kitten

Kitten Saloon and Estate Workshop Manual

Incorporating the Factory supplement pack

Remastered January 2011 by Atodini

Introduction

This Workshop Manual contains all the relevant information to assist Reliant Dealers to service and maintain the Kitten Saloon, Estate and Van Models.

Dismantling, assembly and adjustment procedure for all major units and associated parts are dealt with in detail.

A comprehensive stock of spare parts are available from Reliant Dealers. a spare parts list is available for use when ordering. Only genuine Reliant "R" parts should be used.

Service Department
Reliant Motor Company Limited
Two Gates Tamworth
Staffordshire B77 1HN
Telephone Tamworth 4151
Telegrams Reliant Tamworth 4151
Telex 341501

Parts Supply Department
The Reliant Motor Company Limited
Lynn Lane Shenstone
Staffordshire WS14 0ED
Telephone Shenstone 480671

Original "R" Part No. 91048

Contents

General Specification

Engine

Number of Cylinders		4 in-line
Bore of cylinders		62.50 mm (2.46 in)
Stroke of crankshaft		69.09 mm (2.72 in)
Cubic capacity		848 cc (51.77 cu in)
Compression ratio	saloon/estate	9.5 to 1
	van	8.5 to 1
Speed at 1,000 rpm in top gear	saloon/estate	17 mph (37.4 kph)
	van	15.5 mph (25 kph)
Valve clearance -		
Inlet	0.25 mm (0.010 in) Hot	0.152 mm (0.006 in) Cold
Exhaust	0.25 mm (0.010 in) Hot	0.152 mm (0.006 in) Cold

Performance Data

Brake Horse Power (maximum)	40.0 at 5,500 rpm
Torque (maximum)	6.38 kg/m (46 lb ft) at 3,500 rpm

Lubrication System

Pump	Submerged eccentric rotor type
Filter	External full-flow type
Oil Pressure	3.16 kg/sq cm (45 lb/sq in)

Ignition System

12 Volt battery and coil		Negative Earth
Contact breaker gap		0.38 mm (0.015 in)
Sparking Plugs -	Type	Motocraft AGR 32
	Gap	0.64 mm (0.025 in)
Firing Order		1, 3, 4, 2
Ignition Timing		10° BTDC

Cooling System

Pressurised radiator, pump assisted circulation and four-bladed fan driven by a "V" belt from engine pulley

Radiator cap pressure	0.492 kg/sq cm (7 lbs/sq in)

Fuel System

Carburettor	Emission controlled SU type HS2 - 1¼ in
Fuel Pump	AC Delco mechanical
Air Cleaner	Paper element type

Clutch

Type	Single dry plate 158.75 mm (6.25 in) diameter
Operation	Cable

Gearbox

Four forward speeds and reverse. Synchromesh on all forward gears

Ratio:	Top	1.00:1
	Third	1.32:1
	Second	2.05:1
	First	3.88:1
	Reverse	3.25:1

Rear axle

Type		Spiral bevel gear semi floating
Ratio	saloon/estate	3.23:1
	van	3.545:1

Brakes

System		Lockheed hydraulically operated internal expanding to all wheels
Size -	Front	177.8 x 38.1 mm (7 in x 1.50 in)
	Rear	177.8 x 31.25 mm (7 in x 1.25 in)
Handbrake		Lever type operating rear brakes mechanically by cable linkage

Suspension

Front	Reliant independent - wishbones, coil springs, damper units and anti roll bar
Rear	Reliant - progressive rate leaf spring, telescopic damper units.

Steering	
Type	Rack and pinion
Turning Circle	7.32 m (24 ft)
Castor	12°
Camber	1° positive
Toe-in	Zero
King pin inclination	9°
Conforming to European Safety Regulations	

Chassis Data	
Type	Box section with tubular cross members and channrel section diagonal cross bracing.
Wheelbase	2146 mm (84.65 in)
Track, front and rear	1244.6 mm (49 in)
Ground clearance (fully laden)	127.0 mm (5.0 in)

Wheels and tyres	**Saloon/Estate**	**Van**
Road wheels	350B x 10	350B x 10
Tyres	145 x 10 radials	520 x 10 cross ply

Capacities	
Engine including filter	3.13 litres (5.50 pints)
Gearbox	0.64 litres (1.125 pints)
Rear axle	1.28 litres (2.25 pints)
Steering rack and pinion	0.19 litres (0.33 pints)
Cooling system including heater	3.69 litres (6.5 pints)
Fuel tank	27.3 litres (6 gallons)

Vehicle Dimensions	**Saloon**	**Estate**	**Van**
Overall length	3327.4 mm (131 in)	3346.5 mm (131.75 in)	3346.5 mm (131.75 in)
Overall width	1422.4 mm (56 in)	1422.4 mm (56 in)	1422.4 mm (56 in)
Overall height	1397 mm (55 in)	1397 mm (55 in)	1397 mm (55 in)
Loading height	1016mm (40 in) (ground to tailgate sill)	508 mm (20 in) (ground to rear floor)	508 mm (20 in) (ground to rear floor)
Load width - maximum	1028.7 mm (40.5 in) (width at tailgate sill)	850.9 mm (33.5 in) (rear door aperture)	850.9 mm (33.5 in) (rear door aperture)
Load height - maximum aperture	457.2 mm (19 in) (tailgate aperture height)	749.3 mm (29.5 in) (rear door aperture)	749.3 mm (29.5 in) (rear door aperture)
Load height - maximum inside vehicle	850.9 mm (33.5 in)	876.3 mm (34.5 in)	876.3 mm (34.5 in)
Length behind rear seat	647.7 mm (25.5 in)	693.1 mm (26.5 in)	
Length with rear seat folded	1092.2 mm (43 in)	1168.4 mm (46 in)	
Load floor width behind rear seat	952.5 mm (37.5 in)	952.5 mm (37.5 in)	

Load capacities	
Saloon - capacity of boot area, rear seat up, spare wheel in position below tonneau cover	0.230 cu m (8.5 cu ft)
Saloon - capacity of rear compartment with rear seat folded, spare wheel in position, up to roof level	0.849 cu m (30 cu ft)
Estate - capacity of rear compartment with spare wheel in position and rear seat up	0.270 cu m (9.5 cu ft)
Estate - capacity of complete rear compartment, with spare wheel in position and rear seat folded	1.132 cu m (40 cu ft)
Van - capacity with front passenger seat installed	1.189cu m (42 cu ft)
Van - capacity with front passenger seat removed	1.500 cu m (53 cu ft)

Kerb weight	
Saloon	505.81 kg (1114 lb)
Estate	538.9 kg (1187 lb)
Van	515 kg (1134 lbs)

Maximum towing weights	
Gross laden vehicle weight	862 kg (1900 lb)
Approximate payload	320 kg (700 lb)
Maximum recommended front axle weight	363 kg (800 lb)
Maximum recommended rear axle weight	550 kg (1210 lb)
Recommended towing weight (maximum)	406 kg (896 lb)

Lubrication and maintenance

The maintenance periods fall in to well classified categories.

1. Regular weekly attention.
2. Maintenance at the first 1,000 miles (1500 km).
3. Maintenance at 6,000 mile (10,000 km) intervals - standard service.
4. Maintenance at 12,000 mile (30,000 km) intervals - major service.

The standard and major service intervals are designed to ensure safety and reliability under most operating conditions. However, if your operating conditions are severe, you cover a very low annual mileage or have a high proportion of short journeys, a supplementary service is recommended at intervals of 3,000 miles (5000 km).

This intermediate service is particularly important with increasing vehicle mileage, after the first 12,000 miles (20,000 km). This supplementary service is limited to simple checks and adjustments, easily carried out by an owner, all of which are described in the following pages of this manual. The work can, of course, be entrusted to a dealer if you prefer.

Details of the intermediate service together with the standard and major services, are included in the "Key to service" booklet. Presentation of this service booklet to any Reliant dealer will ensure proper completion of the maintenance operations.

The operations listed below should be carried out at the mileages shown.

Operation

Operation	Weekly	First 1,000 miles (1,500 km)	3,000 miles (5,000 km)	6,000 miles (10,000 km)	12,000 miles (20,000 km)	18,000 miles (30,000 km)	24,000 miles (40,000 km)	30,000 miles (50,000 km)	36,000 miles (60,000 km)
Lubrication									
Check and top up engine oil level	X		X						
Change engine oil		X		X	X	X	X	X	X
Change oil filter		X		X	X	X	X	X	X
Check and top up gearbox oil		X		X		X		X	
Change gearbox oil					X		X		X
Check and top up rear axle oil				X	X	X	X	X	X
Clean oil filler cap and connecting hose			X	X	X	X	X	X	X
Oil or grease all lubrication points		X		X	X	X	X	X	X
Lubricate throttle linkage and top-up carburettor damper		X	X	X	X	X	X	X	X
Lubricate all locks and hinges		X	X	X	X	X	X	X	
General									
Check air cleaner element			X	X		X		X	
Replace air cleaner element					X		X		X
Tighten cylinder head, sump and manifold fixings		X		X	X	X	X	X	X
Check and adjust valve clearances		X		X	X	X	X	X	X
Check and adjust fan belt tension		X	X	X	X	X	X	X	X
Examine and adjust or replace distributor points		X	X	X	X	X	X	X	X
Clean coil, distributor cap and HT leads				X	X	X	X	X	X
Clean and adjust spark plugs				X		X		X	
Replace spark plugs					X		X		X
Remove and clean carburettor					X		X		X
Change fuel filter					X		X		X
Check and top-up master cylinder	X		X						
Check hydraulic system, bleed and top-up		X		X	X	X	X	X	
Replace hydraulic system fluid and seals or replace units, replace hoses									X
Inspect brake system for leaks and hoses for chafing		X		X	X	X	X	X	X
Examine brake shoes			X	X	X	X	X	X	X
Adjust brakes		X	X	X	X	X	X	X	X
Check handbrake cable and adjust				X	X	X	X	X	X
Check security of wheels		X	X	X	X	X	X	X	X
Adjust tyre pressures and inspect condition of tyres	X	X	X	X	X	X	X	X	X
Check and adjust clutch		X		X	X	X	X	X	X
Check condition of steering rack gaiters					X	X	X	X	X
Check body, suspension, steering retaining fixings and connections		X		X	X	X	X	X	X
Check and adjust front wheel bearings					X	X	X	X	X
Repack front wheel bearings and adjust									X
Check front wheel toe-in, also rear wheel alignment		X			X		X		X

Operation

	Weekly	First 1,000 miles (1,500 km)	3,000 miles (5,000 km)	6,000 miles (10,000 km)	12,000 miles (20,000 km)	18,000 miles (30,000 km)	24,000 miles (40,000 km)	30,000 miles (50,000 km)	36,000 miles (60,000 km)
Check door operation, locks and hinges		X		X	X	X	X	X	X
Top-up battery, check connections	X	X	X	X	X	X	X	X	X
Top up radiator coolant	X	X	X	X	X	X	X	X	X
Check for oil and water leaks		X		X	X	X	X	X	X
Check all controls, lights, horn, instruments etc.	X	X	X	X	X	X	X	X	X
Check headlamp alignment				X	X	X	X	X	X
Check washer reservoir and top-up	X	X	X	X	X	X	X	X	X
Check external condition of exhaust system				X	X	X	X	X	X
Check and if necessary renew windscreen wiper blades					X		X		X

Road test

Check brake function		X	X	X	X	X	X	X	X
Adjust ignition timing and dwell angle		X		X	X	X	X	X	X
Adjust carburettor		X		X	X	X	X	X	X

Warning: Emission controlled carburettors require special attention

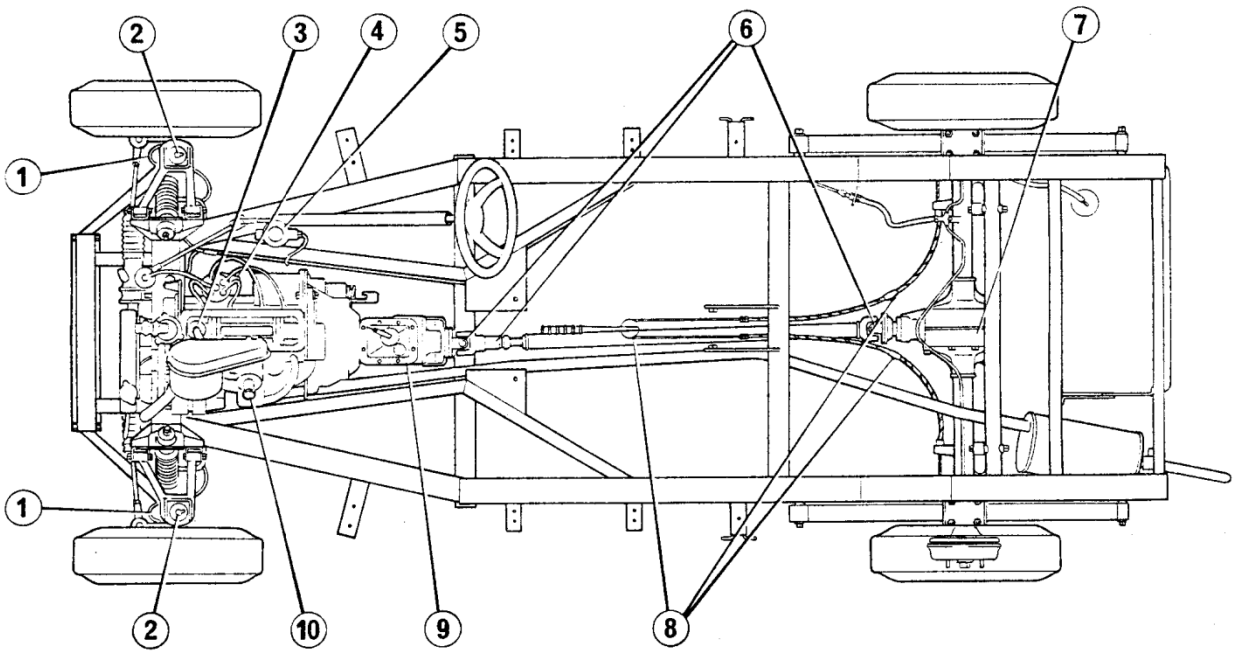


Figure 1 Lubrication points

1 Lower trunnion
2 Upper ball joint
3 Oil filler cap – engine
4 Oil filter
5 Master cylinder
6 Driveshaft
7 Rear axle filler/level plug
8 Handbrake cable
9 Gearbox filler/level plug
10 Carburettor dashpot

Routine maintenance - Engine

Check and top-up engine oil level

1. Withdraw dipstick. Wipe clean and replace. remove again and note oil level indicated by trace of oil to the full mark on the dipstick.

2. If necessary top-up with a recommended grade of oil to the full mark on the dipstick. Do not over fill (**figure 2**)

Drain engine oil and refill

This operation is best carried out when the engine is warm.

1. Place a suitable receptacle under the drain plug and unscrew the plug slowly until oil begins to escape. When the rate of flow lessens, remove the plug completely and allow the oil to drain for a few mintues. (**figure 3**) Care should be taken to ensure that no dirt or grit enters the sump whilst the plug is removed.

2. Clean the plug thoroughly and check the condition of the sealing washer. If damaged the washer should be replaced

otherwise oil leaks may result. refit the plug and screw in tightly. Refill the sump via the oil filler cap with the recommended grade of oil. A flushing oil can be used to advantage on engines which have done a considerable mileage, particularly if the recommended oil change intervals have not been adhered to.

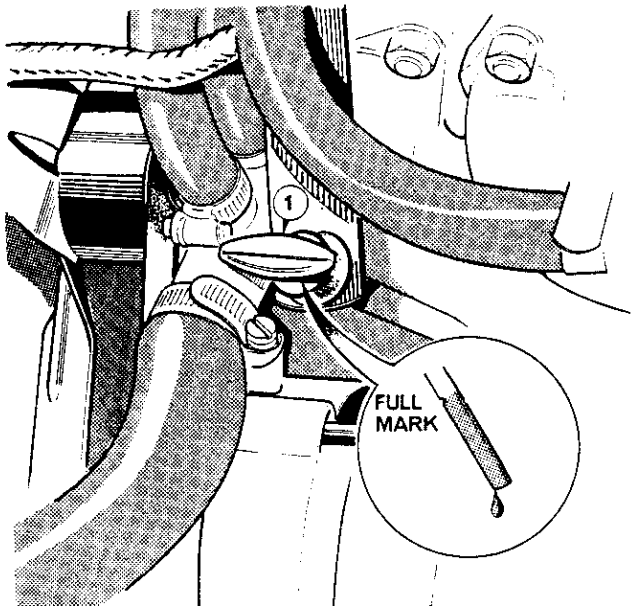


Figure 2 Engine oil level dipstick

1. Dipstick

Renewing oil filter

This operation is best carried out when the engine is warm.

1. Place a suitable receptacle under the drain plug and unscrew the plug slowly until the oil begins to escape. When the rate of flow lessens, remove plug and allow oil to drain for a few minutes. Clean and replace drain plug.

2. Grasp the oil filter with both hands, turn in an anti-clockwise direction, remove and discard. (**figure 4**)

3. Clean the cylinder block face. Fit a new filter and screw firmly home.

4. Refill the sump via the oil filler cap with the recommended grade of oil to the "full" mark on the dipstick.

5. Start engine and check for oil leaks between filter and cylinder block face.

Oil Filler Cap

The cap is a push-pull fit. The oil filler cap contains a wire gauze element and should be washed in clean paraffin. Dip the cap in clean oil and wipe thoroughly before refitting.

The oil filler cap also acts as an engine ventilator and is connected via a hose to the carburettor. It is important that the hose is maintained in good condition and connected securely. air leaks will result in misfiring and erratic running.

Check and top-up cooling system

Warning: Do not remove radiator filler cap when the engine is hot.

1. Remove radiator filler cap.

2. If necessary, top up with water until the top header tank of the radiator is approximately two thirds full. Some vehicles will have a radiator that has a coolant level indicator visible in the filler neck. Replace the filler cap.

Check leaks from cooling and heater system

1. Check hose connections and tightness of clips.

2. Check radiator drain plug (if fitted).

3. Check cylinder block drain plug.

4. Examine cylinder block core plugs

5. Examine heater water system for leaks

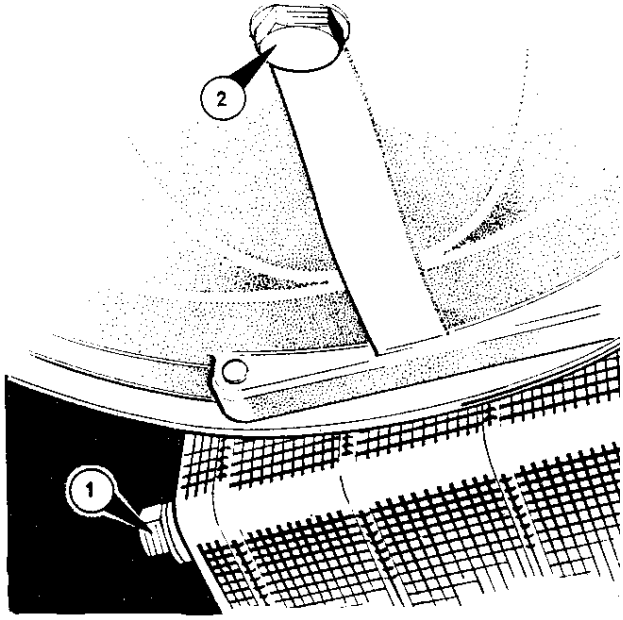


Figure 3 Sump and gearbox drain plugs

1. Sump drain plug

2. Gearbox drain plug

Check and top-up brake fluid reservoir

1. Wipe clean the reservoir cap and surrounding area and remove the cap. Examine the fluid level and top up to the bottom of the reservoir filler neck.

Use only new fluid of the correct specification, taken from a sealed container for topping up. Never under any circumstances use fluid that has been previously bled from a system to top up the master cylinder reservoir as it may be aerated, have too much moisture content or possibly be contaminated.

Note: Castrol Girling "Crimson" brake fluid has been used for initial fill. If not available to top up use Castrol Girling "Universal" or a listed alternative.

Check and top-up windscreen washer fluid reservoir

Examine the water level in the plastic windscreen washer reservoir and if necessary top-up with clean water.

Caution: Do not use Glycol anti-freeze solutions or denatured alcohol (methylated spirits). The use of these chemicals will discolour the paintwork and will damage the wiper blades.

Check and top-up battery

1. Check the electrolyte level, which, when correct should just cover the separators. Top-up if necessary using distilled water only.

2. Remove the battery connections, wipe clean and before refitting, smear the terminal posts with petroleum jelly (vaseline).

3. Check the specific gravity of the electrolyte (**see section T**)

Top-up carburettor piston damper

1. Unscrew and withdraw the plug and piston from the top of the suction chamber (**figure 5**)

2. Note that the oil level, which, when correct, is 13 mm (½in) above the top of the hollow piston rod. Top-up if necessary with clean

engine oil, SAE 20 or 20/50 grade and refit the hexagon plug and piston assembly

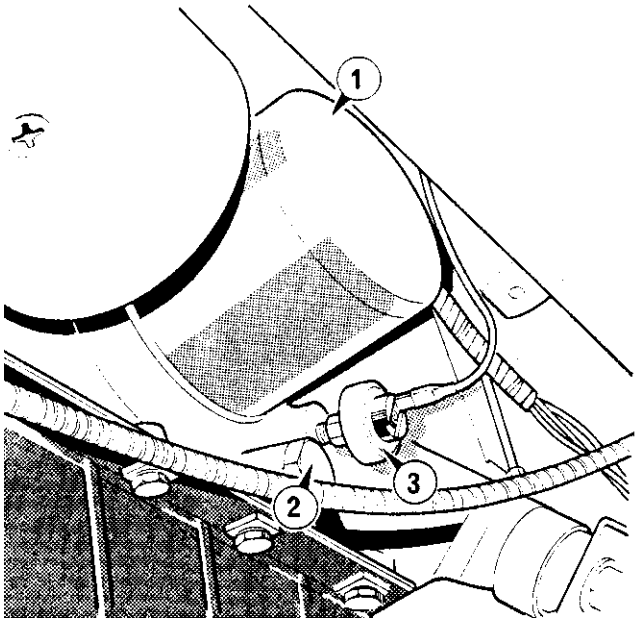


Figure 4 Engine Oil Filter

1. Oil filter
2. Oil pressure relief valve
3. Oil pressure switch

Lubricating distributor

1. Remove distributor cap.
2. Lift off rotor arm.
3. Apply a few drops of oil to the felt pad in the centre of the rotor spindle.
4. Lightly grease the cam surface.
5. Wipe away surplus oil and grease.
6. Refit the rotor arm and distributor cap.

Check condition and adjust distributor points

1. Remove the distributor cap and rotor arm.
2. Turn the engine so that the heel of the contact breaker is on the highest point of the cam. (it may be necessary to remove the sparking plugs to eliminate resistance caused by engine compression).
3. Slacken the slotted head screw in the contact plate and adjust until the gap is 0.38 mm (0.015 in) (**Figure 6**). The gap is measured with a suitable feeler gauge and pressure should be applied to the points, with the feeler gauge inserted, whilst the screw is being tightened.
4. Retighten the screw and make a further check with the feeler gauge in case tightening has altered the setting.
5. Reposition the rotor arm squarely on the distributor cam boss with the slot and lug in line. Press the rotor into position on the spindle

Note: When the rotor is fitted to the spindle the lower face does not abut the cam.

If the points are badly worn or pitted they should be replaced. For replacement procedure see **Section T**.

Clean and adjust spark plugs

1. Remove each spark plug in turn from engine.
2. Clean the electrodes with a wire brush or plug cleaner.
3. Using a 0.64 mm (0.025 in) feeler gauge, check the gap and adjust if necessary by bending the side electrode towards or away from the central electrode as necessary.
4. Discard plugs which have badly burned electrodes or cracked ceramic insulators. A centre electrode in good condition will still have a square form without signs of wear.

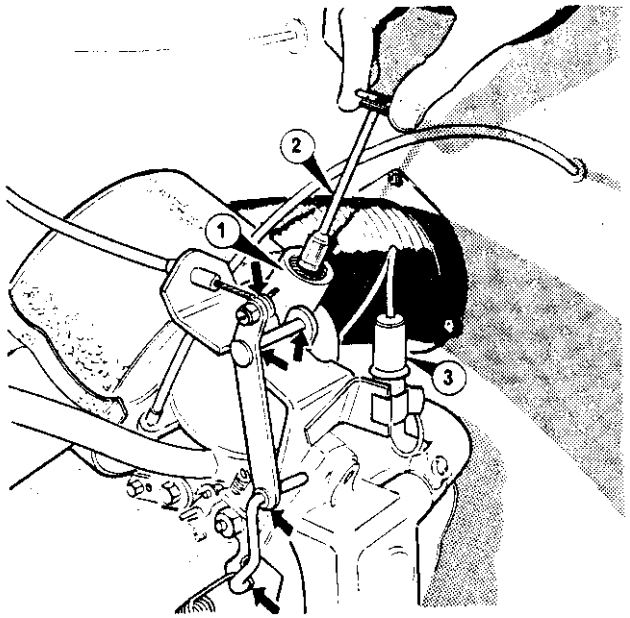


Figure 5 Carburettor - lubrication

1. Suction chamber.
2. Damper.
3. Fuel trap.

5. Refit the plugs complete with washers and tighten to a torque of 2.1 kg/m (15 lb/ft)

Check torque of cylinder head nuts

Cylinder head nuts should be tightened to a torque of 3.46 kg/m (25 lb/ft). The three 5/16 in unf nuts fitted to the spark plug side must be tightened to a torque of 2.07 kg/m (15 lb/ft). The correct sequence for cylinder head nuts tightening is shown in **Section F**

Check and adjust valve rocker clearances

Valve clearances are 0.152 mm (0.006 in) cold, 0.254 mm (0.010 in) hot.

1. Remove rocker cover.
2. Remove spark plugs.
3. Turn engine in normal running direction in order to open and close the valves and check in the following order:

No. 1 valve with No. 8 valve fully open.
No. 2 valve with No. 7 valve fully open.
No. 3 valve with No. 6 valve fully open.
No. 4 valve with No. 5 valve fully open.
No. 5 valve with No. 4 valve fully open.
No. 6 valve with No. 3 valve fully open.
No. 7 valve with No. 2 valve fully open.
No. 8 valve with No. 1 valve fully open.

When adjustment is made the valve must be in the fully closed position (**figure 7**).
4. Refit spark plugs.
5. Refit rocker cover, renewing gasket if necessary and secure with nuts and washers.

Clean air filter element

1. Clean the outside of the air filter body and release the two clips retaining the body to the base plate. (**figure 8**)

2. Carefully withdraw the element from the base plate.

3. Clean the base plate and body interior

4. Clean between folds of the element using a low pressure air line or soft brush.

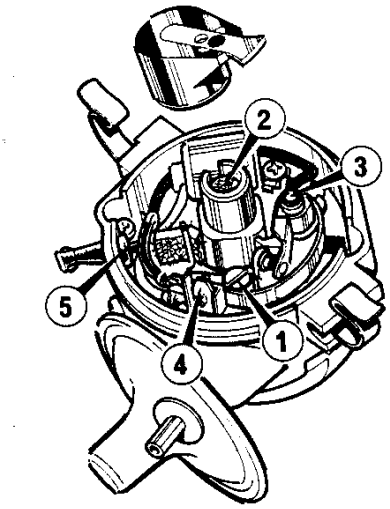


Figure 6 Distributor - general view

1. Locking/adjustment screw.
2. Cam spindle lubrication pad.
3. Breaker arm pivot post.
4. Terminal post.
5. Low tension lead.

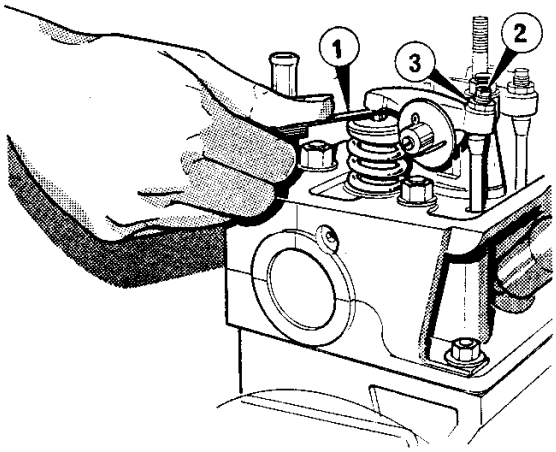


Figure 7 Valve clearance - tappet adjustment

1. Feeler gauge.
2. Adjusting screw.
3. Lock nut.

5. refit the element or replace with a new element ensuring the plastic ends of the element are smeared with petroleum jelly or grease to facilitate sealing.

6. Replace the body and secure with the two clips.

Note: The frequency necessary for cleaning or replacing the element will depend on the severity of the operating conditions and where there are heavy dust concentrations or unusually severe conditions more frequent attention should be given to the cleanliness of the unit.

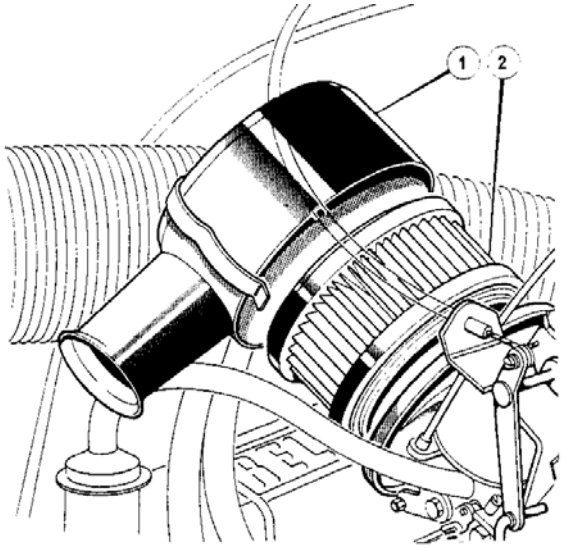


Figure 8 Air Cleaner

1. Body.
2. Element.

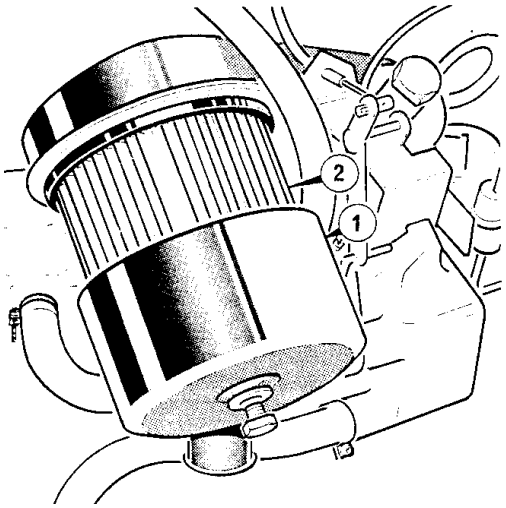


Figure 8A Air cleaner from chassis No 6F7/14701001sal, 6F7/14801002 estate, 6H1/14901043 van

1. Body
2. Element

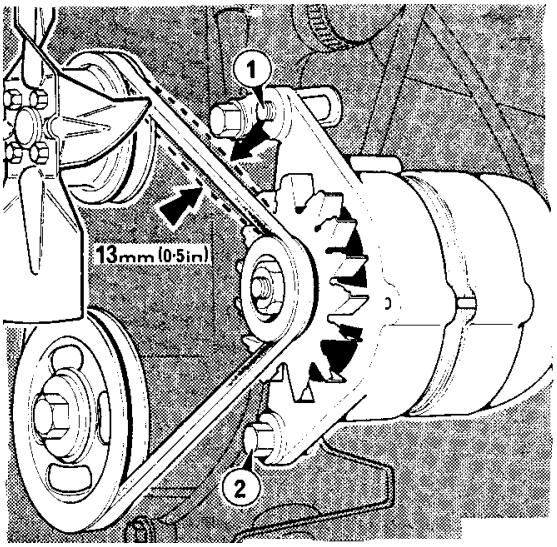


Figure 9 Fan belt adjustment

1. Adjustment locking screw.
2. Alternator front mounting bolt.

Adjust and check condition of the fan belt

The fan belt should be sufficiently tight to drive the alternator and water pump without loading the bearings unduly. The adjustment is correct when the belt can be moved laterally 13 mm (½ in) at the mid point between the alternator and water pump pulleys. (**figure 9**) If adjustment is necessary proceed as follows:

1. Slacken the alternator front mounting bolt.

2. Slacken the adjustment locking screw at the front of the alternator allowing it to be moved on the slotted strap.

3. Pivot the alternator away from the engine until the correct slack is achieved. Maintain the alternator in this position and tighten the locking screw and front mounting bolt. Re-check the adjustment.

Note: The front lower mounting **must** be slackened completely before making any adjustment as any strain on the lower fixings could distort or damage the mountings.

Regularly examine the fan belt for wear and renew if necessary.

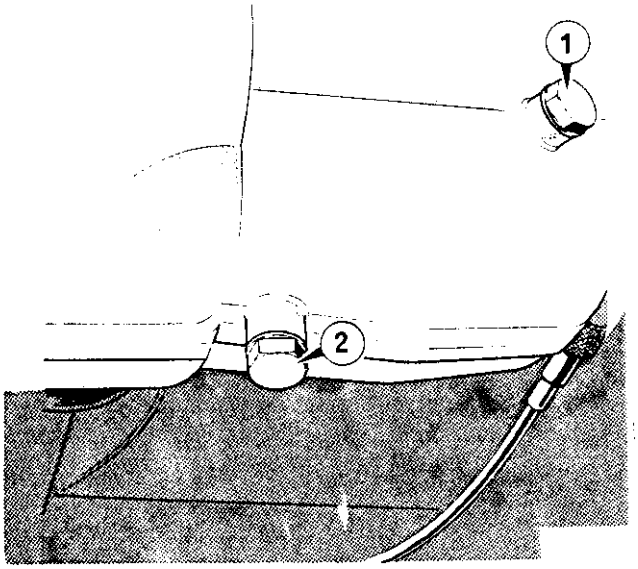


Figure 10 Gearbox oil level and drain plugs

1. Filler/level plugs.

2. Drain plug.

Check security of starter and alternator fixing bolts

Starter Motor

Using a torque wrench set to 4.15 to 4.84kg/m (30 to 35 lb/ft) check tightness of attachment nuts and bolts.

Alternator

1. Check tightness of front mounting bolt - 2.1 to 2,7 kg/m (15 to 20 lb/ft).

2. Check alternator to strap locking screw - 1.1 to 1,3 kg/m (8 to 18 lb/ft).

Check security of engine mountings

The engine and gearbox assembly is secured to the frame at three points.

1. Check tightness of front right and left hand attachment nuts - 2.76 to 3.46 kg/m (20 to 25 lb/ft).

2. Check tightness of gearbox rear attachment nuts - 2.07 to 2.49 kg/m (15 to 18 lb/ft).

Check/adjust carburettor settings

Start the engine and warm to normal running temperature. Push the choke control fully home.

1. Ensure the fast idling screw is clear of the choke cam.

2. Adjust idling screw to achieve an idling speed of approximately 800 to 850 rpm. Should these adjustments fail to achieve satisfactory results refer to **Section P.**

Lubricate accelerator linkage

Using an oil can, lubricate the accelerator linkages on the carburettor. Wipe away surplus oil (**figure 5**)

Routine maintenance - under body

Check and top-up gearbox oil

1. Place the vehicle on ramp or over pit.

2. Remove gearbox level plug and observe oil level correct when in line with the bottom of the level hole threads (**figure 10**).

3. If necessary top up via the level hole using a pump type oil can with a flexible nozzle charged with the recommended oil until the level is correct.

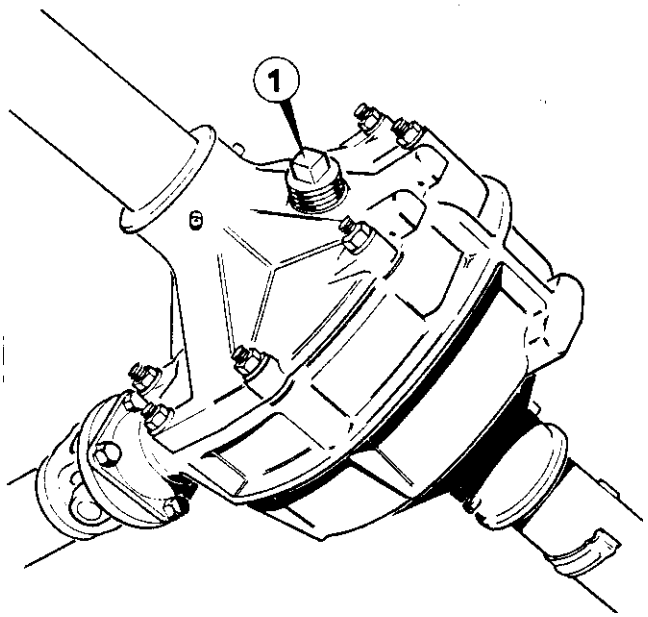


Figure 11 Rear axle oil filler/level plug

1. Filler/level plug.

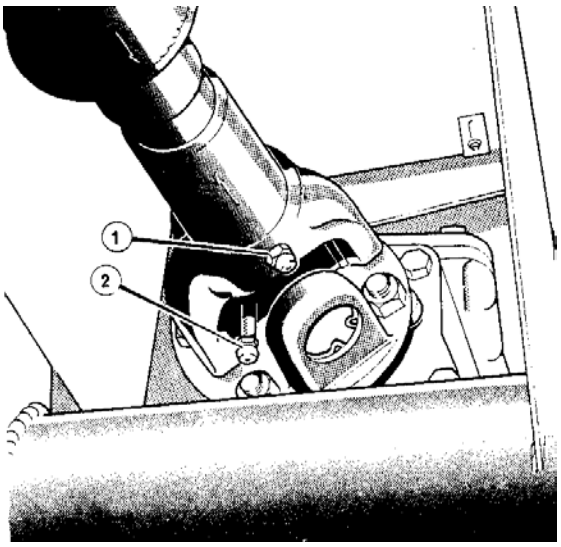


Figure 12 Driveshaft grease nipples

1. Sliding spline grease nipple.

2. Universal joint grease nipple.

4. Wipe clean and refit level plug. Tighten to a torque of 2.07 to 2.76 kg/m (15 to 20 lb/ft)

Check and top up level of rear axle oil

1. Place the vehicle on ramp or over pit.

2. Wipe clean the level plug and surrounding area and remove plug (**figure 11**).

3. Observe oil level which is correct when level with the bottom of the level hole threads.

4. If necessary, top up via the level hole, using a pump type oil can with a flexible nozzle, charged with a recommended oil, until the level is correct.

5. Wipe clean the level plug and refit. Tighten to 2.07 to 2.76 kg/m (15 to 20 lb/ft)

Lubricate drive shaft

1. Place the vehicle on ramp or over pit.

2. Using a grease gun charged with a recommended lubricant.

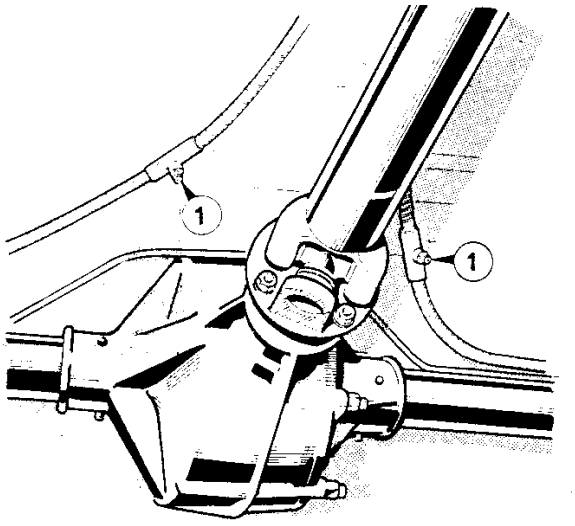


Figure 13 Handbrake cable grease nipples

1. Grease nipples

Apply grease via the nipple located at the gearbox end of the drive shaft and to the nipple on each of the universal joints.

Lubricate handbrake cable and cable guides

1. Place the vehicle on ramp or over pit.

2. Using a grease gun charged with a recommended lubricant, apply grease to the cable by means of the two grease nipples (**figure 13**) Apply grease at any area of the exposed inner cable and liberally coat the cable guides on the axle with grease to prevent the inner cable binding on the guides.

Check hydraulic system and fuel system pipes for chafing, leaks and corrosion

Follow the run of all brake hydraulic pipes and ensure that at no point are they chafing against body or frame members. Note and report any corroded section of pipe. Examine all joints for leaks whilst a second person applies pressure to the brake pedal. Check that the flexible hoses are not kinked or strained when the steering is turned from lock to lock.

Examine the run of the fuel line from tank to carburettor and ensure that at no point is it chafing against the body or fouling components. Check the rubber connections between sections of pipe are not unduly stained, perished or split.

Check exhaust system for leakage and security

Check security of the exhaust connections and manifold bolt tightness. Examine the system for corrosion and deterioration.

Check tightness of suspension fixings, tie-rod levers, steering unit attachments and steering universal coupling bolts plus check gaiters for damage

Rear suspension

1. Check tightness of nuts and bolts securing the leaf springs and shackles to the frame.

2. Check tightness of nuts and bolts securing the upper and lower ends of the dampers to the rear axle and chassis frame.

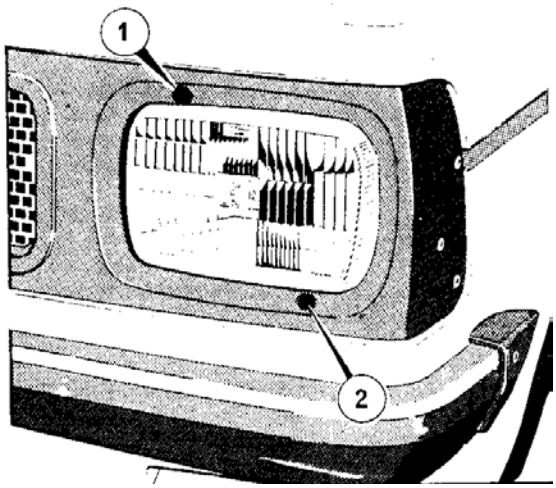


Figure 14 Headlamp adjusting screws

1. Horizontal adjustment screw.

2. Vertical adjustment screw.

Front suspension

3. Check tightness of all nuts and bolts securing the upper and lower wishbones to the frame.

4. Check upper and lower fixings of the coil spring damper units.

5. Check nuts connecting the lower wishbones to the vertical link fulcrum.

6. Check security of the track rod ends to steering arm nuts.

7. Check tightness of all anti roll bar fixings.

Steering unit attachment

8. Check tightness of rack assembly fixings - 2.07 to 2.5 kg/m (15 to 18 lb/ft).

9. Check for and ascertain cause for any backlash in the steering.

10. Examine steering rack gaiters and check condition / leakage.

Steering rack couplings

11. Check pinch bolts through universal couplings - 3.46 to 4.15 kg/m (25 to 30 lb/ft).

Check tightness of drive shaft connecting bolts

1. Place the vehicle on ramp or over pit.

2. Check tightness of coupling bolts at both ends of propellor shaft - 3.46 to 4.15 kg/m (25 to 30 lb/ft).

Routine maintenance - exterior

Adjust front hubs
Refer to **Section B**

Check and adjust front and rear wheel alignment with tracking equipment
Use standard garage equipment and check as described in **Section D**

Inspect brake linings for wear and drums for condition
Front brakes
1. Jack up the vehicle until one front wheel is clear of the ground.
2. Remove the road wheel and fully slacken off the brake adjusters.
3. Remove the brake drum. **Note:** The relative position of the drum to the hub must be noted before removal for correct reassembly.
4. Check the lining material thickness. Linings which are bonded to the shoes must not be allowed to wear below 1/16" in thickness. Riveted shoes must be replaced when the material wears within 1/32" of the rivet heads.
5. If the linings are serviceable, replace the brake drum ensuring it is aligned as originally fitted.
6. Refit the road wheel and re-adjust the brake. Repeat the operation with the opposite front wheel.

Rear brakes
1. Jack up the vehicle until one rear wheel is clear of the ground.
2. Release the handbrake.
3. Check the linings as described for the front wheels.
4. If the linings are serviceable, refit the drum and road wheel and re-adjust the brake. Repeat for other rear wheel.

Check tightness of road wheel nuts
1. Remove nave plate.
Check tightness of wheel nuts - 4.15 to 4.84 kg/m (30 to 35 lb/ft)

Check condition of tyres and depth of tread
1. Check tyre tread depth using a depth gauge and ensure that the depth exceeds the current legal requirements.
2. Examine around the tread and side walls of the tyres for damage or cracking/perishing due to age, including the spare. Since it is dangerous (and illegal in the UK) ensure that cross-ply and radial-ply tyres are not mixed on the same axle. 145 x 10 Radial tyres only are fitted as original equipment.

Check and adjust tyre pressures including the spare
Check tyre pressures when the tyres are cold, i.e. before a run. A tyre set to the recommended pressure when hot will be under inflated when cool.
Using a tyre pressure gauge, check that the tyres are inflated to the following pressures:

Normal load: Saloon/Estate	Front	1.41 kg/cm² (20 lb/in²)
	Rear	1,55 kg/cm² (22 lb/in²)
Van	Rear	1.69 kg/cm² (24 lb/in²)
Full load: Saloon/Estate	Front	1.41 kg/cm² (20 lb/in²)
	Rear	1.99 kg/cm² (28 lb/in²)
Van	Rear	2.11 kg/cm² (30 lb/in²)

Check and adjust headlamp beam alignment
The front grill/bezel has two screwdriver holes for adjustment of the headlamp beam setting screws.
Beam aiming can best be accomplished using equipment such as a "Lucas beam setter" or "Lav-L-Lite".
Horizontal adjustment is obtained with the top beam setting screw, vertical with the lower screw (**Figure 14**).

Check and if necessary replace windscreen wiper blades
Renew wiper blades when vision is impaired due to unsatisfactory clearance of water from the windscreen.
To remove wiper blades.
1. Lift wiper arm, complete with blade, away from the windscreen.
2. Tilt wiper blade assembly away from the wiper arm (towards windscreen) to disengage it from the locating lug.
3. Hold wiper blade assembly in this position and lift the leaf-spring at the rear of the wiper blade assembly, then slide the blade off the wiper arm.

To refit wiper blade
1. Slide the wiper blade assembly over the wiper arm until the lug on the wiper arm locates in the hole in the wiper blade.

Routine maintenance - interior

Check operation of window controls and door latches/locks
Operate window winders and check operation of interior and exterior door handles and locks. Adjust/repair as necessary.

Lubricate all locks, door hinges and striker plates
Sparingly oil above components. Wipe away excess lubricant.

Check condition and security of seat fixings and seat belts
1. Operate driver's seat adjuster and slide the seat to it's rearmost extent.
2. Check tightness of the front seat to floor mounting nuts and bolts.
3. Operate adjuster and slide the seat to it's forward extent.
4. Check tightness of rear seat runner fixings.
5. Check correct operation of seat reclining mechanism (where fitted).
6. Fold seat forward to check correct operation of seat lock.

Repeat above for passenger seat.

Examine seat belts carefully for chafing/fraying and check mountings for tightness. Check seat belt latches operate correctly.

Check function of all electrical systems
Test the operation of the following equipment:

Lights: main beams, dipped beams, side lamps, panel lamps, courtesy light, rear number plate lamp, brake lights, panel warning lights (ignition, oil, main beam, flasher).

Check flashers, horn, heater blower, heated rear window (where fitted), windscreen wipers and washers.

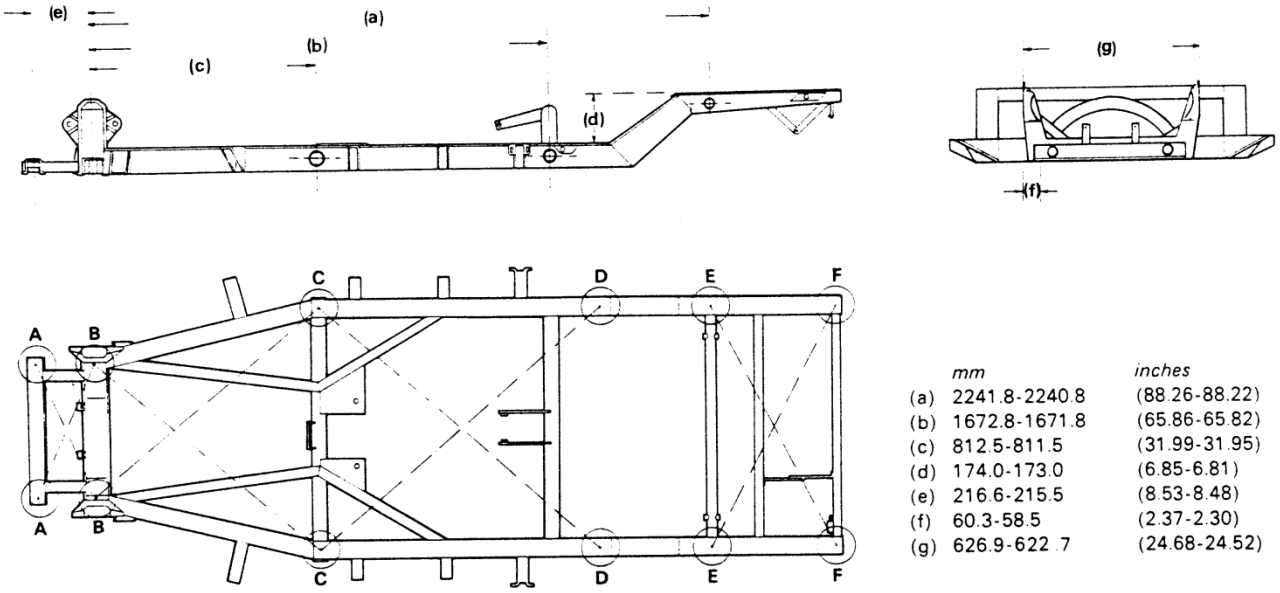
Check alternator and starter motor for correct operation.

Routine maintenance - road test

Road test car and check brake function. Carry out any remedial work required indicated by the road test e.g. adjustment of brakes, carburettor or ignition timing. **Note:** Specialist equipment is needed to ensure that carburation adjustment does not result in the vehicle infringing the emission regulations.

Lubrication chart (not listed in order of preference)
(British Isles)

	Mobil	Castrol	Esso	BP	Shell	Petrofina	Duckhams	Texaco
Engine	Mobiloil super or mobiloil special 20w50	Castrolite Castrol 20w50	Esso Extra Motor Oil 10w30 or Uniflo	BP Super Viscostatic 10w30 or Energol SAE 20w	Shell Super Motor Oil	Fina Multigrade motor oil 10w30 or 20w50	Q20-50 Motor Oil	Havoline motor oil 10w30 or 20w50
Gearbox	Mobilube HD 80	Castrol Hypoy Light	Esso Gear Oil GX 80	Gear Oil SAE 80EP	Spirax 80 EP	Pontonic MP SAE 80	Hypoid 80	Multigear EP 80
Rear Axle	Mobilube HD 90	Castrol Hypoy	Esso Gear Oil GX 90/140	Gear Oil SAE 90 EP	Spirax 90 EP	Pontonic MP SAE 90	Hypoid 90	Multigear EP 90
Steering Rack & Pinion	Mobilube HD 90	Castrol Hypoy	Esso Gear Oil GX 90/140	Gear Oil SAE 90 EP	Spirax 90 EP	Pontonic MP SAE 90	Hypoid 90	Multigear EP 90
Front Hub	Mobilgrease MP	LM Grease	MP Grease H	Energrease L2	Retinax A	Marson HTL2	LB 10	Marfak
Chassis	Mobilgrease	MS3 Grease	MP Grease	Energrease L21M	Retinax AM	Marson LM2	LBM 10	Molytex
Brakes	Castrol Girling Universal Brake & Clutch Fluid or Lockheed Super 105 Fluid or any fluid to J1703 specification							



	mm	inches
(a)	2241.8-2240.8	(88.26-88.22)
(b)	1672.8-1671.8	(65.86-65.82)
(c)	812.5-811.5	(31.99-31.95)
(d)	174.0-173.0	(6.85-6.81)
(e)	216.6-215.5	(8.53-8.48)
(f)	60.3-58.5	(2.37-2.30)
(g)	626.9-622 .7	(24.68-24.52)

Figure 1 Frame checking dimensions

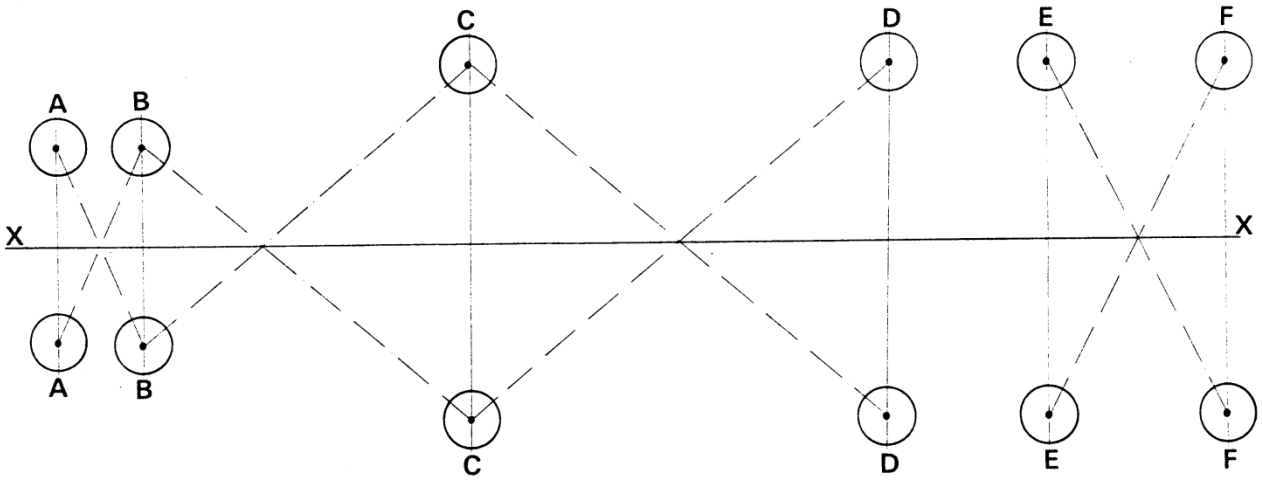


Figure 2 Frame checking diagram

Checking for squareness

Severe damage to the chassis frame is readily apparent. In some cases, however, lesser damage may cause distortion of the frame, which may not be easily detected by visual inspection.

Even when the vehicle has suffered only superficial damage it is possible that the frame members may have been displaced, causing misalignment of the road wheels.

It is recommended that the alignment of the front and rear suspension attachment points are checked including the wheel base dimensions and castor and camber angles. See General specification.

All components including front suspension and rear road springs must be removed to provide access to the checking points. The checking must be carried out on a surface table or a level floor.

Checking points

1 Reference to **Figure 1** shows the critical points by which the chassis should be checked for squareness. Transfer these points to the floor and letter them as shown in **Figure 2.**

2 Connect the letters in pairs by drawing a line between them, using a straight edge, AA, BB, CC, DD, EE and FF, as shown.

3 Measure from each point in turn to the centre and join up all centres thus producing a centre datum line XX. The diagram on the floor should then be similar to **Figure 2.** The frame may be considered true when a straight edge can be placed on the datum line passing through all centre points.

4 A further check on squareness must be made by joining up all the diagonals, the lengths of which must be equal, and bisect each other on the datum line. **(Figure 2)**

Chassis distortion is always assessed by the amount and direction which any central point on the transverse line and/or the point of intersection of any pair of diagonals deviates from the centre datum line XX.

5 Dimensions are given in **Figure 1** which can also be used to determine any chassis distortion.

Section B Front Suspension

Contents

Description

The independent front suspension comprises upper and lower wishbone assemblies and vertical links assisted by coil spring and damper units.
The upper wishbones are attached to a ball joint on the vertical link and secured and pivoted to the vehicle chassis suspension tower.
The lower wishbone assembly, secured to a lower ball joint on the vertical link, supports the coil spring and damper unit. Two brackets bolted to the chassis support the wishbones, which are also pivoted.

Routine maintenance

The front suspension should need little or no maintenance other than the lubrication of the upper wishbone ball joint and the lower wishbone ball joint and at major services the re-packing of the front wheel bearing.
Lubricating nipples are situated at the upper wishbone ball joint **(figure 2)** and at the lower fulcrum ball joint (**figure 3**). Apply three or four strokes of a grease gun every 6,000 miles (10,000 km).
The front wheel bearings are lubricated by means of grease packed in the hub on assembly. Repacking of front wheel bearings should be carried out every 36,000 miles (60,000 km).

Operation 1 **Front suspension assembly - removal and replacement**

To remove (**figure 1**)

1. Place vehicle on a ramp or support on chassis stands.
2. Remove nave plate and road wheel.
3. Remove brake drum.
4. Remove the damper bottom fixing nut and withdraw bolt from damper bush.
5. From inside the engine compartment, remove the damper top fixings, comprising nut and locknut, rubber spacer and two retaining cups.
Note: Access to the fixing on the r/h side of the vehicle can be facilitated by the removal of the heater flexible hose.
6. Remove the bottom wishbone to pivot bracket fixings to facilitate removal of the damper assembly.
7. Withdraw the damper assembly.
8. Remove track rod end nut and using a splitter separate the track rod end from the steering arm.
9. Disconnect the hydraulic brake flexible hose from the bundy pipe at the support bracket and plug to prevent fluid leakage or dirt ingress.
10. Remove the two nuts securing the top wishbone pivot brackets to the frame.
11. Remove the nut, cup washer and rubber spacer securing the anti-roll bar link to the lower wishbone.
12. Remove the bolt, nut and spacer tube securing the strut to the lower wishbone.
13. Remove the nut and bolt securing the nut to the frame.
14. Remove the nut and bolt securing the lower wishbone assembly to the frame.
15. Repeat the procedure for the opposite suspension unit.

To replace
Replace in the reverse order and bleed the brake hydraulics. Check camber and tracking (**Section D**)

Operation 2 **Anti-Roll bar - Removal and replacement**

To remove

1. Place vehicle on ramp, or support on suitable chassis stands.
2. Remove the nut, cup washer and rubber spacer from the link stud on the left hand wishbone.
3. remove the two bolts securing the anti-roll clamping rubber bar to the left-hand chassis rail.
4. Repeat operations 3 and 3 for the right-hand side. (**figure 4**)
5. The anti-roll bar complete with links can be lowered from the frame, withdrawing the link bushes from the lower wishbones.
Replace in reverse order.

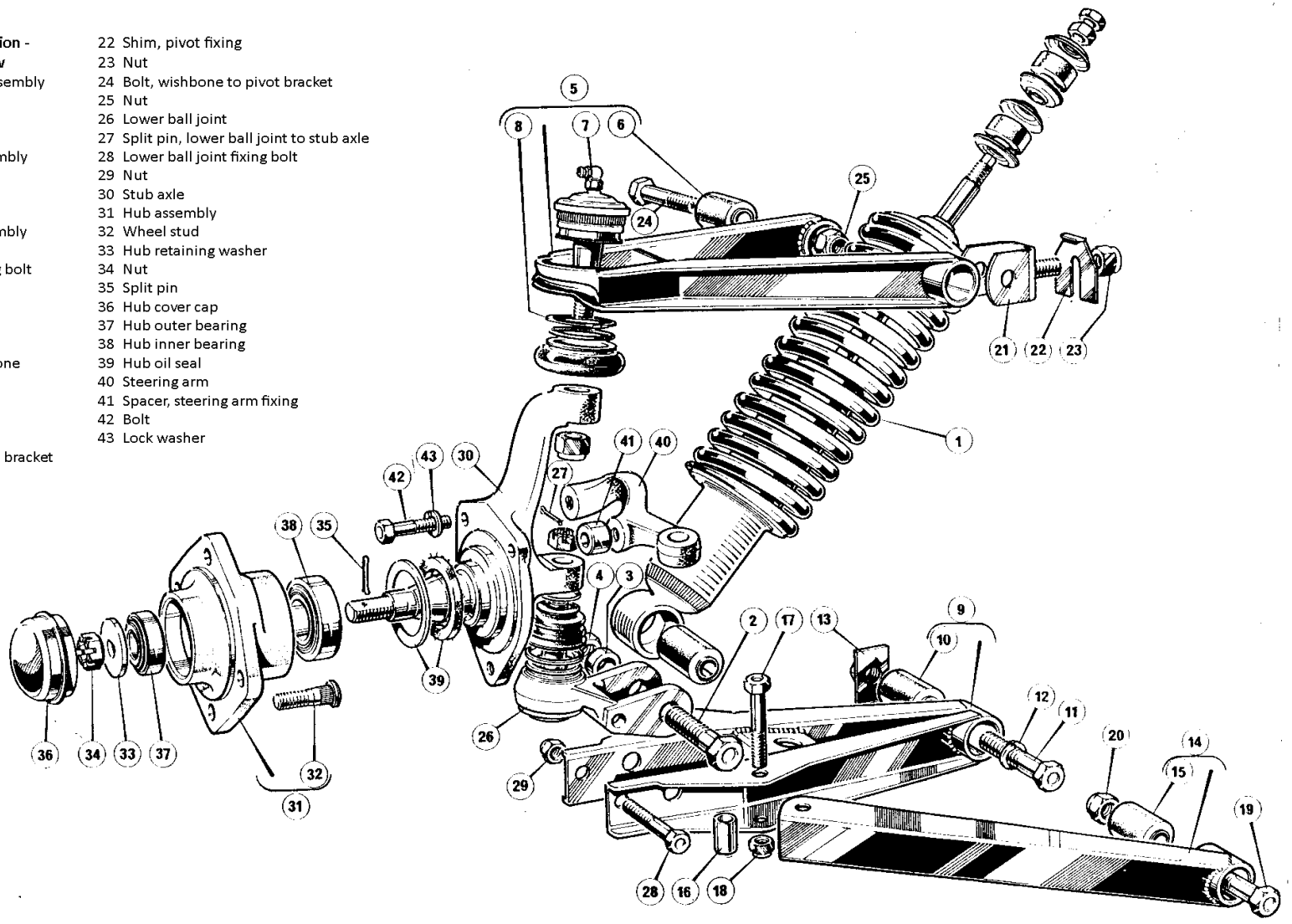
Operation 3 **Damper and spring assembly - removal and replacement**

To remove (**figure 1**)

1. Place vehicle on ramp, or support on suitable chassis stands.
2. Remove road wheel.
3. From inside the engine compartment, remove the damper top fixings, comprising nut and locknut, rubber spacer and two retaining cups.
Note: Access to the fixing on the r/h side of the vehicle can be facilitated by the removal of the heater flexible hose.
4. remove damper bottom fixing nut and spacer and withdraw the bolt from the bush.
5. Remove the bottom wishbone to pivot bracket fixings to facilitate removal of the damper assembly.
Replace in reverse order and check camber and tracking **(section D)**.

Figure 1 Front Suspension - Exploded View

1 Damper and spring assembly
2 Damper fixing bracket
3 Spacer
4 Nut
5 Upper wishbone assembly
6 Bush
7 Upper ball joint
8 Circlip
9 Lower wishbone assembly
10 Bush
11 Lower wishbone fixing bolt
12 Lock washer
13 Retaining plate
14 Strut assembly
15 Bush
16 Spacer, strut to wishbone
17 Bolt
18 Nut
19 Strut fixing bolt
20 Nut
21 Upper wishbone pivot bracket
22 Shim, pivot fixing
23 Nut
24 Bolt, wishbone to pivot bracket
25 Nut
26 Lower ball joint
27 Split pin, lower ball joint to stub axle
28 Lower ball joint fixing bolt
29 Nut
30 Stub axle
31 Hub assembly
32 Wheel stud
33 Hub retaining washer
34 Nut
35 Split pin
36 Hub cover cap
37 Hub outer bearing
38 Hub inner bearing
39 Hub oil seal
40 Steering arm
41 Spacer, steering arm fixing
42 Bolt
43 Lock washer



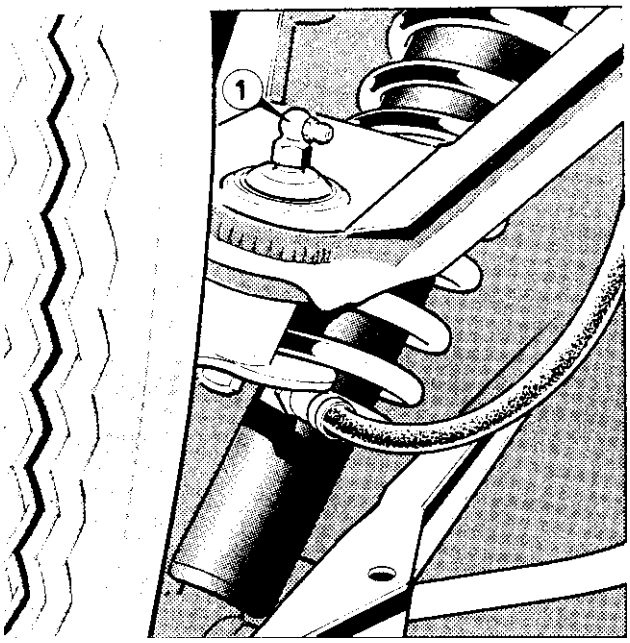


Figure 2 Upper wishbone ball joint lubricator

1. Ball joint - grease nipple

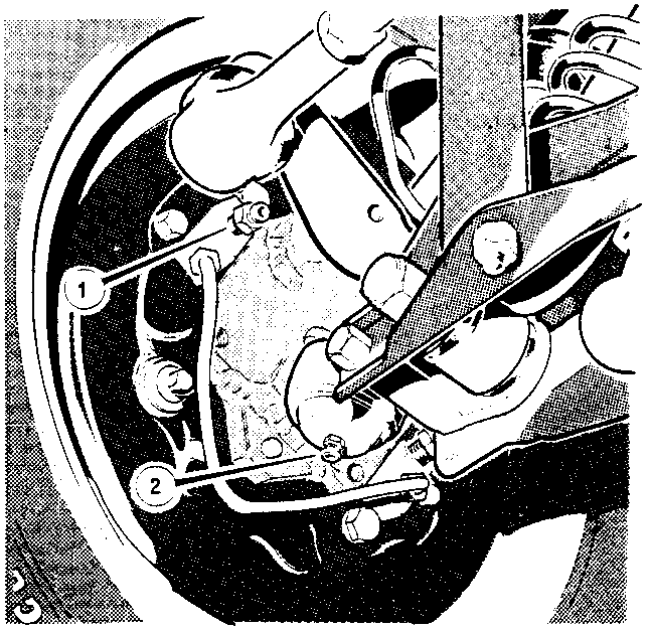


Figure 3 Lower fulcrum - lubricator

1. Bleed screw

2. Lower fulcrum - grease nipple

Operation 4 Upper ball joint - removal and replacement

To remove (**figure 1**)

1. Place vehicle on ramp or support on suitable chassis stands.

2. Remove road wheel.

3. Disconnect the hydraulic brake flexible hose from the bundy pipe at the support bracket and plug to prevent fluid leakage or dirt ingress.

4. Remove the nut securing upper ball joint to vertical link, releasing the brake pipe support bracket.

5. Using a suitable ball joint splitter, release the ball joint taper from the vertical link.

6. Remove the bolts and nuts securing the upper wishbone pivots and remove the wishbone complete with upper ball joint.

Note: If the wishbone bolts cannot be withdrawn because of the damper, the wishbone pivot brackets can be removed by releasing the nyloc nuts securing the brackets to the frame.

7. Remove the external circlip securing the ball joint to the wishbone and prise or press the ball joint from the mounting plate in the wishbone assembly.

Reassemble in reverse order.

Operation 5 Lower ball joint and pivot bracket - removal and replacement

To remove (**figure 1**)

1. Place vehicle on ramp or support on suitable chassis stands.

2. Remove road wheel.

3. Remove bolt, nut and spacer securing damper bottom bush to lower wishbone.

4. Remove bolt and nut securing the lower ball joint pivot bracket assembly to the lower wishbone.

5. Remove the split pin from the castellated nut securing the lower ball joint to the vertical link.

6. Remove the castellated nut.

7. Release the taper on the shank of the ball joint from the vertical link and remove the ball joint and pivot bracket assembly.

replace in the reverse order, tightening the castellated nut to 4.29 to 4.98 kb/m (31 to 36 lb/ft) and renewing the split pin.

Operation 6 Upper wishbone - bush replacement

To remove (**figure 1**)

1. Dismantle upper wishbone assembly as sequence 1-5 of operation 4.

2. Press out the wishbone bushes.

3. Press in the new bushes ensuring that they are centred in the wishbone.

4. Refit the wishbone as in operation 4. Check camber setting see **Section D**

Operation 7 Lower wishbone and strut - bush replacement

To remove (**figure 1**)

1. Place vehicle on ramp or support on suitable chassis stands.

2. Remove road wheel.

3. Remove nut, spacer and bolt securing strut to lower wishbone.

4. Remove nut and bolt securing strut to bracket on frame.

5. Remove nut, spacer and bolt securing bottom of damper to lower wishbone.

6. Remove nut and bolt securing lower wishbone to lower ball joint pivot bracket.

7. Remove bolt, lock washer and nut plate securing lower wishbone to frame. Press out the bushes from strut and lower wishbone and replace bushes ensuring new bushes are centred correctly.

reassemble in reverse order. Check tracking and camber settings see **Section D.**

Operation 8 Vertical link - removal and replacement

1. Place vehicle on ramp or support on suitable chassis stands.

2. Remove road wheel.

3. Remove nut from track rod end ball joint and disconnect the ball joint from the steering arm.

4. Disconnect the hydraulic brake flexible hose from the bundy pipe at the support bracket and plug to prevent fluid leakage or dirt ingress.

5. Remove bolt, nut and spacer securing damper bottom fixing to lower wishbone.

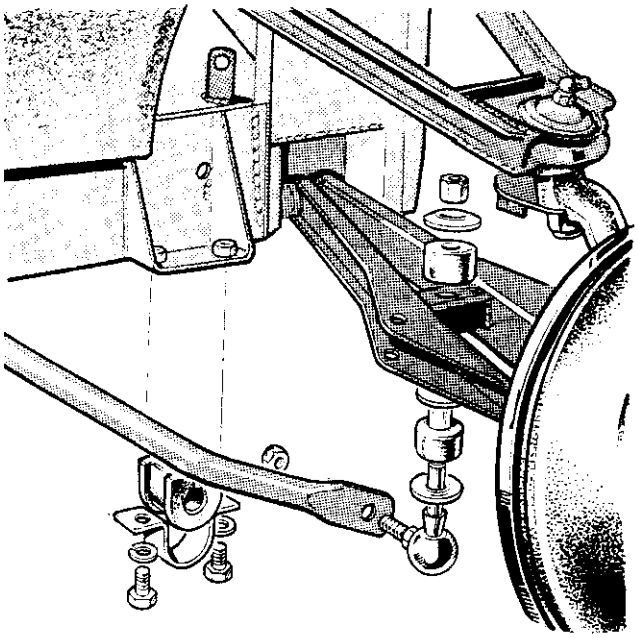


Figure 4 Anti-Roll bar removal

6. Remove nut and bolt securing lower ball joint pivot bracket to lower wishbone

7. Separate lower ball joint pivot bracket from wishbone.

8. Remove nut from upper ball joint and, using a suitable tool, separate the vertical link and hub/brake assembly, from the upper ball joint and wishbone assembly.

9. Remove brake drum.

10. Prise the hub cap from the hub and wipe grease from end of stub axle

11. Remove split pin, castellated nut and washer from stub axle.

12. Withdraw the hub complete with bearings and felt oil seal.

13. Reassemble in reverse order, renewing stub axle split pin. Bleed brakes and adjust.

Operation 9 Front hub - overhaul

1. Place vehicle on ramp or jack up.

2. Remove front wheel.

3. Remove brake drum.

4. Prise off the hub cap and wipe grease from stub axle end.

5. Remove split pin, castellated nut and washer from stub axle.

6. Withdraw the hub complete with bearings and felt oil seal.

7. Ease out the inner cone and roller assembly from the outer bearing. On no account must the inner cone be levered out as this may cause damage to the roller cage.

8. tap out the outer bearing track from the hub using a suitable drift.

9. Using the same drift, tap out the inner bearing track complete with bearing and felt seal. Carefully inspect the bearings for wear, scoring or pitting on the tracks or rollers. If excessive wear is apparent the bearings must be renewed.

Before commencing re-assembly it is essential that the hub is scrupulously cleaned of old grease paying special attention to the area between the bearings. If only one bearing is to be replaced then the remaining bearing must be cleaned free of old grease before re-packing. Do **NOT** use paraffin to clean bearings.

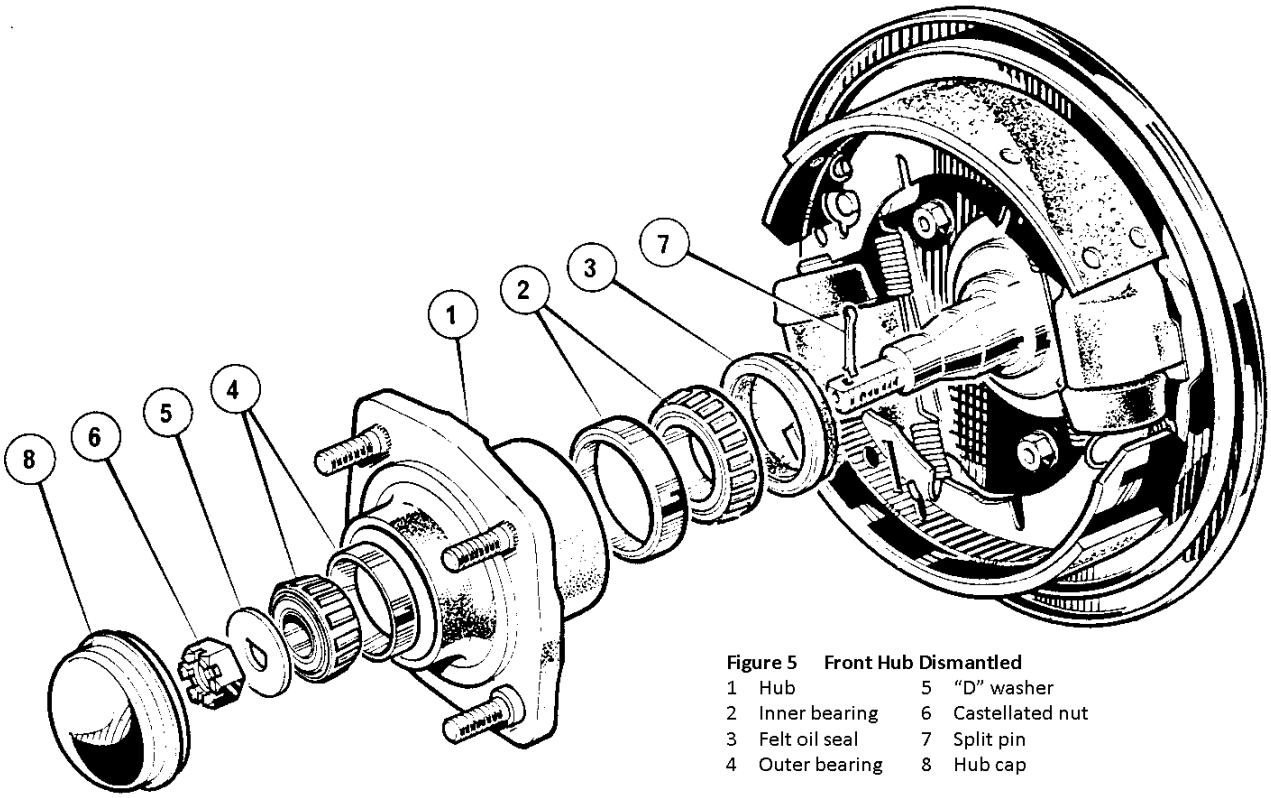


Figure 5 Front Hub Dismantled

1	Hub	5	"D" washer
2	Inner bearing	6	Castellated nut
3	Felt oil seal	7	Split pin
4	Outer bearing	8	Hub cap

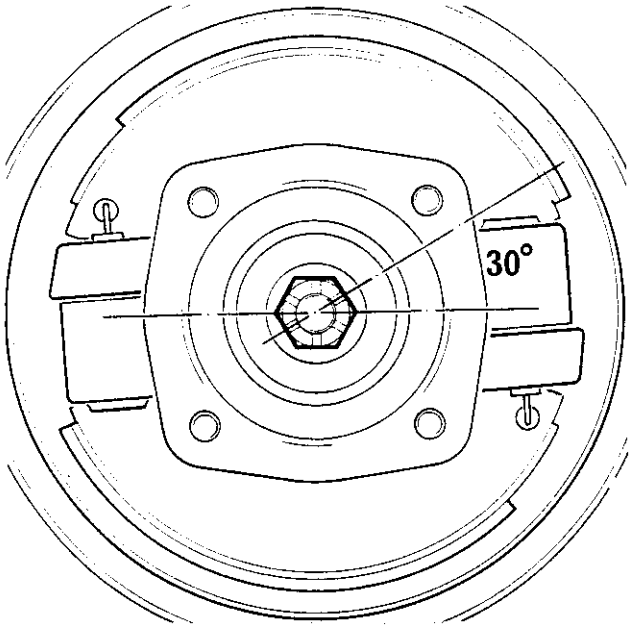


Figure 6 Hub nut adjustment

Re-assembly

1. Locate the outer track of the inner bearing in its housing in the hub and ensure it is firmly and squarely seated. Pack the inner cone and roller assembly with the recommended grease (see lubrication chart **Page 13**) and insert the cone in to the bearing track.

2. Renew the felt seal. This should be securely attached to the retainer with "Hermatite" liquid jointing compound or similar oil resistant adhesive. When dry, soak the seal and retainer assembly with oil with the surplus squeezed out before firmly fitting it in the hub.

3. Lightly grease the front hub with the approved grease, in the area between the inner and outer bearings.

Note: Over packing the hub with grease can lead to overheating and possible bearing failure.

4. Locate the outer bearing outer track in the hub, again ensuring that it is firmly and squarely seated. Pack the outer bearing cone and roller assembly with an approved grease and insert the cone in to the bearing track.

5. Position the front hub assembly on to the stub axle and secure with the large retaining washer and the castellated nut, tightening finger tight until slight resistance can be felt whilst turning the hub.

6. Slacken the nut back until a bearing float of between 0.05 to 0.15 mm is obtained. A dial gauge is preferable for this operation but if one is not available, slacken the nut off half a flay, equivalent to 30 degrees (**figure 6**)**. Note:** The importance of the correct end float cannot be over emphasised. Over tightening the bearings will cause overheating and subsequent bearing failure.

7. Fit a new split pin to the castellated nut.

8. Seal the centre vent hole of the hub cap with grease and apply a quantity to the inside of the cap. Fit the cap to the hub.

9. Refit the brake drum.

10. Refit the road wheel and take the opportunity of testing for bearing end float by rocking the wheel at the outside diameter of the tyre. There should be approximately 1.5 mm (1/16") movement at the tyre periphery.

11. Adjust brakes.

Operation 10 Hub bearing adjustment

Checking

1. Jack up the car and remove the front wheel.

2. Ensure that the brake shoes are not dragging or restricting movement and rotation of the hub. Slacken off the hoes or remove the brake drum as necessary.

3. Check the bearing end-float. a correctly adjusted hub will have end-float within 0.05 to 0.15 mm (0.002 to 0.006 in). a dial gauge should be used for checking purposes.

