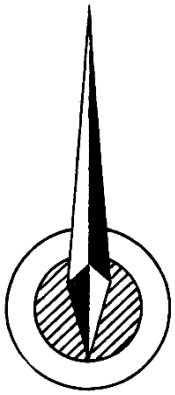
MAINTENANCE MANUAL

FOR THE 1½ LITRE

JOWETT

JAVELIN & *JUPITER*



Price Twelve Shillings and Sixpence

JOWETT CARS LIMITED
IDLE, BRADFORD, YORKSHIRE, ENGLAND
and 48 ALBEMARLE STREET, LONDON WC1

Foreword

This Maintenance manual is intended to act as a general guide to the servicing of the Javelin 1½ litre car. No attempt is made to encroach upon the subject matter of standard text books on automobile engineering practice, as the manual is intended for the use of technically qualified owners and service operators.

The manual is divided into chapters each one dealing with a unit of the car, the text being illustrated by drawings, the exploded drawings in the parts list will also be found useful if used in conjunction with the manual.

We would draw the attention of the owner and the Service operator to the fact that many of the operations detailed, call for special test equipment and tools. The owner is therefore strongly advised to contact his Main Agent. If major electrical operations are necessary, the owner or Agent is recommended to contact the nearest Lucas Service Depot.

We would also point out that our Main Agents are kept in close touch with our Technical developments, and that both the owner and the repairer are advised to make use of our Main Agents' specialised knowledge and up to date information whenever necessary. A full list of Main Agents will be supplied on request.

For information on the Jupiter 1½ litre car refer to the Appendix, Page 94.

Written communications should be addressed to:

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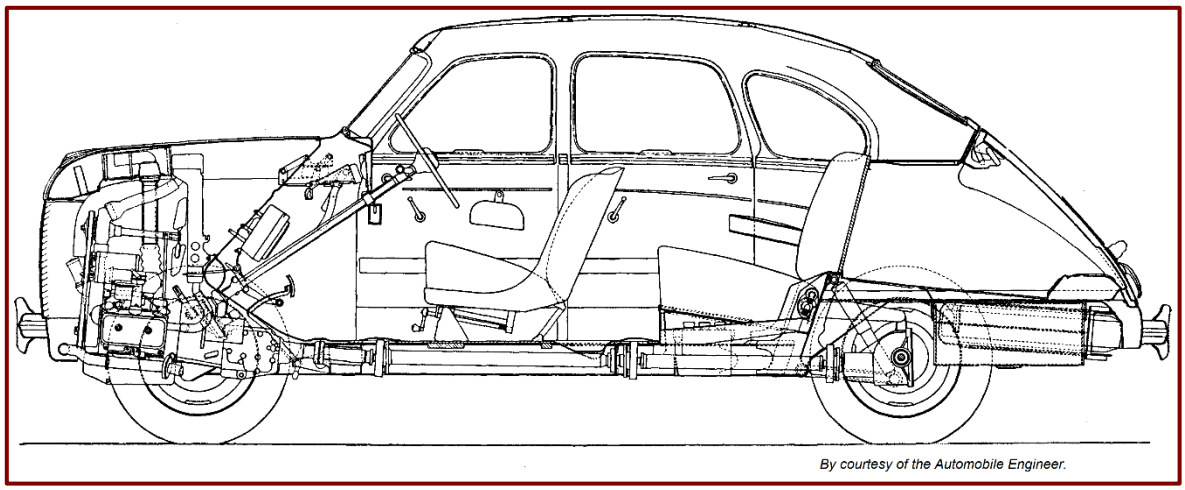

Figure 1. Cross Section Through Javelin.

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CHAPTER 1.

LUBRICATION

LUBRICATION

Every 200 miles or weekly*

Check level of oil in sump

Check level of water in radiator

Every 500 miles or half-monthly*

Grease steering nipples

Check tyre pressure (26 lbs./sq. in. (1.825 kg./sq.cm.) all round)

Check acid level in battery

Every 2,500 miles or quarterly*

Change engine oil

Check level of oil in gearbox

Check level of oil in rear axle

Check level of fluid in brake fluid reservoir

Check steering box. Add lubricant to fill if necessary (pressure must not be used)

Grease steering column bearings

Grease gear control column

Grease brake and clutch pedals

Grease hand-brake cables and linkage

Grease water pump bearing and oil fan spindle

Oil distributor and throttle linkage

Oil direction indicators

Oil gear control linkage

Grease propeller shaft centre bearing

Every 5,000 miles or half-yearly*

Change oil filter element at every 5,000 miles (Vokes and Tecalemit)

Grease front and rear hubs

Grease seat adjuster and spare wheel screw

Clean and re-set sparking plugs

Adjust brakes

Adjust clutch pedal

Remove and replace, or clean, the tappet cover air vent filter felts

Every 10,000 miles or yearly*

Change oil in gearbox

Change oil in rear axle

Grease dynamo rear bearing

Remove sump and clean sump oil filter

***** Or more frequently if necessary

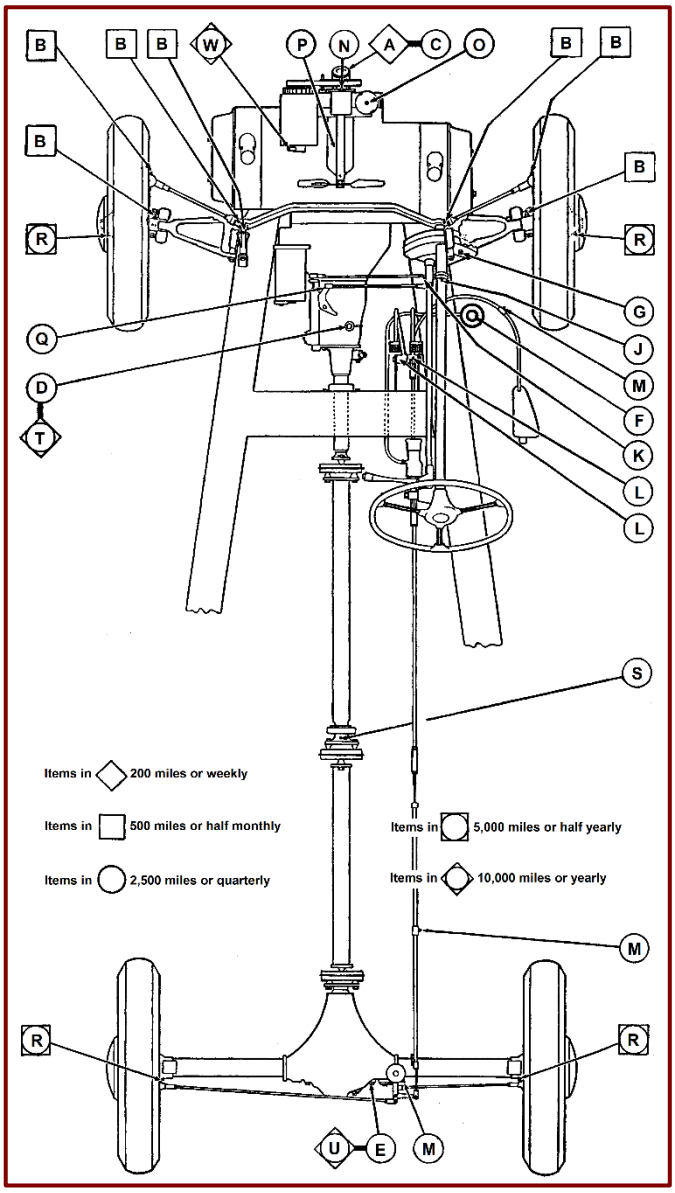

Figure 2. Lubrication Chart.

RECOMMENDED LUBRICANTS

Unit	Wakefield	Duckhams	Esso	Prices	Shell	Vacuum	Filtrate
Engine & Gearbox							
UK All Year	Castrol XL	N.O.L. 30	Essolube 30	Energol SAE 30	Shell X-100 SAE 30	Mobiloil A	Medium Filtrate SAE 30
Overseas Over 90 °F	Castrol XXL	N.O.L. 40	Essolube 40	Energol SAE 40	Shell X-100 SAE 40	Mobiloil BB	Heavy Filtrate SAE40
20°–90 °F	Castrol XL	N.O.L. 30	Essolube 30	Energol SAE 30	Shell X-100 SAE 30	Mobiloil A	Medium Filtrate SAE 30
Rear Axle	Castrol Hypoy	D'hams Hypoid 90	Esso Expee Compound 90	Energol EP SAE 90	Shell Spirax 90 EP	Mobilube GX 90	Hypoid Gear Oil 90
Suspension Nipples, Steering Box, Steering Nipples, Propeller Shaft Centre Bearing, Rear Brake Compens-ator, Chassis Lubrication.	Castrolease Medium or Castrolease CL	Duckhams H.P.G.	Esso Grease	Belmoline D Overseas C2 Energrease	Shell Retinax A or C	Mobilgrease – No. 4	H.P.Solidified Filtrate Oil
Front & Rear Hubs, Water Pump	Castrolease Heavy	Duckham's HBB	Esso Grease	Belmoline C Overseas Energrease C3	Shell Retinax A or RB	Mobilgrease – No. 4	Filtrate RB Grease
Brake Fluid	Girling Crimson Brake Fluid						
Brake Cables	Castrolease Brake Cable Grease	Keenol K.G. 16	Esso Graphite Grease	Belmoline CG Overseas Ener-grease C3G	Shell Retinax A or C	Mobil Graphite Grease	Filtrate Brake Cable Grease
General Lubrication by oil can: Fan Spindle, Door Hinges etc.	As for Engine.						

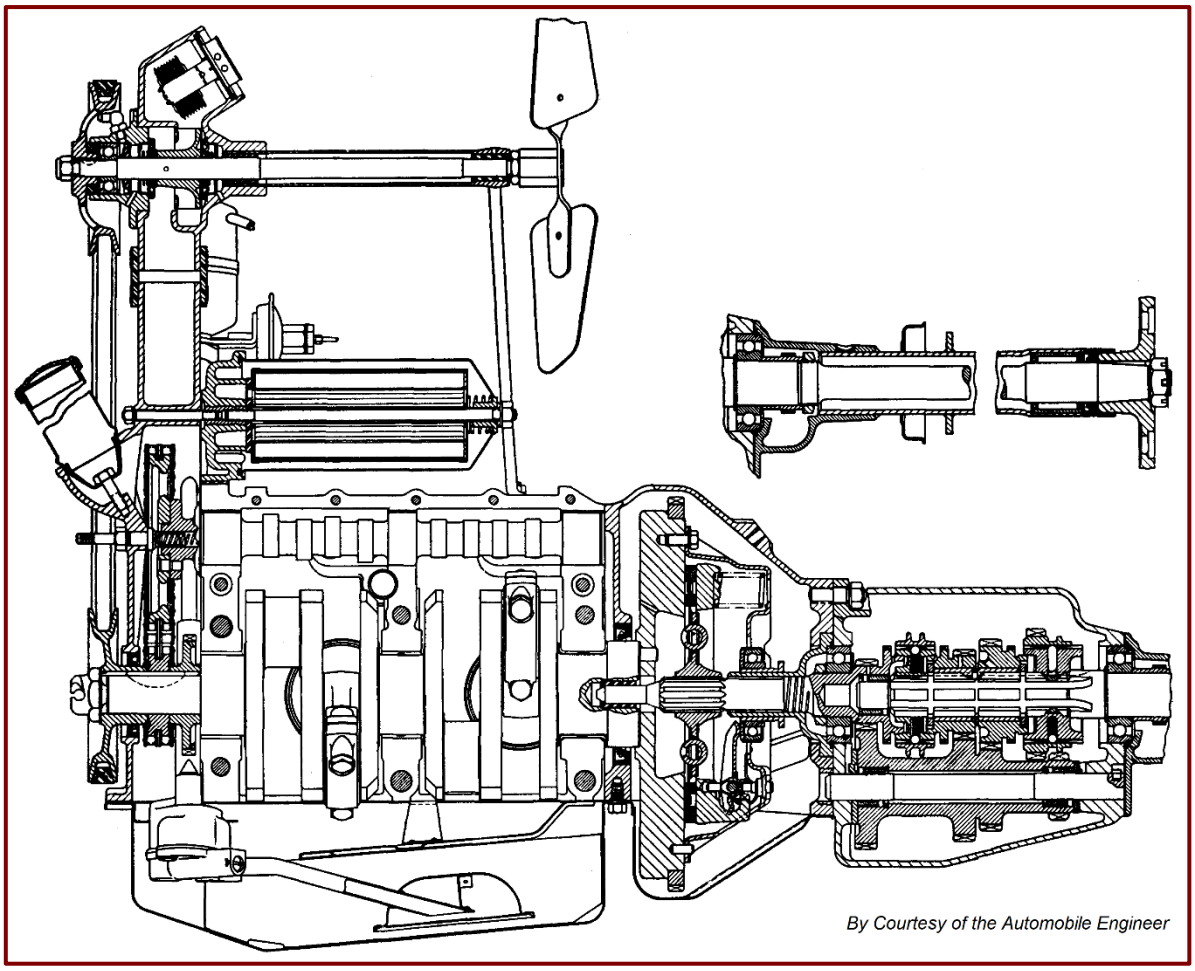

Figure 3. Cross Section Through Engine, Clutch and Gearbox.

CHAPTER 2.

ENGINE

The engine is a 1½ litre four cylinder horizontally opposed, with cylinders located in two banks, see *Figure 3*. A carburettor is located on each of the two cylinder heads.

Valves are overhead push rod operated, from a central camshaft. Ignition is by the coil system. The engine is water cooled and lubricated by a wet sump system.

Detailed descriptions of the various units will be given in the following sections.

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***** If the engine number of the car commences with the prefix letters PE refer to this page first.

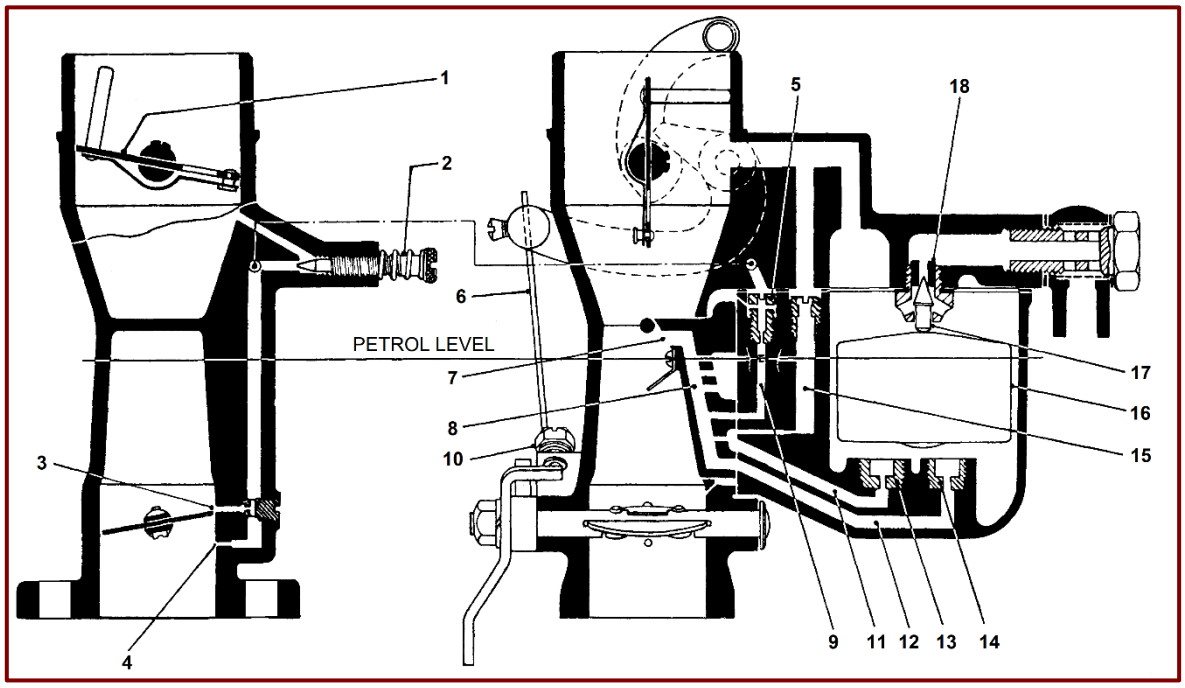


Figure 4. Section through Carburettor.

Figure 4 Legend:

1. Strangler Flap
2. Slow Running Air Screw
3. Progression Jet
4. Slow Running Outlet
5. Slow Running Jet
6. Connecting Wire
7. Emulsion Block
8. Emulsion Block Gallery
9. Slow Running Well
10. Throttle Stop Screws
11. Compensating Jet Passage
12. Main Jet Passage
13. Compensating Jet
14. Main Jet
15. Capacity Well
16. Float
17. Needle Valve
18. Needle Seating

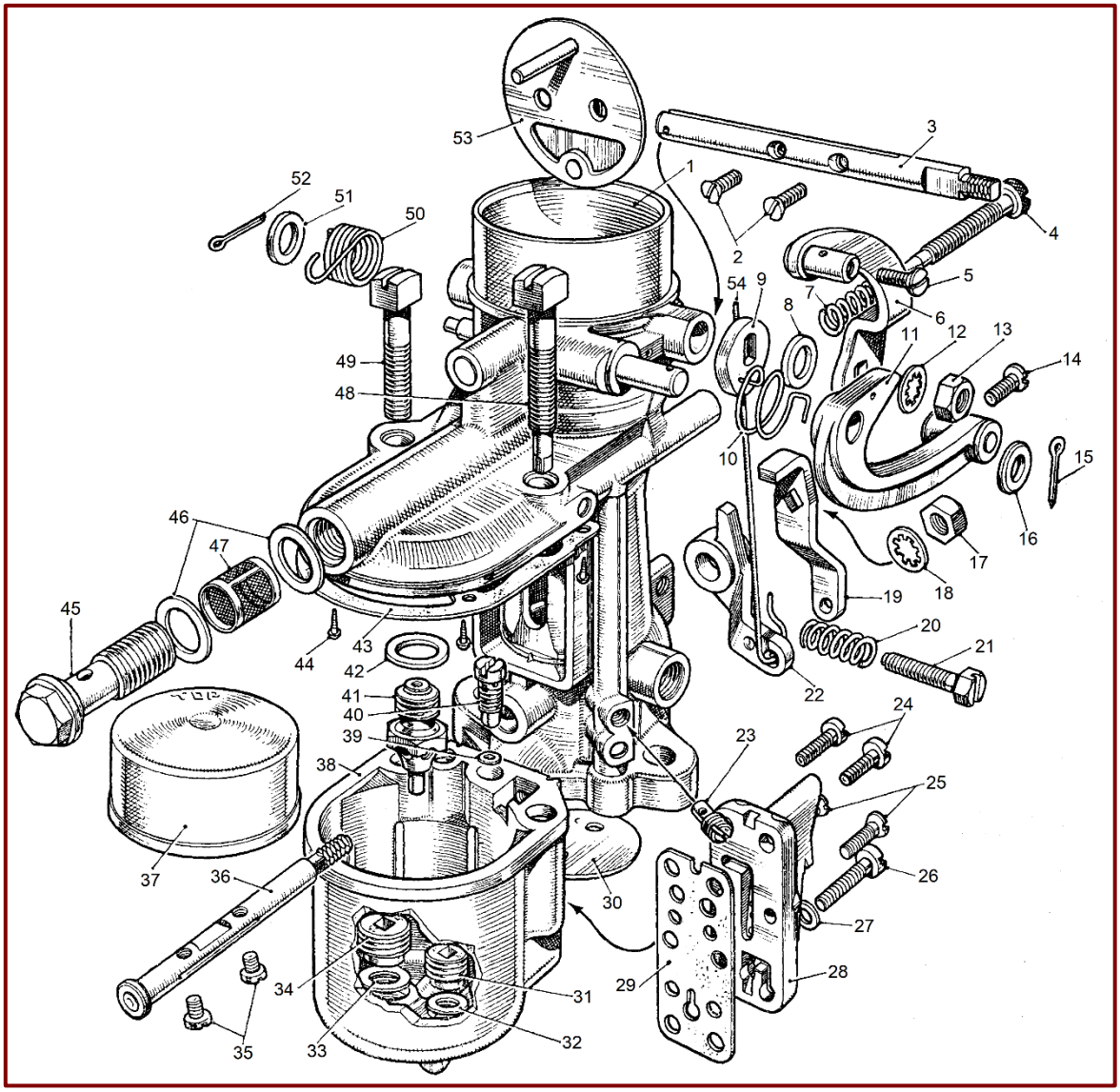


Figure 5. Carburettor, Exploded.

1. Carburettor Barrel
2. Screw, Fixing Strangler Flap
3. Strangler Spindle
4. Air Regulating Screw
5. Screw for Strangler Lever Swivel
6. Strangler Lever
7. Spring for Air Regulator Screw
8. Washer, Strangler Spindle
9. Cam for Fast Idle
10. Spring for Cam Follower
11. Cam Follower
12. Shake-proof Washer for Strangler Spindle
13. Nut for Strangler Spindle
14. Screw for Cam Follower Swivel
15. Split Pin for Cam Follower Pivot
16. Washer for Cam Follower Pivot
17. Nut for Throttle Spindle
18. Shake-proof Washer for Spindle
19. Throttle Lever
20. Spring for Throttle Stop Screw
21. Throttle Stop Screw
22. Floating Lever
23. Progression Jet
24. Screw Fixing Emulsion Block
25. Screw Fixing Emulsion Block
26 Screw Fixing Emulsion Block
27.. Washer
28. Emulsion Block
29. Gasket
30. Throttle
31. Main Jet
32. Washer
33. Washer for Compensating Jet
34. Compensating Jet
35. Screw, Fixing Throttle
36. Throttle spindle
37. Float
38. Carburettor Bowl
39. Washer For Slow Running Jet
40. Slow Running Jet
41. Needle and Seating
42. Washer for Seating
43. Gasket
44. Parker Screws
45. Plug
46. Fibre Washer for Plug or Banjo
47. Filter Gauze
48. Screw, Fixing Bowl
49. Screw, Fixing Bowl
50. Spring for Strangler Spindle
51. Washer
52. Split Pin for Strangler Spindle
53. Strangler Flap
54. Interconnection Link

FUEL SYSTEM

Description

Petrol is drawn through a porous metal filter (Models up to Engine No. E2/PD/21147) in the tank by an A.C. mechanical pump. It is then fed to the two downdraught carburettors, on models after Engine No. E2/PD/21147 *via* an A.C. gauze filter. Air is induced through an oil bath air cleaner.

Carburettors

The carburettors are Zenith type 30 V.M.5 (see *Figure 4*, Page 8). If the throttle plate spindle is worn excessively it is recommended that a replacement carburettor is fitted.

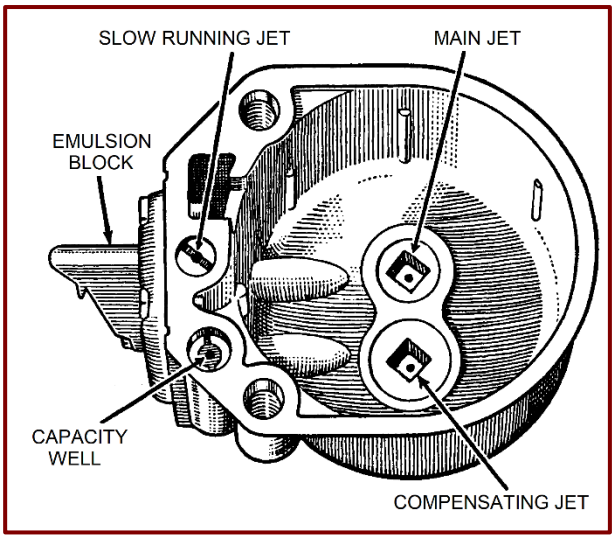


Figure 6. Float Chamber Jets.

To dismantle and clean carburettor bowl and jets (see *Figure 5*, Page 9), unscrew the two set screws securing the bowl to the carburettor body and lift the bowl away. Remove the float, and screw out the main and compensator jets using the square tip of the set screw (see *Figures 5* and *6*). Remove the remaining jets with a screwdriver. Remove the emulsion block by unscrewing the five holding screws taking care not to damage the gasket, if damaged in any way replace the gasket. Wash out the jets, bowl and emulsion block in petrol, blow out thoroughly. To reassemble reverse the above procedure taking care to refit the fibre washers underneath the jets.

Idling Speed

Refer to *Figure 9*. The engine should be warmed up to normal temperature (65 °C to 75 °C) and the air regulating screw (B) on each carburettor should be adjusted; the latter enriches the mixture when turned clockwise and weakens it when turned anti-clockwise.

If it idles too fast, slightly unscrew screw (A) on each carburettor an equal amount until a slower speed is reached. Do not try to make the engine idle too slowly or it will easily stall in traffic. It may now be necessary to readjust the air regulating screws. If the engine is inclined to 'hunt' ('surge') the mixture is too rich and must be weakened by turning the air regulating screw anti-clockwise until a regular 'beat' is obtained.

To Synchronise The Carburettors

Refer to *Figure* 9, Page 11, and proceed as follows:

1. Remove pull off spring (*Figure 9*).
2. Release locknut (**D**) and withdraw throttle cable.
3. Release the throttle rod nut allowing the rod to be lengthened or shortened as required.
4. Turn out throttle stop screws (A) until throttle arms are in the fully closed position.

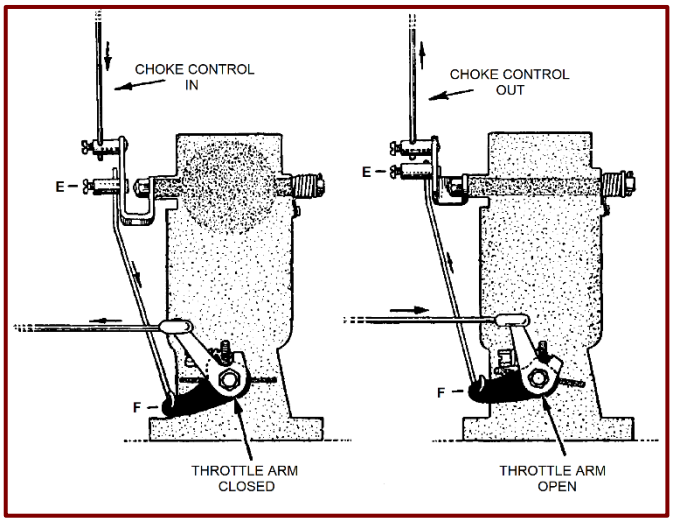


Figure 7. Fast Idling Adjustment.

5. Now holding throttle arms in the closed position turn adjusting screws (**A**, *Figure 9*) until they just contact the arms and then turn a further full turn. This ensures that both throttle plates are open exactly the same amount.
6. Again ensuring that the throttle arms are resting on stop screws (**A**), retighten the throttle rod nut thereby securing the throttle rod at its correct length.
7. Connect the throttle cable making sure that whilst no excessive slack exists, it does allow the throttle arms to rest against stop screws (**A**) when in the fully-closed position. Replace pull-off spring.
8. Screw in fully the air regulating screws (**B**), without forcing, and loosen out two turns, which is the approximate slow running position.
9. Start the engine and allow to warm. If the engine speed is too slow, turn stop screws (**A**) equally in a clockwise direction until the desired speed is obtained. If the engine refuses to run for any length of time and gradually dies, it indicates that the mixture is too weak. To enrich turn mixture screws (**B**) inwards equally. If the engine tends to 'hunt' ('surge'), the mixture is too rich, and mixture screws (**B**) should be turned outwards equally

To Adjust the Choke

Referring to *Figure 9*, proceed as outlined below:

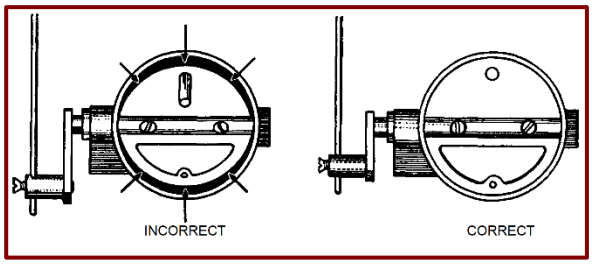


Figure 8. Chokes.

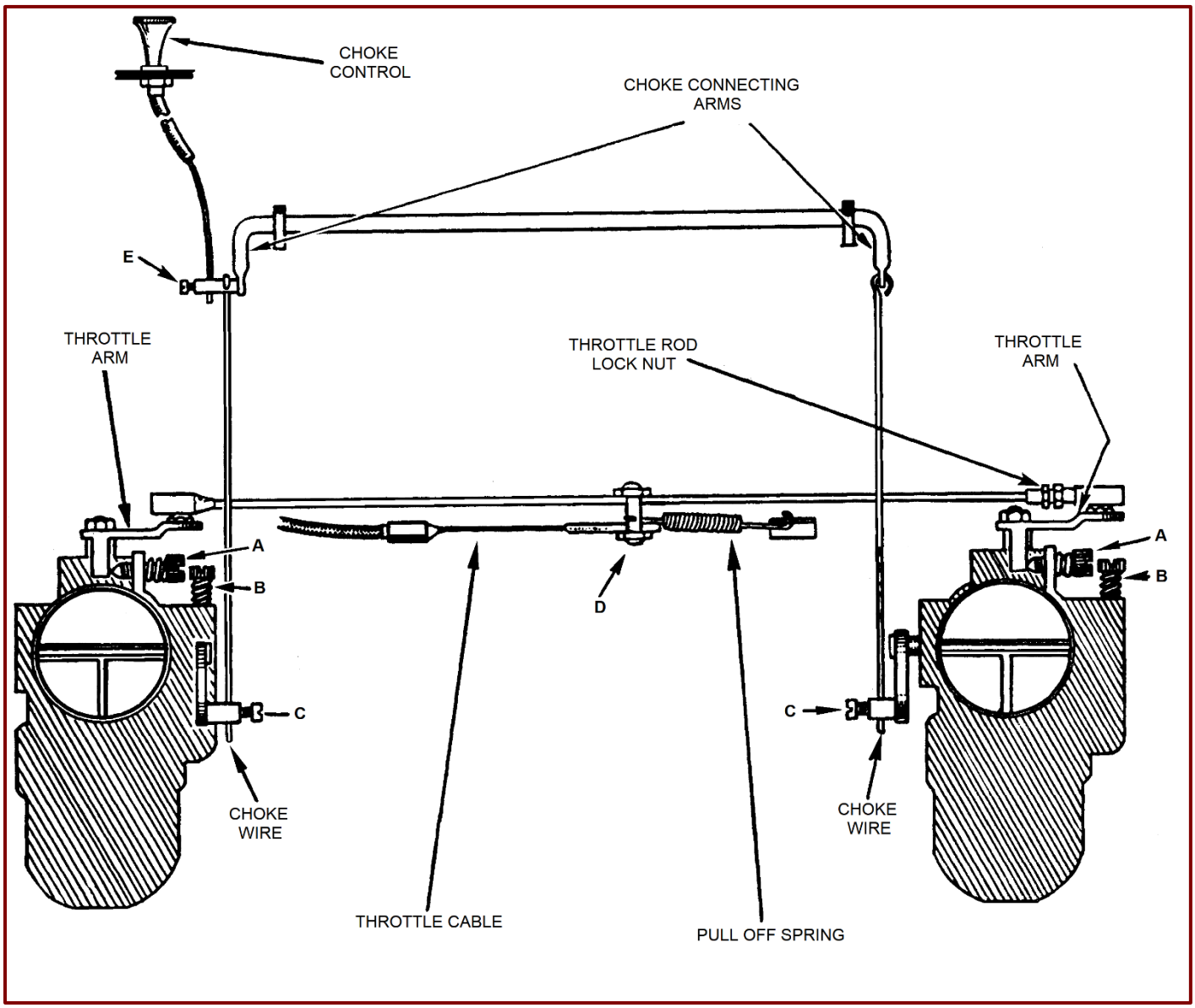


Figure 9. Carburettor Controls.

Legend for *Figure 9*:

A, Throttle Stop Screw; **B**, Air Regulating Screw; **C**, Choke Wire Screw; **D**, Throttle Cable Screw; **E**, Choke Cable Screw.

1. Slacken off choke wire screws (**C**, *Figure 9*), allowing choke wires to move freely in the strangler flap levers.
2. Ensuring the choke control knob is pushed in fully, slacken off choke cable screw (**E**, *Figure 9*) on right-hand side choke connecting arm and move arms until maximum fulcrum position is obtained, which is the choke connecting arms and choke wires pointing in a direct line to the strangler flap levers. Retighten choke cable screw (**E**) in this position.
3. Holding the strangler flap levers forward so that strangler flap is in full open position, tighten choke wire screws (**C**, *Figure 9*). Finally, release air cleaner tube clip from top of carburettor and move tube to one side so that strangler flap is visible. Pull choke control knob out fully and ensure that strangler flap is seating correctly on fully-closed position, as shown in *Figure 8*, Page 10.

To Adjust Fast Idling

This mechanism, operated by a connecting wire fastened to the strangler flap lever on the right-hand carburettor, works in conjunction with the choke (*Figure 7*, Page 10) and increases the engine speed when the choke is operated by opening the throttle plate slightly.

Slacken off choke wire screw and move fast idling lever (**E**) upward until the lever contact opens the throttle plate slightly when the choke is operated, holding arm in this position tighten securing screw (**E**). It is essential that the engine speed is not excessive when the choke is operated.

BALANCING SYSTEM

In order to balance the vacuum in each inlet manifold, they are connected by a balancing pipe. To assist crankcase breathing a pipe incorporating a breather valve runs from the balance pipe and joins the crankcase at the oil filler tube. If this breather valve becomes blocked, carburation will be upset. For method of checking valve, refer to Lubrication and Ventilation section.

PETROL PUMP

The A.C. mechanical petrol pump is of the reciprocating diaphragm type (*Figures 10* and *12*, Page 13). It is driven through a plunger by a cam on the oil pump drive spindle. The pressure should not exceed 2½ lbs. per sq. inch (0·175 kg. per sq. cm.). The most economical pressure is 1·8–1·9 lbs. per sq. inch (0·128–0·133 kg. per sq. cm.). If no proprietary test equipment is available this can be checked using a column gauge. The most economical pressure will lift a column of petrol 5' 6" (1·675 metres).

If the pump linkage is badly worn it is more economical to fit a replacement pump than attempt repair.

Only a skilled mechanic should dismantle the pump beyond the filter cleaning stage. He should note when assembling, that on replacing the upper cover, the pump pull rod should be at the top of its stroke, to ensure sufficient flexing of the diaphragm for its normal working movement. Sometimes apparent failure of the pump is due to the blockage of the vents on the tappet covers causing a depression in the crankcase which neutralises the operation of the petrol pump diaphragm, this should be checked by use of a depression gauge. See Page 29.

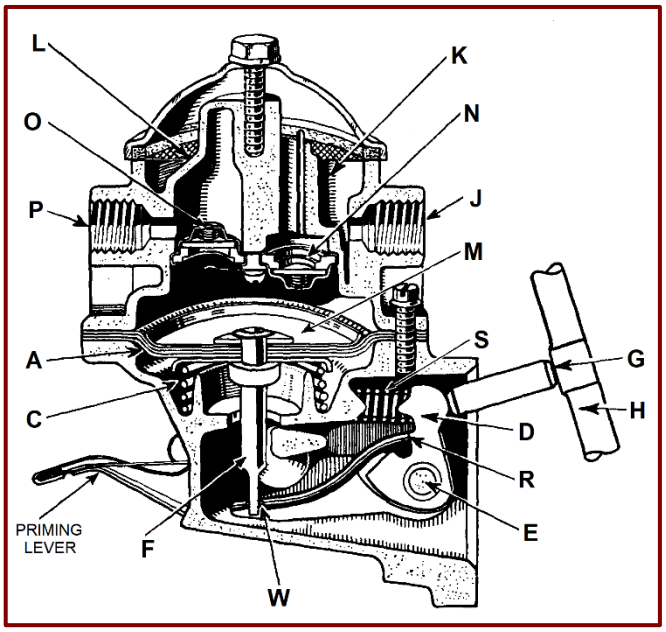


Figure 10. Petrol Pump.

Legend for *Figure 10*:

A, Diaphragm; **C**, Return Spring; **D**, Rocker Arm, **E**, Pivot; **F**, Pull Rod; **G**, Plunger; **H**, Drive Shaft; **J**, Inlet; **K**, Sediment Chamber; **L**, Filter Gauze; **M**, Pump Chamber; **N**, Suction Valve; **O**, Pressure Valve; **P**, Outlet; **R**, Compensation Gap for Non-delivery; **S**, Spring; **W**, Operating Arm.

PETROL FILTERS

In The Tank

This requires no attention (only fitted to models before Engine No. E2/PD/21147). If petrol starvation is apparent this filter should be carefully perforated with a suitable drill.

In The Petrol Pump (*Figure 12*)

This should be cleaned periodically as follows:–

Remove the petrol pump top cover by removing the screw in its centre and lift out the gauze screen or filter. Wash in petrol and blow it through to remove any dirt. When replacing make sure that the cork gasket is correctly located, and that the cover is correctly seated and air-tight. The cork cover gasket must be replaced if it is damaged or over-compressed.

In The Carburettors (*Figure 4*)

These gauze filters will come out when the petrol feed pipe is disconnected from the carburettor. They should be cleaned at the same time as the pump filter.

The A.C. Petrol Filter (*Figure 11*)

Fitted to models after Engine No. E2/PD/21147. It is located just above the petrol pump, and should have the gauze filter cleaned at the same time as the other filters. Check the cork gasket when replacing the filter bowl.

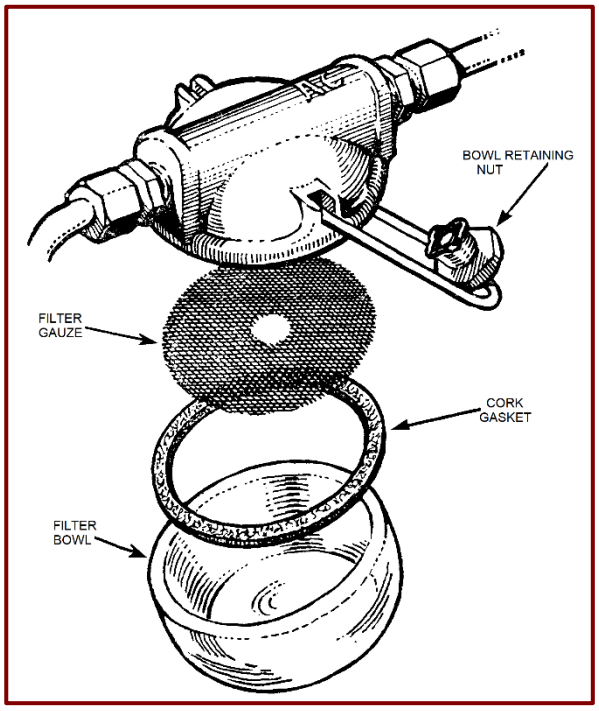


Figure 11. Petrol Filter.

THE AIR FILTER

Attached to the air silencer box positioned underneath the front of the bonnet it should be removed and cleaned every three thousand miles or more frequently if operating under extremely dusty climatic conditions. To carry out this operation remove the oil filter bath and element by unscrewing the two nuts securing the forward end of the oil bath to the air silencer box; the oil bath casing and element can then be lifted away, taking care not to spill the oil contained inside the oil bath. Thoroughly wash the bath and element in clean petrol or paraffin. Soak the element in engine oil and refill the bath with one third of a pint of engine oil. Replace the filter element into the bath and refit the assembly ensuring that the felt joint which is fitted between the bath flange and the silencer box is correctly positioned to obtain an airtight joint.

PETROL TANK

A drain plug is provided at the bottom centre of the tank. The tank can be removed by first taking off the filler cap and the rubber grommet, disconnecting the gauge wiring, which is accessible through a cover in the luggage boot, detaching the feed pipe, then removing the three mounting nuts and bolts.

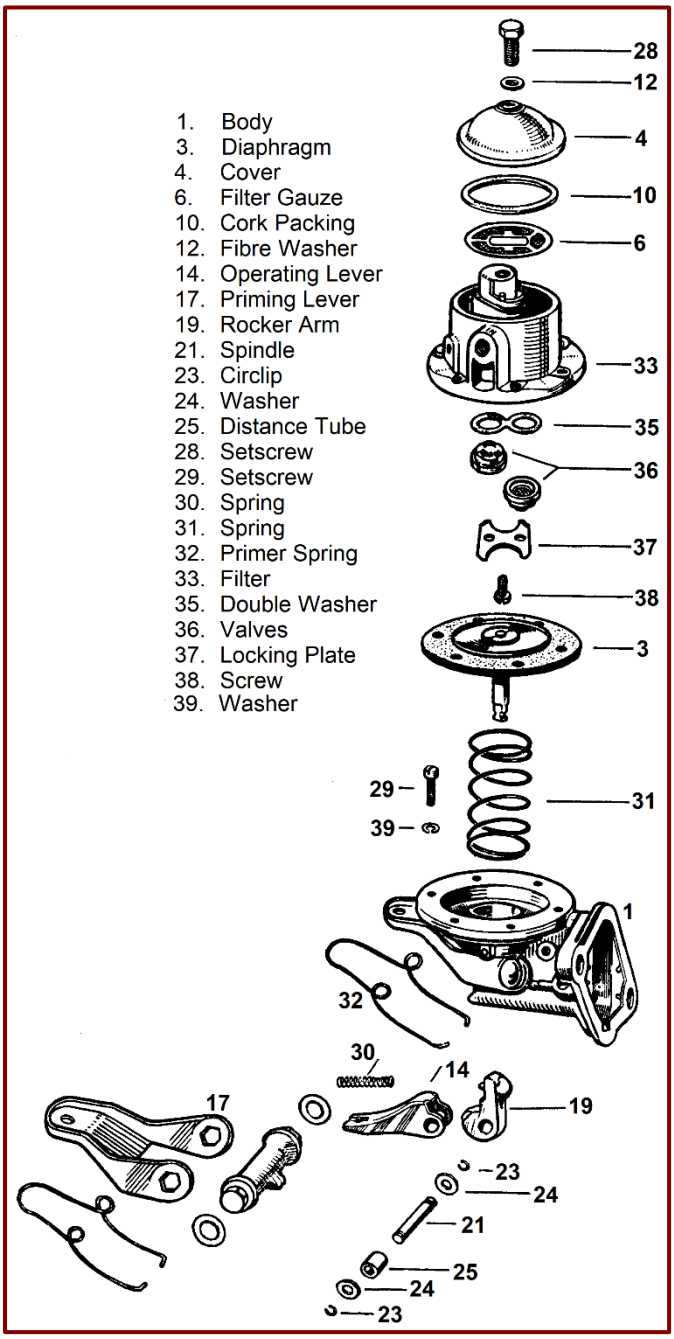


Figure 12. Exploded Petrol Pump (for Reference).

IGNITION SYSTEM

DESCRIPTION

The ignition is by 12-volt coil and distributor system.

DISTRIBUTOR

The distributor (*Figure 18*, Page 15) is a Lucas D.M.2. type generally introduced from Engine No. PD/21016; this incorporates a micrometer adjustment. On models prior to this engine number a Lucas type DKY H4A was fitted.

MAINTENANCE (See *Figures 13* and *14*)

At every 3,000 miles, lightly smear the cam with a very small amount of clean grease. Apply a spot of clean engine oil to the top of the pivot on which the contact breaker works.

On the DKY H4A type lift the rotor arm from the top of the spindle by pulling it off vertically and add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft. Do not remove the screw exposed to view as the screw is drilled to enable the oil to pass through. Take care to refit the rotor arm correctly, pushing it on to the shaft as far as it will go. On both types add a few drops of thin machine oil through the hole in the contact breaker base through which the cam passes, to lubricate the automatic timing control. Do not allow any oil to get in or near the contacts.

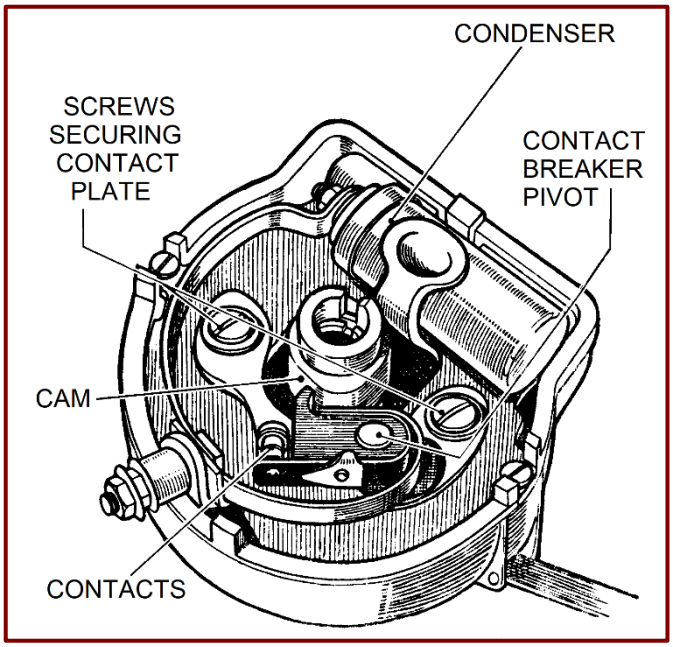


Figure 13. Contact Breaker (DKY H4A)

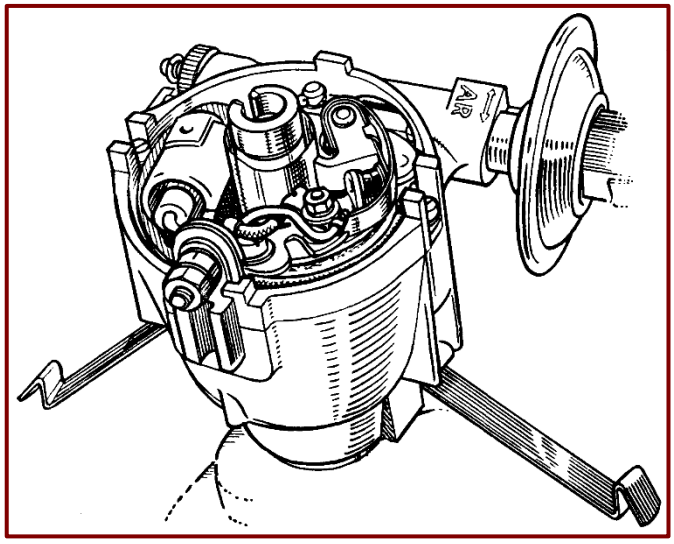


Figure 14. Contact Breaker (D.M.2).

At every 6,000 miles wipe the inside and outside of the distributor cap with a soft dry cloth, paying particular attention to the spaces between the metal electrodes. See

that the small carbon brush on the inside of the moulding moves freely in its holder. Examine the contact breaker. The contacts must be free from grease or oil. If they are burned or blackened, clean them with a fine carborundum stone or very fine emery cloth, afterwards wiping away any trace of dirt or metal dust with a petrol-moistened cloth. Cleaning of the contacts is made easier if the contact breaker lever carrying moving contact is removed. To do this, slacken the nuts on the terminal post and lift off the spring, which is slotted to facilitate removal. After cleaning, check the contact breaker setting.

Contact Breaker Adjustment

Turn the engine by hand until the contacts are seen to be fully opened, and check the gap with a gauge having a thickness of 0·010"–0·012" (0·254–0·305 mm.) in the case of the DKY H4A type, and 0·014"–0·016" (0·356–0·406 mm.) on the D.M.2 type. If the gap is correct, the gauge should be a sliding fit, should the gap vary from the gauge, the setting must be adjusted. To do this, keep the engine in the position giving maximum contact opening and slacken the two screws securing the fixed contact plate. Adjust the position of the plate until the gap is set to the thickness of the gauge and tighten the two locking screws. Re-check the gap for other positions of the engine giving maximum contact opening, i.e., the heel of the moving contact resting on the lobe of the cam.

High Tension Cables

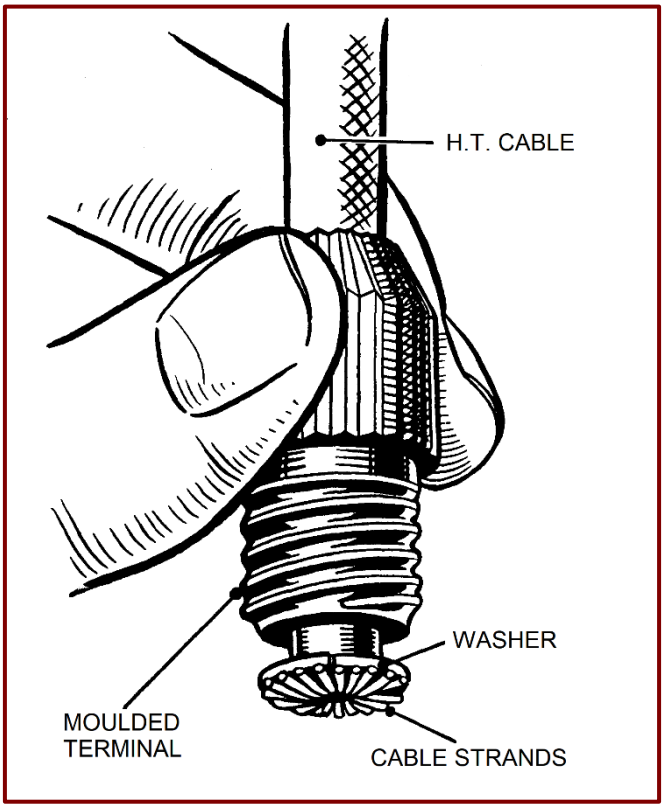


Figure 15. Fitting H.T. Cable to Coil.

Examine the high tension cables. Any which have insulation cracked or perished, or show signs of damage in any other way, must be replaced using 7 mm. ignition cable. To fit new high tension cable to the distributor, unscrew the pointed fixing screw on the inside of the moulding, pull out the old cables and push the new cables, which should not be bared but cut off flush to the required length, well home into their respective terminals. The screw securing the centre cable is accessible when the carbon brush is removed. Finally tighten up the screws which will pierce the insulation and make contact with the cable core. The method of fitting high tension cables to the coil is to thread the knurled moulded nut over the cable, bare the end for about ¼" (6 mm.), thread the wire through the washer removed from the end of the original cable and bend back the wire strands (*Figure 15*). Seal all H.T. cable entry points with Bostik. Finally screw the nut into its terminal housing.

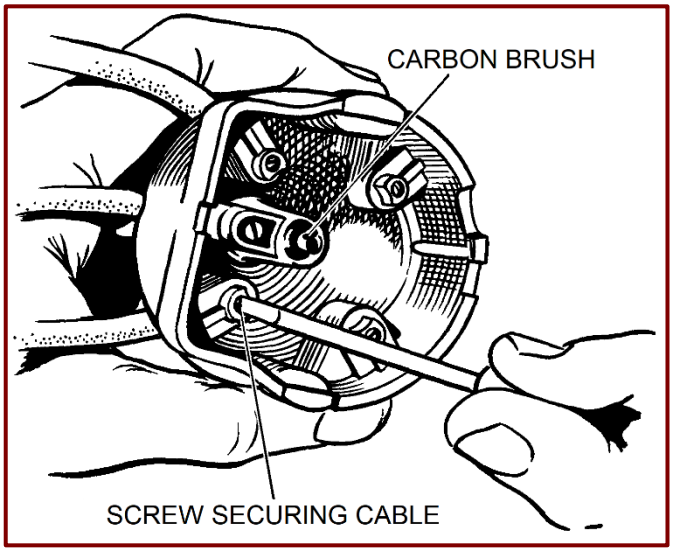


Figure 16. Fitting H.T. Cable to Distributor.

OVERHAUL

Dismantling

1. Spring back the securing clips and remove the moulded cap.
2. Lift the rotor off the top of the spindle. If it is a tight fit, it should be carefully levered off with a screwdriver.
3. Slacken the nut on the terminal post and lift off the end of the contact breaker spring. The contact breaker lever can now be lifted off its pivot. Take out the two screws, complete with spring washers and flat steel washers, which secure the plate carrying the fixed contact, and remove the plate.
4. Take out the two screws and spring washers fitted at the edge of the contact breaker base, which can then be removed from the body of the distributor.
5. Remove the driving dog from the shaft.
6. Lift the cam, automatic timing control and shaft assembly from the distributor. Take out the screw from inside the top of the cam spindle.

   (Before dismantling, carefully note the positions in which the various components are fitted so that they can be replaced correctly). Lift off the cam, then the automatic timing control will be accessible.

Condenser

The best method of testing the condenser is by substitution. Disconnect the original condenser and connect a new one between the L.T. terminal of the distributor and earth.

Should a new condenser be necessary, it is advisable to fit a complete condenser and contact breaker plate assembly, but should a condenser only be available,

care should be taken not to overheat the condenser if it is necessary to solder in position

Replacement of Bearing Bushes (See *Figure 17*)

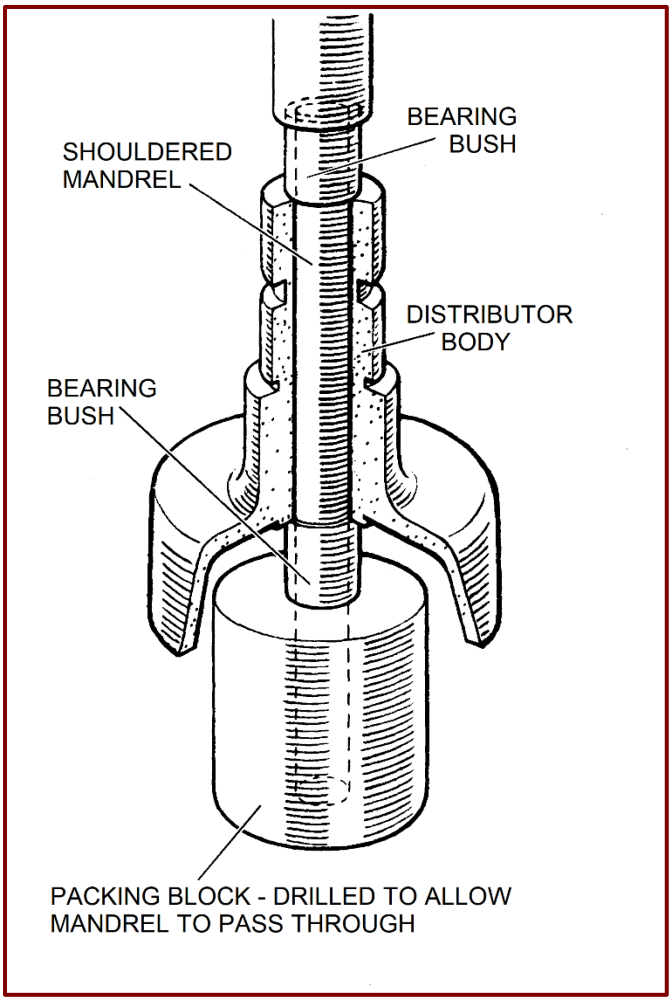


Figure 17. Replacement of Bushes.

1. In order to ensure easy running of the distributor shaft when the shaft has been re-bushed, the new porous bronze brushes must be fitted so that they are in correct alignment. The bushes must be fitted by means of a vertical drilling machine or hand press using a mandrel and a packing block of the type shown.
2. Fit the mandrel in the drilling machine or hand press and place the distributor body in an inverted position on the table below it.
3. To remove the bushes, a sleeve must be fitted over the mandrel to build it up to the required size. With this sleeve fitted in position, force the old bushes out of the shank by applying a steady pressure.
4. Before new bushes are fitted they should be allowed to stand for 24 hours, immersed in thin engine oil.
5. Take the sleeve off the mandrel. Place one of the longer bushes on the mandrel, then the distributor body in an inverted position and finally one of the smaller bushes.
6. Locate the end of the mandrel through the packing piece and press the mandrel downwards, taking care that both bushes enter the distributor shank squarely. Continue forcing the bushes into the shank until they are correctly located in the body.
7. After fitting, the bushes should not be opened out as this would tend to impair the porosity of the bushes and so prevent effective lubrication.

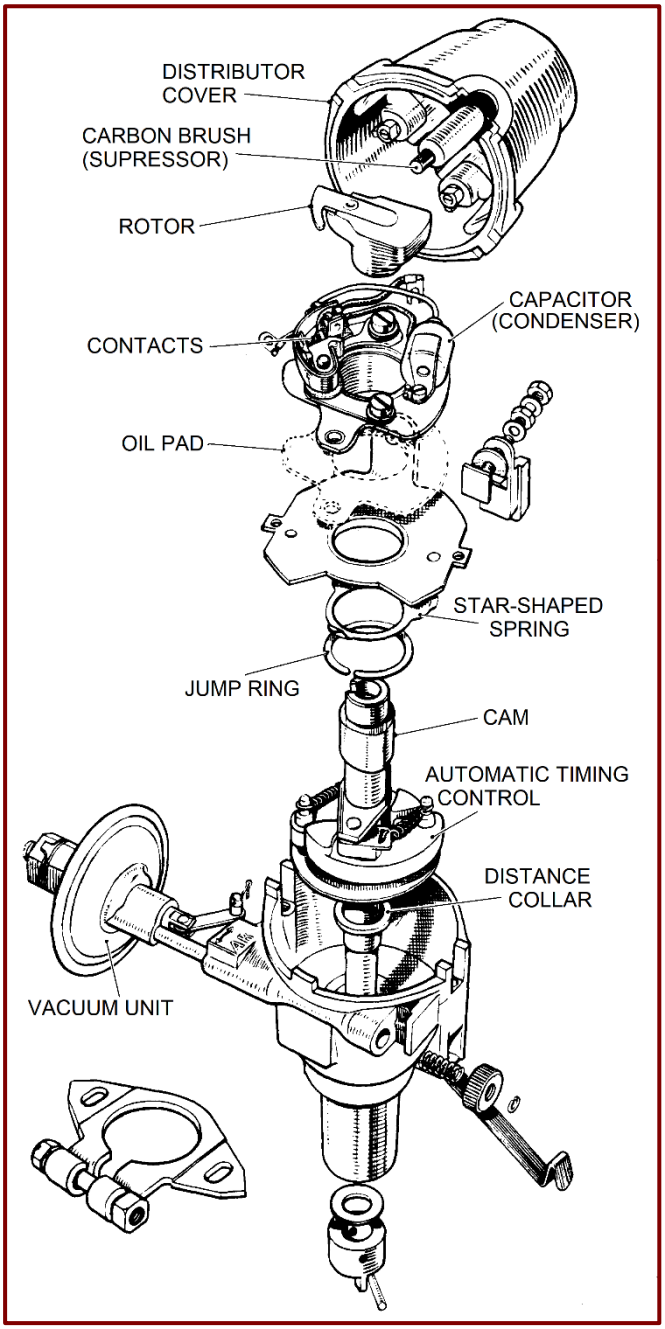


Figure 18. Exploded Distributor (D.M.2 Type).

