b Prising off an exhaust suspension ring

16.10c Exhaust tailpipe bracket



16.10d Exhaust silencer support

11 Cut away the bad sections, taking care not to damage the good sections which are to be retained.
12 File off any burrs at the ends of the new sections of pipe and smear them with grease. Slip the clamps over the pipes and connect the sockets, but do not tighten the clamps at this stage.
13 Push the complete system under the vehicle and jack it up so that the front pipe can be bolted to the manifold and the rear tail pipe mounting connected.
14 Now turn the silencer sections to obtain their correct attitudes so that they will not touch or knock against any adjacent parts when the system is deflected to one side or the other.
15 Tighten all clamps and flexible mountings.

17 Emission control system (engines with carburettors) – general

1 The emission control system used on carburettor engines is very basic and consists of a crankcase ventilation system (refer to Chapter 1, Section 15) and a warm air intake to the air cleaner.
2 It must be realised however that precise carburettor and ignition system adjustment is essential to keep emissions low.
3 In addition, excessive wear in the pistons, rings and cylinder liners which would give rise to smoke emission should be rectified immediately.

18 Fault diagnosis – fuel system (carburettor models)

Note: *Excessive fuel consumption and poor performance are not necessarily due to carburettor or fuel system faults. Before diagnosing a fault from the table below, make sure that the ignition system is in good order and properly adjusted, and that the mechanical condition of the engine is good.*

Symptom	Reason(s)
Excessive fuel consumption	Air filter choked Leakage from pump, carburettor or fuel lines or fuel tank Float chamber flooding Mixture too rich Incorrect valve clearances Tyres under-inflated Dragging brakes
Fuel starvation or mixture weakness	Clogged fuel line filter Float chamber needle valve clogged Faulty fuel pump valves Fuel pump diaphragm split Fuel pipe unions loose Fuel pump cover leaking Inlet manifold gasket or carburettor flange gasket leaking Incorrect adjustment of carburettor

PART B: MODELS WITH FUEL INJECTION

19 Description

A fuel injection system is fitted to all North American models as a means of reducing exhaust emissions, because this system features more precise metering and distribution than is possible with a carburettor installation.

Fuel is injected into the intake port of each cylinder in precisely metered volume, regulated according to the throttle position and engine speed.

The metering device is a control unit incorporating a cam and follower arrangement which controls the delivery of fuel from the injection pump.

During deceleration, fuel delivery is automatically cut off as a means of reducing fuel consumption and eliminating unburned gases.

Other contributions emanating from the control unit are correction facilities for variations in atmospheric pressure, engine and ambient temperatures, cold starting and initial warm-up.

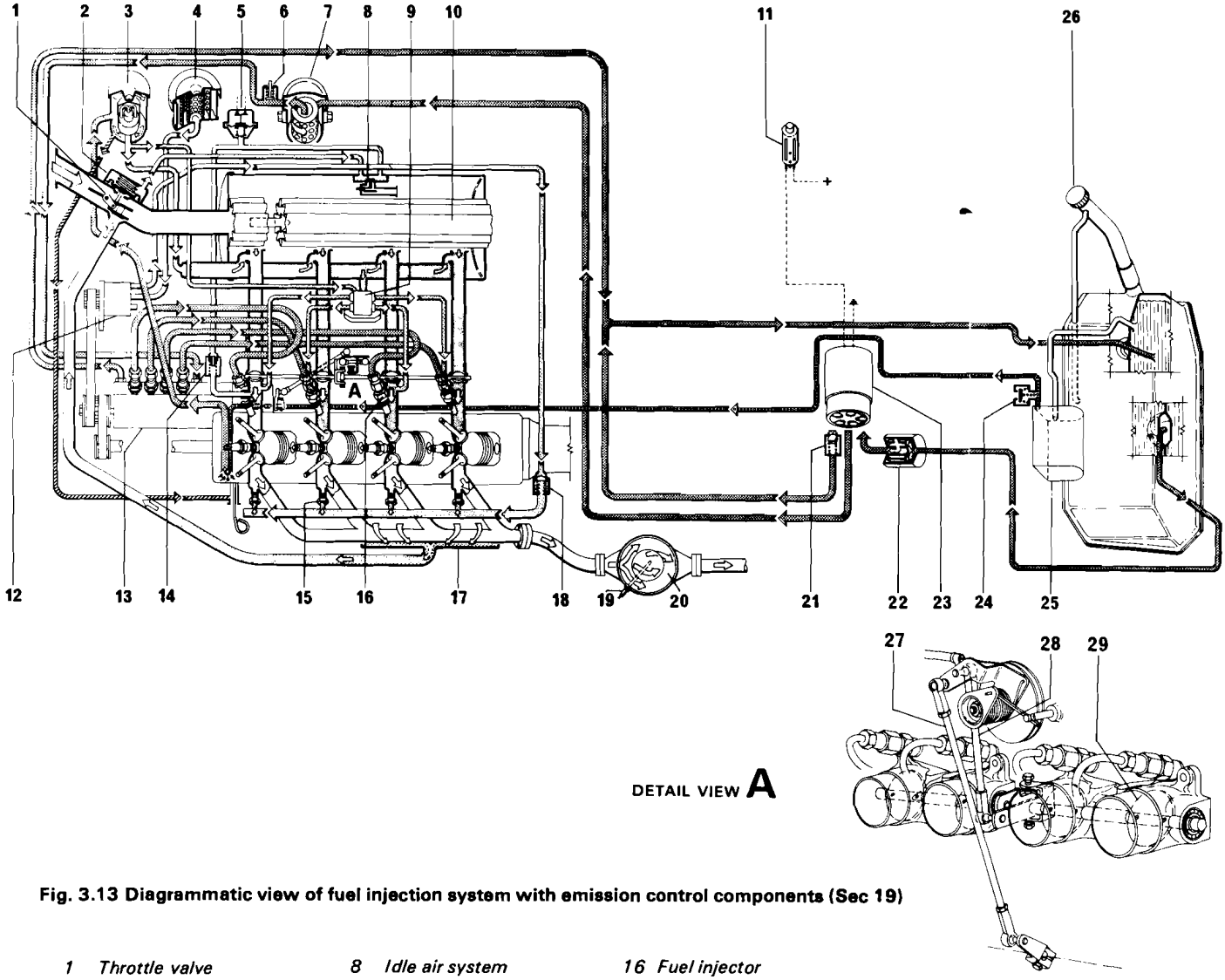


Fig. 3.13 Diagrammatic view of fuel injection system with emission control components (Sec 19)

1 *Throttle valve*
2 *Vacuum actuator*
3 *Oil separator (crankcase ventilation)*
4 *Air pump filter*
5 *Vacuum switch*
6 *Pressure switch*
7 *Main fuel filter*
8 *Idle air system*
9 *Non-return valve*
10 *Air filter*
11 *Inertia switch*
12 *Air pump*
13 *Injection pump*
14 *Check valve*
15 *Air injection nozzle*
16 *Fuel injector*
17 *Hot air pick-up shroud*
18 *Check valve*
19 *Temperature sensor*
20 *Catalytic converter*
21 *Pressure relief valve*
22 *Fuel tank filter*
23 *Electric fuel pump*
24 *Vacuum relief valve*
25 *Liquid/vapour separator*
26 *Filler cap (sealed)*
27 *Relay rod, crank-to-control unit*
28 *Relay rod, crank-to-throttle*
29 *Throttle throat*

An important part of the fuel injection arrangement is the air intake temperature control system, which is designed to maintain the temperature of intake air at a predetermined level. The system includes a sensor element which is in fact a bimetallic bleed unit to modulate the engine vacuum and so control the position of the valve located in the intake air mixer tube. The setting of this valve regulates the proportion of hot air entering the intake manifold in order to maintain the specified air temperature under all conditions.

The air induction system associated with fuel injection permits filtered air to enter the engine through four intake ports each of which incorporates a throttle butterfly valve.

Air required for idling is fed through a separate circuit, running between the air cleaner and the intake ports downstream of the throttle valves, which incorporates an idle air equaliser.

The accelerator pedal is connected jointly to the throttle valves and to the control unit.

The fuel supply system is based upon an electric pump which feeds the injection pump through filters. For safety reasons an inertia type fuel cut-off valve is incorporated in the system in case the car should turn over. Regularly check to see that the fuel low pressure warning lamp goes out after starting the engine. Failure to do so may be due to a faulty feed cut-off inertia switch. Check by depressing the reset button on the switch, which is located on the engine compartment rear bulkhead. If the lamp still remains on, renew the cut-off switch.

Precise fuel pressure regulation is maintained by a metering orifice and pressure switch together with a pressure relief valve, excess fuel being returned to the fuel tank.

All fuel injection models are equipped with a comprehensive emission control system (see Section **32**), and vehicles destined for operation in California are fitted with a catalytic converter which is located in the exhaust system.

When operating fuel injection models in very cold conditions, if performance or engine response are not up to normal standards or if the low fuel pressure lamp comes on, this may be due to vacuum conditions in the fuel tank caused by a seized relief valve or an obstruction in the vent pipe. Should this happen, remove the valve from the tee adaptor and clear any obstruction in it using air pressure from a tyre pump. Also clear the pipe using the same method. If these operations do not rectify the problem, renew the valve.

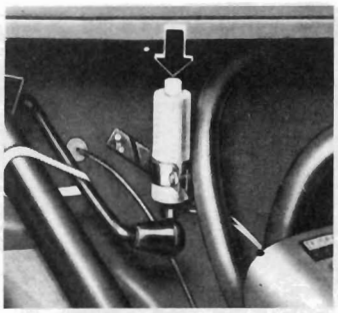


Fig. 3.14 Fuel cut-off inertia switch (Sec 19)

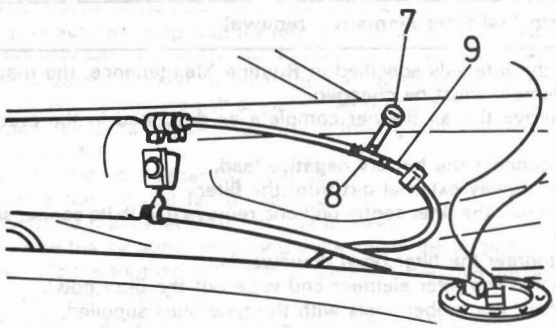


Fig. 3.15 Vacuum relief valve (7) and connecting pipe (9) (Sec 19)

8 Tee union

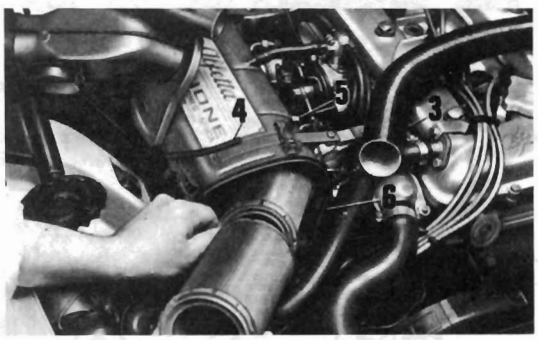


Fig. 3.16 Removing air cleaner elements (Sec 21)

3 Hot air duct
4 Sensor hose
5 Air cleaner toggle clips
6 Cover seal

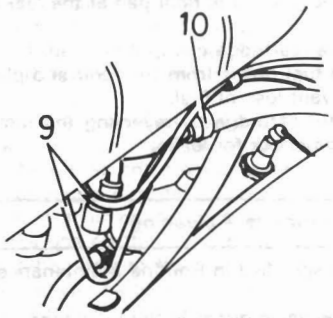


Fig. 3.17 Air cleaner hose connections (Sec 22)

9 Control valve sensor hoses
10 Vent hose from oil separator

20 Fuel injection system – maintenance (general)

Any maintenance or overhaul operations should be limited to those described in the following Sections. On no account attempt to adjust or dismantle the control unit. Such adjustment may be in violation of local or national emission control laws.

21 Air cleaner element – cleaning and renewal

1 Disconnect the hot air duct and the hose from the sensor.
2 Release the two upper and one lower toggle clips to release the cover from the air cleaner casing.
3 Withdraw the cover and the two elements.
4 At intermediate service intervals, clean the elements by blowing compressed air from the inside out.
5 At full service intervals, discard the old elements and fit new ones.
6 Refit the cover and clips, making sure that the sealing ring is in good condition.

22 Air cleaner – removal and refitting

1 Disconnect the control valve sensor hoses.
2 Disconnect the crankcase vent hose from the oil separator.
3 Disconnect the air mixer duct.
4 Disconnect the idle air system hose.
5 Unbolt the air cleaner housing mounting struts.
6 Release the clamps on the intake hoses.
7 Lift the complete air cleaner from the engine.
8 Refitting is a reversal of removal.

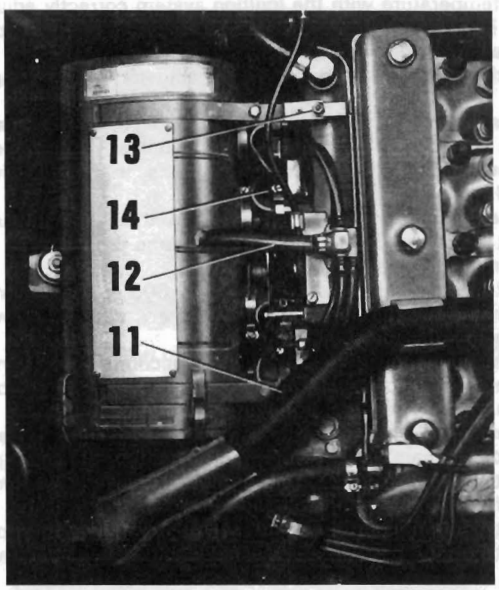


Fig. 3.18 Air cleaner attachments (Sec 22)

11 Air mixer duct
12 Air idle system hose
13 Mounting straps
14 Intake hose clamps

23 Main fuel filter element – renewal

1 At the intervals specified in Routine Maintenance, the main fuel filter element must be changed.
2 Remove the air cleaner complete as described in the preceding Section.
3 Disconnect the battery negative lead.
4 Clean away external dirt from the filter.
5 Unscrew the filter centre bolt and remove it with its copper sealing washer.
6 Withdraw the filter bowl downwards.
7 Discard the filter element and wipe out the filter bowl.
8 Renew the rubber seals with the new ones supplied.
9 Refit by reversing the dismantling operation. Do not use excessive force when tightening the centre bolt.
10 Start the engine and check for fuel leaks.

24 Fuel tank filter – renewal

1 At the intervals specified in Routine Maintenance, the fuel tank filter which is located below the floor pan at the rear of the car should be renewed.
2 Release the filter cartridge clamp bolt.
3 Disconnect the fuel hoses from the filter and plug the inlet hose immediately to prevent loss of fuel.
4 Fit the new filter cartridge by reversing the removal operations. Start the engine and check for leaks.

25 Throttle intake throats – cleaning

1 At the intervals specified in Routine Maintenance, remove the air cleaner complete.
2 Hold the throttle valve plates in the fully open position and clean away any deposits from the plate edges and throat walls. A brush and clean fuel should do the job, but more abrasion can be applied using a nylon scourer. Nothing which could cause scoring or scratching should be used.

26 Fuel injection system – idle adjustment

1 Before carrying out any adjustment, have the engine at normal operating temperature with the ignition system correctly adjusted.
2 If the idle speed is outside the specified range, remove the hose which runs between the idle equaliser and the air cleaner.
3 Start the engine and loosen the idle adjuster screw clamp pinch-bolt.
4 Gradually unscrew the adjuster using a coin in the screw slot until the engine idle speed is at its highest level, but without any tendency to roughness. Count the number of turns that the adjuster is unscrewed.
5 Now screw the adjuster in by one-third of the number of turns that it was just unscrewed, and retighten the clamp pinch-bolt.
6 Reconnect the hose.
7 The idle speed should now be between 600 and 800 rpm. If it is not, slightly readjust the position of the screw, turning it inwards to reduce speed, outwards to increase speed.
8 If the idle speed is too high or too low, accompanied by uneven or rough running, suspect a split or kinked equaliser hose or a poor hose connection.
9 The car should now be taken on the road and plenty of revs used in intermediate gears to burn off any carbon from the spark plugs.
10 Drive the car at a constant speed (in third gear) of 25 mph (40 kph) and then accelerate very slowly to 45 mph (72 kph). If there is any hesitation or jerkiness, the mixture is too weak and the following adjustment to the fuel mixture must be carried out after removing the air cleaner and the idle air oil breather hoses.
11 Look down on the fuel cut-off solenoid and note the eight notches round the edge of the solenoid upper surface. Mark the position of one notch with respect to the control unit housing, quick-drying paint is suitable for this.
12 Disconnect the solenoid feed wire.

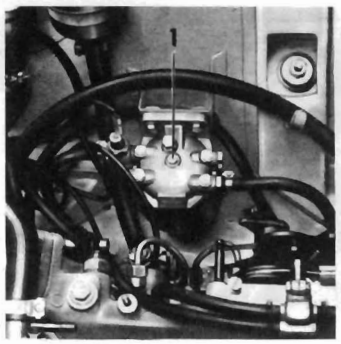


Fig. 3.19 Main filter centre bolt (1) (Sec 23)

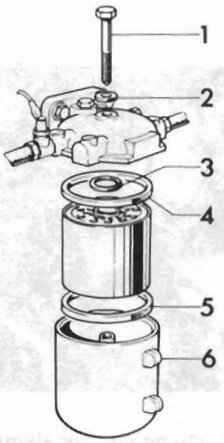


Fig. 3.20 Exploded view of main fuel filter (Sec 23)

1 Centre bolt
2 Copper sealing washer
3 O-ring seal
4 Sealing gasket (upper)
5 Sealing gasket (lower)
6 Filter bowl

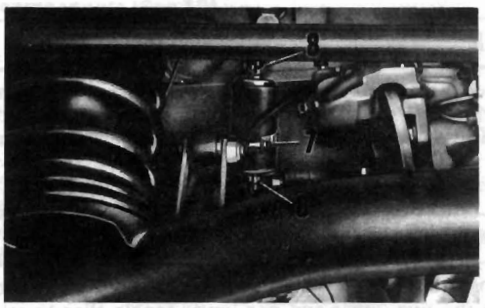


Fig. 3.21 Fuel tank filter location (Sec 24)

7 Clamp pinch-bolt
8 Hose clamps

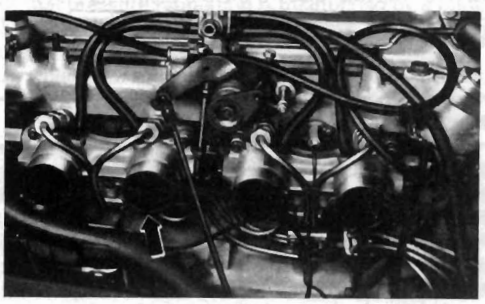


Fig. 3.22 Throttle throats (one arrowed) (Sec 25)

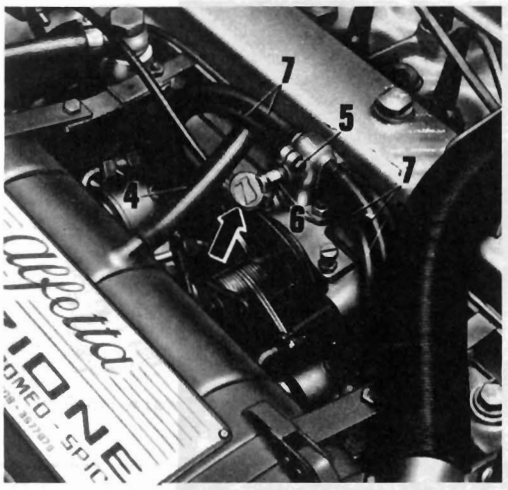


Fig. 3.23 Idle speed adjuster screw (Sec 26)

4 Idle equaliser hose to air cleaner
5 Pinch-bolt
6 Adjuster screw
7 Idle equaliser hoses to throttle throats
Coin used for turning screw arrowed

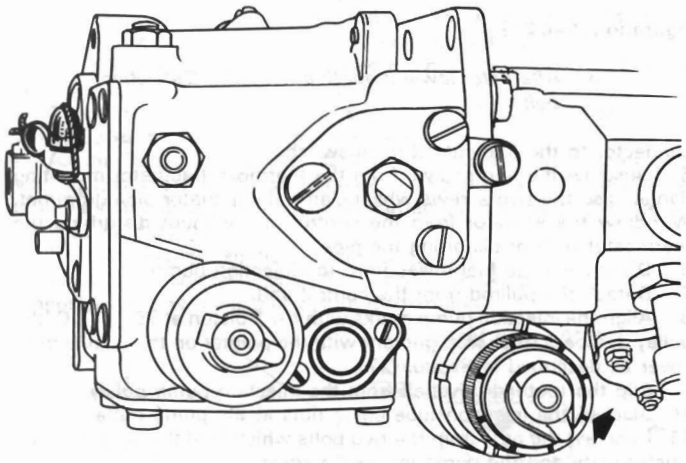


Fig. 3.24 Fuel cut-off solenoid. Notch arrowed. (Sec 26)

13 Using a C-spanner, release the locking ring at the base of the solenoid without altering the alignment of the paint spots.
14 Unscrew the solenoid one notch ($\frac{1}{8}$ turn) to enrich the mixture. Tighten the locking ring and reconnect the feed wire.
15 Refit the air cleaner, reconnect the idle air and breather hoses.
16 Road test the car. If there is still a tendency to weakness, repeat the mixture adjustment operations.
17 When the fuel mixture is suspected of being rich, as confirmed by black exhaust and fouled spark plugs, then the mixture must be weakened by turning the solenoid in by one notch or more as necessary.
18 After any adjustment it is recommended that the exhaust gas CO level is checked, using an exhaust gas analyser connected in accordance with the manufacturer's instructions to the take-off point on the exhaust manifold.
19 At an idle speed of between 600 and 800 rpm with the engine warm, the CO percentage must be within the specified limit.
20 Where the level exceeds that specified, carry out slight adjustment using the idle screw, having first disconnected the equaliser block-to-air cleaner hose. Screwing in reduces the idle speed and increases the CO level. Screwing out increases the idle speed and reduces the CO level.
21 Failure to be able to control the emission level is usually due to incorrectly adjusted ignition timing or faulty ignition system components.

27 Fuel injection pump and air pump drivebelts – renewal

1 One drivebelt is used to drive the fuel injection pump from the crankshaft, while a second belt drives the air pump from the fuel pump.
2 Inspect the belts regularly for cuts or fraying and if evident, renew them immediately.
3 Remove the air cleaner (Section 22).
4 Remove the radiator fan (Chapter 2).
5 Unbolt the main fuel filter from its bracket.
6 Unscrew the air pump mounting bolts, move the air pump slightly aside and slip the toothed bolt from its sprocket. Remove the belt from the injection pump sprocket.
7 Slacken the alternator mounting and adjuster link bolts, push the alternator in towards the engine and slip the drivebelt from the pulley grooves.
8 Remove the inspection pump toothed belt from its sprockets and withdraw it.
9 Engage the new toothed belt with the crankshaft sprocket, but do not engage it with the teeth of the injection pump sprocket.
10 Turn the crankshaft by using a socket spanner on the damper/pulley nut, or by selecting fourth gear and pushing the car, until No 1 piston is at TDC on the firing stroke. To check this, either remove No 1 spark plug and place the finger over the hole to feel the compression being generated, or if the camshaft cover is removed observe that the lobes of the two camshaft cams nearest the front of the engine are pointing outward.
11 The P mark on the crankshaft pulley/damper will now be in alignment with the pointer on the engine front cover.
12 Turn the crankshaft in an anti-clockwise direction until the I mark on the pulley/damper aligns with the pointer.
13 Now turn the fuel injection pump pulley until the mark on the pulley aligns with the one on the pump body.
14 Connect the toothed belt to the fuel injection pump sprocket. If necessary, the sprocket can be turned up to 5.0 mm (0.20 in) – half a spline – to engage the belt without having any adverse effect upon the pump timing.
15 Fit the belt to the front sprocket of the fuel pump and connect it to the air pump sprocket. No timing is necessary for this belt. Bolt the air pump into position.
16 Fit the alternator drivebelt and adjust by pulling the alternator away from the engine until there is a total deflection at the top run of the belt of 12.5 mm (0.5 in) under firm thumb pressure. Tighten the alternator mounting and adjuster link bolts.
17 No adjustment is provided for the toothed belts as they do not stretch until very high mileages have been covered.

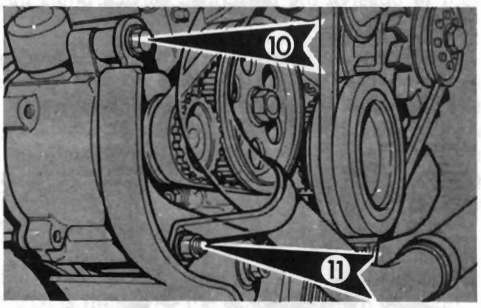


Fig. 3.25 Air pump mounting bolts (10 and 11) (Sec 27)

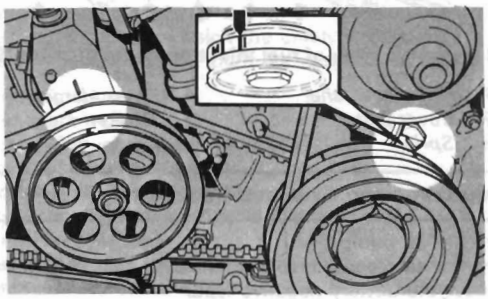


Fig. 3.26 Fuel injection pump correctly timed (Sec 27)

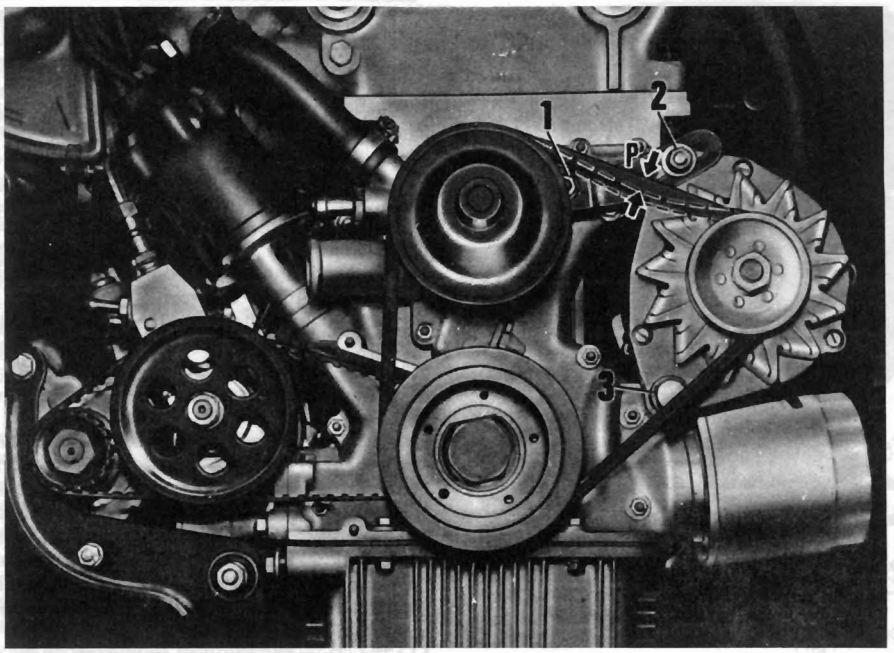


Fig. 3.27 Drivebelt configuration (Sec 27)

1 Adjuster link nut at cooling pump
2 Adjuster link nut at alternator
3 Alternator lower mounting bolt
P Deflection

28 Fuel injection pump oil filter – renewal

1 At the intervals specified in Routine Maintenance, the oil filter located in the fuel injection pump oil feed must be changed.
2 Remove the air pump.
3 Clean away external dirt from the pump oil filter housing cover.
4 Unscrew the three cover nuts, remove the cover and extract the spring and filter element.
5 Wipe out the filter housing and insert a new filter element – followed by the spring.
6 Bolt on the cover, using a new gasket if necessary.
7 As the oil supply comes from the engine lubrication system, it is very important to observe the prescribed service times for renewing the engine oil and filter.

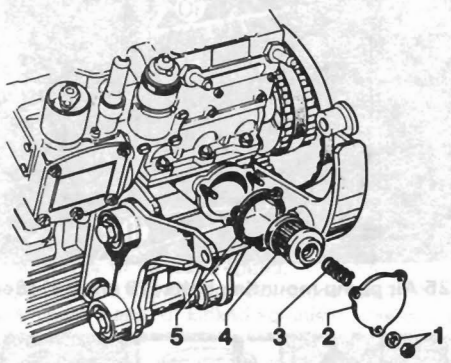


Fig. 3.28 Exploded view of fuel injection pump oil filter (Sec 28)

1 Nut and washer
2 Cover plate
3 Spring
4 Filter element
5 Gasket

29 Fuel injection pump – removal and refitting

1 Remove the air pump.
2 Remove the air cleaner (see Section 22).
3 Disconnect the battery negative lead.
4 Disconnect the lead from the cold start solenoid, also the connector to the fuel cut-off microswitch.
5 Unscrew the two screws from the thermostat actuator mounting flange, also the two screws which clamp the actuator pipe grommet. Withdraw the actuator from the control unit without disturbing the thermostat bulb or distorting the pipe.
6 Disconnect the fuel hoses from the injection pump.
7 Detach the pullrod from the control unit.
8 Align the injection pump marks with No 1 piston at 70° BTDC (the pulley damper I mark in alignment with the pointer on the engine front cover as described in Section 27).
9 Slip the toothed drivebelt from the injection pump pulley.
10 Slacken the injection tube union nuts at the pump outlets.
11 Unscrew the nuts from the two bolts which hold the injection tube cluster plate and the pump inclined bracket.
12 Release the two screws which hold the control unit to its engine mounting bracket.
13 Working underneath the car, unbolt the injection pump support from the engine front cover.
14 Tilt the injection pump and its support, and remove it from the engine compartment.
15 Do not dismantle the pump, but if worn or faulty, install a new or factory-reconditioned unit.
16 Avoid turning the crankshaft while the pump is out of the car, but if it is turned, reset the marks as previously described.
17 Refitting the pump is a reversal of removal. If a new pump is being installed it will be supplied with new injectors which are numbered as to fitting sequence.
18 Check that the pump base gasket and O-ring are in position.
19 Check the idle speed and road test the car as described in Section 26.

30 Fuel injectors – removal and refitting

1 To release the injector pipe unions, use a ring spanner with a slot in it to enable it to pass over the pipe. A similar spanner is used to disconnect brake hydraulic pipe unions. A special tool is available (A50164).
2 Unscrew the injectors using a socket spanner of adequate internal depth (special tool A50165).
3 Make sure that the injectors and the pipe unions are tightened to the specified torque.

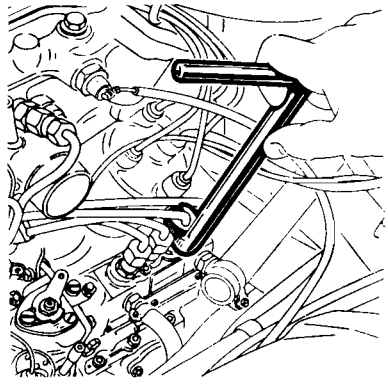


Fig. 3.29 Tool for releasing injection pipe unions (Sec 30)

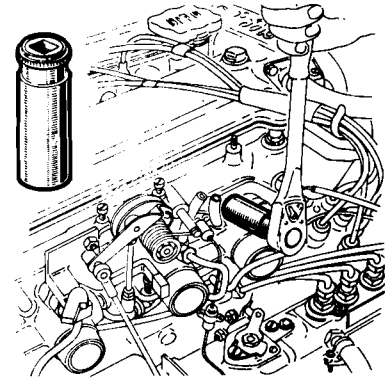


Fig. 3.30 Removing a fuel injector (Sec 30)

31 Cold start solenoid and plunger – removal and refitting

1 Remove the fuel injection pump as described in Section 29.
2 Remove the rear and side inspection plates from the control unit.
3 Extract the split pin and the cotter pin which hold the solenoid to the plunger shaft.
4 Measure and record the distance H from the bottom of the solenoid to the control unit (Fig. 3.31).
5 Release the solenoid locknut and unscrew the solenoid. Now check that the plunger shaft moves freely up and down.
6 Should it be necessary to remove the plunger shaft, unscrew the base plug and withdraw the shaft.
7 Check the diameter of the plastic plunger. This should be 13.55 mm (0.5335 in). If it has swollen, renew it.
8 As the height of the cold start colenoid above the control unit housing governs the operating range of the device, it is absolutely essential that adjustment is precisely carried out, otherwise the control unit may be damaged.
9 Refit the plunger shaft, and base plug.
10 Install the solenoid and the locknut, making sure that the dimension H is as measured before dismantling.

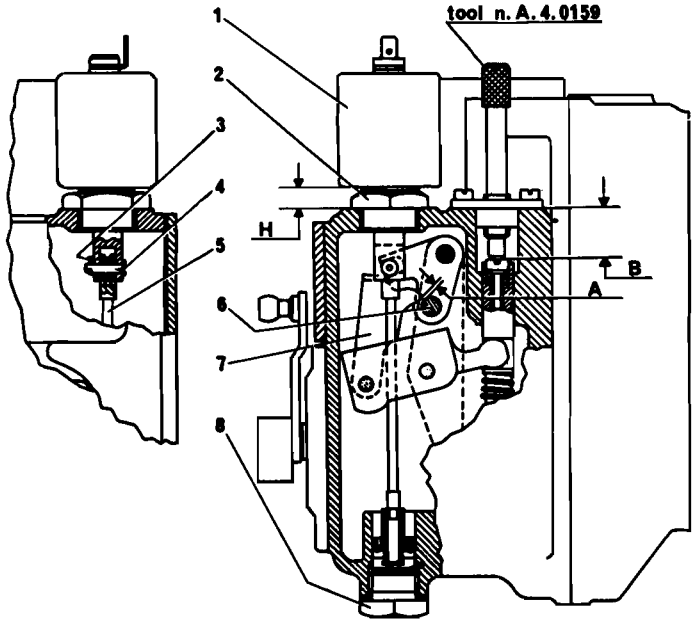


Fig. 3.31 Cold start device and plunger (Sec 31)

1 Solenoid
2 Locknut
3 Split pin
4 Clevis pin
5 Plunger shaft
6 Pivot pin
7 Arm
8 Plug
A 1.15 to 1.25 mm (0.045 to 0.049 in)
B 19.0 mm (0.7490 in)
H Solenoid to control unit clearance

11 Reconnect the plunger shaft to the solenoid and fit the clevis pin and split pin.
12 Solenoid height B is 19.0 mm (0.7490 in) and this can only be adjusted if a dummy thermostat (special tool A 40159) is available.
13 Measure the clearance (A) between the pin on the solenoid lever and the arm. This should be as shown in Fig. 3.31. Where necessary, screw the solenoid out to decrease the clearance, or in to increase it.
14 Tighten the locknut and fit the inspection plates to the control unit.
15 Install the fuel injection pump as described in Section 29.

32 Fuel injection emission control system – description

1 On vehicles destined for operation in North America, the following emission control devices are installed in conjunction with the fuel injection system.

Crankcase ventilation system

2 Refer to Chapter 1, Section 15.

Air injection system

3 This is an arrangement for injecting clean air into the exhaust manifold. This promotes exhaust gas combustion to further reduce the unburned content of the combustion gases and to reduce emission from the exhaust.
4 The air is supplied from a belt-driven pump and passes through a non-return valve to a distribution manifold, which in turn provides air through injectors at the exhaust ports.

Fuel evaporative control system

5 Fuel vapour which is emitted from the fuel tank is collected in a separator. The condensate is returned to the tank, while residual vapour is drawn into the engine crankcase and is eventually drawn into the intake manifold by the action of the crankcase ventilation system. It is then burned during the normal engine combustive processes.
6 An essential part of the system is a sealed fuel tank filler cap, the seal of which must always be maintained in good order.

Catalytic converter

7 This device is fitted into the exhaust system of Californian cars. It is basically a container of catalyst pellets over which the exhaust gases flow to convert HC and CO into water (H_2O) and CO_2.
8 Although a warning lamp system is installed, excessively high operating temperatures to which the catalytic converter is prone can be avoided if the reasons for them are appreciated. These include:

Incorrect ignition timing
Fouled spark plug(s)
Defective fuel injector pump
Clogged air cleaner elements
Defective thermostatic actuator
Faulty air intake temperature regulator
Low fuel level in tank
Excessive low gear operation
Excessive travel on down gradients, or overloading on uphill travel.

9 *Never* coast downhill with the ignition off.
10 Avoid parking over long grass, as the normally high temperature of the catalytic converter could start a fire.
11 On no account use leaded gasoline in vehicles equipped with a catalytic converter. Lead will rapidly poison the catalyst and render it useless.

33 Air pump filter element – cleaning or renewal

1 The air pump air cleaner is located on the side of the engine compartment.
2 Unscrew the wing nut and remove the cover.
3 Take out the filter element and wipe out the casing.

Fig. 3.23 Air pump air cleaner (Sec 33)

1 Cover wing nut *2 Body and bracket*

4 At intermediate service intervals, apply compressed air to the inside of the element to remove any adhering dust.
5 At full service intervals, renew the element.
6 Refit the cover and the wing nut.

34 Emission control system – maintenance (general)

1 Regularly check the system hose connections and electrical wiring for security.
2 Any malfunction in the individual components of the system should be rectified by renewal of the component. Do not dismantle as individual parts are not available.

35 Fuel tank – removal and refitting

The operations are similar to those described in Section 5, but the additional hoses for the evaporative control system must be disconnected before the tank can be removed.

36 Manifolds and exhaust system – general

1 Refer to Section 16. The same considerations apply, making due allowance for the differences between carburettor and fuel injection models.
2 Remember when working on the exhaust system that if a catalytic converter is fitted, it may reach very high temperatures. Take care to avoid burning yourself.

37 Fault diagnosis – fuel injection system

Symptom	Reason(s)
Engine will not start from cold	Faulty cold start device
Exhaust smoky after starting	Cold start plunger stuck
Engine misfires, rough idle	Defective injector or leak in circuit
Engine runs at idle but stalls on acceleration	Altitude compensator faulty
Hesitation during acceleration	Defective injector Low fuel pressure (warning lamp on) Defective control unit Defective air intake temperature control Weak mixture
Excessive fuel consumption	Leak in system Defective thermostatic actuator Excessive idle speed
Engine stalls at speeds other than idle	Defective altitude compensator Excessive vibration of pump or control unit due to loose mountings
Engine suddenly cuts out	Injection pump drivebelt broken
Detonation in exhaust pipe on deceleration	Blown fuse (fuel pump or cut-off solenoid) Disconnected wire at fuel cut-off solenoid Defective fuel cut-off solenoid Defective fuel cut-off microswitch
Engine stalls when idling in neutral, or picks up after delay when accelerating after deceleration	Fuel cut off solenoid stuck or sticking

38 Fault diagnosis – emission control system

Symptom	Reason(s)
Fume emission from exhaust pipe	Broken air pump drivebelt

Symptom	Reason(s)
	Split hose in AIS AIS non-return valve stuck Clogged air pump filter element Air pump defective
Fume emission from engine	Split or collapsed crankcase ventilation hose Clogged crankcase ventilation hose Crankcase ventilation control valve defective
Fuel odour	Split or disconnected evaporative system hose Faulty fuel cap seal
CO level too high	Mixture too rich Main air filter clogged Poor mechanical condition of engine

Chapter 4 Ignition system

For modifications, and information applicable to later models, see Supplement at end of manual

Contents

Condenser (capacitor) – testing, removal and refitting	5	Distributor – removal and refitting	6
Contact breaker points gap – adjustment	3	Fault diagnosis – ignition system	10
Contact breaker points – examination and renewal	2	Ignition coil – general	8
Description	1	Ignition timing – checking and adjusting	4
Distributor – overhaul	7	Spark plugs and HT (high tension) leads	9

Specifications

General type

System type	Battery and coil, mechanical contact breaker distributor
Firing order	1-3-4-2
Location of No 1 cylinder	Timing cover end of engine

Distributor

Make	Bosch or Marelli
Direction of rotation	Clockwise (viewed from above)
Points gap:	
All except Californian models	0.43 to 0.48 mm (0.017 to 0.019 in)
Californian models – primary	0.43 to 0.48 mm (0.017 to 0.019 in)
Californian models – secondary	0.36 to 0.54 mm (0.014 to 0.021 in)
Dwell angle:	
All except Californian models	57° to 63°
Californian models – primary	57° to 63°
Californian models – secondary	55° to 65°

Ignition timing

European models	6° to 8° BTDC at 900 to 1000 rpm
North American models:	
Except California	5° to 7° ATDC at 600 rpm; 27° to 33° BTDC at 5000 rpm
California	0° (TDC) at 600 to 800 rpm; 33° to 39° BTDC at 5000 rpm

Condenser capacity

0.25 mF

Spark plugs

Type (standard):	
Normal driving	Lodge HL
High speed driving	Lodge 2HL
Electrode gap (standard plugs)	Not applicable (surface discharge type)
Type (alternative, not specified by vehicle manufacturers):	
1.6 and 1.8 models	Champion N7YC
2.0 models	Champion N4C (for hard driving use N3C)
Electrode gap (alternative plugs)	0.6 mm (0.025 in)

Torque wrench settings

	Nm	lbf ft
Spark plugs	25	18
Distributor clamp plate nut	22	16
Distributor clamp plate pinch-bolt	22	16

1 Description

The ignition system is of conventional mechanical contact breaker distributor type and comprises the following components:

The battery, which provides a current to the coil

The ignition/starter switch

The coil, which acts as a transformer to step up the 12 volt battery voltage to many thousands of volts, sufficient to jump the spark plug gaps

The distributor, which comprises the contact breaker, condenser, rotor arm, distributor cap with brush and centrifugal advance and retard mechanism, and is driven by the oil pump driveshaft at half crankshaft speed

The spark plugs, which ignite the compressed mixture in the combustion chambers

Low and high tension leads connecting the various components

When the ignition is switched on, a current flows from the battery live terminal to the ignition switch through the coil primary winding to

the moving contact breaker inside the distributor cap and to earth, when the contact breaker points are in the closed position. During this period of points closure, the current flows through the primary windings of the coil and magnetises the laminated iron core which in turn creates a magnetic field through the coil primary and secondary windings.

Each time the points open due to the rotation of the distributor cam, the current flow through the primary winding of the coil is interrupted. This causes the induction of a very high voltage (25 000 volts) in the coil secondary winding. This HT (high tension) current is distributed to the spark plugs in the correct firing order sequence by the rotor arm and by means of the cap brush and HT leads.

A condenser is fitted to the distributor and connected between the moving contact breaker and earth to prevent excessive arcing and pitting of the contact breaker points.

The actual point of ignition of the fuel/air mixture, which occurs around TDC, is determined by correct setting of the ignition timing as described in Section 4. The ignition is advanced to meet the varying operating conditions by the centrifugal counterweights fitted in the base of the distributor body. A few distributors are also fitted with a vacuum advance unit, dependent upon operating territory.

The ignition switch is mounted on the upper part of the steering column in conjunction with the steering column lock.

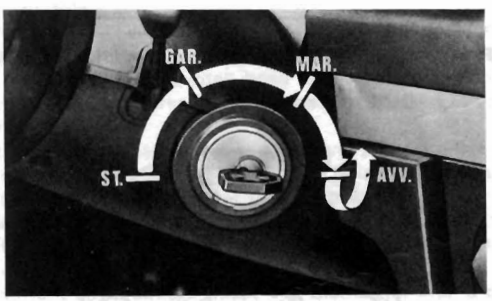


Fig. 4.1 Ignition key positions (Sec 1)

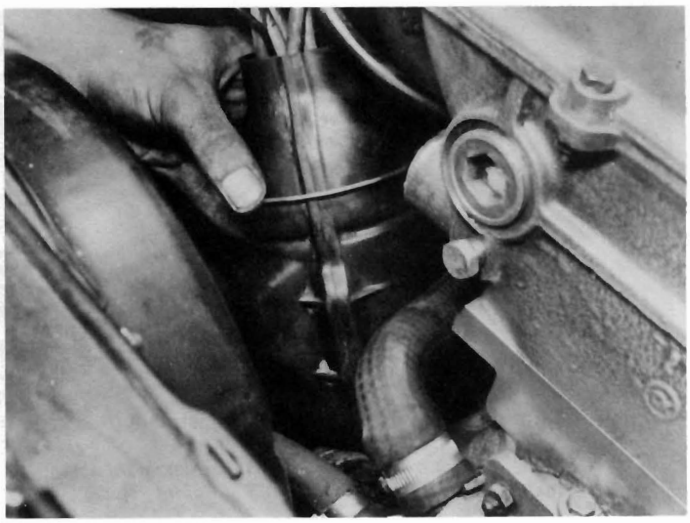
ST Steering locked, key removed
GAR Steering unlocked
MAR Ignition unlocked
AVV Starter actuated

2 Contact breaker points – examination and renewal

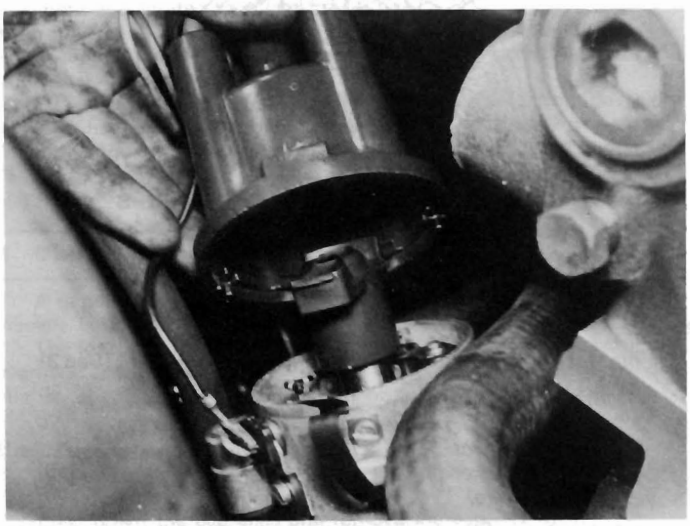
1 At the intervals specified in Routine Maintenance, remove the carburettor air intake and the distributor protective cover, then remove the distributor cap by prising down the clips (photos).
2 Using the thumbnail, move the spring points arm aside and inspect the faces of the contact points.
3 If they are burnt, eroded or show the formation of a pronounced 'pip' or crater, then they must be renewed. Refacing the points on abrasive paper or an oilstone can only be regarded as a temporary measure as it is not possible to maintain the correct face contour essential to correct operation.
4 Remove the rotor arm. On Marelli units, the rotor arm is secured by two screws.
5 Release the wires from the breaker assembly terminal.
6 Unscrew and remove the two screws which secure the contact breaker assembly to the distributor baseplate. Withdraw the assembly upwards off the pivot post.
7 On distributors used in cars operating in California, dual breaker assemblies are used and the removal operations should be repeated for the second set.
8 When fitting the new breaker points, lightly oil the pivot post and apply a smear of high melting-point grease or petroleum jelly to the high points of the cam. Take care not to get any lubricant on the point faces.
9 Leave the contact breaker securing screws finger tight until the points gap has been adjusted as described in the next Section.

3 Contact breaker points gap – adjustment

1 Adjustment of the points gap must be carried out if the contact breaker set has been renewed. Due to subsequent wear of the 'heel'



2.1a Distributor protective cover



2.1b Removing the distributor cap

which is in contact with the cam of the distributor shaft, which will slightly alter the gap over a period of time, it is recommended that the gap is checked and readjusted halfway through the service life of the points, preferably using a dwell meter as described later in this Section as this method compensates for points face deformation which feeler blades do not.

Feeler gauge method

2 This should be regarded as a basic setting to get the engine running. Thereafter use the dwell method to obtain a precise setting.
3 Using a wrench on the crankshaft damper/pulley nut, turn the crankshaft until the heel (heels on Californian versions) of the cam follower is in the centre of one of the high points of the cam.
4 Using a feeler blade, check the points gap and adjust to the specified value by moving the fixed arm. On Californian versions with dual contact breaker sets, the secondary points gap should be adjusted also. Take care not to contaminate the point faces with oil or grease from the feeler blade.
5 When adjustment is correct, tighten the contact breaker fixing screws, refit the rotor arm, protection cover and cap.

Dwell meter method

6 On modern engines, setting the contact breaker gap with a feeler gauge must be regarded as an emergency adjustment only. For optimum engine performance, the dwell angle must be checked. This angle is the number of degrees through which the distributor cam

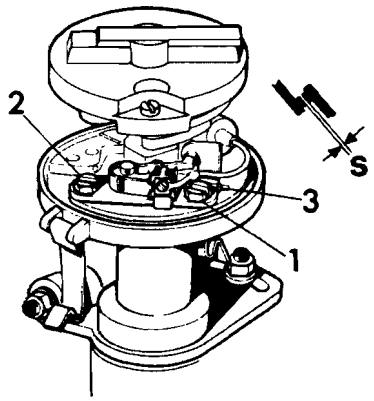


Fig. 4.2 Marelli distributor points gap adjustment (Sec 3)

1 Breaker securing screw
2 Breaker securing screw
3 Adjustment slot
S Points gap

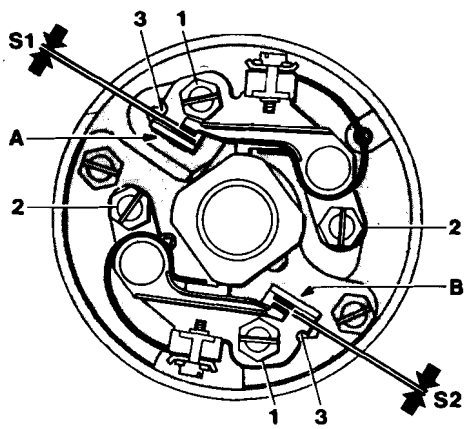


Fig. 4.3 Dual contact breaker points gap adjustment (Sec 3)

1 Breaker securing screw
2 Breaker securing screw
3 Adjustment slot
A Primary breaker (black LT wire)
B Secondary breaker (green LT wire)
S1 Primary breaker gap
S2 Secondary breaker gap

turns during the period between the instants of closure and opening of the contact breaker points. Checking the dwell angle not only gives a more accurate setting of the points gap, but this method also evens out any variations in the gap which could be caused by wear in the distributor shaft or its bushes, or difference in height of any of the cam peaks.

7 The angle should be checked with a dwell meter connected in accordance with the maker's instructions. Refer to the Specifications for the correct dwell angle. If the dwell angle is too large, increase the points gap, if too small, reduce the points gap.

8 The dwell angle should always be adjusted before checking and adjusting the ignition timing.

9 On dual contact breaker distributors, the different dwell angle specifications should be noted for the primary and secondary breaker sets.

4 Ignition timing – checking and adjusting

Static ignition timing, as described in the first half of this Section, should be regarded only as an initial adjustment to enable the engine to be started. For best results, final adjustment should be made dynamically, using a stroboscope.

Test lamp method (static timing)

1 Using a wrench on the crankshaft damper/pulley nut, turn the crankshaft in the normal direction of rotation until No 1 piston is approaching TDC on its compression stroke. This can be verified either by removing No 1 spark plug and with the finger feeling the compression being generated, or by removing the camshaft cover and observing that both No 1 cylinder valves are closed (cam lobes pointing outwards).

2 Continue slowly turning the crankshaft until the static timing mark on the damper is in alignment with the pointer on the engine front cover. If you overshoot the mark, continue turning for another 2 revolutions – do not turn the engine backwards, or inaccurate setting may result.

3 The particular damper mark varies according to model and although the following remarks generally apply, refer also to the individual vehicle decal for confirmation.

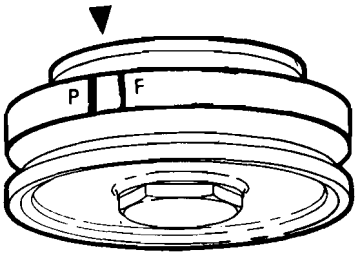


Fig. 4.4 Timing marks (except N America) (Sec 4)

F BTDC (static advance)
P TDC

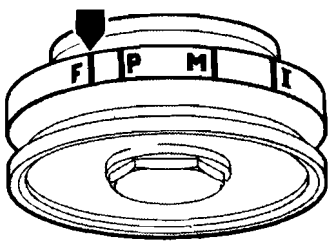


Fig. 4.5 Timing marks (N America except California) (Sec 4)

F Static timing mark (ATDC)
P TDC
M Maximum advance
I Fuel injection start mark

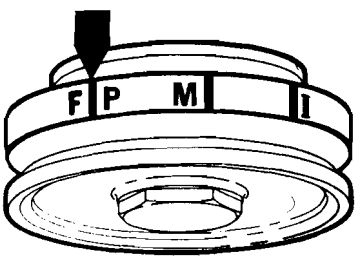


Fig. 4.6 Timing marks (California) (Sec 4)

F/P TDC
M Maximum advance
I Fuel injection start mark

All models except North America

4 Align the damper F mark with the pointer. Remove the coil HT lead so that the engine cannot fire. Connect a test lamp between the distributor LT terminal and earth, then switch on the ignition.

5 Release the distributor clamp plate nut and turn the distributor clockwise or anti-clockwise until the test bulb just comes on. Turn the distributor back until the lamp just goes out.

6 Tighten the clamp plate nut, remove the test lamp and switch off the ignition. Reconnect the coil HT lead.

North American models (except Californian)

7 The operations are similar to those described in earlier paragraphs. Once again, the damper F mark should be aligned with the pointer.

Californian models

8 Static timing with a test lamp is not recommended; refer to the stroboscopic method later in this Section.

Stroboscope method (dynamic timing)

All models except North America

9 Connect a stroboscope in accordance with the maker's instructions. If fitted, disconnect the vacuum pipe from the distributor and plug it. Highlight the timing marks with quick-drying white paint – typist's correcting fluid is ideal.

10 Start the engine, which should be at normal operating temperature, and let it run at an idle speed if between 900 and 1000 rpm. Point the stroboscope at the timing marks: the F mark on the damper should be in alignment with the pointer. If it is not, release the distributor clamp plate nut and rotate the distributor as necessary to bring them into line.

11 Switch off the engine, tighten the distributor clamp nut, remove the stroboscope and reconnect the vacuum pipe, where fitted.

North American models (except California)

12 With the engine at normal operating temperature and a stroboscope connected in accordance with the maker's instructions, start the engine and run it at a steady 5000 rpm. When the lamp is directed at the timing marks, the M mark should appear to be in alignment with the pointer on the engine front cover. If it is not, release the distributor clamp plate nut and rotate the distributor as necessary.

13 Tighten the nut, switch off the engine and remove the stroboscope.

Californian models

14 With the engine idling at normal operating temperature and a stroboscope connected in accordance with the maker's instructions, make sure that the vacuum switch hose is connected and then point the lamp at the timing marks. The F/P mark should be in alignment with the timing pointer.

15 Pinch the vacuum hose at the check valve. After a delay of a few seconds, the ignition should retard until the pointer is aligned with a point about 6.5 mm (0.26 in) after the F/P mark.

16 Release the pinched hose and then increase the engine speed to a steady 5000 rpm. The M mark on the puller damper should be in alignment with the pointer.

17 If adjustment is required, release the distributor clamp plate nut and rotate the distributor as necessary.

18 Tighten the clamp nut, switch off the engine and remove the stroboscope.

5 Condenser (capacitor) – testing, removal and refitting

1 The condenser ensures that with the contact breaker points open, the sparking between them is not excessive, as this would cause severe pitting. The condenser is fitted in parallel and its failure (short-circuit) will automatically cause total failure of the ignition system as the points will be prevented from interrupting the low tension circuit.

2 Testing for an open-circuit condenser may be affected by switching on the ignition and separating the contact points by hand. If this action is accompanied by a strong blue flash then condenser failure is indicated. Difficult starting, missing of the engine after several miles running or badly pitted points are other indications of a suspect condenser.

3 The surest test is by substitution of a new unit.

4 To remove the condenser, unscrew its retaining screw and detach its lead from the LT terminal on the distributor body. Refitting is a reversal of removal.

6 Distributor – removal and refitting

1 Disconnect the HT leads from the spark plugs and the ignition coil. Remove the carburettor air intake.

2 Disconnect the distributor LT lead from the coil negative terminal. Where applicable, disconnect the vacuum pipeline.

3 Remove both halves of the distributor protective cover.

4 Unclip and remove the distributor complete with leads. Mark the position of the clamp plate nut in relation to the cut-out in the clamp plate.

5 Unscrew the clamp plate nut (**not** the clamp plate pinch-bolt) and withdraw the distributor from its recess.

6 Installation is a reversal of removal, simply align the distributor shaft offset dogs with those on the end of the oil pump driveshaft before pushing the unit fully into its recess (photo).

6.6 Distributor driveshaft offset dogs

7 Turn the distributor until the clamp plate takes up its previous alignment and tighten the clamp plate nut.

8 Refit and reconnect all the removed and disconnected items.

9 It is recommended that the ignition timing is checked as described in Section 4.

10 If the distributor is being installed after the engine front cover or oil pump have been disturbed, this is a more complicated procedure. To obtain the correct setting of the rotor arm, refer to Chapter 1, Section 5.

7 Distributor – overhaul

1 A generally worn distributor which has been in service for a high mileage is best replaced by a completely new or reconditioned unit.

2 The following operations should be taken as a guide to the limit of overhaul operations. More extensive work, such as renewing shaft bushes, should be left to your dealer or auto electrical company.

Bosch

3 With the distributor removed from the engine, clean away external dirt.

4 Prise down the cap clips and remove the cap.

5 Take off the rotor arm and remove the protective cover and contact breaker set.

6 Remove the externally-mounted condenser.

7 Extract the screws that secure the cap clip pivots, remove the clips and withdraw the baseplate from the distributor body. If the particular distributor is equipped with a vacuum advance capsule, release its screws and disengage the connecting link from the baseplate as the latter is withdrawn.

8 Disconnect the advance springs and then mark the relationship of the cam to the distributor shaft.

9 Grip the cam in the jaws of a vice that has been fitted with jaw protectors, then tap the distributor body with a plastic-faced hammer until the securing jump ring releases.

10 Remove the spring ring and mark the position of the driving dog in relation to the distributor shaft.

11 Drive out the dog securing pin and extract the remaining components from the distributor shaft.

12 Inspect all components for wear, especially the holes in the centrifugal weights which should not be oval in shape. Shaft bush wear must not exceed 0.2 mm (0.008 in).

13 Reassembly is a reversal of dismantling. Use engine oil for lubrication as the work proceeds.

14 Check the endfloat of the shaft when the drive dog has been re-pinned. This should be between 0.1 and 0.25 mm (0.004 and 0.010 in). Adjustment can be made by varying the number of shaft washers installed.

15 Provision is made for altering the advance characteristics of the distributor but as this requires the use of special equipment, leave this

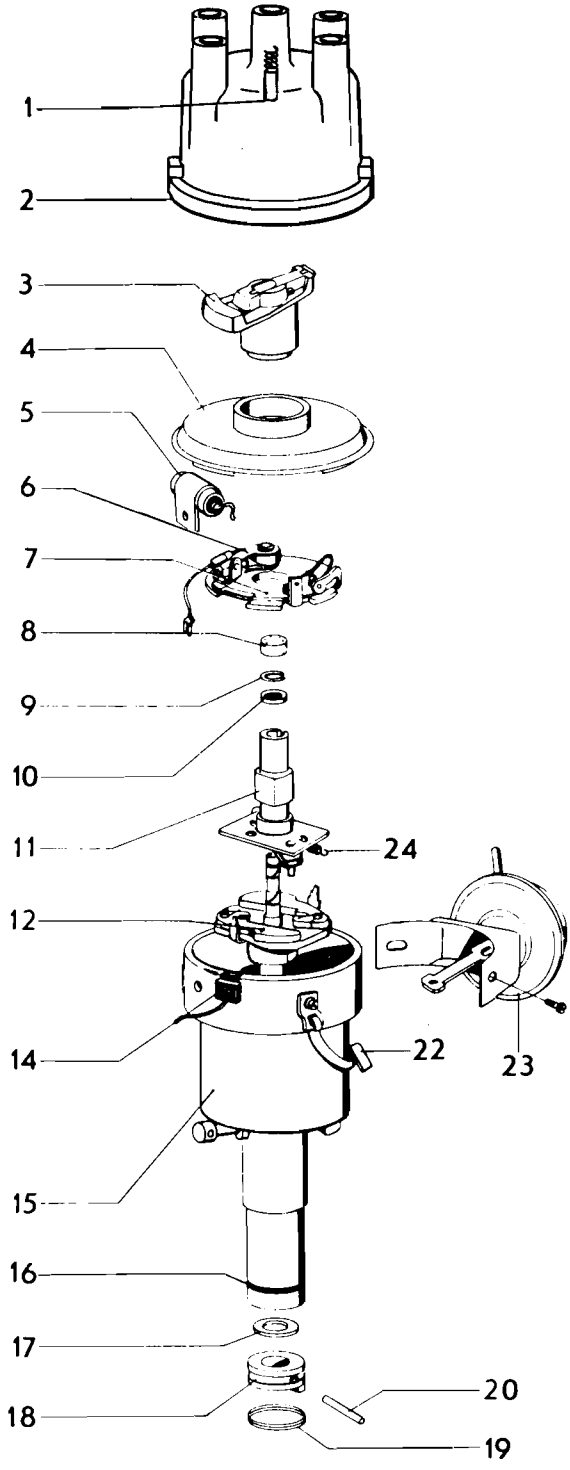


Fig. 4.7 Exploded view of Bosch distributor (Sec 7)

1 Carbon brush	*12 Centrifugal weight*
2 Cap	*14 LT terminal*
3 Rotor	*15 Body*
4 Protective cover	*16 O-ring*
5 Condenser	*17 Washers*
6 Contact breaker	*18 Driving collar*
7 Baseplate	*19 Spring ring*
8 Lubrication pad	*20 Locking pins*
9 Jump ring	*22 Cap clip*
10 Washer	*23 Vacuum capsule*
11 Cam	*24 Centrifugal weight spring*

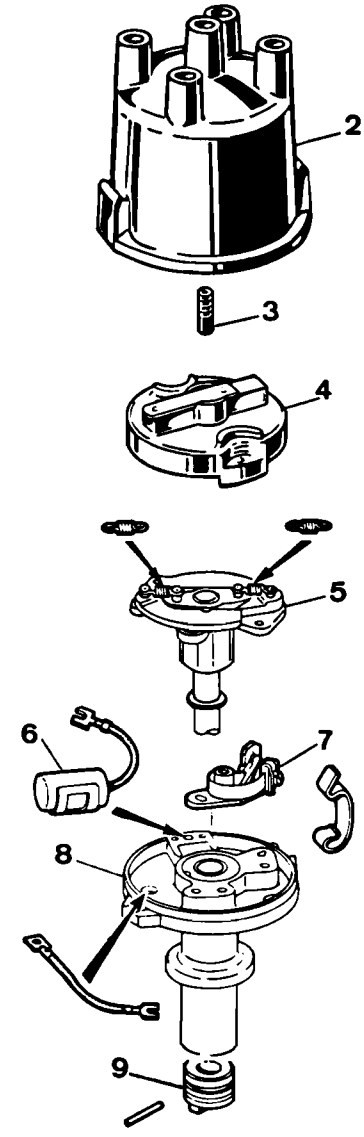


Fig. 4.8 Exploded view of Marelli distributor (Sec 7)

2 Cap	*6 Condenser*
3 Carbon brush	*7 Contact breaker*
4 Rotor	*8 Baseplate*
5 Counterweight assembly	*9 Drive dog*

to your dealer or auto electrician if new parts have been fitted which could affect these characteristics.

Marelli

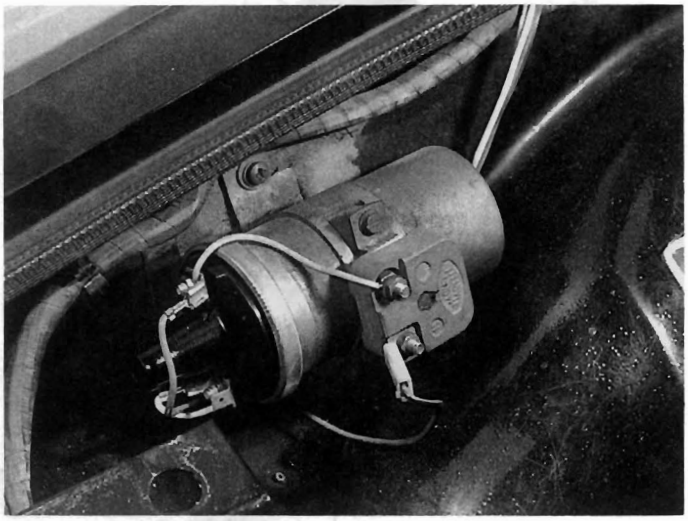
16 The operations are very similar to those just described for the Bosch distributor, except that once the cap has been unclipped, the rotor must be removed (two screws) to expose the baseplate and counterweight assembly.

8 Ignition coil – general

1 The ignition coil is really a transformer which converts battery voltage into HT (high tension) voltage, which is sufficient to jump the spark plug gaps.

2 The connections to the coil should be kept secure, with the LT lead from the distributor always connected to the negative terminal of the coil.

3 Keep the surface of the plastic tower free from grease and dirt to prevent tracking, and make sure that the mounting straps are making a good metal-to-metal bond.
4 A ballast resistor is mounted on the coil (photo). When the starter motor is operated, the ballast resistor is bypassed to allow full battery voltage through the ignition primary circuit.
5 Note that if the ballast resistor is defective (open-circuit) or disconnected, the engine will fire when the starter motor is operated, but will not run when the key is released from the starting position. Bypassing the ballast resistor in such circumstances is not recommended, since the increased current flow may burn out the coil LT windings.



8.4 Ignition coil and ballast resistor

9 Spark plugs and high tension (HT) leads

1 The correct functioning of the spark plugs is vital for the good running and efficiency of the engine. The plugs fitted as standard are listed on the Specifications page.
2 At the specified intervals the plugs should be removed and examined. The condition of the spark plugs will also tell much about the overall condition of the engine.
3 If the insulator nose of the spark plug is clean and white, with no deposits, this is indicative of a weak mixture, or too hot a plug. (A hot plug transfers heat away from the electrode slowly – a cold plug transfers it away quickly).
4 If the top and insulator nose are covered with hard black looking deposits, then this is indicative that the mixture is too rich. Should the plug be black and oily, then it is likely that the engine is fairly worn as well as the mixture being too rich.
5 If the insulator nose is covered with light tan to greyish brown deposits, then the mixture is correct and it is likely that the engine is in good condition.
6 If there are any traces of long brown tapering stains on the outside of the white portion of the plug, then the plug will have to be renewed, as this shows that there is a faulty joint between the plug body and the insulator, and compression is being allowed to leak away.
7 Plugs should be cleaned by a sand blasting machine, which will free them from carbon more thoroughly than cleaning by hand. Some machines will also test the condition of the plugs under compression. Any plug that fails to spark at the recommended pressure should be renewed.
8 The spark plugs fitted as original equipment are of 'surface gap' type, with four electrode gaps. The gaps on this type of plug should not be adjusted.
9 If spark plugs of an equivalent type but alternative make are fitted, then if these are of single electrode type, set the gap to the specified value.
10 To set it, measure the gap with a feeler gauge, and then bend open, or close, the outer plug electrode until the correct gap is achieved. The centre electrode should never be bent as this may crack the insulation and cause plug failure, if nothing worse.
11 The life of a spark plug should be 12 500 to 15 000 miles, (20 000 to 24 000 km) after which they should be renewed as a set. Always use the specified type in accordance with the plug manufacturer's latest recommendations.
12 Before refitting a spark plug, wipe the seat in the cylinder head clean, and apply a smear of grease to the plug threads.
13 Tighten the plugs to the specified torque and reconnect the high tension leads in their correct order.
14 The spark plug leads require no attention other than being given an occasional wipe to remove any grease, or dirt, which might otherwise cause tracking. Renew cracked or damaged leads.

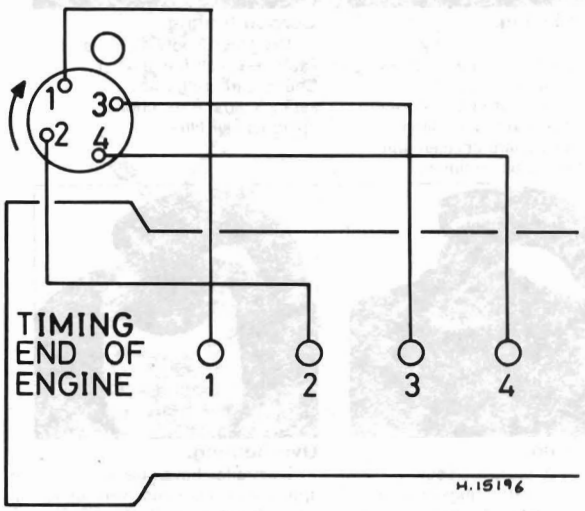


Fig. 4.9 HT lead connecting diagram (Sec 9)

10 Fault diagnosis

Symptom	Reason(s)
Engine fails to start	Loose battery connections Discharged battery Oil on points Disconnected ignition leads Faulty condenser Damp leads or distributor cap
Engine starts, runs but misfires	Faulty spark plugs Cracked distributor cap Cracked rotor arm Worn advance mechanism Incorrect spark plug gap

Symptom	Reason(s)
	Incorrect points gap Faulty condenser Faulty coil Incorrect timing Poor earth connections
Engine overheats, lacks power	Seized centrifugal weights Perforated vacuum pipe (if vacuum capsule fitted) Incorrect ignition timing
Engine 'pinks'	Timing too advanced Advance mechanism stuck in advanced position Broken centrifugal spring Low fuel octane rating
Engine fires but will not run	Ballast resistor defective or disconnected

Chapter 5 Propeller shaft and driveshafts

Contents

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Driveshaft – removal and refitting 5
Driveshaft constant velocity (CV) joint – renewal 7
Driveshaft joint bellows – renewal 6
Fault diagnosis – propeller shaft and driveshafts 8
Propeller shaft – overhaul 3
Propeller shaft – refitting 4
Propeller shaft – removal 2

Specifications

Propeller shaft

Type	Two-section, with centre support bearing and rubber couplings

Driveshafts

Type	Open, with CV joint at each end, interchangeable

Torque wrench settings

	Nm	lbf ft
Propeller shaft coupling bolts	52	38
Driveshaft flange bolts	50	37
Centre support nut and locknut	105	77

1 Description

Due to the fact that the clutch, gearbox and final drive are located at the rear of the car, the propeller shaft transmits engine torque to the clutch flywheel. For this reason, the shaft is manufactured as a precision component and is carefully balanced. The assembly should therefore be treated with care during overhaul operations.

The propeller shaft is of two-section construction, having a centre support bearing and a flexible coupling at each end.

The driveshafts which transmit the power from the differential unit to the rear roadwheels are of open type, with a constant velocity joint at each end. The shafts are interchangeable from side to side.

With this type of power transmission used in conjunction with a de Dion rear axle and an independently mounted gearbox/final drive, the unsprung weight is kept low to improve rear end adhesion and roadholding.

2 Propeller shaft – removal

1 Place the car over an inspection pit or raise it on ramps. Pull off the gear lever knob. The knob is a push fit on the lever.
2 Release the clamp which connects the front section of the exhaust pipe to the rear section.
3 Prise off the exhaust system rubber suspension rings from the gearbox crossmember.
4 Unbolt the exhaust pipe flanges from the manifold.

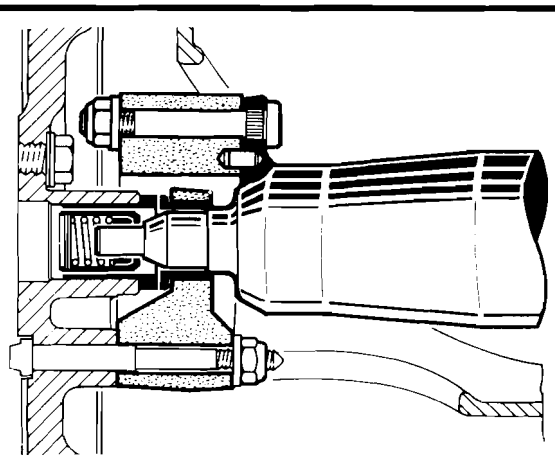


Fig. 5.1 Propeller shaft front joint (Sec 1)

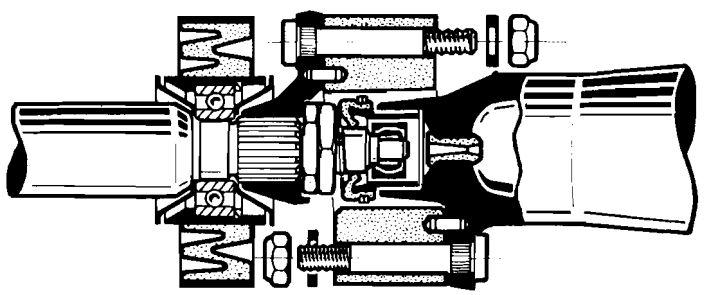


Fig. 5.2 Propeller shaft centre joint (Sec 1)

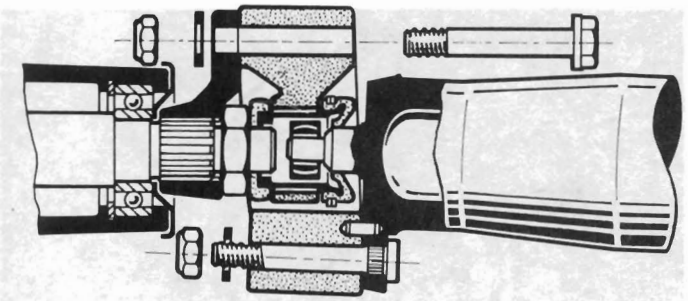


Fig. 5.3 Propeller shaft rear joint (Sec 1)

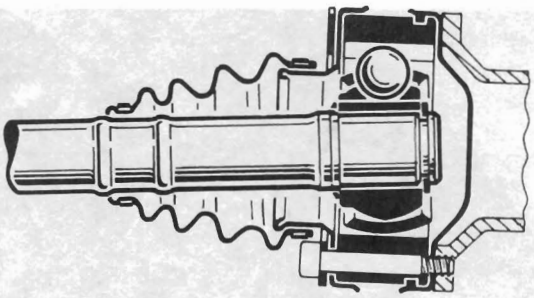


Fig. 5.4 Driveshaft joint (Sec 1)

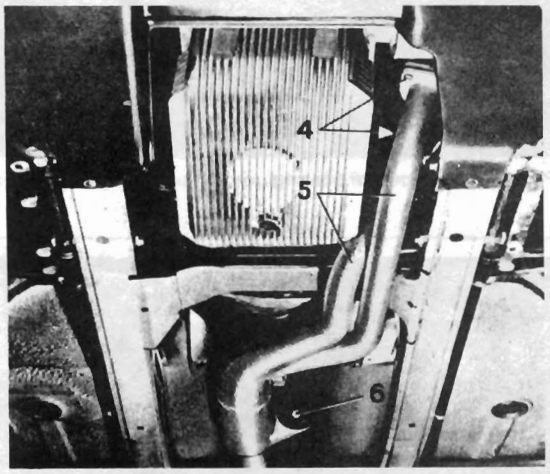


Fig. 5.5 Exhaust disconnection points (Sec 2)

4 Downpipe and connecting flange
5 Twin pipes
6 Flexible mounting

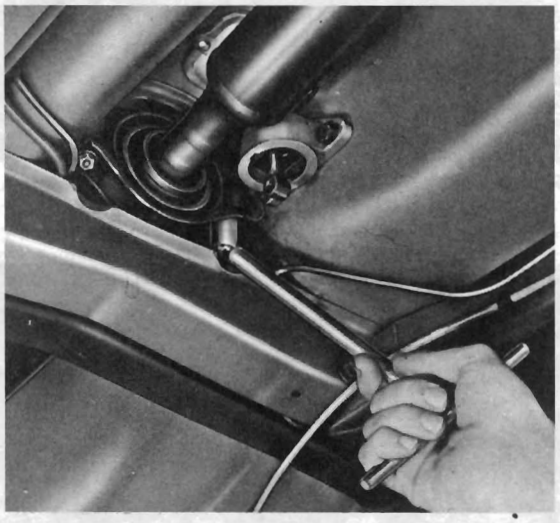


Fig. 5.6 Unscrewing the propeller shaft centre mounting (Sec 2)

5 Disconnect the exhaust flexible mounting at the engine rear mounting, separate the exhaust pipe sections and withdraw the front section.

6 Prise off the rubber dust excluder from the base of the gear lever, unscrew the screw and disconnect the gearchange link rod from the gearchange lever (photo).

7 Working at the other end of the link rod, disconnect it from the gearbox selector lever (photo).

8 Using a socket spanner on the crankshaft pulley nut, turn the crankshaft (and thus the propeller shaft) until one bolt attaching the propeller shaft to the engine flywheel and one bolt attaching the shaft to the clutch drive flange are suitably positioned to be able to unscrew them.

9 Remove the small cover plate from the flywheel housing to gain access to the propeller shaft flywheel stud nut and remove it (photo). If the crankshaft must be prevented from turning, either engage a gear by pushing or pulling the selector rod on the gearbox now that the link rod has been disconnected and apply the handbrake fully, or remove the starter motor and jam the flywheel starter ring gear as described in Chapter 1.

10 Repeat the operations to release the remaining propeller shaft front and rear coupling bolts (photo).

11 Unscrew the propeller shaft centre bearing support from its mounting studs (photo).

12 Support the rear end of the engine by placing a wooden block between the rear end of the cylinder head and the bulkhead, then disconnect the rear mounting on the engine flywheel cover from the body. Retain the distance collars carefully.

13 Working under the car at the base of the gearchange lever, first mark their position and then unscrew and remove the three bolts which retain the gearchange lever ball socket housing to the side of the transmission tunnel. Without withdrawing this it is quite impossible to remove the propeller shaft whether it is pulled towards the front or rear of the car (photo).

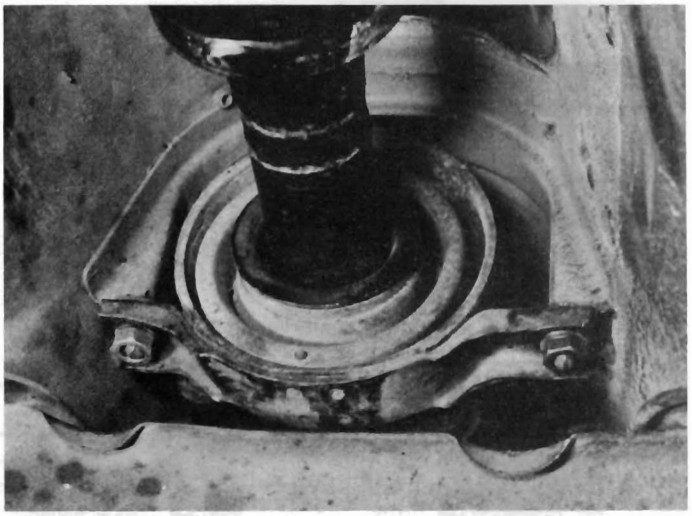
14 Withdraw the gearchange lever assembly downwards and remove it from the car (photo).

2.6 Gear lever disconnected from gearchange link rod

2.7 Gearchange link rod attachment to gearbox selector lever

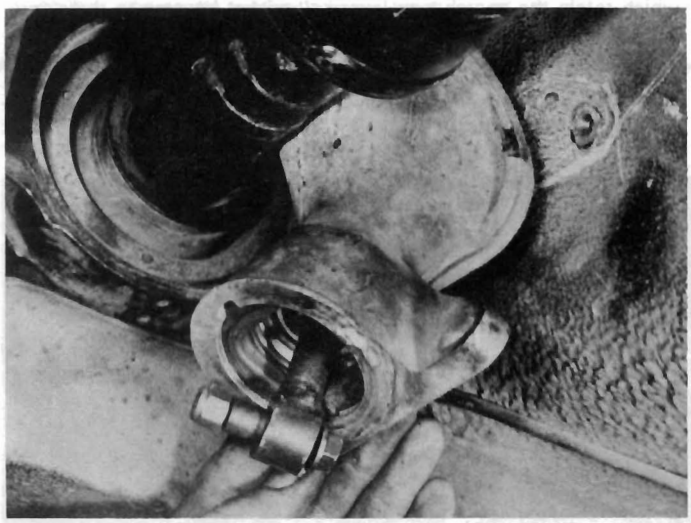
2.9 Unscrewing a propeller shaft front coupling nut

2.10 Propeller shaft front coupling



2.11 Propeller shaft centre bearing

2.13 Gearchange lever ball socket housing



2.14 Removing gearchange lever ball socket housing

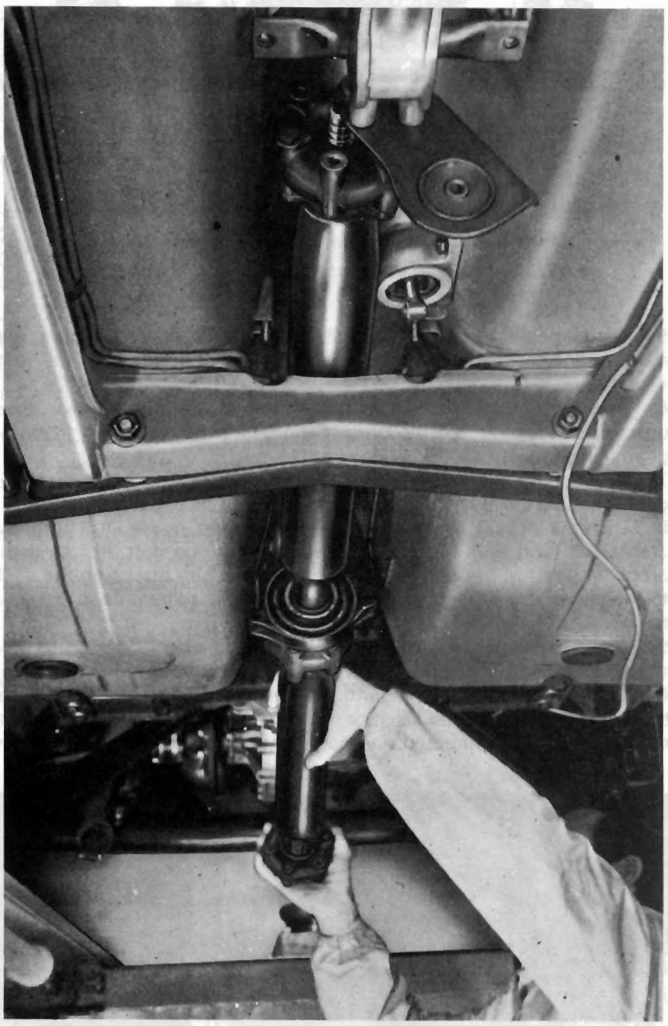
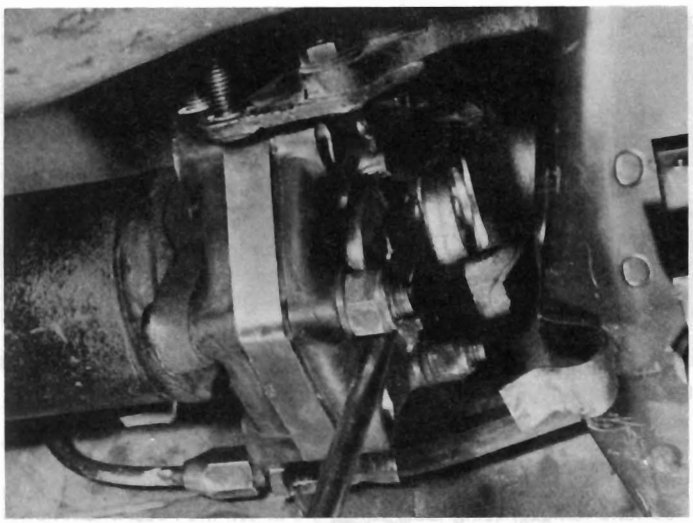


Fig. 5.7 Removing the propeller shaft from under the car (Sec 2)

15 Using a large screwdriver to compress the rubber rear coupling and to prise it over the spigot, disconnect the propeller shaft from the clutch yoke (spider) (photo).
16 Withdraw the propeller shaft towards the rear of the car.



2.15 Disconnecting rear end of propeller shaft from clutch yoke

3 Propeller shaft – overhaul

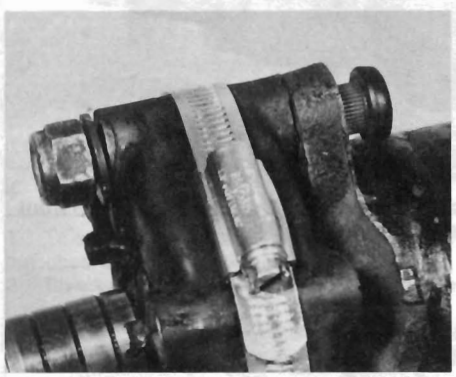
1 With the shaft removed from the car, clean away external dirt and using quick-drying paint, mark the relative alignment of the two sections of the shaft.
2 A clamp should now be fitted to the centre flexible coupling. Although a special tool (A20263) is available, a substitute can probably be made up using an oil filter removal strap wrench, piston ring clamp or even two large worm drive hose clips. New couplings are supplied with clamping bands fitted (photo).
3 Unscrew the bolts and separate the two sections of the propeller shaft.

Front coupling

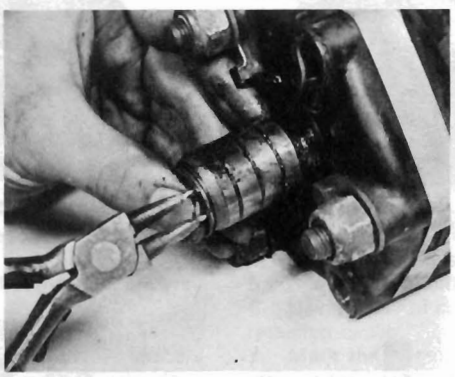
4 Grip the front shaft section in the jaws of a vice and then fit the clamp to the flexible coupling.
5 Remove the small protective rubber cap.
6 Unscrew the nuts and remove them with their washers. Disconnect the flexible coupling from the flange yoke. Pull the rubber coupling over the flange yoke. Pull the rubber coupling over the bush/spherical seat assembly; there is no need to remove the bush/seat assembly unless it is worn or damaged, in which case carry out the following operations.
7 From the end of the shaft extract the circlip; washer and spring using circlip pliers (photos).
8 Remove the spherical seat and bush together from the recess in the shaft. Unless a small extractor having inward-pointing claws is available (special tool A 30361), it may be possible to tap a thread into the bush and screw in a bolt to extract it.
9 Lubricate the new seat and bush, and carefully drive them together into their recess.
10 Fit the spring, washer and a new circlip.
11 With the clamp still on the rubber coupling, refit the coupling, making sure that the holes align with the centring pivot roll pins which project from each arm of the yoke. On later models, these pins are not used but the rubber coupling has projections moulded into it which must engage in the holes provided for them in the yoke. Turn the coupling as necessary to align the projections with the holes before sliding the coupling onto the propeller shaft yoke studs. A large socket will prove useful for applying pressure to the coupling centre in order to force the rubber over the spherical seat/bush assembly (photos).
12 Screw and tighten the set bolts, or bolts and nuts, according to the torque given in the Specifications.
13 Remove the coupling clamp, fit the small protective cap and fill the cap with grease (photo).

Centre coupling

14 Secure the rear shaft section in the jaws of a vice.
15 Mark the position of the coupling in relation to the shaft.
16 Remove the retaining ring and take off the protective rubber cap from the front bush.



3.2 Propeller shaft coupling temporary clamp



3.7a Extracting coupling bush circlip

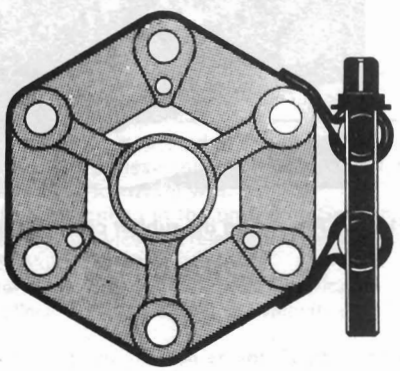
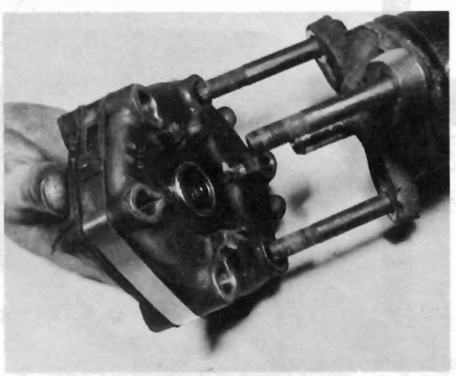


Fig. 5.8 Typical rubber coupling clamp (Sec 3)

3.7b Removing coupling bush coil spring

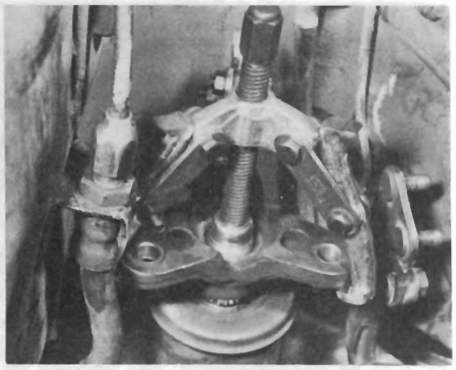


3.11a Later model rubber coupling showing projections and clamp band fitted during production

3.11b Using a socket to install coupling to shaft

3.13 Removing propeller shaft coupling band

3.20a Modified type of clutch yoke



3.20b Removing the clutch yoke

17 Fit the clamp (see paragraph 2) and unbolt the coupling.
18 Reassembly is a reversal of dismantling. Tighten the bolts or setscrews to the specified torque, remove the clamp tool and grease the bush and protective cap.

Rear coupling

19 The operations are very similar to those described for the front coupling but before dismantling, mark the alignment of the coupling to the shaft flange.
20 On some shafts, the spherical seat is provided with a slot to facilitate removal using tools which are in common use. The renewal of early type rear couplings may necessitate fitting a modified yoke. The yoke can be drawn off using a three-legged puller once the yoke securing nut has been unscrewed (photos).

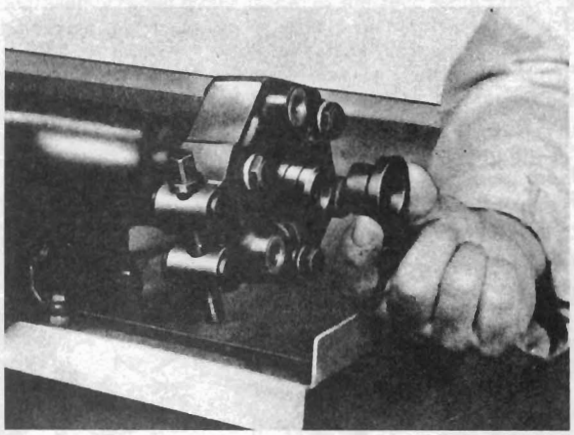


Fig. 5.9 Removing the rubber cap from the front coupling (Sec 3)

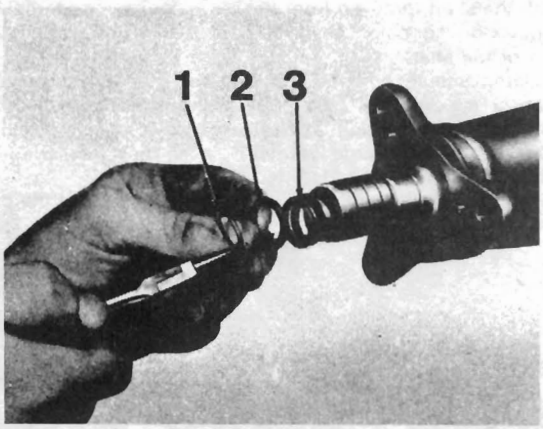


Fig. 5.10 Removing circlip (1), washer (2) and spring (3) from front end of shaft (Sec 3)

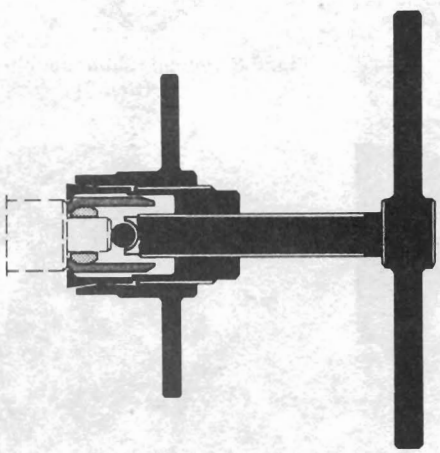


Fig. 5.11 Typical tool for extracting spherical bearing and seat (Sec 3)

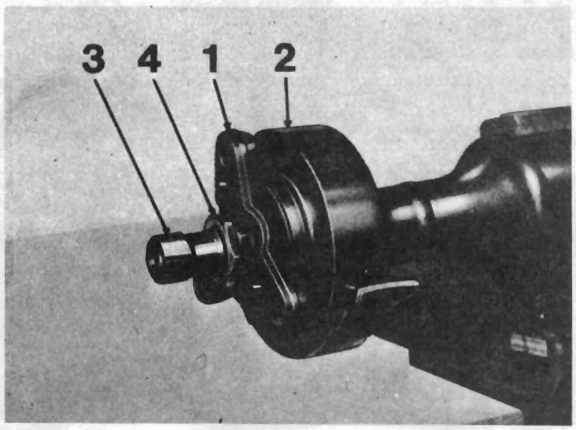


Fig. 5.12 Propeller shaft centre bearing support (Sec 3)

1 Spider
2 Centre bearing
3 Spherical seat
4 Locknut and nut

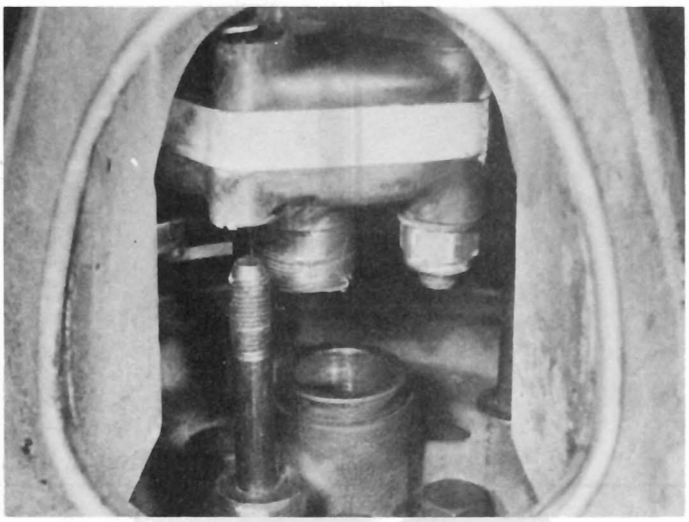
Centre bearing

21 Mark the alignment of the front section of the shaft relative to the flange spider. Refer to Fig. 5.12.
22 Remove the spherical seat.
23 With the shaft gripped in the jaws of a vice, unscrew and remove the locknut and nut.
24 Using a press or puller, remove the spider from the shaft. Take care not to damage the spider, as it is balanced with the shaft and a new component would upset this.
25 Remove the sealing disc and then press the splined section of the shaft out of the centre bearing. Remove the second sealing disc and discard it.
26 The bearing can be removed from its support housing if the retaining circlip is first extracted. Remove the bearing by applying pressure only to its outer track.
27 Reassembly and refitting are reversals of dismantling and removal, but fit new bearing sealing caps and apply jointing compound between the contact surfaces of the spider and bearing. Tighten nuts to the specified torque, having checked that the spider has been fitted to the shaft splines in its original alignment.

Fig. 5.13 Extracting the centre bearing circlip (Sec 3)

4 Propeller shaft – refitting

1 This is a reversal of the removal procedure described in Section 2, but observe the following points.
2 Check that the bushes in the shaft and engine flywheel are well greased (photo).
3 Tighten the coupling bolts to the specified torque.
4 When reconnecting the engine rear mounting, refit the spacers removed at disconnection. These washers are used to provide a clearance (6.0 to 8.0 mm – 0.236 to 0.315 in) between the propeller shaft and the engine mounting, otherwise the shaft could foul the mounting.



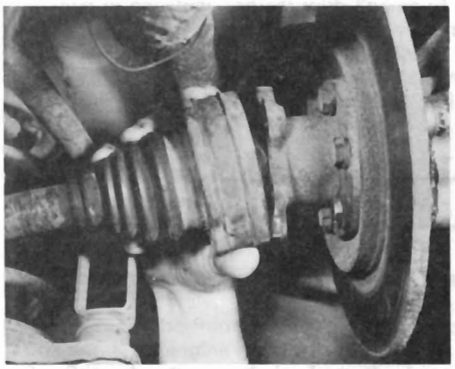
4.2 Propeller shaft and engine flywheel connection

5 Driveshaft – removal and refitting

1 With the rear of the car over an inspection pit or raised on ramps, unscrew the socket-headed screws which secure the inboard end of the driveshaft to the brake disc spacer (photo). Remove the screws, washers and semi-circular plates. A suitable screw extractor for attachment to a socket wrench can be made by cutting an Allen key.
2 Disconnect the outboard end of the shaft from the stub axle flange in a similar way (photos).
3 Refitting is a reversal of removal, but smear the threads of the screws with grease and tighten to the specified torque. Engagement of the driveshaft flange with the differential stub axle flange will be made easier if the driveshaft flange is raised as high as it will go and lowered into position.

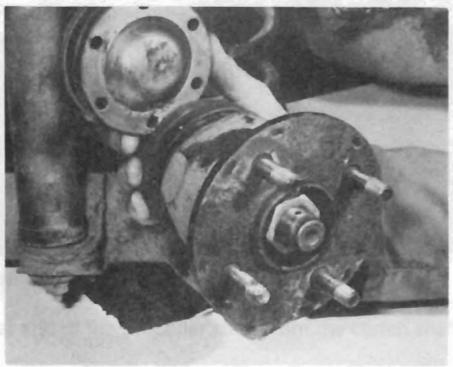
6 Driveshaft joint bellows – renewal

1 The driveshaft bellows should be inspected at regular intervals for splits or leakage of lubricant. Where these conditions are evident, the bellows should be renewed in the following way.
2 Remove the driveshaft as described in the preceding Section.
3 Secure the shaft in the jaws of a vice and release the bellows clips.
4 Slide the bellows back along the shaft.
5 Remove the joint outer cover and wipe away the lubricant.
6 Using a pair of circlip pliers, extract the constant velocity (CV) joint retaining circlip.
7 Mark the alignment of the joint relative to the shaft and then remove the joint from the shaft splines. To do this either support the rear face of the joint while the shaft is pressed from it, or use a suitable two or three-legged extractor.
8 Remove the cup spring and slide the defective boot from the shaft.



5.1 Disconnecting the inboard end of a driveshaft

5.2a Unscrewing driveshaft outboard end flange screw



5.2b Driveshaft outboard end disconnected

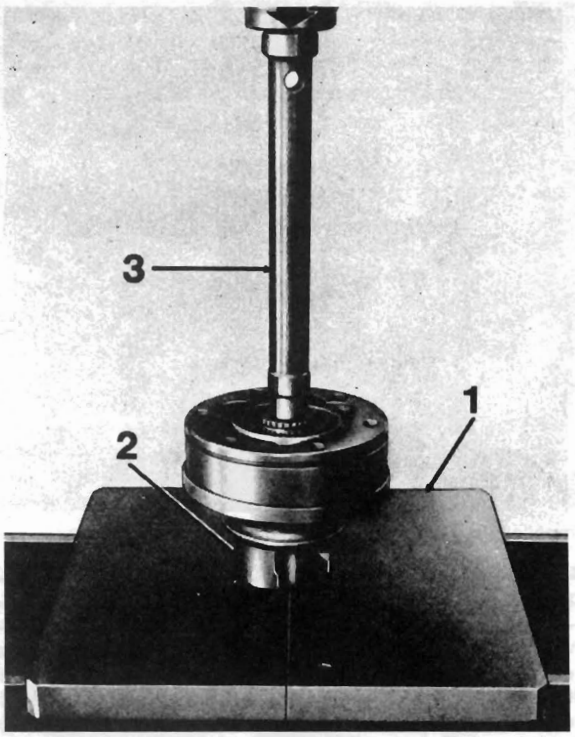


Fig. 5.14 Pressing driveshaft out of CV bearing (Sec 6)

9 Before sliding the new bellows onto the shaft, bind the shaft splines with tape to prevent the neck of the bellows being damaged.
10 Fit the bellows and cup spring and remove the tape.
11 Apply 70g (2.45 oz) of the specified lubricant to the joint and press the joint onto the shaft splines, aligning the marks made before dismantling. Apply pressure only to the centre collar of the joint.
12 Fit the circlip and check that the rubber grease seal on the outer rim of the joint is in position.
13 Fit the outer cover.
14 Apply some sealing compound (Bostik 475 or equivalent) to the surface between the bellows and the inner cover of the joint.
15 Slide the bellows onto the joint and fit new retaining clips.
16 Refit the driveshafts as described in the preceding Section.

7 Driveshaft constant velocity (CV) joint – renewal

1 A driveshaft CV joint will only require renewal if the vehicle has covered an exceptional mileage and wear has occurred to produce the symptoms given in Fault Diagnosis.
2 Accelerated wear can also be caused if a driveshaft bellows has split and has remained undetected or neglected for some time, thus allowing the entry of dirt and road grit.
3 The joint should be removed as described in Section 6 and a complete new assembly fitted. Component parts are not supplied individually.

8 Fault diagnosis – propeller shaft and driveshafts

Symptom	Reason(s)
Propeller shaft	
Vibration	Worn rubber couplings Worn centre support bearing Bent shaft Spherical seat or bearing worn Loose drive flange bolts Out-of-balance shaft
Knocking during starting, deceleration or gear changing	Loose drive flange bolts Rear engine mounting fouling shaft Worn rubber couplings
Driveshafts	
Vibration	Out-of-balance or bent shaft
Continuous noise while driving	Worn CV joint Dry CV joint
Knock at acceleration or on overrun	Worn CV joints or shaft splines Loose flange bolts

Chapter 6 Clutch

For information applicable to later models, see Supplement at end of manual

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Specifications

Clutch type	Single dry plate, diaphragm spring, hydraulic operation
Driven plate diameter	215 mm (8.46 in)
Hydraulic fluid	To SAE 1703C

Torque wrench settings	**Nm**	**lbf ft**
Yoke-to-flywheel shaft nut	105	77
Pressure plate cover bolts	16	12
Gearchange lever pivot nut	35	26
Flexible pipe to cylinder	10	7

1 Description and maintenance

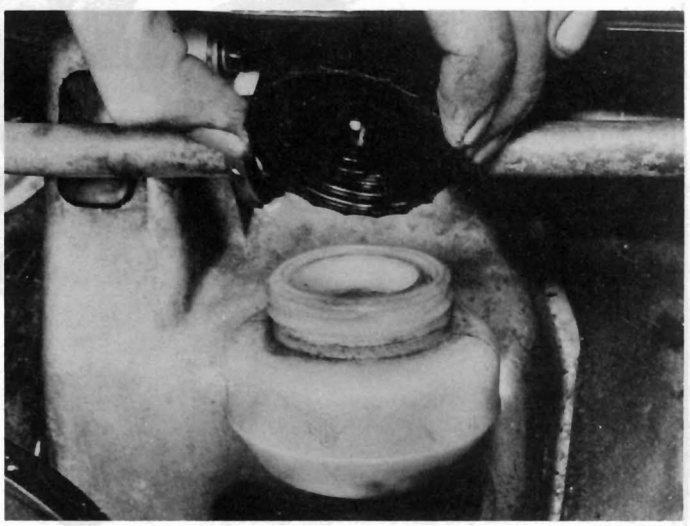
The clutch is of single dry plate type, incorporating a diaphragm spring.

Due to the fact that the transmission is remotely mounted from the engine, the clutch assembly incorporates its own independent flywheel upon which the driven plate bears.

The clutch is actuated hydraulically by means of a conventional master cylinder and slave cylinder.

As the operation of the clutch is hydrostatic, with the release bearing in constant contact with fingers of the diaphragm spring, no adjustment is ever required as any wear in the clutch driven plate friction linings is taken up automatically.

Regular maintenance is limited to keeping the reservoir fluid up to the level marked (photo). Any sudden fall in fluid level should be investigated.



1.0 Clutch fluid reservoir

2 Clutch – removal

Removal from car

1 Place the car over an inspection pit, or raise the rear end on ramps and chock securely.

2 Remove the front section of the exhaust system as described in Chapter 1 for engine removal.

3 Prise the dust excluder from the base of the gearchange lever under the car and disconnect the gearchange link rod from the gear control lever and from the selector lever on the transmission.

4 Disconnect the rear end of the propeller shaft from the clutch shaft yoke (spider).

5 Disconnect the clutch hydraulic hose at its union with the rigid pipeline and release the hose from its body bracket. Cap the end of the pipeline, a brake caliper nipple dust cap is useful for this.

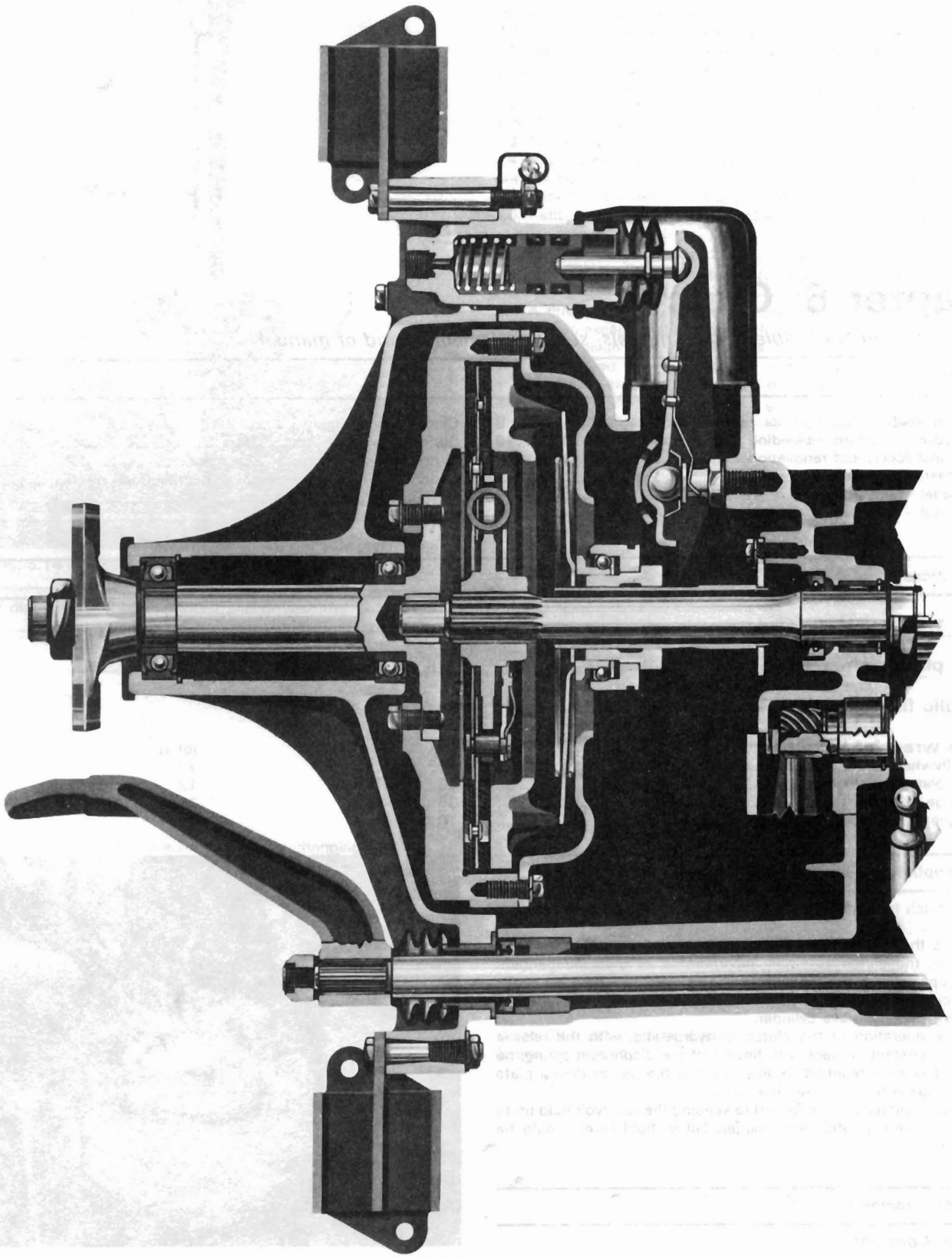


Fig. 6.1 Cutaway view of clutch assembly (Sec 1)

6 Unscrew and remove the three bolts which secure each side of the rear axle front crossmmber to the body side-members.
7 Tape off the clutch slave cylinder rubber dust cover.
8 Place a jack under the rear axle lower tube and raise it slowly. This will have the effect of inclining the front of the transmission and rear suspension downwards.
9 Fit a prop between the side arm of the rear axle and the body, and slacken the bolts which secure the transmission to the flexible mountings.
10 Support the transmission on a second jack and then remove the bolts, previously slackened, to release the transmission from the flexible mountings.
11 Unbolt the gear selector lever from the shaft in the clutch housing. Mark the position of lever relative to the shaft splines.
12 Raise the jack under the transmission until the clutch housing is suitable positioned to pass between the body floor pan and the axle crossmember when it is withdrawn.
13 Unscrew and remove the bolts which hold the clutch housing to the gearcase.
14 Withdraw the clutch assembly from the gearcase.

Removal from previously withdrawn transmission

15 Where the complete transmission assembly has been removed for overhaul, then the clutch removal operations are reduced to four as follows.
16 Unscrew the pivot nut which secures the selector lever to the clutch housing. Remove the lever.
17 Remove the dust cover from the clutch slave cylinder.
18 Unscrew and remove the clutch housing flange bolts.
19 Withdraw the clutch assembly from the gearbox input shaft, making sure to support its weight.

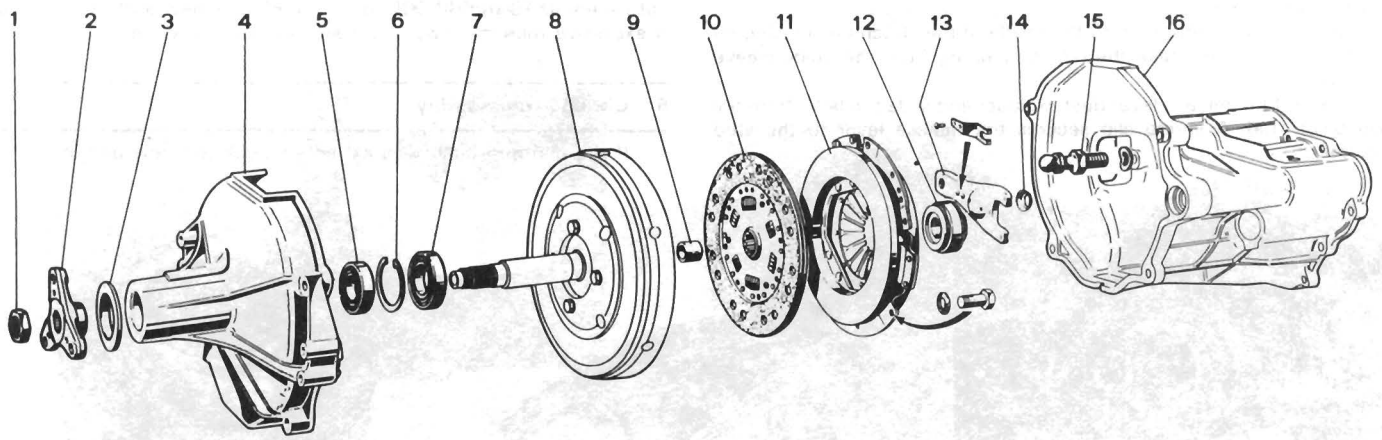


Fig. 6.2 Components of the clutch (Sec 2)

1 Nut
2 Yoke
3 Shield
4 Clutch housing
5 Front bearing
6 Circlip
7 Rear bearing
8 Flywheel/clutch shaft
9 Centering bush
10 Driven plate
11 Pressure plate
12 Release bearing
13 Release lever
14 Dust cover
15 Ball pivot stud
16 Gear casing

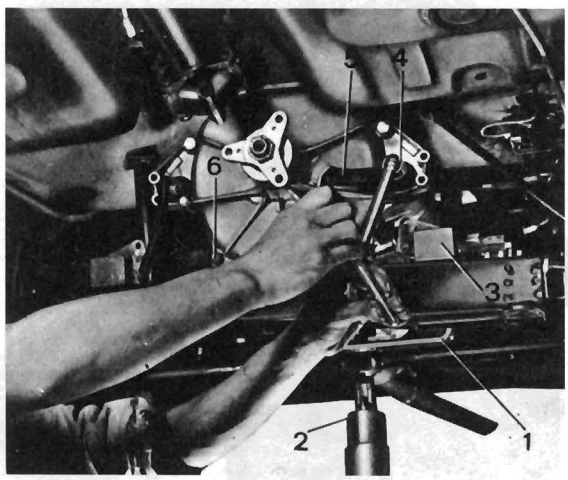


Fig. 6.3 Unbolting gear selector lever (Sec 2)

1 Support cradle
2 Jack
3 Flexible mounting
4 Pivot nut
5 Gear selector lever
6 Clutch housing bolt

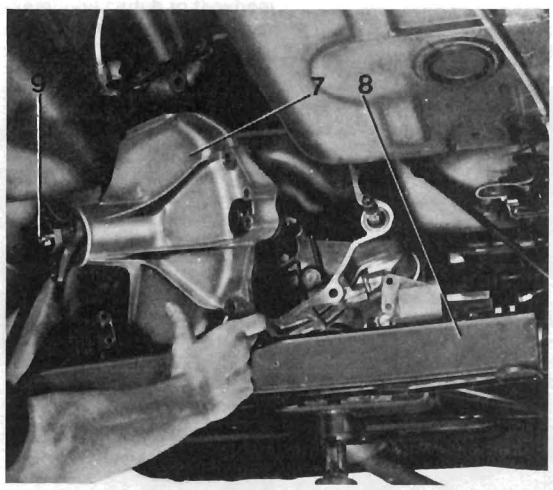


Fig. 6.4 Removing clutch housing (Sec 2)

7 Clutch housing
8 Crossmember
9 Yoke retaining nut

3 Clutch – dismantling

1 With the clutch removed to the bench as described in the preceding Section, unbolt and remove the clutch slave cylinder.
2 Withdraw the gear selector rod and boot.
3 Check that the clutch pressure plate is marked in relation to the flywheel. If it is not, mark it using quick-drying paint.
4 Unbolt and remove the clutch pressure plate from the flywheel.
5 Remove the driven plate, noting that the greater projecting hub and boss are furthest from the flywheel.
6 This will normally be the extent to which dismantling is required for renewal of the driven plate. However if the bearing or centring bush in the clutch housing are worn, extract them in the following way. Remove the yoke nut.
7 Either pull the yoke for the propeller shaft from the flywheel/shaft using a suitable heavy duty puller, or press the flywheel/shaft from the clutch housing. Remove the yoke and the shield. Withdraw the flywheel/shaft from the housing.
8 Extract the clutch shaft bearings and the centring bush as necessary for renewal. The front bearing is retained by a circlip which must be extracted.
9 Now turn your attention to the inside of the clutch bellhousing on the transmission and take the release bearing from the guide sleeve (photo).
10 Take off the release lever dust excluder and slide the lever from the ball pivot stud. A spring clip secures the release lever to the stud (photo).

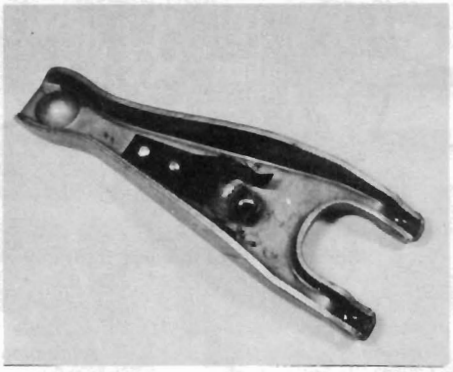
4 Clutch – inspection and renovation

1 Check the condition of the linings on the driven plate. If the friction material has worn down to or nearly down to the rivets, renew the plate.
2 If the linings are relatively unworn but are oil stained, renew the plate and rectify the oil leak, probably from a defective oil seal.
3 Check the torsion springs for breakage and the hub splines for wear.
4 Always renew the clutch driven plate complete, do not attempt to reline it yourself, it seldom proves satisfactory.
5 Check the pressure faces of the flywheel and clutch cover assembly. If grooving is evident, or tiny surface cracks due to overheating are visible, renew the components.
6 Check that the release bearing is not noisy when turned with the fingers. It is recommended that the bearing is renewed as a matter of routine whenever the clutch is dismantled. For the small additional expense involved it is worthwhile fitting a new component rather than one which may be well worn (photo).
7 Check that the driven plate spline backlash on the input shaft does not exceed 0.13 mm (0.005 in). If the plate is new and the backlash is excessive then the input shaft splines must be worn.

5 Clutch – reassembly

1 If the centring bush was extracted, soak the new one in hot oil

3.9 Removing clutch release bearing



3.10 Reverse side of clutch release lever

4.6 Reverse side of clutch release bearing

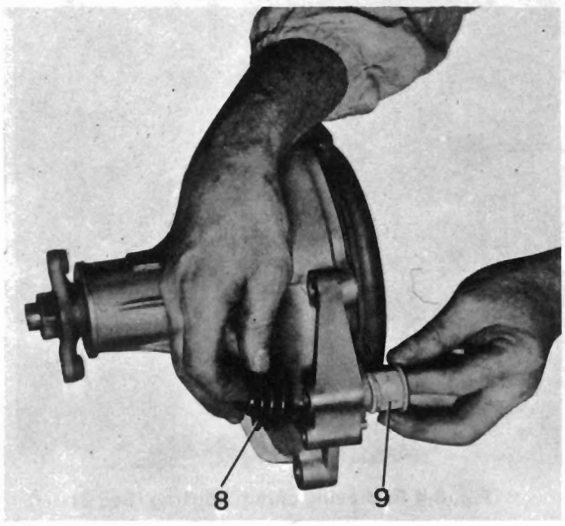


Fig. 6.5 Removing gear selector rod boot (8) and plastic bush (9) (Sec 3)

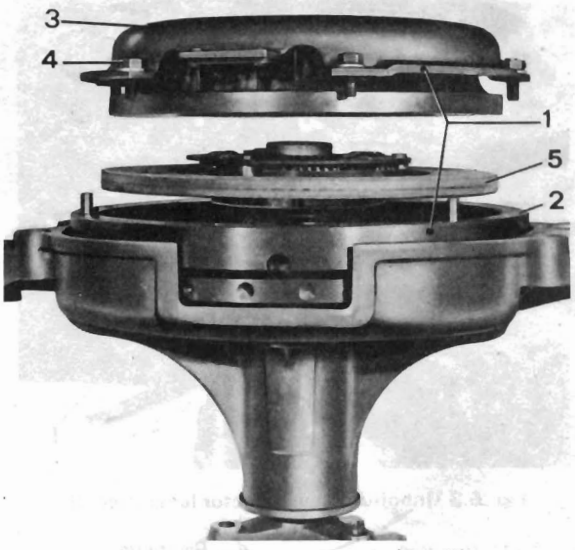


Fig. 6.6 Clutch components (Sec 3)

1 Alignment marks
2 Flywheel
3 Pressure plate cover
4 Cover bolt
5 Driven plate

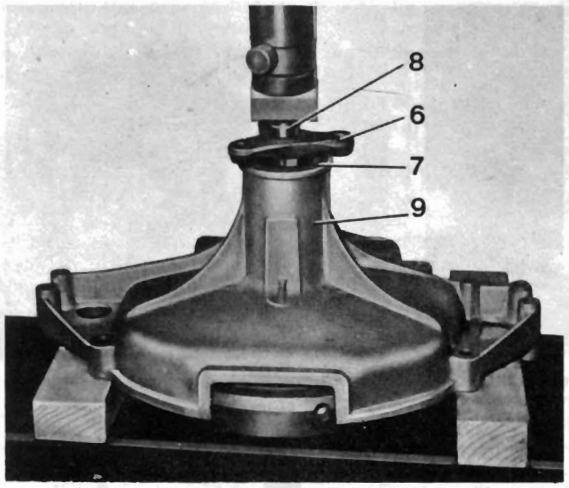


Fig. 6.7 Pressing shaft from clutch housing (Sec 3)

6 Yoke
7 Shield
8 Shaft
9 Housing

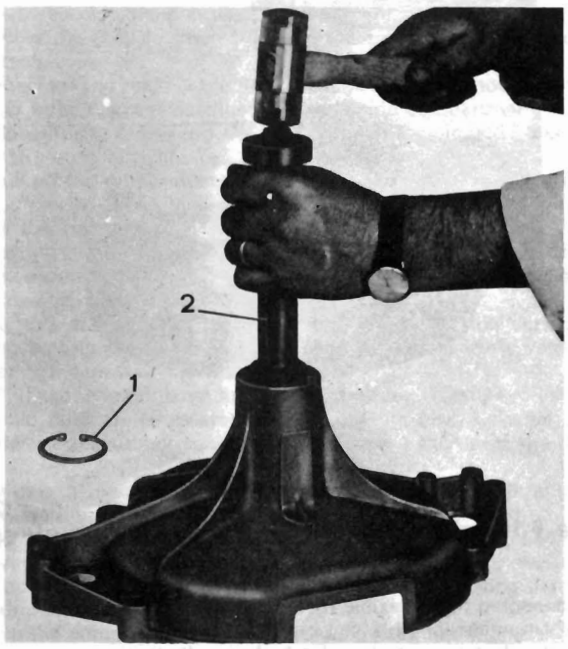


Fig. 6.8 Direction of removal of front bearing (Sec 3)

1 Circlip
2 Drift

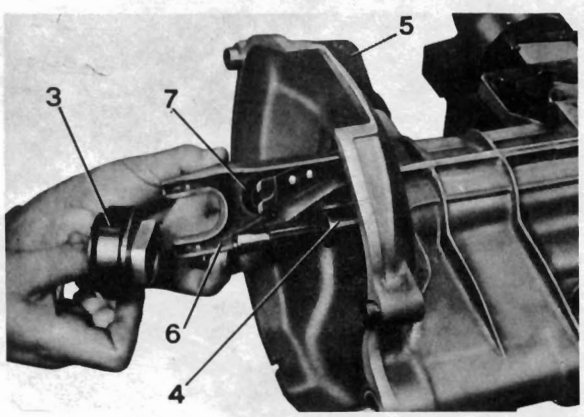


Fig. 6.9 Removing release lever and bearing (Sec 3)

3 Release bearing
4 Bearing guide sleeve
5 Dust cover
6 Release lever
7 Dust excluder

before driving it into position with a piece of tubing or similar.