Adjusting

4. Prise off the hub cap.

5. Wipe off grease from the end of the stub axle.

6. Remove the split pin from the castellated nut and discard.

7. Tighten or slacken the castellated nut as necessary to achieve the correct end-float. (**see Operation 9**)

8. Fit a new split pin.

9. Clean the hub cap and partially fill with fresh grease, ensuring that the vent hole is sealed with grease.

10. Fit the hub cap.

11. Refit the brake drum (if removed) and adjust the brake.

12. Fit the road wheel and remove car from jack.

Section C

Rear suspension

Contents

Description

Rear suspension is provided by damper assisted progressive rate leaf springs. The rear of the springs are suspended and pivoted on shackles attached to the chassis frame. Four "U" bolts secure the springs to the rear axle. The damper units, which have internal bump stops, are secures to the chassis cross-tube and to brackets on the rear axle.

Routine maintenance

The rubber bushes in the damper units, leaf springs and shackles should be kept free from oil or grease and replaced when signs of wear or degrading become apparent.

Periodically check the dampers to ensure full movement is still attainable. a seized unit will allow only minimal suspension movement and result in a hard ride.

Operation 1 Leaf spring

To remove (**Figure 1**)

1. Jack up the vehicle under the differential and lower on to axle stands, securely installed under the chassis frame. Allow the jack to support the axle.

2. remove the road wheel.

3. Remove the nuts and lock nuts from the "U" bolts clamping the axle to the leaf spring. remove "U" bolts and clamping plate.

4. Remove the nut and washer securing the spring to the rear shackle and withdraw the bolt through the shackle and bush.

5. remove the nut and washer from the forward end of the leaf spring and withdraw the bolt through the frame.

Re-assemble in reverse order.

Operation 2 Damper unit

To remove

1. Remove nut and washer securing damper unit to chassis cross tube. Withdraw the bolt and washer.

2. Remove the damper lower fixing nut, washer and bolt from the axle tube mounting bracket.

Replace in reverse order.

Bump Rubber - Van

A bump rubber, separate to the damper unit, was fitted to early Kitten vans to limit the rear suspension bump travel.
The bump rubber is secured to a bracket on the rear chassis upsweep above the axle. It should be checked occasionally for splits or sign of perishing.

To remove **(Figure 2)**

1. Remove a single nut and lock washer securing the bump rubber to the chassis mounting bracket.

Replace in reverse order

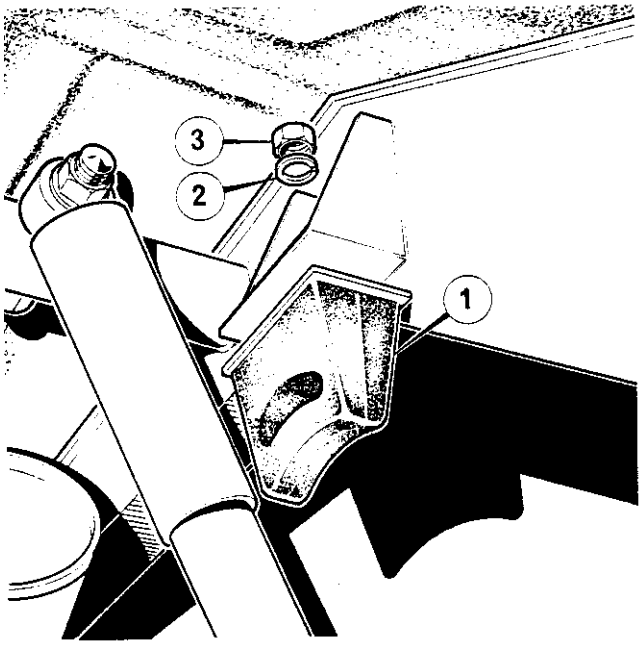


Figure 2 Bump rubber (Van)

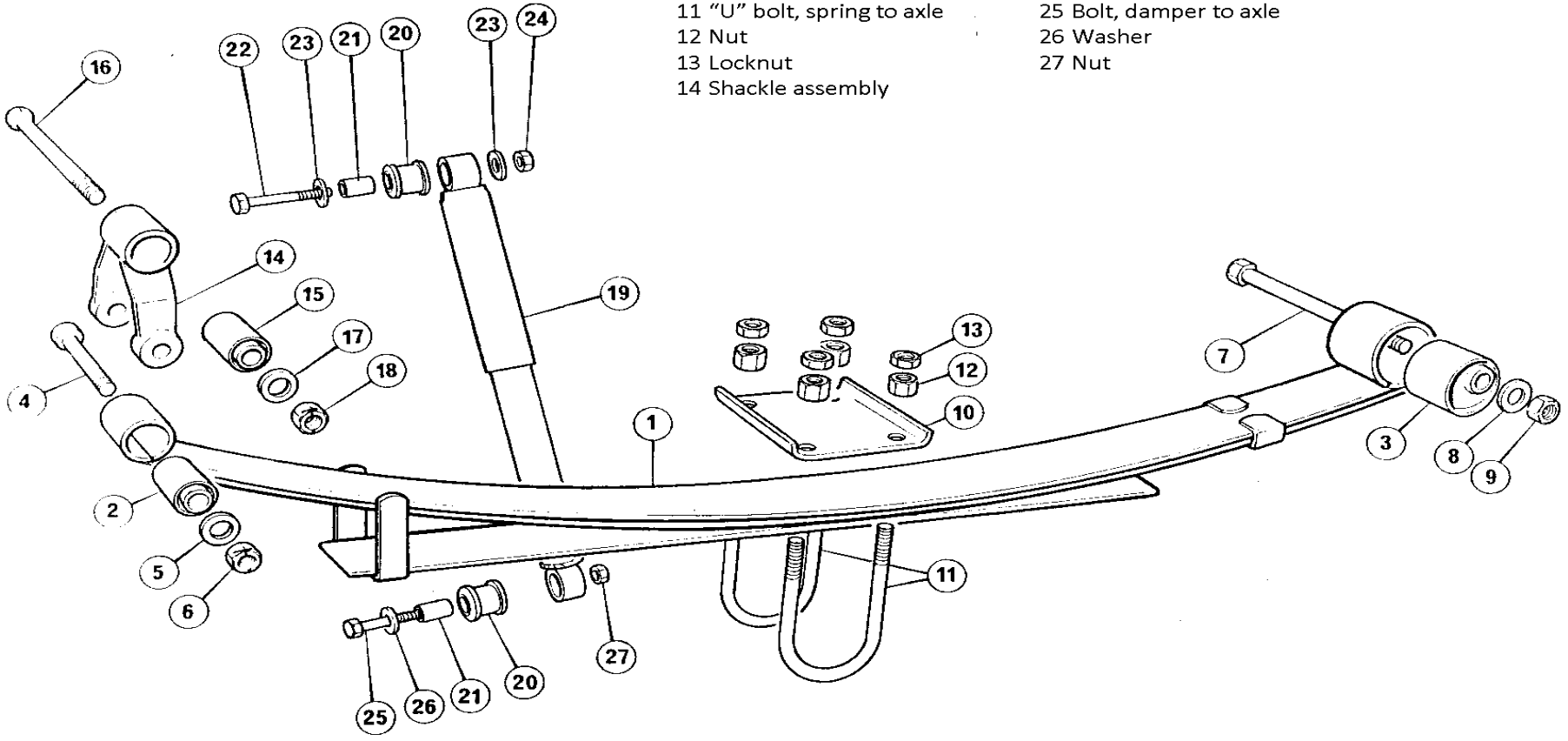
1. Bump rubber

2. Lock washer

3. Nut

Figure 1 Rear suspension - exploded

1 Spring assembly
2 Bush
3 Bush
4 Bolt, spring to shackle
5 Washer
6 Nut
7 Spring fixing bolt
8 Washer
9 Nut
10 Clamping plate
11 "U" bolt, spring to axle
12 Nut
13 Locknut
14 Shackle assembly
15 Bush
16 Shackle fixing bolt
17 Spacer
18 Nut
19 Rear damper
20 Rubber bush
21 Sleeve
22 Damper fixing bolt
23 Washer
24 Nut
25 Bolt, damper to axle
26 Washer
27 Nut



Section D

Steering

Contents

Description

The rack and pinion steering gear is mounted in rubber insulators attached to the front cross member.

Movement of the steering wheel is transmitted by the steering shaft through a flexible coupling to the helically toothed pinion. Rotation of the pinion causes the rack to move laterally and the track rods, attached to the ends of the rack, transmit this movement to the steering arms and thus the road wheels to turn.

The track rod inner ball joints, attached to the rack, are protected by convoluted rubber gaiters and the track rod outer ball joints, attached to the steering arms, are protected by conventional rubber seals.

The unit contains 0.189 litre (½ pint) SAE 90 Hypoid gear oil, which is put in during manufacture and normally no further lubrication is required. On no account should the steering unit be completely filled with oil. This will result in a pressure build-up which could burst or blow off the gaiters.

Rack and pinion adjustments

The design and construction of the steering gear provides for two adjustments:

(a) Rack damper adjustment

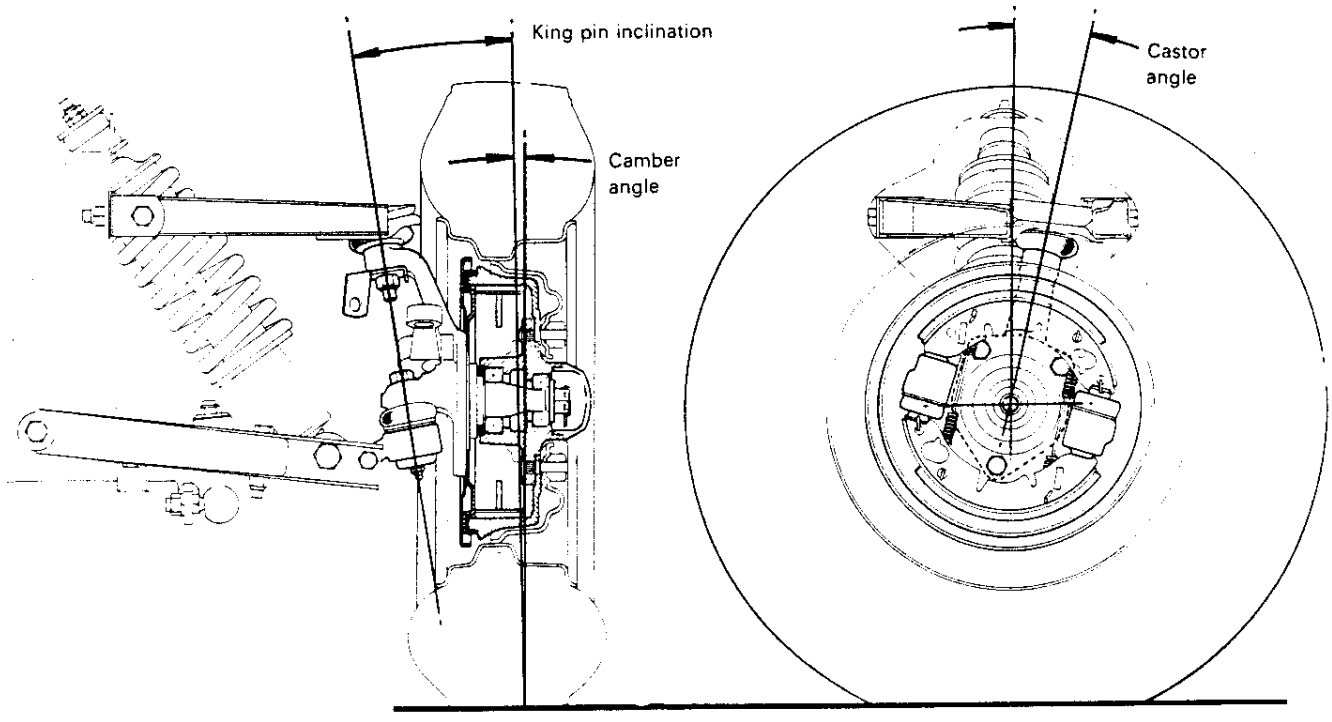
(b) Pinion bearing preload adjustment

Both these adjustments are obtained by varying the thickness of a shim pack under a cover plate. It is necessary to remove the assembly to carry out any adjustment.

Castor, camber and toe-in adjustments

The track rod ends are adjustable for length to permit toe-in setting. The castor, camber and king pin inclination angles are set during production, but provision is made for adjustment of castor and camber angles by the addition or deletion of shims behind the upper wishbone mountings brackets.

Figure 1 Castor, camber and king pin inclination



The lock stops are built in to the steering gear and no adjustments are possible.

Routine maintenance

At the 1,000 miles (1,500 km) free service the toe-in and rear wheel alignment is checked. These checks should also be made at subsequent 12,000 mile (20,000 km) intervals. The condition of steering rack gaiters should be inspected at 6,000 mile (10,000 km) intervals.

Operation 1 Toe-in adjustment, front wheel alignment

1. Position the car on level ground with the front wheels in the straight ahead position. Centralise the steering by turning the steering wheel from lock to lock, counting the turns, and then by turning back exactly half the number of turns. In this position the steering wheel spokes should adopt an inverted "Y" position.
2. Using optical/mechanical wheel alignment equipment, measure the front wheel alignment. The toe-in should be zero degrees (parallel). Take one reading, then roll the vehicle forward until the wheels have rotated 180 degrees then check again, to allow for wheel rim run out.

Adjusting
1. Slacken the outer clips on the steering rack gaiters.
2. Slacken the locking nuts on the track rods.
3. Shorten or extend the rods by rotating them until the correct adjustment is obtained.
4. Tighten the lock nuts.
5. Tighten the gaiter clips.

Operation 2 Camber adjustment

Check that the vehicle is on level ground, that the wheels are pointing straight ahead and that the tyre pressures are correct. Using optical/mechanical wheel alignment equipment check the camber angle. The amount of camber should be 1 degree positive when correctly set.

Adjustment
1. Jack up the vehicle and remove road wheel.
2. Slacken the nyloc nuts securing the upper wishbone pivot brackets to the suspension tower.
3. Add or delete shims as necessary behind both brackets to adjust the camber angle.
4. Re-tighten the pivot bracket nuts.
5. Refit the road wheel and tighten the wheel nuts.
Check the camber setting again with wheel alignment equipment.

Operation 3 Castor angle adjustment

Check that the vehicle is on level ground, that the wheels are pointing straight ahead and that the tyre pressures are correct. Using optical/mechanical wheel alignment equipment check the caster angle. The amount of camber should be 12 degrees.
If this reading is not obtained then adjust by adding or deleting shims to the upper wishbone pivot brackets as detailed in Operation 2

Operation 4 Steering wheel removal

Removal (**Figure 2**)
1. Prise off the steering wheel crash pad.
2. Disengage the steering lock. Scribe a line on the crash pad retaining ring and the top of the steering column to ensure correct alignment on re-assembly.
3. Remove the steering wheel retaining nut and washer.
4. Using a suitable puller, remove the steering wheel from the steering column.

refitting
1. Engage the steering wheel on to the steering column splines ensuring that the alignment marks are correct. If no markings are present, with the road wheels pointing straight ahead, refit the steering wheel with the spokes in an inverted "Y" position.
2. Fit the washer and nut to the steering column and tighten (ensuring the steering lock is disengaged).
3. Refit the steering wheel crash pad.

Operation 5 Steering lock/ignition switch removal

Removal (**Figure 2**)
1. Remove the steering wheel *(see operation 4).*
2. Remove multi switch cover retained by clamp beneath with two screws and washers.
3. Remove multi switch retained by clamping bracket with two screws.
4. Remove the pinch bolt securing the upper steering column to the lower steering column accessible from within the foot well.
5. Remove the two screws, nuts and washers securing the steering column support bracket to the fascia.
6. remove the saddle bracket fixings securing the steering column to the body.
7. Disconnect the ignition switch wires, noting the connections to aid re-assembly.
8. Remove the support lug bolt securing the steering column to the two support brackets attached to the body.
9. Withdraw the steering column and remove from vehicle.
10. Place the column in a vice and drill out the two steering lock shear bolts.

Refitting
1. Locate the steering lock on the column and align the mounting holes.
2. Fit the new shear-head bolts and tighten evenly until the bolt heads shear off.
3. Refit the steering column in reverse order

Operation 6 Steering column removal and replacement

To remove (**Figure 2**)
1. Follow sequence 1 to 9 of operation 5.
2. If the lower steering column is required to be removed from the vehicle remove the pinch bolt securing the lower column to the steering rack.
3. Pull the lower column through the hole in the body, complete with the grommet. Re-assemble in reverse order.

Operation 7 Steering rack removal and replacement

To remove
1. Place the vehicle on a ramp or suitable axle stands.
2. Remove the pinch bolt from the lower universal joint of the lower steering column.

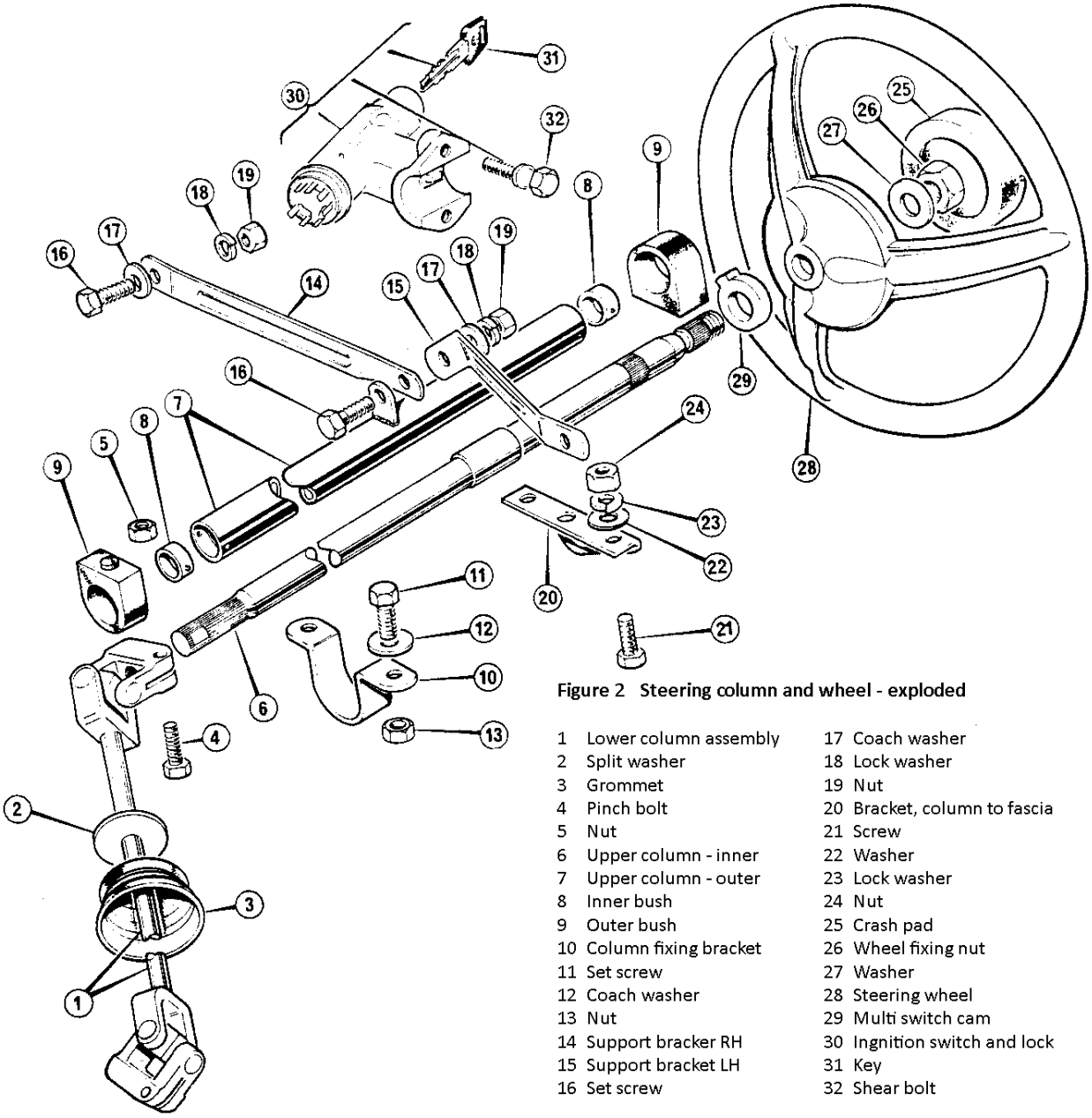


Figure 2 Steering column and wheel - exploded

1	Lower column assembly	17	Coach washer
2	Split washer	18	Lock washer
3	Grommet	19	Nut
4	Pinch bolt	20	Bracket, column to fascia
5	Nut	21	Screw
6	Upper column - inner	22	Washer
7	Upper column - outer	23	Lock washer
8	Inner bush	24	Nut
9	Outer bush	25	Crash pad
10	Column fixing bracket	26	Wheel fixing nut
11	Set screw	27	Washer
12	Coach washer	28	Steering wheel
13	Nut	29	Multi switch cam
14	Support bracker RH	30	Ingnition switch and lock
15	Support bracket LH	31	Key
16	Set screw	32	Shear bolt

3. Remove the nuts securing the track rod ends to the steering arms.

4. Using a suitable tool, free the tapers on the track rod ends.

5. From beneath the vehicle, remove the bolts and lock washers securing the rack clamps and insulating rubbers to the frame.

6. Feed the rack out from one side of the vehicle, after disengaging the splines on the lower steering column.

Operation 8 Steering rack damper adjustment

To adjust (**Figure 3**)

1. Remove the steering rack as shown in operation 7.

2. Carefully mount the assembly in a vice (with protected jaws) so that the pinion is horizontal and the rack (preload) cover is uppermost.

3. Remove the two bolts securing the rack preload cover plate to the casing.

4. Lift off the cover plate, shim pack and gasket. Withdraw the spring, anti-knock pad and damper.

5. Assemble the damper to the rack and fit the anti-knock pad. Do Not fit the spring or shim pack. Fit the cover plate and tighten the bolts evenly until the anti-knock pad is just "nipped".

6. Using feeler gauges, measure the gap between the cover plate and steering gear casing. Note this dimension (to confirm that the cover plate has been pulled down evenly by the retaining bolts, take feeler gauge measurements adjacent to each bolt).

7. Assemble a shim pack (including a gasket which must be next to the cover plate when assembled) which is 0.02 to 0.07 mm (0.001 to 0.003 in) larger than the gap measured with the feeler gauges. There must be 0.02 to 0.07 mm (0.001 to 0.003 in) clearance between the anti-knock pad and the cover when assembled.

8. Remove the cover plate and fit the spring. Position the shim pack and refit the cover plate.

9. Assemble the securing bolts to the cover plate using sealer on the threads. Tighten the bolts to a torque of 0.85 to 1.1 kg/m (6 to 8 lb/ft).

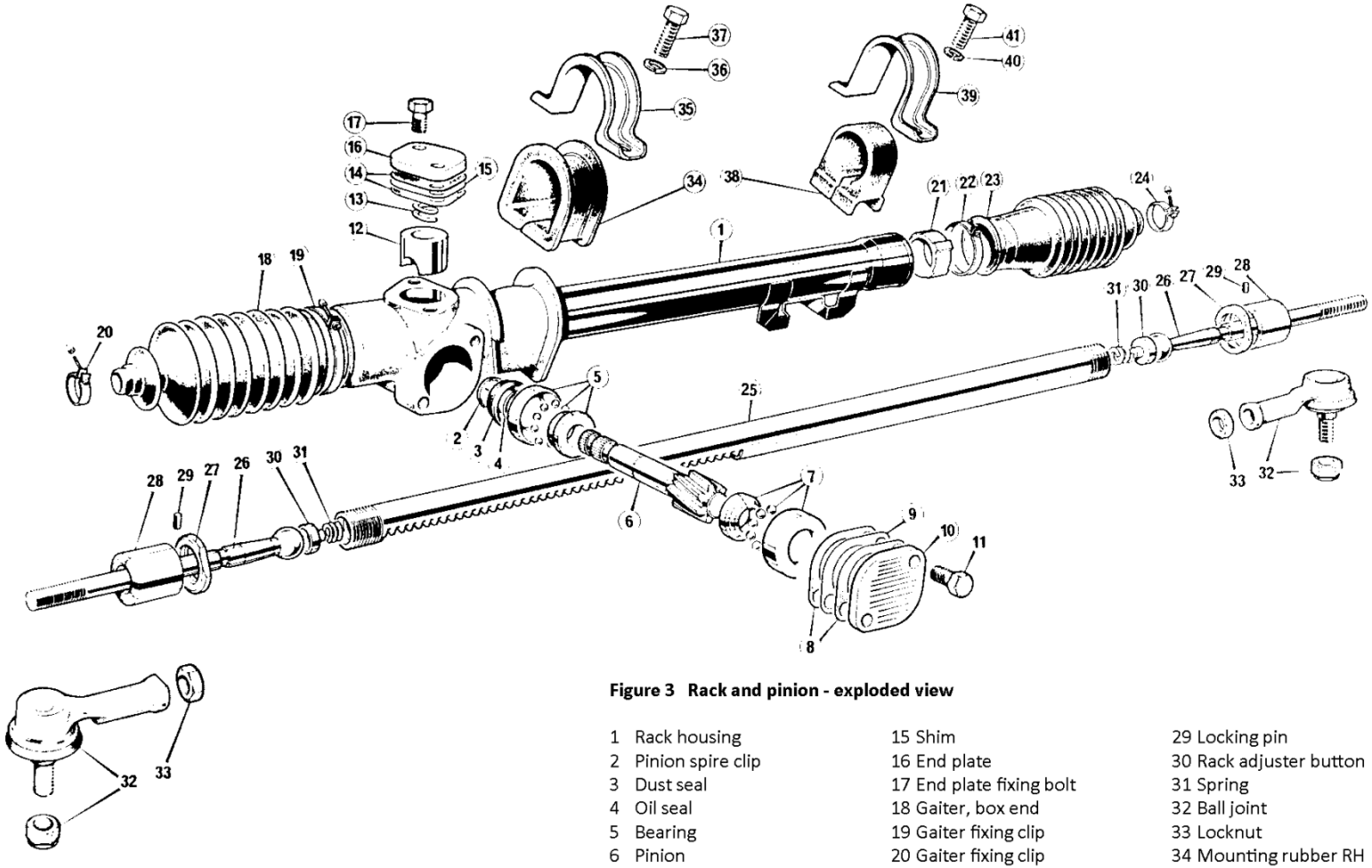


Figure 3 Rack and pinion - exploded view

1 Rack housing
2 Pinion spire clip
3 Dust seal
4 Oil seal
5 Bearing
6 Pinion
7 Bearing
8 Gasket
9 Shim
10 End plate
11 End plate fixing bolt
12 Pinion adjuster button
13 Spring
14 Gasket
15 Shim
16 End plate
17 End plate fixing bolt
18 Gaiter, box end
19 Gaiter fixing clip
20 Gaiter fixing clip
21 Bush, outer tube
22 Gaiter fixing clip
23 Gaiter, outer tube end
24 Gaiter fixing clip
25 Steering rack
26 Track rod
27 locknut
28 Boss
29 Locking pin
30 Rack adjuster button
31 Spring
32 Ball joint
33 Locknut
34 Mounting rubber RH
35 Clamp RH
36 Lockwasher
37 Set screw
38 Mounting rubber LH
39 Clamp LH
40 Lockwasher
41 Set screw

Operation 9 Steering rack pinion preload adjustment

1. Carefully mount the steering rack into a vice so that the pinion cover plate is uppermost.
2. Remove the two bolts securing the pinion bearing preload cover to the casing.
3. Lift off the cover plate, shim pack and gasket.
4. Refit the pinion cover plate and loosely assemble the retaining bolts. **Do not** fit the shim pack and gasket.
5. Tighten the cover plate evenly until the cover plate is just contacting the pinion bearing.
6. Using feeler gauges, measure the gap between the cover plate and the steering gear casing. Note this dimension. (to confirm that the cover plate has been pulled down evenly, take feeler gauge measurements adjacent to each bolt).
7. assemble a shim pack (including a gasket which must be next to the cover plate when assembled) which is 0.0. to 0.10 mm (0.002 to 0.004 in) smaller than the gap measured with the feeler gauges. There must be this amount of preload on the pinion bearings when correctly shimmed. Details of available shim thicknesses and part numbers are given at the end of this section.
8. Remove the pinion cover plate, assemble the shim pack and refit the cover plate. Fit the securing bolts using sealer on the threads and tighten to a torque of 0.85 to 1.1 kg/cm (6 to 8 lb/ft).

Checking the above measurements
Determine the torque required to start the pinion rotating using a rotary torque gauge. This should be 5.77 to 9.21 kg/cm (5 to 8 lb/in). If the actual torque is not within the prescribed limits, the adjustment is incorrect (re-check the shimming) or there is a malfunction within the assembly (tight bearings/bushes, damaged gear teeth, lack of lubricant etc) which is increasing the friction in the unit.

Operation 10 Steering gear overhaul, including inner ball joint removal and gaiter removal

To dismantle (**Figure 3**)
1. Remove the steering rack assembly as described in operation 7.
2. Remove the ball joint and lock nut from one track rod noting the number of turns to remove them.
3. Slacken the clips securing the gaiter to the track rod and the steering rack casing**. Note:** In production, the inner end of the gaiter may be secured with soft iron wire, not a screw clip. The soft iron wire must never be re-used. a screw clip should be used on re-assembly.
4. Pull off the gaiter, keeping the steering rack body below the level of the gaiter to avoid oil spillage.
5. Drain the oil into a suitable waste container. To do this, the rack must be held vertically and traversed from lock to lock several times until all the oil is expelled.
6. Remove the remaining track rod ball joint and locknut, again noting the number of turns necessary to unscrew these.
7. Slacken the clips securing the remaining gaiter to the assembly and remove the gaiter.

Track rod inner ball joint removal

To dismantle (**Figure 3**)
1. Drill out the retaining pin that locks the locknut and the ball housing in position. Take great care not to drill too deeply.
2. Screw the ball housing off the end of the rack shaft.
3. Remove the spring and ball seat from the recess in the end of the rack and discard.
4. Examine the ball housing and the ball formed on the end of the track rod and discard if wear or damage is evident.

To overhaul (**Figure 3**)
1. Remove the pinion cover plate complete with shim pack and gasket.
2. Withdraw the pinion and one of the pinion bearing assemblies.
3. Withdraw the rack from inside the casing. It is better to withdraw the rack from the pinion end of the unit. This avoids passing the rack teeth through the bearing/bush in the opposite end of the casing.
4. Remove the remaining pinion bearing assembly from the casing.
5. Inspect all parts for wear or damage. If the rack or the pinion teeth are damaged, a complete new steering gear must be fitted. Examine the rack support bush and replace if necessary.
6. Remove the pinion oil seal from the casing.

To re-assemble
1. Fit a new pinion oil seal in to the casing.
2. Fit a new pinion bearing assembly and thrust washer to the recess in the casing. Use grease to retain the bearings and thrust washer.
3. Assemble the rack in to the casing and locate it so the teeth are adjacent to the pinion location. Position the rack shaft in the centre of its travel (i.e. the straight ahead position) by measuring the rack protrusion at each end.
4. Assemble the other pinion bearing and thrust washer to the pinion and fit the pinion in to the casing.
5. Replace the shim pack, gasket and cover plate securing with two bolts, using sealer on the bolt threads. Tighten the bolts to a torque of 0.85 to 1.1 kg/m (6 to 8 lb/ft). Check damper and preload adjustments. See operations 8 and 9.
6. Fit a new spring and ball seat into the recess in the end of the rack shaft.
7. Smear SAE 90 EP oil on to the ball, ball housing and seat.
8. Assemble the ball housing to the track rod. Screw the ball housing on to the rack shaft until the track rod articulation becomes stiff.
9. Fit a piece of wire to a pull spring balance and hook the wire round the threaded end of the track rod approximately 13 mm (½ in) from the end.
10. With the track rod in mid position - parallel to the rack shaft, adjust the position of the ball housing on the rack until the effort required to move the track rod, measured on the balance scale is 2.8kg (5lbs).
11. Tighten the locknut against the ball housing.
12. Drill a 3.18 mm (1/8") hole 9.5 mm (3/8") deep on the line of contact of the locknut and the ball housing. Half the drilled hole will be in the locknut and half in the ball housing.
Note: A new hole must be drilled even if the halves of the previous hole align.
13. Insert a new retaining pin and tap it in to position. Peen the end of the pin to secure it.
14. Repeat the sequence 6 to 13 to re-assemble the opposite track rod end.

Replacing the steering gear gaiters (**Figure 3**)
1. Slide the new gaiter along the track rod in to position on the rack.
2. With the rack centralised, fit the inner clip to the gaiter and rack housing.
3. Position the outer end of the gaiter on to the track rod so it is capable of accommodating the full movement of the rack from lock to lock.

4. Secure the outer end of the gaiter to the track rod end with a clip.

5. Refit the locknut and ball joint to the track rod, screwing them on the same number of turns it required to remove them.

6. carefully mount the steering assembly in a vice with the end to which the remaining gaiter has to be fitted uppermost.

7. Traverse the rack to that the upper track rod is in the fully extended position.

8. Pour 0.189 litres (1/3 pint) of SAE 90 Hypoid gear oil into the steering gear casing underneath the track rod inner ball joint. Traverse the rack as necessary to assist the flow of oil.

9. Fit the remaining gaiter in position and secure with the screw clips so that the track rod is capable of accommodating full movement from lock to lock.

10. Refit the locknut and track rod ball joint screwing them on the same number of turns needed to remove them.

Replace the rack assembly in the vehicle and check the tracking, adjusting if necessary. Tighten the lock nuts securing the track rod end ball joints.

Steering specification

Type	Rack and Pinion
Turning circle	7.32 m (24 feet)
Castor	12 degrees
Camber	1 degree positive
Toe-in	Zero
King pin inclination	9 degrees

Pinion preload shims:

0.050mm (0.002 in)	Pt No. 24396
0.127 mm (0.005 in)	Pt No. 24397
0.254 mm (0.010 in)	Pt No. 24938

Contents

Description

The engine is water cooled, assisted by a four bladed fan. The system is of the positive circulation type, incorporating a centrifugal water pump driven by a "V" belt from the crankshaft pulley. The fan is mounted on a pulley pressed on to the front of the water pump spindle. To pressurise the system and raise the boiling point of the coolant, the radiator filler cap has a spring loaded valve set to open at 0.49 kg/cm²(7.0 lb/in²

A wax type thermostat in conjunction with a by-pass hose assists rapid warming up and maintains a constant operating temperature.

The water temperature is indicated by a meter, housed in the left-hand gauge of the fascia. This is measured electrically by a temperature sensitive sender unit screwed in to the thermostat housing.

Routine maintenance

The coolant level should be regularly checked and topped up if necessary. Check the cooling system periodically for leaks and ensure the fan belt is correctly adjusted.

Anti-freeze mixture

In the winter months an anti-freeze must be added to the coolant in the radiator to prevent damage to the cylinder block or radiator caused by freezing.

Before refilling, the cooling system should be flushed out thoroughly. Check the condition of all hoses and connections in the cooling and heater systems.

It is advisable to pre-mix the anti-freeze with water in a separate container before refilling the cooling system.

The percentage of anti-freeze solution in the cooling system will determine the degree of protection and it is advisable to allow a margin of safety in cases where lower temperatures than normal may be encountered.

The quantities of anti-freeze for various degrees of protection are given in a table at the end of this section.

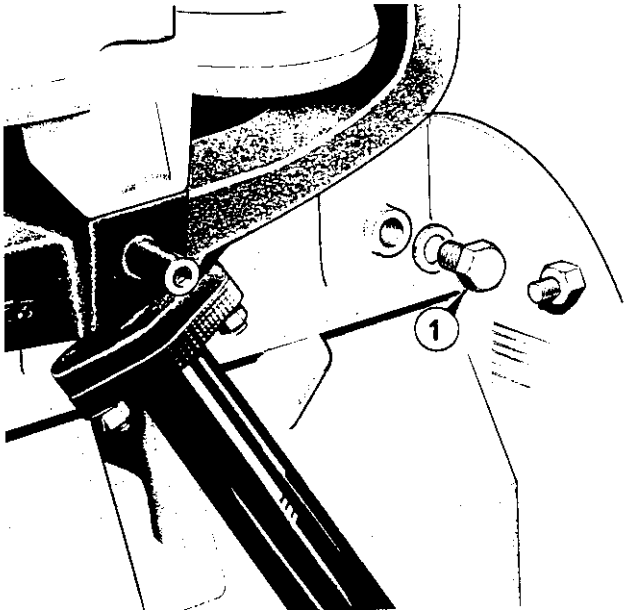


Figure 1 Cylinder block drain plug

1. Drain plug

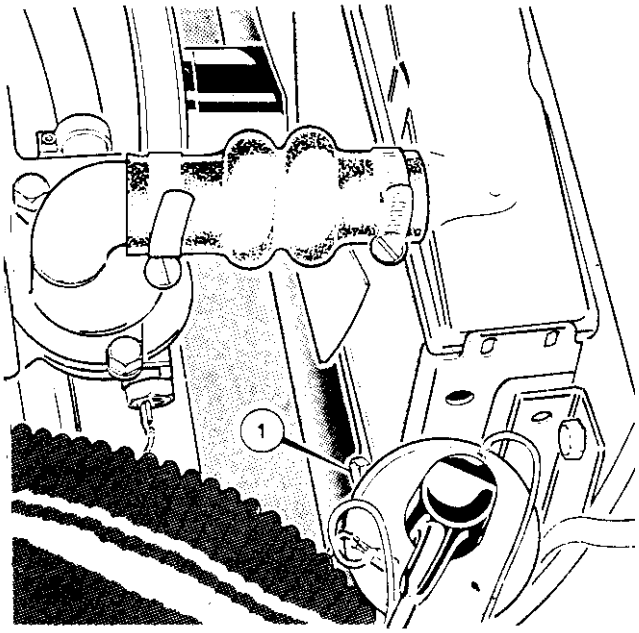


Figure 2 Radiator drain plug *(if fitted)*

1. Drain plug

The percentage of anti-freeze in the cooling system can be checked by measuring the specific gravity of the coolant using a suitable hydrometer.

It is permissible with modern anti-freeze formulation to leave the anti-freeze solution in the cooling system throughout the year, provided that the protection afforded at the onset of Winter has not been reduced by routine topping up of the coolant water during the summer months.

Note: During summer months, if no anti-freeze is used a solution of water plus 3.35 fluid oz of Reliant Coolant Inhibitor "R" part number 10374 **MUST** be used to maintain the system free of corrosion.

Operation 1 Draining the cooling system

Drain plugs are provided, one on the left hand side of the cylinder block (Figure 1) and one in the base of the radiator (Figure 2).
Some vehicles may have a radiator without a drain plug fitted. To drain the radiator on this type the bottom hose must be removed.

1. The vehicle should be standing on level ground with the radiator filler cap removed when draining.

Note: Do not remove the radiator cap when the engine is hot as this will cause very hot water and steam to be blown out of the filler neck possibly leading to injury from scalding.

2. If anti-freeze is being used it is advised that the coolant be collected in a clean container beneath the vehicle and retained for re-use.

3. Drain the cooling system and flush through by inserting a hose pipe in the radiator filler orifice and allowing water to flow through the system until clean.

Note: It is advisable to leave an indication within the vehicle that the cooling system has been drained should the vehicle be left standing. Running the engine without coolant can lead to severe internal damage.

To refill

1. Replace drain plugs (refit bottom hose if removed).

2. If anti-freeze solution has been retained, return it to the cooling system. If the liquid retained is not sufficient to fill the system, add additional anti-freeze solution as required. Do not top up with only water, otherwise the solution may be weakened making it less effective in adverse conditions.

3. Do not over fill the radiator. The correct level of the coolant in the radiator is reached when the top header tank is approximately two thirds full. Some vehicles may have a radiator with a coolant level indicator, visible in the filler neck.

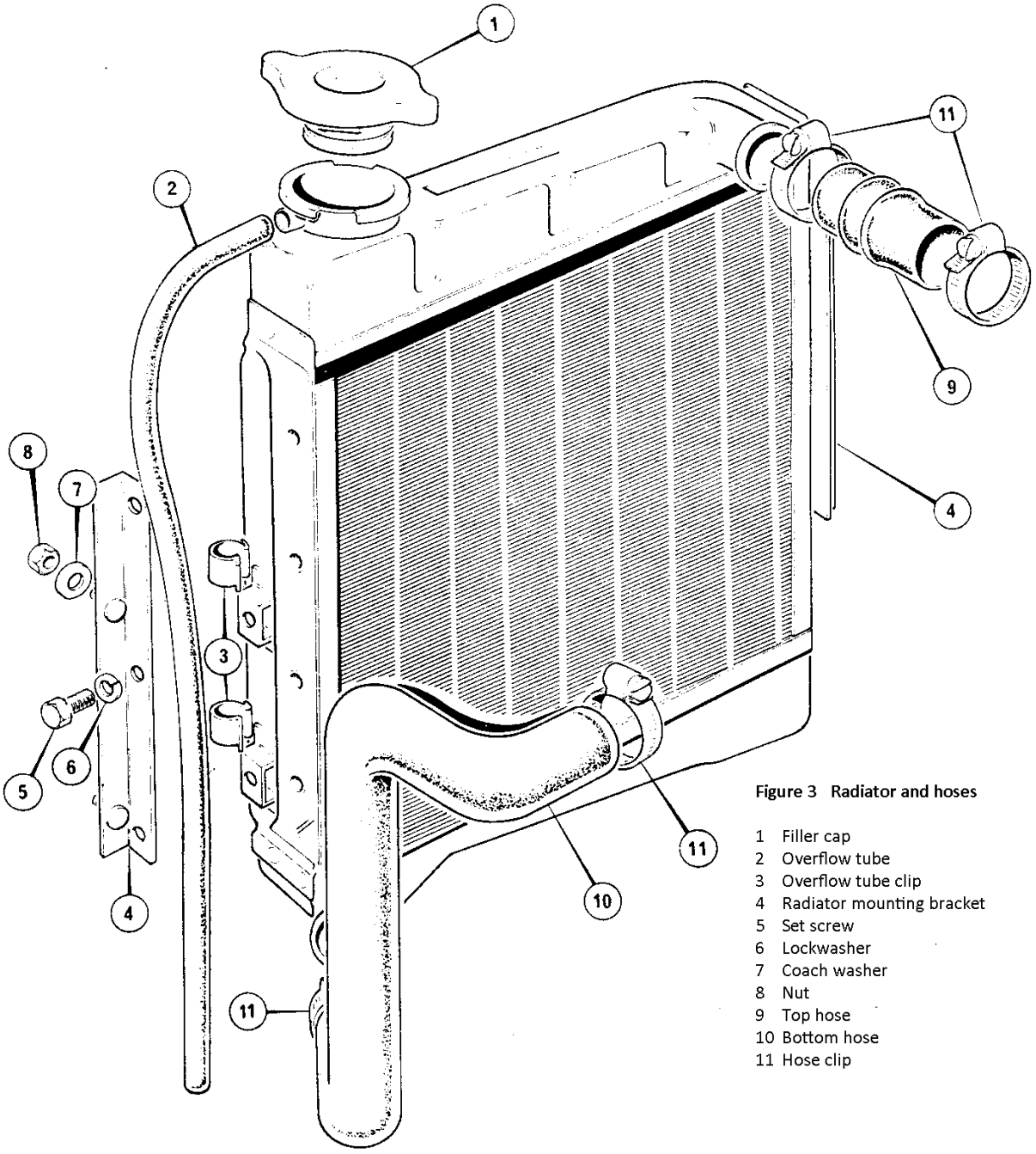


Figure 3 Radiator and hoses

1 Filler cap
2 Overflow tube
3 Overflow tube clip
4 Radiator mounting bracket
5 Set screw
6 Lockwasher
7 Coach washer
8 Nut
9 Top hose
10 Bottom hose
11 Hose clip

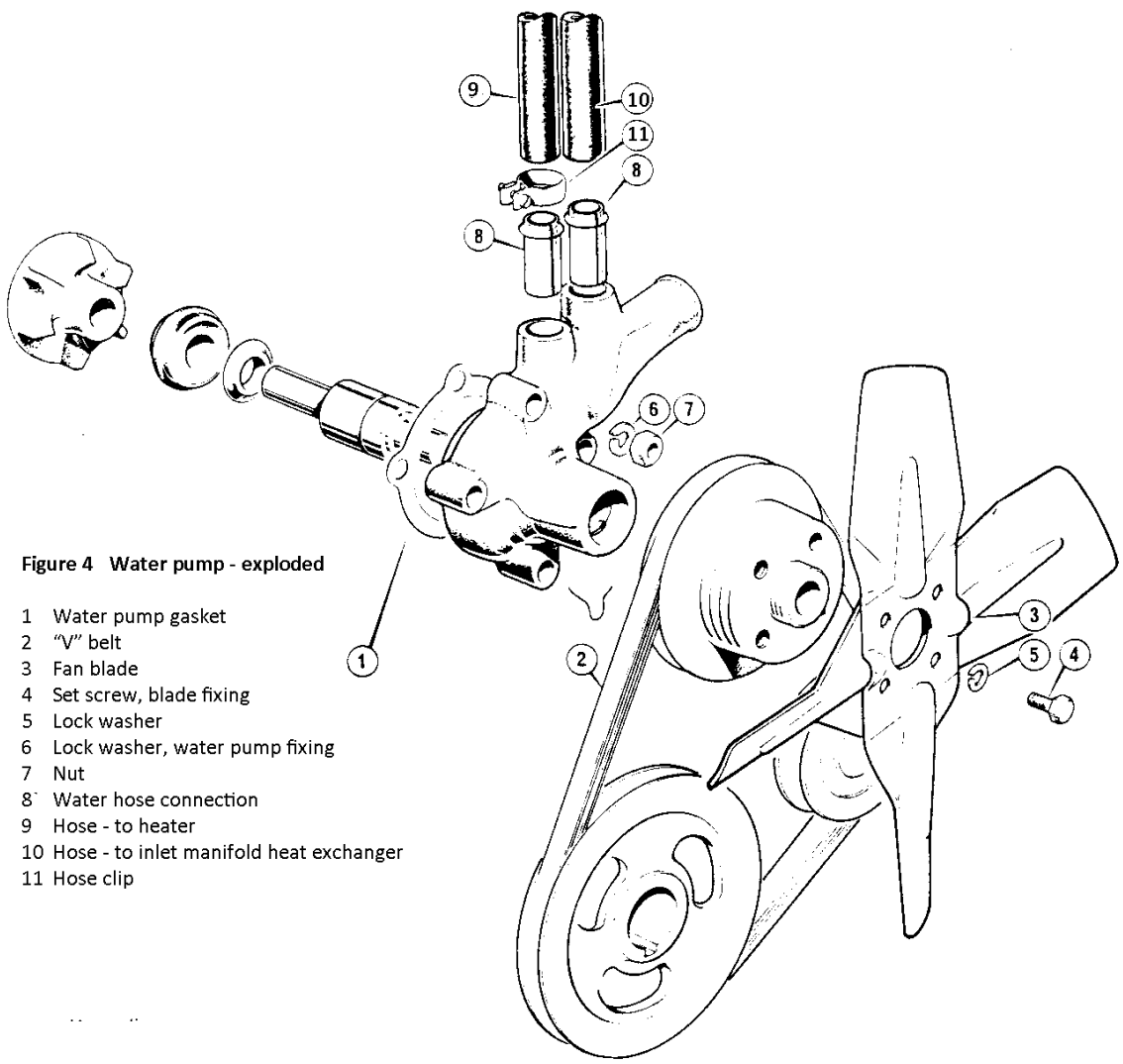


Figure 4 Water pump - exploded

1 Water pump gasket
2 "V" belt
3 Fan blade
4 Set screw, blade fixing
5 Lock washer
6 Lock washer, water pump fixing
7 Nut
8 Water hose connection
9 Hose - to heater
10 Hose - to inlet manifold heat exchanger
11 Hose clip

4. Start the engine and run up to normal operating temperature with the radiator cap removed to clear any air-locks in the system. Stop engine and check coolant level, topping up if required.

5. Replace radiator filler cap.

Checking for leaks

After refilling the system, ensure that the hose connections are securely tightened. Run the engine and check for water leaks.

In the event of the cooling system having been disturbed, i.e. cylinder head removal or water pump change, it is recommended that a "Barseal" pellet ("R" part No. 9947) is introduced through the radiator filler neck. New gaskets should always be fitted and fixing nuts tightened to the correct torque to prevent possible ingress of coolant in to the oil system.

Operation 2 Radiator removal and replacement

The radiator, comprising an upper and lower tank connected by a matrix, is mounted to the body by two support brackets. An overflow pipe drains surplus coolant to the ground should the system be over filled.

To remove (**Figure 3**)

1. Drain the cooling system as described in operation 1

2. Slacken hose clips and disconnect radiator hoses from water pump and thermostat housing

3. Remove the four set screws and washers securing the radiator to the support brackets located on each side of the radiator, attached to the body.

4. Remove the radiator.

5. Slacken the hose clips and remove the hoses. Check the condition and renew if necessary.

Refit in the reverse order, refill the cooling system as described earlier in this section and check the cooling system for leaks.

Operation 3 Water pump removal and replacement

The water pump is mounted on the face of the cylinder block and comprises a cast iron impeller mounted on a spindle with a seal and a thrower. The seal, bearing against the impeller, prevents leaks around the spindle. The coolant inlet is on the right of the pump body. A fabricated pulley, fitted to the front of the spindle, seats the four bladed fan, see **Figure 4.**

Leaking coolant from the seating face of the impeller could indicate a worn gasket or impeller seal. If the latter is the case then a new pump, available only as an assembly, will have to be fitted.

To remove

1. Drain the cooling system and remove the radiator as described in operations 1 and 2.

2. Slacken the alternator adjusting screw and mounting bolts. Pivot the alternator towards the engine and remove the fan belt.

3. Slacken the hose clips and disconnect the hoses from the pump.

4. Remove the four nuts and lock washers and withdraw the pump assembly from the studs on the cylinder block, including the gasket.

To replace

1. Clean the faces of the water pump and cylinder block and fit a new gasket.

2. Fit the pump assembly over the studs and secure it to the face of the cylinder block with four nuts and lock washers, tightening to a torque of 1.66 to 2.07 kg/m (12 to 15 lb/ft).

3. Reconnect the heater and heat exchanger hoses.

4. Replace the fan belt and adjust the tension (Operation 4).

5. Refit radiator, connect hoses, refill the cooling system and check for leaks.

Operation 4 Fan belt adjustment

Correct fan belt tension is important, otherwise the belt itself may be damaged, or undue strain placed on the alternator or water pump bearings. If the belt is too slack, poor battery charging could result. The correct tension of the fan belt is such that when the belt is pushed at a point midway between the alternator and water pump pulleys, a deflection of 13 mm (½ inch) is necessary.

To adjust

1. Loosen the alternator front lower mounting bolt.

2. Slacken the adjustment locking screw at the front of the alternator allowing the alternator to be moved on the slotted strap.

3. Pivot the alternator towards or away from the engine as necessary until the correct belt tension is obtained.

4. Securely tighten the locking screw and lower front mounting bolt.

Note: The lower front mounting bolt **MUST** be slackened completely before making any adjustment as any strain on the lower fixing could distort or damage the mountings.

Operation 5 Fan belt removal and replacement

1. Loosen the alternator front lower mounting bolt.

2. Slacken the adjustment locking screw at the front of the alternator allowing the alternator to be moved on the slotted strap.

3. Pivot the alternator towards the engine and remove the fan belt. It is vital that the alternator is pivoted to its fullest extent. Any attempt to strain a new belt over the sides of the pulleys will easily cause damage to the belt.

Operation 6 Thermostat removal and replacement

The wax type thermostat is located in a housing at the front of the cylinder head. When the coolant is cold, the thermostat is in the closed position and water flow is restricted within the engine by means of a by-pass hose system (through the heater matrix and the inlet manifold heat exchanger). Coolant flowing through the by-pass returns to the water pump. When the thermostat is fully open, complete circulation through the engine block, cylinder head and radiator takes place.

To remove

1. Drain the cooling system as described in operation 1 and remove the top hose.

2. Unscrew the three set screws, complete with lock washers. Lift off the thermostat housing and remove the thermostat. (**see Section F, Figure 13**)

Testing the thermostat

If it is suspected that the thermostat is not operating correctly, it may be tested in the following manner:-

Suspend the thermostat in water in a suitable container, gradually heating the water. Check the water temperature frequently using a thermometer. The thermostat or thermometer must not directly touch the container or the reading will not be accurate.

The thermostat should start to open at 86 to 89°C (187 to 193° F) and be fully opened when the water is boiling.

If the thermostat does not operate correctly then a new one must be fitted. It is not possible to repair or adjust this item.

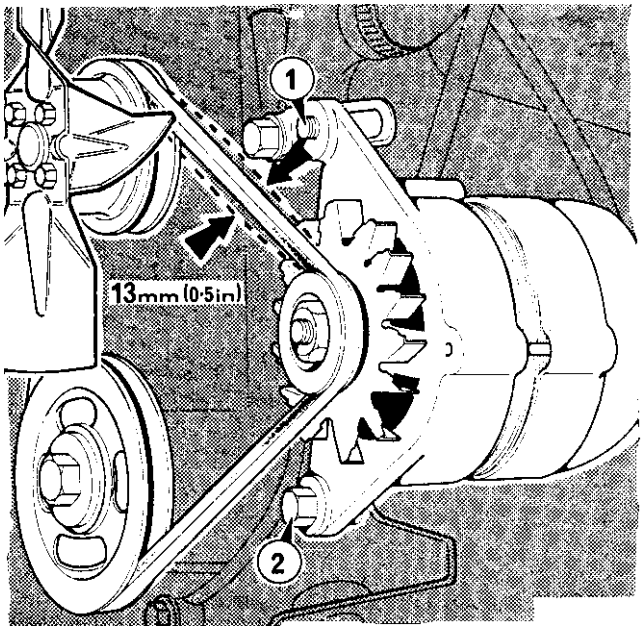


Figure 5 Fan belt adjustment

1. Adjustment locking screw

2. Alternator front lower mounting bolt

To replace

1. Position thermostat in its housing and fit a new gasket.

2. Place the thermostat cover with the outlet facing forward and secure with the three set screws and lock washers (do not over tighten).

3. Refit the top hose and refill the cooling system. Check for water leaks.

Temperature gauge and sender unit - Fault diagnosis

The temperature gauge reading depends upon the variation of resistance of a thermistor.

If faulty readings are suspected on the gauge, check the gauge and the sender unit as follows:-

Diagnosis

1. With the ignition switched on, disconnect the wire from the sender unit on the cylinder head, the temperature gauge needle should then be at the cold mark.

2. Now hold the wire to earth and the gauge needle should move all the way across to the hot mark.

This would indicate that the gauge itself is operating correctly.

The above result would suggest that inaccurate readings are due to the sender unit, which must be replaced, a fault in the wiring, a loose connection, a faulty voltage stabiliser or a defective gauge. If the gauge is deemed defective, the unit will need to be replaced, see **Section T.**

.

Cooling system specification

Cooling system	
Capacity including heater	**3.69 litres (6.5 pints)**
Radiator	
Cap pressure	0.492kg/cm² (7 lb/in²)
Thermostat	
Type	Wax
Starts to open	86-89°C (187-193°F)
Fully open	103°C (218°F)
Opening distance	7.11 mm (0.28 in)
Fan	
Fan Diameter (4 blade)	254 mm (10 in)
Belt tension	13 mm (½ in) total free movement
Water pump	
Type	Centrifugal
Pulley ratio	1.172:1

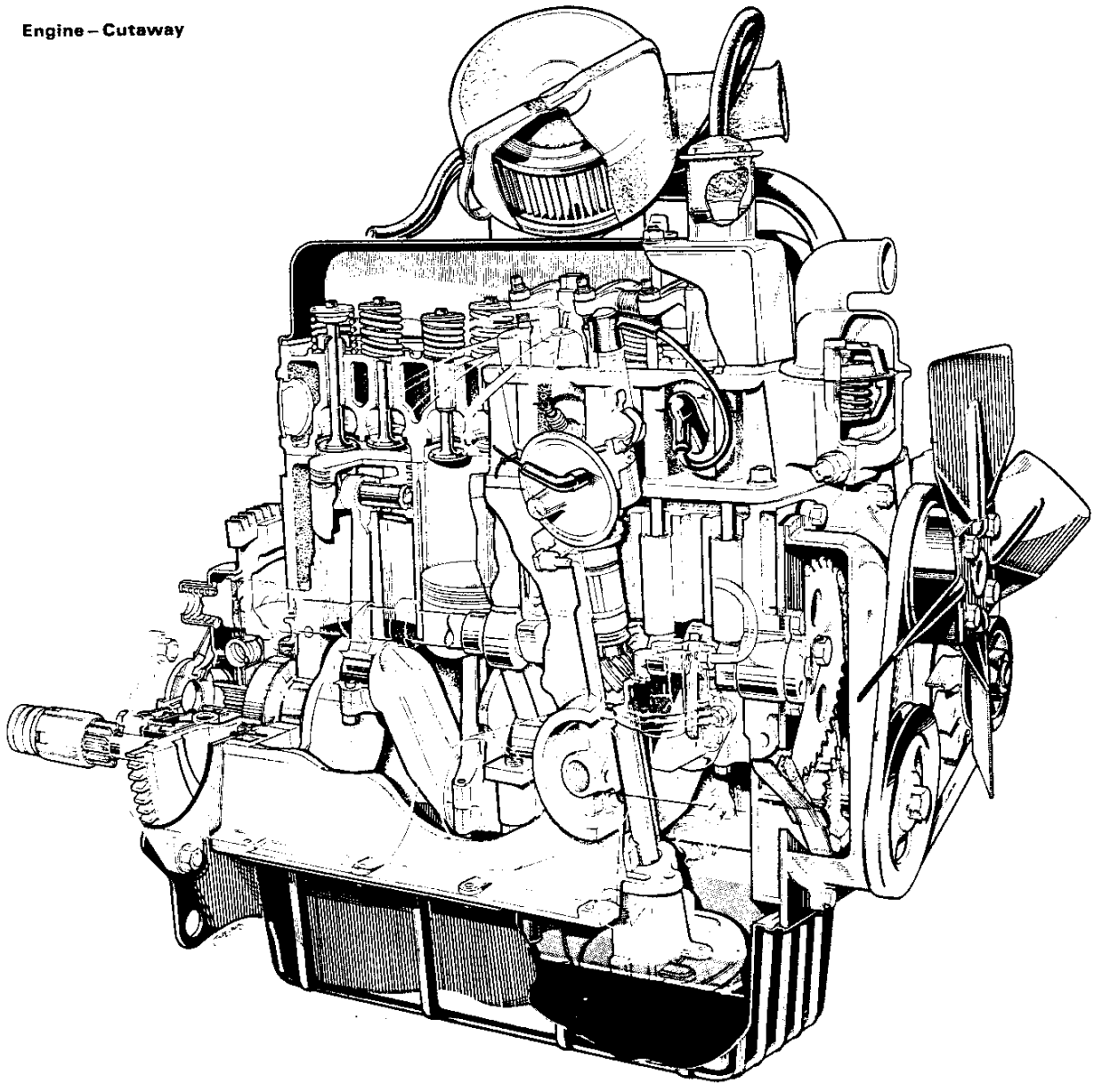
Anti-freeze quantities

Volume In water %	Fluid Down to °C (°F)	Solidifies At °C (°F)	Amount of Anti-freeze required	Specific gravity
10	-4 (+25)	-8 (+17)	0.37 litres (0.65 pints)	1.016
15	-7 (+20)	-14 (+17)	0.55 litres (0.96 pints)	1.026
20	-9 (+15)	-19 (-3)	0.74 litres (1.3 pints)	1.034
25	-13 (+9)	-29 (-20)	0.92 litres (1.62 pints)	1.042
30	-16 (+3)	-39 (-38)	1.11 litres (1.94 pints)	1.050
40	-25 (-13)	-48 (-54)	1.48 litres (2.6 pints)	1.065
50	-37 (-34)	-58 (-72)	1.84 litres (3.25 pints)	1.080

Section F

Contents

Engine – Cutaway



Operation 12	**Crankshaft removal and installation (with sump, front cover, flywheel, rear seal cove, connecting rods and crankshaft sprocket removed**
Operation 13	**Camshaft removal and installation (with timing chain and sprocket removed)**
Operation 14	**Camshaft bearing removal and replacement (with camshaft removed)**
Operation 15	**Cylinder liner replacement**
Operation 16	**Engine rebuild**
Operation 16	**Valve clearance - tappet adjustment**
Stud removal	

Description

The 850cc engine is a four cylinder in-line unit having a die cast aluminium cylinder head with cast iron valve guides and sintered iron valve seats. Die cast aluminium is also used for the cylinder block which incorporates removable wet liners. The forged steel crankshaft is mounted on three steel backed main bearings

Routine maintenance

The engine oil level should be checked weekly and topped up if necessary to keep the oil capacity at 3.13 litres (5.5 pints). It is vital that this capacity is kept constant for any appreciable drop in the level will result in poor lubrication and possible engine damage. To ensure the lubrication system is kept clean and free from impurities the engine oil should be changed and a new oil filter fitted every 6,000 miles (10,000 km).

Engine service operations

The following service operations give detailed instructions for servicing and dismantling all the major engine assemblies. Where it is necessary to remove ancillary components and parts, refer to the appropriate sections of this manual.

Before re-assembly during any operation, all components should be thoroughly cleaned, paying attention to joint faces and bearing surfaces. Any local high spots or burrs on the joint faces should be carefully removed using a fine file. Ensure that any piece of gasket or dirt in a blind tapped hole is removed during cleaning, as the bolt or screw may bottom before the bolt head abuts the mating part. When tightening a bolt which bottoms a characteristic "springing" may be felt. If this occurs, the bolt must be removed and the hole cleaned out.

The engine and gearbox assembly is removed from the vehicle by lifting it through the bonnet aperture. This operation will be greatly facilitated by the use of a hoist bracket that locates on the rocker box studs. The bracket can be constructed as shown in **Figure 1**. The use of this bracket plus the availability of a hoist is assumed in the following information.

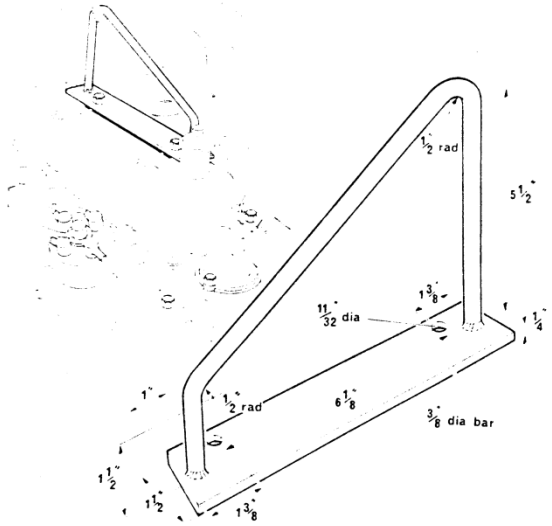


Figure 1 Hoist bracket for engine removal

Operation 1 Engine removal and installation

To remove

1. Remove nuts and washers from bonnet hinges and remove bonnet lid.

2. Disconnect battery.

3. Drain cooling system.

4. Drain engine oil.

5. Remove radiator complete with hoses (Section E).

6. Disconnect the heater hoses from the engine and bulkhead and remove.

7. Remove the fresh air hose from the heater unit and bulkhead stub.

8. Remove the air cleaner body and element.

9. Disconnect the fuel pipe from the tank at the pump and plug to avoid ingress of dirt. Remove the pump to carburettor fuel pipe taking care not to damage the pipe when unclipping from the "P" clip on the rocker cover. Remove the supporting bar for the "P" clip from the rocker stud.

10. Remove the heater hose clip from the remaining stud.

11. Disconnect starter motor lead.

12. Disconnect alternator harness plug, secured by a spring clip.

13. Disconnect the accelerator cable from the carburettor bracket.

14. Release the trunnion and disconnect the choke cable.

15. Remove the two nuts securing the exhaust downpipe to the manifold studs

16. Remove the nut and washer securing the exhaust support bracket to the bell housing allowing the exhaust system to hang clear of the engine.

17. Remove the nuts and washers from the front engine mountings.

18. From inside the car, prise out the gear lever gaiter and remove the gear lever knob. Remove the gaiter from the lever. Remove the centre console. prise out the retaining "C" clip from ball joint cap at the base of the gear lever and lift out the lever.

19. Disconnect the harness earth leads from the front engine cover adjacent to the thermostat housing.

20. Disconnect the HT and LT leads from the coil.

21. Remove the oil pressure warning light lead from the sender on the engine block and disconnect the pipe to the oil pressure gauge if fitted.

22. Disconnect the lead from the temperature gauge sender on the thermostat housing.
23. Disconnect the speedometer cable at the gearbox.
24. Disconnect the clutch cable from the operating arm, remove the locknut and adjusting nut and withdraw the cable from the trunnion.
25. Pull the clutch outer cable from its retaining hole in the engine back plate.
26. Remove nuts, bolts and lock washers connecting the driveshaft to the gearbox output flange.
27. Remove the upper two bolts from the gearbox mounting bracket and disconnect the earth braid. Slacken the lower two bolts securing the gearbox mount to the chassis frame cross member.
28. Install the engine hoist bracket on to the rocker cover studs **(Figure 1)** securing it with the rocker cover nuts.
29. Attach suitable lifting tackle to the hoist bracket.
30. Remove the two remaining gearbox mounting bolts. Support the engine and gearbox assembly on the hoist.
31. Pull the engine and gearbox slightly forwards and lift to clear the front engine mountings. Lift the assembly clear of the bonnet area and lower on to a suitable base, taking care not to damage the engine, sump etc.
32. Remove the bell housing bolts and separate the engine and gearbox.
33. Remove ancillary components and carry out the necessary service or repair operations.

To replace
1. Refit all ancillary components.
2. Re-assemble engine and gearbox.
3. Position engine hoist bracket on to rocker studs.
4. Attach suitable lifting tackle and suspend the assembly over the engine compartment.
5. Carefully lower the engine and gearbox assembly and manoeuvre to locate the front engine mounting lugs on to the front engine mountings in the frame.
6. Attach the nuts and washers on the front engine mountings and leave loose.
7. Raise the gearbox and locate the gearbox rear mounting bracket to the frame, securing with bolts, nuts and lock washers.
8. Tighten front engine mounting nuts.
9. Refit the driveshaft securing with nuts, bolts and lock washers.
10. Reconnect the speedometer cable to the gearbox.
11. Refit the clutch cable into the retaining hole in the engine back plate and reconnect the clutch cable to the operating arm. Adjust the clutch.
12. Refit the exhaust pipe to the manifold with a new gasket and secure with new brass nuts.
13. Refit the exhaust support bracket to the bell housing.
14. Remove the engine hoist bracket and replace the heater hose clip to the rocker cover stud.
15. Reconnect the fuel pipe top both carburettor and fuel pump, securing with the "P" clip on the rear rocker cover stud.
16. Reconnect the fuel supply pipe to the pump.
17. Refit earth leads from harness to front timing cover bolt.
18. Reconnect starter motor lead.
19. Reconnect oil pressure light sender lead and oil pressure gauge pipe (if fitted).
20. Reconnect lead to temperature gauge sender.
21. Reconnect HT and LT leads to coil.
22. From inside the car, refit the gear lever and secure with the "C" clip.
23. Refit the centre console and secure with four screws. Push the gear lever gaiter over the lever and locate in the aperture in the centre console.
24. Refit the gear lever knob.
25. Reconnect the choke and accelerator cables.
26. Re-assemble the air filter.
27. Refit heater hoses.
28. Replace radiator and reconnect top and bottom hoses.
29. Refit heater fresh air hose.
30. Refill engine and gearbox with recommended oils.
31. Refill cooling system.
32. Refit bonnet.
33. Reconnect battery.

Operation 2 Flywheel and ring gear removal and replacement

Flywheel removal
1. Remove the gearbox (see **Section G**)
2. Unscrew the six set screws, complete with lock washers, and remove the clutch cover and driven plate from the flywheel.
3. Release the tab washer and unscrew the three set screws. Remove the flywheel assembly from the flywheel.

Starter ring gear removal
1. Drill a hole 6.35 mm (0.25 in) diameter at the point of intersection of a scribed line between any two teeth and a scribed line mid way between the root diameter and the inside diameter of the ring gear. Ensure that the hole is not drilled through the ring gear in to the flywheel, as this will interfere with the subsequent balance of the flywheel.
2. Hold the flywheel assembly in a soft jaw vice.
3. Place a cloth over the ring gear as a precaution against flying shrapnel.
Warning: Ensure adequate protection, particularly for the eyes to prevent injury from the possibility of flying fragments when the ring gear is split.
4. Place a cold chisel immediately above the centre line of the drilled hole and strike sharply to split the ring gear.

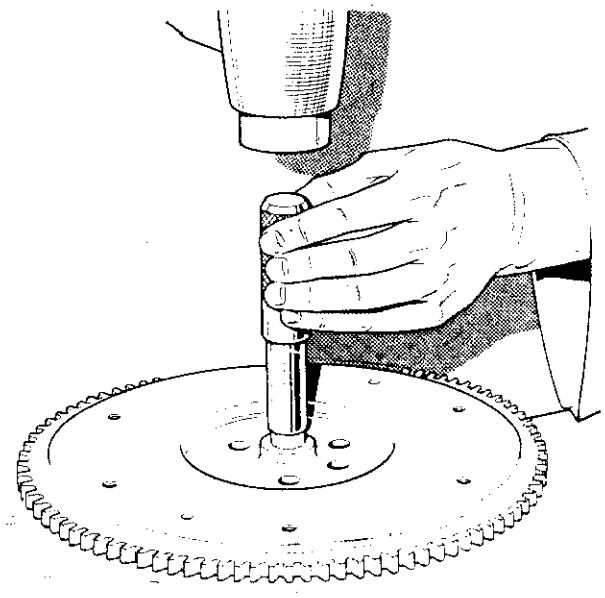


Figure 2 Fitting flywheel bearing

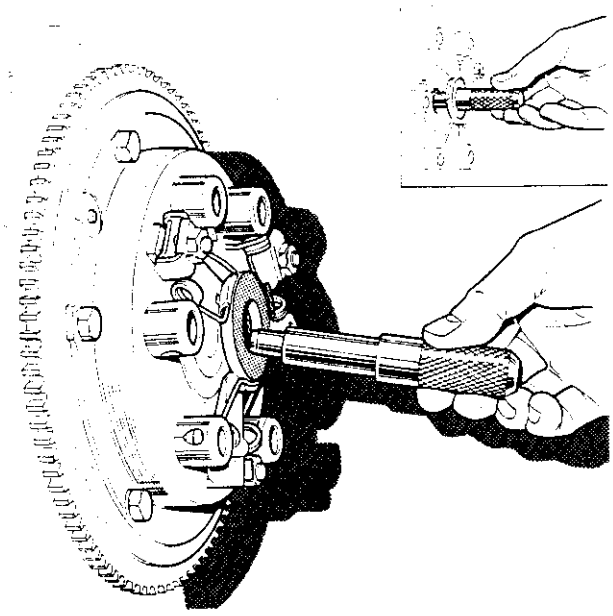


Figure 3 Centralising the clutch

Refitting

1. Heat up the new ring gear uniformly to a temperature of 200°C.

2. Place the flywheel on a stable flat surface, clutch face uppermost and clean the ring gear locating surface.

3. Slip the heated new ring gear in to place and hold in position until it contracts under cooling sufficiently to grip the flywheel.

4. Allow the assembly to fully cool naturally to avoid distortion.

Refitting the flywheel assembly

1. Clean the mating face between the flywheel and the end of the crankshaft. Check that the locating dowel is undamaged and ensure that the spigot bush is in place. Check the bush for wear. If wear is evident then knock the old one out and fit a new one using special tool no. RT 7485 (**Figure 2**). Needle roller bearings have been used as an alternative to the phosphor bronze bush and care must be taken when replacing these. It is vital to note that the hardened square end face of the bearing must face the tool used to press in the bearing. Use of the rolled end of the bearing will distort the shell and damage the rollers. In many cases the part number or makers name will be stamped in to the hardened end to aid identification. If this does not apply, great care must be observed to identify the correct end.

2. Fit the flywheel to the crankshaft locating it over the dowel.

3. Secure the flywheel with three set screws and a new tab washer tightening to a torque of 4.03 kg/m (29 lb/ft). The tabs on the washer should be bent over to secure the set screws.

4. Check the flywheel for alignment using a dial indicator gauge. A 0.08 to 0.13 mm (0.003 to 0.005 in) run out is acceptable. If this is exceeded the flywheel needs to be renewed.

5. Using special tool no. RT 7485 as a centraliser, or if this is not available an input shaft from a spare gearbox, replace the clutch disc and pressure plate assembly on to the flywheel, securing evenly with six set screws and lock washers to a torque of 1.66 to 2.07 kg/m (12 to 15 lb/ft) see **Figure 3**. The pressure plate assembly should be tapped with a hide mallet to ensure it is square on the flywheel.

6. Check clutch run-out does not exceed 0.381 mm (0.015 in) on the steel thrust disc.

7. Refit the gearbox.

Operation 3 Sump removal and replacement

1. Drain engine oil.

2. Undo the 15 set screws and remove the spacers, lock washers, sump and gasket.

3. Clean the sump and the cylinder block facing.

4. To eliminate possible oil linkage, the two centre front and rear sump fixing screws should be thoroughly cleaned, then generously coated with "Hylomar" sealant before refitting.

5. Fit new gasket, replace sump and tighten the 15 set screws, spacers and lock washers evenly.

Figure 4 Engine, cylinder block - exploded (page 38)

1.	*Cylinder block*	*21.*	*Tube, dipstick*	*41.*	*Spring*	*61.*	*Washer*
2.	*Stud, cylinder head*	*22.*	*Mounting plate*	*42.*	*Ball*	*62.*	*Gasket*
3.	*Stud*	*23.*	*Gasket*	*43.*	*Insert*	*63.*	*Set screw*
4.	*Stud*	*24.*	*Stud, plate to block*	*44.*	*Mounting plate*	*64.*	*Lock washer*
5.	*Stud*	*25.*	*Nut, plate to block*	*45.*	*Dowel*	*65.*	*Washer*
6.	*Stud, water pump*	*26.*	*Lock washer*	*46.*	*Dowel*	*66.*	*Nut*
7.	*Stud, alternator strap*	*27.*	*Cover, timing chain*	*47.*	*Set screw*	*67.*	*Washer*
8.	*Stud, fuel pump*	*28*	*Gasket*	*48.*	*Set screw*	*68.*	*Nut*
9.	*Stud, bearing housing cap*	*29.*	*Oil seal, cover*	*49.*	*Washer*	*69.*	*Lock washer*
10.	*Washer*	*30.*	*Bolt*	*50.*	*Lock washer*	*70.*	*Restrictor cup*
11.	*Nut*	*31.*	*Bolt*	*51.*	*Rear oil seal*	*71.*	*Mounting rubber*
12.	*Core plug, camshaft*	*32.*	*Bolt*	*52.*	*Rear cover*	*72.*	*Washer*
13.	*Bridge piece front*	*33.*	*Lock washer*	*53.*	*Gasket*	*73.*	*Nut*
14.	*Bridge piece rear*	*34.*	*Nut*	*54.*	*Set screw*		
15.	*Packing, bridge piece*	*35.*	*Oil filter*	*55.*	*Set screw*		
16.	*Screw*	*36.*	*Oil filter adapter*	*56.*	*Washer*		
17.	*Cylinder liner*	*37.*	*Plug*	*57.*	*Lock washer*		
18.	*Plug, water drain*	*38.*	*Oil pressure switch*	*58.*	*Dowel*		
19.	*Washer, plug*	*39.*	*Oil pressure valve retainer*	*59.*	*Sump*		
20.	*Dipstick*	*40.*	*Washer*	*60.*	*Sump drain plug*		

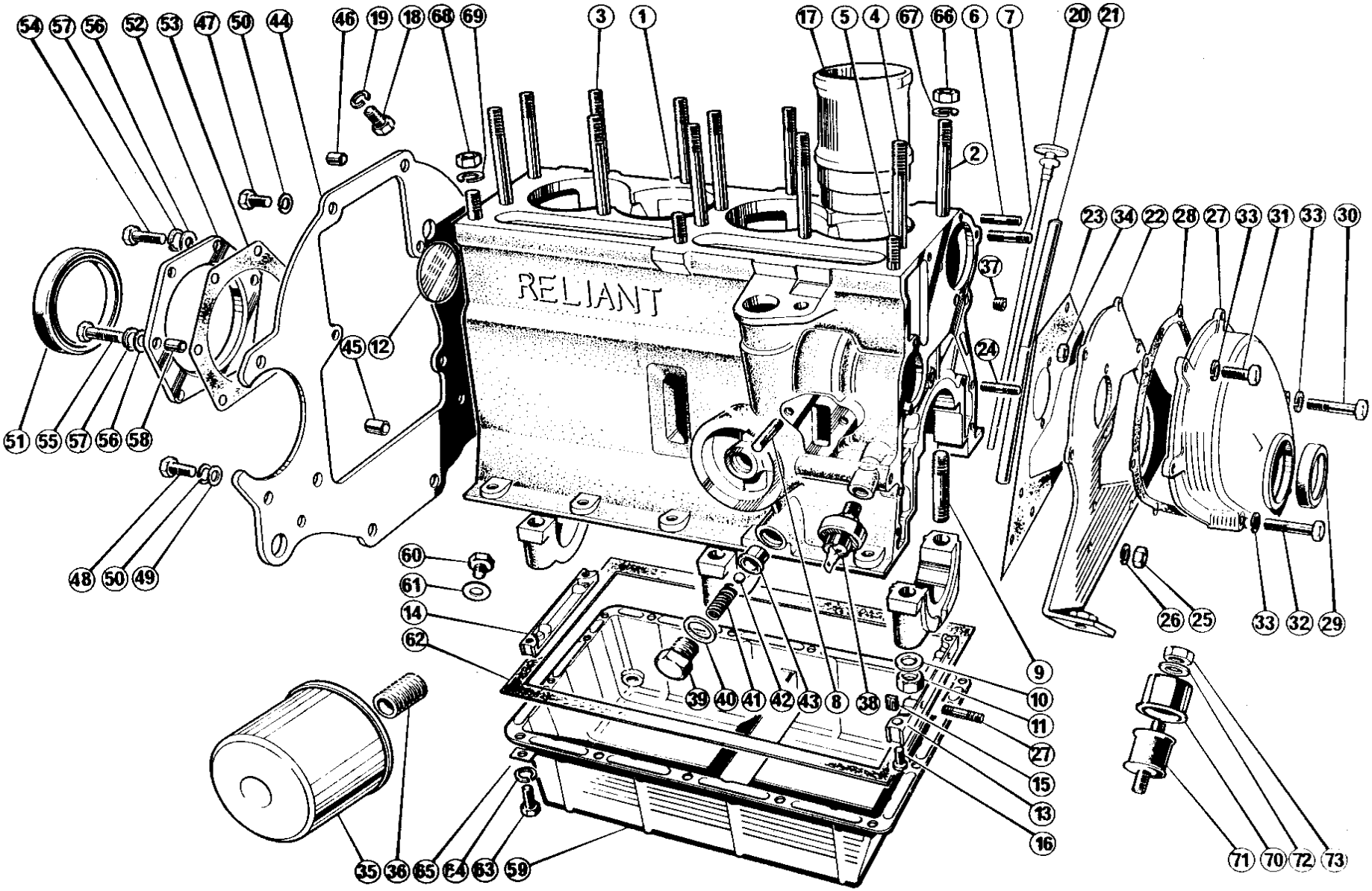


Figure 4 Engine, cylinder block - exploded

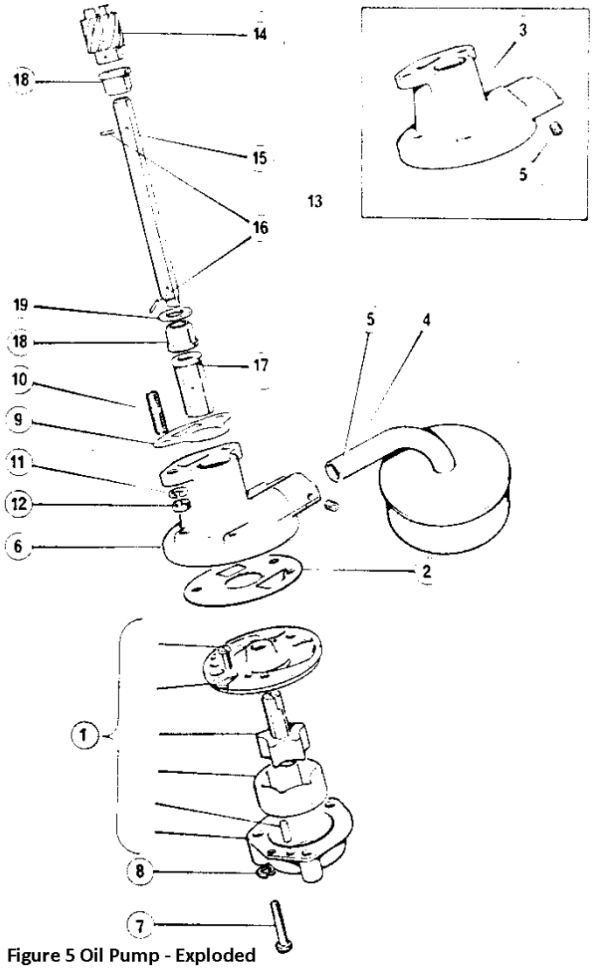


Figure 5 Oil Pump - Exploded

1 Oil pump
2 Gasket
3 Filter
4 Extension
5 Set screw
6 Bolt
7 Lock washer
8 Gasket
9 Stud
10 Lock washer
11 Nut
12 Oil pump drive shaft
13 Gear
14 Shaft
`5 Pin thrust muff and gear
16 Thrust muff
17 Bush
18 Shim

Operation 4 Oil pump removal and replacement (with sump removed)

1. Rotate engine to TDC **(Section T)**

2. Disconnect spark plug leads from terminals.

3. Disconnect the low tension lead from the coil.

4. Unscrew the single retaining bolt at the securing the distributor clamp to the cylinder block, complete with washer and lock washer, and remove the distributor. Do not disturb the actual clamp nut and bolt unless the ignition timing is to be reset.

