THIS MANUAL COVERS:
ALL MAZDA 929 MODELS

PUBLISHED BY

PETER RUSSEK PUBLICATIONS LIMITED
Little Stone House
High Street
Marlow, Bucks.
England

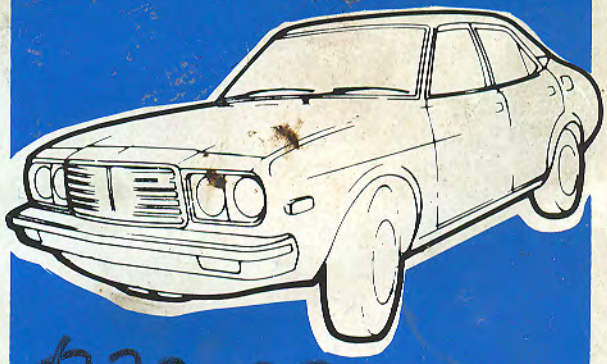
DETAILED DESCRIPTION OF REMOVAL, INSTALLATION, ADJUSTMENTS, REPAIR, OVERHAUL AND SERVICING OF ALL THE MAJOR VEHICLE PARTS, incl. ENGINE, CAR BURETTOR, VALVES, CLUTCH, BRAKES, STEERING, TRANSMISSION, ELECTRICAL EQUIPMENT - WITH EXPLODED VIEWS AND COMPLETE TECHNICAL DATA AND WIRING DIAGRAM

MAZDA 929/CAPELLA 1800 POCKET MECHANIC

POCKET MECHANIC

mazda 929 CAPELLA 1800

Adjustment · Tune up · Repairs
Overhauls · Servicing



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With Troubleshooting Section

PACEMAKER
CUSTOMER REPAIR MANUAL

MAZDA 929

COVERING:

BY PETER RUSSEK

ORDER NO. MCAG244

Published by
Peter Russek Publications Ltd.
Little Stone House, High Street,
Marlow/Bucks.

ISBN No. 0 907779 00-X

The Publisher would like to thank Mr. R. Pickering for producing many of the illustrations in this Repair Guide.

Our Thanks also to Mazda (UK) Ltd. for allowing Mr. P. Russek to attend their Service Training Courses.

PREFACE

Small though this Workshop Manual is in size, it lacks no detail in covering the whole of the servicing and repair of the Mazda 929 vehicles in Saloon, Coupe and Estate form, with manual or automatic transmission. Brief, easy to follow instructions are given, free from all unnecessary complication and repetition, yet containing all the required technical detail and information, and many diagrams and illustrations.

Compiled and illustrated by experts, this guide provides a concise source of helpful information, all of which has been cross-checked for accuracy to the manufacturer's official service and repair procedures. Where special tools are required these are referred to, and identified, in the text and we do not hesitate to advise you if we feel that the operation cannot be properly undertaken without the use of such tools. The author has attended two of the Mazda Service Training Courses (Training Certificate reproduced on Page 4) in order to include as much technical know-how as possible.

The reader's own judgement must ultimately decide just what work he will feel able to undertake but there is no doubt that, with this guide to assist him, there will be many more occasions where the delay, inconvenience and cost of garage repairs can be avoided or minimised.

This guide is produced in a handy glove-pocket size with the aim that it should always be kept in the vehicle whilst you are travelling. Many garage mechanics themselves use these publications in their work and if you have the book with you in the car you will have an invaluable source of reference which will quickly repay its modest initial cost.

Always use genuine Mazda spare and replacement parts.

MAZDA
CERTIFICATE
OF TRAINING

This is to certify that

PETER RAINER DIETER RUSSEK

of

PETER RUSSEK PUBLICATIONS LIMITED

has successfully completed

GENERAL REPAIR COURSE (MZ 312)

held between

18 February and 22 February

Training Manager

Service & Parts Director

0. GENERAL DATA

0.0. General Information

This Repair Guide covers the range of Mazda 929 models, being the piston engine version of the Mazda RX-4 Rotary Engine Vehicle. The engine of the Mazda 929 is a 1,769 c.c. (108 cu.in.) unit, with four cylinders and an overhead camshaft. The camshaft runs in bearings (shells) in the cylinder head. The crankshaft is supported in five bearings of the shell-type and drives the camshaft and the oil pump by means of chains.

All models are fitted with a four- or five speed manual transmission or a Borg-Warner automatic transmission.

0.1. Dimensions

Overall Length:	
Saloon:	4400 mm (173 in.)
Estate:	4540 mm (179 in.)
Hardtop:	4405 mm (173.2 in.)
Overall Width:	
Saloon & Estate:	1660 mm (65.0 in.)
Hardtop:	1665 mm (66.0 in.)
Overall Height:	
Saloon & Estate:	1410 mm (56.0 in.)
Hardtop:	1380 mm (54.0 in.)
Wheelbase:	2510 mm (99 in.)
Front track:	1380 mm (54 in.)
Rear track:	1370 mm (53.6 in.)
Min. road clearance:	175 mm (7.0 in.)
Min. turning radius:	5.0 m (16.5 ft.)

0.2. General Servicing Notes

The servicing and repair instructions in this Repair Guide are laid out in an easy-to-follow step-by-step order and no difficulties should be encountered if the text and diagrams are followed carefully and methodically. The author of this Repair Guide has attended a comprehensive Mazda Service Training Course and all operations have as far as possible been carried out without the use of special tools. Even if the number of a special service tool is given, we have tried to overcome this by giving alternative methods.

In order that space should be allocated to all possible technical data we do not repeat each time the more obvious and simple steps necessary to conform to good engineering practice. It may, however, be useful to briefly draw your attention to the more important general procedures and to list some points of general interest.

Always use the torque wrench settings given in the various sections of the Repair Guide. Bolts and nuts must always be in a clean and dry condition (use sealer only where recommended). Threads and faces must be undamaged and free from burrs or scoring.

All joint washers, gaskets, tab and lock washers, split pins and "O" rings should be renewed on assembly. Oil seals will, in the majority of cases, also need renewal if the shaft has been removed from the seal lip.

Reference to left-hand and right-hand sides (usually shown as L.H. or R.H.) is always to be taken as when the vehicle is viewed from the rear, facing forward.

Adequate precautions must always be taken to ensure that the vehicle is properly supported at all times, particularly if work is to be carried out on the underneath of the car. When the vehicle is to be raised, always support on stands and do not rely on a jack on its own. Support at the front under the crossmembers; at the rear, under the rear axle casing.

Dirt, grease and mineral oil will rapidly destroy the seals of any hydraulic system and even the smallest amounts must be avoided at all times. Use clean brake fluid of the recommended specification to clean the hydraulic system.

Many of the instructions in this Repair Guide will cover the steps to completely dismantle or assemble a unit but, obviously, in some cases this may not always be necessary or desirable.

Use only the recommended greases and oils on the vehicle. Your Owner's Handbook should be used to complement the basic specifications given in this Repair Guide and will indicate the various proprietory products recommended as suitable.

It is strongly recommended that only genuine Mazda spares and replacements are used. The following abbreviations are used in the text and should be noted:

Std.	To indicate sizes and limits of components as supplied by the manufacturer. Also to indicate the production tolerances of new unused parts.
O/S U/S	Parts supplied as oversize or undersize, or recommended limits for such parts, to enable them to be used with worn or re-machined mating parts. O/S indicates a part that is larger than Std. size. U/S indicates a bore of a bushing or female part that is smaller than Std.
Max.	Where given against a clearance or dimension indicates the maximum allowable. If in excess of the value given it is recommended that the appropriate replacement part is fitted.
T.I.R.	Indicates the Total Indicator Reading as shown by a dial indicator.
H.T.	High tension (ignition) wiring or terminals.
T.D.C.	Top Dead Centre (usually No. 1 piston on firing stroke).
MP	Multi-Purpose grease.

1. ENGINE

1.0. Main Features

Engine type:	4-cylinder, 4-stroke engine, in-line arrangement, water-cooled, overhead camshaft

Number of cylinders:	4
Bore:	80.00 mm (3.150 in.)
Stroke:	88.00 mm (3.460 in.)
Displacement:	1,769 c.c. (108.0 cu.in.)
Compression ratio:	8.6 : 1
Max. BHP (SAE):	
929 (Standard):	110 HP at 6000 rpm
929 (Optional):	100 HP at 6000 rpm
929 (European Version):	83 HP at 5000 rpm
Valve Timing:	
Inlet valve opens:	10° B.T.D.C.
Inlet valve closes:	57° A.B.D.C.
Exhaust valve opens:	54° B.B.D.C.
Exhaust valve closes:	13° A.T.D.C.
Ignition timing:	8° B.T.D.C.
Carburettor:	Down-draft, two barrel carburettor.

1.1. Engine – Removal and Installation

Removal and installation of any of the engines covered in this Repair Guide follows the same general procedures in each case, differing only in minor aspects, depending on the model and parts fitted. The engine is in each case removed without the gearbox if this is desired. A suitable hoist or crane is to be attached to the engine hangers to allow the unit to be lifted towards the front and upwards, out of the engine compartment. In every case the coolant must be drained and the battery disconnected and removed. The coolant taps are at the bottom of the radiator and on the side of the engine, on the side of the brake fluid reservoir.

Support the vehicle on stands of adequate strength if necessary. Support only under the front suspension crossmembers, the rear axle casing or the side jacking points. Drain the engine oil.

Carry out the initial operations as mentioned above and remove the engine undercover from below the front bumper. Then remove or disconnect the following parts:

A) Bonnet (mark the hinges)
B) Air cleaner

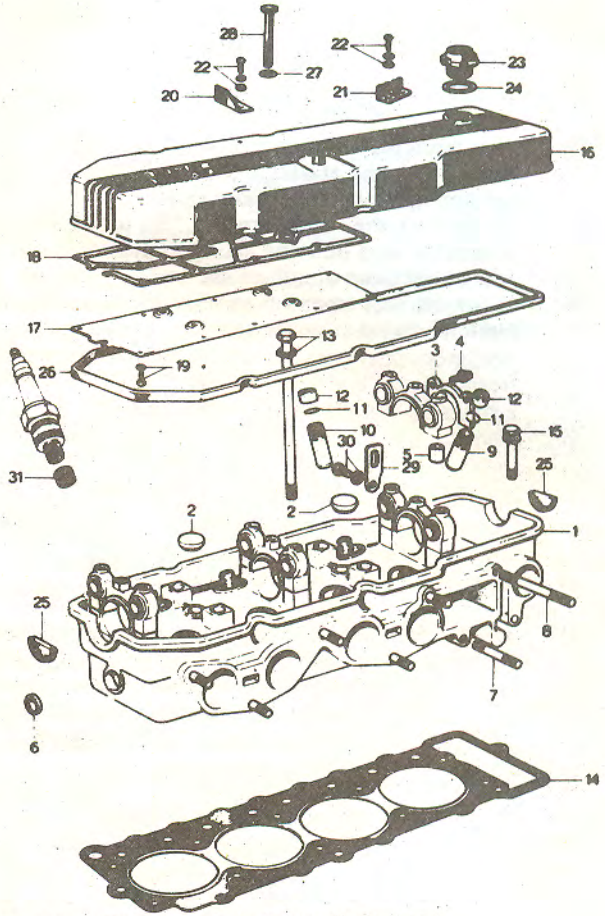


Fig. 1.1. – Exploded view of the cylinder head.

1. Cylinder head
2. Blind plug
3. Thrust plate
4. Bolt
5. Dowel pin
6. Blind plug
7. Manifold stud
8. Manifold stud
9. Inlet valve guide
10. Exhaust valve guide
11. Retaining ring
12. Valve guide seal
13. Cylinder head bolt
14. Cylinder head gasket
17. Oil deflector
18. Gasket
19. Bolt
20. Bracket
21. Bracket
22. Screw
23. Oil filler cap
24. Sealing washer
25. Sealing insert
26. Rocker cover gasket
27. Sealing washer
28. Bolt
29. Lifting bracket
30. Bolt
31. Threaded insert

C) Accelerator cable and choke cable (carburettor)
D) Fuel pipe
E) Heater inlet hose at the intake manifold
F) Primary wire and high tension cable at the distributor
G) Wire from the water temperatur sender unit
H) Wires from the starter motor, oil pressure switch and the idle cut-off solenoid valve
I) Disconnect the wire from the "B" terminal of the alternator and pull the multi-connector from the rear of the alternator.
J) Wiring harness from the engine and the earth strap, from its engine connection.
K) Radiator upper hose from radiator and lower hoses from radiator and water pump
L) Expansion chamber hose at the radiator
M) Remove the screws attaching the fan cowling and remove the cowling. Then remove the radiator securing screws and lift out the radiator.
N) Disconnect the throttle linkage from the rocker cover and the carburettor.
O) The vacuum pipe from the servo unit.

Jack up the vehicle and from underneath remove the clutch housing cover and the starter motor. Separate the exhaust pipe from the manifold connection. Support the gearbox on a suitable trolley jack and raise the engine until all load is taken off the engine mountings. Unscrew the nuts and bolts securing the gearbox to the engine. Attach a suitable lifting sling to the engine hanger brackets and a suitable hoist or other lifting device and take up all slack. Remove the right- and left-hand engine mounting brackets. Pull the engine forward until it is free from the clutch shaft and then lift the engine carefully from the engine compartment, taking care that all connections have been separated.

If the vehicle is fitted with Exhaust Emission Control Equipment, disconnect additionally all wires, pipes and leads between the engine and the equipment. Make sure that each connection is clearly marked before removing to facilitate re-connection.

Installation of the engine is carried out by following the instructions in reverse sequence to removal. Fill the engine with the specified lubricant and fill the coolant system. Run the engine and check for possible leaks in cooling, fuel and lubrication systems.

1.2. Engine – General Dismantling

Before commencing any dismantling of the engine, thoroughly clean all exterior surfaces to prevent any foreign matter finding its way into the engine cavities when the seal faces are separated.

If possible, mount the engine in a suitable stand. If such a stand is not available, make sure that the engine is well supported when placed on a workbench for dismantling.

First remove the ignition distributor. To do this, withdraw the spark plug cables from the plugs and the vacuum hose from the distributor. Undo the locknut for the distributor and withdraw the distributor. Disconnect the fuel hose from the pump outlet. Remove the bolt securing the pump to the cylinder block and lift off the pump together with the intermediate flange and the gaskets. The pump will have to be tilted slightly towards the top to disengage the pump operating lever.

Undo the bolts securing the fan and the pulley from the water pump hub and remove fan and pulley. The water pump is fitted to the front timing cover and can now be unscrewed. Remove the alternator. Remove the water pump gasket.

Remove the screws securing the thermostat housing to the cylinder head and lift off the housing together with its gasket. Withdraw the thermostat. Unscrew the engine hanger bracket and remove the inlet manifold from the cylinder head and lift off together with the carburettor and the manifold gasket. Unscrew the oil filter and the oil pressure switch. Special tool 49 0223 195 is available for the removal of the oil filter. If this tool is not at hand, the oil filter can be removed with a clamp wrench. Most accessory shops sell now universal oil filter clamp wrenches, so that this problem is easily overcome.

Remove the camshaft and the cylinder head as follows: Unscrew the rocker cover bolts and lift off the cover together with the gasket. There are two semi-circular oil seals, one at each side of the cylinder head which must

be removed. Insert a strong screwdriver into the teeth of the flywheel ring gear and remove the nut securing the distributor drive gear to the end of the camshaft. Slide the drive gear off the camshaft and using a large open ended spanner, remove the nut securing the camshaft sprocket (see Fig. 1.2.). Unscrew the cylinder head bolts in the reverse order to the sequence shown in Fig. 1.3.

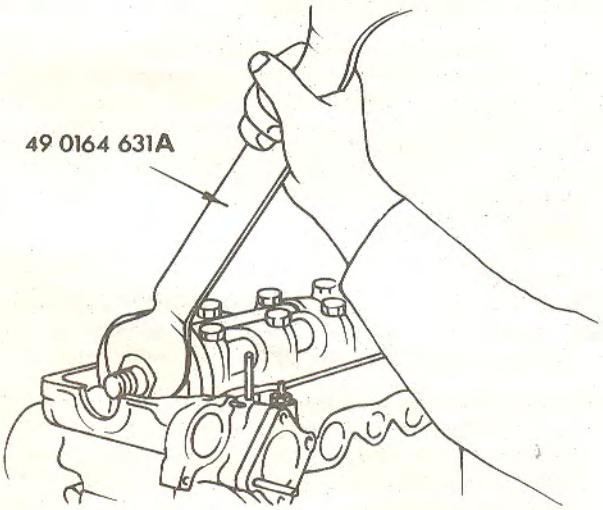


Fig. 1.2. — Removal of the locknut for the camshaft sprocket. The distributor drive gear has already been removed from the end of the camshaft.

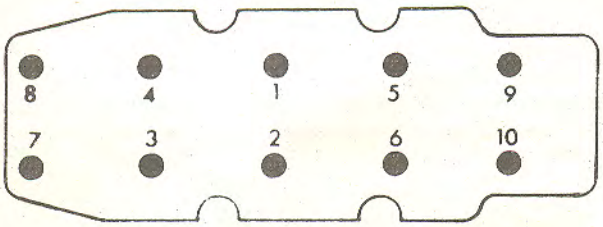


Fig. 1.3. — Tightening sequence for the cylinder head bolts. The bolts are slackened in reverse order starting at "10".

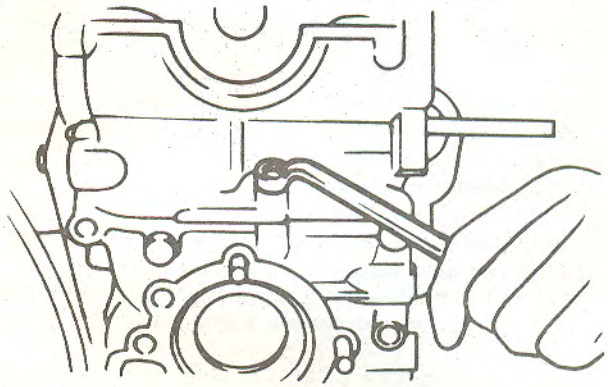


Fig. 1.4. — When removing the cylinder head, note that a bolt is situated on the outside between cylinder head and timing cover.

An additional bolt is located on the outside of the cylinder head, between cylinder head and timing cover (see Fig. 1.4.), which must also be removed. Make sure that the cylinder head bolts are loosened gradually and evenly in several stages.

Lift off both rocker shafts. The rocker pedestals are located on hollow dowels and a screwdriver may be necessary to lift them off. Withdraw the camshaft towards the rear, at the same time disengaging the camshaft sprocket from the shaft. Take care not to damage the bearing shells in the cylinder head. Lift out the shells and keep them together with the other set in the rocker pedestals. The camshaft sprocket can either be left in the chain (it will not drop into the timing chamber) or can be removed from the chain. In this case, tie up the chain in a suitable manner, especially if it is not intended to carry out further dismantling work.

NOTE: When only the camshaft or the cylinder head is removed, pull the timing chain upwards after removing the camshaft sprocket to prevent the slipper head of the chain tensioner from disengaging and thereby making it difficult to adjust the timing.

Counterhold the flywheel with a strong screwdriver or the flywheel locking tool and unscrew the bolt securing

the crankshaft pulley to the crankshaft. Withdraw the pulley from the crankshaft end. With the screwdriver still locking the flywheel, remove the clutch securing screws in a diagonal manner. Remove clutch cover and clutch driven plate from the flywheel. Do not touch the driven plate with greasy fingers. Unscrew the flywheel securing bolts and lift off the flywheel, if necessary using a plastic or a rubber mallet.

Invert the engine on the stand, or if dismantling is carried out on a work bench, place it onto the cylinder block face. Unscrew the oil sump (pan) from the bottom of the crankcase and remove together with the gaskets.

From the front face of the cylinder block unscrew the timing chain cover and remove together with the gasket. Withdraw the oil thrower from the end of the crankshaft and take out the key.

Remove the bolts securing the chain tensioner, chain guide strip and the vibration damper and lift off the parts mentioned.

Remove the sprocket for the oil pump and the drive chain. To do this, undo the sprocket nut (oil pump) and withdraw the crankshaft sprocket and at the same time the oil pump drive chain of the pump sprocket. The oil pump drive chain has no chain tensioner as the tension of the chain is established by means of shims between oil pump body and cylinder block face. Remove the key from the end of the crankshaft.

Remove the nuts securing the oil strainer to the oil pump and remove the oil strainer and the "O" sealing ring. Remove the pump securing screws, the "O" sealing ring and the adjusting shims from the cylinder block.

Loosen the big end bearing cap bolts, lift off the caps and remove the connecting rod/piston assemblies from the top of the cylinder block. Make sure that the piston assemblies are kept in their proper cylinder order. Remove the main crankshaft bearing cap bolts, lift off the caps and shells and remove the crankshaft. Take out the upper bearing shells and place them with their mating caps and lower bearing shells.

NOTE: It may be necessary to use a puller for the removal of the rear main bearing cap which carries the crankshaft thrust. The use of this puller is shown in Fig. 6 and a similar tool can easily be made up. Lift out the crankshaft and the rear oil seal.

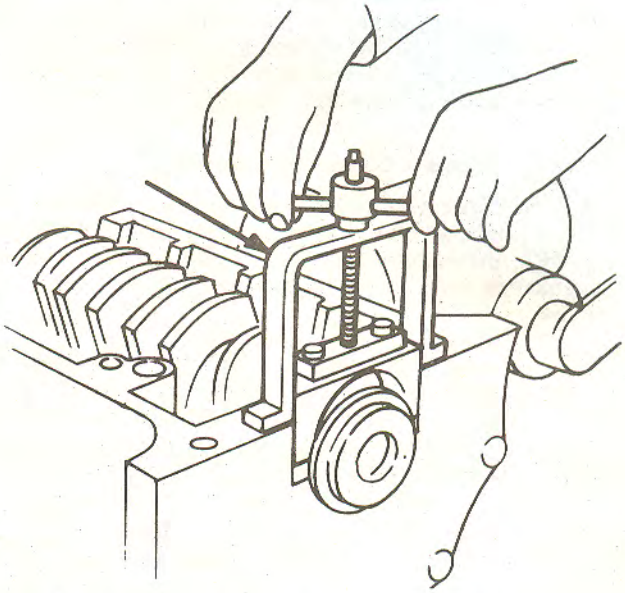


Fig. 1.5. – Removing the rear main bearing cap with the special puller. A similar puller can be made up if necessary.

Dismantle the pistons from their connecting rods. Extract the piston pin snap rings and then heat the piston to 50 - 60° C (122 - 140° F) before pushing out the piston pin. Always keep the piston and pin together. Use a ring expander to remove the piston rings from the pistons.

Use a valve spring compressor to remove the valve springs and other parts. Remove the oil seals from the valve guides, if present. To avoid mixing up of the valves, they should be pierced through a piece of cardboard in their fitting order. Mark one end of the cardboard with "Front" and commence inserting the No. 1 valve from this end.

Dismantle the rocker shafts, taking off the parts one after the other and keeping them in their order of installation. Check immediately all oil drillings for obstructions. Thoroughly clean all parts of sludge, dirt and water scale before overhaul. Blow out all passages with compressed air. Remove all carbon deposits and take care not to stretch or mark the parts. Fig. 7 shows an exploded view of the cylinder block components. Additional exploded views of the engine parts are shown in the relevant sections commencing at 1.4.

1.3. Engine – General Re-Assembly

This section covers general re-assembly procedures and further detailed information on servicing and overhaul is given in the sections commencing at 1.4. For all engines, the general instructions below should be followed at all times.

Take care to keep all parts in as clean a condition as possible. Benches, tools and rugs should be kept free of swarf, dirt and all other foreign matter. When installing any part that rotates or slides be sure to apply a film of clean engine oil. Do this BEFORE the parts are assembled and not afterwards.

Use new gaskets and renew all split pins, lock washers and plates and damaged bolts and nuts. Inspect all oil seals and replace if the sealing lip shows the slightest damage or deterioration.

Follow all specific tightening torque values which are given in Section 1.5. and at the end of other sections; clutch, gearbox, etc. It is most important to note that some tightening torque values are different for certain engines and these values must always be followed.

With all parts serviced and overhauled as necessary, the assembly sequence should be as follows:

Take the assembled pistons and connecting rods (see Section 1.4.3.) and lay them out in their cylinder order. Make sure that the "F" in the piston pin boss and the oil hole in the connecting rod are relative to each other as described in Section 1.4.3. With the engine resting on the cylinder block face, fit the crankshaft and parts. Fit the oil seal into the rear end of the cylinder block. Fit the side seals as described in Section 1.4.4.

Place the upper half of the crankshaft main bearing shells into the block. Install the upper halves of the thrust washers, making sure that the oil grooves are facing the thrust faces. Lift the crankshaft into position and fit the remaining bearing shells, the thrust washers and the bearing caps.

The bearing caps are marked with a number (1 to 5) and their identification can be taken from Fig. 1.6. Make sure that the main bearing caps are installed in their original positions.

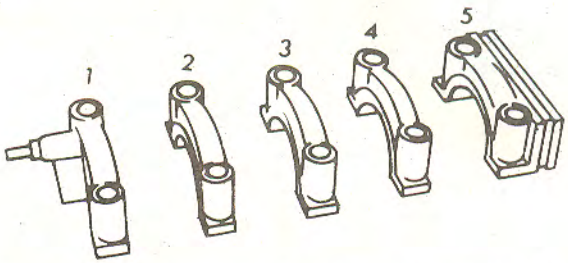


Fig. 1.6. – The identification of the main bearing caps. Arrows in the centre caps (except No. 1 and No. 5) indicate which side of the caps must face towards the front of the engine.

Fit the main bearing cap bolts and tighten them to 8.4 - 9.0 kgm (61 - 65 lb.ft.).

Tighten the cap bolts in the following sequence: Centre bearing, then the cap in front of the centre, then that behind the centre bearing, then the front and finally the rear cap.

Finally check the crankshaft end float.

Oil the pistons and connecting rods and use a ring compressor to insert the assemblies into the top of the block. The piston front mark "F" must face the front of the engine. Ring gaps must be arranged as described in Section 1.4.3.1. Fit the connecting rod bearing caps in their proper positions, making sure that the identification numbers stamped near the fitting surfaces with the caps are properly matched. Tighten the cap bolts to 5.0 - 5.5 kgm (36 - 40 lb.ft.) in several stages in the order given above.

Fit the oil pump in accordance with the following instructions:

Fit the oil pump adjusting shims to the cylinder block, insert a new "O" sealing ring and fit the oil pump over the dowel in the block. Pour a little oil into the inlet port and turn the pump shaft several times to pre-lubricate the moving parts of the pump.

Fit the timing chain over the two sprockets so that the timing mark on each gearwheel is in the marked link on the chain. Take the chain with the two sprockets inside and slide the crankshaft sprocket over the end of the crankshaft so that 41 chain links are arranged on the left-hand side between the two timing marks as shown in Fig. 1.7.

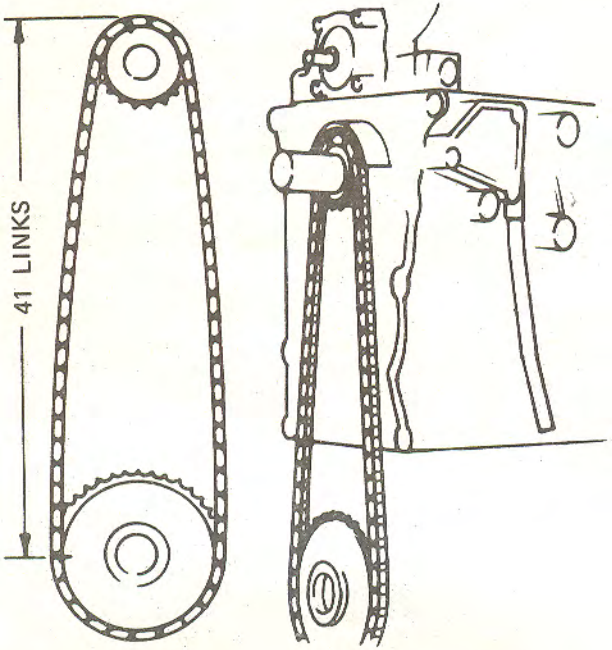


Fig. 1.7. – When fitting the timing chain, note that 41 chain links must be between the two timing marks on the sprockets as shown.

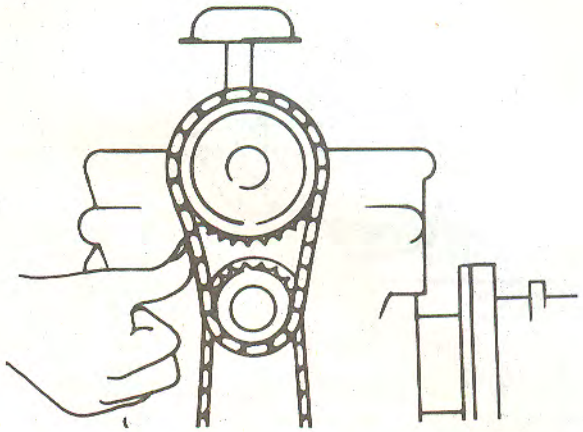


Fig. 1.8. – Checking the oil pump drive chain tension by depressing the chain at the point shown.

Insert the key into the oil pump shaft and fit the oil pump drive chain to the crankshaft and oil pump sprockets. Align the key in the pump shaft and slide on the pump sprocket. Using thumb pressure as shown in Fig. 1.8., check if the chain can be deflected by 4 mm (0.16 in.). If the deflection is greater, add shims between oil pump and cylinder block face. After correct adjustment, tighten the pump sprocket nut to 3.5 kgm (25 lb.ft.) and bend over the lock plate.

Referring to Fig. 1.9., fully compress the spring of the chain tensioner and insert a home-made tool as shown.

Fit the chain tensioner in this position to the cylinder block and refit the securing bolts. DO NOT remove the tool at this stage.

Fit the gasket on the left-hand side of the cylinder block and fit the vibration damper to the block. On the other side of the chain fit the chain guide strip loosely with the two screws. The screws are tightened later when the chain is adjusted.

Install a new oil seal (if necessary) into the timing chain cover and grease the lip of the oil seal. Place the oil thrower over the end of the crankshaft as shown in Fig. 1.10., so that the up-turned edge is facing outwards.

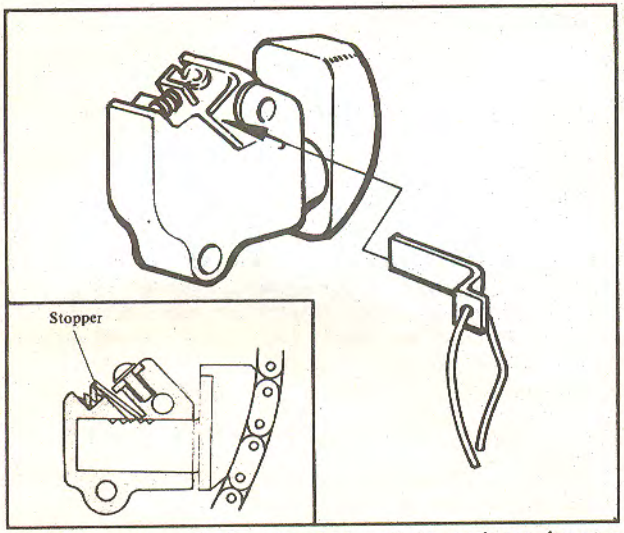


Fig. 1.9. – When fitting the timing chain tensioner, insert a home-made bracket into the position shown to lock the tensioner in position until the chain tension is adjusted.

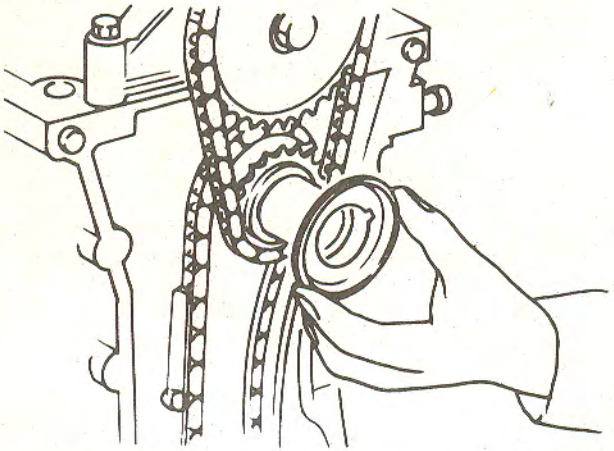


Fig. 1.10. – Fitting the oil deflector in front of the timing sprocket. The up-turned edge is towards the outside.

Place the right-hand timing cover gasket onto the cylinder block and fit the cover, aligning the dowel pins. Tighten the bolts. At the bottom of the crankcase, trim off the protruding ends of the gasket on the timing chain cover

along the mounting face for the oil sump and also at the top for the cylinder head.

Install the oil sump, but make sure to carry out a final inspection of the internal parts. Apply a thin coat of sealing compound on the block and position a new gasket. Tighten the securing bolts a little at a time to 0.7 kgm (5.0 lb.ft.).

Install the cylinder head (assembled with valves, springs, etc.). Fit the cylinder head gasket in dry condition. Tighten the cylinder head bolts a little at a time, working in the order shown in Fig. 1.3. Torque to the values given in Section 1.5.

Insert the bearing shells into the cylinder head bores (Fig. 1.11.) after having lubricated them with engine oil. Insert the camshaft through the camshaft sprocket aligning the key, and place the journals into the cylinder head bearings.

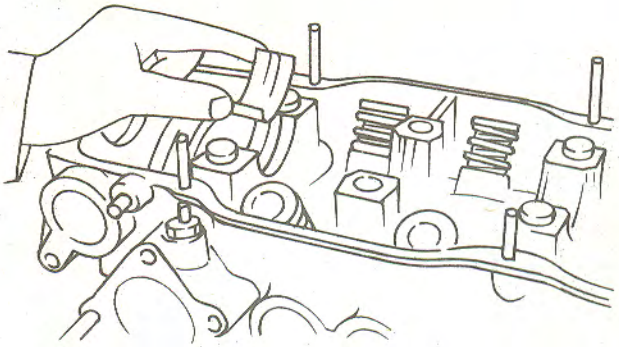


Fig. 1.11. – Inserting the bearing shells for the camshaft into the cylinder head. See also Section 1.4.5.1.

Install the valve rocker shaft assembly and tighten the bolts to the appropriate torque values. Tighten in three or four steps. Note the following points for the installation of the rocker shaft assembly:

– Rocker arms, spacers and rocker pedestals are interchangeable for the inlet and exhaust valves.

The rocker arm shafts for the inlet and the exhaust

valves are not interchangeable. There are two shafts on the inlet side and one shaft on the exhaust side. The two shafts for the inlet valves are, however, interchangeable.

– Fit the rocker shafts on the inlet side so that the two ends with the larger dimension between the oil hole and the end face are opposite each other at the centre.

– The centre bearing cap is installed with the oil hole facing towards the inlet side.

CAUTION! The ball ends in the rocker arms can be moved and it should be noted that the flat surface should be facing downwards, i.e. against the ends of the valve stems as can be seen in Fig. 1.12. The rocker shaft pedestals are located by dowels and before tightening the bolts, make sure that the pedestals are properly engaged with the dowels.

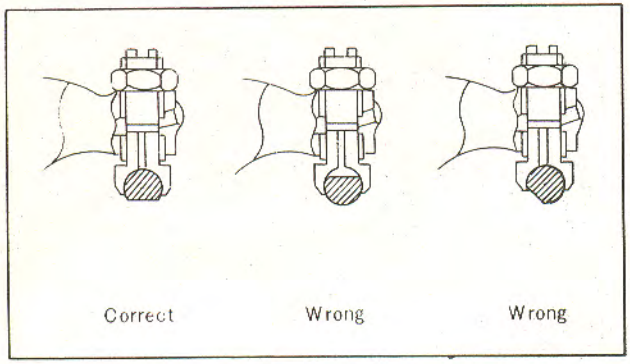


Fig. 1.12. – Correct and incorrect positioning of the ball inserts inside the rocker arm ends.

Tighten the cylinder head bolts temporarily and then move the rocker arm pedestals so that each of the exhaust rocker arms are offset 1.0 mm (0.04 in.) from the centre of the valve stems as shown in Fig. 1.13.

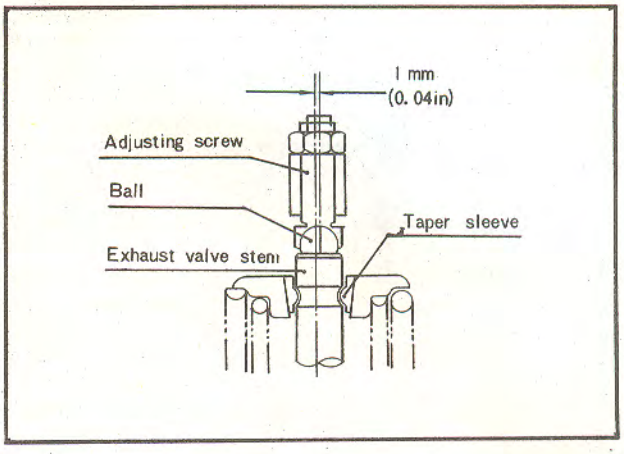


Fig. 1.13. – Offsetting the exhaust rocker arms.

Tighten the cylinder head bolts in the sequence shown in Fig. 1.3. Do not omit the bolt on the outside between timing cover and cylinder head (refer to Fig. 1.4.). Cylinder head bolts are tightened in stages to the final torque given in Section 1.5.

Fit the oil pipe with the oil squirt hole facing towards the camshaft side. Fit the "O" sealing ring for the pipe into the bore of the centre bearing cap.

Lock the flywheel by inserting a screwdriver into the flywheel ring gear teeth and tighten the camshaft gear sprocket nut to 7.0 - 8.0 kgm (51 - 58 lb.ft.) with a large spanner. Bend over the tab washer. Slide the drive gear for the distributor over the end of the camshaft so that the groove is aligned with the locating pin and tighten the nut to the torque given above. Lock the nut.

The timing chain is now adjusted as follows:

Slightly rotate the crankshaft in the direction of rotation and insert a screwdriver into the top of the cylinder head and press it against the chain guide strip, as shown in Fig. 1.14., but not too hard. With a second screwdriver tighten the two securing screws for the chain guide strip inside the timing cover. There are two holes in the cover, immediately below the cylinder head face

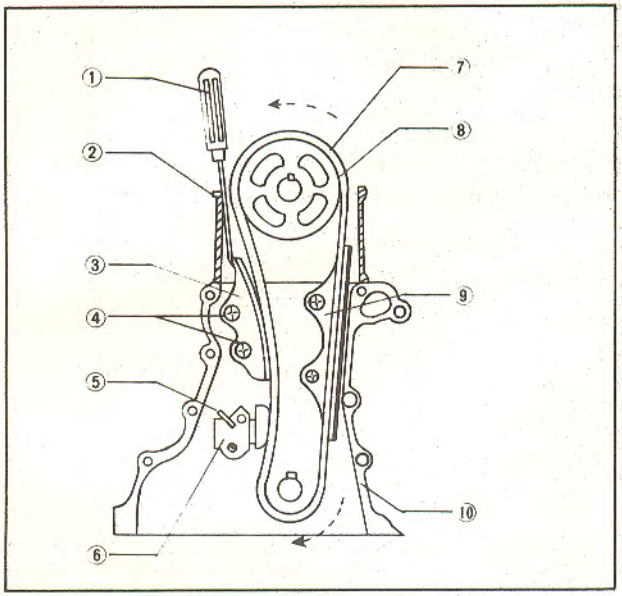


Fig. 1.14. — Details of timing chain adjustment.

1. Screwdriver
2. Cylinder head
3. Chain guide strip
4. Securing screw
5. Special tool (see Fig. 1.9.)
6. Chain tensioner
7. Camshaft sprocket
8. Timing chain
9. Vibration damper
10. Cylinder block

and the screwdriver should be inserted in turn.

Remove the tool previously inserted into the timing chain tensioner. The tensioner is accessible through the opening near the pulley end of the timing cover.

The remaining assembly procedures are carried out in reverse order to the dismantling sequence. When fitting the water pump and the inlet manifold always use new gaskets.

When installing the flywheel, line up the "0" marked hole on the flywheel with the reamed hole on the crankshaft and fit the dowel bolt into this hole. Tighten the flywheel bolts to 15.5 - 16.3 kgm (112 - 118 lb.ft.). As the torque is comperatively high, make sure that the engine cannot tip over and that the flywheel ring gear teeth are well locked against rotation of the crankshaft.

Refer to Section 2. for the installation of the clutch.

When fitting the crankshaft pulley, make sure that the key in the crankshaft is in line with the groove of the pulley. The pulley can be driven on with a piece of tube. Tighten the bolt to 14 - 15 kgm (97 - 108 lb.ft.).

NOTE: Make sure that the two semi-circular oil seals at the front and rear of the cylinder head are fitted with the word "Out" facing towards the outside of the engine.

1.4. Engine — Servicing and Overhaul

1.4.0. INTRODUCTION

In the sub-sections commencing at 1.4.1. will be found all technical data and servicing instructions for the Mazda 929 engine, covered in this Repair Guide. The instructions and data given should be read in conjunction with Sections 1.2. and 1.3. for general dismantling and assembly procedures, together with the further information on ignition, lubrication, cooling and fuel systems given in Sections 1.6. to 1.9.

General engine tightening torque values are given in Section 1.5.

1.4.1. CYLINDER HEAD AND VALVES

1.4.1.0. Technical Data

Cylinder Head:	
Head distortion (max.):	0.15 mm (0.006 in.)
Valve seat re-facing angles:	15°, 45° and 75°
Valve seat width - Both:	1.4 mm (0.055 in.)

Valves:	
Head diameter - Inlet Valves:	42.0 ± 0.1 mm (1.6536 ± 0.004 in.)
Head diameter - Exhaust:	33.0 ± 0.1 mm (1.2992 ± 0.004 in.)
Overall Length:	
Inlet valves:	108.5 mm (4.2717 in.)
Exhaust valves:	107.0 mm (4.2127 in.)
Stem Diameters:	
Inlet valves:	8 mm $^{+0.045\ mm}_{+0.030\ mm}$
	(0.315 $^{0.0018\ in.}_{+0.0012\ in.}$)
Exhaust valves:	8 mm $^{+0.045\ mm}_{+0.025\ mm}$
	(0.315 in. $^{+0.0018\ in.}_{+0.0010\ in.}$)
Wear limit:	7.980 mm (0.3142 in.)
Stem to bush clearance:	
Inlet valves:	0.020 - 0.055 mm (0.0008 - 0.0022 in.)
Wear limit:	0.20 mm (0.008 in.)
Exhaust valves:	0.025 - 0.065 mm (0.001 - 0.0026 in.)
Wear limit:	0.20 mm (0.008 in.)
Valve head edge thickness:	
New:	1.5 mm (0.06 in.)
Wear limit:	0.5 mm (0.02 in.)
Valve head contact angle:	45° (90° full angle)
Valve Guides:	
Inner diameter:	8.0 mm (0.315 in.)
Outer diameter:	14.0 mm (0.5512 in.)
Length:	50.5 mm (1.988 in.)
Valve Springs:	
Outer springs:	
Wire diameter:	4.3 mm (0.169 in.)
Coil diameter:	32.9 mm (1.295 in.)
Free length:	37.3 mm (1.469 in.)
Min. free length:	36.2 mm (1.425 in.)
Fitted length:	34.0 mm (1.339 in.)
Fitted load:	14.25 kg (31.4 lb.)
Min. fitted load:	12.10 kg (26.7 lb.)
Inner springs:	
Wire diameter:	3.0 mm (0.118 in.)
Coil diameter:	23.1 mm (0.909 in.)
Free length:	36.8 mm (1.449 in.)
Min. free length:	35.7 mm (1.406 in.)
Fitted length:	33.0 mm (1.299 in.)
Fitted load:	7.4 kg (16.3 lb.)
Min. fitted load:	6.3 kg (13.9 lb.)

Valve Rocker Shaft:	
Outer diameter:	19.0 mm (0.748 in.)
Length:	
Inlet valve shafts:	159.0 mm (6.26 in.)
Exhaust valve shaft:	336.0 mm (13.229 in.)
Bush to arm clearance:	0.027 - 0.081 mm (0.0011 - 0.0032 in.)
Wear limit:	0.10 mm (0.004 in.)
Manifold surface distortion (max.):	0.15 mm (0.006 in.)

1.4.1.1. Cylinder Head — Servicing

The arrangement of the valve operating mechanism is shown in Fig. 1.15. A sectional view of the assembled cylinder head is also shown in Fig. 1.16.

With the cylinder head removed from the engine, as previously described, and the valve springs removed with a suitable compressor, clean all parts thoroughly and remove all carbon and scale.