2 Drive the new front and rear bearings into the clutch housing, applying pressure only to the outer track. Fit the circlip to the front bearing. **Do not** forget the spacer between the bearings.

3 Apply some locking fluid to three equidistant areas around the inside of the rear bearing inner track and press the flywheel/shaft assembly into position.

4 Fit the shield.

5 Apply locking fluid to the shaft splines and fit the propeller shaft connecting yoke.

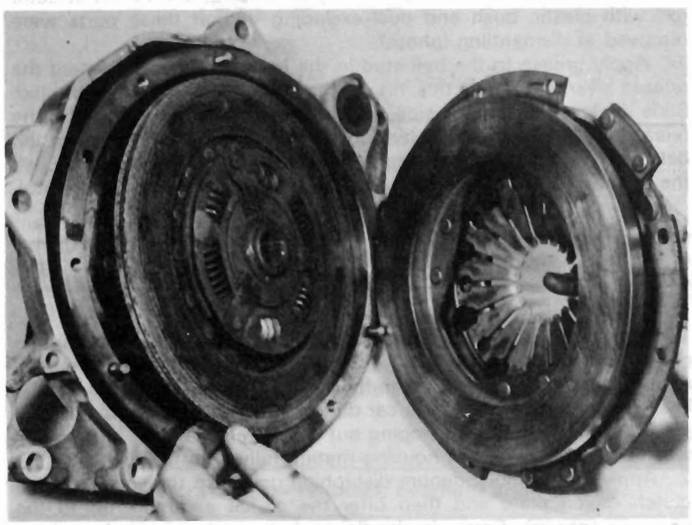
6 Fit the yoke retaining nut and tighten to the specified torque.

7 Locate the driven plate against the flywheel so that the greater projecting hub which holds the torsion springs is away from the flywheel (photo). The other side of the plate may be marked FLYWHEEL SIDE.

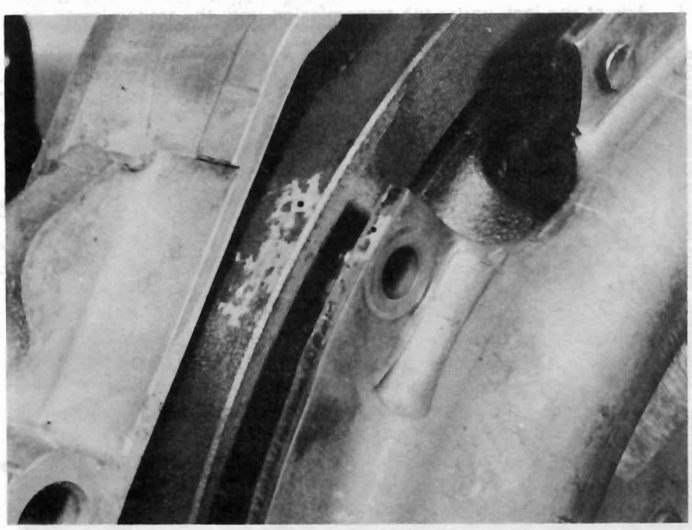
8 Locate the pressure plate on the flywheel, making sure that the alignment marks are in line (photo).

9 Screw in the pressure plate cover bolts finger tight.

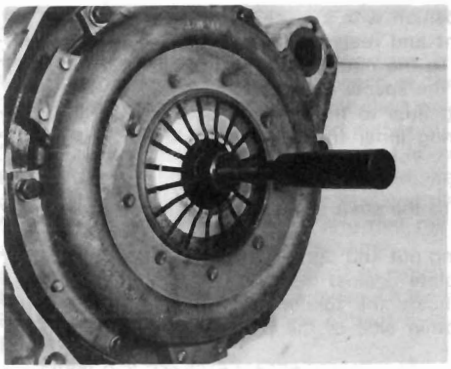
10 The clutch driven plate must now be centred. To do this, a tool must be used to pass through the hub of the driven plate and engage in the bush in the centre of the flywheel. The tool can be a proprietary alignment tool available from most motor tool stores (photo), an old



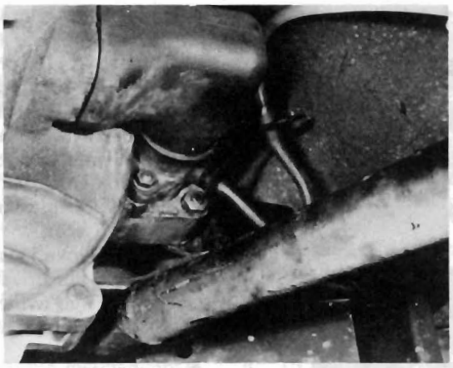
5.7 Assembling clutch to flywheel



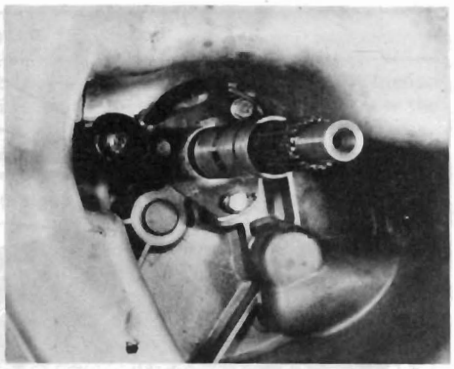
5.8 Clutch pressure plate cover to flywheel alignment marks



5.10 Driven plate alignment



5.13 Clutch slave cylinder dust-excluding boot. Note bleed tube



5.14 Clutch release bearing guide and release lever ball-stud

gearbox input shaft or a rod or dowel having a diameter equal to the splined hole in the clutch plate hub and stepped down at its end to the internal diameter of the bush.

11 Move the alignment tool with a circular motion to ensure that it has centralised the driven plate and is an easy sliding fit in the hub.

12 Withdraw the tool and tighten the clutch pressure plate cover bolts to the specified torque in a diagonal sequence.

13 Bolt the slave cylinder to the clutch housing, and fit the selector rod with plastic bush and dust-excluding boot if these parts were removed at dismantling (photo).

14 Apply grease to the ball-stud in the bellhousing and connect the release lever to it. To do this, first fit the dust-excluder to the ball-stud. Slide the lever in from the side, making sure that the two prongs of the release lever clip engage behind the flange on the pivot stud, not the ball head. Smear a little grease on the bearing guide sleeve and push the bearing on so that its flats engage between the lever fork (photo).

6 Clutch – refitting

Transmission in car

1 Before attempting to offer up the clutch assembly to the end of the gearcase, attach a strong rubber band between the end of the clutch release lever and a projection on the clutch housing. This will keep the lever towards the front of the car during installation of the clutch and stop the release bearing jumping out of the release lever fork, which would prevent the clutch housing mating fully with the gearcase.

2 Apply a little molybdenum disulphide grease to the splines of the clutch driven plate and then offer the clutch assembly up to the gearcase (photo). Screw in the flange bolts and remove the rubber band.

3 Bolt the gear selector lever to the clutch housing and screw on the pivot nut to the specified torque.

4 Adjust the jack under the transmission until the transmission can be reconnected to its flexible mountings and the flexible mounting to the crossmember (photo).

5 Fit the dust cover to the clutch slave cylinder.

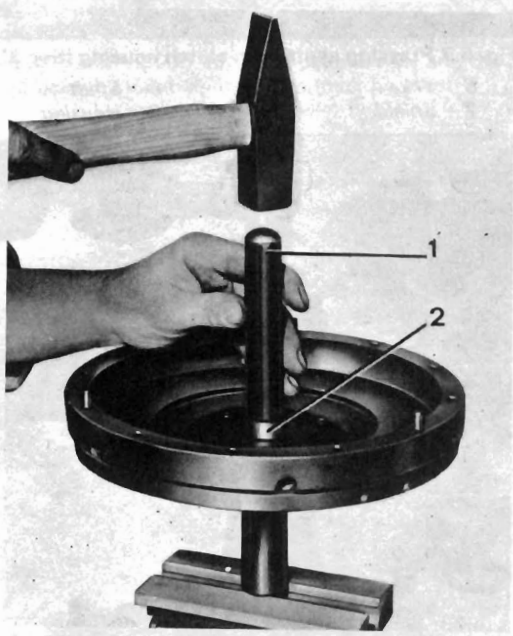
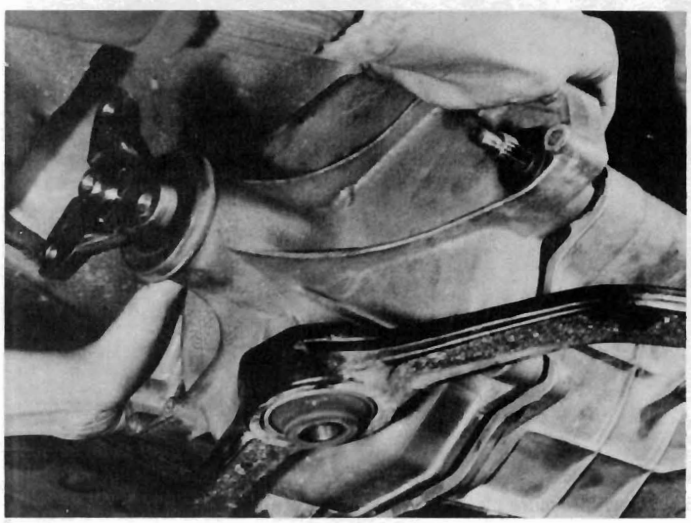
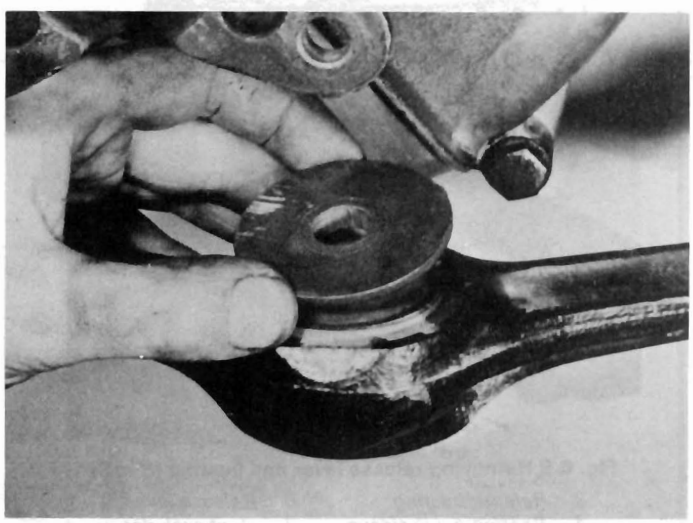


Fig. 6.10 Installing centering bush (2) with drift (1) (Sec 5)



6.2 Fitting the clutch bellhousing to the gearcase



6.4 Transmission crossmember mounting. Note spacer

6 Manipulate the jacks as necessary until the crossmember can be bolted to the body sidemembers.
7 Reconnect the clutch hydrauiic hose and pipe, and anchor them to the support bracket.
8 Grease the seat on the end of the clutch shaft and reconnect the rear end of the propeller shaft to the yoke. Tighten the bolts to the specified torque.
9 Reconnect the gearchange control link rod to the gear lever and the transmission.
10 Refit the front section of the exhaust pipe.
11 Bleed the clutch hydraulic system as described in Section 10.

Transmission out of car

12 The operations are a direct reversal of the operations described in Section 2, paragraphs 16 to 19.

7 Clutch master cylinder – removal, overhaul and refitting

1 Working inside the car, disconnect the master cylinder pushrod and clevis fork from the pedal arm by removing the split pin and clevis pin.
2 Working under the bonnet, unscrew the fluid pipeline from the master cylinder and immediately cap the pipe to prevent the entry of dirt. A bleed nipple cap is useful for this.
3 Allow the fluid to drain from the master cylinder into a suitable receptacle.
4 Unscrew and remove the flange fixing nuts and remove the master cylinder from the rear bulkhead of the engine compartment.
5 Tip out any remaining fluid from the reservoir and clean away external grease and dirt.
6 Pull off the rubber dust excluder from the end of the cylinder and using a pair of circlip pliers, extract the circlip from its groove in the end of the cylinder together with the pushrod.
7 Extract the piston, spring and spring seat. These will probably be ejected automatically but if not, tap the end of the cylinder on a piece of hardwood.
8 At this stage inspect the cylinder bore and piston surfaces for scoring or bright metal-to-metal rubber areas. If evident, renew the master cylinder complete.
9 If these components are in good order, clean everything in hydraulic fluid or methylated spirit – nothing else. Observe the lip direction of the rubber seals and then remove the seals and discard them.
10 Obtain a repair kit which will contain the new seals and other renewable items.
11 Do not remove the fluid reservoir unless essential, and if it is removed, always fit a new rubber seal to its connecting neck.
12 Commence reassembly by fitting the new seals, using the fingers only to manipulate them into place.
13 Dip the components in clean hydraulic fluid before inserting them into the cylinder. Take care not to trap the seal lips.
14 Use a rod to depress the end of the piston against spring pressure while the pushrod and retaining circlip are engaged.
15 Refit the master cylinder by reversing the removal operations, but just before reconnecting the hydraulic pipeline, half fill the fluid reservoir and operate the push rod two or three times to prime the cylinder. Catch any fluid which may be ejected.
16 Reconnect the pipeline and then bleed the system as described in Section 10.

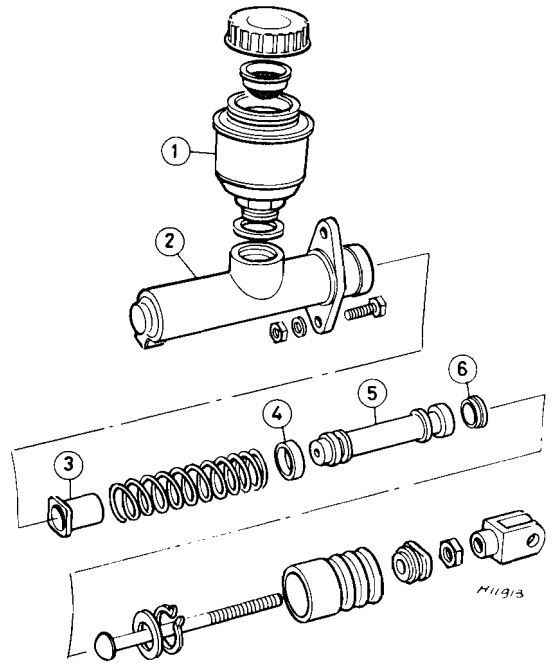


Fig. 6.11 Exploded view of typical master cylinder (Sec 7)

1 Fluid reservoir
2 Master cylinder body
3 Spring retainer
4 Seal
5 Piston
6 Seal

8 Clutch slave cylinder – removal, overhaul and refitting

1 Position the rear of the car over an inspection pit, or raise the rear wheels on ramps.
2 Disconnect the flexible hydraulic hose from the rigid pipeline and release the hose from its bracket.

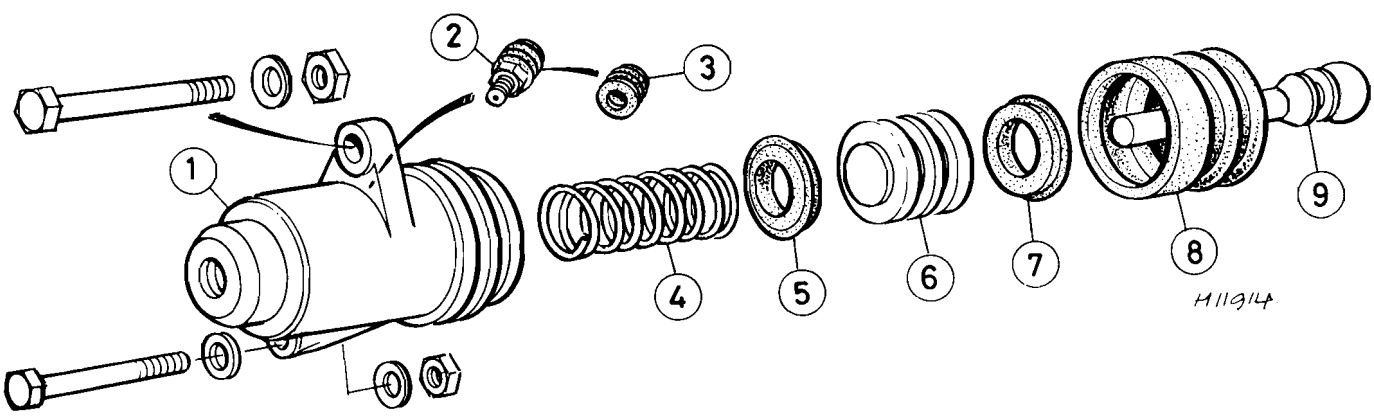


Fig. 6.12 Exploded view of typical clutch slave cylinder (Sec 8)

1 Cylinder body
2 Bleed nipple
3 Dust cap
4 Spring
5 Seal
6 Piston
7 Seal
8 Boot
9 Pushrod

3 Cap the end of the pipeline to reduce fluid loss, a bleed nipple rubber cap is useful for this purpose.
4 Prise back the dust cover and unscrew the slave cylinder mounting bolts. Remove the cylinder, obtaining more clearance if necessary by pulling the release lever away towards the rear of the car. Take care not to exert a side pull on the lever or it may become released from its ball pivot.
5 Overhaul of the slave cylinder is identical to the master cylinder. Reference should be made to the Section 7, paragraphs 7 to 13.
6 Refit the slave cylinder by reversing the removal operations.
7 Bleed the hydraulic system as described in Section 10.

9 Clutch pedal – adjustment

1 This is not a routine adjustment and will only be required after fitting new components. Refer to Chapter 8, Section 14 (LHD), or Section 11 of this Chapter for RHD models.
2 When correctly adjusted, the following dimensions should apply:

Maximum clutch pedal stroke	*140 mm (5.5 in)*
Master cylinder mounting face to furthest side of pedal clevis pin	*99.5 mm (3.9 in)*
Clutch release lever movement	*11.1 mm to 12.7 mm (0.44 in to 0.50 in)*

3 If adjustment is required, release the locknut on the master cylinder pushrod and rotate the pushrod. Tighten the locknut on completion without moving the setting of the push-rod.
4 Further adjustment can be made to the clutch pedal slide by varying the number of pedal box shims at the clutch pedal nuts.

10 Clutch hydraulic system – bleeding

1 Whenever the clutch hydraulic system has been 'broken' by removing a component, it must be bled of air which will have entered the system.
2 One of three methods may be used:

(a) Two-man method
(b) Using a one-way valve
(c) Pressure bleeding

3 All three methods are described in Chapter 8 for bleeding the brakes. The operations for bleeding the clutch are almost identical, except that only one bleed screw is used and this is located on the slave cylinder.
4 On completion, top up the fluid reservoir on the master cylinder to the level marked.

11 Clutch pedal – removal and refitting

The procedure below applies to RHD cars. For LHD models, refer to Chapter 8, Section 14.
1 Remove the steering column lower shroud and then reach up under the facia panel and disconnect the pushrod clevis fork from the pedal arm by removing the split pin and clevis pin.
2 Remove the retaining clip from the end of the pedal pivot shafts.
3 Take off the washer and push out the pivot shaft. Withdraw the pedal.
4 Refitting is a reversal of removal, but on completion, check the pedal adjustment as described in Section 9.

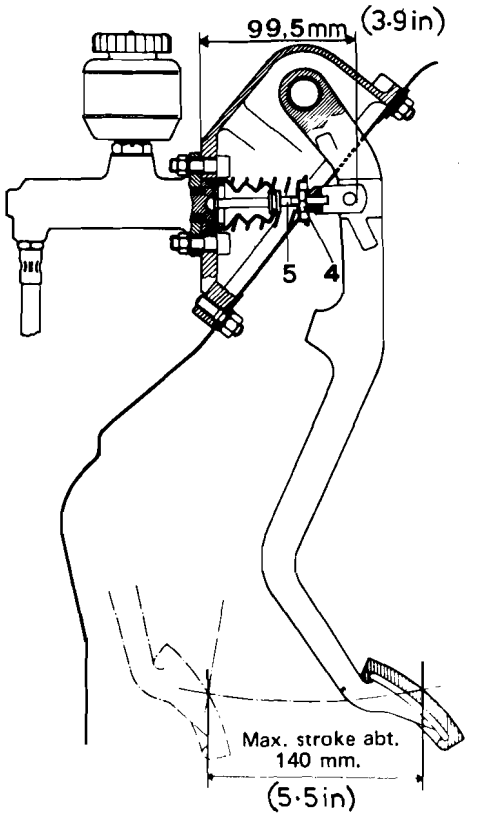


Fig. 6.13 Clutch pedal setting diagram (Sec 9)

4 Locknut *5 Pushrod*

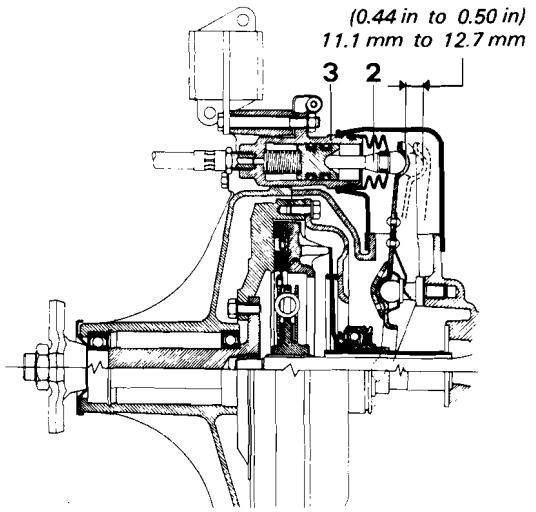


Fig. 6.14 Clutch release lever operating arc (Sec 9)

2 Cylinder piston pushrod *3 Cylinder body*

12 Fault diagnosis – clutch

Symptom	Reason(s)
Judder when taking up drive	Loose engine or gearbox mountings Badly worn friction linings or contaminated with oil Worn splines on gearbox input shaft or driven plate hub Worn input shaft spigot bush in flywheel
Clutch spin (failure to disengage) so that gears cannot be meshed	Incorrect release bearing to pressure plate clearance due to rust. May occur after vehicle standing idle for long periods Damage or misaligned pressure plate assembly Fault in hydraulic system
Clutch slip (increase in engine speed does not result in increase in vehicle road speed – particularly on gradients)	Incorrect release bearing to pressure plate finger clearance Friction linings worn out or oil contaminated
Noise evident on depressing clutch pedal	Dry, worn or damaged release bearing Wash release lever spring Excessive play between driven plate hub splines and input shaft splines
Noise evident as clutch pedal released	Distorted driven plate Broken or weak driven plate cushion coil springs Weak release lever spring Distorted or worn input shaft Release bearing loose on retainer hub

Chapter 7 Transmission

For modifications, and information applicable to later models, see Supplement at end of manual

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Specifications

Transmission type	Rear, independently mounted, integral clutch, gearbox and final drive. Power transmitted through open driveshafts with CV joints
Gear ratios	
1st	3.30 : 1
2nd	2.00 : 1
3rd	1.37 : 1
4th	1.04 : 1
5th	0.83 : 1
Reverse	2.62 : 1
Final drive ratio	
1.6 l models	4.3 : 1
1.8 l and 2.0 l models	4.1 : 1
Lubricant capacity	2.85 litres (5.0 Imp pints, 3.0 US quarts)

Torque wrench settings	**Nm**	**lbf ft**
Intermediate flange nuts	14	10
Selector lever nut	35	26
Reversing lamp switch	49	36
Driveshaft inboard bolts	30	22
Hydraulic pipeline union nuts	10	7
Mainshaft nut	115	85
Detent plug	16	12
Input shaft nut	100	74
Crownwheel bolts	75	55
Differential side cover bolts	23	17
Caliper bolts	54	40
Selector fork lock screw	23	17

1 Description

The rear-mounted transmission incorporates the clutch, gearbox and the final drive.

The clutch is covered separately in Chapter 6, to which reference should be made.

The gearbox is of five-speed all-synchromesh type, plus reverse, having a floor-mounted gearchange lever.

The constant mesh forward gears have helical teeth for silent operation. Reverse gear has straight cut teeth.

The final drive is of crownwheel and pinion hypoid type.

2 Transmission – maintenance

1 The oil used in the transmission provides a common supply for both the gearbox and the differential.

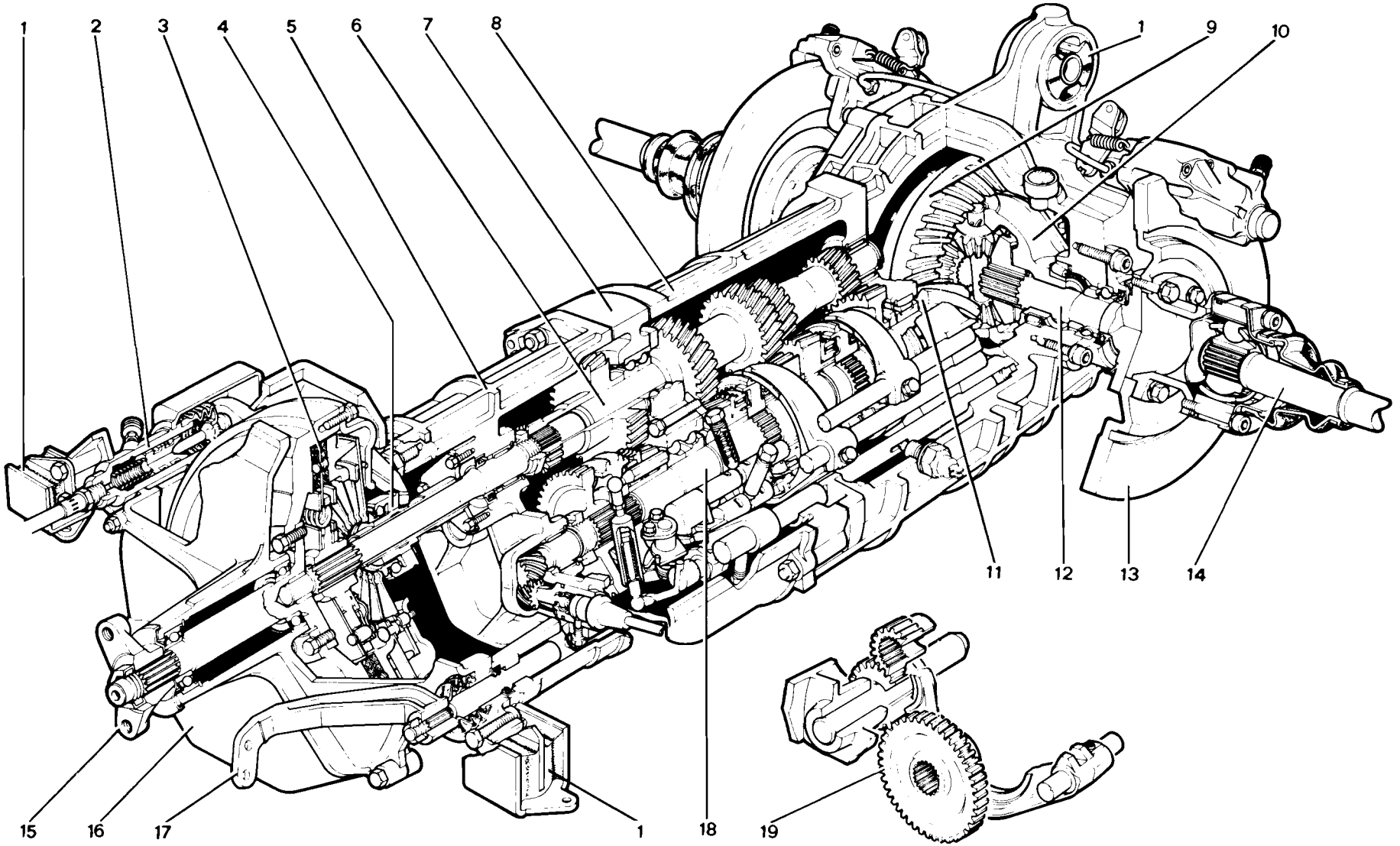
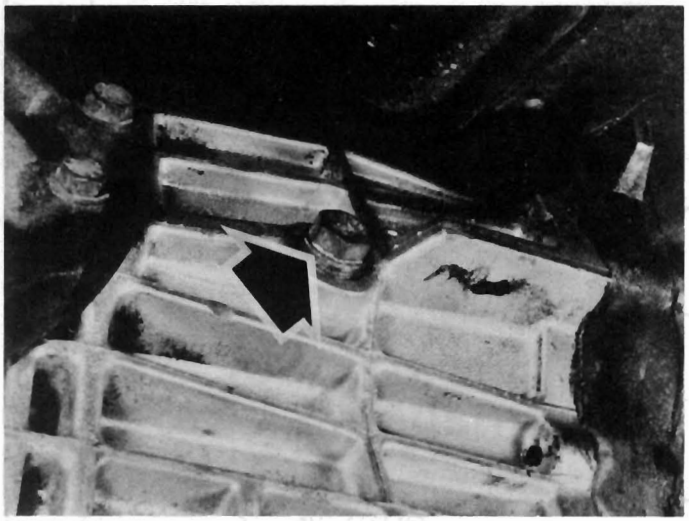
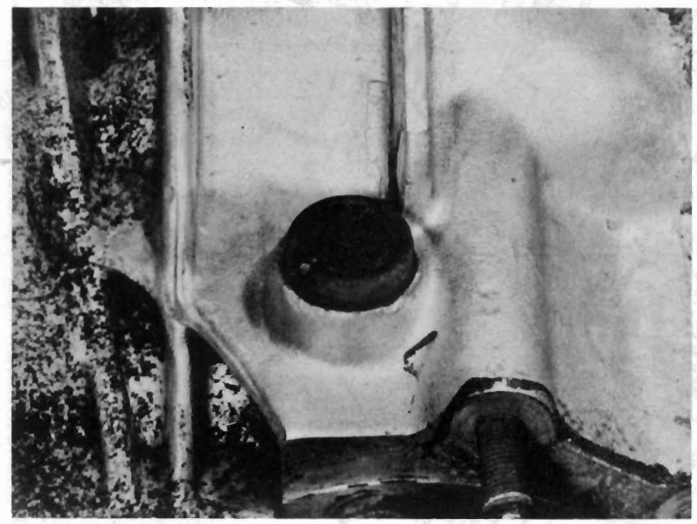


Fig. 7.1 Cutaway view of transmission (Sec 1)

1 *Front flexible mountings*
2 *Clutch slave cylinder*
3 *Clutch driven plate*
4 *Clutch release bearing*
5 *Gearcase/clutch bellhousing*
6 *Input shaft*
7 *Intermediate flange*
8 *Final drive housing*
9 *Crownwheel*
10 *Differential carrier*
11 *Pinion gear*
12 *Output inner driveshaft*
13 *Brake disc*
14 *Outboard driveshafts*
15 *Yoke (spider)*
16 *Clutch cover*
17 *Reverse gearchange lever*
18 *Mainshaft*
19 *Reverse gear components*



2.2 Oil filler/level plug (arrowed)



2.6 Breather must be kept clean

2 At the intervals specified in Routine Maintenance, wipe the filler/level plug on the side of the transmission and unscrew it. The oil level should be at the bottom of the plug hole. If necessary add oil of the specified type until it just starts to run out, then refit the plug (photo).
3 Also at the specified intervals, with the transmission hot, remove the level and the drain plugs and allow the oil to drain into a suitable container.
4 Clean the plugs and refit the drain one.
5 Fill the transmission with the correct quantity and grade of oil until it just starts to flow out of the filler/level plug hole. Refit the plug.
6 Keep the breather on the clutch bellhousing clean (photo).

3 Gearbox and final drive – methods of removal

1 If the gearbox and the final drive are both to be overhauled, then the complete transmission (clutch, gearbox and final drive) should be removed as one unit and then separated.
2 If only the gearbox is to be overhauled, this can be removed on its own, leaving the final drive in the car.
3 Removal of the gearbox alone is more likely to be required for the purpose of renewing synchro units, in which case a much smaller weight will have to be contended with than would be found when removing the complete transmission.
4 Should the pinion drivegear be worn, this will necessitate renewal not only of the gearbox mainshaft but also of the crownwheel in the final drive, as they must be renewed together and are only supplied as a matched pair.

4 Gearbox – removal without final drive

1 Refer to Chapter 6 and remove the clutch assembly.
2 Withdraw the clutch release bearing from its guide bush. Slide the release lever off its ball-stud and remove it together with its dust excluder.
3 Disconnect the leads from the reversing lamp switch and unscrew and remove the switch.
4 Unscrew and remove the speedometer drive locking screw and withdraw the drive from the transmission.
5 Unscrew and remove the nuts which hold the forward section of the gearcase to the intermediate flange.
6 At this stage, clamp the intermediate flange to the final drive housing to prevent them separating when the front gearcase section is withdrawn. Small clamps or two pairs of self-locking grips should serve this purpose.
7 Withdraw the gearcase front section, which incorporates the clutch bellhousing. Tap the end of the selector rod with a plastic-faced hammer if necessary to release the gearcase.
8 Take off the reverse sliding gear.
9 Remove the temporary flange clamps.
10 Withdraw the intermediate flange complete with geartrains and selector gear.
11 Take care to rest the assembly on a clean grit-free surface.

5 Transmission (complete) – removal

1 Place the car over an inspection pit or raise the rear end on ramps.
2 Drain the transmission oil.
3 Release the clamp which secures the front section of the exhaust pipe to the rear section. Apply releasing fluid to the pipe joint.
4 Prise off the exhaust rubber suspension rings from the retainers at the front of the transmission.
5 Unbolt the exhaust downpipes from the exhaust manifold.
6 Disconnect the exhaust pipe bracket at the engine rear mounting.
7 Separate the front pipe from the rear section and remove it.
8 Slide back the rubber dust cover from the base of the gear lever under the car and unscrew the link rod connecting bolt.
9 Working at the opposite end of the link rod, disconnect it from the selector lever on the transmission. Remove the link rod.
10 Unscrew the connecting bolts and disconnect the propeller shaft rear coupling. Tie the shaft up or support it carefully.
11 Unscrew the locking bolt and pull the speedometer drive cable out of the side of the transmission casing.
12 Disconnect the electrical leads from the reversing lamp switch.
13 Disconnect the clutch fluid pipeline at the union adjacent to the propeller shaft rear coupling and plug the open ends of the pipes. Release the hose fitting from the bracket on the body.
14 Disconnect and plug the hydraulic brake pipeline at its bracket close to the brake disc. Release the hose fitting from the bracket on the body.
15 Disconnect the handbrake cables from their caliper levers by unscrewing the adjuster nut and locknut.
16 Unbolt the driveshaft from the disc brake spacers and tie or support the shafts out of the way.
17 Unbolt the axle crossmember from the body (three bolts each side).
18 Place a jack under the rear suspension lower tube and carefully raise it. This will have the effect of causing the front end of the transmission to incline downwards until it is possible to reach the bolts which hold the transmission to the flexible mountings on the front crossmember.
19 Before unscrewing these bolts, place a block of wood between one of the axle side tubes and the body.
20 The transmission may require slightly raising before these bolts can be withdrawn.
21 Move the second jack to raise the rear end of the transmission just enough to relieve the rear flexible mounting bush of any tension, then unscrew and remove the mounting bolt.

22 The rear end should now be lowered and the transmission withdrawn from under the rear axle tube. The unit is very heavy, so have assistance and employ a trolley jack to control the descent.

6 Gearbox – separation from final drive

1 With the complete transmission removed, clean away all external dirt using paraffin or a water-soluble solvent, and a stiff brush.
2 With the unit resting securely on the bench, or on a sheet of plywood or chipboard on the floor, slacken and then remove the nut and washer which retain the selector lever. Remove the lever.
3 Remove the rubber dust cover from the clutch slave cylinder.
4 Unscrew and remove the bolts which hold the clutch housing to the gearbox.
5 Withdraw the clutch assembly in a straight line from the input shaft.
6 From inside the clutch bellhousing, withdraw the release bearing and then slide the release lever off its ball-stud. Remove the lever with its dust excluder.
7 Unscrew and remove the reversing lamp switch.
8 Fully unscrew the speedometer drive lock screw and withdraw the speedometer drivegear.
9 Unscrew and remove the nuts which secure the gearcase to the intermediate flange.
10 Withdraw the gearcase and remove the sliding reverse pinion.
11 Using a plastic-faced hammer, tap the intermediate flange complete with geartrain from the final drive housing.

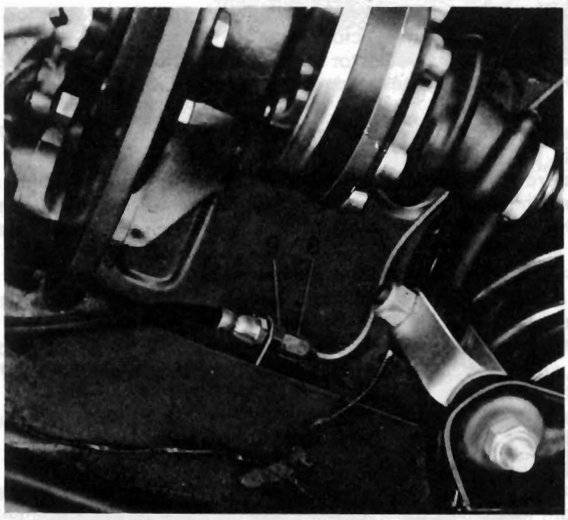


Fig. 7.2 Brake pipeline at propeller shaft rear coupling (Sec 5)

8 Union nut 9 Bracket clamp nut

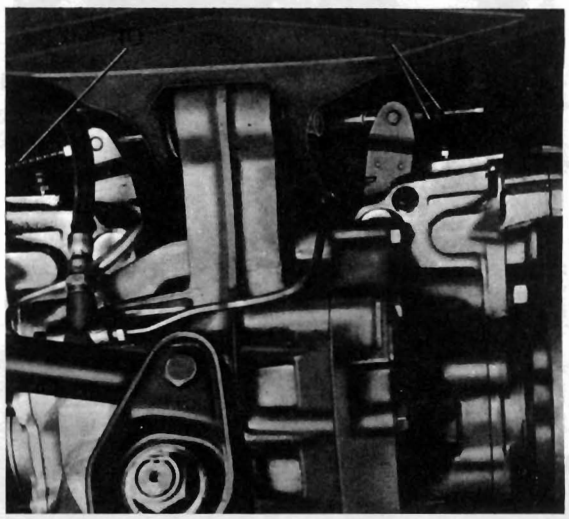


Fig. 7.3 Handbrake cable connections to calipers (Sec 5)

10 Cable 11 Adjuster nut and locknut

Fig. 7.4 Rear axle crossmember bolts (5) (Sec 5)

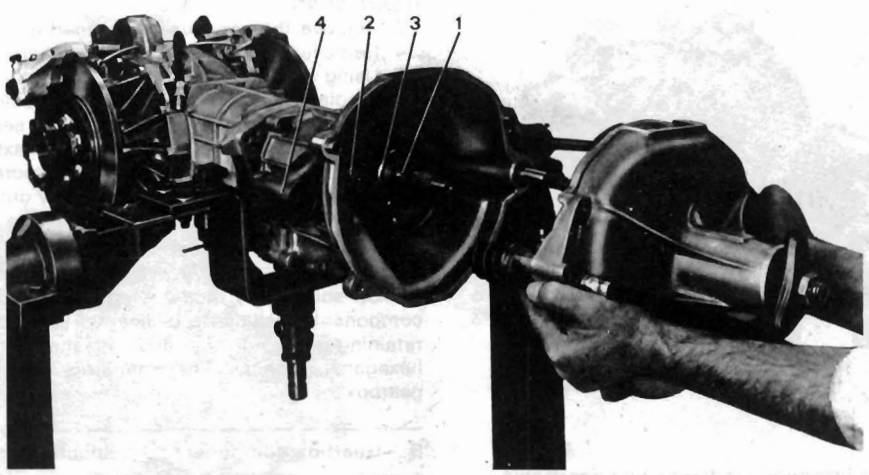


Fig. 7.5 Removing the clutch (Sec 6)

1 Release bearing guide sleeve 2 Release lever 3 Release bearing 4 Dust excluder

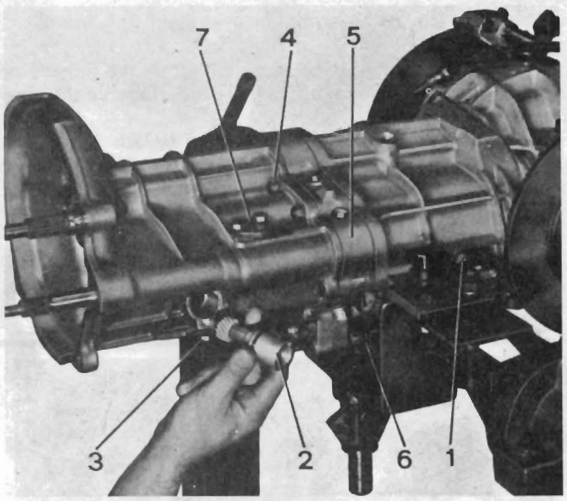


Fig. 7.6 Gearbox disconnection items (Sec 6)

1 Reversing lamp switch
2 Speedometer drivegear
3 Speedometer drivegear lockscrew
4 Gearcase flange securing nuts
5 Intermediate flange
6 Supporting cradle
7 Cover plate (reverse safety interlock)

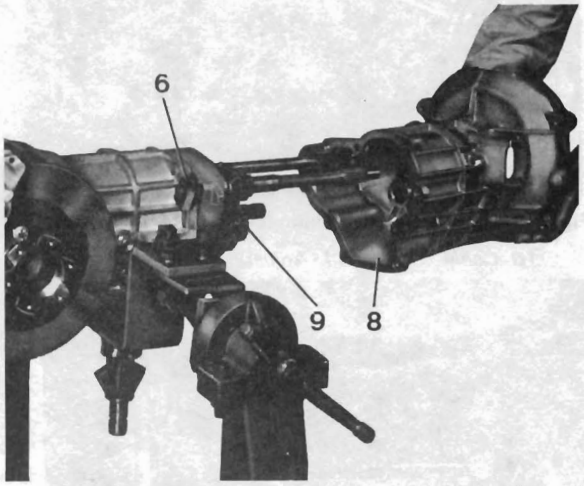


Fig. 7.7 Withdrawing the gearcase/clutch housing (Sec 6)

6 Temporary flange clamp
8 Casing
9 Reverse sliding pinion

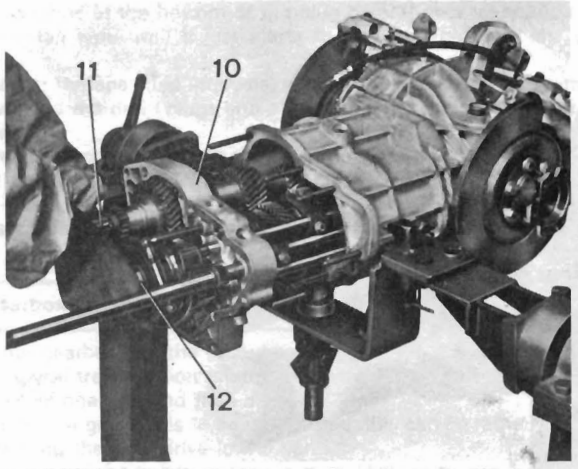


Fig. 7.8 Withdrawing the intermediate flange and geartrains (Sec 6)

10 Intermediate flange
11 Input shaft
12 Mainshaft

7 Gearbox – dismantling

1 Bolt a suitable bracket to the gearbox intermediate flange and grip this in a vice to give firm support to the assembly.
2 Remove the detent spring plugs, springs and balls from the edge of the intermediate flange.

Mainshaft

3 Withdraw 5th/reverse selector shaft. In order to do this, the shaft dog and selector fork will have to be rotated to make the necessary clearance for withdrawal.
4 Grip the end of the gear selector rod and remove it through the intermediate flange. The ends of the centralising spring will slide off the retaining pillar.
5 Unscrew the locking screws on the two remaining selector forks.
6 Withdraw 1st/2nd selector shaft.
7 Withdraw 3rd/4th selector shaft and take the forks for both shafts from their grooves in the synchro rings. Note the O-ring on the 3rd/4th shaft.
8 Using a thin rod, extract the interlock plungers from the detent holes in the intermediate flange.
9 Before any further dismantling is carried out, the dimension between the inside face of the intermediate flange and the end face of the drive pinion must be measured. This will be required to reset the pinion after overhaul, assuming that new components are going to be fitted to the gearbox but not to the final drive. If parts of the final drive are to be renewed, then the measurement will not be required as the setting up procedure will be as described in Section 11.
10 Where the dimension is to be measured, use a pillar and dial gauge or accurate calipers. The nominal measurement is 226.7 mm (8.925 in).
11 Move the synchronisers to engage two gears at the same time and so lock-up the geartrains.
12 Slacken the nut on the input shaft.
13 Unscrew the nut from the end of the mainshaft and remove it.
14 From the end of the mainshaft take off the reverse gearwheel, 5th speed synchro, 5th speed gear with its needle roller bearing and bush.
15 Make sure that the 3rd/4th synchro sleeve is fully engaged with 4th gear and tap the end of the mainshaft with a plastic hammer to drive the shaft from the intermediate flange. As it is withdrawn, remove the intermediate ball-race half section.
16 From the mainshaft take off the ball-race half section, the distance piece used to adjust the pinion height, the 4th speed bush and gear.
17 Remove 3rd/4th synchro sleeve and hub.
18 Remove 3rd speed gear and bush.
19 Remove 2nd speed gear and bush.
20 Remove 1st/2nd synchro hub and sleeve.
21 Remove 1st speed gear.
22 Using a press or an extractor and suitable distance pieces, remove the mainshaft rear roller bearing and distance piece.

Input shaft

23 Remove the previously slackened nut from the input shaft.
24 Remove 5th speed and reverse gears.
25 Using a plastic-faced hammer, tap the end of the shaft out of the intermediate flange. Remove the shaft ball-races, keeping their components identified as to originally fitted sequence.
26 The bearings can be removed by extracting the circlips or by applying pressure to the inner track, according to type.
27 With the gearbox dismantled, carry out the inspection procedures given in the next Section.

Special note – early model gearboxes

28 On some early model gearboxes (refer to Fig. 7.9), the selector components included a balljointed link rod and a return spring. The retaining pillar for the ends of the centralising spring was also hexagonal in shape. These features are not found in the later type gearbox.

8 Gearbox components – inspection

1 Check all gears for chipped or worn teeth and 'rocking' on the shaft. Renew the gears and bushes as appropriate.
2 Check the shafts for scoring or worn splines.

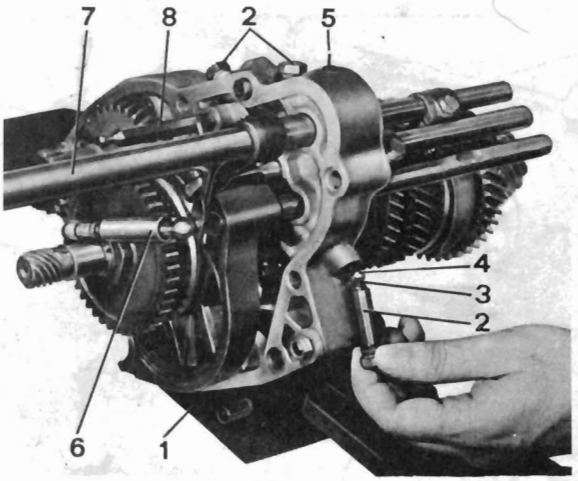


Fig. 7.9 Selector components (Sec 7)

1 *Vice mounting bracket*
2 *Detent spring plugs and guide*
3 *Detent spring*
4 *Detent ball*
5 *Return spring (early model)*
6 *Spring link (early models)*
7 *Gear selector rod*
8 *Hexagonal pillar*

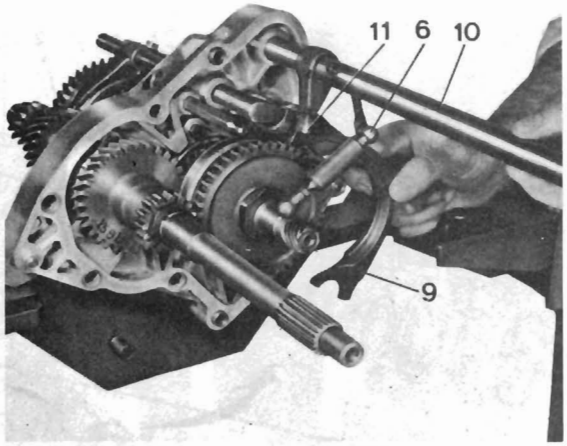


Fig. 7.10 Removing 5th/reverse selector shaft (Sec 7)

6 *Spring link*
9 *Reverse gear selector fork*
10 *Gearchange rod*
11 *Dog*

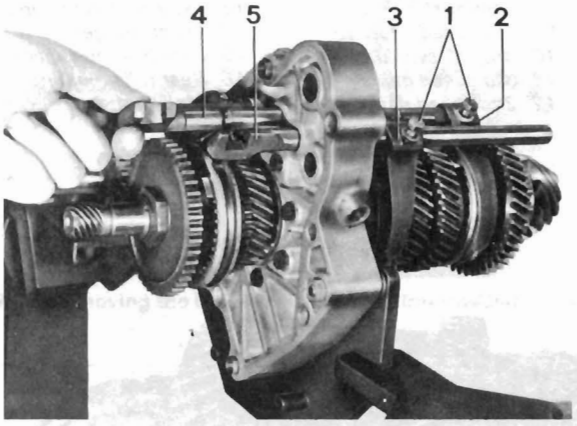


Fig. 7.11 Removing lower speed selector shaft (Sec 7)

1 *Ford lockscrews*
2 *1st/2nd fork*
3 *3rd/4th fork*
4 *1st/2nd selector shaft*
5 *3rd/4th selector shaft*

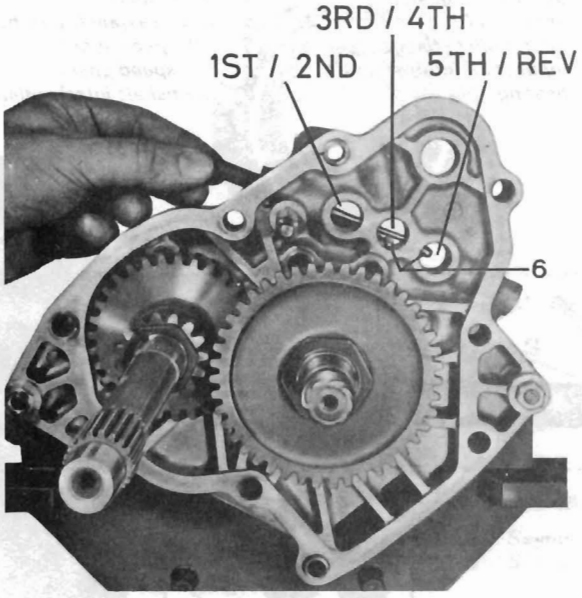


Fig. 7.12 Removing detent interlock plungers (6) (Sec 7)

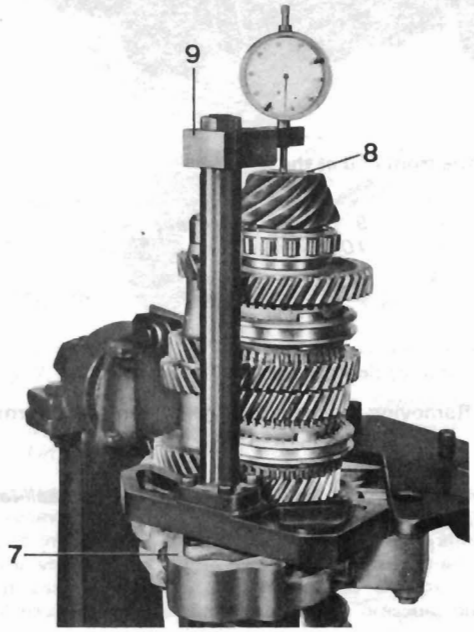


Fig. 7.13 Measuring the distance from the intermediate flange to the drive pinion gear end face (Sec 7)

7 *Intermediate flange*
8 *Pinion gear*
9 *Pillar gauge (zero at nominal height of 226.7 mm (8.925 in))*

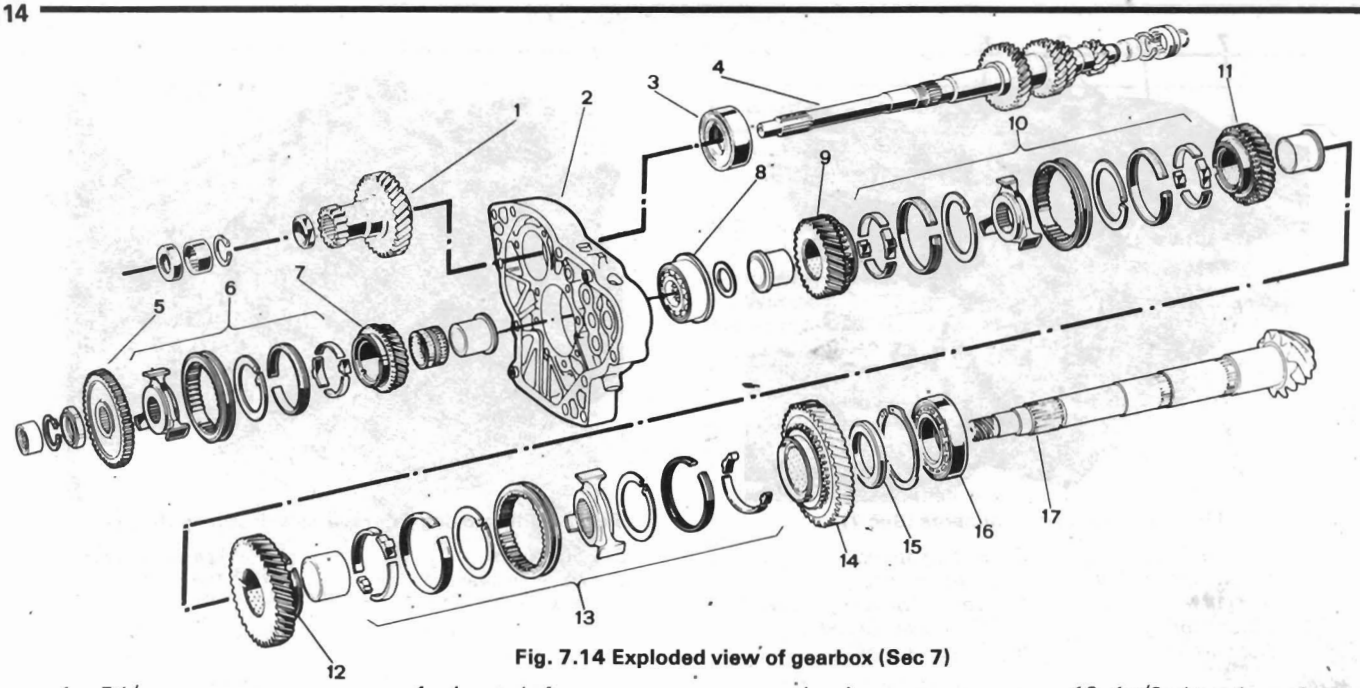


Fig. 7.14 Exploded view of gearbox (Sec 7)

1 5th/reverse gear (input shaft)
2 Intermediate flange
3 Input shaft intermediate bearing
4 Input shaft
5 Reverse gear (mainshaft)
6 5th speed synchro
7 5th speed gear
8 Mainshaft intermediate bearing
9 4th speed gear
10 3rd/4th synchro unit
11 3rd speed gear
12 2nd speed gear
13 1st/2nd synchro unit
14 1st speed gear
15 Rear bearing spacer
16 Rear roller bearing
17 Mainshaft

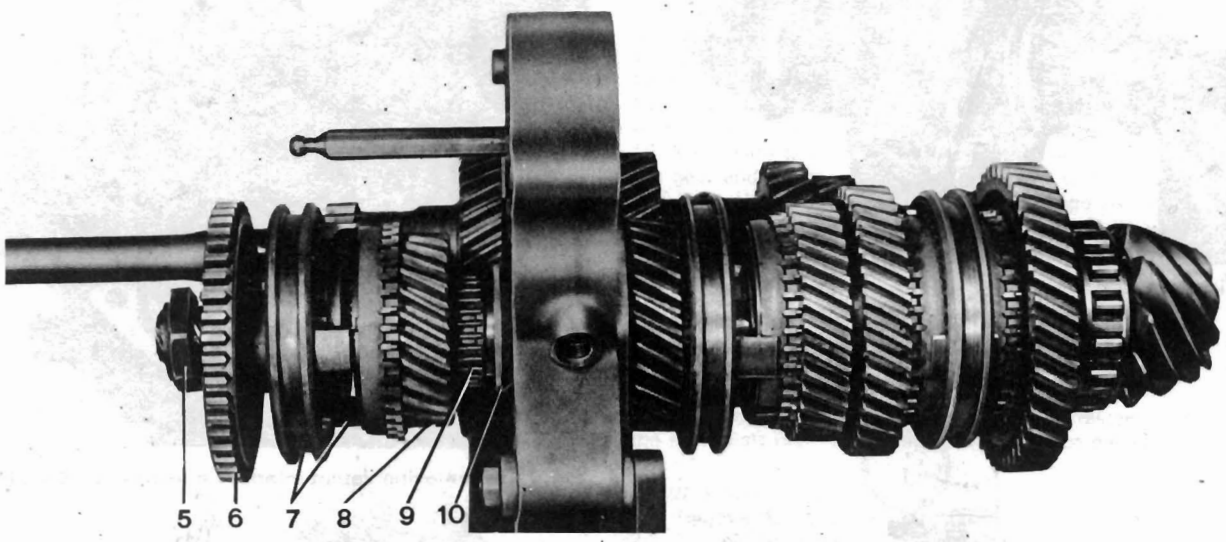


Fig. 7.15 Removing components from the front end of the mainshaft (Sec 7)

5 Nut
6 Reverse gear
7 5th speed synchro
8 5th speed gear
9 Needle roller cage
10 Bush

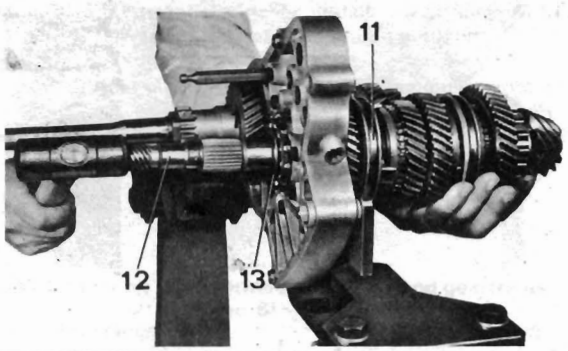


Fig. 7.16 Removing mainshaft geartrain from the intermediate flange (Sec 7)

11 3rd/4th synchro sleeve
12 Mainshaft
13 Front ball-race

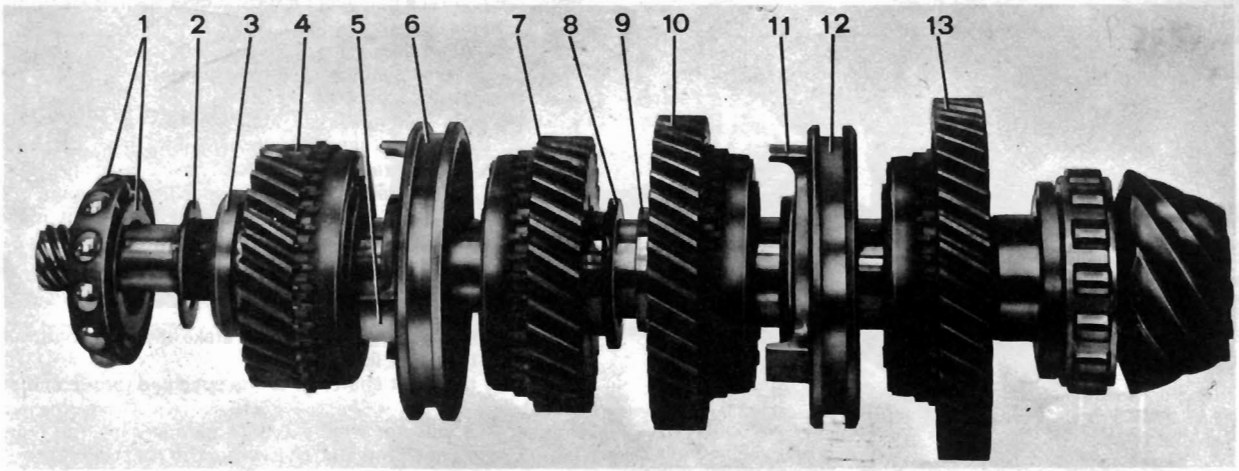


Fig. 7.17 Mainshaft rear end components (Sec 7)

1 *Ball cage*
2 *Distance piece (pinion height adjusting)*
3 *Bush*
4 *4th speed gear*
5 *3rd/4th synchro hub*
6 *3rd/4th synchro sleeve*
7 *3rd speed gear*
8 *Bush*
9 *Bush*
10 *2nd speed gear*
11 *1st/2nd synchro hub*
12 *1st/2nd synchro sleeve*
13 *1st speed gear*

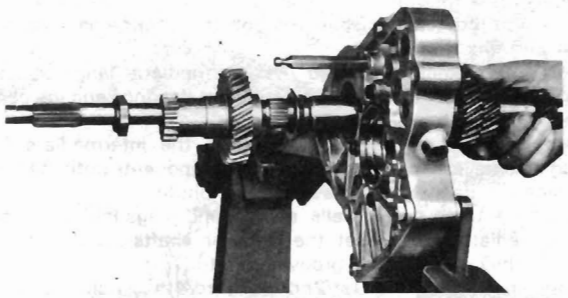


Fig. 7.18 Removing the input shaft from the intermediate flange (Sec 7)

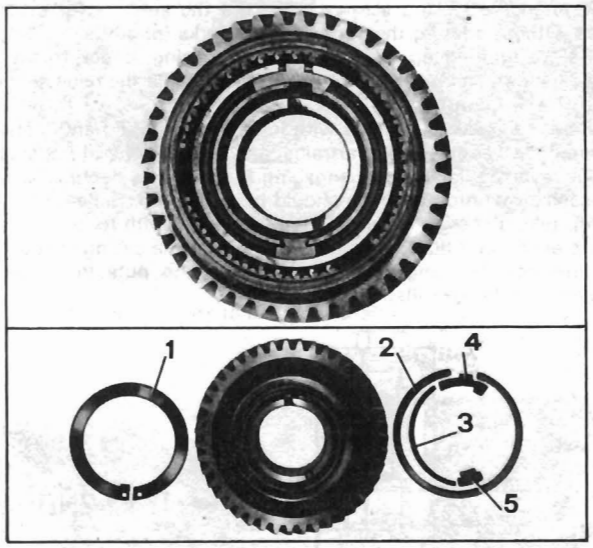


Fig. 7.19 Parts of 1st/2nd synchro unit (Sec 8)

1 *Circlip*
2 *Synchroniser ring*
3 *Limit strip*
4 *Segment*
5 *Segment*

3 If the bearings are noisy when turned or do not turn smoothly in their tracks, renew them. The bearing outer tracks will require a press to remove and install them in the intermediate flange, although the jaws of a large vice can substitute using suitable collars and spacers.
4 The gear casing bearings are retained by circlips. Again the bearings will have to be pressed out, applying pressure only to the outer track.

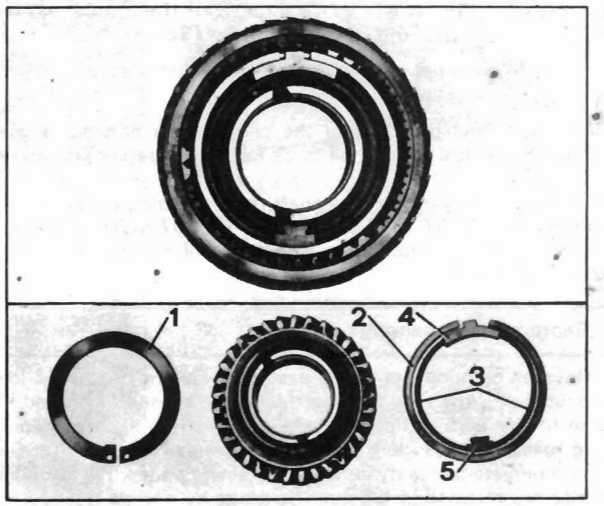


Fig. 7.20 Parts of 3rd/4th and 5th synchro units (Sec 8)

1 *Circlip*
2 *Synchroniser ring*
3 *Limit strip*
4 *Segment*
5 *Segment*

5 Check the selector shaft guide bushes in the casing and renew these if worn.
6 Renew all oil seals as a matter of routine.
7 Check the detent grooves in the selector shafts. If these are worn or the detent balls are in poor shape, or the spring free length is less than 30.6 mm (1.205 in), renew the components.
8 The synchroniser units should now be checked. If there has been a history of noisy gearchanging, or the synchro on certain gears could be easily 'beaten', then renew the components or complete unit after carrying out the following tests.
9 Place each selector fork in its synchro sleeve groove and using a feeler blade, check the side clearance. This should be between 0.2 and 0.5 mm (0.008 and 0.020 in). Excessive clearance can cause the transmission to jump out of gear. Wear usually occurs in the selector fork, not the synchro sleeve.
10 To dismantle a synchro unit, extract the circlip using circlip pliers.
11 Take out the synchro ring.
12 Remove the limit strips with the segments.
13 Check that the rings are not badly worn, and that the points of the limiting strips have not been overheated (indicated by distortion or cracking).
14 The sleeves must slide freely on their hubs.
15 Check that the dog teeth on sleeves and gears are not excessively worn.

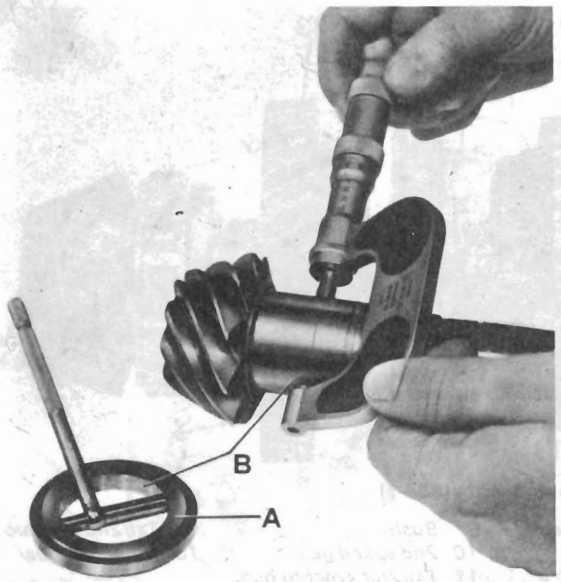


Fig. 7.21 Checking the interference fit of the mainshaft pinion bearing distance piece (Sec 8)

A Thrust face B Shaft contact area

16 Do not interchange any of the components between the three synchro assemblies. Renew parts as necessary, repair kits are available.
17 Finally, check that the mainshaft pinion bearing distance piece is an interference fit (0.019 to 0.060 mm – 0.0007 to 0.0024 in) on the shaft; and that its thrust face is not out of square by more than 0.02 mm (0.00079 in).

9 Gearbox – reassembly

1 Have all components clean, casing flanges free from old jointing compound, and the new bearing tracks and oil seals installed. Apply grease to the oil seal lips and apply gear oil to each component – during reassembly as work progresses. The ball-races are retained in the intermediate flange by bolted on retaining plates. The needle roller bearings are retained in the gear housings by circlips (photos).
2 The operations covered in this Section apply only to an overhaul where the differential/final drive has remained undisturbed and the original gearbox mainshaft is being refitted. If the mainshaft (pinion gear) and final drive crownwheel have been renewed as a matched pair, refer to Section 11.

Input shaft

3 Either press the bearing assembly onto the shaft and fit the retaining circlips, or if a split type bearing is used, fit the inner track half section to the shaft. Now pass the input shaft through the intermediate flange. Fit the bearing second half inner track section (photos).
4 Fit 5th gear and reverse gear to the shaft (photo).
5 Screw on a new shaft nut finger tight (photo).

Mainshaft

6 Support the bearing inner track and press the mainshaft into it (photo).
7 Heat the distance piece to 140°C (284°F) and press this up tightly against the bearing. Allow the distance piece to cool (photo).
8 Refit 1st speed gear (photo).
9 Fit 1st/2nd synchro hub and sleeve (photo).
10 Fit 2nd speed gear and bush (photo).
11 Fit 3rd speed gear and bush (photo).
12 Fit 3rd/4th synchro sleeve and hub (photo).
13 Fit 4th speed bush and gear, the pinion height adjusting spacer, and the ball-race or half inner track (split type bearing) (photo).
14 Slide the 3rd/4th synchro sleeve to fully engage 4th speed gear, then install the mainshaft assembly to the intermediate flange (photo).
15 Fit the ball-race half section for the intermediate bearing, the bush and the needle roller track (greased) (photos).
16 Fit 5th speed gear (photo).
17 Fit 5th reverse synchro assembly (photo).
18 Fit reverse gear (photo).
19 Screw on a new nut finger tight (photo).
20 Slide 5th synchro sleeve to lock up 5th gear (4th gear already engaged – see paragraph 14) (photo).
21 Tighten the mainshaft nut to the specified torque.
22 Now is the time to check that the pinion height matches that recorded before dismantling (refer to Section 7, paragraph 10). If it does not, the spacer fitted between the face of 4th speed gear bush and the ball-race inner track must be removed and one of different thickness substituted.
23 When the adjustment is correct, stake the mainshaft nut into the shaft notch to lock it (photo).
24 Tighten the input shaft nut to the specified torque and stake it on one flat.
25 Insert the selector shaft interlock plungers into the intermediate flange. Use a pencil magnet or tweezers to do this (photos).
26 Locate the 1st/2nd selector fork in its synchro sleeve groove (photo).
27 Locate the 3rd/4th selector fork in its synchro sleeve groove. This synchro is nearest to the intermediate flange (photo).
28 Pass 3rd/4th selector shaft through the intermediate flange and the 3rd/4th fork (photo).
29 Pass 1st/2nd selector shaft through the intermediate flange and the 1st/2nd fork (photo).
30 Insert the selector rod into the intermediate flange so that its centralising spring ends slide up the rod and the dogs engage correctly (photo).
31 Insert 5th/reverse selector shaft into the intermediate flange, rotating it as necessary to clear adjacent components until the fork can be engaged in its synchro sleeve groove (photo).
32 Insert the three detent balls, springs and plugs into their holes in the intermediate flange. Set the selector shafts so that the balls engage in their shaft detent grooves (photo).
33 Now check that the 1st/2nd and 3rd/4th synchro sleeves (in neutral) have an equal space between them and their respective gear faces. Adjust the position of the selector forks on the selector shafts if necessary.
34 Tighten the locking screws to secure the selector forks to their shafts without altering the setting of the forks (photo).
35 Before offering up the gearcase/bellhousing, check that a new needle bearing and oil seal have been installed. Fit the release bearing guide sleeve (photos).
36 Smear the casing flanges with jointing compound and install the intermediate flange, with geartrains, into the differential housing.
37 Fit reverse sliding gear, engaging it with the selector shaft dog. The casing mounted gear pin should be lubricated. Slide on the gear casing, taking care to engage the reverse gear with its pin.
38 Screw on and tighten the nuts which hold the casing sections and the intermediate flange together. Tighten the nuts in a diagonal sequence to the specified torque.

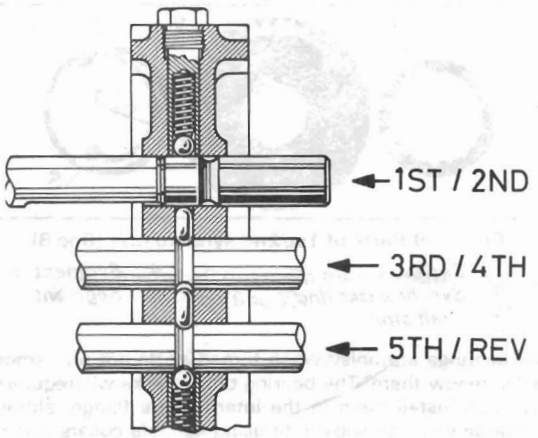
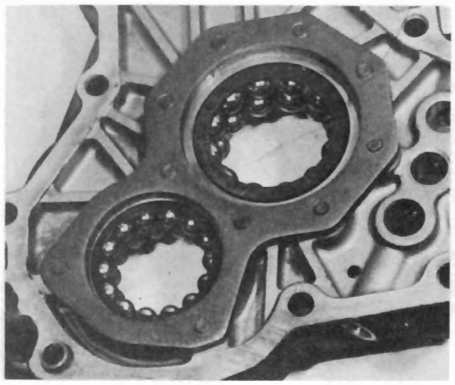
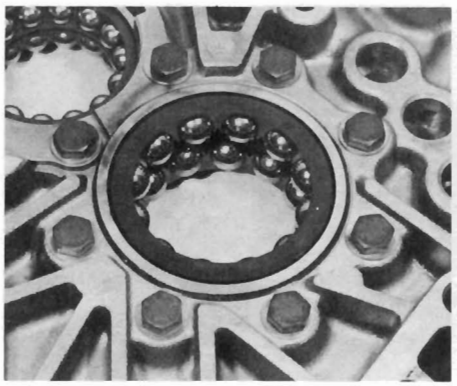


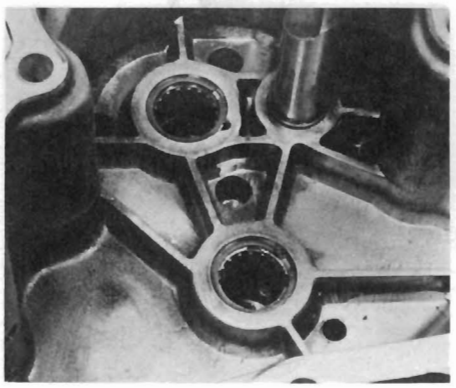
Fig. 7.22 Selector shafts, interlock plungers and detent balls (Sec 9)



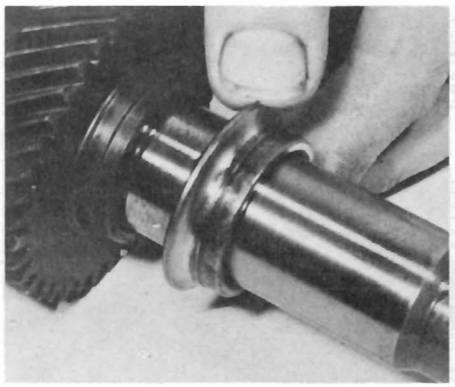
9.1a Bearing retaining plate



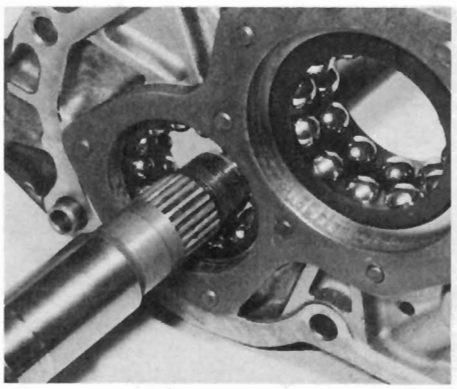
9.1b Bearing retaining plate bolts



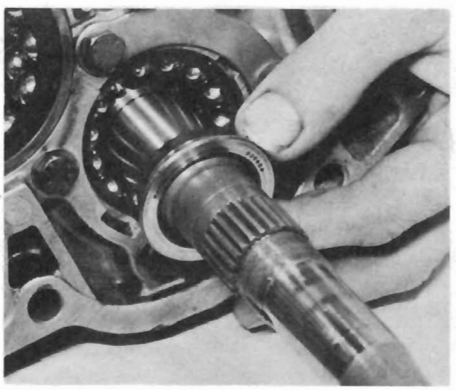
9.1c Needle roller bearings and circlips



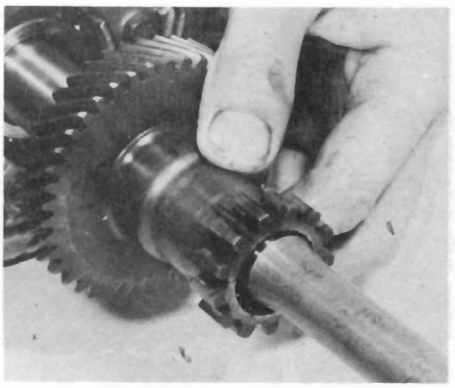
9.3a Bearing track half section



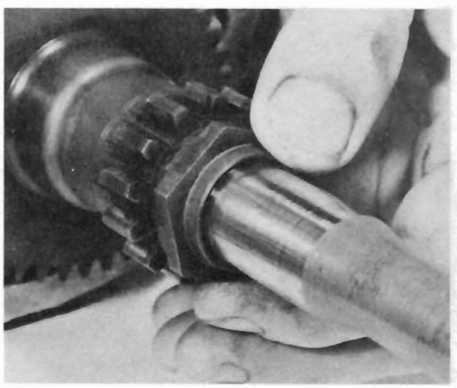
9.3b Passing the input shaft through the intermediate flange



9.3c Fitting a bearing track half section

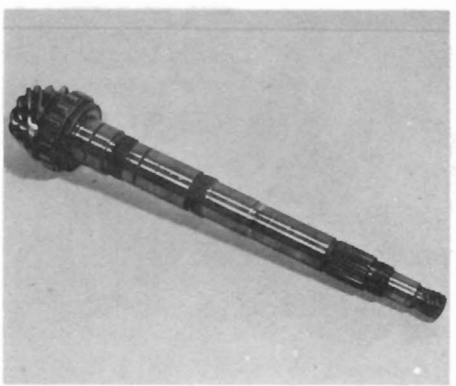


9.4 Fitting 5th/reverse gears to the input shaft

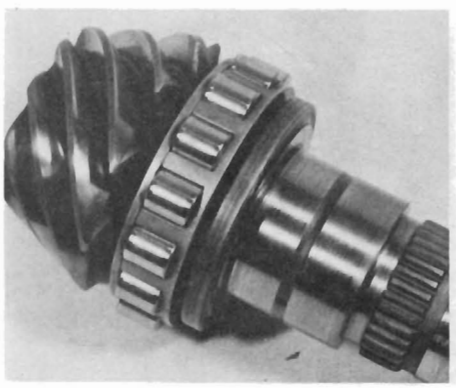


9.5 Screwing on the input shaft nut

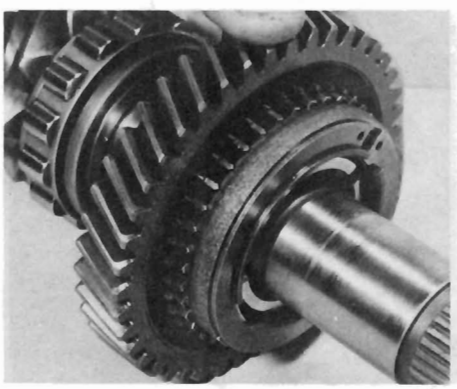
NM 100



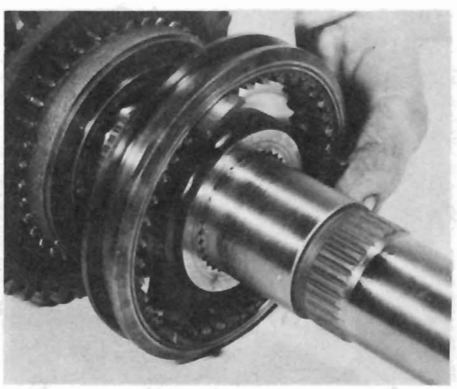
9.6 Mainshaft with bearing and spacer installed



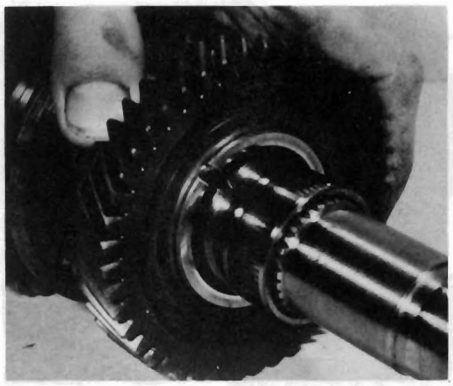
9.7 Close-up view of mainshaft bearing and spacer



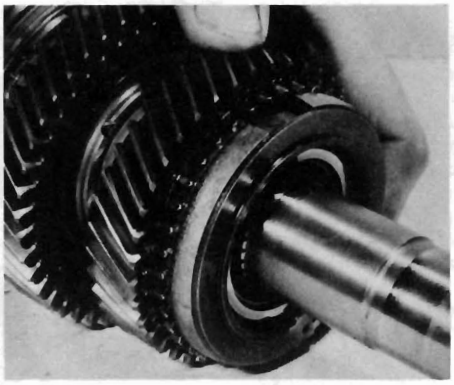
9.8 Fitting 1st speed gear to the mainshaft



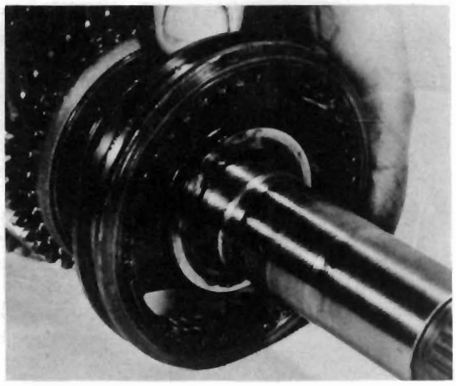
9.9 Fitting 1st/2nd synchro to the mainshaft



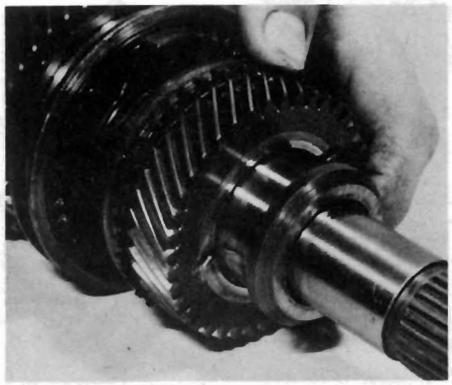
9.10 Fitting 2nd speed gear and bush to the mainshaft



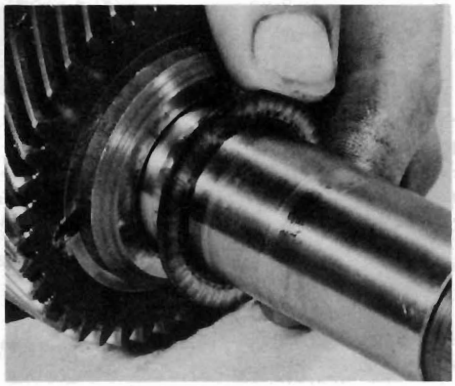
9.11 Fitting 3rd speed gear and bush to the mainshaft



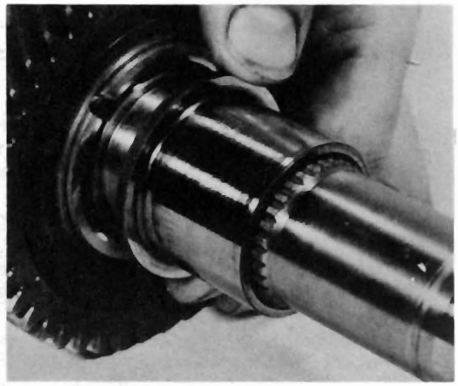
9.12 Fitting 3rd/4th synchro sleeve and hub



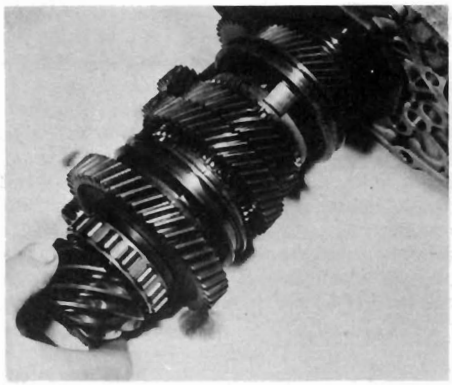
9.13a Fitting 4th speed gear and bush to the mainshaft



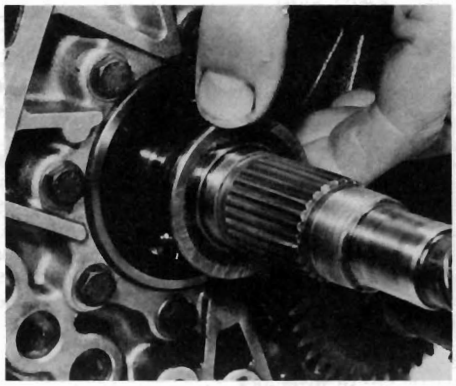
9.13b Fitting the pinion height spacer to the mainshaft



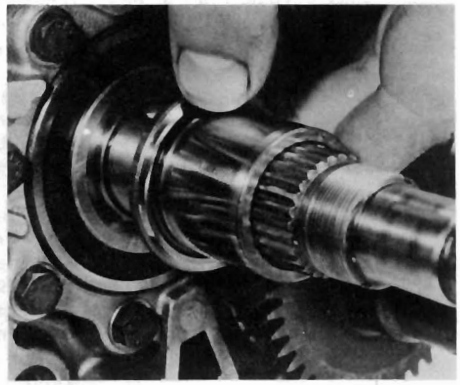
9.13c Fitting the bearing track section to the mainshaft



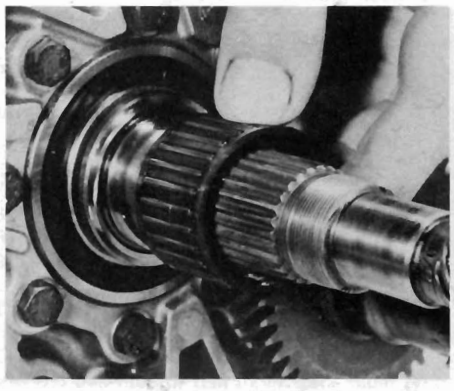
9.14 Installing the mainshaft geartrain to the intermediate flange



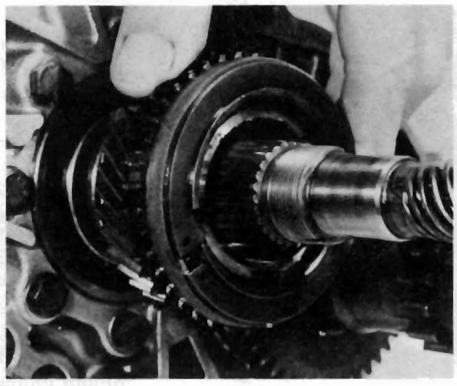
9.15a Fitting the second half bearing track to the mainshaft



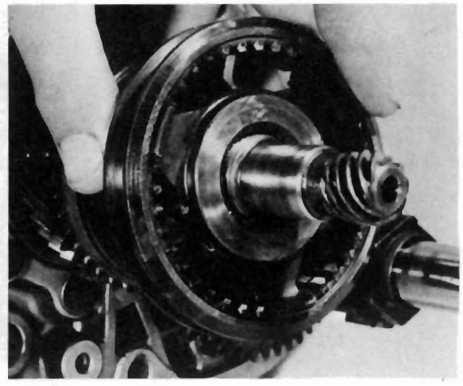
9.15b Fitting the needle roller bearing track to the mainshaft



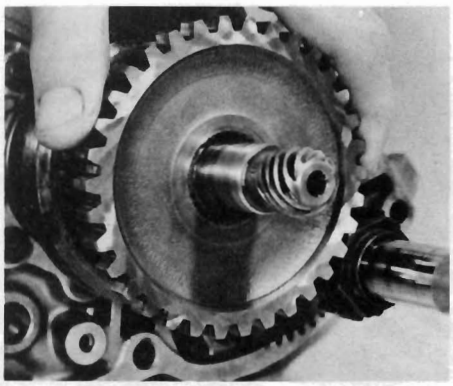
9.15c Fitting the needle roller bearing to the mainshaft



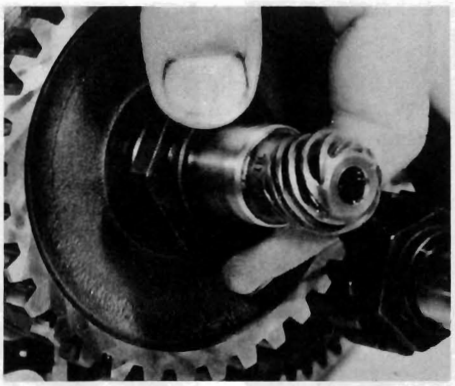
9.16 Fitting 5th speed gear



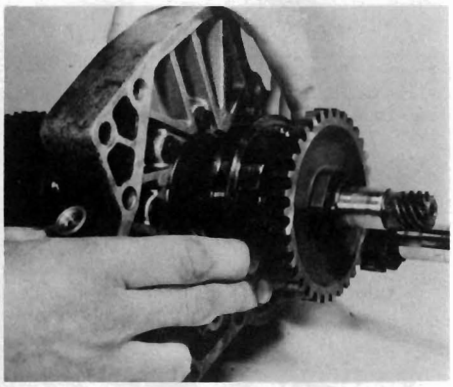
9.17 Fitting 5th/reverse synchro



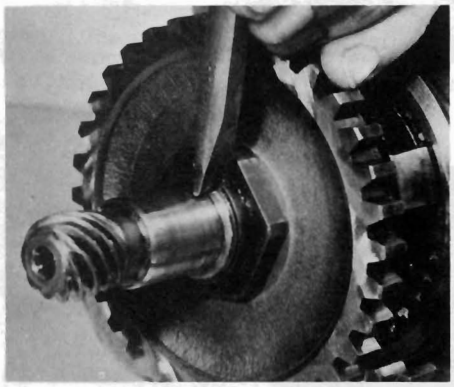
9.18 Fitting reverse gear



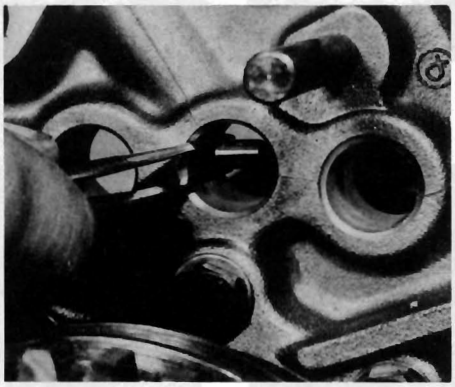
9.19 Screwing on the mainshaft nut



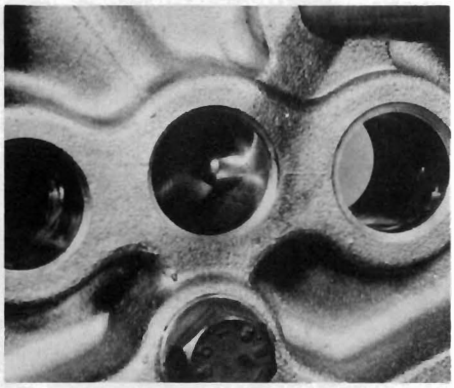
9.20 Sliding 5th synchro sleeve to lock up the gears



9.23 Staking the mainshaft nut

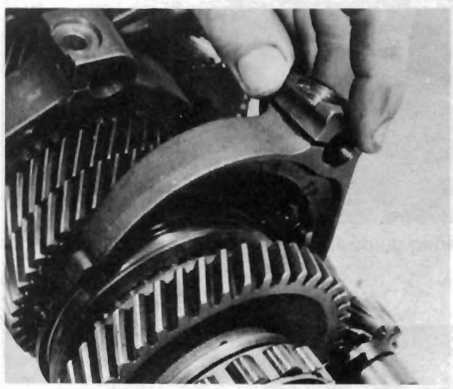


9.25a Inserting an interlock plunger

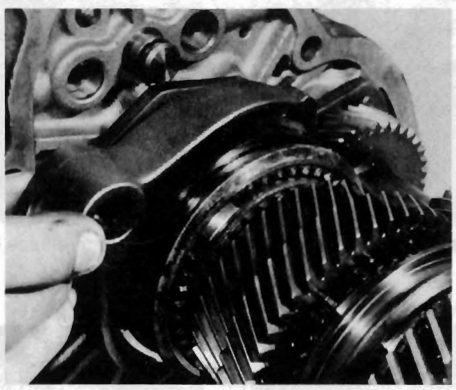


9.25b Interlock plunger in position

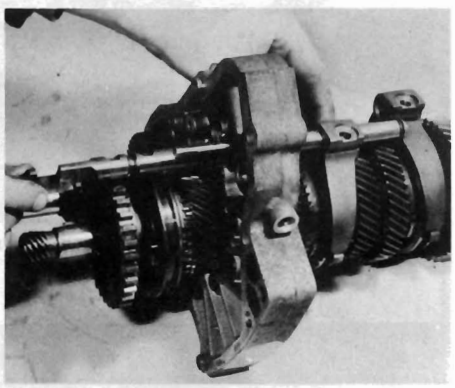
NM 115



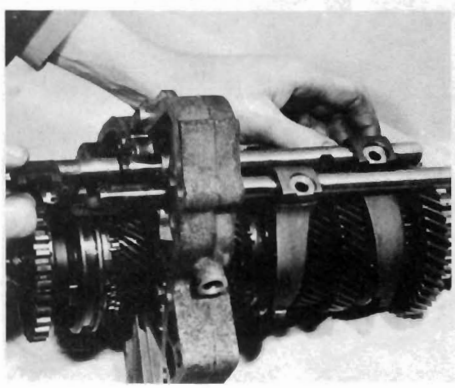
9.26 Locating 1st/2nd selector fork



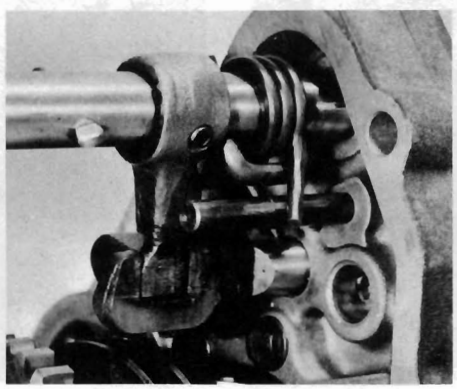
9.27 Locating 3rd/4th selector fork



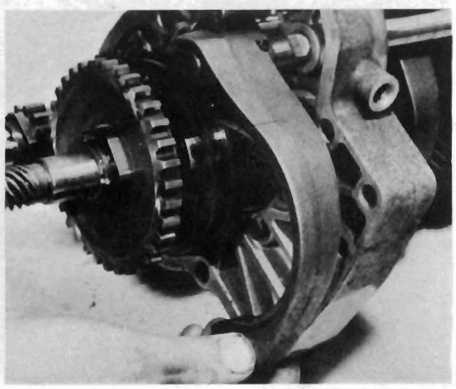
9.28 Installing 3rd/4th selector shaft



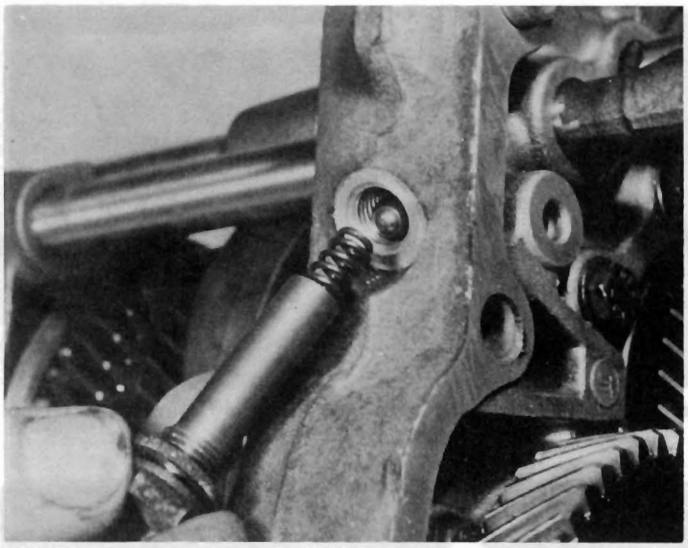
9.29 Installing 1st/2nd selector shaft



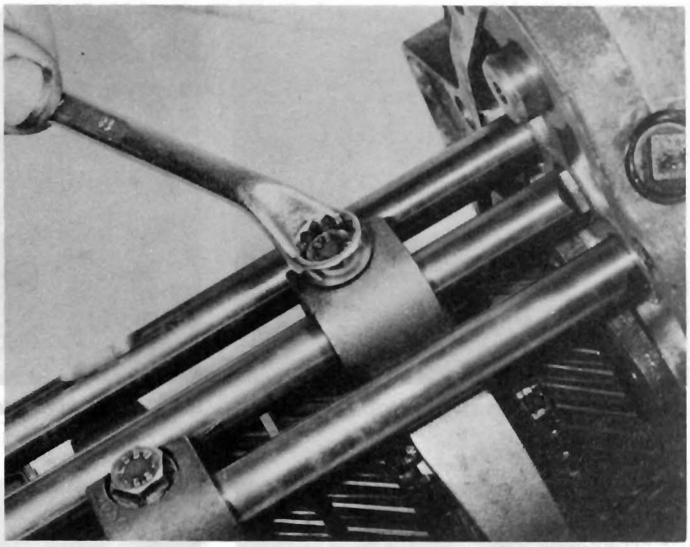
9.30 Selector rod installed



9.31 Installing 5th/reverse selector shaft and fork

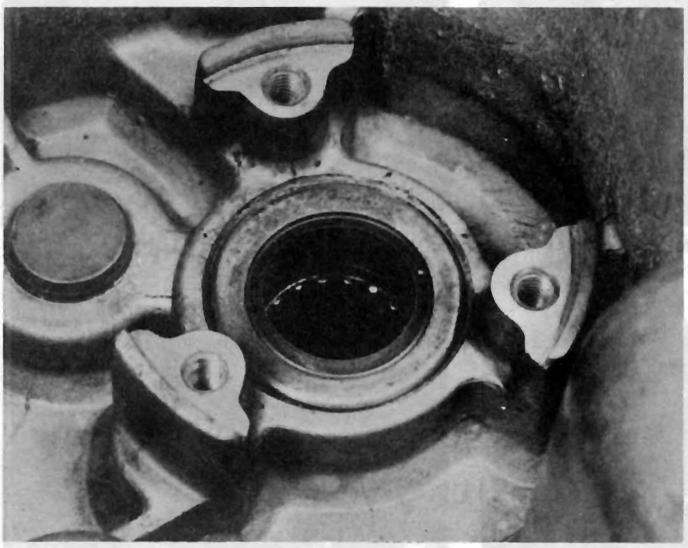


9.32 Installing a detent ball and spring

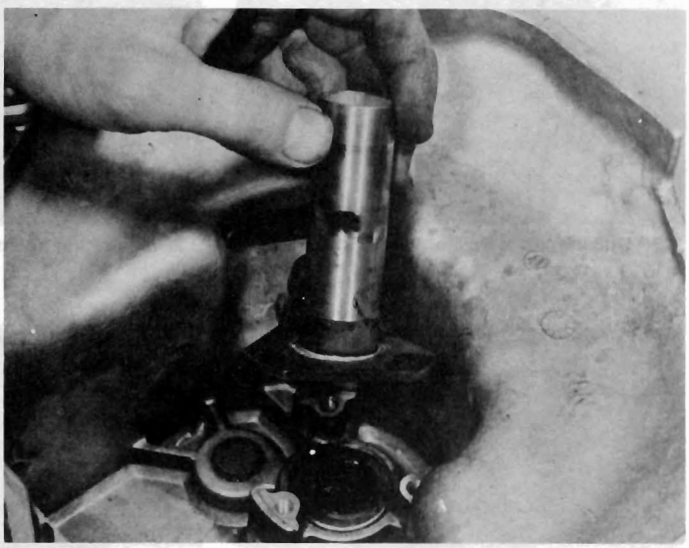


9.34 Tightening a selector fork lockbolt

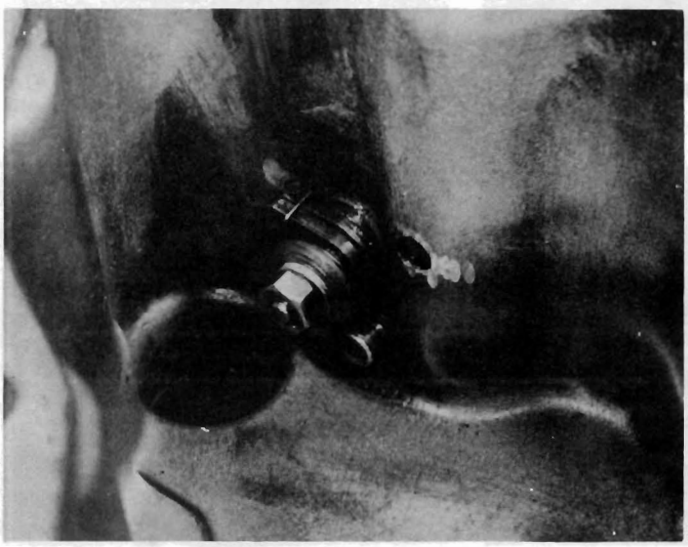
NM 23



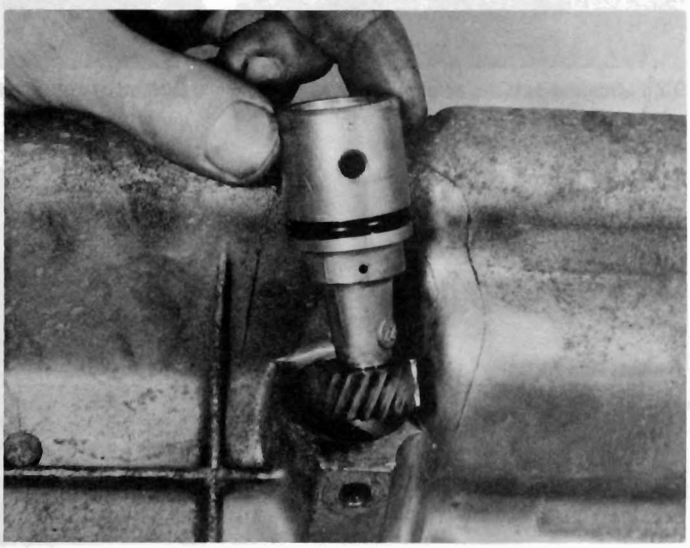
9.35a Bellhousing needle roller bearing and oil seal



9.35b Fitting release bearing guide sleeve



9.39 Reverse safety interlock

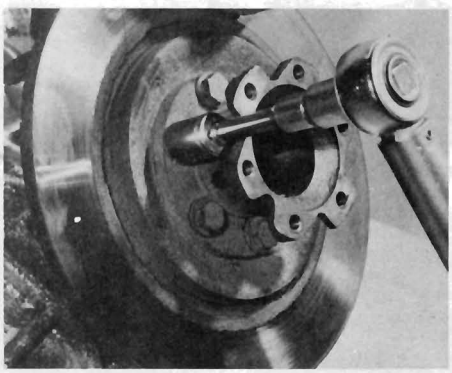


9.40 Fitting the speedometer drive pinion

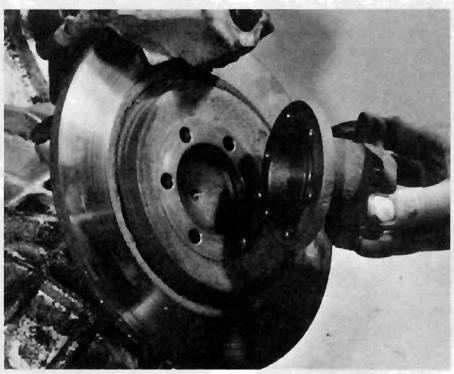
39 Should the reverse safety interlock plate have been removed, apply jointing compound to the plate on reassembly (photo).
40 Fit the speedometer drive pinion and its lockscrew (photo).
41 Screw in the reversing lamp switch, tightening it to the specified torque.
42 Refit the clutch components as described in Chapter 6.
43 The transmission is now ready to be refitted to the car (see Section 12). Refill with oil after installation.

10 Final drive/differential – dismantling

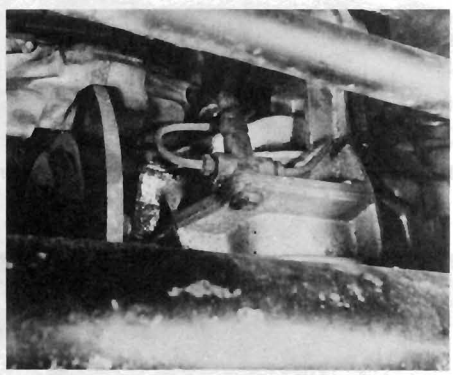
1 With the transmission removed from the car as described in Section 5 and the gearbox withdrawn as described in Section 6, commence dismantling by removing the disc brake pads as described in Chapter 8.
2 Unscrew and remove the bolts which hold the brake discs and distance pieces. Remove the discs and distance pieces (photos).
3 Disconnect the brake hydraulic pipelines from the calipers and release the three-way pipeline connector by extracting its central screw (photo).
4 Unbolt and remove the brake calipers from the final drive housing (photos).
5 Unbolt the side covers from the final drive housing and remove them together with the inner driveshafts. Note that the longer shaft is on the right-hand side (photos).



10.2a Unscrewing the brake disc bolts



10.2b Removing the brake disc distance piece



10.3 Three-way hydraulic pipeline connector

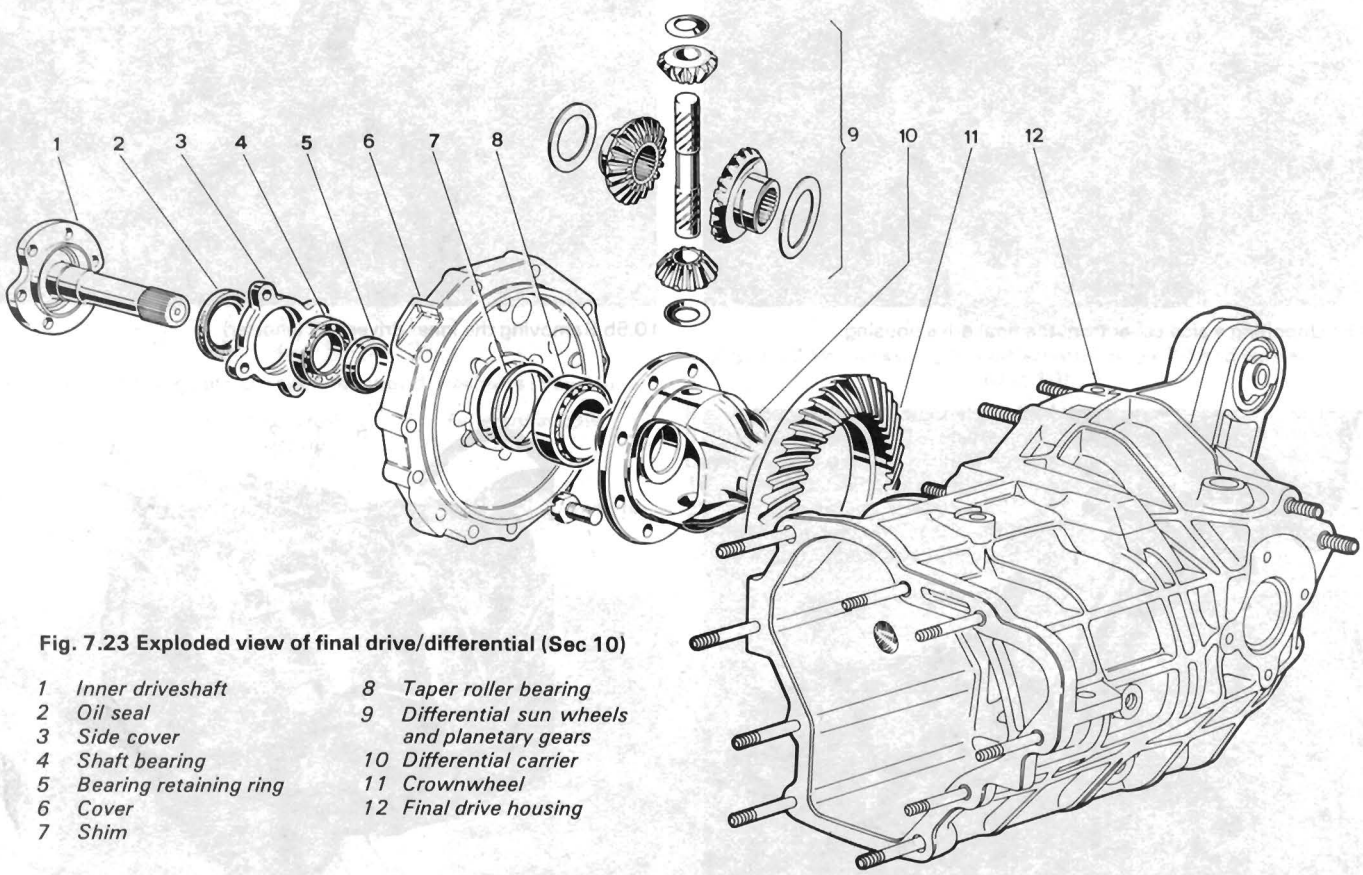
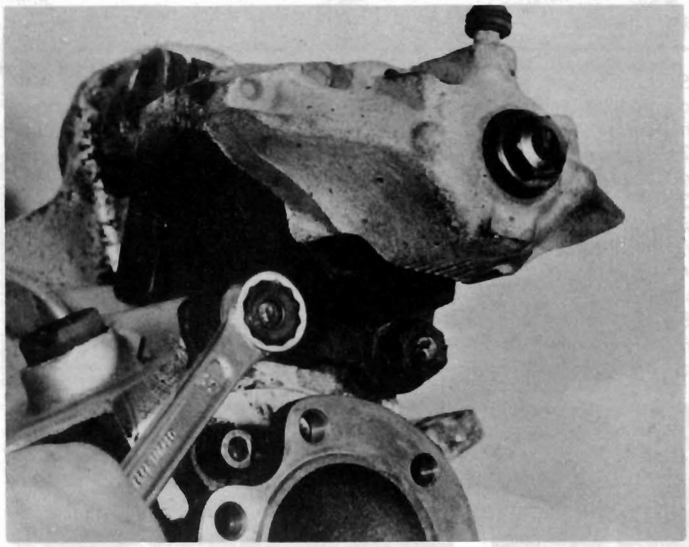
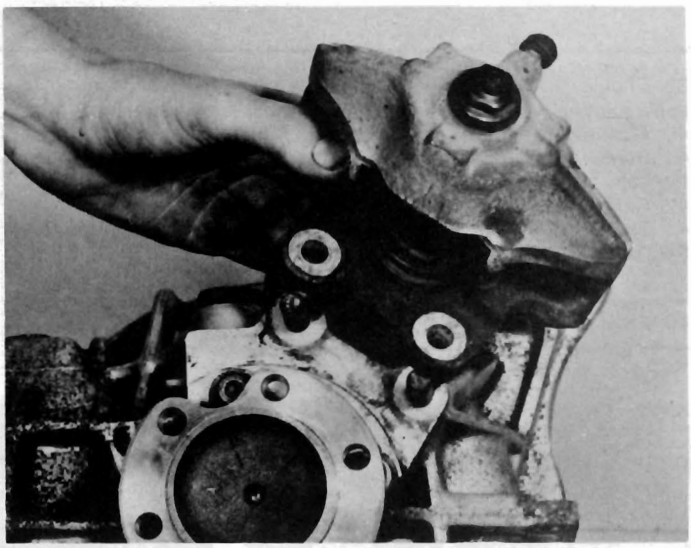


Fig. 7.23 Exploded view of final drive/differential (Sec 10)

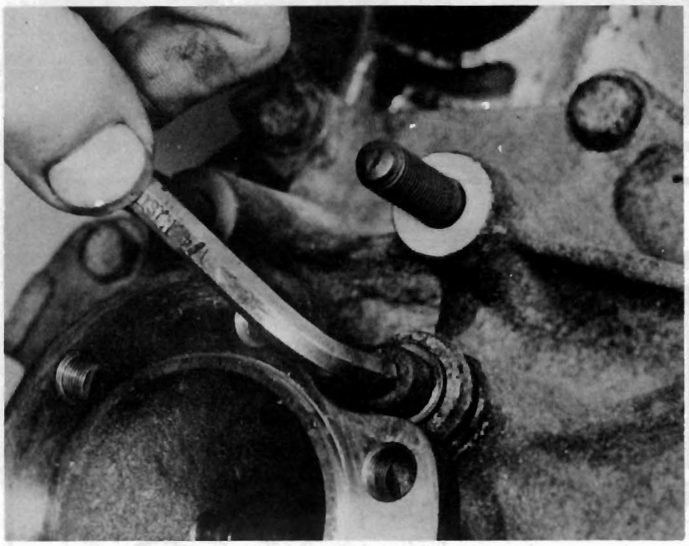
1 *Inner driveshaft*
2 *Oil seal*
3 *Side cover*
4 *Shaft bearing*
5 *Bearing retaining ring*
6 *Cover*
7 *Shim*
8 *Taper roller bearing*
9 *Differential sun wheels and planetary gears*
10 *Differential carrier*
11 *Crownwheel*
12 *Final drive housing*



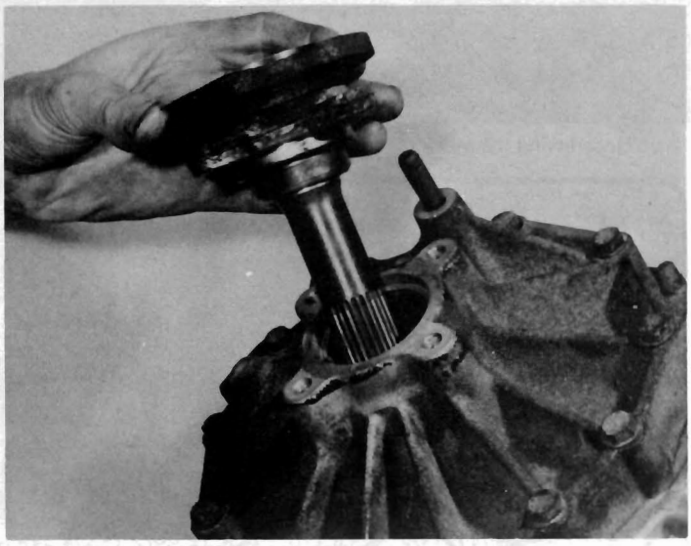
10.4a Removing a rear brake caliper mounting nut



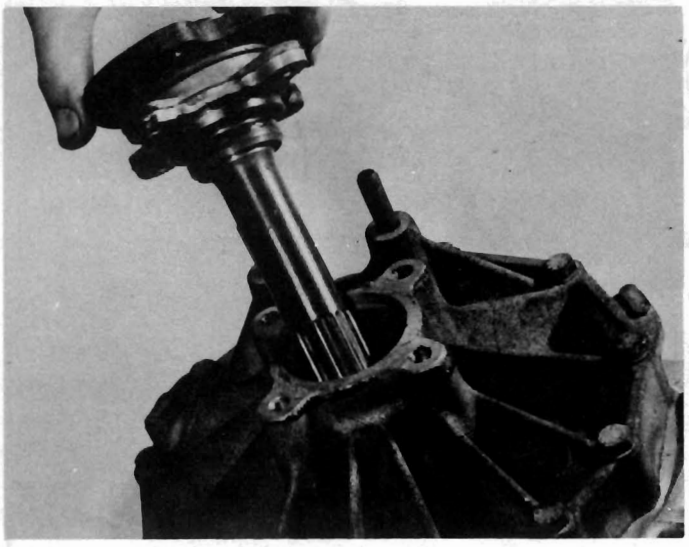
10.4b Removing a rear brake caliper



10.5a Unbolting a side cover from the final drive housing



10.5b Removing the inner driveshaft (shorter)



10.5c Removing the inner driveshaft (longer)

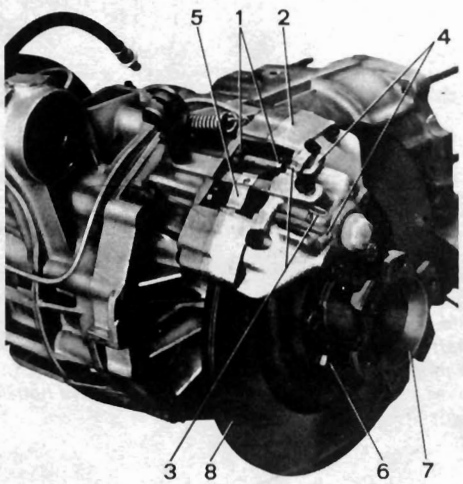


Fig. 7.24 Disc caliper attachment (Sec 10)

1	*Disc pads*	*4*	*Pad retaining pins*	*7*	*Distance piece*
2	*Caliper*	*5*	*Anti-rattle spring*	*8*	*Brake disc*
3	*Locking clip*	*6*	*Brake disc bolts*		

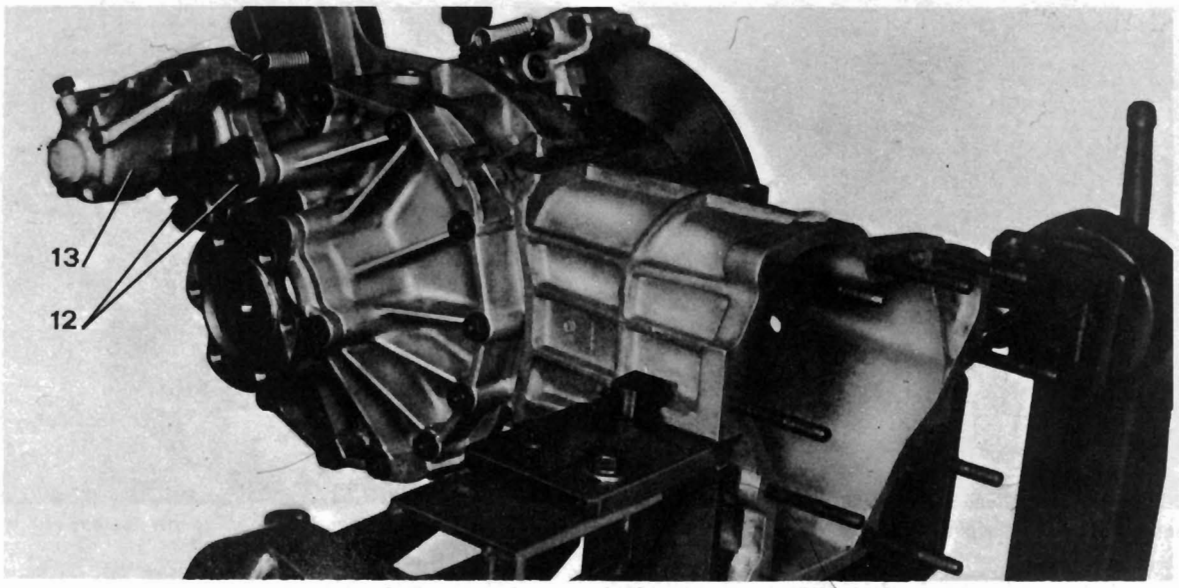


Fig. 7.25 Caliper securing nuts (12) and caliper (13) (Sec 10)

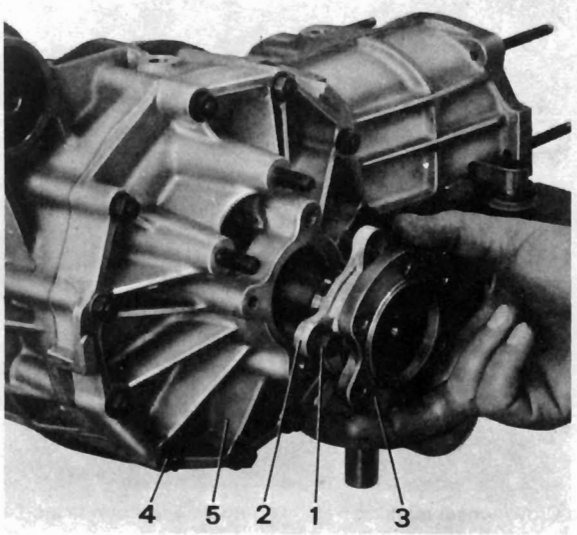


Fig. 7.26 Removing side covers and inner driveshafts (Sec 10)

1 Bolt
2 Side cover
3 Inner shaft
4 Cover nut
5 Differential cover

6 Unscrew and remove the nuts which hold the differential cover to the final drive housing.
7 Remove the differential cover (photo).

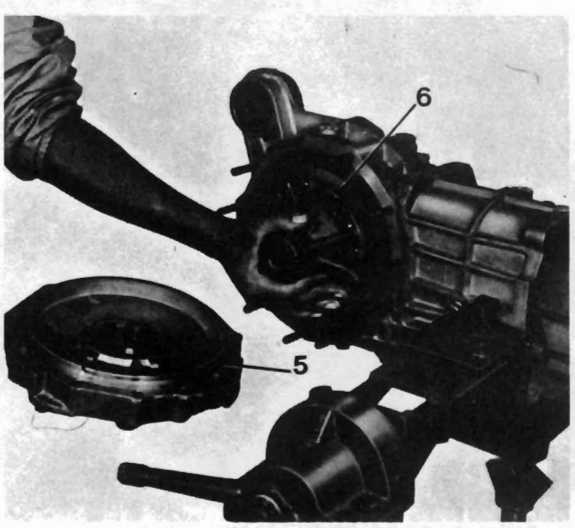
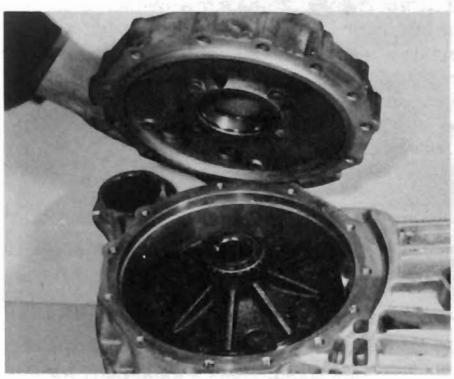
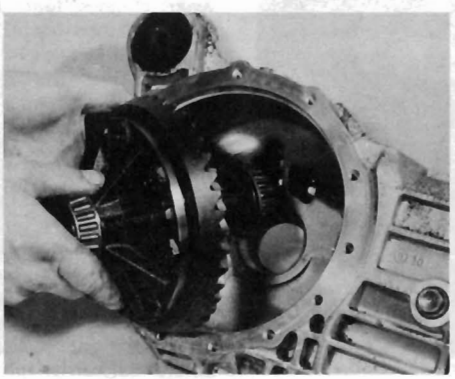


Fig. 7.27 Withdrawing the differential cover (5) and carrier (6) (Sec 10)

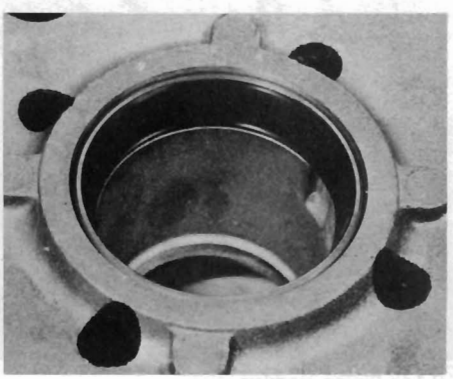
8 Withdraw the differential carrier (photo).
9 If the carrier is to be dismantled, first draw off the tapered roller bearings. Remove the bearing outer tracks from the casing (photo).
10 Extract the differential pin and remove the sun wheels, washers, planetary gears and spacers (photos).
11 Mark the location of the crownwheel (only if the original is to be refitted) and unbolt and remove it (photo).



