Workshop Manual

Rolls-Royce Silver Cloud
Rolls-Royce Silver Cloud II
Phantom V

Bentley S
Bentley S2
Bentley Continental S
Bentley Continental S2

Including:-

Supplements for the Series III and 3 cars

Printed in England

PREFACE

This Workshop Manual has been compiled in an endeavour to assist service personnel responsible for maintenance and overhaul, in properly maintaining the high standard of engineering achieved in the production of Rolls-Royce and Bentley motor cars.

The book is copiously illustrated with photographs and orthographic reproductions which are suitably annotated in order to provide quick reference with minimum searching.

Although all information contained in the Manual was correct when going to print, modifications which may subsequently develop will be kept up to date by means of Service Bulletins.

Information given in the latest Bulletin will supersede that given in the Section of the Manual to which it refers, until such times as the Manual is re-issued with the necessary amendments.

Instructions for the maintenance and overhaul of the S2 engine and the Refrigeration Systems fitted to the Rolls-Royce and Bentley cars are contained in individual volumes. Special Workshop Tools referred to in these publications and the Workshop Manual are listed and illustrated in a further publication.

Personnel of Rolls-Royce Service Departments at Hythe Road, Willesden, London N.W.10, and at Pym's Lane, Crewe, are always prepared to answer queries or give advice on individual servicing problems, but it will assist them if queries are accompanied by the chassis number of the car.

Information contained herein applies to the following cars:

Rolls-Royce	**Bentley**
Silver Cloud	S1
Silver Cloud Long Wheelbase	S1 Long Wheelbase
Silver Cloud II	S2
Silver Cloud II Long Wheelbase	S2 Long Wheelbase
Phantom V	Continental S1
	Continental S2

The following publications are available for reference in conjunction with this Manual:

TSD 471	Automatic Gearbox Service Manual
TSD 720	Car Interior Cooling System. Boot Unit
TSD 753	Rolls-Royce Silver Cloud II and Bentley S2 Engine Manual
TSD 723	Air Conditioning System. Underwing Unit
TSD 727	Workshop Tools
TSD 744	Air Conditioning System. O.M.C. Refrigeration Unit

TSD 729

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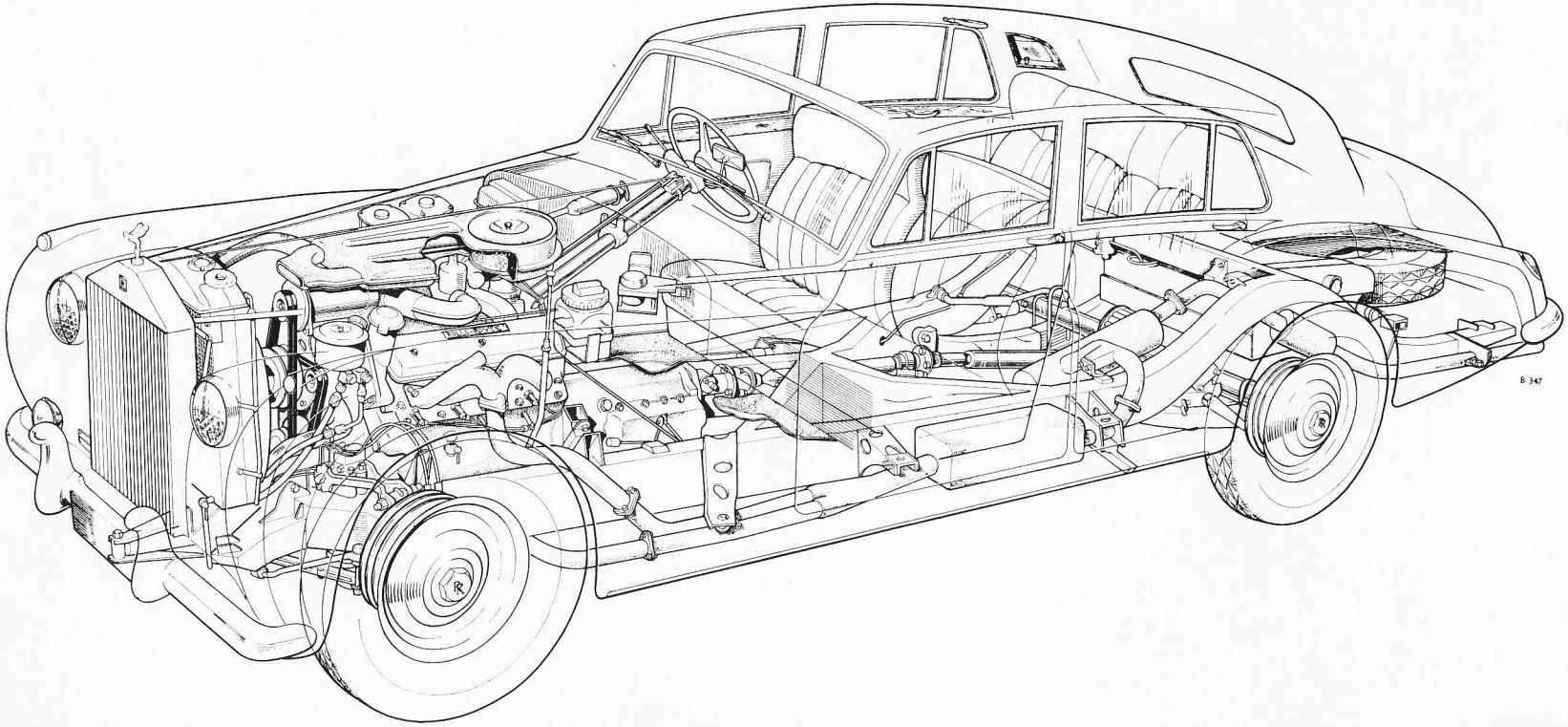
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Cut-away of Rolls-Royce Silver Cloud II car

CHAPTER A

GENERAL INFORMATION

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CHAPTER A

GENERAL INFORMATION

SECTION A1 SPECIFICATION — S1 CARS

Engine

Type	Six cylinders, in line, with overhead inlet and side exhaust valves.
Bore	3·750 in. (95·3 mm.)
Stroke	4·500 in. (114·3 mm.)
Cubic capacity (piston displacement)	298 cu. in. (4887 c.c.)
Compression ratio	
Standard S1 and Long Wheelbase S1 cars	6·6 : 1 (early) 8·0 : 1 (late)
Bentley Continental S1 cars	7·25 : 1 (early) 8·00 : 1 (late)
Suspension of the engine and gearbox	The engine and gearbox are of unit construction. The unit is flexibly mounted on rubber at three points.

Cylinder Block

Type	Monobloc casting, integral with crankcase.
Material	Cast iron with full length, high phosphorus iron cylinder liners. Phosphor-bronze exhaust valve guides.

Cylinder Head

Type	Detachable, 6-port type
Material	Aluminium alloy, with nickel chrome steel inlet valve seat inserts and cast iron inlet valve guides.

Crankshaft

Material	Nitride hardened chrome Molybdenum steel. Dynamically balanced.
Number of Journals	Seven
Balance weights	Integral with shaft
Crankshaft vibration damper	Internal. Combined spring-drive and friction-type damper.

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Main Bearings

Number off	Seven
Type	Copper, lead-indium lined thin steel shells with 'pre-sized' bores to suit diameter of crankshaft journals.

Pistons

Material	Aluminium alloy, split skirt.
Number of rings	Three compression and one Duaflex oil scraper. Top compression ring chromium plated.

Connecting Rods

Type	'H' section. Fully machined and balanced.
Material	Chrome Molybdenum steel.
Big-end bearings	Copper, lead-indium lined thin steel shells with 'pre-sized' bores to suit diameter of crankpins.

Camshaft

Material	Case hardened nickel steel
Number of journals	Four
Bearings	Four Babbitt lined steel shells
Thrust taken	Front
Drive	Helical tooth gears

Valve Gear

Inlet valves	Overhead push rod operated. Dual springs. Gland packing to control lubrication.
Exhaust valves	Side. 'Brightray' heat-resisting faces to prolong life.
Valve tappets	Barrel type, flat face.

Lubrication System

General	High pressure feed to crankshaft, connecting rod and camshaft bearings and to the distributor drive skew gearing. Dual oil relief valve providing a positive low pressure oil supply to the engine gears and to the hollow valve rocker shaft from which valve rockers, push rods, tappets and cams are lubricated.
Type	Pressure throughout
High pressure supply	25 lb/sq.in. (approximate)
Low pressure supply	5 lb/sq.in. (approximate)
Sump capacity	2 galls. (Imperial), 2·4 galls. (U.S.A.), 9·1 litres.
Oil pump	Spur gear type with floating intake strainer.
Oil pressure relief valve unit	Dual type, controlling both high and low pressure feeds.
Oil filter	'British' Full-Flow type

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Fuel System

Carburetters	
Early S1 cars	Two S.U. HD 6 diaphragm type. Automatic choke for cold starting.
Late S1 and Bentley Continental S1 cars	Two S.U. HD 8 diaphragm type. Automatic choke for cold starting.
Air cleaner	Mesh or oil bath
Fuel pumps	S.U. twin electric type 'L'
Fuel tank capacity	18 galls. (Imperial), 21·6 galls. (U.S.A.), 81·8 litres.
Fuel strainers	Main fuel strainer mounted on the side frame member in front of the fuel tank. Small gauze strainer at the carburetter inlets and in the fuel pumps.
Fuel gauge	Electric. Registers when the ignition switch is 'ON'.

Cooling System

Coolant capacity	28 pints (Imperial), 33·61 pints (U.S.A.), 15·91 litres.
Pump	Centrifugal
Fan	Five blades
Fan diameter	17¾ in.
Pump and fan drive	'Vee'-belt
Radiator matrix	Film type
Radiator shutters	Fixed
Coolant temperature control	The pressurised system operated at 7 lb/sq.in. applies to S1 refrigerated cars only. The coolant on all S1 cars is circulated by a centrifugal pump. A thermostat valve is fitted to a by-pass flow pipe to direct coolant from the pump back to the engine, by-passing the radiator matrix when the engine is cold.
Temperature indicator	This instrument is mounted on the facia and operates when the ignition is 'ON'.
Coolant	An inhibited solution of Ethylene Glycol (BSS 3150).

Propeller Shaft

Divided type, having a ball and trunnion universal joint. The shaft is supported in the centre by a flexibly mounted ball race.

Rear Axle

Type	Hypoid bevel gears with semi-floating half-shafts.
Final drive	Through a hypoid crown wheel and pinion.
Pinion teeth	Twelve
Crown wheel teeth	Forty-one
Ratio	
Standard S1 cars	3·42 : 1
Bentley Continental S1 cars	2·92 : 1
Oil capacity of casing	1½ pints

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Brakes

Footbrake	Servo-assisted hydrostatic brakes, hydraulic operation on the front wheels, hydraulic and mechanical on the rear wheels.
Handbrake	Operates through a mechanical linkage to the rear wheels.
Brake shoe linings	Mintex M 14 or Ferodo DS2
Friction lining area (4 brakes)	240 sq.in. (1548 sq.cm.)
Handbrake lever	Twist grip barrel type

Servo Motor

	The servo motor operates on the principle of the dry disc clutch. The lined friction plate is driven from the gearbox output shaft at approximately one fifth of the propeller shaft speed.
Lining	Ferodo DM8
Cam angle	S1 cars (early) 52 deg. — single master cylinder. S1 cars (late) 47 deg. — twin master cylinders.

Front Hubs

General	Two taper roller bearings

Wheels and Tyres

Wheels	Bolted on pressed steel wheels with covering discs.
Rim-wheel	Well-base rims, 15·000 in. × 6·000 in.
Tyres	
Standard S1 cars	8·20 in. × 15 in.
Bentley Continental S1 cars (early)	7·60 in. × 15 in.
Bentley Continental S1 cars (late)	8·00 in. × 15 in.

Steering

Type	Power assisted or manual
Steering unit	Cam and roller
Drive	Right-hand or left-hand
Steering wheel diameter	18 in.
Steering box gear ratio	
Standard S1 cars	20·6 : 1
Bentley Continental S1 cars	18·7 : 1
Power assisted S1 cars	18·7 : 1

Suspension

Front	Independent, incorporating coil springs, hydraulic shock dampers and torsion rod stabiliser.
Rear	Semi-elliptic leaf springs in combination with controllable hydraulic shock dampers. An axle control rod is fitted which, together with the road springs, takes the torque and brake reaction.
Front shock dampers	Rolls-Royce hydraulic double acting.
Rear shock dampers	Rolls-Royce hydraulic double acting. Controllable through a switch on the steering column.

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Chassis Frame

Type	Box section throughout, with all welded joints.

Jacking System

Type	Smith Bevelift jacks

Battery

Make and type	Either P & R Dagenite — 6HZP 9/GZ or Exide 6XCV 9/L.
Voltage	12 volts
Capacity	57 ampere-hours
Earth	Negative to chassis frame

Ignition Distributor

Make and type	Delco-Remy. Twin contact breaker with synchronised contact breaker arms
Rotation	Clockwise
Advance mechanism	Automatic (centrifugal governor)
Firing order	1, 4, 2, 6, 3, 5

Ignition Coil

Make	Lucas or Delco-Remy
Sparking plugs	
Standard S1 cars (early)	Lodge CLNP or Champion RN 8
Bentley Continental S1 and later S1 cars	Lodge CLNP or Champion N 5

Generator

Make	Lucas
Type	Early cars C47PV Late cars C48
Maximum output	Early cars 30 amperes 13·5 volts Late cars 35 amperes 13·5 volts.
Drive	Adjustable 'Vee'-belt
Voltage regulator and cut-out	Lucas RB 310, current voltage type

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Starter Motor

Make and type	Lucas M-45G. 12 Volt with Rolls-Royce built-in planetary reduction gear. Overall reduction 18·05 : 1.
Cranking speed	80–160 engine r.p.m. (under normal temperature climate conditions).
Rotation	Clockwise
Pinion flywheel ratio	14/115

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Horns

Make and type — Lucas WT 618. Twin Wind-tone

Direction Indicators

Make and type — Lucas FL 5. Flashing type indicators

Headlamps

Make and type — Lucas RL 700

General — The headlamps are controlled by two switches, the master switch on the switchbox and a foot-switch for 'beam' selection. A small red warning lamp, mounted in the speedometer, is illuminated whenever the headlamps are on the DRIVING BEAM (full on).

Fog Lamps

General — Twin fog lamps are fitted which incorporate the front FLASHER element. These are double filament pre-focus type bulbs.

Fuse Box

General — The large fuse box carries eight fuses. Each circuit fuse is one strand of No. 28 S.W.G. tinned copper wire. The small fuse box carries the horn fuse. This is a cartridge type fuse of 25 amp. rating.

Car Heater

Alloy heat exchanger under the right-hand front wing ducted to slots under the scuttle and to an outlet in the floor of the rear compartment at the back of the front seat.

The later S1 and Continental cars were fitted with two manually-operated water taps, and two modified vacuum controlled water valves, in order to provide a more efficient means of interior temperature control.

De-mister and De-icer

Alloy heat exchanger under the left-hand front wing delivering hot or cold air to the windscreen. The rear window is electrically heated, controlled by a switch on the parcel shelf.

Windscreen Washer

Make — Lucas Screen-jet

General — Vacuum operated
Special liquid has a low surface tension and anti-freeze properties.

Windscreen Wipers

Make — Lucas DR 1 (early cars)
Lucas DR 3 (later cars)

General — Electrically operated. Two-speed, self-parking.

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Radio

Make and type	Radiomobile
Early S1 cars	4300. All wave radio 200 × B. Medium and long wave radio 202 × B. Medium wave radio
Late S1 cars	200 RB. Medium and long wave radio 202 RB. Medium wave radio 230 R. Medium and short wave radio

Body

General	Steel and light alloy stressed skin construction, the floor being an integral part of the body, to ensure optimum strength and rigidity consistent with lightness.

Dimensions

Wheelbase	
Standard S1 and Bentley Continental S1 cars	10 ft. 3 in. (312·4 cm.)
Long Wheelbase S1 cars	10 ft. 7 in. (322·6 cm.)
Track, front	
Standard S1, Bentley Continental S1 and Long Wheelbase S1 cars	4 ft. 10 in. (147·3 cm.)
Track, rear	
Standard S1, Bentley Continental S1 and Long Wheelbase S1 cars	5 ft. 0 in. (152·4 cm.)
Overall length (including bumpers)	
Standard S1 cars	17 ft. 8 in. (539·5 cm.)
Long Wheelbase S1 cars	17 ft. 11¾ in. (548 cm.)
Bentley Continental S1 cars	17 ft. 2½ in. (524·5 cm.)
Overall width (over wings)	
Standard S1 cars	6 ft. 2½ in. (189·2 cm.)
Long Wheelbase S1 cars	6 ft. 2¾ in. (189·8 cm.)
Bentley Continental S1 cars	5 ft. 11½ in. (181·6 cm.)
Overall height (unladen)	
Standard S1 and Long Wheelbase S1 cars	5 ft. 4¼ in. (163 cm.)
Bentley Continental S1 cars	5 ft. 4 in. (162·6 cm.)
Turning circle diameter	
Standard S1 cars	41 ft. 8 in. (12·7 m.)
Long Wheelbase S1 and Bentley Continental S1 cars	43 ft. 0 in. (13·1 m.)
Weight, kerbside	
Standard S1 cars	40 cwt. (approximate) (2032 kgs.)
Long Wheelbase S1 cars	41½ cwt. (approximate) (2108 kgs.)
Bentley Continental S1 cars	38 cwt. (This value is approximate to the mean weights of various bodies).

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SECTION A2 SPECIFICATION — S2 CARS

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Engine

Engine data appears in TSD 721

Cooling System

Coolant capacity	21 pints (Imperial), 25·21 pints (U.S.A.), 11·93 litres.
Pump	Centrifugal
Fan	Five blade
Pump and fan drive	Twin adjustable 'Vee'-belts
Radiator matrix	Film type
Radiator shutters	Fixed
Coolant temperature control	Pressurised system working at 7 lb/sq.in. Coolant circulation by centrifugal pump thermostatically controlled by a by-pass thermostat valve.
Temperature indicator	On instrument panel. Electric, registers when ignition switch is 'ON'.
Coolant	An inhibited solution of Ethylene Glycol (BSS 3150).

Propeller Shaft

Divided type, having a ball and trunnion universal joint and two needle roller universal joints. The shaft is supported in the centre by a flexibly mounted ball race.

Rear Axle

Type	Semi-floating
Final drive	Through a hypoid crown wheel and pinion
Pinion teeth	
Standard S2 cars	13
Bentley Continental S2 cars	13
Phantom V cars	9
Crown wheel teeth	
Standard S2 cars	40
Bentley Continental S2 cars	38
Phantom V cars	35
Ratio	
Standard S2 cars	3·08 : 1
Bentley Continental S2 cars	2·92 : 1
Phantom V cars	3·89 : 1
Oil capacity of casing	
Standard S2 cars	1⅝ pints
Bentley Continental S2 cars	1⅝ pints
Phantom V cars	1¾ pints

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Brakes

	Power assistance provided by a servo motor.
Footbrake	Independent twin hydraulic system with additional mechanical linkage to rear shoes.
Handbrake	Mechanical to rear wheels
Brake shoe linings	Ferodo DS2 or Mintex M 14
Friction lining area (4 brakes)	
S2 cars	240 sq.in. (1548 sq.cm.)
Bentley Continental S2 cars	304 sq.in. (1960 sq.cm.)
Handbrake lever	Twist grip barrel type

Servo Motor

General	The servo motor operates on the principle of the dry disc clutch. The lined friction plate is driven from the gearbox final shaft at approximately one-fifth of the propeller shaft speed.
Servo motor lining	Ferodo DM8
Cam angle	
S2 cars	37·5 deg. — twin master cylinders
Bentley Continental S2 cars	47 deg. — twin master cylinders

Front Hubs

General	Two taper roller races

Wheels and Tyres

Wheels	Bolted-on pressed steel wheels with covering discs.
Rim wheels	Well base rims, 6L × 15·00 in.
Tyres	
Standard S2 cars	8·20 in. × 15·00 in.
Bentley Continental S2 cars	8·00 in. × 15·00 in.
Phantom V cars	8·90 in. × 15·00 in.

Steering

Type	Power assisted
Steering unit	Cam and roller
Drive	Right-hand or left-hand
Steering wheel diameter	17 in.

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Suspension

Front	Independent coil spring suspension, hydraulic shock dampers and anti-roll stabiliser.
Rear (except Phantom V)	Semi-elliptic leaf springs. Controllable hydraulic shock dampers. A special form of axle control rod is fitted which, together with the road springs, takes the torque and brake reaction.
Phantom V	The Phantom V is as specified above with the exception of the rear axle control rod which is not fitted to the Phantom V chassis.

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Front Shock Dampers

Type and make	Rolls-Royce hydraulic double-acting.

Rear Shock Dampers

Type and make	Rolls-Royce hydraulic double-acting.
General	Controllable through a switch on the steering column.

Chassis Frame

Type	Box section throughout, with all welded joints.

Jacking System

Type	Smith Bevelift jacks

Battery

Make and type	Either P & R Dagenite — 6 HZP 11/9 GZF or Exide — 6 XTHZ 11/L.
Voltage	12 volts
Capacity	67 ampere-hours
Earth	Negative to chassis frame

Ignition Distributor

Make and type	Delco-Remy. Twin contact breakers with synchronised contact breaker arms.
Rotation	Anti-clockwise
Advance mechanism	Automatic (centrifugal governor)
Firing order	A1, B1, A4, B4, B2, A3, B3, A2 1, 5, 4, 8, 6, 3, 7, 2

Ignition Coil

Make	Delco-Remy or Lucas

Sparking Plugs

Make and type	Champion RN 8, Champion RN 13P or Lodge CLNP.

Generator

Make	Lucas
Type	C 48
Maximum output	35 amperes, 13·5 volts
Drive	Twin 'Vee'-belts
Voltage regulator and cut-out	Lucas RB 310, current voltage type

Starter Motor

Make and type	Lucas M-45G. 12 volts
Rotation	Anti-clockwise (from front of the engine)
Flywheel to pinion ratio	18 : 1

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Horns

Make and type — Lucas WT 618. Twin Wind-tone

Direction Indicators

Make and type — Lucas FL 5. Flashing type indicators

Windscreen Wipers

Make and type — Lucas DR 3. Two-speed self-parking

Headlamps

Make and type — Lucas RL 700

General — A small red warning light, mounted in the speedometer, is illuminated whenever the headlamps are on MAIN BEAM.

Fog Lamps

General — Twin fog lamps are fitted which incorporate the front FLASHER element. These are double filament pre-focus type bulbs.

Fuse Box

General — Large box contains eight circuit fuses. Each circuit fuse is one strand of No. 28 S.W.G. tinned copper wire. Spare fuse wire is provided on a special holder within large fuse box.

A small fuse box carries the horn fuse. This is a cartridge type fuse of 25 amp. rating.

Heating, De-misting, De-icing and Ventilation

General — Alloy heat exchanger under right-hand front wing, delivering fresh air, heated or at ambient temperature.

Independently operated recirculatory system utilising lower half of heater matrix. Rear window electrically heated.

Windscreen Washer

Make — Lucas S2J 026

General — Electrically operated. Special liquid has a low surface tension and anti-freeze properties.

Radio

Make — Radiomobile

Type — 501 TA/VT series for use in Belgium, Denmark, Eire, France, Germany, Holland, Norway, Sweden and Switzerland.

The 501 TA/VT series radio has both medium and long wave reception.

502 TA/VT series for use in Spain, Canada, U.S.A, Japan, Australia and New Zealand.

The 502 TA/VT has medium wave reception only.

230 R. radio for use in Africa, Asia, South America, West Indies, Italy and Portugal.

The 230 R. radio has medium and short wave reception.

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Body

General	Steel and light alloy stressed skin construction has been employed, the floor being an integral part of the body, to ensure optimum strength and rigidity consistent with lightness.

Dimensions

Wheelbase	
Standard S2 and Bentley Continental S2 cars	10 ft. 3 in. (312·4 cm.)
Long Wheelbase S2 cars	10 ft. 7 in. (322·6 cm.)
Phantom V cars	12 ft. 1 in. (368·3 cm.)
Track, front	
Standard S2, Bentley Continental S2 and Long Wheelbase S2 cars	4 ft. 10½ in. (148·6 cm.)
Phantom V cars	5 ft. 0⅞ in. (154·6 cm.)
Track, rear	
Standard S2, Bentley Continental S2 and Long Wheelbase S2 cars	5 ft. 0 in. (152·4 cm.)
Phantom V cars	5 ft. 4 in. (162·6 cm.)
Overall length (including bumpers)	
Standard S2 and Bentley Continental S2 cars	17 ft. 7¾ in. (537·8 cm.)
Long Wheelbase S2 cars	17 ft. 11¾ in. (548 cm.)
Phantom V cars	19 ft. 10 in. (624 cm.)
Overall width (over wings)	
Standard S2 and Long Wheelbase S2 cars	6 ft. 2¾ in. (189·8 cm.)
Bentley Continental S2 cars	6 ft. 1 in. (185·4 cm.)
Phantom V cars	6 ft. 7 in. (200·6 cm.)
Overall height (unladen)	
Standard S2, Bentley Continental S2 and Long Wheelbase S2 cars	5 ft. 4 in. (162·6 cm.)
Phantom V cars	5 ft. 9 in. (175·3 cm.)
Turning circle diameter	
Standard S2 and Bentley Continental S2 cars	41 ft. 8 in. (12·70 m.)
Long Wheelbase S2 cars	43 ft. 0 in. (13·1 m.)
Phantom V cars	48 ft. 9 in. (14·86 m.)
Weight, kerbside	
Standard S2 cars	41·5 cwt. (2108 kgs.)
Bentley Continental S2 cars	38 cwt. (1930·5 kgs.)
Long Wheelbase S2 cars	43 cwt. (2184 kgs.)
Phantom V cars	50 cwt. (2540 kgs.)

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SECTION A3

UNIFIED SCREW THREADS

The need for a common standard of screw threads in the United Kingdom, Canada and the United States of America has led to an agreement between the countries concerned to use UNIFIED THREADS of mutually acceptable form, pitch and diameter.

There are three types of unified thread:

1. Unified Coarse.
2. Unified Fine.
3. Unified Special.

These unified threads are clearly identified by the standard system of markings, as illustrated in Figure A1.

There is little difference between the form of the American national thread and the unified thread; therefore the new threads are largely interchangeable with S.A.E. standards. They are not, however, interchangeable with BSF, and although BSW have the same number of threads per inch as the Unified National Coarse series, interchanging is not recommended due to a difference in the thread form.

The following types of thread are used on nuts, bolts and castings fitted to Rolls-Royce and Bentley cars.

For all sizes below $\frac{1}{4}$ in. diameter, BA threads are used.

For all sizes between $\frac{1}{4}$ in. and $\frac{3}{4}$ in. diameter inclusive, the Unified Fine thread is used.

All sizes above $\frac{3}{4}$ in. diameter have been classified by Rolls-Royce and Bentley Motors as Unified Special and have 16 threads per inch.

The Unified Coarse Thread is not used.

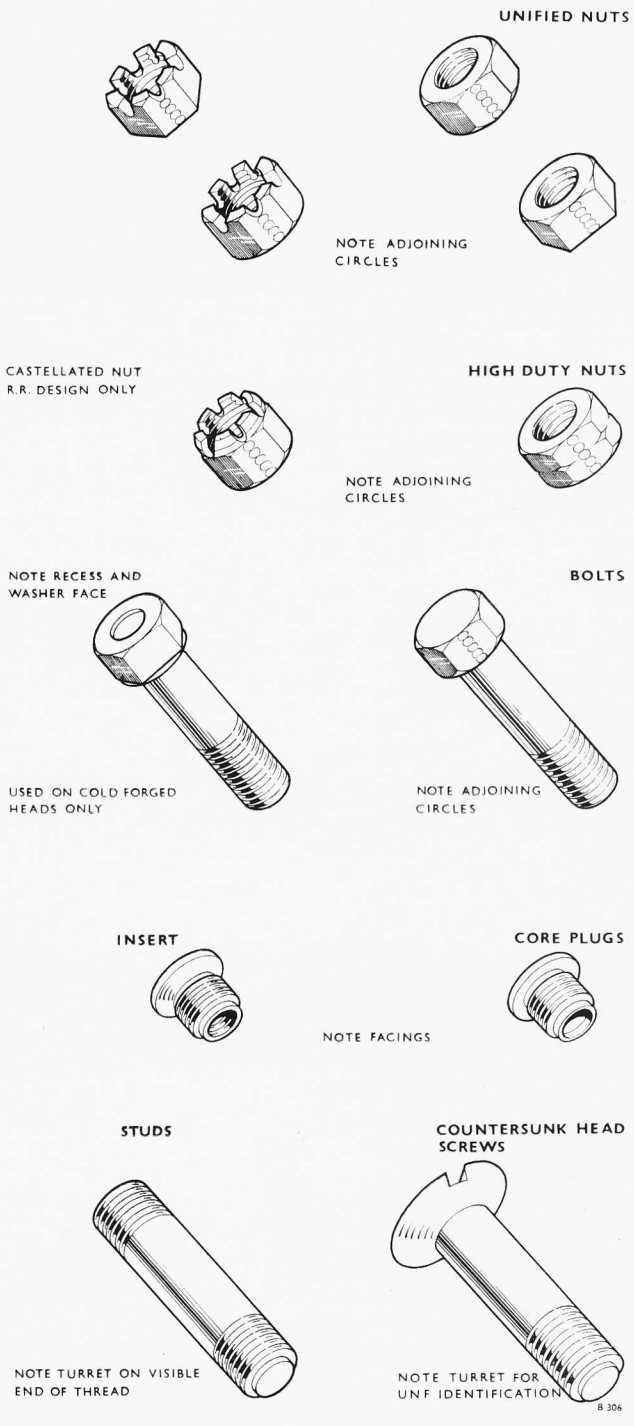


Fig. A1 Identification of unified threads

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CHAPTER A

GENERAL INFORMATION

SECTION A1 SPECIFICATION — S3 CARS

Engine

Engine data appears in T.S.D. 2006.

Fuel system

Carburetters	Two S.U. H.D.8. diaphragm type 2·00 in. choke bores. Automatic choke for cold starting.
Air cleaner	Either a Purolator paper type element or an oil wetted wire mesh filter element depending upon which country the engine will be operating in. For details see latest Service Bulletin Section D, dealing with this subject.
Fuel pumps	Twin S.U. electric.
Fuel tank capacity	18 galls. (Imp.) 21·6 galls. (U.S.) 81·8 litres.
Fuel strainers	Main fuel strainer mounted on the frame member in front of the fuel tank. Small gauze strainer at the carburetter inlets and in the fuel pumps.
Fuel gauge	Electric — registers when the ignition is switched on.

Cooling system

Coolant capacity	21 pints (Imp.) 25·21 pints (U.S.) 11·93 litres.
Pump	Centrifugal
Fan	5-blade
Fan diameter	18 in.
Pump and fan drive	$\frac{13}{32}$ in. adjustable 'Vee' belts
Radiator matrix	Film type
Radiator shutters	Fixed
Coolant temperature control	82 C. – 86 C.
Temperature indicator	On instrument panel. Electric, registers when the ignition switch is on.
Coolant	An inhibited solution of ethylene glycol (B.S.S. 3150).

Propeller shaft

Divided type, having a ball and trunnion universal joint and two needle roller universal joints. The shaft is supported in the centre by a flexibly mounted ball race.

Rear axle

Type	Semi-floating
Final drive	Through a hypoid crown wheel and pinion.
Pinion teeth	
Standard S3 cars	13
Long Wheelbase S3 cars	13
Bentley Continental S3 cars	13
Phantom V cars	9
Crown wheel teeth	
Standard S3 cars	40
Long Wheelbase S3 cars	40
Bentley Continental S3 cars	40
Phantom V cars	35
Ratio	
Standard S3 cars	3·08 : 1
Long Wheelbase S3 cars	3·08 : 1
Bentley Continental S3 cars	3·08 : 1
Phantom V cars	3·89 : 1
Oil capacity of casing	
Standard S3 cars	1⅝ pints
Long Wheelbase S3 cars	1⅝ pints
Bentley Continental S3 cars	1⅝ pints
Phantom V cars	1¾ pints

Brakes

Foot brake	Power assistance provided by a servo motor. Independent twin hydraulic system with additional mechanical linkage to rear shoes.
Hand brake	Mechanical to rear wheels. Warning lamp fitted, operates when hand brake is applied and ignition switched on.
Brake shoe linings	Ferodo DS2 or Mintex M 14
Friction lining area (4 brakes)	
S3 cars	240 sq.in. (1548 sq.cm.)
Early Bentley Continental S3 cars	304 sq.in. (1960 sq.cm.)
Late Bentley Continental S3 cars	240 sq.in. (1548 sq.cm.)
Phantom V cars	240 sq.in. (1548 sq.cm.)
Hand brake lever	Twist grip barrel type

Servo motor

General	The servo motor operates on the principle of the dry disc clutch. The lined friction plate is driven from the gearbox final shaft at approximately one-fifth of the propeller shaft speed.
Servo motor lining	Ferodo DM8
Cam angle	
S3 cars	37·5° — twin master cylinders
Early Bentley Continental S3 cars	47° — twin master cylinders
Late Bentley Continental S3 cars	37·5° — twin master cylinders
Phantom V cars	37·5° — twin master cylinders

Front hubs

General	Two taper roller races

Wheels and tyres

Wheels	Bolted-on pressed steel wheels with covering discs.
Rim wheels	Well base rims, 6L × 15·00 in.
Tyres	
Standard S3 cars	8·20 in. — 15·00 in.
Long Wheelbase S3 cars	8·20 in. — 15·00 in.
Bentley Continental S3 cars	8·00 in. — 15·00 in.
Phantom V cars	8·90 in. — 15·00 in.

Steering

Type	Power assisted
Steering unit	Cam and roller
Drive	Right or left-hand
Steering wheel diameter	17 in.

Suspension

Front	Independent coil spring suspension, hydraulic shock dampers and anti-roll stabiliser.
Rear (except Phantom V)	Semi-elliptic leaf springs. Controllable hydraulic shock dampers. A special form of axle control rod is fitted which, together with the road springs, takes the torque and brake reaction.
Phantom V	The Phantom V is as specified above with the exception of the rear axle control rod which is not fitted to the Phantom V chassis.

Front shock dampers

Make and type	Rolls-Royce hydraulic double-acting.

Rear shock dampers

Make and type	Rolls-Royce hydraulic double-acting.
General	Controllable through a switch on the steering column.

Chassis frame

Type	Box section throughout, with all welded joints.

Jacking system

Type	Smith Bevelift jacks.

Battery

Make and type	Either P & R Dagenite — 6 HZP 11/9 GZF or Exide — 6 XTHZ 11/L.
Voltage	12 v.
Capacity	67 ampere-hours
Earth	Negative to chassis frame

Ignition distributor

Standard S3 cars and Continental S3 cars

Make and type	Lucas 20 D8. Eight lobe cam with double contact breakers.
Rotation	Anti-clockwise
Advance mechanism	Automatic centrifugal advance with built-in vacuum timing control.
Ignition timing	2° B.T.D.C.
Firing order	A1, B1, A4, B4, B2, A3, B3, A2. (1, 5, 4, 8, 6, 3, 7, 2.)
Contact gap	0·014 in. — 0·016 in.
Drive	Through camshaft skew gears

Phantom V

Make and type	Delco-Remy Twin contact breakers with synchronised contact breaker arms.
Rotation	Anti-clockwise
Advance mechanism	Automatic (centrifugal governor)
Ignition timing	2° B.T.D.C.
Firing order	A1, B1, A4, B4, B2, A3, B3, A2. (1, 5, 4, 8, 6, 3, 7, 2.)
Contact gap	0·019 in. — 0·021 in.
Drive	Through camshaft skew gears

Ignition coil

Make	Lucas

Sparking plugs

Make and type	
9 : 1 compression ratio	Champion RN.8
8 : 1 compression ratio	Champion RN.8, Champion RN.13P or Lodge CLNP.
Cars destined for Australia	Champion UN.12 Y
Gap	0·025 in.

Generator

Make	Lucas
Type	C 48
Maximum output	35 amperes, 13·5 v.
Drive	Twin 'Vee'-belts
Voltage regulator and cut-out	Lucas RB 310, current voltage type.

Starter motor

Make and type	Lucas M-45G. 12 v.
Rotation	Anti-clockwise (from front of the engine).
Flywheel to pinion ratio	18 : 1

Horns

Make and type	Lucas WT 618. Twin Wind-tone.

Direction indicators

Make and type	Lucas combined side lamps and flashing indicators, combined rear stop/tail and flashing indicators.

Windscreen wipers

Make and type — Lucas DR 3. Two-speed self-parking.

Headlamps

Make and type — Lucas 5¾ in. twin sealed beam headlamps mounted horizontally in each front wing.

General — A small red warning lamp, mounted in the speedometer is illuminated whenever the headlamps are switched to main beam. A switch for flashing the headlamp main beams is incorporated in the direction indicator switch.

Fog lamps

General — Twin fog lamps with single filament bulbs are fitted.

Fuse box

General — Large box contains eight circuit fuses. Each circuit fuse is one strand of No. 28 S.W.G. tinned copper wire. Spare fuse wire is provided on a special holder within large fuse box.

A small fuse box carries the horn fuse and headlamp flasher relay fuse. These are cartridge type fuses of 25 amp. rating.

Heating, de-misting, de-icing and ventilation

Standard S3 and Long Wheelbase cars — The 'Upper' heat exchanger under the right-hand front wing delivers fresh air which may be heated or at ambient temperature. Additional fresh air at ambient temperature can be obtained from a duct in the left-hand front wing.

The 'Lower' heat exchanger under the right-hand front wing delivers recirculated air to the car interior; this air may be heated or at ambient temperature.

The rear window is electrically heated.

Windscreen washer

Make — Lucas S2J 026

General — Electrically operated. Special liquid has a low surface tension and anti-freeze properties.

Radio

Make — Radiomobile

Type — 620T Medium and long wave radio suitable for the whole of Europe with the exception of Spain, Portugal and Italy.

622T Medium wave radio suitable for the U.S.A., Canada and Japan.

230R Medium and short wave radio suitable for Africa, Asia, South America, West Indies, Italy, Spain and Portugal.

Make — Pye

Type — TCR 2000/E medium wave radio suitable for Australia and New Zealand.

Body

General — Steel and light alloy stressed skin construction has been employed, the floor being an integral part of the body, to ensure optimum strength and rigidity consistent with lightness.

Dimensions

Wheelbase	
Standard S3 and Bentley Continental S3 cars	10 ft. 3 in. (312·4 cm.)
Long Wheelbase S3 cars	10 ft. 7 in. (322·6 cm.)
Phantom V cars	12 ft. 1 in. (368·3 cm.)
Track, front	
Standard S3, Bentley Continental S3 and Long Wheelbase S3 cars	4 ft. 10½ in. (148·6 cm.)
Phantom V cars	5 ft. 0⅞ in. (154·6 cm.)
Track, rear	
Standard S3, Bentley Continental S3 and Long Wheelbase S3 cars	5 ft. 0 in. (152·4 cm.)
Phantom V cars	5 ft. 4 in. (162·6 cm.)
Overall length* (including bumpers)	
Standard S3 and Bentley Continental S3 cars	17 ft. 6¼ in. (534·0 cm.)
Long Wheelbase S3 cars	17 ft. 10¼ in. (544·2 cm.)
Phantom V cars	19 ft. 8½ in. (620·2 cm.)

*Cars destined for America will be approximately 1½ in. longer

Overall width (over wings)	
Standard S3 and Long Wheelbase S3 cars	6 ft. 2¾ in. (189·8 cm.)
Bentley Continental S3 cars	6 ft. 1 in. (185·4 cm.)
Phantom V cars	6 ft. 7 in. (200·6 cm.)
Overall height (unladen)	
Standard S3, Bentley Continental S3 and Long Wheelbase S3 cars	5 ft. 4 in. (162·6 cm.)
Phantom V cars	5 ft. 9 in. (175·3 cm.)
Turning circle diameter	
Standard S3 and Bentley Continental S3 cars	41 ft. 8 in. (12·70 m.)
Long Wheelbase S3 cars	43 ft. 0 in. (13·10 m.)
Phantom V cars	48 ft. 9 in. (14·86 m.)
Weight, kerbside	
Standard S3 cars	41·5 cwt. (2108 kgs.)
Bentley Continental S3 cars	38 cwt. (1930·5 kgs.)
Long Wheelbase S3 cars	43 cwt. (2184 kgs.)
Phantom V cars	50 cwt. (2540 kgs.)

SECTION A2 — CHASSIS TORQUE TIGHTENING CHART

TORQUE FIGURES — CADMIUM PLATED STANDARD PARTS

Size			Full Nut Torque		Half Nut Torque	
2 B.A.			48 lb. in.	to 60 lb. in.	30 lb. in.	to 36 lb. in.
¼ in.	UNF	$\frac{7}{16}$ in. A.F.	8 lb. ft. (0·97 kg.m.)	to 10 lb. ft. (1·39 kg.m.)	5 lb. ft. (0·69 kg.m.)	to 10 lb. ft. (1·39 kg.m.)
$\frac{5}{16}$ in.	UNF	½ in. A.F.	16 lb. ft. (2·21 kg.m.)	to 18 lb. ft. (2·49 kg.m.)	13 lb. ft. (1·80 kg.m.)	to 15 lb. ft. (2·07 kg.m.)
⅜ in.	UNF	$\frac{9}{16}$ in. A.F.	29 lb. ft. (4·01 kg.m.)	to 32 lb. ft. (4·42 kg.m.)	22 lb. ft. (3·04 kg.m.)	to 25 lb. ft. (3·46 kg.m.)
$\frac{7}{16}$ in.	UNF	⅝ in. A.F.	42 lb. ft. (5·80 kg.m.)	to 45 lb. ft. (6·22 kg.m.)	33 lb. ft. (4·56 kg.m.)	to 36 lb. ft. (4·98 kg.m.)
½ in.	UNF	¾ in. A.F.	60 lb. ft. (8·30 kg.m.)	to 65 lb. ft. (9·00 kg.m.)	48 lb. ft. (6·63 kg.m.)	to 52 lb. ft. (7·19 kg.m.)
⅝ in.	UNF	—	85 lb. ft. (11·75 kg.m.)	to 90 lb. ft. (12·44 kg.m.)	73 lb. ft. (10·10 kg.m.)	to 78 lb. ft. (10·80 kg.m.)

Setscrews

All setscrews are to be torque tightened to the appropriate figures quoted in the above table for **full** nuts, unless otherwise specified

Important

In order to ensure correct torque tightness figures are obtained for plated parts, all burrs and foreign matter e.g. grit, grease and paint must be removed from the abutment faces of the nuts, setscrews, washers and components.

Non-Plated Parts

The following non-plated parts are to be torque tightened to the appropriate figures quoted in the above table for cadmium plated parts.

Rear spring 'U' bolts.
Exhaust downtake pipe.

The torque loadings for non-plated nuts and bolts apply when engine oil is smeared on the threads and the bolt or nut faces.

For SPECIAL TORQUE TIGHTNESS FIGURES, see overleaf

SPECIAL TORQUE TIGHTNESS FIGURES

	Torque
Bumpers — Front and Rear	
$\frac{3}{8}$ in. dia. UNF nut — Output flange	10 lb. ft. (1·39 kg.m.) to 12 lb. ft. (1·66 kg.m.)
Dampers — Front	
$\frac{7}{16}$ in. dia. UNF nut — Piston actuating lever	60 lb. ft. (8·30 kg.m.) to 70 lb. ft. (9·68 kg.m.)
$\frac{7}{16}$ in. dia. UNF filler plug	12 lb. ft. (1·66 kg.m.) to 15 lb. ft. (2·07 kg.m.)
$\frac{5}{16}$ in. dia. UNF solenoid control plug	10 lb. ft. (1·38 kg.m.) to 12 lb. ft. (1·66 kg.m.)
$\frac{7}{8}$ in. dia. UNF rear plug	30 lb. ft. (4·15 kg.m.) to 45 lb. ft. (6·22 kg.m.)
Dampers — Rear	
$\frac{7}{16}$ in. dia. UNF nut — Piston actuating lever	60 lb. ft. (8·30 kg.m.) to 70 lb. ft. (9·68 kg.m.)
$\frac{7}{16}$ in. dia. UNF filler plug	12 lb. ft. (1·66 kg.m.) to 15 lb. ft. (2·07 kg.m.)
$\frac{5}{16}$ in. dia. UNF solenoid control plug	10 lb. ft. (1·38 kg.m.) to 12 lb. ft. (1·66 kg.m.)
$\frac{7}{8}$ in. dia. UNF rear plug	30 lb. ft. (4·15 kg.m.) to 45 lb. ft. (6·22 kg.m.)
$\frac{1}{2}$ in. dia. UNF nut — Damper links	45 lb. ft. (6·22 kg.m.) to 60 lb. ft. (8·30 kg.m.)
Drag Link and Track Rods	
$\frac{3}{8}$ in. dia. nut securing ball pins	35 lb. ft. (4·84 kg.m.) to 40 lb. ft. (5·53 kg.m.)
$1\frac{1}{4}$ in. dia. UNF ball pin socket plug	45 lb. ft. (6·22 kg.m.) to 50 lb. ft. (6·91 kg.m.)
Frame and Fittings	
$\frac{7}{8}$ in. dia. nut — Rear spring front anchorage	150 lb. ft. (20·73 kg.m.) to 180 lb. ft. (24·88 kg.m.)
Front Suspension	
B $\frac{3}{4}$ in. dia. UNF fulcrum pin — Upper	150 lb. ft. (20·73 kg.m.)
B $1\frac{1}{4}$ in. dia. UNF threaded bushes — Lower triangle levers	250 lb. ft. (34·57 kg.m.)

Fuel Pumps

$\frac{3}{8}$ in. dia. cone adaptors (light alloy)	17lb. ft. to 20 lb. ft	(2·35 kg.m.) (2·77 kg.m.)

Fuel Tank

$\frac{3}{8}$ in. dia. adaptor	17 lb. ft. to 20 lb. ft.	(2·35 kg.m.) (2·77 kg.m.)
1 in. dia. drain plug	35 lb. ft. to 40 lb. ft.	(4·84 kg.m.) (5·53 kg.m.)

Generator

C47 — Nut — Retaining fan and pulley	50 lb. ft.	(6·91 kg.m.)
C48 — Nut — Retaining fan and pulley	40 lb. ft.	(5·53 kg.m.)

Hubs — Front

$\frac{1}{4}$ in. dia. UNF screw — Drum	30 lb. in. to 35 lb. in.	
$\frac{1}{2}$ in. dia. UNF wheel nuts	45 lb. ft. to 50 lb. ft.	(6·22 kg.m.) (6·91 kg.m.)

Hubs — Rear

$\frac{1}{2}$ in. dia. UNF wheel nuts	45 lb. ft. to 50 lb. ft.	(6·22 kg.m.) (6·91 kg.m.)

Lamps and Body Electrical Fittings

$\frac{5}{8}$ in. dia. nut — Fog lamps	27 lb. ft. to 30 lb. ft.	(3·73 kg.m.) (4·15 kg.m.)

Pipes and Fittings

$\frac{1}{8}$ in. British standard pipe fitting — fuel filter drain plug	7 lb. ft. to 9 lb. ft.	(0·97 kg.m.) (1·24 kg.m.)
Brake hose lock-nuts	10 lb. ft. to 12 lb. ft.	(1·39 kg.m.) (1·66 kg.m.)
All brake pipe nuts are to be torque tightened	10 lb. ft. to 12 lb. ft.	(1·39 kg.m.) (1·66 kg.m.)
All Bijur pipe nuts are to be torque tightened	5 lb. ft. to 8 lb. ft.	(0·69 kg.m.) (1·11 kg.m.)
$\frac{3}{8}$ in. dia. cone adaptors — Filter	17 lb. ft. to 20 lb. ft.	(2·35 kg.m.) (2·77 kg.m.)
$\frac{3}{8}$ in. dia. sleeve — Fuel pipes	12 lb. ft. to 14 lb. ft.	(1·66 kg.m.) (1·94 kg.m.)

Propeller Shaft

1 in. dia. UNF nut propeller shaft flange	150 lb. ft. to 180 lb. ft.	(20·73 kg.m.) (24·88 kg.m.)
A $\frac{7}{16}$ in. dia. UNF nut — Detroit joint to flange	45 lb. ft. to 50 lb. ft.	(6·22 kg.m.) (6·91 kg.m.)
B $\frac{9}{16}$ in. dia. UNF nut — Detroit joint to flange	70 lb. ft. to 75 lb. ft.	(9·68 kg.m.) (10·37 kg.m.)

Rear Axle

1 in. dia. UNF ventilator plug	30 lb. ft.	(4·15 kg.m.)
	to 35 lb. ft.	(4·84 kg.m.)
1 in. dia. UNF filler and drain plug	45 lb. ft.	(6·22 kg.m.)
	to 50 lb. ft.	(6·91 kg.m.)
1 in. dia. UNF nut — Pinion flange	195 lb. ft.	(27·00 kg.m.)
	to 215 lb. ft.	(29·43 kg.m.)
1⅜ in. dia. UNF nut — Pinion bearing	150 lb. ft.	(20·73 kg.m.)
	to 180 lb. ft.	(24·88 kg.m.)
$\frac{5}{16}$ in. dia. UNF setscrews — Axle tube to end plate	22 lb. ft.	(3·04 kg.m.)
	to 24 lb. ft.	(3·32 kg.m.)
$\frac{3}{8}$ in. dia. UNF setscrews — Axle tube to wheel bearing housing	38 lb. ft.	(5·26 kg.m.)
	to 40 lb. ft.	(5·53 kg.m.)
$\frac{5}{16}$ in. dia. UNF nuts — Securing end plate to centre casing	22 lb. ft.	(3·04 kg.m.)
	to 24 lb. ft.	(3·32 kg.m.)
$\frac{3}{8}$ in. dia. UNF nuts — Crown wheel to differential casing	45 lb. ft.	(6·22 kg.m.)
	to 50 lb. ft.	(6·91 kg.m.)

Side Steering Lever

$\frac{3}{8}$ in. dia. UNF setscrew (non waisted and no identification mark)	As torque figure for standard parts	
$\frac{7}{16}$ in. dia. UNF setscrew (non waisted and no identification mark)	As torque figure for standard parts	
$\frac{3}{8}$ in. dia. UNF setscrew (waisted and vee cuts on corners of hexagon for identification)	37 lb. ft.	(5·11 kg.m.)
	to 42 lb. ft.	(5·81 kg.m.)
$\frac{7}{16}$ in. dia. UNF setscrew (waisted and vee cuts on corners of hexagon for identification)	54 lb. ft.	(7·47 kg.m.)
	to 57 lb. ft.	(7·88 kg.m.)

Wiring and Fittings

2 B.A. nut — Starter motor solenoid, tighten lightly (because of pulling on to rubber), fit and tighten lock-nut	24 lb. in. to 30 lb. in.	

Yoke and Cross Steering Pivots

A	$\frac{3}{4}$ in. UNF adaptor with $\frac{1}{8}$ in. reducing adaptor for yoke lubrication	35 lb. ft.	(4·84 kg.m)
		to 40 lb. ft.	(5·53 kg.m)

Miscellaneous

All cheesehead screws including those of worm-drive clips are to be torque tightened to 20 lb. in.

ITEMS WHICH ARE NOT TORQUE TIGHTENED

1. Nuts which are locked by riveting
2. 3 $\frac{9}{16}$ in. dia. UNF nut — Oil seal housing retaining — Rear axle
3. Woodscrews
4. Bearing end float adjustment nuts — Front stub axles
5. The $\frac{1}{4}$ in. dia. screws in door striker plates
6. All threads less than 2 B.A.
7. Front door private locks $\frac{3}{4}$ in. dia. nuts

A S1 Series
B S2 Series onwards

Torque tightening figures for the threads of the **engine** and **gearbox** interior components are not included

CHAPTER B

SPECIAL PROCESSES

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CHAPTER B

SPECIAL PROCESSES

SECTION B1 — STORAGE

Preparation for Storage

The following recommendations are given for storage for periods of six months or longer. Success depends upon correct initial preparation, regular inspection and maintenance. The storage building should be dry, well ventilated and preferably heated.

Cars fitted with refrigeration: The refrigeration system requires no preparation and on no account should it be evacuated or discharged.

Engine and Chassis — preparation

1. Run the car for a sufficient mileage to warm-up the oil in the engine sump, gearbox and back axle.

2. Ensure that the cooling system contains the correct percentage (25 per cent) of anti-freeze mixture. Use only an anti-freeze conforming to British Standards Specification BS.3150 : 1959 (previously known as British Ministry of Supply Specification DTD 779) which is approved by Rolls-Royce Limited and Bentley Motors (1931) Limited. Only use an anti-freeze mixture marketed by a reputable manufacturer.

3. Jack up the car and support it on blocks placed under the lower triangle levers, in line with the coil springs at the front and under the centre of the rear springs. Drain the engine sump and the rear axle, re-fit the plugs and re-fill to the correct level with one of the approved **Anti-oxidant** oils. Attach a label in some conspicuous place on the car as a reminder that these operations have been carried out. Run the engine slowly, with a gear engaged, for a few minutes. Remove and discard the oil filter element. **Do not drain the oil** from the automatic gearbox, but top-up with the recommended running oil and ensure that the gear range selector lever is in Neutral.

4. Drain the fuel tank and run the engine to empty the fuel system. Remove the covers from the float chambers of the carburetters, withdraw the floats and wipe out the chambers; re-fit the floats and covers. Remove the fuel pump filters, allow the pumps to drain, then re-fit the filters. Add two gallons of paraffin to the fuel tank, then switch on the ignition to operate the fuel pumps, thus filling the system with paraffin.

5. Ensure that the tyres are inflated to the normal pressures — do not over-inflate — then cover them to exclude all light.

6. When the engine is cold, remove the sparking plugs and inject into each cylinder two full table-spoons of anti-oxidant oil. Turn the engine, by means of the starter motor, to distribute the oil on the cylinder walls. Re-fit the sparking plugs and screw down lightly.

7. Liberally oil the rocker gear with anti-oxidant oil.

8. Ensure that the handbrake is in the 'off' position.

9. Remove and clean the battery. Top it up with distilled water and fully charge it at the normal rate recommended by the manufacturers.

Recommended Storage Lubricants

B.P.	**Energol Protective Oil 20**
Castrol	**Castrol Storage Oil**
Shell	**Shell Ensis Oil 452**
Mobil	**Infilrex 109 SAE 30**

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Periodic Maintenance

1. Inspect the rubber connections of the cooling system, and if they are found to be unsound, renew them.
2. Maintain normal pressures in the tyres (do not over-inflate).
3. Every four to six weeks give the battery a freshening charge, continuing the charge until the specific gravity of the electrolyte has remained constant for about 10–12 hours on each occasion.

Body

1. Wash the body thoroughly and make good any paint blisters or rust patches to prevent further deterioration. Polish the paintwork using a good quality polish such as 'Lifeguard Car Wax'. In no circumstances use any polishing compound containing ammonia.
2. Thoroughly brush and clean all the carpets, upholstery and cushions. Spray them with D.D.T. or Aerosol and store them in a dry place. Treat the leather upholstery with an application of 'Connolly's Hide Food'.
3. If the place for storage is dry, leave the car windows slightly open. If there is any tendency to dampness, close the car doors and windows and place some form of anti-moisture preparation such as Silicagel bags inside the car.
4. Cover the car with a cotton dust sheet. Do not use a waterproof cover as this induces condensation which may blister the paintwork.

Periodic Maintenance

1. Re-polish the paintwork at regular intervals.
2. Regularly inspect the upholstery, carpets and cushions for moth damage and if necessary re-spray with D.D.T. or Aerosol.
3. Renew the anti-moisture preparation if necessary.

Re-commissioning after Storage

Cars fitted with refrigeration: The refrigeration system should be checked for efficient operation. If the car has been stored for a fairly long period it may be necessary to have the system topped-up with refrigerant before the car is put back into service. Any loss of refrigerant will reduce the efficiency of the system and Service Department attention will be necessary.

Provided that the car has been stored in accordance with the recommended procedure, the following points only should require attention before re-commissioning for use on the road.

1. Check the tyre pressures and if necessary inflate to the correct pressures.
2. Fully charge the battery and re-fit it to the car.
3. Drain the engine sump and rear axle and re-fill to the correct level with the recommended oils. Prime the cylinders with engine oil. **Fit a new oil filter element.**
4. Clean the sparking plugs and re-set the gaps.
5. **S1 cars.** Check the tappet clearances.
6. **S2 cars.** Apply a few drops of oil through the hole in the contact breaker base plate to lubricate the distributor shaft bearings. Lightly smear the contact breaker operating cam with grease.

   S1 cars. Re-charge the distributor shaft lubricator with grease and screw down the cap one or two turns. Apply one or two drops of engine oil to the cam lubricator felt pad.

   S1 and S2 cars. Remove the rotor and apply two or three drops of engine oil to the felt wick to lubricate the automatic advance mechanism. Clean the contact breaker points and if necessary set the gaps. Apply one drop of engine oil to the pivot of each contact breaker rocker arm.
7. Drain the paraffin from the fuel tank. Disconnect the inlet pipes from the carburetters, switch on the ignition to operate the fuel pumps and pump out all the paraffin from the system. Remove all the covers from the float chambers of the carburetters, lift out the floats and mop out the paraffin, using a lint-free cloth. Re-fit the floats, float chamber covers and inlet pipes. Remove the fuel pump filters to drain the pumps and then re-fit them in position.
8. Check the generator brushes for freedom of movement in their holders and clean the commutator.
9. **S1 cars.** Check the level of the oil in the reservoir for the one-shot lubrication system. Pump the pedal and ensure that the oil reaches the

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lubrication points. Grease the universal joints and sliding joint of the propeller shaft.

S2 cars. Lubricate all grease points.

10. **S1 cars** with manual steering, check the level of oil in the steering box.

    S1 and S2 cars with power-assisted steering, check the level of oil in the pump reservoir.

    S2 cars. Check the level of oil in the transfer steering box.

11. Check the level of oil in the shock dampers and level of fluid in the brake reservoirs.
12. Check the brakes and if necessary adjust them. Oil the jaws and pins of the brake linkage.
13. Fill the fuel tank and start the engine. Check the oil pressure and examine for fuel, oil and coolant leaks. Check the level of oil in the automatic gearbox.
14. Check the operation of all instruments, window lifts, lights and accessories.

SECTION B2 — SHIPMENT OVERSEAS

Preparation for Shipment Overseas

Short sea journey: It is unnecessary to drain the engine crankcase, gearbox and rear axle.

1. Drain all fuel from the tank and run the engine until the carburetters are dry.
2. Drain the coolant from the radiator, cylinder block and car heating system. Rotate all taps in the cooling system to the 'off' position. Operate the engine for 15 minutes, using a lead-free fuel, whilst passing a 100 per cent NaMBT (sodium mercapto-benzothiazole) corrosion inhibitor through the engine coolant passages.
3. Blank off the crankcase breather pipe.
4. Smear the exhaust system and all chassis parts liable to corrosion with 'Sozol' or a similar corrosion inhibitor.
5. Cover the radiator and all chromium parts with masking tape to prevent accidental damage.
6. Blank off the exhaust tail pipe.
7. Fit a fully charged battery in the cradle. Do **not** connect the battery leads to the terminals; the leads should be taped.
8. Tie a large warning label to the radiator, indicating that the coolant has been drained.

Long sea journey: 1. Do not drain the automatic gearbox, but top-up with the recommended oil to the correct level.

2. Drain all fuel from the tank and run the engine until the carburetters are dry.
3. Drain the coolant from the radiator, cylinder block and car heating system. Rotate all taps in the cooling system to the 'off' position. Operate the engine for 15 minutes, using a lead-free fuel, whilst passing a 100 per cent NaMBT (sodium mercaptobenzothiazole) corrosion inhibitor through the engine coolant passages.
4. Blank off the crankcase breather pipe.
5. Drain the oil from the engine sump.
6. Remove the sparking plugs and inject 10 c.c. of 'Intava' Inhibiting Oil into each cylinder. Turn the engine by means of the starter motor and re-fit the plugs.
7. Smear the exhaust system and all chassis parts liable to corrosion with 'Sozol' or a similar corrosion inhibitor.
8. Cover the radiator and all chromium parts with masking tape to prevent accidental damage.
9. Fit a new unfilled battery.
10. Blank off the exhaust tail pipe.
11. Tie a large warning label to the radiator and place a copy of the following instructions in a prominent position in the front of the car, or tied to the radiator.

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Instructions with Car

All Rolls-Royce and Bentley cars are specially prepared for shipment before despatch

The oil has been drained from the engine of this chassis and a small quantity of anti-oxidant oil run into the working parts for protection purposes only. The quantity of oil is insufficient to permit the engine to be operated.

The automatic gearbox is filled to the correct level with the recommended running oil.

It will be necessary to re-fill the crankcase with the correct oil before operating the engine.

The rear axle is filled to the correct level with 'Castrol Hi-press S/C' oil and requires no attention. The cylinder bores have been treated with an inhibitor and do not require priming.

The battery is dry and requires filling with electrolyte and charging.

The protective covering must be removed from the engine breather, air silencer and exhaust pipe.

Fill the radiator with suitable coolant and ensure that the drain taps are properly closed.

S1 cars, radiator drain tap, cylinder block drain tap and heater drain tap.

S2 cars, radiator drain tap and two cylinder block drain taps.

Before starting the engine: Fill the engine sump with one of the recommended oils (see Chapter D of the Workshop Manual).

Starting the engine: Ensure that the gear range selector lever on the steering column is in Neutral, quadrant position 'N', also that the handbrake is on.

Before starting the engine, the accelerator pedal must be depressed to its full extent and then released fully.

This will allow the fast idle cam to position itself in relation to the engine temperature, and so set the throttle to the correct opening for starting.

Start the engine, lightly depress and then release the accelerator pedal. This will allow the fast idle cam to again reposition itself in relation to the engine temperature and set the throttle to produce a slightly lower engine speed.

Before taking the car on to the road, allow the engine to warm-up to its normal operating temperature, at which the engine will idle at the normal pre-set speed. During this procedure, an inspection should be made to ensure that there is no leakage from the fuel, oil or coolant systems.

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CHAPTER C

AIR CONDITIONING

On early Standard S1 and early Continental S1 cars, the air conditioning system is basically similar to the Intermediate System described below, the main difference being that a manually operated by-pass valve is incorporated in the heater tap (see inset Fig. C1).

On these early cars, the heater tap and by-pass valve is mounted on the right-hand side of the car, to the rear of the blower motor housing; on later cars, the heater tap is adjacent to the de-mister tap on the left-hand side of the car.

SECTION C1—INTERMEDIATE SYSTEM

All S1 cars and coachbuilt S2 cars are fitted with variants of this system.

In the Intermediate System, fresh air is drawn through gauze covered grilles in the front wings and is boosted by blower motors through a heat exchange matrix mounted under each front wing (see Figs. C1 and C2); the heated air then passes into a transfer duct below the facia. The transfer duct is divided obliquely by a longitudinal separator and air passing into the duct from the left impinges on this separator and is directed upwards through the windscreen de-misting slots; air moving from the right is directed downwards to heat the car interior.

The separator consists of a thin aluminium shield which allows transference of heat between the De-misting and Heating Systems and provides a further degree of heat control. For example, with the de-mister on 'cold' and the heater on 'hot', the de-misting air will be slightly warmed by heat transference through the separator.

Air passing through the right-hand (heater) matrix is also ducted through an extension tube to provide ventilation for the rear of the saloon.

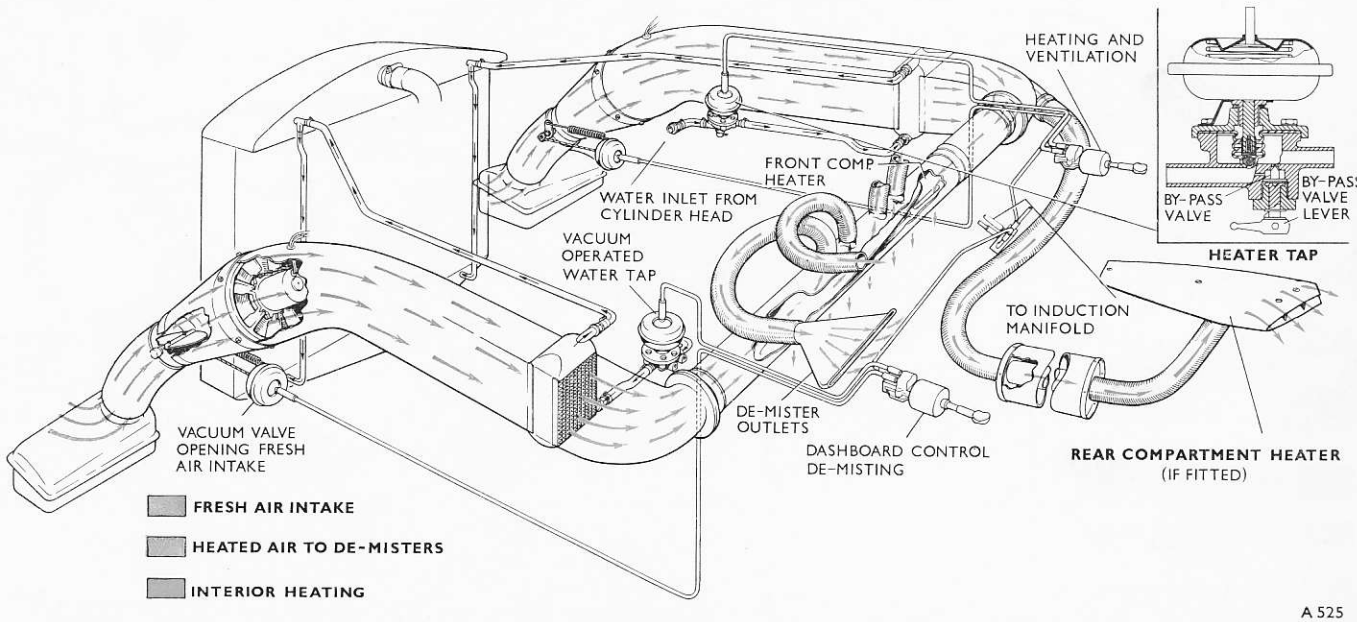


Fig. C1 Early System as fitted to early Standard S1 and early Continental S1 cars

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On S1 and Continental S2 cars, the rear outlet grille is fitted below the driver's seat; **on Long Wheelbase Saloons,** the outlet grille is fitted at the base of the division wall and a butterfly valve is incorporated in the transfer duct. Thus, on Long Wheelbase Saloons, the main flow of warm air is to the rear compartment, but by opening the butterfly valve the driver may divert some of the heated air to the front compartment for his own comfort.

Phantom V cars are provided with additional matrices below the rear seat, together with a recirculatory blower motor (see Fig. C2). The extension duct, which provides the rear compartment with fresh air, is connected to the main ducting *forward* of the heater matrix and thus the air entering the compartment remains at ambient temperature until it is drawn into the recirculatory heater below the rear seat. The extension duct contains a two-speed blower motor to boost rear compartment ventilation when required.

Stale air is exhausted from the car interior through the water drain holes in the door cavities and via the parcel shelf through apertures in the floor of the luggage boot.

The air intakes are positioned in the front wings so that the forward motion of the car constantly forces air through them. Most of this air passes straight through the rear aperture of the air scoop but the overspill flows through the ducting into the car interior without any assistance from the blower motors.

Situated at the forward end of the ducting is a vacuum operated butterfly valve which prevents air from flowing into the ducting when ventilation is not required. The butterfly valve on the de-mister side is, however, perforated by a $\frac{3}{8}$ in. diameter hole and when the valve is closed, this hole allows a small current of air to flow over the windscreen whilst the car is in motion.

The heat exchange matrices are supplied with hot engine coolant by vacuum operated taps. These taps and the vacuum operated valves are actuated by induction manifold depression and are controlled, together with the blower motors, by multi-purpose switches on the facia or division.

On late S1 cars and all coachbuilt S2 cars, each vacuum tap is provided with a by-pass which is

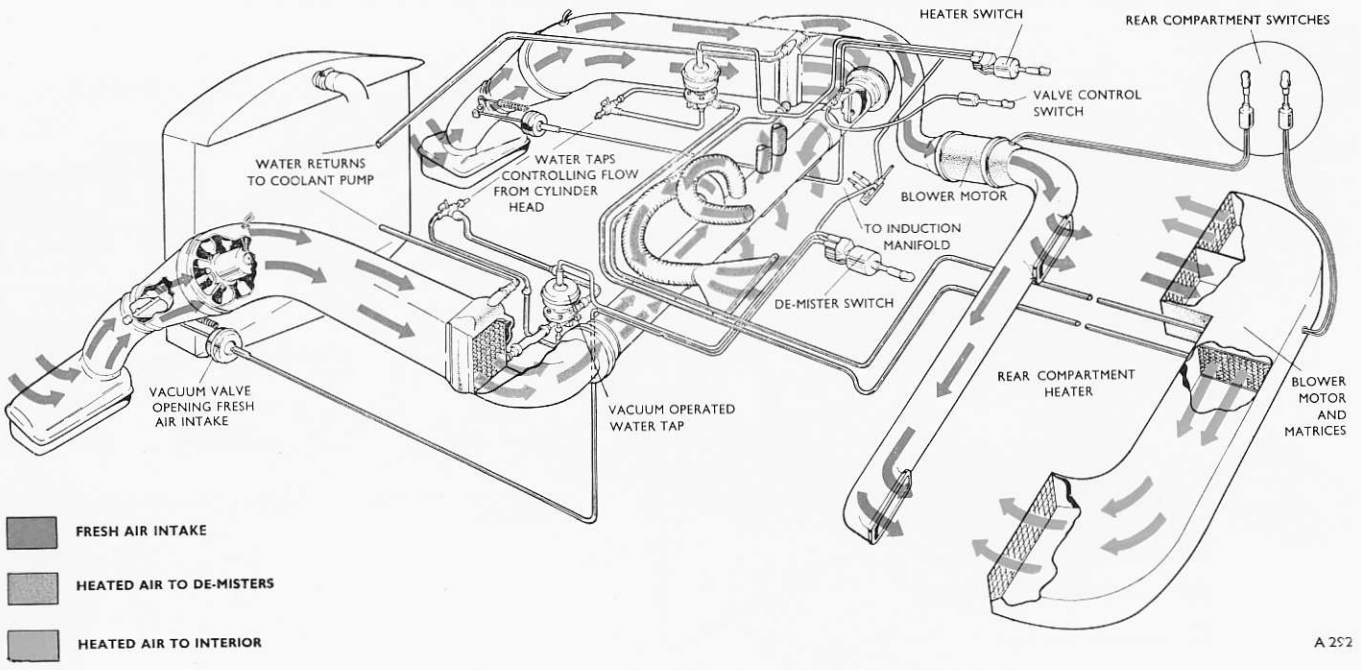


Fig. C2 Intermediate System (shown in the form used on Phantom V cars). Variants of this system are fitted to coachbuilt S2 cars and to S1 cars other than early Standard S1 and early Continental S1 cars

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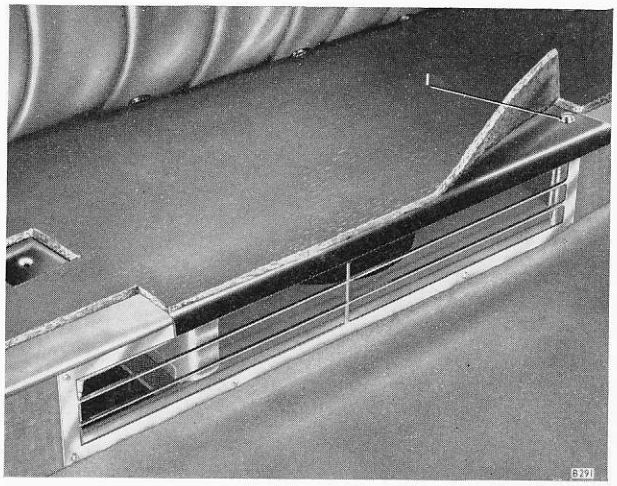


Fig. C3 Access to Phantom V underseat heater

1. COVER RETAINING SCREW

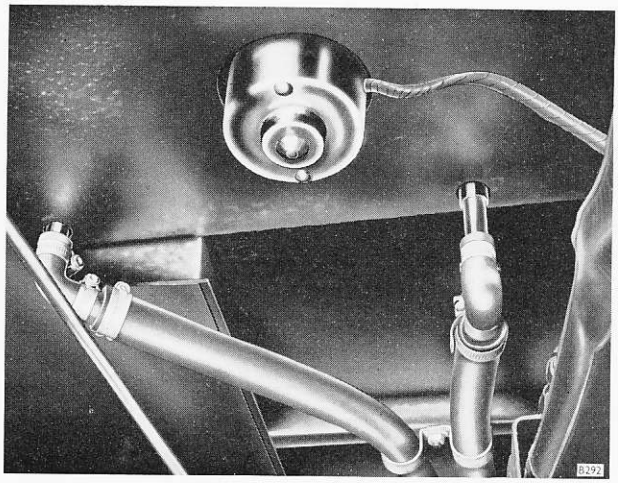


Fig. C4 Motor and supply hoses — Phantom V underseat heater

controlled manually by a separate two-position tap. Each manual tap is marked 'Summer' and 'Winter'; in the 'Winter' position, a capillary supply of hot coolant, in addition to the main flow through the vacuum tap, passes directly to the matrix. In the 'Summer' position, the by-pass is closed and only a reduced flow of coolant is allowed to circulate through the matrix.

The 'Heater' and 'De-mister' control switches are similar units and operate in the same way. Each switch can be withdrawn to either of two stops and at the same time can be turned to either of two clockwise positions. Withdrawal of the control knob to its first stop causes the butterfly valve in the air intake to open; withdrawal of the knob to its second stop opens the vacuum tap and allows hot engine coolant to flow through the heat exchanger. The clockwise positions of the switch operate the blower motor at half and full speed respectively.

The effects produced by the various positions of these switches can be summarised as follows:

HEATER AND DE-MISTER SWITCH		RESULTS	
Withdrawal Stops	Clockwise Positions	Water Tap Summer Position	Water Tap Winter Position
1st	OFF	Cool air — No fan	Warm air — No fan
	1st	Cool air — Half fan	Warm air — Half fan
	2nd	Cool air — Full fan	Warm air — Full fan
2nd	OFF	Warm air — No fan	Hot air — No fan
	1st	Warm air — Half fan	Hot air — Half fan
	2nd	Warm air — Full fan	Hot air — Full fan

Variations in the effects shown above can be obtained by using the various positions of the 'De-mister' in conjunction with those of the 'Heater'

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Ducting — to dismantle

Raise the front of the car with a jack and remove the wheel on the required side.

Disconnect the blower motor leads at their snap connectors.

Remove the rubber tube connecting the motor ducting to the intake grille.

Disconnect the butterfly valve actuating mechanism (see Fig. C9); remove the spring, the three 2 B.A. nuts and the spindle setscrew.

Remove the two $\frac{1}{4}$ in. (·250 in.) nuts and bolts securing the duct retaining bracket to the valance; the ducting can then be 'broken' where it joins the forward edge of the matrix. Withdraw the section which contains the butterfly valve and blower motor.

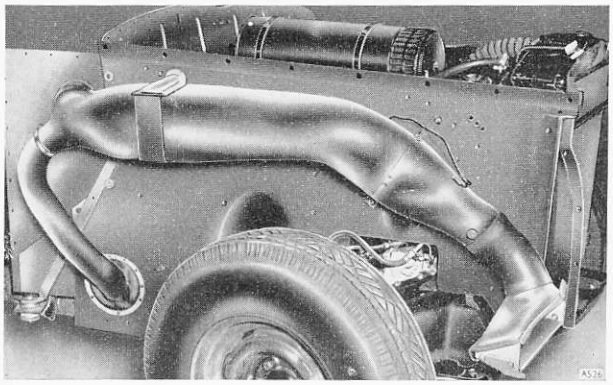


Fig. C5 Ducting — Intermediate System

Ducting — to assemble

The assembly of the ducting is carried out by reversing the procedure for removal outlined above. In addition, it is essential that all ducting joints are rendered waterproof by coating with underseal compound.

Finally, ensure that the butterfly valve can still move freely and will fully close.

Blower Motor and Fan — to remove

Remove the ducting as described above.

Unscrew the seven 2 B.A. screws securing the front section to the centre section of the ducting. Withdraw the front section.

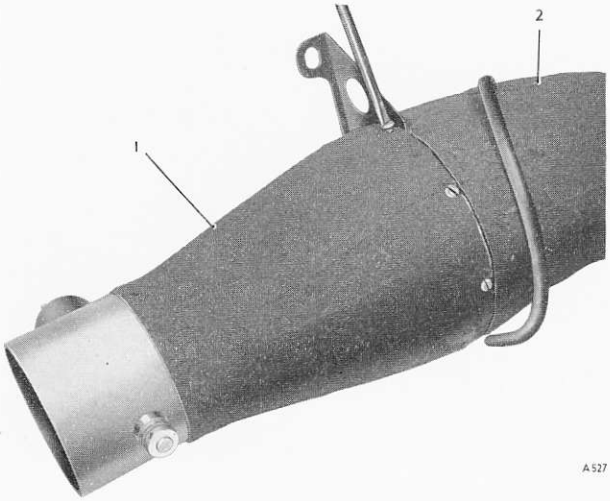


Fig. C6 Disconnecting front ducting — Intermediate System

1. FRONT DUCTING
2. CENTRE DUCTING

Remove the sleeve and grommet from the motor leads.

Unscrew the setscrews supporting the motor in the centre of the ducting, then remove the motor and fan as one unit.

Unscrew the single 7 B.A. setscrew and withdraw the fan from the motor spindle.

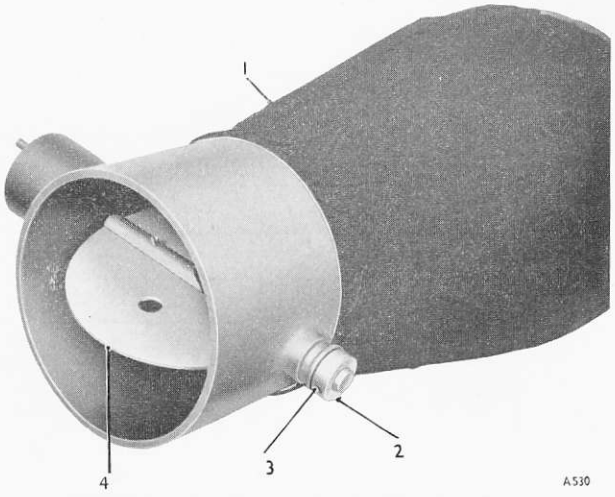


Fig. C7 Intake butterfly valve (de-mister)

1. FRONT DUCTING
2. RETAINING COLLAR
3. ALLEN SCREW
4. DE-MISTER BUTTERFLY VALVE

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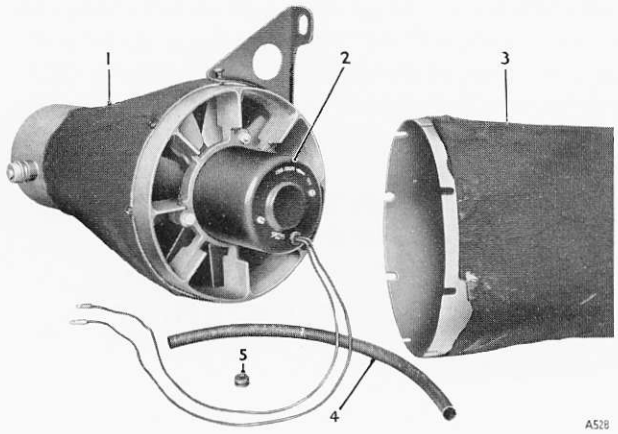


Fig. C8 Blower motor and fan — Intermediate System

1. FRONT DUCTING
2. MOTOR AND FAN
3. CENTRE DUCTING
4. RUBBER SLEEVE
5. GROMMET

Blower Motor — to inspect

The motor is a Smith's Accessories unit, Type CHS 720/4, which utilises CM3H brushes.

Remove the motor cover and inspect the brushes for freedom in their holders; ease them if necessary. Renew them if they are unduly worn.

Check the tension of the brush springs (see Chapter M); renew any that show loss of tension.

Clean the commutator if necessary (see Chapter M for the full procedure).

In the event of an internal fault in the motor, a replacement unit should be fitted.

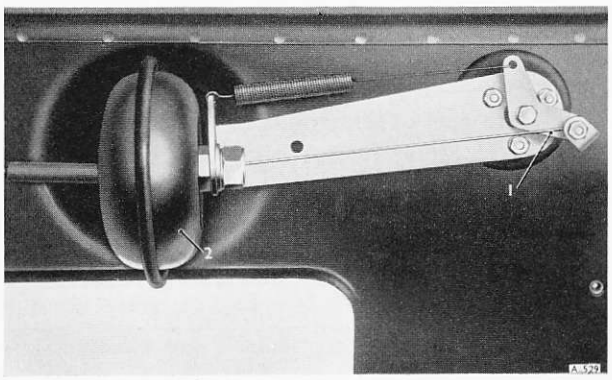


Fig. C9 Butterfly valve actuating mechanism

1. ACTUATING MECHANISM
2. VACUUM VALVE

Heat Exchange Matrix — to remove

Remove the ducting as described above.

Drain the engine cooling system (see Chapter L).

Slacken the worm drive clips and remove the hoses from the matrix.

Remove from the inlet and outlet pipes the two $\frac{3}{4}$ in. (·750 in.) nuts securing the matrix to the valance.

Remove the matrix and the rubber sealing bands from the ducting joints.

Intake Butterfly Valve

Check the valve for freedom of movement. End float in the spindle should not exceed 0·006 in. and may be adjusted by means of the end collar which is secured to the spindle by an Allen screw. The collar end of the spindle is protected from mud etc. by a rubber cap.

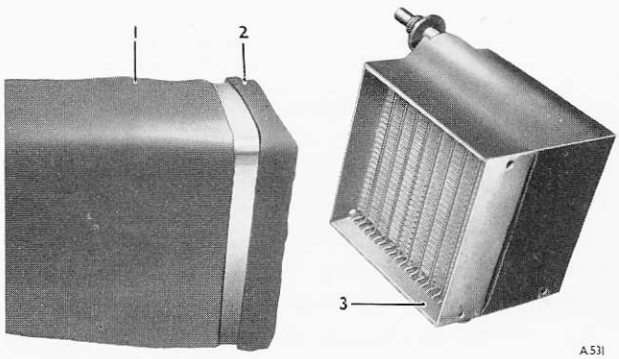


Fig. C10 Heater matrix — Intermediate System

1. CENTRE DUCTING
2. RUBBER SEAL
3. MATRIX

VACUUM CONTROL UNITS

Description

Vacuum valves are used to open the butterfly valves in the intake ducts (see Fig. C9) and also to operate the coolant taps in the pipes between the engine and the heat exchange matrices (see Fig. C11). All vacuum units are operated by inlet manifold depression and therefore function only when the engine is running.

Vacuum Operated Taps — to remove

To remove a vacuum operated tap, drain the engine cooling system and proceed as follows:

Disconnect the hoses and the by-pass line (if fitted) from the tap casing.

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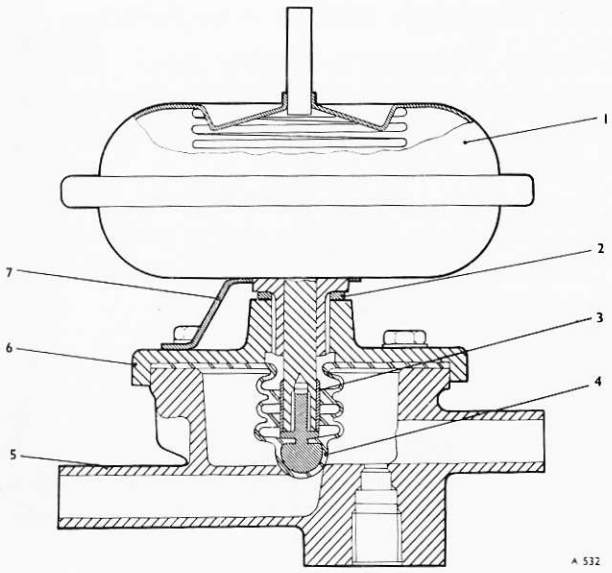


Fig. C11 Section view — vacuum operated tap

1. VACUUM UNIT
2. ADJUSTMENT WASHER
3. DISTANCE PIECE
4. DIAPHRAGM
5. BOTTOM HALF CASING
6. TOP HALF CASING
7. LOCKING PLATE

Remove the vacuum pipe from the top of the vacuum unit.

Remove the four cheesehead screws securing the right-hand tap mounting bracket to the valance; remove the tap and bracket.

Remove the two screws securing the left-hand tap to its mounting bracket; remove the tap.

In the event of unsatisfactory operation of a vacuum unit, it should be renewed. Do not attempt to unscrew the vacuum unit from a tap; withdraw it after removing the six setscrews by which it is retained.

If a tap is dismantled for any reason, it is essential that, on re-assembly, the distance sleeve is re-fitted; otherwise operation of the tap will rapidly render the diaphragm unserviceable.

Vacuum Operated Taps — to assemble

To assemble a vacuum tap, first screw the top half of the tap casing on to the vacuum unit. Screw the rubber diaphragm on to its spindle until finger tight and then offer up the bottom half of the coolant casing, carefully aligning the six screw holes.

Without compressing the spring but with the valve on its seat, check that a gap of 0·050 in. to 0·100 in. exists between the flange of the bottom half casing and the lower surface of the diaphragm flange, if this is not the case, insert an aluminium washer of suitable thickness between the vacuum unit and the top half of the casing (see Fig. C11). Insertion of this washer necessitates the removal of the top half of the casing; before it is re-assembled, fit the locking plate to the hexagon of the vacuum unit (see Fig. C11).

CONTROL SWITCH

Description

The Heating and De-misting Systems are each controlled by a unit combining an electrical switch with a valve applying inlet manifold depression to the vacuum operated units of the system.

It is essential that the terminals and contacts of the switch be kept clean; otherwise no maintenance of the electrical components is necessary.

If the switch is removed for any reason, the wiring should be re-connected as follows:

TERMINAL	COLOUR OF WIRE	
	HEATER SWITCH	DE-MISTER SWITCH
1	Yellow	Blue
2	Blue	Yellow
3	Purple and black	Purple and black

The control valve as shown in Figure C12 contains a sliding rubber seal which in its three positions closes or connects combinations of three ports in the valve body.

Two spring-loaded balls and a register plate accurately locate the seal in its centre position.

The valve port combinations in the three positions of the switch are as follows (see Fig. C12):

SWITCH POSITION	SEAL POSITION	PORT COMBINATION
Off	Forward	Ports 8 and 11 open to atmosphere, Port 9 closed
Withdrawn to first stop	Centre	Ports 8 and 9 connected, Port 11 open to atmosphere
Withdrawn to second stop	Rear	Ports 8, 9 and 11 connected

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No regular maintenance of the valve is necessary but the register plate screws must be kept tight (see Fig. C12).

Control Valve — to dismantle

In the event of leakage at the seal, the seal must be renewed. Dismantle the valve as follows:

Slide the seal to its centre position so that the balls are located in the holes in the register plate.

Lightly holding the register plate against the spring pressure, remove the two screws and slide the plate clear of its groove.

Remove the seal from its housing and fit a new seal in its place. One corner of the seal is chamfered to indicate its location. Check that the seal is not laterally compressed and distorted by the housing.

Control Valve — to assemble

Re-assemble the valve by reversing the procedure for dismantling outlined above.

Ensure that the vacuum pipes are fitted to the correct ports of the valve. The valve port marked 'T' must be connected to the vacuum operated tap and the port marked 'A' to the vacuum unit actuating the air intake butterfly flap. The third port must be connected to the engine inlet manifold.

Should the knob of the switch require renewal, it can be removed after pressing the spring-loaded location peg in the neck of the knob.

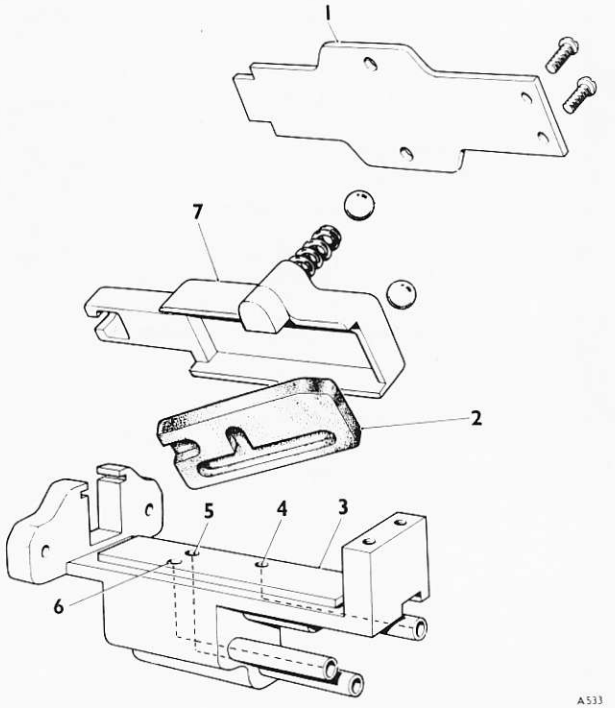


Fig. C12 Control switch valve — Intermediate System

1. REGISTER PLATE
2. RUBBER SEAL
3. VALVE BODY
4. VALVE PORT TO VACUUM FLAP
5. VALVE PORT TO INLET MANIFOLD
6. VALVE PORT TO VACUUM TAP
7. SEAL HOUSING

SECTION C2 — THE UNDERWING AIR CONDITIONING UNIT

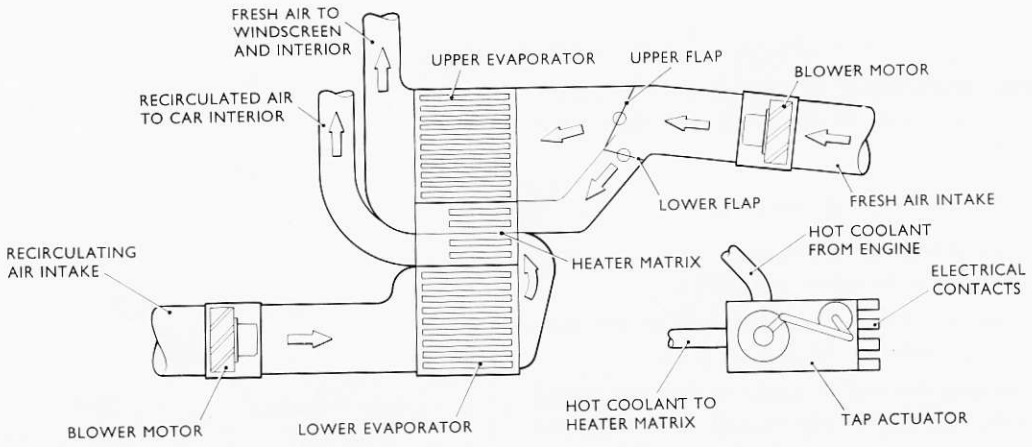
On standard Silver Cloud II and Bentley S2 cars, the De-misting, Heating and Ventilation System is built into a single underwing unit which, at the owner's request, may also contain the Refrigeration System.

The Refrigeration System is the subject of a separate publication — the Air Conditioning Manual (TSD 723).

Fresh air passes through a gauze covered grille in the right-hand front wing of the car and is boosted by a blower motor through the upper half of a heat exchange matrix mounted under the wing. The heated air passes along a cross-duct below the facia and is admitted to the car interior through the windscreen de-misting slots and the adjustable outlets in the capping rail. Additional fresh air passes through a similar gauze covered grille in the left-hand front wing and flows without assistance into the car interior through a grille in the left-hand scuttle wall. A butterfly valve, which is cable operated from the facia, is fitted to control the air flow through the ducting.

A recirculatory heating system is also incorporated in the unit and draws air from the car interior through an intake grille below the driver's seat. A blower motor boosts this air through the lower half of the heat exchange matrix and returns the heated air to the saloon through ducts below the facia.

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UPPER

ANTI-CLOCKWISE

1 — LOWER / UPPER
UPPER FLAP OPEN
LOWER FLAP CLOSED
WATER TAP CLOSED
BLOWER MOTOR MEDIUM SPEED
TEMPERATURE - AMBIENT

2 — LOWER / UPPER
UPPER FLAP OPEN
LOWER FLAP OPEN
WATER TAP CLOSED
REFRIGERATION SWITCHED IN
TEMPERATURE - COOL

3 — LOWER / UPPER
UPPER FLAP OPEN
LOWER FLAP CLOSED
WATER TAP CLOSED
REFRIGERATION SWITCHED IN
BLOWER MOTOR MEDIUM SPEED
TEMPERATURE - COLD

WITHDRAW KNOB FOR FULL SPEED IN ANY ANGULAR POSITION EXCEPT 'OFF'

CLOCKWISE

1 — LOWER / UPPER
UPPER FLAP OPEN
LOWER FLAP CLOSED
* WATER TAP LEAK
BLOWER MOTOR MEDIUM SPEED
TEMPERATURE - AMBIENT

2 — LOWER / UPPER
UPPER FLAP 2/3 OPEN
LOWER FLAP 2/3 OPEN
* WATER TAP LEAK
BLOWER MOTOR MEDIUM SPEED
TEMPERATURE - TEPID

3 — LOWER / UPPER
UPPER FLAP 1/3 OPEN
LOWER FLAP 2/3 OPEN
* WATER TAP LEAK
BLOWER MOTOR MEDIUM SPEED
TEMPERATURE - WARM

4 — LOWER / UPPER
UPPER FLAP CLOSED
LOWER FLAP OPEN
* WATER TAP LEAK
BLOWER MOTOR MEDIUM SPEED
TEMPERATURE - HOT

LOWER

ANTI-CLOCKWISE

1 — LOWER / UPPER
WATER TAP CLOSED
REFRIGERATION SWITCHED IN
RECIRCULATORY BLOWER SLOW SPEED
TEMPERATURE - COOL

2 — LOWER / UPPER
WATER TAP CLOSED
REFRIGERATION SWITCHED IN
RECIRCULATORY BLOWER FULL SPEED
TEMPERATURE - COLD

CLOCKWISE

1 — LOWER / UPPER
WATER TAP LEAK
RECIRCULATORY BLOWER SLOW SPEED
TEMPERATURE - WARM

2 — LOWER / UPPER
WATER TAP OPEN
RECIRCULATORY BLOWER SLOW SPEED
TEMPERATURE - HOT

3 — LOWER / UPPER
WATER TAP OPEN
RECIRCULATORY BLOWER FULL SPEED
TEMPERATURE - HOT

* **NOTE**:- THE WATER TAP LEAK POSITION CAN ONLY BE SELECTED BY THE UPPER AIRSTREAM SWITCH WHEN THE LOWER AIRSTREAM SWITCH IS 'OFF' OR IN POSITION 1 CLOCKWISE. IF THE LOWER AIRSTREAM SWITCH IS IN POSITION 2 OR 3 CLOCKWISE, THEN THE WATER TAP IS FULLY OPEN EVEN IF THE UPPER SWITCH IS IN A COLD POSITION.

TO CLOSE THE WATER TAP, SELECT 'OFF' WITH ONE OF THE SWITCHES AND POSITION 1 ANTI-CLOCKWISE WITH THE OTHER FOR 30 SECONDS BEFORE RETURNING TO ZERO. HOWEVER, WITH BOTH SWITCHES 'OFF' NO HEATING OCCURS AS ALL FLAPS ARE CLOSED AND BLOWER MOTORS STATIONARY.

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Fig. C13 Underwing A.C.U. switch diagram

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The unit is controlled by two rotary switches mounted on the facia and marked UPPER and LOWER.

The UPPER switch controls the fresh air ventilation and has eight positions — 'Off' (vertical), four clockwise positions which control the Heating System and three anti-clockwise positions which control the Refrigeration (if fitted).

The LOWER switch controls the recirculatory system and has five positions in addition to 'Off'. The three clockwise positions control the Heating System and the two anti-clockwise positions control the Refrigeration (if fitted).

Upper Airstream Switch

This switch controls the heater and evaporator flap actuators, the fresh air blower motor, the compressor clutch and the water tap actuator.

The switch utilises eight angular positions which are the vertical or 'Off' position, four positions clockwise and three positions anti-clockwise.

With the switch knob 'in', the fresh air blower motor operates at medium speed in all seven operating positions.

When the switch knob is withdrawn, all seven conditions are duplicated but with the blower motor operating at full speed. This is achieved by the provision of a contact sleeve at the end of the switch spindle. This sleeve connects two fixed contacts when the knob is withdrawn and by-passes the resistance in the blower motor circuit.

The main switch mechanism consists basically of five sets of moving contacts which rotate when the control knob is turned. Lobes on these contacts 'make' and 'break' with eleven sets of fixed contacts spaced around the arc of travel.

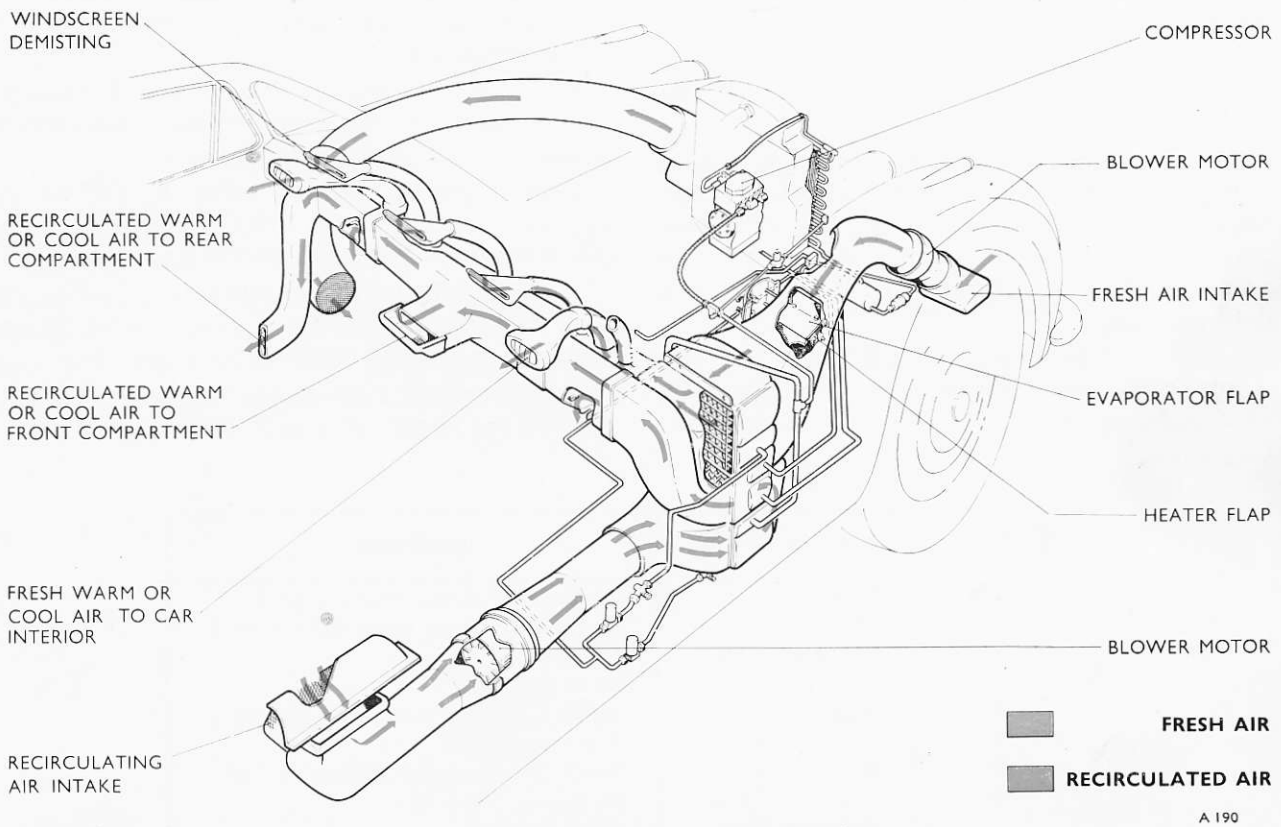


Fig. C14 The underwing air conditioning unit

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A numbered disc is attached to the rear of the switch for terminal identification as follows:

TERMINAL NUMBER	COLOUR OF WIRE	FUNCTION
1	White	Water tap 'leak'
2	Red and white	Evaporator flap closed
3	Purple and black	Supply
5	Blue	Heater flap $\frac{2}{3}$ open
6	Purple	Heater flap fully open
7	Brown and red	Water tap closed
8	Red and green	Heater flap closed
9	Blue and green	Compressor clutch 'in'
10	Red	Evaporator flap fully open
11	Brown	Blower motor medium speed
12	Yellow	Blower motor full speed
13	Blue and black	Evaporator flap $\frac{2}{3}$ open
14	Purple and green	Evaporator flap $\frac{1}{3}$ open

Lower Airstream Switch

This switch controls the recirculatory blower motor, the water tap actuator and the compressor clutch.

Six positions are utilised; they are the vertical or 'Off' position, three positions clockwise and two positions anti-clockwise.

The construction and operation of the mechanism is similar to that of the UPPER airstream switch except that the knob cannot be withdrawn for blower motor full speed — full speed is only obtained in position three clockwise and position two anti-clockwise.

Lobes on four contacts which rotate with the switch spindle complete circuits in combination with nine fixed contacts.

Note: The system will not provide warm fresh air and cold recirculated air simultaneously.

If the LOWER airstream switch is in a 'cold' position (anti-clockwise), the water tap will remain *closed* for all positions of the UPPER airstream switch.

If the LOWER airstream switch is 'Off' or in position 1 clockwise, the UPPER airstream switch selects water tap *leak* for all clockwise positions.

If the LOWER airstream switch is in positions 2 or 3 clockwise, the UPPER airstream switch selects water tap *open* for all clockwise positions.

A numbered disc is attached to the rear of the switch for terminal identification as follows:

TERMINAL NUMBER	COLOUR OF WIRE	FUNCTION
1	Yellow	Recirculation blower motor full speed
2	Blue	Recirculation blower motor medium speed
3	Purple and black	Supply
4	Green and white	Water tap 'leak'
5	White	Supply from upper airstream switch No. 1
7	Red and black	Water tap closed
8	Brown and red	Supply from upper airstream switch No. 7
9	Green and yellow	Compressor clutch 'in'
11	Green and black	Water tap open

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Right-hand Front Wing — to remove

It is necessary to remove the wing in order to gain access to the underwing unit; the following procedure should be closely followed:

The right-hand front door and the radiator shell must first be removed in order to expose the wing securing bolts (see Chapter S).

Open the right-hand front door and place a suitable support beneath the door.

Remove the split pin and withdraw the clevis pin from the checkstrap.

If electrically operated windows are fitted, remove the three screws securing the wiring conduit to the hinge post.

Unscrew the six hinge bolts and remove the door; if electrically operated windows are fitted, the door should be moved rearwards to the full extent of the wires.

Unscrew the four bolts which secure the top of the radiator shell to the matrix and the bonnet centre stay, also the eight bolts securing the lower end of the shell to the undertray and front apron.

Remove the four bolts securing the front apron to the side fairings, also the four nuts, bolts and washers securing the right-hand side fairing to the wing.

Remove the side fairing, the front apron and the radiator shell.

Disconnect the headlamp and sidelamp wiring and remove the wing as follows:

Remove the six bolts from the rear vertical edge of the wing, also two self-tapping screws and one bolt which secure the stainless steel strip to the lower edge of the wing.

Remove six bolts from the lower edge and the front vertical edge of the wing.

Supporting the weight of the wing, remove the ten bolts securing the wing to the valance. Remove the wing.

> **Note:** Should the wiring for the electrically operated window have prevented complete removal of the door, it will be advisable to temporarily re-secure the hinges.

Underwing Unit — to remove

Should the detection of a leaking matrix or similar fault necessitate the removal of the matrices and underwing ducting, proceed as follows:

Remove the right-hand front wing as described above.

If refrigeration is fitted:

Discharge the refrigerant from the system (see the appropriate section of the Air Conditioning Manual, TSD 723).

Forward-seat the compressor low pressure service valve by turning it clockwise to the full extent of its travel. Disconnect the evaporator return pipe at the union adjacent to the flap actuators.

Disconnect the two pipe unions from the forward ends of the solenoid valves.

To prevent loss of engine coolant when removing the hoses from the heater matrix, drain the cooling system; alternatively, seal the heater hoses immediately they are removed by inserting $\frac{5}{16}$ in. bolts into their bores and clamping the hoses with worm drive clips.

Slacken the worm drive clip sealing the forward end of the recirculation ducting.

Disconnect the transfer duct.

Unscrew the seven nuts securing the underwing unit to the valance.

Disconnect the fresh air blower motor leads at the snap connectors, then slide the underwing unit off the motor housing, allowing the motor leads to pass through the hole in the ducting; remove the unit from the car.

Remove the two actuator coupling tubes from within the rubber seals protruding through the valance.

Underwing Unit — to dismantle

If the unit contains refrigeration equipment, the insulating jacket must first be unlaced and removed in order to gain access to the unit and its securing screws.

Remove the self-tapping screws securing the ducting to the matrix block and remove the ducting.

Remove the twelve nuts, bolts and washers holding the three sections of the matrix block together;

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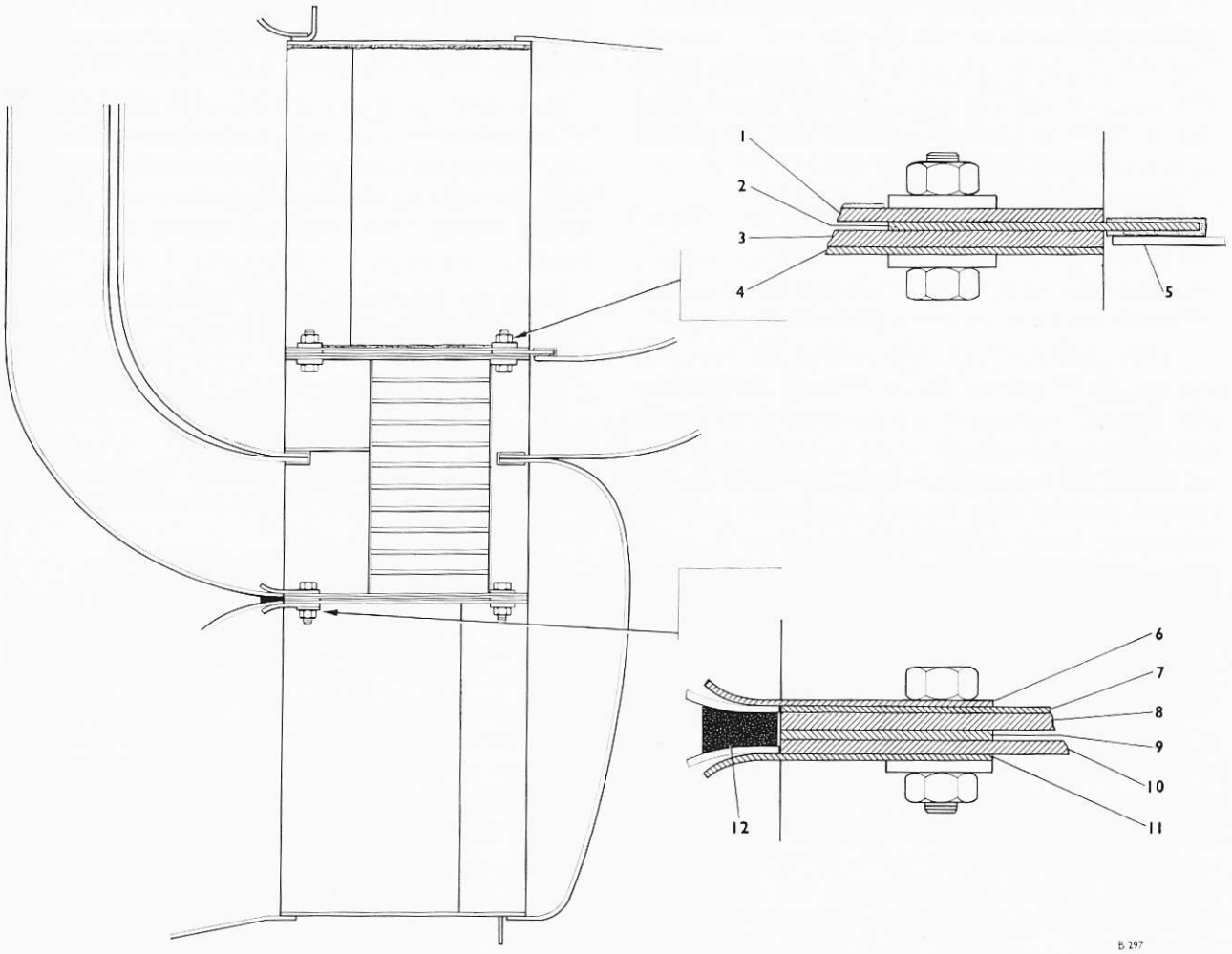


Fig. C16 Section view of matrix block — underwing A.C.U.

1. UPPER (DUMMY) EVAPORATOR
2. FELTED PACKING STRIP
3. UPPER SUPPORT BRACKET
4. HEATER MATRIX
5. DUCTING SEPARATOR PLATE
6. RETAINER PLATE
7. HEATER MATRIX
8. LOWER SUPPORT BRACKET
9. PACKING STRIP
10. LOWER (DUMMY) EVAPORATOR
11. RETAINER PLATE
12. RUBBER SEALING STRIP

Connect the evaporator return pipe union at the 'Tee' junction on the valance.

Evacuate and sweep the Refrigeration System, then check the system for leaks (refer to the appropriate Sections of the Air Conditioning Manual TSD 723).

Charge the system with 7 lb. of refrigerant (see the appropriate Section of the Air Conditioning Manual TSD 723).

Re-fit the wing (reversing the procedure described on page C11 for removal of the wing).

Check and, if necessary, re-set the actuator adjustment.

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ACTUATORS

Description

The heater flap, evaporator flap and water tap actuators are identical units, consisting of small electric motors driving through reduction gear trains. The shaft carrying the final gear in the train also carries a contact disc which has a portion removed. This disc conveys current to the motor through any one of four fixed contacts whenever the circuit is completed by the UPPER or LOWER airstream switch.

Operation of the motor causes the disc to rotate until the gap in the disc reaches the fixed contact, thus breaking the circuit.

Attached to the end of each actuator gear shaft is a crank lever, which is linked to a similar lever fixed either to the water tap spindle or to an extension of the heater or evaporator flap spindle.

The extension spindles protrude through the actuator mounting platform and flexible couplings transmit the drive, through holes in the valance, to the flap spindles. Rubber sleeves are provided between the valance and the ducting to protect these couplings.

The water tap actuator is situated low down at the forward end of the right-hand valance (see Fig. C18).

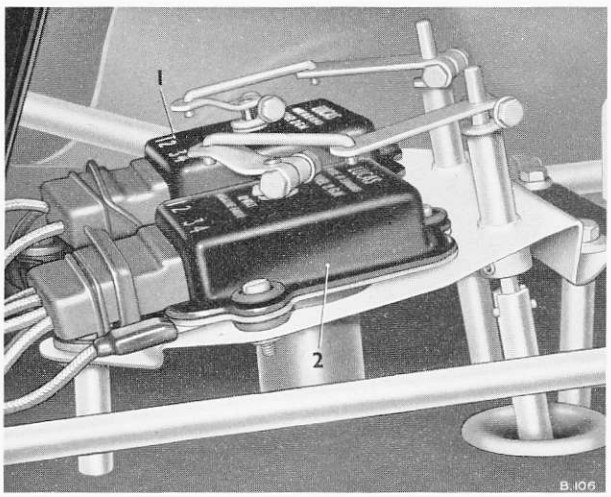


Fig. C17 Flap actuators — underwing A.C.U.

1. LOWER FLAP ACTUATOR MOTOR
2. UPPER FLAP ACTUATOR MOTOR

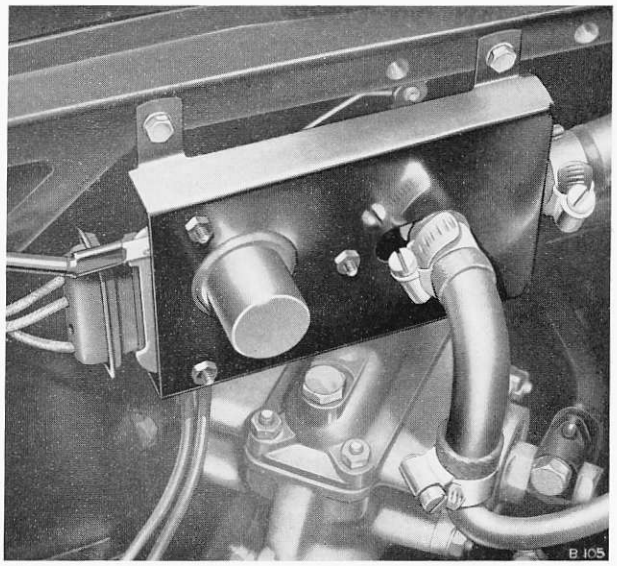


Fig. C18 Water tap actuator — underwing A.C.U.

The heater and evaporator flap actuators are mounted together on a single platform midway along the valance, adjacent to the forward brake fluid reservoir (see Fig. C17).

Actuators — to adjust

Whenever the underwing unit or the wing panel has been removed, it will be necessary to check and possibly adjust the actuator setting. This should be carried out only after the wing has been re-fitted.

The procedure to be adopted is as follows, noting that instructions 2, 3 and 4 do not apply if the wing **only** has been removed:

1. Slacken the four bolts which clamp the crank levers to the extension spindles and gear shafts, also slacken the two Allen screws retaining the collars on the extension spindles.
2. Remove the single nut and washer securing the forward end of the mounting platform to the valance and slacken the two rear securing nuts.
3. Move the forward end of the mounting platform away from the valance and insert the two coupling tubes through the valance holes, locating them on the driving dogs of the flap spindles.
4. Insert the extension spindle dogs into the slots in the coupling tubes and secure the mounting platform to the valance.

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5. Press the extension spindles fully 'home' into the coupling tubes, then tighten the clamping bolts of the two extension spindle crank levers.
6. Slowly withdraw the extension spindles about $\frac{1}{16}$ in. and tighten the Allen screw to lock the collars against the end faces of the bearing tubes.
7. Detach the two crank levers from the gear shafts and rotate the extension spindles by means of their crank arms. The spindles should be free to rotate through 90 deg. Movement through a larger angle indicates that the coupling tubes are not engaged with the dogs on the spindles and the procedure must be repeated from instruction 3.
8. Ensure that the UPPER and LOWER airstream switches are in the 'Off' position, then switch on the ignition for approximately 30 seconds to allow the actuator motors to fully close. The actuators must then be adjusted separately as follows:

Evaporator Flap (upper) Actuator

1. Rotate the extension spindle anti-clockwise (when viewed over the left-hand wing) until resistance is encountered.
2. Slightly slacken the crank lever clamping bolt and rotate the crank lever further anti-clockwise until it slopes forward and upward at 45 deg.
3. Press the gear shaft crank lever loosely into position on the gear shaft.
4. Adjust the position of the extension spindle crank lever so that when the gear shaft crank is rotated clockwise on the shaft, resistance is encountered for a few degrees to each side of the fully rearward position. (This indicates that the flap is being pressed tightly into its fully closed position). Tighten the clamping bolt to lock the extension spindle crank.
5. Rotate the gear shaft crank to the fully rearward end of its stroke (i.e. when the gear shaft crank and the connecting link are parallel), then tighten the clamping bolt.

Heater Flap (lower) Actuator

1. Rotate the extension spindle clockwise (when viewed over the left-hand wing) until resistance is encountered.
2. Slightly slacken the crank lever clamping bolt and rotate the crank lever further clockwise until it slopes 60 deg. forward of the vertical downward position.
3. Place the gear shaft crank lever loosely in position on the gear shaft.

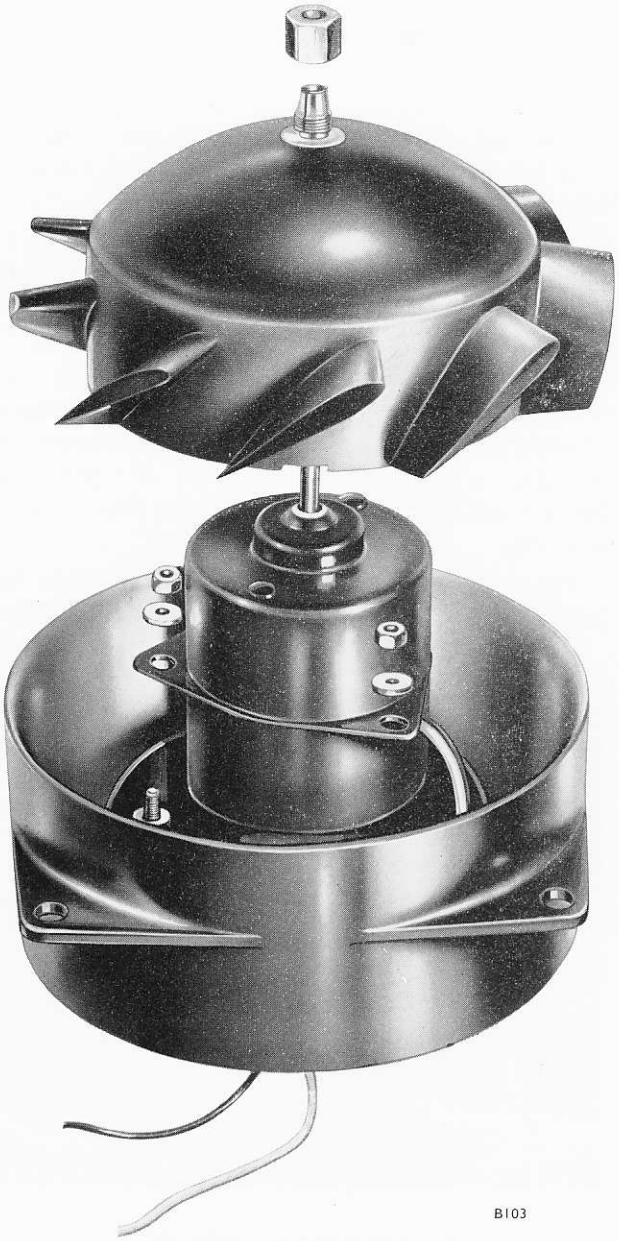


Fig. C19 Blower motor and fan — underwing A.C.U.

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4. Adjust the position of the extension spindle crank lever so that when the gear shaft crank is rotated clockwise on the shaft, resistance is encountered for a few degrees to each side of the fully rearward position. Tighten the clamping bolt to lock the extension spindle crank.
5. Rotate the gear shaft crank to the fully rearward end of its stroke (i.e. when the gear shaft crank and the connecting link are parallel), then tighten the clamping bolt.

Operate the switches and visually check that the actuators are functioning correctly.

The Blower Motors

Model ... Smiths FHM 5342/01

Two identical motors are fitted in the system: the fresh air blower is situated in the inlet ducting beneath the wing, and the recirculation blower is mounted in the recirculation inlet duct beneath the front floor (see Fig. C14).

Each motor and fan is mounted in a cast aluminium housing (see Fig. C19).

The motor shaft is carried in self-lubricating spherical bushes which are self-aligning to ensure smooth operation.

Two speeds — medium and high — are provided, by the incorporation in the motor circuit of a resistance, which is by-passed when the UPPER airstream control knob is withdrawn or when the LOWER airstream switch is turned either to the third position clockwise or to the second position anti-clockwise.

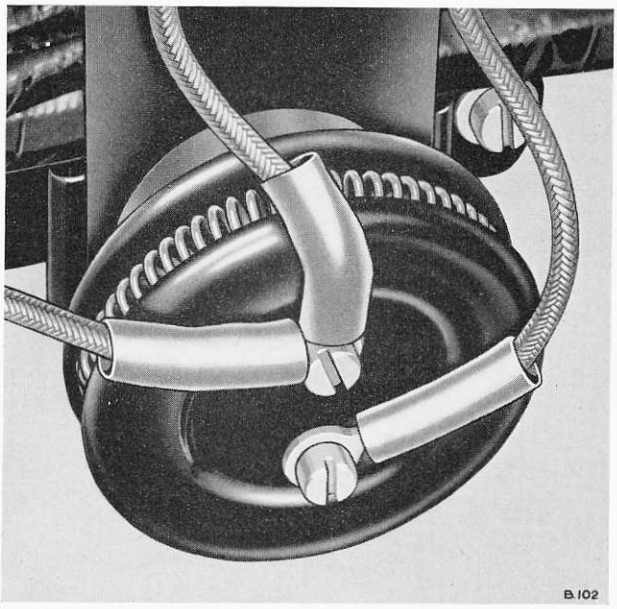


Fig. C20 Blower resistance — underwing A.C.U.

Resistances — Blower motors

Two resistances — one for each blower motor, slow the motors to medium speed when included in the circuit.

The two resistances are mounted on the bulkhead; the resistance for the fresh air blower is mounted on the upper right-hand side and that for the recirculation blower on the upper left-hand side.

Each resistance consists of a 66 in. length of oxidised wire forming a winding of 70 turns with a resistance of 2·8 ohms. The resistance is held in a spool shaped ceramic insulator bolted to a mounting block on the bulkhead (see Fig. C20).

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CHAPTER C

AIR CONDITIONING

SECTION C2

The underwing air conditioning unit
(Page C 7 in Workshop Manual)

Note The air conditioning system fitted to Continental S3 and Phantom V cars is the same as that described in the Workshop Manual.

For S3 cars read as follows

On standard Silver Cloud III and Bentley S3 cars the de-misting, heating and ventilation system is built into a single unit mounted under the right-hand front wing. This unit can supply fresh and recirculated air at the desired temperature to all regions of the car, through concealed ducting.

The air supply of a non-refrigerated car can be considered as two independent systems; one system heating fresh air drawn from outside the car and the second system heating air recirculated within the car interior. As the upper section of the heating unit is devoted to one system and the lower section to the other, the systems are identified as 'Upper' and 'Lower' as shown in Figure C1(S) of this Supplement.

'Upper' or fresh air system

In the 'Upper' system, fresh air is admitted through an intake in the right-hand front wing of the car and is filtered through a fine gauze. It is then boosted, if so required, by a blower motor through the heat exchange matrix in the main air conditioning unit. The air then passes along a cross-duct below the facia and is admitted to the front compartment through the windscreen de-misting slots and the adjustable outlets in the facia capping rail.

The flap valves controlling the air flow through the heat exchanger matrix are controlled by electric actuators, as is the tap controlling the flow of hot engine coolant to the 'Upper' heater matrix.

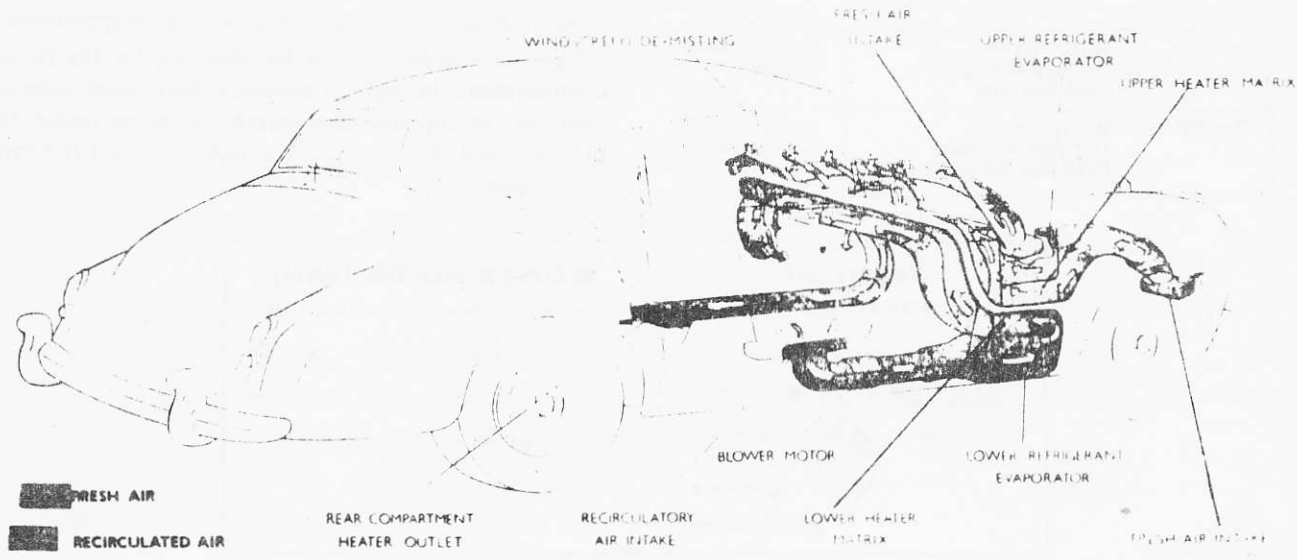


Fig. C1(S) Air circulation diagram

'Upper' airstream switch
(Page C 9 in Workshop Manual)

S3 cars only

This switch controls the heater and evaporator flap actuators, blower motor, water tap actuator and refrigeration compressor clutch (if fitted).

The switch utilises seven angular positions which are: vertical 'off' position, four positions clockwise and two positions anti-clockwise. If refrigeration is fitted a third anti-clockwise position is incorporated.

With the switch knob 'in' air enters the saloon only through ram effect induced by the forward motion of the car. When the switch is withdrawn to its first or second position, air flow is increased by a blower motor operating at half and full speed respectively. This is achieved by the provision of a contact sleeve at the end of the switch spindle; this sleeve connects with two fixed contacts, one of which is placed slightly forward of the other. When the knob is withdrawn to the first position, the most forward of the two contacts connects with the contact sleeve and introduces a resistance into the blower motor circuit, causing the blower motor to operate at half speed. When the knob is withdrawn to the second position the second fixed contact connects with the contact sleeve and by-passes the resistance in the blower motor circuit.

SWITCH POSITION	CORRESPONDING POSITION OF FLAPS AND ACTUATORS	EFFECT PRODUCED
1st right	Water tap leak Hot flap full open Cold flap full open	Tepid air
2nd right	Water tap leak Hot flap full open Cold flap two-thirds open	Warm air
3rd right	Water tap full open Hot flap full open Cold flap one-third open	Hot air
4th right	Water tap full open Hot flap full open Cold flap shut	Very hot air
1st left	Water tap shut Hot flap full open Cold flap shut	Fresh air low volume
2nd left	Water tap shut Hot flap full open Cold flap full open	Fresh air full volume

'Upper' switch terminal identification is as follows

TERMINAL NUMBER	COLOUR OF WIRE	FUNCTION
1	Brown and black	Water tap leak
2	Red and white	Evaporator flap closed
3	Purple and black	Supply
4	Green and purple	Water tap fully open
6	Purple	Heater fully open
7	Brown and red	Water tap closed
8	Red and Green	Heater flap closed
10	Red	Evaporator flap fully open
11	Brown	Blower motor medium speed
12	Yellow	Blower motor full speed
13	Blue and black	Evaporator flap two-thirds open
14	Purple and green	Evaporator flap one-third open

The main switch mechanism consists basically of five sets of moving contacts which rotate when the control knob is turned. Lobes on the contacts 'make' and 'break' with fixed contacts spaced around the arc of travel. The effect produced by each position of the switch is described in Figure C2(S) of this Supplement.

Further ventilation may be obtained for the front compartment through an auxiliary duct which directs fresh air, at ambient temperature, from an intake in the left-hand front wing to a grille in the left-hand scuttle wall.

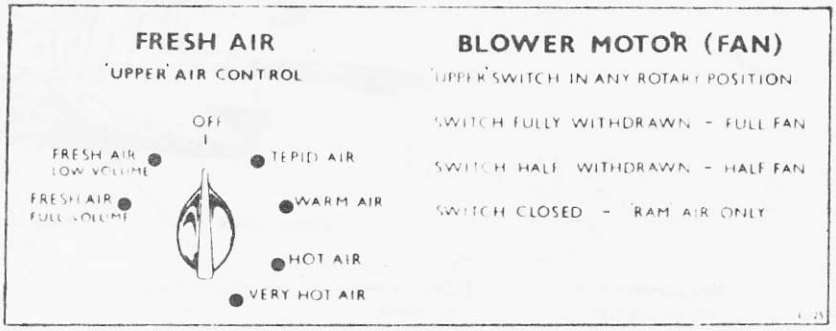


Fig. C2(S) Switch positions heating unit 'Upper' system

Air flow through this duct is controlled by a butterfly valve which is cable operated by an independent control beneath the facia adjacent to the steering column. On long wheelbase cars with a division this control is marked 'Fresh Air' and is positioned adjacent to the 'Upper' switch.

'Lower' or recirculatory system

S3 cars only

The air intake grille for this system is positioned at the right-hand side of the driver's seat, projecting into both the front and rear compartments. Air is drawn through this grille by the action of a blower motor and passed through the lower heat exchanger matrix.

The air then enters the interior of the car via the cross-duct beneath the facia and a centre duct which passes beneath the front seats to the rear compartment.

'Lower' airstream switch

(Page C 10 in Workshop Manual)

For S3 cars the 'Note' is not applicable.

The effect produced by each position of the switch is described in Figure C3 (S) of this Supplement.

SWITCH POSITION	CORESPONDING OPERATIONS OF WATER TAP AND BLOWER MOTOR	EFFECT PRODUCED
1st right	Motor half speed Water tap leak	Warm air Half fan
2nd right	Motor half speed Water tap full open	Hot air Half fan
3rd right	Motor full speed Water tap full open	Hot air Full fan
1st left	Motor half speed Water tap shut	Unheated air Half fan
2nd left	Motor full speed Water tap shut	Unheated air Full fan

'Lower' switch terminal identification is as follows

TERMINAL NUMBER	COLOUR OF WIRE	FUNCTION
1	Yellow	Blower motor full speed
2	Blue	Blower motor medium speed
3	Purple and black	Supply
4	Green and white	Water tap leak
7	Red and black	Water tap closed
8	Purple and black	Supply
11	Green and black	Water tap open

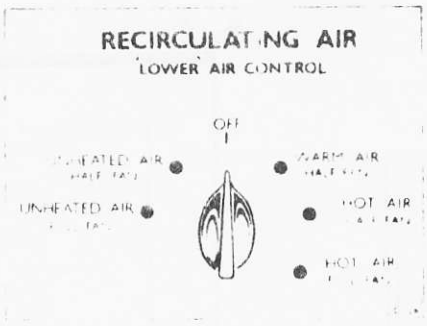


Fig. C3 (S) Switch positions heating unit 'Lower' system

Right-hand front wing To remove

(Page C 11 in Workshop Manual)

For S3 cars the second to sixth paragraphs are not applicable. The seventh and eighth paragraphs to read

Unscrew the four bolts which secure the top of the radiator to the matrix and the bonnet centre stay, also the bolts securing the lower end of the shell to the undertray and front apron.

Remove the bolts securing the front apron to the side fairing, also the four nuts, bolts and washers securing the right-hand side fairing to the wing.

For S3 cars the following three paragraphs should be read in place of the eleventh

Remove the interior trim from the right-hand scuttle wall; this exposes the bolts which secure the rear vertical edge of the wing.

Remove the four bolts from the right-hand scuttle wall. Open the door approximately half way and remove the bolt which secures the rear lower edge of the wing to the sill.

Open the door fully and remove the bolt which secures the rear top edge of the wing to the scuttle wall. Remove also the two self-tapping screws and one bolt which secure the stainless steel strip to the lower edge of the wing.

For S3 cars the paragraph headed 'Note' is not applicable.

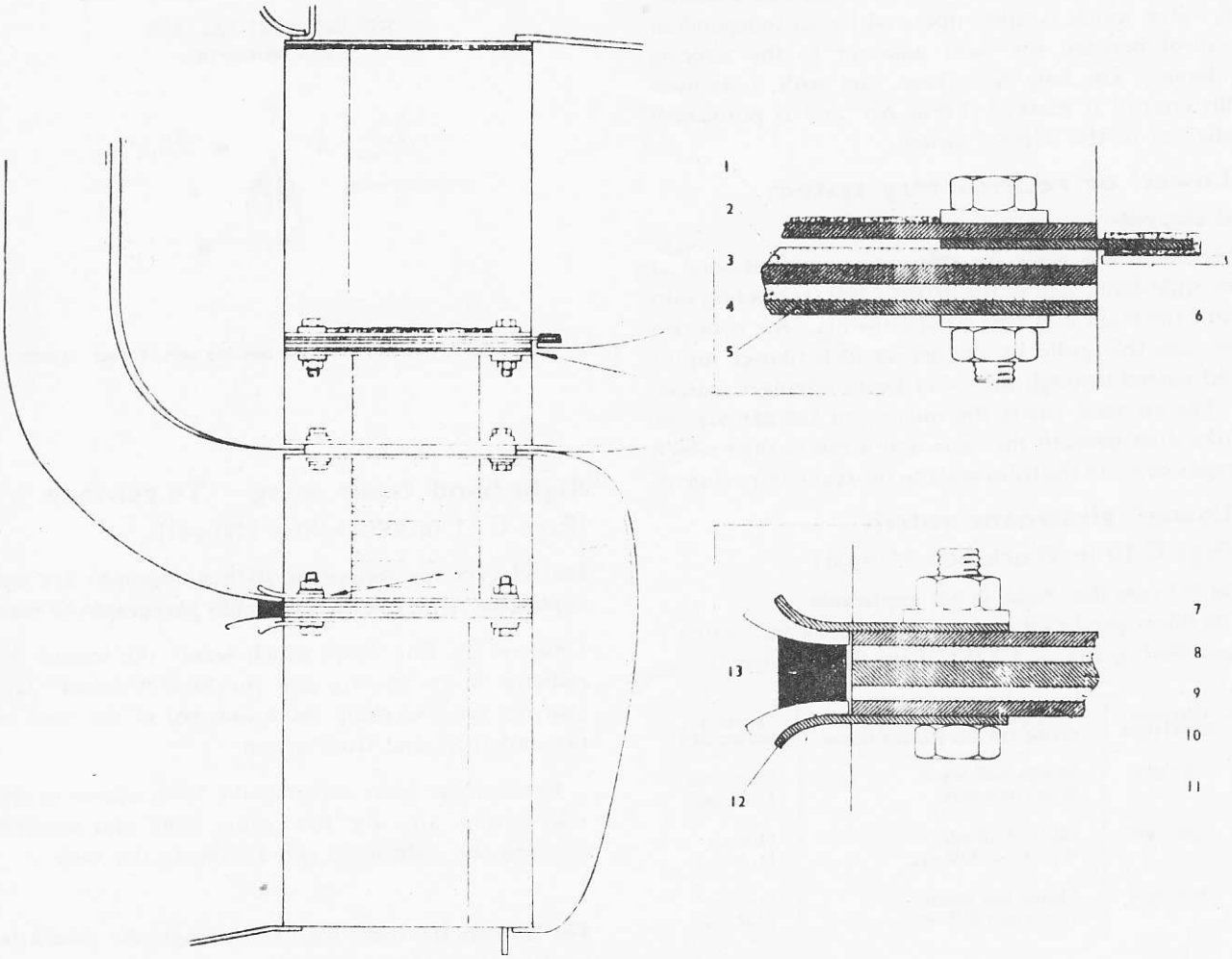


Fig. C4 (S) Sectional view of heating unit

1 UPPER (DUMMY) EVAPORATOR
2 FEROBESTOS PACKING PIECE
3 UPPER SUPPORT BRACKET
4 FEROBESTOS PACKING PIECE
5 UPPER HEATER MATRIX
6 FELTED PACKING STRIP
7 LOWER HEATER MATRIX
8 FEROBESTOS PACKING PIECE
9 LOWER SUPPORT BRACKET
10 FEROBESTOS PACKING PIECE
11 LOWER (DUMMY) EVAPORATOR
12 RETAINER PLATE
13 RUBBER SEALING STRIP

Underwing unit — To dismantle
(Page C 11 in Workshop Manual)

For S3 cars the third paragraph to read

Remove the eighteen nuts, bolts and washers securing the four sections of the matrix block together; separate the sections and retain the packing strips and brackets held between them.

Underwing unit — To assemble
(Page C 13 in Workshop Manual)

S3 cars only

Fit the 'Ferobestos' packing piece between the 'Upper' and 'Lower' matrices, positioning the 'Upper' matrix so that the outlet or straighter of the two pipes face

towards the valance plate; then using six nuts, bolts and twelve plain and 'Ferobestos' washers bolt the two matrices together as shown in Figure C4 (S) of this Supplement.

Continue to assemble the heating unit, following the procedure described on page C13 in Workshop Manual.

For S3 cars the first to fourth paragraphs to read

Fit the main support brackets to the heater matrix block, fitting one of the thinner 'Ferobestos' packing pieces between the upper support bracket and the matrix block, and another one between the lower support bracket and matrix block. The upper bracket is the one with the larger flange.

Fit the upper 'dummy' evaporator above the matrix and bracket placing a thin 'Ferobestos' packing between the evaporator and the bracket. Ensure that the diagonal stiffener of the upper 'dummy' evaporator is to the rear of the assembly as shown in Figure C4 (S) of this Supplement. Refit the felt covered sealing strip between the evaporator and the 'Ferobestos' packing pieces as shown in Figure C4 (S) of this Supplement. If a new felted strip is fitted, the outer edge must be trimmed to fit the ducting; then using six $\frac{1}{4}$ in. nuts, bolts and plain washers, bolt the assembly together.

Repeat the above procedure with the lower 'dummy' evaporator noting that in this case the diagonal stiffener must be to the front of the assembly. Two 'Ferobestos' packing pieces are used, one each side of the mounting bracket, and in addition two curved plates are bolted along the lower edge of the matrix to locate and secure the rear ducting as shown in Figure C4 (S) of this Supplement.

Attach the three ducts to the rear of the matrix block, fitting the edges of the ducts into the slots formed in the matrix block. Coat the adjacent surfaces of the lower two ducts with Bostik adhesive, then press a $9\frac{3}{4}$ in. length of rubber sealing strip between them to wedge the ducts into position.

For S3 cars the eighth paragraph to read

Fit the forward pair of ducts to the matrix block, ensuring that the lower edge of the upper duct and the upper edge of the lower duct fit into the slot formed in the matrix block. Secure the ducting to the matrix block with self-tapping screws and reinforcement strips.

Underwing unit — To fit

(Page C 13 in Workshop Manual)

For S3 cars the following two paragraphs should be read in place of the fourth.

Connnect the coolant hoses to the pipes of the heater matrices; the hose from the water tap on the right-hand valance should be connected to the lower pipe on the 'Lower' heater matrix. The hose from the water tap on the left-hand valance should be connected to the 'Upper' heater matrix. The 'Upper' heater matrix return pipe is connected to the matrix inside the engine compartment.

Secure the hoses with worm drive clips. When fitting the clips, position the screwdriver slots so that when the wing is in position, it will be possible to remove the heater hoses.

ACTUATORS

Description

(Page C 15 in Workshop Manual)

For S3 cars the fifth paragraph to read

The water tap actuators are situated low down, at the forward end of both the left and right-hand valance plates. Figure C18 in the Workshop Manual shows the water tap which is situated on the right-hand valance and controls the flow of hot coolant to the 'Lower' heater matrix.

Actuators — To adjust

(Page C 15 in Workshop Manual)

For S3 cars the fourth to eighth instructions inclusive are not applicable.

Evaporator flap (Upper) actuator — To adjust

(Page C 16 in Workshop Manual)

S3 cars only

1 Push the extension spindle fully 'home' into the flap coupling tube, then tighten the pinch bolt securing the crank lever to the extension spindle.

2 Withdraw the extension spindle and crank lever about $\frac{1}{16}$ in., then tighten the grubscrews securing the collar against the end face of the spindle bearing tube.

3 Remove the crank lever from the actuator gear shaft and check that the extension spindle is free to rotate through 90°. Any movement through more than 90 indicates that the flap coupling tube is not engaged with the extension spindle dogs and requires rectification.

4 Switch on the ignition and turn the 'Upper' and 'Lower' switches to their off positions. Allow approximately 30 seconds for the actuator to return to the fully closed position.

5 Position the actuator crank lever so that it points to the No. 1 position on the actuator motor casing, then tighten the pinch bolt.

6 Slacken the pinch bolt securing the crank lever on the flap extension spindle. Turn the extension spindle anti-clockwise (when viewed over the left-hand wing) to close the flap valve. With the flap valve held closed, adjust the position of the extension spindle crank lever so that the link arm between the two crank levers can just be fitted under slight tension. Fit new split pins on the link arms.

Heater flap (Lower) actuator
To adjust
(Page C 16 in Workshop Manual)

S3 cars only

Repeat the operations 1–4 as described for the evaporator flap.

5 Position the actuator crank lever so that it points to the No. 3 position on the actuator motor casing. Tighten the pinch bolt.

6 Slacken the pinch bolt securing the crank lever on the flap extension spindle. Turn the extension spindle clockwise (when viewed over the left-hand wing) to close the flap valve. With the flap valve held closed, adjust the position of the extension spindle crank lever so that the link arm between the crank levers can just be fitted under slight tension. Fit new split pins on the link arms.

Water tap opening — To check

S3 cars only

To ascertain that the water taps are closed, turn both the 'Upper' and 'Lower' airstream switches to either the 'Off' or one of the anti-clockwise positions, wait 30 seconds to allow the actuator motor to operate and then return the switches to the 'Off' position. Before continuing the check, allow sufficient time for the coolant in the heater matrices to cool; to facilitate this turn both the 'Upper' and 'Lower' airstream switches to the second anti-clockwise position, withdrawing the 'Upper' airstream switch to its full extent. This action causes the blower motor to operate, thereby cooling the heater matrices. After a sufficient time period return the switches to their 'Off' position.

If the taps are closed and the engine is warm, the three pipes which lead to the heater matrices under the right-hand front wing should be cold; if one of the taps is leaking then the pipes will be warm. The pipe which is connected to the 'Upper' heater matrix is in turn connected to the water tap on the left-hand valance. The two pipes connected to the 'Lower' heater matrix are in turn connected to the water tap on the right-hand valance.

If the pipes are warm, adjust each water tap in turn using the following procedure.

'Lower' water tap — To check

S3 cars only

1 Drain the coolant into a suitable container, or disconnect the two pipes connected to the water tap on the right-hand valance and plug them with suitable wooden pegs to prevent any loss of coolant.

2 Close the water tap by turning the 'Lower' air-stream switch anti-clockwise and waiting 30 seconds, then turn the switch back to the 'Off' position.

3 If the coolant has been drained, disconnect the two hoses to the water tap. Remove the four bolts securing the tap and actuator motor to the wing valance, then lift out the tap.

4 Check whether the tap is open or closed by passing air through the tap from the inlet side.

5 If the tap is not properly closed, slacken the clamping bolt on the actuator and push the tap lever to the closed position. Hold the lever in the closed position and tighten the clamping bolt.

6 Check the functioning of the tap, and if correct, fit the tap and actuator motor on the wing valance.

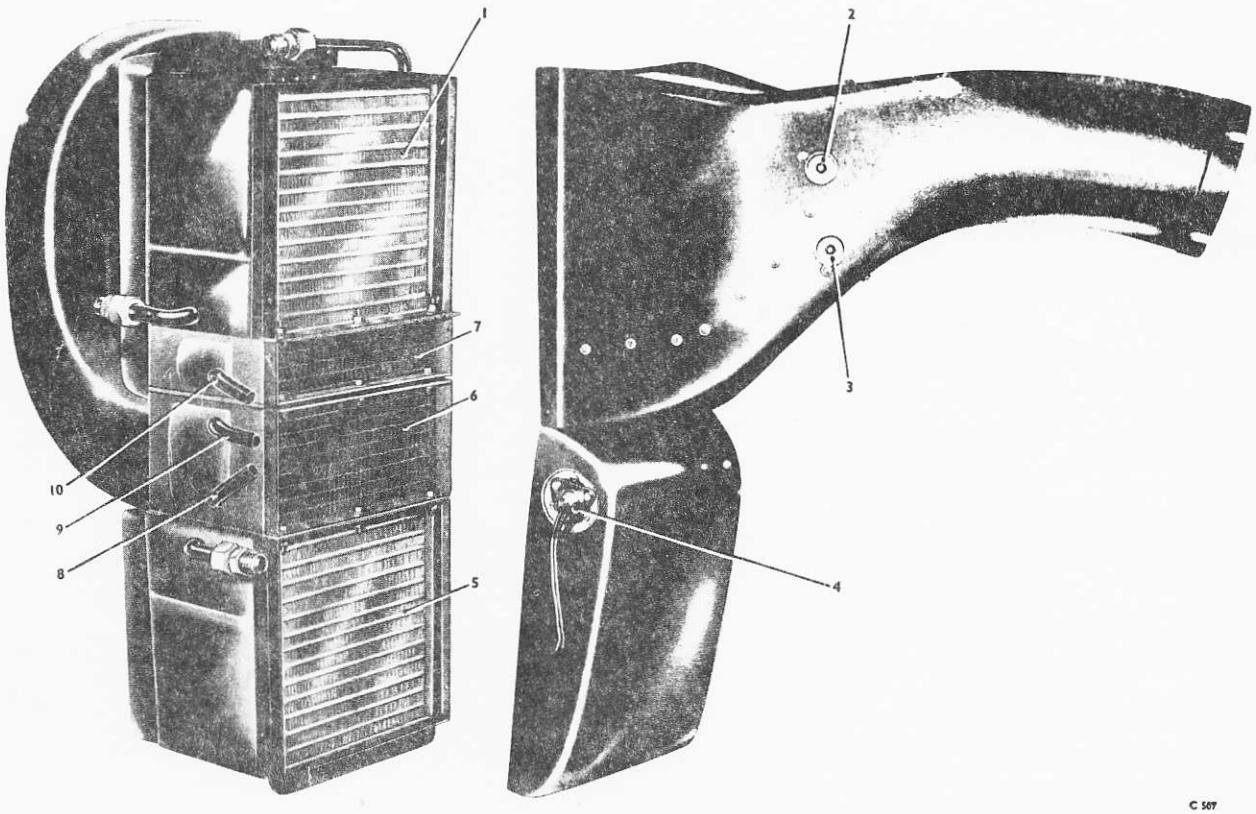


Fig. C5 (S) Access to matrices

1 UPPER EVAPORATOR MATRIX
2 COLD FLAP SPINDLE
3 HOT FLAP SPINDLE
4 THERMOSTATIC SWITCH
5 LOWER EVAPORATOR MATRIX
6 LOWER HEATER MATRIX
7 UPPER HEATER MATRIX
8 LOWER HEATER MATRIX INLET
9 LOWER HEATER MATRIX OUTLET
10 UPPER HEATER MATRIX INLET

'Upper' water tap — To check

S3 cars only

Repeat the operations described for the 'Lower' water tap, noting that the 'Upper' airstream switch controls the 'Upper' tap actuator and that the tap and actuator motor are mounted low down at the forward end of the left-hand valance plate.

Figures C13, C14, C15 and C16 in the Workshop Manual are not applicable to the S3 Air Conditioning Unit.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

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CHAPTER D

LUBRICATION AND MAINTENANCE

SECTION D1 — MAINTENANCE DATA

SILVER CLOUD, BENTLEY S1 AND BENTLEY CONTINENTAL S1

Engine

Valve clearance:	
Inlet	0·006 in. (cold) (0·15 mm.)
Exhaust	0·012 in. (cold) (0·30 mm.)
Distributor contact breaker gap	0·019 in. to 0·021 in. (0·483 mm. to 0·533 mm.)
Distributor 'dwell angle'	44 deg. at 0·020 in. (0·508 mm.) gap
Sparking plugs:	
6·6 : 1 c.r.	Champion RN8 or Lodge CLNP
8·0 : 1 c.r.	Champion N5* or Lodge HLNP
Continental models	
7·25 : 1 c.r.	Champion RN8 or Lodge CLNP
8·0 : 1 c.r.	Champion N5* or Lodge HLNP
	* Not for use on cars with wing mounted aerials
Sparking plug gap	0·025 in. (0·635 mm.)
Firing order	1, 4, 2, 6, 3, 5
Ignition timing	2 deg. B.T.D.C.
Valve timing	No. 1 inlet valve opens at T.D.C. with 0·030 in. (0·762 mm.) valve clearance

Capacities

	Imperial	U.S.	Litres
Engine sump	16 pints	19·2 pints	9
Automatic gearbox	20 pints	24 pints	11·4
Synchromesh gearbox	6 pints	7·2 pints	3·4
Rear axle	1¾ pints	2·1 pints	1
Steering box (manual)	2 pints	2·4 pints	1·1
Steering system (power assisted)	4 pints	4·8 pints	2·2
Cooling system	3½ galls.	4·2 galls.	16
Fuel tank	18 galls.	21·6 galls.	81·8

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Levels

Engine sump	**Max** mark on the dipstick
Automatic gearbox	**F** line on the dipstick
Rear axle	Bottom of the level plug orifice
Steering box (manual)	Filler plug orifice
Steering system (power assisted)	**Full** mark on the dipstick
Starter motor drive	Bottom of the filler plug orifice
Shock dampers	Bottom threads of the filler plug orifice
Hydraulic fluid reservoirs	Level mark on the clamping straps
Chassis lubrication reservoir	1 in. below the top of the filler orifice
Coolant level	Bottom of the radiator filler orifice
Battery electrolyte	$\frac{3}{8}$ in. above the top of the separators
Windscreen washer reservoir	1 in. below the top of the filler orifice

Tyre Pressures

Silver Cloud and Bentley S1 — Power assisted steering — 8·20 × 15 tyres

Front	21 lb/sq.in.	(1·48 kg/sq.cm.)	Cold
Rear	26 lb/sq.in.	(1·83 kg/sq.cm.)	

Silver Cloud and Bentley S1 — Manual steering — 8·20 × 15 tyres

Front	19 lb/sq.in.	(1·33 kg/sq.cm.)	Cold
Rear	26 lb/sq.in.	(1·83 kg/sq.cm.)	

Silver Cloud and Bentley S1 Long Wheelbase — Power assisted steering — 8·20 × 15 tyres

Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold
Rear	28 lb/sq.in.	(1·97 kg/sq.cm.)	

Bentley Continental S1 (early) — Manual steering — 7·60 × 15 tyres

Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold for normal
Rear	24 lb/sq.in.	(1·70 kg/sq.cm.)	speed running
Front	30 lb/sq.in.	(2·1 kg/sq.cm.)	Cold for maximum
Rear	36 lb/sq.in.	(2·46 kg/sq.cm.)	speed running

Bentley Continental S1 (late) — Manual steering — 8·00 × 15 tyres

Front	20 lb/sq.in.	(1·41 kg/sq.cm.)	Cold for normal
Rear	25 lb/sq.in.	(1·76 kg/sq.cm.)	speed running
Front	25 lb/sq.in.	(1·76 kg/sq.cm.)	Cold for maximum
Rear	30 lb/sq.in.	(2·11 kg/sq.cm.)	speed running

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Electrical Equipment

Battery	Dagenite or Exide 12V 57 amp/hr.
Earth	Negative to frame
Generator	Lucas C-47 12V or C-48 12V
Starter motor	Lucas M-45G 12V
Horns	Lucas WT 618/1 Windtone
Bulbs:	
Headlamps	12V 60/36W standard 12V 42/36W Canada and South America 12V 45/36W 'Granilux' France 12V 45/40W Europe except France
Sidelamps	12V 6W
Stop/Tail lamps	12V 18/6W
Rear flashers	12V 21W
Fog lamps	12V 38/21W
Reverse lamp	12V 21W
Number plate lamp	12V 6W
Boot lamp	12V 6W
Roof lamp	12V 6W
Companion lamps	12V 6W
Map lamp	12V 6W
Inspection lamp	12V 6W
Fuses:	30 amp. (one strand of No. 28 S.W.G. (0·0148 in. dia.) tinned copper wire)
Horn fuse	25 amp. cartridge type
Radio fuse	5 amp. cartridge type

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SECTION D2—MAINTENANCE DATA

SILVER CLOUD II, BENTLEY S2, BENTLEY CONTINENTAL S2 AND PHANTOM V

Engine

Distributor contact breaker gap	0·019 in. to 0·021 in. (0·483 mm. to 0·533 mm.)
Distributor 'dwell angle'	44 deg. at 0·020 in. (0·508 mm.) gap
Sparking plugs	Champion RN8, Champion RN13P or Lodge CLNP
Sparking plug gap	0·024 in. to 0·027 in. (0·609 mm. to 0·686 mm.)
Firing order	A1, B1, A4, B4, B2, A3, B3, A2 1, 5, 4, 8, 6, 3, 7, 2
Ignition timing	2 deg. B.T.D.C.
Valve timing	5 deg. A.T.D.C.