Re-assembly

1. Before reassembly, the distributor shaft, automatic advance mechanism, and the portion of the shaft on which the cams fit must be lubricated with thin engine oil.
2. Assemble the automatic timing control, taking care that the parts are fitted in their original positions and that the control springs are not stretched. Two holes are provided in each toggle; the springs must be fitted to the inner hole in each-case. Place the cam on its spindle and secure by tightening the fixing screw.

3. Fit the shaft assembly in position in the body and replace the driving member.
4. Place the contact breaker base in position on the distributor body and secure by replacing the two fixing screws. A spring washer must be fitted under each of the screw heads, and the screws must be fully tightened.
5. Position the plate carrying the fixed contact on the contact breaker base and secure it in position by means of the two screws, first placing a spring washer and a flat steel washer under the head of each screw.
6. Place the insulating washer over the contact breaker , pivot pin and position the contact breaker lever on the pin. Locate the slotted end of the contact breaker spring under the head of the terminal screw and tighten the nut to lock the spring in position. Adjust the contact breaker setting to give a gap of 0·010”–0·012” (0·254–0·305 mm.) in the DKY H4A type, and 0·014”–0·.016” (0·356–0·406 mm.) on the D.M.2 type, when fully opened.

   Note: If it becomes necessary to renew the contacts, a replacement set comprising fixed and moving contacts must be fitted
7. Place the rotor on top of the spindle, locating the register correctly and pushing the rotor fully home.
8. Fit the distributor cover moulding and secure by means of the spring clips.

COIL

The coil is located on the right-hand panel under the bonnet. In the event of coil failure nothing can be done other than replace the coil.

SPARKING PLUGS (see *Figure 19*)

The plugs are Champion type L10. After the first 500 miles, and subsequently at 5,000 mile intervals, the four sparking plugs should be removed for cleaning and re-setting their electrode gaps. Each one is enclosed by a plastic cover attached to the end of the lead; this is removed by turning it in an anti-clockwise direction until it springs out of the metal cover; then withdraw it completely. Using the box spanner provided in the tool kit, unscrew the sparking plug.

When lifting the sparking plug clear from the engine, take care not to lose the copper washer. When the four plugs are out, examine them. The hard carbon deposit should be removed from each plug by brushing or scraping. Finally, check the electrode gap with a feeler gauge. This should be 0·020”–0·025” (0·508–0·635 mm.). When replacing the sparking plugs check the copper washer. Before replacing the plastic cover make sure its rubber seal is correctly in position; lower the cover carefully over the plug, holding it centrally in the hole, aligning the two lugs with the mating slots. Finally, press it home and turn about one-eighth of a turn in a clockwise direction.

Access to each rear sparking plug is improved by turning the steering wheel so that the road wheels are in the opposite lock to the plug being removed. This places the steering linkage in such a position that a longer stroke can be obtained with the spanner.

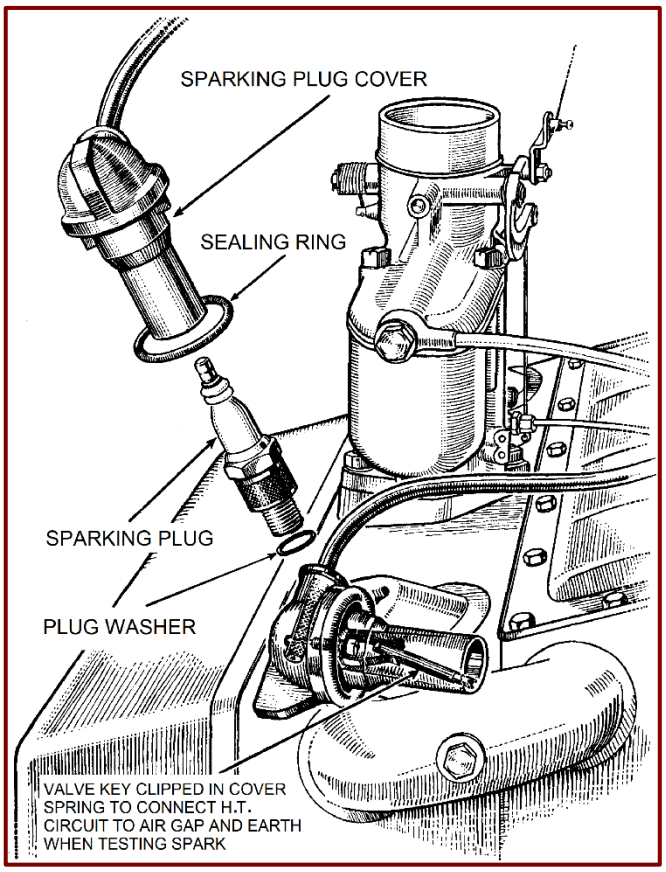


Figure 19. Spark Plug and Ignition Test.

IGNITION TIMING

The suction and centrifugal distributor advance mechanism must work perfectly freely; this point should be very carefully checked. When the DKY H4A distributor is fitted the ignition timing should be set at T.D.C. using a Test Lamp, subject to final adjustment on road test. With this setting, a very slight ‘pink’ will be experienced at speeds under 15 m.p.h. (24 k.p.h.) on part throttle, using 70 octane petrol, but no ‘pinking’ should occur on full throttle. On higher octane rating of high quality fuel, the ‘pinking’ should be considerably reduced. Should full throttle ‘pinking’ be experienced the ignition timing should be retarded slightly. When the D.M.2 distributor is fitted, the above procedure should be followed. An additional point to note with this type is to ensure that the micrometer adjustment setting is central, so that final adjustment can be carried out on the road. The distributor body is stamped to indicate the direction in which the micrometer adjustment should be turned, when advancing or retarding.

ENGINE REMOVAL

Removal of the engine and gearbox as separate units is not recommended.

1. Lift car and place it level on four stands, two under the rear axle and one under each front spring arm.
2. Drain the water.
3. Isolate the battery. (Situated underneath the rear seat).
4. Remove the radiator grille.
5. Detach front apron.
6. Remove the front bumper and sump protection bar complete, by removing the two bumper main-spring centre bolts and the four nuts and bolts (two at each side), securing the sump protection bar to the chassis extension harness.
7. Disconnect the distributor high tension and low tension leads at the coil.
8. Detach the petrol feed at the top flexible pipe joint.
9. Withdraw choke control wire from the strangler flap arm on each carburettor.
10. Disconnect throttle cable from throttle rod mechanism and withdraw cable and outer cover from the outer cover holding bracket and move them to the right hand side of the engine.
11. It is advisable to drain the oil filter by unscrewing the oil gauge adaptor out approximately ⅜" (9.525 mm.). This will prevent oil from the filter draining through the adaptor on to the engine.
12. Disconnect the oil pressure switch wire from the switch situated at the left hand side of the rear timing cover on standard models, or the oil gauge pipe at the right hand side of the rear timing cover on De Luxe models.
13. Uncouple the dynamo wires at rear of dynamo and move these together with indicator switch wire to the left hand side of the engine.
14. Detach the air filter pipes from the carburettors by releasing the bottom Jubilee clips.
15. Withdraw radiator hose from the water pump and also the heater hose if a heater is fitted.
16. Remove the heater tap.
17. Uncouple exhaust pipe at the manifold flange.
18. Detach the two bottom radiator hoses at the water elbows at the rear of the crankcase.
19. Disconnect the starter and harness lead at the rear of the starter and the engine earth lead, secured to the bottom starter flange stud.
20. Detach the front propeller shaft by removing the two nuts and bolts, special washers securing the front Layrub coupling to the gearbox output flange. Place a stand under the propeller shaft so that excessive strain is not put on the midship bearing and cross member supports. The output flange is keyed on to a taper at the end of the gearbox mainshaft, and can be removed with the use of an Extractor. If an alternative method is used, care must be taken that the face is protected from possible damage and mal-alignment.
21. Withdraw the speedo drive cable by unscrewing the knurled nut and withdrawing the cable at the right-hand side of the gearbox extension.
22. Disconnect the clutch operating rod by removing the split pin and clevis-pin from the front end of the rod.
23. Remove inspection cover from the left-hand side of the incline board (six screws) and disconnect the gear change and selector rod joints. Fasten the rods away from the gearbox, so that they do not catch when the engine is being withdrawn. On the De Luxe model the reverse light switch should be disconnected.
24. The Gear-change stay can also be disconnected through the inspection hole, by removing the nut and washer, and lifting the stay clear of the securing stud.
25. Take off the clutch housing base cover.

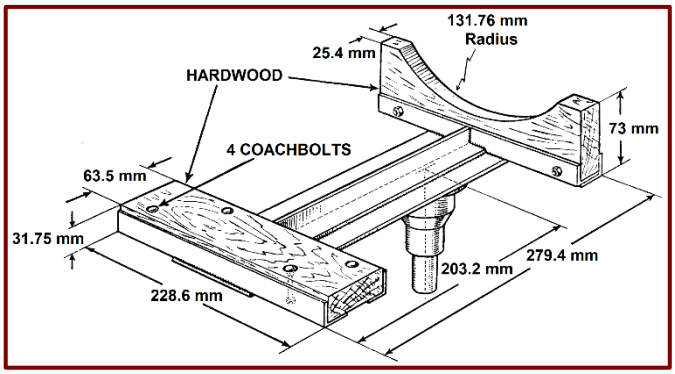


Figure 20. Engine Cradle.

26. The only remaining items now are the three engine mountings. The weight of the engine should now be taken by using a workshop jack and engine cradle (*Figure 20*). Position the Cradle so that the flywheel ring gear teeth rest on the wooden surface of the rear Cradle arm, and the sump base on the front wooden arm.
27. Remove the two bolts and two setscrews securing the front engine mountings to the chassis extensions.
28. Remove the three setscrews securing the rear engine mountings to the gearbox cross-member.

The engine can now be drawn forward, on the jack, clear of the chassis.

If possible a stand, as illustrated in *Figure 21*, Page 18, should be used for working on the engine after removal from the car.

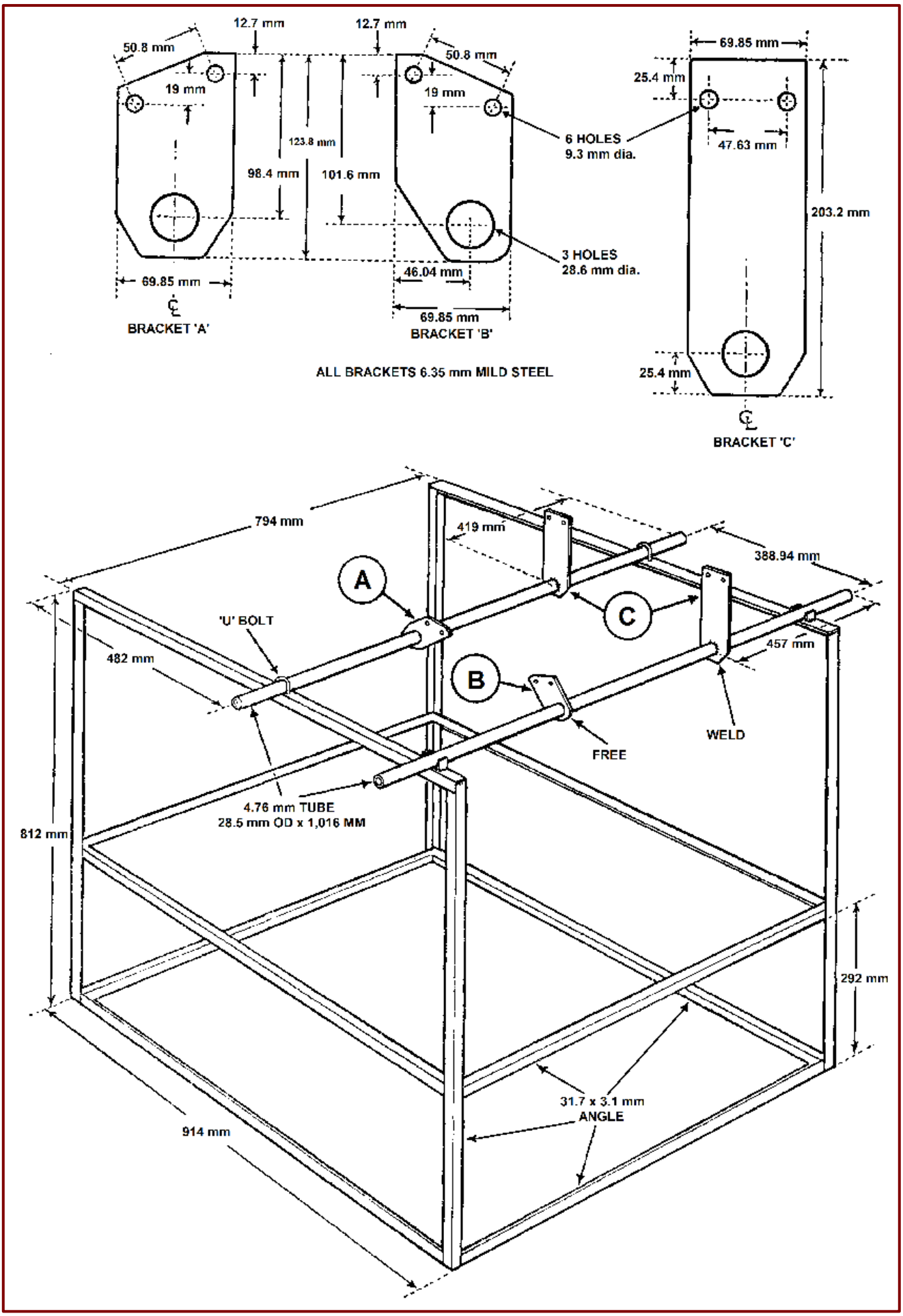


Figure 21. Engine Stand.

Metric Conversions For Figures 20 And 21

Metric	Inch – Fract.	Inch – Dec.
3·1 mm	⅛”	0·125”
4·76 mm	3/16”	0·1875”
12·7 mm	½”	0·50”
19·0 mm	¾”	0·75”
25·4 mm	1”	1·00”
28·5 mm	1⅛”	1·125”
31·75 mm	1¼”	1·25”
46·04 mm	1 13/16”	1·8125”
47·63 mm	1⅞”	1·875”
50·8 mm	2”	2·00”
63.5 mm	2½”	2·50”
69·85 mm	2¾”	2·75”
73·03 mm	2⅞”	2·875”
98·4 mm	3⅞”	3·875”
101·6 mm	4”	4·00”
123·8 mm	4⅞”	4·875”
131·76 mm	5 3/16”	5·1875”
203·2 mm	8”	8·00
228·6 mm	9”	9·00”
279·4 mm	11”	11·00”
292 mm	11½”	11·50”
388·94 mm	15 5/16”	15·3125”
419 mm	16½”	16·50”
457 mm	18”	18·00”
482 mm	19”	19·00”
794 mm	31¼”	31·25”
812 mm	32”	32·00”
914 mm	36”	36·00”
1,016 mm	40”	40·00”

CYLINDER HEADS AND VALVES

DESCRIPTION

The two cylinder heads have the inlet manifolds cast integral, exhaust manifolds are detachable and located on the underside of the heads. The valves are in the heads which carry the push rod operated rocker assembly. Valve seats are part of the head casting, whilst the valve guides are a detachable press fit.

To Remove Cylinder Heads

Drain off the cooling system, remove front road wheels, dynamo, carburettor petrol pipe, throttle controls and carburettors.

Remove rocker covers, tappet covers, and rocker assemblies; withdraw push rods and tappets, placing the rods and tappets in marked containers so that they can be refitted in their original positions. Remove the front exhaust pipe.

Remove water transfers.

The cylinder heads can now be removed. When removing the left hand cylinder head, it may also be necessary to jack under the right hand side of the engine so that the front corner of the head clears the dash side.

Important Note

It is of extreme importance when carrying out any service operation which necessitates the removal of a cylinder head, that the following point is very carefully checked, to eliminate any chance of internal water leaks after the cylinder head has been refitted.

If the engine is turned with the cylinder head removed, there is a possibility of the cylinder liners moving and breaking the cylinder liner seal, Part No. 50643, which results in water seepage into the crankcase after reassembly. To avoid this, the cylinder liners should be clamped firmly in to position after removing the cylinder head by placing a further tube or number of flat washers over the locating plate tube, and tightening down with a cylinder head nut so that the liners are held securely by the liner locating plate.

To Replace Cylinder Heads

Before fitting the heads ensure that the cylinder liners project 0·008”–0·012” (0·203–0·305 mm.) from the face of the cylinder block. If the projection is not within these limits a copper shim (Part No. 52381) should be fitted, between the liner sealing flange and sealing washer.

Update Note

For a number of years, cylinder liners have been fitted into the crankcase with copper washers in place of the original sealing washers. Typically, the copper washers are 0·035” (0·889 mm) thick and usually require shims to adjust cylinder liner protrusion to the copper washer specification of 0·005”–0·008” (0·127–0·2032 mm) proud of the cylinder head gasket surfaces on the crankcase set. This revised specification has been developed in conjunction with new manufacture cylinder head gaskets sourced from New Zealand.

To Continue . . .

Also check that the gasket support tube (of type fitted after Engine No. E1/PC/17900) is perfectly level with the top face of the cylinder liners. This may be adjusted by fitting shim washers under the support tube or by filing the distance washer fitted below the liner locating plate.

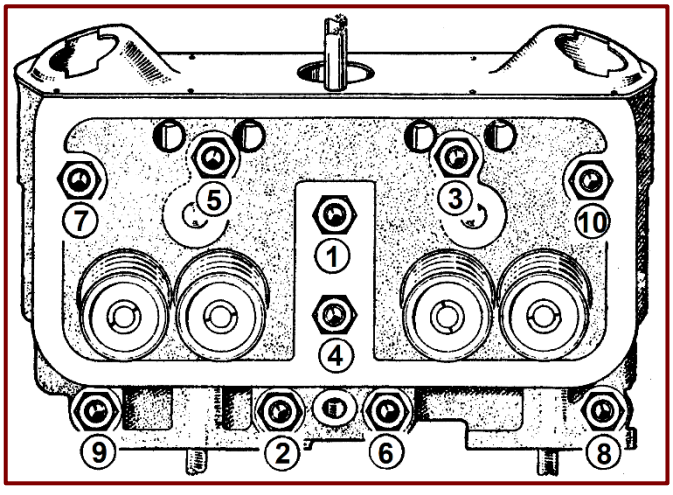


Figure 22. Order of Tightening Cylinder Head Nuts.

Replace cylinder head using a gasket sealed with gasket cement and tighten the cylinder head nuts, in rotation (see *Figure. 22*, Page 19). The torque wrench setting for the cylinder head nuts is 40 lbs. ft. (54·2 Nm.).

Update Note

With the cylinder liners seated on copper washers and shims, tighten cylinder head nuts to 20 lb. ft. (27·1 NM) and then to 37 lb. ft. (50·7 Nm). The oil feed stud, No. 1, should be tightened firmly with a suitable ⅜" Whitworth open end spanner. This stud is milled and drilled for the oil feed to the rocker gear, this stud is not threaded into the crankcase as deep as all other studs. The lower final setting has been found to be suitable.

To Continue . . .

Smear the tappets with oil and refit into the crankcase. Fit the push rods and rocker shafts. Set the push rod adjustment so that with the engine cold there is a clearance of 0·002 in. (0·0508 mm) between the inlet valves and the rocker faces and 0·006 in. (0·1524 mm) between the exhaust valves and the rocker faces. It is necessary to rotate the engine to T.D.C. at the firing point for each cylinder when setting the push rods for that cylinder. Clean or replace the crankcase air vent filter felts and refit the tappet cover. Run the engine until the thermometer registers a temperature of approximately 75 °C., check the flow of oil from the rocker shaft assembly which should be approximately 60 drops per minute, then re-tighten the cylinder head nuts. Finally refit the rocker covers and check for possible oil leaks.

Update Note

The procedure for re-tightening the cylinder head nuts has been improved. Run the engine till it reaches its normal running temperature, approximately 75 °C. Stop the engine and leave for twenty minutes to allow the heat to stabilise. Then, with the torque wrench set at 37 lb. ft. (50·7 Nm), test the nuts in the correct sequence as shown above.

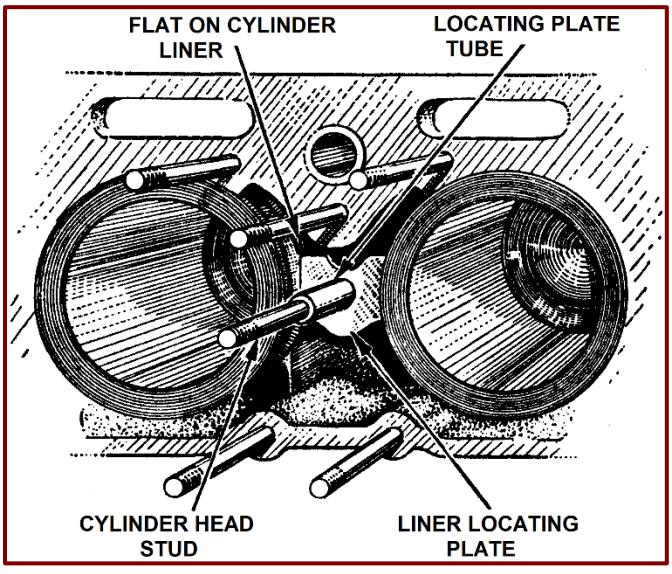


Figure 23. Cylinder Liner Locating Plate in Position.

DECARBONISING AND VALVE GRINDING

Valve springs are held in position by split cones and collars which can be removed once the springs are compressed.

Decarbonising and valve grinding now follows the normal procedure, with the usual precautions to prevent entry of carbon into the water passages, and into the oil drain holes at the lower corners of the heads.

Should the reseating of the valve seats be necessary the angles of 30° Inlet and 45° Exhaust, must be maintained.

If replacement valve guides are to be fitted the worn guides should be pressed out of the head, and the replacements pressed into position with $^{11}/_{16}$" (0·687" or 17.5 mm) protruding from the outer face of the head. If there is any excessive wear on the rocker assembly the worn part should be replaced.

After decarbonising remove and clean sump, allow to dry in air, clean sump oil filter if necessary. No cloth should be used for cleaning.

To Dismantle Rocker Shaft Assembly

Remove the circlips, washers and short springs, and slide the exhaust rockers, pedestal, inlet rocker, and long spring from each end of the shaft if necessary.

The bronze bushed rockers should slide freely on the rocker shaft without play. When pressing in replacement bushes, position these so that the oil hole in the bush is accurately aligned with the drilling in the rocker through which oil is fed to the push rod cup.

To Re-Assemble Rocker Shaft Assembly

Press the oil pipe on to the shaft, positioned so that the oil-way in the pipe union aligns accurately with the inlet oil holes in the centre of the shaft, and so that each outlet oil hole is on the thrust side (i.e., on the cylinder head side of the assembly, the centre line of the oil hole to be at 90° to the cylinder head face).

Fit the long springs on each side of the oil pipe union and fit the inlet rockers, in that order. Fit the short springs and the steel washers, and secure at each end with circlips.

It will be noted that inlet and exhaust rockers are not interchangeable, the angle of the inlet rockers being 12° 20' from vertical, and the exhaust rockers 18°.

Rockers can be identified by the position of the push rod arm of the rocker, in relation to the centre hub. On the exhaust rocker this arm is at the inner end of the hub, while the arm on the inlet rocker is approximately central. The rockers also differ between left hand and right hand, the inclination of the rocker arms being towards the centre of the shaft in each case.

TO CHECK VALVE TIMING (Solid Tappets)

Remove left hand front road wheel, and rocker cover. Fit a suitable pointer to a convenient stud in the timing case cover, so that the point is immediately over the edge of the crankshaft pulley (*Figure 24*).

Turn the crankshaft to T.D.C. 1 and 2, and mark off the position of the pointer on the edge of the pulley. Turn the crankshaft until the marking on the pulley shows roughly 30° before T. D.C. Mount a dial indicator on the push rod arm of No. 1 cylinder inlet rocker (left hand), place a

screwdriver or similar wedge tool between the rocker and the valve so that all free play in the valve train is taken up. (Refer to *Figure 25*)

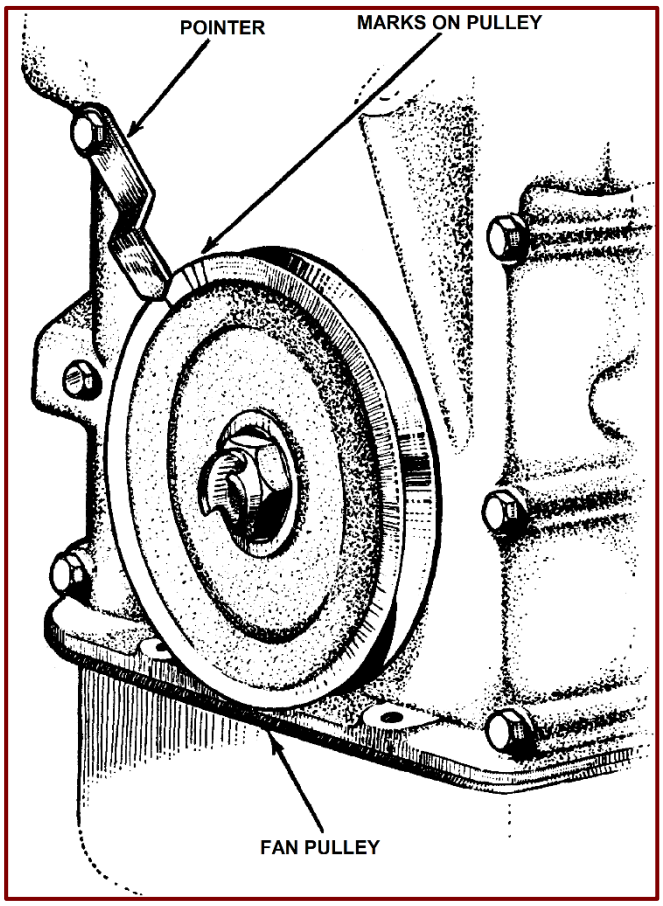


Figure 24. Valve Timing, Pulley Markings.

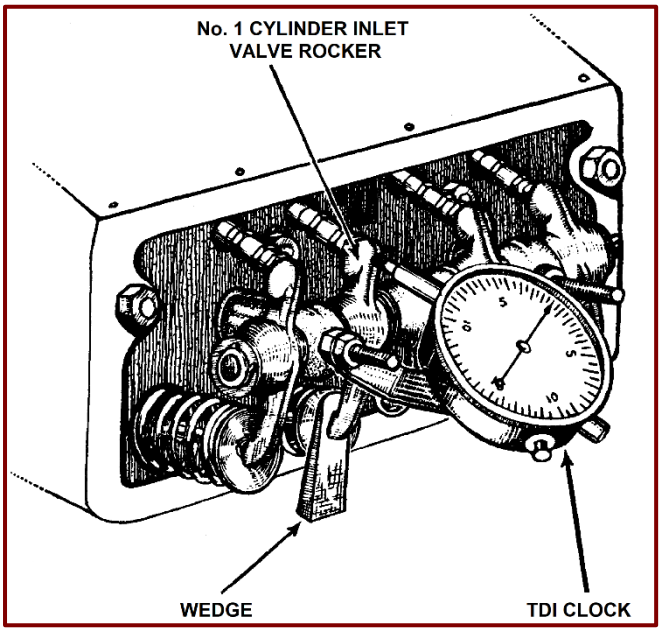


Figure 25. Valve Timing, Indicator Clock in Position.

Now turn the crankshaft steadily until the valve begins to lift, as shown by movement on the dial indicator and stop turning when the indicator shows 0·014" (0·356 mm) lift. Now measure the distance round the periphery of the pulley from the pointer to the T.D.C. mark on the pulley. If valve timing is correctly set at 12° before T.D.C. this dimension will be ½" (12.7 mm), but up to ⅛" (3.175 mm) tolerance, either late or early can be allowed. This tolerance represents a maximum variation in valve timing of plus or minus 3°.

PISTONS AND CONNECTING RODS

DESCRIPTION

Pistons are aluminium alloy diecast, with one 'Vacrom', one compression, and one scraper ring, all fitted above the gudgeon pin.

The big end bearings are steel-backed copper-lead liners. Bronze bushes are fitted to the small ends.

To Remove Piston And Connecting Rod

Remove the sump and cylinder heads (see Cylinder Head section).

Detach the bearing cap, then remove the piston and rod through the bore; care should be taken not to damage the cylinder bore. If a big end bearing replacement only is to be carried out, only the sump need be removed, as bearings can be replaced with piston *in situ*.

Gudgeon Pin And Little End Bearing

The gudgeon pin should be a push fit in the piston and a sliding fit in the little end bearing. It is located by circlips in the piston.

The little end bearing must have an internal diameter of 0·8125" to 0·8130" (20·638–20·65 mm.); if this measurement is exceeded by 0·003" to 0·004" (0·0761–0·102 mm), the bearing should be pressed out and replaced. The oil hole should be drilled with the bearing in position.

CONNECTING ROD AND BIG END BEARING

Connecting rods and caps are normally supplied in sets, each set balanced axially and by weight. Single rods should only be fitted in an emergency and should this be necessary the new rod should be balanced with the existing rods, both axially and by dead weight, within limits of 1.5 grammes, adjustment being made by removing metal from web of the connecting rod cap or from the outer surface of the small end.

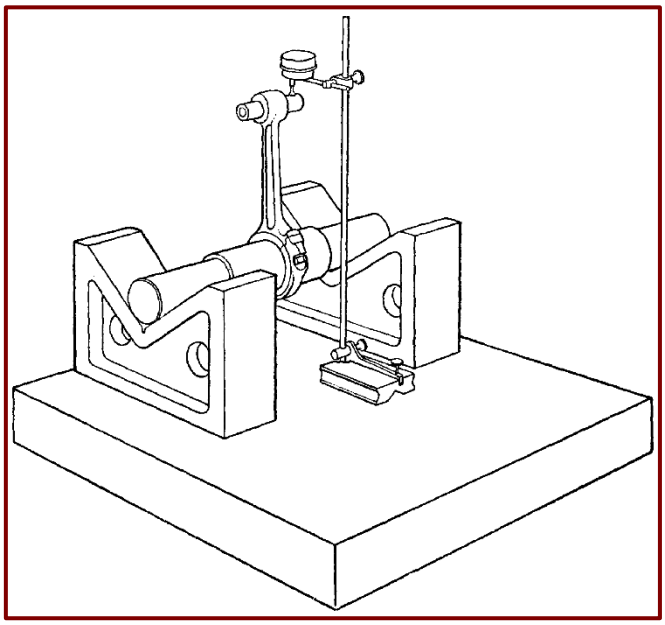


Figure 26. Connecting Rod Alignment.

If the connecting rod part number is suffixed by the letter 'O' it indicates that the rod is a nominal 0·025" (0·635 mm) oversize in width to compensate for the amount of metal removed from the crankpin side faces (see Crankshaft Section). These rods are also marked with red enamel. Connecting rod caps are marked for fitting to the rods, and must be fitted so that the markings correspond.

Before fitting the piston to the rod it is essential that the rod is very carefully checked for alignment and twist. In the absence of special connecting rod alignment equipment, the following method of making this check will be found satisfactory (Figure 26, Page 21).

A surface plate, 'V' blocks, a clock indicator, a mandrel which is a good fit on the big end, and a snug fitting pin, are required. Fit the gudgeon pin and the mandrel to the rod, place the mandrel into the 'V' blocks on the surface plate, and set the rod vertically. Mount the dial indicator on the scribing block and take readings on either side of the small end. The readings taken on the end of the gudgeon pin must be within limits of 0·001" (0·025 mm).

To check the rod for twist, lower it on its V block to the horizontal position, and take further readings. No twist is permitted, and if any variation is found this should be corrected by setting the rod.

When renewing the big end bearings make sure that the correct size is fitted. For under-size bearings the Part Number is suffixed by a /10, /20, /30, or /40, denoting the number of 0·001" the bearing is under size.

From Engine No. E1/PC/174O2 to Engine No. E2/PD/20977 a sludge release hole will be found in the bearing cap. After engine No. E2/PD/20977 the hole is replaced by a sludge cavity. The hole in the bearing shelf should coincide with the sludge cavity or hole. The plain half bearing shell being fitted to the rod. No scraping of big end bearing shells is permissible.

PISTON AND RINGS

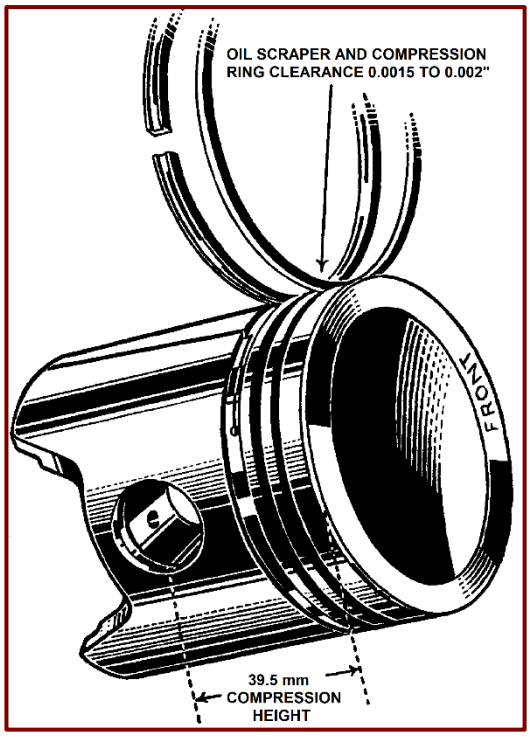


Figure 27. Piston.

When renewing pistons make sure that the correct size is fitted. For over-size pistons the part number is suffixed by /10, /20, or /30. The piston is also marked with an 'A' or 'B'. A piston stamped 'A' must be fitted to a liner stamped 'A' and likewise for pistons stamped with a 'B'.

The piston rings should be free in the grooves. The Vacrom ring is fitted to the top groove, the stepped ring to the second groove, step uppermost. The oil scraper ring is fitted to the third. The ring gap is 0·007"–0·015" (0·178–0·381 mm) and the side clearance 0·0015"–0·002" (0·038–0·051 mm).

Connecting rods must be fitted to pistons so that when assembled in the engine the connecting rod caps will fit on the underside of the journals and the 'FRONT' marking on the pistons is to front of the engine.

To Replace Piston and Connecting Rod

Reverse the procedure given for removal. Note that the connecting rod bolts must be tightened using a torque wrench set at 35 lb. ft. (47·4 Nm).

CYLINDER BLOCK

DESCRIPTION

The combined crankcase and cylinder block consists of two aluminium alloy castings, bolted together. Each casting housing two Vacrit 'wet' type cylinder liners.

To Remove The Cylinder Liners

Remove cylinder heads, pistons and connecting rods as detailed in the appropriate sections. Draw out the cylinder liners together with the locating plate after first removing the cylinder head centre head support tube.

If at any time one liner only is removed the stud should be withdrawn from the crankcase so that the locating plate can be removed and refitted.

On Models after Engine No. E1/PC/17900 a distance washer will be found under the cylinder liner locating plate.

Cylinder Liner Boring

Cylinder liners should be rebored and honed, mirror finish, to the following oversizes, as necessary:–

First +	0·010"	0·254 mm
Second +	0·020"	0·508 mm
Third +	0·030"	0·762 mm

Replacement liners, complete with pistons, gudgeon pins, rings, and liner seal can be supplied. Before Engine No. E0/PB/8825 cylinder liner cannot be rebored and a replacement liner should be fitted.

To Refit Cylinder Liners

Fit new liner sealing washers, before fitting the liners into the cylinder block. Liners, which are a push fit into the block, should be installed so that the flats on the sealing flange register with the parallel sides of the locating plate. The two liners and the locating plate must be fed in together after fitting the distance washer to the stud on later types, as the plate will not pass the top flanges on the liners once they are in position in the block.

It is most important that with the liner hard home, the outer flange stands 0·008–0·012" (0·203–0·304 mm)

proud of the cylinder block faces, so that the liners are held in position by the cylinder heads. Should it be found that liner does not stand proud of the block face, copper packing shims should be fitted between the sealing flange on the liner and the sealing washer, to the required 0·008–0·012" (0·203–0·304 mm) stand out.

On engines after No. E1/PC/17900 the cylinder head centre support should be level with the liner outer flange, that is 0·008–0·012" (0·203–0·304 mm) proud of the block face. If this dimension is incorrect adjustment may be made by fitting brass shim washers under the support tube or by filing the distance washer under the locating plate.

Please refer to Update Notes on Pages 19 and 20.

CRANKSHAFT AND MAIN BEARINGS

DESCRIPTION

The crankshaft has three main bearings. Internal galleries connect the crankpins to the main journals for lubrication purposes. The flywheel is secured to the rear of the crankshaft by setscrews and is located by a dowel, a starter ring gear is shrunk on to the flywheel.

To Remove The Crankshaft

Remove the engine from the car (see Engine Removal section) then remove the gearbox and starter.

1. Drain off engine oil from the oil filter and the sump.
2. Take off the clutch shaft cover.

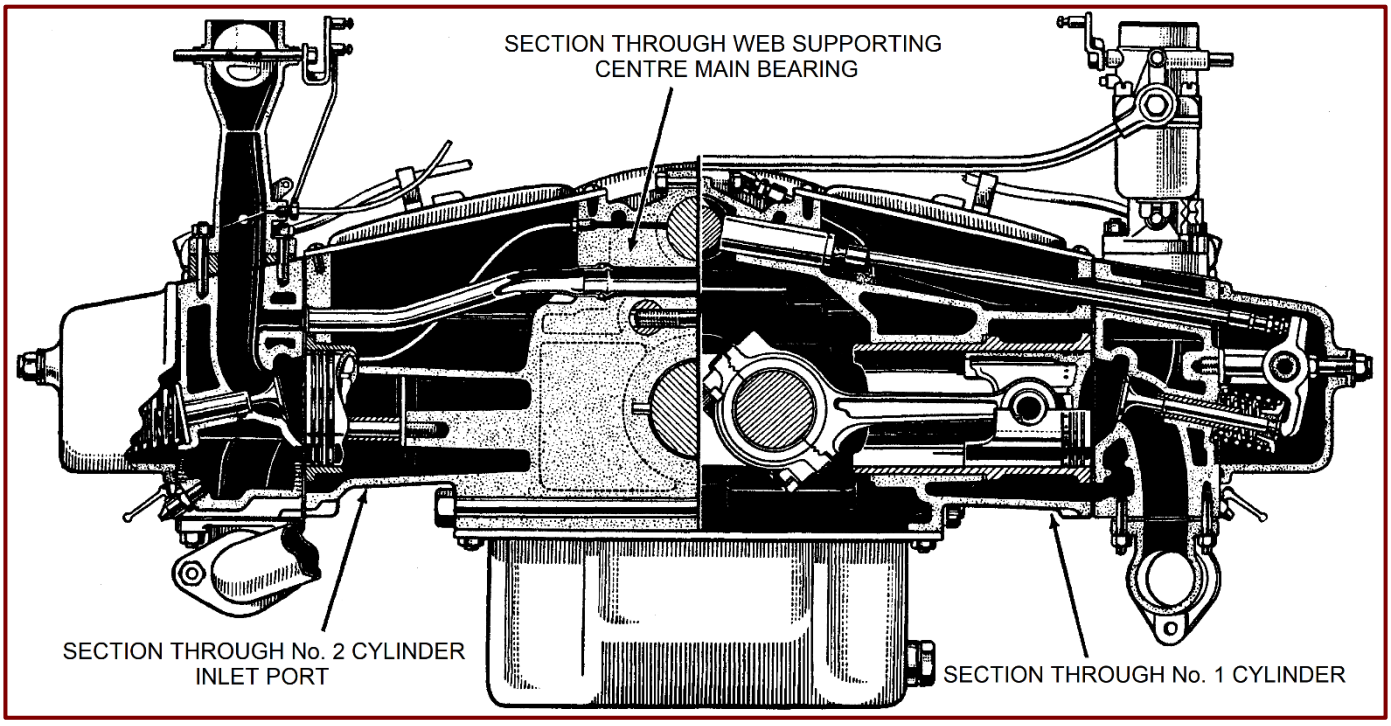


Figure 28. Cross Section of Engine.

3. Remove the dynamo, and the accessory drive belt.
4. Remove the water pump and fan assembly.
5. Disconnect and remove distributor leads.
6. Disconnect the suction control assembly at the carburettor.
7. Release the nut securing the distributor locking plate and lift the distributor with the suction control and drive shaft clear of the engine.
8. Disconnect and remove the pipeline from the petrol pump to the carburettors and the throttle rods.
9. Take off the carburettors and the petrol pump.
10. Remove the oil filter.
11. Disconnect the breather pipe at the breather valve and at the union over the crankcase, and remove the breather valve.
12. Remove the tappet covers and the rocker covers.
13. Remove the water transfers.
14. Take off the rocker shaft assemblies complete, draw out push rods and tappets.
15. Remove the cylinder heads.
16. Remove the starting handle dog and crankshaft pulley.
17. Release the four setscrews and the nut securing the timing case cover, and the two setscrews securing the rear cover to the crankcase. Pull the rear cover clear.
18. Release the setscrews from the sump to the timing case cover, and the setscrews securing the timing case cover to the crankcase. Remove the cover.
19. Withdraw the camshaft thrust plunger and spring from the camshaft, and the petrol pump push rod from the timing case cover.
20. Release the two setscrews securing the camshaft sprocket to the shaft and remove the sprocket, together with the chain pinion and the chain.
21. Withdraw the camshaft from the crankcase.
22. Pull the oil pump drive gear from the crankshaft and remove the crankshaft key.
23. Disconnect the oil delivery pipe at the elbow union on the crankcase.

Turn Unit Over on Stand (If In Use)

24. Draw back the lever ball pivot, and remove the clutch operating lever and the throw-out bearing.
25. Release the setscrews securing the clutch cover and pressure plate assembly to the flywheel, and remove the assembly through the base of the housing.
26. Remove the friction plate.
27. Release the setscrews securing the flywheel to the crankshaft and remove the flywheel.
28. Drop the sump and the sump tray assembly.
29. Remove the clutch housing.
30. Take off the oil pump assembly, with the oil delivery pipe.
31. Disconnect the connecting rod caps, remove the connecting rods and pistons through the cylinder bores, taking special care to ensure that the connecting rods do not damage the liner bores, and refit the caps.
32. Release the cylinder block bolts and tie bolts, and the five bolts along the top of the crankcase, thus dividing the two cylinder block sections.
33. Remove the crankshaft, the main bearing shells, and the balance pipe centre tube, with seals.

CRANKSHAFT REGRINDING

Check the crankpin and journal diameters. If there is more than 0·002" ovality or taper the crankshaft should be replaced by a factory reconditioned shaft, or the journals and crankpins ground to the following dimensions.

Main Journals*

	Inches	Millimetres
First Regrind	2·245–2·244	57·020–56·990
Second Regrind	2·240–2·239	56·895–56·870
Third Regrind	2·230–2·229	56·640–56·270

Big End Journals*

	Inches	Millimetres
First Regrind	1·990–1·989	50·550–50·520
Second Regrind	1·980–1·979	50·290–50·270

* If the Engine Number is prefixed 'PE' Refer to Page 32.

The rear main bearing journals will increase in width in comparison with the undersize as follows:

Standard and 0·005" (0·127 mm) Undersize – No increase in journal width.

0·010" (0·254 mm) Undersize – 0·005" (0·127 mm) Increase in width.

0·020" (0·508 mm) Undersize – 0·010" (0·254 mm) Increase in width.

If it is necessary to grind the side faces of the crankpins, the width should be increased by a nominal 0·025" (0·635 mm); this will involve the fitting of oversize connecting rods (see Piston and Connecting Rod section).

If the rear oil seal has cut a track in the surface of the flywheel spigot, this should be ground down 0·010" (0·254 mm) on the standard diameter, 3·000"-2·999" (76·20–76·175 mm). It is of course vitally important that this diameter is accurately concentric with the main bearings and with the hole for the spigot bearing. After regrind support the crankshaft on its front and rear main journals and check the relating eccentricity of the centre main journal; this should not be more than 0·0015" (0·0381 mm) total clock reading.

Extremely Important! The portion of the rear spigot where the flywheel is seated, must not be ground at all. Also, at this location, there must be no burrs.

The identification of factory reconditioned shafts is as follows:

The part number is located on the web behind number one crankpin, and is prefixed by a letter 'R'. The first suffix number gives the crankpin undersize, the next suffix, the undersize on front and centre journals, the appending of a letter 'O' denotes an increase in crankpin width. In the case of the rear journal, refer to the rear crank web; on this is stamped the part number, with the first suffix number giving the undersize and the second giving the increase in width.

MAIN BEARINGS

The bearing part numbers are suffixed by the oversize. On the rear main bearing a second suffix number gives the increase in bearing width.

It is not permissible to scrape the main bearings.

To Replace The Crankshaft

Dowels are used to secure the front and centre main bearings into both cylinder blocks, on the rear main bearing, only the right hand block is dowelled; make sure that these locating dowels do not protrude into the annular oil groves in the bearings.

Before assembling the two sections, fit the internal balance pipe together with rubber seals, into position in the left hand section, and also fit the two centre tie bolts into the left hand section. Place the left hand section, with the cylinder head face downward on a clean bench, with the lower of the two bolts protruding. Make sure that the crankcase locating dowels are in position.

Update Note

It is well worthwhile to use a softwood bench surface with 10 mm diameter holes drilled through an old cylinder head gasket, for the cylinder head studs to pass through. This makes tightening of the tie bolts easier.

To Continue . . .

Check that the oilways in the crankcases are accurately aligned with the oil drillings in the bearings, and fit the crankshaft.

Apply a (very) light smear of gasket cement (Loctite Master Gasket 515) to the upper edge of the cylinder block faces, where the blocks are held together with five ¼" B.S.F. bolts.

Fit the two halves together, making sure that the internal balance pipe fits snugly into both sections, that the rubber seals are not distorted, and that the sections locate on the dowels. Bolt up the two centre tie bolts, and the five bolts along the top of the cylinder blocks.

Tighten the tie bolts until a Torque wrench reading 75 lb.ft. (101·7 Nm) is obtained.

Apply the Balance pipe test, see lubrication and ventilation section, on Page 30.

Then reassemble engine as reversal of the instructions given under 'To Remove Crankshaft'.

FLYWHEEL

The flywheel dowel, the chamfered end of which is fitted into the crank, should be an interference fit in the crankshaft drilling, and a good fit in the flywheel.

The crankshaft spigot should be clean and free from burrs, and should fit snugly into the recess in the flywheel. Particular attention should be given to the rear face of the crankshaft and to the face of the recess in the flywheel, the depth of which should be ⅛" (3 mm). These faces must not be damaged in any way and action must be taken to rectify any injury before finally fitting the flywheel. The setscrews must be tightened down evenly over new shake-proof washers by diagonal selection, using a Torque wrench loaded to 60 lb. ft. (81·4 Nm).

The maximum permissible run out for the flywheel rear face is 0·003" (0·076 mm), this may be checked using a dial indicator mounted on the clutch housing. Should the limit be exceeded it is probable that dirt or burrs are preventing the even seating of the flywheel on the crank spigot.

Service ring gears, specially heat treated, and ready for shrinking on the flywheel, can be supplied.

To remove the existing gear, split with a cold chisel, taking care to avoid damage to the machined face of the flywheel. Heat the replacement evenly to a temperature

of 260–320 °C' (colour changing from deep straw to purple) and maintain this temperature for two minutes. Drop the gear into position on the flywheel, with the chamfered side of the teeth downward, tapping with a copper hammer if necessary, and allow to cool in air.

Note: It is most important that the flywheel ring is not heated to more than 320 °C, as the temper will be affected if this occurs.

If no temperature gauge is available, a heat sensitive pencil, for the correct temperature range should be used; this can be supplied with the ring.

CAMSHAFT AND TIMING GEAR

DESCRIPTION

The camshaft is located in the crankcase and runs directly on bearing surfaces formed in the casting. It is driven by the crankshaft through a timing chain and chain wheels (*Figure 30*).

To Remove The Camshaft

Carry out items 3, 4, 7,11, 12, t4, 16, 18, 19, 20 and 21, given under 'To Remove The Crankshaft' in the Crankshaft and Main Bearings section, with the engine in the car.

CAMSHAFT

Check the camshaft for wear. If this exceeds more than 0·002–0·003" (0·051–0·076 mm) on the journals or the cams, the camshaft should be renewed.

TIMING CHAIN AND CHAIN WHEELS

If the timing chain showed any excessive slackness when in position it should be renewed.

The chain wheels should accommodate the chain snugly and without excessive side play; should excessive side play be evident the chain wheel should be renewed.

To Replace Camshaft

Replacement is generally a reversal of the operations noted under 'To Remove The Camshaft'. The following additional points should also receive attention.

Turn the crankshaft so that the T.D.C. 1 and 2 marking on the flywheel is approximately at T.D.C.

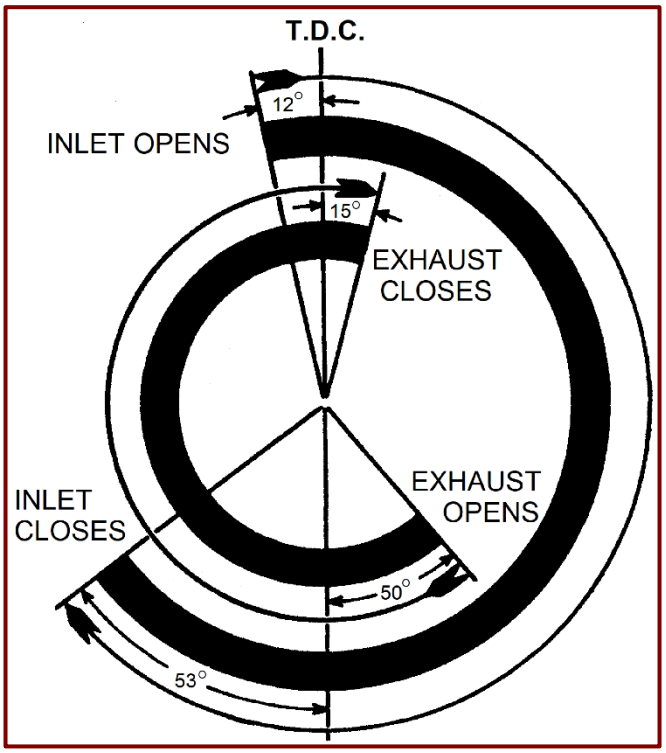


Figure 29. Valve Timing Diagram. To be used in conjunction with the instructions.

Fit the crankshaft chain pinion and the camshaft chainwheel into the timing chain so that the marked tooth on the chainwheel is directly facing the two pop marks on the pinion, and fit to the crankshaft, moving the shafts as necessary so that the pinion slides easily on to the crankshaft key, and the chainwheel locates with the dowel in the camshaft.

Then carry out the timing check described in Cylinder Head and Valve section before re-assembling further.

A modified camshaft and chainwheel which gives a finer degree of accuracy when carrying out valve timing was introduced at Engine No. E1/PD/19295.

Six offset dowel holes are incorporated in the chain wheel and in the forward boss of the camshaft which allows the chainwheel to be set in any desired position in relation to the camshaft when carrying out the valve timing operation. To assist further, a 12° mark is also stamped on the flywheel.

To carry out valve timing adjustment with this camshaft and chainwheel proceed as follows:

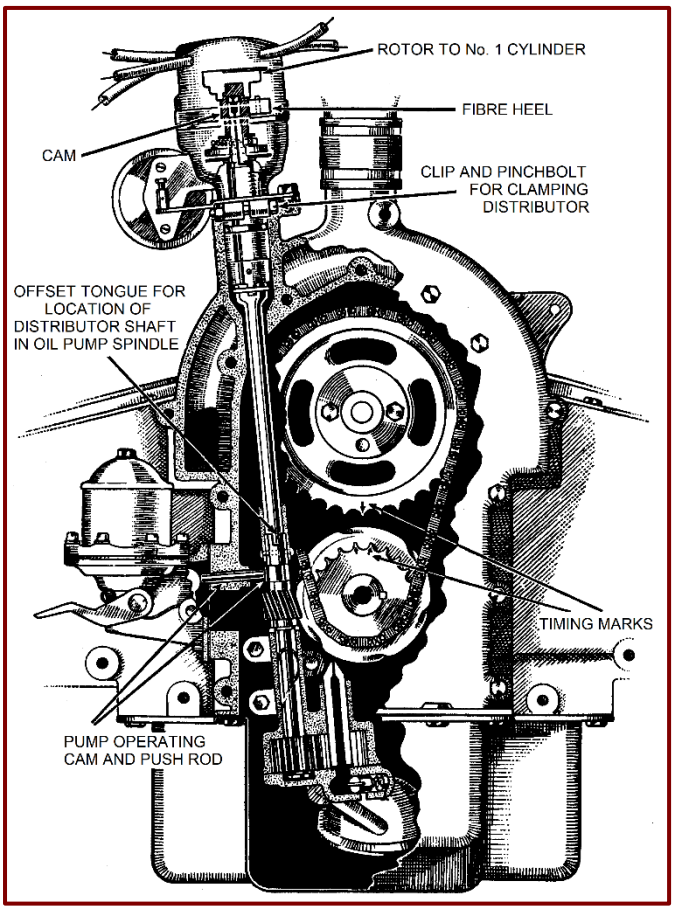


Figure 30. View through Front Cover, Showing Timing

1. Rotate the engine until No. 1 piston is at its T.D.C.
2. Turn the flywheel anti-clockwise (looking from front of the engine) until the 12° mark is in T.D.C. position opposite the centre line of crankcase.
3. Turn the camshaft until the base of the No. 1 Cylinder inlet tappet is resting on the heel of the cam.
4. Fit a dial indicator gauge with the operating rod resting lightly on the top of the tappet and turn the indicator face until a zero reading is registered.
5. Turn the camshaft clockwise until a 0·013" (0·3302 mm) lift of the tappet is registered on the dial indicator gauge.
6. Fit the chainwheels into the timing chain, and fit them to the crankshaft and camshaft ensuring that the bolt holes in the camshaft chainwheel (slightly elongated) are opposite the bolt holes in the camshaft boss.
7. Locate the chainwheel in this position by examining the relative positions of the dowel holes in the chainwheel and the dowel holes in the camshaft boss and inserting the dowel (reduced end towards the camshaft) into the two camshaft and chainwheel dowel holes which are dead opposite each other.
8. Check the position of the 12° mark on the flywheel and the 0·013" (0·33 mm) tappet lift on the dial indicator gauge to ensure that no movement has taken place and with the setting correct, fit the chainwheel bolt locking plate and securing bolts and lock the securing bolts by folding over the locking plate tabs.

LUBRICATION AND VENTILATION SYSTEM

DESCRIPTION

Oil is drawn from the sump through a wire mesh oil strainer, by a gear type pump driven from the crankshaft (*Figure 32*, Page 27). It is then fed through a full flow oil filter to a radiator mounted oil cooler (later models only) or a competition type cooler mounted behind the radiator grille on some earlier types, or direct to two oil galleries in the crankcase. The left hand oil gallery feeds the centre and rear main bearings and the left hand rocker gear. The right hand gallery feeds the front main bearing, camshaft bearings and right hand rocker gear. Internal galleries in the crankshaft carry oil from the main bearings to the big end bearings. Little end bearings are lubricated by splash feed. The timing chain, distributor and oil pump drive are lubricated by oil sprays. A non-adjustable relief valve is located in the oil pump.

The crankcase breathes in through a vent (*Figure 36*, Page 28) on each tappet cover, and out through a pipe and vent valve at the oil filler neck, which connects up to the manifold balance pipe.

REMOVAL AND REPLACEMENT OF OIL PUMP

Remove the distributor, petrol pump, sump and timing case front cover. Then remove the three setscrews and oil pump.

Replacement is a reversal of the. above mentioned operations. It should. be remembered when re-assembling that the slot in the oil pump drive spindle is offset, refer to (*Figure 31*).

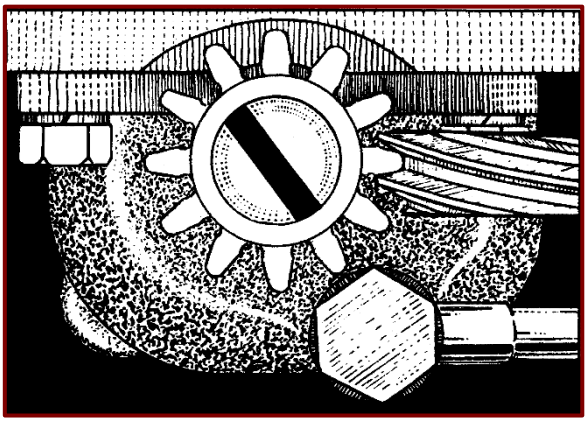


Figure 31. Oil Pump Offset Keyway.

TO DISMANTLE AND RE-ASSEMBLE OIL PUMP

Remove pump cover and filter assembly. Disconnect delivery pipe at union. Allow the gear to drop from the idler spindle.

Remove the drive spindle circlip, and, using a soft drift through the oil delivery hole, gently tap the drive gear off the spindle.

Remove the Woodruff key and draw the drive spindle out of the body.

Drift out the idler spindle, taking care not to damage the jet.

To dismantle the release valve, withdraw the split pin at the rear of the valve, and remove the retainer, spring and piston.

Reverse the operations detailed above, fitting the gears with the chamfered end of the bores at the lower end of the spindles.

It is recommended that before refitting the cover and filter (gauze strainer) assembly, compressed air is blown through the oil intake to ensure that any dirt which may be lodged in the filter is removed.

It should be noted that no release valve adjustment is provided, but the spring should be checked against the following test data:

Before E1/PC/15098	**After E1/PC/15096**
Free Length 2” (50·8 mm)	1¾” (44·4 mm)
Load at 1·1875” (30·1625 mm) length:	
9 lbs. (4.086 kg.)	10 lbs. (4.54 kg.)
Rate: 11·08 lbs. per inch (1·978 kg. per cm)	19.78 lbs. per inch (3·2 kg. per cm)

TO CHECK THE OIL PRESSURE

On standard models up to E1/PD/19064 an oil pressure warning light operates when the pressure drops below 8 lbs. per square inch (0·56 kg. per sq. cm). In order to check the pressure on this model, an oil pressure clock should be tapped into the system at the oil filter drain setscrew, using an adaptor as illustrated Figure 33, Page 28.

On De Luxe models and standard models after E1/PD/19064 an oil pressure gauge is included in the instrument panel; should the accuracy of this instrument be doubted at any time the above described test should be carried out. The correct maximum pressures are – from Engine No. E1/PC/15098, 60-70 lbs. per square inch (4·2–4·9 kg. sq. cm); before No. E1/PC/15098, 50–60 lbs. per square inch (3·5–4·2 kg. per sq. cm).