5. Unscrew two nuts complete with lock washers and remove the oil pump assembly, including strainer, from the cylinder block (**Figure 5**).

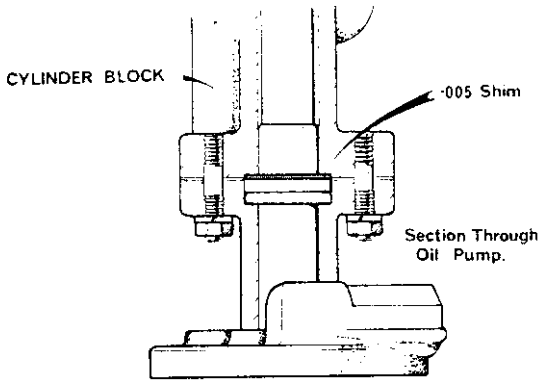


Figure 6 Oil pump drive shaft shims

6. Drift out the pin securing the thrust muff to the distributor/oil pump driveshaft which can then be withdrawn upwards through the distributor housing.

7. Inspect the oil pump and drive shaft assemblies for wear or damage and renew if required. Note: In production, it has sometimes been necessary to fit one or two 0.127 mm (0.005 in) shims between the oil pump driveshaft bush and the cylinder block **(Figure 6)**. It is not necessary when dismantling the pump to remove the drive bush or shim, if fitted. However, if the bush and shim are removed, it is essential that they are both replaced when re-assembling. failure to do this will allow excessive end float of the distributor driveshaft resulting in poor meshing of the oil pump drive gear with resultant engine noise.

The backlash between camshaft gear and driveshaft gear should not exceed 0.0762 mm (0.003 in).

Re-assemble in reverse order. Refit the pump to the block, ensuring that the engine is set to TDC.

When replacing the oil pump driveshaft ensure that the large "D" of the driving gear offset dog is facing towards the cylinder block with the slot aligned in a "5 minutes past 7 o'clock" position.

Operation 5 Crankshaft rear cover and oil seal replacement (with flywheel removed)

1. Unscrew the six set screws and remove the oil seal cover complete with gasket and oil seal, from the cylinder block.

2. Using a suitable tool, press the old seal out of the cover. Note: On no account try to drift or prise the seal out as this will damage/distort the oil seal housing.

3. Carefully press a new seal in to the rear cover. To ensure the seal is seated correctly, use a press tool similar to that shown in (**Figure 7**).

4. Locate the two dowels of the rear cover in the cylinder block and then secure the cover with the six set screws and lock washers. **(Figure 8)**

Operation 6 Timing chain cover, oil seal and gasket replacement (engine still in car)

1. Drain the cooling system.

2. Remove the radiator, complete with hoses from the vehicle.

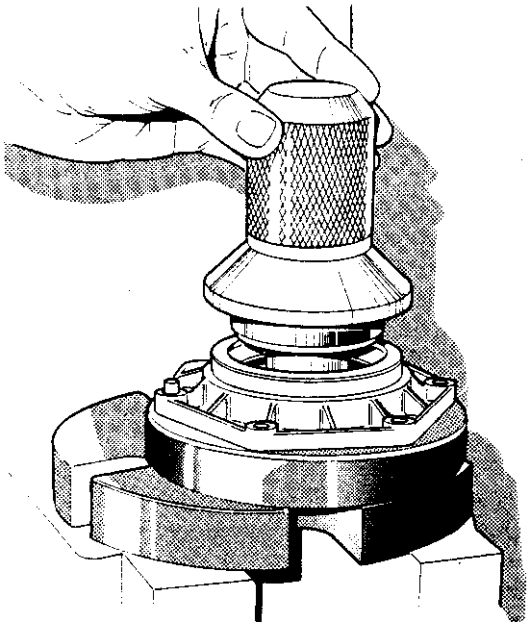


Figure 7 Replacing rear cover oil seal

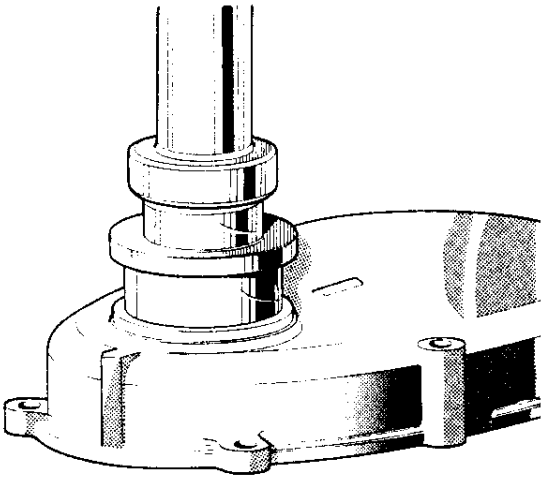


Figure 9 Extracting front cover oil seal

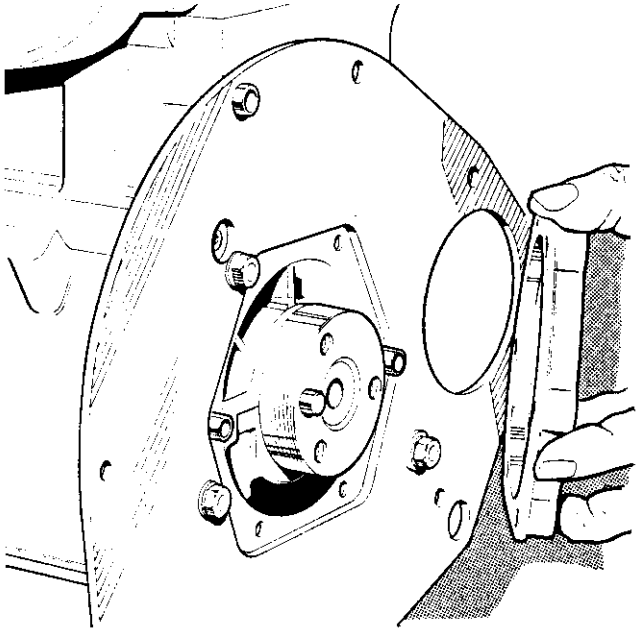


Figure 8 Fitting rear cover

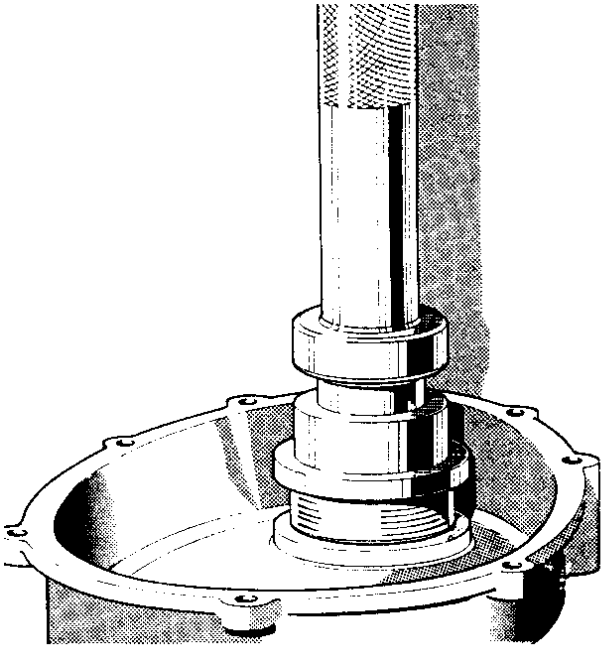


Figure 10 Replacing front cover oil seal

3. Slacken alternator mountings and remove fan belt.

4. Unscrew four nuts and lock washers and remove the water pump from the cylinder block.

5. Unscrew the mounting bolt and pull off the crankshaft pulley.

6. Remove seven bolts, two nuts and lock washers and detach the timing cover from the cylinder block.

7. Extract the oil seal from the cover using special tool no. RT 7480 and drive handle part no. 550 (**Figure 9**).

8. Fit new oil seal using special tool no. RT 7480 and drive handle locating as shown in (**Figure 10**).

9. With the aid of centralising tool no. RT 7481 fit the timing chain cover with a new gasket to the cylinder block, securing with the seven bolts, two nuts and lock washers.

10. Refit crankshaft pulley, water pump and fan belt. Secure and tighten alternator.

11. Refit the radiator, reconnect the hoses and refill the cooling system.

Operation 7 Timing chain replacement (with front cover removed)

1. Release locking plate, unscrew two bolts, remove camshaft sprocket and lift off timing chain.

2. Fit new timing chain to crankshaft and camshaft sprocket which can be secured to the camshaft with the two bolts and the locking plate.

3. Check the valve timing, ensuring that the timing mark on the camshaft sprocket aligns with the woodruff key on the crankshaft (Figure 12).

4. Inspect the cam chain tensioner blade for wear and replace if necessary.

Operation 8 Camshaft sprocket alignment

1. First ensure that the timing mark on the camshaft sprocket aligns exactly with the woodruff key on the crankshaft to align with either no. 1 or no. 4 piston on TDC.

2. Release the locking plate, unscrew two bolts and remove

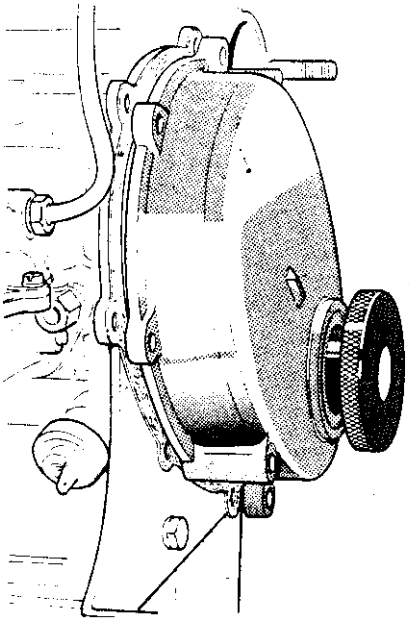


Figure 11 Centralising front cover

the locking plate and screws.

3. Ensure that the timing mark, a notch, on the camshaft end aligns with the woodruff key on the crankshaft.

4. Remove the crankshaft woodruff key.

5. Temporarily refit both sprockets.

6. Check the alignment by placing a straight edge across the teeth of both sprockets.

7. Correct any misalignment by fitting an alternative spacer shim behind the crankshaft sprocket. Alternative spacer shims are available in increments of 0.127 mm (0.005 in).

8. Remove the sprockets.

9. Refit the woodruff key.

10. Fit a new camshaft sprocket locking plate, refit the bolts and bend the tabs to lock them.

Operation 9 Cylinder head removal (with engine in car)

1. Disconnect battery.

2. Remove heater fresh air hose.

3. Drain cooling system.

4. Release the two retaining clips and remove air cleaner body and element.

5. Remove air cleaner base plate from carburettor.

6. Remove the oil filler cap and disconnect the breather hose from the carburettor.

7. Disconnect the heater and inlet manifold heat exchanger hoses from the water pump.

8. Remove the radiator top hose.

9. Remove the distributor cap and leads.

10. To allow easier access, remove the distributor via the single fixing bolt holding the clamp to the cylinder block.

11. Remove the rocker cover nuts and rocker cover, complete with heater hose and fuel pipe clips.

12. Remove the petrol supply pipe from the carburettor plug to avoid dirt ingress. Remove the pipe from the clip on the side of cylinder head and tie back clear of the engine to improve access.

13. Disconnect the lead from the temperature gauge sender on the thermostat housing.

14. Disconnect the accelerator cable from the bracket on the carburettor and pull clear.

15. Disconnect the choke cable from the carburettor.

16. Disconnect the heat exchanger hoses from the exchanger.

17. Disconnect the advance/retard pipe and flame trap (if fitted) from the carburettor.

18. Disconnect the accelerator return spring from the carburettor.

19. Remove the nut securing the carburettor abutment bracket to the carburettor.

20. Remove the remaining nut securing the carburettor to the manifold. remove the carburettor with gasket.

21. Remove the nuts and washers and detach the heat exchanger adapter from the inlet manifold.

22. Remove the drip tray complete with gasket.

23. Remove the four nuts securing the rocker shaft assembly and detach the rocker shaft.

24. Remove the eight push rods keeping them in the correct order.

25. Remove the two brass nuts and disconnect the exhaust downpipe from the exhaust manifold.

26. Remove the three small cylinder head nuts with washers on the spark plug side of the head.

27. Remove the three bolts and washers holding the thermostat cover on to the head.

28. Remove the dipstick support bar and earth cable from the long cylinder head stud.

29. Remove the 12 nuts and washers securing the cylinder head to the cylinder block.

30. Carefully lift the cylinder head complete with inlet and exhaust manifolds from the cylinder block.

Replace in reverse order, after scrupulously cleaning the mating faces and fitting a new gasket. To ensure a good seal when replacing the cylinder head, smear grease around the metal rings of the gasket bore eyelets.

Tighten the cylinder head nuts progressively up to a torque of 3.46 kg/m (25 lb/ft) in the sequence shown in Figure 14. The three smaller nuts along the spark plug side of the head should be tightened to a torque of 2.07 kg/m (15 lb/ft).

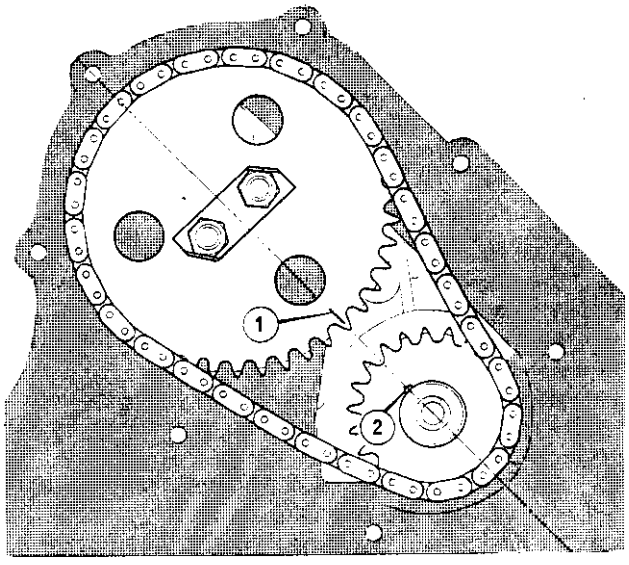


Figure 12 Alignment of camshaft sprocket and woodruff key

1. Timing mark

2. Woodruff key

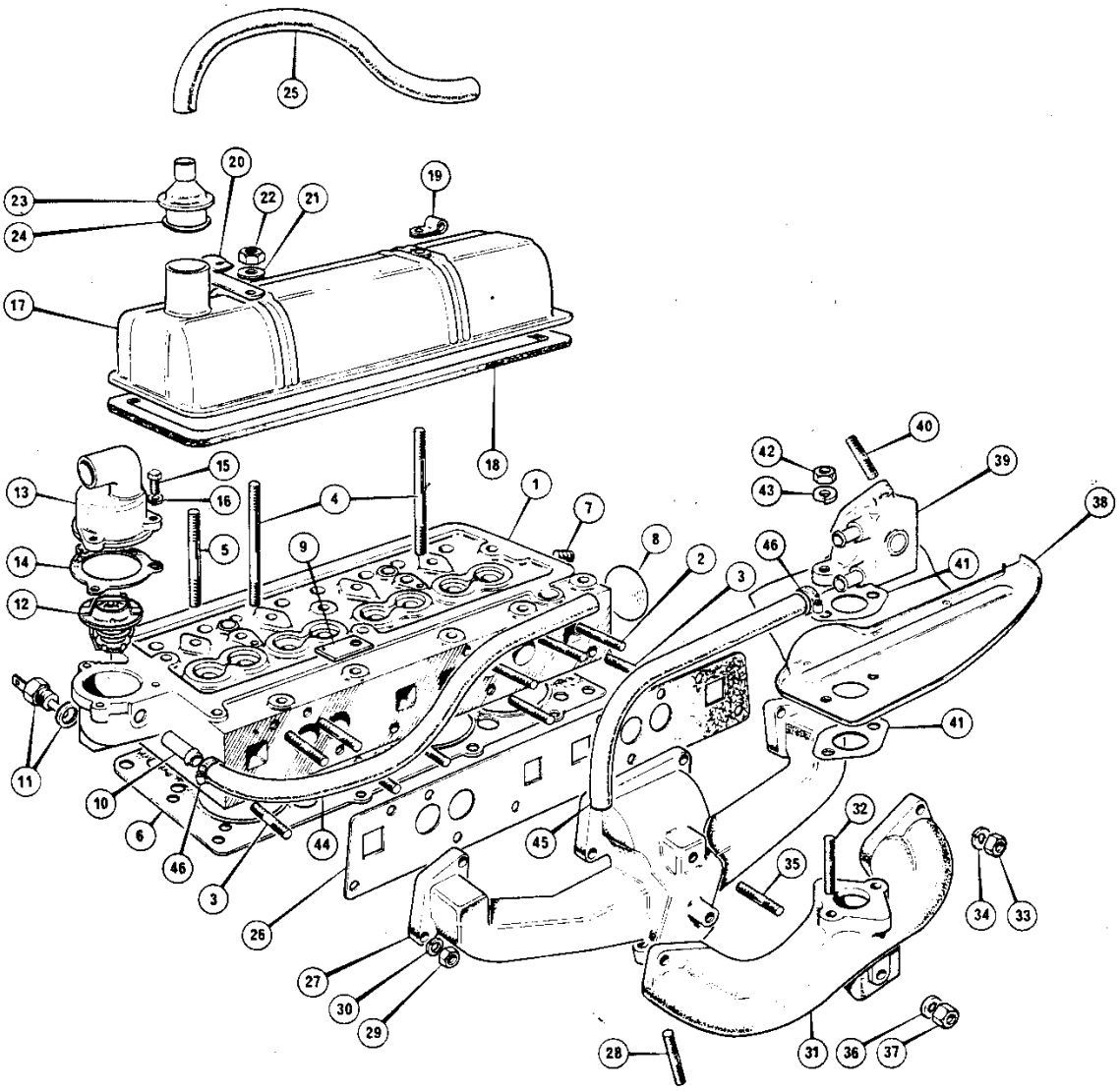


Figure 13 Cylinder head and manifolds - exploded view

1.	*Cylinder head*	*17.*	*Rocker cover*	*33.*	*Manifold nut*
2.	*Stud*	*18.*	*Rocker cover gasket*	*34.*	*Lock washer*
3.	*Stud*	*19.*	*"P" clip*	*35.*	*Stud*
4.	*Stud*	*20.*	*Support bracket*	*36.*	*Washer*
5.	*Stud*	*21.*	*Washer*	*37.*	*Nut*
6.	*Gasket*	*22.*	*Nut*	*38.*	*Drip tray*
7.	*Oil way plug*	*23.*	*Oil filler cap*	*39.*	*Heat exchanger*
8.	*Core plug*	*24.*	*"O" ring*	*40.*	*Stud*
9.	*Return spring plate*	*25.*	*Breather pipe*	*41.*	*Gasket*
10.	*Hose connection*	*26.*	*Exhaust manifold gasket*	*42.*	*Nut*
11.	*Temperature sender*	*27.*	*Exhaust manifold*	*43.*	*Lock washer*
12.	*Thermostat*	*28.*	*Downpipe stud*	*44.*	*Hose*
13.	*Water outlet branch*	*29.*	*Manifold nut*	*45.*	*Hose*
14.	*Gasket*	*30.*	*Washer*	*46.*	*Clip*
15.	*Set screw*	*31.*	*Inlet manifold*		
16.	*Washer*	*32.*	*Manifold stud*		

Operation 10 Cylinder head decarbonise (Head removed)

1. Remove the spark plugs.

2. Remove the inlet and exhaust manifolds and carefully remove the gasket.

3. Using a suitable valve spring compressor, remove the valves, keeping them in the correct order. Retain the valve caps, springs and collets for inspection.

4. Check the valve guides for wear and renew if necessary.

5. If valve guides are worn then remove them using special tool RT 7478 (**Figure 18**).

6. Examine the valve seats for pitting and wear. Re-face if necessary, removing the bare minimum of material.

7. Examine the valves for pitting or wear and re-face if necessary. Renew any valves having bent or worn stems.

8. Test the valve springs for length to the dimensions given in the data at the end of this section.

9. Remove carbon deposits from the combustion chambers and ports using a hardwood scraper. Polish with wire wool.

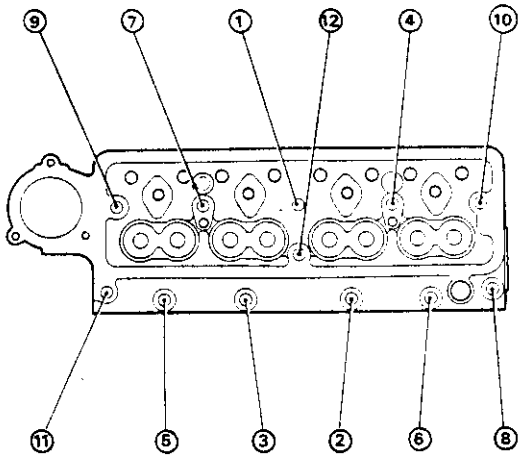


Figure 14 Cylinder head nuts tightening sequence

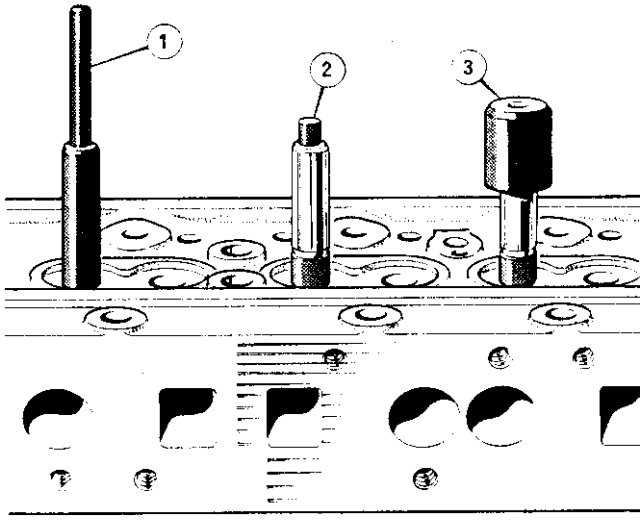


Figure 15 Valve guide removal and replacement

1. Valve guide removal
2. Valve guide replacement
3. Valve guide protection sleeve

10. Clean the face of the cylinder head and remove all trace of carbon and high spots.

11. Clean out the waterways. If deposits exist on the piston crowns proceed as follows:-

(a) Turn the crankshaft until pistons 1 and 4 are at the top.

(b) fill the cylinders of pistons 2 and 3 with clean non fluffy rag to stop carbon falling in to the bores. Cover the cam follower apertures.

(c) carefully, without scoring the crowns, clean the carbon deposits leaving a narrow band approximately 3.1 mm (1/8 in) around the perimeter to maintain the gas seal. Avoid carbon deposits entering the waterways.

(d) Turn the crankshaft until pistons 2 and 3 are uppermost and repeat.

Re-assembly and replacement

1. Clean the cylinder block face removing all traces of carbon and any high spots.

2. Replace the valve guides in the cylinder head using special tool R 7478 (**Figure 15**).

3. Lap in the valves using fine grinding paste until a gas tight seal is attained. Ensure valves are refitted in their original positions and that all trace of grinding paste is removed.

4. Lubricate the valve stems with engine oil and assemble the cylinder head. Ensure that the valve spring collars an collets are correctly seated. renew the valve stem seals.

Refit the cylinder head using a new gasket.

Operation 11 Pistons, connecting rods and bearing replacement (head and sump removed)

To remove

1. Remove oil pump assembly (**Operation 4**).

2. Turn the crankshaft to bring numbers 1 and 4 connecting rod bolts to an accessible position.

3. Check the identifying marks on the bearing caps and connecting rods. Mark if necessary.

4. Release the tab washers, unscrew the bolts and remove the big end bearing caps complete with shells

5. Push the piston/con rod assemblies out through the top and carefully withdraw, keeping the end caps with their respective con rods.

Overhaul

1. Immerse the pistons and con rod assemblies in hot water for a few minutes. remove the circlips retaining the gudgeon pins.

2. Using a suitable drift, remove the gudgeon pins and disconnect the con rods from the pistons.

3. Check the small end bushes for wear and, if necessary, remove the old bushes using a hand press and fit new ones. Ensure that the oil hole in the new bush is correctly aligned with the oil hole in the con rod.

4. Having fitted the new bushes, check that the gudgeon pins will fit. It might be necessary to ream out the bushes (using an expanding reamer) to achieve a tight sliding fit.

Note: It is vital during this operation that the bush is reamed squarely to the con rod to ensure correct alignment.

5. Remove the piston rings and clean.

6. Clean the pistons, removing all carbon deposits, particularly from the ring grooves.

7. Assemble the pistons to the connecting rods using new circlips. It might be necessary to heat the pistons in hot water to enable the gudgeon pins to be pushed through.

Note: Engines up to number 5K/85/100226 have angle con rods which must be assembled with the cutaway to the camshaft side.

8. Before fitting the piston rings to the pistons, place each ring in its appropriate liner to measure the ring gap. This should be between 0.17 to 0.30 mm (0.007 to 0.012 in).

9. Fit the piston rings to the pistons, starting with the oil scraper ring, followed by the taper compression ring, then the compression ring.

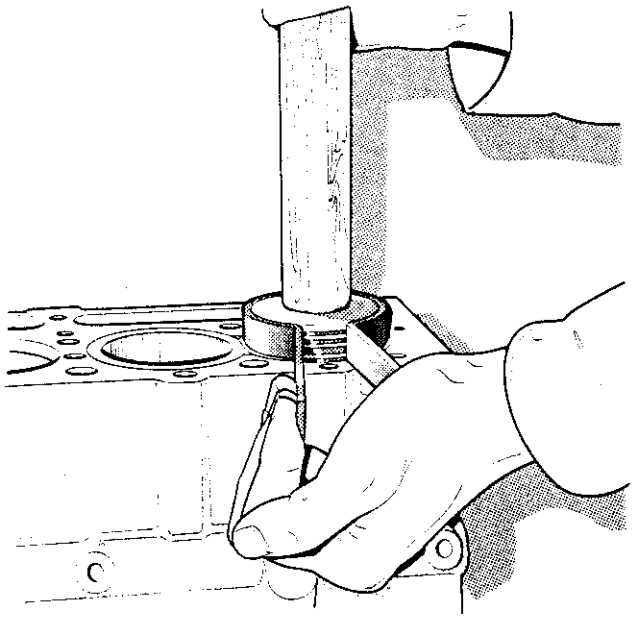


Figure 16 Compressing rings for refitting pistons

Note: The "top" mark on the taper compression ring must face uppermost. The upper groove in the piston accommodates the plain compression ring.

10. Insert the piston and connecting rod assemblies into the appropriate bores, ensuring that the piston crown arrow or front marking is facing the front of the cylinder block. The piston rings should be rotated so the gaps are equally spaced around the circumference of the pistons. Compress the rings using a piston ring compressor **(Figure 16**) and gently tap the assemblies into place.

11. Fit new big end bearing shells to the rods and caps .

12. Locate the rods on to the crankshaft, position the end caps and secure in position with the bolts and new tab washers. Tighten to a torque of 2.9 kg/m (21 lb/ft). Ensure that the correct caps are fitted to the corresponding rods.

13. Replace the oil pump assembly, sump and cylinder head.

Operation 12 Crankshaft removal and installation (sump, front cover, flywheel, rear cover, connecting rods and camshaft sprocket removed

1. Remove two bolts and lock washers and remove camshaft retaining plate.

2. Unscrew two nuts and lock washers and remove front engine plate and gasket from cylinder block.

3. Unscrew four set screws and remove the rear engine plate from the cylinder block.

4. Remove four screws and detach the two bridge pieces from the cylinder block.

5. Remove three main bearing caps each secured by nuts and lock washers.

6. The crankshaft can now be lifted from the cylinder block.

Overhaul

1. Inspect and test crankshaft journals for wear.

2. Fit new main bearing shells to crankcase and main bearing caps. See data for reground journal undersize bearings available.

3. position the crankshaft into the new shells and fit rear and centre main bearing caps.

4. Locate the upper half of the thrust washer in the register on the inside face of the crankshaft main bearing bore in the crankcase.

5. Position the front main bearing cap and locate the lower half of the thrust washer in the register on the cap inside face.

Note: The thrust washer is fitted so that the thrust face, identified by oil grooves, bears against the crankshaft ground face.

6. Fit new bearing cap nuts and lock washers and tighten to a torque of 3.31 kg/m (24 lb/ft).

Check the crankshaft end float as follows:

(a) Assemble the two halves of the outer thrust washer in the register on the outside face of the front bearing cap and block. Ensure that the oil grooves face forwards.

(b) Position the steel countersunk thrust washer against the bi-metal thrust washer halves, with its countersunk aperture facing rearwards.

(c) Refit crankshaft sprocket spacer and sprocket.

(d) Refit crankshaft pulley and secure with bolt, washer and lock washer.

(e) Rotate crankshaft to confirm freedom of movement. Secure a dial gauge to the crank case with the pointer bearing on a machined section of a crankshaft balance weight.

(f) Carefully tap the rear of the crankshaft forwards to force the assembly against the dial gauge plunger. Zero the gauge.

(g) Now tap the front pulley of the crankshaft towards the rear and note the end float on the gauge. This should indicate 0.0764 to 0.279 mm (0.003 to 0.011 in).

(h) If necessary, adjust the end float by replacing the thrust washers with new ones of a different thickness. See data at the end of this section. refit the front cap with the replacement thrust washers and check the end float again.

Note: The end float can also be checked using feeler gauges between the thrust washer and the bearing face of the crankshaft.

To re-assemble

Replace all components in reverse order.

Note: When refitting the crankcase bridge pieces care should be taken to ensure that they are completely flush with the crankcase flange. Also it is essential to fit new cork seas when refitting bridge pieces.

Operation 13 Camshaft removal and installation (timing chain and sprocket removed)

1. Remove engine assembly (see **operation 1**)

2. Remove rocker cover and gasket.

3. Remove rocker shaft.

4. Remove 8 pushrods keeping them in their correct order.

5. remove cylinder head and distributor.

6. remove sump (see **operation 3**)

7. Remove two nuts and lift the oil pump assembly complete with strainer from the cylinder block.

8. Knock out the pin securing the thrust muff to the distributor and oil pump drive shaft and remove the shaft upwards through the distributor aperture.

9. remove the two bolts and lock washers securing the camshaft retaining plate.

10. Undo three nuts and washers and remove the front engine plate from the cylinder block, complete with gasket.

11. Lift the cam followers out through the cylinder block and carefully withdraw the camshaft.

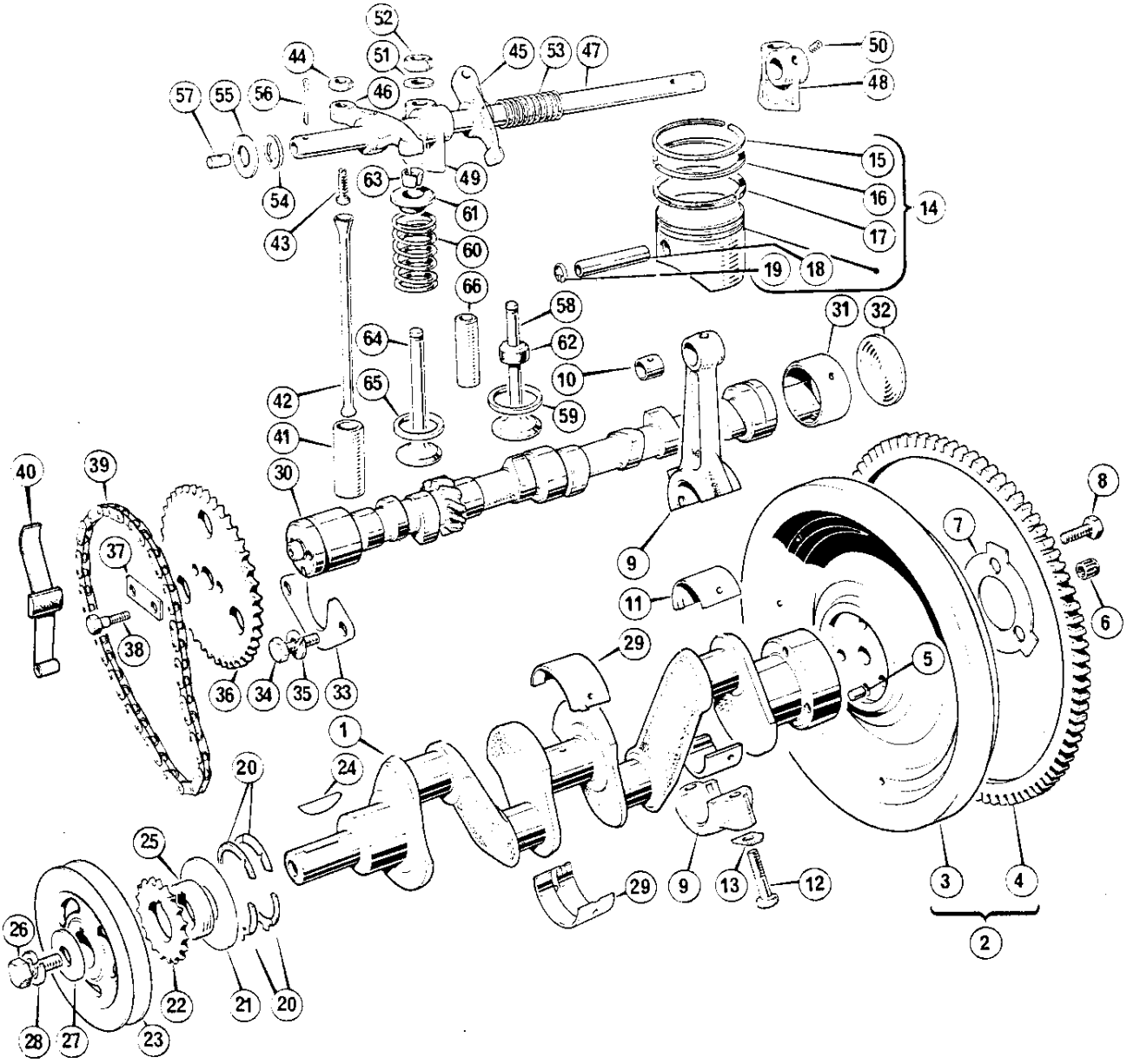


Figure 17 Engine, crankshaft and camshaft - exploded view

1.	*Crankshaft*	*23.*	*Pulley*	*45.*	*Rocker LH*
2.	*Flywheel assembly*	*24.*	*Key*	*46.*	*Rocker RH*
3.	*Flywheel*	*25.*	*Spacer*	*47.*	*Rocker shaft*
4.	*Flywheel ring gear*	*26.*	*Bolt*	*48.*	*Bracket*
5.	*Dowel*	*27.*	*Washer*	*49.*	*Bracket*
6.	*Spigot bearing*	*28.*	*Lock washer*	*50.*	*Screw*
7.	*Flywheel tab washer*	*29.*	*Main bearing shell*	*51.*	*Washer*
8.	*Set screw*	*30.*	*Camshaft*	*52.*	*Nut*
9.	*Connecting rod*	*31.*	*Camshaft bearing*	*53.*	*Rocker shaft spring*
10.	*Small end bearing*	*32.*	*Core plug*	*54.*	*Rocker shaft end spring*
11.	*Big end bearing shell*	*33.*	*Plate*	*55.*	*Washer*
12.	*Bolt*	*34.*	*Bolt*	*56.*	*Split pin*
13.	*Plate*	*35.*	*Lock washer*	*57.*	*Plug*
14.	*Piston assembly*	*36.*	*Sprocket*	*58.*	*Inlet valve*
15.	*Compression ring*	*37.*	*Plate*	*59.*	*Valve seat*
16.	*Taper ring*	*38.*	*Screw*	*60.*	*Valve spring*
17.	*Oil Scraper ring*	*39.*	*Timing chain*	*61.*	*Valve spring cup*
18.	*Gudgeon pin*	*40.*	*Timing chain tensioner*	*62.*	*Valve stem seal*
19.	*Circlip*	*41.*	*Cam follower*	*63.*	*Valve cotter*
20.	*Crankshaft thrust washer*	*42.*	*Push rod*	*64.*	*Exhaust valve*
21.	*Crankshaft thrust washer*	*43.*	*Screw*	*65.*	*Valve seat*
22.	*Sprocket*	*44.*	*Lock nut*	*66.*	*Valve guide*

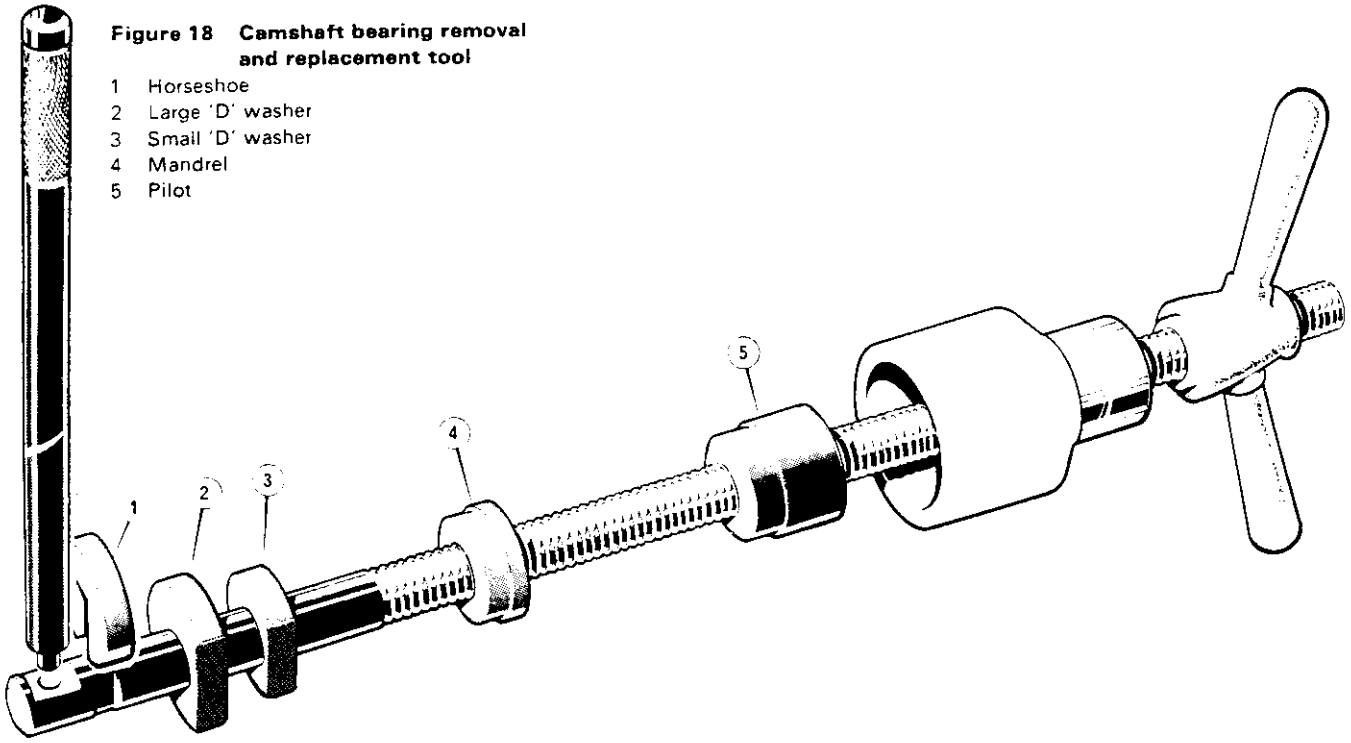


Figure 18 Camshaft bearing removal and replacement tool

1 Horseshoe
2 Large 'D' washer
3 Small 'D' washer
4 Mandrel
5 Pilot

To Replace

Te-assemble in the reverse order, fitting new gaskets where applicable.

Note: When refitting the distributor drive shaft, ensure the large "D" of the driving gear offset dog is facing towards the block at No. 1 piston, i.e. slot in a "5 minutes past 7 o'clock" position. Take the opportunity of checking the camshaft end-float which should be within 0.64 to 0.16 mm (0.0025 to 0.0065 in). Pull the camshaft out against the retaining plate and insert a feeler gauge between the groove and retaining plate. The camshaft retaining plate fitted as original equipment is 4.621 mm (0.182 in) thick. A service plate 5.258 mm (0.207 in) is available to counteract excessive end float but it may, of course, be necessary to reduce the thickness of the service plate to obtain the correct end float, dependent on the amount of wear.

Operation 14 Camshaft bearing removal and replacement (with camshaft removed)

Removal

1. Remove flywheel (see **operation 2**).

2. Unscrew four set screws and remove the rear engine plate from the cylinder block.

3. Drill a hole in the camshaft core plug and prise from the cylinder block.

4. Press out the rear, centre and front camshaft bearings using general tool 18G 124A and tool No. 7482 (**Figure 18**) as follows:

(a) Insert general tool and position pilot, mandrel and horseshoe as shown in **Figure 19**.

(b) Applying firm pressure, rotate the general tool handle until the camshaft bearing is removed completely from its location.

(c) To remove centre and front camshaft bearings position the general tool and components as shown in **Figure 20** and **Figure 21**.

To replace

1. To replace camshaft bearings position the general tool and components as shown in **Figure 22,23,**and **24.**

Note: Ensure that the oil holes in the bearing shells align with those in the block

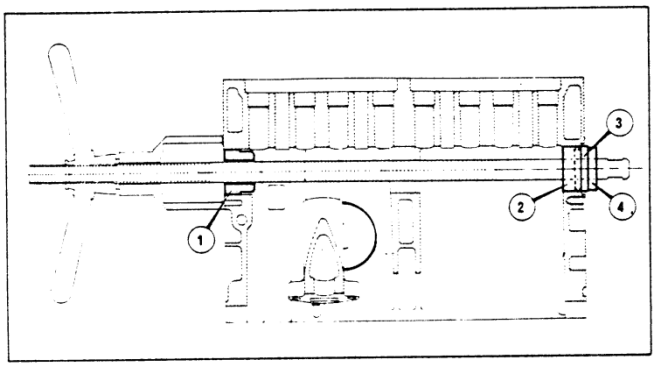


Figure 19 Removing camshaft rear bearing

1. Pilot
2. Bearing
3. Mandrel
4. Horseshoe

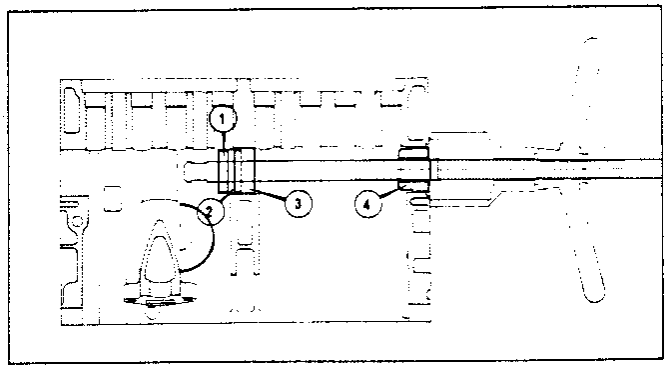


Figure 20 Removing camshaft centre bearing

1. Horseshoe
2. Mandrel
3. Bearing
4. Pilot

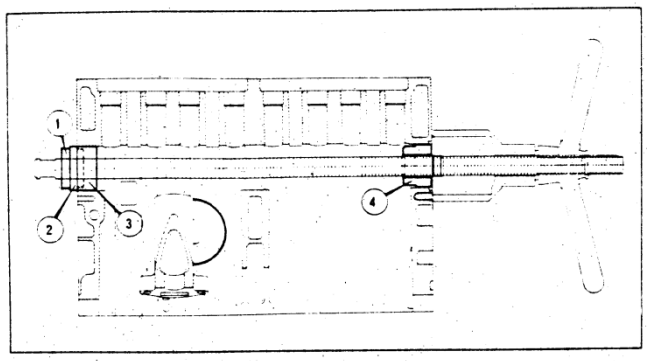


Figure 21 Removing camshaft front bearing

1. Horseshoe
2. Mandrel
3. Bearing
4. Pilot

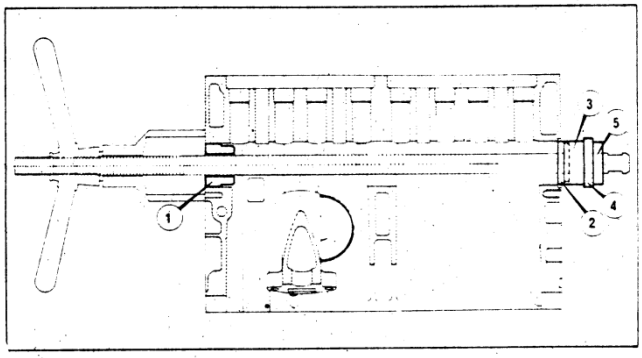


Figure 23 Replacing camshaft rear bearing

1. Pilot
2. Mandrel
3. Bearing
4. Small "D" washer
5. Horseshoe

Operation 15 Cylinder liner replacement

Follow the dismantling procedure outlined in operations 1 to 15 and then continue as follows:-

1. Extract the four liners from the cylinder block using a tool similar to that shown in **Figure 25**.

2. Remove all traces of sealing compound from both the liners and their seats in the cylinder block.

3. Measure the liners for taper, ovality and maximum wear.

Note: Cylinder liners are manufactured in different grade sizes and are graded as high, low or mean. Pistons are similarly graded and it is important that a piston and cylinder liner must be of the same grade. The grade of the piston is stamped on the crown with the appropriate letter, i.e. H=high, M=mean, L=low.

The grade of the cylinder liner is marked on the outside wall with the appropriate letter (**Figure 26**). Pistons and liners are available from the spares department of your dealer in matched pairs.

It should be noted that if pistons or liners are supplied separately, the appropriate grade number must be quoted when ordering.

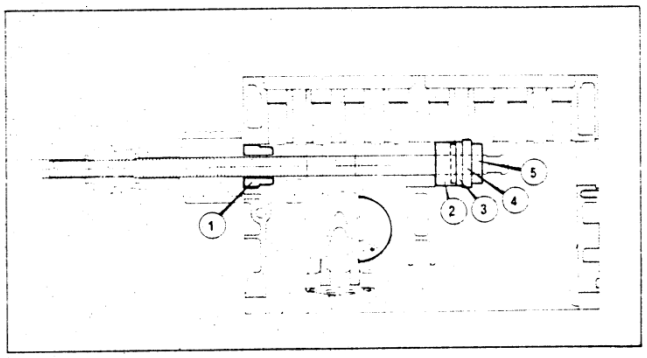


Figure 24 Replacing camshaft centre bearing

1. Pilot
2. Bearing
3. Mandrel
4. Small "D" washer
5. Horseshoe

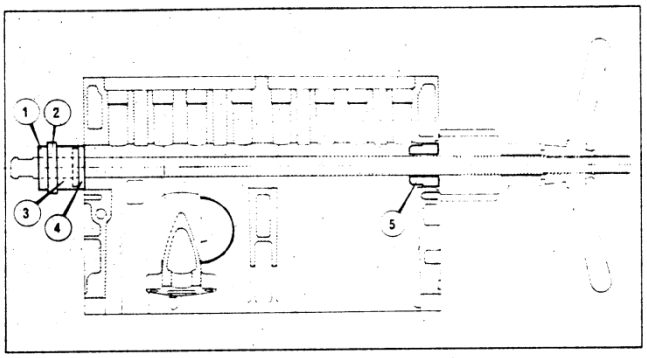


Figure 25 Replacing camshaft front bearing

1. Horseshoe
2. Large "D" washer
3. Bearing
4. Mandrel
5. Pilot

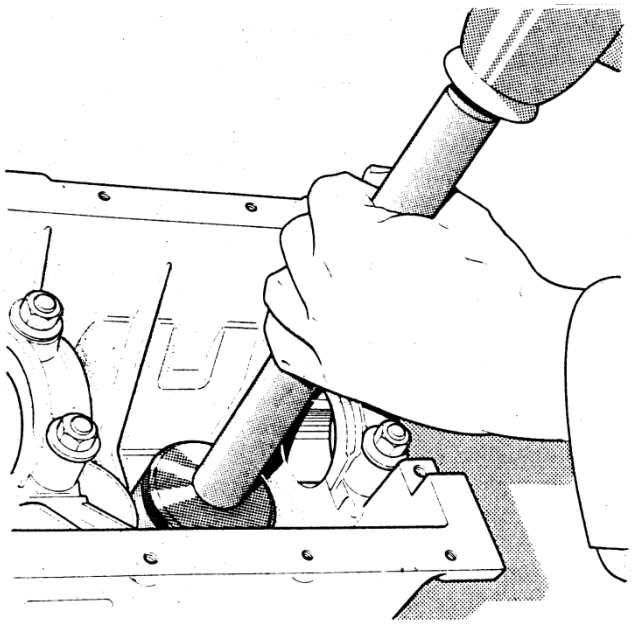


Figure 25 Removing cylinder liners

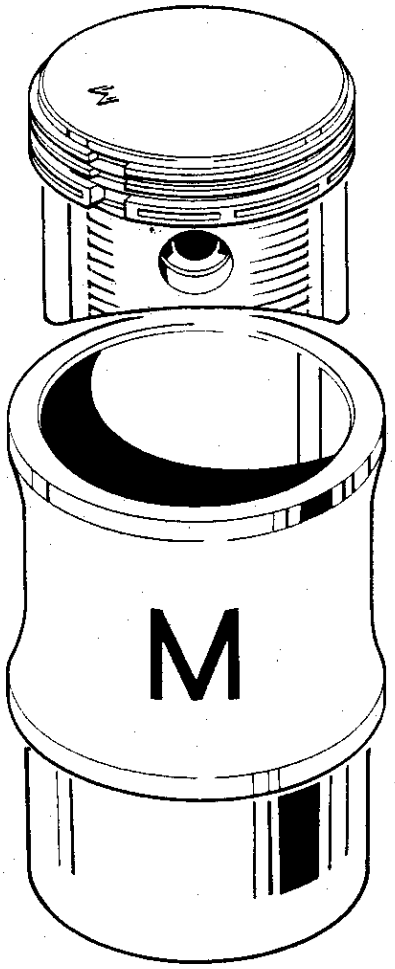


Figure 25 Piston and liner markings

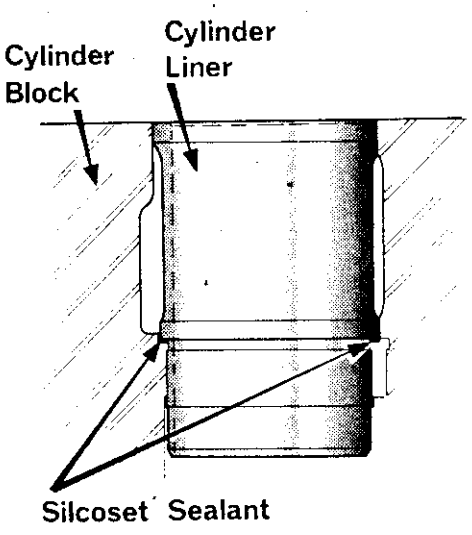


Figure 27 Sealing cylinder liners

Operation 16 Engine rebuild

The following information covers the rebuilding of an engine that has been completely dismantled e.g. to replace liners etc.

1. Smear "Silicoset 152" sealing compound thinly around the seating face of the liner and its location in the cylinder block, making a thin but complete 360° seal. (**Figure 27**)

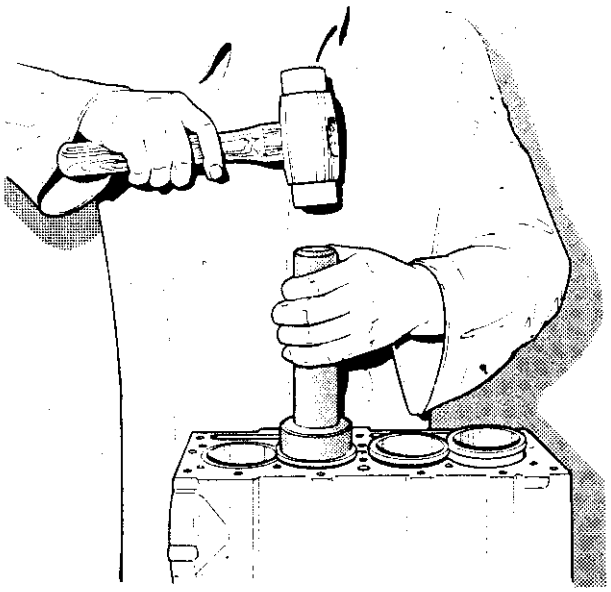


Figure 28 Fitting cylinder liners

2. Using a tool similar to that shown in Figure 28, insert the liners in to the block and ensure that they stand 0.050 to 0.152 mm (0.002 to 0.006 in) proud of the cylinder block face. Check that there is 0.381 mm (0.015 in) clearance between liners.

3. Assemble new pistons to the connecting rods securing in position with the gudgeon pins and circlips. To facilitate this it may be necessary to warm the pistons in hot water. Ensure that the "Front" mark or arrow on the piston is facing forwards.

4. Before fitting the rings to the pistons check the gap in the bore which should be 0.17 to 0.30 mm (0.007 to 0.012 in).

5. Insert the pistons in the bores with the rings in their correct grooves and the ring gapes spaced correctly as described in operation 11. Compress the rings for installation using a compression tool similar to that shown in **Figure 16.**

6. Fit new big end bearings in the connecting rods and caps. Ensure that the correct sizes of bearing are used. *see engine data*.

7. Check crankshaft main bearing journals. *see engine data*.

8. Fit new main bearings to crankcase and main bearing caps.

9. Fit new thrust washers to the crankshaft ensuring the thrust face of the washers makes good contact to the ground face of the crankshaft.

10. Refit the crankshaft to the engine block. Fit main bearing caps in the correct order, rear centre and front. Secure with six nuts and washers. Always use new nuts and washers and tighten to a torque of 3.316 kg/m (24 lb/ft).

11. Fit new oil seal into the rear cover, position a new gasket and secure the cover to the cylinder block. Ensure that the dowels are firmly seated in their locations.

12. Fit the front and rear bridge pieces with new cork seals ensuring that the faces are flush with the cylinder block and secure with four screws.

13. Replace the rear engine plate, fixing it in to position with four set screws and lock washers.

14. Fit the flywheel assembly to the crankshaft and secure with three bolts and a new tab washer. Tighten to a torque of 3.87 to 4.14 kg/m (28 to 30 lb/ft). Check flywheel run-out (see **operation 2**)

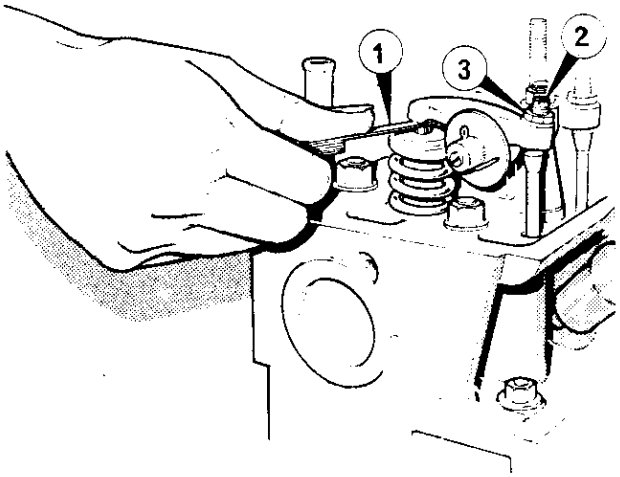


Figure 29 Valve clearance - tappet adjustment

1. Feeler gauge
2. Adjusting screw
3. Lock nut

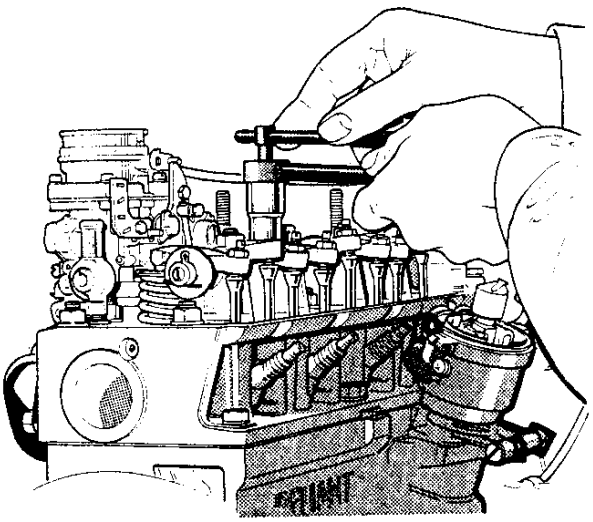


Figure 30 Tappet adjustment tool

15. Refit front engine plate with a new gasket, to the engine block and secure with three nuts and washers.

16. Fit the crankshaft outer thrust washers with the oil slots facing forward, followed by the steel thrust washer with its countersunk aperture facing rearwards.

17. Fit the woodruff key, spacer and crankshaft sprocket.

18. Using the flywheel, turn the crankshaft until the woodruff key is pointing to 11 o'clock.

19. Turn the camshaft until the groove in the end of the camshaft is in alignment with the woodruff key on the crankshaft.

20. Replace the camshaft sprocket along with the timing chain and secure with two bolts and new locking plate.

21. Using a straight edge, check the camshaft sprocket is in alignment with the camshaft sprocket. The valve timing mark on the camshaft sprocket should now be pointing to the woodruff key on the crankshaft.

22. Check timing chain tensioner for wear, renew if worn, and position on the post in the timing cover.

23. Fit the timing chain with a new gasket, using centralising tool No. RT 7481, and secure with seven bolts, two nuts and lock washers (**Figure 11**).

24. replace crankshaft pulley and secure with bolt, plain washer and lock washer.

25. Locate a new gasket and fit the oil pump assembly, complete with strainer, securing to the cylinder block with two nuts and lock washers. Refit oil pump and distributor drive shaft.

26. Fit a new gasket and then fit the sump pan, tightening the fifteen set screws and spacers evenly.

27. Clean the cylinder head and cylinder block faces and fit a new gasket. Smear grease around the metal edges of the gasket bore eyelets.

28. Carefully position the cylinder head squarely on the cylinder block and secure with twelve nuts, plain washers and lock washers. Replace the three bolts on the sparking plug side of the cylinder head.

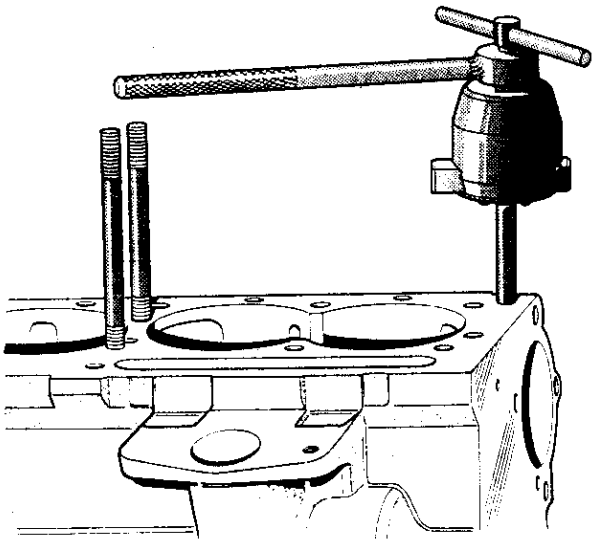


Figure 31 Stud removal tool

Check that the cylinder head nuts indicated in Figure 14 are tightened progressively to a torque of 3.46 kg/m (25 lb/ft). The three smaller nuts should be tightened to 2.07 kg/m (15 lb/ft).

29. Replace the push rods ensuring they are positioned in the correct order.

30. Install the rocker shaft on the four studs and secure firmly with four nuts and washers to a torque of 2.35 to 3.04 kg/m (17 to 22 lb/ft) Check tappet clearance (see Operation 17).

31. Fit a new gasket and refit the rocker cover.

32. Refit all ancillaries.

33. Install the engine and gearbox assembly (see **Operation 1**).

Operation 17 Valve clearance - tappet adjustment

Tappet clearances are:- 0.152mm (0.006 in) cold,
0.254 mm (0.010 in) hot

To adjust

1. Remove rocker cover.

2. Remove spark plugs.

3. Turn engine in normal running direction in order to open and close the valves and check in the following order:

No. 1 valve with No. 8 valve fully open.
No. 2 valve with No. 7 valve fully open.
No. 3 valve with No. 6 valve fully open.
No. 4 valve with No. 5 valve fully open.
No. 5 valve with No. 4 valve fully open.
No. 6 valve with No. 3 valve fully open.
No. 7 valve with No. 2 valve fully open.
No. 8 valve with No. 1 valve fully open.

When adjustment is made the valve must be in the fully closed position (**figure 29**).

4. Refit spark plugs and reconnect HT leads in the correct order.

5. Refit rocker cover, renewing gasket if necessary.

Alternatively the tappets can be adjusted using a proprietary tool similar to No. 6500A (see **figure 30**).

Stud removal

Damaged studs can be removed using extractor tool part No. 450A, in conjunction with the tappet adjuster wrench No. 6500A as shown in **Figure 31**

Engine specification

Cylinder head	
Material	Aluminium alloy
Joint gasket thickness	1.02 mm (0.040 in)
Cylinder Block	
Material	Forged aluminium alloy
Crankshaft	
Material	Forged high tensile steel
Main bearing journals	50.787 to 50.8 mm (1.995 to 2.0 inches)
Crankpin journals	33.07 to 33.08 mm (1.312 to 1.3025 inches)
End float	0.0764 mm (0.003 in) minimum
	0.279 mm (0.011 in) maximum
Crankshaft regrinding size	
1st undersize	0.254 mm (0.010 in)
Main bearing journals	50.533-50.546 mm (1.988-1.989 in)
Crankpin journals	33.07-33.08 mm (1.302-1.3025 in)
2nd undersize	0.508 mm (0.020 in)
Main bearing journals	50.279-50.292 mm (1.978-1.979 in)
Crankpin journals	32.81-32.82 mm (1.292-1.2925 in)
3rd undersize	1.016 mm (0.040 in)
Main bearing journals	49.771-49.784 mm (1.959-1.960 in)
Crankpin journals	32.31-32.32 mm (1.272-1.2725 in)
Crankshaft thrust washer sets	
Oversize sets available	0.0635 mm (0.0025 in)
	0.1270 mm (0.0050 in)
	0.1905 mm (0.0075 in)
	0.254 mm (0.010 in)
Pistons	
Material	Low expansion aluminium alloy
Size	62.53 mm (2.462 in)
All lands	62.17-62.26 mm (2.448-2.451 in)
At skirt	62.47-62.5 mm (2.459-2.638 in)
Piston rings	
Gap	0.17-0.30 mm (0.007-0.012 in)
Width (compression rings)	1.245-1.250 mm (0.49-0.50 in)
Groove clearance	0.038-0.089 mm (0.0015-0.0035 in)
Width (oil scraper ring)	3.150-3.175 mm (0.124-0.125 in)
Groove clearance	0.038-0.089 mm (0.0015-0.0035 in)

Oversize rings available	
Compression ring top	0.254 mm (0.010 in)
Compression ring bottom	0.254 mm (0.010 in)
Oil scraper ring	0.254 mm (0.010 in)
Gudgeon pin	
Diameter	14.283-14.288 mm (0.5623-0.5625 in)
Small end bush	
Bore	14.292-14.298 mm (0.562-0.563 in)
Camshaft	
Bearing diameter	38.66-38.67 mm (1.521-1.522 in)
Bearing clearances	0.0254-0.0889 mm (0.0010-0.0035 in)
End float	0.064-0.16 mm (0.0025-0.0065 in)
Chain pitch	9.525 mm (0.375 in)
Number of pitches	50
Valves	
Seat angle	45°-45°30'
Seat width	
Inlet	1.397-1.524 mm (0.055-0.060 in)
Exhaust	1.397-1.524 mm (0.055-0.060 in)
Valve lift	25.42 mm (1.00 in)
Valve guide lengths (inlet and exhaust)	41.4-41.66 mm (1.63-1.64 in)
Valve guide clearance	0.0381-0.0889 mm (0.0015-0.0035 in)
Valve springs	
Free length	39.62mm (1.56 in)
Fitted length and load	34.11 mm (1.343 in) at 17.01 kg (37.5 lbs)
Length and load valve open	28.6mm (1.125 in) at 39.6 kg (87.3 lbs)
Flywheel	
Material	Chromium cast iron
Diameter	246.126 mm (9.69 in)
Starter ring	
Number of teeth	100
Diameter over teeth	257.81 mm (10.15 in)
Crankshaft identification	
Colour code	-0.254mm (-0.010 in) - red -0.508 mm (-0.020 in) - blue -1.016 mm (-0.040 in) - green

Section G Gearbox

Contents

Description

The gearbox has four forward gears and reverse with synchromesh on all forward gears. The gear lever is directly located in the selector levers through the gearbox top cover.

Routine maintenance

The gearbox oil level should be checked every 6,000 miles (10,000 km) and topped up if necessary, to keep the oil capacity at a constant 0.64 litres (1.125 pints). It is important that the level be kept correct as any drop in the level will lead to poor lubrication with possible transmission damage. To ensure that the internal components are kept clean, the oil should be changed at 12,000 mile (20,000 km) intervals.

Operation 1 **Gearbox removal and installation**

To remove

1. Disconnect the battery.

2. Drain the radiator and disconnect the top hose.

3. Disconnect the distributor HT and LT leads.

4. Remove the fresh air hose.

5. Disconnect the exhaust downpipe at the manifold.

6. From inside the vehicle, prise out the gear lever gaiter and remove the gear lever knob. Remove the gaiter from the lever. remove the centre console. Prise out the retaining "C" clip from the gear lever top ball joint in the gearbox top cover, accessible through the gaiter aperture. Lift out the gear lever and plug the hole with a clean non-fluffy rag to avoid ingress of dirt.

7. Place the vehicle on a ramp or stands. remove the anti-roll bar clamping rubber from the left hand chassis rail.

8. Repeat for the right-hand clamp and lower the anti-roll bar down, away from the chassis.

9. Disconnect the speedometer cable.

10. Disconnect the clutch cable from the trunnion, remove the lock nut and withdraw the cable from the trunnion. Pull the cable outer sleeve from the retaining hole in the engine back plate.

11. Remove the four nuts, lock washers and bolts securing the drive shaft to the rear axle flange, lower the drive shaft to facilitate access to the gearbox flange and remove the front nuts, lock washers and bolts followed by the drive shaft.

12. Support the engine and gearbox assembly from under the sump.

13. Remove the four bolts securing the gearbox rear mount to the chassis cross member.

14. By means of a jack, carefully lower the engine and gearbox assembly, which will tilt on the front engine mountings, until the gearbox rear support is clear of the chassis cross member.

15. Remove the bell housing nuts, lock washers and bolts and withdraw the gearbox assembly from the engine.

To install

1. Raise the gearbox carefully and align the spigot on the primary shaft with the spigot bearing in the flywheel and slide the gearbox forward engaging the splines on the primary shaft with the clutch plate. Locate the fixing studs into the rear engine plate and secure the engine and gearbox together with six nuts, two bolts and lock washers tightening to a torque of 1.66 to 2.07 kg/m (12 to 15 lb/ft).

2. Using a jack under the sump, raise the engine and gearbox assembly, line up the gearbox support with the chassis mounting and secure with the four nuts, bolts and lock washers. **DO NOT** forget to attach the chassis earth braid. Tighten to a torque of 2.07 to 2.49 kg/m (15 to 18 lb/ft).

3. Reconnect the drive shaft to the gearbox using four bolts, nuts and lock washers and tighten to a torque of 3.46 to 4.15 kg/m (25 to 30 lb/ft). Raise the rear end of the drive shaft and reconnect to the axle flange. Tighten as for front fixings.

4. Reconnect the speedometer cable to the gearbox.

5. Refit the clutch cable into the retaining hole and reconnect to the trunnion and adjust.

6. Secure the exhaust downpipe to the manifold with a new gasket and two brass nuts.

7. Refit the exhaust support bracket to the bell housing stud and secure with a nut and lock washer.

8. Refit the anti-roll bar to the chassis securing with two bolts and washers on each side member.

9. Inside the vehicle, re-insert the gear lever into the ball mount and secure with the "C" clip. Refit the centre console.

10. Push the gear lever gaiter over the gear lever and locate in the centre console aperture.

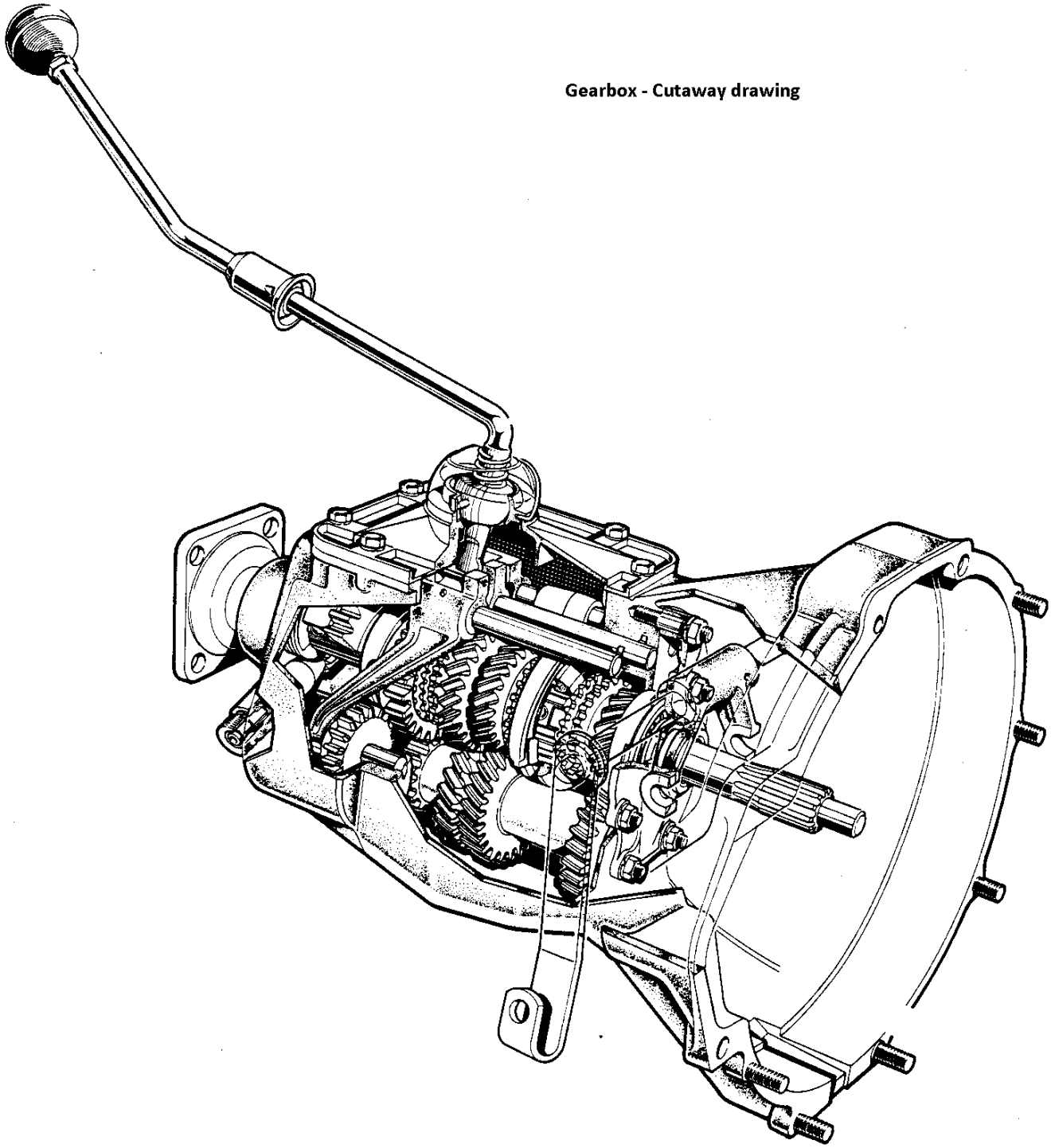
11. Refit the gear knob.

12. reconnect the HT and LT cables.

13. Reconnect the fresh air hose.

14. replace the radiator top hose and refill the cooling system.

15. Reconnect the battery.



Gearbox - Cutaway drawing

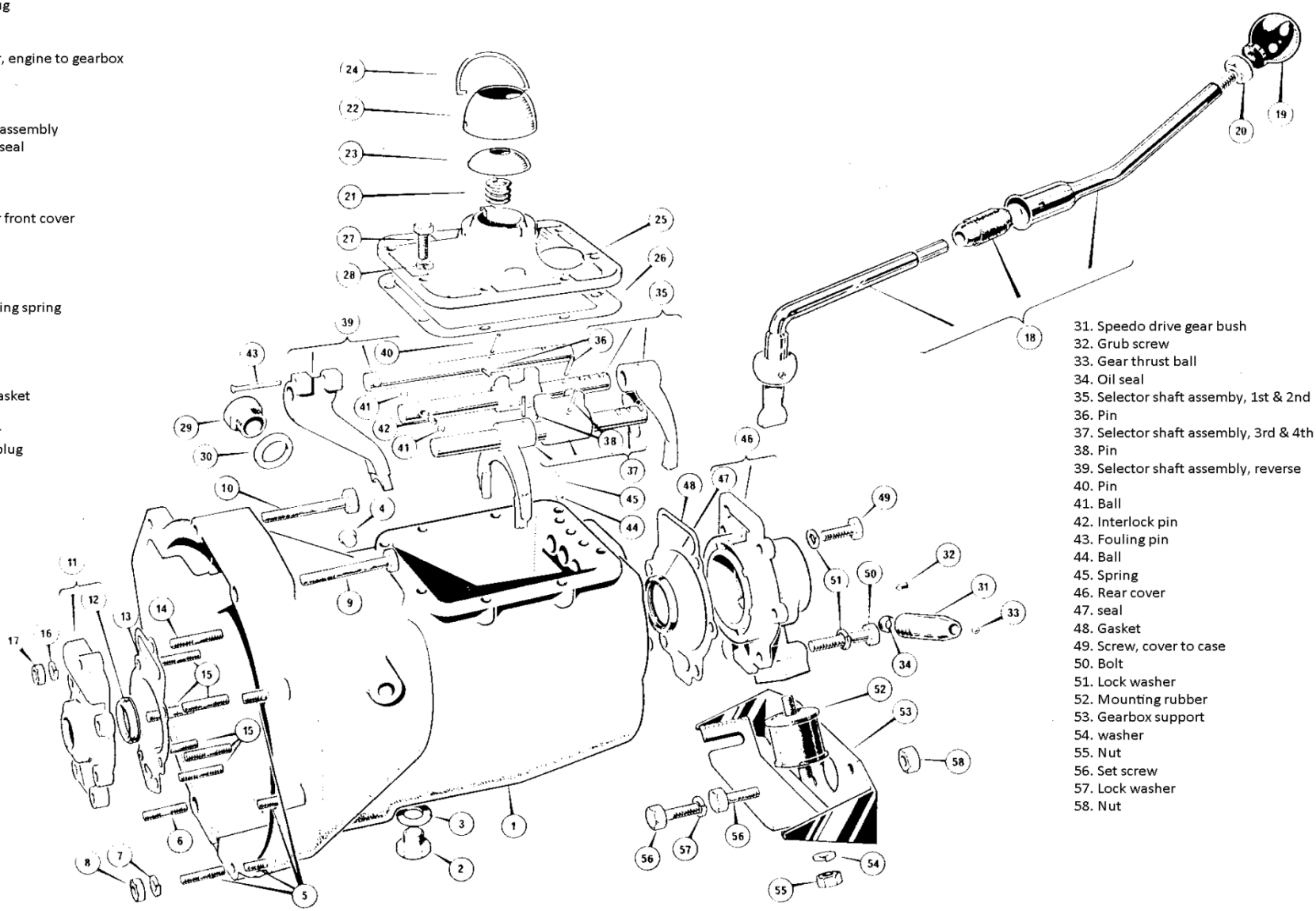
Operation 2 Dismantling the gearbox (Figure 1 & 2)

1. Drain the gearbox oil.
2. Remove the clutch fork and lever assembly (**Section H**)
3. Unscrew eight set screws, with lock washers and remove the top cover, gasket, selector springs and detent balls.
4. Remove seven nuts and lock washers and remove the gearbox front cover.
5. Using a suitable drift, tap out the mills pins from the 3rd/4th selector fork and lever, then withdraw the selector shaft through the bell housing. Remove the selector lever.
6. Repeat the above for the 1st/2nd fork and lever and withdraw the shaft taking note of the interlock pin in the end of the shaft.
7. Tap out the mills pin from the reverse selector lever and withdraw the selector shaft through the bell housing.
8. Lift out the selector forks and tilt the gearbox to remove the two interlock balls from the cross drilling in the bell housing end of the selector shaft bores.
9. Withdraw the lay shaft into the bell housing, allowing the lay gear to drop in to the base of the gearbox.
10. Unscrew six set screws complete with lock washers and withdraw the rear cover and main shaft assembly, taking care not to displace the front or rear synchro sleeves.
11. tap out the primary gear shaft from the bell housing.