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Capacities

	Imperial	U.S.	Litres
Engine sump	12 pints	14·40 pints	6·81
Automatic gearbox	20 pints	24 pints	11·36
Rear axle	1⅝ pints	1·95 pints	0·92
Steering system	3 pints	3·60 pints	1·70
Steering (transfer box)	⅝ pint	0·75 pint	0·36
Cooling system	21 pints	25·21 pints	11·93
Fuel tank	18 galls.	21·60 galls.	81·82
Fuel tank (Phantom V)	23 galls.	27·62 galls.	104·56

Levels

Engine sump	**Max** mark on the dipstick
Automatic gearbox	**F** line on the dipstick
Rear axle	Bottom of the level plug orifice
Steering (transfer box)	Bottom of the level plug orifice
Steering system	**Full** mark on the dipstick
Shock dampers	Bottom threads of the filler plug orifice
Hydraulic fluid reservoirs	Level mark on the clamping straps
Coolant level	Bottom of the radiator filler orifice
Battery electrolyte	⅜ in. above the top of the separators
Windscreen washer reservoir	1 in. below the top of the filler orifice

Tyre Pressures

Silver Cloud II and Bentley S2 — 8·20 × 15 tyres				
	Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold
	Rear	27 lb/sq.in.	(1·90 kg/sq.cm.)	
Silver Cloud II and Bentley S2 Long Wheelbase — 8·20 × 15 tyres				
	Front	23 lb/sq.in.	(1·62 kg/sq.cm.)	Cold
	Rear	29 lb/sq.in.	(2·04 kg/sq.cm.)	
Bentley Continental S2 — 8·00 × 15 tyres				
	Front	20 lb/sq.in.	(1·41 kg/sq.cm.)	Cold for normal
	Rear	25 lb/sq.in.	(1·76 kg/sq.cm.)	speed running
	Front	25 lb/sq.in.	(1·76 kg/sq.cm.)	Cold for maximum
	Rear	30 lb/sq.in.	(2·11 kg/sq.cm.)	speed running
Park Ward Convertible Coupe				
	Front	20 lb/sq.in.	(1·41 kg/sq.cm.)	Cold for normal
	Rear	28 lb/sq.in.	(1·97 kg/sq.cm.)	speed running
	Front	25 lb/sq.in.	(1·76 kg/sq.cm.)	Cold for maximum
	Rear	33 lb/sq.in.	(2·33 kg/sq.cm.)	speed running
Phantom V — 8·90 × 15 tyres				
	Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold
	Rear	27 lb/sq.in.	(1·90 kg/sq.cm.)	

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Electrical Equipment

Battery	Dagenite or Exide 12V 67 amp/hr.
Earth	Negative to frame
Generator	Lucas C48 12V
Starter motor	Lucas M-45G 12V
Horns	Lucas WT 618/1
Bulbs:	
Headlamps	12V 60/36W 12V 42/36W Canada and South America 12V 45/36W 'Granilux' France 12V 45/40W Europe except France
Side lamps	12V 6W
Fog lamp/front flasher	12V 38/21W
Fog lamp (Switzerland)	12V 21W
Front flasher (Switzerland)	12V 21W
Stop/Tail lamps	12V 21/6W
Stop/Rear flasher (Switzerland)	12V 21/6W
Reverse lamp	12V 21W
Number plate lamp	12V 6W
Boot lamp	12V 6W
Roof lamp	12V 6W
Companion lamp	12V 6W
Inspection lamp	12V 6W
Rear flasher	12V 21W
Map lamp	12V 3W
Fuses:	30 amp. (one strand of No. 28 S.W.G. (0·0148 in. dia.) tinned copper wire)
Horn fuse	25 amp. cartridge type
Radio fuse	5 amp. cartridge type

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SECTION D3 — PERIODIC LUBRICATION AND ADJUSTMENT SCHEDULES

A system of periodic lubrication and maintenance has been established to assist retailers with the maintenance of Rolls-Royce and Bentley cars in their area.

Retailers are advised to institute this system as a normal routine and to make appropriate arrangements with any owners wishing to avail themselves of this service.

Should some owners desire to carry out their own maintenance inspections, it should be noted that this system does not in any way supersede the instructions given in Owners' Handbooks.

The following schedules cover the whole car.

SILVER CLOUD, BENTLEY SI AND BENTLEY CONTINENTAL SI

Schedule A

To be carried out every 5000 miles, covers all the items associated with the engine, chassis and coachwork requiring lubrication, cleaning and adjustment.

Schedule B

To be carried out every 10,000 miles. In addition to the repetition of the whole of Schedule A, it covers the complete change of lubricant of all the main components, together with the inspection and rectification of those items not included at the lower mileage.

Schedule C

To be carried out every 20,000 miles. This schedule repeats Schedule B and principally covers the change of lubricant for the automatic gearbox, rear axle and propeller shaft ball and trunnion joint.

SCHEDULE A

EVERY 5000 MILES

Lubrication

1. Ignition distributor shaft, contact breaker pivots and cam.
2. Gear range selector controls and accelerator linkage.
3. Brake system pivot pins and bearings.

Oil Level Checks

1. Steering box.
2. Chassis lubrication tank.
3. Clean carburetter air valves and check oil level in hydraulic damper chambers.
4. Brake master cylinder reservoirs.
5. Automatic gearbox. (Check with engine running as described in Automatic Gearbox Manual).
6. Rear axle.
7. Drain and re-fill the crankcase sump. Renew the oil filter element.
8. Power steering pump (if fitted).

Engine and Chassis Adjustments

1. Check the coolant level and top-up if required. (Check the specific gravity of the coolant and advise the owner if additional anti-freeze is required). Maintain anti-freeze in the system all the year round.
2. Check the tension of the driving belts and adjust if necessary. If individual tension is uneven a new **matched pair** of belts should be fitted.
3. Check and re-set the inlet clearances.
4. Clean the sparking plugs. Check and re-set the gaps.
5. Clean the contact breaker points. Re-set the gaps, check and re-set the ignition timing.

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6. Check the functioning of the fuel pumps (disconnect the electrical leads and check each pump independently).
7. Adjust the rear brakes.
8. Check for excessive leakage at any point in the central chassis lubrication system.
9. Check and adjust the tyre pressures.
10. Clean the oil bath air filter element (if fitted) and re-fill with oil.
11. Clean the 'Vokes' air filter element (Continental models).
12. Inspect the condition of the propeller shaft sealing boot. Check the torque tightness of the four bolts securing the universal joint to the gearbox output flange.

Electrical System

1. Check the battery electrolyte level. Top-up with distilled water if required. Clean, apply a coat of petroleum jelly and tighten the battery terminals.
2. Check the complete electrical system for correct functioning.

Road Test

1. Test the car on the road.

SCHEDULE B
EVERY 10,000 MILES

1. Repeat Schedule A.
2. Lubricate the three grease nipples on the rear propeller shaft.
3. Check the starter motor reduction gear oil level and re-fill if required.
4. Check the oil level in the front and rear shock dampers.
5. Remove the carburetter air filter element and wash in petrol or paraffin and then oil with engine oil. Allow to thoroughly drain before re-fitting.
6. Clean the fuel strainers.
   (i) The main fuel filter on the chassis cross member just forward of the fuel tank.
   (ii) The filter gauzes in each carburetter float chamber feed connection.
   (iii) The filter gauzes in the fuel pumps.
7. Change the filter in the power steering pump reservoir (where fitted).
8. Check and if necessary adjust the brake servo.
9. Grease the master cylinder balance lever bearing (where applicable).
10. On cars fitted with Rolls-Royce Car Interior Cooling System, grease the coolant pump bearing using Retinax 'A' or similar type of grease.
11. Grease the steering points using Molyspring Lubricant 204G, or a good quality grease containing 20 per cent molybdenum disulphide.

SCHEDULE C
EVERY 20,000 MILES

1. Repeat Schedule B.
2. Drain and re-fill the automatic gearbox. Clean the oil breather in the top of the dipstick.
3. Drain and re-fill the rear axle.
4. Dismantle the front ball and trunnion joint on the propeller shaft, inspect and re-fill with $1\frac{1}{2}$ oz. of Mobilgrease No. 2. This should not be carried out if the joint shows no sign of leakage.
5. Remove the front drums and inspect the brake linings for wear. (Lining face should not be less than $\frac{1}{32}$ in. (0·8 mm.) above the rivets).
6. Renew the oil filter pad in the chassis lubrication pump.
7. Renew the 'Vokes' air filter element (Continental models).

EVERY 60,000 MILES

1. Examine the wheel bearings, if they are in a serviceable condition, re-pack with the correct grease.
2. Examine the propeller shaft centre bearing and re-pack with the correct grease.

ANNUALLY

1. Drain and flush the cooling system; re-fill with the correct anti-freeze mixture.

SPECIAL PRECAUTIONS

Should the car be operating in a sustained temperature of 0 deg. F. and below:

1. Drain the crankcase sump when thoroughly warm and re-fill with SAE 10 oil; the carburetter air valve guide should also be drained and re-filled with this oil.

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SECTION D4 — PERIODIC LUBRICATION AND ADJUSTMENT SCHEDULES

SILVER CLOUD II, BENTLEY S2, BENTLEY CONTINENTAL S2 AND PHANTOM V

2500 Miles Schedule

To be carried out every 2500 miles — covers engine oil change, oil level checks, engine and chassis adjustments, electrical system checks and road test.

Schedule A

To be carried out every 5000 miles—covers all the items associated with engine, chassis and coachwork requiring lubrication, cleaning and adjustment.

Schedule B

To be carried out every 10,000 miles. In addition to the repetition of the whole of Schedule A, it covers the complete change of lubricant of all the main components, together with the inspection and rectification of those items not included at the lower mileage.

Schedule C

To be carried out every 20,000 miles. This Schedule repeats Schedule B and principally covers the change of lubricant for the automatic gearbox, rear axle and the propeller shaft ball and trunnion joint.

Schedule D

To be carried out at the conclusion of every 30,000 miles. This Schedule repeats Schedule B or C as required and covers renewal of the filter element in the steering pump reservoir.

2500 MILES SCHEDULE

Oil Changes

1. Drain and re-fill the crankcase sump.

Oil Level Checks

1. Carburetter air valve damper.
2. Steering pump reservoir.
3. Brake fluid reservoirs.
4. Automatic gearbox. (Check with the engine running as described in the Automatic Gearbox Manual).

Engine and Chassis Adjustments

1. Check the coolant level (check the specific gravity of the coolant and advise the owner if additional anti-freeze is required). Maintain anti-freeze in the system all the year round.
2. Check the tension of the driving belts and adjust if necessary. If individual belt tension is uneven a new **matched pair** of belts should be fitted.
3. Check and if necessary adjust the rear brakes.
4. Check and adjust the tyre pressures (including spare).

Electrical System Checks

1. Check the battery electrolyte level and top-up with distilled water if required.
2. Check and if necessary top-up the windscreen washer reservoir with the correct mixture of distilled water and Rolls-Royce Windscreen Washer Fluid.
3. Check the complete electrical system for correct functioning.

Road Test

1. Test the car on the road.

SCHEDULE A

EVERY 5000 MILES

1. Repeat the 2500 Miles Schedule.
2. Renew the oil filter element.
3. Check and if necessary top-up the rear axle oil level.
4. Lubricate the ignition distributor automatic advance mechanism, shaft bearings, governor spindle, contact breaker rocker arm pivots and cam.
5. Lubricate the gear range selector controls and accelerator linkage. **Do not** lubricate the automatic starting device controls.
6. Lubricate the brake system pivot pins and bearings.

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7. Clean the contact breaker points and re-set the gaps. Check and re-set the ignition timing.
8. Check the functioning of the fuel pumps (disconnect the electrical leads and check each pump independently).
9. Remove any foreign matter from the refrigeration condenser matrix (if fitted).
10. Clean the air valves in the carburetters.
11. Check the torque tightness of the four bolts securing the universal joint to the gearbox output flange. Inspect the condition of the rubber boot.
12. Check the static and dynamic balance of the wheels and rectify if necessary. Interchange the front and rear wheels to equalise tyre wear. Check the front brake linings for wear (see Section G).
13. Clean and tighten the battery terminals. Apply them with a light coat of petroleum jelly.

SCHEDULE B

EVERY 10,000 MILES

1. Repeat Schedule A.
2. Check the oil level in the front and rear shock dampers. This should not be carried out if the dampers show no sign of leakage.
3. Lubricate the grease nipple of the master cylinders balance lever pivot.
4. Lubricate the thirteen grease nipples on the steering mechanism.
5. Lubricate the eight grease nipples on the front suspension.
6. Lubricate the three grease nipples on the rear propeller shaft.
7. Clean the sparking plugs, test and if necessary renew.
8. Check and if necessary adjust the brake servo.
9. Remove the front drums and inspect the brake linings for wear. (Lining face should not be less than $\frac{1}{32}$ in. (0·8 mm.) above the rivets).
10. Renew the carburetter air filter element.
11. Clean the main fuel filter (adjacent to the fuel tank), both filter gauzes in the fuel pump and the filter gauze in each float chamber feed connection.

SCHEDULE C

EVERY 20,000 MILES

1. Repeat Schedule B.
2. Drain and re-fill the automatic gearbox and fluid coupling — clean the oil breather in the top of the dipstick.
3. Drain and re-fill the rear axle.
4. Dismantle the front ball and trunnion joint of the propeller shaft, inspect and re-fill with $1\frac{1}{2}$ oz. of Mobilgrease No. 2. This should not be carried out if the joint shows no sign of leakage.
5. Inspect the generator commutator and brushes for wear, also the brushes for freedom in their holders.
6. Release — but do not remove — the fuel tank drain plug to allow any accumulated water to escape.
7. Remove the fuel pumps and bench test them.

SCHEDULE D

EVERY 30,000 MILES

1. Repeat Schedule B or C as required.
2. Renew the filter element in the steering pump reservoir.

EVERY 60,000 MILES

1. Examine the wheel bearings; if they are in a serviceable condition re-pack with the correct grease.
2. Examine the propeller shaft centre bearing and re-pack with the correct grease.

ANNUALLY

1. Drain and flush the cooling system; re-fill with the correct anti-freeze mixture.

SPECIAL PRECAUTIONS

Should the car be operating in a sustained temperature of 0 deg. F. and below:

1. Drain the crankcase sump when thoroughly warm and re-fill with a viscosity SAE 10 oil; the carburetter air valve guides should also be drained and re-filled with this oil.

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SECTION D5 — LUBRICATION OF THE STEERING AND SUSPENSION POINTS — 4 STAGES

Stage 1

When production of S1 cars commenced, lubrication was provided for by the Centralised Chassis Lubrication System.

This system supplies oil to all front suspension and steering joints (see Figs. D1A and D1B).

The rear springs on both S1 and S2 cars are prepacked with grease.

Stage 2

During the production of S1 cars, grease lubrication was introduced on the steering mechanism.

At this stage the track rod ends only were adapted for grease. This modification (shown in Fig. D2) was introduced on the following chassis:

Bentley S1	B-FA.48, 208, 386, 394, 398, 516, 526, 532, 544, 552, 556–650 onwards

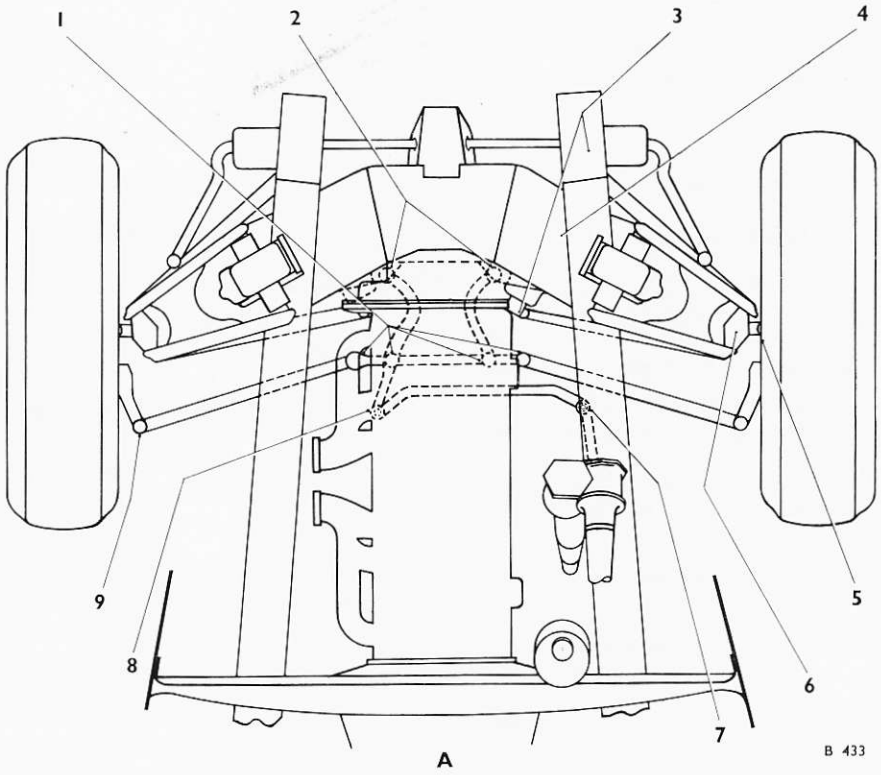


Fig. D1A Chassis lubrication system, right-hand arrangement

1. CROSS BEAM CENTRE STEERING BALL JOINTS
2. CENTRE STEERING LEVER PIVOTS
3. LOWER TRIANGLE LEVER FULCRUM BEARINGS
4. METER VALVE RATE 2
5. SWIVEL PIN
6. YOKE BEARINGS
7. PENDULUM LEVER/DRAG LINK BALL JOINT
8. CENTRE STEERING OPERATING LEVER/DRAG LINK BALL JOINT
9. SIDE STEERING LEVER-CROSS-STEERING TUBE BALL JOINT

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Bentley Continental S1	F series onwards
Bentley S1 L.W.B.	ALB.14–18, 20 onwards
Silver Cloud	F series onwards
Silver Cloud L.W.B.	BLC.18, 19, 21, 23–35, 37–46, 50, 51 onwards

Stage 3

At a later stage in the production of S1 cars, grease lubrication was used more extensively. While the Centralised Chassis Lubrication System was still retained on the suspension, all the steering joints, except the centre steering lever pivot points, were changed to grease lubrication as illustrated in Figure D3.

This modification was introduced on the following chassis:

Bentley S1	B-FA.644 onwards
Bentley Continental S1	BC-FM.1 onwards
Bentley S1 L.W.B.	ALB.17, 21–24 onwards
Silver Cloud	F series onwards
Silver Cloud L.W.B.	BLC.28–40, 42 onwards

Stage 4

At the commencement of the production of S2 cars the Centralised Chassis Lubrication System was omitted and all suspension and steering joints were fitted with grease points (see Fig. D4).

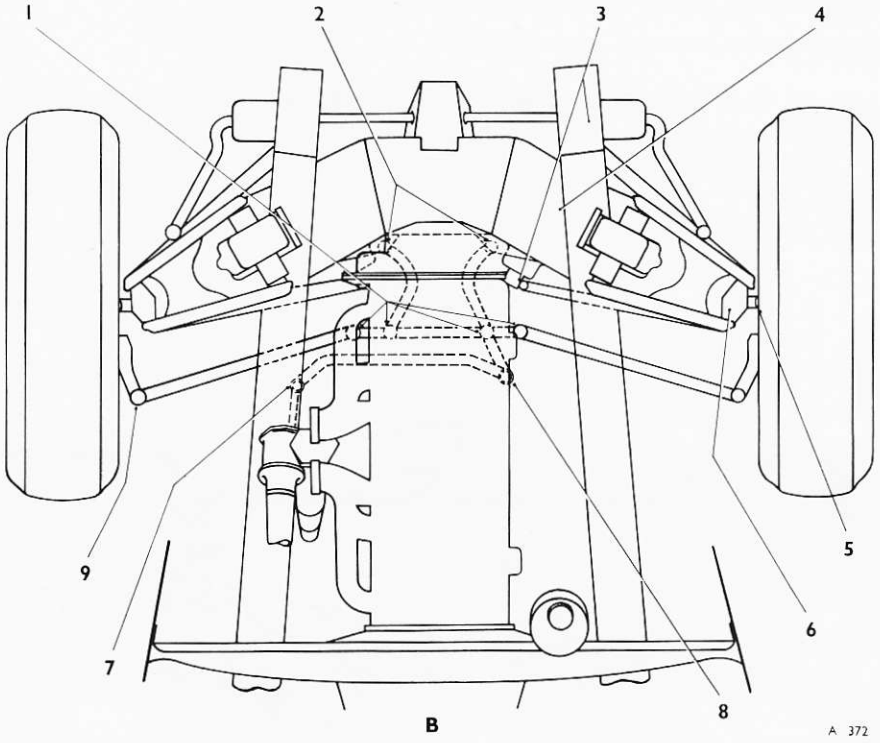


Fig. D1B Chassis lubrication system, left-hand arrangement

1. CROSS BEAM CENTRE STEERING BALL JOINTS
2. CENTRE STEERING LEVER PIVOTS
3. LOWER TRIANGLE LEVER FULCRUM BEARINGS
4. METER VALVE RATE 2
5. SWIVEL PIN
6. YOKE BEARINGS
7. CENTRE STEERING OPERATING LEVER/DRAG LINK BALL JOINT
8. PENDULUM LEVER/DRAG LINK BALL JOINT
9. SIDE STEERING LEVER/CROSS STEERING TUBE BALL JOINT

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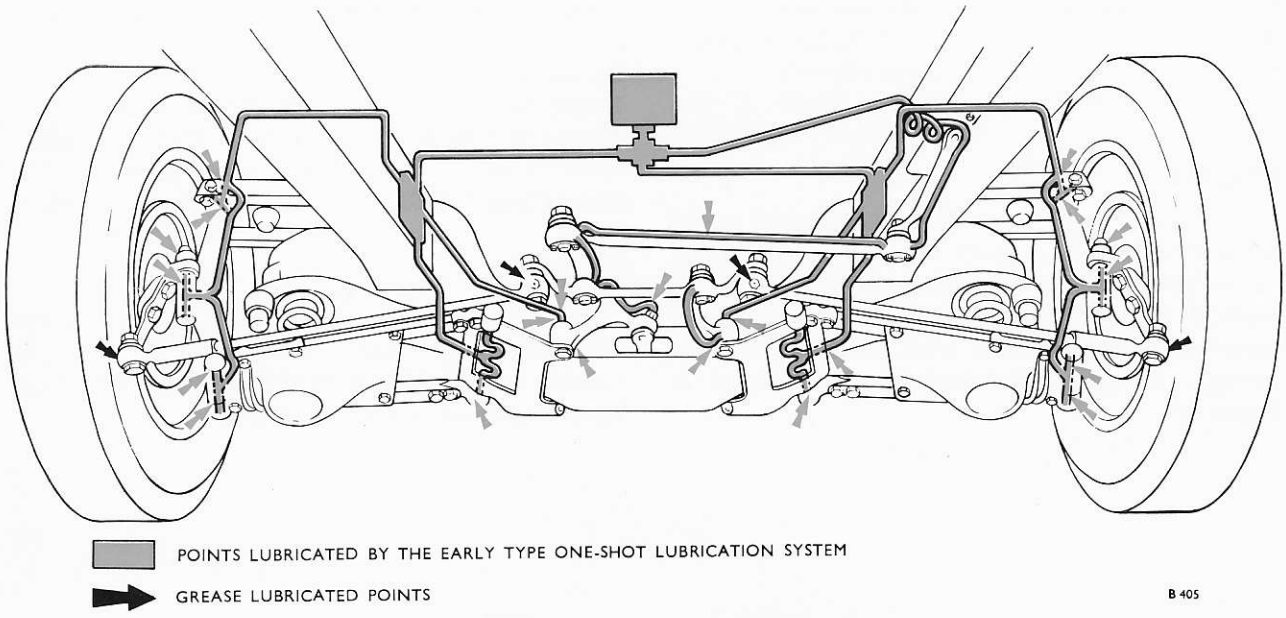


Fig. D2 Early type one-shot oil lubrication system and grease lubricated track rods only

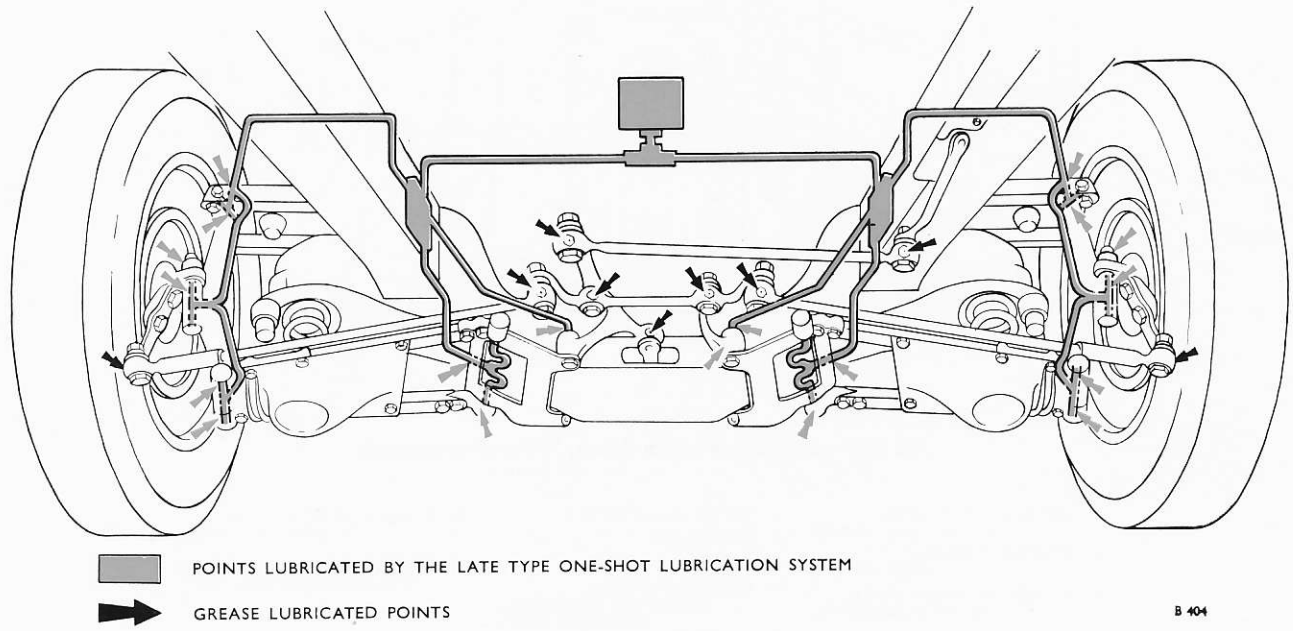


Fig. D3 Late type one-shot oil lubrication system and grease lubricated steering joints

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SECTION D6—THE CENTRALISED CHASSIS LUBRICATION SYSTEM

The Luvax Bijur foot-operated pump and combined oil reservoir is fitted on the front of the bulkhead and supplies oil through brass tubing to the front chassis lubrication points as shown in Figures D1A and B, D2 and D3.

The rear springs are interleaved and pre-packed with grease. They and the rubber-bushed shackle pins require no additional lubrication.

Figure D5. Pressure on the foot pedal raises the piston and compresses the return spring. Oil is drawn through a non-return ball valve in the centre of the piston to the underside of the piston. On releasing the pressure from the pedal, the piston is forced downward by the return spring and oil is forced through the filter pad to the outlet pipe.

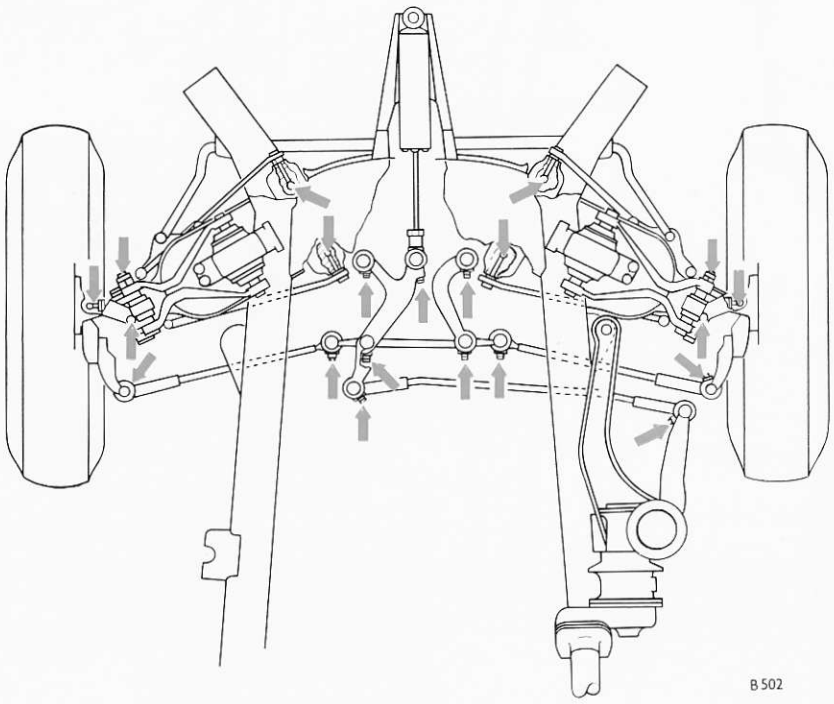


Fig. D4 Steering and front suspension joints, grease lubrication points

The oil delivered is not metered by drip plugs and each bearing point is designed to ensure that correct lubrication is effected. As this is a total loss system, oil leakage from the points is desirable but excessive individual leakage should be rectified. Joints and connections in the piping are made by cap nuts and olives.

The construction of the pump is shown in

The spring is so rated that the pressure is practically constant throughout the stroke and the rate of discharge depends upon the viscosity of the oil. Normally it should take approximately five minutes for the pedal to return to its original position. At the end of its stroke the piston seals the hole in the filter retaining plate, preventing oil leakage by gravity.

The pedal should be depressed four times every 200 miles to ensure adequate lubrication.

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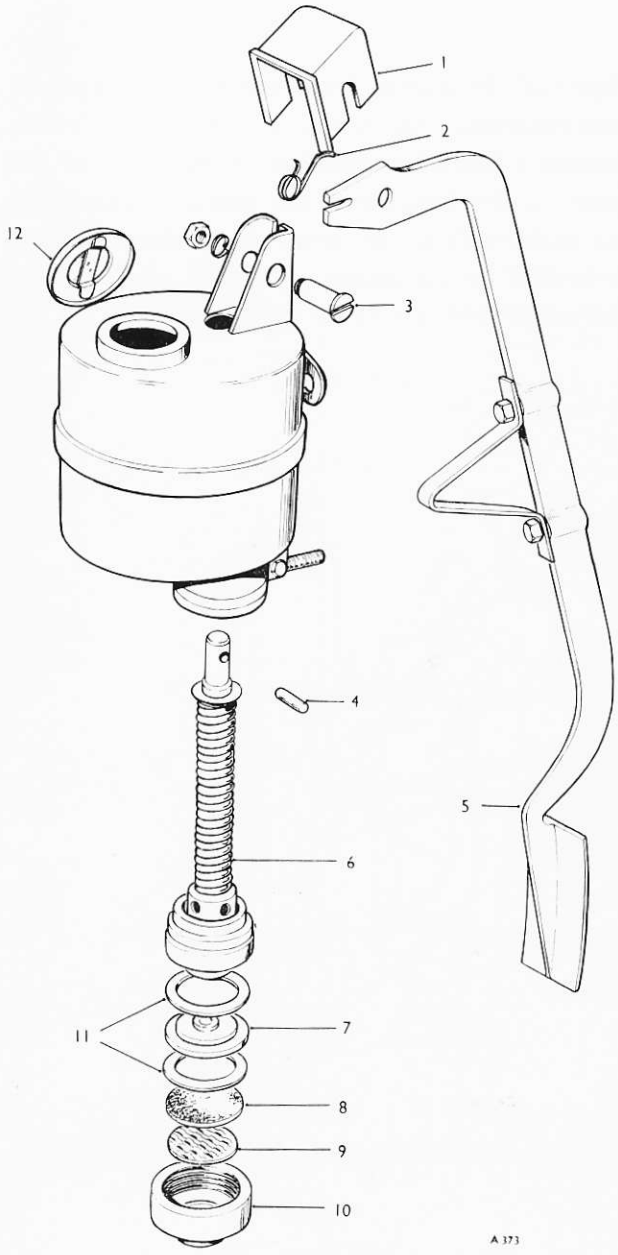


Fig. D5 Chassis lubrication pump

1. COVER
2. PEDAL SPRING
3. PEDAL PIN
4. PISTON ROD PIN
5. PEDAL
6. PISTON ASSEMBLY
7. STRAINER PLATE
8. FELT STRAINER
9. STRAINER SUPPORT
10. CAP NUT
11. JOINT WASHERS
12. FILLER CAP

Pump Filter

If, with the pump unit correctly coupled to the pipe lines, the pump pedal does not return to its normal position within four to five minutes after being pressed down, it is probable that the filter is clogged.

Disconnect the chassis oil line at the pump outlet and unscrew the cap nut below the reservoir. Note the positioning of the filter retaining plate and gaskets to ensure correct re-assembly. Discard the felt disc and replace with a new one. Re-assemble and re-connect. Prime the system until oil is exuding from each bearing.

Pump — to test

Disconnect the chassis oil feed pipe from the connection at the bottom of the pump, and seal the outlet with a plug or re-connect a short piece of tube with its end hammered flat. Press down the pedal. If the pedal shows any upward movement during a period of two minutes a leak past the piston is indicated either at the leather cups or at the ball valve. Check that the reservoir is filled with the correct viscosity oil as too thin an oil will give the same effect. If a leak is evident replace the pump unit.

The approved oils are:

Castrol Hi-press S/C
Energol SAE 90 EP
Spirax 90 EP
Mobilube GX 90

Pump — to dismantle

Normally, reconditioning of an oil pump is only undertaken by the Manufacturers and it is advisable to fit a replacement unit and to return the original for repair. The following instructions are given for occasions when this is impracticable.

Disconnect the chassis feed pipe from the pump. Remove the three nuts, bevelled and plain washers situated under the carpet and insulating material at the front of the bulkhead. The stirrup, which acts as a travel limiter, must be removed from the pedal because

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there is insufficient room for the pedal assembly to pass through the bulkhead. The pump may now be removed. Collect the three plain washers fitted between the pump and the bulkhead.

Remove the filler cap. Remove the nut and spring washer from the cheese-headed pedal pin. Slide the pedal spring cover forward and remove.

Tap out the pedal pin, collect the hairpin spring. Slide the pedal off the flats on the piston rod pin, remove the pin from the piston rod.

Remove the cap nut and remove the piston valve assembly downward.

Pump — to assemble

Thoroughly clean all parts.

Oil the piston cup. With the leather joint washer in position on the collar near the top of the piston rod, fit the piston assembly to the tank. Fit the piston rod pin to the piston rod and slide the pedal on to the flats on the pin.

Fit the pedal pin and pedal spring, the shorter leg in the pedal notch and the longer leg under the small projecting pin (see Fig. D5). Fit the pedal spring cover. Push it fully home against the pedal pin and tighten the pedal pin nut.

With the strainer support, strainer, strainer plate and two washers in position in the cap nut, fit the nut to the tank and fully screw up.

Re-fit the pump to the bulkhead and connect the feed pipe.

Gravity Leakage from the Pump

A gravity leakage from the pump, due to the piston sealing disc not seating correctly on the raised face of the brass strainer plate, will be noticeable by excessive oiling at the joints.

Incorrect sealing of the piston discs may be due to the cylinder cap nut (see 6, Fig. D6) not being sufficiently tightened, or to foreign matter between the piston valve disc and strainer plate.

To check for leakage disconnect the chassis feed pipe from the connection at the bottom of the pump and leave a piece of paper beneath the connection. Inspect after approximately half an hour.

If tightening the cap nut, or dismantling and cleaning does not effect a cure, a new pump should be fitted.

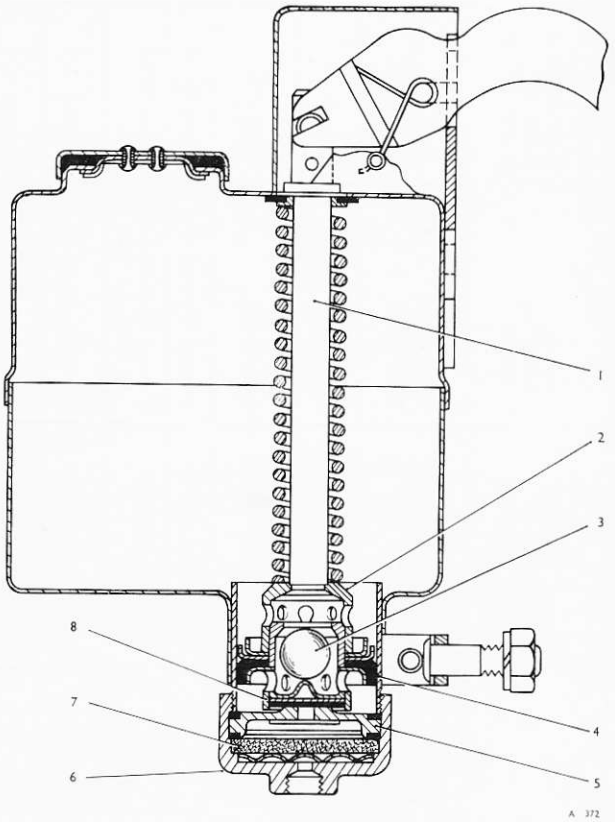


Fig. D6 Exploded view of pump

1. PISTON ROD
2. PISTON ROD VALVE NUT
3. PISTON VALVE BALL
4. PISTON CUP
5. STRAINER PLATE
6. CYLINDER CAP NUT
7. FELT STRAINER
8. PISTON VALVE DISC

SECTION D7 — APPROVED LUBRICANTS FOR S1 AND S2 CARS

	B.P.	CASTROL	SHELL	MOBIL	ESSO
Engine Winter Summer Multi-grade	Energol SAE 20W Energol SAE 30 Energol Viscostatic (10W/30)	Castrolite Castrol XL Castrolite	X-100 20/20W X-100 30 X-100 10W/30	Mobiloil Arctic Mobiloil A Mobiloil Special (10W/30)	Esso Extra Motor Oil 20W/30
Carburetter air valve damper hand oiling points Contact breaker pivots (S1 and S2 cars) Contact breaker cam (S1 cars only)	Energol SAE 20/W	Castrolite	X-100 20/20W	Mobiloil Arctic	Esso Extra Motor Oil 20W/30
Contact breaker cam (S2 cars)	Energrease L2	Castrolease LM	Retinax 'A'	Mobilgrease MP	Esso Multi-purpose Grease H
Automatic gearbox† Shock dampers† Steering pump P.A.S.†	Energol ATF Type A	Castrol TQ	Donax T6	Mobilfluid 200	Esso Automatic Transmission Fluid 55
Synchromesh gearbox	Energol SAE 80 EP	Castrol Hypoy Light	Spirax 80 EP	Mobilube GX 80	Esso Gear Oil GP 80
Rear axle Steering transfer box (S2 cars only)	Energol SAE 90 EP	Castrol Hi-press S/C* or Castrol Hypoy	Spirax 90 EP	Mobilube GX 90	Esso Gear Oil GP 90
Propeller shaft centre bearing Waterpump (S1 refrigerated cars only)	Energrease L2	Castrolease LM	Retinax 'A'*	Mobilgrease MP	Esso Multi-purpose Grease H
Front hubs Rear hubs	Energrease L2	Castrolease LM	Retinax 'A'*	Mobilgrease MP	Esso Multi-purpose Grease H
Propeller shaft sliding and rear universal joints	Energrease L2	Castrolease LM	Retinax 'A'*	Mobilgrease MP	Esso Multi-purpose Grease H
Propeller shaft front ball and trunnion joint	—	—	—	Mobilgrease No. 2	—
Steering box (manual) Starter motor gears (S1 cars only)	Energol SAE 30	Castrol XL	X-100 30	Mobiloil A	Esso Extra Motor Oil 20W/30
Chassis oil pump (S1 cars only)	Energol SAE 90 EP	Castrol Hi-press S/C	Spirax 90 EP	Mobilube GX 90	Esso Gear Oil GP 90
Distributor lubricator (S1 cars only)	Energrease L2	Castrolease LM	Retinax 'A'*	Mobilgrease MP	Esso Multi-purpose Grease H
Distributor lubricator (S2 cars)	Energol SAE 20	Castrolite	X-100 20/20W	Mobiloil Arctic	Esso Extra Motor Oil 20W/30
Master cylinder reservoir(s)	Castrol — Girling Brake Fluid (6293) — Crimson				
Master cylinder balance lever (S2 cars)	Energrease L2	Castrolease LM	Retinax 'A'*	Mobilgrease MP	Esso Multi-purpose Grease H
Steering joints and suspension pivots	Rocol Moly Spring Grease 204 G or Shell Grease S5466				
Refrigeration compressor (Tecumseh or Lehigh)	—	Icematic Heavy	Shell Clavus 33	Gargoyle Arctic 155	—
Refrigeration compressor (York A209)	Regent Texaco Capella E				

* First approval.

† Also approved is: General Motors — Hydramatic Fluid Type AQ ATF.

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CHAPTER D

LUBRICATION AND MAINTENANCE

SECTION D1 — MAINTENANCE DATA

SILVER CLOUD III, BENTLEY S3, BENTLEY CONTINENTAL S3 AND PHANTOM V

Engine

Silver Cloud III, Bentley S3 and

Continental S3

Distributor contact breaker gap	0·014 in. — 0·016 in.
Distributor 'dwell' angle	31° to 37° at 0·015 in. gap
Sparking plugs	
9 : 1 compression ratio	Champion RN.8.
8 : 1 compression ratio	Champion RN.8, Champion RN.13P, Lodge CLNP.
Sparking plug gap	0·025 in.
Firing order	A1, B1, A4, B4, B2, A3, B3, A2.
	(1, 5, 4, 8, 6, 3, 7, 2.)
Ignition timing	2° B.T.D.C.
Valve timing	5° A.T.D.C.

Engine

Phantom V

Distributor contact breaker gap	0·019 in. — 0·021 in.
Distributor 'dwell' angle	31° to 32½° at 0·020 in. gap
Sparking plugs	
9 : 1 compression ratio	Champion RN.8.
8 : 1 compression ratio	Champion RN.8, Champion RN.13P, Lodge CLNP.
Sparking plug gap	0·025 in.
Firing order	A1, B1, A4, B4, B2, A3, B3, A2.
	(1, 5, 4, 8, 6, 3, 7, 2.)
Ignition timing	2° B.T.D.C.
Valve timing	5° A.T.D.C.

Capacities

	Imperial	U.S.	Litres
Engine	12 pints	14·4 pints	6·81
Automatic gearbox	20 pints	24 pints	11·36
Rear axle — Silver Cloud III, Bentley S3, Continental S3	1⅞ pints	1·95 pints	0·92
Rear axle — Phantom V	1¼ pints	2·1 pints	0·99
Steering system	3 pints	3·6 pints	1·7
Steering (transfer box)	⅝ pints	0·75 pints	0·355
Cooling system	22 pints	26·41 pints	12·5
Fuel tank — Silver Cloud III, Bentley S3, Continental S3	18 galls.	21·6 galls.	81·82
Fuel tank — Phantom V	23 galls.	27·62 galls.	104·56

Levels

Engine sump	Maximum mark on dipstick
Automatic gearbox	F line on dipstick
Rear axle	Bottom of level plug orifice
Steering system	Just covering the filter
Steering (transfer box)	Bottom of level plug orifice
Shock dampers	Bottom threads of filler plug orifice
Hydraulic brake fluid reservoirs	Level marks on clamping straps
Coolant level	Bottom of radiator filler orifice
Battery electrolyte	⅜ in. above the top of separators
Windscreen washer reservoir	1 in. below the top of filler orifice

Tyre pressures

Silver Cloud III and Bentley S3 — 8·20 in. × 15 in. tyres		
	Front 22 lb/sq in. (1·55 kg/sq.cm.)	Cold
	Rear 27 lb/sq in. (1·90 kg/sq.cm.)	
Silver Cloud III and Bentley S3 Long Wheelbase — 8·20 in. × 15. in. tyres		
	Front 23 lb/sq.in. (1·62 kg/sq.cm.)	Cold
	Rear 29 lb/sq.in. (2·04 kg/sq.cm.)	
Bentley Continental S3 — 8·00 in. × 15 in. tyres	Front 20 lb/sq.in. (1·41 kg/sq.cm.)	Cold for normal
	Rear 25 lb/sq.in. (1·76 kg/sq.cm.)	speed running.
	Front 25 lb/sq.in. (1·76 kg/sq.cm.)	Cold for maximum
	Rear 30 lb/sq.in. (2·11 kg/sq.cm.)	speed running.
Park Ward Convertible Coupe — 8·00 in. × 15 in. tyres		
	Front 20 lb/sq.in. (1·41 kg/sq.cm.)	Cold for normal
	Rear 28 lb/sq.in. (1·97 kg/sq.cm.)	speed running.
	Front 25 lb/sq.in. (1·76 kg/sq.cm.)	Cold for maximum
	Rear 33 lb/sq.in. (2·33 kg/sq.cm.)	speed running.
Phantom V — 8·90 in. × 15 in. tyres	Front 22 lb/sq.in. (1·55 kg/sq.cm.)	Cold
	Rear 27 lb/sq.in. (1·90 kg/sq.cm.)	

Note The tyre pressures quoted for Phantom V cars are nominal figures only, as the pressures may vary between individual cars according to the weight.

Electrical equipment

Battery	Dagenite or Exide 12v. 67 amp/hr.
Earth	Negative to frame
Generator	Lucas C48 12v.
Starter motor	Lucas M-45 G 12v.
Horns	Lucas WT 618/1
Headlamps	Twin sealed-beam type

Headlamp type and ratings

	Type	Rating	Colour	Fitting
U.K.	1A	12v 37½w	Clear	Push-in two blade
	2A	12v 37½/50w	Clear	Push-in three blade
Europe, except France	1A	12v 37½w	Clear	Push-in two blade
	European	12v 45/40w	Clear	Push-in three blade
France	1A	12v 37½w	Yellow	Push-in two blade
	2A	12v 45/40w	Yellow	Push-in three blade
Middle and Far East, Canada, South and America U.S.A.	1A	12v 37½w	Clear	Push-in two blade
	2 or 2A	12v 37½/50w	Clear	Push-in three blade

Bulbs

Foglamps			
All countries except U.S.A. and Canada	12v 48w	Yellow	B.P.F.
U.S.A. and Canada	12v 48w	Clear	B.P.F.
Front side lamp	12v 6w	Clear	M.C.C. bayonet
Front flasher lamp	12v 21w	Clear	S.C.C. bayonet
Rear stop/tail lamp	12v 21/6w	Clear	S.B.C. bayonet
Rear flasher lamp	12v 21w	Clear	S.C.C. bayonet
Reversing lamp	12v 21w	Clear	S.C.C. bayonet
Number plate lamp	12v 6w	Clear	M.C.C. bayonet
Boot lamp	12v 6w	Clear	M.C.C. bayonet
Inspection lamp	12v 6w	Clear	M.C.C. bayonet
Companion lamp	12v 6w	Clear	M.C.C. bayonet
Map lamp	12v 6w	Clear	M.C.C. bayonet
Roof lamp	12v 6w	Clear	Double-ended festoon
Capping rail lamp	12v 3w	Clear	Double-ended festoon
Speedometer			
Illumination	12v 2·2w	Clear	M.E.S. screw
Flasher warning lamps	12v 2·2w	Clear	M.E.S. screw
Headlamp main beam	12v 2·2w	Clear	M.E.S. screw
'4' in '1' instrument lamp	12v 2·2w	Clear	M.E.S. screw
Clock illumination	12v 2·2w	Clear	M.E.S. screw
Hand brake warning lamp	12v 2·2w	Clear	M.E.S. screw
Switchbox			
Generator warning lamp	16v 3w	Clear	M.E.S. screw
Fuel level warning lamp	16v 3w	Clear	M.E.S. screw

Fuses

	30 amp. (one strand of No. 28 SWG (0·0148 in. dia.) tinned copper wire).
Horn fuse	25 amp. cartridge type
Headlamp flasher relay	25 amp. cartridge type
Radio fuse	5 amp. cartridge type

PERIODIC LUBRICATION AND MAINTENANCE

SCHEDULES FOR

SILVER CLOUD III, BENTLEY S3, BENTLEY CONTINENTAL S3 AND PHANTOM V

The following periodic service schedules have been drawn up to assist retailers and service personnel with the maintenance of Rolls-Royce and Bentley motor cars.

Retailers are advised to adopt these schedules as normal service procedure and to make appropriate arrangements with any owners wishing to avail themselves of this service.

Should some owners wish to carry out their own maintenance inspections, it should be noted that the schedules do not in any way supersede the instructions given in the Owner's Handbook.

INITIAL 3,000 MILE SCHEDULE

At the completion of the first 3000 miles (5000 Kms.) Engine oil change. Oil level checks, engine and chassis adjustments, electrical system checks and road test.

6000 MILE SCHEDULE

At the completion of every 6000 miles (10,000 Kms.).

Repetition of the 3000 mile schedule plus — Engine oil change — engine oil filter change — brake system check — minor engine, chassis and electrical system checks and lubrication.

12,000 MILE SCHEDULE

At the completion of every 12,000 miles (20,000 Kms.).

Repetition of the 6000 mile schedule plus — Complete lubrication of suspension, steering and transmission — further maintenance of engine, chassis and electrical system components.

24,000 MILE SCHEDULE

At the completion of every 24,000 miles (40,000 Kms.).

Repetition of the 12,000 mile schedule plus — change of major components — maintenance of power assisted steering unit.

INITIAL 3000 MILE (5000KM.) SCHEDULE

Oil changes

1 Drain and refill the crankcase sump. For subsequent oil changes refer to the 6000 mile schedule.

Oil level checks and lubrication

1 Carburetter air valve damper.
2 Steering pump reservoir.
3 Brake fluid reservoirs.
4 Automatic gearbox. (Check with the engine running as described in the Automatic Gearbox Manual.)
5 Lubricate the eight grease nipples on the front suspension.

Engine and chassis adjustments

1 Check the coolant level and if necessary top-up with the correct anti-freeze mixture. Tighten the worm drive clips securing all coolant hoses.
2 Check the tension of the belts driving the fan, steering pump, generator and refrigerant compressor (if fitted) and adjust if necessary. If individual belt tension is uneven a new matched pair of belts should be fitted.
3 Check and if necessary adjust the rear brakes and servo.
4 Check and adjust tyre pressures (including spare).

Electrical system checks

1 Check the level of the battery electrolyte and top-up if necessary.
2 Check, and if necessary top-up the windscreen washer reservoir with the correct mixture of distilled water and Rolls-Royce windscreen washer fluid.

Road test

1 Test the car on the road and adjust the T.V. rod ('A' rod) if necessary.

6000 MILE (10,000 KM.) SCHEDULE

1 Repeat the 3000 mile schedule.

Oil changes

1 Drain and refill the crankcase.
If the car is used regularly for town work and is subjected to a considerable amount of 'stop-start' operation, the engine crankcase should be drained and refilled every 3000 miles (5000 Kms.).

Engine adjustments and checks

1 Renew the oil filter element.
2 Clean the air valves in the carburetters.
Check the oil level in the air valve dampers and top-up if necessary to the correct level.
3 Lubricate the ignition distributor automatic advance mechanism, shaft bearings, governor spindle and cam.
4 Clean the contact breaker points, check the gap and apply one drop of engine oil to the pivot pin of each rocker arm.
Check and if necessary, reset the ignition timing.
5 Clean spark plugs and set gaps as necessary.
6 Remove, clean and re-oil the wire mesh air filter element.

Chassis adjustments and checks

1 Remove any foreign matter from the refrigerator condenser matrix (if fitted).
2 Lubricate the gear range selector controls and accelerator linkage.
3 Lubricate the brake system pivot pins and bearings.
4 Remove the brake drums and inspect the brake linings for wear. The face of a lining should not be less than $\frac{1}{16}$ in. above the rivets.
5 Interchange the wheels to minimise variations in tyre wear.
6 Check and if necessary balance the wheels.

Electrical system

1 Check that the heater controls are operating satisfactorily.
2 Check that all lights, flasher units and instruments are operating satisfactorily.

12,000 MILE (20,000 KM.) SCHEDULE

1 Repeat the 6000 mile schedule.

Oil level checks

1 Check the shock absorbers for signs of leakage; if apparent, inspect the oil level and top-up if necessary with the recommended oil.
2 Check and if necessary, top-up the rear axle with oil.

Engine adjustments and checks

1 Renew the sparking plugs.
2 Renew the carburetter air filter element — this only applies where the paper type air filter element is fitted (certain overseas countries only).
3 Clean the gauze filters and the carburetter float chamber feed connections.

Chassis adjustments and checks

1 Lubricate the grease nipple on the master cylinder balance lever.
2 Lubricate the thirteen grease nipples on the steering mechanism.
3 Lubricate the eight grease nipples on the front suspension.
4 Lubricate the three grease nipples on the rear propeller shaft.
5 Clean out the main fuel line filter and filter bowl and the filter gauzes in the fuel pump. Clean the electrical contact points and check the functioning of the fuel pumps. (Each pump should be tested independently.)

Electrical system checks

1 Clean, apply vaseline and tighten the battery terminals.

Heater (recirculatory)

1 Clean the filter gauze in the intake beneath the right-hand front seat. Test the car on the road.

24,000 MILE (40,000 KM.) SCHEDULE

1 Repeat the 12,000 mile schedule.

Oil changes

1 Drain the gearbox and fluid coupling; refill with the recommended fluid.
2 Drain and refill the rear axle.

Oil level checks

1 Check the oil level in the transfer steering box and top-up if necessary.

Engine adjustments and checks

1 Clean the flame traps in the crankcase breather tube.

Chassis adjustments and checks

1 Renew the filter element in the steering pump reservoir.
2 Release, but do not remove the fuel tank drain plug to allow any accumulated water to escape.

Electrical system checks

1 Inspect the generator commutator and brushes for wear and for freedom in their holders.

SEASONAL SCHEDULES

Every 12 months

Engine cooling system

1 Drain the anti-freeze from the radiator and both cylinder blocks. Thoroughly flush out the coolant passages with a continuous flow of water. This should be carried out just prior to the Autumn. (In the U.K. prior to September 21st.)

Refill the system with the correct anti-freeze mixture.

Refrigeration system (if fitted)

These operations should only be carried out by an experienced refrigeration engineer.

Check that the refrigeration system is functioning correctly and if necessary top-up the system with refrigerant. If loss of refrigerant is evident, check the system for leaks.

Check the level of oil in the refrigerant compressor.

Clean the filter gauze fitted over the evaporator air intake (boot units only).

Every 24 months

Repetition of 12 months schedule plus —

Renewal of heater and coolant hoses.

SPECIAL PRECAUTIONS

Should the car be used in constant temperatures of 0°F. and below

Carburetters

Drain and refill the carburetter air valve dampers with oil of viscosity S.A.E. 10.

Engine

Drain the engine sump when thoroughly warm and refill with oil of viscosity S.A.E. 10.

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CHAPTER E

ENGINE

ENGINE DATA CHART—S1 CARS

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSIONS	REMARKS
Cylinders and Pistons			
Cylinder liners	Yellow liner 3·87585 in.–3·879 in. fits crankcase bore of 3·8755 in.–3·8760 in. Blue liner 3·878 in.–3·8785 in. fits crankcase bore of 3·875 in.–3·8755 in.	—	Interference of 0·0025 in.–0·0035 in. in crankcase obtained by colour selection
Cylinder bore (standard)	3·750 in.–3·7515 in.	0·004 in. wear or 0·003 in. ovality requires re-bore	3·790 in. maximum re-bore size
Piston grading F G H J	Piston diameter (standard) 3·7485 in.–3·7488 in. 3·7489 in.–3·7492 in. 3·7493 in.–3·7496 in. 3·7497 in.–3·750 in.	—	Piston clearance in the bore 0·0012 in.–0·0015 in. measured at top of skirt at 90 deg. to the gudgeon pin
Compression rings — end gap measured in position	0·015 in.–0·019 in.	0·025 in.	Must be assembled with gaps staggered
Compression rings — clearance of rings in grooves	0·002 in.–0·0035 in.	0·005 in.	—
Gudgeon pin diameter	0·7499 in.–0·7501 in.	—	—
Gudgeon pin interference in piston bosses	0·0002 in.	—	At room temperature 68–72°F
Gudgeon pin in connecting rod bush — running clearance	0·0001 in.–0·0003 in.	0·0005 in.	—
Connecting Rod and Crankshaft Bearings			
Connecting rod — small-end bush interference	0·0025 in.–0·004 in.	—	—
Connecting rod end float	0·007 in.–0·022 in.	—	Controlled by clearance between rod and piston bosses
Connecting rod and cap diameter of bolt hole	0·375 in.–0·3755 in.	0·3765	—
Connecting rod bolt diameter	0·3745 in.–0·375 in.	0·3735	0·002 in. and 0·004 in. oversize bolts available
Relation of connecting rod bolt split pin hole to tang on head	90 deg.	—	Any variation is a measure of bolt twist
Connecting rod bore for bearing shell	2·142 in.–2·2425 in.	—	—

ENGINE DATA CHART — S1 CARS — *continued*

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSIONS	REMARKS
Connecting Rod and Crankshaft Bearings — *continued*			
Connecting rod nip on bearing	0·004 in.–0 006 in.	—	—
Connecting rod — big-end clearance	0·0012 in.–0·002 in.	0·003 in.	Clearances measured vertically. Renew bearing if lead plating is worn through
Crankpin diameter	1·9985 in.–1·999 in.	1·9975 in.	—
Crankshaft journal diameter	2·7495 in.–2·750 in.	2·7485 in.	—
Crankshaft main bearings — running clearance	0·0012 in.–0·002 in.	0·0045 in.	Renew bearing if lead plating is worn through
Crankshaft end float	0·002 in.–0·006 in.	0·008 in.	—
Flywheel			
Starter motor pinion — flywheel face clearance	0·175 in.–0·200 in.	—	—
Backlash of starter pinion teeth on flywheel	0·015 in.–0·025 in.	0·030 in.	—
Damper and Spring Drive			
Crankshaft damper radial driving spring	Free length 0·800 in. (approx.) Load when compressed to 0·640 in. 32–35 lb.	—	—
Outer springs	Load when compressed to 0·525 in. 55–61 lb.	—	—
Inner springs	Free length: 0·725 in. (approx.) Load when compressed to 0·525 in. 10 lb. ± 6 oz.	—	—
Crankshaft damper	Steady slip poundage 14–15 lb. at 17·50 in. radius	—	—
Presser plate thickness	0·160 in.–0·175 in.	0·150 in.	—
Back drum depth — lip to friction face	0·422 in.–0·425 in.	0·475 in.	Total reduction in assembly dimensions must not exceed 0·060 in.
Friction plate thickness	0·128 in.–0·132 in.	0·105 in.	
Valve Gear			
Camshaft gear backlash	0·002 in.–0·004 in.	0·006 in.	—
True running of camshaft gear face	0·000 in.–0·002 in.	—	—
Camshaft end float	0·002 in.–0·006 in.	—	—
Thickness of camshaft thrust button flange	0·146 in.–0·148 in.	0·140 in.	—
Camshaft journal diameter	1·9975 in.–1·998 in.	1·9965 in.	—
Camshaft bearing internal diameter	2·000 in.–2·0005 in.	2·005 in.	—
Camshaft journal clearance	0·002 in.–0·003 in.	0·004 in.	—

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ENGINE DATA CHART — S1 CARS — *continued*

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSIONS	REMARKS
Valve Gear — *continued*			
Camshaft bearing external diameter	2·1315 in.	—	—
Camshaft bearing interference in crankcase	0·003 in.	—	—
Inlet cam and base circle diameter — overall dimension	1·517 in.	1·497 in.	Cam lift is 0·317 in. Minimum permissible lift is 0·297 in.
Exhaust cam and base circle diameter — overall dimension	1·575 in.	1·555 in.	Cam lift is 0·375 in. Minimum permissible lift is 0·355 in.
Inlet and exhaust valve tappet clearance in crankcase	0·0005 in.–0·001 in.	0·0025 in.	—
Valve tappets colour code	Diameter		
Blue	1·8675 in.–1·870 in.	—	—
Green	1·870 in.–1·8725 in.		
Yellow	1·8725 in.–1·875 in.		
Black	1·875 in.–1·8775 in.		
Black and yellow	1·8775 in.–1·880 in.		
Green and yellow	1·880 in.–1·8825 in.		
Exhaust valve guide external diameter	0·6270 in.–0·6275 in.	—	—
Interference in crankcase	0·0035 in.	—	—
Exhaust valve guide internal diameter	0·3755 in.–0·376 in.	0·378 in.	'Bellmouth' at the upper end is permissible up to 0·006 in. for a depth of 0·375 in.
Exhaust valve stem diameter	0·37175 in.–0·372 in.	0·3705 in.	—
Exhaust valve stem clearance	0·0035 in.–0·00425 in.	0·0075 in.	—
Exhaust valve head side movement	—	0·0113 in.	Measured with valve open 0·375 in.
Exhaust valve spring compressed to 1·170 in.	111–118 lb.	85 lb.	Valve open
Exhaust and inlet valve seat angle	45 deg.	—	'Crown' with 30 deg. cutter to avoid pocketing after re-grinding seat
Exhaust valve seat insert outside diameter	1·8150 in.–1·8155 in.	—	0·005 in.–0·007 in. interference. 0·010 in. oversize seats available
Inlet valve seat insert diameter	1·750 in.–1·760 in.	—	Seat screwed into head 0·002 in. interference
Inlet guide interference in head	0·001 in.–0·0015 in.	—	—
Inlet valve guide internal diameter	0·3437 in.–0·3442 in.	0·3455 in.	—
Inlet valve stem diameter	0·3417 in.–0·3422 in.	0·3405 in.	—
Inlet valve stem clearance	0·0015 in.–0·0025 in.	0·0052 in.	—
Inlet valve head side movement	—	0·0084 in.	Measured with valve open 0·317 in.

ENGINE DATA CHART — SI CARS — *continued*

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSIONS	REMARKS
Valve Gear — *continued*			
Inlet valve outer spring compressed to 1·600 in.	41·8–48·8 lb.	35 lb.	Valve closed
Inlet valve inner spring compressed to 1·300 in.	13–17 lb.	10 lb.	Valve closed
Rocker arm bush internal diameter	0·7495 in.–0·74975 in.	0·751 in.	—
Rocker shaft diameter	0·74825 in.–0·7485 in.	—	—
Rocker shaft clearance	0·001 in.–0·0015 in.	0·0035 in.	—
Oil Pump			
Shaft diameter	0·498 in.–0·499 in.	0·496 in.	—
Shaft clearance in bushes	0·001 in.–0·0025 in.	0·0055 in.	—
Bush internal diameter	0·500 in.–0·5005 in.	0·5015 in.	—
Bush interference in case	0·0005 in.–0·0015 in.	—	—
Stationary spindle	0·4985 in.–0·499 in.	0·496 in.	—
Stationary spindle clearance	0·0005 in.–0·0015 in.	0·004 in.	Permissible only when radial clearance of gears in case exceeds this figure
Diametrical clearance between gears and side of chamber	0·0005 in.–0·002 in.	0·006 in.	—
Pump gears — backlash	0·002 in.–0·006 in.	0·010 in.	—
Pump gears — end float	0·001 in.–0·003 in.	0·004 in.	—
Drive gear — backlash	0·002 in.–0·008 in.	0·020 in.	—

Oil Pump Test Rig Performance PUMP R.P.M.	OIL PRESSURE RESTRICTED TO	MINIMUM FLOW (pints per minute)	OIL TEMPERATURE (INLET)
500	8 lb/sq. in.	11·2	90°C 294°F
1000	18 lb/sq. in.	26·4	
1500	28 lb/sq. in.	42·6	
Engine oil pressure — normal running	High pressure system: 25 lb/sq. in. (approx.) Low pressure system: 5 lb/sq. in. (approx.)	—	—

Oil Relief Valves			
H.P. valve spring	Free length: 1·8125 in. Load when compressed to 1 in.: 4½ lb.	—	—
L.P. valve spring	Free length: 1·750 in. Load when compressed to 0·900 in.: 4 oz.	—	—

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SECTION E1 — ENGINE

Description

The six cylinder in-line engine is mounted with the gearbox as one unit on rubber three-point suspension which provides insulation and controlled flexibility. An iron monobloc casting of crankcase and cylinders incorporates full-length dry liners of high chrome steel, with a six-port head and a sump of aluminium.

The crankshaft is a chrome molybdenum steel forging, nitride hardened, and dynamically balanced. It is carried in seven main bearings of the split steel-backed shell type lined with copper–lead–indium. End thrust is taken by the centre main bearing which is fitted with split thrust pads front and rear. Detachable caps are fitted to the hollow crankshaft journals for cleaning purposes. A combined spring drive and damper is fitted, which utilises frictional, spring and inertia loadings to smooth crankshaft vibration and camshaft drive.

The fully machined connecting rods are of forged chrome molybdenum steel, with gudgeon pin bushes of phosphor bronze. The rods are drilled to permit high pressure lubrication of the gudgeon pins, and a small cross-drilling in the rod provides positive additional lubrication of the cylinder wall and piston thrust face. The big-end bearings are of similar materials to the main bearings.

Aluminium split skirt pistons with four rings are carried on gudgeon pins located by circlips in the pistons. The top ring is chromium plated, the two intermediate rings are of taper section, and the fourth is a Duaflex oil control ring.

The overhead inlet valves are operated by the camshaft through the medium of push rods and chilled iron tappets, whilst the side exhaust valves are operated through tappets only. The inlet valves are carried in cast-iron guides and the exhaust valves in bronze guides.

The camshaft is of forged hardened nickel steel and is carried in four 'Babbitt' lined steel shell bearings. Longitudinal motion of the shaft is controlled by a spring-loaded thrust pad which is fitted to the front end of the camshaft. A helical gear on the centre of the camshaft drives both the oil pump, which is of the spur gear type, and the ignition distributor.

Engine — to remove as a unit with the gearbox

The engine and gearbox should be removed from the chassis frame as a unit, adopting the following procedure.

Disconnect the negative lead from the battery.

Remove the bonnet, windscreen washer reservoir, air cleaner assembly and oil level dipstick.

Drain the coolant and disconnect the hoses, including the heater and de-mister return hoses at the radiator, also the feeds to the vacuum-operated water valves on each side of the engine.

Remove the fan blade assembly, re-fitting the setscrews to retain the pulley in position.

Remove the baffle plate from beneath the radiator shell, after which the front apron and the radiator shell may be removed as an assembly.

Unbolt the matrix from the valances and tubular strays and lift out the matrix.

Disconnect the horns.

Remove the matrix stay and support assembly complete with the horns and the 'Silentbloc' bushed mount.

Disconnect the exhaust manifolds at the down pipes. Remove the tubular stay between the downtake pipe breeches piece and the crankcase lug.

Disconnect the starter cable, between the solenoid and the starter motor, at the starter motor terminal.

Disconnect the long throttle rod between the accelerator and the lever on the bracket attached to the generator end plate.

Disconnect the flexible fuel pipe from the carburetter at the union nut on the adapter which is attached to the frame immediately ahead of the bulkhead.

The electrical wiring is carried in a loom which is clipped to the induction manifold. Disconnect the wires at the following points on the engine:

Temperature indicator transmitter in the thermostat housing.

Generator terminals.

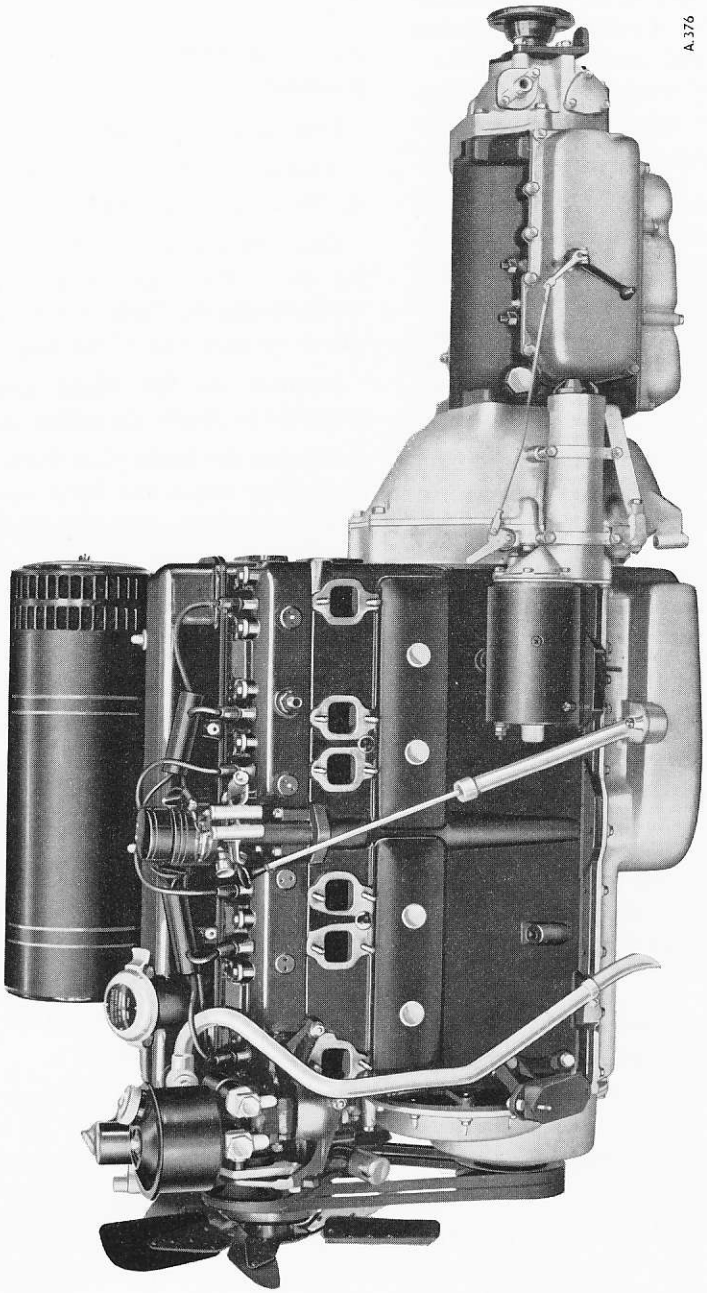


Fig. E1 Engine and gearbox

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Automatic choke solenoid.

Oil pressure operated choke switch, in the oil filter adapter.

Oil level gauge unit in the sump.

Oil pressure switch, adjacent to the cylinder block drain tap.

For convenient identification, the cables may be labelled as they are disconnected.

Disconnect the cable running along the left-hand valance to the positive side of the ignition coil.

Disconnect the two tubes from the vacuum lines fitted in the induction manifold.

Disconnect the gear range lever from the gear range cross shaft, then remove the cross shaft (R.H. cars only) below the flywheel housing.

Disconnect the speedometer cable from the gearbox.

Disconnect and remove the servo, as a precaution against possible damage.

Remove the four bolts and nuts which couple the front universal joint to the gearbox output flange, and break the connection.

Sling the engine at points between the 5th and 6th exhaust ports.

Remove the four $\frac{3}{8}$ in. (0·375 in.) nuts and bolts (2 each side) from the engine front supports, leaving the mounts attached to the frame.

Remove the single setscrew securing the gearbox rear mounting to the transverse chassis member.

Carefully check that all hoses, pipes and cables are disconnected and that nothing impedes the removal of the engine.

Lift the engine and gearbox out of the frame.

Engine and Gearbox — to fit

Before installing the engine, the rear engine mounting should be checked to ensure that the lower rebound rubber is not held tight, but has a 0·006 in. vertical clearance when the mounting assembly is tightened in position, with the engine load on. If there is insufficient clearance, a steel washer (0·030 in. thick) should be fitted between the lower steel washer of the assembly and the distance tube, taking care to ensure the washer seats directly on the base of the distance tube and does not foul the inside of the hole in the rebound rubber. Alternatively a distance tube (0·030 in. longer) can be used.

To install the engine, reverse the procedure given for removal, noting the following points.

Renew all exhaust gaskets.

All hoses showing signs of deterioration should be renewed.

Before starting the engine ensure that the sump is filled with oil.

Ensure that the cooling system is replenished.

Finally, connect the battery leads.

SECTION E2 — LUBRICATION

Description

Pressure lubrication is employed throughout, the oil being delivered from a spur gear type pump, driven at camshaft speed, direct from the camshaft.

The oil enters the suction side of the pump through a fine mesh strainer floating just below the surface of the oil level; this ensures the collection of clean oil. The discharge side of the pump is connected by a passage in the crankcase to the Full-Flow oil filter. The pressure is controlled by an externally fitted dual relief valve unit (see Fig. E5).

The relief valves are connected in series and no means of adjustment is provided. On no account must the springs be altered or the plug washers varied. A slot is provided in the high pressure valve seat to ensure a supply of oil to the low pressure system under all running conditions.

The oil discharge from the Full-Flow filter enters the internal oil gallery in the right-hand side of the crankcase, at approximately 25–30 lb/sq.in.

From the main oil gallery the oil is fed to the crankshaft main journals, via a drilling in the upper bearings shells. The connecting rod big-end bearings are lubricated through drillings in the crankshaft webs and journal pins.

Drillings along the length of each connecting rod also feed oil to the gudgeon pin bushes. Small cross-drillings in the connecting rods direct jets of oil onto the thrust sides of the cylinder walls.

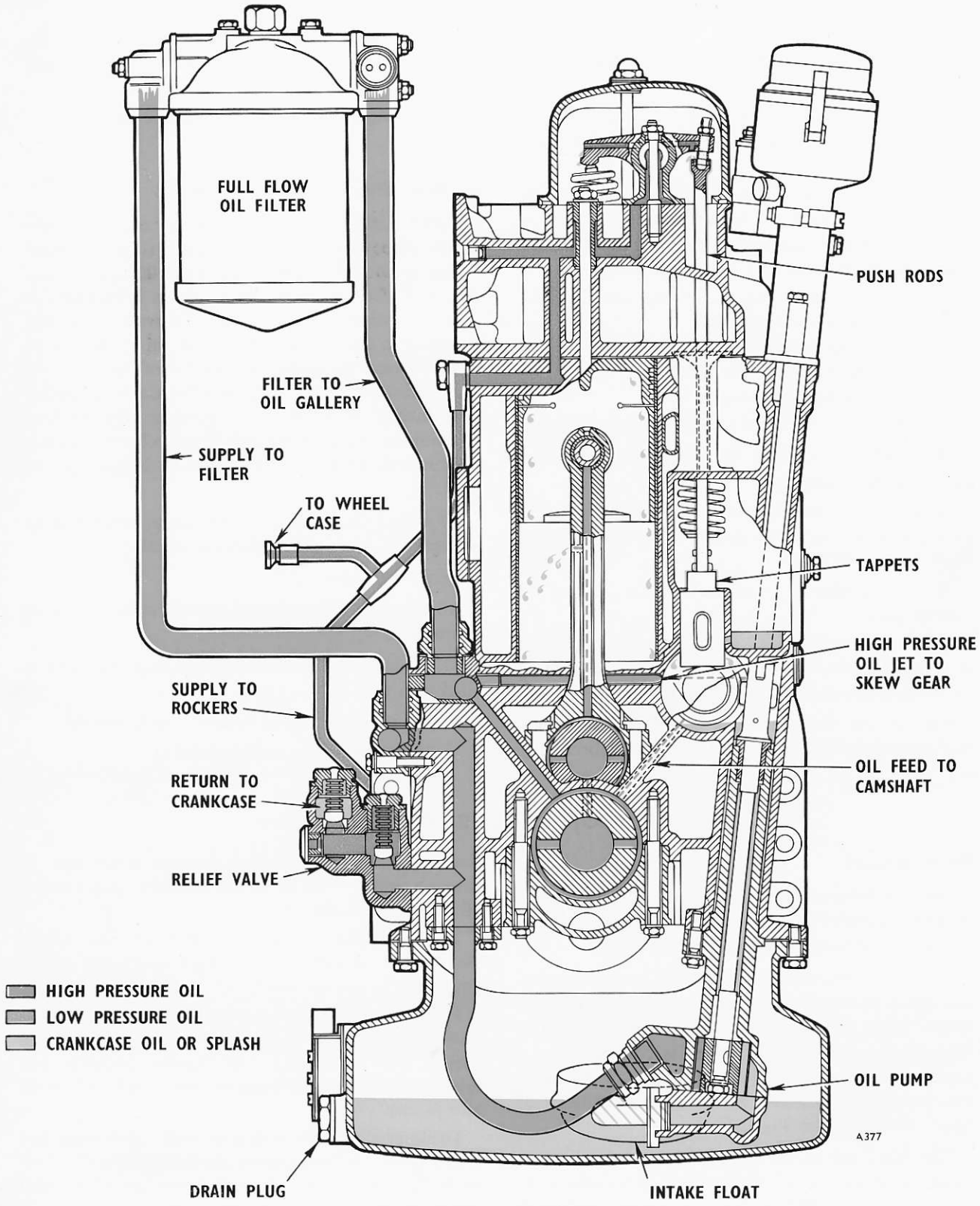


Fig. E2 Engine lubrication system

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The camshaft bearings are supplied with oil at high pressure through integrally cast passages in the crankcase webs from Nos. 1, 3, 5 and 7 main bearings. The camshaft skew gear is lubricated by a high pressure jet from the oil gallery.

Low pressure oil, at approximately 5 lb/sq.in., is fed to the overhead valve mechanism and after circulation it drains through the push rod tunnels in the cylinder head and through the exhaust valve chamber, lubricating the tappets, cam lobes and exhaust valve stems, then back to the sump.

A separate pipe conveys oil to a jet in the timing cover to lubricate the timing gears.

Oil pressure is registered on an electrically operated indicator on the facia panel, the indicator is connected to and operated by a bimetal transmitter screwed into the main oil gallery. Being a sealed unit, this transmitter cannot be repaired or adjusted, and whenever suspect, it must be replaced with a new one.

The 'British' Full-Flow oil filter, Type LF.2R, has a spring-loaded ball relief valve incorporated in the head. Should the filter element become clogged and cause a restriction of the oil flow through the element, the relief valve opens when the back pressure caused by the restriction reaches approximately 6 lb/sq.in. and allows the oil to by-pass the filter (see Fig. E3).

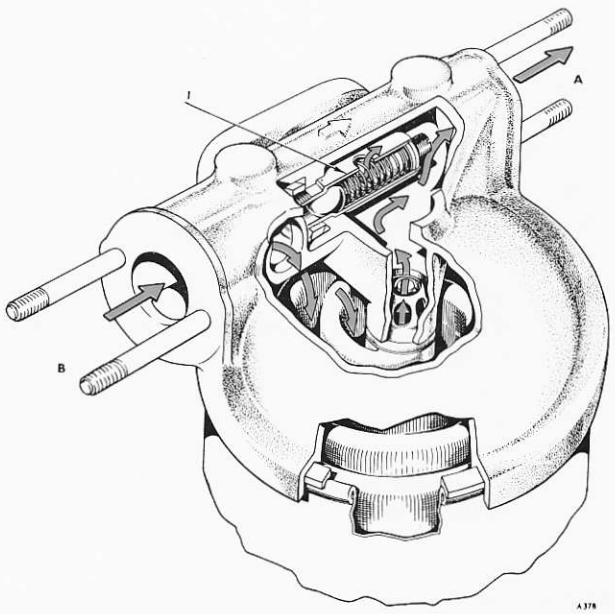


Fig. E3 Filter by-pass

1. BY-PASS VALVE
A. TO ENGINE B. FROM OIL PUMP

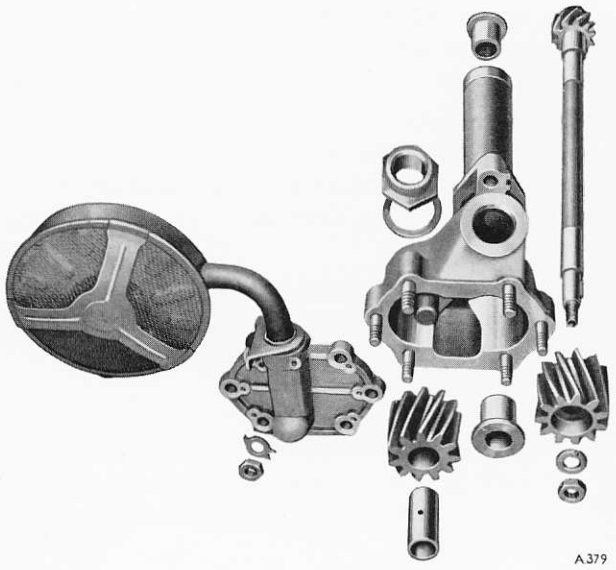


Fig. E4 Oil pump — exploded view

Oil Pump — to remove

Before removing the pump it is necessary to remove the distributor assembly in the following manner.

Remove the distributor cap and rotate the crankshaft until No. 1 piston is at T.D.C. and the rotor arm points towards No. 1 segment in the distributor head. Remove the two $\frac{1}{4}$ in. nuts securing the distributor housing to the cylinder block and lift the distributor assembly off the studs. Note and mark the position of the drive shaft tongue before withdrawing the shaft.

Remove the oil dipstick and guide tube from the sump and disconnect the wire from the oil gauge.

Drain the oil and remove the sump. Disconnect and remove the delivery pipe between the pump and crankcase. Remove the pump assembly with the suction line and gauze float attached.

The oil pump is enclosed within the sump and is secured to the lower face of the crankcase by a single nut and stud.

Oil Pump — to dismantle

Remove the pump end cover, then withdraw the driven gear and bronze bush.

Remove the retaining nut which secures the pump driving gear to the driving shaft. The driving gear is keyed to the shaft and requires a light tap to dislodge it from the shaft.

The shaft may then be withdrawn from the pump casing without disturbing the key. The retaining nut is locked to the driving shaft by three centre punch indentations.

All parts must be cleaned and carefully checked for wear. Refer to the Engine Data Chart for new and worn tolerances.

Oil Pump — to assemble

The driven gear bush is drilled with four oil holes. It is a floating fit in the gear bore, and no fitting is necessary. The shaft is retained in the casing by means of a taper pin.

The end cover should be tested on a face plate for distortion and any irregularity rectified. A taper pin locks the suction line and float to the end cover.

Drive shaft bushes fitted to the pump casing should be renewed only where absolutely necessary. Oil grooves are machined in these bushes.

When renewing, care must be taken to ensure the bush is pressed against the shoulder of the casing bore and not allowed to cant during installation, and so distort or damage the casing. The bushes should be reamed in line using Special Tool RH.132.

End float of the gears is 0·001 in. to 0·004 in, with a permissible worn maximum of 0·007 in. If the end float exceeds this figure, remove the six studs from the casing, and face off as necessary.

A new nut must always be used on the shaft and centre popped when tightened. The fit of the suction line in the pump end cover is not important because the suction line is submerged in oil.

The gauze filter in the oil pick-up should be carefully examined for punctures and renewed where necessary. Cleanliness is of the utmost importance when servicing the lubrication system.

The pump should be re-fitted and the driving gear engaged in such a position that the distributor drive shaft tongue is aligned with the marking made prior to removal.

The Oil Sump

The cast aluminium sump carries the dipstick tube and the electric oil level gauge unit. A baffle surrounds the unit to eliminate gauge fluctuation by preventing oil surge around the float. Whenever the sump is drained a new aluminium washer should be used when the drain plug is re-fitted.

Oil Filter Element — to renew

It is recommended that the oil filter element be renewed at intervals of 5000 miles.

Oil Filter Element — to remove

To renew the filter element unscrew the central nut and remove the casing containing the element. This may be withdrawn through the rearmost portion of the triangular aperture formed by the wing valance, air intake manifold and bulkhead.

Oil Filter Element — to fit

Install the new element so that the drilled sleeve is uppermost. The lower sleeve, which is not drilled, seats against a spring-loaded cork washer on the central stud.

The rubber ring, which fits into the groove in the filter head, must always be renewed when the element is changed. Care must be taken to ensure that the corners of the element are not trapped between the casing and the head, and as a precaution, the corners may be turned inwards.

Fill the casing with one pint of clean engine oil and assemble the filter, fitting a new annealed copper washer between the central nut and filter head.

Oil Pipes

The oil filter connections are grooved and are fitted with two sealing rings. The grooves and the pipe ends must be carefully cleaned and all sharp edges must be removed before assembly. Apply a small amount of grease to the sealing rings and pipe ends, then, at the same time, press and twist them together. A sharp tap from a hide mallet may be necessary to ensure that the end of the pipe is seating against the shoulder in the connection. The faces of the connection can be aligned by twisting. Use new 'Klingerit' gaskets between the joint faces when re-fitting the pipes.

Oil Relief Valves

Cleaning and inspection of the relief valves may be performed without removing the assembly from the crankcase.

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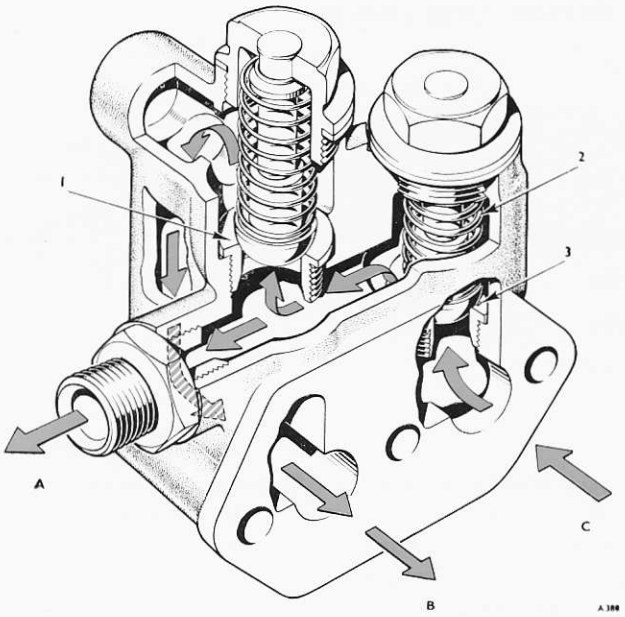


Fig. E5 Dual relief valve unit

1. L.P. VALVE
2. H.P. VALVE
3. BY-PASS PORT

A. L.P. OIL TO ROCKERS AND WHEELCASE
B. RETURN TO CRANKCASE
C. H.P. OIL FROM FILTER

Oil Relief Valve — to remove

Remove both the plugs, which are assembled with a guide pin and appropriate poundage spring. These plugs must only be renewed as an assembly and are not interchangeable.

Withdraw the lower pressure and high pressure valves, clean and carefully examine both seats and valves for signs of pitting. If it is necessary to lap the valves, the relief valve casing should be removed from the crankcase by disconnecting the low pressure feed line and removing the three $\frac{1}{4}$ in. set-screws securing the casing to the crankcase. Only an extremely fine preparation such as Turkeystone powder and thin oil, may be used for lapping in the valves and seats.

Thoroughly clean all parts with paraffin and compressed air before re-assembly.

Oil Relief Valve — to fit

The high and low pressure plungers are of the same diameter and care must be taken to ensure that the plungers are fitted to their respective seats after lapping.

Oil Relief Valve Seats — to renew

The phosphor bronze valve seats are threaded and are made with a special spannering head which is machined off when the seats are screwed into the valve casing. No provision is made for removal, but a suitable wedge-shaped tool driven into the seat will provide a 'bite' strong enough to remove the seat.

Oil Relief Valve Seats — to fit

Care must be taken to fit the slotted high pressure seat in the high pressure side of the casing to ensure a constant flow of oil to the low pressure circuit under all running conditions.

Spring Poundages

High pressure valve spring:

Free length 1·8125 in.

Load when compressed to 1·000 in. — $4\frac{1}{2}$ lb.

Low pressure valve spring:

Free length 1·750 in.

Load when compressed to 0·900 in. — 4 oz.

Oil Pump Pressure and Flow Specification

Pump r.p.m.	500	1000	1500
Oil pressure restricted (lb/sq.in.)	8	18	28
Min. acceptance flow (pints per minute)	11·2	26·4	42·6
Oil temperature (inlet)	90°C 194°F	90°C 194°F	90°C 194°F

Engine Oil Pressure

The engine oil pressure may be checked by removing the oil pressure indicator transmitter from the crankcase main oil gallery and substituting a pressure gauge adapter.

The oil pressure should conform to the following figures:

Engine r.p.m.	Average value	Minimum acceptable
500	8 lb/sq.in.	5 lb/sq.in.
1000	18 lb/sq.in.	
1500	$26\frac{1}{4}$ lb/sq.in.	
3000	31 lb/sq.in.	25 lb/sq.in.

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SECTION E3 — CYLINDER BLOCK AND LINERS

Special tools required:

RH.441 — Exhaust Valve Spring Compressor

RH.626 — Puller, Valve Guide

RH.613 — Extractor and Puller — Camshaft Bushes

RH.562 — Camshaft Bush Reamer

Description

The cylinder block is a monobloc casting of close grained cast iron, and is fitted with full-length high chrome steel cylinder liners. Coolant passages are cast integrally with the cylinder block and a ready means of access is provided to these passages through core plugs and detachable plates. An internal water distribution gallery directs the flow of the coolant around the exhaust valve seats.

The cylinder liners are pressed into the cylinder bores, and have an interference fit of 0·0025 in. to 0·0035 in. which must be maintained. Two liners of different external diameters are available for service renewal, which permit slight dimensional variations in the cylinder block bores to be compensated by selection of the appropriate liner. These are colour coded for identification (see Data Table).

The liners are pressed into the cylinder block under a pressure of approximately 1 ton, until they are 0·015 in. proud at the top of the block and are then ground flush before being bored and honed to size. The bottom of the liner is under-cut for a distance of 0·200 in. to provide a lead-in when pressing the liner into the cylinder block.

Pistons and bores are graded to maintain a 0·0012 in. to 0·0015 in. clearance at the top of the piston skirt. Standard and oversize pistons are available in four grades (see Section E7).

The standard bore is 3·750 in. to 3·7515 in. Cylinder wear of 0·004 in. will necessitate the fitting of oversize pistons, and the cylinders must be bored and honed. Bore 0·003 in. undersize for final finishing by honing. The final surface should show a fine 'diamond' pattern.

It is possible to bore the cylinders and fit new pistons with the engine in position, but this procedure is not recommended. Adequate precautions must be taken against swarf or grindings entering the oil passages of the crankshaft, and the crankpins must be wrapped with adhesive tape during the operation.

When bore dimensions will not permit further re-boring to suit oversize pistons, bore out the liner until about 0·015 in. remains. This will curl up and fall out when split with a sharp chisel. Press in a Yellow or Blue coded liner as required to maintain the correct interference fit (see Data Chart). After boring and honing, chamfer the top edge at 45 deg. for a depth of 0·010 in.

Exhaust Valve Seats

The exhaust valve seats are pressed in with an interference fit of 0·005 in.–0·007 in. and may be removed in a similar manner to the cylinder liners, the seat being bored until it can be split with a chisel. The seat pocket must be thoroughly cleaned before pressing in the new seat.

Valve seat dimensions are 1·8185 in. (—0·001 in.) outside diameter with a depth of 0·250 in.

Where valve seat inserts and guides are being renewed simultaneously, the guide must be installed and reamed before machining the valve seat angle in order to ensure concentricity of the seat angle to the valve guide.

The seat angle is 45 deg. and should be carefully machined free from scratches for a width of 0·062 in. Where necessary, this should be 'crowned' with a 30 deg. cutter to avoid pocketing.

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Exhaust Valve Guides

Exhaust valve guides are of phosphor-bronze, 0·6257 in. outside diameter. Replacement guides are supplied 0·002 in. oversize on the outside diameter to maintain the correct interference fit.

The guides are removed by driving downwards with a suitable punch, after the tappets, valve springs and washers have been removed.

When renewing a guide, press upwards into position, using Special Tool RH.626. The shoulder of the guide must seat against the recess in the boss. A slight undercut on the outside of the guide above the shoulder ensures that the guide is fitting squarely against the boss recess.

When in position ream the guide bore to 0·3755 in.

Valve Tappets

Inlet and Exhaust valve tappets are of cast iron and are chill cast on the camshaft end to resist wear.

Exhaust valve tappets are fitted with adjusting screws and lock-nuts, and the inlet tappets are finished with a seating for the inlet valve push rod.

The inlet and exhaust valve tappets are graded in steps of 0·00025 in. to give a selective fitting. They are colour coded and should be ordered by colour only. The external size and colouring of both exhaust and inlet tappets is as follows:

Diameter in inches	*Colour*
1·8675 to 1·870 in.	Blue
1·870 to 1·8725 in.	Green
1·8725 to 1·875 in.	Yellow
1·875 to 1·8775 in.	Black
1·8775 to 1·880 in.	Black and Yellow
1·880 to 1·8825 in.	Green and Yellow

A master set of six should be used for gauging purposes.

Carefully clean the tappet bore. Select a tappet from the gauge set that will just slide down the bore without lubricant with the finger pressing lightly on the top.

Select a new tappet from stock that is one size less than the gauge tappet. Thus if a 'yellow' gauge tappet should be found to give the required feel a 'green' tappet should be selected for fitting to the bore. Repeat this operation for all the tappet bores.

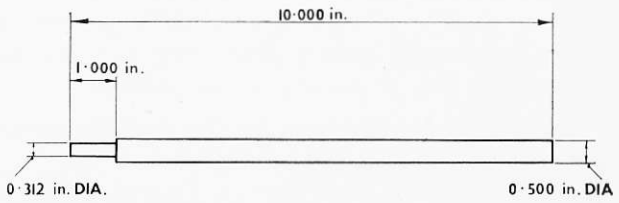


Fig. E.6 Drift for removing valve guide

Wash and wipe clean the new tappets without removing the 'Parkerising' from the bottom face. This surface, as well as being rustproof, is of value during running in. Etch the appropriate number from 1 to 6 on the top of each tappet to correspond with its bore, inlet or exhaust, commencing from the front of the engine.

Fit the tappets to the bores smearing the sides and bottom face with Mobilgrease 234. This grease has a high film strength and will assist in obtaining a good bedding surface during running in. It may be obtained in small quantities from the Manufacturers.

Tappets should be changed if fitted on the bottom face. Serviceable tappets should be re-fitted in their original bores.

Camshaft Bushes — to renew

Remove the engine and gearbox as one unit as described in Section E1.

Place the engine on a suitable stand, drain the oil and remove the sump.

Remove the rocker cover, the rocker arm assembly and the cylinder head, as detailed in Section E8.

Remove the inlet push rods, exhaust valve cover plates, valves, springs and washers.

Remove all tappets and place the valves and tappets in a suitable stand in numerical order.

Remove the crankshaft pulley.

Disconnect the low pressure oil line from the wheel case and remove the case.

Remove the slipper drive assembly, as described in Section E5.

Remove the distributor, drive shaft and oil pump as described in Section E2.

Remove the camshaft gear and thrust plate, then withdraw the camshaft.

Remove the flywheel. It is not necessary to mark the flywheel position relative to crankshaft position as one of the securing holes is offset 2 deg. and thus the flywheel can only be installed in one position.

Remove the flywheel front housing from the crankcase and the camshaft rear bearing cover.

Using Special Tool, RH.613, withdraw the camshaft bushes, then draw in the new bushes, using the same tool. Position the front bush 0·010 in. below the front edge of the boss to eliminate any possibility of a foul between the bush and the thrust plate. Oil drillings in the shells must be correctly aligned with the crankcase oil passages.

Ream the bushes using Tool RH.562. Afterwards the crankcase must be cleaned carefully and all swarf removed. Before re-fitting the camshaft, the bushes should be oiled and the oil holes carefully checked to ensure that they are free of obstruction. Care must be taken to ensure that the rear bush cover is oil tight before re-fitting the flywheel housing and flywheel, as it is not accessible after these units are re-fitted. A test should be made with a lubrication pressure tester if available. If a coating of 'Wellseal' is applied to both sides of the new Vellumoid joint, no leak should occur.

The exhaust valves require 'grinding in' before re-fitting.

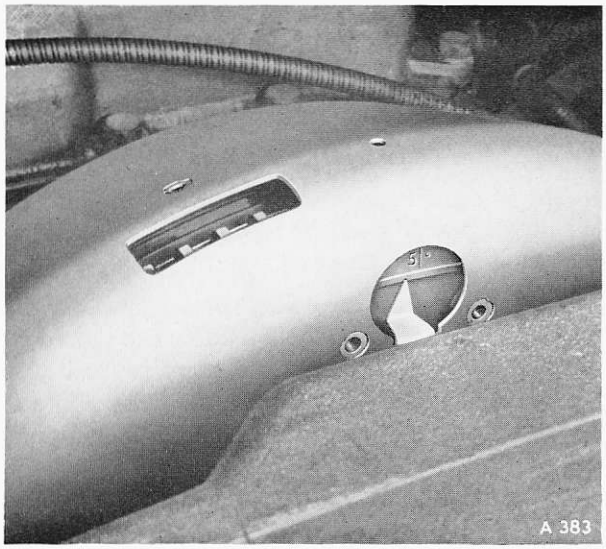


Fig. E8 Flywheel timing mark

New gaskets must be used on all joints when re-assembling, which is a reversal of dismantling procedure.

The valve timing must be correctly set before timing the ignition system. This is described in the following paragraph under Valve Timing.

The sump should not be re-fitted before the ignition timing is set, see Section E2, under the Oil Pump.

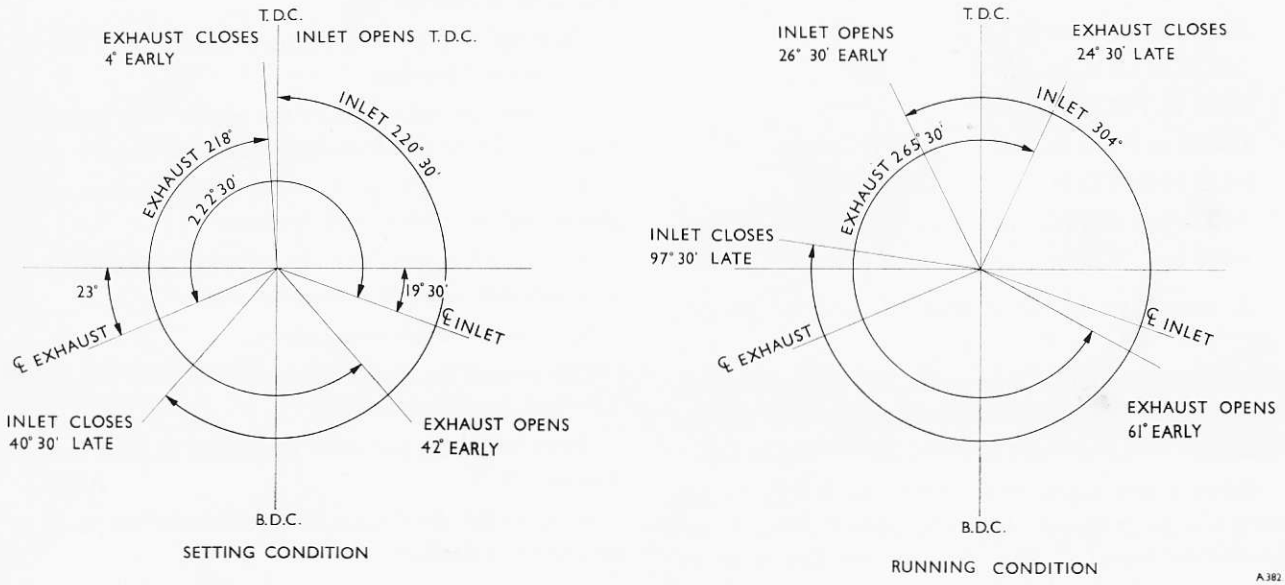


Fig. E7 Valve timing

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Valve Timing

The flywheel is marked 20 deg. before and after T.D.C. in 5 deg. increments; these markings are clearly visible through an inspection port in the flywheel lower cover.

Valve timing procedure is as follows:

Provisionally assemble the camshaft gear to the camshaft using only two setscrews, then rotate the crankshaft in the direction of engine rotation (i.e. clockwise when viewed from the front of the engine) until No. 1 inlet valve is fully open. Rotate the crankshaft one complete turn, then set the rocker clearance of No. 1 inlet valve to 0·035 in.

Again rotate the shaft in the same direction until the valve just commences to open, as ascertained by inserting between the valve tip and the rocker arm a 0·005 in. feeler gauge, which should be just movable at this point.

Remove the camshaft gear then rotate the crankshaft so that the flywheel T.D.C. mark registers with the timing pointer.

Re-fit the camshaft gear to engage with the teeth on the crankshaft pinion, checking that the holes in the timing gear and camshaft are correctly aligned, then secure with two setscrews.

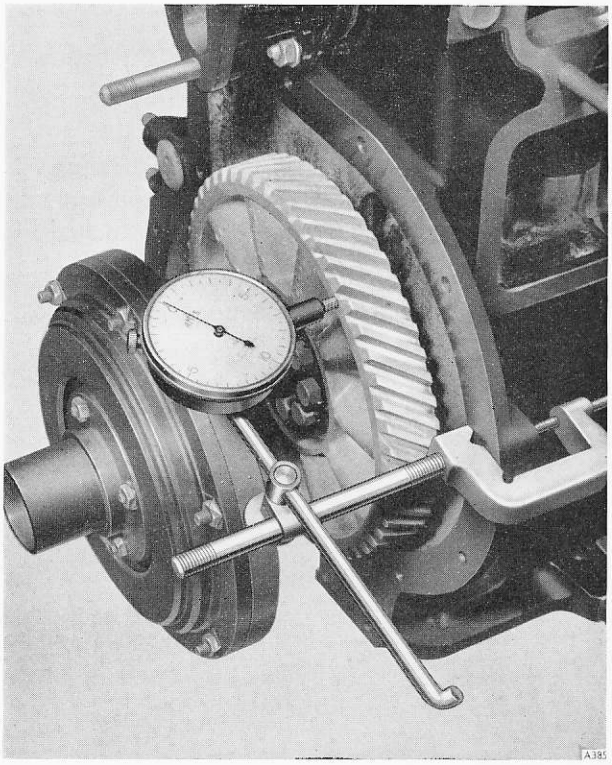


Fig. E10 Checking camshaft end float

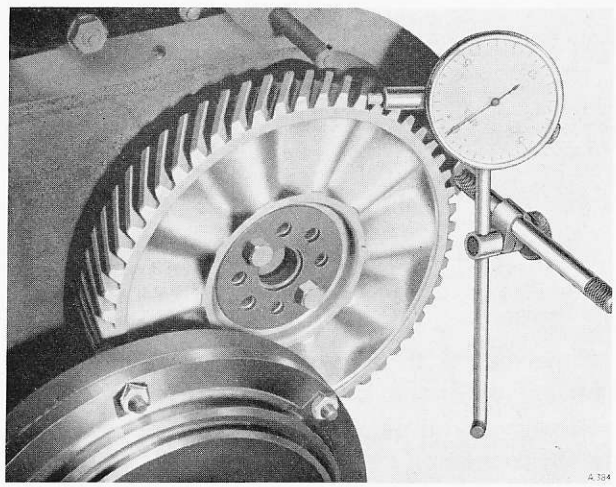


Fig. E9 Checking camshaft backlash

Again check the valve timing and verify that the timing pointer registers with the T.D.C. mark.

If found to be incorrect, the timing must be altered by re-meshing the camshaft gear, making use of the vernier adjustment. The cam wheel has 54 teeth. Rotating this wheel to the next fixing hole (45 deg.) turns the gear $(54+1)\left(\frac{45}{360}\right) = 6\frac{7}{8}$ teeth, i.e. $\frac{1}{8}$th of a tooth variation on the original setting. Re-meshing adjacent teeth will alter the timing by 3 deg. 20 min. at the flywheel. If difficulty is experienced in obtaining the exact timing, it is preferable to be on the late side.

When the correct timing is obtained, re-fit the remaining setscrews and secure them in place with lock tab washers. Finally set the valve clearances to the running conditions.

Inlet rocker clearance — 0·006 in.
Exhaust tappet clearance — 0·012 in. } Cold

Timing Gears

The timing gears are rig paired in manufacture to give 0·002 in. to 0·004 in. backlash and must, therefore, be renewed as a pair.

Camshaft end float is 0·002 in.–0·006 in. and is controlled by a brass thrust plate bolted to the crankcase by three 0·250 in. setscrews locked by tab washers.

Gears are lubricated from a jet screwed into the wheel case and fed from an exterior pipe at approximately 4 lb/sq.in.

A hardened steel thrust pad in the wheel case and a bronze spring-loaded plunger maintain approximately a 15 lb. end load on the camshaft to absorb end float and flutter.

The crankshaft gear, which forms part of the slipper drive assembly, is bushed with a 'Babbitt' lined shell and is a 0·002 in. running fit on the journal. Lubrication is from a drilling in the journal.

When re-fitting the timing gears reference should be made to the instructions given for Slipper Drive Servicing in Section E5.

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SECTION E4 — CRANKSHAFT AND MAIN BEARINGS

Special tool required:

RH.410 — Bearing Cap Extractor

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Description

The crankshaft is of nitride hardened chrome molybdenum steel with integrally forged balance weights. The journals are bored and fitted with steel caps. The shaft is both statically and dynamically balanced, and is supported in seven steel backed copper–lead–indium split type shell bearings.

End thrust is taken by two thrust washers, arranged either side of the centre main bearing. The lower halves of these washers are keyed to the bearing cap to prevent rotation.

Note: Front end washers are etched 'X' on original assembly.

To prevent oil leakage past the rear main bearing cap, the shaft has a single start right-hand 'Acme' thread which returns any surplus oil from the rear main bearing into a recess in the main bearing cap, from where it drains back into the sump.

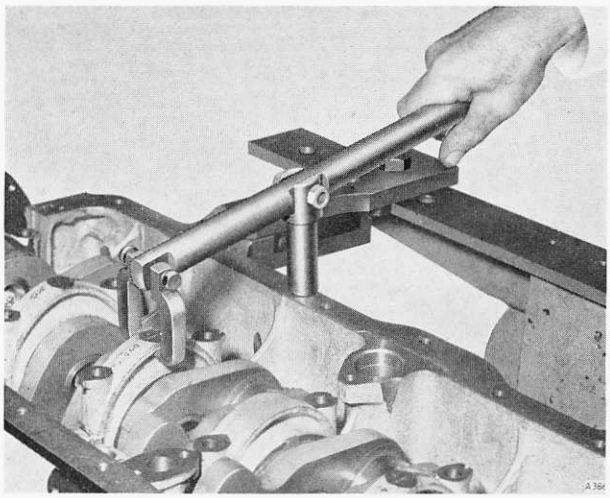


Fig. E11 Removing main bearing caps

Crankshaft — to remove

Remove the engine and gearbox assembly as detailed in Section E1.

Place the engine unit on a suitable stand, remove the sump, wheel case and flywheel lower cover.

If the shaft is to be re-ground, remove the spring drive unit (see Section E5) and the flywheel.

Remove the oil pump delivery pipe, the oil pump and the connecting rod caps.

Remove the main bearing caps using extractor RH.410, then lift out the shaft.

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Crankshaft — to inspect

Before inspecting the crankshaft for wear or bowing, check whether the journals or crankpins have previously been re-ground. It is possible that a second re-grind would reduce the harness value below the minimum of 570 VPN on the Vickers Diamond Pyramid Machine with a 10 kg. load. Shafts below 570 VPN should be nitride hardened. If facilities are not available to carry out this treatment, a Service replacement crankshaft should be fitted.

Inspect the crankshaft as follows:

1. Mount the crankshaft on a suitable stand and check journals and crankpins for wear with a micrometer. Any wear on the journals must be taken into account when checking for bow. For dimensions see Data Chart.
2. Mount the shaft with journals Nos. 1 and 7 in a pair of 'Vee'-blocks placed on a marking-out table, and ensure that the crankshaft axis is parallel with the table and that the shaft is free to rotate. Before mounting the crankshaft, it is advisable to use a test bar on the 'Vee'-blocks to ensure that the crankshaft will be parallel to the table. If a test bar is not available, the journals Nos. 1 and 7 should be checked for diameter, and after the crankshaft is mounted on the 'Vee'-blocks, a second check should be made with a dial height gauge over the journals. If the axis is not parallel, packing pieces should be inserted under the 'Vee'-blocks.

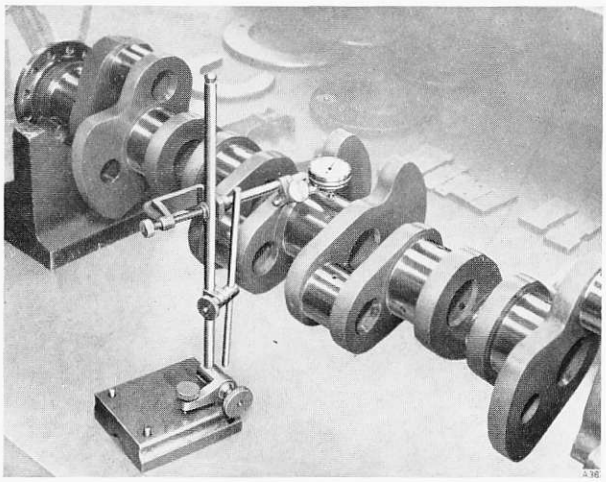


Fig. E12 Checking crankshaft bow

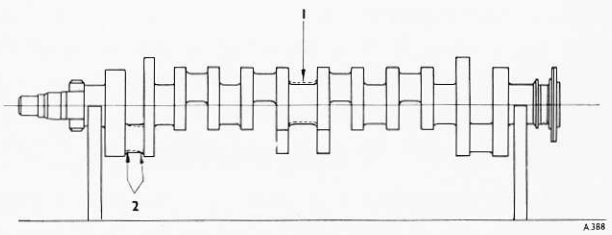


Fig. E13 Crankshaft bow parallelism

3. Turn the shaft in the blocks and test for bowing on the centre journal by means of the dial indicator gauge. The maximum permissible bow before re-grinding is 0·010 in. Over this figure, a Service replacement shaft should be fitted. The errors due to ovality of the journals must be taken into account in arriving at the figure for bowing which will be half the maximum dial reading of the indicator. Next, turn the shaft so that the webs of each crankpin are first at 45 deg. and then at 135 deg. to the table and check the crankpins in each position for parallelism (see Fig. E13).

Re-grinding and Lapping

Shafts should not be re-ground unless it is necessary to remove more than 0·005 in. to restore a true diameter. Up to this amount, the journal or crankpin should be rectified by lapping.

The combined operations should result in the diameter of the journals or crankpins being reduced from standard in multiples of 0·010 in. to a maximum of 0·060 in. undersize.

The shaft should be set up on the grinding machine, using an adapter for the flanged end, and a centring plug for the tapered end when grinding the journals.

The grinding wheel must not be allowed to touch the journals before the crankshaft is thoroughly wetted with grinding lubricant; this should be fed in liberally on the ingoing side of the wheel. In order to avoid cracking, it is desirable that arrangements should be made to heat the lubricant and maintain it at a temperature between 65 deg. C and 69 deg. C. On no account must the grinding wheel touch the side radii of the crank-webs. Stops must be arranged on the machine to limit the travel of the grinding wheel

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within approximately 0·010 in. of each face (see Fig. E14). The radius of the wheel should be carefully controlled to ensure that the grinding fades out not more than halfway round the radius.

Grind to 0·001 in. above the finished size.

Having re-ground the pins and journals, a final operation should be effected whereby the front face of the driving flange is ground true. This should only necessitate a light skimming with the grinding wheel.

Upon completion of the grinding operation, the crankshaft should be tested magnetically for cracks.

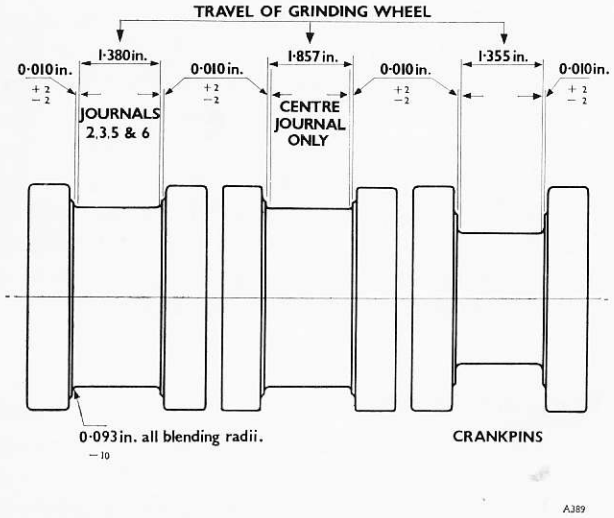


Fig. E.14 Crank pin and journal grinding dimensions

After grinding, lap the crankshaft to remove the remaining 0·001 in. of metal and to obtain a perfectly smooth finish on the journals and crankpins.

If the shaft is to be nitride hardened, this 0·001 in. of metal must be left on. Afterwards the consequent scale and this 0·001 in. of metal should be removed by lapping. Mount the shaft on a suitable machine using cast-iron laps. Set the machine to revolve at approximately 220 to 250 r.p.m. and lap the crankpins and journals separately for convenience of operation. Plug the oil holes in the shaft with corks. Inject lapping compound at frequent intervals. Leave the pins and journals very slightly oversize and allow to cool, when it will be found that they contract. No fixed rule can be specified in regard to this procedure, which depends entirely upon the skill of the operator.

After lapping, wash the crankshaft thoroughly in a high pressure paraffin wash, blow off the surplus paraffin with compressed air, then dry with a soft lint-free cloth. After removing all traces of the compound, ensure that all the corks are in position. Return the shaft to the lapping machine and hand polish.

Using 'Corolite' abrasive strip 1 in. wide, continue polishing until all traces of lapping in the surface have been removed. After polishing, wash the shaft again in a high pressure paraffin wash and remove all traces of polishing compound.

Crankshaft Oil Caps

Reconditioned crankshafts supplied from the Service Department are not supplied with oil caps. Remove the oil caps from the original shaft and fit them to the new shaft using new aluminium washers.

Before fitting the caps clean off any slight signs of corrosion. Badly pitted caps should be renewed. The seatings should be checked with Prussian Blue to ensure that a good oil seal is obtained.

Main Bearings

Bearings removed from an engine during overhaul must be re-fitted in their original positions. This applies particularly to the top shells, as these are drilled to register with the oilways in the crankcase casting.

In no case should upper and lower bearing shells be interchanged and care must be taken to see that the locating lips correctly register in their recesses.

Bearing — to renew without removing crankshaft

It is possible to renew both upper and lower bearing shells without the removal of the crankshaft, but it is not possible to check the crankshaft journals for wear.

1. Drain and remove the engine sump. To afford better access to the centre main bearing, the oil pump delivery pipe should be removed. It is not necessary to remove the oil pump assembly, although it is easier if this is done. It should be noted that if the oil pump is removed the ignition will need re-timing.
2. Remove the sparking plugs and the lower flywheel cover to allow the crankshaft to be rotated by hand.

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3. Remove the cap of the bearing which is to be renewed. If the rear bearing cap is to be removed, the Special Tool, RH.410, will be required. This tool can be used to remove other caps if necessary. If more than one bearing is to be removed, remove only one cap at a time.
4. Using a thin strip of flexible steel slide the top half of the bearing out around the crankshaft in the direction of the crankshaft rotation. It will assist if the engine is also simultaneously turned by hand, in the running direction. Alternatively a setscrew, with the head reduced to 0·078 in. depth, may be located in the journal oil hole, when rotation of the shaft will eject the bearing shell.
5. Note the size stamped on the back of the removed bearing and renew accordingly. The shell may be tapped into position for the last half inch by a thin piece of hardwood until the locating lip on the shell is fully registered in the locating slot. No attempt must be made to press the lip into the slot by drawing up the bearing cap.
6. Clean and oil the lower shell, place the shell in the cap, then tap the cap into position with a hide mallet. Ensure that the shell has not been dislodged before tapping the cap home. Tighten and lock the bearing cap using new lock washers. The shaft should turn easily by hand when all bearings have been installed and tightened.

   The thrust washers may be removed in a similar manner to the above.

Main Bearing — inspection and renewal

1. The main bearings and thrust washers should be removed from the crankcase with their respective caps and thoroughly washed in paraffin.
2. Visually inspect; reject bearings obviously damaged, or those showing any wearing of the lead–indium plating.

A range of pre-finished undersize bearings are available in steps of 0·010 in. for use with re-ground crankshafts.

No reaming is necessary. If the crankshaft has been re-ground, for example 0·010 in. undersize from standard, a set of 0·010 in. undersize bearings will give the correct running clearance.

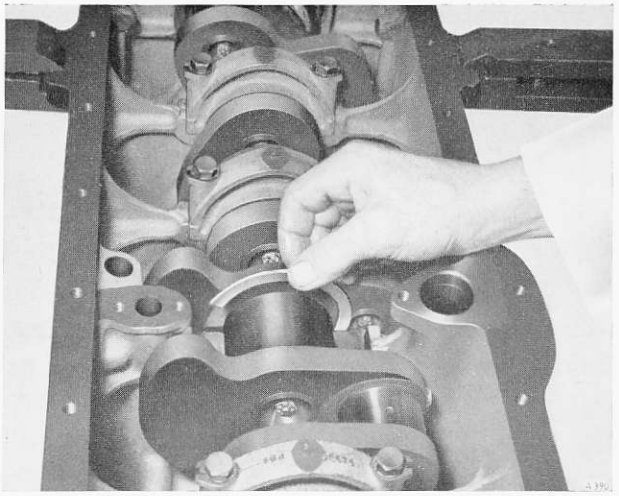


Fig. E15 Re-fitting thrust washers

To check the bearing fit, all the bearings must be fitted and the caps bolted down; the crankshaft should then be free enough to turn by hand.

Do not file, shim or scrape the bearing caps.

The Crankshaft — to re-fit

After the crankshaft has been overhauled and the correct bearing shells have been selected, the crankshaft should be re-fitted as follows. Particular attention should be paid to cleanliness during this operation and the shaft should only be cleaned with a lint-free material.

Insert the upper bearing shells in the crankcase pressing fully into position by hand.

Fit thrust washers into the recesses of the centre bearing webs, taking care to fit the bearing faces towards the thrust faces of the crankshaft.

Lubricate all bearings and thrust washers with clean engine oil.

Carefully lift the crankshaft into position; fit the bearing shells in the caps and the thrust washers into the centre bearing cap.

Using a hide mallet tap the bearing caps into place in their respective numbered order with the numbers towards the camshaft and ensuring that the shells are not dislodged from the caps.

Fit new tab washers under the setscrews and tighten down but do not lock, in the following order — 1, 7, 3, 5, 2 and 6. Check the crankshaft end float. Do not lock the setscrews until the pressure test has been carried out.

Assemble the connecting rods to the crankpins, tighten but do not split-pin the nuts until the oil pressure test has been carried out.

Drive the white pine-wood oil seals into the holes between each side of the rear main bearing cap and the crankcase. The seals should be dipped in oil to facilitate entry. When fully home, cut any excess length from the seal flush with the cap, using a sharp knife. Ensure that particles of wood do not fall into the crankcase.

The crankshaft must turn freely by hand, with all caps tightened.

Crankshaft End Float — to check

To determine the end float, insert a pinch bar between an intermediate bearing web and the crankshaft web, move the shaft to its full extent in either direction, then measure the clearance between the crankshaft thrust face and thrust washer at the centre main bearing. Move the shaft in the opposite direction, and take a reading at the same point on the opposite side. These measurements should be equal, but it must be remembered that the lesser measurement will, of course, be the governing factor of the end float.

Recommended end float clearance is 0·002 in. to 0·006 in. and must not exceed 0·008 in.

Move the crankshaft back and forth several times before finally verifying the end float, then fit new tab lock washers and lock the bearing cap setscrews.

Figure E16 shows a dial gauge mounted in position for checking the crankshaft end float when the wheel case or the engine unit is removed. When it is desired to measure and correct end float with the engine and wheel case in position, a dial gauge can be set up on the lower face of the flywheel housing and a measurement taken off the front face of the flywheel itself.

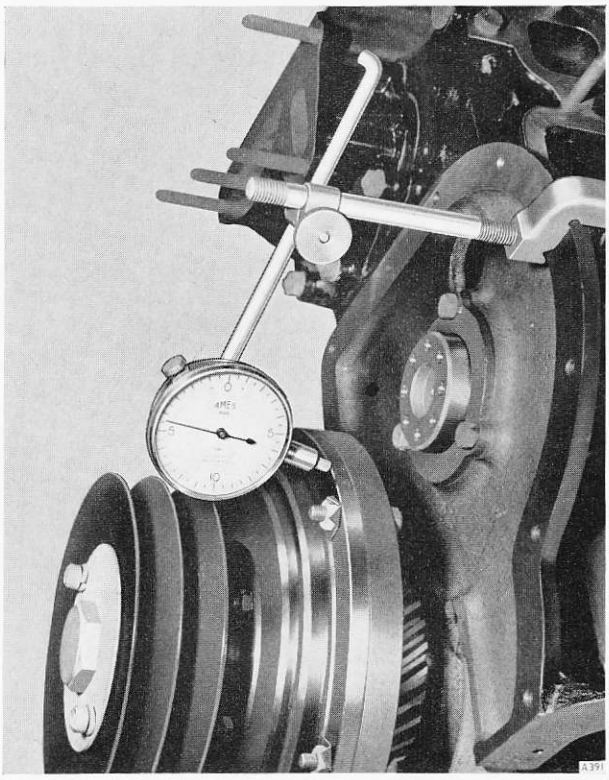


Fig. E16 Checking crankshaft end float

Crankshaft Oil Flow Check

When the crankshaft has been fitted in an overhauled engine, and before proceeding with further re-building, a check should be made to ensure that there is a satisfactory oil flow to the main bearings, connecting rods and camshaft bearings.

Remove the camshaft skew gear oil jet and blank off the drilling with a $\frac{5}{16}$ in. diameter plug threaded 24 t.p.i. RH.UNF/2A. Connect a suitable pressurised oil supply (to give approximately 30 lb/sq.in. pressure) to the main oil gallery and blank off the remaining external outlets.

Pump oil into the crankcase whilst slowly turning the crankshaft and check the oil flow to the main bearings, connecting rods and camshaft. Check for oil leaks from the crankshaft journal oil caps.

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SECTION E5 — CRANKSHAFT DAMPER AND SPRING DRIVE

Special tools required:

RH.552 — Serrated Spanner — Crankshaft
RH.560 — Extractor — Spring Drive
RH.546 — Mandrel — Spring Drive
RH.564 — Poundage Checking Lever
A suitable spring scale graduated 0–25 lb.

Description

A friction plate keyed to the crankshaft, transmits frictional drive, via cotton duck washers, to the damper inertia wheels between which it is bolted (see Fig. E17). Between the front washer and wheel is a presser plate, the thrust being provided by coil springs which seat in the front wheel.

At the rear of the unit is the crankshaft timing wheel. Four dogs on this timing wheel enter apertures in the friction plate hub, which transmits a cushioned drive to the pinion through coil springs. Studs in the crankshaft timing wheel dogs pass through the assembly and secure the front damper wheel and fan pulley hub.

The relative movement between the crankshaft and the damper and timing pinion assembly is thereby controlled by the spring drive and by the inertia and friction loadings which also absorb crankshaft oscillation.

The rear damper wheel is precisely balanced by means of $\frac{1}{4}$ in. dia. Allen screws. These screws should not be disturbed when the damper is removed and dismantled for overhaul.

The unit is free from derangement due to mechanical failure and should not normally require attention between periodic engine overhauls, except in cases where the car has been idle for prolonged periods, such as storage.

In such cases the damping qualities of the unit may become seriously impaired by the adhesion of the cotton duck washers to the friction faces of the damper wheel and friction drum. This condition will cause engine vibration, which is particularly noticeable at approximately 2500 r.p.m.; this is half the torsional period of the crankshaft and is equivalent to between 50 and 55 m.p.h.

To remove the unit proceed as follows:

Remove the radiator and shell assembly.

Remove the wheelcase as described in Section E6, unlock and remove the four $\frac{1}{4}$ in. nuts securing the damper hub to the pinion studs which protrude through the front wheel of the damper.

Before extracting the assembly, the valve timing should be set, in order to facilitate assembly.

Remove the inlet valve rocker cover and turn the engine over until No. 1 cylinder is on firing position, i.e. both valves closed and the piston at T.D.C.

Unlock and remove the crankshaft serrated nut, using Special Tool RH.552.

Attach the extractor to the four pinion studs, using the original nuts, then extract the unit.

The Damper — to dismantle

Clamp the special mandrel tool, RH.546, in a vice.

Place the damper unit over the tapered end of the mandrel and turn the unit until the key in the mandrel enters any one keyway in the friction plate.

Unlock and remove the six $\frac{1}{4}$ in. nuts and bolts securing the damper wheels together, at the same time supporting the rear wheel by hand to prevent possible damage to the pinion teeth.

Remove the front wheel and the six springs between the wheel and the presser plate.

Remove the cotton duck washers.

Remove the friction plate and pinion assembly from the mandrel.

Place the pinion studs on a flat bench and press downwards on the friction plate; the driving springs will then dislodge, allowing the pinion to be removed

from the plate. The cotton duck washers tend to harden and become glazed in service thereby losing their original frictional chracteristics; they must always be renewed when the unit is overhauled.

It is important that the mandrel be kept clean and free from burrs thus preventing possible damage to the 'Babbitt' bush which is pressed into the pinion assembly.

The Damper Wheels and Springs

Thoroughly wash all dismantled parts and inspect the friction surfaces for score marks.

Light score marks may be polished out by mounting the wheel in a lathe and polishing with fine emery cloth and oil.

If the above operation does not remove the scores, the friction surfaces may be ground. Minimum permissible dimensions of the rear wheel, friction plate and presser plate are given in the Data Chart. If these finished limits are not obtainable, the particular part must be renewed. Packing washers may have to be used under the damper springs, to allow for the metal removed in grinding.

The inner and outer radial driving springs must be carefully examined for signs of fatigue and renewed as necessary. Lengths and loads of the springs are as follows:

Outer Springs:
Free length 0·800 in. (approximately).
Load when compressed to 0·640 in.— 32 to 35 lb.
Load when compressed to 0·525 in.— 55 to 61 lb.

Inner Springs:
Free length 0·725 in. (approximately).
Load when compressed to 0·525 in.—10 lb. ±6 oz.

Preparing the Cotton Duck Washers

The cotton duck friction washers should be soaked in a mixture of 75 per cent Castrol Hi-Press and 25 per cent SAE 20 oil for at least 24 hours and then placed on a press under a pressure of 75 lb/sq.in. for a further 24 hours. This will reduce the final smoothing or ironing during re-assembly to a minimum and ensure consistent operation.

Ironing the Duck Washers to obtain Slipping Poundage

Place the mandrel (RH.546) in a vice and position the rear damper wheel on the mandrel. Liberally oil and place one of the duck washers against the friction surface.

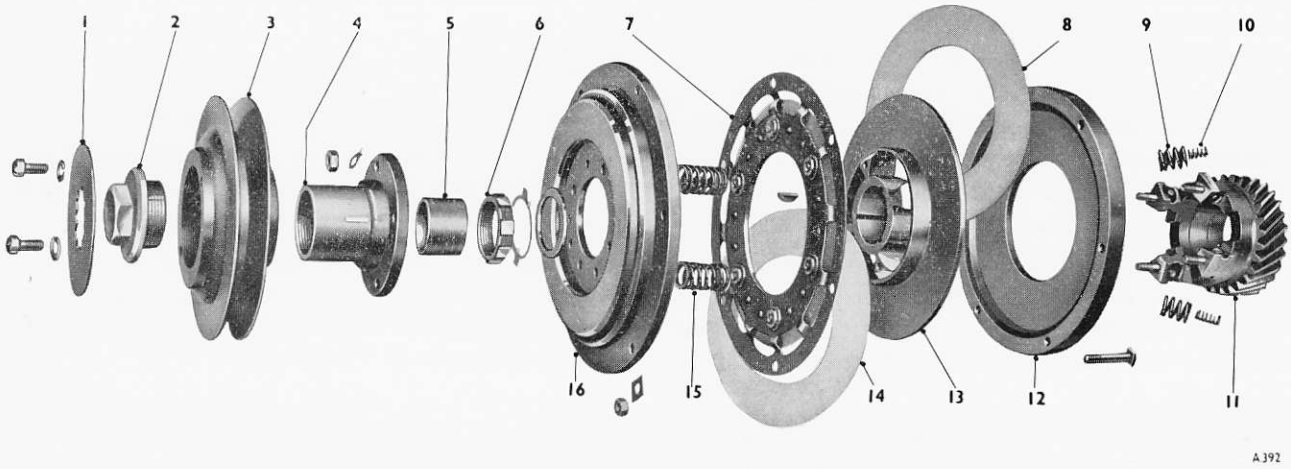


Fig. E17 Crankshaft damper spring drive

1. LOCKING PLATE
2. NUT, CRANKSHAFT
3. PULLEY
4. HUB
5. BUSH
6. LOCK-NUT
7. SPRING PLATE
8. FRICTION WASHER
9. OUTER SPRING
10. INNER SPRING
11. DOG
12. WHEEL-DAMPER, REAR
13. FRICTION DRUM
14. FRICTION WASHER
15. SPRING-DAMPER
16. WHEEL-DAMPER, FRONT

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Place the pinion and friction plate in position on the mandrel. Oil and position the other duck washer against the friction surface of the plate with the scarfed joint diametrically opposed to that of the first washer.

Place the presser plate assembly on the duck washer and position the six damper springs on the spigots. Fit the front damper wheel over the springs and lift the rear damper wheel and pinion up to meet the front damper wheel, after the correlation marks have been lined up; fit two opposite bolts to the wheels, but do not tighten fully until the remaining four have been installed, when all bolts may be fully tightened.

Fit the hub to the pinion studs using two opposite nuts, attach the poundage checking lever to opposite pinion studs and test the slipping poundage before 'ironing' is commenced, noting the poundage with the spring scale attached to the lever as shown in Figure E19. The break-away torque figure is higher than that required to maintain a slow steady slip. Ignore the high initial value when testing.

The washers are ironed by moving the lever back and forth over the full travel between the dogs for as long as necessary to obtain the required slipping poundage of 14–15 lb. at a 17·5 in. radius. The radius is measured between the centre of the mandrel and the notch in the lever to which the spring scale is attached and is a pre-determined measurement incorporated in the manufacture of the lever.

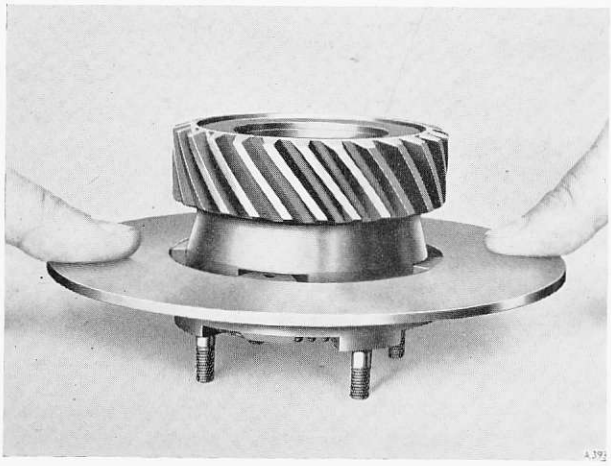


Fig. E18 Removing drive springs

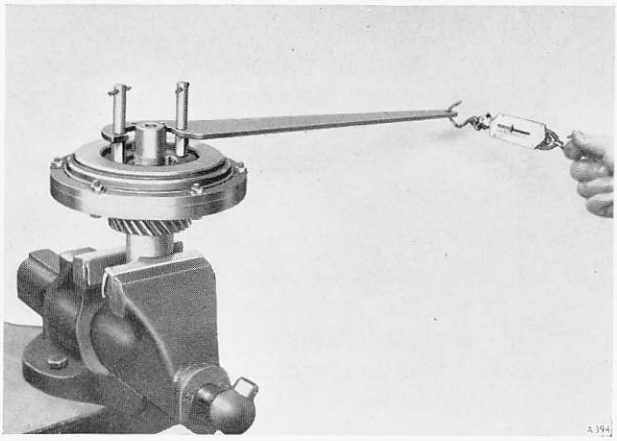


Fig. E19 Slip poundage test

A poundage test lower than 14 lb. indicates that thin packing washers are needed between each damper spring and the front wheel. These washers are 0·020 in. thick and are the only washers recommended for the operation. They are supplied under part number K.8808/Z. A maximum number of four washers is permitted under each spring and where a greater number than this is indicated, a careful check of the damper springs and friction surfaces should be carried out to determine which part or parts, are below the required standard.

Test the slipping poundage in each direction several times, a 14–15 lb. reading indicates that no further ironing is necessary. When a satisfactory reading has been obtained, install the radial driving springs between the pinion and drum dogs.

Remove the poundage checking lever and hub, supporting the rear damper wheel while removing the six nuts and bolts. Remove the front damper wheel and the six springs, care being taken not to misplace the special washers (if used).

Fit two bolts to secure the presser plate to the rear damper wheel. Screw the poundage checking lever to two opposite pinion studs.

Insert the inner and outer radial spring assemblies between alternate dogs, using the poundage checking lever to compress the springs against the dogs when in position and so facilitate fitting of the other spring assemblies.

Attach the lever to alternate pinion studs as necessary to allow access to other springs. A suitable screwdriver may be used to compress and position the springs. When all the springs have been re-fitted, carefully check to make sure that the springs are in their correct position on the pinion spigots and against the friction plate dogs.

Re-fit the front damper wheel, after ascertaining that the duck washers, damper springs and special washers (if used) are correctly positioned, then lightly tighten the six bolts after new lock plates have been fitted. Ensure that the correlation marks are correctly aligned during the re-assembly of the unit.

The cotton duck washers must not be disturbed when the damper is dismantled to fit the radial drive and springs and before closing up the unit. A check should be made to ascertain that the washer scarf joints are diametrically opposed.

The Damper Unit — to fit to the crankshaft

Examine the tapered end of the friction plate and crankshaft and make certain that both are clean and free from burrs; also check that the three Woodruff keys are in place in the crankshaft.

Fit the damper assembly without disturbing the position of the camshaft gear, otherwise the valve timing will be upset.

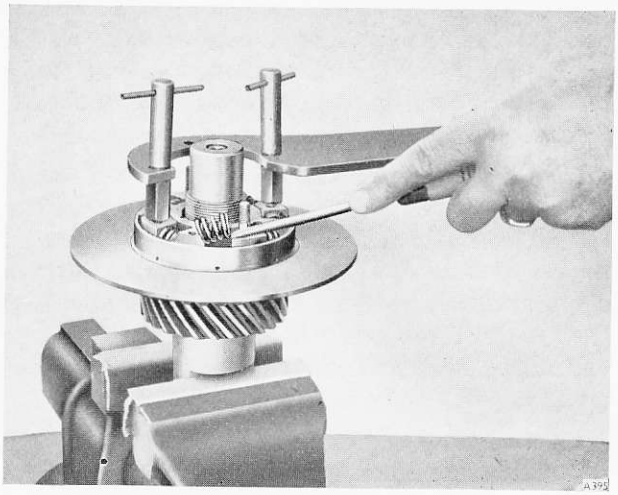


Fig. E20 Re-fitting drive springs

Fit the plain washer against the hub of the friction plate, then fit the lock tab washer and retaining nut; tighten and lock the retaining nut. Fit the hub; tighten and lock the four nuts, using new lock washers, then lock the six damper wheel bolts.

Check the valve timing and re-fit the wheel case.

Re-fit, tighten and lock the fan pulley, then fit and adjust the fan belt.

Re-fit the radiator shell, etc. and check for oil or coolant leakage while the engine is running.

SECTION E6 — WHEEL CASE AND FAN PULLEY

Oil is supplied to the wheel case through a jet which is fed at approximately 4 lb/sq.in. from the low pressure oil circuit, providing constant lubrication of the timing gears, spring drive and vibration damper assembly.

A three-start left-hand 'Acme' thread on the fan pulley prevents oil leakage from the wheel case.

It is most important that this thread is not damaged. No wear takes place between the 'Acme' thread of the pulley and the bore of the case as there is 0·006 in.–0·008 in. radial clearance. The pulley can be removed without the use of any special tool.

Wheel Case — to remove

To remove the wheel case, remove the radiator shell and matrix.

Remove the fan belt and blade assembly.

Remove the fan pulley nut and pulley.

Disconnect the oil supply pipe to the jet and remove the jet and aluminium washer. Remove the wheel case. When removing the wheel case take care that the ends of the oil sump joint are not damaged as this will necessitate the removal of the sump to fit a new joint.

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Wheel Case — to fit

When re-fitting the wheel case, it is not necessary to use the alignment tool RH.547 as the case is located to the crankcase by dowels. If a new wheel case is fitted, the alignment tool should be used to verify the alignment.

Fitting the wheel case is the reverse of the procedure for its removal but the following points should be noted:

Fit a new 'Vellumoid' joint, lightly coated with 'Wellseal' between the wheelcase and crankcase.

Fit a new aluminium washer to the oil jet.

Apply a light coating of 'Wellseal' between the wheelcase and the sump joint.

SECTION E7 — CONNECTING RODS AND PISTONS

Description

The connecting rods are 'H' section forgings of molybdenum steel, accurately balanced, and have a fully machined finish. The rods are drilled internally to provide high pressure lubrication of the small- or top-end bush; they also have a 0·031 in. drilling in the side of the rod to provide lubrication of the cylinder wall. Detachable split steel shell big-end bearings, lined with copper–lead–indium alloy 0·00175 in. minimum thickness, are lubricated from the drilled crankshaft under a pressure of approximately 25–30 lb/sq.in.

The weight of the rod assembly including the cap, bolts, nuts and gudgeon pin bush, but excluding the big-end bearing, is approximately 1 lb. 12 oz. The weight is etched on the rod in the vicinity of the bolt holes. Side float of 0·007 in. to 0·022 in. is controlled at the top end of the connecting rod by the clearance between the rod and the piston bosses.

The pistons are of aluminium alloy with split skirts, which are cam ground to permit a close fit between the piston and cylinder walls. After grinding, the pistons are coated with tin to a depth of 0·0003 in. to reduce friction. Pistons are supplied in standard size and four ranges of oversize (see Spares Schedule).

The top compression ring is chromium plated to a depth of 0·003 in. to 0·004 in, the outer edges of the ring have a 0·010 in. radius, and the inner edges are chamfered to prevent the rings sticking in their grooves.

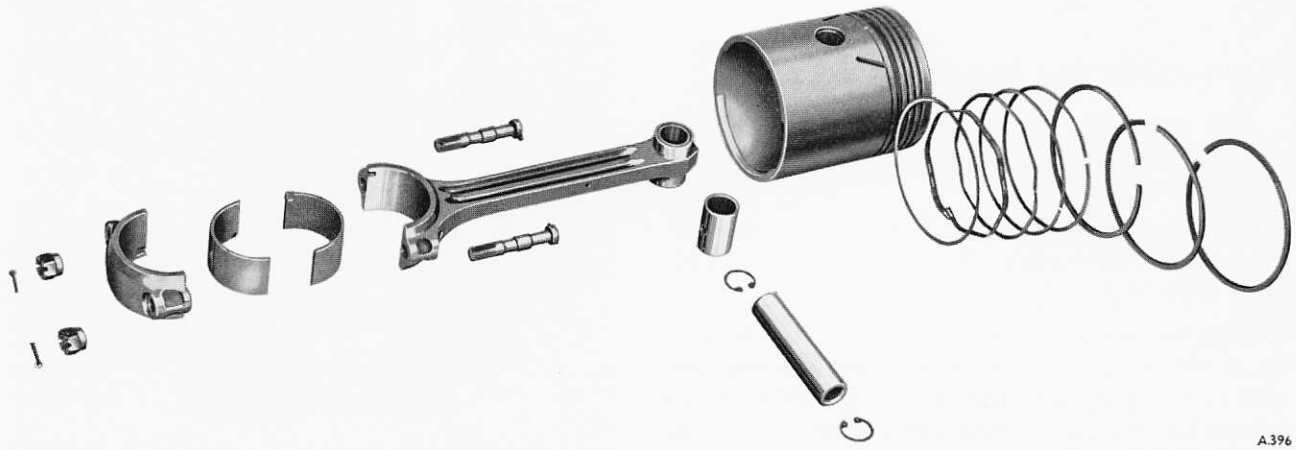


Fig. E21 Exploded view of piston and connecting rod

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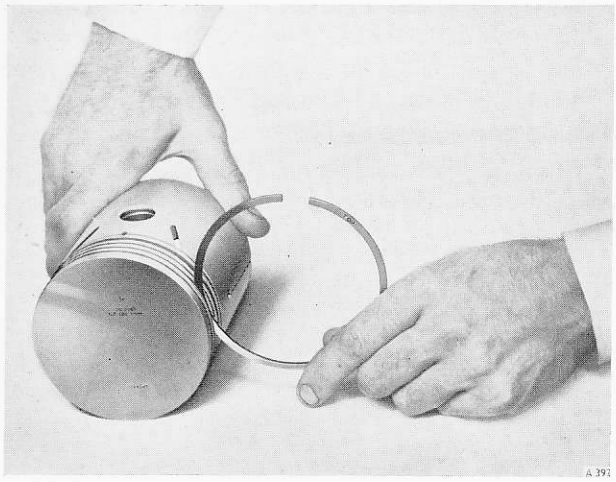


Fig. E22 Checking freedom of piston ring

Both the lower compression rings are finished with their outer edges tapering at 1 deg. towards the upper face. These rings are clearly stamped 'TOP' on the upper face and must be fitted in this manner. The inner edges of these rings are also chamfered to prevent sticking or binding in the piston ring grooves.

The Duaflex oil scraper ring assembly comprises an octagonal spring steel expander, which cushions a centre scraper spring ring between the cylinder wall and the oil ring groove; the spring ring being located between one lower and two upper, thin spring, side rails.

Refer to the Data Chart for the table of fits and clearances.

Connecting Rod Bearings — to renew

The connecting rod big-end bearings may be renewed with the engine in the car, after the sump has been removed.

Remove the sparking plugs to permit the crankshaft to be turned over easily. This can be done by hand, after removing the flywheel lower cover.

Turn the engine until one of the connecting rod caps is at bottom dead centre, then remove the split pins and nuts. Lightly tap on the ends of the bolts with an aluminium drift, at the same time pulling down on the cap, which can then be removed with the lower bearing shell. Oil may sometimes cause the shell to stick to the crankpin. Push the rod up sufficiently to allow the bolts to be swung clear of the crankshaft journal; remove the shell from the rod. Wipe the journal clean, using lint-free cloth, then carefully measure the journal with a micrometer for wear and ovality.

The journal diameter of the crankpin is 1·9985 in. (+0·0005 in.) and the worn dimension must not be below 1·9975 in.

The running clearance between the crankpin and connecting rod big-end bearing is 0·0012 in. to 0·002 in. measured in the plane of the rod centre line. The worn clearance must not exceed 0·0045 in. Bearings on which the lead plating has worn through should be discarded. The 'draw' between the bore of

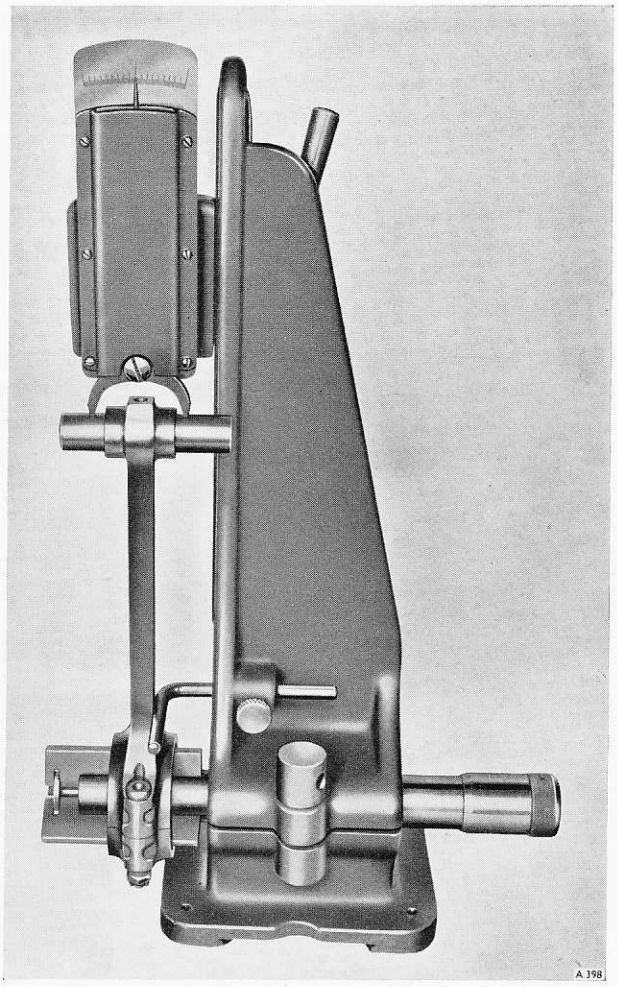


Fig. E23 Connecting rod alignment test

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the rod and the outer diameter of the bearing shell, i.e. (the amount that the diameter of the shell is larger than the bore of the rod) is 0·004 in. to 0·006 in. This 'draw' is necessary to ensure that the shell is firmly positioned between the rod and the cap and to prevent the bearing from rocking or fretting in the bore. The upper and lower bearing shells are interchangeable.

Connecting Rod Bearings — to fit

The new bearings must be thoroughly cleaned before inserting in the rod and cap. Fit the shell in the correct position in the rod, smear the shell with oil, then pull the rod down onto the crankpin.

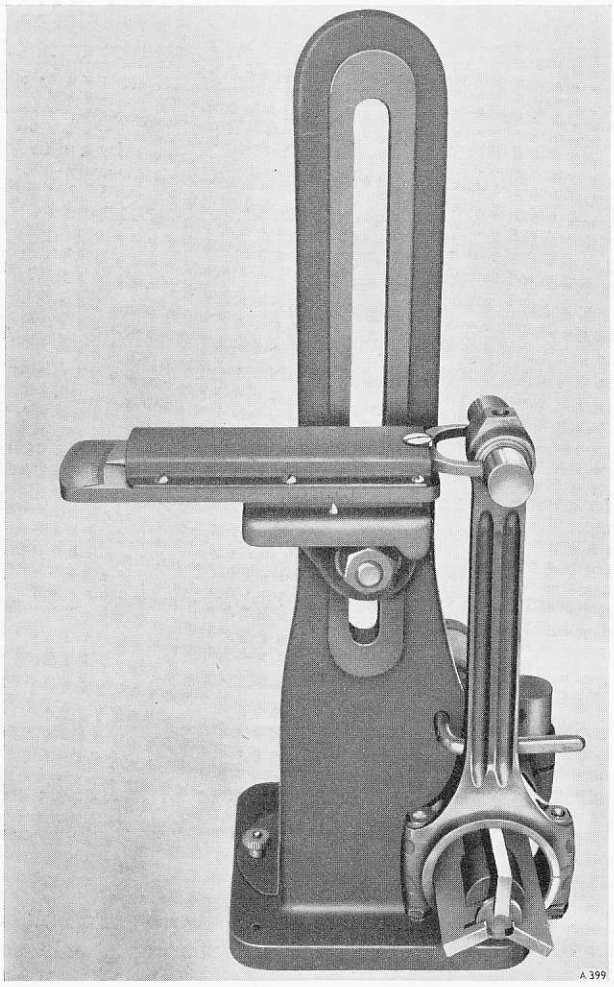


Fig. E24 Connecting rod twist check

Fit the shell in position in the cap, oil the bearing and re-fit the cap on the rod to line up with the number marked on the connecting rod. Tap lightly into position, using an aluminium drift. Ensure that the bolt head tangs are fully registered in their slots before re-fitting, tightening and split-pinning the nuts. When tightened, the rods should be such a fit that they can be laterally moved along the crankpin. Do not file the cap or connecting rod.

If required, oversize connecting rod bolts are available in 0·002 in. and 0·004 in. shank oversizes. No attempt must be made to drive the bolts into the rod. The bolts should be a hard, push-fit in their holes.

Pistons, Rings and Gudgeon Pins — to fit

Remove the cylinder head as detailed in Section E8. Remove the sump. Remove the piston and connecting rod assemblies. Clean and measure the cylinder bore, using a suitable dial indicator gauge.

No attempt should be made to fit new pistons in cylinders which are outside the wear and ovality limits. Cylinders which measure in excess of 0·004 in. wear or 0·003 in. ovality must be re-bored and oversize pistons and rings must be fitted.

Slightly scored pistons may be stoned, but heavily scored pistons must be discarded.

Remove the piston rings, clean the rings, grooves and pistons. Check the ring clearance in the grooves. Measure the pistons across the thrust axis at the top of the skirt. Pistons are graded for size and weight by figures and symbols stamped on the crown:

Grading letter	*Piston diameter (standard)*
F	3·7485 in. to 3·7488 in.
G	3·7489 in. to 3·7492 in.
H	3·7493 in. to 3·7496 in.
J	3·7497 in. to 3·7500 in.

Oversize grading symbols may be determined by adding the oversize figure to the above. For example, 0·005 in. oversize pistons graded 'F' would be 3·7535 in. to 3·7538 in. Piston clearance in the bore should be 0·0012 in. to 0·0015 in. measured at the top of the skirt at 90 deg. to the gudgeon pin axis.

Compression rings must be the same size as the oversize pistons to which they are fitted. When checking the gap in a worn bore, it should always be measured on the least worn portion. If the ring is to be filed by hand,

it is best done by placing the ring on a smooth block of wood and using a smooth file. Avoid clamping a ring in the vice jaws. The ring gap is 0·015 in. to 0·019 in.

The Duaflex scraper ring requires no fitting. The standard ring is suitable for use up to 0·019 in. above nominal bore size. A 0·020 in. oversize ring is suitable for all remaining oversize pistons. Assemble the Duaflex rings first from the top of the piston and not by sliding the ring up the skirt. This avoids any risk of scoring the skirt.

Fit the octagonal expander in the ring groove, then fit one of the scraper rails followed by the wavy centre spring; finally fit the other two scraper rails above the centre spring.

Install the two lower compression rings, then the chromium plated compression ring. Ensure that the markings on the compression rings are at the top.

Before fitting the rings, roll them around the piston grooves to ensure that they do not bind or stick.

When withdrawing or re-fitting the gudgeon pins, immerse the pistons in hot water for a few minutes. The resulting expansion permits the pins to move freely in the pistons.

Pistons and gudgeon pins are supplied as an assembly and are carefully weighed in order to maintain engine balance. Gudgeon pins are selectively fitted and must be kept to their individual pistons.

Pistons should be selectively gauged and fitted to cylinders, then properly stamped; fit them to their respective connecting rods after checking rod alignment and gudgeon pin fit in the rod bush.

The piston must be fitted to the rod so that the split of the piston skirt is opposite to the 0·031 in. oil holes in the side of the rod. The complete assembly should then be fitted to the crankshaft with the split to the camshaft side of the engine.

Before assembly, the interior of the crankcase must be thoroughly washed with paraffin, then dried under air pressure. Special attention should be given to the crankshaft, main bearings and camshaft bearing webs. Oil the pistons, rings and bearings before assembly and stagger the ring gaps.

Gudgeon Pins and Bushes

The gudgeon pin bushes are pressed into the connecting rod small-ends with the split in the bush facing away from the oil spray hole in the rod. The interference fit between the rod and the bush is 0·0025 in. to 0·004 in.

The bushes are diamond bored in position and bushes should be renewed if the clearance exceeds 0·0005 in. Gudgeon pin interference in the piston bosses is 0·0002 in.

Where diamond boring facilities are not available, the bushes must be high-speed turned to obtain as fine a finish as possible. Reaming does not give satistory results, and should not be attempted. The final machined bush bore is 0·7501 in. (+0·0002 in.) giving a gudgeon pin clearance of 0·0001 in. to 0·0003 in.