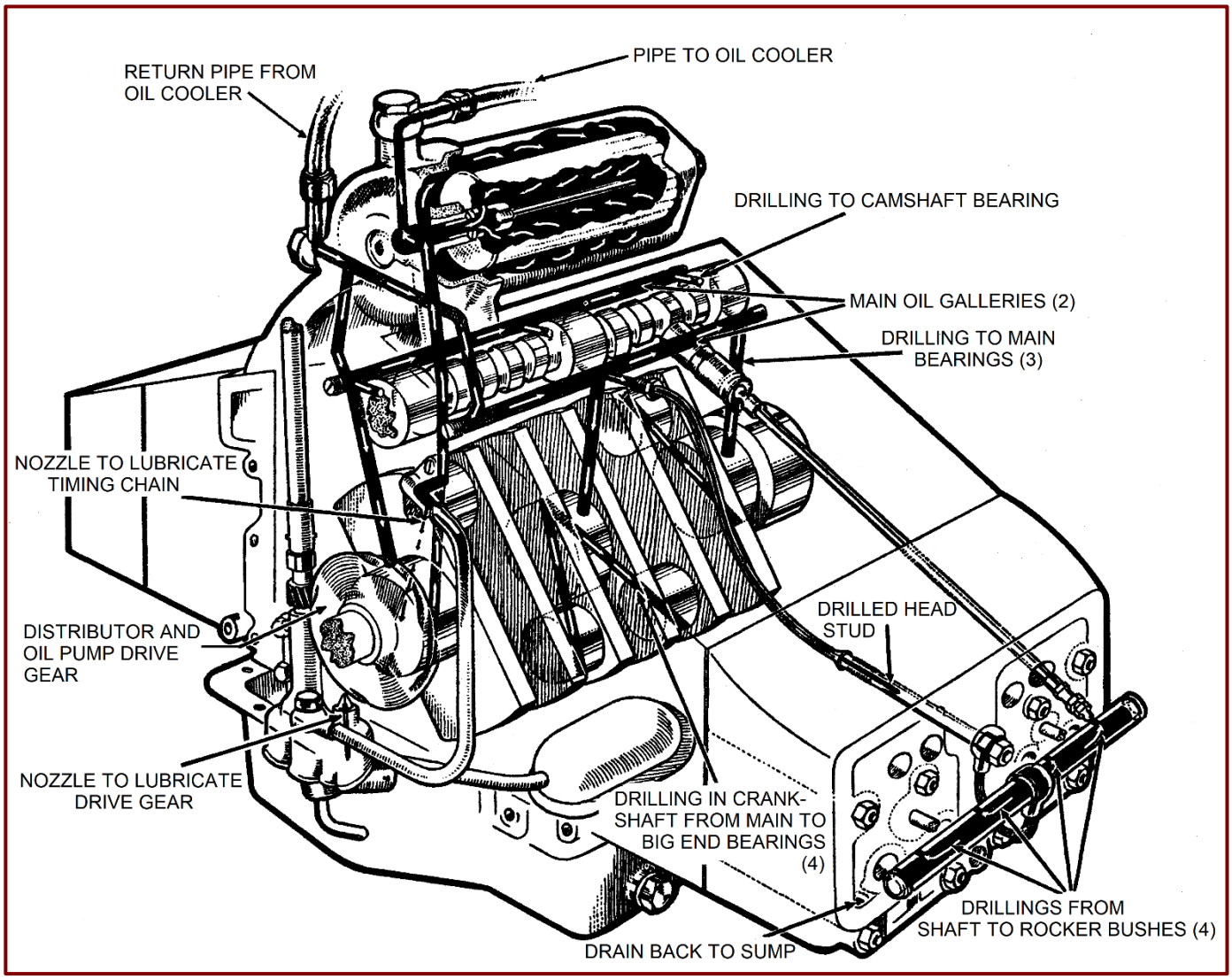


Figure 32. Engine Lubrication System.

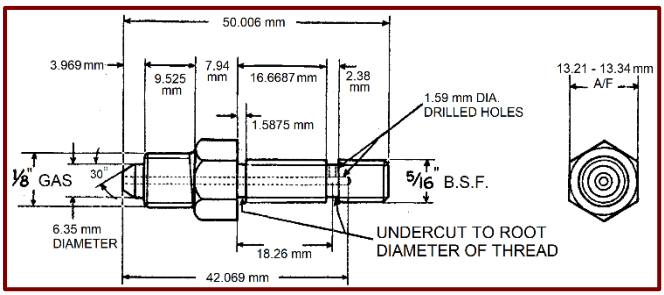


Figure 33. Oil Pressure Test Adaptor.

Metric Conversions For Figure 33

Metric	Inch – Fract.	Inch – Dec.
1.5875 mm	1/16"	0·0625"
2·38 mm	3/32"	0·09375"
3·969 mm	5/32"	0·15625"
6.35 mm	¼"	0·250"
7·94 mm	5/16"	0·3125"
9·525 mm	⅜"	0.375"
13·21 mm	5/16" *	0·520"
13·34 mm	5/16" *	0·525"
16·6687 mm	21/32"	0·656"
18·2562 mm	23/32"	0·719"
42·0688 mm	1 21/32"	1·656"
50·0063 mm	1 31/32"	1·969"

* 5/16" Whitworth Spanner Size

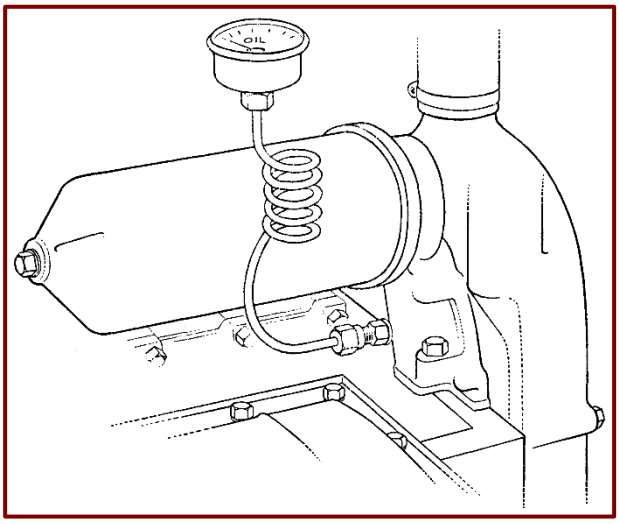


Figure 34. Oil Pressure Test.

OIL FILTERS

From Engine No. E1/PC/16603 the Vokes type oil filter is superseded by a Tecalemit filter; this type incorporates a valve in the timing case rear cover which enables the filter to be by-passed should the element become choked. The Vokes filter element is by-passed by the element lifting due to excess oil pressure.

Replacing Oil Filter Element

First unscrew the drain plug (A, *Figure 35*) until about ¼" (6.3 mm) of thread is showing which will allow oil in the filter to drain back into the sump. Remove the filter body and element by unscrewing the central bolt – this cannot be removed but is lifted away with filter element and body, (open end highest) slightly to prevent any oil remaining inside from spilling on to the top of the engine. Clean the filter body thoroughly in petrol and allow to dry.

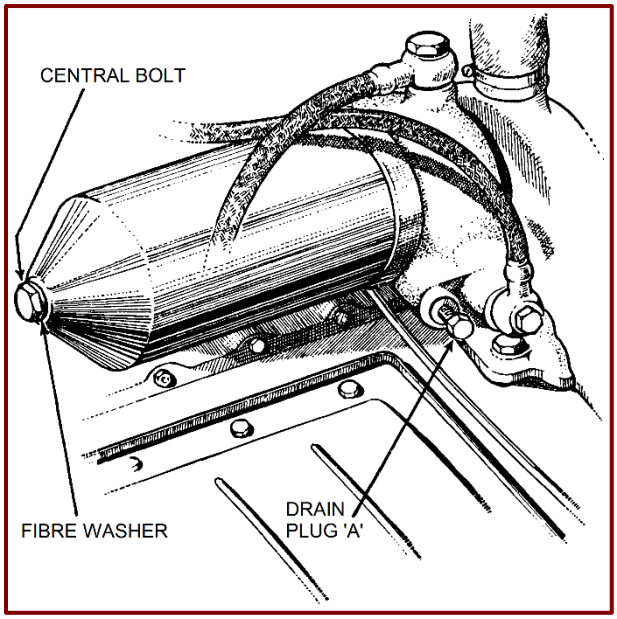


Figure 35. Oil Filter (Tecalemit).

The filter element on both types should be replaced every 5,000 miles. The cleaning of filter elements is not recommended.

Before replacing the filter element soak thoroughly in oil. When replacing the filter, make sure that the rubber sealing ring for the body is in good condition, (replace if necessary), and that the body seats squarely upon it, before screwing home the central bolt tightly.

Finally screw home the drain plug 'A'.

CLEANING AIR VENT FILTER

An air vent filter is fitted in the top of each tappet cover. It is essential that these are kept in a clean condition as any blockage by dust, etc. will interrupt the induction of air to the crankcases and consequently affect the operation of the petrol pump.

Remove the felts and clean or replace every 5,000 miles or more frequently if necessary.

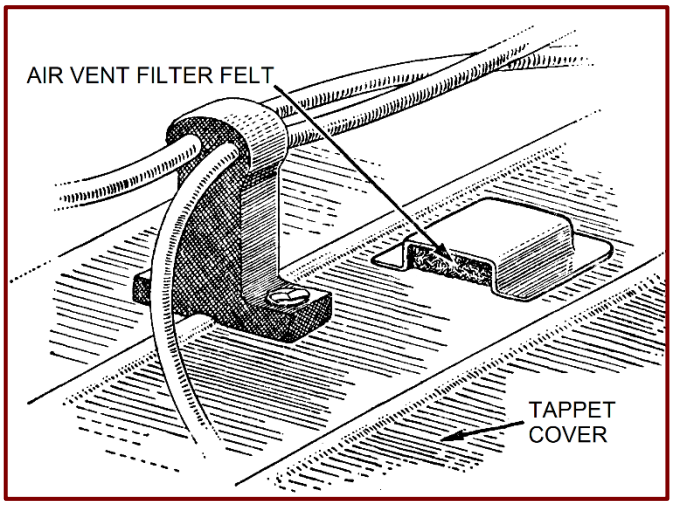


Figure 36. Crankcase Air Vent Filter.

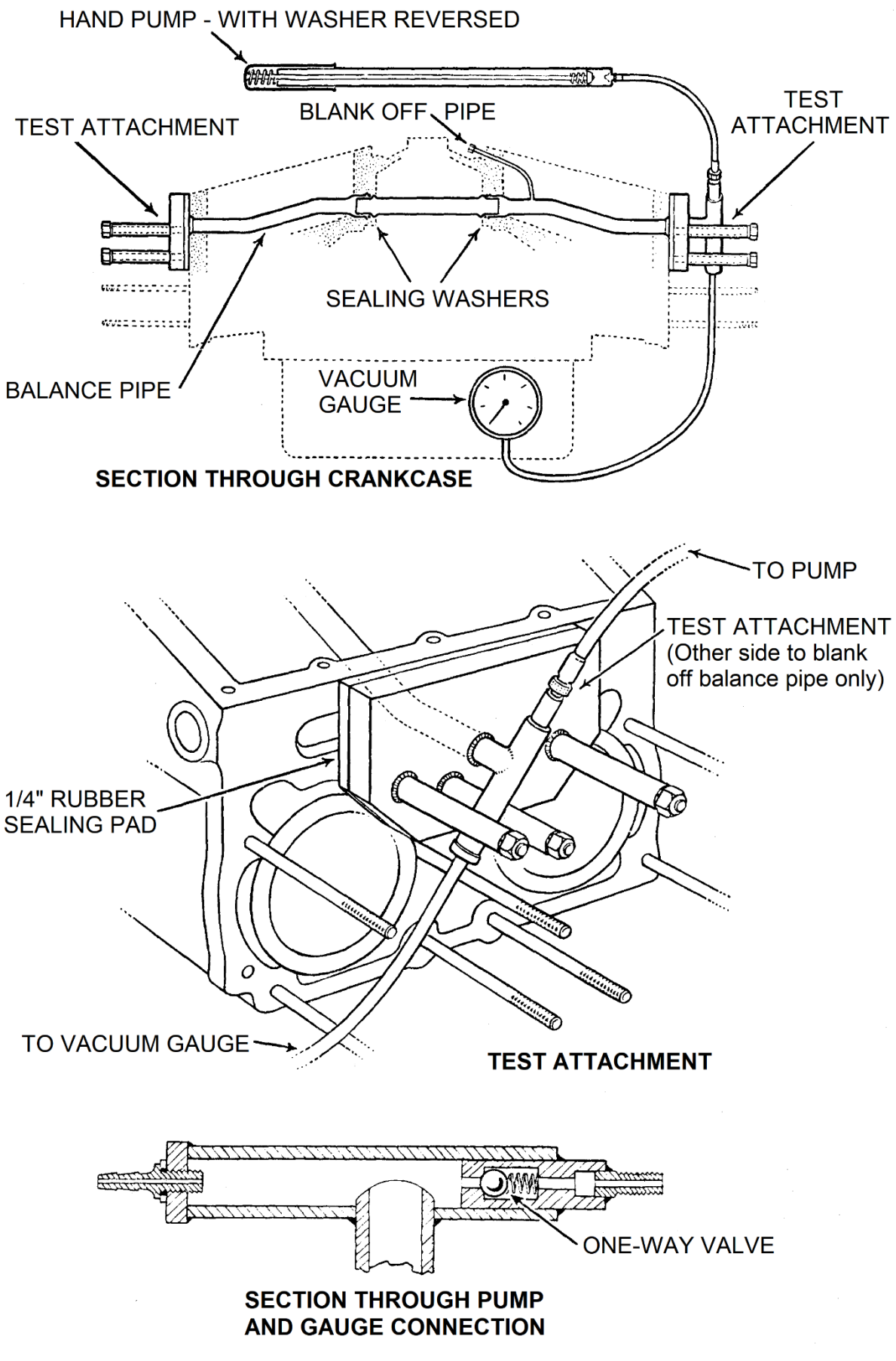


Figure 37. Testing Balance Pipe Seals.

BALANCE PIPE SEAL TEST

This seal is made by the two rubber rings fitted against collars at each end of the internal balance pipe, between the balance pipes in each of the cylinder block sections, and also by the mating of the outer ends of the balance pipes against the cylinder head gaskets. It is essential that the peened over ends of the balance pipes are slightly proud of the cylinder block faces, and that the surface presented by the peening is absolutely flat and even.

As failure of the balance pipe seal will lead to heavy oil consumption, resulting from suction through the balance pipe into the induction ports. A suggested method of testing the seals is illustrated *Figure 37*, Page 29. The seals should hold 20 in. (50.8 cm) mercury for 10 minutes

BREATHER VALVE

This valve should be opened all the time, when the engine is running. This can be checked by removing the filler cap and feeling if the pintle is lifting at the point where the breather pipe enters the filler neck, or a more accurate check of the system may be made by soldering a manometer tube to a filler cap and taking a reading; this should be 12" (30.48 cm) of a proprietary brand of upper cylinder lubricant. If the breather valve is inoperative it should be renewed.

COOLING SYSTEM

DESCRIPTION

Water is circulated by an impellor type pump, the flow and temperature being controlled by bellows type thermostat fitted in the water pump housing. The fan cooled radiator is mounted on the front scuttle assembly panel, a temperature gauge unit is located in the header tank with a lead to the dial on the instrument panel.

To Drain The Cooling System

Remove the radiator cap and open drain taps under cylinder heads (*Figure 38*), when all the water has drained away, run the engine for not more than 10 seconds. It should be noted that the above procedure will not drain a heater water radiator which may be fitted, and antifreeze must be used to protect these units against frost.

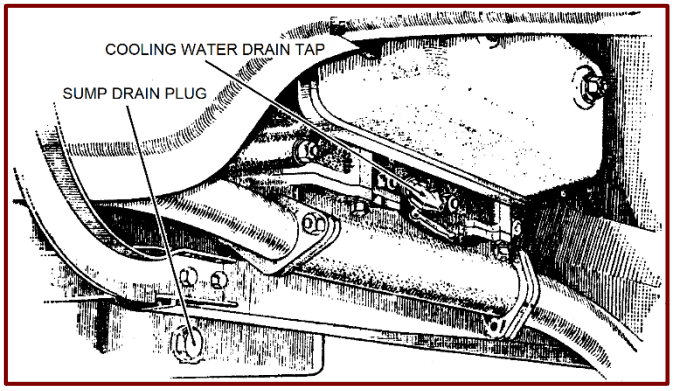


Figure 38. Drain Tap Position (one on each side).

WATER PUMP

Lubrication

The front bearing is lubricated by a grease nipple accessible through the fan pulley. The rear bearing is lubricated by an oil cup at the rear of the fan support tube. After the introduction of the radiator mounted oil cooler, the oil cup is removed. Lubrication and spill holes being provided in the centre of the fan support tube.

Dismantle Water Pump And Fan (See *Figure 39*)

Remove fan assembly by unscrewing from the spindle after releasing the locknut fitted in front of the fan.

Remove water pump pulley and key. Release the setscrews, securing the housing cover to the pump housing. Remove the outer oil seal, and pressing. Free the housing cover by gently tapping at the rear of the spindle, and draw the cover off the spindle. Remove the gasket.

Remove the circlips in front of the water pump bearing and press out the bearing Remove the front water pump seal, the circlip and the inner oil seal washer, seal, and the seal housing.

Draw the spindle and impellor assembly from the housing. The impellor, with its brass ring, which is riveted in position, can then be removed from the spindle by driving out the mills pin and drawing the impellor forward.

Remove the rear water pump seal from the housing.

Finally, if it is necessary to replace the water pump rear bearing and the fan bearing; these can be drifted out.

To remove the thermostat, release the circlip, remove the steel and rubber washers, and lift out the thermostat.

Reassemble Water Pump And Fan

Reverse the operations detailed, fitting a new gasket, and new oil and water seals if necessary. Special care

should be taken to avoid damage to water seals. If new rear and fan bearings are fitted, these should, of course, be pressed into position, using the correct diameter fitting pins.

When refitting the thermostat fit a new rubber seal washer under the steel washer.

Refit the fan so that there is 1/32" (0·79 mm) clearance between the fan locknut and the rear of the fan bearing, and make sure that the locknut is tightened back firmly against the fan hub. Any failure in this respect will allow the locknut and the fan hub to run up against the rear end of the housing extension and will result in seizure of the assembly.

On models after the Engine No. E1/PC/18140 a taper fitting on the fan hub was adopted: when fitting, ensure that the fan hub does not bind on the pump spindle housing.

Note: The Reservoil bushes as used in the water pump assembly must not in any circumstances be opened out. When fitting they should be pressed into position using the following fitting pins:

	Diameter
Up to Engine No. E1/PC/18140 –	
Water Pump Bearing	0·620" (15·75 mm)
Fan Bearing	0·500" (12·70 mm)

Continued on Page 31.

After Engine No. E1/PC/18140 –

Water Pump Bearing	0·620” (15·75 mm)	Fan Bearing	0·620” (15·75 mm)

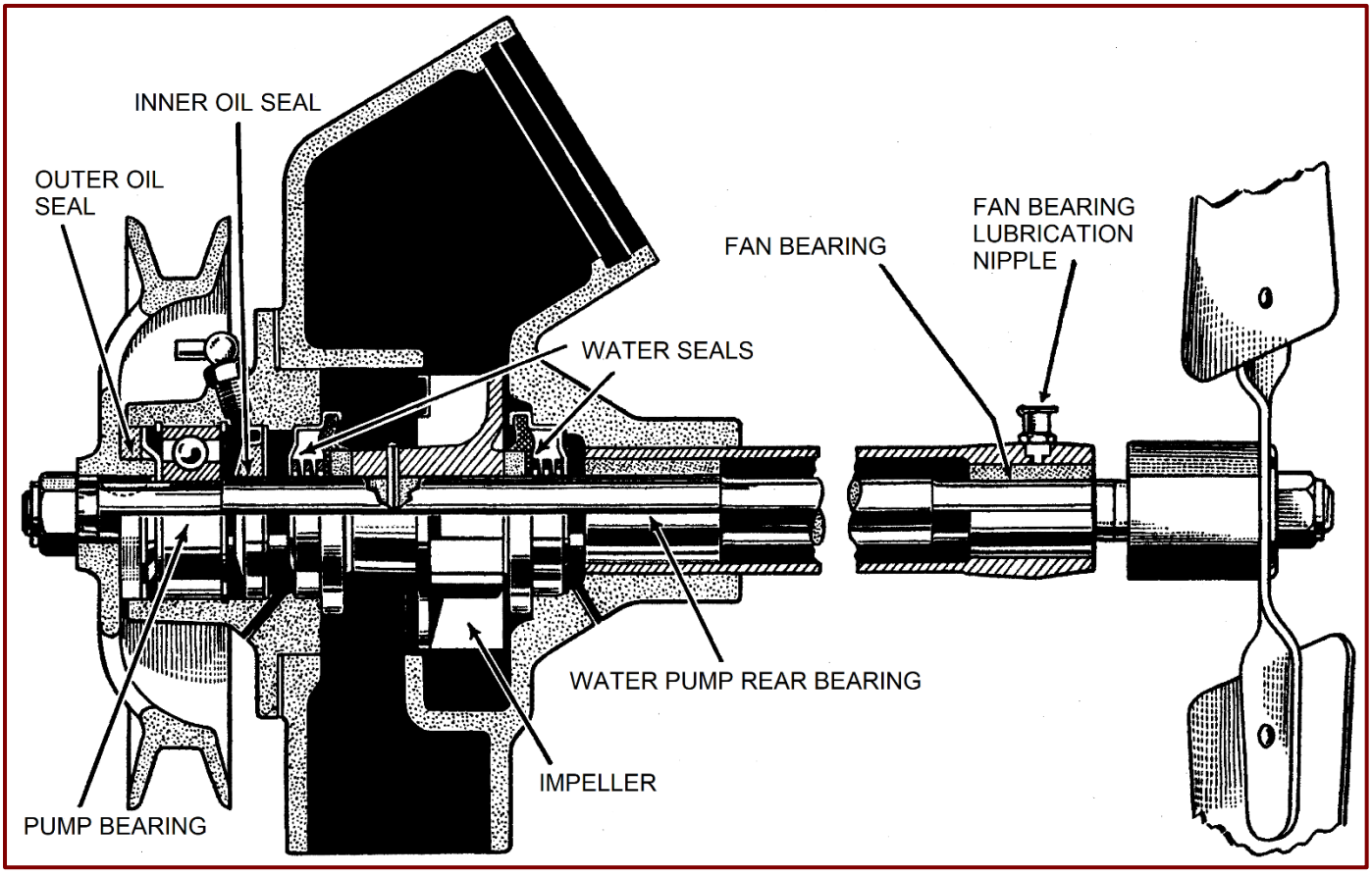


Figure 39. Section Through Water Pump and Fan Spindle Assembly.

To Remove And Replace Radiator

1. Drain cooling system.
2. Disconnect temperature gauge tube at header tank.
3. Detach top water hose at header tank and the bottom hoses at radiator.
4. Uncouple heater hose, if fitted.
5. Release choke wires at carburettors.
6. Disconnect choke cable at right hand side of choke operating rod.
7. Detach radiator mounted oil cooler, if fitted.
8. Release two mounting bolts, and lift radiator clear.

Replacement of the radiator is a reversal of the above procedure: care must be taken to set the chokes correctly – See Fuel System

Fan Belt

In order to obtain the maximum life from the fan belt it is essential that the three pulleys are in correct alignment. Should the dynamo pulley be out of alignment with the water pump and crankshaft pulleys the track can be adjusted by adding or removing washers between the dynamo and mounting bracket.

The fan belt should not be adjusted ‘over tight’, approximately ½” slack should be allowed.

HEATERS

Heaters are fitted to all De Luxe models and are located on the scuttle dash. The supply of water to the heaters is controlled by a tap fitted to the water pump body.

The normal draining of the engine cooling system will not empty the heaters. Therefore an inhibited antifreeze mixture should be used in the engine cooling system. Further information on the heater unit is given in the ‘Electrical System’ section.

NUMERICAL DATA

GENERAL

Cylinders	4
Bore and Stroke	2·85" x 3·34" (72·5 x 90 mm)
Capacity	90 cu. ins. (1,486 c.c.)
Rated H.P.	13·05
Maximum B.H.P.	53·23 Continental B.H.P. at 4,500 r.p.m.

FUEL SYSTEM

Carburettors

Jet Sizes	
Main	90
Compensator	50
Slow Running	45
Progression	110
Screw Over Capacity Well	2·6
Needle Seating Size	1·5 mm
Needle Seating Washer	1 mm thick

Fuel Pump

Delivery Pressure	1·8–2·5 pounds per sq. ins. (0·128–0·175 kg. per sq. cm.)

Fuel Tank

Capacity	8 gallons (36·2 litres)

IGNITION SYSTEM

Distributor

Rotation	Clockwise
Contact Breaker Gap	0·010"–0·012" DKY H4A type (0·254–0·305 mm) DKY H4A
	0·014"–0·016" DM2 type (0·356–0·406 mm) DM2 type

H.T. Lead Lengths (20 Strand)

No. 1	24" (61 cm)
No. 2	27" (69 cm)
No. 3	29" (74 cm)
No. 4	24" (51 cm)
To Coil	14" (35·5 cm)

Sparking Plugs

Point Setting	0·020"–0·025" (0·508–0·635 mm)
Thread Diameter	14 mm
Reach	9/16" (14·3 mm)

CYLINDER HEADS AND VALVES

Valve Seat Angle	Inlet 30°
	Exhaust 45°
Protrusion of Valve Guide above Cylinder Head Outer Face	11/16" (17·5 mm)
Valve Stem Diameter	5/16" (7·9 mm)
Valve Spring Free Length	Inner 1·935" (4·9 cm)
	Outer 2·022" (5·1 cm)
Valve Spring Loaded Length	
	Inner 1·455 (3·7 cm) with 58 lbs. (25·9 kg)
	Outer 1·468" (3·73 cm) with 71 lbs. (31·6 kg)

PISTONS AND CONNECTING RODS

Skirt Clearance	0·0015" (0·038 mm)
Compression Height	39·5 mm
Gudgeon Pin Diameter	13/16" (20·6 mm)
Ring Gap	0·007"–0·015" (0·178–0·381 mm)
Side Clearance in Groove	
	0·0015–0·002 (0·038–0·051 mm)

CYLINDER BLOCK

Protrusion of Cylinder Liner above Cylinder Block Face	0·008"–0·012" (0·203–0·304 mm)
Rebore Sizes	plus 0·010" (0·254 mm)
	plus 0·020" (0·508 mm)
	plus 0·030" (0·762 mm)

CRANKSHAFT AND MAIN BEARINGS

Crankshaft End Float	0·003"– 0·004" (0·076–0·102 mm)
Flywheel Spigot Diameter	3·000"– 2·999" (76·2–76·175 mm)

Main Journal Diameters

Standard	2·250"–2·249" (57·150–57·125 mm)
First Regrind	2·245"–2·244" (57·020–56·990 mm)
Second "	2·240"–2·239" (56·895–56·870 mm)
Third "	2·230"–2·229" (56·640–56·620 mm)

Crankpin Diameters

Standard	2·000"–1·999" (50·800–50·775 mm)
First Regrind	1·990"–1·989" (50·550–50·520 mm)
Second "	1·980"–1·979" (50·290–50·270 mm)

CAMSHAFT AND TIMING GEAR

Diameter of Camshaft Journals	1·50" (38·1 mm)
Overall Height of Cam, from Tip to Base	1·266" (31·65 mm)
Number of Links in Timing Chain	56

LUBRICATION AND VENTILATION SYSTEM

Sump Capacity	9 pints (5·13 litres)
With Oil Cooler	10 pints (5·7 litres)
Oil Pressure at 2,000 r.p.m.	
50–60 lbs. per sq. inch (3·5–4·2 kg. per sq. cm.)	Before Engine No. E1/PC/15098
60–70 lbs. per sq. inch (4·2–4·9 kg. per sq. cm.)	After Engine No. E1/PC/15098

COOLING SYSTEM

Capacity of System	2 gallons (9·1 litres)
Capacity of Heater	1 pint (0·57 litre)
Thermostat Opens	75 °C

Data Note: If the Engine No. is prefixed PE, refer to the information below.

SERIES III ENGINE

The maintenance outlined in the preceding engine chapter applies to the Series III engine. Points where design change has involved a change in maintenance or overhaul procedure are:

CRANKSHAFT

After Javelin Engine No. E2/PE/22873 and Jupiter Engine No. E2/SC/942 with the addition of the following Javelins, E2/PE/22850, 22852, 22855–22864 (inclusive) and 22866–22871 (inclusive) the tolerance on the main journals and crank pins has been revised to:

Main Journal Diameters

Standard	2·2505"– 2·2500" (57·163–57·150 mm)
First Regrind	2·2455"– 2·2450" (57·036–57·023 mm)
Second "	2·2405"–2·2400" (56·909–56·896 mm)
Third "	2·2305"–2·2300" (56·655–56·642 mm)

Crankpin Diameters

Standard	2·0000”–1·9995” (50·800–50·787 mm)
First Regrind	1·9900”–1·9895” (50·546–50·533 mm)
Second ,,	1·9800”–1·9795” (50·292–50·279 mm)

CAMSHAFT

From Javelin engine No. E2/PE/23643 and Jupiter Engine No. E2/SC/957 with the exception of the following Javelins, E2/PE/23805, 23811, 23813, 23816, 23817, 23829, 23837, 23842, and 23825, an adjustable Thrust Peg has been incorporated in the timing case cover to regulate camshaft end float.

The method of adjustment is as follows:

With the engine stopped, slacken the lock nut and screw Thrust Peg into light contact with the camshaft, then slacken back not more than one eighth of a turn and lock up.

If the components are dismantled, the face of the thrust peg and camshaft abutment face should be oiled prior to assembly.

OIL PUMP

From Javelin Engine No. E2/PE/23122 and Jupiter Engine No. E2/SC/945 a modified oil pump incorporating an adjustable relief valve has been fitted. This relief valve is pre-set at the correct pressure of 65–70 lbs. per sq. in. (4.55–4.9 kg/sq. cm) and should not be interfered with.

CYLINDER LINER BOTTOM SEAL AND GASKET SUPPORT

From Javelin Engine No. E2/PE/23184 and Jupiter Engine No. E2/SC/948 a one piece gasket support is fitted, this support does not require adjustment as described on Pages 19 and 20.

If the Cylinder liner bottom seal consists of a rubber ring and no shims are fitted, no adjustment is required on this type and the procedure for obtaining the 0·008” to 0·012” projection from the block face described on Pages 19 and 20 need not be carried out.

SPARKING PLUG COVERS

On late models the plastic plug cover is replaced by a rubber sealing ring and Lodge type plug shield. This shield can be withdrawn by merely pulling it off the plug, the rubber sealing disc can then be lifted clear. A similar method of ignition testing to that shown on Page 16, *Figure 19*, should be adopted.

CHAPTER 3

CLUTCH

CLUTCH

DESCRIPTION

The clutch assembly is a Borg and Beck single dry plate unit, with a ball bearing thrust race, operated by a fork which is pivoted in the flywheel housing, and which is connected to the clutch pedal by a single link. The flywheel and clutch are balanced as an assembly.

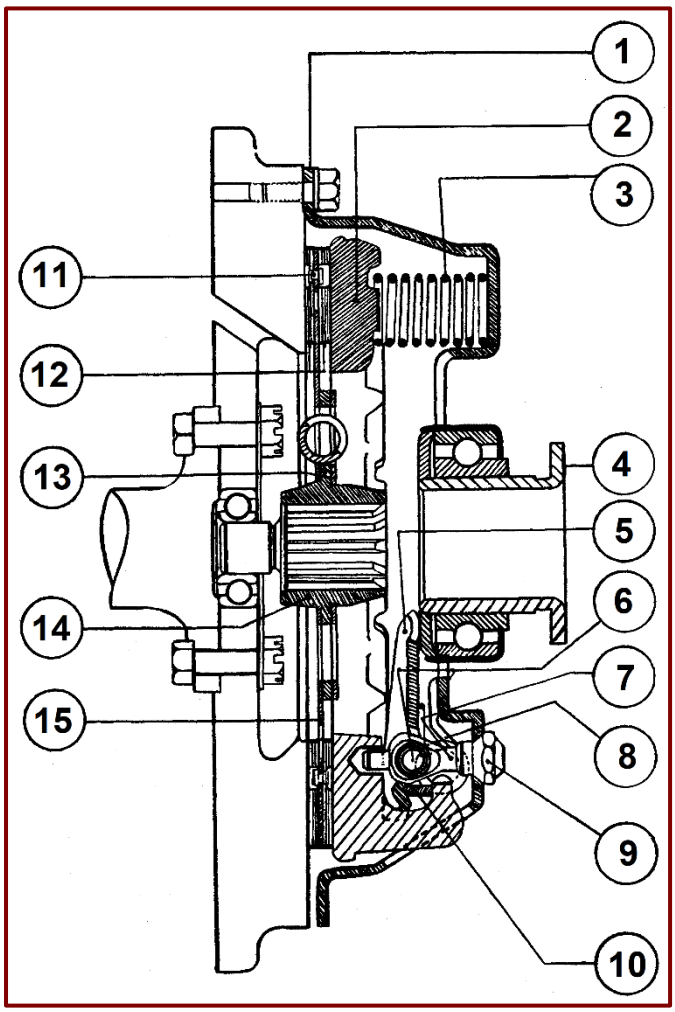


Figure 40. Clutch Assembly.

Note: The above illustration shows a non-Jowett flywheel and spigot bearing assembly.

ADJUSTMENT

The clutch pedal should have approximately 1" (25·4 mm) of free movement, and the only adjustment necessary should be the maintenance of the free play. This should be done by altering the effective length of the operating rod, linking the clutch pedal to the clutch withdrawal fork (*Figure 41*).

The clutch withdrawal fingers can be inspected through the detachable base cover on the underside of the clutch housing.

With correct free play on the clutch pedal, there should be at least 1/16" (1·5 mm) clearance between the release bearing and the lever tip.

To ensure a clean change the pedal should move 2¾" (70 mm) after the release bearing has made contact with the Release Lever tips. At the end of this travel, the clutch pedal should be down to the floor-board. Excessive pedal movement leads to close coiling of the Thrust Springs, after which any pedal pressure exerted tends only Io overstress the release gear and internal mechanism of the clutch.

OVERHAUL

To Remove And Dismantle

Remove the engine from the chassis (see Engine Chapter); remove the housing base cover, and detach the gear box from the flywheel housing. Remove the clutch shaft cover, the operating lever and the throwout bearing. It should be noted that as the clutch and flywheel are balanced as an assembly, they are each marked with a letter 'P' to facilitate re-assembly in the balanced position.

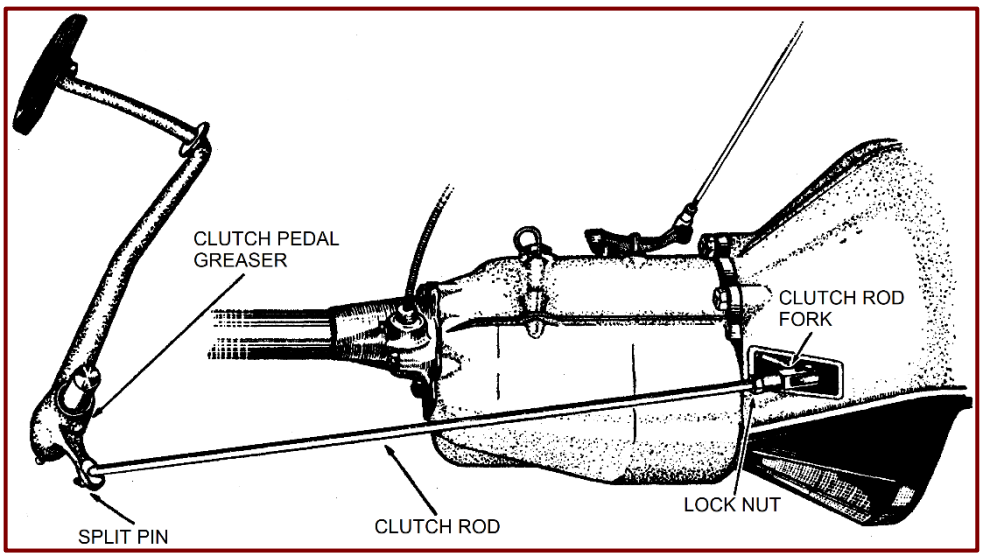
Release the setscrews securing the clutch assembly to the flywheel by diagonal selection and withdraw the clutch through the bottom of the housing.

Mark the clutch cover, the lugs on the pressure plate, and the release levers, so that they can be reassembled in their original positions.

Continued on Page 36.

Right:

Figure 41. Clutch Operating Rod.



Place the clutch cover assembly on the bed of a press with the pressure plate (2, *Figure 40*) resting on blocks, so arranged that the cover is free to move downwards when pressure is applied. Place a block of wood across the cover, resting on the spring bosses, and compress the cover by means of the ram. While under compression, shear away the peening by exerting sufficient pressure on the nuts (9) and remove the nuts. Slowly release the pressure to prevent the thrust springs (3) from flying out.

Remove each release lever (5) by holding the lever and the eye-bolt (7) between the fingers and thumbs so that the inner end of the lever and the threaded end of the eye-bolt pin are as close together as possible, keeping the eye-bolt pin (6) in position in the lever. Lift the strut (10) over the ridge in the lever, and remove the eye-bolt from the pressure plate.

Reconditioning Clutch

When reconditioning the clutch assembly, a reconditioned friction plate should be fitted. Where a reconditioned plate is not available the following procedure may be used in cases of emergency.

When removing the old worn facings, the rivets should be drilled, not punched out. After removing the facings, thoroughly examine the disc and spring plate for cracks; if either are damaged a new driven plate assembly should be used. After re-facing mount the driven plate on a mandrel between centres and check for 'run out' by means of a clock indicator. Where 'run out' exceeds 0·015" (0·38 mm) true the plate by levering in the required direction after finding the high spots. It should be noted that the friction plate on the left hand drive models has a different part number, due to a difference in liner material.

To Re-Assemble

Before assembly thoroughly clean all parts, and renew those which show appreciable wear. A very slight smear of grease such as Duckhams HP 2295, or Keenol, should be applied to the release lever pins, contact faces of the nuts, eyebolt seats in the clutch cover, drive lug sides on the pressure plate and the plain end of the eyebolts.

Assemble one release lever (5, *Figure 40*) eyebolt (7) and eyebolt pin (6), holding the threaded end of the eye-bolt and the inner end of the release lever as close together as possible. With the other hand insert the strut (10) in the slots in the pressure plate sufficiently to allow the plain end of the eyebolt to be inserted in the hole in the pressure plate. Move the strut upwards into the slots in the pressure plate lug, over the ridge on the short end of the lever and drop it into the groove formed in the latter. Fit the remaining release levers in a similar manner.

Place the pressure plate (2) on blocks on the bed of the press and arrange the thrust springs (3) vertically on the plate, with a red (maroon on left hand drive models) spring on the leading side and a yellow spring on the following side of each release lever. Make sure that the springs seat on the bosses provided, lay the cover over the assembly ensuring that the anti-rattle springs (8) are in position, that the tops of the thrust springs are directly under the seats in the cover and that the machined portions of the pressure plate lugs are under the slots through which they have to pass.

Place the block of wood across the cover and compress the cover by means of the ram, guiding the eyebolts and pressure plate lugs through their respective holes. Screw the adjusting nuts (9) on to the eyebolts (7) and adjust in the manner detailed under release lever adjustment, secure by re-peening. Operate the clutch a few times by means of the ram to ensure that the working parts have settled in their correct position.

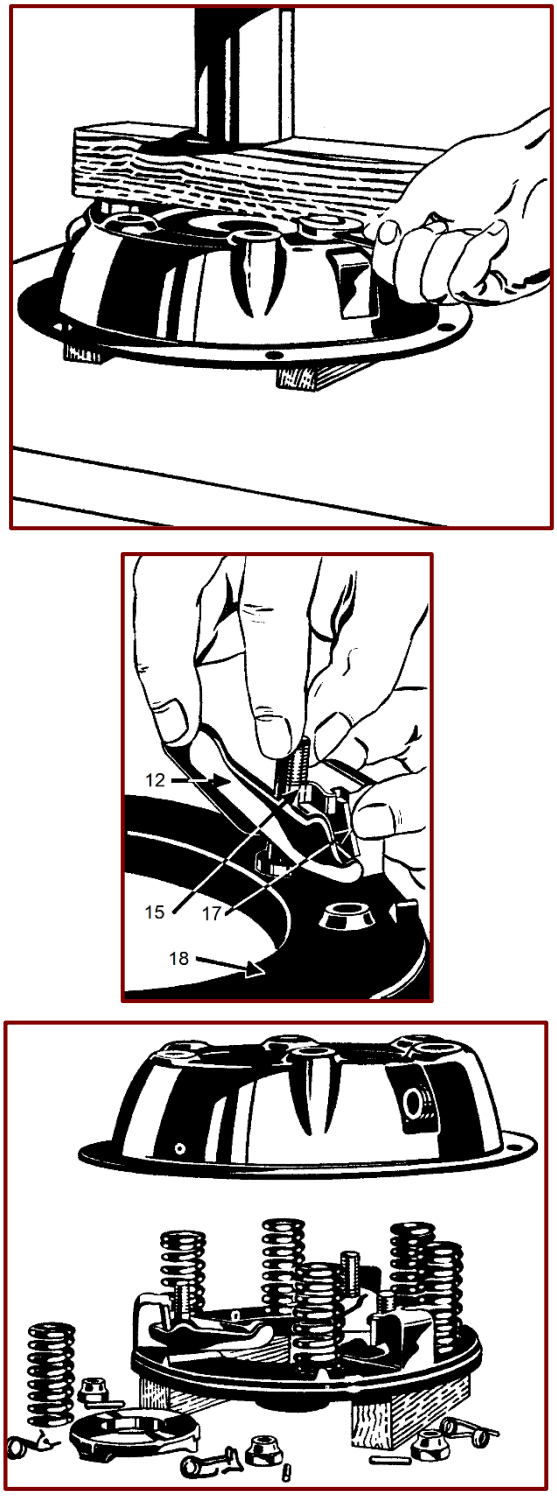


Figure 42. Assembling of Clutch.

Release Lever Adjustment

After reassembling the clutch the following operation for resetting the release levers should be carried out.

Fit the Borg and Beck gauge plate (No.CG 12916) to the flywheel in the position normally occupied by the driven plate and mount the cover plate on the flywheel, tightening the holding setscrews a turn at a time by diagonal selection, and ensuring that the gauge plate is correctly located with the three machined lugs directly under the release levers.

Now place a short straight edge across the centre boss and the bearing surface of one release lever, then turn the adjusting nut until the boss is exactly the same height as the gauge plate boss.

Repeat for the other levers.

If the special gauge is not available, the release levers can be adjusted by clamping the cover assembly, with the friction plate in position, to a flat surface. Then check the release lever adjustment by means of a clock gauge recording, on the tip of each release lever.

The release lever tip height from the flywheel face should be 1·665” (42·5 mm). When checking by this method, it is advisable to release the clutch and turn the friction plate through 90° to counteract any lack of parallelism in the plate, and to ensure that the release levers are in plane with each other.

To Replace The Clutch

When replacing it is important that the clutch friction plate is fitted with the face marked ‘Flywheel Side’ forward (i.e., with the large centre boss to the rear) and that the friction plate and cover plate assemblies are accurately centred with the clutch shaft and the spigot bearing in the end of the crankshaft. A spare clutch shaft is ideal for this purpose, but a 0·996” (25·302 mm) diameter mandrel with a 0·4995” (12·68 mm) diameter x 1·8” (45·72 mm) long spigot will also be found satisfactory.

The setscrews securing the clutch to flywheel should be tightened by diagonal selection.

As the clutch cover plate assembly and flywheel are balanced together it is normally desirable that the components should be replaced together, but where this is not practicable the assembly must be re-balanced.

DATA

FRICTION DISC

External Diameter	7·25” (184 mm)
Internal Diameter	5·00” (127 mm)
Lining Thickness	⅛” (3·2 mm)

SPRINGS

Red:	Free Length	1·96” (49·9 mm)
	Rating	223 lbs. per in. (41 kg. per cm)
Yellow:	Free Length	2·255” (57·5 mm)
	Rating	142 lbs per in. (25·5 kg. per cm)
Maroon:	Free Length	2·150” (54·9 mm)
	Rating	142 lbs per in. (25·5 kg. per cm)
Pressure R.H.D.		3 Yellow 120 lbs. (54·5 kg.)
		3 Red 135 lbs. (61·0 kg.)
Pressure L.H.D.		3 Yellow 120 lbs. (54·5 kg.)
		3 Maroon 105 lbs. 120 lbs. (47·5 kg.)

Cushion R.H.D. and L.H.D.
R.H.D. & L.H.D. 3 blue Drive, 3 Green Overrun

LINING MATERIAL

R.H.D.	Ferodo Moulded Asbestos
L.H.D.	Ferodo Woven Yarn

CHAPTER 4

GEARBOX

GEARBOX

DESCRIPTION (*Figure 43*)

The gearbox has four forward speeds and reverse. Top, third and second gears are synchromesh, all constant mesh gears have helical teeth.

The clutch shaft is supported at the rear by a ball bearing in the gearbox casing, and at the front by a 'Reservoil' bush in the crankshaft boss. Oil is controlled by a throw washer and oil return groove in the clutch shaft face.

The mainshaft is supported at the front by a roller bearing in the clutch shaft. A ball bearing in the rear of the gearbox casing supports the centre of the mainshaft, whilst a roller bearing located in the extension tube supports the rear end of the mainshaft; an oil seal is fitted at the rear of the bearing.

The speedo drive gear is located at the rear of the mainshaft and the driven gear in a detachable bearing housing on the extension housing; lubricant is supplied to the speedo housing by a drilling into the main casing.

The layshaft is a press fit in the casing and is located by a peg. The layshaft gear cluster revolves on roller bearings, the end float being controlled by bronze washers.

The reverse gear shaft is a press fit and is peg located.

The reverse gear has a bronze bush bearing surface.

Gear selection is by means of forks riveted to selector bars; locking plungers operate on V-grooves in the selector bars, through two drillings in the selector housing.

LUBRICATION

The gearbox is fitted with filler plug and dipstick, accessible by removing the large rubber plug in the toeboard. If the gearbox is to be drained it is best done when the oil is warm. A special key for removal of the drain plug is found in the tool kit. See lubrication chart.

MAINTENANCE

The nuts securing the gearbox to the clutch housing should be checked after the first 2,000 miles and afterwards at 5,000 mile intervals.

OVERHAUL

To Remove And Replace Gearbox

The gearbox should be removed with the engine as described in the Engine Chapter. To separate the gearbox from the engine, remove the four securing nuts, two being located inside the clutch housing. Then withdraw the gearbox from the clutch housing.

Replacement is a reversal of the above operations.

When fitting the gearbox to the clutch housing, fit a new packing and smear with gasket cement. The clutch shaft splines should be lightly greased before entering the clutch.

To Dismantle Gearbox

Remove the output flange key, withdraw the speedometer shaft and gear, and remove the speedometer housing extension.

Remove the 1¼" nuts and tab washers from the front and rear of the mainshaft, and remove the speedo drive wheel.

Remove the selector housing (side cover), remove the selector bars, remove the selector bar plunger housing, pivot rocker, spring seats, springs and plungers from the housing.

Remove the mills pin from the gear operating lever. Tap the lever down the gear operating shaft, and remove the Woodruff key. The gear operating shaft, the lever, and the shaft spring can now be withdrawn from the gearbox

If the gearbox is to be completely dismantled the layshaft gear cluster should be lowered, at this stage, by drifting out the layshaft from the FRONT of the box; this gives additional room for movement in the box and reduces the risk of damage to the gears.

The mainshaft gears can however be removed without disturbing the layshaft, if the gearbox is to be partially dismantled only.

Drift out the clutch shaft ball race, from inside the gearbox, taking special care not to damage the casting face. Once the race is clear of the gearbox face a puller should be used to draw the race off the shaft. Remove the mainshaft ball race in the same manner, and slide off the bearing spacing washer.

Separate the clutch shaft from the mainshaft, pull the clutch shaft as far forward as possible, and remove the mainshaft with gears through the side of the gearbox. Remove the bearing oil thrower washer to avoid possible loss and remove the clutch shaft through the gearbox side.

Remove the reverse gear if necessary, by drifting out the shaft from the FRONT of the box.

When removing gears from the mainshaft, it is advisable to hold the shaft in a vice, between the speedo gear thread, and the output flange taper, leaving both hands free.

Slide the top and third gear driving dog off the shaft.

Depress the washer locating pin, and turn the washer until the castellations are in line with the shaft spline, and slide the washer off the shaft. Remove the locating spring and plunger.

Remove the third gear and bush from the shaft.

Repeat for second gear and bush, and for the first and second gear, and sliding dog.

Remove the sliding gear lock plunger which penetrates the sliding dog from the main shaft spline to the sliding gear. First and second and third and top sliding gears can be removed from their sliding dogs by thumb pressure. When doing this it is advisable to cover the gear completely with a piece of cloth, so that the synchro balls are not lost when pressure on the springs is released.

INSPECTION

Apart from normal inspection procedure the following

points should be checked.

1. Place a straight edge across the three machined selector bar location faces, on the selector housing, and check for any difference in height. These should be scraped level with a flat scraper should any variation be evident.
2. Check the reverse gear bush; if this is worn or loose in the gear, the full gear should be replaced.
3. Check the synchromesh cones and seat faces for wear or scoring; if this is excessive replace the gear concerned. It is advisable when fitting rep-

lacement gears or when replacing the original gears to lap in the synchro cone faces with fine lapping compound.

4. The selector bars and forks should be checked for alignment and twist. If the units are loose, the complete selector bar should be renewed.

over the balls itself. When fitting the first and second sliding gear make sure that the cutaway tooth in the internal gear is aligned with the drilled through hole in the sliding dog, which carries the lock plunger.

To assemble the gears onto the mainshaft, grip the shaft in a vice, between the thread and the flange taper.

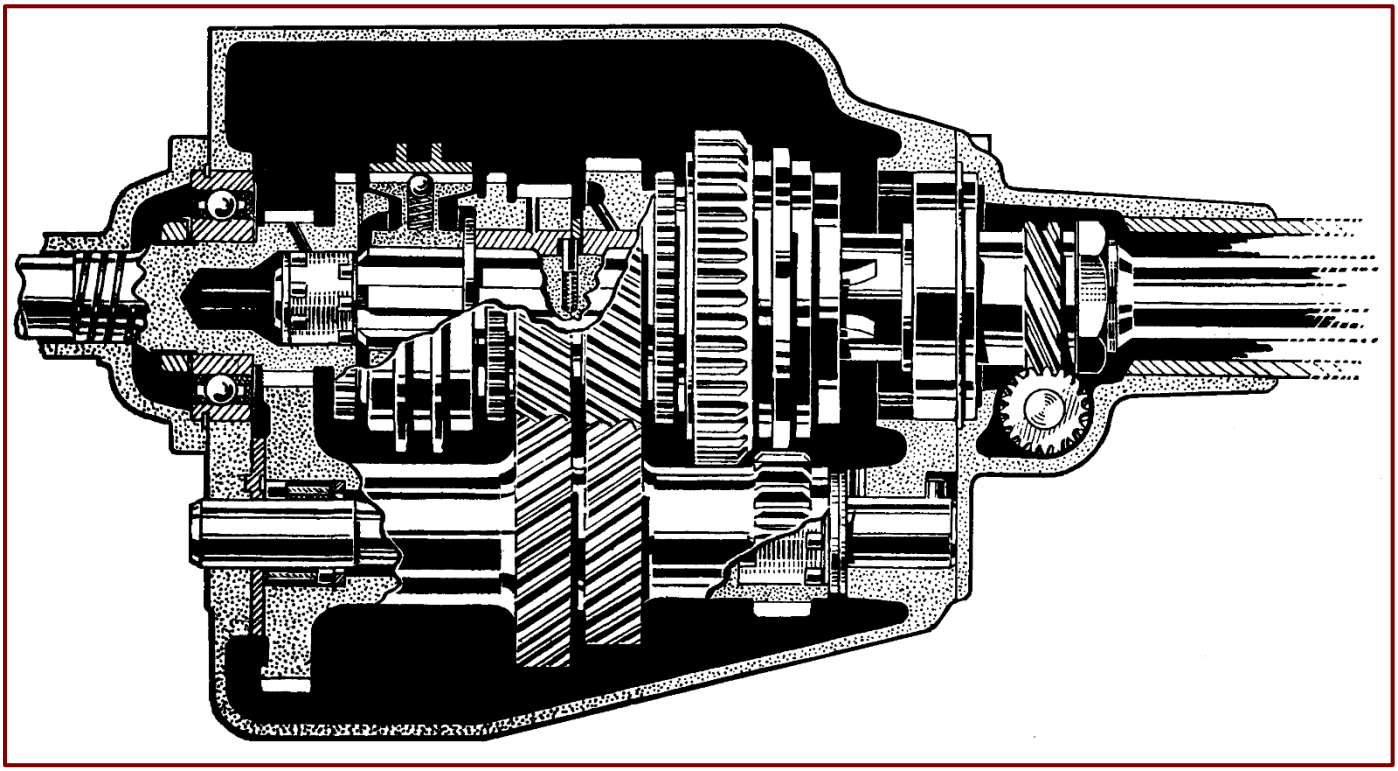


Figure 43. Sections through Gearbox.

TO RE-ASSEMBLE GEARBOX

The following operations are recommended, for reassembling the gearbox.

If the layshaft gear cluster has been dismantled, insert the spacing washers and bearings into the gear cluster, place the cluster in position in the gearbox, and insert the rear pad and rear washer, making certain that the tab on the rear pad is located correctly in the gearbox case.

Insert the layshaft and drift through gently until the gear cluster is held in position. Insert front pad and washer and drift the layshaft home, ensuring that the shaft does not protrude beyond the gearbox faces.

Up to 0·012" (0·305 mm) end play in the gear cluster is permissible. Any play over 0·012" should be removed by fitting shims between the front spacing washer and the gearbox casing.

Place the reverse gear in position, and fit the shaft, by drifting in from the rear, making sure that the peg on the shaft locates with the recess in the box.

The following notes on assembling the gears onto their respective sliding dogs may be found helpful.

Grease the synchro balls and spring thoroughly, place in position. Now fit a Jubilee clip (or similar adjustable ring) over the balls and tighten until the clip is gripping the sliding dog face; place the sliding gear on the dog up to the edge of the hose clip, place the assembly endwise in the vice (using soft clamps), and close up the vice until the gear pushes the clip off the synchro balls, and slides

Insert first sliding gear lock plunger into first and second sliding dog and slide on the shaft up to the end of the splines with the drilled through hole in the dog aligned with the indentation in the mainshaft. Insert spring and locating pin into the drilling in the mainshaft, slide on one of the thick mainshaft washers and turn until locked by the locating pin. Note that only one of the recesses in the washer will locate with the pin.

The second and third gear bushes which are dimensionally identical, can be distinguished by the double oil groove on the second gear bush being at the opposite end to the internal recess which accommodates the portion of the locking pin which protrudes from the locking ring, whilst on the third gear bush the double oil groove is at the same end as the locking pin recess.

Slide on the second gear bush, making certain that the recess in the bush registers with the locating pin allowing the bush to butt against the mainshaft washer, and that the oil grooves in the bush locate with the feed hole in the gear. Place the second gear on the bush with the taper synchromesh face towards the tapered recess in the first gear. Insert the spring and locating pin, slide on the thin mainshaft washer and turn to lock.

Slide on the third gear bush, again registering with the locating pin. Place third gear on bush with synchro taper towards clutch end of mainshaft. Insert spring and locating pin, slide on the remaining thick washer and lock.

Slide third and top gear, and driving dog on the shaft with the inner boss towards the clutch shaft.

Fit the spacing washer and the spigot bearing into the rear end of the clutch shaft; fit the clutch shaft and the mainshaft into the gearbox, And fit together. Fit the clutch shaft oil thrower, the rear bearing washer, and the ball bearings, tapping the bearings into position until the locating rings press against the gear box face.

Fit the speedo drive wheel with the gear to the rear, fit the tab washer and 1¼" nut, lock up and fold over tab.

Insert the gear operating shaft through the drilling in the top of the box, fit the distance collar and the gear operating lever onto the shaft, and fit the shaft spring into position. Fit the Woodruff key and tap the lever into position on the shaft. Secure the lever to the shaft with the Mills pin.

Check that the shaft springs back when pushed down and released and that it can turn freely until the lever comes into contact with the stop.

Fit the selector bars into the gearbox. Fit the selector housing, fitting a new paper packing with a slight smear of gasket cement.

When fitting the selector housing with the gearbox in position in the chassis, it will be found easier to fit the selector bars into the housing and not into the gearbox.

Fit selector plungers, springs, spring seats, rocker and plunger housing. Fit the speedo housing extension making sure that the recess for the selector bars is in line with the recess in the side cover. Fit a new paper packing sealed with a slight smear of gasket cement. Take special care not to damage the mainshaft extension bearing and the oil seal; fit the speedo drive shaft and gear, and lock in position.

Gearbox Selector Plunger Setting (*Figure 44*)

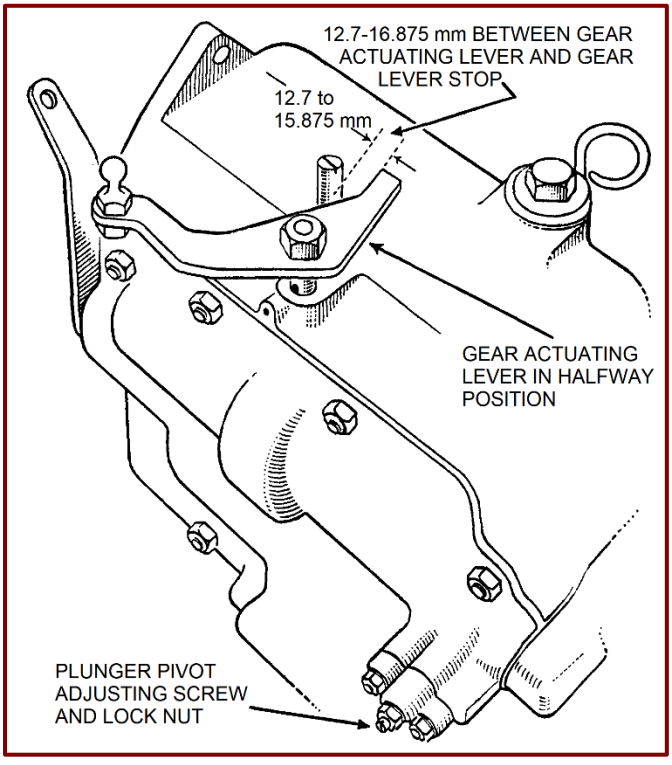


Figure 44. Selector Plunger Setting.