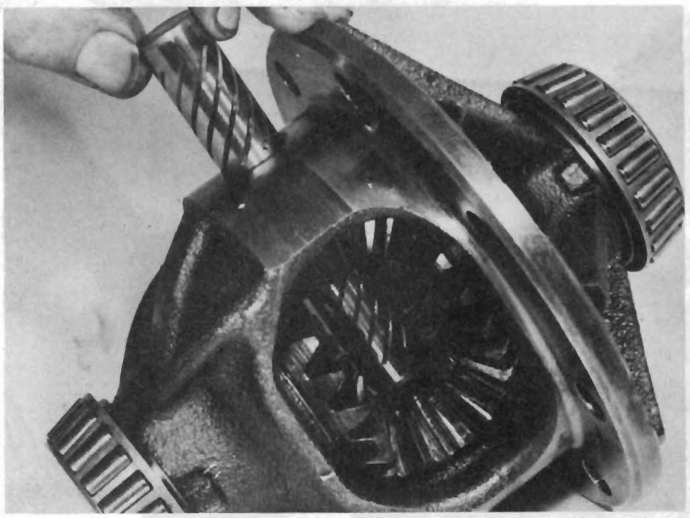
10.7 Removing the differential cover



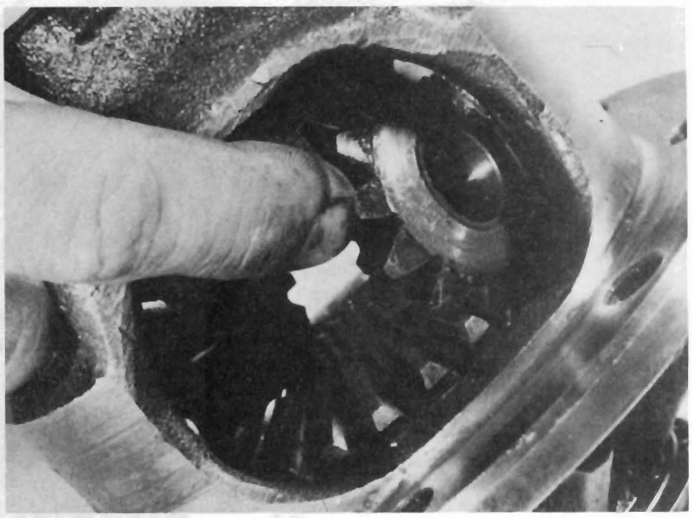
10.8 Removing the differential carrier



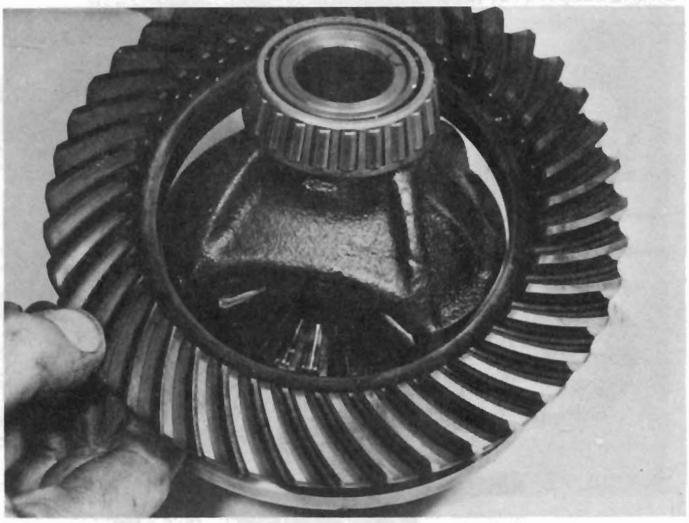
10.9 Tapered roller bearing outer track in final drive housing



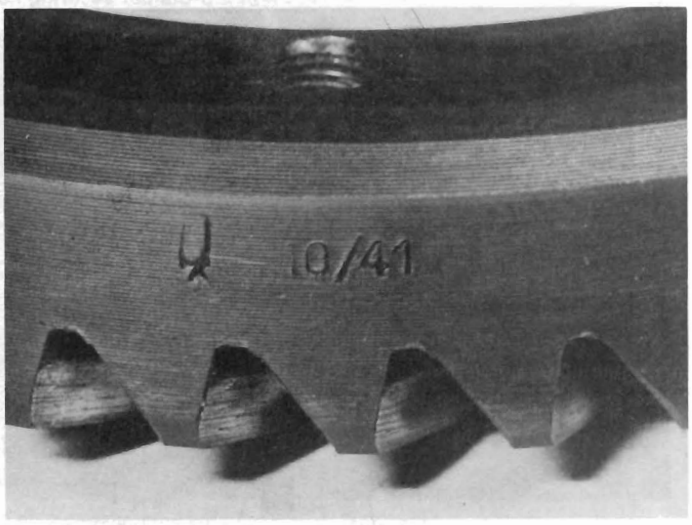
10.10a Extracting the differential pin



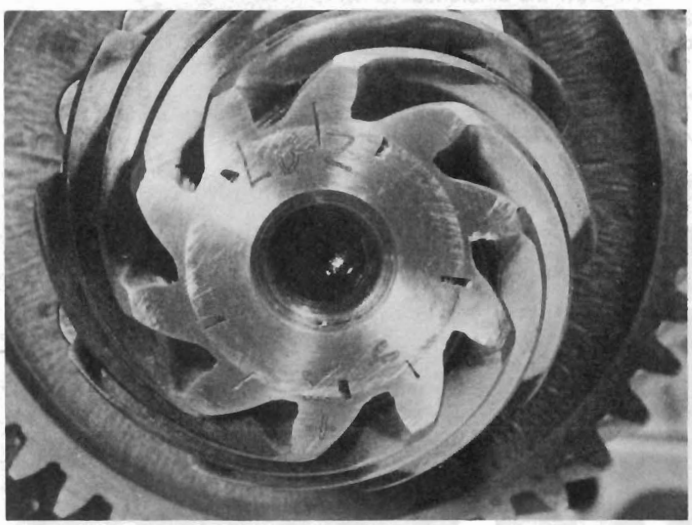
10.10b Removing a sun wheel



10.11 Removing the crownwheel



10.14a Crownwheel marking

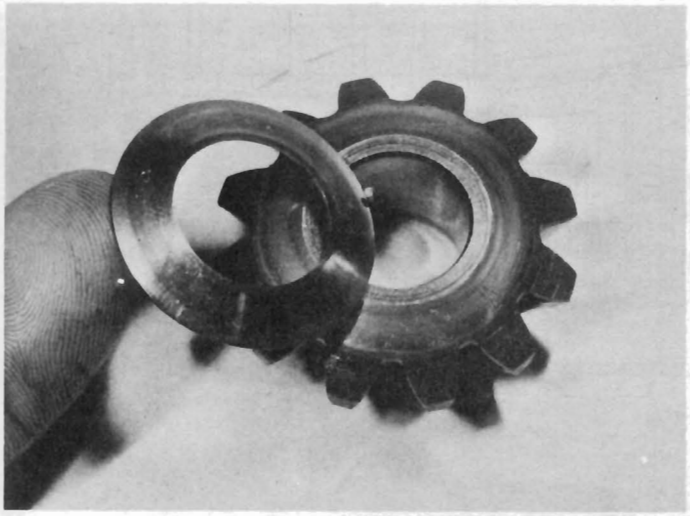


10.14b Pinion marking

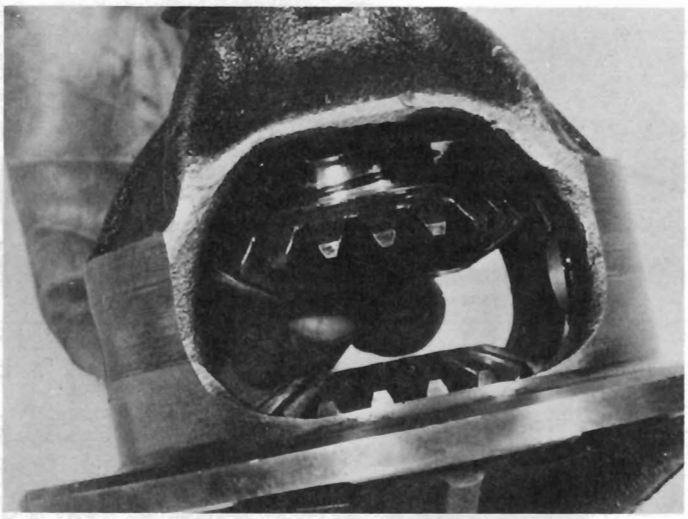
12 If the inner driveshafts must be dismantled, a press will have to be used to press the shaft out of the retainer ring and side plate. Remove the oil seal and the bearing.
13 The bearing tracks can be removed from the final drive housing using a bolt, nut and suitable distance pieces. Retain the shims.
14 With the unit dismantled, inspect each component carefully for wear, chipped teeth and worn splines. If the crownwheel is to be renewed, then the mainshaft/pinion will have to be renewed at the same time as the components are supplied as a matched pair (photo). Refer to Section 7 for details of stripping the gearbox.
15 The adjustments described in the next Section are vital if the bearings or other internal components of the final drive have been renewed.

11 Final drive/differential – reassembly and adjustment

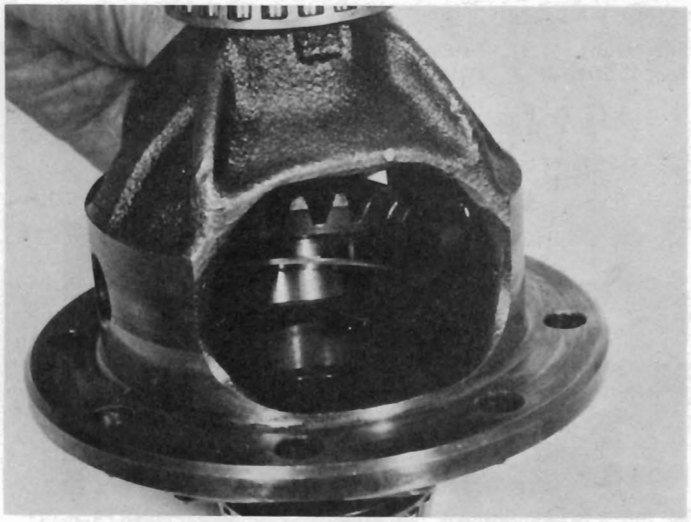
1 With the components clean and parts renewed where necessary, commence reassembly in the following way, apply transmission oil to each component before fitting.
2 Fit the spacer rings to the sun wheels and install them into the differential carrier (photos).
3 Fit the planetary gears with their washers and rotate them until they align with the pin holes. Insert the pin.



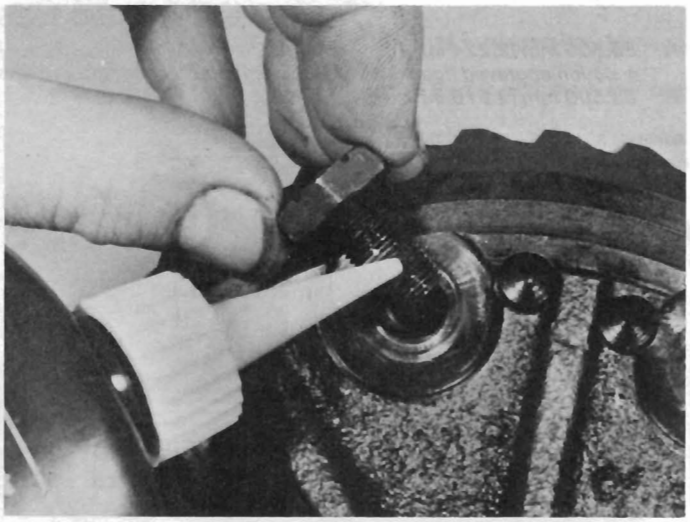
11.2a Spacer ring and sun wheel



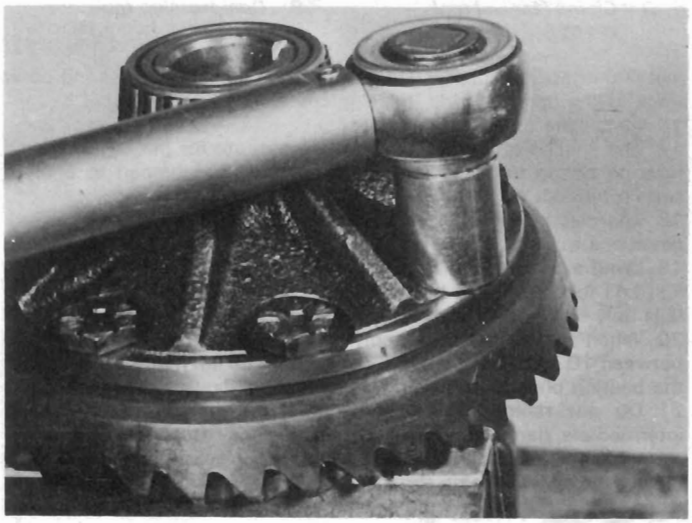
11.2b Inserting a sun wheel into the differential carrier



11.2c Spacer ring installed onto sun wheel



11.5a Applying thread locking compound to a crownwheel bolt



11.5b Tightening a crownwheel bolt

4 The clearance between the gear teeth and sun wheels should not exceed 0.05 mm (0.002 in). If it does, change the spacer rings for ones of different thickness.

5 Fit the crownwheel to the carrier, apply thread locking fluid torque in diagonal sequence (photos).

6 Fit the tapered roller bearings using a piece of tubing as a drift and apply pressure to the inner track of the bearing only.

7 At this stage, certain adjustments must be carried out and unless the necessary gauges can be borrowed, the work will have to be entrusted to your dealer by taking the transmission to him.

8 Fit the special gauge (C 60164) into the inner driveshaft location in the final drive housing.

9 Push the geartrains into the housing and bolt up the intermediate flange.

10 The distance A between the end face of the pinion and the axis of the crownwheel should be 56.500 mm (2.224 in), plus or minus the amount (in hundredths of mm) which is engraved on the end of the pinion gear (Fig. 7.28).

11 To carry out the check, fit a dial gauge to the second special tool (A 40136) and zero the dial gauge to a nominal dimension of 66.500 mm using the distance piece (special tool C 60163).

12 The distance B shown in Fig. 7.28 corresponds to the nominal distance between the end of the pinion and the end of the stylus on the dial gauge.

13 Rest the special pillar tool on the face of the pinion and take the

NM75

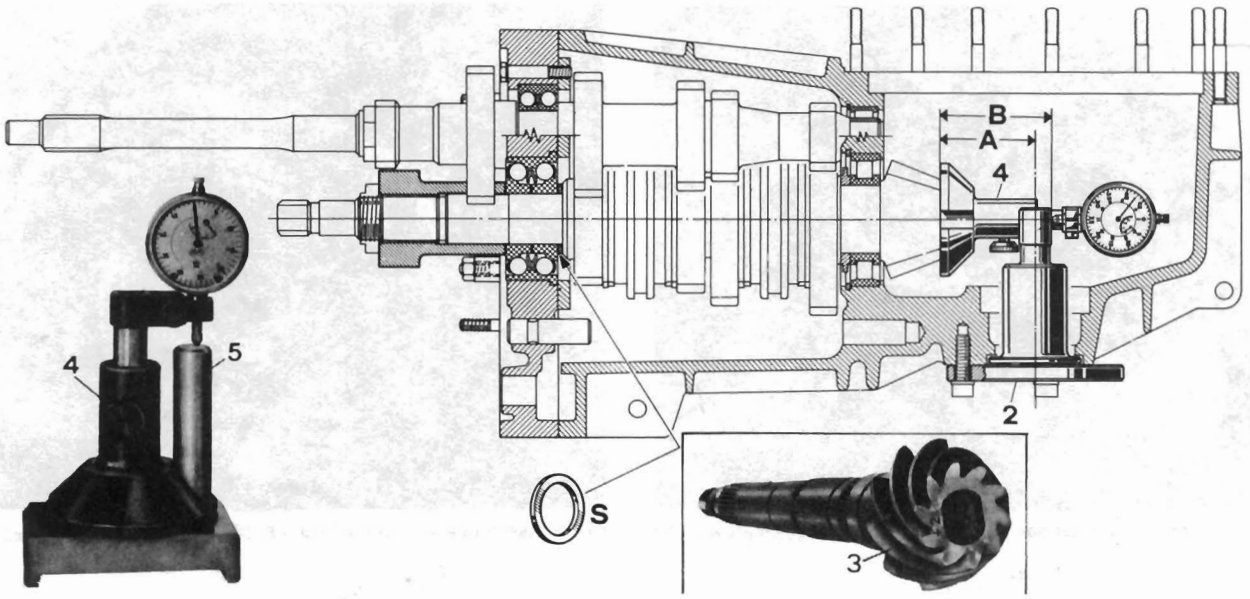


Fig. 7.28 Pinion to crownwheel axis measuring diagram (Sec 11)

A 56.500 mm (2.224 in) ± pinion engraved figure
B 66.500 mm (2.618 in)
nominal
S Adjustment shim (bearing to 4th speed bush)
2 Special tool (C 60164)
3 Pinion
4 Pillar tool (A 40136)
5 Distance gauge (special tool C 60163)

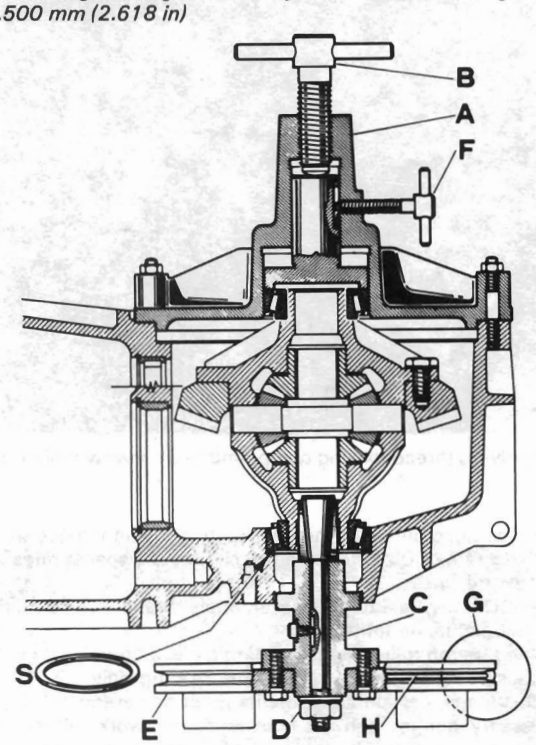


Fig. 7.29 Differential bearing preload tool (Sec 11)

A Special tool (C 60171)
B Compressing screw
C Special tool (C 50123)
D Drawbolt
E Tool disc (C 50124)
F Pinch-screw
G Weight (special tool C 20037)
H Cord
S Adjustment shim

reading for dimension B. The difference between the actual and nominal dimensions should match the figure engraved on the end of the pinion. Where this is not the case, the shims fitted behind the ball-race and against 4th speed bush on the gearbox mainshaft will have to be changed.

14 Withdraw the geartrains and intermediate flange from the final drive housing.

15 Fit the original shim to the recess in the final drive housing and

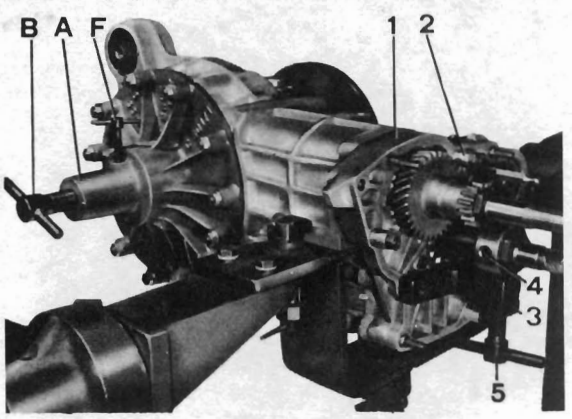


Fig. 7.30 Adjusting crownwheel and pinion backlash (Sec 11)

1 Intermediate flange
2 Distance pieces (special tool A 20234)
3 Clamp (special tool A 20250)
4 Tool sleeve lockscrew
5 Clamp screw
A Special tool (C 60171)
B Compressing tool
F Pinch-screw

install the tapered roller bearing outer track. Install the bearing outer track to the opposite side (housing cover).

16 Install the differential carrier.

17 The special tool (C 50123), as a substitute for the cover, should now be bolted into position and the screw B tightened to apply a certain amount of preload (Fig. 7.29).

18 The disc part of the special tool should now be rotated in both directions to settle the bearings.

19 Wind a cord round the disc groove and check that a weight of 2 kg (4.41 lb) attached to the cord falls rapidly while one of 1 kg (2.2 lb) falls only slowly, starting its travel with a finger if necessary.

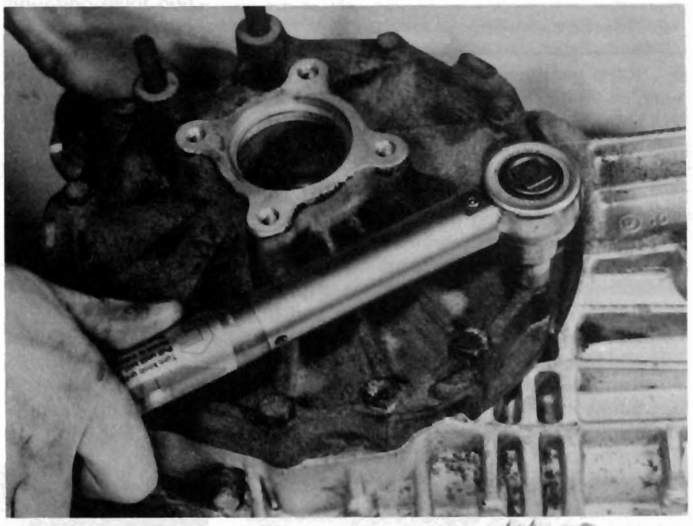
20 When these conditions apply, the bearing turning torque will be between 10 and 20 kgf cm (8.68 and 17.36 lbf in). If necessary, adjust the bearing preload by turning the adjusting screw of the tool.

21 Do not remove the special tools, but fit the geartrain and intermediate flange using the distance pieces (tool A 20234) and screwing on four securing nuts at equidistant points (Fig. 7.30).

22 Fit the special clamp (tool A 20250) and lock it to the mainshaft, using the clamp screw from the special tool used to set the bearing preload.

23 Rest the stylus of the dial gauge against one of the lugs on the disc of the special tool. Turn the disc back and forth very gently and read

off the indicated backlash. The disc lugs correspond to the diameter of the crownwheel.
24 Take a reading at each of the lugs in turn and record the average. This should be within a tolerance of 0.13 to 0.18 mm (0.005 to 0.007 in).
25 If the backlash is incorrect, the shims in the final drive housing at the tapered roller bearing track must be altered. Remove shims to reduch backlash, add shims to increase backlash. In order not to alter the bearing preload, any changes in shims must be compensated for by changing shims in the cover at the opposite track, but to the opposite value.
26 Recheck the backlash of the crownwheel and pinion teeth.
27 Remove the geartrains with intermediate flange and recheck the bearing preload.
28 If the preload is correct but the backlash is less than specified, take out shims from the right-hand bearing and add shims of equivalent thickness to the left-hand bearing. Reverse the procedure if the backlash is greater than it should be.
29 Where the backlash is correct but the bearing preload is incorrect, it will be necessary to add or remove shims of equivalent thickness at both sides.
30 Remove all special tools.
31 Using a suitable piece of tubing, install the oil seal and the cover to the inner driveshaft.
32 Press on the driveshaft bearing, applying pressure equally to the inner and outer tracks.
33 Heat the bearing retaining ring to 190°C (374°F) and press it onto the shaft.
34 Grease the oil seal lips and apply jointing compound to the driveshaft cover mating faces.
35 Fit the differential carrier and the cover, tightening the bolts to the specified torque (photo).
36 Bolt on the driveshafts with covers, noting that the shorter shaft goes on the left-hand side.



11.35 Tightening the differential cover bolts NM 23

37 Bolt on the brake calipers and tighten to the specified torque. Refit the brake discs and spacers.
38 Fit the brake pads (see Chapter 8) and reconnect the hydraulic pipes.
39 Check the clearance between the brake disc and the brake pads and adjust if necessary – see Chapter 8.
40 If the flexible mounting in the final drive housing requires renewal, the rubber bush can be extracted or fitted using a bolt, nut, washers and a distance piece, but note its correct alignment (Fig. 7.33).

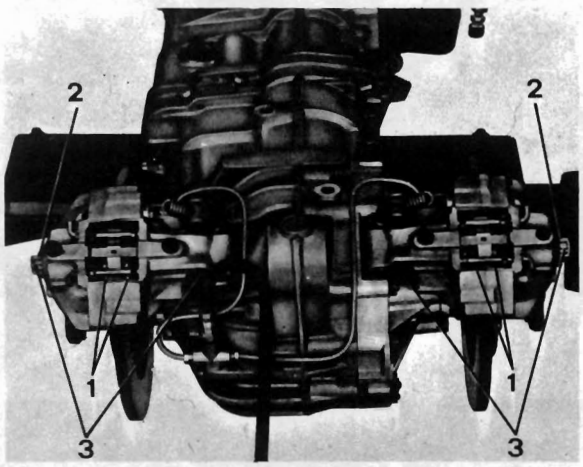


Fig. 7.31 Brake disc pad clearance adjusting items (Sec 11)

1 Pad directional arrow
2 Dust cover
3 Adjusting screws and locknuts

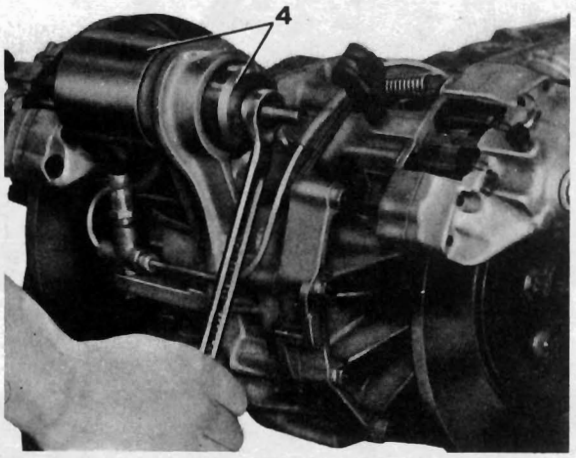


Fig. 7.32 Removing final drive housing flexible mounting bush (Sec 11)

4 Distance pieces

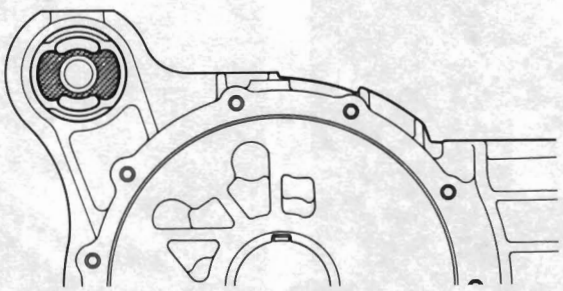
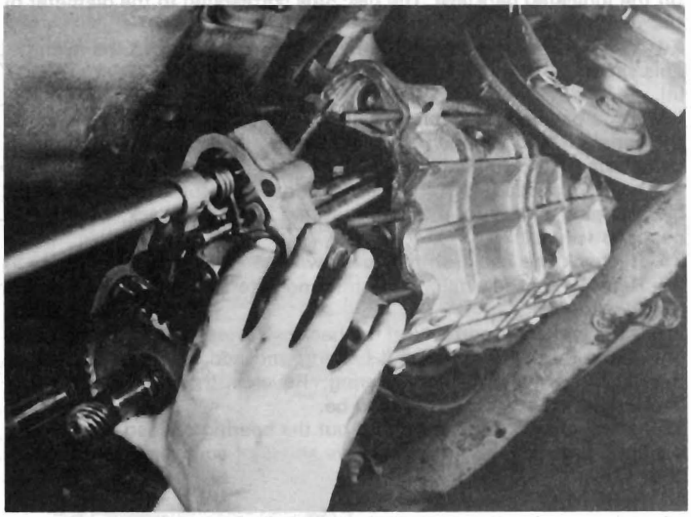


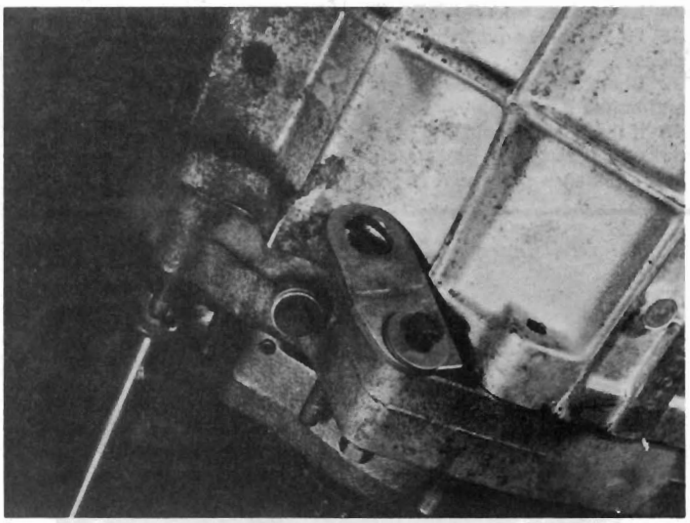
Fig. 7.33 Correct alignment of final drive housing flexible bush (Sec 11)

12 Gearbox – refitting

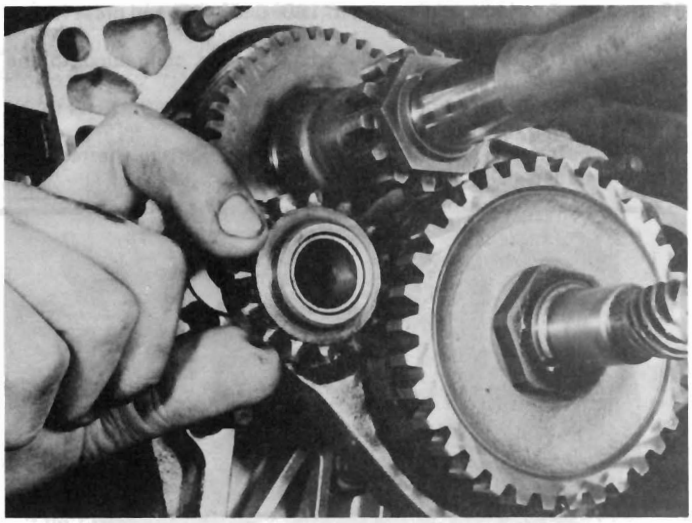
1 If the gearbox was removed independently, refit it in the following way.
2 Offer up the intermediate flange complete with geartrain and selector components, having first applied jointing compound to clean joint faces (photo).
3 Clamp the intermediate flange to the final drive housing (photo).
4 Fit reverse sliding gear (photo).
5 Install the front gearcase section, which is combined with the clutch bellhousing. While pushing it into position, raise the reverse selector fork slightly with the fingers (photo).
6 Remove the temporary clamps and fit the nuts and washers to connect the intermediate flange and gearcase sections together. Tighten the nuts to the specified torque.
7 Refit the speedometer drive and locking screw.
8 Screw in the reversing lamp switch, and then reconnect the switch leads (photo).
9 Refer to Chapter 6, and fit the clutch release bearing and release lever with its dust excluder.
10 Again refer to Chapter 6. Refit the clutch assembly and connect the propeller shaft.



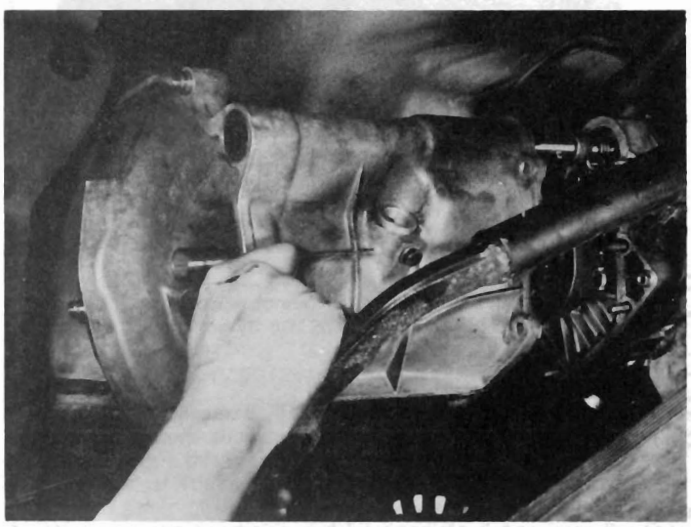
12.2 Offering the intermediate flange and geartrains into position



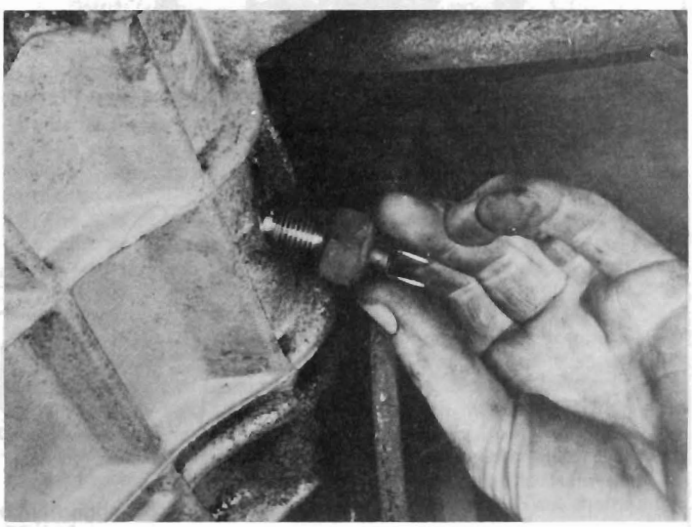
12.3 Suitable intermediate flange temporary clamp



12.4 Fitting reverse sliding gear



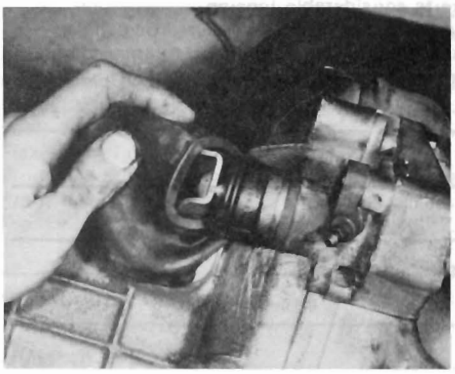
12.5 Installing the gearcase/clutch bellhousing



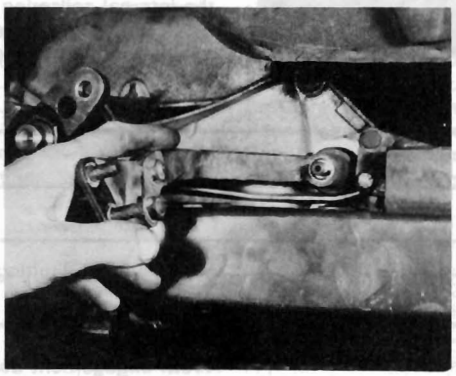
12.8 Screwing in the reversing lamp switch

13 Transmission (complete) – refitting

1 The first thing to do is to connect the gearbox to the final drive housing. Make sure that the mating surfaces of the flanges are clean and apply jointing compound.
2 Fit reverse sliding pinion and offer the gearcase into position. Screw on the nuts and tighten to the specified torque.
3 Refit the speedometer drivegear.
4 Screw in the reversing lamp switch.
5 To the inside of the clutch bellhousing install the clutch release bearing to a sparingly greased guide sleeve. Install the release lever and dust excluder.
6 Refit the clutch assembly as described in Chapter 6.
7 Refit the rubber dust cover to the clutch slave cylinder (photo).
8 Refit the selector lever (photo).
9 With assistance, locate the complete transmission under the car, preferably resting on a trolley jack.
10 Raise the rear end of the transmission and insert the flexible mounting pivot bolt.
11 Using a second jack under the rear axle lower tube, raise the axle and then place a wooden block between one of the axle side tubes and the body.
12 Reconnect the flexible mountings on the front crossmember.
13 Raise and bolt the crossmember to the body (photo).
14 Reconnect the driveshaft inboard ends to the disc brake spacers (photo). Remove the lifting jacks.
15 Reconnect the handbrake cables.
16 Reconnect the brake hydraulic pipelines (photo).
17 Reconnect the clutch hydraulic pipeline (photos).
18 Reconnect the electrical leads to the reversing lamp switch.
19 Reconnect the speedometer drive cable to the transmission (photo).
20 Reconnect the propeller shaft rear coupling.
21 Reconnect the gearchange link rod to the gearchange lever on the floor and to the selector lever on the transmission.
22 Refit the front section of the exhaust pipe.
23 Refill the transmission with oil.

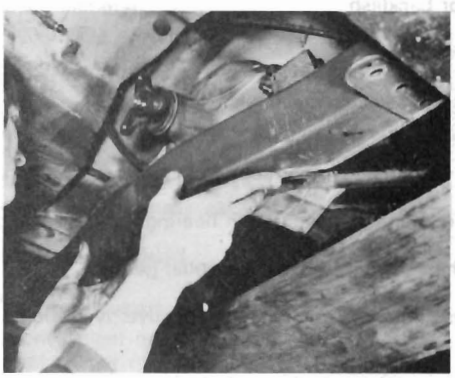


13.7 Fitting the clutch slave cylinder dust excluder

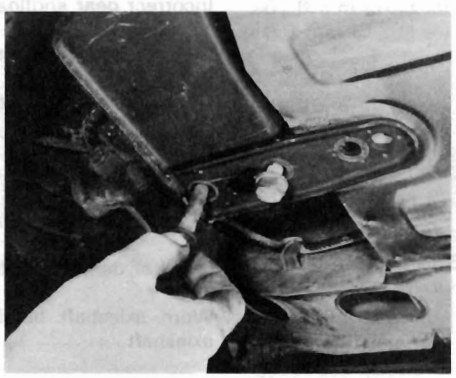


13.8 Refitting the selector lever

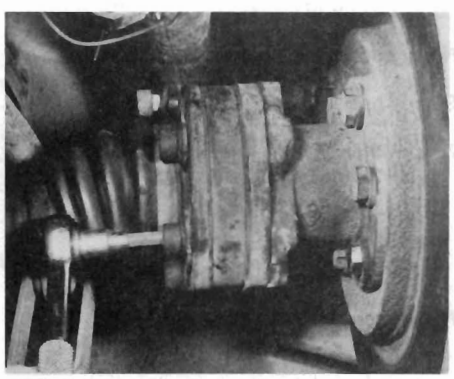
13.13a Raising the transmission front crossmember into position



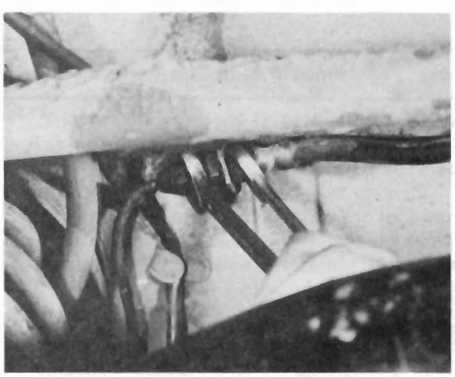
13.13b Engaging the crossmember with the axle torque rod mounting



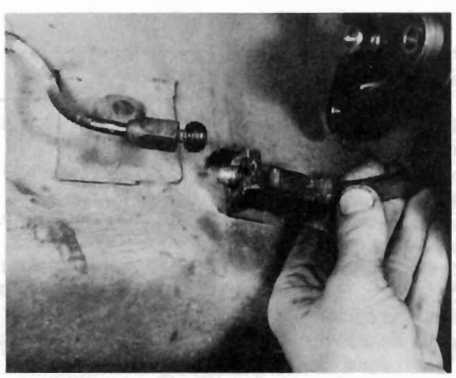
13.13c Fitting the crossmember bolts



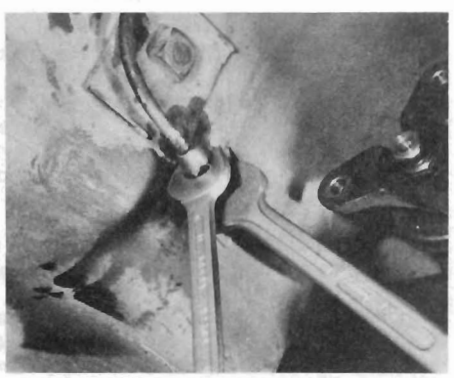
13.14 Reconnecting a driveshaft at the inboard end



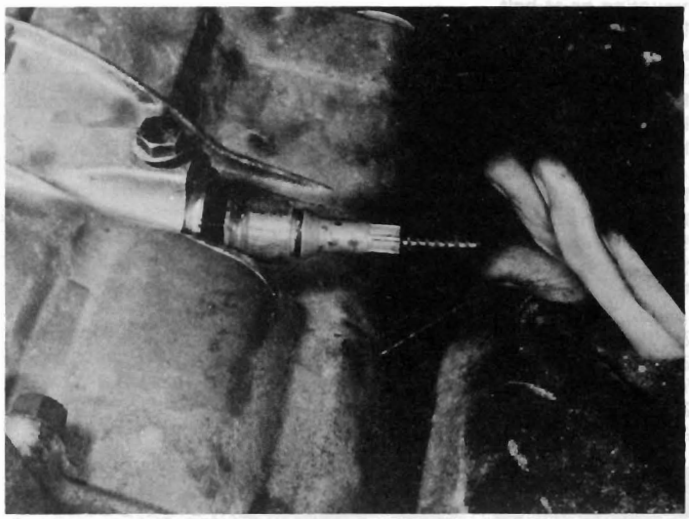
13.16 Reconnecting a brake hydraulic pipeline



13.17a Reconnecting the clutch hydraulic pipeline



13.17b Tightening clutch pipeline unions



13.19 Reconnecting the speedometer cable

24 Bleed the brake hydraulic system (Chapter 8).
25 Bleed the clutch hydraulic system (Chapter 6).

14 Gearchange lever – removal and refitting

1 Pull off the knob from the gearchange lever. This is an interference fit on the lever, using a nylon bush.
2 Disconnect the link rod under the car which connects the base of the gearchange lever to the selector rod of the gearbox.
3 Still working under the car, mark the setting of the bolts in the elongated holes and then unbolt the casting at the base of the gearchange lever from inside the transmission tunnel.
4 Withdraw the gearchange lever downwards.
5 The gearchange lever can be removed from the ball socket housing if the large retaining circlip is first extracted, but take care as the internal coilspring exerts considerable tension.
6 Refitting is a reversal of the removal procedure. Use the marks made at the elongated bolt holes when dismantling to ensure correct alignment, and check for correct operation on completion.

15 Fault diagnosis – transmission

Symptom	Reason(s)
Ineffective synchromesh on one or more gears	Worn synchro limiting strips and rings
Jumps out of one or more gears	Weak detent springs Worn shift forks Worn engagement dogs Worn synchro hubs
Whinning, roughness, vibration allied to other faults	Bearing failure and/or overall wear Incorrect gear endfloat or backlash
Noisy and difficult gear engagement	Clutch not operating correctly
Sloppy and imprecise gear selection	Overall wear throughout the selector mechanism
Noisy differential:	
(a) During normal running	Lack of oil, damaged or worn gears, incorrect adjustment
(b) During deceleration	Incorrect adjustment or damage to drive pinion bearings
(c) During turning of vehicle	Worn or damaged axleshaft bearing, worn differential gears
Noisy rear hub	Worn axleshaft bearings, buckled roadwheel, defective tyre, bent axleshaft

Chapter 8 Braking system

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Specifications

System type	Hydraulic, four-wheel disc, with servo and pressure regulating valve. Handbrake mechanical to rear calipers
Front discs	
Disc diameter	261.6 mm (10.3 in)
Minimum disc thickness after refinishing	10.0 mm (0.394 in)
Rear discs	
Disc diameter	248.9 mm (9.8 in)
Minimum disc thickness	9.0 mm (0.354 in)
Disc pad friction material	
Minimum thickness	2.0 mm (0.079 in)
Hydraulic fluid	To or exceeding SAE J1703c, FMVSS 116 or DOT3

Torque wrench settings	**Nm**	**lbf ft**
Front caliper mounting bolts	84	62
Rear caliper mounting nuts	54	40
Rear disc mounting bolts	54	40
Servo mounting nuts	15	11
Pipeline unions	10	7
Rear crossmember mounting bolts	45	33

1 Description and fluid precautions

The braking system is of dual circuit hydraulic type, with disc brakes at front and rear. A vacuum servo unit is fitted.

The handbrake is cable-operated to mechanical assemblies incorporated in the rear inboard disc calipers.

Use only recommended fluid for topping up or bleed purposes. Never allow anything except methylated spirit or clean hydraulic fluid to come in contact with any internal part of the braking system. Brake fluid will dissolve paintwork, so avoid spilling it on the bodywork.

2 Maintenance

1 At the intervals suggested in Routine Maintenance, check the fluid level in the master cylinder reservoir. Top up as necessary; investigate any sudden fall in level.

2 Regularly inspect the entire hydraulic system for leakage at unions and pipeline connections.

3 At two-yearly intervals, renew the system fluid by bleeding. Hydraulic fluid is hygroscopic (absorbs moisture from the atmosphere) and if left in the system for too long can cause corrosion of the brake cylinders and pistons.

4 The handbrake does not require regular adjustment, but provision is made for initial setting and for taking up slack in the cable due to stretching.

5 Periodically, lubricate the pedal pivot bushes and the handbrake cable pivot pins at the caliper levers.

6 Disc pads must be inspected at the specified intervals. The frequency with which renewal is required will depend on driving style and conditions.

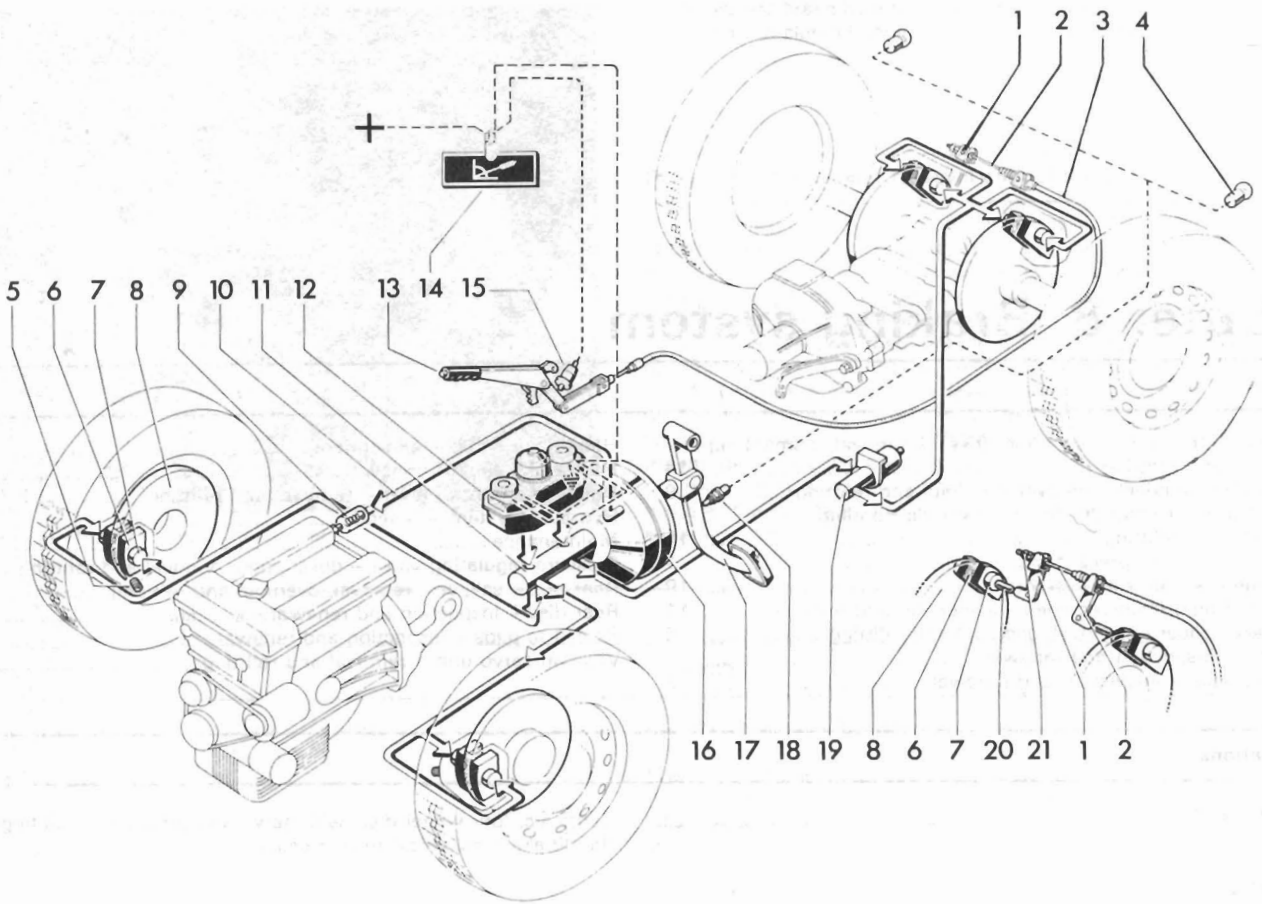
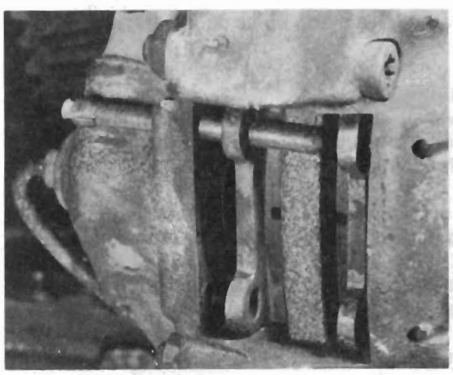


Fig. 8.1 Braking system (LHD) (Sec 1)

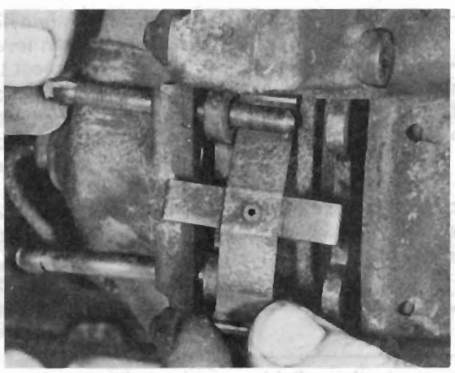
1 *Handbrake operating levers*
2 *Handbrake cable*
3 *Handbrake cable conduit*
4 *Stop-lamps*
5 *Caliper bleed screws*
6 *Disc pads*
7 *Caliper pistons*
8 *Front discs*
9 *Vacuum servo non-return valve*
10 *Servo vacuum hose*
11 *Brake master cylinder*
12 *Fluid reservoir*
13 *Handbrake control lever*
14 *Handbrake/fluid level warning lamp*
15 *Handbrake 'ON' warning switch*
16 *Vacuum servo unit*
17 *Pedal*
18 *Stop-lamp switch*
19 *Pressure limiting valve*
20 *Disc pad pushrods (handbrake operated)*
21 *Handbrake cable adjuster and locking nuts*

3 Front disc pads – inspection and renewal

1 Raise the front of the car and support it securely.
2 Remove the roadwheel.
3 Using a thin rod, drive out the pad retaining pins towards the centre of the car (photo).
4 Take out the cross-shaped spring (photo).
5 Inspect the thickness of the friction material. If it has worn down to the specified minimum, the pads must be renewed. The same applies if the pads are contaminated, in which case the source of contamination must be rectified also.
6 Grip the end of each pad backing plate and withdraw it from the caliper (photo).
7 Brush away all dust and dirt from the caliper jaws, taking care not to inhale it.
8 In order to be able to accommodate the increased thickness of the new pads, the caliper pistons must be pushed fully into their cylinders. This will cause the fluid level in the master cylinder reservoir to rise, so anticipate this by syphoning some out. An old hydrometer or poultry baster is useful for this. Do not syphon by mouth – hydraulic fluid is poisonous.



3.3 Removing a front disc pad retaining pin



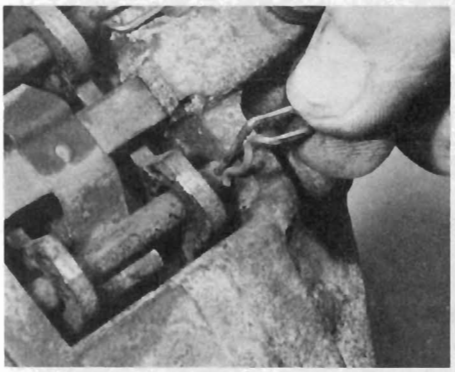
3.4 Removing the disc pad spring

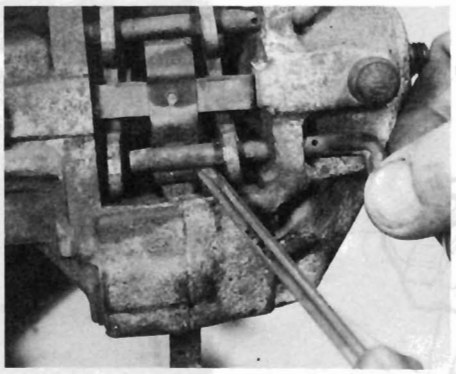
3.6 Withdrawing the disc pads

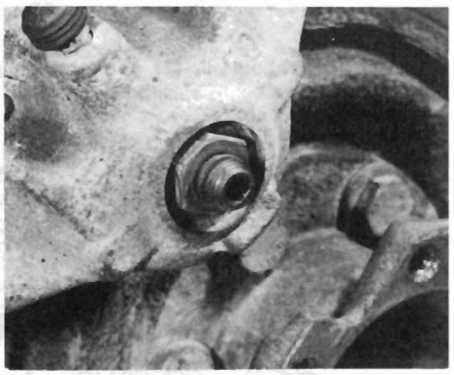
9 Place a wide flat piece of metal between the caliper pistons and twist it to push both pistons squarely into their cylinder bores. Take care not to scratch the bores.
10 Insert the pads, making sure that the friction material is against the disc.
11 Locate the cross-shaped spring and insert the retaining pins from the inboard side.
12 Apply the footbrake hard two or three times to position the pads.
13 Repeat the operations on the opposite wheel, as the pads should always be renewed as an axle set.

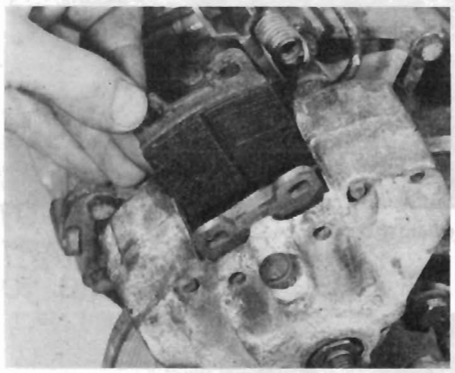
4 Rear disc pads – inspection and renewal

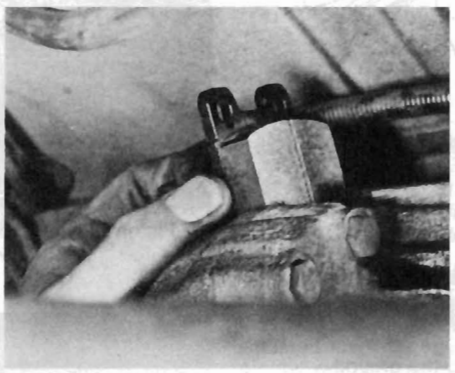
1 Chock the front wheels, raise the rear of the car and support it very securely on axle stands.
2 Prise out the small spring clips from the pad retaining pins (photo).
3 Pull out the retaining pins and the cross-shaped spring. Inspect the pads as described in Section 3, paragraph 5 (photo).
4 Unscrew and remove the cap from the pad adjuster screw and then release the locknut and turn the socket-headed screw (photo). Now turn the adjuster screw on the opposing pad to provide maximum pad clearance. Check that the master cylinder fluid reservoir does not overflow, if necessary syphon some fluid out.
5 Grip the ends of the pad backplates with a pair of pliers and withdraw the pads (photo).
6 Brush out all dust and dirt from the caliper jaws, taking care not to inhale it.
7 Insert the new pads, making sure that the friction material is against the disc, also that the pad reference marks are pointing in the direction of normal forward motion of the car (photo).
8 Insert the pad retaining pins and the cross-shaped spring. Fit the pin retaining clips (photo).
9 The pad adjusting nut and screw must now be turned until the clearance between the face of each pad and the brake disc is between 0.10 and 0.15 mm (0.004 and 0.006 in). Measure this with a feeler blade (photos). Tighten the locknut and refit the adjuster nut dust excluding cap. Do not overtighten it as it is of plastic (photo).

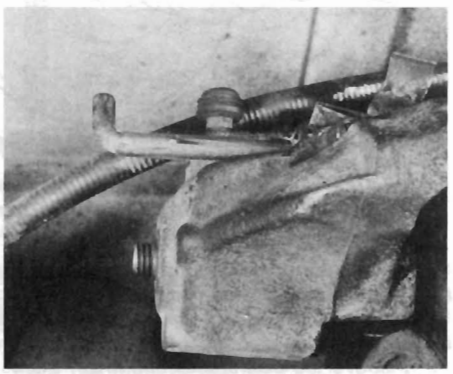

4.2 Rear disc pad pins and clips

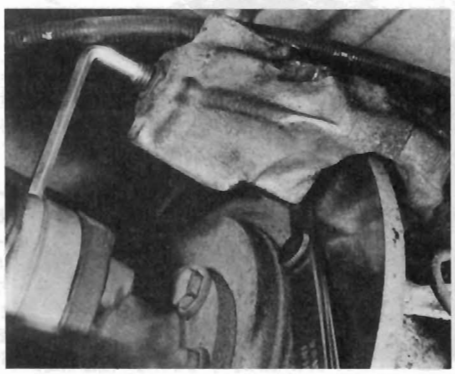

4.3 Removing a disc pad retaining pin

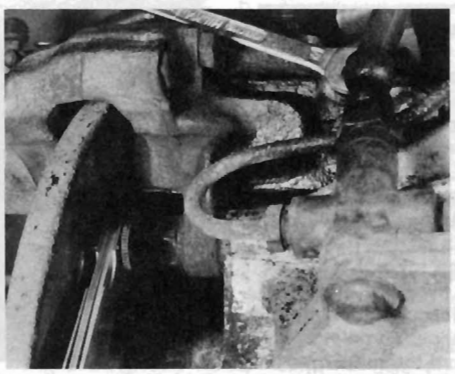

4.4 Rear disc pad adjuster screw showing Allen key hole

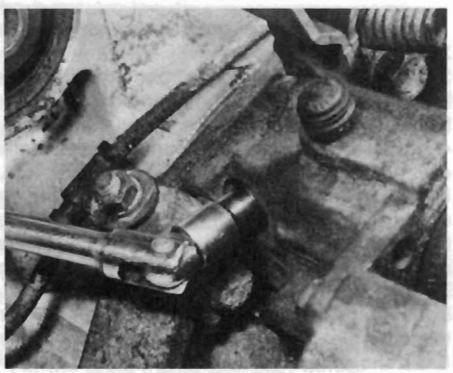

4.5 Removing a rear disc pad


4.7 Inserting a rear disc pad


4.8 Rear disc pad retaining pin partially inserted


4.9a Turning a pad adjuster screw


4.9b Turning the inboard pad adjuster screw


4.9c Tightening rear disc pad adjuster locknut

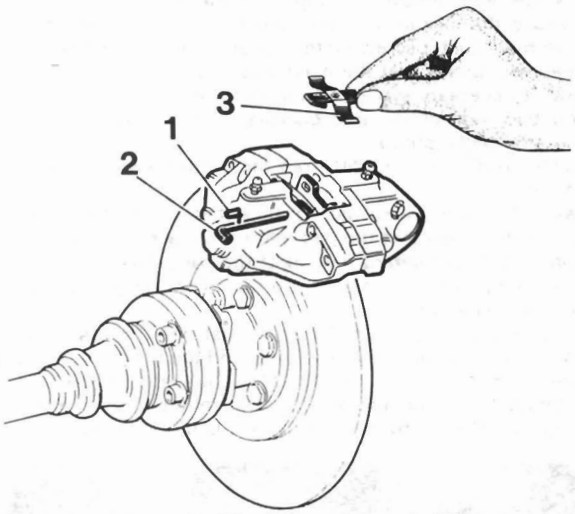


Fig. 8.2 Rear caliper clip (1), pad retaining pin (2) and anti-rattle spring (3) (Sec 4)

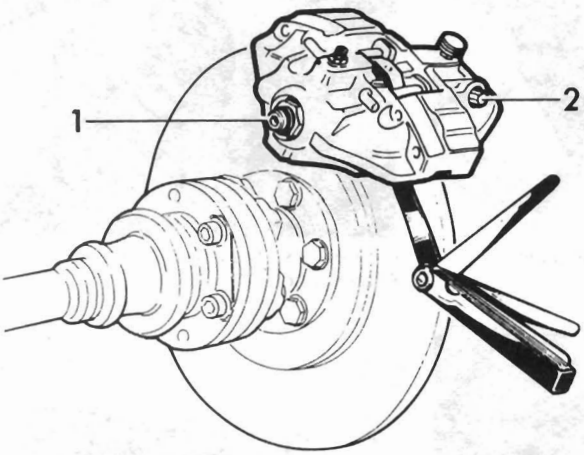


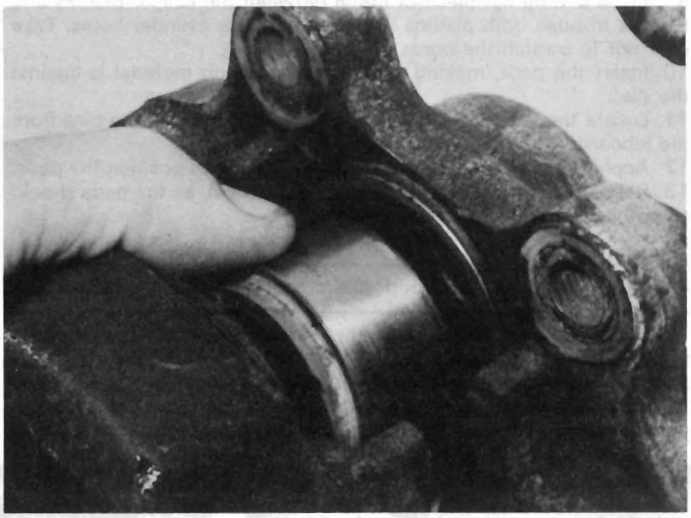
Fig. 8.3 Checking rear disc pad clearance (Sec 4)

1 Inboard pad adjuster nut
2 Outboard pad adjuster screw

10 Repeat the operations on the opposite brake as the pads should always be renewed as an axle set.
11 Apply the footbrake pedal hard two or three times to set the pads against the discs.
12 Remove the axle stands and lower the car to the ground.

5 Front brake caliper – removal, overhaul and refitting

1 Raise the front of the car and support it securely.
2 Remove the roadwheel.
3 Disconnect the flexible hose from the brake pipeline by unscrewing the union nut. Cap the open ends of the hose and pipe to prevent loss of fluid and entry of dirt. Bleed nipple dust caps are useful for this.
4 Unscrew the caliper mounting bolts and slide the caliper off the disc and stub axle.
5 Clean any external dust and remove the disc pads (see Section 3).
6 Low air pressure (eg from a foot pump) should now be applied to the hydraulic connection on the caliper to eject a piston. Retain the opposing piston in its cylinder using a small clamp (photo).
7 Wash all components in methylated spirit or hydraulic fluid, then examine the surfaces of piston and cylinder bore. If scored, or if metal-to-metal rubbing areas are evident, renew the caliper complete.
8 If the components are in good condition, discard the rubber piston seal and dust excluder and obtain a repair kit which will contain all the necessary renewable items.



5.6 Removing a caliper piston

5.9 Piston seal in caliper cylinder bore

5.12 Fitting a caliper dust excluder

9 The seal should be extracted from its groove in the cylinder bore by picking it out with a sharp instrument. Take care not to score the bore (photo).
10 Manipulate the new seal into place using the fingers only.
11 Apply clean hydraulic fluid to the piston and cylinder bore and insert the piston squarely but only partially into the bore. Now turn the piston until the anti-squeal step is at 45° to the horizontal and at the lower part of the piston as shown in Fig. 8.5.
12 Fit the dust excluder and retaining ring (photo).
13 Clamp the reconditioned piston in its bore and blow out the remaining piston. Repeat the reconditioning operations.
14 Remove the piston clamp and depress both pistons fully into their cylinders.
15 Refit the caliper to the stub axle and tighten the bolts to the specified torque.
16 Reconnect the hydraulic line.
17 Fit the disc pads as described in Section 3.
18 Refit the roadwheel and lower the car.
19 Bleed the hydraulic circuit as described in Section 12.

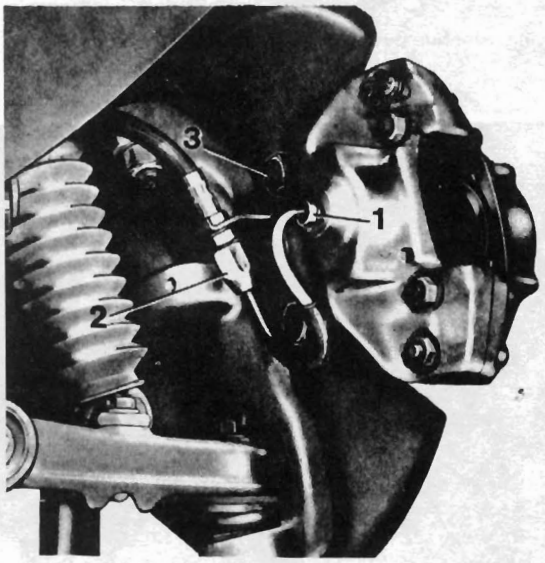


Fig. 8.4 Front caliper pipeline connection (Sec 5)

1 Union 2 Union 3 Caliper mounting bolt

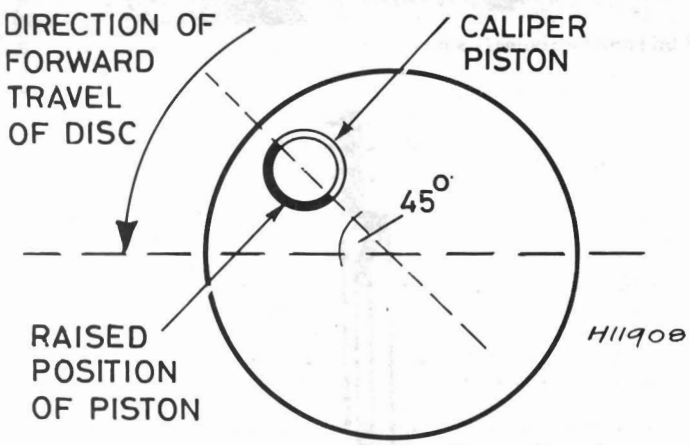


Fig. 8.5 Caliper piston step setting diagram (Sec 5)

6 Rear brake caliper – removal, overhaul and refitting

1 Raise the rear of the car and support it securely.
2 Disconnnect and plug the pipeline from the appropriate side of the three-way adaptor on the final drive housing.
3 Unscrew and remove the locknut and adjuster nut from the end of the handbrake cable.
4 Disconnect the cable from the lever on the caliper.
5 Remove the rear disc, as described in Section 8.
6 Unscrew the caliper mounting nuts and remove the caliper.
7 Overhaul of the caliper is very similar to that described for a front caliper in Section 5, paragraphs 5 to 14.
8 Refit the caliper, tightening the nuts to the specified torque.
9 Refit the disc (Section 8).
10 Reconnect the hydraulic line and brake cable.
11 Fit the disc pads as described in Section 4.
12 Adjust the handbrake cable as described in Section 16.
13 Bleed the hydraulic system, as described in Section 12.
14 Lower the car.

7 Front disc – inspection and renewal

1 Whenever the disc pads are being inspected for wear, always check the discs for deep grooving. Light scoring is a normal condition.
2 Where the disc is found to be deeply grooved it may be machined, provided the finished dimensions are within the specified limits as shown in Fig. 8.6 or Fig. 8.7. If not, renew the disc.

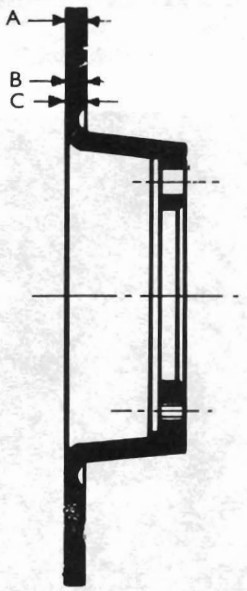


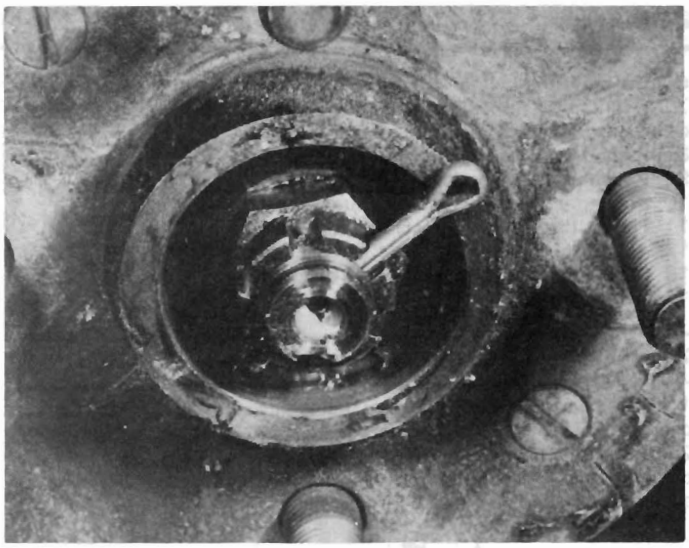
Fig. 8.6 Front disc refinishing diagram (Sec 7)

A Minimum thickness 10.0 mm (0.394 in)
B Surface finish 0.4 to 0.9 microns (circumferential)
C Surface finish 0.5 to 1.2 microns (radial)

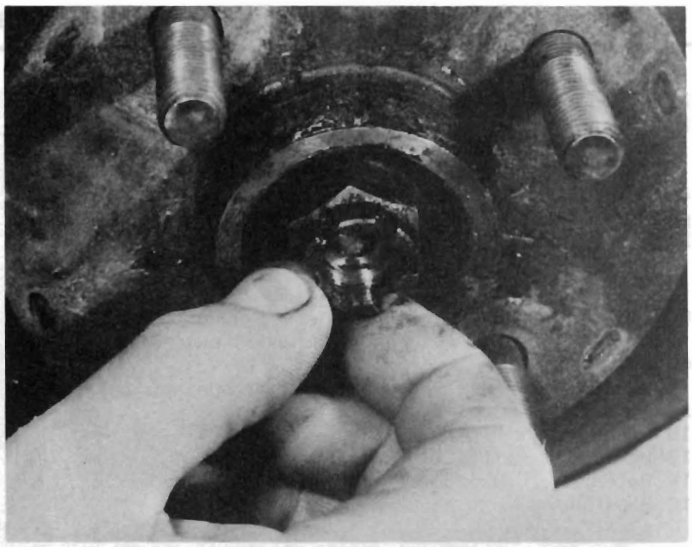
3 If the disc is suspected of being buckled, the run-out can be checked using a dial gauge or feeler blades against a fixed point while the disc is rotated. Make sure that the hub bearings are correctly adjusted first (Chapter 10).
4 To remove the disc, have the front of the car raised with the roadwheel removed. Remove the disc pads.
5 Tap off the hub dust cap, remove the split pin and castellated nut. Take out the thrust washer and the bearing (photos).
6 Unbolt and remove the hub from the disc.
7 Slide the disc from the stub axle and out of the caliper. There is no need to disconnect or remove the caliper to remove the disc (photo).
8 Refit by reversing the removal operations.
9 Adjust the hub as described in Chapter 10.
10 If a new disc is being fitted, make sure that any protective grease is removed from it.

8 Rear disc – inspection and renewal

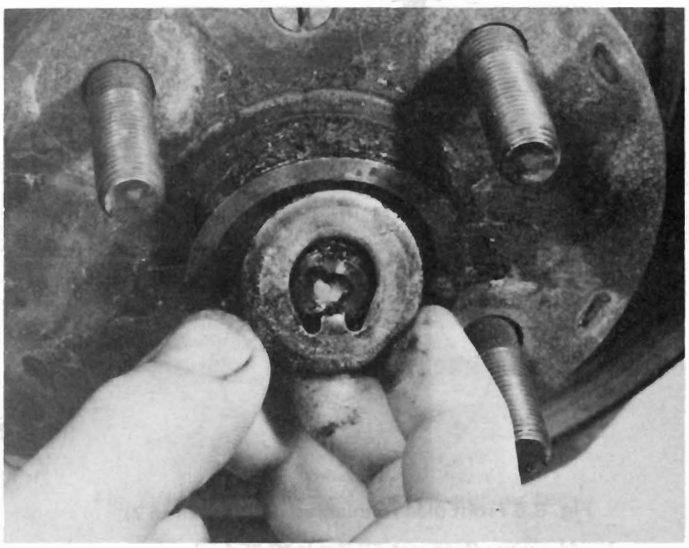
1 Refer to paragraphs 1 to 3 of the preceding Section.
2 To remove the disc, unscrew and remove the bolts which secure the spacer and disc to the differential shaft stubs. Remove the disc pads.
3 Push the driveshaft upwards and withdraw the disc downwards.
4 Refit the disc, tightening the bolts to the specified torque.
5 Refit the disc pads and adjust the pad-to-disc clearance as described in Section 4.



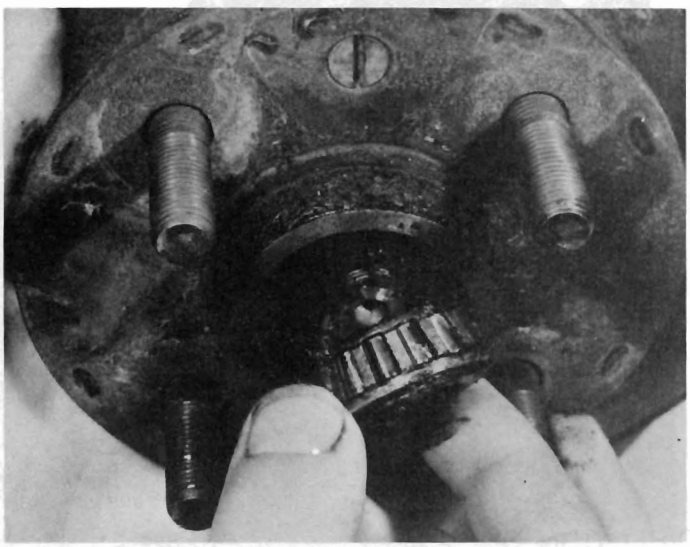
7.5a Removing front hub nut split pin



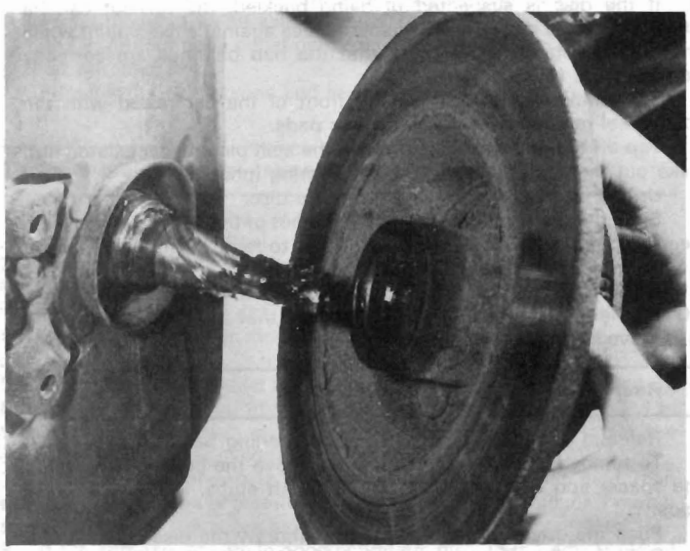
7.5b Removing front hub nut



7.5c Removing front hub thrust washer



7.5d Front hub outer bearing



7.7 Removing a front brake disc

Fig. 8.7 Rear disc refinishing diagram (Sec 8)

A Minimum refinishing thickness 9.0 mm (0.354 in)
B Surface finish 0.4 to 0.9 microns (circumferential)
C Surface finish 0.5 to 1.2 microns (radial)

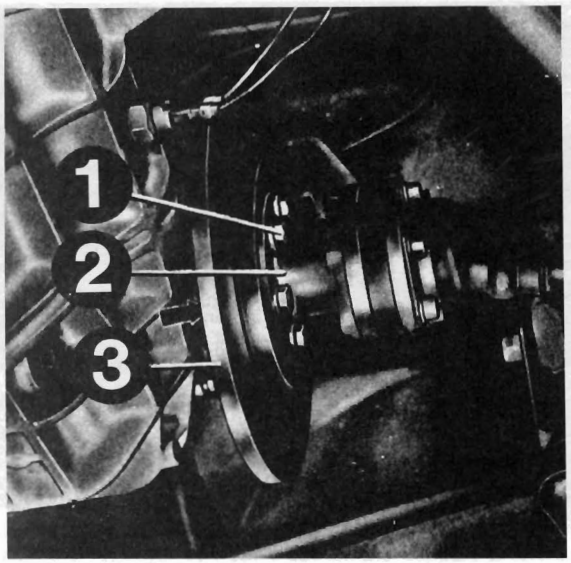


Fig. 8.8 Rear disc retaining bolts (Sec 8)

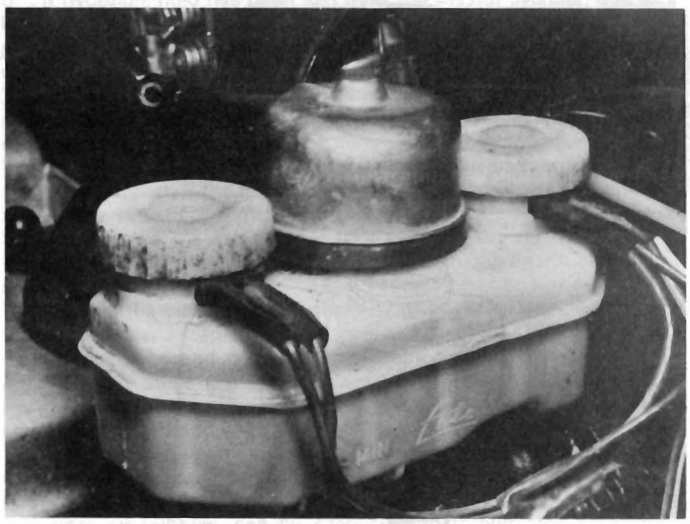
1 Bolts
2 Spacer
3 Brake disc

9 Brake master cylinder – removal, overhaul and refitting

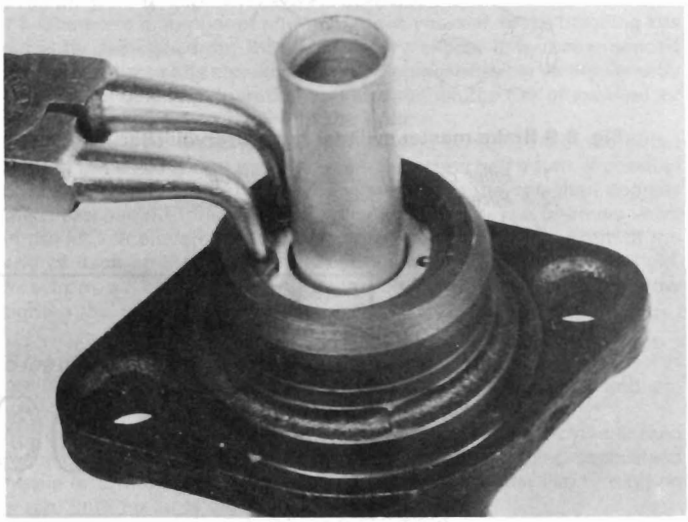
1 The master cylinder is mounted on the front face of the vacuum servo unit (photo).
2 Remove the filler cover and filter gauze.
3 Syphon out as much fluid from the reservoir as possible.
4 Prise off the plastic reservoir and remove the two rubber seals. Guard against fluid spillage onto the paintwork.
5 Unscrew the pipelines from the master cylinder body and cap the open ends of the pipes. Bleed nipple dust caps are useful for this.
6 Unscrew the two flange mounting nuts and lift the master cylinder from the servo unit.
7 Clean away all external dirt and grip the master cylinder carefully in the jaws of a vice.
8 Extract the circlip from the end of the master cylinder. Be prepared for the ejection of the primary piston components, which will come out under spring pressure (photo).
9 Using a long screwdriver or rod, depress the secondary piston while the stop bolt is unscrewed and removed.
10 Remove the rod and extract the secondary piston from the cylinder (photo).
11 Examine the cylinder bore and pistons for scoring or evidence of metal-to-metal rubbing. If these conditions are found, renew the master cylinder complete.
12 Where the components are in good condition, clean them in methylated spirit or hydraulic fluid – nothing else. Discard the rubber seals and obtain a repair kit.
13 Use the fingers only to manipulate the new seals into position, noting carefully the correct direction in which the seal lips face.
14 Dip the secondary piston in clean hydraulic fluid and insert it carefully into the cylinder, taking care not to trap the seal lips.
15 Keep pressure on the end of the piston while the stop bolt is screwed in.
16 Repeat the operations with the primary piston and fit the retaining circlip.
17 Fill the end of the master cylinder with rubber grease and locate the cylinder on the servo. Tighten the mounting nuts.
18 Refit the fluid reservoir, using new rubber seals if required.
19 Reconnect the pipelines.
20 Bleed the complete system as described in Section 12.

10 Pressure regulating valve – description, removal and refitting

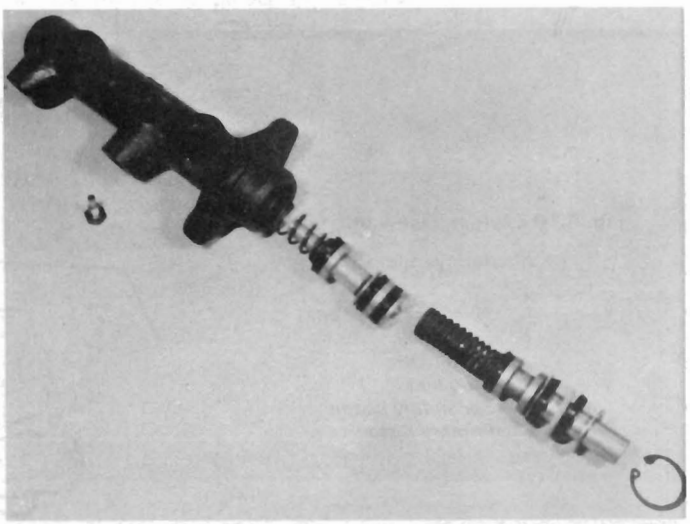
1 A pressure regulating valve is fitted in the hydraulic pipeline to the rear brakes. Its purpose is to limit the pressure to the rear brakes



9.1 Brake master cylinder



9.8 Extracting the brake master cylinder circlip



9.10 Exploded view of the brake master cylinder

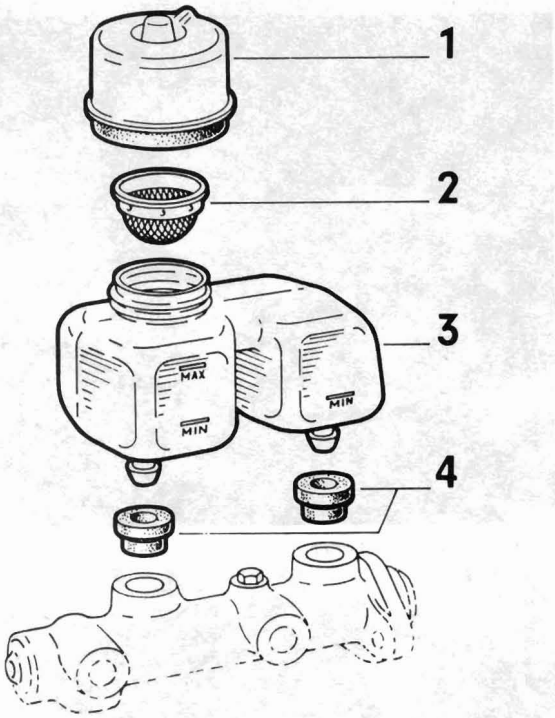
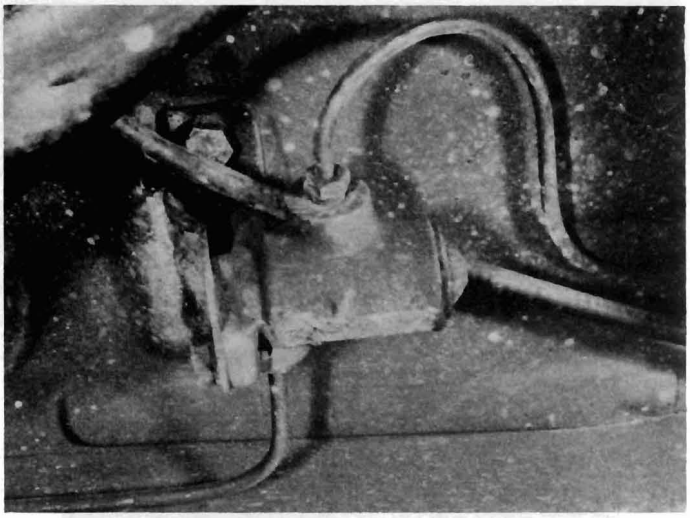


Fig. 8.9 Brake master cylinder fluid reservoir (Sec 9)

1 Filler cap
2 Filter
3 Reservoir
4 Rubber seals



10.2 Brake pressure regulating valve

during heavy applications of the brake pedal, to reduce the possibility of rear wheel lock-up.

2 The valve is of sealed type, bolted to the underside of the floor pan, and it can only be renewed as a complete assembly (photo).

3 Disconnect the hydraulic pipelines from the valve and cap the open ends of the pipes. Bleed nipple dust caps are useful for this.

4 Unscrew the valve mounting screw and remove the valve.

5 Refitting is a reversal of removal, but bleed the hydraulic circuit as described in Section 12 on completion of the work.

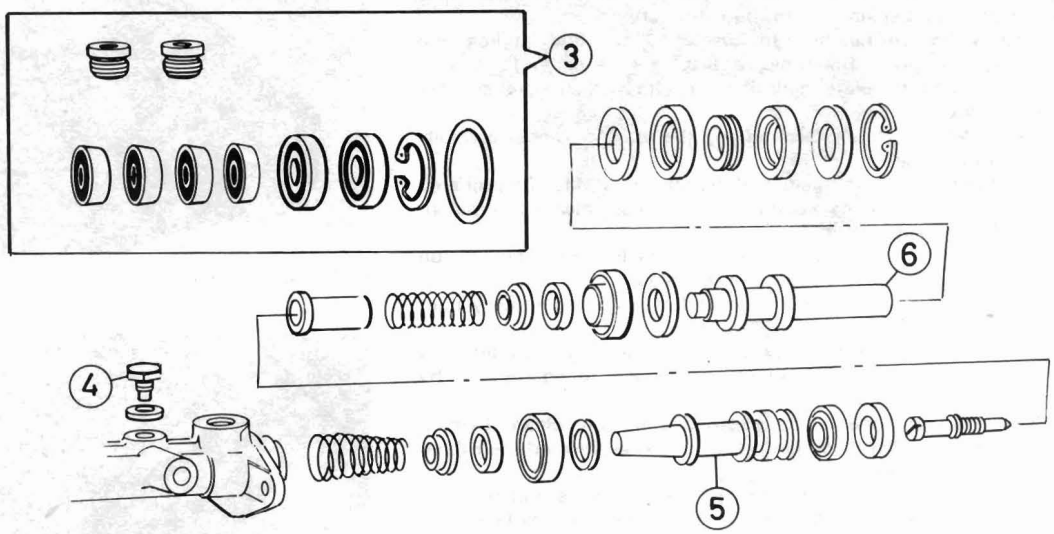
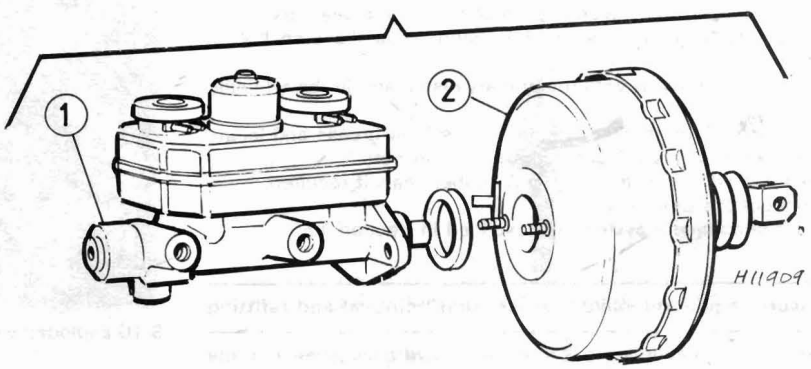


Fig. 8.10 Exploded view of typical brake master cylinder (Sec 9)

1 Master cylinder body
2 Servo unit
3 Repair kit
4 Stop bolt
5 Secondary piston
6 Primary piston



11 Flexible and rigid hydraulic lines – inspection and renewal

1 At regular intervals wipe the steel pipes clean and examine them for signs of rust or denting caused by flying stones.
2 Examine the securing clips. Bend the tongues of the clips if necessary to ensure that they hold the brake pipes securely without letting them rattle or vibrate.
3 Check that the pipes are not touching any adjacent components or rubbing against any part of the vehicle. Where this is observed, bend the pipe gently away to clear.
4 Any section of pipe which is rusty or chafed should be renewed. Brake pipes are available to the correct length and fitted with end unions from most Alfa Romeo dealers and can be made to pattern by many accessory suppliers. When installing the new pipes use the old pipes as a guide to bending and do not make any bends sharper than is necessary.
5 The system will of course have to be bled when the circuit has been reconnected.
6 Inspect the condition of the flexible hoses leading from under the front wings to the brackets on the front suspension units, and also the single hose on the rear axle casing. If they are swollen, damaged or chafed, they must be renewed.
7 Undo the locknuts at both sides of the support bracket. Then holding the hexagon nut on the flexible hose steady, undo the rigid pipe union nut and remove the flexible hose and washer. Unscrew the hose end fitting from the hydraulic component (photo).
8 Refitting is a reversal of the removal procedure, but carefully check that all the securing brackets are in a sound condition and that the locknuts are tight. Bleed the hydraulic system.

12 Hydraulic system – bleeding

1 Two independent hydraulic circuits are used, one for the rear brakes, one for the front.
2 If the master cylinder has been removed and refitted, then the complete system should be bled.
3 If only a component of one circuit has been disturbed then only the particular circuit need be bled.

Bleeding – two-man method

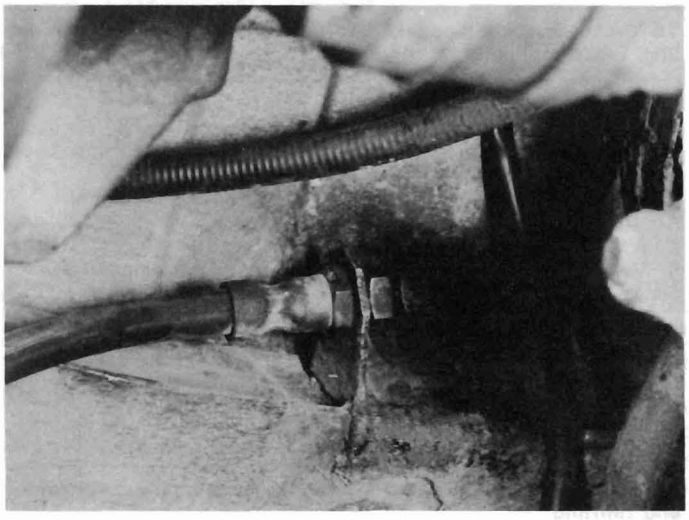
4 Gather together a clean glass jar and a suitable length of plastic or rubber tubing which is a tight fit over the bleed screw. Engage the help of an assistant.
5 Before commencing the bleeding operation, check that all rigid pipes and flexible hoses are in good condition and that all hydraulic unions are tight. Take great care not to allow hydraulic fluid to come into contact with the vehicle paintwork, otherwise the finish will be seriously damaged. Wash off any spilled fluid immediately with cold water.
6 If hydraulic fluid has been lost from the master cylinder, due to a leak in the system, ensure that the cause is traced and rectified before proceeding further or a serious malfunction of the braking system may occur.
7 To bleed the system, clean the area around the bleed screw at the caliper to be bled. If the hydraulic system has only been partially disconnected and suitable precautions were taken to prevent further loss of fluid, it should only be necessary to bleed that part of the system. However, if the entire system is to be bled, start at the wheel furthest away from the master cylinder.
8 Remove the master cylinder filler cap and top up the reservoir. Periodically check the fluid level during the bleeding operation and top up as necessary.
9 Destroy the vacuum in the servo by giving several applications of the brake pedal in rapid succession.
10 Connect one end of the plastic tubing to the bleed screw and immerse the other end in the glass jar containing sufficient clean hydraulic fluid to keep the end of the tube submerged. Open the bleed screw half a turn and have your assistant depress the brake pedal to the floor and then slowly release it. Tighten the bleed screw at the end of each downstroke to prevent expelled air and fluid from being drawn back into the system. Repeat this operation until clean hydraulic fluid, free from air bubbles, can be seen coming through the tube. Now tighten the bleed screw and remove the tube.

Bleeding – using one-way valve kit

11 There are a number of one-man, do-it-yourself, brake bleeding kits currently available from motor accessory shops. It is recommended that one of these kits should be used wherever possible as they greatly simplify the bleeding operation and also reduce the risk of expelled air and fluid being drawn back into the system.
12 If a one-man brake bleeding kit is being used, connect the outlet tube to the bleed screw and then open the screw half a turn. If possible position the unit so that it can be viewed from the car, then depress the brake pedal to the floor and slowly release it. The one-way valve in the kit will prevent dispelled air from returning to the system at the end of each stroke. Repeat this operation until clean hydraulic fluid, free from air bubbles, can be seen coming through the tube. Now tighten the bleed screw and remove the outlet tube (photo).

Bleeding – using a pressure bleeding kit

13 These too are available from motor accessory shops and are usually operated by air pressure from the spare tyre.
14 By connecting a pressurised container to the master cylinder fluid reservoir, bleeding is then carried out by simply opening each bleed nipple in turn and allowing the fluid to run out, rather like turning on a tap, until no air is visible in the fluid.
15 Using this system, the large reserve of hydraulic fluid provides a safeguard against air being drawn into the master cylinder during the bleeding operation.
16 This method is particularly effective when bleeding 'difficult'



11.7 Typical brake hose/pipe connection

12.12 Bleeding a caliper with a one-way valve kit

systems and when bleeding the entire system at time of routine fluid renewal.

All systems

17 When completed, recheck the fluid level in the master cylinder, top up if necessary and refit the cap. Check the 'feel' of the brake pedal which should be firm and free from any 'sponginess' which would indicate air still present in the system.

18 Discard any expelled hydraulic fluid as it is likely to be contaminated with moisture, air and dirt which makes it unsuitable for further use. Clean fluid should always be stored in an airtight container as it absorbs moisture which will lower its boiling point.

13 Vacuum servo unit – removal and refitting

Left-hand drive

1 Syphon the fluid from the brake and clutch master cylinder reservoirs. An old battery hydrometer or poultry baster is useful for this.

2 Disconnect the vacuum hose from the servo unit, and the electrical leads from the master cylinder.

3 Disconnect and plug all hydraulic pipelines from both the brake and clutch master cylinders.

4 Working inside the car, extract the socket-headed screws and remove the lower half of the steering column shroud.

5 Unscrew and remove the securing pinch-bolt from the steering column upper bracket.

6 Lower the steering column and withdraw the upper half of the column shroud.

7 Peel back the carpet from the front footwell and unscrew the five nuts which secure the pedal box to the bulkhead. Note that the two lower nuts retain the clutch pedal stroke adjusting plates.

8 Working within the engine compartment, withdraw the complete pedal box/servo assembly from the bulkhead.

9 Remove the pedal box gasket.

10 Extract the circlip and clevis pin to disconnect the pushrod from the pedal.

11 Remove the spring anchor plate and the coil spring.

12 Unscrew the nuts and separate the servo/master cylinder from the pedal box.

13 Unbolt the master cylinder from the servo unit.

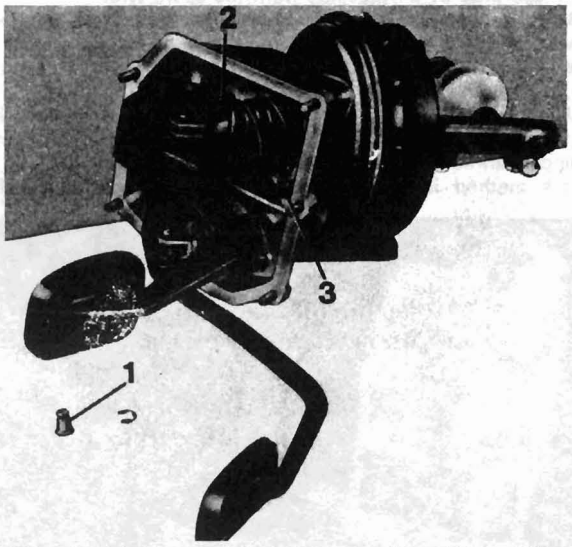


Fig. 8.11 Pedal box/servo assembly (LHD) (Sec 13)

1 Clevis pin
2 Spring retaining plate
3 Servo mounting nut

Right-hand drive

14 These models have been adapted from the original left-hand drive design by using a cross-shaft which connects the pedal to the servo. These are mounted at opposite ends of the engine compartment bulkhead.

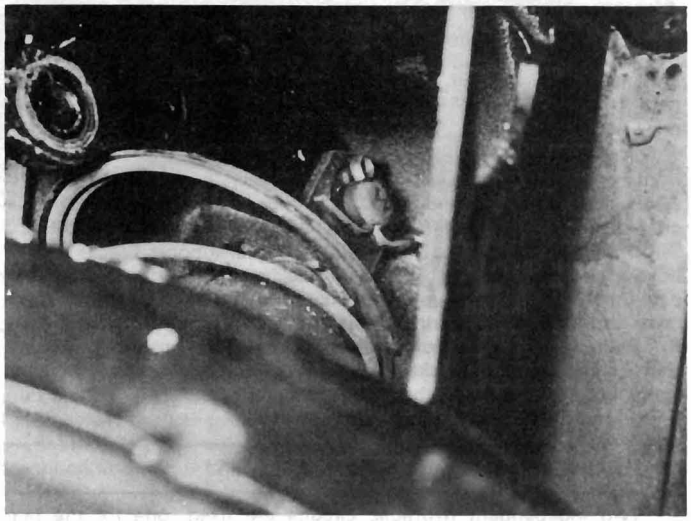
15 Disconnect the vacuum hose from the servo unit, also the electrical leads and fluid pipelines from the master cylinder. Plug the fluid lines.

16 Working at the left-hand end of the pedal cross-shaft, unbolt it from the servo bracket.

17 Working inside the car, peel back the carpet and unbolt the servo from the bulkhead.

18 Now return to the engine compartment and slide the servo off the end of the cross-shaft until the servo pushrod can be disconnected from the cross-shaft bellcrank by extracting the split pin and clevis pin. Remove the coil spring (photo).

19 Unbolt the master cylinder from the servo unit.



13.18 Servo pushrod connection to pedal cross-shaft bellcrank (RHD)

All models

20 A fault in a servo unit should be rectified by renewal. Do not attempt to dismantle or repair a servo unit. Before deciding that a servo unit is at fault, check the vacuum hose for splits or loose end connections. Also check the non-return valve which is screwed into the rear end of the intake manifold. This can be renewed by unscrewing it.

21 Refitting is a reversal of removal. Check the condition of the pedal box and servo weathersealing gaskets. If new components have been installed, check the clutch pedal adjustment as described in Chapter 6, Section 9.

14 Brake and clutch pedals (left-hand drive) – removal, dismantling, reassembly and refitting

1 Remove the pedal box complete with pedals as described in the preceding Section.

2 Extract the clevis pin which secures the clutch pushrod to the clutch pedal.

3 Remove the clutch spring anchor plate and the coil spring.

4 Unscrew the mounting nuts and lift the clutch master cylinder from the pedal box.

5 Extract the retaining pin, pull out the pedal pivot shaft and take the pedals out of the pedal box.

6 Check for wear and renew the pivot bushes if necessary.

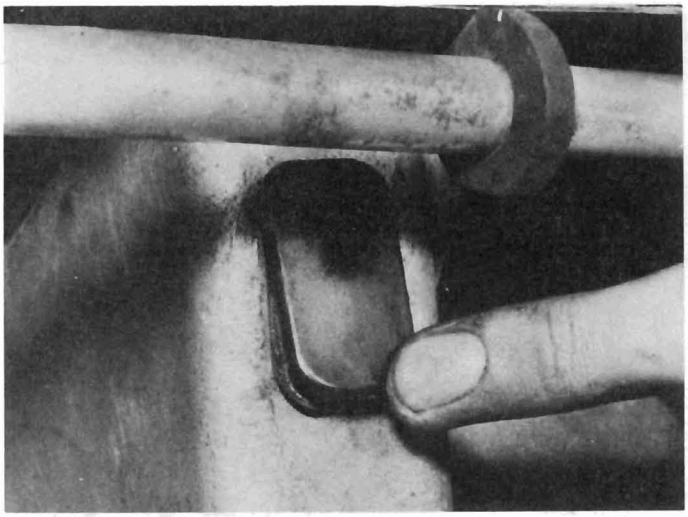
7 Reassembly is a reversal of dismantling, but apply grease to the pedal pivot shaft.

8 Refer to Chapter 6, Section 9 for details of clutch pedal stroke adjustment.

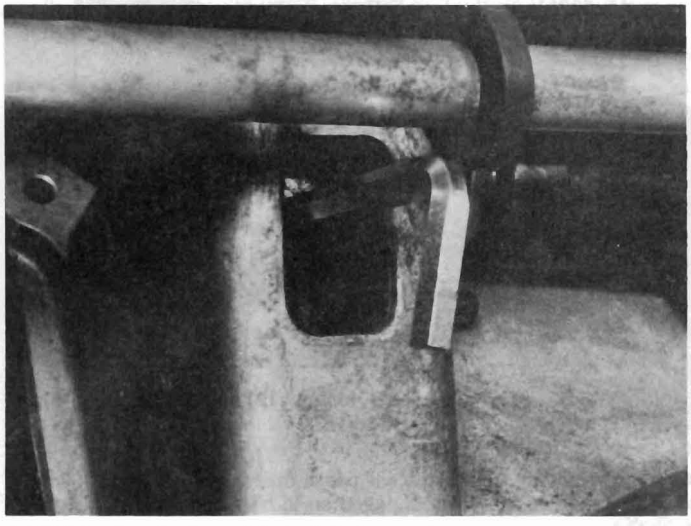
15 Brake pedal (right-hand) – removal, dismantling, reassembly and refitting

1 Working within the engine compartment, prise out the blanking

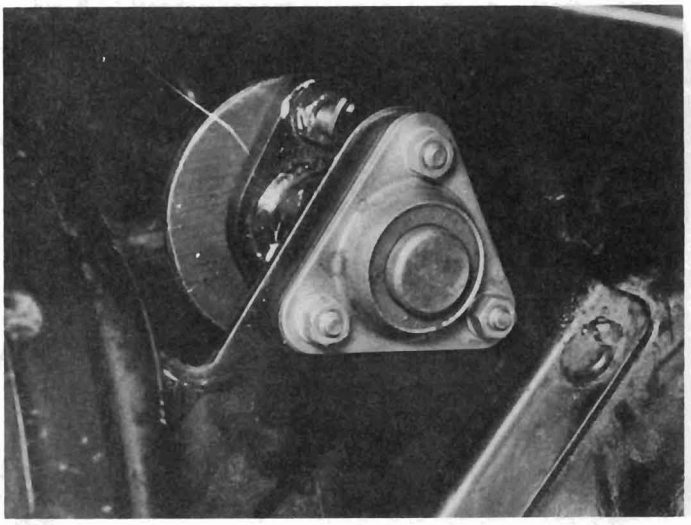
plug from the pedal box (photo).
2 Unscrew the socket-headed pinch-bolt now visible (photo).
3 Unscrew the nuts from the bearing cover plates at both ends of the cross-shaft. This shaft connects the brake pedal to the servo and is located just below the air intake scuttle (photo).
4 Working at the servo end of the cross-shaft, pull out the split pins from the nuts which connect the cross-shaft to the servo pushrod bellcrank. Withdraw the connecting bolts with their retaining nuts, taking care not to drop them. Release the wiper motor mounting bracket from the bulkhead and pull it slightly away (photos).
5 Pass a screwdriver into the hole left by removal of the pedal box blanking plug and retain the pedal so that the cross-shaft can be removed by pulling it sideways out of the pedal arm boss splines. The pedal will now drop into the driver's side footwell.
6 Note the spherical bearing at each end of the cross-shaft, and the inner and outer bearing plates.
7 Refitting is a reversal of removal, but the following preliminary operations will make a difficult job easier.
8 Open the clamp slightly at the top of the pedal arm to make it easier for the cross-shaft to slide into the splines (photo). Note that there is a master spline to provide the correct shaft-to-pedal alignment, but as this cannot be detected during assembly, temporarily fit the cross-shaft to the pedal and paint alignment marks in such a



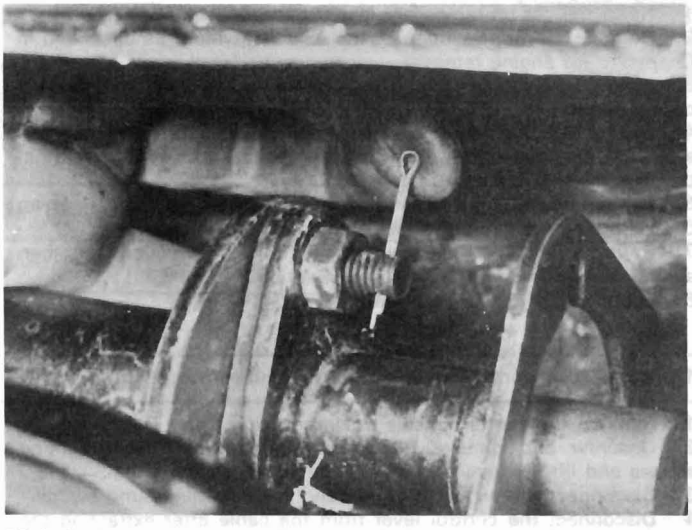
15.1 Pedal box blanking plug (RHD)



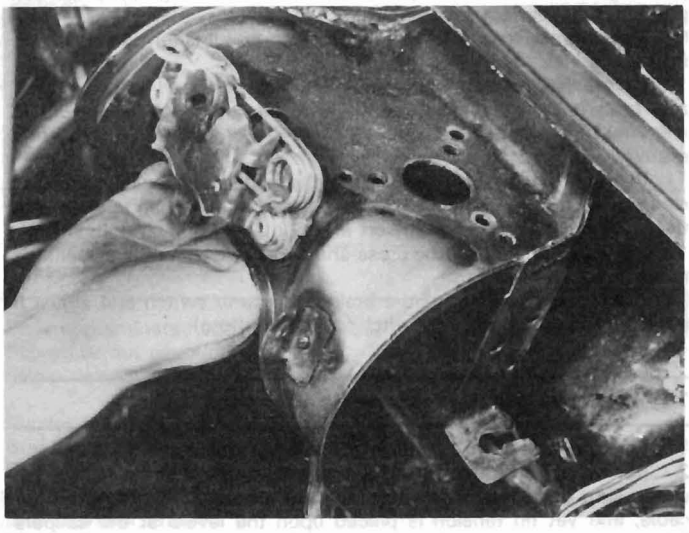
15.2 Releasing brake pedal pinch-bolt



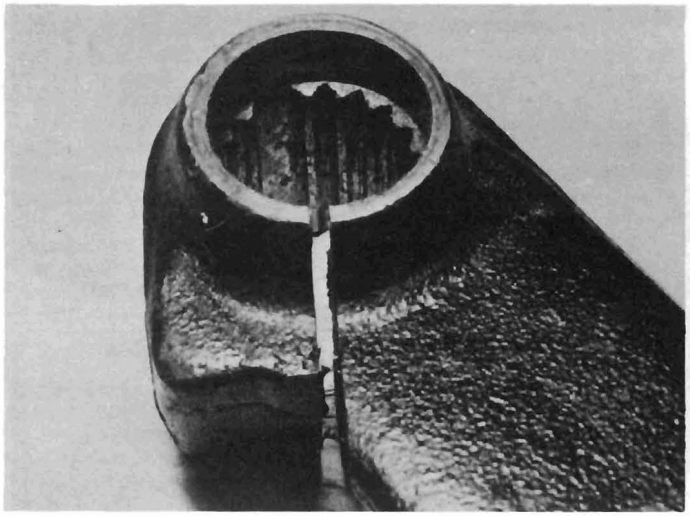
15.3 Brake pedal cross-shaft bearing cover plate



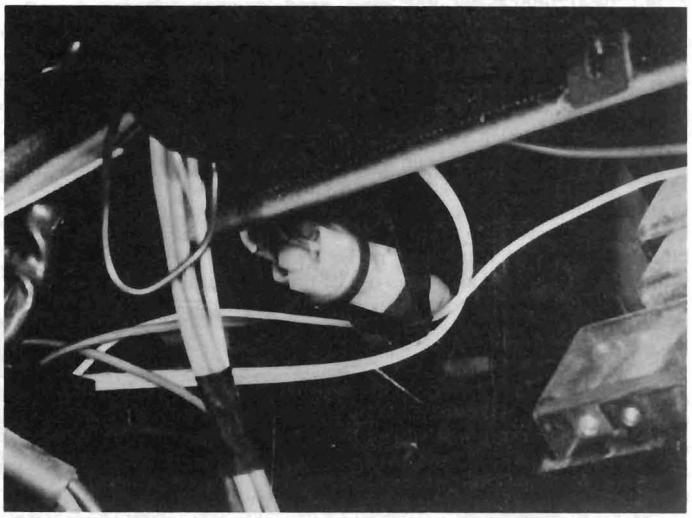
15.4a Brake pedal cross-shaft to servo bellcrank connection



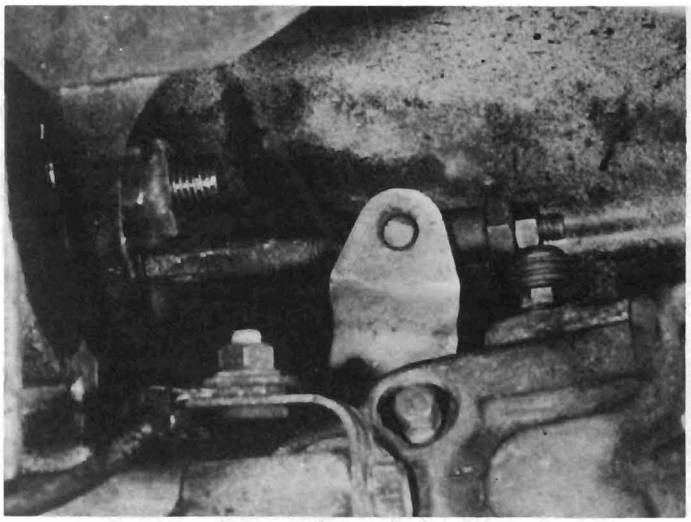
15.4b Wiper motor mounting bracket released



15.8 Brake pedal arm clamp and splines (RHD)



15.13 Brake pedal stop-lamp switch



16.2 Handbrake cable adjuster nut and locknut

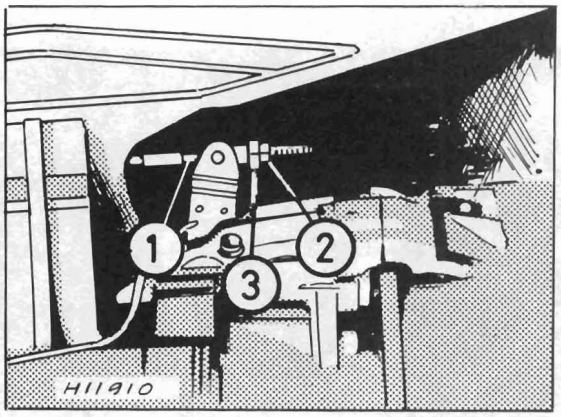


Fig. 8.12 Handbrake cable (1), locknut (2) and adjuster nut (3) (Sec 16)

position that the one on the pedal will be visible through the pedal box plug aperture during reassembly.
9 Have an assistant offer up the pedal so that it is fully back against its stop.
10 Locate the cross-shaft, complete with bearings and bearing plates, and pass it into the pedal arm splines. If the paint marks are in alignment then the master spline must be engaged in the correct groove.
11 Push or tap the cross-shaft into the pedal boss splines until on close inspection, the pinch-bolt groove in the shaft is seen to align with the holes in the pedal arm. Insert and tighten the pinch-bolt.
12 Use new split pins at the cross-shaft-to-servo bellcrank castellated nuts.
13 Check the operation of the brake stop-lamp switch and adjust if necessary by releasing the switch locknuts (photo).

16 Handbrake cable – adjustment

1 Place the handbrake lever in the fully off position.
2 Release the locknut and adjuster nut on the end of the handbrake cable. Turn the adjuster nut so that slackness is eliminated from the cable, and yet no tension is placed upon the levers at the calipers (photo).
3 Tighten the locknut.
4 A correctly adjusted cable will cause the rear wheels to lock when the handbrake control lever is pulled on to between 4 and 6 notches.

17 Handbrake cable – renewal

1 Raise the car on ramps or place it over an inspection pit.
2 Remove the front section of the exhaust system as described in Chapter 1 for engine removal.
3 Remove the cable end nuts and disconnect the cable from the rear caliper levers.
4 Disconnect the rear end of the gearchange link rod to provide access to the connection of the handbrake cable with the lever within the transmission tunnel.
5 Extract the split pin and clevis to separate the cable from the lever.
6 Withdraw the cable from its guides and anchorages.
7 Refit the new cable by reversing the removal operations and then adjust as described in the preceding Section.
8 Lubricate the cable/lever pivots.

18 Handbrake control lever – removal and refitting

1 Remove the centre console as described in Chapter 12.
2 Unscrew and remove the handbrake control lever mounting screws and lift the lever away from the transmission tunnel.
3 Disconnect the wires from the handbrake warning lamp switch.
4 Disconnect the control lever from the cable after extracting the split pin and clevis pin.
5 Refitting is a reversal of removal. Lubricate the clevis pin.

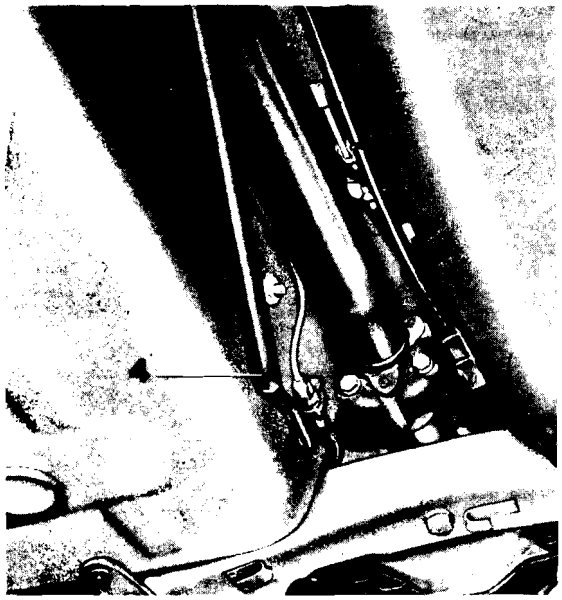


Fig. 8.13 Gearchange rod (4) disconnected from transmission (Sec 17)

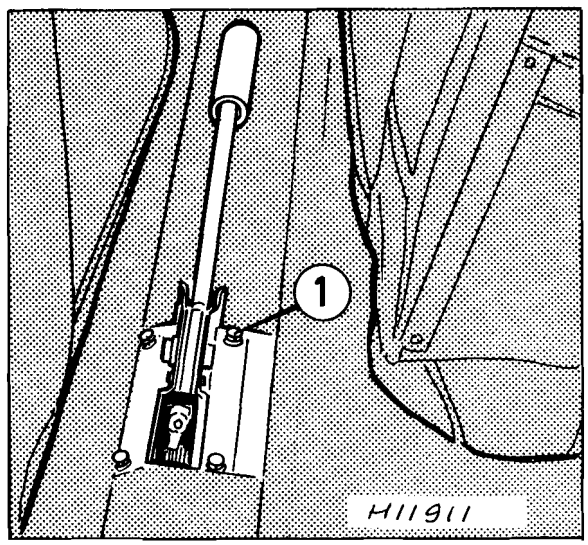


Fig. 8.14 Handbrake control lever mounting bolt (1) (Sec 18)

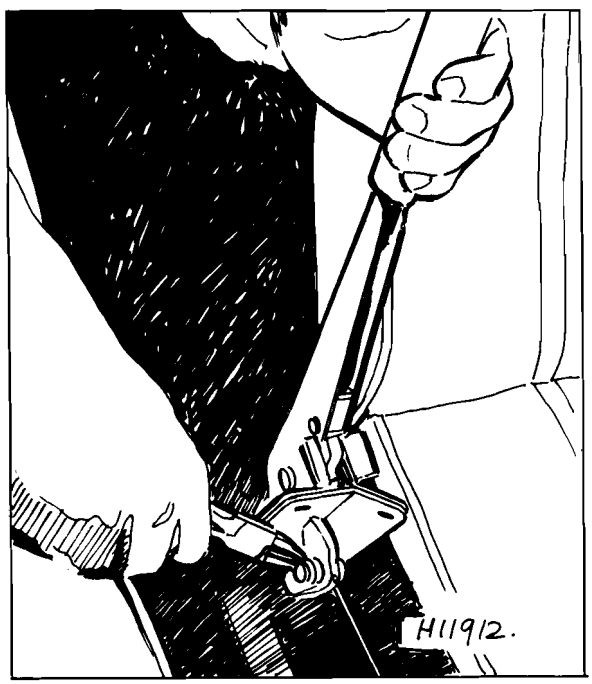


Fig. 8.15 Disconnecting the cable from the handbrake control lever (Sec 18)

19 Fault diagnosis – braking system

Symptom	Reason(s)
Brake grab	Pads contaminated with oil or grease Scored or out-of-round discs Servo unit faulty
Brake drag	Master cylinder faulty Brake foot pedal return impeded Blocked filler cap vent on master cylinder reservoir Master cylinder reservoir or compartments overfilled Seized wheel caliper Incorrect adjustment of handbrake Crushed or blocked pipelines

Symptom	Reason(s)
Brake pedal feels hard	Friction surfaces contaminated with oil or grease Glazed friction material surfaces Rusty disc surfaces Seized caliper Faulty servo unit
Excessive pedal travel	Low fluid level in reservoir Excessive disc run-out Worn front wheel bearings System requires bleeding Worn pads
Pedal creep during sustained application	Fluid leak Faulty master cylinder Faulty servo
Pedal 'spongy' or 'springy'	System requires bleeding Perished flexible hose Loose master cylinder Faulty master cylinder
Fall in master cylinder fluid level	Normal disc pad wear (slow fall over long period) Leakage Internal fluid leak from servo
Servo unit fault diagnosis	
Hard pedal, lack of assistance when engine running	Lack of vacuum due to: Loose connections Restricted hose Blocked air filter/silencer Major fault in unit
Slow action of servo	Faulty vacuum hose Blocked air filter/silencer
Lack of assistance during heavy braking	Air leaks in: Non-return valve grommet Non-return valve Hoses and connections
Loss of fluid	Major failure in unit
Brake pedal pushes back against foot pressure	Hydraulic inlet and outlet pipes incorrectly connected at regulator valve Major fault in unit

Chapter 9 Electrical system

For modifications, and information applicable to later models, see Supplement at end of manual

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Specifications

System type	12V negative earth with alternator, voltage regulator, battery and pre-engaged starter
Battery capacity	
1.6 and 1.8 models	50 Ah (60 Ah with air conditioner)
2.0 models	60 Ah (66 Ah with air conditioner)
Alternator	45 amp max output with separate voltage regulator
Starter motor type	Pre-engaged, four-brush
Wiper motor	2-speed type

Fuses (typical)

Fuse No	Circuit protected	Rating (A)
1	Heated rear screen	16
2	Air conditioner/heater blower	16
3	Hazard warning flasher and air conditioner fan	16
4	Stop-lamps	8
5	Courtesy lamp, clock, power-operated radio aerial, warning buzzer	8
6	Windscreen wiper, cigar lighter, reversing lamps, glovebox lamp	8
7	Instruments, air conditioner, radiator fan, heated rear window relay	8
8	Direction indicators	8
9	RH front parking lamp, LH tail lamps, engine compartment lamp, LH rear number plate lamp	8
10	LH front parking lamp, RH tail lamps, warning and instrument lamps, RH rear number plate lamp	8
11	Left-hand headlamp (low beam)	8
12	Right-hand headlamp (low beam) and rear foglamp	8
13	Left-hand headlamp (main beam)	8
14	Right-hand headlamp (main beam)	8

Bulbs (typical)

	Wattage
Headlamp	60/55 halogen
Front parking	4
Front direction indicator	21
Side repeater	4
Engine compartment	5
Instrument and warning	1.2
Glove compartment	5
Fusebox illumination	4
Interior courtesy	5
Luggage boot	5
Tail	5
Stop	21
Reversing	21
Rear fog	21
Rear number plate	4

1 Description

The electrical system is of 12 volt type and incorporates an alternator, voltage regulator and battery.