Connecting Rods — to align

Alignment of the connecting rods is of the utmost importance. After re-bushing and boring, the rods should be aligned on a reliable connecting rod aligning fixture. Bent connecting rods will produce a light knock under acceleration, besides causing uneven and premature wear between the cylinder and piston.

If an alignment indicator is not available, a check should be made on a surface table with the aid of 'Vee'-blocks and a dial gauge. Insert a gudgeon pin in the small-end bush and a mandrel in the big-end. With the mandrel levelled in the 'Vee'-blocks and the rod vertical, take readings at both ends of the gudgeon pin. The discrepancy must not exceed 0·0005 in. per in. length between the two test points on the gudgeon pin.

The rod must then be tested for 'twist'. With the rod centre line parallel to the table, test in a similar manner to the alignment test. The discrepancy in this case must not exceed 0·001 in. per inch between test points.

A rod will respond to corrective treatment where the inaccuracies are small, but where larger errors exist, a new rod must be fitted.

Connecting Rod Bolts

The connecting rod bolts must be renewed if overstressed or stretched. This will be indicated by 'waisting' of the bolt. Take micrometer readings and renew any bolt showing a variation of over 0·001 in. along its shank.

The bolt diameter is 0·3745 in.–0·375 in. and should be a push fit in the rod and cap. Where a new bolt is found to be a loose fit, the rod and cap should be reamed and oversize bolts should be fitted. These are available in 0·002 in. and 0·004 in. oversizes.

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SECTION E8 — THE CYLINDER HEAD

Special tools required:

RH.365 — Compressor, Inlet Valve Spring
RH.558 — Valve Holder
RH.561 — Reamer, Inlet Guide
RH.167 — Dowel Pin, Cylinder Head
RH.643 — Guide Drawer
Local manufacture — Drift, Removing Inlet Valve Guide

Description

The detachable aluminium alloy cylinder head is fitted with nickel chrome steel inlet valve seats and cast-iron valve guides. The top face carries the rocker shaft and inlet valve operating rockers.

The core plugs are of nickel plated brass and the screwed-in sparking plug adapters are of aluminium bronze.

The compression ratios for the different models are as follows:

Rolls-Royce Silver Cloud (early cars)	6·6 : 1
Rolls-Royce Silver Cloud ('D' series onwards)	8 : 1
Bentley S1 (early cars)	6·6 : 1
Bentley S1 ('E' series onwards)	8 : 1
Bentley Continental S1 BC–1 — AF to BC–20–BG	7·25 : 1
Bentley Continental S1 DC–21–BG onwards	8 : 1

The Cylinder Head — to remove

Disconnect the earth connection from the negative side of the battery. Remove the oil level dipstick and cover the aperture. Remove the air cleaner assembly, taking care not to spill the oil in the reservoir of the oil bath type cleaner, if fitted.

Drain the coolant and disconnect the upper radiator hose and by-pass hose.

Disconnect the supply hoses from the vacuum water taps for the heater and de-mister systems.

Disconnect the tube from the windscreen washer.

Remove the rocker cover breather pipe and the rocker cover, together with the high tension leads and conduits.

Disconnect the throttle controls and fuel feed pipes at the carburetters. The head may be removed without disturbing the carburetters, if desired.

Disconnect and unclip the electrical leads from the coolant temperature transmitter.

Disconnect the leads from the automatic choke.

Disconnect the high tension lead from the ignition coil and the low tension lead from the coil and distributor. Remove the coil, then the distributor with its housing, having previously marked the driving shaft for re-assembly. Cover the aperture.

Disconnect the induction manifold hot-spot pipe at the coolant pump, and the fuel drain pipes from the float chamber cover.

Progressively unscrew, half a turn at a time, the five nuts securing the valve rocker shaft pedestals to the head and remove the rocker shaft assembly.

Remove the tappet covers. Lift out the push rods. The inlet tappets are numbered 1 to 6 and must be re-fitted in their respective bores, if removed.

On Bentley Continental S1 cars only. Disconnect the clip situated under the left-hand side of the water pump retaining the oil supply pipe to the distributor.

Progressively unscrew the cylinder head setscrews commencing with those at the ends and working inwards. Lift the cylinder head from the block, using a 'T'-piece, screwed on to the rear rocker cover stud, and lifting with equal upward pressure on the thermostat casing. Should the joint be difficult to break, the engine should be turned over with the sparking plugs in position, but not connected.

Sparking Plug Adapter — to renew

The sparking plug adapters are screwed into the head and have an interference fit of 0·002 in. which must be maintained. Oversize adapters are available if necessary.

Unscrew the locking ring (left-hand thread), with a peg spanner. Tap in a square section tapered drift and unscrew the adapter, which has a right-hand thread.

Clean up the threads in the cylinder head and select an adapter to give the required interference fit.

Heat the cylinder head in an oven for one hour at 300 deg. F (150 deg. C), and screw in the adapter. Screw in and tighten the locking ring.

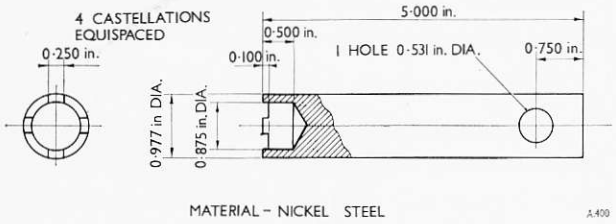


Fig. E25 Plug — locking ring removing tool

Inlet Valve Guides — to renew

Using the piloted drift made up as shown in Figure E6, drive out the old guide from the combustion chamber end. Clean the bore in the head.

Push the new guide into position by hand as far as it will go, then measure the clearance between the shoulder of the guide and the face of the cylinder head. This should be between 0·050 in. and 0·075 in. If the clearance is found to be below this limit, fit a 0·002 in. oversize guide.

Draw the guide into the bore using the draw-bolt, Special Tool RH.643.

Ream out the guide with the special reamer, Tool RH.561, using a suitable cutting oil.

Inlet Valve Seat — to renew

The valve inserts are screwed into the head and have an interference fit of 0·002 in.

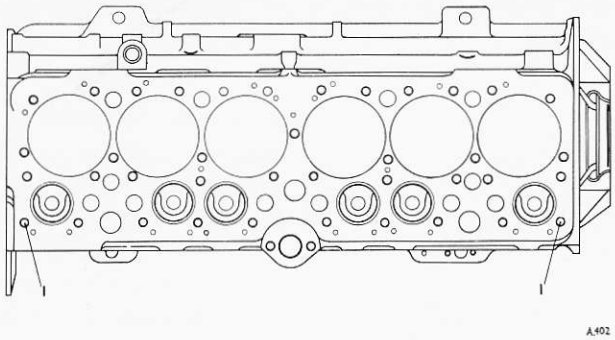


Fig. E26 Cylinder head dowel position

Heat the cylinder head in an oven at 300 deg. F (150 deg. C) for one hour. Tap a square section tapered drift into the insert to obtain a good 'bite' and unscrew it with a suitable spanner.

When cool, clean up the threads in the head.

Again heat the head for one hour at 300 deg. F (150 deg. C) and screw in the insert. Machine off the spannering head and lock the insert in position by centre punching. Grind and finish the seats as described in Section E10.

Cylinder Head — to fit

Fit the cylinder head to the block, reversing the procedure given for removal and noting the following points.

It is essential that the new steel gasket is accurately positioned relative to the cylinder bores and to ensure this, the two special dowel pins, RH.167, should be secured into the upper crankcase face in the positions shown in Figure E26.

No jointing compound is necessary.

The cylinder head tightening sequence is shown in Figure E27.

For final assembly and tuning instructions, see Section E10.

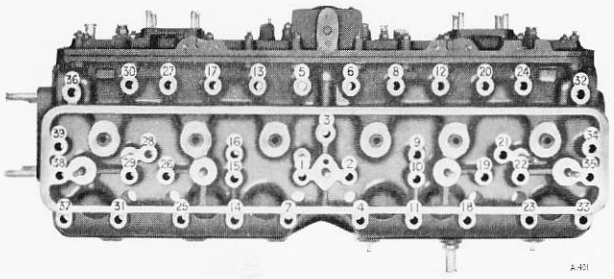


Fig. E27 Cylinder head tightening sequence

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SECTION E9 — VALVE GEAR

Description

Overhead push rod operated inlet valves and side exhaust valves are fitted. The exhaust valves have 'Stellite' treated, heat resisting faces. Dual springs are fitted to the inlet valves.

The overhead valve gear is lubricated by the low pressure delivery from the relief valve unit via the external rocker and timing case feed pipe, and internal drillings in the cylinder head, pedestal and rocker shaft. The rocker arms and bushes are drilled to provide a delivery to the push rod ends and valve stem end faces.

Whenever an overhaul is carried out, the push rods should be checked for bow; rods out of truth should be renewed.

The maximum permissible wear between the rocker arm bush and shaft is 0·003 in. with a maximum of 0·001 in. wear on the shaft. If worn in excess, withdraw the shaft from the rocker arm assemblies, placing them in a suitable container to facilitate assembly in their original positions.

Press out the old bush and remove the valve adjusting screw and lock-nut. Position the new bush with the split uppermost so that when pressed into the rocker arm the groove will be in line with the oil drilling leading from the adjusting screw end.

Drill 0·125 in. through the oil groove in the bush. Ream the bush to 0·7495 in. (+0·00025 in.) giving a running clearance of 0·001 in. to 0·0015 in. on the rocker shaft. Wash off with paraffin and dry by using a high pressure air supply. If it is necessary to re-bush

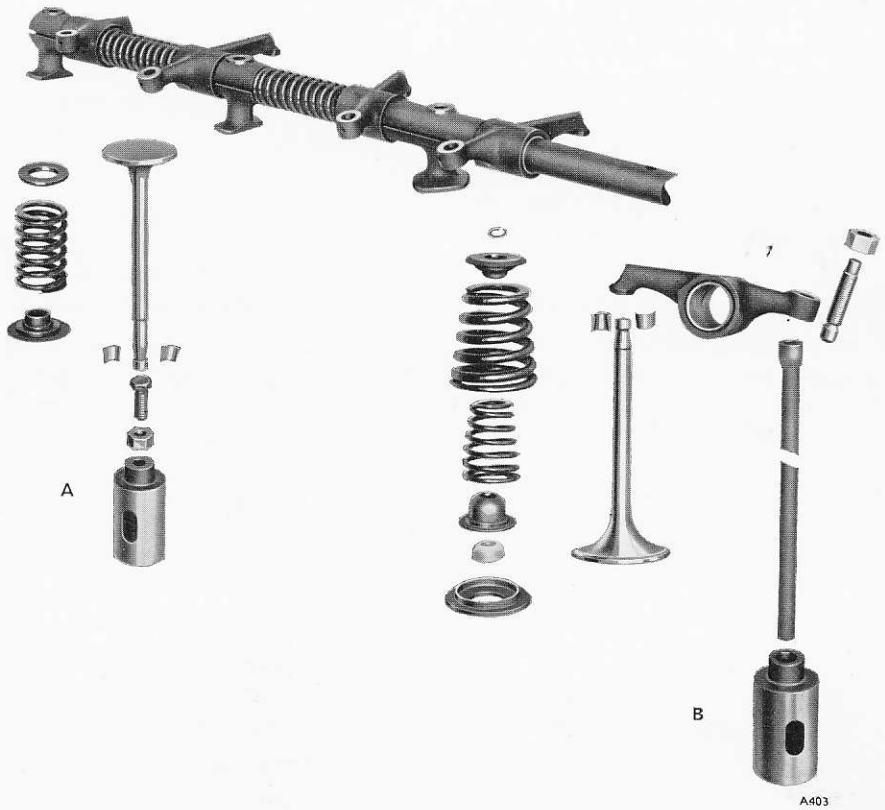


Fig. E28 Valve gear

A. EXHAUST B. INLET

any rocker arm the remaining bushes should also be renewed.

Examine the valve stem contact face of the rocker arm pad for wear and re-face if worn.

Note: This pad is case hardened to a depth of 0·015 in.–0·025 in. and after grinding or stoning it must be of Rockwell hardness C57–C65. If the readings are below this figure renew the rocker.

Lubricate all bearing surfaces with engine oil, re-assemble the rockers and springs on the shaft, ensuring that they are fitted in their original positions.

Inlet Valve Springs — to renew without removing cylinder head

Special tools required:

RH.365 — Compressor — Inlet Valve Spring
RH.588 — Valve Holder

With the rocker shaft assembly removed, set up the spring compressor and valve holder as shown in Figure E29. The locking nut (see '3') on the valve holder should be unscrewed sufficiently to release the split taper collet which grips the spindle (see '2'). The curved end of the spindle can then be inserted into the sparking plug hole and the holder (see '1') screwed into position. Tighten the locking nut whilst holding the spindle up in the hollow of the valve head by means of the tommy bar.

Compress the spring and remove the split collets.

Renew the springs and re-fit the retaining collets. Remove the spring compressor and valve holder.

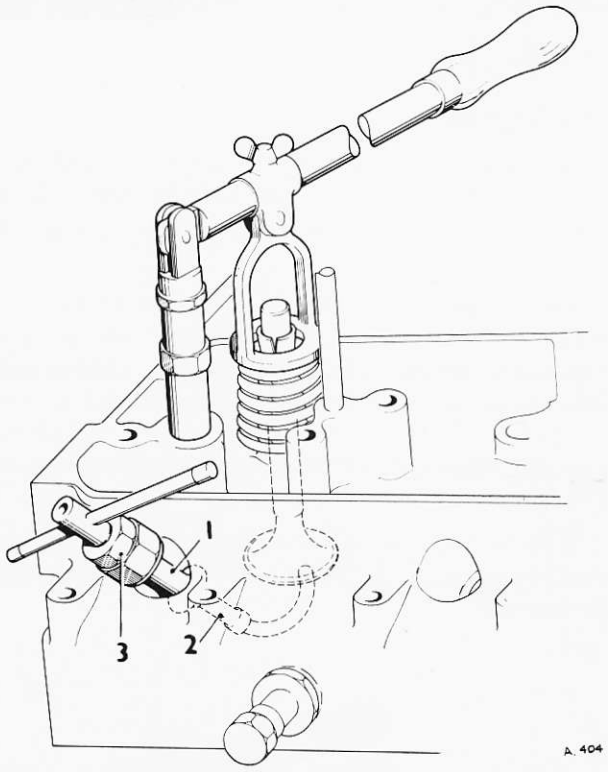


Fig. E29 Changing inlet valve springs in position

1. HOLDER 2. SPINDLE 3. LOCKING NUT

Note: For removing and re-fitting the valves, reconditioning the valves and seats, testing the valve springs and setting the valve clearance, see under 'Decarbonisation', Section E10.

For renewing the valve guides see under 'Cylinder Block', Section E3, and 'Cylinder Head', Section E8.

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SECTION E10 — DECARBONISATION

Special tools required:

RH.365 — Compressor — Inlet Valve Spring
RH.441 — Compressor — Exhaust Valve Spring
UR.964 — $\frac{5}{16}$ in. UNF Jaw Spanner
RH.571 — Tappet Holding Spanner
UR.960 — Inlet Rocker Screw Spanner
RH.167 — Cylinder Gasket Dowel Pins (2)

Note: Normally top decarbonisation is required after periods of 20,000 to 25,000 miles running

Cylinder Head — to remove

See under 'Cylinder Head', Section E8.

Carbon — to remove

Carbon should be removed from the cylinder head, piston crown and cylinder block face with a blunt tool or a wire brush. Sharp tools must not be used on the aluminium head and pistons. Care must be taken not to allow carbon to enter the coolant holes of the cylinder block.

Wash the head in clean paraffin and blow out with compressed air.

Ensure that the oilway to the centre rocker pedestal is clear.

Inlet Valves — to remove

Insert a block of wood of suitable size in the combustion chamber to support the valve. Secure the inlet valve spring compressor to the appropriate rocker shaft pedestal stud and press down the lever. Remove the split collets.

The parts from each valve assembly should be retained in sets and restored to the valve from which they were removed. The valves should be re-fitted to their original guides. On initial assembly the valves are numbered from 1 to 6 by etching near the bottom of the stem.

Exhaust Valves — to remove

To prevent parts falling into the sump, block up the oil return holes in the bottom of the tappet chamber and the large hole from the tappet chamber to the wheelcase with clean cloth.

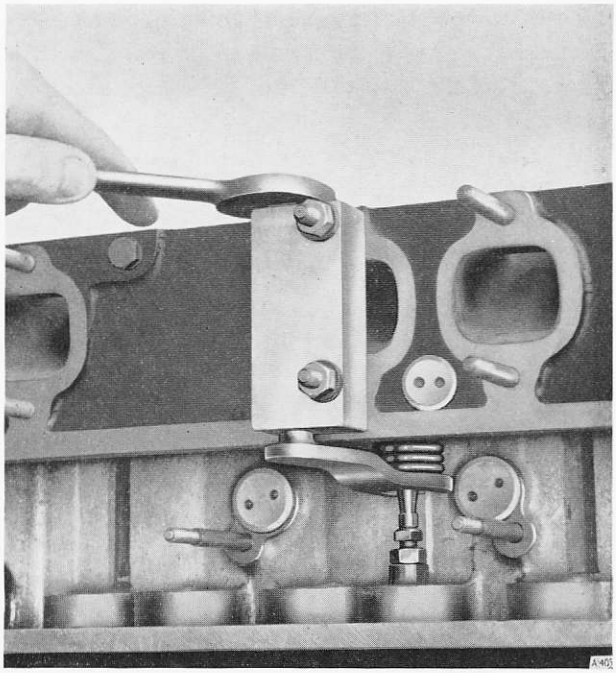


Fig. E30 Removing exhaust valves

With the valve closed mount the exhaust valve spring compressor on the appropriate exhaust manifold studs and compress the spring (see Fig. E30). Remove the split collets and then the valve spring. Should the top washer be displaced when removing the spring, smear it with grease and re-fit it in position.

Parts from each valve assembly should be retained in sets and restored to the valve from which they were removed. The valves should be re-fitted to their original guides. On initial assembly the valves are etched from 1 to 6 near the bottom of the stem.

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Valve Guides — to examine for wear

Insert a new valve in the guide and with the valve in its **open** position (i.e. inlet valve lifted 0·317 in. or exhaust valve lifted 0·375 in.) check with a dial indicator the maximum movement from side to side of the valve head.

The maximum permissible valve head side movement, when using a new valve is:

Exhaust valve 0·0113 in. Inlet valve 0·0084 in.

Excessive movement of either valve head will necessitate the renewal of the valve guide.

Figure E31 illustrates the dial indicator in position. It will be necessary to manufacture locally a suitable extension piece for the needle as shown. The vertical portion of the extension should be kept as short as possible.

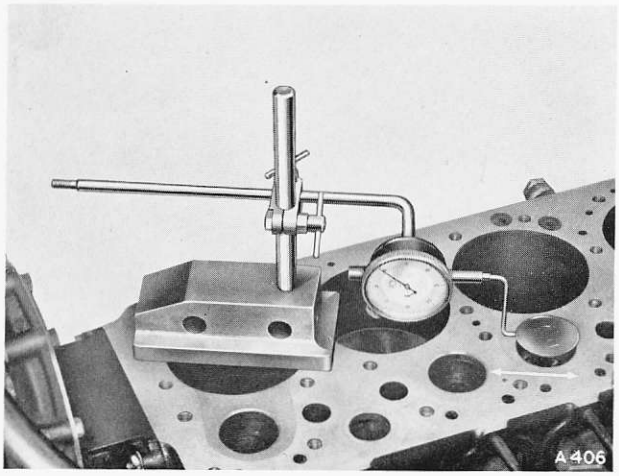


Fig. E31 Checking valve guide wear

Valves and Seats — to re-face

Remove all carbon from the valve heads and stems with a wire wheel or suitable scraper.

Re-face the valves and seats to 45 deg. with standard valve reconditioning equipment, removing the least amount of metal possible to give a clean face. Care must be taken to prevent grinding dust from entering the tappet chambers or cylinder bores. The diameter of the pilot for re-facing the inlet valve seats should be 0·343 in. and for the exhaust valve seats 0·375 in. If necessary valve seats may be crowned with a 30 deg. cutter to avoid pocketing. If seats require renewing, see Section E3 (Exhaust Valve Seats) or E8 (Inlet Valve Seats).

Lightly lap each valve on to its seat with a fine, good quality lapping compound, then test the seating with Prussian Blue. Before lapping the exhaust valves, the tappet adjusting screws should be screwed down several turns to provide clearance.

Wash the valves and seatings with paraffin to remove all traces of lapping compound, ensuring that the compound is not permitted to enter the crankcase.

If valve reconditioning equipment is not available the valves may be ground by hand using a good quality paste and a rubber suction valve holder. Test the seatings with Prussian Blue.

Valve Springs — to test

The valve springs should be examined for visible defects and checked for poundage on an accurate Valve Spring Tester in accordance with the following data:

Spring	Compressed to	Poundage new	Minimum acceptable poundage
Inlet, outer	1·600 in.	42 – 48 lb.	35
Inlet, inner	1·300 in.	13 – 17 lb.	10
Exhaust	1·170 in.	111 – 118 lb.	85

Valves — to re-fit

Inlet valve

Oil the valve stems and fit a new valve stem packing and retaining ring.

Reverse the procedure for removal. After fitting, tap the top of the stem with a hide mallet to ensure that the collets are seating correctly.

Exhaust valve

With the oil return holes in the tappet chamber covered and the washers in position, oil the valve stems and re-fit them by reversing the procedure for removal. Ensure that the retaining collets are correctly seated with the aid of a hand lamp and mirror.

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Exhaust Valve Tappet Clearance — to set

Normal Exhaust Tappet Clearance: 0·012 in. (cold).

Under sustained high speed conditions the recommended 0·012 in. setting is insufficient to maintain adequate clearance for large mileages, and unless tappet adjustment is carried out frequently, this will result in burning of the valves.

In view of the difficulties and inconvenience involved in frequent tappet adjustment, it is recommended that exhaust tappet clearance should be increased to 0·015 in. (cold) when cars are known to be subjected to sustained high-speed driving.

Note: It is not recommended that the 0·015 in. setting be employed in general use owing to the increase in engine noise. The 0·012 in. clearance is adequate for all normal driving conditions.

Connect the battery lead and crank the engine by means of the starter motor. Operate the starter motor by pressing the rubber starter button of the solenoid switch.

Ensure that the tappet to be adjusted is on the base of the cam. When No. 6 valve is fully open, No. 1 tappet will be on the cam base, and similarly with Nos. 2 and 5, and 3 and 4. After adjusting No. 1 valve, rotate the crankshaft one-third of a revolution, when No. 3 will be fully opened. Adjust No. 4 tappet and carry on in the normal firing order.

To prevent the exhaust tappet from turning, place the tappet spanner (see Fig. E32) onto the exhaust and adjacent inlet tappet.

Using two spanners, slacken the locknut and adjust the adjusting screw to give the correct clearance; tighten the locking nut whilst holding the adjusting screw, then check the clearance.

Re-fit the tappet covers.

Cylinder Head — to re-fit

See under 'Cylinder Head', Section E8.

Re-fit the push rods; these are numbered to ensure correct re-assembly.

Unlock the lock-nut of each valve clearance adjusting screw on the rockers and unscrew the adjusting screw as far as possible. Re-fit the rocker shaft spherical washers and nuts and tighten down progressively working from the centre outwards to prevent distortion of the shaft.

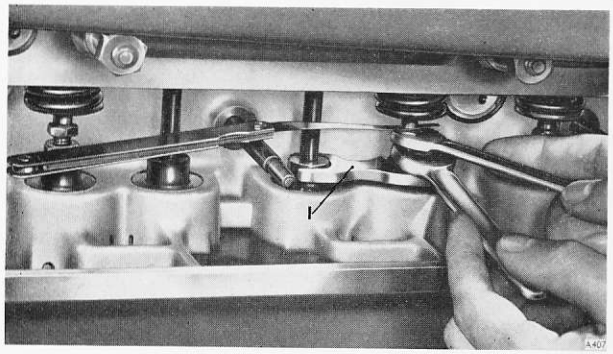


Fig. E32 Exhaust tappet locking tool

1. LOCKING PLATE

Adjust the inlet valve rocker clearance to 0·006 in. (cold). Before adjusting, ensure that the tappet of the valve to be adjusted is on the base of the cam.

Final Assembly and Tuning

Remove the contact breakers from the ignition distributor, trim the points and set the gaps to 0·019 in.–0·021 in. Re-fit the distributor and housing as follows:

1. Turn the crankshaft until No. 1 piston is at T.D.C. on its firing stroke.
2. Turn the distributor spindle until the rotor arm is in line with the No. 1 cylinder firing position (approximately 11 o'clock). Fit the distributor and secure the housing to the cylinder block. Full details of ignition timing are given in Section M5.

Before re-fitting the induction manifold, fit a new element to the Full-Flow filter and fill with clean engine oil. Fit a new rubber seal to the cover and a new washer to the retaining nut.

Clean the sparking plugs and set the gap to 0·025 in.

Drain and renew the engine oil. Re-fill the cooling system. Remove and clean the filter gauzes of the fuel strainer located on the cross member in front of the fuel tank. Drain and clean the bowl, fitting a new cork joint to the cover if necessary. Remove and clean the gauze filters at the unions of the fuel inlets to the carburetters.

Clean out the carburetter float chambers. Full details of Carburation are given in Chapter K of the Workshop Manual.

Start the engine and check for oil and coolant leaks. Check that oil is passing from the oil holes in the

rockers on to the valve stems and the ends of the push rods. The holes may be cleared with fine wire but must not be enlarged.

Re-fit the rocker cover and its breather pipe.

Re-fit the air cleaner (see Chapter K of the Workshop Manual).

After the road test and with the engine warm, remove the rocker shaft and tighten the cylinder head setscrews in the correct sequence (see Fig. E26). Re-fit the rocker shaft and set the inlet rocker clearances to 0·006 in. with the engine cold.

Re-assemble the remaining parts.

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Section E2

S3 ENGINE DATA

SPECIFICATION

Type	Over square 90° V formation, liquid cooled.
Number of cylinders	Eight—in two banks of four.
Bore	4·100 in.
Stroke	3·600 in.
Cubic capacity	380·2 cu. in. (6,230 c.c.).
R.A.C. rated H.P.	53·8.
Compression ratio	9:1 for engines destined for North America, Japan and Europe except Portugal, Spain, Yugoslavia, Greece, Turkey, Finland, Malta, Holland and Cyprus. 8:1 all other countries.
Suspension	The engine and gearbox are of unit construction. The unit is flexibly mounted on rubber at three points. Single-point at the front and two-point at the rear.

CYLINDER BLOCK

Type	Monobloc casting.
Material	Cast aluminium alloy.

CYLINDER LINERS

Type	Detachable wet liners.
Material	Centrifugally spun cast iron.

CYLINDER HEADS

Description	Two detachable heads, each having four separate inlet and exhaust ports.
Material	Aluminium alloy, with phosphor bronze exhaust valve guides and cast-iron inlet valve guides and with exhaust and inlet valve seat inserts of austenitic steel.

CRANKSHAFT

Description	Five journal crankshaft with four crankpins incorporating sludge traps. Integral balance weights and dynamically balanced.
Material	Chrome molybdenum steel with nitride hardened journals and crankpins.
Damper	Metalastik rubber vibration damper.
Direction of rotation	Clockwise.

MAIN BEARINGS

Type	Split thin shells with 'pre-sized' bores to suit crankshaft journal diameter.
Material	Steel backed copper-lead with either lead-tin or lead-indium overlay.
Number	Five.

CONNECTING RODS

Type	'H' section. Forged to size and balanced.
Material	Chrome-molybdenum steel.
Big-end bearings	Steel backed copper-lead with either lead-tin or lead-indium overlay.
Gudgeon pin bushes	Pressed into connecting rod small-end bosses.
Material	Lead-bronze, steel backed.

PISTONS

9:1 compression ratio

Type	Full skirt with a flat crown and offset gudgeon pin.

8:1 compression ratio

Type	Full skirt with a recessed crown and offset gudgeon pin.
Material	Aluminium alloy.
Number of rings	Four. Three compression rings and one oil control ring. Top compression ring is chromium plated. Bottom two compression rings have tapered edges.

VALVE GEAR

Inlet valves	Overhead push rod operated. Single spring. Steel collets with rubber seals to control valve stem lubrication. Seat angle 45°.
Material	EN 24 or S.65.
Exhaust valves	Overhead push rod operated. Single spring. Steel collets with rubber seals to control valve stem lubrication. Seat angle 45°.
Material	KE 965. Stellite tips and valve seats. Brightray coated head.
Valve timing	5° A.T.D.C.
Tappets	Self-adjusting hydraulic tappets with spherical base.
Material	Hardenable cast-iron.
Push rods	Ball-ended tubes.

CAMSHAFT

Material	Cast Monikrom iron.
Cams	5° to 7° longitudinal taper.
Number of journals	Four.
Bearings	Four babbit lined steel shells.
Thrust taken	On front end.
Drive	Through helical tooth gears.

LUBRICATION SYSTEM

General	High pressure oil feed to crankshaft, connecting rods, camshaft bearings, tappets, push rods and rocker ball end seatings and camshaft timing gears. Intermittent oil feed through the front camshaft bearing to rocker shaft, rocker arms and valve tips. Splash feed to connecting rod small-ends, gudgeon pins and cylinder walls.
Type	Pressurised wet-sump system.
High pressure supply	1,000 r.p.m. 37 lb./sq. in.
Relief valve	40 lb./sq. in.
Sump capacity	Minimum—6 pt. (Imp.), 7·2 pt. (U.S.), 3·4 litres. Maximum—12 pt. (Imp.), 14·4 pt. (U.S.), 6·82 litres.
Oil pump	Helical gear type with fine mesh strainer pick up.
Oil filter	'British Filters' Full Flow type with built-in relief valve.

FUEL SYSTEM

Carburetters	Two S.U. H.D.8 diaphragm type 2·00 in. choke bores. Automatic choke for cold starting.
Air cleaner	Either a Purolator paper type element or an oil wetted wire mesh filter element depending upon which country the engine will be operating in. For details see latest Service Bulletin Section D, dealing with this subject.
Fuel pumps	Twin S.U. electric.
Fuel tank capacity	18 galls. (Imp.), 21·6 galls. (U.S.), 81·8 litres.
Fuel strainers	Main fuel strainer mounted on the frame member in front of the fuel tank. Small gauze strainer at the carburetter inlets and in the fuel pumps.
Fuel gauge	Electric. Registers when the ignition is switched on.

COOLING SYSTEM

Coolant capacity	21 pt. (Imp.), 25·21 pt. (U.S.), 11·93 litres.
Pump	Centrifugal.
Fan	5-blade.
Fan diameter	18 in.
Pump and fan drive	$\frac{13}{16}$ in. adjustable 'V' belts.
Radiator matrix	Film type.
Coolant temperature control	82°C.-86°C.
Temperature indicator	On instrument panel. Electric, registers when ignition switch is on.
Coolant	An inhibited solution of ethylene glycol (B.S.S. 3150).

EXHAUST SYSTEM

Through frame exhaust system. Large diameter pipes with two stainless steel resonators, and one stainless steel absorption damper in series. The front resonator is semi-acoustic and the rear resonator is fully acoustic.

IGNITION DISTRIBUTOR

Make and type	Lucas 20 D8. Eight lobe cam with double contact breakers, one contact breaker serves to make and the other to break the low tension circuit.
Rotation	Anti-clockwise.
Advanced mechanism	Automatic centrifugal advance with built-in vacuum timing control.
Ignition timing	2° B.T.D.C.
Firing order	A1, B1, A4, B4, B2, A3, B3, A2. (1, 5, 4, 8, 6, 3, 7, 2).
Contact gap	0·014 in.-0·016 in.
Drive	Through camshaft skew gears.

IGNITION COIL

Make	Lucas.

SPARKING PLUGS

9:1 compression ratio	
Make and type	Champion RN.8.
8:1 compression ratio	
Make and type	Lodge CLNP, Champion RN. 13P or Champion RN.8.
Gap	0·025 in.

Section E3

ENGINE DIMENSIONAL DATA

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
CRANKCASE AND CYLINDERS			
Cylinder liner bore grading ..	H. 4·100 in. — 4·1003 in. J. 4·1004 in. — 4·1007 in. K. 4·1008 in. — 4·1011 in. L. 4·1012 in. — 4·1015 in. M. 4·1016 in. — 4·1019 in.	0·004 in. Wear. 0·003 in. Ovality.	If these measurements are exceeded a new assembly of liner and piston must be fitted.
Cylinder liner "nip"	0·002 in. — 0·003 in		New liners must be selectively fitted or ground on the end to give this dimension.
PISTONS			
Piston grading	H. 4·0985 in. — 4·0988 in. J. 4·0989 in. — 4·0992 in. K. 4·0993 in. — 4·0996 in. L. 4·0997 in. — 4·1000 in. M. 4·1001 in. — 4·1004 in.		Piston clearance in the bore 0·0012 in. — 0·0018 in. measured 0·906 in. from the bottom of the skirt across the thrust axis.
Compression ring groove widths ..	0·0807 in. — 0·0817 in.		
Compression ring widths	0·0777 in. — 0·0787 in.		The rings should be assembled with staggered gaps.
Clearance	0·002 in. — 0·004 in.	0·005 in.	
Compression ring closed gap ..	0·015 in. — 0·020 in.	0·025 in.	
Open gap, nominal	0·520 in.		
Scraper ring groove width ..	0·178 in. — 0·179 in	0·181 in.	
Scraper ring width	0·1755 in. — 0·1760 in.		Neglecting spring.
Clearance	Nil.		Clearance taken up by spring load.
Closed gap	0·015 in. — 0·020 in.	0·025 in.	
Open gap, nominal	0·520 in.		
GUDGEON PINS			
Bore diameter in piston	0·9999 in. — 1·0001 in.		
Gudgeon pin diameter	1·0001 in. — 1·0003 in.		
Interference in boss	0·0002 in.		By selective assembly at room temp. 68–72° F.

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
CRANKSHAFT AND CONNECTING RODS			
Connecting rod small-end bush internal diameter	1·0003 in. — 1·0005 in.		
Clearance on gudgeon pin	0·000 in. — 0·0004 in.	0·0005 in.	At room temp. 68–72° F.
Big-end bearing housing, internal diameter	2·395 in. — 2·3955 in.		
Big-end bearing shell, internal diameter	2·2505 in. — 2·2515 in.		
Crankpin diameter	2·2485 in. — 2·249 in.	2·2475 in.	
Clearance	0·0015 in. — 0·003 in.	0·0035 in.	Clearance measured vertically. Renew bearings if lead plating is worn through.
Small-end bush housing, internal diameter	1·140 in. — 1·1405 in.		
Small-end bush external diameter	1·1425 in. — 1·144 in.		Handpush fit in ring gauge.
Interference	0·002 in. — 0·004 in.		
Connecting rod and cap bolt holes. Diameter for location	0·375 in. — 0·3755 in.		On location diameter.
Connecting rod bolt diameter for location	0·3745 in. — 0·375 in.		On location diameter.
Clearance	Size — 0·001 in.		
Connecting rod bolt diameter	0·389 in. — 0·391 in.		On knurled diameter. Bolts should not be removed from rods unless they are to be renewed.
Connecting-rod and cap bolt diameter	0·3838 in. — 0·3858 in.		
Interference	0·0032 in. — 0·0072 in.		
Theoretical nip on connecting rod bearings shells	0·003 in. — 0·008 in.		
Connecting rod end float	0·008 in. — 0·017 in.		Controlled by clearance between rods and crankpin end faces.
Main bearing shell internal diameter:			
Theoretical	2·501 in. — 2·502 in.		Due to housing expansion under interference fit of shells.
Actual	2·501 in. — 2·503 in.		
Crankshaft journal diameter	2·4995 in. — 2·500 in.	2·4985 in.	
Clearance (Actual)	0·0015 in. — 0·0035 in.	0·0045 in.	Renew bearings if lead plating is worn through.
Crankshaft end float	0·004 in. — 0·010 in.	0·012 in.	
Connecting rod bolt stretch	For 0·005 in. bolt stretch Torque load 32 lb/ft.		

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
MAIN BEARING HOUSINGS			
Bore diameter	2·6655 in. — 2·6660 in.		This diameter should be checked with the main bearing cap nuts in position and torque loaded to 35 lb./ft.
MAIN BEARING CAPS			
Width of cap	5·1005 in. — 5·1010 in.		
Gap width	5·1000 in. — 5·1010 in.		
Interference	0·001 in. minus 0·0015 in.		
Cap nuts	Torque load to 45 lb./ft.		When the bearing shells are in place.
VALVE GEAR			
Camshaft timing gear backlash ..	0·001 in. — 0·0035 in.	0·005 in.	
True running of camshaft gear face	0·000 in. — 0·002 in.		
Camshaft end float	0·002 in. — 0·006 in.		
Camshaft journal diameter ..	1·9975 in. — 1·998 in.	1·9965 in.	
Camshaft bearing, internal diameter	2·000 in. — 2·0005 in.	2·002 in.	
Camshaft journal clearance ..	0·002 in. — 0·003 in.	0·004 in.	
Camshaft bearing, external diameter	2·129 in. — 2·1305 in.		Hand push fit in gauge.
Crankcase bore — diameter for camshaft bearing	2·125 in. — 2·1255 in.		
Camshaft bearing interference in crankcase	0·0035 in. — 0·0055 in.		
Inlet cam and base circle overall dimension	1·465 in. — 1·470 in.	1·455 in.	Cam lift is 0·250 in. Minimum permissible lift is 0·235 in.
Exhaust cam and base circle overall dimension	1·465 in. — 1·470 in.	1·455 in.	Cam lift is 0·250 in. Minimum permissible lift is 0·235 in.
Tappet block bore diameter	Y 0·90475 in. — 0·9050 in. Z 0·9050 in. — 0·90525 in.		
Tappet external diameter ..	Y 0·9040 in. — 0·90425 in. Z 0·90425 in. — 0·9045 in.		
Clearance	0·0005 in. — 0·001 in.	0·0015 in.	
Tappet "leak-down" test ..	Time for a plunger travel of $\frac{1}{8}$ in. under a load of 50 lb. is 20–80 sec. Esso T.S.D.1047 paraffin must be used.	A "leak-down" time of 10–80 sec. will be accepted in service.	This "leak-down" time is critical and any tappet outside these figures should be replaced with a complete assembly. Parts must not be interchanged.

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Exhaust valve guide — external diameter	0·6275 in. — 0·628 in.		
Cylinder head bore diameter for exhaust valve guide	0·625 in. — 0·626 in.		
Interference in head	0·0015 in. — 0·003 in.		
Exhaust valve guide — internal diameter	0·3755 in. — 0·376 in.	0·378 in.	"Bellmouth" at the lower end is permissible up to 0·006 in. for a depth of 0·375 in.
Exhaust valve stem diameter ..	0.37175 in. — 0·372 in.	0·3705 in.	
Clearance	0·0035 in. — 0·00425 in.	0·0060 in.	
Exhaust valve spring compressed to 1·600 in.	82 — 86 lb.	71 lb.	
Exhaust and inlet valve seat angle	45° minus 1/10°		"Crown" with 30° cutter to avoid pocketing after regrinding seat.
Exhaust valve seat insert external diameter	1·7540 in. — 1·7545 in.		
Cylinder head bore for seat insert ..	1·750 in. — 1·751 in.		
Interference	0·003 in. — 0·0045 in.		
Inlet valve seat insert external diameter	2·0290 in. — 2·0295 in.		
Cylinder head bore diameter for seat insert	2·025 in. — 2·026 in.		
Interference	0·003 in. — 0·0045 in.		
Inlet valve guide, external diameter	0·6275 in. — 0·628 in.		
Cylinder head bore diameter for inlet valve guide	0·625 in. — 0·626 in.		
Interference in head	0·0015 in. — 0·003 in.		
Inlet valve guide, internal diameter	0·3755 in. — 0·376 in.	0·3773 in	
Inlet valve stem diameter ..	0·3735 in. — 0·374 in.	0·3723 in.	
Clearance	0·0015 in. — 0·0025 in.	0·005 in.	
Inlet valve spring compressed to 1·600 in.	82 — 86 lb.	71 lb.	
Exhaust valve—overall length ..	5·033 in.		
Inlet valve—overall length ..	5·075 in.		
Distributor gear backlash ..	0·002 in. — 0·004 in.	0·008 in.	

DESCRIPTION	DIMENSION	PERMISSIBLE WORN DIMENSION	REMARKS
Rocker bore diameter	0·74925 in. — 0·74975 in.	0·751 in.	
Rocker shaft diameter	0·74825 in. — 0·7485 in.		
Clearance	0·00075 in. — 0·0015 in.	0·0035 in.	
OIL PUMP			
Driving shaft diameter	0·4990 in. — 0·4995 in.	0·4970 in.	
Shaft bore diameter	0·500 in. — 0·5005 in.		
Shaft clearance in casing bore ..	0·0005 in. — 0·0015 in.	0·003 in.	
Stationary spindle diameter ..	0·499 in. — 0·4995 in.	0·4965 in.	
Driven gear internal diameter ..	0·500 in. — 0·5005 in.	0·5015 in.	
Clearance on spindle	0·0005 in. — 0·0015 in.	0·003 in.	Permissible only when the radial clearance of the gears in the case exceeds this figure.
Diametrical clearance between gears and side of chamber ..	0·0020 in. — 0·0035 in.	0·006 in.	
Pump gears—backlash	0·0005 in. — 0·0025 in.	0·004 in.	
Pump gears—end float	0·001 in. — 0·004 in.	0·005 in.	
Drive gear backlash	0·0012 in. — 0·0033 in.	0·008 in.	
CYLINDER HEAD STUDS			
Stud diameter	Yellow 0·405 in. — 0·404 in. Red 0·404 in. — 0·403 in. Blue 0·403 in. — 0·4019 in.		Studs must be matched to hole, colour for colour.
Threaded hole diameter	Yellow 0·404 in. — 0·403 in. Red 0·403 in. — 0·402 in. Blue 0·402 in. — 0·401 in.		
Interference	0·000 in. to 0·002 in.		
MAIN BEARING HOUSING STUDS			
Stud diameter	Yellow 0·4675 in. — 0·4665 in. Red 0·4665 in. — 0·4655 in. Blue 0·4655 in. — 0·4643 in.		Studs must be matched to hole, colour for colour.
Threaded hole diameter	Yellow 0·4665 in. — 0·4655 in. Red 0·4655 in. — 0·4645 in. Blue 0·4645 in. — 0·4635 in.		
Interference	0·000 in. to 0·002 in.		

OIL PUMP RIG TEST PERFORMANCE

Oil temperature to be 80°C. (176°F.).

Pump R.P.M.	Restricting Orifice Diameter (inches)	Permissible Minimum Pressure (lb./sq. in)
500	0·150 — 0·002	32
1,000	0·105 — 0·002	37
1,500	0·150 — 0·002	40
180	0·100 — 0·002	25 minimum

OIL PUMP RELIEF VALVE SPRING

Free length—1·975 in.

Load when compressed to 1·125 in.—11¼ lb.

Section E4

ENGINE

General description (*Page E15 in Engine Manual*)

First paragraph to read:—

The Rolls-Royce power unit is an over square 'V' engine, having eight cylinders and operating on the four-stroke cycle. It has a bore of 4·100 in. and a stroke of 3·600 in. giving a total capacity of 380·200 cu. in (6,230 c.c.). The compression ratio of the power unit can be either 9·00 : 1 or 8·00 : 1 depending upon which country it will be operating in.

Fourth paragraph to read:—

The nitride hardened dynamically balanced crankshaft is a forging of chrome molybdenum steel, provided with sludge traps in each of the four crankpins and integral balance weights; it is carried in five bearings. These bearings consist of thin steel shells, lined with copper lead indium; the bearings are held in position by forged aluminium bearing caps. Crankshaft end thrust is taken by the centre main bearing, which is fitted with thrust pads at both front and rear.

Sixth paragraph to read:—

The pistons are of aluminium alloy with fully floating gudgeon pins. Engines having a compression ratio of 9·00 : 1 are fitted with pistons having full skirts and flat crowns; these pistons are carried on hardened steel gudgeon pins which are offset to the centre line of the piston.

Engines having a compression ratio of 8·00 : 1 are fitted with pistons having full skirts and recessed crowns; these pistons are carried on hardened steel gudgeon pins which are offset to the centre line of the piston.

Four rings are fitted to each piston—three compression rings and one oil control ring.

First paragraph to read:—(*Page E16 in Engine Manual*)

Air is filtered through either an oil soaked wire mesh filter element or a Purolator paper type, depending upon which country the engine will be operating in.

After passing through the filter element the air is drawn through the carburetters, which are mounted on a 'T' piece over an eight-branch induction manifold.

An automatic choke mechanism is provided for cold starting.

The remaining information is applicable to the S3 engine.

Section E6

ENGINE LUBRICATION

Stage 1 (*Page E25 in Engine Manual*) is not applicable to the S3 engine.

Stages 2 and 3 (*Page E25 in Engine Manual*)

Second paragraph to read:—

The camshaft timing wheel and driving pinion are lubricated by a high pressure jet of oil sprayed directly between the two gears; the feed for this jet is via an adaptor on the oil gallery cover plate. See Fig. 1.

Oil pump (*Page E26 in Engine Manual*)

Third paragraph to read:—

The oil pump driven gear runs on a steel spindle pressed into the pump casing.

The driven gear is not now fitted with a pressed-in bush.

Oil pump—To assemble (*Page E28 in Engine Manual*)

Fourth paragraph is not applicable to the S3 oil pump

To change the oil filter element (*Page E29 in Engine Manual*)

First paragraph to read:—

The felt element of the filter should be renewed every 6,000 miles.

Engine lubrication diagram

The 'Pressure oil jet to camshaft timing gear' shown in Fig. E19 Engine lubrication diagram is not applicable to the S3 engine.

The remaining information in this Section is applicable to the S3 engine.

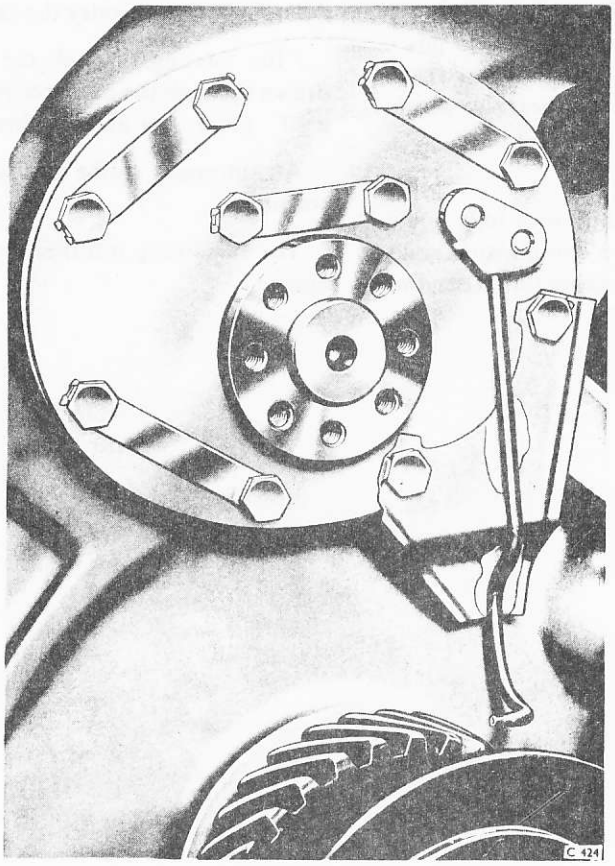


Fig. 1. View of timing gears lubricating jet.

Section E7

CYLINDER HEADS

Description (*Page E31 in Engine Manual*)

The fifth paragraph is not applicable to the S3 engine

The cylinder heads are the same irrespective of compression ratio, the difference being effected by the pistons.

Cylinder heads—To remove (with the engine in the car) (*Page E31 in Engine Manual*)

This paragraph to follow the thirteenth paragraph in the Engine Manual:—

Remove the crankcase breather tube from the oil filler pedestal and butterfly housing.

Cylinder head—To fit (*Page E33 in Engine Manual*)

Fifth paragraph to read:—

Clean the flame traps in the crankcase breather tube by washing them in petrol and drying them with a high pressure air line.

Before re-fitting the union to the oil filler pedestal check the condition of the rubber sealing rings and renew if necessary.

The remaining information in this Section is applicable to the S3 engine.

Section E10

CRANKSHAFT AND MAIN BEARINGS

Description (*Page E39 in Engine Manual*)

The crankpins of the crankshaft are drilled and plugged, as shown in Fig. 2; in this way sludge traps are formed in each of the crankpins, and by means of centrifugal force retain any dirt which may be held in suspension in the oil. This prevents any dirt from reaching the bearings thus reducing wear.

To further reduce wear, the crankshaft is nitride hardened all over.

The paragraph headed **Note** in the description is not applicable to the S3 engine.

The remaining information in the description is applicable to the S3 engine.

Crankshaft—To remove (*Page E40 in Engine Manual*)

This section is applicable to the S3 engine with the addition of the following.

Crankshaft sludge traps—To dismantle

Remove the circlips and withdraw the oil sealing plugs; these plugs can be removed with the aid of a setscrew or stud screwed into the tapped extractor hole.

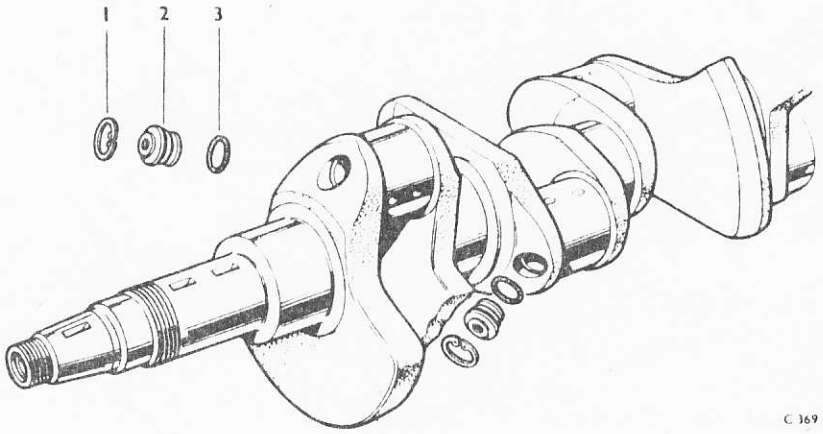
Wash all parts in clean paraffin, paying particular attention to the oilways and sludge traps.

Crankshaft—To regrind (*Page E41 in Engine Manual*)

The crankshaft should be reground when wear or ovality exceeds 0·001 in. or when the crankpins or journals are heavily scored.

Undersize bearings are available in sizes ranging from minus 0·010 in. to minus 0·040 in. in steps of 0·010 in.

The crankshaft journals and crankpins should be reground and lapped to the nearest of the following dimensions which will give a true diameter.



1. CIRCLIP.
2. OIL SEALING PLUG.
3. RUBBER SEALING RING.

Fig. 2. Exploded view of crankshaft sludge traps.

	Crankshaft Journal	Main Shell Bearing
Standard	2·500 in. — 0·0005 in.	2·501 in. + 0·001 in.
0·010 in. undersize	2·490 in. — 0·0005 in.	2·491 in. + 0·001 in.
0·020 in. undersize	2·480 in. — 0·0005 in.	2·481 in. + 0·001 in.
0·030 in. undersize	2·470 in. — 0·0005 in.	2·471 in. + 0·001 in.
0·040 in. undersize	2·460 in. — 0·0005 in.	2·461 in. + 0·001 in.

ACTUAL RUNNING CLEARANCE 0·0015 in. to 0·0035 in.
MAXIMUM PERMISSIBLE CLEARANCE 0·0045 in.

	Crankpin	Big-end Bearing
Standard	2·249 in. — 0·0005 in.	2·2505 in. + 0·001 in.
0·010 in. undersize	2·239 in. — 0·0005 in.	2·2405 in. + 0·001 in.
0·020 in. undersize	2·229 in. — 0·0005 in.	2·2305 in. + 0·001 in.
0·030 in. undersize	2·219 in. — 0·0005 in.	2·2205 in. + 0·001 in.
0·040 in. undersize	2·209 in. — 0·0005 in.	2·2105 in. + 0·001 in.

RUNNING CLEARANCE 0·0015 in. to 0·003 in.
MAXIMUM PERMISSIBLE CLEARANCE 0·0035 in.

When grinding use a stone having a grit and grade equivalent to a NORTON A46 M5V or one grade softer. **A harder stone must not be used.**

For 'plunge' grinding the width of the stone must be 0·020 in. less than the dimension between the journal or crankpin end faces and the machine must be fitted with hydraulic stops. For traverse grinding a suitable width of stone should be selected (see Fig. E34 in Engine Manual).

Care must be taken to ensure that no sharp ridges are left in the radii where the grinding wheel traverse ends and the radii of the grinding wheel must be carefully controlled to ensure that the grinding fades out not more than half-way up the radius on the crankshaft.

On no account must the grinding wheel touch the side faces of the crankpin or journal.

Lubrication must be continuous during re-grinding and the lubricant should be fed liberally on to the ingoing side of the grinding wheel. The grinding wheel must not be allowed to contact the journal or crankpin until the shaft is thoroughly wet. Any approved lubricant can be used.

Grind the crankpins or journals until they are 0·001 in. larger than the required finish size; this will allow for lapping and polishing.

Crankshafts which have been ground to the first undersize, namely minus 0·010 in. will not need to be rehardened.

Crankshafts ground to any of the subsequent undersizes, namely minus 0·020 in., 0·030 in. and 0·040 in., **must be rehardened** by the nitride process.

After rehardening, test the hardness of the journals and crankpins; the minimum acceptable figure for a rehardened crankshaft is 570 VPN/30 kg. using a Vickers Diamond Pyramid machine.

After grinding and if the necessary equipment is available, the shaft should be magnetically crack tested. It should then be lapped and polished to the finished size.

Crankshaft — To lap

The crankshaft journals and crankpins should be lapped to produce a perfectly smooth finish after grinding or hardening.

Cast iron laps should be used and the machine set to run at between 220 and 250 r.p.m.

The lapping compound should consist of a mixture of grade M. 303½ grit and sperm oil in the proportion of 2½ lb. of grit to 1 gallon of sperm oil. The compound must be mixed to a smooth consistency and injected into the laps at frequent intervals.

The crankpins and journals must be lapped parallel within 0·0001 in., whilst lapping, the size of the crankpins and journals should be checked frequently; allowances should be made for the slight contraction which will take place as the shaft cools.

After lapping, wash the crankshaft thoroughly in a high pressure paraffin wash; blow off any surplus paraffin with compressed air and dry the shaft with a soft lint free cloth.

When the shaft is dry, polish the crankpins and journals, using COROLIT 320 grade abrasive strip 1 in. wide, liberally lubricated with either sperm or mineral oil.

After polishing again wash the shaft and repeat the cleaning procedure.

Crankshaft sludge traps — To assemble

Carefully examine for damage the oil sealing plugs

and housings which form the crankshaft sludge traps. Fit new rubber sealing rings to the plugs.

To facilitate easy entry of each plug into its respective bore, lightly smear the sealing ring with engine oil, press the plug firmly 'home' and fit the circlip to secure it in the crankshaft.

(Figures E30, E31, E33, E35, E36 and E37 show the S2 crankshaft). The S3 crankshaft is similar to the S2 crankshaft, but has sludge traps in each of the crankpins as shown in Figure 2.

The remaining information in this Section is applicable to the S3 engine.

Section E11

CONNECTING RODS AND PISTONS

Description (*Page E47 in Engine Manual. See Fig. E38*)

Third paragraph to read:—

The big-end bearings are detachable and are split steel shells copper-lead lined with either lead-tin or lead-indium overlay. The small-end bush is split and has a steel backing lined with lead bronze. The bush is pressed into small-end boss and then reamed out to a final diameter of 1·003 in. + 0·0002 in.

Fifth paragraph to read:—

The pistons are of aluminium alloy, having full skirts which are cam ground to permit a close fit between the piston and the cylinder liner; after grinding they are tin coated to reduce friction between the bearing surfaces.

The pistons fitted to the majority of S3 engines have flat crowns and provide a compression ratio of 9 : 1.

In countries where only low octane fuel is available, pistons with a recessed crown are fitted to the engine and provide a compression ratio of 8 : 1.

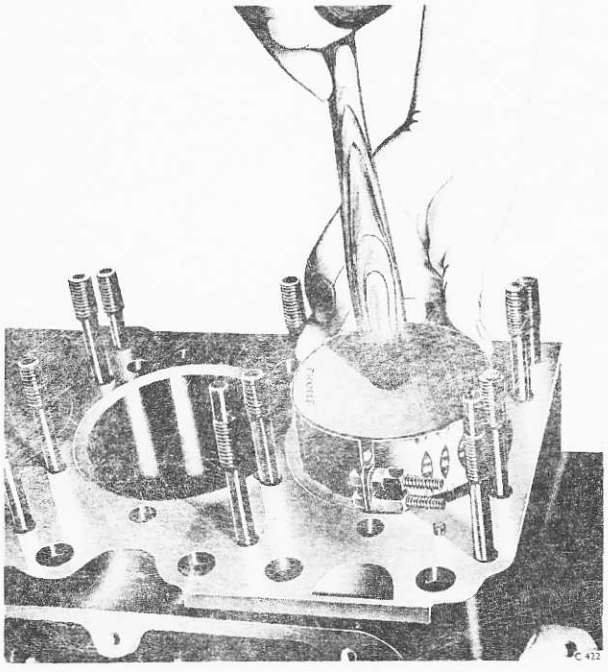


Fig. 3. Method of fitting 9:1 compression ratio piston.

The pistons are carried on gudgeon pins which are larger in diameter than those fitted in the S2 engine and are off-set to the centre line of the piston. Off-setting the gudgeon pins in this way compensates for the increased side thrust on the cylinder walls.

Piston identification

The 9 : 1 compression ratio pistons have a flat crown and off-set gudgeon pins which are larger in diameter than those fitted in the S2 engine.

The 8 : 1 compression ratio pistons have a recessed crown and off-set gudgeon pins which are larger in diameter than those fitted in the S2 engine.

The remaining information in the description is applicable to the S3 engine.

Small-end bush—To renew (*Page E50 in Engine Manual*)

Fourth paragraph to read:—

When fitted the bush should be diamond bored or reamed to the finished diameter of 1·0003 in. +0·0002 in.

Connecting rods and pistons—To reassemble (*Page E52 in Engine Manual*)

Fifth paragraph to read:—

To ensure that the piston is fitted correctly relative to the connecting rod, the following procedure **must** be observed.

Due to the off-set gudgeon pin the piston is **'handed'** as identified by the word 'FRONT' stamped on the crown, and **must** be fitted with the 'FRONT' towards the front of the engine.

Fit the connecting rod to the piston so that when assembled in the engine the tangs on the connecting rod and cap are nearest to the camshaft (see Fig. E44 Section E11 in Engine Manual).

The pistons shown in Figures E38, E41 and E45 in the Engine Manual are 8 : 1 compression ratio pistons. The 9 : 1 compression ratio pistons are similar in appearance but have flat crowns. See Fig. 3.

The remaining information in this Section is applicable to the S3 engine.

Section E12

VALVE GEAR

Hydraulic tappets—To check the 'leak-down' (*Page E57 in Engine Manual*)

Second and third paragraphs to read:—

The 'leak-down' test must be carried out when the tappet is primed with and immersed in clean ESSO T.S.D. 1047 paraffin, using the special fixture RH.7121, (see Fig. E48 Section E12 Engine Manual).

The limits to which this test must conform are between 20 and 80 seconds for a plunger travel of $\frac{1}{8}$ in. under a load of 50 lb.; the measured plunger travel should end $\frac{1}{32}$ in. above the fully collapsed position.

The above 'leak-down' time is for a new tappet; in service a 'leak-down' time of 10–80 seconds is acceptable before replacing the complete assembly.

The remaining information in this Section is applicable to the S3 engine.

Section E13

CAMSHAFT

Camshaft—To fit (*Page E62 in Engine Manual*)

Lightly smear the camshaft bearings with oil and fit the camshaft through the front end of the crankcase. Fit the timing gear lubricating jet to the camshaft thrust plate securing it with two setscrews and tab washers. Fit the camshaft thrust plate and secure it with ten setscrews and tab washers. The setscrews should be tightened to give a torque loading of 8 to 10 lb./ft.

Camshaft timing gear—To fit

Valve gear—To time (*Page E62 in Engine Manual*)

A strengthened aluminium alloy timing gear is fitted to the S3 engine and is of a solid disc type construction as opposed to the fluted type fitted on S2 engines.

(Figures E51, E52, E53 and E54 show the S2 type timing gear).

Distributor

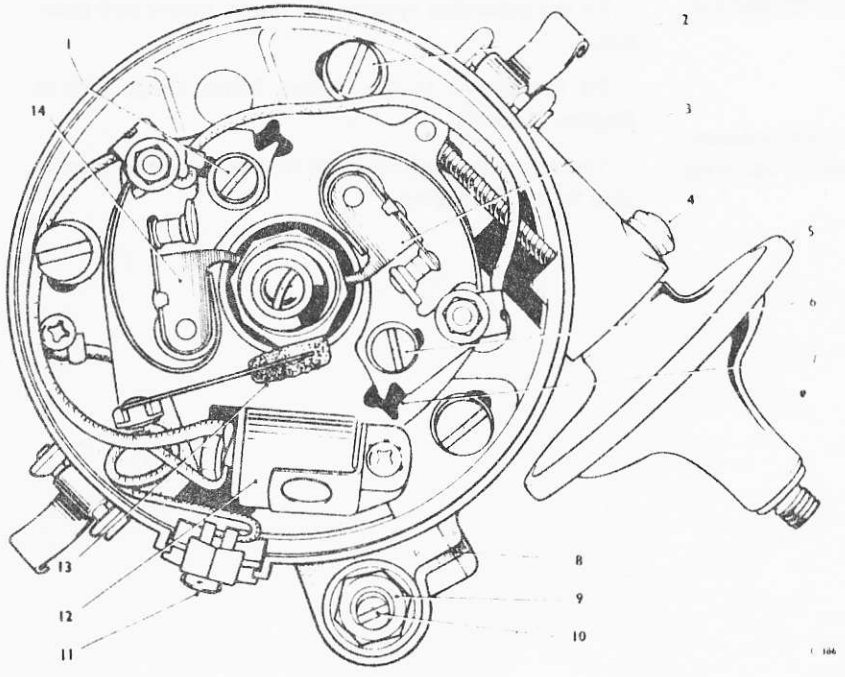
Description

A new type of distributor is fitted to the S3 engine, it has an eight lobe cam and is of the double contact breaker type; one contact breaker serving to make, and the other to break the low tension circuit. In addition to the centrifugal advance and retard mechanism, a vacuum timing control is provided, manifold depression being utilised to vary the timing in accordance with engine loadings.

Ignition system—To time (*Page E64 in Engine Manual*)

For identification of detail parts of the distributor, refer to Fig. 4.

Fit the under cover of the bell-housing to the back of the crankcase. Rotate the engine until No. A1. piston is on its compression stroke, then using the flywheel timing mark on the under cover, set the flywheel 2° B.T.D.C. The engine should be rotated clockwise (i.e. normal rotational direction of the crankshaft); if rotated otherwise an inaccurate timing setting may be obtained due to backlash in the gears. The distributor drive tongue should then be parallel with the engine crankshaft. See Fig. 5.



1. FIXED CONTACT PLATE SECURING SCREWS
2. CONTACT BREAKER HOUSING SECURING SCREW
3. CONTACT BREAKER
4. VACUUM UNIT SECURING SCREW
5. VACUUM TIMING CONTROL UNIT
6. FIXED CONTACT PLATE SECURING SCREW
7. CONTACT BREAKER GAP ADJUSTING SLOT
8. OCTANE SELECTOR SCALE
9. OCTANE SELECTOR ADJUSTING SCREW LOCKNUT
10. OCTANE SELECTOR ADJUSTING SCREW
11. L.T. TERMINAL
12. CAPACITOR
13. CAM LUBRICATING PAD
14. CONTACT BREAKER

Fig. 4. Internal view of distributor.

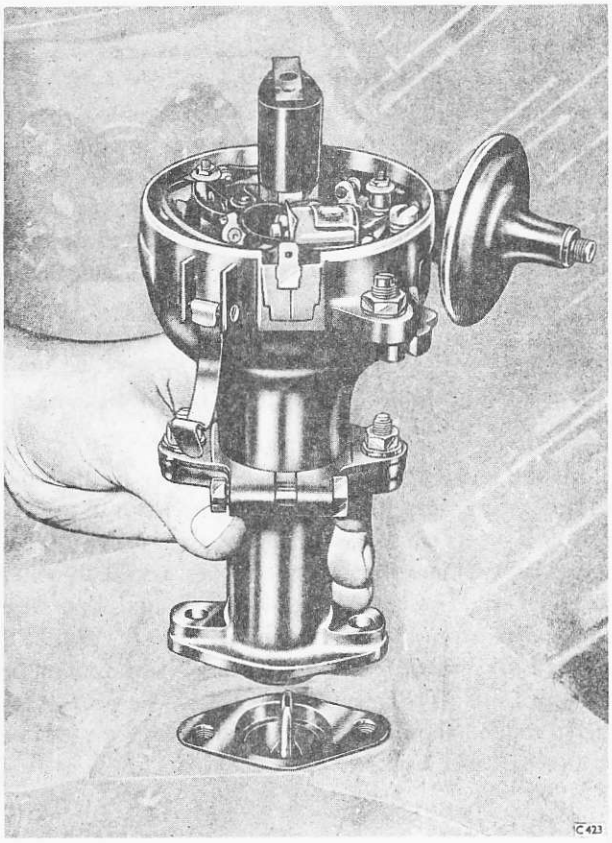


Fig. 5. Method of fitting distributor.

Release the locknut (9), and set the octane selector (8) to the fully advanced position (A) before carrying out the ignition timing.

Turn the distributor spindle until the rotor arm is in line with the No. A1 cylinder firing position.

Fit the distributor, securing the pedestal to the crankcase with two setscrews.

Release the distributor clamping screw, then rotate the body until the set of contacts (14), opposite the vacuum advance unit, are just breaking. During this operation hold the top of the rotor in the fully retarded position to take up any backlash in the centrifugal advance mechanism. Clockwise rotation of the distributor body will advance the timing, and anti-clock wise rotation will retard the timing.

The most suitable method of checking when the contact points are just breaking is with an ignition timing lamp.

Tighten the clamping screw to lock the body in position.

Rotate the crankshaft two full turns and with the ignition timing lamp, recheck to ensure that the contact points are just breaking when the rotor arm is in line with the No. A1 firing position.

Fit the distributor cap.

Fit the induction system, the starter motor and gearbox.

Fit the engine to the chassis frame (Page E18 in Engine Manual).

The remaining information in this Section is applicable to the S3 engine.

Section E14

DECARBONISING

Page E67 *in Engine Manual*

Second paragraph to read:—

To facilitate decarbonising, RH.2264 decarbonizing set can be supplied.

Final assembly and tuning (*Page* E68 *in Engine Manual*)

First and second paragraphs to read:—

Check the ignition timing as described in Ignition system — to time. Section E13 in this supplement. This should be 2° B.T.D.C.

Remove the contact breakers and clean the points. Fit the contact breakers and set the gaps to 0·014 in to 0·016 in.

Eleventh paragraph to read:—

Fit the air silencer after first cleaning the filter element. The remaining information in this section is applicable to the S3 engine.

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CHAPTER F

PROPELLER SHAFTS AND UNIVERSAL JOINTS

SECTION F1 — DESCRIPTION AND OPERATION

A divided propeller shaft incorporating resonance dampers is used to transmit engine torque to the rear axle unit.

The front shaft is connected to the gearbox output shaft by a ball and trunnion type universal joint, as shown in Figure F1. The rear end of the front shaft is carried in a ball race mounted in a carrier bracket, which is flexibly suspended from the frame (see Fig. F2).

This flexible mounting allows for correct alignment of front and rear shafts and also prevents any propeller shaft vibration being transmitted to the chassis.

A flange is keyed and locked to the tapered rear end of the front shaft and this flange is bolted to the combined Hardy Spicer needle roller universal and sliding joint on the front end of the rear shaft.

A Hardy Spicer universal joint on the rear end of the rear shaft is bolted to the flange of the rear axle bevel pinion.

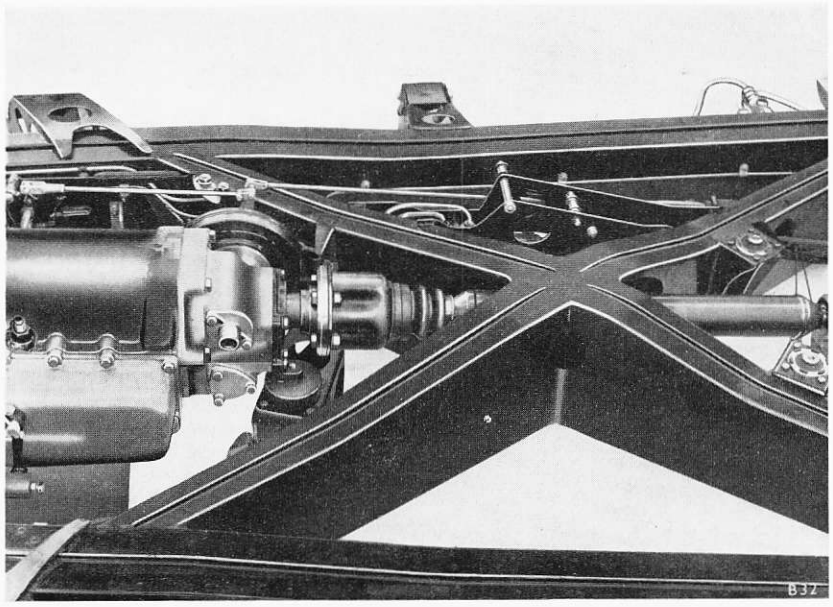


Fig. F1 Front universal ball and trunnion joint (early S1 chassis)

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Before assembly, both shafts are dynamically balanced and care should be taken to ensure that this balance is preserved.

Correlation marks (2) are stamped on the rear flange of the front shaft, the rear end of the front shaft and on one of the Woodruff keys which locate the flange on the shaft (see Fig. F3).

Markings are made also with green paint on the body of the front coupling, the flange on the rear of the front shaft and on the coupling at the front of the rear shaft. If these marks become obscured during service and it is necessary to dismantle the propeller shafts, all parts should be marked as described prior to dismantling in order to ensure correct re-assembly.

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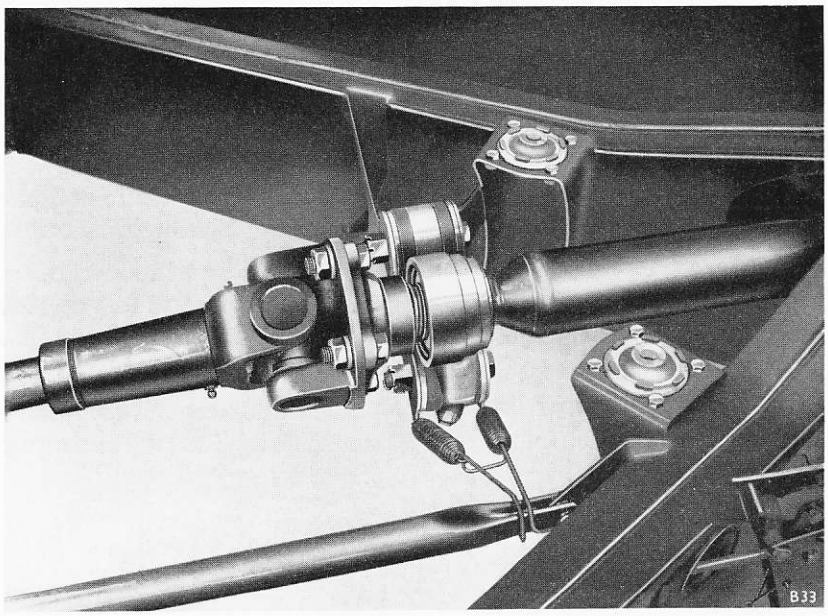


Fig. F2 Propeller shaft centre bearing

SECTION F2 — LUBRICATION AND MAINTENANCE

Every 5000 miles the condition of the rubber boot should be inspected. At the same time the bolts securing the universal joint to the gearbox output flange should be checked for tightness.

If for any reason this joint has to be disturbed, the securing bolts must be re-tightened after a run of approximately 10 miles to take up any slackness due to settling of the gasket between the joint faces.

The correct torque values for these bolts are:

S1 cars 45–50 lb.ft.
S2 cars 70–75 lb.ft.

The joint is packed with approximately 1½ oz. of Mobilgrease No. 2 on assembly after balancing. Examination of the joint should be carried out every 20,000 miles and if found to be externally dry, no maintenance is necessary apart from checking the torque tightness as previously described.

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The centre bearing should be examined every 20,000 miles and re-packed with the correct grease.

The Hardy Spicer universal joint and the sliding joints are provided with grease nipples and should be lubricated every 10,000 miles with one of the approved lubricants stated below:

Shell	Retinax 'A' (First recommendation)
B.P.	Energrease L2
Castrol	Castrolease LM
Mobil	Mobilgrease MP

SECTION F3 — DISMANTLING AND ASSEMBLING

Propeller Shafts and Universal Joints — to remove and dismantle

Remove the four nuts and bolts securing the front joint to the gearbox output shaft.

Remove the two tension springs from between the centre bearing carrier housing and the equaliser bar.

To remove the propeller shafts without removing the centre bearing mounting, it is necessary only to unscrew the nut which is fitted with a lock-washer; this separates the bearing housing from the lower Silentbloc assembly of the bearing mounting.

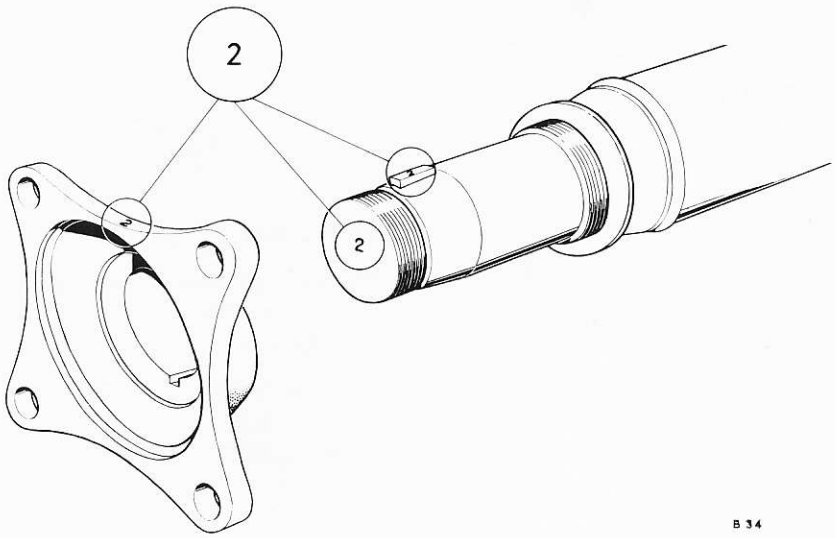


Fig. F3 Position of correlation marks on the front propeller shaft

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Remove the split pin and unscrew the nut from the bolt securing the centre bearing assembly to the frame bracket (see Fig. F4). The mounting can then be detached from the bearing housing by removing the nut and lock-washer from the securing stud. Dismantle the mounting by removing the two 0·500 in. ($\frac{1}{2}$ in.) nuts and bolts which pass through the Silentbloc bushes.

Remove the four bolts, nuts and washers securing the rear universal joint to the rear axle pinion flange.

The front and rear shafts should then be withdrawn from the chassis as an assembly, transferred to a bench and separated by removing the four nuts and bolts attaching the rear flange of the front shaft to the front joint of the rear shaft. Secure the front shaft in a suitably shaped clamp and proceed as follows:

Remove the metal cover from the forward end of the joint body and push the body along the shaft sufficiently to facilitate removal of the two end buttons and the two outer races containing the 62 needle rollers. On early S1 cars a spring compression washer will be located under the end buttons, but later S1 and S2 cars have flat shim washers. A plain hardened washer is located below the outer races (see Fig. F5).

Note: When servicing the front universal joint, the spring compression washers should be replaced by shim washers. When carrying out this operation ensure that the spherical surfaces on the end pads are in light contact with the surfaces in the body, when the body is moved to various positions.

Tie back the housing and rubber boot and press out the trunnion pin. A force in excess of 2½ tons will be required, but on no account should heat be used in this operation.

Remove the clips, rubber boot and housing and clean all parts for inspection.

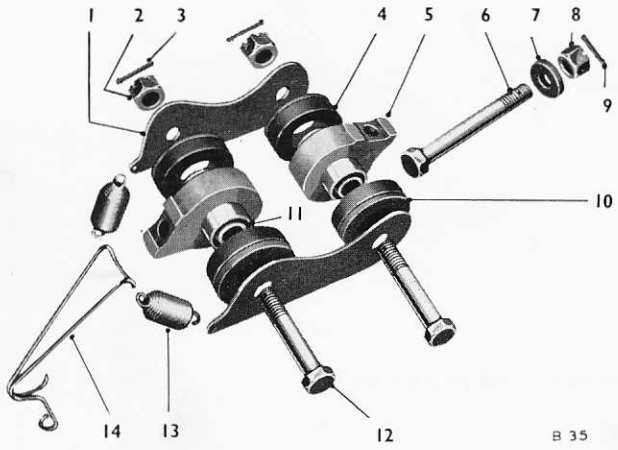


Fig. F4 Centre bearing support

1. LINK
2. NUT
3. SPLIT PIN
4. RUBBER COMPRESSION WASHER
5. HOUSING
6. MOUNTING BOLT
7. PLAIN WASHER
8. NUT
9. SPLIT PIN
10. FRICTION DISC
11. SILENTBLOC BUSH
12. LINK ASSEMBLY BOLT
13. SUSPENSION SPRING
14. SUSPENSION SPRING LINK

Front Universal Joint — to assemble

Reverse the procedure for dismantling but the following instructions must be adopted when fitting the trunnion pin.

The trunnion pin should be fitted within 0·003 in. of true central position relative to the centre line of the shaft using a minimum press load of 2½ tons. The pin must be fitted to this limit to assist correct dynamic balance of the shaft.

Check whether the trunnion pin is correctly fitted, by means of a depth micrometer, and then with the propeller shaft located between centres, check the vertical position of the pin with a dial indicator gauge (see Fig. F6). Care must be taken to ensure that the pin is truly vertical when this test is carried out.

Whenever the joint is dismantled, the opportunity should be taken to fit a new rubber boot.

Pack the joint with 1½ oz. of Mobilgrease No. 2 before fitting the end cover and a new 'Klingerit' joint.

Sealing Boot — Front Universal Joint — to renew

Early S1 cars

On early S1 cars the rubber boot may be changed without removing the trunnion pin by adopting the following procedure:

Remove the propeller shaft assembly from the car and secure it in a suitably shaped clamp.

(i) Dismantle the joint, removing all parts except the body and trunnion pin.

(ii) Thoroughly clean the body, ball head and trunnion pin.

(iii) A complete coating of grease (or suitable rubber lubricant), must be smeared on the outside and inside of the sealing boot, the entire surface of the ball head, pin and the inside of the body. (It is very important that this instruction is observed).

(iv) Stretch the grease-covered boot over the trunnion pin and ball head as shown in Figure F7.

(v) Ease the sealing boot into the body as far as possible.

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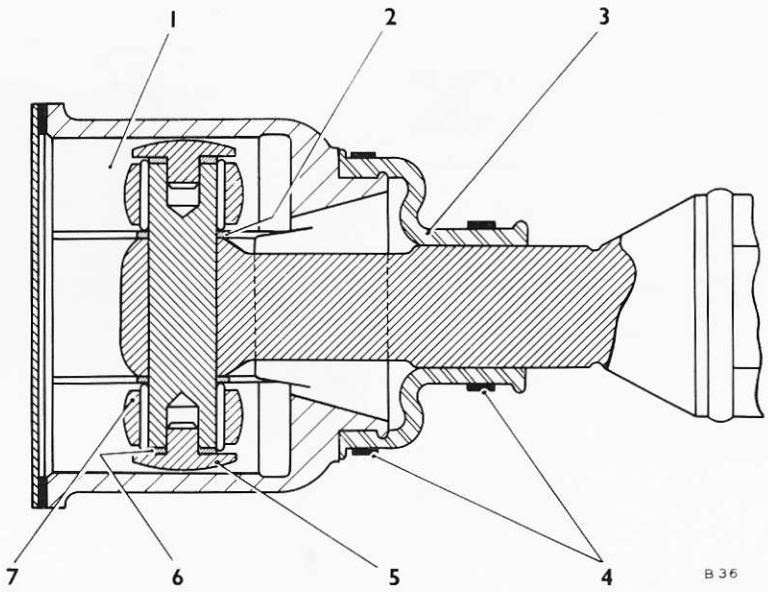


Fig. F5 Section through the front universal ball and trunnion joint

1. JOINT BODY
2. PLAIN HARDENED WASHER
3. SEALING BOOT (LATE S1 AND S2 CARS)
4. SECURITY CLIPS
5. END PAD
6. SHIM WASHER
7. OUTER RACE CONTAINING 62 NEEDLE ROLLERS

(vi) Select a small tube of suitable diameter and gauge, then pass it between the sealing boot and the joint body. Pass a length of cord through the tube as shown in Figure F8 then remove the tube.

(vii) Pass the tube between the sealing boot and the propeller shaft, then pass the cord through the tube to form a loop around the sealing boot as shown in Figure F9. Remove the tube.

(viii) Whilst pulling on the ends of the cord, move the body back and forth until the entire sealing boot has passed through the body.

(ix) Slide the sealing boot into position and secure it with the clips provided.

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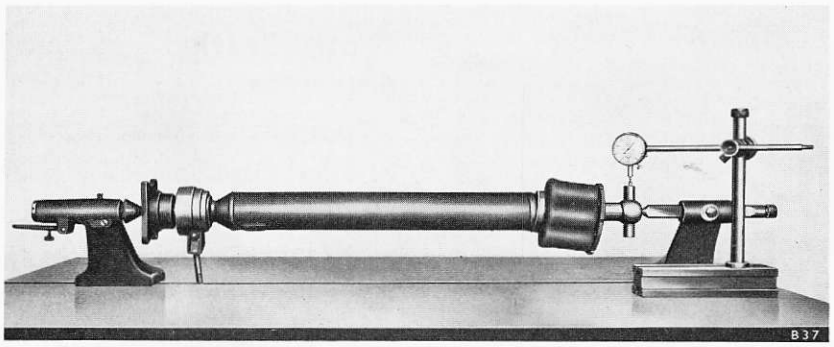


Fig. F6 Checking the centre pin

Late S1 and S2 cars

On later S1 and on S2 cars, the trunnion pin has to be removed to change the rubber boot. The instructions mentioned in 'Front Universal Joint — to assemble' regarding the trunnion pin must be adhered to.

During the production of S1 cars, the rubber sealing boot was modified from a convoluted form to the type shown in Figure F10 and modified clips were fitted.

This seal was later modified by increasing the neck of the boot and extending the width of the sealing land on the shaft stem.

Strap type security clips have been adopted with this long neck seal, the smaller clip being positioned as near as possible to the rear of the neck. These clips are of a more compact design and by virtue of their construction exert an evenly distributed radial clamping pressure.

Figure F10 shows a comparison between the convoluted, short and long neck sealing boots and their associated clips. After installing a propeller shaft fitted with either a short or long neck sealing boot, it is essential that the annular face of the seal is not restrained from assuming its free state.

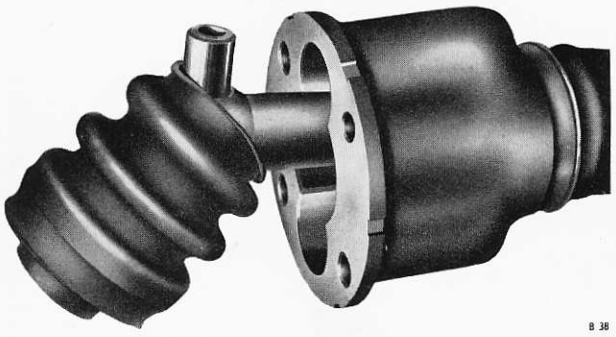


Fig. F7 Stretching the sealing boot over the trunnion pin

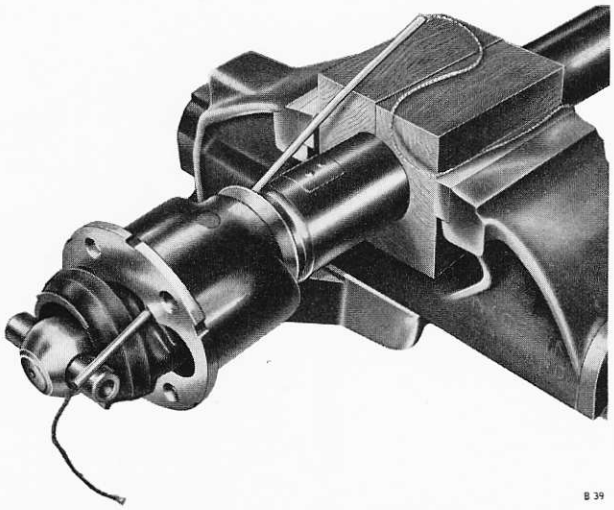


Fig. F8 Method of passing the cord through the tube (first position)

The rear clip should therefore be slackened sufficiently to permit the neck of the seal to assume a position which will relieve any strain, then re-tighten the clip.

When renewing the sealing boot, it is permissible to replace the short neck seal by a long neck seal, but when this is done, the small diameter clip should be repositioned from the end of the neck towards the annular face of the seal to ensure that it is clamping around the sealing land on the propeller shaft.

Centre Bearing — to remove and dismantle

To remove the centre ball bearing, the flange must be unlocked and pressed or drawn from the keyed, tapered end of the shaft. Ensure that correlation marks (2) are stamped on the end of the shaft, the flange and the Woodruff key, as shown in Figure F3. Remove both Woodruff keys from the shaft and the spring-loaded washer from the grease retainer.

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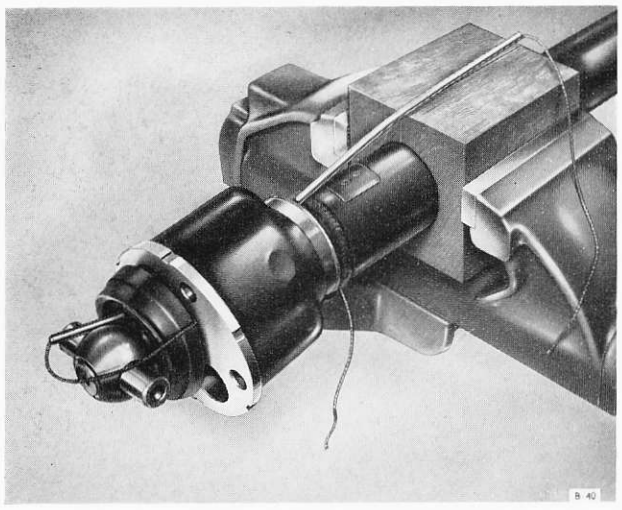


Fig. F9 Method of passing the cord through the tube (second position)

Remove the housing and bearing from the shaft as an assembly by tapping the end of the shaft against a hardwood block. Remove the circlip and push the grease retainer and bearing from the housing.

Centre Bearing — to assemble and fit

Assembly is the reverse procedure of dismantling but the following points should be observed. Examine the bearing for wear and if necessary renew it. Fit a new 'O' ring and pack the bearing with Retinax 'A' grease or its approved equivalent.

Fit the Woodruff keys and flange, ensuring that the correlation marks (2) are in the correct relative positions. Renew the lock-washer and tighten the flange retaining nut to the torque loading of 150–180 lb.ft. An exploded view of the centre bearing is shown in Figure F11.

Hardy Spicer Universal Joints — to dismantle

To dismantle the Hardy Spicer joints, it is first necessary to clean and remove the paint from the yoke eyes. Remove the circlips securing the needle bearing races.

Tap the yokes with a hide mallet until the races are driven out of the eyes (see Fig. F12).

Hardy Spicer Universal Joints — to assemble

Fit the new seals, supplied with the universal spiders, on the sliding yoke.

Press the needle roller assemblies into the yoke eyes sufficiently to enable the circlips to be inserted, care being taken not to press the races more than necessary, otherwise the seals may be damaged. An exploded view of the joint is shown in Figure F13.

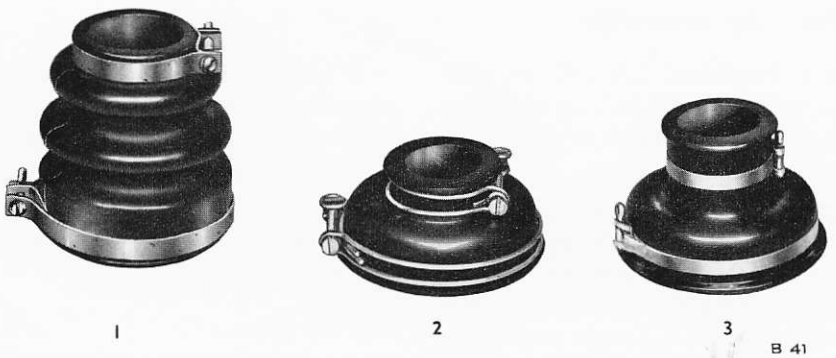


Fig. F10 Three types of sealing boots

1. CONVOLUTED 2. SHORT NECK 3. LONG NECK

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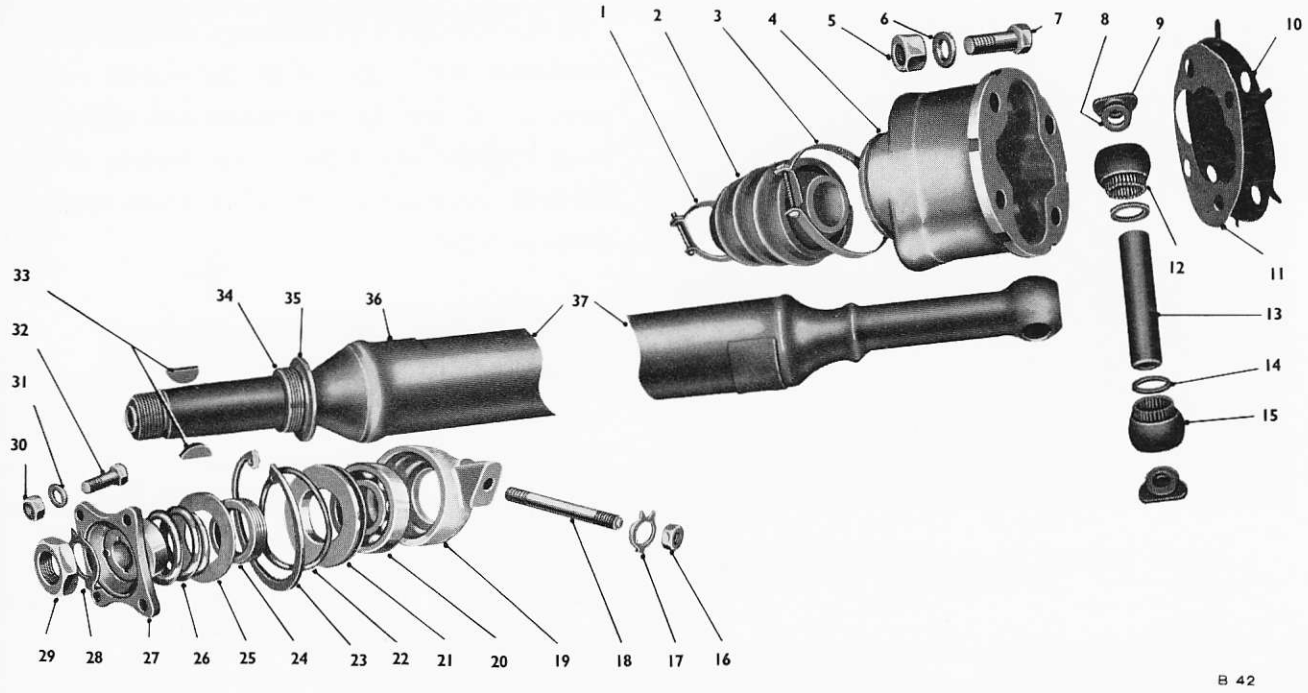


Fig. F11 Front propeller shaft and centre joint (early S1 cars)

1. RUBBER BOOT REAR CLIP
2. RUBBER BOOT
3. RUBBER BOOT FRONT CLIP
4. BALL AND TRUNNION HOUSING
5. NUT
6. PLAIN WASHER
7. BOLT
8. SPRING WASHER
9. END PAD
10. END COVER
11. 'KLINGERIT' JOINT
12. NEEDLE AND RACE ASSEMBLY
13. PIN
14. WASHER
15. NEEDLE AND RACE ASSEMBLY
16. NUT
17. LOCKING WASHER
18. MOUNTING STUD
19. HOUSING
20. BEARING
21. SPACING RING
22. RUBBER SEALING RING
23. CIRCLIP
24. GREASE RETAINER
25. SPACING WASHER
26. SPRING
27. FLANGE
28. LOCKING WASHER
29. FLANGE RETAINING NUT
30. NUT
31. PLAIN WASHER
32. BOLT
33. WOODRUFF KEYS
34. GREASE SEAL
35. WASHER
36. BALANCE WEIGHTS
37. FRONT PROPELLER SHAFT

Propeller Shafts — to assemble

Install the shafts as individual units; fit the front joint to the gearbox output flange, leaving the centre bearing carrier bolts slack until the rear shaft has been re-fitted.

Tighten the flange bolts on the three couplings; the four centre and four rear bolts should be tightened to 42–45 lb.ft. If the centre bearing mounting has been dismantled, the two large bolts through the Silentbloc bushes must be tightened to a torque loading of 60–65 lb.ft., while the front shaft is held in the correct position.

When fitting new friction discs to the centre bearing mounting, ensure that they are of the correct thickness, as discs fitted to S2 cars are thicker than those fitted to S1 cars and these must not be interchanged.

S1 cars:

Friction disc — RG 3466 — 0·187 in. ($\frac{3}{16}$ in.) thick

S2 cars:

Friction disc — UG 3632 — 0·250 in. ($\frac{1}{4}$ in.) thick

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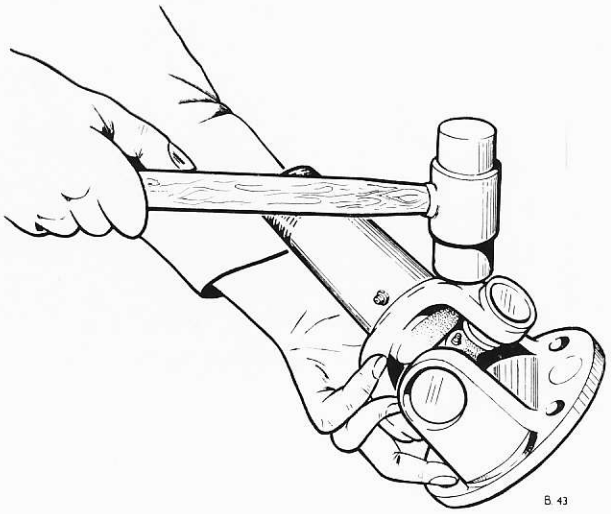


Fig. F12 Method of removing the races from the yoke eyes of the Hardy Spicer universal joint

The front shaft should lie along the centre line of the chassis in the plan view and slope downwards to the rear at approximately $1\frac{1}{2}$ deg. to the horizontal. It is usually sufficient for this to be lined up by eye, but a check should be made to ensure that there is adequate vertical clearance — not less than $\frac{3}{8}$ in. on S2 cars — between the propeller shaft and the frame cruciform.

Lubricate the joints using Retinax 'A' or one of the approved lubricants.

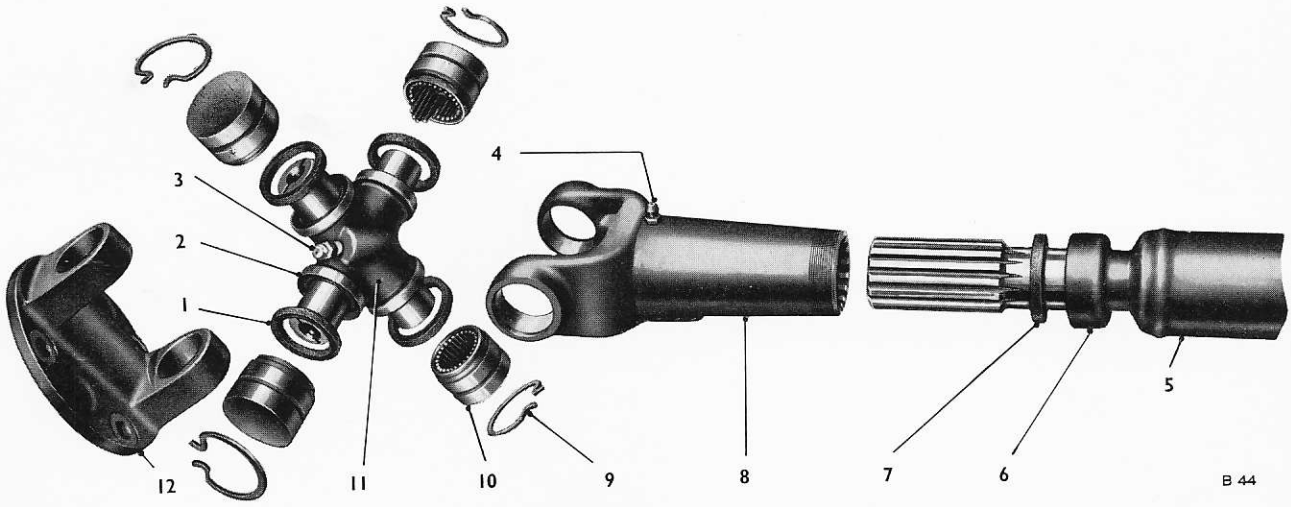


Fig. F13 Hardy Spicer universal joint dismantled

1. CORK GREASE SEAL
2. GREASE SEAL RETAINER
3. GREASE NIPPLE
4. GREASE NIPPLE
5. REAR PROPELLER SHAFT
6. GREASE SEAL RETAINER
7. GREASE SEAL
8. SLIDING YOKE
9. CIRCLIP
10. NEEDLE AND RACE ASSEMBLY
11. UNIVERSAL JOINT SPIDER
12. FRONT YOKE

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CHAPTER G

BRAKING SYSTEM

SECTION G1 — DATA AND GENERAL DESCRIPTION

Data

Effective Drum Diameter

S1, S2, Bentley Continental S2 and Phantom V cars	11·250 in. (28·575 cm.)

Brake Lining Type

S1, S2, Bentley Continental S2 and Phantom V cars	Ferodo DS2 or Mintex M14

Length

S1, S2 and Phantom V cars	10·00 in. (25·4 cm.)
Bentley Continental S2 cars (front)	7·707 in. (19·576 cm.)

Width

S1, S2 and Phantom V cars	3·000 in. (7·62 cm.)
Bentley Continental S2 cars (front)	2·980 in. (7·569 cm.)

Thickness

S1, S2 and Phantom V cars	0·322 in. (8·179 mm.)
Bentley Continental S2 cars (front)	0·347 in. (8·814 mm.)

Diameter of Wheel Cylinder Bores

Front	S1, S2, Bentley Continental S2 and Phantom V cars	1·375 in. (3·492 cm.)
Rear	S1 cars	0·875 in. (2·222 cm.)
Rear	S2, Bentley Continental S2 and Phantom V cars	0·812 in. (2·062 cm.)

Diameter of Master Cylinder System Pistons

Dual system	Upper cylinder	0·980 in. (2·489 cm.)
	Lower cylinder	0·747 in. (1·897 cm.)
Single cylinder system		0·980 in. (2·489 cm.)

Servo Lining — all cars

Type	Ferodo DM8

Servo Operating Levers

		Cam angle
Early S1 cars with single master cylinder		52 deg.
Late S1 cars, Bentley Continental S2 cars	with dual master cylinders	47 deg.
S2 cars, Phantom V cars	with dual master cylinders	37½ deg.

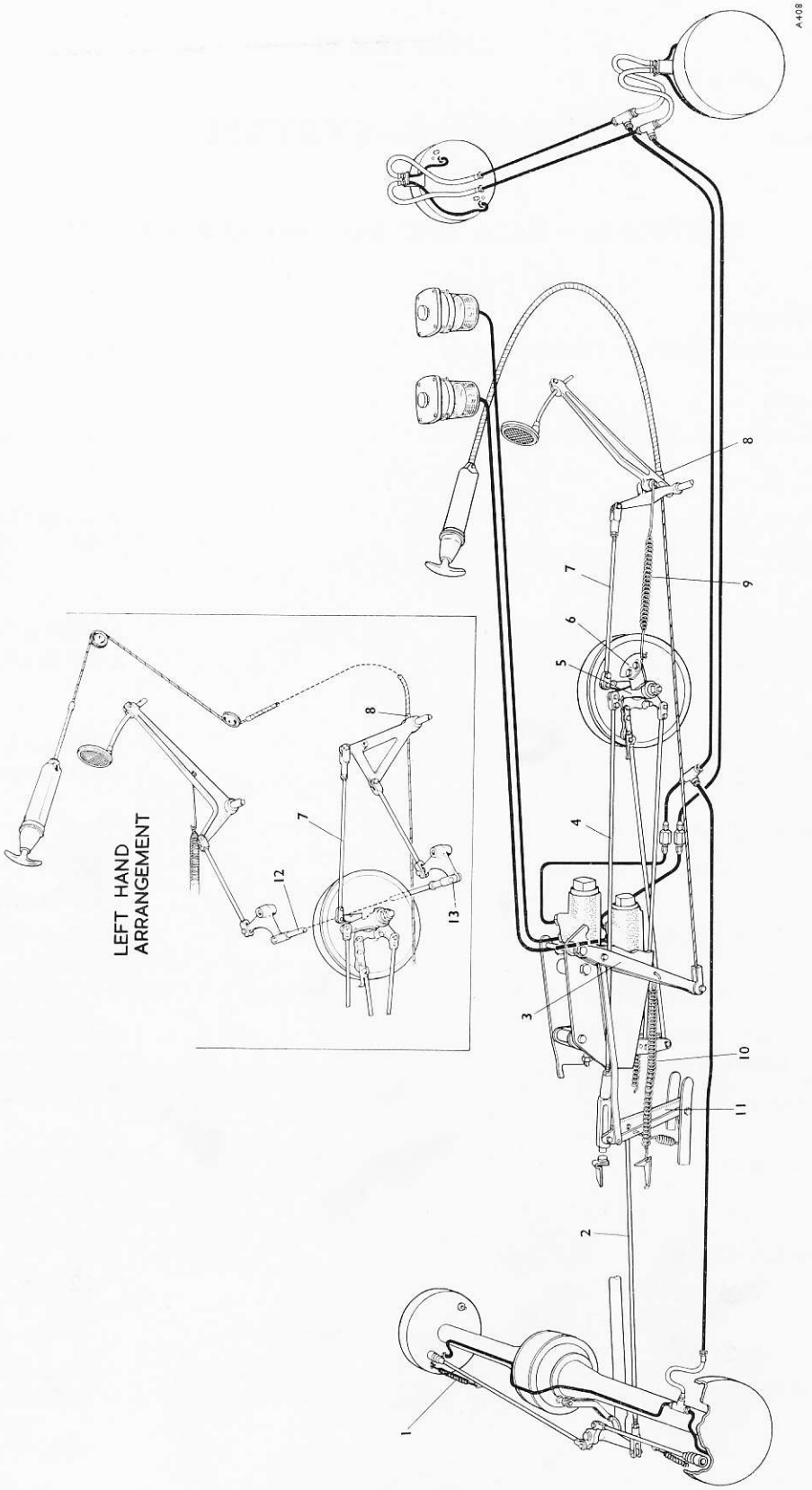


Fig. G1 Diagram — brake linkage

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Description

On both S1 and S2 cars, the braking system incorporates a gearbox-driven friction type servo motor which is engaged by the foot brake pedal. The output from the servo is transmitted through hydraulic cylinders which operate Girling Hydrastatic brakes incorporating special Rolls-Royce features.

In addition to operating the servo, the foot brake pedal is also connected to the rear brakes through a mechanical linkage of rods in tension, as also is the handbrake, and supplies 40 per cent **(S1 cars)** or 30 per cent **(S2 cars)** of the effort applied to the rear brakes, the additional 60 per cent **(S1 cars)** or 70 per cent **(S2 cars)** being provided hydraulically.

The handbrake also is connected to the rear brakes through a mechanical linkage.

Two Shoe Brake System — Front Brakes

Front brakes are of the 'two trailing shoe' type employing two brake operating cylinders for each wheel. The lower 'shoe factor' due to absence of self-wrapping effect with trailing shoes renders them less prone to pulling and grabbing troubles, sometimes associated with leading shoe type brakes. The drum diameter has, of necessity, been reduced to $11\frac{1}{4}$ in. (28·575 cm.) and this, combined with the absence of self-wrapping effect, necessitates the employment of higher shoe tip operating pressures to obtain the same total braking. This higher shoe tip force is derived from the servo motor and increased hydraulic leverage, made possible by the use of self-adjusting shoes.

The importance of self-adjusting shoes in this system lies in the fact that the displacement of fluid when the brakes are applied is much less than in a normal system, since there is virtually no initial shoe clearance to be taken up. With less fluid movement, it has been possible to employ master cylinders of smaller bore diameter than that of the wheel cylinders, thus providing an increased hydraulic leverage without introducing excessive linear travel of the master cylinder pistons.

On all except Phantom V rear brakes, self-adjustment of the shoes is achieved by a friction device known as the 'shake-back stop'. This device retains the front shoes in the expanded position when the hydraulic pressure is released, thus achieving near zero shoe clearance. The 'shake-back stop' is located radially by a steady post attached to the brake carrier plate. Sufficient clearance is provided in this location to allow slight shoe to drum clearance with the brakes off. The tension of the brake shoe return springs (or more correctly 'bias springs') is such that the shoes are in equilibrium with the springs in the wheel cylinders. These exert a slight pressure on the back of the operating rubber cup and piston in the expanders. In consequence, there must be sufficient friction between the shake-back stop and the brake shoe web to prevent the shoe being shaken back by the vertical forces imposed on it when traversing rough roads.

As the front brakes are applied entirely by the servo there would normally be no increase in pedal travel as the linings became worn. A strong pull-off spring is therefore fitted to the shoes which takes effect only when the linings are near the end of their life, and, by the increase in pedal pressure above that which would normally be required, gives warning that the linings require renewal.

Four Shoe Brake System — Front Brakes

On the **Bentley Continental S2** the front brakes are of the 'four-shoe' type.

The four shoe brake consists basically of four neutral shoes mounted in pairs on two trailing shoe carriers. The shoe carriers are operated by two wheel cylinders mounted on a torque plate. A water excluder is fitted to the back of each front brake drum and is positioned between the carrier plate and the stub axle.

With four shoes a greater lining area is obtained, while the arc length of each shoe remains low.

Two bosses with fine limit bores are welded to each shoe carrier and the shoes pivot on hardened pins which are retained in the bosses by spring clips. As the pivots are set well back from the shoe lining surfaces, there is a tendency for the shoes to tip forward due to the rotation of the drum. The two shoes overlap in order to make the tendencies of the shoes to tilt, mutually self-cancelling.

'Shake-back stops' are fitted to the brakes which prevent the shoes from shaking away from the drum when travelling over rough surfaces.

On the four shoe brake, one shake-back stop is fitted to each of the two trailing shoe carriers.

Rear Brakes — all cars

The rear brakes comprise a leading and trailing shoe expanded by a double acting wheel cylinder in conjunction with a mechanical flat wedge type expander, the latter being operated by direct foot pedal linkage and also by the handbrake. The shoes are interconnected by a special equal-wear linkage which converts the floating shoes to a 'fixed-cam' equivalent, thus reducing the self-wrapping effect of the leading shoes and allowing the use of a single shake-back stop on the trailing shoe which simultaneously adjusts both shoes to near zero clearance; it should be noted that shake-back stops are not fitted to the rear brakes **on Phantom V cars.** As lining wear takes place with consequent automatic adjustment, the shoes move away from the tappets of the mechanical expander in the 'Off' position; an adjuster is therefore provided to enable the shoes to be repositioned thus bringing the heels into contact with the tappets again.

A light rubbing when the brakes are 'Off' is quite normal with this type of automatic shoe adjustment.

Operation

Initial movement of the foot brake pedal first applies the rear brakes through the mechanical linkage and supplies 40 per cent (**S1 cars**) or 30 per cent (**S2 cars**) of the effort applied to the rear brakes. Further pressure on the foot brake pedal engages the servo motor which operates the hydraulic master cylinder(s) and supplies the additional 60 per cent (**S1 cars**) or 70 per cent (**S2 cars**) of the effort applied to the rear brakes; the front brakes are operated by the hydraulic system only. On releasing the foot brake pedal, the hydraulic master cylinder piston(s) return by means of an internal spring; the servo operating levers return to their normal positions by means of a torsion spring fitted between the two levers.

The handbrake is also connected to the rear brakes through the mechanical linkage.

Figure G1 shows the brake linkage for a right-hand drive car with the arrangement fitted to left-hand drive cars shown inset. **On Phantom V cars** an extra relay lever is fitted between the intermediate linkage and the rear axle. The lever is fitted to a bracket welded to the right-hand rear member of the propeller shaft tunnel. The single rod (see 2, Fig. G1) fitted **on standard cars,** is divided into two rods **on the Phantom V,** the ends of which are pivoted on the relay lever mentioned above.

A servo motor is mounted on the right-hand side of the gearbox and is driven at approximately one fifth of the propeller shaft speed. A pull-rod (see 7, Fig. G1) is operated by the brake pedal and is coupled to a lever on the servo motor shaft. The lever has inclined cams formed on the face of its boss which engage, through the medium of steel balls, with similar cams formed on the boss of a second lever (5). From the latter lever, rod (4) actuates the rear brakes through an intermediate lever which is pivoted on a bracket bolted to the crossmember of the frame and through rod (2) and the rear equaliser linkage, mounted on a bracket suspended from the rear axle.

Initial movement of the servo lever cams engages the servo motor, and its output is taken to the master cylinder operating lever assembly by one of the two output rods, depending upon whether the motion of the car is forward or reverse.

The handbrake is mounted under the facia, and is connected by an enclosed cable to the handbrake lever carried on the master cylinder support bracket. This lever is linked to a second lever which is connected to the intermediate lever (11) by means of a pin. The remaining linkage is the same as for the foot brake. The intermediate lever is permitted to slide along the slotted link on rod (4) so that application of the handbrake does not disturb the foot pedal.

Hydraulic Systems

On early Rolls-Royce Silver Cloud, Bentley S1 and Bentley Continental S1 cars, a single master cylinder operates all the brakes. In the event of failure of the hydraulic system, the rear brakes remain effective through the mechanical linkage; similarly, provision is made to ensure that the hydraulic system remains effective should the mechanical application fail.

Later S1 cars and all S2 cars are fitted with two reservoirs and two master cylinders; the upper cylinder (0·980 in. (2·489 cm.) piston dia.) operates the upper shoes only in the front brakes and all shoes in the rear brakes, while the lower cylinder (0·747 in. (1·897 cm.) piston dia.) operates only the lower shoes in the front brakes.

Two brake fluid reservoirs, one for each master cylinder, are mounted on the wing valance and

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incorporate fine mesh gauze filters. The pipes leading to the master cylinders are arranged to run in such a manner that no air trapping takes place; any air present in the brake fluid cylinders or pipes is expelled from the reservoirs.

> **Note:** All brake fluid is hygroscopic, i.e. the fluid will absorb and chemically combine with water from the atmosphere.

To overcome this problem, the fluid should be exposed to the atmosphere only for the minimum time. It should always be stored in and used directly from **small** sealed containers.

Check valves were introduced **on early S1 cars** to obviate the possibility of ingress of air at the wheel cylinders, but it was later established that the spreaders were fully capable of maintaining an adequate interference between the lips of the cup seals and the bores, thus preventing air from being introduced into the system. No retrospective action is necessary to remove the check valves. The two sub-divisions of the hydraulic system are not interconnected hydraulically and balance between the two cylinders, and therefore between front and rear brakes, is obtained mechanically by means of a balance lever.

In the event of failure of one system, braking is still retained on all four wheels by the mechanical application of the rear brakes and the operation of the second cylinder.

SECTION G2 — SERVICE OPERATIONS

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Special tools required:

RH.322 — Brake and servo testing lever (single cylinder system)

RH.417 — Brake and servo testing lever (dual cylinder system)

RH.473 — Spring balance — 100 lb. (45·3 kg.) reading

On S1, S2 and Phantom V cars, the front brakes are self-adjusting and no external adjuster is provided. Every 20,000 miles (32,000 kilometres) **on S1 cars** and 10,000 miles (16,000 kilometres) **on all S2 cars,** the brake drums should be removed and the condition of the linings examined. The lining face should not be less than $\frac{1}{32}$ in. (0·794 mm.) above the rivet heads.

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On S1 and early S2 cars, if wear is excessive, the shoes will catch on the warning springs provided on the brake carrier plate whenever the brakes are applied and self-adjustment will be prevented.

Should it be necessary to remove the wheels before this period, for example when the wheels are interchanged and checked for balance after 5,000 miles (8,000 kilometres), it is suggested that an inspection of front brake linings be carried out at the same time.

Remove any lining dust which may have accumulated on the brake mechanism before re-fitting the drums. Push the shoes inwards and place the drum in position; the shoes should be in light contact with the drum after the brakes have once been applied and released. Slight rubbing between shoes and drums is normal for both front and rear brakes.

On both S1 and S2 cars, wear on the rear brakes has the effect of increasing the travel of the foot brake and handbrake controls, therefore check and if necessary adjust the rear brakes every 2,500 miles (4,000 kilometres). It is important that no attempt be made to adjust at any other point by altering the length of the rods.

On initial build, the linkage is carefully set to synchronise the front and rear stops, ensuring that in the event of failure of any parts of the system at least one pair of brakes is available. If dismantled for any reason, the linkage should be reset to the original setting as described in 'Handbrake Ratchet Assembly'.

Rear Brakes — to adjust

Release the handbrake. The adjustment screw protruding through the brake water excluder has a squared end for spannering purposes (see Fig. G2). Four 'clicks' can be felt during every complete turn of the adjustment screw.

To adjust the brakes, it is necessary to jack the rear wheels clear of the ground. Each wheel should be rotated a few degrees in each direction and the adjustment screw (see Fig. G2) turned clockwise until a solid resistance is felt. The adjustment screw should then be turned back two 'clicks'. This will provide the correct brake setting.

If replacement shoes with new linings have been fitted, the adjustment screw should be set back five 'clicks' to allow for initial 'growth' of the linings during road test. After the road test, the brakes should be re-adjusted and the adjustment screws set back three 'clicks'. By the time further adjustment is necessary, the linings will have stabilised and the normal adjustment may be carried out.

Hydraulic System — to 'bleed'

'Bleeding', for the purpose of expelling all air from the system, should only be necessary when completely recharging the system following the renewal of a component or the disconnection of a brake pipe.

To 'bleed' the system, two operators are necessary.

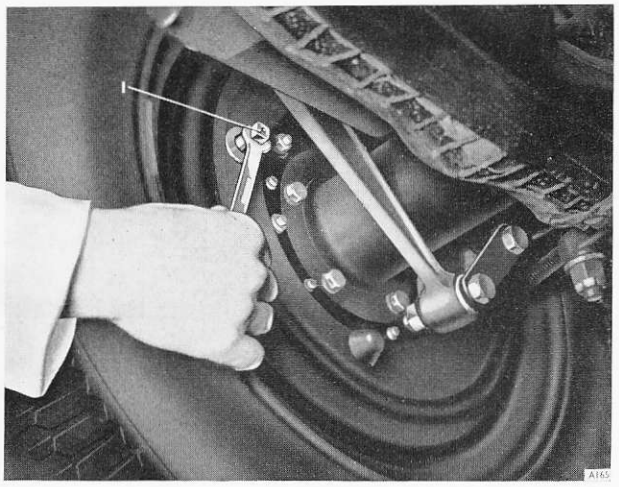


Fig. G2 Adjustment of rear brakes

1. REAR BRAKE ADJUSTING SCREW



Fig. G3 'Bleeding' front brakes

It is important that the following method is always employed, as air can be introduced into the wheel cylinders past the screw threads of the 'bleed' screws, unless the screws are closed on the return stroke of the master cylinder.

1. Fit a rubber 'bleed' tube to one of the front brake 'bleed' screws and immerse the free end of the tube in about one inch of brake fluid in a clean bottle.
2. Ensure that the reservoir(s) situated on the right-hand valance plate is full (the correct fluid is Castrol–Girling Crimson Brake Fluid 6293).
3. Using lever RH.322 on the single master cylinder system or lever RH.417 on the dual master cylinder system, operate the master cylinders with a rapid deliberate forward movement while the second operator slackens the 'bleed' screw. At the end of the forward stroke, close the 'bleed' screw, pull the lever back and pause for 5 seconds to allow the master cylinder plunger to return under the influence of its return spring.

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4. Repeat the pumping action for about 10 cycles or until air bubbles no longer issue from the 'bleed' tube.
5. This operation should be repeated for all wheel cylinders, topping-up the fluid reservoirs as necessary.

On the single master cylinder system, it is necessary only to 'bleed' the front brakes at the point shown in Figure G3, as the two wheel cylinders are inter-connected.

On the dual master cylinder system, it is essential that both cylinders are 'bled' at each front wheel, since these are operated by separate master cylinders and are not inter-connected.

After 'bleeding', a check must be carried out to ensure that the system is completely free of air.

No other method of 'bleeding' is recommended owing to the possibility of aeration of the fluid.

To Check that the System is Free of Air

Single master cylinder system

1. Ensure that the rear brakes are correctly adjusted.
2. Operate the master cylinder with lever RH.322 so that the shoes assume their operating positions.

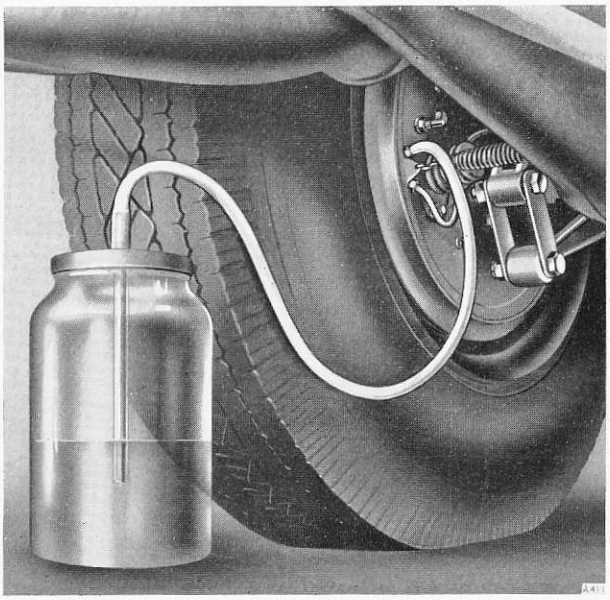


Fig. G4 'Bleeding' rear brakes

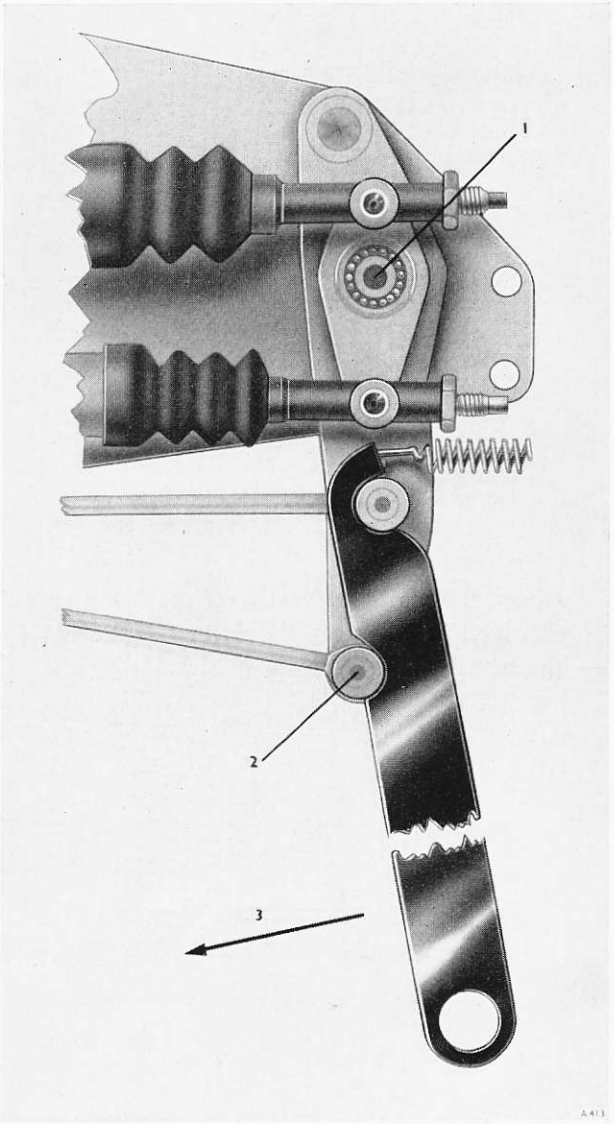


Fig. G5 Lever RH.417 in position

1. MASTER CYLINDER BALANCE LEVER BEARING
2. CLEVIS PIN
3. 100 lb. LOADING

Release the lever and allow the master cylinder plunger to return fully.

3. Attach a spring balance to the lever and operate the master cylinder with a pull of 100 lb. (45·3 kg.) as shown in Figure G5. Measure the length that the push rod has travelled from rest. In the rest position, the 'on-stop' bar should be 1·60 in. (4·064 cm.) from the edge of the master cylinder mounting bracket and the travel of the push rod with the 100 lb. (45·3 kg.) pull on lever RH.322 must not

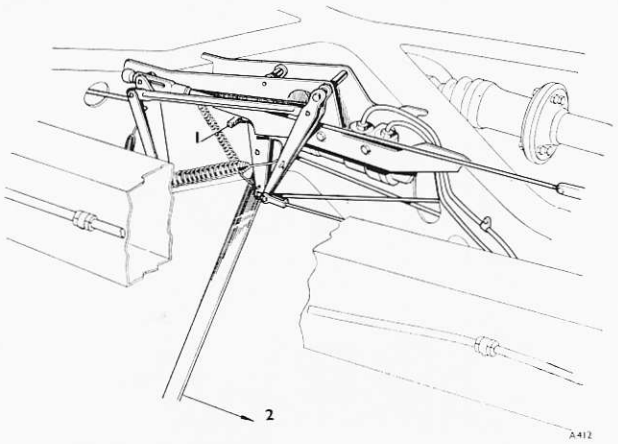


Fig. G6 Lever RH.322 in position

1. 'ON-STOP' BAR 2. 100 lb. LOADING

exceed 0·85 in. (2·159 cm.). If the travel exceeds this figure, the brakes should be 'bled' again and the test repeated.

Dual master cylinder system

Repeat the operation described for the Single Master Cylinder system but refer to Figure G6 for the movement required. Use lever RH.417 for the test.

Movement is measured at the bottom clevis pin on the master cylinder lever 2. Movement of the lever must not exceed 2·250 in. (5·715 cm.); if it does, the brakes should be 'bled' again and the test repeated.

Lubrication

The brake linkage clevis and fulcrum pins should be lightly lubricated with engine or penetrating oil every 5,000 miles (8,000 kilometres).

On the dual cylinder system, the master cylinder balance lever pivot bearing should be lubricated with the approved grease as shown in Chapter D.

The ball bearing cams which actuate the servo motor are packed with grease on initial assembly and require no attention between chassis overhauls.

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SECTION G3 — THE MASTER CYLINDERS

Two Girling master cylinders are fitted to a bracket on the cruciform member and are operated by a servo motor through drag links.

Servo motor operation draws forward the master cylinder operating lever 2 (Fig. G7). Pivoted on this lever is the balance lever to which are connected the two master cylinder push rods.

On the single master cylinder system, the master cylinder push rod is connected directly to the operating lever.

In the rest position, the main seal floats slightly forward and two recuperating holes in the plunger are uncovered, permitting communication between the wheel cylinders and reservoir. This prevents the build-up of pressure differentials due to thermal expansion and contraction.

The initial movement of the plunger brings the recuperation holes forward of the main rubber sealing lip, after which further movement will produce a proportionate movement of the wheel cylinder plungers.

On brake release, the push rod is returned immediately by the operating lever return spring, but master cylinder plunger return is by means of the internal spring only. The plunger should contact the push rod retaining washer between one and four seconds after release.

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Master Cylinder — to remove

Dual cylinder system

Disconnect the brake fluid pipes and drain the reservoirs. Disconnect the return spring and servo rods from the master cylinder operating lever. Disconnect the handbrake cable and return spring from the handbrake operating lever. Remove the pivot bolts and distance pieces from the handbrake operating and intermediate levers, to permit the levers together with rods 4 and 2 (see Fig. G1) to be lowered in order to gain access to the master cylinder carrier plates.

Note: The Phantom V has an extra rod and support bracket positioned in place of the No. 2 rod referred to in the previous paragraph.

Remove the master cylinder operating lever pivot bolt and the carrier plate upper securing bolt. Remove the remaining carrier plate setscrews and master cylinder mounting bolts and withdraw the carrier plate, master cylinders and lever assembly.

Single master cylinder system

Disconnect the return spring and servo motor drag links from the master cylinder operating lever.

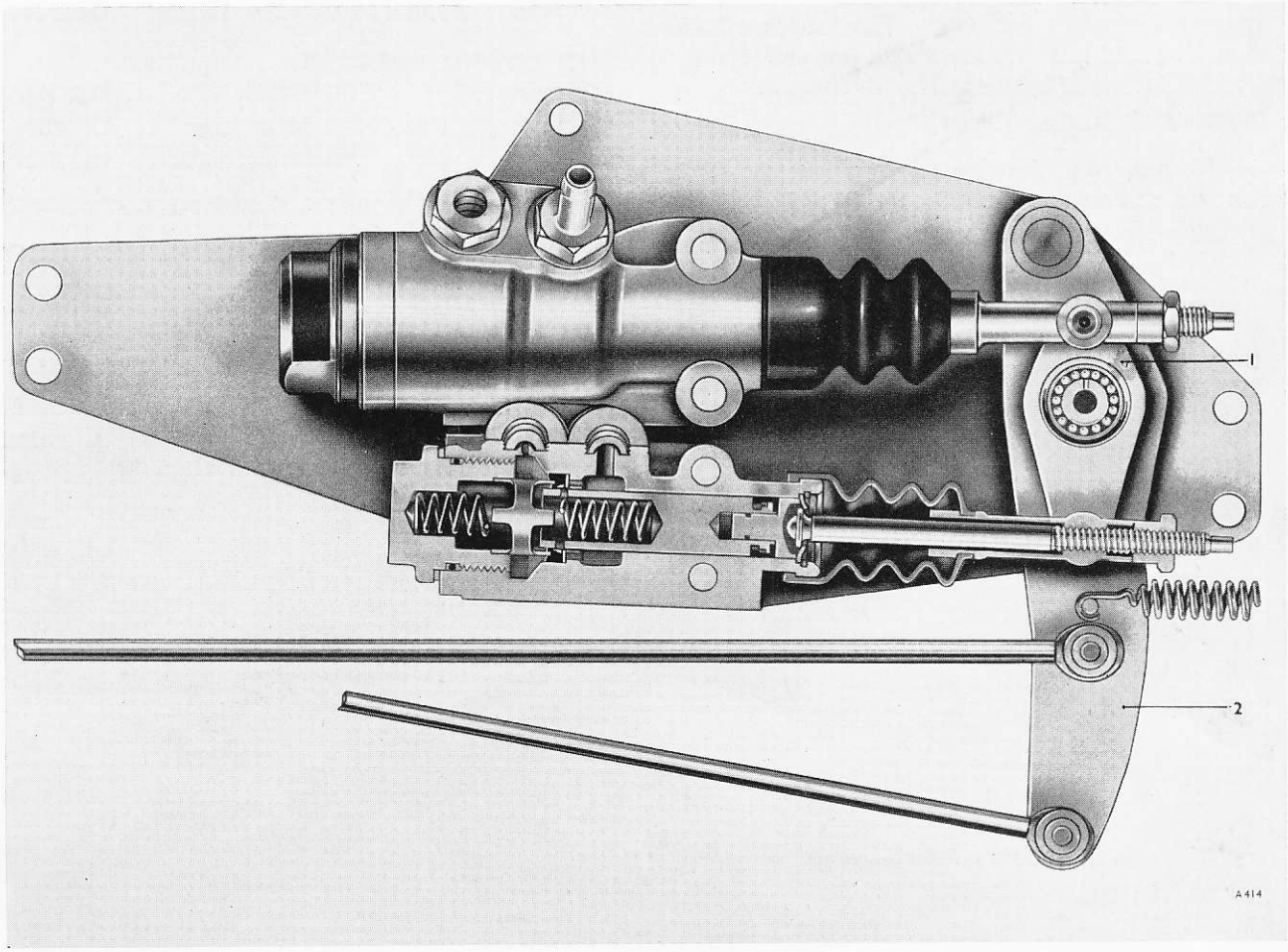


Fig. G7 Dual master cylinder

1. MASTER CYLINDER BALANCE LEVER 2. OPERATING LEVER

Remove the operating lever fulcrum pin and the two through bolts securing the master cylinder to its bracket.

Press down the master cylinder to gain access to the outlet pipe union. Disconnect the union.

Disconnect the inlet pipe and collect the fluid from the reservoir in a clean container.

Remove the master cylinder and lever assembly.

Master Cylinder — to dismantle

Remove the rubber boot and the circlip retaining the push rod washer. Remove the push rod, plunger and spring.

Remove the end cap. (This cap will be found to be very tight and will require a spanner or tommy bar approximately two feet long. The master cylinder should be held in a vice fitted with jaw protectors).

Master Cylinder Overhaul

All single cast iron master cylinders should be removed and single aluminium master cylinders fitted in their place.

Both single and dual aluminium master cylinders may be overhauled provided that condition of the cylinder bore(s) permits further service.

On S1 and S2 dual cylinder systems, complete master cylinder units are interchangeable.

The components of the master cylinders are interchangeable with the exception of the plunger seals. Both types of seals are included in the overhaul kits; the correct seal should be fitted and the surplus one discarded.

Part numbers are as follows:

Master cylinders

Old type		*New type*
UG.2891	1 in. (2·54 cm.) cylinder	UG.3847
UG.2892	$\frac{3}{4}$ in. (1·905 cm.) cylinder	UG.3848

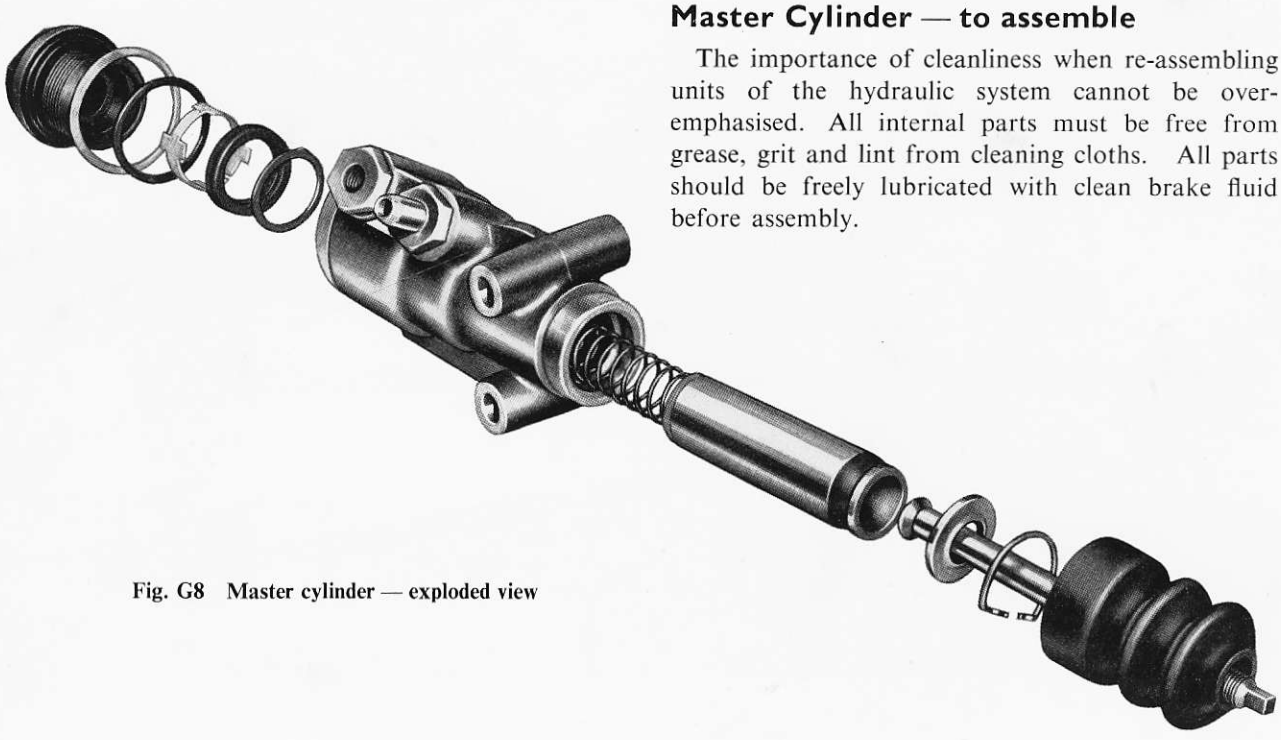
Master cylinder overhaul kits

Old type		*New type*
CD.1206	1 in. (2·54 cm.) cylinder	CD.2026
CD.1207	$\frac{3}{4}$ in. (1·905 cm.) cylinder	CD.2027

The kit for the single master cylinder system CD.1205 is not affected.

Master Cylinder — to assemble

The importance of cleanliness when re-assembling units of the hydraulic system cannot be over-emphasised. All internal parts must be free from grease, grit and lint from cleaning cloths. All parts should be freely lubricated with clean brake fluid before assembly.



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Fig. G8 Master cylinder — exploded view

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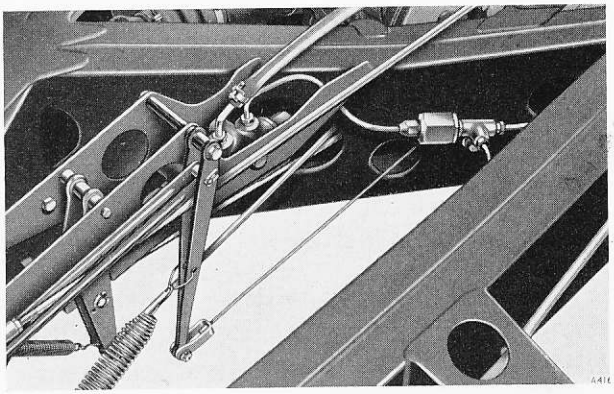


Fig. G9 Master cylinder in position

Fit the seal shim, main seal, gasket and end cap. Tighten the end cap. Insert the plunger spring and plunger, then work the small seal carefully into the cylinder bore.

Fit the push rod and circlip.

Dual Master Cylinder System — to adjust

Before fitting the cylinder to the chassis bracket, adjust the upper cylinder push rod so that the centre of its pivot on the balance lever is 3·700 in. (9·398 cm.) from the master cylinder end face (see Fig. G10).

After fitting the master cylinders and connecting the linkages, take up all clearances on the lower cylinder push rod by means of the adjuster, then slacken the adjuster $\frac{1}{4}$ of a turn.

No 'on-stop' adjustment is provided.

Single Master Cylinder System — to adjust

Fit the master cylinder to the chassis bracket. Press the rear end of the rubber boot forward to allow access to the lock-nut and spannering flats. Release the lock-nut, then shorten the push rod as much as possible so that there is slack between the end of the push rod and the plunger. (The slack can be felt by gently moving the lower end of the operating lever backwards and forwards). Do not pull too hard on the operating lever or the plunger will be forced along the cylinder; as plunger return is slow, the subsequent adjustment may be inaccurate.

Lengthen the push rod until free movement at the lower end of the operating lever is just lost. Shorten the push rod one flat ($\frac{1}{4}$ turn), then lock the nut.

Re-fit the rubber boot.

Adjust the 'on-stop' bar so that it must travel 1·600 in. (4·064 cm.) before contacting the edge of the master cylinder support bracket (see Figs. G5 and G9).

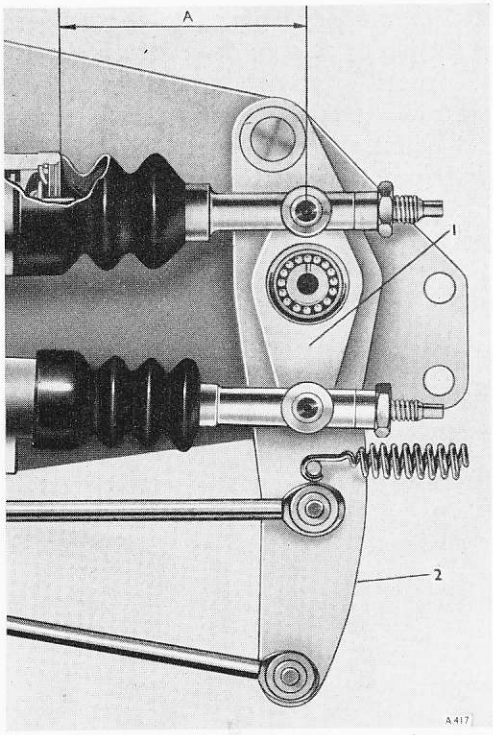


Fig. G10 Dual master cylinder adjustment

A. 3·700 in. (9·398 cm.)
1. MASTER CYLINDER BALANCE LEVER
2. OPERATING LEVER

SECTION G4 — SERVO MOTOR

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The servo motor operates on the same principle as the dry disc clutch. The lined friction plate (see Fig. G11) is driven from the gearbox output shaft at approximately one fifth of the propeller shaft speed and is in continuous rotation whilst the car is in motion.

The pressure plate is freely mounted on a co-axial shaft and is brought into contact with the friction plate, when the foot brake pedal is depressed, by means of cams and steel balls between the operating levers. The motion imparted to the pressure plate causes the pin to pick up one of the brake actuating levers, forward or reverse, according to the motion of the car and to apply the master cylinder by means of the drag link and operating lever. On releasing the foot brake pedal the servo operating levers are returned to their normal positions by a torsion spring fitted between the levers.

Servo — to remove

Remove the right-hand undershield.

Remove the setscrews securing the clevis pin retaining plate and remove the clevis pins.

Disconnect the rods from the servo cam levers.

Disconnect the drag links from the servo brake actuating levers. Remove the servo 'on-stop' to improve access to the servo.

Release the handbrake to slacken the cable which may then be lifted to further improve access to the servo.

Remove the centre bolt and withdraw the servo motor.

Servo — to dismantle

Remove the protector ring and the spring plate.

Should difficulty be encountered in separating the surfaces sealed with Bostik adhesive, the application of trichlorethylene will assist dismantling.

Mount the pressure plate assembly vertically in a vice fitted with jaw protectors, holding it by the inner end of the servo shaft.

Remove the lock-nut and the adjusting nut, then withdraw the components from the shaft (see Fig. G11). Retain the three steel balls and the torsion spring fitted between the servo cam levers. Lightly drive the ball race from the pressure plate hub.

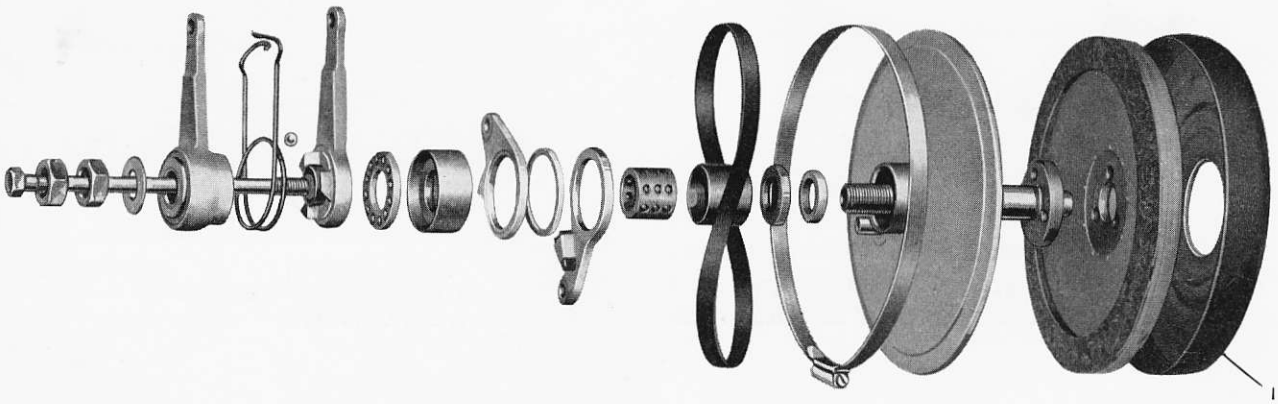


Fig. G11 Servo motor — exploded view

1. SPRING PLATE

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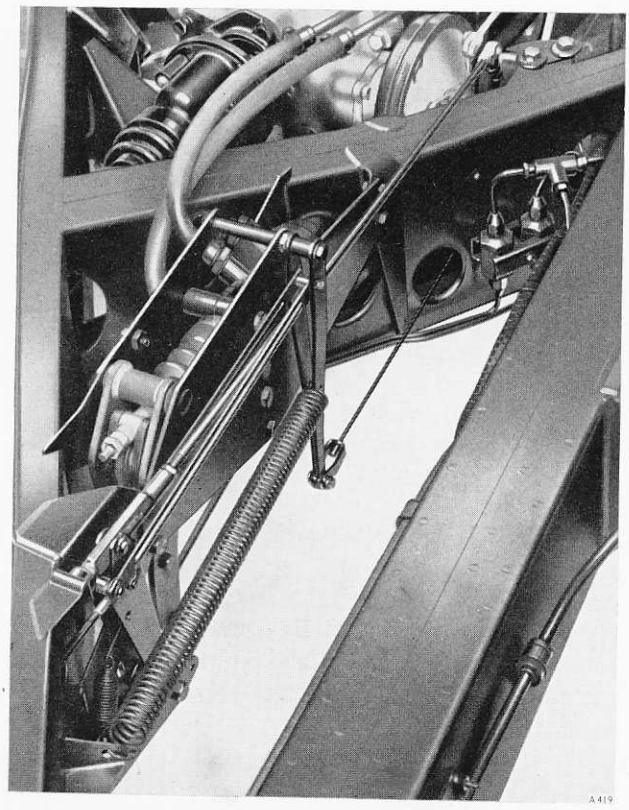


Fig. G12 Servo motor and actuating rods

Servo — to inspect

Thoroughly clean all parts and examine for wear. Special attention should be paid to the friction lining; a glazed friction lining can cause inefficiency of the brakes.

Servo motors fitted to **S1 cars** have spring plates fitted behind the lining. Check that the set of the spring plates is between 0·032 in. (0·813 mm.) and 0·035 in. (0·889 mm.) by means of feeler gauges inserted between the spring and the lining and between the spring and the friction plate (see Fig. G13). If the set is below 0·032 in. (0·813 mm.), a replacement assembly or new spring plates should be fitted. The spring plates are riveted to the friction plate.

If the pressure plate is scored or distorted it should be renewed.

Friction Plate Linings — to renew

Release the pressure of the Belleville washer by inserting a screwdriver between the inertia ring and the friction plate, as shown in Figure G14. Turn the screwdriver so that the ring and plate are separated and hold them in that position.

Insert and turn a second screwdriver between the ring and plate diametrically opposite the first; the Belleville washer will spring away from the inertia ring.

Remove the screwdrivers.

Turn the inertia ring until three access holes are aligned with three rivets.

Drill each rivet to a depth of $\frac{1}{16}$ in. (1·575 mm.) with a $\frac{5}{32}$ in. (3·962 mm.) diameter drill, then with the aid of a $\frac{1}{8}$ in. (3·175 mm.) diameter pin punch, remove the rivets.

Re-fit the Belleville washer.

Attach new linings by inserting and lightly swaging over two new rivets fitted opposite each other.

Insert and lightly swage the remaining rivets.

Finally, swage over all rivets with a spigoted flat punch (see Fig. G15).

It should now be possible to turn the inertia ring by hand. If the assembly feels solid, even on applying considerable effort, the Belleville washer should be renewed by drilling out the old rivets and re-riveting.



Fig. G13 Checking set of the spring plates

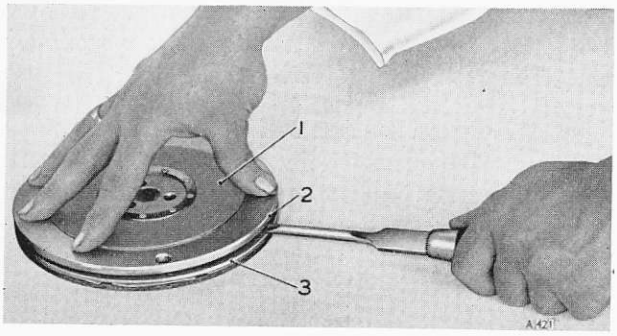


Fig. G14 Releasing the Belleville washer

1. BELLEVILLE WASHER 2. INERTIA RING 3. FRICTION PLATE

Servo Motor Sealing

Early S1 cars

When assembling the servo, care should be taken to obtain complete sealing. On cars fitted with the earlier pattern pressure plate incorporating three ventilation slots, before assembling, the following modifications are required if they are not already incorporated.

By simple unsweating, remove the water drain from the servo spring plate.

Blank off the spring plate drain holes located in the rim by filling with solder. This is best done by tinning the inside of the rim, resting the spring plate (holes downwards) on a sheet of asbestos. The use of asbestos prevents the hot solder from running through the holes and building up on the outside of the rim. The solder should then be smoothed over and the spring plate painted with a good quality, air drying, chassis enamel.

Lubricate the thrust race, operating lever cams and pressure plate ball race with Molytone 265 grease.

Renew and soak the felt washer (located in the pressure plate) in engine oil and lightly coat with Molytone grease. Apply 'Wellseal' sparingly to the end face of the servo drive shaft, both sides of the centre of the inertia plate, to the end face and driving pins of the servo driven shaft and under the head of the servo retaining setscrew after first ensuring that all surfaces are free from oil or grease.

Allow at least five minutes for air drying before assembling the joints.

The Ferobestos seal washer should be assembled, chamfered edge leading, on the spigot formed by the oil seal housing; it should be completely dry and free from adhesive or lubricant.

With the pressure plate uppermost, position the rubber seal with the flap covering the ventilating slots and ease the seal over the rim edge without stretching. Holding the rubber seal in that position, ease the opposite side over the plate edge. It is essential that the pulling is limited to the inner diameter only, thereby preventing distortion of the outer periphery. Ease the remainder of the seal into position until the inner periphery fits closely against the machined surface.

By carefully lifting the rubber seal which overlaps the ventilating slots and machined surface, apply Bostik adhesive 89AA to the inner face of the seal, a small area at a time, until the complete circumference of the inner face has been treated in this way. Allow the adhesive to set for approximately one hour before using the car.

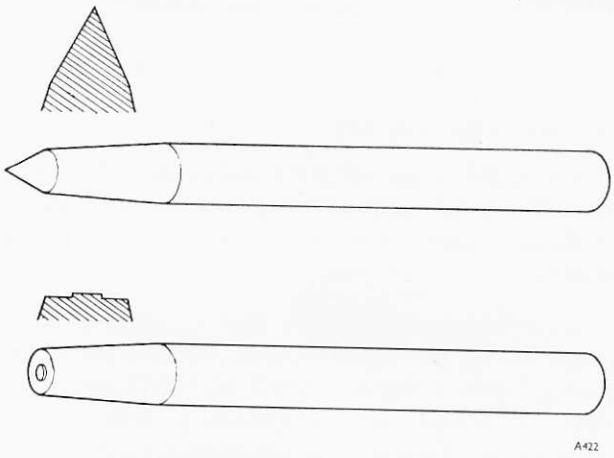


Fig. G15 Punches — servo re-lining

Discard the existing worm drive protecting ring and fit the spring ring in its place. Position the spring towards the rear of the car and not to the lowermost position as was customary on earlier cars.

The position of the baffle plate is immaterial if the earlier type protecting ring is being used.

The servo can then be fitted to the car, the seal being finally checked after road testing.

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Note: (*a*) It is *not* possible to use the rubber seal more than once, nor is it possible to use the seal if it has been distorted in an unsuccessful attempt to fit it.

(*b*) Trichlorethylene applied to the Bostik will assist easy separation when required.

Late S1 and S2 cars

The standard of sealing is improved on late S1 and all S2 cars.

When disturbing the servo for any reason, it will be necessary to carry out the following re-sealing procedure.

Ensure all parts are clean and free from grease.

Pack and lubricate the thrust race, operating lever cams and pressure plate ball race with Molytone 265 grease.

Renew and soak the felt washer (located in the pressure plate) in engine oil and lightly smear the outer surfaces with Molytone grease.

Apply 'Wellseal' sparingly to the end face of the servo driving shaft, both sides of the centre of the inertia plate, to the end face and driving pins of the servo driven shaft and under the head of the servo retaining setscrew after first ensuring that all surfaces are free from oil or grease.

The Ferobestos seal washer is adhered to the spring plate by a special process. In the event of their becoming separated, a replacement spring plate and washer assembly should be obtained and fitted. **Under no circumstances** should the seal washer be fitted to the spring plate using a Bostik adhesive.

Apply Bostik adhesive No. 89AA sparingly to the circumferential joint between the spring plate and pressure plate after assembly, also to the inside of the rubber seal.

With the pressure plate uppermost, place on the rubber seal and ease the seal over the rim edge, without stretching. Holding the seal in that position, ease the opposite side and remainder of the seal into position.

Position the protector ring with the worm drive towards the rear of the car.

Notes (*a*) and (*b*) on the sealing **on early S1 cars** are also applicable to **late S1 and all S2 cars**.

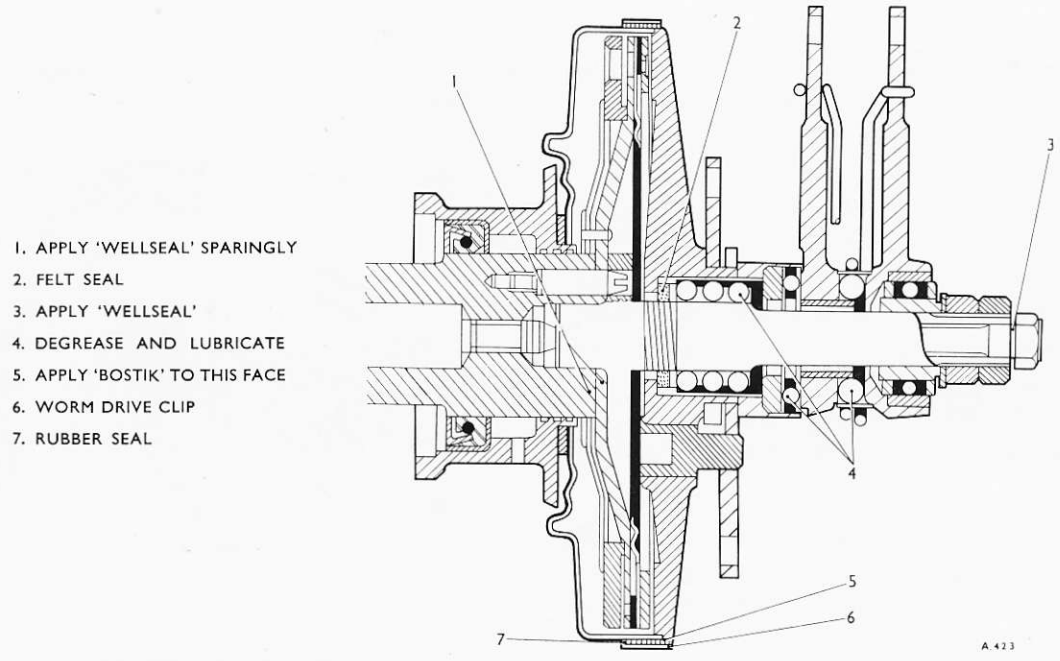


Fig. G16 Servo assembly (late S1 and S2 cars)

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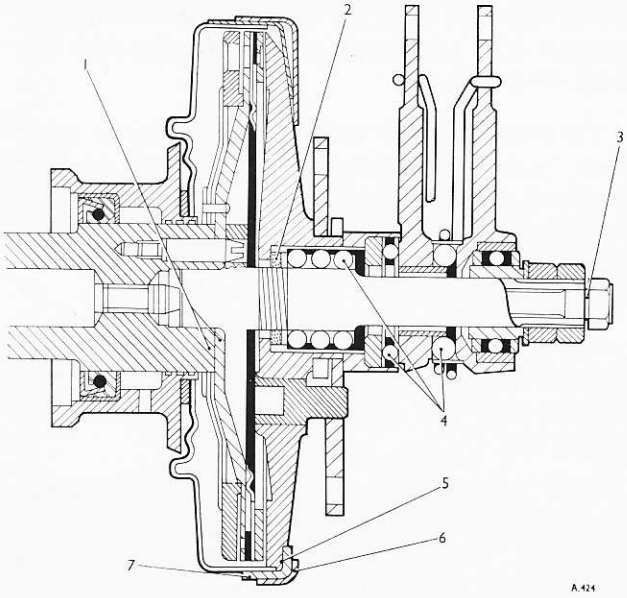


Fig. G17 Servo assembly (early S1 cars)

1. APPLY 'WELLSEAL' SPARINGLY
2. FELT SEAL
3. APPLY 'WELLSEAL'
4. DEGREASE AND LUBRICATE
5. APPLY 'BOSTIK' TO THIS FACE
6. RING RG.3311 OR RG.7997 AND SPRING RH.135
7. RUBBER SEAL RH.377

Servo to Gearbox — to fit

On S2 cars, check the protruding length of the three driving pins above the end of the servo driving shaft; this length should be no more than 0·360 in. (9·144 mm.). If above this length, the driving pins should be unscrewed from the servo driving shaft and modified. Using suitable clamps, hold each pin in a vice and file off the required amount of metal from the slotted end, ensuring that the face is kept square to the centre line of the pin. Remove any burrs, particularly in the slots, then fit the pins in the servo drive shaft ensuring that they are fully tightened. On completion of this modification, the gearbox rear extension must be marked with a blue spot for future identification.