Note: When separating the main shaft from the primary gear shaft the needle roller pilot bearing may remain on the mainshaft.

Figure 1 Gearbox and selectors

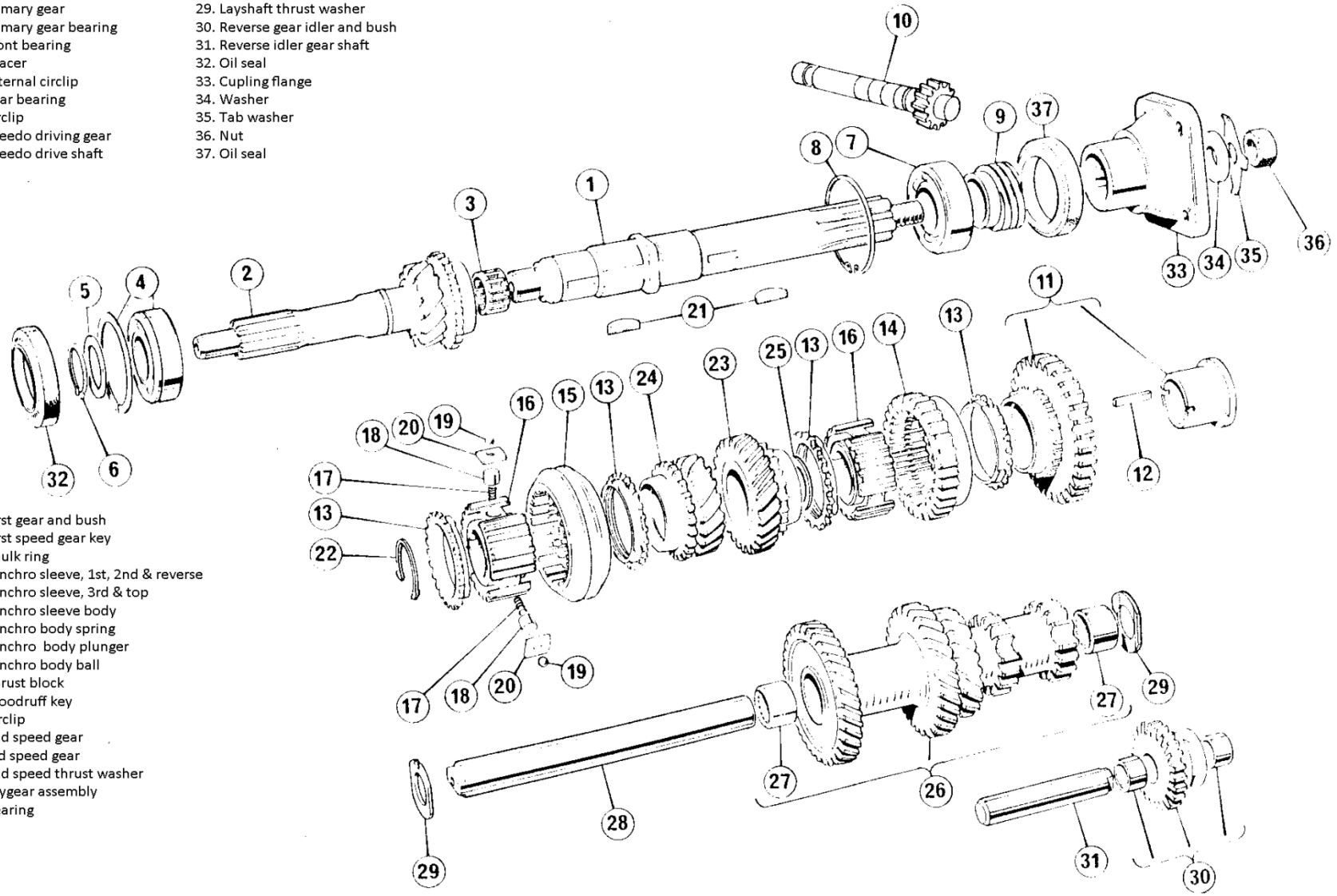
1. Gearbox case
2. Drain plug
3. Washer
4. Blanking plug
5. Stud
6. Stud
7. Lock washer, engine to gearbox
8. Nut
9. Bolt
10 Bolt
11. Front cover assembly
12. Front cover seal
13. Gasket
14. Stud
15. Stud
16. Lock washer front cover
17. Nut
18. Gear lever
19. Knob
20. Lock nut
21. Lever retaining spring
22. Cap
23. Seat
24. "C" clip
25. Top cover
26. Top cover gasket
27. Screw
28. Lock washer
29. Filler/level plug
30. washer



31. Speedo drive gear bush
32. Grub screw
33. Gear thrust ball
34. Oil seal
35. Selector shaft assemby, 1st & 2nd
36. Pin
37. Selector shaft assembly, 3rd & 4th
38. Pin
39. Selector shaft assembly, reverse
40. Pin
41. Ball
42. Interlock pin
43. Fouling pin
44. Ball
45. Spring
46. Rear cover
47. seal
48. Gasket
49. Screw, cover to case
50. Bolt
51. Lock washer
52. Mounting rubber
53. Gearbox support
54. washer
55. Nut
56. Set screw
57. Lock washer
58. Nut

Figure 2 Gearbox interior

1. Main shaft
2. Primary gear
3. Primary gear bearing
4. Front bearing
5. Spacer
6. External circlip
7. Rear bearing
8. Circlip
9. Speedo driving gear
10. Speedo drive shaft
11. First gear and bush
12. First speed gear key
13. Baulk ring
14. Synchro sleeve, 1st, 2nd & reverse
15. Synchro sleeve, 3rd & top
16. Synchro sleeve body
17. Synchro body spring
18. Synchro body plunger
19. Synchro body ball
20. Thrust block
21. Woodruff key
22. Circlip
23. 2nd speed gear
24. 3rd speed gear
25. 2nd speed thrust washer
26. Laygear assembly
27. Bearing
28. Lay shaft
29. Layshaft thrust washer
30. Reverse gear idler and bush
31. Reverse idler gear shaft
32. Oil seal
33. Cupling flange
34. Washer
35. Tab washer
36. Nut
37. Oil seal



12. Lift out the laygear assembly and the two thrust washers.
13. Withdraw the reverse gear shaft through the rear of the gearbox and lift out the reverse gear.
14. Secure the rear cover including the mainshaft assembly in a vice, release the tab washer, unscrew the mainshaft nut and remove the tab washer and coupling flange from the mainshaft.
15. Remove the rear cover from the mainshaft assembly.

Mainshaft Dismantling and re-assembly

To dismantle

1. Remove the first speed gear, bush and bush key complete with baulk ring from the mainshaft.
2. Remove the first/second gear selector sleeve.
Note: It is advisable to carry out this operation with the sleeve wrapped in a suitable piece of cloth which will avoid losing any of the sets of balls, blocks, springs and plungers from the synchro body.
3. After removing the sleeve, recover the springs, balls, blocks and plungers from the cloth.
4. Repeat this operation for the third/fourth selector sleeve.
5. Remove the circlip from the spigot end of the mainshaft.
6. Using tool No. RT 8778, remove the third/fourth synchro body from the mainshaft.
7. Withdraw the first speed gear bush key. Using tool RT 8778, remove the first/second synchro body from the mainshaft and remove the second speed baulk ring.
8. Remove the second/third speed gear from the mainshaft.
9. Examine all components for wear and renew if necessary prior to reassembly.

To reassemble

1. Apply "Moly Grease 799" to second/third gear running faces on the mainshaft.
2. Fit the third speed gear and baulk ring on the mainshaft.
3. Secure the woodruff key in its seating on the mainshaft.
4. Locate the third/fourth synchro body on the mainshaft pressing in to position and fit the circlip.
5. Fit second speed gear and baulk ring to mainshaft followed by the thrust washer. Ensure that the thrust face of the washer abuts the gear.
6. Secure the second woodruff key in its location on the mainshaft.
7. Locate the first/second synchro body on the mainshaft and press in to position.
8. To facilitate further assembly, position the mainshaft in an assembly "pot" or a vice.
9. Fit the three springs and plungers to the third/fourth synchro body.
10. Slide the third/fourth synchro sleeve over the synchro body leaving sufficient room to enable fitment of thrust blocks and balls in the following operation.
11. Fit three thrust blocks leaving the synchro body ball seatings completely visible.
12. Seat the synchro body ball in the thrust block, press the ball down on to the plunger and slide the thrust block between the sleeve and the synchro body.
13. Repeat instruction 12 for the two remaining balls.
14. Slide the third/fourth synchro sleeve along the synchro body until it "clicks" in to position.
Note: Ensure that the sleeve is not pushed in too far, otherwise the synchro balls and thrust blocks will be disturbed.
15. reposition the mainshaft in a vice or assembly "pot" to facilitate first/second synchro body assembly.
16. Fit springs and plungers to the synchro body.
17. Slide first/second synchro sleeve over synchro body leaving sufficient room to enable fitment of thrust blocks and balls. Ensure the teeth of the synchro sleeve are facing forward.
18. Fit the three thrust blocks, leaving synchro ball seatings completely visible.
19. Seat synchro body ball in thrust block, press ball down on to plunger and slide the thrust block between the sleeve and synchro body.
20. Repeat instruction 19 for two remaining balls.
21. Position baulk ring on first speed gear.
22. Fit first speed gear bush key into its location in the synchro body.
23. Apply "Moly grease 799" to gear bush outside diameter and inner flange face and then fit first gear.
24. Position first gear, including bush and baulk ring, on to mainshaft splined end.
25. Rotate first gear bush, until it fully locates in the bush key seated in the first/second synchro body.
Note: Handle mainshaft cluster with care to prevent synchro sleeves etc from being disturbed.
26. Using tool No. RT 7490 press the rear cover on to the mainshaft.

Operation 4 Primary gear assembly - dismantling and re-assembly

To dismantle

1. Prise the primary gear front seal from the gear shaft.
2. Using circlip pliers (Tool No 7066) remove circlip securing the front bearing to the primary gear.
3. Remove the spacer and front bearing.
4. Withdraw the needle roller bearing from inside the gear body.
5. Inspect parts for wear, renewing if necessary.

To re-assemble

Replace components in reverse order. care should be taken when fitting the front seal that it is not damaged when passing the seal over the shaft splines. The seal is correctly fitted when it abuts the shoulder on which is the circlip. It must not abut the circlip.
Note: The lip on the front seal must face forward.

Operation 5 Rear cover - dismantling and re-assembling

To dismantle

1. Remove circlip securing the rear bearing to the cover.
2. Using tool RT 7490, press out the rear bearing and speedometer gear.
3. Prise out the rear cover oil seal.

To re-assemble

1. Press new seal into cover using tool RT 7489 and drive handle 550 (**Figure 3**).
2. Check rear bearing and speedometer gear for wear, renew if worn.
3. Replace he bearing, circlip, speedometer gear, and fit the coupling flange oil seal.

Operation 6 Lay gear - dismantling and re-assembly

1. Examine the lay gear assembly, gear teeth and renew complete assembly if obvious wear or damage is apparent.
2. The lay gear needle rollers should also be checked. remove worn items with a suitable drift.

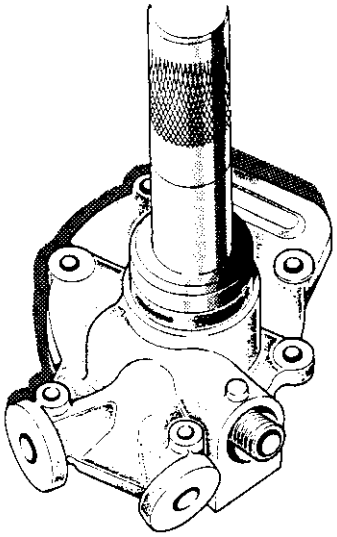


Figure 3 Replacing rear cover oil seal

Care should be taken when fitting new needle roller bearings not to damage the bearing cage (see note on needle roller bearings in **Section F, Operation 2**)

3. If signs of scoring are apparent on the layshaft, due to worn needle roller bearings, it will have to be renewed.

Operation 7 Reverse idler gear assembly and shaft

1. Check reverse idler gear teeth and renew assembly if necessary.

2. Inspect bushes and if worn, drive out old bushes with a suitable drift and fit new ones.

Ensure the end face of the bushes finish flush with the gear face,

3. Check gear shaft for scoring and replace if necessary.

Operation 8 To re-assemble the gearbox

1. Refit reverse idler gear and shaft in to the gearbox case with the select groove to the rear.

2. Position the laygear assembly with its thrust washers in to the base of the gearbox.

3. Refit the primary gear assembly in to the bell housing location.

Note: Drive carefully in to position until the bearing retaining ring is flush with the case.

4. feed in the mainshaft assembly, taking great care not to dislodge the synchro thrust blocks and balls.

5. Refit the rear cover with a new gasket to within 6.35 mm (¼ in) of the gearbox face (to allow rotary movement and facilitate positioning of the layshaft).

6. Turn the gearbox on to its top face and slide the layshaft through the thrust washers and laygear assembly until it mates in its bore with the rear of the box.

Note: The tang end of the layshaft must be at the front.

7. Position the tang end of the reverse shaft to engage with the horizontal slot in the rear cover, then bolt the rear cover fully home.

8. Refit the coupling flange on the mainshaft spline, fit the washer and tab washer and secure with the mainshaft nut. Tighten to a torque of 6.92 kg/m (50 lb/ft). Bend over the tab washer to secure the nut.

9. Return the gearbox to an upright position and insert the reverse, 1st/2nd and 3rd/4th selector forks on to the shafts.

10. Replace the two interlock balls in to the cross drilling in the bell housing, locating in position with grease.

11. Line up the reverse selector shaft in the selector fork and drive home the mills retaining pins.

12. Ensuring the interlock pin is in position, replace the1st/2nd selector shaft in the selector fork and lever. Secure in position with the mills pin.

Note: Rotate the shaft and fit the horizontal pin first, in the selector lever, before pinning to the selector fork.

13. Replace 3rd/4th selector shaft into the mating fork and lever, again retaining in position with mills pins.

14. Refit front cover.

Note: Ensure that the oil seal is correctly positioned on the primary gear shaft (see **Operation 4**).Secure front cover to gearbox with seven nuts and lock washers. Do not attempt to move selectors or change any gear until the front cover is secured as this will result in forcing the mainshaft assembly apart.

15. Replace the selector shaft detent balls and springs and refit top cover and gasket, retaining in position with eight set screws and locking washers.

16. refit the clutch fork and lever assembly.

Section H Clutch

Contents

Description

The clutch assembly comprises a spring pressure plate assembly and a single dry 158.75 mm (6.25 in) diameter clutch plate.
The clutch pedal operates a cable linked to the clutch operating arm and a trunnion which acts as an abutment for the cable adjuster.

Routine adjustment

Check and adjust if necessary every 6,000 miles (10,000 km)

Operation 1 **Clutch adjustment**
The clutch cable is adjusted as follows:
1. Pull back on the clutch cable inner, releasing the adjuster nut on the threaded portion of the cable from the trunnion located in the clutch operating arm. (**Figure 1**)
2. Rotate the adjuster nut along the threaded end of the cable and relocate on the trunnion.
3. The cable is correctly adjusted when the clutch and brake pedal pads are level and there is approximately 1.5 mm (1/16 in) free movement of the clutch operating arm at the trunnion.

Operation 2 **The clutch assembly - removal**
The clutch is located on the flywheel by two dowels and is retained by six set screws and lock washers. Before dismantling, mark all major components so they can be re-assembled in the same relative positions, thus preserving balance and adjustment.

To remove (**Figure 2**)
1. Remove the gearbox (see Section G).
2. Unscrew the six set screws and lock washers and remove the clutch assembly from the flywheel.
3. Check that the lining material, on both sides of the driven plate, are clean and free from oil. The disc should also be checked for excessive wear and signs of overheating. If the linings are worn down to the rivet heads or if any of the above conditions are apparent, the disc must be renewed.
Check the condition of the pressure plate and the thrust pad surfaces. Should any sign of scarring or overheating be present, renew the assembly.

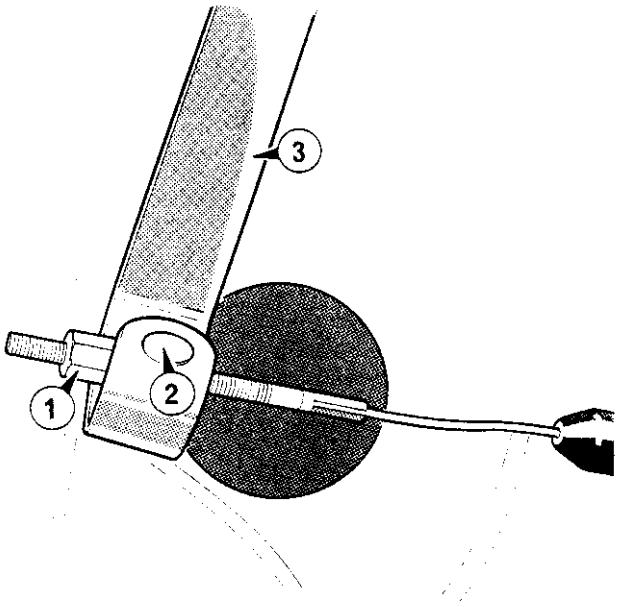


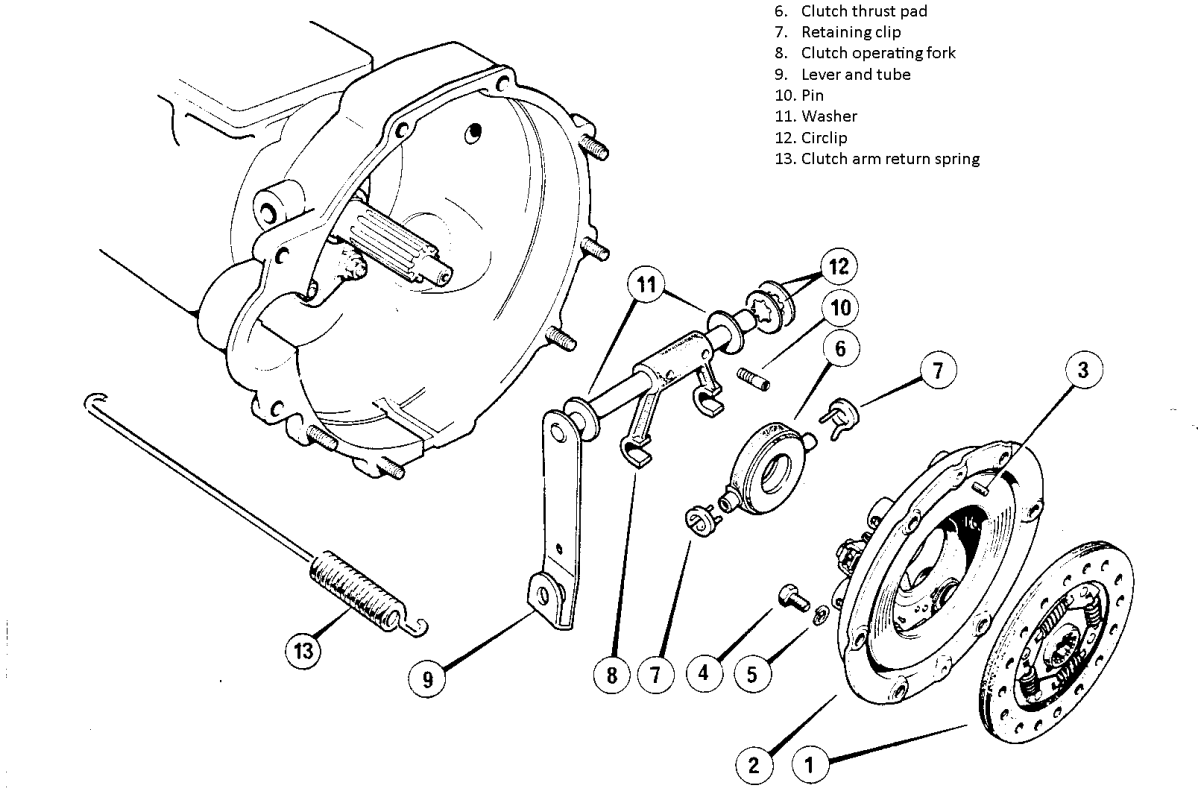
Figure 1 **Clutch adjuster**
1. *Adjuster nut*
2. *Trunnion*
3. *Operating arm.*

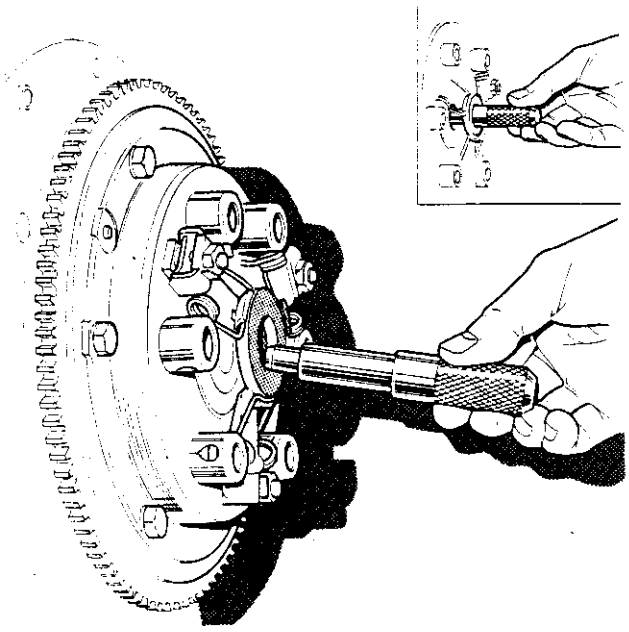
Clutch fault diagnosis
A clutch lining, in service, will develop a "polished" surface. This should not be confused with a "glazed" surface which will be due to a film deposit, a condition that alters the frictional value of the lining. When a "polished" surface is in perfect condition it is a medium brown colour. If for any reason oil should gain access to the clutch and come in to contact with the linings, small quantities will burn off due to heat generated by the slip which occurs under normal starting conditions. This has the effect of darkening the surface of the linings. However, as long as the "polish" on the linings remains such that the grain of material can be clearly distinguished, it has very little affect on clutch performance.
Increased quantities of oil or grease, however, can give rise to harmful conditions. One of two conditions may arise, or a combination of both.
(a) The oil may burn off and leave a carbon deposit having a high "glaze". causing clutch slip. In general this condition ides the grain of the friction material.
(b) The oil may only burn partially. This leaves a resinous deposit resulting in a fierce clutch. It may even cause a spinning clutch due to the linings adhering to the flywheel and pressure plate surfaces.
A clutch that has been misused by the driver, "riding" the clutch or using the clutch pedal as a footrest, is often easily diagnosed by advanced release bearing wear coupled with marked "bluing" of the bearing plate.

To replace
1. Using tool No. RT 7485 as a centraliser, or a primary shaft from a gearbox, position the clutch disc and pressure plate assembly on the flywheel, securing evenly with the six set screws and lock washers to a torque of 1.66 to 2.07 kg/m (12 to 15 lb/ft) (**Figure 3**)

Figure 2 Clutch - Exploded view

1. Driven plate
2. Clutch cover
3. Dowel
4. Screw
5. Lock washer
6. Clutch thrust pad
7. Retaining clip
8. Clutch operating fork
9. Lever and tube
10. Pin
11. Washer
12. Circlip
13. Clutch arm return spring





Tap the pressure plate assembly with a hide mallet to ensure it is correctly seated on the flywheel.

2. Check the clutch run-out does not exceed 0.381 mm (0.015 in) on the steel thrust disc.

Operation 3 Clutch operating fork, lever and thrust pad Removal and replacement

The operating fork is pinned into position on the shaft of the clutch lever and tube assembly which is pivoted through the top of the gearbox bell housing. To ensure that the thrust pad moved in the correct plane it is pivoted in the operating fork and held firm by lock springs. (**Figure 2**)

To remove

1. \\remove gearbox (**Section G**).

2. Using a screwdriver, prise off the locking washers and plain washer, securing the clutch lever shaft to the bell housing.

3. Tap out the two clutch fork retaining mills pins with a 3.175 mm (0.125 in) diameter drift.

Note: It is advantageous to first remove the right-hand pin to facilitate easier withdrawal.

4. Withdraw the clutch lever and shaft assembly from the gearbox bell housing and remove the clutch fork.

5. Release the locking springs and remove the thrust pad from the operating fork.

6. Inspect the thrust pad for wear and renew if the bearing face has worn below a depth of 1.58 mm (0.060 in) or shows any signs of scoring or distortion.

To replace

1. Refit the thrust pad into the operating fork and secure with new lock springs.

2. Insert the clutch lever shaft into the gearbox bell housing and fit the operating fork.

3. Secure the clutch lever shaft to the gearbox bell housing with a plain washer and new locking washers.

4. Align the retaining pin holes of the operating fork with those in the clutch lever shaft and secure the operating fork in position with new mills retaining pins, tapping firmly home with a 3.175 mm (0.125 in) diameter drift.

5. Replace gearbox (see **Section G**)

Operation 4 The pedal assembly, removal and re-assembly

To remove (**Figure 4)**

1. Remove split pin. withdraw clevis pin and washer and disconnect the clutch cable clevis from the clutch pedal lever.

2. Unhook the accelerator cable and nipple from the lugs on the pedal stem and release the plastic fastener on the outer cable from the pedal mounting bracket. Withdraw the cable.

3. From within the engine compartment, prise out the blanking grommet situated over the master cylinder push rod clevis to gain access to the clevis pin securing the push rod clevis to the brake pedal. Remove the split pin and washer.

4. From within the foot well, withdraw the clevis pin and disconnect the clevis from the brake pedal.

5. Disconnect the stop light switch wires after disconnecting the battery.

6. Remove two nuts, lock washers and plain washers and two bolts, lock washers and plain washers securing the pedal assembly and the brake master cylinder to the body.

7. Carefully withdraw the pedal assembly forwards in the foot well to clear the two weld bolts on the pedal mounting bracket. Disengage the master cylinder from the stud on the bracket.

8. remove the pedal assembly from the foot well, manoeuvring it past the low link of the steering column.

To dismantle

1. release the brake pedal return spring tension by unhooking the spring from the pedal lever.

2. Remove the split pin from the brake pedal end of pivot shaft and drive out the shaft from the bracket side members, withdrawing the brake and clutch pedals as the shaft is removed.

3. Rotate the accelerator pedal shaft nylon pivot bushes so that they line up with the square apertures in the bracket side members.

4. Prise out the pivot bushes and remove the accelerator pedal.

5. Two metal bushes are pressed into both clutch and brake pedals. Inspect for wear and if necessary, remove with a suitable drift.

6. Replace the pedal rubbers if worn.

7. Unscrew two lock nuts securing the brake stop light switch to the mounting bracket and remove the switch.

Operation 5 Pedal assembly - re-assemble and replacement

To re-assemble

1. Refit the brake light switch with a lock nut on either side of the mounting bracket.

2. Locate the accelerator pedal pivot shaft in the square apertures in the mounting bracket side member. Fit the nylon pivot bushes and rotate them to secure the pedal in to position.

3. Locate the return spring on the brake pedal right-hand bush boss.

4. Position the brake and clutch pedals between the side members of the mounting bracket and insert the pivot shaft, ensuring the split pin hole in the shaft is adjacent to the brake pedal and bracket.

5. Insert new split pin to the shaft.

6. Locate the brake pedal return spring over the mounting bracket and pedal stem.

To replace pedal assembly

1. Manoeuvre the pedal assembly to clear the steering column lower linkage and position against the pedal mounting face in the toe box. Locate the studs on the bracket through the holes in the body and from within the engine compartment position the master cylinder on the stud and secure the assembly with two bolts, plain washers and lock washers.

2. from inside the foot well align the master cylinder push rod clevis with the hole in the brake pedal and insert the clevis pin.

3. re-connect the brake light switch leads.

4. From within the engine compartment, through the access aperture, refit the clevis pin washer and insert a new split pin. Refit the grommet to the access aperture.

5. Locate the accelerator cable and nipple in the lug on the pedal stem and reconnect the plastic fastener on the outer cable to the mounting bracket.

6. Relocate the clutch pedal clevis to the clutch pedal and fit the clevis pin and washer. Secure using a new split pin.

7. Adjust the clutch cable at the adjuster on the clutch operating arm (see **Operation 1**).

8. Reconnect the battery and adjust the stop light switch.

Operation 6 Clutch cable removal and replacement

To remove

1. From under the vehicle pull back the clutch operating lever to release the adjuster nut from the trunnion. Unscrew the adjuster nut and withdraw the cable from the trunnion located in the operating lever.

2. From inside the foot well, remove the split pin, washer and clevis pin and disconnect the clevis from the clutch pedal lever.

3. From underneath the vehicle, using a 5.56 mm (7/32 in) diameter drill bit, remove the heads from the two rivets securing the clutch cable abutment bracket to the underside of the foot well.

4. Tap out the rivets and withdraw the cable complete with abutment bracket, from the vehicle.

Note: The abutment bracket is press fitted to the cable during manufacture and should not be removed.

To replace

1. When fitting a new cable assembly, which includes the abutment bracket, two methods of securing the bracket to the foot well can be adopted

(a) Riveting the bracket to the foot well as in production or,

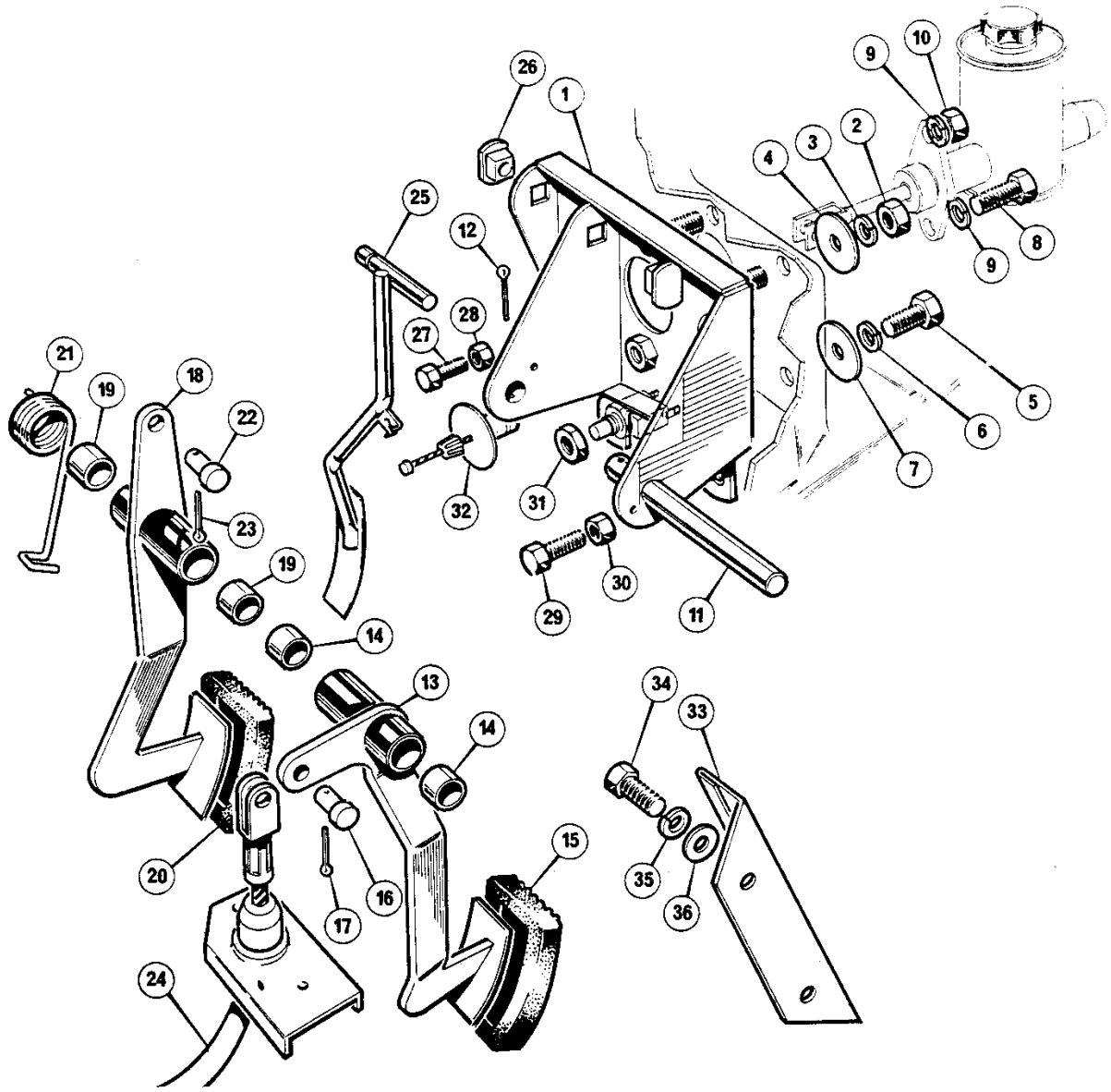


Figure 4 Pedal bracket assembly - exploded view

1.	*Pedal mounting bracket*	*13.*	*Clutch pedal assembly*	*25.*	*Throttle pedal*
2.	*Nut*	*14.*	*Clutch pedal pivot bush*	*26.*	*Throttle pedal pivot moulding*
3.	*Lock washer*	*15.*	*Pedal rubber*	*27.*	*Adjuster bolt*
4.	*Coach washer*	*16.*	*Clevis pin*	*28.*	*Lock nut*
5.	*Bolt*	*17.*	*Split pin*	*29.*	*Adjusting bolt*
6.	*Lock washer*	*18.*	*Brake pedal assembly*	*30.*	*Lock nut*
7.	*Coach washer*	*19.*	*Brake pedal pivot bush*	*31.*	*Lock nut, brake light switch*
8.	*Bolt*	*20.*	*Pedal rubber*	*32.*	*Accelerator pedal assembly*
9.	*Lock washer*	*21.*	*Brake pedal return spring*	*33.*	*Clutch footrest bracket*
10.	*Nut*	*22.*	*Clevis pin*	*34.*	*Bolt*
11.	*Pivot shaft*	*23.*	*Split pin*	*35.*	*Lock washer*
12.	*Split pin*	*24.*	*Clutch cable*	*36.*	*Washer*

(b) Drilling out the fixing holes in the bracket and securing it with two No.10 set screws, nuts and lock washers.

Note: If the fixing holes in the body have been enlarged excessively it is advisable to use method (b).

2. Clean all traces of sealing compound from the abutment bracket under the foot well

3. Smear a coating of "I.C.I. Silcoset 152" sealing compound on the seating face of the new clutch cable abutment bracket.

4. Push the clevis end of the new clutch cable assembly through the hole in the foot well, locate the abutment bracket and secure to the body using either method detailed above.

5. From inside the vehicle foot well connect the clutch cable clevis to the pedal lever with the clevis pin and fit the washer and a new split pin.

6. Underneath the vehicle insert the threaded end of the cable through the trunnion and fit the adjuster nut.

7. Adjust the clutch (see **Operation 1**)

Section J Drive shaft

Contents

Description

The drive shaft (or prop shaft) comprises two sections incorporating a sliding spline and universal joints to allow fore and aft movement of the rear axle. Each universal joint consists of a centre "spider", four needle bearings and two yokes.

Routine maintenance

Three lubrication points are provided, one for each universal joint and one on the sliding spline. Grease should be applied to these points every 6,000 miles (10,000 km) (**Figure 1**)

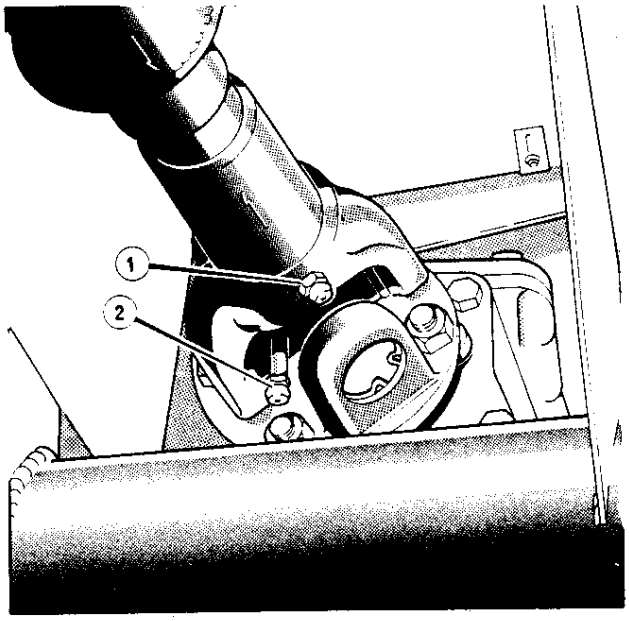


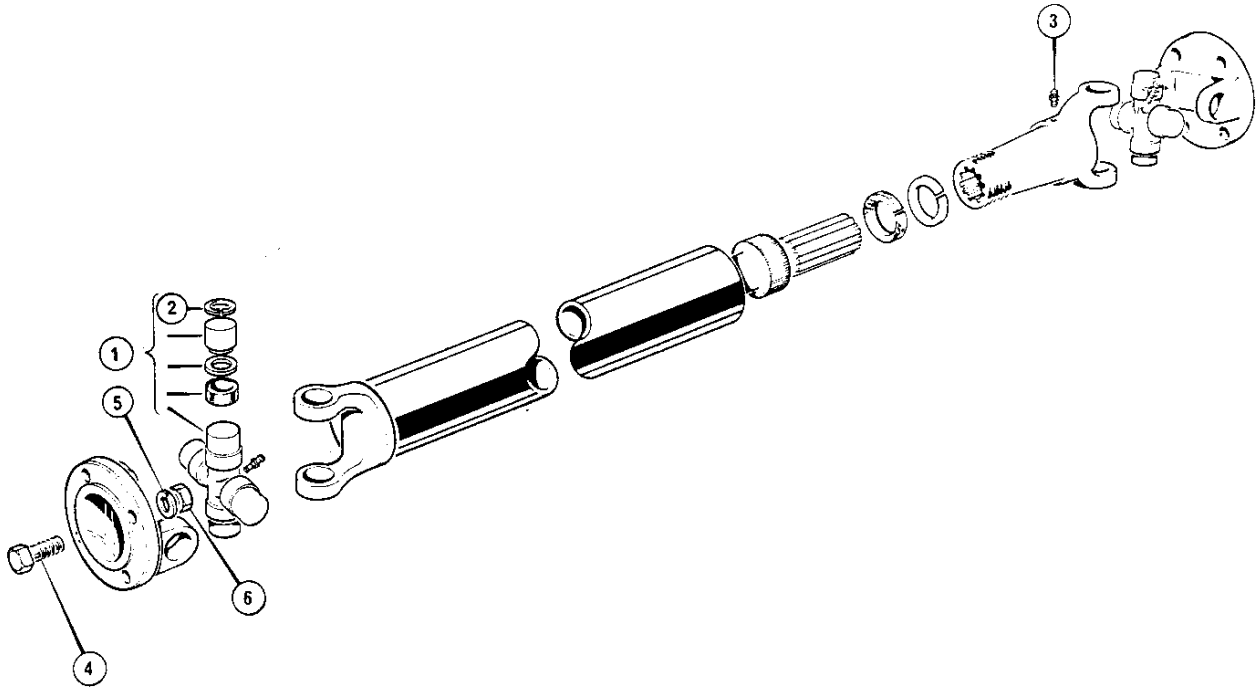
Figure 1 Grease Nipples

1. Sliding spline grease nipple

2. Universal joint grease nipple

Figure 2 Driveshaft exploded

1 Journal kit
2 Circlip
3 Grease nipple
4 Bolt, driveshaft to gearbox and axle
5 Washer
6 Nut



Operation 1 Drive shaft removal

1. Place the vehicle on a ramp, or on axle stands under the chassis.

2. Unscrew four bolts, nuts and locking washers from the coupling flange at the axle end, to allow the shaft to be lowered to facilitate access to the front flange. Now remove the four bolts, nuts and lock washers at the gearbox flange and remove the drive shaft.

Operation 2 Checking the drive shaft for wear.

The degree of wear on the drive shaft thrust faces can be determined by the amount of lift in the joints. This can be measured by hand using a piece of wood suitably pivoted. Any circumferential movement of the shaft relative to the coupling flange yokes indicates wear in the needle roller bearings or the drive shaft spline, or ovality in the yokes. A unit package (joint repair kit) is available for replacing worn needle bearings and journals but if excessive wear is apparent in the yoke bearing or drive shaft splines no action is possible and the drive shaft will need to be renewed as a complete assembly.

Operation 3 Drive shaft - dismantling and re-assembly

To dismantle

1. Using circlip pliers (general tool No. 7066) remove the four circlips from the universal joint.

Note: If no circlips are fitted, as may be the case on late vehicles, then the yoke bearings are "staked" in to position. These shafts are sealed and cannot be overhauled and a new drive shaft assembly complete will need to be procured and fitted.

It may be necessary to clean rust and paint from the yokes to enable the circlips to be removed.

2. Tap the radius of the yoke with a hide mallet to release the yoke bearings. Should this prove difficult then the bearings can be gently prised out from inside the yoke. Withdraw the bearing cups and disengage the journal from the yoke.

3. Repeat the sequence 1 and 2 on the remaining bearings, removing the journal from the yoke on the drive shaft.

4. Similarly separate the yoke and journals at the opposite end of the drive shaft.

5. Unscrew the dust cap to separate the two sections of the drive shaft at the sliding spline.

To re-assemble

1. Re-assemble the two parts of the drive shaft checking carefully that the arrows stamped on them align correctly. This is to ensure that the coupling flanges are correctly in line with each other, thus giving uniform notion of the drive shaft plus the shaft balance will be maintained. Failure to do this will cause accelerated wear of universal joints, gearbox output bearings and axle input bearings as well as a very poor driving experience. Tighten the dust cap.

2. Remove the cups from the new spider journals.

3. Ensure that the cups contain an approved lubricant (one third full, leaving an air space to allow for heat expansion) and that all the needle rollers are in position.

4. Fit the spider to the drive shaft yoke, locating the journals in the yoke and carefully press both bearing cups in to position, ensuring that the spider trunnion engages the cups and that the needle bearings are not displaced. repeat this operation for the other journal.

5. Using two tools of slightly smaller diameter than the bearing cups, press the cups in to the yokes until they reach the lower land of the circlip grooves. Do not press the cups below this point or damage may be caused to the cups, bearings and seals.

6. Fit the circlips.

Operation 4 Drive shaft - refitting

To replace

1. Align the drive shaft with the gearbox coupling flange and secure with four bolts, nuts and lock washers. Tighten to a torque of 3.46 to 5.15 kg/m (25 to 30 lb/ft).

2. Repeat for the rear drive shaft coupling flange to the axle coupling flange.

Section K Rear axle

Contents

Description

The rear axle is of the spiral bevel gear, semi floating type, the saloons and estates having a ratio of 3.23:1. The van models have an axle ratio of 3.545:1.

A two piece axle case assembly houses a taper roller bearing differential unit with the crown wheel bolted to the casting.

The pinion is located in the centre of the housing case supported by taper roller bearings.

Bearing preload in the differential assembly is controlled by shims between the bearings and the differential castings.

The depth of mesh between the pinion and the crown wheel is controlled by a spacing washer and additional shims as required.

The crown wheel and pinion are a selected pair. Identifying numbers are etched on both. This condition applies to spare parts and production alike. Under no circumstances should an unmatched crown wheel and pinion be fitted.

Routine maintenance

Top-up the rear axle every 6,000 miles (10,000 km) if necessary. The rear axle oil level should be checked by means of the combined filler/level plug (**Figure 2**).

The axle does not have a drain plug. The initial oil fill and the recommended oil for topping up the rear axle are formulated to give a sludge-free axle life.

Note: The rear axle has a breather hole, located in the left-hand axle tube and this should be checked and cleaned out, if necessary, every 6,000 miles (10,000 km). If the breather hole is continually blocked, pressure generated within the axle will cause oil leakage from the pinion and half shaft seals.

Operation 1 **Rear axle- removal and replacement.**

To remove

1. If a ramp is not available jack up the car and place securely on axle stands under the chassis rails. Remove the road wheels.

2. Remove the drive (prop) shaft see **Section J.**

3. Disconnect the handbrake cables from the operating levers on the brake back plates by removing the split pins and washer and withdrawing the clevis pins. Disconnect the cables from the stop brackets on the axle tubes.

4. Disconnect the hydraulic flexible pipe from the three way connector on the axle tube and plug both this and the three way adapter to stop fluid leakage and dirt ingress.

5. Place a jack or suitable support under the axle.

6. remove the nuts and washers and disconnect the lower damper mountings, freeing the dampers from the axle.

7. Unscrew the 8 locknuts and 8 nuts and washers from the "U" bolts securing the leaf springs to the axle.

8. The axle unit can now be lowered from beneath the vehicle and removed.

To refit

1. carefully raise the rear axle until it locates on the pegs on the springs.

2. Secure the axle to the leaf springs with four "U" bolts, washers, nuts and lock nuts.

3. Refit the damper units to the axle mounting.

4. Replace the drive (prop) shaft.

5. Reconnect the hydraulic flexible pipe to the three way connector on the axle tube.

6. Locate the handbrake cables in to the stop brackets and reconnect the cables to the levers on the back plates with washers, the clevis pins and new split pins.

7. Refit the road wheels and bleed the brakes.

Operation 2 **Replacing half shaft bearings (axle in vehicle)**

1. If a ramp is not available, jack up the vehicle, place suitable stands under the chassis and remove the road wheels.
2. Disconnect the hydraulic brake pipes from the brake back plates.
3. Disconnect the handbrake cable from the operating arm by removing the split pin and washer followed by the clevis pin.
4. Slacken the brake adjuster and remove the brake drum.
5. Unscrew the half shaft nut complete with washer, whilst preventing the hub turning by using a lever wedged between two studs, or a plate tool as shown in **Figure 3**.
6. A hub puller, part No. RT 8090 is necessary to remove the hub. Fit hub puller sleeve on to the end of the half shaft (**Figure 4**), to prevent damage. If the sleeve is not available, refit the nut and screw until the top face of the nut is level with the end of the half shaft.
7. Secure the hub puller to the hub using all four wheel nuts, tightened securely.
8. Tighten the hub puller to release the half shaft taper.
9. Remove the hub puller and sleeve and withdraw the hub.
10. Unscrew three set screws and washers and remove the brake back plate.
11. The half shaft is removed by using a slide hammer part No. RT 3072 and adapter RT 3072-2. Fit the adapter on to the slide hammer and screw on to the half shaft. Sliding the hammer away from the axle will release the half shaft from the axle and the shaft, complete with slide hammer, can be withdrawn from the axle tube as shown in Figure 8

Rear axle - cutaway drawing

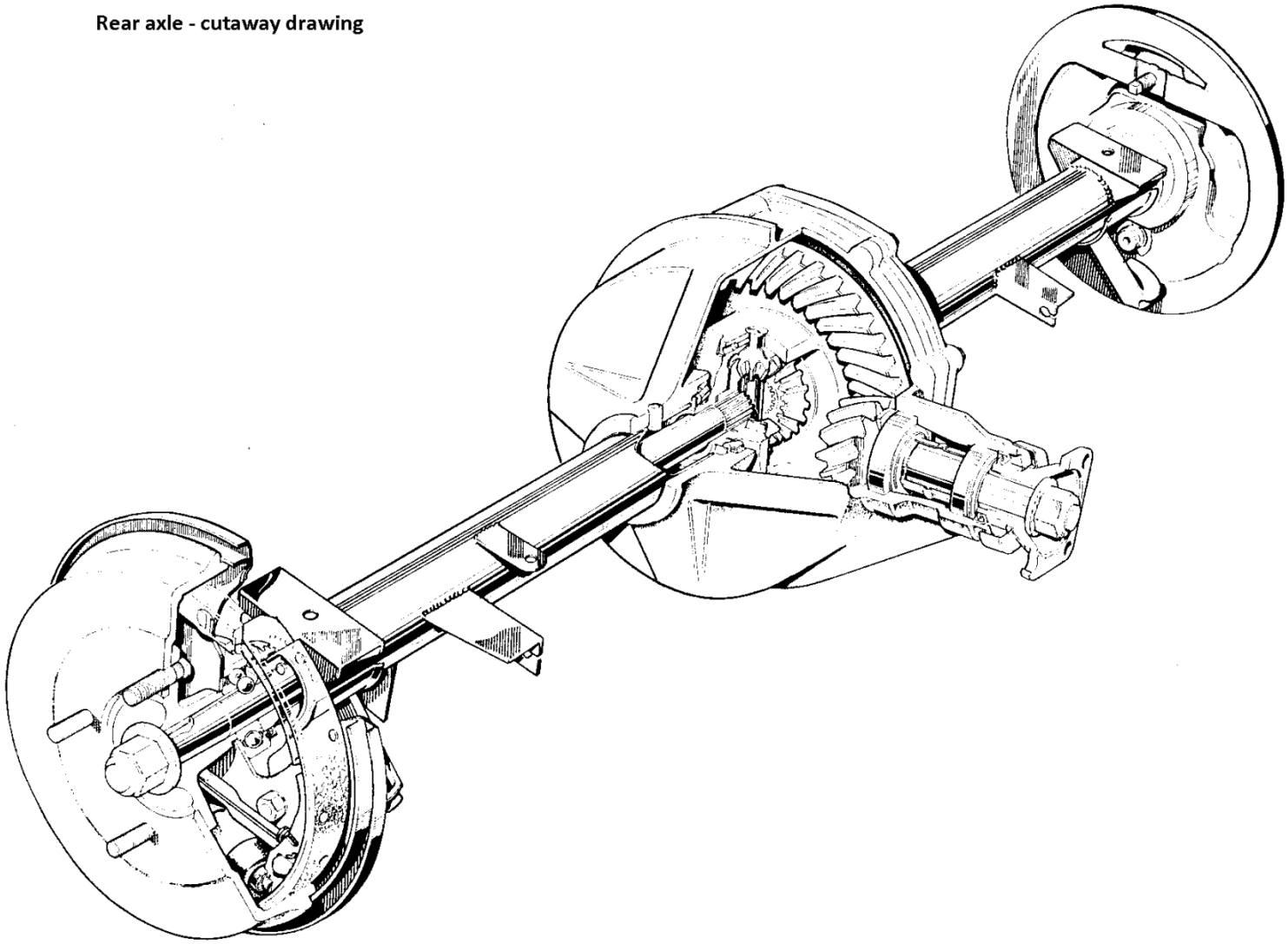
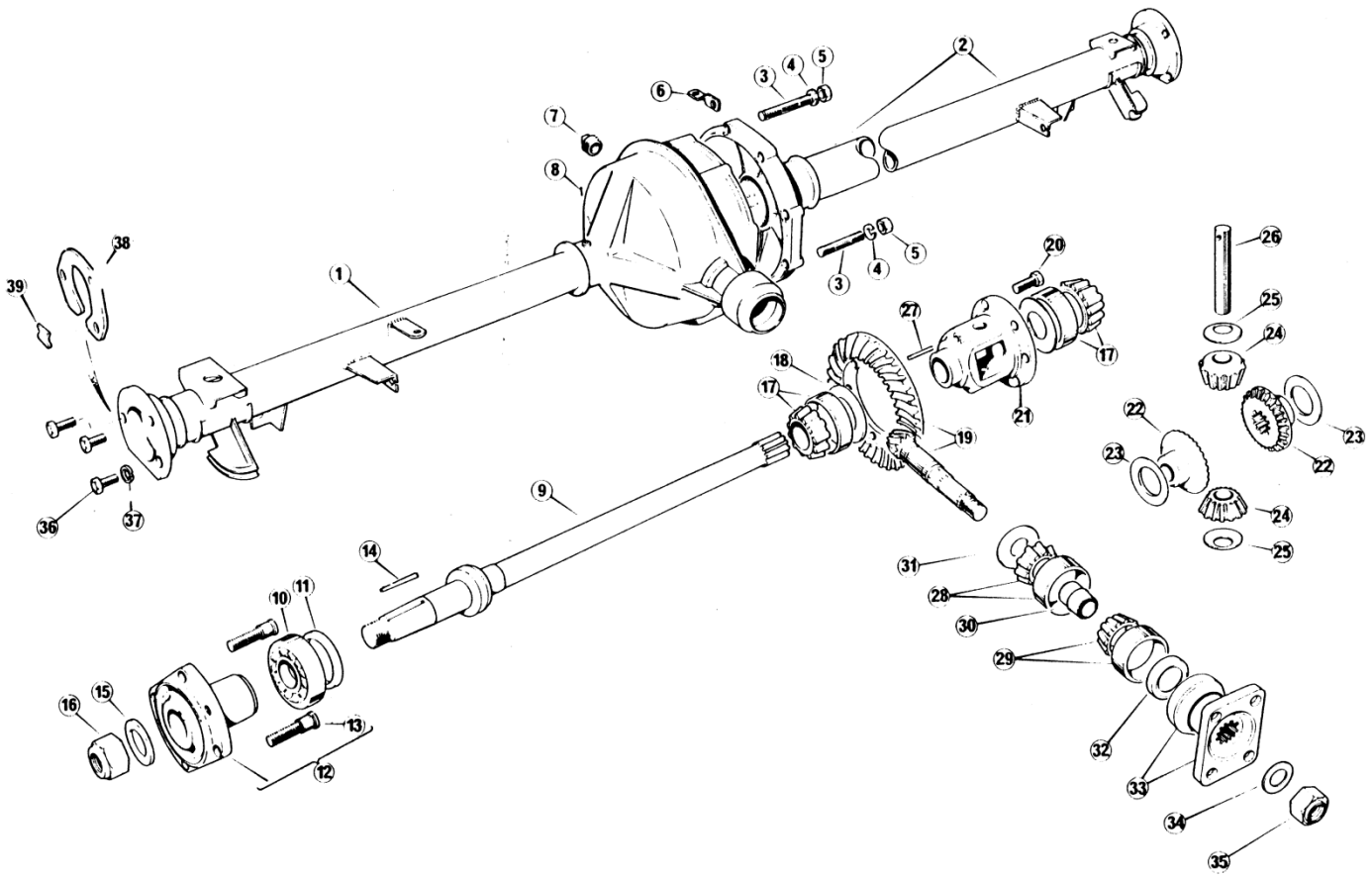


Figure 1 - Rear axle - exploded view

1. RH axle tube assembly
2. LH axle tube assembly
3. Axle cover stud
4. Lock washer
5. Nut
6. Bracket
7. Level/filler plug
8. Split pin
9. Axle shaft assembly
10. Axle end bearing
11. Oil seal
12. Hub assembly
13. Stud
14. Key
15. Washer
16. Nut
17. Differential taper bearing
18. Shim
19. Crown wheel and pinion
20. Crown wheel securing bolt
21. Differential case
22. Planet wheel
23. Thrust washer
24. Planet gear
25. Thrust washer
26. Differential pin
27. Locking pin
28. Bearing
29. Bearing
30. Collapsible spacer
31. Spacer
32. Pinion oil seal
33. Coupling flange
34. Washer
35. Nut
36. Screw
37. Lock washer
38. Spacer
39. Insert



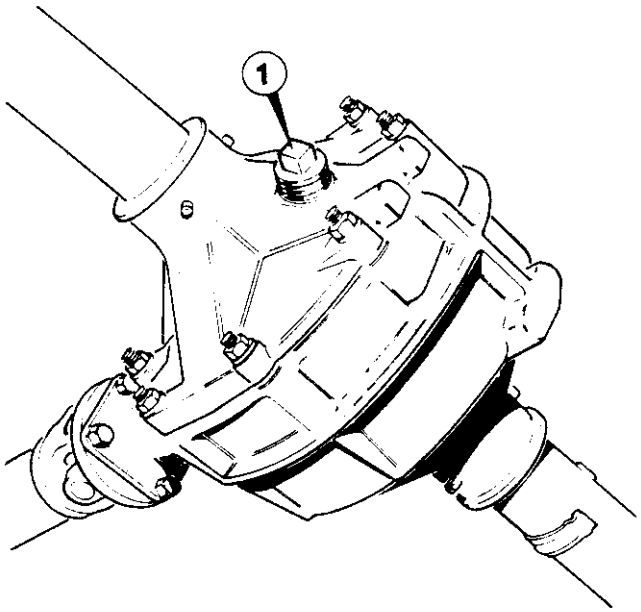


Figure 2 Rear axle oil level/filler plug

1. Level/filler plug

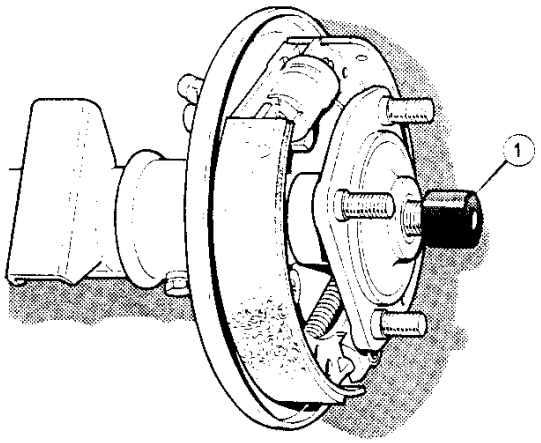


Figure 3 Hub puller sleeve (axle removed)

1. Sleeve

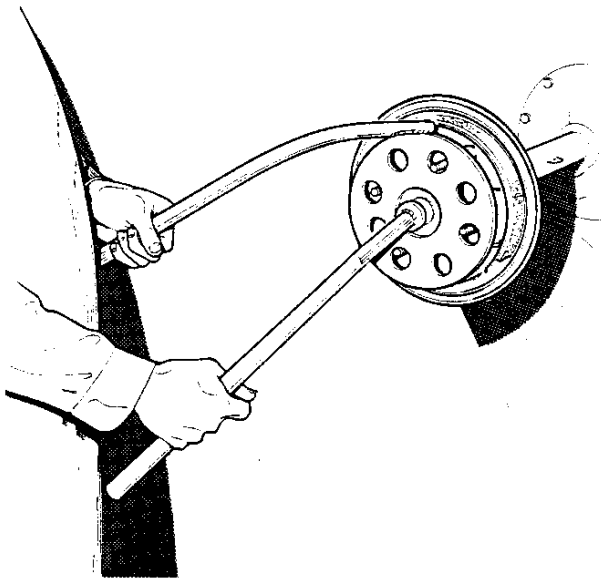


Figure 3 Slackening the half shaft nut (axle shown removed)

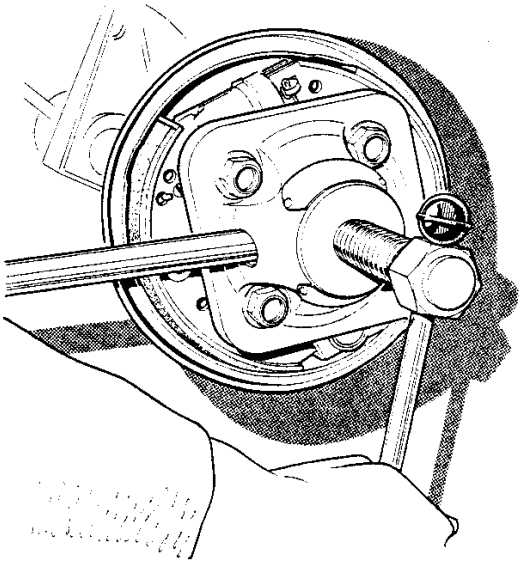


Figure 4 Hub puller in use (axle removed)

12. Remove the hub key and press off the half shaft bearing and remove the oil seal from the housing.

Note: The oil seal collar behind the bearing should not be disturbed, If it is accidentally removed it must be reset with a 73.91 mm (2.91 in) clearance from the outside face of the collar to the end of the half shaft taper. If on removing the hub, the hub key comes away with it, it should be driven out with a suitable drift.

13. Repeat the above operations for the opposite hub.

To replace

1. Fit a new oil seal into the axle end housing.

2. Locate a new half shaft bearing on to the shaft and pack with the recommended grease (see Lubrication chart **page 13**).

3. Insert the half shaft into the axle tube to engage in the differential unit. Then, using the slide hammer and adapter, refit the half shaft.

4. Secure the back brake plate with three set screws and lock washers. Ensure that the back plate spacer is correctly positioned and that the spacer insert is free to move when the back plate screws are tightened.

5. Clean the half shaft taper of all grease and foreign matter.

6. If the wheel studs are damaged they should be pressed out and replaced.

7. Position the hub key in its slot and fit the hub to the half shaft.

8. Secure the hub to the shaft with the nut and washer which must be tightened to a torque of 13.8 to 15.3 kg/m (100 to 110 lb/ft).

9. Check the brake drum face is clean, refit the drum and refit the road wheel.

10. Reconnect the hydraulic pipes to the wheel cylinders.

11. reconnect the handbrake cable clevis to the brake lever. replace the washer and fit a new split pin.

12. Repeat sequences 1 to 11 for opposite hub.

13. Lower the vehicle back to the ground.

14. Bleed the hydraulic braking system

15. Check the rear axle oil level and top up if necessary.

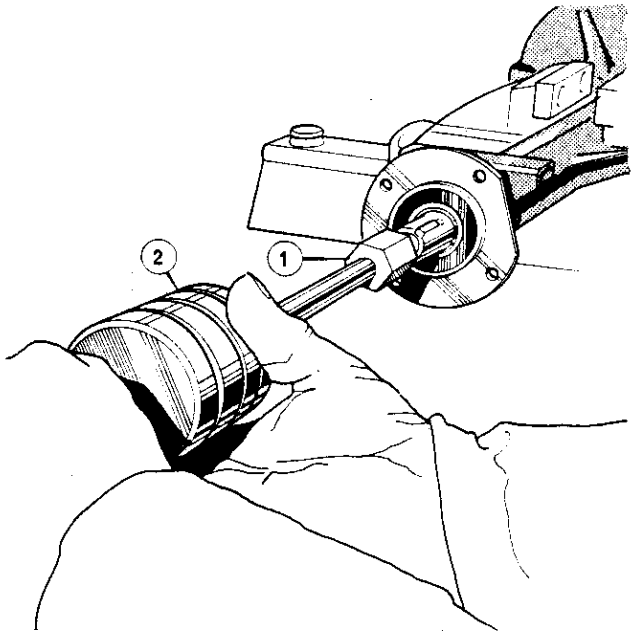


Figure 6 Removing half shaft using slide hammer (axle shown removed from vehicle

1. Adapter

2. Slide hammer

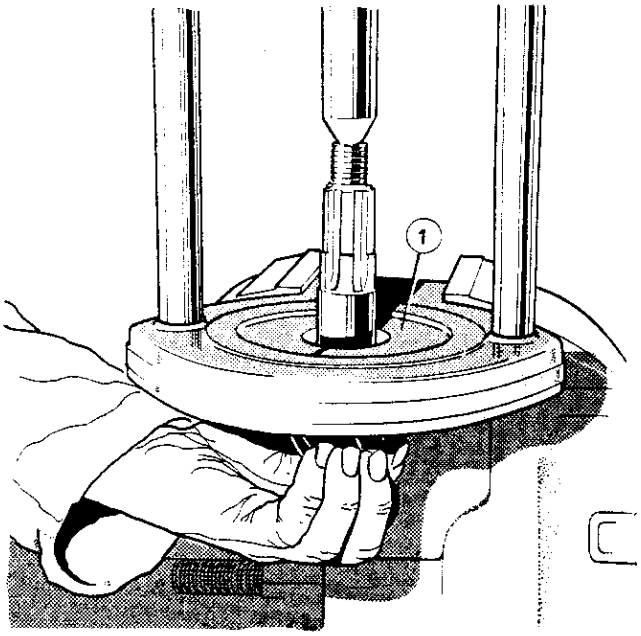


Figure 8 Removal of pinion bearing using collars and hand press

1. Collars

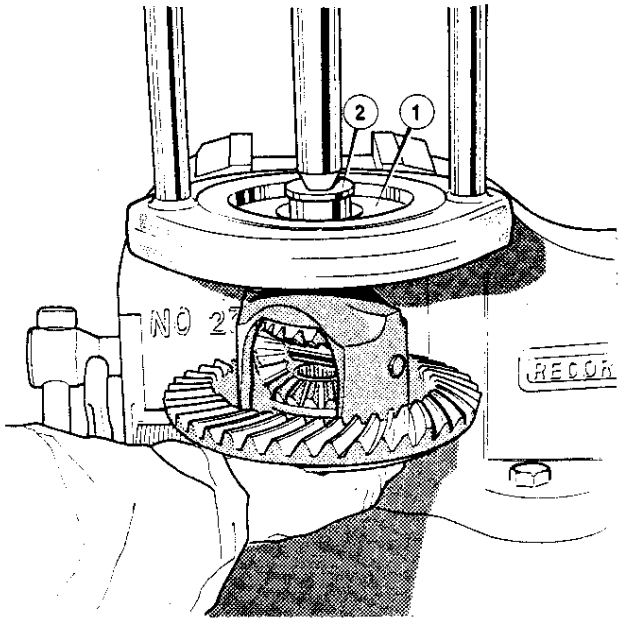


Figure 7 Removal of differential bearing using collars, adapters and hand press

1. Collars

2. Adapter

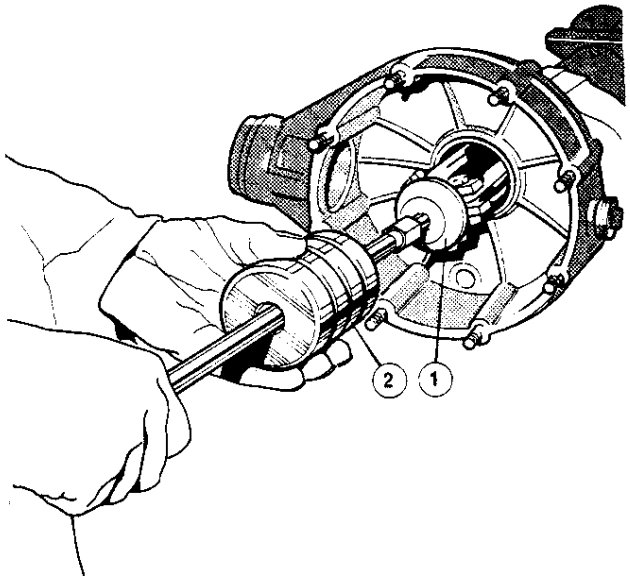


Figure 9 Removal of axle bearing cones from outer housing

1. Puller tool

2. Slide hammer

Operation 3 Dismantling the rear axle

1. Remove the rear axle from the vehicle (see **Operation 1**).

2. Place the axle in a vice with the spring mounts uppermost and the pinion flange facing the operative.

3. Remove the right-hand brake drum and hub (**operation 4**).

4. Remove the right-hand brake plate assembly, remove the spacer and the right hand half shaft.

5. Remove eight nuts and lock washers securing the two halves of the axle case. Remove the right-hand axle housing and withdraw the differential unit.

6. Using a hand press, General tool No. 47, and collars RT 8764/1, with adapter RT 8764/2, remove the differential bearings as follows: Feed the differential unit in to the hand press and fit into the cone of the tool. Ensure that the bearing fits securely into the collars and the rollers on the bearing and fit the adapter to the differential unit (**Figure 7**). Supporting the differential unit from below, turn the hand press to remove the bearing. Repeat this operation for the other bearing and take note of the value of the shims behind each bearing if only the bearings are to be renewed.

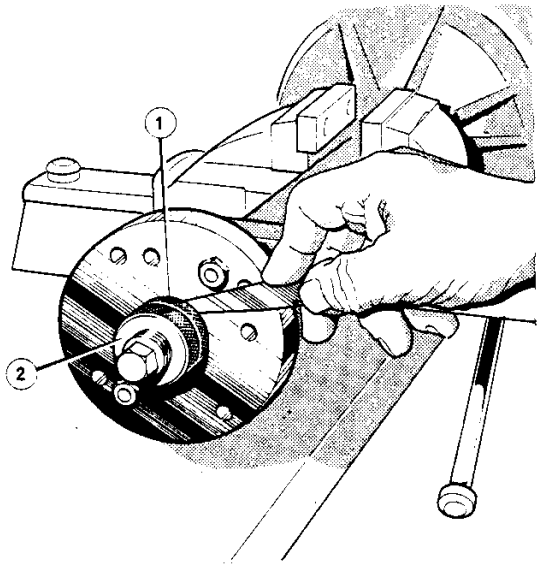


Figure 10 Determining overall differential end float using gauging tool

1. Gauging nut

2. Locking nut

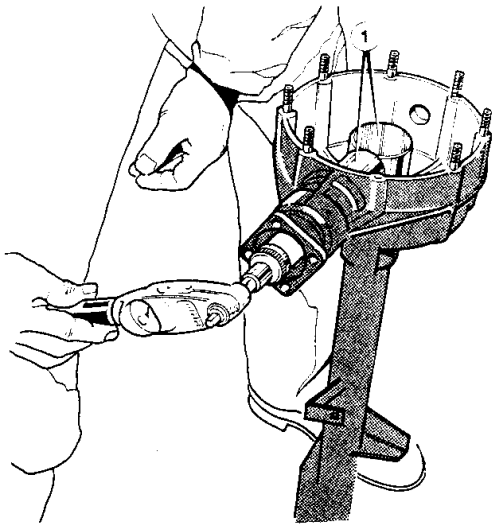


Figure 11 Measuring the torque to turn the pinion using dummy Pinion tool

1. Pinion setting tool

7. Remove the pinion flange nyloc nut and washer and withdraw the flange. Tap the pinion assembly in to centre of the axle and remove.

8. Using hand press tool No. 47 and pinion bearing remover tool RT 8765, follow the same procedure as the differential unit and remove the pinion bearing. (**Figure 8**). Note the value of the spacing washer thickness next to the pinion head plus any additional shims.

9. Following the earlier procedure, remove the left-hand brake assembly and the left-hand half shaft.

10. Using the three legged puller tool No. RT 3072-1 on slide hammer tool No. 3072, remove the axle housing outer bearing cones (**Figure 9**).

11. Should the pinion outer bearing tracks need replacement, remove with a suitable drift after gently heating the appropriate area of the casting.

12. The pinion flange oil seal will come away when the rear bearing is removed.

Operation 4 Re-assembly - determining the overall differential end float.

1. Thoroughly clean all dismantled components.

2. Place two dummy bearings RT 8732 on the ends of the differential carrier without any shims and assemble in the actual casing. Secure the two halves of the axle case.

3. Check that the differential unit rotates freely.

4. **Note:** The gauging tool RT 8732used to determine the overall differential end float, designed originally for the Robin axle, can be modified to fit the Kitten axle as explained at the end of this section. The following sequence describes the use of this modified tool.

Assemble the components of the tool, screwing the circular plates on to the push rods. Insert these through the axle tube, ensuring that the swivel pad on each end is felt to locate in each side of the differential carrier bore. Screw plates up to the axle tube and secure with the bolt supplied. Unscrew both rods slightly before finally clamping the plate. The two round knurled gauging nuts should be screwed on to the push rod, which is facing the crown wheel or pinion side of the crown wheel which, for convenience of explanation, should be on the left-hand side of the operator as they face the axle and referred to as the left-hand side throughout these instructions.

5. Unscrew the right-hand side push rod approximately 3.2 mm (1/8 in). Screw in the left-hand push rod with a load of 2-4 lb/ft maximum, thus pushing the differential assembly over in to the right-hand housing. Screw up the gauging nut lightly to the face of the circular plate. Carefully screw the locking nut up to the gauging nut and screw the push rod back approximately 3.2 mm (1/8 in), ensuring the gauge nuts move with the screw as they come away from the plate. Screw in the right-hand push rod 2-4 lb/ft maximum, thus pushing the differential unit in to the left-hand axle housing. Screw in the left-hand push rod until a stop is felt. Measure the gap between the circular plate and the gauge nut with a feeler gauge and record the figure (**Figure 10**) which will represent the overall end float.

6. Separate the casings and remove the differential assembly complete with dummy bearings , but **Do not remove the dummy bearings from the differential carrier.**

Operation 5 Re-assembly - setting the pinion

1. Ensure the pinion bearing cups are seating correctly in the pinion housing.

2. Locate the thick pinion spacer washer on the dummy pinion RT 8730 followed by the taper bearing cone.

3. Locate the dummy pinion in the pinion housing, placing the outer bearing cone in position, followed by the flange and the dummy pinion nut and tighten to give the running preload, thus setting the rollers.

4. Place the mandrell, RT 8730 in the differential side bearing bore. With a dial gauge torque wrench, check the torque required to turn the dummy pinion nut (**Figure 11**). This should read 0.115 to 0.150 kg/m (10 to 13 lb/in) torque without the oil seal, 0.150 to 0.184 kg/m (13 to 16 lb/ft) with the oil seal. Ensure that the mandrell is seating correctly and measure with feeler gauges the gap between the outside diameter of the mandrell and the dummy pinion face (**Figure 12**). Any amount in excess of 0.030 in will be the spacers required to bring the pinion to its correct operating distance. take in to account, when determining the shims required, any figure stamped on the pinion itself, which represents any variation in manufacture from the nominal mounting distance i.e. if a figure of 0.003 is stamped on the

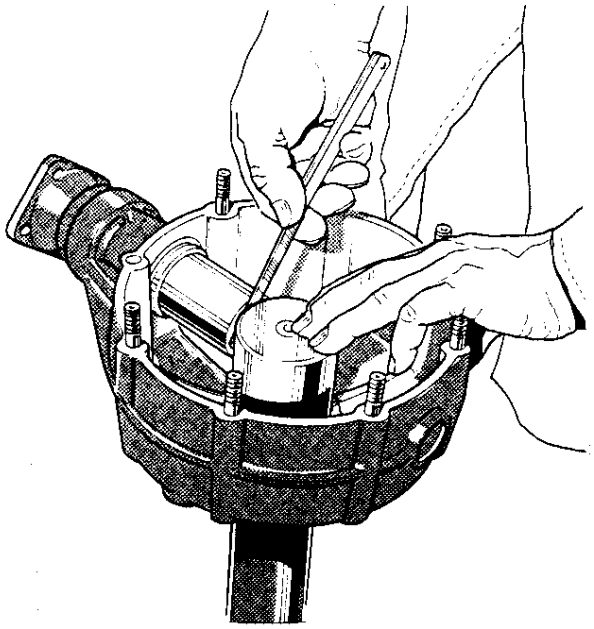


Figure 12 Determining pinion mounting distance using dummy pinion

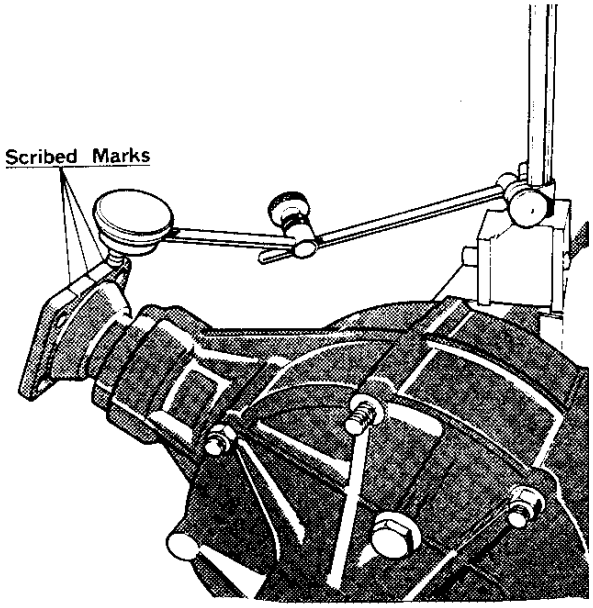


Figure 14 Determining pinion to crown wheel backlash using a dial gauge

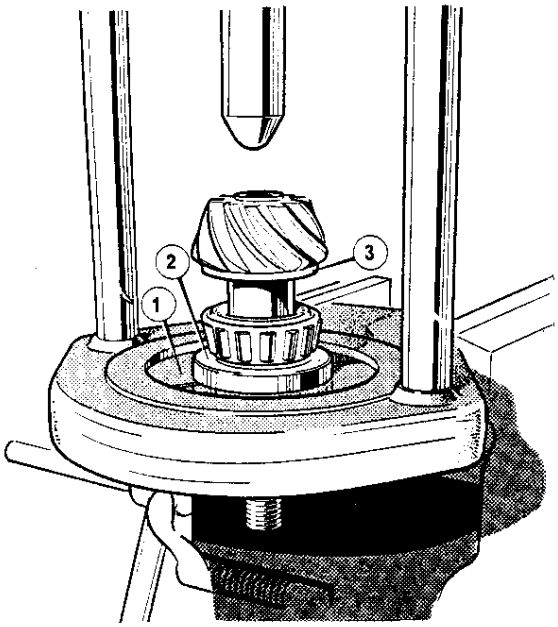


Figure 13 Replacing pinion bearing cone using hand press and collars

1. Collars

2. Adaptor

3. Spacing washer

pinion shank, this means it has been manufactured high and requires reducing in height by the same distance. Therefore if the gap measured is, say 0.044, the spacers required will be 0.44 minus 0.030 minus 0.003 which will equal spacers to the value of 0.011 thicker than that used for measurement.

5. Remove the dummy pinion assembly, place the selected spacer on the pinion and assemble the bearing cone, using the hand press tool No. 47, adapter RT 8765/2 and bearing replacer collars RT 8765/1 (**Figure 13**)

Operation 6 Re-assembly - installation of pinion in axle case

1. Add the collapsible spacer to the pinion assembly and place the new oil seal in the pinion housing. Place the pinion assembly in the pinion housing and replace the pinion flange and the nyloc nut.

2. Using a torque wrench, progressively collapse the spacer starting at 6.91 kg/m (50 lb/ft). Preload begins when end float is eliminated at approximately 11.06 kg/m (80 lb/ft).

3. Turn the pinion to ensure that the pinion rollers are correctly seated.

4. Using a torque meter, check the torque required to turn the pinion nut. This should be set at 0.150 to 0.184 kg/m (13 to 16 lb/in).

Operation 7 Re-assembly - determining the correct backlash, crown wheel to pinion

1. Replace the differential assembly complete with the dummy bearings into the differential housing and secure the two halves of the axle case together.

2. If removed, refit the push rods of tool No. RT8732 as for setting the differential end float. Slacken the right-hand side and then screw in the left-hand push rod as before, using a torque wrench set to 0.28 to 0.55 kg/m (2 to 4 lb/ft) maximum. This will give minimum backlash. Screw up the gauging nut lightly to the face of the disc and lock in position with the lock nut as before.

3. Unscrew the left-hand side and screw in the right-hand side until the correct backlash is obtained. This should be checked at the pinion flange as follows:

Setting the correct backlash, pinion to crown wheel, using a dial gauge

1. With pinion flange horizontal, scribe a centre line on the top end of the flange and a line 7/8 in on either side of it. (**Figure 14**). This represents the overall diameter of the pinion.

2. Set up a dial gauge indicator on a magnetic base as shown in **Figure 14**.

3. Using a screwdriver through the level/filler aperture, lock the crown wheel by wedging it in between the pinion flange and the bolt heads.

4. Rock the pinion flange and read off the backlash readings. This should measure 0.006 to 0.008 in.

5. Screw in the left-hand side until a stop is felt, screw up right-hand side until contact is made. Measure minimum backlash. Unscrew left-hand rod and tighten right-hand rod at approximately half turn intervals until the correct backlash is obtained.