Most major circuits are fused and components with high loading are protected with relays.

2 Battery – maintenance, precautions, removal and refitting

Maintenance and precautions

1 Modern batteries, particularly those charged by an alternator, seldom require topping-up, probably as infrequently as every six months.

2 It is a good policy however to check the electrolyte level at the weekly service check. The level should be between 4.0 and 5.0 mm (0.16 and 0.20 in) above the tops of the battery plates when the vent plugs have been removed for the level to be inspected.

3 If topping-up is required, use distilled water only. A cheap way of obtaining this is to melt refrigerator ice condensate.

4 If the electrolyte should ever be spilled, leave it to your service station to replenish the affected cell as the mixing of acid and water is best left to the experts. Neutralise any spillage immediately – battery electrolyte is highly corrosive.

5 Any sign of acid leakage should be rectified immediately by renewal of the battery.

6 Keep the leads on the battery terminal tight, clean and well coated with petroleum jelly to prevent corrosion.

7 If corrosion does occur on the terminals or other parts, it can be neutralised with a solution of ammonia or baking soda.

8 Never reverse the battery leads or the alternator will be damaged.

9 Frequent or excessive topping-up will indicate that the battery is being overcharged and the regulator is probably faulty. (An old battery may need more topping-up as a matter of course).

10 If mileage covered is very low or if the battery is old and tends to lose its charge, it may be charged overnight using a mains charger, but first disconnect the car battery leads from the battery terminals.

11 A hydrometer may be used to check the specific gravity of each battery cell and the readings compared with the table below. Any large variation between cells will denote that the battery is failing, assuming that electrolyte has not been spilled from the particular cell.

12 The specific gravity of the electrolyte for varying conditions of charge at a mean temperature of 68°F (120°C) are listed below:

1.260	*fully charged*
1.210	*¾ charged*
1.160	*½ charged*
1.110	*¼ charged*
1.060	*fully discharged*

13 Never smoke or bring naked flames near a battery cell plug, the gases are highly explosive.

Removal and refitting

14 The battery is located within the engine compartment except on saloon versions equipped with air conditioning, when it is located in a well in the luggage boot floor (photos).

15 Disconnect the negative lead and then the positive lead in that order, release the battery securing clamp and lift the battery from its mounting platform, taking care to keep it level (photo).

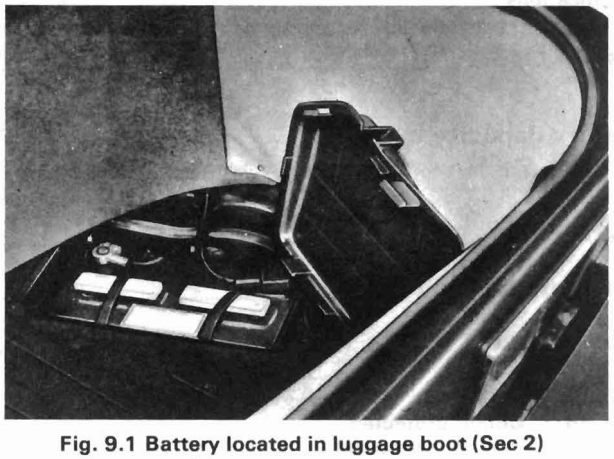
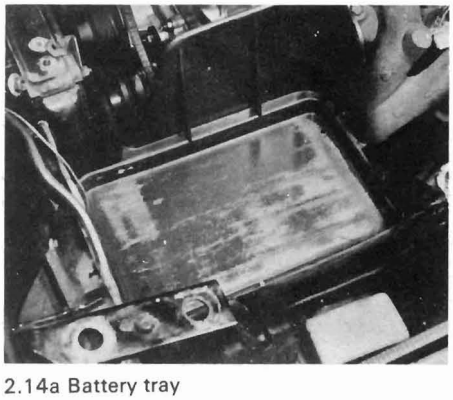
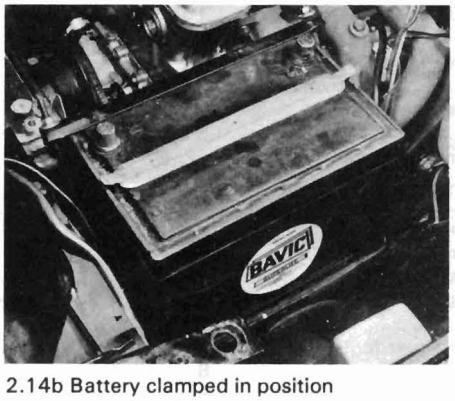


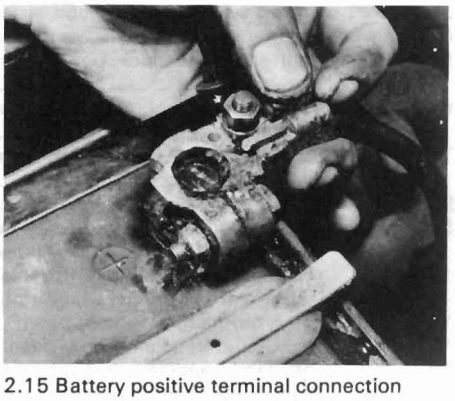
Fig. 9.1 Battery located in luggage boot (Sec 2)



2.14a Battery tray



2.14b Battery clamped in position



2.15 Battery positive terminal connection

16 Refit by reversing the removal operations. Make sure that the battery terminals are clean, tighten the lead clamps and smear them with petroleum jelly.

3 Alternator – description, maintenance and precautions

1 The alternator is belt-driven from the crankshaft pulley.
2 The virtue of an alternator is its ability to charge the battery even at engine tickover speeds.
3 The only maintenance required is to keep the drivebelt tensioned correctly, and occasionally to wipe dirt from the outside of the casing.
4 To tension the drivebelt, refer to Chapter 2, Section 11.
5 Certain precautions are required to prevent damage to the alternator, and the following must be observed:

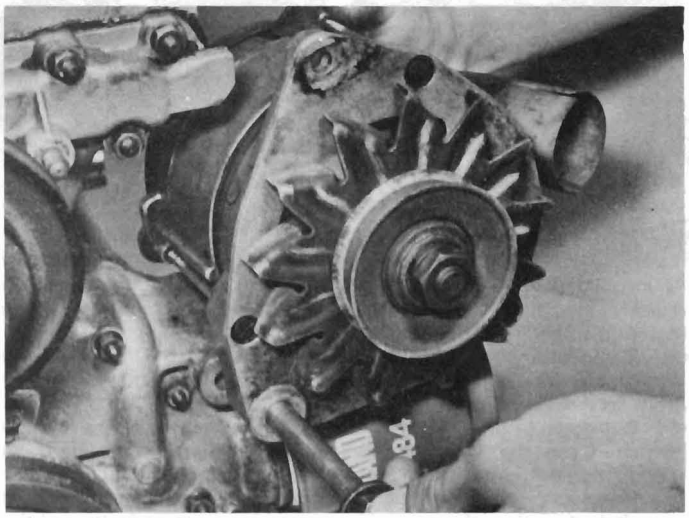
Never disconnect the battery while the engine is running as a means of stopping the engine
If electric welding is being carried out on the car, disconnect both battery terminals
Do not connect ignition timing lamps to the battery
Never over-tension the drivebelt, or the alternator bearings may be damaged

4 Alternator – removal and refitting

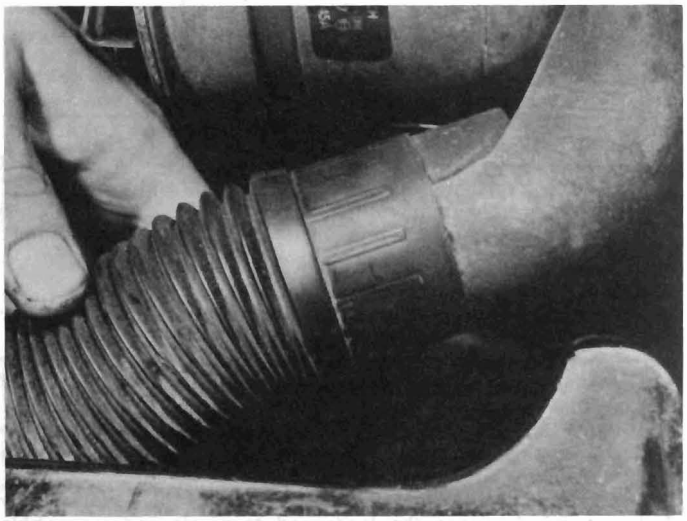
1 Disconnect the battery negative lead.
2 Disconnect the alternator leads, noting that one goes to the voltage regulator and one to the battery terminal.
3 Release the alternator mounting bolts and the nut and bolt on the adjuster link, noting that the link nut also acts as a mounting nut for the coolant pump.
4 Push the alternator in towards the engine and slip the drivebelt from the pulleys.
5 Remove the mounting and adjuster link bolts and lift the alternator from its mounting bracket. Release the air cooling duct as the unit is withdrawn (photos).
6 Refitting is a reversal of removal. Adjust the belt as described in Chapter 2, Section 11.

5 Alternator – overhaul

1 One of three types of alternator may be fitted depending upon supplier. Each alternator is similar, but with detailed differences in the design of some smaller components. The following overhaul instructions relate to the Bosch alternator.
2 Normally the alternator has a very long service life and home repairs are best limited to renewal of brushes and the cleaning of slip rings. A unit which has been in service for a high mileage is best exchanged for a new or factory rebuilt one.
3 With the alternator removed from the car, clean away external dirt.
4 Unscrew the tie-bolts and take off the slip ring and housing, noting the cooling air duct attachment.
5 Inside the housing will be seen the two slip ring brushes. These must be free in the guides and at least 5 mm (0.2 in) long. The new length is 10 mm (0.4 in). The brushes may be renewed by unsoldering the leads from the regulator, fitting new brushes and resoldering the leads.
6 Undo the pulley nut and remove the pulley, the spacer ring, the large washer and the fan. Note which way the fan fits to make assembly easier. There is an arrow showing the direction of rotation.
7 If there is any difficulty in holding the pulley still while the nut is undone, place an old belt in the pulley groove and grip it in the jaws of a vice as close to the pulley as possible. This will prevent the pulley from rotating.
8 The armature will stay in the endplate and the housing bearing will stay on the shaft. Have a good look at the various components. Clean off all the dust using a soft brush and then wipe clean with solvent. Any smell of burnt carbon or signs of overheating must be investigated. Check the slip rings for burning, scoring and ovality. You will have had reason to check the bearings before dismantling, but have a further look now. At this point you must make up your mind whether to do the repair yourself, or whether to take the alternator to a specialist. If you have the tools and the skill, it is possible to renew the bearings, renew the diode carrier complete, clean up the slip-rings and to fit a new rotor or stator. It is not possible to repair the winding, renew individual diodes, renew the slip rings or repair the fan.
9 Dealing with the rotor first. The rotor may be removed from the endplate by using a mandrel press. Then take the screws out of the cover over the endplate bearing and press the bearing out of the frame. The slip ring end bearing may be pulled off using an extractor on the inner race. If you pull on the outer race the bearing will be damaged. Renew the bearings if necessary.
10 The slip rings may be cleaned up by setting the rotor in a lathe and either cleaning them with emery or by taking a very fine skim.
11 Test the rotor electrically. Check the insulation resistance between the slip rings and the shaft. This must be infinity. If it is not there is a short-circuit and the armature must be replaced. Get an auto-electrical specialist to confirm your findings first. Check the resistance of the winding. Measure this between slip rings. It should be about 4 ohms. If there is an open-circuit or high resistance, then again the rotor must be renewed.
12 The stator and the diode carrier are connected by wires. Make a simple circuit diagram so that you know which wire goes to which diode and then unsolder the connections. This is a delicate business as excess heat will destroy the diode and possibly the winding. Grip the wire as close as possible to the soldered joint with a pair of long-nosed pliers.
13 The stator winding may now be checked. First check that the insulation is sound. The resistance between the leads and the frame



4.5a Alternator mounting bolt



4.5b Alternator air cooling duct

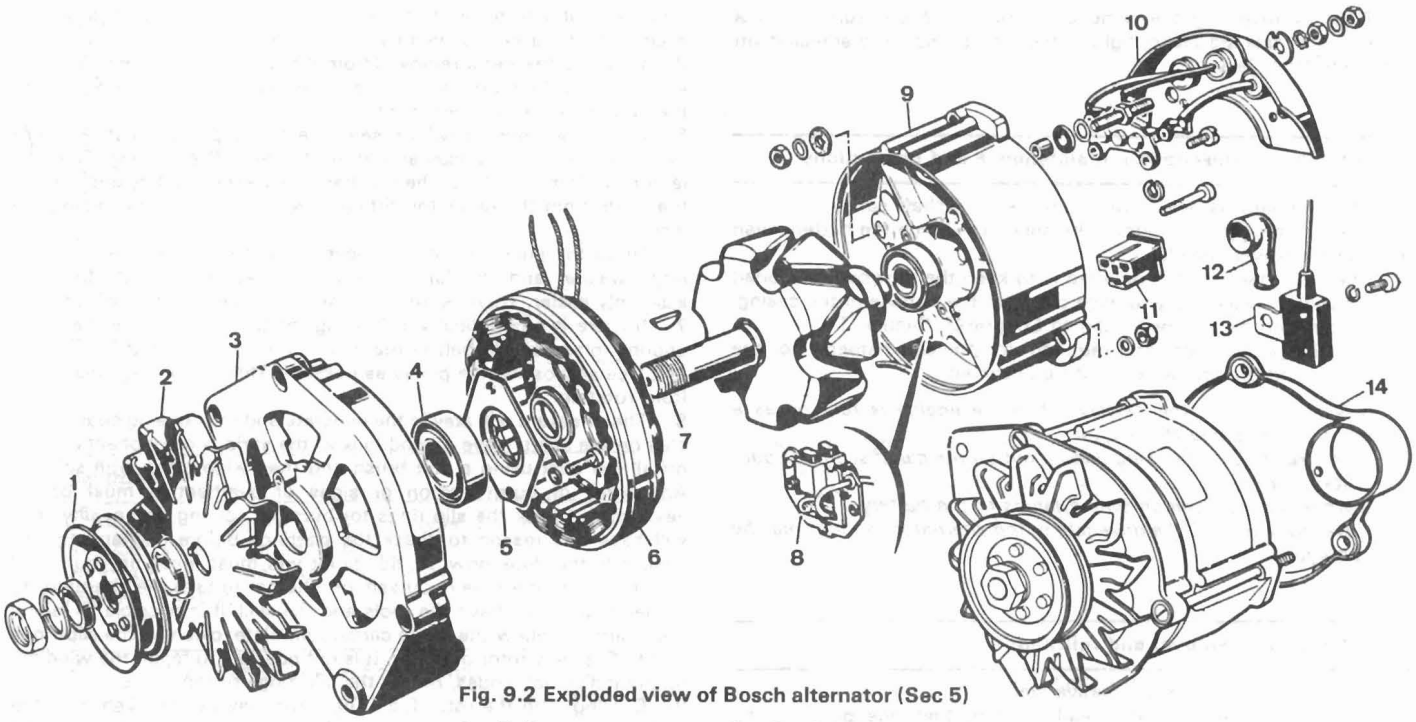


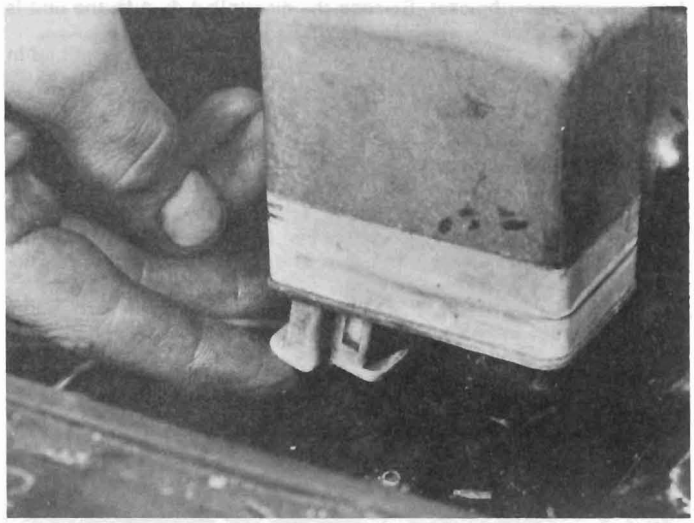
Fig. 9.2 Exploded view of Bosch alternator (Sec 5)

1 Pulley
2 Fan
3 Drive end bracket
4 Bearing
5 Bearing retainer
6 Stator
7 Rotor
8 Brush holder
9 Slip ring end housing
10 Diode assembly
11 Wiring plug
12 Boot
13 Capacitor
14 End cover

must be infinity. Next measure the resistance of the winding. It should be of the order of 1.3 ohms between leads. A zero reading means a short-circuit, and of course a high or infinity reading, an open-circuit.
14 The diode carrier may now be checked. Each diode should be checked in turn. Use a test lamp or an ohmmeter. Current must flow only one way; ie, the resistance measured one way must be high and the other way (reverse the leads), low. Keep the current down and do not allow the diode to heat up. If the resistance both ways is a high one, then the diode is open-circuited, a low one, short-circuited. If only one diode is defective the whole assembly (diode plate) must be renewed.
15 Reconnect the stator winding to the diode circuit, again be careful not to overheat the diode, and reassemble the stator and diode carrier to the housing.
16 A new diode carrier or a new stator may be fitted, but be careful to get the correct parts.
17 Assembly is the reverse of dismantling. Be careful to assemble the various washers correctly.

6 Voltage regulator – removal and refitting

1 The voltage regulator is mounted on the left-hand wing valance within the engine compartment (photo).
2 The unit is not adjustable or repairable, and in the event of a fault developing it should be renewed complete.



6.1 Voltage regulator

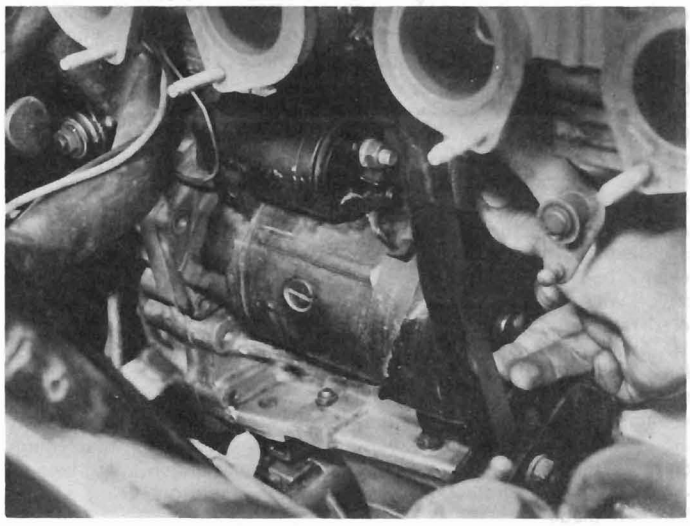
7 Starter motor – description and testing in car

1 The starter motor is of the pre-engaged type and may be one of two or three makes used as original equipment.
2 If when the ignition is switched on the starter will not turn the engine it does not necessarily mean the starter is at fault. So before taking the starter out a routine check should be done.
3 Check the state of charge of battery. Remove the leads from the battery terminals, clean the leads and terminals and reassemble correctly. The quickest way to check the battery is to switch on the headlights. If the lights come on bright and stay bright then the battery is in good order. If the lights are dim, or come on bright and dim quickly, then the battery is discharged. Remedy this state of affairs before dismantling the starter.
4 If the battery is in good order and the earth lead is firmly fixed to the chassis then turn to the starter connections. Are they tight, free from corrosion and rust?
5 Get down by the starter and have someone operate the ignition switch. Does the solenoid work (make a clunking noise), if so disconnect the cable from the solenoid terminal and fit it to the connector strip terminal. If the starter now revolves when the ignition is switched on then the solenoid contacts are worn or faulty and the starter must be removed for overhaul.

6 If the starter still does not work, bridge the heavy terminals on the solenoid. If the starter works then the fault is in the ignition switch wiring, not the starter.
7 If all of the above tests have been done and there is still no life then the starter must be removed for test and overhaul.
8 If the starter turns the engine slowly, and the battery and connections are in good order, then the starter should be removed for testing and overhaul. It is probably brush or commutator trouble, or it may be problems with the field windings.
9 If the starter works erratically or will not disengage then the fault is a mechanical one, and the starter must be removed for overhaul.
10 Only after checking all these points should the starter be dismantled.

8 Starter motor – removal and refitting

1 Disconnect the battery negative lead.
2 Disconnect the leads from the starter motor solenoid terminals.
3 Unbolt the mounting bolts from the starter motor flange and the support bracket at its front end.
4 Withdraw the starter motor from the engine rear plate (photo).
5 Refitting is a reversal of removal.



8.4 Starter motor removal

9 Starter motor – overhaul

1 The different makes of starter motor differ slightly in design of components, but the following description will generally apply.
2 With the starter motor removed from the car, clean away external dirt.
3 Remove the connector strip terminal nut and from the other end remove the two bolts holding the solenoid to the mounting bracket. Now lift the solenoid pullrod so that it is clear of the operating lever and remove the solenoid.
4 At the front end of the starter is a cap held by two screws. Remove this and under it there is a shaft with a circlip and bush. Remove the circlip.

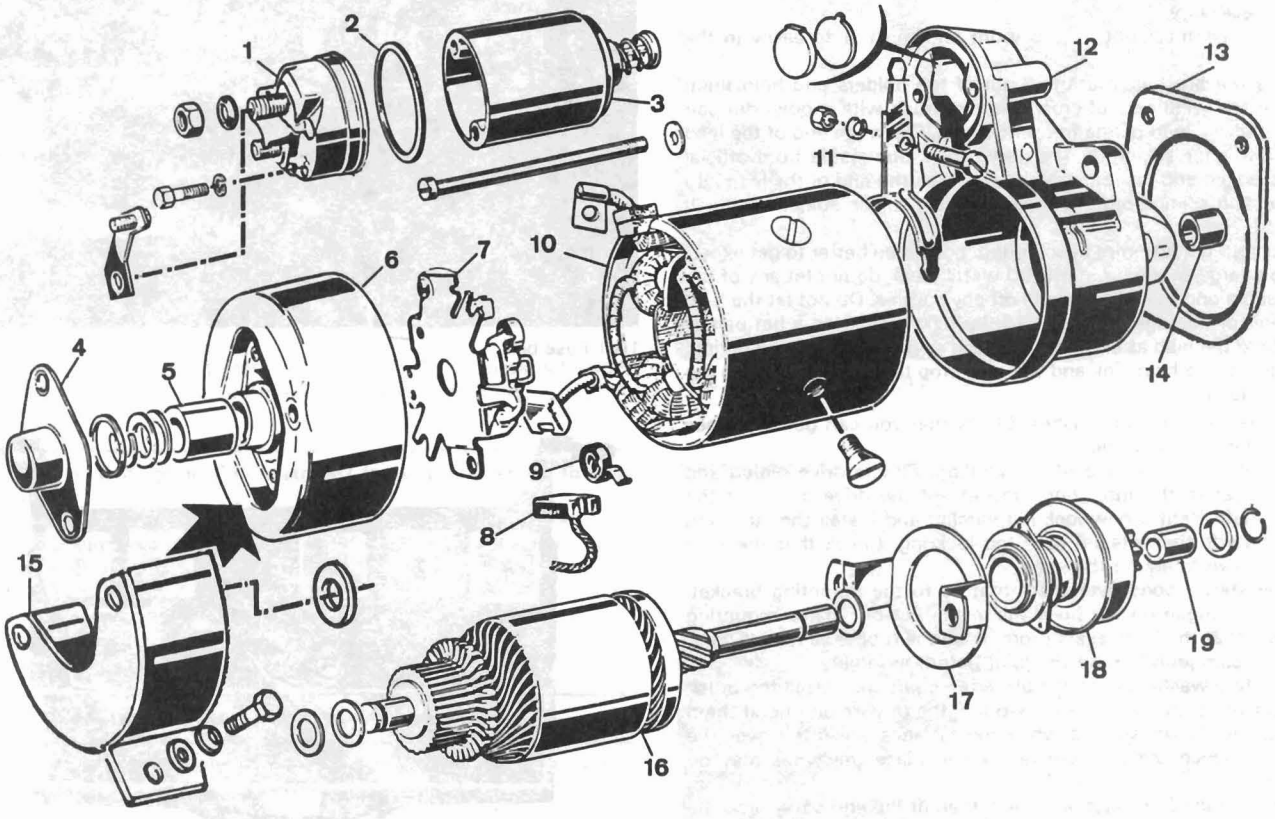


Fig. 9.3 Exploded view of typical starter motor (Sec 9)

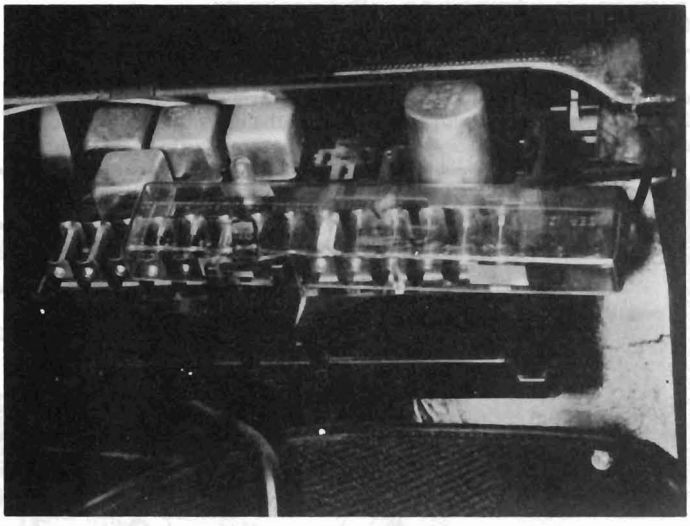
1 *Solenoid end cover*
2 *Sealing ring*
3 *Solenoid*
4 *End cap*
5 *Bush*
6 *Cover*
7 *Brush holder*
8 *Brush*
9 *Brush spring*
10 *Yoke*
11 *Operating lever*
12 *Drive end cover*
13 *Endplate*
14 *Bush*
15 *Front bracket*
16 *Armature*
17 *Retainer*
18 *Clutch/drive assembly*
19 *Bush*

5 Now remove the through-bolts and remove the cover.
6 The brush gear is now visible. Lift the brushes out of the holder and remove the brush holder. The starter body holding the field coils may now be separated from the endplate. This will leave the armature still in the mounting bracket.
7 To remove the mounting bracket from the drive end of the shaft, first push back the stop ring with a suitable tube so that the circlip underneath may be released from its groove. It is now possible to remove the mounting bracket and pinion from the shaft.
8 Finally remove the operating lever pin from the mounting bracket and remove the pinion assembly.
9 Clean and examine the pinion, shaft and lever and inspect for wear. Check the fit of the drive pinion on the shaft. Check that the pinion will revolve in one direction only (one-way clutch) and that the teeth are not chipped.
10 Examine the commutator. Clean off the carbon with a rag soaked in solvent. Minor scoring may be removed with fine glass paper. Deep scoring must be removed by machining in a lathe. Commutator copper is harder than the commercial grade, and requires the lathe tool to be ground off differently. Unless you have had instruction on machining commutators we suggest that the skimming and undercutting be left to the expert. Slightly undercut the mica separators using a fine hacksaw blade.
11 Test the armature electrically. Check the insulation between the armature winding and the shaft. To do this connect the negative terminal of the ohmmeter to the shaft and place the positive probe on each commutator segment in turn.
12 Burning on the commutator is usually a sign of an open-circuited winding. If you have access to a 'growler' have the armature checked for short-circuits.
13 Inspect the field windings for signs of abrasion on stiff and damaged insulation, particularly where the leads leave the coil. Check the field coil for short-circuit to the pole piece and for open-circuits. Renew if necessary.
14 The brushes must not be too worn and must slide easily in the holder.
15 Isolate the brushes, pull them out of the holders and hold them away from the winding and crush the old brush with a powerful pair of pliers until the lead is free from the brush. Clean the end of the lead and prepare it for soldering. The new brush, obtainable from official agents, is drilled and has a tinned insert. Push the end of the lead into the drilling and splay it out, then using a silver solder, solder the brush to the lead.
16 If it is your first attempt at soldering it could be better to get expert help. Use a large soldering iron (250 watts plus), do not let any of the solder creep along the wire and file off any surplus. Do not let the lead get too hot, or damage will occur to the field coils. Use a flat pair of pliers to hold the lead as close to the brush as possible while soldering. These will act as a heat sink and will also stop the solder getting in the core of the lead.
17 One final word about brushes. Check that you can get new ones before crushing the old ones!
18 Assembly is the reverse of dismantling. Fit the drive pinion and operating lever to the mounting bracket. Fit the drive pinion to the armature shaft. Refit a new lockring (circlip) and install the stop ring (groove towards the outside) over the lockring. Check that the stop ring will revolve freely on the shaft.
19 Fit the starter body over the armature to the mounting bracket. See that the tongue on the body fits in the cut-out of the mounting bracket and that the body seats properly on the rubber seating. Smear a little joint compound round the joint before assembly.
20 Fit the two washers onto the armature shaft and install the brush holder over the commutator. Cut two lengths of wire and bend them to hold up the brush springs while the brushes are fitted over the commutator. Once the four brushes are in place the wires may be withdrawn.
21 Wipe the end of the shaft and oil it, then fit the end cover onto the housing and install the through-bolts. Again seal the joint, and seal the ends of the through-bolts. Now refit the shims and the circlips. If a new armature has been fitted the endplay must be checked. It should be between 0.004 and 0.012 in (0.1 and 0.3 mm) and is adjusted by fitting appropriate shims.
22 Check that the solenoid lead grommet is in place and refit the solenoid. Use a seal compound on the joint faces, move the pinion to bring the operating lever to the opening and reconnect the pullrod. Seat the solenoid firmly on the mounting bracket in the sealing compound and install the bolts. Reconnect the wire to the starter body.
23 The starter may now be refitted to the car.
24 The commutator end of the shafts fits into a bearing bush in the endplate. The old bush may be pressed out if necessary and a new one pressed in. The endplate should be dipped into hot oil for five minutes before the bush is pressed in to give a shrink fit. Grease the bush with multi-purpose grease before installing the shaft.

10 Fuses and relays – general

1 The fuse box is located under the facia panel. The fuses are accessible once the translucent lid has been removed by applying pressure in a downward direction (photo).
2 The circuits protected are marked on the lid of the fuse box, which also carries spare fuses. Refer also to the Specifications.
3 The fuse mounting block also carries the various relays. These vary slightly according to particular car specification, and may include some or all of the following.

Direction indicator relay
Heated rear window relay
Heater blower relay



10.1 Fuse box

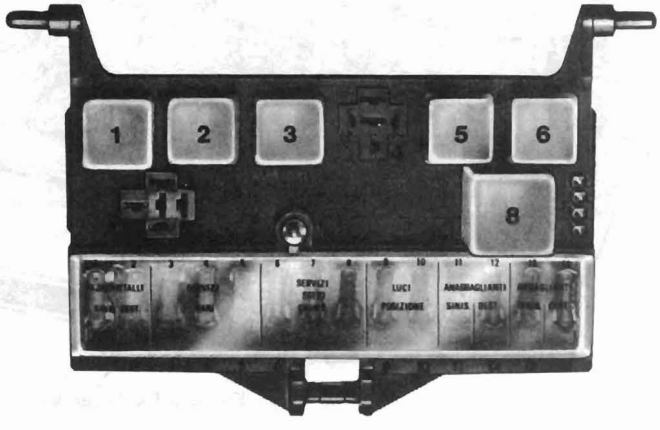


Fig. 9.4 Typical fuse and relay arrangement (Sec 10)

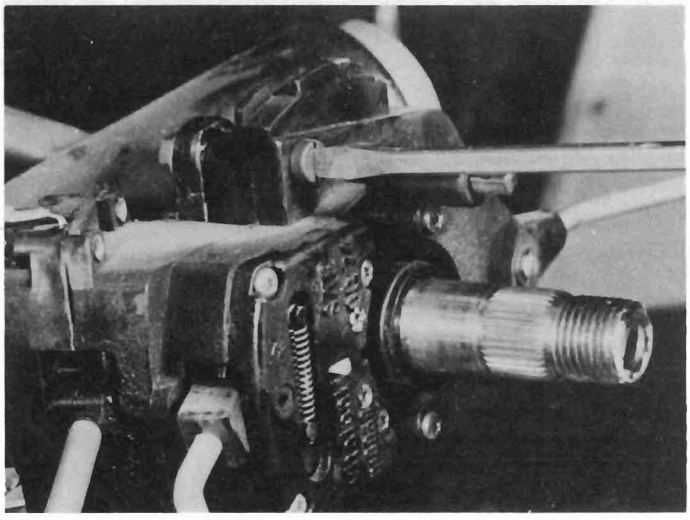
1 *Horn relay*
2 *Radiator fan relay*
3 *Heated rear window relay*
4 *Warning buzzer*
5 *Blower motor relay*
6 *Air conditioner*
7 *Air conditioner*
8 *Direction indicator relay (flasher unit)*

Horn relay
Air conitioner relays
Fuel cut-off solenoid relay

4 Always renew a fuse with one of identical rating and if the new one blows again immediately, trace the fault, very often bad wiring insulation causing a short-circuit.
5 Never be tempted to bypass a persistently blowing fuse with silver foil or wire, nor substitute a fuse of a higher rating. Serious damage to the electrical system, or even fire, may result.

11 Steering column switches – removal and refitting

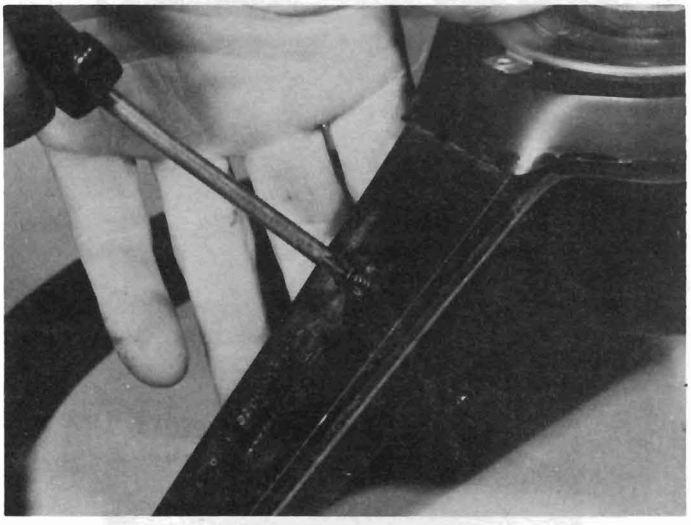
1 Disconnect the battery earth lead. Remove the steering wheel as described in Chapter 10.
2 Take off the hub section from the top of the steering column.
3 Disconnect the switch wiring harness.
4 Extract the two screws which secure the steering column switches (photo).
5 Note the setting of the switch return cam and then take off the switches as an assembly.
6 Refitting is a reversal of removal.



11.4 Extracting steering column switch screw

12 Horn switches – removal and refitting

1 The horn switches are located one in each of the steering wheel spokes.
2 To remove a switch, first remove the steering wheel as described in Chapter 10.
3 Extract the screws from the rear of the steering wheel spokes. Remove the cover panels (photo).
4 Bend up the switch mounting tabs and withdraw the switch, at the same time disconnecting the electrical lead (photo).
5 Refitting is a reversal of removal.



12.3 Steering wheel spoke screw

13 Courtesy lamp switch – removal and refitting

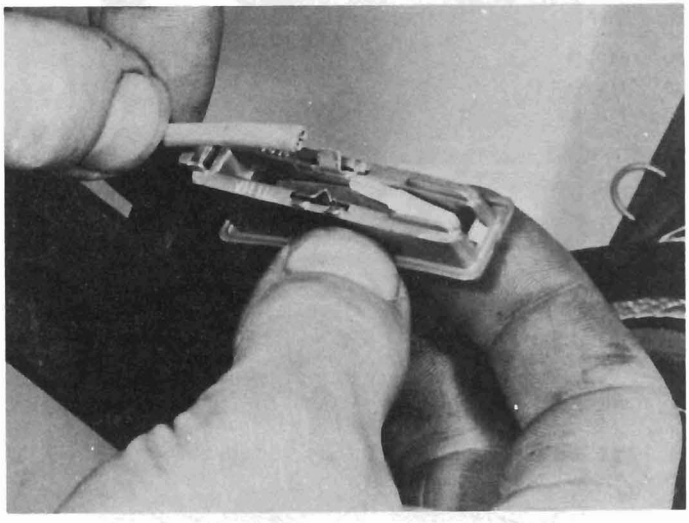
1 The switch which controls the interior lamp when a front door is opened is of plunger type, located between the windscreen body pillar and the door edge.
2 To remove the switch, extract the securing screw and withdraw it. If the leads are to be disconnected, take care that they do not slip back through the switch hole. Tape them to the body panel to avoid this happening.
3 These switches often suffer from corrosion. This can be reduced if the switch is smeared with petroleum jelly before refitting.

14 Engine and luggage compartment lamp switches – removal and refitting

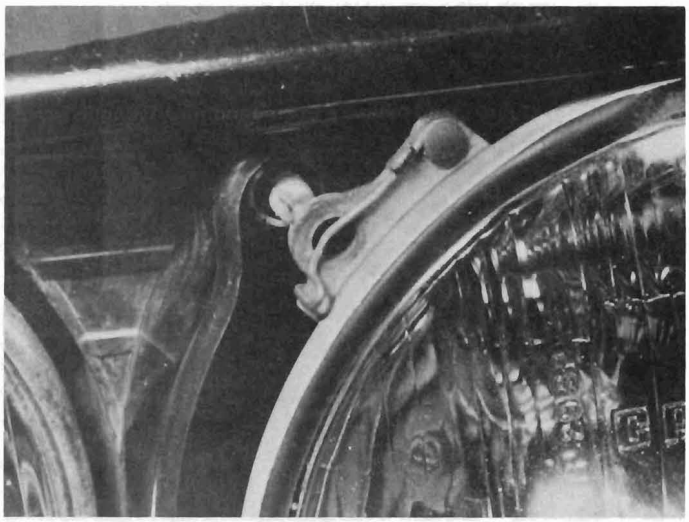
1 These switches are of plunger type, operated by the closure or opening of the lid.
2 Removal is simply a matter of disconnecting the switch leads and removing the switch fixing screws.
3 Refitting is a reversal of removal.

15 Headlamp sealed beam units – renewal

1 On models equipped with this type of headlamp, unscrew the securing screw (3) and free the spring clip (4) from the beam adjuster screw seal (Fig. 9.5). Do not disturb the setting of the adjuster screw (photo).
2 Tilt the headlamp upwards and pull it forward.
3 Pull the wiring connector from the rear of the sealed beam unit.
4 Release the two retainers (6) which hold the metal cup to the headlamp outer trim ring (Fig. 9.6).
5 Remove the sealed beam unit.
6 Engage the new unit with the outer trim ring, taking care that the nibs of the lens seat in their notches in the metal cup which should now be located. Also check that the positioning dowel (7) is at a



12.4 Removing the horn switch



15.1 Headlamp clip at beam adjuster screw

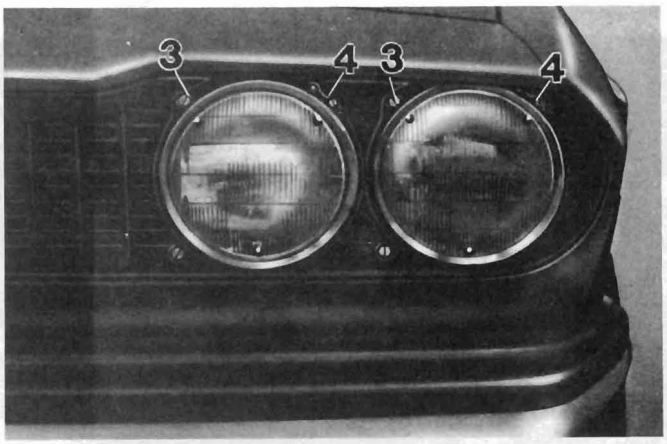


Fig. 9.5 Sealed beam headlamps (Sec 15)

3 Securing screw *4 Fastener*

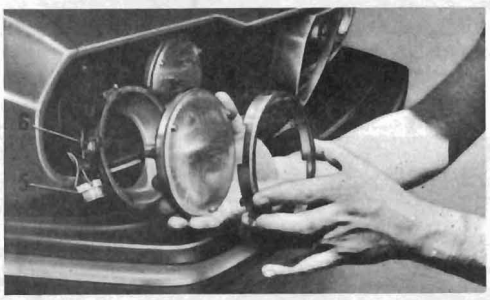


Fig. 9.6 Withdrawing a headlamp sealed beam unit (Sec 15)

5 Connector plug *6 Retainers*

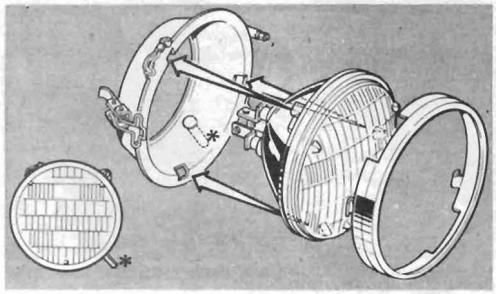


Fig. 9.7 Components of a sealed beam unit (Sec 15)

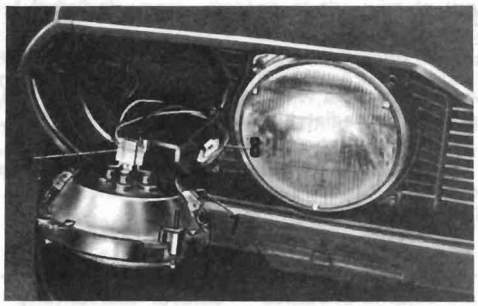


Fig. 9.8 Sealed beam headlamp location (Sec 15)

5 Connector plug *8 Dowel pin seat*
7 Dowel pin

suitable angle to engage with its seat (8) (Fig. 9.8). Lock the toggle clips.

7 Connect the wiring plug and push the unit into place. Tighten the fixing screw and fit the spring fastener to the beam adjuster screw seat.

8 Provided the adjuster screw settings have not been tampered with, the headlamp beam alignment should not have altered. If they have been altered, reset the beams as described in Section 17.

9 The headlamp outer unit has a clip-on type chrome trim ring.

16 Headlamp bulbs – renewal

1 On Saloon models, access to the rear of the headlamp may be obtained from within the engine compartment. On Coupe models, remove the headlamp as described in paragraphs 1 to 3 of the preceding Section and remove the protective cover from the rear of the headlamp (photo).

2 Pull the now exposed wiring plug from the harness socket and pull the spade connector from the bulb holder (photos).

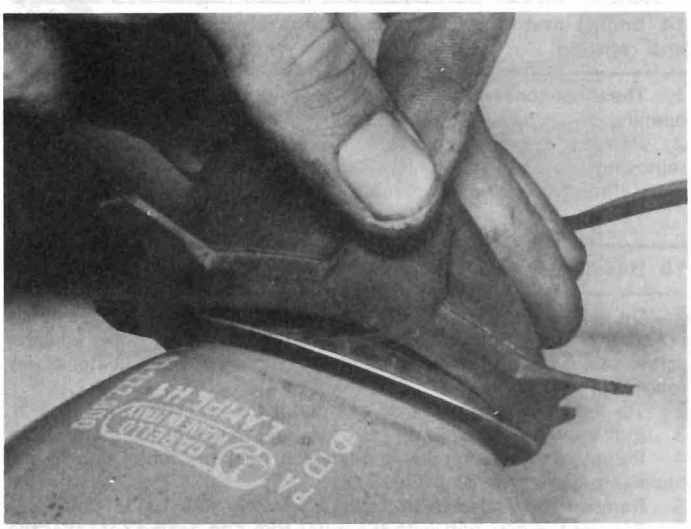
3 Depress the ends of the bulb holder retainer or spring and rotate it anti-clockwise to withdraw the bulb holder (photo).

4 If halogen bulbs are fitted (photo), avoid touching them with the fingers as the grease deposited will shorten their life. If their glass is inadvertently touched, wipe them clean with a cloth dampened with methylated spirit.

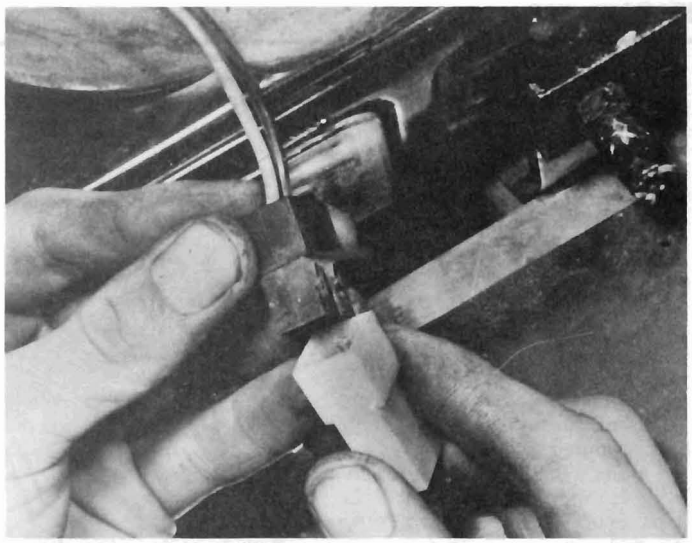
5 Locate the new bulb so that the three positioning tabs engage correctly in their notches.

6 Fit the retainer or spring and rotate it clockwise.

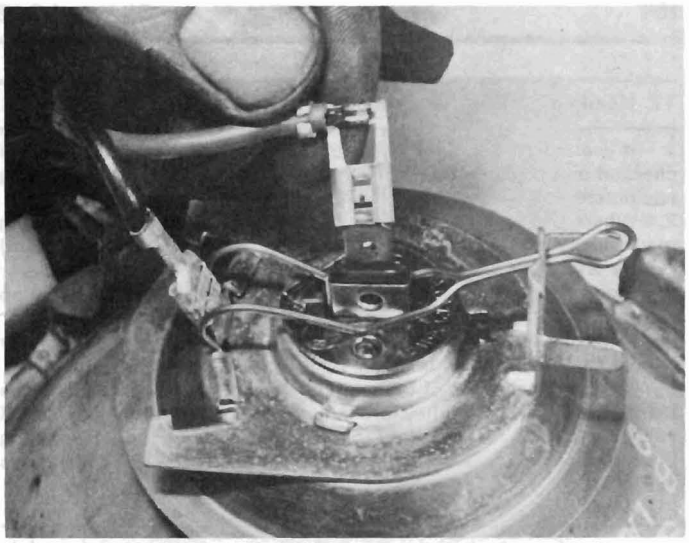
7 Fit the wiring plug, the protective cover and the retaining clip.



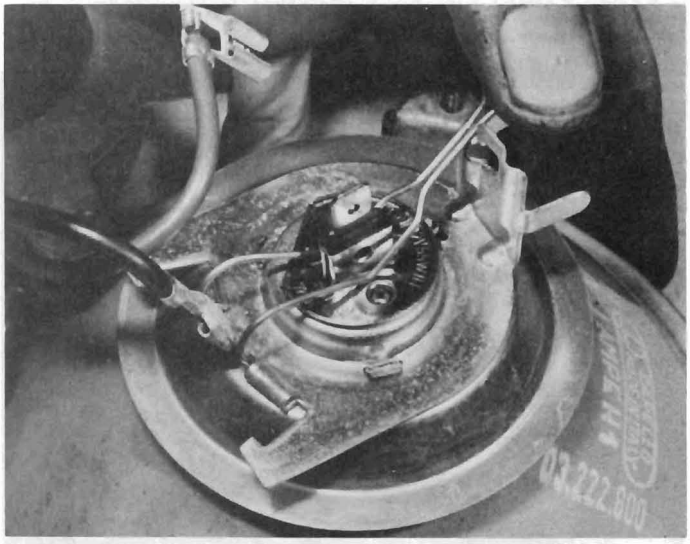
16.1 Removing headlamp rear cover



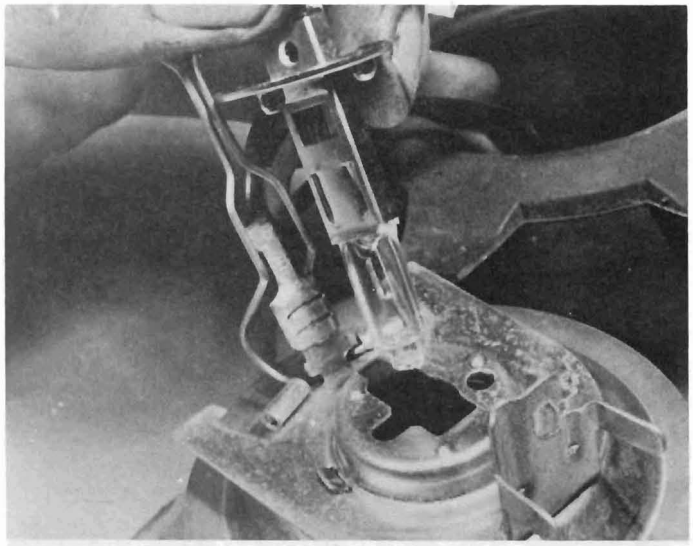
16.2a Headlamp wiring plug



16.2b Headlamp bulb holder



16.3 Releasing headlamp bulb holder spring



16.4 Headlamp halogen bulb

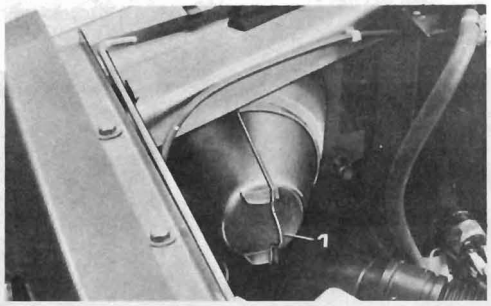


Fig. 9.9 Headlamp protective cover and clip (1) (Sec 16)

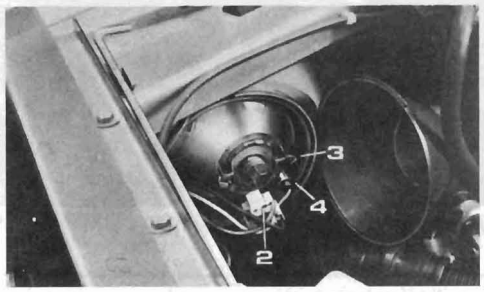


Fig. 9.10 Headlamp protective cover removed (Sec 16)

2 Connector plug
3 Bulb holder retainer
4 Parking lamp bulb holder

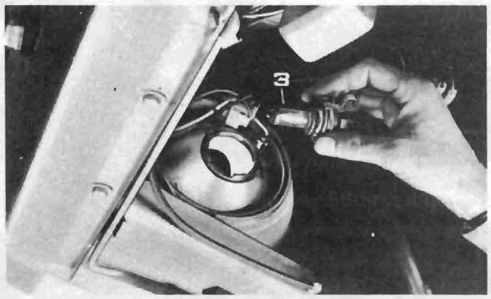


Fig. 9.11 Headlamp bulb and holder (3) removed (Sec 16)

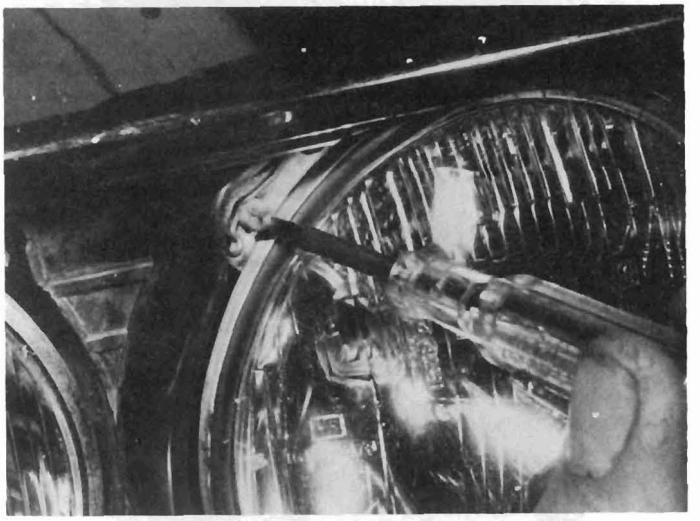
17 Headlamp beam adjustment

1 It is strongly recommended that the headlamp beam alignment is checked and adjusted by a service station using optical beam setting equipment.
2 Where this is not possible, or in an emergency, use the following method. Place the car on a level floor, square to and 10 m (32.8 ft) from a wall or screen.
3 Mark the relative height and distance apart of the headlamp centres on the wall.
4 With the headlamp set on main beam and the beam setting lever (where fitted) set for an unladen vehicle, switch on the headlamps.
5 The brightest spots of the lamp beams should be central over the marks on the wall. If they are not, turn the horizontal or vertical adjusting screws as necessary (photo). Carrying out the work during the hours of darkness will be essential unless a darkened building is available.

18 Bulb renewal – exterior lamps (except N. America and models with sealed beam headlamps)

Front parking lamp

1 Open the bonnet and unclip and remove the protective cover from the rear of the headlamp.



17.5 Turning a headlamp adjuster screw

2 Pull the parking lamp bulb holder out of the headlamp reflector.
3 Remove the bulb, fit the new one and refit the remaining components.

Front direction indicator lamp

4 Unscrew the securing screws and remove the lamp lens. Renew the bulb and refit the lens.

Side repeater lamps

5 Reach up inside the wheel arch and pull the bulb holder from the lamp body. Renew the bulb and refit the holder.

Rear lamp cluster (Saloon)

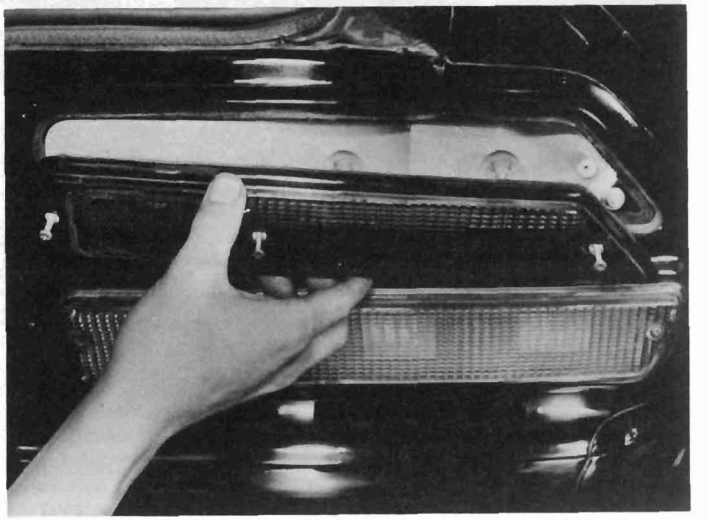
6 Working within the luggage boot, press the retaining tab aside and withdraw the bulb holder mounting plate. Take care not to damage the bulbs, printed circuit or connecting cables.
7 Renew the bulbs as necessary and refit the mounting plate.

Tail, stop and reversing lamps (Coupe)

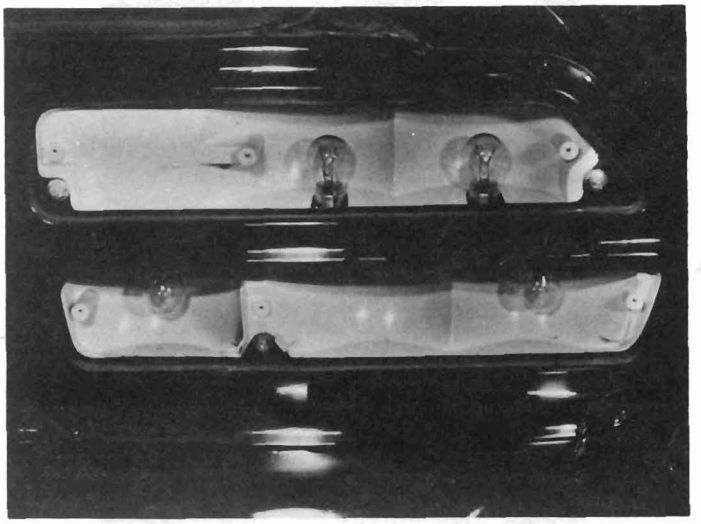
8 The bulbs for these lamps are accessible after removal of their lenses (photos).

Rear number plate lamp (Saloon)

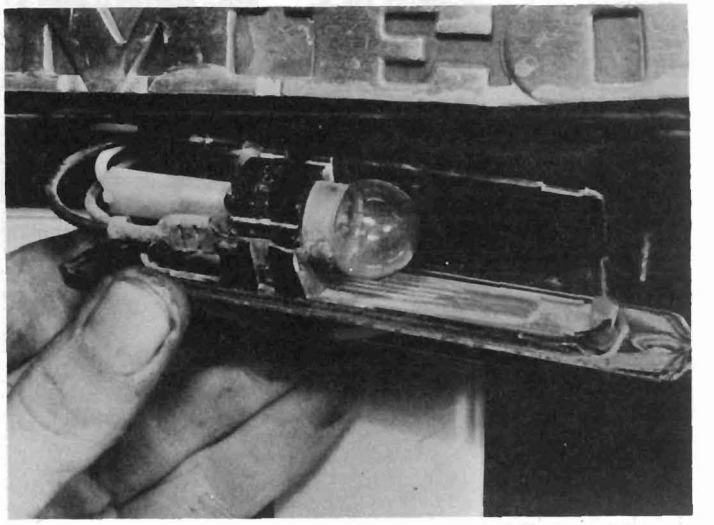
9 Reach under the bumper bar, and pull the bulb holder out of the lamp body. Renew the bulb and refit.



18.8a Removing a rear lamp cluster lens



18.8b Rear lamp bulbs



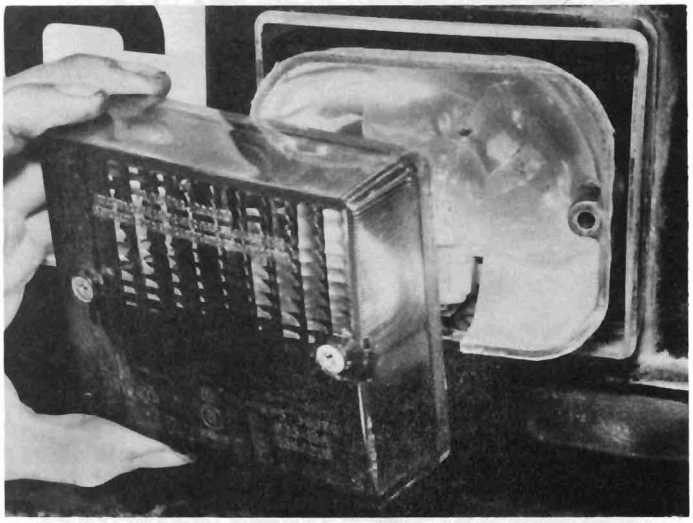
18.10 Rear number plate lamp (Coupe)

Rear number plate lamps (Coupe)

10 Twin lamps are used, each being retained separately by screws. Slacken the screws and remove the lamp to renew the bulb (photo).

Rear fog warning lamp

11 Remove the lens to gain access to the bulb (photo).



18.11 Rear fog warning lamp

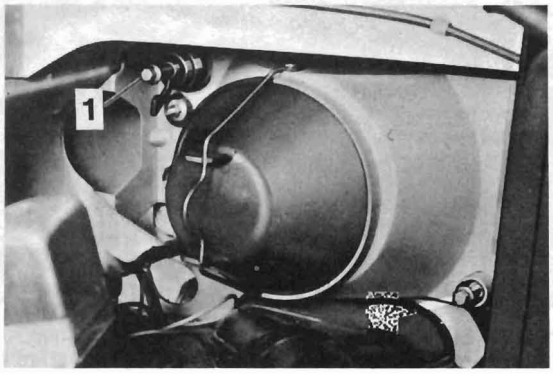


Fig. 9.12 Headlamp beam load lever (1) (Sec 17)

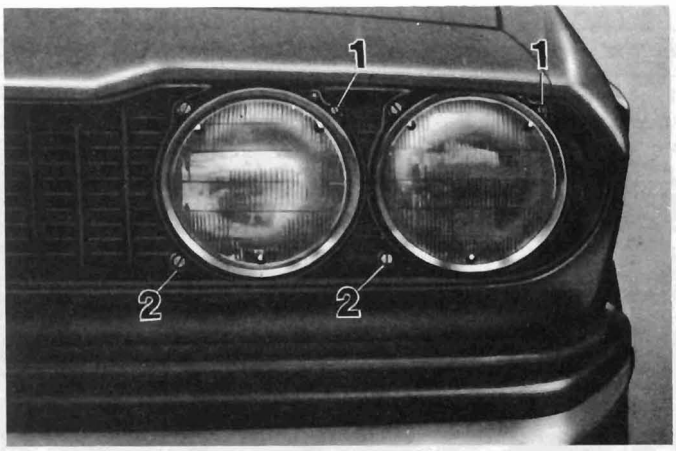


Fig. 9.13 Headlamp beam adjusting screws (Sec 17)

1 Horizontal adjustment screw
2 Vertical adjustment screw

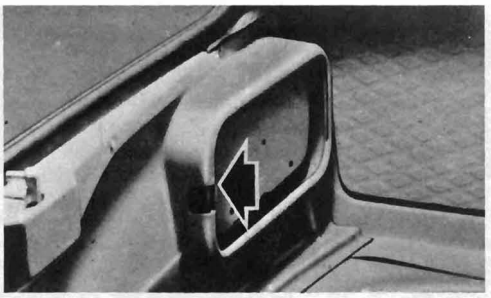


Fig. 9.14 Rear lamp mounting plate clip (Saloon) (Sec 18)

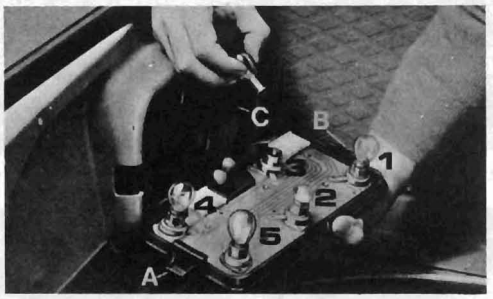


Fig. 9.15 Rear lamp bulbs (Saloon) (Sec 18)

1 Stop
2 Tail
3 Direction indicator
4 Reverse
5 Rear fog
A Clip
B Tongue
C Slot

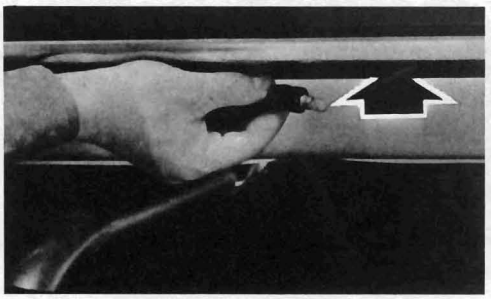


Fig. 9.16 Rear number plate bulb holder (Saloon) (Sec 18)

19 Bulb renewal – exterior lamps (N America and models with sealed beam headlamps)

1 The methods of bulb renewal are similar to those described in the preceding Section, except that the front indicator/parking lamps are independent of the headlamps. Access to these bulbs is obtained after removal of the lens screws and the lens (photo).

2 The rear licence plate lamp is located under a badge-carrying lip on the rear body panel on Saloon versions.

3 The front side marker lamp bulb is accessible after removal of the outer headlamp sealed beam unit.

4 The rear side marker lens is accessible once the side trim panel has been detached from inside the luggage boot.

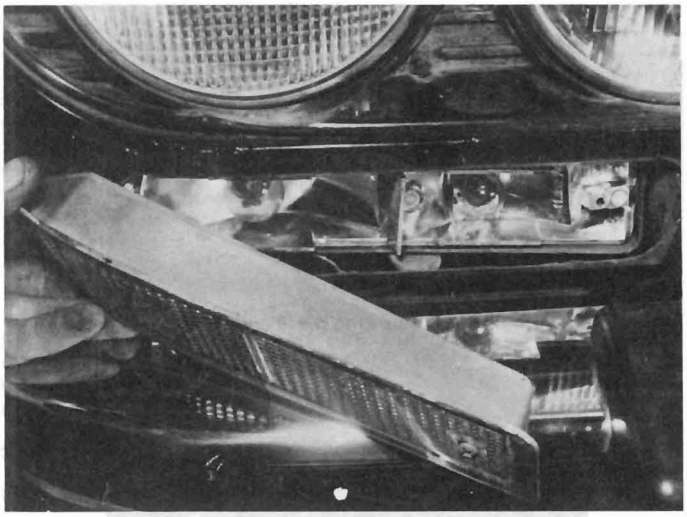
20 Bulb renewal – interior lamps

Engine compartment and luggage boot lamps

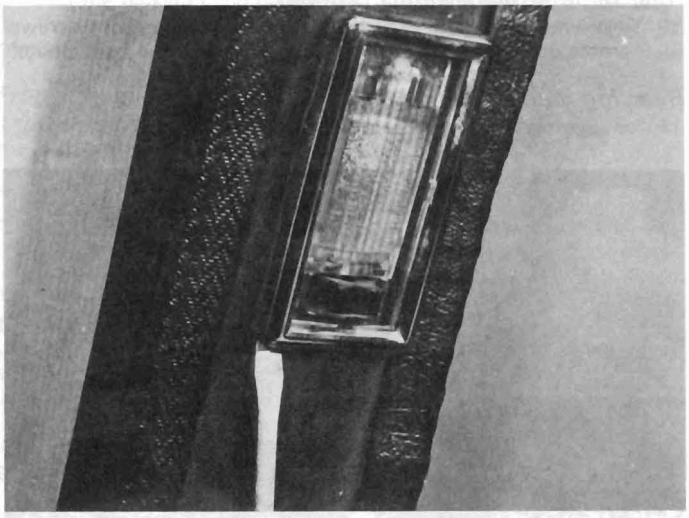
1 These bulbs are of festoon type and may be renewed after pulling them from their contacts.

Interior lamp

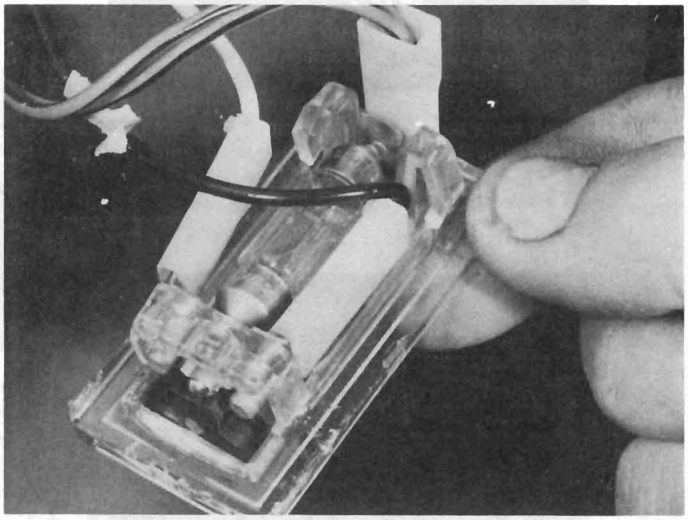
2 Carefully lever off the chrome bezel and then prise the lamp body from the body pillar. The lamp is held by tabs at its sides and they must



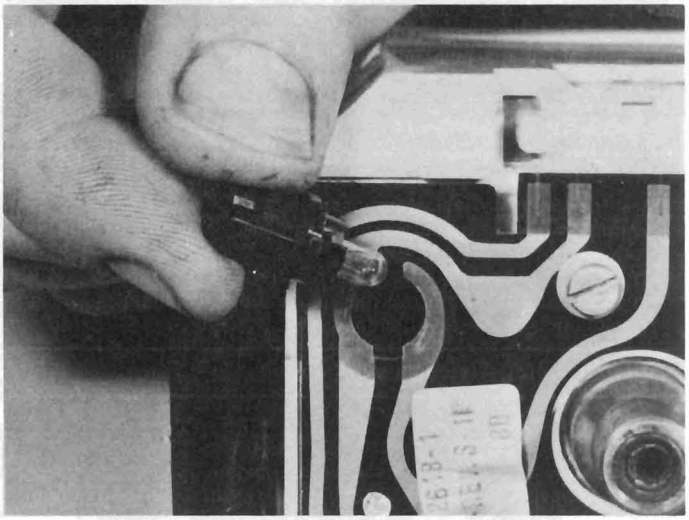
19.1 Front parking/indicator lamp



20.2a Prising off the interior lamp bezel



20.2b Interior lamp removed



20.5 Instrument panel bulb and holder

be well depressed before levering the lamp body, otherwise the plastic lens will be fractured (photos).

3 The bulb is of festoon type which can be renewed by pulling it from its contacts.

Instrument panel lamps

4 The instrument panel illumination and warning lamp bulbs can only be reached after withdrawal of the panel as described in the next Section.

5 The bulb holders are removed using a twisting motion, and the wedge-based bulbs pulled out (photo).

21 Instrument panels – removal and refitting

1 The instruments or panels on all models are held in position by small cross-head screws. Disconnect the battery earth lead before starting work.

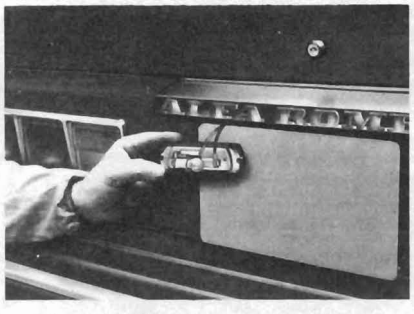


Fig. 9.17 Rear license plate lamp (N America) (Sec 19)

Fig. 9.18 Front side marker lamp bulb and holder (N America) (Sec 19)

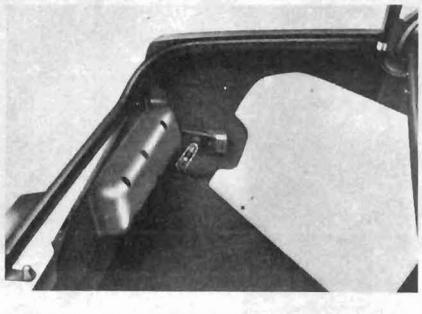


Fig. 9.19 Rear side marker bulb and holder (Saloon) (Sec 19)

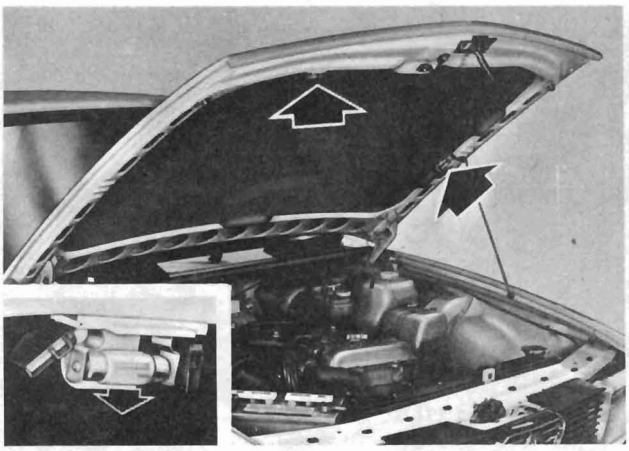


Fig. 9.20 Engine compartment lamp and switch (arrowed) (Sec 20)

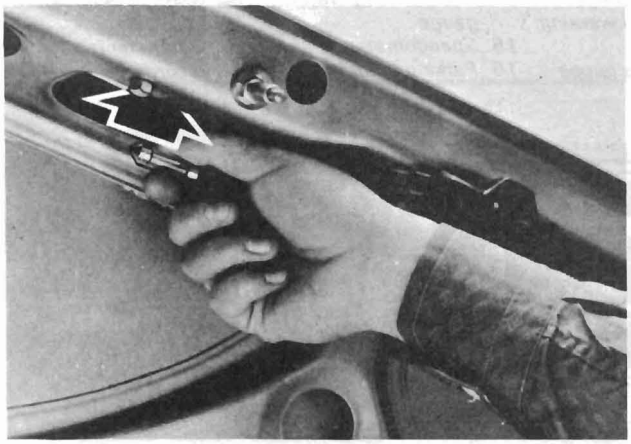
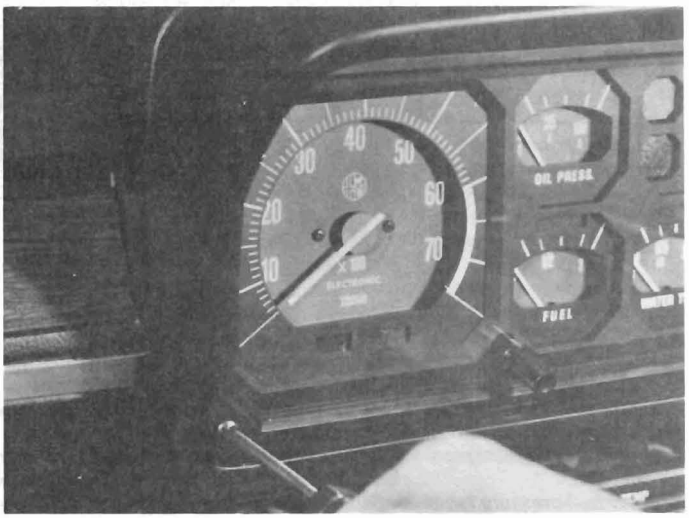


Fig. 9.21 Luggage boot lamp (Saloon) (Sec 20)

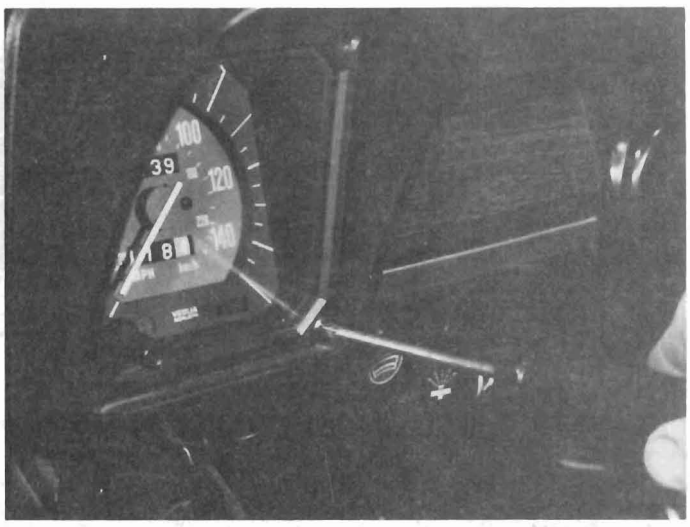
2 Extract the screws, pull the instrument or panel towards you but only enough to be able to disconnect the electrical wiring plugs or instrument drive cables. The panel can then be removed from the facia (photos).

3 On Coupe models with the speedometer mounted independently behind the steering wheel, the column upper tilt device should be removed so that the column can be lowered to provide the clearance required for withdrawing the instrument.

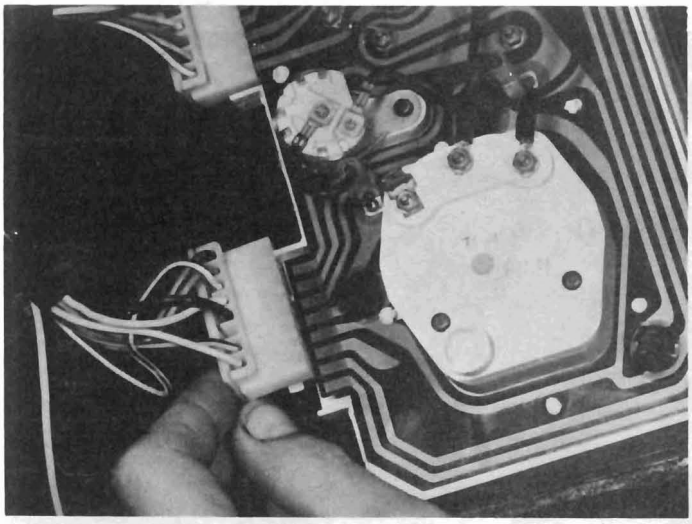
4 Refitting is a reversal of removal.



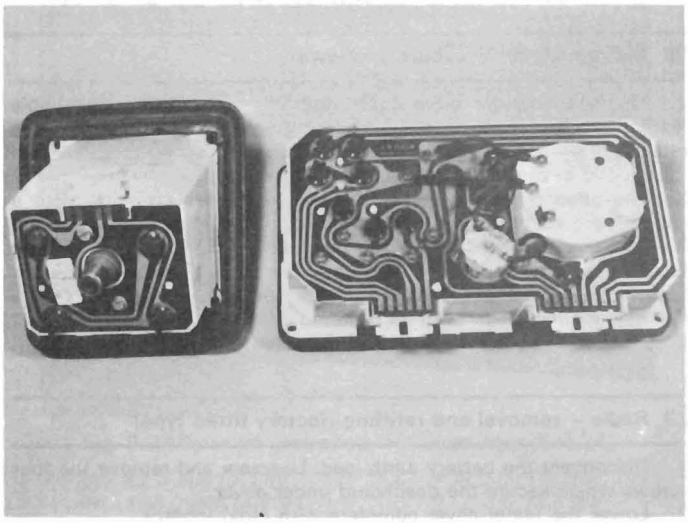
21.2a Extracting an instrument panel screw



21.2b Extracting a speedometer securing screw (Coupe)



21.2c Instrument panel wiring harness plug



21.2d Rear view of speedometer and instrument panel

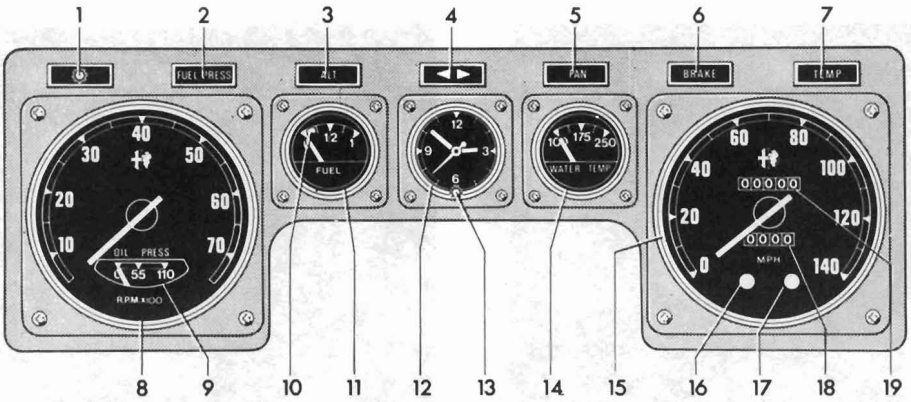


Fig. 9.22 Typical instrument panel (Saloon) (Sec 21)

1 *Instrument lighting rheostat*
2 *Low fuel pressure lamp (fuel injection)*
3 *Charge (ignition) warning lamp*
4 *Direction indicator warning lamp*
5 *Blower warning lamp*
6 *Handbrake on/low fluid level warning lamp*
7 *Coolant temperature warning lamp*
8 *Tachometer*
9 *Oil pressure gauge*
10 *Low fuel level warning lamp*
11 *Fuel contents gauge*
12 *Clock*
13 *Clock reset knob*
14 *Coolant temperature gauge*
15 *Speedometer*
16 *Parking lamp warning lamp*
17 *Headlamp main beam warning lamp*
18 *Trip meter*
19 *Odometer (total mileage recorder)*

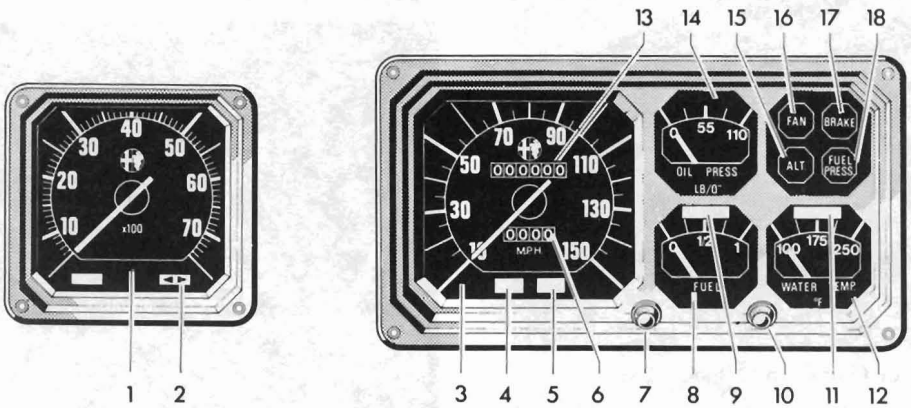
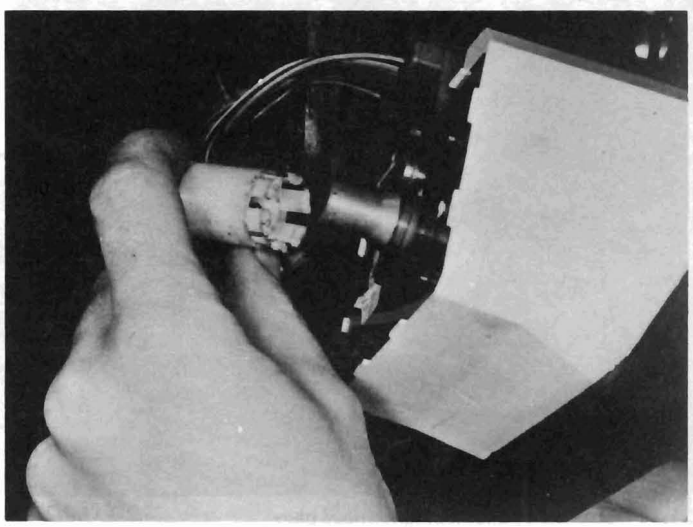


Fig. 9.23 Typical instrument panel (Coupe) (Sec 21)

1 *Tachometer*
2 *Direction indicator warning lamp*
3 *Speedometer*
4 *Headlamp main beam warning lamp*
5 *Parking lamp warning lamp*
6 *Trip meter*
7 *Instrument lighting rheostat*
8 *Fuel contents gauge*
9 *Low fuel level warning lamp*
10 *Trip meter reset knob*
11 *Coolant temperature warning lamp*
12 *Coolant temperature gauge*
13 *Odometer (total mileage recorder)*
14 *Oil pressure gauge*
15 *Charge (ignition) warning lamp*
16 *Blower warning lamp*
17 *Handbrake on/low fuel level and pressure warning lamp*
18 *Low fuel pressure warning lamp (fuel injection models)*

22 Instrument drive cables – renewal

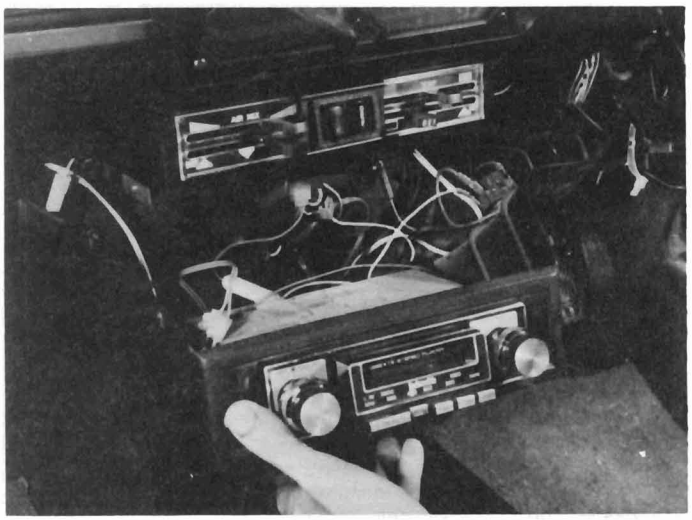
1 The speedometer drive cable and the tachometer drive cable (earlier models) can be disconnected from the instrument if the retaining ring is compressed to release the the holding tongues from the groove at the rear of the instrument (photo).
2 The speedometer cable is secured to the transmission with a knurled ring which can be unscrewed to release the cable assembly.
3 The same method is used on earlier models to hold the tachometer cable to the coolant pump, from which the drive is taken. Later models have an electronic type tachometer.
4 Release the cable from its securing clips and remove it.
5 Fit the new cable by reversing the removal operations.



22.1 Disconnecting cable from speedometer

23 Radio – removal and refitting (factory fitted type)

1 Disconnect the battery earth lead. Unscrew and remove the four screws which secure the dashboard under cover.
2 Lower the under cover complete with radio (photo).
3 Disconnect the aerial, speaker and power leads from the rear of the radio.



23.2 Removing undercover with radio

4 Lift the radio and under cover away.
5 Refitting is a reversal of removal.

24 Radio – later installation as accessory

1 If a radio is to be installed to a car not equipped with one as original equipment, the blanking panel below the heater control panel should be removed and a standard sized receiver fitted.
2 Speakers should be located in the door panels or back shelves in accordance with the accompanying illustrations, or on the facia top panel.
3 An aerial will be required and this may be manually-operated or power-operated, according to choice. Fit in accordance with the manufacturer's instructions.
4 The location for an aerial may be on the front wing, the rear wing, or on the roof above the windscreen.
5 All cars are equipped with the necessary wiring harness for the radio and reference should be made to the appropriate wiring diagram.
6 The radio must have connections for power supply, aerial and speakers, and a really good earth bond.
7 The engine ignition system is suppressed during production and no further modifications should be required.

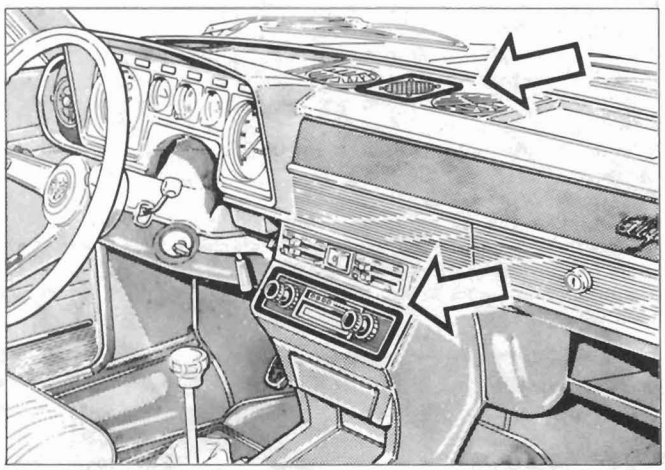


Fig. 9.24 Radio and facia speaker mounting (Saloon) (Sec 24)

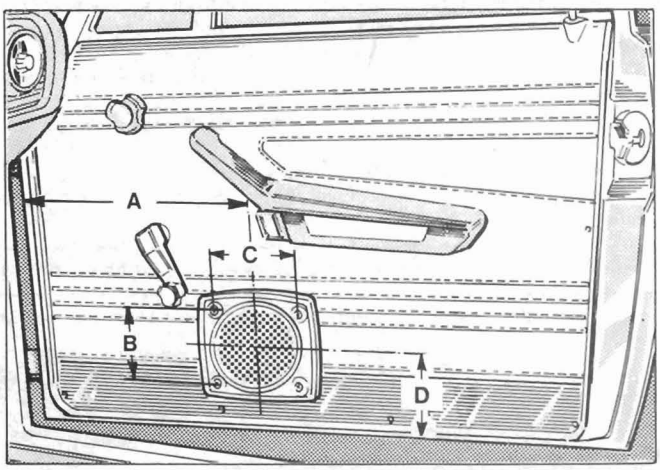


Fig. 9.25 Door mounting for radio speaker (Saloon) (Sec 24)

A 326 mm (12.85 in)
B 108 mm (4.3 in)
C 108 mm (4.3 in)
D 124 mm (4.9 in)

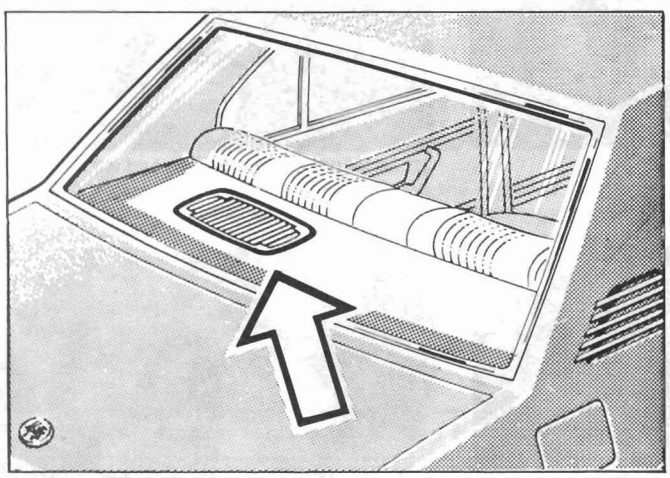


Fig. 9.26 Rear speaker location (Saloon) (Sec 24)

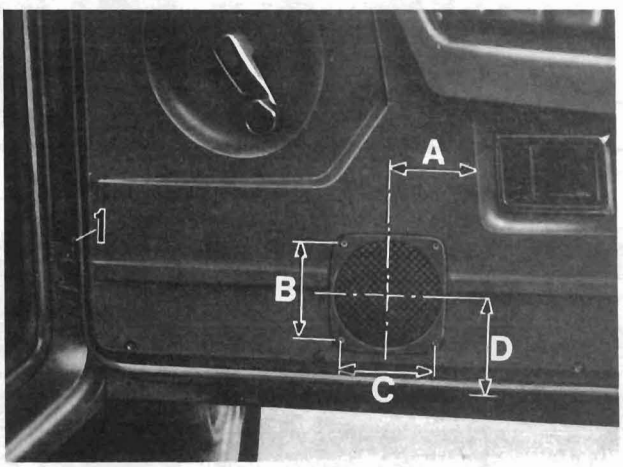


Fig. 9.27 Speaker mounting on Coupe door (Sec 24)

A 87.0 mm (3.4 in)
B 108.0 mm (4.2 in)
C 108.0 mm (4.2 in)
D 97.0 mm (3.8 in)

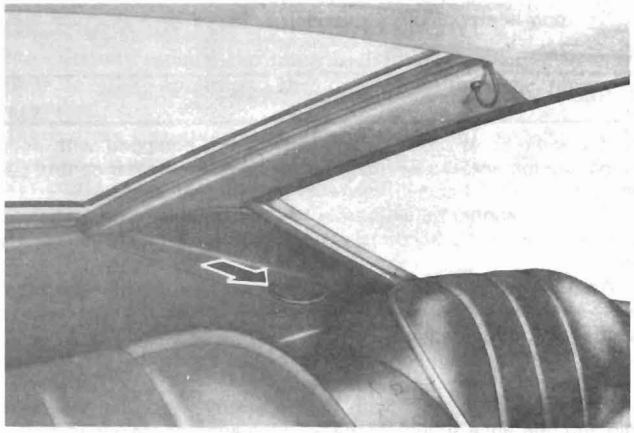


Fig. 9.28 Rear speaker location on Coupe (Sec 24)

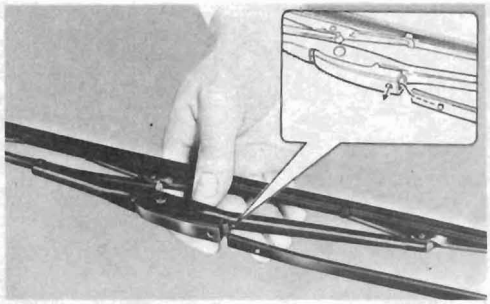


Fig. 9.29 Alternative type of blade fixing to windscreen wiper arm (Sec 25)

25 Windscreen wiper blades and arms – removal and refitting

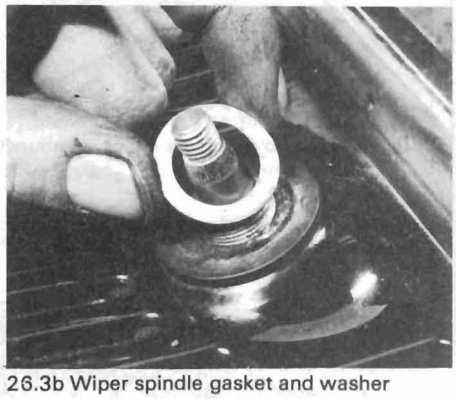
1 To remove a wiper blade, pull the arm away from the glass until it locks.
2 Depress the small tab and slide the blade from the arm pivot pin. On some models, the blade slides off the end of the arm (photo).
3 Gently return the arm to the glass and mark its position on the glass with a strip of masking tape. The motor must be in the parked position.
4 Slide off the cover and unscrew the wiper arm securing nut. Remove the lockplate.
5 Pull the arm from the splined drive spindle.
6 Refitting is a reversal of removal. Apply a smear of grease to the spindle splines.

26 Windscreen wiper motor and linkage – removal and refitting

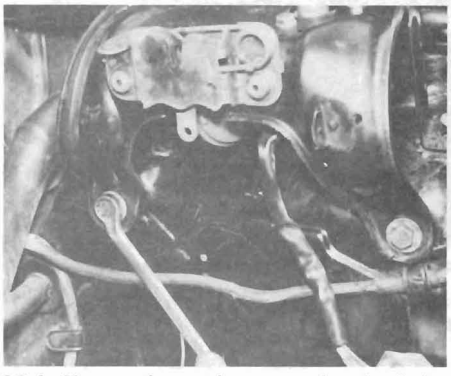
1 On right-hand drive cars, before the wiper motor or linkage can be removed, the brake pedal crossshaft must be withdrawn as described in Chapter 8, Section 15.
2 Remove the wiper arms as described in the preceding Section.
3 Unscrew and remove the spindle nuts at the wheelboxes. Take off the washer and the plastic seal (photos).
4 Open the bonnet and unscrew and remove the three bolts which hold the wiper motor mounting plate to the engine compartment rear bulkhead (photos).
5 Disconnect the bonnet release cable and the emergency cable from the lock on the rear bulkhead.
6 Disconnect the wiper motor wiring plug (photo).
7 Withdraw the motor linkage from under the scuttle until the three bolts can be unscrewed and the wiper motor slipped out of its mounting cradle (photo).
8 Support the motor and disconnect the link from the motor shaft splines (photo).
9 Withdraw the motor (photo).
10 Withdraw the linkage using a twisting motion (photo).
11 Refitting is a reversal of removal. When connecting the link to the wiper motor driveshaft, note the master spline which ensures correct alignment. Remember to refit the plastic sleeve when refitting the left-hand wheelbox.

25.2 Separating wiper blade from arm

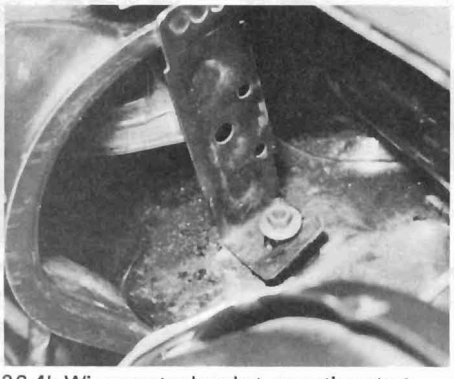
26.3a Wiper spindle nut



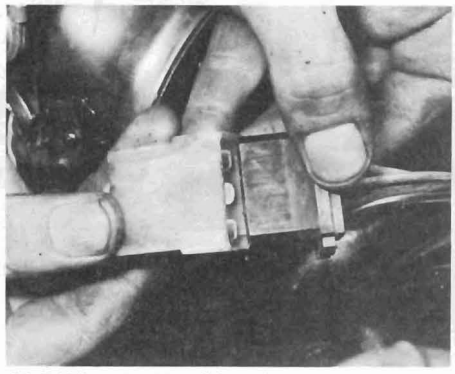
26.3b Wiper spindle gasket and washer



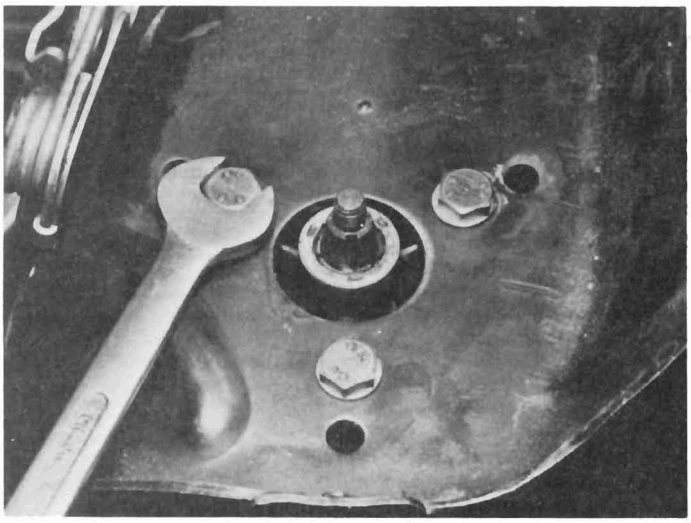
26.4a Unscrewing a wiper motor bracket bolt



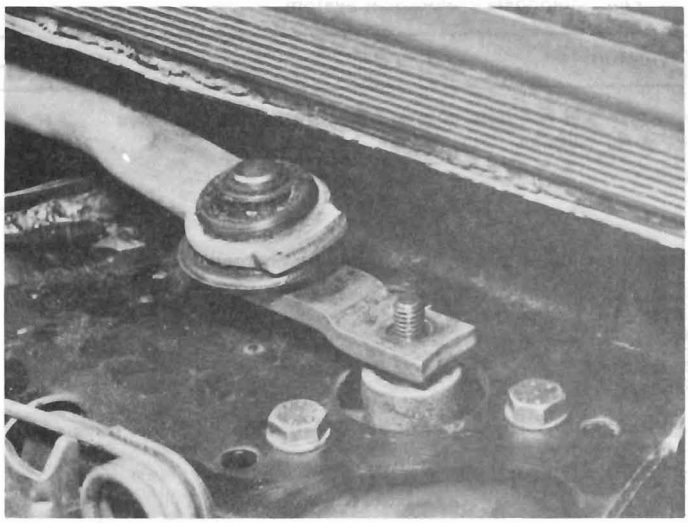
26.4b Wiper motor bracket mounting strut



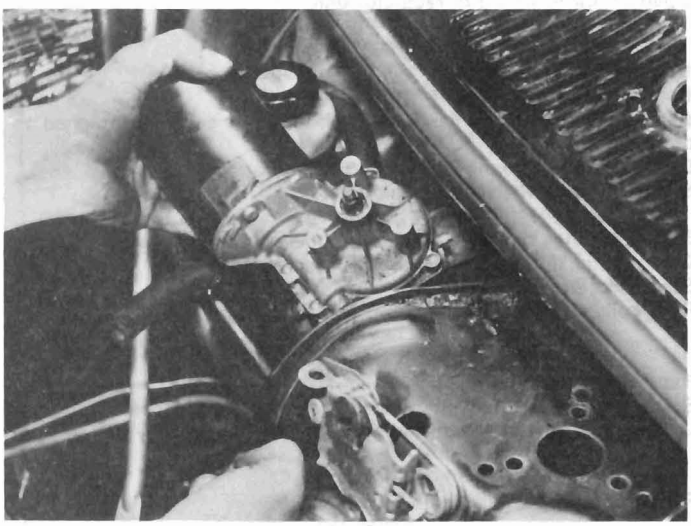
26.6 Wiper motor wiring plug



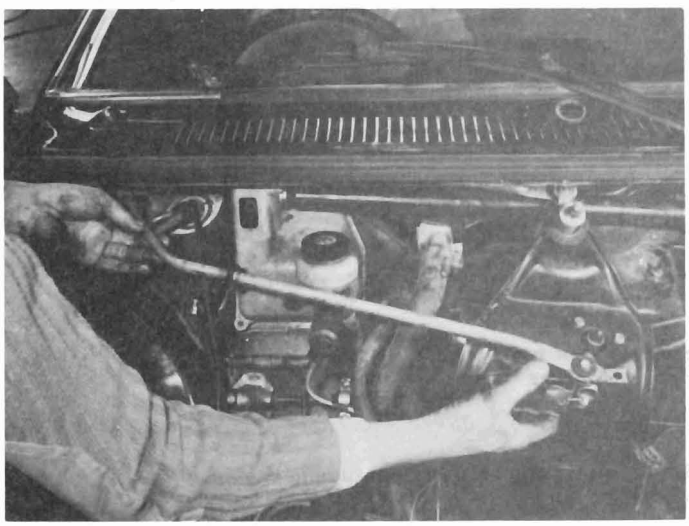
26.7 Unscrewing the wiper motor from its bracket



26.8 Wiper motor shaft connection to link



26.9 Withdrawing the wiper motor from the bracket



26.10 Withdrawing the wiper motor linkage

27 Windscreen washer – description

1 The electrically-operated washer is operated by pinching the wiper switch stalk towards the steering wheel rim.
2 The washer fluid reservoir and pump are located within the engine compartment.
3 At the weekly maintenance check, top up the reservoir. In winter when there is a risk of freezing, add an increased percentage of washer cleaning solvent or pour in some methylated spirit. On no account add cooling system antifreeze, or the paintwork and wiper blades will be damaged.
4 Do not operate the washer pump when the reservoir is empty.
5 The washer jets are adjustable: use a pin in their nozzles to obtain the correct washer jet pattern on the screen.

28 Heated rear window – maintenance and precautions

1 The interior surface of the rear window or tailgate should be cleaned with water and detergent only, wiping the glass in the direction that the elements run.
2 Take care not to scratch the element with rings on the fingers or to allow luggage to rub against the glass.
3 Do not stick adhesive labels over the element.
4 In the event of an element becoming damaged, it may be possible to repair it using one of the special conductive paints available as an alternative to renewing the complete rear window or tailgate glass.

29 Seat belt and anti-theft warning system – description

1 On cars intended for operation in North America, a warning buzzer is located on the fuse block. This has two functions, one being to remind the occupants if the seat belts have not been fastened prior to starting the car, and secondly if the driver's door is opened without having first removed the ignition key from the ignition lock.

30 Wiring diagrams – general

1 The wiring diagrams at the end of this Chapter are only a representative selection, for reasons both of space and of availability. The owner's handbook supplied with the car when new contains a wiring diagram specifically for the vehicle in question.
2 Not all the items appearing on a particular wiring diagram will necessarily be fitted to any one vehicle, particularly with items such as external lights which are subject to legal legislation.
3 Where a figure follows a wire's colour coding in the wiring diagram, tnis indicates the wire gauge in mm^2. Where no number is shown, the wire gauge is 0.5 mm^2.

31 Fault diagnosis – electrical system

Symptom	Reason(s)
Battery will not hold charge for more than a few days	
Wear or damage	Battery defective internally Electrolyte level too low or electrolyte too weak due to leakage Plate separators no longer fully effective Battery plates severely sulphated
Insufficient current flow to keep battery charged	Battery plates severely sulphated Drivebelt slipping Battery terminal connections loose or corroded Alternator not charging Short in lighting circuit causing continual battery drain Regulator unit not working correctly
Ignition light fails to go out battery runs flat in a few days	
Alternator not charging	Drivebelt loose and slipping or broken Brushes worn, sticking, broken or dirty Brush springs worn or broken
Regulator fails to work correctly	Regulator incorrectly set Open-circuit in wiring of regulator unit
Starter motor fails to turn engine	
No electricity at starter motor	Battery discharged Battery defective internally Battery terminal leads loose or earth lead not securely attached to body Loose or broken connections in starter motor circuit Starter motor switch or solenoid faulty
Electricity at starter motor: faulty motor	Starter brushes badly worn, sticking or brush wires loose Commutator dirty, worn or burnt Starter motor armature faulty Field coils earthed
Starter motor turns engine very slowly	
Electrical defects	Battery in discharged condition Starter brushes badly worn, sticking or brush wires loose Loose wires in starter motor circuit
Starter motor operates without turning engine	
Mechanical damage	Pinion or flywheel gear teeth broken or worn
Starter motor noisy or excessively rough engagement	
Lack of attention or mechanical damage	Pinion or flywheel gear teeth broken or worn Starter motor retaining bolts loose
Horn defects	
Horn does not sound	Open circuit in horn wiring Horn relay defective Horn switch defective Horn defective
Horn sounds all the time	Short-circuit in horn wiring Horn relay defective Horn switch defective
Lighting defects	
Headlights give poor illumination	Beam alignment incorrect Reflectors tarnished (if applicable) Headlamp glasses dirty Headlamp bulbs dirty (if applicable) Voltage drop in circuit
Lights do not work	Bulbs blown Open-circuit in wiring Switch defective Bulb holder contacts corroded Earth return defective

Key to Fig. 9.30

1 *Sidelights and front direction indicators*
2 *Headlight*
3 *Connector*
4 *Direction indicator repeaters*
5 *Engine compartment light switch*
6 *Engine compartment light*
7 *Horns*
8 *Coil*
9 *Distributor*
10 *Starter motor*
11 *Cooling fan*
12 *Thermoswitch*
13 *Coolant temperature sender (gauge)*
14 *Coolant temperature sender (warning light)*
15 *Oil pressure switch*
16 *Alternator*
17 *Voltage regulator*
18 *Battery*
19 *Brake fluid level switch*
20 *Heater fan*
21 *Windscreen wiper motor*
22 *Instrument panel connector*
23 *Main beam warning light*
24 *Sidelight warning light*
25 *Coolant temperature warning light*
26 *Brake warning light*
27 *Heater fan warning light*
28 *Direction indicator repeater*
29 *No-charge (ignition) warning light*
30 *Low fuel level warning light*
31 *Choke warning light*
32 *Instrument illumination*
33 *Coolant temperature gauge*
34 *Clock*
35 *Fuel gauge*
36 *Oil pressure gauge*
37 *Instrument lighting rheostat*
38 *Stop-light switch*
39 *Windscreen washer motor*
40 *Hazard warning switch*
41 *Heated rear window switch*
42 *Choke warning switch*
43 *Flasher unit*
44 *Heated rear window relay*
45 *Cooling fan relay*
46 *Horn relay*
47 *Fuse box light switch*
48 *Fuse box light*
49 *Fuse box*
50 *Heater fan switch*
51 *Cigarette lighter*
52 *Ignition/starter switch*
53 *Windscreen wiper switch*
54 *Direction indicator switch*
55 *Horn switch*
56 *Lighting switch*
57 *Door switch*
58 *Interior light*
59 *Interior light switch*
60 *Handbrake switch*
61 *Fuel gauge sender unit*
62 *Heated rear window*
63 *Reversing light switch*
64 *Luggage compartment light*
65 *Luggage compartment light switch*
66 *Rear direction indicators*
67 *Stop and tail lights*
68 *Reversing lights*
69 *Number plate light*

Colour code for wiring diagrams

A	Blue	HN	Grey/black
B	White	AB	Blue/white
C	Orange	AN	Blue/black
G	Yellow	BN	White/black
H	Grey	CN	Orange/black
M	Brown	GN	Yellow/black
N	Black	HR	Grey/red
R	Red	RN	Red/black
S	Pink	SN	Pink/black
V	Green	VN	Green/black
Z	Violet		

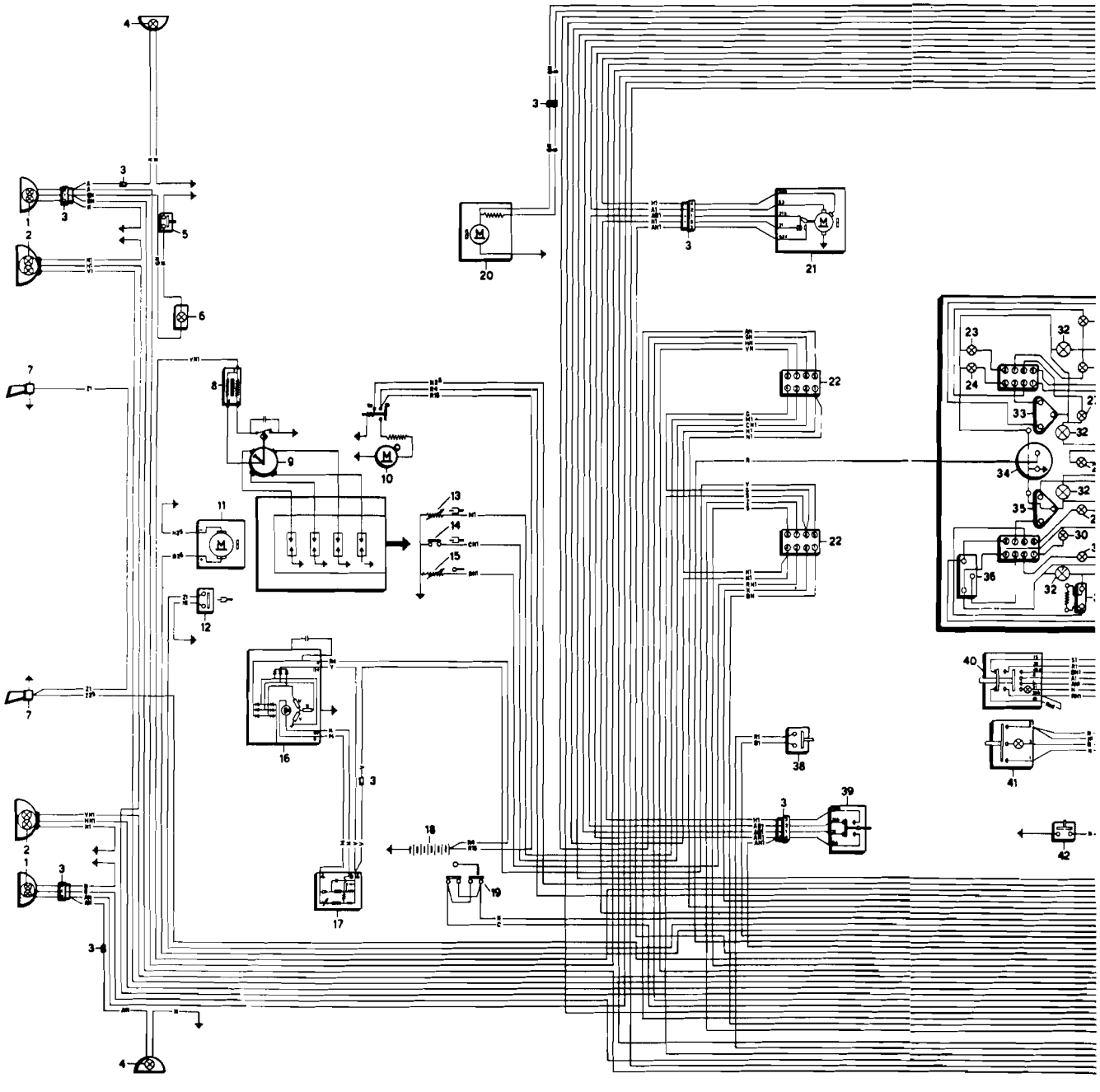


Fig. 9.30 Wiring diagram for 1.6 litre models (except GT). For key see page 163

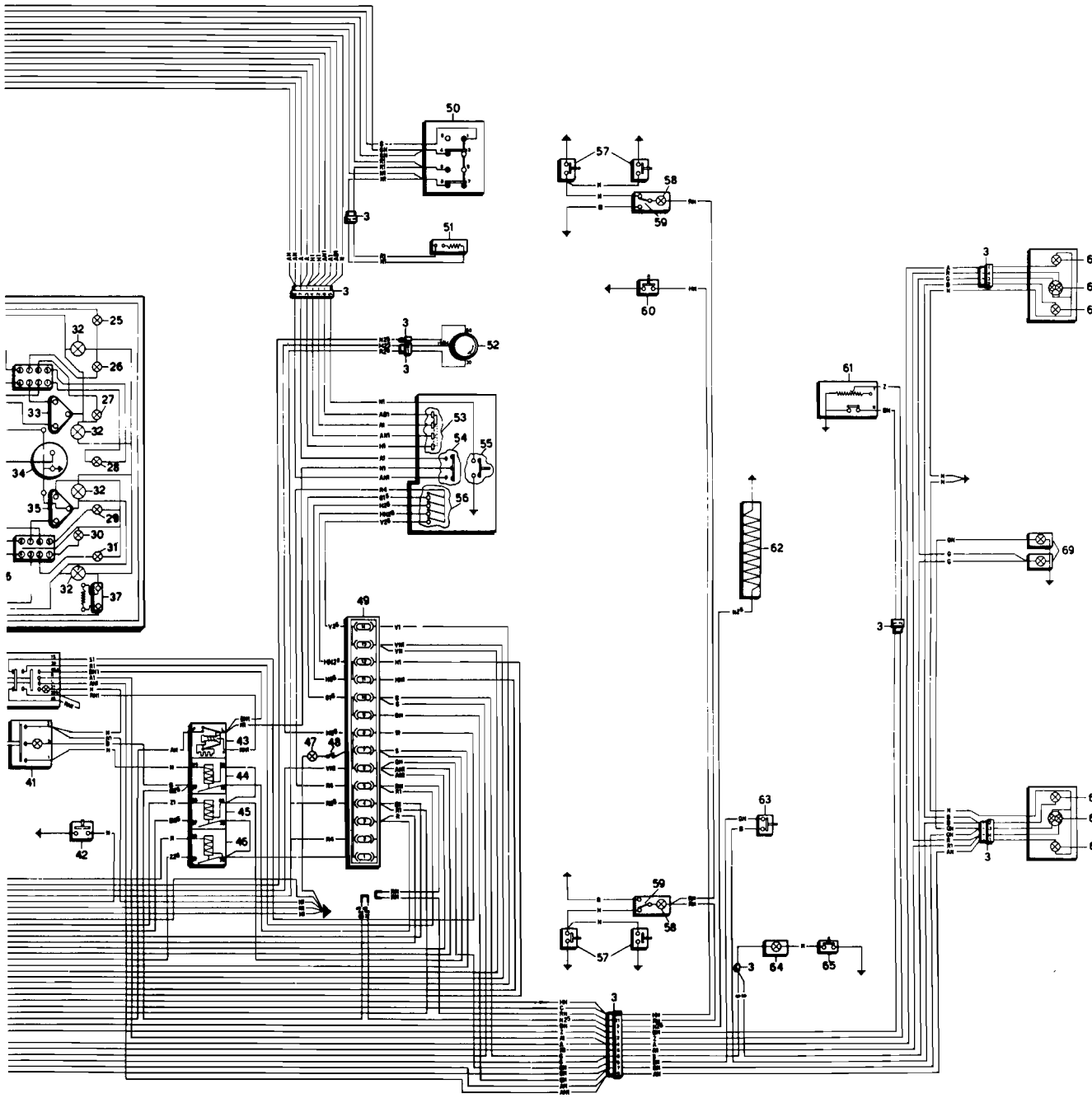


Fig. 9.30 (cont) Wiring diagram for 1.6 litre models (except GT). For key see page 163

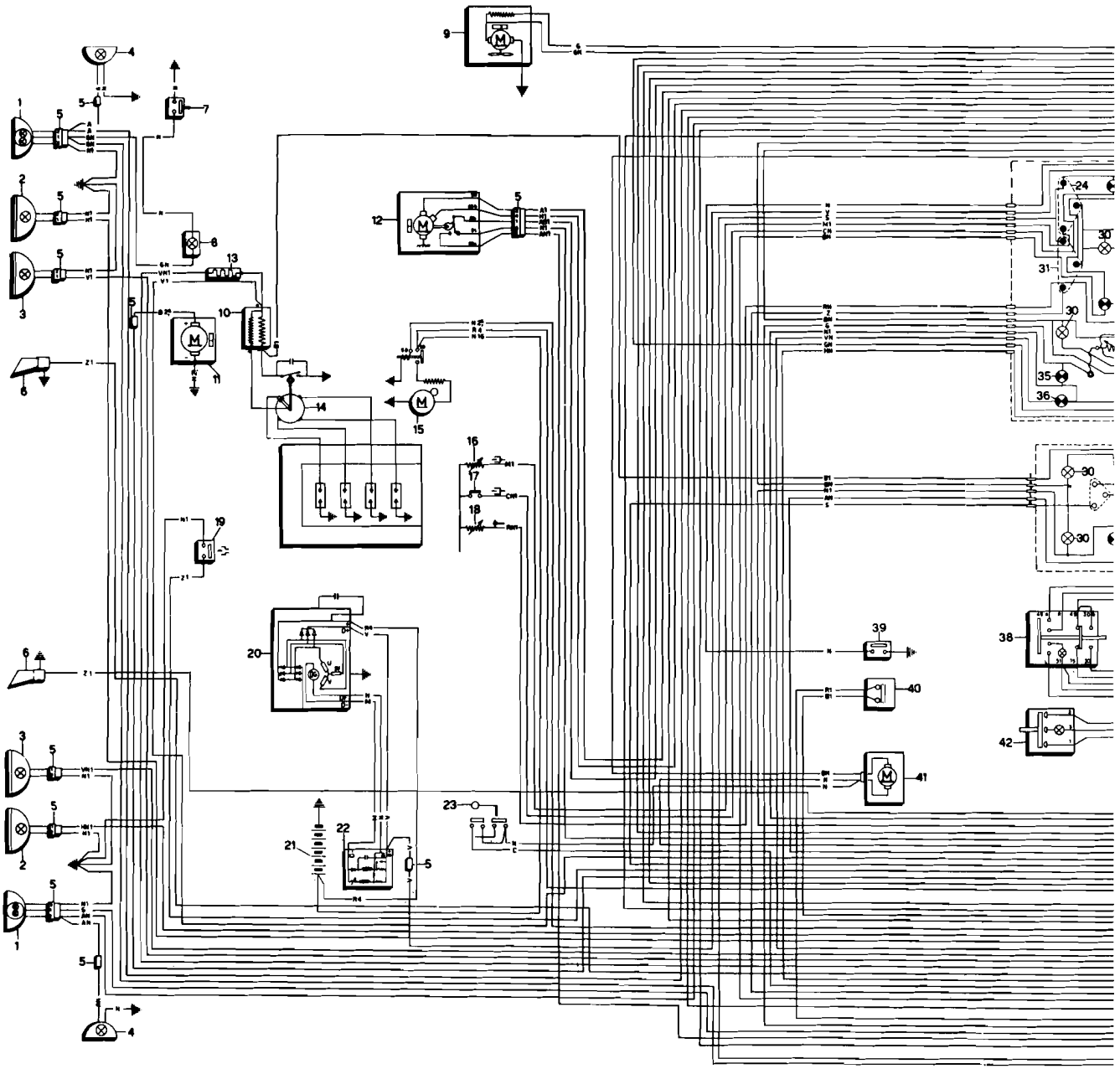


Fig. 9.31 Wiring diagram for 1.6 litre GT and 2000 GTV models. For key see page 168

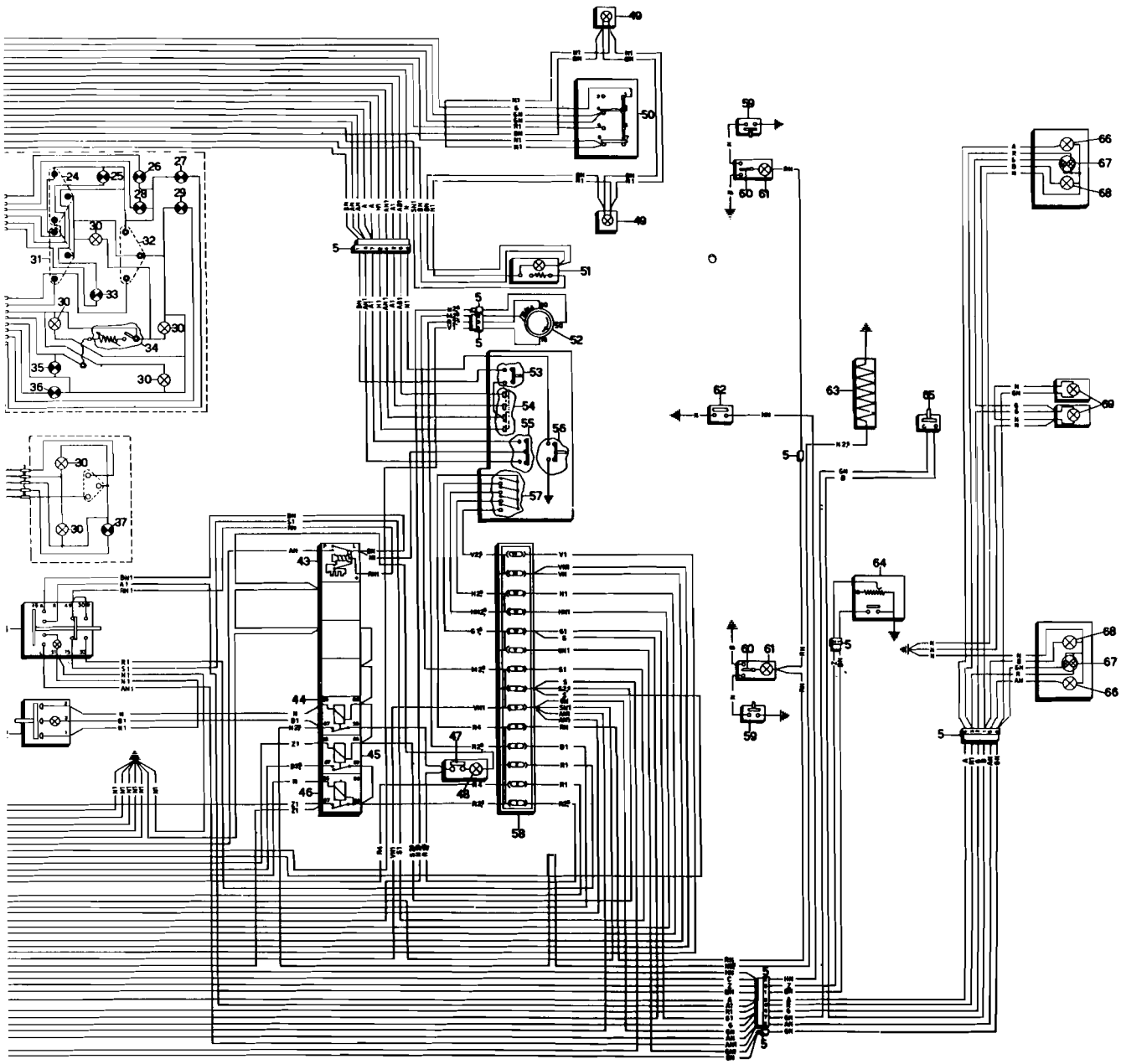


Fig. 9.31 (cont) Wiring diagram for 1.6 litre GT and 2000 GTV models. For key see page 168