Position the servo motor on the driving shaft, ensuring that the three driving pins engage with the holes in the friction plate and the servo shaft flange. Insert and tighten the centre bolt.

Rock the servo to ensure that it is free.

Slacken the adjusting nut if necessary and re-tighten the centre bolt.

Connect the brake rods.

Fit the servo 'on-stop' and ensure that the handbrake cable is correctly positioned **under** the servo shaft.

Fit the undershield.

Servo Cam Angle

Should the servo motor be changed as a unit, or the cam levers be renewed, ensure that the correct cams are fitted.

Should the servo motor be changed as a unit, or the operating levers be renewed, ensure that the operating lever cam angles are correct.

On early S1 cars, fitted with the single master cylinder system, the operating lever cam angle is 52 deg.; it can be identified by the numbers '1126FC' and '1127FC' on the levers.

On Bentley Continental S2 and late S1 cars, fitted with the dual master cylinder system, the operating cam angle is 47 deg.; there are no identification numbers on these levers.

On S2 and Phantom V cars, the operating lever cam angle is 37½ deg.; there are no identification numbers on these levers.

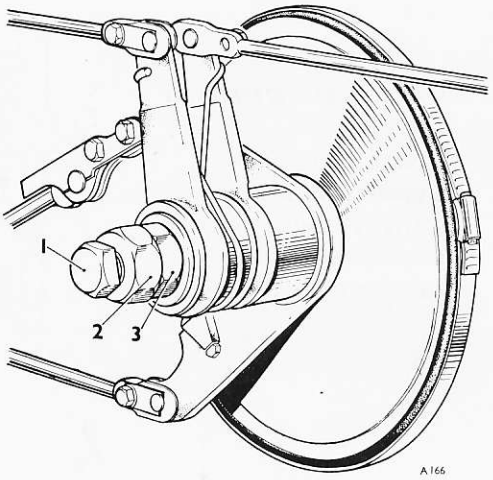


Fig. G18 Servo adjustment

1. CENTRE SECURING BOLT 2. LOCKING NUT 3. ADJUSTING NUT

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Tighten the adjusting nut (see Fig. G11) until drag between the plates can just be felt on rocking the servo. Unscrew the adjusting nut two flats ($\frac{1}{3}$ of a turn) to free the servo. Apply the pedal once to ensure that the outer servo lever has followed the backward turn of the adjusting nut. Hold the adjusting nut and tighten the lock-nut.

Servo 'On-stop' Adjustment

It is essential when fitting the servo 'on-stop' bracket to ensure that it is correctly adjusted (see 'Basic Adjustment of Brake Rods and Linkages — S1 and S2 cars').

SECTION G5
BRAKE SHOES, DRUMS AND EXPANDER MECHANISM

Special tools required:

RH.627 — Trammel

Spring balance — 30 lb. (14 kg.) reading

Replacement shoe and lining assemblies are available and should always be fitted when re-lining is necessary. The front shoe operating fork of the dual master cylinder system has a larger jaw than that of the single master cylinder system in order to accommodate the stiffened web of the later pattern shoe. Shoes are only interchangeable if the operating forks are interchangeable.

When renewing the brake linings due to wear, it is recommended that the following operations are carried out:

1. Fit service replacement shoes.
2. Overhaul the wheel cylinders and fit new rubber seals.
3. Overhaul the master cylinders and fit new rubber seals.
4. Dismantle, clean and grease the rear adjusters.
5. Renew the flexible brake hoses. In the interest of safety it is recommended that these hoses be renewed every 40,000 miles (64,000 kilometres).

Front Brakes — to dismantle

The procedure for the removal of the front shoes **on the S2 Continental** differs from that for the remaining **S2 and all S1 cars.**

Action after removal is common to **all S1 and S2 cars.**

Raise the front of the car using a hydraulic jack.

Remove the wheel and brake drum; if the drum is tight, screw two $\frac{1}{4}$ in. U.N.F. bolts into the tapped extraction holes provided.

Withdraw the shoes from the steady posts and from the wheel cylinder rubbers. Withdraw the shoes from the anchor slots in the rear of the wheel cylinders.

Unhook the pull-off springs and remove the shoes.

It is possible to extract the internal parts of the wheel cylinders, including the rubber seals, without removing the wheel cylinder from the carrier plate (see Fig. G22).

Renew the paper gaskets and locking strips if removed.

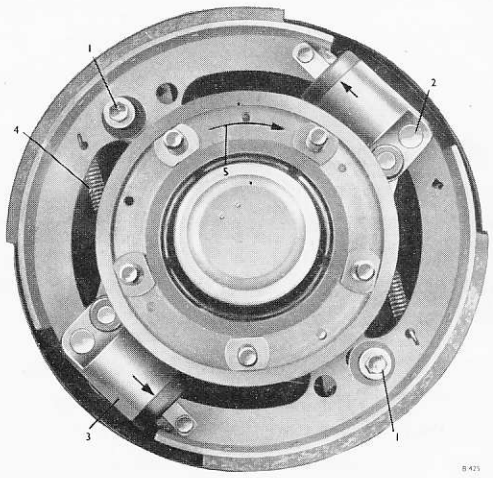


Fig. G19 Front brake — two shoe system — drum removed

1. SHAKE-BACK STOP
2. SHOE PIVOT
3. WHEEL CYLINDER
4. RETURN SPRING
5. FORWARD WHEEL ROTATION

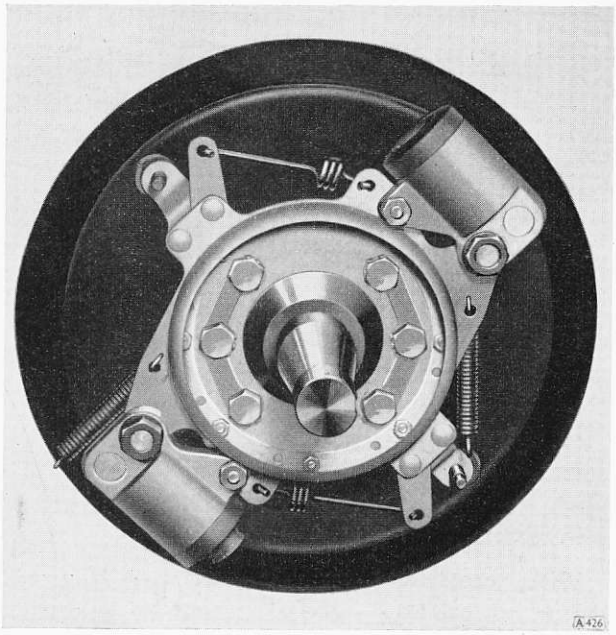


Fig. G20 Front brake — two shoe system — hub and shoes removed

Overhaul

In the past, wheel cylinders requiring reconditioning have always been returned for service replacement. With the co-operation of the Manufacturers it is now possible to release complete overhaul kits, when required, to Retailers who are desirous of carrying out their own repair service on these units.

All aluminium wheel cylinders should be discarded and spreader type cast iron cylinders fitted.

Cast iron cylinders fitted with air excluders should be converted to comply with the latest specification. This entails a systematic renewal of used parts and the installation of spreaders. All parts necessary to bring about the conversion are contained in the wheel cylinder overhaul kits.

On each front wheel cylinder, discard the dust cover, seal abutment, spring and air excluder, together with the bleed valve dust cover and ball; fit new parts as instructed in the leaflet enclosed with the kit.

When overhauling cast iron cylinders already fitted with spreaders, the straightforward method of renewing used parts by those supplied in the overhaul kit should be applied.

The braking system of all cars undergoing extensive overhaul should be fitted with cast iron wheel cylinders incorporating spreaders and either a single or dual, aluminium master cylinder unit.

In all cases, discretion must be used by the Retailer in deciding whether a master cylinder or wheel cylinder is suitable for further service and consequently overhauled, or whether it should be discarded and replaced by a new unit.

Separate overhaul kits are issued containing the necessary parts:

Cast iron front wheel cylinder	Part No. CD.1203	1 off
Cast iron rear wheel cylinder	Part No. CD.1204	1 off

Shake-back Stops

The shake-back stops which are fitted to all rear brakes, **except Phantom V**, prevent the shoes from being shaken away from the drum when the car is moving over rough surfaces. The stop consists of two unpolished chromium plated washers held on either side of the web of the shoe by a spring-loaded collar as shown in Figure G23. The shoe is free to move whenever the frictional resistance of the washers is overcome by the brake actuating mechanism.

With the shoes assembled on the carrier plate, the shake-back stop collar fits over the steady post and on brake application the shoe web slides between the friction washers until zero clearance between shoe and drum is maintained. The radial clearance between the steady post and collar allows the operating movement for the shoes.

When fitting replacement shoes, the slipping poundage on the shake-back stops should be checked with a spring balance and should be between 20 and 30 lb. (9·06 and 13·59 kg.) for two shoe brakes and between 22½ and 32½ lb. (10·193 and 14·723 kg.) for four shoe brakes. Hold the shoe vertically in a vice and connect the spring balance to the shake-back stop collar with a suitable wire hook. Pull on the spring balance so that the direction of pull is parallel to the shoe web and along the centre line of the slotted hole. Note the spring balance reading at which the shake-back stop begins to move. If the poundage is outside the above limits, fit new washers or spring as

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necessary. No grease or lubricant of any kind should be used on the stop assembly.

Ensure that the steady posts are correctly entered into the shake-back stop collars. In order to give more positive engagement, the steady posts were increased in length; where replacement shoes have been fitted, it is essential that the steady post and shake-back stop are a pair as the early pattern post allows the end of its thread to take the thrust of the later pattern collar. It is important that there is a small clearance between the thread and collar, as shown in Figure G23.

A modification was introduced to the shake-back stop collar fitted **on S1 cars**; this modified collar is standard **on S2 cars**.

The modified collar, having a $\frac{1}{4}$ in. diameter external thread and a plain nut, is used to clamp the friction

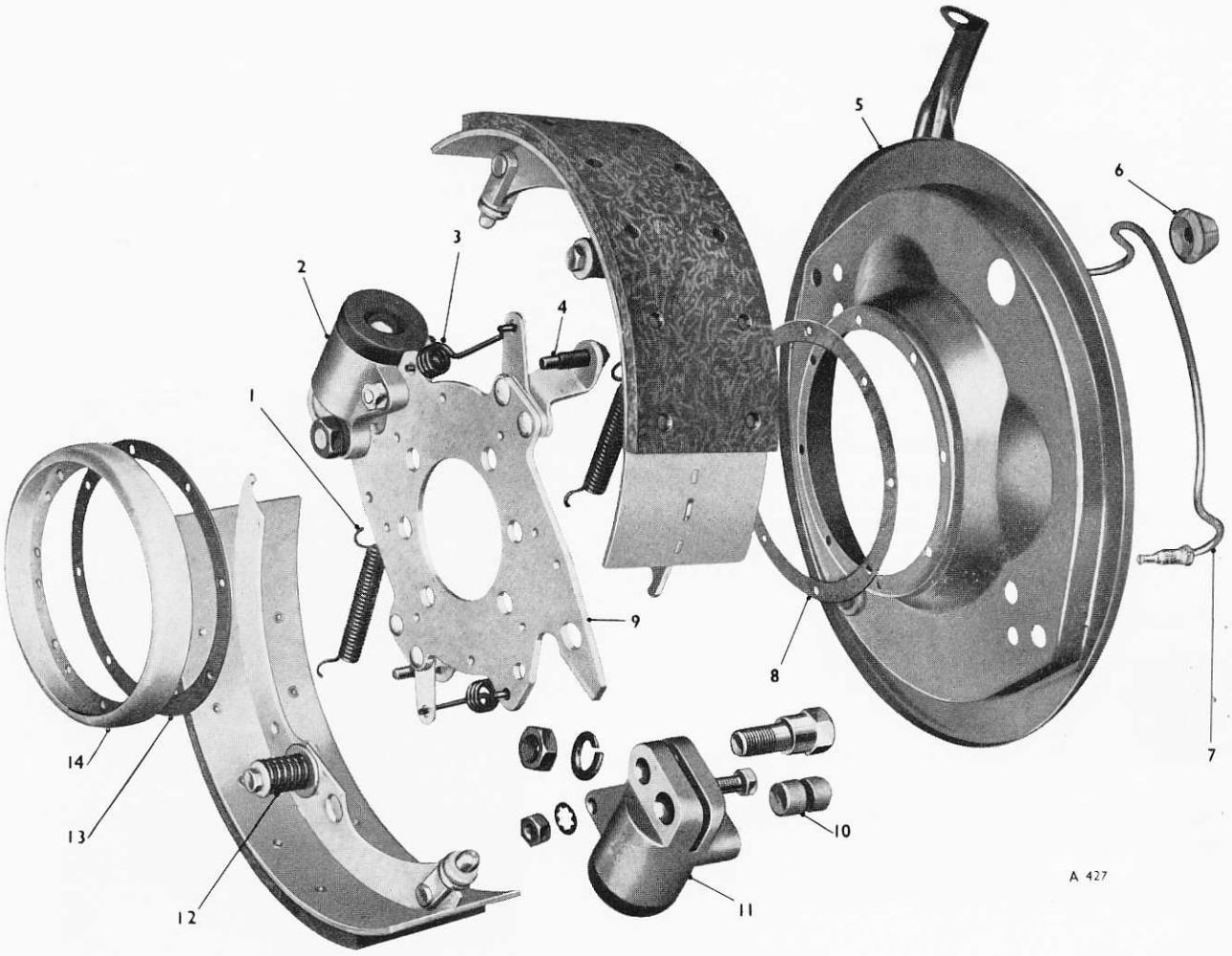


Fig. G21 Front brake — two shoe system — exploded view

1. PULL-OFF SPRING
2. WHEEL CYLINDER
3. WARNING SPRING (NOT FITTED ON LATE S2 CARS)
4. STEADY POST
5. WATER EXCLUDER
6. RUBBER DUST CAP
7. WHEEL CYLINDERS CONNECTING PIPE (SINGLE CYLINDER SYSTEM ONLY)
8. JOINT
9. CARRIER PLATE
10. BRAKE SHOE ANCHOR PIN
11. WHEEL CYLINDER
12. SHAKE-BACK STOP
13. JOINT
14. GREASE CATCHER

washers and spring, whereas the earlier collar is threaded internally and a bolt is used to clamp the friction washers and spring; the modified type of collar is shown in Figure G23. The reason for the introduction of a modified collar is primarily one of economy and it is therefore intended that supplies of the earlier collar and bolt should be used until stocks are exhausted, after which requests for the collar and bolt will be dealt with by supplying the modified collar and nut.

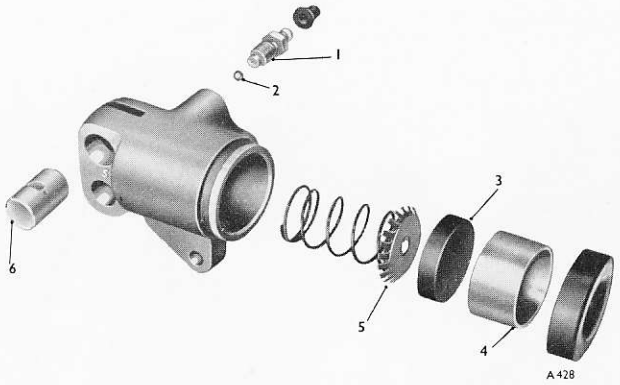


Fig. G22 Wheel cylinder — exploded view

1. 'BLEED' SCREW
2. STEEL BALL
3. RUBBER SEAL
4. PISTON
5. SPREADER
6. BRAKE SHOE ANCHOR PIN

Front Brakes — to fit

Reverse the procedure described for the removal of the brakes.

Check that the lining faces are at right angles to the hub flange. The check may be made with a trammel, Special Tool RH.627, or a parallel bar and set square as shown for the rear shoes in Figure G30; adjustment is made by screwing the steady post in or out as necessary.

Remove the dust cover in the rear of the water excluder and release the steady post lock-nut just sufficiently to permit rotation of the post.

Adjust the steady post by means of a screwdriver in the slot provided in the end of the post, then tighten the outside lock-nut with a box spanner concentric to the screwdriver.

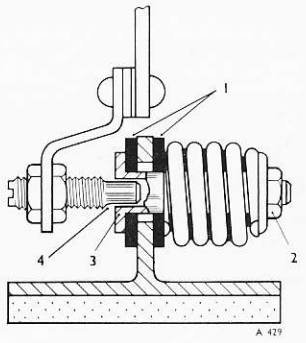


Fig. G23 Shake-back stop

1. FRICTION WASHERS
2. NUT
3. SHAKE-BACK COLLAR
4. CLEARANCE

On early S1 cars, pull the shoe forward, away from the carrier plate and tighten the inner lock-nut on the steady post. **On later cars,** the inner lock-nut is welded to the steady post bracket and does not therefore require tightening.

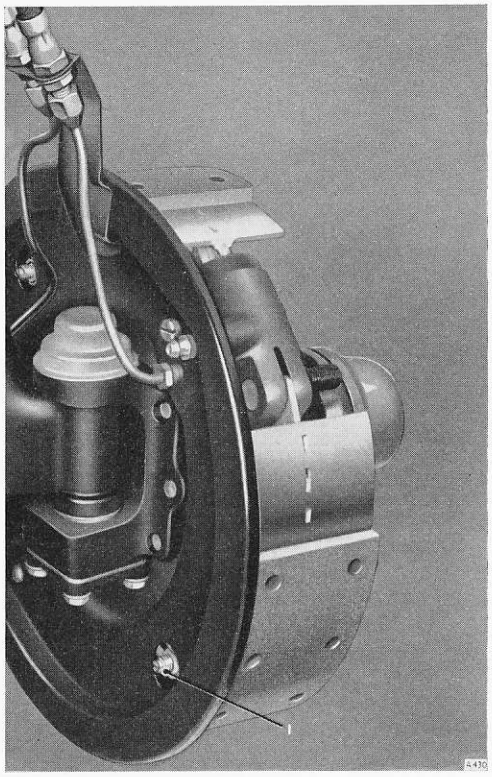


Fig. G24 Front brake — rear view

1. ADJUSTING SCREW

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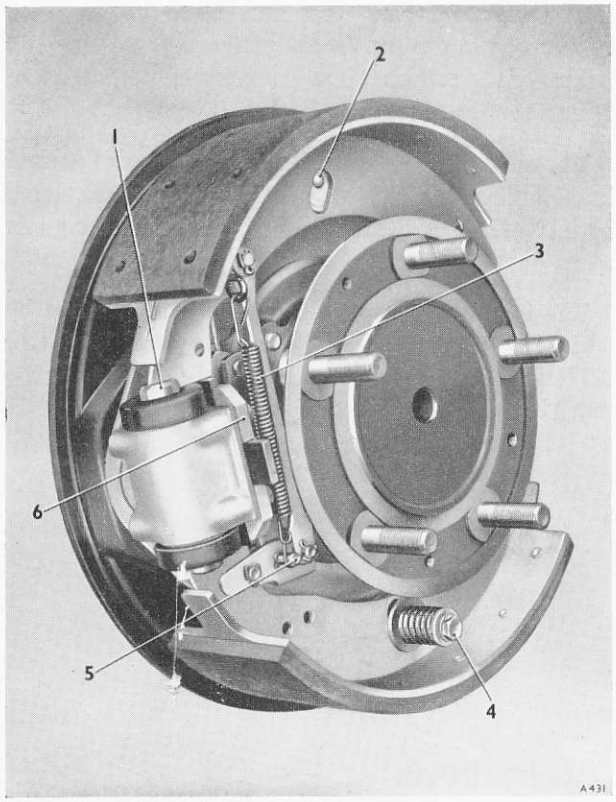


Fig. G25 Rear brake — drum removed

1. HYDRAULIC EXPANDER
2. STEADY POST
3. RETURN SPRING
4. SHAKE-BACK STOP
5. ANCHOR PIN
6. MECHANICAL EXPANDER

Press both shoes inwards and temporarily re-fit the drum, taking care that the shake-back stops are not pulled off their steady posts.

Apply the brakes by means of Special Tool RH.322 or RH.417, to centralise the shoes.

Remove the brake drum, tighten the cylinder mounting bolts then finally re-fit the drum.

Rear Brakes — to dismantle

Raise the rear of the car using a hydraulic jack.

Remove the wheel and brake drum; if the drum is tight, screw two $\frac{1}{4}$ in. U.N.F. setscrews into the tapped holes provided.

Pull the shoes from their steady posts and away from the adjuster plungers. Unhook the return spring adjacent to the expander from its anchor pin on the inter-shoe linkage. A loop is provided to enable the spring to be gripped with pliers.

It should be noted that on **Phantom V rear brakes,** no springs are fitted at the expander end of the brake shoes.

Remove the shoes, working the inter-shoe linkage out between the expander unit and the hub (see Fig. G26).

Disconnect the hydraulic pipe from the expander unit.

Release the lock-tab and remove the 2 B.A. setscrew securing the expander unit to its cover plate on the water excluder.

Remove the expander unit forward.

Remove the two setscrews and plain washers retaining the adjuster unit and remove the unit. Collect the distance pieces fitted between the water excluder and the carrier plate.

Expander Unit — to overhaul

Remove the dust covers and extract the pistons, rubber seals and spreaders.

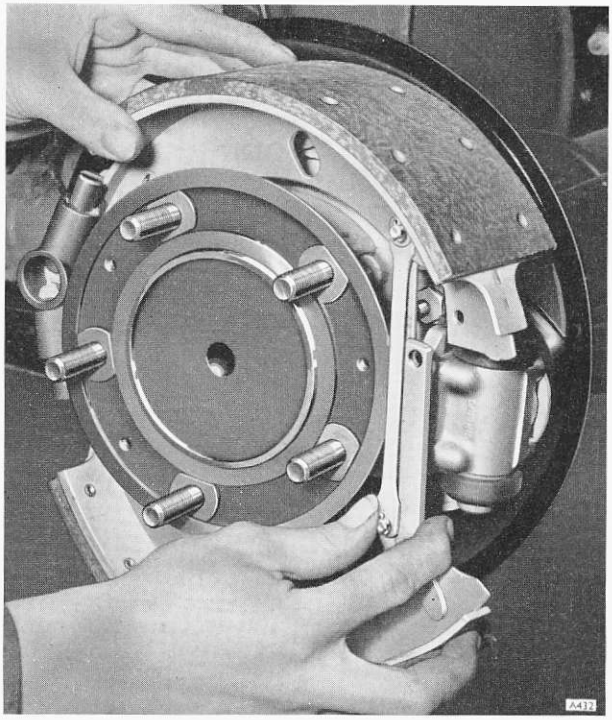


Fig. G26 Rear brake — shoe removal

Remove the four 2 B.A. nuts, shake-proof and plain washers. Remove the tappet guide (see Fig. G28).

Thoroughly clean all parts and inspect for wear.

Renew the rubber seal, smearing the pistons with Molytone C grease.

Inspect the wheel cylinder bores for scoring and corrosion. Renew the cylinder if necessary.

Lubricate the wheel cylinder parts liberally with clean brake fluid and re-assemble.

Re-assemble the mechanical expander, applying Molytone grease freely to the internal parts.

On early S1 cars, instances have occurred of seizure of the tappets in the guide plate resulting in failure of the rod operated expander with consequent failure to release the rear brakes.

The seizure is caused by the accumulation of packed brake lining dust and this condition can be alleviated by increasing the clearance of the tappets in the guide plate.

The four distance pieces have been lengthened by 0·020 in. (0·508 mm.), to give an overall length of 0·274 in. (6·96 mm.), a clearance of 0·025 in. (0·635 mm.) between the tappet and guide plate.

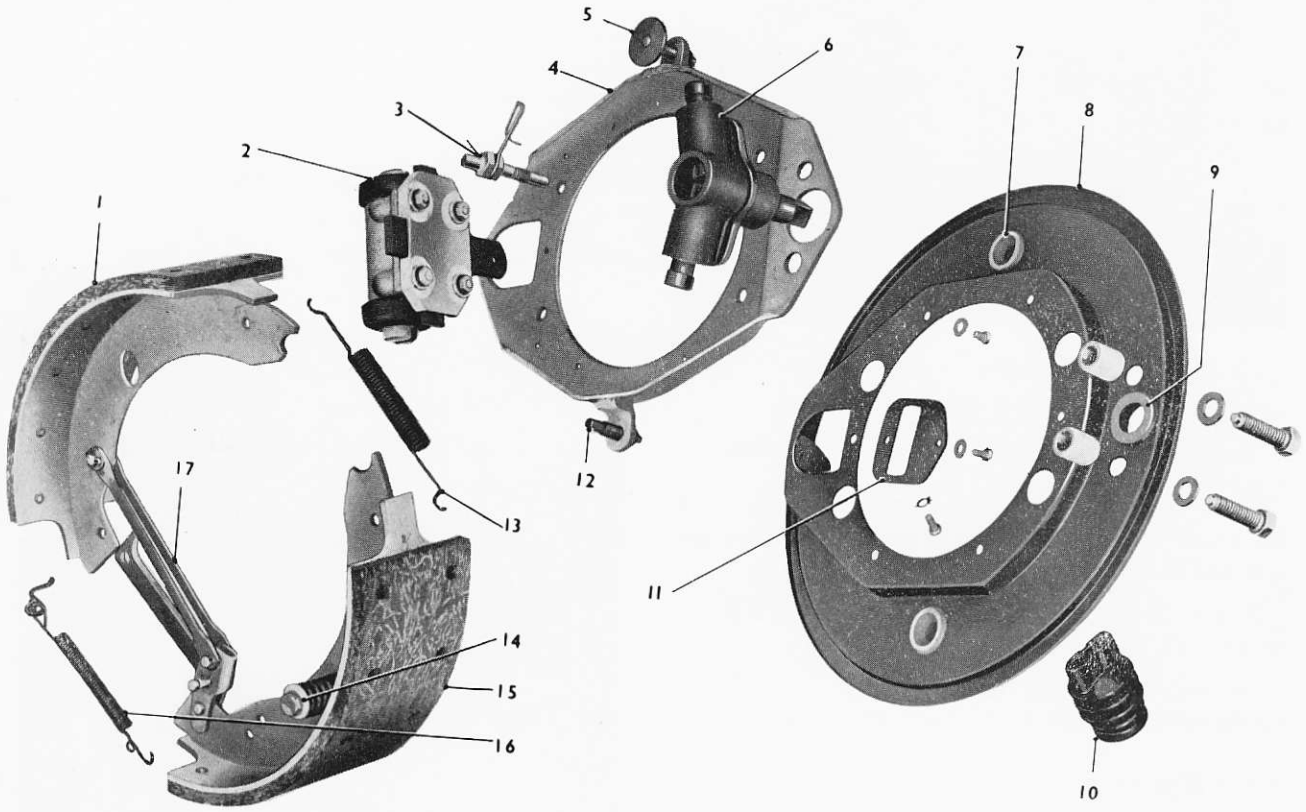


Fig. G27 Rear brake — exploded view

1. LEADING SHOE
2. WHEEL CYLINDER ASSEMBLY
3. ECCENTRIC PIN
4. CARRIER PLATE
5. STEADY POST
6. ADJUSTER UNIT
7. RUBBER DUST CAP
8. WATER EXCLUDER
9. RUBBER SEAL
10. RUBBER BOOT
11. WHEEL CYLINDER COVER PLATE
12. STEADY POST
13. ADJUSTER SPRING
14. SHAKE-BACK STOP
15. TRAILING SHOE
16. PULL-OFF SPRING
17. INTER-SHOE LINKAGE

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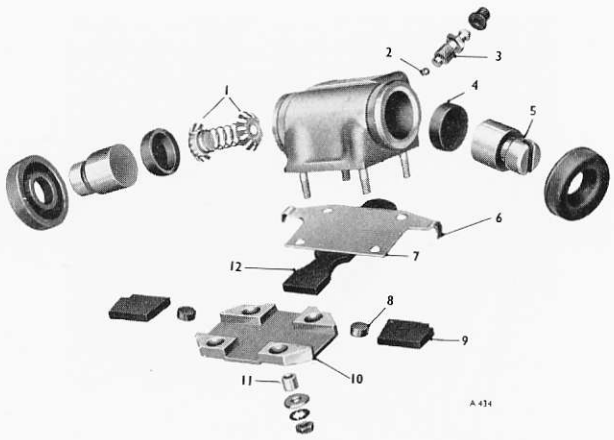


Fig. G28 Expander unit — exploded view

1. SPREADERS
2. STEEL BALL
3. 'BLEED' SCREW
4. RUBBER SEAL
5. PISTON
6. TAPPET STOP
7. SANDWICH PLATE
8. ROLLER
9. TAPPET
10. TAPPET GUIDE
11. DISTANCE PIECE
12. DRAW LINK

Indication of seizure of the tappets can be felt in the operation of the foot brake pedal. If two distinct pressures can be felt, the first movement taking up the slack in the rods and the second operating the servo, it is advisable to check the condition of the tappets. Overheating of the rear brakes may also be experienced.

Should trouble of this nature be experienced, the expander unit should be dismantled, cleaned and washed free of any lubricant.

Re-assemble the expander unit, using the new longer distance pieces and applying Molytone grease freely to the internal parts.

To indicate that this modification has been carried out, a white spot is painted on the angular surface at the extreme rear end of the right-hand side chassis member.

Material

The new part UG.3462 should be ordered and stored for use as necessary. All stocks of the old distance piece should be discarded.

For ease of identification, the expander unit for the right-hand side of the car has a straight draw link; the unit for the left-hand side has a draw link which is bent in order to obtain a direct pull from the rear.

Adjuster Unit — to overhaul

Remove the plungers, noting that they are handed and must be re-fitted in their original bores on re-assembly (see Fig. G29).

Thoroughly clean all parts and re-assemble using white grease. If the plunger ends are pressed in against the adjusting cone there should be four evenly-spaced 'clicks' for each turn of the adjuster screw.

Shoes — to re-fit

Turn the adjuster screw fully anti-clockwise.

Fit the return spring at the adjuster end of the shoes. Position the shoes against the back plate, working the inter-shoe linkage between the hub flange and expander unit.

Fit the shoes into the expander slots and the compression link of the inter-shoe linkage onto the eccentric pin.

Fit the shoes into the adjuster slots, ensuring that the shake-back stop of the lower trailing shoe fits over its steady post; it will be noted that no shake-back stops are fitted on **Phantom V rear brakes** and that no return spring is fitted at the expander end of the shoes.

Fit the return spring at the expander end of the shoes. The top end of the spring is retained by the wire hook attached to the eccentric pin. A loop is provided in the spring to enable it to be gripped by pliers while stretching its lower end onto the anchor pin on the inter-shoe linkage.

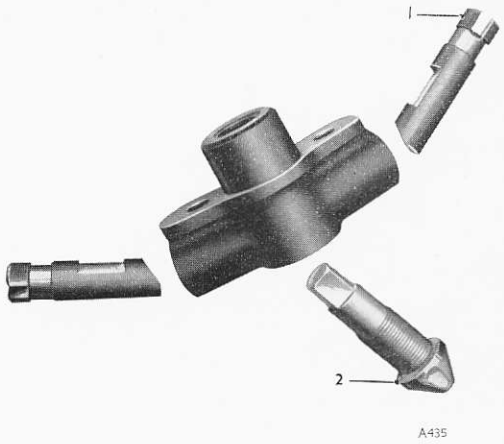


Fig. G29 Adjuster unit — exploded view

1. PLUNGER 2. ADJUSTER SCREW

Brake Shoes — to set

S1 and S2 cars

The alignment gauge RH.627, or a parallel bar and set square, is necessary to ensure that the brake shoes are fitted concentric and square to the drum.

Do not fully tighten the adjuster unit setscrews until the shoes have been aligned by screwing the steady posts in or out as necessary.

Remove the dust cover in the back of the water excluder and release the steady post lock-nut.

Adjust the steady post by means of a screwdriver in the slot provided in the end of the post, then tighten the lock-nut with a box spanner concentric to the screwdriver.

Pull the lower shoe away from the carrier plate and tighten the inner lock-nut on the steady post. It should be remembered that on later cars the nut is welded to the steady post bracket and therefore does not require tightening. The mushroom-headed steady post for the leading shoe has no inner lock-nut.

Slightly slacken the adjuster unit setscrews and the eccentric pin lock-nut (see Fig. G27). The latter should not be slackened more than half a turn, or more than is just sufficient to permit the pin to be turned by means of the inlet valve adjusting spanner provided in the tool kit.

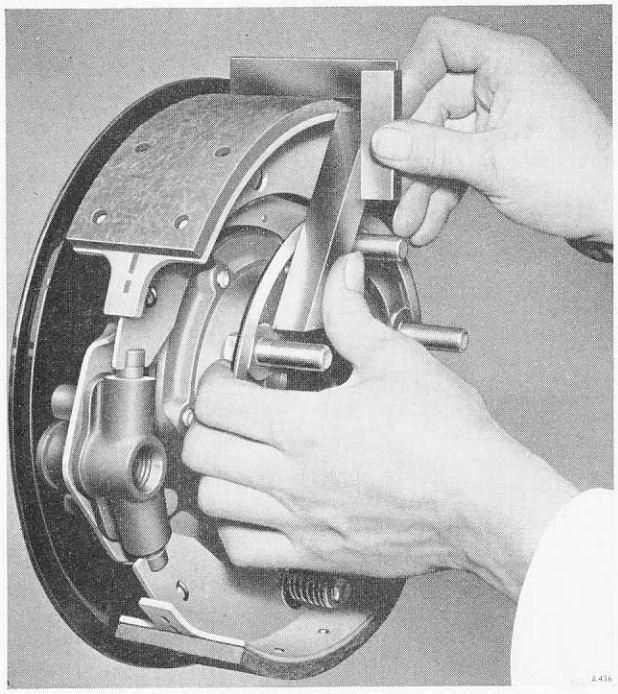


Fig. G30 Aligning the brake shoes

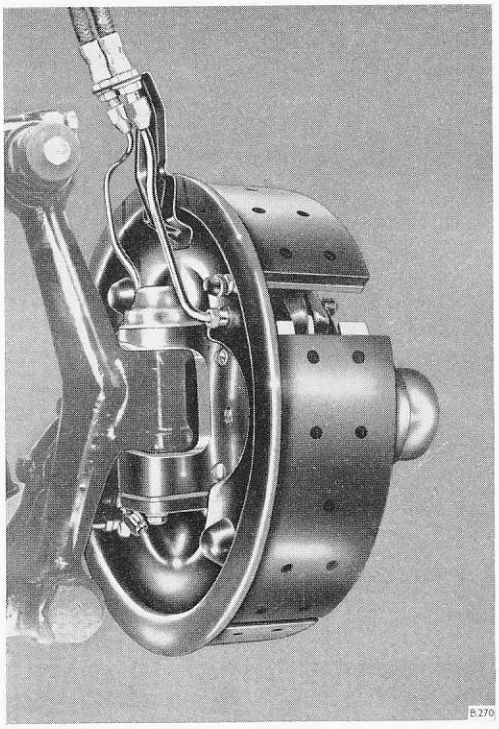


Fig. G31 Bentley Continental S2 — four shoe brake — rear view

Temporarily fit the brake drum and disconnect the rear end of rod 2 (see Fig. G1) from the rear brake equaliser.

Tighten the adjuster screw to centralise the adjuster unit by expanding the brake shoes, then tighten the adjuster setscrews.

Slacken the adjuster screw two 'clicks'.

Remove the brake drum and adjust the eccentric pin to obtain final centralising of the shoes using the trammel, Special Tool RH.627.

Tighten the pin lock-nut.

In cases where a trammel is not available, the eccentric pin must be adjusted with the drum in position. The pin should turn about 45 deg. in either direction when a positive stop will be felt as the shoes are expanded against the drum.

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If the pin appears to toggle over when turned in either direction, tighten the adjuster screw one 'click' and repeat the test.

Set the pin midway between its stop positions and tighten the lock-nut.

The adjuster screw is normally adjusted two 'clicks' back but when new linings have been fitted this should be increased to **five** 'clicks' to allow for their initial growth during road test.

Connect the brake actuating rod and fit the pull-off spring and rubber boot.

'Bleed' the brakes; refer to 'Hydraulic System — to bleed'.

Front Brakes — to dismantle

Bentley Continental S2

Dismantle the four shoe brake in the same way as described for the two shoe brake but as two shoes are fitted to each shoe carrier, the following additional operations are necessary.

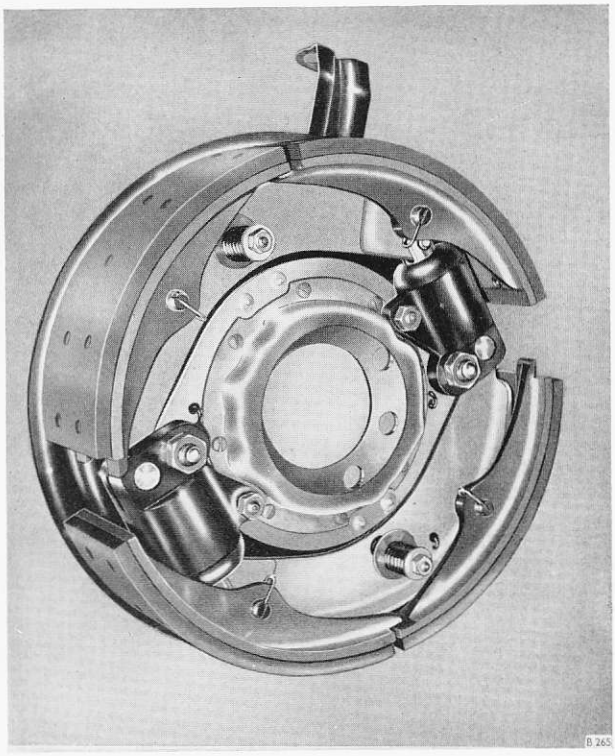


Fig. G32 Bentley Continental S2 — four shoe brake — assembly

Remove the spring clips retaining the hardened pivot pins.

Withdraw the pivot pins and remove each brake shoe.

To assemble

The method of assembly is the reverse of the dismantling procedure, ensuring that the wheel cylinders are hard against their abutment faces but that the wheel cylinder fixing bolts are only partially tightened. This will assist in the following brake setting instructions.

Front Brake — to set

By adjusting the shake-back steady post 'E' (see Fig. G34), set the shoes 'A' and 'B' so that they are square to the hub at the points 'X' and 'Y'.

If it is impossible to position both shoes so that they are square to the hub at the same time, then the difference in 'out of squareness' of the two shoes should be split so that the shoes are an equal amount out of square.

Repeat this operation for shoes 'C' and 'D'.

Fit the special window drum RH.7119.

Disconnect the feed pipes to the wheel cylinders.

Expand the brake shoes against the drum by applying a load to each shoe carrier in the vicinity of the operating link. The load is best applied with a suitable piece of bar.

Release the pressure, thus allowing the shoes to take up their normal 'Off' position.

Check clearances (x) and (y) between the shoes and the drum at points 'X' and 'Y' respectively. Also check the interference or possible clearance at point 'I'.

The clearances (x) and (y) must be equal within 0·003 in. (0·076 mm.) and at the same time the fit at 'I' should be between 0·003 in. (0·076 mm.) clearance and 0·015 in. (0·381 mm.) interference. The interference at 'I' is equivalent to the clearance between the leading edge of shoe 'B' and the drum, provided that the trailing ends of both shoes 'A' and 'B' are touching the drum.

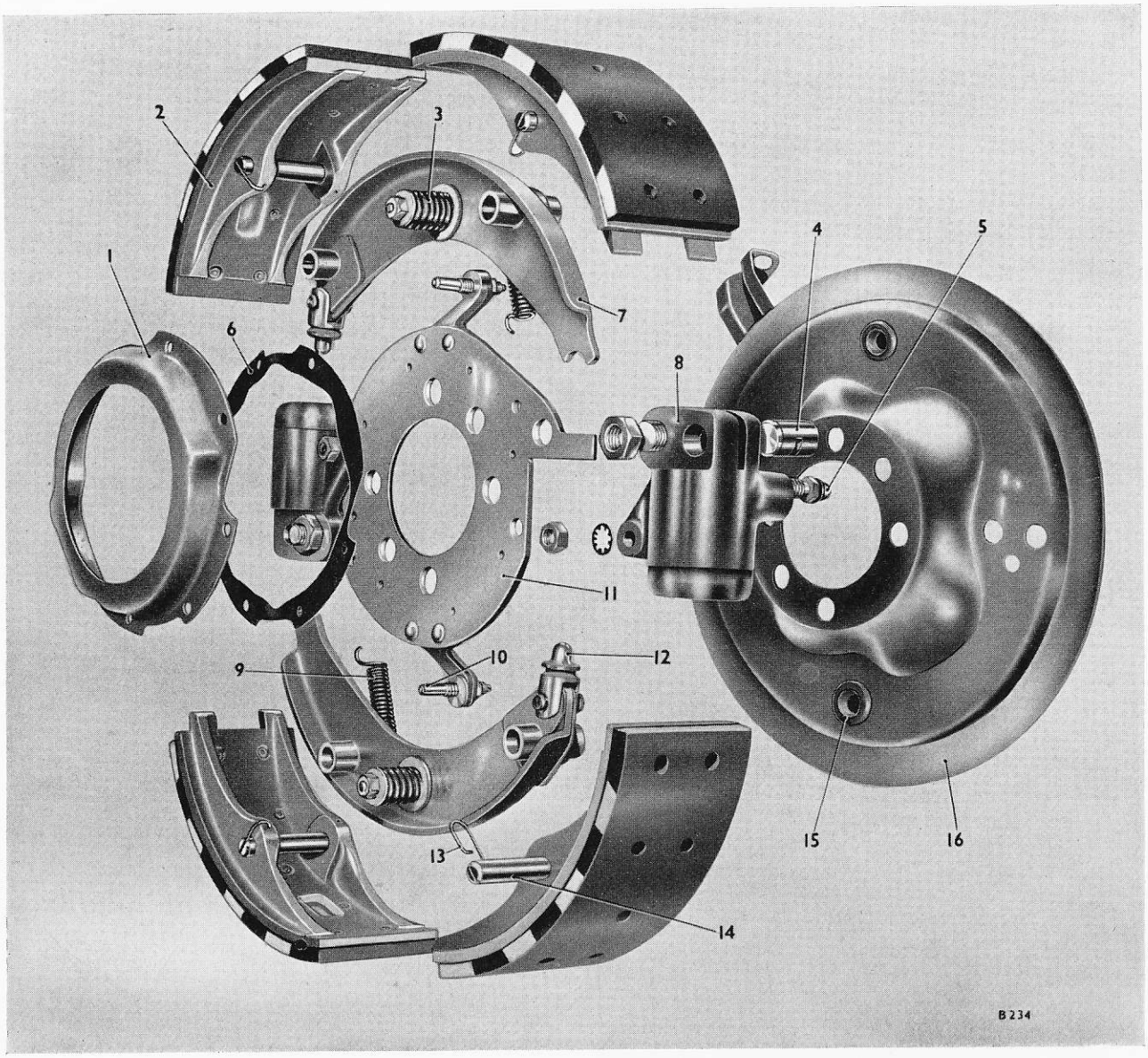


Fig. G33 Exploded view — Bentley Continental S2 four shoe brake

1. GREASE CATCHER
2. SHOE ASSEMBLY
3. SHAKE-BACK STOP
4. BRAKE SHOE ANCHOR PIN
5. BLEED SCREW
6. JOINT
7. SHOE CARRIER
8. WHEEL CYLINDER
9. SHOE RETURN SPRING
10. STEADY POST
11. CARRIER PLATE
12. LINK
13. RETAINING SPRING
14. PIVOT PIN
15. DUST CAP
16. WATER EXCLUDER

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If the clearances are not within the above limits, the wheel cylinders must be re-positioned on the abutment faces. For example, if clearance (x) is much greater than (y), the wheel cylinder 'G' must be moved out from the centre of the brake along the abutment face until (x) and (y) become equal to within 0·003 in. (0·076 mm.).

It is recommended that during this adjustment the brake shoes and carriers be removed to ensure that the wheel cylinder remains hard against its abutment face during movement. As a rough guide, it will be necessary to move the wheel cylinder approximately the same distance as the difference between (x) and (y).

> **Note:** The interaction interference (i) at the point 'I' has precedence over the shoe drum clearance at (x) and (y) and the inequality of (x) and (y) may be varied anywhere in the limit of 0·003 in. (0·076 mm.) in order to achieve the correct tolerance in (i).

Before re-checking clearances, the shoes should be expanded and then brought back to their 'Off' position as previously described.

Repeat the procedure for shoes 'C' and 'D'.

Torque tighten the wheel cylinder fixing bolts; the $\frac{5}{16}$ in. (7·925 mm.) dia. bolts should be tightened to 16–18 lb.ft. (2·21–2·48 kg.m.) and the $\frac{1}{2}$ in. (12·7 mm.) dia. bolts to 48–52 lb.ft. (6·62–7·17 kg.m).

Finally, check once more the fits at 'X', 'Y' and 'I'.

Re-connect the feed pipes.

Repeat the whole procedures for the other brake unit.

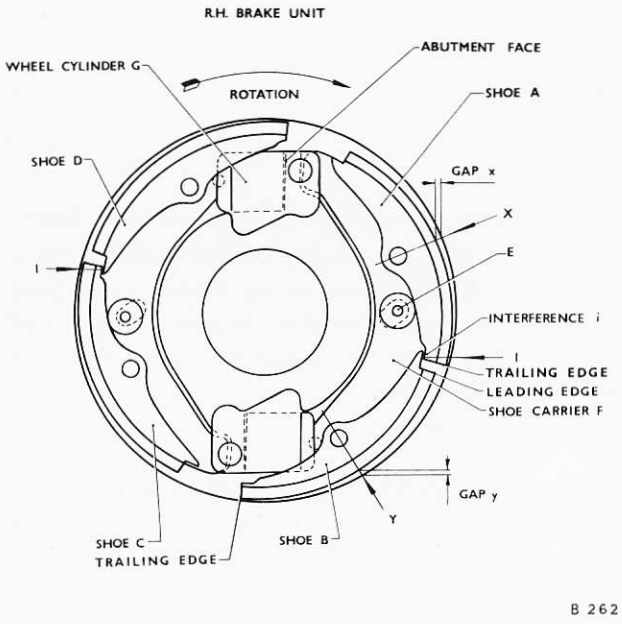


Fig. G34 Setting of four shoe brakes

'Bleed' the brakes; refer to 'Hydraulic System — to bleed'.

> **Note:** Once shoes have bedded in, they are not interchangeable.

Brake Drums

It is permissible to re-grind the brake drums to remove scores or ovality in accordance with the following data.

Standard internal diameter of the brake drum	...	11·250 in. (28·575 cm.)
Grinding limit	... ...	0·050 in. (1·27 mm.) oversize

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If the clearances are not within the above limits, the wheel cylinders must be re-positioned on the abutment faces. For example, if clearance (x) is much greater than (y), the wheel cylinder 'G' must be moved out from the centre of the brake along the abutment face until (x) and (y) become equal to within 0·003 in. (0·076 mm.).

It is recommended that during this adjustment the brake shoes and carriers be removed to ensure that the wheel cylinder remains hard against its abutment face during movement. As a rough guide, it will be necessary to move the wheel cylinder approximately the same distance as the difference between (x) and (y).

> **Note:** The interaction interference (i) at the point 'I' has precedence over the shoe drum clearance at (x) and (y) and the inequality of (x) and (y) may be varied anywhere in the limit of 0·003 in. (0·076 mm.) in order to achieve the correct tolerance in (i).

Before re-checking clearances, the shoes should be expanded and then brought back to their 'Off' position as previously described.

Repeat the procedure for shoes 'C' and 'D'.

Torque tighten the wheel cylinder fixing bolts; the $\frac{5}{16}$ in. (7·925 mm.) dia. bolts should be tightened to 16–18 lb.ft. (2·21–2·48 kg.m.) and the $\frac{1}{2}$ in. (12·7 mm.) dia. bolts to 48–52 lb.ft. (6·62–7·17 kg.m).

Finally, check once more the fits at 'X', 'Y' and 'I'.

Re-connect the feed pipes.

Repeat the whole procedures for the other brake unit.

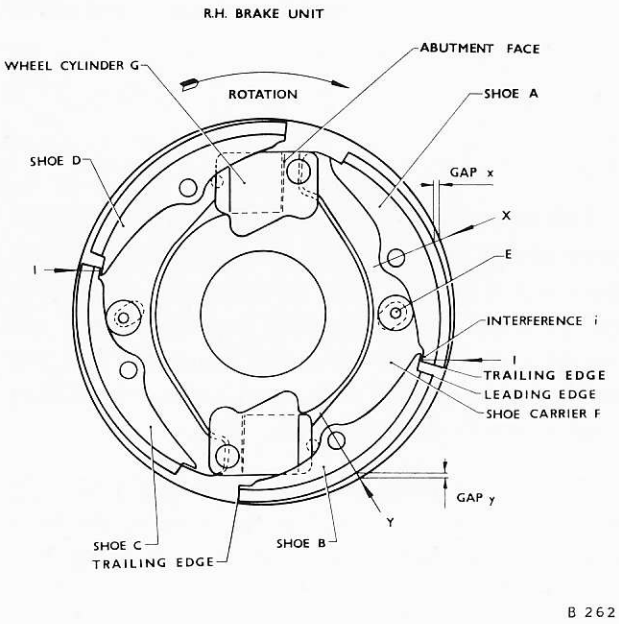


Fig. G34 Setting of four shoe brakes

'Bleed' the brakes; refer to 'Hydraulic System — to bleed'.

> **Note:** Once shoes have bedded in, they are not interchangeable.

Brake Drums

It is permissible to re-grind the brake drums to remove scores or ovality in accordance with the following data.

Standard internal diameter of the brake drum	...	11·250 in. (28·575 cm.)
Grinding limit	... ...	0·050 in. (1·27 mm.) oversize

SECTION G6 — HANDBRAKE RATCHET ASSEMBLY

This assembly is of the twist-to-release type. Incorporated in it are two ratchet pawls which provide lock positions at half the pitch of the ratchet teeth. Two rollers running in guide slots, together with a coil spring, carry the forward end of the ratchet slide and retain the slide rod in the normal position for ratchet engagement (see cut-away Fig. G35).

The ratchet pawls may be eased and lubricated should the necessity arise. In the event of the inner cable bracket becoming loose, the clamping bolt should be tightened through the aperture at the forward end of the assembly.

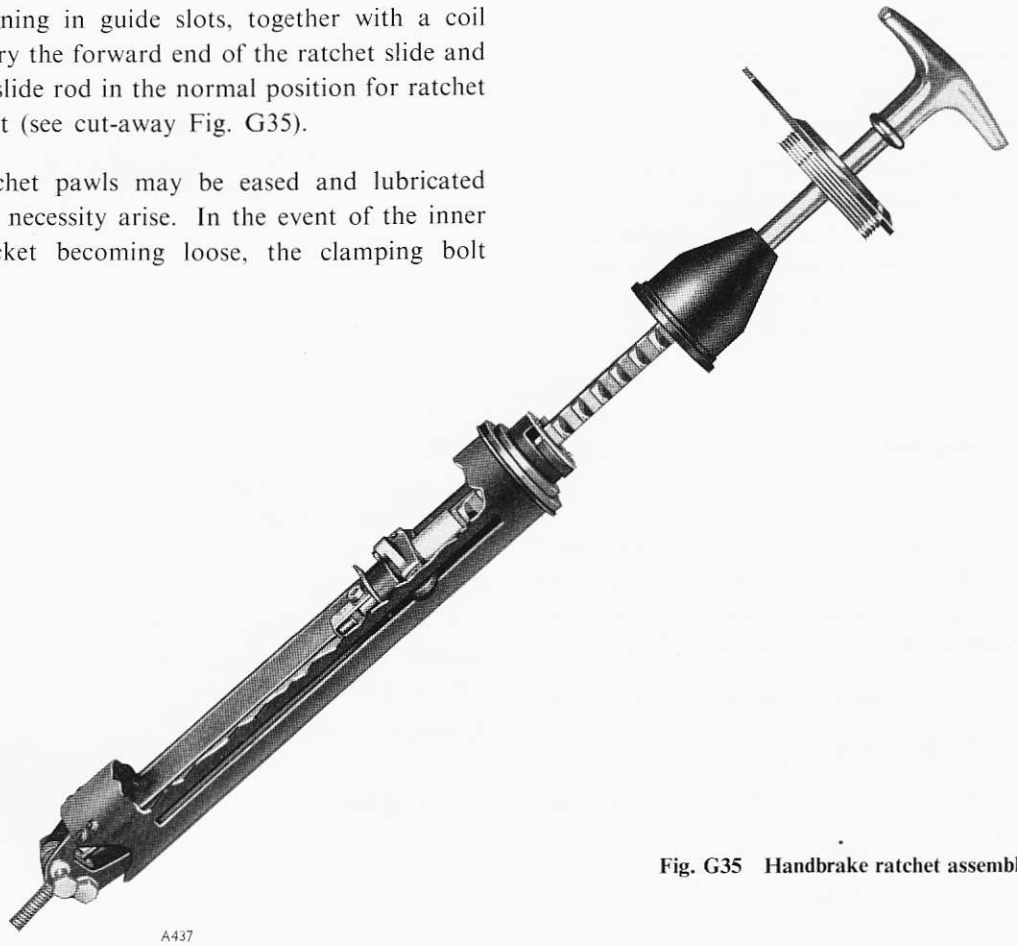


Fig. G35 Handbrake ratchet assembly

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Investigation has shown that there is a possibility of the handbrake cable being placed over the adjustment nuts on the servo shaft, following installation of the servo motor from beneath the car or when for any reason the cable has been disturbed. This incorrect positioning of the cable will cause gradual fraying with consequent breakage of the cable. Damage is also incurred by the servo adjustment nuts where frictional contact is made.

To prevent this trouble occurring, a check of the cable run should be made following displacement of either the servo motor or handbrake cable.

SECTION G7 — BASIC ADJUSTMENT OF BRAKE RODS AND LINKAGES

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Refer to Figure G1 and disconnect the following:

1. Pedal return spring 9.
2. Handbrake cable and return spring 10 from lever 3.
3. Front end of handbrake transfer link from lever 3.
4. Front ends of rods 4 and 7 and the rear end of rod 2. (On Phantom V cars, two rods are fitted instead of the one numbered 2 in Fig. G1).
5. Pin 13 (rod 12) left-hand cars only.
6. Rod return springs from rear brake back plates 1.

Slacken the bolts retaining the 'on-stop' 6 to the frame and tighten the rear brake adjusters to lock the rear brakes.

'On-stop' Adjustment

The following adjustments should be carried out with the rubber 'off-stop' 1 in position on the chassis frame bracket. Refer to Figure G36 to identify the components.

Adjust rod 3 so that when the end of the slotted link 2 is in contact with the rubber 'off-stop' 1 the servo outer lever 4 leans 10 deg. ± 2 deg. towards the rear of the car. Lock the nut on rod 3.

To adjust the 'on-stop' 5, place a 1·250 in. (31·75 mm.) distance piece for S1 cars and a 1·000 in. (25·4 mm.) distance piece for S2 cars, between the end of the slotted link 2 and the rubber 'off-stop' 1. The servo outer lever 4 should now be in contact with the 'on-stop' 5; if not, the 'on-stop' should be adjusted and locked in position.

As a check when the distance piece is removed, the distance between the servo outer lever 4 and the 'on-stop' 5 should be 1·050 (26·67 mm.) **for S1 cars** and 0·800 in. (20·32 mm.) **for S2 cars**.

The continued operation of the hydraulic system in the event of failure of the mechanical rear brake will depend on this adjustment and it is essential that this be carried out correctly.

Rod Adjustment (12) — left-hand cars only

Refer to Figure G1 for all the following adjustments.

Adjust the rod to the nearest turn of the yoke to give a distance of 19·875 in. (50·483 cm.) between the pin centres.

Rod Adjustment (7)

With rod 4 held rearwards on the 'off-stop', adjust rod 7 so that the seal on the pedal stem is compressed approximately 0·200 in. (5·08 mm.) by contact with the pedal gap plate.

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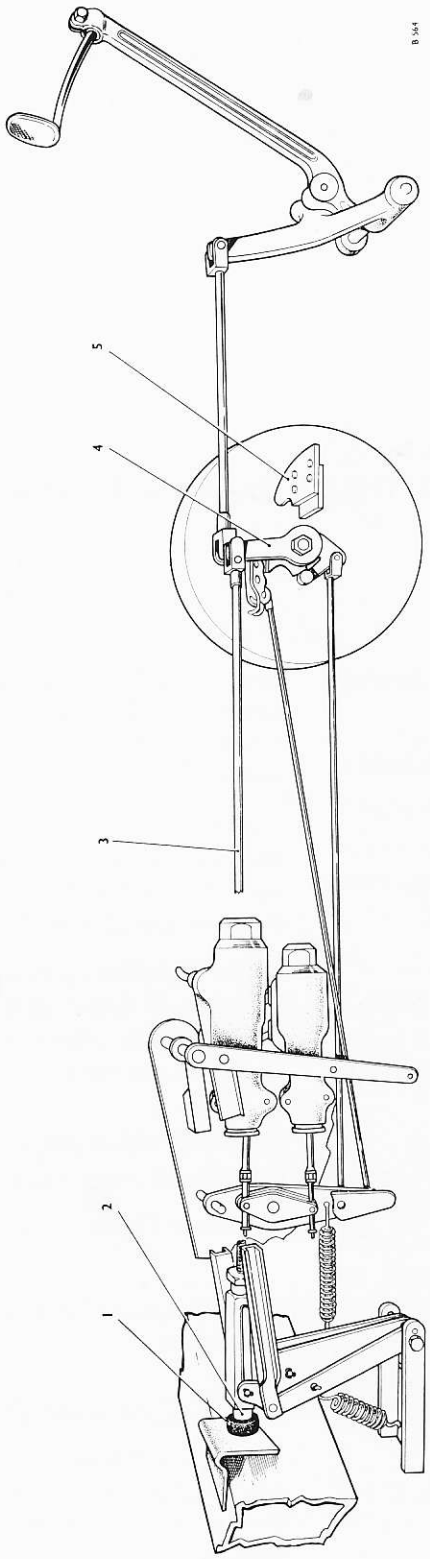


Fig. G36 'On-stop' adjustment

1. RUBBER 'OFF-STOP'
2. SLOTTED LINK
3. MECHANICAL LINKAGE OPERATING ROD
4. SERVO OUTER LEVER
5. 'ON-STOP'

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Rod Adjustment (2)

Adjust to eliminate all the free movement without tensioning the rods. In some cases it may be found that there is insufficient thread on this rod to permit adjustment of the forkpiece. In this case the rear end of rod 2 should have its screw thread extended by $\frac{1}{4}$ in. with a $\frac{1}{4}$ in. dia. U.N.F. die nut.

Check to ensure that no foul occurs between the end of the rod where it protrudes through the forkpiece and the equaliser lever when the brakes are fully applied. If a foul occurs, rod 2 should be shortened by cutting a $\frac{1}{4}$ in. length off its rear end.

Re-adjust the rear brakes as detailed in 'Master Cylinders'.

Handbrake Adjustment

Connect the handbrake cable and return spring.

Adjust the cable at the abutment (8), to give $\frac{1}{4}$ in. free movement of the cable before rod 2 moves. Adjust the master cylinder and servo as detailed in 'Servo Motor and Brake Shoes, Drum and Expander Mechanism'.

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CHAPTER G

BRAKING SYSTEM

SECTION G 1 — DATA AND GENERAL INFORMATION

Four shoe brake system — Front brakes

(Page G 3 in Workshop Manual)

The fitting of four shoe brakes to Bentley Continental cars has been discontinued from Chassis No. BC164XA and replaced by two shoe brakes as fitted to standard S2 and S3 cars.

The information in this Section which applies to Bentley Continental S2 cars is also applicable to Bentley Continental S3 cars to Chassis No. BC164XA inclusive.

The information in this Section which applies to S2 cars is also applicable to S3 cars and Bentley Continental S3 cars from Chassis No. BC166XA inclusive.

SECTION G 4 — SERVO MOTOR

Servo cam angle on Bentley Continental S2 and late S1 cars

(Page G 16 in Workshop Manual)

The information in this Section which applies to Bentley Continental S2 cars is also applicable to Bentley Continental S3 cars to Chassis No. BC164XA inclusive.

On S2 and Phantom V cars

The information in this Section which applies to S2 cars is also applicable to S3 cars and Bentley Continental S3 cars from Chassis No. BC166XA inclusive.

SECTION G 5 — BRAKE SHOES, DRUMS AND EXPANDER MECHANISM

Front brakes — To dismantle

(Page G 17 in Workshop Manual)

The information in the first paragraph of this Section which applies to Bentley Continental S2 cars is also applicable to Bentley Continental S3 cars to Chassis No. BC164XA inclusive.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars and Bentley Continental S3 cars from Chassis No. BC166XA inclusive.

Front brakes — To dismantle Bentley Continental S2

(Page G 25 in Workshop Manual)

The information in this Section which applies to Bentley Continental S2 cars is also applicable to Bentley Continental S3 cars to Chassis No. BC164XA inclusive.

SECTION G7 — BASIC ADJUSTMENT OF BRAKE RODS AND LINKAGES

Hand brake warning lamp — Description

A warning lamp is fitted to all present production cars to indicate to the driver that the hand brake is either 'on' or 'off'. The warning lamp is operated by a micro-switch mounted on a bracket on the chassis frame behind the hand brake operating lever. For the warning lamp to function correctly, it is essential that when the hand brake is applied, the light comes on before the hand brake reaches the first notch on the ratchet. Any warning lamp which is incorrectly set should be adjusted as follows

Hand brake warning lamp — To adjust

With the hand brake in the 'off' position and with the button on the micro-switch held down, the micro-switch should be adjusted so that a 0·060 in. gap is obtained between the button and the hand brake operating lever.

After carrying out the adjustment, check to ensure that the warning light comes on before the first notch on the hand brake is reached.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

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CHAPTER H

SUSPENSION

SECTION H1 — FRONT SUSPENSION

Description and Operation

The independent front wheel suspension system consists of two upper and two lower triangle levers of differing lengths, set at a trailing angle. Coil springs are mounted between the chassis frame and the lower triangle levers (see Fig. H1 for S1 cars and Fig. H2 for S2 cars), to absorb shock caused by varying road conditions.

The upper triangle levers are directly connected to, and constitute the arms of, the double-acting hydraulic shock dampers which damp the movement of the coil springs. The lower triangle levers are attached to fulcrum brackets bolted to the underside of the front frame crossmember.

The yokes carrying the stub axles are mounted between the outer ends of the upper and lower triangle levers by means of threaded bearing bushes.

Provision is made for the adjustment of the castor and camber angles where necessary.

Rubber bump stops are bolted to the underside of the upper triangle levers and also to the frame, to cushion the effect of extreme travel of the upper and lower triangle levers.

A transverse stabiliser bar is fitted in front of the triangle levers and is secured to the frame on rubber blocks, the outer ends of the bar being connected to the lower triangle levers by means of steel links also carried in rubber blocks.

On S1 cars, the suspension bearings are lubricated under pressure from the 'centralised chassis lubrication system'. **On S2 cars,** the bearings are lubricated by grease, no 'centralised chassis lubrication system' being fitted.

FRONT SUSPENSION DATA

S1 Cars	Camber angle	Vertical to $\frac{1}{2}$ deg. positive
	Castor angle — Manual steering	1 deg. negative
	Castor angle — Power assisted steering	Zero
	Toe-in	0·062 in. (0·157 cm.)–0·156 in. (0·396 cm.)
	Pivot pin inclination	$4\frac{1}{2}$ deg. at zero camber angle
		4 deg. at $\frac{1}{2}$ deg. camber angle
Standing height	Standard car	0·600 in. (1·524 cm.)–1·200 in. (3·048 cm.)
	Colonial car	1·100 in. (2·794 cm.)–1·700 in. (4·318 cm.)
S2 Cars	Camber angle	Vertical to $\frac{1}{2}$ deg. positive
	Castor angle	Zero
	Toe-in	0·062 in. (0·157 cm.)–0·125 in. (0·318 cm.)
	Pivot pin inclination	$4\frac{1}{2}$ deg. at zero camber angle
		4 deg. at $\frac{1}{2}$ deg. camber angle
Standing height	Standard car	0·800 in. (2·032 cm.)–1·400 in. (3·556 cm.)
	Colonial car	1·300 in. (3·302 cm.)–1·900 in. (4·826 cm.)

Standing Height

The standing height is the vertical height of point '2' above point '1' (see Fig. H3) and must be checked whenever a front coil spring is re-fitted.

When measuring the standing height the car must be on a level surface with the tyres inflated to the correct pressures. The car must also be in the unladen condition, i.e. without the driver, passengers or luggage but with five gallons of fuel in the tank.

To check the standing height, press down the front of the car and gently release it; measure the heights of points '1' and '2' from the ground on both sides of the car. Subtract '1' from '2' for each side and record the two results. Raise the front of the car by hand and gently release it; again measure the heights of points '1' and '2' on both sides of the car. Subtract '1' from '2' for each side and note the two results.

Add together the two results obtained for the right-hand side of the car and divide the total by two. The average reading so obtained is the standing height of the right-hand front suspension. Repeat this procedure to obtain the average reading for the left-hand side.

The standing height should be within the limits stated in the table and a variation of 0·025 in. (0·635 mm.) should not be exceeded between the two sides.

With the car in the fully laden condition, points '1' and '2' should be level, i.e. the lower triangle levers horizontal.

Adjustment of the standing height is provided for by the addition or removal of the steel washers fitted between the rubber seat on the spring top spigot and the flat end of the coil spring. No adjusting washers are fitted at the bottom of the coil spring as was the case on previous cars.

The adjusting steel washers are 5·375 in. (13·652 cm.) diameter by 0·100 in. (0·254 cm.) thick.

To increase the standing height, steel washers must be added to the coil springs; to decrease the standing height, steel washers must be removed from them. The maximum number of steel washers permissible on any one coil spring is seventeen, and the minimum is two.

For the removal of the coil springs see 'Front Coil Springs — to remove'.

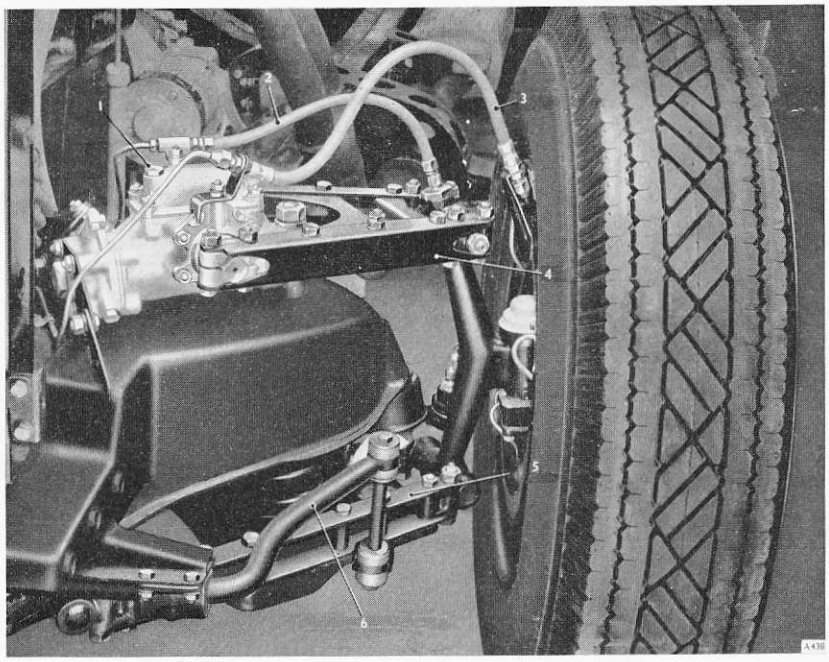


Fig. H1 Front suspension details — S1 cars

1. FILLER PLUG
2. LUBRICATION HOSE
3. BRAKE FLUID HOSE
4. UPPER TRIANGLE LEVER
5. LOWER TRIANGLE LEVER
6. STABILISER ROD

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Toe-in

To measure the toe-in, the car should stand on a level surface with the front wheels set in the straight-ahead position. The car should be rolled forward not less than half a turn of the wheels and a first measurement taken using a standard optical alignment gauge. Roll the car forward a further half turn of the front wheels and take a second measurement. The true toe-in is the average of these two readings. **Rolling the car backward instead of forward will give an incorrect reading.**

To adjust the toe-in, remove the track rod outer ball joint from the side steering lever, slacken the pinch bolt on the outer end of the track rod and screw in or out as necessary. Should more than one turn be necessary to obtain the desired adjustment, the number of turns must be equally divided between both track rods. Both track rods should be so adjusted to centralise the steering wheel in the straight-ahead position.

Camber Angle

The camber angle (see Fig. H3) should be checked with the car on a level surface in the unladen condition and the tyres inflated to the correct pressure.

Before measuring the camber angle of the front wheels, the front of the car should be pushed down and gently released. This will prevent friction in the suspension linkage holding the car in a rolled position.

The camber angle may be checked by using Dunlop Tool No. CG.2 or any other suitable equipment.

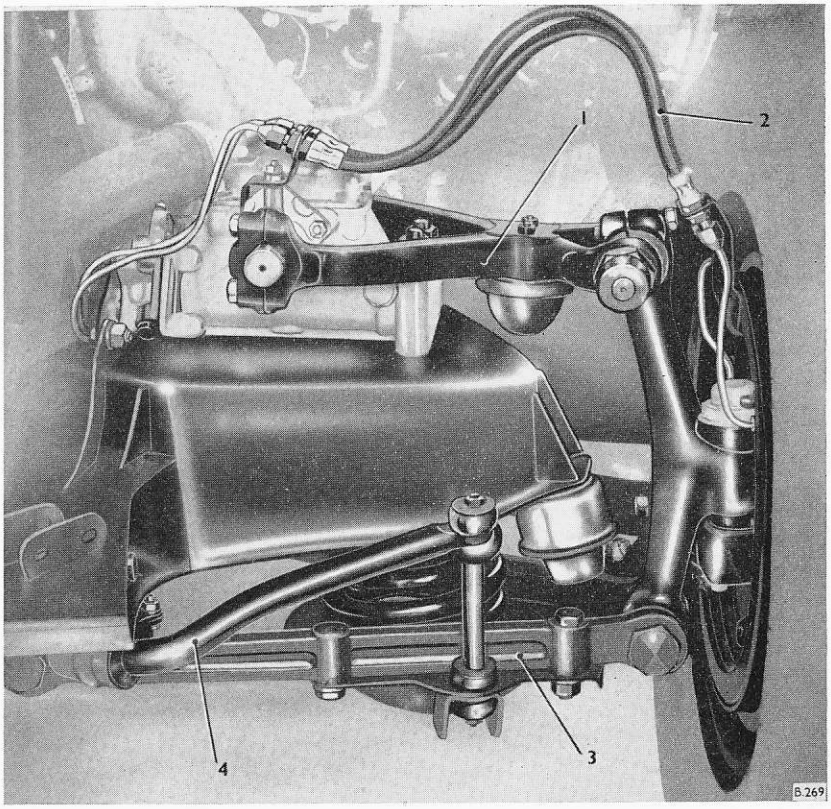


Fig. H2 Front suspension details — S2 cars

1. UPPER TRIANGLE LEVER
2. BRAKE FLUID HOSE
3. LOWER TRIANGLE LEVER
4. STABILISER ROD

Camber Angle — to adjust

S1 cars

To adjust the camber angle, slacken the bolts at '2' (see Fig. H4) and move the upper triangle levers in the slots provided in the upper fulcrum pin blocks.

S2 cars

Camber adjustment is by an eccentric upper fulcrum pin bush fitted in the upper arm of the steering pivot pin yoke as shown in Figure H5.

Adjustment is effected by unlocking the tab washer, slackening the clamping bolt at the top of the yoke and rotating the upper fulcrum pin bush. To obtain positive camber, the eccentric bush should be turned clockwise; for negative camber the bush should be rotated anti-clockwise. Having obtained the correct camber angle, renew the tab washer, tighten the clamping bolt and lock the tab washer.

S1 and S2 cars

If the camber angle is altered by the above adjustment, the castor angle will also alter by approximately 0·4 of this alteration. If the camber angle is made more positive, the castor angle moves in the same direction.

Castor Angle

Special tool required:

RH.197 — Castor Angle Checking Gauge

S1 and S2 cars

Castor is the forward or backward angle of inclination of the pivot pin in relation to the vertical (see Fig. H7).

To check the castor angle, the car should be set on a level surface. The gauge (RH.197) should be placed on the chassis frame side member, lengthwise along

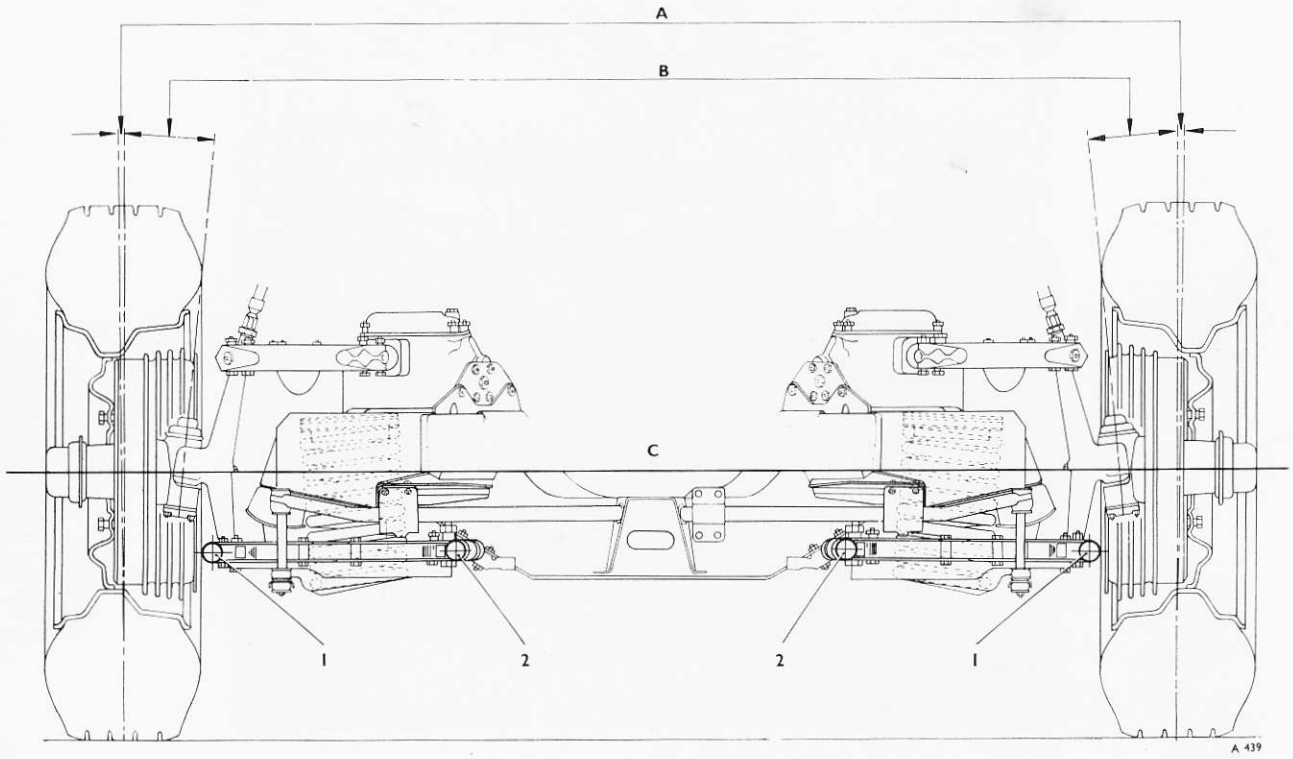


Fig. H3 Front standing height

A. CAMBER ANGLE B. ANGLE OF PIVOT PIN INCLINATION C. LEVEL LINE OF CHASSIS

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the member. A suitable point, accessible from underneath, is opposite the centre of the cruciform where there is a space of approximately one and a half inches between the car floor and the frame. Unlock screw '1' shown in Figure H6, set the spirit level to zero and lock screw '1'.

Remove the gauge and insert the long end as illustrated in Figure H7 between the lower flat face of the stub axle and the pivot pin housing of the yoke.

Unlock screw '2' (see Fig. H6) and move the pointer to adjust the spirit level to zero. Read off the castor angle from the scale, which is calibrated in half degrees on the side of the gauge.

The castor angle is adjusted by releasing the bolts '1' (see Fig. H4 for S1 cars and Fig. H5 for S2 cars) and positioning the upper triangle arms on the front shock damper shaft as necessary.

Should the castor angle be altered by the above adjustment, the wheel camber will also have altered. If the castor angle is made less negative, the wheel camber is made more positive by approximately 0·4 of the castor angle.

Adjustment to either the castor or camber angle will also alter the height of the side steering lever ball pins and will thus affect the toe-in.

Geometric Correction of Ball Pin Relative Height

Ball pins with necks of varying lengths are used to adjust the steering geometry which is designed to ensure that the alignment of the front wheels be retained within the prescribed limits during the vertical oscillations of the front suspension.

The correct length ball pin will have been fitted initially and if renewal is necessary the same length ball pin should be fitted. Renewal with the incorrect length ball pin may cause an increase in car shake or the steering to pull more during high speed driving over uneven roads.

Castor and camber angles should be verified before the adjustment is attempted.

Lock the centre steering levers in the straight ahead position by using the Special Tool as shown in Figure H8. Position the front wheels on turntables which will permit lateral movement and so cope with any alteration of the car track.

Place sufficient ballast onto the front of the car to bring the front suspension into light contact with the rubber bump stops.

Carefully position a jack under the front pan, ensuring that the jack head cannot damage the

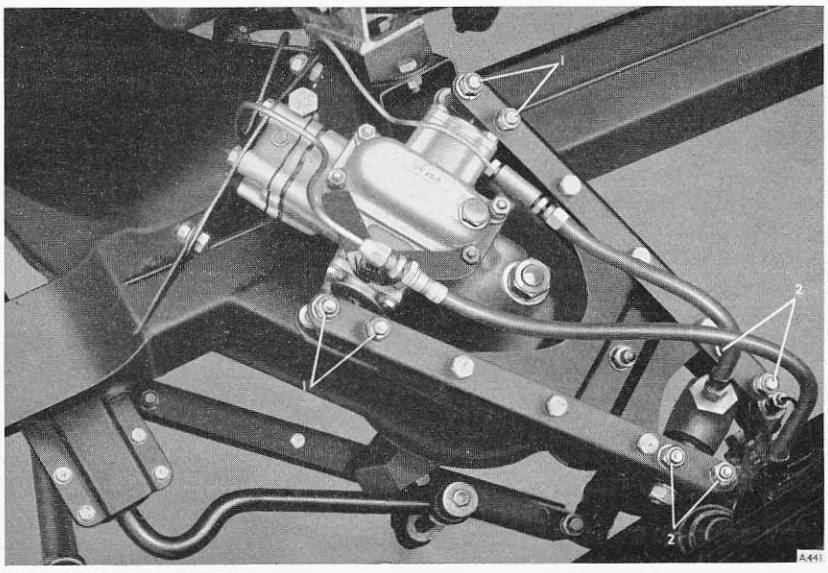


Fig. H4 Camber and castor adjustments — S1 cars

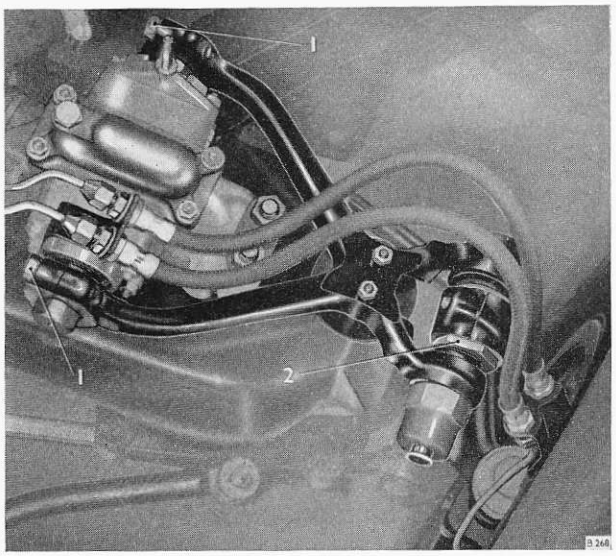


Fig. H5 Camber and castor adjustments — S2 cars

steering power cylinder. Raise the jack head until contact is just made with the front pan.

Remove one of the front wheel discs and unscrew the three wheel nuts positioned at the lowest point of the wheel. Screw on the three special nuts; these nuts have left or right-hand threads for use on the appropriate wheel studs. Fit the mirror support plate onto the extension nuts so that the mirror bar is in the lowest position (see Fig. H9) and secure, using three wheel nuts. The mirror can be mounted on either of the front wheels.

Fit the telescope to the jacking bracket and adjust both the mirror and the telescope until the measurement marks are centralised. Note the reading on the scale which is attached to the telescope. No further adjustment should be made to the mirror.

Raise the car approximately 3 in. (7 cm.) on the jack and adjust the telescope to align with the marks on the front mirror.

The toe-in for the one wheel is the difference between the two readings and should be 0·031 in. (0·078 cm.)–0·078 in. (0·198 cm.) for **S1 cars** and 0·031 in. (0·078 cm.)–0·062 in. (0·157 cm.) for **S2 cars**.

The toe-in should increase as the car is raised but if the increase is not within the limits stated, or if there is a decrease in toe-in, adjustment will be necessary.

The above procedure should be repeated on the other side of the car.

It is often possible to correct small errors by slackening the side steering lever bolts, pushing the lever in the required direction and re-tightening the bolts while holding the lever in position. If this procedure fails to correct the error it will be necessary to renew the ball pins.

To correct too much toe-in the track rod outer end ball pins should be replaced by ball pins with increased neck lengths of 0·100 in. (0·254 cm.) or 0·200 in. (0·508 cm.) and using the appropriate lubricant seal. The 0·100 in. (0·254 cm.) longer ball pin decreases the toe-in by approximately 0·062 in. (0·157 cm.) while the 0·200 in. (0·508 cm.) longer ball pin decreases the toe-in by approximately 0·110 in. (0·279 cm.).

To correct insufficient toe-in, both centre steering lever ball pins should be replaced by ball pins with increased neck lengths of 0·100 in. (0·254 cm.) or 0·200 in. (0·508 cm.) and using the appropriate lubricant seals. Re-track the car.

On S1 cars the toe-in at the kerb standing height should be 0·062 in. (0·157 cm.) to 0·156 in. (0·396 cm.) and **on S2 cars** 0·062 in. (0·157 cm.) to 0·125 in. (0·318 cm.). If the castor angle is altered, the ball pin heights will alter and consequently require re-checking.

Full details on changing the ball pins and the Special Tool required are contained in Chapter N.

> **Note:** If the slope on the underside of the front pan to which the fulcrum brackets are bolted is not 25 deg. 40 min. + 40 min. the above procedure will not put the ball pin heights correct on lock.

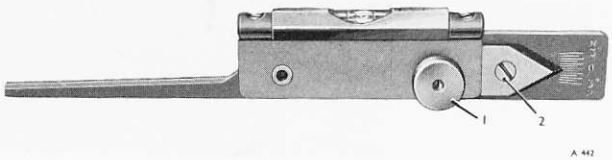


Fig. H6 Castor angle checking gauge

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It is hardly likely that any variation will be encountered in this angle, unless the car has suffered a front end collision. A reading less than the minimum figure will increase car shake and a reading in excess of the maximum will cause the steering to pull more during high speed driving over uneven roads.

Friction Height

S2 Cars only

The friction height, which must not be confused with the standing height, is a means of testing whether excessive friction is present in the front suspension. The friction height check applies **only to S2 cars**, on which there have been a few cases of harsh front suspension.

To check the friction height, ensure that the car is standing on a level surface, then press down the front of the car as far as possible and release it gently. Measure the vertical height from the floor to the underside of the front pan. Raise the front of the car by hand and release gently. Again measure the vertical height to the same point on the underside of the front pan. The difference between the first (lesser) measurement and the second (greater) measurement is the friction height which should not exceed 0·900 in. (22·860 mm.).

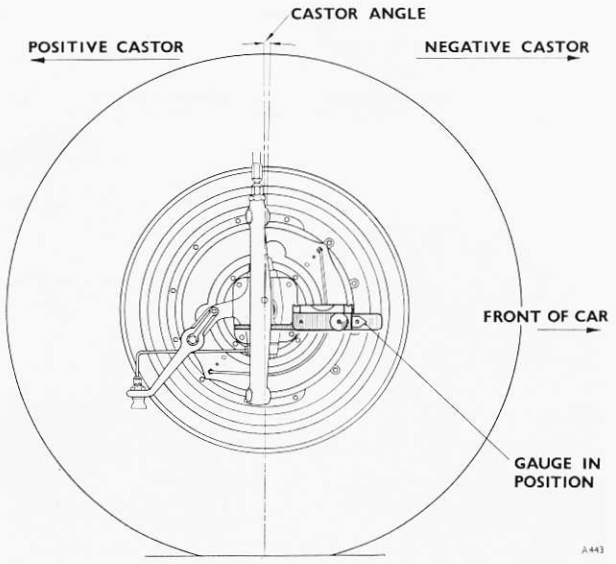


Fig. H7 Castor angle

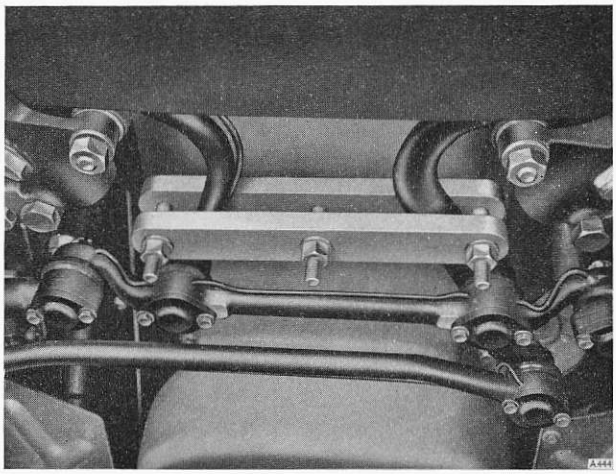


Fig. H8 Steering levers locking tool

If the friction height is over 0·900 in. (22·860 mm.) or if undue effort is required to press down or raise the front of the car, this indicates that there is excessive friction in the front suspension. Excessive friction is caused by either lack of lubricant or incorrect alignment of the front suspension members. Before commencing any adjustment to the front suspension, ensure that the steering geometry is correct (see previous text).

Excessive Friction — to correct

S2 Cars

Lubricate the front suspension pivot points with the approved lubricant. To facilitate the penetration of lubricant to the threaded bearings, the front of the car should be pressed down and then released continuously during the process of lubrication.

After lubricating the suspension, again check the friction height; if it is still in excess of 0·900 in. (22·860 mm.) the following procedure must be carried out:

Special tool required:

Foot scales capable of weighing up to 10 stones.

Press down on alternate sides of the car to determine whether the friction is greater on one side than the other. If the friction is approximately equal on each side it will be necessary to correct both sides.

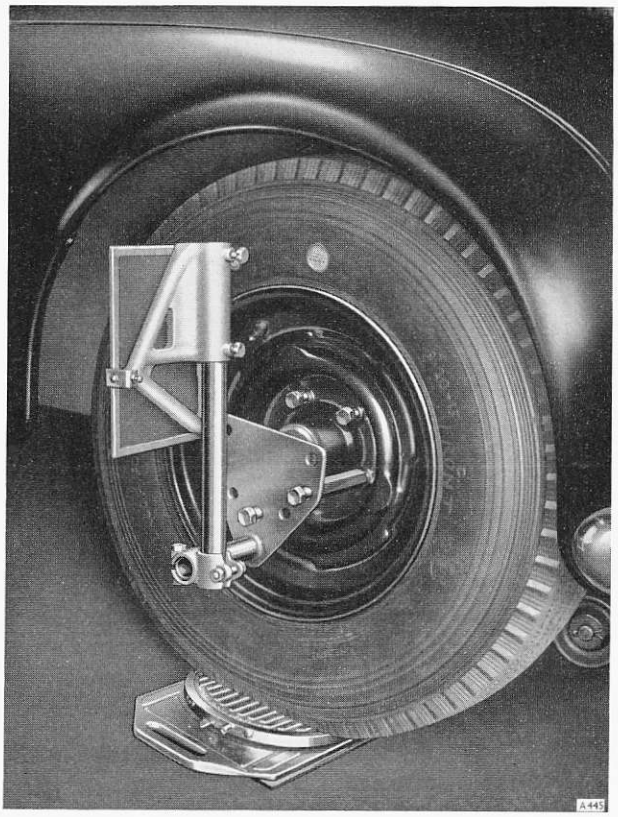


Fig. H9 Front wheel, turntable, mirror and bracket

Position a jack under the front pan, taking care that the jack head does not come into contact with the steering power cylinder. Raise the car on the jack and place supports under the chassis side members well clear of the front suspension.

Remove the road wheel(s), detach the stabiliser rod and remove the front coil spring (see appropriate paragraphs). Re-fit the spring support plate and tighten the four securing bolts to prevent distortion in the lower triangle levers when checking the friction.

Place a screw jack on to the weighing scales and add sufficient wood packing under the scales to enable the jack head to contact the brake drum (see Fig. H12).

Raise the suspension by means of the screw jack and note the reading on the scales as the upper triangle levers pass the horizontal position. Lower the suspension by unscrewing the jack and again note the reading as the upper triangle levers pass the horizontal position. The difference between the first and second reading should not be more than 36 lb. (16·308 kg.). If the difference is more than 36 lb. (16·308 kg.) the following operations should be carried out in order.

The friction should be measured after each of the following operations until a figure is obtained not exceeding 36 lb. (16·308 kg.). If the friction is reduced by any one of the operations it should be noticeable by raising the suspension by hand.

1. Slacken the two $\frac{1}{2}$ in. U.N.F. bolts securing the shock damper to the chassis frame; then re-tighten them.

2. Slacken the two bolts securing the shock damper mounting plate to the chassis frame; then re-tighten them.

3. Slacken all four bolts securing the shock damper, then remove the two rear bolts, nuts and washers. Tighten the two front $\frac{1}{2}$ in. U.N.F. bolts first and then fit and tighten the two rear bolts. If the two rear bolts cannot be positioned in the holes in the mounting plate welded to the chassis frame, these holes should be enlarged by filing to obtain correct alignment.

The previous three operations are usually sufficient to correct most cases of excessive friction in the front suspension, but in extreme cases it may be necessary to adopt the following operation.

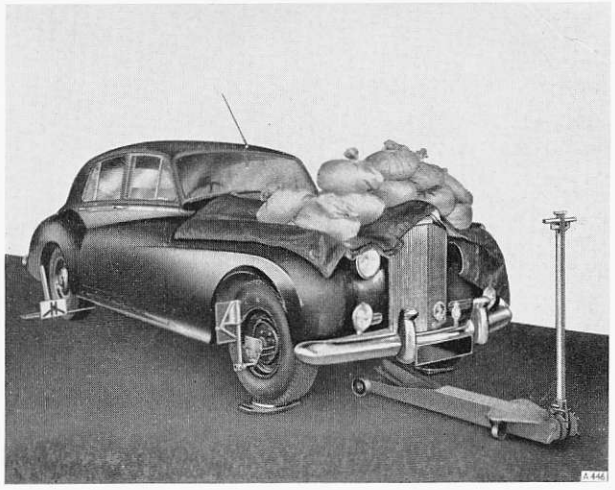


Fig. H10 Car loaded with jack in position

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4. Unlock the tabs on the fulcrum bracket locking plates and slacken the four nuts and bolts securing the fulcrum bracket to the front pan. Experiment by placing feeler gauges between the front pan and either the front or rear faces of the fulcrum bracket and tightening the bolts. A guide to which face of the fulcrum bracket the feeler gauges should be inserted may be obtained by examining the position of the upper triangle levers on the shock damper shaft. If the levers are positioned more to the rear of the car, the feeler gauges should be inserted between the rear faces of the fulcrum bracket.

For each setting the suspension should be weighed until the friction figure does not exceed 36 lb. (16·308 kg.). When the friction figure is correct the feeler gauges should be removed and correct packings fitted as follows:

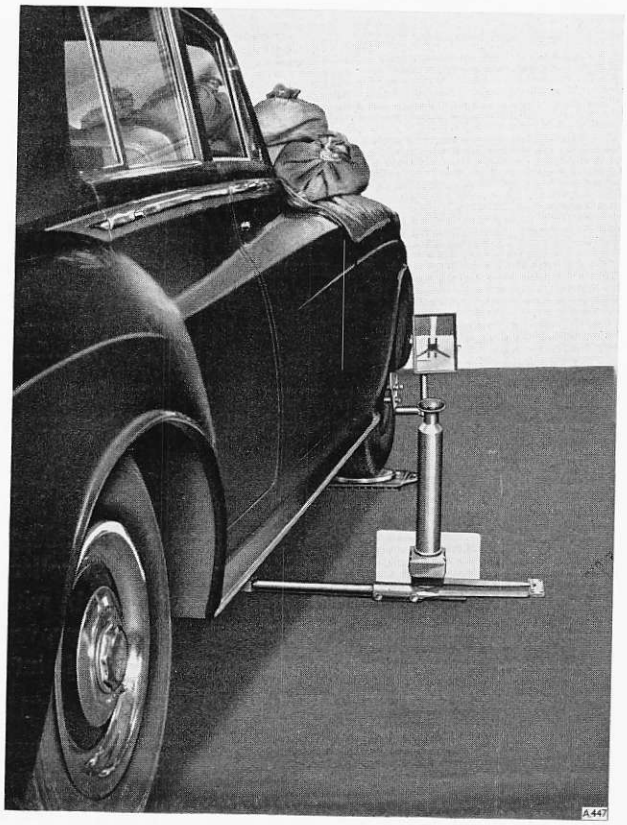


Fig. H11 Telescope on bracket

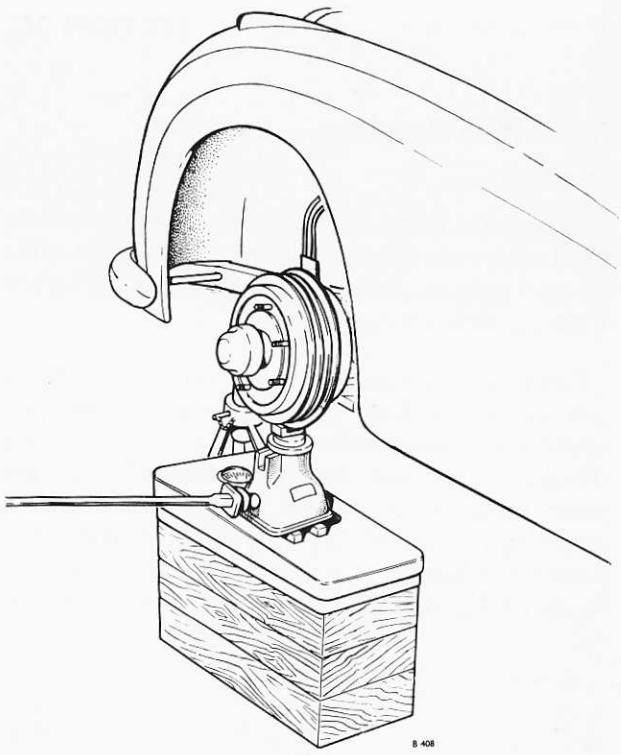


Fig. H12 Front suspension friction — to measure — S2 cars

Part No.	*Thickness*
UR.5325	0·048 in. (1·219 mm.)
UR.5326	0·037 in. (0·939 mm.)
UR.5327	0·024 in. (0·609 mm.)

Fit new locking plates to the bolts securing the fulcrum bracket to the chassis frame. Before tightening and locking these bolts, take up the clearance in the bolt holes by pushing the yoke end of the lower triangle levers towards the rear of the car. Re-fit the other components by reversing the procedure for removal.

After any adjustments to the front suspension unit it is advisable to finally check the steering geometry.

SECTION H2 — FRONT HUBS

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Front Hub Bearings — to renew

S1 and S2 cars

Remove the wheel disc and hub cap and slacken the wheel nuts; note that the wheel nuts on the right of the car have right-hand threads and wheel nuts on the left of the car have left-hand threads.

Firmly apply the handbrake and carefully position a jack under the front pan, ensuring that the jack head cannot contact and so damage the power steering cylinder as it is raised. Jack up the front of the car and place supports under the stabiliser rod chassis mountings. Prise off the dust cover by inserting a screwdriver between the dust cover and the shallow flange on the hub; the dust cover contains an earth contact which must not be damaged. Remove the wheel nuts and the wheel.

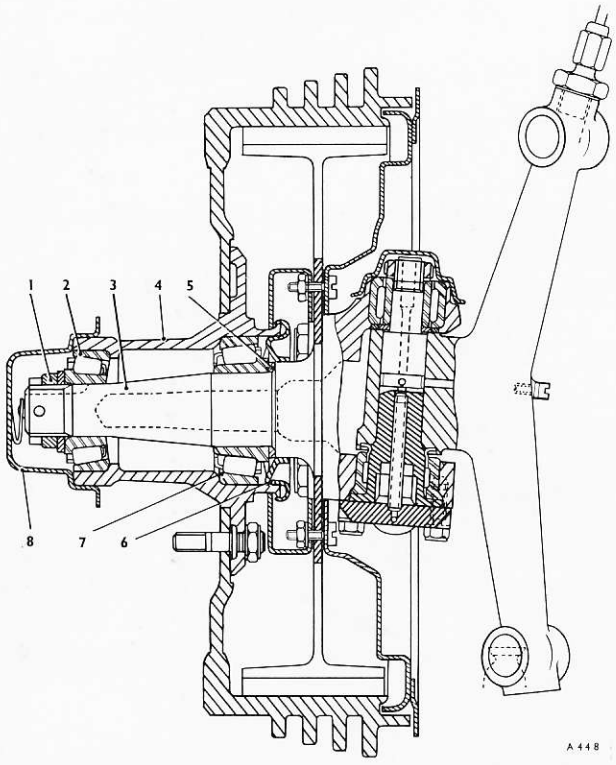


Fig. H13 Front hub bearings

1. CASTELLATED NUT
2. OUTER BEARING
3. STUB AXLE
4. HUB
5. DISTANCE PIECE
6. GREASE RETAINER
7. INNER BEARING
8. DUST COVER

Unscrew the three countersunk headed screws securing the brake drum and withdraw the drum.

Remove the split pin, the castellated nut and the plain washer from the stub axle; it will be necessary to break the sealing band before the split pin can be removed. Note that the right-hand stub axle has a right-hand thread and the left-hand stub axle has a left-hand thread. Withdraw the hub complete with bearings, also the distance piece from the stub axle.

With the hub removed, the opportunity should be taken to examine the condition of the brake shoes and also to examine the hydraulic wheel cylinders for any signs of leaking.

Lift out the inner race and roller cage from the outer bearing. Prise out the inner bearing grease retainer using the three slots incorporated in the retainer for extraction purposes. The grease retainers have either right-hand or left-hand 'Acme' threads and must be fitted to their respective sides; the grease retainers are marked either 'Off-side Right-hand' or 'Near-side Left-hand'. Remove the inner race and roller cage from the inner bearing. Using a hardwood drift, tap out the outer races of the two bearings. Thoroughly clean the hub and all parts which are to be re-fitted.

Press the new outer races into position in the hub with the smaller end of the taper bore leading. Lightly grease and fit the new inner races and rollers in their respective positions. Pack the hub with approximately 2½ oz. (70·875 gm.) of the approved grease and re-fit the grease retainer, tapping it into position with an aluminium drift.

Re-fit the distance piece ensuring that the chamfered end of the bore enters onto the stub axle. Place the hub assembly onto the stub axle and fit the plain washer and castellated nut. Insert a 0·002 in. (0·005 cm.) feeler gauge between the outer bearing and the plain washer. Tighten the nut whilst slowly rotating the hub until resistance is felt; then remove the feeler gauge. The continuous rotation of the hub is essential in order to ensure that the taper rollers seat correctly

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on the tracks of the inner and outer races. If the rotation operation is omitted, the rollers may not be correctly positioned, resulting in excessive play in the bearings.

Fit a replacement sealing band over the nut and split pin.

Re-fit the brake drum, road wheel, dust cover, hub cap and wheel disc, reversing the procedure for dismantling. Lower the car from the supports.

Particular care should be exercised to prevent any grease or oil coming into contact with the brake lining while the hub is removed.

SECTION H3 — STUB AXLES AND PIVOTS

Removing the Stub Axle from the Yoke

Position a jack under the front pan, taking care that the jack head does not contact the power steering cylinder. Jack up the car and place supports under the front lower triangle levers. Remove the front wheel, brake drum and hub, see Section H2. Disconnect the single hydraulic brake pipe on **early S1 cars** and the dual brake pipes on **late S1 and all S2 cars** at the union(s) mounted on the bracket fitted to the front damper.

On all cars, turn down the tabs on the locking plate, unscrew the setscrews and remove the side steering lever from the stub axle. Turn down the tabs on the locking plates, unscrew the six setscrews securing the shoe carrier plate to the stub axle and remove the plate with brake shoes attached. Discard all used locking plates.

Prise off the top cover and remove the pivot pin nut, the tab washer and the plain washer. Remove the four setscrews and plain washers securing the bottom flange, then remove the flange together with the thrust washer and packing plate. Due to the modification to the steering levers on **S1 cars**, introducing a grease lubricated ball joint, the lubrication hole in the lower flange will be sealed off with a 0·250 in. (6·350 mm.) diameter steel ball and a brass union.

On all cars, drive the pivot pin downwards using an aluminium drift; should any difficulty be encountered, the pivot pin may be extracted by using Tool RH.568. The base of the pivot pin is drilled and tapped $\frac{11}{16}$ in. diameter Whitworth thread for extraction purposes. Remove the stub axle from the yoke and discard the felt washers.

Collect all the parts and wash them thoroughly before commencing assembly.

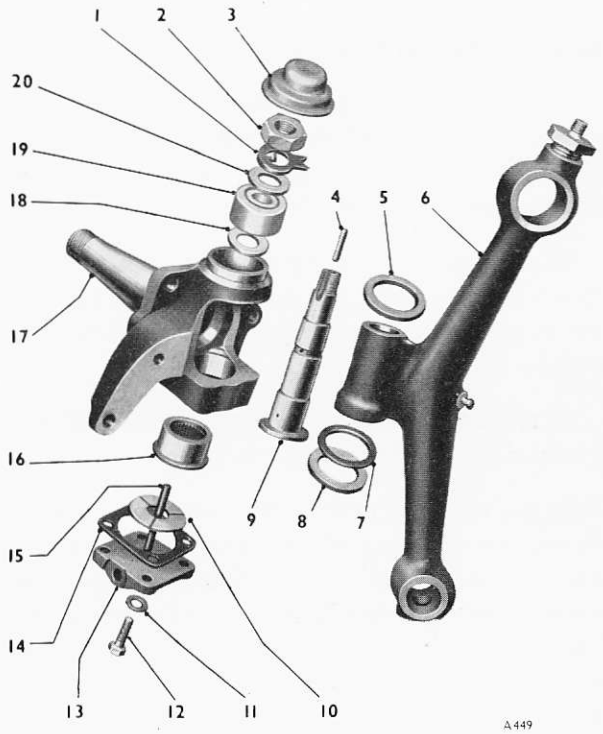


Fig. H14 Exploded view of stub axle

1. LOCK WASHER
2. PIVOT PIN NUT
3. TOP COVER
4. RESTRICTOR PIN
5. FELT WASHER
6. YOKE
7. RETAINER
8. FELT WASHER
9. PIVOT PIN
10. THRUST WASHER
11. PLAIN WASHER
12. BOTTOM FLANGE SETSCREW
13. BOTTOM FLANGE
14. PACKING PLATE
15. OIL TUBE
16. LOWER BEARING
17. STUB AXLE
18. DISTANCE WASHER
19. UPPER BEARING
20. PLAIN WASHER

Stub Axle Bearing Assemblies — to renew

Withdraw the inner race from the upper bearing and remove the needle rollers from both the upper and lower bearings. Tap out the upper and lower outer races with a suitable drift.

To fit the new bearings a press should be used. Press in the upper bearing as an assembly and press in the lower bearing outer race, ensuring that both the outer races are pressed hard against the shoulders in the stub axle.

Apply a thick coating of grease to the lower outer race and position the 34 needle rollers.

Fitting the Stub Axle to the Yoke

Figure H14 shows an exploded view of the S1 stub axle assembly and reference should be made to this illustration for the assembly of both S1 and S2 stub axles as they are very similar.

Fit the upper felt sealing washer together with the distance washer under the top bearing in the stub axle; the stepped side of the distance washer must face towards the top.

Fit the lower retainer and felt washer into the recess provided in the bottom of the yoke bore.

Fit the stub axle to the yoke ensuring that the felt washers are not displaced. Enter the pivot pin into the stub axle with the slot for the lock washer tab facing towards the centre line of the car and push the pivot pin as far as possible by hand; care should be taken not to displace the needle rollers. Using an aluminium drift, drive the pivot pin upwards until it is hard against the shoulder in the yoke.

On S1 cars fit the oil restricting pin to the top of the pivot pin.

On all cars fit the plain washer, the lock washer and nut to the pivot pin and tighten the nut whilst continually checking the stub axle for freedom of movement; do not lock the nut at this stage.

Lubricate the thrust washer and position it in the lower flange. Lightly smear the packing plate and the flange with jointing compound and secure the plate to the stub axle with the four setscrews and plain washers.

Check the stub axle for freedom of movement and for end float; the permissible end float is 0·007 in. (0·178 mm.) to 0·017 in. (0·432 mm.). If the end float is not within these limits it will be necessary to fit a new thrust washer. The thickness of a new thrust washer is 0·098–0·001 in. (2·489–0·025 mm.). Any tightness or binding when moving the stub axle from lock to lock may be relieved by a few sharp blows on the lower flange with a hide mallet.

Ensure that the pivot pin nut is tight, turn up the tabs on the lock washer and fit the top cover. **On S1 cars**, smear a liberal amount of jointing compound on to the top cover and press the cover into position. **On S2 cars**, there are four holes 0·125 in. (3·175 mm.) diameter by 0·100 in. (2·540 mm.) deep drilled in the top diameter of the stub axle. Place the top cover in position and with the aid of a centre punch and hammer make four indentations in the top cover opposite the four holes in the top of the stub axle.

Mount the side steering lever onto the stub axle with the two setscrews and a new locking plate; tighten and lock the setscrews.

Fit the brake shoe carrier plate assembly using new locking plates, connect the brake hose(s) and bleed both the front and rear brakes (see Chapter G).

Fit the wheel and hub assembly, adjusting and locking the bearings as previously described.

On S1 cars, check the oil flow to all points from the 'Central Lubrication System'.

On S2 cars, lubricate the stub axle assembly at the grease points using the Tecalemit grease-gun, RH.709, charged with Rocol Moly Spring Grease 204G or its equivalent.

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SECTION H4 — FRONT ROAD SPRINGS

Special tool required:

RH.195 — Front Spring Compressor

Description

The front coil springs are fitted with packing washers to suit the front axle weight and the terrain over which the car will operate. The poundage rating of the front springs is between 1650 lb. (747·450 kg.) and 2440 lb. (1105·32 kg.) at 9·550 in. (24·257 cm.) depending upon the model and the weight of the car. Steel packing washers 5·375 in. (13·652 cm.) diameter and 0·100 in. (2·540 mm.) thick are available, permitting the effective poundage of the springs to be adjusted with considerable accuracy to suit individual requirements. These steel packing washers fit on the top of the coil spring and each additional washer will increase the poundage by 14 lb. (6·342 kg.). The maximum permissible number of washers fitted to any one coil spring is seventeen and the minimum is two. The front springs are normally supplied with the correct number of packing washers to suit individual chassis.

It is advised that with any front suspension problem, Retailers should contact the London Service Station, Hythe Road, or the Crewe Service Station, Pym's Lane.

Front Coil Spring — to remove

Apply the handbrake and jack up the car at the centre of the front pan, using a suitable plate on the jack head to spread the load; ensure that the plate does not foul the power steering cylinder. Place stands under the stabiliser rod chassis mountings and remove the stabiliser rod link from the side concerned.

Place the compressing tool, RH.195, through the coil spring until the hook on the top end of the tool engages in an eye protruding from the front crossmember for this purpose. Compress the spring sufficiently to enable the securing bolts and setscrews to be safely removed. **On S1 cars**, there are eight bolts securing the coil spring lower seat to the lower triangle levers and **on S2 cars**, two bolts and two setscrews.

After removing the securing bolts, gradually release the pressure on the compressing tool until the coil spring tension is fully released, then detach the tool from the eye on the crossmember.

Care should be taken not to misplace the steel packing washers fitted on top of the coil spring.

Front Coil Spring — to fit

The spring should be fitted by reversing the removal procedure, noting that the top of the spring is ground flat and the correct steel packing washers are used. Before compressing the spring, place two long pieces of rod through opposite holes in the spring lower seat and lower triangle levers; these steel rods will act as guides to align the remaining holes.

When the operation is completed and the jack removed from under the chassis, the car should be rocked from side to side to allow the spring to settle into position.

A check should be carried out of the standing height and steering geometry on completion of this operation, referring to 'Front Suspension' for specifications and methods of adjustment.

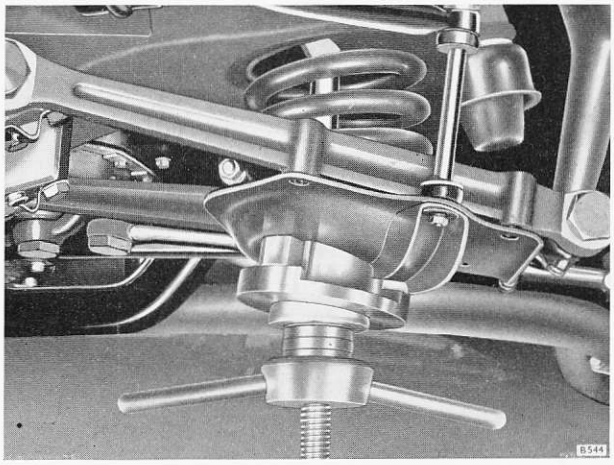


Fig. H15 Front spring compressing tool in position

SECTION H5—UPPER AND LOWER TRIANGLE LEVERS AND STUB AXLE YOKES—S1 CARS

Lower Triangle Levers, Fulcrum Brackets and Lower Bearing Blocks — to remove

Remove the front coil spring as previously described. Disconnect the oil line union on the fulcrum bracket and the oil line union on the top of the idler cross beam pin; remove the pin from the fulcrum bracket and the frame bracket eyes. Support the idler cross beam to prevent dropping and possible damage to the rubber seals on the ball joints.

Remove the remaining two bolts securing the yoke lower bearing blocks to the lower triangle levers. The bearing blocks can be screwed off the lower yoke fulcrum pin when the triangle levers are removed.

Bend the tabs on the locking plates and remove the four bolts and nuts securing the fulcrum bracket to the front chassis member. Remove the four bolts securing the bearing blocks to the lower triangle levers, then unscrew the bearing blocks from the fulcrum bracket.

The right and left-hand fulcrum brackets are interchangeable, as are the right and left-hand triangle levers. The front and rear triangle levers are not interchangeable owing to the rear lever edges being recessed to prevent the track rod inner ball joints fouling when on full lock.

The front and rear fulcrum bracket bearing blocks are interchangeable, as are the lower yoke bearing blocks.

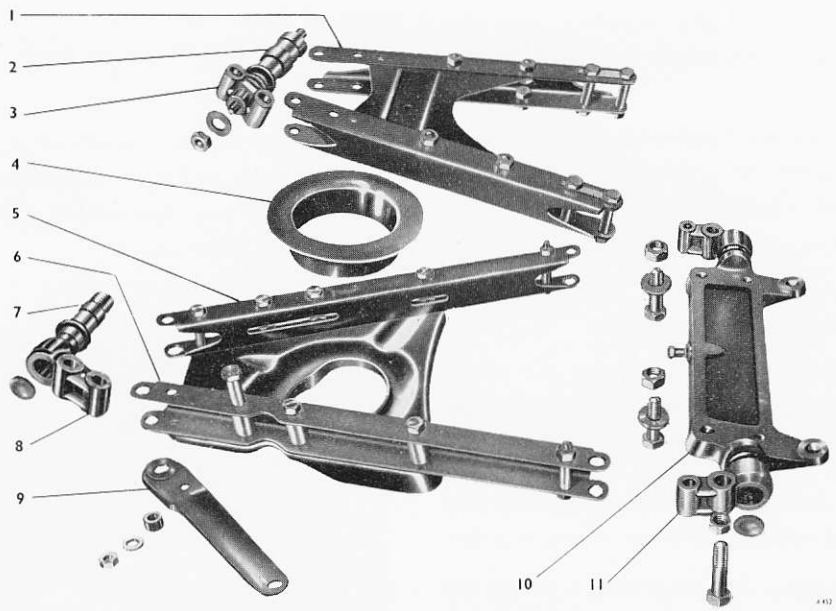


Fig. H16 Triangle levers, fulcrum bushes and bearing blocks — S1 cars

1. UPPER TRIANGLE LEVERS
2. UPPER FULCRUM PIN, BUSH AND RUBBER SEALING RING
3. UPPER BEARING BLOCK
4. RUBBER SEATING FOR FRONT COIL SPRING
5. LOWER FRONT TRIANGLE LEVER
6. LOWER REAR TRIANGLE LEVER
7. LOWER FULCRUM PIN
8. LOWER BEARING BLOCK
9. STABILISER ATTACHMENT BRACKET
10. FULCRUM BRACKET
11. FULCRUM BRACKET BEARING BLOCK

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New rubber sealing rings (see 'Stub Axle Yokes'), must always be used when the bearing blocks have been removed.

Lower Triangle Levers, Fulcrum Brackets and Lower Bearing Blocks — to fit

Fit new rubber sealing rings against the shoulders of the threaded ends of the fulcrum bracket and on both sides of the lower yoke fulcrum pin. Lubricate the lower yoke bearing blocks with a few drops of oil and screw the blocks onto the yoke lower fulcrum pin just sufficiently to compress the rubber sealing rings and in a position for connecting the lower triangle levers.

The lower triangle levers should be assembled on the bench before attaching to the lower yoke bearing blocks. Clamp the fulcrum bracket horizontally in a vice, being careful not to damage the lubrication fitting. Lubricate the bearing blocks with a few drops of oil and screw them onto the fulcrum bracket just sufficiently to compress the rubber sealing rings. It will be noted that the start of the threads on the fulcrum bracket are opposed at 180 deg. Attach the lower triangle levers to the fulcrum bracket bearing blocks and tighten the two retaining bolts on each bearing block.

Connect the lower triangle levers to the lower yoke bearing blocks and fit the two larger bolts; do not fully tighten these bolts until the front coil spring and lower spring seat have been fitted and the holes lined up. Mount the fulcrum bracket on the chassis front member using new locking plates on the four securing bolts. Before tightening and locking these bolts, push the yoke end of the lower triangle levers towards the rear of the car to take up the clearance in the bolt holes.

Fit the front coil spring and the lower spring seat as previously described and while the spring is compressed, fully tighten the bolts securing the lower yoke bearing blocks to the lower triangle levers.

Fit the cross beam idler and tighten the nut on the pin.

Reconnect the oil line unions on the fulcrum brackets and the cross beam idler pin and check the lubrication flow.

Upper Triangle Levers and Upper Bearing Blocks — to remove

Assuming the front coil spring has been removed, proceed as follows to remove the upper triangle levers and bearing blocks.

Before removing the upper triangle levers, scribe marks on the damper shaft or measure from the end of the damper shaft to the position which the upper triangle levers occupy on the shaft; this will enable the upper triangle levers to be re-fitted in exactly the same position. Bend the tabs on the locking plates and release the four bolts securing the triangle levers to the damper shaft.

Remove the two nuts and washers securing the upper bearing blocks to the fulcrum pin and then slide the upper triangle levers from the damper shaft and the upper fulcrum pin. Each of the upper bearing blocks are secured to the upper triangle levers by two bolts locked with a locking plate.

Upper Triangle Levers and Upper Bearing Blocks — to fit

The fitting procedure is the reversal of that used for the removal, noting that new rubber sealing rings (see 'Stub Axle Yoke'), should be fitted on both sides of the fulcrum pin. New locking plates should be used on the bolts securing the upper bearing blocks to the upper triangle levers and on the bolts securing the upper triangle levers and clamps to the damper shaft.

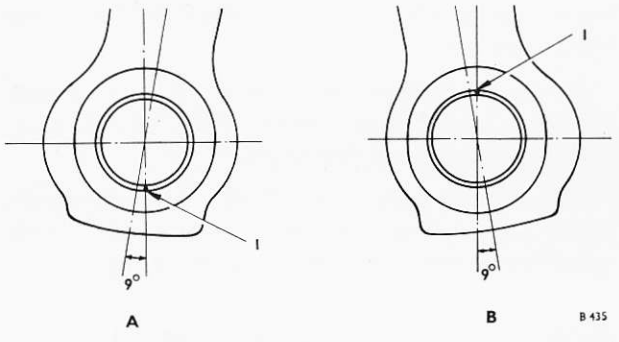


Fig. H17 Front view showing lower fulcrum pins in position — S1 cars

A. LEFT-HAND YOKE B. RIGHT-HAND YOKE I. START OF THREAD

Fulcrum Pins and Bushes — to renew

To renew the upper yoke fulcrum pin it is necessary to remove the upper triangle levers and bearing blocks as described in the previous text. The upper yoke fulcrum pin can be quite easily removed by unscrewing it from the bushed yoke.

If either the lower fulcrum pin or the upper yoke bush require renewing it will be necessary to remove the yoke and stub axle as an assembly.

Assuming that the front coil spring has been removed the procedure is as follows.

Remove the road wheel and disconnect the brake hoses at the unions on the front shock damper. Disconnect the lubrication hose from the top of the yoke and remove the side steering lever from the stub axle. Remove the upper triangle levers and upper bearing blocks and unscrew the upper yoke fulcrum pin. Unscrew and remove the bolts securing the lower yoke bearing blocks to the lower triangle levers and remove the yoke and stub axle assembly. Unscrew the lower yoke bearing blocks from the fulcrum pin.

A press must be used to remove and re-fit both the upper yoke fulcrum bush and the lower yoke fulcrum pin.

When fitting a new upper yoke fulcrum bush to the yoke, the bush should be pressed in position with the oil hole in the bush in line with the holes in the top of the yoke.

To fit a new lower yoke fulcrum pin, press the pin in from the rear of the yoke with the thread start as shown in Figure H17. This is necessary for the correct mounting of the bearing blocks and to ensure that the rubber sealing rings between the yoke and the bearing blocks are equally compressed.

Having correctly pressed the new parts into position, the yoke and stub axle assembly should be re-fitted by reversing the removal procedure.

Bleed the brakes (see Chapter G) and finally check and correct the steering geometry to the specifications given in 'Front Suspension Data'.

Stub Axle Yoke — hollow type

On early S1 cars, hollow stub axle yokes are fitted and lubricant enters the top of the yoke through a flexible pipe. The lubricant is then fed to the pivot pin bearings and outer yoke fulcrum bearings through drillings in the pivot pin and yoke.

The inner fulcrum bearings are fed through a drilled lower fulcrum bracket which is supplied with lubricant by a pipe fed from a distribution block on the inside of the frame behind the front crossmember.

Rubber seals are fitted between the fulcrum points and the bearing blocks. These seals are fitted with a retaining ring to assist in preventing the escape of lubricant and the ingress of dirt and water.

It is important that under no circumstances should a seal without a retaining ring be fitted to cars with hollow stub axle yokes.

The part numbers of the seals with retaining rings are as follows:

UR.4000	UR.4002
UR.4001	UR.4003

Stub Axle Yoke — solid type

On late S1 cars, solid stub axle yokes are fitted and an external pipe is provided through which lubricant is fed to the upper and lower fulcrum pins and the pivot pin.

The amount of lubricant fed to the bearings is controlled by restrictors which are fitted in the top and bottom of the yokes and in the bearing brackets.

Rubber seals are fitted between the fulcrum points and bearing blocks to prevent the escape of lubricant and the ingress of dirt and water; unlike the seals fitted to the hollow stub axle yokes, no retaining rings are fitted to these seals.

It is important that under no circumstances should a seal with a retaining ring be fitted to cars with solid stub axle yokes.

The part numbers of seals without retaining rings are as follows:

UR.3425	UR.3426

Stub Axle Yoke — to renew

Remove the stub axle assembly from the yoke (see 'Stub Axles and Pivots'). Disconnect the lubrication hose from the top of the yoke and remove the upper triangle levers and the upper and lower bearing blocks. Remove the stub axle yoke and unscrew the upper fulcrum pin.

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There are four types of stub axle yokes in service:

(i) Solid type with 1 deg. castor angle for power assisted steering.

(ii) Solid type with ½ deg. to 1 deg. castor angle for manual steering.

(iii) Hollow type with 1 deg. castor angle for power assisted steering.

(iv) Hollow type with ½ deg. to 1 deg. castor angle for manual steering.

When it is necessary to renew a stub axle yoke, a solid type (i) as for power assisted steering must be fitted owing to the other types now being out of production.

The yoke and stub axle assembly should be fitted by reversing the removal procedure and using the appropriate rubber sealing rings on the fulcrum pins.

After fitting the upper triangle levers, bearing blocks and stub axle assembly, bleed the brakes and finally check and correct the steering geometry to the specifications given in 'Front Suspension Data'.

SECTION H6—UPPER AND LOWER TRIANGLE LEVERS AND STUB AXLE YOKES—S2 CARS

Lower Triangle Levers and Fulcrum Brackets — to remove

Remove the front coil spring as previously described and remove the idler lever pin from the fulcrum bracket. Support the idler cross beam to prevent it dropping and causing possible damage to the grease seals on the ball joints.

Unscrew and remove the four threaded bushes securing the lower triangle levers to the fulcrum bracket and the lower yoke fulcrum pin. Withdraw the lower triangle levers from the fulcrum bracket and the lower yoke fulcrum pin and discard the rubber seals.

The fulcrum bracket is removed by bending the tabs on the locking plates and unscrewing the four securing bolts. In some cases it has been necessary to fit distance pieces between the fulcrum bracket and the chassis frame to correct the alignment of the front suspension; note under which faces of the fulcrum bracket these distance pieces are fitted so that they may be re-fitted in the same position.

It should be noted that the four lower triangle levers are interchangeable as are the fulcrum brackets.

Lower Triangle Levers and Fulcrum Brackets — to fit

Position new locking plates onto the fulcrum bracket securing bolts and mount the fulcrum bracket to the chassis frame not forgetting the distance pieces if previously fitted; do not tighten the securing bolts at this stage.

Fit new rubber sealing rings against the shoulders of the threaded ends of the fulcrum bracket and on both sides of the lower yoke fulcrum pin. Fit the lower triangle levers in position on the fulcrum bracket and the lower yoke fulcrum pin. Lubricate the four threaded bushes with the approved lubricant and then screw them on to the fulcrum pivots noting that the longer bearing bush should be fitted on the rear of the lower yoke fulcrum pin. When the four threaded bushes are in position they should be tightened to a torque loading of 250 lb.ft. (34·5 kg.m.).

Before tightening and locking the fulcrum bracket securing bolts take up the clearance in the bolt holes by pushing the yoke end of the lower triangle levers towards the rear of the car.

Fit the front coil spring and the lower spring seat.

Fit the cross beam idler and tighten the securing nut.

Upper Triangle Levers, Upper Fulcrum Pin and Upper Yoke Bearing Bush — to remove

Assuming the front coil spring has been removed, proceed as follows to remove the upper triangle levers.

Unscrew the large cap nut on the upper fulcrum pin and then unscrew and remove the upper fulcrum pin. Note that both the front and rear upper triangle levers as well as the upper yoke bearing bush are tapped with the same thread as the upper fulcrum pin. Discard the rubber seals.

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Before removing the upper triangle lever assembly, scribe marks on the damper shaft or measure from the ends of the damper shaft to the position which the upper triangle levers occupy on the shaft; this will enable the upper triangle levers to be re-fitted in exactly the same position. Bend the tabs on the locking plates, unscrew and remove the four setscrews and two caps securing the upper triangle levers to the damper shaft.

Each pair of upper triangle levers are interchangeable.

Before removing the upper yoke bearing bush, note the position of the tapped hole which is eccentric to the centre of the bearing bush so that it can be re-fitted in the same position. Bend the tabs on the locking washer and unscrew the clamping setscrew at the top of the yoke. Remove the retaining circlip from the rear of the bearing bush; the bush can now be removed from its locating bore.

Upper Triangle Levers, Upper Fulcrum Pin and Upper Yoke Bearing Bush — to fit

The upper yoke bearing bush is fitted by reversing the procedure for removal noting that the bush is entered from the front of the yoke and a new locking plate should be used on the clamping setscrew.

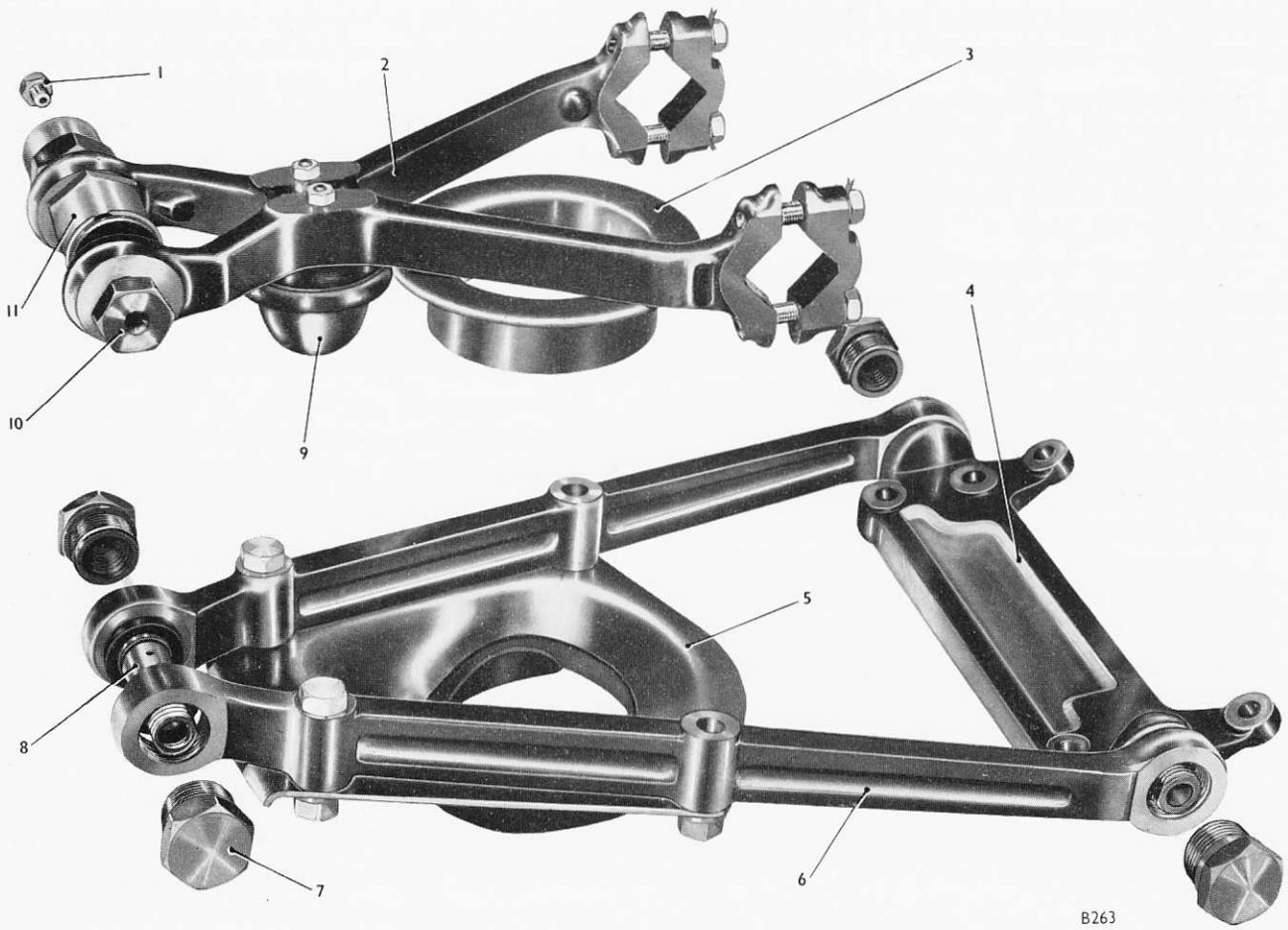


Fig. H18 Triangle levers, fulcrum bracket and fulcrum pin — S2 cars

1. GREASE NIPPLE
2. UPPER TRIANGLE LEVER ASSEMBLY
3. RUBBER SEATING FOR FRONT COIL SPRING
4. FULCRUM BRACKET
5. SPRING SUPPORT PLATE
6. LOWER TRIANGLE LEVER
7. THREADED BUSH
8. LOWER FULCRUM PIN
9. REBOUND RUBBER
10. UPPER FULCRUM PIN NUT
11. UPPER FULCRUM PIN BUSH

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Lubricate the upper fulcrum pin with the approved lubricant and screw the fulcrum pin into the rear upper triangle lever until the end of the fulcrum pin protrudes about $\frac{5}{16}$ in. (7·924 mm.) above the inner face of the rear upper triangle lever; this is necessary for the equal compression of the rubber seals and for the central positioning of the yoke assembly between the inner faces of the upper triangle levers. Place a new rubber seal onto the upper fulcrum pin and position the upper triangle levers on the yoke assembly and continue to screw the upper fulcrum pin through the upper yoke bearing bush. Fit a new rubber seal on the upper fulcrum pin between the inner face of the front upper triangle lever and the front face of the upper yoke bearing bush. Screw the upper fulcrum pin into the front upper triangle lever but do not fully tighten the upper fulcrum pin.

Position the upper triangle levers on the damper shaft as described in the removal procedure and fit the two caps, new locking plates and four setscrews which secure the upper triangle levers to the damper shaft. Tighten and lock the four setscrews.

Torque load the head of the upper fulcrum pin to 200 lb.ft. (27·6 kg.m.). Fit the large cap nut to the front of the upper fulcrum pin and torque load the nut to 250 lb.ft. (34·5 kg.m.).

Re-fit the front coil spring as previously described.

Lower Fulcrum Pin — to renew

To renew the lower fulcrum pin the yoke may be removed with the hub and stub axle assembled and taken to a press for this operation.

Assuming that the front coil spring has been removed the procedure is as follows.

Remove the road wheel and disconnect the brake hoses at the unions on the plate mounted on the front damper. Remove the side steering lever from the stub axle.

Remove the lower triangle levers and upper fulcrum pin as described in the previous text; note that it is not necessary to remove the upper triangle levers from the front damper shaft or to remove the upper yoke bearing bush. The yoke and stub axle assembly can now be removed.

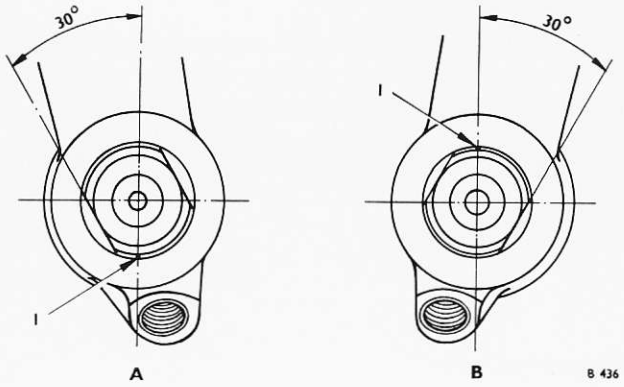


Fig. H19 Rear view showing lower fulcrum pins in position

A. LEFT-HAND YOKE B. RIGHT-HAND YOKE I. START OF THREAD

To remove the lower fulcrum pin from the left-hand yoke, pressure should be applied at the rear face of the fulcrum pin. For removal of the lower fulcrum pin from the right-hand yoke, pressure should be applied on the front face of the lower fulcrum pin.

The new lower fulcrum pin should be pressed into its respective bore by reversing the removal procedure and noting the position of the flats and the start of the thread **as this is very important** (see Fig. H19) showing the lower fulcrum pins in position.

Having correctly pressed the new fulcrum pin into position, the yoke and stub axle assembly should be re-fitted by reversing the removal procedure and using new rubber seals on the upper and lower fulcrum pins.

Bleed the brakes (see Chapter G) and finally check and correct the steering geometry to the specifications given in 'Front Suspension Data'.

Stub Axle Yoke — to renew

If it is necessary to renew the stub axle yoke, remove the stub axle from the yoke (see 'Stub Axles and Pivots') and then proceed in a similar manner to that described in the previous text for the renewal of the lower fulcrum pin. It will also be necessary to remove the upper yoke fulcrum bush from the yoke.

The new yoke should be fitted by reversing the procedure for the removal.

Front Stabiliser Rod

A transverse stabiliser rod is positioned at the front of the chassis frame and cushions the effect of extreme travel of the upper and lower triangle levers.

The stabiliser rod is mounted on three rubber blocks and these blocks are fastened to the chassis frame by three steel brackets. The outer ends of the stabiliser rod are connected to the lower spring seat by steel links carried in rubber bushes. No attention is necessary except to check that all securing bolts and nuts are tight.

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SECTION H7 — REAR SUSPENSION

Description

The rear suspension consists of semi-elliptic leaf springs suspended inside the chassis frame. Double-acting controllable shock dampers are mounted to the chassis frame and the shock damper operating arms are connected to the rear axle housings to dampen the spring action on both deflection and rebound. A solenoid is fitted to each of the rear shock dampers so that when the switch on the steering column is operated a harder 'ride' is obtained.

A feature of the rear suspension is the use of 'Silentbloc' bushes which minimises road noise and requires no lubrication. A 'Z' bar mounted on 'Silentbloc' bushes is fitted to the right-hand side of the chassis frame **on all cars except Phantom V,** no 'Z' bar being fitted to these cars. The 'Z' bar is connected to the right-hand side of the rear axle housing and controls the torque and braking reactions.

Rear Standing Height

The rear standing height is measured between the intersection of the centre line of the bump stop mounting bracket with the chassis frame side member and the rear axle housing (see 'A' Fig. H20). The dimension 'A' Figure H20 should be checked with the car in the unladen condition, that is with no passengers or luggage, but with five gallons of fuel in the tank. For each gallon over five, 0·025 in. (0·0635 cm.) should be subtracted and for each gallon under five, 0·025 in. (0·0635 cm.) should be added to the rear standing height. The permitted variation in the rear standing height for side to side should not be more than 0·375 in. (0·9525 cm.).

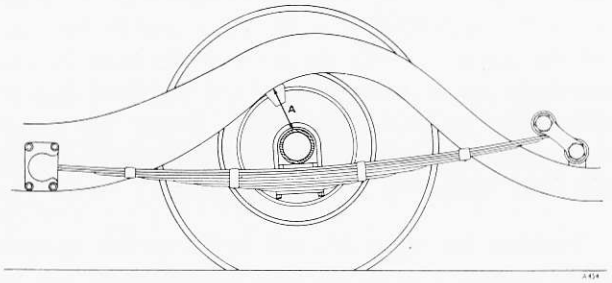


Fig. H20 Rear standing height

In the event of a car being jacked up for any length of time so that the rear springs are allowed to hang, do not check the standing height until the car has been driven on the road approximately thirty miles otherwise an incorrect reading will be obtained.

S1 CARS	REAR STANDING HEIGHT	TOLERANCE
Standard car	6·000 in. (15·240 cm.)	+ 0·600 in. (1·524 cm.) — 0·300 in. (0·762 cm.)
Colonial car	6·500 in. (16·510 cm.)	+ 0·600 in. (1·524 cm.) — 0·300 in. (0·762 cm.)
S2 CARS		
Standard car Colonial car	6·900 in. (17·526 cm.)	+ 0·600 in. (1·524 cm.) — 0·300 in. (0·762 cm.)
Phantom V	7·300 in. (18·542 cm.)	+ 0·600 in. (1·524 cm.) — 0·300 in. (0·762 cm.)

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The 'Z' Bar — description

The 'Z' bar is fitted to **all cars except Phantom V** and is positioned between the right-hand chassis frame side member and the right-hand rear axle housing. The 'Z' bar controls the torque and braking reactions.

On S1 cars each end of the 'Z' bar is supported in two bushes, one 'Harrisflex' and one 'Silentbloc' and no lubrication is required at these points.

A modification to the 'Z' bar was introduced **on Bentley Continental S1 cars** to improve the directional stability, particularly on curving and undulating roads. This modification consists of cutting the 'Z' bar one inch inboard of the outer 'Silentbloc' bush on the rear axle and discarding the inner bush. Care should be taken not to damage adjacent parts when cutting the 'Z' bar. After cutting the 'Z' bar, file the end of the bar smooth, round the edges and finally paint with air drying black enamel. After this modification the 'Z' bar will act purely as a rear axle torque arm and give no anti-roll action thus inducing an increase in understeer.

On S2 cars each end of the 'Z' bar is supported in one 'Silentbloc' bush (see Fig. H22) and no lubrication is required at these points.

'Z' Bar Bushes — to renew

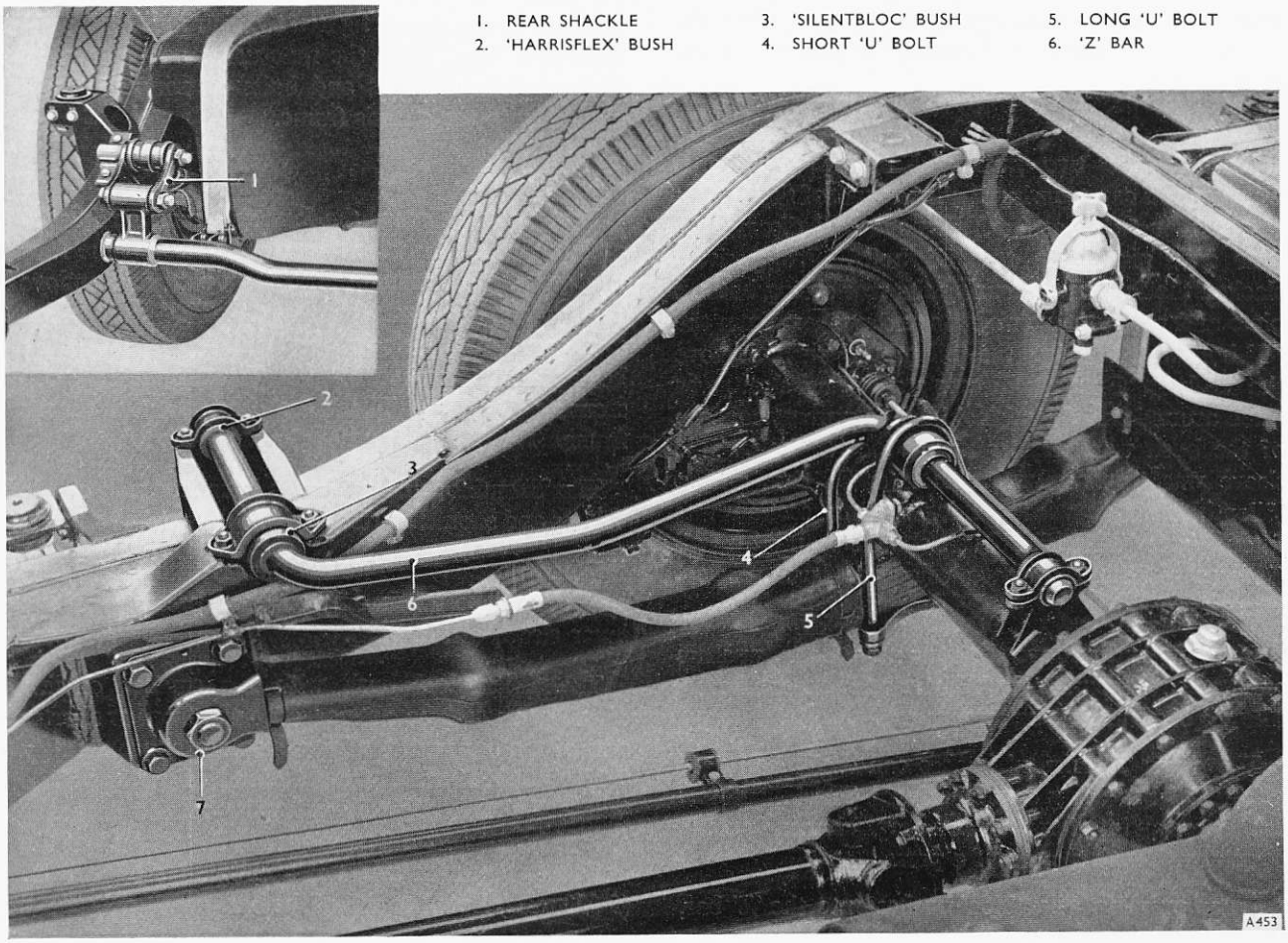
Special tool required:

RH.196 — Rear Spring Compressing Tool

On all cars it will be necessary to remove the 'Z' bar for the renewal of the bushes. Jack up the car and place suitable stands under the tubular crossmember at the rear of the chassis frame so that the rear wheels are clear of the ground. Remove the rear wheels.

Fig. H21 Rear spring shackles, 'U' bolts and 'Z' bar — S1 cars

1. REAR SHACKLE
2. 'HARRISFLEX' BUSH
3. 'SILENTBLOC' BUSH
4. SHORT 'U' BOLT
5. LONG 'U' BOLT
6. 'Z' BAR



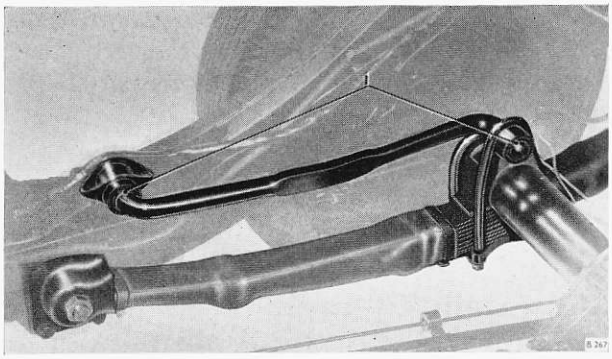


Fig. H22 Rear spring, 'U' bolts and 'Z' bar — S2 cars

1. 'SILENTBLOC' BUSHES

Before fitting the spring compressing tool, place packing material over the spring gaiters at the points where the legs of the compressing tool will clamp, to prevent damage to the gaiters. Fit the spring compressing tool and compress the spring until there is sufficient pressure to prevent the spring flying apart when the 'U' bolts are released and proceed as follows for the respective cars.

S1 cars

Unscrew the two nuts and remove the bolts, washers and cap securing the inner end of the 'Z' bar to the rear axle housing. Remove and discard the four split pins from the 'U' bolts. Progressively slacken the four nuts securing the rear spring bottom plate and remove the two nuts and washers from the 'U' bolt which secures the 'Silentbloc' bush; remove the 'U' bolt. **On early S1 cars** a split steel sleeve was fitted around the 'Silentbloc' bush to prevent collapse of the bush when tightening up the 'U' bolt. This sleeve was dispensed with **on later S1 cars** and a 'Silentbloc' bush with a thicker outer section was fitted. This 'Silentbloc' bush should be used **on all S1 cars** without the sleeve whenever bush renewal is necessary.

Unscrew and remove the four nuts, bolts, washers and two caps securing the 'Z' bar to the chassis frame. The 'Z' bar can now be removed.

The outer 'Harrisflex' bushes can easily be prised off the 'Z' bar using a screwdriver. The 'Silentbloc' bushes are an interference fit on the 'Z' bar and should be removed with the aid of a press.

When pressing 'Silentbloc' bushes onto the 'Z' bar, care should be taken only to exert pressure on the inner sleeve of the bush.

The 'Silentbloc' bush which is to be fitted on the rear or longer arm of the 'Z' bar should be pressed onto the bar until the inner sleeve is approximately 8·500 in. (21·590 cm.) from the end of the arm. The bush on the front or shorter arm of the bar should be pressed on until the inner sleeve is approximately 6·690 in. (16·9 cm.) from the end of the arm.

When the 'Silentbloc' bushes are correctly positioned the 'Harrisflex' bushes may be slipped on the outer ends of the arms, using a little Lanoline to assist assembly.

Fit the 'Z' bar to the chassis frame and rear housing by reversing the removal procedure but do not fully tighten the 'U' bolt nuts or the nuts and bolts securing the front mountings. Ensure that the 'Silentbloc' bushes are able to move in their mountings. Remove the spring compressing tool and lower the car to the ground. Progressively tighten the four nuts on the 'U' bolts and finally lock the nuts using new split pins. Fully tighten the nuts and bolts securing the front mounting to the chassis frame.

S2 cars

Remove and discard the four split pins locking the nuts to the 'U' bolts. Progressively slacken the four nuts securing the rear spring bottom plate and remove the two nuts and washers from the 'U' bolt which secures the 'Silentbloc' bush; remove this 'U' bolt. Unscrew and remove the two nuts, bolts and cap securing the front 'Silentbloc' bush to the chassis frame. The 'Z' bar can now be removed.

The 'Silentbloc' bushes are an interference fit on the 'Z' bar and should be removed with the aid of a press.

When pressing 'Silentbloc' bushes onto the 'Z' bar, care should be taken only to exert pressure on the inner sleeve of the bush.

The 'Silentbloc' bush with the smaller outside diameter should be pressed onto the front or shorter arm of the bar until the inner sleeve is approximately 0·250 in. (6·350 mm.) from the end of the bar. The 'Silentbloc' bush with the larger outside diameter should be pressed onto the rear or longer arm of the bar until the inner sleeve is approximately 0·375 in. (9·525 mm.) from the end of the bar.

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When the 'Silentbloc' bushes are correctly positioned, fit the 'Z' bar to its mountings but do not fully tighten the 'U' bolt nuts or the nuts and bolts securing the front mountings. Ensure that the 'Silentbloc' bushes can move in their mountings. Remove the spring compressing tool and lower the car to the ground. Progressively tighten the four nuts on the 'U' bolts and finally lock the nuts using new split pins. Fully tighten the nuts and bolts securing the front mounting to the chassis frame.

SECTION H8 — REAR ROAD SPRINGS

Description

The rear springs are semi-elliptic and are suspended inside the chassis frame on 'Silentbloc' bushes. Each spring contains nine leaves which are grooved and secured together with four riveted clips to ensure correct alignment. The leaves are positioned by indentations pressed into the centre of each leaf which locate with a raised pip in the centre of each mating leaf. An indentation pressed in the main leaf registers with a raised pip on the rear axle housing spring saddle for rear spring location.

'Neoprene' or interleaving pads are glued to the tapped ends of the four leaves below the main leaf to prevent metal-to-metal contact at these points. 'Bescropene' No. 1400 adhesive is used for this purpose and the makers' instructions must be closely followed for satisfactory results.

On initial assembly, these springs are provided with lubricant and no further attention is required for 50,000 miles unless the springs are dismantled. Two leather gaiters on each spring retain the lubricant and exclude dust and moisture.

It will be noted that the front eye of the main leaf is welded at the joint. This is to eliminate any possibility of the eye 'uncurling' and allowing the large bushes to become slack in the eye at this important point.

Rear Road Springs — to remove

Special tool required:

RH.196 — Rear Spring Compressing Tool

Place the car on a level surface, jack up the car until the rear wheels are clear of the ground and then place stands under the tubular member at the rear of the chassis frame.

Remove the split pin from the rear damper shackle and disconnect the shackle. Before fitting the spring compressing tool fit packing material over the spring gaiters where the legs of the compressing tool will clamp to prevent damage to the gaiters.

Fit the compressing tool in position as shown in Figure H23 and compress the spring sufficiently to prevent the spring flying apart as the 'U' bolts are released. Remove the split pin from the 'U' bolts and progressively slacken the four nuts retaining the spring bottom plate. The plate cannot be removed until the spring has been removed and the compressing tool released. After releasing the four nuts on the 'U' bolts, jack up the rear axle until clear of the spring.

Bend the tabs on the rear shackle locking plate and remove the nuts from the rear shackle bolts. Spread the spring sufficiently with the compressing tool to enable the rear shackle bolts to be pressed out without

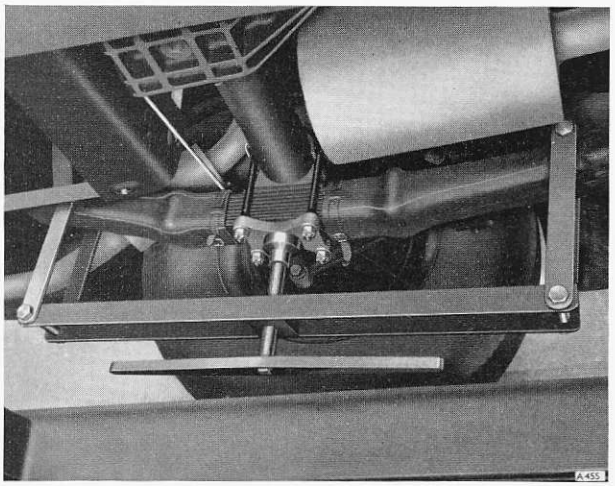


Fig. H23 Rear spring compressing tool in position

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damaging the threads. Support the spring by hand during this operation. Remove the four setscrews and washers securing the front anchorage assembly to the chassis frame and remove the assembly with the spring.

Unscrew and remove the front shackle bolt from the front eye and the anchorage bracket. Before removing the compressing tool, a clamp should be placed around the centre of the spring to prevent the leaves from separating.

Special tool required:

RH.344 — Extractor 'Silentbloc' Bush

To remove the 'Silentbloc' bushes from the spring eyes for renewal purposes it will be necessary to use a press. The shoulders of the front 'Silentbloc' bushes are pressed against the spring eyes and at the moment no tool is available for their removal. A suggested method of removal is to cut a screw thread on the inside of one of the front bushes for a distance of approximately one inch. Screw a suitable bolt into the bush and press from the opposite side until the bush is removed from the spring eye. The other bush may then be pressed out with a suitable mandrel.

When pressing in new 'Silentbloc' bushes care should be taken to apply pressure on the outer sleeve only and not to the inner sleeve or rubber core.