Check the clearance between valve stems and guides, replacing the guides if the clearance exceeds those given. Note that the wear usually occurs more in one direction than the other and the guide will need replacement if the wear is exceeded in any direction. Drive out the valve guide bushing, using the remover and replacer tool 49 0221 251 A. The old bushing is driven out towards the combustion chamber and replaced in the same direction.

Note that the new guide must protrude above the cylinder head surface which is automatically achieved by use of the special tool mentioned. If this tool is not available, measure the protrusion of the old guide and drive in the new guide to obtain the original protrusion.

NOTE: Since February 1972 oversize valve guides have been added. The difference between the oversize valve guide and the standard size valve guide is only in the outer diameter and cylinder heads must be re-bored to take the oversize guides which have the following dimensions:

$$14\ mm\ ^{+0.060\ mm}_{+0.040\ mm}\ (0.5118\ ^{+0.0024\ in.}_{+0.0016\ in.})$$

Note also that the inlet and exhaust valve guides are different as shown in Fig. 1.17. There are valve seals on both ends of the valve guides.

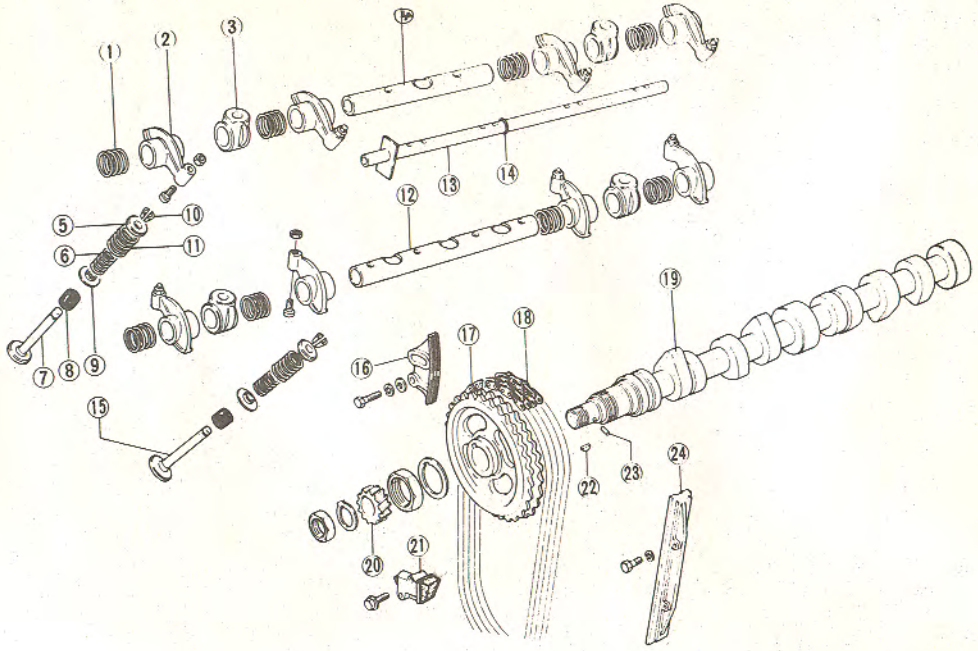
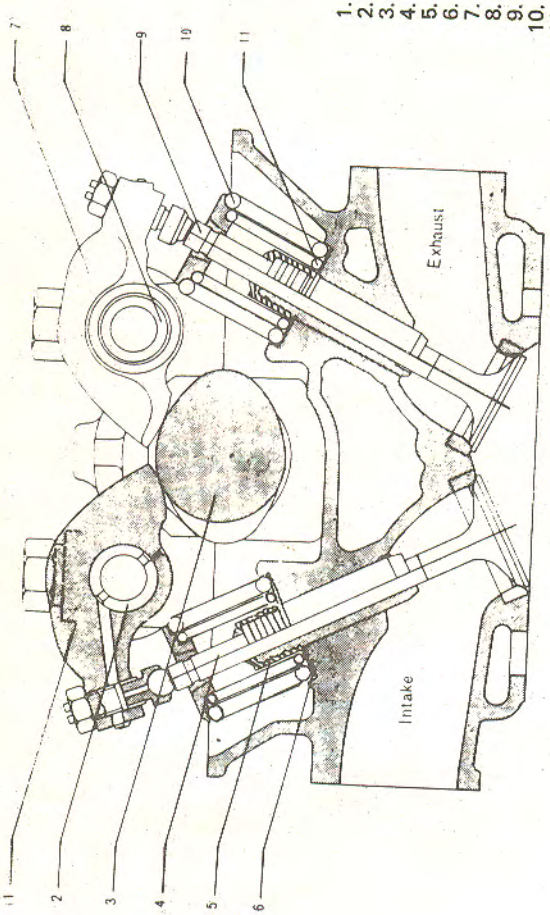


Fig. 1.15. – View of camshaft, rocker arms and timing gear.

1. Spring
2. Rocker arm
3. Spacer
4. Inlet rocker arm shaft
5. Upper spring seat
6. Inner valve spring
7. Inlet valve
8. Valve stem seal
9. Lower spring seat
10. Taper sleeve
11. Outer valve spring
12. Exhaust rocker arm shaft
13. Oil distribution pipe
14. "O" sealing ring
15. Exhaust valve
16. Chain guide strip
17. Camshaft sprocket
18. Timing chain
19. Camshaft
20. Distributor drive gear
21. Chain tensioner
22. Woodruff key
23. Dowel pin
24. Vibration damper



1. Inlet rocker arm
2. Inlet rocker shaft
3. Camshaft
4. Inlet valve
5. Valve seal
6. Lower valve spring seat
7. Exhaust rocker arm
8. Exhaust rocker shaft
9. Exhaust valve
10. Outer valve spring
11. Inner valve spring

Fig. 1.16. — Sectional view of the cylinder head.

Ream the bore of the newly fitted valve guide to obtain the specific clearances to the valve stems.

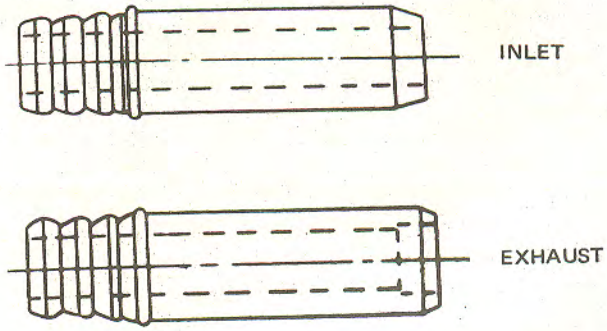


Fig. 1.17. — The drawing shows the difference between the valve guides for the inlet and exhaust valves.

Check the valve seats for damage or wear and re-face as necessary. The valve seats should be finished to the dimensions given in Section 1.4.1.0. Fig. 1.18. shows the dimensions of the valve seats in mm for both the inlet and the exhaust valve seats. Do not attempt to re-face the valve seats with a worn valve guide in position. Replace the valve guide first.

Inspect the valve rocker arm bores and shafts. Replace the arm if badly worn at the ball insert. Slight scoring can be removed with an oilstone.

Valves: Replace if excessively worn, burnt or deformed. Check the head for any signs of cracking or corrosion. Check the valve head edge to the limits given in the "Technical Data". Fig. 1.19. shows the valve and the edge dimensions. Re-surface the valve face on a suitable machine, removing only sufficient material to just take out any pitting or grooving. Grind to the 45° angle shown in the illustration. In case that the valve stem end is to be re-faced do not remove more than 0.5 mm (0.020 in.) of stock.

Valve Springs: Inspect the springs for weakness and free length and replace if outside the limits given. Use a valve spring tester to check the installed load of each spring. New springs should be fitted if their free length has

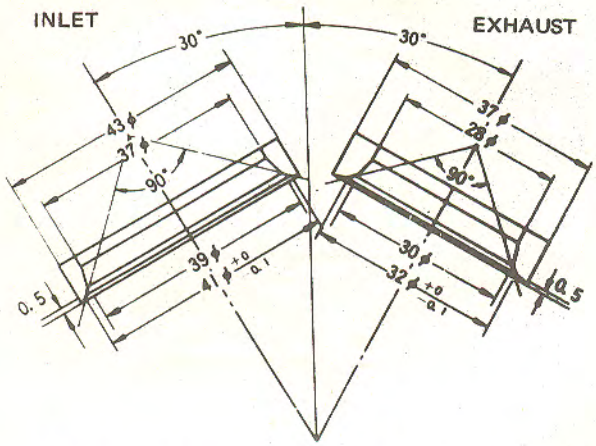


Fig. 1.18. — Dimensional drawings of the inlet and exhaust valve seats. All dimensions are given in millimetres.

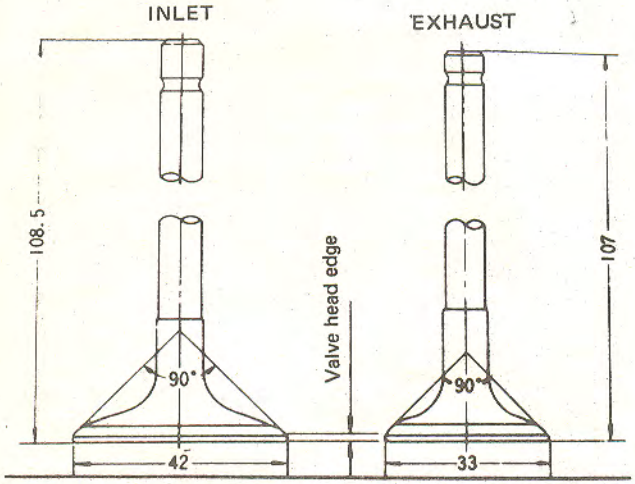


Fig. 1.19. — Dimensions of the valves. All dimensions are given in millimetres. See Section 1.4.1.0. for inch conversions.

decreased by more than 3 % or their fitting pressure by more than 15 % of the standard values.

Check the cylinder head for cracks and the front face for burrs or damage. Use a precision straight edge to check the distortion of the head surface, inserting feeler gauges between straight edge and cylinder head face. If the distortion exceeds the value given it will be necessary to re-grind the head face. Check the inlet and exhaust manifold faces in a similar manner or by placing the manifold onto a surface plate and checking the gap between manifold and surface plate with feeler gauges.

Refer to Sections 1.4.5.0. and 1.4.5.1. for data and information on all camshafts, with servicing procedures.

NOTE: When the valve and valve seats have been re-faced several times or must be re-machined deeply to produce a satisfactory seat, it is necessary to measure the protrusion of the valve stem on the upper face of the cylinder head. This is carried out with a depth gauge as

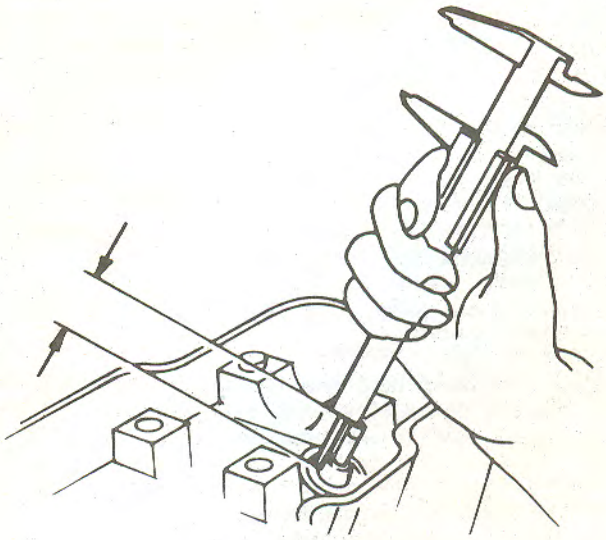


Fig. 1.20. — Measure the length of the protruding end of the valve stem to check whether washers are required under the valve springs or the cylinder head must be replaced.

shown in Fig. 1.20. The standard dimension is 37.5 mm (1.48 in.) for the exhaust valves and 40.5 mm (1.59 in.) for the inlet valves. If these dimensions are exceeded by 0.5 mm (0.02 in.), place a washer under the spring to maintain the spring pressure. If more than 1.5 mm (0.06 in.), replace the valve or the cylinder head.

1.4.1.2. Valve Clearance Adjustment

Valve clearances can be checked on the valve side, i.e. between the end of the valve stem and the rocker arm adjusting screw or between the cam of the camshaft and the opposite end of the rocker arm. If must, however, be noted that the valve clearances are different in accordance where they are checked.

To check the valve clearance, insert a feeler gauge between the valve stem and the rocker arm adjusting screw or the cam and the rocker arm. Valve clearances are set by adjusting the rocker arm screw until the required clearance is obtained. Rocker arms must of course be on the heel of the cam before the clearance can be set and this is carried out in the following manner:

Tighten the cylinder head bolts to the torque settings given in Section 1.5. Check the valve clearance by positioning each piston at T.D.C. in its compression stroke. To adjust the clearance, slacken the locknut and turn the adjusting screw until the following clearances are obtained with the engine WARM:

Checked at the valve stems:	0.30 mm (0.012 in.)
Checked at the cams:	0.22 mm (0.009 in.)

Securely counterhold the adjusting screw whilst the locknut is tightened, as even a small movement of the screw will alter the valve clearance.

1.4.2. CYLINDER BLOCK

1.4.2.0. Technical Data

Cylinder head block face, max. distortion:	0.15 mm (0.006 in.)
Cylinder Bore:	
Marked "A":	80.00 + 0.019 mm (3.1497 + 0.0007 in.)
Marked "B":	80.00 + 0.013 mm (3.1497 + 0.0005 in.)
Marked "C":	80.00 + 0.006 mm (3.1497 + 0.0002 in.)
Oversize bores:	0.25 and 0.50 mm (0.010 and 0.02 in.)
Wear limit of bore:	0.15 mm (0.06 in.)
Max. bore taper and out-of-round:	0.02 mm (0.008 in.)
Piston to cylinder clearance:	0.048 - 0.063 mm (0.0019 - 0.0025 in.)

1.4.2.1. Servicing

The majority of the servicing of the cylinder block will be found to be associated with specific sections: Pistons, crankshaft, etc., but the following general notes and instructions should be observed:

At all major service operations the block should be thoroughly cleaned of all sludge and foreign matter. Pay particular attention to all oilways and cavities and clear out all obstructions. Do not leave any solvent, cleaner or swarf in the interior of the engine. Blow out with compressed air and dry off with a clean lint-free cloth.

If one cylinder requires re-boring, then all four cylinders must be done at the same time. Check the head surface with a straight edge and feeler gauges as described in Section 1.4.1.1. for the cylinder head. Correct by surface-grinding if necessary.

Inspect and measure the entire bore of each cylinder. Use a precision bore gauge and measure each bore in six places: Longitudinally and transversely at the top, centre and bottom. To check the running clearance of the pistons in the bores (see Section 1.4.2.0.), have the piston pin removed from the piston at a temperature of about 20° C (68° F). Measure the piston diameter at 90° to the pin bore axis at a position 20.5 mm (0.8071 in.) below the bottom ring groove. Make sure that the micrometer used for measuring is correctly located. The standard pistons and cylinders are graded into three classes respectively according to the diameter of the piston and

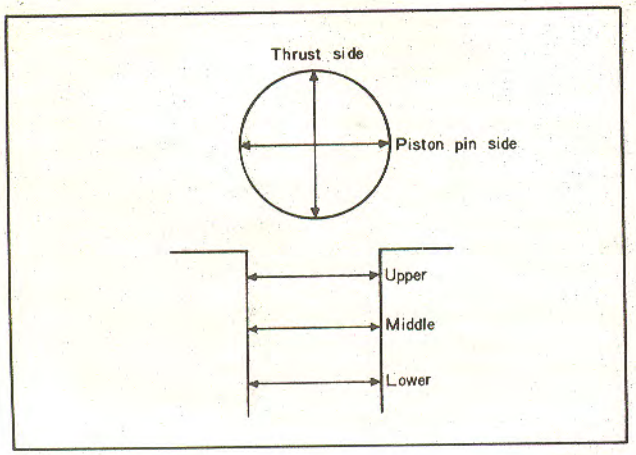


Fig. 1.21. – Measuring the cylinder bores. Measure the diameter at three different heights in the bore and as shown in the upper diagram.

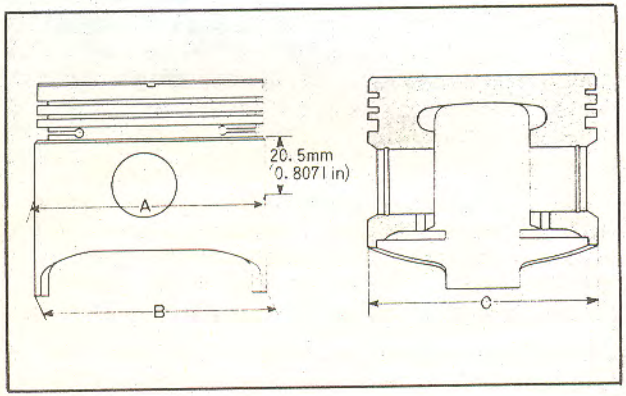


Fig. 1.22. – Piston measurement diagram. Note the different diameters at points "A", "B" and "C".

A.: 79.954 ± 0.01 mm (3.0691 ± 0.0004 in.)
B.: 79.980 ± 0.01 mm (3.1489 ± 0.0004 in.)
C.: 79.669 ± 0.01 mm (3.1367 ± 0.0004 in.)

cylinder bore and each of them is stamped with the letter "A" or "C" or is unmarked. Figs. 1.21. and 1.22. show the two measurements.

1.4.3. PISTONS AND CONNECTING RODS

1.4.3.0. Technical Data

Piston Diameters:	
Marked "A::	79.954 + 0.010 mm (3.1478 + 0.0004 in.)
Marked "B":	79.954 ± 0.004 mm (3.1478 ± 0.0002 in.)
Marked "C":	79.954 – 0.010 mm (3.1478 – 0.0004 in.)
Available oversize pistons:	0.25 and 0.50 mm (0.01 and 0.02 in.)
Piston running clearance:	0.048 - 0.063 mm (0.0019 - 0.0025 in.)

PISTON RINGS

Piston ring gap:	0.2 - 0.4 mm (0.008 - 0.016 in.)
Limit:	1.2 mm (0.047 in.)
Ring Clearance in Grooves:	
Upper ring:	0.035 - 0.070 mm (0.014 - 0.028 in.)
Second ring:	0.030 - 0.064 mm (0.0012 - 0.0025 in.)
Oil ring:	0.030 - 0.062 mm (0.0012 - 0.024 in.)
Piston Ring Width:	
Upper ring:	2.0 mm (0.0787 in.)
Second ring:	2.0 mm (0.0787 in.)
Oil ring:	4.0 mm (0.1575 in.)
Piston Ring Thickness:	
Upper ring:	3.6 mm (0.1417 in.)
Second ring:	3.7 mm (0.1457 in.)
Oil ring:	3.1 mm (0.1220 in.)
Available oversize rings:	0.25 and 0.50 mm (0.010 and 0.020 in.)

PISTON PINS

Diameter:	22.0 mm – 0.016 mm (0.8662 – 0.0006 in.)
Length:	64.5 mm (2.5394 in.)
Clearance in piston:	0.014 mm (0.0006 in.)
Clearance in big end bush:	0.01 - 0.03 mm (0.0004 - 0.0012 in.)
Limit:	Piston must slide through bush with some pressure, but without noticeable play

CONNECTING RODS

Length, centre to centre:	144.0 mm (5.6694 in.)
Permissible twist or distortion:	0,02 mm (0.0008 in.) per 50 mm (0.2 in.) length
Thrust clearance to journal:	0.11 - 0.21 mm (0.0043 - 0.0083 in.)
Crankpin to bearing clearance:	0.027 - 0.077 mm (0.0011 - 0.003 in.)
Connecting Rod Small End:	
Bush inner diameter:	22.0 mm (0.8662 in.)
Bush outer diameter:	25.0 mm (0.9843 in.) +0.056 mm (+0.0022 in.)
Bore in connecting rod:	25.0 mm (0.9843 in.) −0.021 mm (0.0008 in.)
Available undersize big end bearing shells:	0.25, 0.50 and 0.75 mm (0.01, 0.02 and 0.03 in.)

1.4.3.1. Servicing

Fig. 1.24. shows an exploded view of the piston and connecting rod assembly and this illustration should be referred to whenever necessary.

Examine all pistons and rings for wear and damage and replace as necessary. All necessary dimensions are given in the preceding technical data and the inspection checks must include the following:

Install each ring into the cylinder bore and inspect the piston ring gap with a feeler gauge (see Fig. 1.25.). If the

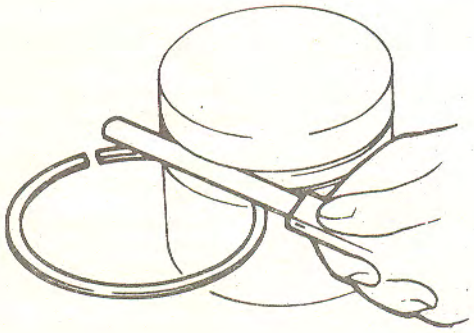


Fig. 1.23. — Measuring the ring to groove clearance.

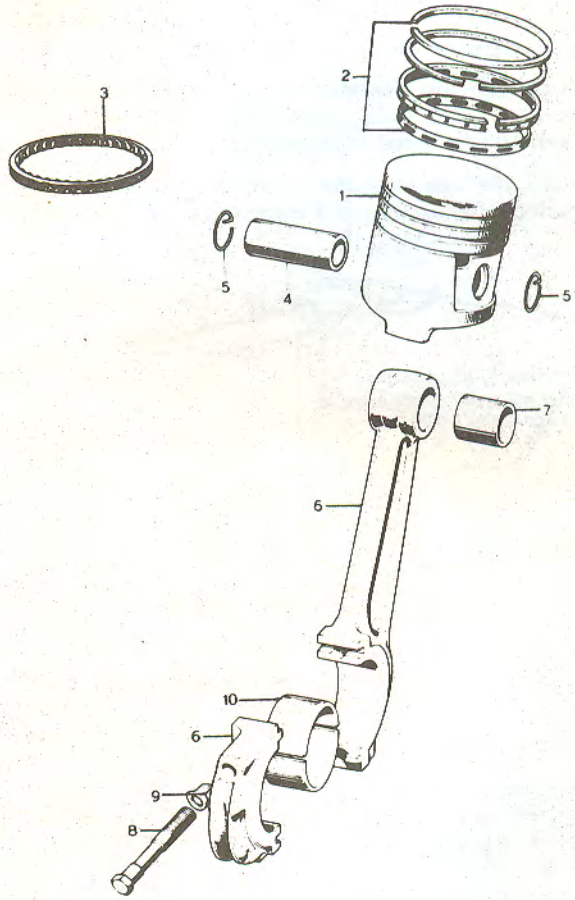


Fig. 1.24. — Exploded view of the piston and connecting rod.

1. Piston
2. Piston ring
3. Oil control ring
4. Piston pin
5. Piston pin circlip
6. Connecting rod
7. Small end bush
8. Connecting rod bolt
9. Lock plate
10. Big end bearing shell

cylinder bore is not to be re-finished then measure the ring gap with the ring at the lower part of the cylinder bore where the wear is at a minimum.

Check the side clearance of the rings in the grooves as shown in Fig. 1.23. Check the connecting rods for bends and twist and straighten if necessary.

Check the side clearance of the connecting rod big end bearings. Renew the rod if the specified limit is exceeded.

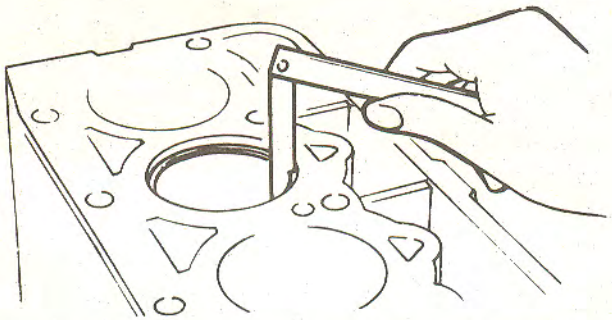


Fig. 1.25. — Measuring the piston ring gap with the ring inserted into the cylinder bore.

Replace the small end bushes if worn, pressing out the old bush with a suitable mandrel. Install the new bush under a press, making sure that the oil hole aligns with the connecting rod oil feed. Ream or preferably hone the pin bush to the specified clearance. The fit should be such that at a temperature of 20° C (68° F) the oiled pin can just be pushed in by applying heavy pressure with the thumb.

Connecting Rod Bearings: Check the condition of the bearings and the journals. Check the bearing clearance by placing a piece of "Plastigage" on the journal, covering the full width and laying it parallel to the crankshaft axis. Fit the cap and shell and tighten the cap bolts to the specified torque (see also Fig. 1.26.)

Remove the cap and check the width of the "Plastigage" with the scale provided (Fig. 1.27.). If the clearance exceeds that specified in Section 1.4.3.0. then the bearing or the journal must be examined for possible replacement or re-grinding. Note that the available under-

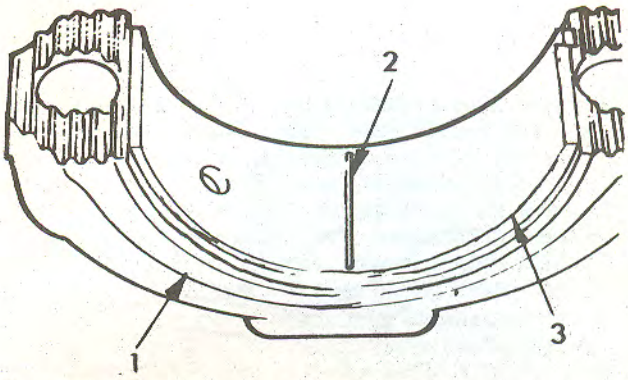


Fig. 1.26. — When checking the running clearance of the big end bearings, insert the "Plastigage" strip as shown into the bearing shell, fit the bearing cap to the crankshaft and tighten the bolts to the specified torque reading.

1. Bearing cap
2. Plastigage
3. Bearing shell

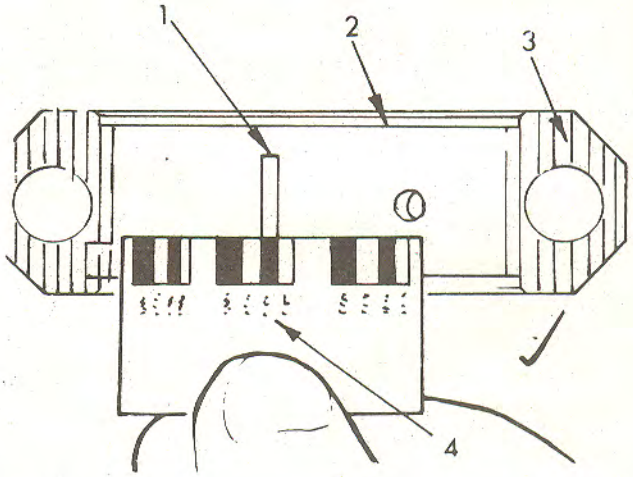


Fig. 1.27. — After the bearing cap has been removed, measure the width of the "Plastigage" strip by means of the scale provided in the repair kit.

1. Flattened Plastigage
2. Bearing shell
3. Bearing cap
4. Scale

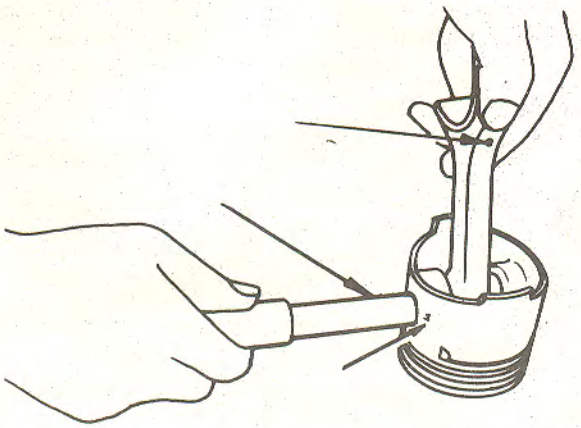


Fig. 1.28. — Installation of the piston pin with the special tool. Ensure that the "F" mark on the piston and the oil hole in the connecting rod are as shown.

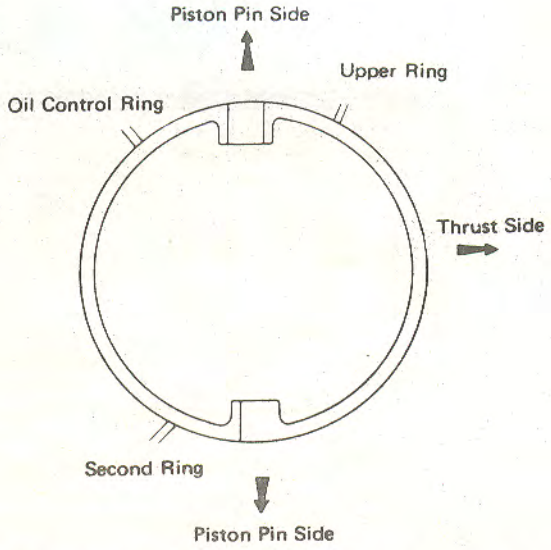


Fig. 1.29. — The arrangement of the piston ring end gaps on the piston in relation to the thrust side and the piston pin fitting direction.

size bearings are selected to suit the journal undersizes listed in the section on the crankshaft.

To assemble the piston and connecting rods, heat the piston to 50 - 60° C (122 - 140° F) and install the piston pin and snap rings. Refer to Fig. 1.28. and ensure that the piston mark "F" near the piston pin bore and the oil squirt hole in the connecting rod are arranged as shown. Use a ring expander to install the piston rings in their appropriate grooves. Always ensure that the letter "R" marked in the oil control ring and the second compression ring faces upwards after installation. Before inserting the pistons into the cylinder block, the ring gaps should be arranged as shown in Fig. 1.29. Face the letter "F" near the piston pin bore towards the front of the engine when assembling piston and connecting rod into the cylinder block.

1.4.4. CRANKSHAFT

1.4.4.0. Technical Data

Number of bearings:	5
Max. taper and out-of-round of main journals:	0.01 mm (0.0004 in.)
Crankshaft bend limit (max.):	0.03 mm (0.0012 in.)
Crankshaft end play:	0.08 - 0.24 mm (0.0031 - 0.009 in.)
End float limit:	0.3 mm (0.012 in.)
Main Journal Diameter:	
Marked "A":	63.0 mm $^{-0.052\ mm}_{-0.060\ mm}$ (2.4804 in. $^{-0.0020\ in.}_{-0.0024\ in.}$)
Marked "B":	63.0 mm $^{-0.045\ mm}_{-0.052\ mm}$ (2.4804 in. $^{-0.0018\ in.}_{-0.0020\ in.}$)
Wear limit of journals:	0.05 mm (0.0020 in.)
Main bearing running clearance:	
"A" journal, green shells:	0.032 - 0.059 mm (0.0013 - 0.0023 in.)
"B" journal, yellow shells:	0.035 - 0.061 mm (0.0014 - 0.0024 in.) (cylinder block bore marked with "A")
"A" journal, brown shells:	0.031 - 0.059 mm (0.0012 - 0.0023 in.)
"B" journal, green shells:	0.034 - 0.061 mm (0.0013 - 0.0024 in.) (cylinder block bore marked with "B")

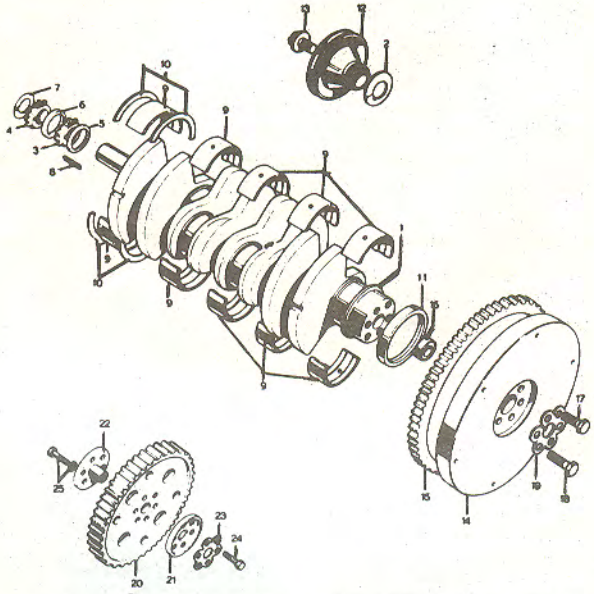


Fig. 1.30. – Exploded view of the crankshaft and its associated parts.

1. Crankshaft
2. Oil thrower washer
3. Crankshaft sprocket half
4. Crankshaft sprocket half
5. Spacer
6. Spacer
7. Spacer
8. Key
9. Bearing shell
10. Half thrust washers
11. Rear oil seal
12. Crankshaft pulley
13. Special bolt
14. Flywheel
15. Flywheel ring gear
16. Clutch shaft pilot bearing
17. Flywheel bolt
18. Flywheel bolts
19. Lock plate (no longer fitted)
20. Drive plate (automatic)
21. Backing plate
22. Adaptor plate
23. Lock washer
24. Bolt
25. Bolt

Available undersizes:	0.25, 0.50 and 0.75 mm (0.01, 0.02 and 0.03 in.)
Crankpin Journal Diameter:	53.0 mm $^{-0.045\ mm}_{-0.060\ mm}$ (2.0866 in. $^{-0.0018\ in.}_{-0.0024\ in.}$)
Wear limit:	0.05 mm (0.002 in.)
Crankpin bearing undersizes:	As for main bearings
Crankpin bearing running clearance:	0.027 - 0.077 mm (0.0011 - 0.0030 in.)
Wear limit:	0.10 mm (0.004 in.)

1.4.4.1. Servicing

A typical view of a crankshaft and bearings is shown in Fig. 1.30. When dismantling the crankshaft, mark the bearing shells and caps to be sure to re-assemble them in the same position.

All technical data for the crankshaft is given in the previous section and the parts must be inspected and renovated as necessary. Measure the thrust clearance at the rear bearing before dismantling the caps.

Check the crankshaft for bend at the centre bearing, placing the two end journals into "V" blocks. Note that the actual bend (see "Technical Data") is one half of that shown by the dial indicator reading. This means that the total indicator reading can show 0.06 mm (0.0024 in.) as a maximum in one complete revolution of the crankshaft.

Fit oversize thrust bearings as necessary. Note that the oil groove side of the thrust washer must face the crankshaft flange. Inspect the crankshaft oil seal diameters for scoring or wear.

The standard main bearings are graded into three classes according to the thickness and are painted with green, brown or yellow paint. The different gradings will achieve different bearing clearances. To check the bearing clearances, proceed as described for the connecting rod bearings in Section 1.4.3.1. Tighten the bearing caps to the correct torque.

To check the end float of the crankshaft, assemble the crankshaft together with the bearings into the crankcase, ensuring the correct fitting of the thrust washer halves.

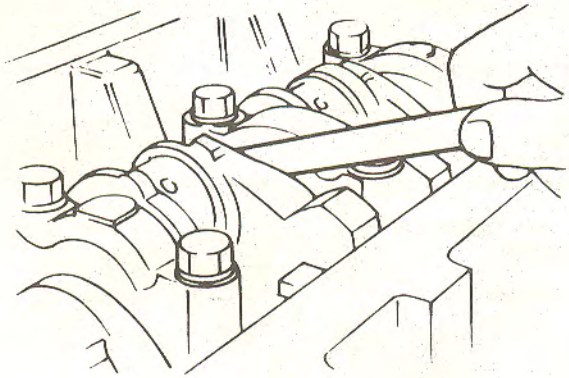


Fig. 1.31. — Checking the crankshaft end play.

Check the end float with a feeler gauge as shown in Fig. 1.31. The standard float is between 0.080 and 0.24 mm (0.0031 and 0.0095 in.). Correct the end float if it exceeds 0.3 mm (0.012 in.). Oversize thrust washers (0.05, 0.25, 0.50 and 0.75 mm/0.002, 0.01, 0.02 and 0.03 in.) are available to correct the end float.

IMPORTANT! When checking the end float of the crankshaft, use a lever to make sure that the end float is fully taken up in each direction.

1.4.4.2. Flywheel and Oil Seals — Servicing

Inspect the flywheel friction face for wear or damage. The flywheel run-out should be checked with the assembled flywheel and crankshaft mounted between centres. Use a dial indicator mounted to the outer edge of the flange. The run-out limit is 0.2 mm (0.008 in.); replace the flywheel if necessary.

Inspect the front and rear crankshaft oil seals and replace if necessary. It is always a good practice to replace the oil seals when the engine has been overhauled. The new rear crankshaft seal should be fitted over the end of the crankshaft before the rear main bearing is placed into position.

Rear Main Bearing Side Seals: After the rear main bearing cap has been fitted and tightened to the specified torque, insert the side seals into the square opening on either side of the bearing cap. The seals should be fitted so that the larger width of the lip faces towards the side of the engine. This is achieved by tapping in the seals so that the holes in one side of the seals are facing either to the front or rear of the engine (See Fig. 1.32.)

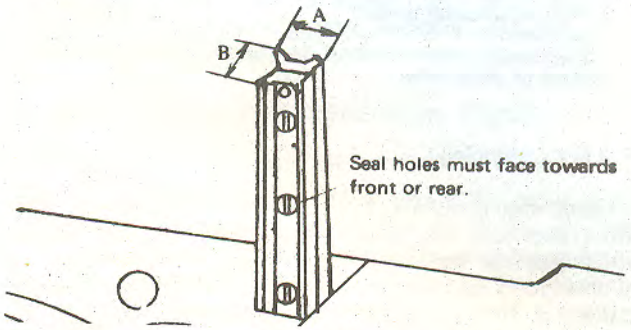


Fig. 1.32. — Diagram showing the correct installation of the main bearing cap side seals.

1.4.5. CAMSHAFT AND TIMING DRIVE

1.4.5.0. Technical Data

Bend limit of shaft:	0.03 mm (0.0012 in.)
End float of camshaft:	0.02 - 0.18 mm (0.0008 - 0.0071 in.)
Wear limit:	0.20 mm (0.008 in.)
Cam Lobe Height:	
Inlet:	45.037 mm (1.7731 in.)
Exhaust:	45.004 mm (1.7718 in.)
Camshaft Bearing Clearance:	
Front and rear:	0.019 - 0.069 mm (0.0007 - 0.0027 in.)
Centre:	0.029 - 0.079 mm (0.0011 - 0.0031 in.)
Camshaft Journal Diameters:	
Front and rear:	45.0 — 0.055 mm (1.772 — 0.0022 in.)
Centre:	45.0 —0.065 mm (1.772 —0.0026 in.)
Wear limit:	0.05 mm (0.002 in.)
Undersize bearings:	0.25, 0.50 and 0.75 mm (0.01, 0.02 and 0.03 in.)

Valve Timing:	
Inlet valve opens:	10° B.T.D.C.
Inlet valve closes:	57° A.B.D.C.
Exhaust valve opens:	54° B.B.D.C.
Exhaust valve closes:	13° A.T.D.C.
Valve lift:	10.0 mm (0.3937 in.)
Camshaft Drive:	
Number of sprocket teeth:	
Camshaft:	38
Crankshaft:	19
Number of chain links:	100

1.4.5.1. Servicing

Inspect the camshaft for run-out, journal wear, end float and cam lobe wear. Also inspect the distributor drive gear for wear or tooth damage. The camshaft is supported in split bearing shells, inserted into the rocker pedestals. All bearing shells in the bearing caps have an oil drilling. Only the bearing shell of the widest bearing in the cylinder head is provided with an oil drilling. The other two shells are plain.

To check the camshaft for bend (run-out), clamp it between the centres of a lathe and check on the centre journal if the run-out exceeds more than 0.03 mm (0.0012 in.). If necessary straighten the shaft under a press. When checking the cam lobe heights (micrometer), note that a wear limit of 0.2 mm (0.008 in.) is permissible.

To check the end float of the camshaft, insert a feeler gauge between the camshaft sprocket and the thrust plate. It is necessary to fit the camshaft in position to carry out this check. A wear limit of 0.2 mm (0.008 in.) must be observed. Replace the thrust plate to correct the end float. Next check the journal diameters of the shaft, noting that the front and rear journals are of the same diameter, the centre journal being slightly larger.

After measuring the camshaft journals and the bearing diameters, it is necessary to measure the running clearance of the camshaft journals in the bearing shells. This can be carried out in the same manner as it has been described in Section 1.4.3.1. for the big end bearings, i.e. using "Plastigage" wire. The bearing cap bolts should be tightened to 8.0 kgm (58 lb.ft.) to flatten the "Plastigage" wire. The prescribed running clearances are given in Section 1.4.5.0.

Inspect the chains and sprockets for wear and damage. Also inspect the chain tensioner body and replace if worn. Replace the vibration dampers and the chain guide (if fitted) if they are unduly worn or badly scored.

1.4.6. CYLINDER COMPRESSION TEST

To carry out compression tests, proceed as follows:

Warm up the engine and then remove the spark plugs. Make sure the battery is fully charged. Fully open the throttle valve and choke valve. Fit a pressure gauge in turn to each of the cylinders and turn over the engine on the starter. The specified compression pressures are as follows:

Normal:	12.0 kg/sq.cm. (170.6 psi.)
Wear limit:	Less than 75% of the highest reading

NOTE: When checking the compression pressures, take the highest compression reading and compare to the lowest reading. The lowest reading must be within 75 % of the highest reading.

1.5. Engine – Tightening Torques

Main bearing caps:	8.4 - 9.0 kgm (43 - 47 lb.ft.)
Connecting rod caps:	5.0 - 5.5 kgm (36 - 40 lb.ft.)
Oil pump sprocket:	3.0 - 3.5 kgm (22 - 25 lb.ft.)
Cylinder head:	
Cold engine:	8.2 - 8.8 kgm (60 - 64 lb.ft.)
Warm engine:	9.5 - 10.0 kgm (69 - 72 lb.ft.)
Camshaft sprocket:	7.0 - 8.0 kgm (51 - 58 lb.ft.)
Crankshaft pulley:	14 - 15 kgm (101 - 108 lb.ft.)
Inlet manifold:	1.9 - 2.8 kgm (14 - 20 lb.ft.)
Exhaust manifold:	1.6 - 2.3 kgm (12 - 17 lb.ft.)
Oil pressure switch:	1.2 - 1.8 kgm (9 - 13 lb.ft.)
Flywheel:	15.5 - 16.3 kgm (112 - 118 lb.ft.)
Clutch cover:	1.8 - 2.7 kgm (13 - 20 lb.ft.)
Oil pump:	1.0 kgm (7.2 lb.ft.)
Water pump:	2.2 kgm (16 lb.ft.)

Thermostat cover:	0.9 kgm (7.0 lb.ft.)
Cylinder head cover:	0.15 - 0.20 kgm (1.1 - 1.4 lb.ft)
Cooling fan:	0.9 kgm (7.0 lb.ft.)
Distributor:	0.9 kgm (7.0 lb.ft.)
Camshaft bearing caps:	8.0 kgm (58 lb.ft.)

1.6. Ignition System

1.6.0. DISTRIBUTOR

1.6.0.0. General Notes

The distributor consists of a contact breaker mechanism, centrifugal advance mechanism, vacuum advance mechanism and a condensor. The distributor is shown in Fig. 1.34. as exploded view and all operations described in this section will be easier understodd, if this drawing is referred to.

1.6.0.1. Technical Data

Drive:	Gear on camshaft
Point gap:	0.5 mm ± 0.05 mm (0.02 ± 0.002 in.)
Dwell angle:	49° to 52°
Capacitor (condensor):	20 to 24 mfd
Centrifugal Advance Angles:	
Starts at:	0° at 550 rpm
Maximum:	12.5° at 2150 rpm
Vacuum Advance Angles:	
Starts:	0° at 220 mm Hg
Maximum:	8.5° at 420 rpm
Firing order:	1 – 3 – 4 – 2
Ignition timing:	8° B.T.D.C.
Timing mark location:	Crankshaft pulley

1.6.0.2. Removal and Installation

Disconnect the spark plug leads and take off the primary lead from the side of the distributor. Disconnect the high tension lead from the ignition coil and take off the vacuum advance pipe from the vacuum unit.