Key to Fig. 9.31

1 *Sidelights and front direction indicators*
2 *Headlights (dipped)*
3 *Headlights (main beam)*
4 *Direction indicator repeaters*
5 *Connectors*
6 *Horns*
7 *Engine compartment light switch*
8 *Engine compartment light*
9 *Heater fan*
10 *Coil*
11 *Cooling fan*
12 *Windscreen wiper motor*
13 *Ballast resistor*
14 *Distributor*
15 *Starter motor*
16 *Coolant temperature transmitter (gauge)*
17 *Coolant temperature transmitter (warning light)*
18 *Oil pressure switch*
19 *Cooling fan thermoswitch*
20 *Alternator*
21 *Battery*
22 *Regulator*
23 *Brake fluid level switch*
24 *Coolant temperature gauge*
25 *Coolant temperature warning light*
26 *Choke warning light*
27 *Brake warning light*
28 *No-charge (ignition) warning light*
29 *Heater fan warning light*
30 *Instrument illumination*
31 *Fuel gauge*
32 *Oil pressure gauge*
33 *Low fuel level warning light*
34 *Instrument lighting rheostat*
35 *Sidelight warning light*
36 *Main beam warning light*
37 *Direction indicator repeater*
38 *Hazard warning switch*
39 *Choke warning switch*
40 *Stop-light switch*
41 *Windscreen washer pump*
42 *Heated rear window switch and warning lamp*
43 *Flasher unit*
44 *Heated rear window relay*
45 *Cooling fan relay*
46 *Horn relay*
47 *Fuse box light switch*
48 *Fuse box light*
49 *Heater control illumination*
50 *Heater fan switch*
51 *Cigarette lighter*
52 *Ignition/starter switch*
53 *Windscreen washer switch*
54 *Windscreen wiper switch*
55 *Direction indicator switch*
56 *Horn switch*
57 *Main lighting switch*
58 *Fuse box*
59 *Door switch*
60 *Interior light switch*
61 *Interior light*
62 *Handbrake switch*
63 *Heated rear window*
64 *Fuel gauge sender unit*
65 *Reversing light switch*
66 *Rear direction indicators*
67 *Stop and tail lights*
68 *Reversing light*
69 *Number plate light*

For colour code, see page 163

Key to Fig. 9.32

1 *Sidelights and front direction indicators*
2 *Headlights (dipped beam)*
3 *Headlights (main beam)*
4 *Direction indicator repeaters*
5 *Connector*
6 *Horn*
7 *Engine compartment light switch*
8 *Engine compartment light*
9 *Heater fan*
10 *Coil*
11 *Distributor*
12 *Starter motor*
13 *Cooling fan*
14 *Thermoswitch*
15 *Coolant temperature transmitter (gauge)*
16 *Coolant temperature transmitter (warning light)*
17 *Oil pressure switch*
18 *Alternator*
19 *Voltage regulator*
20 *Battery*
21 *Brake fluid level switch*
22 *Windscreen wiper motor*
23 *Instrument panel connector*
24 *Instrument panel printed circuit*
25 *Instrument panel illumination*
26 *Main beam warning light*
27 *Sidelight warning light*
28 *Coolant temperature warning light*
29 *Brake warning light*
30 *Heater fan warning light*
31 *Direction indicator repeater*
32 *No-charge (ignition) warning light*
33 *Low fuel level warning light*
34 *Choke warning light*
35 *Temperature gauge*
36 *Clock*
37 *Fuel gauge*
38 *Oil pressure gauge*
39 *Instrument illumination rheostat*
40 *Stop-light switch*
41 *Windscreen washer pump*
42 *Hazard warning switch and repeater*
43 *Heated rear window switch and warning light*
44 *Choke warning light switch*
45 *Flasher unit*
46 *Heated rear window relay*
47 *Cooling fan relay*
48 *Horn relay*
49 *Fuse box light*
50 *Fuse box light switch*
51 *Fuse box*
52 *Heater control illumination*
53 *Heater fan switch*
54 *Cigarette lighter*
55 *Ignition/starter switch*
56 *Windscreen washer switch*
57 *Windscreen wiper switch*
58 *Direction indicator switch*
59 *Horn switch*
60 *Main lighting switch*
61 *Door switch*
62 *Interior light switch*
63 *Interior light*
64 *Handbrake switch*
65 *Fuel gauge sender unit*
66 *Reversing lamp switch*
68 *Luggage compartment light switch*
69 *Luggage compartment light*
70 *Rear direction indicators*
71 *Stop and tail lights*
72 *Reversing light*
73 *Number plate light*

For colour code, see page 163

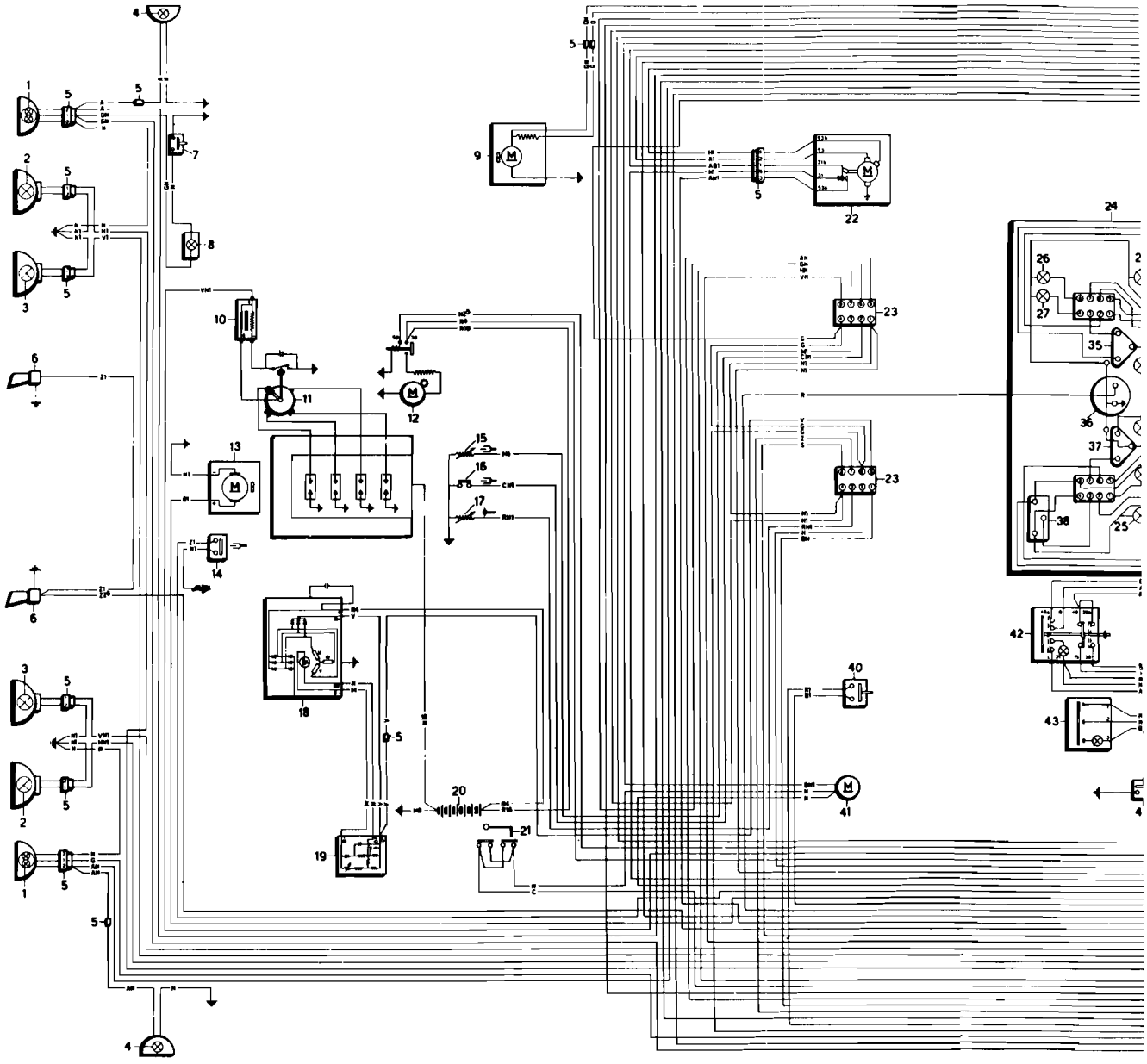


Fig. 9.32 Wiring diagram for 1.8 litre models (except GT). For key see page 169

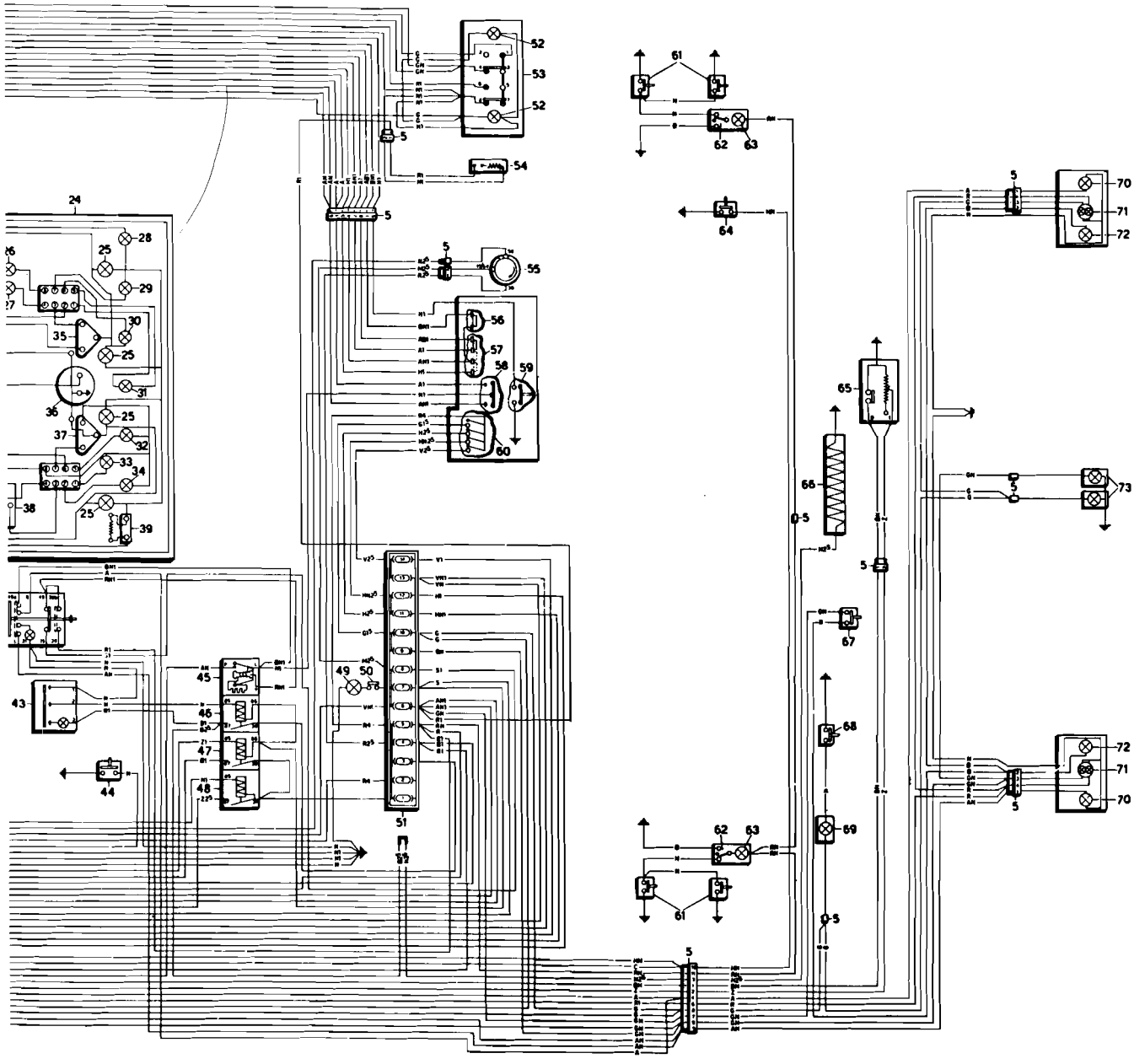


Fig. 9.32 (cont) Wiring diagram for 1.8 litre models (except GT). For key see page 169

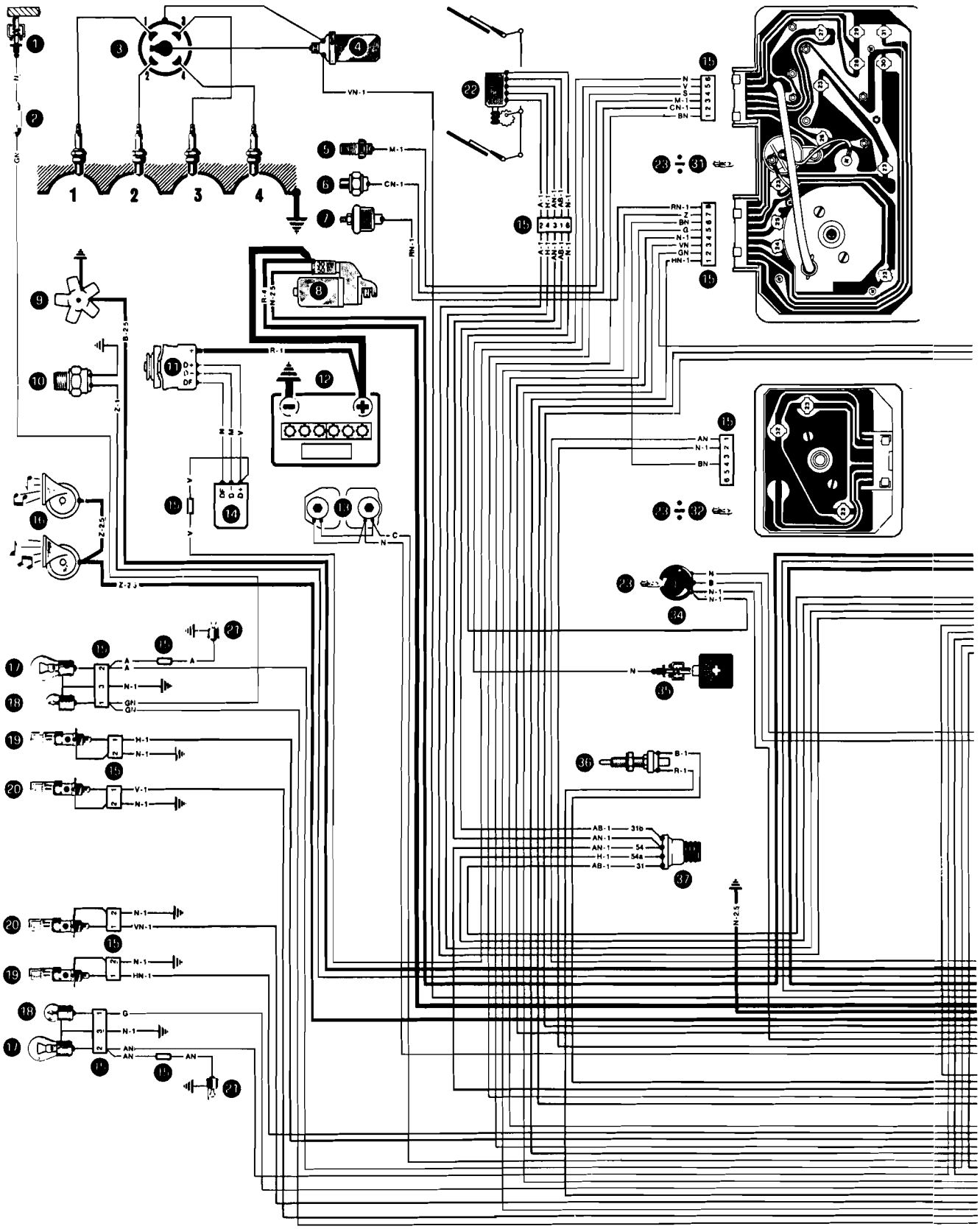


Fig. 9.33 Wiring diagram for 1.8 litre GT models. For key see page 174

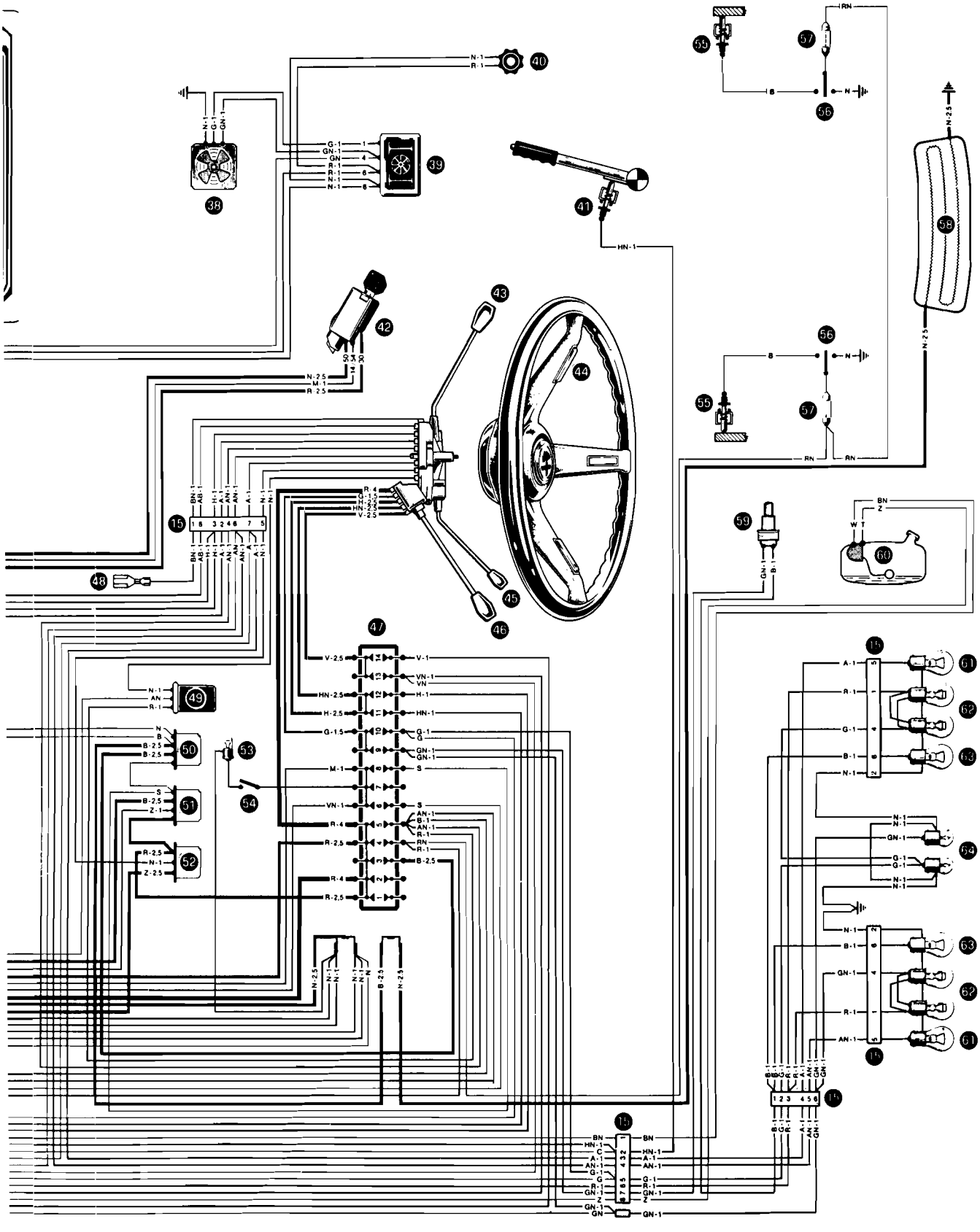


Fig. 9.33 (cont) Wiring diagram for 1.8 litre GT models. For key see page 174

Key to Fig. 9.33

1 *Engine compartment light switch*
2 *Engine compartment light*
3 *Distributor*
4 *Coil*
5 *Thermoswitch (warning light)*
6 *Coolant temperature sender (gauge)*
7 *Oil pressure sender*
8 *Starter motor*
9 *Cooling fan*
10 *Thermoswitch*
11 *Alternator*
12 *Battery*
13 *Brake fluid level switch*
14 *Voltage regulator*
15 *Junction boxes and connectors*
16 *Horns*
17 *Direction indicators*
18 *Sidelights*
19 *Headlights (dipped beam)*
20 *Headlights (main beam)*
21 *Direction indicator repeaters*
22 *Windscreen wiper motor*
23 *Instrument panel illumination*
24 *Main beam warning light*
25 *Sidelights warning light*
26 *Low fuel level warning light*
27 *Coolant temperature warning light*
28 *No-charge (ignition) warning light*
29 *Choke warning light*
30 *Heater fan warning light*
31 *Brake warning light*
32 *Direction indicator repeater*
33 *Heated rear window switch*
34 *Heated rear window warning light*
35 *Choke warning light switch*
36 *Stop-light switch*
37 *Windscreen washer pump (if fitted)*
38 *Heater fan motor*
39 *Heater fan switch*
40 *Cigarette lighter*
41 *Handbrake warning light*
42 *Ignition/starter switch*
43 *Windscreen wiper (or wiper/washer) switch*
44 *Horn switch*
45 *Direction indicator switch*
46 *Main lighting switch*
47 *Fuse box*
48 *Washer pump connector*
49 *Flasher unit*
50 *Heated rear window relay*
51 *Cooling fan relay*
52 *Horn relay*
53 *Fuse box light*
54 *Fuse box light switch*
55 *Door switch*
56 *Interior light switch*
57 *Interior light*
58 *Heated rear window*
59 *Reversing light switch*
60 *Fuel gauge sender unit*
61 *Rear direction indicators*
62 *Stop and tail lights*
63 *Reversing lights*
64 *Number plate lights*

For colour code, see page 163

Key to Fig. 9.34

1 *Front direction indicators*
2 *Sidelights*
3 *Headlights*
4 *Horns*
5 *Connectors*
6 *Cooling fan**
7 *Direction indicator repeaters*
8 *Battery*
9 *Engine compartment light*
10 *Ballast resistor*
11 *Coil*
12 *Distributor*
13 *Cooling fan*
14 *Alternator*
15 *Thermoswitch*
16 *Voltage regulator*
17 *Fast idle solenoid**
18 *Engine compartment light switch*
19 *Brake fluid level switch*
20 *Fast idle switch**
21 *Fast idle switch**
22 *Coolant temperature transmitter (gauge)*
23 *Oil pressure transmitter*
24 *Coolant temperature transmitter (warning light)*
25 *Starter motor*
26 *Windscreen wiper motor*
27 *Instrument panel illumination*
28 *Tachometer*
29 *Instrument panel lighting rheostat*
30 *Fuel gauge*
31 *No-charge (ignition) warning light*
32 *Brake warning light*
33 *Choke warning light*
34 *Low fuel level warning light*
35 *Oil pressure gauge*
36 *Clock*
37 *Main beam warning light*
38 *Direction indicator repeater*
39 *Coolant temperature warning light*
40 *Sidelights warning light*
41 *Heater fan warning light*
42 *Coolant temperature gauge*
43 *Speedometer*
44 *Connector*
45 *Choke warning switch*
46 *Stop-light switch*
47 *Windscreen washer pump*
48 *Connection for rear foglight switch*
49 *Heated rear window warning light*
50 *Heated rear window switch*
51 *Connectors for hazard warning switch*
52 *Hazard warning flasher*
53 *Direction indicator flasher*
54 *Cooling fan relay**
55 *Heater fan relay**
56 *Heated rear window relay*
57 *Cooling fan relay*
58 *Horn relay*
59 *Fuse box light*
60 *Fuse box light switch*
61 *Fuse box*
62 *Main lighting switch*
63 *Horn switch*
64 *Windscreen washer switch*
65 *Direction indicator switch*
66 *Windscreen wiper switch*
67 *Ignition/starter switch*
68 *Cigarette lighter light*
69 *Cigarette lighter*
70 *Heater fan rheostat*
71 *Heater fan switch*
72 *Thermostat**
73 *Heater control illumination*
74 *Heater fan*
75 *Door switch*
76 *Interior light switch*
77 *Interior light*
78 *Handbrake switch*
79 *Fuel gauge sender unit*
80 *Heated rear window*
81 *Reversing light switch*
82 *Luggage compartment light switch*
83 *Luggage compartment light*
84 *Rear direction indicators*
85 *Tail lights*
86 *Stop-lights*
87 *Reversing lights*
88 *Number plate lights*
* *Only with air conditioning*

For colour code, see page 163

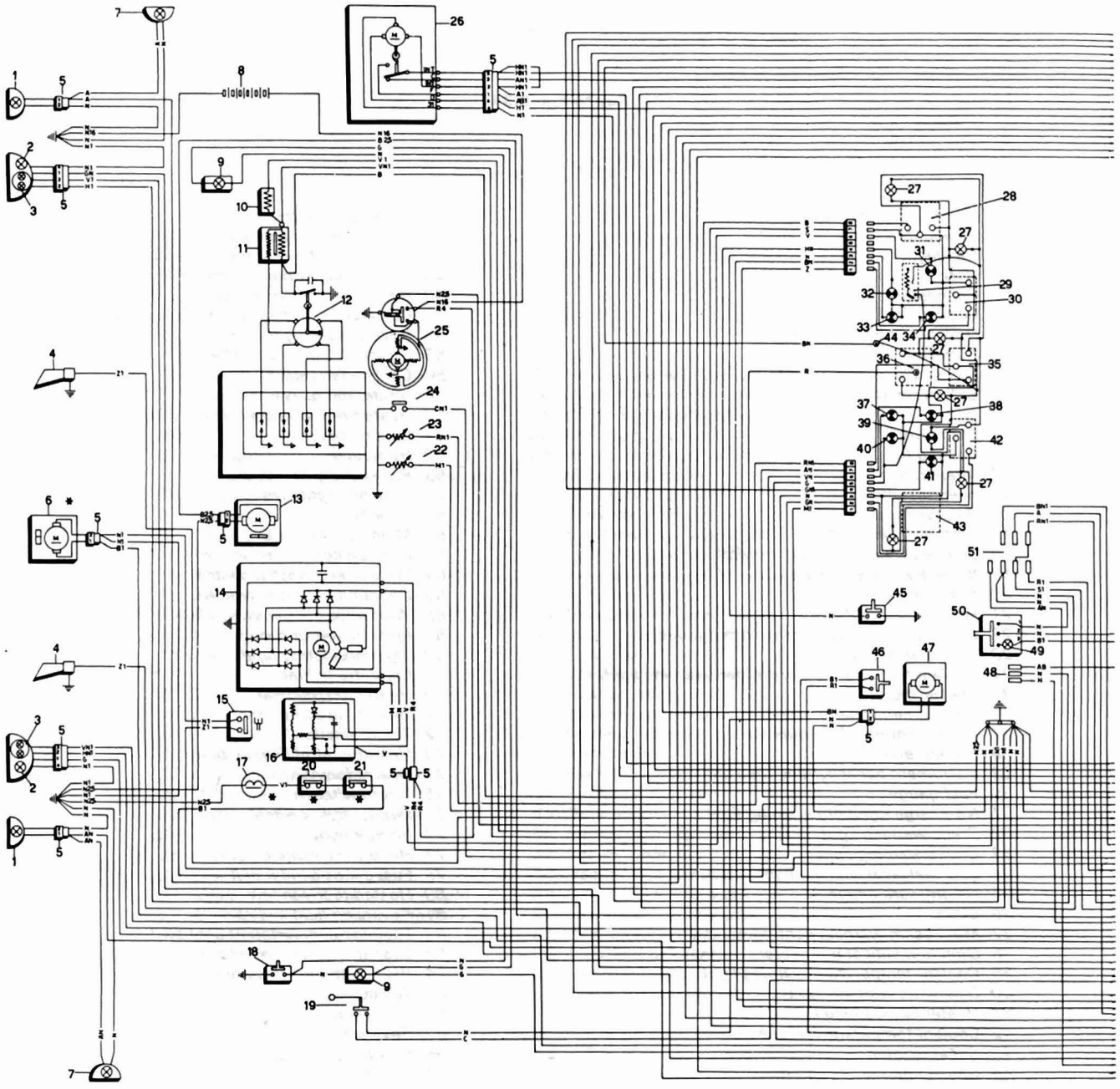


Fig. 9.34 Wiring diagram for 2000 Saloon (early European models). For key see page 175

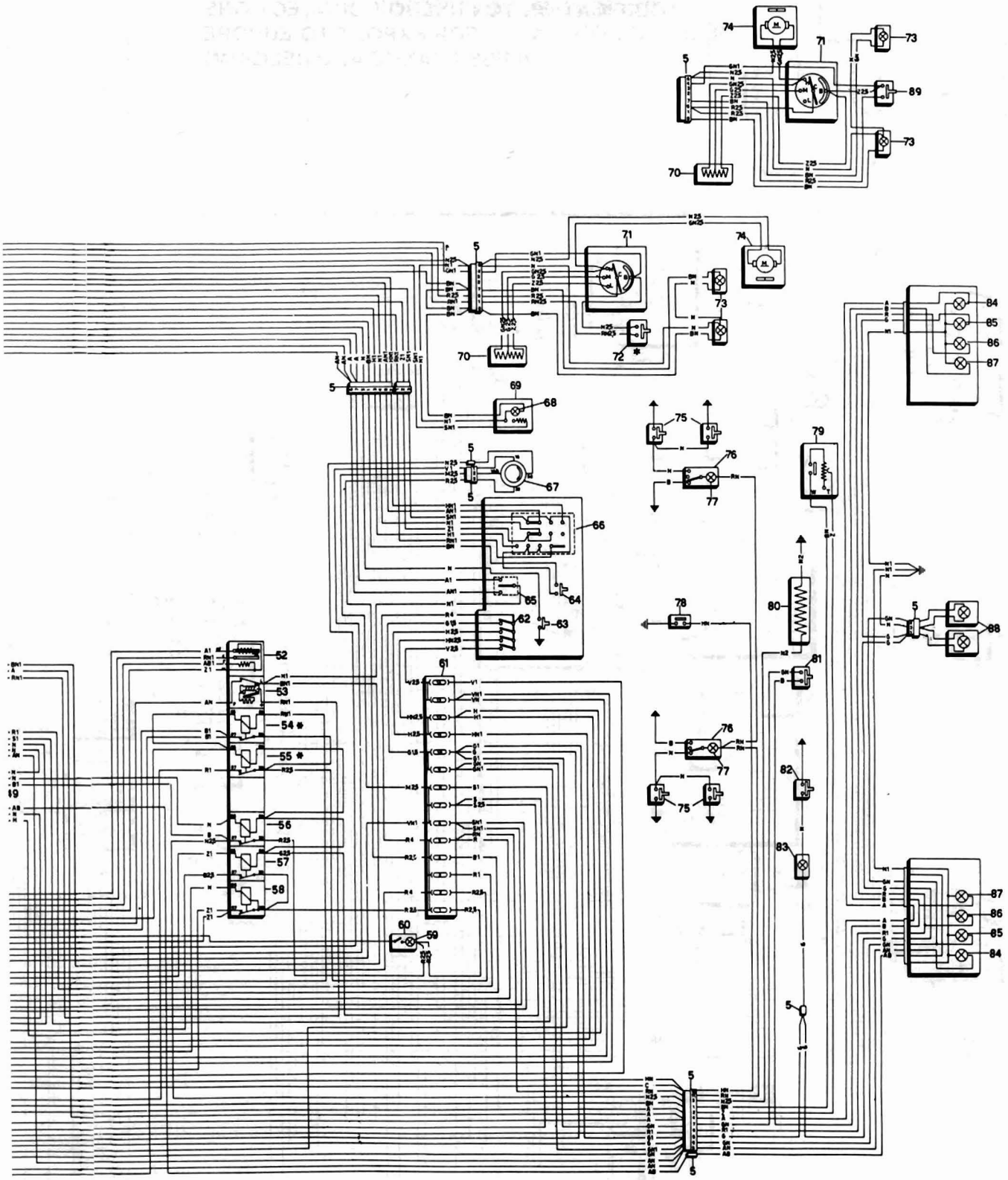
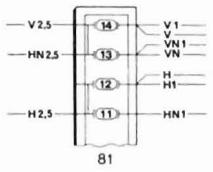


Fig. 9.34 (cont) Wiring diagram for 2000 Saloon (early European models). For key see page 175

MODIFICATION TO FUSEBOX CONNECTIONS FOR EXPORT TO EUROPE (LESS FRANCE AND BELGIUM)



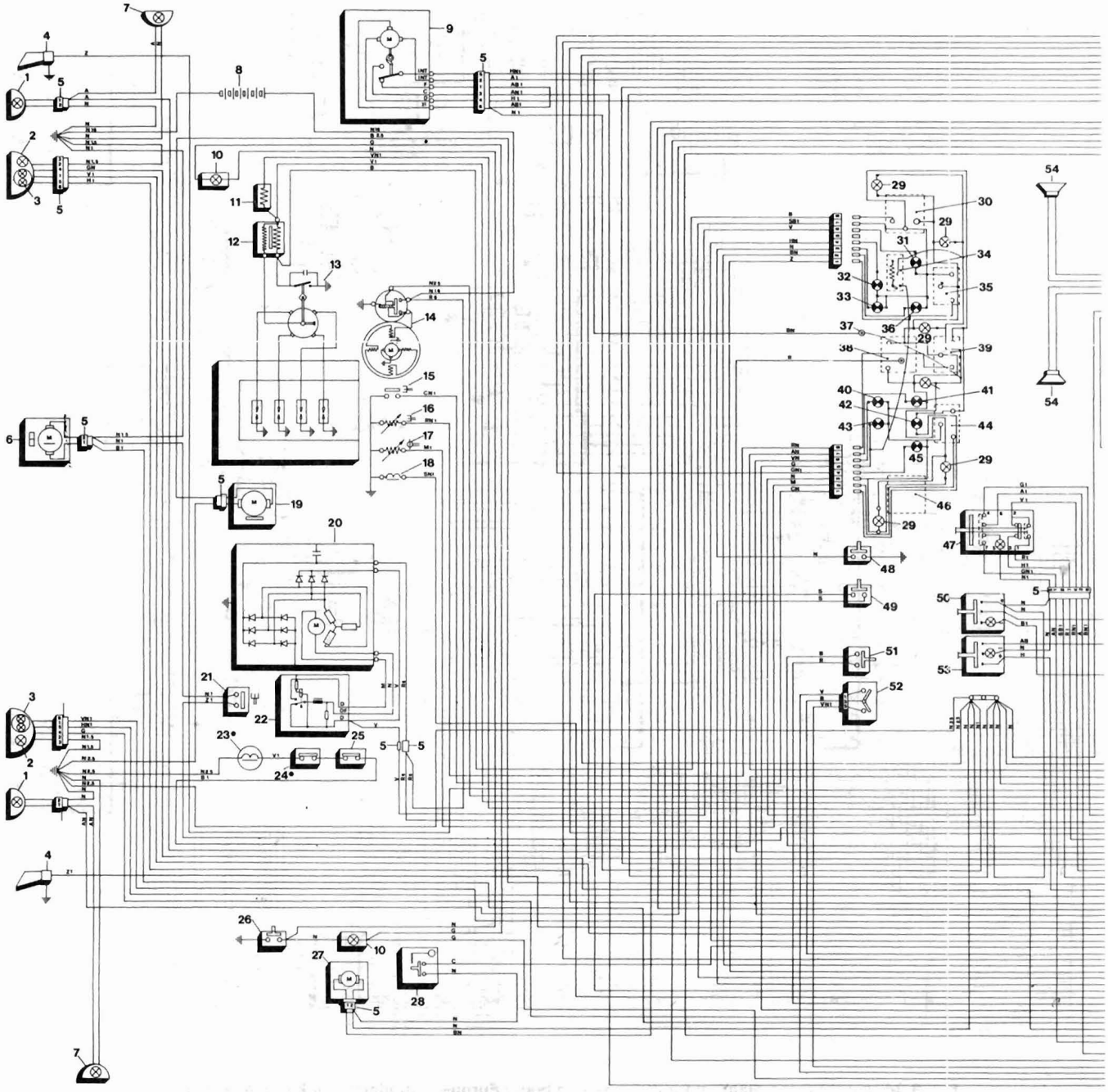


Fig. 9.35 Wiring diagram for 2000 Saloon (later European models). For key see page 180

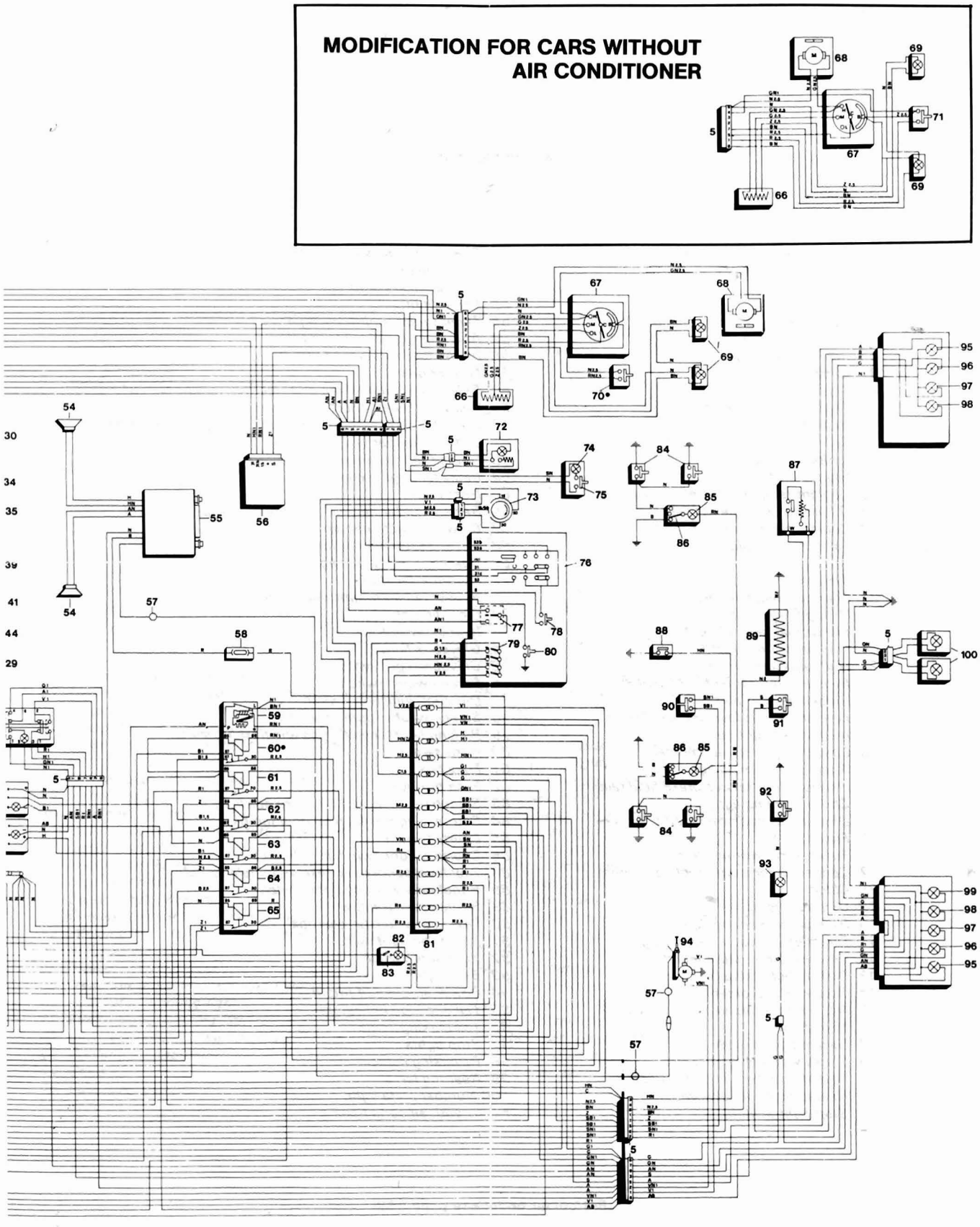


Fig. 9.35 (cont) Wiring diagram for 2000 Saloon (later European models). For key see page 180

Key to Fig. 9.35

1 *Front direction indicators*
2 *Front parking lights*
3 *Headlamp*
4 *Horns*
5 *Junction boxes and connectors*
6 *Additional electric fan**
7 *Side repeater bulb*
8 *Battery*
9 *Screen wiper*
10 *Engine compartment light*
11 *Ballast resistor*
12 *Coil*
13 *Ignition distributor*
14 *Starter motor*
15 *Coolant temperature telltale switch*
16 *Oil pressure gauge sender*
17 *Coolant thermometer sender*
18 *Fast idle solenoid*
19 *Electric fan*
20 *Alternator*
21 *Thermal switch for electric fan*
22 *Voltage regulator*
23 *Electromagnetic clutch**
24 *Low pressure switch**
25 *High pressure switch**
26 *Engine compartment light switch*
27 *Screen washer pump*
28 *Low brake fluid level telltale switch*
29 *Instrument light bulb*
30 *Electromagnetic tachometer*
31 *Alternator warning light*
32 *Handbrake & service brake fluid telltale*
33 *Choke warning light*
34 *Dimmer for instrument light*
35 *Fuel gauge*
36 *Fuel reserve warning light*
37 *Connector for instrument light dimmer*
38 *Clock*
39 *Oil pressure gauge*
40 *High beam warning light*
41 *Direction indicator warning light*
42 *Coolant temperature telltale*
43 *Parking light telltale*
44 *Coolant thermometer*
45 *A/C – Heater blower warning light*
46 *Speedometer*
47 *Hazard light switch*
48 *Choke warning light switch*
49 *Fast idle switch (on clutch pedal)*
50 *Heated rear window switch*
51 *Stop-light switch*
52 *Power antenna switch (if fitted)*
53 *Rear foglamp switch*
54 *Loudspeakers (if fitted)*
55 *Radio (if fitted)*
56 *Timer for intermittent single wipe*
57 *Antenna coaxial cable (if fitted)*
58 *In-line fuse for radio (if fitted)*
59 *Flasher unit*
60 *Relay for additional fan and electromagnetic clutch**
61 *Relay for conditioner* (or blower fan)*
62 *Relay for simultaneous operation of engine cooling fan and conditioner fan**
63 *Heated rear window relay*
64 *Relay for engine cooling fan*
65 *Horn relay*
66 *Resistance for blower/conditioner fan speed control*
67 *Blower/conditioner fan switch*
68 *A/C – Heater blower fan*
69 *Heater control panel light bulb*
70 *Fluid thermostat**
71 *Blower fan automatic cut-in switch*
72 *Cigar lighter*
73 *Ignition switch*
74 *Glovebox light*
75 *Glovebox light switch*
76 *Screen wiper switch*
77 *Direction indicator switch*
78 *Screen washer pump switch*
79 *Parking lights, headlamps and flashing switch*
80 *Horn switch*
81 *Fuse box*
82 *Fuse box light*
83 *Switch (usually open) for fuse box light*
84 *Courtesy light switch on door jambs*
85 *Courtesy light*
86 *Courtesy light switch in light unit*
87 *Fuel level sender and reserve telltale switch*
88 *Handbrake warning light switch*
89 *Heated rear window*
90 *Fast idle switch (in gearbox)*
91 *Reversing light switch*
92 *Boot light switch*
93 *Boot light*
94 *Power antenna (if fitted)*
95 *Tail direction indicators*
96 *Tail parking lights*
97 *Stop lights*
98 *Reversing lights*
99 *Rear fog lamp*
100 *Number plate light*
* *Only with air conditioning*

For colour code, see page 163

Key to Fig. 9.36

1 *Front direction indicators and parking lights*
2 *Headlamp Hi/Low*
3 *Headlamp Hi*
4 *Side marker lights*
5 *Junction boxes and connectors*
6 *Horn*
7 *Engine compartment light switch*
8 *Blower motor (two-speed)*
9 *Safety belt device*
10 *Engine compartment light*
11 *Resistance*
12 *Electric fan*
13 *Coil*
14 *Coolant thermometer sender*
15 *Windshield wiper*
16 *Ignition distributor*
17 *Starter*
18 *Injection pump solenoid*
19 *Low fuel pressure warning light switch*
20 *Fuel cut-off solenoid switch*
21 *Fuel cut-off solenoid*
22 *Thermal switch for electric fan*
23 *Thermal switch for coolant temperature warning light*
24 *Oil pressure gauge sender*
25 *Alternator*
26 *Brake fluid level warning light switches*
27 *Battery*
28 *Low oil pressure warning light switch*
29 *Voltage regulator*
30 *Reminder buzzer switch*
31 *Instrument panel connectors*
32 *Instrument cluster*
33 *Instrument lights*
34 *High beam warning light*
35 *Parking light warning*
36 *Coolant temperature warning light*
37 *Warning light for fluid level, service brake pressure and parking brake*
38 *Blower warning light*
39 *Direction indicators warning light*
40 *Alternator warning light*
41 *Fuel reserve warning light*
42 *Low fuel pressure warning light*
43 *Coolant thermometer*
44 *Clock*
45 *Fuel level gauge*
46 *Oil pressure gauge*
47 *Instrument light dimmer*
48 *Reminder buzzer*
49 *Dimmer for hazard switch light and heater control panel light*
50 *Windshield washer electric pump*
51 *Stop-lights switch*
52 *Buzzer*
53 *Direction indicators and hazard lights switch*
54 *Heated rear window relay*
55 *Electric fan relay*
56 *Horn relay*
57 *Fasten seat belts light*
58 *Ignition and starting switch*
59 *Windshield washer switch*
60 *Windshield wiper switch*
61 *Direction indicators switch*
62 *Horn control switch*
63 *Parking lights, headlamps and flashing switch*
64 *Fuse box*
65 *Fuse box light switch*
66 *Fuse box light*
67 *Heated rear window switch*
68 *Heated rear window warning light*
69 *Hazard flashers switch*
70 *Hazard switch light*
71 *Hazard flashers warning light*
72 *Cigarette lighter*
73 *Heater control panel light*
74 *Blower switch*
75 *Courtesy light microswitch on door jambs*
76 *Courtesy light switch in light unit*
77 *Courtesy light bulbs*
78 *Heated rear window*
79 *Back-up light switch*
80 *Parking brake warning light switch*
81 *Fuel level sender and warning light switch*
82 *Electric fuel pump*
83 *Belt switch (driver's side)*
84 *Trunk light bulb*
85 *Trunk light switch*
86 *Side marker lights, rear*
87 *Rear direction indicators*
88 *Rear parking and stop-lights*
89 *Back-up lights*
90 *License plate lights*

For colour code, see page 163

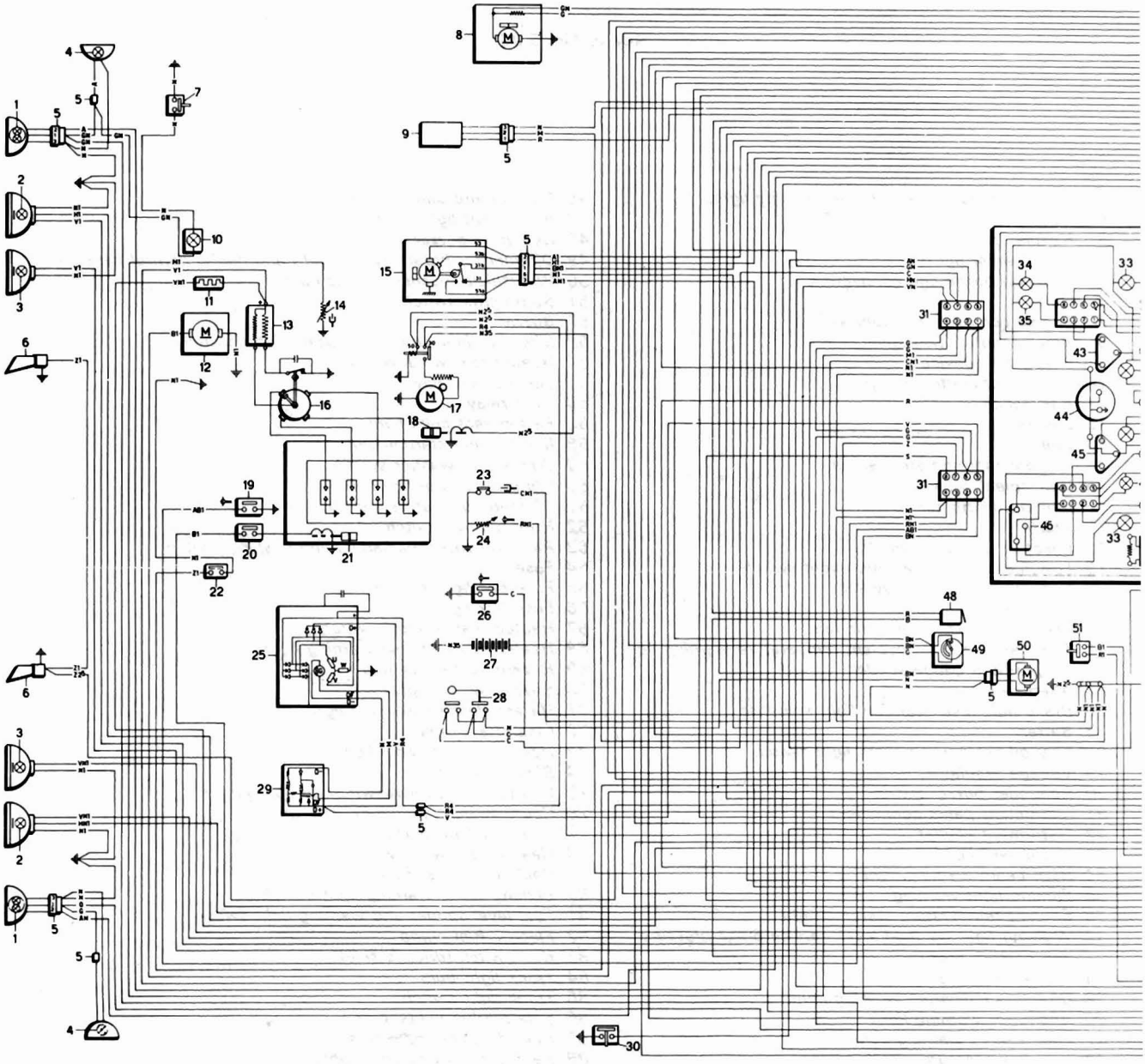


Fig. 9.36 Wiring diagram for 2000 Saloon (1975 N American models). For key see page 181

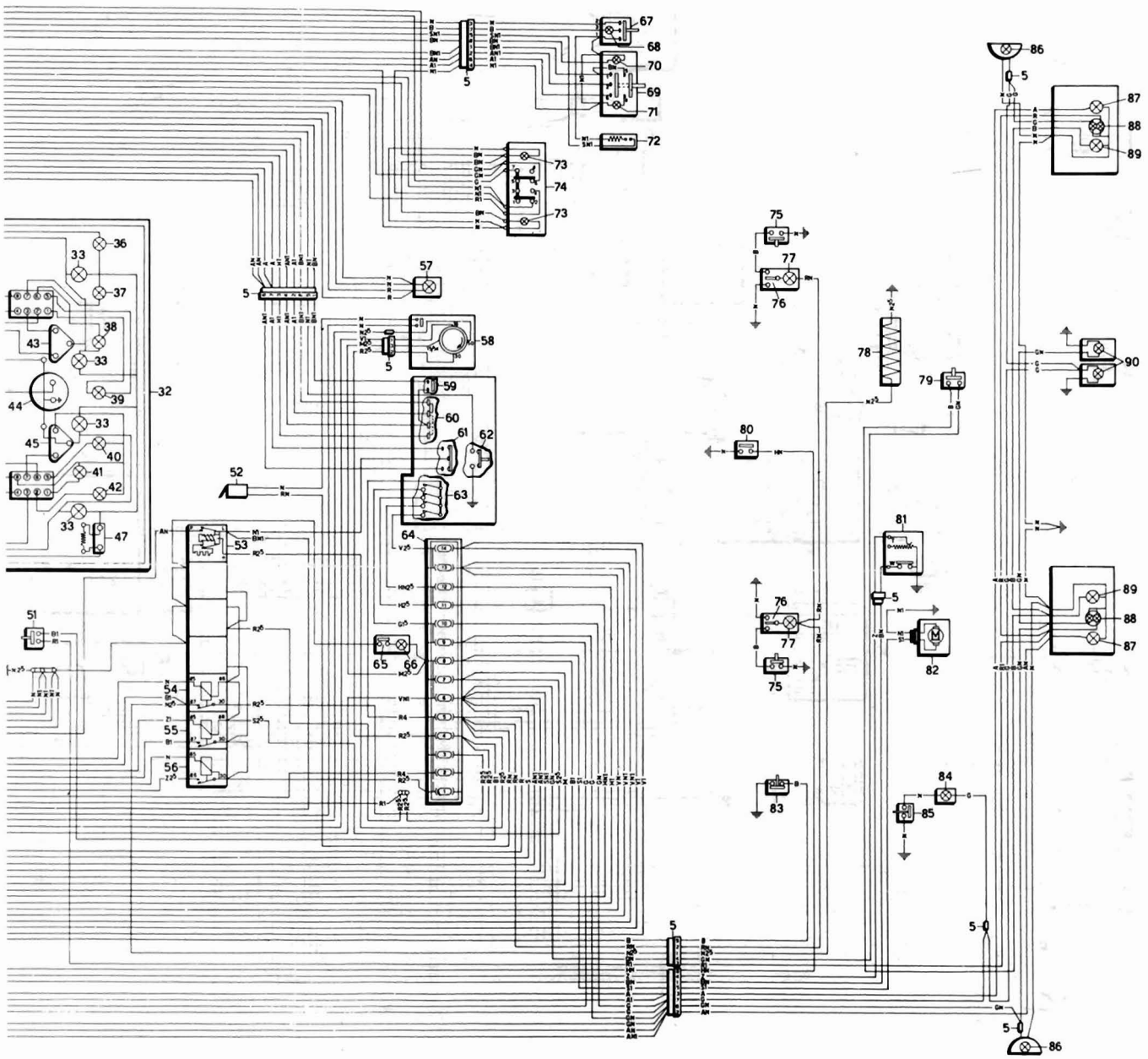


Fig. 9.36 (cont) Wiring diagram for 2000 Saloon (1975 N American models). For key see page 181

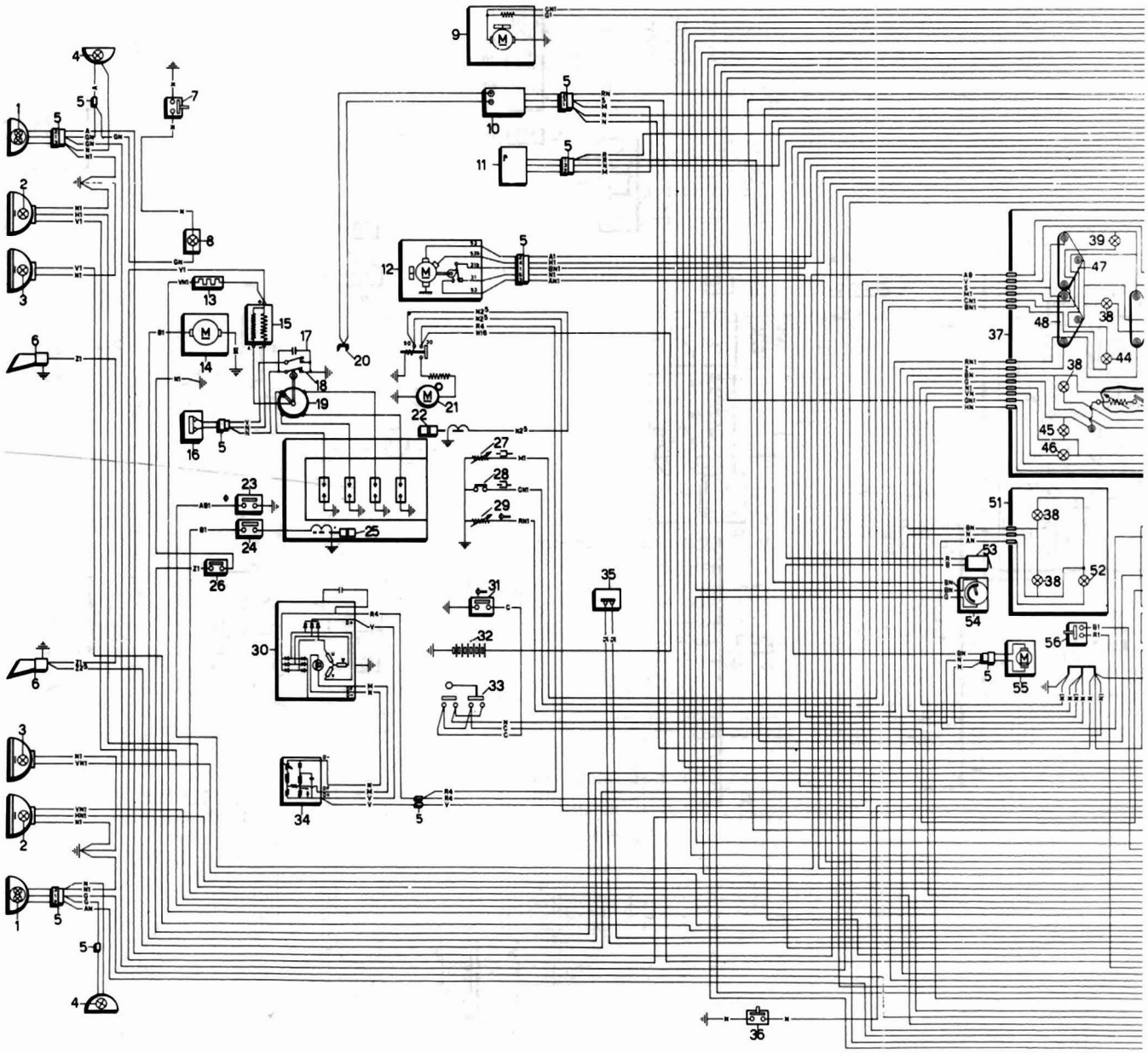


Fig. 9.37 Wiring diagram for 2000 GT (1976 Californian models). For key see page 186

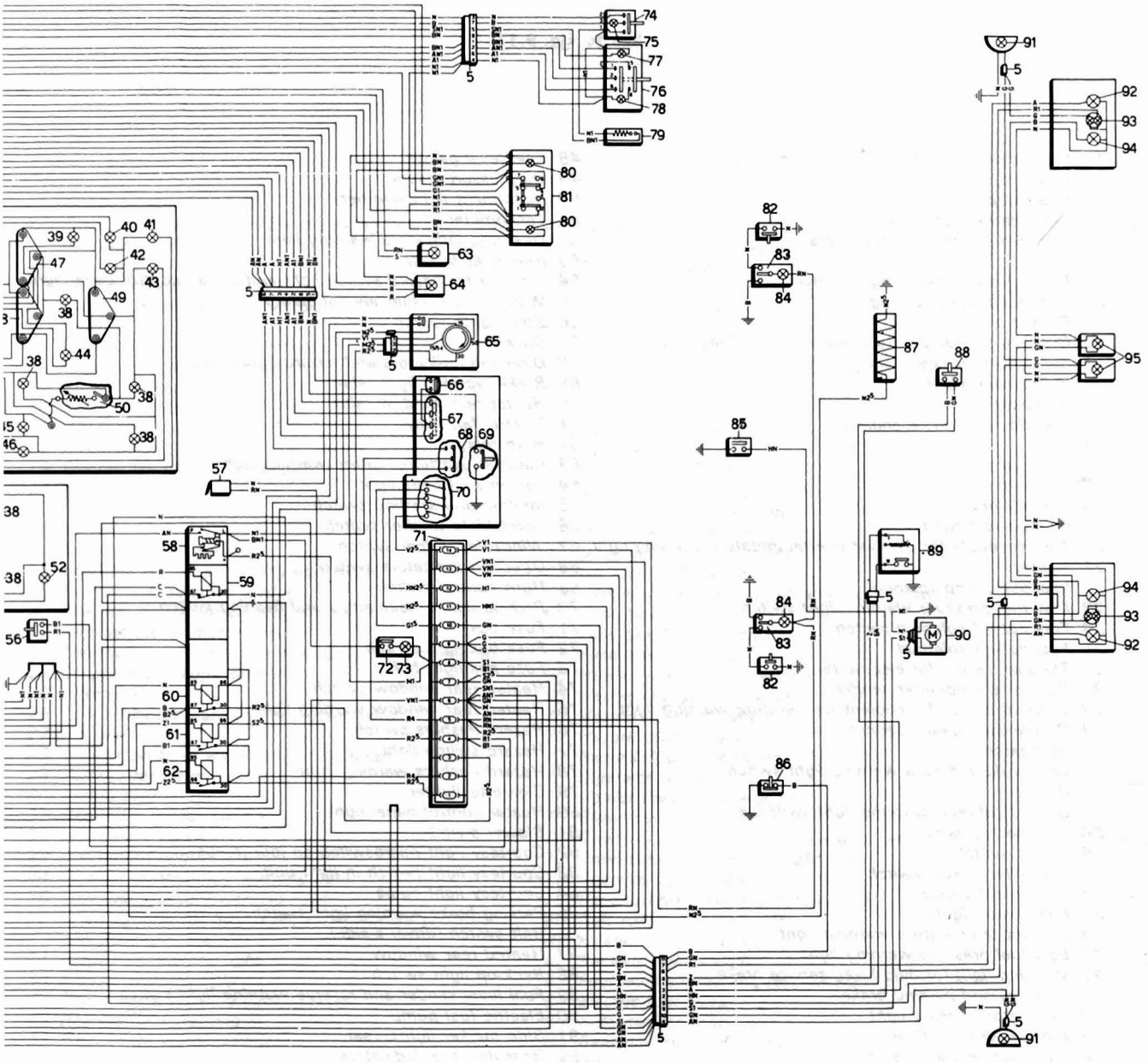


Fig. 9.37 (cont) Wiring diagram for 2000 GT (1976 Californian models). For key see page 186

Key to Fig. 9.37

1 *Front direction indicators and parking lights*
2 *Headlamp Hi/Low*
3 *Headlamp Hi*
4 *Side marker lights, front*
5 *Junction boxes and connectors*
6 *Horn*
7 *Engine compartment light switch*
8 *Engine compartment light*
9 *Blower motor*
10 *Catalyst overtemperature warning light feed unit*
11 *Safety belt device*
12 *Windshield wiper*
13 *Resistance*
14 *Electric fan (engine cooling)*
15 *Coil*
16 *Vacuum switch*
17 *Secondary breaker*
18 *Primary breaker*
19 *Ignition distributor*
20 *Thermocouple for catalyst overtemperature warning light*
21 *Starter*
22 *Injection pump solenoid*
23 *Low fuel pressure warning light switch*
24 *Fuel cut-off solenoid switch*
25 *Fuel cut-off solenoid*
26 *Thermal switch for electric fan*
27 *Coolant themometer sender*
28 *Thermal switch for coolant temperature warning light*
29 *Oil pressure gauge sender*
30 *Alternator*
31 *Low brake pressure warning light switch*
32 *Battery*
33 *Brake fluid level warning light switches*
34 *Voltage regulator*
35 *Inertia switch*
36 *Reminder buzzer switch*
37 *Instrument cluster*
38 *Instrument lights*
39 *Coolant temperature warning light*
40 *Low fuel pressure warning light*
41 *Warning light for fluid level, service brake pressure and parking brake*
42 *Alternator warning light*
43 *Blower warning light*
44 *Fuel reserve warning light*
45 *Parking light warning*
46 *High beam warning light*
47 *Coolant thermometer*
48 *Fuel level gauge*
49 *Oil pressure gauge*
50 *Instrument light dimmer*
51 *Tachometer*
52 *Direction indicators warning light*
53 *Reminder buzzer*
54 *Dimmer for hazard switch light and heater control panel light*
55 *Windshield washer electric pump*
56 *Stop-lights switch*
57 *Buzzer*
58 *Direction indicators and hazard lights unit*
59 *Brake warning light relay*
60 *Heater rear window relay*
61 *Electric fan relay*
62 *Horn relay*
63 *Catalyst overtemperature warning light*
64 *Fasten seat belts light*
65 *Ignition and starting switch*
66 *Windshield washer switch*
67 *Windshield wiper switch*
68 *Direction indicators switch*
69 *Horn control switch*
70 *Parking lights, headlamps and flashing switch*
71 *Fuse box*
72 *Fuse box light switch*
73 *Fuse box light bulb*
74 *Heated rear window switch*
75 *Heated rear window warning light*
76 *Hazard flashers switch*
77 *Hazard switch light*
78 *Hazard flashers warning light*
79 *Cigarette lighter*
80 *Heater control panel light*
81 *Blower switch*
82 *Courtesy light microswitch on joor jambs*
83 *Courtesy light switch in light unit*
84 *Courtesy light bulbs*
85 *Parking brake warning light switch*
86 *Belt switch (driver's side)*
87 *Heated rear window*
88 *Back-up light switch*
89 *Fuel level sender and reserve warning light switch*
90 *Electric fuel pump*
91 *Side marker lights, rear*
92 *Rear direction indicators*
93 *Rear parking and stop-lights*
94 *Back-up lights*
95 *License plate lights*

For colour code, see page 163

Key to Fig. 9.38

1 *Front direction indicators and parking lights*
2 *Headlamp Hi/Low*
3 *Headlamp Hi*
4 *Side marker lights, front*
5 *Junction boxes and connectors*
6 *Horn*
7 *Engine compartment light switch*
8 *Engine compartment light*
9 *Blower motor*
10 *Safety belt device*
11 *Windshield wiper*
12 *Resistance*
13 *Electric fan (engine cooling)*
14 *Coil*
15 *Ignition distributor*
16 *Starter*
17 *Injection pump solenoid*
18 *Low fuel pressure warning light switch*
19 *Fuel cut-off solenoid switch*
20 *Thermal switch for electric fan*
22 *Coolant thermometer sender*
23 *Thermal switch for coolant temperature warning light*
24 *Oil pressure gauge sender*
25 *Alternator*
26 *Low brake pressure warning light switch*
27 *Battery*
28 *Brake fluid level warning light switches*
29 *Voltage regulator*
30 *Inertia switch*
31 *Reminder buzzer switch*
32 *Instrument cluster*
33 *Instrument lights*
34 *Coolant temperature warning light*
35 *Low fuel pressure warning light*
36 *Warning light for fluid level, service brake pressure and parking brake*
37 *Alternator warning light*
38 *Blower warning light*
39 *Fuel reserve warning light*
40 *Parking light warning*
41 *High beam warning light*
42 *Coolant thermometer*
43 *Fuel level gauge*
44 *Oil pressure gauge*
45 *Instrument light dimmer*
46 *Tachometer*
47 *Direction indicators warning light*
48 *Reminder buzzer*
49 *Dimmer for hazard switch light and heater control panel light*
50 *Windshield washer electric pump*
51 *Stop-lights switch*
52 *Buzzer*
53 *Direction indicators and hazard lights unit*
54 *Brake warning light relay*
55 *Heated rear window relay*
56 *Electric fan relay*
57 *Horn relay*
58 *Fasten seat belts light*
59 *Ignition and starting switch*
60 *Windshield washer switch*
61 *Windshield wiper switch*
62 *Direction indicators switch*
63 *Horn control switch*
64 *Parking lights, headlamps and flashing switch*
65 *Fuse box*
66 *Fuse box light switch*
67 *Fuse box light bulb*
68 *Heated rear window switch*
69 *Heater rear window warning light*
70 *Hazard flashers switch*
71 *Hazard switch light*
72 *Hazard flashers warning light*
73 *Cigarette lighter*
74 *Heater control panel light*
75 *Blower switch*
76 *Courtesy light microswitch on door jambs*
77 *Courtesy light switch in light unit*
78 *Courtesy light bulbs*
79 *Parking brake warning light switch*
80 *Belt switch (driver's side)*
81 *Heated rear window*
82 *Back-up light switch*
83 *Fuel level sender and reserve warning light switch*
84 *Electric fuel pump*
85 *Side marker lights, rear*
86 *Rear direction indicators*
87 *Rear parking and stop-lights*
88 *Back-up lights*
89 *License plate lights*

For colour code, see page 163

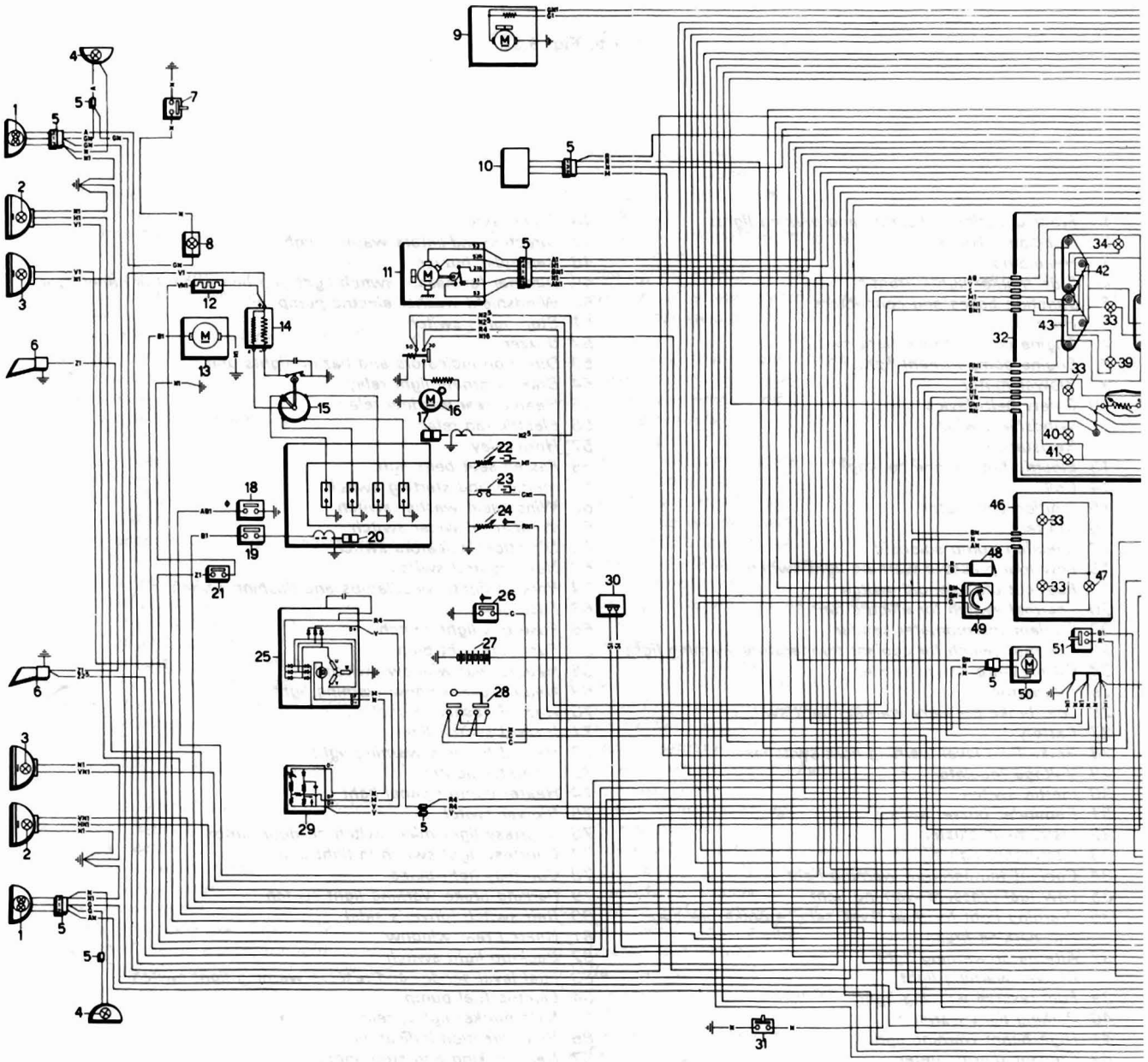


Fig. 9.38 Wiring diagram for 2000 GT (1976 N American models, except California). For key see page 187

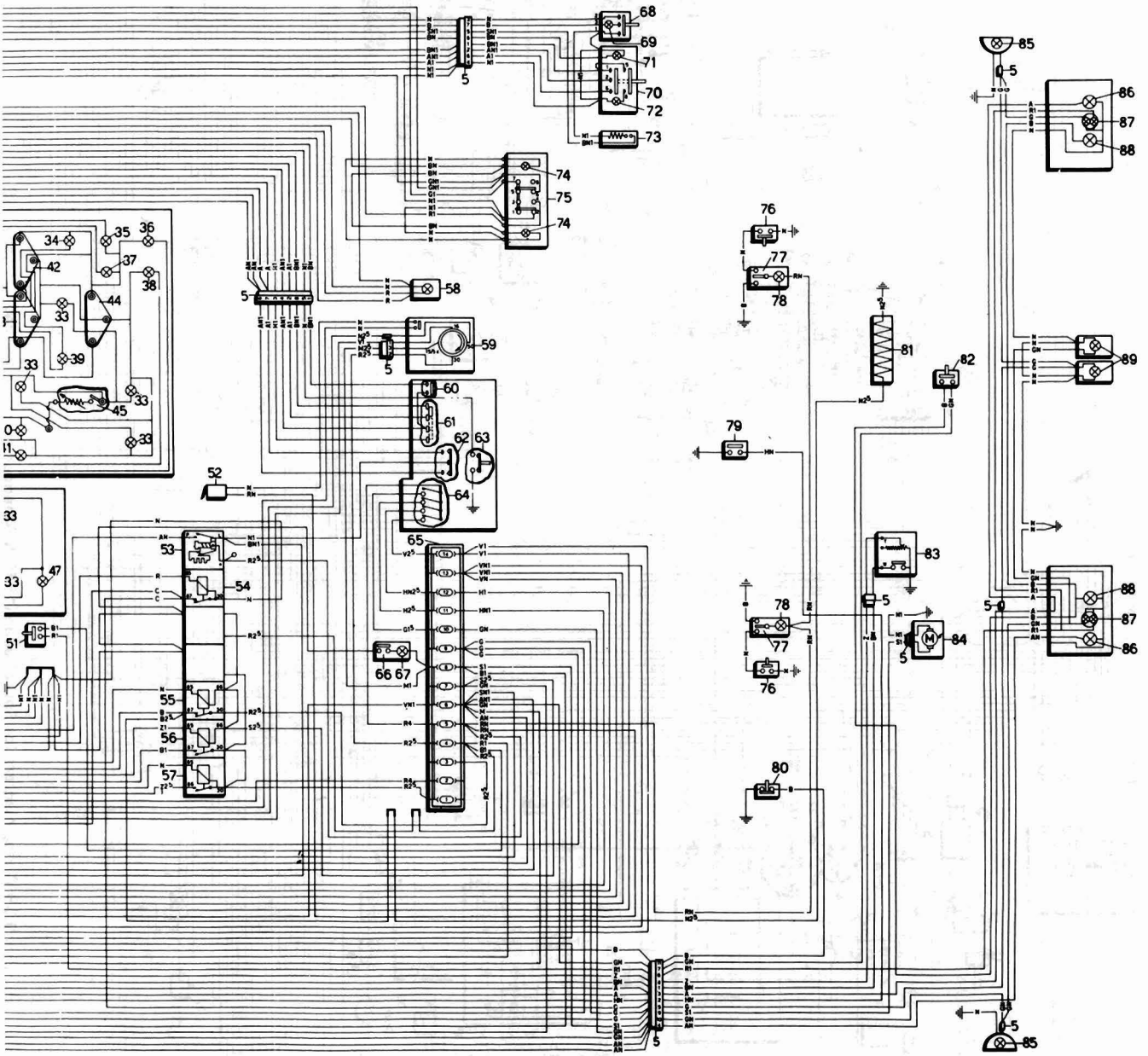


Fig. 9.38 (cont) Wiring diagram for 2000 GT (1976 N American models, except California). For key see page 187

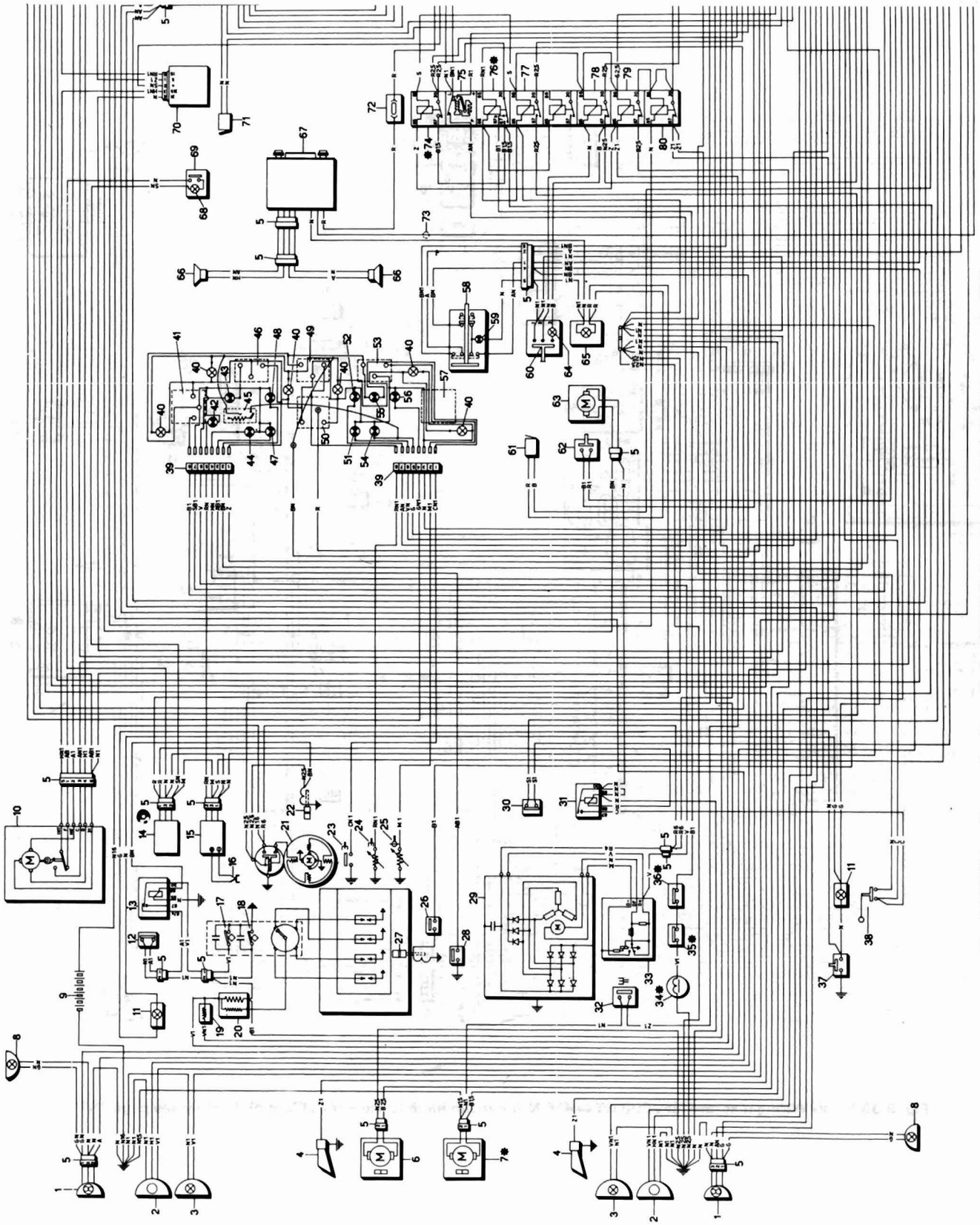


Fig. 9.39 Wiring diagram for Sport Sedan (1979 N American models). For key see page 192

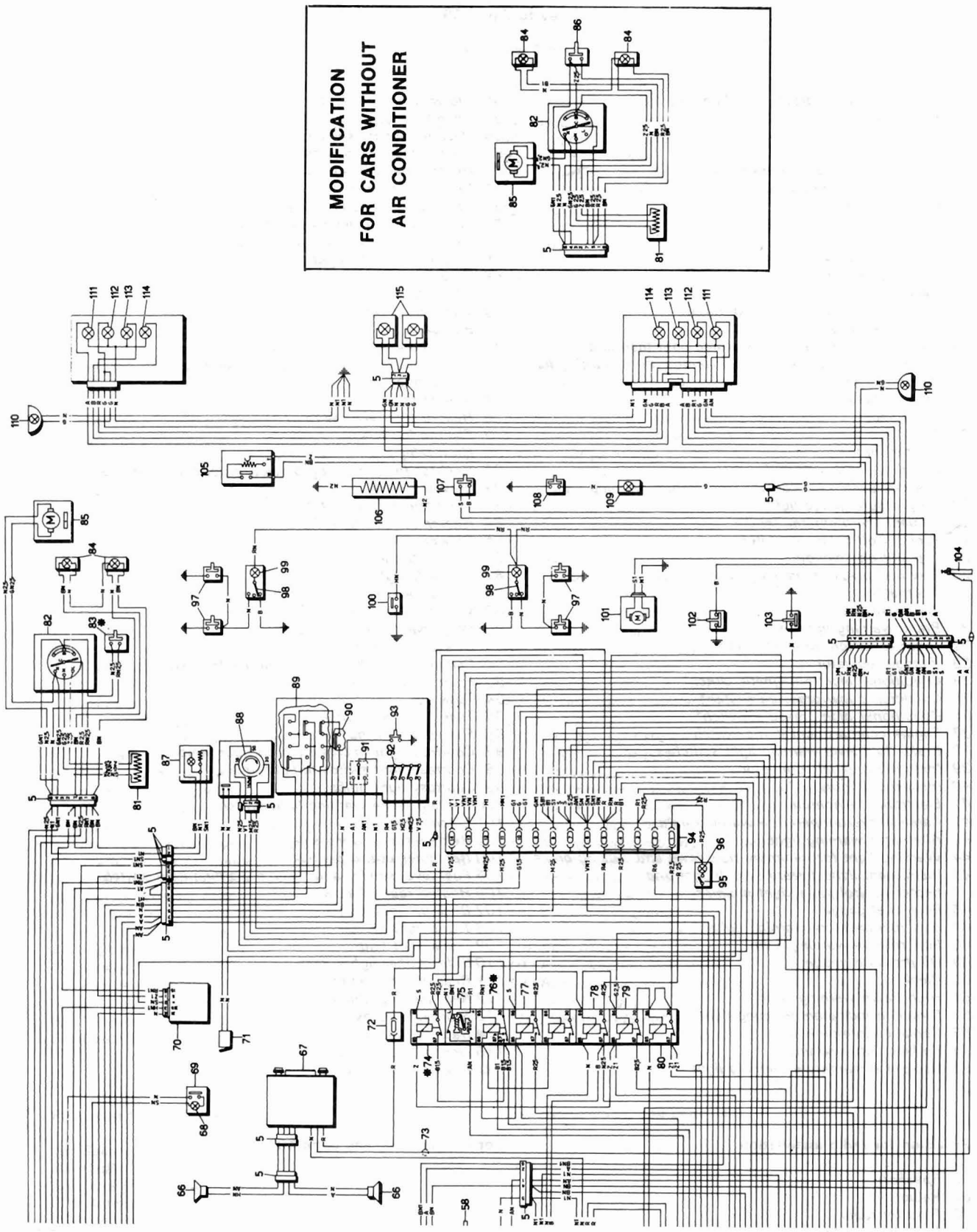


Fig. 9.39 (cont) Wiring diagram for Sport Sedan (1979 N American models). For key see page 192

Key to Fig. 9.39

1 *Front direction indicators and parking lights*
2 *Headlamp Hi/low*
3 *Headlamp Hi*
4 *Horn*
5 *Junction boxes and connectors*
6 *Electric fan (engine cooling)*
7 *Conditioner electric fan**
8 *Side marker lights front*
9 *Battery*
10 *Windshield wiper*
11 *Engine compartment light*
12 *Vacuum switch*
13 *Ignition advance relay (on starting)*
14 *Safety belt device*
15 *Catalyst overtemperature warning light feed unit*
16 *Thermocouple for catalyst over-temperature warning light*
17 *Secondary breaker*
18 *Primary breaker*
19 *Resistance*
20 *Coil*
21 *Starter motor*
22 *Injection pump solenoid*
23 *Thermal switch for coolant temperature warning light*
24 *Oil pressure gauge light*
25 *Coolant thermometer sender*
26 *Fuel cut-off solenoid switch*
27 *Fuel cut-off solenoid*
28 *Low fuel pressure warning light switch*
29 *Alternator*
30 *Inertia switch*
31 *Brake warning light relay*
32 *Thermal switch for electric fan*
33 *Voltage regulator*
34 *Conditioner electromagnetic clutch**
35 *Conditioner low pressure switch**
36 *Conditioner high pressure switch**
37 *Engine compartment lights switch*
38 *Brake fluid level warning light switches*
39 *Instrument panel connector*
40 *Instrument lights*
41 *Electronic tachometer*
42 *Catalyst overtemperature warning light*
43 *Alternator warning light*
44 *Warning light for minimum fluid level and parking brake*
45 *Instrument light, hazard switch light and heater control panel light dimmer*
46 *Fuel level gauge*
47 *Low fuel pressure warning light*
48 *Fuel reserve warning light*
49 *Oil pressure gauge*
50 *Clock*
51 *High beam warning light*
52 *Direction indicators warning light*
53 *Coolant thermometer*
54 *Parking light warning*
55 *Coolant temperature warning light*
56 *Blower warning light*
57 *Speedometer*
58 *Hazard flashers switch*
59 *Hazard rear window switch*
60 *Heated rear window switch*
61 *Reminder buzzer*
62 *Stop-lights switch*
63 *Windshield washer electric pump*
64 *Heated rear window warning light*
65 *Fasten seat belts light*
68 *Glovebox light*
69 *Glovebox light switch*
70 *Windshield wiper timer*
71 *Buzzer*
74 *Conditioner electric fan relay**
75 *Direction indicators and hazard lights relay*
76 *Conditioner relay**
77 *Blower fan relay*
78 *Heated rear window relay*
79 *Electric fan relay*
80 *Horn relay*
82 *Resistor for controlling blower fan or conditioner fan speed*
82 *Blower switch*
83 *Conditioner thermostat**
84 *Heater control panel light*
85 *Blower motor*
86 *Blower fan automatic cut-in switch*
87 *Cigarette lighter*
88 *Ignition and starting switch*
89 *Windshield wiper switch*
90 *Windshield washer switch*
91 *Direction indicators switch*
92 *Parking lights, headlamps and flashing switch*
93 *Horn control switch*
94 *Fuse box*
95 *Fuse box light switch*
96 *Fuse box light bulb*
97 *Courtesy light microswitch on door jambs*
98 *Courtesy light switch in light unit*
99 *Courtesy light bulbs*
100 *Parking brake warning light switch*
101 *Electric fuel pump*
102 *Belt switch (driver's side)*
103 *Reminder buzzer switch*
105 *Fuel level sender and reserve warning light switch*
106 *Heated rear window*
107 *Back-up light switch*
108 *Trunk light switch*
109 *Trunk light bulb*
110 *Side marker lights, rear*
111 *Rear direction indicators*
112 *Rear parking and stop-lights*
113 *Stop-light bulbs*
114 *Back-up lights*
115 *License plate lights*
* *Only with air conditioning*

Provision for radio installation

66 *Speaker*
67 *Radio*
72 *Fuse for radio*
73 *Coaxial cable for antenna*
104 *Antenna*

For colour code, see page 163

Key to Fig. 9.40

1 *Front direction indicators and parking lights*
2 *Headlamp Hi/Low*
3 *Headlamp Hi*
4 *Horn*
5 *Junction boxes and connectors*
6 *Side marker lights, front – 4W*
7 *Engine compartment light switch*
8 *Engine compartment light*
9 *Resistance*
10 *Electric fan (engine cooling)*
11 *Coil*
12 *Primary breaker*
13 *Secondary breaker*
14 *Ignition distributor*
15 *Ignition advance relay (on starting)*
16 *Vacuum switch*
17 *Low fuel pressure warning light switch*
18 *Fuel cut-off solenoid switch*
19 *Fuel cut-off solenoid*
20 *Thermal switch for conditioner electromagnetic clutch*
21 *Conditioner electromagnetic clutch*
22 *Thermal switch for electric fan*
23 *Conditioner electric fan*
24 *Alternator*
25 *Voltage regulator*
26 *Blower motor*
27 *Catalyst overtemperature warning light feed unit*
28 *Safety belt device*
29 *Windshield wiper*
30 *Thermocouple for catalyst overtemperature warning light*
31 *Starter*
32 *Injection pump solenoid*
33 *Coolant thermometer sender*
34 *Thermal switch for coolant temperature warning light*
35 *Oil pressure gauge sender*
36 *Brake fluid level warning light switches*
37 *Inertia switch*
38 *Reminder buzzer switch*
39 *Instrument cluster*
40 *Instrument lights*
41 *Coolant temperature warning light*
42 *Low fuel pressure warning light*
43 *Warning light for minimum brake level and parking brake*
44 *Alternator warning light*
45 *Blower warning light*
46 *Fuel reserve warning*
47 *Parking light warning*
48 *High beam warning*
49 *Coolant thermometer*
50 *Fuel level gauge*
51 *Oil pressure gauge*
52 *Instrument light dimmer*
53 *Conditioner electric fan resistor*
54 *Electronic tachometer*
55 *Direction indicators warning light*
56 *Reminder buzzer*
57 *Dimmer for hazard switch light and heater control panel light*
58 *Windshield washer electric pump*
59 *Stop-lights switch*
60 *Electronic flasher unit for windshield wiper*
61 *Buzzer*
62 *Direction indicators and hazard lights relay*
63 *Conditioner electric fan relay*
64 *Conditioner relay*
65 *Brake warning light relay*
66 *Heated rear window relay*
67 *Electric fan relay*
68 *Horn relay*
69 *Glovebox light switch*
70 *Glovebox light*
71 *Heated rear window warning light*
72 *Heated rear window switch*
73 *Hazard switch light*
74 *Hazard flashers switch*
75 *Hazard flashers warning light*
76 *Cigarette lighter*
77 *Heater control panel light*
78 *Blower switch*
79 *Conditioner thermostat*
80 *Catalyst overtemperature warning light*
81 *Fasten seat belts light*
82 *Ignition and starting switch*
83 *Windshield wiper switch*
84 *Windshield washer switch*
85 *Horn control switch*
86 *Direction indicators switch*
87 *Parking lights, headlamps and flashing switch*
88 *Fuse box*
89 *Fuse box light switch*
90 *Fuse box light bulb*
91 *Battery*
94 *Courtesy light microswitch on door jambs*
95 *Courtesy light switch in light unit*
96 *Courtesy light bulbs*
97 *Parking brake warning light switch*
99 *Heated rear window*
100 *Back-up light switch*
101 *Fuel lever sender and reserve warning light switch*
102 *Electric fuel pump*
105 *Belt switch (driver's side)*
106 *Side marker lights, rear*
107 *Rear direction indicators*
108 *Rear parking and stop-lights*
109 *Back-up lights*
110 *License plate lights*

Provision for radio installation

92 *Speakers*
93 *Radio*
98 *Coaxial cable for antenna*
103 *Antenna*
104 *Fuse for radio*

For colour code, see page 163

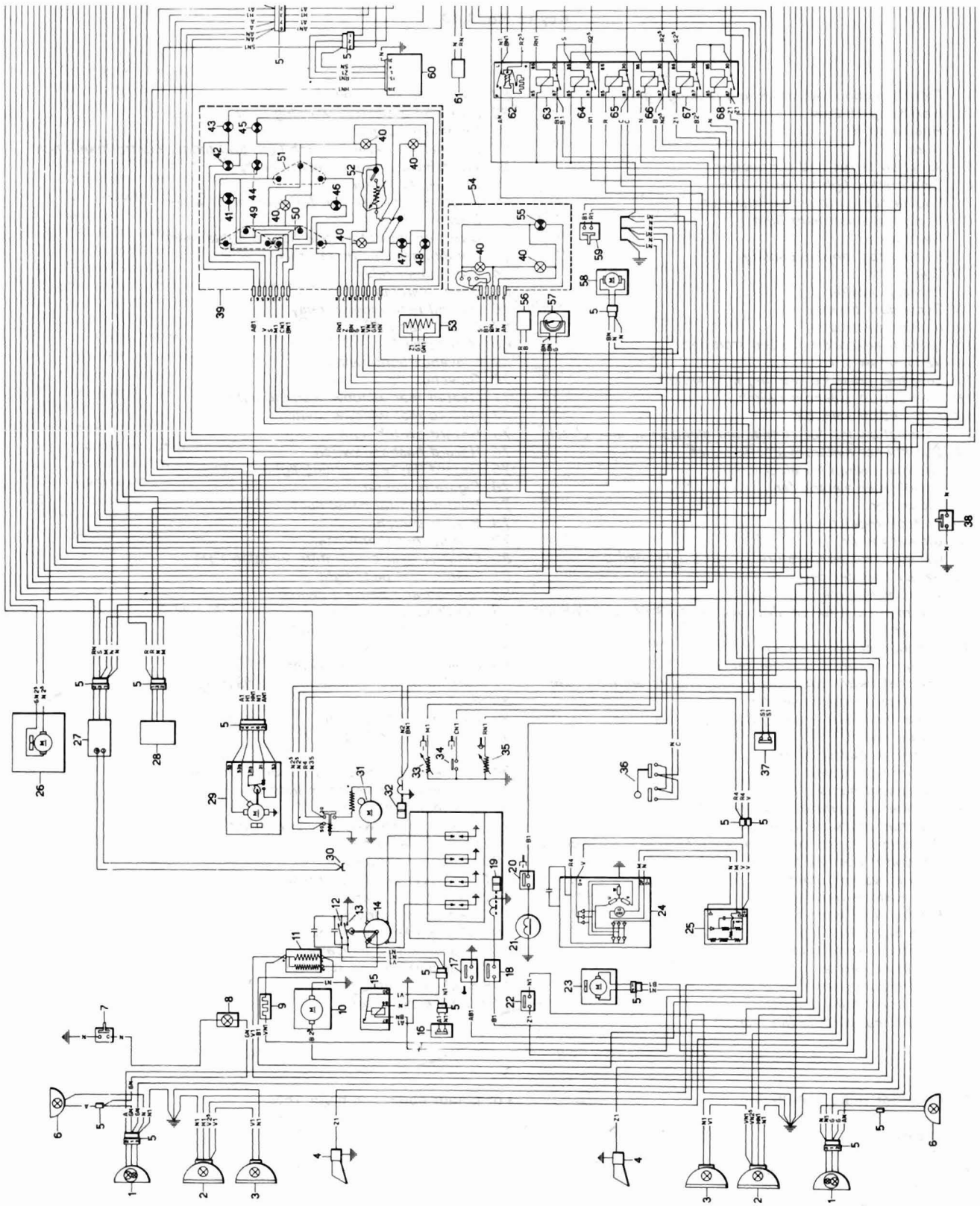


Fig. 9.40 Wiring diagram for Sprint Veloce (1979 N American models). For key see page 193

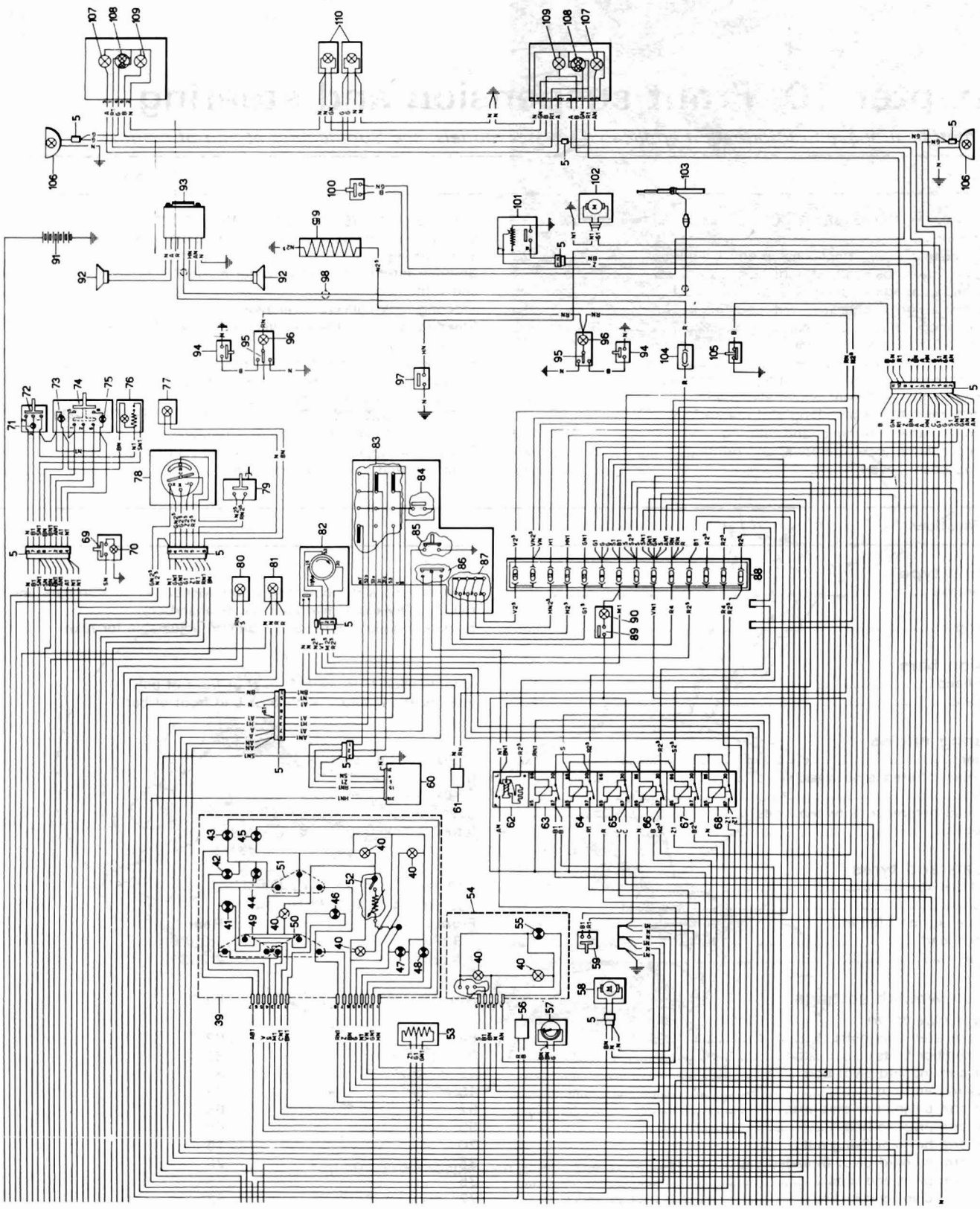


Fig. 9.40 (cont) Wiring diagram for Sprint Veloce (1979 N American models). For key see page 193

Chapter 10 Front suspension and steering

For modifications, and information applicable to later models, see Supplement at end of manual

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Suspension lower arm and torsion bar – removal and refitting 8
Suspension lower arm balljoint – renewal 9
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Track rod end balljoints – renewal 14

Specifications

System type

Suspension	Independent with upper and lower wishbones, torsion bars and anti-roll bar. Telescopic hydraulic shock absorbers
Steering	Rack-and-pinion, with safety column adjustable for rake

Torsion bars

Right-hand	Identification blue, with D or R at front of bar
Left-hand	Identification yellow, with S or L at front of bar

Steering angles

Camber	0°20′ ± 0°30′ positive
Maximum difference between sides	0°40′
Caster	4°30′ ± 0°30′ positive
Maximum difference between sides	0°20′
Toe-out	0 to 2.0 mm (0 to 0.079 in)

Wheels and tyres

Wheel rim size	139.7 mm (5.5 in)	
Tyre size	165 HR 14 or 185/70 HR 14	
Pressure, kgf/cm² (lbf/in²)	**Front**	**Rear**
Half load	1.8 (26)	1.8 (26)
Full load	1.8 (26)	2.2 (31)

Torque wrench settings

	Nm	**lbf ft**
Front suspension		
Caliper-to-stub axle bolts	84	62
Crossmember bolts	90	66
Upper arm inboard pivot bolt	45	33
Radius rod end nut	45	33
Upper arm balljoint to stub axle	92	68
Lower arm pivot to body	92	68
Lower arm balljoint fixing nut	20	15
Lower arm inboard pivot threaded cap	35	26
Lower arm pivot end nuts	35	26
Lower arm pivot end locknut	72	53
Steering gear		
Rack housing mounting bolts	15	11
Track rod-to-rack fixing nuts	45	33
Damper and pinion cover bolts	15	11

1 Description

The front suspension is of independent type, incorporating upper and lower wishbones, torsion bars, an anti-roll bar and hydraulic telescopic shock absorbers (photo).

A radius rod positively locates the upper suspension arm. The rod is adjustable for camber setting.

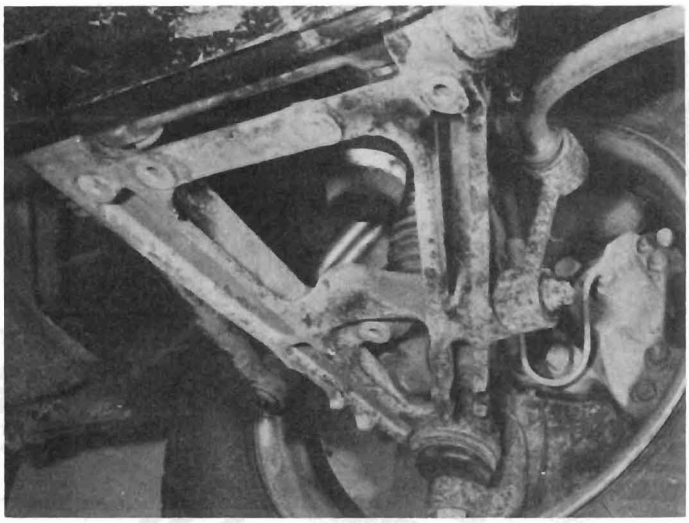
The steering is of rack-and-pinion type, with sealed-in lubrication.

The steering column is of the safety type, incorporating a universal joint.

The dished type of steering wheel is adjustable for rake by means of a simple clamp device at the column upper mounting bracket.

2 Maintenance

1 Carry out the following tasks at the intervals specified in Routine Maintenance, or whenever wear or damage is suspected.
2 Check the tightness of all suspension and steering nuts and bolts.
3 Inspect the steering gaiters and those on the balljoints and shock absorbers for splits. Renew immediately if damage is evident.
4 With the help of an assistant, move the steering wheel rapidly in



1.0 One side of the front suspension

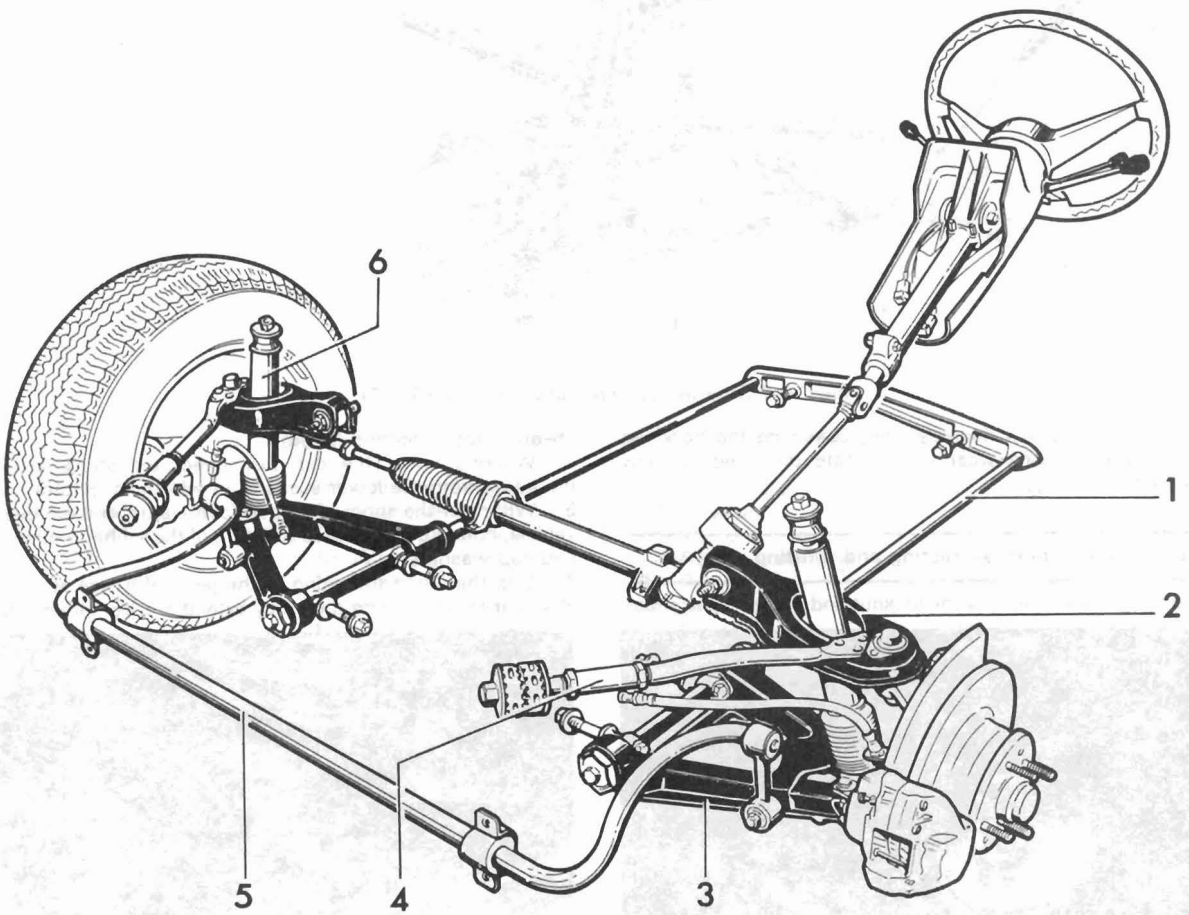


Fig. 10.1 Front suspension (early column) (Sec 1)

1 Torsion bar
2 Upper arm (wishbone)
3 Lower arm
4 Radius rod
5 Anti-roll bar
6 Shock absorber

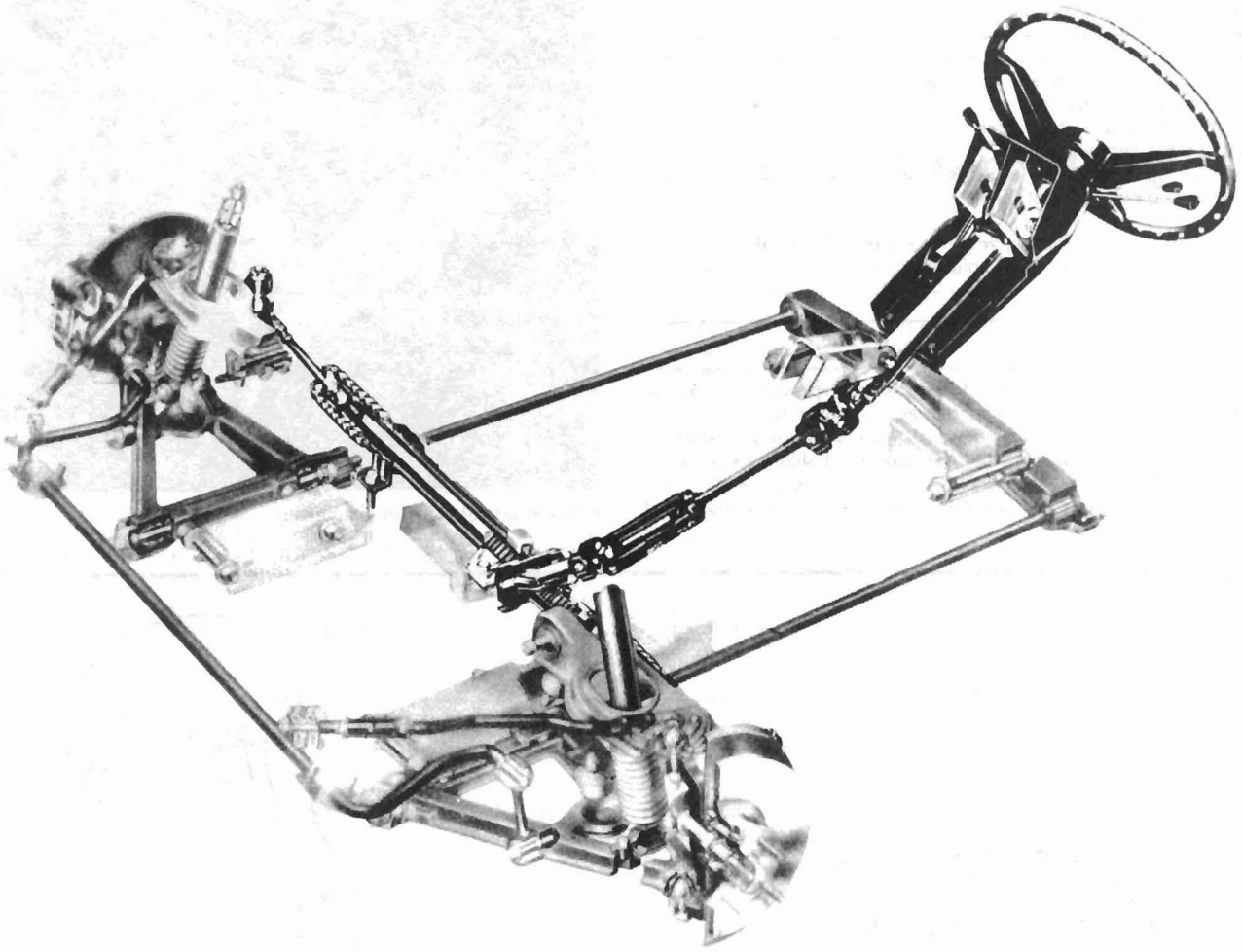


Fig. 10.2 Steering system (later column) (Sec 1)

both directions through a few degrees while observing the track rod end balljoints for wear. Any wear will indicate the need for new balljoint assemblies.

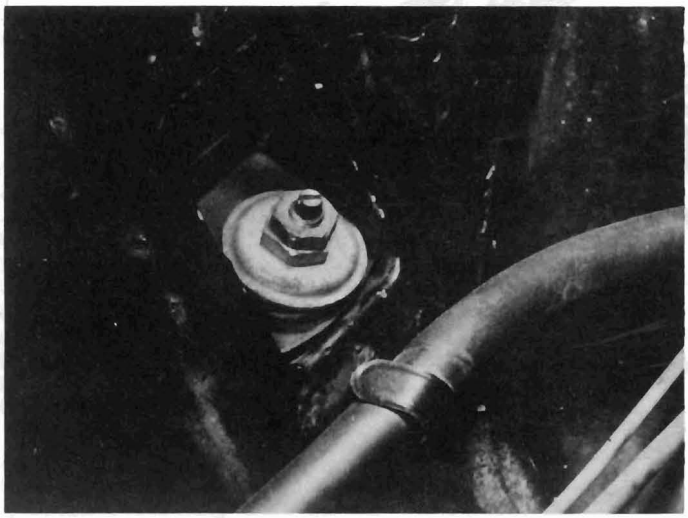
3 Shock absorbers – removal, testing and refitting

1 Open the bonnet and unscrew the locknut and nut from the shock absorber top mounting (photo).

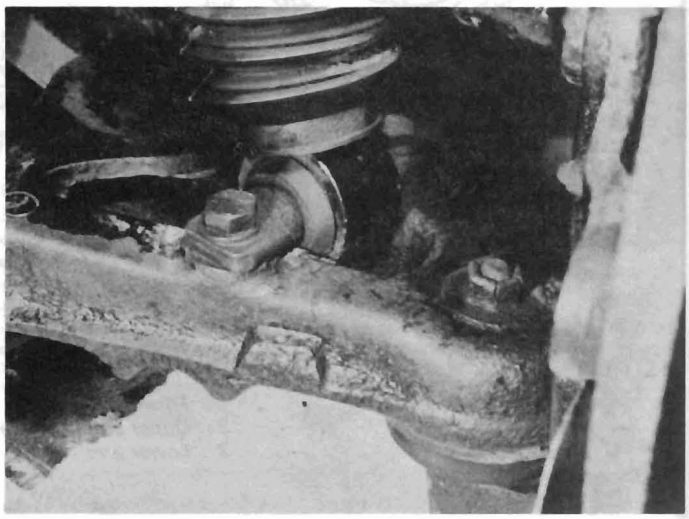
2 Working under the car, disconnect the shock absorber lower mounting from the lower suspension wishbone (photo).

3 Withdraw the shock absorber downwards, and remove it from the vehicle, noting the sequence of fitting of the rubber mounting cushions and cup washers.

4 Grip the lower mounting in the jaws of a vice so that the shock absorber is vertical and then fully extend and compress it between six



3.1 Front shock absorber top mounting



3.2 Front shock absorber lower mounting

and ten times. Any evidence of jerkiness, lack of resistance or seizure can only be rectified by renewal of the unit as no repair is possible.

5 If a new shock absorber is being installed and it has been stored horizontally, operate the unit vertically several times as described for testing in order to de-aerate it before fitting.

6 Refitting is a reversal of removal. Tighten the upper nuts to apply reasonable pressure to the rubber mounting cushions, but do not overtighten them.

4 Front hub bearings – adjustment

1 At the intervals specified in Routine Maintenance, raise the front

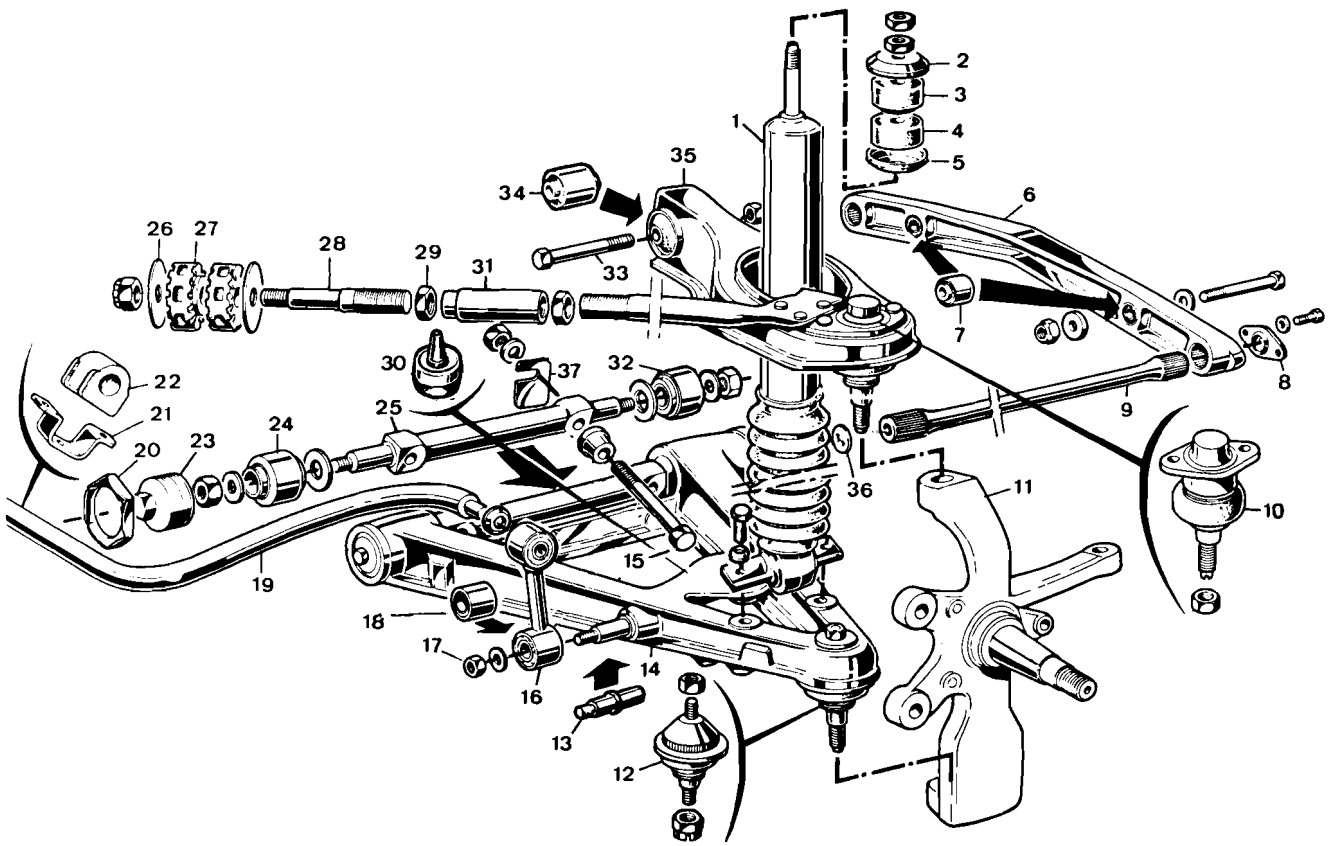


Fig. 10.3 Components of one side of the front suspension (Sec 3)

1 *Shock absorber*
2 *Cup washer*
3 *Cushion*
4 *Cushion*
5 *Cup washer*
6 *Torsion bar anchor bridge*
7 *Bush*
8 *Cover plate*
9 *Torsion bar*
10 *Upper arm balljoint*
11 *Stub axle carrier*
12 *Lower arm balljoint*
13 *Pin*
14 *Lower arm*
15 *Pivot mounting bolt*
16 *Anti-roll bar drop link*
17 *Nut*
18 *Bush*
19 *Anti-roll bar*
20 *Locknut*
21 *Clamp*
22 *Flexible mounting*
23 *Cap nut*
24 *Bush*
25 *Pivot shaft*
26 *Washer*
27 *Flexible cushion*
28 *Radius rod (part)*
29 *Locknut*
30 *Bump stop*
31 *Adjuster sleeve*
32 *Bush*
33 *Pivot bolt*
34 *Bush*
35 *Upper arm*
36 *Plug*
37 *Camber adjusting shim*

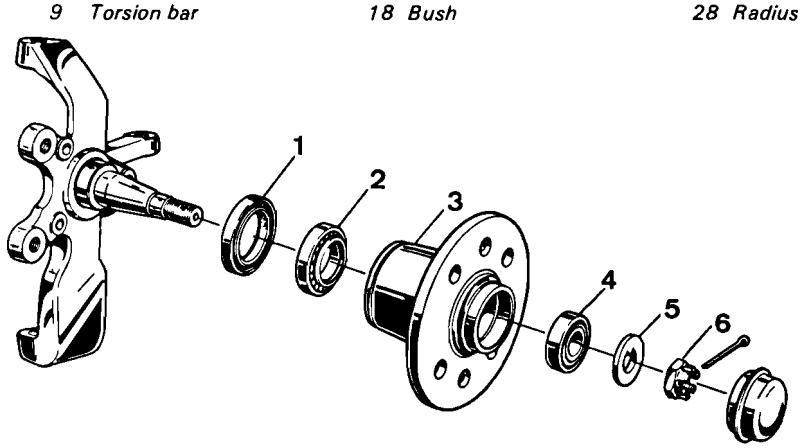


Fig. 10.4 Exploded view of front hub (Sec 4)

1 *Oil seal*
2 *Bearing*
3 *Hub*
4 *Bearing*
5 *Thrust washer*
6 *Castellated nut*

of the car and grip the road wheel at two diametrically opposite points. If any more than an almost imperceptible movement is felt when the wheel is rocked, the bearings may require adjusting.
2 Remove the roadwheel.
3 Tap off the dust cap from the end of the hub.
4 Pull out the split pin and unscrew the castellated nut two or three turns.
5 Turn the hub in its normal direction of forward travel, at the same time tightening the nut to a torque of between 20 and 25 Nm (15 and 18 lbf ft).
6 Unscrew the nut, then retighten to a torque of between 6 and 10 Nm (4 and 7 lbf ft).
7 Finally unscrew the nut through a quarter of a turn (90°) and insert a new split pin.
8 In the absence of a suitable torque wrench to adjust the bearings, the nut should be tightened with the fingers until any hub endfloat just disappears, then locked with a new split pin.
9 Bend the ends of the split pin around the nut and fit the dust cap.
10 Refit the roadwheel and then repeat the operations on the opposite hub.

5 Front hub bearings – renewal

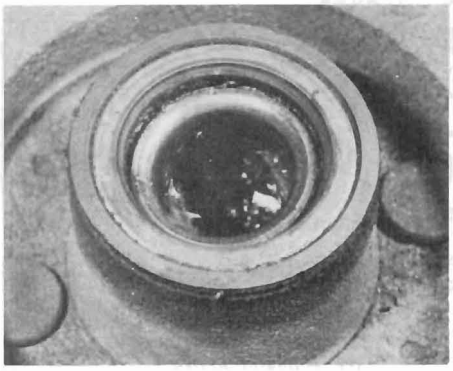
1 If the hub bearings are noisy when the hub is rotated, or if endfloat or 'rocking' of the hub cannot be eliminated by normal adjustment, then the bearings are worn and must be renewed.
2 Jack up the front of the car and remove the roadwheel.
3 Tap off the dust cap from the end of the hub.
4 Unscrew and remove the screws which secure the hub and brake disc together.
5 Extract the split pin and unscrew and remove the castellated nut.
6 Remove the thrust washer.
7 Pull the hub slightly towards you and then push it back. This will have the effect of partially ejecting the hub outer bearing race, which can now be removed.
8 Remove the hub. There is no need to disturb the brake caliper.
9 Remove the oil seal and inner bearing race (photo).
10 The bearing outer tracks should now be pressed from the hub. Alternatively, the tracks can be drawn out using a bolt, nut and distance pieces, or carefully driven out.
11 Install the new bearing tracks and oil seal.
12 Generously apply grease to the cavity between the two bearings and press some into the bearing rollers. Apply grease to the seal lips and fit the hub to the stub axle.
13 Fit the outer bearing race and the thrust washer and screw on the nut.
14 Adjust the bearings as described in Section 4.
15 Refit the roadwheel and lower the car.