The new front 'Silentbloc' bush should be pressed into the spring eye until the shoulders of the bush contact the sides of the spring eye. The pressure required for this operation will be between 1400 lb. (634·2 kg.) and 2500 lb. (1132·5 kg.).

The 'Silentbloc' bush fitted in the rear spring eye may be removed by pressing through from either side using a suitable mandrel.

The new 'Silentbloc' bush should be pressed into the rear spring eye until the bush is approximately 0·156 in. (3·964 mm.) proud on both sides of the spring eye. The pressure required for this operation will be between 500 lb. (226·5 kg.) and 1000 lb. (453·0 kg.).

The rear fixed shackle brackets are also fitted with 'Silentbloc' bushes and extractor RH.344 must be used to extract or re-fit these bushes as a pressure of approximately eight tons is required.

Care must be taken to allow no oil or grease to come into contact with the 'Silentbloc' bushes as this would have a detrimental effect on the rubber.

Rear Road Springs — to fit

If both rear springs have been removed, the right-hand spring must be fitted first. The 'Z' bar mounted

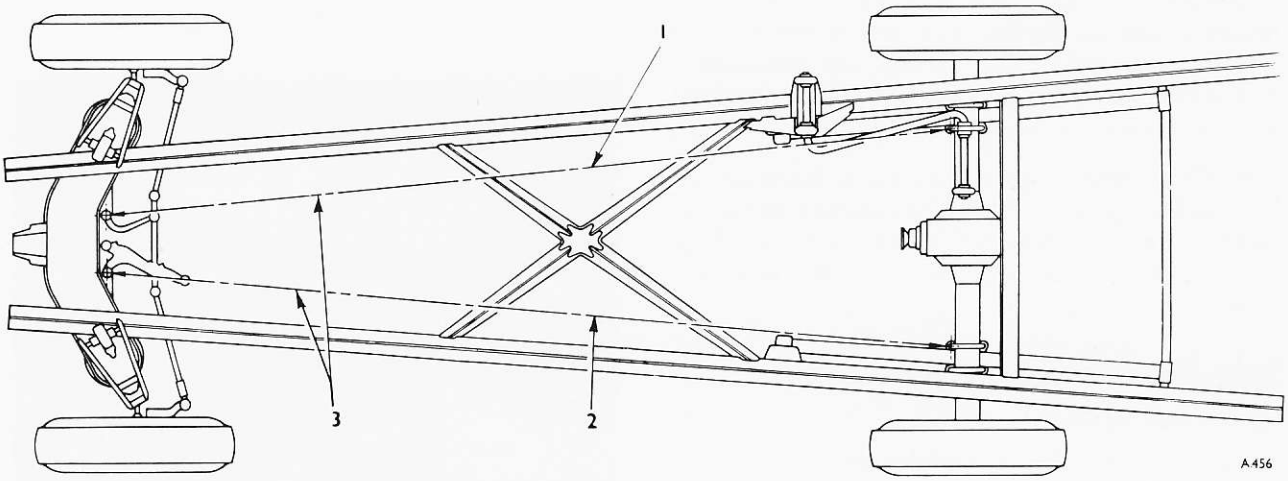


Fig. H24 Rear axle alignment

1. CENTRE OF IDLER LEVER PIVOT TO CENTRE OF 'U' BOLT
2. CENTRE OF OPERATING LEVER PIVOT TO CENTRE OF 'U' BOLT
3. THESE DIMENSIONS TO BE EQUAL

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to the chassis frame and rear axle housing will enable this spring to find its correct position in relation to the front spring anchorage. It will be noticed that the four holes in the front anchorage bracket are elongated for alignment purposes.

Fit the front anchorage bracket onto the spring and insert the front shackle bolt. Screw the nut onto this bolt but do not tighten it.

With the spring compressor and bottom spring plate in position, mount the front anchorage assembly to the chassis frame with the four setscrews and washers; do not tighten these setscrews on the front shackle bolt. Spread the spring with the aid of the compressor and fit the rear shackle bolts, plates and new locking plate. To aid the assembly of the rear shackle bolts a small amount of Lanoline may be used. Screw the nuts onto the rear shackle bolts but do not tighten them.

Lower the rear axle onto the rear spring ensuring that the locating spigot on the rear axle housing enters the indentation in the centre of the main spring leaf. Fit the 'U' bolts over the rear axle housing and the 'Z' bar mounting, and through the bottom spring plate. Fit the four nuts and washers on the 'U' bolts and progressively tighten the nuts until the 'Z' bar mounting can only just be moved on the rear axle housing.

Fully tighten the four setscrews securing the front anchorage bracket.

It is essential that the shackle bolts are not fully tightened until the supports have been removed and the car is on the floor in its free standing condition.

The procedure for fitting the left-hand spring is similar to that used for the right-hand spring, the position of the front anchorage bracket being determined by measurement. With the 'U' bolts tightened in position, a measurement should be taken from the inner 'U' bolt on the right-hand side to the pivot pin of the right-hand front idler lever as shown in Figure H24. A similar measurement should be taken on the left-hand side and this measurement should correspond with that for the right-hand side for correct alignment; the four setscrews securing the front anchorage bracket should be tightened.

Connect the rear damper shackle and lock the nuts using new split pins. Remove the spring compressor, fit the rear road wheels and lower the car to the ground. Fully tighten the nuts on the 'U' bolts and then lock the nuts using new split pins. Fully tighten the front and rear shackle bolts and lock the nuts.

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SECTION H9 — SHOCK DAMPERS

Description and Operation

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The front and rear shock dampers are similar in construction and operate on the same principle. A horizontal piston assembly operates in a cylinder maintained full of oil. The oil is displaced from one end of the cylinder to the other through a hole drilled parallel to the main cylinder and past a spring-loaded valve. A slow leak passage which by-passes the main valve is incorporated and the diameter of this passage is controlled by the position of the slow leak valve.

A solenoid controlled by a switch on the steering column is fitted to each of the rear shock dampers only. On moving the control switch to the 'H' position, the solenoid is energised and pushes the slow leak valve forward in the bore against its spring by means of a push rod. The diameter of the slow leak passage is thus reduced and harder 'ride' is obtained.

A bleed jet is fitted at each end of the cylinder to bleed any air that may be trapped between the ends of the piston and the cylinder. The piston is made in two parts held together by spring-loaded bolts so that it clamps on the main piston actuating lever. A recuperating valve is fitted in each end of the piston.

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Specification

Front Damper — S1 cars

Cylinder diameter	1·750 in. + 0·001 in. (44·45 mm. + 0·0254 mm.)
Piston diameter	1·749 in. — 0·0005 in. (44·4246 mm. — 0·0127 mm.)
Mainshaft journal diameter	0·9995 in. — 0·00025 in. (25·3873 mm. — 0·0063 mm.)
Bush internal diameter (after reaming in position)	1·000 in. + 0·00025 in. (25·4 mm. + 0·00635 mm.)
Bush external diameter	1·1305 in. — 0·0005 in. (28·7147 mm. — 0·0127 mm.)
Bush housing internal diameter	1·125 in. + 0·001 in. (28·575 mm. + 0·0254 mm.)
Mainshaft end float	0·001 in. to 0·004 in. (0·0254 mm. to 0·1016 mm.)

Front Damper — S2 cars

Cylinder diameter	1·750 in. + 0·001 in. (44·45 mm. + 0·0254 mm.)
Piston diameter	1·749 in. — 0·0005 in. (44·4246 mm. — 0·0127 mm.)
Mainshaft journal diameter	1·1245 in. — 0·00025 in. (28·5623 mm. — 0·00635 mm.)
Bush internal diameter (after reaming in position)	1·125 in. + 0·00025 in. (28·575 mm. + 0·00635 mm.)
Bush external diameter	1·253 in. — 0·0005 in. (31·8262 mm. — 0·0127 mm.)
Bush housing internal diameter	1·250 in. + 0·001 in. (3·175 mm. + 0·0254 mm.)
Mainshaft end float	0·001 in. to 0·004 in. (0·0254 mm. to 0·1016 mm.)

Rear Damper — S1 and S2 cars

Cylinder diameter	1·750 in. + 0·001 in. (44·45 mm. + 0·0254 mm.)
Piston diameter	1·749 in. — 0·0005 in. (44·4246 mm. — 0·0127 mm.)

Mainshaft Journals

Large journal diameter	1·2807 in. — 0·0005 in. (32·5298 mm. — 0·0127 mm.)
Small journal diameter	0·9995 in. — 0·0005 in. (25·3873 mm. — 0·0127 mm.)

Bushes (after reaming in position)

Large bush internal diameter	1·2812 in. + 0·001 in. (32·5425 mm. + 0·0254 mm.)
Small bush internal diameter	1·000 in. + 0·001 in. (25·4 mm. + 0·0254 mm.)
Large bush external diameter	1·440 in. — 0·0005 in. (36·576 mm. — 0·0127 mm.)
Small bush external diameter	1·1587 in. — 0·0005 in. (29·431 mm. — 0·0127 mm.)

Bush Housings

Large bush housing internal diameter	1·4375 in. + 0·001 in. (36·5125 mm. + 0·0254 mm.)
Small bush housing internal diameter	1·1562 in. + 0·001 in. (29·3675 mm. + 0·0254 mm.)

Service Operations

Every 10,000 miles the oil level in the front and rear shock dampers should be checked. Carefully clean all dirt and grit from filler plug and surrounding area before removing the plug. Top-up as necessary with the correct fluid to the bottom threads of the filler plug orifice. Cleanliness is essential as small particles of grit lodging under the main or recuperating valves will completely destroy the efficiency of the damper.

Note: The setting of the main and slow leak valve, and hence the degree of damping, can only be carried out on a shock damper testing machine. It is most important that if a shock damper is dismantled for renewal of the main shaft seals, or for any other reason, that the main valve cap nut (see Fig. H30) is not disturbed or the setting will be destroyed.

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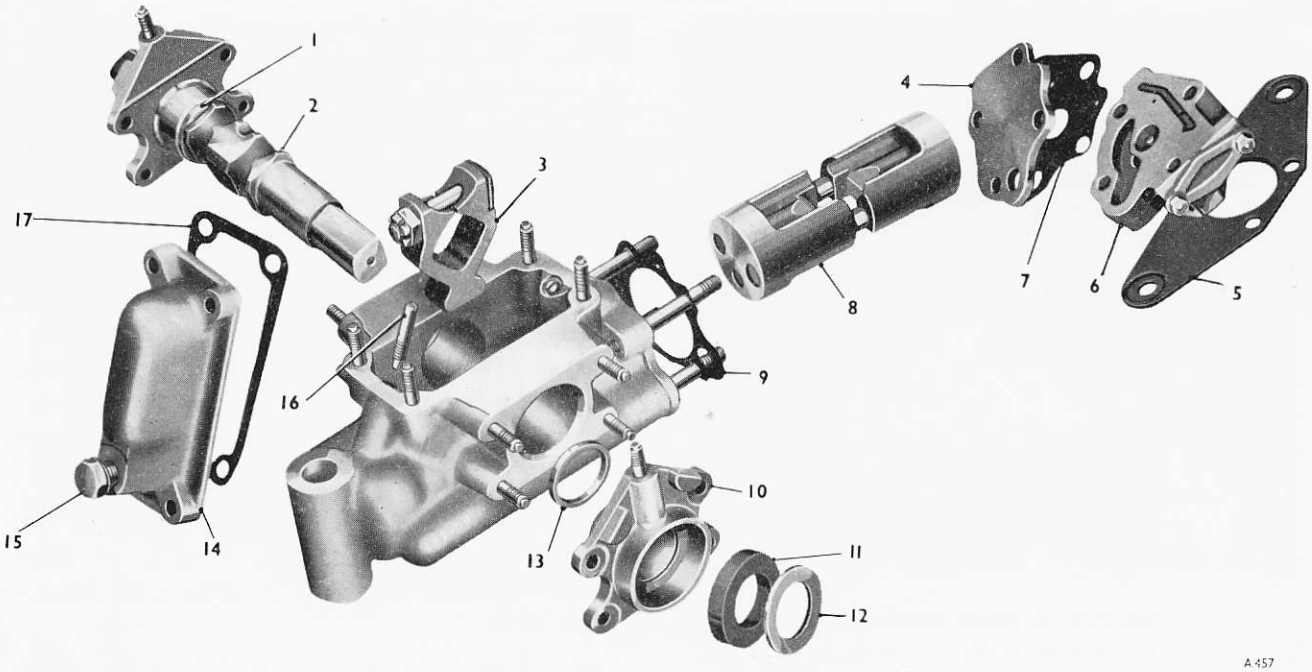


Fig. H25 Exploded view of front damper — S1 cars

1. ADJUSTING WASHER
2. MAINSHAFT
3. DAMPER LEVER
4. VALVE SEAT PLATE
5. MOUNTING BRACKET
6. VALVE CHAMBER
7. 'VELLUMOID' JOINT
8. PISTON ASSEMBLY
9. 'VELLUMOID' JOINT
10. BUSH HOUSING
11. RUBBER SEAL
12. SEAL RETAINING WASHER
13. ADJUSTING WASHER
14. TOP COVER
15. FILLER PLUG
16. BLEED JET
17. 'VELLUMOID' JOINT

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The shock dampers should give long service without attention, but if loss of damping is experienced that is not attributable to evident leakage, it is recommended that the shock damper be removed and a new or reconditioned one fitted. When practicable the shock damper which has been removed should be returned to the London Service Station, Hythe Road, or to the Crewe Service Station, Pym's Lane, for reconditioning and re-setting.

Front Shock Damper — to remove

Jack up the car at the front pan, taking care not to damage the power steering cylinder. Place supports under the stabiliser rod chassis frame mountings so that the front wheels are clear of the ground. Remove the front wheel from the side concerned and remove the front coil spring referring to the appropriate section. Place a supporting stand under the front stub axle and **on all cars** remove the brake hose bracket from the damper casing; **on S1 cars** remove the chassis lubrication hose bracket. The hoses need not be disconnected.

On S1 cars, bend the tabs on the locking plates and remove the two bolts, nuts and washers securing each pair of clamps to the shock damper mainshaft and upper triangle lever. The clamps cannot be removed until the shock damper has been released and moved towards the engine. Unscrew and remove the two bolts, nuts and washers securing the shock damper mounting plate to the chassis frame. Unscrew and remove the mounting bolt at the outer end of the shock damper, taking care not to misplace the eye for front spring compression which is fitted between the mounting bolt head and the chassis frame. The shock damper can now be removed.

On S2 cars, bend the tabs on the locking washers and remove the setscrews securing the clamps to the upper triangle levers and shock damper mainshaft. The clamps should be marked so that they can be re-fitted in the same position and to the same upper triangle lever from which they were removed. Unscrew and remove the two bolts, nuts and washers securing the shock damper mounting plate to the chassis frame. Unscrew and remove the two nuts, heavy duty washers

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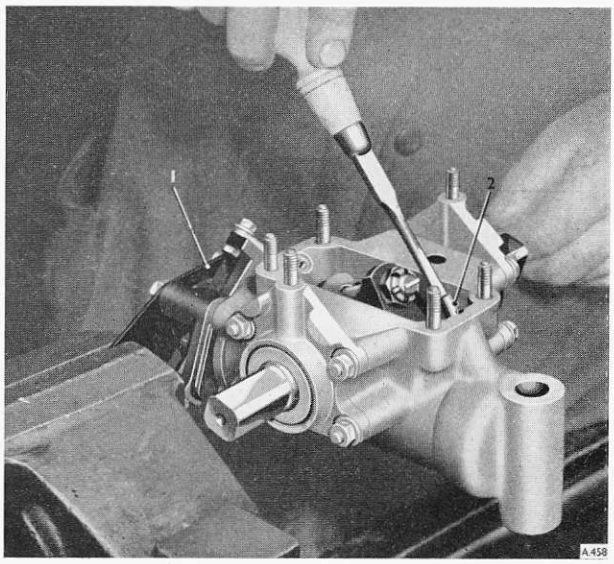


Fig. H26 Removing the bleed jets

1. MOUNTING PLATE HELD IN VICE
2. BLEED JET

and mounting bolts at the outer end of the shock damper. Care should be taken not to misplace the eye for the front spring compression which is fitted between the mounting bolt heads and the chassis frame. The shock damper can now be removed.

Mainshaft Oil Seals — to renew

S1 cars

The mainshaft oil seals are made of rubber and are held in the bush housings on each side of the shock damper by an aluminium washer which is a press fit on the mainshaft. The rubber seals may be renewed as follows without dismantling the shock damper.

Prise off and discard the retaining washers and rubber seals. The new rubber seals should be fitted dry, but a little 'Palmolive' grease may be smeared on the inside diameter of the seal to ease the fitting of the seal over the mainshaft. Tap the rubber seal into its housing with a blunt drift and fit a new retaining washer over the mainshaft. Tap the retaining washer up to the rubber seal with a hollow drift placed over the mainshaft.

S2 cars

The mainshaft oil seals are made of rubber and are held in the bush housings on each side of the shock damper by a brass retaining ring which is pressed into position. It will be necessary to remove the bush housings as follows for the renewal of the rubber seals.

Unscrew and remove the four nuts and spring washers securing each bush housing to the damper casing and withdraw the bush housings. The bush housings should be marked so that they can be fitted to the same side of the shock damper. Prise out and discard the rubber seal from each bush housing but do not disturb the brass retaining ring. Fit a new rubber seal into the recess behind the brass retaining ring on each of the bush housings. The rubber seals should be fitted dry but a little 'Palmolive' grease may be smeared on the inside diameter of the seals to ease the fitting of the bush housings over the mainshaft. It is advisable that the rubber sealing rings fitted on the spigot diameter of the bush housings are also renewed before fitting the bush housings to the shock damper casing.

After renewing the oil seals, slide the bush housings onto the mainshaft and fit the spring washers and securing nuts.

Front Shock Damper — to dismantle

Note: When dismantling, the shock damper body should not be directly clamped in a vice. A suitable position for clamping is the mounting plate or the squared ends of the mainshaft.

Remove the filler plugs and drain out the oil. Unscrew and remove the nuts and plain washers securing the top cover and then remove the cover; the 'Vellumoid' joint should be discarded. Unscrew and remove the four nuts and spring washers securing each of the bush housings to the shock damper casing and mark the bush housings to ensure that they can be re-fitted to the same side of the damper casing from which they were removed. Remove the split pin, nut and pinch bolt from the damper lever and drive out the mainshaft from one side; one bush housing will remain on the mainshaft. Collect the two end float adjusting washers and remove the other housing from the damper casing.

Remove the damper lever by levering with a short rod as shown in Figure H28. Unscrew and remove the four nuts and washers securing the mounting bracket to the shock damper casing and remove the mounting

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bracket, valve chamber and valve seat plate; collect the oil that has not been drained. The two 'Vellumoid' joints, one fitting between the casing and the valve seat plate and the other between the valve seat plate and valve chamber, should be discarded. Extract the piston assembly.

> **Note:** Further dismantling of the valve chamber should not be undertaken, as any disturbance of the main valve cap will affect the damper poundage which can only be re-set on a shock damper testing machine. The valve chamber is identical with that for the rear shock dampers except that a blanking plate is fitted over the aperture for the solenoid.

Inspection

Thoroughly clean all parts. The joint edges are painted on initial assembly with 'Osotite' which may be removed with methylated spirits; it is not soluble in paraffin. Check the cylinder bore for scoring or abrasions; if necessary the cylinder bore may be cleaned up with fine emery cloth but if deeply scored it should be renewed. The indentation at the centre of the bottom of the cylinder bore acts as a grit trap and is a feature of the design. Check that the recuperating valve in each of the piston assemblies is seating correctly, by pouring a little paraffin/oil mixture into the boring for the valve; if the mixture leaks away the spring-loaded valve is not seating and the piston assembly should be renewed.

Check that the bushes are a tight fit in the bush housings and if not, renew both the bush and the housing. The bushes are pressed into the housings, reamed in position, and can be supplied as an assembly. Check the bores of the bushes for wear and renew if necessary.

Remove any burrs from the joint faces and renew all the 'Vellumoid' joints. It is essential that the correct 'Vellumoid' joints are used because joints of incorrect thickness will alter the setting of the valve. Blow out the bleed jets with compressed air.

On early S1 cars renew the mainshaft oil seals and seal retaining washers and **on late S1 cars** also renew the rubber sealing rings fitted on the bush housing spigots.

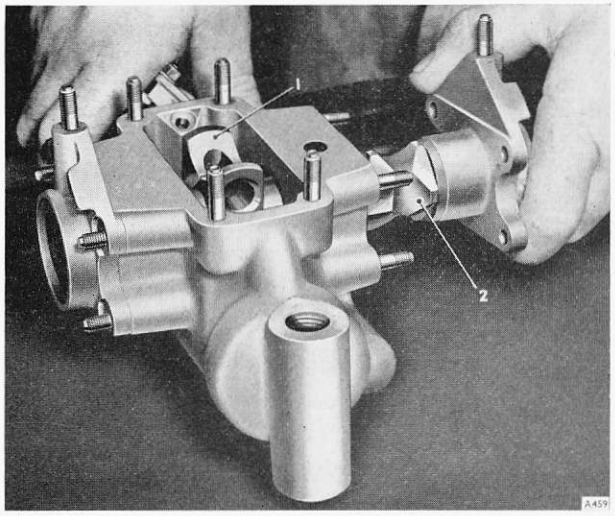


Fig. H27 Removing the mainshaft
1. DAMPER LEVER 2. MAINSHAFT

On S2 cars renew the mainshaft oil seals and the rubber sealing rings fitted on the bush housing spigots. The brass retaining rings for the mainshaft oil seals should not be renewed unless badly damaged.

Front Shock Damper — to assemble

It is essential that all parts are assembled in a scrupulously clean condition. The internal parts should be lubricated with one of the approved lubricants and all nuts should be tightened to the torque figures given in the table.

The assembly procedure is the reverse of that used for dismantling, noting the following points.

Where rubber sealing rings are not fitted as standard parts on the bush housing spigots, it will be necessary to smear 'Wellseal' or a similar jointing compound on the joint faces.

The piston assembly is reversible on most front shock dampers, but **on late S2 cars** a tapered piston was introduced and replaced one of the parallel pistons in the piston assembly. This piston assembly may only be fitted with the tapered piston facing the blind end of the casing and the parallel piston facing the valve chamber end. The tapered piston may be identified by the number 378 stamped on the face and shock dampers fitted with this tapered piston may be identified by a spot of blue paint on the casing. When renewal of the parallel piston at the blind end of

the casing becomes necessary a tapered piston may be fitted; a spot of blue paint should be painted on the damper casing for identification purposes.

When fitting the piston assembly the small bar between the two halves must be at the bottom. New 'Vellumoid' joints should be used throughout.

The damper lever should be inserted in the piston assembly so that the head of the pinch bolt is towards the valve chamber. A new split pin should be used to lock the pinch bolt nut in position.

After assembly, fill up the shock damper with the correct fluid, bleed the air by pumping the damper with a slave arm fitted to the mainshaft and top-up as necessary.

Paint the edges of all the joints with 'Osotite' and check the joints for leaking by chalk testing.

Front Shock Damper — to install

Installation of the shock damper is the reverse of the procedure used for the removal. Note that the shock damper mounting plate should be secured to the outer side of the mounting plate welded to the chassis frame **on S1 cars** and to the engine side **on S2 cars**.

Fit all the mounting bolts, washers and nuts but do not fully tighten the bolts; it is most important that the mounting bolt(s) positioned vertically through the chassis frame securing the base of the shock damper to the chassis frame are fully tightened before tightening the mounting plate bolts.

> **Note:** After re-fitting the shock damper to the chassis frame it is important that the steering geometry is re-set to the specifications given in 'Front Suspension Data'.

Rear Shock Damper — to remove

Position a jack under the differential box and jack up the car until the rear wheels are clear of the ground. Place stands under the axle tubes and remove the rear wheel from the side concerned. Disconnect the shock damper operating arm from the side links on the rear axle housing by removing the split pin and unscrewing and removing the through bolt and nut. Disconnect the electrical connections to the solenoid, unscrew and remove the two mounting bolts, washers and nuts and remove the shock damper from the chassis frame.

Rear Shock Damper — to dismantle

> **Note:** When dismantling, the shock damper body should not be clamped directly in a vice. A suitable point for clamping during preliminary dismantling is the operating arm.

Remove the filler plug and drain the oil. Unscrew and remove the four nuts and plain washers securing the top cover, lift off the top cover and discard the 'Vellumoid' joint.

Unscrew and remove the two nuts and plain washers securing the solenoid to the valve chamber and remove the solenoid, rubber sealing ring and the push rod. Unscrew and remove the four nuts and plain washers securing the valve chamber and valve seat plate to the shock damper casing, remove the valve chamber and valve seat plate and collect the remainder of the oil which will not have drained. The 'Vellumoid' joints, one between the valve seat plate and damper casing and the other between the valve seat plate and valve chamber, should be discarded.

> **Note:** Further dismantling of the valve chamber should not be undertaken as any disturbance of the main valve cap nut will affect the damper poundage which can only be re-set on a shock damper testing machine.

Unscrew and remove the four nuts and plain washers securing the bush housing to the shock damper casing on the opposite side to the operating arm. Remove the bush housing and collect the end

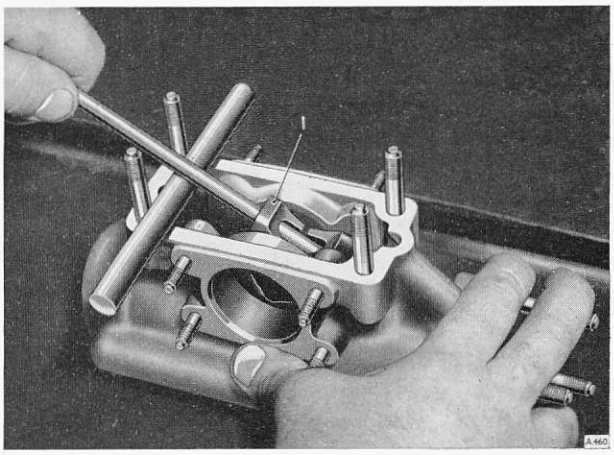


Fig. H28 Removing the damper lever
1. DAMPER LEVER

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float adjusting washer and the 'Vellumoid' joint, the joint being applicable to **early S1 cars** only.

Remove the split pin from the damper lever pinch bolt, unscrew the nut and withdraw the pinch bolt. With the aid of an aluminium drift, drive out the mainshaft and operating arm assembly. Remove the remaining bush housing by unscrewing and removing the four nuts and plain washers and then collect the end float adjusting washer; the 'Vellumoid' joint fitted to **early S1 cars** only should be discarded. Remove the damper lever by levering with a short rod as shown in Figure H28. Extract the piston assembly and remove the two bleed jets.

Inspection

Thoroughly clean all parts. The joint edges are painted on initial assembly with 'Osotite' and this may be removed with methylated spirits; it is not soluble in paraffin.

Check the cylinder bore for scoring or abrasions; if necessary the cylinder bore may be cleaned up with fine emery cloth but if deeply scored it should be renewed. The indentation at the centre of the cylinder bore acts as a grit trap and is a feature of the design. Check that the recuperating valve in each end of the piston assembly is seating correctly by pouring a little paraffin/oil mixture into the boring for the valve; if the mixture leaks away the spring-loaded valve is not seating and the piston assembly should be renewed.

Check that the bushes are a tight fit in the bush housings and if not, renew both the bush and the housing. The bushes are pressed into the housings, reamed in position and can be supplied as an assembly. Check the bores of the bushes for wear and renew if necessary.

Remove any burrs from the joint faces and renew all the 'Vellumoid' joints. It is essential that the correct 'Vellumoid' joints are used because joints of incorrect thickness will alter the setting of the valve. Blow out the bleed jets with compressed air.

Renew the mainshaft oil seal on all rear shock dampers, and also, **on late S1 and S2 cars,** renew the rubber sealing rings fitted on the bush housing spigots.

Check the operation of the solenoid by connecting across a twelve volt battery; the plunger should protrude as the circuit is closed.

Rear Shock Damper — to assemble

It is essential that all parts are assembled in a scrupulously clean condition. The internal parts should be lubricated with one of the approved lubricants and all nuts should be tightened to the torque figures given in the table.

Insert the piston assembly into the cylinder bore; note that the piston assembly is reversible and may be fitted either end first, but the small bar between the two halves must be at the bottom. Insert the damper lever so that the head of the pinch bolt will face the valve chamber and push it into position between the two halves of the piston assembly.

Fit the rubber seal onto the mainshaft assembly; the seal should be fitted dry but a little 'Palmolive' grease may be smeared on the inside edge to ease the entry of the mainshaft. Fit the bush housing to the mainshaft assembly pressing the rubber seal into position with a blunt drift. **On early S1 cars,** new 'Vellumoid' joints coated with 'Wellseal' should be fitted between the bush housings and the damper casing. **On late S1 and all S2 cars,** new rubber sealing rings should be placed over each of the bush housing spigots; this seal locates in an annular groove in the shock damper casing and no joint is required.

On all rear shock dampers, fit the large bore adjusting washer to the mainshaft assembly and fit the bush housing and mainshaft assembly to the shock damper casing. Fit the small bore adjusting washer and the bush housing to the other side of the damper casing. Fit the pinch bolt to the damper lever, tighten the nut and lock in position using a new split pin. Fit the two bleed jets and the top cover.

Fit the valve seat plate and the valve chamber using new 'Vellumoid' joints between each of these parts; note that the joint with the centre cut out should be positioned between the valve seat plate and the shock damper casing. Fit a new rubber sealing ring to the valve chamber and fit the solenoid with the leads facing towards the shock damper casing. The solenoid is sealed with 'Selastik' under the rubber cap and if it becomes necessary to renew the 'Selastik'

ensure that the hole in the cover through which the leads emerge is sealed.

After assembly, fill up the shock damper with the correct fluid, bleed the air by pumping with the operating arm and top-up as necessary. Paint the edges of all the joints with 'Osotite' and check the joints for leaking by chalk testing.

Rear Shock Damper — to install

On early S1 cars, the 'Silentbloc' bushes retained in the shock damper operating arms and in the brackets welded to both axle tubes have occasionally collapsed due to excessive torque tightening of the clamping bolts. New 'Silentbloc' bushes with thicker section centre tubes have been produced for renewal purposes and parts of the old bush assembly are no longer available. If either of the thin section centre tube 'Silentbloc' bushes are to be renewed it will be necessary to renew both the bushes and to fit thicker section centre tube 'Silentbloc' bushes; this will also necessitate the fitting of new side links and clamping bolts.

On all cars, the installation procedure is the reverse of that used for the removal. The clamping bolts through the 'Silentbloc' bushes should be tightened and locked using new split pins after the car has been lowered to the ground and the suspension has adopted its normal ride position.

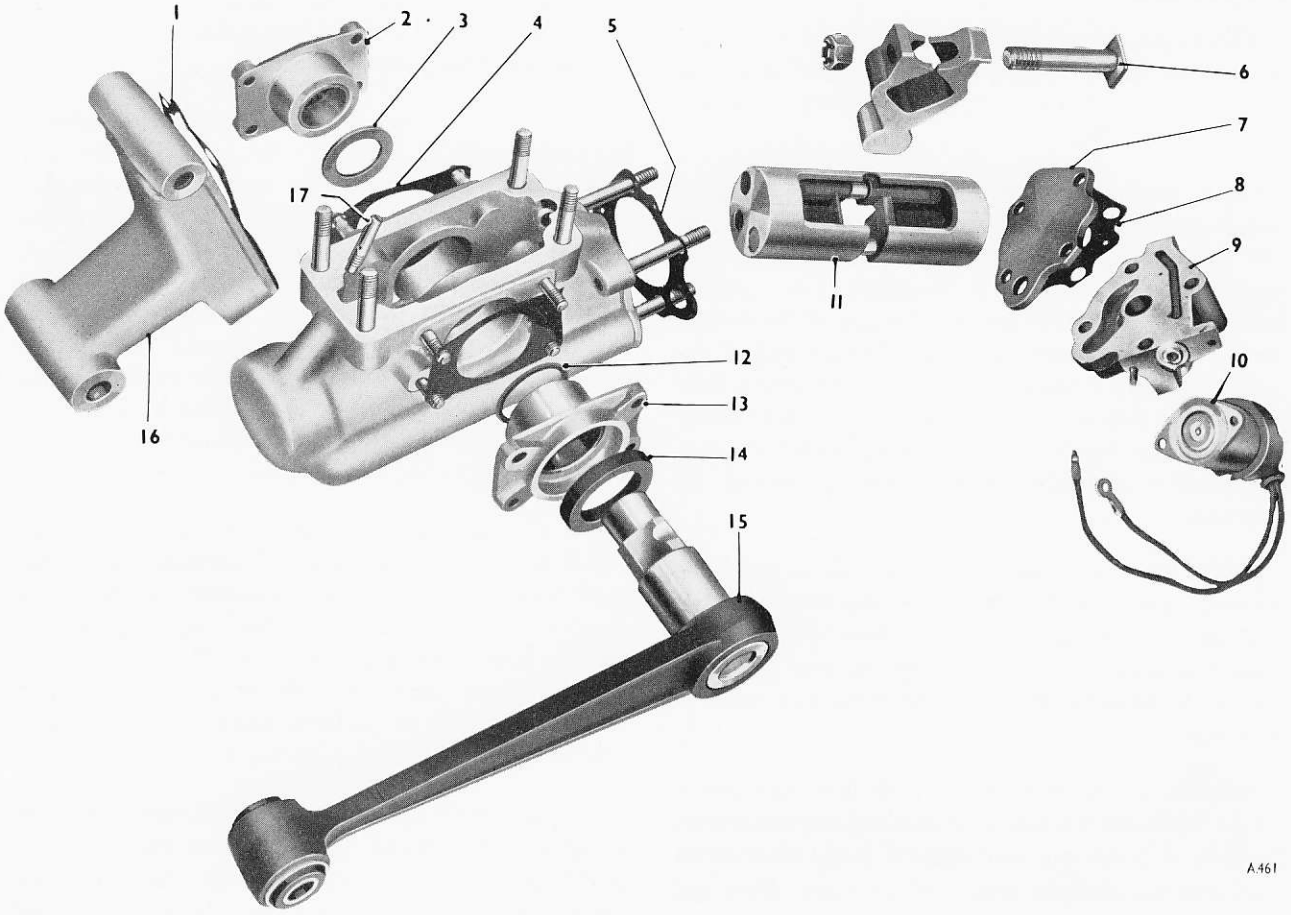


Fig. H29 Exploded view of rear damper

1. 'VELLUMOID' JOINT
2. BUSH HOUSING
3. ADJUSTING WASHER
4. 'VELLUMOID' JOINT
5. 'VELLUMOID' JOINT
6. PINCH BOLT
7. VALVE SEAT PLATE
8. 'VELLUMOID' JOINT
9. VALVE CHAMBER
10. SOLENOID UNIT
11. PISTON ASSEMBLY
12. ADJUSTING WASHER
13. BUSH HOUSING
14. RUBBER SEAL
15. OPERATING ARM
16. TOP COVER
17. BLEED JET

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The Valve Chamber

Although stripping of this unit is not recommended as the shock damper poundage can only be re-set accurately with a shock damper testing machine, a few notes are included in this section so that the operation of the shock damper may be more easily understood.

The slow leak valve has a groove machined at its centre which in the normal ride position lies opposite a small transverse drilling in the valve bore. This drilling forms the slow leak passage. On moving the switch on the steering column, the solenoid is energised and a plunger moves out to push the valve forward in the bore against spring pressure by means of a push rod. The diameter of the slow leak is thus reduced and subsequently the ride is stiffened up. A range of valves with grooves of differing widths is available and the slow leak poundage is set by selective fitting of the valve. Minor adjustments may be made by varying the length of the push rod.

Any grit or foreign matter in the shock damper may cause the slow leak valve to stick in its bore. The assembly may be removed for cleaning but it is most important that the valve be re-fitted in the bore the same way round as the groove may not be exactly central.

The main valve is adjusted by selective fitting of the adjusting washer under the valve spring, a thicker washer increasing the spring poundage to stiffen the ride and vice versa. The adjusting washers under the valve head are selected by measurement to give the correct valve seating. Tightening the cap nut will cause the aluminium sealing washer to collapse and will increase the damper poundage; it is therefore recommended that this nut is not disturbed.

The valve spring should normally be set to exert a pressure of $6\frac{3}{4}$ lb. (30·58 kg.) on the main valve. The operating length of the spring to give this pressure is 0·422 in. (10·7188 mm.) and it is essential that this dimension is set accurately. A decrease of only 0·010 in. (0·254 mm.) in this dimension can have the effect of increasing the work done by the shock damper by about 50 per cent. On no account should the spring operating length be reduced below 0·422 in. (10·7188 mm.) as severe damage may result.

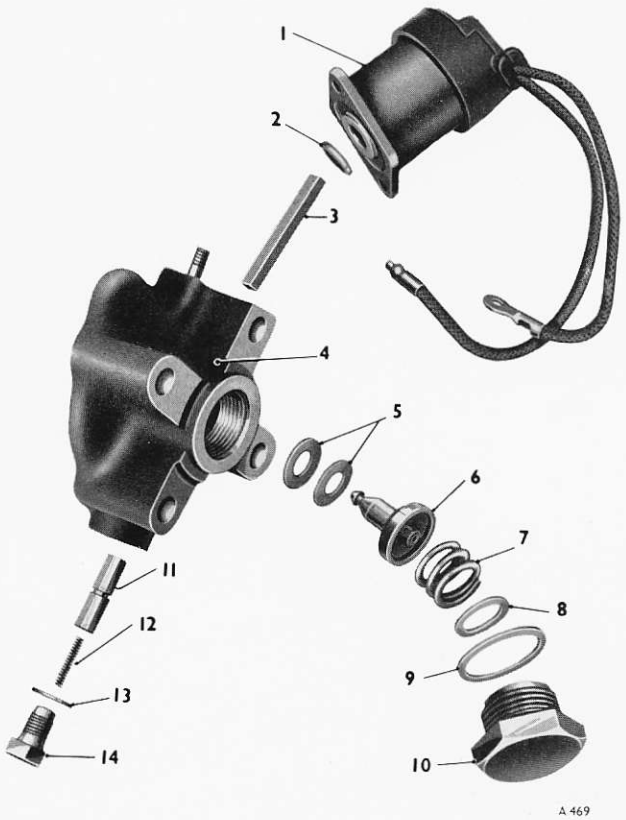


Fig. H30 Exploded view of valve chamber

1. SOLENOID UNIT
2. RUBBER SEAL
3. PUSH ROD
4. VALVE CHAMBER
5. ADJUSTING WASHERS
6. MAIN VALVE ASSEMBLY
7. VALVE SPRING
8. ADJUSTING WASHER
9. ALUMINIUM WASHER
10. CAP NUT
11. SLOW LEAK VALVE
12. SPRING
13. ALUMINIUM WASHER
14. CAP NUT

CHAPTER H

SUSPENSION

SECTION H 1 — FRONT SUSPENSION

FRONT SUSPENSION DATA

S2 cars

(Page H 1 in Workshop Manual)

For S3 cars, castor angle to read 1° positive.

SECTION H 6

Upper and lower triangle levers and stub axle yokes — S2 cars

(Page H 17 in Workshop Manual)

The stub axle yokes fitted on S3 cars are machined to provide a castor angle of 1° positive. These yokes are for use with the lighter steering introduced on S3 cars and are not interchangeable with the stub axle yokes fitted on S1 and S2 cars.

The remaining information in this Chapter which applies to S2 cars is also applicable to S3 cars.

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CHAPTER J

REAR AXLE

SECTION J1 — GENERAL DESCRIPTION AND DATA

The rear axle is of the semi-floating design with the final drive through a hypoid crown wheel and pinion.

Spiral Angles:

Silver Cloud	44 deg.	46 min.
Bentley S1	44 deg.	46 min.
Bentley Continental S1	45 deg.	11 min.
Silver Cloud II	45 deg.	7 min.
Bentley S2	45 deg.	7 min.
Bentley Continental S2	45 deg.	8 min.
Phantom V	45 deg.	36 min.

A die cast aluminium centre casing which contains the pinion, crown wheel and differential assembly, is bolted centrally between two forged steel axle tubes. Tapered roller bearings support the differential assembly casing and opposed tapered roller bearings support the pinion shaft. A parallel double row roller bearing supports the pinion nose.

The axle shafts are forged integrally with the wheel hubs and can be withdrawn without dismantling the axle. The inner ends are splined into the differential bevel wheels and the outer ends are supported in single row bearings mounted in a housing which is bolted to the axle tubes.

	Rear axle ratios	*Oil capacity*
Silver Cloud	12/41	1½ pints
Bentley S1	12/41	1½ pints
Bentley Continental S1	13/38	1½ pints
Silver Cloud II ...	13/40	1⅝ pints
Bentley S2	13/40	1⅝ pints
Bentley Continental S2	13/38	1⅝ pints
Phantom V	9/35	1¾ pints

FITS AND CLEARANCES

	SILVER CLOUD and BENTLEY S1		SILVER CLOUD II, BENTLEY S2 and BENTLEY CONTINENTAL S2		PHANTOM V	
	Inches	mm.	Inches	mm.	Inches	mm.
Backlash, pinion to crown wheel	Etched on the crown wheel		Etched on the crown wheel		Etched on the crown wheel	
Backlash, differential pinions to bevel wheels	Nil	Nil	Nil	Nil	Nil	Nil
End float, differential pinions and wheels	Nil	Nil	Nil	Nil	Nil	Nil
Differential trunnion bearing diameter	0·686–0·6885	17·42–17·44	0·7802–0·7797	19·82–19·80	0·7802–0·7797	19·82–19·80
Differential pinion bore	0·6875–0·68775	17·46–17·47	0·7812–0·7817	19·85–19·86	0·7812–0·7817	19·85–19·86
Crown wheel run-out, maximum	0·002	0·05	0·002	0·05	0·002	0·05
Axle shaft bearing end float	0·013–0·017	0·33–0·43	0·013–0·017	0·33–0·43	0·013–0·017	0·33–0·43

Fig. J1 Cut-away view of rear axle — S2 cars (excluding Phantom V)

1. END PLATE
2. OIL SEAL
3. SPACER
4. THRUST WASHER
5. CENTRE CASING
6. CROWN WHEEL
7. THRUST WASHER
8. DIFFERENTIAL CASING—L.H.
9. BEARING
10. ADJUSTING WASHER
11. OIL SEAL HOUSING
12. NUT, OIL SEAL HOUSING
13. LOCKING WIRE
14. OIL SEAL
15. HALF SHAFT—L.H.
16. END PLATE
17. TRUNNION
18. BEVEL GEAR
19. THRUST WASHER
20. DIFFERENTIAL CASING—R.H.
21. BEARING
22. BELLEVILLE WASHER
23. OIL SEAL HOUSING
24. HALF SHAFT—R.H.

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FITS AND CLEARANCES — *continued*

	SILVER CLOUD and BENTLEY S1		SILVER CLOUD II, BENTLEY S2 and BENTLEY CONTINENTAL S2		PHANTOM V	
	Inches	mm.	inches	mm.	Inches	mm.
Diameter of axle shaft at bearing	1·7725–1·77225	45·02–45·01	1·7726–1·77235	45·025–45·019	1·9695–1·96925	50·03–50·02
Axle shaft bearing bore	1·7710–1·7715	44·98–45·00	1·7716–1·7711	45·00–44·99	1·9685–1·968	49·99–49·98
Axle shaft bearing retaining collar bore	1·768–1·7685	44·91–44·92	1·768–1·7685	44·91–44·92	1·9639–1·9644	49·88–49·89
Axle shaft bearing outside diameter	3·937–3·9365	99·99–99·98	3·937–3·9364	99·99–99·98	4·875–4·8737	123·82–123·792
Axle shaft bearing housing bore	3·9367–3·93695	99·99–99·998	3·9367–3·93695	99·99–99·998	4·8739–4·87415	123·79–123·803
Hypoid bevel pinion shaft	1·3795–1·37925	35·04–35·03	1·3795–1·37925	35·04–35·03	1·3795–1·37925	35·04–35·03
Pinion bearing bore diameter	1·378–1·3785	35·00–35·01	1·378–1·3786	35·00–35·01	1·378–1·3786	35·00–35·01
Pinion nose bearing shaft diameter	1·0630–1·06275	27·00–26·99	1·0629–1·0627	27·00–26·99	1·0629–1·0627	27·00–26·99
Nose bearing running clearance	0·0003–0·0008	0·008–0·020	0·0003–0·0008	0·008–0·020	0·0003–0·0008	0·008–0·020

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SECTION J2 — AXLE SHAFTS

Axle Shafts — to remove

Using a suitable piece of wood on the jack head, jack up the rear of the car under the rear axle casing. Taking care not to damage the spring gaiters, place suitable stands under the 'U' bolt plates, then remove the jack.

Remove the wheel discs and road wheels.

Note: The right-hand and left-hand threads on the wheel nuts are indicated by means of arrows stamped on the crown of the nuts. Remove the three countersunk screws securing each brake drum, then remove the drums.

Remove the nut and washer from the square-ended eccentric adjuster, then unscrew the nuts and bolts securing the brake carrier to the bearing housing. Tie the carrier plate to some convenient place to relieve the brake fluid pipes of any weight.

Remove the bolts securing the bearing housing to the axle tube, then hold the brake carrier in position and withdraw the axle shaft.

Care should be taken when withdrawing the shaft to avoid damage to the oil seals adjacent to the crown wheel bearing.

Bearings — to renew

Attention is drawn to the appreciable end float which exists on new bearings, 0·013 in. (0·330 mm.)–0·017 in. (0·4318 mm.). Bearings should not be renewed unless end float considerably exceeds this figure or unless they are rough in operation.

Bearings — to remove

Special tool required:

RH.7183 — Extractor

Mount the axle shaft assembly in a lathe and turn sufficient off the bearing retaining collar to enable it

Fig. J2 Cut-away view of rear axle — Phantom V cars

1. END PLATE
2. OIL SEAL
3. SPACER
4. ADJUSTING WASHER
5. CROWN WHEEL
6. DIFFERENTIAL CASING—R.H.
7. THRUST WASHER
8. DIFFERENTIAL CASING—L.H.
9. BEVEL GEAR
10. ADJUSTING WASHER
11. NUT, OIL SEAL HOUSING
12. LOCKING WIRE
13. HALF SHAFT—L.H.
14. OIL SEAL
15. OIL SEAL HOUSING
16. BEARING
17. END PLATE
18. THRUST WASHER
19. TRUNNION
20. CENTRE CASING
21. BEARING
22. BELLEVILLE WASHER
23. OIL SEAL HOUSING
24. HALF SHAFT—R.H.

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to be split. This method avoids damage to the axle shaft by the turning tool.

Remove the shaft from the lathe, split the retaining collar and remove the bearing assembly; press the bearing from its housing. Remove all grease, paying particular attention to any between the outer grease retainer and housing.

Important

If the bearing journal is worn due to the inner ball race having rotated on the shaft, a new shaft must be fitted. If possible, the original shaft should be returned to either the London or Crewe Service Station for salvaging.

New Bearings — to fit

Fit the distance piece on the shaft. Press the new bearing and grease retainer into the housing using new sealing rings. The bearing should be packed with 1 oz. of Retinax 'A' grease or its approved equivalent.

With the exception of Phantom V cars, a spring plate is fitted (see Fig. J3). Where applicable, place the spring plate over the shaft and onto the bearing. Lubricate the bore of the new retaining collar, and press it home (see Fig. J5); a minimum load of 3·5 tons is required. It is important that a wooden block not more than $4\frac{1}{2}$ in. (114·3 mm.) in diameter and not less than $1\frac{1}{4}$ in. (31·75 mm.) thick should be placed beneath the flange of the axle shaft to protect the wheel studs when pressing home the bearing retaining collar.

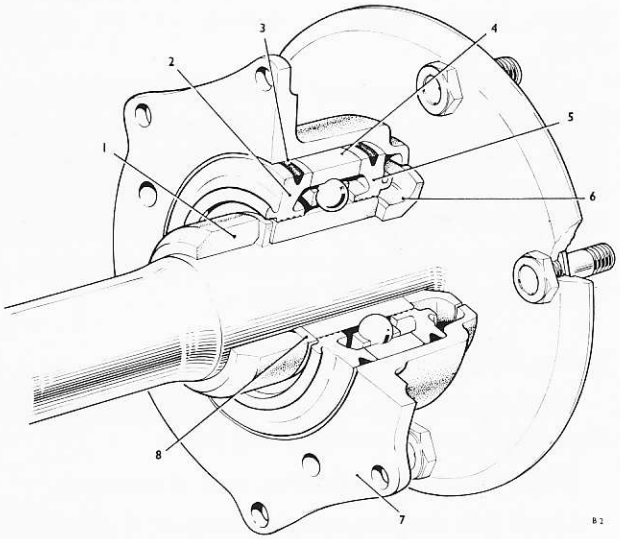


Fig. J3 Cut-away view of half shaft bearing assembly — S1 and S2 cars (excluding Phantom V)

1. COLLAR
2. GREASE RETAINER
3. SEALING RING
4. BEARING
5. GREASE RETAINER
6. DISTANCE PIECE
7. BEARING HOUSING
8. SPRING PLATE

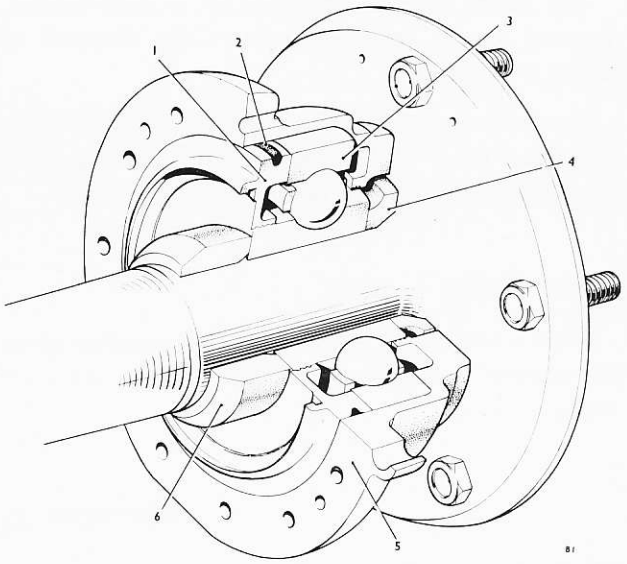


Fig. J4 Cut-away view of half shaft bearing assembly — Phantom V cars

1. GREASE RETAINER
2. SEALING RING
3. BEARING
4. DISTANCE PIECE
5. BEARING HOUSING
6. COLLAR

Grease Retainer — to inspect

If a dry wheel bearing is suspected, it is possible to make an inspection by removing the inner half of the grease retainer using the special extraction tool shown in Figure J7.

Withdraw the axle shaft and fit the extractor as shown in Figure J7.

The amount of grease packed into the bearing is most important, as over-filling will cause the grease to creep, and it may find its way to the brake shoes.

The grease retainers are either left or right-handed. Arrows on the retainers indicate the direction of wheel rotation.

It must be understood that this operation should only be carried out if the bearings are suspected of running dry, and not treated as a normal maintenance item.

Axle Shafts — to fit

Fit the axle shafts by reversing the procedure given for removal, taking care to avoid damage to the oil seals.

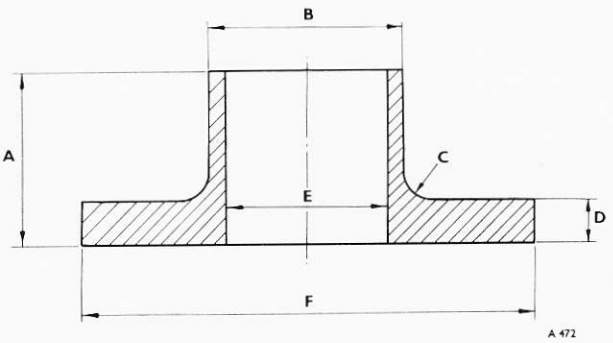


Fig. J5 Hollow press tool for pressing on bearing retaining collar

A. 2·000 in. (50·80 mm.)
B. 2·125 in. (53·97 mm.) DIA.
C. 0·312 in. (7·92 mm.) RAD.
D. 0·500 in. (12·70 mm.)
E. 1·775 in. (45·08 mm.) DIA.
F. DIA. TO SUIT PRESS

SECTION J3 — FINAL DRIVE

Rear Axle — to remove

Jack up the rear end of the car and place suitable trestles under the rear shackle brackets. Remove the wheel discs and wheels.

Disconnect the propeller shaft from the differential assembly.

Disconnect the two brake rods from the equaliser and secure them together with a piece of wire, then remove the equaliser mounting bracket from the right-hand side axle tube.

Disconnect and remove the rear silencer.

Disconnect the flexible brake fluid hose and seal the end to prevent the possibility of fluid siphoning out or the entry of foreign particles.

All S1 cars excluding the Bentley Continental S1 are fitted with an anti-roll bar mounted between the right-hand chassis side member and the axle tube. It is secured to the axle by a 'U' bolt and mounting bracket welded to the axle tube. Disconnect and remove the anti-roll bar.

On Bentley Continental S1 cars and on all S2 cars excluding the Phantom V a 'Z' bar is fitted between the chassis and rear axle. The 'Z' bar is secured to the axle by a 'U' bolt. Disconnect and remove the 'Z' bar.

When removing either the anti-roll bar or the 'Z' bar, the securing bolts should be slackened evenly.

Jack up the rear axle so that the shock damper arms are clear of the rebound stops, then disconnect the damper arms from the axle. Remove the jack.

Removal of the axle will be facilitated if the shock dampers are removed but this operation is not essential.

Remove the remaining three 'U' bolts.

Withdraw the axle, on the right-hand side of the chassis, from between the springs and the chassis frame.

Removal of the axle will be made easier if two lifting handles are made to bolt onto the brake drums. The lifting handles consist of discs, suitably drilled to fit over the wheel studs, and welded to steel tubes, one of which should be at least 4·0 in. (101·6 m.m.) in length.

Note: When removing the rear axle **do not** attempt to unfasten the spring shackles.

Rear Axle — to fit

To fit the rear axle, reverse the procedure given for its removal, noting the following points:

Renew the rubber mounting pads if necessary.

Check that the rear equaliser support is positioned correctly.

Ensure that the 'Silentbloc' bushes, fitted to the anti-roll bar or 'Z' bar, are positioned in the centre of the mounting brackets when fitting the bar to the axle.

Bleed the rear brakes.

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SECTION J4 — THE BEVEL PINION

Bevel Pinion Assembly — to remove

Remove the nine nuts securing the pinion housing to the axle casing and withdraw the housing complete with the pinion. It may be necessary to use small levers if the housing is a tight fit.

Bevel Pinion Taper Roller Bearings — to renew

Note: Retailers in the British Isles are advised that the Service Stations in London or Crewe will undertake the fitting and pre-loading of new taper roller bearings on their behalf should they require it. The bearing housing and old adjusting washers must be returned by the Retailer.

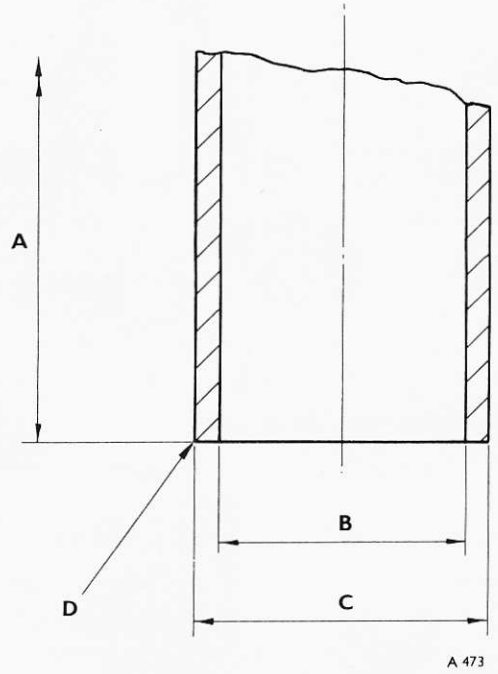


Fig. J6 Solid press tool for pressing on bearing retaining collar

A. 29·00 in. (736·60 mm.)
B. 1·775 in. (45·08 mm.) DIA.
C. 2·125 in. (53·97 mm.) DIA.
D. STEEL TUBE

Special tools required:

RH.7183 Extractor — Bevel Pinion Bearing Holding Block as shown in Figure J10

Box Spanner (1·478 in. (37·541 mm.) across the flats)

RH.339 Serrated Box Spanner (not needed for Phantom V)

RH.574 Pre-load Checking Gauge, Bevel Pinion Bearings

RH.7118 Arm — to replace arm of RH.574 when checking pre-load of S1 and S2 Bevel Pinion Bearings

RH.7128 Arm — to replace arm of RH.574 when checking pre-load of Phantom V Bevel Pinion Bearings

RH.7225 Extractor — Bearing Grease Seal, rear axle Phantom V

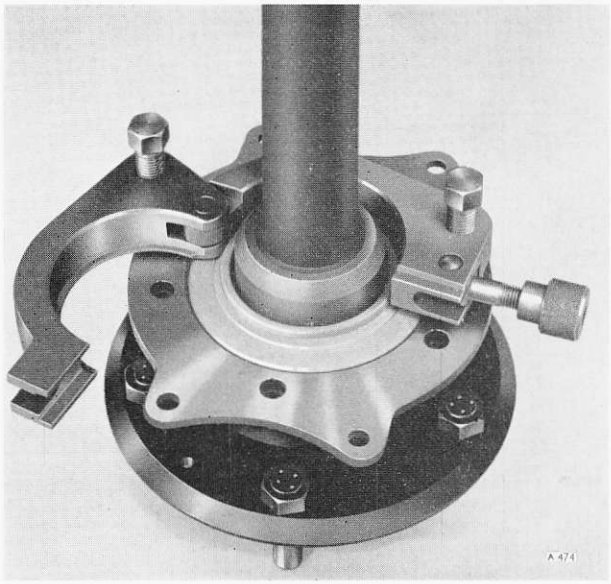


Fig. J7 Grease retainer extractor

Taper roller bearings should be renewed as follows:

Place the nose of the pinion in the holding block and tighten in a vice.

Remove the driving flange retaining nut and lock washer; withdraw the driving flange.

On Phantom V cars, the driving flange is located on parallel splines and is in contact with the top bearing (see Fig. J8), therefore any pre-load adjustment to the bevel pinion bearings must be carried out at the driving flange retaining nut.

On all other S2 and S1 cars, the driving flange is fitted on a taper and is located by two Woodruff keys; an extractor is therefore required to withdraw it.

A special bearing retaining nut, located above the oil seal, is provided for pre-load adjustment and such adjustment of the bevel pinion bearings must be carried out at this nut.

S1 and S2 cars (not Phantom V): Unscrew the pinion bearing retaining nut (left-hand thread) using the spanner RH.339. Remove the lock washer and the oil seal.

All cars: Place the pinion housing downward on a supporting tube and press out the pinion.

Withdraw the upper bearing and the two adjusting washers from between the bearings.

Remove the lower bearing from the pinion shaft using the extractor RH.7183 shown in Figure J11. Place the extractor in position under the bearing and press the bearing off the shaft. Remove the outer races from the bearing housing.

Fit the new outer races into the bearing housing.

Method of Pre-loading

It is necessary to use Special Tool RH.574 when using the following method of pre-loading.

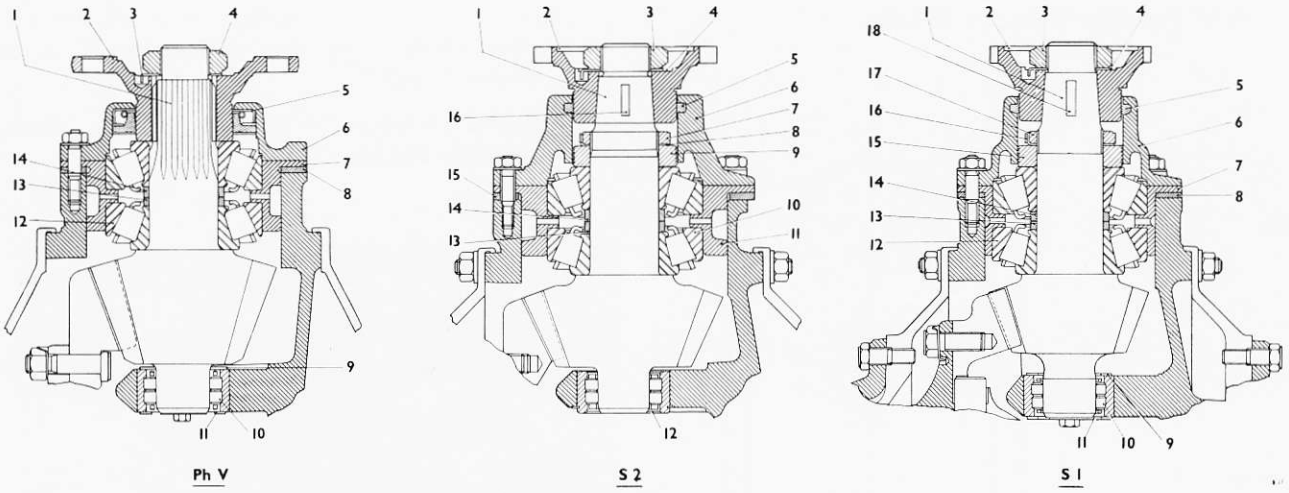


Fig. J8 Sectional view of pinion assembly — Phantom V S2 and S1 cars

PHANTOM V

1. PINION
2. DRIVING FLANGE
3. TAB WASHER
4. DRIVING FLANGE NUT
5. OIL SEAL
6. BEARING HOUSING COVER
7. BEARING HOUSING
8. ADJUSTING WASHER
9. LOCKING PLATE
10. PINION NOSE BEARING
11. LOCKING PLATE
12. BEARING—2 OFF
13. ADJUSTING WASHER
14. ADJUSTING WASHER

S2

1. PINION
2. DRIVING FLANGE
3. DRIVING FLANGE NUT
4. TAB WASHER
5. FELT WASHER
6. BEARING HOUSING COVER
7. LOCK-NUT
8. TAB WASHER
9. PINION OIL SEAL
10. BEARING—2 OFF
11. PINION BEARING HOUSING
12. PINION NOSE BEARING
13. ADJUSTING WASHER
14. ADJUSTING WASHER
15. ADJUSTING WASHER
16. KEY

SI

1. PINION
2. DRIVING FLANGE
3. DRIVING FLANGE NUT
4. TAB WASHER
5. FELT WASHER
6. BEARING HOUSING COVER
7. BEARING HOUSING
8. ADJUSTING WASHER
9. LOCKING PLATE
10. PINION NOSE BEARING
11. LOCKING PLATE
12. BEARING—2 OFF
13. ADJUSTING WASHER
14. ADJUSTING WASHER
15. PINION OIL SEAL
16. TAB WASHER
17. LOCK-NUT
18. KEY

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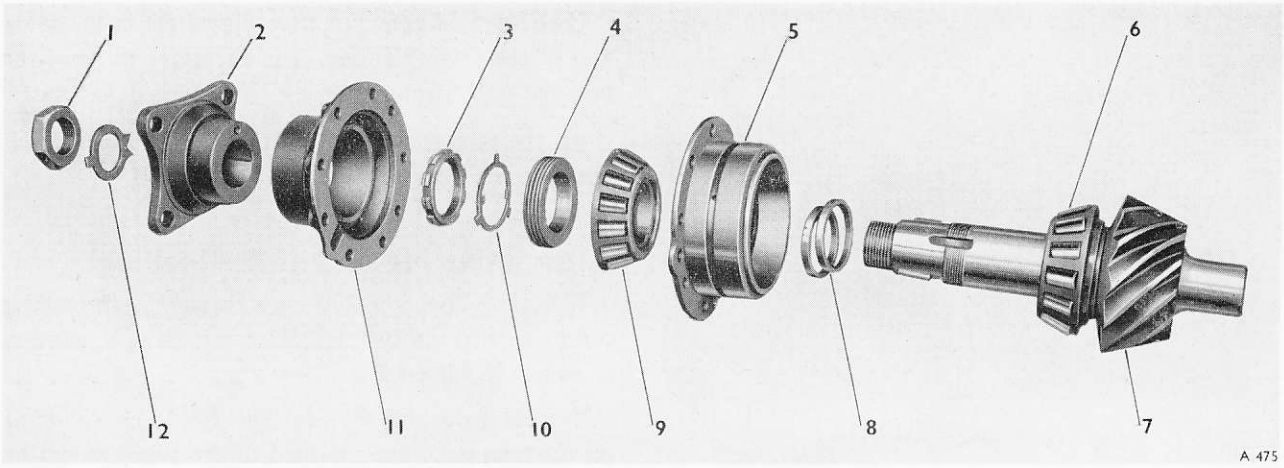


Fig. J9 Exploded view of pinion assembly — S1 cars

1. DRIVING FLANGE NUT
2. DRIVING FLANGE
3. SERRATED LOCKING NUT
4. OIL SEAL
5. HOUSING OUTER BEARING
6. ROLLER BEARING (LOWER)
7. PINION
8. ADJUSTING WASHERS
9. ROLLER BEARING (UPPER)
10. LOCK WASHER
11. COVER
12. TAB WASHER

Fit the new bearings and housing assembly in a clean, dry condition on a dummy pinion as shown in Figure J12.

Tighten the knurled nut until the drag torque is between 5 and 12 in.lb. This is measured by means of the arm and weight provided (RH.574) which should be hooked into a hole in the bearing housing flange. The fixed weight and jaw assembly measures 5 in.lb. and with the addition of the removable weight measures 12 in.lb.

With a 4–5 in. micrometer, measure the overall dimension between the outer face of the flange on the dummy pinion and the outer face of the knurled nut as shown in Figure J13; record this dimension.

Dismantle the assembly and measure the overall width of each inner race, add 2 in. (50·80 mm.) to this dimension plus the width of the knurled nut and flange.

This total dimension deducted from the first dimension recorded will give the thickness of adjusting washers required to obtain the correct pre-loading.

Although the knurled nut is marked with the dimension 1·250 in. (31·75 mm.), an expansion

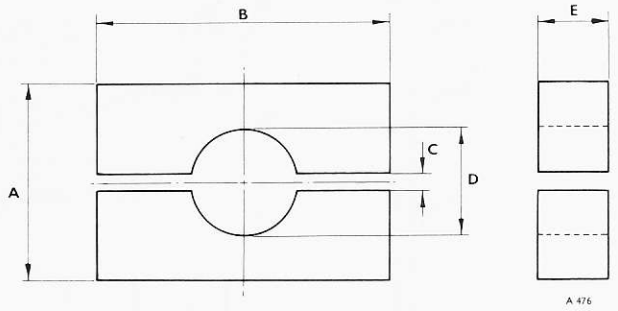


Fig. J10 Details of holding block

A. 2·000 in. (50·80 mm.)
B. 3·000 in. (76·20 mm.)
C. 0·125 in. + 0·010 in. (3·175 mm. + 0·254 mm.)
D. 1·0635 in. + 0·00025 in. (27·0129 mm. + 0·00635 mm.) DIA.
E. 0·750 in. (19·05 mm.)

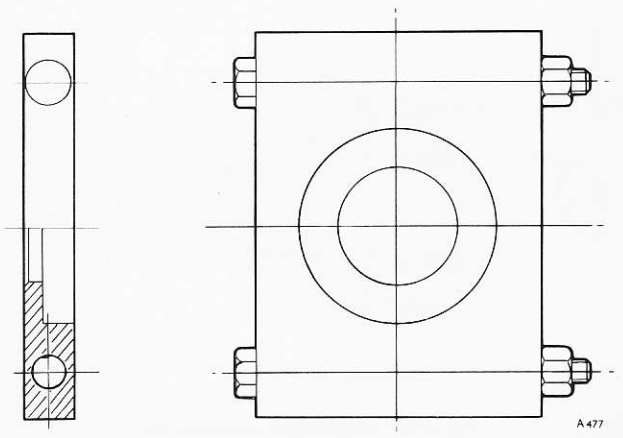


Fig. J11 Tool for removing lower bearing

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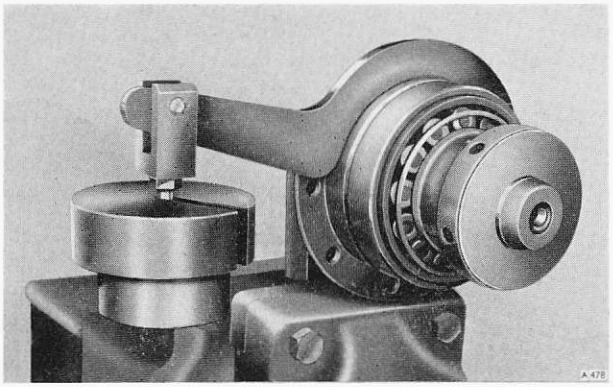


Fig. J12 Measuring drag torque

allowance of 0·002 in. (0·0508 mm.) on the true width of the nut is made when using the gauging tool.

Select two adjusting washers from the available range to obtain this thickness and re-assemble the pinion housing.

(**On Phantom V cars,** fit a new oil seal in the housing).

The overall thickness of the two adjusting washers required to give 5 to 12 in.lb. can vary between 0·352 in. (8·941 mm.) and 0·378 in. (9·601 mm.). By suitable pairing of the adjusting washers, this range can be covered in steps of 0·001 in. (0·0254 mm.).

Lubricate the bearings with axle oil.

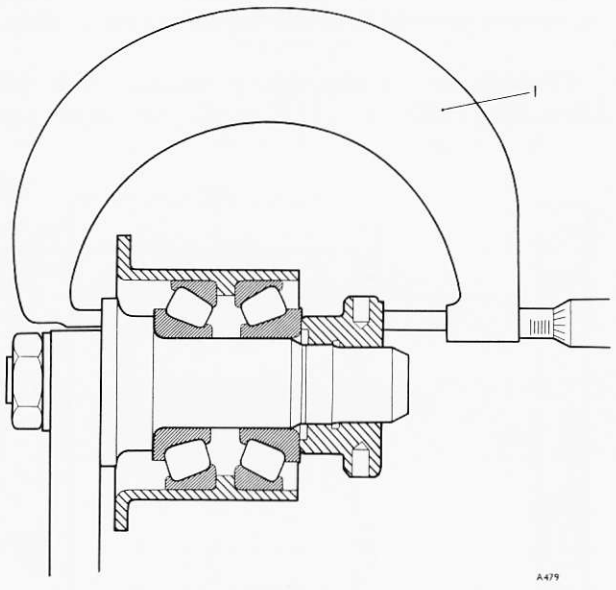


Fig. J13 Micrometer measurement

1. 4 in.–5 in. MICROMETER

On S1 and S2 cars, fit a new oil seal felt in the cover and fit the driving flange. It is necessary to press the new felt seal firmly down into its recess.

Fit the pinion assembly to the axle casing. Check the oil level.

Alternative Method of Pre-loading

If Special Tool RH.574 is not available, pre-loading can be carried out by trial and error, using a mandrel as shown in Figure J15.

The inner races of the bearings should be a slide fit on the mandrel. The pre-load of the bearings can be ascertained by the use of an accurate spring balance hooked into one of the holes in the flange of the pinion housing.

Firmly grip the mandrel vertically in a vice as shown in Figure J14. Fit the new outer races into the bearing housing and assemble the bearings and housing in a clean, dry condition onto the mandrel. The two adjusting washers which were removed with the old bearings should be fitted between the new bearings.

It is most important that oil is not used on the bearings when checking is taking place, as oil drag may occur and so cause in accuracies in the readings.

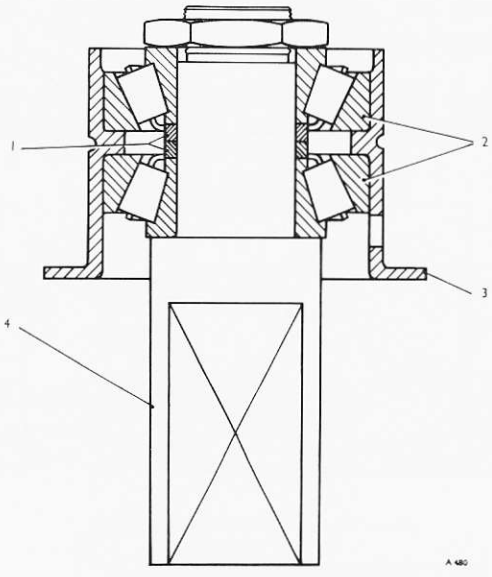


Fig. J14 Bearing assembly on mandrel

1. ADJUSTING WASHERS
2. BEARINGS
3. HOUSING
4. MANDREL

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Fit the retaining nut (left-hand thread), gradually screw it down, at the same time turning the housing by hand to ensure no undue load is being applied to the bearings. Thicker adjusting washers must be fitted if the drag measured by the spring balance at the bearing housing flange begins to exceed 6 lb. It is important not to overload the bearings.

The loading of the bearings should be measured by pulling on the spring balance on a line tangential to the pitch circle of the holes in the bearing housing. The housing should be turned steadily when the reading is taken as the starting torque will be high.

The pitch radius of the holes in the bearing housing flange is approximately 2 in. (50·80 mm.). With the retaining nut fully tightened (150–180 lb.ft.) the correct pre-load is obtained when the spring balance shows a reading of between $2\frac{1}{2}$ lb. and 6 lb.

The adjusting washers may be paired so that a range of thickness from 0·353 in. (8·966 mm.) to 0·385 in. (9·779 mm.) in steps of 0·001 in. (0·0254 mm.) may be obtained. Washers of varying thickness may have to be tried until the correct drag torque is obtained, with the retaining nut fully tightened.

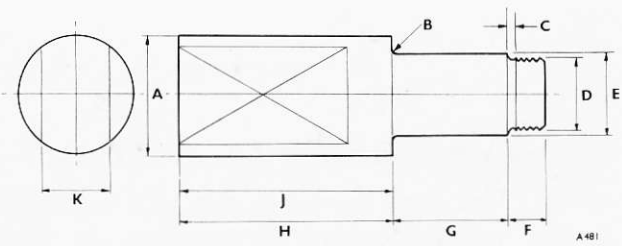


Fig. J15 Details of mandrel

A. 2·000 in. (50·80 mm.)
B. 0·062 in. (1·575 mm.)
C. UNDERCUT 0·100 in. (2·54 mm.) WIDE BY 1·187 in. (30·150 mm.) DIA.
D. TURN 1·303 in. (33·096 mm.) DIA. SCREW 1·3125 in. DIA. × 16 T.P.I. (L.H.)
E. 1·3775 in −0·0005 in. (34·9885 mm. −0·0127 mm.) DIA.
F. 0·625 in. (15·875 mm.)
G. 2·000 in. (50·80 mm.)
H. 3·750 in. (95·25 mm.)
J. 3·000 in. (76·20 mm.)
K. 1·250 in. (31·75 mm.) ACROSS FLATS

To allow for the expansion of the inner races when they are pressed onto the pinion, increase by 0·002 in. (0·0508 mm.) the thickness of the adjusting washers as obtained on the mandrel.

Lubricate the bearings. Fit a new oil seal in the cover and re-fit the driving flange. Where a felt oil seal is fitted ensure that it is pressed down firmly into the recess.

Re-fit the pinion housing to the axle casing and check the oil level.

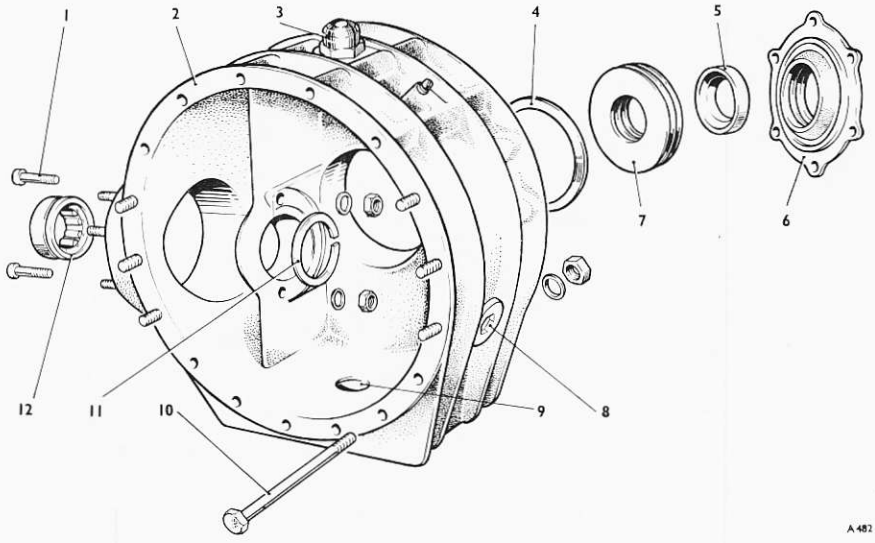


Fig. J16 Centre casing — S2 cars (excluding Phantom V)

1. ALLEN SCREW
2. CENTRE CASING
3. VENTILATOR
4. THRUST RING
5. OIL SEAL
6. OIL SEAL HOUSING
7. BELLEVILLE WASHER
8. OIL LEVEL PLUG
9. DRAIN PLUG
10. CENTRE CASING BOLT
11. SNAP RING
12. BEARING

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SECTION J5 — CROWN WHEEL AND PINION

Crown Wheel and Pinion — to renew

The crown wheel and pinion, which are supplied in lapped pairs, must not be separated or fitted independently.

Crown Wheel and Pinion — to dismantle

Remove the rear axle assembly. Disconnect the axle tubes from the centre casing and remove both tubes complete with the shafts and brake drums.

Remove the nuts and washers securing the pinion housing to the centre casing and withdraw the pinion assembly.

Remove the locking wire on the left-hand side of the casing, mark the position of the castellated nut relative to the side plate of the casing and remove the nut with the special spanner, 1649/T.1002. This nut has a **left-hand thread** and will be found to be very tight. Remove the oil seal housing and adjusting washer.

Mark the position of both side plates relative to the centre casing and remove the plates.

Withdraw the crown wheel and differential assembly from the left-hand side.

The right-hand side of the casing houses the three Belleville washers which apply the pre-load to the crown wheel bearings. Before unscrewing the nuts securing the oil seal housing, place the casing under a press with the housing uppermost, apply load and release the nuts progressively, at the same time gradually releasing the load. Remove the cover, spacer, Belleville and thrust washers.

Remove the nuts securing the halves of the differential casing and dismantle the assembly.

The four bevel pinions are marked in relationship to the trunnion bearings and the two splined bevel wheels are stamped 'A' and 'B': the wheel marked 'A' is fitted to the left of the casing.

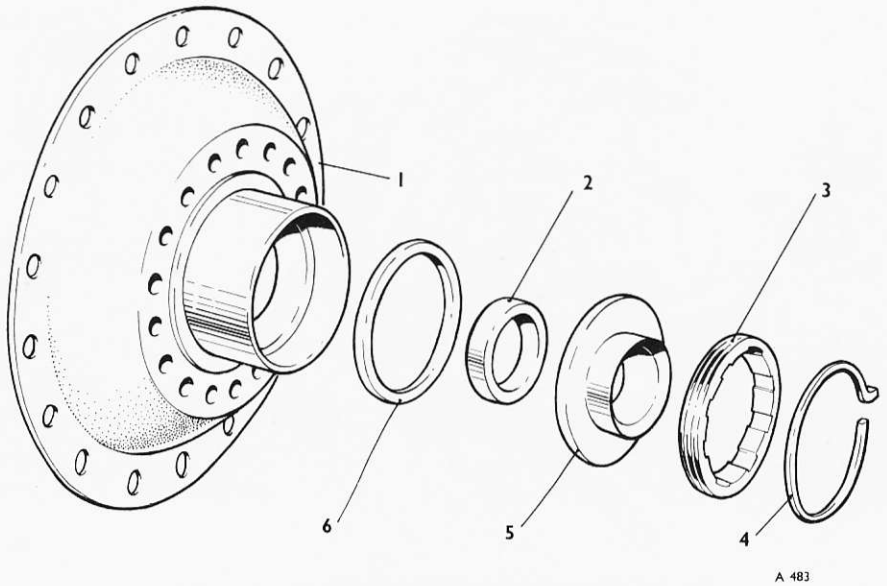


Fig. J17 Centre casing end plate

1. END PLATE
2. OIL SEAL
3. SERRATED LOCKING RING
4. LOCKING CIRCLIP
5. OIL SEAL HOUSING
6. ADJUSTING WASHER

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All spacing washers should be wired to their respective gears.

On re-assembly, if the parts are to be used again, they should be fitted in their original positions; this includes the trunnion, relative to the casing, and the halves of the casing, relative to each other.

Remove the crown wheel from the differential casing.

Remove the nose bearing.

On all S1 and Phantom V cars the nose bearing is secured by two plates.

On all S2 cars the nose bearing is secured by a circlip.

Remove the outer races of both taper roller bearings from their housings and mark them to their respective sides.

With the nose of the pinion secured in the holding block remove the driving flange retaining nut and driving flange.

S1 and S2 cars, remove the pinion bearing retaining nut (Tool RH.339).

All cars, remove the oil seal.

Place the housing (pinion downward) in a supporting tube and press out the pinion.

Crown Wheel and Pinion — to assemble

Assemble the bearings, bearing housing and oil seal, etc., to the new pinion and check the bearing pre-load as described under **Bevel Pinion Taper Roller Bearings — to renew**.

Fit the driving flange but do not lock the nut.

Set the pinion depth in relation to the crown wheel as follows:

1. Subtract 0·500 in. (12·7 m.m.) from the dimensions etched on the pinion in the radius behind the nose bearing.
2. Using a micrometer, set the measuring piece to the resulting dimension and lock at this setting.
3. Fit the left-hand side plate to the centre casing with packing pieces under the bolt heads and tighten to 22–24 lb.ft. The packing pieces must be equal to the thickness of the opposite side plate.
4. Fit the pinion setting tool into the casing as shown in Figure J19, using the original adjusting washer under the pinion housing flange (i.e. chamfer upwards).
5. Gradually tighten down the pinion housing, using three equally spaced nuts. The correct pinion depth is obtained when there is no end float at the measuring piece with the nuts tightened to 45–50 lb.ft.

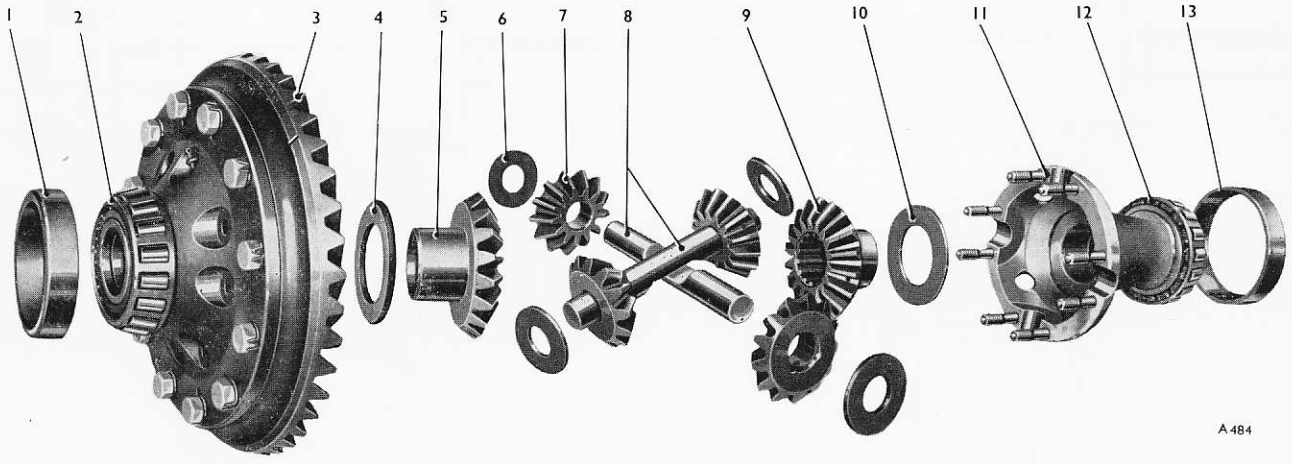


Fig. J18 Differential assembly

1. OUTER RACE
2. ROLLER BEARING
3. CROWN WHEEL
4. SPLINED PINION ADJUSTING WASHER
5. SPLINED PINION
6. PLAIN PINION ADJUSTING WASHER
7. PLAIN PINION
8. TRUNNION
9. SPLINED PINION
10. SPLINED PINION ADJUSTING WASHER
11. DIFFERENTIAL CASING
12. ROLLER BEARING
13. OUTER RACE

When tightened, the pinion will be slightly stiff to turn due to 'nip' on the bearings; this may give the impression that the nose of the bearing is butting hard on the distance piece, but the actual clearance can be ascertained by moving the measuring piece itself while tightening up.
If the original spacing washer is not of a suitable thickness, select one from the range provided.
Fit the remaining nuts, tighten to 45–50 lb.ft. and re-check. A slightly thicker washer may be required when all the nuts are tightened to the correct poundage.

6. Remove the pinion setting tool.
Fit the new crown wheel to the differential casing. Do not turn up the tabs on the lock washers.
Fit the four bevel pinions on their respective trunnion bearings and fit the assembly into the right-hand half of the differential casing without washers behind the gears.

Take the **left-hand** splined wheel and mesh it with the four pinions. Draw the four pinions up to it so that the mitres at the back all match exactly as shown at '1' in Figure J20.

Measure the gap ('2' in Fig. J20), between the back of each bevel and the casing, using feeler gauges or the actual range of adjusting washers, then fit washers to suit.

Mark the trunnion assembly relative to the casing, lift the trunnion and fit the left-hand splined wheel into its casing, together with an adjusting washer of suitable thickness beneath, to give very light backlash between the bevels and splined wheel.

Fit the opposite splined wheel into its casing with a similar washer beneath it and bolt the halves together.

Check the backlash between the splined wheels and bevels when fully tightened down and fit washers selected to give exactly zero backlash and

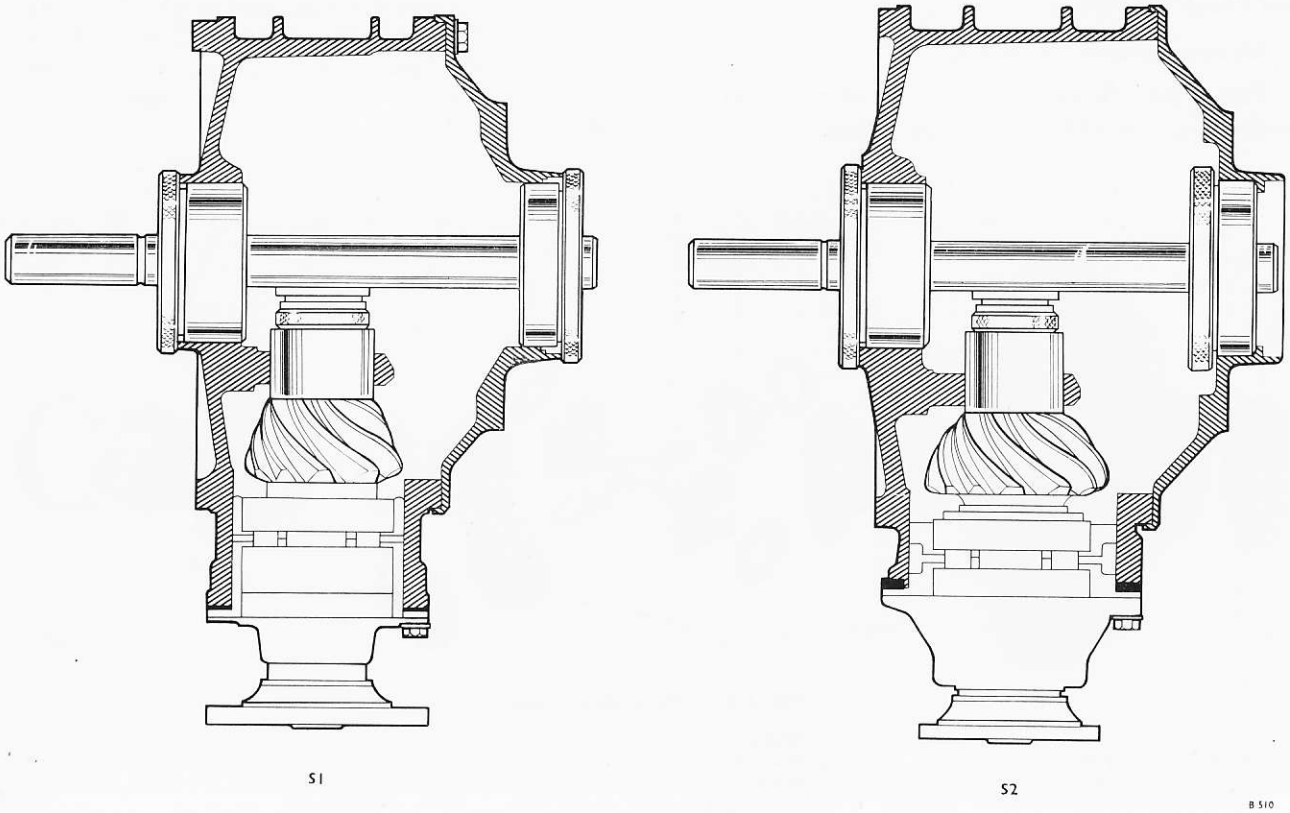


Fig. J19 Pinion setting tool in position

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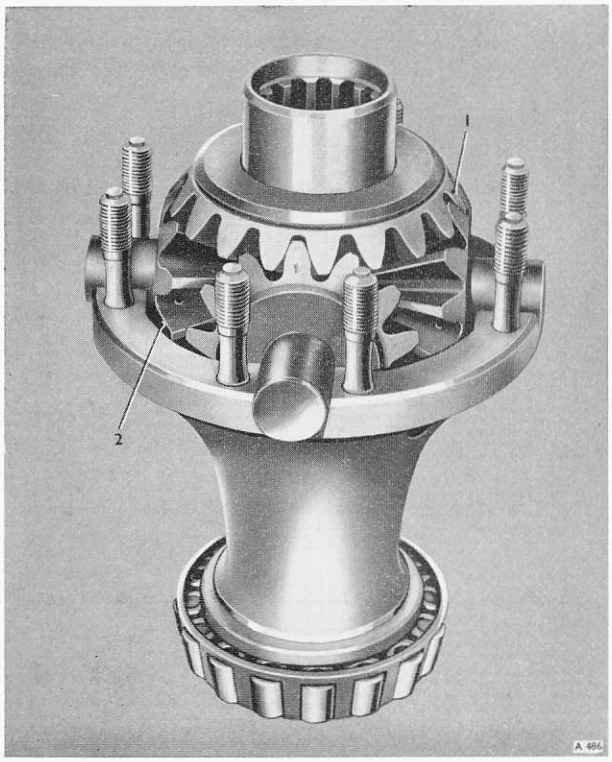


Fig. J20 Re-mitring the differential pinions

at the same time allow the whole assembly still free to turn.

Dismantle the assembly sufficiently to lubricate all moving parts, before final re-assembly.

Re-assemble, taking care to re-fit each part in its original position.

Crown Wheel — to check the truth

1. Make up distance pieces as shown in Figure J21.
2. Place the crown wheel complete with roller bearings and outer races under a press with the distance pieces at '1' and '2' as shown in Figure J22.
3. Apply light pressure and rotate the assembly slowly.

   The run-out should not exceed 0·002 in. (0·051 mm.). If this figure is exceeded, other positions of the crown wheel relative to the differential casing should be tried until the run-out is within the 0·002 in. (0·05 mm.) limit.

   Fit the outer race of the right-hand roller bearing into the casing.

   Fit the pinion nose bearing.

   Fit new axle shaft oil seals.

   Fit the thrust washer, the Belleville washers, distance piece and housing to the casing. Ensure that the Belleville washers are fitted correctly (i.e. convex side outward).

Crown Wheel to Pinion Backlash — to check and adjust

1. Tap the left-hand outer race into position. Select the thinnest adjusting washer and lightly grease one side of it, then place this side against the outer race and fit the oil seal housing. Gradually tighten the retaining nut whilst at the same time checking that there is always backlash between the crown wheel and the pinion.
2. Remove the nut and lock washer securing the driving flange to the pinion then fit the adapter RH.577 and dial indicator gauge as shown in Figure J23. The lever attached to the adapter can be rotated if the wing nut is released.
3. Position the plunger of the dial indicator gauge so that it is exactly in the centre of the half-spherical indentation on the adapter lever.
4. Take readings of the backlash at 12 different points around the crown wheel. Average the readings.
5. The average reading should coincide with that etched on the crown wheel. If these figures do not agree the adjusting washer behind the left-hand roller race must be changed. An approximate guide to the correct thickness of washer required

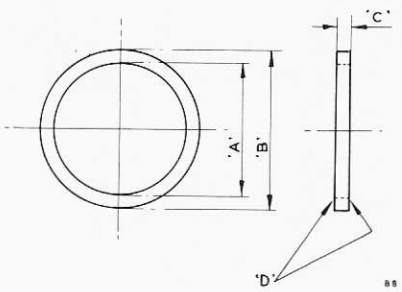


Fig. J21 Distance piece for crown wheel checking

A. 2·850 in. (72·39 mm.)
B. 3·350 in. (85·09 mm.)
C. 0·250 in. (6·35 mm.)
D. THESE FACES TO BE FLAT AND PARALLEL

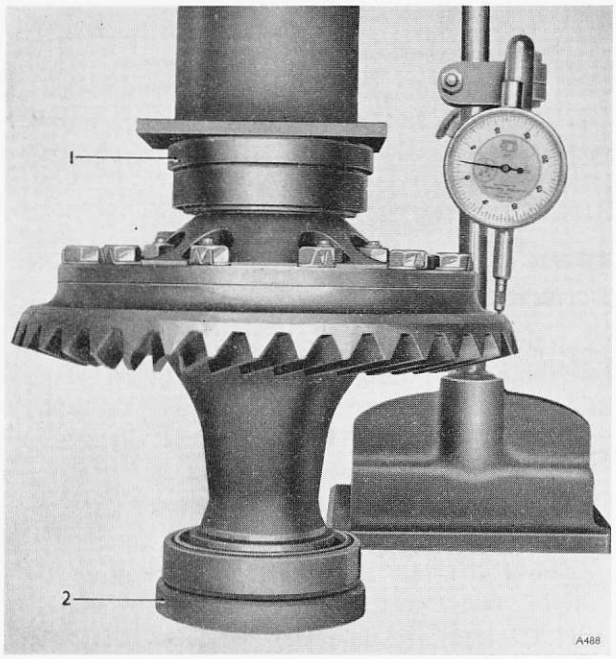


Fig. J22 Checking the crown wheel for truth

1. DISTANCE PIECE 2. DISTANCE PIECE

can be obtained by assuming that the ratio of washer thickness to the backlash is 1:1 (i.e. if the backlash exceeds the correct figure by 0·004 in. (0·102 mm.) then an adjusting washer approximately 0·004 in. (0·102 mm.) thicker than the original washer will be required). A soft trial washer R.4575 should then be ground down until it is 0·005 in. (0·127 mm.) thicker than the required size. Fit the washer and check the backlash, then

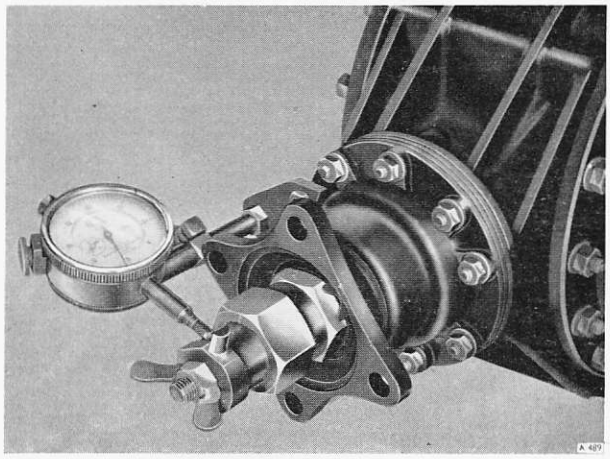


Fig. J23 Checking the crown wheel and pinion backlash

gradually reduce the thickness of the washer until the correct backlash is obtained.

6. Adjusting washers are supplied with a case hardening of 0·020 in. (0·508 mm.)–0·030 in. (0·762 mm.). Select a washer that is nearest in thickness to the soft trial washer, then grind an equal amount off each side until the correct thickness is obtained. Fit the washer and check the backlash.

7. Assemble and fully tighten the retaining nut to its original mark. Fit the locking wire.

   Apply jointing compound to the axle tube faces and fit both tubes.

   Fit the pinion driving flange and secure the nut in position with the lock washer.

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CHAPTER K

FUEL SYSTEM AND CARBURETTERS

SECTION K1 — FUEL SYSTEM

Description

On all cars the fuel tank is mounted within the rear of the chassis frame and is secured by two flexible metal straps. It can easily be removed from the car, with the minimum amount of disturbance of other parts.

The fuel filler is fitted in the rear wing; **on Phantom V cars** it is situated on the right-hand side of the car and on all other cars it is on the left-hand side.

The fuel filler door provides access to the tank filler tube and is normally released by operating a switch on the facia board.

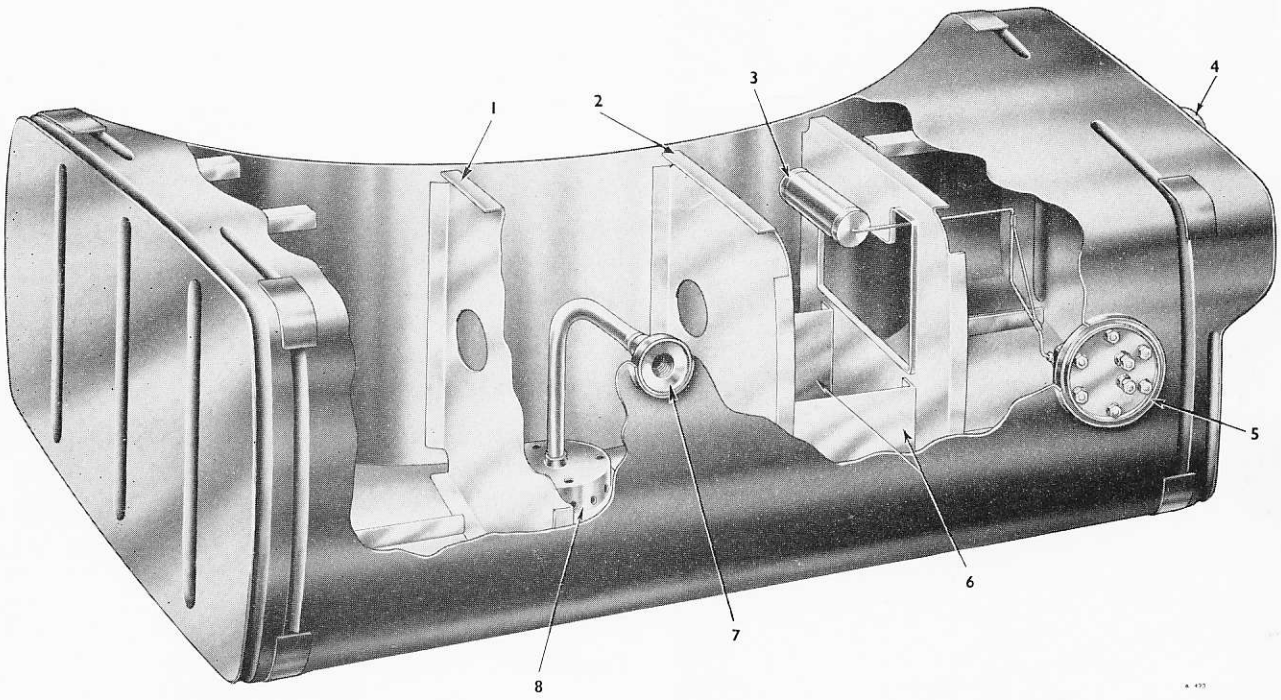


Fig. K1 Fuel tank

1. BAFFLE
2. BAFFLE
3. FLOAT IN FULL TANK POSITION
4. FUEL FILLER
5. FUEL GAUGE
6. GAUGE UNIT BAFFLES
7. OUTLET CONNECTION
8. ANTI-SURGE TOWER

Should the solenoid fail to operate by means of this switch, the locking catch on the fuel filler door can be released manually from within the luggage compartment.

The electric fuel gauge, mounted on the facia, is operated by a rheostat mounted inside the fuel tank.

The fuel gauge, the fuel filler door switch and the filler door solenoid are described in detail in the Electrical System, Chapter M of the Workshop Manual.

The fuel pipe line from the tank is connected to the main fuel filter, mounted on the rear crossmember of the chassis frame, from where it passes along the right-hand side member to the electrically operated fuel pumps, which are mounted on the chassis frame. The pipe then continues along the frame and connects to the flexible feed pipe leading to the carburetter float chambers.

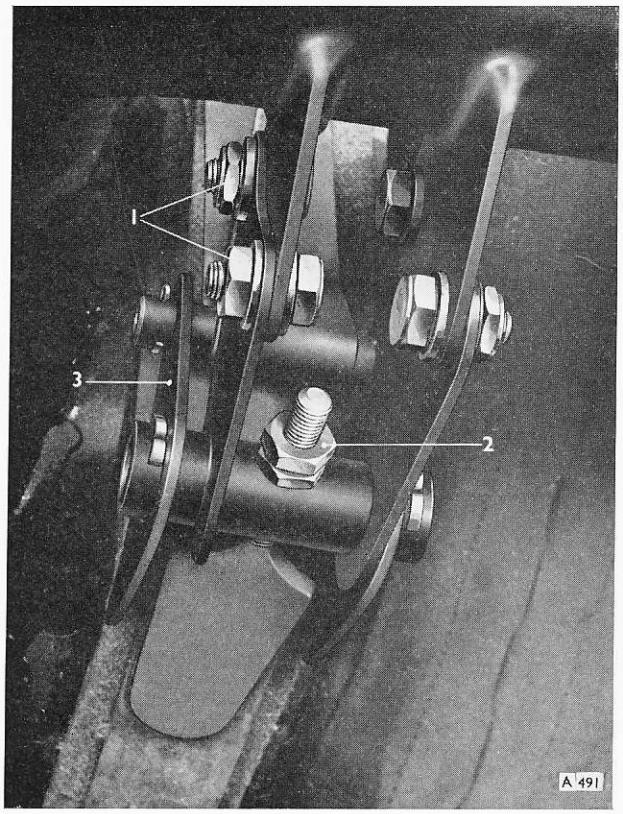


Fig. K2 Fuel tank support strap

1. SADDLE BOLTS 2. TENSIONING BOLT 3. INTERMEDIATE BRACKET

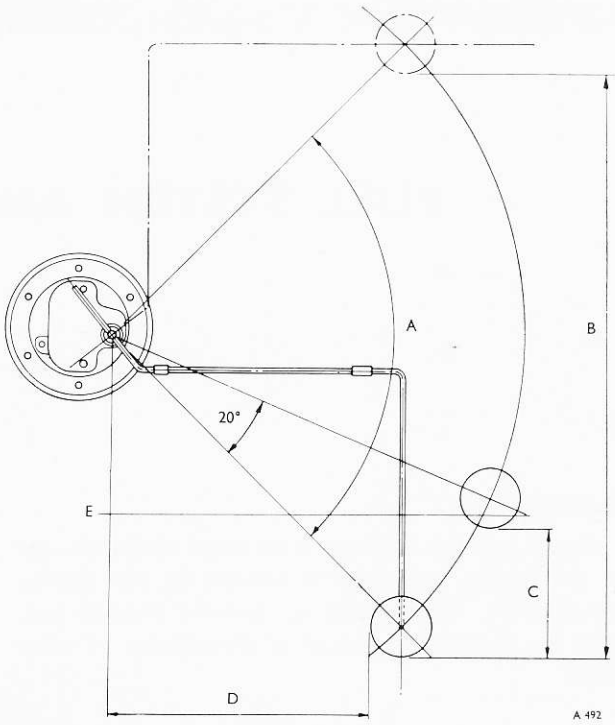


Fig. K3 Float setting

A. 90 deg. FREE TRAVEL
B. 11·609 in. (29·487 cm.)
C. 2·390 in. (6·071 cm.)
D. 5·406 in. (13·731 cm.)
E. WARNING LAMP TO OPERATE WHEN FUEL FALLS TO THIS LEVEL (3·5 GALLONS APPROXIMATELY)

On Phantom V cars, the fuel filter is situated on the left-hand side of the chassis; **on all other cars** the filter is on the right-hand side.

Service Operation

The rear fuel filter and the gauze filters in the carburetter float chambers and the fuel pumps should be removed and cleaned every 10,000 miles (16,000 km.).

Fuel Tank

Capacities

All cars except Phantom V	...	18 Imperial gallons (81·8 litres)
Phantom V	... ...	23 Imperial gallons (104·5 litres)

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The fuel tank is fabricated from 16 S.W.G. 0·064 in. (1·625 mm.) gauge aluminium alloy and is fitted internally with baffles to prevent any surging of the fuel. An additional anti-surge tower is fitted around the lower end of the outlet pipe on the base of the tank.

The electric fuel gauge mechanism is fitted to the tank, the float being protected by extra baffles which are provided to prevent flickering on the gauge.

On Phantom V cars, the tank is fabricated from 21 B.G. Zintec 0·035 in. (0·8890 mm.) thick.

All cars

A vent pipe is fitted at the top of the fuel tank filler tube; the pipe is clipped to the upper surface of the rear crossmember to minimise the possibility of the open end becoming blocked.

Fuel Tank — to remove and fit

Run the car over a pit or, alternatively, jack up the rear end of the car and support it on stands.

Disconnect the battery. Disconnect the electrical leads from the electric fuel gauge unit and remove the earthing strip which is fitted between the chassis crossmember and the fuel gauge unit.

Remove all dirt from around the drain plug, then, using the special adapter and spanner from the tool kit, remove the plug and drain the fuel into a suitable storage container.

Remove the carpet from the luggage compartment, then remove the three screws which secure the trim cover in position over the fuel filler hose where it passes through the boot. Slacken the worm drive clip securing the hose connection to the filler tube.

Disconnect the fuel pipe line at the tank outlet union.

Using a box spanner, remove the two nuts from the tensioning bolts which secure the tank straps, then remove the four saddle bolts and nuts from the mounting bracket (see Fig. K2).

Remove the tank together with the fabric packing strips.

To fit the fuel tank, reverse the procedure adopted for its removal.

Rear Filter

The rear filter, shown in Figure K4, contains two circular gauze filters. The fuel passes upwards through these gauzes and any dirt present settles on the lower faces of the gauzes and in the filter bowl.

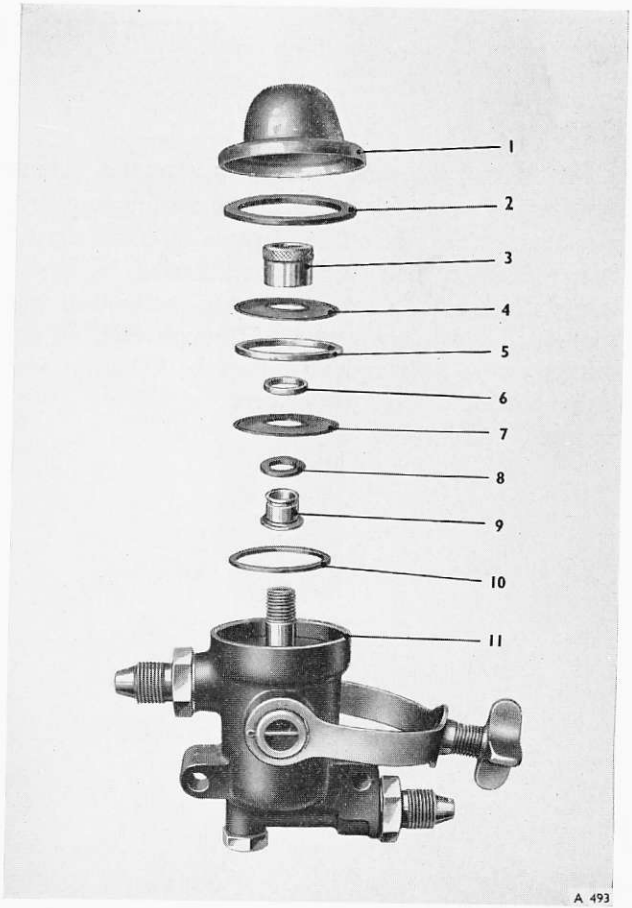


Fig. K4 Rear filter

1. COVER
2. COVER SEAL
3. KNURLED NUT
4. FILTER GAUZE
5. DISTANCE WASHER (OUTER)
6. DISTANCE WASHER (INNER)
7. FILTER GAUZE
8. RUBBER WASHER
9. REMOVAL SLEEVE
10. RUBBER WASHER
11. FILTER BODY

To remove the gauzes for cleaning, unscrew the yoke retaining nut, move the stirrup to one side and remove the cover. Unscrew the knurled nut securing the gauzes in position, and withdraw the gauzes by means of the centre sleeve, then clean them in petrol with a stiff brush. Remove the drain plug from the filter bowl and wipe out the bowl.

When re-fitting the cover, ensure that the sealing washer is in good condition and is correctly positioned. Care should be taken to ensure that when securing the yoke it is not over-tightened. Any leaks on the suction side of the pumps, although not apparent by the leakage of fuel, will impair the engine performance.

SECTION K2 — THE FUEL PUMPS

Description

On S1 and S2 cars, the fuel pump unit, which consists of two electrically operated pumps, is mounted on the outer side of the right-hand chassis frame member. Each pump has a flexible Neoprene fabric diaphragm, a solenoid, a trip mechanism and suction and delivery valves. Although each of the pumps works independently, they both deliver fuel into a common delivery chamber.

Failure of the Pump Unit to Deliver Fuel

If the pump fails to operate, proceed as follows:

Switch on the ignition system, then slacken the outlet union of the pump unit. If fuel is pumped out, filters in the carburetter inlets should be examined for the presence of foreign matter; also check the operation of the float chamber needle valves.

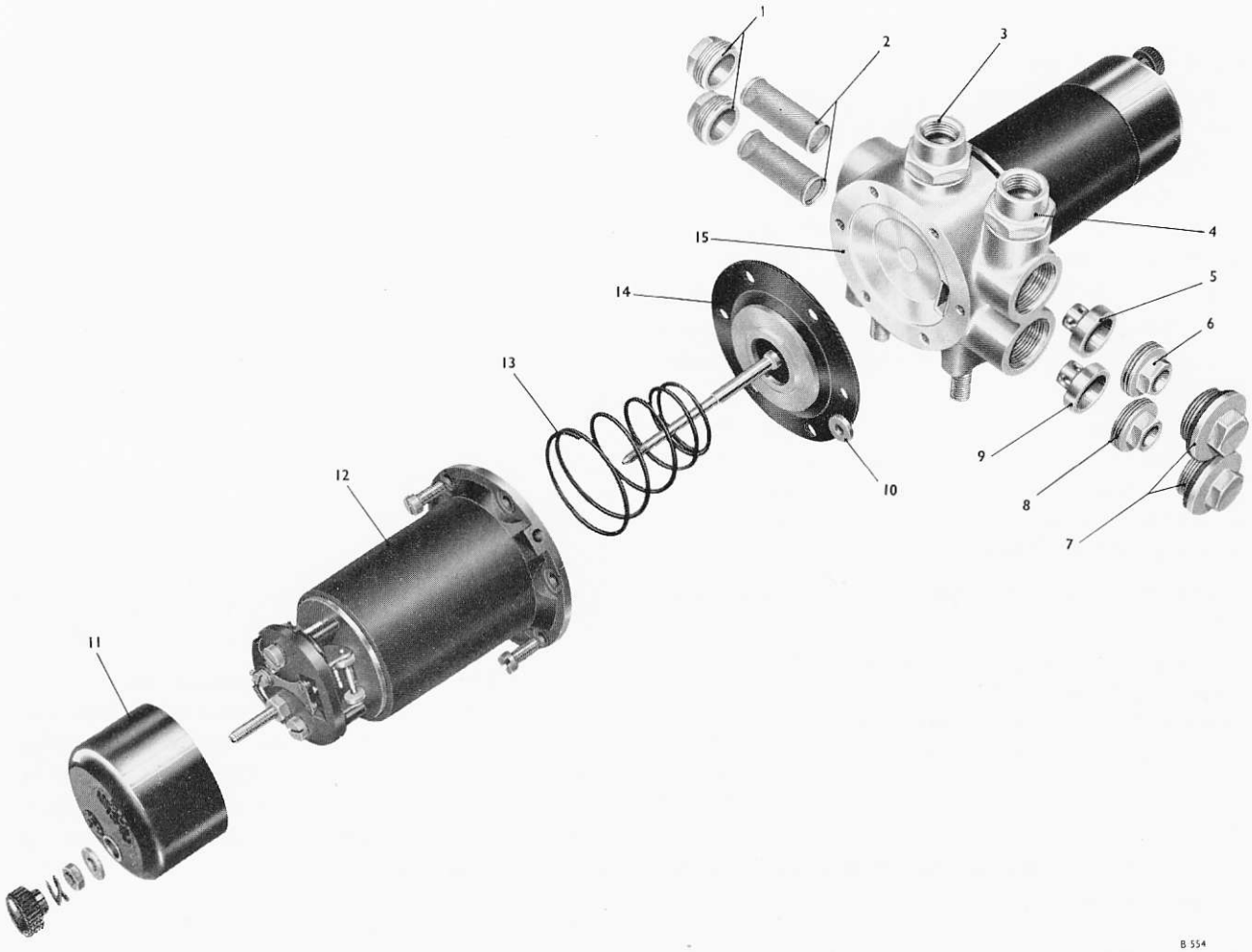


Fig. K5 Fuel pump details

1. CAP NUTS
2. FILTERS
3. PUMP INLET ADAPTER
4. PUMP OUTLET ADAPTER
5. OUTLET VALVE ASSEMBLY
6. OUTLET VALVE RETAINING RING
7. CAP NUTS
8. INLET VALVE RETAINING RING
9. INLET VALVE ASSEMBLY
10. ROLLER
11. END COVER
12. SOLENOID HOUSING
13. SPRING
14. DIAPHRAGM ASSEMBLY
15. PUMP BODY

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If fuel is not pumped out of the outlet union, check the electrical supply to the fuel pump unit by connecting a 12 volt bulb between the electrical supply and the pump body. If the bulb fails to light, check the earthing of the pump and the supply lead back to the main ignition fuse (No. 11).

If the fault still persists after checking the above points, remove the inlet and outlet valve assemblies from the pump (see Fig. K5). Check that the assemblies are clean and that they operate freely. The two valves should be fitted with their smooth faces downwards.

If the pump still fails to operate, disconnect the terminals at each end of the pump unit and remove the end covers. Examine each pumping unit in turn, ensuring that the points are making contact. Clean the points by drawing a piece of fine glass paper across them whilst they are held together.

In order to check the flow of current through the units, touch each end terminal in turn with its corresponding supply lead. If a spark is not obtained then a fault in the electrical circuit of the pump is denoted and the pump should be renewed.

If the pump unit ticks excessively, yet does not deliver fuel to the engine, this is an indication that there is either a shortage of fuel, an air leak or a defect in the unit itself.

A hot pump indicates a restriction on the inlet side of the unit. Check the level of the fuel in the tank and examine all unions and joints between the tank and the pump unit for leaks.

If no leak is apparent, release the cover of the rear fuel filter to prevent siphoning of the fuel from the tank, then remove the fuel inlet pipe from the pump. Replace the pipe with a length of rubber tubing, the end of which should be immersed in a container of petrol. Check the operation of the pump; if it is satisfactory, a blockage is indicated in the fuel inlet pipe or the rear filter. If, however, the fault still persists, remove the pump and examine the diaphragms.

Fuel Pump — to remove and fit

Disconnect the battery leads.

Remove the cover from the rear filter; this will prevent loss of fuel by siphoning, as the level of the fuel in the tank is above the pump.

Disconnect the delivery and feed pipes from the fuel pump.

Disconnect the following electrical leads: the supply lead from the rear pump terminal, the lead to the radio interference suppressor, the connecting lead to the front pump terminal and the suppressor lead from the front pump.

Remove the two nuts and spring washers securing the pump unit to the mounting bracket on the chassis frame.

To fit the fuel pump, reverse the procedure given for its removal. It is essential to ensure that when fitting the fuel pump, the delivery and feed pipes of the fuel system are kept clear of the chassis frame between the insulated mounting clips, in order to prevent excessive transmission of noise from the pumps.

Diaphragms — to renew

Remove the six screws which secure the solenoid housing to the pump body, then withdraw the housing complete with the diaphragm assembly. Release the membranes from the housing flange, then unscrew the diaphragm assembly and remove the eleven brass rollers.

Wash all parts in clean petrol and examine the brass rollers and diaphragm; the diaphragm assembly must be renewed if the membranes are found to be swollen, warped or perforated.

The spherical edges of the rollers should be examined for flats and renewed if necessary.

> **Note:** Before re-assembling the pump, the spring blade retaining screw in the contact breaker should be released sufficiently to ensure that pressure is not applied to the tungsten points and the outer rocker. If pressure is applied at this point during assembly, the correct setting of the diaphragm cannot be obtained.

To re-assemble the pump, place the large end of the spring in the solenoid housing, then check that the impact washer is located correctly in the armature recess. Insert the bronze rod of the diaphragm assembly through the hole in the solenoid core and screw it firmly into the inner rocker trunnion.

Holding the solenoid housing with the flange uppermost, lift the edge of the diaphragm and insert the eleven brass rollers into the annular recess in the armature.



Fig. K6 Adjusting the diaphragm

1. ROCKER HINGE PIN

Turn the solenoid housing horizontally as shown in Figure K6 and progressively unscrew the diaphragm assembly one sixth of a turn at a time; i.e. one hole in the solenoid flange. Whilst unscrewing the assembly, the diaphragm should be moved in and out until finally the outer rocker 'toggles over' when the diaphragm is pressed in. Unscrew the assembly one further complete turn.

Tighten the spring blade retaining screw in the contact breaker.

Secure the solenoid housing to the main pump body with six setscrews, ensuring that the rollers are not trapped.

Remove the rocker hinge pin, allowing the armature spring to press the diaphragm assembly further back and stretch the diaphragm membranes. Tighten the setscrews securing the solenoid housing to the pump body. Re-fit the hinge pin and the end cover.

Test Data

On all S1 cars, both pumps operating together deliver 1 pint of paraffin in 32 seconds with a suction lift of 3 ft. (0·91 m.).

On all S2 cars, both pumps operating together deliver 1 pint of paraffin in 22 seconds with a suction lift of 1 ft. (0·3 m.).

The pump unit should be mounted on a test rig either 1 ft. (0·3 m.) or 3 ft. (0·91 m.) above a paraffin bath, according to the type of car. Fit pipes to the inlet and outlet of the pump and check the pump delivery over a given period.

SECTION K3 — AIR CLEANERS

S1 cars

The air supply to the carburetters is thoroughly cleaned in passing through the combined air cleaner and intake silencer.

The standard air cleaner for 'home' use is the A.C. type, illustrated in Figure K7.

This cleaner should be serviced every 10,000 miles (16,000 km.) as follows:

(i) Remove the butterfly nut and end cover.

(ii) Remove the filter element and wash it in petrol or paraffin, then oil with engine oil. Before re-fitting allow it to drain thoroughly.

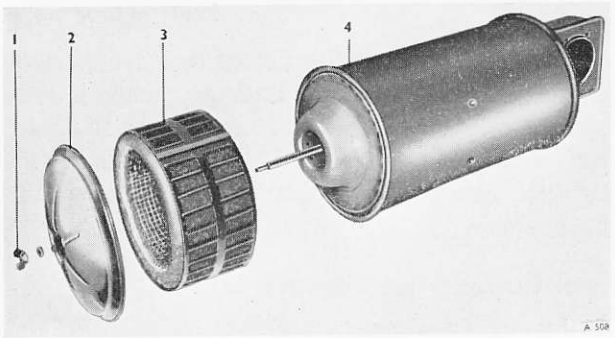


Fig. K7 A.C. type air cleaner — S1 cars

1. WING NUT
2. END COVER
3. FILTER ELEMENT
4. BODY

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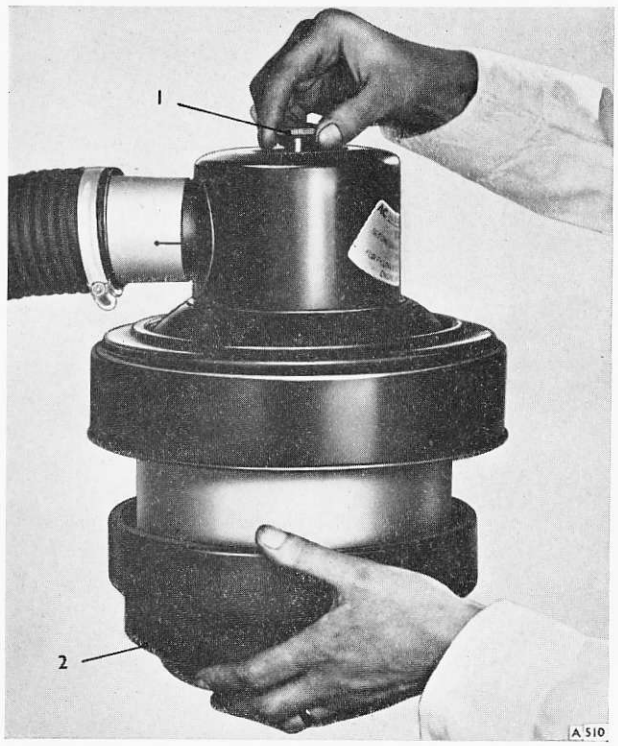


Fig. K8 Removing oil bath air cleaner — S1 cars

1. OIL BATH RETAINING SCREW 2. OIL BATH

The 'oil bath' type cleaner, shown in Figures K8 and K9, is fitted to cars destined for overseas and is available for cars operating in dusty conditions.

This cleaner should be serviced every 1,000 miles (1,600 km.), or more frequently if conditions warrant, as follows:

(i) Support the filter bowl in one hand and unscrew the knurled nut.

(ii) Remove the oil container, then empty and clean it. Wash the filter element in petrol and allow it to dry.

(iii) Re-fit the element, re-fill the filter bowl with SAE 20 oil to the indicated level, and re-fit in position.

The air cleaner fitted to **Continental S1 cars** is the 'Vokes' type.

This cleaner should be serviced every 5,000 miles (8,000 km.) as follows:

(i) Unscrew the wing nut and remove the end cover; withdraw the felt element.

(ii) Blow off any dust and grit with compressed air; it is necessary to clean each corrugation separately.

(iii) Re-fit in position.

Every 20,000 miles (32,000 km.) the felt element should be discarded and a new one fitted.

S2 cars

The air cleaner fitted to all S2 models is the 'Purolator' type illustrated in Figure K10.

The element should be renewed at intervals of 10,000 miles (16,000 km.)

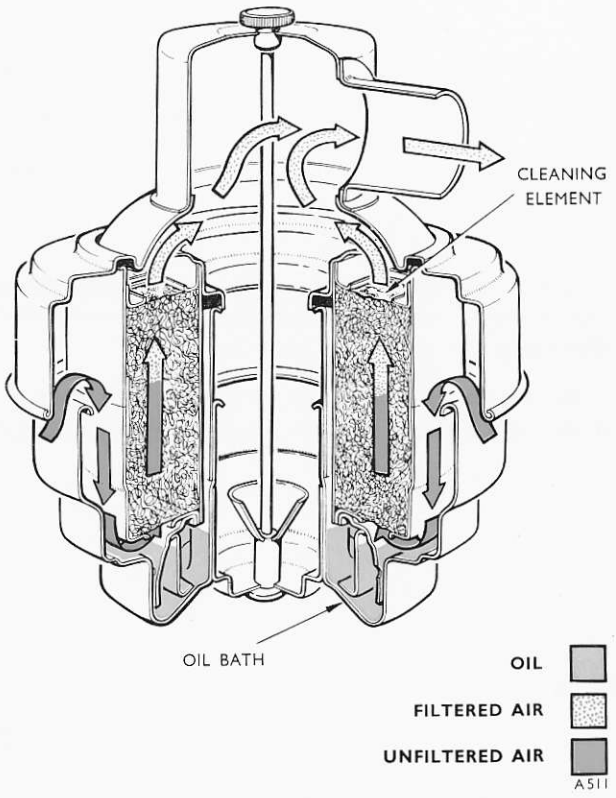


Fig. K9 Air flow through oil bath cleaner

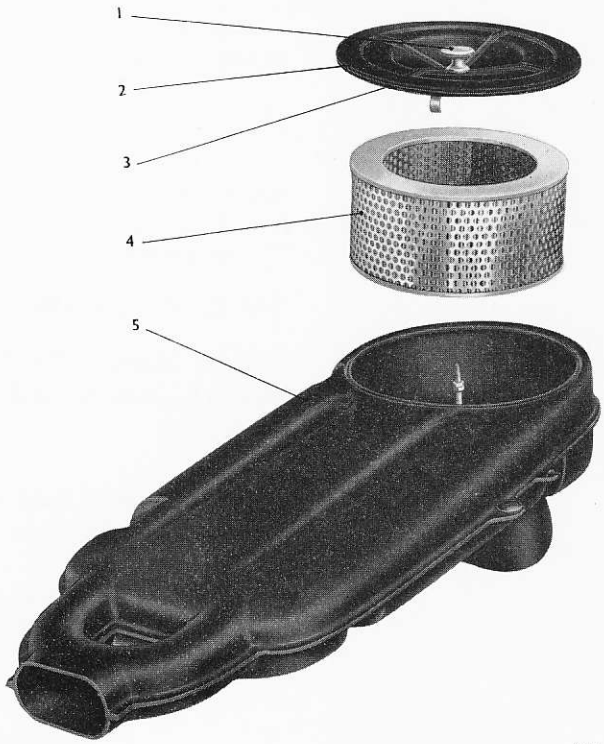


Fig. K10 Air cleaner — S2 cars

1. COVER SECURING NUT
2. TOP COVER
3. RUBBER SEAL
4. FILTER ELEMENT
5. AIR CLEANER CASING

Access to the element is gained by unscrewing the knurled nut from the top of the unit and detaching the top cover and the element.

Should it be necessary to remove the element except at the stated intervals, care should be exercised to ensure that the element does not come into contact with petrol, oil or paraffin.

In cases of a choked filter element, the element should be renewed, as effective cleaning is impracticable.

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SECTION K4 — THE CARBURETTER AND THE AUTOMATIC CHOKE SYSTEM

Data

	Early S1 cars	All S2 cars
Carburetter	S.U. HD 6 diaphragm type	S.U. HD 6 diaphragm type
Choke size	1·750 in. (44·45 mm.) dia. bore	1·750 in. (44·45 mm.) dia. bore
Jet size	0·100 in. (2·54 mm.) dia.	0·100 in. (2·54 mm.) dia.
Jet needle	TA — AC type cleaner TC — oil bath cleaner	SH

	Bentley Continental and late S1 cars
Carburetter	S.U. HD 8 diaphragm type
Choke size	2·00 in. (50·80 mm.) dia. bore
Jet size	0·125 in. (3·175 mm.) dia.
Jet needle	Bentley Continental with 'Vokes' cleaner UC late S1 AC cleaner UC late S1 oil bath cleaner UD

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Description

On S1 cars, two S.U. carburetters of the diaphragm type are fitted to the engine on a side induction manifold.

On S2 cars, the carburetters are fitted to the engine on a central 'Tee'-piece which is mounted over an eight branch induction manifold.

This type of carburetter automatically adjusts both its choke and jet area to meet the demand of the engine which is dependent on the degrees of throttle opening, engine speed and loading. This is effected by using the manifold depression to raise the air valve carrying the jet needle which regulates the fuel delivery.

Whilst employing the fundamental design and principle of the standard S.U. carburetter, two differences are incorporated. These consist of a flexible synthetic rubber diaphragm, which replaces the jet glands, and a throttle by-pass, which feeds the idling mixture directly from the choke space to the manifold side of the carburetter instead of it passing under the throttle butterfly. The carburetter main jet is secured to the diaphragm by the jet cup and the jet return spring cup. The diaphragm is in turn secured at its

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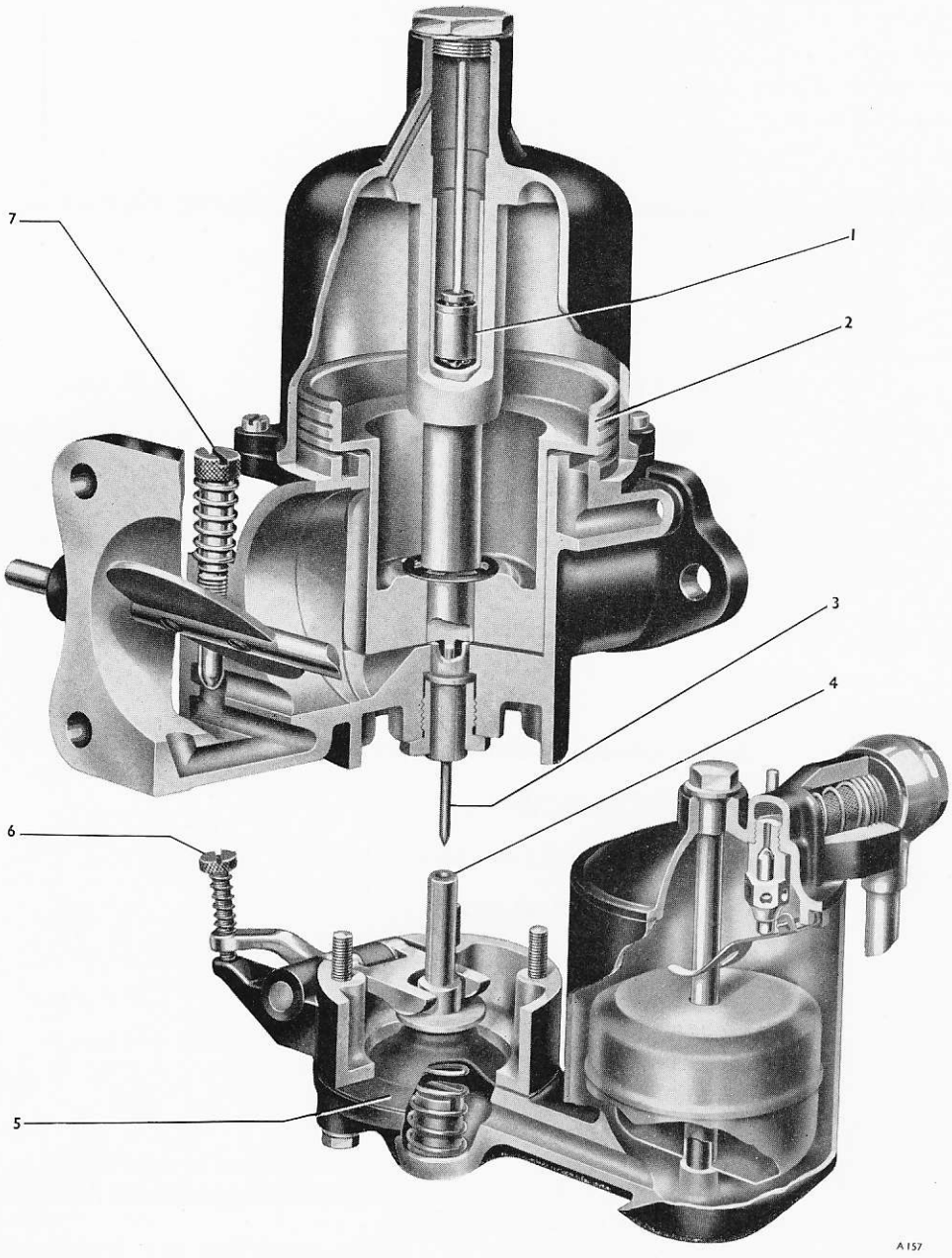


Fig. K11 Carburetter details

1. HYDRAULIC DAMPER
2. PISTON
3. NEEDLE
4. JET
5. DIAPHRAGM
6. MIXTURE ADJUSTMENT
7. SLOW RUNNING ADJUSTMENT

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outer edge between the diaphragm housing and the main jet well. The jet is spring-loaded away from the base of the jet well.

On S2 cars, the carburetters are fitted with a nylon block in the jet well to prevent vaporisation of the fuel.

The jet is fed through its lower end from the main jet well, its movement being controlled by the jet return spring and the adjusting screw which actuates a rocking lever. This lever raises or lowers the jet as required, and so controls the idling mixture. Turning the adjusting screw clockwise lowers the jet and enriches the mixture; turning the screw anti-clockwise weakens the mixture.

When idling with a warm engine the mixture passes through the by-pass. This passage is restricted by an adjusting screw, which controls the amount of mixture passing through the by-pass and so determines the engine's idling speed.

When the engine has attained its normal working temperature and is at idling speed, the throttle butterfly is closed, but when the engine is cold the throttle is slightly open, due to the action of the automatic choke system. In this case the mixture passes both under the throttle butterfly and through the by-pass to give 'fast–idle' conditions.

Defects in Operation

In the event of unsatisfactory running of the engine, a thorough examination should be made of the following:

1. Ignition system, sparking plugs for efficient operation.
2. Fuel pump for correct delivery.
3. Air silencer for a choked element.
4. All manifold joints for security.

If, after examination, it is found that the carburetters are faulty, check the following points:

Sticking piston

A sticking piston can be recognised by any one of the following faults:

1. Stalling.
2. Poor slow running.
3. Lack of power.
4. High fuel consumption.

To determine over which part of the stroke the piston is sticking, proceed as described below.

Remove the hosing from the butterfly housing, then remove the air silencer and hosing from the bonnet. A spring-loaded pin, located on the right-hand side of the suction chamber, is provided for lifting the piston.

Normally, when the engine is not running, the piston rests on the buffer pin in the base of the piston just above the bridge of the main carburetter body. Raise the piston to its highest position, against the resistance of the damper piston, then release it and check that it drops freely. If the downward movement of the piston is sluggish or if the piston does not readily leave the bridge of the carburetter, lower the main jet by means of the mixture adjustment screw and repeat the check on the piston.

The elimination of sticking by lowering the jet indicates that the needle is fouling the jet. First check for a bent needle; if the needle is satisfactory, it will be necessary to centralise the jet (see sub-section 'Main Jet — to centralise').

After lowering the jet, if the piston continues to stick it is probable that the piston is fouling the side of the suction chamber or that the piston rod is not free to move within its bush.

An alternative cause is that the damper may be bent, thereby inducing friction between the damper piston and the bore of the main piston rod.

To check the latter cause remove the oil cap and damper piston assembly and repeat the check for a sticking piston. If it is determined that the damper rod is bent, it should be straightened before re-fitting it to the carburetter.

Dirt between the piston and suction chamber, and piston rod sticking in its bush

Remove the suction chamber and damper piston assembly, then remove the piston and needle. Clean all the parts with clean petrol and wipe dry with a clean lint-free cloth. Apply a few drops of a clean light oil to the piston rod. If there are any signs of

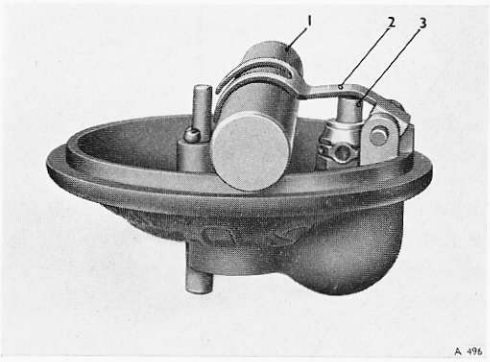


Fig. K12 Checking fuel level

1. TEST BAR 2. FORKED LEVER 3. NEEDLE VALVE

rust or corrosion the oil should be diluted with a few drops of paraffin. Invert the suction chamber and fit the piston, then check that it is free to rotate and slide up and down. On no account must any attempt be made to increase the bore of the suction chamber, or to reduce the diameter of the enlarged part of the piston, as the maintenance of a limited clearance between these two parts is essential for the correct operation of the carburetter.

Flooding of the float chamber or the jet

The following points should be checked if this fault is suspected:

1. Punctured float.
2. Dirty or worn needle valve seating.
3. Incorrectly set float level.

To remedy this fault, remove the centre bolt securing the float chamber lid and remove the lid. Thoroughly clean the float chamber and needle valve or renew the float if it is punctured. When assembling the float chamber, re-set the float level forks and ensure that the cork washer, fitted between the float chamber body and the lid, is correctly seated. Examine the fibre sealing washer fitted to the centre bolt and renew if necessary.

Water or foreign matter in the float chamber

Remove the float chamber lid, then withdraw the float. Thoroughly clean the float chamber and the filter in the lid. If dirt is present in the float chamber, it is possible that the main jet may also be choked. The following method should successfully clear a choked jet:

1. Lower the jet to its bottom position by means of the mixture adjusting screw.
2. Remove the suction chamber and withdraw the piston and needle.
3. Re-fit the suction chamber and seal the air intake.
4. Ensure that the ignition is switched 'Off' and operate the starter motor by means of the solenoid mounted on the chassis frame. This should result in any foreign matter being drawn out of the jet into the carburetter body. Should this fail to clear the blockage, remove and clean the jet. If globules of water are found in the carburetter, the fuel system should be cleaned thoroughly and the fuel tank drained to inspect the fuel for water content.

To Check the Fuel Level in the Float Chamber

The level of fuel in the carburetter float chamber is determined by the position of the forked lever which bears on the top of the float (see Fig. K12). The lever should be set so that when it holds the needle against its seat a $\frac{7}{16}$ in. (11·11 mm.) dia. rod can be just passed between the lever and the sealing rim of the float chamber lip, as shown in Figure K12. Examine the needle and seating for wear and renew if necessary.

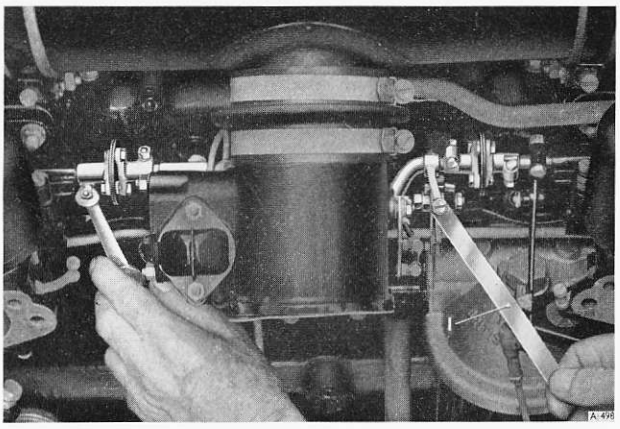


Fig. K13 Synchronising throttles — S1 cars

1. FEELER GAUGE IN POSITION

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Failure of Fuel Supply to the Float Chamber

If the engine stalls when idling or under light running conditions and it is known that a good supply of fuel is available at the float chamber inlet union, it is possible that the float needle valve is stuck to its seating. This results from a gum deposit, which forms in the fuel system after prolonged storage of fuel in the tank. Remove the float chamber lid and withdraw the needle valve, then clean the valve and its seating with a clean cloth soaked in alcohol. Cleaning of the seat will be facilitated by wrapping the cloth around a match stick. Repeated trouble of this nature can only be rectified by completely dismantling and thoroughly cleansing the fuel system and tank.

If the engine shows signs of serious power loss, evident at high speeds and engine loading, it is possible that the delivery of fuel is not sufficient. The fuel pump should be checked for adequate delivery and the filters in the system should be inspected and cleaned.

Sticking Jet

If it is difficult to raise and lower the jet by means of the mixture adjustment mechanism, the jet should be lowered to its bottom position and the lower part of the lever thus exposed should be smeared with petroleum jelly or a similar type of lubricant. Raise and lower the jet repeatedly until the lubricant has coated the jet and its surrounding parts.

Carburetters — to remove

S1 cars

1. Remove the air cleaner by removing the two securing straps and rubber connecting hose.
2. Disconnect the windscreen washer pipe from the induction manifold and the electrical leads from the choke solenoid.
3. Disconnect the fuel pipes from both carburetters.
4. Disconnect the throttle control at the ball joint.
5. Remove the nuts securing the air intake pipe to the carburetter air intake flanges.
6. Unscrew the four nuts retaining each carburetter and remove the carburetters.

Note: If necessary, both carburetters can be removed while attached to the air intake.

S2 cars

The carburetters should be removed in the following manner.

Disconnect the battery lead.

Disconnect the hosing from the air silencer and butterfly housing.

Remove the air silencer from the bonnet.

Disconnect the electrical wiring system from the automatic choke solenoid.

Disconnect the throttle linkage from the fore and aft manifold shaft to 'B' bank carburetter.

Disconnect the fuel feed and drain pipes.

Remove the two choke stove pipes from the 'A' bank exhaust manifold also the butterfly housing and bimetal coil cover.

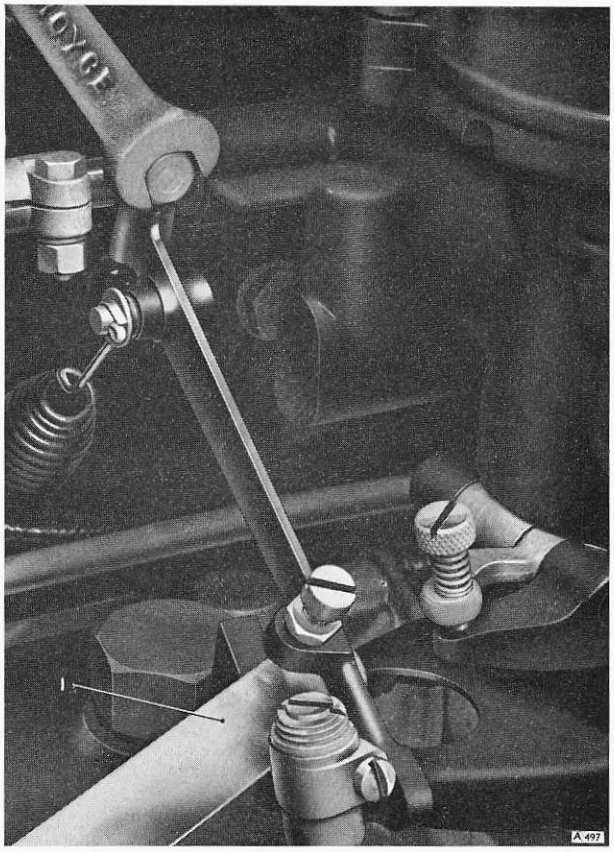


Fig. K14 Setting throttle lever — S1 cars

1. FEELER GAUGE IN POSITION

Remove the air horns, the butterfly housing, the carburetters and the 'Tee'-piece as a complete assembly. The assembly is secured to the induction manifold by a single bolt, location being provided by two dowel pins.

Remove the 'fast-idle' link rod from the choke butterfly.

Remove the link and spring connecting the two throttles.

Remove the air intake assemblies from the carburetters and the butterfly housing.

Remove the carburetters.

Carburetter — to dismantle

Remove the lid of the float chamber, together with the needle valve and filter, then withdraw the float.

Remove the three screws securing the suction chamber to the main carburetter body, then withdraw the piston and needle.

Remove the hydraulic piston damper assembly from the top of the suction chamber. Unscrew and remove the four bolts retaining the float chamber and diaphragm casing to the carburetter body.

Remove the jet diaphragm assembly taking care to retain the spring.

The jet needle may be removed from the piston by unscrewing the small grub screw in the piston.



Fig. K15 Setting throttle lever — S2 cars

1. THROTTLE STOP ADJUSTING SCREW
2. FEELER GAUGE IN POSITION

Main Jet — to centralise

Remove the float chamber and diaphragm casing. Slacken the nut securing the jet bearing, then with the piston resting on the bridge of the carburetter, fit the jet into its bearing so that the jet cup seats on the jet bearing. It is important that the jet and diaphragm be kept in the same radial position relative to the carburetter body, as the jet orifice is not necessarily concentric with its outside diameter; therefore turning may cause decentralisation. Make correlation marks by the diaphragm hole and its corresponding hole in the carburetter body. Then tighten the nut securing the jet bearing. Having tightened the nut, check that the jet is free to move inside the jet bearing and does not foul the needle.

Re-fit the diaphragm, the float chamber and diaphragm casing ensuring that the correlation marks line up with each other.

Carburetter — to overhaul

Check that the piston is not sticking in its bore.

The suction chamber and the piston are fitted as mated pairs and must not be interchanged. Clean the piston and suction chamber with a clean lint-free cloth moistened with petrol. **Do not** use a polishing paste or other abrasive compound.

Inspect the jet and jet needle for wear. Should they require renewal, the same size jet and needle must be fitted. When fitting a new needle, it should be noted that its shoulder **must** be flush with the underface of the piston.

Inspect the diaphragm and jet assembly for wear. Leaks will occur if the jet cup is insecurely fitted, or if the sealing is faulty at its outer edge, between the diaphragm casing and the main jet well.

Leaking at the outer edge may be cured by tightening the four securing bolts but if the diaphragm is leaking around the jet assembly or is torn, it must be replaced by a new assembly. When fitting a new assembly ensure that the jet is of the correct size.

Examine the hydraulic piston damper in the top of the suction chamber, checking that the piston rod is not bent. Re-fill the damper with an approved oil of viscosity SAE 20.

Check that the mixture adjustment mechanism is free to raise and lower the jet.

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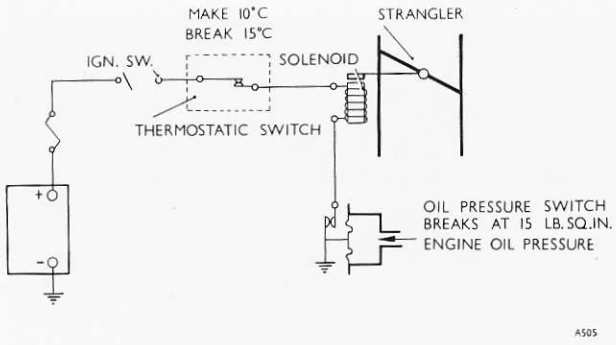


Fig. K16 Temperature control circuit — S1 cars

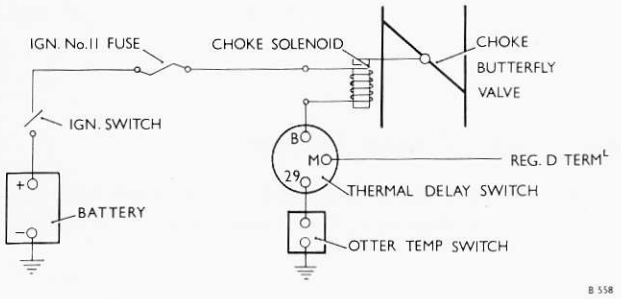


Fig. K17 Temperature control circuit — S2 cars

Throttle Synchronisation

S1 cars

Disconnect the throttle operating lever at the ball joint.

Slacken the throttle operating lever pinch bolt and screw the throttle stop fully out.

Remove the cold start adjusting screw.

Slacken the two inner pinch bolts adjacent to the flexible couplings. Close the choke butterfly and place a 0·098 in. (2·489 mm.) feeler gauge between the 'fast-idle' cam and the lever boss (see Fig. K13). Close both throttle valves by turning the couplings; tighten the pinch bolts.

Place a 0·187 in. —0·002 in. (4·08 mm. —0·05 mm.) feeler gauge between the throttle lever and the out-rigged stop. With the throttles closed while holding the lever on to the stop, tighten the pinch bolt. Enter the stop screw into position. Place a 0·002 in. (0·050 mm.) feeler gauge on the throttle stop and screw in the stop screw until it just nips the gauge (see Fig. K14). Screw in the stop screw one further half turn and tighten the lock-nut.

S2 cars

Unscrew the three screws securing the dashpots of each carburetter and remove the dashpots together with the pistons and dampers.

Slacken the two pinch bolts which clamp the operating levers to the throttle spindles.

Ensure that the choke is in the 'Off' position.

With 'B' bank throttle blade held closed, tighten the pinch bolt on 'B' bank carburetter spindle. Holding 'B' bank throttle blade in the closed position, close 'A' bank throttle blade and tighten the pinch-bolt on 'A' bank carburetter spindle.

Adjust the throttle stop screw until the gap between the screw and the throttle lever is 0·002 in. (0·050 mm.) (see Fig. K15).

Screw in the stop screw one further half turn. This will be sufficient to just 'crack off' the throttles and prevent damage to the bores of the carburetters.

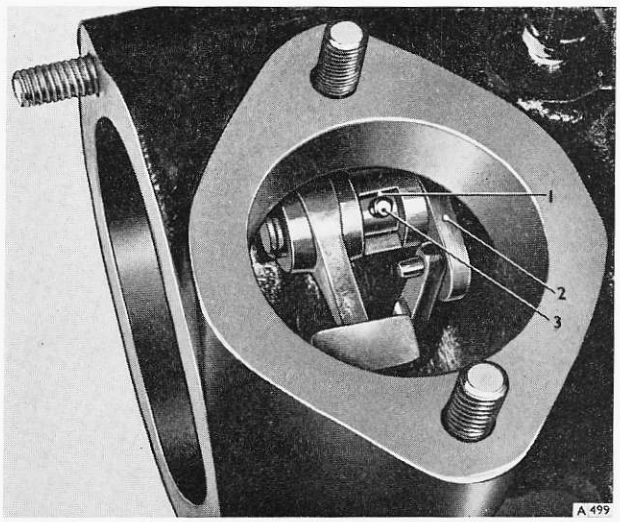


Fig. K18 Pick-up lever clearance — S1 cars

1. 0·010 in. (0·254 mm.) 2. PIN 3. LEVER

Re-fit the carburetter dashpots and pistons. Top-up with the correct oil (see Chapter D) and fit the dampers.

Automatic Choke System

The engine induction system is provided with an automatic choking device to improve starting with a cold engine.

The automatic choke system consists of five main features:

1. An out of balance butterfly valve in the butterfly housing.
2. A rubber diaphragm, subject to induction manifold depression, and indirectly connected to the butterfly valve spindle.
3. A small electromagnet wired in parallel with the starter relay circuit and in series with a thermal delay switch and temperature sensitive switch.
4. A 'fast–idle' cam, loose coupled to a pick-up lever which is in turn connected to the butterfly spindle.
5. A bimetal coil, coupled to the butterfly shaft, which is sensitive to hot air from the exhaust stove on **S2 cars** and heated water in the induction manifold on **S1 cars.**

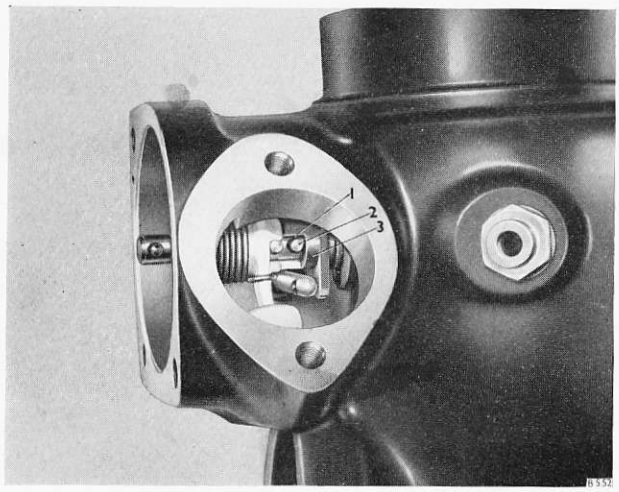


Fig. K19 Pick-up lever clearance — S2 cars

1. 0·010 in. (0·254 mm.) 2. PIN 3. LEVER

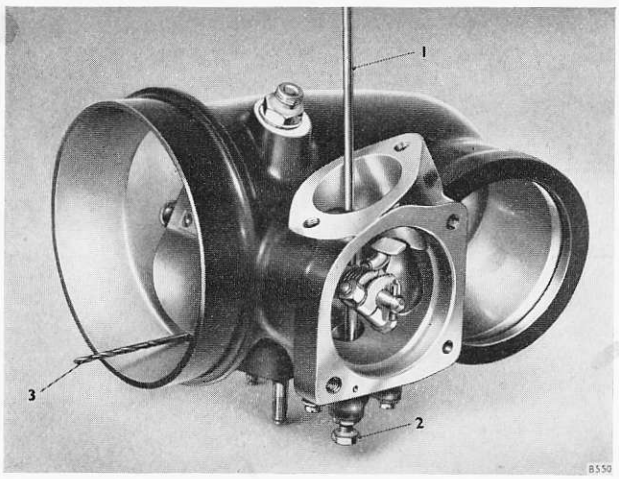


Fig. K20 Kick diaphragm adjustment — S2 cars

1. ROD HOLDING DOWN THE DEPRESSION LEVER
2. ADJUSTING SCREW
3. 0·100 in. (2·57 mm.) DRILL

Before starting the engine, depress the accelerator pedal; with a cold engine this will release the 'fast–idle' cam and allow the bimetal coils to close the butterfly valve. On releasing the accelerator pedal, the throttle stop rests on the high step of the 'fast–idle' cam, thereby giving a greater degree of throttle opening than is obtained from normal idling.