Remove the nut securing the distributor to the cylinder head and withdraw the distributor. If the engine is not to be dismantled or rotated, the distributor can be replaced in the correct position in the following manner:

Rotate the crankshaft in the direction of rotation until the No. 1 cylinder is set to 8° B.T.D.C. on the compression stroke. This is indicated when the first mark on the edge of the crankshaft pulley is in line with the needle on the timing chain cover. The rotor must be in position to fire the No. 1 cylinder. Lift out the distributor carefully and note that the rotor will rotate slightly as the distributor drive gear is disengaged from the drive gear on the camshaft. When refitting the

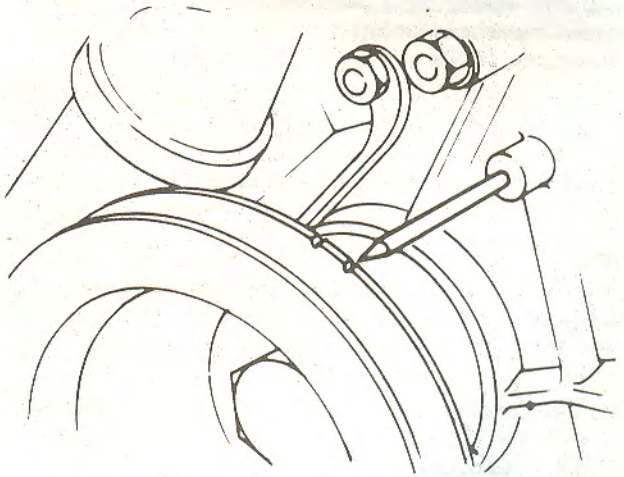


Fig. 1.33. – The pointer on the timing cover and the two notches in the crankshaft pulley.

distributor, first turn the distributor shaft so that the two identification marks at the bottom of the distributor drive gear are in line as shown in Fig. 1.35. and then install the distributor. The spiral teeth will then turn the rotor as they mesh and the final position of the rotor arm should be in line with the marks as when removed.

To install the distributor after a major engine service, proceed as follows:

Position the No. 1 piston (the front one) at 8° on the compression stroke (B.T.D.C.). The first mark on the outer edge of the crankshaft pulley should then be aligned to the tip of the needle on the timing cover. To double-check, move the rocker levers of the first cylinder which both should show a slight play. Now align the identification marks on the distributor drive gear as shown in Fig. 1.35. and insert the distributor into the cylinder head. Turn the distributor until the fibre heel on the contact breaker is on the top of the cam and tighten the clamp nut in this position.

1.6.0.3. Ignition Timing

The preferred method of setting the ignition timing is by the use of a timing light when the engine is running. Set up the timing light according to the manufacturer's instructions and point it at the timing marks on the casing and pulley.

Adjust the distributor body to set the timing to the value appropriate to the engine. Start the engine and set to idle at 600 rpm. Using a timing light, observe the position of the timing mark on the crankshaft pulley. The mark on the edge of the crankshaft pulley should be in line with the tip of the needle on the timing cover. If this is not the case, slacken the distributor locknut and rotate the distributor housing until the timing marks are aligned as described above. Tighten the distributor locknut in this position. Re-check the timing.

1.6.0.4. Checking the Dwell Angle

The dwell angle is the angle of the distributor cam through which the contact points remain closed. To check the dwell angle, a dwell angle tester is necessary and should be connected in accordance with the manufacturer's instructions. The dwell angle for the two engine types are given in Section 1.6.0.1. If the obtained reading is outside the specifications given, first correct the breaker point gap. Reduce the point gap to increase the dwell angle or increase the point gap to reduce the dwell angle. If no satisfactory results can be obtained, check for worn distributor cam, fibre heel or distorted contact arm.

1.6.0.5. Distributor – Servicing

A distributor is shown in Fig. 1.34. When dismantling the distributor proceed as follows:

Remove the distributor cap and the rotor. Slacken the primary terminal screw and disconnect the condenser lead and primary lead. Remove the condenser. Remove the screws securing the cam assembly and contact breaker assembly to the breaker base plate and withdraw the parts. Unscrew the screws attaching the vacuum control unit to the distributor housing, take the clip securing the unit link to the contact breaker base plate, disconnect the link and remove the control unit. Remove the earth wire and the breaker base plate from the distributor. Remove the cam attaching screw from the inside of the cam and withdraw the cam. Using a suitable drift, drive out the lock pin for the distributor drive gear and withdraw the gear and the three washers. Remove the distributor shaft towards the top of the distributor housing. If further dismantling is necessary undo the clips securing the flyweights, disconnect the springs and remove the flyweight assembly.

Thoroughly clean all parts and inspect as outlined below.

CAUTION! Do not use any solvent on the vacuum unit or the capacitor.

Distributor Cap: Inspect the cap for cracks, tracking or other damage. Faulty caps must always be replaced. Clean corroded high tension terminals.

Distributor Rotor: Inspect the rotor for cracks or excessive burning at the end of the metal strip. Faulty rotors should be replaced.

Contact Points: Inspect the points for wear, burning or pitting. Slight damage can be cleaned off with an oil-stone. Replace points if necessary.

Contact Arm Spring: Hook a spring scale onto the contact arm as shown in Fig. 1.36. and pull on the spring scale in the direction shown in the illustration. Compare the reading with the values given in Section 1.6.0.1. If the reading is less than 0.5 kg (1.1 lb.), replace the contact arm.

Flyweight Mechanism: Check the flyweight mechanism for freedom of movement. Make sure that the maximum

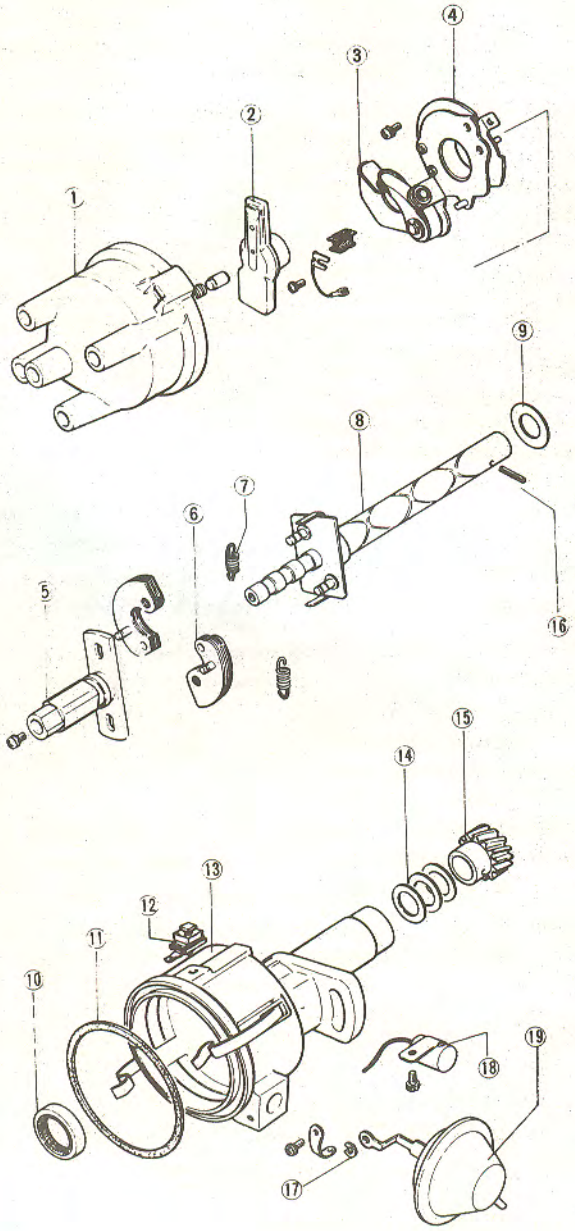


Fig. 1.34. – Exploded view of the ignition distributor.

1. Distributor cap
2. Distributor rotor
3. Contact breaker points
4. Breaker plate
5. Distributor cam
6. Flyweight
7. Flyweight spring
8. Distributor shaft
9. Washer
10. Oil seal
11. Gasket
12. Terminal block
13. Distributor housing
14. Washer
15. Drive gear
16. Lock pin
17. Clip
18. Condensor
19. Vacuum advance unit

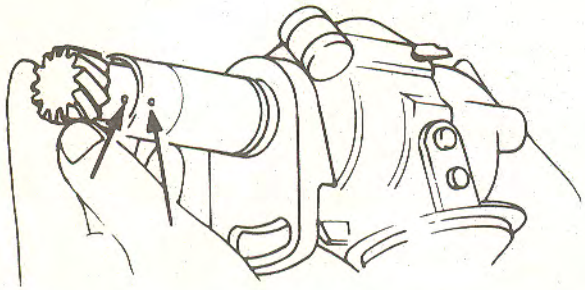


Fig. 1.35. — Before installation of the distributor, align the marks on the distributor body and the driven gear as shown.

clearance of 0.2 mm (0.008 in.) exists between the fly-weight and the pin.

Distributor Shaft: Check the shaft for wear and proper fit in the distributor housing. The run-out of the shaft should not exceed 0.05 mm (0.002 in.). Assemble the

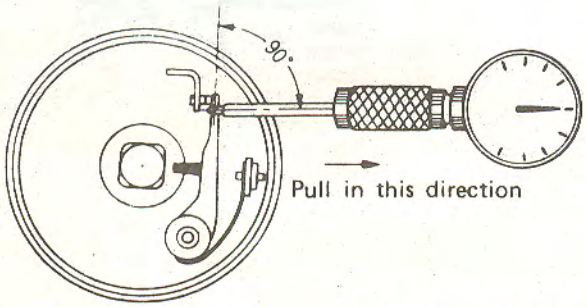


Fig. 1.36. — Checking the tension of the contact breaker arm spring.

distributor shaft, washers and drive gear with the retaining pin to the distributor body and check the end float of the shaft, using a dial gauge or a feeler gauge. The clearance should be between 0.15 - 0.5 mm (0.006 - 0.02 in.). If the clearance exceeds the upper limit, correct by inserting new adjusting washers (shown by (9) in Fig. 1.34.).

Assemble the distributor as follows:

Insert the oil seal into the inside of the distributor housing. Lubricate the shaft with oil and insert into the distributor housing. Fit the three washers onto the end of the shaft and attach the drive gear and the retaining pin to the bottom shaft end and rivet the pin ends to the gear collar.

Assemble the flyweight mechanism to the plate, making sure that the flyweight springs are properly located. Refit the hair pin spring and the lock clips. Lubricate all moving parts with engine oil and check for freedom of movement.

Fit the contact breaker plate into the distributor housing and secure with the retaining screws. Refit the contact breakers and the vacuum unit in reverse order to the dismantling procedure. Fit the distributor cam to the end of the distributor shaft with the single screw, plain washer and spring washer.

Install the terminal bolt and the insulators and tighten the nut with the condenser lead underneath it.

1.6.0.6. Point Gap Setting

The point gap setting is given in Section 1.6.0.1. when the point gap is at the widest opening, that is, when the breaker arm heel rides on the highest point of the cam. The point gap can be checked with a feeler gauge, setting the gap by slightly loosening the two setscrews and turning the adjusting screw until the feeler gauge just slides in. A more accurate method of setting the points is to use a dwell angle measuring instrument which measures the angle of rotation during which the points remain closed as described in Section 1.6.0.4.

The point gap setting and, of course, the dwell angle can only be accurately set if the points themselves are in good condition. Any build-up on one of the points should be removed with a fine-grade oilstone, making sure that the dressing does not alter the flatness of the surface. Do not attempt to remove cratering from the points since this will reduce the points to an unacceptable thickness — replace the points if badly worn. Note also that excessive build-up on the points after a short period of service may be the result of a faulty capacitor which should be replaced. Clean the points with a little

solvent and make sure no grease or oil remains on the surfaces.

1.6.0.7. Contact Points – Replacing

Take off the distributor cap and the rotor. Unscrew the two setscrews securing the fixed contact breaker to the contact breaker base plate, slacken the terminal screw at the side of the distributor and withdraw the fixed contact breaker together with the contact breaker arm. Refit the new contact breakers in reverse order and adjust the contact breaker gap as described above.

NOTE: The distributor should be removed for this operation. Read Section 1.6.0.2. to remove the distributor without disturbing the fitting position of the distributor. Re-time the ignition after adjusting the contact breaker gap or replacing the contact breaker points.

1.6.1. IGNITION COIL

The ignition coil cap and terminals should be kept clean and the terminals and leads inspected occasionally for good electrical conductivity. Apart from these minor points the coil cannot be serviced and must be replaced if faulty. The substitution of a known good coil is usually the easiest way of checking the operation of the original unit.

1.6.2. SPARK PLUGS

Standard plug types:	NGK BP-6ES or Denso W-20EP
Cold type:	NGK BP-7ES or Denso W-22EP
Plug gap:	0.8 mm (0.031 in.)
Tightening torque:	1.5 - 2.1 kgm (11 - 15 lb.ft.)

1.7. Lubrication System

1.7.0. TECHNICAL DATA

Oil sump capacity:	3.6 litres (7.6 U.S. pints; 6.4 Imp. pints)

Oil Pump:	
Driven by:	Chain from crankshaft
Number of chain links:	46
Number of sprocket teeth:	33
Type:	Trochoid rotor
Delivery capacity:	13.0 litres/min. (3.4 U.S. gall./min.; 2.9 Imp. gall./min. at 2000 engine rpm.
Oil Pump Clearances:	
Outer rotor to body:	0.14 - 0.25 mm (0.006 - 0.010 in.)
Wear limit:	0.30 mm (0.012 in.)
Rotor tip clearance:	0.15 mm (0.006 in.) max.
Rotor end float:	0.04 - 0.10 mm (0.0016 - 0.004 in.)
Wear limit:	0.15 mm (0.006 in.)
Oil Pressure:	
At 3000 rpm:	3.5 - 4.5 kg/sq.cm. (50 - 64 psi.)
At idle speed:	0.3 kg/sq.cm. (4.3 psi.)
Oil Filter:	
Type:	Full-flow
Relief valve opens:	0.8 - 1.2 kg/sq.cm. (11.4 - 17.1 psi.)

1.7.1. OIL PUMP – REMOVAL

The oil pump is of the trochoid design, i.e. two eccentric rotors rotate within each other to develop the pressure. Fig. 1.37. shows an exploded view of the oil pump together with its drive and the oil strainer.

To remove the pump, lift the engine from the car and remove the timing cover together with the timing mechanism at the front of the engine to gain access to the pump drive chain. Undo the locknut and washer for the oil pump sprocket. Pull off the pump sprocket and crankshaft sprocket together with the drive chain. Remove the nuts securing the suction pipe to the oil pump and take off the oil strainer with the "O" sealing ring. Remove the bolts securing the pump to the cylinder block, taking care not to lose any of the adjusting shims for the drive chain tension when lifting off the pump.

1.7.2. OIL PUMP – SERVICING

Dismantle the pump by referring to the illustration.

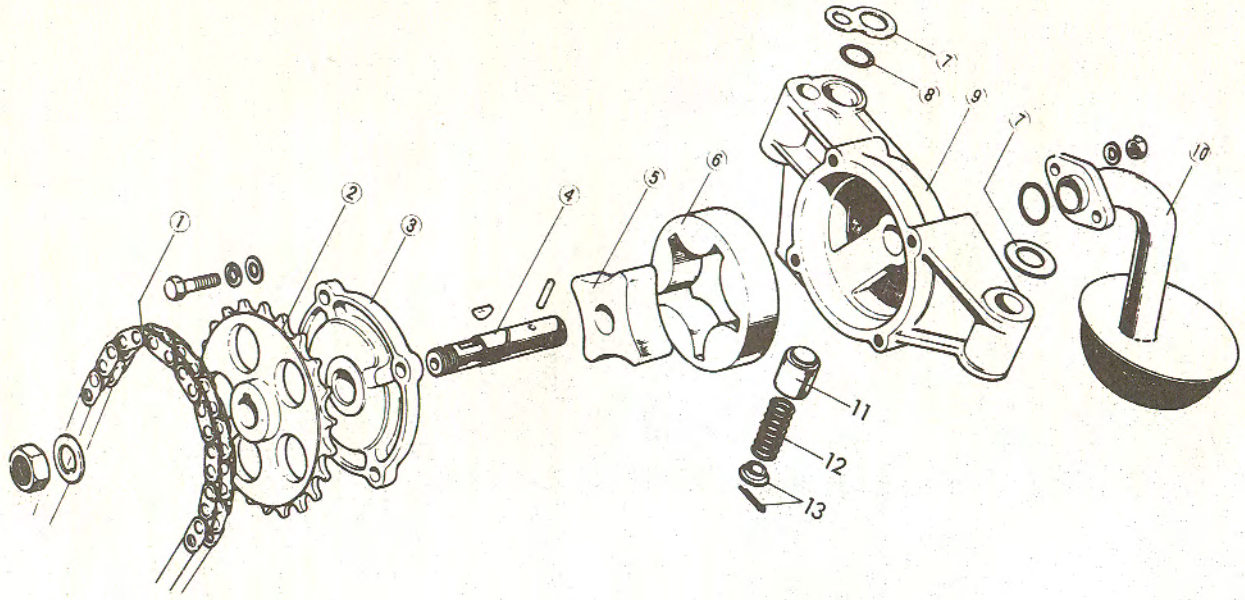


Fig. 1.37. — Exploded view of the oil pump together with the drive sprocket and chain.

1. Oil pump drive chain
2. Oil pump sprocket
3. Pump cover
4. Pump shaft
5. Inner pump rotor
6. Outer pump rotor
7. Adjusting shims
8. "O" sealing ring
9. Pump body
10. Oil strainer
11. Relief valve plunger
12. Relief valve spring
13. Plug and split pin

Unscrew the pump cover and lift out the rotors. Before removing the rotors, note that there are matching marks on the faces. If this is not the case and the rotors are to be re-used, punch in marks so that they can be re-assembled in the same position.

Thoroughly clean all parts in a suitable solvent, replacing any parts that are worn or damaged. Carry out a complate inspection of the rotors as detailed below. Note that rotors must only be replaced as a matched pair.

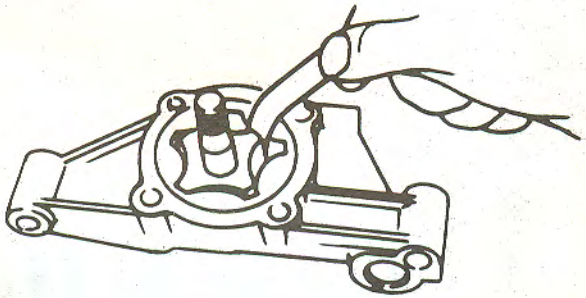


Fig. 1.38. — Checking the tip clearance between the two rotors. Turn the rotors in the position shown before inserting the gauge.

Check the tip clearance as shown in Fig. 1.38. If the clearance exceeds the value given in Section 1.7.0., then the rotors should be replaced as a set.

Check the clearance between the rotors and the face of the pump body with a feeler gauge and a straight edge. The maximum allowed is 0.15 mm (0.006 in.).

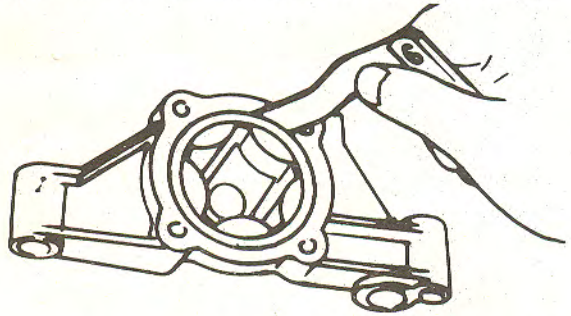


Fig. 1.39. — Checking the clearance between the outer rotor and the pump housing bore with a feeler gauge.

Check the clearance between the outside diameter of the driven rotor and the pump body bore. Use a narrow feeler gauge strip inserted between the rotor and the pump body bore as shown in Fig. 1.39. If the clearance exceeds 0.3 mm (0.012 in.) the rotor set or in extreme cases the oil pump will need replacement. The standard reference values are given in Section 1.7.0.

Inspect all parts of the relief valve for wear. The relief valve is held in the pump body by a split pin. Replace the spring if weak or distorted. Make sure the oil passage is not clogged and that the seating is in good condition.

When assembling the pump, note that the centre punch marks on the rotors must be facing towards the oil pump cover (the marks will be visible to the operator before the cover is fitted to the body). The two sprockets must be fitted together with the drive chain at the same time with the keyways on the two shafts aligned with the keys.

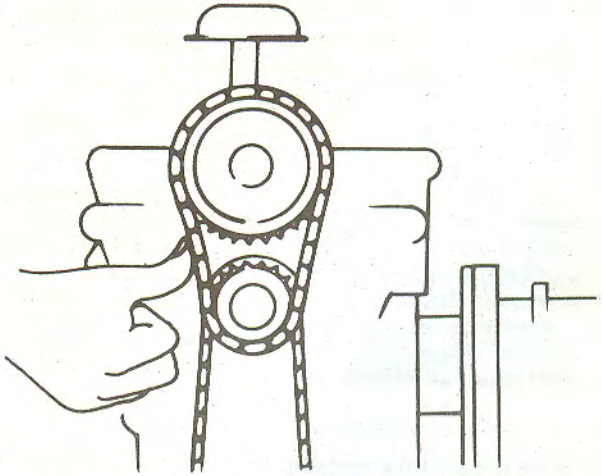


Fig. 1.40. — Checking the tension of the oil pump drive chain with thumb pressure. The deflection must not exceed 4.0 mm (0.16 in.) — See text for adjustment.

Check that the shims are inserted between oil pump body and cylinder block face. Tighten the pump sprocket nut to a tightening torque of 3.5 kgm (25 lb.ft.) and secure by bending over the lockplate.

Check the drive chain tension as shown in Fig. 1.40. If the deflection of the chain exceeds 4.0 mm (0.16 in.) remove the oil pump and fit additional shims between pump and cylinder block. Secure the pump sprocket lock plate after completed installation.

When fitting the oil thrower to the end of the crankshaft, observe that the edge of the thrower is turned outwards. Lubricate the sprockets and the chain with oil.

When assembly is complete, make sure that the pump rotates freely without tight spots. The pump can additionally be tested by immersing the intake pipe into a container of engine oil. Turn the pump shaft with a screwdriver until the oil flows from the outlet port. Block the outlet port with a thumb and again rotate the shaft in a continuous motion. A pump in good condition will build up a substantial pressure against the finger.

Install the oil pump in the reverse sequence to removal, noting the points regarding the timing chain tensioner in the section on assembly of the engine.

1.7.3. OIL FILTER

The oil filter should be changed at the recommended intervals. The oil filter is provided with a relief valve. If the oil filter is clogged due to impurities in the oil and the filtering resistance reaches a certain value, the oil cannot pass through the element, will however, open the relief valve so that unfiltered oil can reach the engine. The filter element should be replaced every 12.000 km (8.000 miles) as follows:

Remove the oil filter cartridge with special tool 49 0223 195. If this tool is not available, then make up a simple band-type wrench but on no account grip the casing with any other type of wrench. When installing a new filter cartridge apply oil onto the rubber gasket and screw in the cartridge until it just touches the seating. From this position turn the cartridge a further 2/3 of a turn, using the hand only. Start the engine and check the oil filter joint for leaks. Finally check the engine oil level.

1.7.4. CHECKING THE OIL PRESSURE

Remove the oil pressure switch and connect a suitable pressure gauge in its place. Warm up the engine until it has reached its normal operating temperature. Run the engine at 3.000 rpm and read off the gauge. An indication of 3.5 - 4.5 kg/sq.cm (50 - 64 psi.) should be obtained. If not, check the following:

A. Ensure that the oil level is between the "F" and "L" mark on the dipstick.
B. Check the oil filter for clogging. If necessary replace the cartridge.
C. Remove the oil pump and check the oil pump clearances as described in Section 1.7.1.
D. Check the oil pressure relief valve and measure the free length of the spring. The specified value is 46.4 mm (1.83 in.).

1.8. Cooling System

All vehicles covered in this Repair Guide employ a thermo-syphon system with impeller-assisted circulation. A sealed filler cap, an expansion chamber with pressure cap, centrifugal water pump, wax pellet type thermostat.

1.8.0. TECHNICAL DATA

Type of system:	Thermo-syphon, impeller-assisted, belt-driven or visco coupling fan, depending on version.
Radiator type:	Corrugated fin
Radiator cap pressure rating:	0.9 kg/sq.cm (13 psi)
Pressure relief valve:	In expansion chamber. Press button to release pressure in cooling system.
Thermostat:	
Type:	Wax pellet
Starts to open:	82 ± 1.5^{o} C (180 ± 2.7^{o}F) 88^{o}C/190^{o}F — cold countries
Fully open at:	95^{o} C (203^{o} F) 100^{o} C/212^{o} F - cold countries
Opening travel:	8 mm (0.315 in.) or more

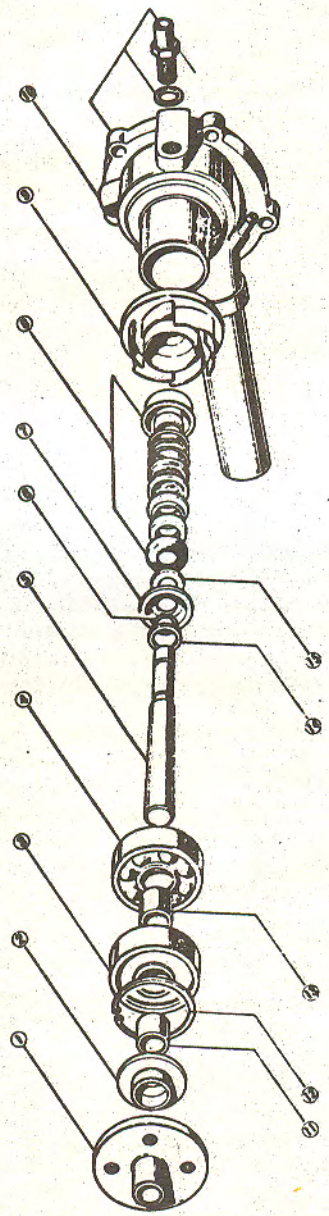


Fig. 1.41. – Exploded view of the water pump.

1. Pulley hub
2. Dust seal plate
3. Water pump bearing
4. Water pump bearing
5. Water pump shaft
6. Stop ring
7. Dust seal plate
8. Seal assembly
9. Impeller
10. Pump body
11. Spacer
12. Snap ring
13. Spacer
14. Washer
15. Baffle plate

Water Pump:	
Type:	Centrifugal impeller
Driven by:	V-belt
Ratio of crankshaft and pump:	1.1 : 1
Coolant Capacity:	
Without heater:	6.5 litres (1.7 U.S. gall.; 1.4 Imp. gall.)
With heater:	7.0 litres (1.9 U.S. gall.; 1.5 Imp. gall.)

1.8.1. WATER PUMP – SERVICING

The water pump is shown in an exploded view in Fig. 41. No special instructions are required for removal and installation since this will be quite clear from an examination of the engine.

When installing the water pump, it is recommended that a new gasket is used. Adjust the fan belt tension as described in Section "Electrical Equipment". Check the cooling system for leaks after the engine has reached its operating temperature. The water pump can be dismantled for servicing but it is recommended that the tools listed are used or alternative equipment is made up. Do not remove the sealed bearing from the housing unless it requires replacement.

Remove the fan pulley and then draw off the pulley flange with tool 49 0187 270B. If this tool is not available, use a two-arm puller that can be inserted below the flange with the centre spindle pressing against the pump shaft. From the other side of the pump remove the impeller in a similar manner. Slide the dust seal plate off the shaft and remove the snap ring now visible.

Support the pump body and press against the rear end of the shaft to remove the shaft, spacer and bearing assembly through the front of the pump body. The bearings can be removed from the shaft with a suitable puller.

Inspect all parts for wear or damage and replace as necessary. When assembling the pump, refer to Fig. 1.41. First insert the stopper ring (6) into the groove of the shaft and slide the dust seal plate (7) onto the shaft. Drive the baffle plate (15) onto the shaft taper. Now insert the shaft (5) into the pump body and press in the bearing (4) so that the sealed side faces towards the rear. Now fit the washer (14) and place the spacer sleeve (13) over the bearing. Fill the cavity with grease. Slide the bearing (3) over the shaft, with the sealed side facing towards the front and press onto the shaft until the circlip (12) can be fitted. Place the dust seal plate (2) over the bearing and press on the pulley flange (1) until it is flush with the front end of the shaft. Onto the other end of the shaft fit the seal assembly (8) and press on the impeller (9) until it is flush with the end of the shaft.

1.8.2. THERMOSTAT

The thermostat specification is given in Section 1.8.0. and the valve opening temperature can be used for a simple test. The thermostat is located in the cylinder head. To remove it, partially drain the cooling system, remove the water hose between radiator and thermostat cover and the hose between water pump and thermostat housing.

Disconnect the water temperature gauge sender unit wire and undo the nuts securing the thermostat cover and the bolts. Push the engine hanger bracket to one side and lift off the cover and the gasket. Take out the thermostat.

To test the thermostat, immerse the unit in water at about 78° C (140° F). The valve should be closed before immersion. Now gradually raise the temperature of the water and check that the valve opens at the temperature stated and is fully open at the specific value. The valve must have a travel of 8 mm (0.315 in.). Replace the unit if it fails these tests. When refitting the thermostat, use a new gasket.

NOTE: Observe that thermostats with higher opening values are used in countries with cold climates.

1.8.3. EXPANSION CHAMBER

Some expansion chambers are fitted with a cap with a release button in the centre. To drain the coolant on this type of installation, press in the button until all pressure in the system is released. Then remove the

radiator cap. On vehicles without release button in the expansion chamber cap, the radiator cap is provided with a stop. To release the pressure on this arrangement, turn the radiator cap to the stop and wait until all pressure is released. Then remove the radiator cap.

1.8.4. COOLANT

Check the coolant level at regular intervals. A properly filled cooling system should have the radiator filled and the expansion chamber filled to about one third. Do not overfill.

1.9. Fuel System

1.9.0. CARBURETTOR

1.9.0.0. Technical Data

Type:	Downdraft, two-barrel
Throat Diameter:	
Primary:	28 mm
Secondary:	32 mm
Choke Tube Diameter:	
Primary:	23 x 15 x 8 mm
Secondary:	28 x 14 x 7 mm
Main Jets:	
Primary:	1.06 mm
Secondary:	1.45 mm
Main Air Bleeds:	
Primary:	0.5 mm
Secondary:	0.5 mm
Main Nozzle Diameters:	
Primary:	2.1 mm
Secondary:	2.5 mm
Slow-running Jets:	
Primary:	0.46 mm
Secondary:	0.80 mm
Slow-running Air Bleeds:	
Primary:	No. 1 – 140
Secondary:	No. 2 – 180
Power jet:	0.55 mm
Pump jet diameter:	0.5 mm

Float level:	See Section 1.9.0.4.
Slow-running speed:	700 ± 50 rpm
Fast Idle Adjustment: (clearance between primary throttle valve and bore when choke valve is fully closed):	1.29 mm (0.051 in.)

1.9.0.2. Removal and Installation

Remove the air cleaner. Disconnect the control cables for throttle valves and choke. Disconnect the fuel pipe between carburettor and fuel pump and the other pipe (fuel return hose) between carburettor and fuel tank.

Withdraw the vacuum pipe from the carburettor end and disconnect the wire from the idling fuel cut-off valve. Remove the nuts securing the carburettor to the inlet manifold, lift off the washers and take off the carburettor, together with the gaskets and the intermediate flange.

CAUTION! Take care that no foreign matter enters the manifold opening when the carburettor is removed.

Install the carburettor in the reverse sequence to removal. Place one gasket on each side of the intermediate flange. Do not use sealing compound. After installation of the carburettor carry out the adjustments listed in Section 1.9.0.4.

1.9.0.3. Servicing

When servicing or dismantling the carburettor, keep all parts strictly in order of removal and have available a clean bench or table to arrange the components in order. Wash all parts in clean fuel and dry off with compressed air or a lint-free cloth.

Use new gaskets throughout and always obtain genuine manufacturer's spares or service kits. Never clean the jets or nozzles with wire, pins or any other metal objects. Replace all parts that are worn or damaged. For the servicing of the carburettor refer to Fig. 1.42. for a sectional view. The position of the various parts will be seen in this drawing.

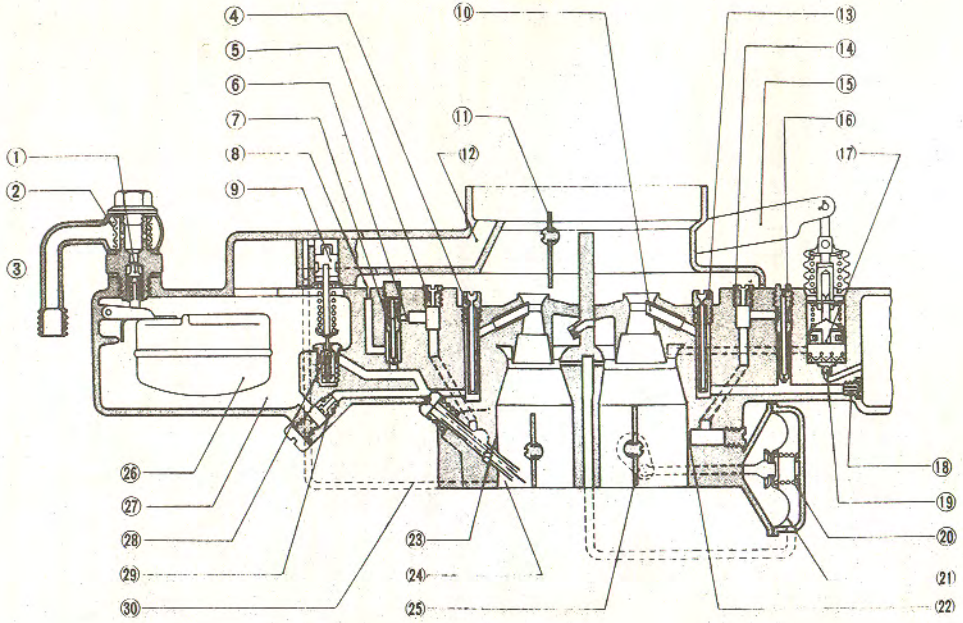


Fig. 1.42. – Sectional view of the carburettor.

1. Fuel inlet connection
2. Fuel strainer
3. Needle valve assembly
4. Primary main air bleed
5. Primary No. 2 main bleed
6. Slow-running economiser
7. Primary slow-running jet
8. Primary No. 1 air bleed
9. Vacuum piston
10. Secondary main nozzle
11. Choke valve
12. Air vent
13. Secondary main air bleed
14. Secondary slow-running air bleed
15. Accelerator pump lever
16. Secondary slow-running air bleed
17. Accelerator pump piston
18. Secondary main jet
19. Pump inlet check ball
20. Spring
21. Diaphragm
22. Secondary slow-running port
23. Slow-running port
24. Slow-running port
25. Secondary throttle valve
26. Float
27. Float chamber
28. Power valve
29. Primary main jet
30. Idle adjusting screw

Unhook the throttle valve return spring. Remove the retaining ring securing the accelerator pump lever to the body (see arrow in Fig. 1.43.) and from the other end of the lever remove the split pin and the washer to separate the connecting rod from the lever. Do not lose the washer and spring from the end of the rod. The lever can now be taken off.

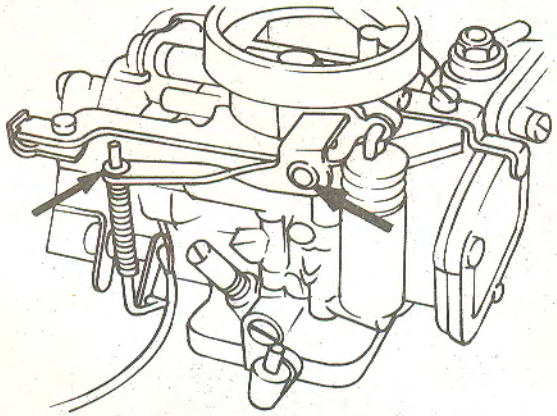


Fig. 1.43. — The arrow points to the retaining pin which secures the accelerator pump lever to the carburettor body.

Remove the fuel inlet bolt, fuel strainer and fuel return valve assembly from the main body. An open-ended spanner is used (on the side where the fuel level indicator is positioned). Remove the retainer and unhook the fast idle rod from the fast idle lever.

Remove the screws securing the carburettor cover and lift off the cover, at the same time removing the choke cable support bracket and the support bracket for the throttle return spring. Remove the cover gasket.

Invert the carburettor so that the bottom face is facing you and remove the three visible screws with a screwdriver to separate the throttle body from the main body. To dismantle the throttle body, unscrew the diaphragm cover screws and lift off the cover and the spring. The slow-running adjusting screw and the spring are also located in this part and can be removed if this is necessary. Do not remove the throttle shafts and plates.

To dismantle the main body, remove the float needle valve, the spring and the pin. Unscrew the float chamber cover from the side of the carburettor and lift off the cover and the rubber gasket, the glass and the other rubber gasket. Invert the carburettor housing and remove the float pin and the float.

Remove the pump plunger (with the rubber bellows) from the carburettor housing. Invert the carburettor and shake out the pump inlet ball valve.

Next to the opening for the pump plunger remove the screw and the washer retaining the pump discharge weight and ball valve. Place the carburettor over the open palm of the hand and shake out the two parts.

The power valve can only be removed with a special tool (49 0118 870A). The valve can be seen through the opening for the fuel level glass and the special tool, which is a kind of screwdriver, is to be inserted from the top.

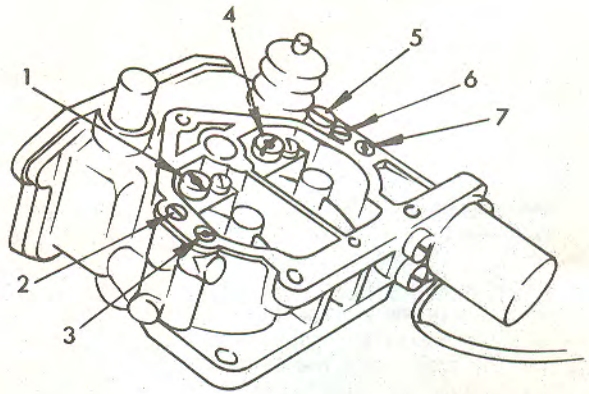


Fig. 1.44. — View of the carburettor body with the cover removed to show the location of the various jets.

1. Secondary main air bleed
2. Secondary slow-running jet
3. Secondary slow-running air bleed
4. Primary main air bleed
5. Screw for pump discharge weight
6. Primary slow-running jet
7. Primary slow-running air bleed

Refer to Fig. 1.44., remove all jets and all air bleeds from the main body. The two main jets are inserted below two plugs and are arranged side by side opposite the two barrels. Finally unscrew the fuel cut-off solenoid from the body.

Further dismantling should not be undertaken although it is possible to replace the throttle valves and the choke valve plate. To do this, unscrew the valve plate in question from its shaft.

Thoroughly clean all carburettor parts and dry with compressed air. Check the float for distortion, damaged float tabs or abnormal wear in the float lever pin bores. Check the float needle for wear and proper seating. This is easily checked, by inverting the carburettor cover with the needle valve and the float assembled and sucking with the mouth at the main fuel passage. If a leak is present, the valve seating is not satisfactory. Check the fuel strainer for rust or damage and the choke valve for proper closing, smooth operation and excessive play of the choke shaft. Inspect all jets and air drillings for clogging, damaged threads or damaged jet openings. Check the pump plunger for excessive wear on the gliding surface and free movement in its bore. Both throttle valves must close firmly and should not have excessive play of the shafts.

The assembly of the carburettor is carried out in reverse order to the dismantling, noting the following points:

Replace all gaskets. As both the primary and secondary systems have their respective parts of the same shape it is essential, therefore, that care should be taken not to interchange jets, etc. After assembly open the throttle valve of the primary stage fully and check if the throttle valve of the secondary stage is also fully opened. If this is not the case, bend the connecting rod between the throttle valves accordingly. To check the opening angle of the secondary throttle valve, open the primary throttle to an angle of 49° when the secondary valve should just begin to open. If necessary adjust these openings by bending the throttle shaft link.

1.9.0.4. Carburettor Adjustments

Slow-running Adjustment (without Emission Control):

Remove the plug from the inlet manifold and connect a vacuum gauge to the opening. Connect a revolution counter (tachometer) to the ignition coil. Start the engine and run at idle speed. Turn the throttle adjustment screw in or out until the engine turns over smoothly without stalling. Then turn the slow-running volume control screw until the maximum vacuum reading with the lowest possible slow-running speed is obtained. The engine should run with 600 rpm and have a vacuum of 430 mm Hg (17 in. Hg). Screwing in the slow-running volume control screw will obtain a leaner mixture. Unscrewing this screw will obtain a richer mixture.

Slow-running Adjustment (with Emission Control):

Connect the vacuum gauge and the revolution counter (tachometer) as described above and warm up the engine. Check if the choke valve is fully open. By adjusting the throttle valve stop screw, adjust the slow-running speed to 600 $\pm$ 50 rpm. Now regulate the slow-running volume control screw until a max. reading with the lowest possible slow-running speed is obtained. Re-adjust the throttle valve stop screw until the slow-running speed has increased by 50 rpm above the last speed noted and turn in the slow-running adjusting screw to reduce the slow-running speed by 50 rpm.

Next connect an exhaust gas analyser in accordance with the instructions of the manufacturer and adjust the slow-running volume control screw until the carbon content of the exhaust gas is below 4.5 %. Repeat the above adjustment until the final slow-running speed is 600 $\pm$ 50 rpm without altering the CO contents.

Float Level: The float level can be seen with the carburettor installed, as a fuel level indicator is fitted to the outside of the carburettor body. Start the engine and check that the fuel in the float chamber is in height with the mark "Level" on the glass.

If the fuel level is not up to the specified mark, or if the carburettor has been overhauled, the float setting must be adjusted as follows. The carburettor must be removed in the first case.

Remove the float chamber cover and with the car-

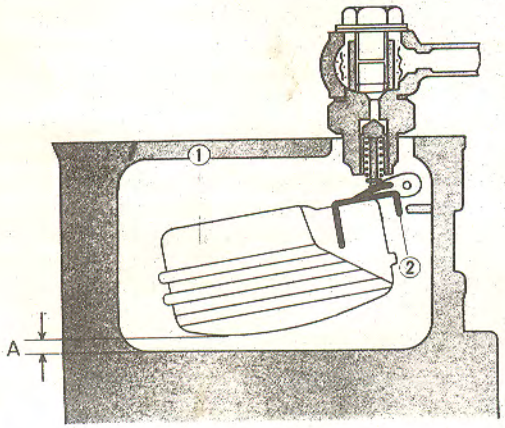


Fig. 1.45. – Checking the float level with the carburettor in its normal position. The float tongue (2) can be bent to correct the setting. (1) is the float.

burettor in its normal position, check the gap between the bottom of the float and the bottom face of the float chamber. The gap should be 1.2 mm (0.047 in.) If the setting is outside this value, refer to Fig. 1.45.

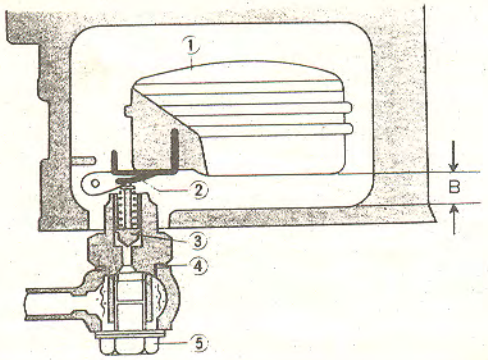


Fig. 1.46. – Checking the float level with the carburettor in the inverted position. The important dimension is "B".

and bend the tongue (2) until this dimension is obtained.

Now invert the carburettor, making sure that it is in a horizontal position and measure the dimension "B" in Fig. 1.46., which should be 22.5 ± 1.0 mm (0.886 ± 0.04 in.). The illustration shows the location of shims and the thickness, i.e. the quantity of shims at the fuel inlet bolt should be altered in order to obtain the correct dimension. Small corrections can be obtained by bending the tongue (2) in the illustration.

Fast Idle Adjustment: Refer to Fig. 1.47. for details. When the choke valve is fully closed, the primary throttle valve should be open by 18°. To check the setting, insert the shank of a drill of 1.29 mm (0.051 in.) diameter between the primary throttle valve plate and the carburettor bore. If necessary, adjust the setting by bending the fast idle connecting rod (1).

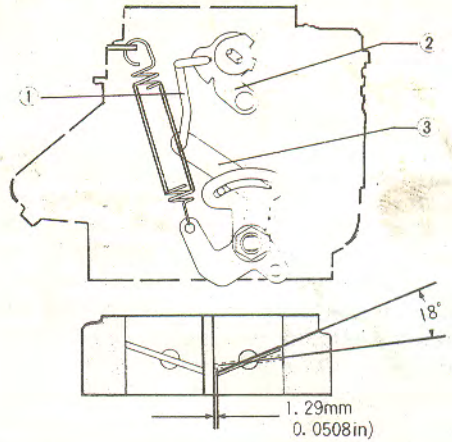


Fig. 1.47. – Details of the fast idle adjustment.