Metric Conversion:

12.7 mm	½"
16.875 mm	⅝"

If the grubscrew in the selector plunger housing is disturbed, it is essential that this is correctly re-set after reassembly of the gearbox.

Set the gear operating shaft halfway between neutral and first gear position, slacken the grubscrew locknut, tighten down fully the grubscrew, and then slack back half a turn. Retighten the locknut with the grubscrew held in position.

If this adjustment is not set correctly, 'jumping' out of gear may be experienced. Should this fault persist after the adjustment has been set check the gear change linkage setting.

It is most important that the adjusting grubscrew is NOT screwed in further, once the adjustment has been set.

STEERING COLUMN GEAR CHANGE

DESCRIPTION

The gear change mechanism is mounted on the steering column. It consists of an inner and outer column, the outer column transmits motion to the gear operating shaft (*Figure 45*, Page 42), whilst the inner column operates the selector lever on the side cover.

The movement of the gear lever into reverse gate is restricted by lugs on the inner column which butt against a shoulder on the outer column. Pressure on the reverse button moves the inner column, and the lugs enter the slots in the outer column.

On left hand drive models, the operation follows the same principle with the addition of an intermediate lever assembly between the base of the column and the gearbox.

ADJUSTMENT

After refitting the gearbox in the frame, or after refitting a replacement gearbox, the gear-change and selector change links must be reset before they are connected up.

1. Set the gear operating shaft, on the gearbox top, in neutral position between first and second gears and insert a $^{5}/_{32}$" (3·9 mm) pin through the hole in the gearbox side, immediately below the gear operating shaft, so that the shaft is secured in position.
2. Set the gear lever at the steering wheel in neutral and move slightly until the point is located where; with the reverse button depressed, a clean movement into the reverse 'gate' can be obtained. The gear lever at this point should normally be set 10° above horizontal, hold in this position throughout operation 3.
3. Adjust the length of the gear change link to line up with the position of the gear operating shaft as set in Para. 1 and of the heavy arm at the base of the gear change column. Connect the link to the shaft and to the arm.
4. Set the gear lever at the steering wheel in neutral between first and second. With the gear lever held in this position, set the length of the selector change link to line up with the position of the light arm at the base of the column, and the selector operating lever on the gearbox, and fit the link onto the arm and the lever. Remove the $^{5}/_{32}$" (3·9 mm) pin securing the arm and check the movement of the gear lever.

Should the gear change link be incorrectly adjusted it will be found difficult, or in certain cases impossible, to move the gear change lever into the reverse gate. Incorrect setting of the selector change link affects all gears.

On left hand drive models the above procedure should be followed, adjustment being made on the rods running from the gearbox to the intermediate lever assembly.

OVERHAUL

To Remove Gearchange Assembly

1. Remove the draught excluder and metal surround at the base of the column and the gear change rod inspection cover in the toe board.
2. Disconnect the gear change link and the selector change link at the ball joints from the gear change and selector operating levers on the gearbox.
3. Disconnect the gear change stay from the gear change by removing the gear change stay securing bolt at the base of the gear change column.

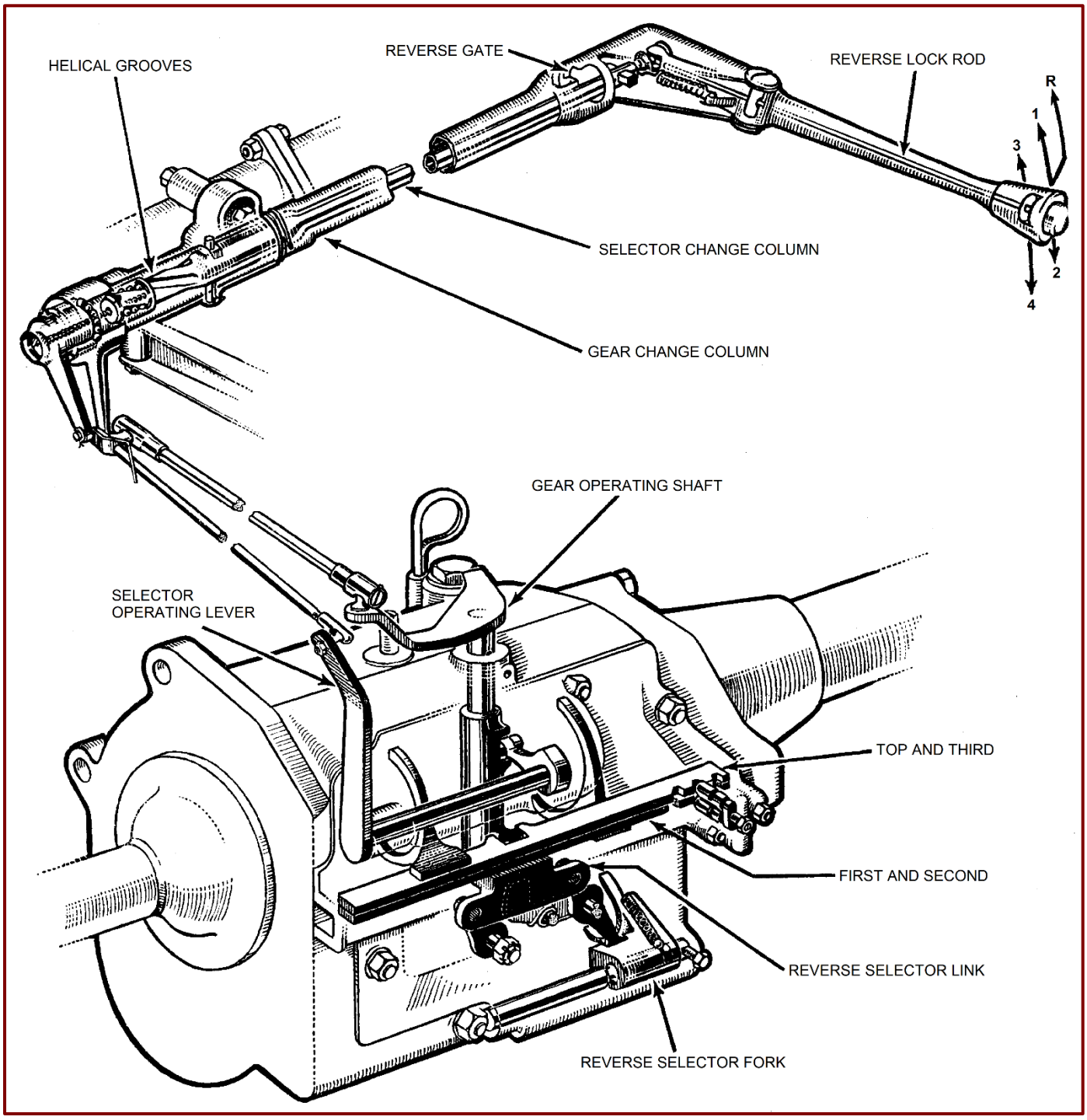


Figure 45. Gearchange and Selector Mechanism.

4. Disconnect the gear change stay from the gear change stay pin on the clutch housing.

5. Remove the setscrew securing the gear change to the steering column at the gear change bracket.
6. Disconnect the 'U' bolt at the facia panel steering column support bracket. The column can then be withdrawn, guiding the column lever and link through the aperture in the toe board. On Left Hand drive models proceed as detailed for the Right Hand drive with the exception of the gear change linkage which in this case will have to be disconnected at its lever connection at the base of the gear change column.

To Replace Gearchange Assembly (Right Hand Drive)

1. Insert gear change column and connecting links through toe board aperture and replace the set-screw connecting the gear change to base of steering column.
2. Connect gear change stay to gear column bracket and gear change stay pin on bell housing.
3. Connect gear change column to the facia panel at the facia panel bracket.
4. Connect gear change link and selector operating link to operating levers on gearbox and reset as detailed in Adjustment Section.

To Replace Gearchange Assembly (Left Hand Drive)

1. Insert the gear change column and selector change link attached through the board and replace the setscrew securing the gear change column to the base of steering column.
2. Secure column to facia panel bracket.
3. Connect gear change link to gear change operating lever at base of column.
4. Connect selector change link to operating lever on gearbox.
5. Reset linkage as detailed in Adjustment Section.
6. Replace metal surround, draught excluder and inspection cover.

To Dismantle Gearchange Assembly –

(Right Hand Drive and Left Hand Drive)

1. Unscrew the gear lever knob and withdraw the reverse lock rod from gear lever.
2. Remove gear lever pin, nut, and detachable gear lever spring from selector change column, withdraw the gear lever from the column.
3. Remove the reverse lock plunger by driving the 1/16" (1·6 mm) pin securing the reverse lock plunger to the internal column.
4. The reverse lock plunger should then be driven out of the internal column through the hole in the gear change column.
5. Remove gear change column circlip and washer.
6. Remove 1/16" (1·6 mm) split pin securing selector change pad spindle to gear change column bracket. Withdraw spindle.

   Raise the bracket away from the nut assembly, remove locking grub screw in gear lever nut and screw in selector change thrust cap using a 'C' spanner.
7. Partly withdraw selector change column and remove 18 steel balls and selector change pad from its location.
8. The selector nut and selector column can now be withdrawn.
9. Slide thrust cap up the column to remove.
10. Remove internal circlip (Seager), thrust plate and return spring.
11. Remove circlip holding steel balls in helical grooves. Circlip is located at the end of the selector change column.
12. Remove 3 (or on early types 9) steel balls from selector change nut, and withdraw nut from column.

    N.B. When removing the selector change nut from the helical groove the position should be noted as it is essential that the nut is re-assembled in exactly the same position as before dismantling.

To Re-Assemble Gearchange Assembly

1. Place the selector change column in the vice in an inverted position. Grease the splines on the helical grooves on the column.
2. Place selector change nut in position.
3. The steel balls should now be located in the helical grooves (1, or 3 on earlier types, to each-groove) and replace selector change screw circlip 9/16" (14·3 mm) diameter retaining the balls in position. When refitting the change screw circlip the width of the gap in the circlip must not exceed 3/16" (4·76 mm). Should the gap be wider than this, and a groove in the column coincides with the gap, the steel balls will drop through into the base of the change nut, blocking the movement of the column into first, second and reverse gears.
4. Replace selector change spring, thrust plate and secure in position with the Seager internal circlip.
5. Remove the column from the vice and slide the selector change nut on to the selector change column ensuring that the bearing surface on the nut is correctly positioned. The two thrust rings should be placed in their position at this stage.
6. Place gear change column in vice and enter selector column into the gear change column at the same time placing the pad in its location in the selector column.

   Enter column and pad into the column.
7. Locate pad spindle into pad, and secure to gear change bracket with 1/16" (1·6 mm) split pin.
8. Replace the 18 steel balls into the thrust cap bearing surface. To assist in this operation the use of thick grease is recommended. Screw the thrust cap into the gear lever nut and tighten up until the thrust cap becomes tight. Lock in position with grub screw located in gear change lever housing.
9. Replace gear change column circlip and washer.
10. Insert reverse lock plunger into selector change column so that the square end is located towards the squared recess in the column. Drive the 1/16" (1·6 mm) pin through the plunger to the selector change rod.

11. Attach gear lever spring to selector change rod and connect lug on the gear lever to the opposite end. Locate the gear lever, so that the gear lever pin can be passed through gear column and lever. Tighten nut ensuring freedom of movement in lever.
12. Replace reverse lock rod and knob.

DATA

GEAR RATIOS

From Engine No. E0/PC/11270

Top Speed	1 : 1
Third Speed	1·37 : 1
Second Speed	2·17 : 1
First Speed	3·56 : 1
Reverse	3·56 : 1

Before Engine No. E0/PC/11270

Top Speed	1 : 1
Third Speed	1·50 : 1
Second Speed	2·38 : 1
First Speed	3·88 : 1
Reverse	3·88 : 1
Oil Capacity	1 pint (0·568 litre)

CHAPTER 5

PROPELLER SHAFTS

PROPELLER SHAFTS

DESCRIPTION

The propeller shaft assembly consists of two shafts, three Layrub couplings, and a midship bearing assembly.

The front shaft has a Layrub coupling at the gearbox end, and is splined at the rear end to run through the midship bearing assembly and accommodate a companion flange. The rear shaft is fitted with a Layrub coupling at each end.

LUBRICATION

The Layrub couplings require no lubrication. The midship bearing should be lubricated every 2,500 miles. See Lubrication chart, Page 5.

MAINTENANCE

The following possible causes of transmission vibration mat be encountered during the life of a car as a result of wear or damage.

The propeller shaft midship bearing may be dry or worn, or the rubber housing supporting the bearing may be damaged or distorted.

It is possible for the midship bearing support cross member to be fitted, or forced off centre, allowing metal to metal contact with the frame-side. Another possible cause of vibration is wear or damage to the rubber and fabric strips which retain the cross member to the frame-side.

The slotted nut or setscrew securing the companion flange to the rear end of the front propeller shaft must be fully tightened.

Vibration can be caused by a loose Universal Joint bolt, or by wear on the Universal Joint rubbers. When examining these rubbers special attention should be given to any cracks appearing round the coupling bolt.

The possibility of damage to one of the propeller shafts, causing it to run out of line must not be overlooked, and it should also be noted that an arrow showing the direction of rotation is stamped on the forward end of the rear shaft.

As a general guide it can be taken that vibration at 2,000 – 2,500 propeller shaft r.p.m. is likely to be traced to the front end of the transmission, while a 4,000 - 4,500 r.p.m. vibration usually originates from the centre assembly, or the rear propeller shaft.

If, after checking the above mentioned items and they are found to be correct, proceed as follows.

Raise both rear wheels off the floor, obtain a No. 2 Jubilee clip and fit round the front propeller shaft, immediately behind the front Layrub coupling; this will have the effect of acting as a balance weight on the propeller shaft. Mark the position of the Jubilee clip, adjusting screw on the propeller shaft and carry out a series of tests by running the vehicle with both rear wheels off the floor. After each test turn the Jubilee clip through approximately 15° until the position is obtained where the minimum amount of vibration is recorded.

Note this position and move the clip approximately 1½" (38·1 mm) towards the rear of the Propeller shaft, checking the vibration at each position. By this method the position will be found where the vibration is eliminated In the event of the vibration still being experienced, remove the Jubilee clip and carry out the same testing procedure on the rear propeller shaft.

OVERHAUL

To Remove And Replace Propeller Shaft

1. Remove centre Layrub coupling, then detach the rear propeller shaft at the axle end. If the front propeller shaft only is to be removed, a stand should be placed under the free end of the rear propeller shaft.
2. Remove the four bolts from the midship bearing housing.
3. Detach the propeller shaft at the gearbox companion flange.
4. Turn the propeller shaft until the midship companion flange lies In a horizontal plane, then remove the propeller shaft by drawing the flange through the aperture in the midship bearing support.

Replacement is a reversal of the above procedure. The following points should be noted:

1. It is essential that there is no movement between the spigots on the trunnion sleeves and registered portion of the bolt holes in the companion flange.
2. Nuts should not be slackened back to fit split pins; tighten to the next Pin hole.

To Remove And Replace Midship Bearing Support

1. Remove the petrol pipe, battery to solenoid wire and brake rod which pass through the support.
2. Disconnect the centre Layrub coupling.
3. Remove the four nuts and bolts securing the midship bearing.
4. Remove the four setscrews from the midship bearing support, and withdraw the support over the companion flange.

To replace the midship bearing support, reverse the removal operation ensuring that when the support is in position it is central between the two frame side members, and that the rubber packings are in good condition. The bolt holes in the support are elongated to allow for centralisation.

Layrub couplings And Midship Bearing Assembly

If any fault is found in a Layrub coupling, the coupling should be replaced as a complete unit.

The midship bearing assembly should be renewed, when necessary, as a complete assembly.

CHAPTER 6

REAR AXLE

REAR AXLE

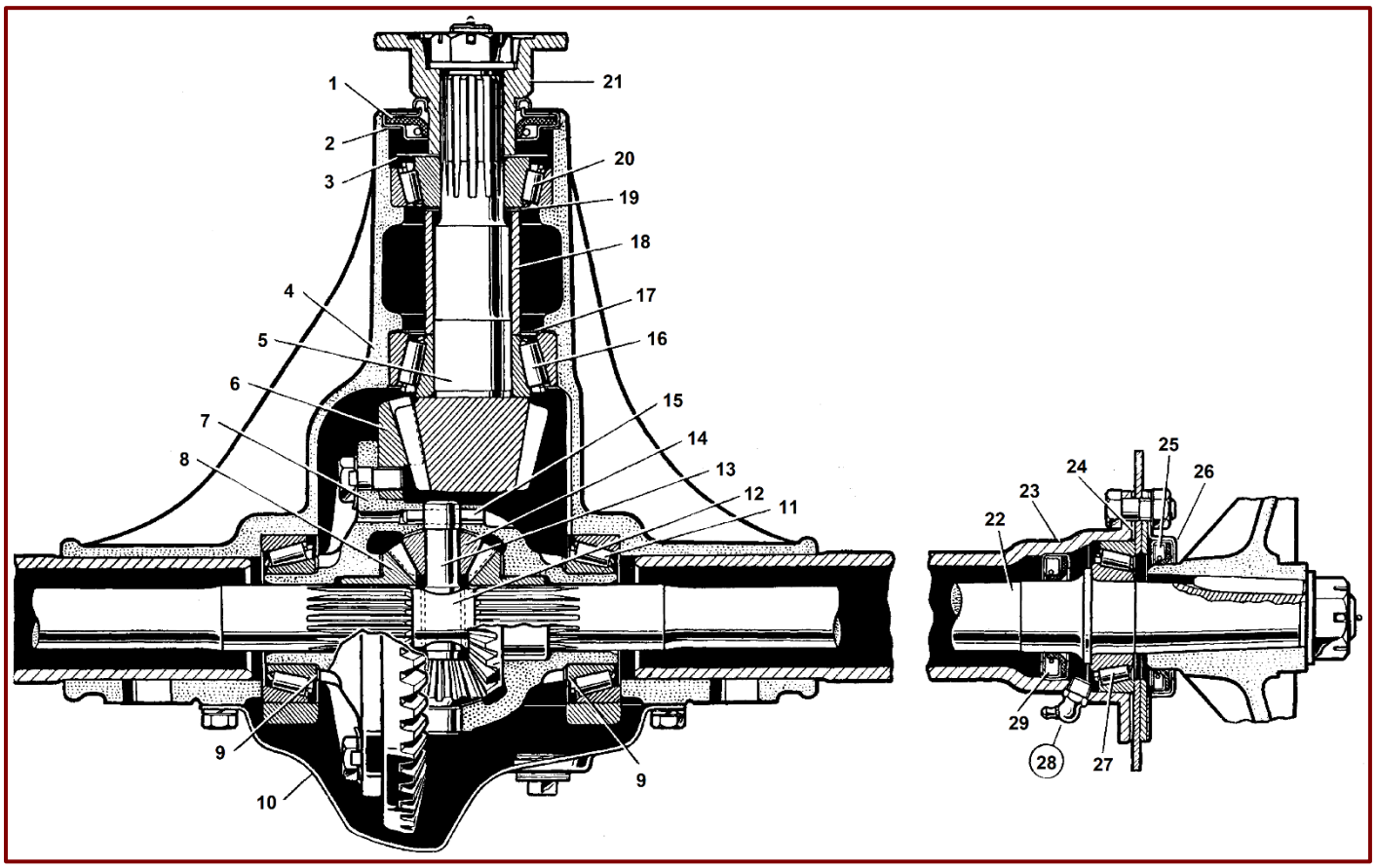


Figure 46. The Rear Axle Assembly.

Legend For *Figure 46.*

1. Drive Pinion Seal
2. Drive Pinion Seal Gasket
3. Drive Pinion Oil Slinger
4. Gear Carrier
5. Hypoid Drive Pinion
6. Hypoid Drive Gear
7. Differential Case
8. Differential Side Gear
9. Differential Bearing Shim
10. Gear Carrier Cover
11. Differential Bearing
12. Axle Shaft Spacer
13. Pinion Mate Shaft
14. Differential Bevel Pinion Mate
15. Pinion Mate Shaft Lock Pin
16. Drive Pinion Bearing (Inner)
17. Drive Pinion Bearing Shim (Inner)
18. Drive Pinion Bearing Spacer
19. Drive Pinion Bearing Shim (Outer)
20. Drive Pinion Bearing (Outer)
21. Universal Joint Flange
22. Axle Shaft
23. Axle Stub
24. Hub Bearing Shim
25. Hub Oil Seal
26. Hub Oil Seal Container
27. Hub Bearing
28 Grease Nipple
29. Axle Shaft Oil Seal

DESCRIPTION

The Rear Axle Assembly (*Figure 46*) is of the hypoid, semi-floating type with shim adjustment for all bearings and for the meshing of the driving gear and pinion. The Axle Shafts are splined at the inner ends to engage splines in the differential side gears. The outer ends of the shafts are provided with tapers and keys for attaching the wheel hubs (brake drums). The wheels are each supported on a taper roller bearing pressed on to the axle shaft and the side thrust from the wheels is transferred from one shaft to the other by a thrust block straddling the differential pinion mate shaft. A cover on the rear of the gear carrier housing permits inspection and flushing of the differential assembly without dismantling the axle. The axle gear ratio is stamped on a plate attached to the assembly by one of the rear cover screws. The axle serial number is stamped on the top of the gear carrier casting on the width of the metal forming the facing for the rear cover.

LUBRICATION

For lubrication of this axle, hypoid lubricant only should be used. This should conform to specification S.A.E. 90. See Lubrication chart for recommended brands.

Do not at any time mix various brands of hypoid lubricants. Should there be any doubt concerning the brand of lubricant previously used, drain and flush the axle with a flushing oil or light engine oil before filling with the new lubricant. Do not use paraffin for flushing. Check the level of the lubricant every 1,500 miles. The axle should be drained and refilled to the bottom level of the filler plug hole every 10,000 miles.

Lubricant capacity – 2¼ Pints (1·27 litres)

The wheel bearings are each lubricated by a grease nipple located in the axle tube housing adjacent to the brake back plate. Where, on the top side of the housing, a vent hole is provided, the greasing operation should be continued until grease appears at this hole indicating that the chamber is full. Do not overfill. The bearings should be lubricated with a good bearing grease every 5,000 miles. See lubrication chart, Page 3.

OVERHAUL

To Remove and Replace Axle

See Suspension chapter.

To Remove Axle Shafts And Hubs

1. Remove the road wheel, brake drums which should be withdrawn with an extractor, after removing the axle shaft nut, washer and split pin.
2. Check the end-float of the axle shaft with the dial indicator assembly, Tool No. SE. 101, as shown in *Figure 47*. The correct tolerance for axle shaft end-float is 0·006” to 0·008” (0·152–0·203 mm).
3. Remove the brake back plate retaining bolts, the outer oil seal assembly, the hub bearing retaining plate and the brake back plate, taking care not to lose or damage any of the hub bearing adjusting shims.
4. Remove the axle shaft, with its taper roller bearing, using Tool No. SE.102.

   Note: To remove a broken axle shaft, make a loop at one end of a length of stiff wire. Slide the loop down the axle tube and over the broken end of the shaft for a sufficient distance so that on pulling, the loop will bind on the shaft, and withdraw it from the differential side gear.
5. Examine the axle shaft oil seal, inside the axle tube, and if necessary replace with a new seal.
6. Examine the hub bearing, and if replacement is necessary, the cone may be withdrawn by means of the extractor, Tool No. SE.103.
7. Fit the replacement bearing (if required) making sure that the cone is pressed squarely on the bearing diameter until it firmly abuts against the shoulder provided.

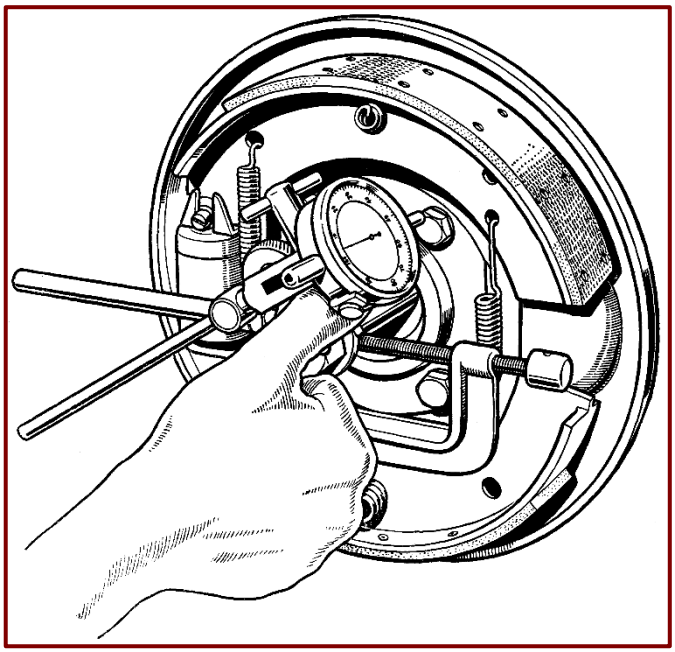


Figure 47. Checking Axle Shaft End Float.

To Replace Axle Shaft

1. Install the shaft with the taper roller bearing cone, taking care not to damage the oil seal.
2. Assemble the bearing cup whilst making absolutely sure that the cup enters the housing squarely.
3. Add or subtract adjusting shims (available in thicknesses of 0·003”, 0·005”, 0·010” and 0·030”) until the correct axle shaft end-float of 0·006” to 0·008” (0·152–0·203 mm), which is just perceptible by hand, is obtained. Adding shims increases end-float, subtracting shims decreases end-float.

   Remove or install approximately an equal thickness of shims at each end of the axle, in order to retain the axle shaft spacer in a central position.
4. Examine the hub oil seal and replace if necessary.
5. Fit the brake back plate and centralise the hub oil seal. When re-installing, fit new paper gaskets on either side of the hub bearing retaining plate.
6. Check the axle shaft end-float (*Figure 47*) with a dial indicator assembly, after gently tapping with a rawhide mallet on each axle shaft to ensure that the bearing cups are butting against the brake back plate.
7. Finally, it is essential to grease hub bearings.

DIFFERENTIAL AND PINION ASSEMBLIES

To Dismantle Differential Unit

1. Drain the lubricant from the gear carrier housing and then remove the gear carrier rear cover. Flush out the unit thoroughly so that the parts can be carefully inspected.
2. Remove the axle shafts as previously detailed.
3. Withdraw the four bolts securing the two differential bearing caps and remove the two caps.
4. Before attempting to remove the differential assembly, fit the stretching fixture, Tool No. SE.104 as shown in *Figure 48*. The fixture should be adjusted to suit the model being serviced, a series of holes being provided in the member opposite the turnbuckle for this purpose. Open the fixture by means of the turnbuckle until it is hand tight, then spread the case by using a spanner. DO NOT OVER-SPREAD, OR THE AXLE CASING WILL BE DAMAGED BEYOND REPAIR. The correct spread does not exceed a half turn on the turnbuckle, and this figure should not be exceeded even if the differential is still stiff to remove.

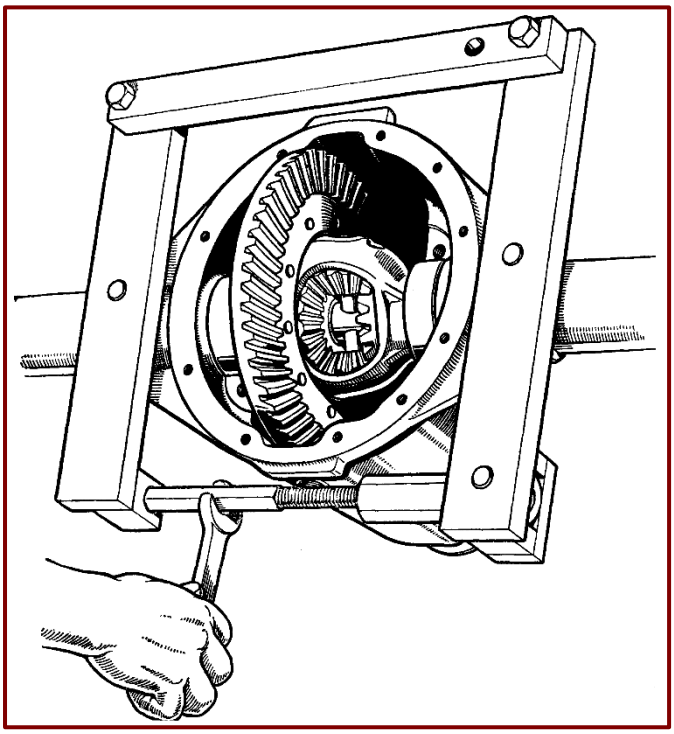


Figure 48. Stretching Axle Casing in order to remove Differential Assembly.

5. The differential assembly may now be prised out by means of two levers, one on each side of the differential case opening. During this operation use suitable packing between the levers and the gear carrier

   Note: In an emergency Stage 4 may be omitted, taking care not to tilt the assembly when removing as described in Stage 5.

To Dismantle Differential Assembly

1. Bend down the tabs on the drive gear bolts locking straps and remove the drive gear bolts.
2. Remove the drive gear from the differential case by tapping with a rawhide mallet.
3. Using a small punch, drive out the pinion mate shaft locking pin, which is secured in place by peening the case, and remove the pinion mate shaft.

   Figure 49 indicates the direction in which the locking pin is removed; it is not possible to drift the pin in the opposite direction.

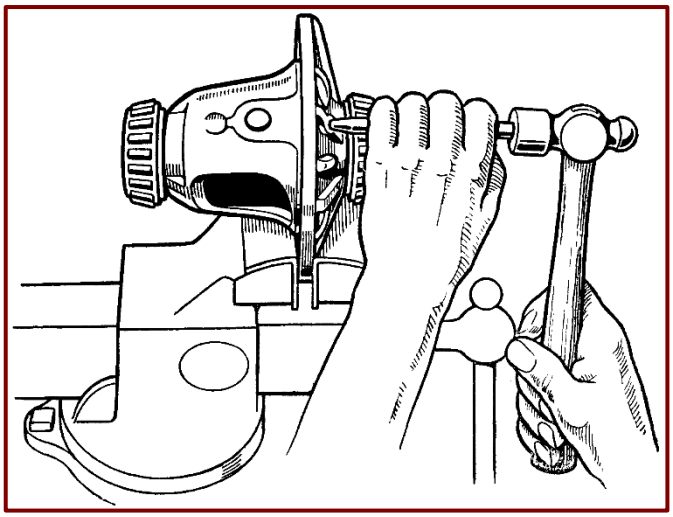


Figure 49. Removing Locking Pin.

4. Remove the axle shaft spacer.
5. Rotate the side gears by hand until the pinions are opposite the openings in the differential case, then remove the differential gears, care being taken not to lose the thrust washers fitted behind them.
6. If the drive gear setting is to be altered, it will be necessary to withdraw the differential bearings, using the extractor, Tool No. SE.103, to gain access to the shims located between the bearing and the abutment face on the differential case.

Re-Assembly Of Differential

1. Assemble the side gears with the thrust washers in position.
2. Insert the differential pinions, through the openings in the differential case, and mesh them with the side gears. Hold the pinion thrust washers on the spherical thrust faces of the pinions, whilst rotating the differential gear assembly into its operating position by hand.
3. Line up the pinions and thrust washers, then install the pinion mate with the axle shaft spacer in position.
4. Line up the cross hole in the shaft with the hole in the differential case, then fit the pinion mate shaft lock pin.
5. Using a punch, peen some of the metal of the differential case over the end of the lock pin to prevent its working loose and thereby causing extensive damage to the axle assembly.
6. Clean the drive gear and differential case contacting surfaces and carefully examine same for burrs.
7. Align the drive gear attaching bolt holes with those in the flange of the case, and gently tap the drive gear home on the case, with a hide or lead hammer.
8. Insert the drive gear bolts, with NEW locking straps, and tighten them uniformly, preferably with

a torque spanner 40–50 lb. ft. (54·2–67·8 Nm). Then bend the locking tabs round the bolt heads to prevent their working loose.

The procedure for fitting the differential case assembly into the gear-carrier is given under 'Differential Bearing Adjustment'.

Removing Pinion

1. Remove the pinion split pin, nut and washer.
2. Withdraw the universal joint companion flange with a puller.
3. Press the pinion out of the outer bearing. It is important that the pinion should be pressed and not driven out, to prevent damage to the outer bearing. The pinion, having been pressed from its outer bearing, may now be removed from the gear carrier housing. Keep all shims intact.
4. Remove the pinion oil seal together with the oil slinger and outer bearing cone.
5. Examine the outer bearing for wear, and, if replacement is required, extract the bearing cup, using Tool No. SE.105 shown in *Figure 50*. The extractor plate should be installed behind the cup and then the drawback may be fitted together with the extractor bar which seats on the nose of the gear carrier. The bearing cup may then be withdrawn by tightening the nut on the drawbar.

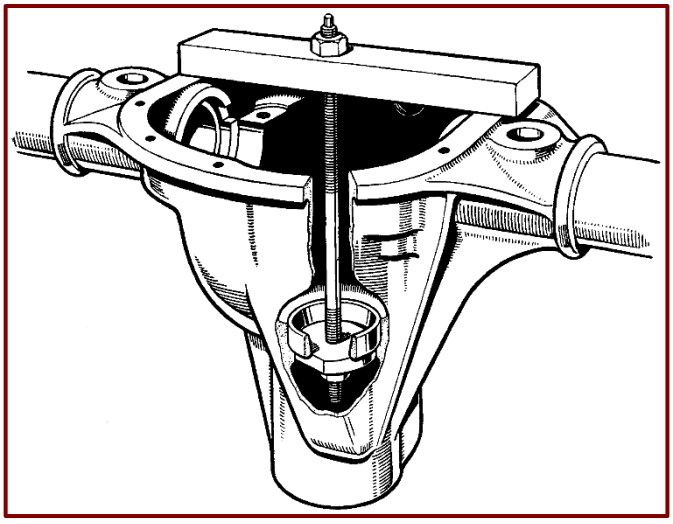


Figure 50. Extracting the Bearing Cup.

If the correct service tool is not available, and the old bearing cup is to be scrapped, it is possible to drive out the cup, the shoulder locating the bearing being recessed to facilitate the operation.

6. Remove the pinion inner bearing cup (*Figure 50*) using Tool No. SE.105 if the bearing requires replacement or adjustment of the pinion setting is to be undertaken. Take care of the shims fitted between the bearing cup and the housing abutment face. If the inner bearing is to be replaced it may be driven out, but the correct Service Tool should be used when the bearing is removed in order to carry out the pinion setting adjustment.

Differential Bearing Adjustment

The thickness of shims required in the installation of the differential bearings is determined as follows:

1. Fit the differential bearings, without shims, on the differential case, making sure that the bearing cones and cups and the housing are perfectly clean.
2. Place the differential assembly, with the bearing cups in their housing, within the gear carrier, the pinion not being assembled.
3. Install the dial indicator set, Tool No. SE. 101 on the gear carrier, with the button against the back face of the drive gear.
4. Inserting two levers between the housing and the bearing cup, move the differential assembly to one side of the carrier (*Figure 51*).

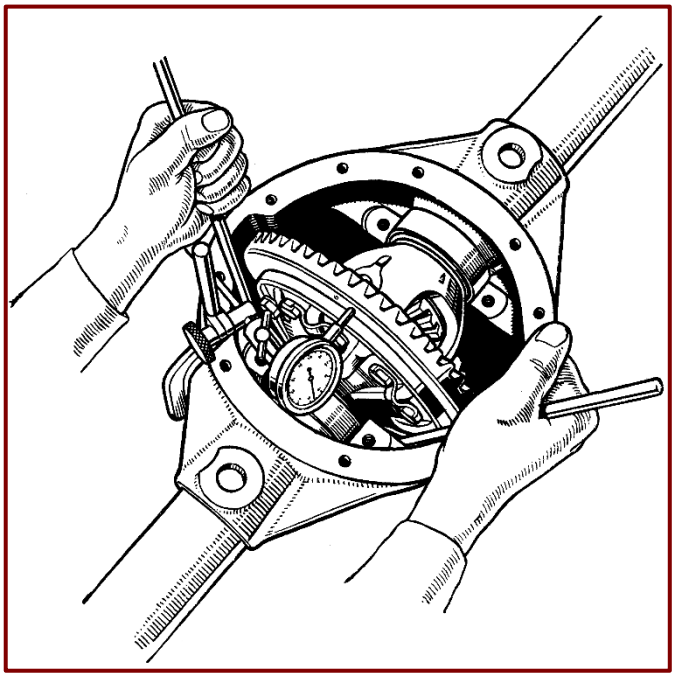


Figure 51.Differential Setting.

5. Set the indicator to zero.
6. Move the assembly to the other side and record the indicator reading, which gives the total clearance between the bearings as now assembled and the abutment faces of the gear carrier housing. Add 0·008" (0·203 mm) more to the clearance reading to give preload; this thickness of shims to be used in the installation of the differential bearings, the shims being divided to give the gear position with correct backlash as detailed under 'Drive Gear Adjustment'.
7. Remove the differential assembly from the gear carrier.
8. Re-install the pinion outer bearing cup with Tool No. SE.106.
9. Re-install the pinion bearing inner cup with the original adjusting shims positioning same.
10. Press the inner bearing cone on the pinion, using an arbor press and a length of tube, contacting the inner race only and not the roller retainer cage.

PINION ADJUSTMENT

The hypoid drive pinion should be correctly adjusted before attempting further assembly, the greatest care being taken to ensure accuracy.

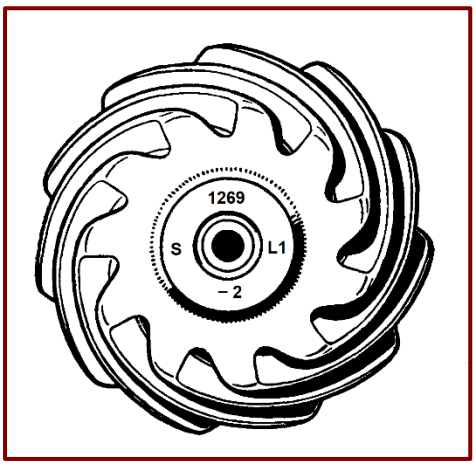


Figure 52. Pinion Setting Marks

The correct pinion setting is marked on the ground end of the pinion as shown in *Figure 52*. The matched assembly serial number at the top is also marked on the drive gear, and care should be taken to keep similarly marked gears and pinions in their matched sets, as each pair is lapped together at the factory. The letter on the left is a production code letter and has no significance relative to assembly or servicing of an axle. The letter and figure on the right refer to the tolerance on offset or pinion drop (dimension 'A' Figure 53), which is stamped, on the cover facing of the gear carrier housing. When ordering spares, specify offset required if the best perforrnance is to be obtained. Thus, L.1 carrier requires L.1 gears, or H.2 carrier requires H.2 gears.

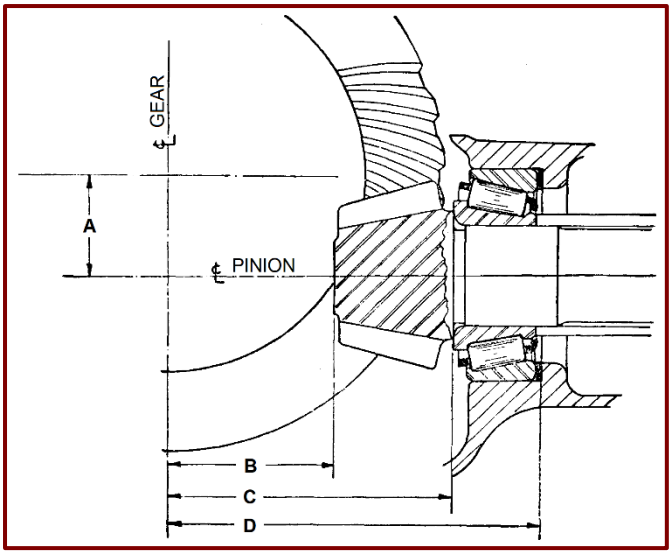


Figure 53. Pinion Setting.

Legend (*Figure 53*)

A 1·375" **B** 2·250" **C** 3·937" **D** 5·130"–5·120"

The number at the bottom gives the cone setting distance of the pinion and may be Zero (0), Plus (+) or Minus (–). When correctly adjusted, a pinion marked Zero will be at the zero cone setting distance (dimension 'B' *Figure 53*) from the centre line of the gear to the face on the small end of the pinion; a pinion marked Plus Two (+ 2) should be adjusted to the nominal (or Zero) cone setting plus 0·002" (0·051 mm), and a pinion marked Minus Two (– 2) to the cone setting distance minus 0·002".

Thus, for a pinion marked Minus Two (– 2) the distance from the centre of the drive gear to the face of the pinion should be 2·248" (57·1 mm) (i.e., 2·250" – 0·002") and for a pinion marked Plus Three (+ 3) the cone setting distance should be 2·253" (57·23 mm).

When the pinion bearing cups have been installed in the gear carrier, with the original pinion inner bearing adjusting shims, as described in Items 7 to 10 in the section entitled 'Differential Bearing Adjustment', proceed with pinion adjustment as follows:

1. Place the pinion, with the inner bearing cone assembled, in the gear carrier.
2. Turn the carrier over and support the pinion with a suitable block of wood for convenience before attempting further assembly.
3. Install the pinion bearing spacer.
4. Install the original outer bearing shims on the pinion shank so that they seat on the spacer or a shoulder on the shank, according to the construction of the unit.
5. Fit pinion outer bearing cone, companion flange, washer and nut only, omitting the oil slinger and oil seal assembly, and tighten the nut.
6. Check the pinion cone setting distance by means of the gauge, Tool No. SE. 107 (*Figure 54*, Page 53). The procedure for using the gauge is:

a) Adjust the bracket carrying the dial indicator to suit the model being serviced, then set the dial indicator to zero with the setting block.

b) Place the dial indicator assembly on the fixed spindle of the gauge body.

c) Fit the fixed spindle of the gauge body into the centre in the pinion head, slide the moveable spindle into position, locating in the centre in the pinion shank with the gauge body underneath the gear carrier, and lock the spindle with the screw provided.

d) Check the pinion cone setting by taking a dial indicator reading on the differential bore with the bracket assembly seated on the ground face on the end of the pinion. The correct reading will be the minimum obtained, i.e., when the indicator spindle is at the bottom of the bore. Slight movement of the assembly will enable the correct reading to be ascertained easily. The dial indicator shows the deviation of the pinion setting from the zero cone setting, and it is important to note the direction of any such deviation as well as the magnitude.

Continued on Page 53.

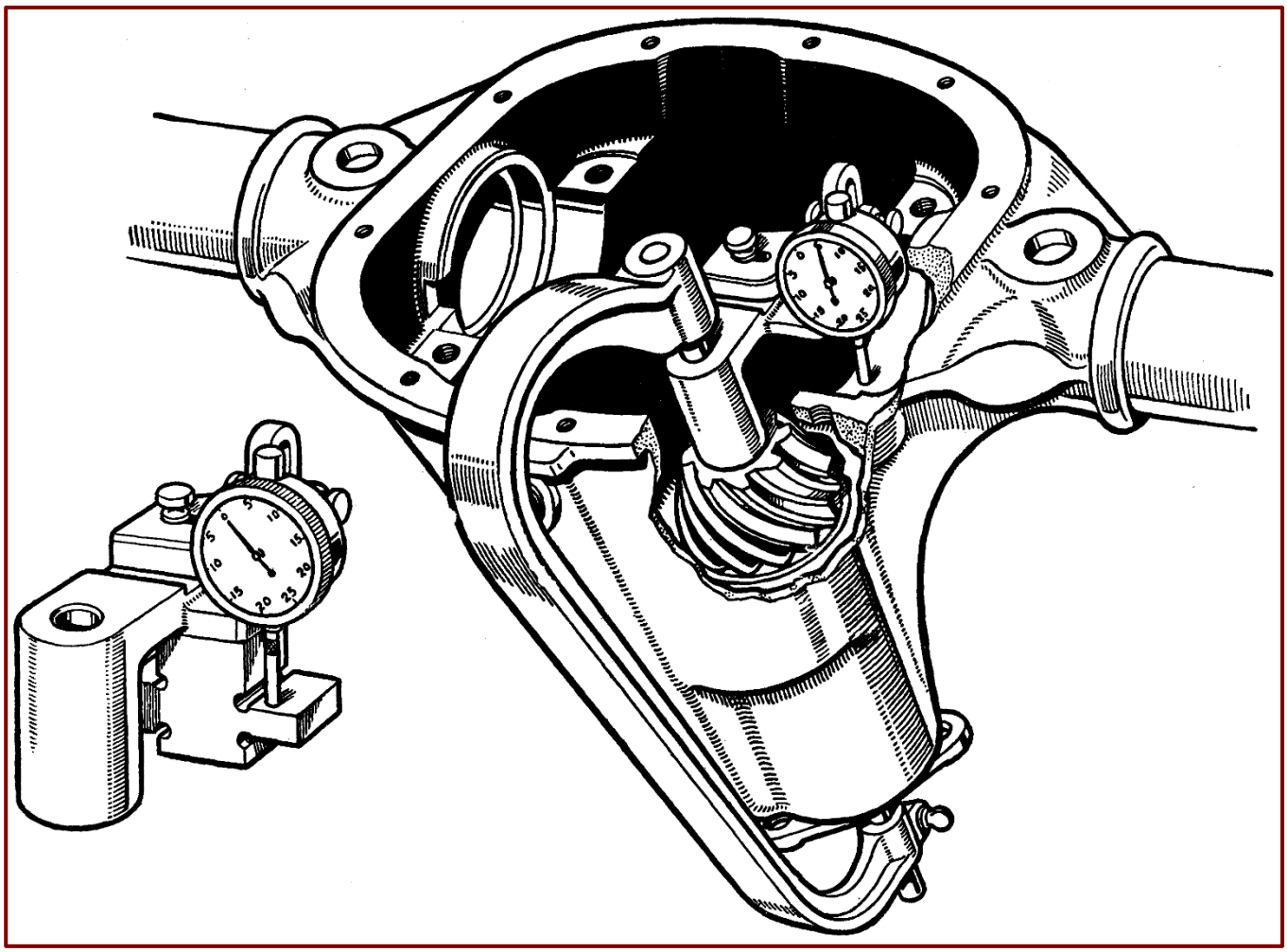


Figure 54. Checking Pinion Cone Setting.

7. If the pinion setting is incorrect it is necessary to dismantle the pinion assembly and remove the pinion inner bearing cup, using Tool No. SE.105. Add or remove shims as required from the pack locating the bearing cup and re-install the shim pack and the bearing cup. The adjusting shims are available in thicknesses of 0·003, 0·005" and 0·010". Then carry out the operations detailed as above.
8. When the correct pinion setting has been obtained, check the pinion bearing preload, which should afford a slight drag or resistance to turning, there being no end play of the pinion. The correct pre-load for the pinion bearings gives a torque of 8 to 12 lbs. in. (9.2–13.8 kg. cm.). Less than the correct range will result in excessive deflection of the pinion under load, whilst too much preload will lead-to pitting and failure of the bearings.

   To rectify the preload, adjust the shim pack between the outer bearing cone and the pinion shaft or spacer, but do not touch the shims behind the inner bearing cup, which control the position of the pinion. Remove shims to increase preload and add shims to decrease preload Installation of pinion oil seal assembly and oil slinger is usually effected after fitting differential assembly, see operations 1 ,2 and 3 under 'Final Assembly'.

DRIVE GEAR ADJUSTMENT

1. Place the differential assembly with bearing cups, less shims, in the housing, being sure that the bearing cones, cups and housing are perfectly clean.
2. Install a dial indicator on the- housing with the button on the back face of the drive gear (*Figure 51*, Page 51).
3. Inserting two small levers between the housing and bearing cup, move the differential case and drive gear assembly away from the pinion until the opposite bearing cup is seated against the housing.
4. Set the dial indicator to zero, then move the differential assembly towards the pinion until the drive gear is in metal to metal contact deeply in mesh with the pinion.

   The indicator reading now obtained (clearance between drive gear and pinion) minus the backlash allowance as etched on the drive gear (e.g., B/L 0·007) denotes the thickness of shims to be placed between the differential case and the bearing cone on the drive gear side of the differential.
5. Install the thickness of shims, determined in operation 4, on the drive gear side of the differential, taking the shims from the pack determined previously, see 'Differential Bearing Adjustment'.
6. Install the balance of the total shims required on the opposite side of the differential case.

As an example of differential and drive gear adjustment, assume that the total indicator reading obtained, as described under 'Differential Bearing Adjustment', is 0·080" (2·03 mm). This figure, plus 0·008" (0·203 mm) for the recommended preload, equals 0·088" (2·23 mm) which denotes the total thickness of shims to be used. Also assuming the clearance between the drive gear and pinion to be 0·042" (1·07 mm), determined as in oper-ations 1 to 4 above, subtract the backlash as etched on the gear, say 0·007" (0·18 mm) from the 0·042" (1·07 mm) clearance. The 0·035" (0·89 mm) difference de-notes the thickness of shims to be placed between the differential case and bearing cone on the drive gear side of the differential. Then subtract the thickness of shims 0·035" (0·89 mm) inserted on the drive gear side of the differential case, from 0·088" (2·23 mm), and the 0·053" (1·35 mm) difference denotes the thickness of shims to be installed on the opposite side of the case.

7. To facilitate installation of the differential asse-mbly, fit the stretching fixture, Tool No. SE. 104 as shown in *Figure 48* (Ref. operation 2 in 'To Dis-mantle Differential Unit with Service Tool'). Stretch the gear carrier, being sure not to exceed the half turn specified on the turnbuckle or the axle casing will be damaged beyond repair.

   In an emergency it is possible to install the differ-ential assembly by slightly tilting the bearing cups and tapping lightly into position with a hide hammer. This method increases the difficulty of avoiding damage to gear teeth, and extreme care is necessary to prevent damage to the differential bearings. This procedure is not recommended and should be strictly reserved for emergencies.

8. Lower the differential assembly into position, lightly tapping the bearings home with a hide hammer, whilst ensuring that the gear teeth are led into mesh with those of the pinion. Careless handling at this stage may result in bruising the gear teeth, and removal of the consequent damage can only be partially successful and result in inferior performance.

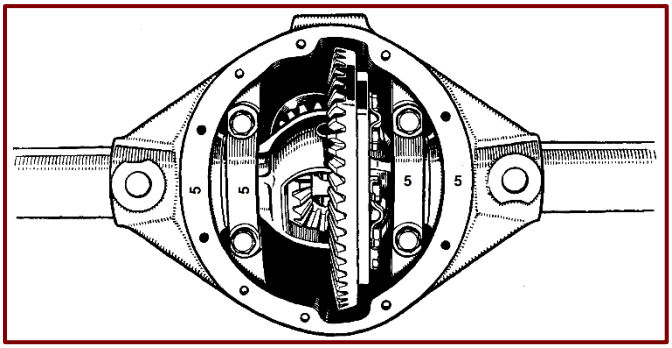


Figure 55. Correct Fitting of Bearing Caps.

9. When refitting the bearing caps, be sure that the positions of the numerals marked on the gear car-rier housing face and the caps correspond, as indicated in *Figure 55*. Tighten the caps lightly, remove the stretching fixture if used, then finally tighten the bolts securing the bearing caps.

10. Mount a dial indicator on the gear carrier housing with a button against the back face, in a similar manner to that employed for differential bearing adjustment as shown in *Figure 51*. Turn the pinion by hand and check the runout on the back face, which should not exceed 0·005" (0·127 mm). If there is excessive runout, strip the assembly and rectify by cleaning the surfaces locating the drive gear. Any burrs on these surfaces should be removed.

11. Re-mount the dial indicator on the gear carrier housing with the button against one of the drive gear teeth, as nearly in line with the direction of tooth travel as possible. (*Figure 57*). Move the drive gear by hand to check the backlash which should be as etched on the gear. If the backlash is not in accordance with the specification, transfer the necessary shims from one side of the dif-ferential case to the other side to obtain the desired setting. To increase backlash, remove shims from the drive gear side of the differential and install on the opposite side. Backlash is decreased by transferring shims to the drive gear side from the opposite side of the differential case.

12. After setting the backlash to the required figure, use a small brush to paint eight or ten of the drive gear teeth with stiff mixture of marking raddle, used sparingly, or engineer's blue may be used. Move the painted gear teeth in mesh with the pinion until a good impression of the tooth contact is obtained. The resulting impression should be similar to Case 1 in the table on Page 56.

FINAL ASSEMBLY

To complete the rebuilding of the-unit:

1. Remove the drive pinion nut, washer and com-panion flange.

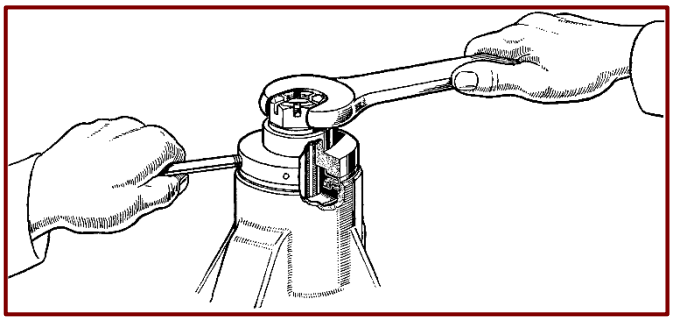


Figure 56. Fitting Pinion Oil Seal Assembly.

2. Install-the oil slinger, and then fit the pinion oil seal assembly, using Tool No. SE.108 as shown in *Figure 56*. Place the oil seal with the dust excluder flange uppermost (not omitting the oil seal gasket used with the metal case type seal on later mod-els), fit the installation collar SE. 108 and then tighten down the pinion nut and washer to drive the assembly home. Remove the installation collar.

3. Fit the companion flange with dust excluder, washer and pinion nut, tighten, and secure with a cotter pin.

4. Fit the rear cover gasket, renewing it if required, and rear cover, securing same with set bolts and

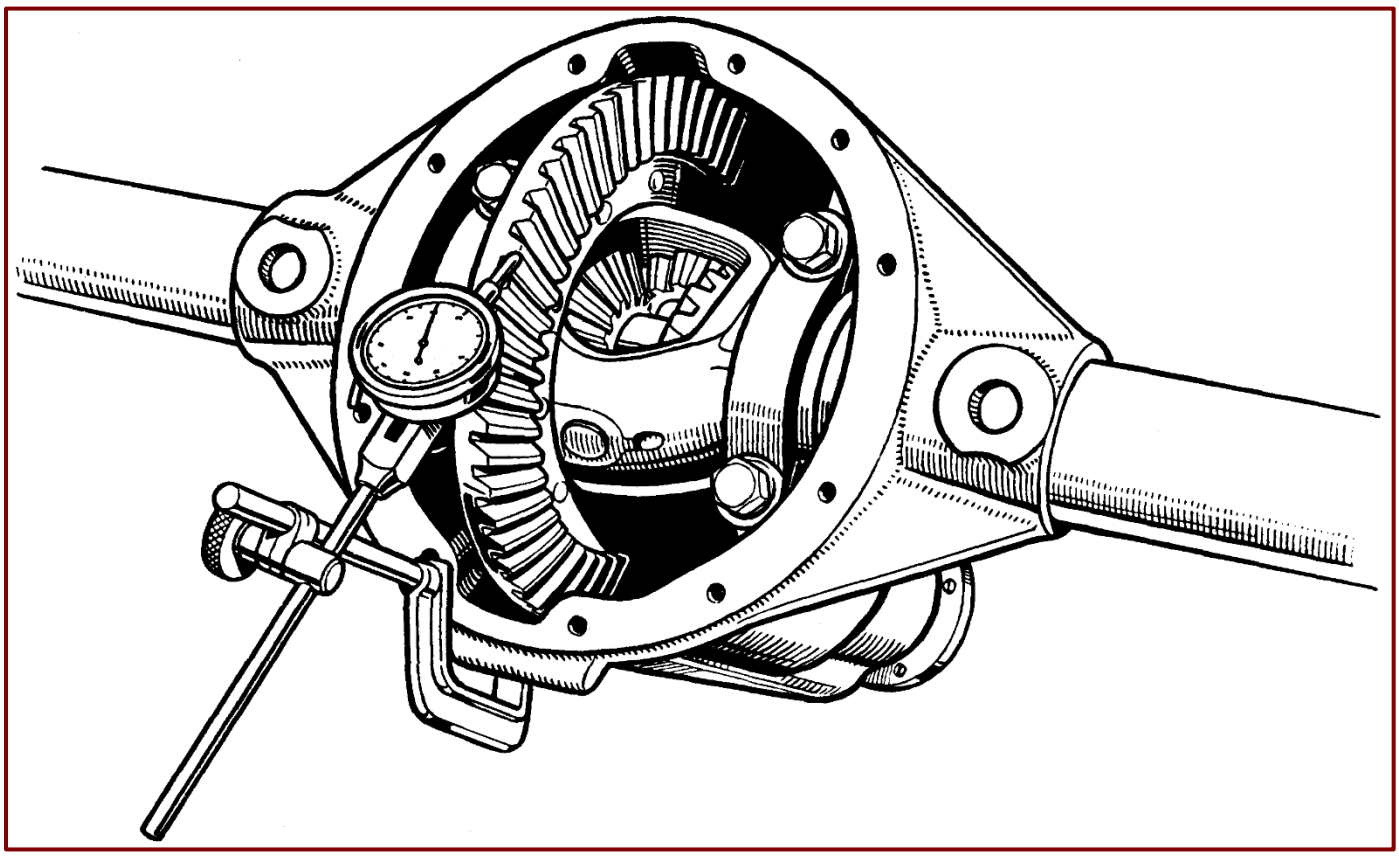


Figure 57. Checking Backlash.