As the engine warms up the bimetal coils will start to open the butterfly, thereby allowing the throttle stop to rest on a lower step of the 'fast–idle' cam and giving a smaller degree of throttle opening.

Operation of the automatic choke solenoid is dependent on the underbonnet temperature of the car. If the temperature is below 15 deg. C, the 'Otter' temperature switch will be closed, completing the circuit. On switching the ignition 'On', the choke solenoid will be energised and will hold the choke butterfly valve closed. The thermal delay switch, wired in series with the solenoid and the temperature switch, is dependent on generator output: as the generator builds up to its full charge, the bimetal coil in the switch is heated and finally the switch breaks the circuit at 29½ deg. C.

The solenoid will then no longer hold the butterfly valve closed. Also, as soon as the engine is running the manifold depression acts on the rubber diaphragm, which in turn transmits its energy to the loose lever on the choke butterfly spindle. The solenoid choke lever

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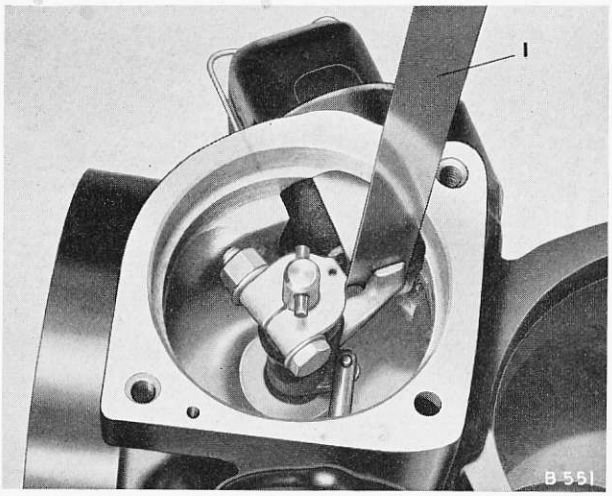


Fig. K21 Solenoid adjustment — S2 cars

1. FEELER GAUGE IN POSITION

and the depression lever are so fitted to the butterfly spindle that whilst the choke solenoid lever is held down by the solenoid, the depression lever can open the choke butterfly; the actual degree of movement being determined by the setting of the depression kick-gap.

Since the depression lever is slotted and its movement is limited, the butterfly spindle can over-ride the movement of the loose lever.

As the engine continues to run, the choke solenoid is cut out, and the movement of the choke butterfly is then controlled by the bimetal coils. The coils are temperature sensitive and heat is fed to them from the exhaust manifold stove. As the bimetal coils are heated, they gradually wind up, thus releasing the load on the butterfly spindle which will gradually open.

With the depression of the accelerator pedal for driving away, the 'fast–idle' stop on the throttle spindle will move away from the 'fast–idle' cam and the cam will fall onto the pick-up lever, coupled by a rod to the choke butterfly spindle.

The loading of the bimetal coil and the radiused section and offset of the choke butterfly have been arranged so that any required air flow greater than that for 'fast–idle' conditions will open the butterfly, against the loading of the bimetal coil, sufficiently for engine demand.

Automatic Choke — to set

S1 and S2 cars

Adjustments of kick diaphragm

Holding the choke butterfly closed, check the clearance between the depression valve operating link and the choke spindle pin. The clearance should be 0·010 in. (0·254 mm.) (see Figs. K18 and K19). The clearance can be adjusted by fitting washers on the diaphragm operating rod.

Adjustment of the kick-gap

The kick-gap should be set to give a reading of 0·100 in. (2·54 mm.) at the top of the choke valve.

To obtain this setting, proceed as follows:

Slacken the choke depression diaphragm locking nut (see Fig. K20). Ensure the choke is in the 'closed' position, then press down the depression valve operating lever so that the depression valve link rod bears against the end of the 2 B.A. adjusting screw.

The screw should then be adjusted so that a 0·100 in. (2·54 mm.) diameter rod or drill can be inserted between the butterfly housing and the butterfly valve (see Fig. K20). Tighten the adjusting screw lock-nut; re-check the kick-gap and adjust if necessary.

Re-fit the solenoid and shims to the butterfly housing.

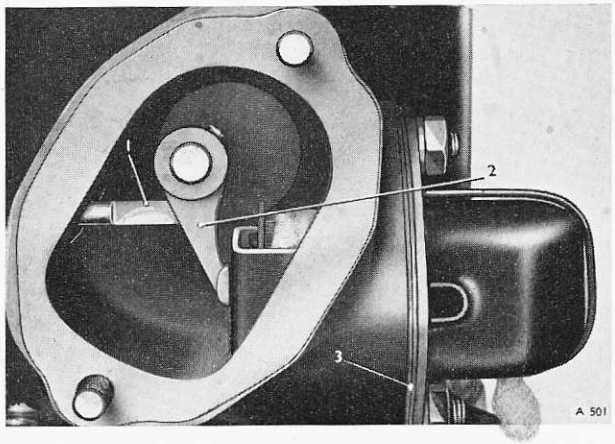


Fig. K22 Solenoid adjustment — S1 cars

1. DIAPHRAGM LINK ROD 2. BUTTERFLY LEVER 3. SHIMS

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Solenoid air gap

Hold the choke butterfly firmly closed. Check the air gap (between the solenoid lever and the solenoid) with a feeler gauge (see Fig. K21). This should be 0·0015 in. + 0·0025 in. (0·038 mm. + 0·063 mm.). Adjustment is effected by fitting shims between the solenoid and the body (see Fig. K22).

Solenoid lever spring tension setting

The spring tension should be set so that a weight of 8·25 oz. (233·88 gm.) acting on a 2 in. (50·8 mm.) arm will open the choke valve just sufficiently to allow a 0·062 in. (1·587 mm.) drill to be inserted between the valve and body as shown in Figure K23.

Having set the kick diaphragm travel and the solenoid air gap, check the setting of the lever spring as follows:

Produce a lever 2 in. (50·8 mm.) between centres to fit the choke spindle as shown in Figure K23. Secure the lever in a horizontal position, using a 2 B.A. nut and washer, connect a 12-volt battery to the solenoid and hang the weight on the lever; this should open the choke valve 0·062 in. (1·58 mm.) as described above.

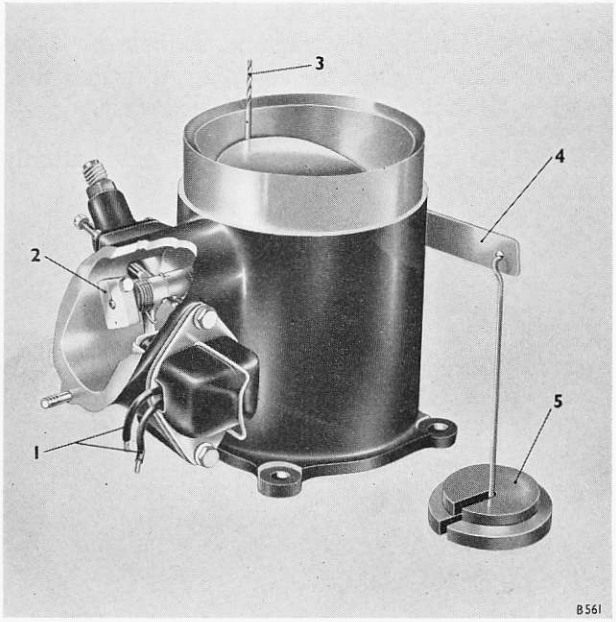


Fig. K23 Lever spring tension

1. CONNECT TO BATTERY
2. CLAMP ADJUSTER
3. ROD OR DRILL
4. LEVER
5. WEIGHT

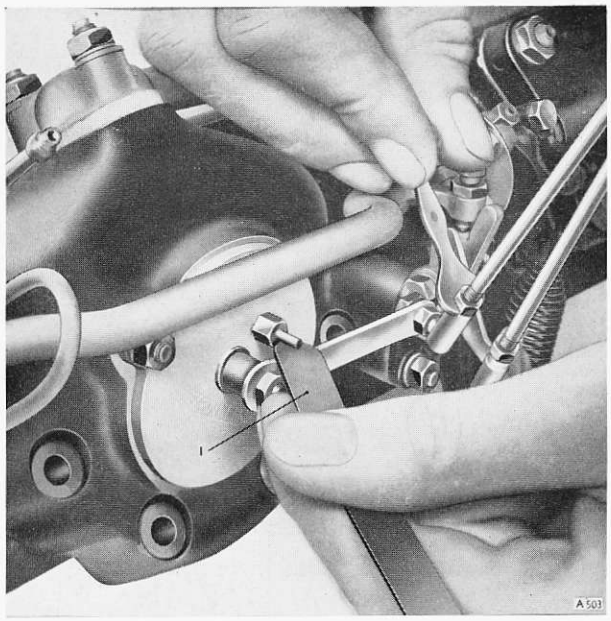


Fig. K24 Adjusting thermostat rod — S1 cars

1. FEELER GAUGE IN POSITION

Adjustment of the spring can be effected by slackening the clamping bolt and turning the clamp (see Fig. K23).

'Fast–idle' cam

Ensure that the 'fast–idle' adjusting screw is directly over the cam.

Remove the 'fast–idle' adjusting screw and ensure that the gap between the high step of the cam and the lever boss is 0·098 in. (2·489 mm.).

The 'fast–idle' cam position should be set so that there is a small clearance between the back face of the cam and the boss of the operating lever.

Adjustment of the cam is provided by lengthening or shortening the rod from the cam pick-up lever to the choke butterfly.

In cases of complaints of the car sticking on 'fast–idle' too long, when starting from cold, the clearance between the back face of the cam and the operating lever boss should be increased.

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Thermocoils

Adjustment of the thermocoils is carried out in a temperature controlled room and under no circumstances should re-adjustment be attempted without specific instructions from the factory.

The factory setting is indicated by a 'centre pop' opposite the pointer. Should any trouble be encountered this setting should be checked.

Adjustment of the thermostat linkage — S1 cars

Adjust the thermostat to butterfly rod to give a 0·031 in. (0·794 mm.) clearance between the lever and stop screw with the choke valve fully closed (see Fig. K24).

Carburetter — to set

Remove the carburetter suction chambers and pistons, taking care that the spring does not cause the piston and suction chambers to fly apart. Check that the needle shoulders are level with the piston base.

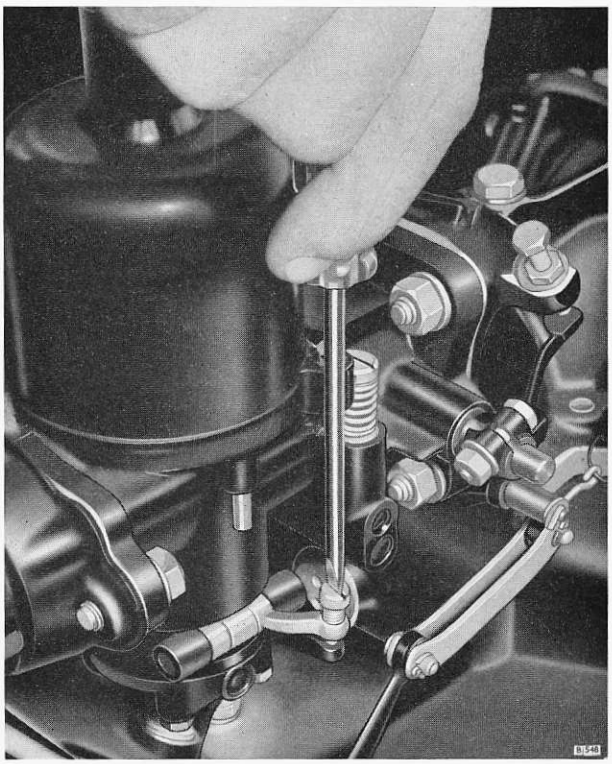


Fig. K25 Adjusting mixture control

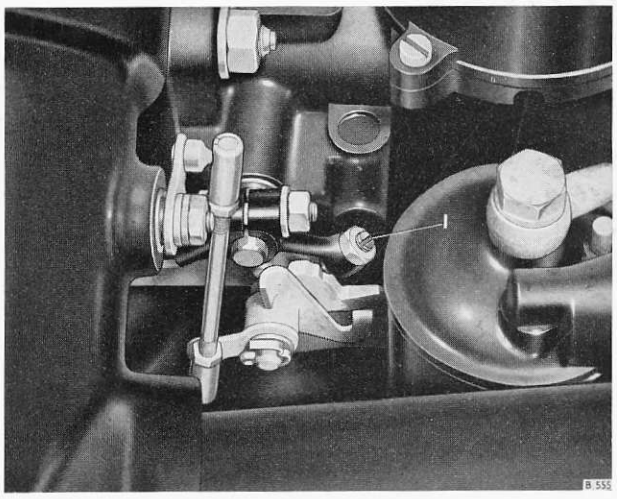


Fig. K26 'Fast-idle' adjustment — S2 cars

1. ADJUSTING SCREW

Check again that each piston is free to slide in its suction chamber.

With the suction chambers removed, roughly set the slow running as follows:

Screw down the idle bleed adjustment screw until its conical end bottoms, then turn the screw four complete turns anti-clockwise.

The mixture strength is regulated by the jet adjusting screw (see Fig. K25) and this should be unscrewed (anti-clockwise) until the jet just begins to tighten on the boss of the operating lever. Then screw it down 1½ turns.

Re-fit the suction chambers and top-up the damper reservoir with oil (see Chapter D).

Run the engine until normal running temperature is reached and carry out the final adjustments as follows:

Slow running: Set the slow running by adjusting the idle speed screws until the engine is running at approximately 400 r.p.m. to 425 r.p.m. for **S1 cars** and 450 r.p.m. to 500 r.p.m. for **S2 cars.**

It is important that both idle bleed screws are turned equal amounts whether it be clockwise to decrease engine speed or anti-clockwise to increase engine speed. If one screw is turned more than the other the carburetters will no longer be synchronised.

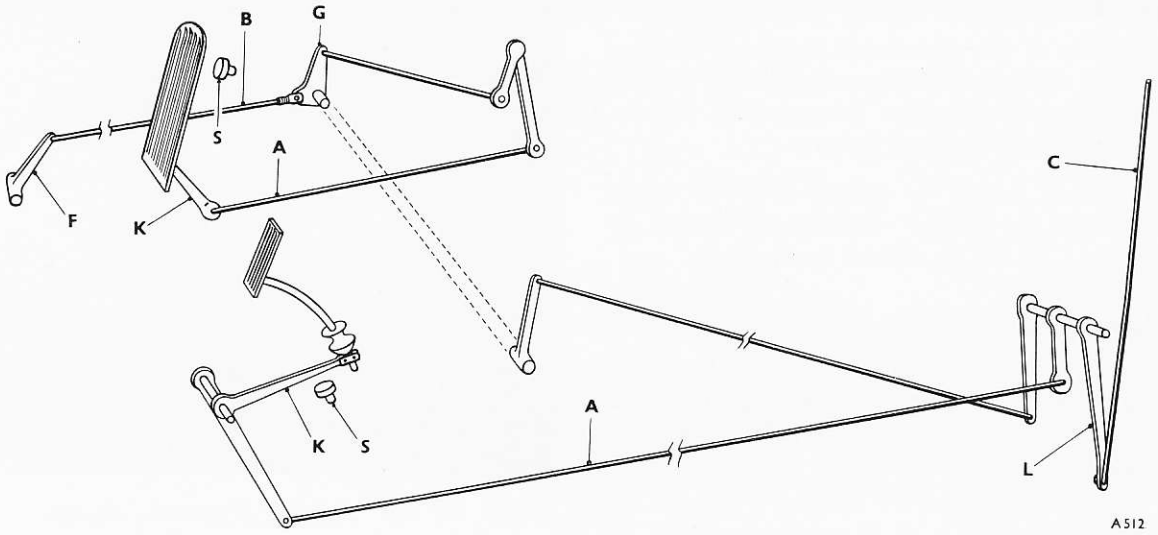


Fig. K27 Throttle valve linkage — early S1 cars

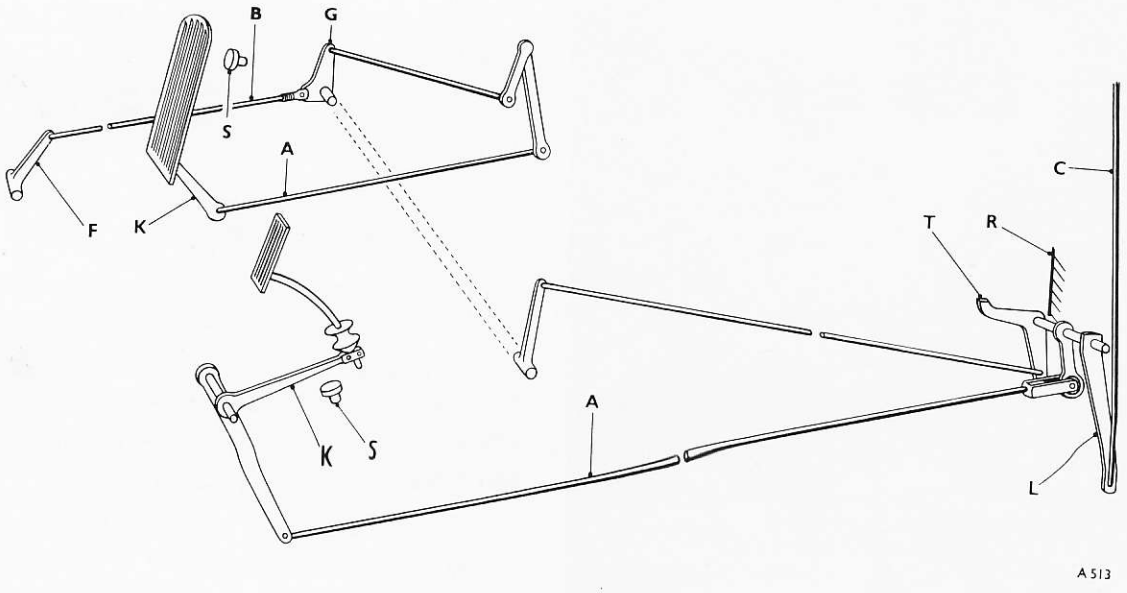


Fig. K28 Throttle valve linkage — late S1 cars

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Mixture adjustment: Slowly screw out the mixture adjusting screw on one carburetter (thereby enriching the mixture) until the engine starts to run roughly, then screw it in one full turn and repeat the procedure for the other carburetter.

It will now be possible to make finer adjustments to the mixture until the engine runs smoothly.

To check for a weak mixture, raise the piston very slightly, using the spring-loaded pin. If the mixture on that carburetter is weak the engine will speed up slightly. If the mixture is correct, the engine will begin to run roughly. Repeat for the other carburetter.

As a final check, raise the 'A' bank piston as high as possible with the spring-loaded pin. This will cut out this carburetter and cause the engine to run on 'B' bank carburetter only. If the engine stalls, richen the mixture very slightly on 'B' bank carburetter. Repeat the test on 'B' bank carburetter to test 'A' bank carburetter. If these tests prove satisfactory, re-check and if necessary set the idle speed.

Cold start engine speed

The cold start engine speed should be set with the engine at normal running temperature.

With the engine stopped, depress the accelerator; at the same time close the choke butterfly by hand. Release the accelerator; this will leave the throttles in the cold start position.

Ensure that the range selector lever is in position 'N'. **On S1 cars,** start the engine and set the speed to 1750 to 1800 r.p.m. **On S2 cars,** set the speed to 2000 r.p.m. This can be done by means of the fast idle lever adjusting screw (see Fig. K26). By slightly opening the throttles the cam will fall away; on releasing the throttles, the engine will idle normally.

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SECTION K5—THROTTLE VALVE CONTROL LINKAGE SETTINGS

Initial Control Settings—S1 cars

On early S1 cars, first disconnect rods A and B (see Fig. K27).

Check the distance between the rear face of the gearbox and the centre of the hole in lever F with the lever held forward to the limit of its travel. This should be 8·375 in. —0·060 in. (209·8 mm. —1·5 mm.). If necessary, remove the lever, and bend to suit.

Ensure that the choke is in the 'Off' position and the 'fast–idle' cam out of action. Adjust rod C so that the lever L hangs vertically or just rearwards of the vertical position. It is sufficient to position this lever by eye.

With lever F held forward to the limit of its travel, adjust rod B until it will just fit the hole in lever G, then lengthen rod B by $1\frac{1}{2}$ turns of the jaw.

Adjust the pedals of left- or right-hand drive cars as follows.

On right-hand drive cars adjust rod A so that in the full throttle position the accelerator pedal will just make contact with the pedal stop. Check that lever K is clear of the toe board in the closed throttle position.

On left-hand drive cars select one of the three holes in lever K which will give the nearest approximation to the 0·375 in. (9·525 mm.) clearance as shown in Figure K29. Connect rod A (using the selected hole), and adjust to give the 1·750 in. (44·450 mm.) dimension shown in Figure K29 in the throttle 'closed' position. Adjust the pedal 'on-stop' so that at full throttle the pedal will just make contact with it.

After the controls have been set initially it will be necessary to test the car on the road.

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On late S1 cars, to set the controls first disconnect rods A and B (see Fig. K28).

Check the distance between the rear of the gearbox and the centre of the hole in lever F with the lever held forward to the limit of its travel.

This should be 8·375 in. —0·060 in. (209·845 mm. —1·586 mm.). If necessary remove the lever and bend to suit.

Ensure that the choke is in the 'Off' position and the 'fast–idle' cam out of action.

Adjust rod C so that the lever L hangs vertically. This can be set by eye.

With lever F held forward to the limit of its travel, adjust rod B until it will fit the hole in lever G, then lengthen rod B by 1½ turns of the jaw.

Adjust the pedals of left- or right-hand drive cars as follows.

On right-hand drive cars hold the lever T in contact with the 'on-stop' R (carburetters in full throttle position) and with the accelerator pedal in contact with 'on-stop' S, adjust rod A so that it will just fit the hole in the pedal lever. Lengthen rod A by 0·250 in. (6·35 mm.) (8 turns).

On left-hand drive cars select one of the three holes in lever K, to give the nearest approximation to the 0·375 in. (9·525 mm.) dimension, as shown in Figure K29. Connect rod A (using selected hole), and adjust to give the 1·750 in. (44·450 mm.) dimension as shown in Figure K29. With the throttles closed, adjust the pedal 'on-stop' S so that the pedal will just make contact with it at the same time as lever T contacts the 'on-stop'. Raise the pedal 'on-stop' S by 2½ turns.

After the controls have been set initially it will be necessary to test the car on the road.

Road Test

With the engine and gearbox at normal running temperature, i.e. after approximately 5 to 10 miles (8 to 16 kilometres) select a suitable quiet stretch of road and proceed as follows:

Place the gear range selector lever into range 4; accelerate the car using light throttle and note the quality of the gear changes.

Gear changes should take place at the following speeds: first to second gear between 5 and 7 m.p.h. (8 and 11 k.p.h.), second to third gear between 10 and 13 m.p.h. (16 and 21 k.p.h.), third to top gear between 19 and 22 m.p.h. (30 and 36 k.p.h.).

It should be noted that the greater the throttle opening the higher will be the speeds at which the gear changes occur.

Starting the car from rest, apply full throttle and again note the quality of the gear changes.

Kick-down — to test

Choose a suitable section of road and with the car running at approximately 40 m.p.h. (64·37 k.p.h.) apply full throttle; 'kick-down' should occur just as the accelerator pedal touches the 'on-stop' S or it may require slight additional pressure. This should finally be set to the customer's requirements.

Kick-down should be obtained in top gear from speeds of 30 m.p.h. to 65 m.p.h. (48 to 105 k.p.h.) and should be tested at various speeds up to 65 m.p.h. (105 k.p.h.).

Jerky Gear Changes — to rectify

Jerky changes can be caused by excessive throttle valve pressure and can be overcome by shortening rod B one half turn at a time until satisfactory gear changes are obtained.

Slipping Gear Changes — to rectify

Slipping gear changes can be caused by insufficient throttle valve pressure. This can be overcome by lengthening rod B one half turn at a time until satisfactory changes are obtained.

Kick-down Adjustment — right-hand drive cars

When satisfactory gear changes are obtained, set the kick-down as follows:

Inability to obtain kick-down can be caused by insufficient travel of lever F towards the rear of the car and can be corrected by shortening rod A. In the case of the kick-down being too easy, lengthen rod A.

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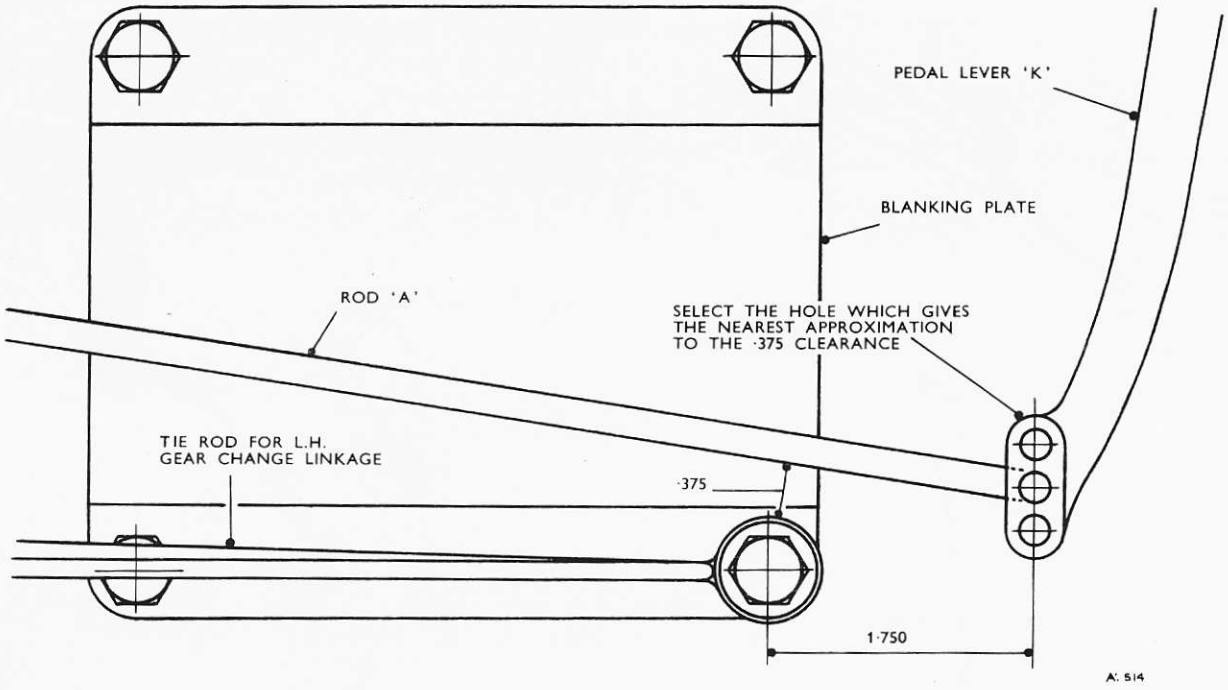


Fig. K29 Throttle valve linkage — S1 cars

Kick-down Adjustment — left-hand drive cars

The kick-down on left-hand cars is adjusted by means of the throttle stop S. To ease the kick-down, lower stop S and to make the kick-down harder, raise the stop S. Further adjustment may be effected by lengthening or shortening rod A.

Initial Control Settings — S2 cars

On right-hand drive S2 cars, first place the car on a ramp or over a pit then disconnect the T.V. rod 2 (see Fig. K30) at the gearbox end by removing the split pin and clevis pin.

Ensure that the choke is in the 'Off' position and the 'fast–idle' cam out of action.

Remove the split lever 1 by slackening the pinch bolt. Slacken the lock-nut on the 2 B.A. adjusting screw and adjust the screw so that it lies approximately half way through the lever.

Tighten the locking nut and re-fit the lever to the gearbox.

Detach rod 3 by removing the pinch bolts and ball joint adjusting screws. Check the distance between the ball joint centres as indicated in Figure K30. This should be approximately 6·200 in. (15·748 cm.).

Slacken the clamp bolts on the carburetter levers 7 and the throttle stop lock-nut. Screw out the throttle stop screw slowly until the joint 6 begins to toggle over. Screw in the throttle stop screw one full turn and lock the lock-nut.

Re-fit rod 3, ensuring that the clearance in the ball joints is a minimum, but that the joints are not tight.

Slacken the clamp bolt 5 on the manifold shaft and place a 0·3125 in. (7·9375 mm.) distance piece between the boomerang lever and the bell housing as indicated in Figure K30. If no assistance is available to hold this in position it may be secured with adhesive tape.

Hold the throttle stop lever 7 against the throttle stop screw and ensure that there is no end float in shaft 4 by pushing towards each other the two levers, then tighten the clamp bolt. Remove the

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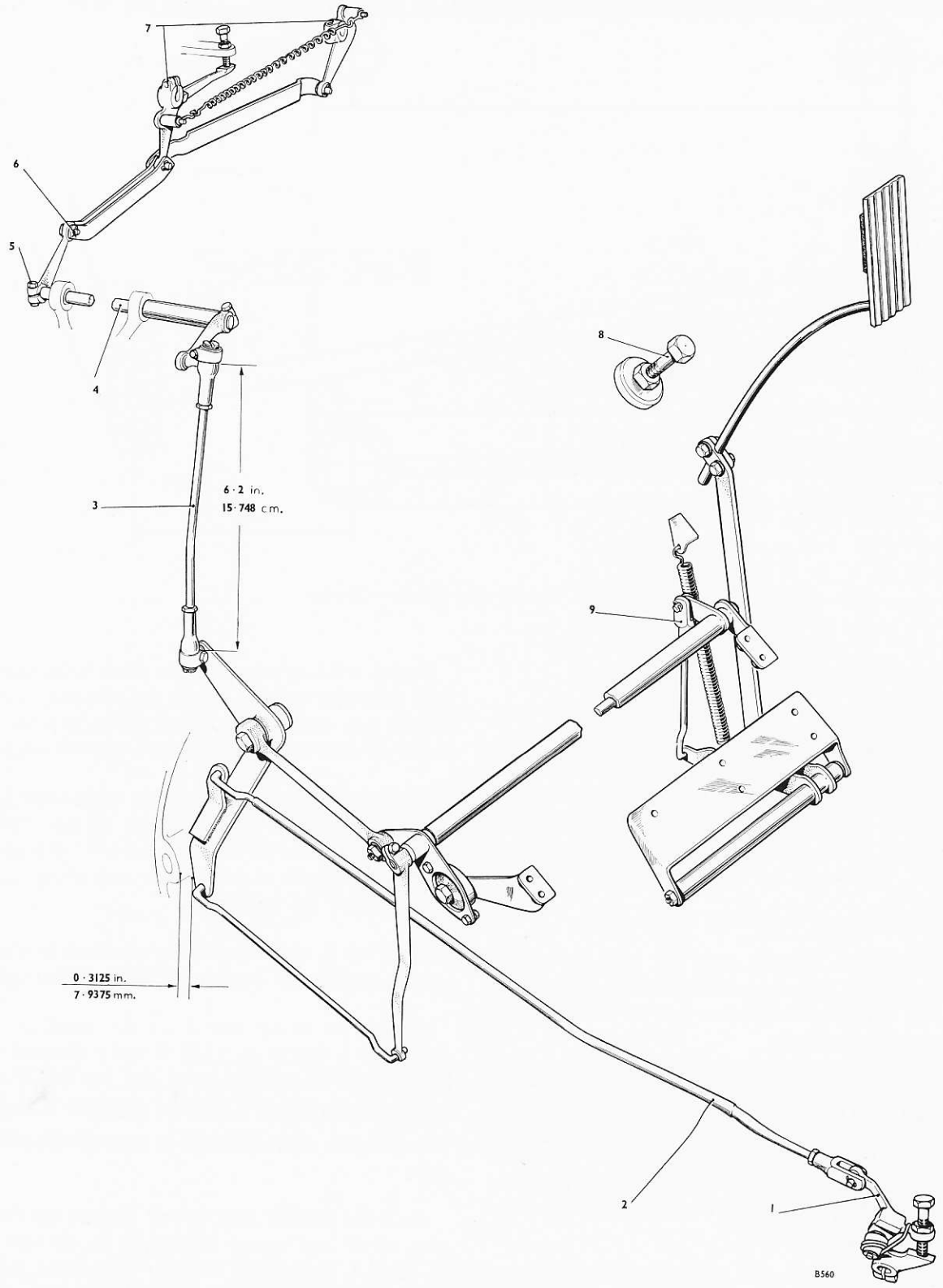


Fig. K30 Throttle linkage right-hand drive — late S2 cars

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0·3125 in. (7·9375 mm.) distance piece. Check that the boomerang lever does not foul the bell housing when it is released. If this occurs, the distance piece size must be increased to obviate this.

Adjust the T.V. rod 2 so that when the clevis pin is inserted into the hole in the split lever, the lever will be held forward to the limit of its travel. Shorten rod 2 by one full turn of the jaw and tighten the lock-nut.

It will now be necessary to synchronise the carburetters (see Section K3).

Before fitting the dashpots check that the butterflies are opening fully by depressing the accelerator pedal onto the full throttle stop.

If the butterflies do not open fully, screw down the full throttle stop 8 or shorten the rod 9. This is dependent upon the position of the accelerator pedal and the customer's requirements. If rod 9 is shortened, the pedal will be higher in the throttle closed position whereas if the stop is screwed down the pedal will be lower in the full throttle position. If the throttles open too wide, reverse the two adjustments.

Check throughout that the split pins, lock-nuts and pinch bolts are fitted and road test the car.

On left-hand drive cars, first place the car on a ramp or over a pit, then disconnect the T.V. rod 2 (see Fig. K31) at the gearbox end by removing the split pin and clevis pin.

Ensure that the choke is in the 'Off' position and the 'fast–idle' cam out of action.

Remove the split link lever 1 by slackening the pinch bolt. Slacken the lock-nut on the 2 B.A. adjusting screw and adjust the screw so that it lies approximately half way through the lever. Lock the 2 B.A. nut. Re-fit the lever to the gearbox.

Detach rod 3 by removing the pinch bolts and ball joint adjusting screws. Check the distance between the centre as indicated in Figure K31. This should be approximately 6·200 in. (15·748 cm.).

Slacken the clamp bolts on the carburetter levers 7, and the throttle stop lock-nut. Screw out the throttle stop screw slowly until the joint 6 starts to toggle over. Screw in the stop screw one full turn and lock the lock-nut.

Re-fit rod 3 ensuring that the clearance in the ball joints is at a minimum, but that the joints are not tight.

Slacken the clamp bolt on lever 5 on the manifold shaft and place a 0·250 in. (6·35 mm.) distance piece between lever 11 and the steady bracket boss 10 as indicated in Figure K31. If no assistance is available to hold this in position, it may be secured with adhesive tape.

Hold the throttle stop lever 7 against the throttle stop screw and ensure that there is no end float in shaft 4 by pushing towards each other the two levers then tighten the clamp bolt. Remove the 0·250 in. (6·35 mm.) distance piece.

Adjust rod 2 so that when the clevis pin is inserted into the hole in the split lever, the lever will be held forward to the limit of its travel. Shorten rod 2 by one full turn of the jaw and tighten the lock-nut.

It will now be necessary to synchronise the carburetters (see Section K3).

Before fitting the dashpots, check that the butterflies open fully, by depressing the accelerator pedal onto the full throttle stop.

If the butterflies do not open fully, screw down the full throttle stop 8 or shorten the rod 9. This is dependent upon the position of the accelerator pedal and the customer's requirements. If rod 9 is shortened the accelerator pedal will be raised; if the stop 8 is screwed in, the pedal will be lower in the full throttle position. If the throttles open past full throttle, then reverse the two adjustments.

Check throughout that all split pins, lock-nuts and pinch bolts are fitted, then road test the car.

Road Test

Run the car on the road for approximately 10 miles (16 km.) to warm the engine and gearbox to the normal working temperature.

Select a suitable quiet stretch of road and proceed as follows.

Place the gear range selector lever into position '4' and accelerate the car using light throttle. Note the

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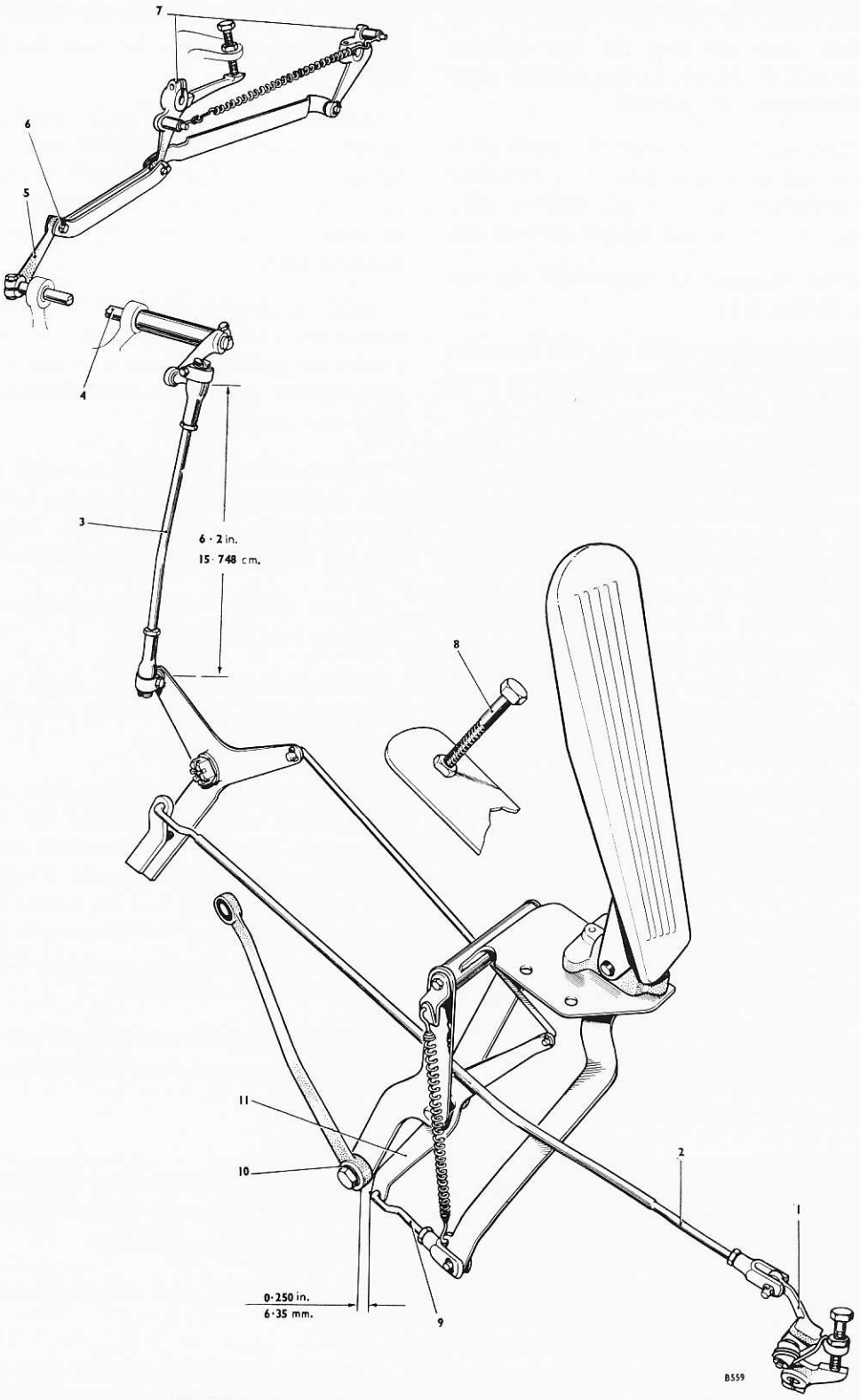


Fig. K31 Throttle linkage left-hand drive — late S2 cars

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quality of the gear changes: on light throttle these should take place as follows:

First to second gear at 7 to 9 m.p.h. (11 to 14·5 k.p.h.).

Second to third gear at 15 to 17 m.p.h. (24 to 27·5 k.p.h.).

Third to top gear at 22 to 24 m.p.h. (35·5 to 38·5 k.p.h.).

It should be noted that larger throttle openings cause the gear changes to be progressively delayed.

Jerky Gear Changes

If the gear changes are jerky or are delayed it will be necessary to adjust the screw on lever 1.

This may be carried out during the road test by first removing the rubber grommet from the floor to the left of the band adjustment blanking plate.

Slacken the lock-nut and screw out the 2 B.A. screw one quarter turn; lock the nut.

Repeat the previous test and adjust again if necessary.

This should be repeated until satisfactory gear changes are obtained.

Slipping During Gear Changes

Remove the rubber grommet from the floor. Slacken the lock-nut or lever 1 and screw in the 2 B.A. adjusting screw one quarter turn. Re-lock the nut. Repeat the test and if necessary adjust the screw again until satisfactory gear changes are obtained.

Kick-down

Choose a suitable section of road to do some fast driving. With the car running at approximately 40 m.p.h. (64 k.p.h.) apply full throttle. The car should kick-down just as the accelerator pedal touches the stop or it may require a slight squeeze. This should finally be adjusted to the customer's requirements. Kick-down should be obtainable from speeds of 30 m.p.h. (48 k.p.h.) to 70 m.p.h. (112·6 k.p.h.) and the car should be tested through this range.

To produce a more easily obtainable kick-down it will be necessary to adjust the accelerator pedal position. This can be effected either by lowering the stop 8 or shortening rod 9. If the kick-down is obtainable too easily, reverse either of these two adjustments. Kick-down should finally be set to the customer's requirements.

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CHAPTER K

FUEL SYSTEM AND CARBURETTERS

SECTION K1 — FUEL SYSTEM

Fuel tank
(Page K2 in Workshop Manual)

For S3 cars the paragraph headed 'All cars' to read
A vent pipe is fitted to the top of the fuel tank; the pipe is connected by a length of rubber hose to a further vent pipe which is fitted in the filler tube assembly. This eliminates the possibility of an air lock forming, when the tank is being filled.

Fuel tank — To remove and fit
(Page K3 in Workshop Manual)

For S3 cars the seventh and eighth paragraphs to read
Allow the tank to drop sufficiently for the rubber hose connected to the tank vent pipe to be removed. Remove the tank together with the fabric packing strips.

To fit the fuel tank, reverse the procedure adopted for its removal, making sure that the rubber hose is connected to the vent pipe as the tank is lifted into position.

SECTION K2 — THE FUEL PUMPS

Test data
(Page K6 in Workshop Manual)

On S3 cars both pumps operating together deliver 1 pint of paraffin in 28 seconds at a delivery head of 4 ft. and a suction lift of 2 ft. 6 in.

Mount the pump on a test rig 2 ft. 6 in. above a paraffin bath. Fit $\frac{5}{16}$ in. bore pipes to both the inlet and outlet unions of the pump; immerse the pipe connected to the inlet union in the paraffin bath and suspend the pipe connected to the outlet union 4 ft. above the pump unit. A measuring jar or receptacle of known capacity should be placed beneath the outlet union, and the delivery of the pump checked against a stopwatch.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

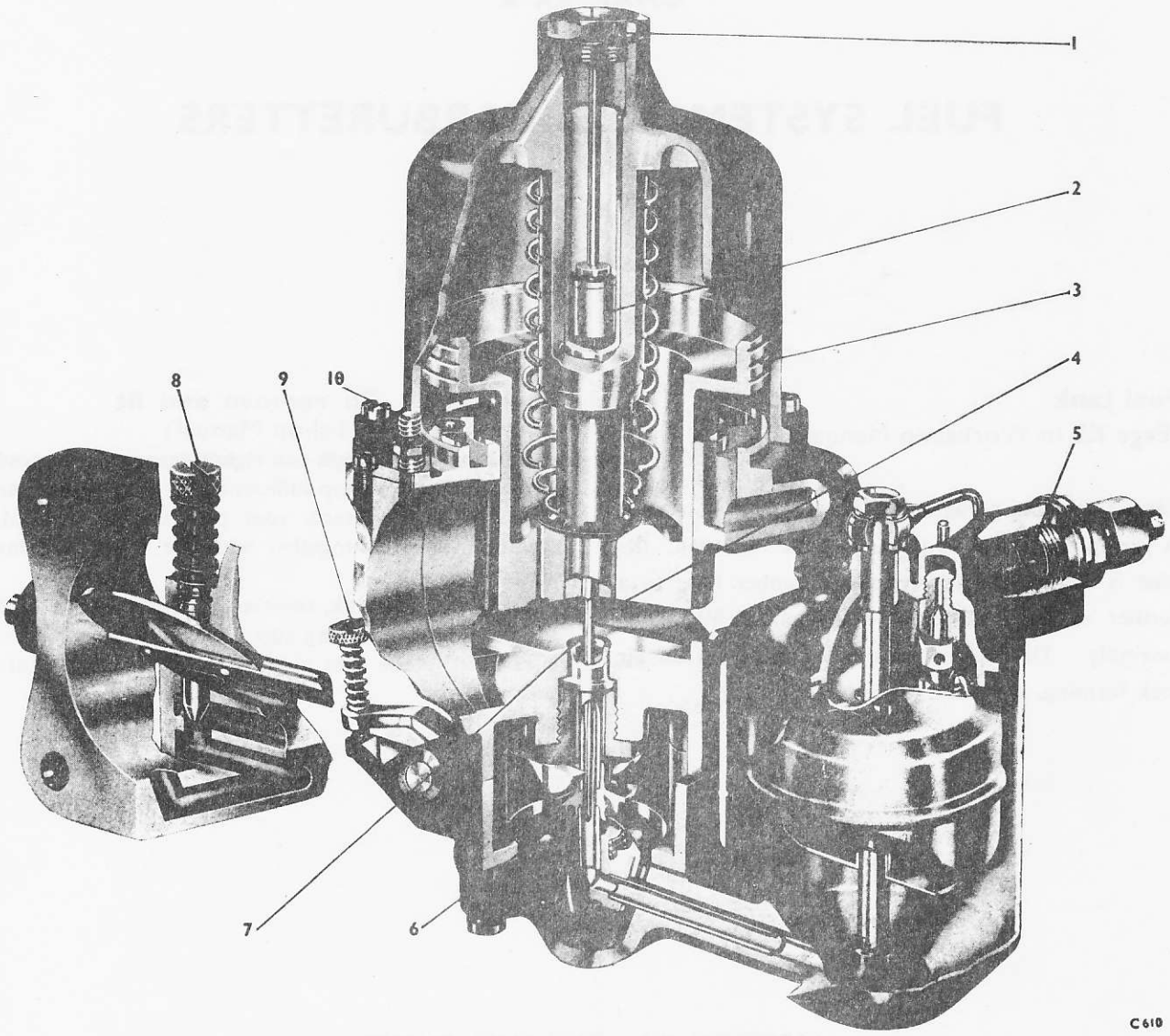


Fig. K1 (S) Cut-away view of one carburetter

1 OIL RESERVOIR CAP
2 HYDRAULIC DAMPER PISTON
3 AIR VALVE PISTON
4 NEEDLE
5 FILTER
6 DIAPHRAGM
7 JET
8 VOLUME ADJUSTMENT SCREW
9 JET ADJUSTMENT SCREW
10 VACUUM PIPE UNION

SECTION K 3 — AIR CLEANERS

S2 cars
(Page K7 in Workshop Manual)

S3 cars only

The air filter and silencer unit fitted may be either an oil soaked wire mesh element or a 'Purolator' paper element depending upon the destination of the car.

All cars destined for the following countries are fitted with a Purolator paper air filter element:

Africa (including Algeria, Egypt, Kenya, South Africa, Morocco, Sudan, Tunisia, Madeira, Tangiers, Nigeria, etc.) also Asia (including India, Turkey, Iran, Iraq, Syria, Lebanon, Israel, Jordan, Hong Kong, etc.) also Australia, New Zealand, Spain, Portugal, Greece, Yugoslavia, Gibraltar, South America, Jamaica, Bahamas and Mexico.

The Purolator element of this filter should be renewed every 12,000 miles (20,000 Kms.).

All cars destined for countries other than those previously listed are fitted with an oil wetted wire mesh air filter element.

Every 6000 miles (10,000 Kms.) the filter should be removed and washed thoroughly in petrol.

After washing, all surplus petrol should be removed by blowing through the filter from the inside with a high pressure air line.

The filter should then be completely immersed in engine oil and allowed to soak for a period of approximately five minutes and afterwards allowed to drain for a period of two hours.

Refit the element to the silencer.

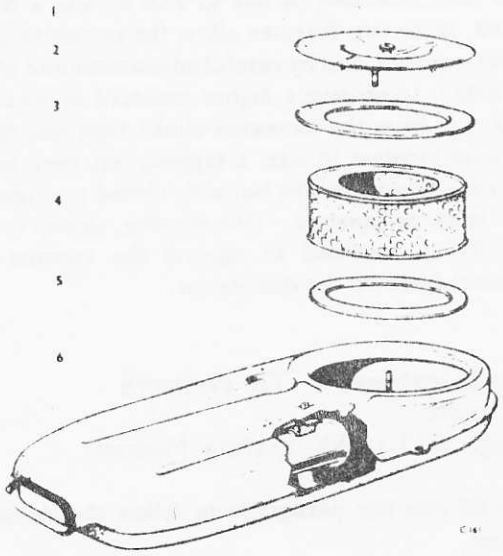


Fig. K2 (S) Exploded view of air filter

1 KNURLED NUT
2 COVER
3 JOINT WASHER
4 FILTER ELEMENT
5 JOINT WASHER
6 SILENCER

SECTION K 4 — THE CARBURETTER AND AUTOMATIC CHOKE SYSTEM

Data
(Page K9 in Workshop Manual)

S3 cars only

Carburetter S.U. HD8 diaphragm type
Choke size 2·00 in. (50·80 mm.) dia. bore.
Jet size 0·125 in.
Jet needle U.S.

S3 cars only

Two HD8 diaphragm carburetters with 2·00 in. choke bores are fitted to the engine on a central 'Tee' piece which is mounted over an eight-branch induction manifold.

Whilst operating on the same principles as the HD6 carburetter fitted to the S2 engine, the HD8 carburetter embodies a number of differences. The choke bore has been increased in size to 2·00 in. and a larger jet fitted, these two features allow the engine to produce greater power, and by careful adjustment and attention to detail, to achieve a higher standard of economy.

Apart from the increased choke bore and resultant general increase in size, a tapping has been provided immediately above the butterfly closed position on the 'A' bank carburetter. This tapping, shown in Figure K1 (S), is provided to operate the vacuum timing control fitted to the distributor.

Carburetters — To remove
S2 cars
(Page K13 in Workshop Manual)

For S3 cars this paragraph to follow the eighth paragraph.

Remove the closed circuit engine breather from the butterfly housing and from the oil filler pedestal.

Carburetters — To fit

S3 cars only

To fit the carburetters reverse the procedure given for removal noting the following points.

New gaskets to be fitted to all the joints.

Clean the flame traps in the crankcase breather tube by washing them in petrol and drying them with a high pressure air line.

Before refitting the union to the oil filter pedestal check the condition of the rubber sealing ring and renew if necessary.

Automatic choke system
(Page K16 in Workshop Manual)

For S3 cars the fourth feature to read

A 'fast-idle' cam, loose coupled to a pick-up lever which is in turn connected to the butterfly spindle. The 'fast-idle' cam has only two steps, the second of which is tapered to provide a progressive closing of the throttle.

'Fast-idle' cam
(Page K18 in the Workshop Manual)

For S3 cars the second paragraph onward to read

Remove the 'fast-idle' adjusting screw and ensure that a clearance of approximately $\frac{1}{16}$ in. exists between the cam link which is mounted alongside the 'fast-idle' cam and the boss on the carburetter 'fast-idle' lever.

Insufficient clearance at this point could result in the cam link fouling the 'fast-idle' lever. In the event of this happening the 'fast-idle' lever would be prevented from returning to the throttle closed position, thus causing a fast idling speed.

Ensure that the throttles are closed.

Screw down the 'fast-idle' adjusting screw until it just makes contact with the high step of the cam.

Place a 0·100 in. drill between the short side of the choke butterfly and the choke housing, as for setting the kick-gap.

With this drill in position adjust the length of butterfly rod so that the tip of the 'fast-idle' screw rests on the edge of the high step of the cam (i.e. the position when the tip of the adjusting screw is about to fall from the high step to the low step).

Remove the 0·100 in. drill from the choke housing.

Carburetter — To set
(Page K19 in Workshop Manual)

For S3 cars the fourth paragraph onward to read

Screw down each idle bleed adjusting screw, shown in Figure K3 (S) of this Supplement, to the full extent of its travel, then unscrew $1\frac{1}{2}$ turns.

The mixture strength is regulated by the jet adjusting screw, shown in Figure K3 (S) of this Supplement, which should be manipulated until the jet is level with the top of the bore in which it is located. Then screw the adjusting screw two complete turns down.

Fit the suction chambers and top-up the damper reservoir with oil. See Chapter D in this Supplement.

Run the engine until normal operating temperature is reached and carry out the final adjustment as follows.

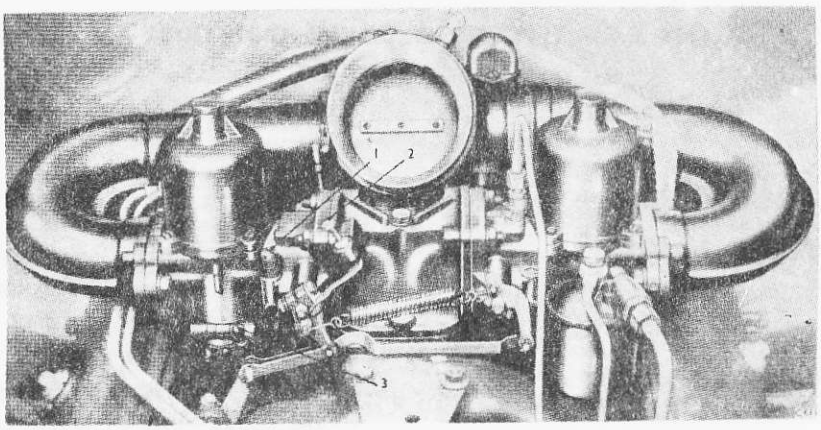


Fig. K3 (S) The carburetters

1 VOLUME ADJUSTMENT SCREW 2 THROTTLE STOP SCREW

3 JET ADJUSTMENT SCREW

Slow running — To adjust

Engage the refrigeration compressor (if fitted).

Adjust the mixture control screw on each carburetter until the smoothest running of the engine is obtained. Turning the screw clockwise lowers the jet and richens the mixture; turning the screw anti-clockwise raises the jet and weakens the mixture.

Then using the volume screws balance the carburetters so that the hiss heard from each carburetter is of equal intensity. The volume screws should only be adjusted within the range, fully closed to two complete turns up, otherwise an obtrusive whistle from the carburetters may result.

After balancing the carburetters with the volume screws, adjust the slow running by means of the throttle stop screw to the maximum speed that will not cause the car to creep when in gear. This is usually in the order of 475 r.p.m. in neutral and 450 r.p.m. in gear. After adjusting the slow running speed, lock the throttle stop screw by means of the lock-nut.

Cold start engine speed

(Page K21 in Workshop Manual)

For S3 cars the following three paragraphs should be read in place of the eleventh

Ensure that the gear change selector is in the neutral 'N' position.

Check to see that the 'fast-idle' adjusting screw is resting on the high step of the cam, then using the 'fast-idle' adjusting screw adjust the engine speed to 1850 r.p.m. Lock the adjusting screw by means of the lock-nut and recheck to ensure that the engine speed is still 1850 r.p.m. By slightly opening the throttles the cam will fall away; on releasing the throttles the engine will idle normally.

Where the engine is required to start below a temperature of 10°F. (—12°C.) the 'fast-idle' speed should be set to 2000 r.p.m.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

SECTION K5 — THROTTLE VALVE CONTROL LINKAGE

Throttle valve control linkage settings

(Page 21 in Workshop Manual)

S3 cars

Throttle valve control settings which apply to S2 cars are also applicable to S3 cars.

The closed circuit engine breather — S3 cars

The engine crankcase is ventilated through a breather pipe connected at one end to the rear of the oil filler pedestal and the other end to the choke butterfly housing. On a number of early S3 cars the breather pipe is connected on the engine side of the choke butterfly; on later S3 cars the pipe is positioned on the air cleaner side of the choke butterfly.

The breather pipe is of double skin construction with insulating material sandwiched between the two skins to prevent condensation forming on the inside of the tube.

A flame trap in the form of six gauze filters is incorporated in the union at the oil filler pedestal end of the breather tube. Every 24,000 miles, the filters in the flame trap should be removed and cleaned.

Breather pipe — To remove

Remove the setscrews securing the breather pipe union to the oil filter pedestal; disconnect the union from the pedestal (slight pressure may be felt owing to the rubber joint on the union).

Remove the setscrews securing the breather pipe to the choke butterfly housing.

Disconnect the pipe from the engine.

Remove from the pipe the union containing the flame trap.

Remove the filters and wash them in clean petrol, then dry them with a high pressure air line.

Breather pipe — To assemble

To assemble the crankcase breather pipe reverse the procedure given for its removal, noting the following points.

Before refitting the union to the oil filler pedestal check the condition of the rubber sealing rings and renew if necessary.

Check the condition of the sealing ring in the union at the choke butterfly housing end of the breather pipe; renew if necessary.

Check the aluminium washer on the centre securing bolt; renew if damaged.

CHAPTER L

ENGINE COOLING SYSTEM

SECTION LI — DATA

Capacity	Imperial	U.S.	Litres
Silver Cloud, Bentley S1	28 pints	33·61 pints	15·91
Bentley Continental S1	27 pints	32·43 pints	15·34
Silver Cloud II, Bentley S2, Bentley Continental S2	21 pints	25·21 pints	11·93
Phantom V	23 pints	27·60 pints	13·07

Pump — Centrifugal

Pump Drive

S1 cars with manual steering	Single belt 47·75 in. × 0·625 in.
S1 cars with power-assisted steering	Twin belts 46·25 in. × 0·625 in.
S2 cars	Twin belts 46·00 in. × 0·406 in.

Fan — Five blade

S1 cars	17¾ in. dia.
S2 cars	18 in. dia.

Thermostat

'Summer' opening temperature of:		
S1 cars with interior cooling system	70–73 deg. C	158–163 deg. F
S1 cars without interior cooling system	75–77 deg. C	167–171 deg. F
S2 cars	66–70 deg. C	151–158 deg. F
'Winter' opening temperature of:		
S1 cars with interior cooling system	75–80 deg. C	167–176 deg. F
S1 cars without interior cooling system	84–86 deg. C	183–187 deg. F
S2 cars	76–80 deg. C	169–176 deg. F

Radiator — Fixed shutters

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SECTION L2 — COOLING SYSTEM

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Description

The engine cooling system comprises two principal components; a brass matrix and a centrifugal pump. The pump is driven by the crankshaft through single or twin 'Vee'-belts. **On S1 cars** fitted with power-assisted steering and **on all S2 cars** twin belts are used.

A balanced, five-bladed fan is mounted on the pump shaft and is driven by the pump driving belts.

On standard S1 cars a steam valve incorporated in the radiator header tank maintains the cooling system at atmospheric pressure. **On all S2 cars and S1 cars** fitted with the Rolls-Royce Interior Cooling System the pressure is maintained at 7 lb/sq.in.

On assembly, the system is filled with a mixture of water and 25 per cent anti-freeze. This mixture is adequate for use in temperatures down to 10 deg. F, but for complete protection in more severe weather conditions, a higher percentage of anti-freeze is necessary.

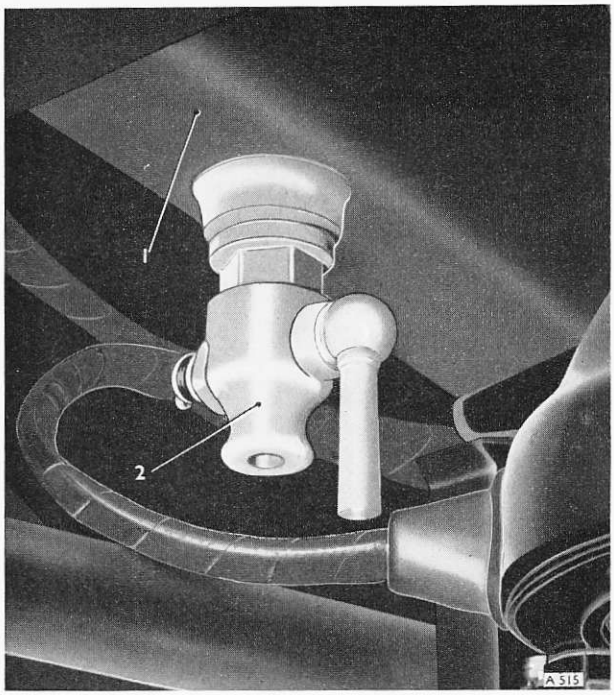


Fig. L1 Radiator drain tap — S1 cars

1. RADIATOR BOTTOM TANK 2. DRAIN TAP — 'OFF' POSITION

In addition to providing protection against frost, approved anti-freeze contains inhibitors to prevent corrosion of the coolant passages; it is therefore essential to use an anti-freeze mixture all the year round in all parts of the world; water alone must never be used. In hot climates, anti-freeze has the additional advantage of raising the boiling point of the coolant.

One of the inhibitors, NaMBT (sodium mercapto-benzothiazole), is consumed during the first 1500 miles in the life of a car. This should be replenished from the sachet of NaMBT supplied with each new car. Whenever any part of the cooling system is renewed, a fresh sachet of NaMBT should be added to the coolant.

These sachets can be obtained from Rolls-Royce Limited.

Due to deterioration of the inhibitors, the cooling system should be flushed annually and the coolant renewed (see page L18).

On S1 cars, coolant from the pump is circulated through a water gallery running along the exhaust side of the cylinder block.

The gallery is made of brass and along its upper surface slots of irregular length are provided to ensure even distribution of coolant around the exhaust valve seats. Coolant returns from the cylinder block past the thermostatic valve and into the radiator header tank. Coolant from the cylinder block also circulates around the carburetter choke thermostat housing in the induction manifold and is returned to the system through a $\frac{1}{2}$ in. dia. pipe connecting the manifold to the coolant pump.

On S2 cars, coolant from the pump is delivered through transfer tubes in the pump casing, and circulates around the 'wet' cylinder liners. Coolant leaves the cylinder block through passages cast integrally with the inlet manifold and flows past the thermostat valve to the radiator header tank.

Under cold ambient conditions, the closed thermostat assists rapid warming-up by causing the warm coolant from the engine to by-pass the radiator. This is achieved by passing the coolant through a hose from the thermostat housing direct to the pump. The warm coolant is then recirculated through the engine.

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On all S1 and S2 cars a coolant temperature indicator mounted on the facia is electrically operated by a bimetallic transmitter unit screwed into the thermostat housing. The indicator registers the coolant temperature when the ignition is switched on and registers 'Hot' when the ignition is off. The bimetallic transmitter is a sealed unit and if faulty must be renewed. If a unit is suspected of being faulty, its performance should be checked against that of an instrument known to be in good condition.

Cooling System — to drain

The cooling system should contain anti-freeze and if it is intended to use the coolant again, it should be drained into a clean container and stored.

To drain the system, remove the radiator filler cap and open all the drain taps.

On S1 cars two drain taps are provided, one tap is fitted to the radiator bottom tank and the other to the cylinder block (see Figs. L1 and L2).

On S2 cars three drain taps are provided, one tap is fitted to the radiator bottom tank and one tap is fitted to each cylinder bank (see Figs. L3 and L4).

Cooling System — to flush

Remove the radiator cap and open all the drain taps situated on the cylinder block or radiator bottom tank.

Radiator

Remove the hoses, fit a waste pipe to the upper connection and apply water under pressure through the lower connection. Mains water pressure should remove any sediment in approximately half an hour.

Engine

Remove the drain tap(s) from the cylinder block, remove the thermostat cover and withdraw the thermostat, then re-fit the cover: **on S2 cars** note the position of the thermostat in the body to ensure correct re-fitting.

Fit a suitable waste pipe and apply water under pressure to each drain tap aperture in turn; continue flushing for approximately half an hour or until the water runs clear.

Re-fit the drain tap(s) to the cylinder block and re-fit the thermostat; fit the cover, using a new gasket.

Examine all the rubber hoses and re-fit if in a serviceable condition. Renew any hose which shows signs of deterioration.

Using a fresh anti-freeze mixture fill the system slowly in order to avoid air locks.

To ensure uniform distribution of the anti-freeze mixture throughout the system, start the engine and allow time for it to reach normal operating temperature; stop the engine and again check the level of the coolant.

Examine all hoses for leaks.

Under no circumstances must any strong alkaline compound or detergent be used to clean the system. Several such compounds are available but their use must be carefully avoided as they have a detrimental chemical action on aluminium alloys.

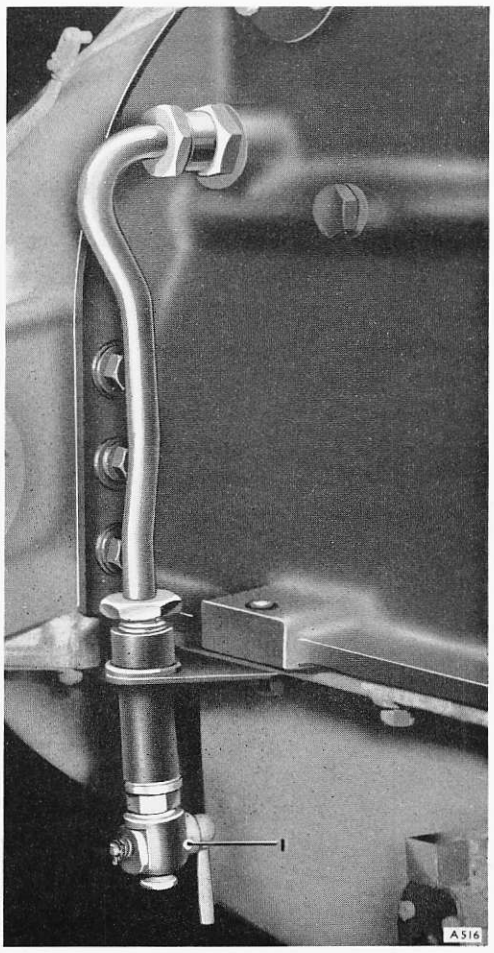


Fig. L2 Cylinder block drain tap — S1 cars

1. DRAIN TAP

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SECTION L3—RADIATOR

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Description

The dimensions of matrices fitted to S1 and S2 cars are as follows:

	Surface Area	*Dimensions*
Silver Cloud and Bentley S1 Silver Cloud II and Bentley S2 Phantom V	449·675 sq.in.	22·625 in. × 19·875 in. × 2·283 in.
Continental S1	420·350 sq.in.	20·150 in. × 19·875 in. × 2·283 in.
Continental S2	400·000 sq.in.	20·125 in. × 19·875 in. × 2·283 in.

The radiator is mounted on a Silentbloc-bushed bracket which is secured by a single bolt to a bracket welded to the front cross member. The assembly is supported by tubular struts, attached by weld nuts to the support straps which are sweated to the header and bottom tanks (see Fig. L5).

A transverse tubular strut, bolted between the upper ends of the longer diagonal struts, increases stability; further stabilising struts are fitted between the Silentbloc-bushed bracket and each valance panel.

The radiator is provided with a pressure control valve which is fitted into the header tank. The valves control the pressure by releasing excess steam past a spring-loaded seat into an escape pipe which is open to the atmosphere.

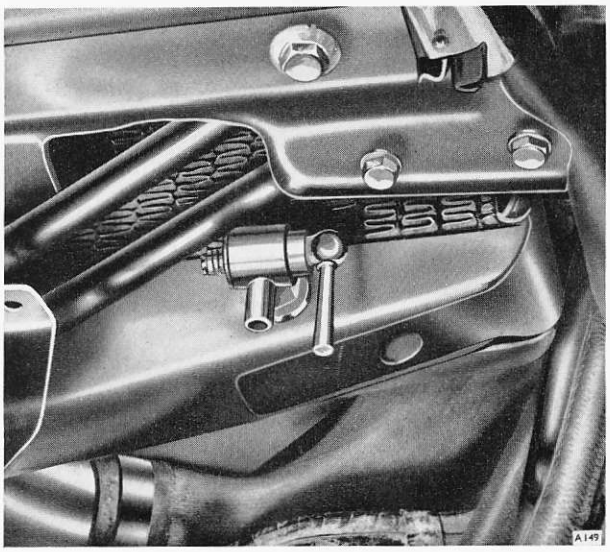


Fig. L3 Radiator drain tap — S2 cars

On standard S1 cars, the control valve operates at atmospheric pressure.

On S1 cars fitted with a refrigeration unit, the control valve operates between $6\frac{1}{4}$ and $7\frac{1}{4}$ lb/sq.in.

On all S2 cars, the A.C. Delco control valve operates between $6\frac{1}{4}$ and $7\frac{1}{4}$ lb/sq.in. and in addition contains a reversible seal which acts as a vacuum valve, which opens at 1 lb/sq.in. below atmospheric pressure. If this valve is found to be faulty it should be discarded and new one fitted.

A feature of the radiator is the provision for direct return of coolant from the car heating and de-misting systems. The coolant is returned direct to the **bottom** tank by brass pipes which are brazed to blind adapters attached to the header tank. A negligible amount of coolant is allowed to enter the header tank through a $\frac{1}{16}$ in. (0·062 in.) bleed hole in each adapter which is provided to eliminate air locks in the return pipes.

Rubber hoses are used to connect the radiator to the coolant pump; these are secured in position by worm drive clips.

On S1 cars, both radiator pipes are brass and have an outside diameter of $1\frac{1}{4}$ in. and are of 18 S.W.G. (0·048 in.).

On S2 cars, both radiator pipes are brass and have an outside diameter of $1\frac{1}{2}$ in.; the header tank pipe being 18 S.W.G. (0·048 in.) while the bottom tank pipe is of 20 S.W.G. (0·036 in.).

A large bakelite radiator filler cap, which screws into the filler boss, has coarse threads for quick removal.

The engine should at all times be stopped before the filler cap is removed.

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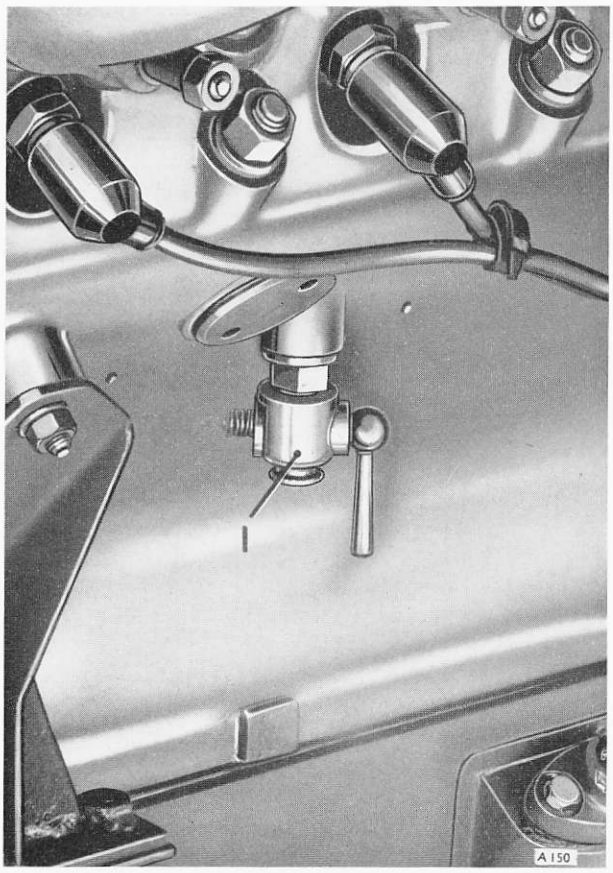


Fig. L4 Cylinder block drain tap — S2 cars

1. DRAIN TAP

Radiator — to remove

Care must be taken when removing the radiator to avoid accidental damage to chromium surfaces and paintwork.

Drain the coolant into a clean container (see Cooling System — to drain).

Unlock the bonnet on both sides and remove the bonnet assembly.

Slacken the worm drive clips and remove the hoses from the header and bottom tanks.

On S1 cars, remove the heater and de-mister hoses from the return pipes on the radiator.

Remove the front apron and radiator shell.

Remove the bolts securing the radiator tubular stays to the valance panels.

Support the radiator and remove the bolt from the Silentbloc bush.

Remove the radiator from the car.

Radiator — to fit

Fit the radiator, reversing the procedure given for its removal, noting the following points.

Examine all hoses for deterioration and if they are not in a serviceable condition, new ones should be fitted.

Fill the system with fresh coolant containing the correct percentage of anti-freeze mixture: the coolant should be poured in slowly in order to avoid air locks.

Radiator — to flow-test

A flow test can be carried out while the radiator is in position in the car. A simple reservoir is necessary for this operation and can be constructed as described in the following paragraph.

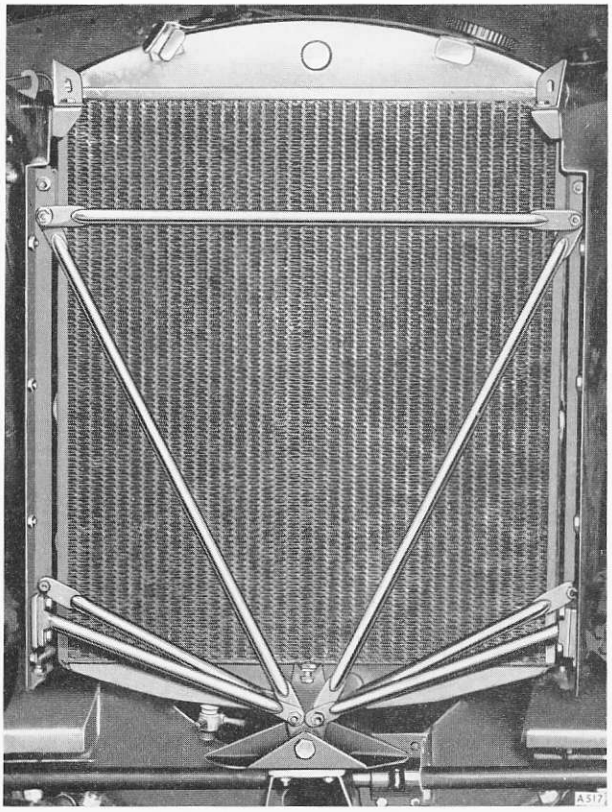


Fig. L5 Radiator matrix supports

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Obtain an 18-gallon container, such as a clean oil drum from which the top has been removed, and weld a length of tube into the bottom of the container to serve as an outlet pipe (the tube should be 2 in. long and have an internal diameter of 1 in.). Using suitable hoses and clips, attach to the outlet pipe a sight glass of the same bore, approximately 4 in. long.

Mount the container on a suitable stand so that the centre of the container is 3 ft. above the radiator inlet pipe (see Fig. L6) and connect the lower end of the sight glass to the inlet pipe on the radiator header tank.

Fit suitable rubber bungs or caps to the radiator outlet pipe on the bottom tank. Rubber bungs or caps will also be required for the heater and de-mister pipes on S1 cars.

Pour water into the container until both the radiator matrix and the container are full.

Remove the bung from the radiator outlet pipe then record the time taken for the **container only** to drain by observing cessation of flow through the sight glass.

If the radiator is in 100 per cent condition the time taken for the 18-gallon container to drain is as follows:

Silver Cloud and Bentley S1 Silver Cloud II and Bentley S2 Phantom V	54 seconds
Bentley Continental S1	50 seconds
Bentley Continental S2	48 seconds

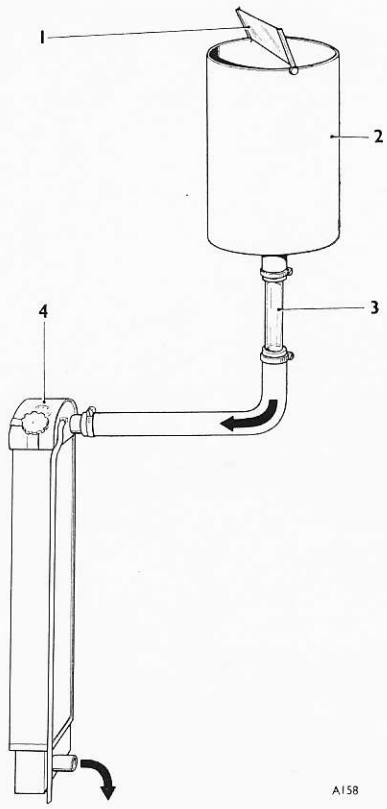


Fig. L6 Matrix flow testing rig

1. MIRROR
2. 18 GALLONS CONTAINER
3. OBSERVATION TUBE
4. RADIATOR

If the flow time exceeds the above figures by 25 per cent, a restriction in the system is indicated and must be cleared.

SECTION L4 — THERMOSTAT

Description

The thermostat comprises a sealed brass bellows which is held in position in a bridge piece by an adjusting screw and a lock-nut. The bridge piece is secured to the thermostat body by four screws.

A dished valve, which seats on top of the thermostat body, is sweated to the upper end of a spindle which passes through the body and is attached at its lower end to the top face of the bellows (see 1, Fig. L7).

The valve incorporates a vent hole containing a 'jiggle' pin. This vent allows air to escape while the cooling system is being replenished, thus avoiding air locks. When the system is full, the 'jiggle' pin rises to close the vent against the passage of coolant (see Fig. L7).

An increase in temperature of the coolant causes the bellows to expand and open the valve. A decrease in temperature causes the bellows to contract and close the valve.

Movement of the valve is thus proportional to the coolant temperature and controls the flow of coolant through the thermostat housing to suit the cooling requirements of the engine.

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The valve has a minimum stroke of 0·275 in. and is 1·310 in. in diameter. The bore of the coolant passage in the main body of the thermostat is 1·251 in. in diameter.

The by-pass valve is fully open when the dished valve is closed (see 4, Fig. L7) and allows the coolant to circulate around the engine only, excluding the radiator.

Thermostat — to remove

Drain approximately half the coolant into a clean container.

Remove the four $\frac{1}{4}$ in. setscrews (or nuts on S1 cars) securing the thermostat cover to the housing and move the cover to one side. It is not necessary to remove the hose as it is sufficiently flexible to allow the desired movement (see Fig. L8).

Remove the thermostat housing. Two 3 B.A. tapped holes are provided in the thermostat body to allow bolts to be fitted for easy withdrawal.

A number of thermostats were supplied with 2 B.A. holes and so, to avoid damage to the holes, care must be taken to ascertain the size of withdrawal bolts required before attempting removal. Under no circumstances must a screwdriver or similar tool be used to lever out the thermostat.

Thermostat — to test

A thermostat which is suspected of being faulty can be tested as follows.

Suspend the thermostat and a thermometer in a container of water so that they are completely immersed; they must not be allowed to touch the bottom of the container as this will cause a false reading.

Gradually heat the water and stir it to ensure that the water and thermostat are of a uniform temperature. Note the temperature at the point when the valve begins to open; movement of the valve should be smooth.

The opening temperature setting has been accurately determined by the manufacturers and no attempt should be made to adjust the thermostat.

If the thermostat does not function correctly, do not attempt to repair it; a new one must be fitted.

On S1 cars, the thermostat is marked either 'Summer' or 'Winter'. The 'Summer' thermostat is the standard fitting; the 'Winter' unit is provided for use in countries which experience severe winter conditions.

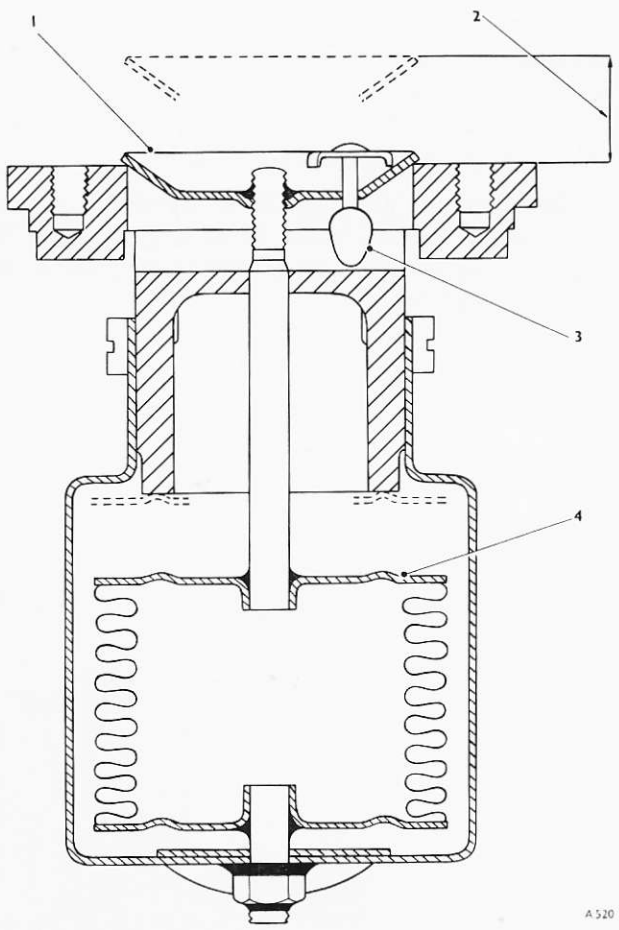


Fig. L7 Sectional view of thermostat

1. VALVE
2. 0·257 IN. MINIMUM STROKE
3. JIGGLE PIN
4. BY-PASS VALVE

The valve of a 'Summer' thermostat should open between 75 and 77 deg. C (167 and 170 deg. F); the by-pass valve should be fully closed at 96 deg. C (205 deg. F).

The valve of a 'Winter' thermostat should open between 84 and 86 deg. C (183 and 188 deg. F); the by-pass valve should be fully closed at 104 deg. C (219 deg. F).

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On S2 cars, the thermostats are marked with their opening temperature range on the body upper face. The standard fitting is the unit marked 'opens 66–70 deg. C' (151–158 deg. F). The by-pass valve should be fully closed at 85 deg. C (185 deg. F).

The thermostat provided for use during the winter in Canada is marked 'opens 76–80 deg. C' (169–176 deg. F). The by-pass valve should be fully closed at 95 deg. C (203 deg. F).

Thermostat — to re-fit

Insert the thermostat into its housing. A slot provided in the thermostat body enables it to register with a locating screw in the housing and so ensure correct positioning of the unit.

Lightly smear a new cover joint with 'Wellseal' and fit the joint and cover to the housing. Secure the cover in position by progressively tightening the four $\frac{1}{4}$ in. setscrews on S2 cars (or nuts on S1 cars).

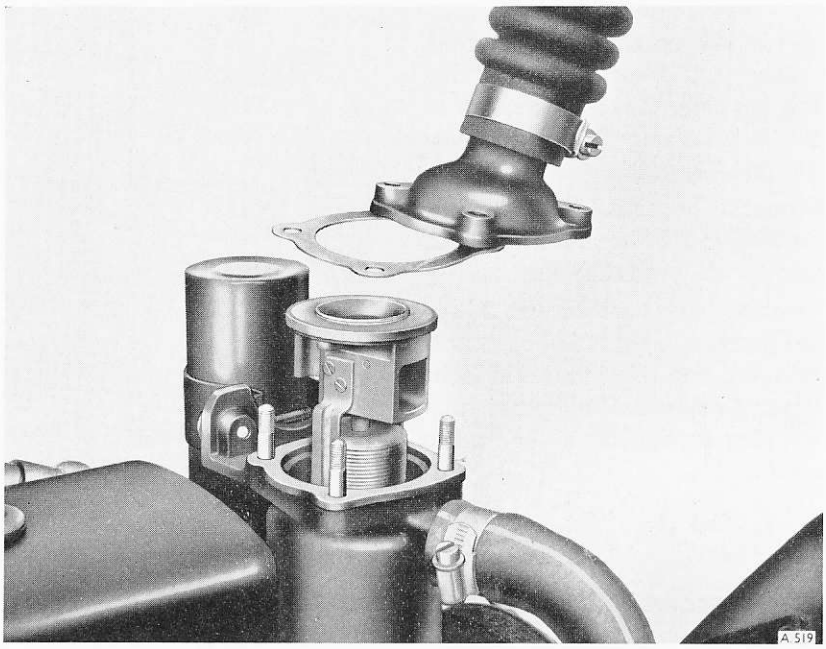


Fig. L8 Access to thermostat

SECTION L5 — COOLANT PUMP

Description

The coolant pump is belt driven at approximately 0·85 times the engine speed. The pump draws coolant from the bottom tank of the radiator matrix and distributes it under pressure to the water gallery in the cylinder block. The coolant re-enters the radiator header tank past the open thermostat, or by-passing the radiator through the thermostat by-pass, according to the coolant temperature.

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Pressure of the pump discharge to the engine is as follows:

S1 cars 20 lb/sq.in. at 3200 pump r.p.m.

S2 cars 15 lb/sq.in. at 2500 pump r.p.m.

The main body of the pump is a cast iron housing, which **on S1 cars** comprises the pump chamber. The pump chamber **on S2 cars** is a separate aluminium casing which also incorporates the inlet pipes and delivery ports. The casing is independently secured to the engine crankcase.

A double ball race, retained in the housing by spring rings, supports a shaft, on the end of which is pressed an impeller; a driving spider or adapter is pressed onto the outer end. These are an interference fit on the shaft and no other means of retention is necessary.

On S1 cars fitted with refrigeration, the adapter is integral with the shaft (see Fig. L9). This shaft is supported by a ball bearing at the forward end and a smaller bearing towards the inner end. An impeller is pressed on to the end of the shaft.

On all cars a driving pulley and fan extension cone are secured to the spider or adapter by four $\frac{5}{16}$ in. U.N.F. setscrews.

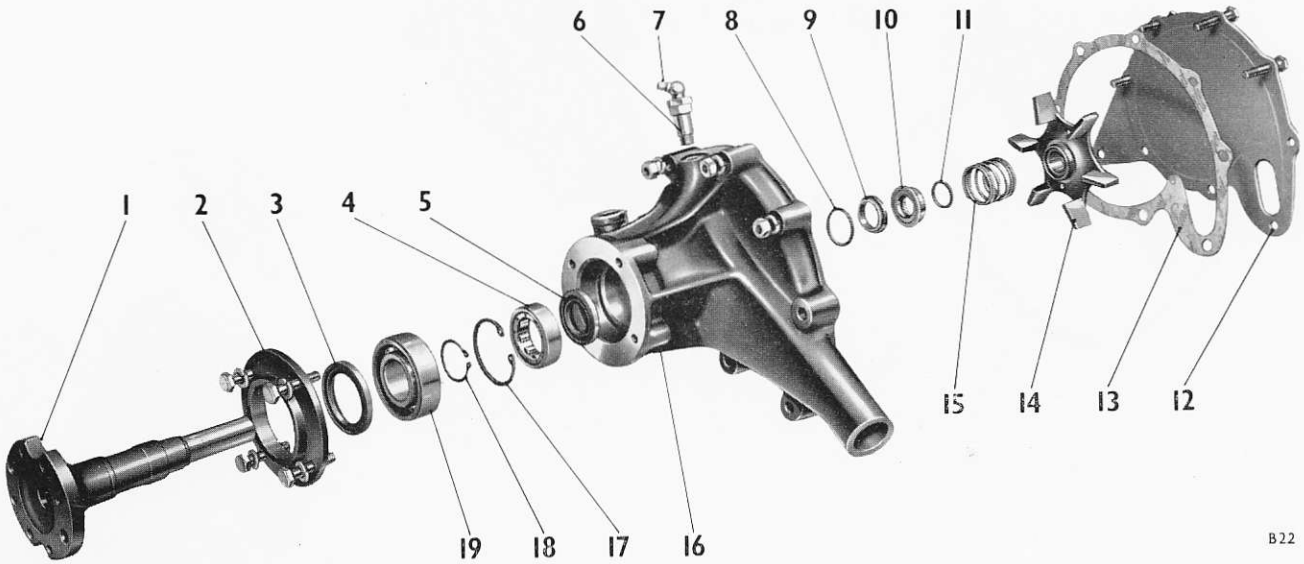


Fig. L9 Exploded view S1 cars — coolant pump with refrigeration

1. IMPELLER SHAFT
2. OIL SEAL HOUSING
3. OIL SEAL
4. REAR BEARING
5. OIL SEAL
6. GREASE NIPPLE EXTENSION
7. GREASE NIPPLE
8. SEALING RING
9. STATIONARY SEAL RING
10. ROTARY SEAL RING
11. SHAFT SEAL
12. BACKING PLATE
13. PLATE JOINT
14. IMPELLER
15. 'FLEXIBOX' SPRING
16. PUMP CASING
17. BEARING CIRCLIP
18. BEARING CIRCLIP
19. FRONT BEARING

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The methods of sealing adopted for the three pumps differ as follows:

S1 cars — without refrigeration (see Figs. L10 and L11):

A stainless steel coil spring is mounted on the shaft between the impeller and rotary seal ring. The spring exerts a pressure of 8–10 lb. on the 'Flexibox' seal assembly and prevents coolant leakage along the shaft. A 'Klingerit' joint is bolted between the housing and a backing plate.

S1 cars — with refrigeration (see Figs. L9 and L12):

Coolant sealing is the same as above but as separate bearings are used, seals are mounted on the shaft forward of the front ball bearing and to the rear of the inner roller bearing.

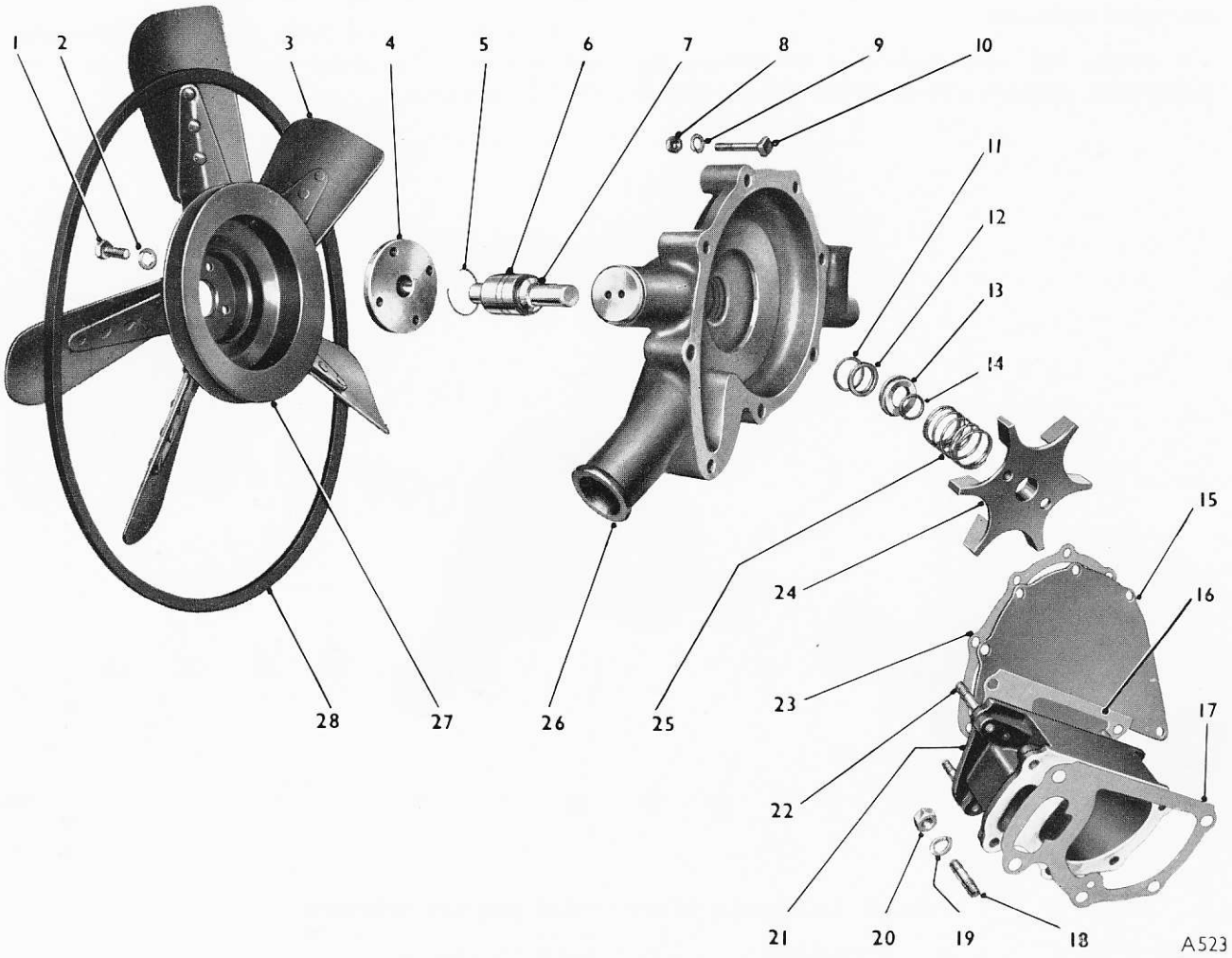


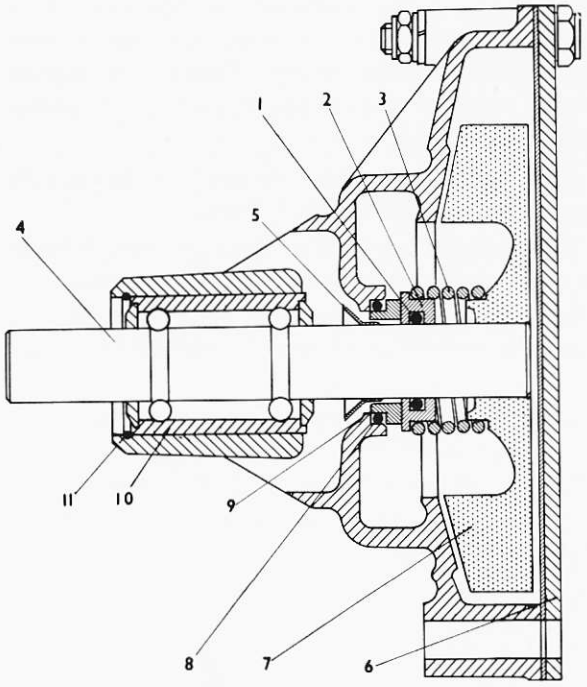
Fig. L10 Exploded view S1 cars — coolant pump without refrigeration

1. SETSCREW
2. WASHER
3. ASSEMBLY — FAN BLADES
4. ADAPTER — FAN PULLEY
5. CIRCLIP
6. SHAFT AND BEARING ASSEMBLY
7. BRASS FLINGER
8. NUT
9. WASHER
10. RETAINING BOLT
11. COVER SEAL
12. STATIONARY SEAL RING
13. ROTARY SEAL
14. SHAFT SEAL
15. COVER PLATE
16. PUMP TO ADAPTER JOINT
17. ADAPTER TO CYLINDER BLOCK JOINT
18. STUD
19. WASHER
20. NUT
21. ADAPTER
22. PUMP TO ADAPTER STUD
23. COVER PLATE JOINT
24. IMPELLER
25. 'FLEXIBOX' SEAL SPRING
26. PUMP CASING
27. PULLEY
28. FAN BELT

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Fig. L11 Sectional view S1 cars — coolant pump without refrigeration

1. SEALING RING
2. ROTARY SEAL RING
3. SPRING
4. SHAFT
5. FLINGER
6. BACKING PLATE
7. IMPELLER
8. SEALING RING
9. STATIONARY SEAL RING
10. BEARING ASSEMBLY
11. CIRCLIP

S2 cars (see Figs. L13 and L14):

A gland is mounted on the shaft between the impeller and thrust collar. The gland comprises a rubber shell with an integral stainless steel spring and a plastic thrust face (see Fig. L15). A 'Klingerit' joint is fitted between the bearing housing and pump casing (see Fig. L13).

Coolant Pump — to remove

S1 cars

Drain the coolant into a clean container. Slacken the generator bracket bolts and remove the adjustable support nut and bolt at the backing plate.

Move the generator towards the engine and remove the generator driving belt.

Remove the setscrews securing the fan and pulley to the adapter flange, then remove the fan and pulley.

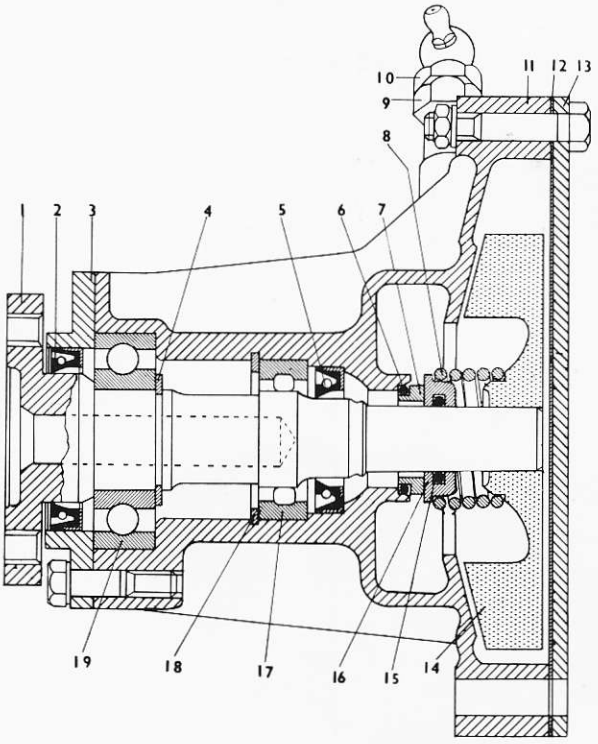
Slacken the two worm drive clips securing the by-pass hose to the pump and thermostat housing and remove the hose and clips.

Unscrew the union nut connecting the induction manifold return line to the coolant pump; move the line to one side.

Slacken the worm drive clip retaining the hose to the pump inlet pipe and detach the hose.

Remove the nuts and lock-washers from the cylinder block adapter studs.

Withdraw the assembly, taking care to avoid damaging the radiator matrix.



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Fig. L12 Sectional view S1 cars — coolant pump with refrigeration

1. IMPELLER SHAFT
2. SEAL
3. SEAL HOUSING
4. CIRCLIP
5. SEAL
6. STATIONARY SEAL RING
7. SEALING RING COVER
8. 'FLEXIBOX' SPRING
9. GREASE NIPPLE EXTENSION
10. GREASE NIPPLE
11. PUMP CASING
12. JOINT PLATE
13. BACKING PLATE
14. IMPELLER
15. SEALING RING
16. ROTARY SEAL RING
17. REAR BEARING
18. CIRCLIP
19. FRONT BEARING

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S2 cars

For normal service operations, including reconditioning, it is not necessary to remove the pump casing from the engine; all moving parts can be removed complete with the bearing housing.

Drain the coolant into a clean container by means of the taps provided on each side of the cylinder block and at the base of the radiator.

Remove the bolts securing the generator, detach the driving belts and move the generator to facilitate access to the coolant pump.

Unscrew the setscrews securing the pulley and fan to the spider; remove the pulley and fan.

Unscrew the setscrews securing the generator bracket and bearing housing, also the remaining setscrew which is one of the screws securing the pump casing to the engine crankcase. A light tap with a mallet is usually sufficient to 'crack' the joint between the housing and the casing. Detach the bearing housing together with all moving parts of the pump. Discard the 'Klingerit' joint.

If it is necessary to remove the pump casing from the engine, the procedure is as follows:

Slacken the clip and disconnect the hose between the pump casing and the radiator bottom tank.

Remove the setscrews and plain washers and detach the connection between the thermostat by-pass hose and the pump casing.

Disconnect the heater matrix return pipe union from the casing.

Remove the two $\frac{5}{16}$ in. U.N.F. setscrews and washers securing the top of the casing to the engine.

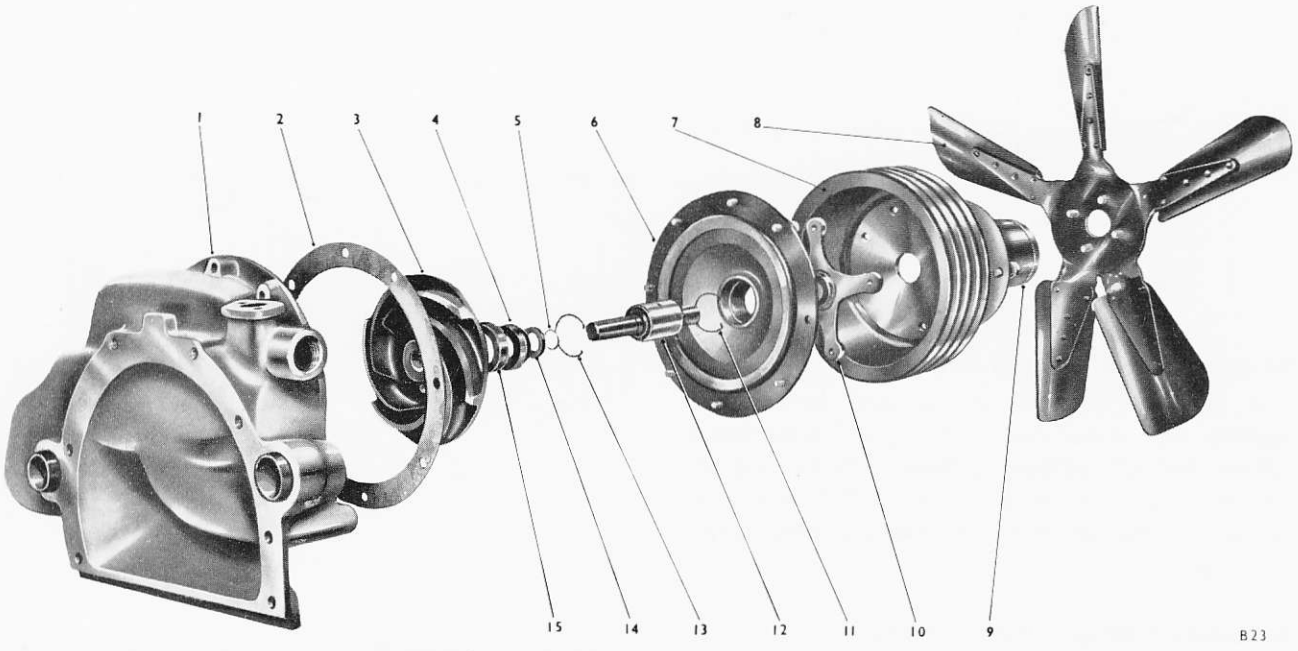


Fig. L13 Exploded view S2 cars — coolant pump

1. VOLUTE CASING
2. 'KLINGERIT' JOINT
3. IMPELLER
4. GLAND
5. SPRING RING
6. BEARING HOUSING
7. PULLEY
8. FAN
9. FAN EXTENSION CONE
10. SPIDER
11. CIRCLIP
12. BEARING ASSEMBLY
13. CIRCLIP
14. THRUST COLLAR
15. GLAND COVER

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Remove the four remaining $\frac{5}{16}$ in. U.N.F. setscrews and washers securing the casing to the engine, then detach the pump casing, together with the 'Neoprene' sealing strip which runs along its lower edge.

Coolant Pump — to dismantle

S1 cars — without refrigeration

Special tool required — RH.570 Universal Extractor.

Remove the four $\frac{1}{4}$ in. U.N.F. bolts, nuts and washers retaining the pump backing plate. Discard the joint.

Withdraw the impeller from the shaft using special tool RH.570 in conjunction with two $\frac{5}{16}$ in. holes tapped through the impeller (see Fig. L16).

Remove the 'Flexibox' seal, coil spring and the stainless steel rotary seal ring which contains a rubber seal.

Two tapped holes are provided in the adapter flange for extraction purposes.

Withdraw the adapter flange from the shaft using special tool RH.570 (see Fig. L17).

Remove the spring ring from the outer end of the bearing housing bore.

Support the housing to enable the shaft assembly to be tapped out with the aid of a cylindrical drift, pressing on the edge of the bearing.

It is not necessary to remove the brass flinger which is pressed on the spindle, behind the bearing assembly.

The assembly contains 'Retinax' lubricant and should not be washed.

Remove the 'Morganite' stationary seal from the boss in the casing.

Due to its fragile nature, a new flinger must always be used with a new spindle assembly.

The friction is confined between the rotary seal ring bearing on the 'Morganite' seal and no moving part is in contact with the pump body.

It is not advisable to use the old adapter flange with a new shaft assembly as the interference fit is lost when the shaft and the flange are separated.

When re-fitting the shaft, use a complete unit which includes the brass flinger.

The old impeller can be used on a new shaft if in good condition and the bore is not oversize, i.e. the interference fit is not lost.

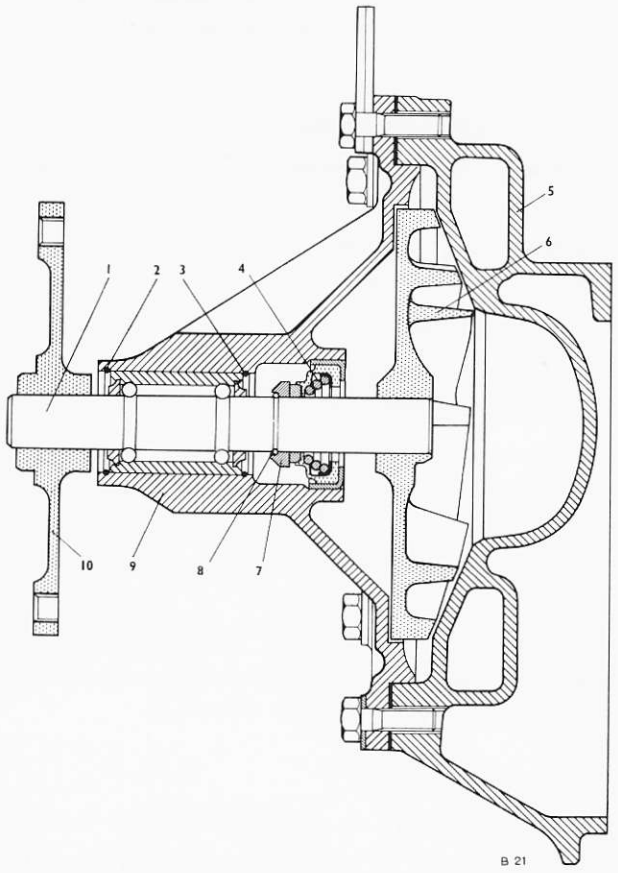


Fig. L14 Sectional view S2 cars — coolant pump

1. ASSEMBLY SHAFT AND BEARING
2. SPRING RING
3. SPRING RING
4. SPRING
5. PUMP CASING
6. IMPELLER
7. THRUST COLLAR
8. SNAP RING
9. HOUSING
10. SPIDER

The shaft diameter should be 0·6267 in. —0·0005 in. and the bore diameter of both the impeller and adapter flange 0·625 in. + 0·0005 in.

Both the impeller and flange have to be pressed into position on the shaft.

The 'Flexibox' gland spring has a free length of 1·650 in. and is compressed to a working length of 0·738 in. to exert 8–10 lb. pressure on the gland.

It is of the utmost importance that the bearing faces of the rotary and the stationary seals are perfectly flat and square to the bore axis. Fit a new seal ring.

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A light smear of petroleum jelly applied to the shaft seal rubber and cover seal rubber will facilitate assembly.

S1 cars — with refrigeration

Special tool required — RH.570 Universal Extractor.

Remove the setscrews and washers securing the pulley to the pump shaft.

Remove the pulley.

Remove the grease nipple and adapter to avoid damage during servicing.

Remove the four $\frac{1}{4}$ in. U.N.F. bolts, washers and nuts securing the backing plate and joint to the pump casing.

Remove the backing plate and discard the 'Klingerit' joint.

Using special tool RH.570, draw the impeller off the shaft. (It may be necessary to run a tap through the extraction holes to clear corrosion).

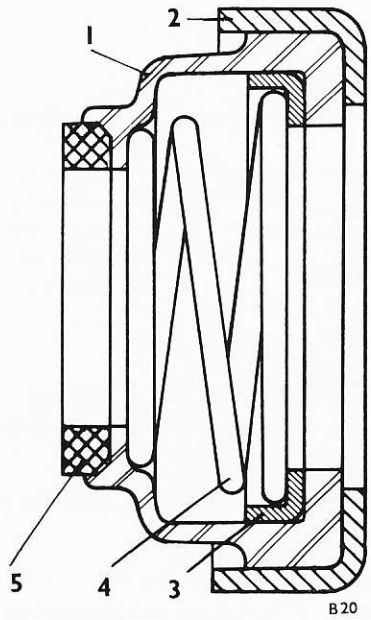


Fig. L15 Sectional view S2 cars — sealing gland

1. SEAL
2. COVER
3. INNER SHELL
4. SPRING
5. THRUST COLLAR

Remove the four $\frac{1}{4}$ in. U.N.F. setscrews and spring washers securing the seal housing to the pump casing. (Make use of the two scollops in the end of the shaft to facilitate access to the tapped holes for the set-screws).

Support the pump casing. Tap out the shaft from the casing using a hide mallet. Remove the circlips from the shaft.

Support the seal housing and press the shaft out of the bearing and housing. Press out the seal from the housing and remove the circlip from the bore of the pump casing.

Remove the carbon gland and rubber ring from the counterbore of the pump casing.

The roller bearing is removed by tapping with a drift, using the seal as a cushion.

Examine and clean all parts; renew any part that is damaged.

S2 cars

Special tools required:

RH.7098 — Universal Extractor
RH.7099 — Spider Extractor

For normal service operations, the bearing housing will already have been separated from the pump casing.

Draw the spider off the shaft using special tool RH.7099 (see Fig. L18).

Draw the impeller off the shaft using special tool RH.7098 (see Fig. L19).

If the spider, impeller and shaft conform to the following dimensions, they may be used for further service:

Spider bore	... ...	0·6250 in. to 0·6255 in.
Spider end of shaft	...	0·6262 in. to 0·6267 in.
Impeller bore	... ...	0·6200 in. to 0·6205 in.

Remove the spring ring which retains the bearing in the housing.

Support the bearing housing to enable the bearing assembly to be driven out with a mallet. During this operation, the thrust collar will sustain damage through contact with the inner spring ring in the housing bore and must be renewed.

Examine the shaft and bearing for wear or damage. The assembly contains 'Retinax' lubricant; no attempt should be made to wash it.

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If the existing shaft is suitable for further service, the snap ring should not be disturbed.

Using a suitable drift, tap the gland and gland cover out of the housing bore; these parts must be renewed.

Remove the inner spring ring from the housing. Examine it for damage sustained through contact with the thrust collar; if necessary, it should be renewed.

Coolant Pump — to assemble

S1 cars — without refrigeration

Before assembling the pump, the joint face should be cleaned to remove any part of the old joint. Any damage marks should be polished out to ensure a good sealing.

Stretch the new cover sealing ring into position on the stationary seal ring and press the assembly into the counterbore of the pump body.

Using a cylindrical hollow drift, tap the shaft assembly, longer end first, into the bearing housing of the casing and re-fit the spring ring into the groove.

Press the adapter flange into position on the shaft until $\frac{1}{8}$ in. (0·125 ± 0·005 in.) of the shaft protrudes through the outer end of the flange.

Assemble the shaft rubber seal into the groove of the stainless steel rotary ring and press the assembly over the shaft, so that the wide face presses against the sealing face of the 'Morganite' stationary seal. Place the seal pressure spring against the shoulder of the rotary seal ring and press the impeller squarely on the shaft until the end of the impeller is just flush with the end of the shaft.

Assemble the backing plate to the pump casing using a new 'Klingerit' joint coated with 'Wellseal' but do not tighten the four $\frac{1}{4}$ in. U.N.F. bolts until the pump has been mounted on the studs, so that the plate can be evenly tightened down. A new 'Klingerit' joint, similarly coated, must be used between the pump and the cylinder block adapter.

S1 cars — with refrigeration

Before assembly clean the pump face to remove any part of the old joint which may have remained; remove any damage marks.

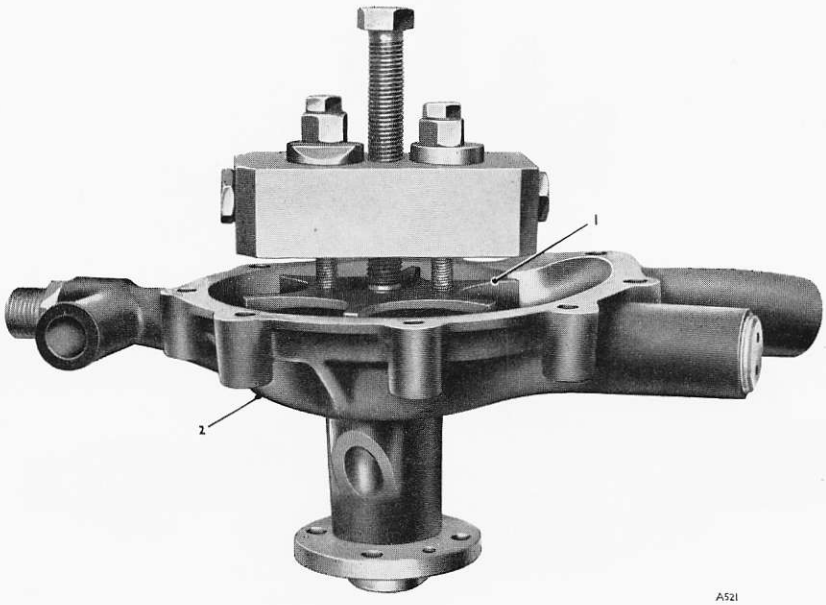


Fig. L16 Extraction of impeller — S1 cars (Special tool RH.570)

1. IMPELLER 2. PUMP CASING

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Press the small oil seal into position in the pump casing using minimum pressure to prevent damage to the rubber. Pack the roller bearing with Retinax 'A' grease, and press the roller bearing into position in the pump casing. Fit the large bearing retaining circlip into the groove in the casing bore.

Fill the bearing housing with Retinax 'A' grease but allow for insertion of the pump shaft.

Fit the seal into the seal housing. The rubber part should be level with the outer edge of the housing. Smear the seal bore with a film of petroleum jelly.

Press the bearing onto the shaft and fit the smaller circlip into the groove on the shaft.

Fit the larger rubber ring onto the carbon gland and press the assembly with the rubber ring leading into the counterbore of the casing.

Polish the hardened thrust face of the seal rotary ring to ensure it is free from scratch marks. Use grade 3/0 emery polishing cloth for this operation.

Press the assembled shaft into position in the pump casing and secure it with the four setscrews and washers, making use of the scollops on the end of the shaft provided to facilitate access to the tapped holes in the pump body.

Fit the end of the rotary seal ring into one end of the spring, the other end of which is fitted onto the impeller spigot. Smear the bore of the impeller with a light coating of grease and press the impeller into position on the shaft.

The face of the impeller must lie flush with the end of the shaft.

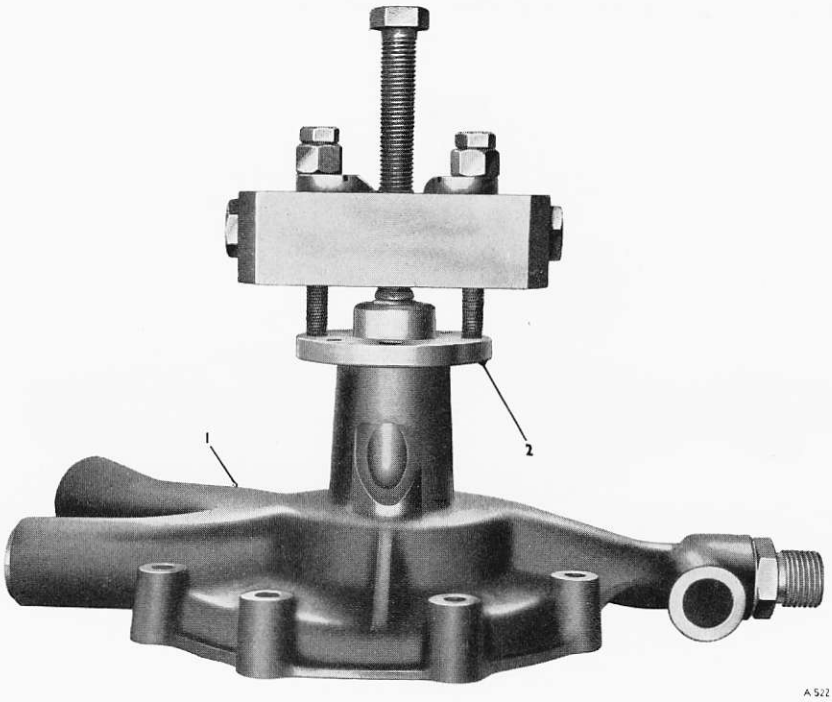


Fig. L17 Extraction of adapter flange (Special tool RH.570)

1. PUMP CASING
2. ADAPTER FLANGE

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Fit the backing plate to the pump casing, using a new joint coated with 'Wellseal'. Do not tighten the four $\frac{1}{4}$ in. U.N.F. bolts until the pump has been mounted on the studs, so that the plate can be evenly tightened down.

A new joint, similarly coated, must be fitted between the pump and the cylinder block adapter.

S2 cars

Before assembly clean the joint faces to remove any part of the old joint which may have remained; remove any damage marks. Fit a bearing retaining spring ring in the inner groove in the housing bore.

Insert the longer end of the shaft assembly into the outer end of the housing bore. Using a mallet, drive the bearing into the bore to seat against the inner spring ring, then fit a second bearing retaining spring ring.

If a new shaft is to be fitted, press a new snap ring onto the inner end of the shaft so that it locates in the groove.

If the existing shaft is to be used, the snap ring will already be in position.

Examine the new thrust collar to ensure that its thrust face is free from damage. Fit the collar on the shaft with its chamfered face touching the snap ring. Using a cylindrical drift, sharply tap the thrust collar so that the snap ring locates the counterbore in the collar. Examine the assembly through the inspection ports in the housing to ensure that the snap ring and collar are correctly located.

Examine the new gland cover to ensure that it is free from damage then insert a new gland. Smear the outside of the gland cover with 'Wellseal' and place the unit over the inner end of the shaft with its plastic thrust face towards the thrust collar. Press the unit into the housing bore so that the gland cover is flush with the end of the counterbore.

Ensure that the outer end of the shaft and the bore of the spider are free from burrs and lightly smear the contact surfaces with Retinax 'A' grease. Press the spider into position on the shaft until the shaft protrudes $\frac{1}{8}$ in. (0·125 in.) from the outer face of the spider.

Ensure that the inner end of the shaft and the bore of the impeller are free from burrs and lightly smear the contact surfaces with Retinax 'A' grease. Press the impeller into position on the shaft so that the inner face of the impeller is flush with the end of the shaft.

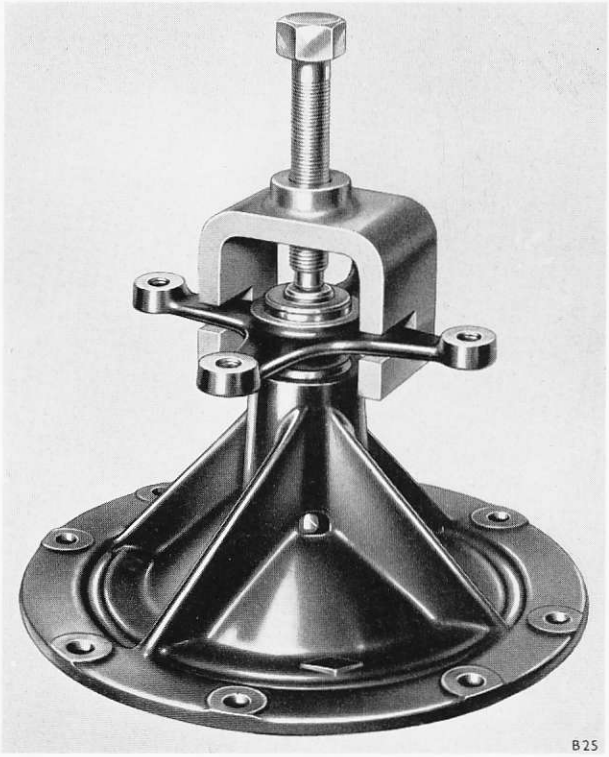


Fig. L18 Extractor — Coolant pump driving spider (S2 cars) (RH.7099)

Spin the assembly to ensure that the shaft rotates freely.

Coolant Pump — to fit

Refrigerated and non-refrigerated S1 cars

Connect the hoses and induction manifold return pipe union nut. Re-fit the fan pulley and blade assembly, tightening the setscrews evenly. Re-fit the generator adjusting bracket and fan belt. Adjust the fan belt tension, with the use of a spring balance midway between the generator and fan pulley. Check that an 18 lb. pull will give $\frac{1}{2}$ in. deflection of the belt.

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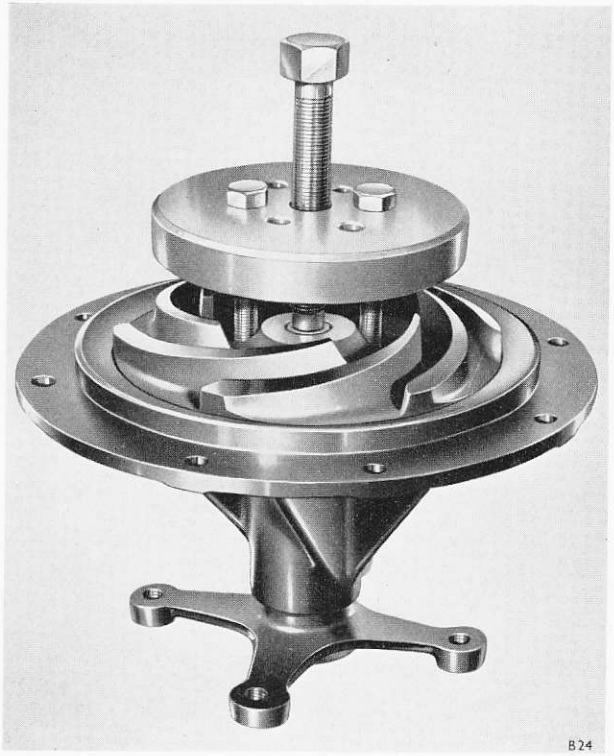


Fig. L19 Extractor — Coolant impeller

Too slack an adjustment of the fan belt will cause the belt to slip at high speed, resulting in squealing, overheating, and premature wear of the pump shaft bearings.

Fill the cooling system and examine the system for leaks.

S2 cars

If the pump casing has been detached from the engine, it should be re-fitted by reversing the procedure for removal described earlier.

Use a fine carborundum stone to remove any burrs which may exist on the joint face of the pump casing.

Fit a new 'Klingerit' joint on the face of the bearing housing and press the housing into position in the casing.

Secure the generator bracket and the housing to the casing with the following setscrews and washers:

One $\frac{5}{16}$ in. U.N.F. setscrew $3\frac{1}{2}$ in. long, one plain washer.

Four $\frac{1}{4}$ in. U.N.F. setscrews $\frac{7}{8}$ in. long, four plain washers.

Three $\frac{1}{4}$ in. U.N.F. setscrews 1 in. long. (No washers are required for these generator bracket setscrews).

Secure the driving pulley, extension cone and fan assembly to the spider with four $\frac{5}{16}$ in. U.N.F. setscrews and plain washers.

Re-fit the generator and generator driving belts. Adjust the tension of the driving belts so that an applied force of 6 lb. causes each belt to deflect $\frac{3}{8}$ in. at the centre of the run between the compressor and generator pulleys (cars fitted with refrigeration) or the coolant pump and generator pulleys (non-refrigerated cars).

Re-fit and adjust the steering pump driving belts so that an applied force of 8 lb. at the centre of the run between the coolant pump and steering pump pulleys causes each belt to deflect $\frac{3}{8}$ in.

Re-fill the cooling system and carefully examine all joints and hoses for leaks.

SECTION L6 — ANTI-FREEZE

On leaving the factory, the cooling systems of new cars are filled with a 25 per cent anti-freeze mixture conforming to British Standards Specification 3150 : 1959 (previously known as British Ministry of Supply Specification DTD 779). Anti-freeze mixtures to this specification can be identified by the specification number which is marked on the container.

Only anti-freeze mixtures conforming to the above specification are approved by Rolls-Royce Limited, and Bentley Motors (1931) Limited, and should the

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cooling system require replenishing, an anti-freeze mixture to this specification should be used.

Important: Do NOT mix different types of anti-freeze at any time.

Anti-freeze mixtures to the above specification can be obtained from:

Rolls-Royce Limited
Spares Department
Pym's Lane
Crewe

Rolls-Royce Limited
Repair Department
Hythe Road
Willesden
London. N.W.10.
(Counter service only)

In addition to providing protection against frost, anti-freeze contains inhibitors which prevent corrosion of the cooling system; it is therefore essential to use an anti-freeze mixture all the year round in all parts of the world; water alone must never be used. In hot climates the anti-freeze acts as a corrosion inhibitor and raises the boiling point of the coolant.

The following chart indicates the temperature at which anti-freeze mixtures of various concentrations begin to freeze.

Percentage concentration	25%	30%	35%	40%	45%	50%
Freezing point (deg. Fahrenheit)	10	4	−3	−9	−22	−35
Degrees of frost (Fahrenheit)	22	28	35	41	54	67
Degrees of frost (Centigrade)	12	16	19	23	30	37
Quantity of anti-freeze (pints)						
S1 cars	7·0	8·4	9·8	11·2	12·6	14·0
S2 cars	5·3	6·3	7·4	8·4	9·5	10·5

The above temperatures are those at which small ice crystals begin to form, a further reduction in temperature causing the mixture to solidify as the minimum safety limit is approached. For example, ice crystals will not form in a 25 per cent anti-freeze mixture unless the temperature falls below 10 deg. F (−12 deg. C).

The percentage concentration of anti-freeze in the coolant can be obtained as follows:

Using a suitable hydrometer, measure the specific gravity of the coolant. At the same time, measure the temperature of the coolant with an accurate thermometer; the coolant temperature indicator on the facia of the car is not suitable for this purpose.

Plot the obtained temperature against the obtained specific gravity on the graph in Figure L20. The nearest diagonal line to the plotted position corresponds to the percentage concentration of anti-freeze in the coolant; each diagonal line is marked with its equivalent concentration at the top of the graph.

Example

Specific gravity of coolant	1·05
Temperature of coolant	95 deg. F (35 deg. C)

Plotting these figures on the graph in Figure 20 produces a point on the diagonal line marked 40 per cent.

The coolant is thus a 40 per cent anti-freeze mixture and will protect the system against frost down to a temperature of −9 deg. F (−23 deg. C).

A mixture of this strength could safely be topped-up with water only if it is unlikely that temperatures in the area would fall as low as −9 deg. F (−23 deg. C).

If it is at all likely that this low temperature be approached, the system must be replenished only with 40 per cent anti-freeze mixture.

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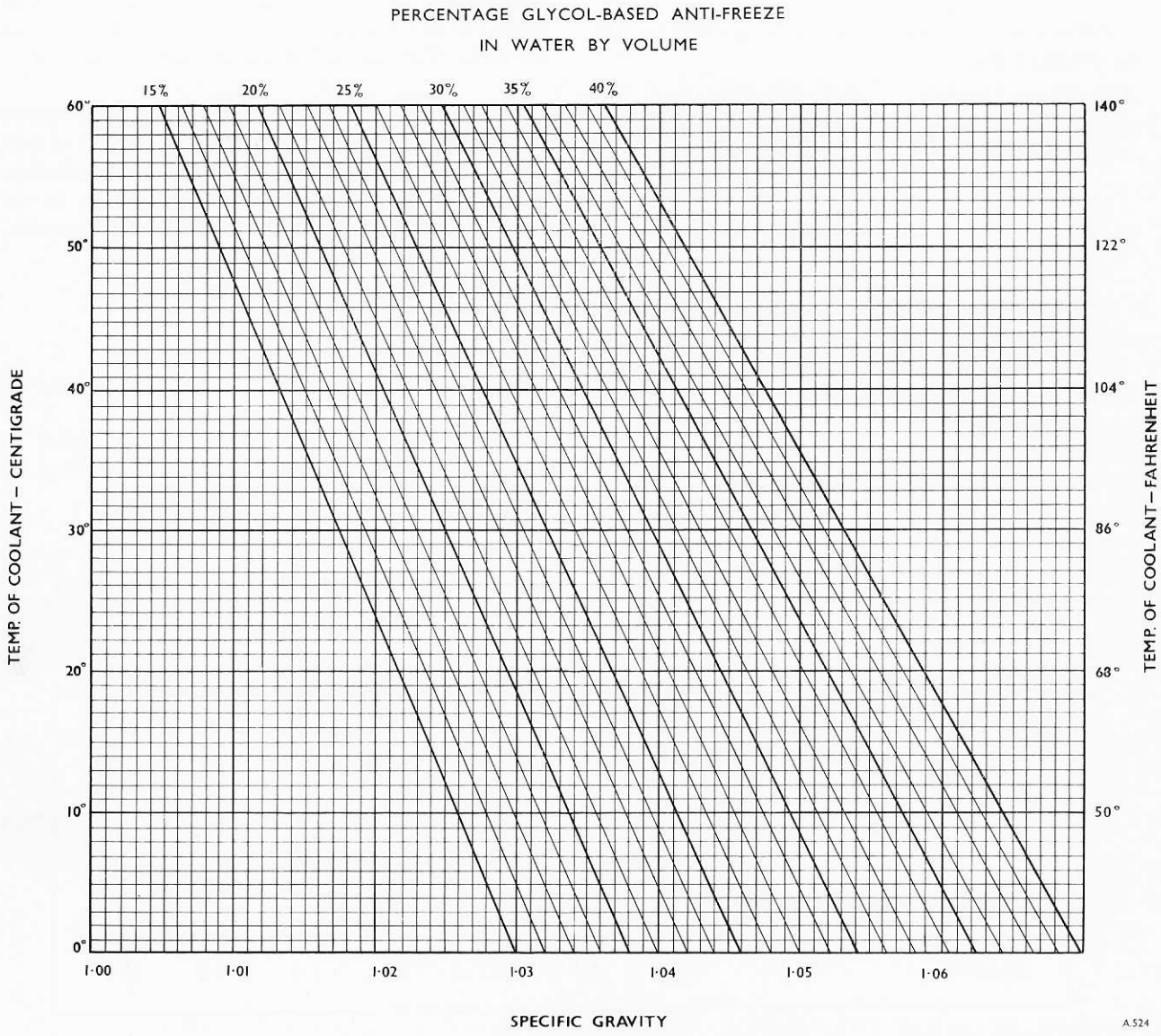


Fig. L20 Anti-freeze chart

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CHAPTER L

ENGINE COOLING SYSTEM

SECTION L 1 — DATA

(Page L 1 in Workshop Manual)

For S3 cars read as follows

Capacity	**Imperial**	U.S.	**Litres**
Silver Cloud III, Bentley S3, Bentley Continental S3	22 pints	26·41 pints	12·50
Phantom V	23 pints	27·60 pints	13·07
Pump	Centrifugal		
Pump drive	Twin belts	46·00 in × 0·406 in.	
Fan	Five blade	18 in. diameter	
Thermostat	'Summer' opening temperature of 82°C to 86°C 'Winter' opening temperature of 87°C to 89°C		
Radiator	Fixed shutters		

SECTION L 3 — RADIATOR

Description

(Page L 4 in Workshop Manual)

For S3 cars read as follows

The dimensions of the radiator matrices are as follows

	Surface area	**Dimensions**
Silver Cloud III and Bentley S3	420·000 sq.in.	21·150 in. × 19·875 in. × 2·283 in.
Phantom V	449·675 sq.in.	22·625 in. × 19·875 in. × 2·283 in.
Continental S3	400·000 sq.in.	20·125 in. × 19·875 in. × 2·283 in.

On all S2 cars

(Page L4 inWorkshop Manual)

For S3 cars the second paragraph is not applicable.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

SECTION L 4 — THERMOSTAT

Description

(Page L6 in Workshop Manual)

For S3 cars read as follows

The thermostat comprises a cast body having a bridge piece on top; into this bridge piece is screwed a stud to act as a fixed piston. A dished valve, which seats on the underside of the thermostat body, incorporates a cylinder enclosing the piston, and carrying a wax filled capsule in its base. The valve is held in the closed position by a spring which is retained by a 'U' piece, the latter also serving as a guide for the cylinder.

The valve incorporates a vent hole containing a 'jiggle' pin. This vent allows air to escape while the cooling system is being replenished, thus avoiding air locks. When the system is operating, the 'jiggle' pin rises to close the vent against the passage of coolant.

An increase in coolant temperature causes the wax capsule to expand and force the valve downward off its seat.

A decrease in temperature causes the wax to contract and under the action of the spring the valve closes.

The valve is thus sensitive to the coolant temperature and controls the flow of coolant through the thermostat housing to suit the cooling requirements of the engine.

The bore of the coolant passage in the main body of the thermostat is 1·406 in. in diameter.

When the dished valve is closed, the by-pass valve is fully open, and allows the coolant to circulate around the engine only, excluding the radiator. The by-pass valve closes when the temperature reaches 93·3°C to 96·1°C, and allows all the coolant to pass through the radiator.

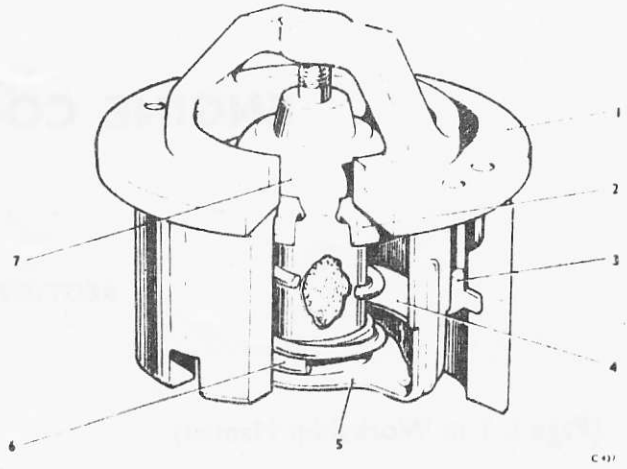


Fig. L1 (S) Sectional view of thermostat

1 THERMOSTAT BODY
2 THERMOSTAT VALVE
3 BY-PASS VALVE
4 BY-PASS PORT
5 'U' PIECE
6 THERMOSTAT VALVE RETURN SPRING
7 WAX FILLED CAPSULE

Thermostat — To test

On S2 cars

(Page L8 in Workshop Manual)

On S3 cars, the thermostats are marked with their opening temperature range on the base of the wax filled bulb.

The standard thermostat unit is marked 82°C or 180 F. The by-pass valve is fully closed at 93°C to 96°C.

The thermostat provided for use in very cold conditions is marked 87·7°C or 190°F.

With this thermostat the by-pass valve fully closes at 98·8°C.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

SECTION L 5 — COOLANT PUMP

(Page L8 in Workshop Manual)

All information which applies to the S2 coolant pump is also applicable to the S3 coolant pump.

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CHAPTER M

ELECTRICAL, IGNITION AND RADIO

SECTION M1 — BATTERY

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Specification	*Type*	
S1 cars	P & R Dagenite 6HZP 9/GZ Exide 6XCV 9/L	12 volts, 57 ampere hour capacity at 20 hour rating
S2 cars	P & R Dagenite 6HZP 11/9 GZF Exide 6XTHZ 11/L	12 volts, 67 ampere hour capacity at 20 hour rating

Service

On all cars with the exception of the Phantom V, the battery is mounted in a cradle which is welded to the right-hand frame member and is accessible through the floor of the boot.

On Phantom V cars, the battery is carried in a recess in the rear right-hand side of the boot and is accessible through the floor of the boot.

On all cars, to gain access to the battery, remove the carpet from the luggage boot, then remove the cover panel and the battery cover which is clamped in position by two wing nuts (see Fig. M1).

The negative terminal of the battery is earthed to the chassis.

In cases of corrosion of the terminals and posts, disconnect the terminals and remove all deposits, either with hot water or a weak solution of ammonium carbonate; this solution should then be removed with

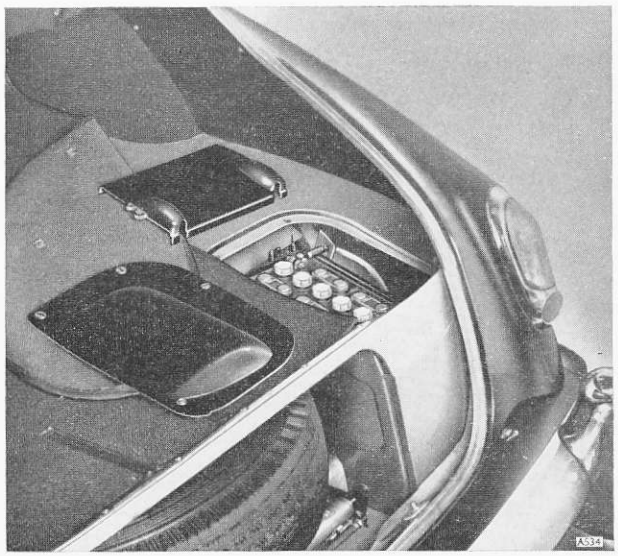


Fig. M1 Access to battery

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clean water and the terminals and posts thoroughly dried. Smear the leads and terminal surfaces with petroleum jelly (not grease).

The top of the battery should be kept clean and dry and the battery should be secure in its cradle.

Initial Charge

The acid specific gravity figures (corrected to 60 deg. F) given below apply to both makes of battery.

To correct the specific gravity to 60 deg. F add 0·004 for every 10 deg. F above this temperature, to the specific gravity figure obtained, e.g. 1·265 at 90 deg. F = 1·277 corrected to 60 deg. F.

Fill each cell with cool 'accumulator' acid of the correct specific gravity as indicated in the table below, until the level of acid is 0·25 in. (6·35 mm.) above the tops of the separators.

The electrolyte level will fall soon after filling and should be restored by the addition of the correct acid, after which the battery must be allowed to stand for 12 hours. At the end of this period, topping-up will again be necessary to obtain the correct level before fitting the vent plugs.

The recommended charge rate for the initial charge is 3·5 amps. for 96 hours, but in cases of extreme urgency, a charging current of 5 amps. for a 70 hour period is permissible.

The charge may be interrupted, providing that the charging periods are of at least 8 hours and the rest periods do not exceed 16 hours.

Warning: If the acid temperature reaches the maximum stated in the preceding table, the charging current should be reduced and the time increased proportionally, otherwise the charge should be suspended.

The charge will not be complete until:

(i) The total charging time as specified for the rate of charge employed has been achieved.

(ii) The voltage and the specific gravity of each cell remain constant throughout five successive hourly readings.

(iii) Gas is freely evolved from each cell.

On completion of the charge, the specific gravity of the acid in each cell should not exceed the figure stated in the table; if it does, acid must be withdrawn from the cell and replaced by an equal volume of distilled water. The battery should then be charged for a further hour and the specific gravity measured once more.

The acid level must be adjusted to 0·25 in. (6·35 mm.) above the tops of the separators by the addition of acid of the correct specific gravity.

The plug vents should be checked and cleaned of any obstruction before the plugs are fitted.

Battery — to charge

If necessary, the battery may be charged whilst in position in the car by means of the two-pin plug socket provided on the facia. To ensure that the current direction is correct, the sockets are marked + and — and are of different sizes to indicate the plug fitting.

	Air temperature generally below 90 deg. F (32 deg. C)	*Air temperature frequently above 90 deg. F (32 deg. C)*
Specific gravity of acid for filling new cells (corrected to 60 deg. F)	1·260	1·215
Specific gravity of acid at the end of charge period (corrected to 60 deg. F)	1·270 to 1·285	1·225 to 1·240
Maximum permissible acid temperature during charge	110 deg. F (43·5 deg. C)	125 deg. F (52 deg. C)

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The specific gravity of the electrolyte may be obtained by means of a hydrometer and gives an indication of the condition of the battery, as follows:

A filled battery not in service should be maintained in good condition by fully charging it and then giving it a fresh charge once a month. The battery should never be allowed to remain in a discharged condition and should be fully charged before being put back into service.

Climate	*Condition of battery*	*Specific gravity (corrected to 60 deg. F)*
Air temperature generally below 90 deg. F (32 deg. C)	Fully charged	1·270 to 1·285
	Half discharged	1·200
	Fully discharged	1·110
Air temperature frequently above 90 deg. F (32 deg. C)	Fully charged	1·225 to 1·240
	Half discharged	1·170
	Fully discharged	1·100

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SECTION M2 — GENERATOR

Data	**Early S1 cars**	**Late S1 and S2 cars**
Type	Lucas C47PV, shunt wound, two-pole, two-brush with negative earth	Lucas C48, shunt wound, two-pole, two-brush with negative earth
Cutting-in speed	900 to 1,050 r.p.m. at 13 generator volts	865 r.p.m. at 13 generator volts
Maximum output	30 amps. at 1,550 to 1,750 r.p.m. at 13·5 generator volts	35 amps. at 1,635 r.p.m. at 13·5 generator volts
Field resistance	5·9 ohms	5·9 ohms
Brush spring tension	20 to 25 oz. (567 to 708·7 gm.)	20 to 25 oz. (567 to 708·7 gm.)
Brush material	HAM-EGO	HAM-EGO
Clearance of brushes in holders		
End clearance	0·018 to 0·024 in. (0·457 to 0·609 mm.)	0·018 to 0·026 in. (0·457 to 0·660 mm.)
Face clearance	0·004 to 0·006 in. (0·102 to 0·152 mm.)	0·004 to 0·012 in. (0·102 to 0·305 mm.)
Suppressor condenser	1·0 mfd. (internal)	1·0 mfd. (internal)
Direction of rotation	Clockwise, viewed from driving end	Clockwise, viewed from driving end

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Maintenance

Belt tension

The generator driving belt(s) should be checked for correct tension every 5,000 miles (8,000 kilometres).

On S1 cars fitted with one driving belt, a load of 18 lb. (8·165 kg.) applied mid-way between the coolant pump pulley and the generator pulley should produce a deflection of 0·50 in. (12·7 mm.).

On S1 cars fitted with twin driving belts, a load of 14 lb. (6·35 kg.) applied mid-way on each belt is required to produce a deflection of 0·50 in. (12·7 mm.) (see Fig. M2).

On S2 cars, the two driving belts are correctly adjusted when a load of 6 lb. (2·7 kg.) applied mid-way between the coolant pump and the generator pulleys (on standard cars) or the compressor and the generator pulleys on cars fitted with refrigeration (see Fig. M3), causes each belt to deflect 0·375 in. (9·525 mm.).

If the tension of one belt in a pair differs markedly from the other, a new matched set of belts should be fitted.

To increase the tension of the belt(s), release the three generator securing nuts and move the generator outwards on the slotted link.

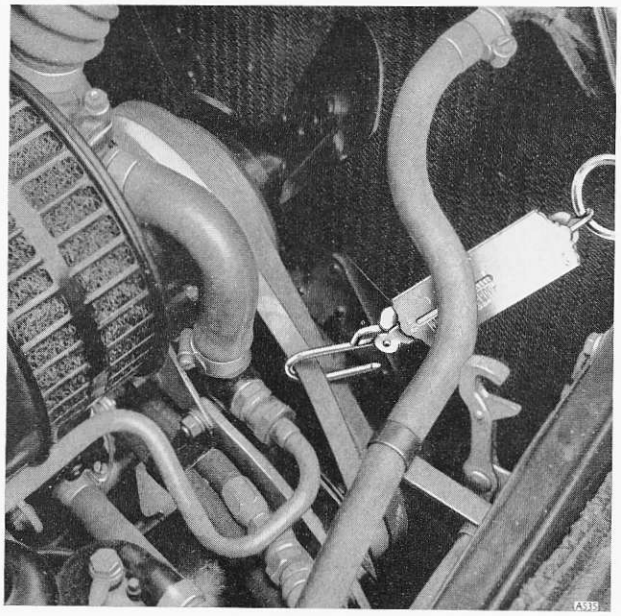


Fig. M2 Checking generator belt tension — S1 cars



Fig. M3 Checking generator belt tension — S2 cars

Lubrication

On early S1 cars, every 10,000 miles (16,000 kilometres), a few drops of S.A.E.30 engine oil should be injected into the hole marked 'OIL' in the end of the bearing housing. It is suggested that the lubrication of the generator be carried out when the oil filter container is removed for element renewal (see Fig. M4).

On late S1 and all S2 cars, no lubrication is required until the generator is dismantled at major overhaul periods when the ball bearing at each end of the armature shaft should be packed with grease.

Service

On early S1 cars used primarily in town areas, it may occasionally be found that the average engine speed is too low to permit adequate charging of the battery.

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A modification has been introduced to increase the charge rate under such circumstances by increasing the speed ratio, generator to engine. The increase is accomplished by fitting a generator pulley giving a 2 : 1 ratio instead of the standard pulley having a ratio of 1·451 : 1.

When fitting the new pulley, a modified swivel arm will also be required.

This modification results in high generator speed at the upper end of the engine speed range and it is essential that the 2 : 1 pulley is only fitted to generators on which the four securing screws of the drive end bearing plate have been peened over. To prevent loosening at high speed, longer screws were fitted and locked in this manner on all generators identified by the suffix 'L' and 'M'.

The generator should be changed if of pre-'L' pattern.

The increase in speed of the generator will result in an increase in maximum output up to an engine speed of approximately 900 r.p.m.; above this speed it will have no effect.

The pulley should not be changed until it has been shown that the complaint is attributable to low engine speed and not to a defect in the charging system or battery.

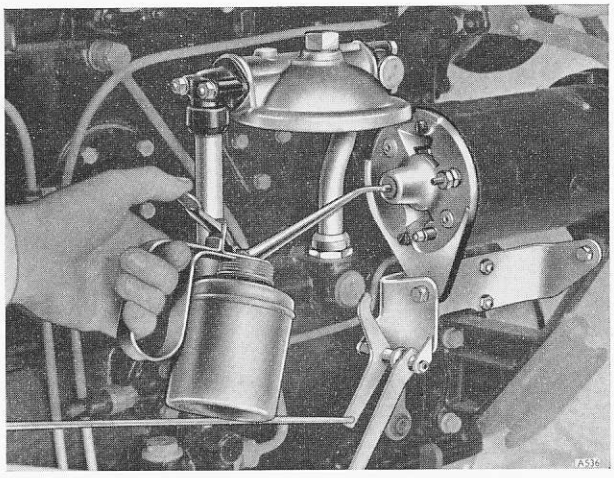


Fig. M4 Oiling commutator end bearing — C47 PV generator

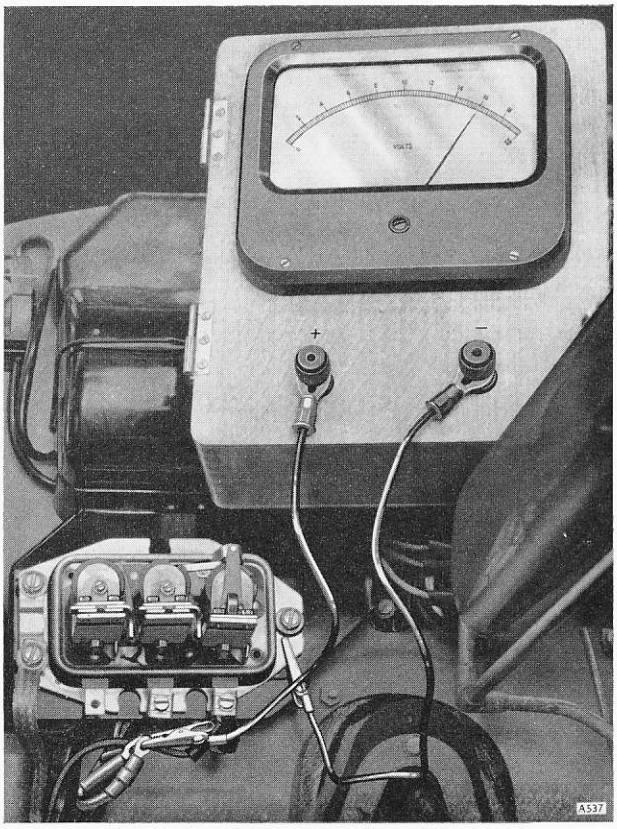


Fig. M5 Generator voltage test

Testing in Position to Locate a Fault in the Charging Circuit

(i) Check and if necessary adjust the driving belt tension (see Figs. M2 and M3).

(ii) Disconnect the generator leads at the control box terminals 'D' and 'F'. Connect the two leads to the positive terminal of the voltmeter and test as shown in Figure M5; do not exceed an approximate generator speed of 1,000 r.p.m. If the generator builds up normal voltage, check the control box (see 'Control Box'), the wiring and the battery connections.

(iii) If there is no voltage build-up, remove the generator and examine the brushes and commutator. Hold back each brush spring in turn and move the brush by gently pulling on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file.

Clean out the brush holders if dirty and check the clearances of the brushes in the boxes (see Fig. M6), as sticking of the brushes may occur in service if these clearances are inadequate. It is important that the brushes always be fitted in their original positions.

Excessive brush wear may cause damage to the commutator by the brush wire becoming exposed at the running face, or by inadequate spring pressure due to the brush spring reaching the end of its travel. The minimum recommended length of the brushes is 0·400 in. (10·16 mm.); they MUST be renewed when worn to this extent.

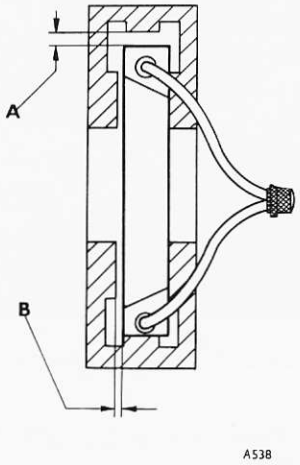


Fig. M6 Brush clearances

C47 PV GENERATOR	C48 GENERATOR
A. 0·018 in. (0·4572 mm.)–0·024 in. (0·6096 mm.)	A. 0·018 in. (0·4572 mm.)–0·026 in. (0·6604 mm.
B. 0·004 in. (0·1016 mm.)–0·006 in. (0·1524 mm.)	B. 0·004 in. (0·1016 mm.)–0·012 in. (0·3048 mm.)

Generator charging failures have sometimes been caused by the brush leads hooking on the corners of the brush boxes or by a short-circuit between the brush leads and the band cover. The latter fault can only occur if the insulating sleeves have been pulled from their normal positions, exposing the wires. This fault should be rectified by stretching the insulating sleeves into their original positions, fully covering the brush leads.

Should the generator require further attention, it is recommended that a replacement unit be fitted.

The following information is included to assist repair when renewal is impracticable.

Bench Testing

(i) Connect a 12-volt test lamp to terminal 'D' and to the generator body. Rotate the armature slowly; the lamp should remain lit. If the generator is open-circuited the lamp will not light.

(ii) Remove the earthed brush; if the test lamp remains lit, the generator has a short circuit to earth.

(iii) With both of the brushes removed, transfer the test lead from terminal 'D' to the commutator. If the lamp lights, the short circuit is in the armature.

(iv) Check the field coil with an ohmmeter, or with a voltmeter and ammeter. This should indicate 5·9 ohms, or approximately 2 amps. at 12 volts.