1. Connecting rod
2. Choke valve lever
3. Throttle operating lever

Adjusting the Choke Valve: The choke valve lever has two holes to attach the choke valve return spring. The spring is normally engaged in the upper hole, but can be fitted to the lower hole if temperatures are consistent below –20° C (–4° F).

1.9.1. FUEL PUMP

1.9.1.0. Technical Data

Type:	Electrical transistor pump
Fuel pressure:	0.20 - 0.25 kg/sq.cm. (2.8 - 3.6 psi.)
Fuel delivery capacity:	800 c.c./min. (1.7 U.S. pts./min.; 1.4 Imp. pts./min.)

1.9.1.1. Removal and Installation

The fuel pump is situated on the car body, next to the fuel tank and is mounted on two rubber blocks. To remove the pump, disconnect the electrical plug and unscrew the two nuts from the rubber blocks. Lift out the pump.

Installation is a reversal of the removal procedure. Note that the pump will only operate when the ignition is switched on.

1.9.1.2. Servicing and Testing

As already mentioned, the pump is electrically operated and should not be dismantled. Low delivery pressure or a low delivery amount could lead to poor performance of the engine. To check, if the fault is in the pump, disconnect the fuel inlet pipe from the carburettor and connect a pressure gauge. Switch on the ignition without starting the engine. If the pressure is between 0.20 - 0.25 kg/sq.cm. (2.8 - 3.6 psi.), then the pump is in working order. Replace the pump if this is not the case.

To check the pump delivery, connect a hose to the outlet connection on the pump and with a suitable measuring vessel, collect an amount of 800 c.c. without the engine running. This amount should be collected within one minute.

1.9.2. FUEL FILTER

The fuel filter is made of a paper element and is fitted near the fuel tank, above the fuel pump. The filter should be replaced every 8,000 miles (12,000 km). To replace the filter, open the luggage boot lid and remove the partition board by removing the two fasteners.

Disconnect the two hoses from the filter and remove the filter from its retainer. Refit the new filter in reverse order to the removal procedure. Make sure that the new filter is installed in the correct position, as indicated by the arrow in the filter.

1.9.3. AIR CLEANER

The air filter is fitted with a paper insert and should be cleaned every 3,000 km (2,000 miles) by blowing through it with compressed air and should be replaced every 36,000 km (24,000 miles). If the car is mainly driven on dusty roads, the frequency of cleaning or replacing should be approximately halved.

2. CLUTCH

2.0. Description

The dry single plate clutch is of the diaphragm spring type for all Mazda vehicles covered in this Repair Guide with manual gearbox. The operation of the clutch is by hydraulic system. The clutch is balanced as an assembly during manufacture and it is essential that all parts are refitted in the original positions to retain the balance.

2.1. Technical Data

Type:	Single dry plate with diaphragm spring
Pressure Plate:	
Inner diameter of pressure plate:	126 mm (4.961 in.)
Outer diameter of pressure plate:	203 mm (7.992 in.)
Perm. run-out:	0.05 mm (0.002 in.)

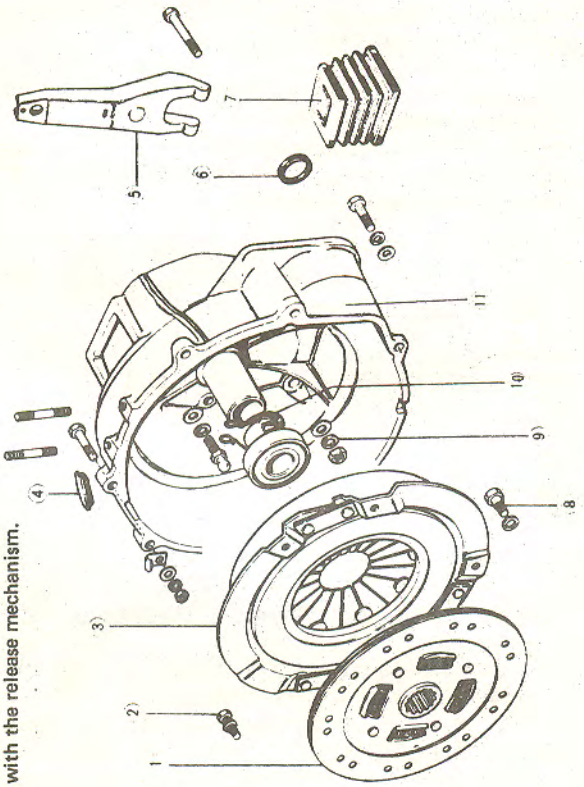


Fig. 2.1. – Exploded view of the clutch together with the release mechanism.

1. Clutch driven plate
2. Bolt
3. Clutch cover assembly
4. Inspection cover
5. Release fork
6. Oil seal
7. Dust boot
8. Dowel bolt
9. Release bearing
10. Spring
11. Clutch housing

Driven Plate Linings:	
Inner diameter:	130 mm (5,118 in.)
Outer diameter:	200 mm (7.874 in.)
Thickness:	3.5 mm (0.138 in.) per lining
Max. run-out of driven plate:	1.0 mm (0.04 in.)
Hydraulic System:	
Master cylinder bore:	15.87 mm (0.625 in.)
Operating cylinder bore:	17.46 mm (0.687 in.)
Max. bore to piston clearance:	0.15 mm (0.006 in.)
Fluid specification:	SAE 70R3
Release fork free play:	None
Clutch pedal free play:	0.5 - 3.0 mm (0.02 - 0.12 in.)

2.2. Clutch – Removal and Installation

Refer to the section on the transmission and follow those instructions to remove the unit. Mark the clutch cover and the flywheel face to ensure correct re-assembly. Remove the clutch bolts carefully, a little at a time. Do not allow grease or oil to get on the lining faces or any other part. If necessary, the flywheel can also be removed (see Section on dismantling the engine).

To install the clutch, the use of an alignment mandrel or a spare main drive shaft is necessary. Note that the long end of the clutch disc hub must face towards the rear, away from the flywheel. If the flywheel has been removed, note that one of the bolts is a dowel bolt, which must be inserted into the hole marked "0" of the flywheel. Counter-hold the flywheel by inserting a screwdriver into the teeth of the starter motor ring gear and evenly tighten the flywheel bolts to the torque setting given in Section 1.5. Before inserting the driven plate, have a last look to make sure that no foreign matter remains in the flywheel.

When refitting the clutch, align the "0" mark on clutch cover and flywheel and insert the two dowel bolts into the holes in clutch and flywheel. Tighten the clutch securing bolts to 2.0 kgm (14 lb.ft.). Always tighten the bolts a little at a time, working in a diagonal pattern.

2.2.1. INSPECTION AND SERVICING

Check the facing surfaces for wear, glazing or contamination by grease or oil. Inspect the splines of the driven plate for excessive play and for tooth damage. Mount the driven plate between centres, on a suitable mandrel, and check with a dial indicator to the outer diameter of the plate that the run-out does not exceed the value given. Clutch cover and diaphragm spring should not be dismantled and are to be replaced in case of damage.

Check the pressure plate friction area for burning or wear (remove light scoring with No. 180 sandpaper or take a light cut in a lathe). Inspect the friction area of the flywheel for burning or scoring. Slightly scored surfaces can be re-worked in a lathe. If necessary, replace the flywheel.

2.2.2. CLUTCH RELEASE FORK – REMOVAL AND INSTALLATION

Remove the return spring for the clutch release bearing and withdraw the release bearing. Pull the release fork towards the outside until the retaining spring is free from the pivot pin in the inside of the clutch bell housing. Remove the fork from the clutch housing.

Check the release bearing by turning the bearing race by hand. If the bearing feels rough or noisy when turning, replace it. Also check the gliding face for the bearing on the gearbox front cover and remove any burrs visible.

NOTE: The release bearing is packed with lubricant and must, therefore, not be washed in petrol or any other solvents.

To refit the release fork, apply grease to the pivot pin, insert the fork from the inside of the clutch housing and press the fork against the pivot pin until the retaining spring engages behind the ball seat.

2.3. Clutch Pedal Height Adjustment

Adjust the clutch pedal height with the height adjusting bolt (4, in Fig. 2.2.) and nut (5). The height between the clutch pedal pad and the floor mat is shown in the illustration.

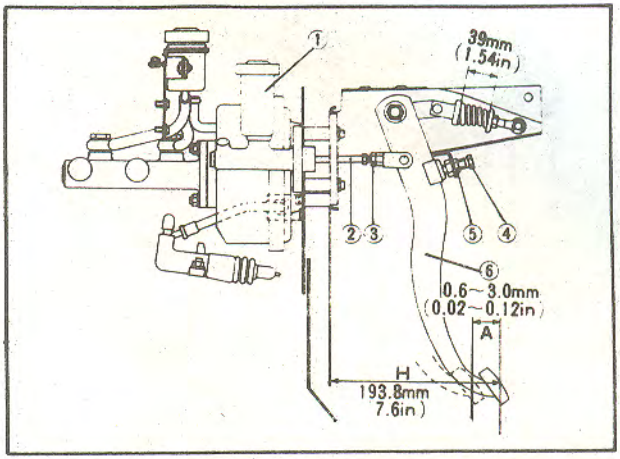


Fig. 2.2. – View of the clutch pedal with details of the clutch pedal adjustments.

A. Clearance between piston and push rod
B. Pedal height

1. Master cylinder
2. Push rod
3. Locknut
4. Height adjusting bolt
5. Locknut
6. Pedal

2.4. Release Fork – Free Play Adjustment

The adjustment for the clutch pedal free play is obtained by adjusting the clearance between the push rod connected to the clutch release cylinder and the clutch release fork after slackening of the locknut. This clearance will ensure a play of 1.5 mm (0.06 in.) between the release bearing and the diaphragm spring and should be adjusted to 3.0 mm (0.12 in.). The release fork return spring must be disconnected before carrying out the adjustment. Fig. 2.3. shows details of the adjustment.

2.5. Clutch Master and Operating Cylinder

2.5.0. REMOVAL AND INSTALLATION

Master Cylinder: Disconnect the fluid pipe from the master cylinder. Remove the two nuts securing the cylinder and withdraw the cylinder from the dash panel.

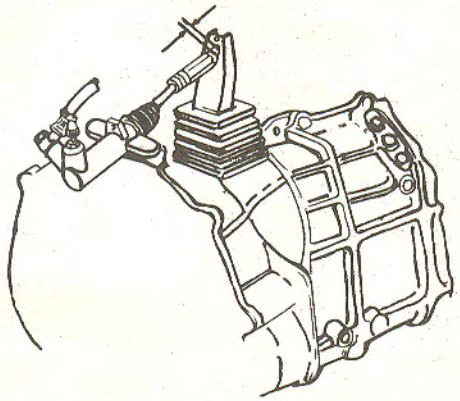


Fig. 2.3. — Adjusting the free play on the clutch release fork. The dimension shown by the arrow should be 3.0 mm (0.12 in.).

Take care that brake fluid is not spilled on the body. Plug the end of the pipe to prevent dirt entering the system.

Install the master cylinder in the reverse sequence to removal. Adjust the free plays as described in Section 2.4. After making these adjustments, the clutch pedal free play should be within the limits of 20 - 30 mm (0.8 - 1.2 in.). After installation bleed the clutch system of air.

Clutch Operating Cylinder: Disconnect the fluid pipe from the clutch operating cylinder. Remove the two nuts securing the cylinder to the clutch housing. Fig. 2.3. shows the location of the operating cylinder.

Install the operating cylinder in the reverse sequence to removal. Adjust the release fork to push rod clearance as described in Section 2.4. to provide the required clearance for the operation of the clutch.

2.5.1. CLUTCH SYSTEM CYLINDERS — SERVICING

The cylinders are shown in Fig. 2.4. (master cylinder) and Fig. 2.5. (operating cylinder). Note that these diagrams show the proper order of assembly and disposition and these must be followed exactly as shown.

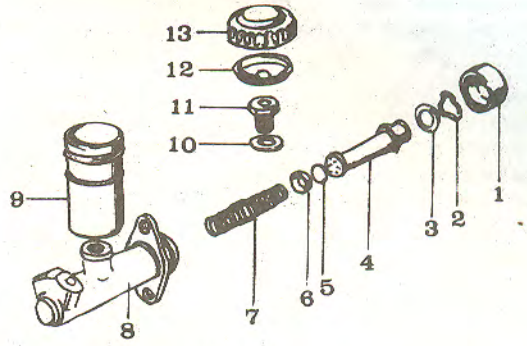


Fig. 2.4. — Exploded view of the clutch master cylinder.

1.	Rubber boot	8.	Cylinder body
2.	Retaining ring	9.	Reservoir
3.	Stop washer	10.	Sealing washer
4.	Piston with cup	11.	Connecting plug
5.	Filling disc	12.	Baffle plate
6.	Primary cup	13.	Cap
7.	Piston return spring		

It is recommended that all cylinder cups are replaced with new parts each time that the units are dismantled. Rubber parts tend to deteriorate with age and the cost of a new set of seals is a small price to pay for safe motoring. With all hydraulic systems it is imperative that no dirt, grease or mineral oil is allowed to come into contact with the components. Use only clean brake fluid to clean the parts and keep benches, tools and hands clean and dry.

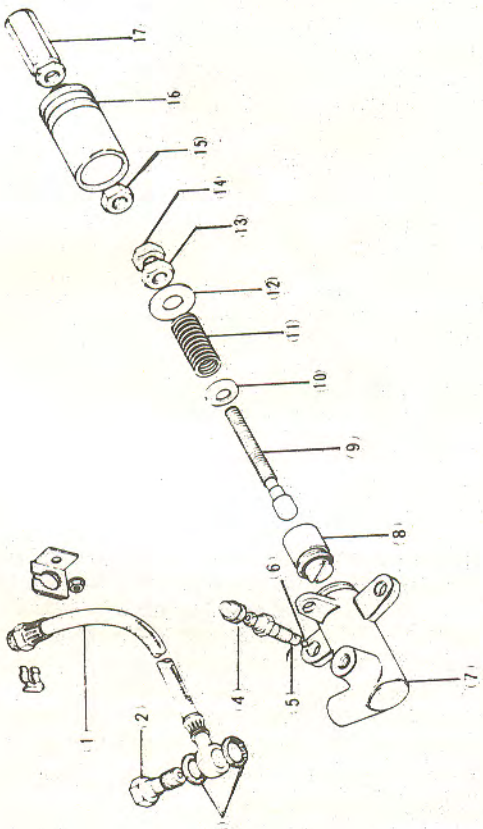
After thoroughly cleaning the outside of the cylinder, remove the rubber cap from the end of the cylinder.

Pry out the retaining ring with a screwdriver and remove the internal parts from the cylinder. In the case of the master cylinder unscrew the reservoir if necessary.

The dismantling of the operating cylinder is obvious from a study of Fig. 2.5.

NOTE: The operating cylinder can either be an adjustable type or a non-adjustable type. The cylinder shown is the adjustable type (two-part push rod).

Inspect the cylinder bore for wear and corrosion, also the pistons. Check the spring and make sure that it is not



1. Fluid hose
2. Banjo bolt
3. Sealing washers
4. Rubber dust cap
5. Bleeder screw
6. Ball valve
7. Operating cylinder
8. Piston assembly
9. Push rod
10. Spring seat
11. Spring
12. Washer
13. Adjusting nut
14. Locknut
15. Locknut
16. Rubber boot
17. Adjusting nut

Fig. 2.5. — Exploded view of the clutch operating cylinder. Shown is the type with the adjustable push rod.

weakened or distorted. Reject all parts that are substandard. If bore corrosion or wear is found the complete unit should be replaced.

The assembly of the cylinders is carried out in reverse order to the dismantling. When fitting the retaining ring to the master cylinder, make sure that it is properly located in its groove. Fit the piston cup with the fingers only. The flat side of the cylinder cup must be facing against the piston in the case of the master cylinder. Make sure that the lips of the cup are not turned over. Lubricate all rubber parts with clean brake fluid before assembly. Fit all parts strictly in accordance with the exploded views.

2.5.2. BLEEDING THE CLUTCH SYSTEM

Bleeding of the clutch system must be carried out at any time that any part of the fluid system has been dismantled or disconnected. The clutch operating cylinder is provided with a bleeder screw, and protective cap, to enable this to be carried out.

Jack up the vehicle and support on stands. Fill the master cylinder reservoir with clean brake fluid of the recommended specification and make sure that the reservoir remains full throughout the bleeding operation. Connect a plastic tube to the clutch cylinder bleed point and place the other end in a container about half full of clean brake fluid. Depress the clutch pedal firmly to its full extent and then open the bleeder screw about half a turn to allow the fluid to bleed out. Tighten the bleeder screw and release the pedal slowly. Keep repeating the operation until no more air can be seen coming from the open end of the tube. The final operation must be to tighten the bleed screw with the pedal fully depressed. Tighten the bleeder screw firmly, but do not apply excessive force.

3. GEARBOXES (TRANSMISSIONS)

3.0. Description

Either a four- or five-speed gearbox can be fitted to vehicles in the Mazda 929 range. The four-speed gearbox is of conventional construction that must be dismantled by removing bottom cover, bell housing and

tail piece. Shafts and gears are removed through the bottom of the gearbox. Models with 5-speed gearbox have a similar gearbox, with the difference that the 5th speed is added.

3.1. Technical Data

Gear Ratios:	4-speed	5-speed
1st gear:	3.403 : 1	3.683 : 1
2nd gear:	2.005 : 1	2.263 : 1
3rd gear:	1.373 : 1	1.397 : 1
4th gear:	1.000 : 1	1.000 : 1
5th gear:	----------	0.862 : 1
Reverse gear:	3.665 : 1	3.692 : 1

Lubricant Capacities:	
4-speed gearbox:	1.4 litres (2.4 Imp. pts.; 3.0 U.S. pts.)
5-speed gearbox:	2.2 litres (4.6 U.S. pts., 3.8 Imp. pts.)
Recommended Lubricant:	
Above -18^{o} C (0^{o} F):	EP SAE 90
Below -18^{o}C (0^{o} F):	EP SAE 80
Repair Data:	
Max. run-out of mainshaft:	0.03 mm (0.0012 in.)
Max. clearance between mainshaft and gear (or bush):	0.15 mm (0.006 in.)
Min. clearance between selector fork and operating sleeve:	0.5 mm (0.02 in.)
Clearance between reverse idler shaft and bush:	0.15 mm (0.006 in.)
Clearance between synchroniser ring and side of gearwheel when fitted:	
New:	1.5 mm (0.06 in.)
Wear limit:	0.8 mm (0.031 in.)

3.2. Gearbox — Removal and Installation

Disconnect the battery earth cable. From the inside of the vehicle remove the gear change lever knob and unscrew the console box. Unscrew the screws securing the gear change lever boot to the body floor and remove the boot. Remove the bolts securing the retainer cover to the gear change retainer and pull out the lever together with the shim and the bush. Jack up the vehicle and place on stands.

Unscrew the clutch operating cylinder from the gearbox without disconnecting the flexible hose. Disconnect the reversing light switch connector and the neutral switch connector near the operating cylinder. On left-hand drive vehicles unscrew the clip securing the vacuum pipe to the clutch housing.

Remove the bolts securing the wiring harness holder to the bracket near the starter motor. Remove the upper starter motor bolt and then unscrew the bolts connecting the gearbox to the engine at the upper end. Unscrew the heat insulators from the exhaust front pipe and disconnect the exhaust front pipe from the exhaust manifold down pipe. Also unscrew the front pipe from the brackets and from the main silencer (muffler) and lift out the exhaust pipe.

Unscrew the bolts securing the heat insulator to the underbody and remove the insulator. Remove the propeller shaft. Further details of this operation are given in Section 4. Tie a plastic bag around the end of the gearbox to prevent the loss of gearbox oil.

Remove the lower starter motor bolt and lift out the starter motor. Disconnect the lead. Place a jack under the front of the gearbox and slightly lift up the gearbox. Unscrew the gearbox support bracket from the body and lift out the bracket. Unscrew the remaining two bolts from the bottom of the engine/gearbox assembly and remove the gearbox towards the rear, without resting the weight of the gearbox on the clutch shaft.

Install the gearbox in the reverse sequence to removal, noting the following points:

Apply a thin coating of grease to the input shaft splines and a little to the contact faces between the release bearing and the diaphragm spring. Lift in the gearbox carefully to avoid any load on the main drive shaft and clutch. After installation fill the gearbox with the right amount of the specified lubricant. Apply a little grease to the gear shift lever bush and the spherical end of the gear shift lever.

3.3. Gearbox – Dismantling

3.3.0. FOUR-SPEED GEARBOX

Care must be taken when dismantling or servicing the gearbox so that the aluminium casings are not damaged. Special attention should also be given to the following points:

1. Always use the correct bearing puller to avoid damage to the bearings or circlips.
2. Always ensure the correct assembly of the synchroniser units. Incorrect fitting results in "slipping out of gear" under overrun conditions.
3. Take care when dismantling synchronisers so that shifting keys cannot drop out. Keep the operating sleeve on the synchroniser hub.
4. Take care not to lose the steel ball located beneath the speedometer drive on the mainshaft, take it out.

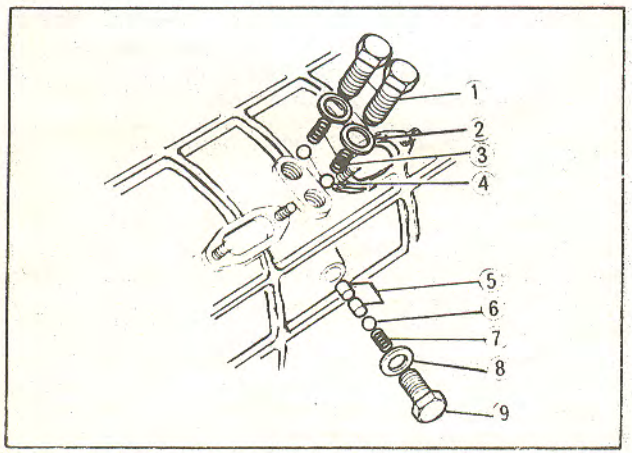


Fig. 3.1. – The location of the spring cap bolts on the gearbox.

1. Spring cap bolt
2. Sealing washer
3. Detent spring
4. Detent ball
5. Shift interlock pin
6. Detent ball
7. Detent spring
8. Washer
9. Spring cap bolt

5. Take care when removing the bearings. The shims fitted under the bearings should be re-used when new bearings are fitted. Only replace shims when damaged.

To dismantle, proceed as follows:

Remove the screw attaching the speedometer driven gear to the extension housing and withdraw the complete assembly. Unscrew the reversing light switch and on models for the U.S.A. and Canada unscrew the neutral switch.

Unscrew the bottom cover and the two blind covers and remove the selector fork locking balls and springs and also the interlock pins. Unscrew the selector fork nuts and remove the selector forks with the reverse idler gear from the case. Remove the circlip from the end of the speedometer drive gear, remove the gear and take out the steel ball, being careful not to lose it.

Clamp the mainshaft end carefully into a vice, using soft-metal jaws or the special tool 49 0259 440, which fits over the splined end of the shaft and remove the reverse gear nut. A large spanner is necessary. Remove the lock plate, reverse gear and the key (11, 12 and 13 in Fig. 3.2.).

Remove the circlip on the countershaft gear and remove the gear. Remove the bearing stopper and then the reverse idler gear shaft. For the next operation the bearing puller set 49 0839 425 is necessary to remove the mainshaft ball bearing and the countershaft needle roller bearing from the shaft and out of the casing. It is very difficult to adapt another kind of puller for this operation, as the claws of the puller must be inserted into the recesses in the case and below the outer race of the bearings. Countershaft and mainshaft are now free to remove.

Further dismantling is carried out as follows:

3.3.0.0. Main Drive Shaft (Clutch Shaft)

The dismantling of the clutch shaft should be carried out by referring to Fig. 3.2. Remove the clutch shaft from the main shaft and remove the synchroniser ring and the needle roller bearing (8 and 9) from the end of the shaft. Remove the circlip from the front of the shaft and press off the bearing (6) with a suitable press or carefully drive the shaft through the bearing (bearing well supported).

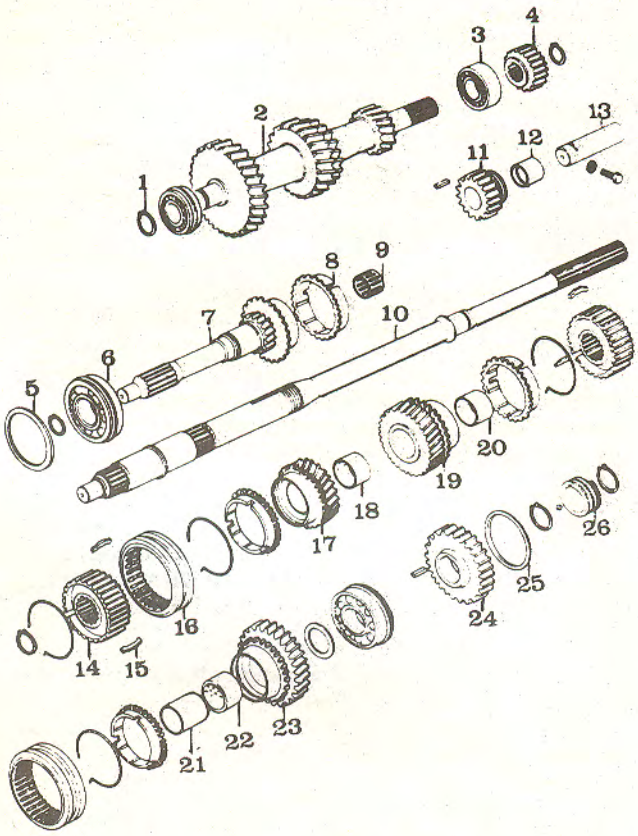


Fig. 3.2. — Exploded view of the gearwheels and shafts fitted to the four-speed gearbox.

1. Circlip
2. Countershaft (layshaft)
3. Ball bearing
4. Reverse gearwheel
5. Shim
6. Ball bearing
7. Main drive shaft (clutch shaft)
8. Synchroniser ring
9. Needle roller bearing
10. Main shaft
11. Reverse sliding gearwheel
12. Bush
13. Reverse idler shaft
14. Synchroniser hub
15. Synchroniser key
16. Operating sleeve
17. 3rd speed gearwheel
18. Bush
19. 2nd speed gearwheel
20. Bush
21. Sleeve for 23.
22. Bush
23. 1st speed gearwheel
24. Reverse gearwheel
25. Spacer ring
26. Speedometer drive worm

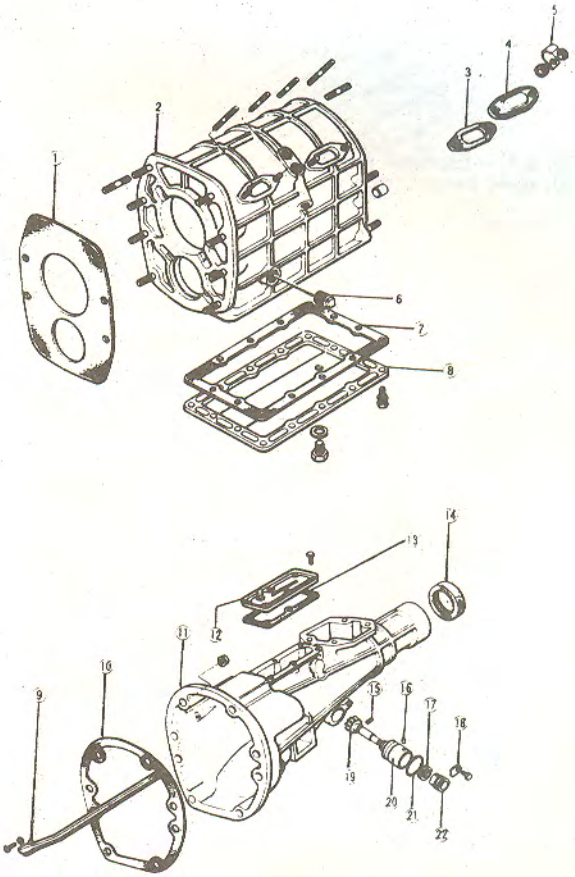
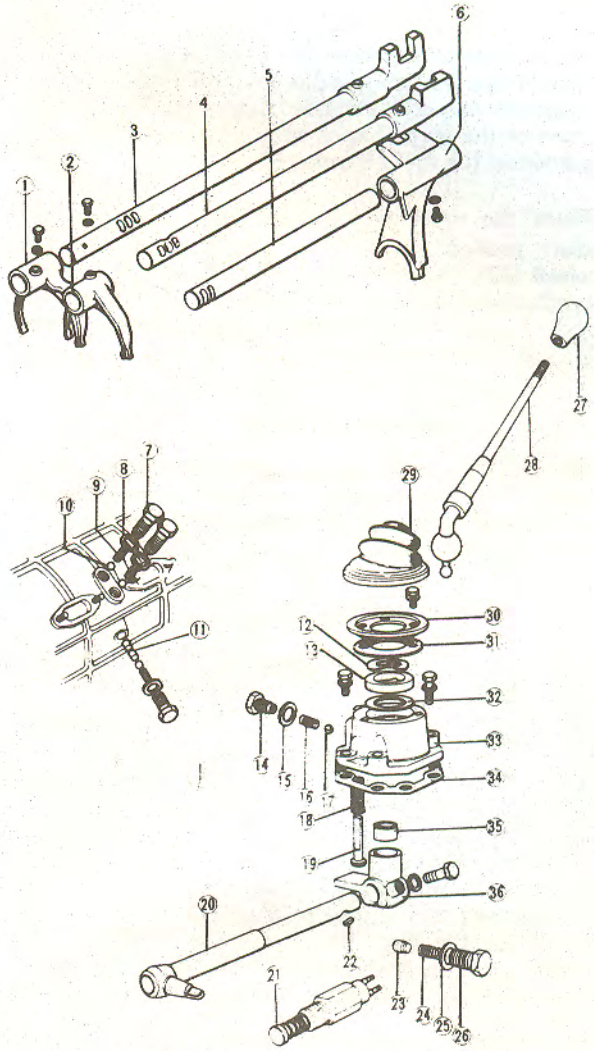


Fig. 3.3. — Exploded view of the transmission case and extension housing as fitted to the four-speed gearbox.

1. Gasket
2. Transmission case
3. Gasket
4. Blind cover
5. Clip
6. Drain plug
7. Gasket
8. Transmission bottom cover
9. Oil conduit
10. Gasket
11. Extension housing
12. Cover
13. Gasket
14. Mainshaft oil seal
15. Pin
16. Pin
17. Oil seal
18. Lock plate
19. Speedometer drive gear
20. Bearing sleeve
21. "O" sealing ring
22. Speedometer cable joint

Fig. 3.4. — Exploded view of the gearchange mechanism of the four-speed transmission.

1. Selector fork, 3rd/4th
2. Selector fork, 1st/2nd
3. Selector shaft, 3rd/4th
4. Selector shaft, 1st/2nd
5. Selector shaft, reverse
6. Selector fork, reverse
7. Spring cap bolt
8. Washer
9. Detent spring
10. Detent ball
11. Interlock pin
12. Washer
13. Bush
14. Spring cap bolt
15. Washer
16. Spring
17. Detent ball
18. Spring
19. Lock spindle
20. Gearchange lever shaft
21. Reversing light switch
22. Key
23. Friction piece
24. Spring
25. Washer
26. Spring cap bolt
27. Gearchange lever knob
28. Gearchange lever
29. Dust boot
30. Cover
31. Gasket
32. Shim
33. Gearchange lever turret
34. Gasket
35. Bush
36. Selector finger
37. Neutral switch



Remove the circlip from the front of the mainshaft and slide off the 3rd/4th speed synchroniser (14, 15, 16), synchroniser ring and 3rd speed gearwheel (17) towards the front of the shaft. Leave the synchroniser ring with the gearwheel (tie them together).

From the other end of the shaft, remove the rear shaft bearing, shim, thrust washer, 1st speed gearwheel (23), bush (21 and 22) and synchroniser ring. The synchroniser unit for 1st/2nd gears, 2nd gear synchroniser and 2nd speed gearwheel (19) are also removed from the same end of the shaft.

3.3.0.2. Countershaft (Layshaft)

Remove the circlips from both ends of the shaft and remove the ball bearing from the front and the reverse countershaft gear and the needle roller bearing from the rear end of the shaft.

3.3.1. FIVE-SPEED GEARBOX

Dismantle the gearbox to the stage that the speedometer driven gear is removed and then proceed as follows:

Remove the bottom cover and unscrew the selector rod end pieces from the end of the selector rods. Using two screwdrivers inserted between bearing housing and gearbox case, and as shown in Fig. 3.5., remove the bearing housing. Remove the mainshaft bearing circlip in front of the bearing and pull off the bearing with a suitable puller. Also remove the circlip from the rear end of the countershaft and with a suitable puller (the same tool set as for the 4-speed) remove the rear bearing with the 5th speed gearwheel from the rear of the shaft. The claws of the puller must be inserted under the gearwheel.

On the side of the centre housing there is a bolt which should be removed and gently tap off the housing with a plastic mallet. After removing the two covers at the top of the case, remove selector forks-to-shaft securing bolts. The three visible plugs conceal the detent balls and springs, which should also be removed. All selector shafts should be withdrawn towards the rear of the gearbox case.

Remove the circlip securing the 5th speed gearwheel on

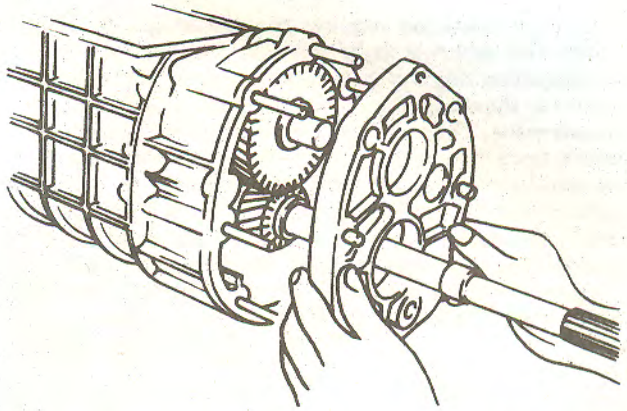


Fig. 3.5. — Removal of the bearing housing on the 5-speed gearbox.

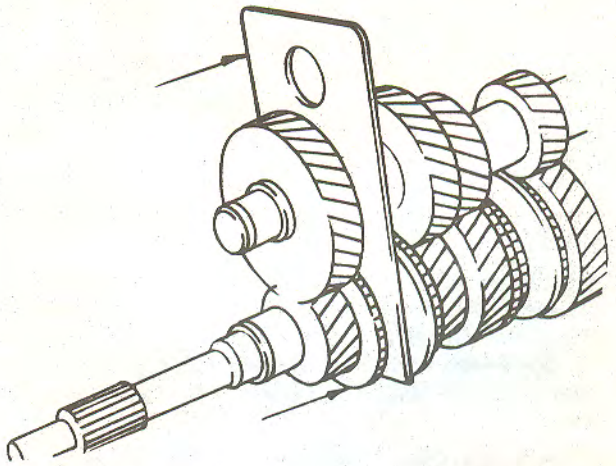


Fig. 3.6. — Fitting the retaining plate (49 0839 445) between the 4th speed synchroniser ring and the operating sleeve of the mainshaft.

the mainshaft and remove all parts now free. Lock the mainshaft by engaging 2nd and reverse gear and using a suitable wrench (or special tool 49 0813 465A) undo the mainshaft nut. Reverse gear and synchroniser unit can now be removed and also the reverse idler gear.

The next operation requires the use of special tool 49 0839 445 which is to be inserted between the 4th gear synchroniser ring and the operating sleeve of the synchroniser as shown in Fig. 3.6. This tool could perhaps be home-made. Then remove the circlip from the countershaft front bearing and with the special bearing puller referred to above, withdraw the bearing. Take off the adjusting shim. Unscrew the bearing cover from the gearbox case and remove the countershaft centre bearing again using the bearing puller set. After removal of the circlip, remove the bearing from the front of the main drive shaft. Take out all shafts from the gearbox case.

3.4. Inspection and Assembly

Wash all parts in solvent and dry off. All parts must be inspected and repaired or replaced as necessary. Major inspection procedures and tolerances are given in this section or in the technical data and these must be followed. In addition, the general inspection of parts must include the following aspects:

Bearings: Check bearings for wear, chipping of the plating, damage or scoring or evidence of seizure. Bearings must not show excessive side play. Do not spin the bearings when drying them with compressed air.

Covers and Housings: Check all surfaces for burrs, distortion or scratches.

Gearwheels and Shafts: Inspect all gearwheels and shafts for wear, chipping of teeth, scoring or other damages. Check the splines in a similar manner. The bushes for the gearwheels should be replaced if a clearance of more than 0.15 mm (0.006 in.) is present between bush and gearwheels.

Synchroniser Rings: First check the synchroniser rings in general for wear, pitting, cracks or other damage. Then place each ring onto the cone of its respective gearwheel and by means of a feeler gauge measure the gap between the ring face and the gear face as shown in Fig. 3.7. Fig. 3.8. shows this gap in a diagram. If the clearance is less than 0.8 mm (0.031 in.), replace the synchroniser ring or the gearwheel in question. The clearance on new parts should be 1.5 mm (0.06 in.). Also check the contact between the inner surface of the synchroniser ring and the cone surface of the gear. To do this, apply a thin

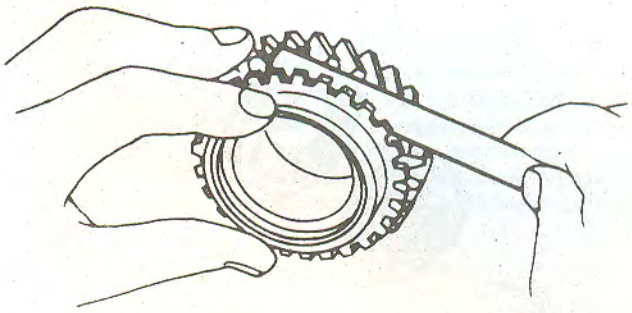


Fig. 3.7. — Checking the gap between the face of the synchroniser ring and the gearwheel by means of a feeler gauge.

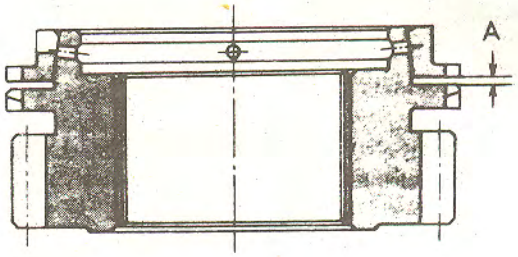


Fig. 3.8. — The gap measured as shown in the illustration is indicated by the letter "A".

coat of engineer's blue onto the cone face and place the ring over it. Apply slight pressure against ring and turn the ring to and fro. Lift off the ring and check the contact pattern. Poor patterns can be corrected by lapping the ring and the gearwheel with very fine grinding paste.

Synchroniser Keys: Inspect the keys for uneven wear or distortion and replace if necessary. To dismantle a synchroniser, place a clean rag around the outside of the operating sleeve and press the synchroniser hub through the sleeve. Fig. 3.9. shows an exploded view of a synchroniser.

Oil Seals: Always replace oil seals when the seal lip shows the slightest wear or other damage. Before deciding to re-use an oil seal, check the spring in the inside of the seal lip, as it may have lost its tension. If the gearbox

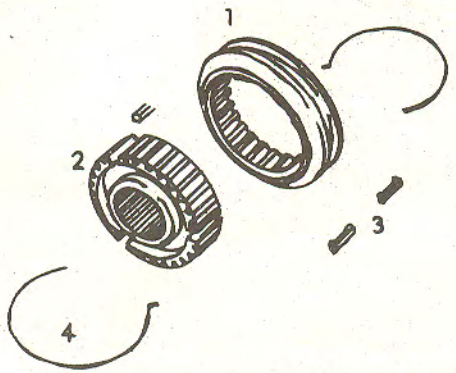


Fig. 3.9. — The component parts of the synchroniser unit.

1. Operating sleeve
2. Synchroniser hub
3. Synchroniser keys
4. Synchroniser spring

is completely overhauled the oil seals should be replaced in any case.

3.4.0. ASSEMBLY OF MAINSHAFT

Referring to Fig. 3.10., assemble the two synchroniser units. When fitting the springs, make sure that the ends of the springs are opposite to each other and have properly engaged in their grooves. Apply clean gear oil to all parts that rotate or slide. Do this BEFORE they are assembled.

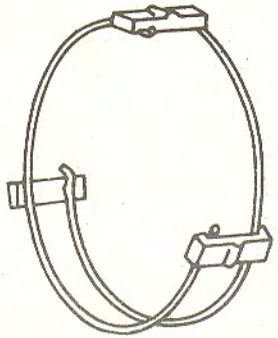


Fig. 3.10. — The correct installation of the synchroniser key springs.

Slide the 2nd speed gearwheel together with the synchroniser ring over the rear of the mainshaft and then fit the pre-assembled 1st/2nd speed synchroniser unit over the shaft so that the oil grooves on the synchroniser hub are facing against the 2nd speed gearwheel as shown in Fig. 3.11. To the other side of the synchroniser unit fit the bush for the 1st speed gearwheel, the 1st speed gearwheel and the synchroniser ring, followed by the spacer.

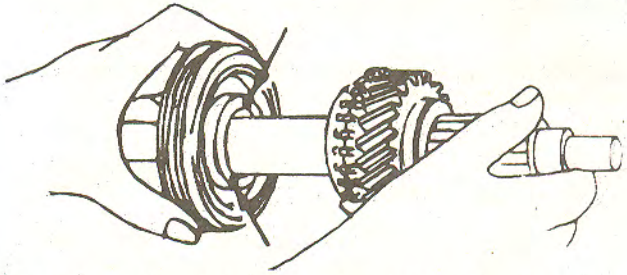


Fig. 3.11. — When fitting the synchroniser unit for the 1st and 2nd speeds, check that the oil grooves (arrows) are facing the gearwheel.

Place the 3rd speed synchroniser ring on the 3rd speed gear and slide the gearwheel over the front of the shaft, with the synchroniser ring towards the front. Slide the 3rd/4th speed synchroniser unit over the shaft, making sure that the synchroniser shifting keys engage the grooves of the synchroniser ring. Press the bearing over the other end of the shaft, using a press or a piece of tube applied at the inner bearing race only. Install the reverse gearwheel with the key and the spacer and using a feeler gauge as shown in Fig. 3.12., check the clearance between the gearwheel and the fitted circlip. This should be between 0 - 0.1 mm (0 - 0.004 in.).

3.4.1. MAIN DRIVE SHAFT

Press-fit the bearing over the shaft and fit the circlip. Fit the needle roller bearing into the end of the shaft and place the synchroniser ring over the gearwheel on the shaft. Fit the main drive shaft and mainshaft together, making sure that the shifting keys engage with the notches in the synchroniser ring.

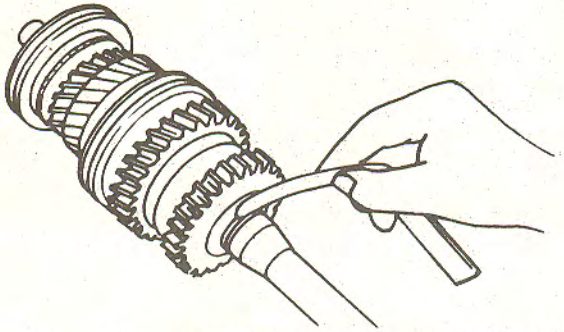


Fig. 3.12. — Check the clearance at the position shown to fit a circlip of the correct thickness.

3.4.2. FINAL ASSEMBLY

Before the final assembly, check the mainshaft bearing end float, by first measuring the depth of the bearing bore in the gearbox case and then by measuring the height of the mainshaft bearing. The difference between the two measurements represents the thickness of the adjusting shim. An overall end-float of 0 - 0.1 mm (0 - 0.004 in.) should be retained. Shims are available in thicknesses of 0.1 and 0.3 mm (0.004 and 0.012 in.).

Check the end float for the countergear bearing in the same manner. The same end float and the same shim thicknesses apply.

Insert the special tool mentioned in Fig. 3.6. between the 4th speed synchroniser ring and the synchroniser gear on the main drive shaft and with both the mainshaft and the countershaft inserted into the gearbox case, fit the countershaft front bearing and the rear bearing into their respective bearing bores. Carefully drive or press in the bearings and fit a circlip to the front bearing. Fit the countergear reverse gearwheel to the rear bearing and secure with the circlip. Fit the reverse idler gear to the gearbox case.

Fit the bearing cover plate to the gearbox case and tighten with the screws.