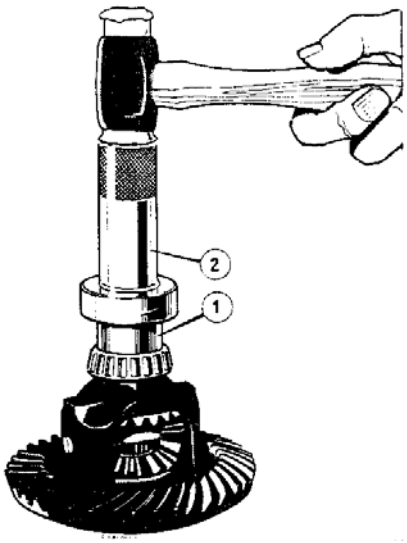


Figure 15 Replacing the differential bearing using special tool and universal handle

1. Replacer tool

2. Universal handle

6. Measure the gap between the gauge nut and the disc and record the figure. This figure represents the amount of shims, taking in to account the bearing width variation plus the manufacturers' preload, that must be fitted to the right-hand differential carrier bearing. The remainder of the shims from the overall end-float, taking in to account again any variation in bearing width, will be fitted to the left-hand or pinion side of the differential.

Example

To give correct backlash, shims required on right-hand side equals 0.030. therefore shims on right hand side will be 0.050 minus 0.030 equals 0.020. These figures have been obtained using the dummy bearings. Separate the axle cases, remove the differential and proceed as follows:

Measure and compare each dummy bearing with the overall width of the new taper bearing assembly to be fitted on each end. Ensure that the rollers are settled by rotating before measurement. The plus readings from the dummy bearings width are subtracted from the selected shims. The minus readings are added to the selected shims.

Right-hand side

Dummy bearing width example 0.710

Taper bearing width example 0.715

Actual shims required 0.30 minus 0.005 = 0.025 plus 0.002 which represents the manufacturers' preload allowance. Therefore total shims required = 0.027.

Left-hand side

Dummy bearing width example 0.712

Taper bearing width example 0.710

Actual shims required 0.020 plus 0.002 = 0.025 plus 0.022 which represents the manufacturers' preload allowance. Therefore total shims required = 0.024.

Operation 8 Final re-assembly of axle

1. Tap both the differential bearing outer tracks in to the two halves of the axle case.

2. Replace the correct shims on the differential unit. Using a hide mallet and tool number RT 550.1 and universal handle 550, replace the differential unit bearing (**Figure 18**)

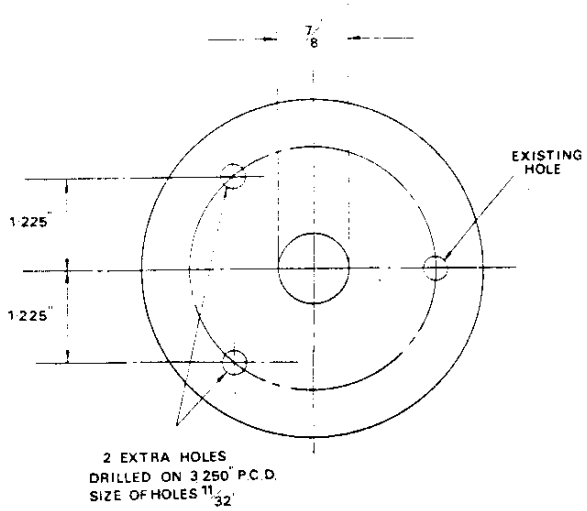


Figure 16 Modification of gauging tool RT 8732

3. Place the differential unit in to the differential case housing.

4. Replace the left-hand half shaft to assist in supporting the crown wheel and differential assembly.

5. Secure the two halves of the axle case together using Hylomar jointing compound and secure with the eight nuts and lock washers to a torque of 2.76 - 3.46 kg/m (20 - 25 lb/ft).

6. Refit the right-hand half shaft complete with hub bearing to engage in the differential unit.

7. Check that the total torque to turn the pinion flange is 0.265 to 0.334 kg/m (23 to 29 lb/in)

8. Locate the right-hand back plate and brake assembly to the axle end, positioning the back plate spacer and insert against the back plate. Align the holes and secure with the three set screws and lock washers. Ensure that the insert is free to move in the spacer aperture.

9. Clean the taper of all grease and foreign matter.

10. Position the hub key in its location and fit the hub.

11. Secure the hum to the half shaft with the nyloc nut and washer tightening to a torque of 13.8 - 15.2 kg/m (100 - 110 ft/lb).

12. Repeat the operations for the left-hand hub, back plate and brake assembly.

13. Refit the axle unit on the vehicle (see previous axle replacement procedure)

14. Reconnect the hydraulic brake pipes.

15. Check the brake drum faces are clean and refit the brake drums and wheels.

16. Adjust the brakes and bleed the brake system.

17. Top up the axle with the recommended lubricant.

18. Tighten the level/filler plug to 2.07 to 2.76 kg/m (15 to 20 ft/lb)

Modification of gauging tool RT 8732

The tool, originally intended for Robin axles, requires the drilling of two additional 11/32 in holes in the circular plate. The tool will then accommodate both Robin and Kitten axles.

It is suggested that a template is made as shown in **Figure 16** to ensure accurate drilling of the plate.

Section L

Brakes

Contents

Description

The hydraulic braking system operates drum brakes at both front and rear. A mechanical handbrake linkage is provided, operating on the rear brakes only. The brake pedal, connected directly to the master cylinder via a short push rod, also incorporates a stop light switch mounted on the pedal bracket assembly.

Routine maintenance and adjustments

Check the level of the brake master cylinder weekly and top-up if necessary.
Every 6,000 miles (10,000 km)
Adjust brakes.
Check and grease handbrake cable.
Check, bleed if necessary and top up the hydraulic system.
Inspect the hydraulic system for leaks and chafing.
Every 36,000 miles (60,000 km)
Replace fluid, renew seals or replace units, replace hoses.

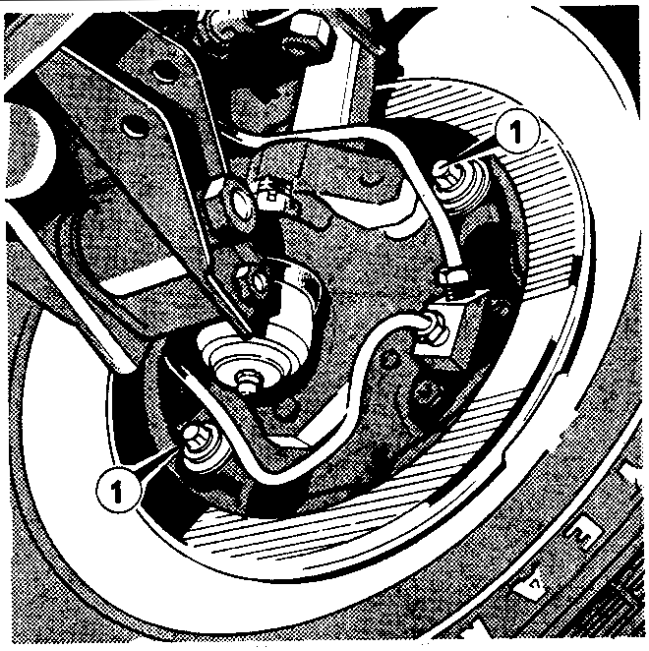
Operation 1 **Check front brake lining and adjustment**

A manual eccentric pin type brake adjuster is fitted to both brake shoes (**Figure 1**).

1. Check brake drums are cold.

2. Jack up the vehicle until the front wheel is clear of the ground.

]



Front brake adjusters
1. Adjuster

3. Remove the road wheel and fully slacken off the brake adjusters.

4. Remove the front brake drum.

5. Check the lining material thickness. Linings that are bonded to the shoes must not be allowed to wear below 1.5 mm (1/16 in) in thickness. Riveted linings should be changed when the material wears within 0.75 mm (1/32 in) of the rivet heads.

6. If the linings are serviceable refit the brake drum, locating the larger stud hole over the stud with a collar on it (this is to preserve the balance of the hub/drum assembly).

7. Replace the road wheel and adjust as follows: Turn the adjuster of one shoe to bring the lining away from the shoe (in the opposite direction to wheel rotation). Turn the other adjuster in the direction of wheel rotation until the drum is locked. Then slacken back until the wheel is sufficiently free to rotate without binding.

8. Rotate the other adjuster in the direction of wheel rotation until the drum is locked. Again back off until the wheel is just sufficiently free to turn without binding.

Note: This minimum adjustment must be performed accurately to obtain the minimum clearance between the shoe linings and drum, with consequent minimum pedal travel.

Repeat with the opposite wheel.

Operation 2 **Check rear brake lining and adjustment**

1. Jack up the vehicle until one rear wheel is clear of the ground.

2. Check the linings as described for the front wheel.

3. If the linings are serviceable, replace the drum and road wheel and adjust as follows:

Release the handbrake and whilst rotating the wheel, turn the adjuster (**Figure 2**) clockwise until the shoes touch the drum. Continue "one click" at a time until the drum is locked. Slacken the adjuster "two clicks" when the wheel should rotate freely. repeat with the other wheel.

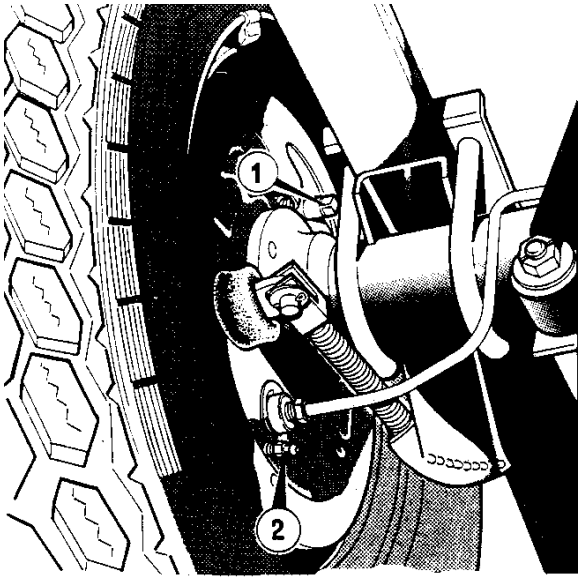


Figure 2 Rear wheel adjuster and bleed screw

1. Adjuster

2. Bleed screw

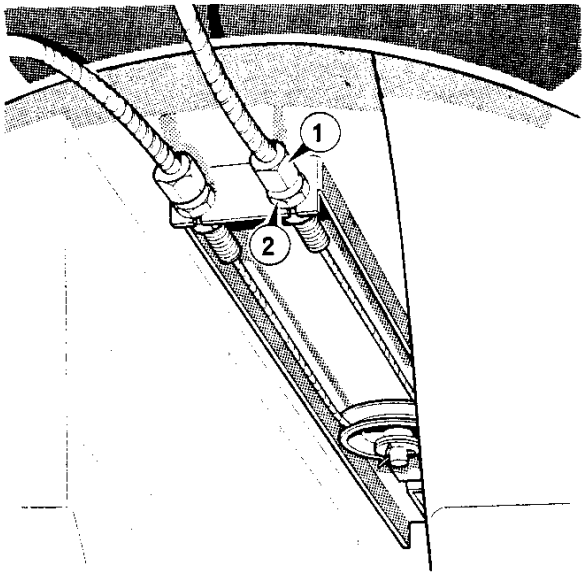


Figure 3 Handbrake adjusters

1. Adjuster nut

2. Lock nut

Operation 3 Handbrake adjustment

Before adjusting the handbrake cable, ensure that the rear brakes are correctly adjusted.

1. Ensure that the handbrake lever is in the fully "**off**" position and the cable is slack.

2. Slacken off the lock nuts shown in **Figure 3**. Adjustment can be affected by means of the main adjuster screws. Adjust the two screws equally. Re-tighten the lock nuts securely.

Handbrake cable lubrication

The handbrake cable is greased on assembly but the cable inner should be greased by means of the two grease nipples (where fitted). in adverse weather conditions especially it is wise to grease the pulley and all exposed sections of cable with special attention to the guides to avoid chafing/binding.

The hydraulic system

The hydraulic brake master cylinder is situated in the engine compartment above the driver's foot well. Before checking or replenishing the system, wipe the sides of the reservoir to prevent dirt entering the system when the cap is unscrewed. Top -up the reservoir as and when necessary using a recommended hydraulic fluid - see **Lubrication** chart page 13. Do not use other fluids, otherwise the seals may be damaged causing brake failure. Ensure that the breather hole in the filler cap is clear before replacing the cap.

Operation 4 Bleeding the hydraulic system

Bleeding - elimination of air from the hydraulic system, should only be necessary when any part has been disconnected or if the fluid level in the master cylinder has been allowed to fall so low that air has been drawn in to the system. This is usually indicated by the need to "pump" the brake pedal to obtain efficient braking. The system must then be bled.

The apparatus needed to bleed the hydraulic system consists of a clean glass jar containing some brake fluid and a rubber tube of sufficiently small diameter to fit tightly over a bleed nipple. An assistant will be required to pump the brake pedal.

1. Locate the bleed nipple on the nearside rear wheel brake back plate (**Figure 2**). Remove the dust cover and fit the rubber tube over the nipple. Immerse the other end of the tube in the brake fluid in the glass jar.

2. Unscrew the nipple about a quarter of a turn.

3. Pump the brake pedal. The operation of the brake pedal is important. The pedal must be pushed down firmly through the full stroke, followed by three short rapid strokes and the pedal should be allowed to return quickly to its stop with the foot right off.

4. Repeat this operation until the fluid expelled is free from air bubbles. Tighten the bleed nipple during a down stroke of the brake pedal.

5. Remove the bleed tube from the nipple and replace the dust cover. The above procedure must be carried out on all wheels in the order: Nearside rear - offside rear - nearside front and offside front.

Always check that the stoke of the brake pedal is not impeded by floor mats or other obstructions.

Note: Throughout the above procedure, keep the master cylinder topped up with fresh clean brake fluid. Never re-use old fluid. Scrupulous cleanliness must be observed at all times.

6. Check the operation of the brakes on road test.

Important: at 36,000 miles or three years the fluid should be changed. Brake fluid is hygroscopic so will absorb moisture over time, lowering the boiling point leading to fade or even failure of the brakes.

Operation 5 Front brakes - fitting new shoes

Always fit Reliant replacement shoes, including a new set of return springs.

To remove

1. Jack up the vehicle and place on suitable stands.

2. Remove the front road wheel and brake drum.

3. Using a large screwdriver, prise both the shoes from the grooves in the wheel cylinder pistons.

4. Remove both shoes and return springs.

Note: To prevent loss of fluid, slip a rubber band over each wheel cylinder to hold the pistons in place.

5. Clean the back plate using a vacuum cleaner or wipe out with a damp cloth. Remove all traces of dust. The old-established practice of blowing off with an air line is **NOT** recommended as it represents a potential health hazard.

6. Check the adjusters for correct operation and lubricate. Use only a proprietary brake grease.

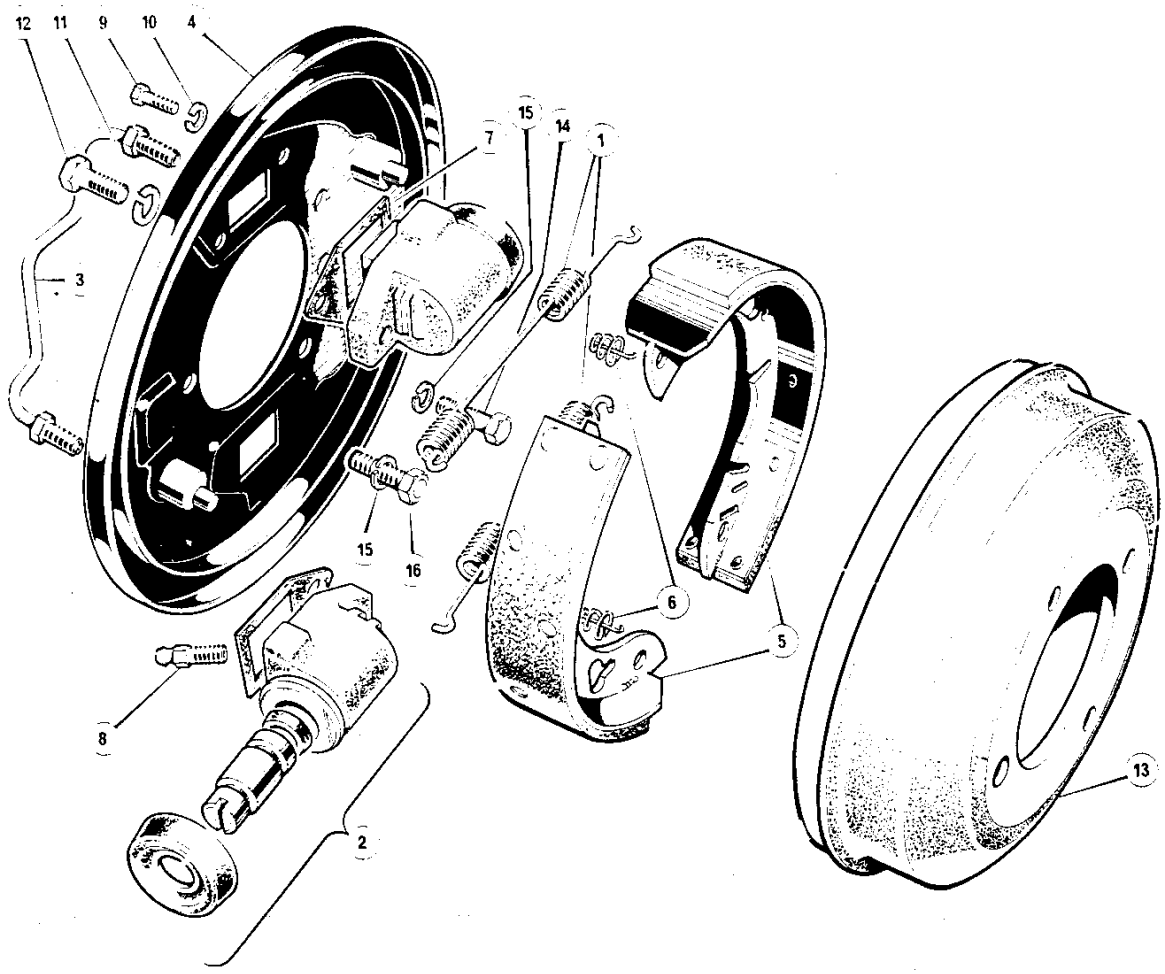


Figure 4 Front brake - exploded view

1. Pull-off spring.	9. Bolt
2. Wheel cylinder	10. :ock washer
3. Bundy pipe	11. Spring washer
4. Back plate	12. Bolt
5. Brake shoe	13. Brake drum
6, Spring	14. Bolt
7, Gasket	15. Lock washer
8, Bleed screw	16. Set screw

To replace

1. Attach new return springs to the new shoes, ensuring the springs are correctly located and positioned such as they are between the shoe webs and the brake plate on assembly (Figure 4)

Note: Try not to touch the lining material and avoid contact with grease and other contaminants.

2. Remove the rubber bands from the wheel cylinders.

3. Place the shoes in place with the springs attached, against the back plate locating the tongues of the shoes in to the grooves of the wheel cylinder bodies.

4. Locate a screwdriver under the web of one shoe against the back plate and lever the shoe over the adjuster spindle and into the wheel cylinder piston groove.

5. Repeat for the remaining brake shoe.

6. refit the brake drum, making sure it is clean and free from dust or grease.

7. Refit the road wheel and adjust the brake.

Note: Brake shoes **MUST** be changed in axle sets. Repeat for the opposite front wheel.

8. Lower the vehicle and road test to check braking performance.

Operation 6 Front wheel cylinders - removal & replacement

A leaking wheel cylinder will cause fluid loss and may lead to excessive pedal movement and contamination of the brake shoe linings, The vehicle may also show a tendency to pull or veer under braking. A seized wheel cylinder may also exhibit some of these characteristics. In either case the defective cylinder must be replaced with a new one.

To remove(**Figure 4**)

1. Remove the brake shoes as previously described.

2. Disconnect the hydraulic pipes from the wheel cylinders and plug them to avoid fluid loss or dirt ingress.

3. Remove the bleed nipple.

4. Remove the two screws and lock washers securing the wheel cylinder and withdraw the cylinder and gasket.

Repeat for the other cylinder if necessary.

Re-assemble in reverse order. Bleed the brakes.

Safety Note: Brake shoes contaminated by leaking fluid must always be replaced. On no account try to clean contaminants from brake shoe linings.

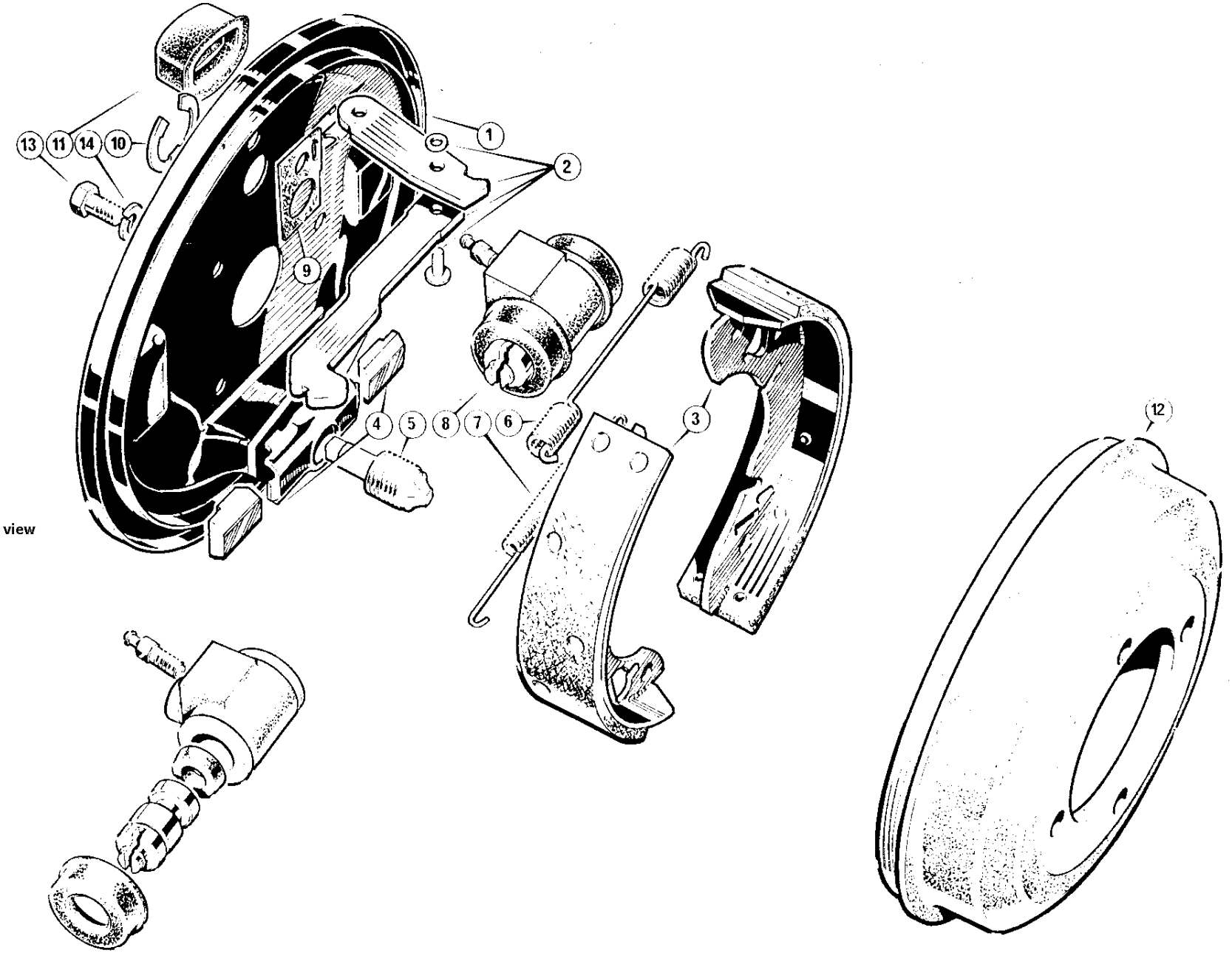


Figure 5 Rear brakes - exploded view

1. Back plate
2. Handbtake lever
3. Brake shoe
4. Tappet
5. Adjuster screw
6. Upper pull-off spring
7. Lower pull-off spring
8. Wheel cylinder
9. Gasket
10. Spring clip
11. Boot
12. Brake drum
13. Set screw
14. Lock washer

Operation 7 Rear brakes - fitting new shoes

to remove (**Figure 5**)

1. Jack up the rear of the vehicle and secure on stands.

2. Remove the road wheel.

3. Slacken off the brake adjuster and remove the drum.

4. Prise the tongue of the shoe from the wheel cylinder piston groove, adjacent to the handbrake operating lever.

5. Lift the other end of the shoe from the slot in the adjuster.

6. Lever the second shoe from the piston and adjuster, disengaging the shoe from the handbrake lever.

7. Remove both shoes complete with springs and put a rubber band around the wheel cylinder to hold the pistons in place.

8. Clean the back plate using a vacuum cleaner or wipe out with a damp cloth. Remove all traces of dust. The old-established practice of blowing off with an air line is **NOT** recommended as it represents a potential health hazard.

9. Inspect the wheel cylinder for leakage and check the condition of the rubber dust seals.

10. Inspect the adjuster for ease of operation. Lubricate if necessary using "copaslip" or a proprietary brake grease.

To replace

1. Attach new springs to the new shoes. Arrange the springs so they are on the back plate side f the shoe webs with the single coil spring adjacent to the adjuster.

2. Remove the rubber band and position the shoes on the back plate so that the handbrake lever locates in the aperture in the web of the shoe.

3. Engage the tongues of the shoe into the slots in the adjuster and wheel cylinder.

4. Repeat with the other shoe.

5. refit the brake drum after ensuring it is clean and free from grease or contaminant.

6. Refit the road wheel and adjust the brake.

Note: Brake shoes **MUST** be changed in axle sets. Repeat for the opposite rear wheel.

7. Lower the vehicle and road test to check braking performance.

Operation 8 Rear wheel cylinders - removal & replacement

Faulty rear wheel cylinders will show similar symptoms to faulty front ones. If the vehicle has a tendency to gently pull to the left or right under braking, a rear cylinder might be the cause.

To remove

1. Remove the brake shoes as previously described.

2. Disconnect the hydraulic pipe from the cylinder and plug to avoid leakage and dirt ingress. Remove the bleed nipple.

3. Prise off the wheel cylinder retaining circlip and remove the cylinder.

Replace in reverse order. Bleed the brakes.

Note: The circlip **MUST** be replaced with a new one and can be awkward to fit.

Safety Note: Brake shoes contaminated by leaking fluid must always be replaced. On no account try to clean contaminants from brake shoe linings.

Operation 9 Master cylinder - removal & replacement

A faulty master cylinder can be diagnosed by excessive pedal movement or signs of leakage around the rubber sealing gaiter and push rod. A very stiff brake pedal might indicate a seized master cylinder piston. Overhaul is not advised with complete replacement of a faulty or worn unit being the recommended course of action.

To remove

1. From within the engine compartment, prise out the grommet located on top of the driver's foot well to gain access to the split pin and clevis connecting the master cylinder to the brake pedal. Remove the split pin and washer.

2. From within the foot well, remove the clevis pin and disconnect the master cylinder.

3. Disconnect the fluid pipe from the master cylinder and plug to avoid leakage or dirt ingress.

4. Unscrew the nut and set screw compete with lock washers, securing the master cylinder to the body and pedal bracket and remove the master cylinder.

Replace in reverse order. Bleed the brakes.

Brake pedal assembly

Removal and dismantling / re-assembly of the brake pedal assembly is explained in **Section H** - The clutch.

Operation 10 Handbrake cable - replacement

To replace handbrake cable (**Figure 6**)

1. With the handbrake in the off position, remove the split pins washers and clevis pins and disconnect the cable from the right and left-hand rear brake plates.

2. Remove the inner cables from the cable guides and release the outer cables from the stop brackets on the axle tubes.

3. Pull down the handbrake pulley and detach from the clevis by removing the split pin, washer and clevis pin.

4. Slacken the adjuster locking nut, release the cable from the handbrake mounting plate and withdraw the cable from the vehicle.

5. Locate the new cable in the handbrake mounting plate and secure with the lock nuts.

6. Fit the pulley in the cable and secure with the clevis pin, washer and a new spilt pin.

7. Locate the cables in the axle stops and feed the inners around the cable guides.

8. Connect the right and left-hand cables to the operating arms on the brake plates with the clevis pins, washers and new split pins.

9. Adjust the hand brake.

Operation 11 Handbrake lever - removal & replacement

1. With the handbrake off, remove the split pin, washer and clevis pin connecting the handbrake cable pulley clevis to the handbrake lever.

2. From inside the vehicle, peel back the carpet around the handbrake lever. Unscrew three set screws, lock washers and coach washers and detach the handbrake lever from the body mounting.

Replace in the reverse order, and re-adjust the handbrake if necessary.

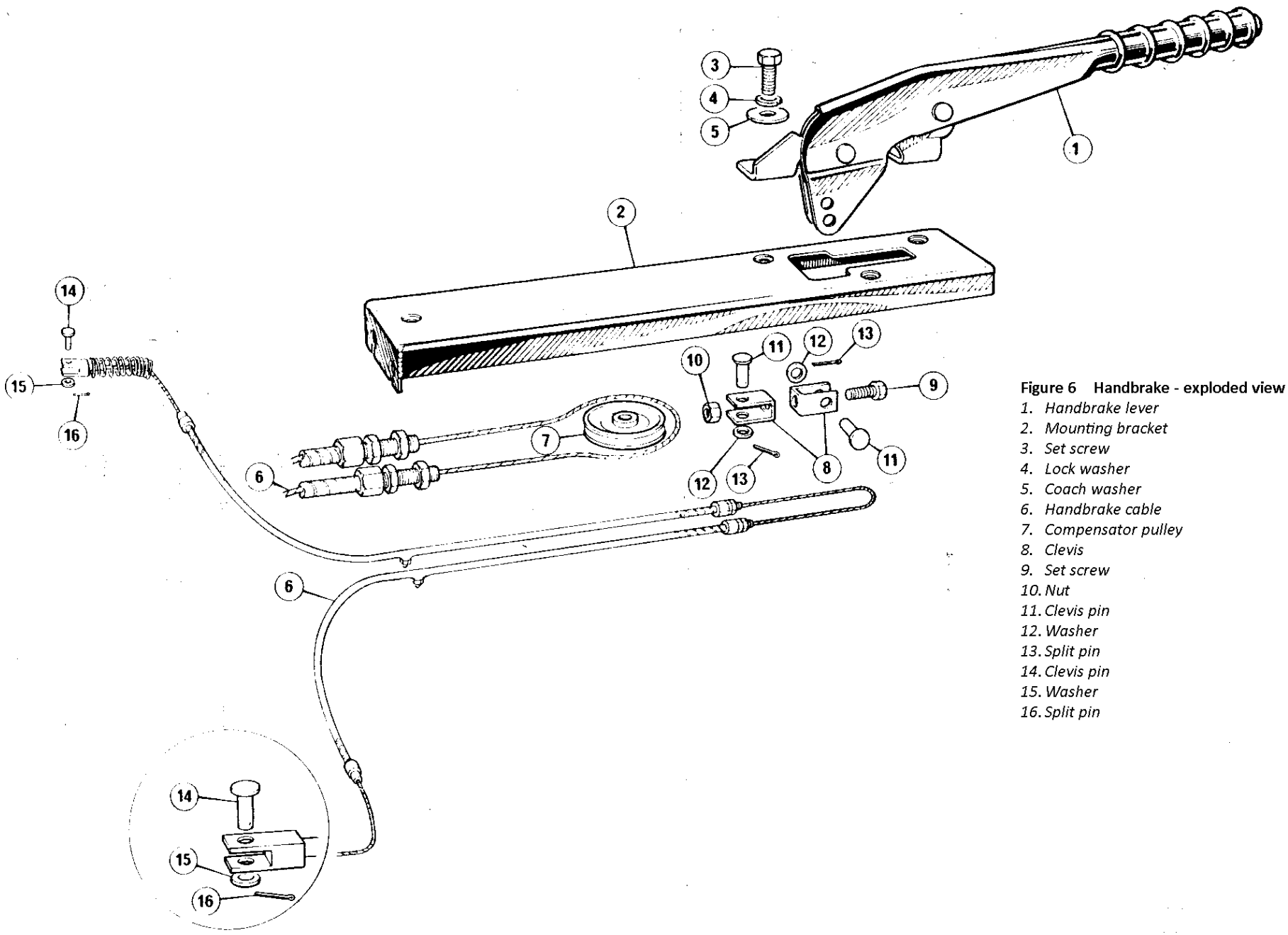


Figure 6 Handbrake - exploded view

1. *Handbrake lever*
2. *Mounting bracket*
3. *Set screw*
4. *Lock washer*
5. *Coach washer*
6. *Handbrake cable*
7. *Compensator pulley*
8. *Clevis*
9. *Set screw*
10. *Nut*
11. *Clevis pin*
12. *Washer*
13. *Split pin*
14. *Clevis pin*
15. *Washer*
16. *Split pin*

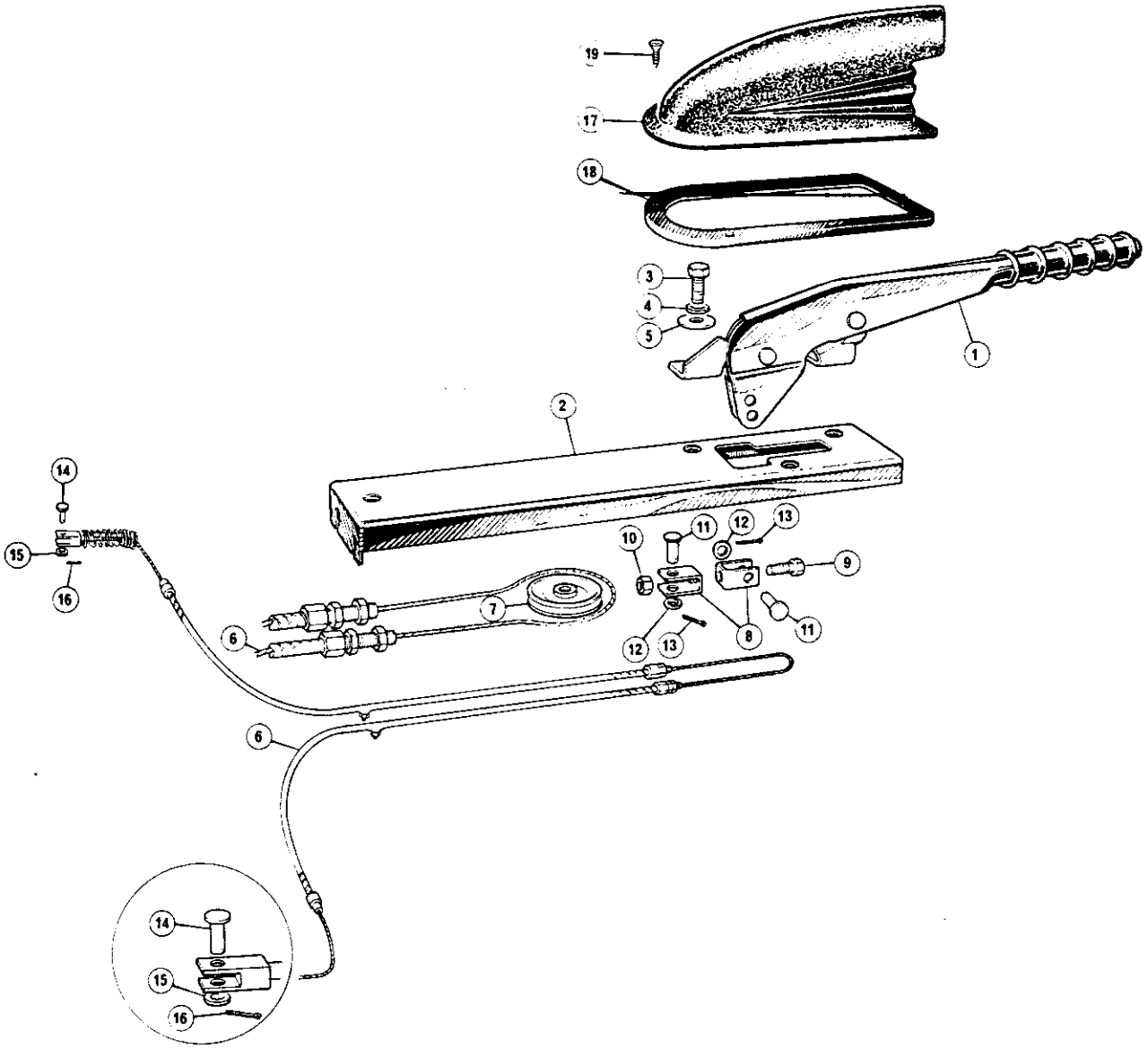


Figure 7 Handbrake lever - after chassis no:
6F7/14701001 - saloon,
6F7/14801002 - estate,
6H1/14901043 - van.

1. Handbrake lever
2. Mounting bracket
3. Set screw
4. Lock washer
5. Coach washer
6. Handbrake cable
7. Compensator pulley
8. Clevis
9. Clevis bolt
10. lock nut
11. Clevis pin
12. Washer
13. Split pin
14. Clevis pin
15. Washer
16. Split pin
17. Handbrake gaiter
18. Retaining ring
19. Screw

Dual circuit braking system

A dual line braking system was fitted to later cars. A tandem master cylinder is fitted for use with the dual line system.
The master cylinder incorporates a pressure failure switch, the purpose of which is to provide a visual warning of front or rear brake failure caused by pressure loss. Pressure generated in the master cylinder passes either side of a shuttle valve, which under normal conditions remains stationary. A pressure failure in either the front or rear circuits causes the shuttle valve to move and actuate the switch. This completes and electrical circuit which operates a warning light on the dash panel, located between the speedometer and the combination gauge. The warning light includes a test switch that can be manually operated to test the circuit and the bulb operation.
Repairs and maintenance of the dual circuit system are the same as for the single line system with the exception of the pressure release valve, not fitted to the earlier cars.

The hydraulic system pressure reducing valve is fitted to stop the rear wheels locking prematurely under heavy braking. In the event of front hydraulic failure the valve allows full pressure to operate the rear brakes.
The valve is fitted to a bracket on the right-hand chassis main rail below the drivers' foot well.

To remove

1. Disconnect the brake fluid pipes from the valve and plug to avoid leakage/ dirt ingress.
2. Remove the single set screw securing the valve to the chassis bracket and withdraw the valve.

Replace in reverse order

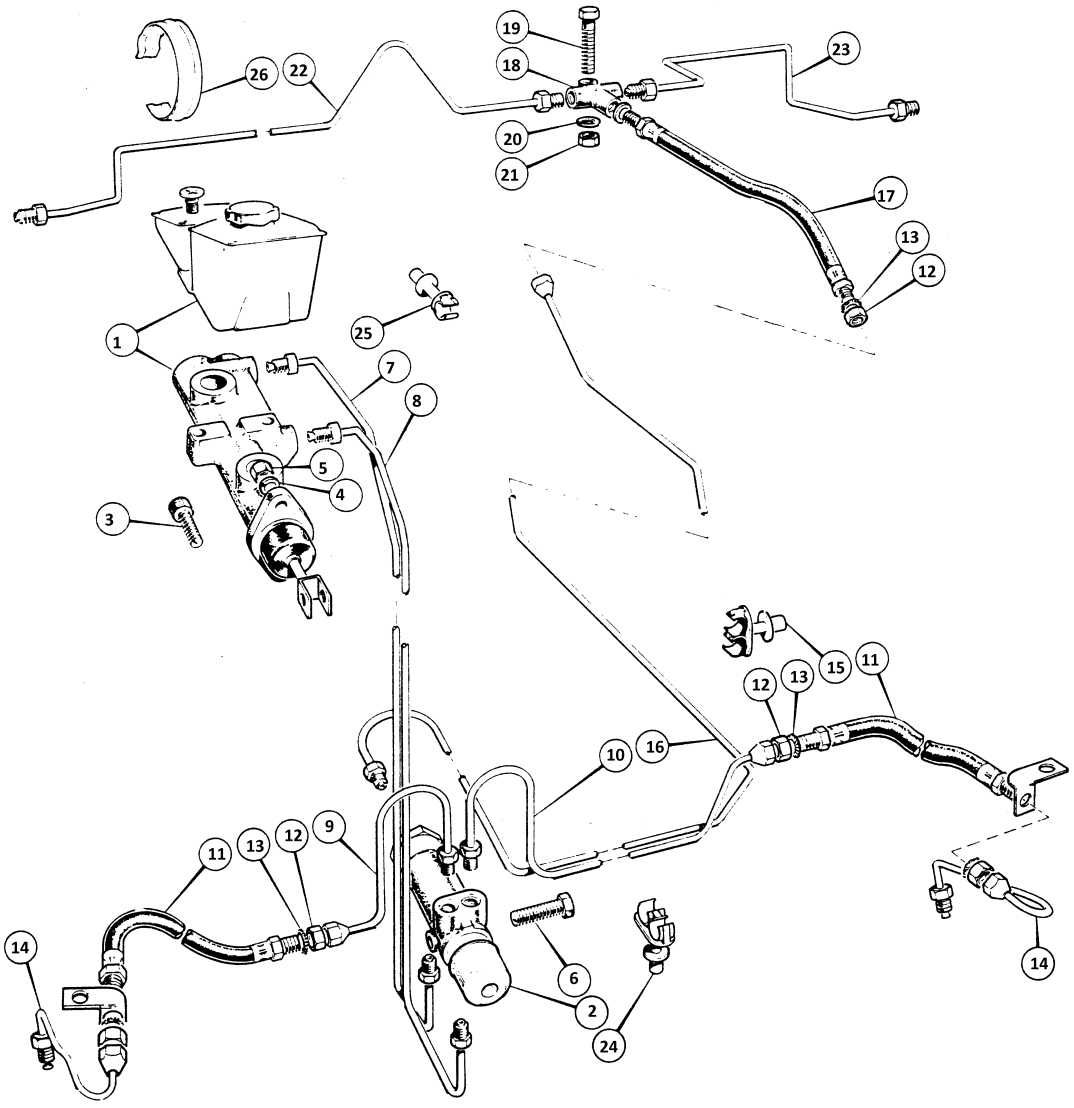


Figure 8 Dual circuit braking system

1.	*Master cylinder*	*10.*	*R/H bundy link pipe*	*19.*	*Set screw*
2.	*Pressure reducing valve*	*11.*	*Front flexible hose*	*20.*	*Lock washer*
3.	*Bolt*	*12.*	*Lock nut*	*21.*	*Nut*
4.	*Lock washer*	*13.*	*Lock washer*	*22.*	*L/H rear brake bundy pipe*
5.	*Nut*	*14.*	*Wheel cylinder link bundy pipe*	*23.*	*R/H rear brake bundy pipe*
6.	*Set screw*	*15.*	*Clip*	*24.*	*Bundy clip*
7.	*Primary bundy pipe*	*16.*	*PRV to rear circuit bundy pipe*	*25.*	*Bundy clip*
8.	*Secondary bundy pipe*	*17.*	*Rear flexible hose*	*26.*	*Bundy to axle clip*
9.	*L/H bundy link pipe*	*18.*	*3-way connector*		

Section M Wheels and tyres

Contents

Description

Wheels fitted as standard equipment are pressed steel type with polished wheel nave/hub caps which spring over projections on the wheel.
Radial ply tyres size 145 x 10 are fitted to all models. Replacements must be of radial ply construction.

Tyre pressures and care of tyres

Regular inspection of tyres should be made to check the condition of the tyre, treads and walls. Flints and stones should be removed from the tyre tread, if neglected they may work through and damage the casing. Any oil or grease contamination must be cleaned off with petrol lest deterioration of the rubber be caused. Do not use paraffin as this will damage the tyre. Tyre pressures must only be adjusted when cold. During use, the tyre warms up and pressure increases and this additional pressure must not be released as the tyre will be under inflated when cold. Under inflation will result in accelerated tread wear and can cause side wall damage.
Maintain the tyres, including the spare, at the recommended pressures as follows:

Tyre pressures - saloon and estate

Normal load: Saloon/Estate	Front	1.41 kg/cm² (20 lb/in²)
	Rear	1,55 kg/cm² (22 lb/in²)
Van	Rear	1.69 kg/cm² (24 lb/in²)
Full load: Saloon/Estate	Front	1.41 kg/cm² (20 lb/in²)
	Rear	1.99 kg/cm² (28 lb/in²)
Van	Rear	2.11 kg/cm² (30 lb/in²)

Repairs

A puncture must be repaired either with a permanent vulcanised repair if possible, or by the fitment of a tube. Any damage to the tread edges or side walls will render the tyre unusable and it must be replaced.

Tyre rotation

With radial ply tyres, the tyre manufacturers recommend that tyres are changed around at intervals no greater than 3000 miles (5000 km) to even out wear, but best results are obtained if they are left in the positions first fitted. If wheel changes are undertaken it is advised only to change from side to side on the same axle, never diagonally. With cross ply tyres it is recommended that the tyres be rotated diagonally front to rear every 6,000 miles (10,000 km)

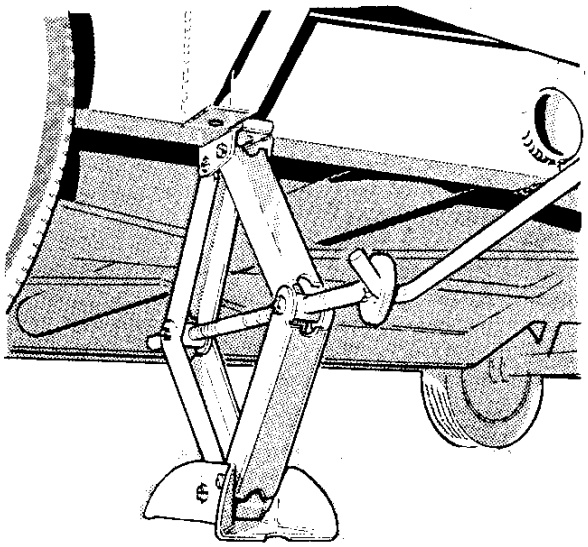


Figure 1 Jacking point - front

Jacking positions

Before changing a wheel, or carrying out any servicing, ensure that the vehicle is on level ground, with the handbrake applied and, if necessary, the wheels properly chocked.
Note: Work must never be carried out underneath a vehicle when it is supported only on a jack. A proper chassis stand must be used to support the vehicle.

Front

The front wheel can be raised by positioning the jack at the front of either main chassis rail adjacent to the front outrigger (**Figure 1**).

Rear

For the rear, the recommended jacking point is at the extreme rear end of the main chassis member (**Figure 2**).

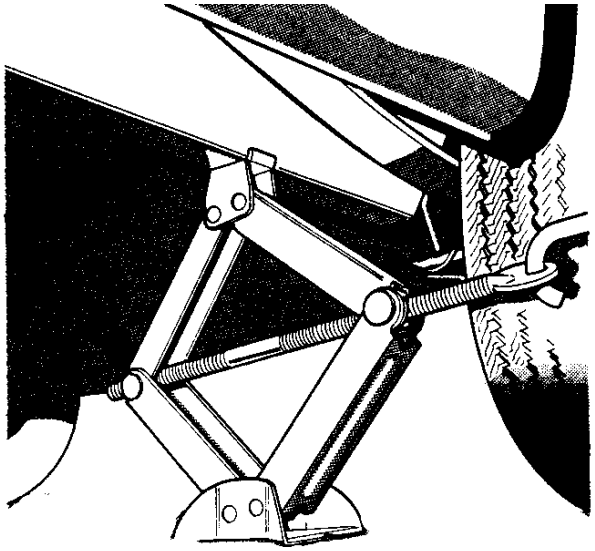


Figure 2 jacking point - rear

Wheel removal and inspection

1. Remove the nave/hub caps and wheel trims and loosen the wheel nuts.

2. Jack up the vehicle until the wheel is clear of the ground.

3. Remove the wheel.

4. Examine the wheel carefully for damage. Use a wire brush to clear any corrosion. Inspect the centre for cracking, especially in the area of the wheel nut apertures. Repairs to damaged wheels should not be carried out. The wheel should be renewed.

5. Refit the wheel.

6. The wheel nuts must be fitted with the tapered end towards the wheel face. Do not over tighten the wheel nuts. The pressure that can be applied with the supplied wrench will be sufficient. If a torque spanner is used the tightening torque should be 4.15 to 4.84 kg/m (30 to 35 lb/ft).

Valves and caps

When checking tyre pressures always ensure that the dust cap is replaced on the valve and tightened down firmly by hand only. The cap prevents the ingress of dirt and acts as an extra barrier against leakage should the valve fail. New valve cores can be fitted using a valve coring tool (Figure 3).

When replacing a tyre, a new tubeless valve complete should also be fitted.

Wheel and tyre balance

unbalance in wheel and tyre assemblies will be responsible for various effects such as wheel wobble, abnormal war of tyres and suspension components, vibration through the steering or, in extreme cases the whole vehicle.

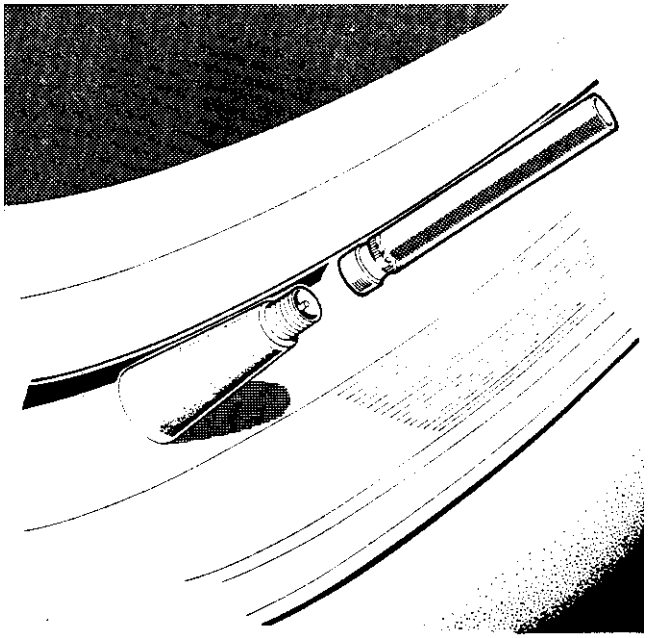


Figure 3 Valve fitting tool

Wheels should be balanced when new tyres are fitted. This can be done statically but all tyre suppliers should have a dynamic balancing machine. Failing to have the wheels balanced is false economy as the tyre life will be noticeably better with the wheels balanced.

Contents

Description

The exhaust system of both saloon an estate comprises of two main units, the manifold and a one-piece downpipe and silencer assembly. The downpipe is secured to the manifold by two brass nuts and supported by means of a bracket and clamp attached to a bell housing stud at the front of the system. The rear is supported with a flexible rubber ring attached to hooks on the tail pipe and the rear chassis cross member.

Routine maintenance

The only routine maintenance is to inspect the system for corrosion and damage paying particular attention to the silencer, plus the periodic checking of the tightness of all nuts, bolts and fixings. It is recommended that these checks be carried out every 6,000 miles (10,000 km).

Operation 1 **Exhaust system - removal and replacement**

To remove (**Figure 1**)

1. Remove the two brass nuts securing the downpipe to the exhaust manifold.
2. Slacken the nut securing the support bracket to the bell housing.
3. At the rear, prise off the rubber ring supporting the tail pipe.
4. Remove the nut and washer from the bell housing bolt and manoeuvre the exhaust system out from under the car.

To replace

Replace in the reverse order, fitting a new manifold to downpipe gasket and new brass nuts. Check the tightness of all fixings after the engine has been run up to normal temperature.

Operation 2 **Exhaust silencer - replacement**

A silencer repair kit is available to enable a system to be repaired when only the silencer has deteriorated leaving the downpipe in good condition. The repair involves cutting off the silencer and splicing a new one on to the existing downpipe.

1. Remove the exhaust system.
2. Cut off the damaged silencer 76.2 mm (3 in) forward of the silencer box.
3. Join the new silencer to the downpipe using the stub pipe in the kit.
4. Fit the supplied clamps but do not fully tighten.
5. Refit the system to the car, adjust at the rear for clearance

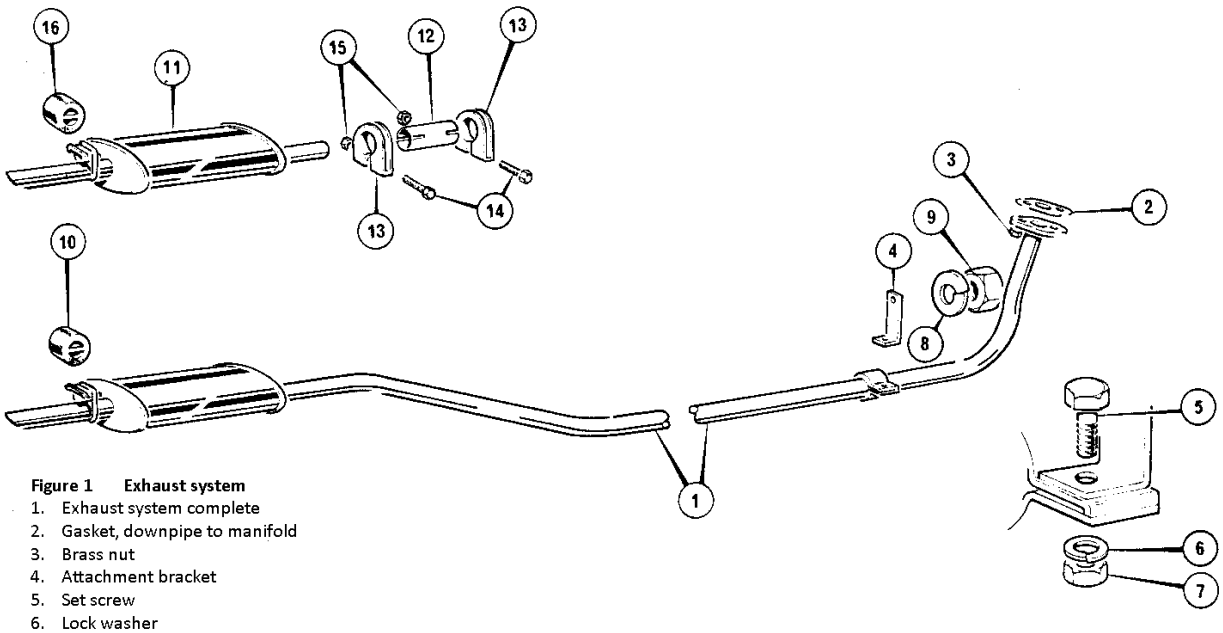


Figure 1 **Exhaust system**

1. Exhaust system complete
2. Gasket, downpipe to manifold
3. Brass nut
4. Attachment bracket
5. Set screw
6. Lock washer
7. Nut
8. Lock washer
9. Nut
10. Rubber ring
11. Exhaust silencer repair kit
12. Connecting tube - repair kit
13. Clamp - repair kit
14. Bolt - repair kit
15. Nut - repair kit
16. Rubber ring - repair kit

Section P

Fuel system

Contents

Description

Fuel is pumped by a diaphragm pump to the carburettor from a rectangular fuel tank mounted under the floor at the rear of the vehicle. The fuel is filtered by a gauze filter located on the pick-up pipe adjacent to the fuel tank. The float operated sender unit in the tank actuates the fuel gauge situated in the fascia.
The carburettor is an SU type HS2 conforming to the department of the environment vehicle emission regulations.
Air drawn in to the carburettor is filtered by a dry paper element air filter.

Routine maintenance

The carburettor dash pot in the suction chamber requires topping up every 3,000 miles (5,000 km) (Figure 1).
The air filter element should be checked every 6,000 miles (10,000 km) and replaced at 12,000 mile (20,000 km) intervals.
The in-line fuel filter should be renewed at 12,000 mile (20,000 km) intervals.

Operation 1 **Fuel tank - removal and replacement**

If water, or any other contaminant detrimental to the fuel system are present in the fuel tank it should be removed and flushed out with clean petrol.

To remove

1. disconnect the battery.

2. If a ramp is not available, block the front wheels, jack up the rear of the vehicle and support on secure axle stands under the chassis.

3. Remove the drain plug and drain the contents of the fuel tank.

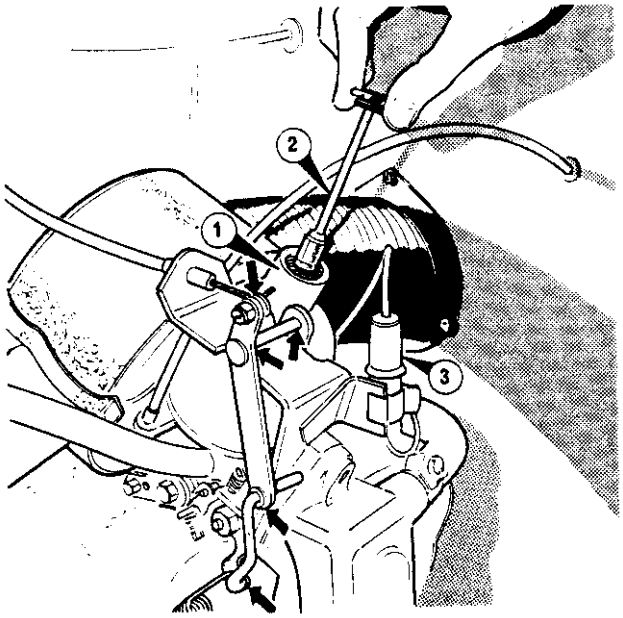


Figure 1 **Carburettor lubrication**

1. *Suction chamber*
2. *Damper*
3. *Fuel trap*

4. Slacken the jubilee clip securing the filler hose to the tank filler tube and lever the hose off the tank.

5. Slacken the jubilee clip holding the smaller breather hose to the tank and disconnect the hose.

6. Disconnect the fuel supply pipe at the sleeve connector located on the right-hand chassis side member.

7. Remove the nut and washer securing the fuel tank to the left-hand and right-hand support straps.

8. Remove the screw, lock washer and nut securing the fuel tank to the support bracket to the chassis member.

9. Bend the retaining straps outwards away from the tank mounting studs. take care not to damage the mounting stud threads.

10. Carefully lower the tank, disconnect the sender unit and remove the fuel tank from the car.
Re-assemble in reverse order.

Operation 2 **Fuel tank sender unit - removal and replacement**

If faulty readings are suspected on the indicator gauge check the indicator and sender unit as follows:

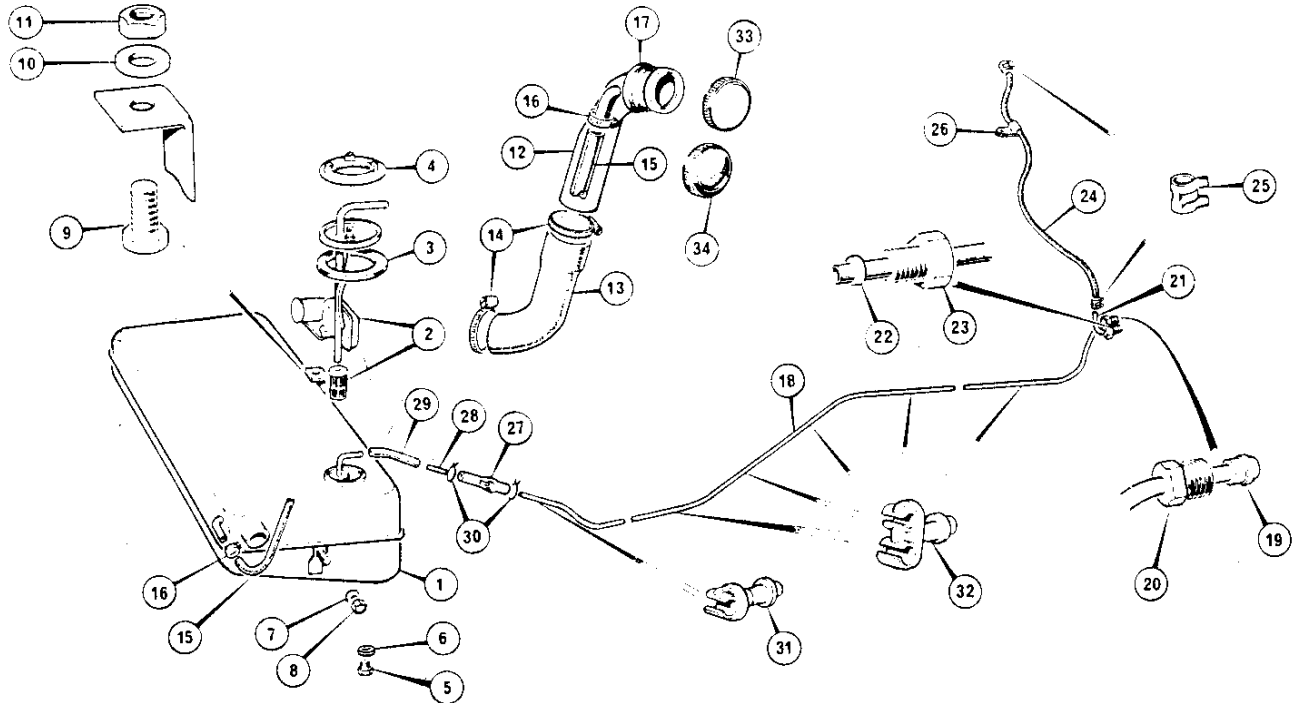
1. Remove the fuel tank a previously described in **Operation 1**.

2. Twist the sender unit locking ring to release the unit from the tank and withdraw the sender unit.

3. With the sender lead disconnected, turn on the ignition and the gauge should read empty.

4. Now touch the lead to ground and the gauge should move to full. This will confirm that the gauge and circuitry is working correctly.

5. Reconnect the sender lead to the sender and earth the body. Manually operate the float lever. With the float at the bottom the gauge should read empty. raising the float, the needle should smoothly move to full. Any deviation from these readings will confirm that the sender unit is faulty and will need renewing.



1

Figure 2 Fuel tank and pipes

1.	*Fuel tank*	*13.*	*Hose*	*24.*	*Pipe, pump to carburettor*
2.	*Sender unit*	*14.*	*Clip*	*25.*	*Clip*
3.	*Sealing ring*	*15.*	*Breather hose*	*26.*	*"P" clip*
4.	*Locking ring*	*16.*	*Clip*	*27.*	*In-line petrol filter*
5.	*Drain plug*	*17.*	*Grommet*	*28.*	*Pipe*
6.	*Washer*	*18.*	*Pipe, pump to filter*	*29.*	*Sleeve*
7.	*washer*	*19.*	*Olive*	*30.*	*Clip*
8.	*Nut*	*20.*	*Nut*	*31.*	*Clip*
9.	*Set screw*	*21.*	*Pipe, filter to pump*	*32.*	*Clip*
10.	*Washer*	*22.*	*Olive*	*33.*	*Petrol cap*
11.	*Nut*	*23.*	*Nut*	*34.*	*Filler cap (chrome)*
12.	*Filler tube*				

Operation 3 Fuel pump - Check function, removal, replacement and overhaul

Testing the fuel pump

Providing there are no leaks or obstructions in the fuel line, a quick check on the fuel pump efficiency can be made a follows:

1. Disconnect the carburettor feed pipe at the fuel pump outlet.

2. Connect a slave pipe to the outlet and place in a clean jar.

3. Crank the engine, when a well defined spurt of fuel should be apparent for each revolution of the engine. If the pump does not operate satisfactorily an overhaul is needed.

To remove and dismantle (**Figure 3**)

1. Disconnect the fuel pump inlet and outlet pipes and plug to avoid leakage or dirt ingress.

2. Unscrew the fixing nuts and lock washers and remove the pump.

3. Before dismantling, clean the exterior of the pump and mark the upper and lower halves in line with the tang on the diaphragm to aid re-assembly.

4. Remove the five screws and separate the upper and lower halves of the pump.

5. Hold the pump in an inverted position, push in and then turn the diaphragm through 90° to release the pull rod from the key in the rocker arm assembly.

Note: The diaphragm and pull rod assembly are riveted together and must not be dismantled.

6. release the circlip and withdraw the rocker arm and extension spindle from the lower body.

7. Remove the rocker arm and extension, complete with washers and return spring.

8. Check components for wear and renew if necessary for subsequent re-assembly.

Note: If the valves are peened in they are **not** replaceable. If these are faulty a new pump complete will need to be fitted.

To re-assemble and refit

1. Locate the rocker arm, complete with return spring and extension into the lower pump body.

2. Insert the spindle, locate the two washers and secure with the circlips.

3. Position the diaphragm on the lower body seating and pull rod key plate if fitted.

4. Insert the diaphragm pull rod into the rocker arm extension key and rotate through 90° to lock in to position.

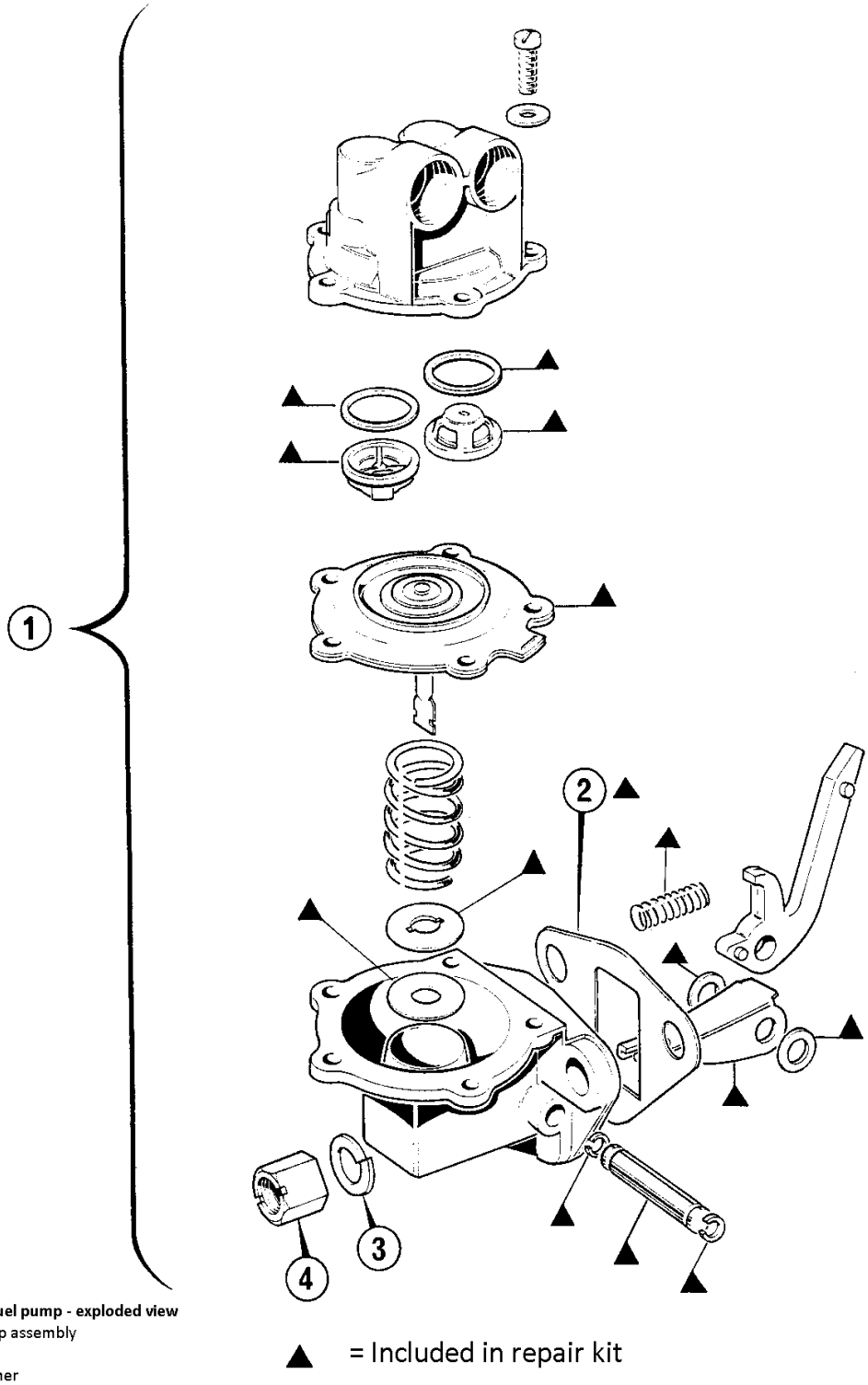


Figure 3 Fuel pump - exploded view

1. Fuel pump assembly
2. Gasket
3. Lock washer
4. Nut

Note: Ensure the tab on the diaphragm aligns with the mating mark on the lower body.

5. Fit the upper body, ensuring the mark aligns, and replace the five screws only finger tight. Operate the pump a few times to centralise the diaphragm. then tighten the screws securely diagonally.

6. Clean the pump mounting face on the cylinder block and fit a new gasket.

7. Locate the pump on the studs. Insert the rocker arm through the aperture in the cylinder block wall so the arm rests on the camshaft eccentric.

8. Secure the pump with nuts and lock washers.

9. Remove the plugs and reconnect the fuel pipes.

10. Run to check for leaks.

Exhaust emission

Kittens have been manufactured to conform with legislation on exhaust emission. The law requires that carbon monoxide (CO) emission must not exceed 4.5% with the idle speed increased by 250 rpm or decreased by 100 rpm from the manufacturer's recommendation.

Vehicles fitted with a carburettor having a tamper proofing device conform with more stringent regulations requiring the mandatory sealing of adjusters to prevent the value of exhaust emissions exceeding the permitted level.

The tamper proof carburettor has the mixture factory sealed by the fitting of semi-circular plastic shrouds with a snap fastening around the mixture adjusting nut after the correct setting has been obtained. If any attempt is made to remove these they will break off. Early vehicles do not have these shrouds but are still required to be adjusted to meet the regulations.

The information in the manual includes details of slow running and fast idle adjustments only.

These are the only legal adjustments within the scope of the owner mechanic, without specialised equipment.

If further servicing or adjustment is needed this can only be carried out by an authorised Reliant Dealer. Any adjustment made without the specialist equipment, or the breaking of the tamper proof shrouds is now an offence and will result in the vehicle failing to comply with the emission regulations specified by the Department of Transport.

Carburettor

The following information includes details of slow running and fast idle adjustments. It cannot be over emphasised that these are the only adjustments to be carried out by the owner.

Adjusting the carburettor

Before adjusting the carburettor it is essential that maladjustment or faults from other sources are eliminated. Therefore, it is essential to check the following:

(a) Valve clearances
(b) Spark plug condition
(c) Contact breaker gap
(d) Ignition timing and advance
(e) Possible air leakage into induction system

The latter will result in erratic running and misfiring due to weak mixture. Air leaks can be caused by split or perished hoses, a worn, split r missing "O" ring in the oil filler cap, a damaged rocker cover gasket or even by the dipstick not being fully seated in its tube.

Operation 4 Adjusting - idling or slow running

1. Run the engine until it reaches normal running temperature.

2. Turn the throttle adjusting screw (**Figure 4**) clockwise to increase the speed, or anti clockwise to decrease until the desired idling speed is obtained.

The exhaust note should be regular and even at the correct idling speed of 900 rpm. The carburettor is factory set to idle at this speed. Should the idle speed alter over time, due to usual wear and tear, and restoring the correct idling speed results inerratic running, then the vehicle must be returned to an authorised Reliant dealer for rectification.

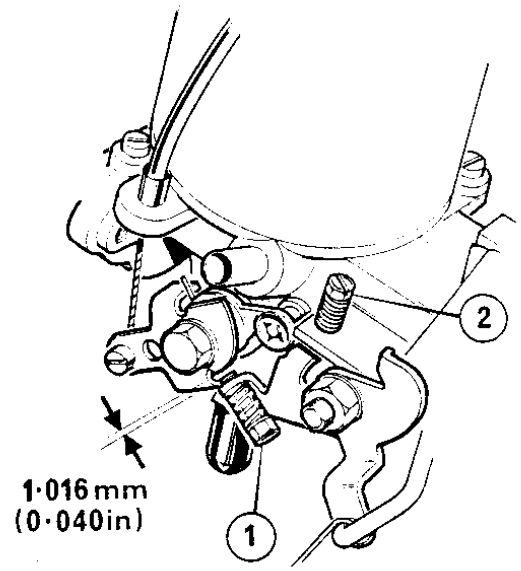


Figure 4 Slow running and fast idle screws
1. Fast idle adjustment screw
2. Throttle adjustment screw

Operation 5 Fast idling (choke) adjustment

Pull out the mixture control (choke) until the linkage is just about to move the jet. Start the engine and adjust the fast idle screw (**Figure 4**) to give an engine speed of 2,250 rpm. Push the choke fully in and check that there is a clearance of 1.016 mm (0.040 in) between the end of the screw and the cam. The choke cable should have a clearance of 1.6 mm (1/16 in) free movement before it starts to pull on the cam lever.

Note: Any adjustment of the slow running (idling) must be followed by a check of the fast running adjustment.

Accelerator pedal assembly

The accelerator pedal shares the mounting bracket with the brake and clutch pedals. This assembly has to be removed from the foot well before the pedals can be dismantled. The procedure for this is described in **Section H.**

Accelerator cable

The accelerator cable is adjusted by means of the trunnion (solderless nipple) on the operating linkage.

To adjust

1. Slacken the trunnion securing the accelerator cable.

2. Pull the inner cable through the trunnion to take up the slack.

3. Tighten the screw.

4. Start the engine and check operation. Readjust if necessary.

Accelerator cable removal (Figure 5)

1. From within the vehicle foot well disconnect the inner cable and nipple from the lug on the pedal stem.

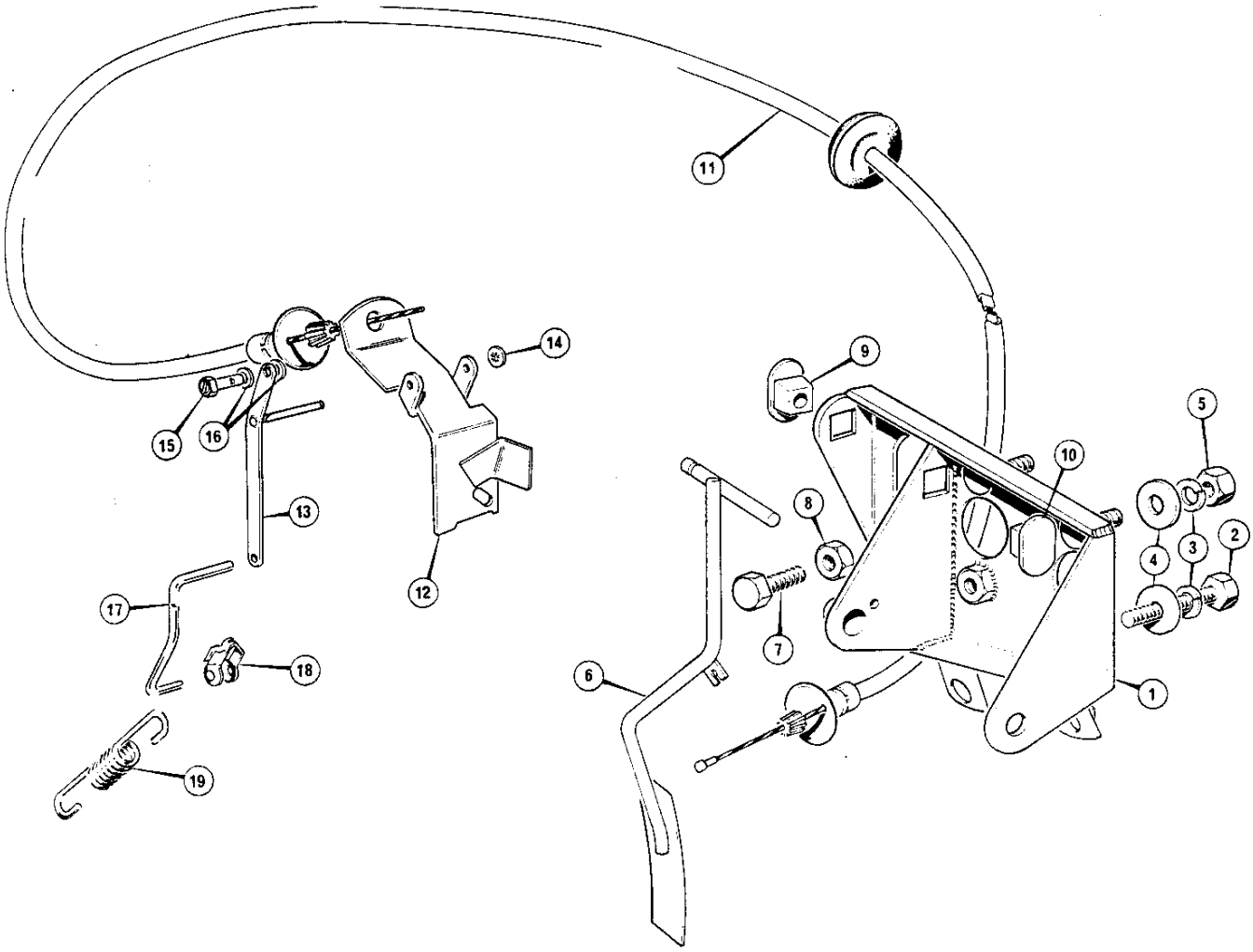


Figure 1 Accelerator mechanism

1.	*Pedal mounting bracket*	*10.*	*Bearing*
2.	*Set screw*	*11.*	*Throttle cable*
3.	*Lock washer*	*12.*	*Abutment bracket*
4.	*Washer*	*13.*	*Pivot pin and lever assembly*
5.	*Nut*	*14.*	*Star lock washer*
6.	*Accelerator pedal*	*15.*	*Trunnion (Solderless nipple)*
7.	*Pedal adjuster screw*	*16.*	*Washer*
8.	*Lock nut*	*17.*	*Link*
9.	*Accelerator pedal bearing*	*18.*	*Clip*
		19.	*Throttle return spring*

2. Apply pressure to the lugs on the plastic fastener securing the outer cable to the pedal bracket and withdraw the cable from the bracket.

3. Remove the accelerator cable grommet from the bulkhead.

4. Slacken the screw in the trunnion and withdraw the cable.

5. Apply pressure to the lugs on the plastic fastener and disconnect the cable from the linkage bracket.

6. Remove the cable.

Replace in reverse order

Air cleaner (Figure 6)

To remove air cleaner element

1. Wipe clean outside of the air cleaner and release the two clips retaining the body to the base plate..

2. Remove the body, then remove the element.

To replace

1. Clean the base plate and body interior.

2. lightly smear the plastic ends of the element with petroleum jelly.