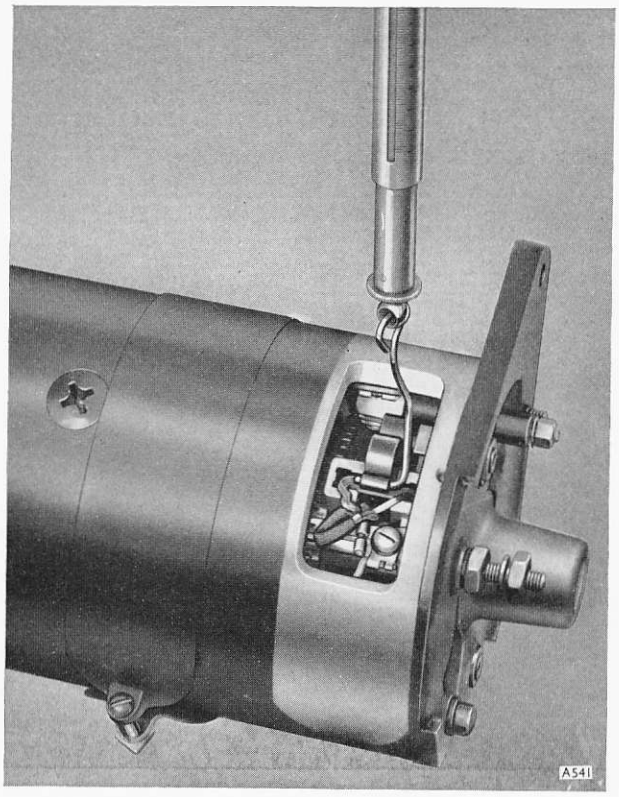


Fig. M7 Checking the brush spring tension

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Overhaul

On both types of generator, release the screw on the band cover and slide the cover clear of the brush apertures in the casing. Check the brush spring tension as shown in Figure M7. The tension should be 20 to 25 oz. (567 to 708·7 gm.), although it may fall as low as 15 oz. (425·2 gm.) before performance is affected. Remove the brushes from their holders and examine the commutator. Discoloration of the commutator may be removed by means of a clean lint-free cloth soaked in methylated spirits. If this is unsuccessful, insert a strip of fine grade glass paper through one of the apertures in the case, around the commutator and back through the same aperture. Hold the glass paper taut and rotate the armature in its normal direction (clockwise viewed from the driving end), until the commutator is clean. Never attempt to clean individual bars of the commutator as this will produce flats and induce burning. Should the commutator be too badly burned, worn, or pitted to respond to this treatment, it may be skimmed in a lathe, taking a light, high-speed cut. The mica between the segments of the commutator should then be undercut to a depth of 0·030 in. (0·762 mm.) as shown in Figure M8.

To dismantle both types of generator, reference should be made to the exploded views (see Fig. M9 for early S1 generators and Fig. M10 for late S1 and all S2 generators).

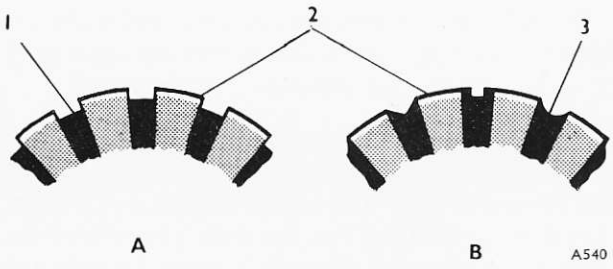


Fig. M8 View of undercut mica

A. CORRECT B. INCORRECT
1. MICA 2. SEGMENTS 3. MICA

On early S1 cars, the standard generator driving pulley may be removed from the armature shaft by using Extractor Tool RH.570 after removing the nut and spring washer from the shaft. If the generator is driven through the 2 : 1 ratio pulley, Extractor Tool RH.583 should be used. After withdrawing the pulley, remove the locating key from its keyway before further dismantling the generator.

On late S1 and S2 cars, to remove the generator driving pulley, first unscrew the nut and remove the spring washer from the armature shaft. Using Extractor Tool RH.7098, withdraw the pulley from the shaft and remove the locating key from its keyway before further dismantling the generator.

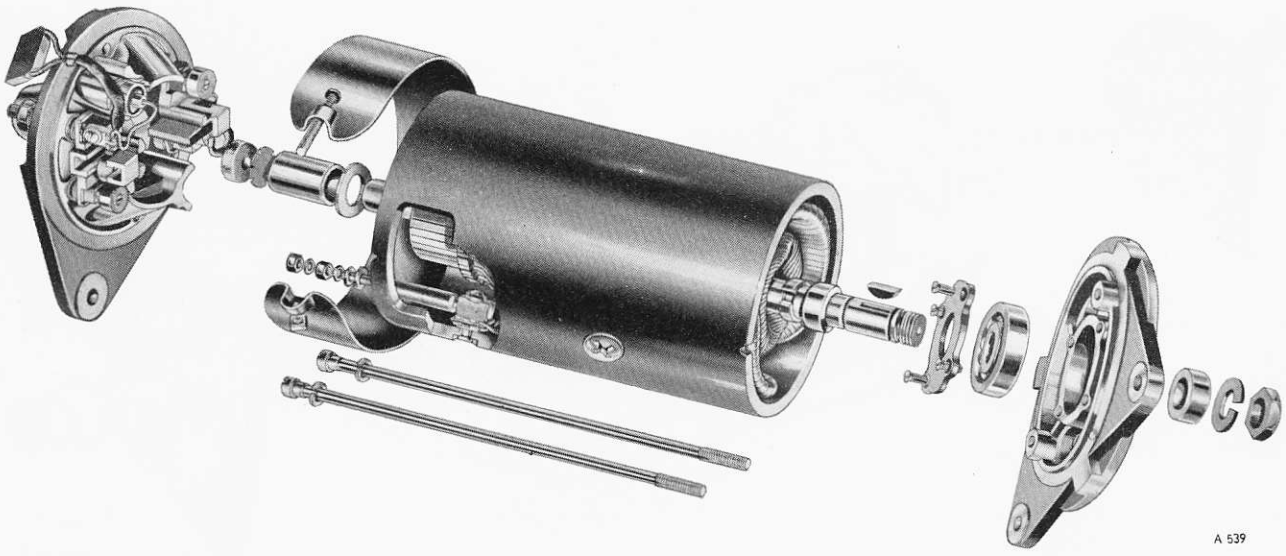


Fig. M9 Exploded view of C47 PV generator

On both types of generator, unscrew and withdraw the two long body screws, thus permitting removal of the drive end housing complete with armature.

If it is necessary to remove the ball bearing from the drive end of the shaft on both types of generator, the end cover complete with retaining plate and bearing should be withdrawn from the shaft. To remove the retaining plate from the bearing housing, file away the peened ends of the four securing screws and remove the screws. The bearing is a light interference fit in its housing and can easily be withdrawn.

Before assembly, pack the ball bearing with high melting point grease and use four new securing screws in the retaining plate. Lock the screws in position by peening over the ends, then fit the assembly to the drive shaft.

On early S1 generators, the commutator end bearing is a porous bush; a new bush should be immersed in engine oil for 24 hours before being fitted.

On late S1 and all S2 generators, the commutator end bearing is a ball bearing housed in the end cover and locked onto the armature shaft by a setscrew and tab washer. To remove the bearing, unlock the tab washer and remove the setscrew. Remove the locking cup, then withdraw the bearing from the armature shaft.

When fitting the commutator end bearing to the armature shaft, pack the bearing with high melting point grease and use a new tab washer to lock the setscrew.

On both types of generator, examine the brushes for wear and clearance in their respective holders. If the brushes are worn below the minimum recommended length of 0·400 in. (10·16 mm.), fit new brushes. When renewing brushes, it is important that the correct brush be used and that a minimum of 75 per cent bedding is obtained on the face with 100 per cent bedding at the trailing edge.

Bedding the Brushes

In order to bed the brushes of both types of generator, wrap a strip of fine grade glass paper around the commutator, allowing the two ends just to meet. The glass paper should be the same width as the commutator and be positioned with the abrasive side facing outwards. Fasten one end of the glass paper to the commutator with a strip of adhesive tape,

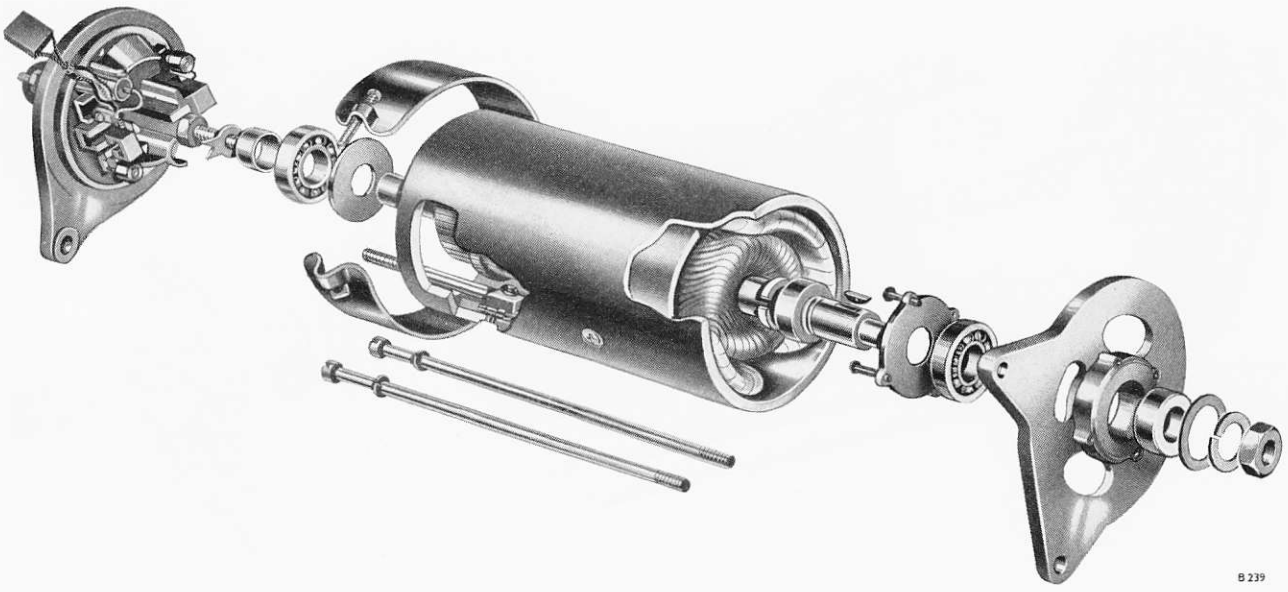


Fig. M10 Exploded view of C48 generator

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then similarly secure the other end so that the commutator is completely encircled (see Fig. M11).

Temporarily assemble the generator and secure the end covers with the two long screws. **On early S1 generators,** do not forget to fit the fibre washer to take up the play between the commutator and the end cover.

Fit the new brushes and rotate the armature in its normal direction of rotation, until the whole brush face shows continuous bedding. Remove the brushes from their holders and dismantle the generator once more.

Remove the glass paper from the commutator and carefully clean away all abrasive dust and carbon. When thoroughly clean, re-fit the end covers and the two long screws. Re-fit the brushes, ensuring that they are fitted in their respective holders in their original 'bedding in' positions.

The generator should be 'motored' by connecting the positive terminal of a 12 volt battery to terminal 'D', the negative battery terminal to earth on the generator casing and the field terminal of the generator to the 6 volt section of the battery. The generator should be 'motored' for 15 minutes, or until the brushes are 75 per cent bedded overall but with 100 per cent bedding at the trailing edges. This 'motoring' is essential to prevent any brush or commutator burning during service.

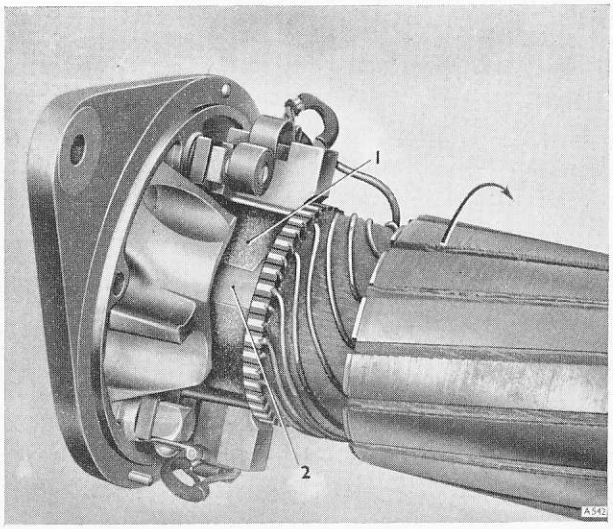


Fig. M11 Bedding the brushes

1. GLASS PAPER 2. ADHESIVE PAPER

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SECTION M3 — CONTROL BOX

Data

Type	Lucas RB310
Cut-out	Cut-in voltage is 12·7 to 13·3 volts Drop-off voltage 9·5 to 10·5 volts Reverse current 3 to 5 amps
Voltage regulator	Open circuit setting at 20 deg. C (68 deg. F) and 1,500 generator r.p.m., 14·8 to 15·1 volts. Voltage must not rise above 16 volts at 3,000 generator r.p.m. **Note:** For every 10 deg. C (50 deg. F) above 20 deg. C (68 deg. F), subtract 0·3 volts and for every 10 deg. C below, add 0·3 volts to this setting.
Current regulator	30 amps. for cars fitted with C47PV generator, 35 amps. for cars fitted with C48 generator.

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Description

On all S1 and S2 cars, the control boxes are common, except that in the later control box the current regulator rating has been increased to 35 amps. and the adjusting screws have been changed from grub screws with lock-nuts to cheesehead screws and springs.

The control box houses three units; the voltage regulator, the current regulator and the cut-out.

The voltage regulator has a high resistance operating coil and is connected in parallel with the generator. The armature tension spring of the voltage regulator is bimetallic, providing a thermal compensation for battery variation due to temperature.

On the voltage regulator winding is a bucking coil which increases the frequency of armature vibration and acts as an output stabiliser. As the fully charged state of the battery is reached, the voltage regulator allows the charging current to drop and continue at a trickle rate.

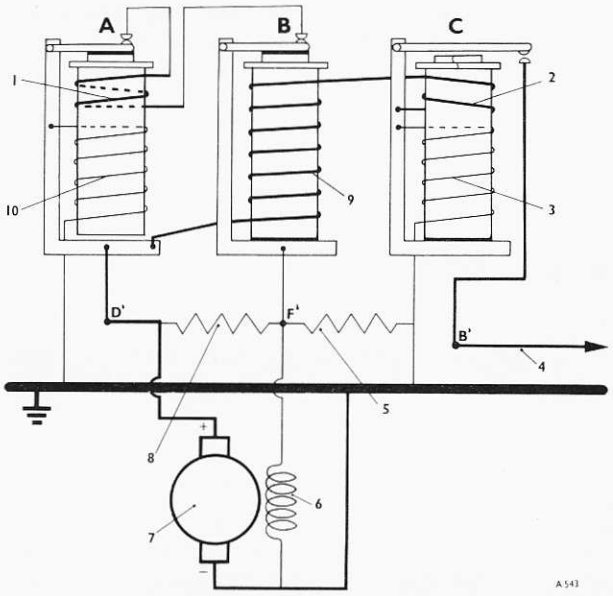


Fig. M12 Control box circuits

A. VOLTAGE REGULATOR B. CURRENT REGULATOR
C. CUT-OUT RELAY

1. BUCKING COIL
2. SERIES WINDING
3. SHUNT WINDING
4. TO BATTERY AND AMMETER
5. 40 OHM QUENCH RESISTANCE
6. FIELD
7. GENERATOR
8. 63 OHM POINTS RESISTANCE
9. CURRENT COIL
10. VOLTAGE COIL

The current regulator has a low resistance operating coil connected in series with the generator and limits the generator output to a safe value when the battery is in a low state of charge or when the electrical load on the system is high.

The contacts of both the voltage and current regulators are normally closed and are connected in series with the generator field.

The cut-out is a high resistance winding connected in parallel with the generator. The function of the cut-out is to break the circuit between the battery and the generator whenever the generator voltage falls below that of the battery, thus preventing battery discharge through the generator.

Control Box — to test in position

To locate the source of a complete failure to charge, remove the two screws holding the control box cover in position and withdraw the cover. Examine the contact points for oxidation, burning, pitting and poor surface finish. If any of these defects are found, the contacts should be very carefully cleaned using fine glass paper and then washed with methylated spirits.

If the contacts are found to be satisfactory, test the control box as follows:

(i) Ensure that the generator is functioning as described in the Generator Section.

(ii) With the 'D' and 'F' wires to the generator disconnected, the engine switched off and the cut-out points held closed, test as shown in Figure M13.

(*a*) A zero reading indicates a failure at the cut-out or regulator points. Transfer the voltmeter positive lead to the 'D' terminal of the control box. A full voltage reading in this position indicates that the failure is in the field circuit.

(*b*) If the reading remains at zero, transfer the voltmeter lead to the 'B' terminal. A zero reading at the 'B' terminal indicates a fault in the wiring or the battery connections. A normal voltage reading indicates a failure at the cut-out points.

Should the operation of the control box be unsatisfactory, it is recommended that the unit be renewed.

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The following information is given only to assist servicing where it is impracticable to obtain a replacement unit.

Electrical Settings

Cut-out Relay

With the generator leads connected to the control box in their respective positions, connect the voltmeter positive lead to the 'D' terminal and the negative lead to earth. Increase the engine speed and adjust the cutting-in voltage as shown in Figure M14, locking the adjustment screw in the case of the early type of control box. The cutting-in voltage should again be checked after tightening the lock-nut as the adjustment

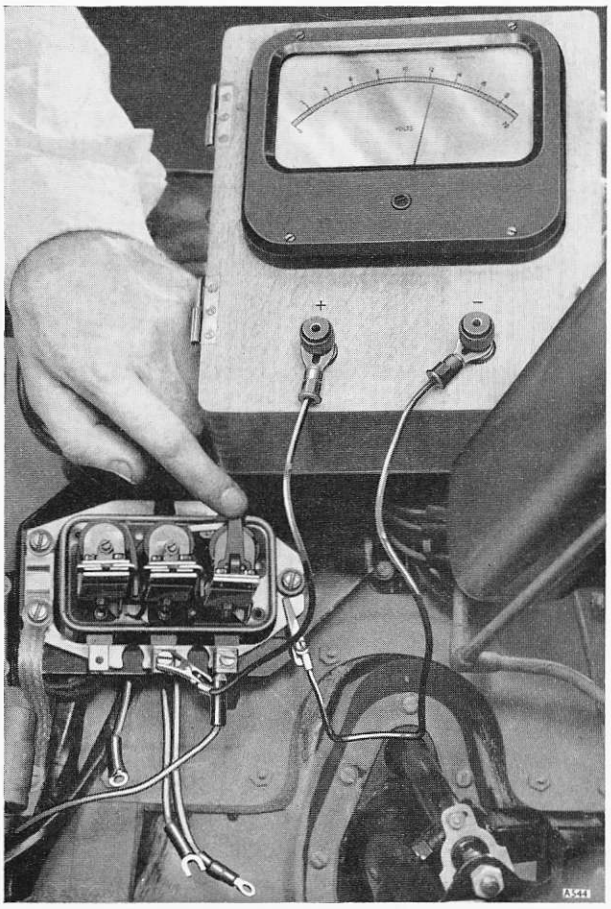


Fig. M13 Control box continuity test

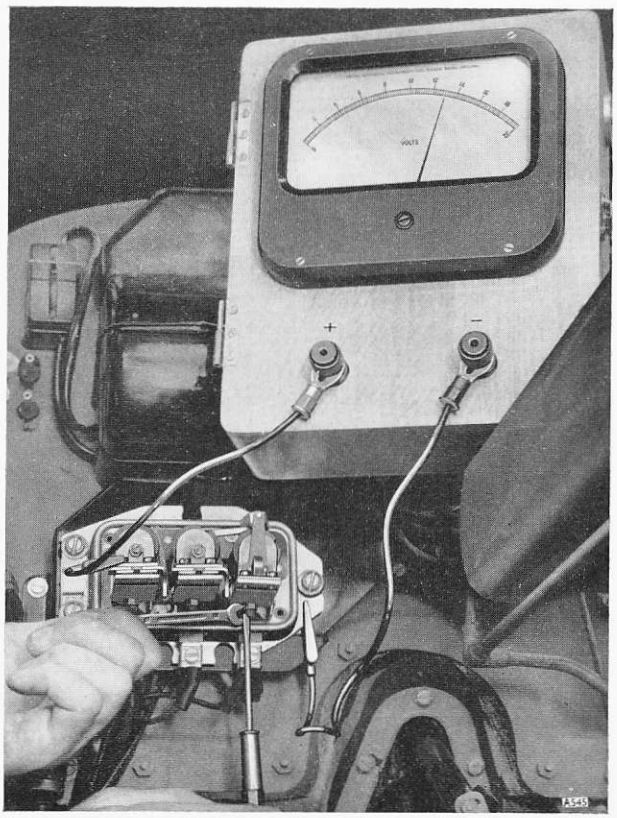


Fig. M14 Cut-in voltage adjustment

is very sensitive. The drop-off voltage is adjusted by setting the neck of the fixed contact post; this should not be necessary unless the contact post has been damaged.

Voltage Regulator Open Circuit Setting

With the control box connected as described above for the cut-out relay, insert a piece of paper between the cut-out points to isolate the generator from the battery circuit (see Fig. M15). The engine speed should be slowly increased until the voltmeter needle flicks and steadies; the generator speed should then be approximately 1,500 r.p.m.

Set the voltage regulator by means of the adjustment screw and then increase the engine speed and check the maximum voltage at approximately 3,000 generator r.p.m.

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Current Regulator Setting

Remove the two leads from the 'D' terminal on the control box and connect them to the positive terminal of an ammeter; the negative terminal of the ammeter should be connected to the 'D' terminal of the control box as shown in Figure M16. Switch on all available electrical equipment to ensure maximum output and adjust the current regulator at 2,000 to 2,500 generator r.p.m. by means of the adjustment screw. On the early type of control box, the setting should again be checked after locking the adjustment screw. The generator speed should now be increased to 4,000 r.p.m. to ensure that the output remains constant.

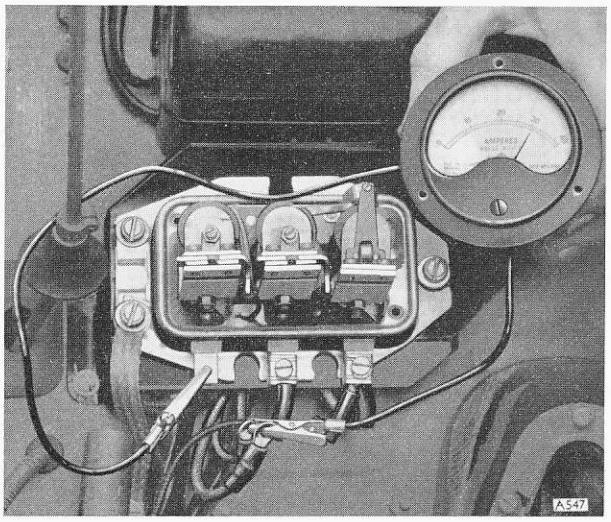


Fig. M16 Checking current regulator

Mechanical Settings

Where the electrical values are unobtainable or the units have been disturbed, the following settings should be carried out:

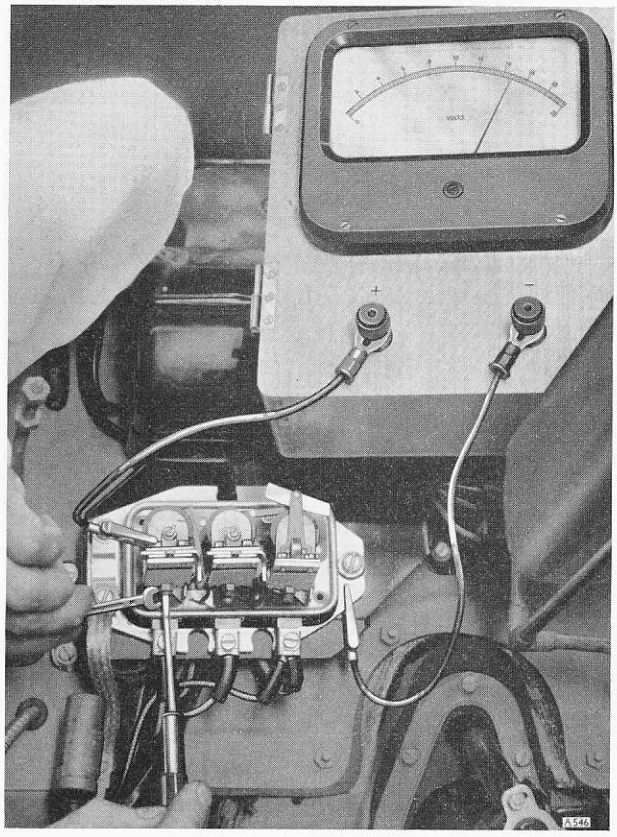


Fig. M15 Open circuit voltage adjustment

Cut-out Relay

(i) Slacken the two armature securing cheesehead screws and unscrew the adjusting screw until it is well clear of the armature tension spring.

(ii) Press the armature squarely down against the core face and tighten the two armature securing screws.

(iii) Retaining the armature in this position and using a pair of round-nosed pliers, adjust the armature back-stop (see Fig. M17) to give 0·018 in. (0·457 mm.) clearance between the back-stop tip

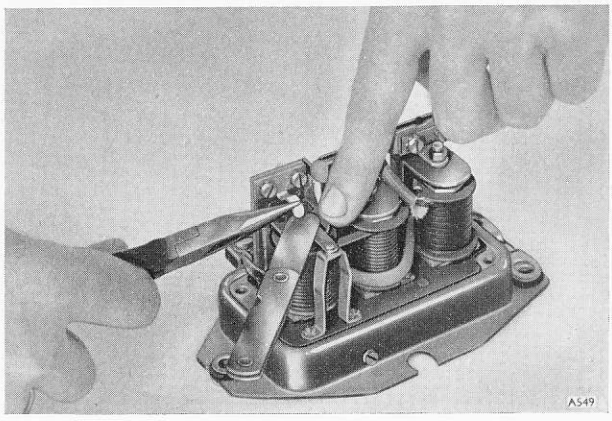


Fig. M17 Adjusting cut-out armature back stop

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and the contact blade. Adjust the fixed contact post to give a follow-through gap of approximately 0·010 in. (0·254 mm.) between the moving contact blade and the front edge of the armature (see Fig. M18).

The electrical settings should be carried out as detailed previously.

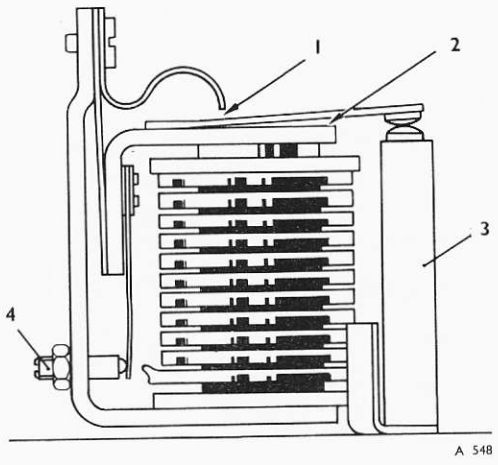


Fig. M18 Cut-out relay adjustment

1. BACK-STOP GAP 0·018 in. (0·457 mm.)
2. FOLLOW-THROUGH GAP 0·010 in. (0·254 mm.)
3. CONTACT POST
4. ADJUSTING SCREW

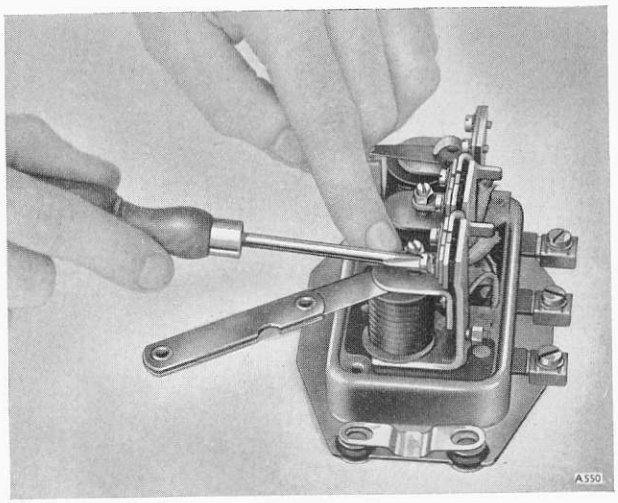


Fig. M19 Adjusting armature air gap

Voltage and Current Regulator

(i) Slacken the two armature securing screws and unscrew the adjusting screw until it is well clear of the armature tension spring.

(ii) Insert a 0·015 in. (0·381 mm.) feeler gauge between the armature and the core shim. Press the armature squarely against the gauge (see Fig. M19) and tighten the two armature securing screws. Screw in the top (fixed) contact until it just touches the armature moving contact, then tighten the locking nut. Remove the feeler gauge and carry out the electrical settings as described above.

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SECTION M4

STARTER MOTOR AND DRIVE UNIT — S1 CARS

Data

Type	Lucas Model M45G fitted with a Rolls-Royce reduction gear and drive unit. An overall reduction of 18·05 : 1 is obtained between the starter motor pinion and the engine flywheel.
Performance	**Approximate current value**
No-load condition at 4·5 volts (terminal voltage)	30 amps.
Loaded condition at 8·5 volts (terminal voltage)	220 amps.
Lock-torque test at 7·6 volts (terminal voltage)	440 amps.
Drive slip torque	20 to 25 lb.ft. (276 to 3·45 kg.m.)
Brush spring tension	21 to 27 oz. (595·35 to 7·65·45 gm.)

Description

The starter motor, which is positioned on the left-hand side of the engine, is a Lucas Model M45G fitted with a Rolls-Royce reduction gear and drive unit.

The drive unit consists of a small train of gears arranged in a casing behind the starter motor and provides a reduction in ratio between the starter motor pinion and the engine flywheel. A clutch is incorporated in the drive unit to reduce shock and prevent overloading of the starter motor.

The starter motor is energised through a solenoid switch mounted on the left-hand side of the chassis frame, adjacent to the motor. The solenoid switch is energised by turning the ignition key to the extreme right.

Maintenance

Every 10,000 miles (16,000 kilometres), inject sufficient S.A.E.30 engine oil into the reduction gear casing to bring the oil level up to the filler plug hole (see Fig. M21).

Starter Motor — to test in position

Check the condition of the battery.

Remove the ignition fuse (No. 11) from the main fuse box and turn the ignition key to the extreme right to operate the starter motor. If the solenoid switch is working, it will be heard to operate every time the circuit is completed; if the solenoid switch is not working, the wiring should be checked between the switchbox and the solenoid switch. Check the micro-switch fitted at the base of the steering column

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(automatic gearbox cars only) and ensure that current is available at the ignition switch.

Should all the abovementioned points be satisfactory, the fault must be in the starter motor or the electrical connections to the starter motor. These may be checked by connecting a voltmeter between the starter motor terminal and a good earth point on the chassis frame, then operating the ignition switch with the ignition fuse removed.

(i) A full voltage reading indicates an open circuit in the starter motor (see 'Starter Motor and Drive Unit — to remove' and 'Motor Overhaul').

(ii) If the starter motor operates but does not turn the engine and the voltage reading is between 6 and 10 volts, examine the drive unit (see instructions for the Drive Unit).

(iii) A low voltage reading indicates either poor electrical connections or a short circuit in the starter motor. Check the battery voltage while the starter motor is operating; if the reading is very low it indicates a short circuit.

If necessary, tighten the electrical connections; if the voltage reading remains low, a short circuit in the motor is indicated (see 'Starter Motor and Drive Unit — to remove' and 'Motor Overhaul').

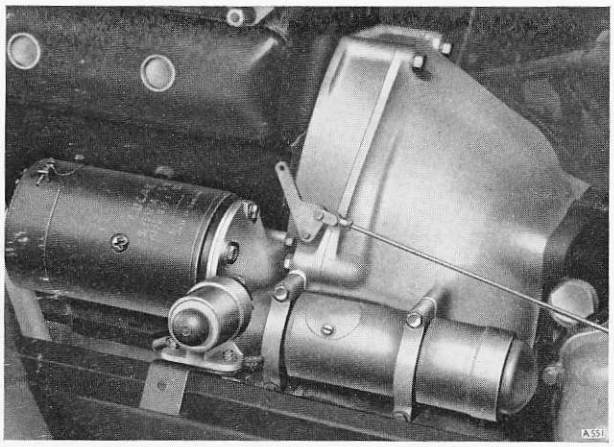


Fig. M20 Starter motor and relay — S1 cars

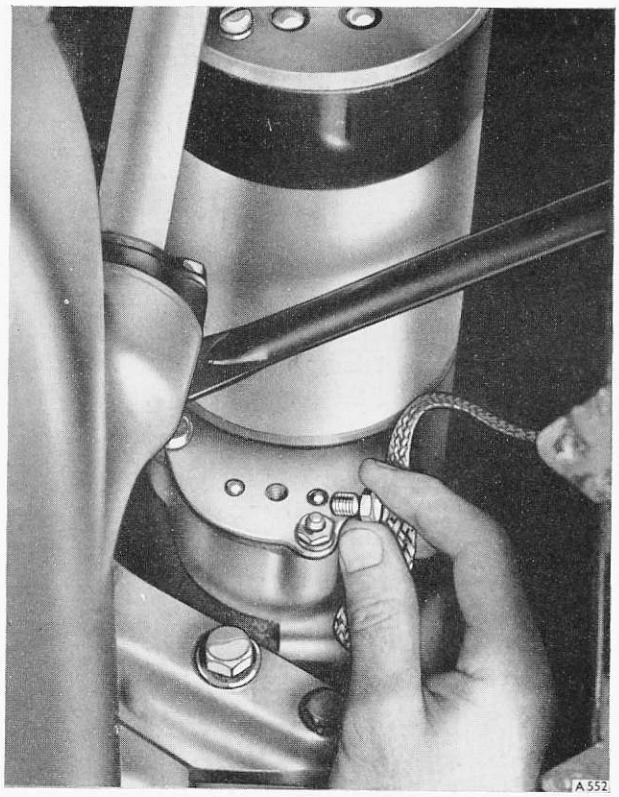


Fig. M21 Filling starter reduction gear casing — S1 cars

Starter Motor and Drive Unit — to remove

Disconnect the negative lead from the battery.

Disconnect the cable from the starter motor, then remove the starter motor complete with the drive unit.

Drain the oil from the gear casing and remove the drive unit from the motor.

Note that on re-assembly, the gears must be meshed in accordance with the markings on the teeth. Fill the gear case with oil after re-fitting the unit to the engine.

Bench Testing

(i) Connect a test lamp in series with a battery across the starter motor terminal and the starter motor body. The lamp should remain lit when the armature is rotated slowly; if the lamp will not light, an open circuited motor is indicated.

(ii) Remove the cover band and lift the pair of earthed brushes clear of the commutator; the brushes should be held in their respective boxes, clear of the commutator, by applying pressure on the sides of the brushes with the aid of the brush springs. If the test lamp remains lit, this indicates that the starter motor has a short circuit to earth.

(iii) Lift the second pair of brushes clear of the commutator, holding them in their respective boxes in a similar manner to that previously described in (ii). If the test lamp remains lit with the four brushes clear of the commutator, the fault lies in the field circuit.

(iv) If the lamp does not light in (iii), transfer the test lamp lead from the starter motor terminal to the commutator. If the lamp lights, the fault lies in the armature.

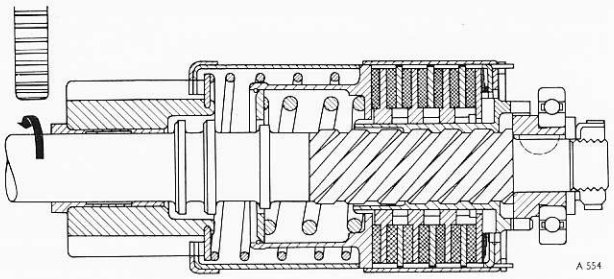


Fig. M22 Starter drive sectional view — S1 cars

Motor Overhaul

Remove the brushes and withdraw the two long body screws, then remove the drive end bracket complete with armature.

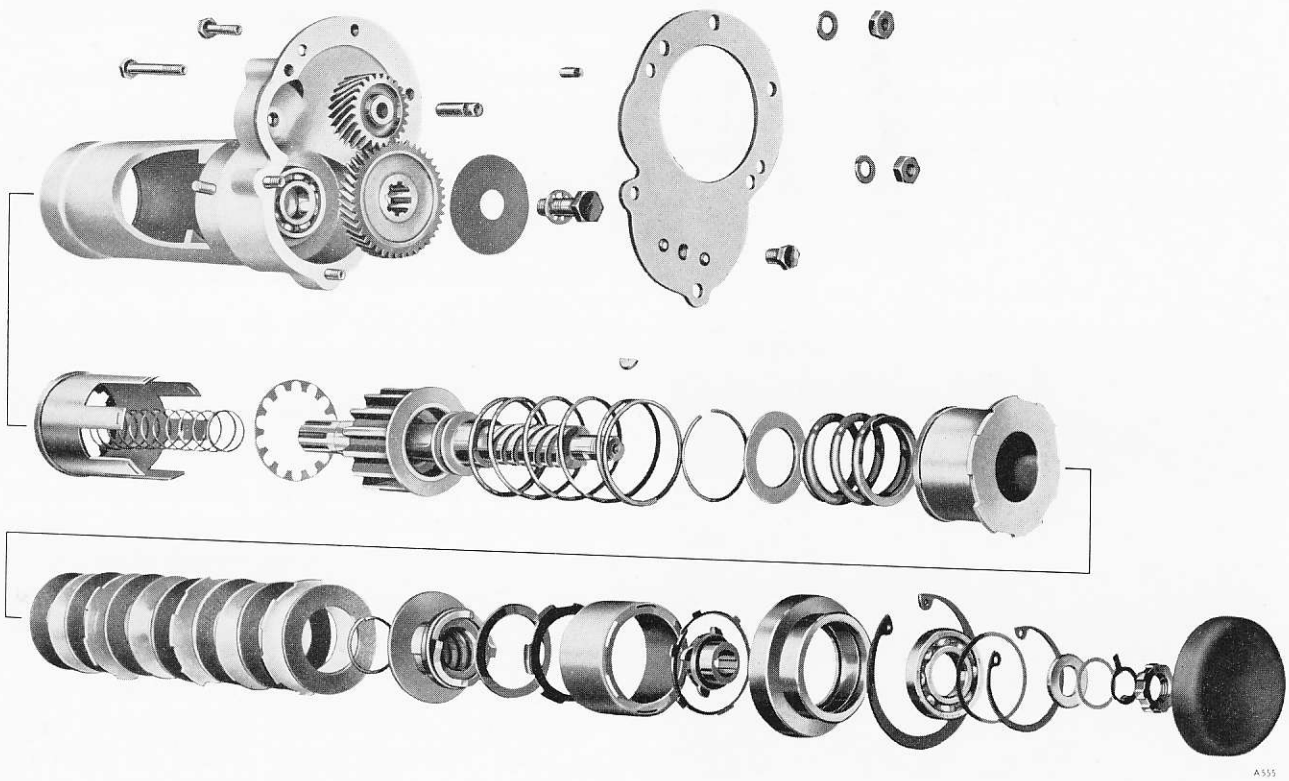


Fig. M23 Starter drive exploded view — S1 cars

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To renew the drive end ball bearing, press out the armature shaft, file off the peened ends of the two studs and remove the two nuts securing the drive end bearing plate. Press the bearing from the end bracket. On re-assembly pack the ball bearing with high melting point grease and lock the two securing nuts by centre popping.

The commutator end bearing is a sintered bronze, oil retaining bush; before fitting, a new bush should be soaked in engine oil for 24 hours.

Checking the brush spring tension, fitting and bedding the brushes and cleaning the commutator should be carried out as described for the generator (see Generator Section), except that the mica of the starter motor commutator must not be undercut.

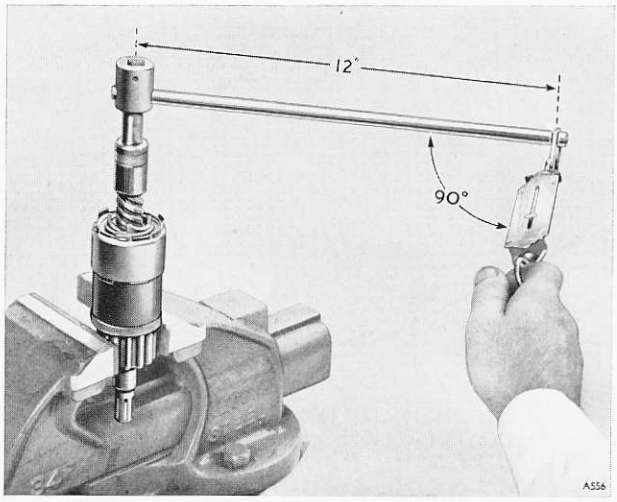


Fig. M24 Checking slip torque — S1 cars

Drive Unit

The clutch incorporated in the drive unit reduces shock and prevents overloading of the starter motor.

When overhauling the drive unit, the total thickness of the clutch discs must be maintained at 1·070 in. to 1·080 in. (27·178 mm. to 27·432 mm.). The thickness of the Ferodo disc is 0·086 in. to 0·090 in. (2·184 mm. to 2·286 mm.) and selective assembly will usually permit the correct overall thickness to be obtained. If necessary, light rubbing on medium grade glass paper will reduce the thickness.

Before assembly, the Ferodo discs should be soaked in S.A.E.30 engine oil for 30 minutes. Care should be taken to assemble in the precise order shown in the exploded view (see Fig. M23) but do not lock the slotted ring before obtaining the correct slip torque. Pack the ball race with high melting point grease.

The slip torque, which is that required to maintain steady slip, should be 20 to 25 lb.ft. (2·76 to 3·45 kg.m.); the high break-away figure should be ignored. The test for the slip torque may be carried out as illustrated in Figure M24 by substituting a standard nut in place of the slotted ring nut, and utilising a spring balance, box spanner and bar.

Several readings should be taken and the clutch disc overall thickness should be adjusted to obtain the correct values.

Micro-switch

On cars fitted with the automatic gearbox, a micro-switch is attached to the base of the steering column. This switch is included in the starter motor circuit and is operated by the gear range selector lever so as to ensure that the engine can only be started when the lever is in the 'Neutral' position.

In cases of failure of the starter motor to operate, the gear change selector lever should be inspected to ensure that it is operating the toggle lever on the switch. If necessary, the switch should be re-positioned on the steering column, care being taken not to disturb the micro-switch controlling the reversing lamps.

Solenoid Switch

The starter solenoid switch is mounted on the chassis frame adjacent to the starter motor. The solenoid is energised by turning the ignition key to the extreme right.

To test the solenoid switch in position, inter-connect the 2 B.A. screw terminal and the main battery feed terminal. If the relay is working, it will be heard to operate every time the circuit is completed; if not, ensure that the feed and earth circuits are complete.

For emergency use or for testing purposes, the solenoid may be manually operated by pressing the rubber cap which covers an extension of the switch.

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SECTION M5

STARTER MOTOR AND DRIVE UNIT — S2 CARS

Data

Type	Lucas Model M45G fitted with a combined freewheel and clutch unit which provides a ratio of 18 : 1 between the starter motor pinion and the engine flywheel.

Performance	Approximate current value
No-load condition at 12 volts (terminal voltage) and at 5,800 to 6,500 r.p.m.	60 amps.
Loaded condition at 9·75 volts (terminal voltage) Torque loading should not be less than 6·7 lb.ft. (0·9246 kg.m.)	220 amps.
Lock-torque test at 7·35 volts (terminal voltage) Torque loading should not be less than 18·8 lb.ft. (2·5944 kg.m.)	425 amps. 435 amps. with the solenoid connected
Brush spring tension	21 to 27 oz. (595 to 765 gm.)

Description

The starter motor is a Lucas Model M45G, fitted with a combined freewheel and clutch unit to transmit the drive. The combined unit allows the starter motor pinion to freewheel on its shaft when being driven by the engine flywheel.

The starter motor is operated by turning the ignition key to the extreme right; this operates the solenoid switch which in turn energises the starter motor solenoid. This solenoid, working against spring pressure, draws the plunger into the solenoid barrel and causes the actuating lever to engage the starter motor pinion with the flywheel. As the plunger nears the end of its travel, the moving contacts connected to the switch operating rod close the solenoid contacts and complete the starter motor circuit.

A safety measure is incorporated in the starter motor solenoid which breaks the contacts if the pinion is held in mesh with the flywheel.

Maintenance

The starter motor will operate for long periods before requiring attention and should only need to be serviced during major overhauls of the car.

The starter motor requires lubrication only when major overhauls are necessary as all the bearings in the motor are made of oil retaining sintered bronze.

Service

When first introduced, the starter motor drive unit consisted of a combined clutch and three-roller flywheel assembly. This type of freewheel was found

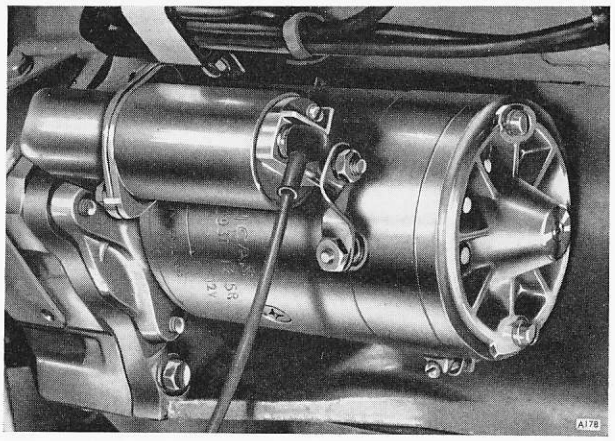


Fig. M25 Starter motor and solenoid — S2 cars

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to be slightly noisy in operation and has been superseded by a four-roller assembly. If the starter drive clutch unit has to be renewed, it will be noted that the four-roller freewheel assembly can only be fitted to a starter motor previously fitted with the three-roller assembly, if the nose bearing housing and pinions are also changed.

The four-roller freewheel and clutch is identified by a blue and yellow spot painted on the assembly. In addition, the type of freewheel and clutch can be identified by rotating the pinion in its freewheel direction; the three-roller unit will rotate with the pinion while the four-roller unit will remain stationary, allowing the pinion to rotate alone.

A small number of starter motor failures have occurred on S2 cars fitted with the three-roller freewheel and clutch and a modification has been introduced to rectify these faults. The failures are attributed either to slipping of the starter motor clutch unit or to poor electrical connections.

The sign of a slipping clutch is that the starter motor pinion engages normally with the engine flywheel when the ignition key is turned in the switch but the starter motor driving shaft spins without turning the engine. A modified clutch unit is available, incorporating stronger springs and in the event of failure the starter motor assembly should be exchanged either for a unit with the modified clutch or for a unit fitted with the four-roller freewheel (see 'Starter Motor — to remove').

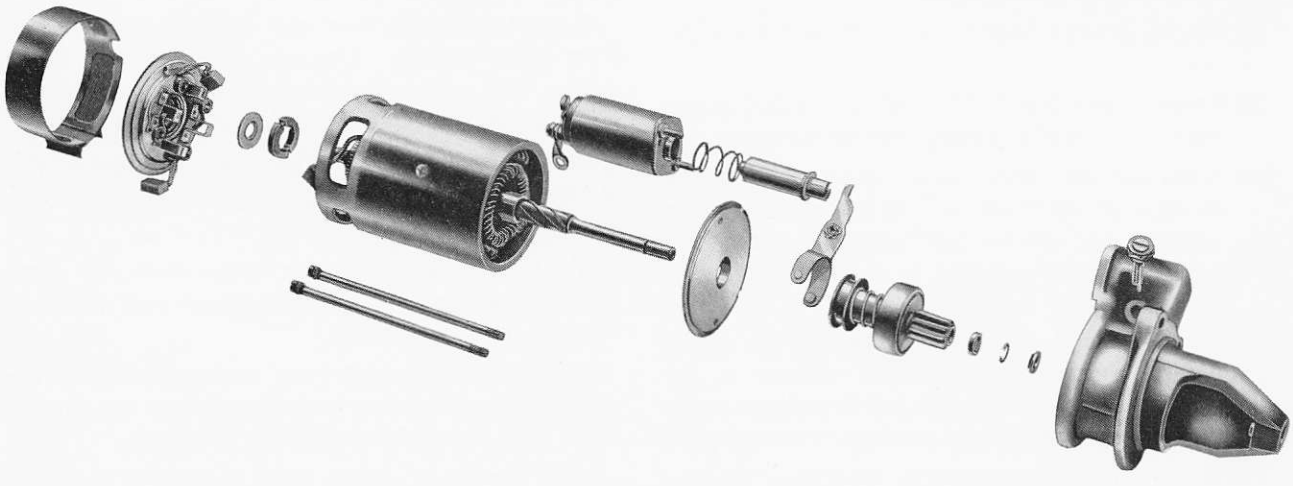
Should failure be due to poor electrical connections, the fault can be identified by the fact that the starter motor pinion engages normally with the flywheel and then remains silent. This is due to the poor electrical connections producing a high resistance in the circuit. The results of this high resistance are that although sufficient current is available to engage the starter motor pinion with the engine flywheel, this is insufficient to turn the engine. To remedy this fault, inspect and tighten all electrical connections on the starter motor and solenoid.

Starter Motor — to test in position

Check the condition of the battery.

Remove the ignition fuse (No. 11) from the main fuse box, then turn the ignition key to the extreme right to operate the starter motor and check that the solenoid switch is closing. The solenoid switch should be heard to operate every time the circuit is completed; if the solenoid switch is not working, the wiring should be checked between the switchbox and the solenoid switch. Check the micro-switch fitted at the base of the steering column on the left-hand side and ensure that current is available at the ignition switch.

Check that the starter motor solenoid, which is attached to the starter motor body, is engaging the pinion with the engine flywheel; the solenoid should be heard to operate with a metallic sound.



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Fig. M26 Exploded view of starter motor — S2 cars

Should all the abovementioned points be satisfactory, the fault must lie in the starter motor or in the electrical connections to the starter motor. These may be checked by connecting a voltmeter between the starter motor terminal and a good earth point on the chassis frame and operating the ignition switch with the ignition fuse disconnected. Note that the link between the starter motor solenoid and the starter motor terminal should not be removed for this test.

(i) A full voltage reading indicates an open circuit in the starter motor (see 'Starter Motor — to remove' and 'Motor Overhaul').

(ii) If the starter motor operates but does not turn the engine and the voltage reading is between 6 and 10 volts, the drive clutch unit should be renewed (see 'Starter Motor — to remove' and 'Motor Overhaul').

(iii) A low voltage reading indicates either poor electrical connections or a short circuit in the starter motor. Check the battery voltage while the starter motor is operating; if the reading is very low, a short circuit is indicated. If necessary, tighten the electrical connections and if the voltage reading remains low, a short circuit in the motor is indicated (see 'Starter Motor — to remove' and 'Motor Overhaul').

Starter Motor — to remove

Access to the starter motor is obtained from beneath the car and it is therefore desirable to have the car placed on a ramp or over a pit.

(i) Disconnect the negative or earth lead from the battery.

(ii) Remove the undershield which is attached to the frame side member beneath the starter motor.

(iii) Withdraw the rubber cover which shrouds the terminal at the front end of the starter motor solenoid and remove the heavy duty lead; also remove the lead attached to the terminal clip of the solenoid.

(iv) Unscrew the three setscrews retaining the starter motor, noting that the upper setscrew is not readily detachable from the bell housing owing to the close proximity of the crankcase breather pipe.

(v) Remove the starter motor by lowering it between the engine and the chassis frame.

Bench Testing

(i) Connect a test lamp in series with a battery across the starter motor terminal and the starter motor body. When the armature is rotated slowly, the lamp should remain lit. When connected to an open circuited motor, the lamp will not light.

(ii) Remove the cover band and lift the pair of earthed brushes clear of the commutator; the brushes should be held in their respective boxes, clear of the commutator, by applying pressure on the sides of the brushes with the aid of the brush springs. If the test lamp remains lit, this indicates that the starter motor has a short circuit to earth.

(iii) Lift the second pair of brushes clear of the commutator, holding them in their respective boxes in a similar manner to that previously described in (ii). If the test lamp remains lit with the four brushes clear of the commutator, the fault lies in the field circuit.

(iv) If the lamp does not light in (iii), transfer the test lamp lead from the starter motor terminal to the commutator. If the lamp lights, the fault lies in the armature.

Motor Overhaul

Remove the starter motor solenoid from the motor by unscrewing the two nuts on the nose bearing housing. Remove the nut and solenoid connector strip from the starter motor terminal. Remove the outer casing of the solenoid and detach the solenoid plunger from the actuating lever.

Release the cover band and withdraw the brushes from their holders. Unscrew the two long body screws, then remove the nose bearing housing and the commutator bearing housing (see Fig. M26).

Withdraw the armature from the drive end of the starter motor body, complete with the drive end bearing housing in position.

To remove the actuating lever from the nose bearing housing, unscrew the lock-nut and withdraw the eccentric centre pivot.

Should the drive end bush need renewing or the clutch unit and pinion require attention, removal of these units should be carried out as follows:

Slide the thrust washer from the end of the drive shaft, then using a suitable hollow drift which must fit

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over the snap ring, lightly tap the retaining collar clear of the snap ring.

Remove the snap ring from its groove and withdraw the retaining collar.

Withdraw the clutch unit and pinion assembly from the end of the armature shaft, thus permitting removal of the drive end housing and bush.

When renewing any of the three bushes in the starter motor, the new bush should be immersed in engine oil for 24 hours before being fitted.

To remove the sliding collar and spring from the clutch and pinion assembly, press the collar clear of the snap ring (against spring pressure), then remove the snap ring and withdraw the collar and spring from the shaft.

The clutch unit and pinion is a combined assembly. If the clutch is slipping or the pinion is damaged, the complete assembly must be renewed; no attempt should be made to dismantle it.

Brush spring tension should be 21 to 27 oz. (595 to 765 gm.). Checking the spring tension, fitting and bedding the brushes and cleaning the commutator should be carried out as described for the generator (see Generator Section) except that the *mica of the starter motor commutator must not be undercut.*

The assembly procedure is the reverse of dismantling but it should be noted that if either of the two snap rings on the clutch unit and drive assembly are damaged, they should be renewed.

To assemble the retaining collar, snap ring and thrust washer on the drive shaft, first place the retaining collar over the end of the shaft, past the snap ring groove. Fit the snap ring in its groove, then place the thrust washer on the shaft. Position both the retaining collar and thrust washer as close as possible to the snap ring, then with two pairs of pliers, close the retaining collar and thrust washer together over the snap ring.

On assembly, the components should be liberally greased with Retinax 'A' and the following notes strictly observed:

(i) The forked engaging lever must be free to move on its pivot with no tendency to bind.

(ii) The operating collar must be free to move along the driving sleeve with no tendency to bind.

(iii) The assembled drive unit must be free to move along the drive shaft helix without any roughness or tendency to bind.

Starter Motor Solenoid — to adjust

When the starter motor has been fully assembled, the solenoid should be adjusted by means of the eccentric operating lever pivot pin to give an end float of 0·005 in. to 0·010 in. (0·129 mm. to 0·254 mm.) between the retaining collar and the pinion (see Fig. M27).

To adjust the actuating lever, remove the connecting link between the starter motor terminal and the lower terminal of the solenoid; connect one lead of a 12-volt battery to the solenoid lower terminal and connect the other battery lead to the solenoid Lucar connector.

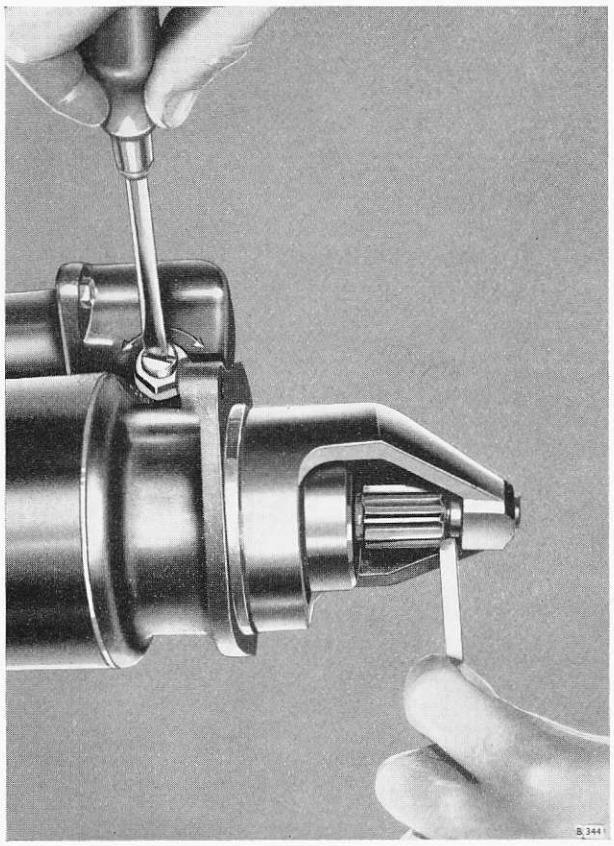


Fig. M27 Setting the pinion clearance — S2 cars

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This energises the solenoid and causes the actuating lever to move the pinion along the shaft. A feeler gauge should then be inserted between the pinion and the retaining collar while light pressure is applied to the pinion against the direction of travel.

> **Note:** When the solenoid is properly adjusted the 'arrow' marked on the eccentric pivot pin should lie between the two arrow heads on the nose bearing housing.

Micro-switch

Two micro-switches are fitted at the base of the steering column, one of which is included in the starter motor circuit. This switch is operated by the gear change selector lever to ensure that the engine can only be started when the lever is in the 'Neutral' position.

In cases of failure of the starter motor to operate, the gear change selector lever should be inspected to ensure that it is operating the toggle lever on the switch. If necessary, the switch should be re-positioned on the steering column, care being taken not to disturb the adjacent micro-switch which controls the reversing lamps.

Solenoid Switch

The starter motor solenoid switch is clipped onto the heavy duty battery lead, adjacent to the starter motor. The solenoid switch is energised through the ignition switch and its purpose is to isolate the ignition switch from possible overloading and burning out while the starter motor is operating.

To test the solenoid switch in position, inter-connect the 2 B.A. terminal and the main battery feed terminal. If the switch is working satisfactorily, it will be heard to operate every time the circuit is completed. If the switch fails to operate, ensure that the feed and earth circuits are complete. Should the switch still fail to operate, the unit should be removed and renewed.

For emergency use or for testing purposes, the solenoid switch can be manually operated by pressing the rubber cap which covers an extension of the switch mechanism.

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SECTION M6 — IGNITION SYSTEM — S1 CARS

Distributor

Type	Delco–Remy
Firing order	1, 4, 2, 6, 3, 5
Timing	2 deg. B.T.D.C.
Direction of rotation	Clockwise
Contact gap	0·019 to 0·021 in. (0·483 to 0·533 mm.)
Dwell angle	44 deg. at 0·020 in. (0·508 mm.)
Contact arm spring tension	15 to 17 oz. (425 to 481 gm.)
Condenser capacity	0·18–0·25 mfd.
Radio interference suppressor: Resistor in rotor arm	5,000 to 6,500 ohms (approx.)

Coil

Insulation resistance to case	20 meg. at 500 volts
Primary winding resistance	4·25 to 4·65 ohms at 75 deg. F
Secondary winding resistance	5,500 to 7,100 ohms at 75 deg. F
Radio interference suppressor: Capacitor on '+' (S.W.) terminal	1 mfd.

Sparking Plugs

Gap	0·025 in. (0·635 mm.)

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DISTRIBUTOR

Maintenance — Lubrication

The grease cap on the side of the distributor should be given two turns every 1,000 miles (or 1,600 kilometres). When replenishing this supply, high melting point grease should be used.

Every 5,000 miles (or 8,000 kilometres) apply a drop of oil to each contact arm pivot and apply a few drops of oil to the felt wick in the top of the distributor shaft.

Check the condition and setting of the contact points.

Spare Condenser

Two condensers are mounted on the side of the distributor; one is connected to the distributor terminal and the other one is carried as a spare.

If the engine misfires or fails to start and this condition is not due to fuel starvation, it is possible that the condenser may be faulty. To remedy this fault, disconnect the lead from the suspect condenser and connect it to the spare condenser. The faulty condenser should be renewed at the earliest opportunity.

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Contact Points — to clean and adjust

If the contact points require cleaning or re-facing, they should be removed from the distributor as follows:

Remove the distributor cap and rotor arm.

Unscrew the two nuts, setscrews and washers securing the contact breaker springs to the connecting strip and withdraw the contacts from their pivots.

Unscrew the two screws (4 and 8, Fig. M28) and remove the contact points. Examine the contact surfaces for pitting and piling. They should be cleaned as necessary with a fine carborundum stone, taking care to keep the contact faces square to one another. If the points are seriously corroded they should be renewed.

Fit the contact points by reversing the removal procedure, taking care to align the points so that they make full face contact.

To adjust the contact points, release the two locking screws (4 and 8, Fig. M28), and using the two eccentric screws (5 and 9, Fig. M28), set the gaps to between 0·019 in. (0·483 mm.) and 0·021 in. (0·533 mm.). Tighten the two locking screws.

Screws 1, 2 and 6 shown in Figure M28 should not be disturbed except when synchronising the contact points, which must be carried out whenever the contact points have been renewed or re-fitted.

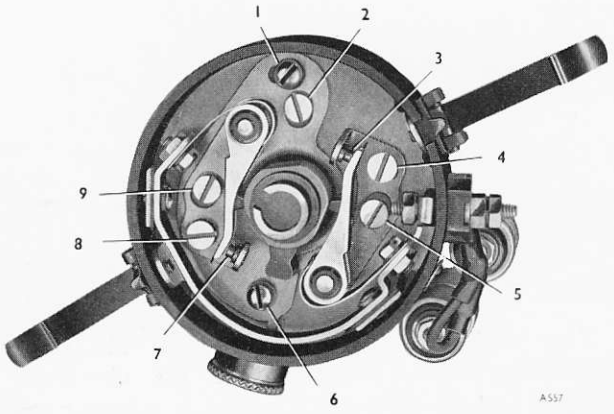


Fig. M28 Contact points adjustment — S1 cars

1. SYNCHRONISATION LOCKING SCREW
2. SYNCHRONISATION ADJUSTING ECCENTRIC
3. FIXED POINTS FEEDING 1, 2 AND 3 CYLINDERS
4. LOCKING SCREW
5. GAP ADJUSTING ECCENTRIC
6. SYNCHRONISATION LOCKING SCREW
7. SYNCHRONISING POINTS FEEDING 4, 5 AND 6 CYLINDERS
8. LOCKING SCREW
9. GAP ADJUSTING SCREW

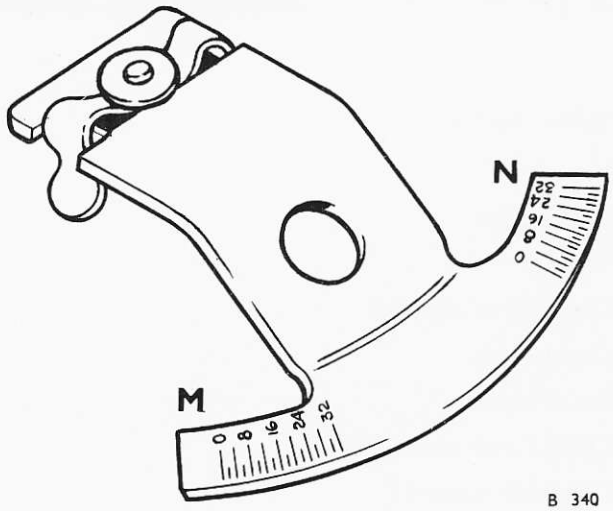


Fig. M29 Synchronising tool STD.410

Ignition Timing

Distributor—to remove

Remove the sparking plugs and press the rubber button on the end of the starter motor relay until the No. 1 cylinder ignition position is approached. This point can be identified by the position of the rotor arm relative to the markings on the distributor cap.

Remove the flywheel housing inspection cover and turn the crankshaft by hand (or use Tool R.5011 for cars fitted with synchromesh gearboxes), to the correct timing position of 2 deg. B.T.D.C. The flywheel should only be rotated in its normal direction. Any reversal of direction during this operation may render the ignition timing inaccurate due to relative movement in the spring drive unit and backlash in the gears.

Disconnect the low tension lead from the distributor terminal. Remove the two nuts and washers securing the distributor to the crankcase and withdraw the distributor.

Contact Points — to synchronise (using Tool STD.410)

Tool STD.410 (see Fig. M29) has been introduced to facilitate the synchronising of the contact points.

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Position the setting tool on the top of the distributor shaft with the 'N' side of the spring fitting into the slot in the shaft.

Rotate the distributor shaft clockwise until the graduated scale on the 'M' side of the setting tool approaches the slot in the rim of the distributor casing (see Fig. M30). Continue turning the shaft until the precise moment of opening of the fixed contact points (3, Fig. M28) is attained and note the exact reading on the graduated scale relative to the edge of the slot.

The precise moment of opening the contact points may be obtained by means of an ignition timing lamp.

Continue rotating the shaft until the edge of the slot in the rim is exactly aligned with the same graduation on the 'N' side of the setting tool as was obtained on the 'M' side.

The synchronising contact points (7, Fig. M28) should just begin to open at this stage; if not, they should be synchronised as follows:

Release the two locking screws (1 and 6, Fig. M28).

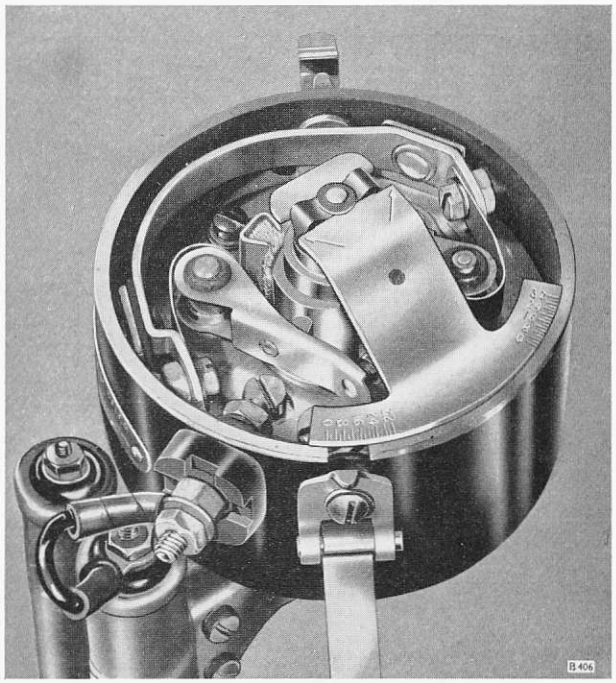


Fig. M30 Synchronising tool in position — S1 cars

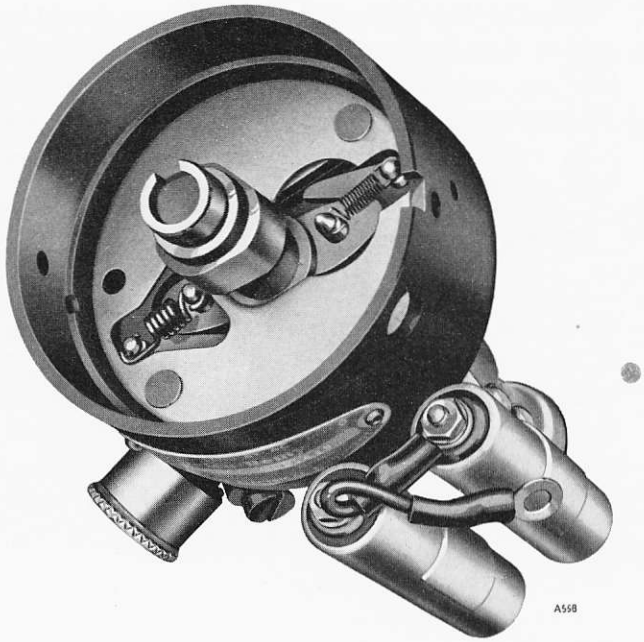


Fig. M31 Centrifugal advance mechanism — S1 cars

Adjust by means of the eccentric screw (2, Fig. M28).

Tighten the two locking screws.

Check the synchronisation.

Turn the rotor arm to the No. 1 cylinder ignition position, which may be identified by the markings on the distributor cap.

Fit the distributor in position and tighten the two securing nuts.

Ignition Timing — to adjust

An octane selector is fitted to the distributor on 8 : 1 compression ratio engines to permit the advancing or retarding of the ignition to suit the grade of fuel being used. This octane selector must be set to the fully advanced position for ignition timing.

Adjust the crankshaft to 2 deg. B.T.D.C. for the No. 1 cylinder as described in 'Distributor — to remove', above.

To time the ignition, release the clamping screw and turn the distributor body until the precise moment of opening of the contact points (3, Fig. M28). This may be observed by means of an ignition timing lamp.

During the timing operation, the rotor arm should be held in the fully retarded (anti-clockwise) position to take up any backlash in the centrifugal advance mechanism. Anti-clockwise rotation of the distributor body will advance the timing and clockwise rotation will retard the timing.

Tighten the clamping screw.

Rotate the flywheel one complete revolution and check the contact synchronisation. The contacts (7, Fig. M28) which control the ignition of Nos. 4, 5 and 6 cylinders must open at the same flywheel setting for No. 6 cylinder as the other contacts (3, Fig. M28) open for the No. 1 cylinder. If adjustment is necessary, release the two locking screws (1 and 6, Fig. M28) and adjust by means of the eccentric screw (2, Fig. M28).

Distributor overhaul

Remove the rotor arm, terminal block and base plate assembly.

Remove the driving sleeve tapered retaining pin and sleeve, then withdraw the shaft assembly.

Before re-bushing and reaming, check the shaft for parallelism and wear.

The centrifugal mechanism seldom requires attention, but should the springs have to be disturbed, the positions of the heavier and the lighter tension spring should be noted (see Fig. M31). Care should be taken not to distort these springs, since the correct advance curve cannot be obtained unless the tensioning is accurate.

Whenever the springs have been renewed, it will be necessary to check the advance characteristics on a testing machine; these characteristics should lie within the shaded area of the advance curves shown in either Figure M32 or M33 depending upon the compression ratio of the car.

IGNITION COIL

The ignition coil fitted may be either of Lucas or Delco–Remy manufacture, the main difference being

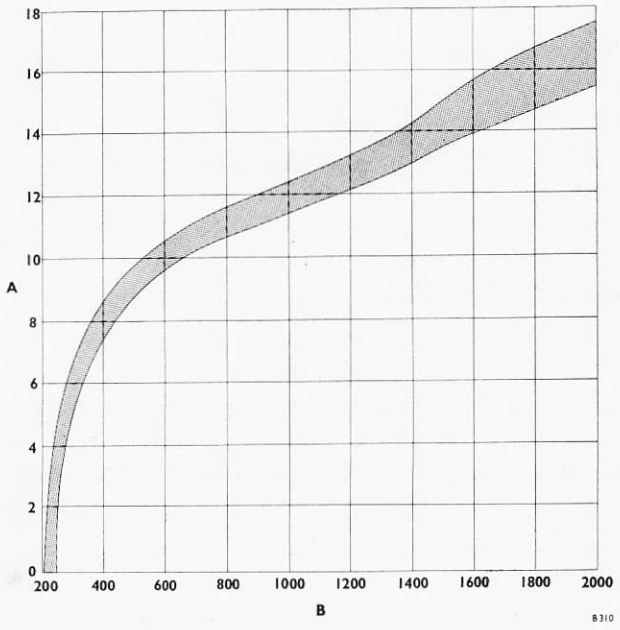


Fig. M32 Ignition advance curve for S1 cars with compression ratio of 6·6 : 1 or 7·25 : 1

A. DEGREES ADVANCE B. DISTRIBUTOR R.P.M.

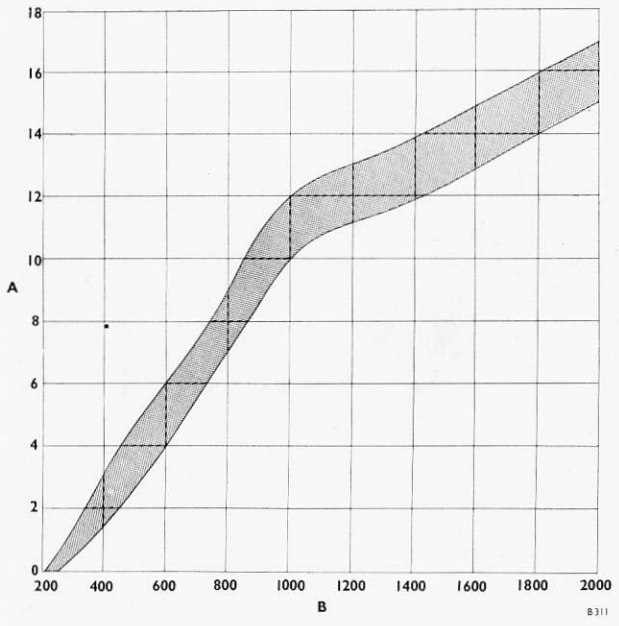


Fig. M33 Ignition advance curve for S1 cars with compression ratio of 8 : 1

A. DEGREES ADVANCE B. DISTRIBUTOR R.P.M.

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the marking of the terminals. The Lucas coil terminals are marked 'S.W.' (switch wire) and 'C.B.' (contact breaker); the Delco–Remy coil terminals are marked '+' (switch wire) and '—' (contact breaker).

Complaints of weak or erratic operation are usually attributable to poor low tension connections. Check that the coil negative terminal ('—', 'C.B.') is connected to the distributor. Check the voltage at the positive ('+', 'S.W.') terminal.

Remove the HT lead from the coil and insert a temporary HT lead. Hold the end of the lead about 0·5 in. (13 mm.) from a good earth point and operate the contact breaker by hand. A regular spark should be produced every time the distributor contact points open.

Heavy arcing at the distributor indicates the need for attention to the contact points or the condenser.

Should it be necessary to fit a new coil, it is most important that this coil is of the correct polarity, i.e. suitable for negative earth return.

It is also important that the 1 mfd. condenser, fitted to reduce electrical interference to the radio from the ignition system, be reconnected to the correct terminal ('+', 'S.W.').

The outside casing of the coil should be kept clean as misfiring can be caused by an accumulation of dirt around the terminals.

SPARKING PLUGS

The table below shows the sparking plugs recommended for each S1 engine.

Compression ratio	*Recommended sparking plug*
6·6 : 1 c.r. 7·25 : 1 c.r.	Lodge CLNP Champion RN8
8·1 : 1 c.r.	Lodge HLNP Champion N5

With the exception of the Champion N5, the above sparking plugs embody an internal suppressor resistor; this plug should not be used on cars fitted with wing-mounted aerials as it may cause radio interference.

The standard sparking plug servicing and sand-blasting machine should be used for cleaning and testing sparking plugs fitted with nickel electrodes. This servicing should be carried out every 5,000 miles (8,000 kilometres) and the points set to a 0·025 in. (0·635 mm.) gap. It is recommended that sparking plugs fitted with nickel electrodes be renewed every 10,000 miles (16,000 kilometres).

If the sparking plugs have platinum points (e.g. Lodge CLNP or HLNP), service is only required every 10,000 miles (16,000 kilometres). At the end of this period, the sparking plugs should be inspected, the carbon brushed off and the gaps set to 0·025 in. (0·635 mm.). A sandblasting machine should never be used for servicing these plugs.

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SECTION M7—IGNITION SYSTEM — S2 CARS

Distributor

Type	Delco–Remy
Firing order	A1, B1, A4, B4, B2, A3, B3, A2
Timing	2 deg. B.T.D.C.
Direction of rotation	Anti-clockwise
Contact gap	0·019 to 0·021 in. (0·483 to 0·533 mm.)
Dwell angle	34 deg. at 0·020 in. (0·508 mm.) gap
Contact arm spring tension	15 to 17 oz. (425 to 481 gm.)
Condenser capacity	0·18 to 0·25 mfd.
Radio interference suppressor: Resistor in rotor arm	5,000 to 6,500 ohms approx.

Coil

Type	Lucas or Delco–Remy
Insulation resistance to case	20 meg. at 500 volts
Primary winding resistance	4·25 to 4·65 ohms at 75 deg. F
Secondary winding resistance	5,500 to 7,100 ohms at 75 deg. F
Radio interference suppressor: Capacitor on '+' terminal	1 mfd.

Sparking Plugs

Gap	0·025 in. (0·635 mm.)

DISTRIBUTOR

Maintenance — Lubrication

The distributor should be lubricated every 5,000 miles or 8,000 kilometres, by pouring 16 c.c. of S.A.E.20 oil into the hole provided (see 1, Fig. M34); this also provides lubrication for the automatic advance mechanism.

At the same mileage of 5,000 miles (8,000 kilometres), lightly grease the operating cams at the top of the distributor shaft and apply one drop of engine oil to each of the contact breaker pivots; a few drops of engine oil should also be applied to the felt pad located in the top of the distributor shaft, beneath the rotor arm.

Ignition Timing

Contact Points — to clean and adjust

To clean or adjust the contact points, it is recommended that the distributor be removed from the crankcase; it is very difficult to adjust the contact points accurately with the distributor in position.

Remove the distributor cap, noting the position in which the rotor arm should be placed for the ignition of cylinder A1.

Press the rubber button on the end of the starter motor relay to turn the crankshaft until the ignition position of cylinder A1 is approached. This may be seen by the position of the rotor arm.

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Remove the flywheel housing inspection cover and turn the flywheel by hand to the correct ignition timing mark of 2 deg. B.T.D.C. The flywheel should only be turned in the normal direction of rotation (anti-clockwise when viewed from the rear of the engine). Any reversal of rotation during this operation may render the ignition timing inaccurate due to backlash in the timing gears.

To remove the distributor from the crankcase, disconnect the low tension lead from the terminal on the distributor casing and unscrew the two setscrews securing the distributor to the crankcase.

If the contact points require cleaning or re-facing they should be removed from the distributor as follows:

Disconnect the condenser lead from the terminal at each set of points, noting that each terminal nut is locked by a tab washer.

Remove the screws (5 and 12, Fig. M34) and withdraw each pair of contacts as an assembly.

Examine the contact points for pitting and piling. They should be cleaned as necessary with a fine carborundum stone, taking care to keep the contact faces as 'square' as possible. If the points are seriously corroded they should be renewed.

To fit the contact points, reverse the removal procedure, described above, taking care to align the points so that they make full face contact.

To adjust the contact points, release the two locking screws (5 and 12, Fig. M34) and using the eccentric screws (6 and 11, Fig. M34), set the gaps to between 0·019 in. (0·483 mm.) and 0·021 in. (0·533 mm.). Tighten the two locking screws.

Screws 4, 8 and 9 shown in Figure M34 should not be disturbed except when synchronising the contact points.

Contact Points — to synchronise

This operation must be carried out whenever the contact points have been renewed or re-fitted.

Special Tool RH.7216 has been introduced to facilitate synchronisation of the distributor contact points. The tool consists of an aluminium setting ring engraved with each ignition position and a pointer which fits on the top of the distributor shaft.

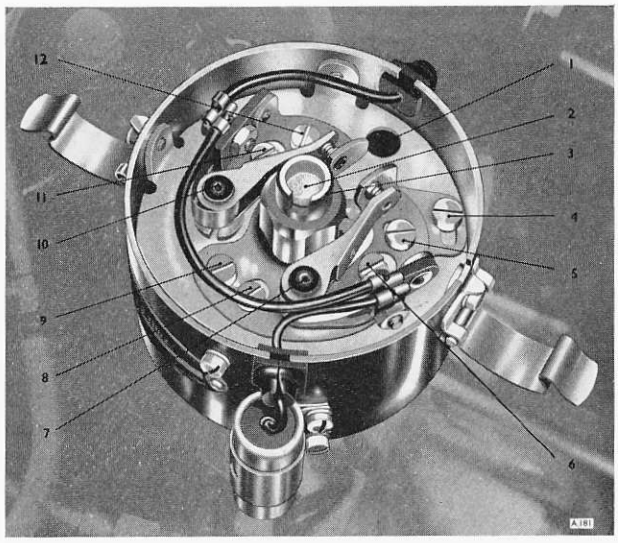


Fig. M34 Contact points adjustment — S2 cars

1. OIL HOLE
2. FELT WICK
3. CAM
4. SYNCHRONISATION LOCKING SCREW
5. LOCKING SCREW
6. GAP ADJUSTING ECCENTRIC
7. PIVOT
8. SYNCHRONISATION ADJUSTING ECCENTRIC
9. SYNCHRONISATION LOCKING SCREW
10. PIVOT
11. GAP ADJUSTING ECCENTRIC
12. LOCKING SCREW

The setting ring fits in the top of the distributor casing. It is roughly positioned angularly by a dowel in its underside which locates in a slot in the top face of the distributor. The slot is wider than the dowel and thus allows the setting ring a small amount of angular movement for accurate setting.

The distributor has two sets of contact points. One set is fixed and the other set is adjustable and may be moved angularly around the distributor shaft; this adjustable set of contact points will be referred to in the following text as the synchronising contact points.

The fixed set of contact points control the ignition feed to cylinders B1, B4, A3 and A2 and the synchronising contact points control the ignition feed to cylinders A1, A4, B2 and B3.

To synchronise the contact points, first place the setting ring and pointer in position on the distributor (see Fig. M35). Slowly rotate the distributor shaft from the driving end in its normal direction (anti-clockwise when viewed from above) until the fixed set of contact points open. The precise moment of opening of the contact points may be obtained by means of an ignition timing lamp.

Position the setting ring so that the pointer on the distributor shaft is accurately aligned with a mark on the ring.

Slowly rotate the shaft in its normal direction until the pointer is accurately aligned with the next mark on the setting ring. This position should exactly coincide with the moment of opening of the synchronising contact points; if not, the synchronising contact points should be adjusted as follows:

Release the two locking screws (4 and 9, Fig. M34).

Adjust by means of the eccentric screw (8, Fig. M34) until the contact points are just beginning to open.

Tighten the two locking screws and check the synchronisation as described above.

On S2 cars produced before December 1959, synchronising of the contact points can only be carried out by using Tool RH.7216.

On later S2 cars, if Tool RH.7216 is not available it is possible to synchronise the contact points with the distributor in position on the crankcase. To enable this operation to be carried out, an additional mark has been stamped on the flywheel for the ignition timing of cylinder B4.

To synchronise the contact points, press the rubber button on the end of the starter motor relay to turn the crankshaft until the distributor rotor arm approaches the ignition position for cylinder B4.

The flywheel should then be turned by hand in its normal direction to the B4 timing mark.

Release the distributor clamping screw and adjust the distributor so that the fixed contact points are beginning to open. During this operation, hold the rotor arm in the fully retarded (clockwise) position to take up any backlash in the centrifugal advance mechanism. Clockwise rotation of the distributor body will advance the timing and anti-clockwise rotation will retard it.

Tighten the distributor clamping screw and rotate the crankshaft by means of the starter motor until the distributor rotor arm is approximately in the ignition position for cylinder A1.

Turn the flywheel by hand in its normal direction until the flywheel is at 2 deg. B.T.D.C. or A1 (both figures are stamped on the flywheel).

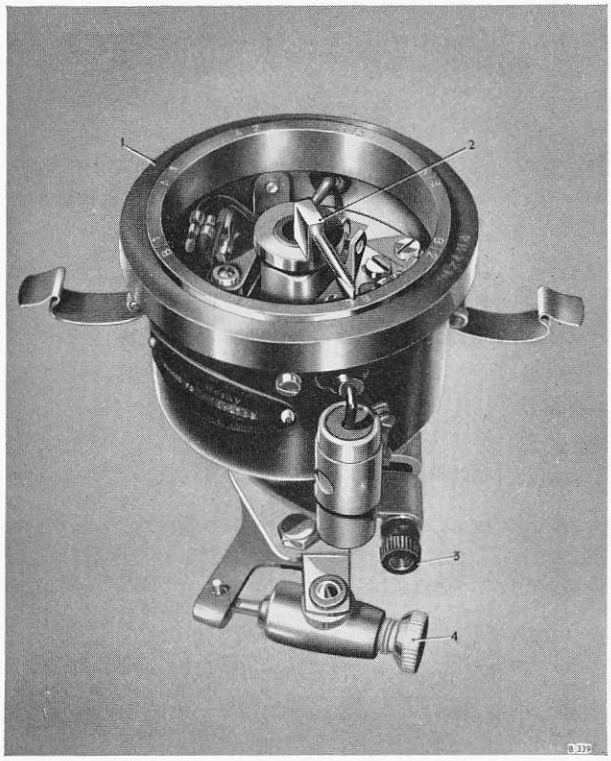


Fig. M35 Synchronising tool in position — S2 cars

1. SETTING RING
2. POINTER
3. CLAMPING BOLT
4. OCTANE SELECTOR

The synchronising contact points should just begin to open at this stage with the rotor arm held in the retarded (clockwise) position. If adjustment is necessary, release the two locking screws (4 and 9, Fig. M34) and adjust the synchronising contact points to the correct position by means of the eccentric screw (8, Fig. M34); tighten the two locking screws and check the synchronisation.

Note: Should the crankshaft accidentally be rotated while the distributor is removed from the crankcase, the correct position for the ignition timing of A1 cylinder may be obtained as follows:

Remove the 'A' bank rocker cover which is on the right-hand side of the engine when viewed from the driver's seat. Rotate the crankshaft by means of the starter motor until the A1 inlet valve (the first valve at the front of the engine) has opened and just closed.

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Turn the flywheel by hand in its normal direction until the flywheel is at 2 deg. B.T.D.C.

Re-fit the 'A' bank rocker cover.

Ignition Timing — to adjust

An octane selector is fitted to the distributor and provides fine adjustment by means of a knurled screw, enabling the setting of the distributor to be advanced or retarded in accordance with the octane rating of the fuel being used.

When timing the ignition, the octane selector should be set in the fully advanced position. This is the correct setting for 95 octane fuel.

When the S2 car was first introduced, the octane selector was positioned on the 'A' bank (right-hand) side of the engine. In this position there was a tendency for the main charging cable to chafe against the knurled adjustment nut, thereby creating a short circuit. To eliminate such an occurrence, the octane selector should be rotated through 180 deg. so that the adjustment nut is positioned on the 'B' bank (left-hand) side of the engine (see 4, Fig. M35).

If this modification is necessary, it should be carried out as follows:

Release and remove the two 0·250 in. UNF nuts and plain washers securing the octane selector to the pedestal and slacken the distributor clamping bolt.

The distributor can now be removed from the pedestal enabling the octane selector to be removed and turned through 180 deg.

After positioning the octane selector, re-fit the two washers and 0·250 in. UNF nuts.

Position the rotor arm approximately in the ignition position for cylinder A1. Fit the distributor in its housing and tighten the two securing setscrews.

With the aid of an ignition timing lamp, turn the distributor body until the synchronising contact points begin to open. During this operation, hold the top of the rotor arm in the fully retarded position to take up any backlash in the centrifugal advance mechanism. Clockwise rotation of the distributor body will advance the timing; rotation anti-clockwise will retard the timing.

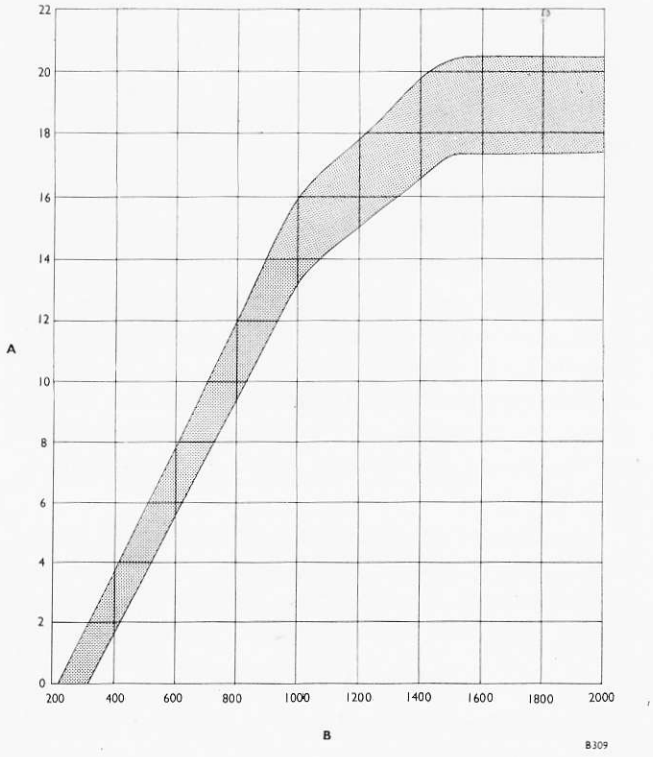


Fig. M36 Ignition advance curve for S2 cars with compression ratio of 8 : 1

A. DEGREES ADVANCE B. DISTRIBUTOR R.P.M.

When the correct ignition timing is obtained, tighten the clamping screw, then check the timing.

Distributor Overhaul

Remove the distributor from the crankcase as described in 'Contact Points — to clean and adjust', above.

The distributor should be dismantled as follows:

Remove the rotor arm.

Unscrew and remove the two 0·250 in. UNF nuts securing the pedestal to the distributor and remove the pedestal.

Release and unscrew the two setscrews securing the condenser to the distributor casing.

Withdraw the two rubber grommets holding the condenser leads to the distributor casing.

Remove the four external setscrews fastening the base plate assembly to the distributor; withdraw the base plate assembly.

Remove the driving sleeve tapered retaining pin together with the sleeve.

Withdraw the shaft assembly.

Before re-bushing and reaming, inspect the shaft for parallelism and wear.

The centrifugal advance mechanism requires very little attention, but should the springs have to be disturbed, the position of the heavier and the lighter tension springs should be noted. Take care not to distort these springs as the correct ignition advance curves cannot be obtained unless the tensioning is accurate.

Assembly of the distributor is the reverse of the dismantling procedure, care being taken to ensure that the adjustment for the octane selector is positioned on the same side of the distributor as the condenser.

IGNITION COIL

The ignition coil fitted may be either of Lucas or Delco–Remy manufacture, the main difference being the marking of the terminals. The Lucas coil terminals are marked 'S.W.' (switch wire) and 'C.B.' (contact breaker); the Delco–Remy coil terminals are marked '+' (switch wire) and '—' (contact breaker).

Complaints of weak or erratic operation are usually attributable to poor low tension connections. Check that the coil negative terminal ('—', 'C.B.') is connected to the distributor. Check the voltage at the positive ('+', 'S.W.') terminal.

Remove the HT lead from the coil and insert a temporary HT lead. Hold the end of the lead about 0·5 in. (13 mm.) from a good earth point and operate the contact breaker by hand. A regular spark should be produced every time the distributor contact points open.

Heavy arcing at the distributor indicates the need for attention to the contact points or the condenser.

Should it be necessary to fit a new coil, it is most important that this coil is of the correct polarity, i.e. suitable for negative earth return. It is also important that the 1 mfd. condenser fitted to reduce electrical interference to the radio from the ignition system be reconnected to the correct terminal ('+', 'S.W.').

The outside casing of the coil should be kept clean as misfiring can be caused by an accumulation of dirt around the terminals.

SPARKING PLUGS

The recommended sparking plugs are as follows:

Lodge CLNP Champion RN13P	Platinum-tipped points
Champion RN8	Nickel points

Maintenance

If Champion RN8 sparking plugs are fitted, it is recommended that they be serviced every 5,000 miles (8,000 kilometres) using the standard sparking plug servicing and sandblasting machine. The gaps should be set to 0·025 in. (0·635 mm.). These plugs should be renewed every 10,000 miles (16,000 kilometres).

If either of the platinum pointed sparking plugs are fitted, they should be serviced every 10,000 miles (16,000 kilometres) and the gaps set to 0·025 in. (0·635 mm.). To service these sparking plugs, brush off the carbon and inspect the points. Sparking plugs with platinum points should never be cleaned by sandblasting.

Sparking Plugs — to remove and fit

Raise the bonnet, detach the plug leads and remove the sparking plugs using Special Tool RH.7327; when removing the sparking plugs from a hot engine protective gloves should be worn. If the special tool is not available the sparking plugs may be removed as follows:

Using the jacking system provided, raise the right-hand side of the car and remove the front right-hand wheel (see 'Wheels and Tyres').

Unscrew the nine setscrews retaining the valance panel under the wheel arch and remove the panel.

Detach the plug leads and remove the four sparking plugs.

The plugs on the left-hand side of the engine are accessible from above and may be removed in the normal manner.

The sparking plugs should be re-fitted by reversing the procedure described for removal.

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SECTION M8 — SWITCHBOX

Description

The switchbox mounted on the instrument panel incorporates the lighting switch, the ignition switch, the starter motor switch and the ignition and fuel warning lamps.

The lighting switch is a four-position rotary switch mounted above the ignition switch. This switch may be turned to any of the four positions which are clearly marked on the switchbox casing and are identified as follows:

OFF	...	All lamps off
S & T	...	Side and tail lamps on
H, S & T	...	Head, side and tail lamps on
F, S & T	...	Fog, side and tail lamps on

The lighting switch can be locked in either the 'OFF' or 'S & T' positions for parking by removing the key from the ignition switch; the lighting switch cannot be operated again until the ignition key is inserted in the lock.

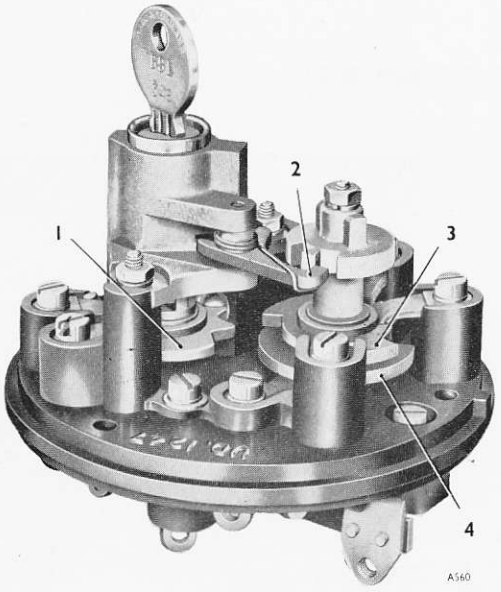


Fig. M37 Internal view of switchbox contacts

1. IGNITION CONTACT
2. LIGHTS SWITCH LOCKING PAWL
3. H, S AND T LIGHTS CONTACT
4. FOG LIGHTS CONTACT

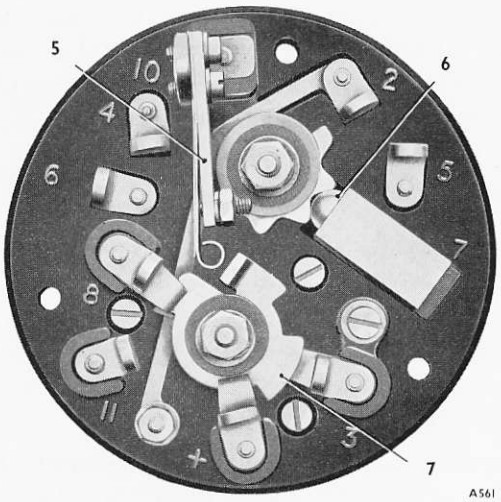


Fig. M38 External view of switchbox contacts

5. STARTER CONTACT ARM
6. LIGHTS SWITCH POSITIONING BALL AND CAM
7. ACCESSORIES AND STARTER RELAY CONTACT

On all S2 cars produced after June 1960, alterations have been made to the design of the switchbox. The switchbox is similar to the one used on previous cars, the main modifications being that the rotary lighting switch locking mechanism has been deleted and the switch modified to include a push–pull action. It is now possible to operate the lighting switch without first having to insert the ignition key in the ignition switch. When the lighting switch knob is withdrawn in any position except 'OFF', the capping rail lamp is energised. This illuminates the ignition switch and allows the keyhole to be located for the insertion of the ignition key in conditions of darkness with all the doors closed.

The ignition switch is a master control and is operated by turning the ignition key. Turning the key anti-clockwise permits the use of the radio, the windscreen wipers, the windscreen washer, cigar

lighters, and the fuel filler door while the car is parked. The generator warning lamp will also be illuminated with the switch in this position but the engine ignition will not be in circuit. Turning the key clockwise to the normal running position permits the use of all circuits. Further clockwise rotation against the action of the return spring energises the starter relay.

Switchbox — to dismantle

Remove the facia board and unscrew the switchbox mounting setscrews. Withdraw the switchbox and remove the rear cover.

Disconnect the wiring and unscrew the three base plate retaining nuts. Withdraw the base plate from the switchbox.

The mechanical and electrical arrangements of the switches in the earlier type of switchbox are shown in Figures M37 and M38 and are very similar to that of the later type.

When re-assembling, all sliding contacts should be coated with a good quality electrical contact grease.

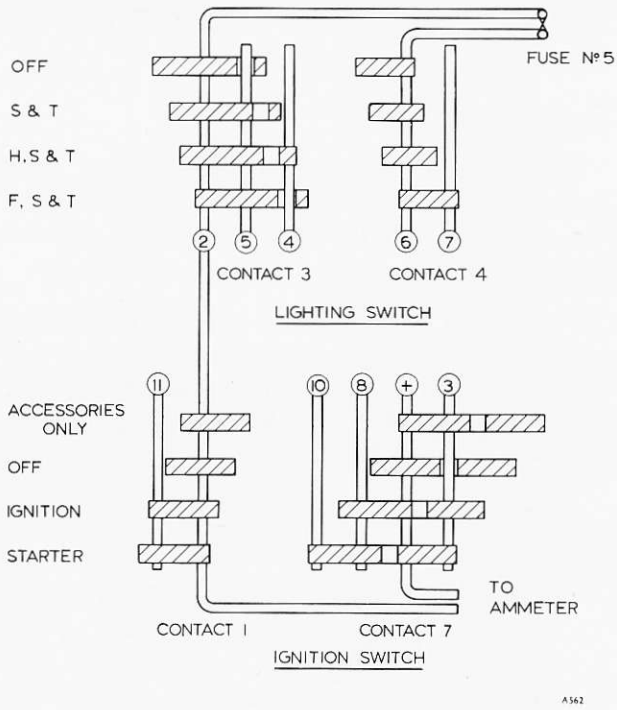


Fig. M39 Switchbox circuits

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SECTION M9 — LIGHTING EQUIPMENT

Headlamps

The twin headlamps are controlled by two switches, the master switch on the switchbox and a foot-operated switch for beam selection. A small red warning lamp is mounted in the speedometer and is illuminated whenever the headlamps are on 'main' beam. Double filament bulbs are fitted and operation of the foot switch changes the beams from the 'main' to the 'dipped' filaments and extinguishes the red warning lamp.

In cases of complaint of faulty foot switch operation, first check and ensure that the carpet does not restrict the plunger travel.

Two main types of headlamp are fitted, differing only in the method of bulb mounting. Each headlamp incorporates a light unit consisting of a pre-focused bulb, a reflector and a front glass assembly provided

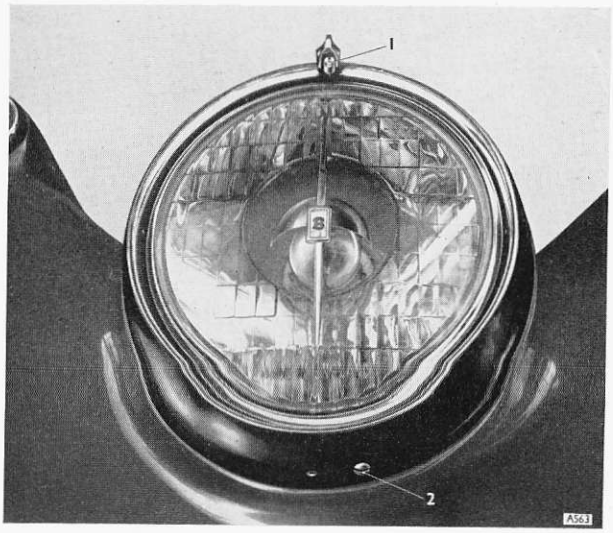


Fig. M40 Headlamp

1. VERTICAL BEAM ADJUSTER 2. RIM RETAINING SCREW

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with a mounting flange. The light unit is secured in the rear shell which is in turn secured to the lamp housing. The bulb is correctly positioned relative to the focal point of the reflector and no focusing is necessary when fitting a new bulb. Cleaning of the reflector should not be attempted and care must be taken not to touch the reflector surface when handling the unit. The only lamp servicing required is bulb renewal and headlamp alignment.

Headlamp Bulb — to renew

Remove the rim screw (2, Fig. M40) and lift off the rim and the dust excluding rubber ring. Press the light unit against the tension of the adjusting screw springs and turn it anti-clockwise until the heads of the screws can pass through the enlarged ends of the slots in the mounting flange. The light unit can now be lifted out of the lamp body.

On cars fitted with the double contact bulb (see Fig. M43) turn the bakelite contact holder and remove it. Withdraw the bulb holder complete with bulb. Remove the circlip securing the bulb to the holder and withdraw the bulb. It will be necessary to tilt the bulb so that the flange on the bulb cap can pass through the two slots in the bulb holder.

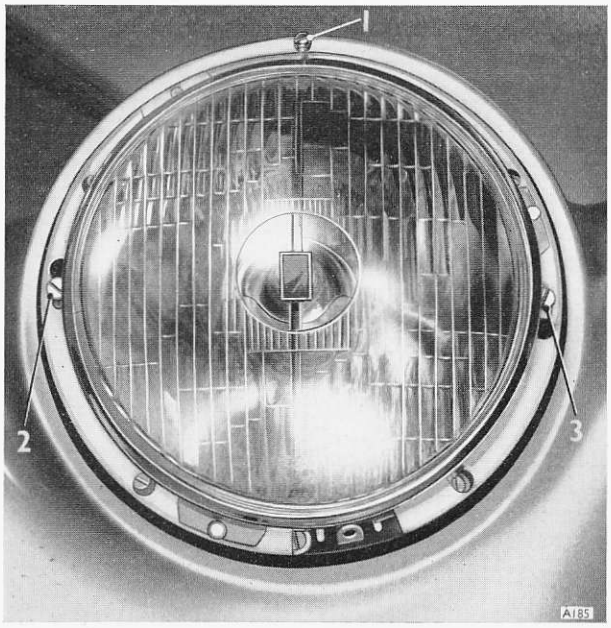


Fig. M41 Headlamp beam adjustment

1. VERTICAL ADJUSTER
2. HORIZONTAL ADJUSTER
3. HORIZONTAL ADJUSTER

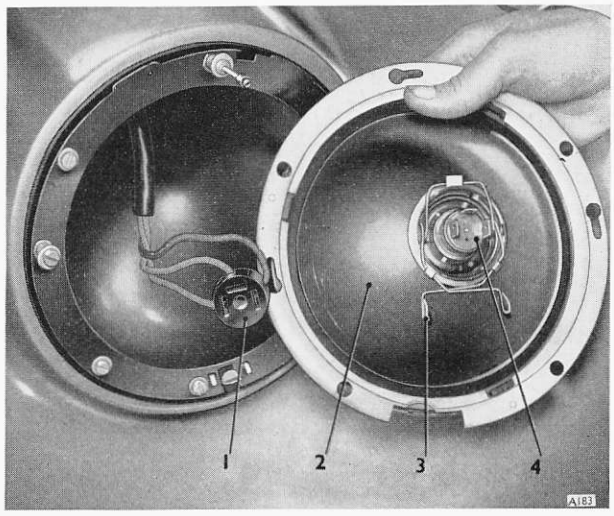


Fig. M42 Access to headlamp bulb (S.A.E. blade type contact)

1. CONTACT HOLDER
2. LENS UNIT
3. BULB RETAINING CLIP
4. BULB

On cars fitted with the three-blade terminal bulb (see Fig. M42), detach the terminal socket, spread the retaining clip and remove the bulb from the reflector. On cars supplied to the U.S.A., waxed cardboard transportation discs are fitted in place of the light unit. Sealed beam light units are fitted to the cars on arrival in the U.S.A. by Rolls-Royce Agents. The sealed beam unit comprises the filaments, reflector and front glass moulded together. These parts cannot be separated and failure of a filament necessitates the renewal of the complete sealed beam unit.

Main Beam Setting

For accurate beam setting, it is recommended that a Lucas Beam Setter or other suitable equipment be employed.

Vertical adjustment of the headlamp beam is by means of the single screw (1) shown in Figure M41. Roadside adjustment of the vertical setting by the driver may be necessary to compensate for variation of load. This adjustment can be carried out with the rim in position.

Horizontal adjustment of the beam is by means of two spring-loaded screws (2 and 3, Fig. M41). This adjustment can only be carried out with the headlamp rim removed.

Sidelamps

To renew a bulb, unscrew the rim retaining screw and withdraw the light unit forward. The bulb holder is of the 'clip-in' type and can easily be detached. Remove the bulb, which is of standard bayonet fitting, from the bulb holder.

Fog lamps

Twin fog lamps are fitted which incorporate the front 'flashers' in double filament pre-focus bulbs.

To renew a bulb, unscrew the lens retaining screw and lift out the complete light unit. Release the bakelite contact holder by turning it in the direction of the arrow, then remove the bulb.

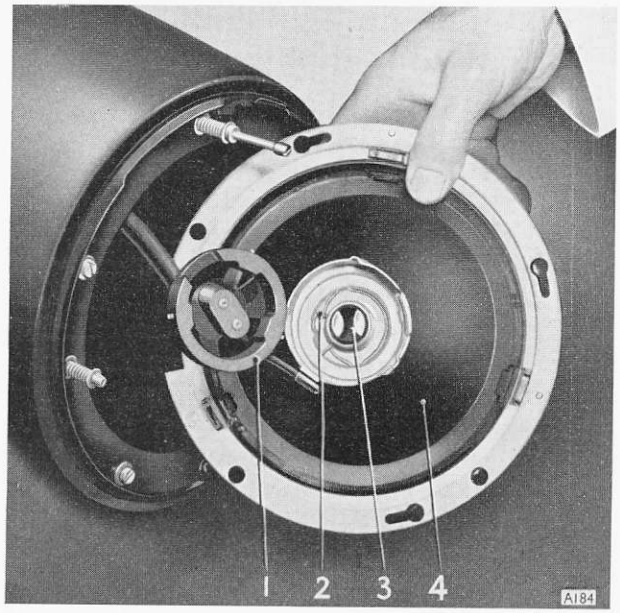


Fig. M43 Access to headlamp bulb (double contact)

1. CONTACT HOLDER
2. BULB RETAINING CLIP
3. BULB
4. LENS UNIT

Stop/Tail and Rear Flasher Lamps

The unit contains the rear 'flasher' bulb, the stop/tail lamp bulb and the rear reflector.

Access for bulb renewal is gained from inside the luggage boot (see Fig. M46). Turn the bulb holder anti-clockwise, then withdraw the bulb holder complete with bulb. The bulbs can only be fitted in their respective holders and the holders cannot be fitted in the wrong sockets. Both holders are marked 'TOP' to show their correct positioning. The 'flasher' bulb is a single filament bulb and the stop/tail lamp bulb is a double filament bulb; both bulbs are of standard bayonet fitting.

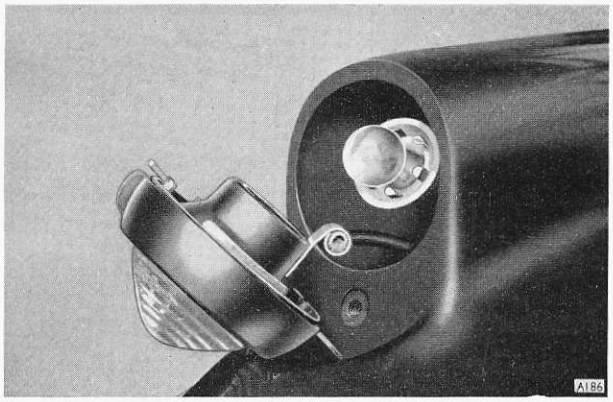


Fig. M44 Access to sidelamp bulb

Reversing and Number Plate Lamps

The reversing lamp is controlled by a micro-switch fitted at the base of the steering column and is operated by the gear range selector mechanism; in cases of complaint, check and if necessary adjust the position of the switch.

Access in the lamp for bulb renewal is obtained from inside the luggage boot lid. Remove the trim panel which is retained by two spring clips. Unscrew the two screws and remove the bulb carrier plate (see 2, Fig. M47). The bulbs are of standard bayonet fitting.

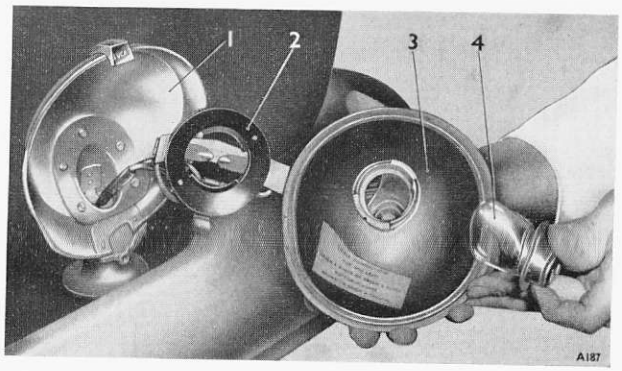


Fig. M45 Access to fog lamp bulb

1. LAMP BODY
2. CONTACT HOLDER
3. LENS UNIT
4. DOUBLE FILAMENT BULB

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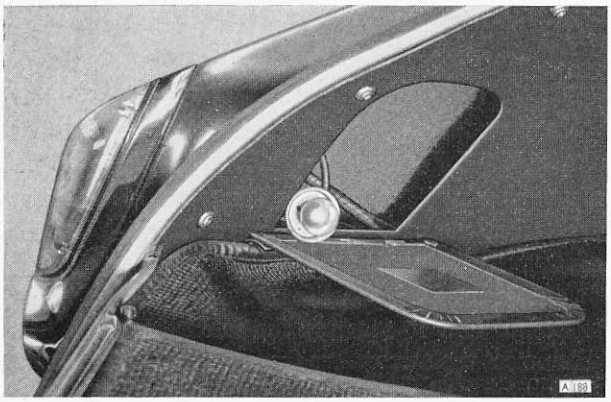


Fig. M46 Access to stop and tail lamp bulbs

Boot Lamp

This lamp (see 1, Fig. M47) is controlled by a mercury switch (see 3, Fig. M47). When the boot lid is opened to about a quarter of its travel, the mercury covers and connects two contacts in the switch capsule and so switches on the lamp.

To gain access to the bulb for renewal, first remove the boot lid trim pad which is retained by spring clips. Release the two screws and remove the cover plate, screen and shade.

Roof Lamp

Automatic control of the lamp is effected by door-operated switches; the roof lamp will light whenever any of the doors are opened.

Manual control is by means of the 'see-saw' switch on the left-hand centre door pillar, except for **L.W.B. cars** on which this switch is positioned above the rear right-hand window. Also on **L.W.B. cars,** an additional two-position switch is fitted beneath the right-hand side of the facia panel for operation by the driver.

Operation of the manual switch enables the roof lamp to be used with all the doors closed.

Two types of roof lamp have been fitted, differing only in the method of mounting the lens retaining rim. On the early type of roof lamp, the rim is screwed into position. On the later type, the rim is held in position by three clips and a spring-loaded plate.

Bulb access on the early type of roof lamp is obtained by unscrewing the lens retaining rim and removing the lens.

To gain access to the bulb on the later type of roof lamp, turn the lens retaining rim anti-clockwise until the three clips on the rim align with the three slots in the roof lamp casing. The lens retaining rim can then be removed. To assemble the roof lamp, align the three clips on the lens retaining rim with the three slots in the roof lamp casing. Press the rim upwards against spring pressure, then turn it clockwise until the three clips on the rim clip over three lugs on the roof lamp casing.

Companion Lamps

On S2 cars, these lamps are always in circuit, but **on S1 cars** they are only in circuit when the ignition switch is 'On'. The lamps are controlled by the adjacent switches.

The bulbs can be renewed without dismantling the lamps.

Capping Rail Lamp

The capping rail lamp was introduced **on S2 cars** to provide sufficient light to illuminate the switches on the facia panel, especially the ignition switch, facilitating insertion of the ignition key.

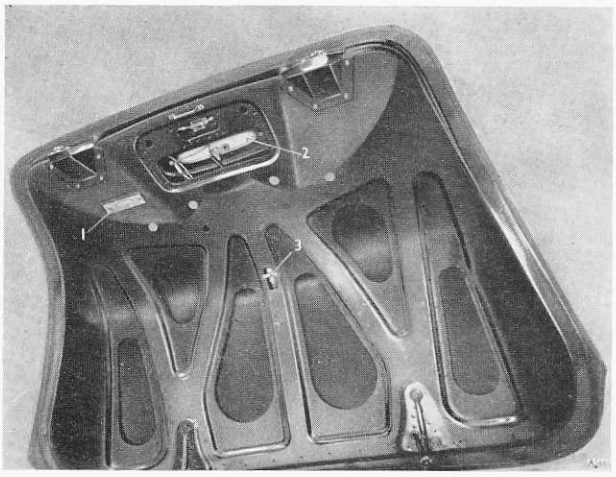


Fig. M47 Switch and lamps in boot lid

1. BOOT LAMP
2. ACCESS PLATE TO NUMBER PLATE AND REVERSING LAMP
3. BOOT LAMP MERCURY SWITCH

The lamp is positioned in the capping rail directly above the switchbox and is operated by the push–pull action incorporated in the instrument panel lamp switch. The capping rail lamp cannot be switched on unless the main lighting switch in the switchbox has been turned away from the 'OFF' position.

On S2 cars produced after June 1960, an alteration to the capping rail lamp switching arrangement was made. This modification consisted of incorporating control of the capping rail lamp in the main lighting switch. At the same time, the locking system was deleted from the main lighting switch so that the lights can be operated without first having to insert the ignition key. To operate the capping rail lamp, the main lighting switch should be turned away from the 'OFF' position and the switch knob withdrawn to its fullest extent.

To renew the bulb, remove the two screws and green lens.

Map Lamp

On S2 cars produced after June 1960, a map lamp has been included with the alteration to the capping rail lamp switch arrangement, although it has always been a feature of **S1 cars.**

This map lamp is positioned under the capping rail on the opposite side to the driver. To operate the map lamp **on all cars,** turn the main lighting switch away from the 'OFF' position and withdraw the knob of the instrument panel lamp switch. **On S2 cars produced before June 1960,** this switch was used for operating the capping rail lamp.

Instrument and Warning Lamps

S1 cars

The instrument panel lamps are operated by turning the main lighting switch away from the 'OFF' position and turning the instrument panel lamp switch clockwise. Turning the switch to the first position provides a subdued light; turning the switch to the second position provides brighter illumination.

If the instruments are not sufficiently illuminated, it may be found that the reflecting surface of the inner bezel rim has been oversprayed black. To remedy this defect, remove the facia panel and the glass of the defective instrument unit and paint the oversprayed surface white to increase reflection of light.

To increase the illumination above the standard setting, the following alterations to the wiring circuit may be made. There are two dimming resistors in the circuit but the main resistor controlling the intensity of illumination of all the instrument lamps is located on the back of the panel lamp switch. To reduce the resistance and so increase the intensity of the light, disconnect the three wires from the No. 5 terminal of the switch and connect them directly to the No. 2 terminal. The second resistor is attached to the back of the five-in-one unit and controls the lamps on this instrument only. The intensity of these lamps can be increased by moving the resistor clamping bands closer together.

S2 cars

On S2 cars produced prior to November 1959, the instrument panel lamps are operated by turning the main lighting switch away from the 'OFF' position and turning the panel lamp switch clockwise. This will give full brilliance of light. A more subdued lighting can be obtained by turning the panel lamp switch further clockwise.

On S2 cars produced after October 1959, a two-position panel lamp switch was fitted and illumination of the instrument was improved. Turning the panel lamp switch to the first position clockwise will provide a subdued light; further clockwise rotation of the panel lamp switch to the second position will increase the brilliance of the light.

On S2 cars produced prior to November 1959, illumination of the instruments can be improved by fitting larger bulbs in the speedometer and the four-in-one instrument, and by modifying the panel lamp switch. Exchange the three existing 12V 2·2W, M.E.S. bulbs which illuminate the speedometer and the four-in-one instrument for three 12V 3·6W, M.E.S. bulbs. At the same time as the larger bulbs are fitted, the panel lamp switch should be modified by disconnecting the wire soldered to the base of the fixed resistor and connecting it to terminal 3 of the switch.

On all cars, two warning lamps are situated in the switchbox. The red lamp, marked 'GEN', on the left

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of the switchbox, glows when the ignition is switched on and is extinguished when the engine speed increases and generator charge commences. The green warning lamp, marked 'FUEL', on the right of the switchbox, is illuminated when the fuel level in the fuel tank falls below 3 gallons.

Bulb Renewal

On all cars, the bulb holders fitted in the instrument panel, speedometer and the switchbox are a push fit in their sockets. To gain access for bulb renewal, remove the facia panel and withdraw the unit concerned.

SECTION M10 — INSTRUMENTS AND ACCESSORIES

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Fuel/Oil Level Indicator

This indicator is positioned in the instrument panel and indicates the fuel level when the ignition is switched on.

The oil level in the engine sump can be indicated on the same instrument by depressing the push button in the centre of the facia (below the switchbox on S1 cars and above the switchbox on S2 cars). The oil level indicator is only intended for use on a journey as a quick check before refuelling. The dipstick should always be used when topping-up with oil.

The fuel level indicator is controlled by a float operated rheostat unit in the fuel tank. Complaints of faulty operation of the indicator may be due to the wiring or connections. Where the instrument constantly indicates 'EMPTY', check the wiring and the connections of the feed wire; when the instrument constantly indicates 'FULL', check the earth connection to the indicator body, the fuel/oil change-over switch connections and the wiring of the fuel tank unit. Check the earthing of the fuel tank. Inaccurate readings are usually caused by a distorted float arm on the fuel tank rheostat unit. Care must be taken not to foul the baffles in the fuel tank when fitting a rheostat unit (see Fig. K1 'Fuel System').

The fuel tank rheostat unit may be checked with an ohmmeter, its resistance varying from 0 to 82 ohms over the range of travel of the float arm.

The oil level indicator is controlled by the fuel/oil change-over switch and a float operated rheostat unit situated in the engine sump. When the change-over switch button is depressed, the fuel tank rheostat unit is isolated and the rheostat unit in the engine sump is energised; the level of oil in the sump is then shown by the indicator needle. As the rheostat unit is similar to that used in the fuel tank, fault diagnosis and rectification is the same as described in the previous paragraphs on the fuel level indicator.

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Coolant Temperature Indicator

Early S1 cars

The coolant temperature indicator needle operates by the deflection of an electrically heated bimetal strip. The transmitter unit located in the thermostat housing incorporates a second heater coil and bimetal strip, the oscillation of which allows intermittent earth contact through a resistor. The bimetal strip is biased by the coolant temperature and the indicator needle deflection is a measure of the electrical heat in the circuit.

Late S1 and S2 cars

The coolant temperature indicator is connected electrically to a semi-conductor type transmitter unit located in the thermostat housing. The indicator has two magnetic coils: a 'control' coil and a 'deflecting' coil. The indicator needle is fixed to a soft iron armature which pivots between the two coils. Any variation in current flowing from the transmitter unit through the 'deflecting' coil will affect the magnetic circuit and deflect the needle; the 'control' coil compensates for any variation in voltage.

The semi-conductor transmitter unit comprises a silver plated carbon disc; one side of the disc is connected to earth and the other side to the supply through a coil spring inside the transmitter. The disc has a negative temperature coefficient, the resistance decreasing as the temperature increases.

On both types of temperature indicator, no attempt should be made to carry out repairs; all servicing should be by renewal. Any electrical overload is likely to render the indicator inaccurate and if errors in the readings are observed after changing only the transmitter, the indicator also should be renewed.

Oil Pressure Indicator

This thermal type indicator is similar to the temperature indicator used on the early S1 cars, but in this case the transmitter is biased by an oil pressure operated diaphragm.

Fuel Filler Door

The fuel filler door solenoid is operated by a switch on the facia. Should the solenoid fail, the locking bolt can be withdrawn manually by pulling a release cable inside the luggage boot.

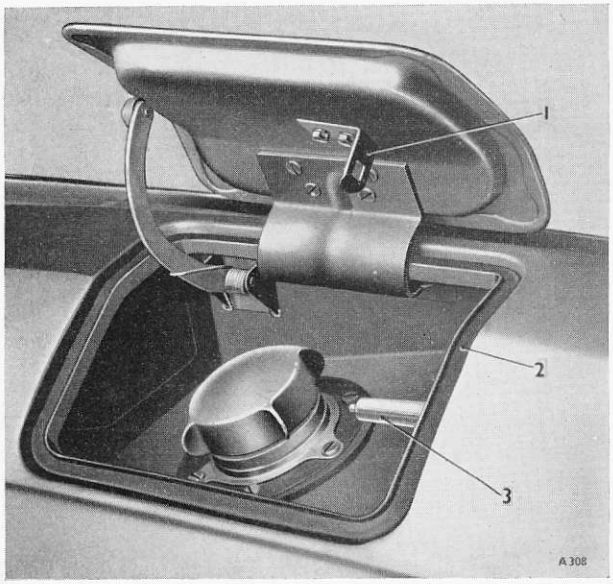


Fig. M48 Fuel filler door

1. STRIKER PLATE 2. RUBBER SEAL
3. ELECTRICALLY OPERATED BOLT

Occasionally lubricate the locking bolt with Retinax 'A' grease, whilst operating the bolt by means of the release cable.

Operational failure may be due to excessive door loadings or to engagement tag distortion. Check the door and rubber seal and rectify any distortion. Operation of the solenoid can be checked visually with the filler door open.

Access to the solenoid unit is gained through the side panelling of the boot. When removing the unit, the mounting plate need not be disturbed.

Windscreen Wiper Motor

The Lucas windscreen wiper motor drives a flexible reciprocating rack by means of an eccentric. The rack operates the twin wheelboxes which carry the wiper arms.

A thermostatic cut-out switch safeguards the motor against overheating due to overloading. After cooling, the cut-out will permit continued operation until further overheating is experienced. Overloading may be caused by the higher speed of operation being selected on an incompletely wetted screen, but where it occurs during normal operation, the cause should be ascertained and corrected as soon as possible (see under 'Service').

No maintenance is required, but the wiper blades should regularly be inspected for deterioration of the rubber and renewed if necessary.

Self-parking Adjustment

When switched to 'Park', the direction of rotation of the motor is reversed and the motor is switched off by the striker box (see Fig. M49). Adjustment is by means of the knurled adjuster (see Fig. M49).

Service

On early S1 cars, the Lucas DR1 wiper motor was fitted. This motor was later superseded by the Lucas DR3 wiper motor which is superior by reason of its greater torque output and modified design.

The DR3 wiper motor was fitted as standard equipment on cars having the following chassis numbers and onwards:

Bentley S1 Chassis No. B-595-EK
Bentley S1 Continental Chassis No. ... BC-1-EL
Rolls-Royce Silver Cloud, Chassis No. ... SFE-303

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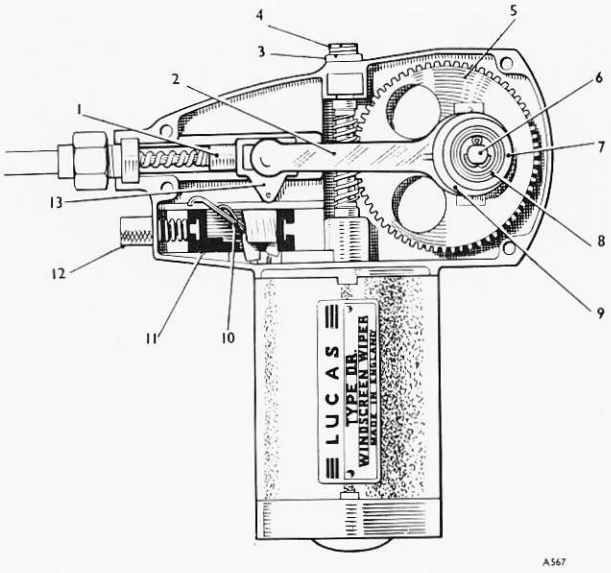


Fig. M49 Windscreen wiper motor details

1. CROSSHEAD
2. CONNECTING ROD
3. LOCKING RING
4. ARMATURE END FLOAT ADJUSTING SCREW
5. FINAL GEAR
6. CRANKPIN
7. FRICTION PLATE
8. CONICAL SPRING
9. ECCENTRIC COUPLING
10. SWITCH CONTACTS
11. AUTOMATIC SELF-PARKING SWITCH
12. SELF-PARKING SWITCH ADJUSTMENT
13. STRIKER

A special mounting plate was designed to enable the DR3 wiper motor to be fitted as a replacement unit on cars previously equipped with the DR1; no alteration to the Bundy tubing or rack is necessary.

To fit a DR3 wiper motor in place of the DR1, the following materials are required:

Part No.	*Part*	*Quantity*
RH.712	Wiper motor assembly	1
RD.6932	Connector	1
RD.7050	Connector	1
RD.3425	Terminals	6
RD.3690	Cable eye	1
RD.7589	Sleeve	1
F.59140	Straps	3
3L/10606	Cable (pink)	5 ft.
	P.V.C. tube (5 mm. dia.)	5 ft.

DR 1 Wiper Motor — to remove

Unscrew the four screws and remove the cover from the wiper motor.

Remove the circlip which retains the connecting rod and withdraw the plain washer, the conical spring and the shaped washer; care should be taken when removing the conical spring as it is held under compression.

Lift the connecting rod to disconnect it from the crosshead, then withdraw the crosshead and Bundy tubing from the motor.

Fit the connecting rod to the gear wheel, together with the shaped washer, the conical spring, the plain washer and the circlip.

Fit the cover to the motor and secure it in position with the four screws.

Unscrew the three nuts securing the motor to the mounting bracket on the bulkhead and detach the motor. Disconnect the bonding braid and the five cables from the motor. Cut the terminals from the five cables and in their place fit nipples for snap connectors. Detach the triangular mounting bracket from the wiper motor by removing the two 2 B.A. screws.

DR 3 Wiper Motor — to fit

Attach the triangular bracket to the mounting plate supplied with the wiper motor by means of two 2 B.A. screws. Fit the motor to the mounting plate and secure it with three 2 B.A. screws; secure the black earth wire from the motor and the bonded braid to the mounting bracket by means of one of the fixing bolts. Fit the wiper motor assembly to the bracket on the bulkhead and secure the mounting plate with three nuts. When the DR3 motor is fitted to the car it should occupy the same position (approximately) as did the DR1. Should the motor foul the pipe to the de-mister valve, carefully bend the pipe clear of the motor.

Fit the crosshead to the motor by reversing the procedure described for removing it. Connect the cables on the DR3 motor to the cables in the loom as follows:

Cable on motor		*Cable in loom*
Brown	to	Green and White
White	to	Red and White
Orange	to	Purple
Red	to	White
Blue	to	Brown
New feed:		
Green	to	Pink

New Feed Cable — to fit

Remove the cover from the distribution box and examine the diagram inside the cover showing the position of the terminals. Locate the terminal marked 'Wiper and Fuel Door', then remove from this terminal the feed cable to the wiper switch. Ascertain that the correct cable has been removed by switching on both the wiper motor and the fuel door to see which operates. Insulate this cable and secure it at the distribution box with insulating tape. Attach the eye (RD.3690) to the new feed cable (pink) and connect the cable to the No. 2 terminal of the distribution box. Cover the cable with the 5 mm. P.V.C. tube and secure the cable to the loom on the bulkhead with straps (F.59140). Fit a snap connector nipple to the cable and connect it to the green cable on the wiper motor.

Cases have occurred where the connections between the wiper motor and switch have been incorrect. Check to ensure that the pink cable from the distribution box and the brown cable from the switch terminal are connected to the green and blue cables on the wiper motor respectively. With the cables incorrectly connected the wiper motor will operate normally with no apparent defect. Should the wiper motor overheat however, the thermostatic switch contact points will open, thus breaking the circuit supplying current to the field wiring of the wiper motor. This will cause the wiper motor to stop although current will still be flowing through the brushes and commutator. Under these conditions, the wiper motor will take longer to cool and will therefore further delay the closing of the contact points in the thermostatic switch and the resumption of wiper motor operation.

Complaints of noisy operation are usually due to the run of the drive tubing. A metal-to-metal contact will permit high sound transference and the car body will act as a sounding board to accentuate the noise. Felt or rubber packing will eliminate this.

Complaints of failure on a drying screen are sometimes encountered due to high-friction blade rubbers. To test for this, sprinkle the screen with a few drops of water, remove the blade and wipe across by hand a number of times. When the screen is almost dry, a high-friction blade will offer considerable resistance and should be renewed.

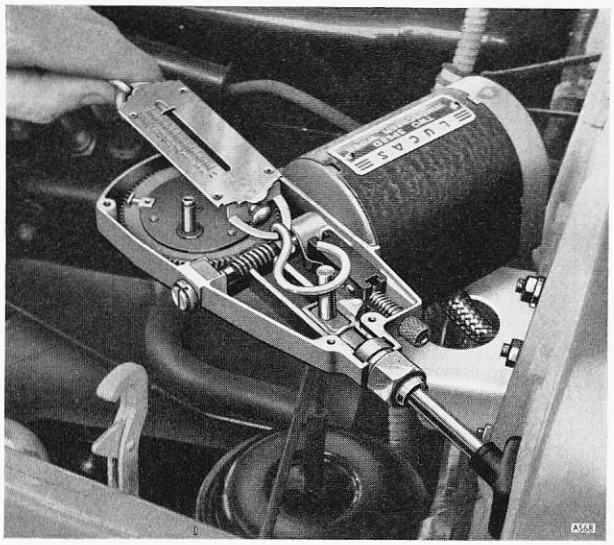


Fig. M50 Windscreen wiper load test

Motor overloading may also be caused by slight 'kinking' of the Bundy tubing. To test for overloading of the motor, the method shown in Figure M50 may be used; the following figures are quoted for guidance:

	Average values
Arms and blades removed	4½ to 6 lb. (2·0 to 2·7 kg.)
With blades on dry screen	20 to 24 lb. (9·0 to 10·9 kg.)

Windscreen Washers

On S1 cars, the windscreen washer is vacuum operated and **on S2 cars** it is electrically operated. The windscreen washer enables the driver to clean the windscreen whilst driving the car. To operate the windscreen washer, the windscreen wiper control switch should be pressed and then released; this causes fluid to be directed onto the windscreen through two jets mounted on the scuttle, just forward of the windscreen. To complete the cleaning the windscreen wipers should be switched on.

Should the jets become obstructed by foreign material, they may easily be cleared by slackening the knurled screws and operating the pump in the normal way. The jet consists of a small slot which becomes

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exposed when the knurled screw is slackened; any obstruction is therefore easily washed away.

Adjustment of the angle of the jet is effected by turning the hexagon portion of the jet with a suitable spanner. The jet should impinge on the windscreen towards the top of the arc traversed by the windscreen wiper blades.

No maintenance is required except for the replenishing of the large glass container under the bonnet with the windscreen washing fluid.

In cases of failure, the vacuum operated windscreen washer should be renewed.

Before renewing an electrically operated windscreen washer unit, check and ensure that the fuse, switch and wiring are satisfactory:

Examine the windscreen washer fuse in the main fuse box.

To check the switch wiring, remove the three leads from the electric motor and connect a test bulb between the pink and red leads.

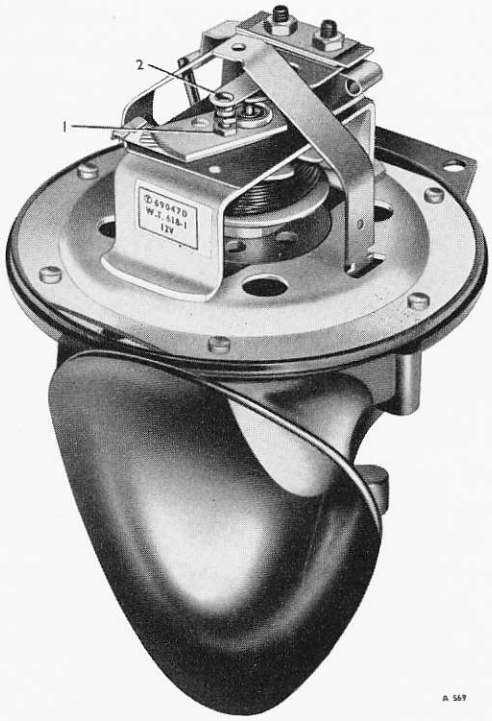


Fig. M51 Wind-tone horn

1. ADJUSTABLE CONTACT 2. VIBRATING CONTACT

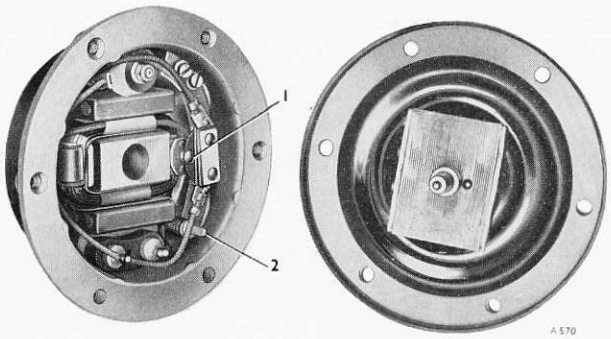


Fig. M52 High frequency horn

1. CONTACT POINTS 2. CONTACT ADJUSTER

Switch on the ignition and press the windscreen wiper switch; the test bulb should light every time the switch is pressed. Connect the test bulb between the pink and black lead; the test bulb should light. After ensuring that current is available at the electric motor and that the armature will not rotate, the fault must lie in the motor and the unit should be renewed. No attempt should be made to adjust the electric motor or to remove the motor from its mounting.

Horns

The horns fitted may be either a matched pair of Lucas Wind-tone horns or a matched pair of high frequency horns; either type of horn can be fitted at the customer's request.

The horns are mounted on the front of the chassis frame and are operated by the push button switch in the centre of the steering wheel through a relay on the left-hand side of the bulkhead. A separate fuse box is provided for the horn circuit and is mounted on the right-hand side of the bulkhead, adjacent to the main fuse box.

Wind-tone horns

There is no adjustment provided to alter the pitch of the horn, but a poor note may be due to the condition of the contact points or arm tension. To remedy this fault, clean the contact points, then remove the horn fuse and disconnect the horn which is not being adjusted. Insert an ammeter across the fuse terminals. Screw in the adjustable contact (see Fig. M51) until the horn just fails to sound. Unscrew half a turn and lock. Slight re-adjustment may be necessary to limit the current consumption to 6·5 amps.

High frequency horns

Figure M52 illustrates the contact adjustment which is carried out externally at the rear of the horn. This adjustment is carried out in a similar manner to that described for the Wind-tone horn. Maximum permissible current is 4 amps.

Horn Circuit — to test

(i) Connect the horn relay terminal 'C1' to the main battery terminal of the starter relay. If the horns do not operate, the fault lies in the circuit forward of the relay. If the note is poor, check the voltage at this terminal with the horn operating. The minimum value for satisfactory operation is 10 volts.

(ii) To isolate a failure not reproduced in test (i), short circuit the 'W1' terminal to earth. Horn operation indicates a failure in the push button, lead or earth connector on the steering column. Failure of the horn to operate indicates a defective relay.

Modification to the Horn Cable on S1 cars

Normal movement of the steering wheel twists and untwists the horn cable which runs from the horn button assembly, through the centre of the steering column and out at the base to a snap connector.

At the top of the steering column, the horn cable terminal screw into which the horn cable is soldered moves with the steering wheel, whereas the horn cable tends to remain stationary; this action places a torsional load on the cable close to the terminal screw and may cause fatigue failure of the cable at this point.

To overcome this possibility, the horn cable assembly has been exchanged for one having a cable more resistant to fatigue failure and incorporating a horn cable bush. This bush fits next to the terminal screw and clamps the cable within the horn contact housing so that rotation of the steering wheel does not tend to twist the terminal screw relative to the cable, but twists the whole cable.

The modified assembly was introduced on cars having the following chassis numbers:

Silver Cloud	...	...	SWA-200
Bentley S1 ...	...	...	B-375-AP
Bentley Continental S1	...		BC-1-BG

Modification Procedure

Disconnect the cable from the snap connector at the base of the steering column and remove the horn button housing by unscrewing the three retaining setscrews in the underside of the steering wheel boss. This allows the horn button housing and the contact housing to be removed complete with cable. Remove the insulator bush and unscrew the horn cable contact point; note the number of turns taken to unscrew it so that on re-assembly, the horn contact can be screwed onto the new cable using the same number of turns; this will give the approximate horn contact gap. Discard the existing horn cable assembly and fit the modified assembly, Part No. F.58688 S/A. Fit the horn contact using the same number of turns as were required to remove it.

Mount the whole assembly and check the horn button movement before the horn operates; this should be approximately 0·040 in. (1·02 mm.) and is measured by placing feeler gauges under the rim of the horn button and noting the clearance between the under surface of the button and the housing. Reduce the feeler gauge thickness by 0·040 in. (1·02 mm.) and press the horn button; the horn should sound just as the feeler gauges are gripped. If the clearance is incorrect, the necessary adjustment should be made by removing the complete assembly and screwing or unscrewing the horn cable terminal screw one turn at a time.

Direction Indicators

On S1 cars, the indicators are operated by a self-cancelling time switch mounted on the facia capping rail. If a turn to the right is to be indicated, the switch handle should be moved to the right and if a turn to the left is to be indicated, the switch handle should be moved to the left; after approximately 10 seconds, the switch will return to its original 'OFF' position.

On S2 cars, the indicators are operated by a switch mounted on the steering column. To indicate a turn to the right, move the control switch up and to indicate a turn to the left, move the control switch down; the switch is automatically cancelled by returning the steering wheel to the straight-ahead position after completing a turn.

On all S1 and S2 cars, two warning lamps are fitted in the speedometer head; the warning lamp corresponding to the direction of the indicated turn will flash

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when the indicators are operating. The indicators flash approximately 90 times per minute and are controlled by two flasher units mounted behind the facia panel. If one of the indicator bulbs fails, the warning lamp will flash once and then remain out.

In addition to the flashing of the warning lamps, a clicking noise in the flasher unit provides an audible signal when the indicators are operating. The flasher units are sealed and are not adjustable; if service is necessary, it must be by renewal.

Two relays are mounted on the front of the bulkhead, their function being to extinguish the appropriate fog lamp should the fog lamps be in use when the indicators are operating. The relay units are not adjustable and if service is necessary it must be by renewal.

Radio

'His Masters Voice' automobile radio receivers are standard equipment, as follows:

Model No.	*Type*
	Early S1 cars
4300	All wave
200 XB	Medium and long wave
202 XB	Medium wave
	Late S1 cars
200 RB	Medium and long wave
202 RB	Medium wave
	Early S2 cars
401 TA/VT	Medium and long wave
402 TA/VT	Medium wave
	Late S2 cars
501 TA/VT	Medium and long wave
502 TA/VT	Medium wave
	Late S1 and all S2 cars
230 R	Medium and short wave

Description

On S1 cars, the receivers fitted consist basically of a high sensitivity permeability tuned superheterodyne circuit incorporating one stage of R.F. amplification prior to the frequency changer. The amplifier provides push–pull output, the high tension supply being by means of a non-synchronous vibrator rectified conventionally by a compact metal rectifier.

On S2 cars, the receivers fitted, with the exception of the 230R model, consist of a hybrid valve-transistor unit. This comprises a high sensitivity permeability tuned superheterodyne circuit, incorporating one stage of R.F. amplification prior to the frequency changer, one I.F. amplifier, demodulator and audio amplifier feeding a single transistor output stage. Low voltage valves operating directly from the 12 volt battery supply are used, eliminating the need for a vibrator.

The controls and the position of the controls are very similar on all models; the combined volume control and 'ON/OFF' switch is positioned on the left of the receiver. This control switches on the receiver when turned clockwise and further clockwise rotation of the control progressively increases the volume. Turning the control switch fully anti-clockwise will switch off the receiver. Allow about 40 seconds for the receiver to 'warm-up' after switching on.

The tone control is concentric with the volume control on all models and provides variable tone correction. Turning the control anti-clockwise reduces the amount of bass reproduction. With the control in the central position no correction is applied. Turning the control clockwise reduces the amount of treble reproduction.

On all models except the 4300 and 230R, five tuning push buttons are fitted, in addition to the manual tuning control. The push buttons provide automatic tuning of five pre-selected stations.

On medium and long wave receivers, four medium wave stations and one long wave station can be tuned in this way; the extreme right-hand button should be pressed to change from the medium to the long wave band. If any long wave stations are required other than the pre-selected one, these must be obtained by manual tuning. To change from the long to the medium wave band, any of the four left-hand push buttons should be pressed.

Manual tuning is controlled by the switches on the right of the receiver on all models.

On the 4300 receiver, which covers all wave bands, and the 230R receiver, which covers the medium and short wave bands, the frequency is changed by a control knob which is concentric with the manual tuning control on the right of the receiver.

On late S2 (non-division) cars, in order to improve the quality of the radio sound reception in the rear seats, an additional loudspeaker is fitted in the parcel shelf. A control is positioned in the front loudspeaker grille which controls the balance of volume between the front and rear loudspeakers. With the control centrally positioned, the volume of sound issuing from the two loudspeakers is equal. Turning the control clockwise reduces the volume of the front loudspeaker and increases the volume of the rear loudspeaker. Turning the control anti-clockwise reduces the volume of the rear loudspeaker and increases the volume of the front loudspeaker. The overall volume of sound is controlled by the volume control on the receiver.

Tuning Push Buttons — to set

1. Switch on the receiver and allow 10 minutes for the receiver to warm-up thoroughly.
2. Select the wave band required by pressing the appropriate push button.
3. Tune-in the desired station by means of the manual tuning control.

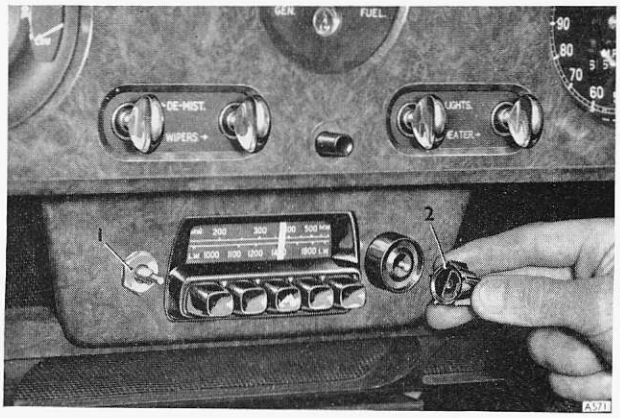


Fig. M53 Radio controls — S1 cars

1. STOP-NUT 2. CONTROL KNOB

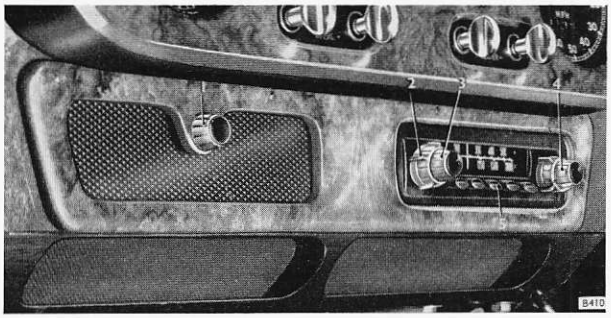


Fig. M54 Radio and speaker controls — S2 cars

1. VOLUME BALANCE CONTROL 2. TONE CONTROL
3. VOLUME CONTROL AND *ON/OFF* SWITCH
4. MANUAL TUNING CONTROL 5. TUNING PUSH BUTTONS

4. With the station accurately tuned-in, withdraw the push button outwards to its full extent (approximately 0·25 in. (6·3 mm.) of movement) to release the locking mechanism, then push the button firmly home, thus locking the mechanism in the required position. The push button is then set to tune the station required and, whenever pressed, will 'bring-in' the station irrespective of the position to which the scale pointer may be adjusted. Proceed in the same manner for the remaining push buttons.

S1 cars

Receiver — to remove

Remove the control knobs and unscrew the two stop-nuts (see Fig. M53), then remove the finisher. Free the clock winder and the trip recorder controls. Remove the 2 B.A. screws retaining the mounting box. Disconnect the receiver connecting link by pulling out the plug and remove the aerial plug connector. Disconnect the feed cable at the fuse capsule. Remove the four hexagon-headed screws securing the receiver to its brackets, slide the receiver gently towards the rear of the car and remove it, taking care not to trap the battery lead.

Installation of the receiver is carried out by reversing the removal procedure.

Amplifier — to remove

On right-hand drive cars, remove the cubby box which is held in position by six 2 B.A. screws.

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On left-hand drive cars, remove the carpet covering the heater ducting. Remove the two worm drive clips from either end of the heater and de-mister cross duct positioned below the facia. Push this duct to the right, drop the left-hand side and pull gently to remove it. The amplifier unit can then be readily removed. Disconnect the loudspeaker lead and connector link. Remove the two hexagon-headed 2 B.A. screws on each side of the unit and remove the unit.

Installation is carried out by reversing the removal procedure.

Bulbs — to renew

Remove the control knobs and unscrew the two stop-nuts. Remove the finisher and the push button surround. The bulb is mounted on the right-hand side of the receiver and can simply be unscrewed from its holder.

A 14V 2·2W bulb is used for the illumination of the tuning scale.

Loudspeaker — to remove

Withdraw the control knobs from the receiver, unscrew the two stop-nuts and remove the finisher. Remove the picnic table. Unscrew the four screws securing the loudspeaker lower ducting to the upper ducting and remove the lower ducting. Remove the screws securing the loudspeaker mounting board to the upper ducting and lower the mounting board until the loudspeaker leads can be disconnected at the loudspeaker. Release the screws securing the loudspeaker to the mounting board.

S2 cars

Receiver and Amplifier — to remove

Withdraw the control knob positioned above the front loudspeaker grille (if fitted). Unscrew and remove the four wood-screws from the top of the receiver/loudspeaker finisher and the four wood-screws positioned under the finisher. Remove the finisher.

Unscrew the six wood-screws securing the receiver surround to the facia panel; this surround need not be removed from the receiver. Unscrew the four bolts positioned under the facia, securing the receiver brackets to their supports. Disconnect the battery feed to the receiver by unscrewing the two halves of the fuse carrier and removing the glass cartridge fuse. Remove the screw securing the earth cable to the receiver frame. Withdraw the loudspeaker and aerial plugs and remove the lead linking the receiver and amplifier, noting that this cable is clipped to the receiver. Withdraw the receiver and amplifier as one unit through the front of the facia.

Installation of the receiver and amplifier is carried out by reversing the removal procedure.

Bulb — to renew

Remove the control knobs from the receiver and also the control knob positioned above the front loudspeaker (if fitted). Unscrew the stop-nuts from the receiver controls and remove the spring washers.

Unscrew the four wood-screws from the top of the receiver loudspeaker finisher and also unscrew the four wood-screws positioned under the finisher. Remove the finisher.

Unscrew the six wood-screws securing the surround to the receiver and remove this surround. The bulb is positioned on the right-hand side of the receiver and can simply be unscrewed from its holder.

A 14V 0·8W bulb is fitted for the illumination of the tuning scale.

Front Loudspeaker — to remove

Withdraw the picnic table to its full extent to gain access to the rear of the facia. Remove the two set-screws securing the loudspeaker mounting board to the rear of the facia. Carefully lower the loudspeaker assembly through the space at the rear of the picnic table until the two leads can be disconnected at the loudspeaker terminals. Remove the loudspeaker assembly and remove the screws securing the loudspeaker to the mounting board.

Installation of the loudspeaker is carried out by reversing the removal procedure, noting that either of the loudspeaker leads may be connected to either of the loudspeaker terminals.

Rear Loudspeaker — to remove

Access to the rear loudspeaker is gained through the luggage boot. Remove all the screws retaining

the boot roof trim and remove the trim. Disconnect the two leads from the loudspeaker. Unscrew the wood-screws securing the loudspeaker to its mounting board and remove the loudspeaker.

Fuse

On all cars, a 5 amp. cartridge fuse is housed in a plastic container on the feed cable under the receiver. To remove the fuse, unscrew the plastic container.

Radio Aerial

On all cars, the aerial is normally mounted above the centre of the windscreen on the outside of the car and is controlled from the inside by a bakelite knob. An arrow engraved on the bakelite knob indicates the position of the aerial, which should be vertical for normal use and horizontal when not required.

An electrically operated aerial can be fitted in the front wing at customer's request. The aerial is electrically raised and lowered and is controlled by a switch on the facia.

No maintenance is required, but to ensure that the best reception is obtained the aerial should be kept clean.

Cigar Lighters

Two cigar lighters are fitted on all standard S1 and S2 cars. One is positioned in the facia, adjacent to the switchbox, and the other is positioned in the right-hand rear quarter companion.

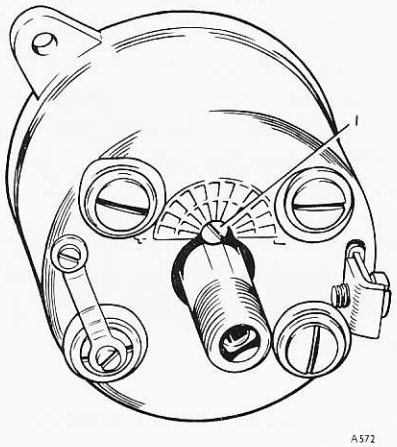


Fig. M55 Clock fitted to standard S1 cars

1. REGULATOR

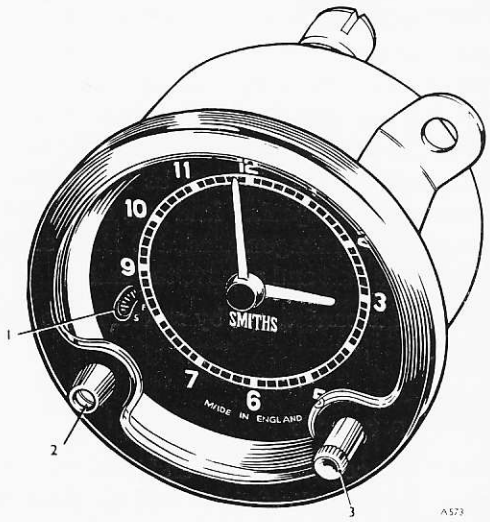


Fig. M56 Clock fitted to S2 and coachbuilt cars

1. INDICATOR 2. REGULATOR
3. SETTING CONTROL FOR HANDS OF CLOCK

The cigar lighter is of the normal push-in, automatic 'pop-out' type and it should not be held by hand in the pushed-in position as this will cause overheating of the element and failure of the fuse. No maintenance is required except **on S2 cars,** on which the illuminating bulb may occasionally require renewal. To renew this bulb, remove the instrument panel finisher and unscrew the two screws securing the cigar lighter housing to the instrument panel. Withdraw the cigar lighter housing from the instrument panel but do not disconnect the leads. Remove the bulb carrier from the side of the cigar lighter housing by pressing both sides of the bulb carrier until it is clear of the two slots in the housing. The 12V 1·8W bulb is of standard bayonet fitting.

Installation is carried out by reversing the removal procedure; note that the earth lead should be connected to one of the two screws securing the cigar lighter housing to the instrument panel.

Clocks

Two types of electrically operated clock are fitted: **on standard S1 cars,** the clock is regulated from the rear (see Fig. M55) and **on S2 and all coachbuilt cars,** the clock is regulated from the front (see Fig. M56).

Complaints of poor timekeeping are usually due to incorrect regulation.

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On S1 cars, to regulate the clock, turn the adjusting screw at the rear of the clock to the right to lose time and to the left to gain time.

On S2 and all coachbuilt cars, to regulate the clock, turn the left-hand adjusting screw so that the indicator moves in the required direction. Clockwise rotation of the adjusting screw moves the indicator face towards the 'S', thus slowing the clock, and vice versa.

Movement of the regulator adjusting screw must be very limited otherwise over-regulation will result.

Rear Window De-mister

On all cars, the rear window is de-misted electrically by fine heater wires which are sandwiched between the two glass layers and which are controlled by a toggle switch on the parcel shelf.

Complaints of misted patches under severe conditions may be due to the formation of an oxide film between the heater wires and bus-bars. This oxidation gives a low current consumption and where a check shows this to be 4·5 amps. or less at 12 volts, disconnect the window completely from the car wiring system and burn off the oxide by applying 24 volts for approximately 20 minutes, until the glass is thoroughly warmed. When cold, re-test at 12 volts for current consumption and cold patches. If necessary, the boost voltage may be repeated.

Complete failure is occasionally encountered due to fracture of the flexible connectors adjacent to the glass. These may be repaired by soldering, care being taken to ensure that direct heat is not applied to the glass.

For removal and installation instruction, see Chapter S.

CHAPTER M

ELECTRICAL, IGNITION AND RADIO

SECTION M7—IGNITION SYSTEM—S3 CARS

Distributor
(Page M 28 in Workshop Manual)

Type	Lucas 20D8
Firing order	A1, B1, A4, B4, B2, A3, B3, A2
Timing	2° B.T.D.C.
Direction of rotation	Anti-clockwise
Contact gap	0·014 in. to 0·016 in. (0·356 mm. to 0·406 mm.)
Dwell angle	31° to 37° at 0·015 in. gap
Contact arm spring tension	18 oz. to 24 oz.
Condenser capacity	0·18 mfd. to 0·23 mfd.
Radio interference suppressor carbon resistor pick-up brush	5000 ohms to 6500 ohms approximately

Coil
(Page M 28 in Workshop Manual)

Type	Lucas HA12 negative earth
Insulation resistance to case	20 meg. at 500 v.
Primary winding resistance	4·25 ohms to 4·65 ohms at 75°F.
Secondary winding resistance	5500 ohms to 7100 ohms at 75°F.
Radio interference suppressor: Capacitor on 'SW' terminal	1 mfd.