Fit the reverse gearwheel together with the key to the mainshaft and tighten the mainshaft nut to a torque reading of 21.0 - 25.0 kgm (151 - 180 lb.ft.). Carefully clamp the mainshaft into a vice (soft-metal jaws) for this operation. Bend over the lockwasher tab.

Place the gear shift rod into neutral position and insert the interlock pin into the gearbox case with the special tool 49 0862 350 or a thin rod as shown in Fig. 3.13. Slide the 3rd/4th selector shaft into the case from the rear and secure the selector fork to the shaft with the set bolt. Insert the second interlock pin into the case and fit the reverse selector shaft with the reverse idler gear into the case from the rear. Fit the selector fork to the shaft.

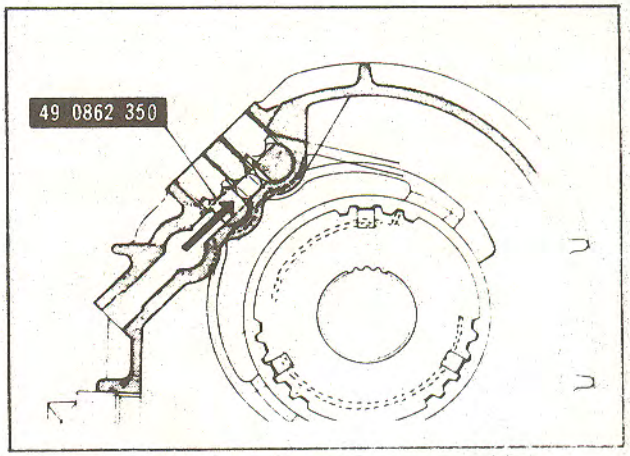


Fig. 3.13. — The special tool shown is used to insert the shift interlock pin into the bore holes. A rod of suitable diameter can also be used.

Position the three detent balls and springs into the case (see also Fig. 3.1.) and install the plugs.

Check the clearance between the synchroniser key and the exposed edge of the synchroniser ring with a feeler gauge. This measurement is shown in Fig. 3.14. and should be 0.66 - 2.0 mm (0.026 - 0.079 in.). If the measurement exceeds the upper limit, change the thrust washer behind the synchroniser. Washers are available in thicknesses of 2.5, 3.0 and 3.5 mm (0.098, 0.118 and 0.138 in.).

Install the two blind covers and the gaskets and fit the snap ring, the speedometer drive gear (with the lock ball) and the second snap ring to the end of the shaft.

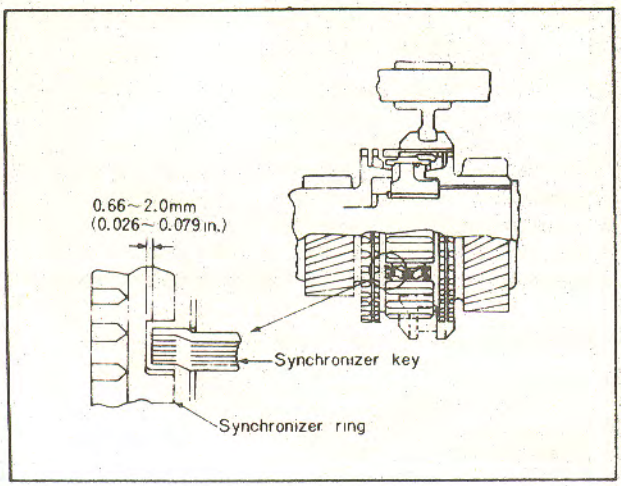


Fig. 3.14. – Checking the clearance between the synchroniser key and the exposed edge of the synchroniser ring with a feeler gauge.

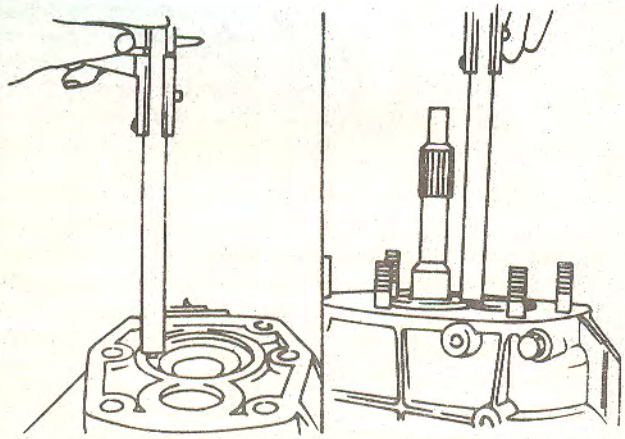


Fig. 3.15. – Before installation of the clutch housing, measure the depth of the bearing seat (left-hand illustration) and the protrusion of the bearing (right-hand illustration) to obtain the correct clearance.

Refit the extension housing in reverse order to the removal procedure. A measurement is necessary during the installation of the clutch housing. This involves the measuring of the bearing seat depth in the clutch housing

Fig. 3.16. – Exploded view of the transmission case components fitted to the five speed transmission.

1. Gasket
2. Transmission case
3. Gasket
4. Blind cover
5. Clip
6. Drain plug
7. Oil filler plug
8. Gasket
9. Bottom cover
10. Centre housing
11. Bearing housing

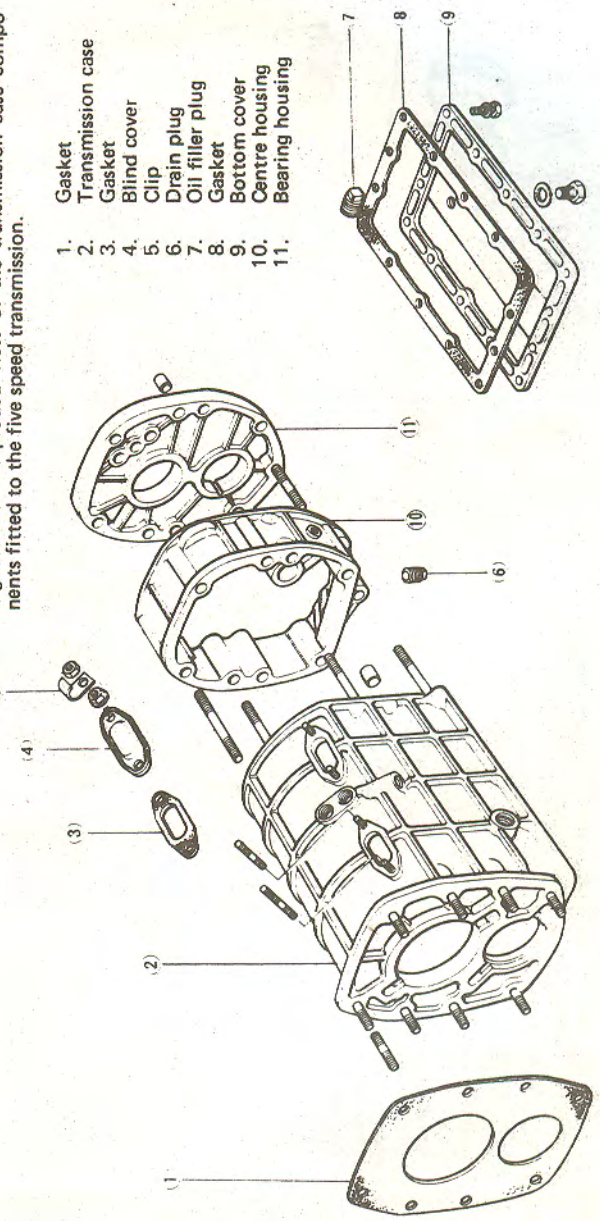
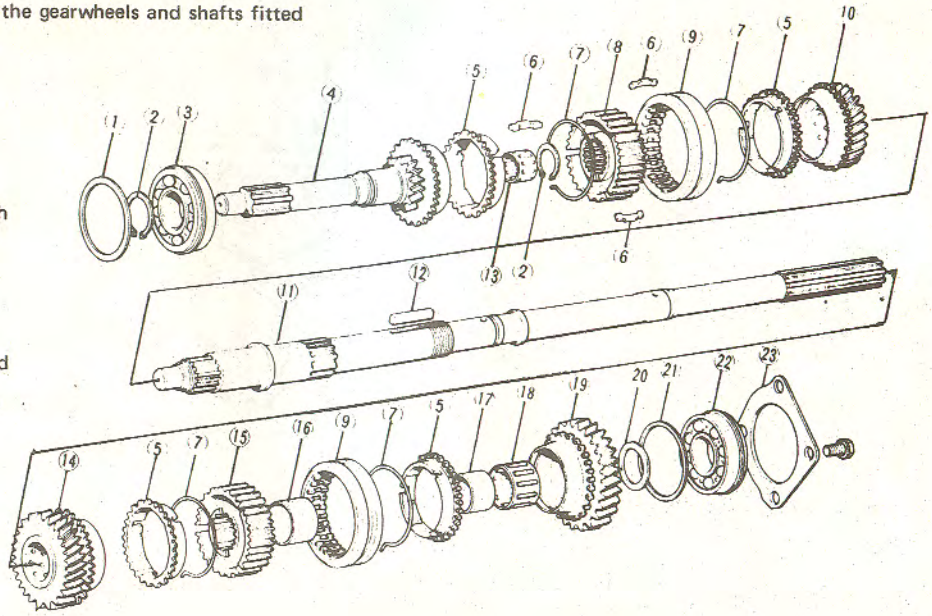
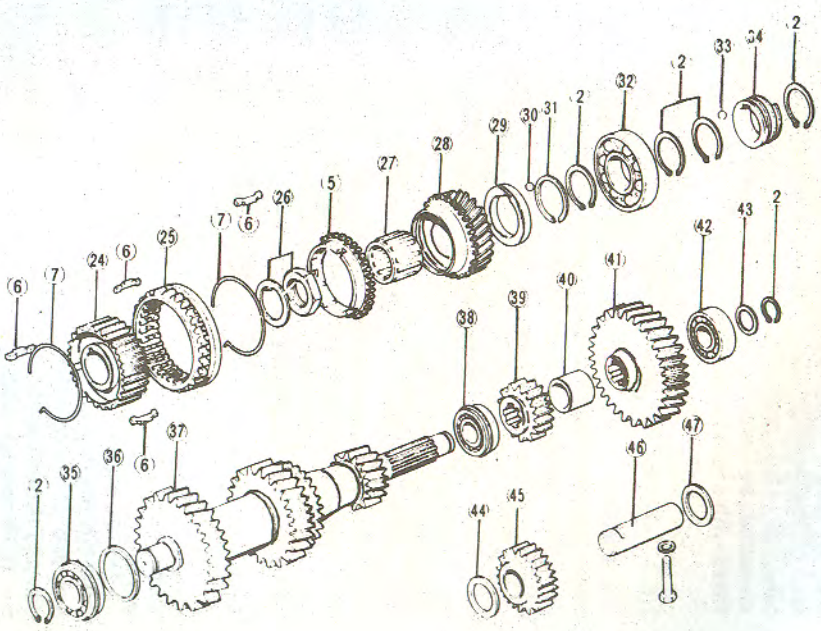


Fig. 3.17. — Exploded view of the gearwheels and shafts fitted to the five speed transmission.

1. Adjusting shim
2. Circlip
3. Main drive shaft bearing
4. Main drive shaft gear
5. Synchroniser ring
6. Synchroniser key
7. Synchroniser key spring
8. Synchroniser hub, 3rd/4th
9. Operating sleeve, 3rd/4th
10. 3rd speed gearwheel
11. Mainshaft
12. Key
13. Needle roller bearing
14. 2nd speed gearwheel
15. Synchroniser hub, 1st/2nd
16. Spacer
17. Needle bearing inner race
18. Needle roller bearing
19. 1st speed gearwheel
20. Thrust washer
21. Adjusting shim
22. Mainshaft front bearing
23. Bearing cover
24. Synchroniser hub, 5th
25. Reverse gear and sleeve
26. Washer and nut



27. Needle roller bearing
28. 5th speed gearwheel
29. Thrust washer
30. Lock ball
31. Thrust washer
32. Mainshaft rear bearing
33. Lock ball
34. Speedometer drive gear
35. Countershaft front bearing
36. Adjusting shim
37. Countershaft gear cluster
38. Countershaft centre bearing
39. Countershaft reverse gear
40. Spacer
41. Reverse gearwheel
42. Countershaft rear bearing
43. Thrust washer
44. Washer
45. Reverse idler gear
46. Reverse idler shaft
47. Washer



and the height of the outer bearing race above the end face of the gearbox case. The difference should be between 0 - 0.1 mm (0 - 0.004 in.) and this can be corrected by inserting shims. The clutch housing is fitted with a gasket (see also Fig. 3.15.).

3.4.3. FIVE-SPEED GEARBOX

The assembly of the five-speed gearbox follows more or less the assembly of the four-speed gearbox. Check the end floats as described in Section 3.4.2. and also the clearance between the synchroniser key and the exposed edge of the synchroniser ring (see also Fig. 3.14.). After fitting the 5th speed gearwheel to the mainshaft, fit the thrust washer and the circlip and measure the gap between the thrust washer and the circlip. The normal clearance is between 0.1 - 0.3 mm (0.004 - 0.012 in.). Fit a thrust washer of different thickness to correct the gap. Thrust washers are available in different thicknesses from 6.2 to 7.2 mm (0.2362 to 0.2835 in.) in steps of 0.1 or 0.2 mm (0.004 or 0.008 in.) between sizes.

When fitting the centre housing, align the threaded hole in the centre housing with the reverse idler shaft boss to insert the bolt. The 5th speed gearwheel for the countershaft is fitted with the "F" mark facing to the front of the shaft.

After fitting the thrust washer and the circlip to the rear end of the mainshaft, measure the gap between circlip and thrust washer. This clearance should be between 0 - 0.15 mm (0 - 0.006 in.) and can be corrected by fitting a thrust washer of different thickness (4 available).

Fig. 3.17. shows an exploded view of the gearwheels and the shafts and should be referred to during assembly. Fig. 3.16. shows the gearbox casing components.

3.5. Tightening Torque Values

Main shaft locknut:	21.0 - 25.0 kgm (151 - 180 lb.ft.)
Shift lock plugs:	4.5 - 5.5 kgm (33 - 40 lb.ft.)
Plug for interlock pin hole:	1.0 - 1.5 kgm (7 - 11 lb.ft.)
Control lever to control rod:	2.8 - 3.4 kgm (20 - 25 lb.ft.)
Selector fork set screws:	0.9 - 1.3 kgm (7 - 9 lb.ft.)
Reverse lock spring cap:	4.5 - 5.5 kgm (33 - 40 lb.ft.)
Bottom cover to case:	0.6 - 0.9 kgm (4 - 7 lb.ft.)
Reverse lamp switch:	2.5 - 3.5 kgm (18 - 25 lb.ft.)
Extension to gearbox case:	2.0 - 2.5 kgm (15 - 18 lb.ft.)

4. PROPELLER SHAFT

4.0. Description

The 929 is fitted with a propeller shaft of conventional design, with spider-type universal joints and a sliding yoke to take the drive from the gearbox. It consists of a two-part tubular steel shaft, supported by a centre bearing. Universal joints are fitted to the front, centre and rear of the propeller shaft. The joints can be serviced and snap rings are available in different thicknesses to enable the axial clearance of the spider to be controlled.

All propeller shafts are balanced in production. To maintain this balance, it is essential that all parts are marked before removal to ensure re-assembly in the correct position. Take precautions to avoid damage or distortion during servicing. Do not strike the shaft or apply any leverage during dismantling or assembly.

4.1. Technical Data

Type:	Two-part tubular shaft with universal joints and sliding yoke.
Max. distortion, measured at the centre of the shaft with each end in V-blocks:	0.4 mm (0.016 in.)
Spider diameter:	14.72 mm (0.580 in.)

4.2. Removal and Installation

Raise the vehicle and support on stands. If available, a pit or garage-type lift will provide easier access. Mark the flanges of the propeller shaft and the rear axle drive flange by means of a punch or chisel. Remove the bolts and nuts securing the heat insulators to the exhaust front pipe and remove the insulators. Disconnect the exhaust front pipe from the manifold and from the mounting brackets. Then remove the bolts and nuts securing the exhaust front pipe flange from the main silencer and lift out the pipe.

Remove the four bolts securing the rear flange to the final drive flange and unscrew the centre bearing from the floor panel. Withdraw the propeller shaft from the gearbox end and lift from underneath the car. Tie a plastic bag around the end of the gearbox to avoid the loss of gearbox oil.

To install the propeller shaft, first apply a little M.P. grease to the sleeve splines and to the outer diameter where it fits into the gearbox. Check that all marks are in line and insert the flange bolts and also the centre bearing support bolts. Tighten the bolts to the specified torque setting. Refit the front exhaust pipe and the heat insulators.

4.3. Inspections

Place the shafts on V-blocks at the ends and check with a dial indicator that the run-out limit (bend limit) is not exceeded (see "Technical Data"). Inspect all parts of the universal joints for wear, damage, corrosion or excess end-float. Check the splines of the yoke and the oil seal bearing surface. Clean both flange surfaces and remove any burrs or marks.

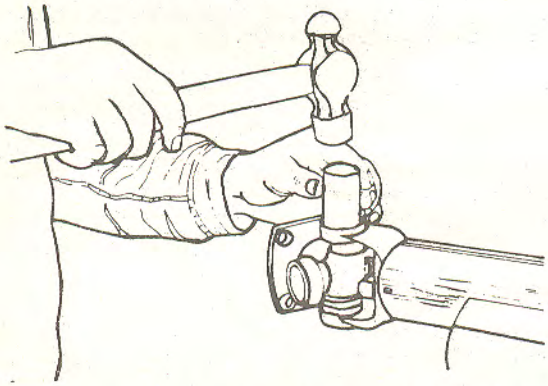


Fig. 4.1. — Dismantling a universal joint by driving one of the bearing cups into the yoke and removing the other cup.

4.4. Servicing

4.4.0. UNIVERSAL JOINTS

To dismantle the universal joints, first make matching

marks on the yokes and shaft and then remove the snap rings. Using a hammer and a suitable drift, drive one of the bearing cups towards the inside and remove the opposite bearing cup from the yoke. The drift used should be equal to the diameter of the bearing cups. Remove the remaining bearing cup from the yoke by pressing against the spider. Remove the other bearing cups of the second yoke in a similar manner. Fig. 4.1. shows how the first cup is removed.

Examine the bearing surfaces of the spider, measuring their diameters by means of a micrometer. If the wear of the spider journals exceeds 0.1 mm (0.004 in.), i.e. based on the standard diameter of 16.55 mm (0.6516 in.), replace with a new one. Inspect the needle rollers for wear or damage. The rollers should have a good appearance and roll freely inside the bearing cups. Fig. 4.2. shows an exploded view of one of the universal joints.

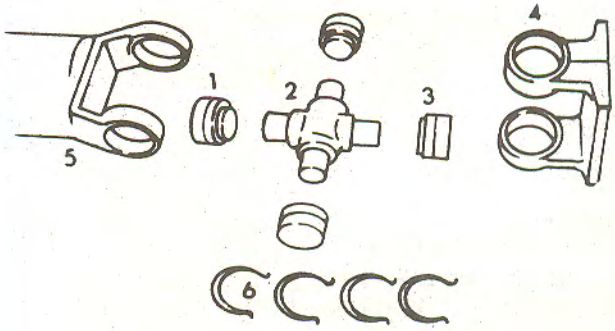


Fig. 4.2. — The component parts of a universal joint.

1.	Bearing cup	4.	Yoke
2.	Spider journal	5.	Propeller shaft
3.	Oil seal	6.	Retaining ring

Grease the inside of the bearing cup and assemble the needle rollers into the cups. Fill the cups with grease to retain the rollers in position. Fit the bearing seal to the cup. Insert the spider into the yoke bore and drive one of the bearings into the yoke. Now insert the second bearing cup from the opposite side of the yoke until the circlips can be inserted into their grooves on both sides. Install

the remaining bearings to the second yoke in a similar manner. To correct excessive axial clearance, select a circlip that will give a minimum of clearance. Circlips are available in nine different thicknesses, ranging from 1.22 to 1.38 mm (0.048 to 0.054 in.) in steps of 0.02 mm (0.008 in.) between sizes. Make sure that the circlips are seated properly in their grooves.

NOTE: Ensure that only circlips of the same thickness are fitted to both sides of any one yoke. Do not re-use the original circlips.

4.4.1. CENTRE BEARING

To renew the centre bearing, remove the universal joint next to it, which will give access to the large nut that secures the yoke to the front shaft. Mark the yoke before removal. Pull the bearing off the front of the shaft. Note that a high tightening torque is needed for the nut.

4.5. Tightening Torque Values

Yoke to rear axle flange:	3.5 - 3.8 kgm (25 - 27 lb.ft.)
Centre bearing to shaft:	16 - 18 kgm (116 - 130 lb.ft.)
Centre bearing support:	2.0 - 2.9 kgm (14 - 21 lb.ft.)

5. REAR AXLE

5.0. Description

The Mazda vehicles covered in this Repair Guide are equipped with a semi-floating type rear axle with a hypoid final drive unit. The drive pinion bearing pre-load adjustment is carried out by means of a collapsible spacer and shims. The crown wheel (drive gear) and the drive pinion are both mounted in taper roller bearings.

5.1. Technical Data

Final drive type:	Hypoid bevel gear
Number of differential gears:	2 or 4
Crown wheel and pinion, number of teeth:	43/11
Backlash of crown wheel:	0.17 - 0.19 mm (0.0067 - 0.0075 in.)
Mesh depth of pinion:	90 ± 0.025 mm (5.5434 ± 0.001 in.)
Pre-load of pinion bearings:	9 - 14 cmkg (7.8 - 12.2 lb.in.)
Pre-load of differential bearings:	6 - 16 cmkg (5.2 - 13.9 lb. in.)
Spread of final drive case:	185.5 - 0.072 mm (7.3033 - 0.0028 in.)
Backlash between differential gears:	0.1 mm (0.004 in.)
Lubricant:	
Capacity:	1.3 litres (2.8 U.S. pints, 2.2 Imp. pints)
Oil type:	
Below −18° C (0° F):	Hypoid Gear Oil SAE 80
Above − 18° C (0° F):	Hypoid Gear Oil SAE 90
End float of rear wheel bearings:	0 - 0.1 mm (0 - 0.004 in.)

5.2. Rear Axle Shaft

5.2.0. REAR AXLE SHAFT – REMOVAL AND INSTALLATION

Jack up the rear of the vehicle and support on stands. Remove the wheel and the brake drum. Remove the brake shoes as described in Section "Brakes" under the appropriate heading. Remove the four brake back plate securing bolts, at the same time separating the bearing cover from the rear axle tube. Withdraw the axle shaft from the housing by using a slide hammer attached to the wheel studs. Remove the back plate from the shaft.

Service the bearing as detailed in the next section.

Install the rear axle shaft in the reverse sequence, noting the following points:

Grease the lip of the oil seal in the rear axle tube and insert the axle shaft with the bearing into the axle tube, engaging the splines of the shaft with the splines in the inside of the differential side gear. Firmly push the shaft against the axle tube and measure the gap between the tube and the brake back plate by means of a feeler gauge (see Fig. 5.1.). If necessary insert a shim between the axle tube and the brake back plate to adjust the gap to between 0 - 0.1 mm (0 - 0.004 in.). Shims are available in thicknesses of 0.1 and 0.4 mm (0.004 and 0.016 in.)

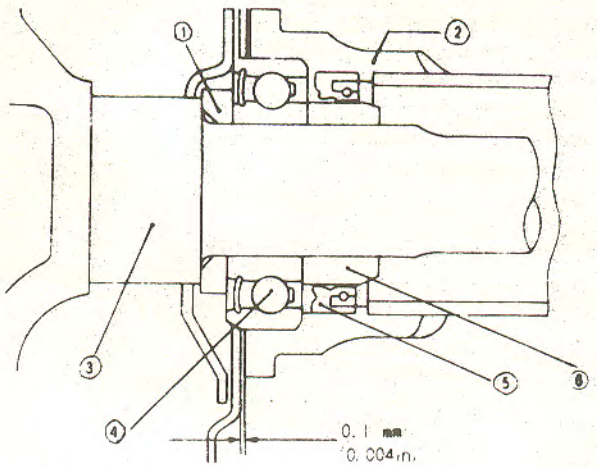


Fig. 5.1. — Checking the clearance between the brake back plate and the rear axle housing.

and should be inserted with sealing compound. Refit the brake back plate and the bearing cover to the axle tube and tighten the nuts to 2.5 kgm (18 lb.ft.). Refit the brake shoes (see Section "Brakes"), brake drum and rear wheel. Finally check the oil level in the final drive housing.

NOTE: The end float can also be measured by checking the depth of the bearing seat in the axle tube (depth gauge) and measuring the width of the axle shaft bearing. The difference between the two measurements indicates the required thickness of the shim.

5.2.1. BEARING REPLACEMENT

A bearing remover set (49 0259 745) is available to remove the wheel bearing from the rear axle shaft. This press tool will fit below the bearing spacer between the end of the shaft and the bearing. If this press tool is not available, grind off the bearing inner retaining ring and split it with a cold chisel. Then press the bearing off the shaft, supporting the bearing well from underneath. Remove all parts from the shaft. When the bearing is replaced, always check the oil seal in the rear axle tube and renew if necessary. Fig. 5.2. shows an exploded view of an axle shaft and gives the location of the various parts.

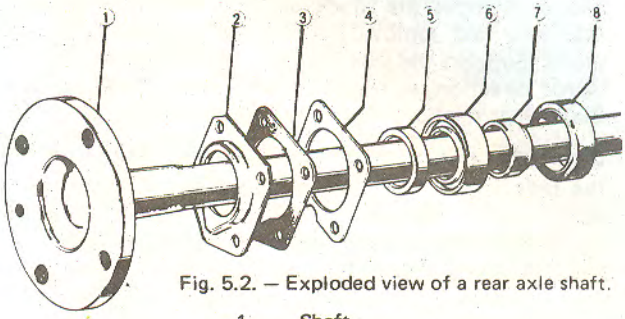


Fig. 5.2. — Exploded view of a rear axle shaft.

1. Shaft
2. Bearing housing
3. Gasket
4. Adjusting shim
5. Spacer ring
6. Shaft bearing
7. Retaining ring
8. Oil seal

To assemble the rear axle shaft, slide the parts in the order shown over the shaft and press on a new bearing with the identification mark on the bearing facing towards the differential, i.e. to the splined end of the shaft. Press on the bearing until the spacer rests against the shaft collar. Now press the bearing retaining ring onto the shaft until it is in firm contact with the bearing inner race. Note that a press force of 3 tons. (6600 lbs.) is necessary to fit the retaining ring, so that this operation may have to be carried out at your Mazda Dealer.

When fitting the new oil seal into the axle tube (seal lip well greased), use a drift, the size of which covers the diameter of the oil seal. Drive in the seal squarely.

5.2.2. REAR AXLE — REMOVAL AND INSTALLATION

Note that the complete differential and final drive unit can be removed from the rear axle casing by withdrawing the half shafts and removing the propeller shaft to enable the carrier to be withdrawn from the axle casing. If the axle casing is to be removed from the vehicle, first support the vehicle at the rear jacking points and remove the road wheels.

Drain the axle lubricant and disconnect the propeller shaft at the flange. Disconnect the brake hose from the pipe connection and the handbrake (parking brake) cables. Remove the shock absorber mounting from the rear axle and remove the "U" bolt securing nuts and plates. Support the axle on a jack and remove it in a rearwards direction, at the same time freeing the axle from the springs to allow it to be lowered to the ground.

Install the axle in the reverse sequence. Make sure that the hole in the "U" bolt seat lines up with the centre bolt of the rear springs on both sides of the rear suspension. Bleed and adjust the brakes and refill the axle casing with lubricant.

5.3. Final Drive and Differential

5.3.0. REMOVAL AND INSTALLATION

No special instructions are necessary for the removal of the final drive since these will be obvious from a study of the instructions already given. Refill the axle with the recommended lubricant after installation of the final drive and double-check that both filler and drain plugs are in position and securely tightened.

5.3.1. DISMANTLING

Dismantling and adjustment of the final drive should only be carried out if the appropriate tools are available. It will also be necessary to have access to the various spacers and shims that are an essential requirement to set the mesh depth and pre-load values.

Dismantle by first clamping the carrier to a suitable stand. Mark, with a centre punch, the bearing caps, the adjusting nuts and the carrier. This is essential since all parts must be re-assembled in the same position. Remove the bolts securing the adjusting nut lock plates and then take out the bearing cap bolts. Slightly slacken the adjusting nuts by means of special wrench 49 0259 720 or a suitable peg spanner to release the pre-load of the differential bearings. Lift off the bearing caps and adjusting nuts and lift out the differential assembly, keeping the outer races together with their cones and rollers.

The differential side bearings can be removed with a suitable two-arm puller. Remove the bolts and washers securing the crown wheel to the differential case and separate the crown wheel from the differential case. The position of the crown wheel should be marked before removal by means of a centre punch. To remove the differential gears, first unscrew the differential case cover bolts, separate the halves and lift off the cover. Remove side gears, pinion gears and spider.

5.3.1.0. Removal of Drive Pinion

Hold the drive pinion flange with a suitable tool and remove the drive pinion nut. Take care that the pinion cannot drop after the nut is completely removed. Withdraw the flange and remove the drive pinion from the differential carrier. If necessary, slight taps with a plastic mallet will facilitate this operation. Remove the pinion oil seal and the pinion front bearing. If necessary remove the pinion rear bearing from the shaft. The pinion outer bearing races can be removed from the differential carrier by using a brass drift, inserted into the slots provided for this purpose (see Fig. 5.3.).

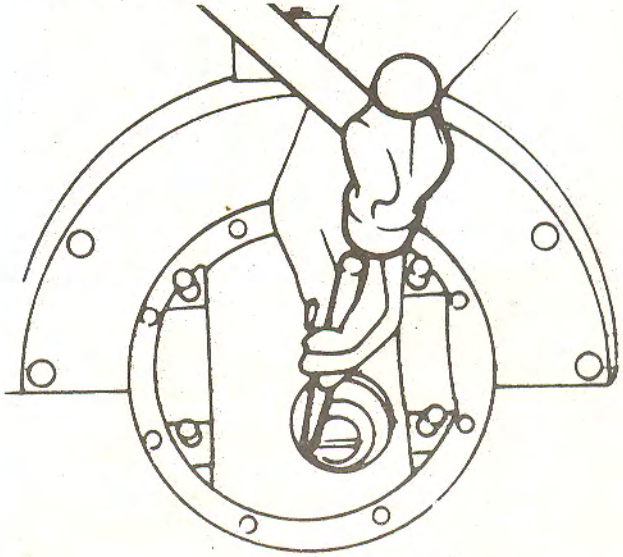


Fig. 5.3. — Outer bearing races can be driven out of their seats in the differential carrier as shown.

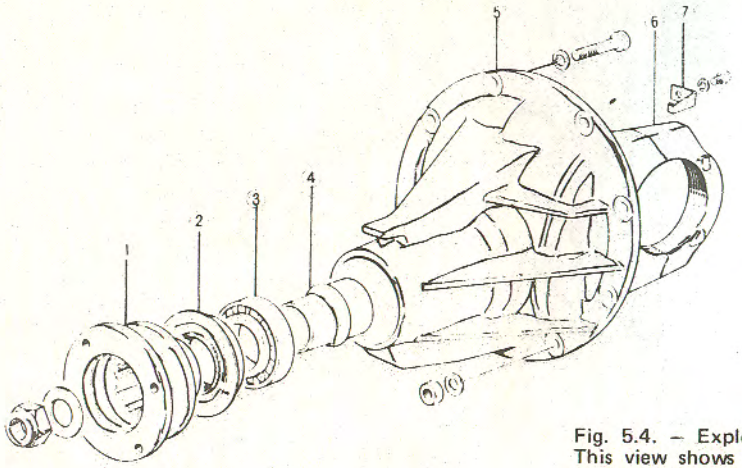
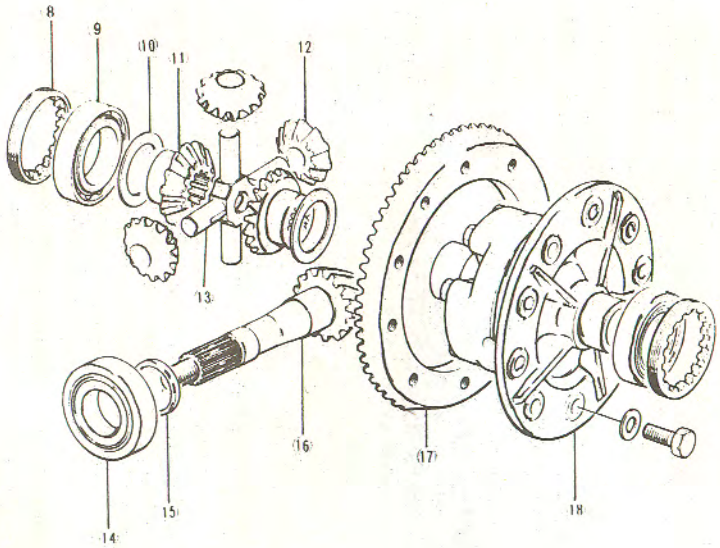


Fig. 5.4. – Exploded view of the rear axle and differential. This view shows the differential with four bevel pinions. See Section 5.4. for differential with two bevel pinions.



1. Drive flange
2. Oil seal
3. Front bearing
4. Collapsible spacer
5. Differential carrier
6. Bearing cap
7. Adjuster lock plate
8. Adjuster nut
9. Differential bearing
10. Thrust washer
11. Differential side gear
12. Differential pinion gear
13. Spider
14. Rear bearing
15. Spacer
16. Drive pinion
17. Crown wheel
18. Differential case

5.3.2. INSPECTION OF PARTS

Fig. 5.4. shows an exploded view of the final drive and differential assembly and should be referred to when identifying the following parts:

Crown Wheel and Pinion: Check the crown wheel and the pinion for damage or excessively worn teeth, damaged bearing journals and splines. Inspect the crown wheel for chipped teeth. If necessary, crown wheel and pinion must be replaced together as a set.

Differential Gears: Inspect the differential side gears and pinions and the thrust washers for wear, cracks, chipped teeth or any other damage. Check the fit of the differential pinion shaft in the bevel pinions and fit new parts if the clearance is excessive. Slide the two side gears over their respective axle shafts to check their side play on the splines. Side gears or axle shafts must be replaced if the play exceeds 0.3 mm (0.012 in.).

Bearings: Bearings that show signs of excessive side play or discolouration should be replaced. Always replace bearing cones together with their outer races.

Collapsible Spacer: Measure the length of the spacer from end to end. The standard length is 59 $\pm$ 0.15 mm (2.3229 $\pm$ 0.0059 in.).

Oil Seal: Replace the oil seal if the seal lip shows the slightest sign of wear or distortion. Before deciding to re-use an oil seal, check the spring in the inside of the seal lip for distortion. When the final drive is completely overhauled, always replace the oil seal.

5.3.3. ASSEMBLY

5.3.3.0. Assembling the Differential

Fit the thrust washers over the two differential side gears and insert the side gears into their bores in the differential housing. Insert the two bevel pinions through the openings so that they face each other by exactly 180°. Then turn the pinions by 90° until the pinion shaft holes in the differential housing are aligned with the holes in the bevel pinions. Insert the pinion shaft through the case and the pinions. Using a dial gauge, with a suitable holder, check the backlash between side gears and pinions. To do this, hold one of the pinions stationary with the fingers of one hand and move the side gear to and fro with the forefinger of the other hand. The needle of the dial gauge should be resting against one of the teeth of the side gear. If the backlash is not within 0 - 0.1 mm (0 - 0.004 in.), adjust by fitting new thrust washers, which are available in three sizes: 1.6, 1.7 and 1.8 mm (0.063, 0.067 and 0.071 in.). After adjusting turn over the pinions several times to check for tight spots.

Refit the crown wheel in accordance with the marks made during dismantling. If a new crown wheel is used, fit it in any position. Tighten the crown wheel bolts with a torque setting of 5.5 - 6.5 kgm (40 - 47 lb.ft.).

5.3.3.1. Adjusting the Drive Pinion

The mounting distance or the drive pinion mesh depth is shown in Fig. 5.5. and should be adjusted to the value given to obtain a silent operation of the final drive. To adjust, proceed as follows:

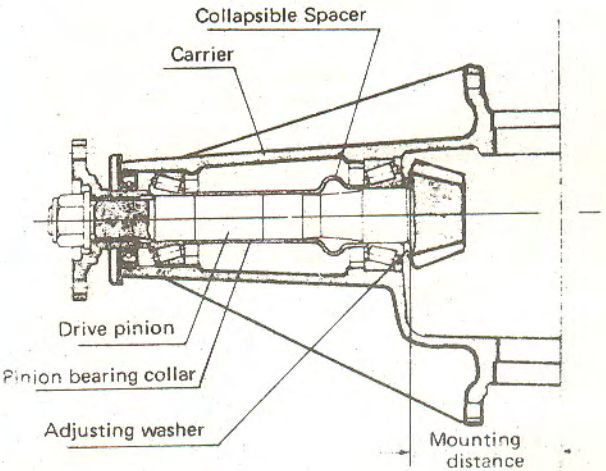


Fig. 5.5. — Sectional view of the drive pinion carrier to show the location of the parts.

Insert the dial gauge into the master gauge 49 0727 570 as shown in Fig. 5.6. and place the assembly into a surface plate. Push the dial gauge downwards until the pointer rotates approx. 3/4 turn clockwise and clamp in position. Set the dial gauge to "Zero" by turning the outer ring.

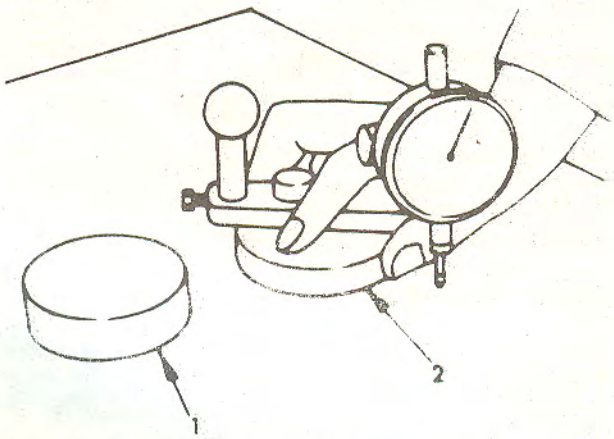


Fig. 5.6. — Using the gauge body (49 0727 570) to set the dial gauge to zero.

Make sure that the differential bearing locating bores are free from dirt or burrs and fit the pinion bearing adjusting washer and the rear pinion bearing over the pinion shaft. Insert the pinion into the differential carrier and place the gauge block 49 0305 555 on top of the ground face of the pinion as shown in Fig. 5.8. Now place the master gauge on the gauge block so that the needle of the dial gauge rests in the lowest part of the differential bearing locating bore. Read off the dial gauge and record the reading. Remove the pinion from the carrier, withdraw the pinion rear bearing and measure the thickness of the adjusting washer originally fitted for the measurement.

If the reading on the dial gauge shows a "+" value, this indicates that the original washer is too thick and should be replaced by a thinner washer. If the reading is "–", replace the washer by a thicker washer. Before deciding on the thickness of the washer, place the master gauge once more on the surface plate and check if the "Zero" setting is still obtained.

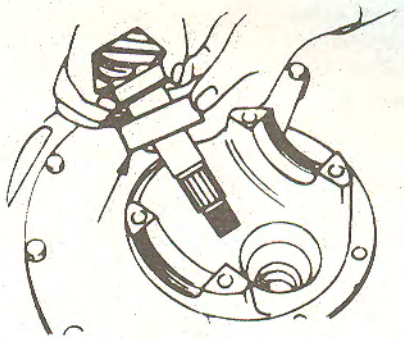


Fig. 5.7. — The arrow shows the dummy bearing on the pinion shaft. The spacer should be placed between the bearing and the pinion head.

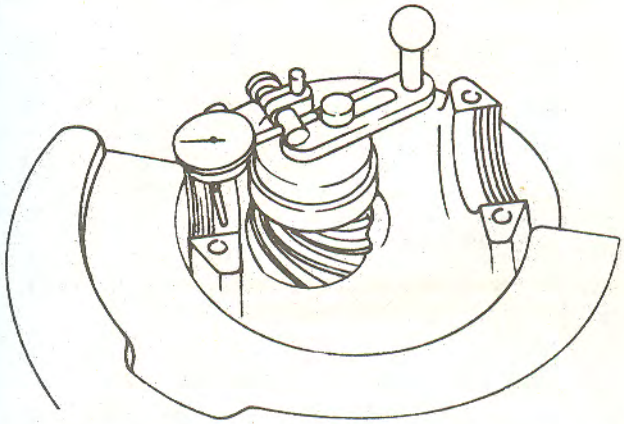


Fig. 5.8. — The dial gauge, the setting gauge and the gauge block (49 0305 555) in position in the differential carrier.

Now place the dummy bearing and the actual rear pinion bearing onto a surface plate and compare their height as shown in Fig. 5.9. If the actual bearing is higher than the dummy bearing, subtract the difference from the washer thickness. If the actual bearing is lower than the dummy bearing, add the difference to the washer thickness.

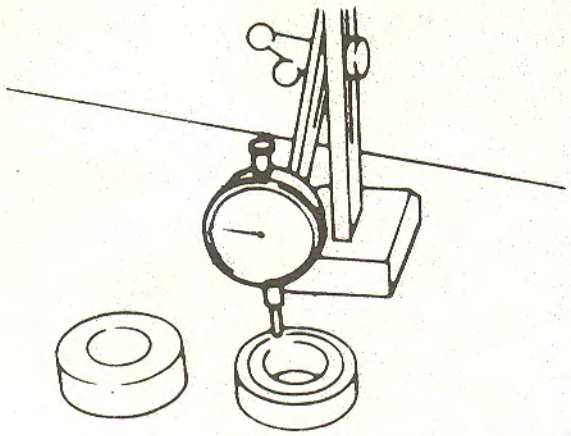


Fig. 5.9. – Comparing the heights of the dummy bearing and the actual pinion bearing with a dial gauge (on a surface plate).

NOTE: To compensate manufacturing tolerances, the pinion is marked with a "+" or "–" value, which is recorded in 1/100 millimetres. If the pinion is marked with a plus sign ("+"), for example "+2" = 0.02 mm – then subtract this amount from the thickness of the newly found pinion adjusting washer. Is the pinion mark a minus value ("–"), add the amount to the thickness of the pinion adjusting washer.

Place the determined adjusting washer onto the pinion shaft and press the pinion rear bearing over the shaft.

5.3.3.2. Adjusting the Pinion Bearing Pre-load

Drive in the pinion bearing cups into the differential carrier. Slide the collapsible spacer over the end of the pinion shaft and position the drive pinion shaft assembly into the carrier (as in Fig. 5.7.). Slide the pinion front bearing cover over the shaft and drive it in until it is fully seated. Grease the lips of the pinion oil seal and install the seal into the carrier. Fit the drive flange to the pinion shaft end and secure with washer and nut. Before tightening of the pinion nut attach a spring scale to the drive flange and turn the flange by pulling on the spring scale to check the drag of the pinion seal. Add the amount of the oil seal drag to the specified pre-load of 2.1 - 3.3 kg (4.60 - 7.30 lb.), as this is the value for the bearing pre-load WITHOUT oil seal. Now tighten the pinion nut to a torque reading of 14 kgm (101 lb.ft.). DO NOT EXCEED THIS VALUE.

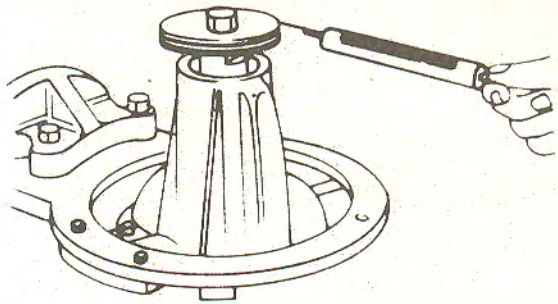


Fig. 5.10. – Checking the pinion bearing pre-load by means of a spring scale attached to the flange.

Re-check the bearing rotating torque as shown in Fig. 5.10. If the indication is within the specification, the bearing pre-load adjustment is satisfactory. If the torque required to rotate the pinion drive is less than specified, tighten the pinion nut a little at a time, re-checking the torque frequently. NEVER OVER–TIGHTEN. The max. permissible tightening torque is 18 kgm (130 lb.ft.). If excessive pre-load has resulted from over-tightening of the nut, the collapsible spacer must be replaced. If on the other hand the tightening torque of the pinion nut is less than 14 kgm (101 lb.ft.) when the pre-load figure has been reached, change the collapsible spacer.