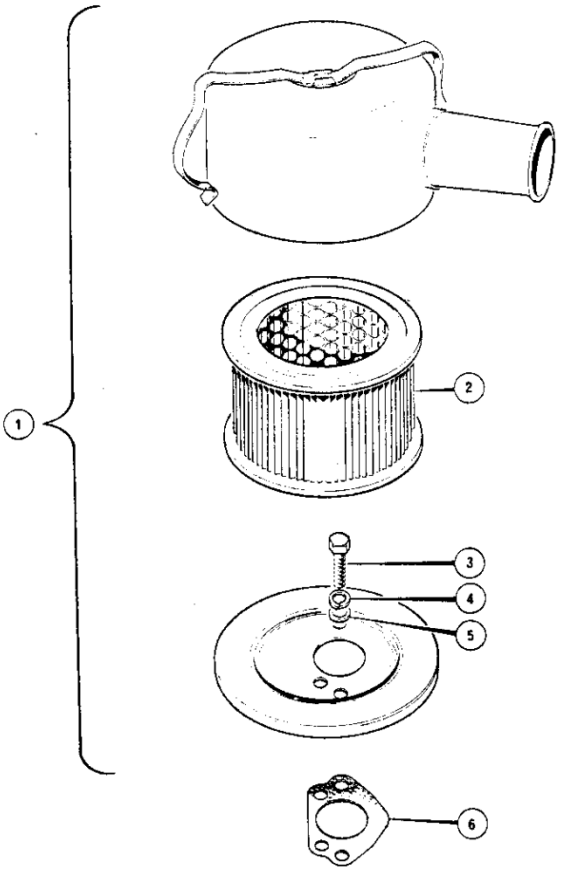


Figure 6 Air cleaner

1. Air cleaner
2. Paper element
3. Set screw
4. Lock washer
5, Washer
6. Gasket

3. Position the new element, refit the body and secure with the two clips.

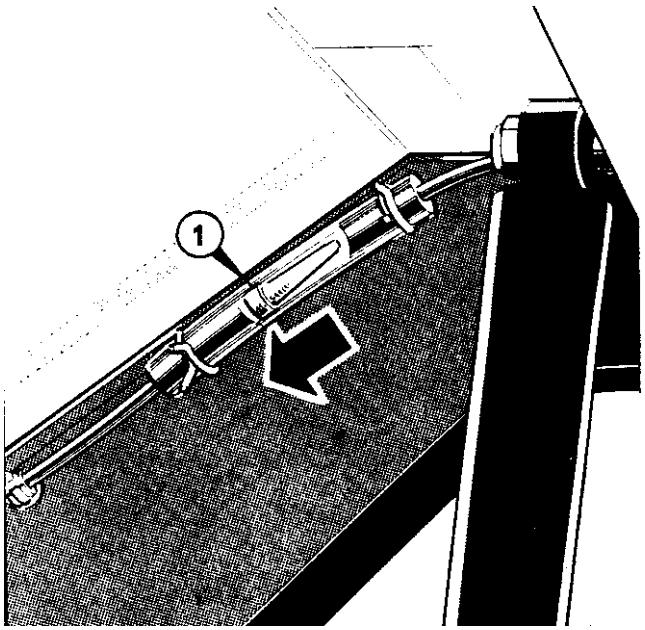


Figure 7 In-line fuel filter

1. Filter element

In-Line fuel filter - Removal and replacement

The in-line fuel filter, situated on the rear chassis side member forward of the fuel tank, is secured to the pipes by means of spring clips. The fuel pipe is a push fit into each end of the transparent filter tubing. When replacing it is vital to note the direction of fuel flow, which is indicated in **Figure 7**.

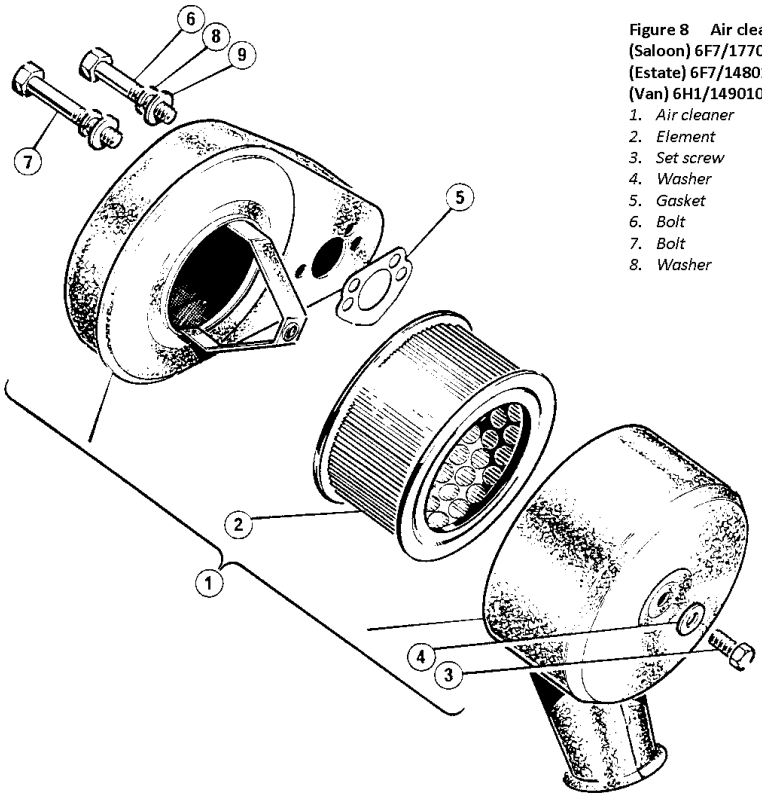


Figure 8 Air cleaner from chassis number
(Saloon) 6F7/17701001
(Estate) 6F7/14801002
(Van) 6H1/14901043

1. Air cleaner
2. Element
3. Set screw
4. Washer
5. Gasket
6. Bolt
7. Bolt
8. Washer

Section Q Body

Contents

Operation 1 **Door window regulator mechanism- removal & replacement**

To remove **(Figure 1 & 2)**

1. Remove the single screw securing the window winder and remove the handle.

2. Prise the plastic bezels from the door release handle. The bezel consists of two halves, upper and lower, of interlocking plastic mouldings.

3. Remove the door panel. This is secured by six "tap-it" fastenings and three capped screws. Prise the caps from these and remove the screws, leaving the plastic inserts in the door moulding.

4. Remove the six set screws and lock washers securing the winder mechanism to the door and detach the mounting plate.

5. Peel off the waterproof membrane from the bottom and raise enough to clear the winder mechanism.

6. Lower the regulator mechanism and slide the operating arm from the window channel.

To replace

When refitting the window regulator it is advised that you fit a "drop glass stop", if not already modified. The procedure is as follows:

1. Liberally grease the window winder regulator and the mechanism spring.

2. Secure the regulator mounting plate to the door using three set screws and lock washers.

3. Slide the operating arm into the regulator channel attached to the door glass.

4. Line up the mechanism with the three pre-drilled holes on the door and secure to the plate with three set screws and lock washers.

5. Temporarily fit the winder handle.

6. Wind the window down until the top of the glass is one inch above the door weather strip.

7. With the glass in this position, drill a 5 mm (3/16 in) hole in the regulator lower arm directly below the rivet on the operating arm as shown in Figure 3.

8. Push a 13 mm (1/2 in) set screw through the hole and secure with a nut and lock washer to provide the necessary drop glass stop (Figure 3).

9. remove the winder handle.

10. Refit the door panel using the three capped screws and six "tap-it" fixings.

11. Refit the winder handle and door handle bezels.

Operation 2 **Door lock mechanism - removal & replacement**

To remove

1. remove the regulator handle, mouldings and door panel as described above.

2. Unhook the lock to release mechanism linkage at the door handle.

3. Unscrew three screws and remove the door handle from the door.

4. remove four countersunk screws and lock washers and withdraw the door lock, complete with the door handle linkage.

5. remove the retaining clips and disconnect the linkage from the lock.

6. remove the exterior door handle secured by set screws and washers.

Figure 1 Door mechanism

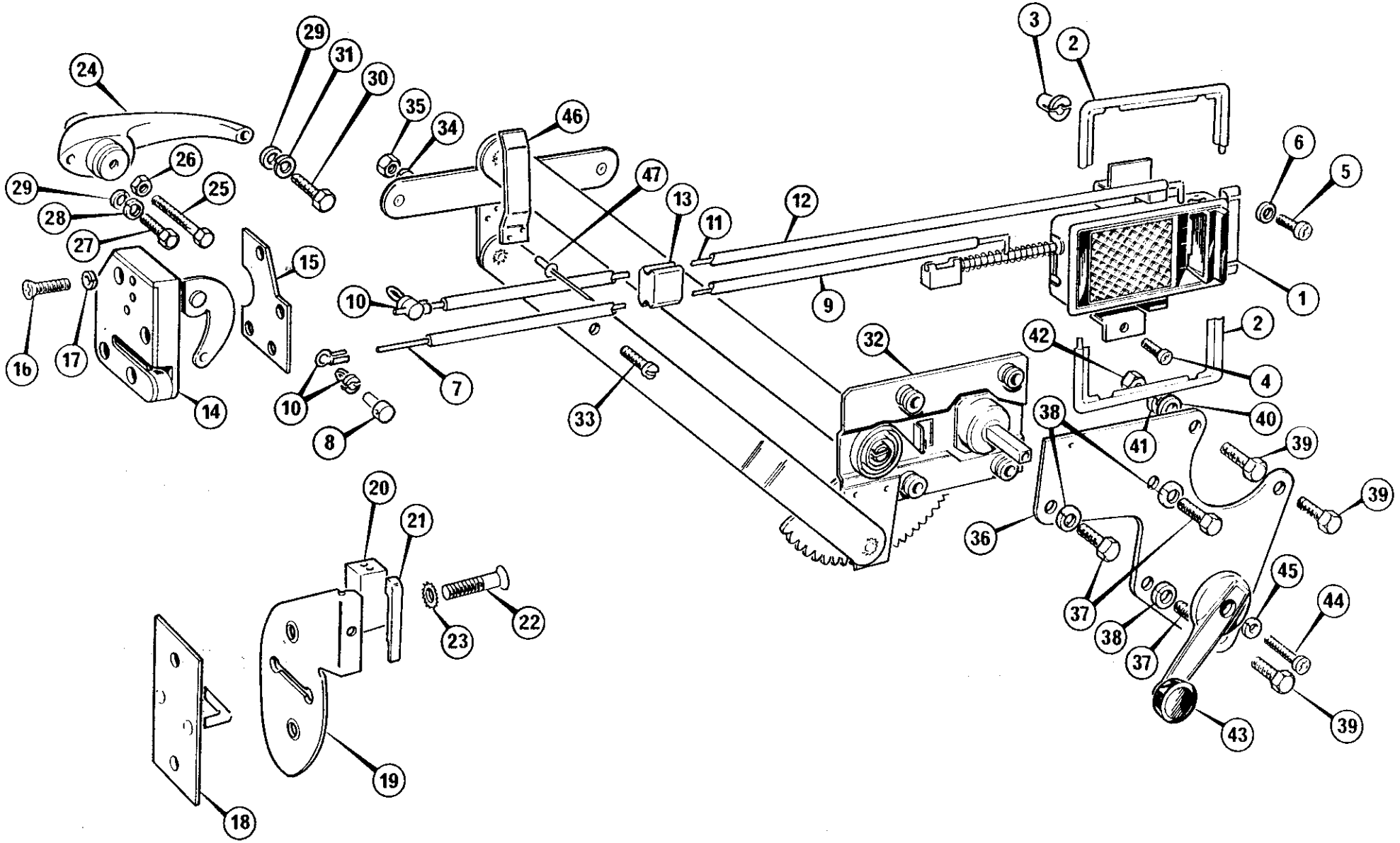


Figure 1 Door mechanism

1.	*Interior door handle*	*17.*	*Lock washer*	*33.*	*Screw*
2.	*Bezel*	*18.*	*Striker back plate*	*34.*	*Lock washer*
3.	*Insert*	*19.*	*Striker cover plate*	*35.*	*Nut*
4.	*Screw*	*20.*	*Striker cover travel stop*	*36.*	*Regulator mounting plate*
5.	*Screw*	*21.*	*Clip*	*37.*	*Screw*
6.	*Washer*	*22.*	*Screw*	*38.*	*Lock washer*
7.	*Link, lock to handle*	*23.*	*Lock washer*	*39.*	*Screw*
8.	*Adjustment pin*	*24.*	*Exterior handle*	*40.*	*Washer*
9.	*Insulation*	*25.*	*Screw*	*41.*	*Lock washer*
10.	*Clip*	*26.*	*Nut*	*42.*	*Nut*
11.	*Link, internal lock*	*27.*	*Screw*	*43.*	*Winder handle*
12.	*Insulation*	*28.*	*Lock washer*	*44.*	*Screw*
13.	*Spacer clip*	*29.*	*Washer*	*45.*	*Lock washer*
14.	*Lock assembly*	*30.*	*Screw*	*46.*	*Regulator link guard*
15.	*Backing plate*	*31.*	*Lock washer*	*47.*	*Rivet*
16.	*Screw*	*32.*	*Window winder regulator*		

Replace in reverse order. after fitting the external handle to the door, the plunger screw (adjuster screw) should be set to give a clearance of 1.58 mm (0.063 in) between the plunger and the lock thrust plate.

Operation 3 Adjustment of door striker plate

1. Slacken the two striker plate retaining screws **Do Not** remove the screws, otherwise the catch of the striker plate will fall between the inner and outer body mouldings.

2. Adjust the striker plate (elongated holes in the body facilitate this) until the door is flush with the body.

3. Retighten the striker plate and then check that the lock mechanism engages properly on the catch.

Operation 4 Window frame and glass - removal & replacement

To remove **(Figure 2)**

1. remove the door panel, regulator mechanism and lock mechanism as described in **Operations 1 & 2**.

2. Remove the waterproof sheet completely from the door.

3. With the window fully closed, peel out the rubber silent channel from the lower frame to expose the lower rivets.

4. Carefully drill off the rivet heads using a 3.97 mm drill (5/32 in), then tap the rivet bodies from the frame.

5. Press the rubber silent channel back in to the frame and fully lower the window glass.

6. prise the rubber silent channel from the upper frame and drill off the six rivet heads, tapping the rivet bodies from the frame.

7. Pull the frame slightly outwards, then remove from the door.

8. The window glass can now be lifted out from the base of the door.

9. Retrieve the rivet bodies from the bottom of the door and discard.

To replace

1. Place the window glass into the base of the door.

2. Locate the window frame into the door and carefully locate over the window glass. Ensure that the glass fits correctly in the rubber silent channels.

3. Prise the rubber silent channel from the frame and secure the top half of the frame to the door using six rivets.

4. Press the rubber silent channel back in to the frame and raise the window glass.

5. Prise the rubber silent channel from the bottom of the window frame and rivet the frame to the door.

6. Press the rubber silent channel back in to the frame ensuring it is squarely seated.

7. Lower the window glass.

8. Refit the regulator mechanism, lock assembly, waterproof membrane door card etc.

Operation 5 Side door weather strips - removal & replacement

To remove and replace **(Figure 2)**

1. Remove the door panel as described on **Operation 1**.

2. Using a 3.97,, (5/32 in) drill, carefully drill off the rivet heads holding the weather strip to the door panel. Remove the weather strip and rivet shafts.

3. Position the new weather strip on the door panel and secure using six 3.175 x 8.89 mm (0.125 x 0.35 in) rivets.

4. With the window fully open, carefully drill out the rivet heads off the rivets securing the weather strip to the door frame.

5. Push the rivet heads through and remove the weather strip from the door.

6. Clean off all adhesive or sealant from the weather strip seating on the door.

7. Smear the back of the weather strip with adhesive/sealant and its seating on the door and leave to go tacky.

8. Fit the weather strip and rivet in to position.

9. Re-assemble the door.

Operation 6 Side door - removal & replacement

To remove

1. Peel back the carpet from the foot well side to expose the hinge access panel.

2. Remove the access panel (six screws).

3. With an assistant supporting the door, remove three set screws, complete with plain washers and lock washers, securing the lower hinge to the body. Remove the single set screw located at the rear of the hinge box, secured to the support plate behind the body, accessible through the access panel in the foot well. Carefully retain all shims as they were fitted.

4. Repeat instruction 3 for the upper hinge and remove the door, complete with hinges from the vehicle.

Replace in reverse order.

Figure 2 Door shell and trim

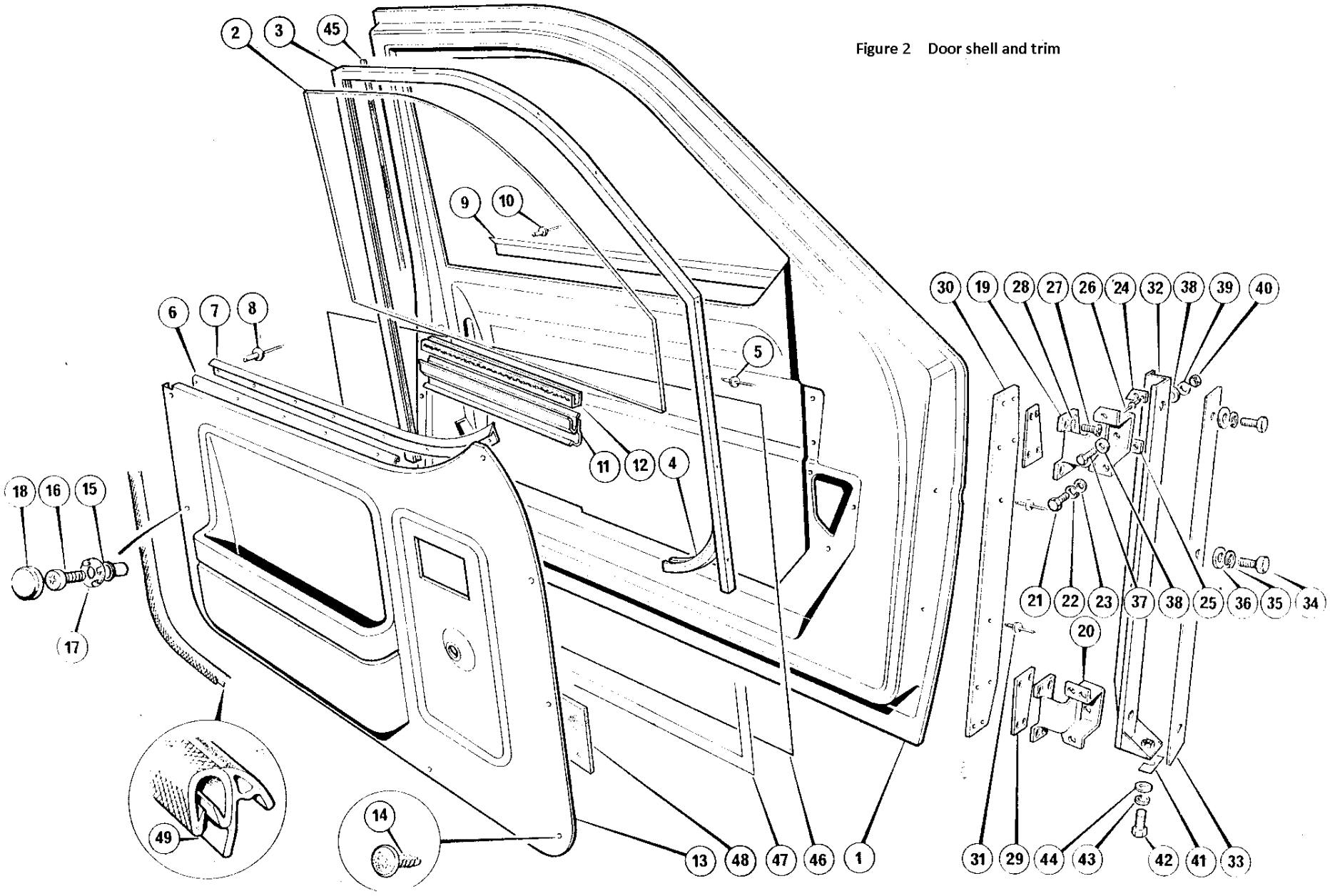


Figure 2 Door shell and trim

1.	*Door*	*18.*	*Snap cap*	*35.*	*Lock washer*
2.	*Glass*	*19.*	*Upper hinge*	*36.*	*Coach washer*
3.	*Frame*	*20.*	*Lower hinge with check strap*	*37.*	*Screw*
4.	*Rubber silent channel*	*21.*	*Screw*	*38.*	*Coach washer*
5.	*Rivet*	*22.*	*lock washer*	*39.*	*Lock washer*
6.	*Stiffener*	*23.*	*Washer*	*40.*	*Nut*
7.	*Weather strip*	*24.*	*Backing plate*	*41.*	*Shim*
8.	*Rivet*	*25.*	*Backing plate*	*42.*	*Set screw*
9.	*Weather strip*	*26.*	*Rivet*	*43.*	*Lock washer*
10.	*Rivet*	*27.*	*Screw*	*44.*	*Coach washer*
11.	*Regulator channel*	*28.*	*Lock washer*	*45.*	*Door seal*
12.	*Insulation*	*29.*	*Plate*	*46.*	*Waterproof membrane*
13.	*Door panel*	*30.*	*Backing plate*	*47.*	*Tape for membrane*
14.	*Insulation*	*31.*	*Rivet*	*48.*	*Anti rattle pad*
15.	*Door panel insert*	*32.*	*Support plate*	*49.*	*Sealing ring*
16.	*Screw*	*33.*	*Stiffener*		
17.	*Washer*	*34.*	*Screw*		

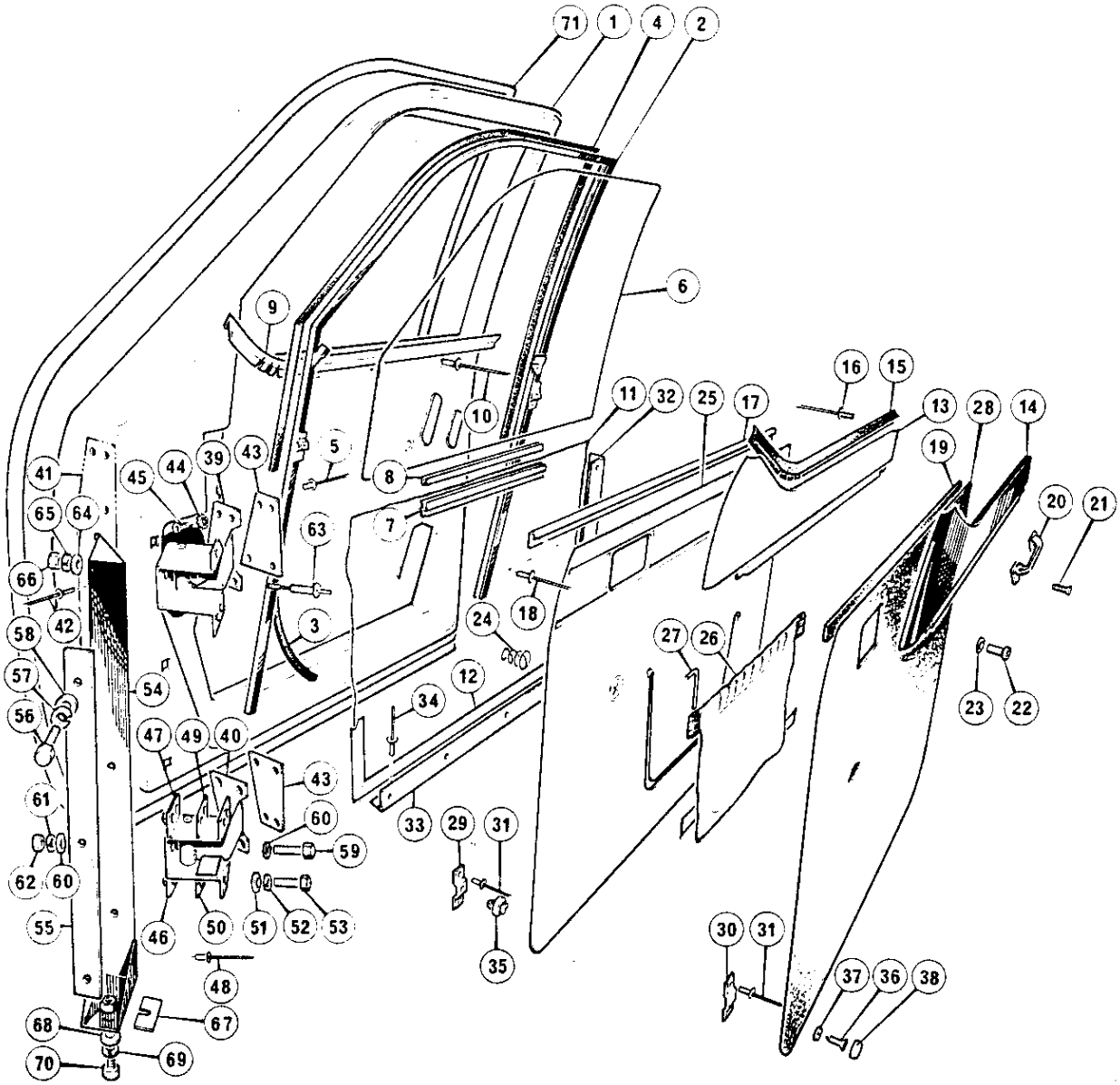


Figure 2a Door shell and trim DL models

1.	*Door*	*25.*	*Casing board (saloon/estate)*	*49.*	*Shim (2 hole)*
2.	*Frame*	*26.*	*Casing board pocket*	*50.*	*Shim (1 hole)*
3.	*Silent channel*	*27.*	*Retaining bar*	*51.*	*Washer*
4.	*Frame seal*	*28.*	*Casing board (van)*	*52.*	*Lock washer*
5.	*Rivet*	*29.*	*Retaining plate (saloon/estate)*	*53.*	*Set screw*
6.	*Glass*	*30.*	*Retaining plate (van)*	*54.*	*Support plate*
7.	*Regulator channel*	*31.*	*Rivet*	*55.*	*Stiffener*
8.	*Insulation*	*32.*	*Rear retaining channel (saloon/estate)*	*56.*	*Set screw*
9.	*Weather strip (outer)*	*33.*	*Rear retaining channel (van)*	*57.*	*Lock washer*
10.	*Rivet*	*34.*	*Rivet*	*58.*	*Coach washer*
11.	*Waterproof membrane*	*35.*	*Fastener*	*59.*	*Set screw*
12.	*Tape*	*36.*	*Screw(van)*	*60.*	*Coach washer*
13.	*Upper casing board (saloon/estate)*	*37.*	*Washer(van)*	*61.*	*Lock washer*
14.	*Upper casing board (van)*	*38.*	*Snap cap(van)*	*62.*	*Nut*
15.	*Weather strip (inner)*	*39.*	*Upper hinge*	*63.*	*Courtesy light switch*
16.	*Rivet*	*40.*	*Lower hinge*	*64.*	*Coach washer*
17.	*Trim strip*	*41.*	*Hinge backing plate*	*65.*	*Lock washer*
18.	*Rivet*	*42.*	*Rivet*	*66.*	*Nut*
19.	*Seal*	*43.*	*Hinge to door plate*	*67.*	*Shim*
20.	*Door pull*	*44.*	*Lock washer*	*68.*	*Coach washer*
21.	*Screw*	*45.*	*Set screw*	*69.*	*Lock washer*
22.	*Screw*	*46.*	*Hinge backing plate*	*70.*	*Set screw*
23.	*Lock washer*	*47.*	*Backing plate*	*71.*	*Door seal*
24.	*Conical spring*	*48.*	*Rivet*		

Operation 7 Door hinge - removal & replacement

To remove

1. Remove door as described in **Operation 6**.

2. Unscrew four countersunk screws and lock washers and remove the upper hinge from the door

Note: The backing plate assembly is riveted to the door.

3. Repeat for the lower hinge.

Operation 8 Rear door (estate) - removal & replacement

To remove **(Figure 4)**

1. From inside the rear of the vehicle, remove three screws securing the rear lamp access panel adjacent to the rear door lower hinge.

2. Disconnect the snap connector for the number plate lamp, accessible in the panel.

3. Disconnect the heated rear window wiring (if fitted).

4. Withdraw the rear door harness and grommet from the body.

5. Remove the check link lug pivot screw and separate the link from the lug.

6. Remove four nuts, lock washers and plain washers from the upper and lower hinge studs on the inner face of the door aperture.

7. Support the door and, withdrawing the hinge studs from the body, lift the door clear of the vehicle.

The rear door hinges are mounted to the door by means of two studs secured by nuts and plain washers.

Operation 9 Rear door lock mechanism (estate) - removal & replacement

To remove

1. Remove two countersunk screws and remove the outer handle from the door.

2. Unscrew six countersunk wood screws and remove the door lock from the door moulding.

3. If it is necessary to remove the dovetail, use a 3.97 mm (5/32 in) drill bit to remove the rivet heads, then tap the shafts in to the door.

4. The dovetail on the body is retained by four rivets and should be removed using the method above but with a 5.56 mm (7/32 in) drill.

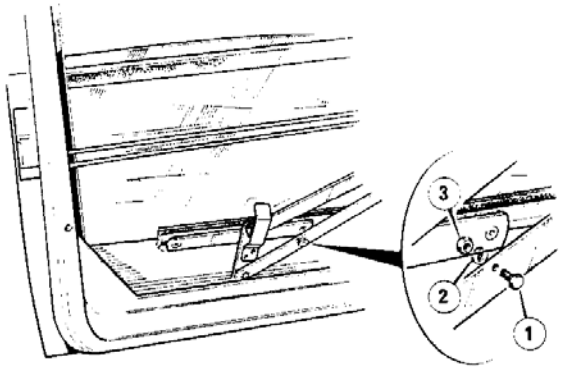


Figure 3 Window drop glass stop

1. *Stop screw*

2. *Washer*

3. *Nut*

Replace components in reverse order taking note of the following: Secure the dovetail (female) to the body with four 4.76 x 16.50 mm (3.175 x 0.65 in) rivets. Secure the (male) dovetail to the door using six 3.175 x 12.7 mm(0.125 x 0.5 in) rivets.

Door seals

The rubber seals are carried on a "V" shaped metal section clipped to the body flanges. Care should be taken not to hammer the seals on to the flange as this will cause the metal section to open up so the claw clips will not hold. A rubber mallet is recommended for this operation.

Operation 10 Bonnet - removal & replacement

To remove **(Figure 5)**

1. Remove the two nuts, washers and lock washers securing the right-hand hinge to the body.

2. Repeat item 1 for the left-hand hinge, the fixings for which also support the lid support bar plate.

3. Withdraw the hinge studs and lift the bonnet clear, retaining the two hinge to lid gaskets.

Refit in reverse order.

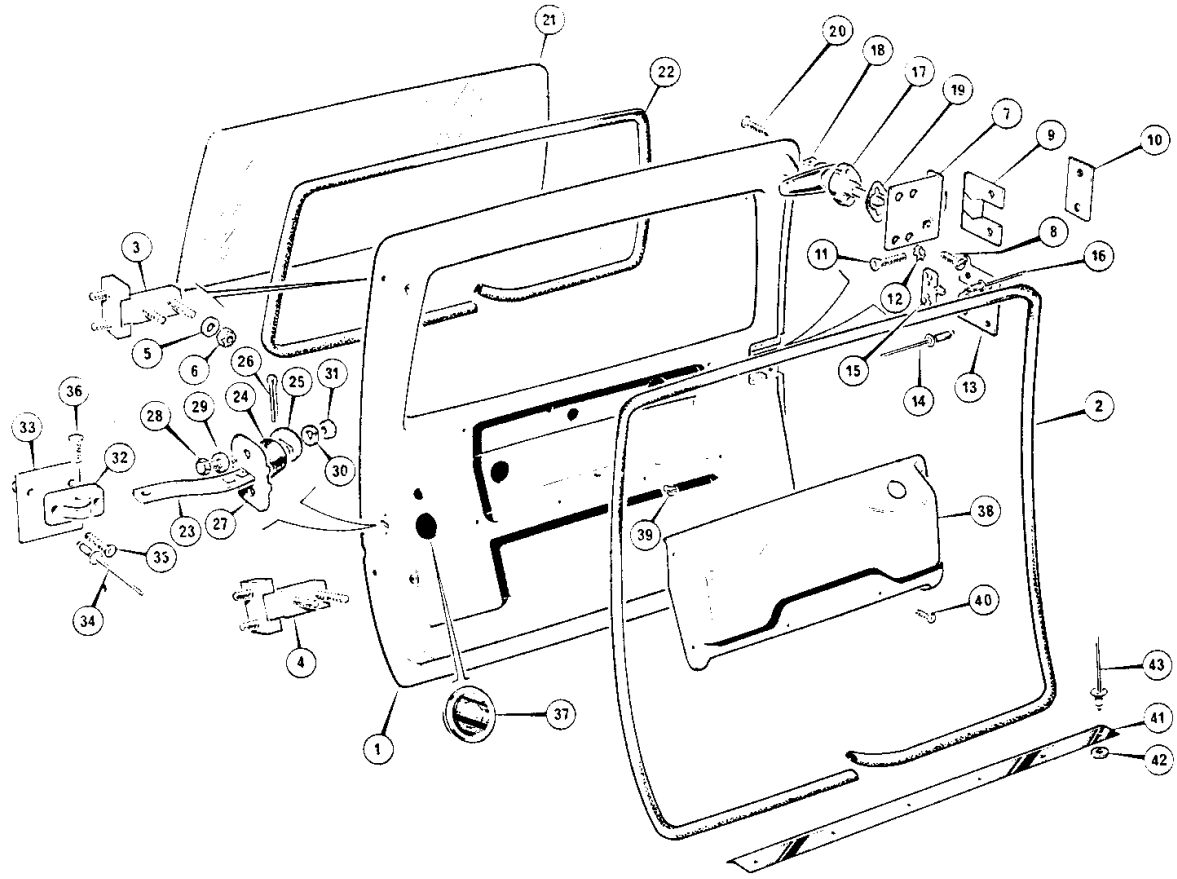


Figure 4 Estate rear door

1.	*Rear door*	*16.*	*Rivet*		*31.*	*Nut*
2.	*Seal*	*17.*	*Locking handle*		*32.*	*Lug*
3.	*Upper hinge*	*18.*	*Key*		*33.*	*Backing plate*
4.	*Lower hinge*	*19.*	*Washer*		*34.*	*Rivet*
5.	*Washer*	*20.*	*Screw*		*35.*	*Screw*
6.	*Nut*	*21.*	*Rear window*		*36.*	*Screw*
7.	*Rear door lock*	*22.*	*Weather strip*		*37.*	*Grommet*
8.	*Screw*	*23.*	*Link*		*38.*	*Wiper motor cover*
9.	*Striker*	*24,*	*Buffer*		*39.*	*Insert*
10.	*Backing plate*	*25.*	*Washer*		*40.*	*Screw*
11.	*Set screw*	*26.*	*Split pin*		*41.*	*Kick plate*
12.	*Lock washer*	*27.*	*Slide plate*	*42.*	*Washer*	
13.	*Dovetail (female)*	*28.*	*Screw*		*43.*	*Rivet*
14.	*Rivet*	*29.*	*Washer*			
15.	*Dovetail (male)*	*30.*	*Lock washer*			

Operation 11 Bonnet hinge renewal

To remove

1. Remove the bonnet as described in **Operation 10**

2. Remove the radiator grill/headlamp bezel as described in **Operation 15**

3. The right-hand hinge to body fixing is accessible through the heater blower air duct. Unscrew the single nut. Unscrew the single nut, lock washer and washer.

4. Withdraw the hinge and gasket from the body.

5. The left-hand hinge to body fixing is accessible only through the headlamp aperture. Remove the headlamp as described in **Section T Operation 6.**

Re-assemble in reverse order.

Operation 12 Body, complete - removal from chassis

The saloon and estate models share the same body mounting points on the chassis frame.

The mounts comprise screw and nut inserts in the frame plus conventional nuts , screws and bolts through holes in the frame outriggers and front support bracket. Stiffening brackets located behind the "A" post to support door hinges are also tied to outriggers in the chassis side rails and the "B" post roll-over bar is similarly secured to the frame.

To remove body

1. Disconnect and remove battery.

2. Disconnect starter motor leads.

3. Disconnect Alternator leads.

4. Disconnect temperature sender lead.

5. Disconnect oil pressure lead/pipe.

6. Disconnect high/low tension leads.

7. Disconnect the earth leads from the timing cover screw.

8. Disconnect the speedo cable from the gearbox.
9. Disconnect the throttle cable at the carburettor.
10. Disconnect the choke cable at the carburettor.
11. Disconnect the clutch cable at the bell housing
12. Disconnect the handbrake cable from the rear axle.
13. Drain and remove the radiator.
14. Disconnect the heater hoses ant the bulkhead.
15. Disconnect the steering column lower universal joint.
16. Remove the gear lever gaiter and gear lever.
17. Disconnect the exhaust downpipe at the manifold.
18. Disconnect the brake bundy tube from the master cylinder at the four-way connector.
19. Remove the seat belt fixings from the transmission tunnel.
20. Remove the seat belt lower mountst.
21. Disconnect the earth lead from the fuel tank support.
22. Remove the front seats complete with runners.
23. Remove five screws from the rear of the body locating to tapped inserts in the chassis.
24. Remove the carpets followed by the two screws on the right-hand side and one on the left-hand side securing the floor to the chassis.
25. Remove two screws holding the body to the front support bracket and the single screw fixing the air ducts to the front support bracket on the left-hand side.
26. Remove the screws, lock washers and washers securing the "A" post hinge support brackets to the chassis outriggers.
27. Remove the four nuts, bolts and washers securing the roll-over bar to the chassis adjacent to the "B" post.

The body is now free to be manoeuvred over the engine and lifted from the chassis.

Operation 13 Tread plate (side door) removal & replacement

To remove
1. Using a 3.175 mm (1/8 in) drill, remove the heads from the eight rivets securing the tread plate to the door sill.
2. Tap out the rivets and remove the tread plate. Replace in reverse order with eight 3.87 x 9.4 mm (0.150 x 0.37 in) rivets.

Operation 14 Kick plate, (estate rear door) - removal & replacement

To remove
1. Drill the heads off the six retaining rivets using a 5.56 mm (7/32 in) diameter drill. Tap out the rivet shafts and remove the kick plate.
Replace in reverse order using six 4.76 x 10.16 mm (0.181 x 0.4 in) rivets and plain washers.

Operation 15 Front grill/headlamp bezel - removal & replacement

To remove
1. Remove the four screws and cup washers securing the grille to the headlamp bezel moulding. Remove the grille.
2. Remove the two screws and cup washers at each end of the headlamp bezel, securing the bezel to the body. The bezel can now be removed.
Replace in reverse order.

Operation 16 Exterior mirror - removal & replacement
The exterior rear view mirrors mounted on each door are secured by two countersink screws in nylon inserts. The nylon inserts should remain captive in the door skin when the screws are removed.

Operation 17 Windscreen - removal & replacement
To remove
1. Remove the windscreen wiper arms and blades.
2. Cover the bonnet with a suitable cloth to avoid damage to paintwork.
3. Using a screwdriver with all the sharp edges removed, ease the ends of the locking strip from the windscreen rubber. pull out the locking strip
4. With the aid of an assistant working outside the vehicle, apply hand pressure to the inside of the screen whilst easing down the lip of the windscreen rubber to release the screen.
5. Lift the windscreen clear, placing it on a blanket or similar to avoid scratching the class.
6. Examine the windscreen rubber for damage/perishing and renew if necessary.

To replace
1. Fit the windscreen rubber to the windscreen aperture, positioning the joint half way up one of the "A" pillars.
Note: If a new rubber is being fitted it should be cut approximately 25.4 mm (1 in) oversize. The ends of the rubber can be forced back so a tight butt joint is formed.
2. The windscreen can now be fitted by inserting a corner onto the rubber and progressively easing the lip over the glass using a suitable tool or a soft tapered piece of dowelling.
3. Using a suitable tool the locking strip can now be inserted with the join at the opposite "A" pillar. If the old locking strip is to be re-used it should be lightly stretched before inserting.

Operation 18 Rear quarter light (saloon & estate) - removal & replacement

To remove
1. Apply firm pressure to the glass from inside the vehicle adjacent to the "B" pillar whilst easing the lip of the rubber away from the flange. The quarter glass should now lift out, leaving the plastic air vent cover attached to the body by four rivets.

To replace
1. Fit the weather strip rubber to the quarter glass.
2. Run a draw cord around the rubber to body groove with the overlap of approximately 152 mm (6 in) at the bottom edge of the glass.
3. Whilst an assistant applies firm pressure to the outside of the glass, pull the draw cord out springing the rubber lip over the flange.
4. Check for good sealing paying special attention to the area of the air vent moulding.

Operation 19 Rear window (saloon) - removal & replacement

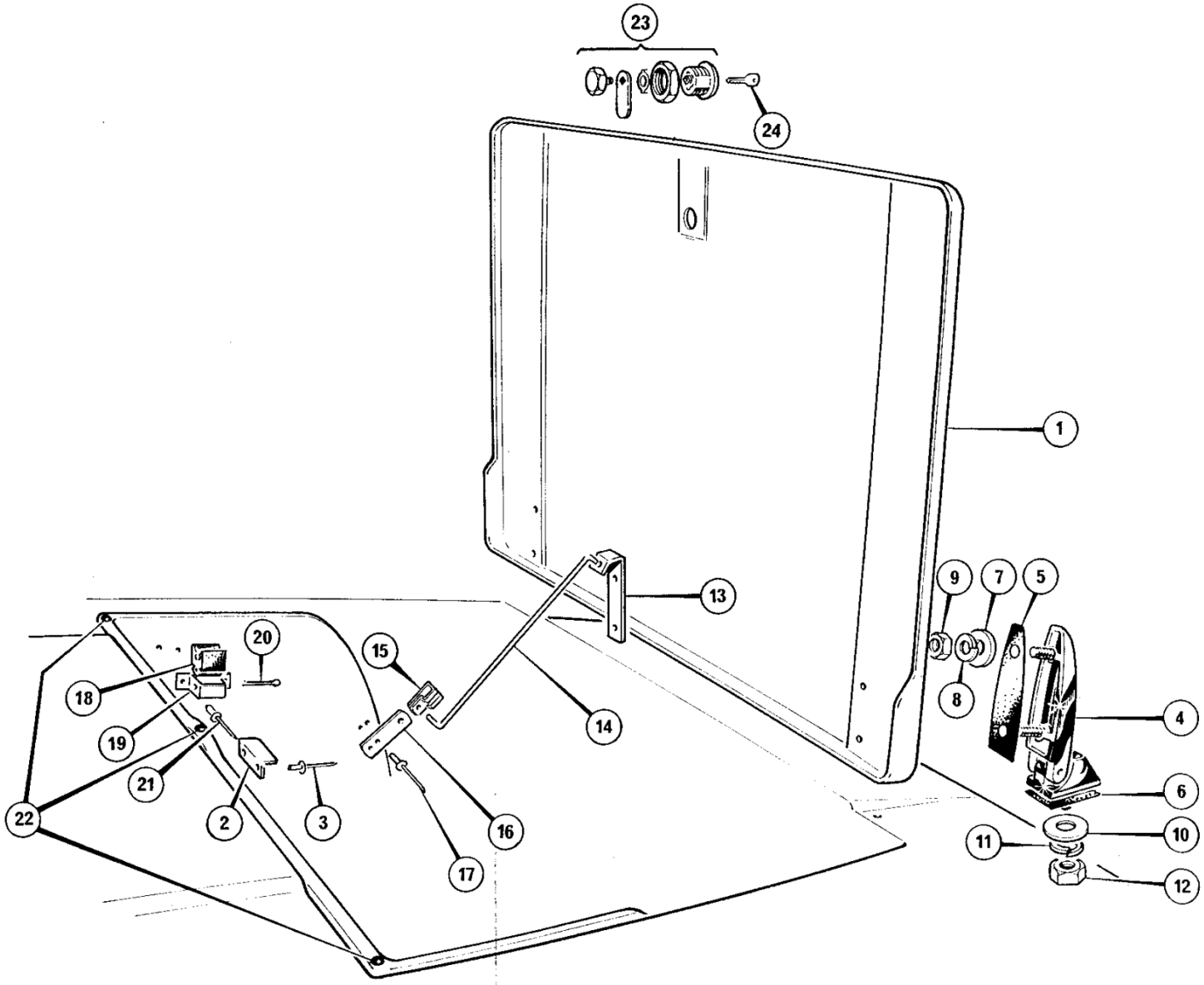
To remove **(Figure 6)**
1. Raise the rear window.
2. Disconnect the heated rear window (if fitted) at the bullet connectors.
3. Remove the domed nut and lock washer securing the window stay to the window.
4. Whilst supporting the glass, remove the domed nuts, coach washers and insulating washers from both hinges.
5. Carefully remove the glass, taking care to retain the hinge gaskets.
6. The locking release handle is secured to the glass by the lock retaining nut.
7. The hinges are each secured to the body by two domed nuts, lock washers and backing plates.

Replace components in reverse order.

Rear Window (Estate) - Removal & refitting
Follow the procedure as for the saloon and estate rear quarter light glass **(Operation 18)**

Figure 5 Bonnet

1. *Bonnet*
2. *Striker plate*
3. *Rivet.*
4. *Bonnet hinge*
5. *Gasket*
6. *Gasket*
7. *Coach washer*
8. *Lock washer*
9. *Nut*
10. *Coach asher*
11. *Lock washer*
12. *Nut*
13. *Support rod bracket*
14. *Rod*
15. *Linkage clip*
16. *Plate*
17. *Rivet*
18. *Rod retainer*
19. *Bracket*
20. *Split pin*
21. *Rivet*
22. *Buffer*
23. *Bonnet lock*
24. *Key*



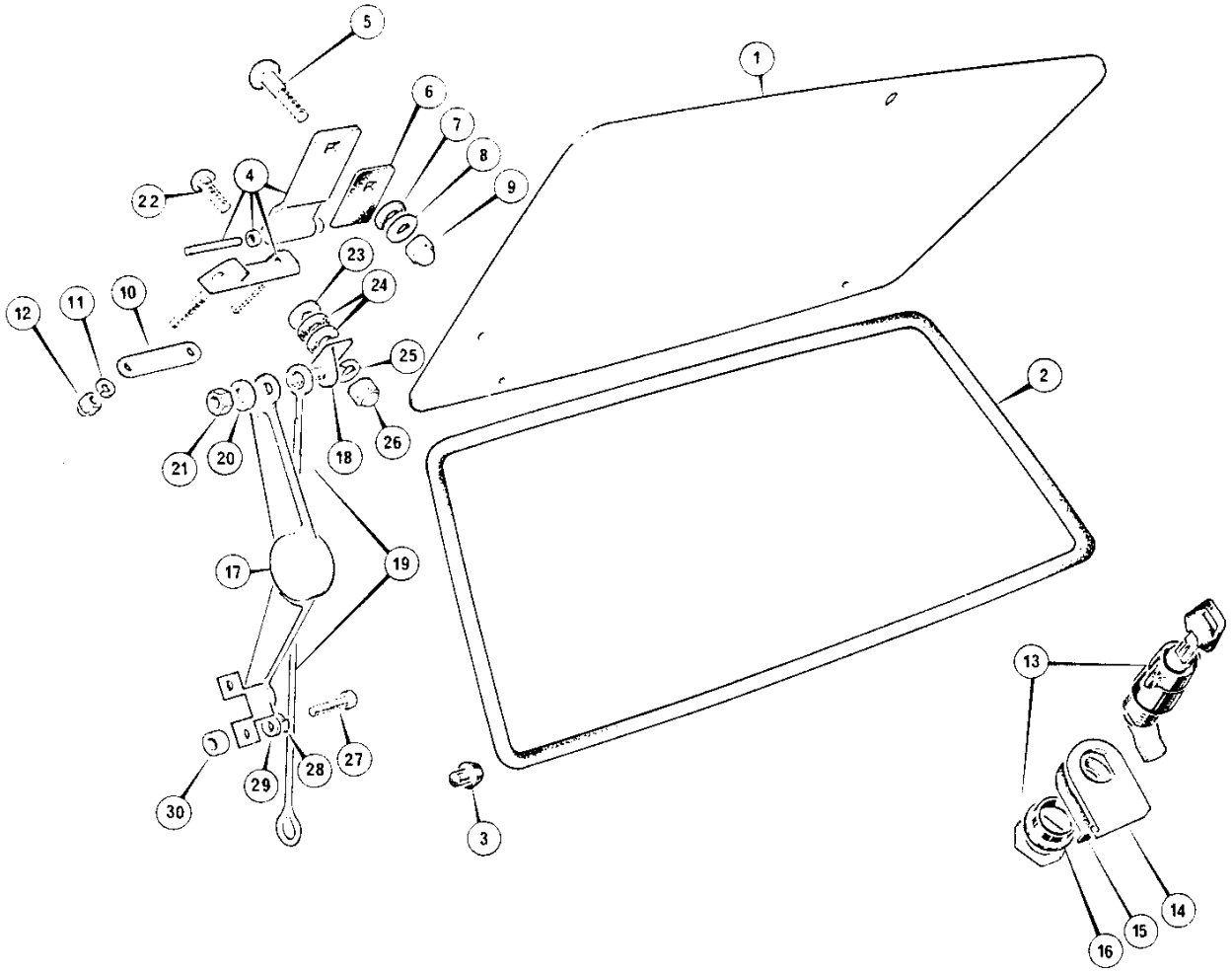


Figure 6 Rear window - Saloon

1.	*Rear window*	*11.*	*Lock washer*	*21.*	*Nut*
2.	*Sealing rubber*	*12.*	*Nut*	*22.*	*Coach bolt*
3.	*Buffer*	*13.*	*Locking handle*	*23.*	*Lock washer*
4.	*Hinge*	*14.*	*Retaining plate*	*24.*	*Washer*
5.	*Coach bolt*	*15.*	*Gasket*	*25.*	*Lock washer*
6.	*Gasket*	*16.*	*Washer*	*26.*	*Domed nut*
7.	*Insulation*	*17.*	*Rear window stay*	*27.*	*Screw*
8.	*Coach washer*	*18.*	*Bracket*	*28.*	*Lock washer*
9.	*Domed nut*	*19.*	*Tonneau lifting stay*	*29.*	*Washer*
10.	*Backing plate*	*20.*	*Washer*	*30.*	*Spacer*

Operation 20 Rubber bumper sections - removal & replacement

Both the front and rear bumpers comprise a rubber trim section supported on a metal channel mounted the full width of the body moulding. The ends of the bumpers are covered by plastic caps, each retained by a single screw, screwed to the body, through the rubber trim.

To remove

1. Remove the single screw securing the bumper end cap to the side of the body, retained by a clip behind the moulding. repeat for the opposite cap.
2. Remove the self-tapping screws retaining the ends of the bumper to the body.
3. The rubber bumper is supported on a metal channel riveted to the body. Pull the rubber from the channel section.
4. The metal channels may be removed if required, by drilling out the nine retaining rivets.

Replace in reverse order, ensuring that the rubber section is correctly engaged in the metal channel before securing with the two self tapping screws.

Contents

Front seats - adjustment

Seat adjustment

The front seat is adjustable for reach by moving the lever at the front of the seat as shown, whilst applying forward or rearward pressure until it is in the required position **(Figure 1)**. Releasing the lever secures the seat.

Passenger access to the rear seat is obtained by releasing the floor catch at the rear of the seat and tilting the seat forward. the catch will refasten when the seat is lowered. **(Figure 2).**

Front seats having the reclining seat backrest mechanism fitted are adjusted by means of the lever at the base of the squab on the outside of the seat. The seat is adjusted by pulling the lever up to adjust, then back down to lock. **(Figure 2).**

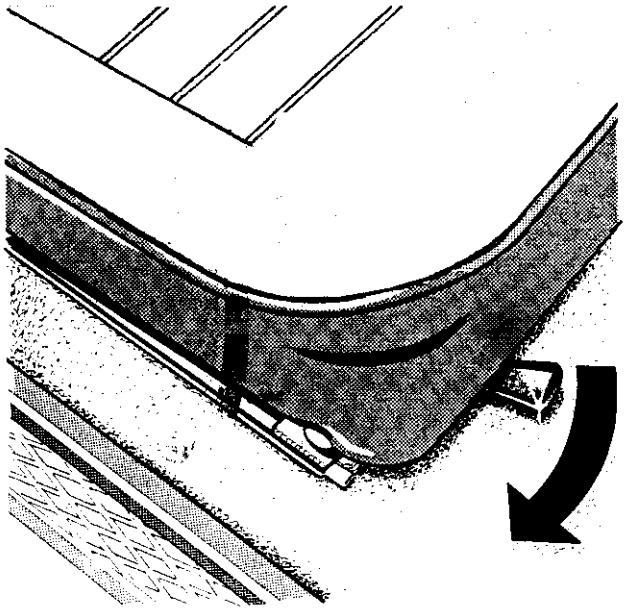


Figure 1 Front seat fore-aft adjustment

Operation 1 Front seats - removal & replacement

1. From underneath the vehicle remove the four nuts with lock washers and coach washers securing the seat runners to the floor.

2. The seat can now be lifted out of the vehicle complete with the runners.

Replace in reverse order ensuing that the thick spacer washers between the runners and floor are correctly located.

Operation 2 Dismantling front seats

1. Remove the two retaining clips securing the pivot rivets on the frame to the front brackets on the runners.

2. Prise open the retaining clips, securing the squab cover to the seat casing frame at the rear of the seat. Pull the cover up over the padding and frame.

3. Remove the wire retaining clips from the seat cushion casing frame and peel the cover from the padding and frame. Remove the padding.

4. The squab support springs can be removed by stretching the spring and releasing the retaining clip. Refit in reverse order. The cushion and squab covers should be kept as taut as possible when fastening the wire retaining clips to the frame.

The reclining mechanism is not user serviceable.

Rear seats - to fold down

The squab of the rear seat folds down to give a flat loading floor. The seat back is secured by means of rubber retaining straps looped over brackets mounted on the body sides. To fold the seat, release the tonneau cover from the rear window (saloon only), lift up the rear seat cushion, release the rubber retainer straps and fold the rear seat cushion forward.

Fold the tonneau cover flat against the seat squab to give a flat floor. Reverse the above routine to return the seat to normal configuration, remembering to lift the tonneau cover before raising the seat squab.

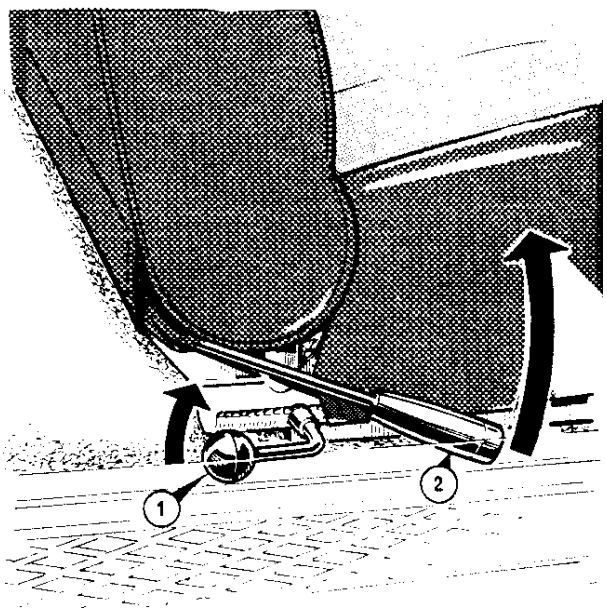


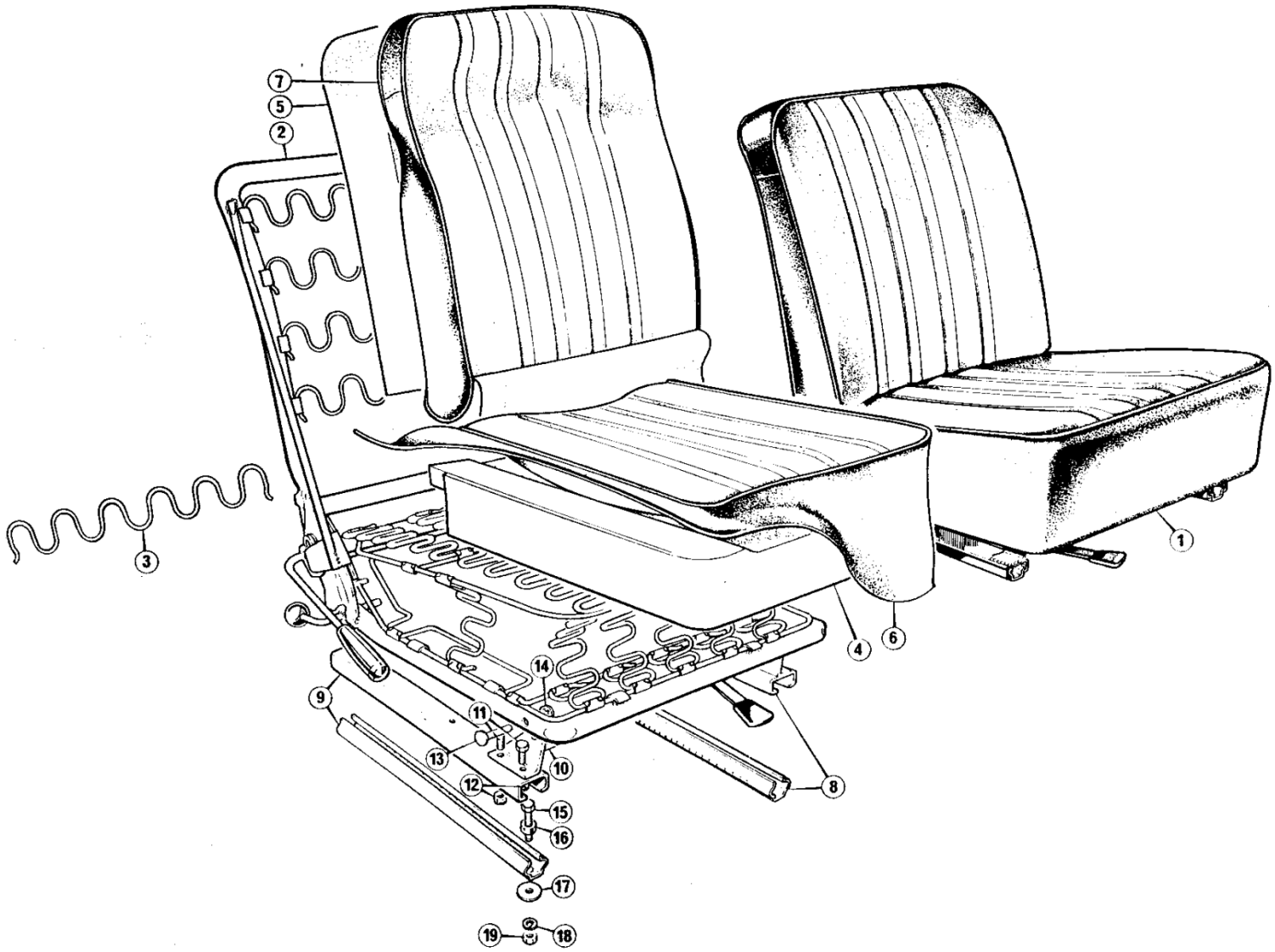
Figure 2 Front seat release and reclining mechanism

1. Seat release catch - lift to tilt

2. Reclining mechanism lever

Figure 3 Front seat - Exploded view

1. *Passenger seat (non-reclining)*
2. *Seat frame assembly (reclining)*
3. *Serpentine spring*
4. *Cushion padding*
5. *Squab padding*
6. *Cushion cover*
7. *Squab cover*
8. *Seat slide and adjuster*
9. *Seat slide*
10. *Cross member*
11. *Set screw*
12. *Nut*
13. *Rivet*
14. *Capped ratchet plate*
15 *Screw*
16. *Spacer*
17. *Coach washer*
18 *Lock washer*
19 *Nut*



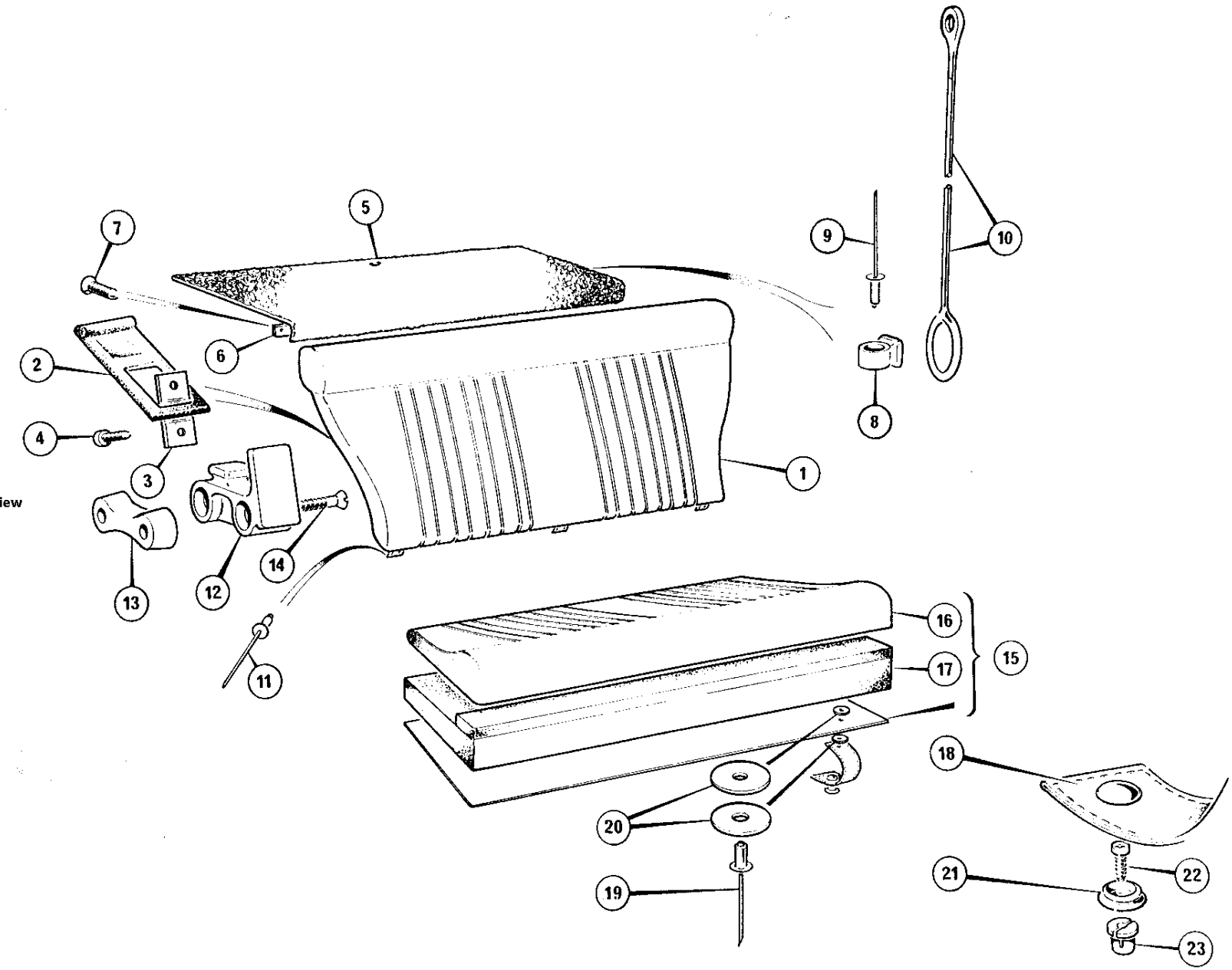


Figure 4 Rear seat - Exploded view

1 *Squab assembly*
2. *Squab retaining strap*
3. *Strap clmp*
4. *Screw*
5. *Tonneau cover*
6. *Tonneau fixing strip*
7. *Screw*
8. *Lifting knob*
9. *Rivet*
10. *Lifting stay*
11. *Rivet*
12. *Abutment*
13. *Spacer*
14. *Screw*
15. *Cushion assembly*
16 *Cover*
17 *Padding*
18 *Strap*
19 *Rivet*
20 *Washer*
21 *Stud*
22 *Screw*
23 *Insert*

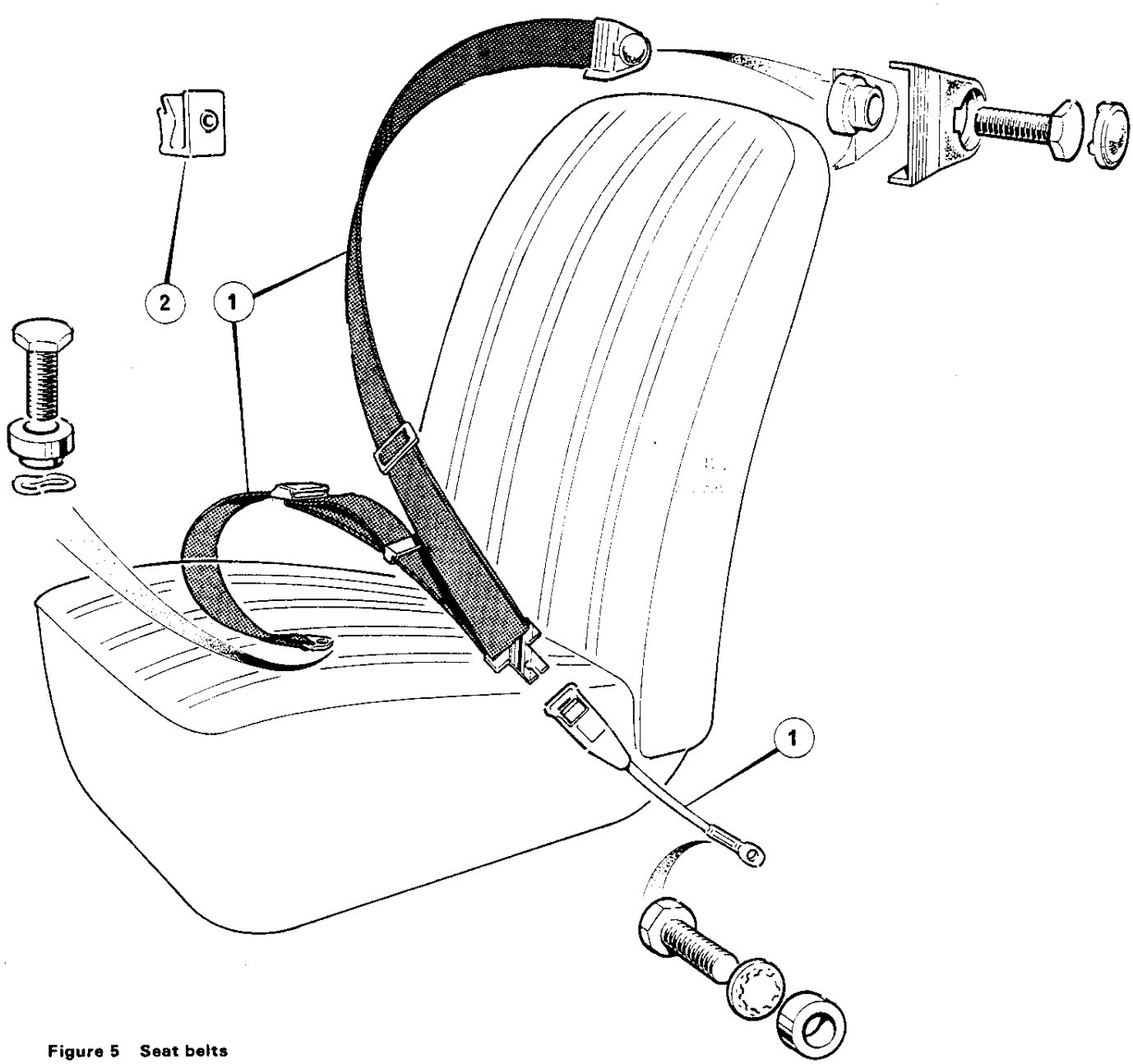


Figure 5 Seat belts
1 Kit, seat belt
2 Clip, seat belt

Operation 3 Rear seat - removal & replacement

The rear seat cushion is retained by press and stud fasteners at each end of the cushion. The rear squab hinges are riveted to the body floor.

To remove

1. Unclip the cushion retaining straps and remove the cushion from the vehicle.

2. Unhook the tonneau cover lifting straps

3. Using a 5.56 mm (7/23 in) drill, remove the heads of the rivets securing the seat squab hinges to the floor.

4. Tap out the rivet shafts and remove the squab assembly from the vehicle.

Both the squab and cushion are available as assemblies only so no further dismantling is recommended.

The squab retaining straps however, can be replaced by detaching the fixing clamp from the back board, secured by two screws.

The two abutment brackets which support the seat squab in the raised position are secured to the body by means of screws that also retain the trim panels.

Replace the seat and components in reverse order, securing the back board hinges to the floor with six 4.76 x 16.51 (0.188 x 0.65 in) rivets.

Seat Belts

In accordance with current regulations, all Kittens have seat belts fitted to both driver and passenger front seats, incorporating s "one handed" type clasp.

If the seat belt shows signs of severe fraying, having been cut, or having suffered extreme stress in an accident, the belt must be renewed.

To remove **(Figure 5)**

1. Remove the bolt, spacer and waved washer securing the lap strap belt mounting on the floor, adjacent to the "B" post

2. Prise the plastic plug from the shoulder strap belt mounting. Remove the bolt and spacer and detach the seat belt.

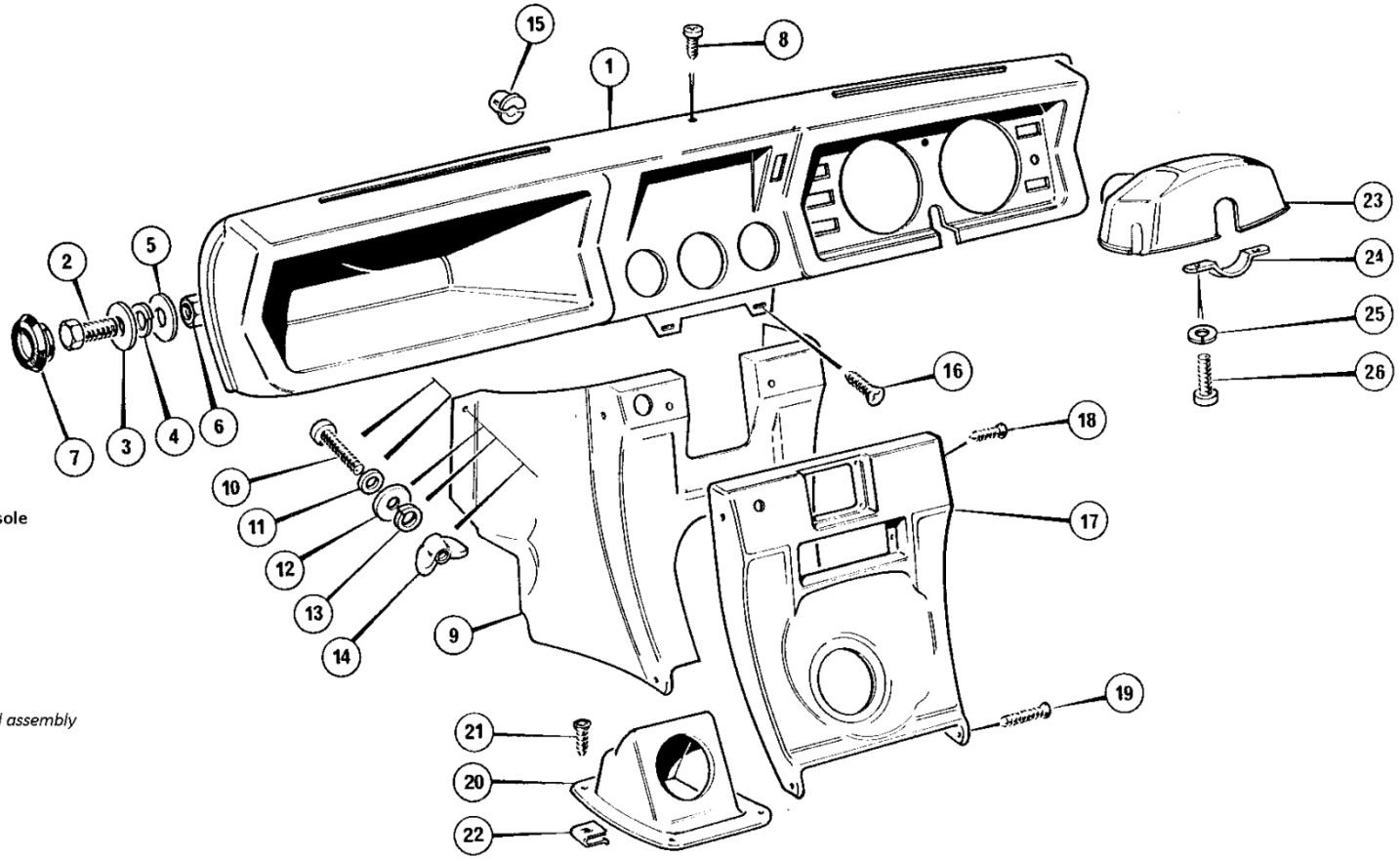


Figure 6 Fascia and centre console

1. *Fascia*
2 *Screw*
3 *Washer*
4 *Lock washer*
5 *Washer*
6 *Nut*
7 *Grommet*
8 *Screw*
9 *Centre console mounting panel assembly*
10 *Screw*
11 *Washer*
12 *Coach washer*
13 *Lock washer*
14 *Wing nut*
15 *Inserts*
16 *Screw*
17 *Centre console*
18 *Screw*
19 *Screw*
20 *Gr=earbox access panel*
21 *Screw*
22 *Captive nut*
23 *Multi switch cover*
24 *Clamp*
25 *Lock washer*
26 *Set screw*

3. Remove the bolt, lock washer and spacer from the seat belt catch arm and remove the arm from the drive shaft tunnel mounting.

Carpets & interior trim

Except for the two foot well/floor carpets, all the carpets are glued to the body and floor of the vehicle.

When replacing any of the carpets that are glued, all traces of the fixing glue must be removed before new carpets are glued in.

Dunlop S1359 general purpose glue is recommended for this purpose following the manufactures instructions.

The main floor/foot well carpets can only be removed after the seats have been taken out of the vehicle **(Operation 1)**.

Operation 4 Headlining - removal & replacement

To remove

1. Disconnect battery

2. Remove the windscreen and rear quarter windows, all rubber seals, weather strips, rear window complete with seal and hinges (saloon), rear quarter trim fillets, rear door seal (estate).

3. Remove rear view mirror, interior lamp and sun visors.

4. Peel down the top sections of the "A" and "B" post trims.

5. Gently peel the headlining away from the window and door apertures.

6. Starting at the rear of the vehicle, release the listing rods from their retainers.

Note: There are five listing rods on saloons, six on estates.

7. Remove the headlining from the vehicle.

8. Withdraw the listing rods from the headlining.

Note: The listing rods are different lengths so be sure to mark them to ensure they are re-fitted in the correct positions.

To replace

1. Thread the listing rods into the new headlining in the correct order.

2. Starting from the front, apply a thin film of contact adhesive to the headlining (Dunlop S1359 recommended).

3. Ensuring the headlining is central to the vehicle, attach the cloth to the windscreen opening, securing with "spire" clips.

4. Apply adhesive to the rear edge and tack to the rear window aperture (saloon) or door aperture (estate) with "spire" clips.

Note: The headlining should be kept as taut as possible to avoid wrinkles in the finished installation.

5. Apply adhesive to the right-hand edge of the cloth, insert the listing rods on their retainers and tack the headlining to the door and window apertures using "spire" clips.

6. Repeat for the left-hand side of the vehicle, again ensure the headlining is kept taut

7. .Trim excess material from the headlining.

8. Leave the vehicle for a while to allow the adhesive to go off, then remove the "spire" clips.

9. Using a light smear of adhesive, refit the top of the "A" and "B" post trim covers over the headlining.

10. Refit the door seals.

11. Refit the quarter trim fillets, replace rear window seal (saloon) or rear door seal (estate).

12. Refit sun visors, interior lamp and rear view mirror.

13. Refit windscreen and rear quarter windows plus the vent mouldings.

14. Reconnect battery.

Operation 5 Fascia & centre console - removal & replacement

To remove

1. Disconnect battery.

2. Remove windscreen **(Section Q)**

3. Disconnect the choke cable from the carburettor and pull out the knob complete with cable. Undo the choke knob escutcheon from the centre console trim panel.

4. Pull off the heater control knobs.

5. Remove the centre console trim from the main moulding (four screws).

6. Remove the gear lever knob.

7. Withdraw the gear lever gaiter from the trim panel and remove from the lever.

8. Remove the centre console trim panel.

9. Remove the ash tray if required.

10. Remove the steering wheel **(Section D)**

11. Remove the multi switch and cover **(Section T)**

12. Disconnect all instruments and switches **(Section T)**

13. Remove the steering column clamp bracket.

14. Remove radio (if fitted).

15. Remove the two screws securing the centre console moulding to the fascia.

16. Remove the single centre screw holding the fascia to the windscreen frame.

17. Prise the grommets from the holes on the "A" posts and remove the nuts, washers and bolts securing the ends of the fascia to the "A" posts.

18. The fascia can now be removed from the vehicle.

Re-assemble in reverse order.

Section S

Heater

Contents

Description

The heater is of the fresh air type and is mounted behind the centre console on the engine bulkhead. Water from the cooling system is fed to the heater via hoses from the engine. Fresh air is drawn from the front of the vehicle and ducted to the heater. The heated air is forced through vents in the foot wells and via hoses to the demisters.

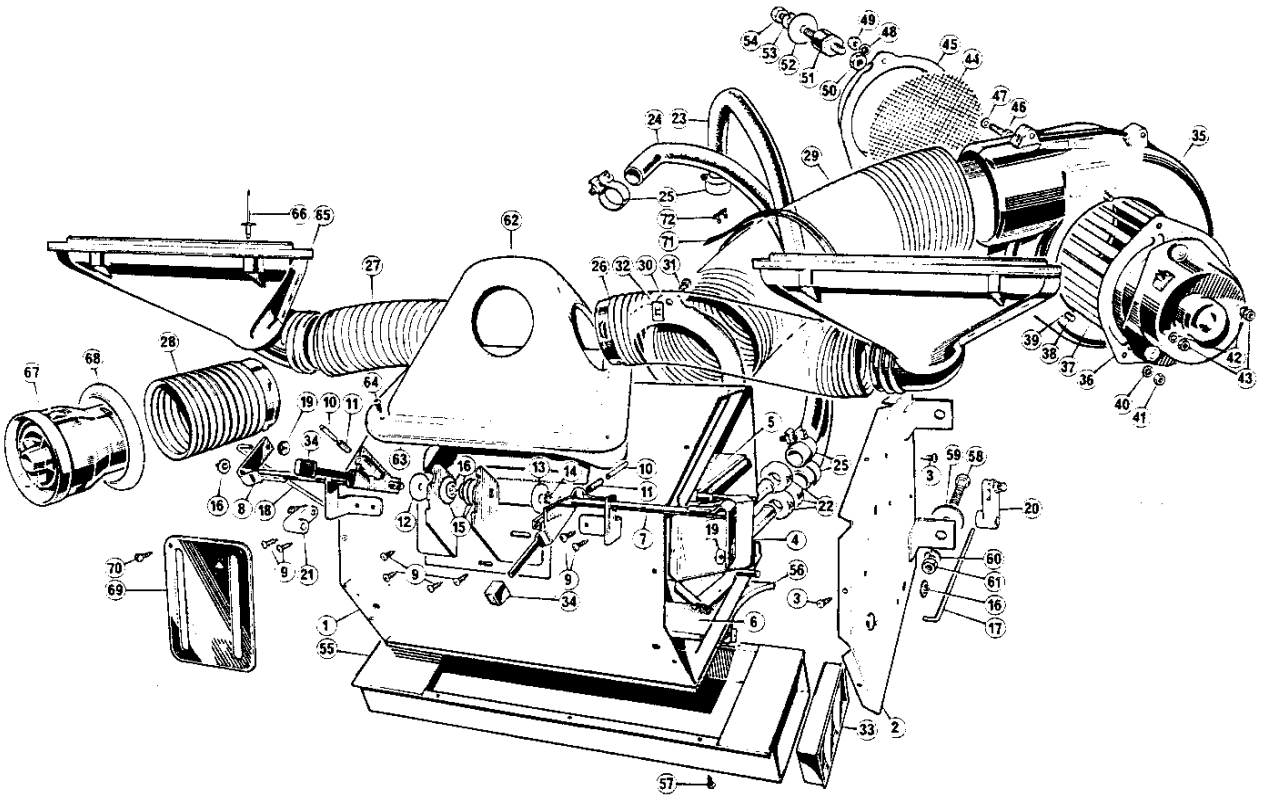


Figure 1 **Heater system - exploded view**

1.	*Heater casing assembly*	*25.*	*Clip*	*49.*	*Nut*
2.	*Side cover assembly*	*26.*	*Air hose demist RH*	*50.*	*Rubber mounting nut*
3.	*Screw*	*27.*	*Air hose demist LH*	*51.*	*Rubber mounting*
4.	*Radiator and seals*	*28.*	*Air hose fascia*	*52.*	*Coach washer*
5.	*Air mixing valve and seal*	*29.*	*Air hose ram*	*53.*	*Spring washer*
6.	*Distribution valve and seal*	*30.*	*Flange pipe*	*54.*	*Nut*
7.	*Lever and spindle RH*	*31.*	*Screw*	*55.*	*Air distribution box*
8.	*Lever and spindle LH*	*32.*	*Clip*	*56.*	*Seal*
9.	*Screw*	*33.*	*Air vent RH*	*57.*	*Screw*
10.	*Plunger*	*34.*	*Heater control knob*	*58.*	*Screw*
11.	*Spring*	*35.*	*Blower halves*	*59.*	*Coach washer*
12.	*Spacer*	*36.*	*Blower and mounting plate*	*60.*	*Washer*
13.	*Friction disc*	*37.*	*Rotor*	*61.*	*Nut*
14.	*Shake proof washer*	*38.*	*Screw*	*62.*	*Air chamber*
15.	*Spring washer*	*39.*	*Washer*	*63.*	*Air chamber seal*
16.	*Spire clip*	*40.*	*Shake proof washer*	*64.*	*Screw*
17.	*Link rod RH*	*41.*	*Nut*	*65.*	*Demister*
18.	*Link rod LH*	*42.*	*Washer*	*66.*	*Rivet*
19.	*Star lock washer*	*43.*	*Nut*	*67.*	*Fascia air vent nozzle*
20.	*Distribution valve lever*	*44.*	*Air intake mesh*	*68.*	*Retaining ring*
21.	*Air blend valve lever*	*45.*	*Inlet extension*	*69.*	*Escutcheon*
22.	*Sponge washer*	*46.*	*Screw*	*70.*	*Screw*
23.	*Water hose*	*47.*	*Washer*	*71.*	*Strap*
24	*Water hose*	*48.*	*Shake proof washer*	*72.*	*Stud*

Lever valves control both temperature and distribution. The temperature of the air is controlled by mixing warm and cold air in proportion within the heater unit. The centre vent on the fascia, also regulated by the levers, can deliver hot or cold air as required.