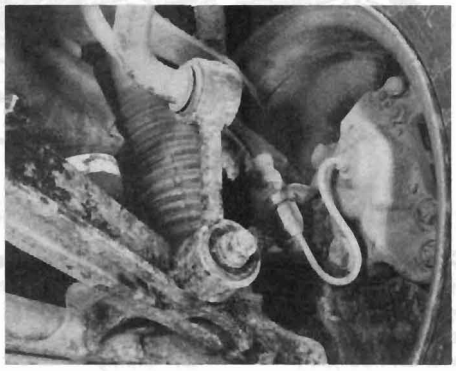
6 Anti-roll bar – removal and refitting

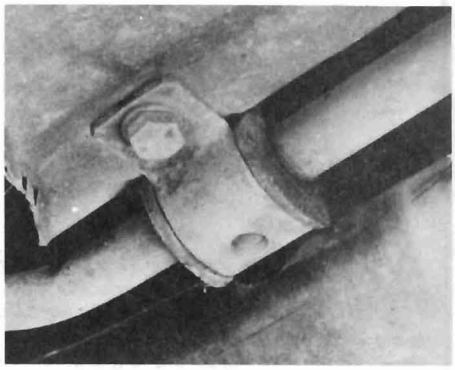
1 Disconnect the links at the ends of the anti-roll bar from the lower suspension arms (photo).
2 Unscrew and remove the bolts which attach the clamps to the body (photo).
3 Remove the anti-roll bar.
4 Refitting is a reversal of removal.

7 Radius rod cushions – renewal

1 Raise the front of the car and remove the roadwheel.
2 Unscrew and remove the nut from the threaded end of the radius rod.


5.9 Front hub oil seal


6.1 Anti-roll bar end link


6.2 Anti-roll bar body clamp

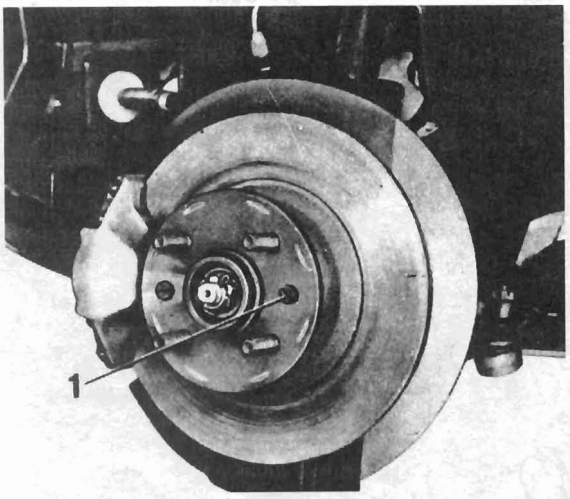


Fig. 10.5 Hub-to-disc retaining screw (1) (Sec 5)

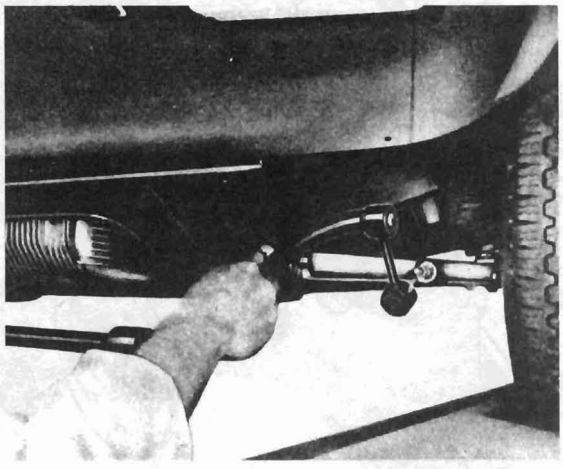


Fig. 10.6 Disconnecting the end of the anti-roll bar (Sec 6)

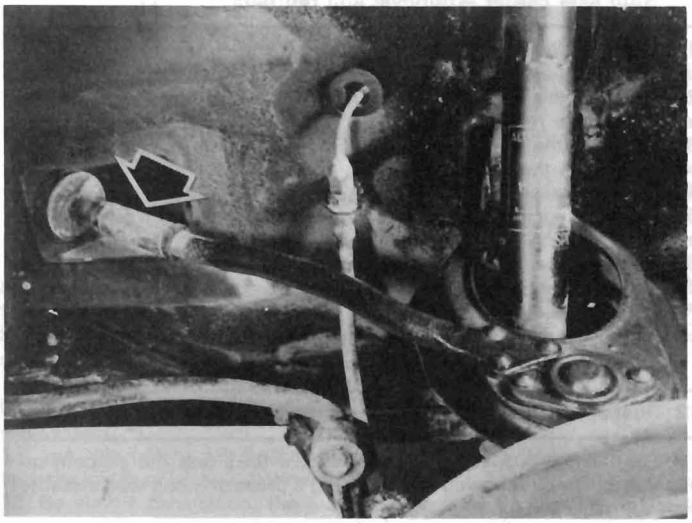
3 Remove the washer and cushions.
4 Count and record the number of exposed threads and then release the adjuster locknuts (photo).
5 Screw the adjuster down as far as possible in order to take off the inner mounting cushion. To ease removal, push the suspension upper arm in a rearward direction.
6 Fit the new inner cushion, reset the adjuster to its original position and tighten the locknuts.
7 Fit the end cushion, washer and nut. Tighten the end nut to the specified torque.
8 It is recommended that the castor angle is checked by your dealer (see Section 25).

8 Suspension lower arm and torsion bar – removal and refitting

1 Jack up the lower suspension arm until the upper arm moves away from the rebound stop.
2 Undo the castellated nut, then using a balljoint separator, disconnect the lower suspension arm from the stub axle carrier (photo).
3 Lower the jack under the suspension arm, but place a safety stand under the sill front jacking point to retain the body in a raised position.
4 Check for spline positioning marks between the front end of the torsion bar and the suspension arm. If none can be seen, mark the components now.
5 Unbolt the suspension lower arm from the body pivot clamps. Note the location of spacers.
6 Slide the suspension arm off the torsion bar (photo).
7 To withdraw the torsion bar from its anchor bridge, first unbolt the small cover plate (photo) and attach a small pressure driver to force the torsion bar out of the anchor bridge. A suitable tool can easily be made up from a piece of flat steel with holes drilled to correspond with those for the cover plate bolts. Drill a further centre hole and tap a thread into it. If the device is then bolted into position, a bolt screwed into the tapped hole will force the torsion bar out of its splined hole.
8 Refitting is a reversal of removal, but make sure that the correct torsion bar is fitted with respect to the left or right-hand side of the car – see Specifications.
9 A torsion bar has 35 splines at its front end and 34 at its rear end.
10 Always apply waterproof grease or similar to the torsion bar splines before installation.
11 Tighten all bolts and nuts to the specified torque.
12 Check the suspension angles (Section 25) and ride height (Section 13) on completion.

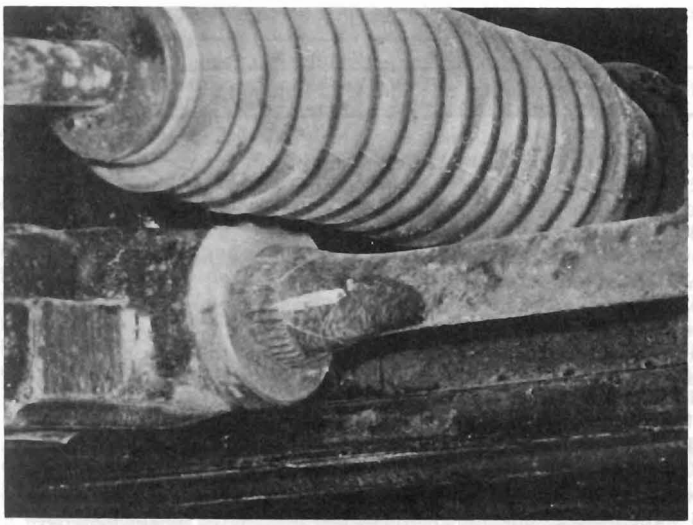
9 Suspension lower arm balljoint – renewal

1 Where the balljoint is found to be worn, it may be removed and a new one fitted without the need to remove the complete suspension arm.
2 Raise the front of the car and support it under the sill front jacking

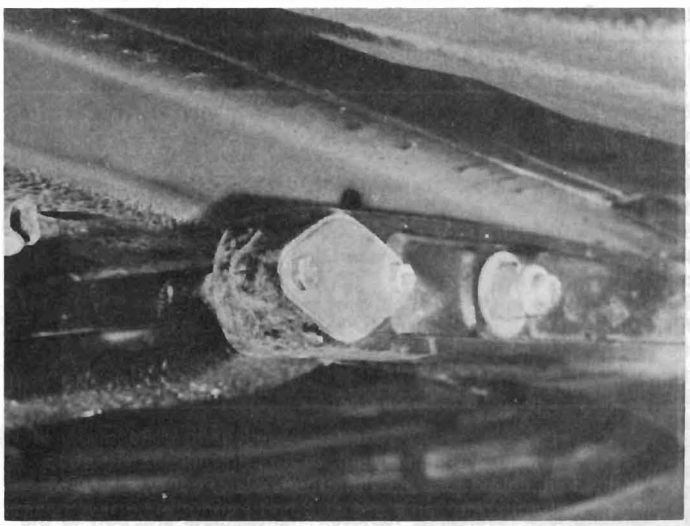


7.4 Radius rod showing adjuster (arrowed)

8.2 Front suspension lower balljoint



8.6 Torsion bar connection to suspension arm



8.7 Torsion bar rear end cover plate

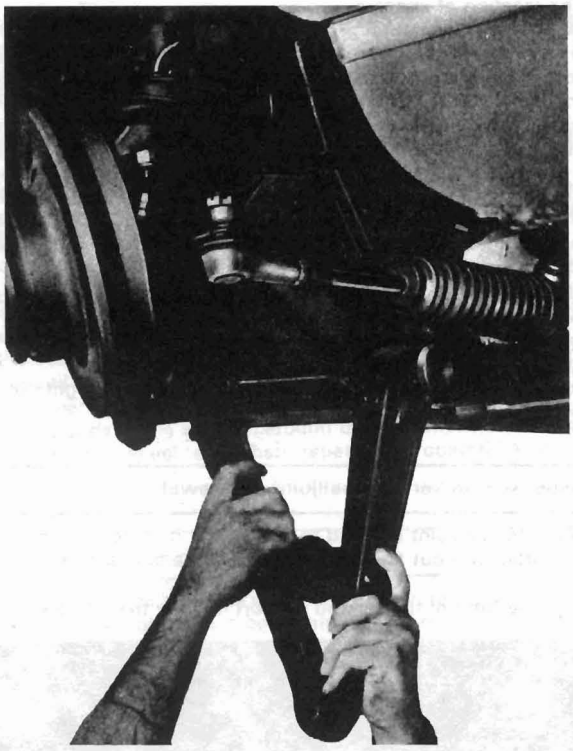
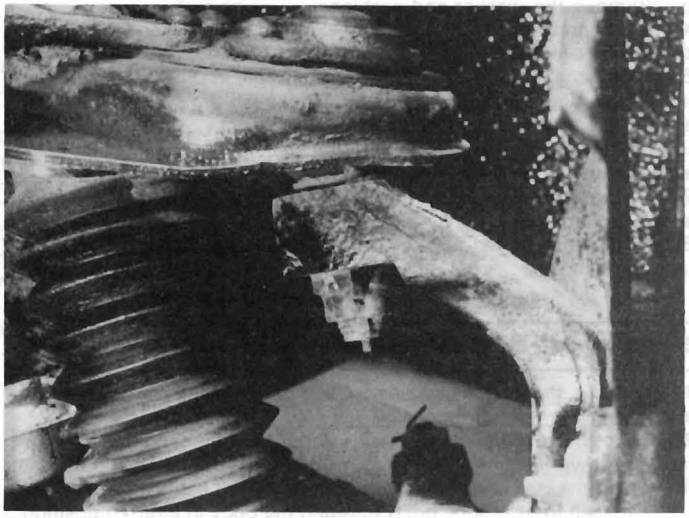


Fig. 10.7 Removing the suspension lower arm (Sec 8)

point and the suspension lower arm. Remove the roadwheel.
3 Unscrew the balljoint taper pin nut and using a suitable balljoint separator, disconnect the balljoint from the stub axle carrier.
4 On two-legged puller using a fabricated bridge piece to take the pressure of the screw will enable the balljoint to be drawn out of the suspension arm. The same tool can then be used without the bridge piece to fit the new balljoint. Where a suitable puller is not available, the complete suspension arm should be removed (Section 8) and the balljoint removed and refitted using a press or the jaws of a vice with distance pieces.
5 Reconnect the balljoint to the stub axle carrier. Tighten the nut to the specified torque. Fit a new split pin.
6 Refit the roadwheel and lower the car to the ground.

10 Suspension upper arm – removal and refitting

1 Raise the front of the car and support it securely under the sill front jacking point.
2 Jack up under the suspension lower arm until the upper arm moves away from the rebound rubber.
3 Remove the roadwheel.
4 Disconnect the shock absorber mountings (Section 3) and remove the unit.
5 Unscrew the nut from the taper pin and using a suitable balljoint separator, disconnect the suspension arm balljoint from the stub axle carrier (photo).
6 Unscrew the nut from the end of the radius rod.
7 Disconnect the inboard end of the suspension arm by removing the pivot bolt. Lift the suspension arm from the car complete with radius rod.
8 The balljoint is normally only renewed complete with the arm, but some proprietary repair kits are available which enable the original rivets to be drilled out and the nuts and bolts supplied with the new balljoint used to secure the new assembly. Follow the manufacturer's fitting instructions carefully.
9 Refitting is a reversal of removal. Tighten nuts and bolt to the specified torque and check the suspension angles on completion.



10.5 Front suspension upper balljoint

11 Stub axle carrier – removal and refitting

1 Raise the front of the car and support it securely under the front jacking point below the body sill. Remove the roadwheel.
2 Jack up the suspension lower arm until the upper arm moves away from the rebound stop.
3 Unscrew the taper pin nuts and separate both upper and lower balljoints from the stub axle carrier.
4 Disconnect and unbolt the brake caliper (see Chapter 8).
5 Again using the balljoint separator, disconnect the track rod end balljoint from the steering arm on the stub axle carrier.
6 Remove the carrier, which may be dismantled if required as described in Section 5.
7 Refitting is a reversal of removal. Bleed the front brake circuit on completion.

12 Suspension flexible bushes – renewal

1 The flexible bushes in the anti-roll bar links and the suspension upper arm can be renewed if worn using a press or a bolt with suitable distance pieces.
2 Apply brake hydraulic fluid or soapy water to the rubber bushes to ease fitting. Do not use oil.
3 The bushes in the suspension lower arm should be renewed by your dealer as special tools are required to avoid damaging the torsion bar splined seat.

13 Front ride height – checking and adjusting

1 Before carrying out this work, have the car standing on a level floor, with tyres correctly inflated and a full fuel tank.
2 Disconnect the anti-roll bar and links and the shock absorber lower mountings.
3 The car should then be loaded with blocks or similar weights, evenly distributed as shown in Fig. 10.8. Bounce the car up and down two or three times to settle the suspension.
4 Refer to Fig. 10.9. Measure the distance B from the floor to the suspension lower arm pivot bolt underside.
5 Measure the distance A from the floor to the end of the suspension arm balljoint taper pin.
6 Subtract one measurement from the other and the difference should be between 39.0 and 49.0 mm (1.5 and 1.9 in). The value should be the same on the opposite side of the front suspension.
7 Where new torsion bars have been installed, the difference can be between 44.0 and 54.0 mm (1.7 and 2.1 in) on both sides of the car.
8 The need for adjustment will usually occur if the torsion bars have been removed and refitted incorrectly in anchor bridge or suspension

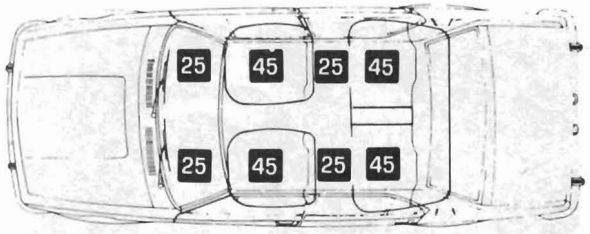


Fig. 10.8 Car loading diagram. Weight in kg (1 kg = 2.2 lb) (Sec 13)

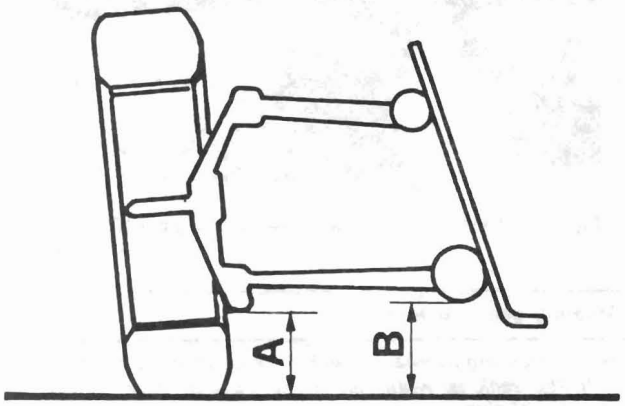


Fig. 10.9 Front ride height measuring diagram (Sec 13)

A Floor to tip of balljoint taper pin B Floor to pivot

arm splines without reference to the alignment marks. To adjust, refer to the following paragraphs.

9 Repositioning of a torsion bar by rotating it one spline will alter the ride height differential by 1.5 mm (0.06 in).

10 When viewed from the rear of the car, the car ride height will be increased by turning the torsion bars clockwise (RH) and anti-clockwise (LH).

11 The ride height will be decreased if the torsion bars are rotated anti-clockwise (RH) and clockwise (LH).

12 By simple calculation, the number of splines through which the torsion bar must be turned to bring the car level on its suspension can be established.

14 Track rod and balljoints – renewal

1 Set the roadwheels in the straight-ahead position.

2 Holding the track rod to prevent it turning using an open-ended spanner on the flats provided, unscrew the track rod end locknut, but only through half a turn (photo).

3 Using a balljoint separator, disconnect the balljoint from the steering arm on the stub axle carrier, having first removed the nut from the taper pin.

4 Unscrew the balljoint from the track rod.

5 Wire brush the track rod threads and smear them with grease. Screw on the new balljoint until it takes up its original position to give the locknuts one half turn to tighten. Do not however lock the nut until the front wheel alignment has been checked and adjusted as described in Section 25.

6 Reconnect the balljoint to the steering arm.

7 Repeat the operations for the other balljoint if necessary.

15 Steering rack bellows – renewal

1 At the first sign of a split in the bellows or of grease leaking from them, the bellows must be renewed.

14.2 Track rod end balljoint

2 To do this, remove the track rod end balljoint(s) as described in the preceding Section.

3 Release the bellows clips and slide the bellows off the end of the track rod.

4 If grit has entered the bellows, wipe away as much of the contaminated grease as possible and apply fresh lubricant.

5 Slide on the new bellows and refit the clips.

6 Refit the balljoints.

7 Check and adjust the front wheel alignment as decribed in Section 25.

16 Steering gear – removal and refitting

1 Working inside the car, extract the socket-headed screws and remove the steering column lower shroud.

2 Unscrew the column rake pinch-bolt lever from the column upper bracket.

3 Withdraw the upper section of the steering column shroud.

4 Unscrew and remove the bolt from the column lower mounting.

5 Open the bonnet and unbolt and remove the shield from the steering rack.

6 Unscrew the nuts from the track rod end balljoints and using a balljoint separator, disconnect the balljoints from the steering arms.

7 Unscrew and remove the pinch-bolt from the steering column-to-pinion shaft coupling.

8 Unscrew and remove the steering rack from the crossmember.

9 Returning to the inside of the car, pull the steering wheel upwards to disconnect the column coupling from the pinon shaft on the rack.

10 Raise the left-hand roadwheel by placing a jack under the

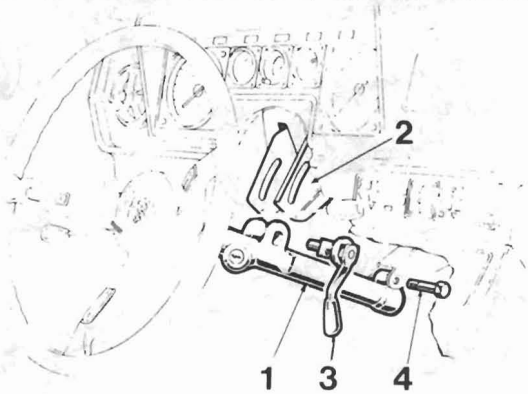


Fig. 10.10 Steering column rake adjuster (Sec 16)

1 Column 3 Lever
2 Bracket 4 Pinch-bolt

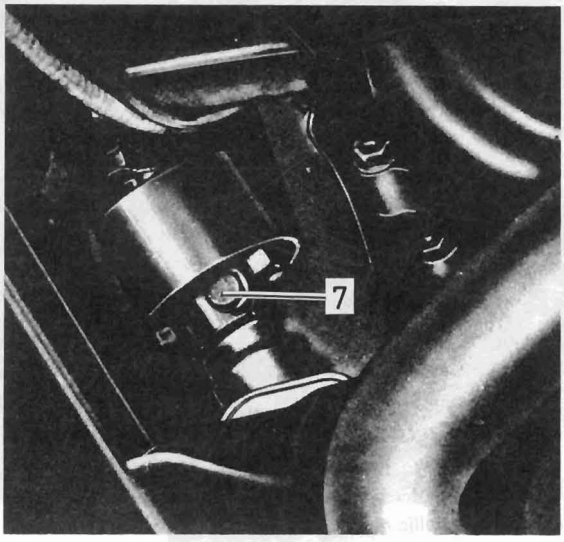


Fig. 10.11 Steering shaft coupling pinch-bolt (7) (Sec 16)

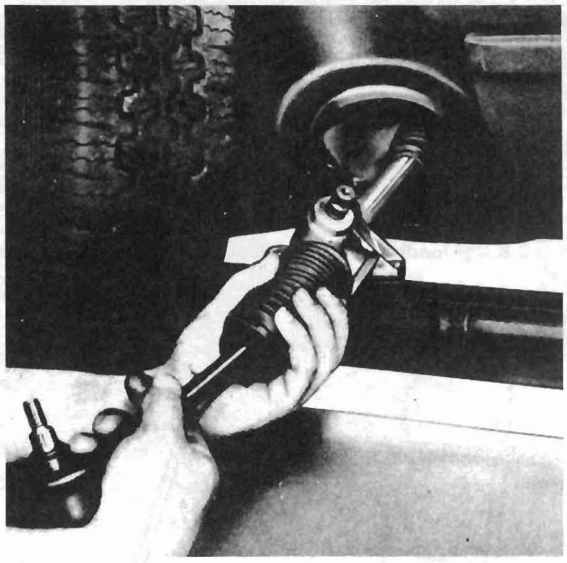


Fig. 10.12 Withdrawing rack-and-pinion gear (Sec 16)

suspension lower arm and then turn the roadwheel until the rack can be withdrawn through the aperture in the wing valance.

11 To refit the rack assembly, locate it in position and bolt it to the crossmember.

12 Set the roadwheels in the straight-ahead parallel position, and also set the steering wheel in the straight-ahead position before connecting the column coupling to the pinion shaft on the steering gear.

13 Reconnect the column upper and lower mountings, remembering to locate the column upper shroud.

14 Fit the lower coupling pinch-bolt.

15 Reconnect the track rod end balljoints.

16 Refit the rack shield.

17 Fit the column lower shroud.

18 If the steering gear has been overhauled or the track rod settings disturbed, the wheel alignment must be checked and adjusted as described in Section 25.

17 Steering gear – overhaul

Before commencing overhaul, check the availability and price of spare parts. If the rack is worn, an exchange unit may be the most satisfactory solution.

1 With the gear removed as described in the preceding Section, grip the rack housing.

2 Release the track rod end balljoint nuts. Flats are provided on the track rods to prevent them rotating if held with an open-ended spanner.

3 Unscrew and remove the track rod end balljoint assemblies.

4 Take off the clips from the steering rack bellows and withdraw the bellows.

5 Withdraw the rack sufficiently to enable it to be gripped with a

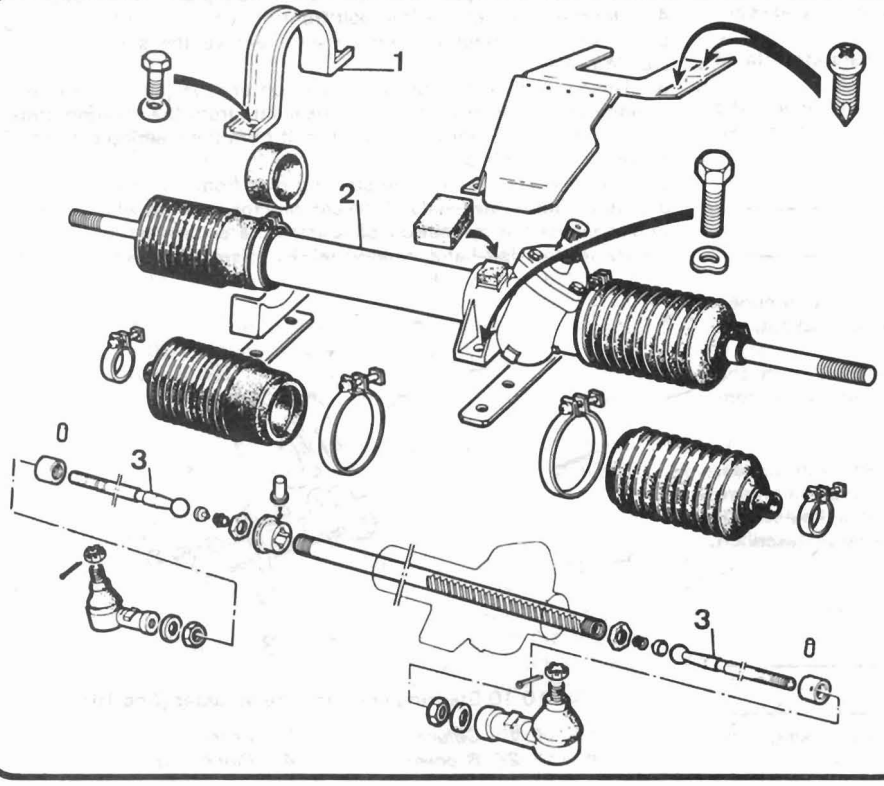


Fig. 10.13 Rack-and-pinion components (Sec 17)

1 *Mounting clamp*
2 *Rack housing*
3 *Track rods*

self-locking wrench, but use a piece of soft sheet metal to prevent the rack being damaged.
6 Unscrew the track rods from the rack using a suitable spanner.
7 Unbolt and remove the damper cover from the rack housing.
8 Extract the shim, spring and damper plunger.
9 Unbolt the pinion cover and remove the shim.
10 Using a plastic-faced hammer, tap out the pinion.
11 Withdraw the rack from the housing.
12 Clean and examine all components for wear and renew as necessary.
13 The pinion may be dismantled for bearing renewal by extracting the circlip and shim and then pulling off the bearing with a two or three-legged extractor.
14 Always renew the flexible bellows if split or hardened.
15 Commence reassembly by applying thread locking compound to the outer surface of the rack guide bush (if removed) and installing it in its seat, carefully cleaned.
16 Fit the ball-bearing to the pinion using a press or a piece of tubing as a drift. Apply pressure only to the bearing centre track.
17 Fit the original shim to the pinion and secure with a circlip.
18 Check the clearance between circlip and shim using a feeler blade. This must not exceed 0.05 mm (0.0020 in). If it does, change the shim for a thicker one available from your dealer.
19 Drive the needle roller bearing into position and locate the rubber ring in its seat.
20 Use 90g (3 oz) of the specified grease and apply it to the rack, the rack pinion and bearings.
21 Insert the rack into its housing, teeth towards the pinion gear.
22 Fit the pinion, meshing the gear teeth and using a piece of tubing to drive it home.
23 Use a depth gauge to measure the distance of the pinion bearing outer track below the surface of the housing.
24 Measure the thickness of the original shim, which should equal the depth measurement just taken. If it does not, change it for one of different thickness.
25 Fit the pinion cover plate, having first applied a thin bead of RTV type instant gasket. Tighten the cover bolts to the specified torque.
26 Fit the damper slipper, well lubricated but without its sealing ring.
27 Fit the original shim between the damper bush and the cover. Fit the cover and tighten bolts to specified torque.
28 Turn the splined pinion shaft by hand and check for freedom of movement without binding or endfloat. If the action is too free or stiff, change the shim for one of alternative thickness.
29 Finally, remove the cover, shim and slipper and fit the slipper sealing ring.
30 Install the slipper, spring and shims. Apply a thin bead of RTV instant gasket to the cover and bolt it into position. Tighten the bolts to the specified torque.
31 Connect the track rods to the rack, tightening to the specified torque. Use new lockplates.
32 Fit the rack bellows and secure with clips.
33 Centralise the rack ready for fitting to the car by referring to Fig. 10.18.
34 Set the track rod end balljoint locknuts as shown in Fig. 10.19. Screw on the balljoints but do not tighten the locknuts until the front wheel alignment has been checked as described in Section 25.
35 The steering gear is now ready for refitting to the car.

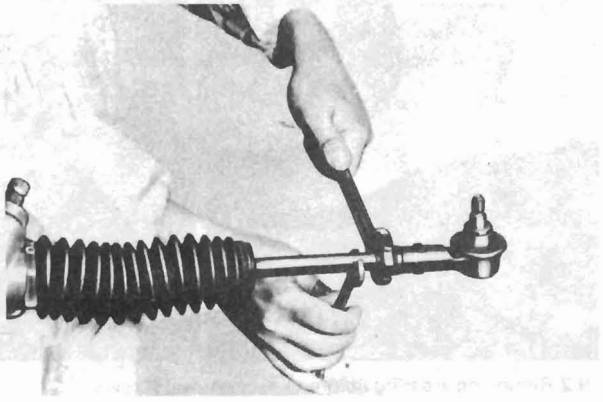


Fig. 10.14 Releasing track rod end locknut (Sec 17)

Fig. 10.15 Releasing track rod from rack (Sec 17)

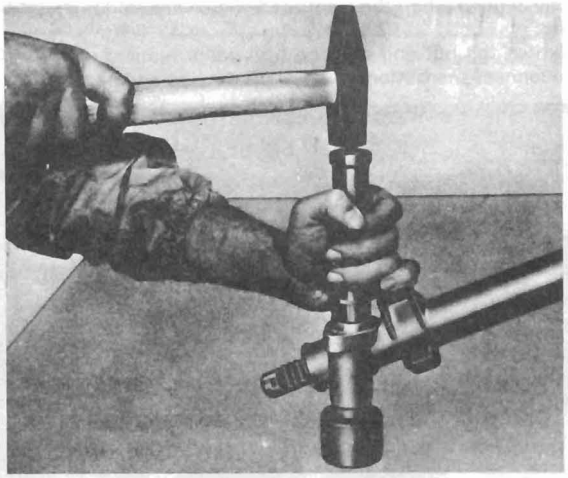


Fig. 10.16 Installing pinion assembly (Sec 17)

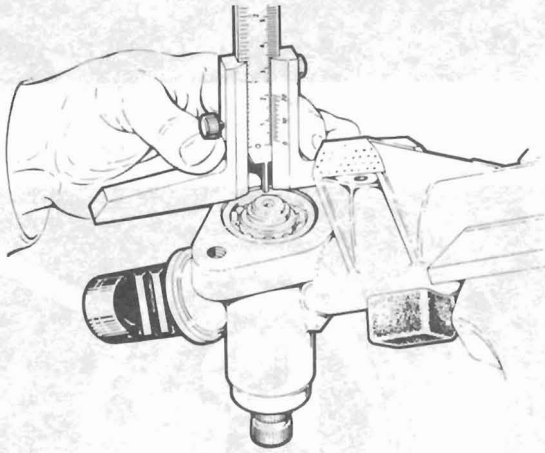


Fig. 10.17 Measuring pinion bearing recess (Sec 17)

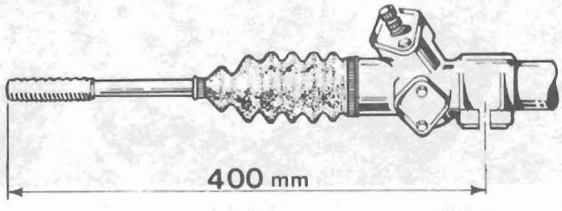


Fig. 10.18 Steering rack centralising diagram (Sec 17)

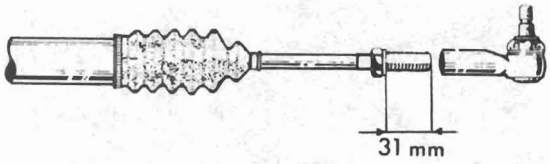
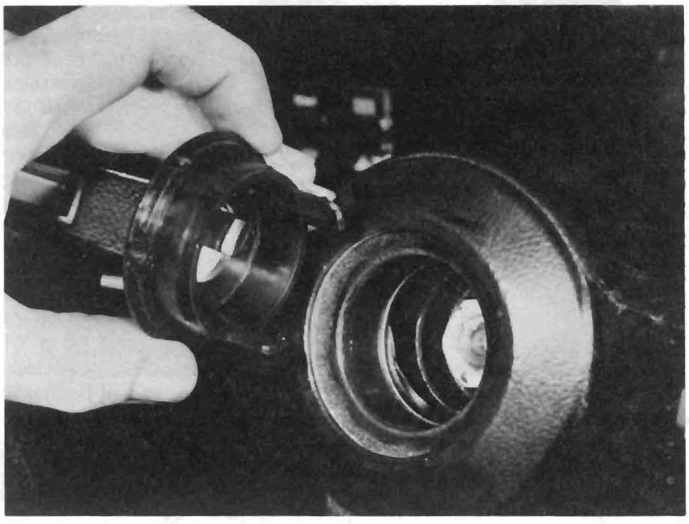


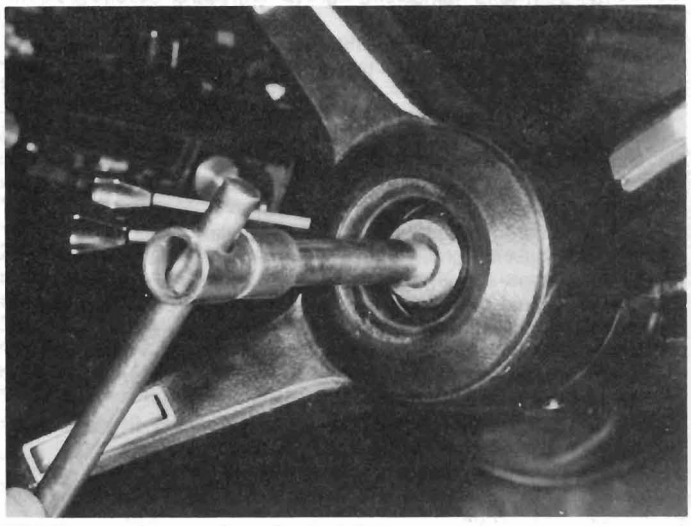
Fig. 10.19 Track rod thread length for basic setting (Sec 17)

18 Steering wheel – removal and refitting

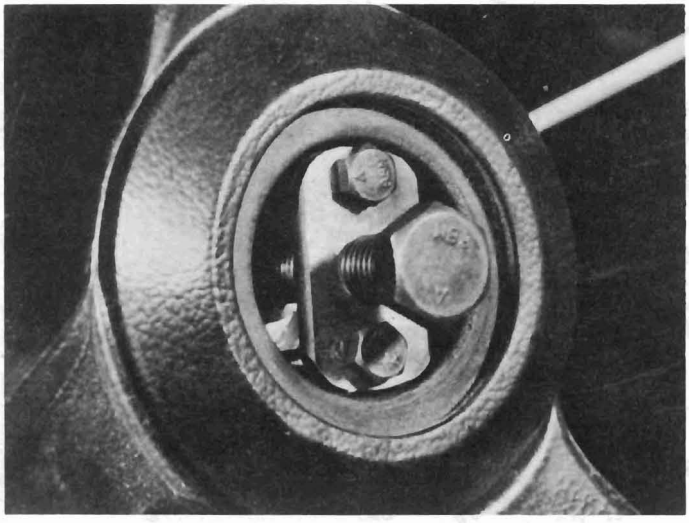
1 Disconnect the battery negative lead.
2 Prise out the small trim panel from the centre of the steering wheel (photo).
3 Unscrew the steering wheel retaining nut and remove it (photo).
4 The steering wheel should be removed using a small puller bolted into the two tapped holes provided in the wheel hub (photo).
5 Refitting is a reversal of removal. Check that the spokes are correctly aligned when the front roadwheels are set for straight-ahead steering.
6 Tighten the nut and refit the trim panel.
7 Reconnect the battery.



18.2 Steering wheel hub trim panel



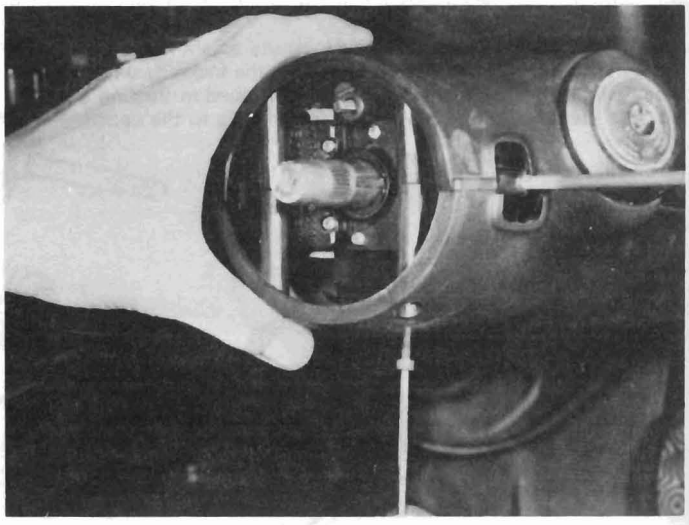
18.3 Unscrewing steering wheel retaining nut



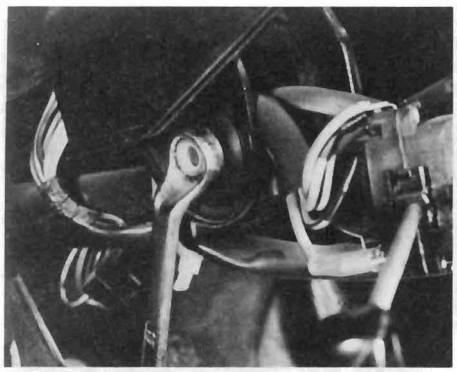
18.4 Removing steering wheel with a puller

19 Steering column – removal and refitting

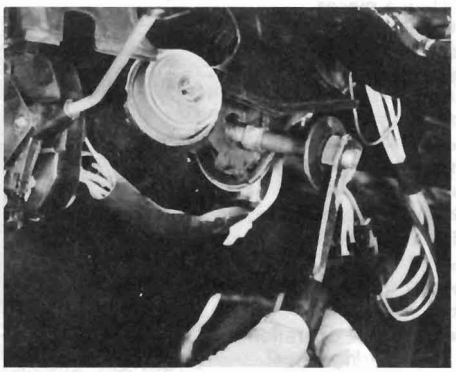
1 Remove the steering wheel as described in the preceding Section.
2 Unscrew the socket-headed screws and remove the steering column lower shroud (photo).
3 Unbolt and remove the rake adjusting lever from the column upper mounting (photos).
4 Lower the columns and withdraw the upper shroud (photo).
5 Disconnect the ignition switch wiring harness.
6 Extract the bolt from the column lower mounting.
7 Disconnect the column at the intermediate steering shaft coupling. Extract the special washer located between the steering column tube and the universal joint.
8 Withdraw the column assembly into the car interior.
9 Before refitting the column, set the front roadwheels in the straight-ahead position.
10 Locate the special washers between the end of the column and the universal joint.
11 Offer up the steering column and check that the notch which actuates the direction indicator lever is correctly aligned with the pawl of the self cancelling cam.
12 Fit the steering wheel with spokes set for straight-ahead steering. Tighten the nut.
13 Reconnect the column upper and lower mountings and fully



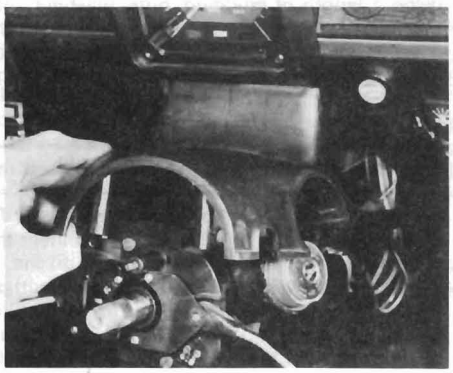
19.2 Removing steering column lower shroud screws



19.3a Removing steering column rake adjuster nut



19.3b Removing rake adjusting lever from upper steering column



19.4 Removing steering column upper shroud

tighten the intermediate shaft coupling bolt. Remember to fit the upper shroud.
14 Reconnect the wiring harness.
15 Fit the column lower harness.
16 Fit the column lower shroud.
17 Fit the steering wheel hub cover panel.
18 Reconnect the battery.

20 Steering column – dismantling and reassembly

1 With the column removed as previously described, clamp it carefully in the jaws of a vice.
2 Using a plastic-faced hammer, tap the shaft from the column.
3 The bushes and end cover can be removed by drawing them out

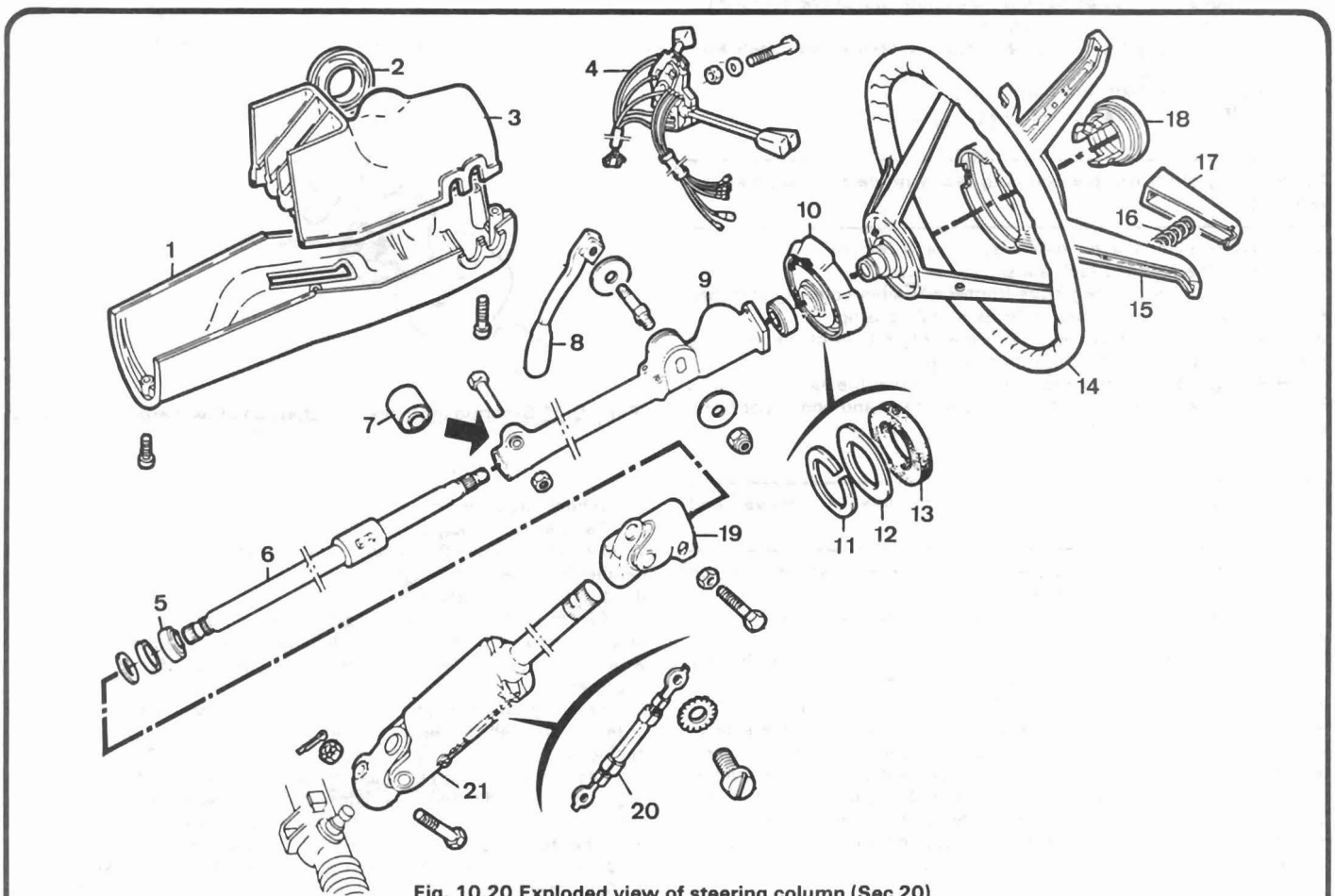


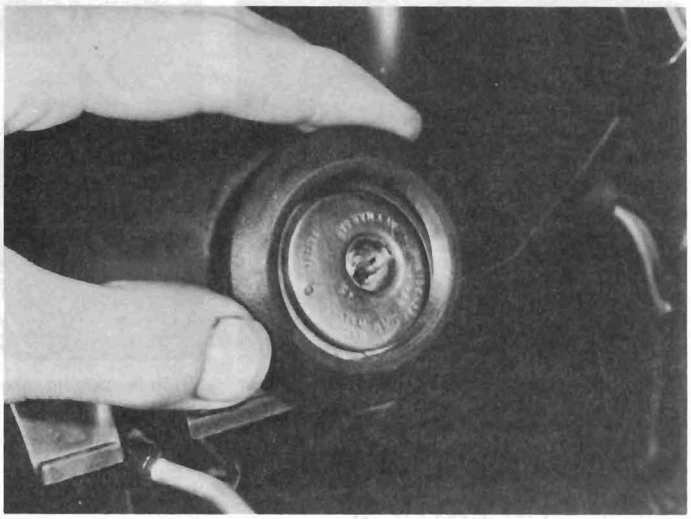
Fig. 10.20 Exploded view of steering column (Sec 20)

1 Lower shroud
2 Ignition switch bezel
3 Upper shroud
4 Steering column switch
5 Lower bearing
6 Column shaft
7 Flexible mounting
8 Rake adjuster lever
9 Column tube
10 Hub
11 Circlip
12 Washer
13 Felt ring
14 Steering wheel
15 Spoke
16 Spring
17 Horn button
18 Hub centre cover
19 Upper coupling
20 Earthing link
21 Lower coupling

using a length of studding, nuts, washers and distance pieces.
4 Renew the rubber bush if necessary in the lower mounting lug.
5 Reassemble by first installing the lower bush.
6 Apply grease to the bush and insert the steering shaft.
7 Fit the upper bush, again well greased.

21 Steering column lock – removal and refitting

1 Remove the column lower shroud and ignition switch bezel, to give access to the lock (photo). Disconnect the ignition switch wiring harness.
2 Drill out the lock securing bolt and withdraw the lock assembly.
3 Fit the new lock and screw in the bolt, but only just more than finger tight. Now jack up the front roadwheels and check the operation of the lock with the ignition key and by turning the steering wheel.
4 If the lock operates correctly, fully tighten the bolt until its head breaks off.
5 Reconnect the ignition switch wiring harness.



21.1 Removing ignition switch bezel

22 Steering intermediate shaft (early models) – removal and refitting

Either the steering column or the steering rack must be removed before the intermediate shaft can be removed.
1 This type of intermediate shaft incorporates a flexible coupling.
2 To remove this type of intermediate shaft, unbolt and remove the protective cover from the steering rack.
3 Remove the pinch-bolt and separate the intermediate shaft from the flexible coupling.
4 Withdraw the shaft into the car interior.
5 Refitting is a reversal of removal.

23 Steering shaft flexible coupling (early models) – removal and refitting

1 Working under the bonnet, unscrew and remove the protective shield from the steering rack housing.
2 Unscrew the four fixing bolts from the flexible coupling and then remove the coupling together with its metal housing.
3 Disconnect the earth cable from the centre hole of the coupling and separate the coupling from its housing.
4 Refitting is a reversal of removal, but note that the earth cable runs between the coupling centre hole and one lower and one upper fixing bolt.

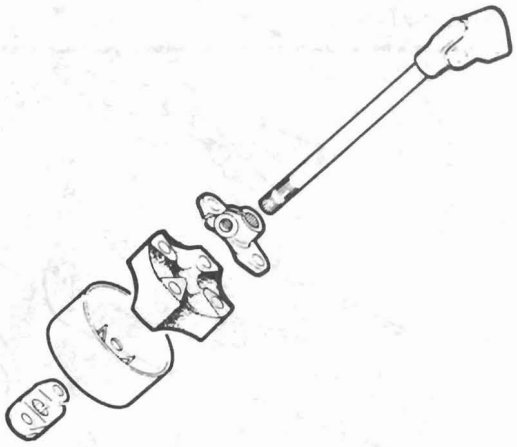


Fig. 10.21 Steering intermediate shaft and flexible coupling (early models) (Sec 22)

24 Steering intermediate shaft (later models) – removal and refitting

Either the steering column or the steering rack must be removed before the intermediate shaft can be removed.
1 Unbolt and remove the protective shield from the steering rack within the engine compartment.
2 Disconnect the shaft upper and lower couplings by unscrewing the pinch-bolts.
3 Withdraw the intermediate shaft from the dust-excluding boots.
4 Refitting is a reversal of removal,, but make sure that the special washers are in position between the upper universal joint coupling and the base of the column tube. On some models these washers are not fitted, in which case the upper coupling must be so positioned that the gap between it and the column tube does not exceed 5.0 mm (0.20 in). Adjust by releasing the lower pinch-bolt and moving the coupling upwards.

25 Steering angles and front wheel alignment

1 Accurate front wheel alignment is essential to good steering and for even tyre wear. Before considering the steering angles, check that the tyres are correctly inflated, that the front wheels are not buckled, the hub bearings are not worn or incorrectly adjusted and that the steering linkage is in good order, without slackness or wear at the joints.
2 Wheel alignment consists of four factors:

Camber is the angle at which the road wheels are set from the vertical when viewed from the front or rear of the vehicle. Positive camber is the angle (in degrees) that the wheels are tilted outwards at the top from the vertical.

Castor is the angle between the steering axis and a vertical line when viewed from each side of the vehicle. Positive castor is indicated when the steering axis is inclined towards the rear of the vehicle at its upper end.

Steering axis inclination is the angle, when viewed from the front or rear of the vehicle, between the upper and lower suspension swivel balljoints.

Toe is the amount by which the distance between the front inside edges of the roadwheel rims differs from that between the rear inside edges. If the distance between the front edges is *less* than that at the rear, the wheels are said to *toe in*. If the distance between the front inside edges is *greater* than that at the rear, the wheels *toe out*.

3 Due to the need for precision gauges to measure the small angles of the steering and suspension settings, it is preferable that adjustment of camber and castor is left to a service station having the necessary equipment. For information purposes however, adjustment of camber and castor is carried out in the following way.
4 Camber: Adjust by varying the thickness of shims located between the lower suspension arm pivot and the body member.
5 Castor: Adjust by altering the length of the radius rod by releasing the locknuts and turning the adjuster sleeve.
6 To check the front wheel alignment, first make sure that the

lengths of both track rods are equal when the steering is in the straight-ahead position. These can be adjusted if necessary by releasing the locknuts and turning the track rods.

7 Obtain a tracking gauge. These are available is various forms from accessory stores, or one can be fabricated from a length of steel tubing suitably cranked to clear the sump and bellhousing, and having a setscrew and locknut at one end.

8 With the gauge, measure the distance between the two wheel inner rims (at hub height) at the rear of the wheel. Push the vehicle forward to rotate the wheel through 180° (half a turn) and measure the distance between the wheel inner rims, again at hub height, at the front of the wheel. The last measurement should be greater than the first by the appropriate toe-out according to the Specifications.

9 Where the toe-out is found to be incorrect, release the track rod balljoint locknuts and turn the track rods equally. Only turn them a quarter of a turn at a time before rechecking the alignment. Do not grip the threaded part of the track rod/balljoint during adjustment, and make sure that the bellows outboard clip is released, otherwise the bellows will twist as the track rod is rotated. When each track rod is viewed from the centre line of the vehicle, turning each rod clockwise will increase the toe-out. Always turn both rods in the same direction when viewed from the centre-line of the vehicle, otherwise the rods will become unequal in length. This would cause the steering wheel spoke position to alter, and could cause problems on turns with tyre scrubbing.

10 On completion, tighten the track rod locknuts without disturbing their setting, check that the balljoint is at the centre of its arc of travel and then retighten the bellows clips.

26 Roadwheels and tyres – general

1 Regularly check the tyre pressures including the spare.

2 At regular intervals, remove the roadwheels, extract any flints which are embedded in the treads and (if wished) move the position of the wheels to even out the wear of the tyres. This rotation should only be carried out if the wheels have been balanced off the vehicle then moving the roadwheels cannot be carried out unless the wheels are re-balanced afterwards.

3 Where radial tyres are fitted, any movement of the wheels should be limited to changing their position between front and rear on the same side of the vehicle, not from one side to the other.

4 When new tyres are fitted, always renew the valve at the same time.

5 Never mix radial and crossply tyres on the same axle.

6 Never attempt to mend a puncture by the insertion of a plug from the outside. The cover must be removed and a 'mushroom' type plug inserted from the inside. The wheel must be re-balanced after insertion of the plug.

7 The types fitted as original equipment incorporate wear indicators. These take the form of bands moulded into the bottoms of the tread grooves. When the bands appear across two or more adjustment grooves, the tyres must be renewed as soon as possible.

8 Periodically inspect the wheels themselves for dents, cracks, rusting or corrosion. Alloy wheels are particularly liable to impact damage; a cracked or badly corroded wheel must be renewed without delay.

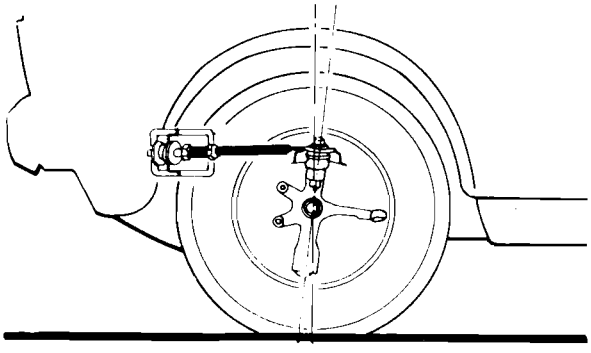


Fig. 10.22 Castor angle (Sec 25)

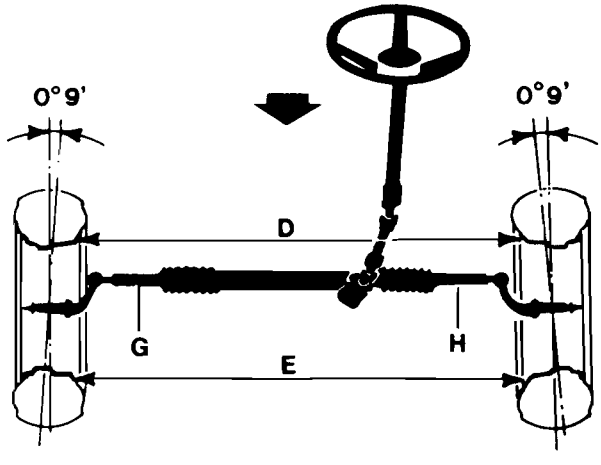


Fig. 10.24 Toe-out measurement (Sec 25)

D Track – rear of wheels *G Track rod*
E Track – front of wheels *H Track rod*

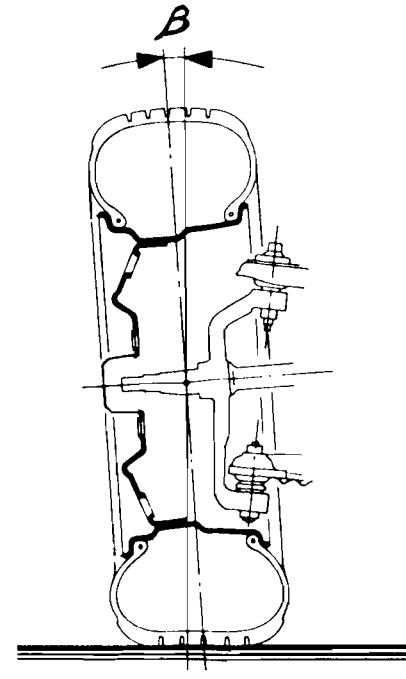


Fig. 10.23 Camber angle (Sec 25)

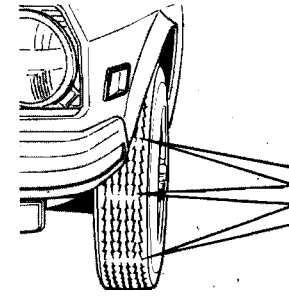


Fig. 10.25 Tyre tread wear indicator bands (Sec 26)

27 Fault diagnosis – front suspension and steering

Before diagnosing faults from the following chart, check that any irregularities are not caused by:

1 *Binding brakes*
2 *Incorrect 'mix' of radial and crossply tyres*
3 *Incorrect tyre pressures*
4 *Misalignment of the bodyframe*

Symptom	Reason(s)
Steering wheel can be moved considerably before any sign of movement of the wheels is apparent	Wear in steering linkage, gear or column coupling
Vehicle difficult to steer in a consistent straight line – wandering	As above Wheel alignment incorrect (indicated by excessive or uneven tyre wear) Front wheel hub bearings loose or worn Worn suspension unit swivel joints
Steering stiff and heavy	Incorrect wheel alignment (indicated by excessive or uneven tyre wear) Excessive wear or seizure in one or more of the joints in the steering linkage or suspension unit balljoint Excessive wear in the steering gear unit
Wheel wobbles and vibration	Roadwheels out of balance Roadwheels buckled Wheel alignment incorrect Wear in the steering linkage, suspension unit bearings or track control arm bushes
Excessive pitching and rolling on corners and during braking	Defective shock absorbers

Chapter 11 Rear suspension

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Coil spring – removal and refitting 6
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Hub, stub axle shaft and bearing – removal and refitting 5
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Rear ride height adjustment 9
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Shock absorber – removal, testing and refitting 3

Specifications

System type	De Dion layout with transverse link, coil springs, telsecopic shock absorbers and anti-roll bar
Coil springs	
Spring free length	475 mm (18.7 in)
Spring length installed with static load	265 mm (10.4 in)
Spring grades	04 – 05 – 06
Rear suspension angles (not adjustable)	
Camber	0° ± 30'
Camber difference side-to-side	0° 20' maximum
Toe-in	0° ± 10'. Max side to side difference 0° 10'

Torque wrench settings	**Nm**	**lbf ft**
Axle-to-crossmember bolts	100	74
Crossmember-to-body bolts	45	33
Stub axle shaft nut	176	130
Hub bearing ring nut	185	136
Stub axle shaft-to-driveshaft flange bolts	30	22
Propeller shaft rear flange to clutch yoke	45	33
Driveshaft inboard bolts to spacer	30	22

1 Description

The rear suspension incorporates a de Dion type axle.

The transmission being flexibly mounted to the body gives a reduction in unsprung weight.

The axle is of triangular design with a large rear tubular member and side tubes.

A transverse link locates the axle together with an anti-roll bar.

Springing is provided by coil springs and telescopic hydraulic shock absorbers.

The rear hubs are supported on double ball-bearing assemblies.

2 Maintenance and inspection

1 Periodically check the tightness of all rear suspension bolts and nuts. Inspect the suspension rubber mountings for wear or deformation, particularly those on the anti-roll bar.

2 Check the hub bearings for wear by jacking up the roadwheel, gripping the tyre at two opposite points and attempting to rock it. Any movement will indicate the need for bearing renewal.

3 At the specified intervals, check the operation of the shock absorbers as described in Section 3.

3 Shock absorber – removal, testing and refitting

1 Raise the rear of the car on ramps.

2 Remove the rear seat (Chapter 12).

3 The shock absorber upper mountings will now be exposed. Unscrew the locknut, retaining nut and rubber bushes and cup washers.

4 Working under the car, disconnect the lower mountings in a similar way.

5 Compress the shock absorber slightly and remove it from the car.

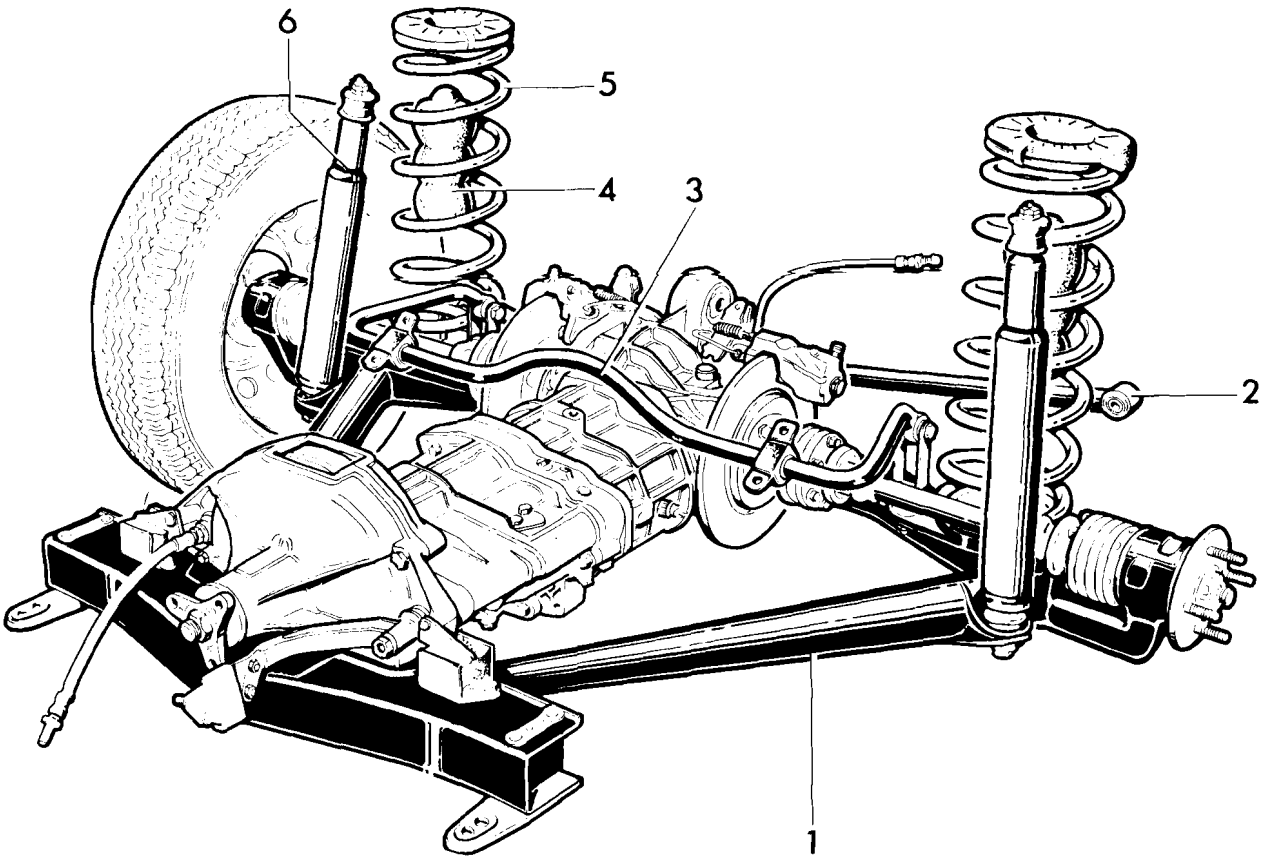


Fig. 11.1 Rear suspension components (Sec 1)

1	*Axle side tube*	*3*	*Anti-roll bar*	*5*	*Coil spring*
2	*Transverse link*	*4*	*Bump rubber*	*6*	*Shock absorber*

6 Grip the lower mounting stud in the jaws of a vice fitted with soft metal protectors so that the shock absorber body is vertical. Fully extend and compress the shock absorber between six and ten times. Any jerkiness, lack of resistance or seizure will indicate the need for a new unit, no repair being possible.
7 Before fitting a shock absorber which has been stored in a horizontal attitude, hold it in the upright position and fully extend and compress it six times in order to de-aerate the fluid.
8 Refitting is a reversal of removal. Make sure that the mounting bushes and cup washers are fitted in their correct sequence. Tighten the retaining nuts to exert reasonable pressure on the rubber bushes, but do not overtighten them.

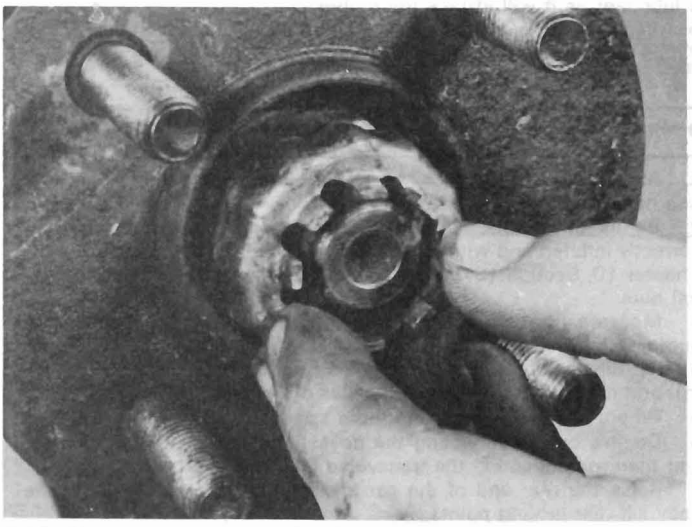
4 Anti-roll bar – removal and refitting

1 Disconnect the links from the ends of the anti-roll bar.
2 Unscrew the bolts and remove the rubber insulated clamps which hold the anti-roll bar to the body.
3 Disconnect the handbrake cable from the operating levers on the calipers (see Chapter 8).
4 Using a jack and a block of wood, raise the rear of the transmission casing until the mounting bolt can be removed from the transmission rear flexible mounting.
5 Carefully lower the transmission just enough to be able to withdraw the anti-roll bar.
6 Refitting is a reversal of removal.

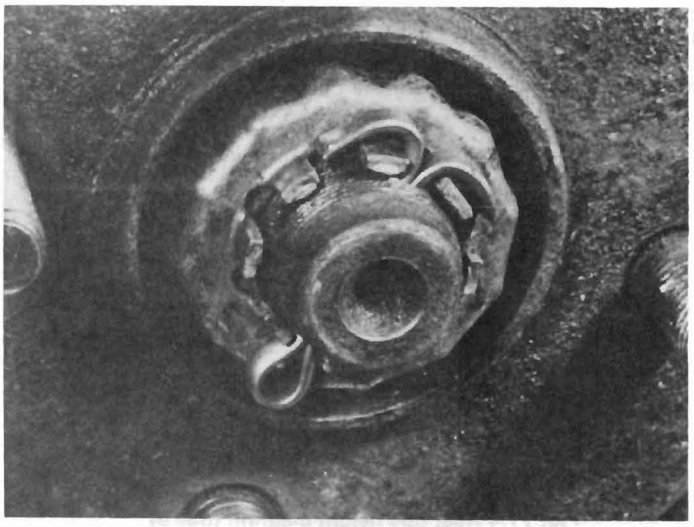
5 Hub, stub axle shaft and bearing – removal and refitting

1 Raise the rear of the car and remove the roadwheel.
2 Unscrew and remove the socket-headed bolts which secure the driveshaft to the stub axle shaft flange.
3 Push the driveshaft upwards to disconnect it from the stub axle shaft and then move it to one side out of the way.
4 Extract the split pin from the nut at the end of the stub axle shaft. Take off the castellated nut retainer and then unscrew and remove the nut. This nut is very tight.
5 Using a suitable puller, draw off the hub from the splines of the stub axle shaft.
6 Withdraw the stub axle shaft from the inboard face of the stub axle carrier.
7 If the reason for dismantling was to renew the bearing assembly, this should now be withdrawn in the following way.
8 Relieve the staking on the bearing ring nut and unscrew it using a suitable pin wrench or C-spanner. Remember that the ring nut on the left-hand side of the car has a *left-hand thread,* and a right-hand thread on the right-hand side.
9 Using a bolt and distance pieces, draw the bearing out of the stub axle carrier.
10 Install the new bearing using the same method. The bearing is grease sealed and requires no further lubrication. Apply pressure to the bearing outer track only.
11 Screw in the ring nut and tighten to the specified torque. This is very tight and in the absence of a suitable torque wrench, use a 2 ft (610 mm) length of piping on the end of the wrench and tighten it as hard as possible.
12 Stake the ring nut at two diametrically opposite points.
13 Grease the stub axle shaft splines. Insert the shaft and then fit the hub.
14 Screw on the hub nut and tighten to the specified torque (photo).
15 Fit the nut retainer and insert a new split pin. Bend the ends of the pin to lock securely (photos).

5.14 Fitting rear hub nut



5.15a Fitting rear hub nut lock



5.15b Rear hub split pin correctly fitted

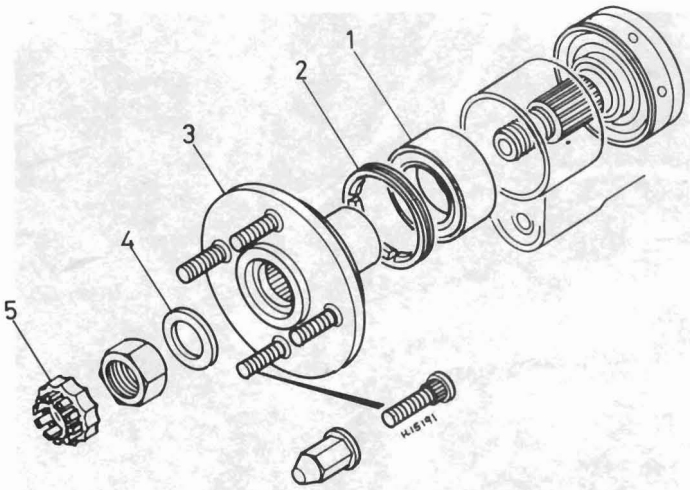


Fig. 11.2 Rear hub components (Sec 5)

1 Bearing
2 Ring nut
3 Hub
4 Thrust washer
5 Nut retainer

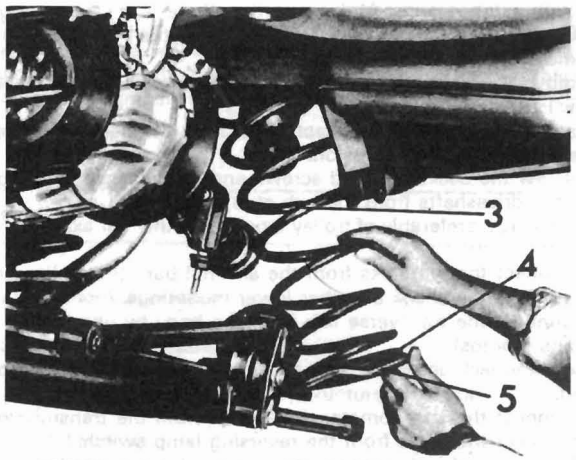


Fig. 11.3 Removing a rear coil spring (Sec 6)

3 Spring
4 Spring ring
5 Rubber pad

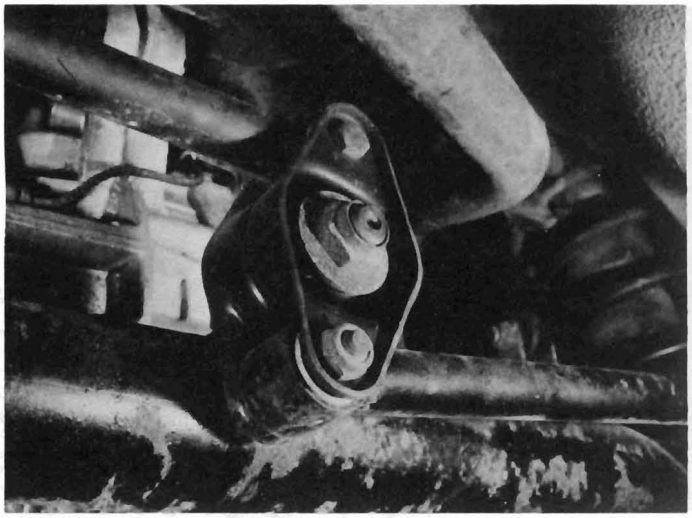
6 Coil spring – removal and refitting

1 Raise the rear of the car and support it securely under the body members.
2 Unscrew and remove the socket-headed screws and disconnect the outboard ends of the driveshafts from the flanges of the hub stub axle shafts. Tie the driveshafts up out of the way.
3 Support the main axle tube on a jack and disconnect the anti-roll bar and links from the axle.
4 Disconnect the shock absorber lower mountings.
5 Disconnect the transverse link from the body by unscrewing its pivot bolts.
6 Lower the axle jack until both coil springs are completely free and then lift them out of their seats together with rings and rubber pads.
7 If a coil spring is to be renewed, make sure that it is of similar grade to the original (see Specifications). If this cannot be determined, renew both rear springs at the same time. Always renew the rubber mounting components.
8 Refitting is a reversal of the removal operations.

7 Rear suspension components – removal and refitting

1 If major renewal of rear suspension parts is necessary, it will probably be worthwhile removing the rear suspension completely and dismantling it out of the car.

7.10a Rear suspension transverse link connection to body



7.10b Rear suspension transverse link connection to axle tube

2 Raise the rear of the car and support it under the body sill jacking points with safety stands. Make sure that there is a clearance of at least 400 mm (15.7 in) between the ground and the bottom of the sill.
3 Remove the rear roadwheels.
4 Remove the front section of the exhaust system as described in Chapter 1, Section 11.
5 Remove the gearchange selector rod from the gearchange lever and the lever on the transmission.
6 Unscrew the socket-headed screws and disconnect the outboard ends of the driveshafts from the hub stub axle flanges.
7 Place a jack, preferably of trolley type, under the rear axle tube and support its weight.
8 Disconnect the end links from the anti-roll bar.
9 Disconnect the shock absorber lower mountings.
10 Disconnect the transverse link from the body by unscrewing the pivot bolts (photos).
11 Lower the jack under the axle tube until both coil springs can be removed.
12 Disconnect the speedometer drive cable from the transmission.
13 Disconnect the leads from the reversing lamp switch.
14 Using a second jack, support the weight of the transmission.
15 Disconnect the rear end of the propeller shaft from the clutch spider.
16 Unbolt the axle front end bolt from the crossmember and then unscrew the bolts which hold the crossmember to the body.
17 Release the crossmember from the transmission by unscrewing the flexible mounting bolts. Adjust the height of the axle tube jack to tilt the transmission downwards and so provide better access to the transmission flexible mounting bolts which are located at the front end.
18 Temporarily bolt the ends of the crossmember up to the body. This will support the front end of the transmission when the jack is removed during withdrawal of the axle, which can now be done from under the rear end of the car.
19 Refitting is a reversal of removal. Tighten all nuts and bolts to their specified torques.

8 Rear suspension components – dismantling, servicing and reassembly

1 With the complete suspension removed, clean away accumulations of mud and grease.
2 Unbolt and remove the transverse link.
3 Remove the hub and stub axle shaft as described in Section 5. If the stub axle bearings are worn they should be renewed, also as described in Section 5.
4 Examine all rubber bushes and flexible mountings and renew as necessary. The bushes on the transverse link can be removed using a press, or a bolt, nut and suitable distance pieces. Application of brake fluid or soapy water will ease the fitting of the new bushes, which should always be entered from their chamfered side. Do not use oil as a lubricant as it will atttack the rubber.
5 Reassembly is a reversal of dismantling. Refer to Section 5 for details of hub and bearing installation.

9 Rear ride height adjustment

1 After major overhaul or renewal of components, check the rear ride height.
2 Before doing this, have the car standing on a level floor, tyres correctly inflated and with a full fuel tank. Load the car as described in Chapter 10, Section 13, and disconnect the shock absorbers and anti-roll bars.
3 Measure the distance between the spring locating cup and the bump rubber pad (Fig. 11.4).
4 The dimension F must be between 39.0 and 49.0 mm (1.5 to 1.9 in), and it must be equal on both sides of the car.
5 Where correction is required, the springs must be shimmed.
6 Do this by disconnecting the driveshafts at their outboard ends, and then disconnecting the transverse link from the body.
7 Raise the rear end of the car and support it securely under the body sill rear jacking points.
8 Support the rear axle tube and then remove the roadwheels.
9 Lower the axle tube jack until the coil springs are free.
10 Insert the necessary spacer shims between the bump rubber and the body to bring the height within the specified tolerance. Spacer shims are available in thicknesses of 7, 14 and 21 mm (0.28, 0.55 and 0.83 in).
11 If the shim correction exceeds 21 mm, then it is recommended that new coil springs are fitted (see Section 6).

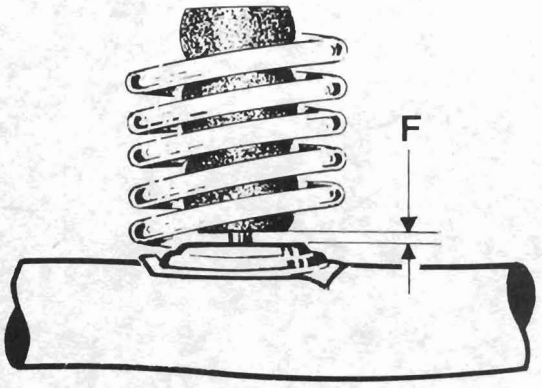


Fig. 11.4 Rear ride height diagram (Sec 9)

F = 39.0 to 49.0 mm (1.5 to 1.9 in)

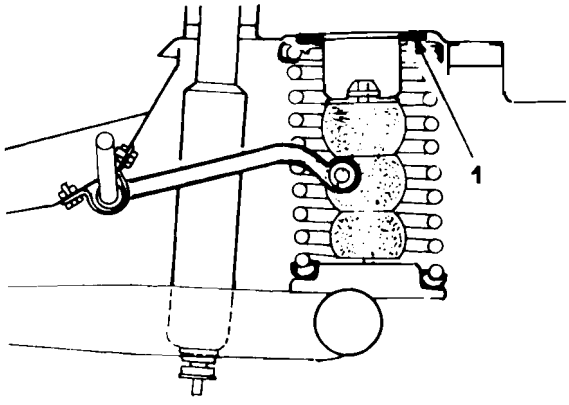


Fig. 11.5 Location of ride height spacer shims (1) (Sec 9)

12 Reconnect the driveshafts and the transverse link.
13 Refit the roadwheels and lower the car to the ground.

10 Rear suspension camber angle – checking

1 This is set during production. No provision is made for adjustment of this or other rear suspension angles.

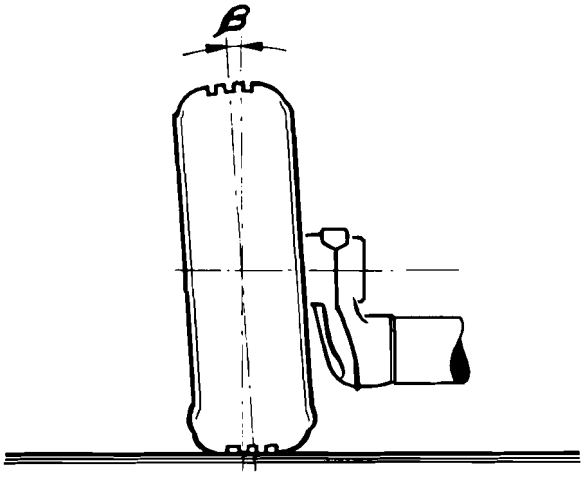


Fig. 11.6 Rear wheel camber angle (Sec 10)

$B = 0° \pm 30'$

2 Where a suitable gauge is available for checking the camber angle, the angle must be within the specified tolerance. If it is not, suspect collision damage to the rear axle tubes or stub axle carrier. This should be corrected by installation of new parts, or professional realignment.

11 Fault diagnosis – rear suspension

Symptom	Reason(s)
Excessive pitching or rolling on corners or during braking	Weak coil spring Defective shock absorbers
Wheel wobble or vibration	Roadwheels out of balance Roadwheels out of true Incorrect wheel alignment due to structural damage
Wander and severe tyre wear	Worn hub bearings Worn transverse link bushes Incorrect wheel alignment due to structural damage

Chapter 12 Bodywork

For modifications, and information applicable to later models, see Supplement at end of manual

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1 Description

The bodywork is either in 3-door Coupe hatchback form, or 4-door Saloon with conventional luggage boot.

All modeis are attractively finished and well equipped but the underbody, especially on older versions, will require regular attention to keep it free from rust and corrosion.

The steel, welded unitary form of construction does not incorporate any detachable panels except for doors, bonnet and boot lid. Extensive repair work must therefore be entrusted to body repair specialists.

2 Maintenance – bodywork and underframe

1 The general condition of a vehicle's bodywork is the one thing that significantly affects its value. Maintenance is easy but needs to be regular. Neglect, particularly after minor damage, can lead quickly to further deterioration and costly repair bills. It is important also to keep watch on those parts of the vehicle not immediately visible, for instance the underside, inside all the wheel arches and the lower part of the engine compartment.

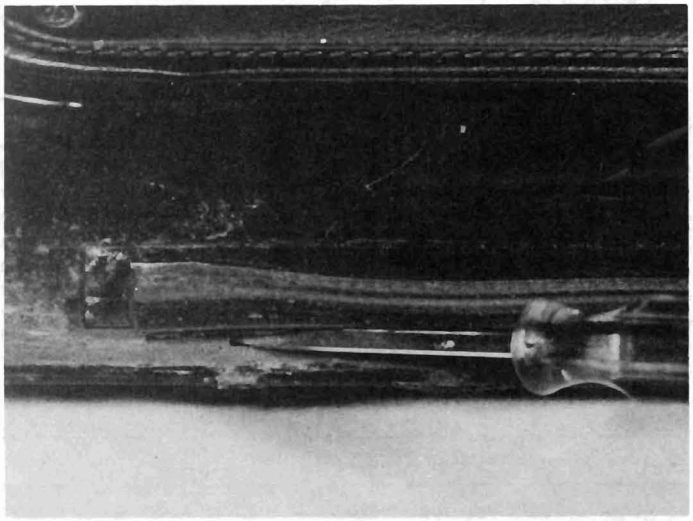
2 The basic maintenance routine for the bodywork is washing – preferably with a lot of water, from a hose. This will remove all the loose solids which may have stuck to the vehicle. It is important to flush these off in such a way as to prevent grit from scratching the finish. The wheel arches and underframe need washing in the same way to remove any accumulated mud which will retain moisture and tend to encourage rust. Paradoxically enough, the best time to clean the underframe and wheel arches is in wet weather when the mud is thoroughly wet and soft. In very wet weather the underframe is usually cleaned of large accumulations automatically and this is a good time for inspection.

3 Periodically, it is a good idea to have the whole of the underframe of the vehicle steam cleaned, engine compartment included, so that a thorough inspection can be carried out to see what minor repairs and renovations are necessary. Steam cleaning is available at many garages and is necessary for removal of the accumulation of oily grime which sometimes is allowed to become thick in certain areas. If steam cleaning facilities are not available, there are one or two excellent grease solvents available which can be brush applied. The dirt can then be simply hosed off.

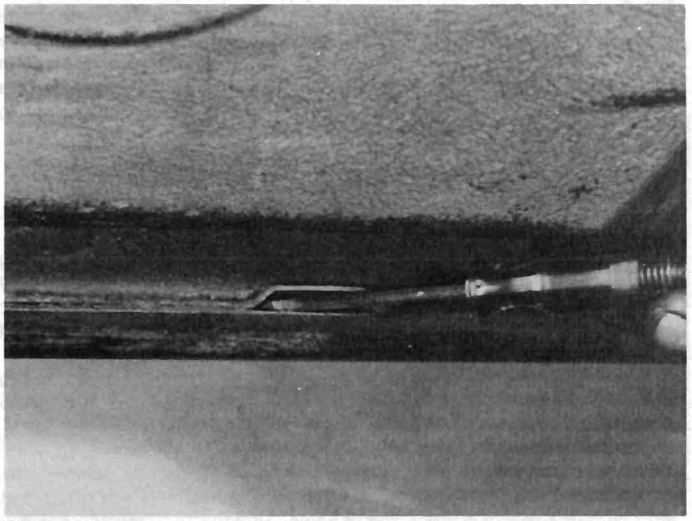
4 After washing paintwork, wipe off with a chamois leather to give an unspotted clear finish. A coat of clear protective wax polish will give added protection against chemical pollutants in the air. If the paintwork sheen has dulled or oxidised, use a cleaner/polisher combination to restore the brilliance of the shine. This requires a little effort, but such dulling is usually caused because regular washing has been neglected. Always check that the door and ventilator opening drain holes and pipes are completely clear so that water can be drained out (photos). Bright work should be treated in the same way as paintwork. Windscreens and windows can be kept clear of the smeary film which often appears, by adding a little ammonia to the water. If they are scratched, a good rub with a proprietary metal polish will often clear them. Never use any form of wax or other body or chromium polish on glass.

3 Maintenance – upholstery and carpets

1 Mats and carpets should be brushed or vacuum cleaned regularly to keep them free of grit. If they are badly stained remove them from the vehicle for scrubbing or sponging and make quite sure they are dry



2.4a Door drain hole



2.4b Sill drain hole

before refitting. Seats and interior trim panels can be kept clean by wiping with a damp cloth. If they do become stained (which can be more apparent on light coloured upholstery) use a little liquid detergent and a soft nail brush to scour the grime out of the grain of the material. Do not forget to keep the headlining clean in the same way as the upholstery. When using liquid cleaners inside the vehicle do not over-wet the surfaces being cleaned. Excessive damp could get into the seams and padded interior causing stains, offensive odours or even rot. If the inside of the vehicle gets wet accidentally it is worthwhile taking some trouble to dry it out properly, particularly where carpets are involved. *Do not leave oil or electric heaters inside the vehicle for this purpose.*

4 Minor body damage – repair

The photographic sequences on pages 222 and 223 illustrate the operations detailed in the following sub-sections.

Repair of minor scratches in bodywork

If the scratch is very superficial, and does not penetrate to the metal of the bodywork, repair is very simple. Lightly rub the area of the scratch with a paintwork renovator, or a very fine cutting paste, to remove loose paint from the scratch and to clear the surrounding bodywork of wax polish. Rinse the area with clean water.

Apply touch-up paint to the scratch using a fine paint brush; continue to apply fine layers of paint until the surface of the paint in the scratch is level with the surrounding paintwork. Allow the new paint at least two weeks to harden: then blend it into the surrounding paintwork by rubbing the scratch area with a paintwork renovator or a very fine cutting paste. Finally, apply wax polish.

Where the scratch has penetrated right through to the metal of the bodywork, causing the metal to rust, a different repair technique is required. Remove any loose rust from the bottom of the scratch with a penknife, then apply rust inhibiting paint to prevent the formation of rust in the future. Using a rubber or nylon applicator fill the scratch with bodystopper paste. If required, this paste can be mixed with cellulose thinners to provide a very thin paste which is ideal for filling narrow scratches. Before the stopper-paste in the scratch hardens, wrap a piece of smooth cotton rag around the top of a finger. Dip the finger in cellulose thinners and then quickly sweep it across the surface of the stopper-paste in the scratch; this will ensure that the surface of the stopper-paste is slightly hollowed. The scratch can now be painted over as described earlier in this Section.

Repair of dents in bodywork

When deep denting of the vehicle's bodywork has taken place, the first task is to pull the dent out, until the affected bodywork almost 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 reshaped fully to its original contour. It is better to bring the level of the dent up to a point which is about $\frac{1}{8}$ in (3 mm) below the level of the surrounding bodywork. In cases where the dent is very shallow anyway, 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. Whilst doing this, hold a suitable block of wood firmly against the outside of the panel to absorb the impact from the hammer blows and thus prevent a large area of the bodywork from being 'belled-out'.

Should the dent be in a section of the bodywork which has a double skin or some other factor making it inaccessible from behind, a different technique is called for. Drill several small holes through the metal inside the area – particularly in the deeper section. Then screw long self-tapping screws into the holes just sufficiently for them to gain a good purchase in the metal. Now the dent can be pulled out by pulling on the protruding heads of the screws with a pair of 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' bodywork. This is accomplished most easily by using a wire brush or abrasive pad on a power drill, although it can be done just as effectively by hand using sheets of abrasive paper. To complete the preparation for filling, score the surface of the bare metal with a screwdriver or the tang of a file, or alternatively, drill small holes in the affected area. This will provide a really good 'key' for the filler paste.

To complete the repair see the Section on filling and re-spraying.

Repair of rust holes or gashes in bodywork

Remove all paint from the affected area and from an inch or so of the surrounding 'sound' bodywork, using an abrasive pad or a wire brush on a power drill. If these are not available a few sheets of abrasive paper will do the job just as effectively. With the paint removed you will be able to gauge the severity of the corrosion and therefore decide whether to renew the whole panel (if this is 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 satisfactory to fit a new panel than to attempt to repair large areas of corrosion.

Remove all fittings from the affected area except those which will act as a guide to the original shape of the damaged bodywork (eg headlamp shells etc). Then, using tin snips or a hacksaw blade, remove all loose metal and any other metal badly affected by corrosion. Hammer the edges of the hole inwards in order to create a slight depression for the filler paste.

Wire brush the affected area to remove the powdery rust from the surface of the remaining metal. Paint the affected area with rust inhibiting paint; if the back of the rusted area is accessible treat this also.

Before filling can take place it will be necessary to block the hole in some way. This can be achieved by the use of zinc gauze or aluminium tape.

Zinc gauze is probably the best material to use for a large hole. Cut a piece to the approximate size and shape of the hole to be filled, then position it in the hole so that its edges are below the level of the surrounding bodywork. It can be retained in position by several blobs of filler paste around its periphery.

Aluminium tape should be used for small or very narrow holes. Pull a piece off the roll and trim it to the approximate size and shape required, then pull off the backing paper (if used) and stick the tape over the hole; it can be overlapped if the thickness of one piece is insufficient. Burnish down the edges of the tape with the handle of a screwdriver or similar, to ensure that the tape is securely attached to the metal underneath.

Bodywork repairs – filling and re-spraying

Before using this Section, see the Sections on dent, deep scratch, rust holes and gash repairs.

Many types of bodyfiller are available, but generally speaking those proprietary kits which contain a tin of filler paste and a tube of resin hardener are best for this type of repair. A wide, flexible plastic or nylon applicator will be found invaluable for imparting a smooth and well contoured finish to the surface of the filler.

Mix up a little filler on a clean piece of card or board – measure the hardener carefully (follow the maker's instructions on the pack) otherwise the filler will set too rapidly or too slowly.

Using the applicator apply the filler paste to the prepared area; draw the applicator across the surface of the filler to achieve the correct contour and to level the filler surface. As soon as a contour that approximates to the correct one is achieved, stop working the paste – if you carry on too long the paste will become sticky and begin to 'pick up' on the applicator. Continue to add thin layers of filler paste at twenty-minute intervals until the level of the filler is just proud of the surrounding bodywork.

Once the filler has hardened, excess can be removed using a metal plane or file. From then on, progressively finer grades of abrasive paper should be used, starting with a 40 grade production paper and finishing with 400 grade wet-and-dry paper. Always wrap the abrasive paper around a flat rubber, cork, or wooden block – otherwise the surface of the filler will not be completely flat. During the smoothing of the filler surface the wet-and-dry paper should be periodically rinsed in water. This will ensure that a very smooth finish is imparted to the filler at the final stage.

At this stage the 'dent' should be surrounded by a ring of bare metal, which in turn should be encircled by the finely 'feathered' edge of the good paintwork. Rinse the repair area with clean water, until all of the dust produced by the rubbing-down operation has gone.

Spray the whole repair area with a light coat of primer – this will show up any imperfections in the surface of the filler. Repair these imperfections with fresh filler paste or bodystopper, and once more smooth the surface with abrasive paper. If bodystopper is used, it can be mixed with cellulose thinners to form a really thin paste which is ideal for filling small holes. Repeat this spray and repair procedure until you are satisfied that the surface of the filler, and the feathered edge of the paintwork are perfect. Clean the repair area with clean water and allow to dry fully.

The repair area is now ready for final spraying. Paint spraying must be carried out in a warm, dry, windless and dust free atmosphere. This condition can be created artificially 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 atmosphere. If the repair area is confined to one body panel, mask off the surrounding panels; this will help to minimise the effects of a slight mis-match in paint colours. Bodywork fittings (eg chrome strips, door handles etc) will also need to be masked off. Use genuine masking tape and several thicknesses of newspaper for the masking operations.

Before commencing to spray, agitate the aerosol can thoroughly, then spray a test area (an old tin, or similar) 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 paint rather than one thick one. Using 400 grade wet-and-dry paper, rub down the surface of the primer until it is really smooth. While doing this, the work area should be thoroughly doused with water, and the wet-and-dry paper periodically rinsed in water. Allow to dry before spraying on more paint.

Spray on the top coat, again building up the thickness by using several thin layers of paint. Start spraying in the centre of the repair area and then, using a circular motion, work outwards until the whole repair area and about 2 inches of the surrounding original paintwork is covered. Remove all masking material 10 to 15 minutes after spraying on the final coat of paint.

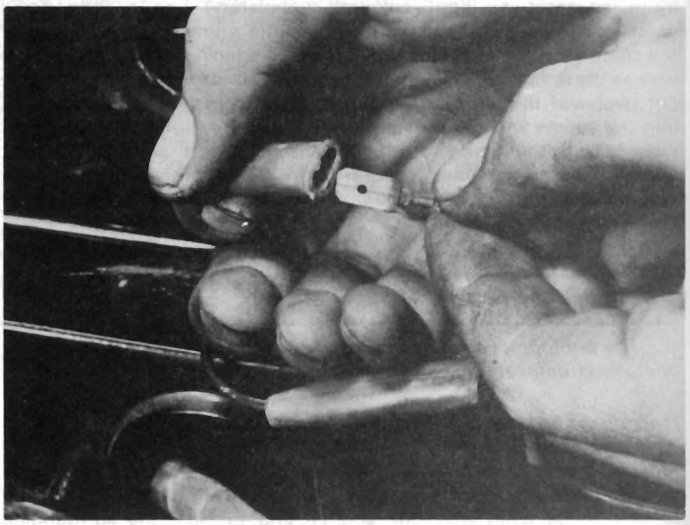
Allow the new paint at least two weeks to harden, then, using a paintwork renovator or a very fine cutting paste, blend the edges of the paint into the existing paintwork. Finally, apply wax polish.

5 Major body damage – repair

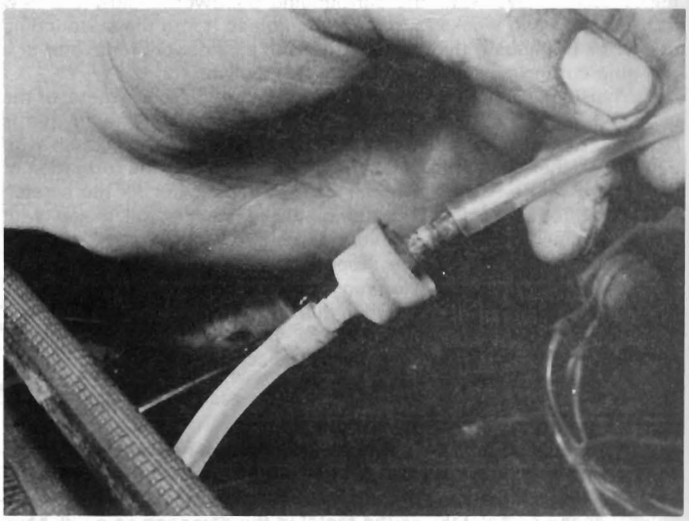
Where serious damage has occurred or large areas need renewal due to neglect, which means certainly that completely new sections or panels will need welding in, this is best left to professionals. If the damage is due to impact it will also be necessary to completely check the alignment of the bodyshell or chassis frame. The services of an Alfa Romeo dealer with specialist checking jigs are essential. If a body or chassis frame is left misaligned it is first of all dangerous, as the car will not handle properly and secondly, uneven stresses will be imposed on the steering, engine and transmission causing abnormal wear or complete failure. Tyre wear may also be excessive.

6 Bonnet – removal and refitting

1 Open the bonnet and disconnect the leads from the engine compartment inspection lamp (photo).
2 Disconnect the windscreen washer tube (photo).
3 Have an assistant support the bonnet while the hinge bolts are



6.1 Disconnecting engine compartment lamp leads



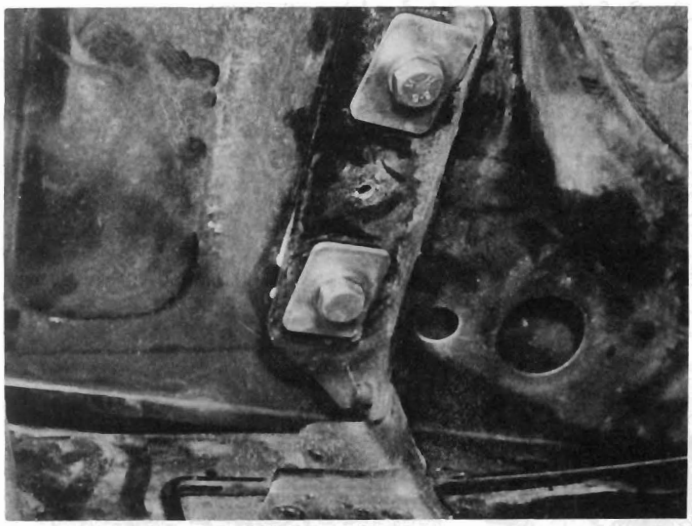
6.2 Disconnecting windscreen washer tube at non-return valve

unscrewed. Remove the packing shims from the hinges, noting their locations (photos).

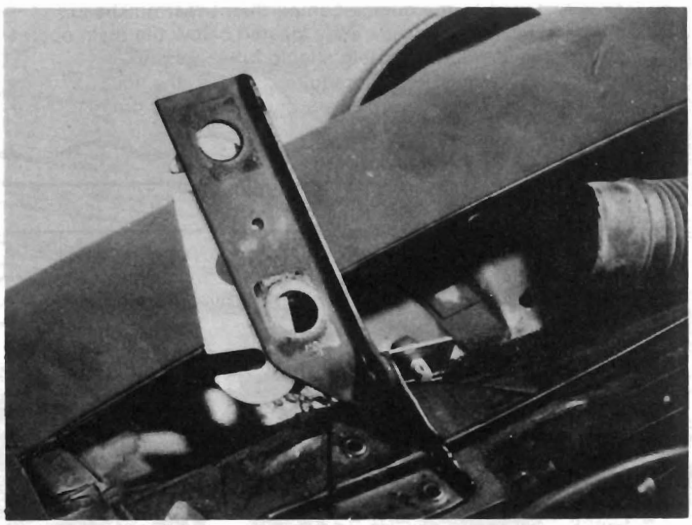
4 Lift the bonnet from the car and store it in a safe place.

5 Refitting is a reversal of removal, but leave the hinge bolts untightened until the bonnet has been partially closed to check its alignment. Where necessary, adjust the bonnet within the tolerance provided at the hinge bolt holes, then fully tighten the bolts. The position of the lock striker may need slight adjustment to compensate.

6 The hinges are riveted to the crossmember and the rivets will have to be drilled out to remove a hinge.



6.3a Bonnet hinge



6.3b Bonnet hinge with packing shim

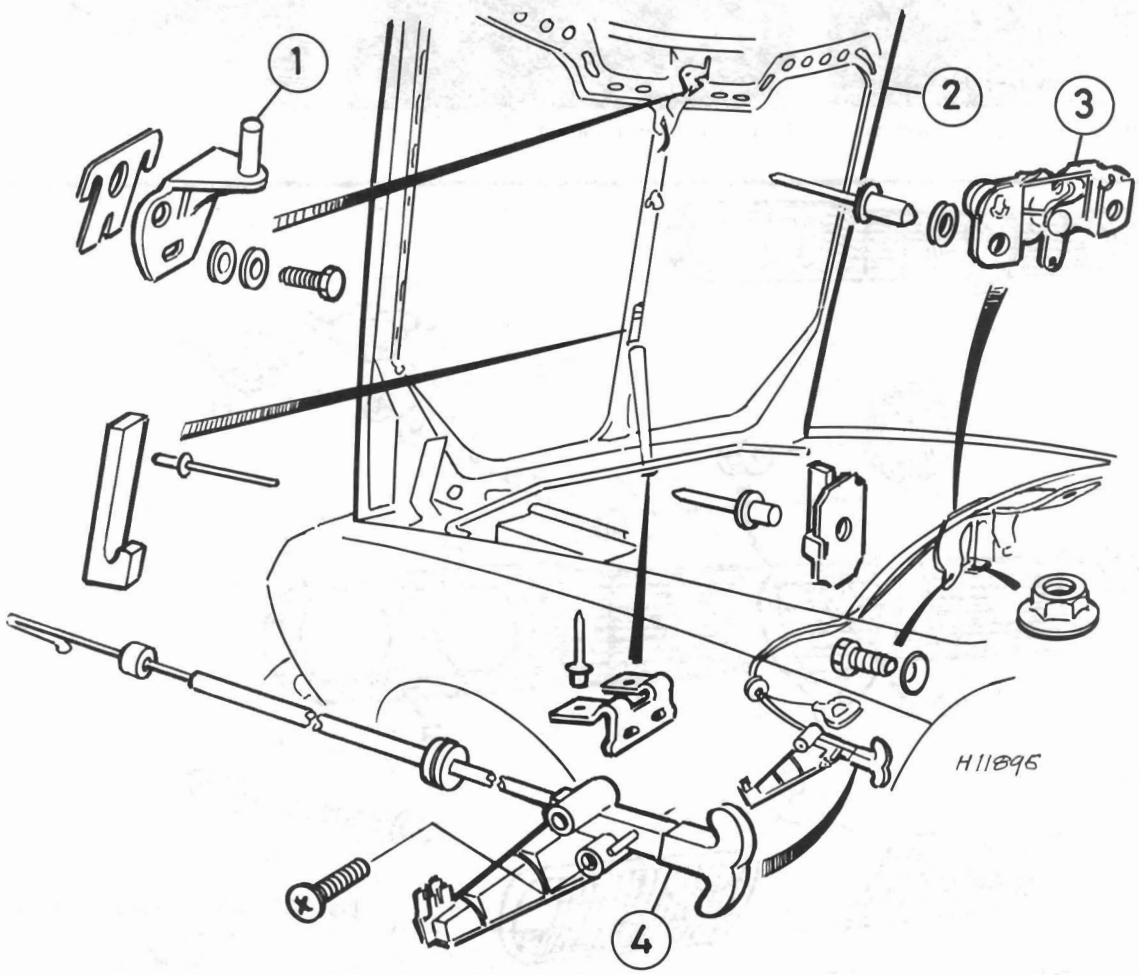


Fig. 12.1 Bonnet lid and release components (Sec 6)

1 Striker 2 Bonnet 3 Lock 4 Bonnet lock release

7 Bonnet release – removal and refitting

1 The bonnet release is of cable-operated remote control type. The control lever is located under the lower edge of the facia panel, while the lock is fastened to the engine compartment rear bulkhead.
2 An emergency cable is separately located below the main operating cable for use if the main cable should break (photo).
3 No adjustment is normally required, but if the lock is to be renewed due to wear, the fixing rivets must be drilled out.

8 Radiator grille – removal and refitting

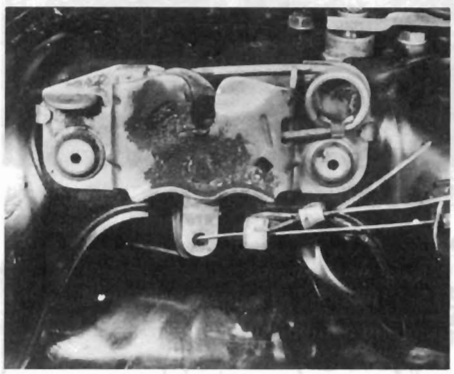
1 The radiator grille is held in position by pop rivets which will have to be drilled out for removal. Refer to Fig. 12.2 for further details.
2 Refitting is a reversal of removal. Use new rivets, or small nuts and bolts.

9 Bumpers (except N America) – removal and refitting

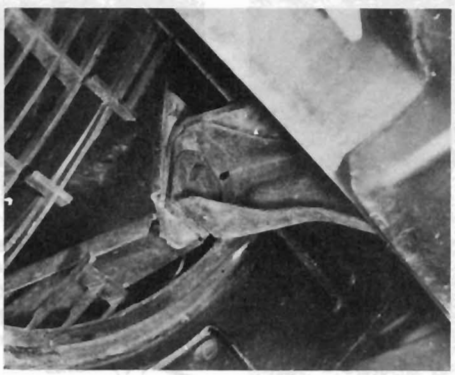
1 This is simply a matter of unbolting the bumper bars from their body brackets and removing them (photo).
2 On Saloon versions when removing the rear bumper, remember to disconnect the leads from the rear number plate lamps.

10 Bumpers (N America) – removal and refitting

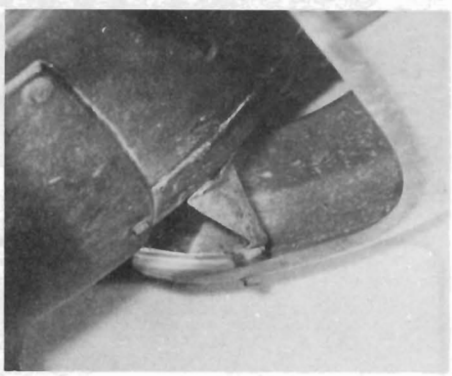
1 Impact resistant bumpers are fitted to these models.
2 To remove such a bumper, unbolt it from the shock absorber telescopic tubes and lift it away.
3 If the shock absorber tubes themselves must be removed, unbolt them from the body members.
4 Refitting is a reversal of removal, but before tightening the nuts and bolts fully, check the bumper bar for alignment both in the vertical and horizontal planes.



7.2 Bonnet lock showing cable connections



9.1a Front bumper bracket



9.1b Bumper corner bracket

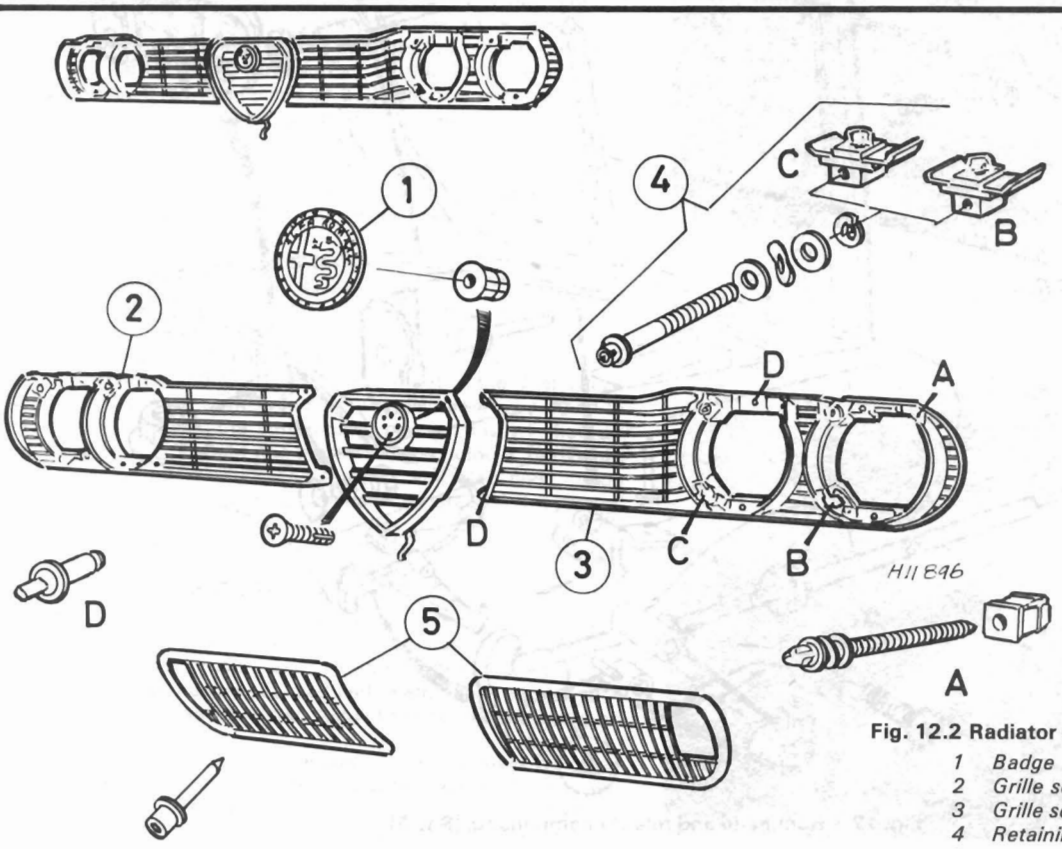


Fig. 12.2 Radiator grille components (Sec 8)

1 Badge
2 Grille section (RH)
3 Grille section (LH)
4 Retaining screw and clip
5 Lower grille

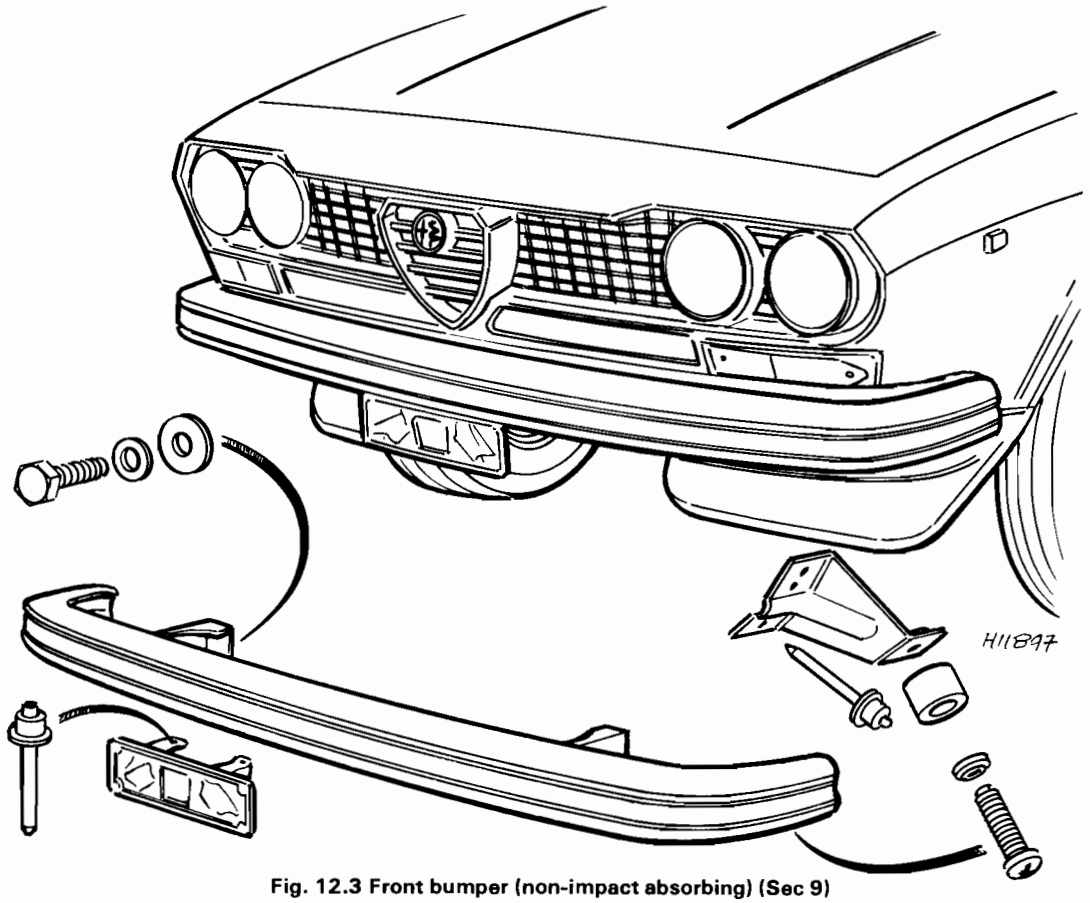


Fig. 12.3 Front bumper (non-impact absorbing) (Sec 9)

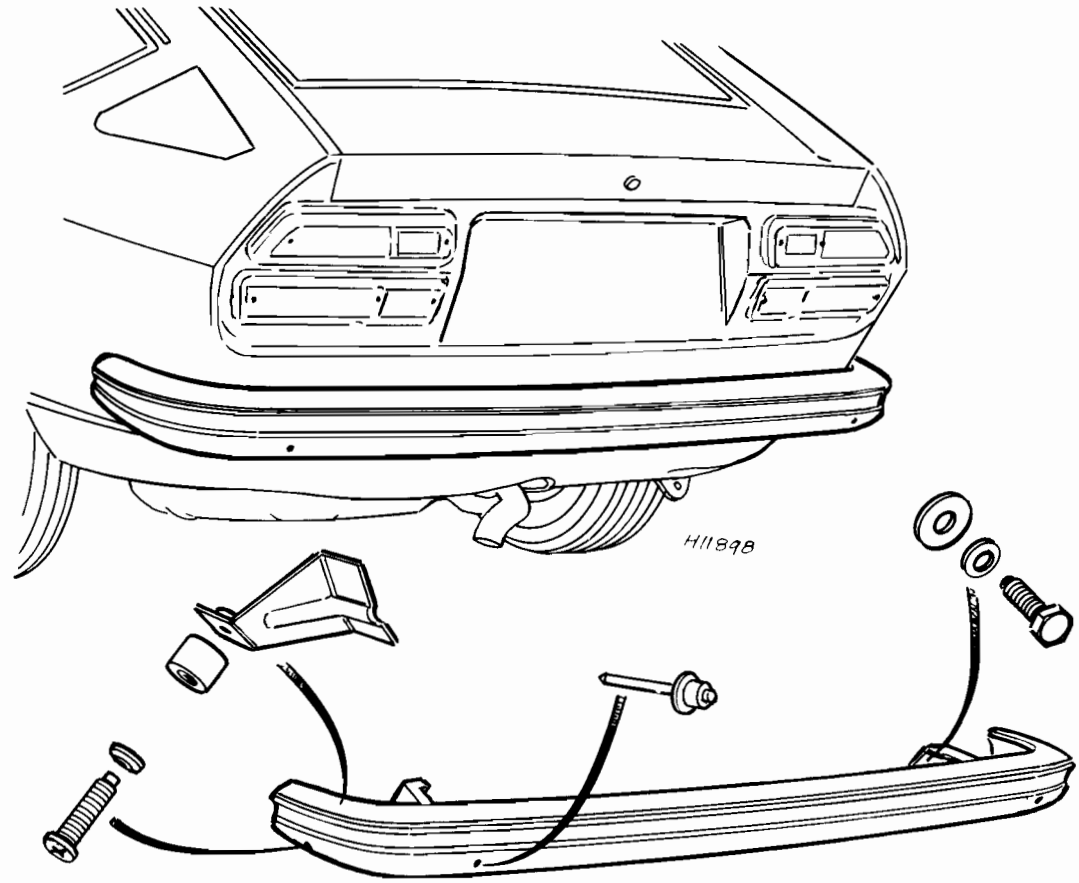


Fig. 12.4 Rear bumper (non-impact absorbing) (Sec 9)

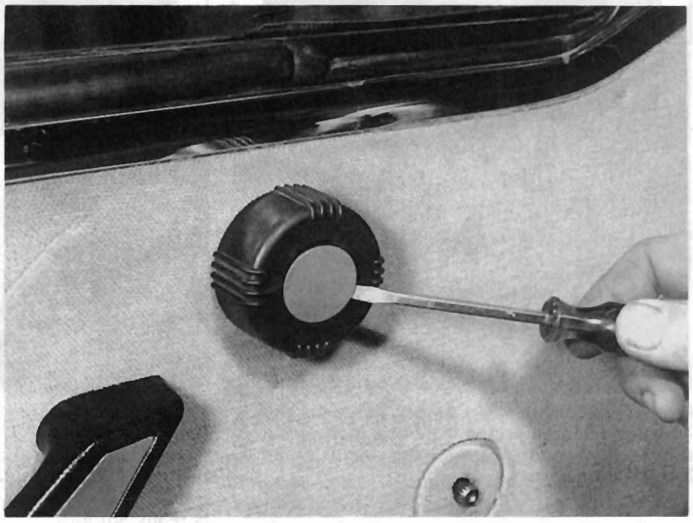
11 Door trim panel – removal and refitting

Front door

1 Prise out the blanking plug from the quarter ventilator control knob (photo).
2 Remove the screw which is now exposed and pull off the knob. Remove the window winder handle in a similar way (photos).
3 Unscrew and remove the screws which secure the armrest. On some models access to these screws is obtained by prising out the blanking plate (photos).
4 Remove the door remote control lock lever escutcheon panel and the lock plunger knob (photos).
5 Remove the door interior trim panel screws.
6 Remove the trim panel and peel off the waterproof sheet (photos).
7 Refitting is a reversal of removal.

Rear door

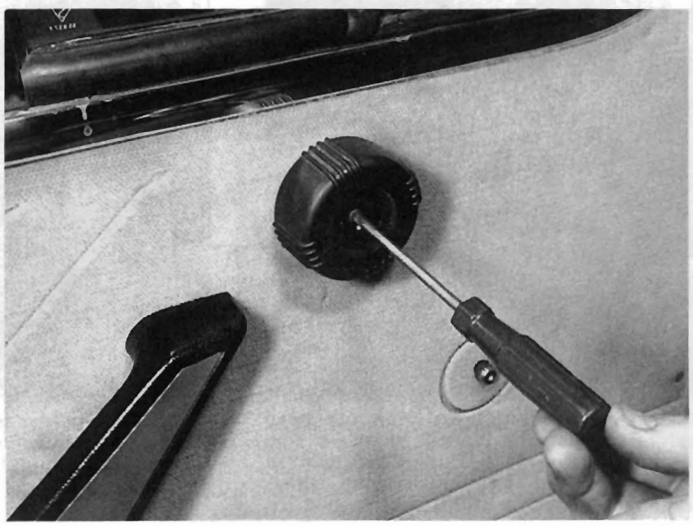
8 The operations are similar to those just described except that there is no ventilator control knob, the quarter window being fixed.



11.1 Removing blanking plate from quarter ventilator control handle

12 Door lock – removal and refitting

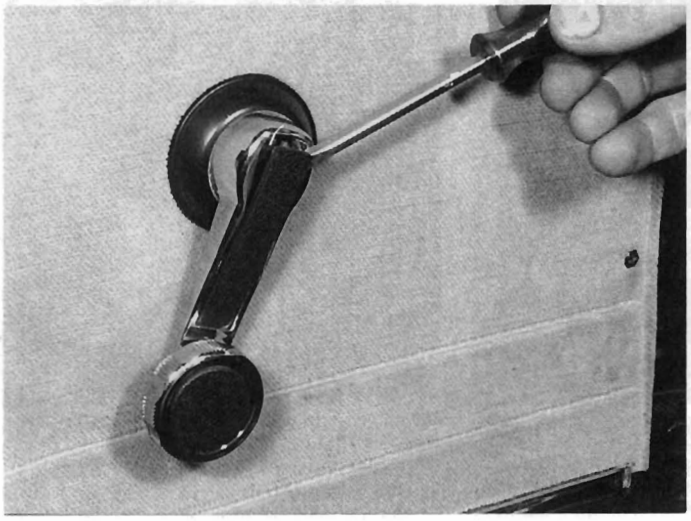
1 Wind the window fully up.
2 Remove the door interior trim panel as described in the preceding Section.
3 The lock can be released by extracting the screws which secure it to the edge of the door.
4 Insert the hand through the aperture in the door panel and manoeuvre the lock so that the link control rods can be detached from it. Withdraw the lock from the door cavity.
5 If the lock is faulty, it should be renewed complete.
6 If the exterior handle must be removed, then the fixing nuts will have to be unscrewed from inside the door cavity.
7 The remote control handle is riveted to the door and its removal will mean drilling out the rivets.
8 Refitting of all components is a reversal of removal. Note the child safety lock lever on the rear doors of Saloon models.



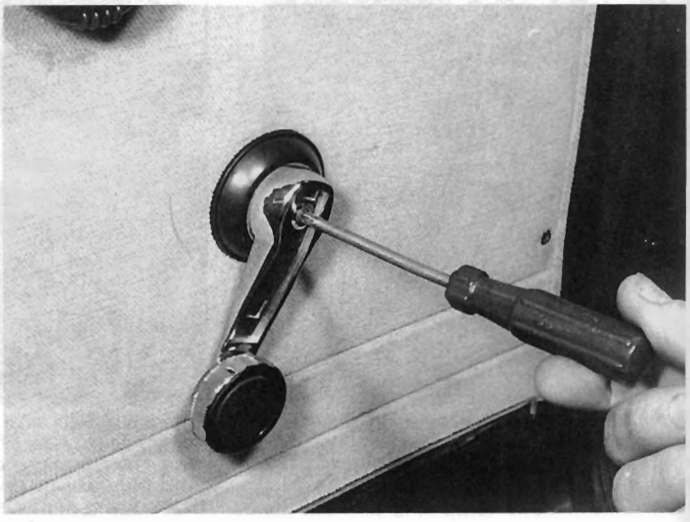
11.2a Extracting control handle screw

13 Door window winder mechanism – removal and refitting

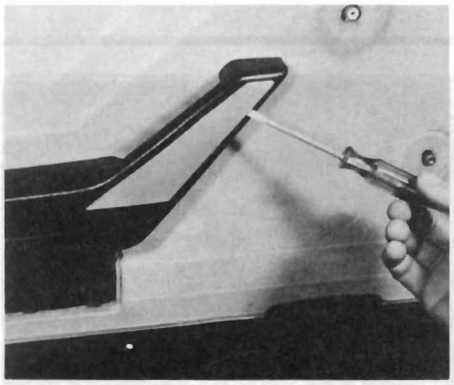
1 The window control mechanism is of cable-operated type, and removal and refitting is recommended as a job best left to your dealer due to the difficulty of correct adjustment. However, the procedure is given for those wishing to tackle the work.
2 Remove the door interior trim panel as described in Section 11.