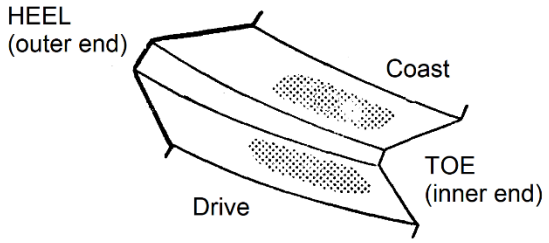
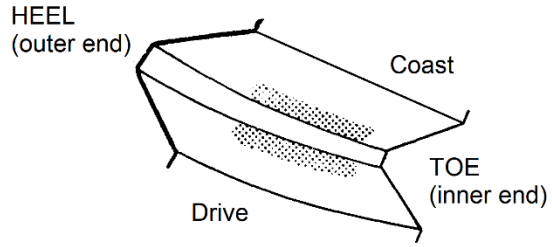
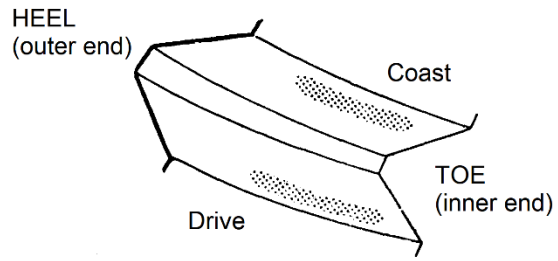
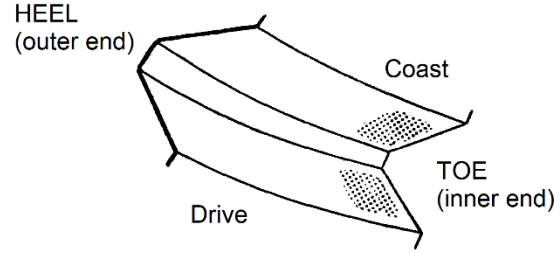
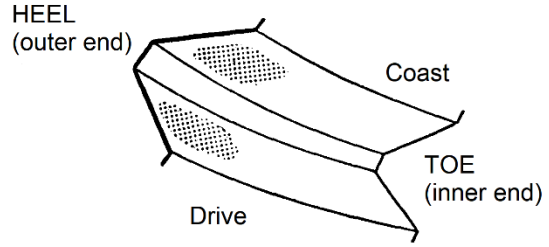
lock washers, not omitting the ratio tag which is attached by one of the set bolts.

5. Re-install the axle shafts and hub bearings, etc., as described under 'To Replace Axle Shafts'.
6. Check that the drain plug is securely tightened, then fill with hypoid lubricant.
7. Replace the filler plug and check that the cover set bolts are tight.
8. Check for oil leaks at the cover, pinion oil seal and where the differential cap bolt holes break through the carrier.
9. Finally, grease the hub bearings.

DATA

Ratio	4·875 : 1
Axle Shaft End Float	0·006"–0·008" (0·152–0·203 mm)
Drive Gear and Pinion Backlash – Etched on Gear	Minimum 0·004" (0·102 mm)
Pinion Bearing Pre-load	8–12 lbs, ins. (9·2–13·8 kg. cm)
Drive Gear Pre-load Shim Allowance	0·008" (0·203 mm)
Drive Gear Bolts – Torque Setting	40–50 lbs. ft. (54·2–67·8 Nm)

TOOTH CONTACT CHART

TOOTH CONTACT	CONDITION	REMEDY
	IDEAL TOOTH CONTACT Evenly spread over profile, nearer toe than heel.	
	HIGH TOOTH CONTACT Heavy on the top of the drive gear tooth profile.	Move the drive pinion deeper into mesh i.e. reduce the pinion cone setting.
	LOW TOOTH CONTACT Heavy in the root of the drive gear tooth profile.	Move the pinion out of mesh i.e. Increase the pinion cone setting.
	TOE CONTACT Heavy in the root of the drive gear profile.	Move the drive gear out of mesh. i.e. Increase backlash.
	HEEL CONTACT Hard on the large end of the drive gear tooth.	Move drive gear into mesh i.e. Decrease backlash *but* maintain minimum backlash.

CHAPTER 7

FRONT HUBS

FRONT HUBS

DESCRIPTION (*Figure 58*)

The integral hubs and brake drums are carried on the stub axles by two ball bearings at each hub. The bearings are located by a nut and screwed insert at the stub axle end, a distance tube between the bearings and a corner spacer behind the inner bearing.

Before Engine No. E0/PB/10594, a hub of slightly different construction (refer to *Figure 60*) was fitted; this did not include a screwed insert.

LUBRICATION

A greaser is provided on the hub, under the wheel cover caps. The hubs should be lubricated every 5.000 miles, see Lubrication chart.

OVERHAUL

To Remove The Hub

1. Jack up and remove road wheel.
2. Remove hub cap, split pin and slotted nut.
3. Remove setscrew on hub neck, then screw out locking ring.
4. Release the brakes fully at the back plate adjusters, and draw off the hub.

To Dismantle The Hub

1. Use a soft drift, through the bore of the hub to drive out the inner bearing, the oil seal will be removed with the bearing.
2. Remove distance tube and press out the outer race. Before attempting this, be sure that the locking ring has been removed.

To Re-assemble Hub

1. Press outer race into position.
2. Screw the race locating ring hard down on bearing.
3. Fit the locating ring setscrew; it may be necessary to drill the locating ring in position. For this operation, a 9/64" (3·572 mm) drill should be used to a depth of ⅝" (15·9 mm) from the outer surface of the hub.
4. Fit the distance tube and inner bearing.
5. Fit the oil seal with a light smear of gasket cement round the oil seal housing.

To Replace The Hub

1 Fit corner spacer to stub axle.

2. Force hub on to stub axle shaft.
3. Fit hub washer and slotted nut. Tighten nut dead tight and do not back-off for split pin, tighten nut to align with split pin hole in stub axle.
4. Fill hub with grease through greaser and fit the grease cover and gasket.
5. Re-adjust front brake.

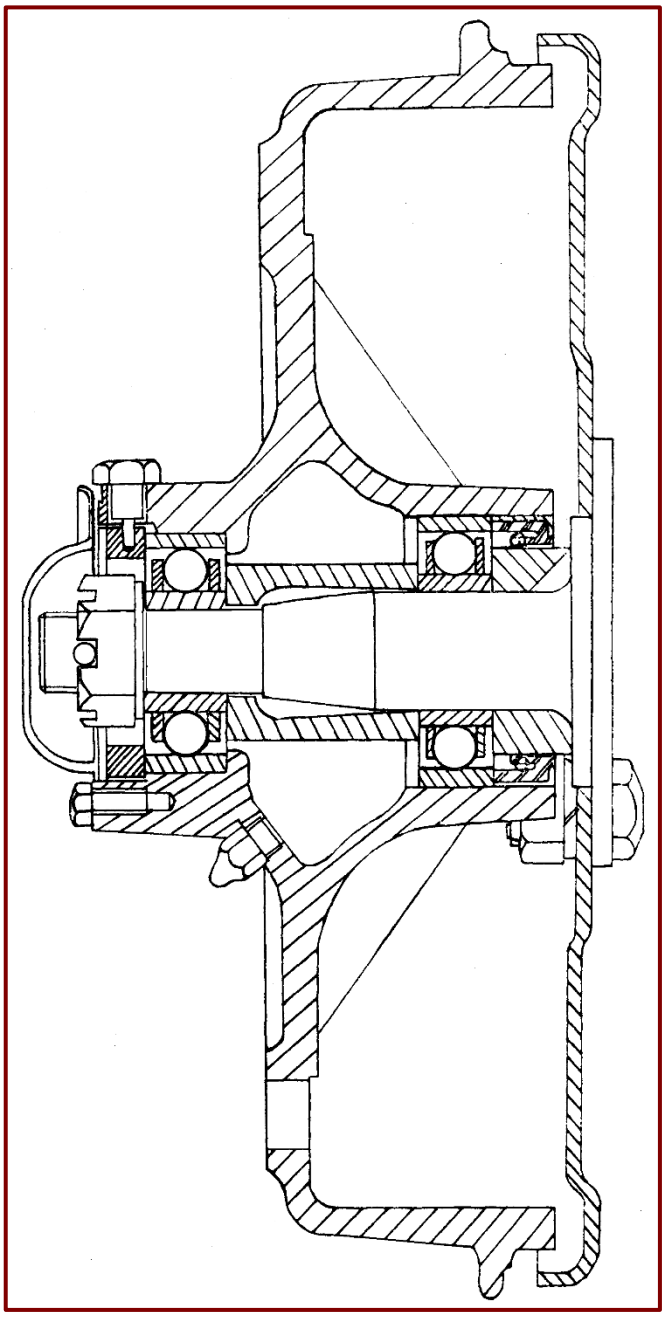


Figure 58. Section Through Hub.

CHAPTER 8

SUSPENSION

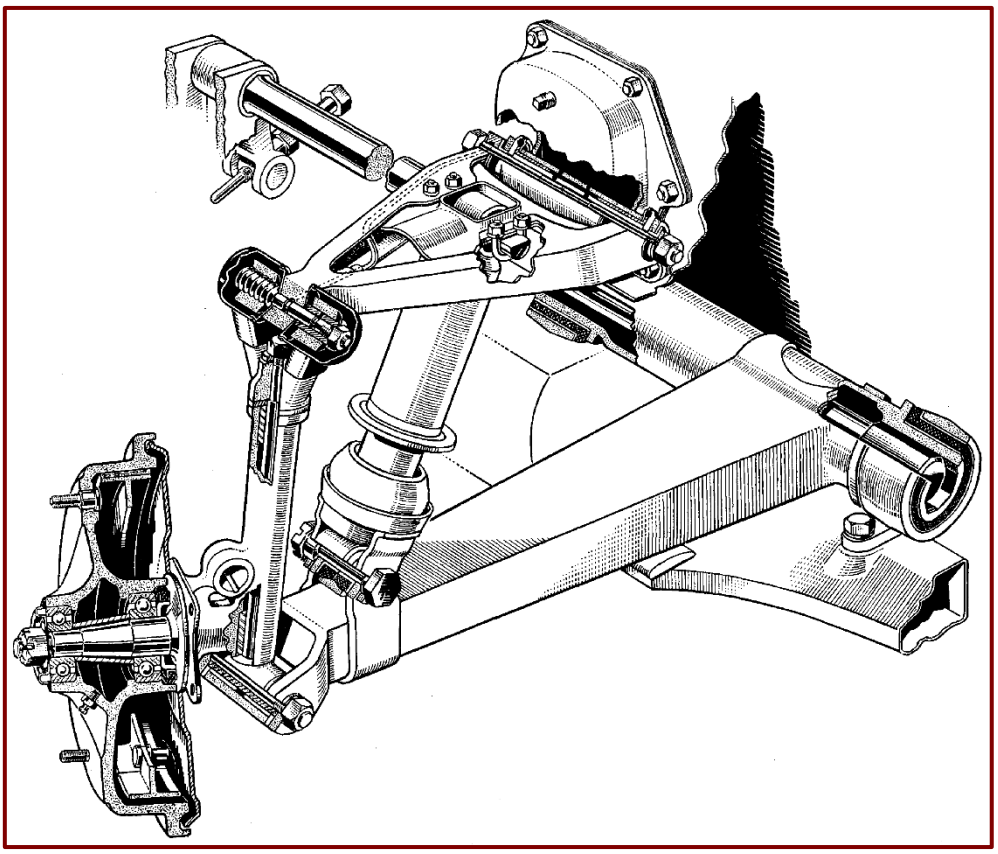


Figure 59. Front Suspension – Before Engine No. E2/PD/21868.

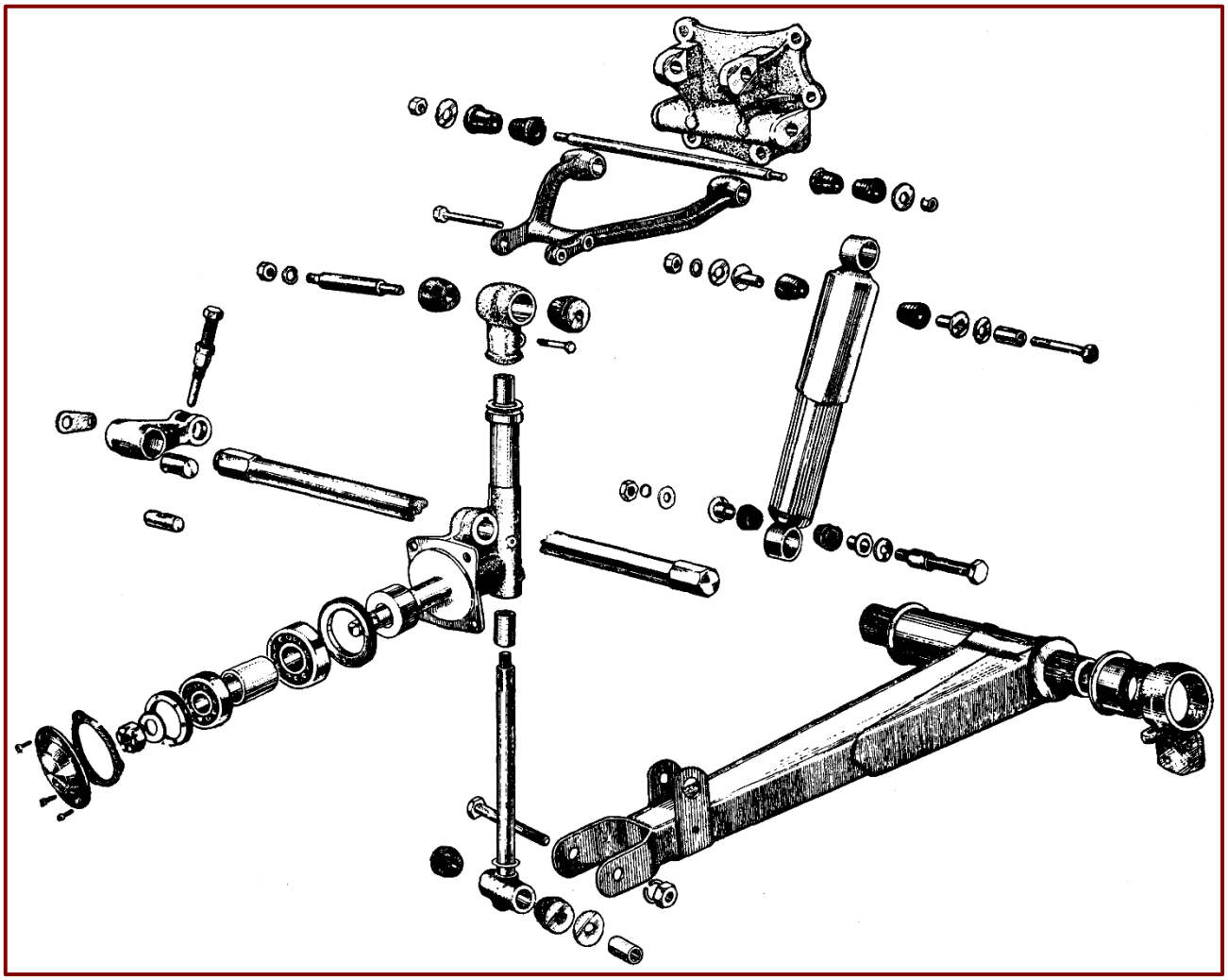


Figure 60. Front Suspension Exploded – After Engine No. E2/PD/21868

DESCRIPTION

On the front suspension each stub axle is carried by a swivel pin suspended between an upper link and spring arm; the spring arm is fitted to a torsion bar which runs along the inside of the frame section. A telescopic shock absorber runs from the upper link to the spring arm.

The upper trunnion pin passes through an oil reservoir on the frame side member (*Figure 59*, Page 60).

After Model Engine No. E2/PD/21868 the suspension is rubber bushed throughout and the upper link assembly is modified to allow the telescopic shock absorber to pass through it and connect with the upper link bracket on the frame side member (*Figure 60*, Page 60).

The rear axle is attached to the frame at each side, by a spring arm at the top, and an axle link at the bottom. The spring arm is fitted to a transverse torsion rod at the frame end. A telescopic shock absorber runs from the axle link pin to the frame structure. A single transverse stay is fastened to the axle tube slightly to the offside and runs to the rear side of the body structure (*Figure 63*).

LUBRICATION

The early type front suspension requires the oil reservoir level checking every 2,500 miles and the swivel pin, upper link pin, and spring arm pin, greasing every 500 miles. On the rubber bushed front suspension, only the swivel pin requires attention (see Lubrication Chart).

The rear suspension requires no lubrication.

ADJUSTMENT

Front Torsion Rods

The following method should be adopted for setting the chassis height, by adjusting the Torsion rod tension.

Stand the car on level floor, and measure the distance from the underside of each frame side to the floor. Measurements should be taken at the front of the gearbox cross member and noted.

Jack up the car, using a jack under the centre of the gearbox cross member, until the wheels are just clear of the ground.

It is important that a wooden protection pad should be placed on the jack pad, to protect the frame member.

Slack off the locating plates at the rear end of the Torsion rods, and slack back the lock-nuts on the adjuster.

Reset the adjuster as necessary, in relation to the measurements previously taken, to obtain a ground clearance of 9¾"–10" (24·78–25·4 cm) at each end of the underside of the gearbox cross member. Lower the jack, and measure the ground clearances again. Jack up and make final adjustments if necessary.

Finally lock up the adjuster locknut and the locating plate.

In isolated cases it may be found that the 9¾"–10" (24·78–25·4 cm) measurement cannot be obtained due to excessive wear on the adjusting bolt spigot or thread. This is normally caused by adjusting with the weight of the car on the road wheels, and it will be necessary either to build up the spigot or to replace the bolt. It should be noted that no wear takes place once the adjusting bolt is locked in position.

OVERHAUL

To Remove And Replace Front Torsion Bars

The torsion rod can be removed with the minimum of dismantling using a special puller (*Figure 61*).

Jack the front of the car until the wheels are clear of the ground.

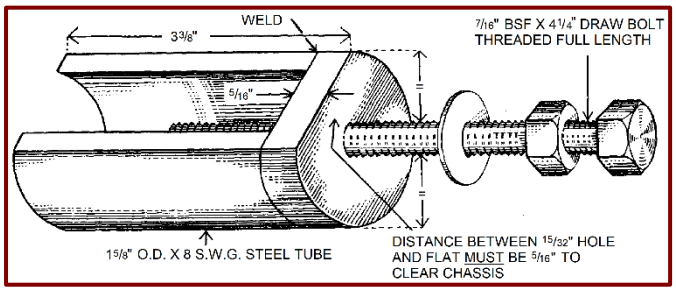


Figure 61. Front Torsion Rod Puller.

Remove the battery and disconnect the midship bearing support from the frame-side, on the side from which the torsion rod is to be removed.

Slack off the torsion rod adjustment completely and remove the locating plate.

Place the drawer in position against the bracket on the frame-side at the rear end of the torsion rod and insert the draw-bolt into the tapping at the rear end of the rod. Draw the rod clear of the Octagons in the normal manner.

Remove the torsion rod to the rear, driving the front end Octagons through the adjusting lever. When refitting set the spring arm against the rebound rubbers, and the adjusting lever against the frame-side, smear the octagonal ends with graphite oil (Loctite 771 Nickel Anti-seize or Permatex 133A Anti-seize) and drive the torsion rod ends into position, taking special care to guide the front end into position, and to make certain that the rod suffers no surface damage. The rod should of course be fitted with the tapped end at the rear.

The locating plate should now be fitted, and the adjusting bolts set so that both frame-side members are 9¾"–10" (24·78–25·4 cm) clear of the ground at the gearbox cross member. (Refer to Torsion Rod Adjustment).

If the torsion rod drawer is not readily available the rod can be removed by driving out to the front, after removing the front apron, disconnecting the front engine mountings and jacking the engine slightly so that the cylinder blocks are clear of the torsion rod line. The rod can also be refitted from the front with the engine in this position. Attention is drawn to the paragraph on 'Handling and Storage of Torsion Rods'.

To Remove And Replace Rear Torsion Rods

To remove either of the rear torsion rods:

Jack up the rear of the car under the frame side members. Remove the rear road wheels and support the rear axle on a jack or stand.

Pull out the rear seat cushion, detach the spring arm from the bracket on the axle, remove the aluminium covers at each end of the torsion rods, and draw off the spring arm which has already been detached from the axle. Drive free the torsion rod (taking care not to drive the rod so far that it fouls against the other spring arm), towards the end from which the arm has been removed

and pull out the rod, from inside the body, moving to one side as necessary to clear. Remove the rubber bushes fitted at each side of the spring arm, replace as necessary. Worn rubber bushes will affect the height of the car at the rear. In an emergency, worn bushes may be turned to regain normal height.

Special attention should again be given to the notes on handling and storage of torsion rods.

When refitting the torsion rod smear the octagonal ends with graphite oil (Loctite 771 Nickel Anti-seize or Permatex 133A Anti-seize) and make certain that the faces of the octagons line up with those in the bracket in the body frame side, before actually driving the rod home, and, also that the faces in the bore of the spring arm line up with those on the rod, when refitting the arm.

It should be noted that the arm can be fitted to the rod in only one position and that no adjustment for tension on the rods is provided.

HANDLING AND STORAGE OF TORSION RODS

When handling the rods, make sure that they are not struck in any way likely to cause damage to the surface. Even a scratch can weaken a rod and exceptional care should be taken when handling.

Extreme care must be taken while welding close to the torsion rods. Electric weld spatter fusion damage will, most likely result in torsion rod breakage. Cover the rods with suitable protection before welding commences.

Should surface damage occur, the torsion rod should be replaced at the earliest opportunity.

Torsion rods in storage should be laid in a felt covered wooden stand, suitably ledged so that each rod is stored separately.

To Renew Swivel Pin Bushes

Remove the road wheel, disconnect and drain off the hydraulic brake pipeline. Detach the swivel pin yoke from the upper end of the swivel pin. Lift the stub axle assembly clear of the swivel pin, saving the thrust washer fitted at the top, and the brass shims fitted at the bottom of stub axle column. Remove the swivel pin, from the spring arm and remove the distance tube.

Draw out the worn bushes from the swivel pin tube, and from the stub axle column, and press in replacements as necessary. Burnish the replacement bushes to size after fitting.

Re-assemble the swivel pin to the stub axle assembly, refitting any shims at the lower end and the thrust washer at the upper end. Fit the assembly to the swivel pin yoke, tighten down, and check end movement of the swivel pin in the column, which should not exceed 0·010" (0·25 mm). If necessary, fit additional shims at the lower end of the column to reduce end movement to less than 0·010" (0·25 mm). On later types various thicknesses of stub axle washer are available, see *Figure 62*.

Check the spring arm distance tube and the pin for wear and replace if necessary. It should be noted that no wear will take place on this pin unless the nut has been loose for some time. Re-assemble the swivel pin tube to the spring arm and tap lightly around the base of the stub axle column before tightening the pin, to make certain that the distance tube and the swivel pin tube are settled correctly. After settling it is most important that the pin and nut are fully tightened. On completing assembly, bleed the hydraulic brake system as described in the Brakes Chapter.

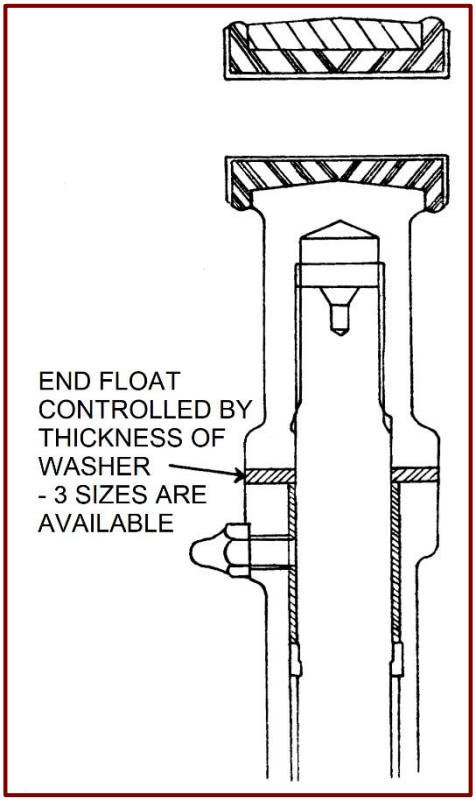


Figure 62. Swivel Pin Lift.

Washer Part Numbers:

J54748	0·1005”–0·0995”
J54749	0·1085”–0·1075”
J54750	0·1165”–0·1155”

To Renew Upper Link Bushes (Before E2/PD/21868)

Disconnect the swivel pin yoke from the pin and support the stub axle assembly so that the brake pipeline does not carry weight. Remove the two ‘U’ bolts securing the shock absorber to the Upper Link.

Detach the upper link bracket from the dash side, taking care to note the number of shims behind the bracket, remove the upper link and bracket assembly, which should be placed in a suitable vice.

Cut the cords securing the rubber seals to the seal washers at the outer end of the upper link, and fold back the seals over the yoke.

Release the nut securing the upper link pin, and screw out the pin. Examine the bush and the pin for wear, and also check that the oil drillings in the pin are clear. Remove and replace the rubber seals if these have perished or are worn.

Check that the seal washers are a good fit against the side faces of the upper link, correct any distortion, or replace if necessary. Examine the side faces of the upper link and clean up if necessary.

Refit the bush. Fit the upper link, and the seal washers between the arms of the yoke with the threaded arm to the rear, and fit the pin threading in to the tapped arm of the yoke. Fit the washer and nut, and tighten up fully, setting the pin as necessary in the yoke so that when the

nut is fully tightened down on the bush the upper link is central between the arms of the yoke.

Secure the rubber seals to the seal washers with cord and if necessary seal the arms of the yoke to the rubber seals with Bostik, or a similar sealing compound.

Now release and remove the trunnion pin, securing the upper link to the upper link bracket, remove and save the sealing sleeves fitted into the drillings in the upper link and the trunnion washers. Remove the trunnion rubber seals. Remove the trunnion tube and renew if necessary.

Draw out the bushes from the bracket, and press in replacements, making sure that the seal retainers are fitted between the flanges of the bushes and the bracket.

Re-assembly is a reversal of the routine detailed above, but the following points should be given attention.

It will ease fitting if the trunnion seals are fitted to the seal retainers first, and the locating pegs in the upper link are removed or driven back before the upper link is fitted to the bracket.

Both ends of the trunnion tube should be slightly proud of the flanges on the trunnion bushes. The sealing sleeves must be a good fit in the trunnion washers.

New trunnion rubber seals should be fitted and the fit and location of the trunnion washers should be very carefully checked. The head of the trunnion pin must be fitted at the rear of the upper link.

The flat on the lubricating tube banjo must engage with the flat on the head of the trunnion pin and the nut must be fully tightened so that the upper link turns as a unit with the trunnion pin and the trunnion tube.

It is of course important that the shims behind the upper link bracket are refitted in their original positions so that the correct castor and camber angle is maintained.

The camber should always be checked as detailed in the Steering Gear Chapter after re-assembly.

To Renew Upper Link Bushes (After E2/PD/21910)

On models after Engine No. E2/PD/21910, the procedure will vary slightly from the above. It will not be necessary to disconnect the shock absorber, and normally the removal of the upper link bracket from the side member will not be required, as the upper link arm is in two halves which can be split, giving access to all the rubber bushes (*Figure 60*, Page 60).

To Remove And Replace Front Spring Arms

To remove a spring arm, slack off the torsion rod adjustment. Remove the pin and distance tube securing the lower end of the column to the outer end of the arm, and the pin securing the lower end of the shock absorber to the bracket on the arm. Support the stub axle assembly clear of the spring arm.

Slack off the clamp bolt at the rear of the spring arm trunnion, and detach the bracket from the frame-side at the front end of the trunnion.

Draw the torsion rod clear of the spring arm by the method detailed under ‘To Remove And Replace Torsion Rods’, draw the spring arm forward, clear of the clamp, and lift out. Alternatively if the engine has already been removed from the chassis, the torsion rod and spring arm can be removed together, by detaching the spring arm, as described above, removing the torsion rod locating plate, driving the torsion rod clear of the rear end octagons, and drawing the rod and arm forward until clear of the chassis.

Check the outer end of the spring arm for excessive wear on the swivel pin and shock absorber drillings, and for any possible distortion.

It should be noted that wear will occur only if these bolts are loose. Check the trunnion bushes for wear and if necessary, drive the spring arm bracket and bush from the front end of the trunnion, and press out the worn bush. Press the replacement bush into the bracket, and press the bracket on to the spring arm trunnion positioned so that the face of the larger of the two arms on the bracket is at approximately 80° to the line of the spring arm.

Drive or chisel off the bush at the rear of the trunnion and press on the replacement, with the flanged end forward.

To re-assemble, reverse the routine outlined for dismantling, with special attention to the following points.

The swivel pin and distance tube must be settled correctly in the outer end of the spring arm, so that the suspension movement is free.

Shock absorber bushes and thimbles should be examined for wear and replaced if necessary.

Set the chassis ground clearance to 9¾”–10” (24·78–25·4 cm) on completion of the operation.

On the later type front suspension, the above instructions generally apply. Rubber bushes are fitted at swivel pin yoke (*Figures 60 and 62*).

TO REMOVE AND REPLACE REAR AXLE

Lift the car to a convenient working height by jacking under the frame-side members, which should be protected with wooden blocks placed between the jack pads and the frame-sides.

Disconnect the rear coupling of the propeller shaft from the pinion joint jaw and support the propeller shaft.

Disconnect the rear brake cable at the rear axle compensator, and the hydraulic brake hose at the tee-piece.

Detach the transverse steady stay from the bracket on the axle casing, remove and save the outer cup and the rubber pad. The pad should of course be examined for wear or distortion and replaced if necessary.'

Detach the shock absorbers and the lower links from the axle. Examine the Silentbloc bush pressed into the bore at the rear ends of the lower links, and the shock absorber rubber bushes for wear or distortion.

Take the weight of the axle on a garage jack, or trolley, detach the spring arms from the brackets on the axle casing, and lower the axle clear of the suspension.

Before refitting the axle, examine the Silentbloc bushes in the brackets to which the spring arms are secured, and replace if worn or distorted.

When refitting the axle, fit the spring arm bolt with the head on the inside. The bolt may foul the body side, if fitted with the head on the outside. Fit the transverse stay washers and thread the stay into the bracket as the axle is being lifted into position. Lever the axle into position so that the torque arm pin, which secures the lower link and the shock absorber, to the axle, can be fitted easily.

Finally nip up all suspension bolts with the weight of the car resting on the axle. Tighten the transverse stay nut to hold the rubbers firmly, without over-compressing.

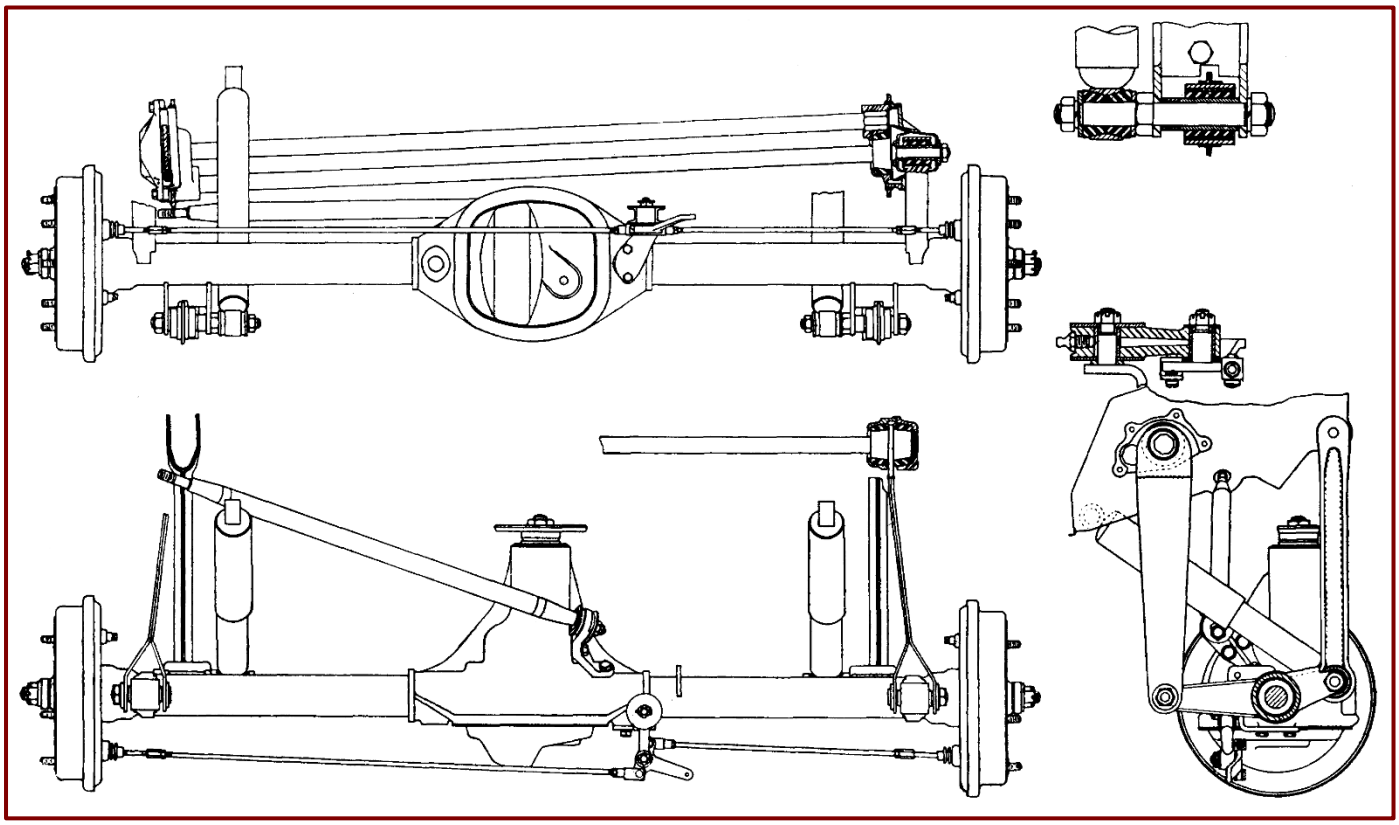


Figure 63. Rear Axle Installation

SHOCK ABSORBERS

DESCRIPTION

The shock absorbers (*Figures 59 and 60*, Page 60) are of the hydraulic telescopic type and give a fluid resistance proportioned to the suspension speed.

Up to Engine No, E2/PD/21868 the upper mounting of the front shock absorbers was by 'U' bolts to the upper links.

With the introduction of the rubber bushed type front suspension at Engine No. E2/PD/21868 the front shock absorbers pass through the upper links and are mounted on the upper link bracket. Owing to the difference in the length of these two types they are not interchangeable.

OVERHAUL

Both types are sealed and should not be dismantled.

CHAPTER 9

STEERING

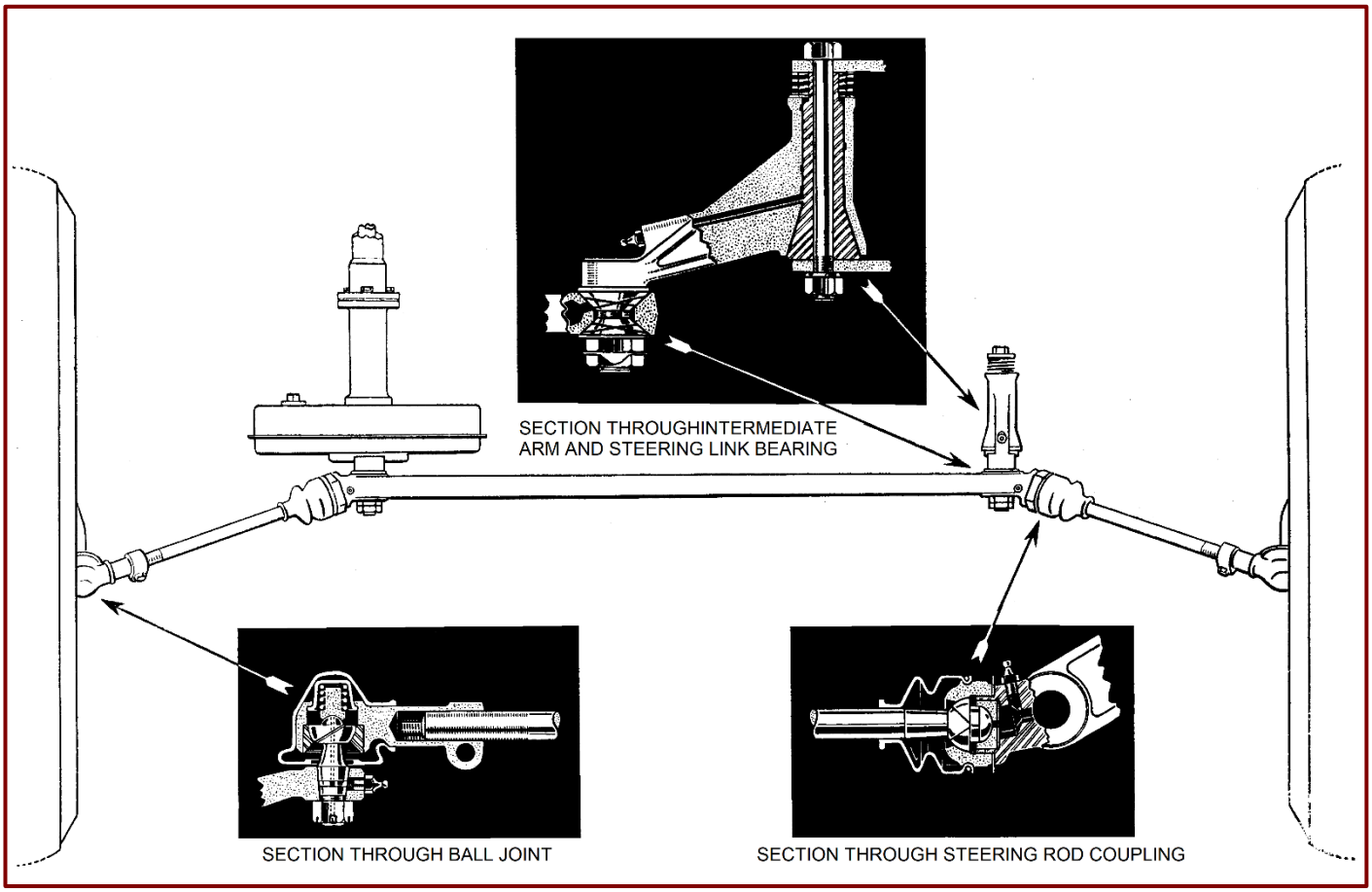


Figure 64. Steering (Old type ball joint, new type illustrated below, Figure 65).

STEERING

DESCRIPTION

Internal gear and pinion steering box assembly (*Figure 69*) with shim adjustment for inner column end float at the flange between the outer column and the box extension.

The steering box casing is a welded assembly, and the steering box arm is riveted to the internal gear. Re-conditioned replacement assemblies can be supplied.

The steering gear consists of a single connecting link, with an intermediate steering arm secured to the left hand side of the body frame, reversed for left hand drive cars, and coupling rods to the steering arms at the road-wheels (*Figure 64*).

Adjustable bearing cone nuts secure the steering box arm and the intermediate arm to the connecting link, and the intermediate arm is pivoted on a bearing cone which is spring loaded.

The coupling rods are secured to the connecting link by ball sockets. Adjustment for play in these sockets is by shims fitted behind the steering rod socket pads.

Castor angles can alter only if damage has been sustained by the suspension linkage, the frame-side member extensions, or the dash side panel assemblies.

Should these angles be found incorrect, it will be necessary to investigate the cause and repair, or replace the damaged part.

Camber angles are controlled by the number of shims fitted behind the upper link bracket.

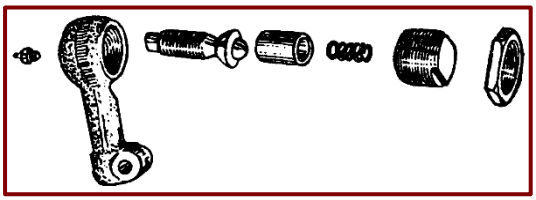


Figure 65. Adjustable Ball Joint.

LUBRICATION

Grease steering linkage every 500 miles, check steering box every 2,500 miles, do not use pressure lubricator on steering box. See Lubrication Chart (Page 5).

ADJUSTMENT

Steering Track And Camber

Camber angle and track should be checked together as the track cannot be checked effectively before the camber is checked, and if necessary, reset.

The following routine is the only satisfactory method of carrying out these checks, and we would emphasise the fact that short cuts should be avoided.

1. Check wheel bearings, upper links, lower links, stub axles and wheel rims for damage, wear, etc., and rectify as found necessary.

   In addition, when checking track, it is essential that the following points are checked for play and adjusted if necessary.

   a) Steering cone nuts and steering rods should move freely in the steering linkage assembly without play.

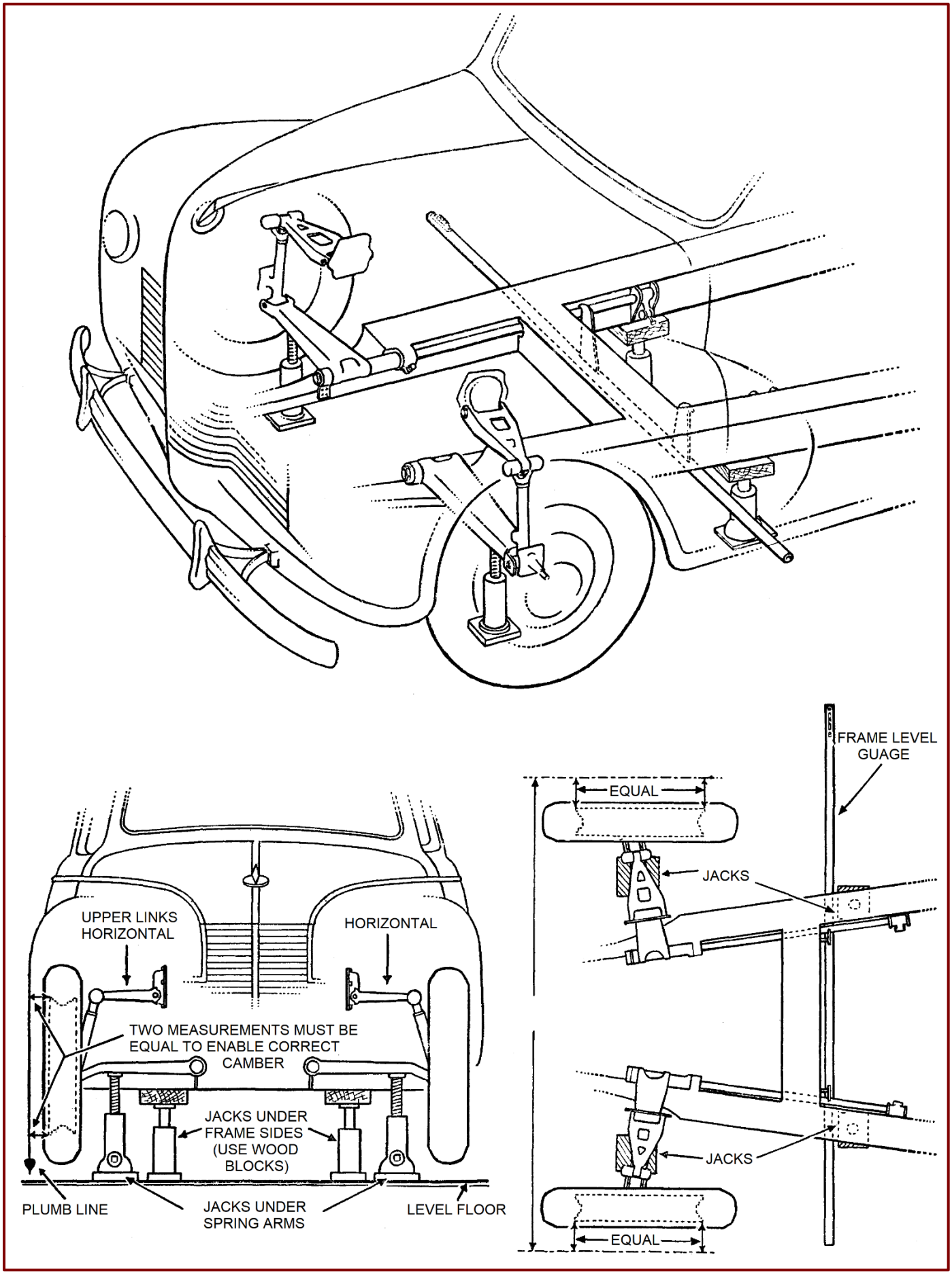


Figure 66. Track and Camber Check.

Step 1. Continued.

b) The lift between the swivel pin and the stub axle should NOT exceed 0·008" (0·20 mm.).

2. Slack off the torsion bar adjusters completely.

3. Set the car level (*Figure 66*, Page 67). To do this, jack up the front of the chassis, using a screw type jack under each frame side member at the gear-box cross member, so that the underside is approximately 9¾" (247·8 cm) from the ground. This distance will, of course, be governed by the adjustment necessary to level the car transversely. The level gauge is essential for this purpose. (Refer to *Figure 67*).

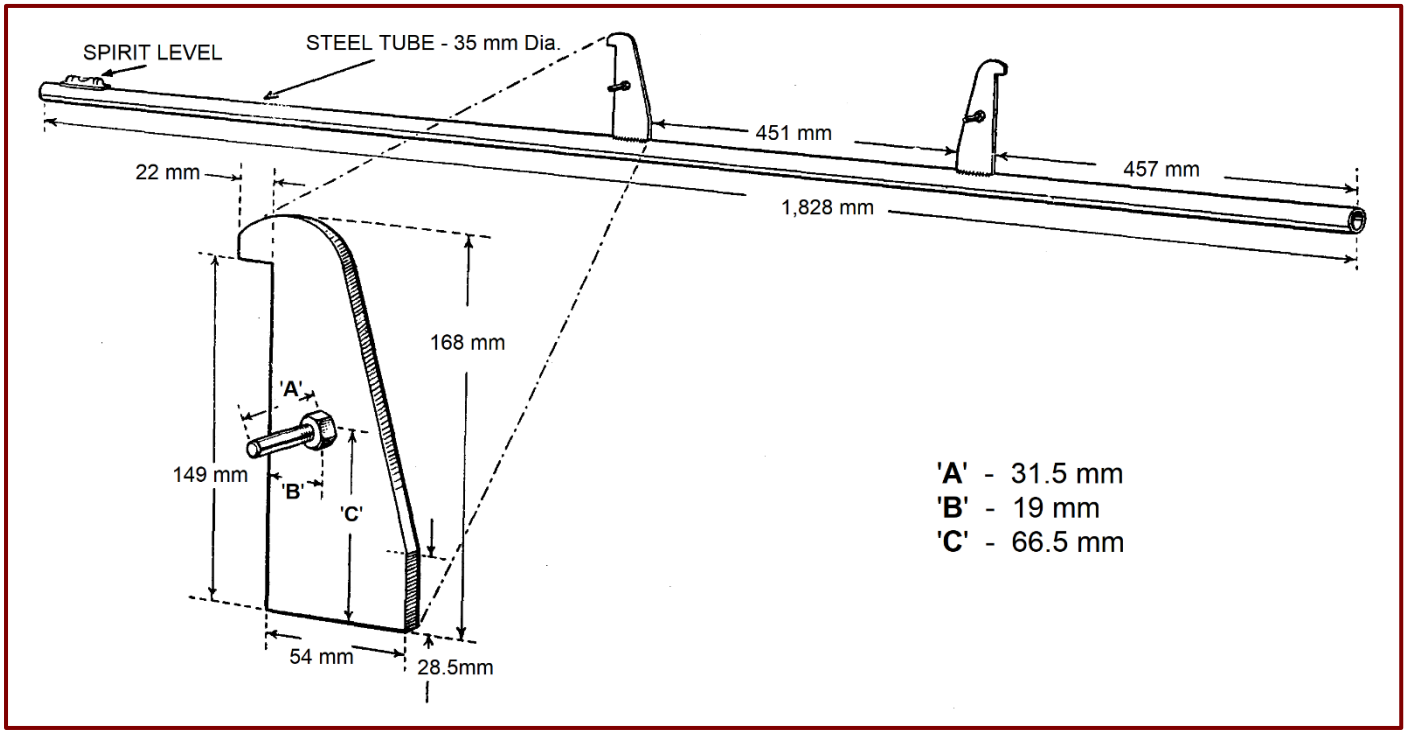


Figure 67. Chassis Level Gauge.

***Figure 67* – Table of Dimensions**

19 mm	¾" (0·75")
22 mm	⅞" (0·875")
28·5 mm	1⅛" (1·125")
31·5 mm	1¼" (1·25")
35 mm	1⅜" (1·375")
54 mm	2⅛" (2·125")
149 mm	5⅞" (5·875")
168 mm	6⅝" (6·625")
451 mm	17¾" (17·75")
457 mm	18"
1,828 mm	72"

To Continue:

4. With the use of screw type jacks, raise the spring arms until they are horizontal. The wheels will now be clear of the ground.

5. Check the camber angle, which should be zero, with the suspension in this position, and the wheels 'straight ahead'.

   The maximum tolerance permissible is:

   VERTICAL to Minus ⅛" (3 mm) or;

   ZERO to Minus 0°–27'.

6. Camber angles may be reset by adding or removing shims behind the upper link bracket.

   Note: All installations require shims.

   As a general guide, it can be taken that removing or adding ⅛" (3 mm) thickness of shims alters the camber angle by 5/32" (3·95 mm) or 0°–35'.

7. Remove all jacks by lifting with a garage jack under the centre of the gearbox cross member. Lower the chassis until, with the wheels on the ground, the spring arms are again horizontal. Set the track dead parallel.

   It is essential that the steering rod assemblies are within 3/16" (4·5 mm) of equal length. This length may be measured between the inner face of the steering ball joints, and the face of the steering ball socket. If this point is not given careful attention the steering assembly will be strained on an extreme lock, also 'kick' on the steering wheel may be experienced.

8. Lock the steering box with the wheels straight ahead. It is essential that the straight ahead position is maintained during the whole of the check. The steering must therefore be locked by some method such as inserting a wooden wedge between the steering box case and the steering box arm. When doing this, special care should be taken to avoid damage to the steering box casing.

9. Raise the car until the wheels are clear of the ground, and remove the front road wheels. Fit the independent tracking equipment in the following manner (*Figure 68*). Remove the grease nipple from the bottom of the swivel pin boss, and thoroughly clean the boss. Fit the pointer and secure with an ⅛" gas setscrew, (or ¼" B.S.F. with rubber suspension) screwed into the greaser drilling. Care should be taken to avoid distorting the pointer by overtightening the setscrew.

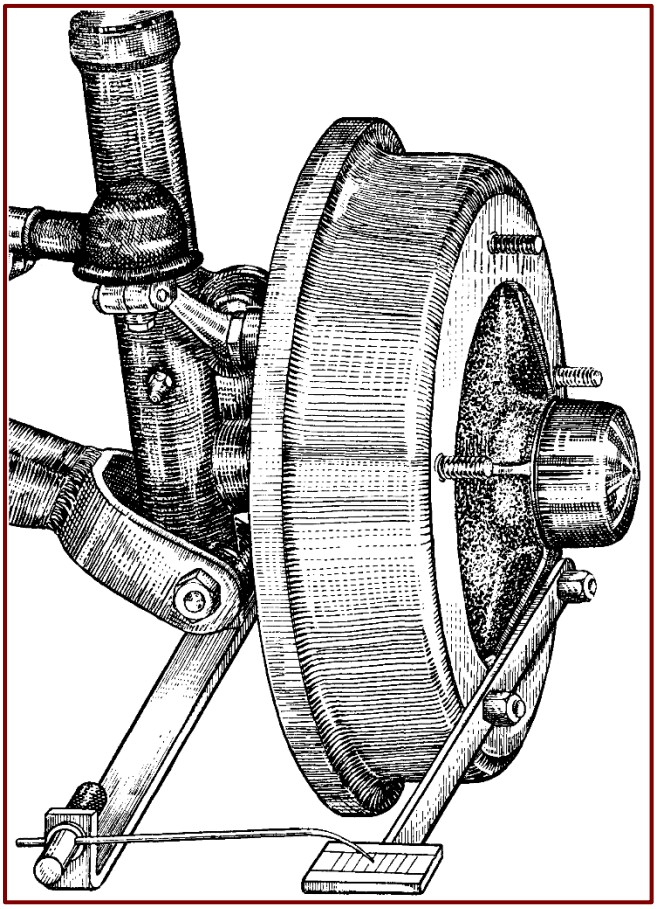


Figure 68. Wheel Track Equipment.

10. Fit the calibrated arm to the brake drum and secure with wheel nuts and tighten the brake adjuster so that the drum is locked and the plate in line with the pointer arm. Set the pointer on the centre mark of the calibrated plate with the spring arm horizontal.
11. Raise the spring arm until the suspension is at maximum bump position (i.e., until the full weight of the car is resting on the front wheel buffer).

    Check the pointer reading in this position.
12. Lower the spring arm until it is resting hard against the rebound buffer on the frame-side, and again note the reading. The maximum difference in readings on the calibrated plate must not exceed 1/32" (0·794 mm). The ideal of course is to have no track variation at all and this should be achieved wherever possible.

    1/32" (0·794 mm) reading on the plate represents a difference of 1/16" (1·587 mm) on each wheel, which in turn represents ⅛" (3·175 mm) difference in track. Should these limits be exceeded it will be necessary to alter the height of the steering ball, either by replacement if the ball joints are the fixed type (taper fit), or by screwing as necessary, if the balls are adjustable.

    For cars with fixed type ball joints, the following steering ball joints to correct track variations can be supplied, assembled into steering ball joint assemblies:

    Standard – 25/32" – Shank Height
    Plus 5/32" – 30/32" – Shank Height
    Plus ¼" – 33/32" – Shank Height

    The following will be found a useful general guide when correcting excessive track variation:

Steering Ball Too Short

a) 'Toe in' at rebound.
b) 'Toe out' at bump.
c) Combination of conditions a) and b).

Steering Ball Too High

d) 'Toe out' at rebound.
e) 'Toe in' at bump.
f) Combination of conditions d) and e).

After checking, and if necessary, correcting on one side, the operation should be repeated on the other side.

13. Finally, reset the torsion rods, refit the greasers and road wheels, remove the wooden block from the steering box, readjust the front brakes, and re-check the overall track. The track setting should be parallel to 1/16" (1·587 mm) toe out.

Most Important

14. After the chassis height has been reset and with the spring arm resting hard against the rebound buffer on the frame-side, check the distance between the steering ball housing and the steering arm which must not under any circumstances be less than 1/16" (1·587 mm), also check that the inner edge of the steering ball housing does not foul the neck of the steering arm ball.

OVERHAUL

Steering Linkage

Adjustment for wear on the steering linkage is provided on the bearing cone nuts at each end of the steering link. To make adjustment, remove the locknut and tab washer, fully tighten the bearing cone nut, and then slack back through 1/6th turn. Fit new tab washers and lock up in this position. Before folding over tabs check that the steering is free. Adjustment is also provided for end movement in the steering rod couplings at each end of the link.

Fold back the rubber cover at the inner end of each steering rod, unscrew the socket, and withdraw the rod from the housing in the end of the link. The steering rod pad can then be removed from the housing and sufficient shims fitted behind the pad to eliminate all end movement, while allowing the coupling to move freely.

It should be noted that stiffness in these couplings does not affect the freedom of steering movement, and that it is therefore necessary to disconnect the ball joint from the steering arm at the brake drum, in order to check the full arc of the rod.

To remove the steering linkage from the car, detach the ball joints at the outer end of the steering rods, from the steering arms, and remove the lock nuts and cone nuts securing the link to the steering box arm and to the intermediate arm. The linkage can now be manoeuvred clear of the chassis.

Steering ball joints are adjusted by slackening the lock nut and screwing the ring retaining nut solid, then releasing quarter of a turn. Should it be necessary to replace these joints the track should be reset, as detailed.

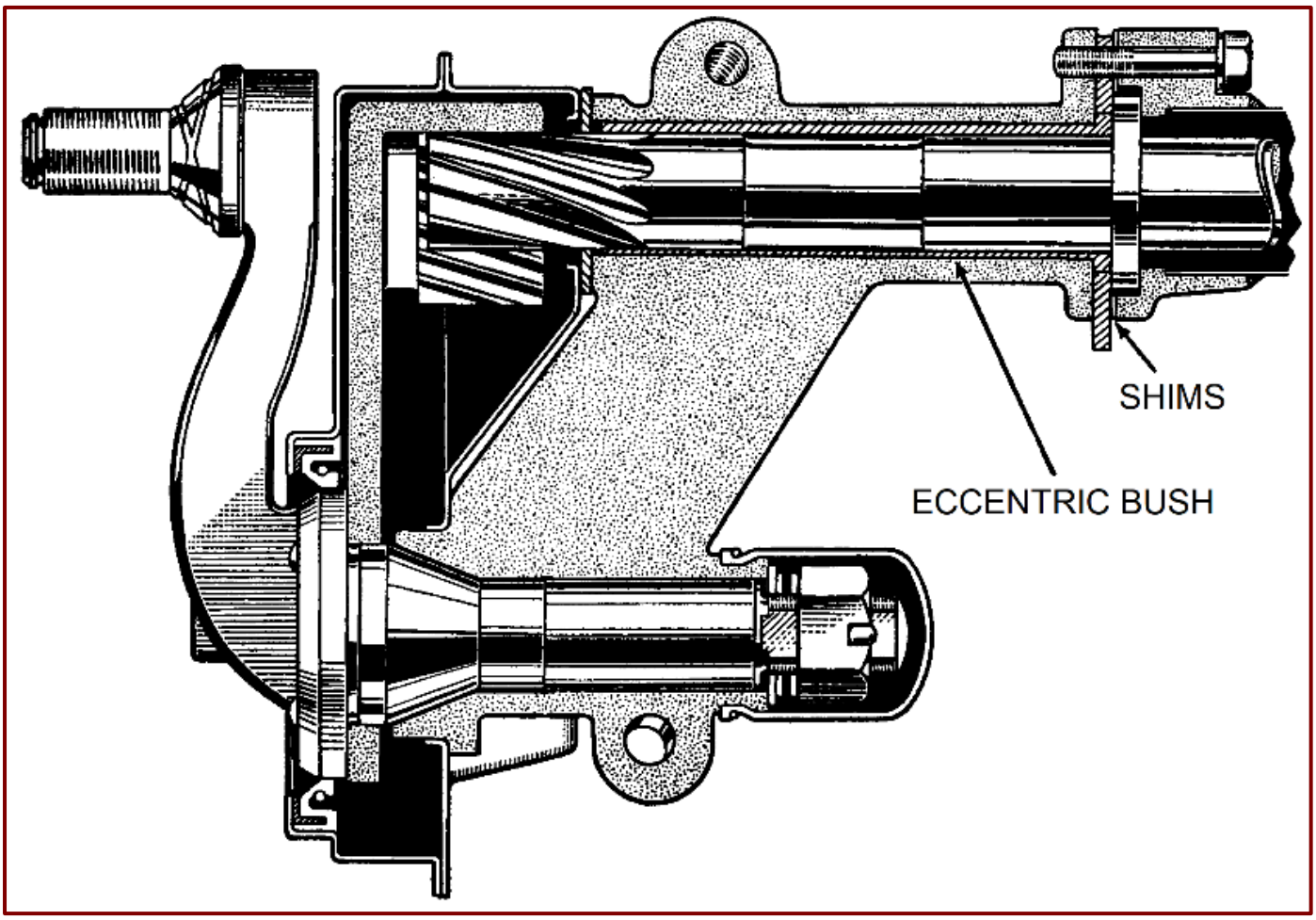


Figure 69. Steering Box Assembly.