Operation 1 Heater unit - removal & replacement

To remove

1. Remove the fresh air pipe from the stub on the bulkhead.

2. Drain the cooling system **(Section E).**

3. Loosen the jubilee clips and remove the coolant hoses from the heater pipes at the bulkhead.

4. Remove the centre console trim panel **(Section R)**.

5. Remove the two screws securing the centre console to the fascia.

6. Remove the two wing nuts securing the centre console moulding to the body.

7. Prise the three air hoses from the air chamber on the top of the heater unit.

8. Remove the gear lever cover secured by four self-tapping screws. It may be necessary to peel back the drive shaft carpet to gain full access.

9. Remove the gear lever **(Section G)**.

10. Remove the four nuts, bolts and washers securing the heater assembly to the bulkhead and withdraw the unit.

The heater assembly can now be further dismantled for replacement of radiator, seals etc.

Operation 2 Blower unit - removal & replacement

To remove

1. Remove the fresh air pipe from the heater blower.

2. Remove the front grill/headlamp bezel **(Section Q).**

3. Disconnect the battery.

4. Disconnect the wiring from the blower motor.

5. From within the air duct, remove the three nuts and lock washers securing the blower unit to the body.

6. Withdraw the heater body, complete with rubber mountings.

Replace in reverse order.

The heater motor is replaceable and is secured to the blower case with nuts and washers.

Section T Electrics

Contents

Ignition system

Ignition system

The ignition system comprises battery, ignition switch, coil, distributor and sparking plugs as shown in **Figure 1.**

If trouble is experienced with the ignition components shown in **Figure 1**, they should be systematically checked to diagnose the fault. Particular attention should be given to cleanliness and security of earth braids as if the ignition system fails to function correctly, a loose earth braid can often be the cause.

The distributor is described in full below but for the details of the other components refer to the General Electrical equipment section on page

Distributor

Description

The distributor is mounted on the right-hand side of the cylinder block and is driven by an offset dog from the camshaft. Ignition advance is mechanically regulated according to engine speed by governor weights inside the unit and according to engine load by vacuum control acting directly on the contact breaker mounting plate which

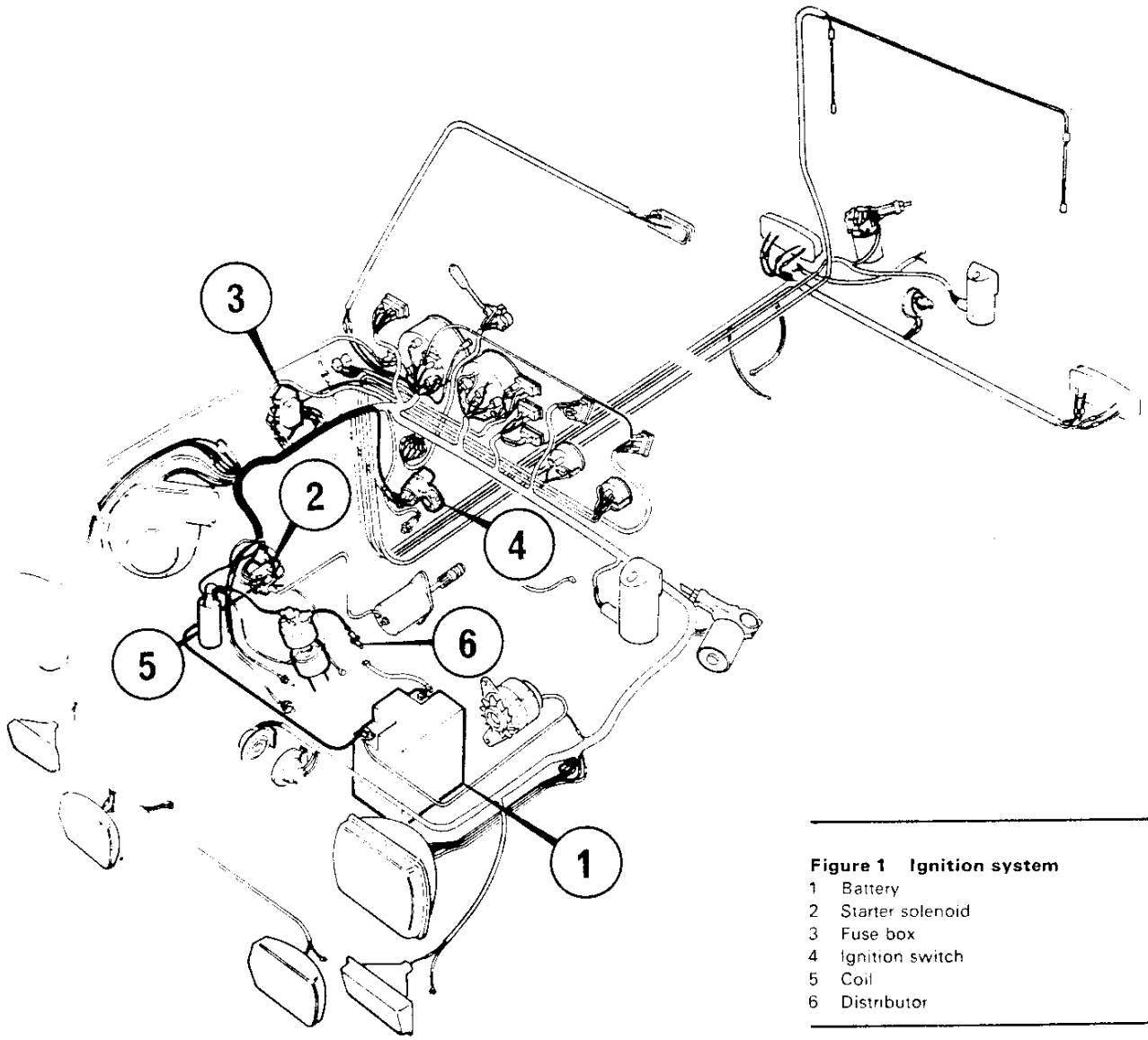
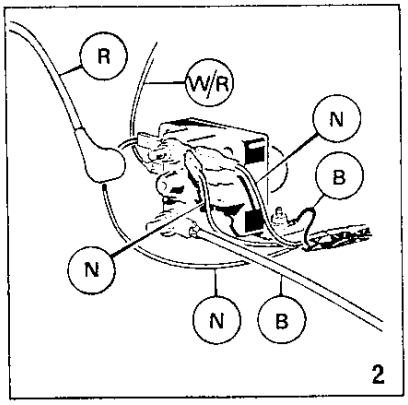


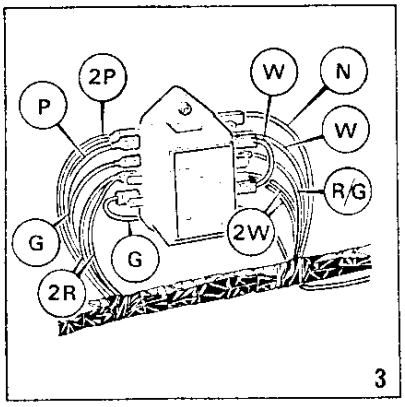
Figure 1 Ignition system

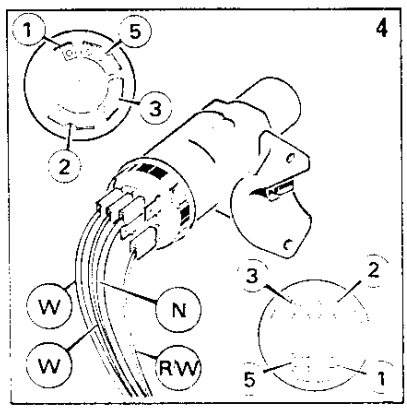
1 Battery
2 Starter solenoid
3 Fuse box
4 Ignition switch
5 Coil
6 Distributor

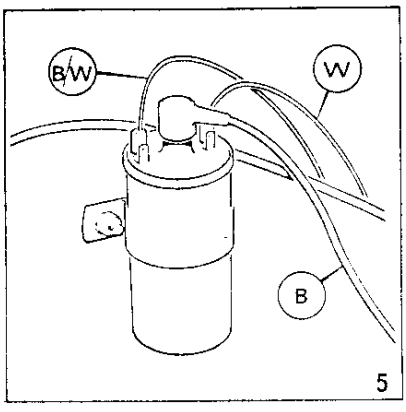
Colour Codes

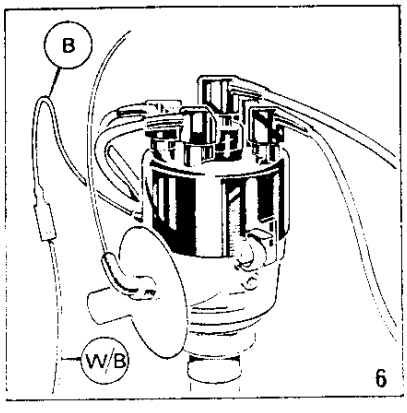
Letter	*Colour*
R	Red
W	White
G	Green
B	Black
Y	Yellow
S	Slate
U	Blue
P	Purple
LG	Light Green
N	Brown
O	Orange
K	Pink











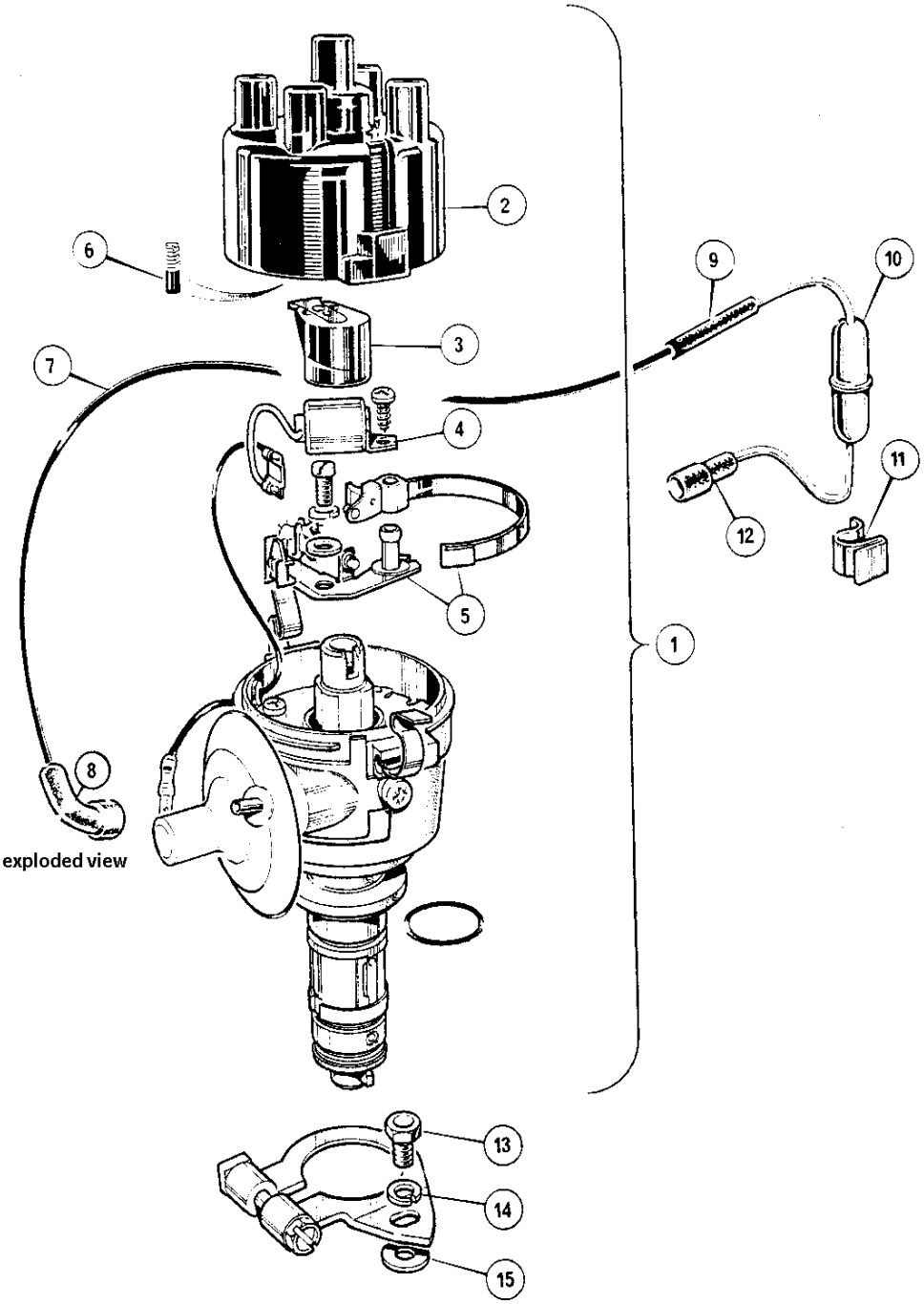


Figure 2 Distributor - exploded view

1 Distributor
2 Distributor cap
3 Rotor arm
4 Condenser
5 Contact set
6 Brush & spring
7 Suction pipe
8 Elbow sleeve
9 Sleeve
10 Fuel trap
11 Clip
12 Reduction sleeve
13 Screw
14 Lock washer
15 Washer

has a limited arc of movement in relation to the distributor body. Distributor rotation is anti-clockwise when viewed from above.

Lubrication of distributor

The cam and contact breaker plate pivots and bushing, when assembling after overhaul, should be lightly lubricated with Shell Retinax "A" or equivalent. The governor weights and contact breaker arm pivot should be lightly oiled every 6,000 miles (10,000 km). To lubricate the cam spindle, remove the rotor arm and apply two drops of oil to the felt pad. The felt brush fitted to the contact breaker plate augments lubrication of the cam. This does not require periodic lubrication as it is impregnated before fitting. Only a film of engine oil should be applied to the hollow breaker arm pivot post, ensuring that none contaminates the distributor points.

Caution: Do not over lubricate any part of the distributor. the presence of dirt, oil or water on the points, the central carbon brush or in the contact segments in the distributor cap will cause erratic running or may even prevent the engine from running at all.

Contact breaker points

To adjust

1. Remove the distributor cap and rotor arm.

2. Turn the engine so that the heel of the contact breaker is on the highest point of the cam. (it may be necessary to remove the spark plugs to eliminate the resistance caused by engine compression).

3. Slacken the slot headed screw **(Figure 3)**in the contact plate and adjust until the gap is 0.38mm (0.015 in). The gap is measured with a suitable feeler gauge and pressure should be applied to the points, with the feeler gauge inserted between them whilst the screw is tightened.

4. re-tighten the screw and make a further check with the feeler gauge in case tightening has altered the setting.

5. Refit the rotor arm with the slot and lug in line. Press the rotor firmly in to place on the spindle.

Note: When the rotor arm is fitted to the spindle the lower face **does not** abut the cam

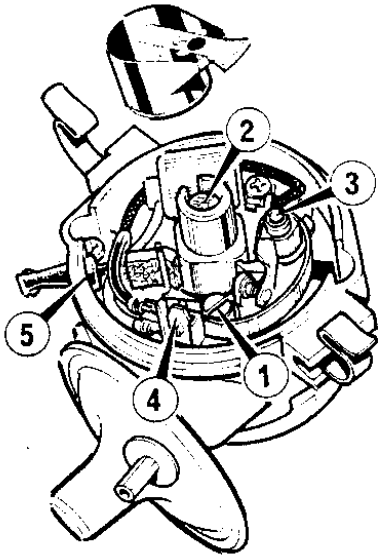


Figure 3 Contact breaker adjustment

1. Locking/adjustment screw
2. Cam spindle lubrication pad
3. Breaker arm pivot point
4. Terminal post
5. Low tension lead

Operation 1 Removal & examination of contact breaker points

1. Remove the distributor cap and rotor arm.

2. Press the terminal end of the moving contact spring towards the cam (Figure 4). this will disengage the spring from the insulating piece attached to the terminal post. The capacitor lead and the low tension fly-lead can then be detached from the folded end of the spring. remove the slotted screw securing the fixed contact and lift the assembly from the base plate.

3. Check the condition of the points for signs of wear or burning on the contacts. If this is apparent, the complete assembly will need replacing. Contacts showing a greyish colour and only slightly pitted can be smoothed with a fine emery stone and then thoroughly cleaned with carbon tetrachloride.

To replace

1. When refitting or replacing a contact breaker set, it is important to note that the capacitor and low tension fly-lead connecting terminal in the folded end of the moving contact spring has the cable clips facing outward. Otherwise the lower clip may foul the fixed contact plate short circuiting the contact breaker. **(Figure 4)**

2. Replace the slotted screw and adjust the contact breaker points as previously described.

Note: If a new contact set is fitted, set the contact gap to 0.40 to 0.45 mm (0.016 to 0.019 in) to allow for initial bedding in of the plastic heel.

3. Replace the rotor arm and distributor cap.

Operation 2 Condenser - removal & replacement

The condenser is fitted in parallel with the contact breaker points. A short circuit in the condenser will cause ignition failure as the contact points will no longer interrupt the low tension circuit. In such cases the condenser will need replacing.

An open circuit, however, cannot be readily checked without the use of specialised equipment such as a diagnostic test set. The usual symptoms of this are excessive arcing and burning of the contact

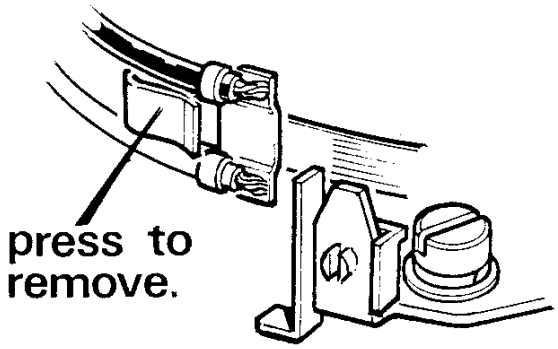


Figure 4 Correct replacement of points

breaker points and difficult starting.

To remove the condenser

1. Remove the distributor cap and rotor arm.

2. Remove the contact breaker assembly

3. Remove the cross head screw and lift the condenser from the base plate.

4. The condenser, condenser lead and low tension fly-lead are a complete assembly. The fly-lead, complete with grommet and insulated "lucar" terminal should be withdrawn through the hole in the distributor body (Figure 2).

5. replace in reverse order taking care that there is no possibility of a short circuit between the condenser lead terminal and the contact breaker plate.

Note: Dismantling of the complete distributor is not recommended as only the cap, rotor arm, condenser and lead assembly and contact breaker assembly are available as spares.

Operation 3 To remove the distributor from the engine

1. Disconnect the spark plug leads and "King" lead to the coil.
2. Remove the low tension fly-lead from the coil.
3. Unscrew the single colt and washer securing the distributor clamp to the block, and withdraw the distributor. Do not disturb the clamping bolt securing the clamp to the distributor body.
4. Replace in reverse order.

Distributor specification

Type	Lucas 45D4 single pair contact breaker points
Drive	Dog-gear from camshaft
Firing order	1, 3, 4, 2.
Ignition advance	Vacuum
Static timing	10°BTDC
Rotation	Anti-clockwise (from above)
Firing angle	0-90°- 180°- 270°+/- 1°
Dwell angle	51° +/- 5°
Contact breaker gap	0.38 mm (0.015 in) 0.40-0.45 mm (0.016-0.018 in) for new contact set
Contact spring loading	522-880 gf (18-24 ozf)
Condenser	0.18 to 0.25 microfarads

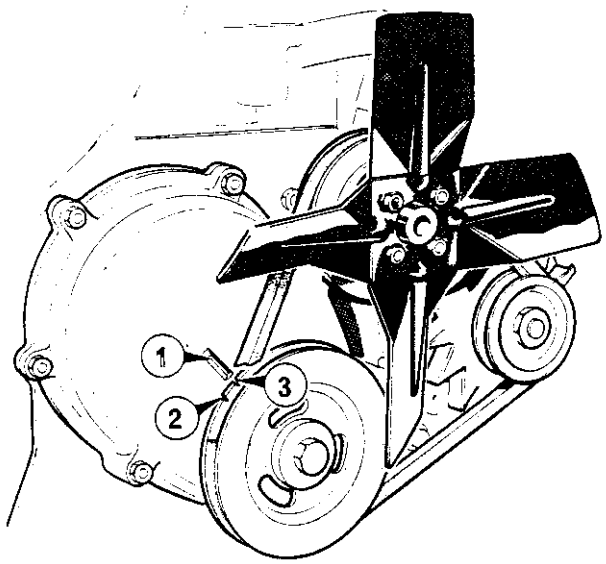


Figure 5 Timing marks

1. Timing pointer

2. TDC mark

3. 10° BTDC mark

Ignition timing

Incorrect ignition timing can cause rough running, poor idling, high fuel consumption and poor performance. It is therefore important that the timing should be correctly set. In order to facilitate the timing, two marks are stamped on the crankshaft pulley indicating TDC and 10° crankshaft rotation. **(Figure 5)** The TDC mark aligned with the pointer on the timing chain cover indicates that pistons 1 & 4 are at top dead centre. All Kittens should be timed at 10° BTDC. Two methods for obtaining correct ignition timing are described as follows:-

Method 1 - static

1. Rotate the crankshaft in a clockwise direction until the 10° pulley mark is aligned with the pointer on the timing cover **(Figure 5)**.

2. Remove the distributor cap and connect a 12 volt bulb between the low tension terminal and a good ground. With the ignition switched on, the bulb will glow when the contact breaker points are open.

3. Slacken the distributor clamp bolt and rotate the distributor clockwise as far as possible.

4. Switch on the ignition and apply light finger pressure to the rotor arm. Turn the distributor body slowly back until the bulb lights.

5. Tighten the distributor clamp bolt.

6. Check the timing by rotating the engine two revolutions in a clockwise direction, observing the relative position of the pointers, until the bulb lights. The 10° mark should be aligned with the pointer on the timing cover.

7. Turn off the ignition, remove the test lamp and reassemble all parts.

Method 2 - dynamic

1. Connect the leads of a "strobe" timing light in accordance with the makers instructions.

2. Check that the pointer on the timing cover and the notches on the front pulley are visible. Mark the pointer and the 10° mark with chalk, "Tippex" or similar.

3. Disconnect the vacuum tube from the distributor and plug the end of the tube with a suitable plug to stop air being drawn in.

4. Start the engine and allow to idle at normal tick over speed. Aim the "strobe" light at the timing marks taking care not to contact the spinning fan. Ensure that the 10° mark is aligned with the pointer. If the mark is to the left of the pointer the ignition is too far advanced. Slacken the distributor and turn slightly anti-clockwise to retard the ignition until the marks align. If the mark is to the right of the pointer then the ignition is too far retarded. Turn the distributor slightly clockwise until the marks align. When the marks are correctly aligned, securely tighten the distributor clamp and re-check the timing. Stop the engine.

5. Disconnect the "strobe" light and refit the vacuum tube.

Starting system

The starting system comprises battery, ignition switch, solenoid and starter motor **(Figure 6)**.

If the starter fails to operate when the ignition is switched on then the components in **Figure 6** should be systematically checked to diagnose the fault. Examine the starter pinion which can become jammed in mesh with the flywheel ring gear. It can be released by turning the square end of the starter motor shaft in an anti-clockwise direction or occasionally a sharp blow from a hammer on the casing.

Check the battery is in good condition and fully charged and that the terminals are tight and free from corrosion. The condition and security of earth braids is also important, particularly the braid between the chassis frame and gearbox casing adjacent to the rear gearbox mountings.

The starter solenoid could be faulty. When the ignition is switched on and in the start position the solenoid should click and the starter "bendix" gear engages with the flywheel ring gear which makes a distinctive sound. If this is not apparent a faulty solenoid could be indicated.

If the components of the starting system are found to be functioning correctly this would indicate that the fault lies elsewhere in the ignition or charging systems. Starter motor testing is detailed below but for details of other starting system components see the **General Electrics** section page 121.

Starter motor

Description

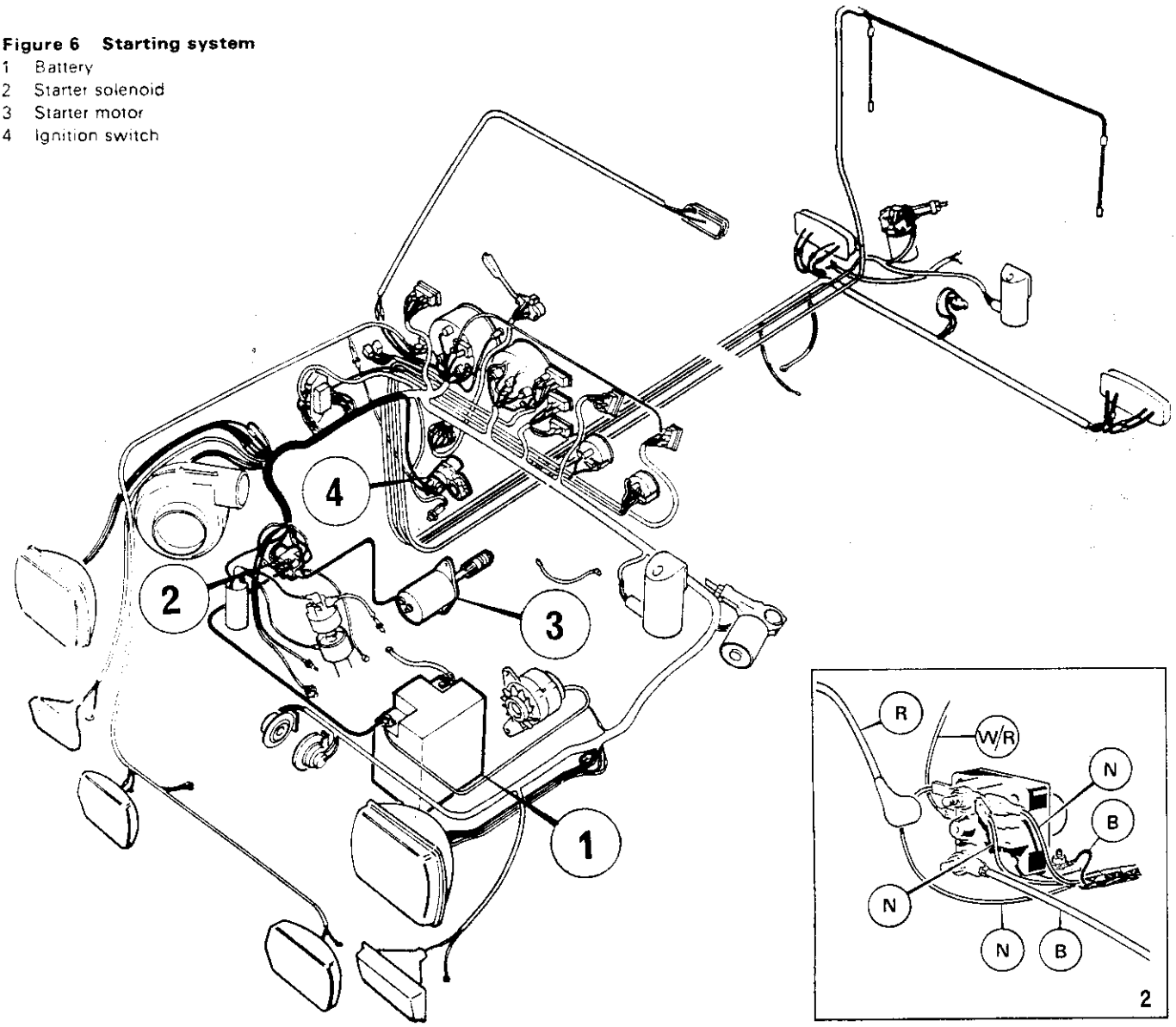
The starter motor is a four-pole four-brush machine with inertia drive and is secured on the right-hand side of the engine to the rear engine plate and gearbox bell housing.

Operation 1 To remove starter motor (Figure 7)

1. Disconnect the battery.
2. Remove the oil filter.
3. Disconnect the starter motor supply cable and remove the two nuts, bolts and lock washers securing the starter motor to the engine.
4. remove the starter motor from the vehicle.

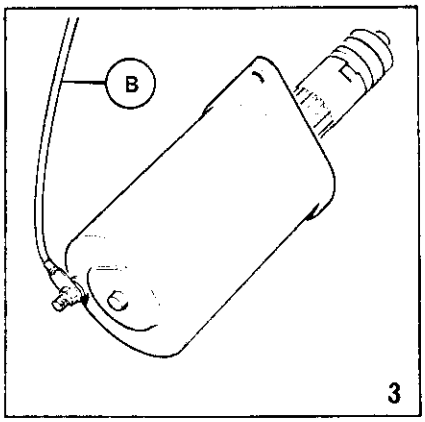
Re-assemble in reverse order.

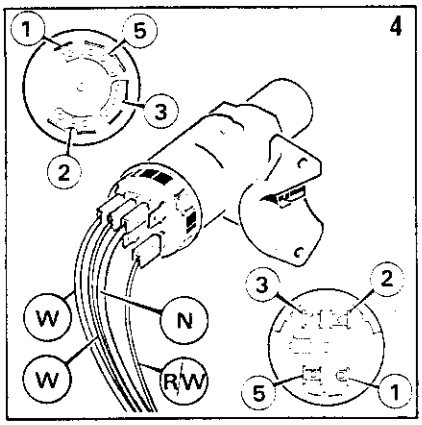
Figure 6 Starting system
1 Battery
2 Starter solenoid
3 Starter motor
4 Ignition switch



Colour Codes

Letter	*Colour*
R	Red
W	White
G	Green
B	Black
Y	Yellow
S	Slate
U	Blue
P	Purple
LG	Light Green
N	Brown
O	Orange
K	Pink





Bench testing
Remove the commutator end cover from the motor and check the brushes for wear and replace if necessary.

Measuring light running current
Clamp the motor in a vice and, using a 12 volt battery. with a moving coil ammeter of suitable range, check the light running current and the armature speed. Always use heavy gauge cabling for this test. Under light load the motor should run freely with a current of 65 amps at 8000-10,0000 rpm. The test only proves that the motor functions correctly when not at its normal operating load. If, on refitting the motor, it again fails to crank the engine an internal fault is indicated and a replacement motor will need to be fitted.

Starter motor specification

Lock torque	0.97kg/m (7.0 lb/ft) @ 350 amps
Running torque	0.61 kg/m (4.4 lb/ft) @ 260 amps
Light running current	65 amps @ 8-10,000 rpm
Brush spring pressure	800gf (28 ozf)

Charging system
The charging system comprises a battery, alternator and ignition warning light as shown in Figure 8.

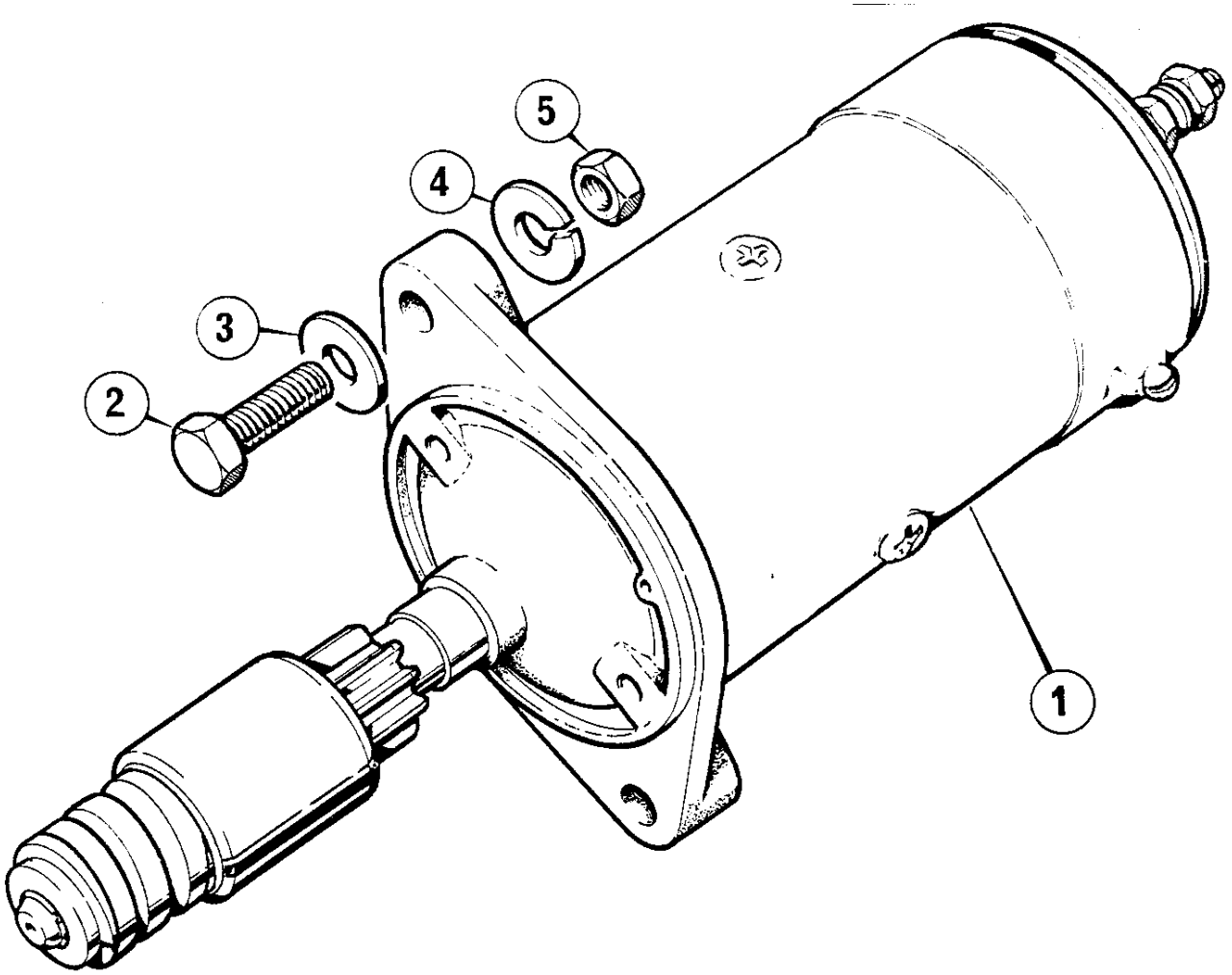


Figure 7 Starter motor

1 Starter motor
2 Bolt
3 Washer
4 Lockwasher
5 Nut

It is important that the charging system be kept in good working order because the ignition, starting and lighting systems depend on it. These systems will be rendered inoperative if the battery is in an extremely low state of charge. The electrolyte level in the battery must be regularly checked and topped-up if necessary. Keep the battery terminals clean and tight.

The correct fan belt tension is important. a slack belt will slip and prevent the alternator from fully charging the battery.

Attention should also be given to the cleanliness and security of the earth leads / braids.

The ignition warning light serves the dual purpose of reminding the driver to switch off the ignition and acting as a no charge indicator. With the ignition switched on the lamp should only be illuminated when the engine is either not running, or is running at a very low speed. As the engine speed increases the lamp should extinguish. Failure to do so indicates a fault in the charging system.

The alternator is described in full in the following text but for details of the other charging components see **General Electrics** page 121.

Alternator

Description

The alternator is a 12 pole 2 brush machine and is driven by a belt from the crankshaft pulley. to ventilate the interior components a multi bladed fan is fitted behind the drive pulley.

The brush gear is enclosed in a moulding screwed to the slip-ring end bracket thus providing protection against adverse effects of dust and moisture.

Voltage control is achieved by a model 14TR solid state regulator built in to the slip-ring end bracket, replaceable if faulty. A normal type of charge indicator (warning light) system is used with this alternator. The warning light is connected in series with the field supply diodes and is extinguished when the voltage generated in the diodes equals the supply voltage from the battery.

The only attention that the alternator is likely to require is the occasional checking of the brushes. remove the alternator end cover, unscrew two 4BA bolts and lift the brush box clear from the slip-ring moulding bracket. Check that they are free from oil or grease. If necessary they can be cleaned with a petrol moistened cloth. Check brush and springs for ease of movement in the holders. If the overall length of the brush has worn to less than 7.62 mm (0.30 in) the brushes and springs need to be renewed.

Wipe away any oil or dirt which may have collected around the slip-ring end cover ventilation apertures. The main bearings are packed with grease during manufacture so do not require attention.

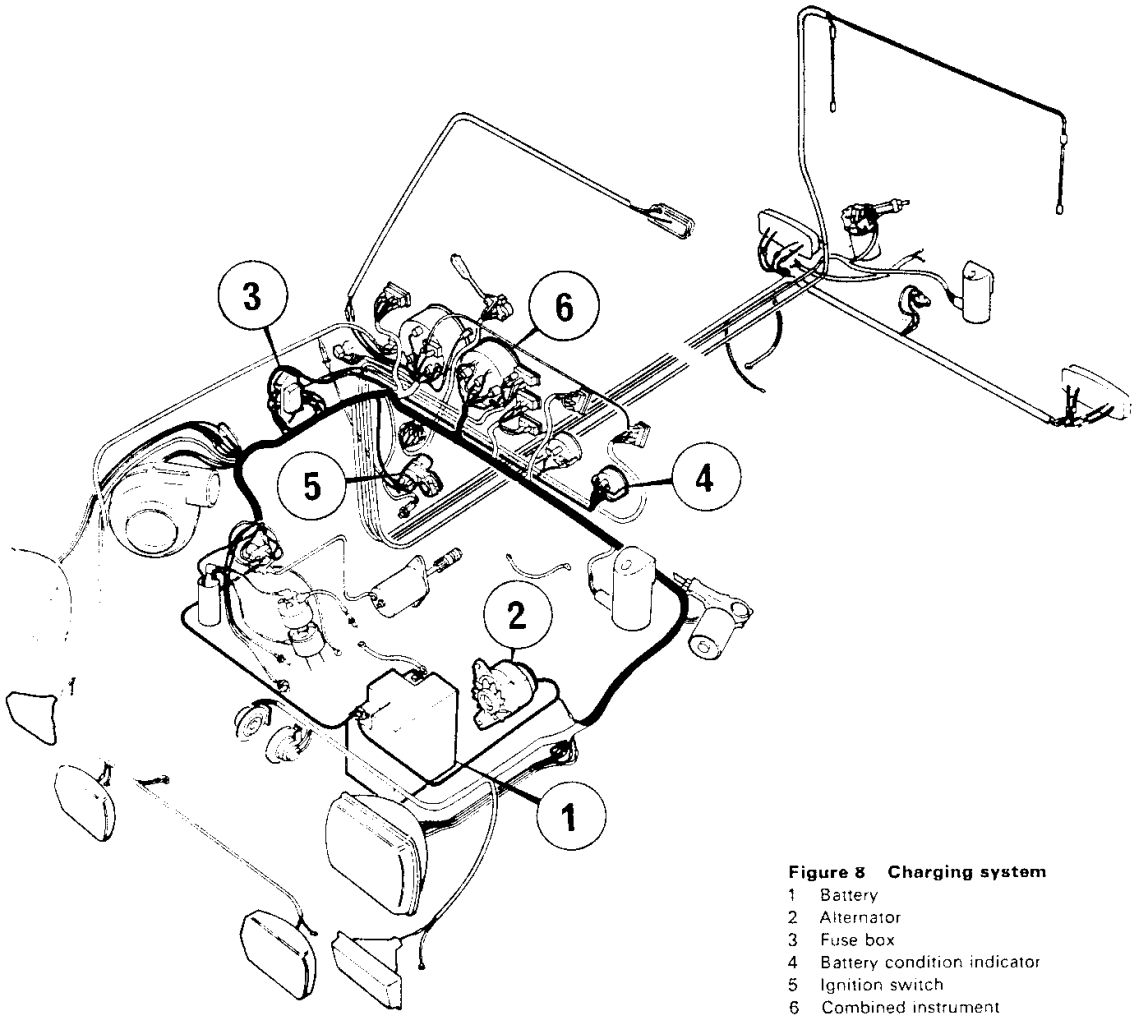
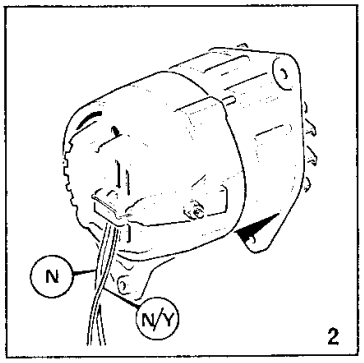
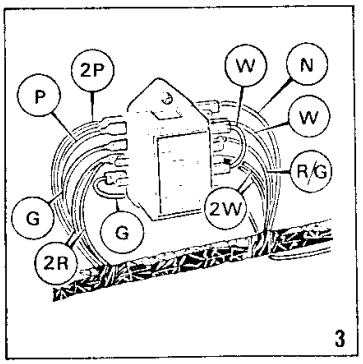


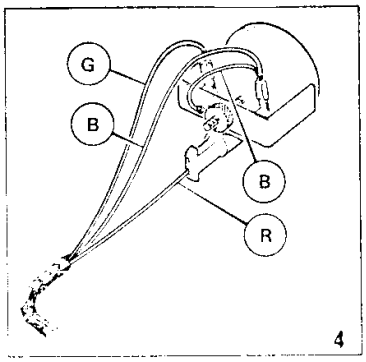
Figure 8 Charging system
1 Battery
2 Alternator
3 Fuse box
4 Battery condition indicator
5 Ignition switch
6 Combined instrument

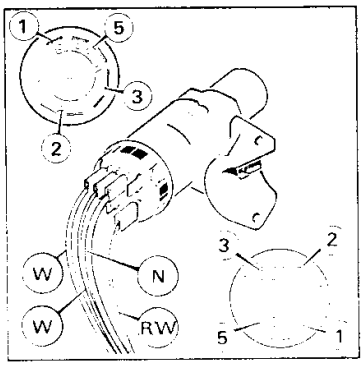
Colour Codes

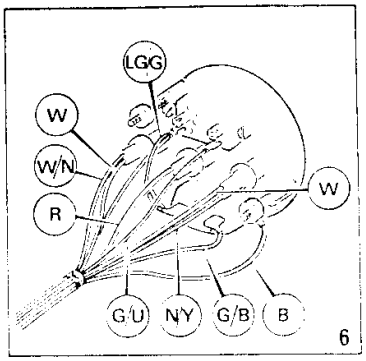
Letter	*Colour*
R	Red
W	White
G	Green
B	Black
Y	Yellow
S	Slate
U	Blue
P	Purple
LG	Light Green
N	Brown
O	Orange
K	Pink











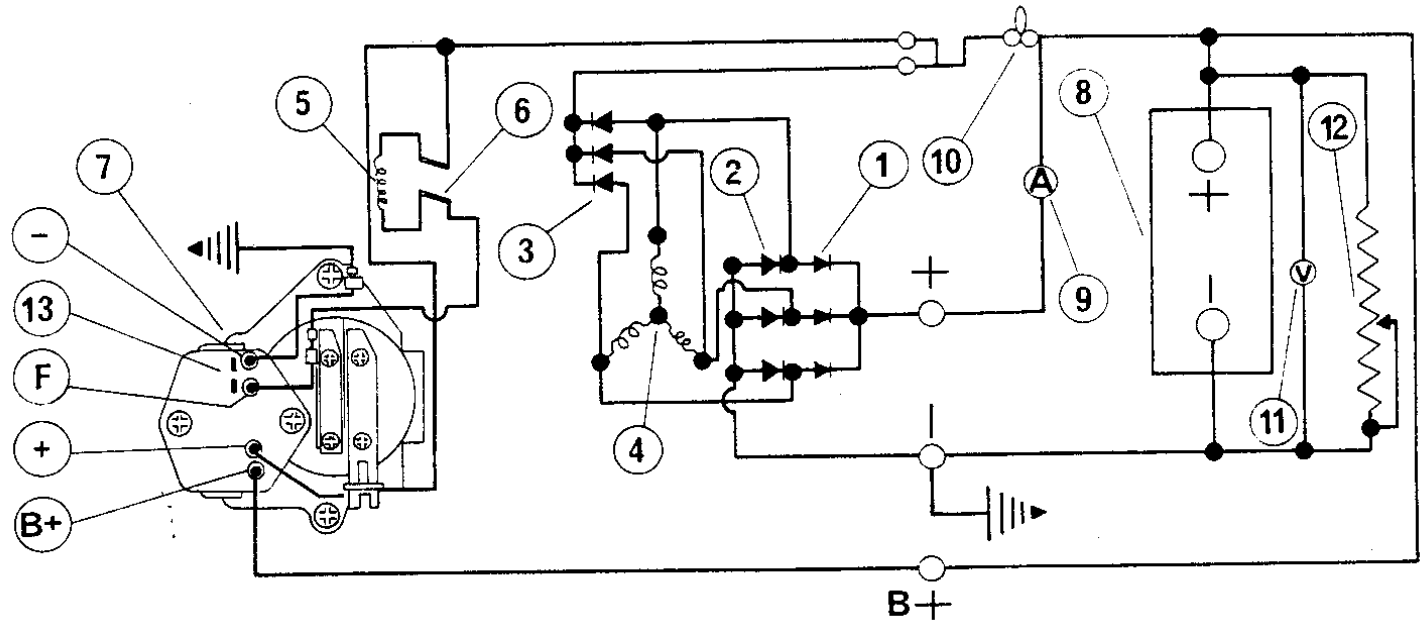


Figure 9 Alternator output test circuit

1. *Live side output diodes (3)*
2. *Earth side output diodes (3)*
3. *Field feed diodes*
4. *Stator winding*
5. *Field winding*
6. *Slip-rings*
7. *Voltage regulator*
8. *12 volt battery*
9. *0-40 or 0-60 ammeter*
10. *12 volt 2.2 watt lamp*
11. *0-20 volt meter*
12. *0-15 ohms 35 amp variable resistor*
13. *Link between regulator terminals "F" and "-"*

Note: Serious damage to the alternator can occur if the following points are not observed.

1. Ensure that the battery is connected **Negative** earth. Reversed battery connection will destroy the alternator diodes.

2. Never earth the output (B+) terminal of the alternator. It should be connected directly to the battery positive terminal.

3. Always disconnect the battery earth cables at the battery before removing the alternator or its connecting wires. Serious damage to the wiring harness and the alternator can result through accidentally earthing the output terminal.

4. Never attempt to run the engine with the output cable from the alternator to the battery disconnected. A very high voltage will develop which might burn out the rotor or the diodes.

5. When the battery is to be recharged in the car it is wise to disconnect it from the vehicle wiring before connecting the battery charger.

6. When starting from a slave battery or "jump" starting another vehicle ensure the polarity of the leads is correct, i.e. positive to positive, negative to negative. Incorrect connection may well cause one or both batteries to explode destroying the alternator and severely damaging the vehicle wiring.

Testing the alternator

First check for condition and correct tension of the drive belt. The nominal ratings given at the end of this section are for the vehicle fully warmed up. These figures may be exceeded slightly during cold running. To avoid misleading results, the following procedure should be carried out only with the unit at normal operating temperature.

Alternator output test

1. Unplug the alternator connector and remove the rear cover. link together the regulator terminals "F" and "-".

2. Connect an exterior test circuit as shown in **Figure 9**. Observe carefully the polarity of the battery and alternator terminals. The variable resistor across the battery terminals must not be left connected for longer than is necessary to conduct this test.

3. Start the engine. At 1,500 alternator rpm (1000 engine rpm), the test circuit bulb should be extinguished. Increase the engine speed until the alternator is running at 6,000 alternator rpm (4,000 engine rpm) approximately and adjust the variable resistance until the volt meter reads 14.0 volts. The ammeter reading should then be approximately equal to the rated output of the alternator. Any appreciable deviation would suggest an internal defect and if so a new alternator will need to be fitted.

Operation 5 To remove the alternator (Figure 10)

1. Disconnect the battery and alternator cables.

2. Slacken the alternator mounting bolts and tilt the unit towards the engine.

3. Remove the drive belt.

4. Remove the securing bolts, nuts, washers and spacers and detach the alternator from the engine.

Replace in reverse order. Tighten the pivot bolts to a torque of 2.08-2.77 kg/m (15-20 lb/ft). Tighten the adjuster bolt to 1.11-1.39 kg/m (8-10 lb/ft).

Alternator specification

Polarity	Negative
Nominal voltage	12 vdc
DC output (hot @ 14 volts/6,000 alternator rpm.	28 amps
Max rotor speed	12,500 rpm
Stator phases	3
Stator winding layout	Star
Rotor poles	12
Resistance of windings	4.33 ohms +/- 5%
Brush spring tension	255-368 gf (9-13 ozf)

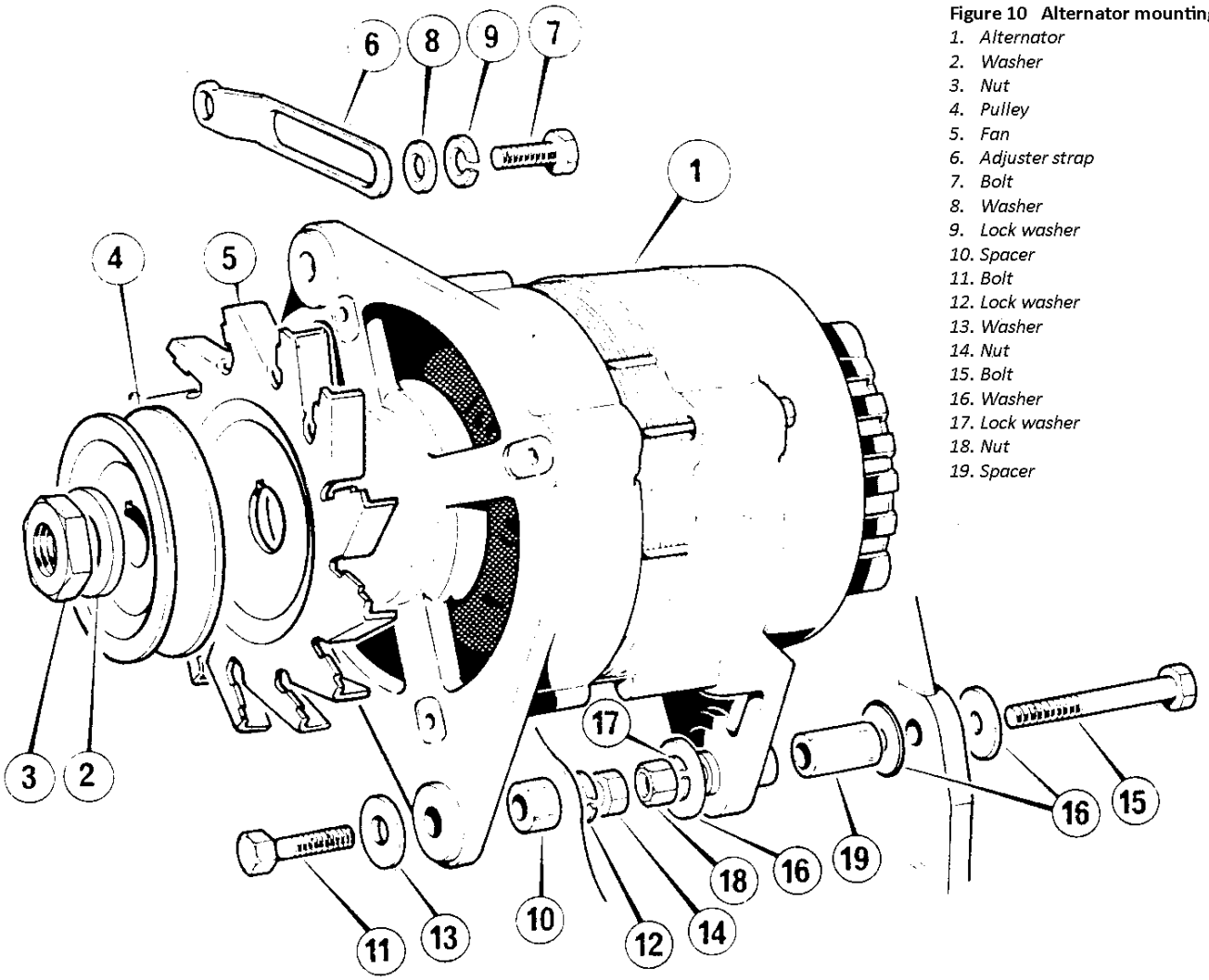


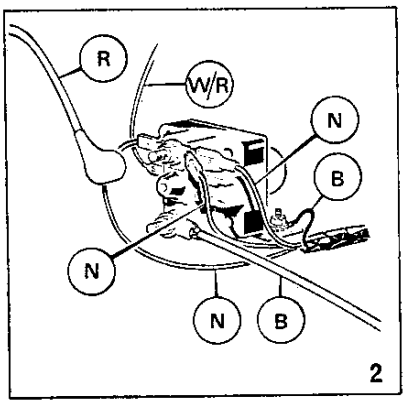
Figure 10 Alternator mountings

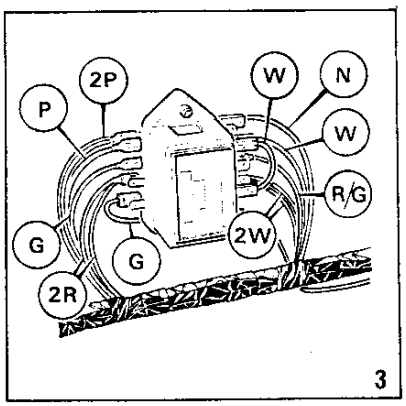
1. *Alternator*
2. *Washer*
3. *Nut*
4. *Pulley*
5. *Fan*
6. *Adjuster strap*
7. *Bolt*
8. *Washer*
9. *Lock washer*
10. *Spacer*
11. *Bolt*
12. *Lock washer*
13. *Washer*
14. *Nut*
15. *Bolt*
16. *Washer*
17. *Lock washer*
18. *Nut*
19. *Spacer*

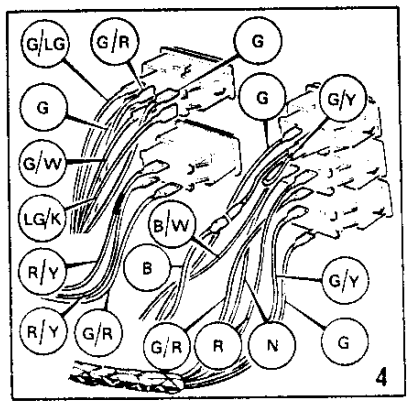
Figure 11 Lighting system

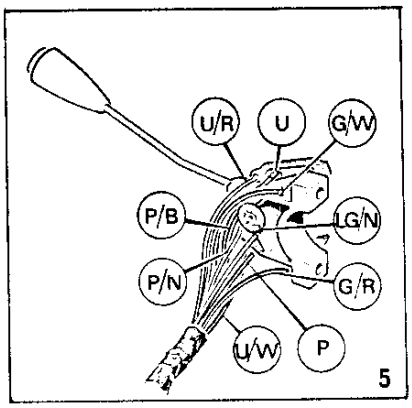
Colour Codes

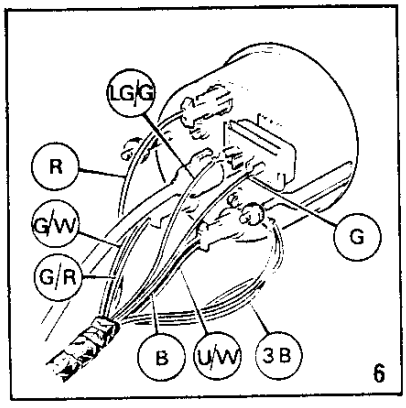
Letter	*Colour*
R	Red
W	White
G	Green
B	Black
Y	Yellow
S	Slate
U	Blue
P	Purple
LG	Light Green
N	Brown
O	Orange
K	Pink











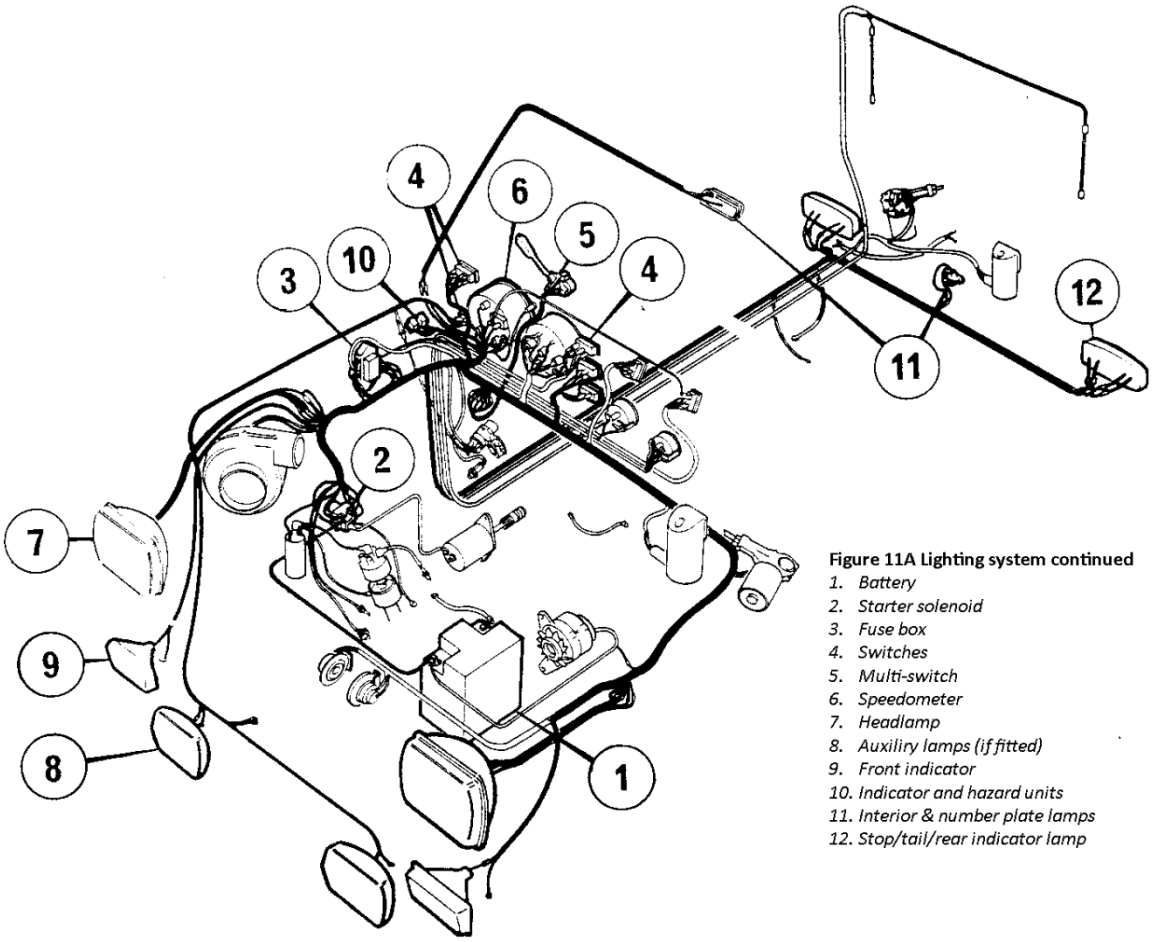
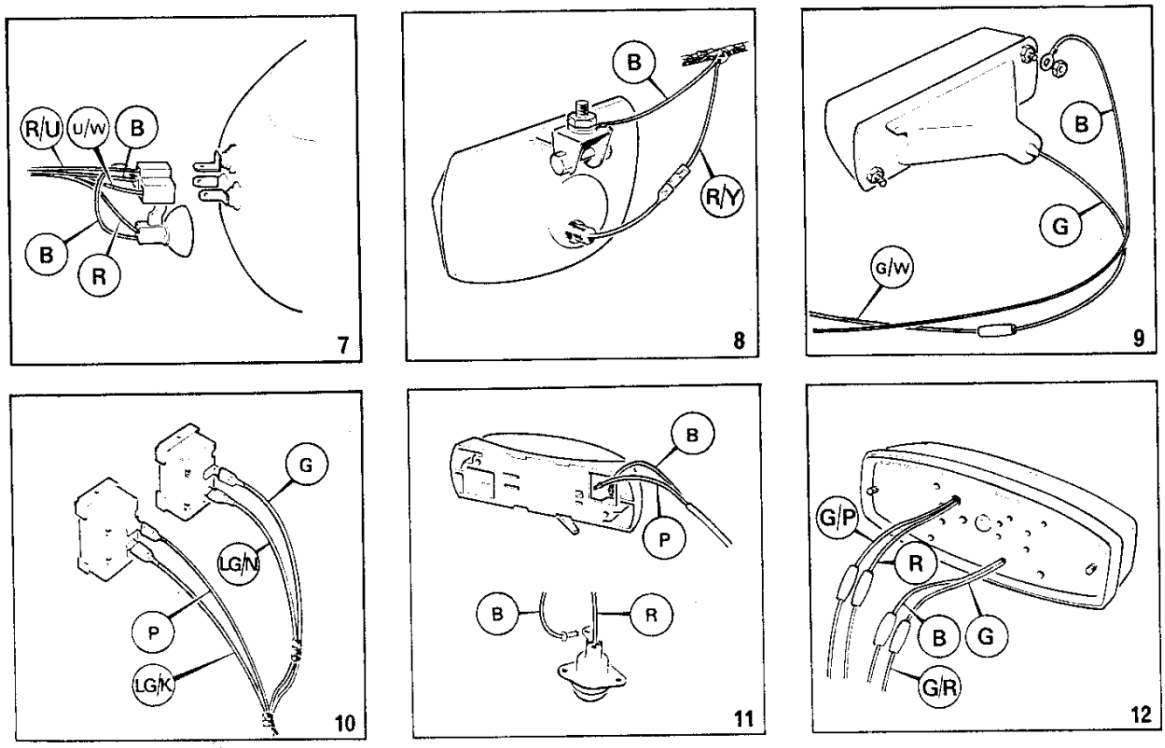


Figure 11A Lighting system continued

1. *Battery*
2. *Starter solenoid*
3. *Fuse box*
4. *Switches*
5. *Multi-switch*
6. *Speedometer*
7. *Headlamp*
8. *Auxiliry lamps (if fitted)*
9. *Front indicator*
10. *Indicator and hazard units*
11. *Interior & number plate lamps*
12. *Stop/tail/rear indicator lamp*



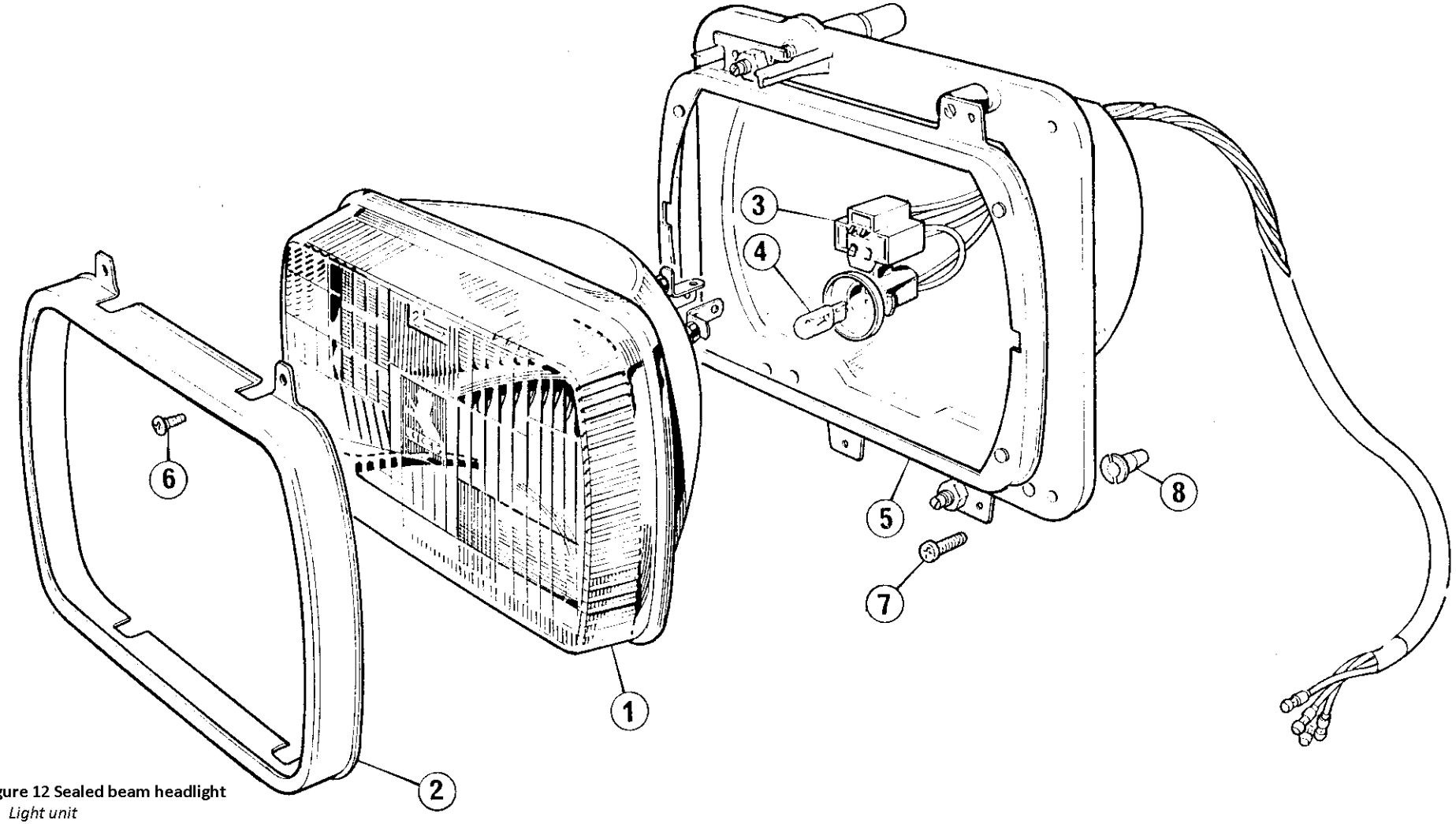
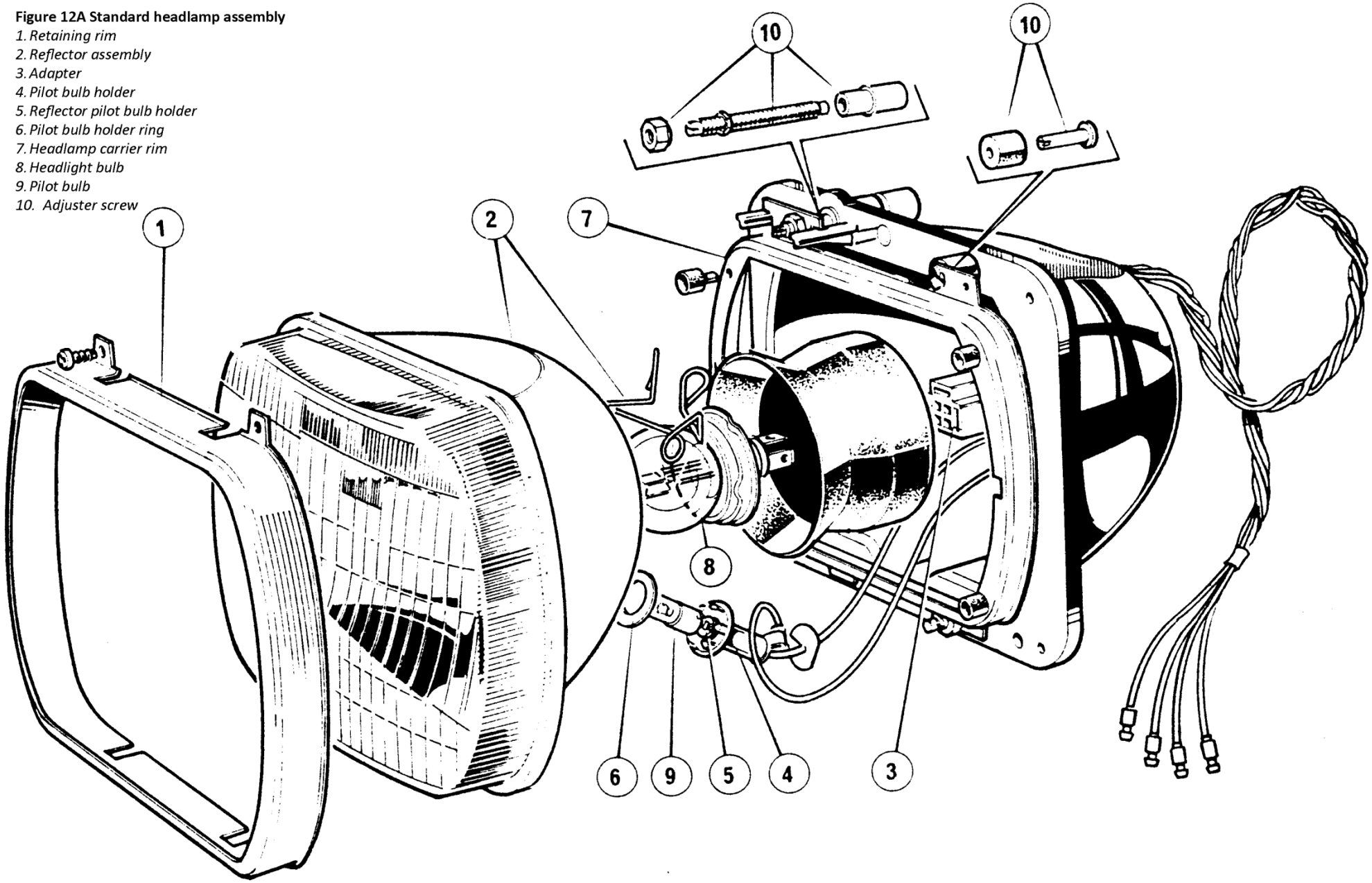


Figure 12 Sealed beam headlight

1. *Light unit*
2. *Retaining rim*
3. *Adapter*
4. *Pilot light bulb*
5. *Rim*
6. *Screw*
7. *Insert*

Figure 12A Standard headlamp assembly

1. Retaining rim
2. Reflector assembly
3. Adapter
4. Pilot bulb holder
5. Reflector pilot bulb holder
6. Pilot bulb holder ring
7. Headlamp carrier rim
8. Headlight bulb
9. Pilot bulb
10. Adjuster screw



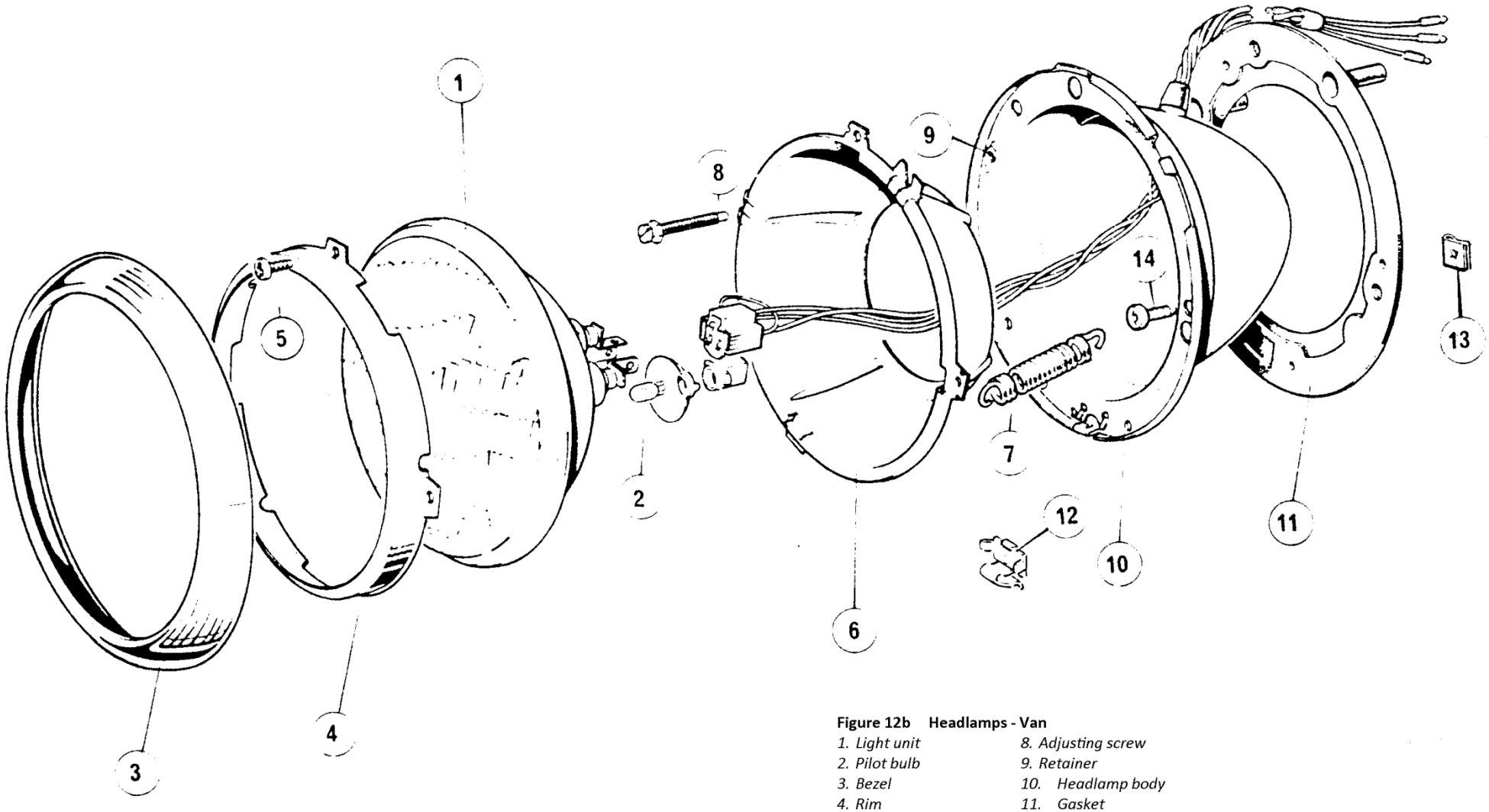


Figure 12b Headlamps - Van

1. Light unit	*8. Adjusting screw*
2. Pilot bulb	*9. Retainer*
3. Bezel	*10. Headlamp body*
4. Rim	*11. Gasket*
5. Screw	*12. Clip*
6. Seating ring	*13. Captive nut*
7. Spring	*14. Screw*

Lighting system

The lighting system comprises headlamps, front indicators, rear stop/tail/indicators, number plate lamp, battery, solenoid, light switch and multi-switch as shown in **Figure 11**.
The condition of earth leads and earth connections is important. The main harness earth connections are on the engine front cover, the battery to engine earth lead and the gearbox to chassis earth strap. It is of the utmost importance that these leads are kept clean and tight. If any section of the lighting system fails to function the condition and security of the earths described above should be checked. a blown fuse could also be the cause which can be confirmed by examination of the fuse. Before replacing a blown fuse inspect the applicable wiring for evidence of a short circuit.
The lighting system is described in full below but for details of fuses and lighting system components refer to the **General Electrics** section page 121.

Headlamps
The headlamps comprise of rectangular units incorporating the side lamps, either all glass sealed beam units or conventional type with replaceable bulbs. Should a beam fail, the sealed beam types must be replaced complete. The side lamps are 12v 5w, cap-less for the sealed beam assemblies, micro bayonet fitting for the conventional lamps. **(Figures 12 & 12A)**

Operation 6 Renewal of sealed beam/headlamp bulb/pilot bulb

1. Access to the unit is gained by removing the front grill/headlamp bezel secured by four screws in the grille and two at either end of the bezel.
2. The light unit is held secure by the inner rim affixed with four self tapping screws. Remove these and lift off the sealing rim.
3. The light assembly can now be withdrawn and the cable plug disconnected. The headlamp bulb is held in to the reflector by two captive spring clips. Release these to remove the bulb. If replacing a halogen type bulb do not touch the glass envelope as this will lead to reduced light output and premature failure. The pilot lamp holder is simply unclipped from the reflector to allow bulb replacement. The sealed beam reflector assembly needs to be replaced as a unit as the bulb is integral to the unit. The pilot bulb on this type is a cap-less push fit the holder being integral to the cable plug assembly. It shines through a window in the back of the sealed beam unit.