5.3.3.3. Installation of the Differential

Place the assembled differential into the differential carrier and check that the marks for the backlash adjustment on the side of the pinion face and the crown wheel teeth are aligned with each other. As the adjusting nuts have right-hand and left-hand thread, note the identification marks and fit each to its respective side. Fit the bearing caps in accordance with the marks made during dismantling and tighten the nuts fingertight. Now turn the adjusting nuts by means of wrench 49 0259 720 or a suitable peg spanner until the bearings are properly positioned in their outer races and all end-play is eliminat-

ed. There must, however, exist some backlash between crown wheel and the drive pinion. Slightly tighten one of each of the bearing cap nuts and adjust the backlash as follows:

Fit a dial gauge to the differential carrier so that the needle of the gauge rests at right angles on one of the crown wheel teeth. Check the backlash between the teeth at four or five different points. Adjust each of the adjusting nuts by the same amount until the mean value of the four or five measurements is between 0.17 - 0.19 mm (0.0067 - 0.0075 in.). After this operation adjust the differential bearing pre-load as follows:

By means of a large micrometer or a calliper or a large vernier gauge, measure the spread of the differential carrier at the positions shown in Fig. 5.11. The bearing pre-load is adjusted by tightening the adjusting nuts. Tighten the nuts until the distance between the two faces shown in Fig. 5.11 is 185.428 mm (7.3004 in.). A tolerance of −0.072 mm (0.0028 in.) is permissible.

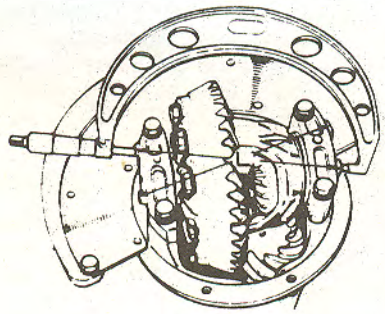


Fig. 5.11. — To adjust the differential side bearing pre-load, the assembled differential must be measured as shown. Measuring instruments for this operation are mentioned in the text.

NOTE: When adjusting the pre-load, take care not to affect the setting of the backlash between the drive pinion and the crown wheel.

After correct adjustment, tighten the differential bearing caps to 4.0 kgm (30 lb.ft.) and fit the lock plates for the adjusting nuts so that they engage into one of the holes of the nuts. Finally check the tooth marking of the

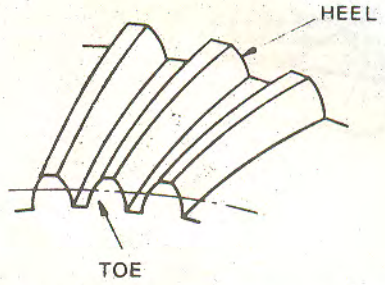


Fig. 5.12. — The correct tooth contact pattern on the crown wheel teeth.

crown wheel by smearing a little engineer's blue on the pinion teeth. Rotate the pinion whilst restraining the crown wheel with a block of wood. An ideal marking should be as shown in Fig. 5.12. The corrections possible are as follows:

To correct heel contact (towards outer edge), or face contact (high up on tooth flanks): Move the pinion towards the crown wheel.

To correct toe contact (towards inner edge), or flank contact (low down in root of teeth): Move the pinion away from the crown wheel.

All the above references are to the crown wheel markings. The differential must be re-adjusted if any of these corrections are carried out.

5.4. Two-Pinion Differential

Some final drive assemblies may have a slightly different differential. In this case the differential only has two pinion gears and the dismantling and assembling is therefore different. Dismantle as follows:

First drive out the securing pin fro the differential pinion shaft from the side shown in Fig. 5.13. Then drive out the differential pinion shaft, turn the differential gears by 90° and remove the pinion gears through the opening in the differential case. Differential side gears and thrust washers are now free for removal.

When assembling the differential, insert the two bevel gears through the openings so that they face each other

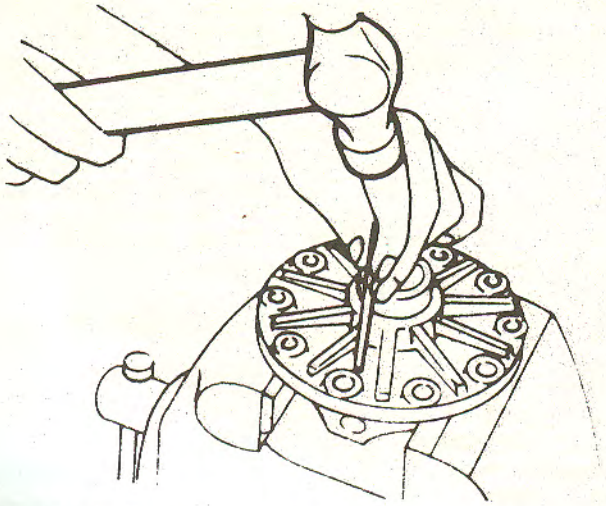


Fig. 5.13. — When dismantling the differential, drive out the differential pinion shaft securing pin from this side of the differential housing.

by exactly 180°. Then turn the pinions by 90° until the pinion shaft holes in the differential housing are aligned with the holes in the bevel pinions. Insert the pinion shaft through the case and the pinions. Check the backlash between the side gears and pinions in the same manner as described previously for the 4-pinion differential and after adjusting, insert the pinion shaft securing pin from the opposite side of the differential housing to that shown in Fig. 5.13. Peen over the ends of the pin and secure it in position.

The remaining operations are carried out in the same manner as described for the 4-pinion differential. The crown wheel bolts should be tightened to the torque value given in Section 5.5. The bolts are fitted with lock washers.

5.5. Tightening Torque Values

Propeller shaft to rear axle flange:	3.5 - 3.8 kgm (25.0 - 27.0 lb.ft.)
Crown wheel to pinion:	5.5 - 6.5 kgm (40.0 - 47.0 lb.ft.)
Differential case halves:	2.5 - 3.0 kgm (18 - 21 lb.ft.)
Differential bearing caps:	3.2 - 4.7 kgm (23 - 34 lb.ft.)
Drive flange to pinion:	See Section 5.3.3.2.
Propeller shaft to flange:	3.5 - 3.8 kgm (25 - 27 lb.ft.)
Rear axle to housing:	2.3 - 2.7 kgm (17 - 19 lb.ft.)

6. REAR SUSPENSION

6.0. Description

The rear suspension of the 929 is by leaf springs and shock absorbers. The shock absorbers are filled with gas under pressure WHICH SHOULD NOT BE DIS–MANTLED. If a shock absorber is found defective, always replace it.

6.1. Technical Data

Type:	Leaf spring suspension with gas-filled shock absorbers and torque rod between axle housing and frame
Number of leaves:	4 — Estate 6
Length of leaves:	1150 mm (45.28 in.)
Width of leaves:	50 mm (1.97 in.)
Thickness of leaves:	
Saloon, Hardtop ECE:	6.0 mm (0.24 in.)
Hardtop, except ECE:	No. 1 & 4 = 6 mm (0.24 in.) No. 2 & 3 = 7 mm (0.28 in.)
Estate Car:	No. 1 = 6 mm (0.24 in.) No. 2 to 5 = 5 mm (0.20 in.) No. 6 = 12 mm (0.47 in.)

6.2. Rear Suspension

6.2.0. SHOCK ABSORBERS — REMOVAL AND INSTALLATION

With the rear of the vehicle resting on stands, remove the rear seat and undo the fasteners to take out the fuel tank partitioning board. Remove the nuts, washers and the rubber bush from the upper shock absorber end and remove the nuts and rubber mounting from the bottom end of the shock absorber. Remove the shock absorber.

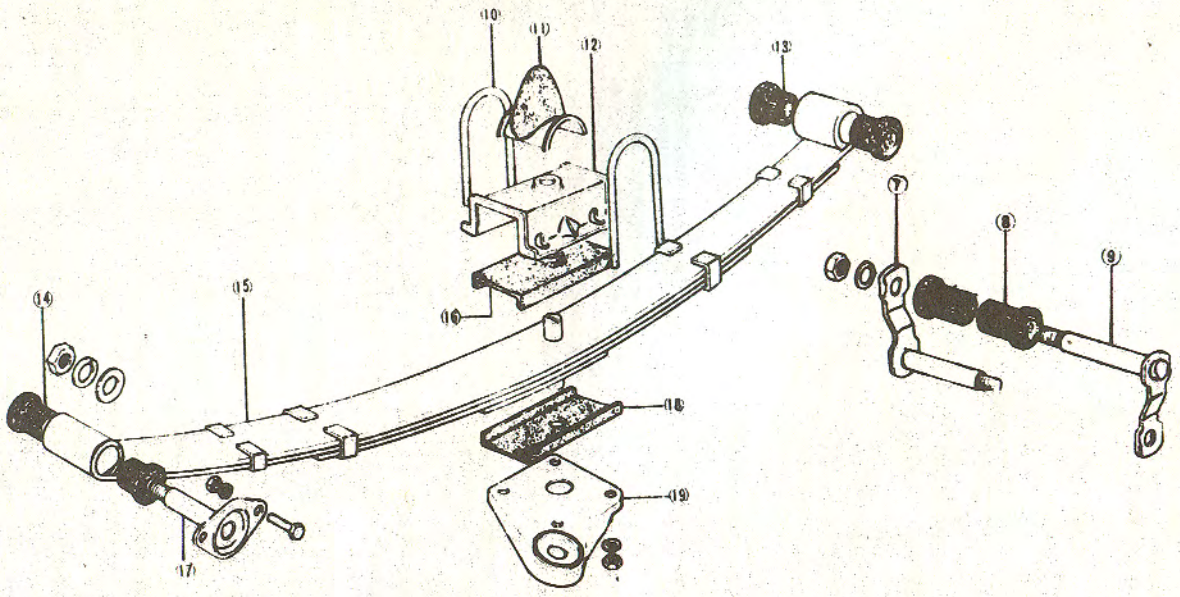
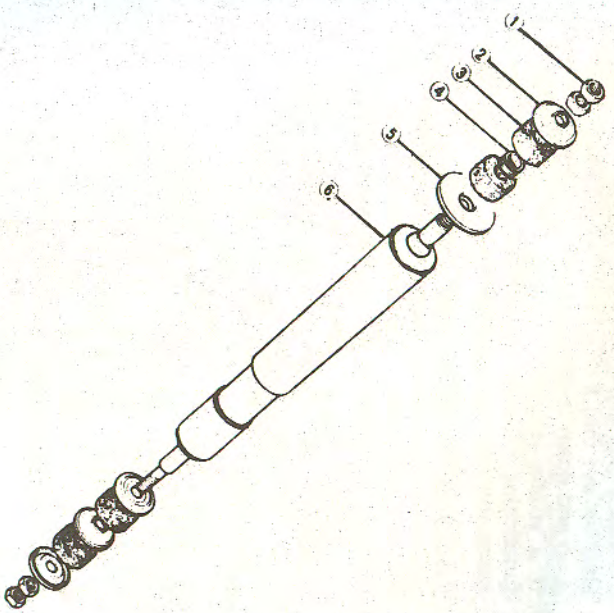


Fig. 6.1. – Exploded view of the rear suspension.

1. Nut
2. Washer
3. Rubber bush
4. Rubber bush
5. Washer
6. Rear shock absorber
7. Spring shackle plate
8. Rubber bush
9. Spring shackle
10. Spring "U" bolt
11. Rebound rubber
12. Spring retainer
13. Rubber bush
14. Rubber bush
15. Rear spring
16. Rubber pad
17. Spring pin
18. Rubber pad
19. Spring clamp plate



To check the shock absorber, clamp the lower shock absorber eye into a vice in an upright position and work it up and down in its full length of travel several times. If a strong resistance is felt, the shock absorber is functioning properly. No resistance or sudden free movements requires the replacement of the shock absorber.

The installation of the shock absorbers is carried out in reverse to the removal procedure. When tightening the shock absorber nuts, make sure that the stud is protruding by 11.1 mm (0.44 in.) at the upper end and by 5.5 mm (0.22 in.) at the lower end, above the face of the locknut. Fig. 6.2. shows a diagram of these dimensions.

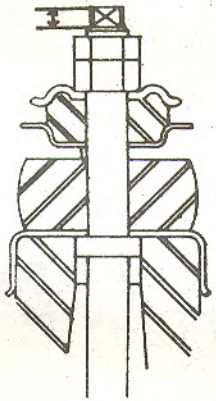


Fig. 6.2. – When tightening the upper mounting nuts of the shock absorbers, make sure to obtain the dimension shown by the arrows (see text above).

6.2.1. REAR LEAF SPRINGS – REMOVAL AND INSTALLATION

Refer to Fig. 6.1. for an exploded view of the rear suspension. To remove a spring, place the vehicle on stands and disconnect the lower mounting of the shock absorber. Remove the securing nuts from the "U" bolts and jack up the rear axle until it is clear of the spring. Remove the "U" bolts, spring pad and retainer. Remove the rear spring shackle after undoing the nuts and driving the shackle pins through their locations. Remove the bracket pin nut at the spring front end and unscrew the two bolts securing the bracket pin to the side of the frame. Pry off the bracket pin with a screwdriver as shown in Fig. 6.3.

CAUTION! Make sure that the spring is properly supported and take care to avoid injury.

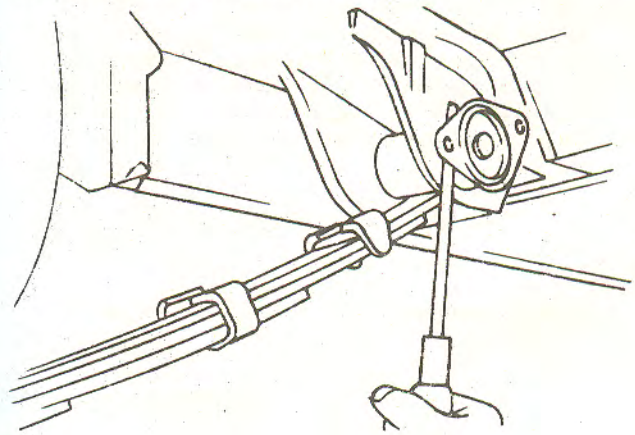


Fig. 6.3. – Removal of the front spring pin. A screwdriver is inserted as shown to pry out the pin.

Thoroughly clean the spring and check the spring leaves for wear, cracks and other damage. If necessary, replace the complete spring, mainly when the vehicle has covered a large mileage.

To refit, insert the two rubber bush halves (14 in Fig. 6.1.) into the front spring eye and insert the eye between the spring hanger. Insert the spring eye pin (17) from the outside and attach the nut, spring washer and washer from the inside without tightening the nut. Fit the bracket pin plate to the spring hanger. Insert the rubber bushes (8 and 13) at the rear end into the spring eye and the spring hanger and then drive in the shackle pins (7 and 9) from the sides shown in the illustration. Secure the shackle pins with the washers and nuts, without tightening the nuts completely.

Fit the spring retaining plate (19) with the rubber pad (18) from below the spring and lower the jack slowly, engaging the centre pin of the spring into the locating hole in the axle pad. Fit the upper rubber pad (16) and the rubber pad holder (12) on top of the spring and

insert the "U" bolts (10) together with the rebound rubber (11) without damaging their threads. Tighten the "U" bolt nuts to a torque reading of 3.8 - 4.6 kgm (27 - 33 lb.ft.). The remaining operations are carried out in reverse order to the removal procedure. With the wheels of the car resting on the ground, tighten the spring pin nut and the spring shackle nuts to a torque setting of 4.0 kgm (30 lb.ft.). Before final tightening of the nuts, bump the car up and down several times in order to settle the suspension.

7. FRONT SUSPENSION

7.0. Technical Data

Type of suspension:	Independent suspension, McPherson strut-type with hydraulic shock absorbers, coil springs, suspension arms and stabiliser bar
Shock Absorbers:	
Type:	Hydraulic
Diameter of Piston Rod:	
New:	20.0 mm (0.7874 in.)
Wear limit:	19.94 mm (0.785 in.)
Max. run-out of rod:	0.15 mm (0.006 in.)
Pressure tube inner diameter:	30.0 mm (1.1811 in.)
Wear limit:	30.07 mm (1.1839 in.)
Max. run-out of pressure tube:	0.2 mm (0.008 in.)
Fluid capacity:	270 c.c.
Coil Springs:	
Wire diameter:	
Saloon, Estate and Hardtop for ECE:	11.8 mm (0.46 in.)
Hardtop, except ECE:	11.5 mm (0.45 in.)
Coil diameter:	124 mm (4.84 in.)
Free Length:	
Saloon:	381 mm (15.0 in.)
Estate:	381 mm (15.0 in.)
Hardtop for ECE:	381 mm (15.0 in.)
Hardtop, except ECE:	362 mm (14.25 in.)
Fitted Length:	
Saloon:	203 mm (7.99 in.)
Estate:	203 mm (7.99 in.)
Hardtop for ECE:	203 mm (7.99 in.)
Hardtop, except ECE:	203 mm (7.99 in.)
Fitted Load:	
Saloon, Estate:	299 - 323 kg (659 - 712 lb.)
Hardtop for ECE:	299 - 323 kg (659 - 712 lb.)
Hardtop, except ECE:	295 - 319 kg (650 - 703 lb.)

Front Wheel Alignment

King pin inclination:	
All models:	9° 11'
Camber:	
Saloon and Estate:	1° 02' ± 3'
Hardtop:	1° 02' ± 3'
Max. difference between sides:	30'
Castor:	
Saloon and Estate:	2° 03' ± 45'
Hardtop:	2° 03' ± 45'
Max. difference between sides:	40'
Toe-in setting:	0 - 6 mm (0 - 0.24 in.)

7.1. Front Shock Absorber

7.1.0. REMOVAL

Jack up the front end of the car and place on stands. Remove the front wheel and disconnect the brake fluid pipe. Plug the pipe end to prevent entry of dirt. Unscrew the brake caliper mounting bolts and remove the caliper. Remove the hub grease cap, withdraw the split pin and remove the bearing adjusting nut from the steering

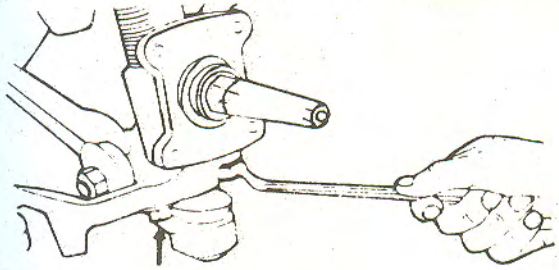
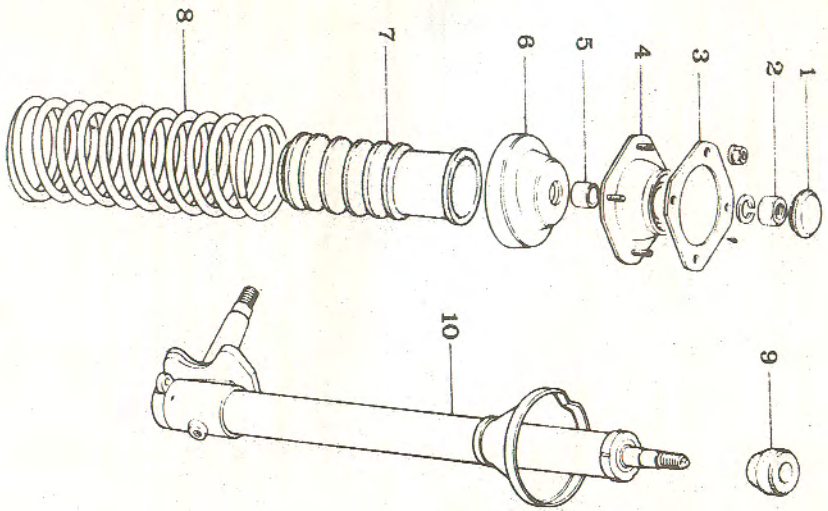


Fig. 7.1. — Removal of the spring strut from the steering knuckle at the bottom of the front suspension.



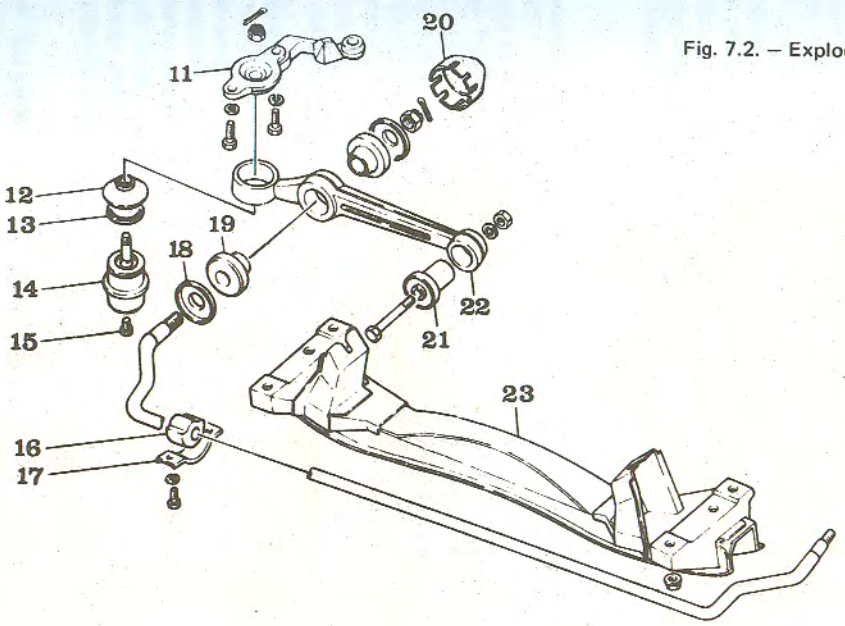


Fig. 7.2. – Exploded view of the front suspension.

1. Cap
2. Nut
3. Road clearance adjusting plate
4. Upper spring strut bearing
5. Spacer tube
6. Upper spring seat
7. Rubber dust boot
8. Coil spring
9. Damper stopper
10. Front shock absorber
11. Steering knuckle arm
12. Rubber dust seal
13. Retaining ring
14. Lower ball joint
15. Plug
16. Rubber bearing
17. Stabiliser bar clamp
18. Dished washer
19. Rubber bush
20. Steering stopper
21. Rubber bush
22. Lower suspension arm
23. Front suspension cross member

knuckle spindle. From below the steering knuckle remove the two bolts securing the shock absorber to the steering knuckle arm and disconnect the track rod end by means of a suitable ball joint puller. From the inside of the engine compartment undo the three nuts securing the shock absorber upper rubber mounting to the front wing apron. Do not remove the nut in the centre of the upper bearing.

7.1.1. DISMANTLING

Clamp the shock absorber into a vice. Compress the coil spring with the spring compressor 49 0223 640A and 49 0223 641 or any other suitable spring compressor that can be placed over four of the coils. Remove the nut in the centre of the upper spring strut bearing, while holding the piston rod at the flats. As this nut is sealed after tightening and it is sometimes difficult to slacken it, we recommend to drive the car to a workshop to undo the nut with a compressed air operated impact wrench. After slackening of the nut, re-tighten it provisionally until it is finally removed.

Now remove the parts from the upper end of the piston rod. Clamp the reservoir tube into a vice equipped with soft-metal jaws and remove the upper cap nut from the reservoir tube. The special wrench 49 0259 700A is necessary for this purpose, in order not to spoil the nut or the tube. A blunt drift can be used if the above tool is not available. Remove the "O" seal ring from the piston rod with a suitably pointed tool. Withdraw the piston rod from the pressure tube and remove the parts shown in the exploded view in Fig. 7.3. in their respective order.

Clamp the upper end of the piston rod into a vice with soft-metal jaws and remove the piston nut from the lower end. In the order shown in the exploded view remove the parts from the piston rod. Withdraw the pressure tube from the reservoir tube and remove the base valve from the pressure tube. Remove the bolt and nut of the bottom valve assembly and slide off the valve seat, relief valves, base valves and the other relief valves. Finally drain the fluid from the reservoir tube.

Check all parts of the dismantled shock absorber in accordance with the values given in the "Technical Data".

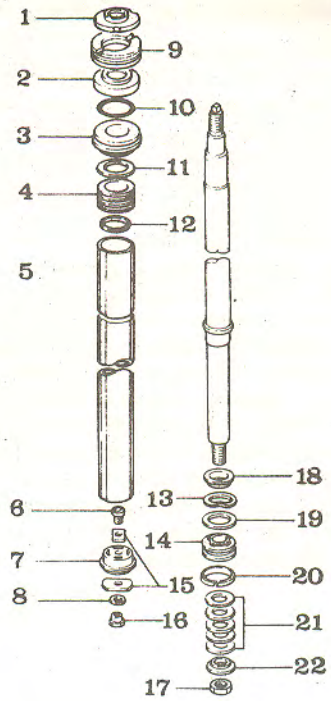


Fig. 7.3. – Exploded view of the inner shock absorber parts.

1. Dust cover
2. Oil seal
3. Piston rod guide
4. Stopper guide
5. Pressure tube
6. Bolt
7. Base valve casing
8. Valve seat
9. Cap nut
10. "O" sealing ring
11. Back-up ring
12. Stopper
13. Check valve spring
14. Piston
15. Relief valve
16. Nut
17. Nut
18. Washer
19. Check valve
20. Piston ring
21. Relief valve
22. Washer

7.1.2. ASSEMBLY OF SHOCK ABSORBER

Clamp the upper end of the piston rod into a vice with soft-metal jaws and fit the parts shown in the exploded view over the piston rod. When fitting the piston ensure that the check valve side faces towards the upper end of the piston rod. Tighten the piston nut to a torque setting of 1.5 kgm (10 lb.ft.) and peen over the threads between the piston nut and the piston rod at two places to secure the nut in position. Fit the four relief valves onto the bolt for the base valve and install the parts into the base valve casing. Then fit the remaining relief valves, the valve seat and the nut to the base valve casing. Tighten the bolt to a torque setting of 0.25 kgm (1.88 lb.ft.) and punch the centre of the bolt to secure in position. Install the stopper guide, back-up ring and piston rod guide into the pressure tube. When fitting the two oil stop rings, arrange the first ring at about 60 mm (2.4 in.) from the base of the pressure tube and the 2nd ring at about 130 mm (5.1 in.) from the base. Now insert the piston rod assembly into the pressure tube and fit the base valve into the bottom end of the tube.

Insert the pressure tube together with the piston rod assembly into the reservoir tube and pour in the correct amount of shock absorber fluid (see "Technical Data"). Grease the lip of the oil seal on the top nut, install the "O" seal ring and fit the top nut slowly on the piston rod. Temporarily tighten the top nut with the piston rod extended to its max. length and finally to a torque value of 5.5 kgm (40 lb.ft.) after the piston rod is fully pushed in. For this operation the special wrench 49 0259 700A should be used.

7.1.3. INSTALLATION

The installation of the shock absorber is carried out in reverse order to the removal procedure.

7.2. Front Suspension Arm – Removal and Installation

With the front of the vehicle resting on stands, remove the road wheel and disconnect the track rod end from the knuckle arm with a suitable puller and unscrew the bolts securing the knuckle arm to the lower end of the shock absorber. Remove the connection between the suspension arm and stabiliser bar and unscrew the arm from the crossmember. If necessary, remove the arm from the lower ball joint.

If necessary, replace the rubber bushes of the suspension arm. Details of the arm mounting are shown in the exploded view in Fig. 7.2.

The installation is carried out in reverse order to the removal procedure. Tighten all nuts and bolts to the specified torque settings at the end of this Section.

7.3. Suspension Ball Joints – Removal and Installation

Remove the suspension arm from the vehicle as already described in Section 7.2. and remove the knuckle joint from the suspension arm by means of a suitable puller (49 0118 850C) after withdrawing the split pin and unscrewing the castellated nut. Take off the retaining ring and the rubber boot from the ball joint and press the ball joint stud out of the suspension arm, using ball joint remover 49 0370 860, if possible. Any other suitable press mandrel can also be used. The same tool is also used for the installation of the new ball joint, with the

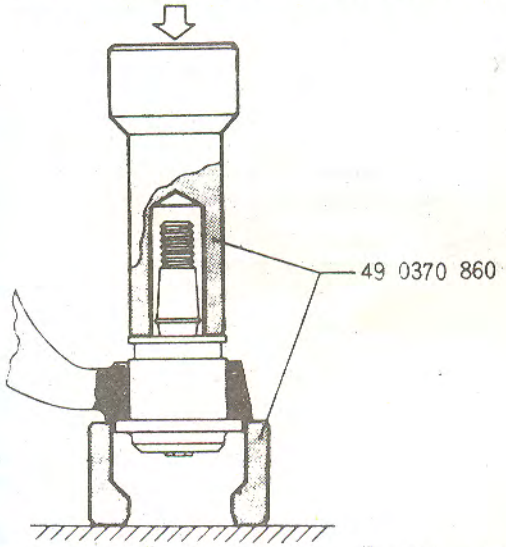


Fig. 7.4. – Removal of the ball joint. The installation of the joint is carried out with the same tool, but this must be turned round for this operation.

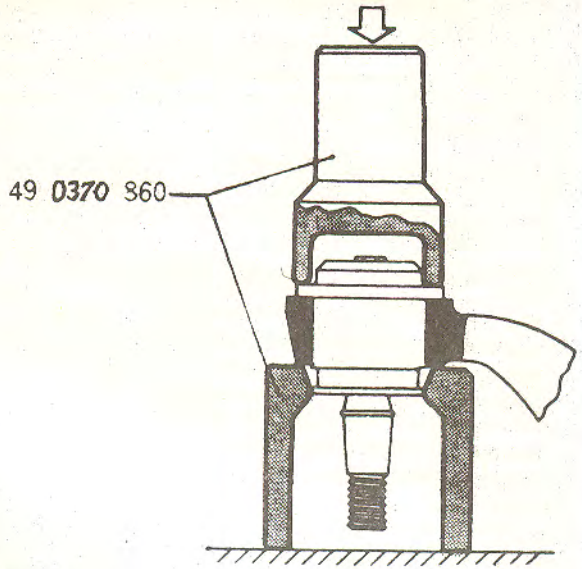


Fig. 7.5. — Installation of the ball joint into the lower suspension arm.

difference that it is applied from the other side of the suspension arm. Fig. 7.4. and 7.5. show how the puller is applied for removal and installation. Note that a pressure of 1500 kg (3300 lbs.) is necessary to press in the new ball joint. If the pressure needed is less than the specified figure, the suspension arm should be replaced.

The installation of the ball joint is a reversal of the removal procedure. Tighten the ball joint nut with a torque reading of 6.0 - 7.0 kgm (43 - 50 lb.ft.). Refit the arm to the shock absorber strut.

7.3.0. LUBRICATION OF SUSPENSION BALL JOINTS

After a mileage of 32,000 miles it may be necessary that the ball joints of the front suspension need re-greasing as described below:

Remove the retaining ring from the groove on the dust cap and turn the dust cap inside out. Remove the exposed plug and screw a grease nipple in its place. Remove all

used grease in the ball socket and the dust cap by pumping new lithium grease through the nipple, using a grease gun. After the old grease has been thoroughly removed, refit the dust cap to the groove of the socket and secure in place with the retaining ring. Add more grease until the dust cap begins to bulge. Then press the dust cap together with the fingers so that about half of the grease remains in the cap. Wipe off excess grease, remove the grease nipple and refit the plug.

7.4. Front Hubs

7.4.0. REMOVAL AND INSTALLATION

Jack up the front of the car and support on stands. Remove the road wheel. Refer to Fig. 7.6. for an exploded view of the hub and disc and dismantle as follows:

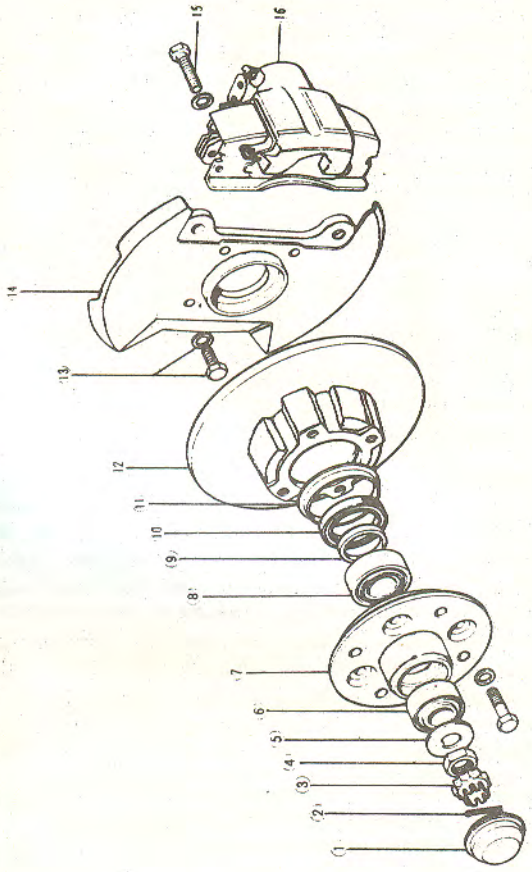
Take off the grease cap, the split pin, the securing castle nut and the bearing adjusting nut together with the washer. Remove the brake caliper from the steering knuckle without disconnecting the brake fluid pipe. Slide the hub assembly off the steering knuckle together with the outer bearing. If necessary unscrew the brake disc from the hub.

Remove the oil seal and the inner wheel bearing with a brass drift. Remove the cup of the outer race in the same manner.

Inspect the bearing races and rollers for wear, discolouration and cracking and replace as necessary. Check the oil seal and replace if necessary.

Install the outer races and then wipe a thick coat of MP grease to the space between the bearings (the old grease should be removed when cleaning the hub). Work a little grease into the bearing cages and rollers and also wipe a thick film over the inner surface of the grease cap.

Fit the oil seal and bearing cone (inner) and place the hub in position. Fit the outer race, washer and nut. Tighten the nut by hand and then refer to the next section to adjust the wheel bearings.



1. Grease cap
2. Split (cotter) pin
3. Nut lock
4. Bearing adjusting nut
5. Flat washer
6. Outer wheel bearing
7. Wheel hub
8. Inner wheel bearing
9. Bearing spacer
10. Oil seal
11. Dust protection ring
12. Brake disc
13. Bolt and washer
14. Caliper mounting plate
15. Bolt and washer
16. Brake caliper

Fig. 7.6. – Exploded view of the front wheel hub.

7.4.1. FRONT WHEEL BEARINGS – ADJUSTMENT

To check the bearing pre-load, wind a cord around one of the wheel studs and attach a spring scale to the end of the cord. Pull the spring scale in a tangential direction and note the reading to just start the hub rotating as shown in Fig. 7.7. This reading should be between 0.4 - 1.0 kg (0.9 - 2.2 lb.). If the pre-load is not correct, tighten the adjusting nut until the correct reading is obtained. Align the locking nut so that one of the slots is in line with the hole in the knuckle spindle and insert the split pin.

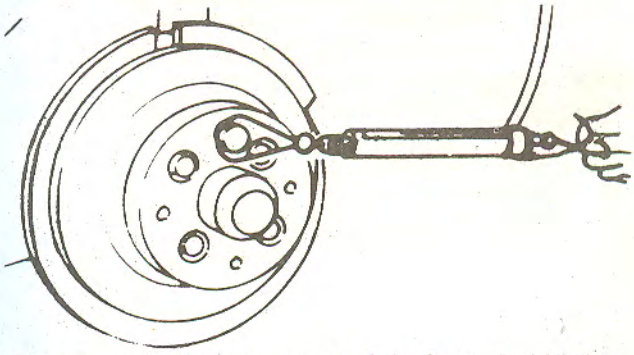


Fig. 7.7. – Checking the pre-load of the front wheel bearings with a spring scale.

When new bearings are fitted, rotate the hub and at the same time tighten the adjusting nut until the hub binds. Then back off the adjusting nut by 1/6 of a turn, making sure that the hub rotates freely without clearance. Then check the rotating torque as described above.

7.5. Tightening Torque Values

Stabiliser bar support:	3.8 - 4.7 kgm (27 - 34 lb.ft.)
Stabiliser bar to suspension arm:	8.1 - 9.8 kgm (58 - 71 lb.ft.)
Crossmember to body:	4.4 - 6.2 kgm (31 - 45 lb.ft.)
Steering drop arm to centre track rod (tie rod):	2.5 - 3.5 kgm (18 - 25 lb.ft.)
Steering drop arm to sector shaft:	15.0 - 18.0 kgm (108 - 130)
Suspension arm to cross-member:	4.0 - 5.5 kgm (29 - 40 lb.ft.)
Knuckle arm to shock absorber:	6.4 - 9.5 kgm (46 - 69 lb.ft.)

Ball joint to knuckle arm:	6.0 - 7.0 kgm (43 - 51 lb.ft.)
Piston rod to mounting:	6.5 - 8.2 kgm (47 - 59 lb.ft.)
Seal cap nut:	5.0 - 6.0 kgm (36 - 43 lb.ft.)
Piston rod nut:	1.5 kgm (10 lb.ft.)
Base valve nut:	0.15 kgm (1.0 lb.ft.)
Wheel nuts:	9.0 - 10.0 kgm (65 - 72 lb.ft.)
Track rod to knuckle:	2.5 - 3.5 kgm (18 - 25 lb.ft.)
Track rod locknut:	7.0 - 8.0 kgm (51 - 58 lb.ft.)
Upper spring strut to body:	2.3 - 3.0 kgm (17 - 22 lb.ft.)

8. STEERING

8.0. Technical Data

Type:	Recirculating ball, with variable gear ratio of 18.0 : 1 to 20.0 : 1.
Column type:	Collapsible
Free play of steering wheel:	5 - 20 mm (0.2 - 0.8 in.)
Backlash between steering nut and sector:	0 mm
Worm pre-load:	
Without sector shaft:	1 - 4 cmkg (0.9 - 3.5 lb.in.)
With sector shaft:	9 - 15 cmkg (7.8 - 13.0 lb.in.)
Clearance of sector shaft in bush:	0.007 - 0.049 mm (0.0003 - 0.0019 in.)
Wear limit:	0.20 mm (0.008 in.)
End clearance of adjusting screw in sector shaft:	0 - 0.1 mm (0 - 0.004 in.)
End clearance of steering ball ball joint studs:	0 - 0.25 mm (0 - 0.01 in.)
Wear limit:	1.0 mm (0.04 in.)
Steering lubricant:	EP SAE 90

8.1. Steering Unit

8.1.0. REMOVAL AND INSTALLATION

With the front end of the car resting on stands, remove the front wheel on the side of the bearing. Withdraw the split pin from the nut on the steering drop (pitman) arm, undo the nut and separate the drop arm from the shaft with a suitable puller. Remove the bolt securing the flexible steering disc to the worm shaft and remove the speedometer cable from the clips securing it to the steering gear housing and the brake servo unit in the case of models with left-hand steering.

Remove the bolts securing the steering unit to the frame and remove the steering in a downward direction. Make a note of the position of shims, to refit them in the same position on installation.

The installation of the steering unit is a reversal of the removal procedure, noting the correct torque values for the steering drop arm nut and the steering mounting bolts.

8.1.1. DISMANTLING

Remove the plug and drain out the oil. Unscrew the nut securing the steering drop arm (pitman arm) to the sector shaft and withdraw the drop arm with special puller 49 0223 695B or a similar puller as the one shown in Fig. 8.1. Unscrew the adjusting screw locknut on the side cover of the steering unit and the side cover bolts

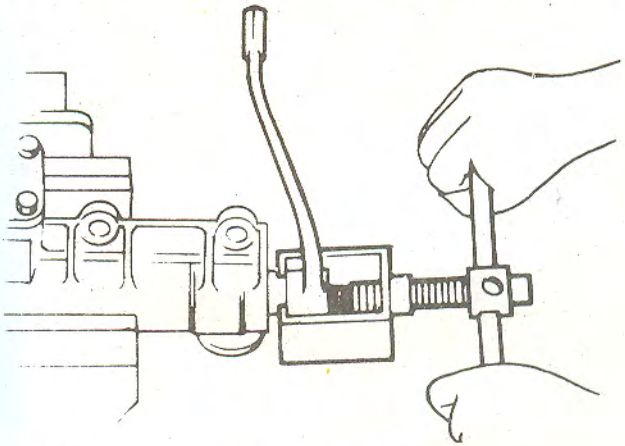


Fig. 8.1. – Removal of the steering drop arm (pitman arm).

and remove the side cover and gasket by turning the adjusting screw clockwise through the cover. Remove the adjusting screw and shim from the slot in the end of the sector shaft. Remove the sector shaft carefully from the steering housing, not damaging the oil seal. Unscrew the rear cover and lift off together with the shims and withdraw the worm shaft and ball nut assembly through the bottom of the steering unit housing. The steering unit parts are shown in Fig. 8.2. in an exploded view.

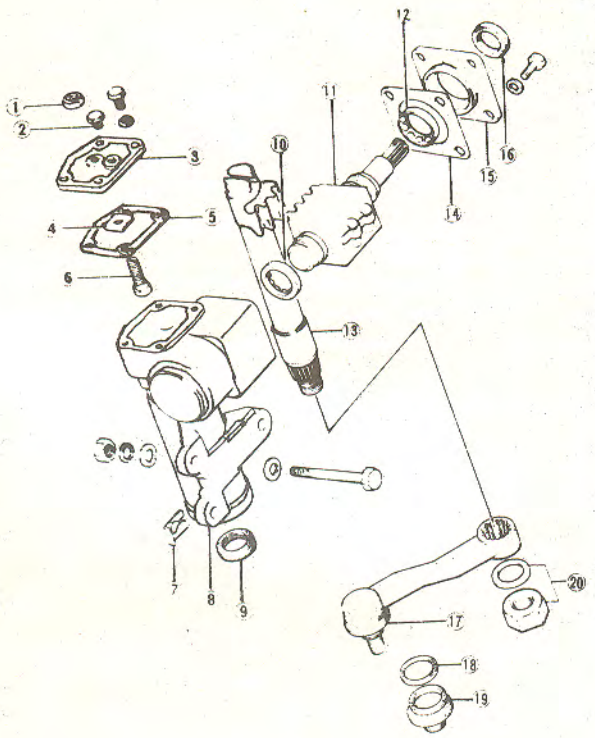


Fig. 8.2. — Exploded view of the steering unit.

1. Locknut
2. Oil plug
3. Side cover
4. Thrust washer
5. Gasket
6. Adjusting screw
7. Adjusting shim
8. Steering gear housing
9. Oil seal
10. Worm shaft bearing
12. Worm shaft bearing
13. Sector shaft
14. Adjusting shim
15. End cover
16. Oil seal
17. Steering drop (pitman) arm
18. Retaining ring
19. Rubber dust boot
20. Washer and nut

8.1.2. SERVICING

The ball nut must not be dismantled from the steering worm. The unit cannot be repaired and must be replaced if worn or defective. When dismantling, do not allow the worm nut to be forced against the end of the ball grooves. Keep the unit away from any dirt or foreign matter. Check the oil seal for wear, cracks or any other damage. If traces of oil leaks are visible, replace the oil seal.

8.1.3. ASSEMBLY

Thoroughly clean the steering housing and insert the worm shaft and steering nut into the housing. Refit the end cover together with its shim and adjust the bearing pre-load as follows:

Apply a torque wrench or a spring scale as shown in Fig. 8.3. to the worm shaft and check the rotating torque. If

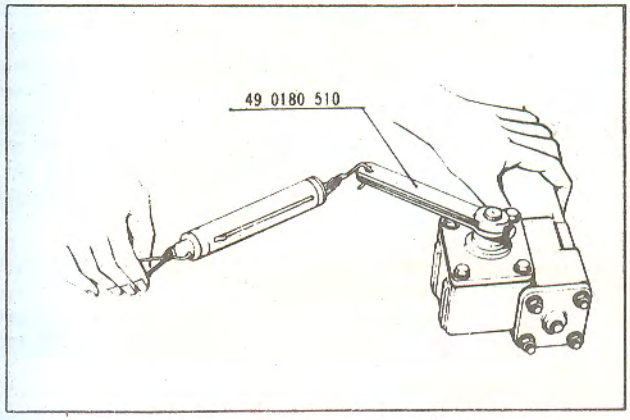


Fig. 8.3. — Checking the steering bearing pre-load. The special lever is clamped to the end of the sector shaft.

a torque wrench is used, the value should be 1.0 to 4.0 kgcm (0.87 to 3.48 lb.in.). If the spring scale is used, an indication of 0.1 to 0.4 kg (0.22 to 0.88 lb.) should be obtained. If the reading is not within the above limits, remove the end cover with its shim and add shims if the pre-load is more than the upper limit or remove shims

if the pre-load is less than the lower limit. Shims are available in the following thicknesses: 0.050, 0.075, 0.1 and 0.2 mm (0.002, 0.003, 0.004 and 0.008 in.). Refit the cover together with the shims and re-check the torque reading.