With the linkage removed, check the steering intermediate arm for signs of wear or excessive play. The bolt securing the arm to the chassis should be tightened fully so that the bearing cone is nipped up; the arm should move freely without play.

Special Note – Australian Safety Tests

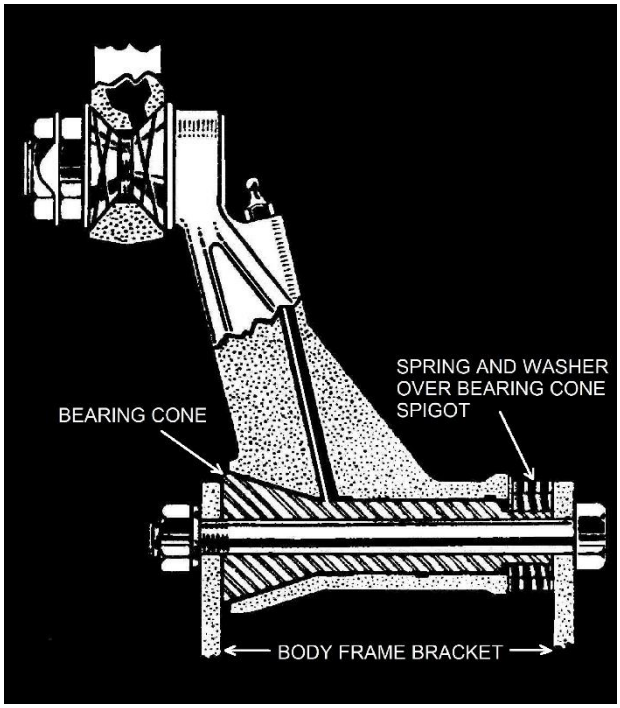


Figure 69a. Steering Intermediate Arm in Section.

During a State road-worthiness check, when the front wheels are clear of the floor, should one wheel be moved by swivelling on swivel pin, 'slack' in the steering linkage may be observed. This movement would feel similar to excessive play at the steering rod sockets. An observant mechanic could observe the intermediate arm moving against the spring. This is normal.

Attempts to rectify 'excessive play', by coil-binding the spring (*Figure 69a*) will render the car, on the road, as being virtually non-driveable due its steering tending to lock up. This matter must be made clear to the vehicle road-worthiness tester.

Steering Column And Box Adjustment

Adjustment is provided, on all cars, for pinion end movement by means of shims fitted between the face of the column and the flange on the box. A flange on the pinion registers with the recess and with the flange. Removal of the shims reduces the end movement of the pinion.

To adjust, release the three setscrews securing the column to the box and also the column 'U' bolt and the gearchange column bolt, lift the column and pinion clear of the box, and remove shims as necessary, to reduce end movement. Check that the pinion can move freely through the full arc of the quadrant before completing reassembly.

An eccentric pinion bush is fitted into the bore of the steering box bracket (after engine No. D9/PA/287l), and a drilled lock washer is keyed into the flange of the bush

and fits between the flanges on the column and the box. To adjust, remove the three setscrews securing the column to the box and turn the lock washer until the best possible meshing is obtained, bearing in mind that if wear has taken place this will be mainly in the centre of the gear, and that adjustment will be limited on each extreme lock.

Adjustment is also provided for steering box arm play. This can be reset, by removing the rubber cover on the top of the arm shaft, removing the split pin, tightening down the nut fully, and slacking back until the arm can move freely. Refit the pin and rubber cover.

STEERING COLUMN AND BOX

To Dismantle The Steering Column

Release the setscrew on the side of the steering wheel hub and remove the horn push assembly, disconnect and remove the horn brush on the side of the column, release the steering wheel nut, and draw off the wheel. Disconnect and remove the accelerator pedal (R.H.D. models only). Release the three setscrews securing the column to the box, and the gearchange column bolt. Remove the 'U' bolt which retains the steering column and gearchange column to the facia panel. The steering column and pinion are now free for removal, and should be lifted upward, so that the pinion clears the box, before moving to the side. Note and save the shims and the locking washer fitted between the flanges on the column and the box.

Remove the pinion downward from the column, check the felt bearing at the top of the column, and replace if necessary, and also check the horn slip ring and its connection.

To Remove The Steering Box

Jack up the front of the car, remove the right hand, (left hand on L.H.D. models), front road wheel, detach the steering, detach the steering ball joint from the steering arm and lift clear. Disconnect the stub axle column and the shock absorber at the lower pins, lift clear, and support, preferably by tying up. Release the bolt and setscrew (through the bottom rear of the upper link bracket) securing the steering box to the dash side, and lower the box, which can then be removed from under the dash side.

It is not normally necessary to dismantle the steering box assembly, as reconditioned units can be supplied and dismantling involves grinding away the welded edge of the box casing, and re-welding when reassembling.

The steering box is filled with oil on assembly, but should be replenished with grease during service. Fill to the level of the plug hole, taking care to avoid air pockets in the grease. It is important that a grease nipple is not fitted to the steering box as air locks will be experienced if this is done.

The eccentric bush can be replaced, if worn. The bush should turn freely in the bore of the steering box bracket.

To Re-assemble Steering Box And Column

Re-assembly of the steering box and column is the reverse of the routine outlined for dismantling, but the following special points should be noted.

When fitting the column to the box, add or remove shims as necessary to eliminate end float in the pinion, and set the eccentric bush adjustment to the best possible meshing position, in both cases allowing the column pinion and the gear to turn easily.

Make certain when securing the column to the facia panel that the column is settled in its normal position, i.e., there must be no side strain whatever on the column.

Check that the horn brush is free to move up and down in its holder, and that the spring is working correctly before refitting the brush holder to the steering column.

Also check that the horn push contacts are clean when refitting the push button.

CHAPTER 10

BRAKES

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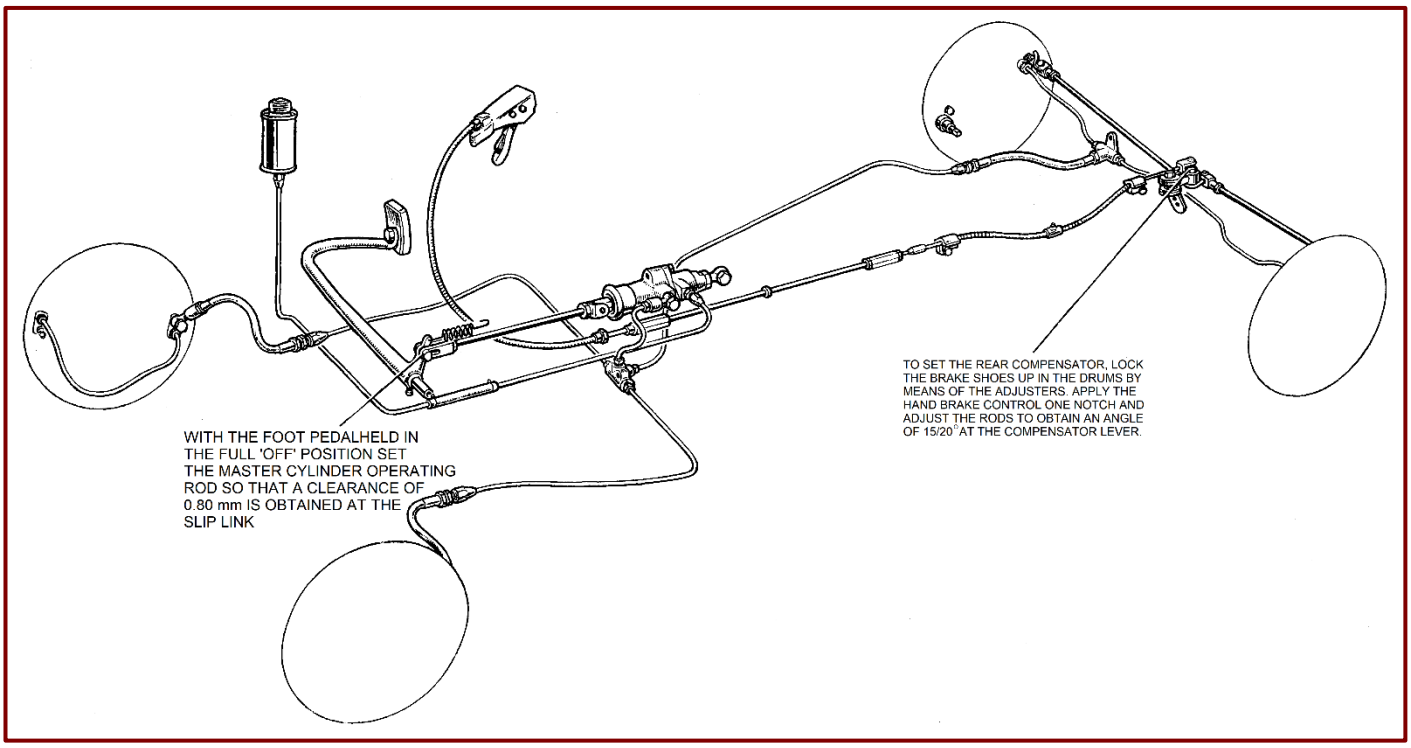

Figure 70. Layout of the Brake System.

BRAKING SYSTEM

DESCRIPTION

The foot brake is directly coupled to a hydraulic master cylinder which operates all four brakes through separate cylinders at each wheel. The hand brake is fully mechanical and operates on the rear wheels only (*Figure 70*).

The front brakes are 9" by 1¾" (228·6 x 44·5 mm) two leading shoe type, and the rear brakes are 9" by 1¾", both brakes incorporate a sliding shoe action. Before Engine No. E0/PB/10594 Girling hydro-mechanical brakes were fitted.

LUBRICATION

The hand brake cable and linkage, together with the foot brake pedal should be lubricated every 2,500 miles.

See Lubrication Chart on Page 5.

MAINTENANCE

The level of the fluid in the brake reservoir should be checked every 2,500 miles.

The brakes should be adjusted every 5,000 miles or if the brake pedal free play becomes excessive.

Shoe adjustment is done individually at each wheel by the single adjusting screw on each rear carrier plate, and the two adjusting screws at each front brake carrier plate (*Figure 71*). Jack up the car at one side until the front and rear wheels are clear of the ground. The two adjusting screws on the front brake are located at the front and rear of the brake carrier plate (*Figure 71*), and are turned with the use of a ⅜" B.S.W. spanner. Spin the wheel in the rotation of forward movement of the car, and at the same time tighten up one of the adjusting screws until the brake shoe rubs and stops the wheel. (Turn adjuster clockwise on both left and right hand brake carrier plate). Then slacken back the adjusting screw until the wheel just spins freely, carry out the same operation on the other adjusting screw at the opposite side of the brake carrier plate.

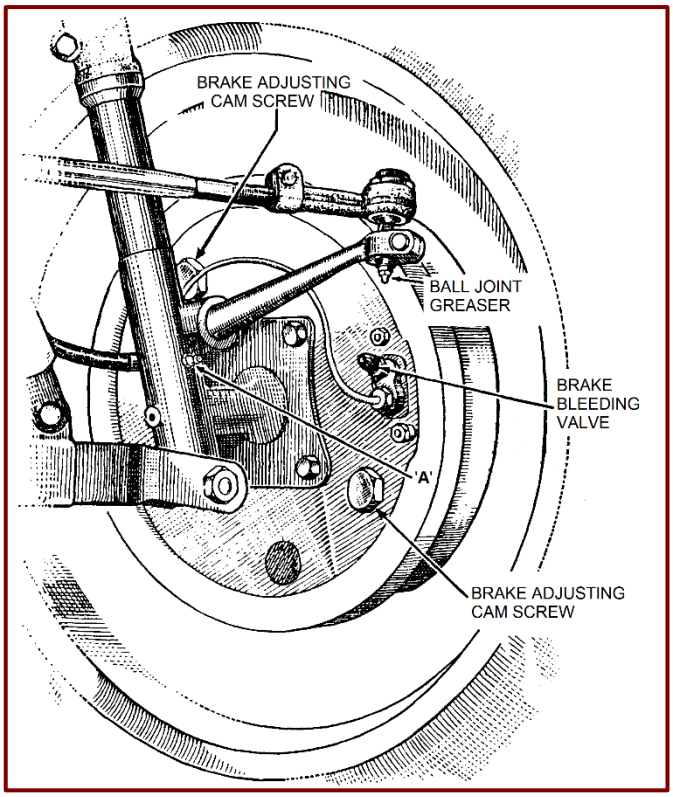

*Figure 71. Front Brake Adjusters. '**A**' – Swivel Pin Greaser.*

In the case of the rear brakes, the adjusting screw is located at the back plate (*Figure 72*) and is turned with the use of an ⅛" B.S.W. spanner. It clicks over notches as it is tightened in a clockwise direction; do this as far as it will go without forcing, until the shoes are binding on the drum. Then slacken off the adjusting screw until the

drum revolves without binding on the brake shoes, releasing two notches is normally sufficient.

Jack the car up at the other side and repeat the above procedure. Brake shoe adjustment should only be done with the drums cold.

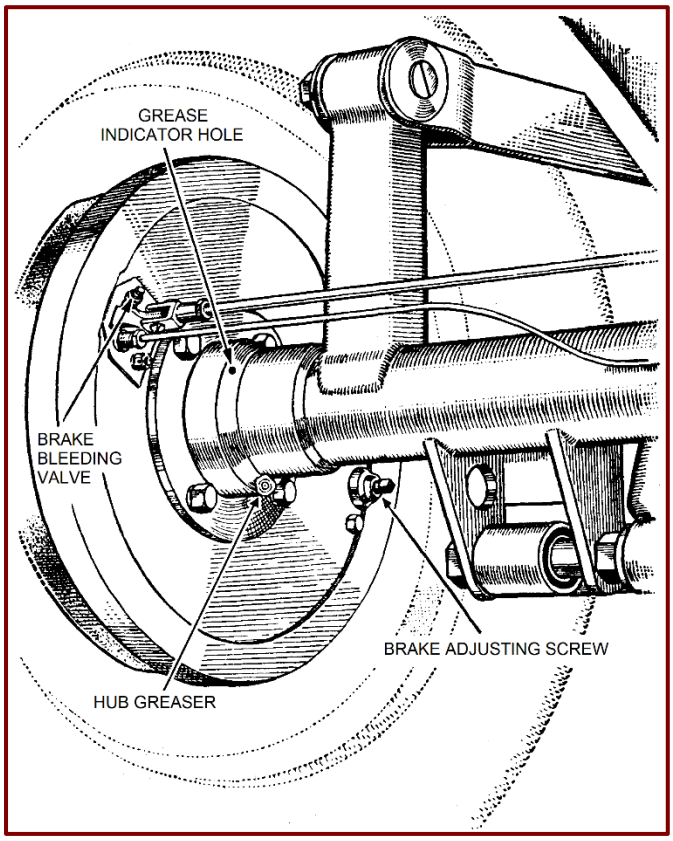

Figure 72. Rear Brake Adjusters.

The handbrake normally requires no adjustment as its setting should be restored with the adjustment of the rear brake shoes. If however, after the latter have been adjusted the handbrake lever can be pulled on hard so that its ratchet clicks over seven or more notches it will be necessary to readjust the setting.

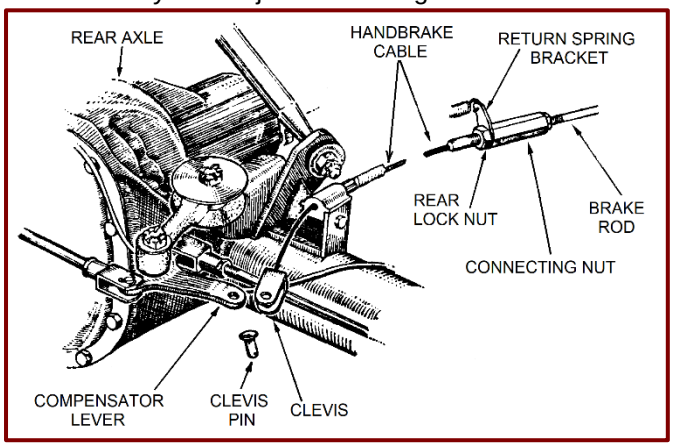

Figure 73. Handbrake Adjustment.

To do this, remove the split pin and withdraw the clevis pin from the clevis connecting the handbrake cable to the brake compensator lever at the rear axle (*Figure 73*). Move the compensator lever forward to take up any free movement in the brake linkage, leaving the lever in this position, move the brake cable and brake rod connecting nut which is situated at the side of the centre universal joint. Slacken off the rear locknut which secures the threaded end of the cable in the connecting nut, and disconnect the return spring. Screw the threaded end of the cable into the connecting nut until the holes in the rear handbrake cable clevis just coincide with the hole in the compensator lever. Replace the clevis pin and test the handbrake, which should click over four or five notches at this setting. Replace the split pin in the clevis pin and tighten the rear cable lock nut positioning the return spring bracket so that the spring pulls in line with the brake cable. Refasten the return spring.

OVERHAUL

To Remove And Replace Master Cylinder

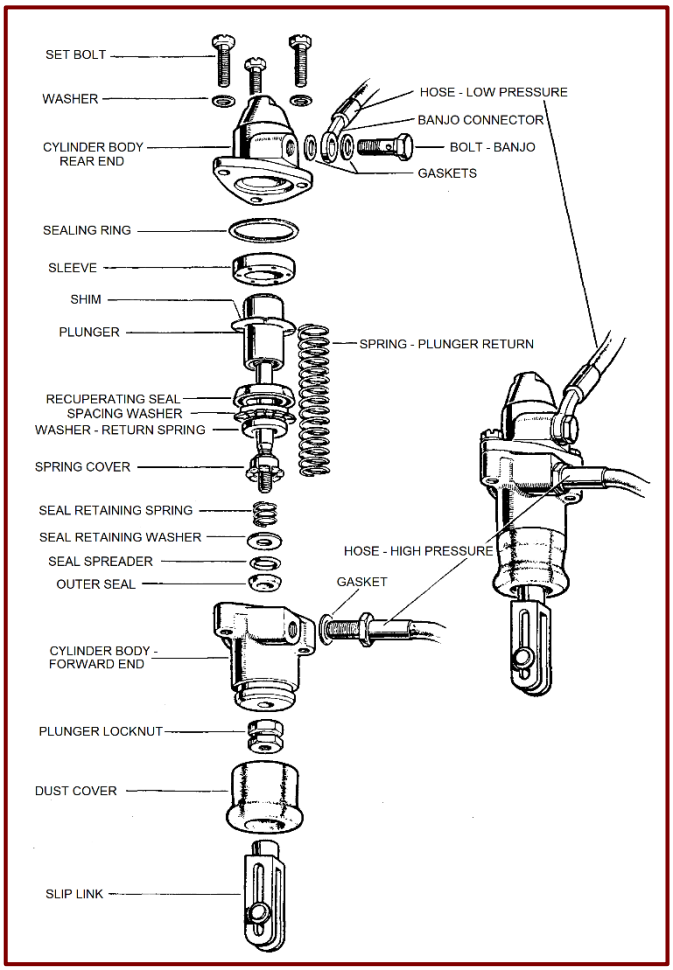

Figure 74. Master Cylinder.

Release the return spring from the master cylinder rod to brake light switch. Disconnect low pressure hydraulic pipe at master cylinder body, and allow the fluid to drain off into a clean container. Unscrew the pressure pipe to the four way union at the master cylinder body. Remove clevis pin and brake pedal so that the master cylinder fork is disconnected from the brake pedal. Release master cylinder rod lock nut and unscrew the rod so that it can be drawn forward through gearbox cross member. Remove the locking nut securing the master cylinder bolt eye to the chassis, and withdraw the master cylinder

Replacement of the master cylinder is a reversal of the above procedure; the brake pedal should be adjusted after replacement of the master cylinder.

To Dismantle The Master Cylinder

Remove the jaw end, locknut and the rubber boot, unscrew the three setscrews joining the two halves of the

body. Remove the plunger complete with the return spring, then withdraw the sleeve with the sealing ring, the steel shim, recuperating seal, seal spacer, spring cover, seal retaining spring and finally washer and seal spreader together with the end seal.

To Re-assemble The Master Cylinder

After thoroughly cleaning all parts with Girling brake fluid or alcohol, place the end seal with lips facing upper-most into the plunger rod end of the body making sure it is correctly seated, followed by the seal spreader with flat side uppermost, then the steel washer, seal retaining spring and cover. The recuperating seal spacer is then placed with flat side first into the recess of the bore in the same half of cylinder, followed by the recuperating seal with back uppermost. Place the steel shim against the back of the seal and refit the sleeve, complete with sealing ring, with relieved side facing upwards. Insert the plunger complete with return spring through the assembly, and screw on the lock nut. Refit the low pressure end of the body with the inlet and the outlet holes on the same side and secure with the three set bolts.

Replace the rubber boot packed with Wakefield Girling Rubber Grease No. 3, followed by the jaw end.

To Remove And Replace Front Wheel Cylinders

Remove brake drums and shoe assemblies. See ‘To Remove And Replace Front Brake Shoes’

Disconnect the front hose at the metal fluid pipe connection, allow the brake fluid to drain into a suitable container. Then screw the hose connection out of the wheel cylinder.

Remove the bridge pipe and the nuts which secure the wheel cylinder to the brake backing plate, then withdraw the cylinder.

Replacement is a reversal of the above operation; the brakes must be bled after replacement of the wheel cylinder.

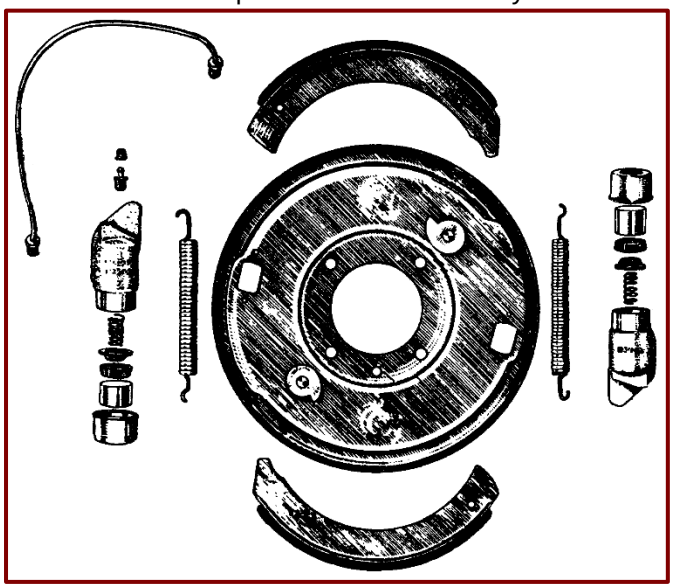

Figure 75. Front Brake Assembly.

To Dismantle And Re-assemble The Front Wheel Cylinders

Lever off the dust cap and allow the piston to be pushed out of the cylinder by its spring. Remove the seal and seal support and pull out the spring. Remove bleed screw nipple, and ball valve.

Re-assembly is a reversal of the above operations; the following points should be noted however:

The rubber seal and inner surface of the cylinder should be examined for scoring or damage.

To Remove And Replace The Rear Wheel Cylinders

Remove the brake drum and shoe assemblies. See ‘To Remove And Replace Rear Brake Shoes’. Disconnect the feed pipe at the wheel cylinder inner connection, and disconnect the hand brake linkage by removing the clevis pin at the brake rod fork. Remove the two Simmonds nuts which secure the cylinder to the back plate. The cylinder can now be withdrawn.

Replacement is a reversal of the above procedure; the following points should be noted:

It is advisable to smear the handbrake components with Girling brake grease. When replacing the cylinder on the back plate smear the portion of the cylinder which comes into contact with the back plate with white grease.

Tighten the cylinder Simmonds nuts and release one half turn to allow cylinder movement to take place when the shoe assembly is automatically centralising itself.

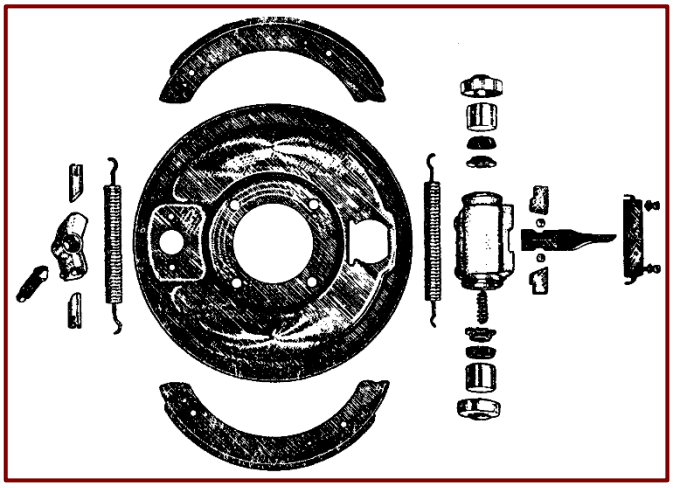

Figure 76. Rear Brake Assembly.

To Dismantle And Re-assemble The Rear Wheel Cylinders

Remove the four machine screws which secure the retaining cover of the hand brake mechanism and remove the two flat tappets together with the two steel rollers and draw link. The wheel cylinder is fitted with two dust covers, two pistons, two seals, two seal supports and one spring.

They should be dismantled in the order given. Remove the bleed nipple and ball valve.

Re-assembly is a reversal of the above procedure.

The condition of the cylinder bore and rubber seals should be examined carefully before replacing. The hand brake mechanism should be lubricated with Girling white grease before assembly.

To Bleed The Hydraulic System

This action is necessary if any air has been allowed to enter the system.

Top up the fluid reservoir, remove the rubber cap from the left hand rear brake bleed nipple, fit a bleed tube and immerse the free end in a clean jar containing a little Girling brake fluid. Unscrew the bleed nipple about three quarters of a turn, then operate the brake pedal with full

slow strokes until the fluid enters the jar completely free of air bubbles. Then during a downward stroke of the brake pedal tighten the bleed nipple; no excessive force should be used when tightening the bleed screw. This procedure should be carried out at every brake, finishing at the wheel nearest the master cylinder. It is most important when carrying out the bleeding operation to keep the fluid reservoir topped up otherwise air will enter the master cylinder. Never use the fluid which has just been removed from the system until it has been allowed to stand for at least 24 hours.

BRAKE ASSEMBLIES

To Remove And Replace The Front Brake Shoes

Jack up the car and remove the road wheel and brake drum, see 'Front Hub' Chapter. Lift one shoe out of its abutment slot and allow the return spring to contract. The end of the return spring can then be slipped out of the holes in the shoe and the back plate. Each shoe should be removed in this manner. It is advisable to place a rubber band round each wheel cylinder in in order to prevent the cylinder expanding. The adjuster should then be turned to the fully off position.

When replacing the shoes the swan neck ends of the springs should go through the holes in the back plate.

Each shoe should be replaced independently. The brake shoe steady rests should be smeared with Girling brake grease before assembly. The brakes should be readjusted.

To Remove And Replace The Rear Brake Shoes

Jack up the rear axle, remove the road wheels and remove the brake drum as detailed in the 'Rear Axle' Chapter. Lift one shoe out of the slot in the adjuster link. Both shoes can then be removed. When replacing the. brake shoes the shorter return spring is fitted at the adjuster end of each shoe, and the springs when fitted should be between the shoes and the back plate. Locate one shoe in the adjuster and expander slots and prise the other into the correct position. The steady rest and shoe ends should be lubricated with Girling brake grease.

To Reline The Brake Shoes

Should it not be possible to fit Girling 'factory lined' replacement shoes, the shoes may be relined as follows:

1. Remove rivets by chipping off burred over end of rivets and punch rivets through shoe; care should be taken not to damage the shoe.
2. Clean shoe thoroughly and smooth off face of shoe with fine emery.
3. Fit replacement lining to shoe by aligning the holes of the lining with those in the brake shoe. Fit centre rivets first, rivet over and fit remaining rivets by working outwards to each end of the shoe. Extreme care should be taken to keep the lining free from oil and dirt.

CHAPTER 11

BODY

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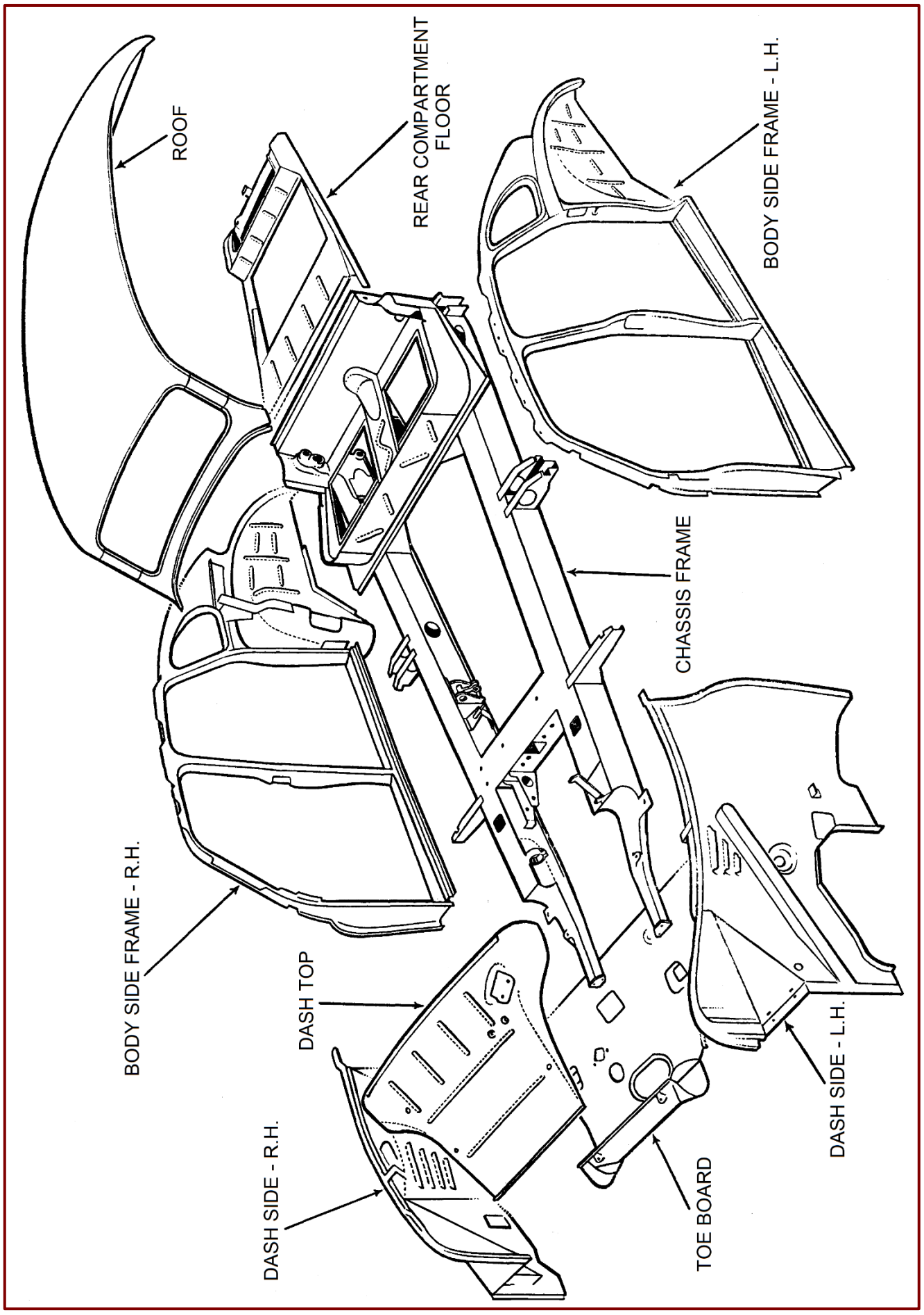

Figure 77. Chassis Frame and Body Structure.

DESCRIPTION

The Body and Frame are an integral unit of welded steel construction (*Figure 77*). The frame consists of a side member and body side frame assembly sections linked by the box section cross member, the front end panel assembly, and the rear seat floor pan assembly, and stressed by strainers running across the roof.

Jacking Points

Using the Stephenson Jack supplied in the tool kit, the car can be raised by inserting the jack into the socket immediately below the centre door pillar on each side.

Using a Loway (garage) Jack, the car can be lifted by placing 'the jack pad under the frame side members, or under the box section cross members. It is advisable to use a timber protection pad at least 12” (30·5 cm) long between the frame members and the jack pad.

ADJUSTMENTS

Side Doors

Adjustments can be made to the fit of the doors by slackening off the setscrews securing the door hinges to the centre pillar and moving the hinge in or out as necessary. Adjust to obtain a snug fit at the top or bottom of the door by placing a block of wood wrapped in felt, between the door edge and the lock pillar, and by springing the door as necessary.

Luggage Boot Door

Provision is made for resetting the fit of the luggage boot door. The bolt holes, through which the hinges are secured to the door and the body, are elongated so that adjustments can be made as necessary. The tension on the luggage boot door support catch can also be adjusted, by slackening off the setscrews which retain the catch to the body, and moving the catch assembly forwards or backwards as required. The two holes in the luggage boot locker striker plate are elongated and where adjustment is required for the correct closing of the door, slacken off the two setscrews and move the striker plate in the required direction until the correct setting is obtained and the boot door is firmly closed.

Side Door Lock Striker Plate

The two holes in the striker plate are elongated to allow for side movement. Adjustment can be made by slackening off the setscrews, securing the striker plate to the door pillar and moving the striker plate in the required direction until the correct setting is obtained when the side door is firmly closed.

Tongued Dovetails

Where the fitting of the tongued dovetail is found to be out of line with the grooved dovetail, adjustment can be made by fitting the required type from the three available for selection.

If only part of the width of the tongued dovetail is found to be bearing on the faces of the grooved dovetail, shims can be fitted under the tongued dovetail on the side door until the required width of bearing face has been obtained.

Bonnet

1. Horizontal adjustment of the bonnet fit can be made by slackening off the setscrew securing the hinge to the bonnet, and moving the setscrews and the elongated holes in the hinge. Vertical adjustments can be made in the same way on the arm of the hinge fitted on the dash side.
2. Adjustment for the correct fit of the bonnet catch assembly to the bonnet catch bolt can be made, by releasing the four setscrews securing the bonnet catch assembly to the bonnet and moving the catch assembly backwards or forwards until the bonnet catch operates correctly.
3. The bonnet catch bolt located on the radiator grille opening frame can be adjusted by releasing the locking nut and raising or lowering the bolt until the required height has been obtained to enable the bonnet to close firmly.

Door Check Arms

1. Remove the door handle, the window regulator handle and the door trim pad.
2. Extract the split pin which retains the rubber buffer and flat washer to the arm.
3. The check arm is drilled so that the required door opening can be obtained by fitting the split pin into the drilling at the required position.

Side Door Hinges

Release the tab washer on the centre pin nut and tighten the nut to compress the spring until all play is, eliminated without excessive binding on the bearings. Should the required adjustment be unobtainable, a new hinge should be fitted.

SERVICE OPERATIONS

To Remove Windscreen (Toughened Type)

1. Remove the rear view mirror, the interior finish moulding, the trim piping and the beading at each side of the screen, and also the wooden tacking rail.
2. Release the chrome windscreen finish moulding by sliding back the centre space cover, on the top edge, using a rubber block or a similar tool. Ease the moulding out of the rubber at the top centre edge and gradually follow round, taking care not to distort the moulding.
3. Ease the rubber moulding off the body frame and tap the screen inwards, with the palm of the hand, towards the inner recess.
4. As the screen moves inwards, work gradually round the outside edge until the screen drops into the inner recess. Insert a lever between the body frame and the outside edge of the screen, and lever out of the recess towards the inside of the car.

To Replace Windscreen

1. Fit the rubber moulding round the edge of the screen, noting the positions of the five ‘pop marks’ which indicate the lower edge of the screen. Place a length of stout cord in the outer groove of the rubber moulding, to meet at the bottom centre with two loose ends, at least 6” (15 cm) long.
2. Apply soft soap liberally, on the surface of the rubber moulding near the groove which fits over the body frame lip. Place one end of the screen into the frame recess, and lever the opposite end over the inner frame lip into the recess. Lift the two

loose ends of the cord over the outer lip of the body frame, and leave resting on the cowl.

3. Two men are now needed. Press the screen and rubber, from the inside, against the outer lip of the frame and lift the edge of the rubber over the lip by pulling one end of the cord towards the middle of the screen. Follow the rubber all the way round, pulling the cord steadily towards the middle of the screen.
4. Now seal the moulding by inserting Expandite Seelastik (trowelling grade) or a similar sealing compound, between the body frame and the rubber moulding, and between the windscreen and the moulding.

To Remove Windscreen (Laminated Type)

1. Remove the interior rear view mirror, and the windscreen interior finish moulding.
2. Remove the two moulding clips at the top and bottom centres of the outside finish moulding and with the use of a scribing tool inserted between the adjacent inner lips of the finish moulding. Ease it out of the weatherstrip for the full circuit, care being taken not to damage the weatherstrip. The finish moulding can now be lifted clear of the weatherstrip.
3. Locate the butt joint of the lace wedge fitted in the groove in the weatherstrip under the finish moulding, release one end of the lace wedge and carefully remove by pulling out of its location in the weatherstrip for the full circuit.
4. At this stage, obtain the assistance of a second operator to steady the removal of the windscreen from outside the car and carefully press the upper edge of the windscreen glass, from the inside of the car, out of its location in the weatherstrip.
5. The windscreen glass can now be lifted clear of the lower channel in the weatherstrip from outside the car. Remove the weatherstrip from its location on the flange of the windscreen body opening

To Replace Windscreen (Laminated Type)

1. Before fitting the windscreen, straighten out all dents which may be found on the flange of the windscreen body opening, and clean up any uneven portions of the edge of the flange.
2. Inject a small quantity of Expandite Seelastik into the groove in the weatherstrip which fits over the body windscreen flange.
3. Fit the weatherstrip to the body windscreen opening with the two ends of the rubber strip overlapping at the centre of the body lower windscreen flange. After ensuring that the weatherstrip is firmly in position over the body windscreen flange, cut away the surplus strip at the bottom centre joint leaving an overlap of ½" (12.7 mm). Repeatedly press the rubber weatherstrip on to the body windscreen flange until the overlap is taken up and a butt joint can be formed. Any slight ripples which may now be left in the weatherstrip will straighten out when the windscreen is fitted.
4. Apply liquid soap to the front inner edge of the weatherstrip which will allow a 'skidding' action as the windscreen glass is fitted into position.

   At this stage it is essential that two men are employed on the actual fitting of the windscreen, one man being required to support and guide the windscreen, while the other man manipulates the lip of the weatherstrip over the edge of the windscreen with the use of the 'lipping' tool.
5. Position the lower end of the windscreen glass into the channel of the weatherstrip, from the outside of the car, and with the use of the lipping tool, gently work the edge of the weatherstrip over the edge of the windscreen, around the full perimeter, taking care that no undue pressure is exerted on the windscreen, and that a steady progressive 'lipping' movement is maintained to avoid fracture of the glass, particularly at the corners.
6. Apply liquid soap into the 'lace wedge' groove of the weatherstrip and smear the lace wedge.
7. Thread one end of the lace wedge through the wedging tool and allow two or three inches of the end to protrude past the wedging end of the tool. Place the protruding end of the lace wedge into the weatherstrip lace wedge groove three inches from the weatherstrip butt joint. This end should be held firmly by one operator. Position the wedging tool with the toe end of the tool pressed well into the lace wedge groove. In this manner, proceed around the full weatherstrip. When the circuit has been completed, cut off any surplus of the lace wedge and form a tight butt joint.

   To ensure that the lace wedge is seated correctly in its groove after it has been fitted with the wedging tool, proceed with the rolling tool which should be positioned with the roller over the surface of the lace wedge and rolled firmly around the full circuit.
8. As the finish moulding is left slightly longer than required, it will be found necessary to cut off approximately ¼" (6.350 mm) from each end of one half section of the moulding. Apply liquid soap to the outer face of the lace wedge and adjacent lips of the weatherstrip. Fit the finish moulding to the weatherstrip with the outer edge inside the outer lip of the weatherstrip.
9. Leave the inner lip of the weatherstrip over the inner edge of the finish moulding by inserting the scribing tool and running it carefully around the full circuit.
10. Fit the two moulding clips to cover the points of the windscreen finish moulding at the top and bottom centres of the weatherstrip.

To Remove Rear Window And Quarter Lights

The method for removing the rear window follows very closely the routine for removal of the windscreen.

It is necessary to remove the interior moulding, slide the spacing cover back on the chrome moulding and ease it out the moulding. The rubber moulding can then be eased over the metal lip of the body.

To remove a rear quarter light, lift clear the interior moulding, and after removing the screws press the window inwards.

To Replace the Rear Window and Quarter Lights

When refitting the rear window and quarter lights, reverse the procedure for removal; the following special points should be noted. When refitting the window a good seal should be made between the rubber and glass, and the body frame.

To Remove Side Door Windows

1. Remove the window regulator mechanism and remove the door inner moulding.
2. Lower the window and at the same time turn the window at the top in the direction of the inclined side until clear of the runners.
3. Raise the window and withdraw from the side of the upper opening in the door.

To Replace Side Door Windows

To replace the window, reverse the operations for removal. If a new window is being fitted the following additional procedure will be necessary:

1. Remove the channel from lower edge of glass and thoroughly clear out the channel.
2. Fold a new rubber strip (1½" x 3/32"), cut to the same length as the channel and place equally over the lower edge of the glass.
3. Fit the channel over the rubber strip on the glass ensuring that the runners are positioned on the correct side.
4. With the use of a rubber mallet, carefully tap the channel over the rubber strip and trim off any surplus rubber strip protruding above the edge of the channel.

To Remove Side Doors

1. Remove the interior door handle, the window regulator handle and door trim pad.
2. Withdraw split pin on the inner end of the door check arm and remove the flat washer and rubber buffer.
3. Remove the counter sunk setscrews securing the top and bottom hinges to the door and lift the door clear of the body.

To Replace Side Doors

Replacement is a reversal of the above procedure and adjustment should be carried out as described under the adjustment section.

To Remove Side Door Hinges

Two double type hinges support both front and rear doors from the body centre pillar. It is recommended that when hinges are removed complete, both front and rear doors are removed. Then remove the six setscrews securing the two hinge centre supports to the body centre pillar, from the front door side of the centre pillar and withdraw the hinges.

Replacement is a reversal of the above operation; adjustment should be carried out as detailed in the Adjustment Section.

To Remove Side Door Handle Lock

1. Remove door handle.
2. Extract the securing pin by punching out at the handle side of the lock housing.
3. Place the key into the lock and turn the key one quarter of a turn and with the key in this position withdraw the lock from its housing, then the lock plunger.

To Replace Side Door Handle Lock

This is generally a reversal of the above operations and the following points should be noted when reassembling.

Smear all faces of the lock plunger and the round face of the lock with grease.

To Remove Side Door And Window Regulator Handles

1. To remove the inside door handle and window regulator handle, press back the collar fitted next to the handle and extract the pin from the boss of the handle.
2. Withdraw the handle, crown, base and spring from the square section spindle.
3. To remove the outside door handle, remove the counter sunk setscrew under the handle lever and the nut on the inside edge of the door panel.

Replacement is a reversal of the above procedure.

To Remove Window Regulator Mechanism

1. Remove the door lock handles, the window regulator handle and the door trim pad. Remove the four setscrews securing the regulator mechanism to the door inside panel.
2. Lower the door window until the lower edge is accessible through the regulator handle apertures in the door inside panel.
3. Using a screwdriver through the aperture, slide the window support stay of the regulator mechanism off the two runner sections on the channel attached to the lower edge of the window.
4. The mechanism can now be lowered and removed from the large opening in the lower portion of the door.

Replacement is a reversal of the above procedure; all working parts should be smeared with grease on assembly.

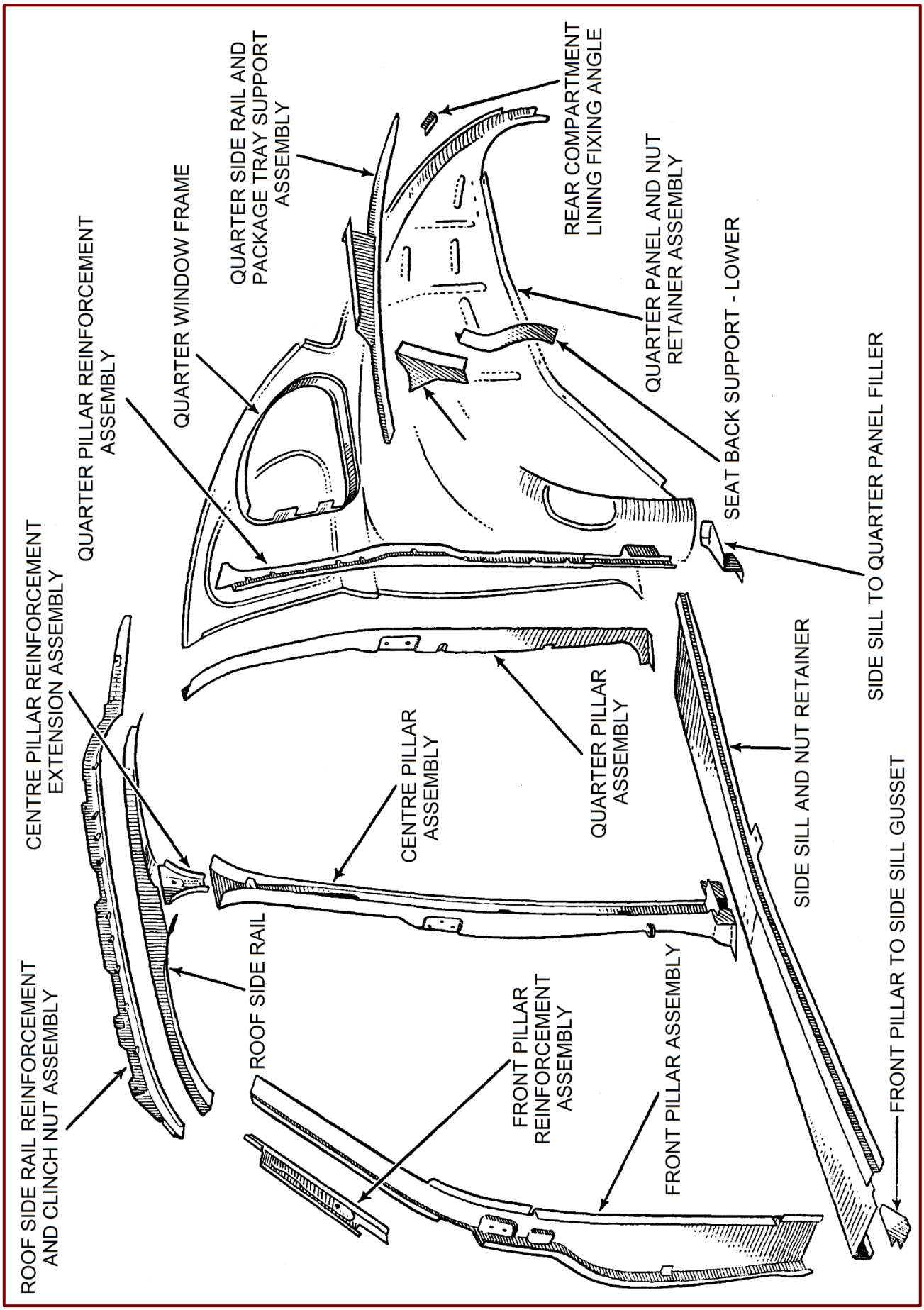

Figure 78. Body Side Frame.

ACCIDENT DAMAGE

CHASSIS FRAME

It is important that the following points are checked in all cases of accident damage, where there is any possibility that frame distortion has taken place.

A. Lines drawn:

(i) Between the right hand front engine mounting fixing points, and a point 1¼" (32 mm) behind the left hand mounting fixing point.

(ii) Along the gearbox cross member.

(iii) Between the rear torsion rod anchor brackets.

Must be parallel, and must be at right angles to the centre line of the chassis, drawn through the centre point of each of the three lines.

B. The fixing points for the suspension upper link brackets on each dash side must be accurately centralised and aligned in relation to the front torsion rod trunnion tubes.

The undermentioned jigs are necessary for accident damage repair; drawings can be supplied, so that the jigs can be manufactured locally. Full instructions and illustrations, showing the correct methods of fitting and using the jigs will be supplied.

CHECKING JIGS

Main Frame Alignment Jig.

Extension Jig.

Intermediate Jig.

Torsion Rod Mandrel.

Floating Bushes.

Radiator Gate Frame Jig and Pointer.

Front Suspension Jig.

REPLACEMENT OF DISTORTED PANELS

In cases where a panel is seriously damaged, it may be found advisable to replace the damaged portions with new panels, which can be obtained from our Spares Dept. After breaking the welding where necessary, any portion of the body can be removed and a suitable replacement installed.

Often, due to the localised nature of damage, it will be found that replacement of a complete panel or unit is uneconomical. In these circumstances it will be perfectly satisfactory to cut a corresponding part from a replacement unit, and to fit into position by gas welding. An example of this is possible damage to the front of the dash side panel, with twisting of the ventilating tube. The appropriate portion of the front end of the assembly could be cut, together with the tube, and a corresponding replacement welded into position.

PILLARS AND SIDE SILLS

The body side frame can be supplied as a complete assembly or alternatively, sections of the assembly can be supplied separately. The pillars and rails will normally be supplied assembled to the reinforcements, although again these can be supplied separately, if required.

Illustration *Figure 78* shows the location of joints in the body side frame, there is no reason why, if these are cut and welded correctly, the repair should not be as strong as the original construction.

Further Information

Our Service Technical Department will gladly supply further information to any repairer requiring assistance. The repairer, faced with an accident damage problem, is invited to submit full details, including if possible rough sketches, when any information required will be supplied.

CHAPTER 12

ELECTRICAL EQUIPMENT

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ELECTRICAL SYSTEM – BATTERY

DESCRIPTION

A single Lucas type GTW 9A 12-volt battery is fitted under the rear seat; an access panel is incorporated in the seat floor (*Figure 79*).

Maintenance

1. Topping Up

About once a month, or more often in warmer climates, remove the vent plugs and examine the level of the electrolyte. If necessary, add distilled water until the top edge of the separator is just covered.

Note: In very cold weather it is essential that the car is used immediately after topping up, to ensure that the distilled water is thoroughly mixed with the electrolyte. Neglect of this point may cause damage to the battery by the distilled water freezing.

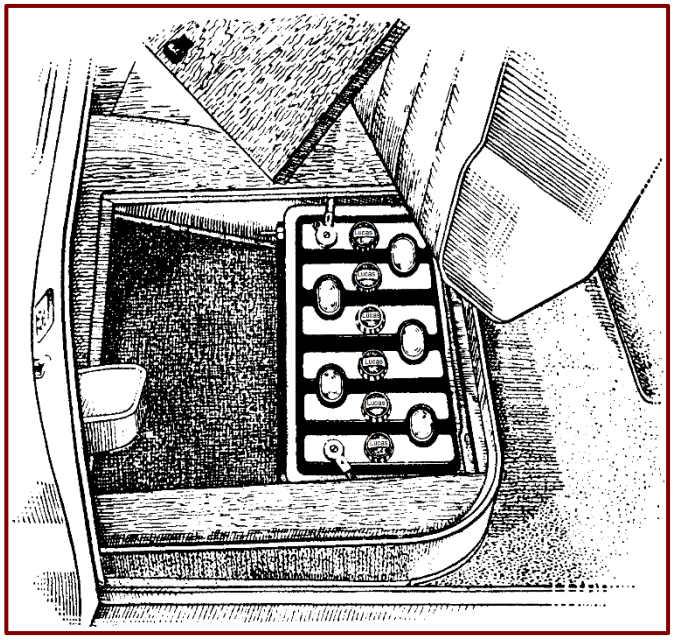


Figure 79. Battery in Position.

2. Testing Condition Of Battery

Occasionally check the condition of the battery by taking hydrometer readings.

The specific gravity readings and their indications are as follows:

1·280–1·300	Battery fully charged.
About 1.210	Battery about half discharged.
Below 1·150	Battery fully discharged.

These figures are given assuming that the electrolyte temperature is 60 °F (15.5 °C). If the electrolyte temperature exceeds this, 0·002 must be added to the observed hydrometer reading for each 5 °F (–15 °C) rise in temperature, to give the true specific gravity at 60 °F.

Similarly 0·002 must be subtracted from the hydrometer reading for every 5 °F below 60 °F.

The readings for each cell should be approximately the same. Should the battery be in a low state of charge, it should be recharged from an external source of D.C. supply at a current rate of 5 amperes until the cells are gassing freely.

Storage

If batteries are to be out of use for any length of time, they should first be fully charged and then given a refreshing charge about every fortnight.

DYNAMO

DESCRIPTION

The Lucas type C39 PV dynamo is a two brush machine controlled by a regulated unit. It is driven from the engine crankshaft by means of a V-belt and pulley.

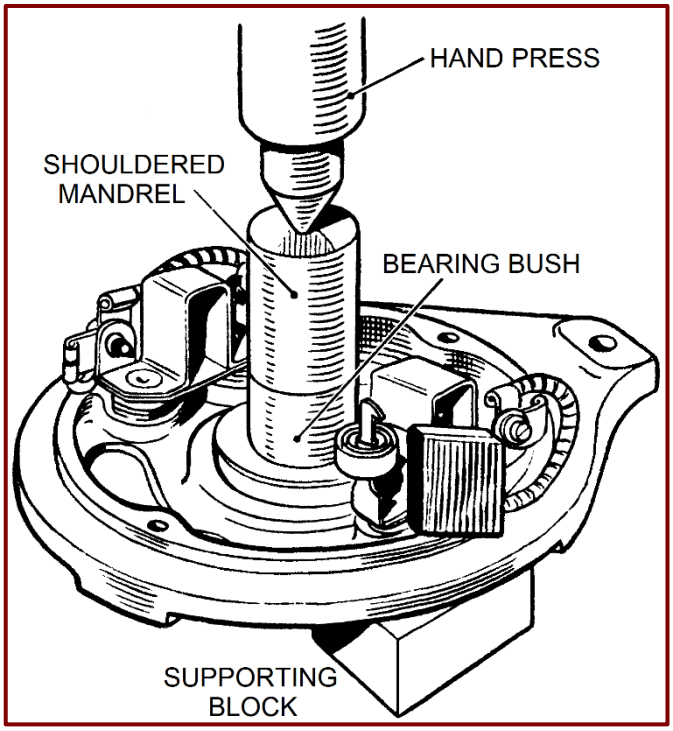


Figure 80. Fitting Bearing Bush.

To Test In Position

Withdraw the leads from the 'D' and 'F' terminals, and connect the terminal with a short length of wire. Connect a voltmeter (0–20-volts) between the dynamo terminals and a good earthing point on the dynamo yoke. Increase the engine speed gradually and note the voltmeter reading. This should reach 12-volts at a comparatively low engine speed. Do not run the engine at a speed above 1,500 r.p.m. If no reading is given, or if it is low or erratic, the dynamo must be removed for examination.

OVERHAUL

To Dismantle The Dynamo

1. Remove the dynamo from the engine.
2. Take off dynamo pulley.
3. Remove the cover band, hold back the brush springs, and remove the brushes from their holders.
4. Unscrew the locking nuts from the through bolts at the commutator end.
5. Withdraw the two through bolts from the driving end.
6. Remove the nut, spring washer and flat washer, from the small terminal (field terminal) from the commutator end bracket and remove bracket from the dynamo yoke. *Continued on next page.*

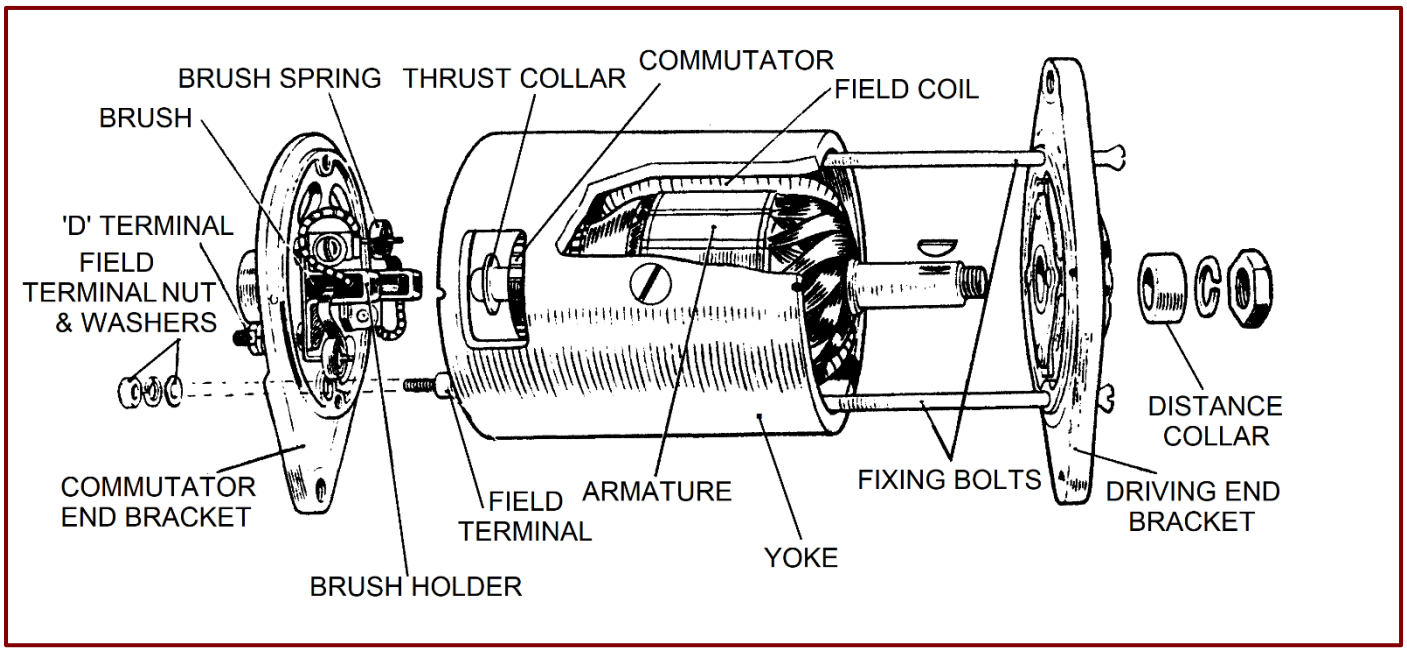


Figure 81. Exploded View of Dynamo C39 PV.

7. The driving end bracket together with the armature can now be lifted out of the dynamo yoke.

TO RECONDITION DYNAMO UNITS

Commutator

Examine the commutator and if burned or blackened, clean with a petrol-moistened rag or in bad cases by carefully polishing with very fine glass paper. If necessary, undercut the mica insulation to a depth of 1/32" with a hacksaw blade ground down to the thickness of the mica (*Figure 82*).