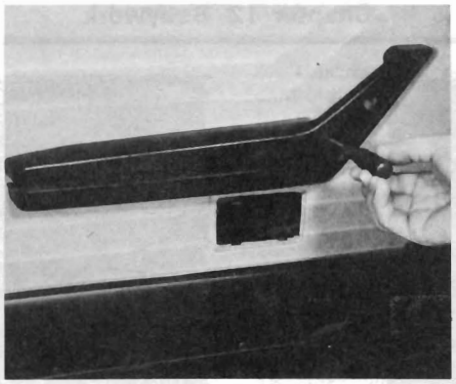
11.2b Prising out blanking strip from window regulator handle



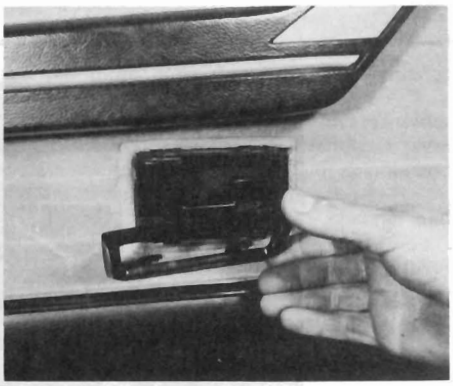
11.2c Extracting regulator handle screw



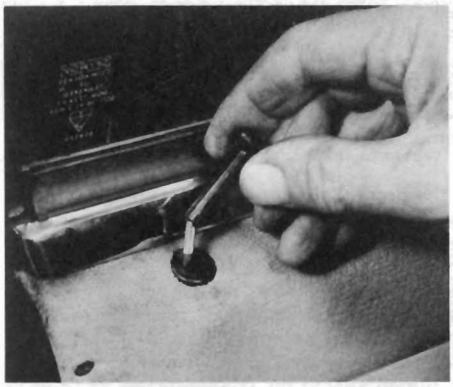
11.3a Prising out armrest blanking plate



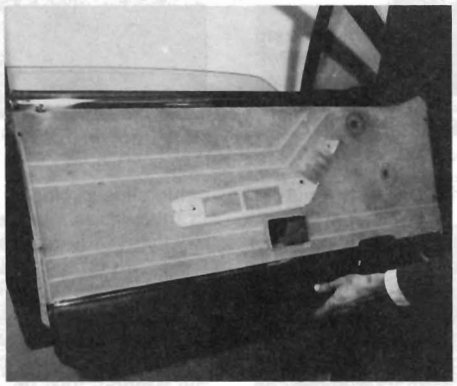
11.3b Extracting armrest screw



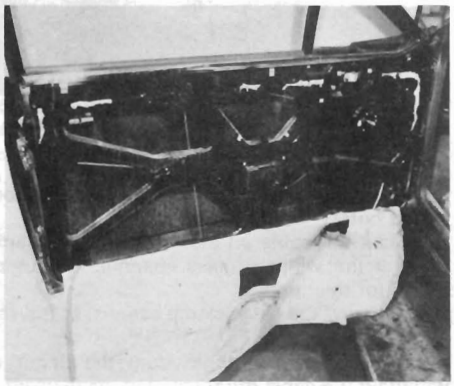
11.4a Removing door lock remote control escutcheon panel



11.4b Removing door lock plunger rod knob



11.6a Removing door trim panel



11.6b Door waterproof sheet removed

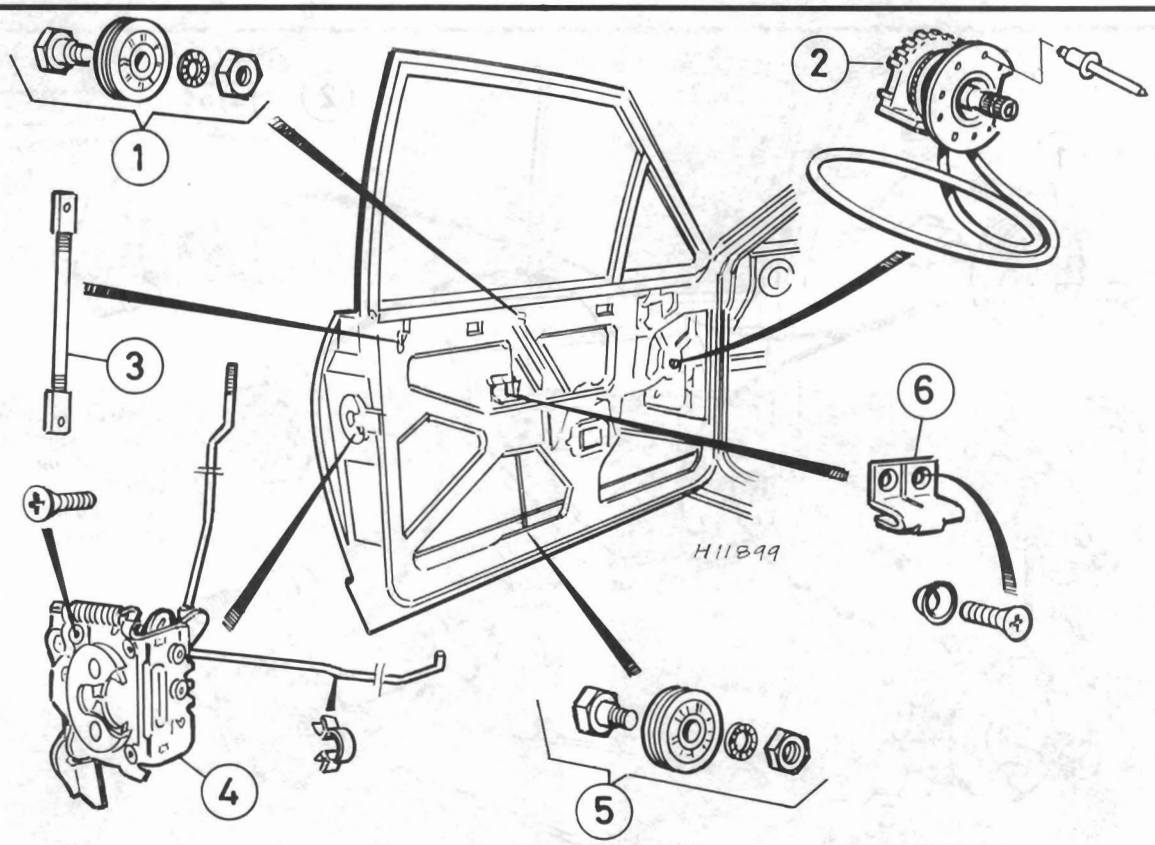


Fig. 12.5 Door lock and window regulator components (front door) (Sec 12)

1 Cable upper pulley 2 Window winder cable drum 3 Control link 4 Lock 5 Cable lower pulley 6 Glass channel cable clamp

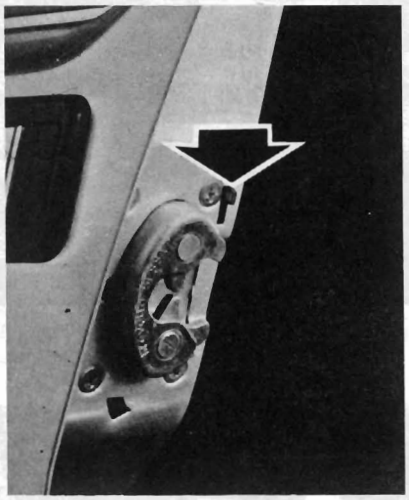
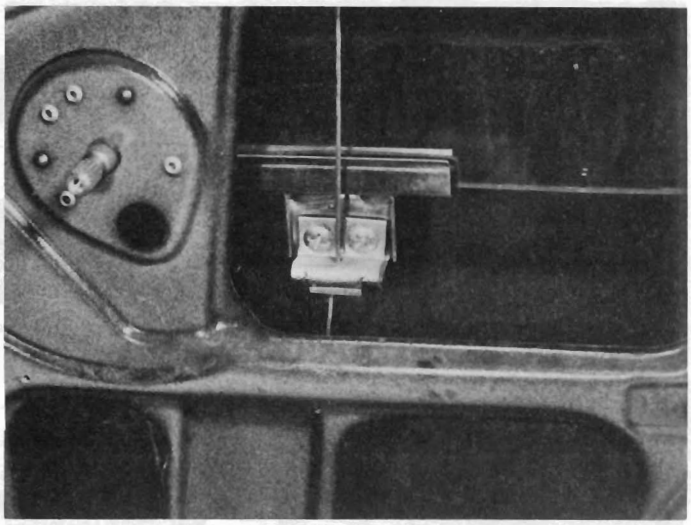


Fig. 12.6 Rear door child safety lock lever (Saloon) (Sec 12)



13.4 Door glass cable clamp

3 The winder mechanism is secured by pop rivets which must be drilled out.
4 Mark the cable on either side of the clamp which holds it at the base of the window glass channel. A spot of quick-drying paint is useful for this (photo).
5 Unscrew the cable clamp screws, at the same time supporting the glass.
6 Slip the control cable from the upper and lower pulleys and withdraw the cable drum winding mechanism. Unbolt and remove the pulleys as necessary.
7 If a new cable/drum assembly is being fitted, it is supplied with the cable clipped closely to the drum. The purpose of retaining the cable in this way is to be able to route the cable over the pulleys and then to align the drum mounting plate with its rivet holes, thus tensioning the cables so that the retaining clip will eventually fly off. It is essential that the correct tensioning is applied to the cables, which should be taut on the drum while the drum mounting plate is riveted in position.
8 Position the glass channel clip on the marked position if the original cable is being refitted. If a new cable has been installed, wind the window fully up and temporarily fit the winder handle and turn it to the end of its travel. Fit and tighten the clamp screws.
9 Check the operation of the winder and then fit the door trim panel.

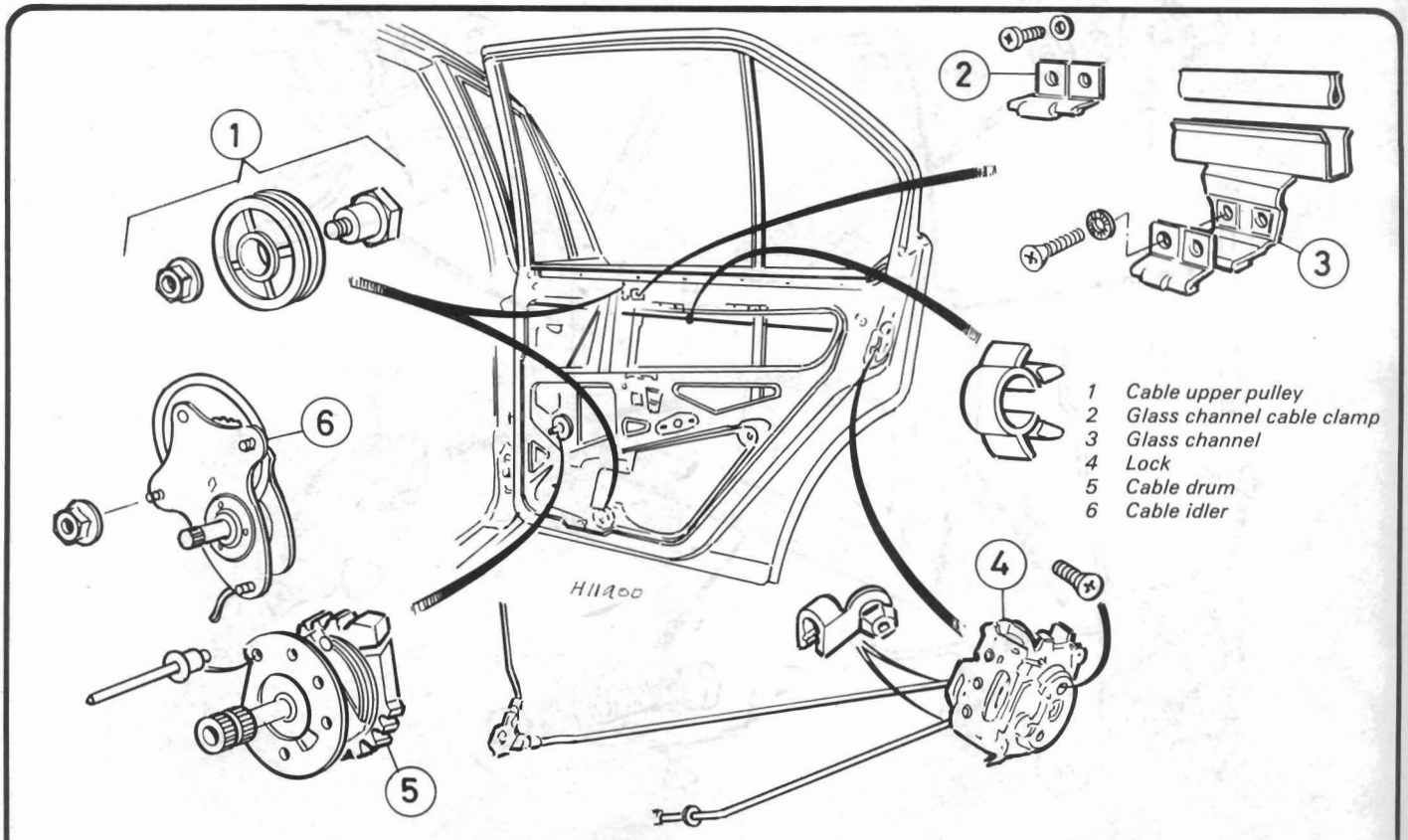


Fig. 12.7 Door lock and window regulator components (rear door – Saloon) (Sec 13)

14 Rear quarter window winder mechanism (Coupe) – removal and refitting

1 Remove the rear seat cushion and back as described in Section 24.
2 Prise out the centre of the window winder control handle and extract the securing screw (photos).
3 Unscrew and remove the panel securing screws and withdraw the trim panel (photo).
4 The control mechanism is riveted to the door panel. If it must be removed, the rivets will have to be drilled out.
5 The mechanism is cable-operated in a similar way to that used for the front door. Reference should be made to the preceding Section for removal, refitting and adjusting details (photo).

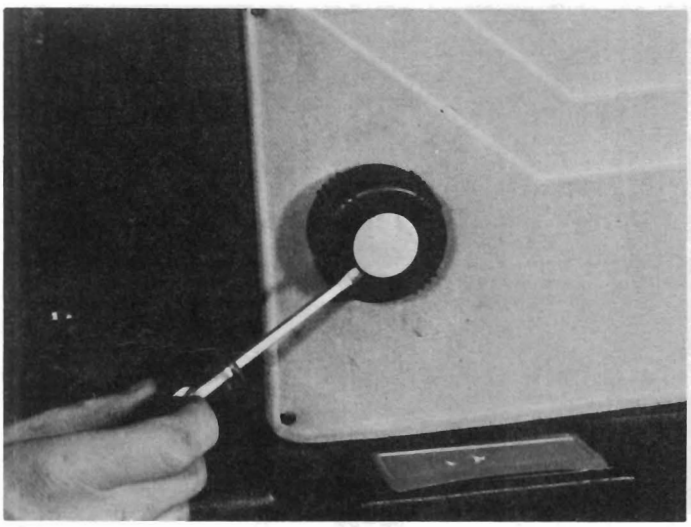
15 Front door ventilator – removal and refitting

1 Wind the main window glass fully down and then remove the door interior trim panel as previously described.
2 Prise up the rubber seal from the top edge of the door to expose two rivets which secure the upper end of the window glass channel.
3 Drill out these rivets and then unscrew the channel lower fixing screws.
4 Unscrew and remove the three bolts that hold the ventilator control mechanisms.
5 Release, but do not remove, the wedge bolt which is located under the mechanism. This will release the stiffness in the ventilator pivot and enable the control mechanism to be slid off the pivot spindle and removed through the aperture in the door panel.
6 Ease out the weatherseal channel, tilt the glass channel and remove the ventilator.
7 Refitting is a reversal of removal. Adjust the tension on the pivot bolt until the ventilator can be swivelled stiffly.

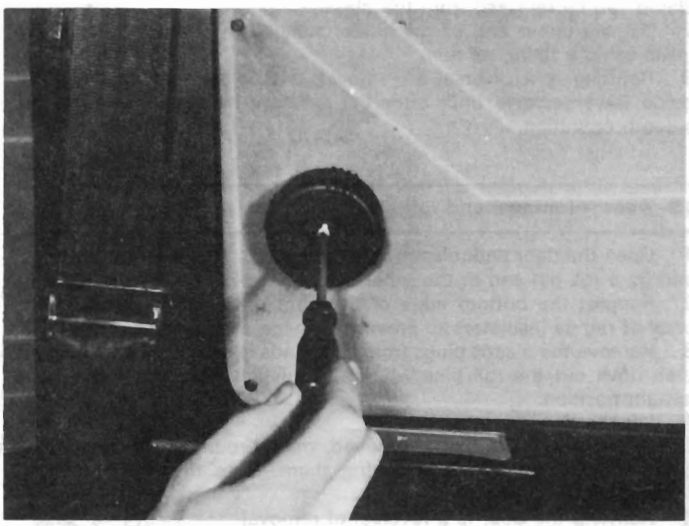
16 Door window glass – removal and refitting

Front door

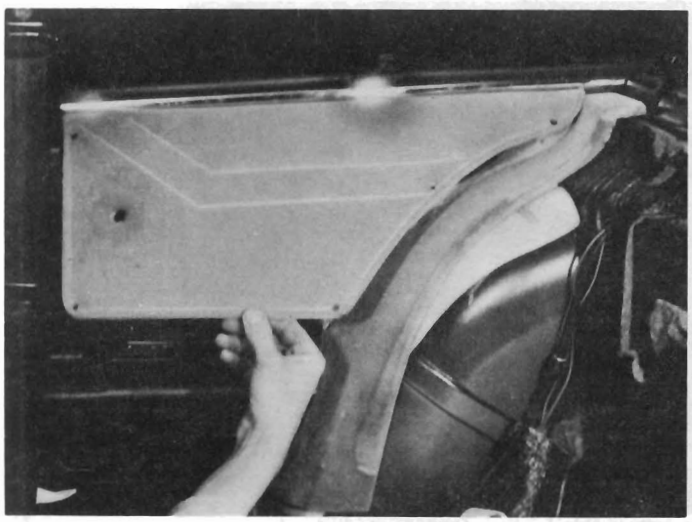
1 Remove the ventilator as described in the preceding Section.
2 Drill out the rivets and remove the inner weatherstrip from the glass slot at the door waist.
3 Extract the screws from the cable clamp at the window glass channel. Support the weight of the glass as the screws are removed and then lift the glass from the door using a tilting action.
4 Refitting is a reversal of removal. Adjust the bottom screws of the glass channel as necessary to ensure smooth motion of the glass as it is wound up and down.



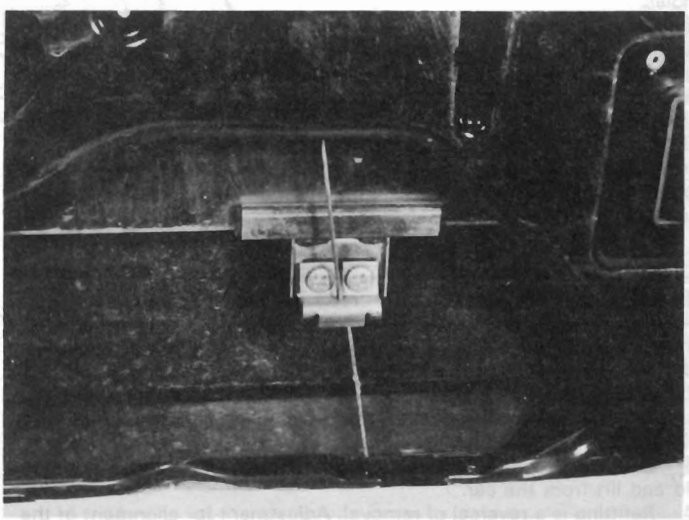
14.2a Rear quarter window regulator blanking plate being removed



14.2b Extracting regulator handle screw



14.3 Removing rear quarter panel



14.5 Rear quarter glass cable clamp

Rear door

5 The operations are similar to those just described for the front door, but before the main glass can be removed, the fixed quarterlight must be withdrawn.
6 Prise up the weatherseal rubber strip from the top edge of the door to expose the rivets which secure the upper end of the glass channel.
7 Drill out the rivets. Unscrew the screws which secure the bottom end of the glass channel, and tilt the channel so that the fixed quarterlight complete with rubber weatherseal can be removed.
8 Refitting is a reversal of removal. Adjust the glass channel before finally tightening the screws at its lower end.

17 Rear quarter window glass (Coupe) – removal and refitting

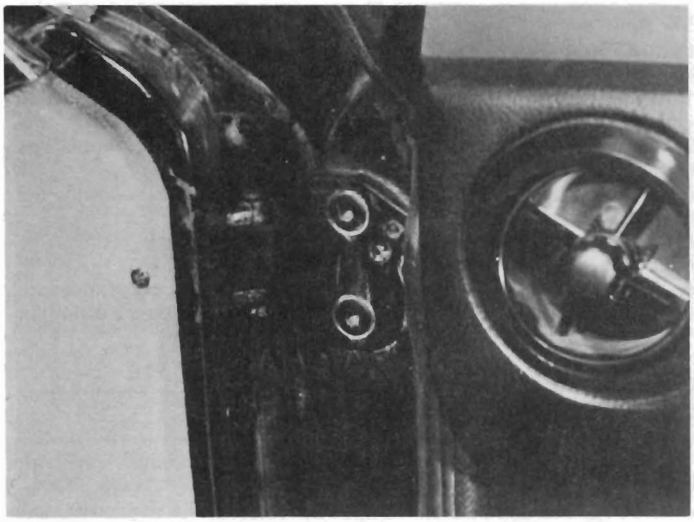
1 Remove the rear seat and the quarter trim panel as described in Sections 14 and 24.
2 Wind the glass fully down.
3 Prise out the weatherseal from the upper end of the window glass channel to reveal the rivets which secure its upper end. Drill out the rivets. Remove the sliding glass inner weatherstrip.
4 Unscrew and remove the screws from the lower end of the guide channel.
5 Tilt the guide channel and remove the fixed glass complete with weatherseal.
6 Straighten the channel and wind the window up until the cable clamp can be released from the glass.
7 Tilt the upper end of the guide channel and remove the sliding glass using a tilting motion.
8 Refitting is a reversal of removal, but do not tighten the glass guide lower screws until after the window has been checked for smooth operation.

18 Door – removal and refitting

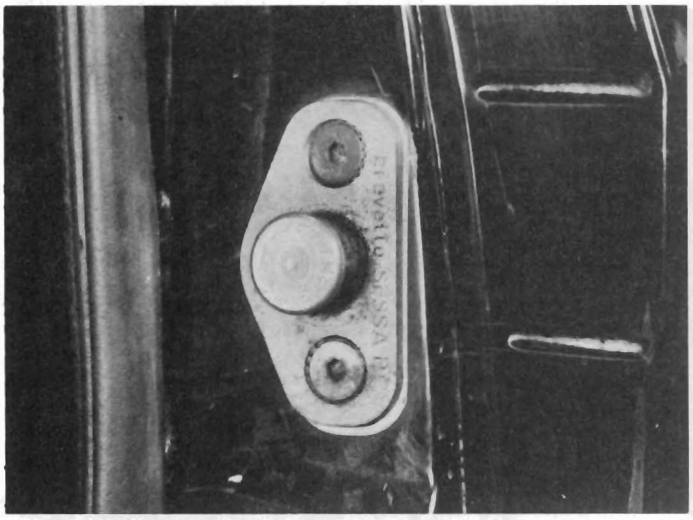
1 Open the door and release the check strap. This is retained at one end by a roll pin and at the other by a bolted-on anchor plate.
2 Support the bottom edge of the door on blocks or jacks, using pads of rag as insulators to prevent damage to the paintwork.
3 Remove the plastic plugs from both ends of the hinge roll pins and then drive out the roll pins while an assistant holds the door in an upright position.
4 Lift the door from the car.
5 If the hinges are to be removed, mark around their edges as a guide for refitting before unbolting them. Note the socket-headed retaining screws (photo).
6 Refitting the door is a reversal of removal.
7 If alignment within the body aperture is not correct with an even gap all round the edge of the door, slightly release the hinge bolts so that the door can be moved within the limits of the hinge plate bolt holes.
8 Close the door gently but before the lock engages with the striker on the door pillar, observe whether the striker is going to pass centrally into the latch jaws of the lock. If not, move the position of the striker after releasing its socket-headed retaining screws with an Allen key (photo).
9 Shims are also available for inserting under the striker if it is necessary to increase its projection from the body pillar. Incorrect projection of the striker will cause the outer rim of the roller to impinge upon the latch jaws, with subsequent damage (photo).

19 Luggage boot lid (Saloon) – removal and refitting

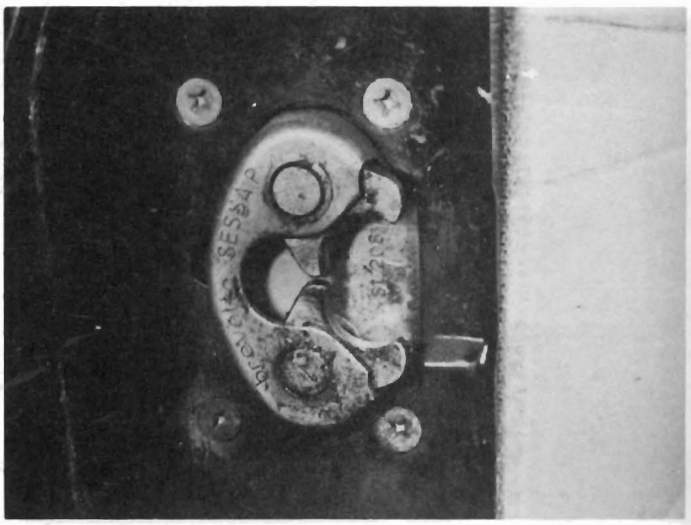
1 Open the lid and mark around the hinge plates on the underside of the boot lid to facilitate refitting.
2 Disconnect the ends of the counterbalance springs from the hinges, and have an assistant support the lid as the springs are released.
3 With the assistant still holding the lid, unbolt the hinges from the lid and lift from the car.
4 Refitting is a reversal of removal. Adjustment for alignment of the lid within the body aperture may be made if the hinge plate bolts are released and the lid moved within the limits of the hinge plate bolt



18.5 Door hinge securing screws



18.8 Door lock striker



18.9 Door lock securing screws

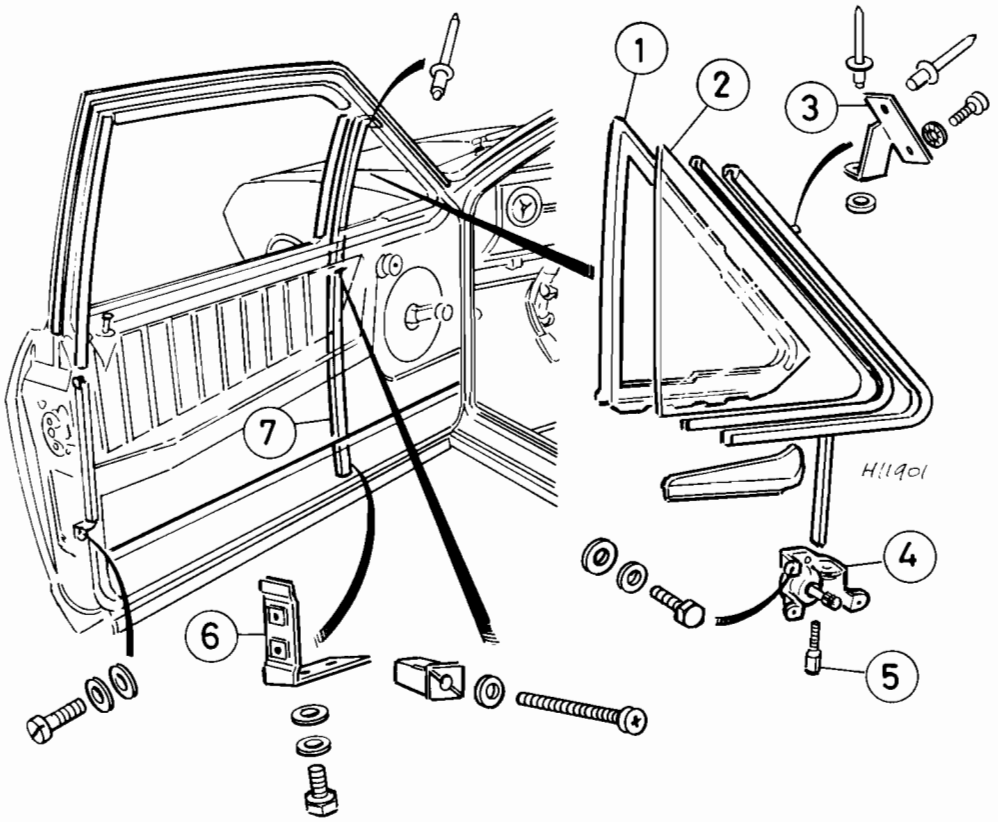


Fig. 12.8 Front door ventilator (Sec 15)

1 Ventilator frame
2 Glass
3 Ventilator hinge
4 Swivel clamp
5 Wedge pinch-bolt
6 Channel lower mounting
7 Glass guide channel

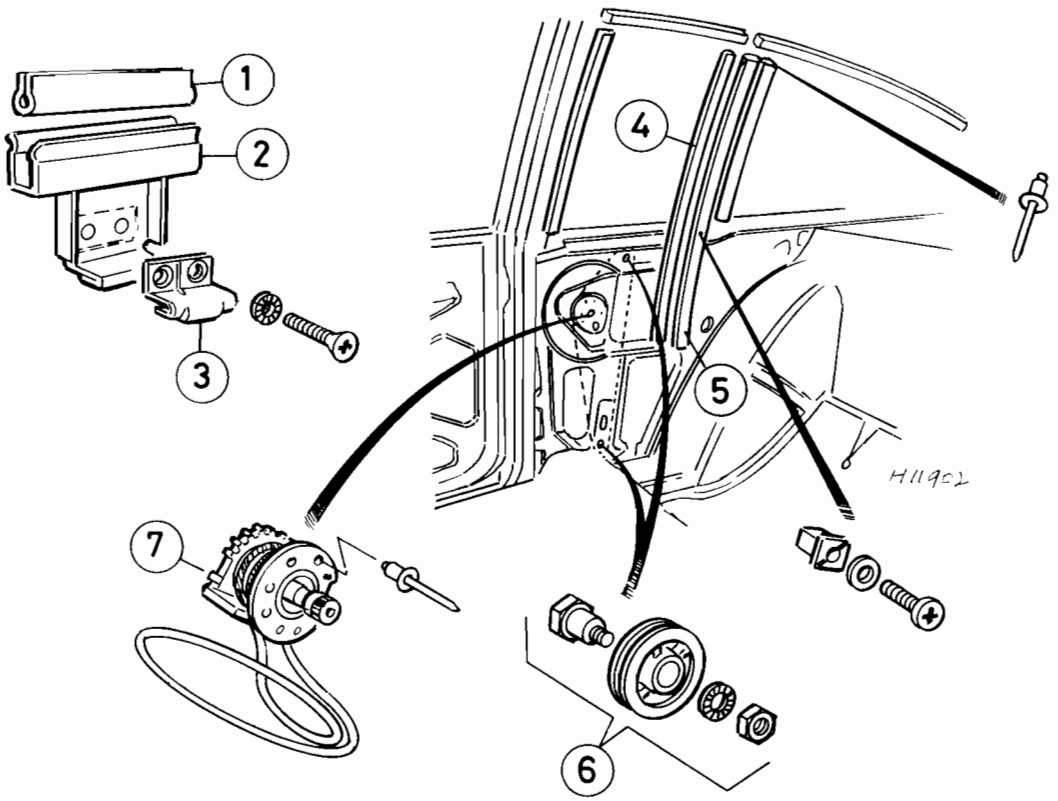


Fig. 12.9 Rear quarter window components (Coupe) (Sec 17)

1 Rubber channel
2 Glass channel
3 Cable clamp
4 Weatherseal
5 Glass guide channel
6 Cable pulley
7 Cable drum

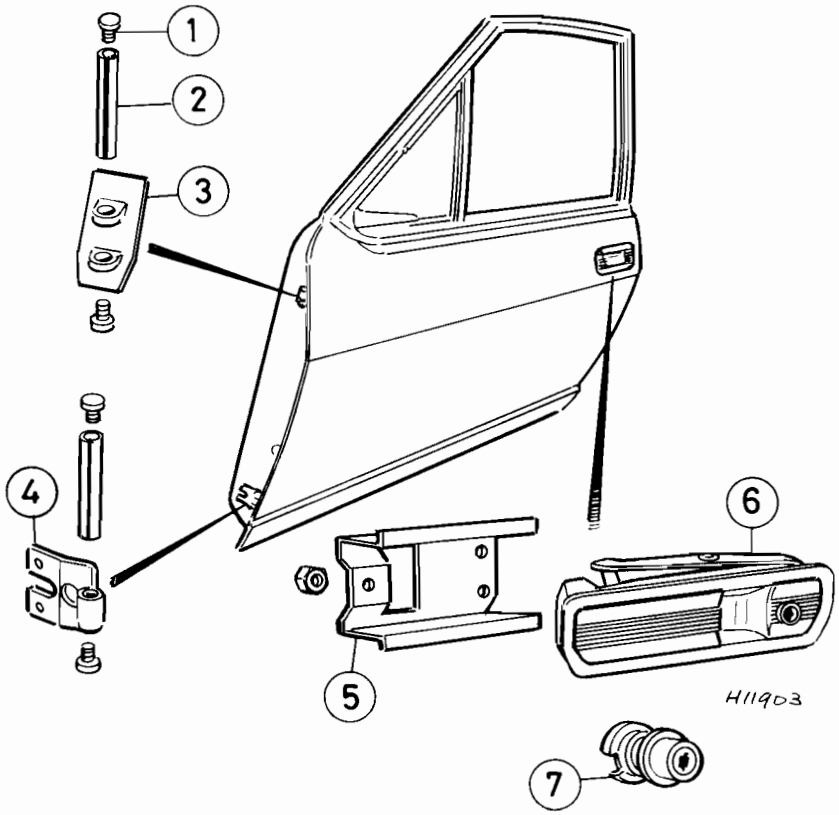


Fig. 12.10 Door components (Sec 18)

1 Plastic cap 3 Hinge plate (upper) 5 Exterior lock casing 7 Lock cylinder
2 Roll pin 4 Hinge plate (lower) 6 Exterior lock

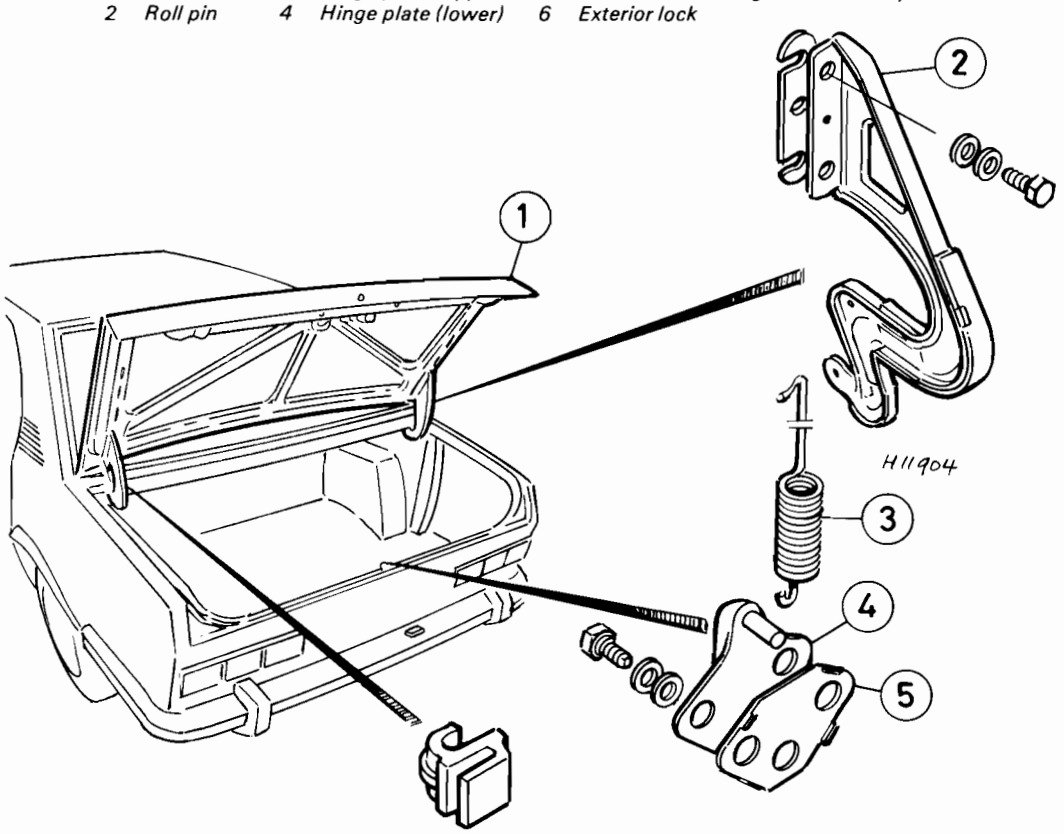


Fig. 12.11 Luggage boot lid components (Sec 19)

1 Lid 2 Hinge 3 Counterbalance spring 4 Lock striker 5 Shim

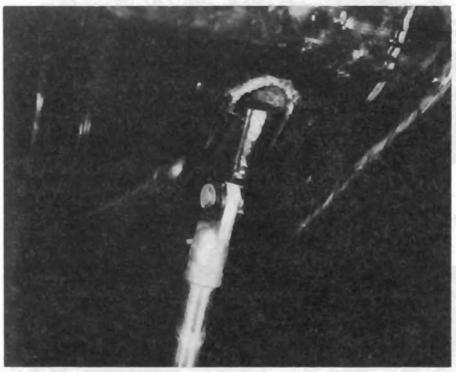
holes. The lock striker may then require repositioning to compensate this adjustment.

20 Tailgate (Coupe) – removal and refitting

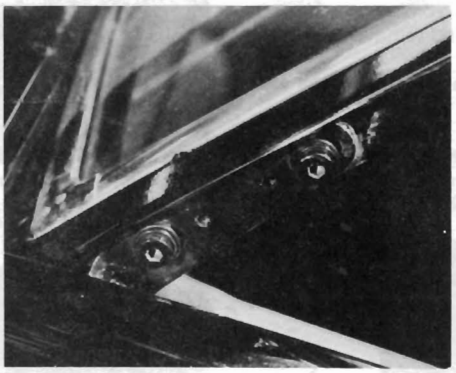
1 Open the tailgate fully and disconnect the electrical leads which run to the heated rear window.
2 With an assistant supporting the weight of the tailgate, disconnect the tailgate strut by extracting the circlip and pivot pin at its upper end (photo).
3 Mark the position of the hinges on the sides of the tailgate and then unbolt the hinges, retaining any alignment shims (photo). Lift the tailgate from the car.
4 Refitting is a reversal of removal. Side-to-side alignment is adjusted by varying the number of shims, whilst fore-and-aft movement can be altered within the limits of the elongated hinge bolt holes.
5 Once alignment of the tailgate is complete, adjust the position of the lock striker, again using shims under its mounting plate if necessary to increase its projection.

21 Luggage boot lid or tailgate lock – removal and refitting

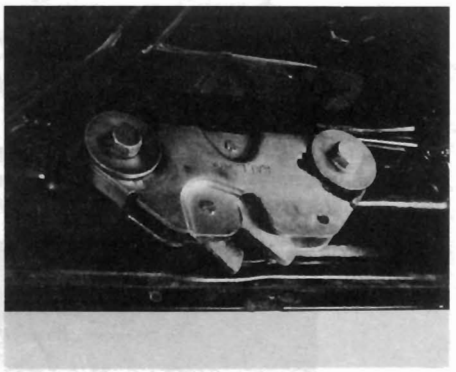
1 In order to remove the luggage boot lid lock from Saloon models, the rivets fixing it must first be removed by drilling them out.
2 On Coupe models, the tailgate lock can be removed simply by unscrewing the fixing bolts (photo).
3 Refitting is a reversal of the removal operations, all adjustment being carried out by the positioning of the striker.



20.2 Tailgate strut connection (Coupe)



20.3 Tailgate hinge (Coupe)



21.1 Tailgate lock (Coupe)

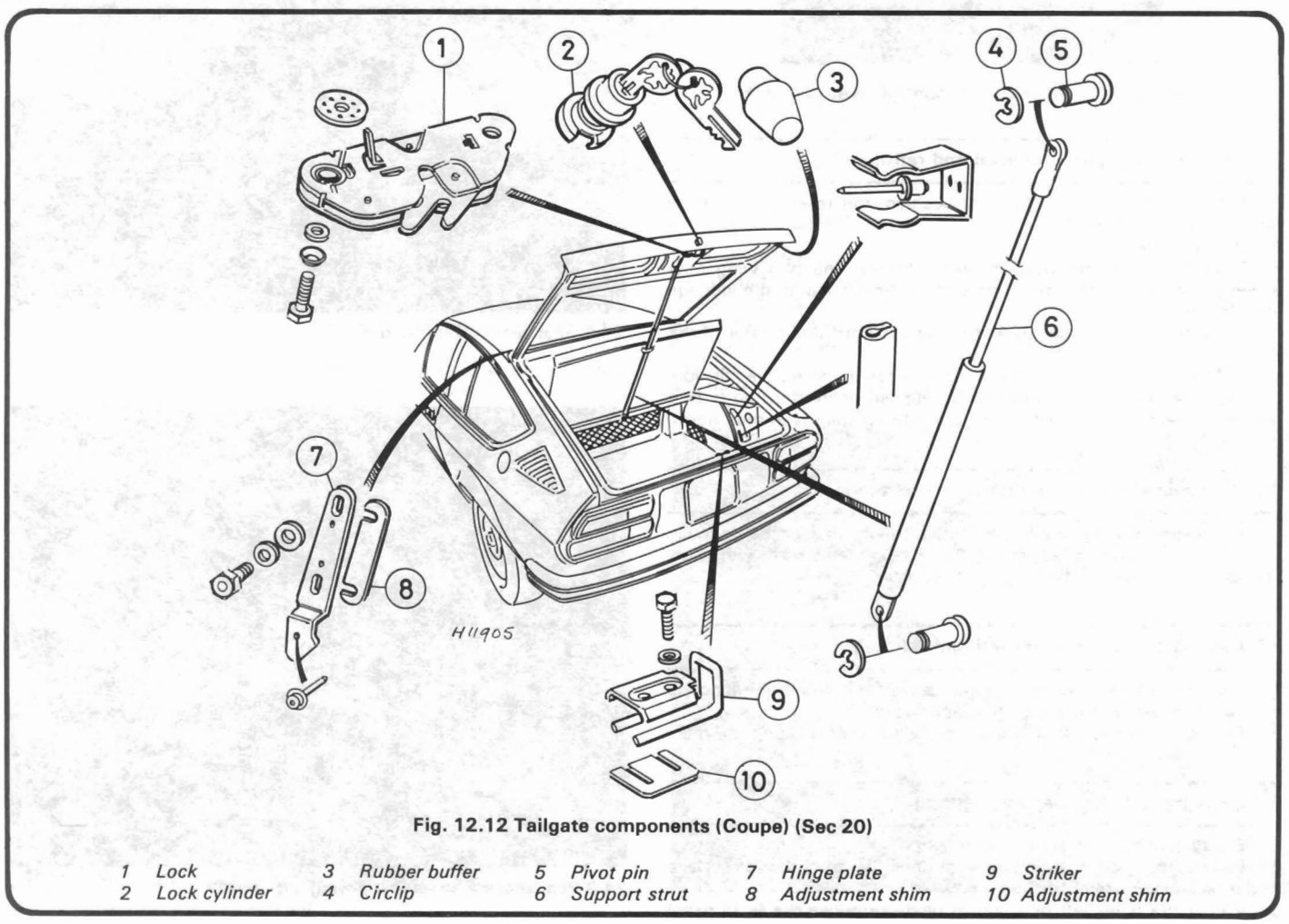


Fig. 12.12 Tailgate components (Coupe) (Sec 20)

1	*Lock*	3	*Rubber buffer*	5	*Pivot pin*	7	*Hinge plate*	9	*Striker*
2	*Lock cylinder*	4	*Circlip*	6	*Support strut*	8	*Adjustment shim*	10	*Adjustment shim*

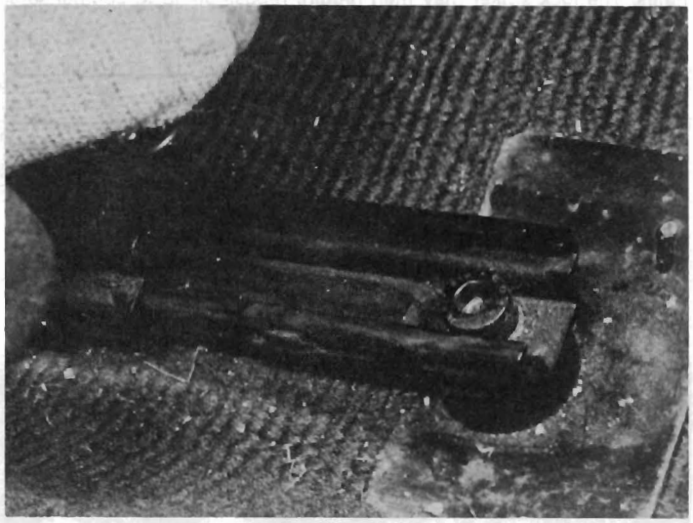
22 Windscreen, back window or tailgate glass – removal and refitting

1 The removal and refitting of this glass is best left to your dealer or windscreen fitting agent.
2 The wide bright trim used on the weatherseal on these models makes fitting very difficult without the special tools.
3 The windscreen is of laminated type and its renewal when cracked is not a matter of urgency but only of convenience.

23 Front seat – removal and refitting

1 The front seats are secured to the floor pan by their slide channels, which in turn are held by socket-headed screws (photo).
2 Push the seat fully to the rear and unscrew and remove the screw from the front end of each slide.
3 Push the seat fully forward and unscrew the screw from the rear end of each slide.
4 Lift the seat from the interior of the car.
5 Refitting is a reversal of removal but before fully tightening the slide channel screws, move the seat fully forwards and backwards two or three times to align the channels, otherwise the seats may be stiff to operate.

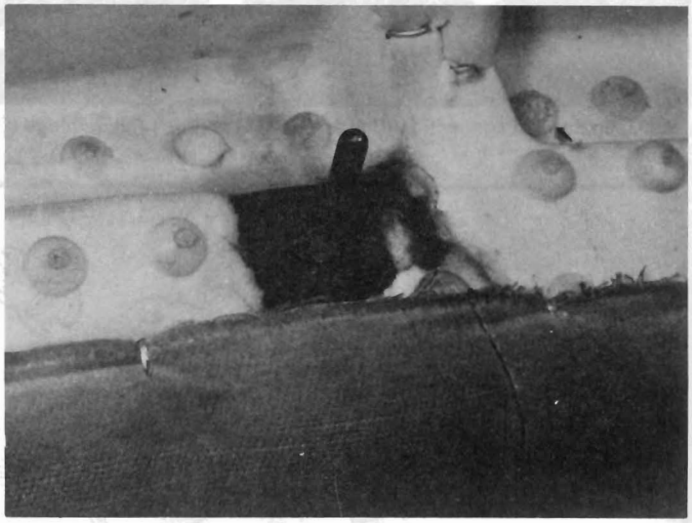
Fig. 12.13 Front seat slide control lever (Sec 23)



23.1 Front seat runner

24 Rear seat (Coupe) – removal and refitting

1 Lift the front edge of the seat cushion and release it from its retaining spigots (photo).
2 Remove the cushion.
3 Working within the luggage area, unscrew the two wing nuts which are located at the top corners of the front panel of the luggage area (photo).
4 Raise the rear seat squab and remove it from the interior of the car.
5 Refitting is a reversal of removal, but when installing the cushion, considerable pressure will have to be applied to its front edge in a rearward direction in order to engage the fixing spigots in their holes.



24.1 Rear seat cushion spigot

25 Rear seat (Saloon) – removal and refitting

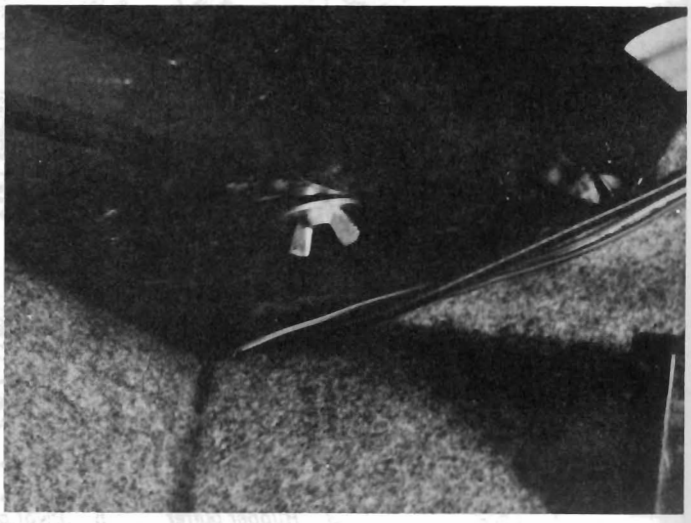
The operations are very similar to those described for the Coupe in the preceding Section, the seat back again being retained by wing nuts accessible from within the luggage boot.

26 Rear parcels shelf – removal and refitting

1 This is retained by wing nuts accessible from within the luggage boot or compartment depending upon model.
2 Removal and refitting are straightforward after undoing the nuts.

27 Facia panel – removal and refitting

1 Disconnect the battery negative lead.
2 Pull out the windscreen demister outlet grilles from the top surface of the facia panel (refer to Chapter 2).
3 Within the holes left by removal of these grilles the facia panel



24.3 Rear seat squab retaining wing nut

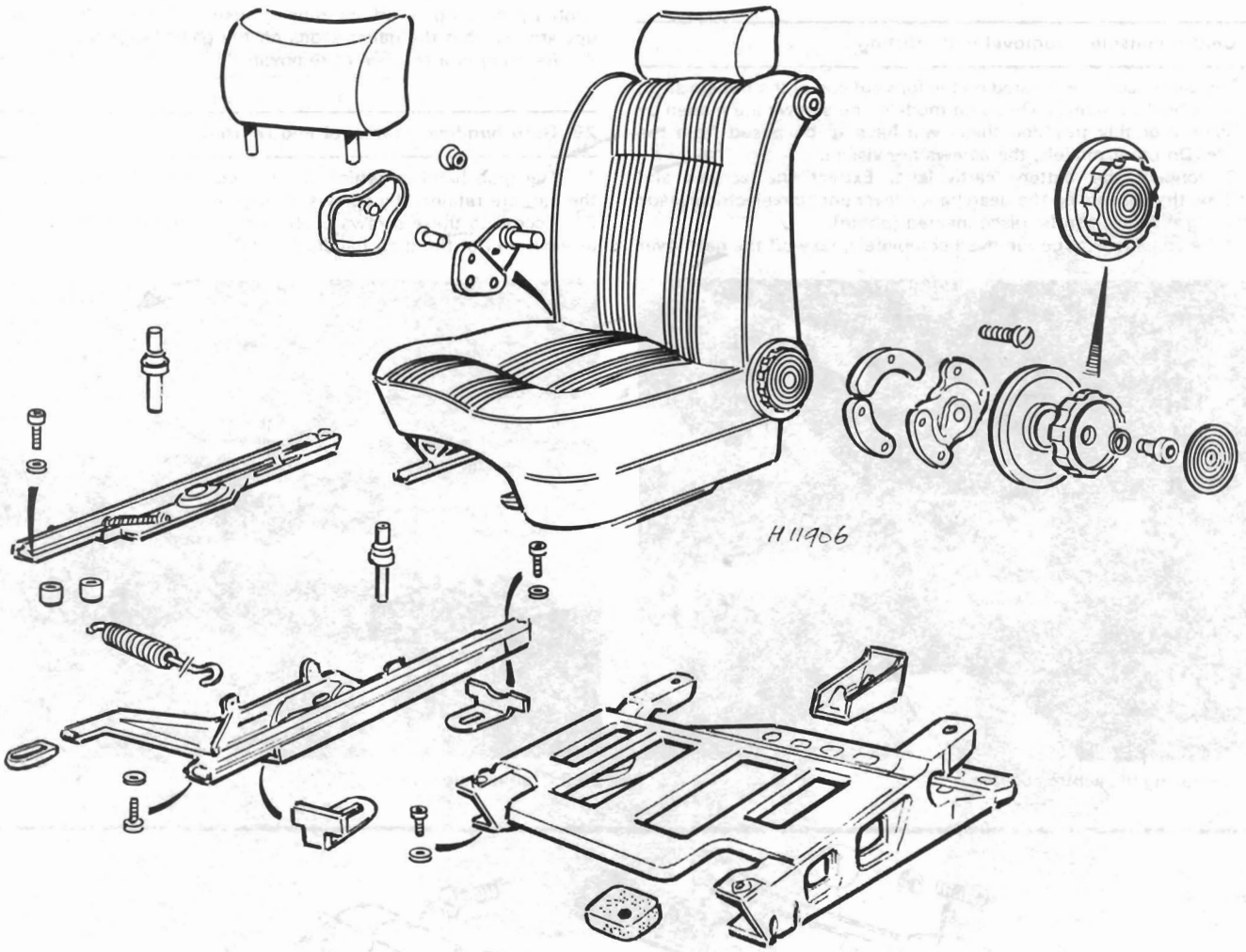
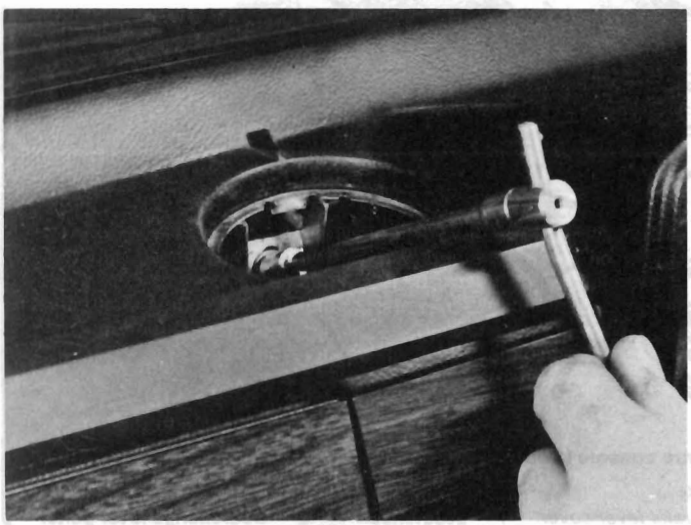
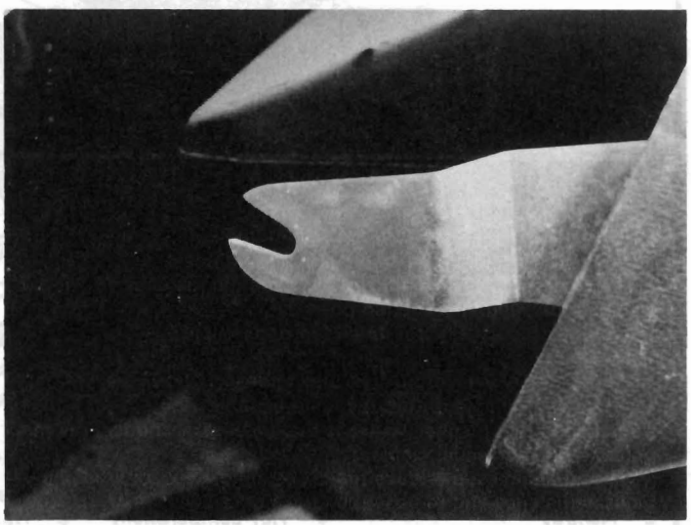


Fig. 12.14 Front seat components (Sec 23)

upper fixing nuts will be seen. Unscrew and remove them (photo).
4 At the lower outer ends of the facia panel, unscrew and remove the lower fixing bolts (photo).
5 Extract the two screws to release the heater control panel from the facia panel.
6 Unscrew the rake adjusting lever frm the steering column upper bracket and lower the steering column (see Chapter 10).
7 Pull the facia panel forwards, complete with instruments, until the speedometer and (on early models) tachometer drive cables can be disconnected and the wiring plugs separated as described in Chapter 9 for instrument removal.
8 The instrument panels may be removed from the facia panel as necessary.
9 Refit by reversing the removal operations.



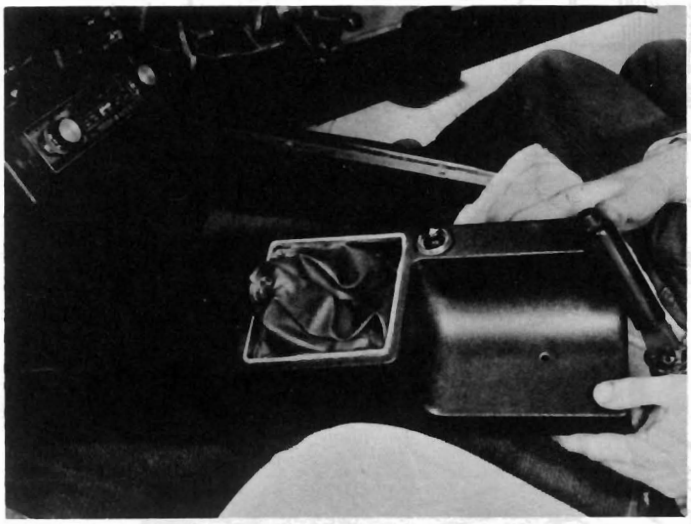
27.3 Unscrewing a facia panel nut



27.4 Facia panel end bracket

28 Centre console – removal and refitting

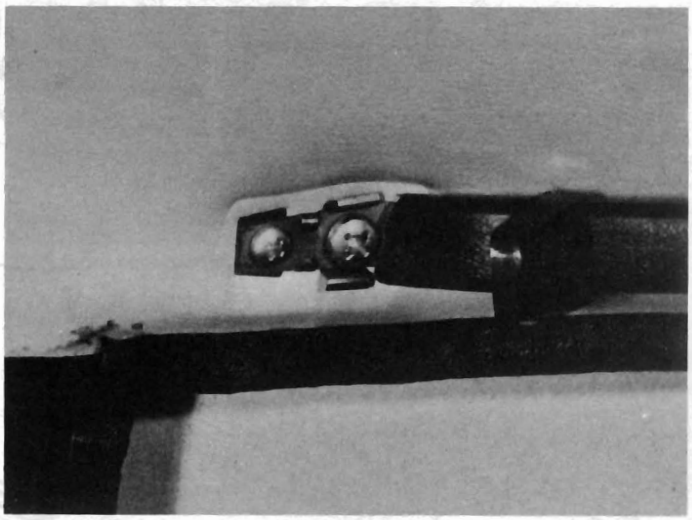
1 The centre console, located on the forward end of the transmission tunnel, is held by screws. On some models, the screws are hidden by the ashtray or tidy tray and these will have to be prised from the console. On other models, the screws are visible.
2 Disconnect the battery earth lead. Extract the screws and withdraw the console up the gearchange lever until the electrical leads to the cigar lighter can be disconnected (photo).
3 If the console is to be removed completely, take off the gear lever knob by twisting it off its rubber bush and then lift the console upwards so that the gaiter slides off the gearchange lever.
4 Refitting is a reversal of removal.



28.2 Removing the centre console

29 Grab handles – removal and refitting

1 The grab handles, which are located above the doorways inside the car, are retained by screws at each end.
2 Access to these screws is obtained by prising off the small cover at each end of the grab handle (photo).



29.2 Grab handle screws

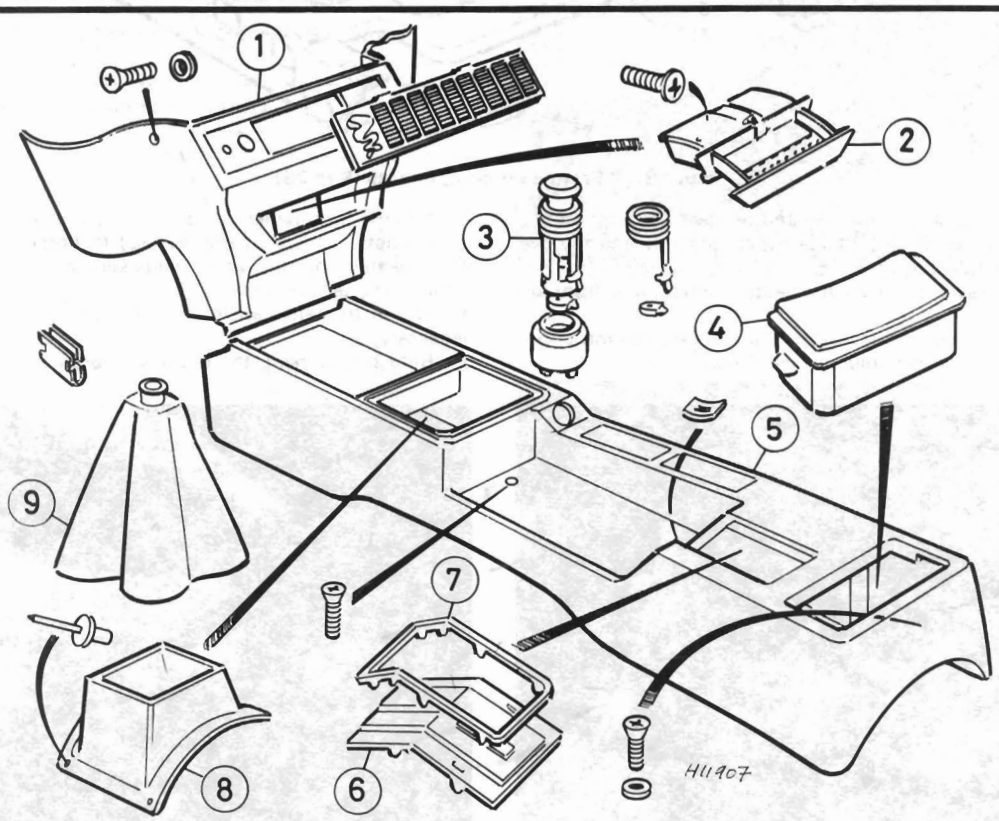


Fig. 12.15 Typical centre console (Sec 28)

1 Radio and ashtray housing
2 Ashtray
3 Cigar lighter
4 Tidy compartment
5 Console
6 Handbrake lever cover plate
7 Escutcheon
8 Gearchange lever turret
9 Gearchange lever gaiter

30 Seat belts – maintenance and precautions

1 The seat belts are of inertia reel type at the front, and static type for rear seat passengers (photos).
2 At regular intervals check the belts for fraying, cuts or stitching which has become loose. If any such faults are found, the belt must be renewed immediately.
3 Any dirt should be removed from the belts by wiping with a damp cloth and detergent only. **Do not** use solvent of any kind.
4 Check the anchor bolts regularly for tightness.
5 Never alter the belt anchor points and if a belt is removed, make sure that when refitting takes place the original fitted sequence of spacers, washers and anchor plate is maintained.
6 If any belt is subjected to accident loads, it should be renewed.

31 Interior rear view mirror – general

1 On earlier models the interior mirror is secured by a spring-loaded stem.
2 The mirror can be disconnected from its baseplate by giving it a sharp jerk. If the screws now exposed are removed, the baseplate can be withdrawn.
3 On later models, the mirror is bonded directly to the inside surface of the windscreen (photo).
4 Due to the need for special solvents and bonding agents, removal and refitting of this type of mirror should be left to your dealer.

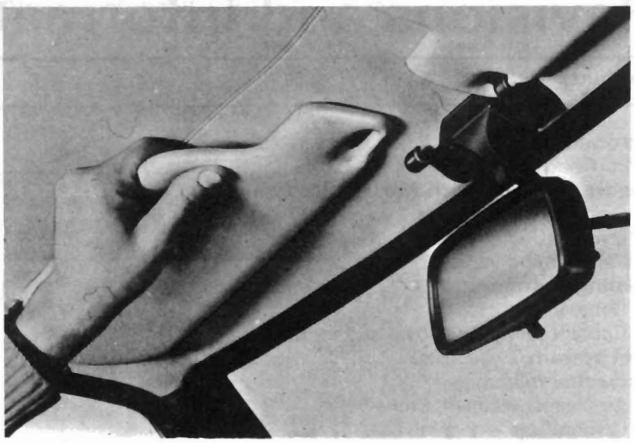
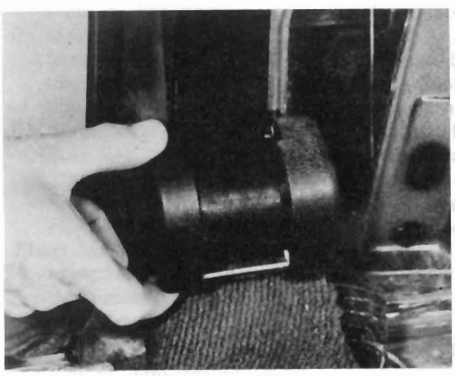
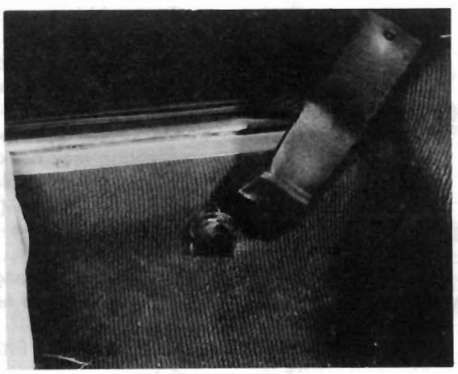


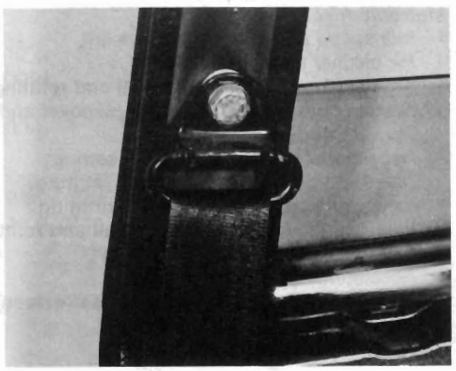
Fig. 12.16 Non-bonded type interior rear view mirror (Sec 31)



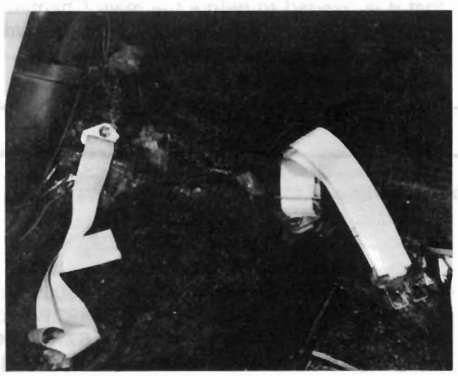
30.1a Inertia type seat belt reel



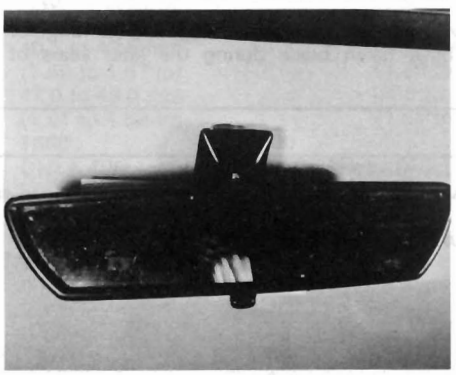
30.1b Seat belt floor anchorage



30.1c Seat belt pillar anchorage



30.1d Rear seat belt anchorage (Coupe)



31.3 Glass-bonded interior mirror

Chapter 13 Supplement: Revisions and information on later models

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1 Introduction

This Supplement covers modifications and changes to the range of Alfetta models which have taken place during the later years of production up to its discontinuation in 1987.

In order to use the Supplement to best advantage, it is suggested that it is referred to before the main Chapters of the Manual; this will ensure that any relevant information can be collated into the procedures described before starting work.

2 Specifications

The specifications below are supplementary to, or revisions of, those at the beginning of the preceding Chapters.

Engine (carburettor models from 1986)

Valves

	1600	1800 and 2000
Valve timing:		
Inlet valve opens	40° 30' BTDC	48° BTDC
Inlet valve closes	64° 30' ABDC	67° ABDC
Exhaust valve opens	63° 54' BBDC	60° 20' BBDC
Exhaust valve closes	27° 54' ATDC	41° 20' ATDC
Valve stem diameter:		
Inlet	8.972 to 8.987 mm (0.3532 to 0.3538 in)	
Exhaust	8.935 to 8.960 mm (0.3518 to 0.3528 in)	
Valve head diameter:	**1600 and 1800**	**2000**
ATE type:		
Inlet	41.00 to 41.20 mm (1.614 to 1.622 in)	44.01 to 44.15 mm (1.733 to 1.738 in)
Exhaust	37.00 to 37.20 mm (1.457 to 1.465 in)	40.01 to 40.15 mm (1.575 to 1.581 in)
Eaton-Livia type:		
Inlet	41.00 to 41.15 mm (1.614 to 1.620 in)	44.00 to 44.15 mm (1.732 to 1.738 in)
Exhaust	37.00 to 37.15 mm (1.457 to 1.463 in)	40.00 to 40.15 mm (1.575 to 1.581 in)

Crankshaft

Main bearing journal running clearance:	
Blue	0.004 to 0.045 mm (0.0002 to 0.0018 in)
Red	0.006 to 0.047 mm (0.0002 to 0.0019 in)
Crankpin running clearance:	
Blue	0.025 to 0.060 mm (0.0010 to 0.0024 in)
Red	0.027 to 0.062 mm (0.0011 to 0.0025 in)

Engine (Motronic system models)

Compression ratio 10:1

Valve timing

Inlet valve opens	28° 44′ to 21° 44′ BTDC
Inlet valve closes	90° 28′ to 97° 28′ ABDC
Exhaust valve opens	58° 12′ BBDC
Exhaust valve closes	33° 48′ ATDC

Torque wrench settings

	Nm	lbf ft
Valve timing variator to camshaft	100	74
Variator gear lock ring (oiled)	110	81

Fuel system (carburettor)

Calibration

Weber (unsealed adjusting screws):			
Identification	40 DCOE		
Venturi	32		
Main jet	1.38		
Main air corrector	1.60		
Main emulsion tube	F41		
Idle jet	0.59 (1800) or 0.57 (2000)		
Idle air corrector	F21		
Accelerator pump jet	0.40 (1800) or 0.35 (2000)		
Fuel inlet needle valve	1.50		
Starting jet	1.50		
Accelerator pump stroke	16.5 mm (1800) or 15.0 mm (2000)		
Float setting (A – Fig. 3.7)	6.75 to 7.25 mm (0.27 to 0.29 in)		
Solex (unsealed adjusting screws):	**1600**		**2000**
Identification	C 40 ADDHE		C ADDHE
Venturi	30		32
Main jet	1.30		1.32
Main air corrector	1.60		1.55
Idle jet	0.57		0.55
Idle air corrector	1.75		1.70
Accelerator pump jet	0.45		0.45
Fuel inlet needle valve	1.60		1.60
Starting jet	1.40		1.40
Float height (Fig. 13.5):			
A	40.5 to 42.5 mm (1.59 to 1.67 in)		40.5 to 42.5 mm (1.59 to 1.67 in)
B	41.0 to 43.0 mm (1.61 to 1.69 in)		41.0 to 43.0 mm (1.61 to 1.69 in)
Dellorto (unsealed adjusting screws):	**1600**	**1800**	**2000**
Identification	DHLA 40H	DHLA 40H	DHLA 40H
Venturi	30	32	32
Main jet	1.30	1.48	2.10
Main air corrector	1.80	2.10	2.10
Main emulsion tube	7772.11	7772.11	7772.11
Idle jet	0.57	0.57	0.57
Idle air corrector	2.20	2.20	2.20
Accelerator pump jet	0.42	0.40	0.40
Fuel inlet needle valve	1.50	1.50	1.50
Starting jet	0.80	0.80	0.80
Starting air corrector	2 x 3.5	2 x 3.5	2 x 3.5
Starting emulsion tube	7482.3	7482.3	7482.3
Float setting	14.5 to 15.0 mm (0.57 to 0.59 in)	14.5 to 15.0 mm (0.57 to 0.59 in)	14.5 to 15.0 mm (0.57 to 0.59 in)
Weber (sealed mixture adjusting screw):			
Identification	40 DCOE from 1978		
Venturi	30		
Main jet	1.32		
Main emulsion tube	F41		
Main air metering jet	1.80		
Idling jet	0.55		
Idling air metering jet	F21 – 55		
Choke jet	F9 – 85		
Choke air metering jet	3 x 2.50		

Accelerator pump jet	0.30		
Accelerator pump inlet valve bypass	0.35		
Accelerator pump control rod stroke	18 mm (0.71 in)		
Fuel inlet needle valve	1.50		
Float setting	7.5 to 8.5 mm (0.30 to 0.33 in)		
Solex (sealed mixture adjusting screw):	**1600**	**2000**	
Identification	C 40 ADDHE	C 40 ADDHE	
Venturi	30	32	
Main jet	1.27	1.40	
Main emulsion tube	2 x 0.80, 5 x 1.00	2 x 0.80, 5 x 1.00	
Main air metering jet	1.50	1.65	
Idling jet	0.57	0.57	
Idling air metering jet	1.67	1.67	
Choke jet	1.40	1.40	
Choke air metering jet	4.5	4.5	
Accelerator pump jet	0.45	0.45	
Fuel inlet needle valve	1.60	1.60	
Float setting (needle valve protrusion) – C in Fig. 13.5	4.4 to 4.6 mm (0.17 to 0.18 in)	4.4 to 4.6 mm (0.17 to 0.18 in)	

Solex (sealed mixture adjusting screw):	C 40 ADDHE from 1980
Identification	32
Venturi	1.325
Main jet	2 x 1.2, 1 x 1.2, 4 x 1.0
Main emulsion tube	1.45
Main air orifice	0.55
Idle jet	1.50
Idle air orifice	1.40
Choke jet	4.50
Choke air orifice	0.45
Accelerator pump jet	1.60
Fuel inlet needle valve	4.4 to 4.6 mm (0.17 to 0.18 in)
Float setting (needle valve protrusion) – C in Fig. 13.5	

	1600	**1800**	**2.0 GTV**
Dellorto (sealed mixture adjusting screw):	DHLA 40G	DHLA 40G	DHLA 40G
Identification	30	32	32
Venturi	1.32	1.45	1.45
Main jet	7772-10-28	7772-10-28	7772-10-28
Main emulsion tube	2.20	2.40	2.40
Main air metering jet	0.55	0.58	0.58
Idling jet	2.20	2.20	2.20
Idling air metering jet	0.80	0.80	0.80
Choke jet	2 x 3.5	2 x 3.5	2 x 3.5
Choke air metering jet	7482.3	7482.3	748.3
Choke emulsion tube	0.33	0.35	0.40
Accelerator pump jet	1.50	1.50	1.50
Fuel inlet needle valve	14.5 to 15.0 mm (0.57 to 0.59 in)	14.5 to 15.0 mm (0.57 to 0.59 in)	14.5 to 15.0 mm (0.57 to 0.59 in)
Float setting			

Adjustment data (all carburettors)

	Unsealed screws	**Sealed screws**
Idle speed:		
Weber	850 to 1000 rpm	850 to 1000 rpm
Solex	750 to 950 rpm	850 to 1000 rpm
Dellorto	850 to 1000 rpm	750 to 950 rpm
Fast idle speed:		
Weber	1700 rpm	1450 to 1700 rpm
Solex	1700 to 2000 rpm	1450 to 1700 rpm
Dellorto	1450 to 1700 rpm	1700 to 2000 rpm
CO level at idle:		
Weber	2.5 to 3.5%	max 3.5%
Solex	max 4.5%	max 3.5%
Dellorto	max 3.5%	max 4.5%

Fuel system (Motronic)

General

Fuel tank capacity	49 litres (10.8 gals)
Fuel system pressure	2.74 to 3.14 bar (40 to 46 lbf/in²)
Throttle body setting (using Solex flowmeter)	240 to 260 on N scale
Throttle switch setting:	
Throttle valve closed:	
Terminals 2 and 18	0 ohms
Terminals 3 and 18	Infinity
Throttle valve open by 72°:	
Terminals 2 and 18	Infinity
Terminals 3 and 18	0 ohms

Adjustment data

Idle speed	850 to 950 rpm
CO level at idle	0.5 to 1.5%

Ignition system (breakerless)

Distributor

Make	Bosch or Marelli
Pulse generator coil resistance:	
Bosch	1000 ohms
Marelli	730 ohms
Rotor arm internal resistance:	
Bosch	1000 ohms
Marelli	5000 ohms
Air gap	0.5 to 0.6 mm (0.020 to 0.024 in)

Electronic control unit (ECU)

Maximum current	6A

Ignition coil

Make	Bosch or Marelli
Primary winding resistance	0.7 ohms at 20°C (68°F)
Secondary winding resistance:	
Bosch	6700 to 9600 ohms at 20°C (68°F)
Marelli	7900 ohms at 20°C (68°F)

Spark plugs

Standard	Lodge 2HL
Alternative (not specified by vehicle manufacturer)	Champion N7YC

Ignition system (Motronic)

Ignition timing

Static (check only)	9 to 11° BTDC

Ignition coil

Primary winding resistance	0.5 ohms at 20°C (68°F)
Secondary winding resistance	6000 ohms at 20°C (68°F)

Spark plugs

Standard	Silver Lodge 2HL-E
Alternative (not supplied by vehicle manufacturer)	Champion N7YC

Clutch

Driven plate diameter

1600 from 1979	200.0 mm (7.9 in)

Transmission

Gear ratios – all models from September 1984

1st	3.50:1
2nd	1.96:1
3rd	1.26:1
4th	0.95:1
5th	0.78:1
Reverse	3.00:1
Final drive	3.8:1

Electrical system

Alternator (with integral voltage regulator)

Make	Bosch 55A Marelli 60A Paris-Rhone 50A
Brush wear limit (projection beyond holder):	
Bosch	5.0 mm (0.20 in)
Marelli	7.0 mm (0.28 in)
Paris-Rhone	6.0 mm (0.24 in)

Front suspension and steering

Torsion bars – 1600 and 1800 from 1977

Left-hand	Red/yellow A
Right-hand	Blue D

Torsion bars – 1600 and 2000 from 1978

Diameter	21.1 mm (0.83)
Left-hand	Marked F
Right-hand	Marked F

Anti-roll bar – 1600 and 2000 from 1978

Diameter	20.0 mm (0.79 in)

Steering angles from 1985

Castor	2° 30′ to 3° 30′ positive
Maximum side to side variation	0° 20′
Camber	0° 50′ negative to 0° 10′ positive
Maximum side to side variation	0° 40′

Steering – general

Steering wheel diameter	381.0 mm (15.0 in)
No of turns lock to lock	3.6
Turning circle	10.0 m (32.8ft)

3 Engine (2000 cc with Motronic system)

Removal and refitting

1 With the help of an assistant, remove the bonnet.
2 Disconnect and remove the battery.
3 Drain the cooling system and remove the radiator.
4 Disconnect the lead from the airflow sensor.
5 Release the clips and remove the intake duct.
6 Release the clips and remove the cover/airflow sensor assembly.
7 Remove the air cleaner element.
8 Anticipating that the fuel system is pressurised, disconnect the fuel delivery line and remove it from the inlet manifold side.
9 Disconnect the fuel return line and remove it from the pressure regulator side.
10 Disconnect the accelerator inner and outer cables.
11 Remove the alternator cooling hose.
12 Disconnect the brake vacuum servo hose from the intake manifold.
13 Disconnect the crankcase ventilation system hoses.
14 Disconnect the HT lead from the ignition coil.
15 Disconnect the alternator leads.
16 Disconnect the starter motor leads.
17 Disconnect the oil pressure switch lead.
18 Disconnect the lead from the valve timing variator solenoid.
19 Pull the wiring plugs from the fuel injectors.
20 Disconnect the leads from the coolant temperature sensors.
21 Disconnect the leads from the throttle positioner.
22 Disconnect the lead from the auxiliary air valve.
23 Disconnect the earth leads from the intake manifold and from the auxiliary air valve.
24 Disconnect the leads from engine speed and timing transducers.
25 Disconnect the oil level indicator lead at the in-line connector adjacent to the alternator.
26 Disconnect the low oil level switch lead.
27 Remove the heat shield from the left-hand engine mounting.
28 Remove the upper screws from both the side engine mountings.
29 Working under the car, drain the engine oil.
30 Extract the screws and withdraw the engine speed and timing transducers from the flywheel housing.

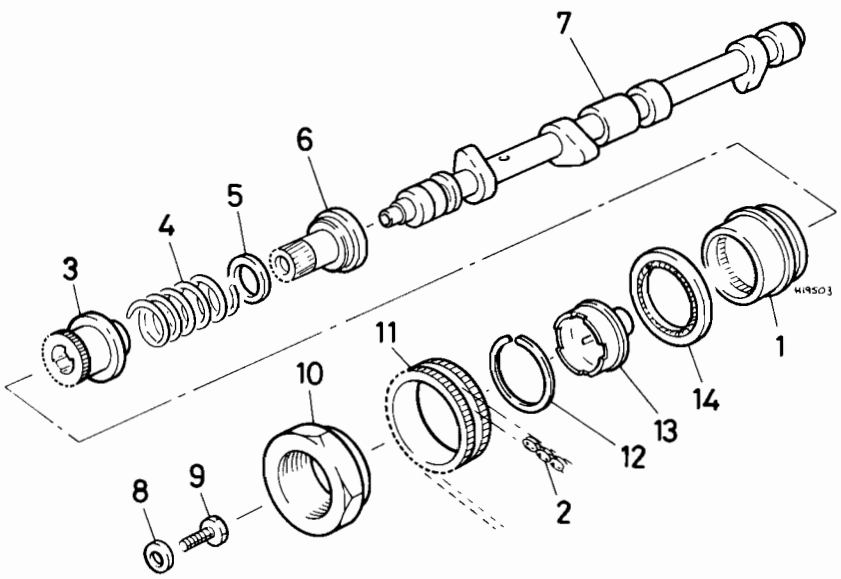

Fig. 13.1 Camshaft with valve timing variator components (Sec 3)

1 Sleeve
2 Timing chain
3 Piston
4 Coil spring
5 Washer
6 Pinion support sleeve
7 Camshaft
8 Seal
9 Actuator
10 Ring nut
11 Timing chain sprocket
12 Retaining ring
13 Control valve
14 Front clutch

31 Unbolt the exhaust pipe from the engine manifold then release and withdraw the exhaust pipe from under the car.
32 Unbolt the rear mounting from the cylinder block, note the earth strap.
33 Disconnect the gearchange lever link.
34 Unscrew the four screws which retain the gearchange lever support to the body to allow movement of the support when removing the propeller shaft.
35 Remove the flywheel guard from the rear engine mounting.
36 In order to remove the propeller shaft it will have to be turned to gain access to the bolts which secure it to the flywheel.
37 Make sure that the flexible coupling is marked in relation to the flywheel flange before dismantling to ensure exact refitting.
38 Disconnect the rear flexible coupling from the clutch yoke.
39 Unbolt the centre bearing from the body.
40 Unbolt the engine rear mounting from the bodyshell, retain the spacers which are used to give a clearance of between 6.0 and 8.0 mm (0.24 to 0.31 in) between the propeller shaft and the top of the mounting.
41 Free the propeller shaft from the clutch shaft spigot, taking care not to damage the seal between the flexible coupling and the clutch yoke.
42 Free the propeller shaft centre bearing from its studs and remove the front bush, together with the flexible coupling, from the flywheel spigot. Withdraw the propeller shaft from the tunnel.
43 Unbolt the exhaust pipe bracket from the engine rear mounting.
44 Support the weight of the engine with a suitable hoist or lifting gear and unbolt the engine side mountings from the bodyshell.
45 Hoist the engine out of the car. The engine rear mounting may require levering to free it.
46 Refitting is a reversal of removal. Tighten all fixings to those specified in Chapters 1 and 5.
47 Fill the engine with coolant and oil.

Overhaul

48 Overhaul procedures are essentially as described in Chapter 1, observing of course the different operations necessary to remove the fuel injection, ignition and variable valve timing components. These are covered in Section 7 of this Supplement.

Valve timing variator

49 This device, described in Section 7, is an integral part of the inlet valve camshaft.

4 Cooling system

General

1 The cooling system layout for the 2000 cc carburettor engine (also the 2000 cc fuel injection (Motronic) engine) differs from the one used in 1600 and 1800 cc engines. See Figs. 13.2 and 13.3.

Coolant pump – removal and refitting

2 The coolant pump can be removed from later model engines without the necessity of first taking off the crankshaft pulley/damper. This is due to the greater clearance provided by not having the tachometer drive at the base of the pump housing.
3 It is recommended that the radiator is removed before starting to remove the coolant pump.

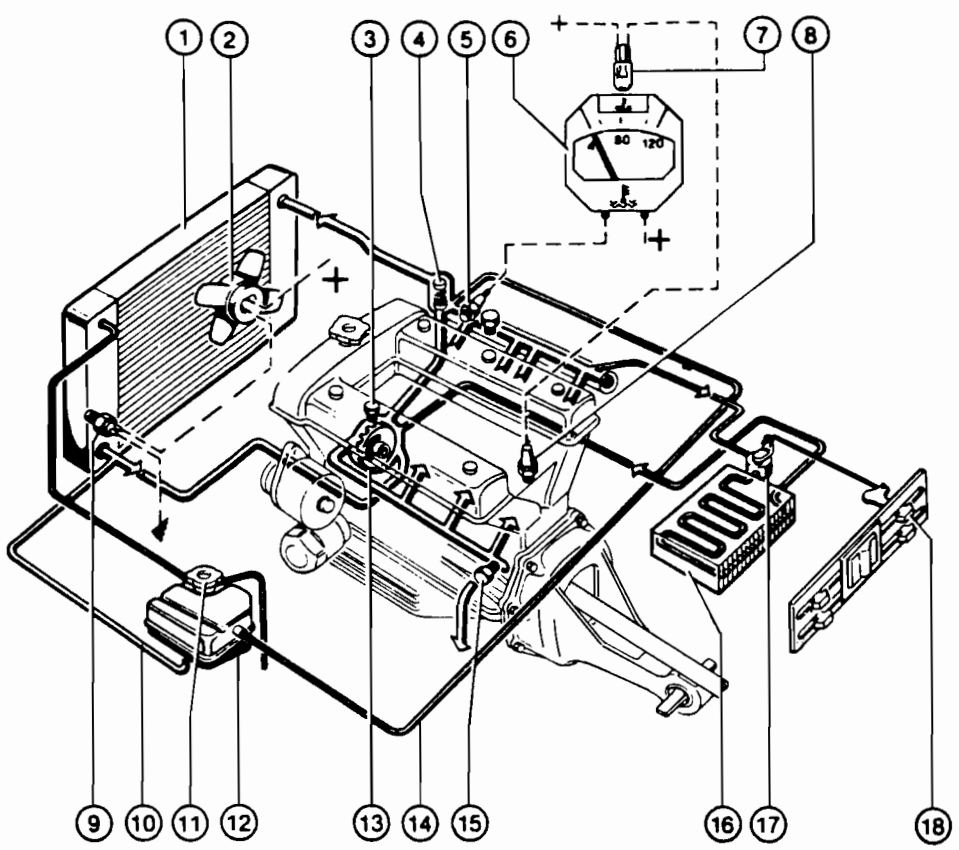

Fig. 13.2 Cooling system – 2.0 GTV (Sec 4)

1 *Radiator*
2 *Cooling fan*
3 *Pump bleed screw*
4 *Thermostat*
5 *Temperature gauge sender unit*
6 *Coolant temperature gauge*
7 *High temperature warning lamp*
8 *High temperature warning lamp switch*
9 *Fan thermal switch*
10 *Expansion tank hose to radiator*
11 *Expansion tank cap*
12 *Expansion tank*
13 *Coolant pump*
14 *Expansion tank hose to thermostat*
15 *Cylinder block drain screw*
16 *Heater*
17 *Heater coolant valve*
18 *Heater coolant valve control lever*

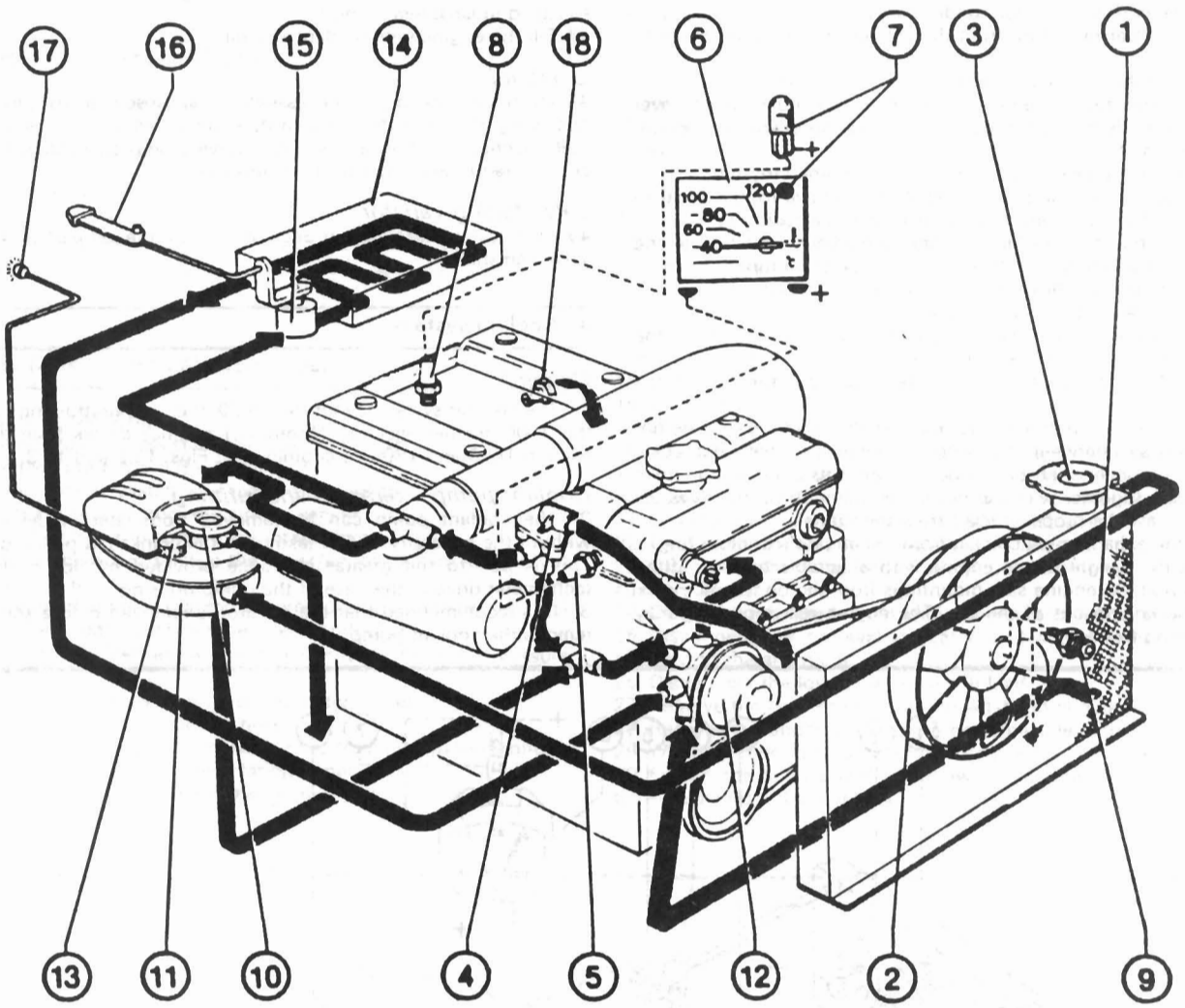

Fig. 13.3 Cooling system – 2000 cc with Motronic (Sec 4)

1 *Radiator*
2 *Cooling fan*
3 *Radiator cap*
4 *Thermostat*
5 *Temperature gauge sender unit*
6 *Coolant temperature gauge*
7 *Coolant high temperature warning lamp*
8 *Coolant high temperature warning lamp switch*
9 *Fan thermal switch*
10 *Expansion tank cap*
11 *Expansion tank*
12 *Coolant pump*
13 *Coolant low level switch*
14 *Heater*
15 *Heater coolant flow valve*
16 *Heater coolant valve control lever*
17 *Coolant low level warning lamp*
18 *Cylinder block drain screw*

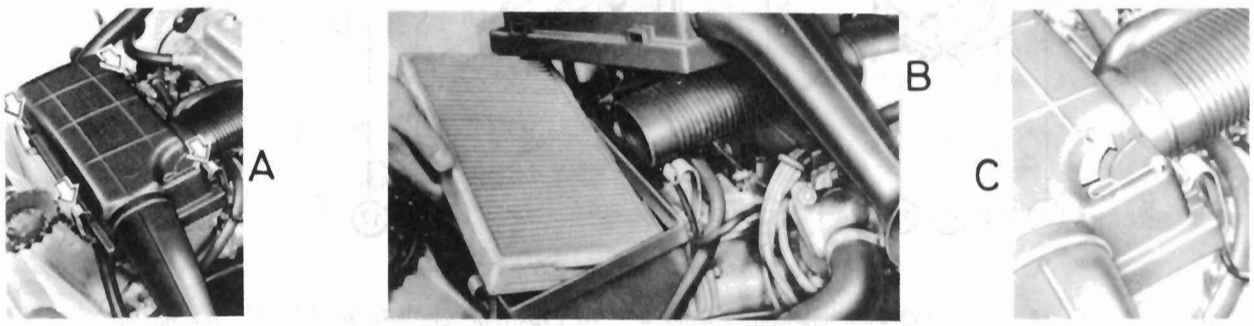

Fig. 13.4 Air cleaner on later carburettor models (Sec 5)

A Cover toggle clips *B Removing air cleaner element* *C Winter/summer control lever*

5 Fuel system

Carburettor models

Air cleaner element – renewal

1 The air cleaner used on later carburettor models is of box section design instead of the cylindrical pattern used previously.
2 To renew the filter element, release the toggle clips, lift the cover upwards and disconnect the hot air duct from the cover.
3 Remove and discard the element and wipe out the casing.
4 Fit the new element so that the wire mesh is at the bottom. Refit the cover, duct and clips.
5 According to model and production date, a summer/winter control lever or an automatic temperature control device may be fitted.
6 The latter device relies on a thermostatically-controlled flap valve positioned upstream of the air cleaner to mix the volume of cold and warm air (from the manifold) so maintaining the intake air at a constant temperature.

Carburettor – general

7 Various different carburettors have been fitted to later models. Refer to Specifications at the beginning of this Supplement for calibration and tuning details.
8 Details of adjustments peculiar to these carburettors are given in the following sub-sections.

Idle speed and mixture adjustment

9 Later model carburettors have tamperproof caps or plugs fitted to the adjusting screws.
10 To adjust the idle speed, refer to Chapter 3, Section 8 and to Fig. 3.5.
11 The engine must be at normal operating temperature with the valve clearances and ignition system correctly set. The air cleaner element must be clean.
12 Turn the idle speed screw (2) as necessary to bring the speed within the specified range.
13 Turn the coupling screw (3) to balance the vacuum pressure as described in Chapter 3.
14 The mixture is set in production and should not be tampered with unless essential, in which case it can only be carried out satisfactorily using an exhaust gas analyser connected in accordance with the manufacturer's instructions.
15 Prise out the sealing plugs from the mixture screw recesses and turn the mixture screws (4) equally until the CO percentage in the exhaust gas is within the specified range.
16 Recheck the idle speed and, if required by local legislation, fit new tamperproof caps and plugs.

Carburettors – overhaul and major adjustment

17 The overhaul operations for later types of carburettor are similar to those described for earlier versions in Chapter 3 with the following exceptions.

Solex C 40 ADDHE carburettor – float setting

18 With the top cover removed, invert it so that the floats rest on the needle valve.
19 If float height is given in the Specifications, refer to Fig. 13.5 and measure the distance between the surface of the top cover gasket and the highest point of the floats (note that there are 2 dimensions). If outside specification, either renew the needle valve washer or gently bend the float arm. If the Specifications give needle valve protrusion, measure the distance between the surface of the top cover and the needle tip (Fig. 13.5). If necessary, remove the needle valve and change its packing.

Dellorto DHLA 40H – resetting idle solenoid

20 This carburettor is fitted to later 2.0 litre models and incorporates a solenoid device which provides an alternative throttle opening (fast idle) under certain throttle closed conditions.
21 One opening (850 to 1000 rpm) is set when the vehicle is stationary with engine idling, and the second opening (1700 to 2000 rpm) is set during overrun conditions with the accelerator released. The latter mode helps to reduce noxious exhaust emissions.
22 The solenoid device is fitted to the rear carburettor and controlled by clutch pedal and gearlever switches.

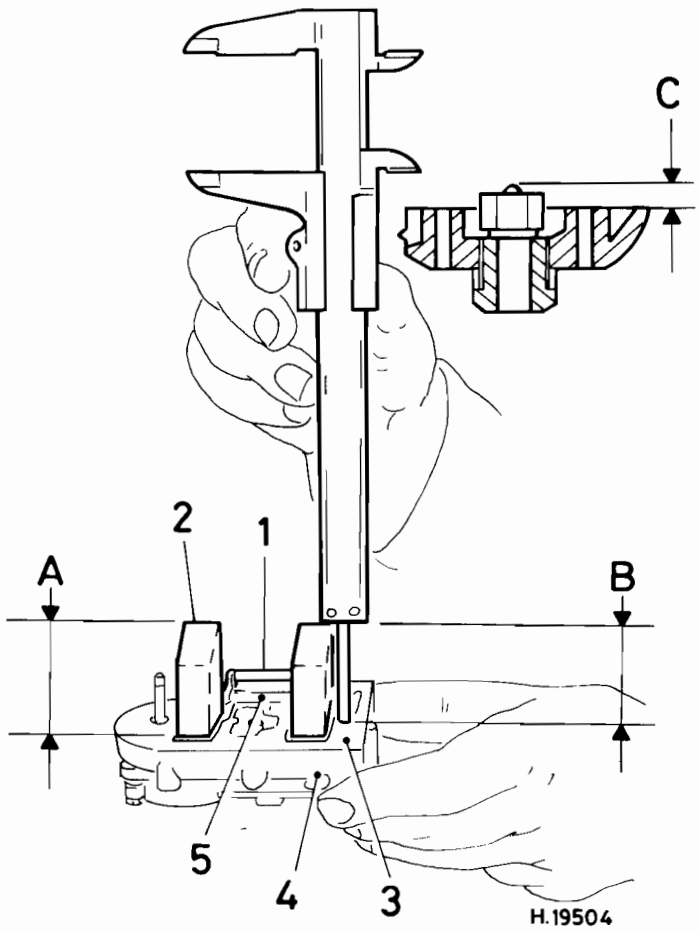

Fig. 13.5 Checking float setting – Solex C 40 ADDHE (Sec 5)

1 Float bridge
2 Float
3 Gasket
4 Top screw
5 Fuel inlet needle valve

A, B and C see Specifications

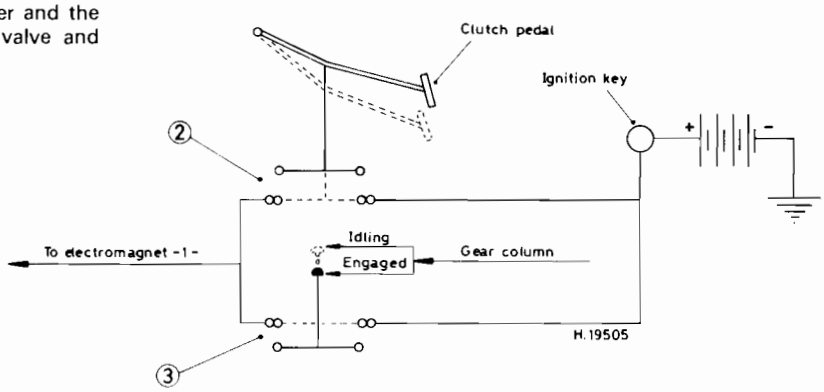

Fig. 13.6 Idle solenoid wiring diagram for Dellorto DHLA 40H (Sec 5)

1 Solenoid
2 Clutch pedal switch
3 Gearchange lever switch

23 Should any adjustment be required to the second opening 'fast idle', disconnect the power feed wire from the solenoid, increase the engine speed to between 1700 and 2000 rpm and turn the screw (4) (Fig. 13.7) until this speed is held. Reconnect the power feed.
24 If the carburettor is to be dismantled, or the solenoid renewed, it is imperative that the setting of the solenoid within its clamp (dimension A) is measured and recorded so that the refitted position will be exactly as originally set during production.

Accelerator linkage adjustment
25 Have an assistant depress the accelerator pedal fully.
26 Refer to Fig. 13.8 and check that the clearance (G) is between 1.0 and 2.0 mm (0.04 and 0.08 in).
27 If adjustment is required, release the locknut on the accelerator pedal stop screw and turn the screw as necessary. Retighten the locknut.

Motronic fuel injection models

Idle speed and mixture adjustment
28 The engine should be idling at normal operating temperature with all electrical equipment switched off.
Idle speed
29 Release the locknut and turn the control device union (3) which is located on the air intake box (Fig. 13.9). Once the specified idle speed is achieved, tighten the locknut.
Idle mixture
30 Prise out the tamperproof plug (9) from the airflow sensor to expose the adjusting screw.
31 Connect an exhaust gas analyser in accordance with the maker's instructions.
32 Turn the adjusting screw with an Allen key as necessary to bring the CO level to the specified level.
33 The mixture can be judged by the colour of the spark plugs which should be mid grey to fawn. Turning the adjusting screw clockwise will enrich the mixture, unscrewing it will weaken it.

Air cleaner element – renewal
34 Disconnect the ducts from the airflow gauge.
35 Disconnect the wiring plug from the airflow gauge.
36 Release the five toggle clips which secure the cover and remove the cover and airflow gauge.
37 Withdraw the air cleaner element.
38 Wipe out the casing and fit the new element. Refit the removed and disconnected components.

Air cleaner assembly – removal and refitting
39 Remove the element as previously described.
40 Extract the fixing screws and remove the casing.
41 Refitting is a reversal of removal.

System components – testing, removal and refitting
Airflow gauge
42 Remove the airflow gauge, complete with air cleaner cover, as previously described.
43 Extract the screws and separate the airflow gauge from the air cleaner cover.
44 Wipe out any dirt from the internal surfaces of the airflow gauge and check that the vane rotates freely.
45 Refitting is a reversal of removal, use new gaskets.
Auxiliary air solenoid valve
46 Have the engine cold, start it and pinch the outlet hose of the solenoid valve.
47 At an ambient temperature of 20°C (68°F), the engine speed should decrease during a period of about three minutes.
48 Now run the engine to normal operating temperature, pinch the outlet hose of the solenoid valve and check that the engine speed does not decrease.
49 The valve can be removed after disconnecting the hoses, multi pin plug and the mounting screws. Note the earth leads under the mounting screws. Refitting is a reversal of removal.
Throttle body
50 Disconnect the hoses from the throttle body and tie them up as high as possible to minimise coolant loss.
51 Disconnect the accelerator control cable from the lever on the throttle body, also the cable conduit from the bracket.

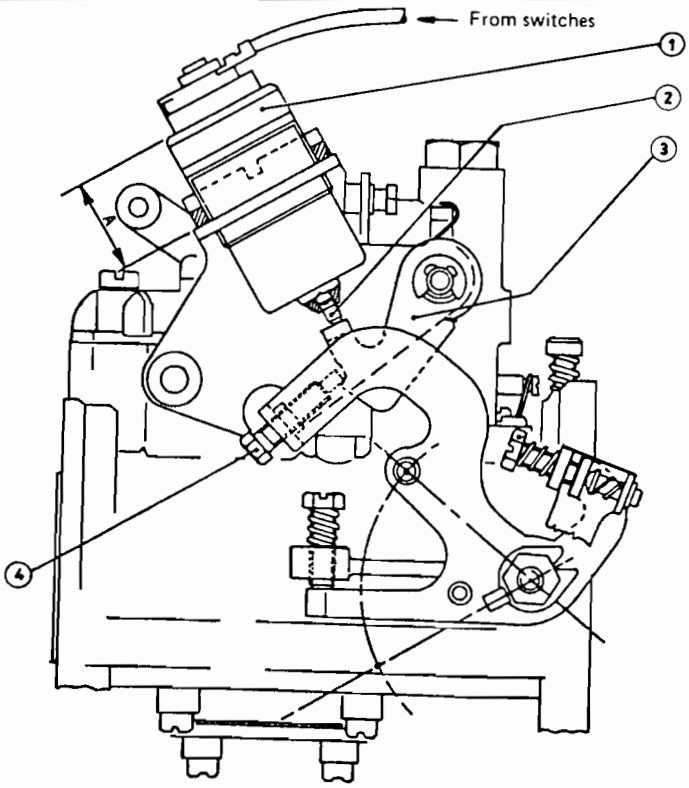

Fig. 13.7 Location of idle solenoid valve on Dellorto DHLA 40H carburettor (Sec 5)

1 Solenoid
2 Solenoid plunger
3 Throttle lever
4 Adjustment screw
A Production setting must be retained

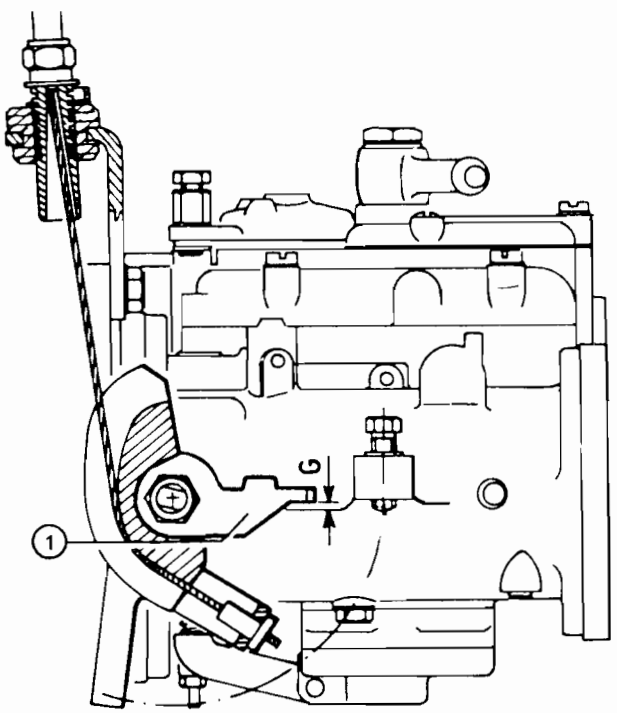

Fig. 13.8 Accelerator linkage adjustment diagram (Sec 5)

G = 1.0 to 2.0 mm (0.04 to 0.08 in)
1 Throttle lever

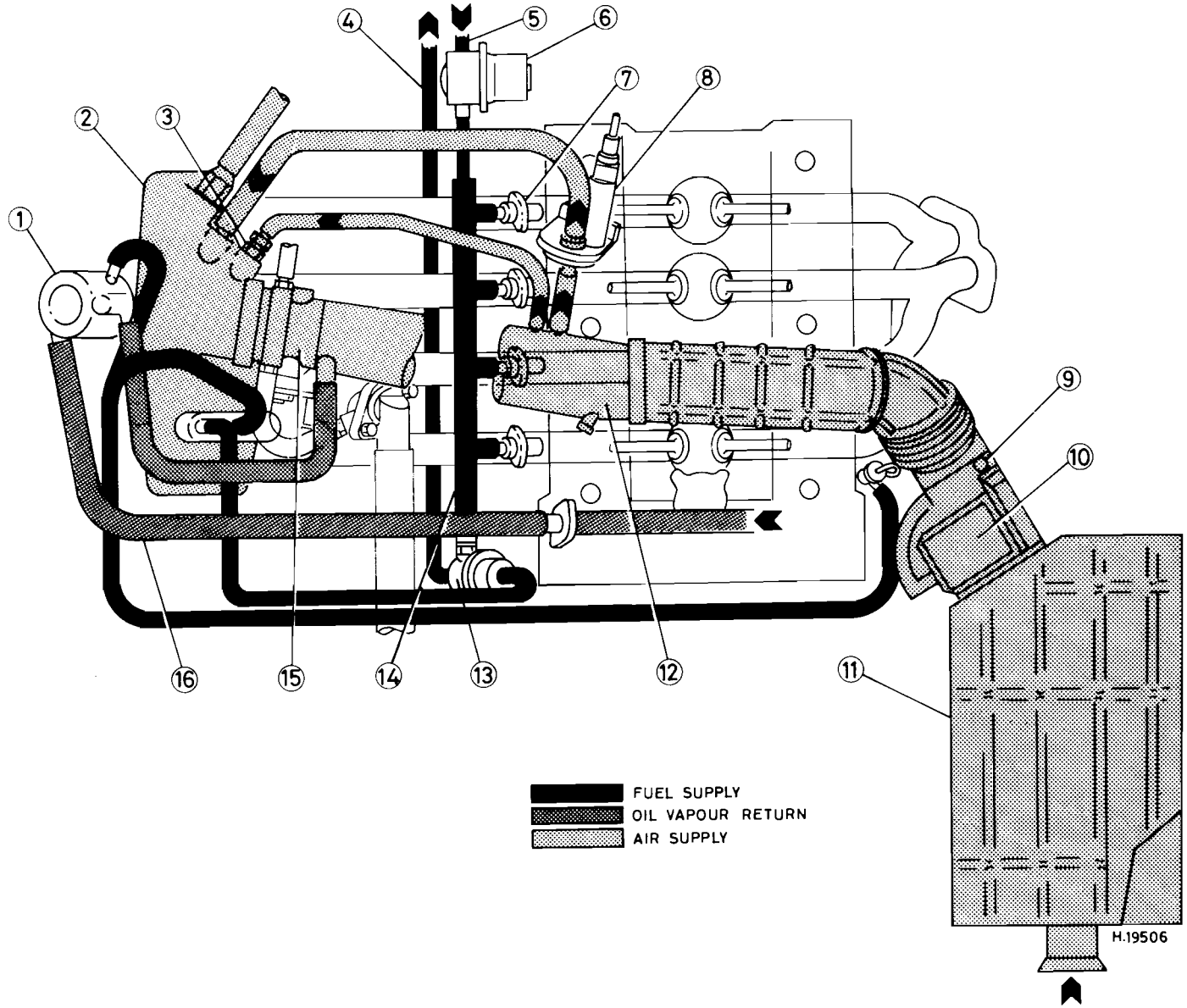

Fig. 13.9 Motronic fuel supply system (Sec 5)

1 *Oil vapour separator*
2 *Air intake box*
3 *Idle speed adjuster*
4 *Fuel return line*
5 *Fuel feed line*
6 *Hammering damper*
7 *Fuel injectors*
8 *Auxiliary air solenoid valve*
9 *Idle mixture (CO) adjusting screw*
10 *Airflow gauge*
11 *Air cleaner*
12 *Intake duct*
13 *Pressure regulator*
14 *Fuel supply manifold*
15 *Throttle body*
16 *Oil vapour breather hose*

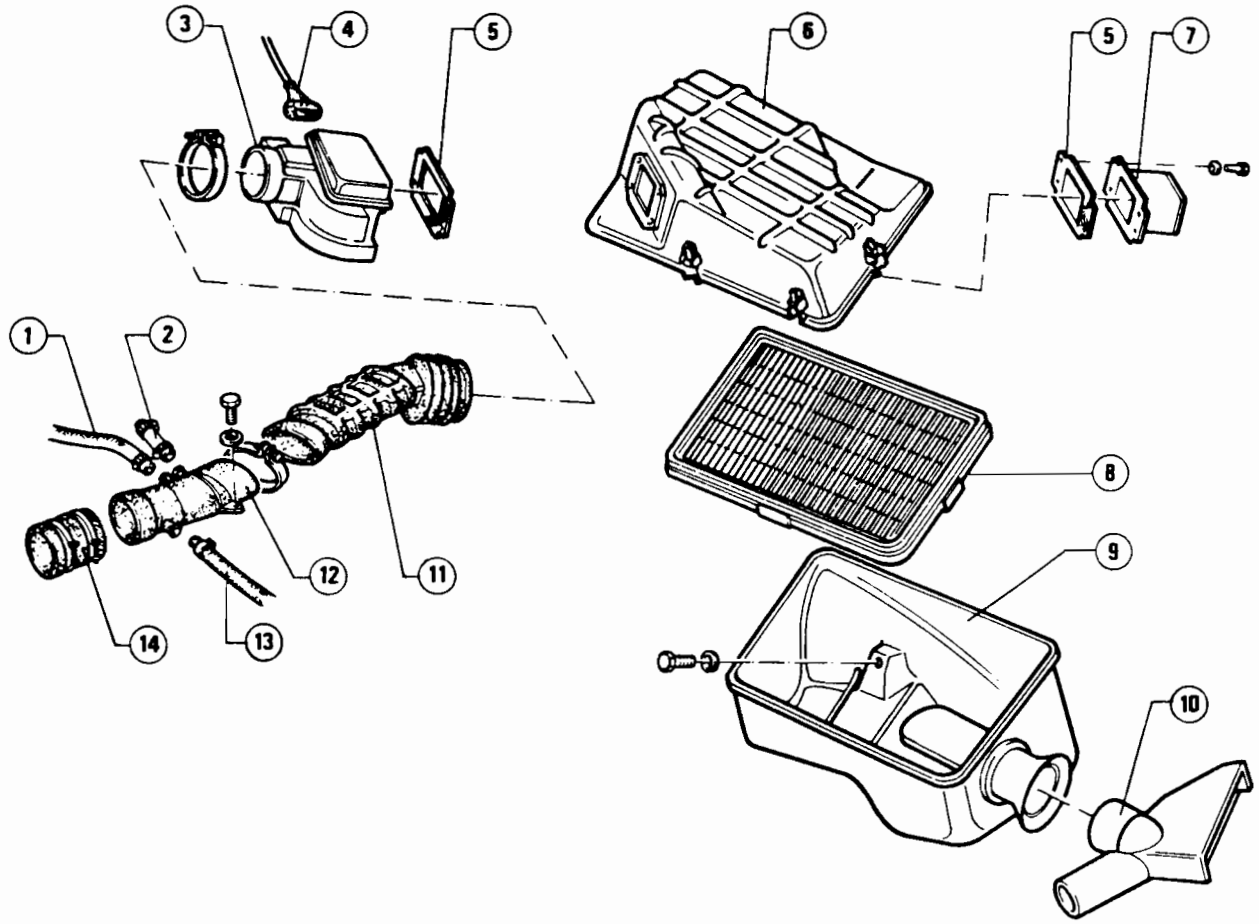

Fig. 13.10 Motronic air cleaner components (Sec 5)

1 *Idle speed bypass hose*
2 *Auxiliary air solenoid valve hose*
3 *Airflow gauge*
4 *Airflow gauge connector*
5 *Gasket*
6 *Air cleaner cover*
7 *Flange*
8 *Filter element*
9 *Casing*
10 *Air intake*
11 *Convoluted duct*
12 *Duct*
13 *Oil vapour return hose (max revs)*
14 *Sleeve*

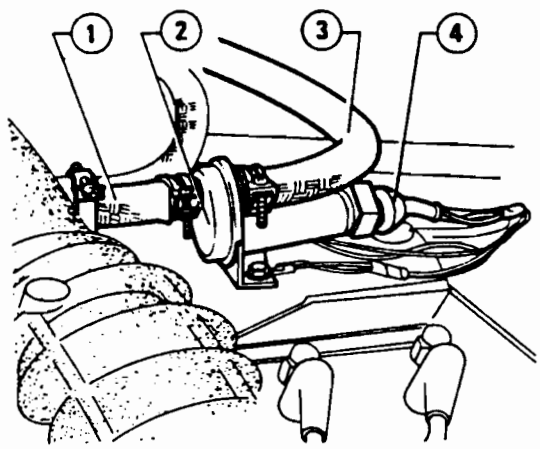

Fig. 13.11 Auxiliary air valve (Sec 5)

1 *Air inlet hose*
2 *Auxiliary air solenoid valve*
3 *Air outlet hose*
4 *Valve wiring plug*

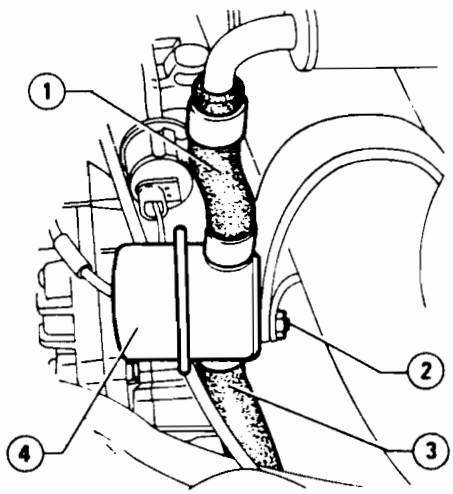

Fig. 13.12 Hammering damper (Sec 5)

1 *Fuel outlet hose*
2 *Fixing nut*
3 *Fuel inlet hose*
4 *Hammering damper*

52 Remove the screws which hold the duct to the timing cover, also release the duct clamp, then remove the duct from the throttle body.
53 Disconnect the wiring from the throttle body switch.
54 Unbolt the throttle body from the intake air box.
55 Refitting is a reversal of removal, use new gaskets. Top up the cooling system.

Intake air box

56 Disconnect the brake servo vacuum hose, the auxiliary air hose and the bypass (idle speed) hose from the intake air box.
57 Disconnect the pressure regulator vacuum hose and the idle speed oil vapour return hose.
58 Disconnect the wiring plug from the throttle body switch.
59 Disconnect the accelerator cable and the coolant hoses from the throttle body.
60 Disconnect the coolant hoses from the throttle body and tie them up high to reduce coolant loss.
61 Release the clips on the air box to manifold duct.
62 Extract the intake air box mounting screws and the earthing strap.
63 Remove the intake air box and throttle body.
64 Disconnect the throttle body from the air intake box after extracting the connecting screws.
65 Reassembly and refitting are reversals of removal and dismantling. Use new gaskets and top up the cooling system.

Hammering damper

66 Unscrew the damper mounting nut and withdraw the damper until the fuel hoses can be disconnected from it. Take care to remove the hoses gently and slowly as the system may be under pressure.
67 Fitting a damper is a reversal of removal.

Fuel injectors

68 Each injector may be checked by disconnecting its wiring plug and bridging the injector terminals with an ohmmeter. The resistance should be between 2 and 3 ohms.
69 To remove an injector, first disconnect the battery.
70 Disconnect the HT leads from the spark plugs and ignition coil, remove the distributor cap and place it to one side with the leads.
71 Remove the flexible sleeve from the intake duct.
72 Disconnect the hose from the idle speed adjuster, also the one from the auxiliary air solenoid valve.
73 Disconnect the hose from the intake duct.
74 Remove the mounting screws, release the duct hose clip and remove the intake duct.
75 Disconnect the coolant temperature sensor leads.
76 Disconnect the hose from the throttle body.
77 Disconnect the hoses from the pressure regulator.
78 Disconnect the wiring plugs from the fuel injectors.
79 Release the hammering damper from its support.
80 Disconnect the hose from the fuel distributor.
81 Unscrew the nut and release the fuel distributor manifold from its support bracket.
82 Unscrew the fuel injector fixing screws and withdraw the fuel injectors and manifold as an assembly.
83 If an injector must be renewed, then cut the hose clip, pull off the hose and recover the bush (3 – Fig. 13.13).
84 Fit a new hose and bush, wetting the rubber with petrol or paraffin to ease fitting, but never apply grease or petroleum jelly.
85 Push the hose onto the manifold stub until the stub contacts the bush.
86 Fit the injector into its seat using a new O-ring.
87 Refit all the removed components by reversing the removal operations.
88 Top up the cooling system.
89 Check the mixture (CO level).

Fuel pressure regulator

90 Anticipating that the fuel system may be pressurised, disconnect the hoses from the pressure regulator and then unscrew the union nut and unscrew the regulator from the injection manifold.
91 Refitting is a reversal of removal.

Throttle body – setting

92 A suitable flowmeter will be required for this operation.
93 Disconnect the hoses from the intake duct.
94 Release the fixing screws and remove the duct.
95 Loosen the screws which secure the accelerator throttle switch.
96 Disconnect the accelerator control cable.
97 Locate the flowmeter on the inlet of the throttle body.

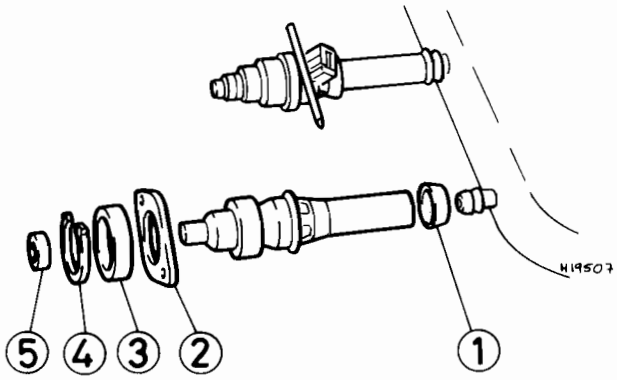

Fig. 13.13 Fuel injector components (Sec 5)

1 Bush
2 Flange
3 Rubber gasket
4 Ring
5 O-ring

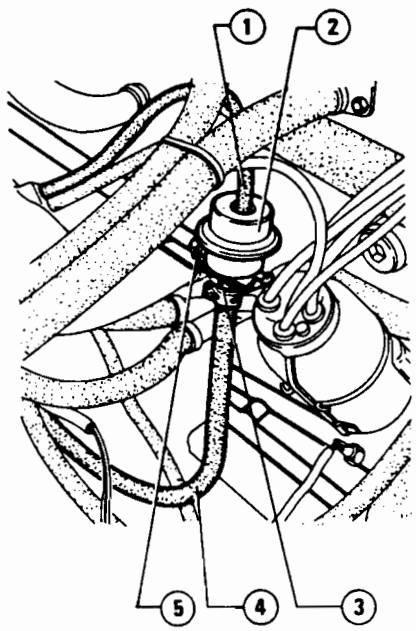

Fig. 13.14 Fuel pressure regulator (Sec 5)

1 Vacuum hose
2 Pressure regulator
3 Fixing nut
4 Excess fuel return hose
5 Union (pipeline to fuel manifold)

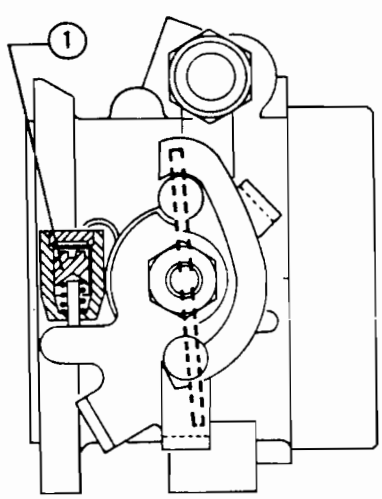

Fig. 13.15 Throttle body setting screw (1) (Sec 5)

98 With the engine running and the throttle closed, the flow should be as specified.
99 If adjustment is required, remove the tamperproof plug and turn the screw (1 – Fig. 13.15) as necessary. Fit a new plug.
100 Refit the components which were removed or disconnected.