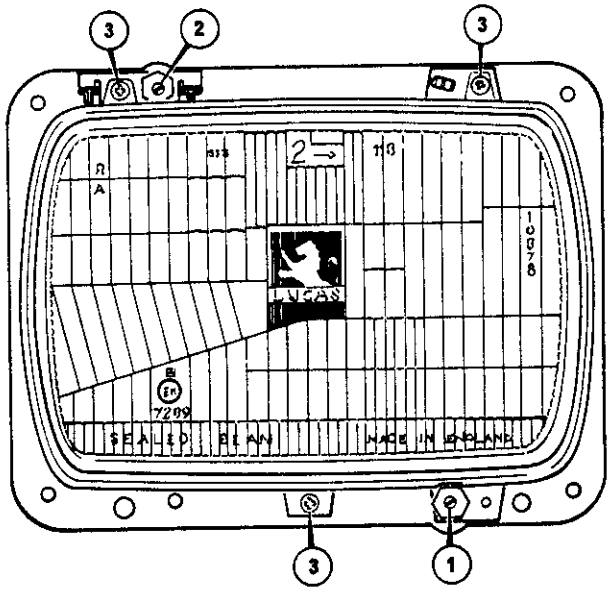


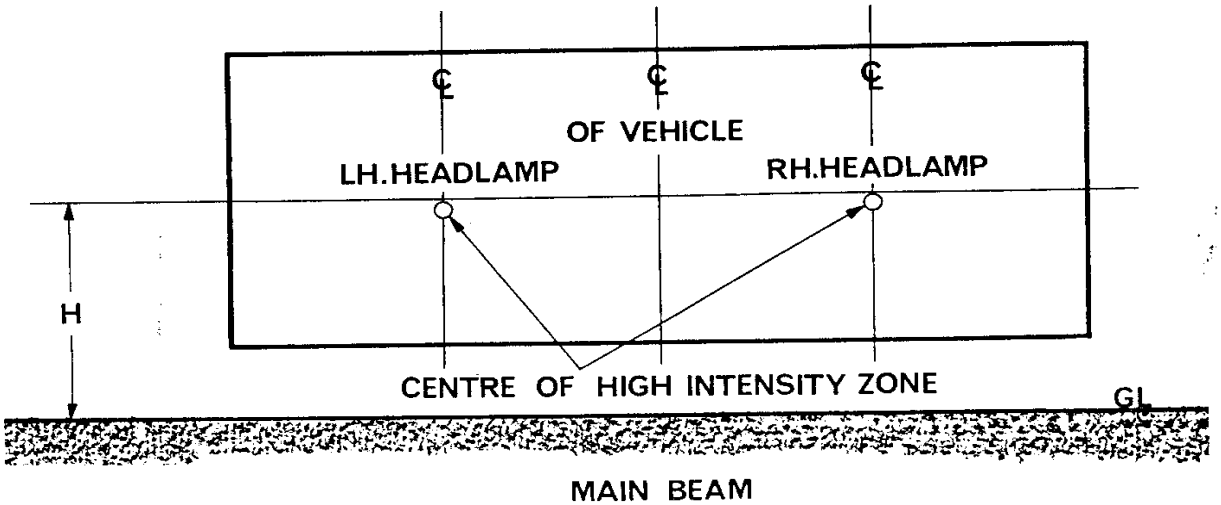
Figure 13 Headlamp adjuster screws
1. Vertical adjuster
2. Horizontal adjuster
3. Inner rim securing screw

To replace (sealed beam)
1. Fit the cable to the new light unit and place in to the carrier locating the two projections on the unit in to the slots on the carrier.
2. Replace the sealing rim fixing it with the four self tapping screws.
3. Check the beam setting and adjust if necessary.
4. refit the front grill/headlamp bezel.

To replace (conventional reflector)
1. Locate a new bulb in to the rear of the reflector, noting that it can only fit in one orientation, then secure with the two spring clips.
2. Fit the dust/moisture seal and plug in the cable plug assembly.
3. Refit the pilot light holder into its hole in the back of the reflector.

Final assembly is the same as the sealed beam type.

Figure 14 Headlamp alignment



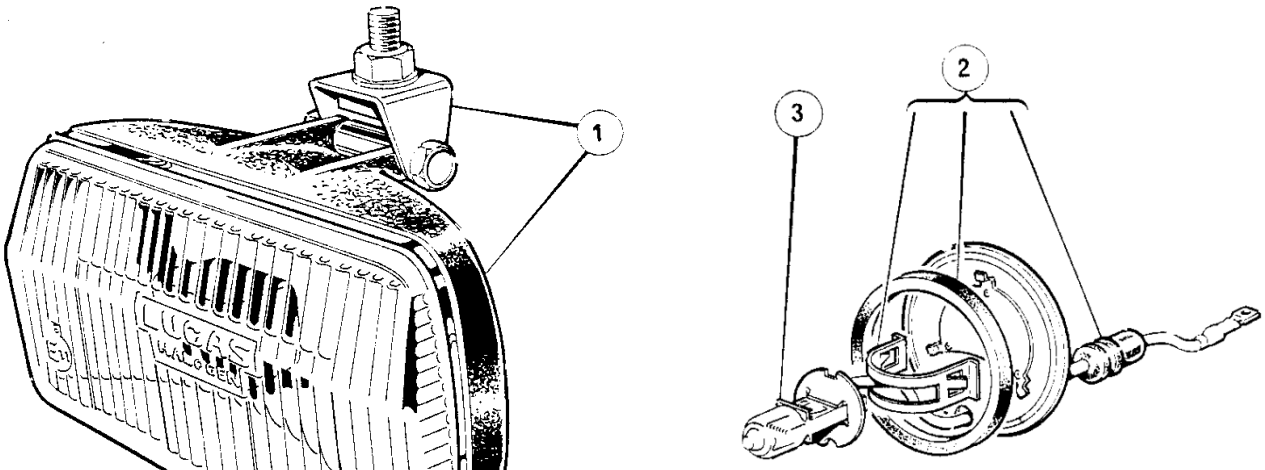


Figure 15 Auxiliary lamp
1 Lamp
2 Cap assembly
3 Bulb

Operation 7 Headlamp beam adjustment

It is recommended that beam setting equipment is used to ensure accurate beam adjustment. Follow the manufacturer's instructions for the correct procedure. If such equipment is unavailable beam adjustment can be obtained by the following method.

1. The vehicle should be at its kerbside weight with a person in the drivers' seat, the fuel tank approximately half full and the tyres at the correct pressures.

2. Position the vehicle on level ground approximately 10 m (32.8 ft) from and square to a suitably darkened screen.

3. Measure the height from the ground to the centre of the headlamp and adjust the screen so that the dividing line "H" corresponds to this height **(Figure 14)**.

4. Position the screen so the central dividing line corresponds to the centre line of the vehicle.

5. Switch the headlamps on to main beam and cover the offside lamp.

6. The nearside lamp should be adjusted until the area of concentrated light (hot spot) is focused just below "H" on the aiming board on the centre line of the left-hand headlamp, as shown in **Figure 14**. Vertical adjustment is obtained with adjusting screw "1" **(Figure 13)** and horizontal with adjusting screw "2".
With the main beam correctly set the dipped beam will automatically be correct.

7. Repeat for the offside headlamp.

Auxiliary lamps (if fitted)

The auxiliary front lamps are available as optional extras and are fitted with Quartz Halogen bulbs. Access to the bulb is gained by removing the cap on the rear body of the lamp. Twisting the cap by means of a suitable tool in the slot provided releases the bulb and holder assembly. **(Figure 15)**. Tilting the light unit upwards makes this easier to do. When replacing the bulb, **the glass envelope must not be touched with the fingers**. Always hold the bulb using a piece of tissue paper to stop the fingers actually contacting the glass envelope.
If the glass envelope is accidentally touched it must be carefully cleaned with methylated spirit before use. Failure to do so will lead to reduced light output and premature failure of the bulb

Front direction indicators

The front direction indicators lamps are actuated by the steering column multi-switch and the flasher unit secured behind the dash panel on the right-hand side. Failure of any of these components will render the front and rear indicators inoperative.
Access to the front indicator bulb is by removing the two cross head screws fixing the lens to the body of the lamp, removing the lens and then the bulb can be inspected or replaced. Later cars have a rubber seal between the lens and the lamp body and great care should be taken not to damage this.

To remove

1. Disconnect the indicator wire from the wiring harness.

2. Remove two nuts and lock washers securing the indicator lamp assembly to the body. Note the position of the earth lead **(Figure 16)**

3. The indicator lamp assembly can now be withdrawn. Refit in reverse order ensuring that the earth lead is securely fitted behind the outside nut.

Rear stop/tail and indicator lights

Access to the bulbs of the rear lamp cluster s obtained by removing the two cross head screws and lifting off the lens cover from the lamp body.

To remove

1. From beneath the vehicle disconnect the rear lamp leads from the wiring harness.

2. Remove the lens and release the bulbs to avoid damage.

3. Unscrew four "tap-it" fixings and remove the lamp back plate assembly from the body. replace in reverse order.

Note: Before fitting the unit it will be necessary to push the nylon inserts back in to the base of the back plate to close up the claws of the inserts.

Number plate lamp

Access to the bulb is by removing the two cross head screws securing the chrome bezel to the body and detaching the bezel, then releasing the lens from the rubber flange.

Figure 16 Front indicator lamp

1. *Lens*
2. *Screw*
3. *Bulb holder*
4. *Body*
5. *Bulb*
6. *Lock washer*
7. *Nut*

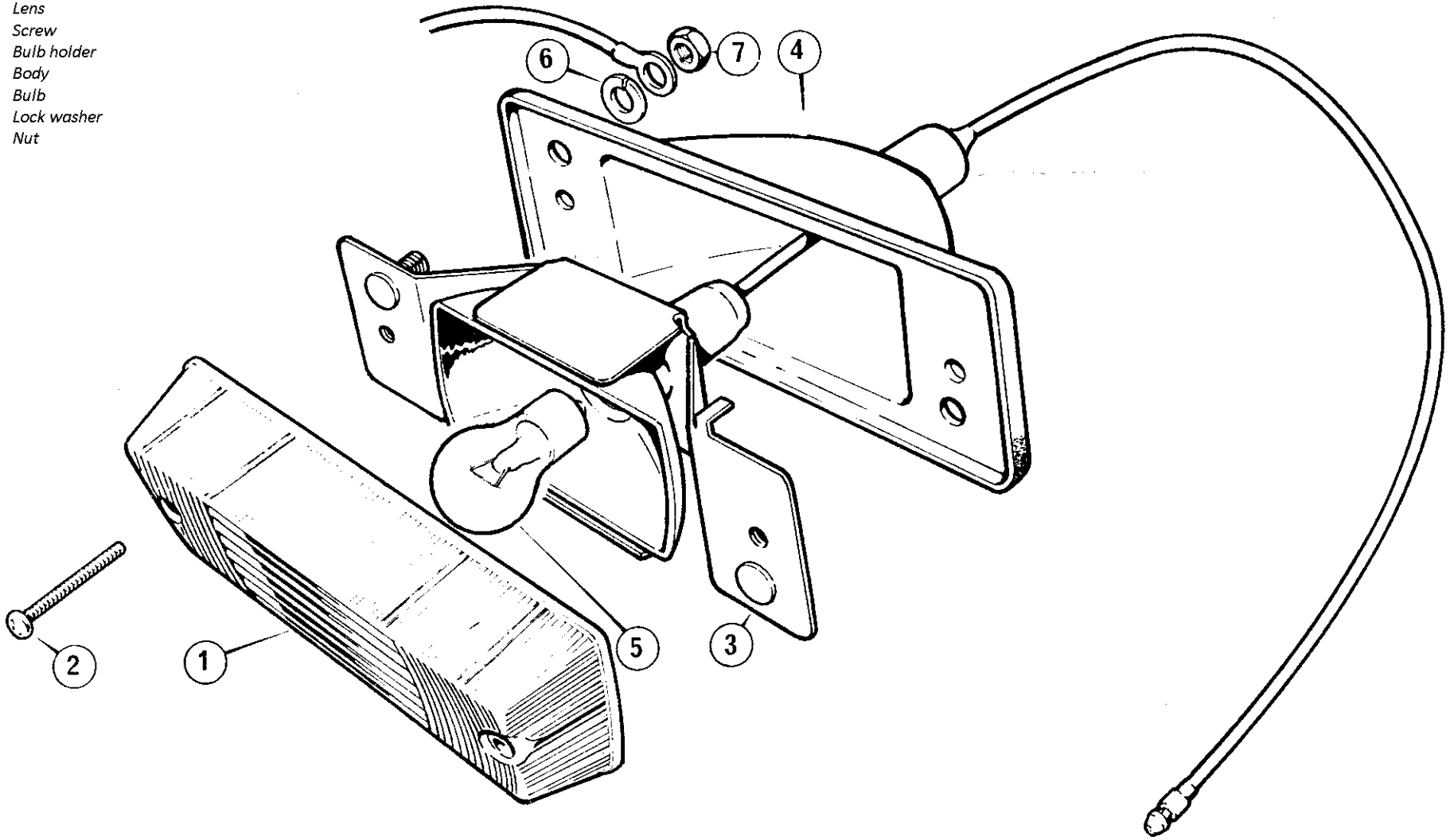
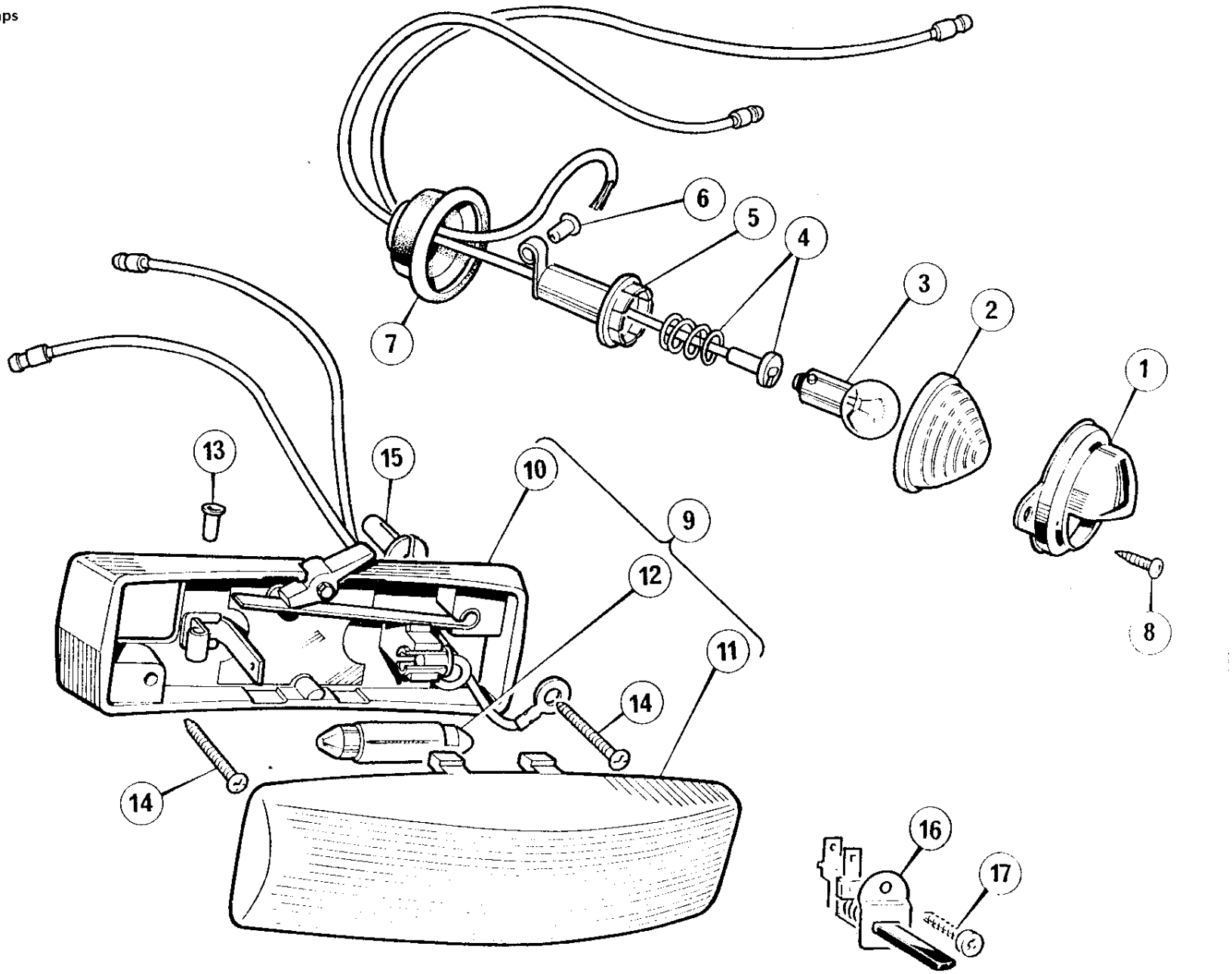


Figure 17 Number plate and interior lamps

1. *Bezel*
2. *Glass*
3. *Bulb*
4. *Bulb contct*
5. *Bulb locating sleeve*
6. *Sleeve*
7. *Body*
8. *Screw*
9. *Interior lamp assembly*
10. *Base*
11. *Lens*
12. *Bulb*
13. *Terminal sleeve*
14. *Screw*
15. *Insert*
16. *Door switch*
17. *Screw*



To remove **(Figure 17)**

1. Remove the bezel, glass and bulb.
2. Withdraw the lamp body and disconnect the leads.

Replace in reverse order.

Interior lamp

The interior lamp is located above the rear view mirror and has an integral light switch within the unit. The light is also operated by a "courtesy" switch on the drivers' door (both doors on later cars). Removal of the bulb is facilitated by the removal of the lamp lens. Gently squeezing the sides of the lens releases the clips to enable the lens to be removed.

To remove

1. Disconnect the battery (The interior lamp is permanently live). Remove the lamp lens.

2. Remove two screws, withdraw the lamp assembly and disconnect from the wiring harness.

(Figure 17)

Bulb list

Bulb	Rating	Type
Headlamp (early)	12v 75/60w	Sealed beam unit
Headlamp (later cars)	12v 45/40w	P43T
Pilot lamp (early)	12v 6w	Cap-less
Pilot lamp (later cars)	12v 6w	MBC
Stop/tail	12v 6/21w	SBC (staggered)
Indicators	12v 21w	SBC
Instruments	12v 3w	Cap-less
Oil warning	12v 3w	Cap-less
Ign warning	12v 3w	Cap-less
Main beam	12v 3w	Cap-less
Indicator	12v 3w	Cap-less
HRW lamp	12v 1.2w	Cap-less
Hazard lamp	12v 2w	BA7S
Interior lamp	12v 6w	Festoon
Voltage gauge illumination	12v 2,2w	MES
Oil gauge illumination	12v 2.2w	MES
Number plate lamp	12v 5w	MBC

MBC = miniature bayonet cap; SBC = small bayonet cap
MES = miniature edison screw

General electrics system

The general electrics include battery, fuses, coil, starter solenoid, spark plugs, horn, windscreen wiper motor, instruments and switches as shown in **Figure 18**

Battery

The battery is a 12 volt negative earth wet cell lead acid type and is mounted in a well in the left-hand side of the engine compartment. A metal strap connected to two hook bolts secured by wing nuts holds the battery firmly in place **(Figure 19)**.

General maintenance

Keep the battery terminals tight and clean. A smear of petroleum jelly over the terminals will keep them free from corrosion and protect the battery posts. Regularly check the electrolyte level in the cells and if necessary top up with distilled or de-ionised water to bring the level up to the recommended level. This is just above the separator plates, visible through the battery cap orifices. The need for frequent topping up must be investigated, for example the electrolyte may be "boiling off" because the battery is being over charged by the alternator, in which case the alternator regulator needs to be checked **(page 112)**.

If one cell needs topping up more than the others carefully inspect the battery casing for cracking. If damage is found the only solution is to replace the battery.

The efficiency of the battery can be checked using a hydrometer to test the specific gravity of the electrolyte. The specific gravity readings are as follows:

1.280-1.300 - fully charged
1.200 (approx) - half charged
1.150 - fully discharged

If electrolyte has been spilled at any time from any of the cells, check the specific gravity of the remaining cells and then top-up with sulphuric acid solution to the same specific gravity value. Always add the acid to water when mixing the electrolyte, never the other way round. **It can be extremely dangerous to add water to concentrated acid.**

Never use a naked flame when examining the battery. The fumes given off are highly flammable and can cause an explosion.

To remove the battery

1. Disconnect the positive and negative leads from the battery.

2. Unscrew the two wing nuts securing the battery retaining strap and remove it and the rubber insulation.

3. Lift the battery carefully out of the vehicle, keeping it upright to avoid spilling any electrolyte.

Replace in the reverse order and ensure that the negative is connected to earth on reconnection.

High rate discharge test

The high rate of heavy discharge test is carried out as a timed on-load voltage check usually applied to each of the six battery cells in turn. Before testing, the battery must have been off charge for several hours and each cell should be at least 70% charged. The correct "drop tester" should be rated at 150 to 160 amps. **It is vital to use only a correctly rated tester.**

A cell in good condition should sustain 1.2 to 1.5 volts under test for 10 seconds when the prongs of the tester are held across the terminals. A weak cell will show a rapidly declining voltage. If all the cells appear weak, it might be that the battery is still sound, just discharged. Weakness of any cell requires the battery be renewed.

Battery voltage

By means of the test already described, the condition of the battery has been ascertained and also its state of charge. The working voltage should then be checked.

Connect a volt meter between the positive and negative terminals and note the reading. The minimum reading for a 12 volt battery should not fall below 10.5 volts. If the voltage does drop rapidly below this figure the battery should be renewed.

Battery specification

Type		Lead acid
Voltage		12
Amp hour capacity		22 for 20 hrs (Exide)
		30 for 20 hrs (Lucas)
Specific gravity	(charged)	1.280-1.300
	(discharged)	1.150

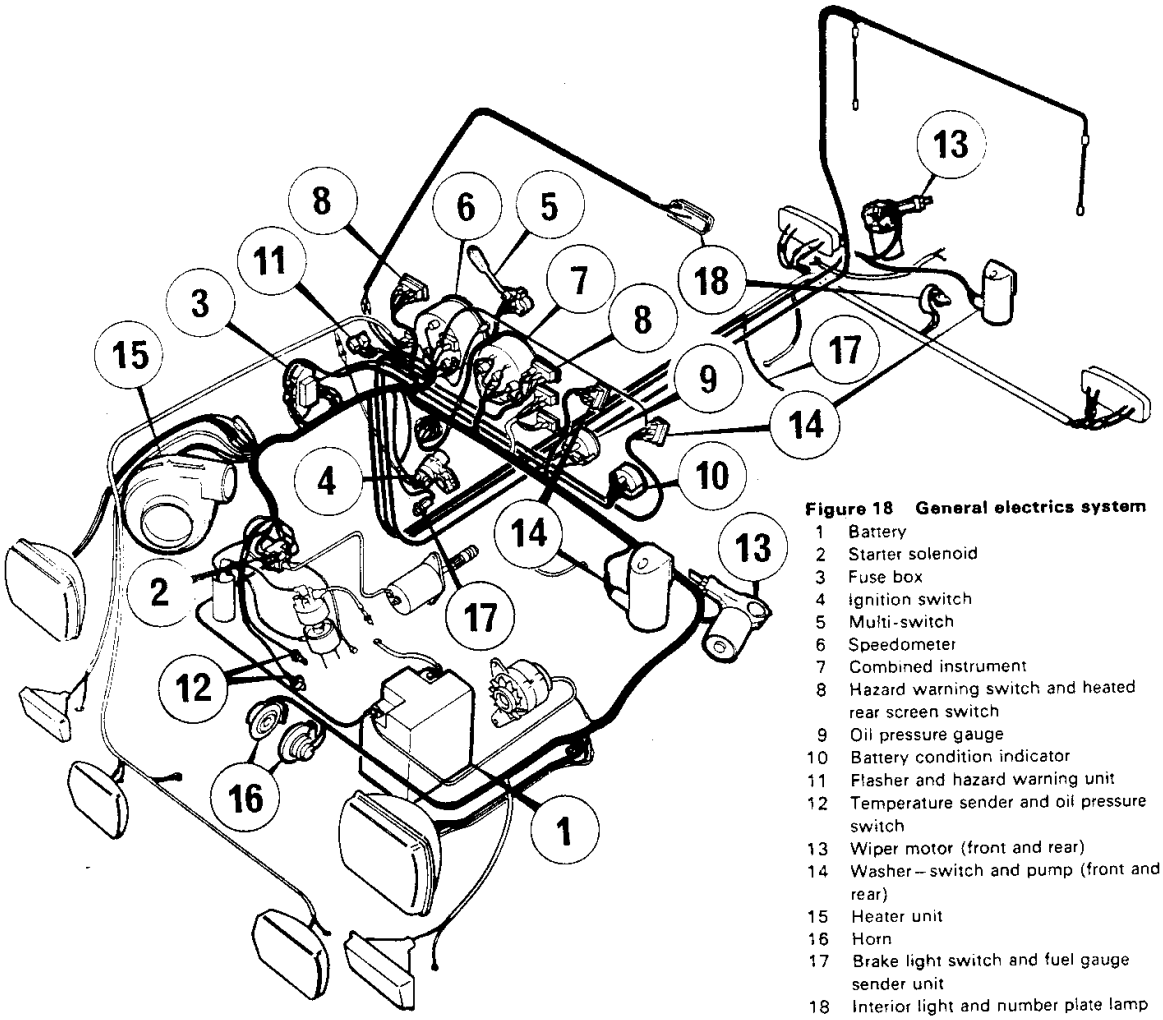
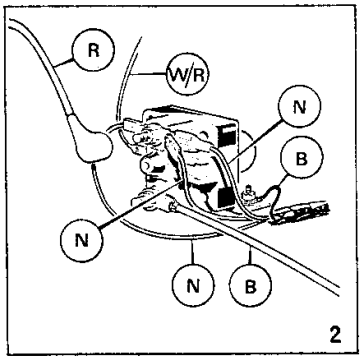


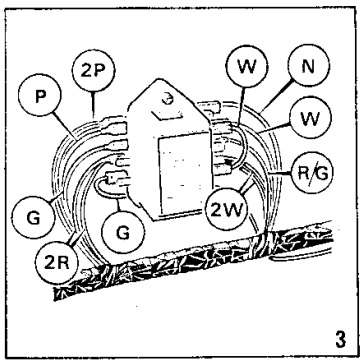
Figure 18 General electrics system

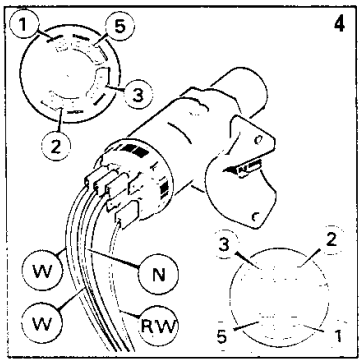
1 Battery
2 Starter solenoid
3 Fuse box
4 Ignition switch
5 Multi-switch
6 Speedometer
7 Combined instrument
8 Hazard warning switch and heated rear screen switch
9 Oil pressure gauge
10 Battery condition indicator
11 Flasher and hazard warning unit
12 Temperature sender and oil pressure switch
13 Wiper motor (front and rear)
14 Washer – switch and pump (front and rear)
15 Heater unit
16 Horn
17 Brake light switch and fuel gauge sender unit
18 Interior light and number plate lamp

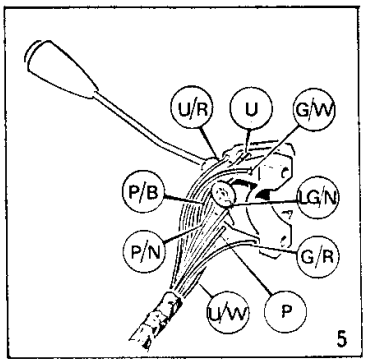
Colour Codes

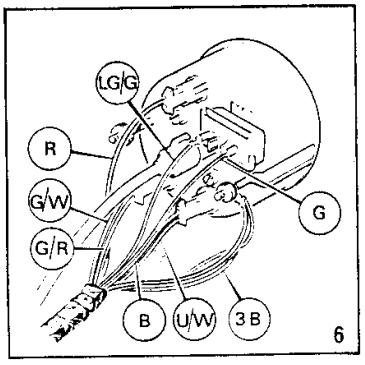
Letter	*Colour*
R	Red
W	White
G	Green
B	Black
Y	Yellow
S	Slate
U	Blue
P	Purple
LG	Light Green
N	Brown
O	Orange
K	Pink

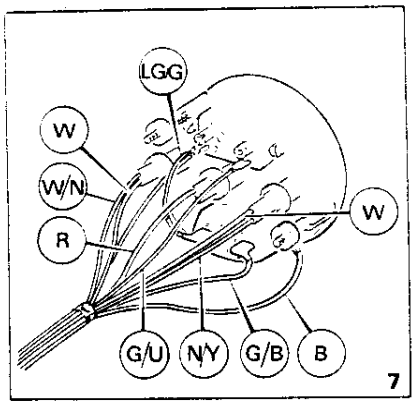


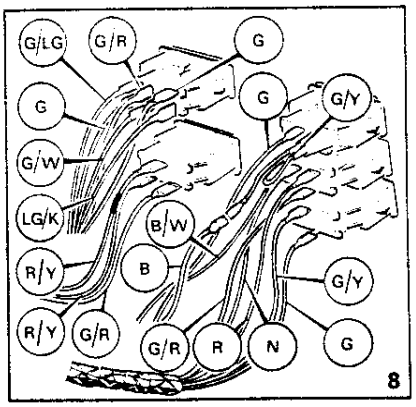


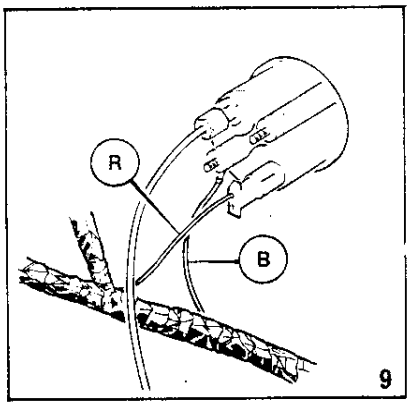


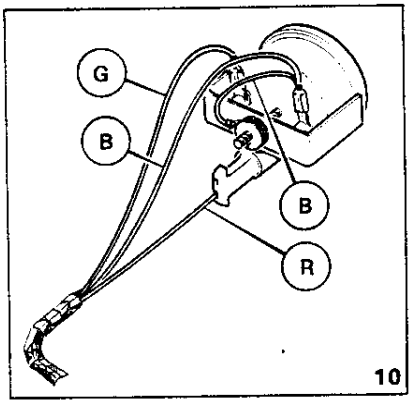


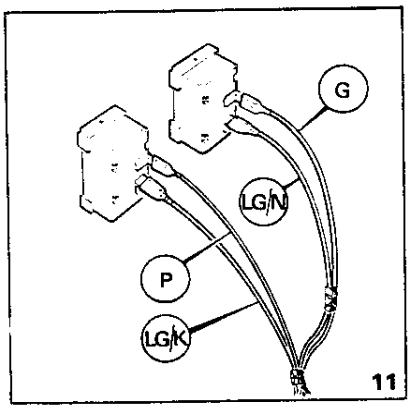


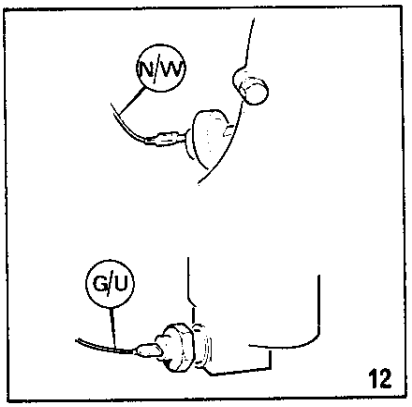


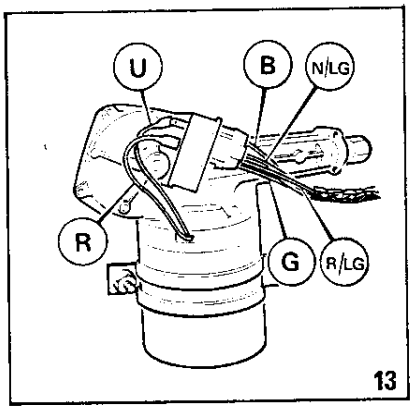


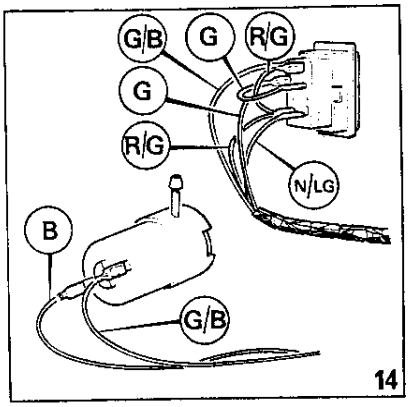


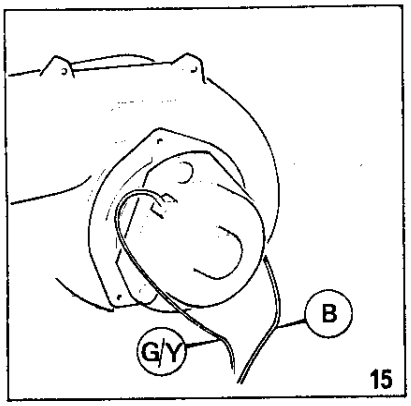


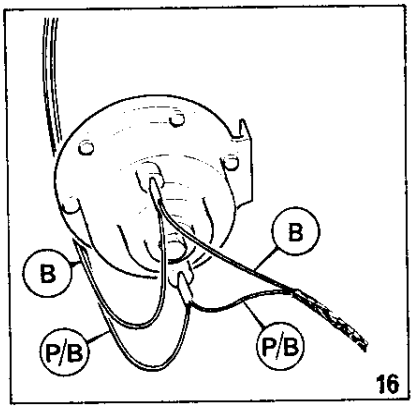


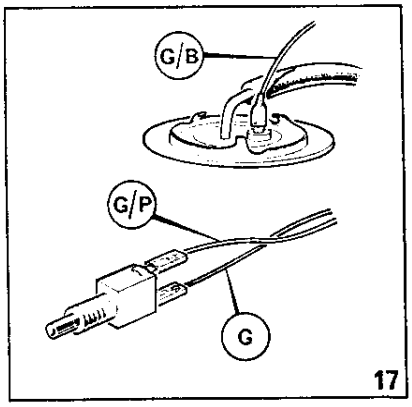


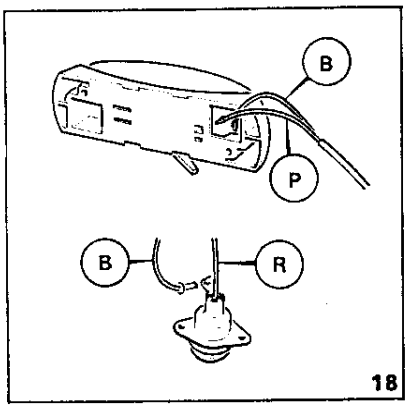












Fuses

The fuse box is secured to the right-hand side of the engine compartment by two screws and nylon inserts.

A blown fuse will result in the failure of all dependent circuits and is confirmed by the inspection of the fuse hen removed. Before renewing a blown fuse inspect the wiring and the dependent components for evidence of a short circuit, preferably by using an ohmmeter. Replace only with the correct fuse. The fuse value is marked on a paper slip inside the glass tube of the fuse

The fuses indicated in Figure 20 show the top 35 amp fuse protecting the unswitched battery circuit which includes headlamps, hazard lamps, interior lamp and horn. the second 35 amp fuse protects the switched components, ignition circuit, indicators, heater blower, wiper motor and instruments. The fuse also protects auxiliary gauges . The third fuse is a 35 amp in series with the battery lighting circuit protecting the side and rear lamps and instrument illumination. The fourth fuse supplies the heated rear window (where fitted). This fuse is designated as "spare" on vehicles which are not fitted with a heated rear window.

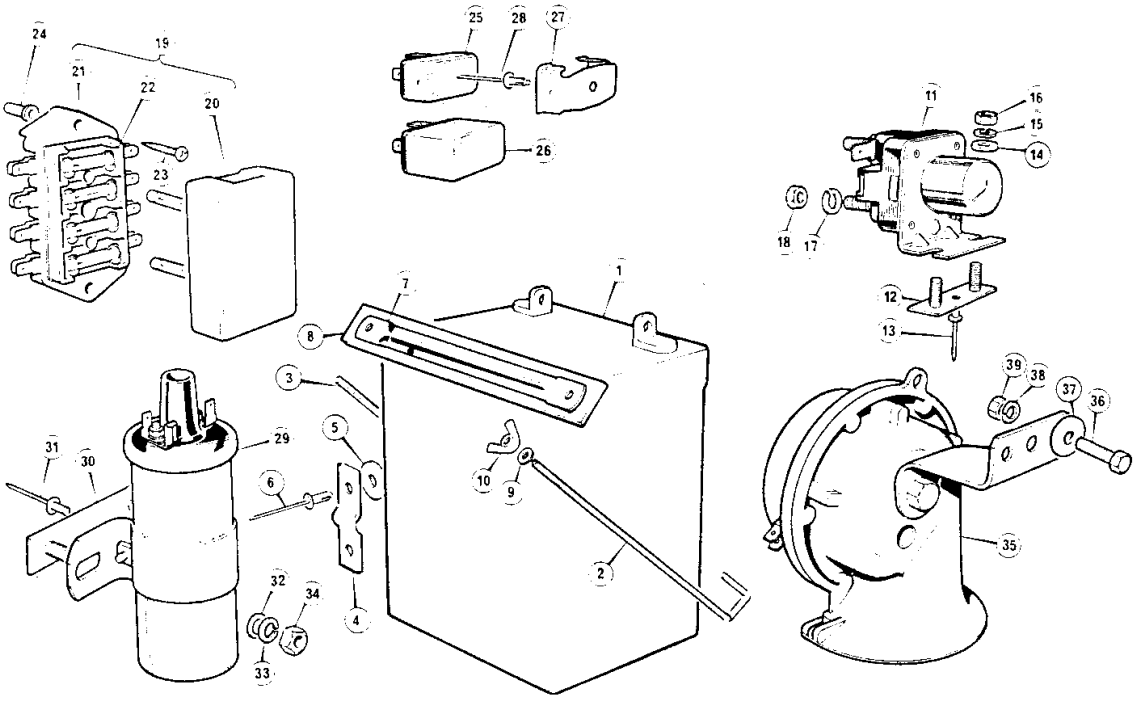


Figure 19 General electrics - components

1.	*Battery*	*14*	*Washer*	*27.*	*Clip*
2.	*Front securing hook*	*15.*	*Lock washer*	*28.*	*Rivet*
3.	*Rear securing hook*	*16.*	*Nut*	*29.*	*Ignition coil*
4.	*Saddle plate*	*17.*	*Lock washer*	*30.*	*Coil bracket*
5.	*Washer*	*18.*	*Nut*	*31.*	*Rivet*
6.	*Rivet*	*19.*	*Fuse box assembly*	*32.*	*Washer*
7.	*Clamping strap*	*20.*	*Fuse box cover*	*33.*	*Lock washer*
8.	*Insulator*	*21.*	*Fuse box body*	*34.*	*Nut*
9.	*Washer*	*22.*	*Fuse*	*35.*	*Horn*
10.	*Wing nut*	*23.*	*Screw*	*36.*	*Screw*
11.	*Starter solenoid*	*24.*	*Insert*	*37.*	*Coach washer*
12.	*Solenoid mounting plate*	*25.*	*Flasher unit*	*38.*	*lock washer*
13.	*Rivet*	*26.*	*Hazard flasher relay*	*39.*	*Nut*

Coil

The coil is secured to its mounting plate on the front right-hand side of the engine bay by two nuts, washers and lock washers. **(Figure 19)** Very little attention to the coil is necessary aside from keeping the terminals tight and the insulation clean.

The efficiency of the coil can be tested as follows:

1. Remove the distributor cap and turn the engine until the points are closed.

2. Unplug the "king" lead (coil to distributor cap) from the distributor cap and, whilst holding the cable approximately 6.0 mm (0.25 in) from a good ground, open and close the points with a screwdriver (ignition switched on). A strong blue spark should jump from the end of the "king" lead to ground as the points are opened. If the spark is pink, or weak then there is a problem which requires further investigation. If there is no spark this might indicate a defective coil. This can only be proved by substitution.

Note: The voltage generated in this test is very high. To avoid the chance of an electric shock it is recommended that rubber gloves be worn for this exercise.

Starter solenoid

The starter solenoid is secured to a mounting plate on the right-hand side of the engine bay, by two nuts, washers and lock washers.

If difficulty is encountered when trying to start the engine a faulty solenoid could be the cause but before replacing the unit, check all connections and earths for cleanliness and security. **(Figure 19)**

Sparking plugs

Motocraft AGR 32 plugs are fitted as standard to all Kittens. The gap should be maintained at 0.64 mm (0.025 in). as long as the carburation and timing are correct a set of plugs should last for at least 6,000 miles (10,000 km) without attention. When attention is necessary the plugs should be cleaned on a specialised sand blasting machine. If the plugs are worn or the electrodes badly eroded they must be renewed to maintain acceptable engine performance. The centre electrode of a plug in good condition should be square and flat without signs of wear.

When setting the plug gap, only the side electrode should be adjusted, being gently levered to obtain the required gap. On replacement ensure that the plugs are screwed firmly home.

Plugs should be replaced every 12,000 miles (20,000 km).

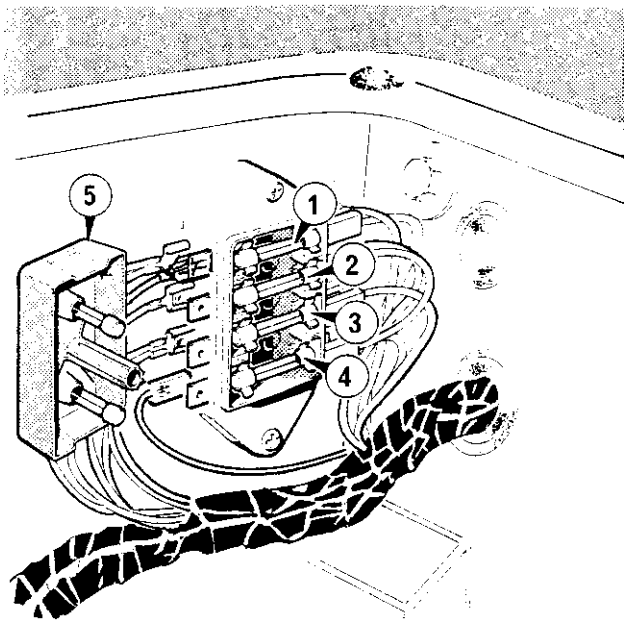


Figure 20 Fuses

1. Battery/headlamp circuit fuse
2. Ignition/wiper circuit fuse
3. Rear/side light fuse
4. Heated rear window/spare fuse
5. Fuse cover with spare fuses

Horns

Twin (high and low tone) horns are fitted within the duct moulding behind the radiator grille. These are secures by two set screws, nuts, washers and lock washers. (Figure 19)
If the horns fail to operate first check the wiring. Horns are not serviceable and must be replaced if faulty.

Windscreen wiper motor and blades

Description

The windscreen wiper motor is located inside the vehicle above the passenger foot well (behind the glove box). It is a single-speed type incorporating a self-parking facility which drives two wheel boxes by means of a cable rack and pinion running through bundy tubing.

Routine maintenance

To ensure sufficient wiping keep the blades in good condition. The windscreen should be kept clean at all times to prevent damage to the blade rubbers and to avoid scratching by grit trapped in the rubbers. Oil, tar spots etc should be removed from the windscreen using methylated spirit, sparingly as it can discolour the paintwork. Silicone or wax polishes must never be used on the windscreen as these smear badly. An unsatisfactory wiper action or complete failure may be caused by a mechanical or electrical problem, remedial procedure being described as follows:

Mechanical

A badly kinked or flattened rack bundy tube will prevent the rack cable from traversing freely, therefore restricting the movement at the wheel boxes. The tubing must be re-formed or renewed and must have a radius of no less than 228 mm (9 in). Check the wheel boxes' spindles for freedom of rotation. A seized unit or one with chipped or worn teeth should be replaced.

Electrical

Check the wiring connection is secure in the limit (parking) switch in the motor and ensure the voltage supply is adequate. A delay or failure of the blades can also be caused by a faulty switch which should be tested by substitution.
If all other electrical and mechanical components have been inspected and found to be correct the wiper motor may be faulty. These are nor serviceable so a replacement will need to be fitted.

Operation 8 To remove wiper motor (Figure 21)

1. Remove the wiper arms from the wheel box splines.
2. Disconnect the wiring plug from the wiper motor.
3. Uncouple the cable tubing from the wiper motor by unscrewing the gland nut.
4. Remove the two set screws, nuts, washers and lock washers securing the motor to the fire wall and release the motor by carefully pulling the drive cable from the wheel boxes and guide tubes.
Replace in the reverse order being very careful not to damage the drive cable.

Operation 9 Wheel boxes & cable rack - remove & replace

To remove

1. Disconnect battery.
2. Disconnect speedo cable from rear of speedometer.
3. Pull the fresh air nozzle from the fascia and disconnect the hose.
4. Withdraw the fascia just far enough to gain access to the wheel boxes **(see Section R)** and rack. It is not necessary to disconnect the instruments.
5. Remove wiper arms and wheel box spindle retaining nuts, washers and spacers. Push the spindles back through their locations in the body.
6. Slacken the left-hand wheel box clamping nuts and remove the right-hand box complete with intermediate and overrun bundy tube.
7. Unscrew the gland nut on the wiper motor and remove the left-hand wheel box complete with bundy tube.
Replace in reverse order.
Note: Before fitting a new wheel box ensure that it is the correct side as they are not interchangeable, and the wheel box gear and rack cable are liberally coated with grease.

Rear window wiper (if fitted) - Estate models only

The rear window wiper uses the same type of motor as the windscreen. Access to the unit is by removing the cover on the inside of the rear door. The cover is secured by six screws.

Wiper assembly specification

Type	Lucas 14 watt 12 volt
Light running current	1.5 amps
Light running speed	46-52 rpm
Wheel box left-hand	32 teeth
Wheel box right-hand	40 teeth

Instruments and switches (Figure 22)

Speedometer

Located to the right of the steering column, the meter indicates the road speed of the vehicle and incorporates an odometer (mileometer) to record total distance travelled.

Direction indicator warning light

A green light in the lower right hand quadrant of the speedometer face (some vehicles will have an amber light). The light flashes with the indicators when operated. Intermittent flashing (or no flashing) indicate a faulty bulb or indicator relay/switch.

Figure 21 Windscreen wipers

1. *Wiper motor*
2. *Rack*
3. *Pad*
4. *Strap*
5. *Washer*
6. *Nut*
7. *Bundy tube*
8. *Wheel box*
9. *Bundy tube (intermediate)*
10. *Wheel box*
11. *Bundy tube (overrun)*
12. *Wiper arm*
13. *Wiper blade*

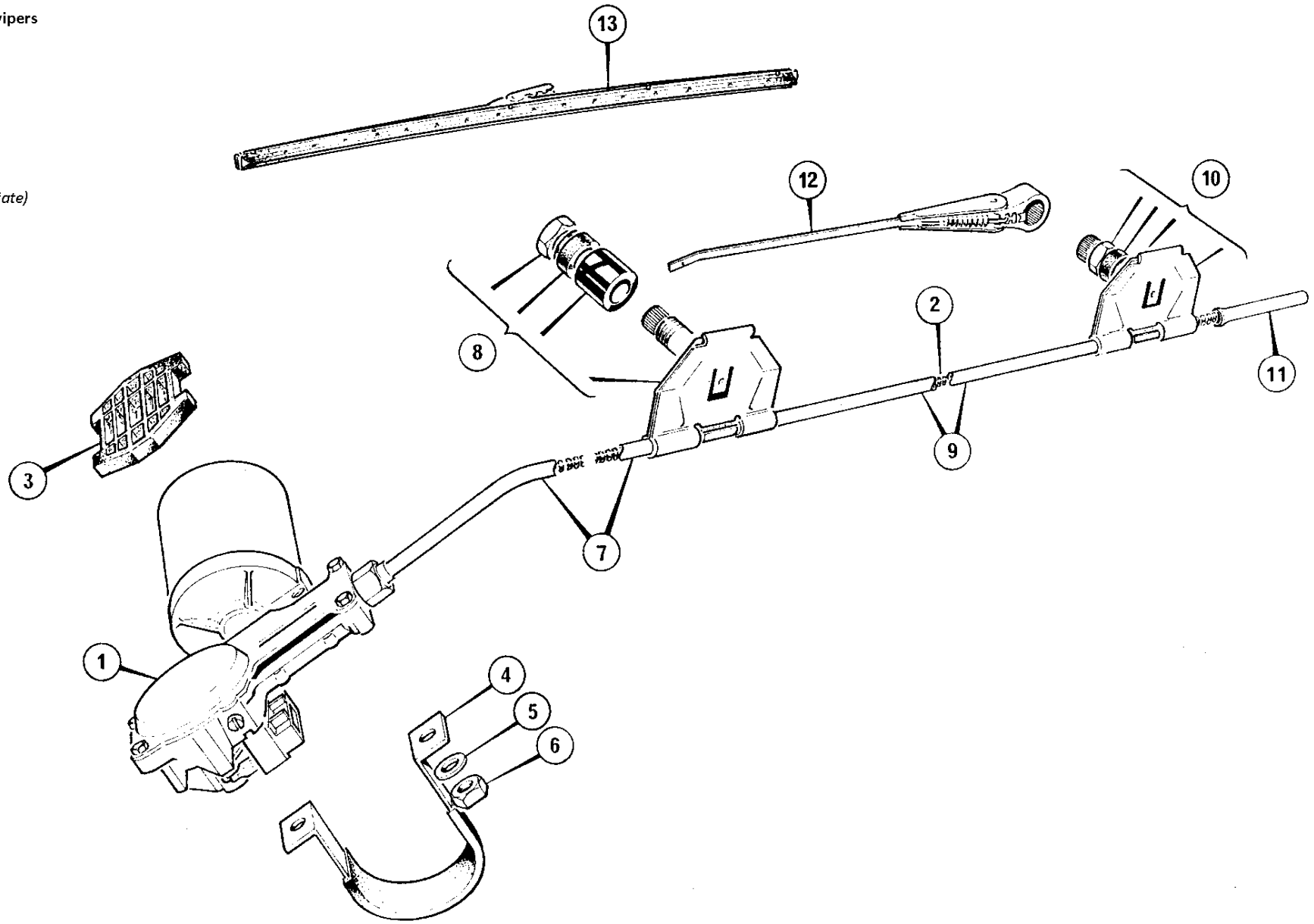
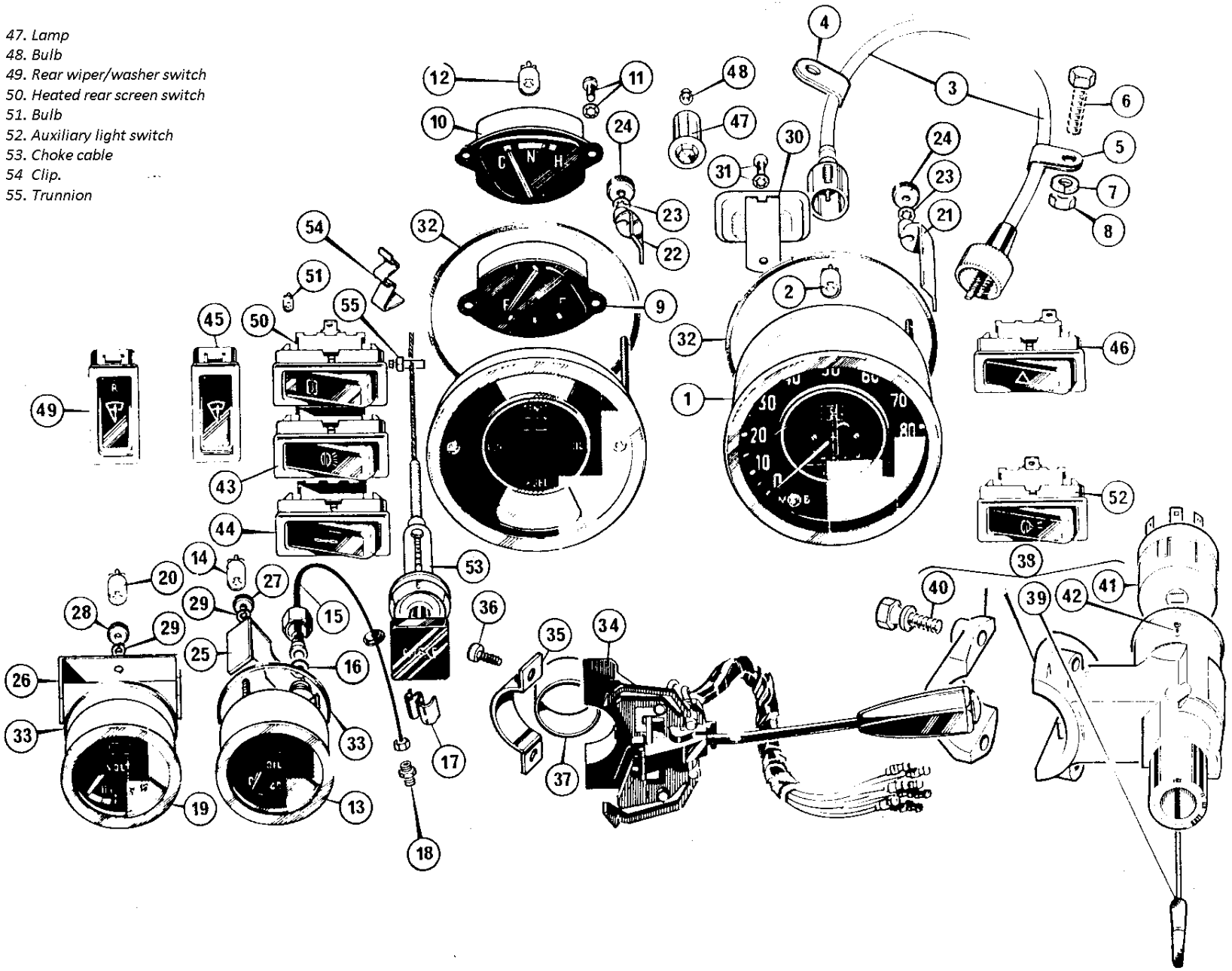


Figure 22 Instruments and switches

1. *Speedometer*
2. *Bulb*
3. *Speedo cable*
4. *"P" clip*
5. *"P" clip*
6. *Set screw*
7. *Lock washer*
8. *Nut*
9. *Fuel gauge*
10. *Temperature gauge*
11. *Screw and captive washer*
12. *Bulb*
13. *Oil pressure gauge*
14. *Bulb*
15. *Pipes*
16. *Washer*
17. *Clip*
18. *Adapter*
19. *Battery condition meter*
20. *Bulb*
21. *Clamp*
22. *Clamp*
23. *Washer*
24. *Knurled nut*
25. *Clamp*
26. *Clamp*
27. *Knurled nut*
28. *Knurled nut*
29. *Lock washer*
30. *Voltage stabiliser*
31. *Screw and captive washer*
32. *Sealing ring*
33. *Sealing ring*
34. *Multi-switch*
35. *Clamp*
36. *Screw*
37. *Spacer*
38. *Ignition and steering lock*
39. *Key*
40. *Shear bolt*
41. *Ignition switch*
42. *Screw*
43. *Light switch*
44. *Heater blower switch*
45. *Wiper/washer switch*
46. *Hazard switch*
47. *Lamp*
48. *Bulb*
49. *Rear wiper/washer switch*
50. *Heated rear screen switch*
51. *Bulb*
52. *Auxiliary light switch*
53. *Choke cable*
54. *Clip.*
55. *Trunnion*



Headlamp main beam warning light
A blue lamp. To the left of the indicator warning light in the lower left-hand quadrant of the speedometer, the lamp is illuminated when the lights are switched to main beam.

Water temperature and fuel gauge
This combined instrument is located to the left of the steering column and comprises two separate gauges and two warning lights. The upper gauge is the temperature gauge. After the initial warming up of the engine, any sudden upward change in the reading requires urgent investigation.
The lower gauge indicates the level of the petrol in the fuel tank. When the ignition is switched on the gauge will rise only slowly as the motion is damped.

Ignition warning light
On the left of the combined gauge is the red ignition warning light. This serves the purpose of informing the driver to switch off the ignition if it is turned on and the engine is not running. The light should extinguish after starting when the engine revolutions are increased. Should it illuminate whilst driving this indicates that the battery is not charging.

Oil pressure warning light
The oil pressure warning light is amber in colour (green on some vehicles) and is located on the right of the combined instrument dial. The light should only be illuminated with the engine stopped and the ignition switched on. After starting, the lamp should extinguish indicating that the engine oil is circulating under pressure. Should the light come on whilst driving, stop immediately and check the oil level. Driving the car with the light on could cause severe engine damage.
Note: it is not unusual for the lamp to flicker slightly at tick over speed with a hot engine, but it must extinguish immediately the engine rpm is increased.

Battery condition meter (if fitted)
Located in the dash centre panel to the left of the fresh air vent, this instrument reports the voltage present in the wiring harness. Ideally, with the engine running, the voltage should be in the range of 13.2 - 14.4 volts. If the reading (engine running) is below 12 volts it is possible that the battery is not charging so this needs to be investigated. A constant reading above 14.4 volts suggests that the battery is over charging, again this must be investigated and rectified promptly.

Oil pressure gauge (if fitted)
Located in the centre panel to the right of the air vent, this gauge reports the oil pressure. The oil pressure will fall during warm up with an optimum pressure when fully warmed up of 3.16 kg/cm² (45 lb/ft) at normal driving speed. The reading will be lower at idle speed. If a very low reading is indicated at normal driving speeds the oil level must be checked immediately. If the gauge shows no reading at all with the engine running the vehicle should not be driven or severe engine damage may result.

Combined ignition/starter switch and steering lock
The combined ignition/starter/steering lock assembly is attached to the steering column below the fascia to the right of the column. The switch is operated by a special key. The steering lock is released by inserting the key, pushing down and rotating it to position "1". Turning the key further to position "2" turns the ignition on. Further turning the key against the pressure of a return spring, to position "3" engages the starter to start the engine. When the engine starts the key should be released back to position "2". The keys for this lock, unlike the other key(s) for the vehicle, do not have a number stamped on them. This is for security/anti theft reasons.
The keys are supplied with a tag on which the unique number of the key is stamped. It is important not to lose this tag, bur to store it securely **NOT** in the vehicle in case of key loss or theft, when a replacement will need to be obtained.
Note: When the key is removed, the steering lock will be activated but it will not actually lock the steering column until the spring loaded bolt engages in the internal slot in the inner column. The steering will need to be turned slightly to enable this, after removing the key, to lock the steering. **NEVER** remove the ignition key whilst the vehicle is in motion.
Position "1" is also the auxiliary position enabling the radio (if fitted) to be used without the ignition being switched on.

Light switch
The light switch is a three position rocker switch positioned in the centre of the left-hand fascia panel to the left of the combination gauge. The three positions are "off"-"side and tail lights"-"headlights". Headlamp dipping is achieved by the use of the steering column multi-switch.

Windscreen wiper/washer switch
The switch is located to the immediate right of the radio aperture and is a three way switch. Position "1" is off, position "2" turns the wipers on and position "3" against spring pressure, maintains the wipers and energises the screen washer pump.

Rear wiper/washer switch (if fitted) Estate models only
Situated to the immediate left of the radio aperture, this switch operates exactly the same as the windscreen wiper/washer switch.

Heater blower switch
The switch is situated to the left of the combination gauge just below the light switch and turns on the booster fan for the car heater.

Hazard switch
The hazard switch is positioned to the right of the speedometer in the upper right-hand corner of the dash panel. A rocker type switch which, when operated, flashes all four indicator lights in unison. A yellow warning light is situated between the combination and speedometer gauges.

Heated rear window switch (if fitted)
The switch is located to the left of the combination gauge just above the light switch. The switch incorporates a green indicator lamp which illuminates if the heated rear window is switched on.

Auxiliary light switch (if fitted)
This switch is fitted to the right of the speedometer in the lower right-hand corner of the dash and is a three position switch in the sequence: "off"-"left hand lamp"-"both lamps"

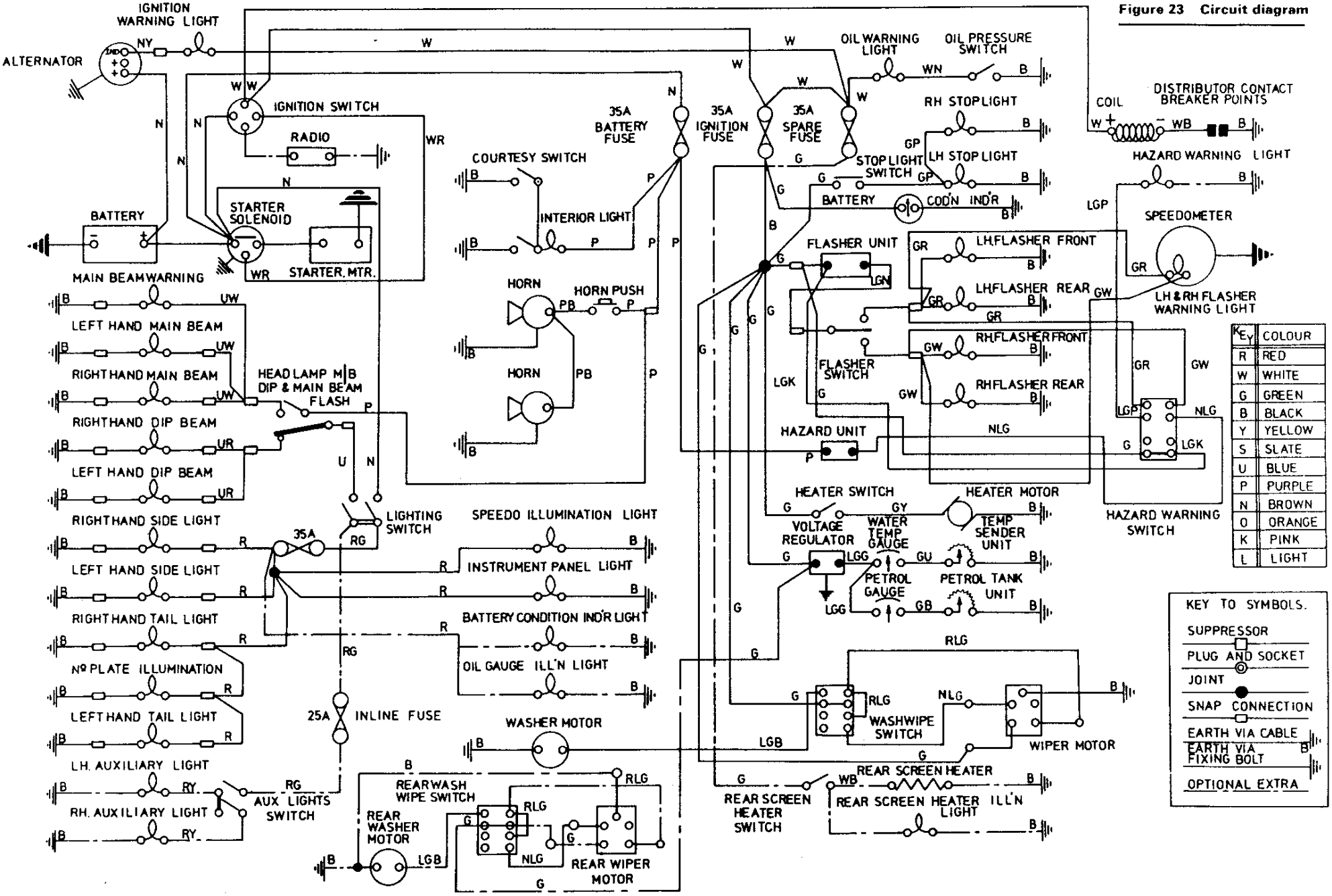
Steering column multi-switch.
This column stalk, situated on the right of the steering column, operates as follows:

Forward	main beam
Centre	dipped beam
Back	headlamp flash
Up	left-hand indicators
Down	right-hand indicators

Pressing the button on the end of the stalk sounds the horns.

Interior lamp switch
This switch is integral to the lamp unit. The lamp is also linked to a switch on the drivers' door (both doors on later cars).

Figure 23 Circuit diagram



Instrument and switch removal

Access to both main instrument fixings is achieved from bemeath the fascie. Unscrew the knurled nuts securing the instruments, remove the clamps and push the instruments out from behind. This task is much easier if the multi switch cover is first removed. The switches simply clip in to the fascia so can be eased out from behind, or carefully prised free with a wide bladed screwdriver, and disconnecting the leads.

Multi-switch removal and replacement

1. Disconnect the battery

2. Remove two screws and the clamp, then lift the multi-switch cover off the steering column.

3 Unscrew the two multi-switch securing screws and remove the clamp, spacer and multi-switch, leaving the indicator cancelling bush on the steering column.

4. Disconnect the mukti-switch wiring from the main harness and withdraw the wires thriugh the grommet in the ignition switch mounting bracket.

Replace in reverse order.

Operation 10 to remove ignition switch

The ignition switch assembly is integral with the steering column lock but the switch itself can be removed as follows:

1. Disconnect the battery

2. Access to the switch unit is gained from below the fascia to the left of the steering column.

3. Note carefully the position of the connecting leads and disconnect them from the switch.

4. Locate and remove the small cross head screw from the lock casting and withdraw the switch unit.

Replace in reverse order.

Note: When refitting the switch to the steering lock assembly ensure that the tang on the end of the lock barrel locates correctly in its receptacle in the switch unit. Inserting and operating the ignition key will facilitate this.

Section U

Windscreen washer

Contents

Description

An electric windscreen washer is fitted to all Kittens as standard. A similar washer is available as an extra for the rear window of Estate and Van models. Further pressure on the wiper switch, against spring pressure, operated the pump. water from the reservoir is then piped to the nozzle and then squirted onto the windscreen. The washer jet will continue until the switch is released. The pump is built in to the base of the screen was reservoir. Do not continue to operate the pump after the water in the reservoir is used up as this will damage the pump. Refilling the container will restore normal operation of the unit

The washer reservoir should be checked regularly and topped up as necessary. Denatured alcohol (methylated spirit) should never be mixed with the water because whilst it will help stop the fluid freezing in cold weather, it does tend to cause the paintwork to discolour. It is much better to add a dedicated screen wash additive.
The washer jet can become blocked by dirt or polish residue and can be cleaned out by inserting a fine needle into the jet orifice. If badly blocked the jut must be removed and blown out with an air line.

Operation 1 **Reservoir pump - removal & replacement (Figure 1)**

1. Disconnect the battery.

2. Disconnect the "Lucar" terminals from the pump.

3. Remove the outlet tube from the pump.

4. Lift the reservoir assembly from its bracket and remove.

5. On early vehicles, access to the plastic nut holding the pump to the reservoir is via the filler hole, using a suitable tool. Later vehicles have a "one fit" clip to hold the pump into the reservoir and these can be removed with great care. If the pump fails it is recommended that a complete pump and reservoir assembly should be fitted.

The rear window washer assembly (if fitted) can be similarly dismantled after removing the cover secured by six screws from the inside of the door..

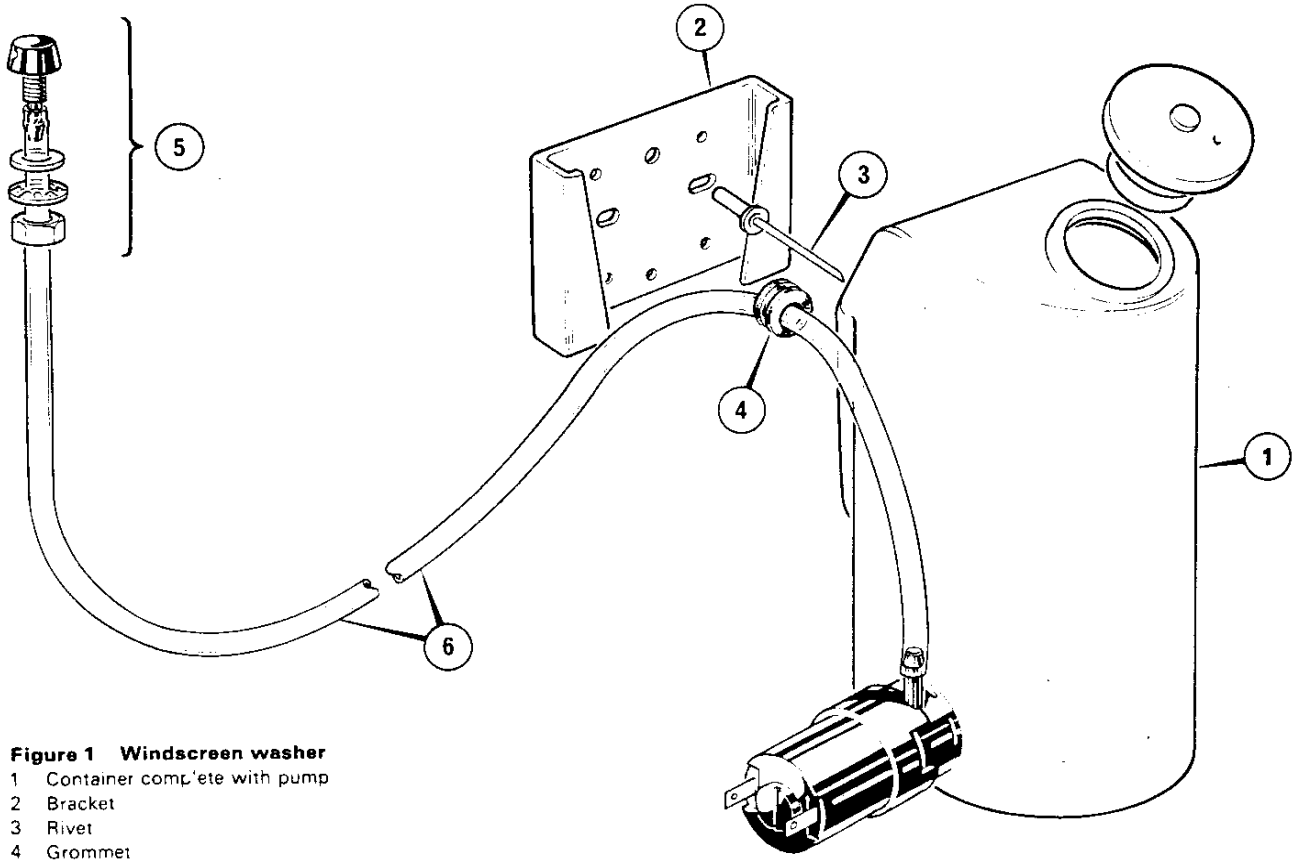


Figure 1 Windscreen washer
1 Container complete with pump
2 Bracket
3 Rivet
4 Grommet
5 Jet assembly
6 Tube

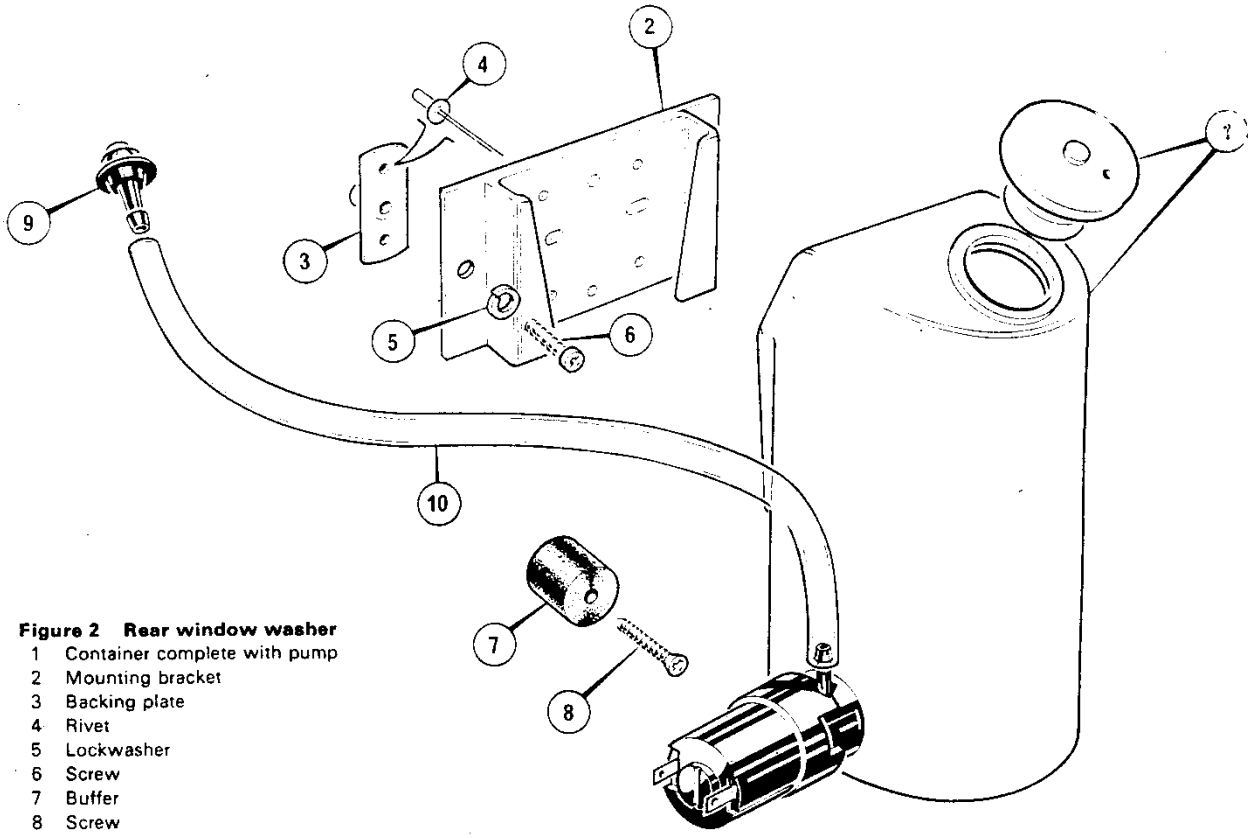


Figure 2 Rear window washer

1 Container complete with pump
2 Mounting bracket
3 Backing plate
4 Rivet
5 Lockwasher
6 Screw
7 Buffer
8 Screw
9 Jet assembly
10 Tube

Operation2 Jet nozzle - removal & replacement

1. Disconnect the supply tube from the nozzle, accessible from beneath the fascia behind the radio aperture.

2. Remove the nut and washer securing the nozzle to the body and push out the nozzle.

Replace in reverse order. Adjust the jets for spray direction.

Operation 3 Estate/van rear washer nozzle - removal & replacement

1. Remove the cover from inside the door, secured by six screws.

2. Pull the supply tube from the nozzle.

3. The nozzle is a push fit in the door, using a "one fit" clip. **(Figure 2)** Although designed to be used once only, these can be removed and re-used with care.

Replace in reverse order.

Front Suspension			
Lower ball joint (pin)	7/16" UNF	4.29-4.98kg/m	31-36 lb/ft
Spring/damper unit top fixing	3/8" UNF	4.15-4.84 kg/m	30-35 lb/ft
Spring/damper unit lower fixing	1/2" UNF	4.84-5.53 kg/m	35-40 lb/ft
Upper ball joint (pin)	7/16" UNF	4.98-5.67 kg/m	36-41 lb/ft
Upper wishbone to pivot bracket	3/8" UNF	4.15-4.84 kg/m	30-35 lb/ft
Upper wishbone pivot to chassis	3/8" UNF	4.15-4.84 kg/m	30-35 lb/ft
Lower wishbone to ball joint	5/16" UNF		
Lower wishbone to chassis	7/16" UNF	5.53-6.22 kg/m	40-45 lb/ft
Front strut to chassis	7/16" UNF	5.53-6.22 kg/m	40-45 lb/ft
Front strut to lower wishbone	5/16" UNF	2.07-2.49 kg/m	15-18 lb/ft
Anti-roll bar link to wishbone	7/16" UNF	4.15-4.84 kg/m	30-35 lb/ft
Anti roll bar to link	7/16" UNF	4.15-4.84 kg/m	30-35 lb/ft
Anti roll bar clip to chassis	1/4" UNF	1.11-1.38 kg/m	8-10 lb/ft
Rear suspension			
Damper to frame	3/8" UNF	4.15-4.84 kg/m	30-35 lb/ft
Damper to axle	3/8" UNF	4.15-4.84 kg/m	30-35 lb/ft
"U" bolt to spring	M10	4.15-4.84 kg/m	30-35 lb/ft
Shackle to chassis	1/2" UNF	4.84-5.53 kg/m	35-40 lb/ft
Leaf spring to shackle	1/2" UNF	4.84-5.53 kg/m	35-40 lb/ft
Leaf spring to chassis	1/2" UNF	4.84-5.53 kg/m	35-40 lb/ft
Steering			
Steering wheel to column	9/16" UNF	2.76-3.46 kg/m	20-25 lb/ft
Steering rack to chassis	5/16" UNF	2.07-2.49 kg/m	15-18 lb/ft
Steering column universal joint pinch bolts	5/16" UNF	2.76-3.18 kg/m	20-23 lb/ft
Steering rack damper preload cover bolts	M6	0.83-1.11 kg/m	6-8 lb/ft
Track rod ends (pins)	3/8" UNF	3.59-3.87 kg/m	26-28 lb/ft
Cooling system			
Water pump fixing nuts	5/16" UNF	1.66-2.10 kg/m	12-15 lb/ft
Engine			
Cylinder head nuts	3/8" UNF	3.46 kg/m	25 lb/ft
	5/16" UNF	2.07 kg/m	15 lb/ft
Big end bearing caps	5/16" UNF	2.90 kg/m	21 lb/ft
Main bearing caps	3/8" UNF	3.32 kg/m	24 lb/ft
Flywheel to crankshaft bolts	3/8" UNF	4.04 kg/m	29 lb/ft
Rocker shaft nuts	3/8" UNF	3.04 kg/m	22 lb/ft
Manifold nuts	5/16" UNF	2.07 kg/m	15 lb/ft
Fuel pump nuts	5/16" UNF	2.07 kg/m	15 lb/ft
Rocker cover nuts	5/16" UNF	0.3 kg/m	2 lb/ft
Spark plugs	M14	2.07 kg/m	15 lb/ft
Engine mountings	3/8" UNF	3.46 kg/m	25 lb/ft
Gearbox			
Gearbox to engine (nuts)	5/16" UNF	1.66-2.07 kg/m	12-15 lb/ft
Gearbox to engine (bolts)	5/16" UNC	2.07-2.49 kg/m	15-18 lb/ft
Front cover	1/4" UNF	0.69-1.10 kg/m	5-8 lb/ft
Rear cover	1/4" UNC	0.83-1.24 kg/m	6-9 lb/ft
Top cover	1/4" UNC	0.83-1.24 kg/m	6-9 lb/ft
Drain and filler plugs	3/4" gas thread	2.07-2.76 kg/m	15-20 lb/t
Gearbox mounting to support frame	3/8" UNF	2.76-3.46 kg/m	20-25 lb/ft
Support frame to chassis	5/16" UNF	2.07-2.49 kg/m	15-18 lb/ft
Main shaft to flange nut	1/2" UNF	6.92 kg/m	50 lb/ft
Clutch			
Clutch cover to flywheel	5/16" UNF	1.66-2.07 kg/m	12-15 lb/ft

Drive shaft			
Universal joint flange to axle/gearbox	5/16" UNF	3.46-4.15 kg/m	25-30 lb/ft
Rear axle			
Axle case nuts	5/16" UNF	2.77-3.46 kg/m	20-25 lb/ft
Hub to half shaft nut	5/8" UNF	13.8-15.2 kg/m	100-110 lb/ft
Coupling flange pinion nut	5/8" UNF	9.67-11.75 kg/m	70-85 lb/ft
Axle filler/level plug	3/4" BSP	2.07-2.76 kg/m	15-20 lb/ft
Brakes			
Front backplate to vertical link	5/16" UNF	2.50-3.18 kg/m	18-23 lb/ft
Rear backplate to axle	5/16" UNF	2.50-2.77 kg/m	18-20 lb/ft
Master cylinder mountings	5/16" UNF	2.50-3,18 kg/m	18-23 lb/ft
Road wheels			
Wheel nuts	3/8" UNF	4.15-4.84 kg/m	30-35 lb/ft
Electrical			
Alternator pivot bolts	5/16" UNF	2.08-2.77 kg/m	15-20 lb/ft
Alternator adjusting bolt	M8	1.11-1.38 kg/m	8-10 lb/ft
Starter motor bolts	3/8" UNF	4.15-4.84 kg/m	30-35 lb/ft