Now insert the adjusting screw into the slot at the end of the sector shaft and insert a feeler gauge as shown in Fig. 8.4. to check the end clearance between the head of the screw and the flat face in the inside of the sector shaft. The specified clearance is between 0.02 - 0.08 mm (0.001 - 0.003 in.) and should be obtained by inserting the appropriate shims. Shims are available in the following thicknesses: 1.95, 2.00, 2.05 and 2.10 mm (0.077, 0.079, 0.081 and 0.083 in.).

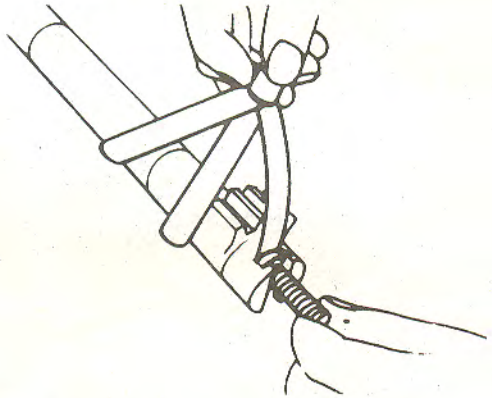


Fig. 8.4. — Checking the end clearance between the head of the adjusting screw and the thrust washer in the end of the sector shaft.

Turn the steering worm shaft and place the tooth segment of the rocker shaft in the centre position of the steering nut. Carefully insert the rocker shaft with the adjusting screw, being careful not to damage the bushes or the oil seal and check that the tooth segment and the steering nut are aligned as shown in Fig. 8.5. The slot in the end of the sector shaft must be exactly in the centre of the steering nut.

Refit the side cover together with its gasket to the adjusting screw and turn the adjusting screw until the cover

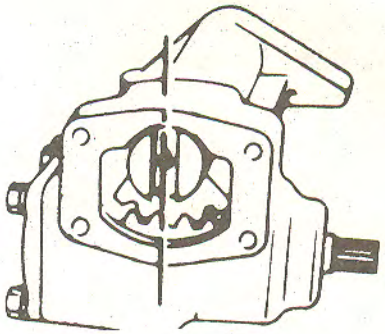


Fig. 8.5. — When assembling the steering, take care to line up the toothed sector and the steering nut as shown.

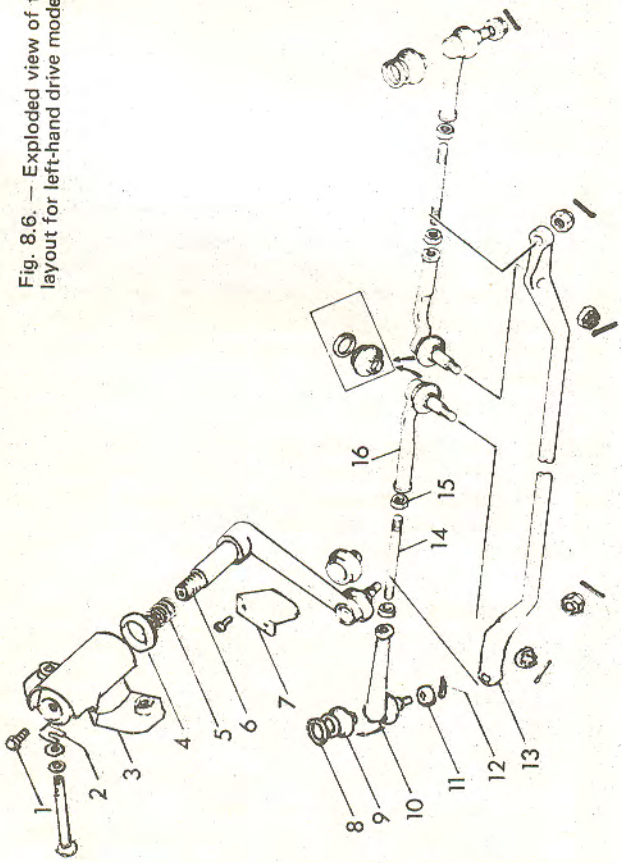
rests against the steering housing. Attach the cover with the bolts and check the backlash between the sector gear and the steering nut as follows:

Turn the steering worm shaft slowly until it is in the centre position. Slacken the adjusting screw locknut and turn the adjusting screw until a backlash of less than 0.1 mm (0.004 in.) is obtained. This is the equivalent of a worm shaft movement of about 2°. Re-tighten the adjusting screw locknut and turn the worm shaft to check if the sector shaft can be turned by 40° to the left or right without binding.

Refit the steering drop arm (pitman arm) in accordance with the marks made during dismantling and tighten the drop arm nut to the torque reading given in the Tightening Torque Table at the end of this Section.

8.2. Steering Linkage

The steering linkage parts are shown in an exploded view in Fig. 8.6. and removal of parts will be obvious from a study of the illustration. Ball joint studs should be removed with special puller 49 0118 850C or any other suitable ball joint puller. All ball joint nuts, i.e. (11) in Fig. 8.6. should be tightened to a torque reading of 3 kgm (21 lb.ft.). As there are differences between the layout of the linkage of L.H. and R.H. drive vehicles, the following text should be noted:



1. Plug
2. Adjusting shim
3. Idler arm bracket
4. Oil seal
5. Spring
6. Idler arm
7. Insulator
8. Retaining ring
9. Rubber dust boot
10. Track rod end
11. Castellated nut
12. Split (cotter) pin
13. Centre track rod
14. Track (tie) rod
15. Locknut
16. Track rod end

Fig. 8.6. — Exploded view of the steering linkage. Shown is the layout for left-hand drive models.

8.2.0. IDLER ARM

The removal of the steering idler arm is the same for both left-hand and right-hand drive vehicles. When fitting the ilder arm to left-hand drive vehicles, check the clearance as shown in Fig. 8.7., which should be between 3.5 - 5.5 mm (0.14 - 0.21 in.). The top plug in Fig. 8.6. and in Fig. 8.7. is used to hold the assembly together. In case of idler arms for right-hand drive vehicles, a castellated nut is attached to the idler arm spindle, secured by a split pin.

When refitting the idler arm bracket to the side frame, tighten the bolts to a torque reading of 4.4 - 5.5 kgm (32 - 40 lb.ft.) and in the case of right-hand drive models the idler arm to the idler arm bracket to the same value. Tighten the idler arm lever to the centre track rod with a torque setting of 2.5 - 3.5 kgm (18 - 25 lb.ft.).

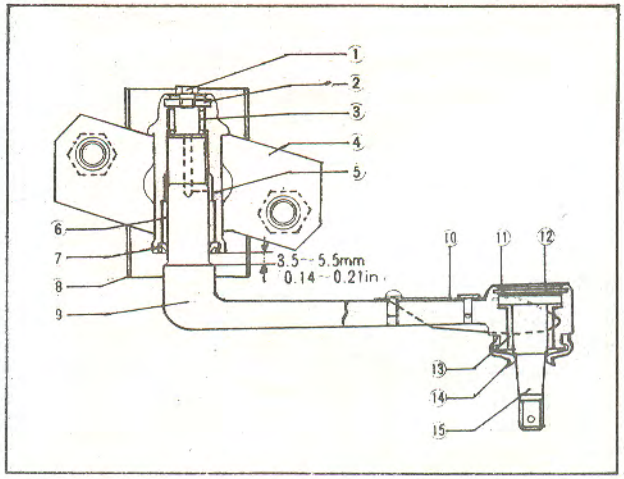


Fig. 8.7. — Sectional view of the steering idler arm mounting as fitted to left-hand drive steering linkage.

1. Grease plug
2. Plug
3. Spring
4. Bracket
5. Idler bracket housing
6. Bush
7. Oil seal
8. Insulator
9. Idler arm
10. Insulator
11. End plate
12. Shim
13. Bush
14. Dust seal
15. Idler arm ball stud

8.2.1. STEERING DAMPER (USA and CANADA)

A steering damper is fitted into the steering linkage to these models. To remove the damper, jack up the front of the vehicle and support on stands. Remove the clip that attaches the steering damper to the bracket at the centre track rod and the nut securing the damper to the bracket at the body frame. Lift out the damper.

The installation is a reversal of the removal procedure. Tighten the steering damper securing nut to a torque reading of 3.2 - 4.7 kgm (23 - 34 lb.ft.).

8.3. Front Wheel Alignment

8.3.0. PRE-ALIGNMENT CHECKS

Before carrying out wheel alignment checks, it is essential that the following points are checked and adjusted or rectified as follows:

a) All tyres must be at specified pressures.
b) Check the track rod ends for wear.
c) Check the suspension ball joints for looseness or wear or damage.

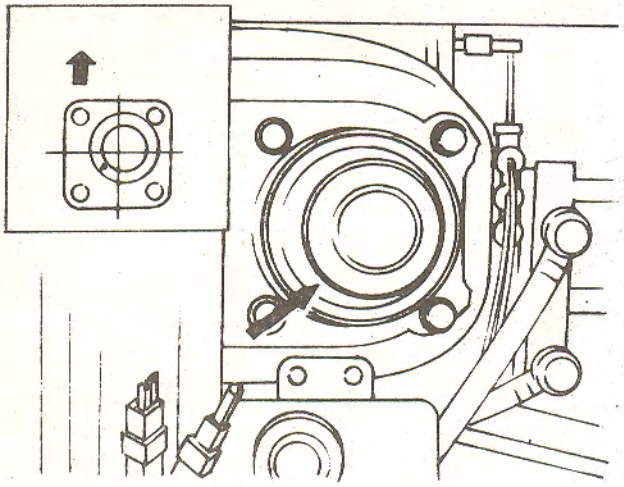


Fig. 8.8. – View of the upper spring strut (shock absorber) mounting, showing the offset for the camber and castor adjustment.

d) Check the front wheel bearings for proper adjustment and correct if necessary,
e) Check the wheel rims for true-running.

8.3.1. CASTOR AND CAMBER ANGLES

The castor and camber angles can be adjusted by changing the position of the upper spring strut (shock absorber) bearing. During the manufacture, the bearing mount is installed so that the triangular identification mark is aligned as shown in Fig. 8.9. If necessary, re-adjust the settings as follows:

Open the bonnet (hood) and remove the four nuts that secure the spring strut support to the wing apron. Jack up the front of the vehicle and support on stands. Remove the front wheel, press the shock absorber downwards and change the bearing support according the the following table:

Shock Absorber Position:	Camber:	Castor:
As in Fig. 8.8.	0°	0°
As in Fig. 8.9B	0°	+28'
As in Fig. 8.10C	+28'	+28'
As in Fig. 8.10D	+28'	0°

The degree values refer to the variations.

Finally tighten the spring strut support bearing nuts in the new position and re-check the camber and castor, using conventional equipment.

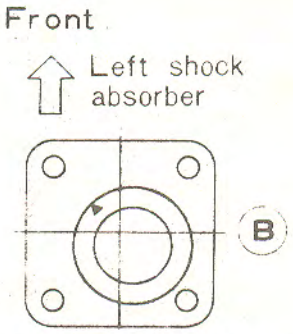


Fig. 8.9. – Position of the upper spring strut mounting to obtain the values given in Section 8.3.1.

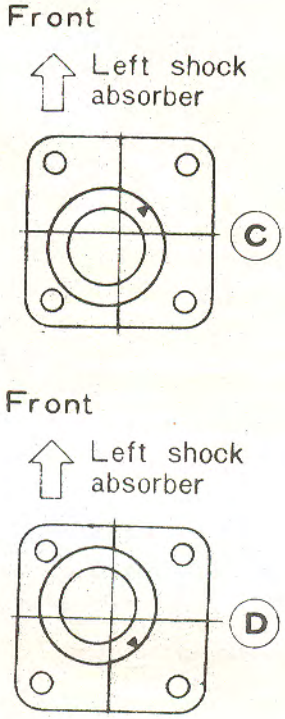


Fig. 8.10. – Position of the upper spring strut mountings to obtain the values given in Section 8.3.1.

8.3.2. TOE-IN

Place the front wheels in the straight ahead position and place a toe-in gauge against the front of the wheels rims, in height of the wheel hubs. Set the scale to zero.

Mark the measuring point with a piece of chalk. Push the car forward by half a turn of the wheels and check the distance between the wheels at the rear of the wheel rims. The pointers of the checking gauge must rest against the points marked with the chalk. Read off the indication on the gauge, which should be between 0 - 6 mm (0 - 0.24 in.). If the setting is outside the specified limits, adjust the toe-in by slackening the clamp nuts and turning the centre track rod tube in the appropriate direction. The track rod has left-hand and right-hand threads to provide equal adjustment at both wheels.

8.4. Steering Lock/Ignition Switch – Removal and Installation

Pull the centre knob out of the steering wheel, remove the steering wheel nut and withdraw the steering wheel. Slacken the nut securing the ventilator knob and remove the knob from the panel. Remove the choke knob in the same manner. Unscrew the steering column cover screws and lift off the cover. Disconnect the wiring connector and remove the stop ring from the column shaft. Unscrew the combination switch from the column shaft.

Remove the bolts securing the instrument frame junction and remove the junction. Loosen the two nuts securing the column shaft bracket to the dash board and remove the bracket. Move the column shaft approx. 30 mm (1 in). from the dash board. Using a hacksaw blade, cut a groove into the heads of the lock securing bolts. With a screwdriver unscrew the bolt and lift off the steering lock. The installation of the lock is a reversal of the removal procedure. Use new bolts and tighten until the heads break off.

8.5. Tightening Torque Values

Steering wheel nut:	3.0 - 4.0 kgm (22 - 29 lb.ft.)
Steering unit to frame:	4.4 - 5.5 kgm (32 - 40 lb.ft.)
Drop arm to sector shaft:	15.0 - 18.0 kgm (108 - 130 lb.ft.
Idler arm bracket to frame:	4.4 - 5.5 kgm (32 - 40 lb.ft.)
Idler arm to bracket:	4.4 - 5.5 kgm (32 - 40 lb.ft.)
Idler arm to centre rod:	2.5 - 3.5 kgm (18 - 25 lb.ft.)
Drop arm to centre rod:	2.5 - 3.5 kgm (18 - 25 lb.ft.)
Track rod to centre rod:	2.5 - 3.5 kgm (18 - 25 lb.ft.)
Track rod to knuckle:	2.5 - 3.5 kgm (18 - 25 lb.ft.)
Track rod locknut:	7.0 - 8.0 kgm (51 - 58 lb.ft.)

9. BRAKES

9.0. Description

The brake system is hydraulically operated, acting on all four wheels. Disc brakes are fitted as standard equipment.

The rear wheels are fitted with drum brakes of the leading/trailing shoe type. All models built at present

are operating with a dual-line braking system, i.e. a tandem master brake cylinder is fitted. Master brake cylinders for left-hand and right-hand drive cars are slightly different in construction.

The parking brake (handbrake) is mechanically operated by a system of cables and linkages. The adjustment of the handbrake is carried out at the front end of the front handbrake cable.

9.1. Technical Data

Type:	Disc brakes at the front and leading/trailing shoe rear brakes at the rear. Handbrake operating mechanically on rear brakes. Servo unit.
FRONT BRAKES	
Disc diameter:	230.0 mm (9.055 in.)
Thickness of disc:	12.0 mm (0.4724 in.)
Wear limit:	11.0 mm (0.4331 in.)
Max. run-out of disc:	0.10 mm (0.004 in.)
Brake Pads:	
Thickness — New:	14.0 mm (0.551 in.)
— Wear limit:	7.0 mm (0.276 in.)
Wheel Cylinder Bore:	
In caliper:	53.97 mm (2.1248 in.)
REAR BRAKES	
Drum diameter:	228.6 mm (9.00 in.)
Max. perm. diameter:	229.6 mm (9.0395 in.)
Brake Linings:	
Thickness - new:	4.8 mm (0.177 in.)
Wear limit:	1.0 mm (0.04 in.)
Wheel brake cylinder dia.:	20.46 mm (5/8")
Clearance between piston and cylinder:	
New:	0.040 - 0.125 mm (0.0016 - 0.0049 in.)
Wear limit:	0.15 mm (0.006 in.)
MASTER BRAKE CYLINDER	
Bore diameter:	22.22 mm (7/8 in.)
Clearance between piston and cylinder:	
New:	0.040 - 0.125 mm (0.0016 - 0.0049 in.)
Wear limit:	0.15 mm (0.006 in.)
Push rod clearance:	7 - 9 mm (0.28 - 0.35 in.) before operation of power piston of servo unit

9.2. Front Brakes

The front disc brakes have floating caliper assemblies and two self-adjusting friction pads, one on either side of the brake disc. A single piston operates directly onto one of the brake pads and the reaction force from this piston operates the other brake pad against the disc.

9.2.0. REPLACEMENT OF PADS

Brake pads must be replaced when the thickness of the pad material and the backing plate has reached the wear limit of 7.0 mm (0.276 in.). Always replace brake pads as a set to avoid unequal performance of the brakes. Replace the pads as follows:

Jack up the front end of the vehicle and support on stands. Take off the road wheel. Remove the retaining clips with a pair of pliers and drive out the wedges with a suitable drift or pull them out with a pair of pliers. Figs. 9.1. and 9.2. show these two operations. Lift off the caliper and take out the brake pads.

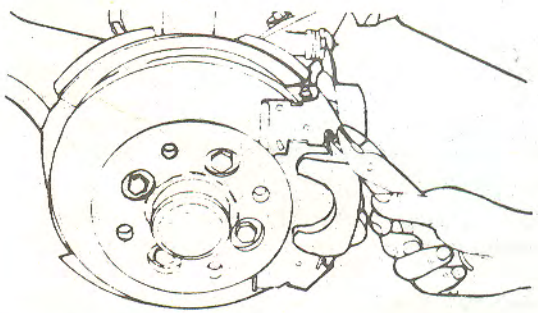


Fig. 9.1. — Removal of the spring clips when replacing the brake pads on the front disc brake.

Do not depress the brake pedal when the brake pads are removed. Check the thickness of the brake pads, including the backing plate and renew the pads if necessary.

Before fitting new brake pads, open the bleeder valve on the caliper slightly and push the pistons back into their bores. A tube should be attached to the bleeder valve to

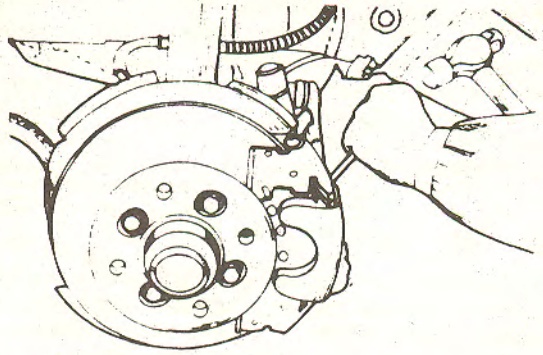


Fig. 9.2. — Drive out the wedges with a suitable drift when replacing the front brake pads.

catch escaping fluid. Install the new brake pads into the caliper in reverse to the removal procedure.

9.2.1. BRAKE CALIPER — REMOVAL AND INSTALLATION

Jack up the front of the vehicle and support on stands. Remove the road wheel. Remove the brake pads as described in Section 9.2.0. and lift off the caliper. Unscrew the brake fluid pipe from the caliper. Plug the end of the pipe to prevent entry of foreign matter. Remove the caliper bracket mounting bolts from the steering knuckle and lift off the bracket.

The installation of the caliper is a reversal of the removal procedure, noting the following points:

Bleed the brake systemas described later on. Depress the brake pedal several times to settle the brake pads against the disc and take up the adjustment.

9.2.2. BRAKE CALIPER — SERVICING

Thoroughly clean the outside of the caliper and remove the rubber boot. Insert a piece of hard wood into the opening of the caliper and apply compressed air at the fluid pipe threaded bore to eject the piston from the cylinder. Remove the wood and fully extract the piston. Remove the piston seal from the cylinder groove. Fig. 9.4. shows this operation.

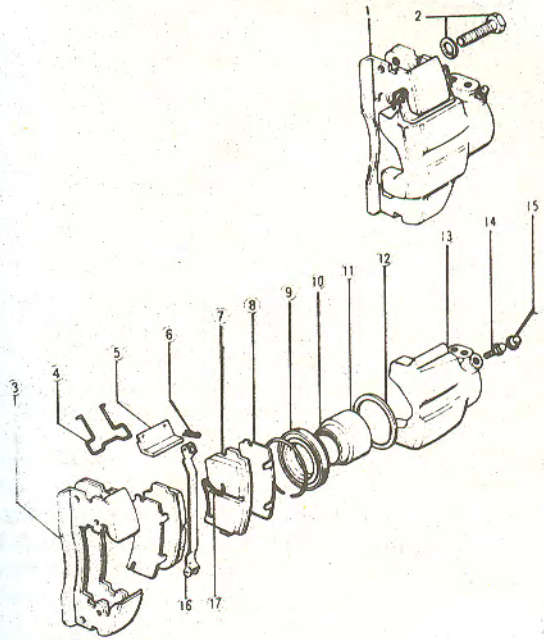


Fig. 9.3. — Exploded view of a disc brake caliper.

1. Caliper assembly
2. Bolt and washer
3. Caliper mounting bracket
4. Spring
5. Retaining wedges
6. Spring clip
7. Brake pad
8. Shim
9. Dust boot retaining ring
10. Dust boot
11. Caliper piston
12. Piston seal
13. Caliper body
14. Bleeder screw
15. Rubber dust cap
16. Spring clip
17. Anti-rattle spring

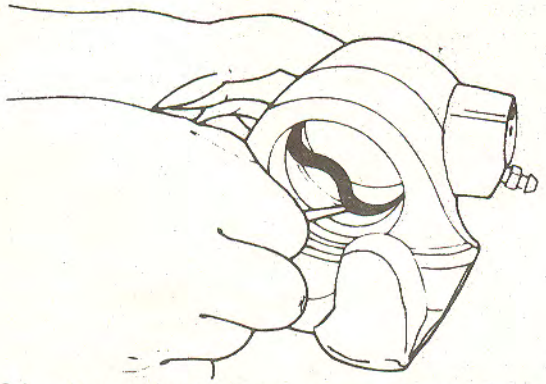


Fig. 9.4. — Use a pointed, blunt instrument when removing the seal from the groove in the cylinder body.

Clean all parts in clean brake fluid or alcohol and dry with compressed air. Inspect the cylinder and piston for damage, wear or corrosion and replace as necessary. Always replace the dust seal and the cylinder seal. Fig. 9.3. shows an exploded view of the caliper and should be used for reference.

Coat the cylinder and seal with rubber grease or brake fluid before assembly and insert the piston carefully so as not to damage the cylinder seal (Fig. 9.5.). Fit the dust seal over the cylinder and secure with the retaining ring.

NOTE: The brake disc should be inspected for thickness and run-out to the values given in Section 9.1. Removal

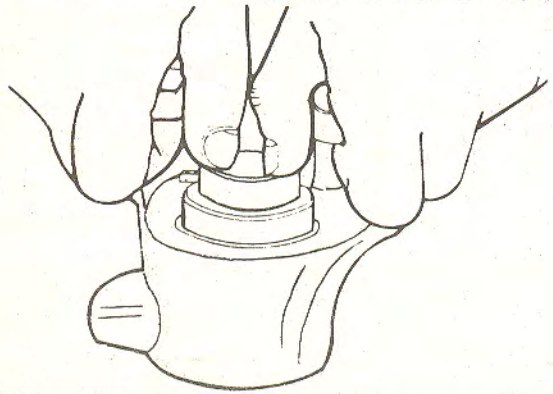


Fig. 9.5. — When assembling the brake caliper, carefully press in the piston with the two thumbs.

of the disc and hub is already described in Section "Front Suspension".

9.3. Rear Brakes

9.3.0. BRAKE SHOES — REMOVAL AND INSTALLATION

Rear brake drums are of the leading/trailing shoe type. A single wheel brake cylinder is used to expand the brake shoes against the drums. To remove the brake shoes proceed as follows:

Jack up the rear of the vehicle and support on stands. Remove the road wheel, chock the front wheels, release the handbrake and slacken the brake adjusters. Undo the drum securing screws and remove the drum, if necessary by turning two screws into the threaded holes to withdraw the drum. Remove the shoe hold-down springs from the front of the brake shoes and withdraw the pins from the rear. Using a screwdriver, lever the brake shoes from their locations in the pistons. The upper shoe return spring is now free and can be unhooked. Lift the shoes from the lower anchorage and from the backplate after disconnecting the handbrake cable. Remove the push rod between the brake shoes.

Clean all parts and inspect the drums. Drums can be re-skimmed, provided that their inner diameter does not exceed the values given in Section 9.1. for the respective model. Replace the brake shoes if the thickness of the lining material is less than 1.0 mm (0.04 in.).

The installation of the brake shoes is a reversal of the removal procedure. Apply a little High Point Melting grease to the backplate where the shoes are in contact and also grease the sliding faces of the brake shoes. First engage the lower return spring, fit the shoes over the anchorage and then with the upper spring engaged, prise the shoes into their wheel cylinder locations. After installation of the brake shoes bleed the brake system as described later on, if the wheel cylinder has been disconnected from the brake system.

1. Rear wheel
2. Drum securing screw
3. Brake drum
4. Spring seat
5. Shoe hold-down spring
6. Brake shoe
7. Shoe return spring
8. Shoe hold-down pin
9. Wheel brake cylinder
10. Brake back plate
11. Nut and washer
12. Plug
13. Adjuster push rod
14. Adjuster wheel
15. Adjuster push rod
16. Retaining clip
17. Shoe return spring
18. Brake shoe
19. Wave washer
20. Handbrake operating lever
21. Wheel bolt
22. Balance weight

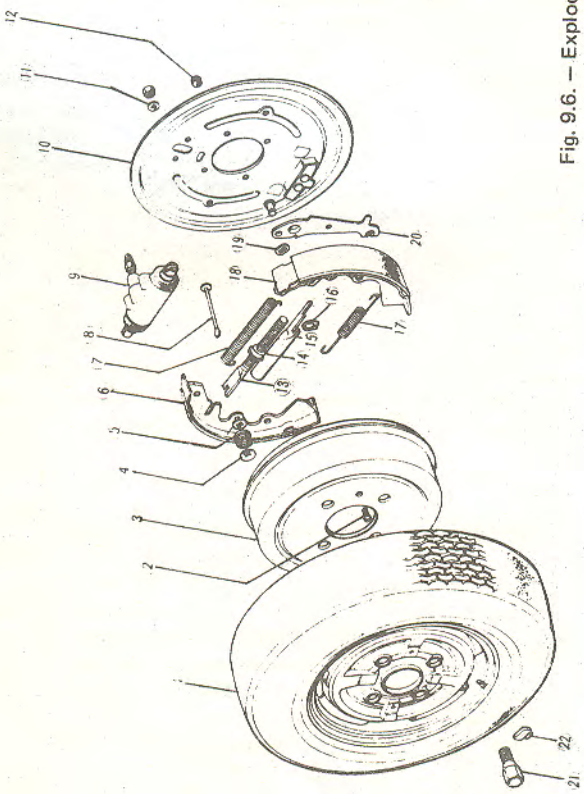


Fig. 9.6. – Exploded view of the rear brake assembly.

9.3.1. WHEEL CYLINDER – SERVICING

Details of the rear wheel brake cylinder are given in Fig. 9.7. and the order of assembly must be exactly as shown. Wheel cylinders need not be removed from the backplate for removal and replacement of cylinder seals, but care must be taken in this case that no dirt or grease enters the cylinder bore.

To replace the pistons or cup seals, first remove the brake shoes as described. Remove the rubber boots and withdraw the pistons together with the cylinder cup and the filling piece.

Inspect the bore and piston for wear and corrosion and replace if necessary. Also measure the inner diameter of the cylinder bore and the outer diameter of the pistons to check the running clearance which must not exceed 0.15 mm (0.006 in.). When ordering new parts, note that different diameter cylinders are fitted to models covered in this publication. Soak the new piston cups in clean brake fluid before insertion.

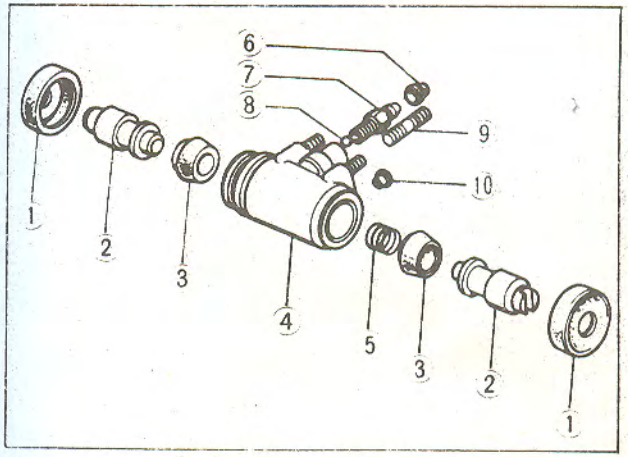


Fig. 9.7. – Exploded view of the rear wheel brake cylinder.

1. Rubber boot
2. Piston
3. Piston cup
4. Wheel cylinder body
5. Return spring
6. Steel ball
7. Bleeder screw
8. Bleeder dust cap
9. Stud
10. Tube seat

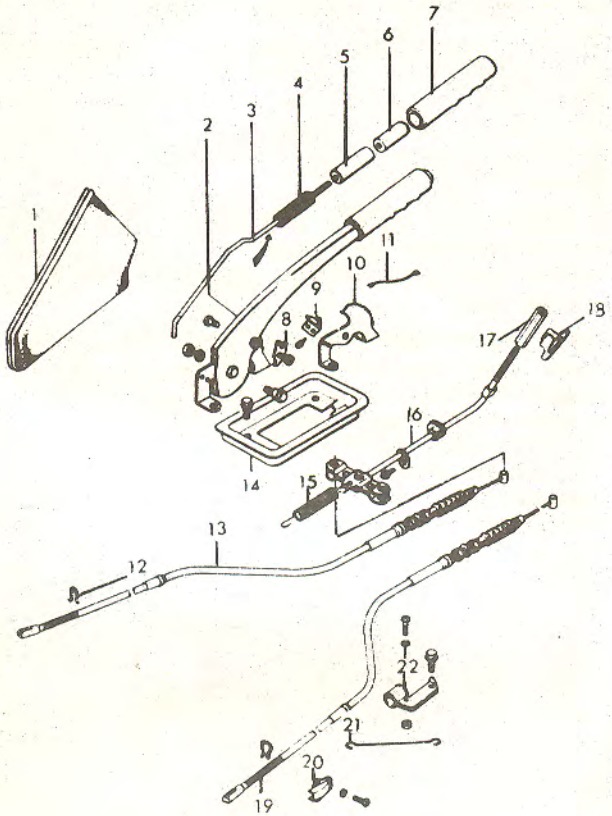


Fig. 9.8. — Component parts of the handbrake (parking brake).

1.	Rubber boot	12.	Rear cable clip
2.	Lever	13.	Rear cable
3.	Release rod	14.	Plate
4.	Spring	15.	Spring
5.	Spacer	16.	Front cable
6.	Release button	17.	Adjusting screw
7.	Cap	18.	Clip
8.	Ratchet	19.	Rear cable
9.	Handbrake lamp switch	20.	Setting plate
10.	Sector	21.	Bar (if fitted)
11.	Cable	22.	Clip

The assembly of the wheel cylinder is a reversal of the dismantling procedure. Place the spring into the filling pieces before inserting the assembly into the cylinder bore. The flat side of the cylinder cup must bear against the piston on both sides.

9.4. Brake Adjustments

9.4.0. WHEEL BRAKES

The front disc brakes require no adjustment since they automatically take up their position as the pads wear. The rear brakes are adjusted as follows:

Chock the front wheels, release the handbrake and jack up the rear end of the vehicle. Remove the plugs from the holes in the rear of the back plate (near the wheel cylinder pipes) and insert a screwdriver blade into the hole, engaging it with the adjuster wheel and turn the wheel in the direction of the arrow marked on the plate until the brake shoe has locked the drum. Then back off the adjuster by about 5 notches so that the drum rotates freely without binding. Carry out the same operation on the other three adjusters (two per wheel).

9.4.1. HANDBRAKE

With the rear wheel brakes adjusted as described above, turn the handbrake lever adjusting nut at the end of the front handbrake cable so that the brakes begin to apply

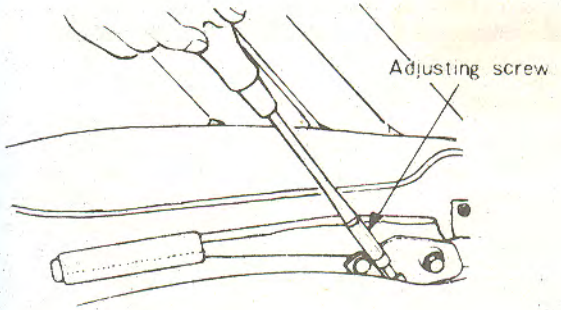


Fig. 9.9. — Adjusting the handbrake cable. The adjusting screw located next to the handbrake lever in the car interior.

when the handbrake lever is pulled three to seven "clicks", ALWAYS ADJUST THE REAR BRAKES BEFORE ATTEMPTING TO ADJUST THE HAND-BRAKE.

9.5. Master Brake Cylinder

The master brake cylinder for the left-hand and right-hand drive vehicles is of different construction. The reservoir on left-hand drive vehicles is mounted separate from the master cylinder and is connected with the latter by means of fluid pipes. On right-hand drive vehicles, the cylinder and the reservoir form a single unit, it is, however, possible to seaparate the two parts after removal of the cylinder. Figs. 9.10 and 9.11 show the two types.

9.5.0. REMOVAL AND INSTALLATION

On left-hand drive vehicles disconnect the fluid pipes between the reservoir and the master cylinder and plug up the pipe ends to prevent entry of dirt. Disconnect the brake fluid pipes at the master cylinder outlet and unscrew the nuts securing the master cylinder to the servo unit.

On right-hand drive vehicles disconnect the brake fluid pipes from the cylinder and unscrew the cylinder from the brake servo unit. When lifting out the cylinder, take care not to spill brake fluid over the painted surfaces of the vehicle.

The installation of the master cylinder is a reversal of the removal procedure in both cases. Adjust the brake pedal height and bleed the brakes after installation. Check the push rod clearance as described in Section 9.6.1.

9.5.1. SERVICING

Clean the outside of the cylinder and empty the cylinder of remaining brake fluid. On cylinders for left-hand drive vehicles, remove the connectors from the primary and secondary inlets and take off the unions and washers. On cylinders for right-hand drive vehicles, unscrew the connectors (4 in Fig. 9.11.) to separate the reservoir from the cylinder. Both cylinders are now similar as the one shown in Fig. 9.10. for the left-hand drive vehicles. Dismantle as follows:

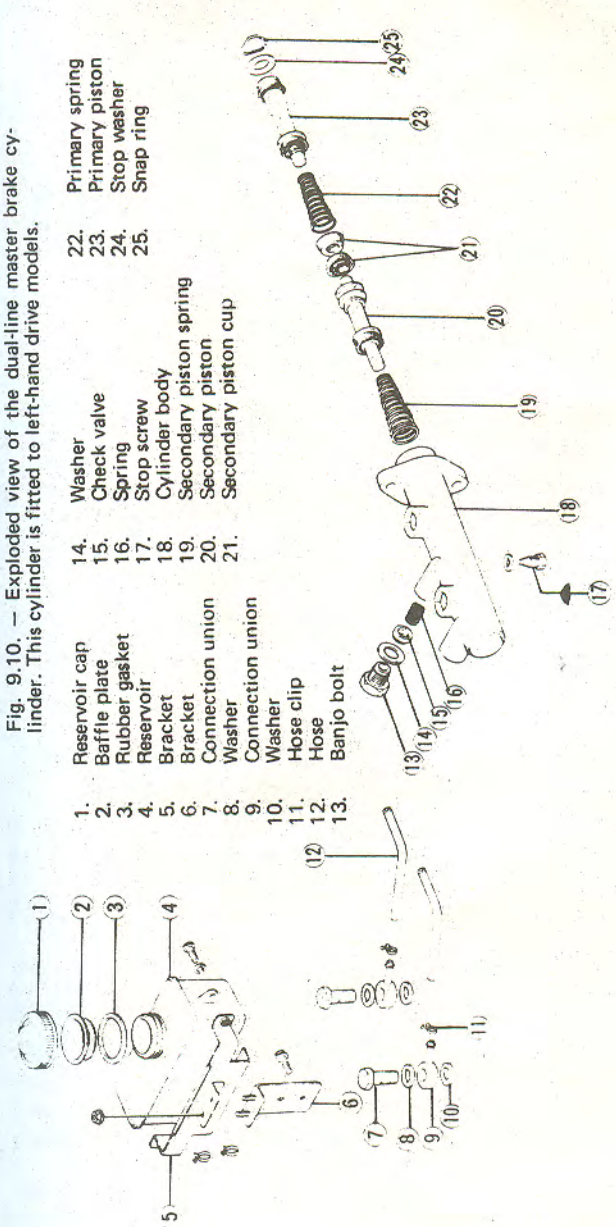


Fig. 9.10. – Exploded view of the dual-line master brake cylinder. This cylinder is fitted to left-hand drive models.

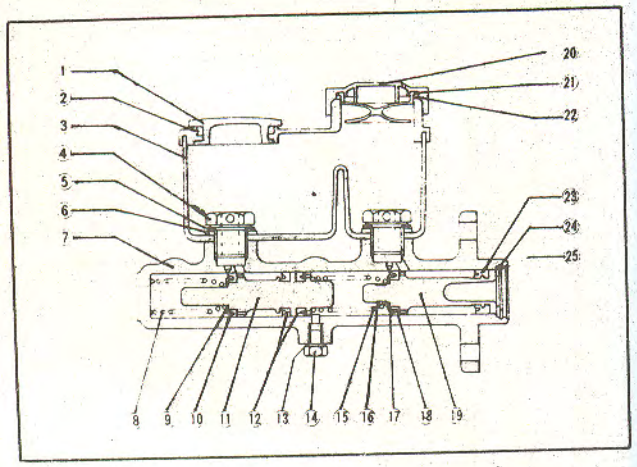


Fig. 9.11. — Sectional view of the dual-line master brake cylinder. This cylinder is fitted to right-hand drive models.

1. Reservoir cap
2. "O" sealing ring
3. Reservoir
4. Filler connector
5. Conical spring
6. Washer
7. Cylinder
8. Secondary piston spring
9. Spring seat
10. Primary cup
11. Secondary piston
12. Secondary piston cup
13. Gasket
14. Banjo bolt
15. Primary spring
16. Spring seat stopper
17. Spring seat
18. Primary cup
19. Primary piston
20. Reservoir cap
21. Baffle plate
22. Rubber gasket
23. Secondary cup
24. Washer
25. Snap ring

Slightly depress the piston by means of a screwdriver and remove the retaining ring (25) in the end of the cylinder bore and the stop washer (24). Slacken the stop screw (17) at the bottom of the cylinder, without removing it.

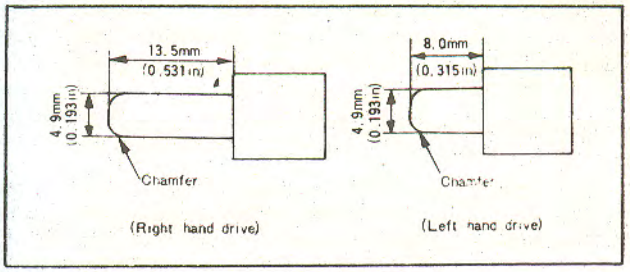


Fig. 9.12. — Dimensioning diagram of the guide pin to be used during dismantling and assembling of the master brake cylinder.

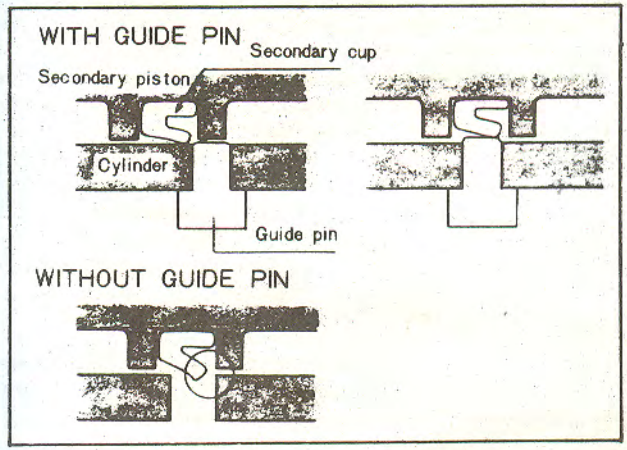


Fig. 9.13. — When dismantling the cylinder, the guide pin shown in Fig. 9.12. should be inserted instead of the stop bolt as shown. This will prevent damage to the secondary piston cup.

Make up a guide in accordance with the dimensions given in Fig. 9.12. and insert it in place of the stop screw into the cylinder (after unscrewing the stop screw) as shown in Fig. 9.13. This prevents damage to the secondary piston cup by the threads of the stop screw hole. After this operation, the secondary piston and cup assembly can be removed from the cylinder bore.

Remove the fluid pipe fittings with gaskets from the primary and secondary brake system outlets and then remove the check valves and guides from the outlets.

Thoroughly clean all parts in brake fluid or alcohol. Do not allow the parts to come in contact with dirt, grease or mineral oil. Measure the inner diameter of the cylinder bore and the outer diameter of the pistons to determine the running clearance which should not exceed 0.15 mm (0.006 in.). Note that master cylinders could be changed at short notice, so always check the diameter.

This is important when ordering parts. Renew all cups, seals and valves, even when they appear satisfactory. Make sure to obtain genuine manufacturer's spares only.

The assembly is a reversal of the dismantling procedure. When fitting the check valves, note that the valve with the hole in the centre is for the disc brake (front brake) and the check valve without the hole for the drum brake (rear brake). Tighten the outlet fittings to 6.0 - 7.0 kgm (43 - 51 lb.ft.). When inserting the secondary piston, have the guide pin in position (Fig. 9.13) and push the piston into the cylinder with a suitable rod. Now remove the guide pin and insert the stop screw with a new washer. The flat sides of the primary and secondary piston cups are fitted against the piston flanges. Soak all rubber parts in clean brake fluid before assembly and fit in wet condition (dipped in brake fluid).

9.5.2. BLEEDING THE BRAKE SYSTEM

Bleeding of the hydraulic system must be carried out when any part of the system has been dismantled, or at any time that the brake pedal feels "spongy".

It is important that the reservoir is kept topped up during the bleeding operations and that each point is dealt with in turn. Always start at the wheel cylinder furthest away from the master cylinder. Attach a transparent tube over the bleeding valve of the wheel cylinder in question and immerse the other end of the tube into a glass jar, filled with a little brake fluid. Open the bleed valve by 1/3 of a turn when the brake pedal is fully depressed by a second person and close the bleeder screw before the pedal is released. Repeat this pumping operation until no more air bubbles are entering the fluid in the glass jar and keep the brake pedal fully depressed whilst closing the bleeder valve.

Repeat the same operations in turn on the other wheel cylinders, finishing with the one nearest to the master cylinder. Do not use brake fluid ejected from the system to top up the reservoir.

9.6. Brake Pedal

9.6.0. ADJUSTING THE BRAKE PEDAL HEIGHT

The brake pedal height is adjusted by means of the stop bolt at the front of the pedal and should be the same height as the clutch pedal. Slacken the locknut and adjust the stop bolt until the height of the pedal is 185 mm (7.3 in.) from the floor board. Re-tighten the locknut.

9.6.1. ADJUSTING THE PUSH ROD TO PISTON CLEARANCE

The clearance between the end of the master cylinder push rod and the piston is adjusted by turning the push rod in the appropriate direction after slackening the locknut. This clearance can be easily measured at the top of the brake pedal where a dead play of 5 - 15 mm (0.2 - 0.6 in.) should be present before it is felt that the push rod contacts the piston.

9.7. Brake Servo Unit

The brake servo unit assists the effort applied on the brake pedal, improving the performance of the brakes. The vacuum cylinder within the servo unit is connected with the intake manifold of the engine (by means of a hose). Faults in the brake servo unit should be rectified by replacing the complete servo unit or take the car to your local dealer to have the unit repaired.

9.7.0. CHECKING THE BRAKE SERVO UNIT

Stop the engine and operate the brake pedal several times to release all vacuum from the cylinder. Slightly depress the brake pedal and start the engine. If the vacuum system is operating satisfactory, the brake pedal will fall slightly under foot pressure and less pressure will be necessary to hold the pedal in the applied

position. No movement of the pedal indicates a faulty servo unit.