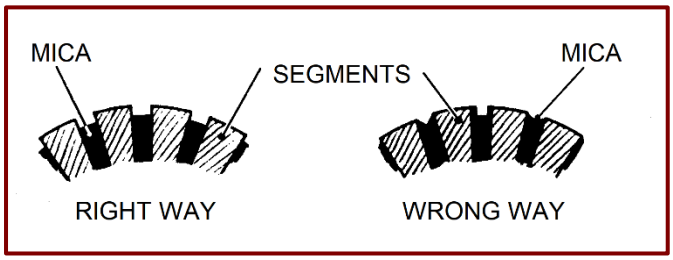


Figure 82. Under Cutting Commutator Insulation.

Armature

Check the armature by means of a growler test or volt drop test, and test the insulation by connecting a test lamp at mains voltage, between the commutator segments and the shaft.

Brush Gear

Examine the brushes. If they are worn and do not make good contact on the commutator, or if the brush flexible is exposed to running face, take out the screw securing the eyelet on the end of the brush flexibles and remove the brushes. Fit new brushes into the holders and secure the eyelets on the ends of the brush lead in the original positions.

Brushes are preformed and do not require bedding.

Field Coils

Test the resistance of the field coils by means of an Ohmmeter, when the reading should be 6.3 Ohms. If this is not available, connect a 12-volt D.C. supply with an ammeter in series, between the field terminal and the dynamo frame. The ammeter reading should be approximately 2 amps. If no reading is registered, the field coils are open circuited and should be replaced.

To test for an earthed field coil, unsolder and isolate the end of the field winding from the earth terminal of the dynamo yoke. With a test lamp connected to a mains supply, check between field terminal and yoke. If the lamp lights, the field coils are earthed and must be replaced. When replacing field coils, an expander must be used to press the pole shoes into position. A few taps on the outside of the dynamo will assist the expander to seat the pole shoes. When the pole shoes are finally home, fully tighten up the fixing screws and caulk to lock them in position.

Bearings and Bushes

If the bearings show excessive wear, these should be replaced, also replace any bushes which are badly worn.

It should be noted that before fitting a new porous bronze bearing bush, it should be soaked in clean thin engine oil or at least 24 hours.

Refer to *Figure 80*, Page 85.

To Re-assemble The Dynamo

In the main, re-assembly of the dynamo is a reversal of the dismantling procedure.

CONTROL BOX AND REGULATOR

DESCRIPTION

The compensating voltage control and regulating unit ensures that the battery receives a charge best suited to its condition, the control of the charging current being automatic.

Variation of the charging current with temperature is obtained by the incorporation in the regulator of a bi-metal strip, which also allows the dynamo to give a charge in excess of its normal rating for a short period on starting, thus quickly replacing the energy taken from the battery by the starter. Incorporated in the assembly are two 35

amp. fuses which provide protection to the electrical accessories.

The regulator is carefully set by the manufacturer to suit the normal requirements of the standard equipment and on no account must the setting be interfered with unless there are reasonable grounds.

To Check And Adjust The Electrical Setting

The regulator setting can be checked without removing the cover of the control box.

Withdraw the cables from the terminals marked 'A' and 'A1' at the control box and join them together.

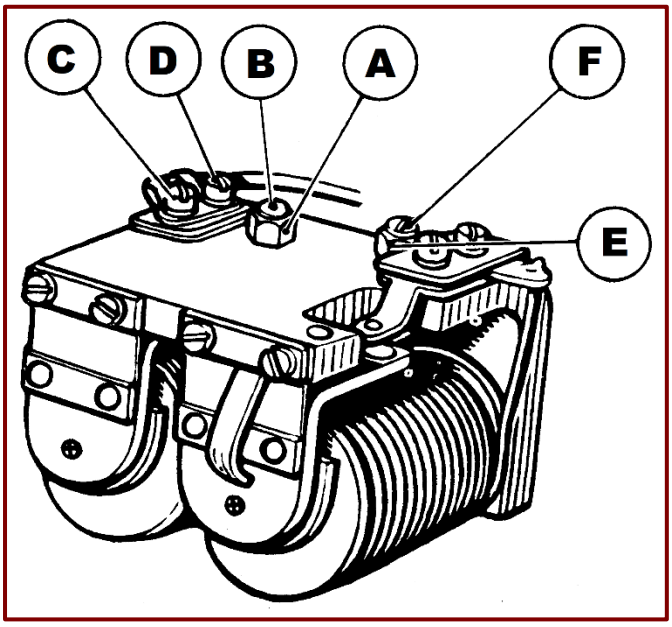


Figure 83. Cutout and Regulator Assembly.

Connect the negative lead of a moving voltmeter (0–20-volts full scale reading) to the 'D' terminal on the dynamo and connect the other lead from the meter to a convenient chassis earth.

Slowly increase the speed of the engine until the volt meter needle flickers and then steadies; this should occur at a volt meter reading between the limits given below for the appropriate temperature of the regulator.

Setting at 10 °C (50 °F) 16·1–16·7-volts

Setting at 20 °C (68 °F) 15·8–16·4-volts

Setting at 30 °C (86 °F) 15·6–16·2-volts

Setting at 40 °C (104 °F) 15·3–15·9-volts

If the voltage at which the reading becomes steady occurs outside these limits the regulator must be adjusted.

Shut off the engine, remove the control box cover, release the locknut holding the adjusting screw and turn the screw in a clockwise direction to increase the setting. Turn the adjustment screw a fraction of a turn and then tighten the locknut

When adjusting, do not run the engine up to more than half a throttle, as while the dynamo is on open circuit, it will build up to a high voltage if run at a high speed, and so a false voltmeter reading would be obtained.

Mechanical Setting (*Figure 84*)

The mechanical setting of the regulator is accurately adjusted before leaving the works and provided the armature carrying the moving contact is not removed the regulator will not require mechanical adjustment.

If however the armature has been removed from the regulator for any reason the contacts will have to be reset. To do this proceed as follows:

(i) Slacken the two armature fixing screws (E). Insert a 0·018" (0·457 mm) feeler gauge between the back of the armature (A) and the regulator frame.

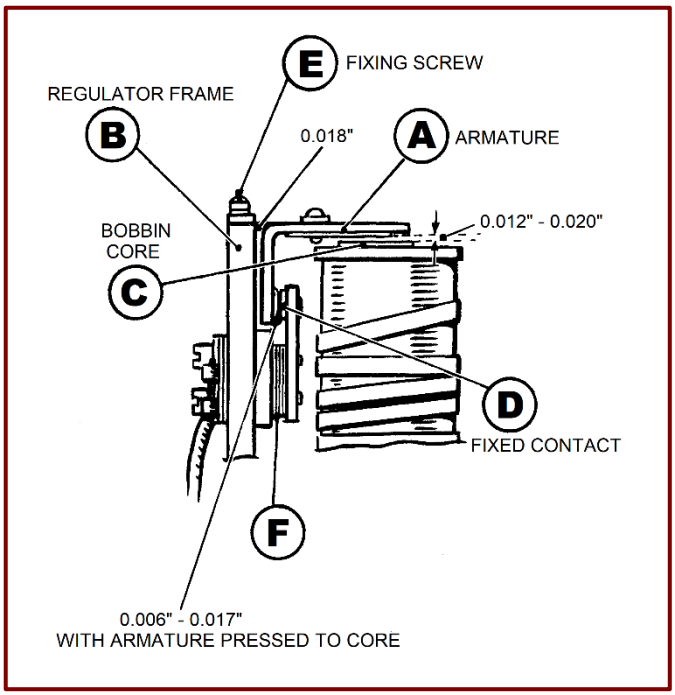


Figure 84. Mechanical Setting.

(ii) Press back the armature against the regulator frame and down on top of the bobbin core with gauge in position and lock the armature by tightening the two fixing screws.

(iii) Check the gap between the underside of the arm and the top of the bobbin core. This should be 0·012–0·020" (0·305–0·508 mm). If the gap is outside these limits, correct by adding or removing shims at the back of the fixed contact.

Note: Earlier types of control boxes are fitted with a stop rivet on the underside of arm instead of a shim. When checking this type the gap should be 0·022–0·030" (0·559–0·762 mm) between the underside of the arm and bobbin core. Do not check gap between stop rivet and bobbin core.

(iv) Remove the gauge and press the armature down when the gap between the contacts should be 0·006–0·017" (0·152–0·431 mm).

Cleaning Contacts

To render the regulator contacts accessible for cleaning, slacken the screws securing the plate carrying the fixed contact. It will be necessary to slacken the upper screw (C, *Figure 83*) a little more than the lower (D) so that the contact plate can be swung outwards. Clean the contacts by means of a fine carborundum stone or fine emery cloth. Carefully wipe away all traces of dirt or other foreign matter. Finally tighten the securing screws.

Cut Out Adjustment

If it is suspected that the cutting in speed of the dynamo is too high, connect a volt meter between the terminals marked 'D' and 'E' at the control box and slowly raise the engine speed. When the volt meter reading rises to about 12·7–13·3, the cut out contacts should close.

If the cut out has become out of adjustment and operates at a voltage outside these limits it must be reset. To make the adjustment (*Figure 83*), slacken the locknut (E), turn the adjusting screw (F) a fraction of a turn in a clockwise direction to raise the operating voltage or in an anti-clockwise direction to lower the voltage. Tighten the locknut after making the adjustment.

Cleaning

To clean the contacts remove the cover, place a strip of fine glass paper between the contacts and then closing the contacts by hand, draw the paper through. This should be done two or three times, with the rough side towards each contact.

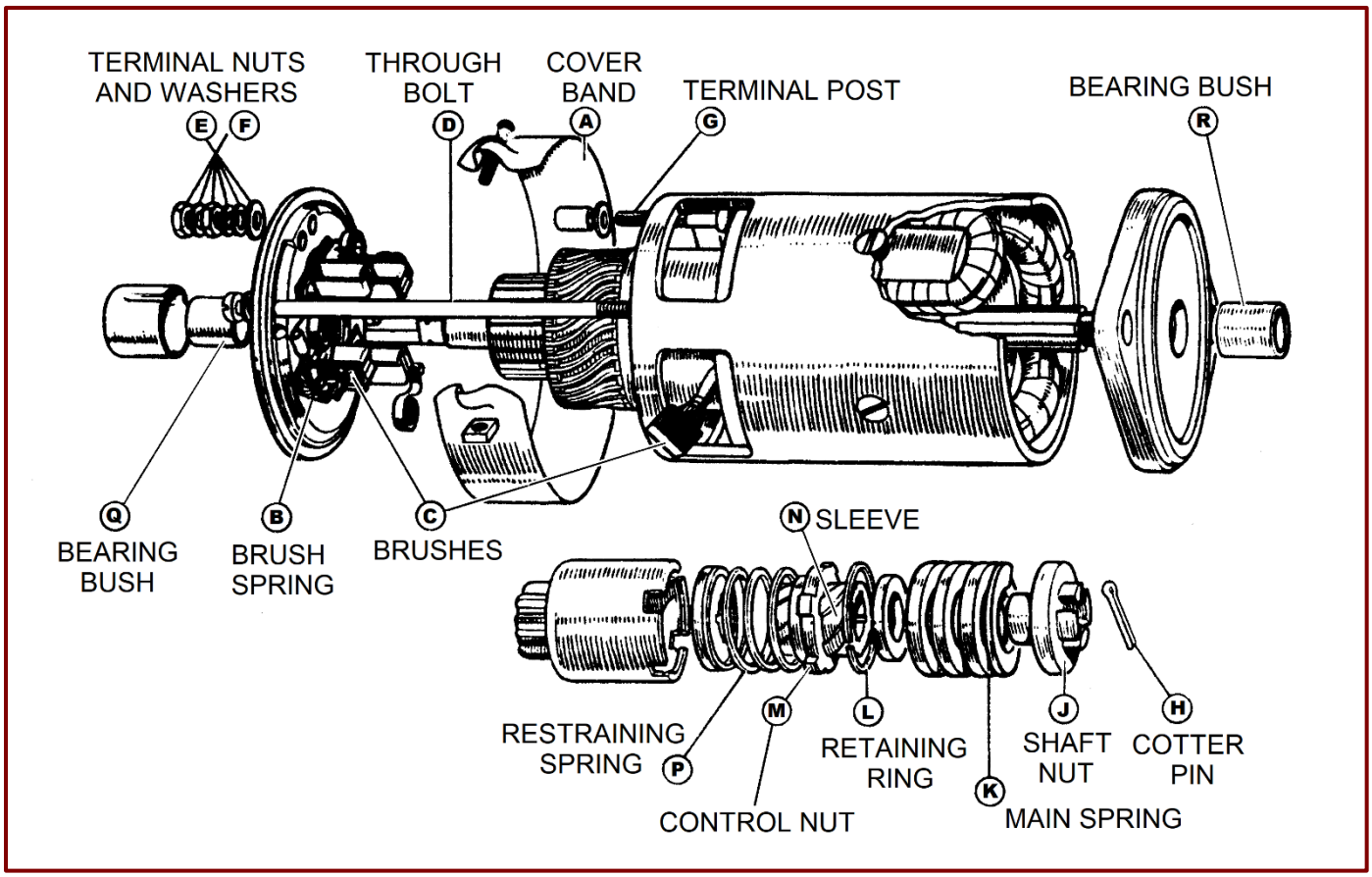


Figure 85. Exploded View of Starter M35G (25025).

STARTER MOTOR

DESCRIPTION

The starter motor is a Lucas type M35G four brush machine (*Figure 85*). The starter switch is fitted as a separate unit under the front floor board.

To Test Starter Motor

The starter should be tested with a well charged battery of the appropriate voltage, and of a capacity not less than that of the car battery. A voltmeter and ammeter should be connected in the circuit and the lock torque figures taken as given in the data section. Where facilities are available a second test can be made by varying the load to obtain a speed of 1,000 r.p.m. and checking the current consumption and voltage against the figures given in the data section.

To Dismantle Starter Motor

Remove the starter motor from the engine. Take off the cover band at commutator end, hold back the brush springs, and take out the brushes from their holders. Unscrew the nut (accessible on the commutator end bracket) securing the field coil lead to the contact plate. Unscrew and withdraw the two through bolts and take off the commutator end bracket. Remove the armature complete with drive from the starter frame.

TO RECONDITION THE STARTER MOTOR UNITS

Commutator

Examine the commutator and if burned or blackened clean with a petrol-moistened rag, in bad cases carefully polish with very fine glass paper. Note that the mica on the commutator must not be undercut. (Fig. 82).

Brushes

Examine the brushes; if they are worn and do not make good contact on the commutator, or if the brush flexibles are exposed on the running face, they must be replaced. The four brushes are connected to the starter in the following manner: two brushes are connected to terminals on the brush boxes (*Figure 87*) and the remaining two to a tapping on the field coil (*Figure 86*).

When replacing brushes the flexible connectors must be removed by unsoldering. The connectors of the new

brushes should be secured in place by soldering. The brushes are pre-formed so that bedding to the commutator ls unnecessary.

Check the tension of the brush springs. This should be 18–25 ounces (0·51–0·71 kg), *refer to Figure 88*.

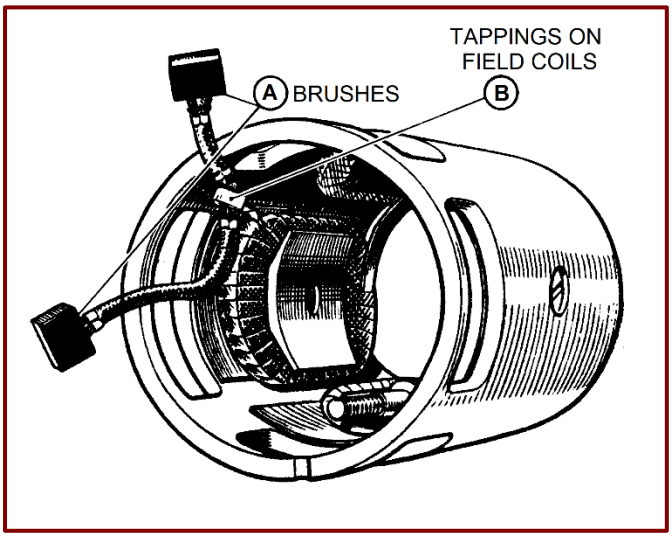


Figure 86. Brush Connections (4).

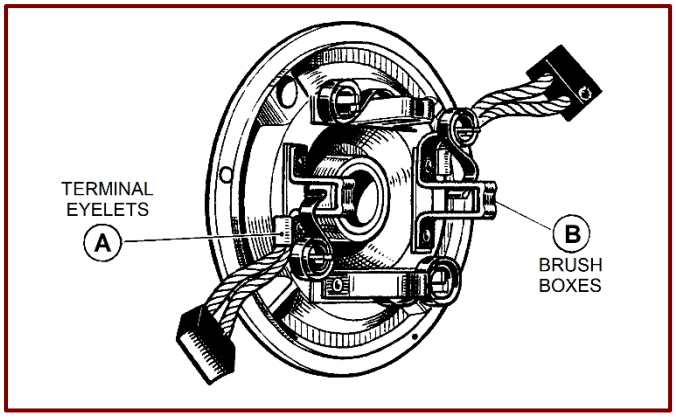


Figure 87. Brush Connections (3).

Field Coils

The field coils can be tested for open circuit by connecting a 12-volt battery and test lamp between the tapping point on the field coils at which the brushes are connected and the field coil connecting bolt. If the lamp does not light there is an open circuit on the wiring of the field coil. Lighting of the lamp does not necessarily mean that the field coils are in order, it is possible that one of them may be earthed to a pole shoe or to the starter yoke. This may be checked with a test lamp connected from supply mains, the test leads being connected to the field coil connecting bolt and to a clean part of the starter yoke. Should the lamp light, it indicates that the field coils are earthed and must be replaced. When replacing field coils the procedure as detailed in the Dynamo Section should be followed.

Bearings and Bushes

The remarks made in the dynamo section also apply to the starter motor.

STARTER SOLENOID SWITCH

To Test In Position

Press the starter push and listen to see if the solenoid starter switch operates. If not, connect a 12-volt supply directly across the small terminal on the solenoid switch and switch body. If the switch does not operate, a replacement unit must be fitted. If the switch operates but does not complete the circuit to the starter (check by means of a 12-volt test lamp between starter terminal on switch and earth) an indication is given that the contacts are faulty and the switch must be replaced.

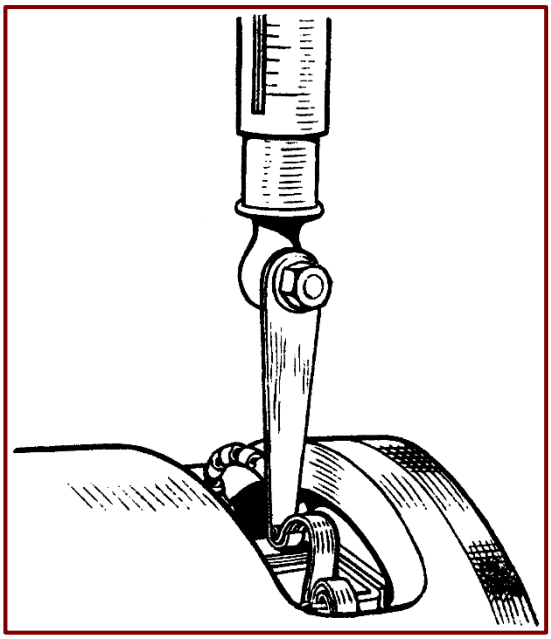


Figure 88. Testing Brush Spring Tension.

LIGHTING

DESCRIPTION

On right hand drive home model a double filament left hand dip bulb was fitted in the left hand headlamp and a single filament bulb in the right hand headlamp. This arrangement allowed the left hand head lamp to dip to the left and the right hand head lamp to be extinguished when in the dip position. On left hand drive models double filament right hand dip bulbs were fitted in both headlamps to dip to the right. On right hand drive export models the arrangement is as above but left hand dip bulbs are used.

On later PC models and PD models a modified headlamp is fitted. The only difference between the two headlamps is that the later type is of special anti-dazzle design, the same bulb arrangement is retained except in the case of home models where both headlamps are fitted with left hand dip double filament bulbs.

The later type headlamp lenses differ in design for right and left hand drive models and can be identified by the letters RHD or LHD moulded into the lens. The lenses are identical for both left hand and right hand headlamps.

To Replace Headlamp Bulb (*Figure 89*)

1. Unscrew the headlight rim securing screw and lift off the rim, which is split to facilitate removal.
2. Remove the dust excluding rubber, which will expose three spring loaded adjustment screws.
3. Press the light unit against the pressure of the adjustment screw springs and turn the light unit in an anti-clockwise direction until the heads of the screws coincide with the largest diameter section of the elongated hole in the light unit rim when the unit can be withdrawn.
4. Twist the back shell in an anti-clockwise direction, withdraw from the light unit and remove the bulb.
5. Fit the replacement bulb with the side marked 'top' uppermost.
6. To re-assemble the light unit, reverse the above procedure, ensuring that the arrow on the back shell coincides with the arrow on the headlight unit.

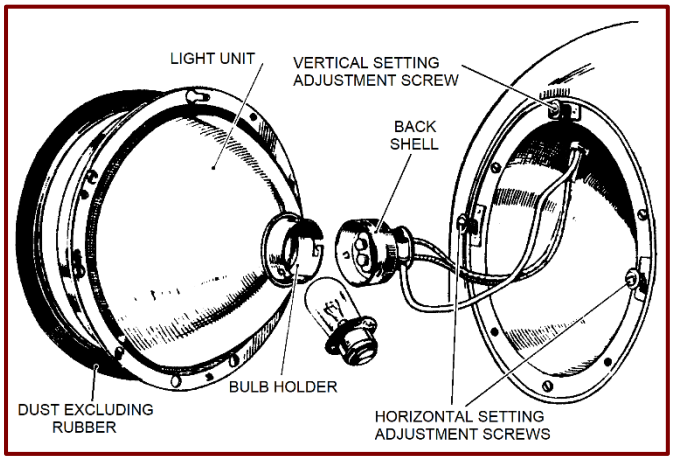


Figure 89. Bulb Replacement.

HEADLAMP BEAM SETTING

The lamps should be set so that the main driving beams are directed straight ahead, parallel with the road surface and with each other. If adjustment is required, remove the rim by removing its securing screw. Set the horizontal adjustment first by turning in or out, the adjustment screws at each side of the light unit. Set each lamp to correct vertical position by means of the vertical adjustment screw at the top of the light unit; turn the screw clockwise to raise the beam and anti- clockwise to lower it (*Figure 91*).

The setting of the lamps can best be carried out by placing the car in front of a blank wall at the greatest possible distance, taking care, of course, that the surface on which the car stands is not sloping relative to the wall. It will be found an advantage to cover one lamp while setting the other.

To Replace Light Unit (*Figure 92*)

In the event of damage to either the front lens or reflector, a replacement Light Unit must be fitted as follows:

1. Remove the Light Unit assembly.
2. Withdraw the three screws from the unit rim and remove the seating rim and unit rim from light unit.
3. Position the replacement light unit between the unit rim and seating rim taking care to see that the die-cast projection at the edge of the light unit fits into the slot in the seating rim and also that the seating ring is correctly positioned.

   Finally secure in position by means of the three fixing screws.

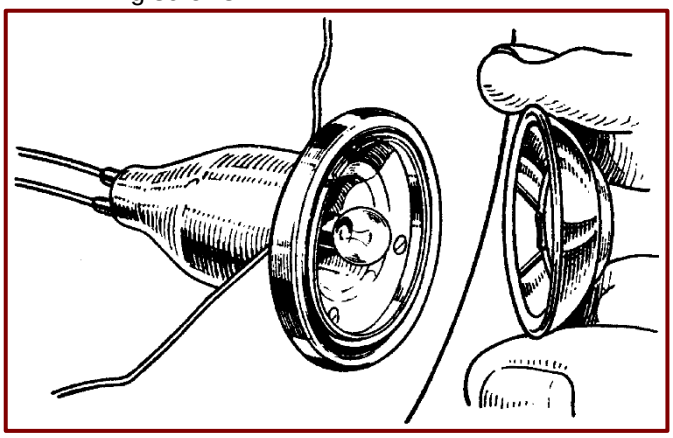


Figure 90. Lamp, Front Side.

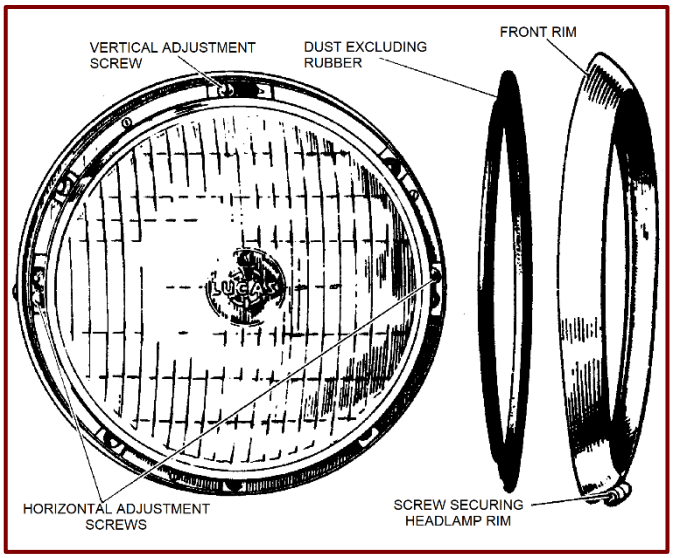


Figure 91. Beam Setting.

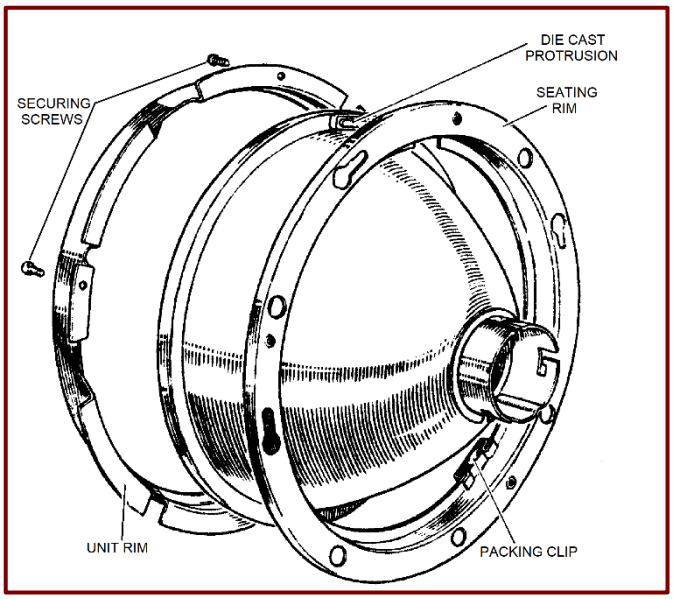


Figure 92. Light Unit Assembly.

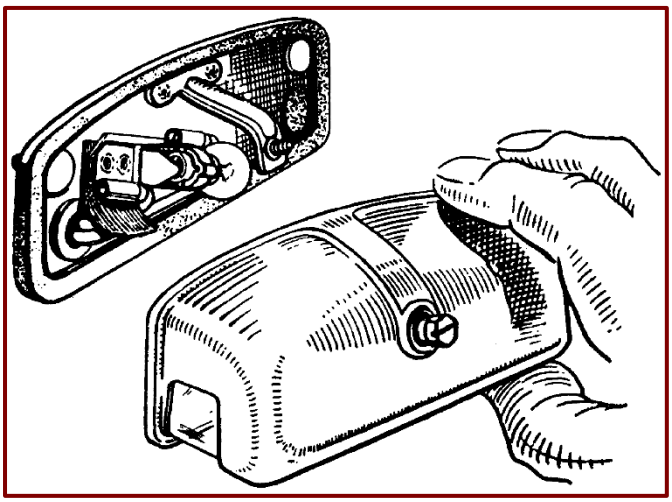


Figure 93. Number Plate Lamp (Jupiter). (Invert for Javelin Standard Model)

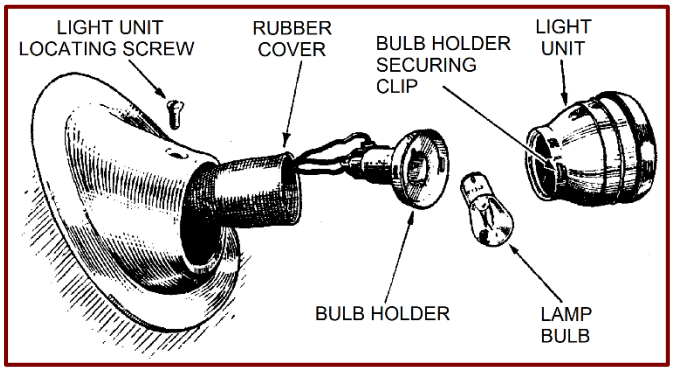


Figure 94. Stop Tail Lamp.

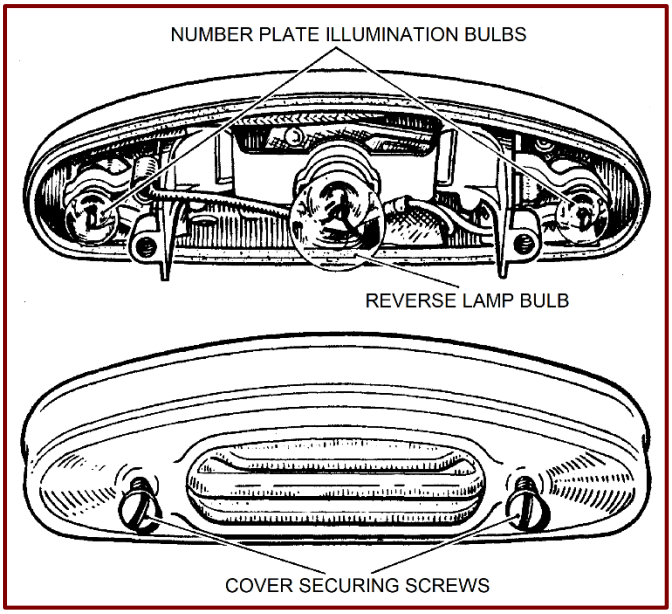


Figure 95. Number Plate and Reverse Lamp. (Deluxe Model)

STOP LIGHT SWITCH

Description

The stop light switch is situated alongside the brake master cylinder and fixed to the underside of the floorboard. When the footbrake is applied the operating spring draws forward the switch plunger which completes the electrical circuit and operates the stop lamp.

ADJUSTMENT

If the stop fails to operate and the bulb is not faulty check the action of the switch operating spring which may not have sufficient tension to operate the plunger; if the spring has stretched excessively it must be replaced. Should the switch still remain inoperative after the above adjustment has been carried out, remove the switch and thoroughly clean the contacts.

If the stoplight stays on when the footbrake pedal is released the plunger mechanism of the switch should be checked to ensure that freedom to return to the 'Off' position is not prevented by any foreign matter or the return spring inside the switch is not broken.

TRAFFICATORS

DESCRIPTION

The Lucas trafficators are of the solenoid operated type and are a flush fit in centre door pillars. A two-way clockwork operated type switch is mounted in the centre of the facia board except in the case of the PD Standard model which has manually cancelled switch and red indicator warning light.

To Remove And Replace Trafficators

Remove the screws securing the interior trim to the pillar and remove the pillar trim. On the offside pillar removal of the interior light switch cover is necessary. Remove the screws from the trafficator attachment strip and withdraw the indicator unit, disconnecting the lead.

Replacement is a reversal of the above procedure.

To Test The Trafficator

The magnet may be checked for continuity by applying a 12-volt current between the metal frame and the insulated terminal.

Test the bulb, and ensure that the end caps are making contact with the spring and its outer channel.

Check the arm for distortion or damage and examine the mechanism for signs of wear.

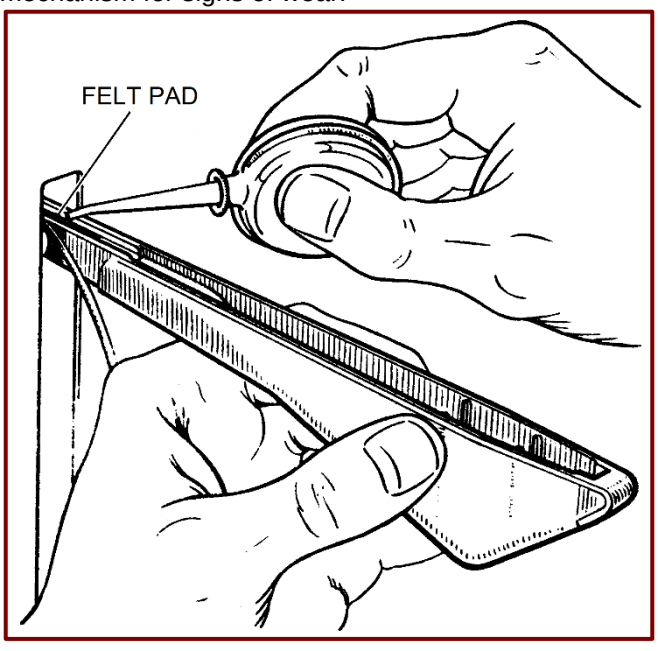


Figure 96. Lubricating Arm Pivot Bearing.

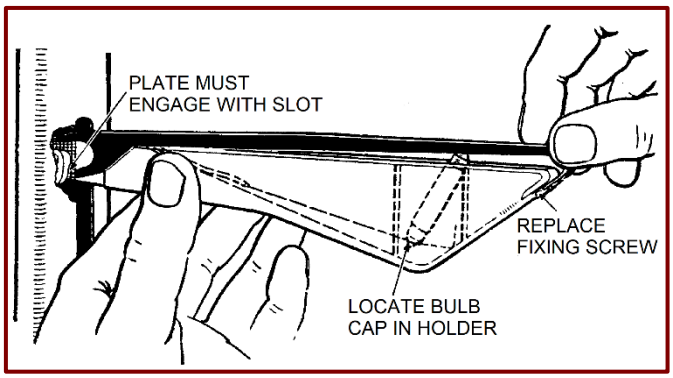


Figure 97. Bulb Replacement.

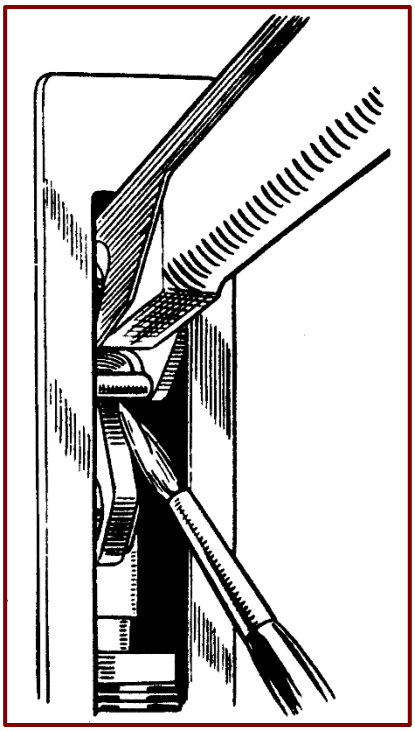


Figure 98. Lubricating Trafficator Catch Pin.

HORNS

DESCRIPTION (*Figure 99*)

Dual Windtone horns are fitted to all models and are controlled through a push switch in the centre of the steering wheel via the ignition switch.

ADJUSTMENT

Remove fixing screw from top of horn and take off cover. Detach the cover securing bracket by springing it out of its position, slacken the bracket on the fixed contact and rotate the adjusting nut until the contacts are just separated (indicated by the horn failing to sound) turn the adjusting nut half a turn in the opposite direction and tighten the locknut.

To Remove And Replace Slip Ring

Withdraw the inner steering column. Remove the bearing support ring which is spot welded to the top of the column. Unsolder the horn wire at the slip ring and withdraw the wire through the top of the column. Remove the horn wire nipple from the slip ring and the slip ring can be drawn off the insulating bush. Remove the insulating bush grommet and slide the insulating bush from the column.

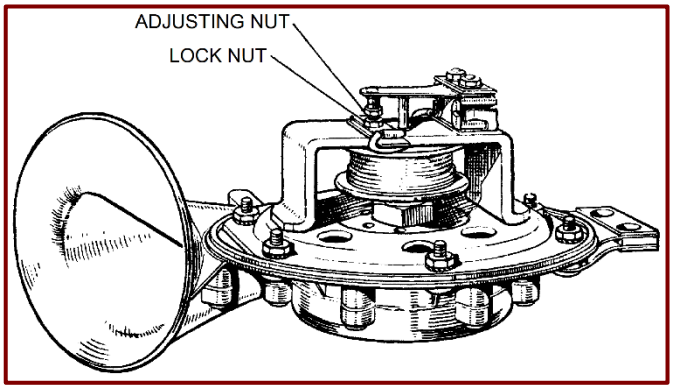


Figure 99. Horn with Cover Removed.

When replacing the assembly slide the brass slip ring down the column past the horn lead aperture. Slide on the plastic insulating bush until the grommet hole is opposite the hole in the column, ensuring that the bush flange is towards the top of the column. Position the grommet and slide the slip ring into position. Thread the horn wire down the column and through the insulating grommet and fit the horn wire nipple over the wire.

The nipple can now be soldered to the wire and the slip ring removing any surplus solder protruding above the slip ring surface with a fine file. Fit the bearing ring in its original position with the shoulder uppermost and spot weld in position. On models after E2/PD/20881 standard model and E2/PD/21838 De Luxe model, the modified type inner column is fitted to the steering gear and the horn slip ring cannot be removed from the inner column.

WINDSCREEN WIPERS

DESCRIPTION (*Figure 100*)

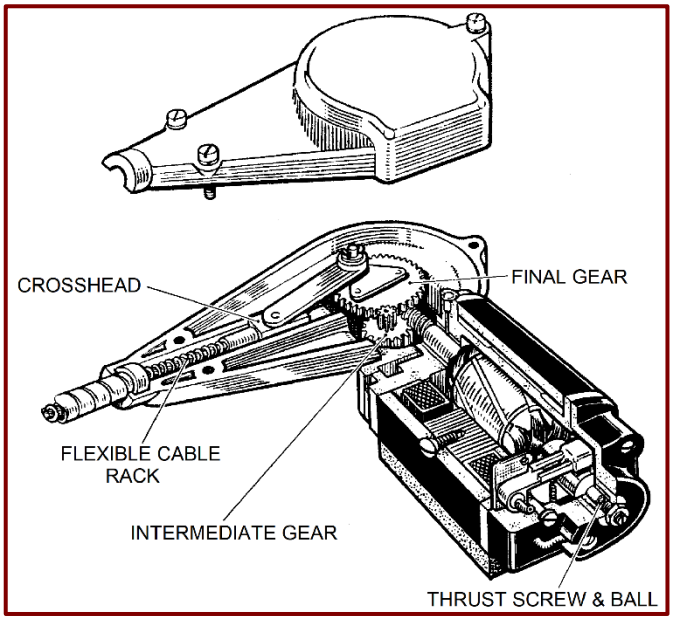


Figure 100. Wiper Motor and Gearbox.

The windscreen wiper motor is located on the nearside bulkhead and drives the wiper arms by a flexible cable. The current is fed to the motor via the ignition switch and the switch marked ‘W’.

MAINTENANCE

Commutator

Remove the connecting leads from the terminals, withdraw the three screws securing the cover at the commutator end. Lift off the cover and clean the commutator with a cloth moistened with petrol. Remove any carbon dust from between the commutator segments.

Brush Gear Lever Stiff Or Brushes Not Bedding On Commutator

Check that the brushes bear freely on the commutator. If they are loose and do not make contact, a replacement spring is necessary. The brush levers must be free on their pivots, if they are stiff they should be freed by working them backwards and forwards by hand and applying a trace of thin machine oil.

Packing shims are fitted beneath the legs of the brush levers to ensure that the brushes are central and that there is no possibility of the brush boxes fouling the commutator. If the brushes are considerably worn they must be replaced.

HEATER

DESCRIPTION

A Smiths re-circulator heater unit is fitted to the De Luxe Model, with heater control through a switch on the facia panel. When the heater is in operation, hot water from the engine passes to the heater. As the water circulates, air is heated in the vicinity of the tubes and is circulated through the car by the fan rotation. The hot air is also supplied from the heater to the windscreen for de-misting purposes.

FROST PRECAUTIONS

Refer to Cooling section in Engine Chapter. The heater is not drained when the cooling system is drained.

To Remove And Replace The Heater Unit

1. Drain the engine cooling system and when fully drained turn off the heater tap.
2. Disconnect the heater wire plug connectors situated at the rear of the glove box.
3. Disconnect the two water hoses at the heater and detach the de-mister hoses by pulling the demister hose ‘Y’ connection out of its location in the heater housing.
4. Remove the three nuts which secure the heater unit to the toe board; the heater unit can then be lifted clear. Care should be taken not to spill any water remaining in the heater.

Replacement is a reversal of the above procedure.

Before filling the cooling system open the heater tap fully, to eliminate the possibility of air locking.

DATA

BATTERY

Type	Lucas GTW 9A
No. of Plates per Cell	9
Capacity (amp. hours)	50
Earth Terminal	Positive

DYNAMO

Type	Lucas C39 PV
Voltage	12
Maximum Output	17 amps. 2,000 r.p.m.
Field Resistance	6.1 Ohms
Direction of Rotation	Clockwise
Cut In Speed	1,050–1,200 13-volts
Brush Spring Pressure	22–25 ozs

CONTROL BOX AND REGULATOR

Type	Lucas RF 95
Location	Dash Top Panel
Voltage	12-volts
Fuses	2 x 35 amp

STARTER SOLENOID SWITCH

Type	Lucas ST 950
Voltage	12-volts
Location	Under N/S Floor-board

STARTER

Type	Lucas M35G 25025
Voltage	12-volts
Lock Torque	9·3 lb. ft.
Lock Voltage	7·9
Lock Current Draw	335
No. of Pinion Teeth	9
Direction of Rotation (Commutator End)	Clockwise
Brush Spring Pressure	32–42 ozs.

REVERSE LIGHT SWITCH

Type	Lucas
Location	Gearbox Top
Method of Operation	Gear Lever Pressure

STOP LIGHT SWITCH

Type	Lucas
Location	Under Front Floor-board
Method of Operation	Spring from Foot Brake Mechanism

WINDSCREEN WIPERS

Type	Lucas C.R.4

JUPITER APPENDIX

This appendix is intended for use in conjunction with the Javelin chapters as the Jupiter running units are basically identical with those fully described for the Javelin.

They are, however, modified in some cases to give a higher performance; any major changes which require different service procedure are dealt with in this supplement, it should be pointed out however that although certain units and parts require the same procedure for maintenance and overhaul it does not necessarily mean that the parts are identical and that interchangeability exists; the parts list should be referred to at all times when a replacement part is required.

	Page
Lubrication	95
Engine	98
Clutch	99
Gearbox	99
Propeller Shaft	100
Rear Axle and Front Hubs	101
Suspension	101
Steering	102
Brakes	106
Body	106
Electrical Equipment	107
Chassis Frame	108

Note: If the Engine Number commences with the prefix SC, please also read Page 32.

LUBRICATION

Every 200 miles or weekly*

(**A**) Check level of oil in sump
Check level of water in radiator

Every 500 miles or half-monthly*

(**B**) Grease steering connections and front suspension nipples
Grease steering pinion universal joint
Check tyre pressures
Check acid level in battery

Every 2,500 miles or quarterly*

(**C**) Change engine oil
(**D**) Check level of oil in gearbox
(**E**) Check level of oil in rear axle
(**F**) Check level of fluid in brake fluid reservoir
(**G**) Grease steering pinion shaft
(**H**) Check level of oil in front suspension reservoirs
(**J**) Grease steering column bearings
(**K**) Grease gear control column
(**L**) Grease brake and clutch pedals
(**M**) Grease brake cable and linkage
(**N**) Grease water pump bearing and oil fan spindle
(**O**) Oil distributor and throttle linkage
Oil direction indicators
(**Q**) Oil gear control and brake linkage

Every 5,000 miles or half-yearly*

(**P**) Change oil filter element every 5,000 miles
(**R**) Grease front and rear hubs
(**S**) Oil propeller shaft, universal joints, and spline
Grease tachometer drive gear
Clean and re-set sparking plugs
Adjust brakes
Adjust clutch pedal
Remove and replace, or clean, the tappet cover air vent filter felts

Every 10,000 miles or yearly*

(**T**) Change oil in gearbox
(**U**) Change oil in rear axle
(**X**) Grease dynamo, rear bearing
(**Y**) Remove sump and clean sump oil filter

* Or more frequently if necessary

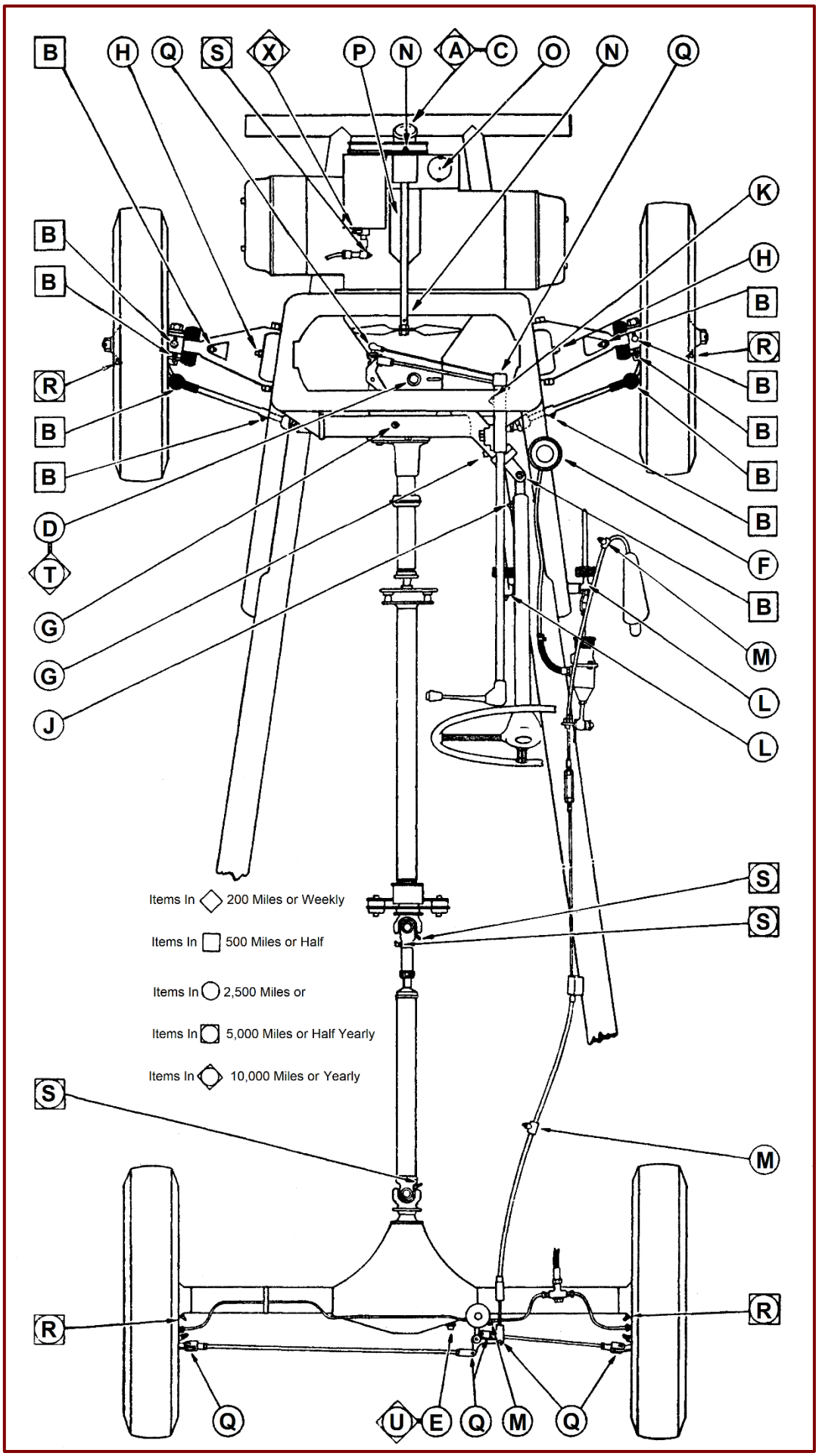


Figure 101. Jupiter Lubrication Chart.

RECOMMENDED LUBRICANTS

Unit	Climatic Conditions	Wakefield	Duckham's	Esso	Prices	Shell	Vacuum	Filtrate
ENGINE AND GEARBOX								
	U.K. *All Year*	Castrol XL	N.O.L. 30	Essolube 30	Energol SAE 30	Shell X-100 SAE 30	Mobiloil A	Medium Filtrate SAE 30
	Overseas Over 90°F.	Castrol XXL	N.O.L. 40	Essolube 40	Energol SAE 40	Shell X-100 SAE 40	Mobiloil BB	Heavy Filtrate SAE 40
	20°–90°F.	Castrol XL	N.O.L. 30	Essolube 30	Energol SAE 30	Shell X-100 SAE 30	Mobiloil A	Medium Filtrate SAE 30
REAR AXLE		Castrol Hypoy	Duckham's Hypoid 90	Esso Expee Compound 90	Energol EP SAE 90	Shell Spirax 90 EP	Mobilube GX 90	Hypoid Filtrate Gear Oil 90
SUSPENSION NIPPLES **TACHOMETER DRIVE** **STEERING GEAR** **STEERING NIPPLES** **REAR BRAKE** **COMPENSATOR** **CHASSIS LUBRICATION**		Castrolease Medium or Castrolease C.L.	Duckham's H.P.G.	Esso Grease	Belmoline D *Overseas* Energrease C2	Shell Retinax A or C	Mobilgrease No. 4	H.P. Solidified Filtrate Oil
SUSPENSION RESERVOIRS		Castrol XXL	N.O.L. 40	Essolube 40	Energol SAE 40	Shell X-100 SAE 40	Mobiloil BB	Heavy Filtrate SAE 40
FRONT AND REAR HUBS **WATER PUMP**		Castrolease Heavy	Duckham's HBB	Esso Grease	Belmoline C *Overseas* Energrease C3	Shell Retinax A or RB	Mobilgrease No. 4	Filtrate RB Grease
BRAKE CABLES		Castrolease Brake Cable Grease	Keenol K.G 16	Esso Graphite Grease	Belmoline CG *Overseas* Energrease C3G	Shell Retinax A or C	Mobil Graphited Grease	Filtrate Brake Cable Grease
UNIVERSAL JOINTS		Castrol D	N2 Gear Oil	Esso Gear Oil 140	Energol SAE 140	Shell Spirax 140 E.P.	Mobilube C	Filtrate Universal Joint Grease
BRAKE FLUID		Girling Crimson Brake Fluid						
GENERAL LUBRICATION BY OIL CAN: **FAN SPINDLE BEARING,** **DOOR HINGES, ETC.**		As for Engine						

Figure 101a. Recommended Lubricants.

ENGINE

For most operations on the engine the Javelin engine Chapter should be referred to for instructions. The information given here is exclusive to the Jupiter. If the Engine Number commences with the prefix SC Page 32 should also be consulted.

PETROL PUMP

This is an S.U. electric type pump (*Figure 102*) positioned on the right-hand side of the chassis, before Engine No. E1/SA/439 the pump is located on the front of the dash panel. Apart from cleaning the points if the pump tends to work rather sluggishly after switching on the ignition no maintenance is normally required. To clean the points take off the front plastic cover by unscrewing the terminal screw and cover nut. With an abrasive card clean the points. Great care should be taken not to force the outer point too far back when cleaning as this may tend to bend the point arm. No point adjustment necessary.

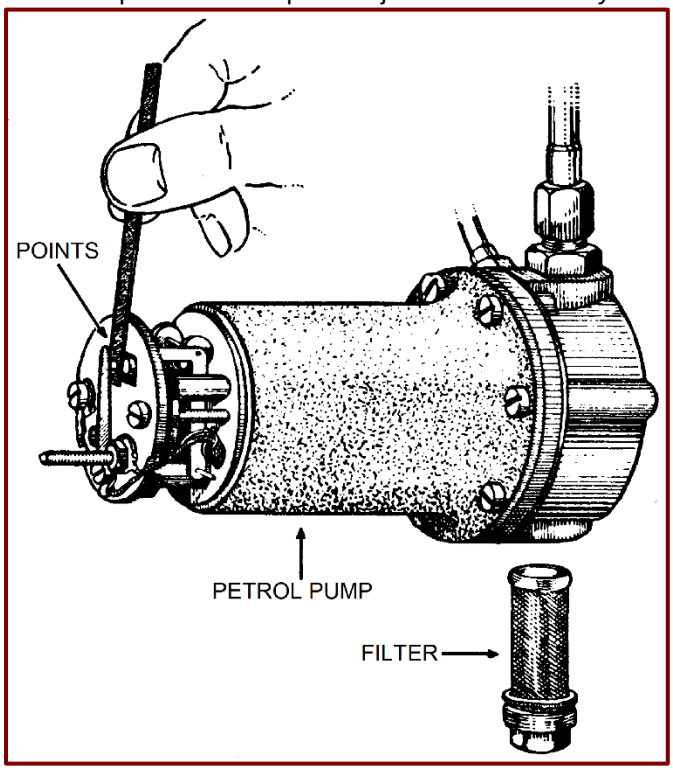


Figure 102. S.U. Petrol Pump.

Note: After Engine No. E1/SA/438, the petrol pump was mounted on a bracket, welded to the chassis side tube, to the rear of the brake master cylinder. It should also be noted that the earlier pump was of suction type and the later pump is a pusher type. The earlier pump was, in warm operating conditions, subject to vapour locks.

PETROL FILTERS

The filter (*Figure 102*) located in the pump should be cleaned periodically. This gauze filter is removed by unscrewing the brass hexagon at the underside of the pump.

There is no filter installed in the fuel tank and the instructions given for the A.C. filter, located on the right hand side of the chassis, and carburettor filters on the Javelin apply to the Jupiter.

AIR FILTERS

An A.C. steel wool air filter is fitted to each carburettor alter Engine No. E2/SA/590. Before this Engine No. a Vokes type air cleaner was fitted to the front of the dash panel assembly and fed both carburettors *via* connecting tubes.

The A.C. type filters should be removed every 1,000 miles or more frequently if necessary, and washed in petrol, allowed to dry in air and replaced.

In dust affected conditions, the wire wool should be oiled sparingly with light oil. They should, of course, be cleaned more frequently, depending on conditions.

Vokes type filter element can be withdrawn by removing the wing nut and end cover from the filter and withdrawing the element. The element should be cleaned with petrol.

PETROL TANK

A drain plug is provided. The tank can be removed by first removing the spare wheel and carrier. Detach the feed pipe and gauge wires at the top of the tank and slacken the Jubilee clip on the filler hose. The mounting straps should then be opened allowing the tank to be dropped. The car should be raised to allow the tank to be withdrawn from underneath.

On S.C. Models the Petrol Tank should be removed as follows:

Remove tool locker, behind seat, then remove battery and battery carrier. Disconnect the gauge wire, remove the plate behind the seat and detach the filler hose. Remove the rear propeller shaft, detach petrol pipe and unfasten the pins at the frame cross member. Withdraw the tank towards the left hand side of the car.

Replacement is a reversal of the above, but the support strap packings should be stuck in position on the tank before replacement commences.

ENGINE REMOVAL

The engine can be removed as a separate unit or together with the gearbox.

1. Drain the water.
2. Isolate the batteries (located behind the seat).
3. Remove front bumper and valance assembly.
4. Disconnect the distributor high tension and low tension leads at the coil.
5. Remove the flexible carburettor feed pipes.
6. Take off the air intake pipes if Vokes type air filter is fitted.
7. Disconnect choke control wire from the strangler flap arm on each carburettor.
8. Detach throttle cable from throttle rod mechanism and withdraw cable and outer cover from the outer cover holding bracket and move them to the right hand side of the engine.
9. Disconnect the oil gauge pipe at the left hand side of the rear timing case cover. If the coiled tube type oil cooler is fitted, disconnect the feed and return pipes and fasten them clear of the engine units.

10. Uncouple the dynamo wires at the rear of the dynamo, also the flexible revolution counter drive together with the warning light wire, and move these to the left hand side of the engine.
11. Remove the radiator top hose and disconnect the two radiator bottom hoses. Disconnect the heater pipe fitted.
12. Detach the right hand exhaust pipe and the left hand exhaust pipe from the manifold flanges and withdraw the right hand pipe from the sliding joint, the left hand pipe may then be secured clear of the engine unit.
13. Disconnect the starter and harness lead at the rear of the starter and the engine earth lead.
14. If the gearbox is to be removed with the engine, disconnect the propeller shaft at the gearbox output flange and secure the free end of the propeller shaft to the frame. Disconnect the speedometer cable from the right hand side of the gearbox ex-tension. Detach the selector and gear change rods from the top of gearbox and fasten them clear of the box.
15. If the engine is to be removed as a separate unit, pack up the gearbox and remove the four nuts securing the gearbox to the clutch housing, two of these nuts are located inside the clutch housing and are accessible by removing the clutch housing base plate.
16. Disconnect the clutch operating fork by removing the split pin and clevis pin from the front end of the rod.
17. Take the weight of the engine (and gearbox) with a suitable lifting gear.
18. Remove the two bolts and two setscrews securing the front engine mounting.
19. If the engine only is being removed, it may now be detached from the gearbox and removed from the chassis.
20. If the engine and gearbox are being removed the three setscrews securing the rear mounting to the gearbox cross member should be removed; the engine and gearbox may then be brought forward clear of the chassis.

CYLINDER HEADS AND VALVES

The instructions given for the Javelin apply, but the tappet setting for the Jupiter is as follows:

Inlet	0·004” (0·10 mm)
Exhaust	0·008” (0·20 mm)

DATA

Cylinders	4
Bore and Stroke	2·85” x 3·54”
Capacity	90·9 cu. ins.
Rated H.P.	13·05
Maximum B.H.P.	62·5 at 4,500 r.p.m.

FUEL SYSTEM

Carburettor Types:

Before Engine No. E2/SA/657	Zenith 30 VIG 5
From Engine No. E2/SA/657	Zenith 30 VM

Carburettors (Continued)

Jet Sizes (30 VIG 5)

Main	105
Compensating	60
Pump Jet	90
Leak	70
Slow Running	45
Choke	26

Jet sizes (30 VM)

Main	120
Compensating	65
Progression	120
Vent	2·5
Slow Running	45
Choke	27
Needle Seat	1·5 mm
Needle Seating Washer	1 mm

Fuel Tank

Capacity	10 gallons (45 litres)
Capacity (SC Model)	8 gallons (36·4 litres)

SPARKING PLUGS

Champion	L10S

CLUTCH

The instructions given for the Javelin clutch apply to the Jupiter. There are, however, some changes in the clutch design involving a change in the clutch liner material and a difference in the spring rating of the clutch pressure springs.