Accelerator (throttle) switch – setting

101 Disconnect the female connector from the throttle switch.
102 Using a suitable tester, check the following resistances:
103 Throttle closed, measure resistance between terminals 2 and 18 (Fig. 13.16). The resistance should be 0 ohms.
104 Rotate the throttle lever slowly. Infinity must be registered before the throttle opens 1°. If this does not happen, loosen the switch fixing screws and rotate the switch to correct the reading.
105 Now rotate the throttle through 72° and check that the full load contact closes. This can be verified if the resistance measured between terminals 3 and 18 is 0 ohms. If not, renew the switch.

Main fuel pump – removal and refitting

106 Disconnect the battery negative lead.
107 Raise the car and support securely for access, and disconnect the electrical connections.
108 Clamp the fuel hoses using self-locking pliers with jaws suitably protected and then disconnect the hoses from the pump.
109 Release the mounting clamp and remove the pump.
110 A new pump is supplied filled with protective oil, it is not necessary to drain the oil.
111 Refitting is a reversal of removal.

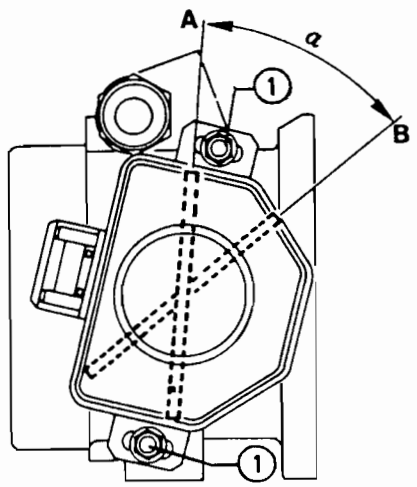

Fig. 13.17 Accelerator switch setting diagram (Sec 5)

1 Switch securing screws
a Throttle valve plate travel
A Valve plate closed
B Valve plate open

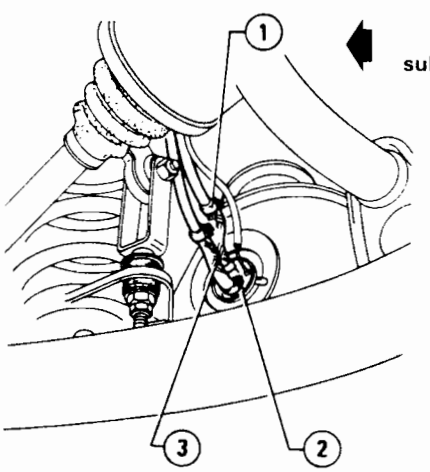

Fig. 13.19 Fuel tank submerged pump (Sec 5)

1 Fuel return hose
2 Pump flange
3 Fuel supply hose

Tank fuel pump – removal and refitting

112 A submerged fuel pump and filter is fitted into the fuel tank.
113 Disconnect the battery negative lead.
114 Drain the fuel tank by syphoning.
115 Remove the luggage compartment floor and disconnect the wiring plug from the pump.
116 Disconnect the fuel hoses from the pipe stubs of the pump.
117 Using a suitable tool, rotate the pump flange in an anti-clockwise direction and withdraw the pump carefully, together with its gasket.
118 Refit by reversing the removal operations. Use a new sealing gasket.

Fuel gauge sender unit – removal and refitting

119 The operations are very similar to those described for the submerged type fuel pump in earlier paragraphs.

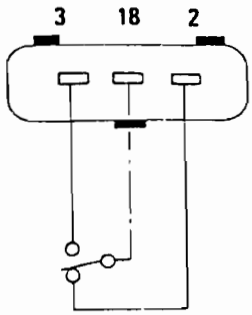

Fig. 13.16 Accelerator switch terminals (Sec 5)

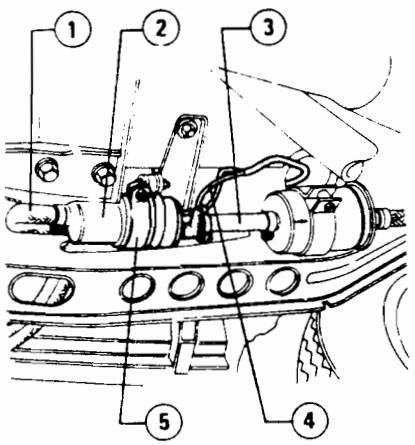

Fig. 13.18 Main fuel pump (Sec 5)

1 Fuel inlet hose
2 Fuel pump
3 Fuel outlet hose
4 Electrical leads
5 Mounting clamp

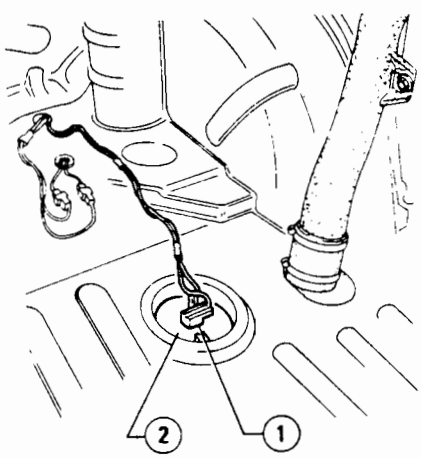

Fig. 13.20 Fuel gauge sender unit (Sec 5)

1 Electrical leads
2 Sender unit mounting flange

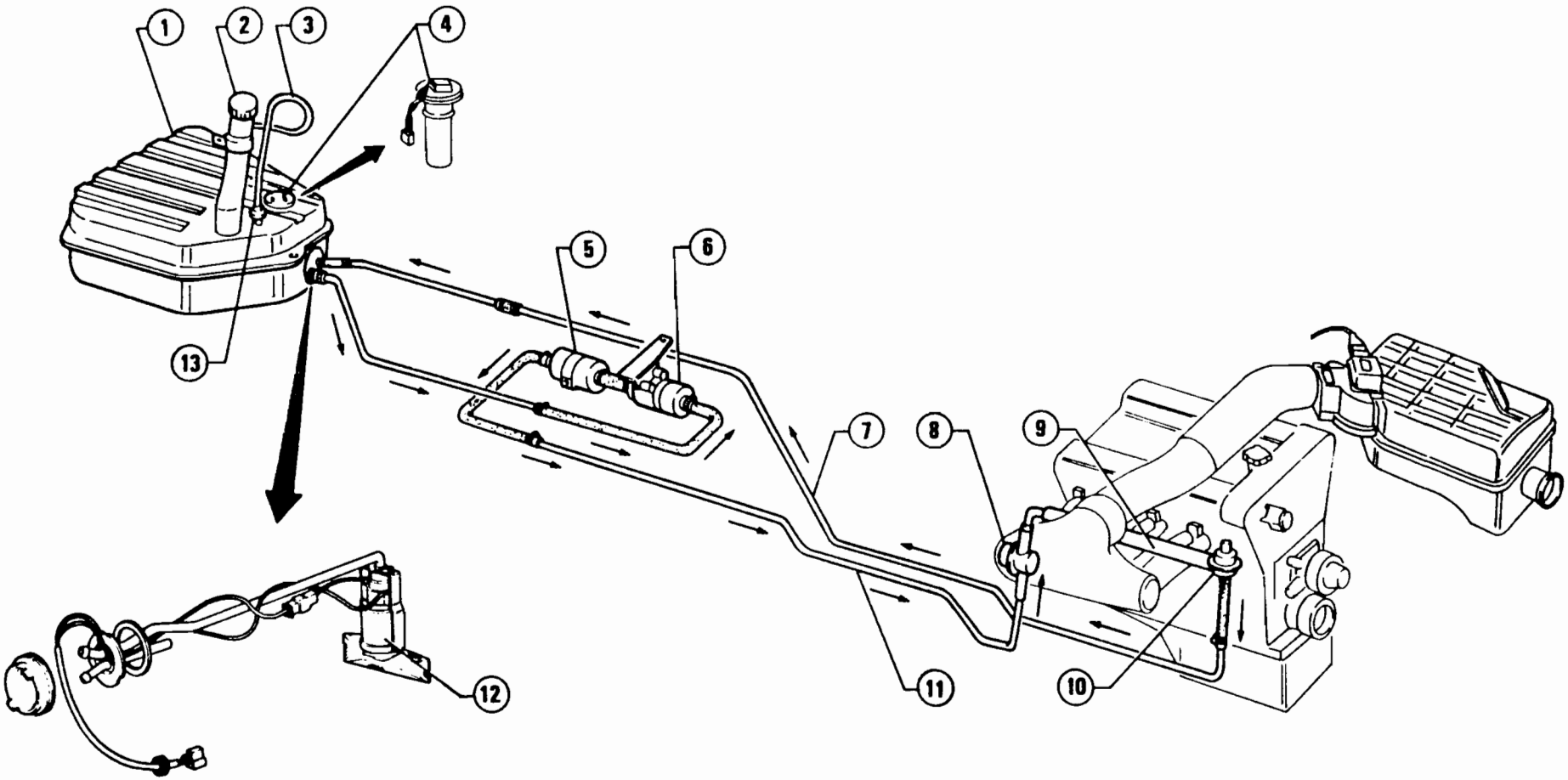

Fig. 13.21 Motronic fuel supply system (Sec 5)

1 *Fuel tank*
2 *Fuel filler pipe*
3 *Vent hose*
4 *Fuel contents sender unit*
5 *In-line filter*
6 *Main electric pump*
7 *Excess fuel return pipeline*
8 *Hammering damper*
9 *Fuel injection manifold*
10 *Pressure regulator*
11 *Fuel inlet pipeline*
12 *Submerged pump*
13 *Relief valve*

Fuel tank – removal and refitting

120 Disconnect the battery.
121 Drain the tank by syphoning.
122 Remove the lower and right-hand side trim panels from within the luggage compartment.
123 Take off the protective cover from the sender unit, and disconnect the leads and the fuel hoses from the sender unit and the submerged pump.
124 Disconnect the fuel filler hose and the breather hose.
125 Unscrew the tank flange mounting screws and remove the tank.
126 Refitting is a reversal of removal, but make sure that the sealing gasket is in good condition.

Accelerator cable – setting

127 The accelerator cable should be tensioned to give a clearance of between 1.0 and 2.0 mm (0.04 and 0.08 in) between the cable end fitting and throttle lever with the accelerator pedal released. Check that the cable is not over tensioned with pedal fully depressed.

6 Ignition system – electronic (breakerless) type

Description

1 This system was fitted to models built after late 1983.
2 A Bosch or Marelli system may be fitted and comprises an ignition coil, an electronic control system, and a breakerless distributor. On Bosch systems, a resistor is fitted.
3 The electronic system has several advantages over the conventional ignition system. These include the following:

Elimination of points adjustment and renewal
Reduction in number of moving parts
Lower current draw
Higher secondary voltage

4 These factors improve performance and reduce the exhaust emission levels.
5 With electronic systems, primary voltage is applied from the battery through the ignition switch to the electronic control module, and through a resistor to the coil. The resistor acts as a heat sink.
6 The earth (negative) terminal of the coil is connected to the control module, which itself connects to a negative pick-up in the distributor.
7 Primary voltage is regulated by the control module, to supply a regulated current to the primary windings of the ignition coil. The control module is triggered by an impulse, generated within the distributor. This interrupts the coil primary circuit. Each time the primary circuit is broken, a high voltage is induced in the coil secondary windings, which is in turn distributed to the spark plugs through the conventional means of distributor cap and rotor.
8 A conventional, oil filled ignition coil is used. The electronic control module incorporates a current limiter to provide a constant supply to the primary circuit and so prevent damage to the coil.
9 The control module also monitors the impulses from the distributor pick-up assembly to provide the necessary dwell and spark duration, irrespective of engine speed.
10 The pick-up assembly consists of a wire wound coil, a four-pole stator and a permanent magnet. The trigger incorporates four teeth, 90° apart. As a tooth passes through the magnetic field, an electrical impulse is generated in the coil winding of the pick-up assembly and then fed to the control module, so interrupting the coil primary circuit.
11 A vacuum capsule is attached to the breakerless type distributor body, to provide ignition advance according to engine load. Vacuum is obtained from the carburettor bore above the throttle valve plate, and provides high vacuum during part throttle operation.

Maintenance

This type of distributor is virtually maintenance-free. No points adjustment, renewal or lubrication is required.
12 Occasionally, wipe the distributor cap clean and check for cracks.
13 Check the system interconnecting leads for security of connection and for the condition of the insulation.

Timing

It is rare to find that the timing on the system requires adjustment: there are no contact points to wear, which could alter the timing.
14 Where it is required (perhaps after removal and refitting of the distributor), timing adjustment must be carried out using a stroboscope.
15 Connect the stroboscope in accordance with the maker's instructions.
16 Have the engine at normal operating temperature, idling at specified speed and the distributor vacuum hose disconnected from the distributor and plugged.
17 Shine the light on the timing marks, which should have been painted white. Slacken the distributor, and move it as required to get the correct relationship of the notch on the pulley with the mark on the cover, as 'frozen' by the light. Reclamp the distributor. Speed up the engine, and check the automatic advance is working.

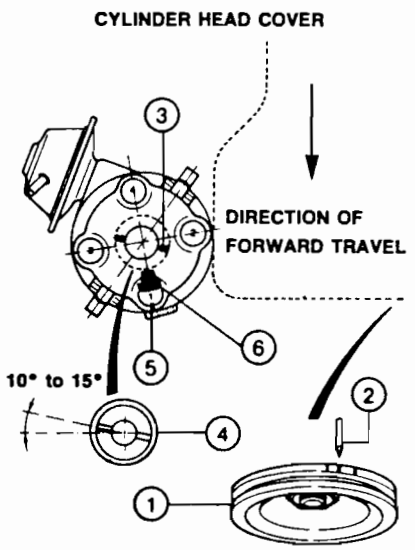

Fig. 13.22 Breakerless distributor installation diagram (Sec 6)

1 *Crankshaft pulley*
2 *Timing pointer*
3 *Drive coupling*
4 *Oil pump driveshaft*
5 *Rotor/rim reference mark*
6 *Rotor arm*

Distributor – removal and refitting

18 Turn the crankshaft pulley, using a wrench on its centre nut, until No 1 piston is at its firing position, indicated by the F mark on the pulley being aligned with the timing pointer on the coolant pump.
19 Remove the distributor cap and place it to one side, complete with the HT leads. Note that the contact end of the rotor is in alignment with the mark on the rim of the distributor body.
20 Disconnect the vacuum hose and the LT lead connecting plug.
21 Release the clamp and withdraw the distributor.
22 Before refitting, check that the crankshaft pulley and coolant pump timing marks are in alignment; if they are not, reset them.
23 Hold the distributor over its mounting hole with the contact end of the rotor in alignment with the mark on the body rim. Push the distributor fully home, giving the rotor a slight turn in each direction to engage the dog with the groove in the end of the oil pump driveshaft.
24 Align the mark on the body rim with the rotor and tighten the distributor clamp.
25 Refit the cap, and HT and LT leads.
26 Check the ignition timing as previously described. Reconnect the vacuum hose.

Distributor – overhaul (general)

27 The following overhaul procedures are limited to those operations for which spare parts are available. Where a distributor is well worn and has given long service, it is recommended that a new unit is fitted.

Distributor (Bosch) – overhaul

28 With the distributor removed, take off the cap, rotor and dust cover.
29 Extract the timer retaining circlip.
30 Remove the screws and take off the cap spring clips.

31 Remove the screws which secure the stator and the advance vacuum capsule.
32 Remove screw and take off the connector.
33 Lift up the timer and pulse generator, unhook the advance capsule link rod and remove the capsule.
34 Take off the circlip and withdraw the internal components from the distributor body.
35 The advance weights can be removed, if essential, after unhooking the small springs – but mark the exact position of the springs and weights before removing them.
36 Clean all parts and renew any worn items, then reassemble by reversing the dismantling procedure.

Distributor (Marelli) – overhaul

37 With the distributor removed, loosen the screws and take off the cap.
38 Extract the screws and take off the rotor.
39 Release the springs and take out the advance weights, noting the exact location of the springs and weights.
40 Extract the screws and remove the pulse generator (stator) and insulating support.
41 Extract the screws and remove the advance vacuum capsule by prising the link rod.
42 Clean all parts and renew any worn items, then reassemble by reversing the dismantling procedure.

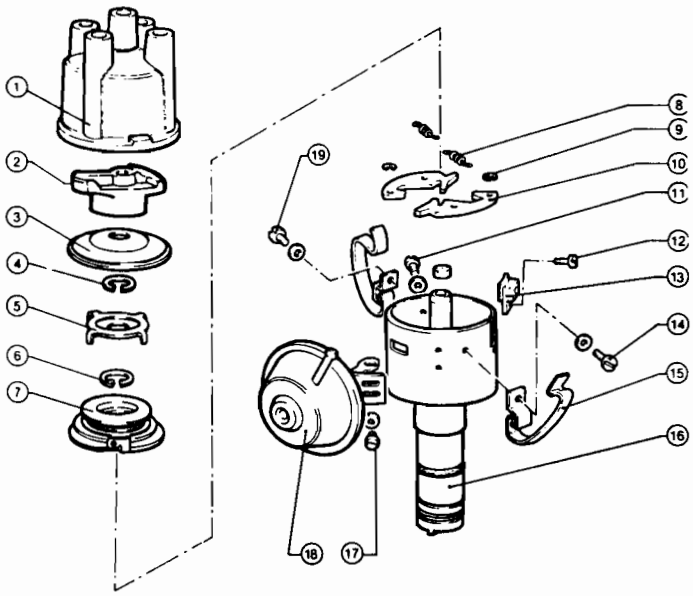

Fig. 13.23 Exploded view of Bosch breakerless distributor (Sec 6)

1 *Distributor cap*
2 *Rotor arm*
3 *Dust cover*
4 *Circlip*
5 *Timer*
6 *Circlip*
7 *Pulse generator (stator)*
8 *Advance weight spring*
9 *Circlip*
10 *Advance counterweight*
11 *Stator retaining screw*
12 *Connector block retaining screw*
13 *Connector block*
14 *Cap clip screw*
15 *Cap clip*
16 *Distributor body*
17 *Vacuum diaphragm capsule screw*
18 *Vacuum diaphragm capsule*
19 *Cap clip screw*

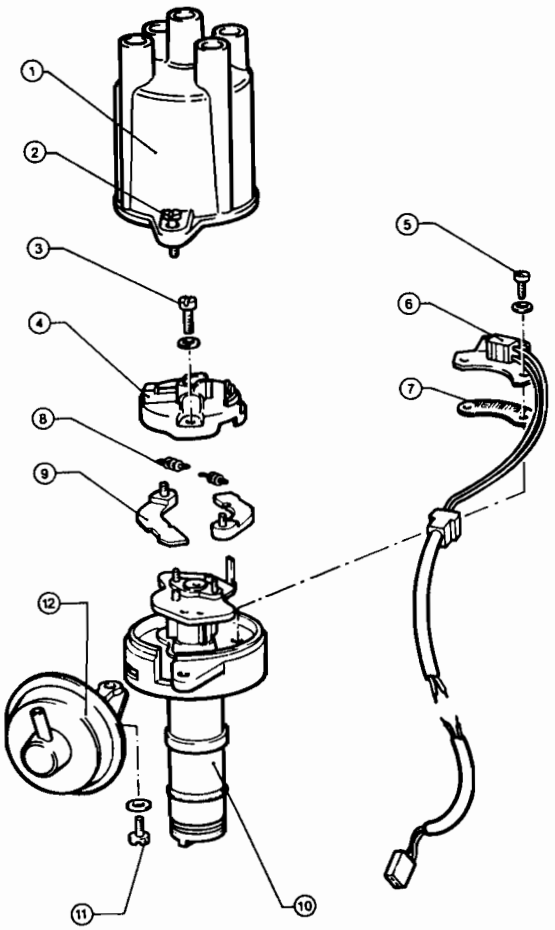

Fig. 13.24 Exploded view of Marelli breakerless distributor (Sec 6)

1 *Distributor cap*
2 *Cap retaining screw*
3 *Rotor arm retaining screw*
4 *Rotor arm*
5 *Stator retaining screw*
6 *Pulse generator (stator)*
7 *Insulator*
8 *Advance weight spring*
9 *Advance counterweight*
10 *Distributor body*
11 *Vacuum diaphragm capsule screw*
12 *Vacuum diaphragm capsule*

7 Ignition system – Motronic

Description

1 The Motronic engine management system is fitted to 1962 cc engine models from early 1984.
2 The system comprises indirect fuel injection and electronic ignition controlled by a single unit.
3 In addition, the control unit alters the timing of the engine intake valves (see later in this Section).
4 The central control unit obtains information from various sensors to compute the opening period of the fuel injectors, the ignition timing and the intake valve timing as required under all engine load and speed conditions.
5 The main components of the system are shown in Fig. 13.25.

Precautions

6 To prevent damage to the system components observe the following precautions.
7 Never attempt to start the engine unless the battery leads are connected correctly.
8 Never disconnect the battery while the engine is running.
9 Never allow the vehicle to enter a paint baking oven (80°C/176°F or higher) unless the control unit is first removed.
10 Do not unplug the control unit with the ignition switched on.
11 Do not earth the HT or LT system cables for test purposes.

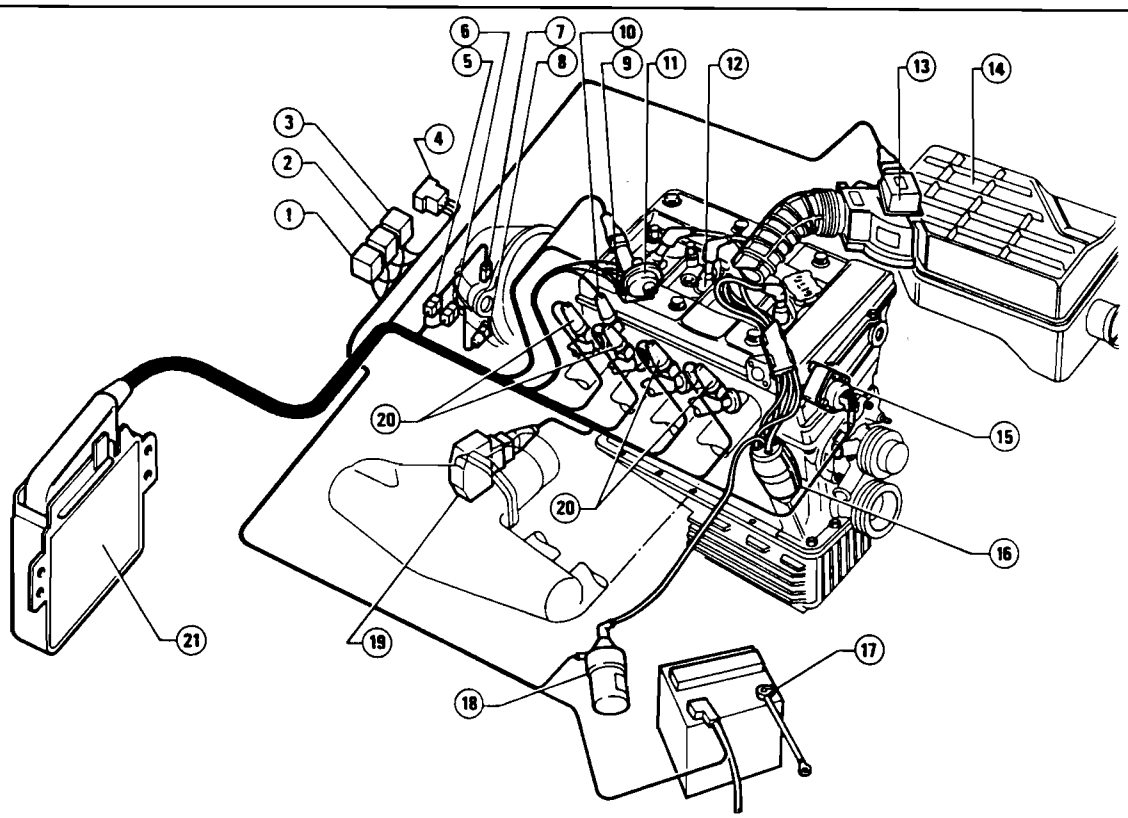

Fig. 13.25 Motronic engine management system (Sec 7)

1 *Relay – fuel pump and auxiliary air solenoid valve*
2 *Relay – control unit and fuel injectors*
3 *Relay – valve timing variator*
4 *Wiring harness connector*
5 *Rev transducer connector*
6 *Timing transducer connector*
7 *Rev transducer (sensor)*
8 *Timing transducer (sensor)*
9 *Earth*
10 *Coolant temperature sender*
11 *Auxiliary air solenoid valve*
12 *Spark plugs*
13 *Airflow gauge*
14 *Air cleaner*
15 *Valve timing variator control solenoid*
16 *Ignition distributor*
17 *Battery*
18 *Ignition coil*
19 *Throttle opening switch*
20 *Fuel injectors*
21 *Electronic control unit (ECU)*

Fault diagnosis

12 Without special test equipment, component checking cannot be carried out but, should a fault occur, first make sure that all wiring and hose connections are secure.

13 After reference to the following check list, the component suspected of being faulty can be removed and taken for detailed testing by your dealer or fuel injection/ignition specialist.

Fault diagnosis

Symptom	Reason(s)
Difficult cold start	Faulty main or fuel pump relay Faulty fuel pump Low fuel pressure Ignition distributor, coil or spark plug fault Leak in air supply system Faulty coolant temperature sensor or rev transducer Auxiliary air valve not opening
Difficult hot start	As above plus: Fuel pressure too high Idle speed incorrect
Irregular idle and maximum speed unobtainable	Faulty fuel pump Low fuel pressure Auxiliary air flow not closing Leak in air supply system Throttle switch out of adjustment
Excessive fuel consumption	Fuel pressure too high Faulty air flow gauge Coolant temperature sensor faulty Incorrect mixture Clogged air cleaner element Faulty valve timing variator relay

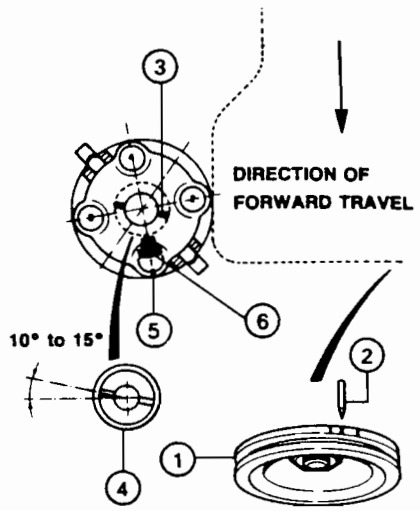

Fig. 13.26 Motronic distributor installation diagram (Sec 7)

1 Crankshaft pulley
2 Timing pointer
3 Drive coupling
4 Oil pump driveshaft
5 Rotor arm/rim alignment mark
6 Rotor arm

Electronic control unit – removal and refitting

14 The ECU is located under a protective cover on the panel onthe right-hand side of the driver's footwell.
15 Extract the retaining screws and withdraw the ECU until the multi-pin connectors can be unplugged. The connectors are of different widths so they cannot be confused.

Ignition coil

16 The ignition coil is located on the right-hand wing valance within the engine compartment.

Distributor – removal and refitting

17 As the ECU performs the timing functions normally associated with a conventional distributor, the distributor used in the Motronic system consists of only a driven rotor and cap.
18 To remove the distributor, first turn the crankshaft pulley so that the reference mark F on the pulley is aligned with the timing pointer cast on the coolant pump. This indicates No 1 piston is at 9 to 11° BTDC.
19 Note that the contact end of the rotor is aligned with the mark on the rim of the distributor body.
20 Unclip the distributor cap and place it to one side with HT leads attached.
21 Unclamp the distributor and withdraw it, noting that the driveshaft engages with the oil pump driveshaft by means of a dog.
22 Before refitting the distributor, check that the crankshaft pulley timing marks have not moved, otherwise reset them.
23 Hold the distributor over its locating hole with the contact end of the rotor in alignment with the mark on the rim. Push the distributor fully home, giving the rotor a slight turn in each direction to engage the dog.
24 Align the rim mark with the rotor and tighten the distributor clamp.
25 Refit the cap with leads.
26 Start the engine and bring to normal operating temperature. Using a stroboscope, check that, at the specified idle speed, the crankshaft pulley F mark is aligned with the timing pointer.
27 Never attempt to advance the ignition timing by turning the distributor beyond its normal setting, or damage will be caused.

Variable valve timing – description

28 This arrangement is designed to aid starting and improve low speed running and flexibility by advancing the period during which the inlet valves are open when the engine speed exceeds 1200 rpm.
29 This is achieved by turning the camshaft relative to the drive sprocket using an oil pressurised coupling.
30 The electronic control unit of the Motronic system controls the valve timing variation.
31 Differences between the standard camshaft and the camshaft used with the Motronic system can be observed in Fig. 13.1 of this Supplement.
32 Operation of the valve timing variator can be checked in the following way.
33 Have the engine idling then disconnect the wiring plugs from the solenoid. The engine should run roughly or stall if the timing variator is operating correctly.

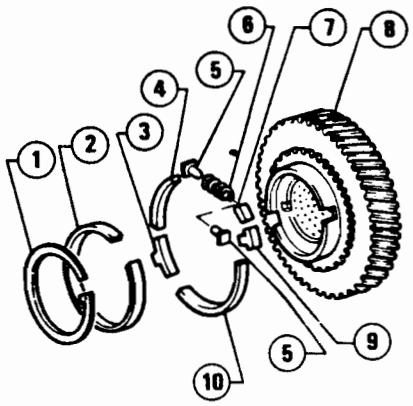

Fig. 13.27 Later type 1st/2nd synchro unit (Sec 8)

1 Circlip
2 Baulk ring
3 Locking sector
4 Retainer
5 Strikers
6 Coil spring
7 Pawl
8 1st gear
9 Key
10 Retainer

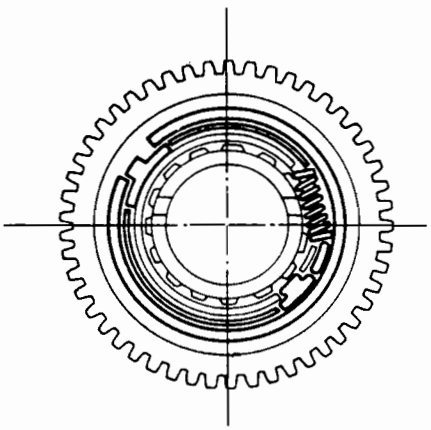

Fig. 13.28 1st/2nd synchro unit correctly assembled (Sec 8)

8 Transmission

Gearchange linkage – removal and refitting

1 Working inside the car, set the gear lever in neutral and remove the knob.
2 Working under the car, disconnect the exhaust system and lower it to the floor.
3 Pull the rubber boot aside and extract the pivot bolt which connects the gearchange lever to the link rod. Remove the boot.
4 Extract the four screws which hold the support to the floorpan. Withdraw the support/lever assembly.
5 The lever can be dismantled from the support after extracting the securing circlip.
6 The link rod can be removed from the transmission if necessary after driving out the connecting roll pin.
7 Reassembly and refitting are reversals of removal and dismantling, but smear the gear lever ball with molybdenum disulphide grease.

Synchroniser – modification

8 The 1st/2nd synchro unit on later models has been modified to include a coil spring.

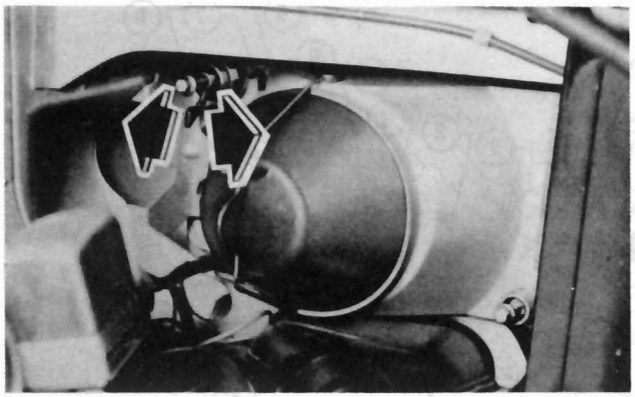

Fig. 13.29 Headlamp beam load adjuster lever (Sec 9)
Move in direction of arrows

9 When reassembling the unit it is important that the longer and shorter locking sectors are located in relation to the coil spring as shown in Fig. 13.28.

Transmission – modifications

10 As from the beginning of January 1979, various modifications were carried out to the five speed transmission; these include:

Mainshaft

11 Insertion of an 8.0 mm thick distance piece between the intermediate flange bearing and 3rd and 4th gears.

Reverse/5th speed gear synchromesh

12 This has been redesigned with a lightweight hub. The shoulder on the hub must be towards 5th gear.

Differential

13 The modified differential now requires a crownwheel-to-pinion tooth backlash of 0.01 to 0.11 mm (0.0004 to 0.0043 in). A wider range of selective shims is available.

9 Electrical system

Headlamp beam load adjuster

1 Certain models are fitted with a beam adjusting device which can be set according to the vehicle load in order to prevent dazzling approaching drivers.

2 Move the lever towards the outside of the car if the car is heavily loaded.

Alternator (later models) – description

3 The alternator used on later models is of integral voltage regulator type. It is recommended that overhaul is limited to renewal of the brushes and cleaning the slip rings.

4 A generally worn alternator is best changed for a new or factory exchange unit rather than undertake a complete overhaul. This will normally prove to be more economical than purchasing many individual components.

Alternator brushes – renewal

5 Remove the alternator from the car.

Bosch

6 Remove the screws which secure the voltage regulator to the rear face of the alternator.

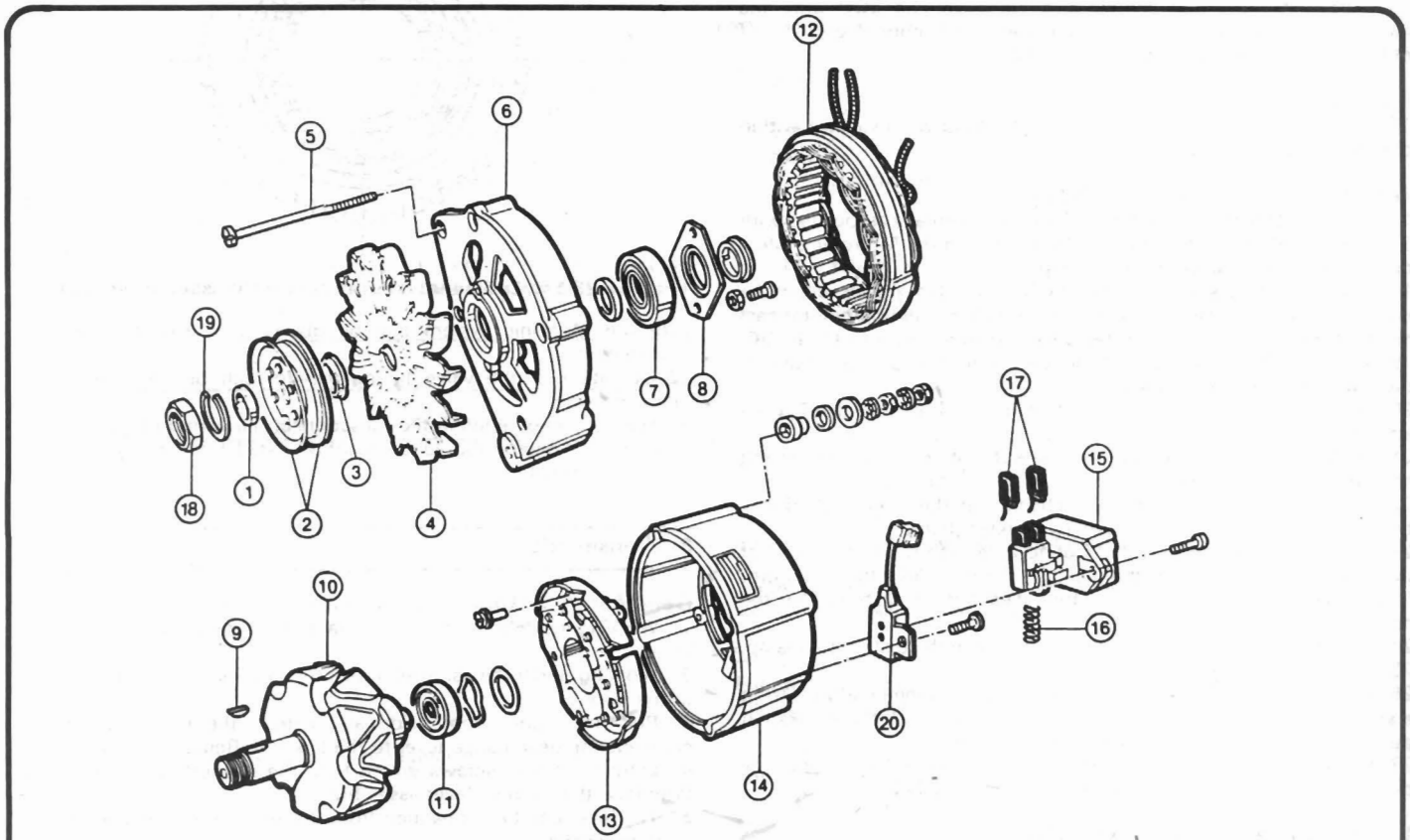

Fig. 13.30 Exploded view of Bosch alternator (Sec 9)

1 *Spacer*
2 *Pulley*
3 *Spacer*
4 *Fan*
5 *Tie-bolt*
6 *Drive end bracket*
7 *Drive end bearing*
8 *Bearing retaining plate*
9 *Woodruff key*
10 *Rotor*
11 *Rear end bearing*
12 *Stator*
13 *Heat sink*
14 *Rear end housing*
15 *Voltage regulator/brush holder*
16 *Brush spring*
17 *Brush*
18 *Pulley nut*
19 *Lockwasher*
20 *Voltage regulator connector*

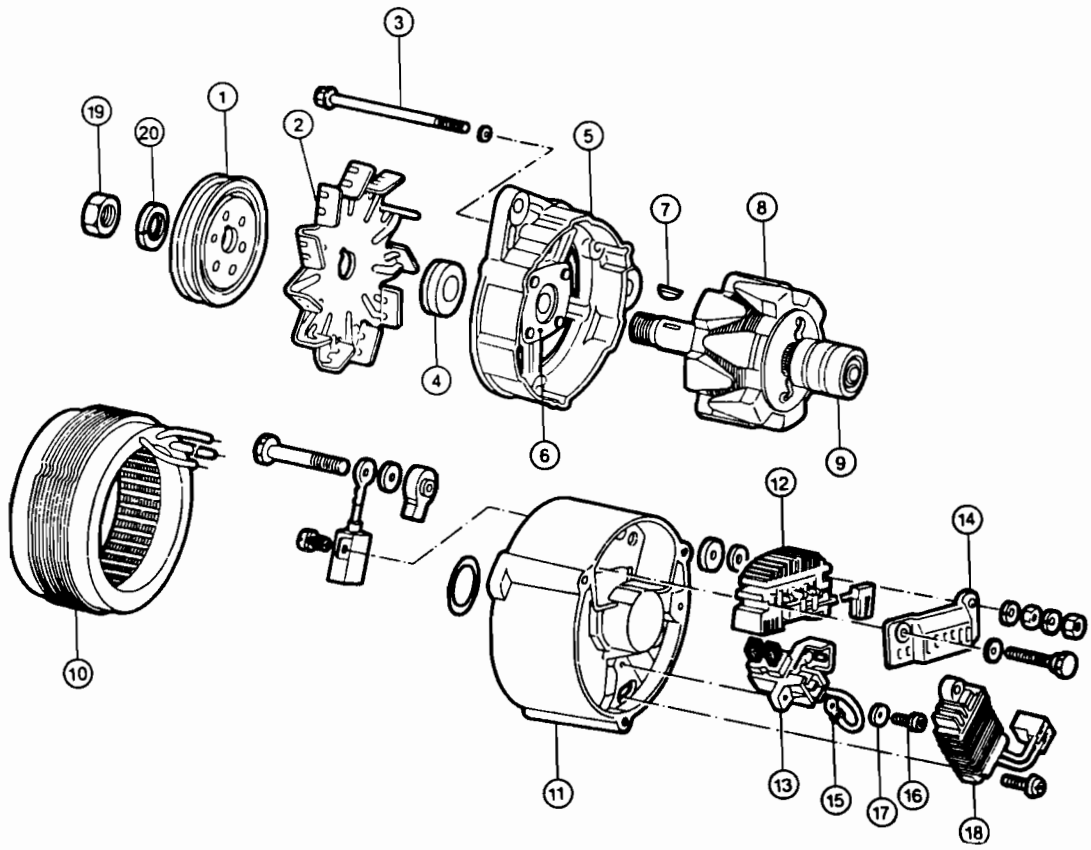

Fig. 13.31 Exploded view of the Marelli alternator (Sec 9)

1 *Pulley*
2 *Fan*
3 *Tie-bolt*
4 *Spacer*
5 *Drive end bracket*
6 *Bearing retaining plate*
7 *Woodruff key*
8 *Rotor*
9 *Rear end bearing*
10 *Stator*
11 *Rear end housing*
12 *Heat sink*
13 *Brush holder*
14 *Rectifier bridge cover*
15 *Field terminal*
16 *Screw*
17 *Insulating washer*
18 *Voltage regulator*
19 *Pulley nut*
20 *Lockwasher*

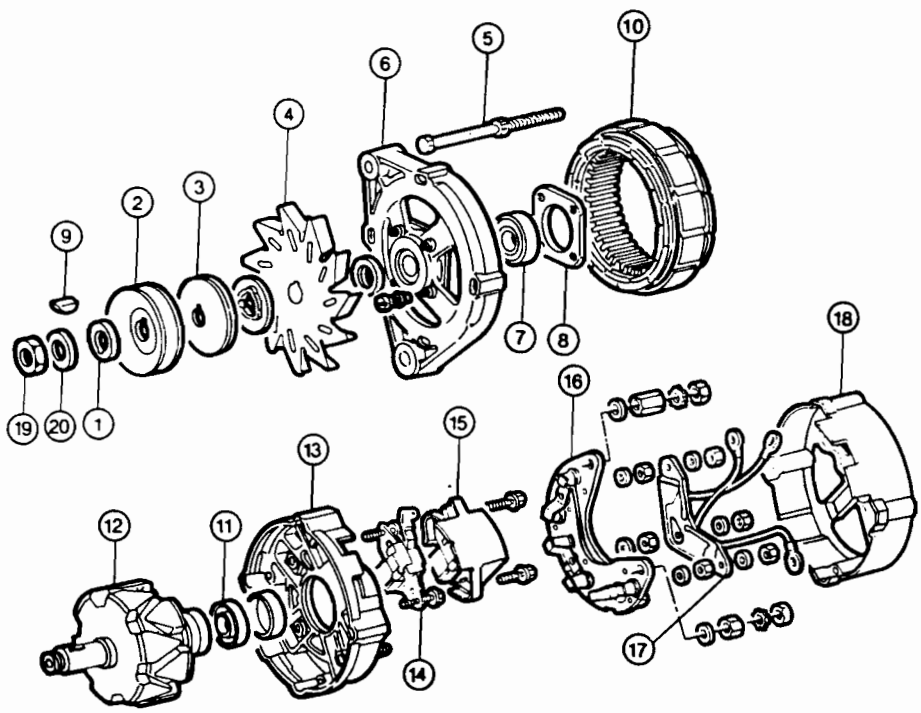

Fig. 13.32 Exploded view of Paris-Rhone alternator (Sec 9)

1 *Washer*
2 *Pulley*
3 *Spacer*
4 *Fan*
5 *Tie-bolt*
6 *Drive end bracket*
7 *Drive end bearing*
8 *Bearing retaining plate*
9 *Woodruff key*
10 *Rotor*
11 *Rear end bearing*
12 *Stator*
13 *Rear end housing*
14 *Brush holder*
15 *Voltage regulator*
16 *Heat sink (positive and negative diodes)*
17 *Heat sink (field diode)*
18 *Diode cover*
19 *Pulley nut*
20 *Lockwasher*

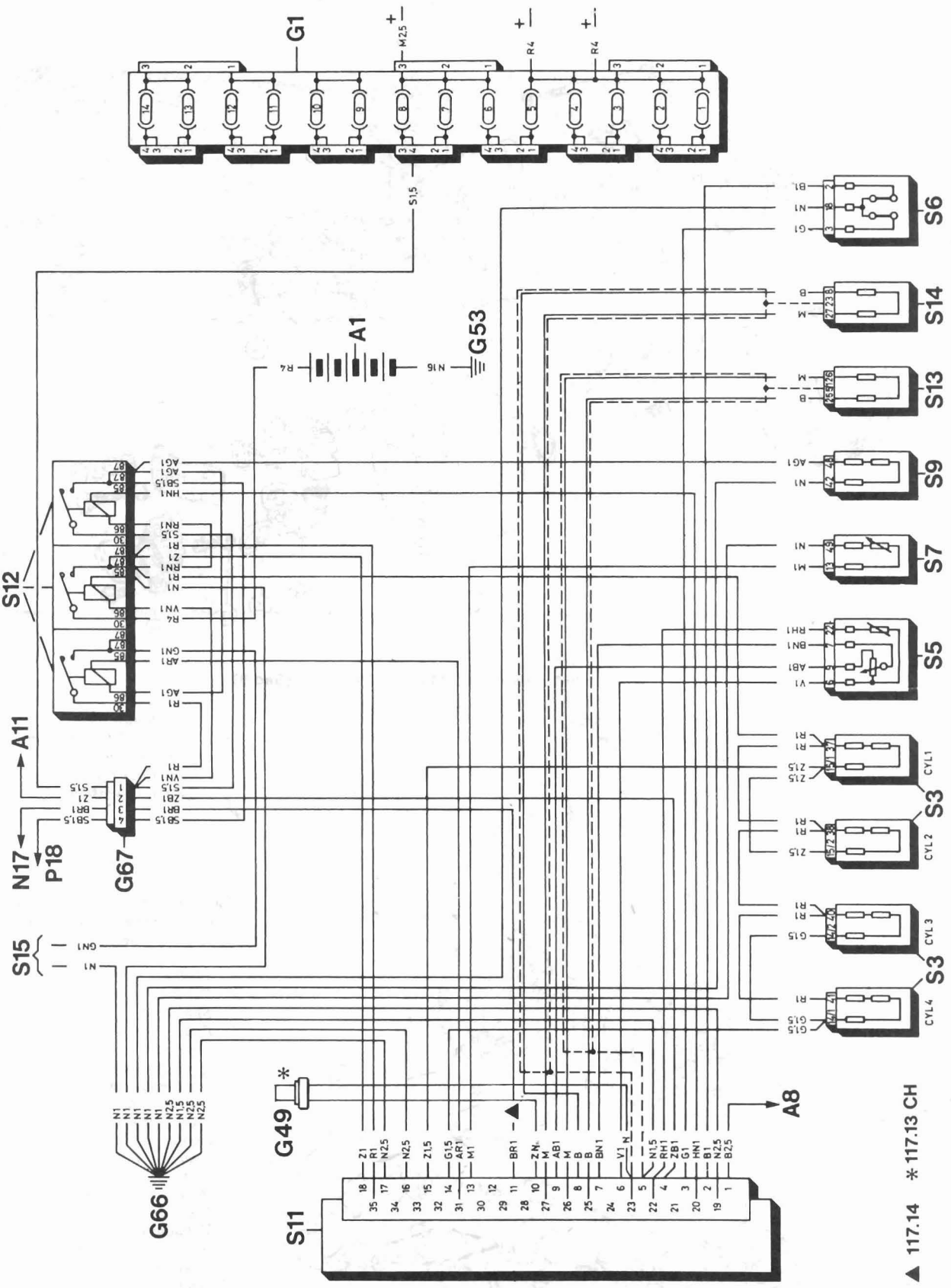

Fig. 13.33 Typical wiring diagram for Gold Cloverleaf models – fuel injection

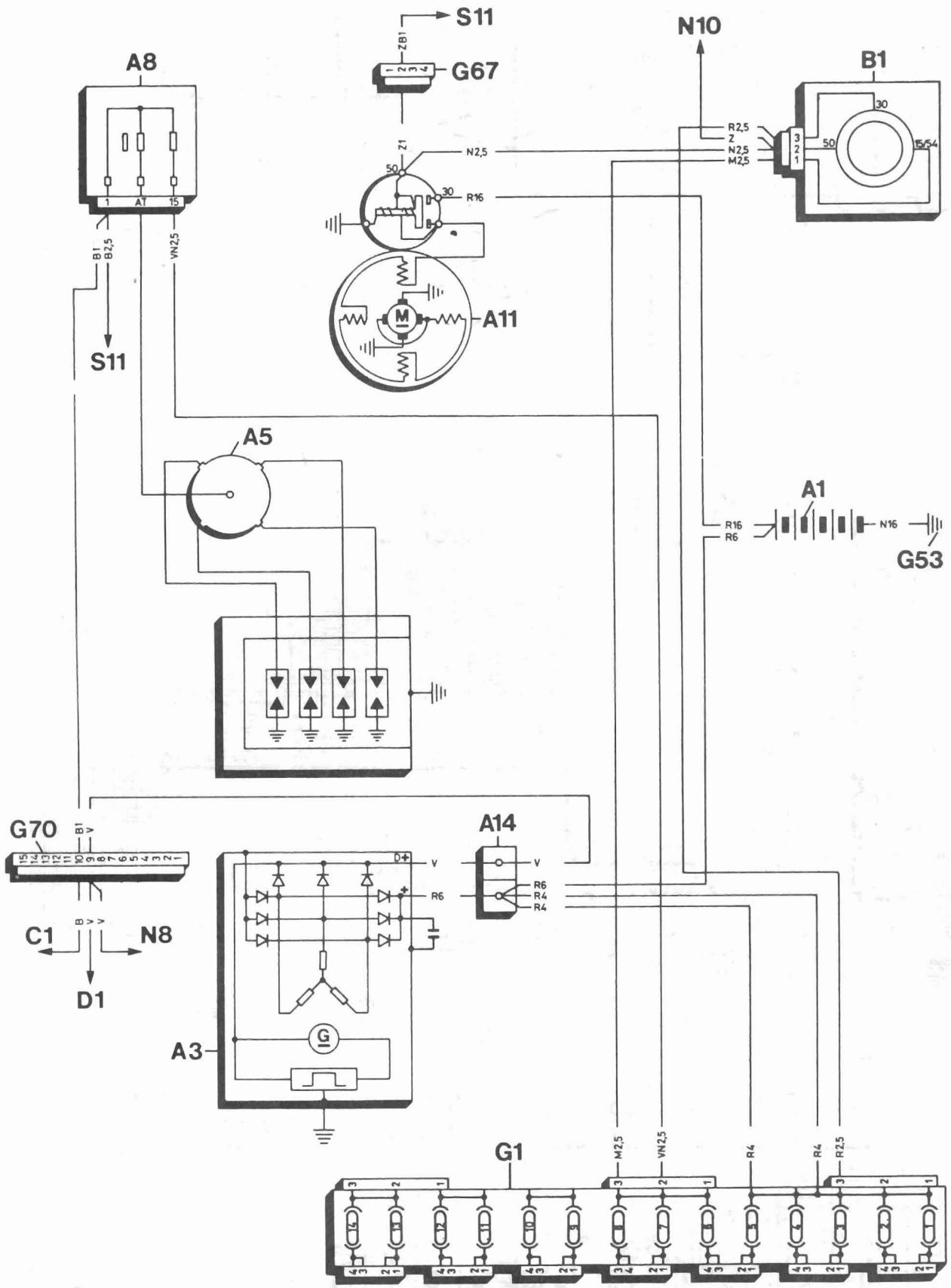

Fig. 13.34 Typical wiring diagram for Gold Cloverleaf models – starting, charging and ignition

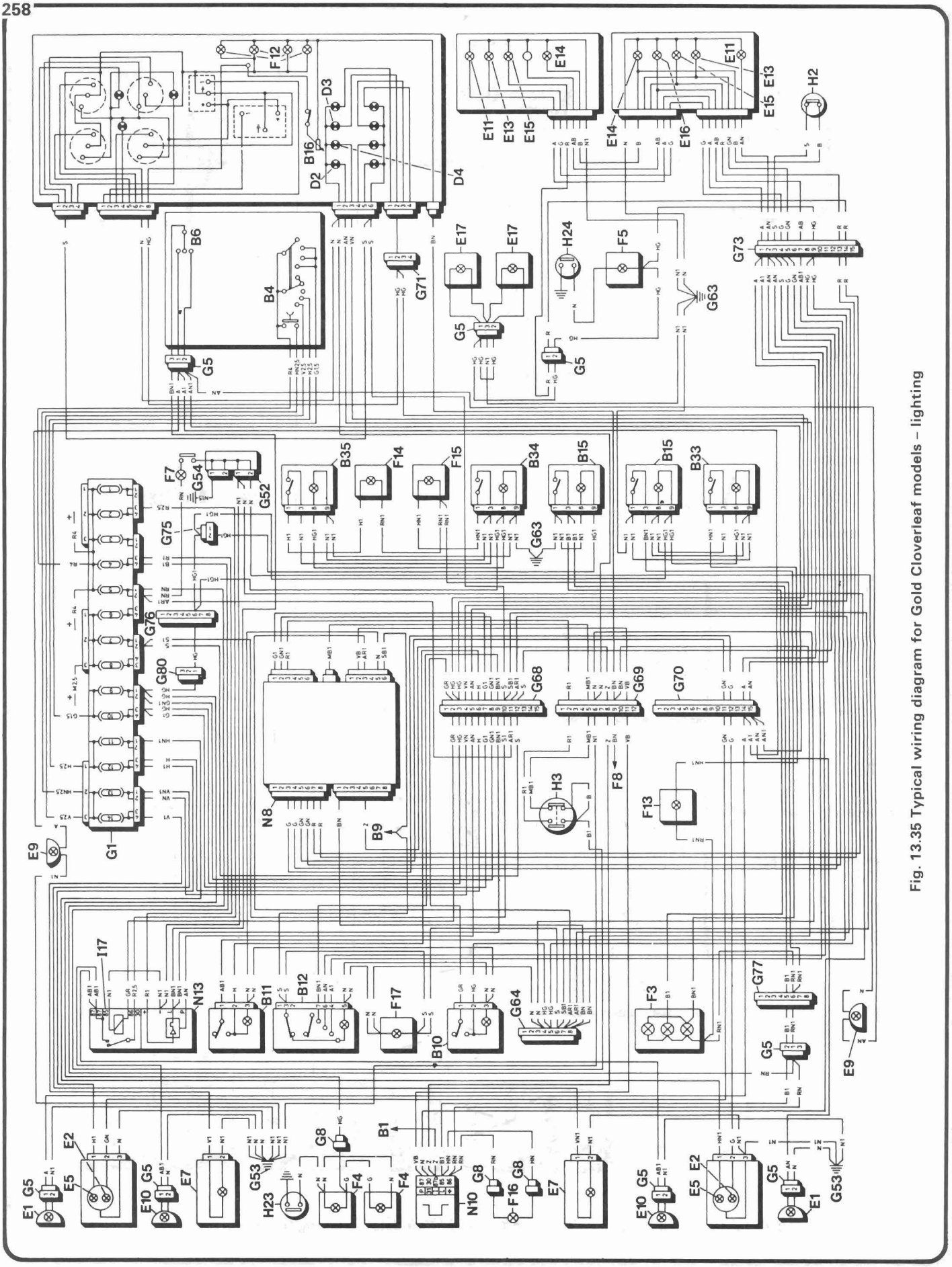

Fig. 13.35 Typical wiring diagram for Gold Cloverleaf models – lighting

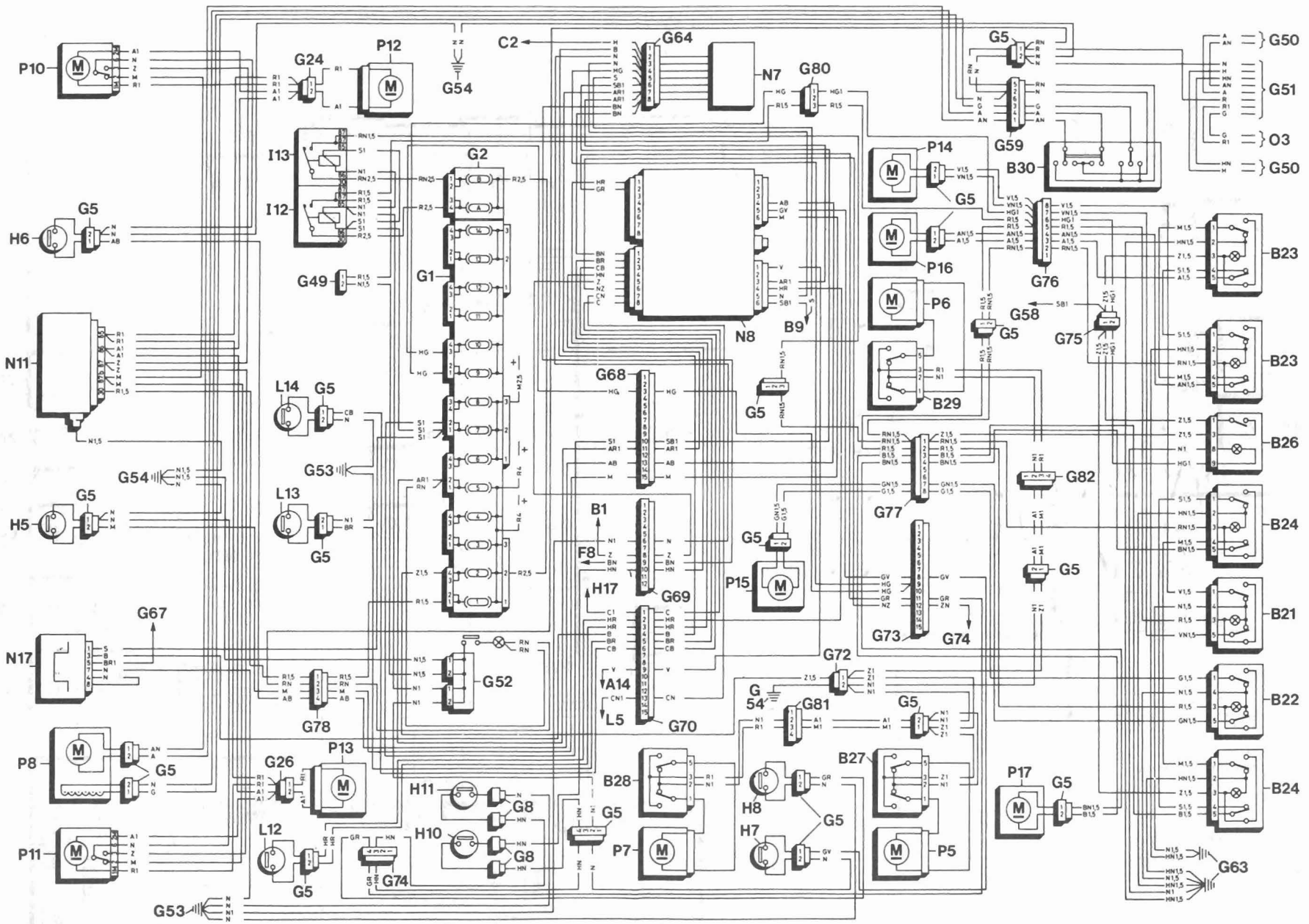

Fig. 13.36 Typical wiring diagram for Gold Cloverleaf models – in-car entertainment and electric mirrors

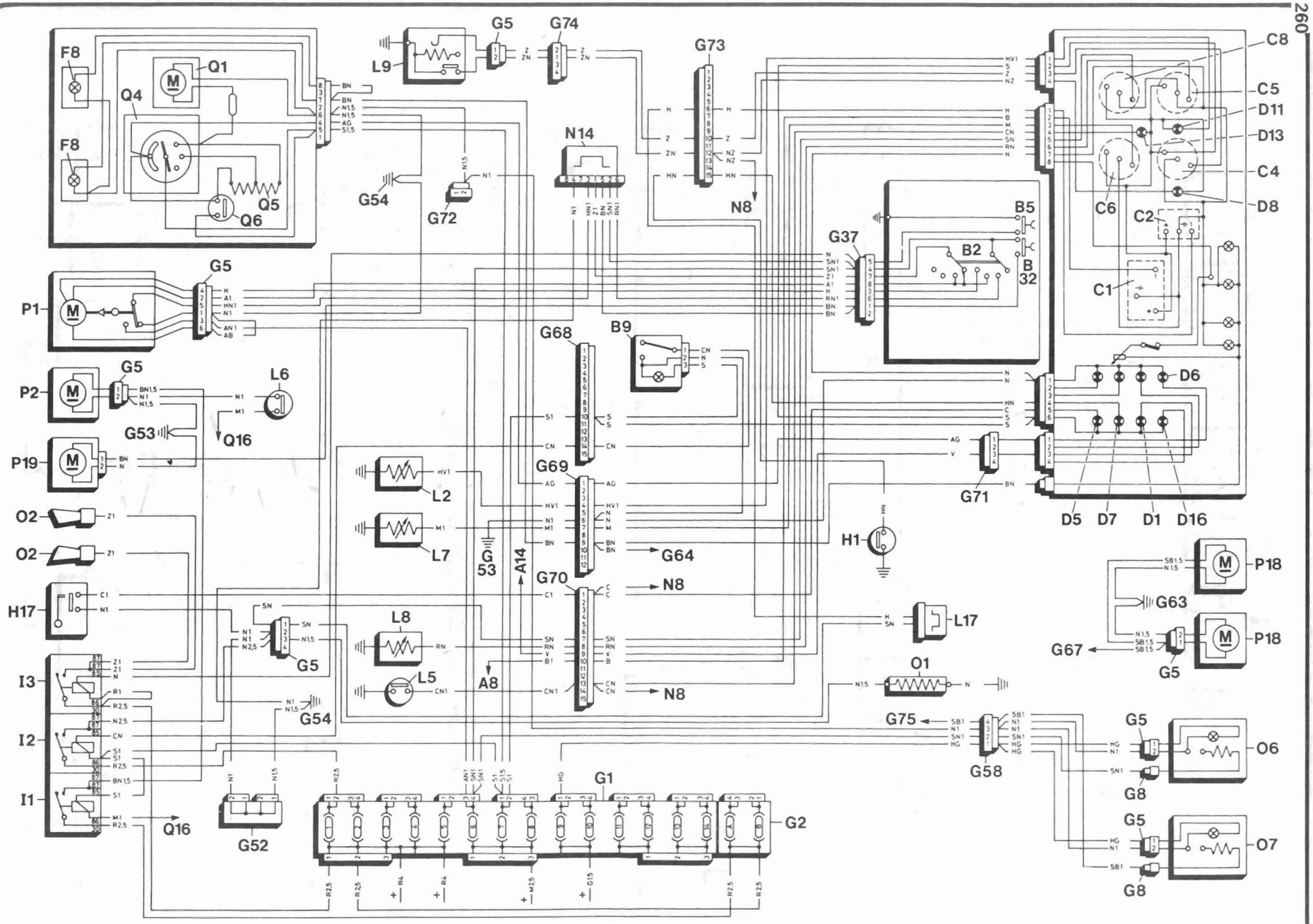

Fig. 13.37 Typical wiring diagram for Gold Cloverleaf models – horn, wipers and heated rear window

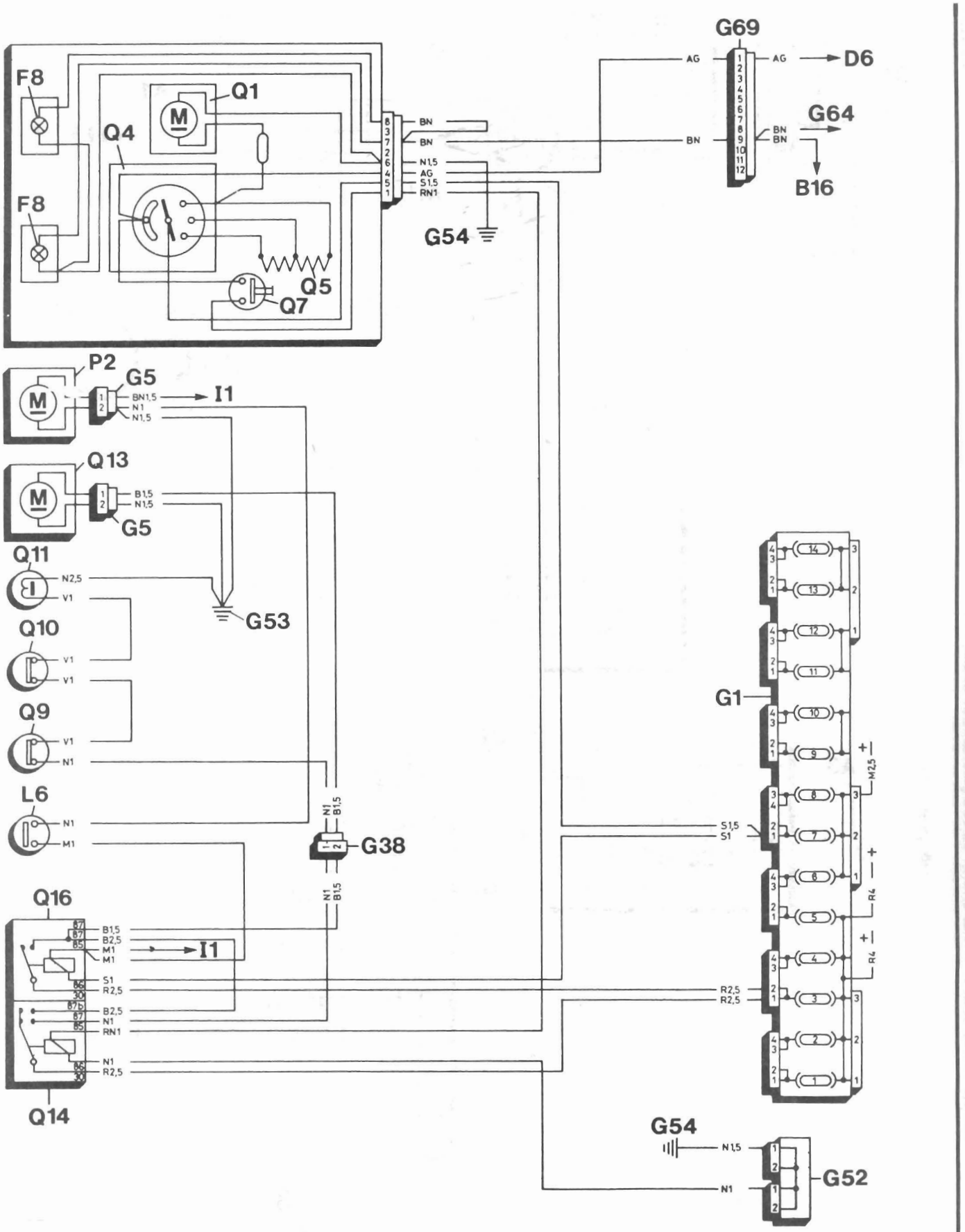

Fig. 13.38 Typical wiring diagram for Gold Cloverleaf models – air conditioning

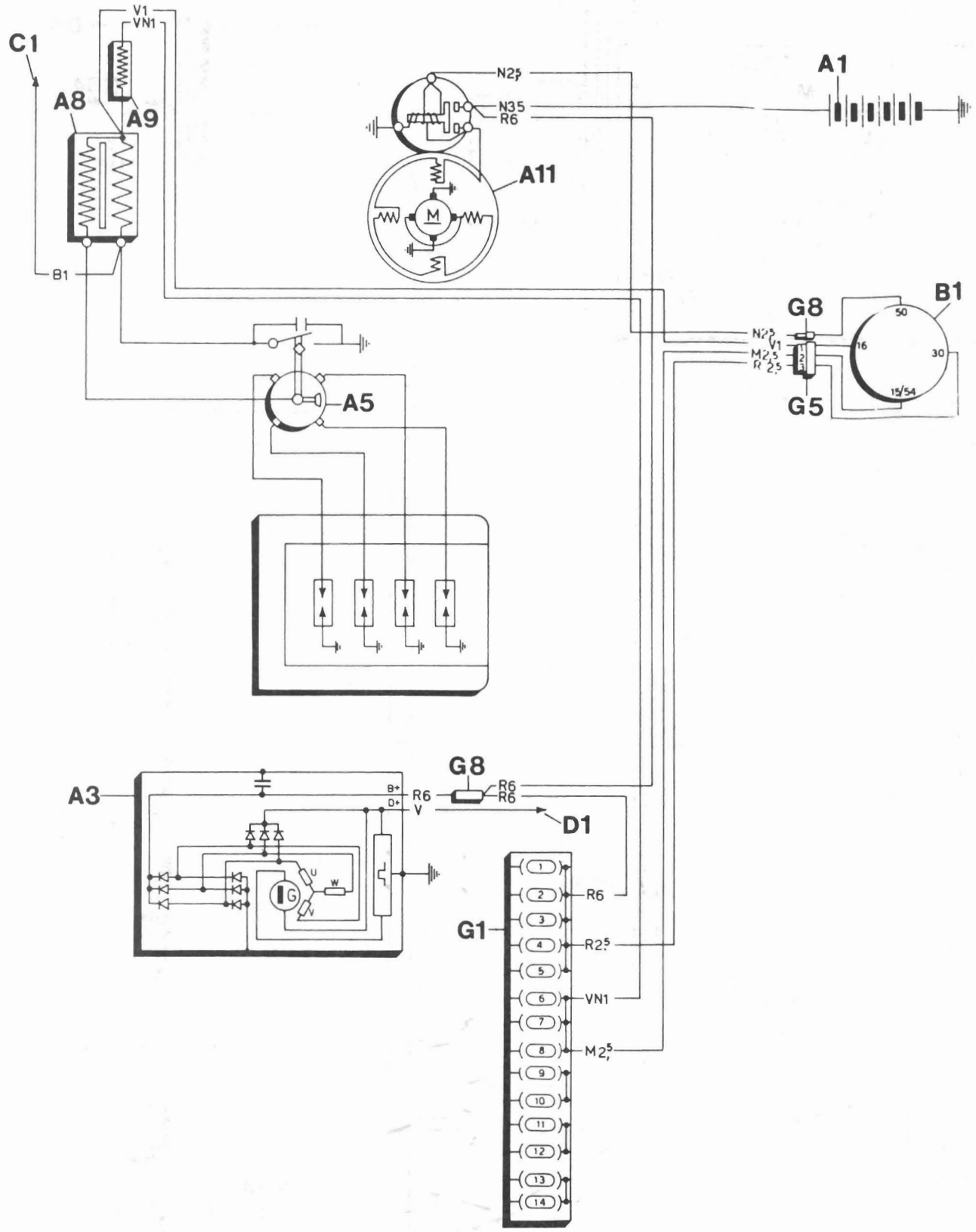

Fig. 13.39 Typical wiring diagram for GTV 2.0 models – starting, charging and ignition

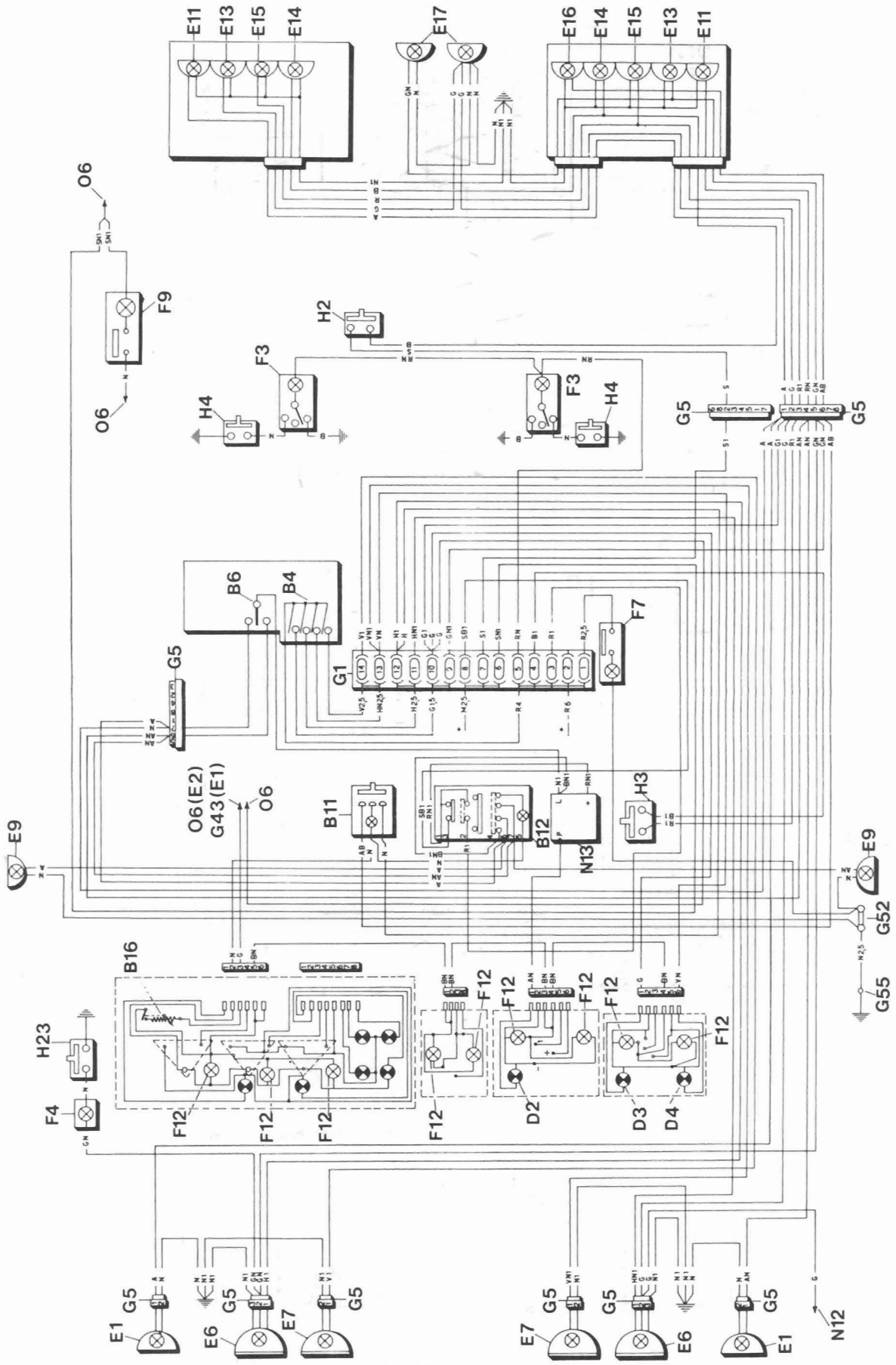

Fig. 13.40 Typical wiring diagram for GTV 2.0 models – lighting

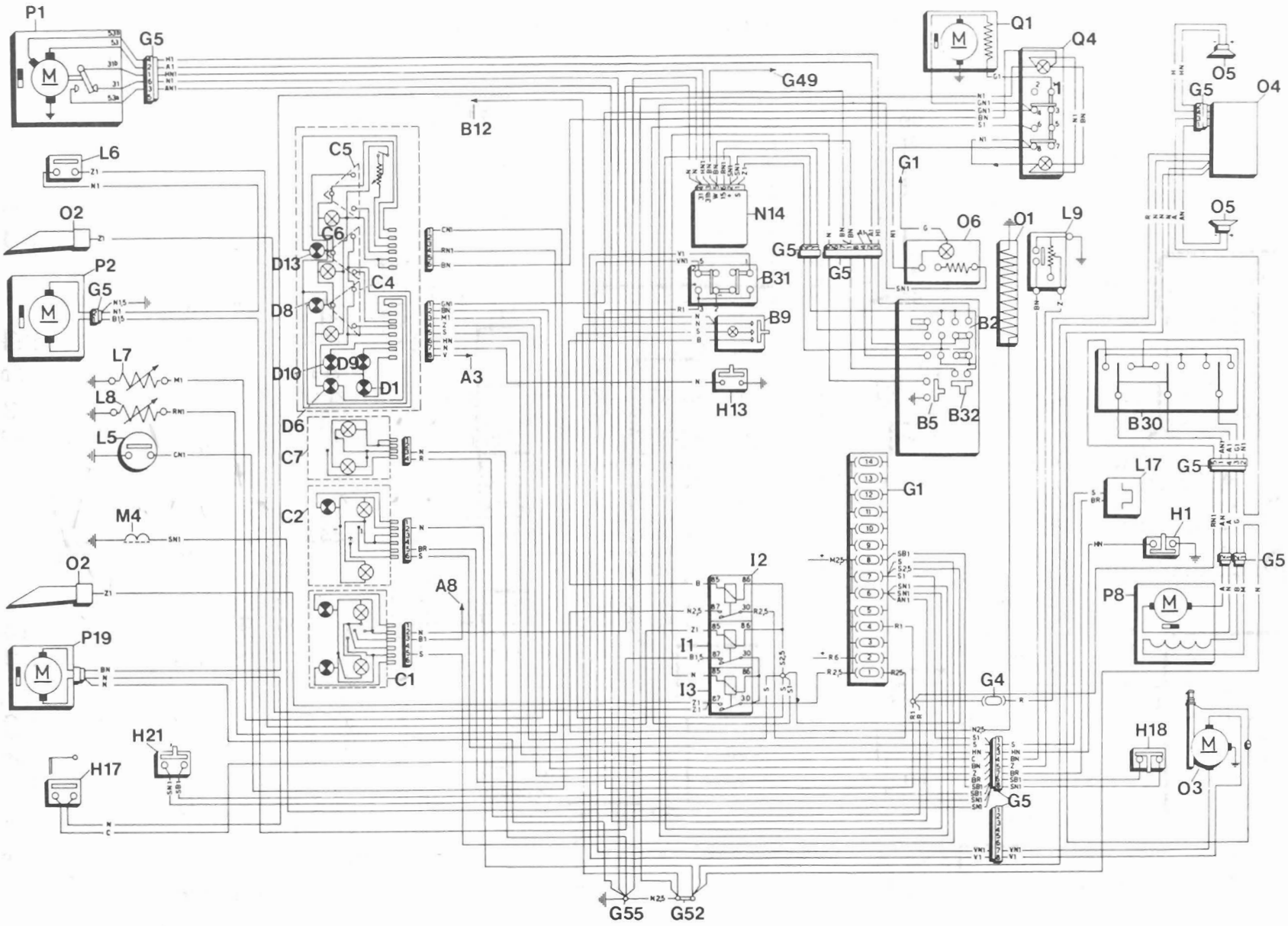

Fig. 13.41 Typical wiring diagram for GTV 2.0 models – in-car entertainment, electric mirrors, horn, wipers and heated rear window

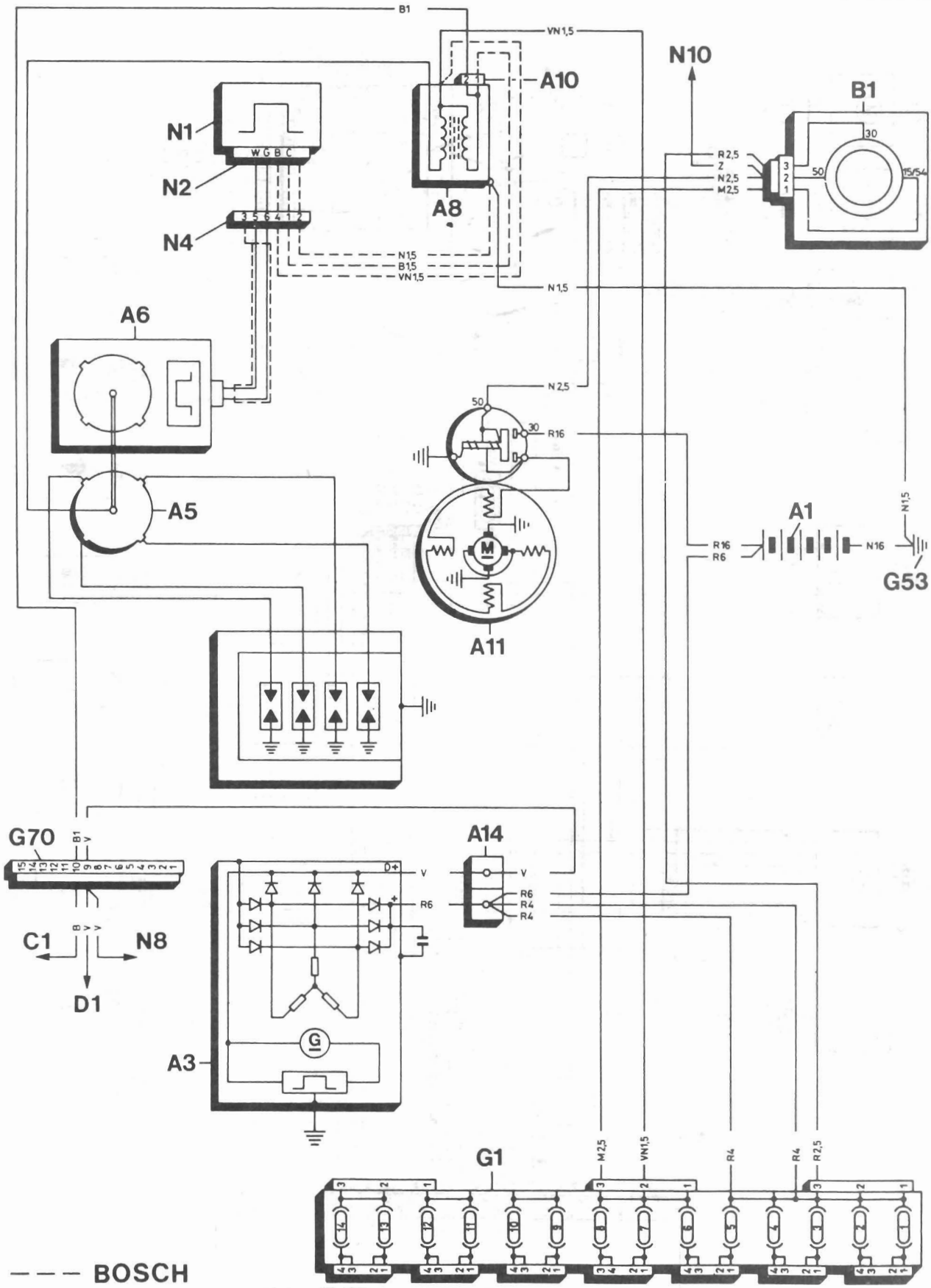

Fig. 13.42 Wiring diagram for electronic (breakerless) ignition. Broken lines apply to Bosch system

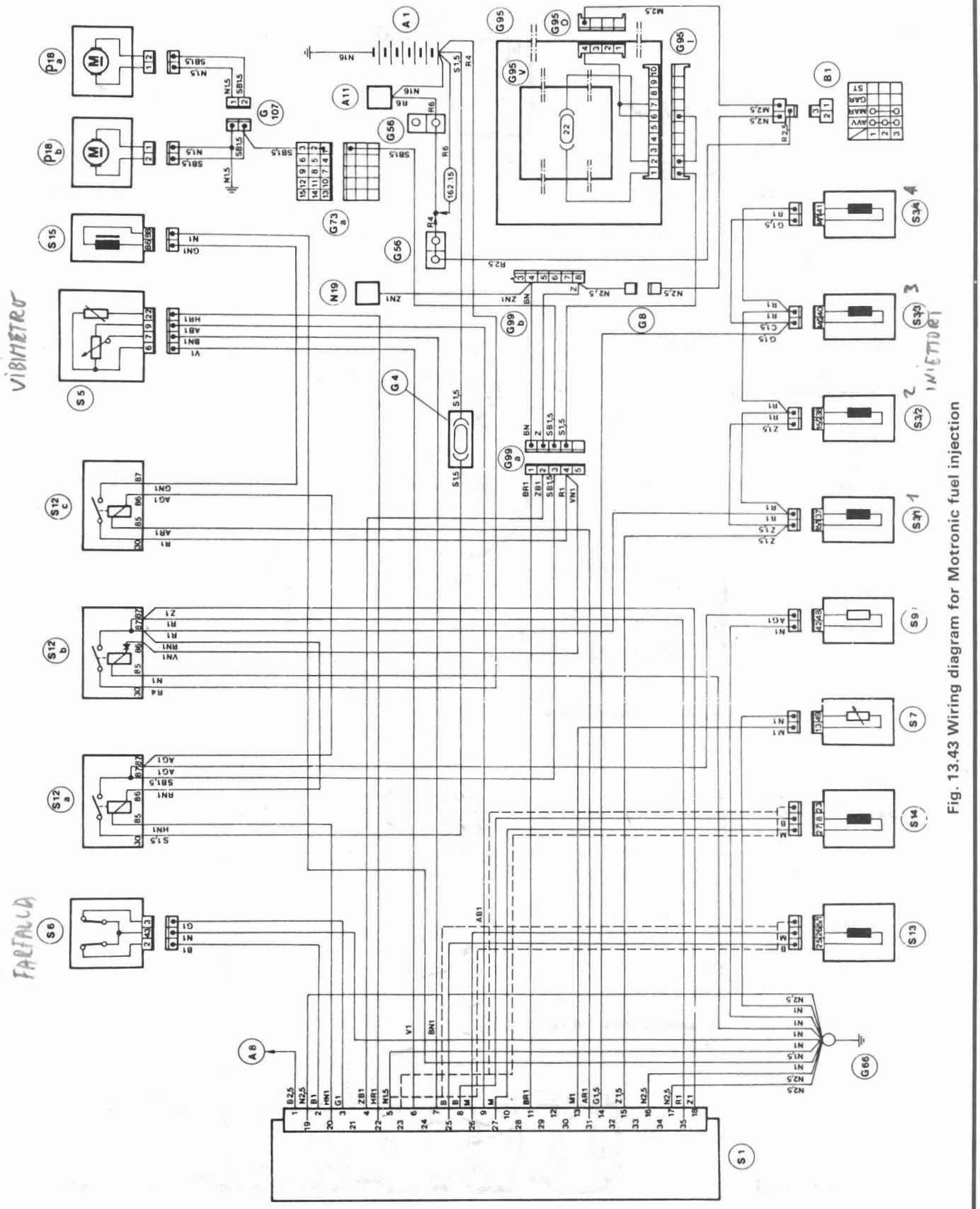

Fig. 13.43 Wiring diagram for Motronic fuel injection

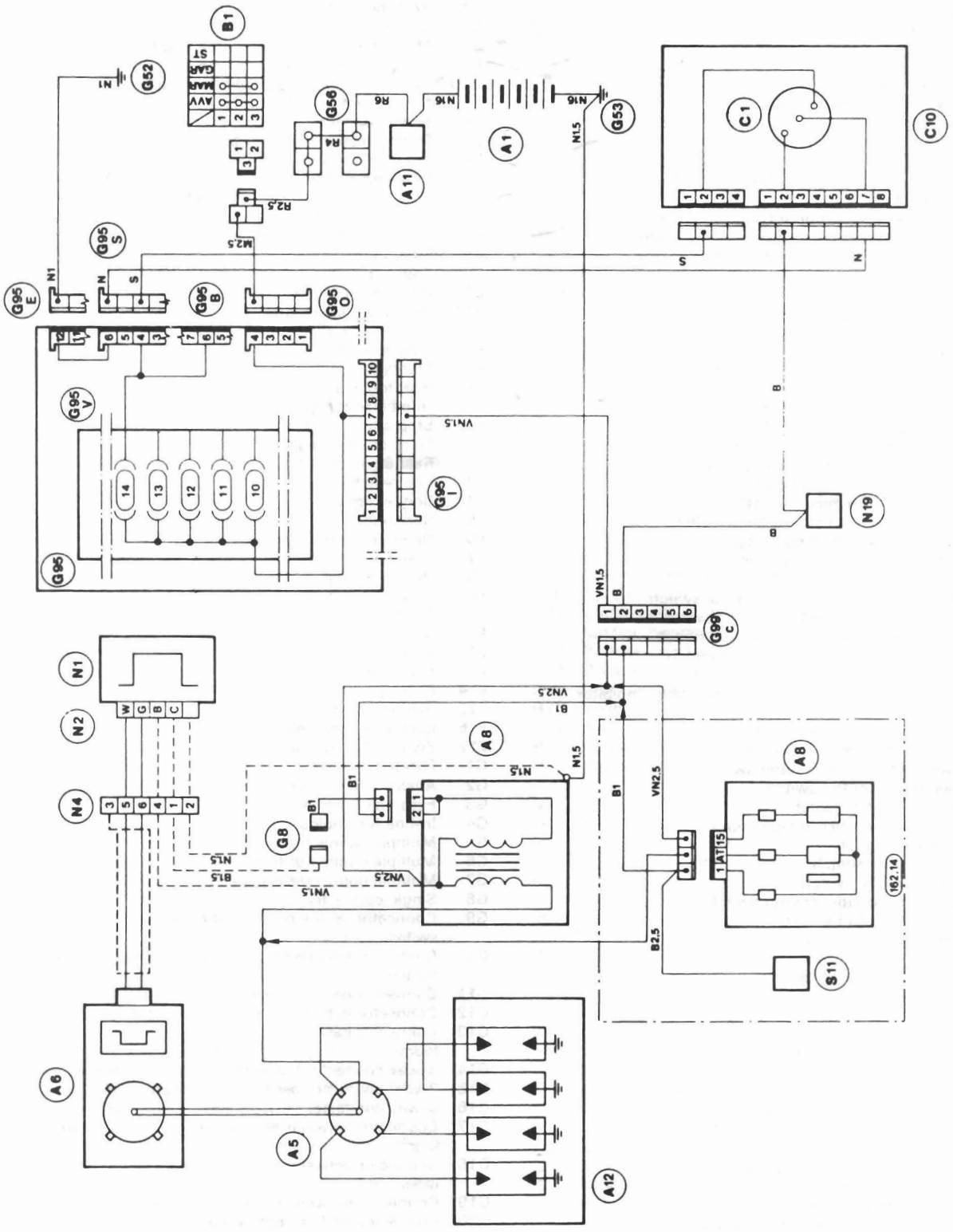

Fig. 13.44 Wiring diagram for Motronic fuel ignition

Key to all wiring diagrams

A1 Battery
A2 Alternator
A3 Alternator with integral electronic voltage regulator
A4 Voltage regulator
A5 Ignition distributor
A6 Impulse generator
A7 Rotor
A8 Ignition coil
A9 Coil resistor
A10 2-way connector for coil
A11 Starter motor
A12 Spark plugs
A13 Glow plugs
A14 Alternator cable terminal board
B1 Ignition switch
B2 Windscreen wiper control
B3 Windscreen and/or headlamp washer pump control
B4 Control for sidelights, flashing, low/full beam headlamps
B5 Horn control switch
B6 Direction indicators control
B7 Low beam flashing control switch
B8 Full beam flashing control switch
B9 Heated rear screen control switch
B10 Foglamp control switch
B11 Rear foglamp control switch
B12 Road hazard lights control switch
B13 Front courtesy light control switch
B14 Rear courtesy light control switch
B15 Courtesy light control switch
B16 Panel lighting dimmer rheostat
B17 Gearbox oil level warning lamp switch
B18 Front right door locking switch
B19 Front left door locking switch
B20 Interior door locking switch
B21 Front right power window control switch
B22 Front left power window control switch
B23 Rear right power window control switch
B24 Rear left power window control switch
B25 Rear power window inhibitor switch
B26 Rear power window and rear cigar lighter inhibitor switch
B27 Front seat height control switch
B28 Front left backrest control switch
B29 Front right backrest control switch
B30 Door mirror control switch
B31 Antenna control switch
B32 Windscreen washer pump control
B33 Front spot switch
B34 Rear left spot switch
B35 Rear right spot switch
B36 Door mirror double control switch
B37 Side light control switch
B38 Rear screen wiper control switch
C1 Electronic rev counter
C2 Electronic speedometer
C3 Voltmeter
C4 Fuel level gauge
C5 Oil pressure gauge
C6 Water temperature gauge
C7 Clock
C8 Space free for instrument
C9 Turbocharger air pressure gauge
C10 Instrument panel
D1 Alternator warning lamp
D2 Direction indicator warning lamp
D3 Sidelight warning lamp
D4 Full beam warning lamp
D5 Brake fluid low level warning lamp
D6 Heater fan warning lamp
D7 Handbrake warning lamp
D8 Fuel reserve warning lamp
D9 Choke warning lamp
D10 Handbrake/fluid level warning lamp
D11 Engine oil minimum pressure warning lamp
D12 Preheating glow plug warning lamp
D13 Engine water high temperature warning lamp
D14 Maximum air pressure warning lamp
D15 Minimum fuel pressure warning lamp
D16 Warning lamp free
D17 Gear position warning lamp
D18 Manual injection advance warning lamp
D19 Brake pad wear warning lamp
D20 Rear-wheel-drive engaged warning light
E1 Front direction indicator light
E2 Front sidelight
E3 Front direction indicator and sidelight
E4 Front side marker light
E5 Low beam light
E6 Low beam light with incorporated sidelight
E7 Full beam light
E8 Low and full beam light
E9 Side repeater
E10 Foglight
E11 Rear direction indicator
E12 Rear side marker light
E13 Rear sidelight
E14 Reversing light
E15 Stoplight
E16 Rear foglamp
E17 Numberplate light
E18 Stop and rear sidelight
F1 Front courtesy light
F2 Rear courtesy light
F3 Courtesy light
F4 Bonnet light
F5 Boot light
F6 Open door signalling light
F7 Fuse light
F8 Heater controls light
F9 Glovebox light
F10 Ashtray light
F11 Map light
F12 Panel light
F13 Front spot
F14 Rear right spot
F15 Rear left spot
F16 Ignition switch light
F17 Switch illumination light
G1 Fusebox
G2 Auxiliary fuse holder
G3 Fuse box terminal
G4 In-line fuse holder
G5 Multiple connector
G6 Multiple connector B panel
G7 Multiple connector R panel
G8 Single connector
G9 Connector between front left door loom and mirror switch
G10 Connector between front right door loom and mirror switch
G11 Connector between main harness and rear loom
G12 Connector between main harness and mirror switch
G13 Connector between main harness and console wiring loom
G14 3-way connector between main harness and door loom
G15 2-way connector between main harness and door loom
G16 6-way connector between main harness and door loom
G17 Connector between main harness and front right door loom
G18 Connector between main harness and front left door loom
G19 Connector between main harness and courtesy light
G20 Connector for front right door locking motor
G21 Connector for front right door loom
G22 Connector for front left door locking motor
G23 Connector for front left door loom
G24 Connector for rear right door locking motor
G25 Connector for rear right door loom
G26 Connector for rear left door locking motor

Key to all wiring diagrams (continued)

G27 Connector for rear left door loom
G28 Connector between front right door loom and window switch
G29 Connector between central door locking loom and rear window lift loom
G30 Connector for window lifts and central door locking system looms
G31 Connector between front left door loom and window switch
G32 Connector for console loom and rear right door loom
G33 Connector for console loom and rear left door loom
G34 Connector for power window supply wire
G35 Connector for rear loom and rear right light loom
G36 Connector for power window switch cables
G37 Connector for multi-switch on steering column
G38 Connector for conditioner loom
G39 Connector for clock
G40 Connector for central door locking system
G41 Connector for tachymetric inhibitor switch/rev counter impulse generator
G42 Connector for alternator engine/engine oil minimum pressure switch
G43 Connector for heater control cables
G44 Connector for rear foglight
G45 Connector for headlight wiper/washer cables
G46 Connector for headlights
G47 Connector for right side repeater cables
G48 Connector for remote control mirror/left side repeater cables
G49 Provision for connection
G50 Provision for speaker
G51 Provision for radio
G52 Fusebox earth
G53 Engine compartment earth
G54 Passenger compartment earth
G55 Inner wing panel earth
G56 Branch terminal board
G57 Provision for idle petrol supply cut-off solenoid valve
G58 Cigar lighter connector
G59 Door mirror connector
G60 Injection loom earth
G61 Ignition coil connector
G62 Clutch switch connector
G63 Rear earth
G64 Clock/trip computer connector
G65 Coaxial cable
G66 Motronic loom earth
G67 Motronic connector
G68 Connection A with cabling loom
G69 Connection B with cabling loom
G70 Connection C with cabling loom
G71 Connector for warning lamp on instruments
G72 Connector for backrest adjustment device loom
G73 Connector for rear ancillary services loom
G73A Rear right services connector
G74 Connector for fuel level sender/check control rear loom
G75 Connector for right and left roof panel ancillary services
G76 Connector for right roof panel ancillary services
G77 Connector for left roof panel ancillary services
G78 Connector for front door ancillary services loom
G79 Connector for rear door ancillary services loom
G80 Main cabling loom connector
G81 Connector for front left backrest adjustment device loom
G82 Connector for front right backrest adjustment device loom
G83 Rear connector for fast-idle device
G84 Connector for console loom
G85 Connector for front ancillary services
G86 Connector for courtesy light
G87 Connector rear door locking motor
G88 Connector for tail lights
G89 Intermediate connection A
G90 Intermediate connection B
G91 Earth connection for rear door sensors
G92 Luggage compartment earth
G93 Windscreen bow earth
G94 Engine compartment connection
G95 Central fusebox
G95A Switch connector
G95E Console connector
G95I DX interface connector
G95O Ignition switch connector
G95S Instrument panel connector
G95V Fuses
G99A Connector for dashboard – engine
G99B Connector for dashboard – engine
G99C Engine bulkhead C connector
G107 Fuel pump connector
H1 Handbrake switch
H2 Reversing light switch
H3 Stop-light switch
H4 Courtesy light switch on pillar
H5 Left front door open indicator switch
H6 Right front door open indicator switch
H7 Left rear door open indicator switch
H8 Right rear door open indicator switch
H9 Right front brake pad switch
H10 Left front brake pad switch
H11 Right rear brake pad switch
H12 Left rear brake pad switch
H13 Choke switch
H14 Injection advance switch
H15 Gearbox oil low level switch (magnetic bulb)
H16 Starting and reverse inhibitor switch
H17 Brake fluid minimum level check switch
H18 Fast idle switch in gearbox
H19 Low fuel pressure switch
H20 Inertia switch
H21 Clutch pedal fast idle switch
H22 Ignition microswitch
H23 Bonnet light switch
H24 Boot light switch
H25 Glovebox light switch
H26 Switch on rear door for rear screen wiper
H27 Switch on rear door for heated rear screen
H28 Carburettor contact/switch
H29 Rear-wheel-drive warning light switch
I1 Engine cooling fan relay
I2 Heated rear screen relay
I3 Horn relay
I4 Headlight wiper relay
I5 Auxiliary relay for headlight wiper timer
I6 Fast idle relay
I7 Fuel pipe closing relay
I8 Relay excluding retarded rotor arm
I9 Glow plug relay
I10 Starter inhibitor relay
I11 Front power window and seat raising relay
I12 Front power window relay
I13 Rear power window relay
I14 Brake fluid automatic warning lamp control relay
I15 Low fuel pressure warning light relay
I16 Headlight relay
I17 Foglight relay
I18 Double contact relay
I19 Headlight washer pump relay
I20 Beam change-over relay
I21 Full beam exclusion relay
I22 Low beam exclusion relay
I23 Supplementary engine cooling fan relay
L1 Low fuel pressure switch
L2 Low oil pressure switch
L3 High air pressure pressure switch
L4 Thermoswitch for engine cooling fan electromagnetic drive
L5 Thermoswitch for engine water high temperature warning lamp
L6 Thermoswitch for engine cooling fan

Key to all wiring diagrams (continued)

L7 Water temperature gauge sender
L8 Oil pressure gauge sender
L9 Fuel level gauge sender
L10 Water temperature gauge sender and temperature warning light switch
L11 Retarded rotor arm cut-out pressure switch
L12 Engine oil level sensor
L13 Windscreen washer liquid level sensor
L14 Engine coolant level sensor
L15 Fuel flow sensor
L16 Rev counter impulse generator
L17 Speedometer impulse generator
M1 Idle petrol supply cut-out solenoid valve
M2 Injection pump solenoid valve
M3 Solenoid with injection pump fuel cut-off microswitch
M4 Fast idle solenoid
M5 Engine stop solenoid
M6 Fuel pipe closing electromagnet
M7 Door opening/closing electromagnet
M8 Supplementary air valve (for A/C equipped car)
N1 Electronic ignition module
N2 Connector for Marelli module
N3 Capacitor for electronic ignition
N4 Connector for Bosch module
N5 Tachymetric switch device
N6 Preheating glow-plug timer
N7 Trip computer
N8 Check control
N9 Brake pad wear unit
N10 Courtesy light timer
N11 Central door locking unit
N12 Headlight wiper timer
N13 Road hazard and direction indicators intermittence
N14 Electronic windscreen wiper intermittence
N15 Electronic windscreen wiper intermittence and warning light control
N16 Tachometric unit
N17 Trip unit for fuel flow
N18 Electronic device for headlamps and flashing
N19 Performance gauge
N20 Ignition advance ECU
N21 Power module
O1 Heated rear screen
O2 Horn
O3 Electrically-operated antenna
O4 Radio
O5 Speaker
O6 Cigar lighter
O7 Rear cigar lighter
P1 Windscreen wiper motor
P2 Engine cooling fan motor
P3 Engine cooling fan electromagnetic drive
P4 Headlight wiper motor
P5 Front left seat adjustment motor
P6 Front right backrest adjustment motor
P7 Front left backrest adjustment motor
P8 Left remote control rearview mirror motor
P9 Right remote control rearview mirror motor
P10 Front right door locking motor
P11 Front left door locking motor
P12 Rear right door locking motor
P13 Rear left door locking motor
P14 Front right power window motor
P15 Front left power window motor
P16 Rear right power window motor
P17 Rear left power window motor
P18 Fuel pump motor
P18a Fuel pump motor
P18b Supplementary fuel pump
P19 Windscreen washer pump
P20 Headlight washer pump
P21 Rear screen wiper motor
P22 Rear screen washer pump motor
P23 Supplementary engine cooling fan motor
Q1 Heater blower fan
Q2 Pneumatic pushbutton control for air conditioning
Q3 Pneumatic pushbutton control for ventilation
Q4 Heater blower fan control
Q5 Heater blower fan speed adjustment resistance
Q6 Switch on flap for heater blower fan
Q7 Fluid thermostat
Q8 Electromagnetic coupling pressure switch
Q9 Minimum pressure switch
Q10 Maximum pressure switch
Q11 Compressor electromagnetic coupling
Q12 Thermoswitch for exclusion of compressor electromagnetic coupling
Q13 Supplementary conditioner fan
Q14 Relay for supplementary conditioner fan and electromagnetic compressor coupling
Q15 Heater blower fan relay
Q16 Relay for simultaneous control of engine cooling fan and supplementary fan
Q17 Relay for simultaneous control of engine cooling electromagnetic coupling and supplementary fan
R1 Seat belt device
R2 Catalytic converter temperature indicator
R3 Thermocouple for catalytic converter temperature detection
R4 Unfastened seat belt buzzer
R5 Open door buzzer
R6 Mileometer
R7 Seat belt warning lamp
R8 30,000 mile warning lamp
R9 Switch on seat belts
R10 Catalytic converter maximum temperature warning light
S1 Injection control unit
S2 Relay set
S3 Electronic injector
S4 Cold starting injector
S5 Air flow sensor
S6 Throttle switch
S7 Engine water temperature sensor
S8 Thermo-time switch
S9 Supplementary air valve
S10 CO_2 sensor
S11 Motronic unit
S12 Motronic relay
S13 Timing sensor
S14 Rev sensor
S15 Timing variator device
S16 Automatic altitude compensation device

Colour code

A Sky blue
B White
BL Blue
Br Dark brown
C Orange
G Yellow
H Grey
M Brown
N Black
No Hazen brown
R Red
S Pink
V Green
Z Violet

The figure following the colour code is the wire gauge in mm². If no figure is given, the gauge is 0.5 mm²

7 Withdraw the regulator with brush holder. The brushes must project from the holder by at least 5.0 mm (0.20 in) otherwise unsolder their leads and fit new brushes. Do not allow heat to be conducted to the regulator. If necessary, grip each lead with a pair of pliers to act as a heat sink when applying the soldering iron.
8 Discolouration of the slip rings should be removed by wiping with a fuel-moistened cloth. Where necessary, use very fine abrasive cloth to remove more stubborn marks.
9 Fit the regulator/brush holder by reversing the removal operations.

Marelli

10 Pull the wiring plugs from the voltage regulator and the rectifier bridge on the rear face of the alternator.
11 Extract the retaining screw and withdraw the brush holder.
12 The brushes should project beyond their holders by at least 7.0 mm (0.28 in).
13 If the brushes must be renewed, apply a soldering iron to the lead joint, at the same time pulling the brush with a pair of pliers.
14 Drill out the hollow rivet inside the brush holder using a 3.2 mm (1/8 in) diameter twist drill.
15 Clean the slip rings as described for the Bosch type alternator.

Paris-Rhone

16 Take off the protective cover from the rear of the alternator.
17 Extract the screws and withdraw the voltage regulator with brush holder.
18 The brushes should project by at least 6.0 mm (0.24 in) otherwise renew the brush holder as a complete assembly. To do this, unsolder the connecting leads from the voltage regulator.
19 Clean the slip rings as described for the Bosch type alternator.

10 Front suspension and steering

Steering rack backlash (Spica gear) – adjustment

1 The steering rack on later models has a spring-loaded ratchet type adjustable slipper instead of the selective shim type used previously.
2 Should adjustment be required, often indicated by a knocking sound when travelling over a rough surface, carry out the following operations.
3 Set the rack in the central position. If the steering gear is in the car, set the front roadwheels in the straight-ahead attitude. If the gear is out of the car, turn the pinion to full lock and then turn it to full opposite lock, counting the number of turns. Now turn the pinion through half the number of turns recorded. A cardboard disc fitted to the pinion splines will make the job easier.
4 Tighten the slipper adjusting screw until it just seats and then unscrew it three 'clicks'.
5 Check that the rack moves smoothly without binding.

Steering rack (Spica type) – overhaul

6 Later types of this steering gear should not be overhauled but replaced with a new or factory reconditioned unit.

Front ride height (from 1978)

7 On later models with 21.1 mm dia torsion bars the calculated difference (B-A) – Chapter 10, Section 13, should be:

Old torsion bars	*59.5 to 60.5 mm (2.34 to 2.38 in)*
New torsion bars	*64.5 to 65.5 mm (2.54 to 2.58 in)*

Wheels and tyres – general care and maintenance

8 Wheels and tyres should give no real problems in use provided that a close eye is kept on them with regard to excessive wear or damage. To this end, the following points should be noted.
9 Ensure that tyre pressures are checked regularly and maintained correctly. Checking should be carried out with the tyres cold and not immediately after the vehicle has been in use. If the pressures are checked with the tyres hot, an apparently high reading will be obtained owing to heat expansion. Under no circumstances should an attempt be made to reduce the pressures to the quoted cold reading in this instance, or effective underinflation will result.
10 Underinflation will cause overheating of the tyre owing to excessive flexing of the casing, and the tread will not sit correctly on the road surface. This will cause a consequent loss of adhesion and excessive wear, not to mention the danger of sudden tyre failure due to heat build-up.
11 Overinflation will cause rapid wear of the centre part of the tyre tread coupled with reduced adhesion, harsher ride, and the danger of shock damage occurring in the tyre casing.

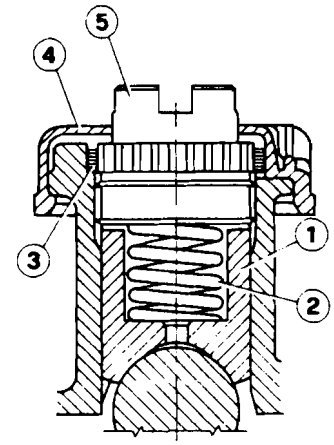

Fig. 13.45 Sectional view of rack backlash adjuster on later models (Sec 10)

1 Slipper
2 Coil spring
3 Ratchet spring
4 Cover
5 Adjuster screw

12 Regularly check the tyres for damage in the form of cuts or bulges, especially in the sidewalls. Remove any nails or stones embedded in the tread before they penetrate the tyre to cause deflation. If removal of a nail *does* reveal that the tyre has been punctured, refit the nail so that its point of penetration is marked. Then immediately change the wheel and have the tyre repaired by a tyre dealer. Do *not* drive on a tyre in such a condition. In many cases a puncture can be simply repaired by the use of an inner tube of the correct size and type. If in any doubt as to the possible consequences of any damage found, consult your local tyre dealer for advice.
13 Periodically remove the wheels and clean any dirt or mud from the inside and outside surfaces. Examine the wheel rims for signs of rusting, corrosion or other damage. Light alloy wheels are easily damaged by 'kerbing' whilst parking, and similarly steel wheels may become dented or buckled. Renewal of the wheel is very often the only course of remedial action possible.
14 The balance of each wheel and tyre assembly should be maintained to avoid excessive wear, not only to the tyres but also to the steering and suspension components. Wheel imbalance is normally signified by vibration through the vehicle's bodyshell, although in many cases it is particularly noticeable through the steering wheel. Conversely, it should be noted that wear or damage in suspension or steering components may cause excessive tyre wear. Out-of-round or out-of-true tyres, damaged wheels and wheel bearing wear/maladjustment also fall into this category. Balancing will not usually cure vibration caused by such wear.
15 Wheel balancing may be carried out with the wheel either on or off the vehicle. If balanced on the vehicle, ensure that the wheel-to-hub relationship is marked in some way prior to subsequent wheel removal so that it may be refitted in its original position.
16 General tyre wear is influenced to a large degree by driving style – harsh braking and acceleration or fast cornering will all produce more rapid tyre wear. Interchanging of tyres may result in more even wear, but this should only be carried out where there is no mix of tyre types on the vehicle. However, it is worth bearing in mind that if this is completely effective, the added expense of replacing a complete set of tyres simultaneously is incurred, which may prove financially restrictive for many owners.
17 Front tyres may wear unevenly as a result of wheel misalignment. The front wheels should always be correctly aligned according to the settings specified by the vehicle manufacturer.
18 Legal restrictions apply to the mixing of tyre types on a vehicle. Basically this means that a vehicle must not have tyres of differing construction on the same axle. Although it is not recommended to mix tyre types between front axle and rear axle, the only legally permissible combination is crossply at the front and radial at the rear. When mixing radial ply tyres, textile braced radials must always go on the front axle, with steel braced radials at the rear. An obvious disadvantage of such

mixing is the necessity to carry two spare tyres to avoid contravening the law in the event of a puncture.
19 In the UK, the Motor Vehicles Construction and Use Regulations apply to many aspects of tyre fitting and usage. It is suggested that a copy of these regulations is obtained from your local police if in doubt as to the current legal requirements with regard to tyre condition, minimum tread depth, etc.

11 Bodywork

Minor body damage – repair of plastic components

1 With the use of more and more plastic body components by the vehicle manufacturers (eg bumpers, spoilers, and in some cases major body panels), rectification of more serious damage to such items has become a matter of either entrusting repair work to a specialist in this field, or renewing complete components. Repair of such damage by the DIY owner is not really feasible owing to the cost of the equipment and materials required for effecting such repairs. The basic technique involves making a groove along the line of the crack in the plastic using a rotary burr in a power drill. The damaged part is then welded back together by using a hot air gun to heat up and fuse a plastic filler rod into the groove. Any excess plastic is then removed and the area rubbed down to a smooth finish. It is important that a filler rod of the correct plastic is used, as body components can be made of a variety of different types (eg polycarbonate, ABS, polypropylene).
2 Damage of a less serious nature (abrasions, minor cracks etc) can be repaired by the DIY owner using a two-part epoxy filler repair material. Once mixed in equal proportions, this is used in similar fashion to the bodywork filler used on metal panels. The filler is usually cured in twenty to thirty minutes, ready for sanding and painting.
3 If the owner is renewing a complete component himself, or if he has repaired it with epoxy filler, he will be left with the problem of finding a suitable paint for finishing which is compatible with the type of plastic used. At one time the use of a universal paint was not possible owing to the complex range of plastics encountered in body component applications. Standard paints, generally speaking, will not bond to plastic or rubber satisfactorily. However, it is now possible to obtain a plastic body parts finishing kit which consists of a pre-primer treatment, a primer and coloured top coat. Full instructions are normally supplied with a kit, but basically the method of use is to first apply the pre-primer to the component concerned and allow it to dry for up to 30 minutes. Then the primer is applied and left to dry for about an hour before finally applying the special coloured top coat. The result is a correctly coloured component where the paint will flex with the plastic or rubber, a property that standard paint does not normally possess.

Windscreen and rear screen (rubber sealed type) – removal and refitting

4 Early models were fitted with bonded type screens, renewal being a job for specialists.
5 Later models have screens sealed by a conventional rubber channel and for those wishing to undertake renewal, observe the following.
6 Remove the wiper arms and blades.
7 Sitting in the front seats, apply pressure with the feet (suitably protected with soft shoes or slippers) to the top corners of the glass and push the glass and rubber surround off the body flange. Have an assistant ready to catch the glass.
8 Make sure that the rubber surround and the body flange are clean and free from old sealant. If the rubber has hardened or otherwise deteriorated, renew it.
9 Fit the rubber surround, smear petroleum jelly lightly into the body flange groove of the rubber surround, then insert a length of nylon or terylene cord into the groove so that the ends of the cord overlap at the centre of the bottom of the screen.
10 Engage the bottom edge of the rubber with the body flange and, with an assistant applying gentle pressure to the glass, withdraw the two ends of the cord simultaneously to engage the lip of the rubber with the body flange. Apply the pressure from outside the glass so that it follows the two places where the cord is being drawn out.
11 Refit the wiper arms.
12 Renewal of the rear screen is similar to the procedure just described, but it is of toughened glass. When shattered, therefore, make sure that all the glass fragments are removed from the rubber surround before using it again.

Bodywork and fittings – later models

13 No information about the removal and refitting of body panels or trim was available at the time of writing.

General repair procedures

Whenever servicing, repair or overhaul work is carried out on the car or its components, it is necessary to observe the following procedures and instructions. This will assist in carrying out the operation efficiently and to a professional standard of workmanship.

Joint mating faces and gaskets

Where a gasket is used between the mating faces of two components, ensure that it is renewed on reassembly, and fit it dry unless otherwise stated in the repair procedure. Make sure that the mating faces are clean and dry with all traces of old gasket removed. When cleaning a joint face, use a tool which is not likely to score or damage the face, and remove any burrs or nicks with an oilstone or fine file.

Make sure that tapped holes are cleaned with a pipe cleaner, and keep them free of jointing compound if this is being used unless specifically instructed otherwise.

Ensure that all orifices, channels or pipes are clear and blow through them, preferably using compressed air.

Oil seals

Whenever an oil seal is removed from its working location, either individually or as part of an assembly, it should be renewed.

The very fine sealing lip of the seal is easily damaged and will not seal if the surface it contacts is not completely clean and free from scratches, nicks or grooves. If the original sealing surface of the component cannot be restored, the component should be renewed.

Protect the lips of the seal from any surface which may damage them in the course of fitting. Use tape or a conical sleeve where possible. Lubricate the seal lips with oil before fitting and, on dual lipped seals, fill the space between the lips with grease.

Unless otherwise stated, oil seals must be fitted with their sealing lips toward the lubricant to be sealed.

Use a tubular drift or block of wood of the appropriate size to install the seal and, if the seal housing is shouldered, drive the seal down to the shoulder. If the seal housing is unshouldered, the seal should be fitted with its face flush with the housing top face.

Screw threads and fastenings

Always ensure that a blind tapped hole is completely free from oil, grease, water or other fluid before installing the bolt or stud. Failure to do this could cause the housing to crack due to the hydraulic action of the bolt or stud as it is screwed in.

When tightening a castellated nut to accept a split pin, tighten the nut to the specified torque, where applicable, and then tighten further to the next split pin hole. Never slacken the nut to align a split pin hole unless stated in the repair procedure.

When checking or retightening a nut or bolt to a specified torque setting, slacken the nut or bolt by a quarter of a turn, and then retighten to the specified setting.

Locknuts, locktabs and washers

Any fastening which will rotate against a component or housing in the course of tightening should always have a washer between it and the relevant component or housing.

Spring or split washers should always be renewed when they are used to lock a critical component such as a big-end bearing retaining nut or bolt.

Locktabs which are folded over to retain a nut or bolt should always be renewed.

Self-locking nuts can be reused in non-critical areas, providing resistance can be felt when the locking portion passes over the bolt or stud thread.

Split pins must always be replaced with new ones of the correct size for the hole.

Special tools

Some repair procedures in this manual entail the use of special tools such as a press, two or three-legged pullers, spring compressors etc. Wherever possible, suitable readily available alternatives to the manufacturer's special tools are described, and are shown in use. In some instances, where no alternative is possible, it has been necessary to resort to the use of a manufacturer's tool and this has been done for reasons of safety as well as the efficient completion of the repair operation. Unless you are highly skilled and have a thorough understanding of the procedure described, never attempt to bypass the use of any special tool when the procedure described specifies its use. Not only is there a very great risk of personal injury, but expensive damage could be caused to the components involved.

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)
Millibar (mbar)	X	100	= Pascals (Pa)	X	0.01	=	Millibar (mbar)
Millibar (mbar)	X	0.0145	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	X	68.947	=	Millibar (mbar)
Millibar (mbar)	X	0.75	= Millimetres of mercury (mmHg)	X	1.333	=	Millibar (mbar)
Millibar (mbar)	X	0.401	= Inches of water (inH_2O)	X	2.491	=	Millibar (mbar)
Millimetres of mercury (mmHg)	X	0.535	= Inches of water (inH_2O)	X	1.868	=	Millimetres of mercury (mmHg)
Inches of water (inH_2O)	X	0.036	= Pounds-force per square inch (psi; lbf/in^2; lb/in^2)	X	27.68	=	Inches of water (inH_2O)
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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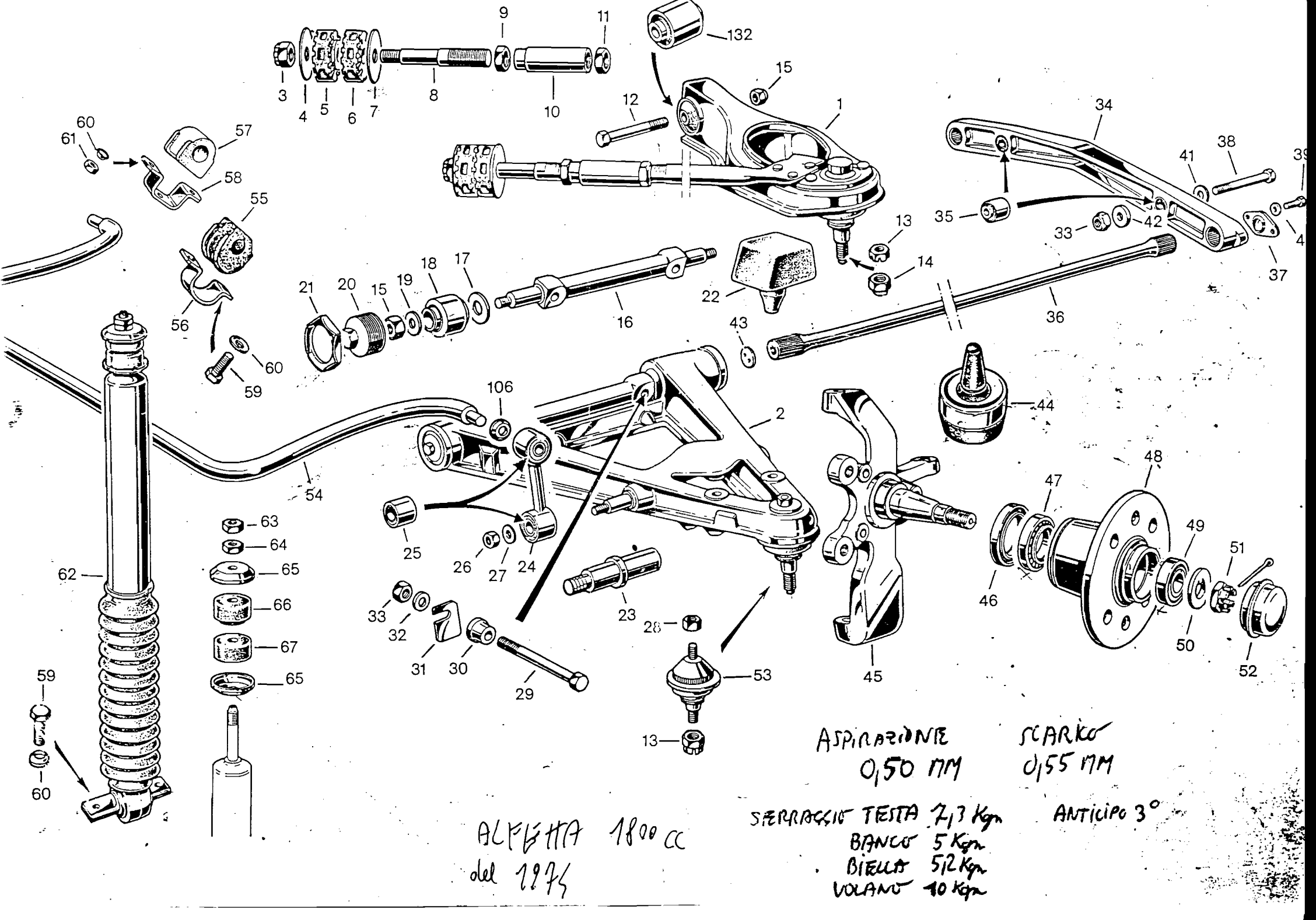
ALFETTA 1800 cc
del 1974
ASPIRAZIONE
0,50 MM
SCARICO
0,55 MM
SERRAGGIO TESTA 7,3 Kgm
BANCO 5 Kgm
BIELLA 5,2 Kgm
VOLANO 10 Kgm
ANTICIPO 3°