For the next check apply the handbrake with the brake pedal released. Run the engine at increased idling speed, switch off the ignition and immediately release the accelerator pedal. This will create vacuum in the system. Wait for a period of 90 seconds and with the engine still switched off, depress the brake pedal. If no vacuum assistance can be felt after operating the brake pedal at least twice, there is a fault in the check valve.

9.7.1. SERVO UNIT – REMOVAL AND INSTALLATION

Disconnect the brake pipes at the brake master cylinder and the vacuum hose at the servo unit. Remove the push rod from the brake pedal after withdrawing the split pin and clevis pin from the fork end. Unscrew the nut securing the servo unit to the bulkhead and lift out the brake servo unit together with the master cylinder. If necessary, disconnect the master cylinder from the servo unit.

The installation is a reversal of the removal procedure. Bleed the brakes as described above.

9.8. Tightening Torque Values

6 mm bolts/nuts:	
Marked 6T:	0.7 - 1.0 kgm (5 - 7 lb.ft.)
Marked 8T:	0.8 - 1.2 kgm (6 - 9 lb.ft.)
8 mm bolts/nuts:	
Marked 6T:	1.6 - 2.3 kgm (12 - 17 lb.ft.)
Marked 8T:	1.8 - 2.7 kgm (13 - 20 lb.ft.)
10 mm bolts/nuts:	
Marked 6T:	3.2 - 4.7 kgm (32 - 34 lb.ft.)
Marked 8T:	3.7 - 5.5 kgm (27 - 40 lb.ft.)
12 mm bolts/nuts:	
Marked 6T:	5.6 - 8.2 kgm (41 - 59 lb.ft.)
Marked 8T:	6.5 - 9.5 kgm (46 - 69 lb.ft.)
14 mm bolts/nuts:	
Marked 6T:	7.7 - 10.5 kgm (56 - 76 lb.ft.)
Marked 8T:	10.4 - 14.0 kgm (75 - 101 lb.ft.)

10. ELECTRICAL EQUIPMENT

10.0. Battery

Voltage:	12 volts
Type:	
Manual transmission:	N50Z
Automatic transmission and Arctic Countries:	N70Z
Capacity:	
Manual transmission:	60 A/h
Automatic transmission:	70 A/h
Polarity:	Negative earth (ground)
Specific gravity at full charge:	1.260
Specific gravity discharged:	1.200

10.1. Starter Motor

10.1.0. TECHNICAL DATA

Type:	Direct current, series wound, pre-engaged pinion by means of solenoid, mounted on drive end bracket
Nominal rated Voltage/ Output:	0.8 kW at 12 volts
Control switch:	Solenoid
Voltage required to close solenoid contacts:	8 volts or less
Number of poles:	4
Lock test data:	
Voltage:	6.0 volts
Current:	400 amps or less
Torque:	0.93 kgm (6.7 lb.ft.)
Free running test data:	
Voltage:	10.5 volts
Current:	53 amps or less
Speed:	5000 rpm or more
Number of brushes:	4
Brush Length:	
New:	18.5 mm (0.73 in.)
Wear limit:	11.5 mm (0.45 in.)
Brush spring pressure:	1.4 - 1.8 kg (49 - 63 oz.)

10.1.1. SERVICING

Removal and installation of the starter motor is a straight forward operation. Suitably mark the electrical leads at their terminals in order to reconnect as original.

Routine servicing of the starter motor should include attention to the brush gear to ensure that the brushes are not worn below the length stated as a minimum.

Inspect the spring tension with a spring scale to see that it is within the values given.

Clean the commutator with fuel or grease, but do not allow to get on the windings. If necessary, sandpaper of a fine grade can be used on the commutator or the segments can be re-skimmed. In this case undercut the mica between the commutator segments to a depth of 0.5 - 0.8 mm (0.02 - 0.031 in.), using a ground-off hacksaw blade.

The armature is best tested by replacing it with a substitute part. Never attempt to straighten a bent armature shaft or to re-machine the armature core.

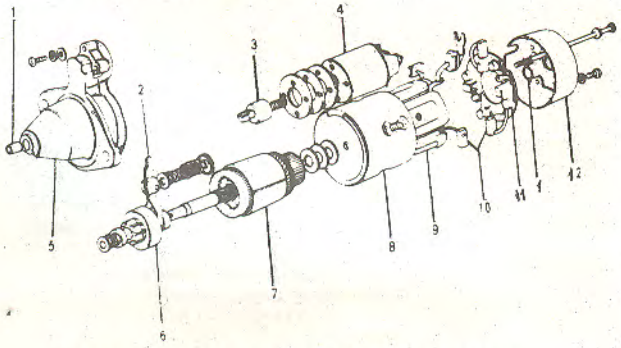


Fig. 10.1. — Exploded view of the starter motor.

1.	Bush	7.	Armature
2.	Engagement lever	8.	Starter motor housing
3.	Solenoid plunger	9.	Field coils
4.	Solenoid switch	10.	Brushes
5.	Drive end bracket	11.	Brush holder
6.	Free wheel clutch	12.	Commutator bracket

To dismantle and assemble the starter motor, refer to Fig. 102 which shows an exploded view of the starter motor. Note the arrangement of all parts before dismantling.

10.2. Alternator

10.2.0. GENERAL NOTES

All models are fitted with an alternator and certain precautions are necessary to avoid damage to the diodes.

Always observe the following conditions otherwise immediate damage will result to the alternator.

Electrical welding equipment must never be used anywhere on the vehicle unless the battery and the alternator leads have first been disconnected. Never disconnect the battery or the alternator leads WHILST THE ENGINE IS RUNNING.

A rapid battery charger can be used, provided that the battery leads are ALWAYS disconnected first. Always take great care that the battery is connected correctly. Check the polarity BEFORE making the connections. Remember that the battery is always connected to the alternator current terminal. When the ignition switch is closed, the battery is also connected to the field terminal. Take care that these two points are never shorted out inadvertently.

Do not allow water to be sprayed directly onto the alternator.

10.2.1. TECHNICAL DATA

Nominal voltage:	12 volts
No Load Test Data:	
Voltage:	14 volts
Current:	0 amps
Speed:	1050 rpm or less
Load Test Data:	
Voltage:	14 volts
Current:	50 amps
Speed:	2500 rpm or less
Number of brushes:	2
Length of Brushes:	
New:	15 mm (0.59 in.)
Wear limit:	8 mm (0.31 in.)
Slip Ring Diameter:	
New:	33 ± 0.2 mm (1.299 ± 0.008 in.)
Wear limit:	32.5 mm (1.280 in.)
Brush spring pressure:	384 - 396 mm (0.85 - 0.87 lb.)

10.2.2. ALTERNATOR — SERVICING

The alternator requires no lubrication since the bearings are pre-packed and sealed. Keep the outside of the alternator free from oil and dirt by wiping over occasionally with a dry cloth. The brushes operate on plain slip rings and the life of the brushes and slip rings can be expected to be quite long.

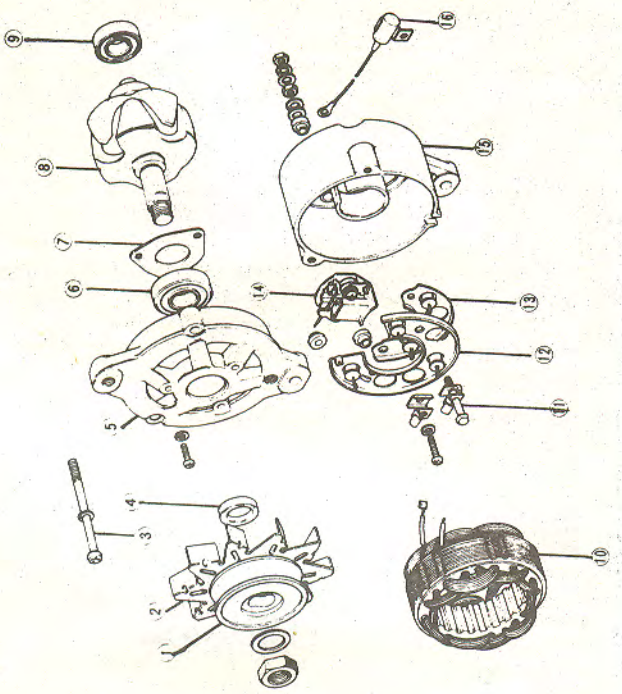


Fig. 10.2. – Exploded view of the alternator.

1. Pulley
2. Fan
3. Tension bolt
4. Spacer
5. Drive end bracket
6. Drive end bearing
7. Bearing retaining plate
8. Rotor
9. Slip ring and bearing
10. Stator
11. Terminal bolt
12. Positive diode and holder
13. Negative diode and holder
14. Brush and holder
15. Slip ring end housing
16. Condenser

Servicing and testing of the alternator requires special test equipment and it is recommended that such work is entrusted to your dealer or a specialist. Fig. 10.2. shows, however, an exploded view of the alternator and this should be used if it is attempted to dismantle and assemble the alternator to replace suspected parts.

10.3. Regulator

10.3.0. TECHNICAL DATA

The air gap, point gap and back gap mentioned in the following data are shown in Fig. 10.3. and can be checked accordingly:

Constant Voltage Relay:	
Air gap:	0.7 - 1.3 mm (0.028 - 0.051 in.)
Point gap:	0.30 - 0.45 mm (0.012 - 0.018 in.)
Back gap:	0.70 - 1.50 mm (0.028 - 0.059 in.)
Regulated voltage (no load) at 4000 rpm of alternator:	14 - 15 volts

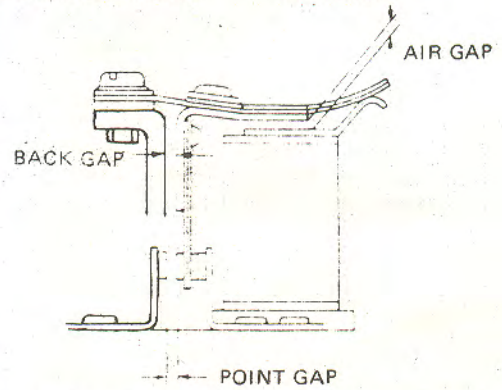


Fig. 10.3. – The gaps to be measured on the voltage regulator. The values of the three gaps are given in Section 10.3.0.

10.3.1. REGULATOR – SERVICING

Keep the contact point faces clean and free from grease or dirt. Polish with No. 400 sandpaper if necessary and clean with a little trichlorethylene or other solvent. If the point faces are excessively damaged or fused it will be necesary to replace the unit.

11. AIR POLLUTION CONTROL SYSTEMS

11.0. Description

The engine is fitted with the following additional equipment to control air pollution:

Thermal reactor
Air pump
Air control valve
2 control units (situated under dash)
2 thermosensors

The control units control electrically the ignition circuit and the air control valve. The thermal reactor returns the hot exhaust gases after they leave the combustion chamber and in order to achieve a combustible mixture, air is fed into the thermal reactor via the air control valve. This reduces the hydro-carbon and carbon monoxide content. The thermal reactor is kept cool by cold air circulated around its casing which is controlled by the air control valve.

The anti-after-burn valve, as the name implies, feeds additional air into the combustion chamber on deceleration which prevents backfiring in the exhaust system. The thermosensors send signals to the two control units which brings them into operation when the engine is cold. During idling speed there is air injection into the cylinders of the engine. During deceleration there is NO air injection and both the coasting valve and the after-burn-valve are open.

11.1. Checking of Systems

11.1.0. CHECKING OF THERMAL REACTOR

Remove the air hose leading to the air control valve and check to see that the non-return valve works smoothly. Start the engine and check whether the air injection system works properly. Make sure that most of the exhaust gas is not released from the cooling air injection pipe for the thermal reactor.

11.1.1. CHECKING OF AIR CONTROL VALVE

Turn off the ignition switch. If a "clicking" can be heard

in the solenoid it is working normally. If a direct connection between the solenoid terminal and the battery produces no "clicking", the solenoid is defective.

11.1.2. CHECKING OF AFTER-BURN-VALVE

Remove the air suction hose. Run the engine at idle speed and hold the hand over the opening of the suction hose. If strong vacuum is felt, replace the valve. Run the engine between 3500 and 3800 rpm and make sure that, when the throttle valve is fully closed suddenly, air is sucked in for 0.4 - 1.0 seconds through the air suction hose of the valve. Reduce the speed to idling and remove the wire from the valve. Make sure that the air continues to be sucked in through the hose while the wire is disconnected.

11.1.3. CHECKING THE IDLE SWITCH

Remove the idle switch terminal. If there is conduction when an external force is not applied to the switch knob (when the primary throttle valve opens at idle angle), the idle switch is normal.

11.1.4. CHECKING OF CHOKE SWITCH

Remove the choke switch terminal. If the two terminals of the switch are disconnected by pulling the choke control knob about 10 mm (0.4 in.) and connected by returning the knob, the switch is normal.

11.1.5. CHECKING OF AIR SUPPLY VALVE

Remove the air hose from the air suction pipe of the air supply valve. When the engine is running at idle speed, close the air supply valve with the hand and check if there is a reduction in idle speed of at least 30 rpm. When the wiring to the supply valve solenoid is dis-

connected, a large amount of air should be supplied into the intake manifold.

11.2. Exhaust Emission Tests

CO and HC contents are regulated, but there is no regulation on NOx at present. The CO content should be less than 3 %. The HC content should be under 300 ppm.

To check the CO and HC contents of the engine, first check if the water temperature gauge shows the normal reading. Adjust the idling speed to 900 - 970 rpm and the ignition timing (see Section "Ignition"). Measure the CO and HC contents with an analyser, following the instructions given by the manufacturer of the instrument.

As the idling emissions are closely related with the idle fuel flow, any adjustments should be carried out by your Mazda dealer or distributor, as the idle limiter is adjusted by the manufacturer and should not be disturbed.

11.3. Evaporative Emission Control System

This system prevents emission of fuel vapour generated by the ambient temperature around the fuel tank when the car is running or standing. The fuel vapour rising from the surface of fuel in the fuel tank due to the ambient temperature is channelled into the condense tank and then fed back to the fuel tank when the engine is not running. Any fuel vapour that has not condensed in the condense tank is led into the air space of the engine where such vapour goes to the charcoal filter and is trapped there, The fuel vapour rising from the fuel tank when the engine is running is directly channelled to the ventilation valve from which it is sucked into the intake manifold to be burnt up in the combustion chamber.

11.4. Charcoal Filter

When the car is stationary, some of the fuel vapour generated in the fuel tank does not condense in the condense tank and, when channelled into the engine air without being fed back to the fuel tank, still cannot be trapped in the air space. Such vapour is absorbed by the charcoal filter. While the engine is running, the fuel vapour trapped in this filter is released into the intake manifold together with fresh air from the air cleaner and burnt up in the engine. The condense tank condenses the fuel vapour coming from the fuel tank and returns it to the fuel tank.

11.4.0. CHECKING OF CHARCOAL FILTER

Check that the air cleaner element is not clogged. When the whole surface is damp with oil, measure the ventilation resistance. Attach a vacuum gauge and check that at an engine speed of 2500 - 3000 rpm the vacuum gauge reads under 60 mm Hg (2.4 in. Hg).

FAULT FINDING SECTION

The following section lists some of the more common faults that can develop in a motor car. The section is divided in various categories and it should be possible to locate faults or damage by referring to the assembly group of the vehicle in question.

The faults are listed in no particular order and their causes are given a number. By referring to this number it is possible to read off the possible cause and to carry out the necessary remedies, if this is within the scope of your facilities.

ENGINE FAULTS

Engine will not crank:	1, 2, 3, 4
Engine cranks, but will not start:	5, 6, 7, 8
Engine cranks very slowly:	1, 2, 3
Engine starts, but cuts out:	5, 6, 9, 10
Engines misfires in the lower speed ranges:	5, 6, 9, 11
Engine misfires in the higher speed ranges:	5, 6, 11, 12
Continuous misfiring:	5, 6, 7, 10 to 15, 21, 22
Max. revs. not obtained:	5, 6, 9, 12, 22
Faulty idling:	5, 6, 8 to 11, 13, 15, 16, 21 and 22
Lack of power:	3, 5 to 11, 13 to 15, 22
Lack of acceleration:	5 to 8, 12, 14 to 16
Lack of max. speed:	5 to 8, 10, 12, 13 to 15, 22
Excessive fuel consumption:	3, 5, 6, 15, 16
Excessive oil consumption:	16 to 19
Pinking and running-on (dieseling)	5, 6
Low compression:	7, 11 to 13, 16, 20 to 22

CAUSES AND REMEDIES

1. Fault in the starter motor or its connections. Refer to "Electrical Faults".

2. Engine oil too thick. This can be caused by using the wrong oil, low temperatures or using oil not suitable for the prevailing climates. Depress the clutch whilst starting. Otherwise refill the engine with the correct oil grade.

3. Moveable parts of engine not run-in. This fault may be noticed when the engine has been overhauled. It may be possible to free the engine by adding oil to the fuel for a while.

4. Mechanical fault. This may be due to seizure of the piston(s), broken crankshaft, connecting rods, clutch or other moveable parts of the engine. The engine must be stripped for inspection.

5. Fault in the ignition system. Refer to "Ignition Faults".

6. Fault in the fuel system. Refer to "Fuel Faults".

7. Incorrect valve timing. This will only be noticed after the engine has been re-assembled after overhaul. Re-dismantle and check the timing marks on the timing gear wheels.

8. Compression leak due to faulty closing of valves. Check valve clearances. See also under (7.) or leakage past worn piston rings or pistons. Cylinder head gasket blown.

9. Entry of air at inlet manifold, due to split manifold or damaged gasket. Correct as necessary.

10. Restriction in exhaust system, due to damaged exhaust pipes, dirt in end of pipe, kinked pipes, or collapsed silencer. Repair as necessary.

11. Worn valves or valve seats, no longer closing the valves properly. Top overhaul of engine is asked for.

12. Sticking valves due to excessive carbon deposits or weak valve springs. Top overhaul is asked for.

13. Cylinder head gasket blown. Replace gasket and check block and head surfaces for distortion.

14. Camshaft worn, not opening or closing one of the valves properly, preventing proper combustion. Check and if necessary fit new camshaft.

15. Incorrect valve (tappet) clearance. Re-adjust.

16. Cylinder bores, piston or piston rings worn. Overhaul is the only cure. Fault may be corrected for

a while by adding "Piston Seal Liquid" into the cylinders, but will re-develop.

17. Worn valve guides and/or valve stems. Top overhaul is asked for.

18. Damaged valve stem seals. Top overhaul is asked for.

19. Leaking crankshaft oil seal, worn piston rings or pistons, worn cylinders. Correct as necessary.

20. Loose spark plug, gases escaping past threads, or plug sealing washer damaged. Correct.

21. Cracked cylinder or cylinder block. Dismantle, investigate and replace block if necessary.

22. Broken, weak or collapsed valve spring(s). Top overhaul is asked for.

IGNITION FAULTS

Engine does not start:	1 to 3, 5, 6, 8 to 14, 19
Engine misfires:	2 to 7, 9 to 12, 14, 19
One cylinder not working:	2 to 7, 9 to 14
Engine fails to rev, misfires on acceleration:	2 to 7, 9 to 12, 14, 19
Incorrect idling speed:	1 to 3, 5 to 15, 17
Lack of power:	2 to 12, 14, 15, 17, 19
Poor acceleration:	As for "Lack of Power"
Lack of max. speed:	As for "Lack of Power"
Excessive fuel consumption:	As for "Lack of Power"
Pinking and running-on (dieseling):	2, 3, 5, 6, 8, 11, 12, 15, 16, 18

CAUSES AND REMEDIES

1. Battery discharged or defective. Try charging the battery or replace. Use slave battery to start the engine.

2. Contact breakers not working properly. Clean old points or replace.

3. Contact breakers connected to earth. This could happen after replacement of the points.

4. Contact breaker arm spring too weak. Check with spring scale. Renew points if necessary.

5. Spark plugs need attention. Check condition of plug faces, clean plugs and adjust electrode gaps to specification. Check when plugs have been replaced last time.

6. Incorrect spark plug gaps. See also under 5.

7. Wrong type of spark plug fitted. Check with the specifications and install correct plugs.

8. Ignition timing not correctly adjusted. Check and re-time ignition if necessary, using a stroboscopic timing lamp if possible.

9. Coil or condensor defective. No repairs possible, replace, making sure that condensor with correct mfd value is fitted.

10. Loose connection in L.T. circuit (small lead at side of distributor for example). Check and correct.

11. Open circuit, short circuit to ground (earth) or centre lead of coil not fitted properly. Check all cables and make sure centre lead makes contact.

12. The same as 11, but fault is in the spark plug leads. Check for broken cables and proper connections.

13. Plug leads incorrectly connected. Fault only evident after distributor or plugs have been removed and leads incorrectly connected. Follow firing order and reconnect properly.

14. "Tracking" present. This means that H.T. voltage is creeping to ground (earth) due to dirt, or or dampness. Various products (damp start) are available to overcome problem, mainly if caused by dampness (water spray, rain, etc.).

15. Centrifugal advance not operating properly. Check by removing distributor cap, turn rotor against tension of flyweight springs and release. Rotor should return to original position (no sticking).

16. Vacuum advance not operating. Pull off vacuum hose at distributor with engine running and then re-connect. Engine noise must change if engine speed is increased.

17. Distributor cam or shaft worn. Overhaul distributor or fit replacement unit (correct one).

18. Fuel with incorrect octane rating used. Check with

manufacturers recommendation.
Pinking can also be caused by overheating of the engine or too much advanced ignition timing.

19. Carbon brush in distributor cap worn or spring too weak. Check and replace if necessary.

LUBRICATION SYSTEM FAULTS

The only problem the lubrication system should give is excessive oil consumption or low oil pressure, or the oil warning light not going off.

Excessive oil consumption can be caused by worn cylinder bores, pistons and/or piston rings, worn valve guides, worn valve stem seals or a damaged crankshaft oil seal or leaking gasket on any of the engine parts. In most cases the engine must be dismantled to locate the fault.

Low oil pressure can be caused by a faulty oil pressure gauge, sender unit or wiring, a defective relief valve, low oil level, blocked oil pick-up pipe for the oil pump, worn oil pump or damaged main or big end bearings. In most cases it is logical to check the oil level first and then the operation of the oil pressure gauge. All other causes require the dismantling and repair of the engine.

If the oil warning light stays on (if fitted), switch off the engine IMMEDIATELY, as delay could cause complete seizure of the engine within minutes.

COOLING SYSTEM FAULTS (water-cooled engines only)

Common faults are: Overheating, loss of coolant and slow warming up of the engine:

Overheating:

1. Lack of coolant: Open the radiator cap with care to avoid injuries. Never pour cold water into an overheated engine. Wait until engine cools down and pour in coolant whilst engine is running.
2. Radiator core obstructed by leaves, insects, etc.: Blow with air line from the back of the radiator or with the water hose to clean.
3. Fan belt loose or slipping: Re-adjust fan belt tension or replace. In emergency use a nylon stocking to make up a make-shift fan belt by tieing the stocking around all pulleys.
4. Thermostat sticking: If sticking in the closed position, coolant can only circulate within the cylinder block. Remove thermostat and check as described in Section "Cooling".
5. Water hose split: Identified by rising steam from the engine compartment. Slight splits can be repaired with insulation tape. Drive without radiator cap to keep the pressure in the system down, to the nearest service station.
6. Ignition or carburettor incorrectly adjusted: Adjust accordingly.
7. Water pump inoperative: Overhaul or replace water pump.
8. Cylinder head gasket blown: Replace the cylinder head gasket.

Loss of Coolant:

1. Radiator leaks: Slight leaks may be stopped by using radiator sealing compound (follow the instructions of the manufacturer). In emergency a raw egg can be cracked open and poured into the radiator filler neck.
2. Hose leaks: See under 5, "Overheating".
3. Water pump leaks: Check the gasket for proper sealing or overhaul (replace) the pump.

Long Warming-up Periods:

1. Thermostat sticking in the open position: Remove thermostat, check and if necessary replace.

FUEL SYSTEM FAULTS

Engine does not start:	1 to 8
Engine starts, but stops soon afterwards:	1, 3 to 6, 8 to 13, 18, 19
Engine misfires low revs.:	3, 4, 8, 9
Engine misfires at high revs.:	1, 3, 4, 8, 9
Engine misfires continuously:	1 to 6, 8, 9, 12 to 14
Engine fails to rev:	1, 3, 4, 8, 9, 11 to 17, 21
Bad idling:	4, 8 to 14, 18, 19, 21
Lack of power:	4, 8, 11 to 14, 19, 21

Lack of max. speed:	4, 8, 11 to 15, 17, 19, 21
Excessive fuel consumption:	3, 4, 11, 12, 16, 17, 19, 21
Pinking:	15, 20, 21
Backfiring:	4, 9, 11, 13, 14,

CAUSES AND REMEDIES

1. Fuel tank empty. Refuel.
2. Fuel line or pipe blocked. Remove pipes and blow through it with compressed air to remove obstruction.
3. Fuel pump not operating. Remove pump and check operation. Repair or replace.
4. Carburettor jets blocked (if applicable). Remove all jets and blow through them with compressed air or in emergency with the mouth.
5. Air lock in fuel pipe. Unscrew pipe and blow through it with compressed air.
6. Fuel filter blocked. Remove filter from its location and clean or replace.
7. Float chamber needle valve sticking. Unscrew float chamber cover, remove needle valve and free off or replace valve. Fit cover with new gasket.
8. Water in carburettor. Clean out float chamber and all jets.
9. Restricted fuel flow due to foreign body in fuel supply lines. Clean out lines.
10. Slow-running speed too low. Adjust to proper value.
11. Choke control improperly adjusted. Adjust in the case of manual choke and check setting in the case of automatic choke.
12. Float level out of adjustment. Adjust in accordance with instructions in Section "Fuel System".
13. Carburettor icing up. Very rare fault on modern carburettors. Engine will restart after the ice has thawed up.
14. Inlet manifold sucks in additional air. Check all gaskets on manifold and replace if necessary.
15. Fuel with incorrect octane rating used. Use proper fuel grade. Check with manufacturer.
16. Accelerator pump not operating. Dismantle carburettor and check linkage, lever and diaphragm.
17. Throttle operating linkage wrongly adjusted. Check and adjust as necessary.
18. Slow-running mixture not adjusted properly. Readjust slow-running speed in accordance with instructions in Section "Fuel System".
19. Air filter element obstructed. Remove element and check. Replace if due for renewal.
20. Ignition timing incorrectly adjusted. Adjust in accordance with instructions in Section "Ignition System".
21. Incorrect carburettor jets fitted. Applies not to fixed jet carburettors. Check with setting table in Section "Fuel System".

CLUTCH FAULTS

Clutch slipping:	1, 2, 3, 4, 5
Clutch will not disengage fully:	4, 6 to 12, 14
Clutch judder:	1, 2, 7, 10 to 13
Whining from clutch when pedal is depressed:	13
Clutch noise when idling:	2, 3
Clutch noise during engagement:	2

CAUSES AND REMEDIES

1. Insufficient clutch free play at pedal. Adjust in accordance with instructions in Section "Clutch".
2. Clutch disc linings worn, hardened, oiled-up, loose or broken. Disc distorted or hub loose. Clutch disc must be replaced.
3. Pressure plate fault. Replace clutch.
4.* Air in hydraulic system (only applicable to models with hydraulic clutch control). Low fluid level in clutch cylinder reservoir.
5. Insufficient play at clutch pedal and clutch release linkage (the latter in the case of mechanical clutch operation). Adjust as described.

6. Excessive free play in release linkage (only for cable and linkage operated clutch). Adjust or replace worn parts.
7. Misalignment of clutch housing. Very rare fault, but possible on transmissions with separate clutch housings. Re-align to correct.
8. Clutch disc hub binding on splines of main drive shaft (clutch shaft) due to dirt or burrs on splines. Remove clutch and clean and check splines.
9. Clutch disc linings loose or broken. Replace disc.
10. Pressure plate distorted. Replace clutch.
11. Clutch cover distorted. Replace clutch.
12. Fault in transmission or loose engine mountings.
13. Release bearing defective. Remove clutch and replace bearing.
14. Bend clutch release lever. Check lever and replace or straighten if possible.

* The above faults and remedies are for hydraulic and mechanical clutch operation and should be read as applicable to the model in question, as the clutch fault finding section is written for all types of clutch operation.

STEERING FAULTS

Steering very heavy:	1 to 6
Steering very loose:	5, 7 to 9, 11 to 13
Steering wheel wobbles:	4, 5, 7 to 9, 11 to 16
Vehicle pulls to one side:	1, 4, 8, 10, 14 to 18
Steering wheel doe not return to centre pos.:	1 to 6, 18
Abnormal tyre wear:	1, 4, 7 to 9, 14 to 19
Knocking noise in column:	6, 7, 11, 12,

CAUSES AND REMEDIES

1. Tyre pressures not correct or uneven. Correct.
2. Low oil level in steering gear (if steering is filled with oil). Otherwise lack of lubricant on rack and pinion steering.
3. Stiff steering linkage ball joints. Re-grease if provisions are made for it, otherwise replace ball joints in question.
4. Incorrect wheel alignment. Correct as necessary.
5. Steering needs adjustment. Adjust as necessary.
6. Steering column bearings too tight or seized or steering column bent. Correct as necessary.
7. Steering linkage joints loose or worn. Check and replace joints as necessary.
8. Front wheel bearings worn, damaged or loose. Re-adjust bearing play or replace the bearings if no result can be obtained.
9. Front suspension parts loose. Check and correct.
10. Wheel nuts loose. Re-tighten.
11. Steering wheel loose. Re-tighten nut.
12. Steering gear mounting loose. Check and tighten.
13. Steering gear worn. Although it may be possible to overhaul the steering, the fitting of a replacement steering could be the solution.
14. Steering damper (if fitted) defective or loose.
15. Wheels not properly balanced or tyre pressures uneven. Correct pressures or balance wheels.
16. Suspension springs weak or broken. Replace spring in question or both.
17. Brakes are pulling to one side. See under "Brake Faults".
18. Suspension out of alignment. Have the complete suspension checked by a dealer.
19. Improper driving. We don't intend to tell you how to drive and are quite sure that this is not the cause of the fault.

BRAKE FAULTS

Brake Failure: Brake shoe linings or pads excessively worn, incorrect brake fluid (after overhaul), insufficient brake fluid, fluid leak, master cylinder defective, wheel cylinder or caliper failure. Remedies are obvious in each instance.

Brakes Ineffective: Shoe linings or pads worn, incorrect lining material or brake fluid, linings contaminated, fluid level low, air in brake system (bleed brakes), leak in pipes or cylinders, master cylinder defective. Remedies are obvious in each instance.

Brakes pull to one side: Shoes or linings worn, incorrect linings or pads, contaminated linings, drums or discs scored, fluid pipe blocked, unequal tyre pressures, brake back plate or caliper mounting loose, wheel bearings not properly adjusted, brakes need adjustment, wheel cylinder seized. Remedy as necessary.

Brake pedal spongy: Air in hydraulic system, System must be bled of air.

Pedal travel too far: Linings or pads worn, brakes need adjustment, drums or discs scored, master cylinder or wheel cylinders defective, system needs bleeding. Rectify as necessary.

Loss of brake pressure: Fluid leak, air in system, leak in master or wheel cylinders, brake servo not operating (vacuum hose disconnected from inlet manifold – if a brake servo is fitted). Place vehicle on dry ground and depress brake pedal. Check where fluid runs out and rectify as necessary.

Brakes binding: Incorrect brake fluid (boiling), weak shoe return springs, brakes adjusted improperly, piston in caliper or wheel cylinder seized, push rod play on master cylinder insufficient (compensation port obstructed), handbrake adjusted too tightly. Rectify as necessary. Swelling of cylinder cups through use of incorrect fluid could be another reason.

Handbrake ineffective: Brake shoe linings worn, linings contaminated, operating lever on brake shoe seized, brake shoes or handbrake need adjusting. Rectify as necessary.

Excessive pedal pressure required: Brake shoe linings or brake pads worn, linings or pads contaminated, brake servo vacuum hose disconnected from manifold, master or wheel brake cylinder seized. Rectify as necessary.

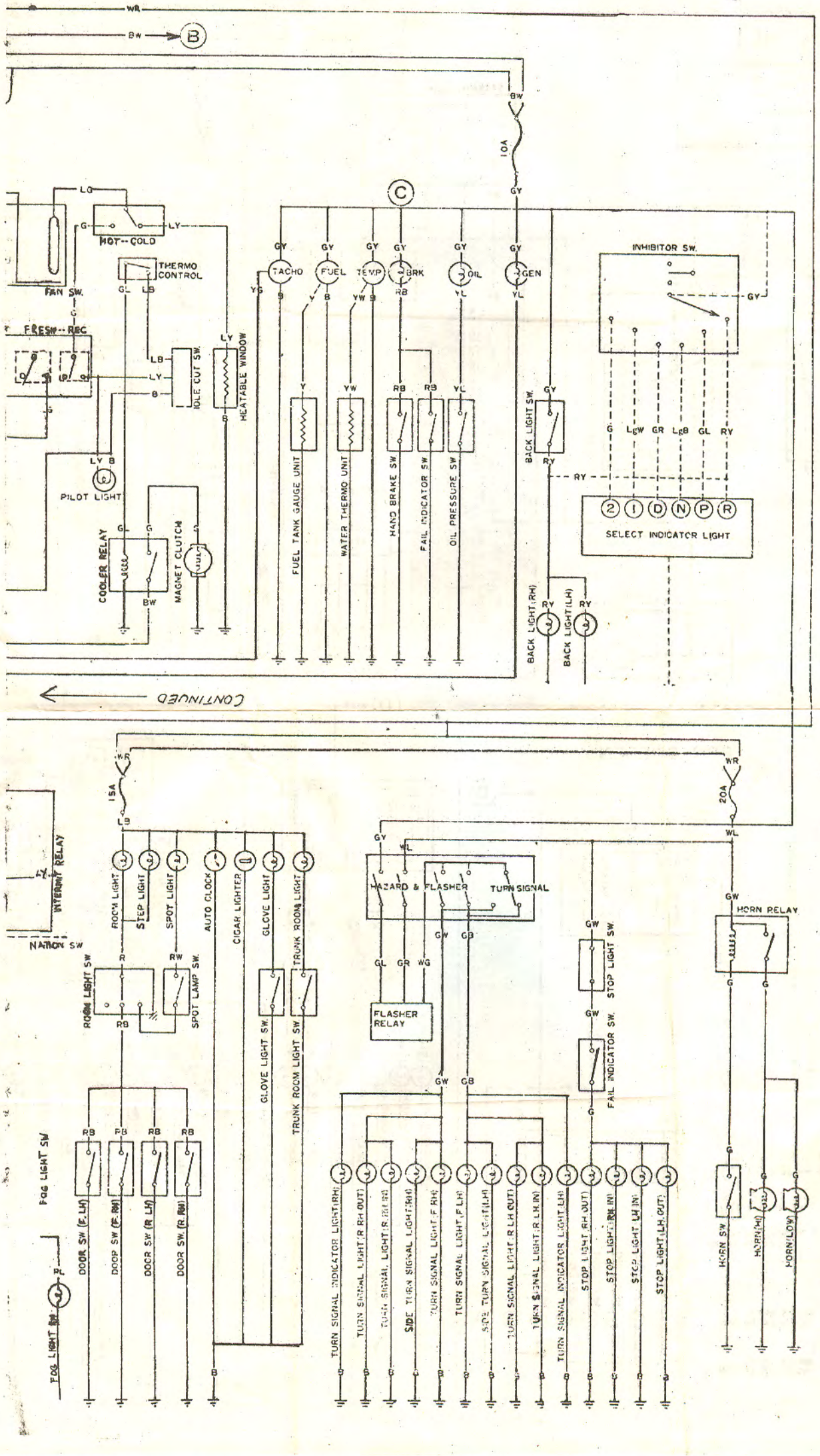
Brakes squealing: Brake shoe linings or pads worn so far that metal is grinding against drum or disc. Inside of drum is full of lining dust. Remove and replace, or clean out the drum(s).

ELECTRICAL FAULTS

Starter motor failure:	2 to 5, 8, 9
No starter motor drive:	1 to 3, 5 to 7
Slow cranking speed:	1 to 3
Charge warning light remains on:	3, 10 to 12
Charge warning light does not come on:	2, 3, 9, 11, 13
Headlamp failure:	2, 3, 11, 13, 15 to 17
Battery needs frequent topping-up:	11
Direction indicators not operating:	2, 3, 9, 13, 15, 18
Battery frequently discharged	3, 10, 11, 12,

CAUSES AND REMEDIES

1. Tight engine. Check and rectify.
2. Battery discharged or defective. Re-charge battery or replace if older than approx. 2 years.
3. Interrupted connection in circuit. Trace and rectify.
4. Starter motor pinion jammed in flywheel. Release.
5. Also 6, 7 and 8. Starter motor defective, no engagement in flywheel, pinion or flywheel worn or solenoid switch defective. Correct as necessary.
9. Ignition/starter switch inoperative. Replace.
10. Drive belt loose or broken. Adjust or replace.
11. Regulator defective. Adjust or replace.
12. Generator inoperative. Overhaul or replace.
13. Bulb burnt out. Replace.
15. Flasher unit defective. Replace.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BW
B
C
10A
GY
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LY
HOT--COLD
THERMO CONTROL
FAN SW.
GL
LB
FRESH--REC
IDLE CUT SW.
HEATABLE WINDOW
PILOT LIGHT
COOLER RELAY
MAGNET CLUTCH
BW
TACHO
FUEL
TEMP
BRK
OIL
GEN
FUEL TANK GAUGE UNIT
WATER THERMO UNIT
HAND BRAKE SW
FAIL INDICATOR SW
OIL PRESSURE SW
BACK LIGHT SW.
INHIBITOR SW.
G LGW GR LGB GL RY
2 1 D N P R
SELECT INDICATOR LIGHT
BACK LIGHT(RH)
BACK LIGHT(LH)
RY
CONTINUED
15A
WR
LB
WYPER RELAY
NAITON SW
ROOM LIGHT
STEP LIGHT
SPOT LIGHT
AUTO CLOCK
CIGAR LIGHTER
GLOVE LIGHT
TRUNK ROOM LIGHT
ROOM LIGHT SW
SPOT LAMP SW.
GLOVE LIGHT SW.
TRUNK ROOM LIGHT SW
20A
WL
HAZARD & FLASHER
TURN SIGNAL
GW
GB
GL GR WG
FLASHER RELAY
STOP LIGHT SW
FAIL INDICATOR SW.
HORN RELAY
HORN SW
HORN(HI)
HORN(LOW)
FOG LIGHT SW
DOOR SW.(F.LH)
DOOR SW.(F.RH)
DOOR SW.(R.LH)
DOOR SW.(R.RH)
TURN SIGNAL INDICATOR LIGHT(RH)
TURN SIGNAL LIGHT(F.RH)
SIDE TURN SIGNAL LIGHT(RH)
TURN SIGNAL LIGHT(R.RH OUT)
TURN SIGNAL LIGHT(F.LH)
SIDE TURN SIGNAL LIGHT(LH)
TURN SIGNAL LIGHT(R.LH OUT)
TURN SIGNAL LIGHT(R.LH IN)
TURN SIGNAL INDICATOR LIGHT(LH)
STOP LIGHT(RH OUT)
STOP LIGHT(RH IN)
STOP LIGHT(LH IN)
STOP LIGHT(LH OUT)

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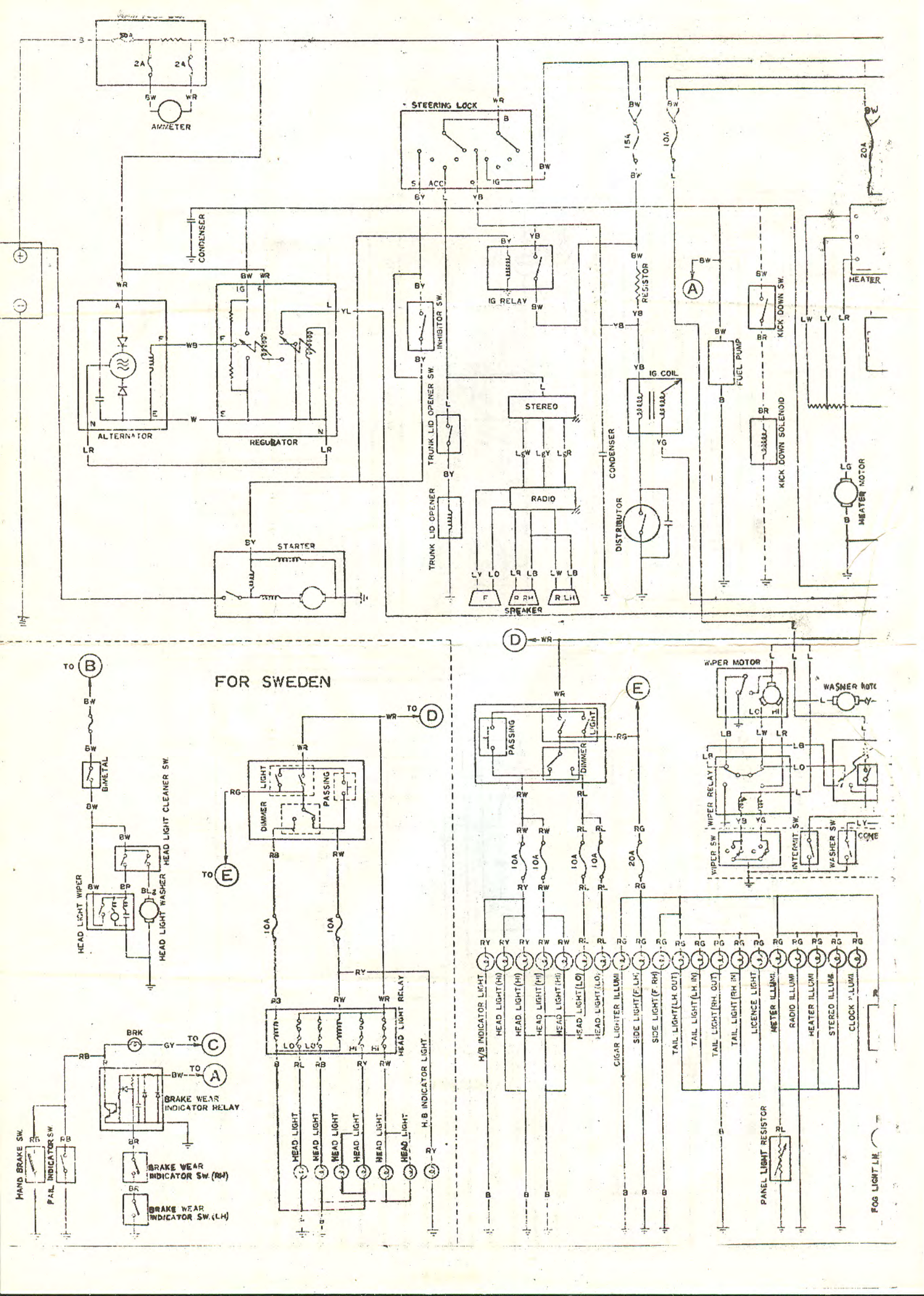
AMMETER
STEERING LOCK
CONDENSER
ALTERNATOR
REGULATOR
IG RELAY
INHIBITOR SW.
TRUNK LID OPENER SW.
TRUNK LID OPENER
STEREO
RADIO
SPEAKER
STARTER
REGISTOR
IG COIL
DISTRIBUTOR
CONDENSER
FUEL PUMP
KICK DOWN SW.
KICK DOWN SOLENOID
HEATER
HEATER MOTOR
FOR SWEDEN
BIMETAL
HEAD LIGHT CLEANER SW.
HEAD LIGHT WIPER
HEAD LIGHT WASHER
LIGHT
PASSING
DIMMER
HEAD LIGHT RELAY
HEAD LIGHT
H.B INDICATOR LIGHT
BRAKE WEAR INDICATOR RELAY
BRAKE WEAR INDICATOR SW. (RH)
BRAKE WEAR INDICATOR SW. (LH)
HAND BRAKE SW.
PARK INDICATOR SW.
WIPER MOTOR
WIPER RELAY
WIPER SW.
INTERMIT SW.
WASHER SW.
WASHER MOTOR
H/B INDICATOR LIGHT
HEAD LIGHT (HI)
HEAD LIGHT (LO)
CIGAR LIGHTER ILLUMI
SIDE LIGHT (F.LH)
SIDE LIGHT (F.RH)
TAIL LIGHT (LH OUT)
TAIL LIGHT (LH IN)
TAIL LIGHT (RH OUT)
TAIL LIGHT (RH IN)
LICENCE LIGHT
METER ILLUMI
RADIO ILLUMI
HEATER ILLUMI
STEREO ILLUMI
CLOCK ILLUMI
PANEL LIGHT RESISTOR
FOG LIGHT LH