DATA

The dimensions given for the Javelin apply.

Liner Material	Woven Yarn
Pressure Springs	Six Light Blue (145 to 155 lbs.)

GEARBOX

The instructions given in the Javelin Gearbox Chapter apply to the Jupiter, with the exception of the gearbox removal operation.

To Remove And Replace Gearbox

The gearbox can be removed without removing the engine.

1. Detach the propeller shaft and speedometer cable.
2. Disconnect the gearchange linkage.
3. Disconnect rear engine mounting.
4. Pack up the engine. Remove the four nuts securing the gearbox to the clutch housing. Two are located inside the clutch housing and are accessible by removing the clutch housing base plate; the gearbox can then be withdrawn from the clutch housing. On SC models it may be found necessary to slacken the front engine mounting.

PROPELLER SHAFTS

DESCRIPTION

The propeller shaft assembly consists of two shafts, two Hardy Spicer couplings, one Layrub coupling, and a midship bearing. The front shaft has a Layrub coupling at the gearbox end, and is tapered and keyed at the rear end to accommodate a companion flange. The midship bearing, which is secured by two rubber insulated studs to the chassis cruciform member, supports the rear of the front propeller shaft. The rear shaft is fitted with a Hardy Spicer coupling at each end, and features a sliding spline at the front end.

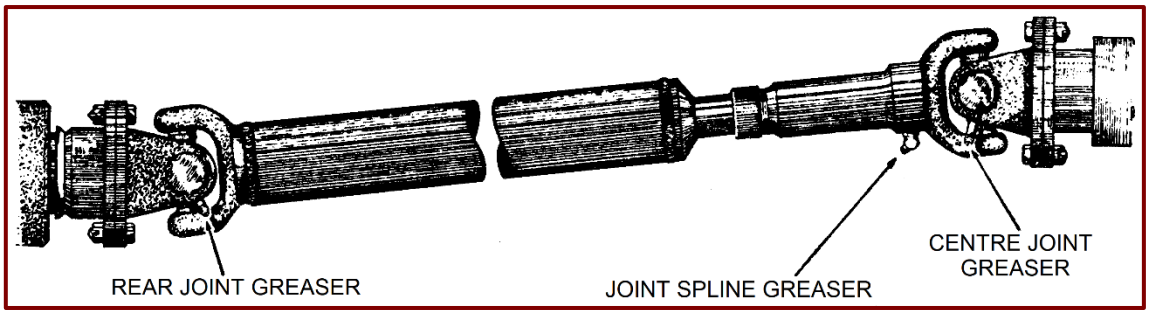


Figure 103. Rear Propeller Shaft.

LUBRICATION

The Layrub coupling requires no lubrication and the midship bearing is pre-packed, therefore requiring no further lubrication. The Hardy Spicer couplings and propeller shaft splines should be lubricated every 5,000 miles (*Figure 103*). See Lubrication chart (Pages 95 and 96).

MAINTENANCE

The following possible causes of transmission vibration or noise may be encountered during the life of a car as a result of wear or damage.

The propeller shaft midship bearing may be dry or worn, or the two rubbers supporting the midship bearing housing may be damaged or distorted, and the two insulator studs may be loose or damaged.

It is also possible for the bolts securing the centre companion flange to the rear shaft and the rear flange to the rear axle to be loose.

Vibration can also be caused by wear on the front Layrub coupling rubbers, and on the Hardy Spicer journals.

When examining the front universal rubbers, special attention should be given to any cracks appearing around the coupling bolts.

When assembling the rear propeller shaft ensure that the arrows on the sleeve assembly and the splined assembly are in line.

Any circumferential movement of shaft relative to the flange yoke indicates wear in the needle roller bearings or the sliding splines.

OVERHAUL

To Remove And Replace Front And Rear Propeller Shafts

Never let the propeller shaft hang from the bearing after uncoupling one end; if no support is available sling to a convenient part of the chassis.

Detach the rear propeller shaft at the rear axle flange and the companion flange and lift clear.

Detach the front propeller shaft at the Layrub coupling and remove the insulator studs securing the bearing housing assembly to the centre cruciform plate; the shaft is now withdrawn to the rear of the car.

Replacement is the reverse of the foregoing procedure, but the following procedure should be carried out.

1. Where a slip stub shaft has been removed from a sleeve yoke, it should always be replaced so that the arrow stamped on the shaft lines up with the arrow on the yoke.
2. Wipe the companion flange and flange yoke faces clean to ensure that the pilot spigot registers correctly and they bed evenly all round.
3. The dust cap must be screwed up by hand as far as possible.
4. The sliding joint is always to the front of the car.

To Dismantle The Propeller Shaft Joints

1. Remove the snap rings by pressing the ends together and extract with a screwdriver. Should difficulty be experienced, a gentle tap on the needle bearing assembly will remove pressure on the ring.
2. Support the flange and sleeve yokes on two pieces of wood with lug of the sleeve yoke uppermost and with a soft nosed drift slightly smaller than the outside diameter of the needle bearing race, drive out the underneath bearing housing. The bearing will gradually emerge and can be removed finally with the fingers. Take care not to lose any needle rollers from the bearing race. Reverse the joint and repeat the operation for the opposite bearing, using the drift on the exposed end of the journal trunnion.
3. Repeat Operation 2 with the lug of the flange yoke uppermost.
4. Separate the yokes from the journal trunnion.
5. To remove the splined stub shaft, unscrew the dust cap and pull the shaft from the sleeve yoke.

To Examine Individual Parts For Wear

1. The parts most likely to show signs of wear after long usage are the bearing assemblies and journal trunnions. Should looseness in the fit of these, load markings, or distortion be detected, they must be renewed complete as no oversize journals or bearing housings are provided. It is essential that the bearings are a light drive fit in the yoke trunnions. Should any wear have taken place in the holes of the yoke, the yokes must be renewed. In

the case of wear of holes in the sleeve yoke assembly, the whole assembly must be renewed.

2. The other parts likely to show wear are the sleeve yoke assembly and the splined shaft. A total of 0·004" (0·102 mm) circumferential movement, measured on the outside diameter of the spline, should not be exceeded. Should wear on the splined shaft be apparent, a new unit must be fitted.

To Reassemble The Propeller Shaft Joints

1. Ensure that the drilled holes in the journals are free from foreign matter, and fill with oil. Place the needle rollers in position in the bearing races and fill with oil. Smear the walls of the race with Vaseline if necessary, to retain the needle rollers in position.
2. Renew the cork journal gaskets and retainers on the journal trunnion. The journal shoulders should be shellacked prior to fitting the retainers to get a good oil seal. A tubular drift should be used to ensure that the gaskets and retainers fit down on the trunnion shoulders.
3. Insert the journal trunnion in the yokes. Tap the bearings into position at opposite ends of the trunnion in turn with a soft drift.
4. Replace the snap rings.
5. Refill the joints with oil through the lubricator provided.

To Dismantle The Centre Support Bearing

1. Remove the flange nut, draw the companion flange off the taper and remove the key.
2. Support the flanges of the bearing housing assembly and press the shaft from the centre support bearing assembly. The bearing assembly can now be pressed from the housing.

To Re-assemble The Centre Bearing

1. Press the bearing assembly into the bearing housing, making sure that the bearing is hard against the abutment shoulder in the housing.
2. Press the bearing and housing assembly on the shaft until the bearing is hard against the dust cover.
3. Replace the key and companion flange, making certain that the flange is a good fit hard up the taper. Tighten the nut and secure with a split pln.

LAYRUB COUPLING

If any fault is apparent in the Layrub coupling, it should be replaced as a unit.

REAR AXLE AND FRONT HUBS

The Jupiter rear axle is identical to that fitted to the Javelin with the exception of the rear axle ratio.

The front hub assembly fitted to the Jupiter is identical with that of the later type Javelin.

DATA

Axle Ratio 4·56 to 1

SUSPENSION

DESCRIPTION

Identical to Javelin with the exception of chassis height and torsion bar removal and adjustment.

After Model Engine No. E2/SA/865 the bonded rubber bushed suspension is incorporated.

LUBRICATION

See Lubrication chart, Pages 95 and 96.

FRONT TORSION RODS

Adjustment

The following method should be adopted for setting the chassis height, by adjusting the torsion rod tension.

With the car standing on level ground, measure the distance from the underside of each chassis side-member to the ground. Measurements should be taken immediately below the rear of the spring arm trunnion.

1. Jack up the car as detailed in Steering Chapter.
2. Fully release the front torsion bar adjusters, located on the chassis side members at the rear of the torsion bars.
3. Fit the frame level gauge (*Figure 105*, Page 104) and reset the torsion bar adjusters until a chassis height of 8¼" (210 mm) is obtained immediately below the rear of the spring arm trunnion. *It should be noted that the light weight of the body does not give sufficient loading on the torsion bars and it is necessary that two persons be seated in the car when this adjustment is carried out.*
4. Finally lock up the adjuster locknuts.

OVERHAUL

To Remove And Replace Front Torsion Bars

The torsion rod removal procedure is identical to the Javelin, but it is not necessary to remove the batteries.

To Remove And Replace Rear Torsion Rods

To remove either of the rear torsion rods:

1. Jack up the rear of the car, remove the rear road wheels, support the rear axle on a jack or stand and remove the rear mudwings.
2. Detach the spring arm for the torsion rod to be removed from the rear axle bracket, remove the aluminium covers at each end of the torsion rods and draw off the spring arm which has already been detached from the axle.
3. Drive free the torsion rod towards the end from which the arm has been removed. Remove the rubber bushes fitted at each side of the spring arm, replace as necessary. Worn bushes will affect the height of the car at the rear.

Note: Attention is drawn to the notes given in the Javelin suspension chapter regarding storage of Torsion Rods.

When refitting the torsion rod, make certain that the faces of the octagon line up with those in the bracket in the chassis, before actually driving the rod home, and also that the faces in the bore of the spring arm line up with those on the rod, when refitting the arm.

No provision is provided for adjusting the tension on the rods.

To Remove Swivel Pin Bushes

Refer to Javelin suspension chapter.

To Renew Upper Link Bushes

Refer to Javelin suspension. On models after Engine No. E2/SA/865 the instructions on the modified suspension must be applied.

To Remove And Replace Front Spring Arms

1. Slacken off the torsion rod adjustment, remove the pin and distance tube securing the lower end of the swivel pin to the outer end of the arm, and the pin securing the lower end of the shock absorber to the bracket on the arm. Support the stub axle assembly clear of the spring arm.
2. Withdraw the torsion rod as detailed in appropriate Javelin section.
3. Remove the two Simmonds nuts securing the lower arm brackets to the chassis and lift the arm clear of the chassis.
4. To check for wear and for further dismantling see Javelin section.
5. To reassemble reverse the routine outlined for dismantling, paying attention to the special points outlined in the Javelin section.
6. Set the chassis height as detailed in front torsion rod adjustment section.

TO REMOVE AND REPLACE REAR AXLE

Carry out procedure outlined for the Javelin.

STEERING

DESCRIPTION (*Figure 104*)

Straight rack and pinion assembly, universal jointed column to allow slight transverse variation in the steering wheel position, with shim adjustment for steering pinion zero end float between the ball bearing outer race and the ball bearing abutment face in the eccentric bush.

Adjustment of the steering rack and pinion is by the eccentric bush fitted to the steering rack housing.

The steering rack housing is an aluminium casting, mounted in brackets on the chassis rear upright supports, immediately behind the front suspension, and is located and clamped in the brackets by the three clamping studs and ring. These are at the left hand end of the housing on R.H.D. models and at right hand end on L.H.D.

A key which is a sliding fit in the keyway milled along the rack, prevents the rack turning in the housing. The key is locked in position by a locating screw and locknut in the plate fitted at the centre of the housing.

The steering rods are attached to the rack and to the steering arms by ball joints, adjustment of play in these joints being by shims behind the steering rod pads at the rack ends and by the screwed spring retaining nuts at the steering arm ends. The length of the steering rod, which is screwed and clamped by the steering arm ball joint, can be adjusted by rotating in the required direction after releasing the clamp bolt. Similarly the height of the ball joint, which is screwed and clamped in the steering arm base can be adjusted by screwing up or down, as necessary, again after releasing the clamp bolt.

The steering internal column is connected to the steering pinion shaft by a universal joint and the steering wheel is splined to the internal column to facilitate the positioning of the steering wheel.

Castor angles can alter only if damage has been sustained by the suspension linkage or the frame structure. Should these angles be found incorrect, it will be necessary to investigate the cause and repair or replace the damaged part. Camber angles are controlled by the number of shims fitted behind the upper link bracket.

LUBRICATION

Grease steering connections and steering pinion universal joint every 500 miles and grease the steering pinion shaft and steering column bearings every 2,500 miles.

See Lubrication Chart, Pages 95 and 96.

STEERING TRACK AND CAMBER

The following routine is the only satisfactory method of checking steering track and camber on Jupiter cars, and should be used in all cases when carrying out these checks.

1. Place two screw jacks under the chassis front body cross member, one at each point where the cross member is welded to the chassis side member.
2. Adjust the jacks until the front wheels are lifted clear of the ground, when the weight of the car will be taken off the front torsion bars.
3. Fully release the front torsion bar adjusters located on the chassis side members at the rear of the torsion bars.
4. Fit the frame level gauge described in the Javelin Manual, on to the torsion bars with the stops in contact with the front of the chassis front body cross member.
5. Adjust the two jacks until the chassis is, transversely level, as indicated by the spirit level reading on the frame level gauge.
6. Place a further screw jack under each spring arm and adjust until the spring arms are horizontal. The wheels are now positioned correctly for checking the camber and this may be carried out with the use of a camber gauge or by dropping a weighted line from the edge of the mud wing and measuring the distance between the line and the wheel rim. If the latter method is adopted care must be taken to ensure that a false reading is not obtained due to the wheel rim being distorted.

   Camber angles may be reset by adding or removing shims behind the upper link bracket. The camber limits are as follows:

   Vertical . . . minus ⅛" (3·175 mm)

   Zero . . . . . minus 0° 27'

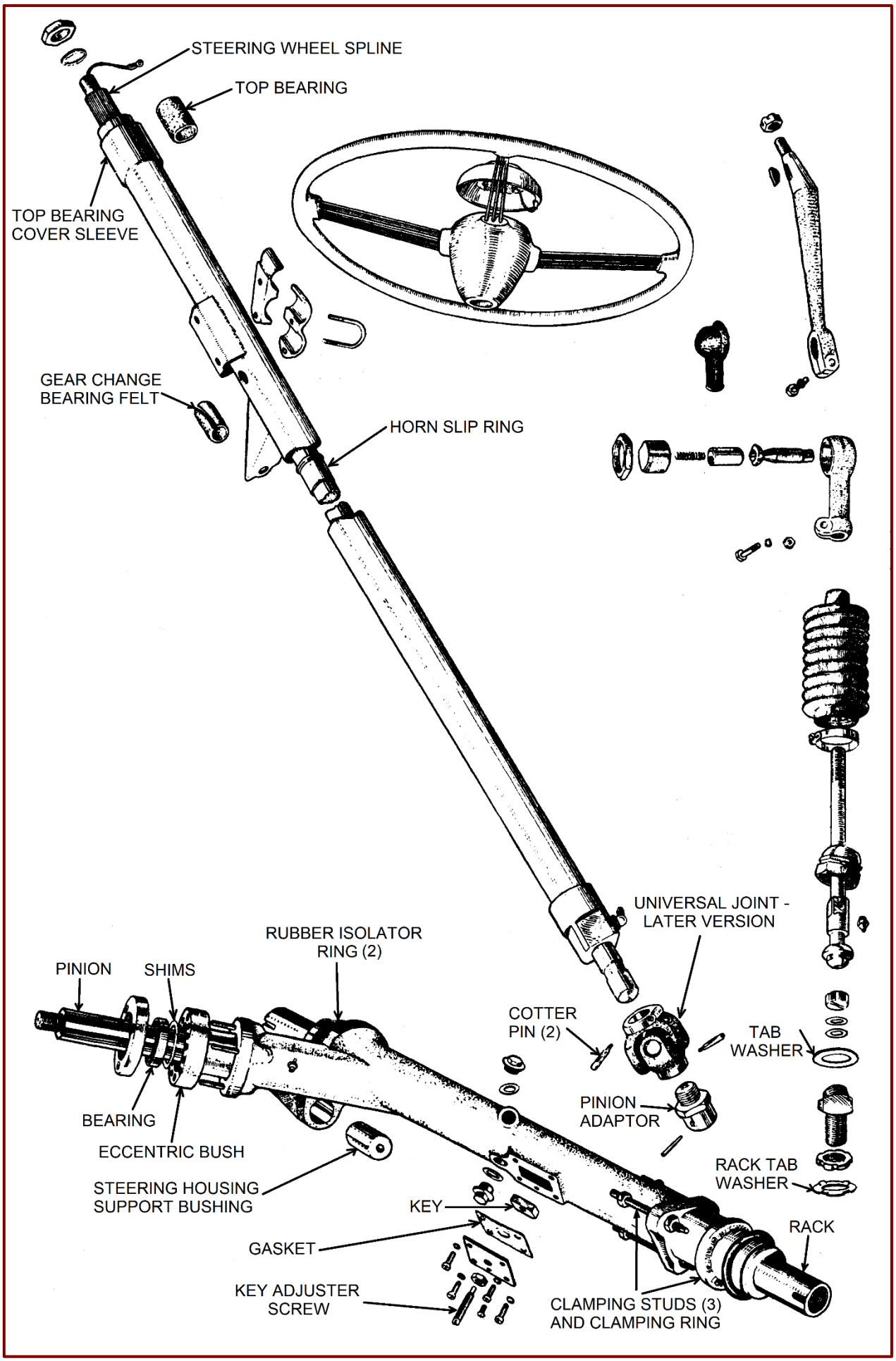


Figure 104. Steering Gear Exploded.

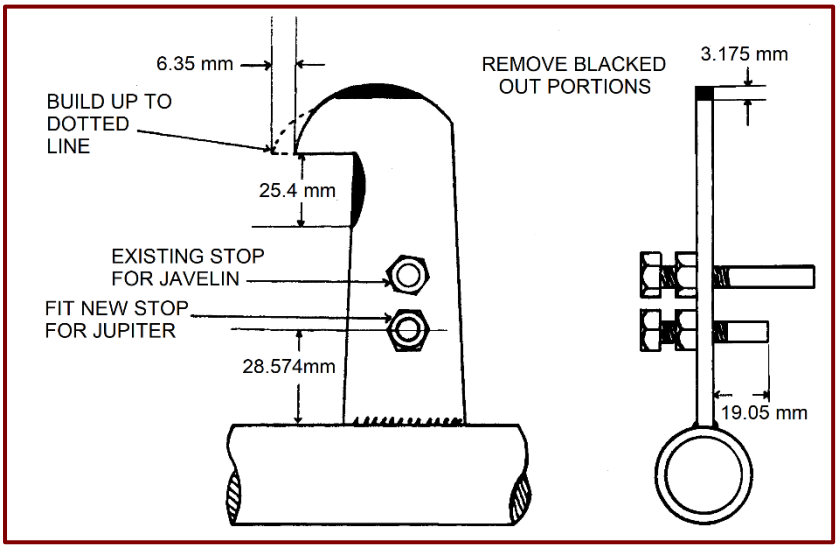


Figure 105. Frame Level Gauge.

Modifications to that shown in *Figure 67* to make it apply to both Javelin and Jupiter. The dimension conversion is as follows:

3.175 mm	⅛" (0·125")
6.35 mm	¼" (0·250")
19·05 mm	¾" (0·750")
25.4 mm	1"
28·574 mm	1⅛" (1·125")

INDIVIDUAL WHEEL TRACK

The Javelin individual tracking gauge and procedure for individual and full tracking as detailed in the Javelin Maintenance Manual should always be used on the Jupiter apart from the following points:

1. Steering cones and nuts are not fitted to the Jupiter and the steering arms are fitted at the opposite side of the stub axle to the Javelin, and this will reverse the adjustment table detailed in the Javelin Steering Chapter as follows:

Steering Ball too high:

(a) 'Toe in' at the rebound.

(b) 'Toe out' at the bump.

(c) Combination of conditions (a) and (b).

Steering Ball too short:

(d) 'Toe out' at the rebound.

(e) 'Toe in' at the bump.

(f) Combination of conditions (d) and (e).

2. **Locking the Steering**

   To lock the steering prior to carrying out the individual wheel track check, release the plate screw locknut and turn the locating screw until the key which runs in the steering rack keyway is pressed against the bottom of the keyway, thereby locking the steering rack in position. A quarter of a turn is normally sufficient when screwing in the plate screw and under no circumstances must excessive force be used.

   To readjust the key after carrying out the individual track test, release the locating screw approximately one quarter of a turn and retighten the locknut. Finally test the steering for ease of movement at this point, and if any tightness is evident, release the locating screw slightly until a perfectly free movement is obtained.

3. **Lifting Spring Arms**

   When lifting the spring arms to horizontal or full bump position, it will be necessary to place additional weight inside the body to overcome the torsion bar tension and ensure that the chassis is not lifted clear of the two jacks under the front body cross member.

4. **Chassis Height**

   When finally resetting the chassis height, the under side of the chassis side member immediately below the rear of the spring arm trunnion should be 8¼ (210 mm) from the ground.

OVERHAUL

To Remove The Rack and Pinion Assembly

Carry out the routine outlined for rack and pinion adjustment and removal, with the following additions.

Note: *The sentence above may not make true sense, at this stage. Read the remainder of the Steering Section before commencing the task of removing the rack and pinion assembly.*

Fully release the clamping studs so that the clamping ring can be moved back to the flange in the rack housing.

The rack assembly can now be moved into the mounting bracket sufficiently to allow the opposite end to be withdrawn and moved clear of its bracket and allow the assembly to be withdrawn from its location in the bracket and manoeuvred clear of the car.

To Dismantle The Rack And Pinion

Release the locknut and locating screw and remove the key location plate positioned at the centre upper portion of the rack housing and remove the key from its location in the steering rack. Release the tab washer and locknuts at each end of the steering rack and remove the steering ball housings, noting their positions for reassembly. Withdraw the pinion assembly and eccentric bush by removing the three nuts and washers securing them to the rack housing. The steering rack can now be withdrawn from the rack housing. Should the ball race or fork end of the steering pinion require replacing, it will be necessary to extract the taper pin from its location through the fork end and pinion shaft. Secure the reduced centre portion of the pinion shaft firmly between the jaws of a vice and unscrew the fork end of the pinion shaft in an anti-clockwise direction, remove the pinion end plate and press the ball race off the pinion shaft. If the universal joint centre block or pivot pins require replacing, drive out the two taper pins through the centre block and pivot pins, and using a suitable punch, drive the pivot pins out of their locations in the centre block. If the Hardy Spicer universal joint is fitted it should be inspected and overhauled as described in the propeller shaft section.

Re-Assembling The Rack And Pinion

This is the reverse of the routine outlined for dismantling, but the following special points should be noted.

Examine all parts for excessive wear or damage and the steering rack for alignment; replace where necessary.

Should a new fork end be fitted to the existing pinion shaft, ensure that when drilling the taper pin hole that if it cannot be drilled in line with the hole in the pinion shaft, that the new hole does not break into the existing hole in the pinion shaft.

When refitting the existing fork end to the existing pinion shaft ensure that the fork end is screwed hard down on to the ball bearing inner race and that the pin holes are perfectly in line. If the holes in the fork end have passed the hole in the pinion shaft, a thin shim fitted between the bearing centre race and the abutment face on the pinion shaft should give the necessary alignment of the holes.

If new pivot pins are being fitted to the universal centre block, press the pins, with the 'V' cut foremost, into the block, ensuring that the inner ends of the pin do not foul the centre pivot pin. Using the taper pin holes as a guide, drill the pivot pins and fit new taper pins. When fitting the key to the groove in the steering rack ensure that an easy sliding fit is obtained and that on assembly, the locating screw peg is correctly located in the hole in the centre of the key. After assembly, screw the locating screw fully down without undue force, and release until freedom of movement is felt on each extreme lock. Lubricate with the recommended lubricant.

To Replace The Rack And Pinion

Reverse the routine outlined for the removal, but the following special points should be noted.

Examine the rubber rings fitted between the mounting brackets and the ends of the rack housing for damage and the clamping ring for damage or distortion. Replace where necessary. Ensure that when the rack and pinion assembly is correctly positioned that the clamping studs are evenly tightened until the assembly is held firmly between the mounting brackets.

Steering Linkage

Adjustment is provided for end movement in the steering rod couplings at each end of the steering rack. Release the clip securing the rubber bellows to each end of the steering rack housing and remove the bellows, unscrew the socket and withdraw the rod from the housing in the ends of the rack. The steering rod pads can then be removed from the housings and the necessary shims fitted behind the pad to eliminate all end movement, while allowing the coupling to move freely.

It should be noted that stiffness in the couplings does not affect the freedom of steering, and that it is therefore necessary to disconnect the ball joint from the steering arm at the brake drum in order to check the full arc of the rod. Steering ball joints are adjusted by slacking the locknut and screwing the spring retaining nut solid, then releasing a quarter of a turn. After the above operations have been carried out, the individual and overall wheel track should be checked.

Pinion Adjustment

The pinion ball bearing should have no perceptible lift in its housing in the eccentric bush. Sufficient shims should be fitted between the pinion ball bearing outer race and the ball bearing abutment face in the pinion eccentric bush to ensure that the ball bearing outer race is firmly clamped between the pinion end plate and the abutment face in the eccentric bush.

To Adjust The Steering Rack And Pinion

Remove the universal joint pivot pin and the bolt securing the gear change column to the rack housing. Remove the steering rods from the housings at each end of the steering rack, detailed in the Steering Linkage Section and release the three clamping bolts at the opposite end of the steering rack to the pinion until the steering rack housing can turn freely in the mounting brackets. Remove the three nuts and washers securing the pinion end plate and eccentric bush to the steering rack housing and turn the rack housing so that the pinion assembly faces downwards. From underneath the car, the pinion and eccentric bush can be withdrawn clear of the studs and turned in the required direction until the best possible meshing is obtained, bearing in mind that if wear has taken place, that it will be mainly in the centre of the rack teeth and that adjustment will be limited on each extreme lock.

Re-assembly is the reverse of the routine outlined for dismantling, but the following special point should be noted.

When the rack and pinion is correctly positioned in the chassis, ensure that the clamping studs are evenly tightened until the assembly is held firmly between the mounting brackets.

To Remove And Replace The Steering Pinion Assembly

Carry out the routine outlined for the adjustment of the steering rack and pinion.

To Renew The Rubber Sealing Ring In The Pinion End Plate

Remove the pinion assembly as outlined in Removal And Refitting of Steering Pinion, leaving the eccentric bush in position. The rubber sealing ring can be eased out of the recess on the underneath side of the pinion end plate and over the ball bearing. Smear the new rubber ring with grease and ease it gently over the ball bearing and into its location in the pinion end plate.

To Dismantle The Steering Column

Disconnect and remove the horn bush assembly positioned on the steering column just below the handbrake attachment bracket. Remove the countersunk setscrew at the side of the steering wheel hub; withdraw the horn push assembly and disconnect the horn wire. Remove the steering wheel nut and draw the steering wheel off the internal column. Remove the handbrake assembly which is secured to the column by two nuts and washers, and remove the handbrake cable from the side of the cable fork; the handbrake cable can now be withdrawn from its location on the column. Disconnect the universal joint by removing the pivot pin, remove the 'U' bolt, support bracket and cap which secures the steering column and gear change column to the facia panel.

The steering column can now be withdrawn through the dash front panel from inside the car. Remove the top bearing cover sleeve and the locking nut from the outer column and withdraw the internal column from the lower end of the outer column.

To Re-Assemble The Steering Column

Reverse the routine outlined for dismantling, but the following special points should be noted.

If excessive wear in the pivot pin holes in the fork end of the inner column is evident, the complete inner column assembly should be replaced. Check the outer column locking nut and felt bearing for excessive wear, replace if necessary. Ensure that the horn bush is free to move up and down in its holder and that the spring tension is satisfactory before refitting the brush holder to the steering column. Check that the horn push contacts are clean when refitting the horn push assembly. For details of the horn slip ring, refer to the Jupiter Electrical Section.

To Replace The Steering Column Top Bearing

Remove the steering wheel, top bearing cover sleeve, horn brush holder and universal joint pivot pin described in Dismantling Steering Column and lift the inner column upwards until the collar, which is integral with the inner column, is sufficiently clear of the outer column to allow the unserviceable felt bush to be withdrawn. Fit the new felt bush, in a dry condition with a small amount of petroleum jelly on the internal bore, leaving a small portion protruding from its location in the column.

Re-assembly

Is the reverse of the routine outlined for dismantling.

DATA

RACK

Number of Teeth	20

PINION

Number of Teeth	6
Ratio	3·33 to 1

FRONT WHEEL TRACK

Parallel to ⅛" (3.175 mm) Toe Out

TURNING CIRCLE	31 ft. (9·45 m)
NORMAL WHEEL CAMBER.	0°
CASTER ANGLE	1¼°

BRAKES

The Javelin Braking System is almost identical to the Jupiter and all instructions and adjustments contained in the Javelin Brake Chapter should be referred to for information. Page 73.

BODY

DESCRIPTION

The two door 2/3 seater body is constructed of 16 gauge aluminium and is mounted to six brackets on the chassis members, each bracket incorporating a Silentbloc bush to prevent road shocks being transmitted to the body. Hide upholstery and cellular rubber cushioning are used. The windscreen is easily detachable for competition work, when two aero screens can be fitted. Normally, toughened glass is used for windscreen and side windows, but laminated safety glass can be used when required. The bonnet and front mudwings, which are detachable from the bonnet when required, lift in a complete assembly to expose the engine, radiator and front suspension and when lifted, is supported by two telescopic support tubes, the release catches being connected by a curved bar which enables the bonnet to be released with one operation. The bonnet is hinged to the cowl panel and is secured at the front end by screw fasteners and clips. The rear end is secured at the lower rear portion of the mudwing by Budget locks, (not fitted to SC models). A full length bumper bar is fitted to the front of the car and corner bumpers are fitted to the rear. The spare wheel compartment is positioned at the rear of the car between the corner bumpers and the luggage compartment is located behind the seat back (an external opening luggage boot is fitted to SC models) which can be moved forward when required. Access to the gearbox filler is obtained behind the radiator when the bonnet is lifted. The tool compartment is located immediately behind the driver's seat.

ADJUSTMENTS

Doors

Adjustments can be made to the side doors by slackening off the bolts securing the door hinges to the body hinge pillars. The elongated holes in the hinges will allow the doors to be adjusted so that a snug fit is obtained.

Bonnet

Adjustment of the bonnet is provided for at the hinges, all bolt holes being elongated to allow the bonnet to be moved in the required direction until the correct fit is obtained.

Door Check Arms

Refer to the Body section in the Javelin Maintenance Manual.

To Remove The Bonnet

Disconnect the head and side lamp leads from the wiring harness underneath the bonnet and remove the wiring harness from the clips securing it to the bonnet. Remove the clevis pins connecting the telescopic supports to the underneath side of the bonnet and the four nuts and bolts securing the bonnet to the hinges. The bonnet can now be lifted clear of the car.

To Refit The Bonnet

Reverse the routine outlined for the removal.

To Remove The Window Winder Handles

Press the escutcheon plate inwards and tap out the securing peg.

To Refit The Handles

Reverse the routine outlined for the removal.

To Remove The Side Door Handles

Remove the screws on the inside edge of the door panel and ease the handle out of its location in the door.

To Refit The Door Handles

Reverse the routine outlined for the removal.

To Remove The Side Door Trim Pads

Remove the window winder handle, see Removing Window Winder Handles, and the door lock internal handle which is secured by a grub screw in the handle.

Remove the top finish rail from the upper edge of the door and the two screws at the two lower corners of the trim pads. Gently lever the trim pad and spring clips fitted to the rear of the trim pad from their location on the door frame.

To Refit The Trim Pads

Reverse the routine outlined for the removal.

To Remove The Side Door Locks

Remove the trim pads, see Removing Trim Pads, and the exterior door handles, see Removing Exterior Door Handles. Remove the screws securing the female dovetail to the outer edge of the door and the screws securing the lock to the door frame, also the extension intermediate bracket. The lock and handle extension can now be manoeuvred clear of the door frame.

To Refit The Door Lock

Reverse the routine outlined for the removal.

To Remove The Side Door Windows

Remove the trim pads, see Removing Trim Pads, and lower the window to the full extent. Remove the mechanism stop and lower the window further down and ease the slider off the window channel runner. Withdraw the window from the upper end of the door.

Remove The Door Side Screen

Remove the bracket at the lower end of the double channel and the two nuts on the underside of the door top member. The door side screen can now be withdrawn from the upper end of the door.

Remove The Winder Mechanism

Carry out the action described above to remove the side door window.

Remove the four screws securing the mechanism to the door.

To Refit The Side Door Windows And Winder Mechanism

Reverse the routine outlined for the removal.

To Renew The Windscreen Glass

Remove the interior rear view mirror and the interior finish mould and the screws securing the windscreen assembly to the outer frame. The windscreen can now be removed from the outside of the car. Remove the portion of rubber weather strip from the outer edge of the lower channel of the windscreen frame and the screws securing the lower channel to the centre and side channels. Remove the lower channel. The windscreen glasses can now be withdrawn from their location in the frame.

Refitting

Reverse the routine outlined for the removal, but the following points should be noted.

Fit the sealing strips into their respective channels and smear the edges of the windscreen glasses with soft soap or gold-size to provide an easy sliding movement of the glass when being inserted into the channels of the windscreen frame.

ELECTRICAL EQUIPMENT

Two six-volt Lucas type SLTW 11E of 50-amp. hour capacity are fitted behind the seat, access being gained by pulling the rear of the seat forward.

On SC models a single unit, Lucas type GTW9A, is housed at the rear of the seat.

For maintenance and testing the instructions contained in the Javelin section are applicable.

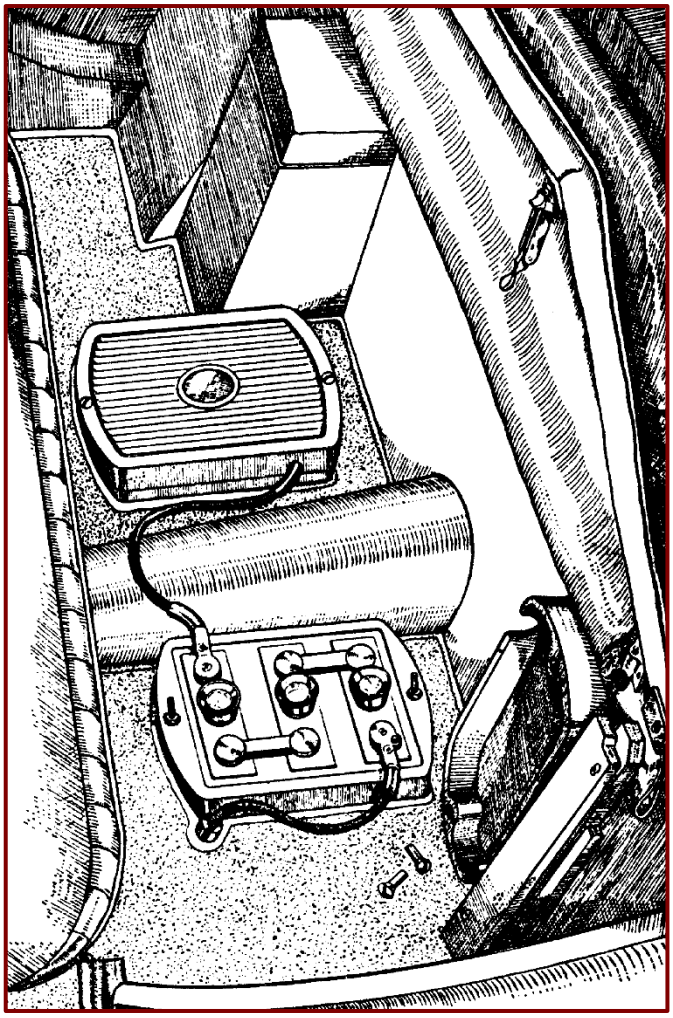


Figure 106. Batteries in Position.

The Lucas type C45 PV4 dynamo is a two-brush machine controlled by a regulating unit and is driven from the engine crankshaft by means of a V-belt and pulley. A gearbox is fitted, to the commutator end bracket. This supplies the drive to the revolution counter.

To Dismantle The Dynamo

Identical to the Javelin C39 PV with the exception of the revolution counter drive gearbox which must be unscrewed from the commutator end bracket.

To Recondition The Dynamo Unit

Identical to Javelin C39 PV.

CONTROL AND REGULATOR, STARTER MOTOR, STARTER SOLENOID

Refer to the equivalent Javelin sections.

LIGHTING

Each head lamp incorporates a Lucas light unit, which consists basically of a reflector and front glass assembly, provided with a mounting flange by means of which it is screwed in the body housing. The bulb, which is of pre-focus type, is located accurately in the rear of the light unit and is secured by a bayonet fixed back shell, which also provides the contact to the bulb.

To Replace Head Lamp Bulb

1. Unscrew the headlamp rim securing screw and lift off the rim.
2. Press the light unit against the pressure of the adjustment screw springs and turn in an anti-clockwise direction, until the heads of the screws coincide with the largest diameter of the elongated holes in the light unit rim, when the unit can be withdrawn.
3. Twist the back shell in an anti-clockwise direction, withdraw the light unit and remove the bulb.
4. Fit the replacement bulb with the side marked ‘Top’ uppermost.
5. To re-assemble the light unit, reverse the above procedure ensuring that the arrow on the back shell coincides with the arrow on the head light unit.

HEAD LAMP BEAM SETTING

As for the Javelin.

TO REPLACE LIGHT UNIT

As for the Javelin.

STOP LIGHT SWITCH

As for the Javelin.

TRAFFICATORS

As for the Javelin.

HORNS

As for the Javelin.

To Remove And Replace Slip Ring

Remove steering column and proceed as detailed in the Javelin section.

WINDSCREEN WIPERS

As for the Javelin.

HEATER

As for the Javelin.

CHASSIS FRAME

DESCRIPTION

The Jupiter has a tubular steel chassis frame of entirely welded construction, consisting basically of two side members which incorporate the front engine bearer tubes; a centre cruciform assembly, and a rear frame.

The front suspension is mounted in a front super-structure which is also part of the Chassis Frame.

All fittings such as engine mounting brackets, bumper brackets, body mounting brackets, etc. are welded to the frame.

For identification purposes the chassis number of the car is stamped on the L.H. Bonnet Catch Bracket.

LUBRICATION

No Lubrication is required on the chassis frame.

MAINTENANCE

In the absence of bolts and rivets no routine inspection is necessary, but it is advisable to check suspension mounting points and engine mountings for possible damage when carrying out a major overhaul.

If the vehicle has been involved in an accident, it is possible that the chassis frame may have bent or distorted, in this case, the frame must be checked for correct alignment.

TOOLS AND EQUIPMENT APPENDIX

The following tools and equipment for the overhaul and maintenance of the Jowett Javelin and Jupiter are available from Jowett Distributors and Dealers or direct from the Factory.

The hand tools are normally supplied in sets mounted on robust steel panels as illustrated in *Figure 107*. Individual items from the sets may be obtained from Messrs. Jenks Bros., Ltd., Britool Works, Bushbury, Wolverhampton.

The tools illustrated individually are of a more specialised nature, and are applicable as indicated in the Data.

The price of the above mentioned tools will be supplied on application.

Special tools for the overhaul of the Salisbury axles fitted to the Javelin and Jupiter are available from Messrs. A. V. Churchill Co., Ltd., Walnut Tree Walk, Kennington, London, S.E.2, who will supply literature and prices on request. It is strongly recommended that where factory reconditioning facilities are available these are used rather than the individual overhaul of axles.

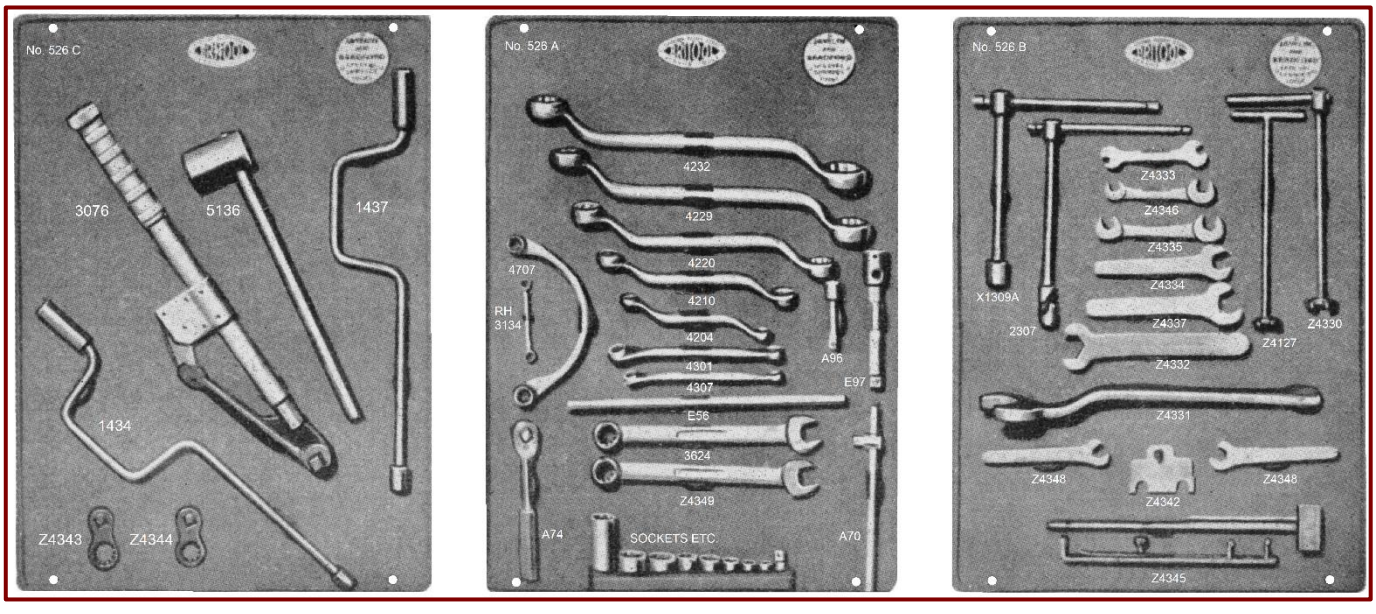
TOOL PANELS

'A' PANEL

Note: All Ring Spanners and Sockets are of the Bi-Hex Form, unless otherwise stated.

Tool	Part Fitted	Model
Z4349 7/16" Whit. Open End – Ring	Fan Locknut, Swivel Pin Nut, Layrub Coupling, Rear Axle Link Bolt, Spring Arm Stub Axle Pin, Upper Link Pin Locknut.	Javelin & Jupiter*
3624 ½" Whit. Open End – Ring	For Centre Crankcase and General Purposes.	Javelin & Jupiter
4707 ¼" x 5/16" Half-moon Ring	Rear Timing Cover, Exhaust Flange Bolts.	Javelin & Jupiter*
4232 ⅝" x ¾" Ring (Flare Type)	Starting Dog, Rear Axle Pinion Nut.	Javelin & Jupiter
4301 3/16" x ⅛" Ring (Flare Type)	Distributor Suction Control Pipe, Nut and Union (Carb End), General Purposes.	Javelin & Jupiter
4307 ¼" x 5/16" Ring (Flare Type)	Petrol Branch Pipe Nut at Pump, Petrol Pipe Union Nuts at Tank and Petrol Pipe Union Nuts at Tank and General Purposes	Javelin & Jupiter*
4204 3/16" x ¼" Whit. Ring	General Purposes	Javelin & Jupiter
4210 ⅜" x 5/16" Whit. Ring	Bumper Bolts, General Purposes	Javelin & Jupiter*
RH3134 5/16" AF x 11/32" Hex. Ring	Chrome Bonnet Strip Nuts, Dash Panel Nuts, Coil and Distributor Terminal Nuts	Javelin & Jupiter*
AB445 3/16" Socket	Gearbox Selector Housing, Timing Case Cover, General Purpose with Ratchet A74 and Extension A96	Javelin & Jupiter
AB525 ¼" Socket	Big End Bolts – use with Torque Wrench and Extension, General Purposes	Javelin & Jupiter*
AB600 5/16" Socket	Cylinder Head Nuts – use with Torque Wrench and Extension, General Purposes	Javelin & Jupiter*
AB710 ⅜" Socket	Steering Ball Joints, General Purposes	Javelin & Jupiter*
A74 Ratchet	General Purposes with Sockets and Extensions	Javelin & Jupiter*
A96 3" Ratchet Extension	General Purpose with Sockets and Ratchet	Javelin & Jupiter*
A70 Sliding Offset Handle	For use with Extension A96 and Small Range Sockets	Javelin & Jupiter*
APES ⅜" x ½" Reduction	For Adapting ⅜" Square Sockets and Extension to Torque Wrench	Javelin & Jupiter*
EB920 ½" Whit. Socket**	Crankcase Bolts**, Torsion Bar Adjusting Bolts, Front Shock Absorber Pin and Nut.	Javelin & Jupiter*

PANEL 'C' **PANEL 'A'** **PANEL 'B'**



'A' PANEL (Continued)

Tool	Part Fitted	Model
EB1010 9/16" Whit. Socket	Track Rod Cone Lock Nut, Front and Rear Hub Nuts, Steering Arm Nuts and Torque Arm Pin Nut.	Javelin & Jupiter*
4220 7/16" x ½" Whit. Ring Spanner	Layrub Coupling Bolts, Spring Arm Pin and Nut, Shock Absorber Pin and Nut, Shock Absorber Retaining Nut, Top and Bottom Retaining Nuts on Rear Shock Absorbers, Torsion Bar Adjusting Bolt and General Purposes.	Javelin & Jupiter*
ED820 7/16" Whit. Socket	Crankcase Top Rear and Top And Bottom Front Bolts	Javelin & Jupiter
E97 Extension	For General Purpose with Torque Wrench and Sockets	Javelin & Jupiter
4229 9/16" x 11/16" Ring Spanner	Front and Rear Hubs, Steering Arm Nuts, Steering Cone Lock Nuts, Torque Arm Pin Nuts	Javelin & Jupiter*
A63 ⅜" Adaptor	For use with small range sockets, Ratchet A74 and Extension A96.	Javelin & Jupiter*
E56 Sliding Bar	For use with Extension E97.	Javelin & Jupiter*

* Also used for Bradford Commercial Vehicles. ** Use with Torque Wrench.

'B' PANEL

Note: All Ring Spanners and Sockets are of the Bi-Hex Form, unless otherwise stated.

Tool	Part Fitted	Model
X1309A 9/16" Square T Handle	Rear Axle Filler Plugs	Javelin & Jupiter*
2307 ¼" Whit. T. Handle Wrench	Rear Axle Differential Cover Plate, Rear Timing Cover Bolts and Clutch Cover Plate	Javelin & Jupiter*
Z4334 ⅜" Whit. Single Ended Thin	Front Brake Adjusting Nut, Oil Switch Unit	Javelin & Jupiter*
Z4332 9/16" Whit. Jenbro Thin Single Ended (2 off)	Steering Cone and Locknut	Javelin
Z4335 Right Angle D/E 5/16" x ¼"	Right hand Carburettor Nut (Inner) (O/S)	Javelin & Jupiter*
Z4346 Obstruction D/E 3/16" x ¼"	Left hand Carburettor Nut (Inner) (N/S)	Javelin & Jupiter
Z4330 Crowfoot 3/16" Whit.	Steering Column Flange Nut	Javelin & Jupiter*
Z4331 1½" S/E Open End	Gearbox, Clutch and Main Shaft Nuts	Javelin & Jupiter*
Z4333 5/16" x ⅜" AF Open Ends	Gearbox Drain Plug, Upper Link Reservoir Plug, Steering Box Filler Plug, Rear Brake Adjuster, Coil and Distributor Terminals and, Dash Panel Nuts.	Javelin & Jupiter*
Z4127 ¼" Whit. Crowfoot	Suspension Reservoir Nut	Javelin & Jupiter*
Z4337 ½" Flat S/End	Tappets	Bradford CB
Z4345 Gauge	Independent Front Suspension	Javelin & Jupiter
Z4348 (2 off) S/End	Tappets	Bradford CC
Z4342 Special Tool	Tappet Locking Plate	Bradford CC

* Also used for Bradford Commercial Vehicles.

'C' PANEL

Note: All Ring Spanners and Sockets are of the Bi-Hex Form, unless otherwise stated.

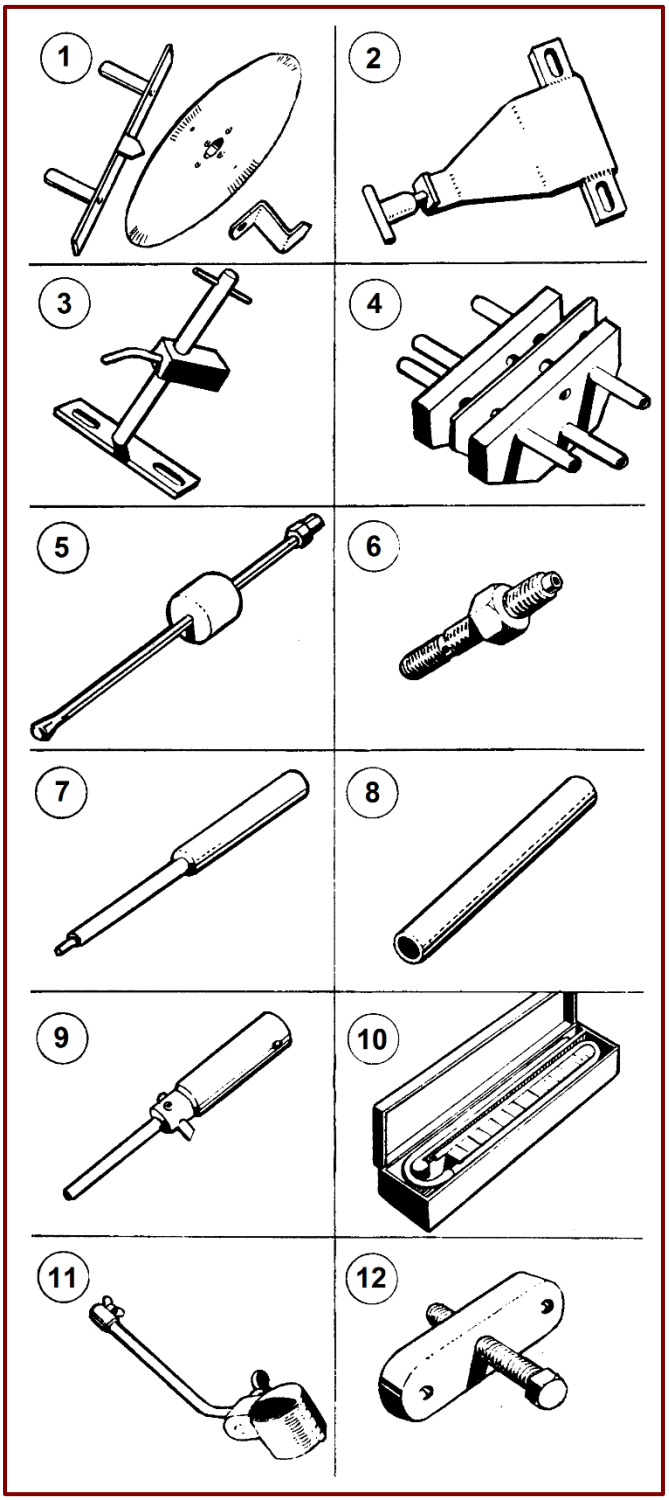
Tool	Part Fitted	Model
1437 ¼" Whit. Brace. (To be used mostly when engine removed)	Timing Case Nuts (Bradford), Fuel Pump Set Screws, General Purposes	Javelin & Jupiter*
1434 3/16" Whit. Brace	Timing Case Set Screws, General Purposes	Javelin & Jupiter*
5135 11/16" Whit. S/Ended Wrench	Heavy Duty, Companion Flange Nut, Steering Wheel Nut and Companion Flange Nut (Bradford).	Javelin & Jupiter*
Z3076 Torque Wrench (100 lbs. ft.)	To Be Set As Per Schedule – Crankcase Bolts, Cylinder Head Bolts, Big End Bolts and Flywheel Bolts.	Javelin & Jupiter*

'C' PANEL (Continued)

Tool	Part Fitted	Model
Z4343 ½" Drive, 7/16" Whit. Crow-foot Ring Adaptor	Crankcase Tie Bolts in Conjunction with Z3076 Torque Wrench.	Javelin & Jupiter
Z4344 ½" Drive, ½" Whit. Crow-foot Ring Adaptor	Crankcase Tie Bolts in Conjunction with Z3076 Torque Wrench.	Javelin & Jupiter

* Also used for Bradford Commercial Vehicles.

SERVICE EQUIPMENT



Tool, Number and Application

(**1**) Valve timing degree plate complete with indicator pointers. J11236C.
Application: Accurate setting of valve timing.

(**2**) Dial mounting bracket, crankcase. J10851D.
Application: Checking tappet travel in conjunction with tool J11236C.

(**3**) Dial mounting bracket, rocker shaft. J10806D.
Application: Quick check of valve timing.

(**4**) Balance pipe testing unit, with two rubber gaskets. J10807C.
Application: Testing balance pipe seals.

(**5**) Hydraulic tappet body extractor. J11245D.
Application: Removal of hydraulic tappet assembly from crankcase. Before Eng. No. E0/PC/11940.

(**6**) Oil pressure test adaptor bolt. JDK279.
Application: Testing oil pressure on Javelin Standard models, not fitted with an oil gauge.

(**7**) Valve guide extractor punch. J11235D.
Application: Valve guide extraction.

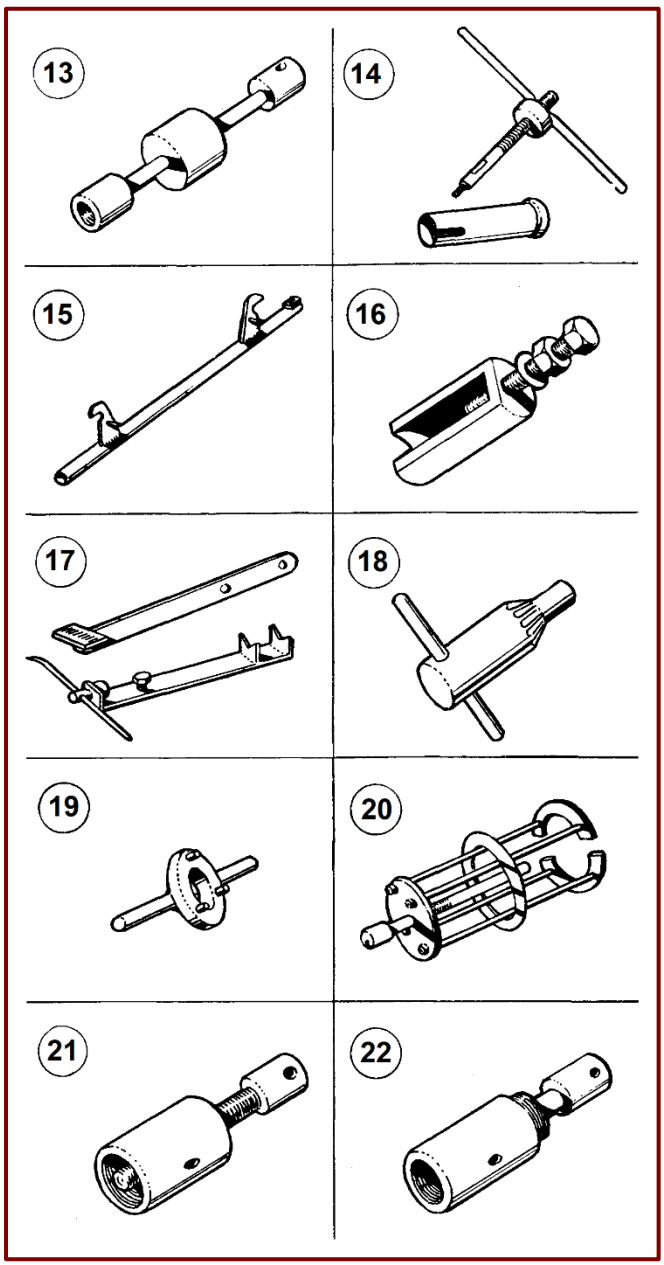
(**8**) Valve guide inserting punch. J11234D.
Application: Replacement of valve guides to correct depth.

(**9**) Valve seat reducing cutter. J11233D.
Application: Valve seat reduction cutter.

(**10**) Crankcase depression manometer gauge.
Application: Checking crankcase depression.

(**11**) Engine vibration indicator mounting bracket. J10858C.
Application: Engine vibration check.

(**12**) Output flange extractor. J10805.
Application: Removal of gearbox output flange



Tool, Number and Application

(**13**) Rear axle shaft extractor. J14836.
Application: Remove rear axle shafts.

(**14**) Gearbox reverse idler shaft extractor. J11232C.
Application: Gearbox reverse idler shaft extraction.

(**15**) Frame level gauge. J9127C.
Application: Chassis level gauge for independent track alignment.

(**16**) Torsion bar extractor. J14835.
Application: Extraction of torsion bars.

(**17**) Independent track gauge. J14839.*
Application: Checking independent wheel alignment.

(**18**) Steering yoke seat cutter. T10997D.
Application: Reduction of lift in stub axle body.

(**19**) Spanner for front hub ball race ring nut. J10968D.
Application: Removal and replacement of front hub ring nut. After Eng. No. E0/PB/10594.

(**20**) Gearbox ball race extractor. J14834.
Application: Extractor of gearbox bearings.

(**21**) Rear brake drum drawer. Britool J14837.
Application: Rear brake drum withdrawal (hydro-mechanical brakes).

(**22**) Rear and front brake drum drawer. J14838.
Application: Rear and front brake drum withdrawal (full hydraulic brakes).

* Incorporated in Tool Panel 'B'.

Note: Reference tools on Panel 'A' Spanner 4204 is shown in the original manual as 3/16" x ¾" size. It should be 3/16" x ¼", which is a standard Whitworth size combination.

RESTORER'S NOTES

COMMENT

The *Maintenance Manual for the Jowett Javelin and Jupiter* motor cars has been restored as this PDF document in as faithful a manner as possible. The text was scanned using the Canon 5600F Flat Bed Scanner's optical character reading (OCR) software. That purports there could be spelling errors that the MS Word Spelling Checking system could not detect as errors. Some typing errors were found and corrected, as were some metric conversions.

All illustrations were scanned at 600 d.p.i. resolution and then, individually 'cleaned' using Corel Paint-Shop. Text items and item numbers were all erased and then inserted using MS Paint. This was done for two reasons – clarity for reading and for more appropriate cropping size for insertion into the MS Word document.

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