Sparking plugs

9 : 1 compression ratio	
Make and type	Champion RN 8
8 : 1 compression ratio	
Make and type	Lodge CLNP Champion RN 13P Champion RN 8
Cars destined for Australia	
Make and type	Champion UN 12 Y
Gap	0·025 in. (0·635 mm.)

Distributor

(Page M 28 in Workshop Manual)

Description

On S3 cars the distributor contains two sets of contacts which are wired in parallel and are so arranged that their actions overlap.

In this way, one set of contacts break the low tension circuit and initiate the high tension spark and after a brief dwell period the other set of contacts reconnect the low tension circuit.

The timing of the spark is controlled by a centrifugal governor, mounted on the distributor driving shaft beneath the contact breaker base plate. In addition to the centrifugal advance and retard mechanism, a vacuum timing control is provided, manifold depression being utilised to vary the timing in accordance with engine loadings.

An octane selector is mounted adjacent to the vacuum timing unit on the outside of the contact breaker housing. The octane selector consists of an eccentric pin working in a slot in the lower part of the distributor body, thus affording final manual adjustment of the ignition timing to suit low octane fuels.

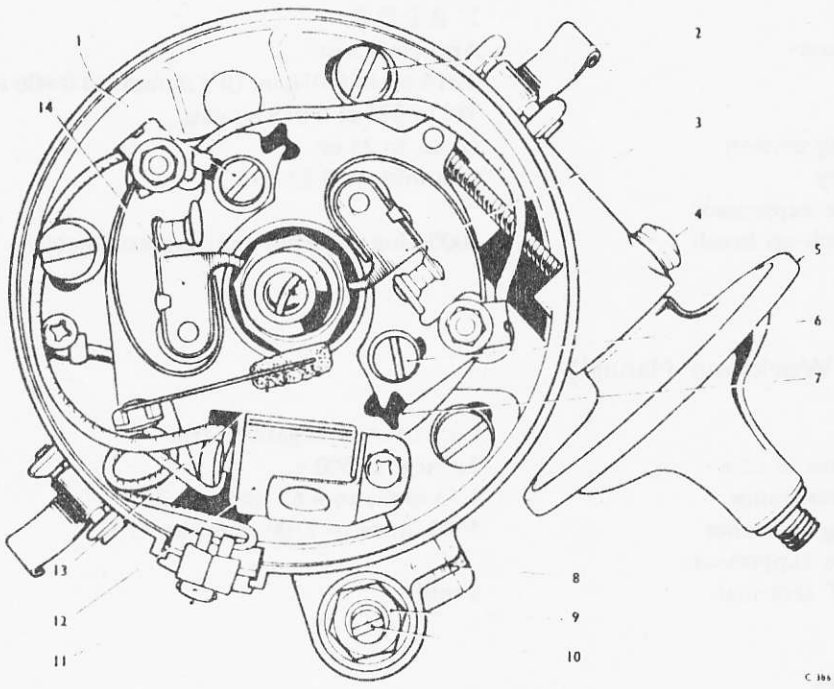


Fig. M1 (S) Internal view of distributor

1 FIXED CONTACT PLATE SECURING SCREWS
2 CONTACT BREAKER HOUSING SECURING SCREW
3 CONTACT BREAKER
4 VACUUM UNIT SECURING SCREW
5 VACUUM TIMING CONTROL UNIT
6 FIXED CONTACT PLATE SECURING SCREW
7 CONTACT BREAKER GAP ADJUSTING SLOT
8 OCTANE SELECTOR SCALE
9 OCTANE SELECTOR ADJUSTING SCREW LOCK-NUT
10 OCTANE SELECTOR ADJUSTING SCREW
11 L.T. TERMINAL
12 CONDENSER
13 CAM LUBRICATING PAD
14 CONTACT BREAKER

Maintenance—Lubrication
(Page M 28 in Workshop Manual)
Every 6000 miles (10,000 kilometres)

S3 cars only

Remove and clean the distributor cap, using a soft dry cloth; pay particular attention to the areas between the terminals. Check that the carbon brush is in its bore and that it moves freely.

Lubricate the centrifugal advance mechanism by injecting a few drops of clean engine oil through a convenient aperture in the contact breaker base plate.

Withdraw the rotor arm and inject a few drops of clean engine oil into the rotor arm spindle.

Lightly smear the faces of the cam with grease or clean engine oil.

Apply one drop of oil to each of the contact breaker pivots.

Important Do not allow oil or grease on or near the contacts when lubricating the distributor.

Ignition timing
Contact points—To clean and adjust
(Page M 28 in Workshop Manual)

S3 cars only

For identification of detail parts of the distributor, refer to Figure M1(S) of this Supplement.

Note:

To clean and accurately adjust the contact points, it may be considered more convenient to remove the distributor from the crankcase, therefore instructions for removing the distributor have been included in the following passages.

Remove the distributor cap, noting the position in which the rotor arm should be placed for the ignition of cylinder A1.

Press the button on the end of the starter motor relay to turn the crankshaft until the position of cylinder A1 is approached. This may be seen by the position of the rotor arm.

Remove the flywheel housing inspection cover and rotate the flywheel by hand to the correct ignition timing mark of 2° B.T.D.C.

The flywheel should only be turned in the normal direction of rotation (anti-clockwise when viewed from rear of engine). If rotated otherwise an inaccurate timing setting may be obtained due to backlash in the gears.

To remove the distributor from the crankcase, disconnect the low tension lead from the terminal on the distributor casing, then unscrew the two setscrews securing the distributor to the crankcase.

If the contact points require cleaning or refacing they should be removed from the distributor as follows.

Remove the nuts from the posts to which the contact breaker springs are anchored.

Remove the insulating pieces and electrical connections.

The contact breaker levers can then be lifted off the pivot posts.

Remove the screws (1 and 6 see Fig. M1 (S) of this Supplement) which secure the fixed contact points and withdraw the fixed contact points from the distributor.

Examine the contact points for pitting and piling. They should be cleaned as necessary with a fine carborundum stone, taking care to keep the contact faces as square as possible. If the points are seriously corroded they should be renewed.

To fit the contact points reverse the procedure for removal, taking care to align the points so that they make full face contact.

To adjust the points slacken the two screws (1 and 6) shown in Figure M1(S) of this Supplement, which secure the fixed contact points, then using a screwdriver in the contact breaker gap adjusting slot (7), set the gaps to between 0·014 in. (0·256 mm.) and 0·016 in. (0·406 mm.).

Tighten the two locking screws.

Note Should the crankshaft be rotated inadvertently while the distributor is removed from the engine, the correct position for ignition timing of A1 cylinder may be obtained as follows.

Remove the 'A' bank rocker cover which is on the right-hand side of the engine when viewed from the driver's seat. Rotate the crankshaft until the A1 inlet valve (the first valve at the front of the engine) has opened and just closed.

Rotate the crankshaft by hand in its normal direction of rotation until the flywheel is at 2° B.T.D.C.

Refit the 'A' bank rocker cover.

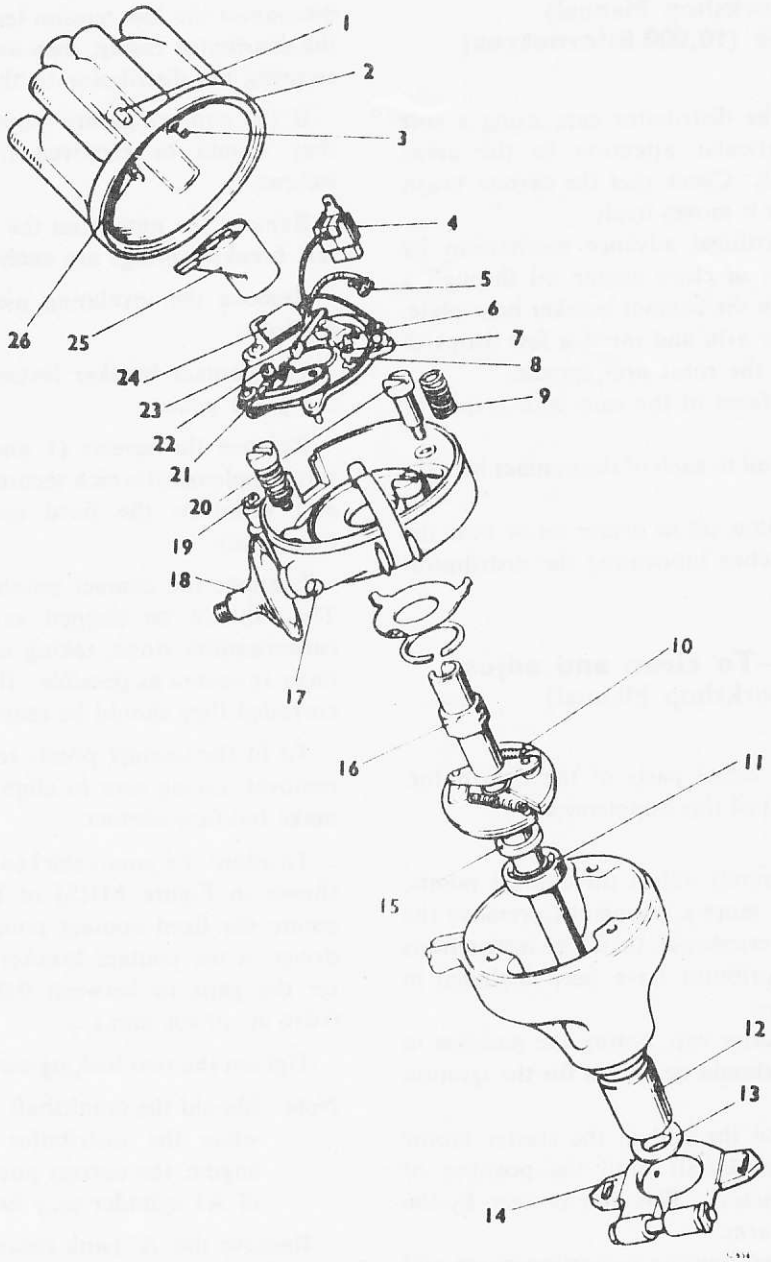


Fig. M2 (S) Exploded view of distributor

1 CARBON BRUSH
2 DISTRIBUTOR CAP
3 H.T. ELECTRODE
4 L.T. TERMINAL
5 C.B. EARTH LEAD
6 CONTACTS
7 FIXED CONTACT SECURING SCREW
8 C.B. GAP ADJUSTING SLOT
9 SPRING
10 CENTRIFUGAL TIMING CONTROL
11 BEARING
12 DISTRIBUTOR BODY SPIGOT
13 THRUST WASHER
14 SECURING PLATE
15 DISTANCE COLLAR
16 CAM
17 VACUUM TIMING CONTROL FIXING SCREW
18 VACUUM TIMING CONTROL UNIT
19 OCTANE SELECTOR ADJUSTING SCREW
20 SCREW C.B. HOUSING
21 CONTACTS
22 FIXED CONTACT SECURING SCREW
23 CAM LUBRICATING PAD
24 CONDENSER
25 ROTOR
26 H.T. ELECTRODE

Ignition timing—To adjust
(Page M 31 in Workshop Manual)

S3 cars only

Time the ignition with the octane selector in the fully advanced position, this should be carried out as follows.

Release the lock-nut (9) shown in Figure M1(S) of this Supplement and set the octane selector (8) to the 'A' mark on the scale before carrying out the ignition timing.

Turn the distributor spindle until the rotor arm is in line with No. A1 cylinder ignition position.

Fit the distributor and secure the pedestal to the crankcase with two setscrews as shown in Figure M3(S) of this Supplement.

Release the distributor clamping screw, then rotate the distributor body until the set of contacts (14) shown in Figure M1(S) of this Supplement, opposite the vacuum advance unit, are just breaking.

During this operation hold the top of the rotor in the fully retarded position to take up any backlash in the centrifugal advance mechanism. Clockwise rotation of the distributor body will advance the timing, and anti-clockwise rotation will retard the timing.

The most suitable method of checking when the contact points are just breaking is with an ignition timing lamp.

Tighten the distributor clamping screw to lock the body in position.

Rotate the crankshaft two full turns and with the aid of an ignition timing lamp, recheck to ensure that the contact points are just breaking when the rotor arm is in line with No. A1 firing position and the flywheel is at 2° B.T.D.C.

Distributor overhaul
(Page M 31 in Workshop Manual)

For identification of the distributor components refer to Figure M2(S) of this Supplement.

Remove the distributor from the crankcase and remove the rotor arm and the contact breaker points, see 'Contact points—To clean and adjust' in this Supplement.

The distributor should then be dismantled as follows.

Unscrew and remove the condenser securing screw; withdraw the condenser.

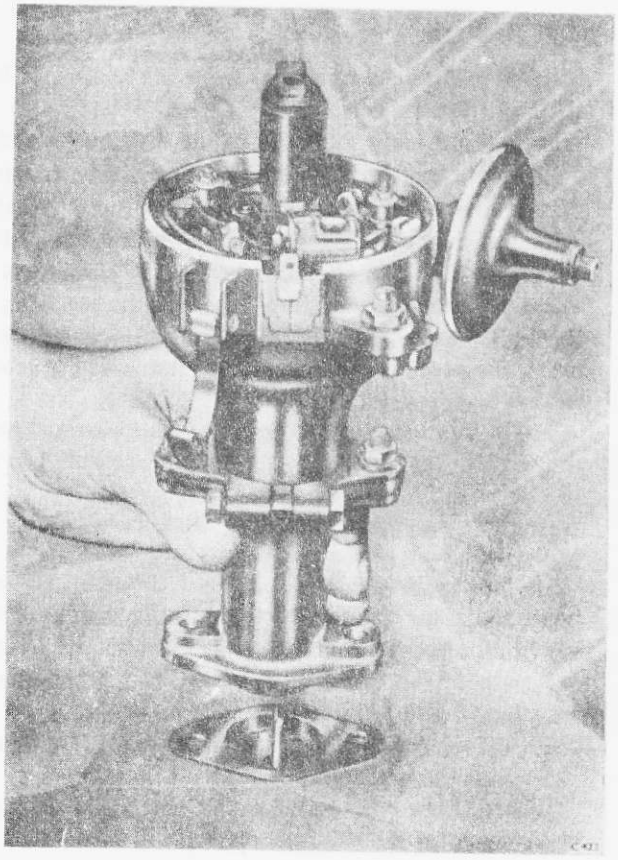


Fig. M3 (S) Method of fitting distributor

Remove the three spring-loaded screws (20) shown in Figure M2(S) of this Supplement; the upper portion of the distributor can then be withdrawn exposing the centrifugal advance mechanism.

Remove the circlip which retains the star washer on the underside of the contact breaker housing.

Lift the contact breaker base plate out of the contact breaker housing.

Unscrew the fixing screw (17) shown in Figure M2(S) of this Supplement and remove the vacuum diaphragm unit.

Remove the cam spindle screw and withdraw the cam assembly.

Lift the weights, springs and toggles off the action plate. To ensure correct re-assembly take care to note the position in which the parts are fitted in relation to each other.

Remove the tapered retaining pin which secures the driving sleeve to the shaft.

Remove the driving sleeve from the shaft and lift off the thrust washer.

Press the driving shaft out of the distributor body, taking care not to lose the distance piece located beneath the centrifugal timing control mounting plate.

Inspect the ball bearing at the top of the distributor body shaft housing. If excessive wear or roughness is apparent, the bearing should be withdrawn using a claw type extractor. Before fitting a new bearing, renew the neoprene oil seal located immediately below the bearing.

To facilitate fitting of the upper ball bearing, heat the distributor body to a temperature of 110°C. to 120°C.

Inspect the shaft for wear and parallelism; if excessively worn the shaft should be renewed.

If a new shaft is fitted, or if the shaft is only slightly worn a new bush should be fitted at the bottom of the distributor body. After fitting the bush ream it to size.

Assemble the distributor, reversing the procedure for dismantling, noting the following points.

Fit the distance collar to the shaft before fitting the shaft into the distributor body.

Ensure that the vacuum advance peg engages correctly with the vacuum unit spring link.

If facilities permit, it is advisable to check the automatic advance mechanism to ensure that the performance curves lie within the prescribed limits. The advance curves are shown in Figure M4(S) of this Supplement.

Ignition coil
(Page M 32 in Workshop Manual)

For S3 cars the first paragraph to read

The ignition coil fitted to S3 cars is of Lucas manufacture and is of negative earth polarity. The terminals are marked 'S.W.' (switch wire) and 'C.B.' (contact breaker).

Sparking plugs
(Page M 32 in Workshop Manual)

S3 cars only

The recommended sparking plugs are as follows

9 : 1 compression ratio	Champion RN 8
8 : 1 compression ratio	Lodge CLNP
	Champion RN 13P
	Champion RN 8
Cars desined for Austrailia	Champion UN 12Y

Lodge CLNP and Champion RN 13P are platinum pointed plugs.

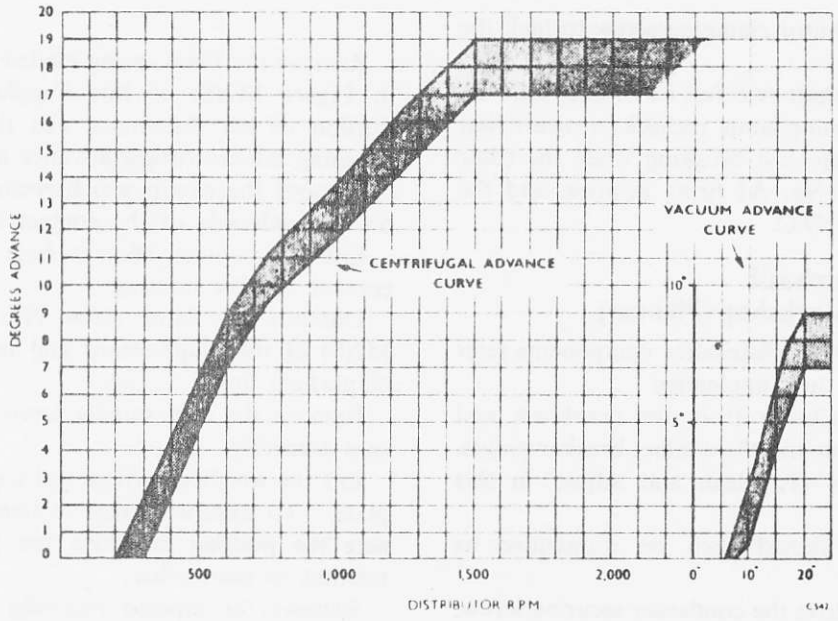


Fig. M4 (S) Ignition advance curves S3 cars

Maintenance
(Page M 32 in Workshop Manual)

S3 cars only

Every 6000 miles (10,000 kilometres) the plugs should be removed and cleaned. Before refitting the plugs, set the gaps by feeler gauge to 0·025 in. (0·635 mm.).

If Champion RN.8 sparking plugs are fitted, it is recommended that they be serviced using a standard sparking plug servicing and sand blasting machine.

If either Lodge CLNP or Champion RN.13P platinum pointed sparking plugs are fitted, they should be serviced by brushing off the carbon and inspecting the points.

Every 12,000 miles (20,000 kilometres) the plugs should be renewed to maintain satisfactory performance.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

SECTION M9—LIGHTING EQUIPMENT

Headlamps
(Page M 34 in Workshop Manual)

S3 cars only

The headlamps are controlled by two switches, the master switch on the facia and a foot operated switch for beam selection. A small red warning lamp mounted in the speedometer is illuminated whenever the headlamps are on 'main beam'.

Four headlamps are fitted which are of the sealed beam type. The '**all glass**' sealed beam units which are fitted to the majority of cars are in effect large gas filled bulbs having internal aluminised glass reflectors fused to the front lens; the filaments are accurately focused and sealed in the reflector.

Alternative lamp units are fitted to cars intended for countries where special lighting requirements exist. These units consist of a metal reflector and front glass sealed together and contain either a soldered in bulb or a detachable bulb.

The components of the '**all glass**' sealed beam unit and the metal backed lamp unit with a soldered in bulb cannot be separated; failure of a filament necessitates the renewal of the complete unit.

In the case of the metal backed lamp unit which contains a bulb, failure of a filament necessitates the renewal of the bulb.

The two inner lamps each contain a single filament placed at the focal point of the reflector to provide long range illumination for main beam driving. The two outer lamps each contain two filaments, one fitted at the focal point to provide the dipped beam, and the other displaced from the focal point to provide short range flood illumination for use in conjunction with the main beam.

For main beam driving all four lamps are switched on, the two inner lamps providing controlled long range illumination, whilst the out of focus filament in each outer lamp provides the short range flood illumination necessary to light the nearer section of the road. For dipped beam driving the filaments which are placed at the focal point of the outer two lamps are switched on, and provide illumination at intermediate range; when dipped beam is selected the four main beam filaments are switched off.

This arrangement of four separate lamps, enables the filaments for both the main and dipped beams to be accurately focused as required, to give the improved light distribution and greater accuracy of beam setting.

Headlamp bulb—To renew
(Page M 35 in Workshop Manual)

For S3 cars read

Sealed beam unit—To renew

To gain access to the lamp units, remove the headlamp fairing as follows.

Remove the two retaining screws and pull the top of the headlamp fairing out of the recess into which it is fitted.

Lift the fairing off the locating peg in the bottom of the headlamp recess.

Remove the lamp units as follows.

Slacken the three setscrews securing the headlamp bezel sufficiently to allow the bezel to be rotated; rotate the bezel so that the screw heads can pass through the enlarged end of the slots. Remove the bezel taking care that the sealed beam unit does not fall.

Withdraw the sealed beam unit and detach the connecting plug from the terminal at the rear of the unit.

The replacement unit should then be fitted by reversing the procedure described above, noting the following points.

Before refitting the headlamp fairing, the large rubber ring which fits around the lamp unit retaining bezel should be drawn forward slightly, thus effecting a pleasing appearance when the fairing is fitted.

To ensure that the lamps are correctly paired, lamp units for the inner two lamps have '1' or '1A' inscribed on the lens; these are single filament units. Similarly, lamp units for the outer two lamps have '2' or '2A' or 'European' inscribed on the lens and each contain two filaments.

When a replacement unit has been fitted, no appreciable change should be apparent in the alignment of the headlamp beams. If the alignment is in doubt, the headlamp beams should be checked and if necessary reset.

Main beam setting
(Page M 35 in Workshop Manual)

For S3 cars read

Alignment and setting

The headlamp beams should be checked, and if necessary reset if the headlamp units or the wings have been disturbed for any reason.

To obtain the best results with the four headlamp system it is recommended that the Lucas 'Lev-L-Lite' beam aimer is used.

Headlamps—To adjust

Drive the car onto a flat surface and ensure that the tyres are inflated to the recommended pressures.

Rock the car to equalise the suspension.

Remove the two retaining screws from each fairing and withdraw the fairings from around the headlamps to expose the beam adjusting screws.

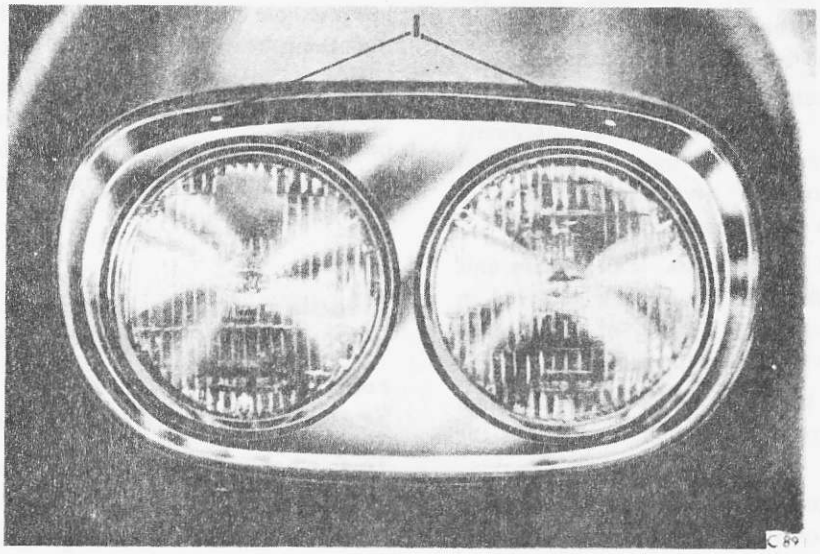


Fig. M5 (S) The headlamps
1 SECURING SCREWS

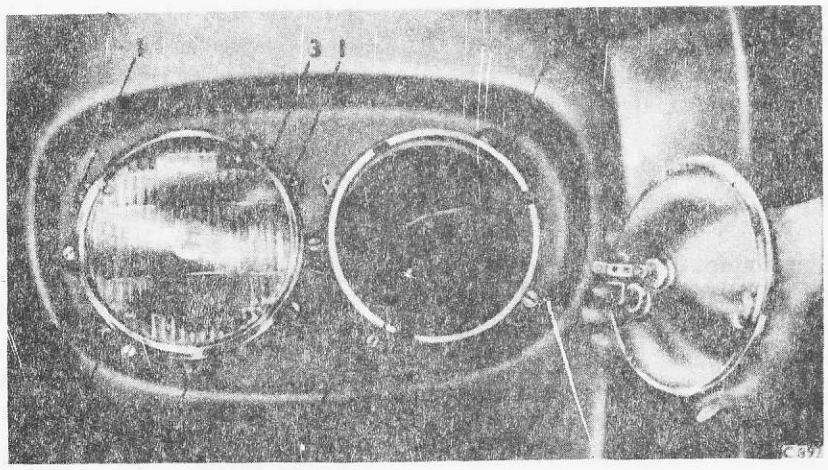


Fig. M6 (S) Access to the sealed beam units

1 SEALED BEAM UNIT SECURING SCREW
2 HORIZONTAL BEAM ADJUSTING SCREW
3 VERTICAL BEAM ADJUSTING SCREW
4 CONNECTING PLUG

Clean the headlamp lens with a damp cloth.

Fit the Lucas 'Lev-L-Lite' beam aimers to each outer headlamp as follows.

The sight openings of the beam aimers must be facing the centre of the car. Place each beam aimer on the headlamp lens making sure that the three aiming pads of the lens engage the smooth inner ring of the aimer. Secure the aimer to the lamp by pushing forward the sliding handle situated underneath the beam aimer, until the vacuum cup engages the headlamp lens. Draw back the handle until the spring catch is engaged.

Set the pointer of the scale marked RIGHT—LEFT to ZERO, by means of the knob provided, then set the pointer of the scale marked UP—DOWN to one division down, by means of the knob provided; this must be done on each aimer.

Place the transit target on the floor by one of the rear wheels then place the transit on the floor by the front wheel on the same side. Turn the transit until the target is visible through the viewer.

Adjust the screw on the rear end of the transit until the split image of the target is aligned, then turn the knob situated on the left-hand side of the transit, until the bubble of the spirit level on top of the transit is central.

Note the reading on the dial of the transit, then obtain the same plus or minus reading on the dial situated in the end of the beam aimer, on that side of the car, by rotating the floor level compensator screw using a screwdriver.

Place the transit target on the floor by the rear wheel on the other side of the car and carry out the same procedure.

To check the horizontal aim, look through the viewer port on top of each beam aimer. If the images are aligned the horizontal setting is correct. If the images are not aligned adjustments should be made as follows.

Slacken the lock-nut on each of the horizontal adjusting screws, shown in Figure M6(S), then adjust the screws until the images are aligned. The final adjustments should always be made by turning the screw clockwise to eliminate backlash.

When the adjustment is correct, tighten the lock-nut.

To check the vertical aim, note the position of the bubble in the spirit level situated on the top of each beam aimer. If it is central then the vertical aim is correct, if it is not central adjustment should be made as follows.

Slacken the lock-nut on each of the vertical adjusting screws, shown in Figure M6(S), then adjust the screw

until the bubble in each spirit level is central. The final adjustment should always be made by turning the screw clockwise to eliminate backlash.

When the adjustment is correct, tighten the locknuts.

To remove the beam aimer, hold the aimer, release the spring catch, then push the sliding handle toward the headlamp.

To adjust the inner headlamps it is not necessary to again use the transit target and transit, but the setting of the floor compensator dial in the end of the beam aimers should not be altered.

The adjustment for the inner headlamps is similar to that described for the adjustment of the outer headlamps, the only difference being that both dials on top of the beam aimers must be set at ZERO.

When all the headlamps have been adjusted correctly refit the headlamp finishers making sure that the finishers do not foul the lamp bezels.

Before moving the car after the headlamp finishers have been fitted, the headlamps should again be checked with the 'Lev-L-Lite' beam aimers to make sure that the setting has not been upset.

In the event of a Lucas 'Lev-L-Lite' beam aimer not being available the headlamps may be adjusted by a visual setting using either of the following methods of alignment.

1 By employing a matt white painted movable screen marked out as shown in Figure M7(S) provided with an adjustable horizontal tape and aiming block and cords also shown in Figure M7(S).

The screen should be used on a flat floor which is approximately 40 ft. in length.

2 By employing a flat wall surface, preferably with a light coloured matt finish, marked out as in Figure M8(S) adjacent to a flat floor which is approximately 40 ft. in length and marked out as in Figure M8(S). An adjustable horizontal tape should also be provided.

Method 1

To prepare for checking the headlamp beam setting, drive the car onto the flat surface, then ensure that the tyres are inflated to the recommended pressures.

Remove the rear wheel discs.

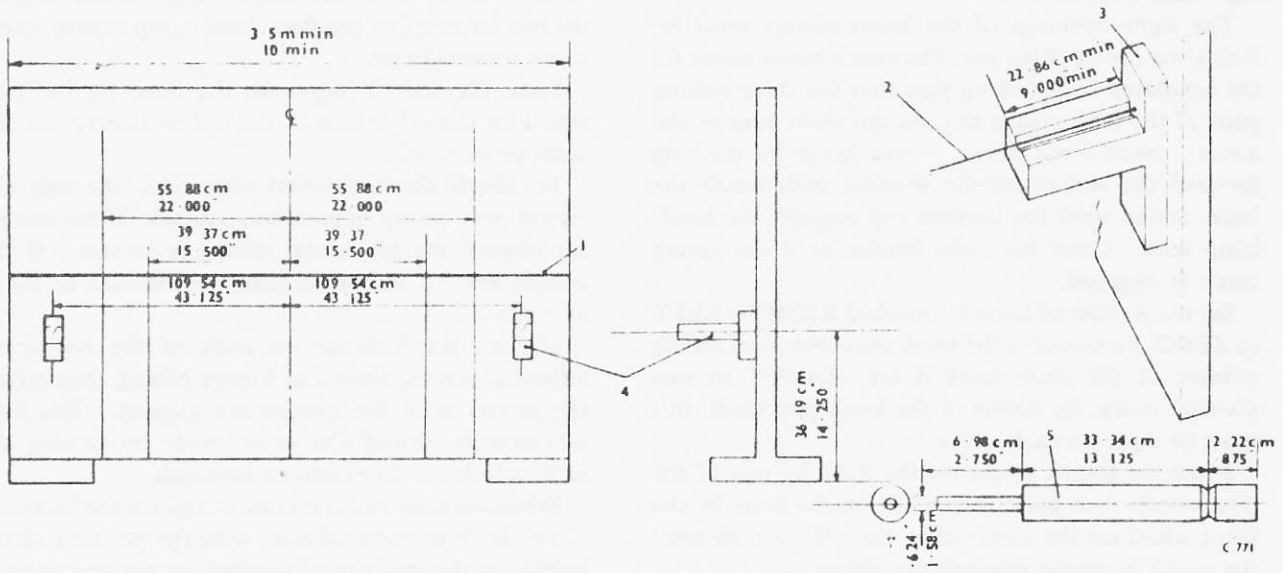
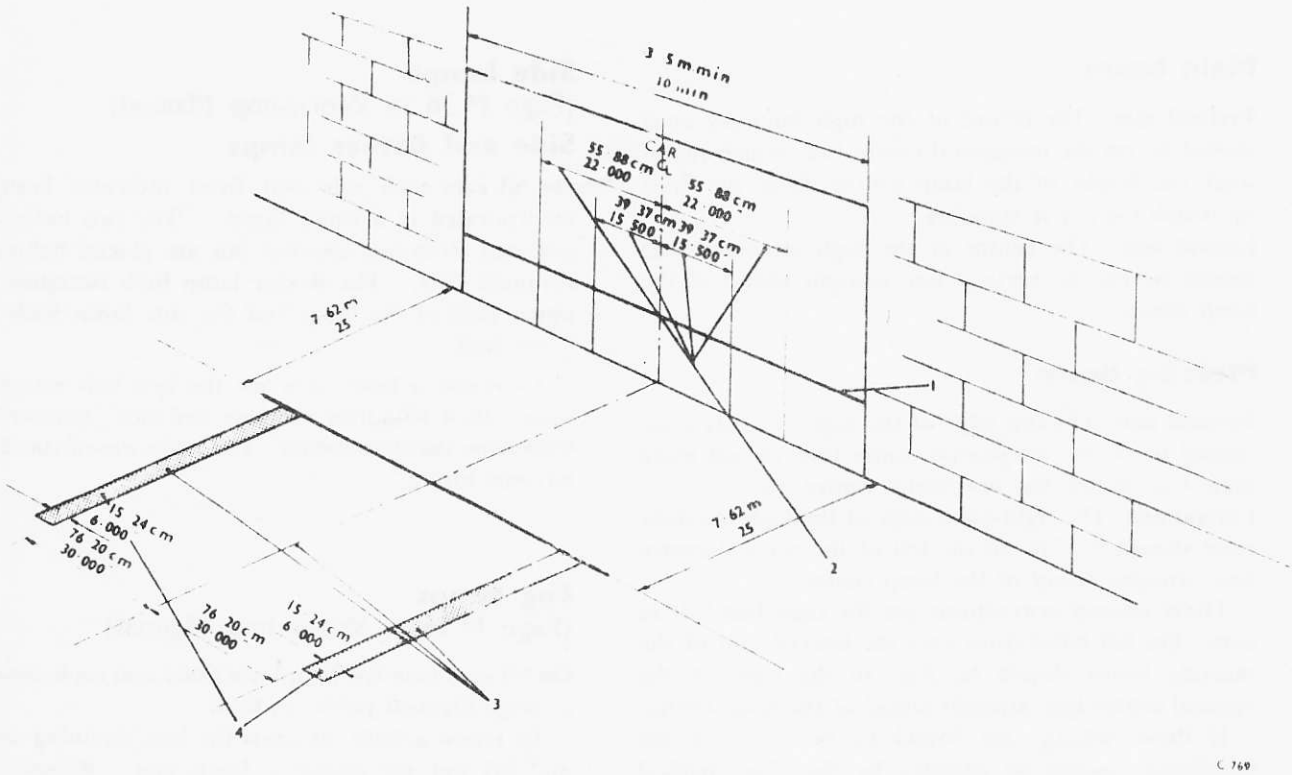


Fig. M7 (S) Headlamp adjusting screen and accessories

1 ADJUSTABLE HORIZONTAL TAPE
2 CORD
3 AIMING BLOCK
4 POSITION OF AIMING BLOCKS
5 CORD ANCHORAGE PEG



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Fig. M8 (S) Wall and floor marked for headlamp adjustment

1 ADJUSTABLE HORIZONTAL TAPE

2 MEASUREMENTS OF HEADLAMP CENTRES

3 MEASUREMENTS OF REAR WHEELTRACK

4 WHEELTRACKS

Remove the two retaining screws from each fairing and withdraw the fairings from around the headlamps to expose the beam adjusting screws.

Clean the headlamp lens with a damp cloth.

Rock the car to equalise the suspension.

Push the cord anchorage pegs into the holes in the rear axle shafts, then move the screen away from the car until the cords are taut. Move the screen sideways until the cords line up with the grooves in the aiming blocks.

Method 2

To prepare for checking the headlamp beam setting, drive the car onto the flat surface with the front and rear wheels in alignment with the marks on the floor and the headlamps 25 ft. from the wall.

Because of the difference in front and rear wheel tracks, the front wheel should be $\frac{1}{4}$ in. further inboard than the rear wheels. Check to ensure that the tyres are inflated to the recommended pressures. Remove the two retaining screws from each fairing and withdraw the fairings from around the headlamps to expose the headlamp adjusting screws.

Clean the headlamp lens with a damp cloth.

Rock the car to equalise the suspension.

Whichever of the previous methods is employed for alignment, the aiming and adjustment of the headlamps is identical.

Headlamp aiming

Measure the height to the centre of the headlamps from the ground and adjust the horizontal tape on the screen or wall to this height.

The lamps should be aimed in pairs, i.e. the two outer lamps for the meeting beam, and the two inner lamps for the main beam.

The outer pair of lamps must be covered whilst aiming the main beam.

Main beam

Vertical aim The centre of the high intensity zone should be on the horizontal centre line, which represents the height of the lamp centres from the floor on which the car is standing.

Lateral aim The centre of the high intensity zone should be on the vertical line straight ahead of the lamp centre.

Meeting beam

Vertical aim The top edge of the high intensity zone should be on the horizontal centre line, or not more than 1 in. below the horizontal centre line.

Lateral aim The right-hand edge of the high intensity zone should be 2 in. to the left of the vertical centre line, straight ahead of the lamp centre.

These aiming instructions are for right-hand drive cars. On left-hand drive cars the lateral aim of the meeting beam should be 2 in. to the right of the vertical centre line, straight ahead of the lamp centre.

If these settings are found to be incorrect the headlamps should be adjusted by the same method employed when using the Lucas 'Lev-L-Lite' beam aimer.

Side lamps
(Page M 36 in Workshop Manual)

Side and flasher lamps

On S3 cars each side and front indicator lamp is incorporated in a single lamp. The two bulbs are screened from one another but are placed behind a common lens. The flasher lamp bulb occupies the upper part of the lamp and the side lamp bulb the lower half.

To renew a bulb, unscrew the two lens retaining screws then withdraw the lens and rim; remove the bulb from the bulb holder. The bulbs are of standard bayonet fitting.

Fog lamps
(Page M 36 in Workshop Manual)

On S3 cars twin fog lamps are fitted and each contain a single filament pre-focus bulb.

To renew a bulb, unscrew the lens retaining screw and lift out the complete lamp unit. Release the bakelite contact holder by turning it in the direction of the arrow, then remove the bulb.

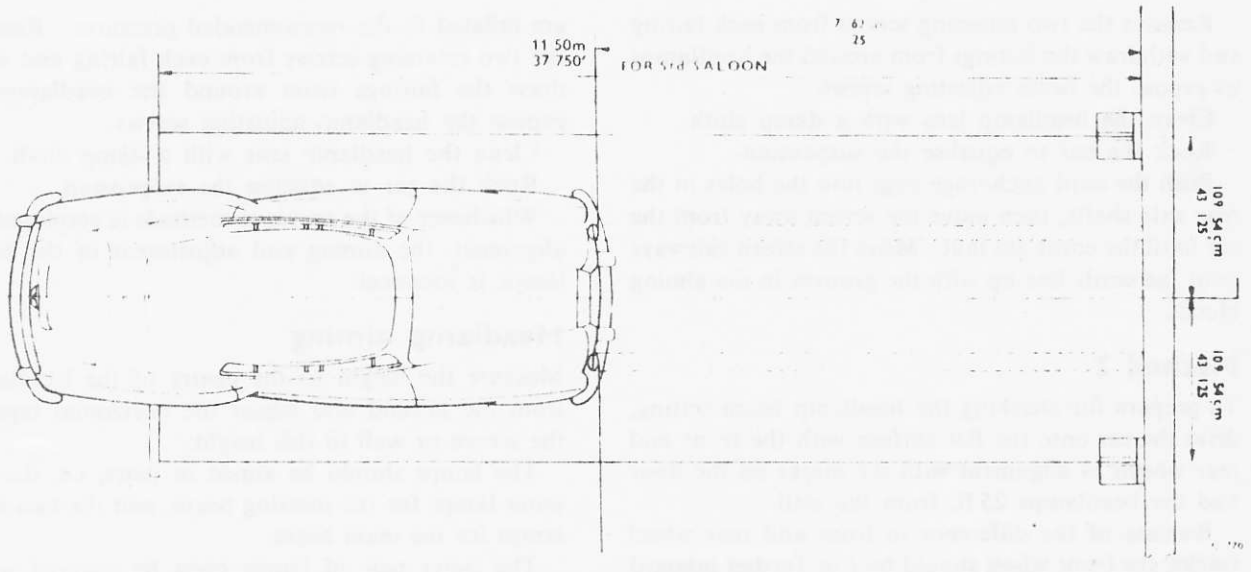


Fig. M9 (S) Car in position for headlamp aiming

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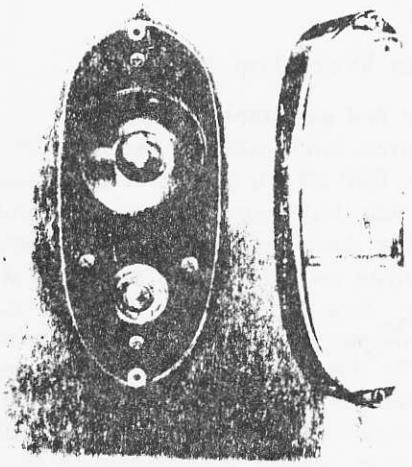


Fig. M10 (S) Access to the side flasher lamp bulbs

Hand brake warning lamp

On S3 cars a warning lamp is fitted to the facia to remind the driver that the hand brake is applied. The lamp operates whenever the hand brake is applied and the ignition switched on.

Access to the bulb is gained behind the facia: withdraw the lamp unit and remove the bulb. The bulbs are of standard screw in fitting.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

SECTION M10 INSTRUMENTS AND ACCESSORIES

Direction indicators

(Page M 44 in Workshop Manual)

On S3 cars, the direction indicator switch mounted on the steering column is designed to indicate a turn and to flash the headlamps simultaneously. The switch energises the headlamp main beam circuit only.

To indicate a turn to the right, move the control lever up and to indicate a turn to the left, move the control lever down. The switch is cancelled automatically when the steering wheel is moved to the straight ahead position after a turn.

To flash the headlamps draw the control switch towards the steering wheel. It is not possible to flash the headlamps when main beams are already in use.

On cars destined for the U.S.A. the headlamp flashing connection is omitted.

The sixth paragraph in the Workshop Manual is not applicable to the S3 car.

Direction indicators— Self-cancelling adjustment

S3 cars

If the steering box or steering column have been removed and the position of the steering column, relative to the steering box, has been altered it will be necessary to adjust the 'knock-off' cam mounted on the steering column.

To obtain access to the 'knock-off' cam, withdraw the lower half of the gear control quadrant after removing the two Allen screws.

Set the steering in the straight ahead position, then adjust the 'knock-off' cam by slackening the Allen grub screw and moving the cam until it lies directly between the two direction indicator switch 'knock-off' levers.

Tighten the Allen grub screw, then refit the lower half of the gear control quadrant and secure with the two Allen screws.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

Radio

(Page M 45 in Workshop Manual)

On S3 cars, the radio receivers fitted as standard equipment are as follows.

Model No.	Type
Smiths 'Radiomobile' 620 T	Medium and long wave, suitable for the whole of Europe with the exception of Spain, Portugal and Italy.
Smiths 'Radiomobile' 622 T	Medium wave only, suitable for the U.S.A., Canada and Japan.
Smiths 'Radiomobile' 230 R	Medium and short wave, suitable for Africa, Asia, South America, West Indies, Italy, Spain and Portugal.
Pye TCR 2000/E	Suitable for Australia and New Zealand.

Description

On S2 cars

(Page M 45 in Workshop Manual)

For S3 cars the first paragraph to read

The radio receivers fitted, with the exception of the 230 R and Pye TCR 2000/E consist of all-transistor units utilising nine transistors and two germanium diodes, operating directly from the 12 volt battery supply. The circuit comprises tuned aerial and R.F. amplifier stages, frequency changer and one stage I.F. amplification, demodulator, and a direct-coupled A.F. pair. The direct coupled A.F. pair drives a push-pull emitter follower stage which in turn drives the push-pull stage. The output stage is transformer coupled to a twin speaker balance-control circuit. Continuously-variable tone control is provided in conjunction with negative feed-back from the output transformer to the driver stage input. The receiver and controls are shown in Figure M11(S) of this Supplement

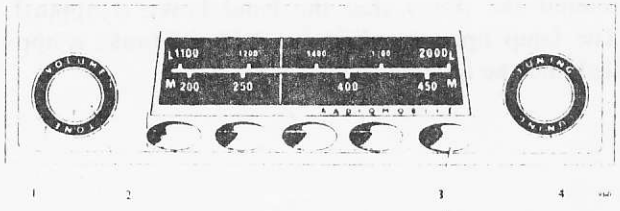


Fig. M11 (S) Radio controls 620T receiver

1 TONE CONTROL
2 VOLUME CONTROL AND ON OFF SWITCH
3 TUNING BUTTONS
4 MANUAL TUNING CONTROL

Receiver and amplifier—To remove

(Page M 47 in Workshop Manual)

For S3 cars the second paragraph to read

Unscrew the six wood-screws, securing the receiver surround to the facia panel; this surround need not be removed from the receiver. Withdraw the picnic table to its full extent to gain access to the receiver securing bolts. Unscrew the four 2 B.A. bolts positioned under the facia, which secure the receiver brackets to their supports. Disconnect the battery feed to the receiver by unscrewing the fuse carrier and

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CHAPTER N

STEERING

SECTION N1 — DATA AND DESCRIPTION

Data

S1 steering wheel diameter	18 in. (45·72 cm.)
S2 steering wheel diameter	17 in. (43·18 cm.)

Steering Box Gear Ratio

Standard S1 cars	20·6 : 1
Bentley Continental S1 cars	18·7 : 1
Power assisted early S1 cars (left-hand drive only)	20·6 : 1
Power assisted S1 and S2 cars	18·7 : 1

Number of Turns of Steering Wheel, Lock to Lock

Standard S1 cars	$4\frac{1}{2}$
Bentley Continental S1 cars	$4\frac{1}{4}$
Power assisted early S1 cars (left-hand drive only)	$4\frac{1}{2}$
Power assisted S1 and S2 cars	$4\frac{1}{4}$

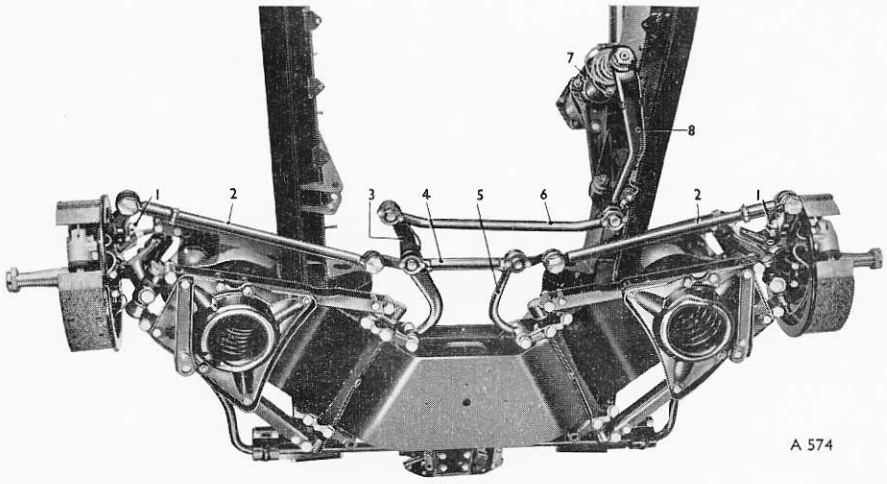


Fig. N1 Steering linkage details — manual steering — S1 cars

1. SIDE STEERING LEVER
2. TRACK ROD
3. CENTRE STEERING LEVER
4. CROSSBEAM
5. IDLER LEVER
6. DRAG LINK
7. STEERING BOX
8. PENDULUM LEVER

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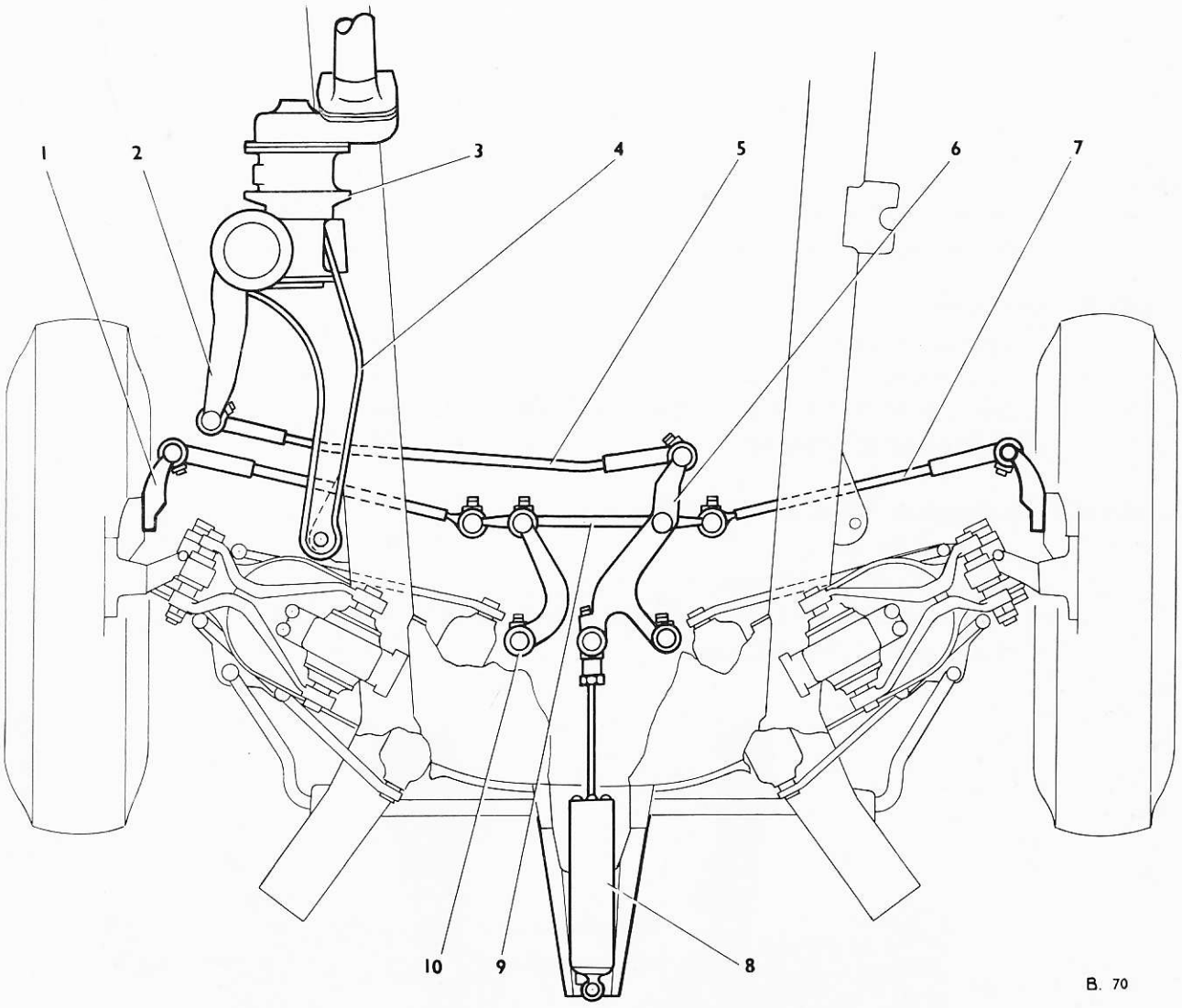


Fig. N2 Steering linkage details — S2 cars

1. SIDE STEERING LEVER
2. PENDULUM LEVER
3. STEERING BOX
4. MOUNTING ARM
5. DRAG LINK
6. CENTRE STEERING LEVER
7. TRACK ROD
8. POWER CYLINDER
9. CROSSBEAM
10. IDLER LEVER

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Description — Manual Steering

On S1 cars, the steering gear consists of a modified worm type cam, which engages in a double-toothed roller follower; the roller is carried on ball bearings mounted between the rocking shaft jaws. The cam is supported in the steering box by upper and lower taper roller bearings. The cam, roller and bearing are submerged in oil.

The rocking shaft is similarly supported in the steering box detachable rocker shaft housing. Provision is made for adjustment to all bearings. Tapered splines are cut at the lower end of the rocking shaft, to which the pendulum lever is secured by a nut and locked with a tab washer.

A transverse drag link connects the pendulum lever to the centre steering lever; the ends of the drag link are offset to reduce the possibility of joggle and road shock transmission to the steering wheel.

The centre steering lever forms part of a crossbeam idler assembly, pivoted on the rear of the frame front crossmember as shown in Figure N1. The idler lever and centre steering lever pivot at these points on steel sleeves which are free to rotate in the bronze bushed idler lever bores. End float of the idler lever and centre steering lever is maintained within the limits of zero and 0·003 in. (0·076 mm.) by means of hardened and ground adjusting washers, the thickness of which ranges from 0·050 in. (1·27 mm.) to 0·075 in. (1·905 mm.) in steps of 0·003 in. (0·076 mm.).

Track rods fitted with ball joints connect the crossbeam to the side steering levers, which are secured to the stub axles by setscrews; ball joints are used at all other pivot points.

The ball joints are self-adjusting, but any abnormal wear of the ball seat must be corrected by renewing the seat and ball pin. A bronze seat will require a pressure of 175 lb. (79·3 kg.) to 400 lb. (181·2 kg.) to press it into position against the shoulder in the ball joint socket; a steel seat will require a pressure of 800 lb. (362·4 kg.) to 1250 lb. (545 kg.).

On early S1 cars, all steering joints are lubricated by the Central Chassis Lubrication System. A modification was then introduced to increase the life of the track rod ball joints by substituting grease lubrication at these points. Oil resisting rubber seals are fitted to all joints, and the lubricant is conveyed to all moving parts by brass pipes attached by unions to the idler lever pins; these pins are drilled and undercut sufficiently to allow restricted oil flow. The restriction of lubricant flow in the ball joints is dependent upon the fit of a ball in its seat.

On late S1 cars, all the steering joints are grease lubricated with the exception of the centre and idler lever bearings. Rubber seals are fitted to all joints and lubrication is effected by grease injected through nipples screwed into the ends of the levers.

Description — Power Assisted Steering

This type of steering is fitted to **all S2 cars** and on certain **S1 cars.**

The steering unit is very similar to that previously described for the manual steering, except that a modified centre steering lever and a power cylinder are incorporated (see Fig. N2); the steering linkage arrangement for S2 cars is shown in Figure N2. All joints and pivots are grease lubricated.

On S1 cars, the connecting shaft at the lower end of the steering tube enters a rubber coupling; the coupling transmits steering wheel movement to a coupling dog and thence to the steering cam. The flexible coupling helps to isolate the reaction movement of the lower cam tube from the steering wheel. The cam tube is supported in the steering box on two sets of needle rollers.

Lubrication of the steering box components is by oil from the steering pump.

On S2 cars, the connecting shaft at the lower end of the steering tube enters a rubber coupling; the coupling transmits steering wheel movement to a gear mounted on two taper roller bearings on an eccentric shaft in the transfer gearbox. The function of the transfer gearbox is to offset the drive from the lower end of the steering column to the steering box, positioned outboard of the chassis sidemember. The cast aluminium casing contains two helical gears mounted on 3·758 in. (7·545 cm.) centres and having a gear ratio of 1 : 1. Serrations in the bore of the transfer driven gear locate on splines at the upper end of the cam tube which carries the steering cam.

The steering cam is supported in the steering box between needle rollers and lubrication of the steering box components is by oil from the steering pump.

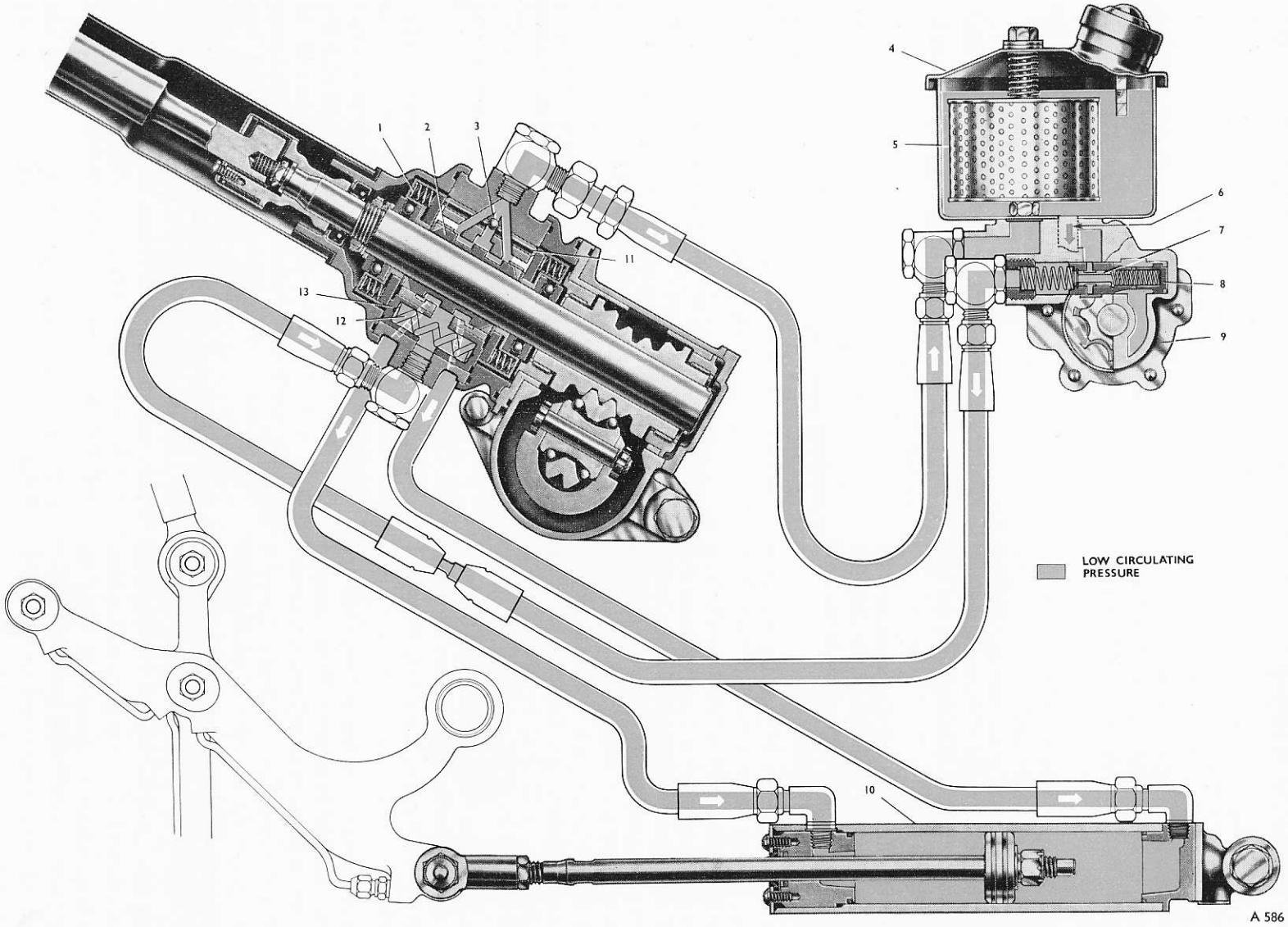


Fig. N3 Steering straight ahead condition — no load

1. SECONDARY SPRING
2. SPOOL VALVE
3. NON-RETURN VALVE
4. RESERVOIR
5. FILTER ELEMENT
6. FEED TO PUMP
7. PRESSURE RELIEF VALVE
8. FLOW CONTROL VALVE
9. HYDRAULIC PUMP
10. POWER CYLINDER
11. SPACING PIN
12. PRIMARY SPRING
13. REACTION PLUNGER

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The transfer gearbox is isolated from the steering box and spool valve with regard to lubrication and contains SAE 90 oil (see Chapter D).

On S1 and S2 cars, the power assistance unit provides a variable proportion of assistance controlled by the effort required at the steering wheel. When maximum assistance is necessary for low-speed manoeuvring, such as shunting or parking the car, this is provided automatically; for normal straight ahead driving conditions, assistance is provided from zero to 48 per cent, depending on the steering wheel rim load.

The system ensures that a degree of 'feel' is maintained at the steering wheel, so that the driver is not isolated from contact with the road wheels, but is nevertheless automatically protected against sudden violent reactions caused by bad road surfaces.

It is emphasised that the steering is not operated through the medium of power assistance; the assistance is in fact superimposed on a normal steering mechanism. Therefore in the unlikely event of a failure occurring in the assistance mechanism, the car may be steered in the normal manner, the only noticeable effects being a reduction in the lightness of the steering and excessive movement at the steering wheel.

The power assistance is derived from hydraulic pressure supplied by an engine-driven internal gear type pump. The hydraulic pressure operates a hydraulic ram connected to the centre steering lever; this lever is connected to and operates the steering drag link.

Control of the oil distribution to either side of the ram, also the oil delivery pressure, is effected by two methods:

1. By movement axially of a spool valve in the housing situated between the steering column and steering box **on S1 cars** and between the transfer box and steering box **on S2 cars,** causing annular grooves in the valve to communicate with passages which direct oil to the appropriate side of the hydraulic ram. Movement of the spool valve is effected by the reaction of a normal steering cam against the roller when the steering wheel is turned. The spool valve is normally held in the central or neutral position by two sets of four reaction plungers exposed from the inside to oil pressure, which is assisted by four springs called 'primary' springs. The valve is therefore constrained from axial movement by the pressure of the primary springs and by oil pressure when this is generated. A load of 1 lb. (0·453 kg.) applied at the steering wheel rim is sufficient to displace the valve against the pressure exerted by the primary springs.
2. A flow control valve is provided in the hydraulic pump body to maintain a constant output flow of $1\frac{1}{4}$ to $1\frac{1}{2}$ gallons (5·68 to 6·82 litres) per minute irrespective of the pressure, which may vary between 15 lb./sq.in. (1·055 kg./sq.cm.) and the controlled maximum of 500 lb./sq.in. (35·15 kg./sq.cm.) in the case of **S1 and S2 cars** and 600 lb./sq.in. (42·18 kg./sq.cm.) in the case of the **Phantom V**. The pressure at which oil is delivered is dependent upon the resistance encountered at the ram. Since oil at this same pressure is delivered to the reaction plungers to resist endwise movement of the spool valve, it follows that a degree of assistance is proportional to the applied pressure at the steering wheel. This results in assistance being provided from zero to 48 per cent until an applied load of 8 to 12 lb. (3·63 to 5·44 kg.) at the steering wheel rim is reached, at which load there must necessarily be a heavy resistance at the road wheels and consequently at the ram. The pump therefore builds up hydraulic pressure until at a predetermined point, the pressure, which is also applied to the reaction plungers, causes the plungers to collapse the secondary springs. These prevent a further load increase on the steering wheel and the maximum controlled pressure of the pump is then applied, if required, to turn the front wheels.

Figure N3 shows the oil circulating system when the steering is in the straight ahead or neutral position. The pressure in the system is only that due to fluid friction and restrictions in the various passages.

Figure N4 shows the condition when commencing a normal right turn on the open road. The pressure is automatically regulated to provide between zero and 48 per cent power assistance, depending on the steering wheel rim load.

Figure N5 shows the condition when parking on left-hand lock. After the collapse of the secondary springs due to the steering wheel rim load, the pressure builds up as required to the maximum allowed by the pressure relief valve.

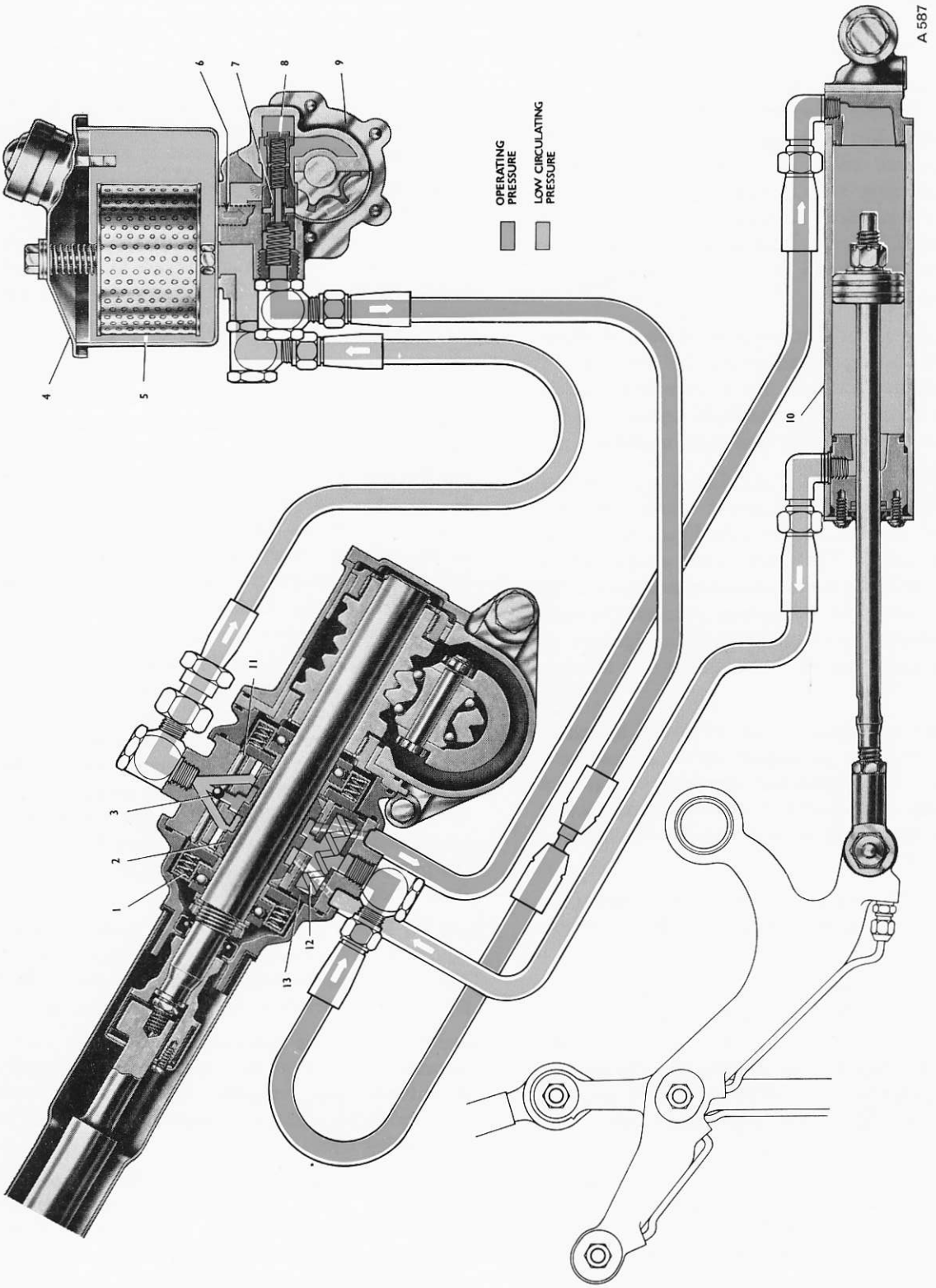


Fig. N4 Normal turning condition — right-hand lock — light load

1. SECONDARY SPRING
2. SPOOL VALVE
3. NON-RETURN VALVE
4. RESERVOIR
5. FILTER ELEMENT
6. FEED TO PUMP
7. PRESSURE RELIEF VALVE
8. FLOW CONTROL VALVE
9. HYDRAULIC PUMP
10. POWER CYLINDER
11. SPACING PIN
12. PRIMARY SPRING
13. REACTION PLUNGER

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The Flow Control Valve and Pressure Relief Valve

The flow control valve is situated in the outlet bore of the hydraulic pump body; its function is to control the flow of oil leaving the pump. The oil leaving the pump chamber passes through two metering holes in the valve body, which allow the oil to pass at the rate of 1¼ to 1½ gallons (5·68 to 6·82 litres) per minute. As the output of the pump increases, the volume of oil becomes too great to pass through these holes. This causes a pressure build up on the end of the flow control valve, which forces the valve forward against its spring, at the same time uncovering an annular passage in the valve housing through which oil in excess of 1¼ to 1½ gallons (5·68 to 6·82 litres) per minute is directed back to the suction side of the pump.

When pressure in the system exceeds 500 lb./sq.in. (35·15 kg./sq.cm.) or in the case of the **Phantom V,** 600 lb./sq.in. (42·18 kg./sq.cm.), the relief valve inside the flow control valve is forced back, compressing its spring and uncovering a bore through which oil in excess of this pressure is returned to the inlet side of the pump.

SECTION N2 — OIL PUMP — POWER ASSISTED STEERING

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Description

The power assisted steering pump basically comprises two rotors, one mounted eccentrically inside the other. Both rotors are mounted inside the pump body and the inner rotor is keyed to a shaft which is driven by the engine.

Oil is drawn into the rotor chamber from the oil reservoir via the inlet port. It is then carried round by the rotors to the outlet port and forced out into the pipe line. After passing through the system, the oil returns to the reservoir through the main filter. For technical reasons it is necessary that the main filter be placed in the return flow to the reservoir and any foreign matter which is passed in can find its way through the entire system before it is filtered. Constant oil flow is maintained at varying engine speeds by the flow control valve.

The pump also incorporates a relief valve which ensures a maximum working pressure of 500 to 550 lb./sq.in. (35·15 to 38·6 kg./sq.cm.) **for S1 and S2 cars** and 600 to 650 lb./sq.in. (42·18 to 45·7 kg./sq.cm.) **on Phantom V cars.** This working pressure is stamped on the side of the pump.

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Servicing

Oil Level — to check

The oil level in the hydraulic pump reservoir should be checked at weekly intervals and if necessary topped-up with the approved Automatic Transmission Fluid.

On early S1 cars, some dipsticks are incorrectly marked 'Use 10W oil'. This instruction should be disregarded and only the specified fluids of type AQ/ATF should be used when replenishing the hydraulic pump reservoir.

Rubber filler cap seals are available and should replace any cork washers fitted during the production of S1 cars. The seal part number CD.972 remains unaltered.

Belt Tension — to check

The belt tension on all cars should be checked every 5,000 miles (8,000 kilometres). **On S1 cars,** the steering pump is driven by a single belt from the coolant pump pulley. The coolant pump pulley is driven by two belts from the crankshaft pulley via the generator.

The tension of the steering pump driving belt is checked by applying a load of 6 lb. (2·722 kg.) to the belt at the mid-point of the driveside run (see Fig. N6). This should cause a deflection of 0·750 in. (19·050 mm.).

On S2 cars, a matched pair of belts drive the fan and steering pump. The tension of the belts is checked by applying a force of 8 lb. (3·629 kg.) at the centre of the run between the coolant pump and steering pump. Each belt should show a deflection of 0·375 in. (9·525 mm.).

In the case of twin belts, if individual belt tension is uneven a new matched pair of belts should be fitted.

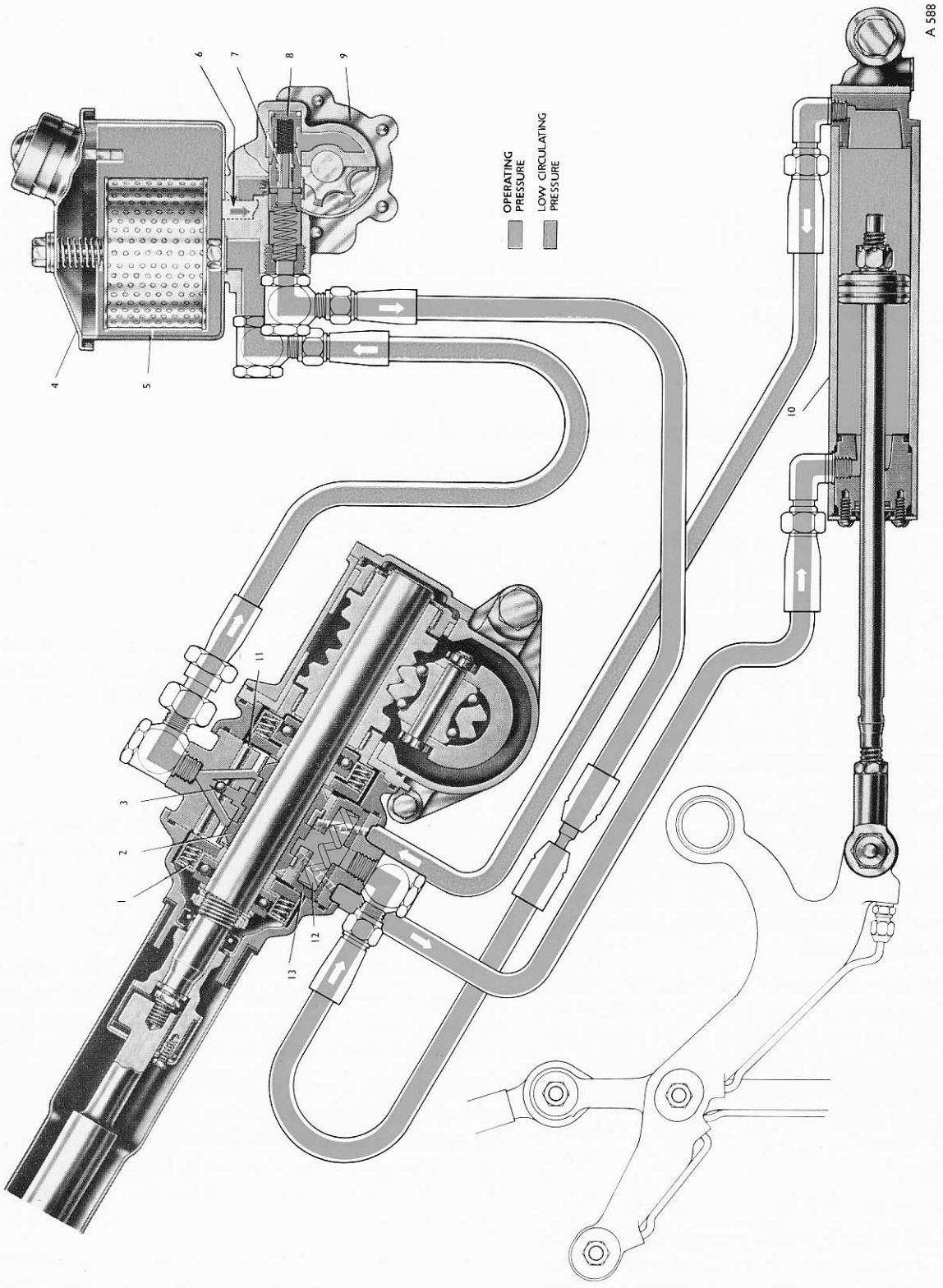


Fig. N5 Parking condition — left-hand lock — heavy load

1. SECONDARY SPRING
2. SPOOL VALVE
3. NON-RETURN VALVE
4. RESERVOIR
5. FILTER ELEMENT
6. FEED TO PUMP
7. PRESSURE RELIEF VALVE
8. FLOW CONTROL VALVE
9. HYDRAULIC PUMP
10. POWER CYLINDER
11. SPACING PIN
12. PRIMARY SPRING
13. REACTION PLUNGER

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Provision for adjustment of the belt tension **on both S1 and S2 cars** is by a setscrew which locates in a slot cut in the steering pump mounting bracket.

A slipping drive belt will produce a squealing noise and will also result in a 'jerky' feel on the steering wheel, especially as each lock is approached. No dressing of any kind is to be applied to the belts.

Filter Element — to renew

The oil filter element must be changed every 30,000 miles (48,000 kilometres).

Using a syringe, draw off as much oil as possible from the pump and discard the oil.

Unscrew the setscrew securing the cover, remove the cover and spring, lift out the filter element and discard it. Fit the new filter element in position in the pump reservoir. Examine the oil seal in the cover and if necessary renew it. Fit the cover to the pump and tighten the setscrew.

Re-fill the pump with oil and prime the system, at the same time checking thoroughly for leaks.

Priming and Filling the System

Fill the pump and allow the engine to idle while operating the steering from lock to lock. Check and maintain the oil level in the reservoir during this operation. A considerable amount of noise will be apparent during the initial priming of the system. All joints must be carefully checked for leaks during the initial running and of course rectified if found to be leaking.

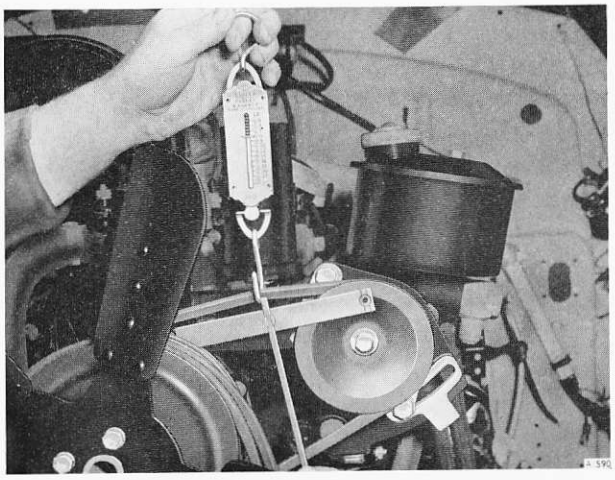


Fig. N6 Steering pump belt tension — to check

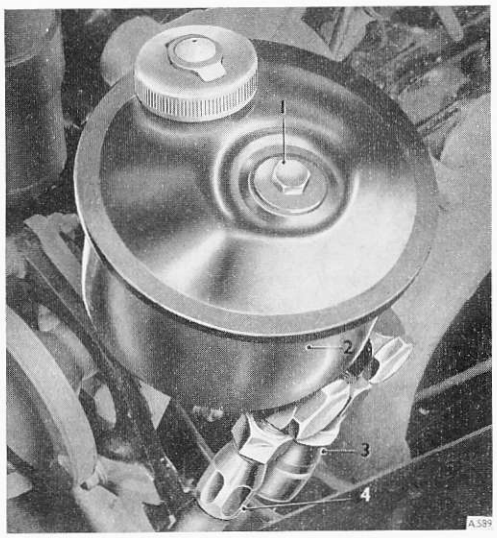


Fig. N7 Steering pump reservoir and filler cap

1. COVER RETAINING BOLT
2. PUMP RESERVOIR
3. DELIVERY PIPE
4. RETURN PIPE

On S1 cars the capacity of the system is approximately 4 pints (2·273 litres).

On S2 cars the capacity is approximately 3 pints (1·704 litres).

The recommended fluids are in the table in Chapter D. Only scrupulously clean fluid should be used and care should be taken to ensure that any containers etc., which may be used are equally clean. Fill the reservoir to the full mark on the dipstick attached to the filler cap, taking care to avoid spilling especially onto the pump drive belts.

On completion of the filling and priming operation the pump belts should again be checked for correct tension and if necessary adjusted to provide the correct deflection.

Oil Pump — to remove

S1 and S2 cars

If the pump is to be dismantled or the pulley removed from the pump it is advisable to slacken the pulley retaining setscrew while the pump is in position and the belt(s) are tight.

Slacken the belt adjuster and remove the belt(s).

Remove the filler cap and, using a syringe, remove as much oil as possible from the reservoir.

Disconnect the hoses at the banjo unions and support the ends in a raised position to prevent the oil draining from the system.

Remove the two nuts securing the pump mounting bracket to the engine and remove the pump.

Oil Pump — to dismantle and inspect

Thoroughly clean the exterior of the pump, taking care that no foreign matter enters the inlet or outlet holes.

Clamp the pump mounting bracket in a vice fitted with protective grips.

Remove the reservoir cover and filter (see Fig. N8).

Remove the setscrews 7 and plate 9. Remove the reservoir body, collecting the seals 3 and 2 from the pump top face.

Remove the pump pulley, using a suitable extractor if necessary and also taking care not to misplace the Woodruff key.

Remove the five screws 13 and separate the pump from the cover. Collect the seal ring 5.

Before removing the rotor, check the clearance of the lobes as indicated in Figure N9. The maximum permissible clearance is 0·008 in. (0·203 mm.). If the clearance exceeds this, a new pair of rotors must be fitted. It should be noted that these are fitted as matched pairs and should not be renewed individually.

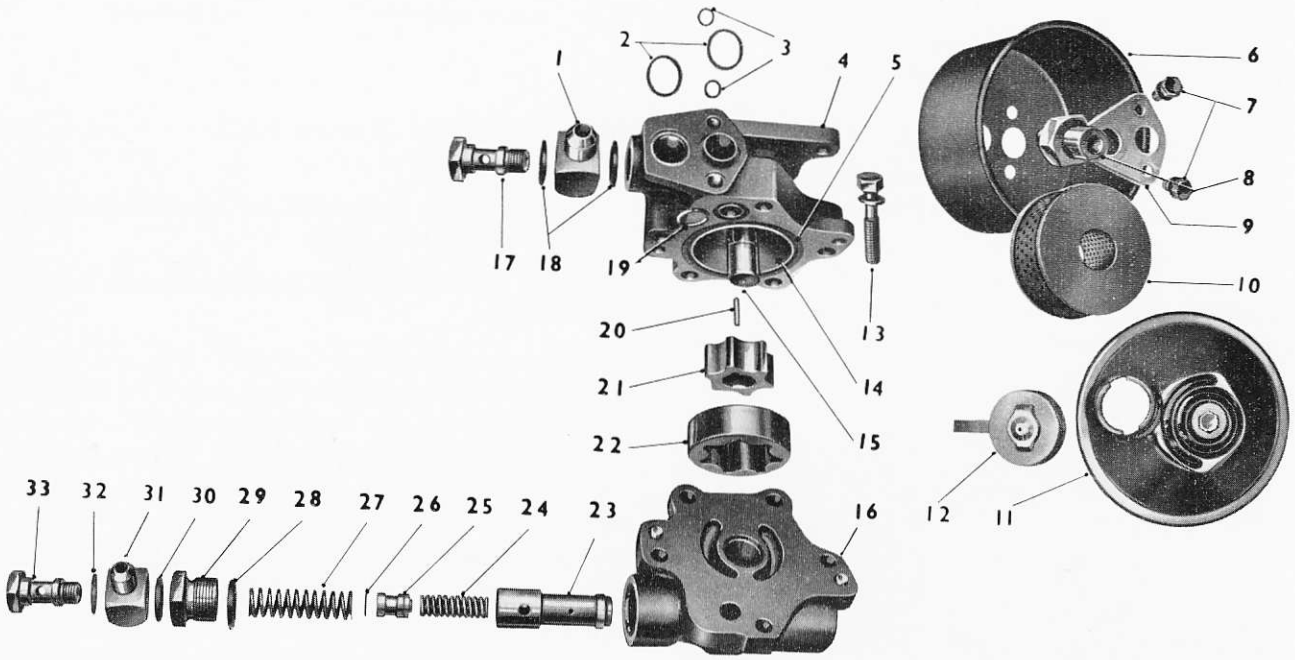


Fig. N8 Steering pump details

1. BANJO
2. SEAL
3. SEAL
4. PUMP BODY
5. OIL SEAL
6. RESERVOIR
7. SETSCREW — RESERVOIR
8. ADAPTOR
9. PLATE
10. FILTER ELEMENT
11. RESERVOIR COVER
12. DIPSTICK AND CAP ASSEMBLY
13. SETSCREW — PUMP BODY
14. 'BABBITT' BUSH
15. SPINDLE
16. END COVER AND VALVE HOUSING
17. BANJO BOLT
18. 'O' RING
19. 'O' RING
20. KEY
21. INNER ROTOR
22. OUTER ROTOR
23. FLOW CONTROL VALVE
24. RELIEF VALVE SPRING
25. RELIEF VALVE
26. CIRCLIP
27. FLOW CONTROL VALVE SPRING
28. 'O' RING
29. FLOW CONTROL VALVE CAP
30. 'O' RING
31. BANJO
32. 'O' RING
33. BANJO BOLT

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Using a straight edge across the body of the pump, check the end clearance of the rotors with a feeler gauge. Renew the rotors if this is in excess of 0·0025 in. (0·063 mm.).

Check the clearance between the outer rotor and the bush in which it rotates. This should not exceed 0·003 in. (0·076 mm.). If the clearance exceeds this limit it will be necessary to renew the housing. Remove the rotors from the body. Do not reverse the inner rotor in the outer rotor.

Remove the shaft from the housing.

Inspect the bearing for wear or damage; if necessary remove the bearing by extracting the circlip and gently tapping out the bearing. The oil seal can then be removed and renewed on assembly.

Remove the valve cap adaptor 29 and the seal 28 from the pump cover; extract the flow control valve 23 and the relief valve 25 and spring 24.

Check the pump cover and body for wear or scoring by the rotors.

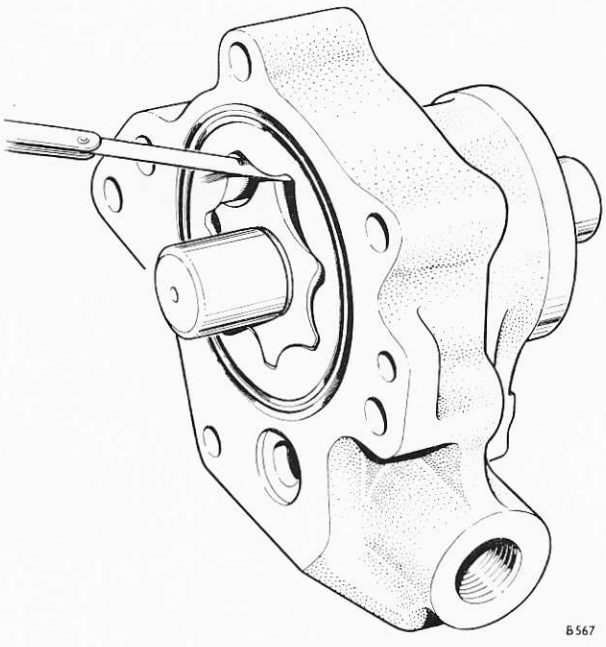


Fig. N9 Checking rotor clearance

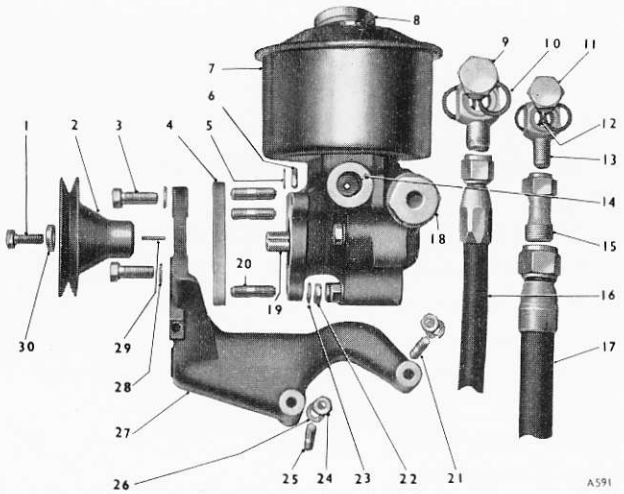


Fig. N10 Steering pump mounting details

1. SETSCREW — PULLEY
2. PULLEY
3. SETSCREWS — PUMP TO BRACKET
4. ADAPTOR — PUMP TO BRACKET
5. SPRING WASHER
6. NUT
7. PUMP ASSEMBLY
8. FILLER CAP AND DIPSTICK ASSEMBLY
9. BANJO BOLT
10. 'O' RING
11. BANJO BOLT
12. 'O' RING
13. PRESSURE HOSE BANJO
14. PUMP RETURN
15. ADAPTOR
16. RETURN HOSE TO RESERVOIR
17. PRESSURE HOSE FROM PUMP
18. PRESSURE PUMP
19. PUMP SPINDLE
20. STUD — ADAPTOR TO PUMP
21. STUD — BRACKET TO BLOCK
22. NUT
23. SPRING WASHER
24. NUT
25. STUD — BRACKET TO BLOCK
26. SPRING WASHER
27. MOUNTING BRACKET
28. SPRING WASHER
29. KEY
30. PLAIN WASHER

Oil Pump — to assemble

Clean all parts thoroughly in paraffin before commencing assembly.

Grease the lip of the new oil seal and insert the seal into the pump body with the lip towards the rotor. Press the seal right home using a bar 1·218 in. (30·75 mm.) dia. Care should be taken not to damage the seal.

Replace the bearing and circlip. Insert the drive shaft, turning it so as to minimise the risk of damage to the oil seal. Replace the rotors on the shaft. Place a new oil seal in position in the annular groove in the body and secure the cover to the body with five setscrews. Rotate the shaft to ensure that no binding takes place when the setscrews are tightened.

Fit the flow control valve, relief valve spring and valve ensuring that the valves move freely. Fit the relief valve retaining ring and the flow control valve spring, then fit the valve cap using a new 'O' ring.

Fit the reservoir to the pump body, again using new oil seals.

Oil Pump — to fit

Install the oil pump to the engine, reversing the removal procedure. Reset the belt tension and prime the system as previously described.

Fault Diagnosis

High steering effort

1. Check the oil level in the reservoir and replenish if necessary.
2. Check the tension of the driving belts; adjust if necessary. Slack driving belts will produce a squealing noise, more noticeable when the wheels approach full lock.
3. Check the pump delivery pressure by introducing a pressure gauge into the discharge line as close to the pump as possible.

The pump delivery pressure should be approximately 500 to 550 lb./sq.in. (35·15 to 38·66 kg./sq.cm.) for **S1 and S2 cars** and 600 to 650 lb./sq.in. (42·18 to 45·7 kg./sq.cm.) **on Phantom V cars,** with the engine idling and the wheels against the stops.

If the pump is not delivering the correct pressure, check the operation of the flow control and relief valves. If the valves are found to be functioning correctly, it will be necessary to dismantle the pump as previously described in the overhaul procedure.

Steering judder

A probable cause of steering judder is the presence of air in the system. This can be removed by driving the car for between 30 and 40 miles (48 and 64 kilometres), ensuring that the correct fluid level is maintained in the reservoir.

Noise

A hissing noise may be detected when the wheels are on full lock and against the stops, or when they are against a kerb and further effort is applied to the steering wheel. This noise is caused by oil discharging through the relief valve and may be accepted as normal.

If the oil level is low, noise in the system and joggle at the steering wheel may be caused on starting during cold weather, by funneling of the oil, thus permitting air to be drawn into the inlet port; this will cease when the oil warms-up, but the reservoir should be replenished to the correct level. The symptoms described in the previous paragraph may apply in this case.

Should the installation produce a rumbling or grinding noise when the engine is running and the steering is turned from lock to lock, check for and isolate hoses touching or rubbing against the valance.

Oil leaks

Shaft seal leakage; replace the oil seal. It may be necessary to coat the oil seal housing with a jointing compound which is not soluble in Automatic Transmission Fluid.

Should oil be leaking from the body of the pump, it will be necessary to dismantle the pump and renew the oil seals shown in Figure N8.

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SECTION N3 — POWER CYLINDER AND HOSES

Power Cylinder

The power or operating cylinder is attached by a pivot bolt to the bracket projecting forwards from the front pan. Contained within the power cylinder is a double acting hydraulically operated piston which is connected by a piston rod to the centre steering lever. In the straight-ahead or neutral steering position, the piston is positioned centrally in the power cylinder.

To prevent the piston fouling the power cylinder end covers when the wheels are on right or left-hand full lock, a clearance or 'sponge' allowance of 0·150 in. (0·381 cm.) is provided at each end of the travel. This allowance will vary, but the **maximum permissible is 0·200 in. (0·508 cm.).**

In order to centralise the piston travel, the piston rod is threaded at the steering lever end and screws into a jaw which accepts the steering lever.

To prevent damaging the installation whilst making centralising adjustments, the procedure described below should be closely followed:

Remove the power cylinder mounting bolt and turn the steering wheel to the full lock required to move the piston fully forwards, i.e. left-hand lock on R.H. control cars and right-hand lock on L.H. control cars.

Support the power cylinder by hand in its normal position, noting that the bore of the 'Silentbloc' mounting bush is in line with the hole in the mounting bracket. Slide the power cylinder towards the rear of the car until further movement is prevented by the piston contacting the end of the power cylinder. The distance which the power cylinder has moved represents the 'sponge' allowance and is indicated by the resulting eccentricity of the mounting bracket hole and the mounting bush bore mentioned previously.

Should the specified 0·150 in. (0·381 cm.) allowance be incorrect, adjustment of the piston rod may be carried out by releasing the lock-nut from against the jaw, screwing the rod in or out of the jaw as necessary and re-checking the allowance.

When a satisfactory allowance is obtained, turn the wheels to the opposite full lock and check the figure for this position by sliding the power cylinder forward and checking the eccentricity as previously described.

In the event of an unequal allowance being indicated at this end, a further adjustment should be made to centralise the travel.

Finally, tighten the lock-nut against the jaw to prevent the piston rod from moving out of position and secure the power cylinder to its mounting bracket.

Leakage from the Power Cylinder

The above fault may be attributed to the incorrect assembly of the sealing washer, and to eliminate any possibility of leakage, the recommended method of assembly must be followed.

Damage to the sealing washer lip may occur if the washer is pushed over the sharp edges of the spanner flats on the piston rod.

As the piston rod is chromium plated, it is inadvisable to remove the sharp edges by filing or grinding, as this will cause the plating to peel. The use of metal shims is **not** advised due to the possibility of the sealing washer stretching or the sealing lip being cut by them.

The following recommended method when assembling the power cylinder will ensure satisfactory sealing.

Thoroughly clean all parts before assembly. Lubricate the sealing washer and slide it onto the rod from the piston end, followed by the bush assembly. Assemble the piston complete with the rings, flat washer and castellated nut. Tighten and lock the nut using a new split pin.

Lubricate the piston assembly and, with the ring gaps staggered at approximately 180 deg. to one another, fit the assembly into the power cylinder. Check to ensure the correct positioning of the bush assembly, then fit the oil union. Fit the circlip.

Slide the sealing washer into position followed by the composite washer, plain aluminium washer and split brass ring; then fit the end plate and securing screws.

Hoses

The hoses to the power cylinder are attached by union nuts to a 90 deg. elbow at the front of the cylinder and a straight adaptor at the rear.

S1 cars

The delivery and return hoses from the pump to the valve body are passed over the wheelcase housing and below the water pump adaptor. They are then secured by a clip fastened to the fixed end of the generator swivel arm **on right-hand drive cars,** and finally clipped to the valance.

Power cylinder front and rear hoses are swept upwards behind the front stabiliser rod and over the front pan and then clipped together at a convenient point along the valance.

Hose connection sequences are as follows:

The hose from the front or pivot end of the power cylinder is connected to the right-hand port of the valve body (away from the engine on R.H. drive cars and nearest the engine on L.H. drive cars).

The hose from the rear or jaw end of the power cylinder is connected to the diametrically opposite side of the valve body (nearest the engine on R.H. drive cars, and away from the engine on L.H. drive cars).

The expansible hose connects the pressure side, or rear end of the pump, to the pressure port of the valve body; this port is easily identified by its longer boss and position adjacent to the return port which contains a one-way valve. A further hose is connected between the return port and the return or front end of the pump.

The connecting sequences apply to L.H. and R.H. installations.

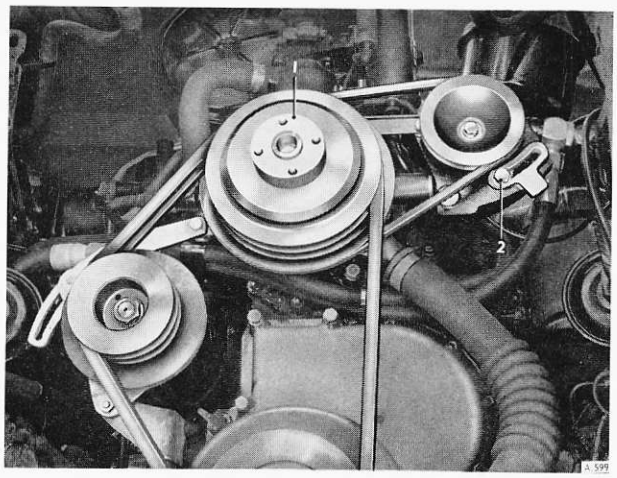


Fig. N11 Run of hoses — S1 cars

1. FAN DISTANCE PIECE 2. PUMP BELT ADJUSTMENT

Right-hand drive — S2 cars

From the power cylinder the hoses sweep upwards behind the front stabiliser rod and over the front pan. They then pass through clips at the lower corner of the valance, the right-hand damper top and the steering box mounting arm. From this point, the power cylinder rear hose passes below the steering box to the lowest port in the valve housing; the front hose passes above the steering box to the port diametrically opposite.

The delivery and return hoses from the pump to the valve housing sweep down from the pump to clips at the centre of the front pan and the right-hand damper top. From this point the delivery hose runs adjacent to the power cylinder hose and the return hose runs parallel to the power cylinder rear hose, the delivery hose connecting with the lower of the two remaining ports.

Left-hand drive — S2 cars

From the valve housing, the pump return hose and the two power cylinder hoses sweep inwards and down to a clip on the inner surface of the chassis frame sidemember, then forward to a clip on the left-hand damper top. The return hose rises from this point to the pump; the power cylinder hoses pass through a clip at the lower corner of the valance, before leading under the front stabiliser rod to the power cylinder unions.

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The delivery hose connecting the pump and the valve housing, drops vertically from the pump to a clip on the steering box mounting arm to ensure adequate clearance from the exhaust manifold, before sweeping around outside the steering box to the valve housing banjo.

When the hoses are clipped and bolted in position, check to ensure that the run of hoses is free from kinks and sharp bends which tend to produce pressure noise. No sealing compound should be used on banjo fittings, but it is recommended that a light coating of 'Wellseal' be used on the power cylinder elbow and adaptor, before they are screwed into the power cylinder ends. No sealing compound should be used on the union ends of the hoses.

SECTION N4 — STEERING LEVERS

On early S1 cars, lubrication of the steering joints and pivots is from the Centralised Chassis Lubrication System, except the track rod ends, which are grease lubricated.

On late S1 cars, grease lubrication was substituted at all steering joints except the centre steering lever pivots, which are served by the Centralised Chassis Lubrication System.

On S2 cars, the Centralised Chassis Lubrication System is omitted and all steering joints are fitted with grease points.

Grease Lubricated Ball Joints — to renew

The ball pins and steel seats are of uniform size and are interchangeable. It should be noted however that the inner and outer ball pins fitted to the track rods may be either 0·100 in. or 0·200 in. (2·54 mm. or 5·08 mm.) longer than the others; in such a case, it is essential that the correct length pin be fitted when renewal is necessary.

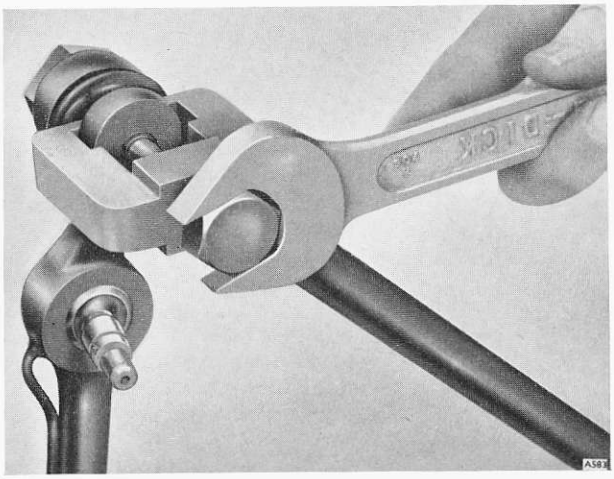


Fig. N12 Removing ball pin

To facilitate removal of any link assembly, the car should be placed over a pit, or the front of the car raised, whichever is convenient. Should the car be raised using a jack, care should be taken on cars fitted with power assisted steering, not to damage the power cylinder or its support bracket positioned at the front of the chassis.

Remove the split pin and castellated nut from the ball pin end, and using Special Tool RH.320, extract the ball pin from the eye of the lever. Remove the ball pin from the opposite lever eye in a similar manner.

On S1 cars, it will be noted that the drag link ends are offset at an angle of 18 deg.

On S2 cars, the drag link ends are offset at an angle of 10½ deg.

On all cars, care should be taken to replace the drag link in the correct position, i.e. with the drag link ends inclined towards the rear of the car.

Remove the plug retaining the ball pin and collect the seal washer; the spring, spring seat and steel ball can then be removed together with the ball pin.

The spring-loaded rubber seals between the socket and lever eyes should always be renewed when the joints have been disturbed.

The rubber seals used on the track rod ball joints are supplied in three sizes, small, medium and large denoted by S, M, and L respectively; these are to be

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used on the appropriate length pin. The number which appears next to the letter on the seal can be ignored as this is only a mould number.

A press must be used to remove and replace the ball seat, which is squarely pressed in position against the socket shoulder. The pressure required for the steel seat is from 800 to 1250 lb. (402·8 to 566·9 kg.). It is important not to damage the chamfered top edge of the seat during the operation, otherwise the sealing feature of the seat will be destroyed.

When the seat has been pressed into position, the ball pin should be lightly lubricated (see Chapter D) and inserted, followed by the steel ball, spring seat, and the spring. Refit the aluminium joint washer and plug. Repeat the procedure to install the other ball pin in the drag link.

Check that all seal faces are free from burrs and clear from grease, then fit the seal and spring. Ensure that the tapers of the ball pins are free from lubricant, then locate the ball pin tapers in position; tighten the castellated nuts and fit the split pins.

Using Tecalemit grease gun RH.709, or Wanner grease gun RH.7202, lubricate the ball joints with Rocol Molyspring Grease 204G, or Shell Grease S5466, until it exudes from the seals. Each joint will require approximately $\frac{2}{3}$ oz. (9·5 gm.) lubricant for the initial filling operation, but this quantity will be reduced for periodic servicing, which should be conducted every 10,000 miles (16,000 kilometres).

Particular care should be exercised in the refitting of the track rods. The adjustable ends must **always** be placed outwards, towards the pivot pins, to eliminate possible fouling between the pendulum lever end of the drag link and the adjustable end of the track rod. This fouling can occur when the steering gear is on the extreme right-hand lock on R.H. control cars and the opposite lock on L.H. control cars.

Both the adjustable ends of the track rods are right-hand threaded for adjustment of toe-in. Verification of this adjustment must always be undertaken whenever any replacement parts have been fitted to the track rods.

Oil Lubricated Ball Joints — to renew

S1 cars

The ball pins and seats are of uniform size and are interchangeable.

To facilitate removal of the ball pin assembly, the car may be placed over a pit, or the front end of the

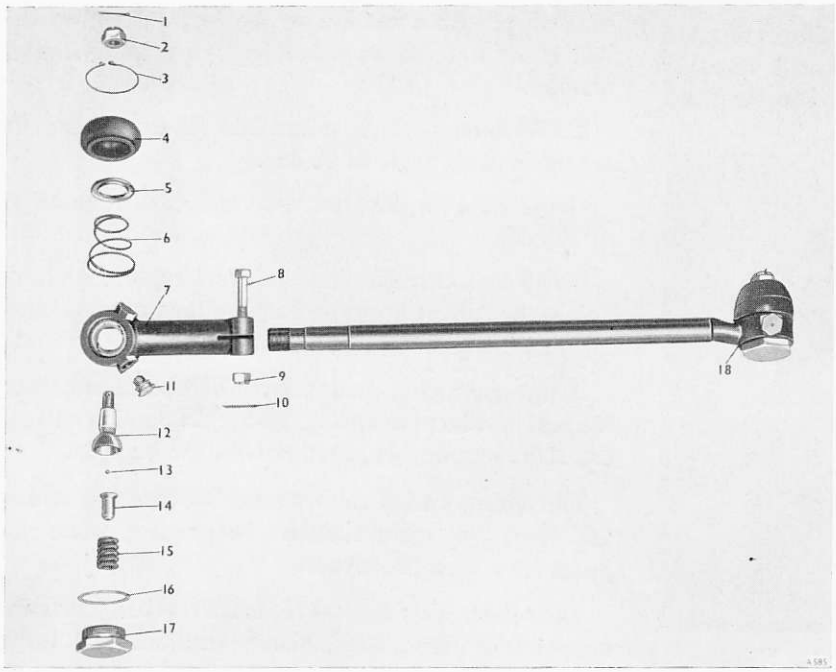


Fig. N13 Track rod and ball joint details

1. SPLIT PIN
2. BALL PIN NUT
3. OIL SEAL RETAINING RING
4. RUBBER OIL SEAL
5. SPRING RETAINING RING
6. SPRING
7. ADJUSTABLE SOCKET
8. CLAMP BOLT
9. NUT
10. SPLIT PIN
11. GREASE NIPPLE
12. BALL PIN
13. STEEL BALL
14. BALL JOINT SPRING SEAT
15. SPRING
16. ALUMINIUM WASHER
17. BALL PIN RETAINING NUT
18. INNER END OF TRACK ROD

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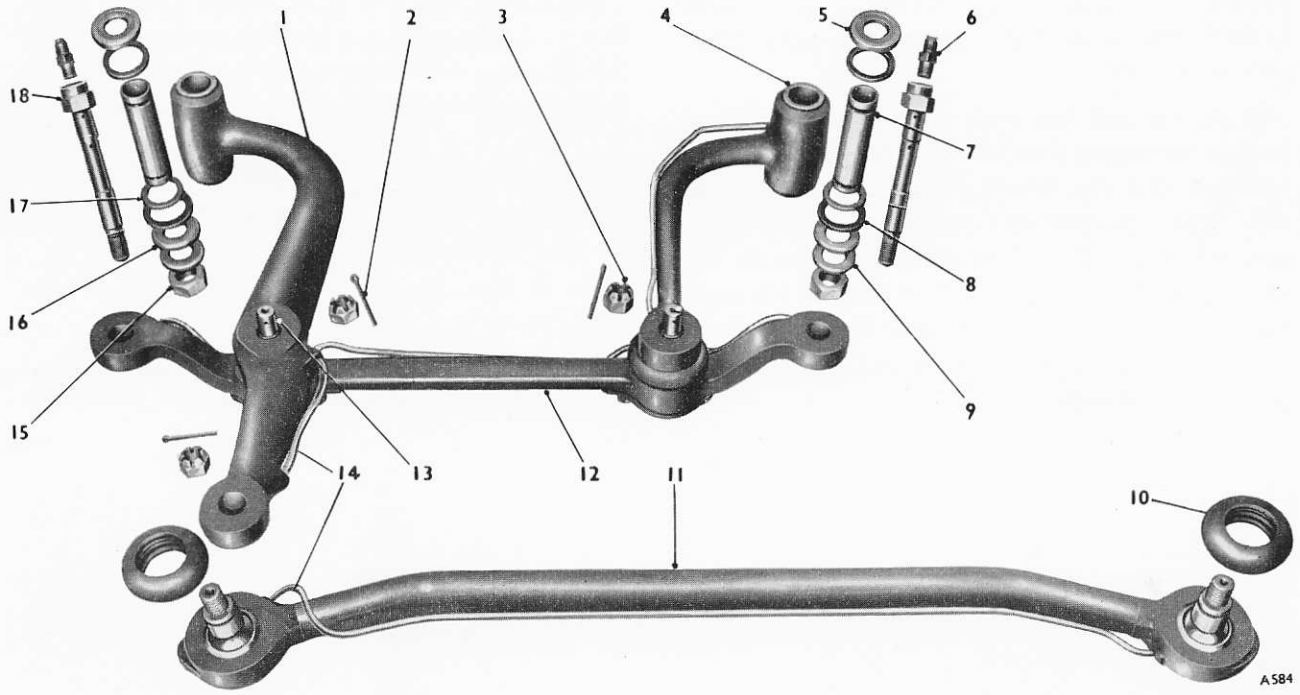


Fig. N14 Centre steering levers and drag link details — manual steering — S1 cars

1. IDLER LEVER
2. SPLIT PIN
3. BALL PIN NUT
4. BUSH
5. PLAIN WASHER
6. 'BIJUR' CONNECTION
7. DISTANCE SLEEVE
8. SEALING RING
9. PLAIN WASHER
10. OIL SEAL
11. DRAG LINK
12. IDLER LEVER CROSSBEAM
13. BALL PIN
14. OIL LINE
15. NUT — IDLER LEVER BOLT
16. BEVEL WASHER
17. ADJUSTING WASHER
18. IDLER LEVER BOLT

car raised, whichever is convenient. When cars having power assisted steering are raised on a jack at the front, care should be taken not to damage the power cylinder or its support bracket, positioned at the front of the car.

Remove the split pin and castellated nut from the ball pin end and, using Special Tool RH.320, extract the ball pin from the eye of the lever. Remove the ball pin from the opposite lever eye in a similar manner. It will be noted that the drag link ends are offset at an angle of 18 deg. Care should be taken to replace the assembly in the correct position, i.e. with the drag link ends inclined towards the rear of the car.

Mark the relative position of the ball joint end cover to socket and remove the 2 B.A. setscrews and locking washers retaining the end cover. The spring, spring seat and steel ball, can then be removed together with the ball pin. The spring-loaded oil-resisting rubber seals and washer between the socket and lever eyes should always be renewed when the joints have been disturbed.

A press must be used to remove and replace the ball pin bronze seat. The seat is pressed squarely into position against the shoulder in the socket, under a pressure of 175 to 400 lb. (79·3 to 181·4 kg.). It is important not to damage the chamfered top end of the bronze seat during the operation, otherwise the oil sealing feature of the seat will be destroyed.

When the seat has been squarely pressed home against the socket shoulder, the ball pin should be lightly lubricated and placed in position, then the steel ball, followed by the spring seat and spring. Apply a

coating of 'Wellseal' to the joint faces, fit the end cover in the marked position and tighten down on the 2 B.A. setscrews evenly.

When the seat has been correctly assembled, no endwise movement should be present. It will be noted however, that the lateral movement will be quite stiff. This is normal, and occurs because the necessary restriction of the lubrication supply to the ball joint is dependent upon the fit of the ball pin on its seat. Excessive stiffness may occur if there are burrs on the edge of the seat or if the seat has been compressed too much on assembly.

Replace the drag link in the correct manner, that is with the 18 deg. offset ends inclined towards the rear of the car, using new sealing washers and oil seals, then tightening and locking the ball pin castellated nuts.

Idler Lever Bush — to renew

On S1 cars, remove the oil line and the elbow which are screwed into the pivot bolt.

On all cars, disconnect the crossbeam ball joint using Special Tool RH.320.

Remove the nut and lock-washer retaining the pivot bolt, tap out the pivot bolt using a suitable aluminium

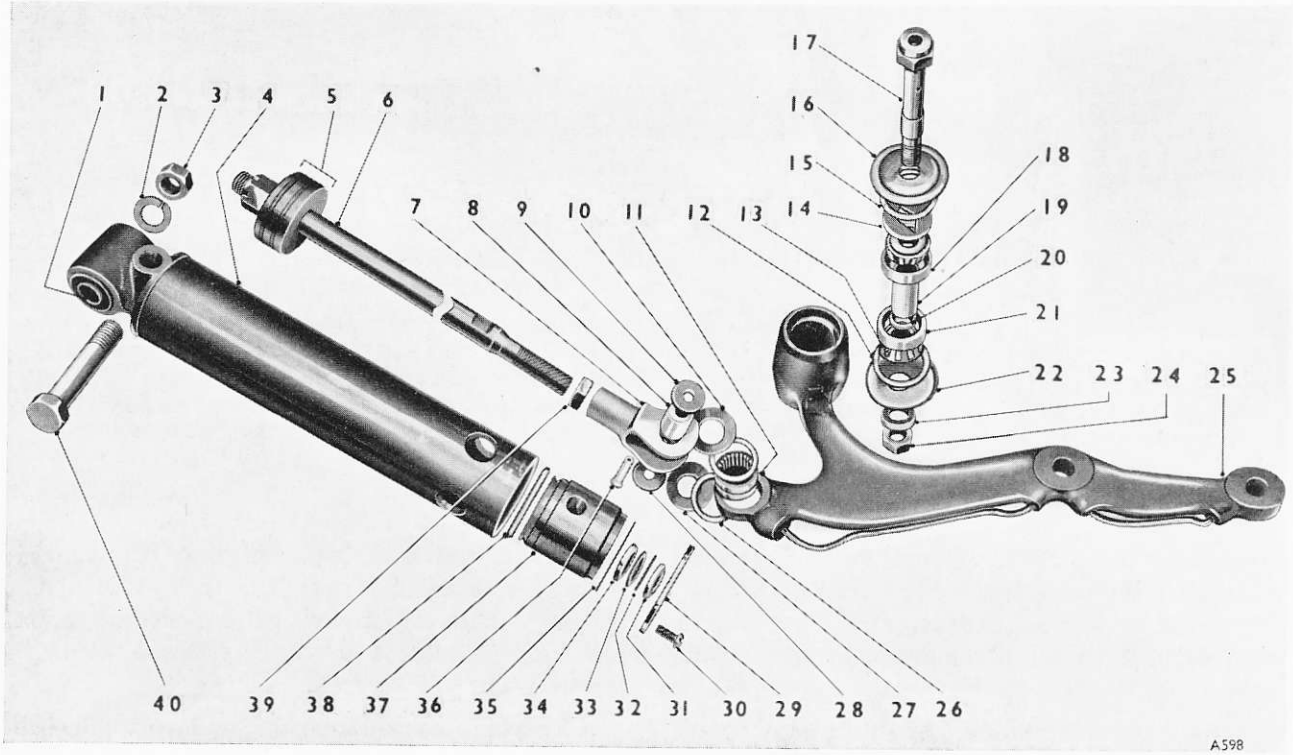


Fig. N15 Centre steering lever details and power cylinder — power assisted steering — S1 cars

1. 'SILENTBLOC' BUSH
2. SPRING WASHER
3. NUT
4. POWER CYLINDER
5. PISTON ASSEMBLY
6. PISTON ROD
7. JAW
8. SLEEVE
9. RETAINING WASHER
10. SPACING WASHER
11. NEEDLE ROLLER RACE
12. SEAL
13. TAPERED ROLLER BEARING
14. OIL TRANSFER WASHER
15. SEAL
16. SEAL RETAINER
17. STEERING LEVER BOLT
18. ROLLER BEARING CUP
19. DISTANCE SLEEVE
20. ADJUSTING WASHER
21. ROLLER BEARING CUP
22. SEAL RETAINER
23. LOWER ADJUSTING WASHER
24. NUT
25. CENTRE STEERING LEVER
26. OIL SEAL
27. SPACING WASHER
28. RETAINING WASHER
29. END PLATE
30. END PLATE SCREW
31. RING
32. WASHER
33. SEAL
34. SEAL
35. CIRCLIP
36. TUBULAR RIVET
37. BUSH
38. SEALING RING
39. LOCK-NUT
40. MOUNTING BOLT

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drift. Remove the idler lever from the chassis frame, together with the washers and seals.

On S1 cars, it will be noted that oil lubricated distance pieces are undercut to allow circulation of the oil, which enters an axial hole in the bolt from a pipe connected to the Centralised Lubrication System.

On all cars, the bushes can be removed by placing the lever bore over a hollow mandrel, through which they may be tapped out by means of a suitable drift.

After pressing the new bushes into position they should be reamed to 0·625 + 0·0005 in. (15·875 + 0·0127 mm.) to give the correct tolerance to the distance piece.

After the pressing operation, all sharp edges must be removed to prevent damage to the rubber seals.

Adjustment — all cars

The lever should be temporarily assembled without the sealing rings which would 'muffle' the adjustment. Under no circumstances should the chamfer on the distance piece be increased as this may cause the collapse of the distance piece and tightness in the bore of the lever when tightening the nut. Use a feeler gauge to measure the end float between the hardened adjusting washer and the plain washer. Washers of various thicknesses are available (see Spares Schedule); a washer must be selected to produce an end float of between zero and 0·003 in. (0·076 mm.).

Centre Steering Lever — Manual Steering

S1 cars

The method of re-bushing or adjusting these levers is the same as that described in the previous text, except that the lever must be disconnected from two ball end pins to permit removal.

Power Assisted Steering

S1 and S2 cars

Disconnect the power steering cylinder from the centre steering lever by slackening off the lock-nut and screwing out the piston rod.

On S1 cars, with oil lubricated levers, disconnect the oil lines from the levers.

Remove the two ball joints using Tool RH.320. Remove the nut and washer which lock the pivot bolt in position; tap out the pivot bolt.

Withdraw the lever from the frame and lower fulcrum bracket, taking care to retain the distance pieces and taper roller bearings.

The oil resistant rubber rings held between the chamfered edges of the lever bores and their adjacent washers form seals against oil and dust.

The distance pieces of the S2 lever are drilled diametrically to allow the lubricants to reach the bearings.

The taper bearing cups can be removed by placing the lever bore over a hollow mandrel, through which they may be tapped out by means of a suitable drift.

Inner races are separated by a standard distance piece and also a short distance piece which is ground to eliminate float.

Piston Rod Pivot Bearing — to renew

Incorporated in the centre steering lever on cars fitted with power steering is the needle roller bearing for the piston rod pivot; this can be renewed if necessary when the lever has been removed.

To renew a bearing, proceed as follows:

File off the head of the rivet and remove the rivet together with the inner race and needle rollers. The outer race can be removed using a light press.

The method of fitting a new bearing is a reversal of the removal procedure.

Taper Roller Bearings — to adjust

Clamp the lever in a vice and temporarily assemble the bearings and distance pieces in position using the original adjusting washer. Select a bolt of suitable size and tighten the assembly using normal pressure. This should result in a pre-loading of 12 to 30 oz.in. (8·64 to 21·6 gm.m.).

To increase this loading, the adjusting washer should be ground; to decrease the loading, a new washer should be fitted.

A further adjustment is necessary to ensure that the centre lever is the same height as the idler lever.

To adjust the height, proceed as follows:

Assemble all the unit except the rubber seals onto the frame. When assembling oil lubricated bearings the oil transfer washer should be placed between the

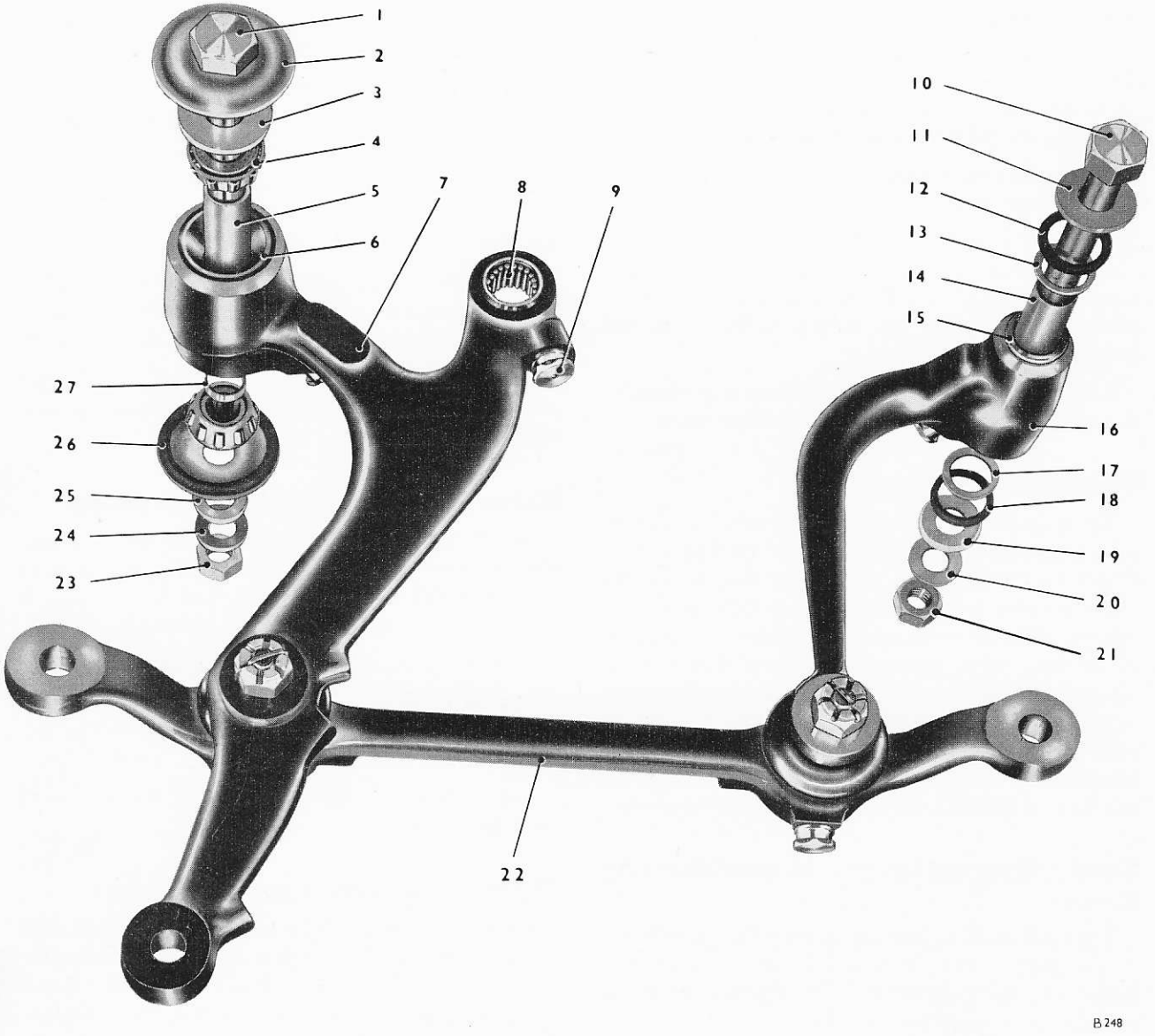


Fig. N16 Centre steering lever details — S2 cars

1. PIVOT BOLT
2. SEAL RETAINER
3. WASHER
4. TAPER ROLLER BEARING
5. DISTANCE PIECE
6. BEARING OUTER RACE
7. CENTRE STEERING LEVER
8. NEEDLE ROLLERS
9. GREASE NIPPLE
10. IDLER LEVER BOLT
11. ADJUSTING WASHER
12. SEALING RING
13. ADJUSTING WASHER
14. DISTANCE PIECE
15. BUSH
16. IDLER LEVER
17. ADJUSTING WASHER
18. SEALING RING
19. ADJUSTING WASHER
20. PLAIN WASHER
21. NUT
22. CROSSBEAM
23. NUT
24. PLAIN WASHER
25. ADJUSTING WASHER
26. SEAL RETAINER
27. ADJUSTING WASHER

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upper seal retainer and the bearing. Ensure that the height adjusting washer is placed under the oil seal retainer.

Check the height of the centre steering lever with that of the idler lever by moving both the levers an equal amount to touch one another; it is most important that the levers are moved an equal amount in relation to the car centre line, as the pivot bolts are mounted at a slight angle. The heights of both levers should be the same. Adjustment can be made by selecting a suitable washer from the range provided (see Spares Schedule).

Final Assembly

To assist in the assembly of the components in the frame, a 0·468 in. (11·9 mm.) dia. bar 2·250 in. (57 mm.) long should be used.

Assemble the centre lever, bearings and washers onto the bar using new oil seals. Enter the pivot pin through the bracket and lever, slowly forcing out the bar.

Re-assembly from this point is a reversal of the dismantling process.

SECTION N5 — STEERING COLUMN AND STEERING BOX
MANUAL STEERING — S1 CARS

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Servicing

The steering box oil level should be checked every 5,000 miles (8000 kilometres). Clean the casing surrounding the filler plug and then remove the filler plug. If necessary top-up to the level of the filler plug orifice using one of the approved lubricants; fit the filler plug.

Steering Column and Steering Box — to remove

Remove the front seats as described in Section S10 to facilitate the removal of the steering column.

Disconnect the battery.

Apply the hand brake, place a jack under the front pan and jack up the car.

Disconnect the coiled oil pipe at the rocking shaft.

Remove the ball pin connecting the pendulum lever to the drag link using Special Tool RH.320.

Remove the nut, lock-washer, plain washer and counterbored washer securing the pendulum lever to the splined end of the rocking shaft. Mark the relative position of the pendulum lever to the rocking shaft to assist in re-assembly, then remove the pendulum lever using Special Tool RH.321.

Disconnect the horn and ride control solenoid wires at the junctions along the valance.

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Remove the two micro-switches from the steering column without detaching the wires.

Unscrew and remove the nut and bolt securing the lower end of the gear control rod to the operating lever; care should be taken not to misplace the locating key fitted in the lower end of the control rod.

Remove the front carpet and disconnect and remove the foot brake pedal from the brake lever.

Disconnect and remove the flexible hoses from the heater and de-mister ducting and remove the ducting assembly.

Remove the sound insulation panel from the bulkhead, then remove the plate and gas seal covering the large aperture in the bulkhead. The plate and gas seal should be maintained as an assembly to the steering column.

On early S1 cars, remove the split pin, castellated nut, plain nut, washers and bolt securing the steering box mounting arm to the mounting bracket on the chassis frame.

On late S1 cars, remove the nut, washers and bolt securing the steering box mounting arm to the mounting bracket on the chassis frame.

On all cars, support the steering column while removing the bracket holding the steering column to the rear of the facia panel. The assembly may be

withdrawn through the front door, care being taken not to damage the enamelled column or the upholstery. The rocking shaft nut should be screwed onto the end of the rocking shaft to prevent accidental damage to the threads.

Steering Column and Steering Box — to dismantle

Drain the oil from the steering box and clamp the rocking shaft body bracket in a vice fitted with fibre grips; do not over tighten.

Remove the three screws retaining the horn push plate assembly to the steering wheel. Disconnect the horn wire snap connector and withdraw the assembly.

Unscrew the five setscrews securing the steering wheel retaining nut lockplate and remove the lockplate. Unscrew and remove the retaining nut and the plain washer; replace the retaining nut loosely to prevent damage to the threaded end of the tube when withdrawing the steering wheel.

A scribed line or centre punch dot should be used to mark the wheel hub to shaft position for convenient re-assembly.

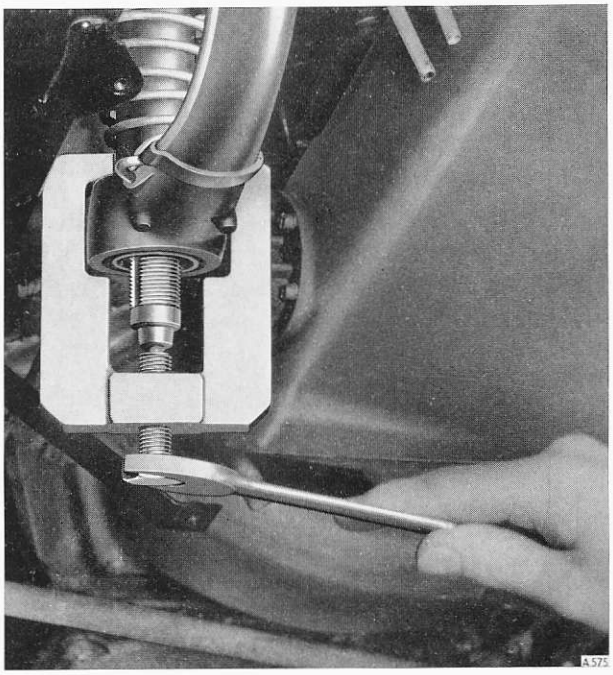


Fig. N17 Removing pendulum lever

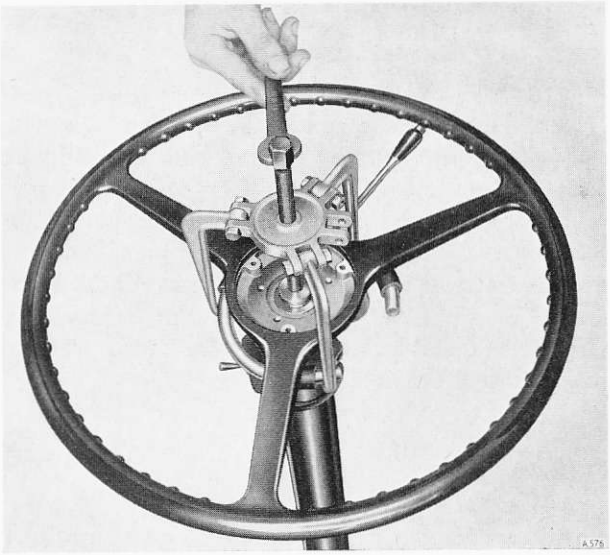


Fig. N18 Removing steering wheel

Using Special Tool RH.593 withdraw the steering wheel; care should be taken not to trap the horn wire between the steering tube and the extractor. Remove the extractor and the retaining nut and lift off the steering wheel.

Mask the splined ends of the rocking shaft and cam tube to prevent accidental damage.

Mark the position of the rocking shaft end thrust cover and remove the cover, taper roller bearing and adjusting washer. Mark the position of the lower cover and remove the cover containing the oil seal, taper roller bearing and adjusting washer. Push the rocking shaft out by hand.

Mark the position of the eccentric adjusting sleeve in relation to the steering box to assist in the re-assembly.

Remove the nuts holding the steering column outer tube to the steering box and pull off the tube.

Mark the position of the cam tube end cover and remove the cover, taper roller bearings, adjusting washer and horn earth contact spring.

Using an aluminium drift, tap the bottom of the cam and pull at the same time in order to remove the cam tube assembly from the steering box. An eccentric adjusting sleeve, taper roller bearing and adjusting

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washer should be released with the cam tube, but if the adjusting sleeve remains in the steering box, a light tap will dislodge it.

The rocking shaft assembly should be dismantled only if there is evidence of roughness in the ball bearings and races.

Thoroughly clean all parts for examination.

Cam Roller Assembly — to renew

To dismantle the rocking shaft assembly, remove the slotted nut by splitting it with a cold chisel. File the end of the bolt to prevent damaging the locating hole and tap out the bolt with a drift; collect all the parts.

Before the new cam roller assembly is fitted into the rocking shaft, it will be necessary to determine the thickness of the adjusting washer by the following method.

Insert a new bolt through the bore of the new roller assembly and add a distance piece or enough flat washers to ensure that the nut will tighten sufficiently to bring the inner races into contact; the distance piece or washers should be a close fit on the bolt and the faces should be square and parallel to the bore. When the inner races are in contact, the roller has a pre-load of 9 to 13 oz. (255 to 368 gm.) at a 4 in. (10·16 cm.) radius; this pre-load is determined in manufacture and is not adjustable.

A measurement should then be taken of the overall width of the roller assembly inner races; this measurement should be approximately 1·490 — 0·004 in. (3·785 — 0·010 cm.) for **early S1 cars** and 1·446 — 0·008 in. (3·673 — 0·02 cm.) for **late S1 cars.**

On all cars, the width across the inner machined faces of the rocking shaft jaw is 1·495 + 0·005 in. (3·797 + 0·013 cm.) and should be checked to obtain the actual dimension.

The difference between the two measurements should be noted, and equal or near-equal adjusting washer(s) selected to total this dimension.

Remove the nut and distance piece or flat washers from the roller assembly, then install the roller assembly and adjusting washer(s) between the rocking shaft jaws; a 'G' clamp or any other suitable clamp may be used to clamp the roller assembly in order to ease the entry into the shaft jaws. The adjusting washer(s) should be placed away from the head of the securing bolt **on early S1 cars** and on each side of the bearing assembly **on late S1 cars.** If adjusting washer(s) of the correct thickness have been selected, it will be noted that a good hard push will be necessary to position the roller assembly in the rocking shaft.

Insert the new bolt and tighten the nut in position using two spanners RH.640; before peening the end of the bolt to lock the nut, ensure that a satisfactory 'feel' is present.

Note: It is most important that measurement of the shaft jaw and roller assembly and choice of the adjusting washer be accurate; if the adjusting washer is too thin, the outer edges of the jaw will close up when the nut is tightened, resulting in misalignment of the taper rollers.

The adjusting washers are 1 in. (2·54 cm.) diameter, and have a bore diameter of 0·515 in. (1·308 cm.); they are supplied in a range of thicknesses from 0·002 in. (0·051 mm.) to 0·010 in. (0·254 mm.), excepting 0·004 in. (0·102 mm.) for **early S1 cars** and from 0·022 in. (0·559 mm.) to 0·027 in. (0·686 mm.) for **late S1 cars.**

On early S1 cars, while it is desirable to use only one adjusting washer to give the required setting, any combination of the range may be used.

Renewal of Cam on Cam Tube

If the cam requires renewal, it is advisable that the complete cam tube assembly be replaced by a new assembly owing to the difficulty of assembling the cam to the cam tube accurately.

The following method should be employed when repair by replacement is impracticable.

A hydraulic press capable of applying a load of between 3 and 6 tons (3·048 and 6·096 tonnes) is required for pressing on a new cam.

Before removing the cam, a measurement should be taken of the distance the cam is proud of the end of the cam tube. The distance should be approximately 0·312 in. (0·792 cm.) and it is important to be as accurate as possible with this measurement, as the replacement cam must be pressed into the same position. If the cam is pressed too far along the tube on assembly, the steering wheel hub will bind on the Oilite bush in the top of the outer tube.

Draw off the old cam.

After removal, all burrs should be removed from the cam tube with a smooth file, special attention being given to the keyway on the tube.

To facilitate the installation of the new cam, a lubricant such as tallow should be applied to the cam tube. Under no circumstances should the cam be shrunk onto the cam tube.

The part number is etched on the bottom of the cam; to positively identify the top and bottom ends of the cam, it will be noted that the splines on the top end begins at approximately 1·025 in. (2·603 cm.)

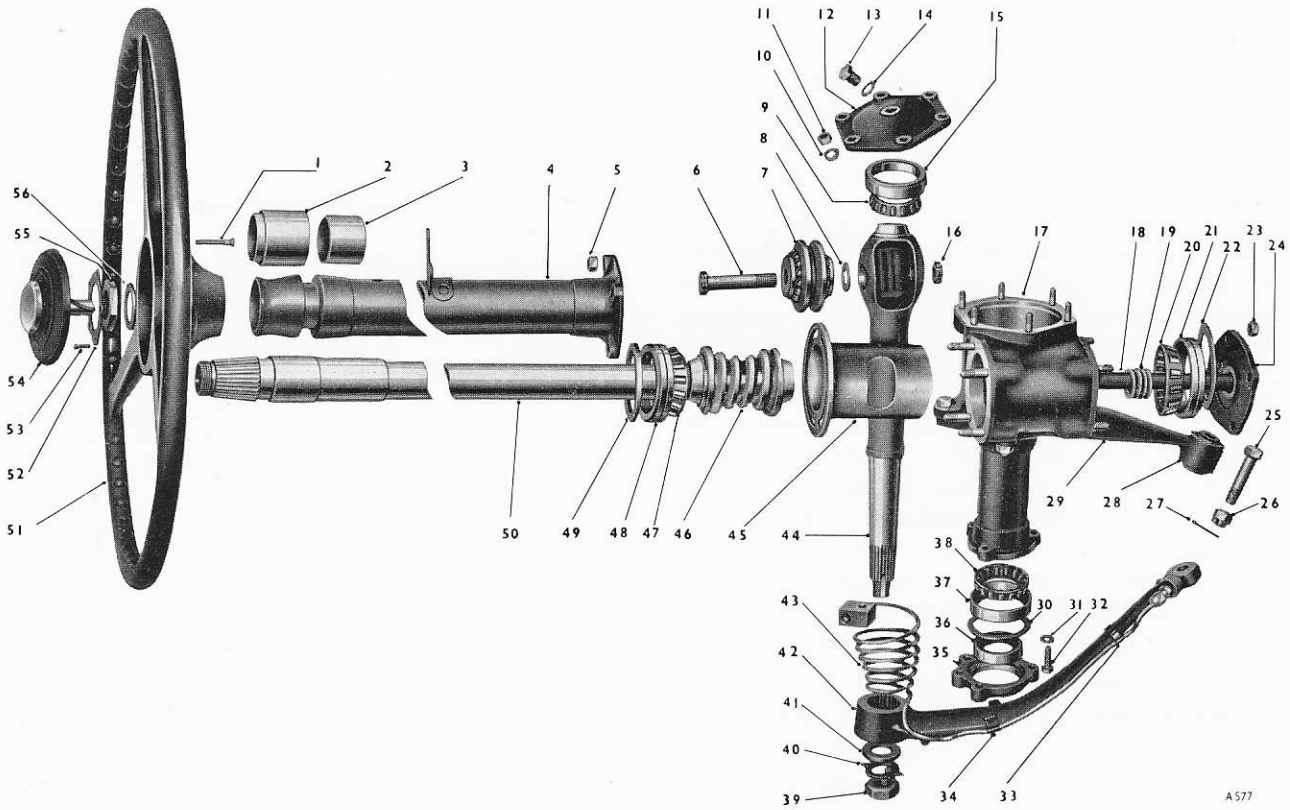


Fig. N19 Steering column details

1. SCREW RETAINING HORN SWITCH
2. SLEEVE
3. OILITE BUSH
4. OUTER TUBE
5. END PLATE NUT
6. BOLT — CAM ROLLER
7. CAM ROLLER ASSEMBLY
8. ADJUSTING WASHER
9. ROCKING SHAFT BEARING
10. PLAIN WASHER
11. TOP COVER NUT
12. ROCKING SHAFT TOP COVER
13. FILLER PLUG
14. ALUMINIUM WASHER
15. BEARING OUTER RACE
16. NUT — CAM ROLLER BOLT
17. STEERING BOX
18. OIL LEVEL TUBE
19. HORN EARTH SPRING
20. CAM BEARING
21. CAM BEARING OUTER RACE
22. LOWER ADJUSTING WASHER
23. END COVER NUT
24. END COVER
25. MOUNTING BOLT
26. CASTELLATED NUT
27. SPLIT PIN
28. 'SILENTBLOC' BUSH
29. MOUNTING ARM
30. ADJUSTING WASHER
31. PLAIN WASHER
32. SETSCREW — END COVER
33. CLIP
34. CLIP
35. ROCKING SHAFT END COVER
36. OIL SEAL
37. BEARING OUTER RACE
38. ROCKING SHAFT BEARING
39. PENDULUM LEVER NUT
40. TAB WASHER
41. PLAIN WASHER
42. PENDULUM LEVER
43. OIL LINE ASSEMBLY
44. ROCKING SHAFT
45. ECCENTRIC SLEEVE
46. CAM
47. CAM BEARING
48. BEARING OUTER RACE
49. UPPER ADJUSTING WASHER
50. CAM TUBE
51. STEERING WHEEL
52. LOCKPLATE
53. 5 B.A. SCREW
54. HORN SWITCH ASSEMBLY
55. STEERING WHEEL RETAINING NUT
56. PLAIN WASHER

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from the end of the cam race track. At the bottom end of the cam the splines begin at a distance of 0·462 in. (1·173 cm.) from the end of the bottom race track.

Ensure that the key or master spline of the cam is lined-up with the keyway in the cam tube before any attempt is made to press on the cam.

Care must be taken to ensure that the cam does not tilt during the initial stage of pressing on and so damage the cam tube. As a precaution against damage to the cam tube threads, the steering wheel retaining nut should be screwed onto the cam tube.

After pressing on the cam, the cam race tracks and the upper bearing diameter which locates in the Oilite bush should be concentric within 0·002 in. (0·051 mm.); if necessary the tube should be stretched to produce this indicator reading.

Outer Steering Tube Oilite Bush — to renew

An Oilite bush is pressed into the housing at the top of the outer steering tube. When renewing the bush, care must be taken to position the bush 0·125 in. (0·317 cm.) proud of the top of the sleeve. Any tight spots on the bush should be relieved by reaming. Lubricate the bush with engine oil before fitting the outer tube to the steering box.

Steering Column and Steering Box — to assemble

Pre-loads

Two sets of figures are quoted below, one for use when using new parts, the other for use when re-building a steering box and refitting original parts. It should be noted that after a period of running-in the pre-load settings of production steering boxes will decrease. Should a steering box be reset after this running-in period and without any new parts being used, the settings quoted for use with new parts would prove too tight.

Rocking Shaft Bearings

6 to 12 oz. (170 to 340 gm.) — Using new parts
3 to 12 oz. (85 to 340 gm.) — Refitting original parts

Effort applied horizontally to pendulum lever as shown in Figure N22.

Steering Cam Bearings

14 to 22 oz. (397 to 623 gm.) — Using new parts
6 to 14 oz. (170 to 397 gm.) — Refitting original parts

Effort applied at rim of steering wheel.

Mesh Adjustment

14 oz. (397 gm.) increase at tight spot — Using new parts
8 oz. (227 gm.) increase at tight spot — Refitting original parts

Effort applied at rim of steering wheel.

Rocking Shaft Bearings Pre-load — to set

The setting of the rocking shaft bearings pre-load should be carried out before the oil seal is placed in the rocking shaft housing. A more accurate setting can be reached without the possibility of interference from the snug fit of the oil seal on the rocking shaft.

Bolt the lower cover on the rocking shaft housing with the adjusting washer in position and tighten the three setscrews.

Place the lower tapered roller bearing and rocking shaft in position.

Fit the outer bearing race in the bore in the top cover. Position the tapered roller bearing on the upper face of the rocking shaft and fit the top cover, aligning the markings; tighten down the six setscrews evenly.

Fit the pendulum lever to the rocking shaft in the marked position, tightening the nut just sufficiently to hold the lever firmly in position. The rocking shaft must be in a vertical position during the pre-load setting, as shown in Figure N22. Before checking the pre-load, rotate the rocking shaft to ensure correct seating of the taper rollers.

Attach a suitably calibrated spring balance to the pendulum lever eye and note the pull required to move the rocking shaft through an arc of 92 deg. this arc is approximately the rotation of the shaft required to move the steering geometry from lock to lock.

A pre-load of from 6 to 12 oz. (170 to 340 gm.) when using new parts or 3 to 12 oz. (85 to 340 gm.) when refitting original parts, is permissible. Should the pre-load be lower than that stated, a thicker adjusting

washer must be fitted; if the pre-load is higher, a thinner adjusting washer must be fitted. Adjusting washers are provided in a range of thicknesses (see Spares Schedule).

When an alteration to the pre-load is required, it can be calculated by assuming that a difference of 0·001 in. (0·025 mm.) in the thickness of the adjusting washer will alter the pre-load by approximately 8 oz. (227 gm.).

On completion of the pre-load setting operation, remove the pendulum lever, the top end cover and the bearing. Withdraw the rocking shaft and remove the lower cover, taking care not to misplace the adjusting washer. Fit a new oil seal into the cover and fit the cover complete with the oil seal, adjusting washer and outer race.

Cam Bearing Pre-load — to set

Fit the cam lower end cover with the bearings and adjusting washer, aligning the markings; the horn contact earthing spring should be omitted until pre-loading has been carried out.

Assemble the eccentric sleeve, bearing and adjusting washer on the cam tube and place the assembly in position in the steering box. Place the outer steering tube into position and tighten down the four nuts evenly.

Fit the steering wheel into position, tightening the retaining nut just sufficiently to hold the steering wheel firmly in place; rotate the steering wheel to ensure correct seating of the taper rollers. Attach a suitably calibrated spring balance to the rim of the steering wheel and note the pull on the spring balance required to turn the wheel. The pre-load should be between 14 and 22 oz. (397 and 623 gm.) using new parts, and between 6 and 14 oz. (170 and 397 gm.) when refitting original parts. The adjusting washers are supplied in a range of thicknesses (see Spares Schedule). A pre-load, less than the minimum requirement, necessitates a thicker adjusting washer; a pre-load in excess of the maximum indicates that a thinner adjusting washer should be used. As a guide to the selection of the adjusting washer, a variation of 0·001 in. (0·025 mm.) will alter the pre-load by approximately 8 oz. (227 gm.).

When the pre-load has been set, remove the lower cover and install the horn contact earthing spring. Apply 'Wellseal' to the joint faces and tighten down the cover evenly.

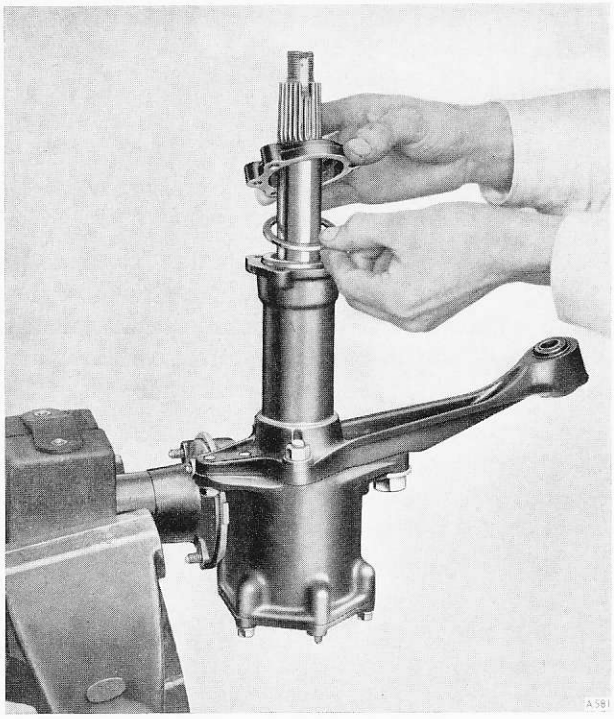


Fig. N20 Rocking shaft adjusting washer

Adjusting Cam to Roller Mesh and Centralising Cam to Roller

Apply 'Wellseal' to the joint face of the rocking shaft top cover and fit the rocking shaft, bearing and top cover; tighten down the top cover evenly.

Before the mesh adjustment can be undertaken, the cam and roller must first be centralised; i.e. the keyway in the cam should be 180 deg. from the top and the roller meshed at right angles to the cam. In this position it will be possible to turn the steering wheel approximately 2 or $2\frac{1}{4}$ turns depending on the steering type, toward either lock.

Correct cam to roller centralisation is most important in order that the 'tight-spot' in the steering shall occur with the steering in the straight ahead position, thereby preventing steering wheel 'joggle'. When on either lock, a small amount of backlash will be felt which is normal and due to the cam formation.

Before finding the 'tight-spot', fit the pendulum lever to the rocking shaft in the position marked when dismantling; do not tighten the locking nut as it will be

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necessary to remove the lever at a later stage in order to install the steering assembly.

Using a dial test indicator on the pendulum lever, the 'tight-spot' may be found by obtaining an equal amount of slack measured at the two minimum positions. These positions are approximately half a turn away from the straight ahead position in each direction. It must be stressed that these minimum positions must be found by experiment and are not exactly half a turn away from the straight ahead position.

On right-hand drive cars, if the 'tight-spot' is to the right of the straight ahead position, dismantle the steering box and fit a thinner adjusting washer at the lower end of the cam. To maintain the correct pre-load on the bearings, it will be necessary also to fit an adjusting washer of increased thickness at the upper end of the cam; the increase must be equal to the reduction in thickness of the lower adjusting washer in order to preserve the same overall dimension.

On left-hand drive cars, if the 'tight-spot' is to the right of the straight ahead position, dismantle the steering box and fit a thinner adjusting washer at the upper end of the cam. To maintain the correct pre-load on the bearings, it will be necessary also to fit an adjusting washer of increased thickness at the lower end of the cam; the increase must be equal to the reduction in thickness of the upper adjusting washer in order to preserve the same overall dimension.

After finding the 'tight-spot', adjustment of the cam to roller is obtained by rotating the eccentric adjusting

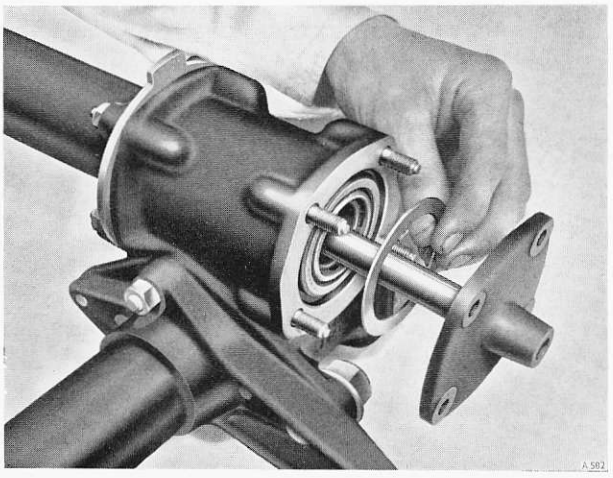


Fig. N21 Steering box lower adjusting washer

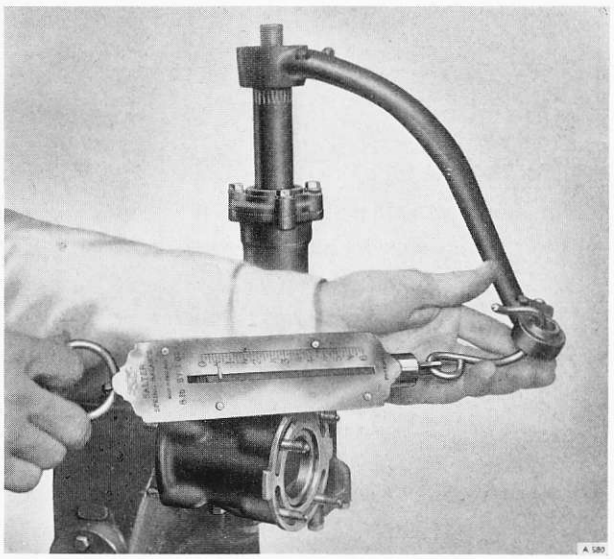


Fig. N22 Checking rocking shaft bearings pre-load

sleeve, which has four elongated holes, about the four studs securing the outer steering tube; either one or two lugs are provided on the side of the eccentric sleeve for this purpose. Turning the eccentric sleeve anti-clockwise **on right-hand drive cars,** or clockwise **on left-hand drive cars** when viewed from the steering wheel end, moves the cam closer to the roller and so reduces the mesh.

Slacken the four outer steering tube securing nuts and turn the eccentric sleeve to the position where backlash has just been eliminated, a vigorous movement back and forth of the pendulum lever will indicate when this point is reached. Tighten the four securing nuts.

An increase of 14 oz. (397 gm.) or 8 oz. (227 gm.) load (see table) on the steering wheel rim will be noticed when the mesh spot is correctly adjusted.

Turn the steering wheel from lock to lock to ensure that there is no binding or other tight spots.

Fill the steering box with the approved lubricant (see Chapter D) and carefully check for any oil leaks.

Tighten and lock the steering wheel retaining nut and fit the horn button assembly.

Install the steering gear assembly in the car, reversing the procedure given for removal, noting that an oil resisting sleeve should be fitted to the rocking shaft to prevent contact between the coiled oil line and the rocking shaft.

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SECTION N6 — STEERING COLUMN AND STEERING BOX POWER ASSISTED STEERING — S1 CARS

Servicing

The cam and roller assembly is lubricated together with the valves etc., by oil under pressure from the oil pump. The pump is supplied by an oil reservoir which should be topped-up as necessary, with the approved automatic transmission fluid as described in Section N2.

Steering Column and Steering Box — to remove

Remove the front seats as described in Section S10.

Disconnect the battery.

Apply the hand brake, place a jack under the front pan and jack up the car taking care to avoid damaging the power cylinder or its mounting bracket.

Disconnect the coiled oil pipe at the rocking shaft. Remove the ball pin connecting the pendulum lever to the drag link using Special Tool RH.320.

Remove the nut, lock-washer, plain washer and special washer securing the pendulum lever to the splined end of the rocking shaft. Mark the relative position of the pendulum lever to the rocking shaft to assist in re-assembly and remove the pendulum lever using extractor tool RH.321.

Disconnect the horn wire positioned midway along the steering column and disconnect the ride control solenoid wires at the connecting points on the valance.

Remove both the micro-switches from the steering column without detaching the wires.

Unscrew and remove the nut and bolt securing the lower end of the gear control rod to the operating lever; care should be taken to avoid misplacing the locating key fitted in the lower end of the control rod.

Remove the front carpet and disconnect and remove the foot brake pedal from the brake pedal shaft.

Disconnect and remove the flexible hoses from the heater and de-mister ducting and remove the ducting assembly.

Remove the sound insulation panel from the bulkhead and release the screws securing the plate and gas seal covering the large aperture in the bulkhead; the plate and gas seal should be left assembled to the steering column.

Disconnect the oil pipes from the spool valve housing and mask the ends to prevent oil leakage or dirt entering.

Unscrew the two bolts securing the steering box mounting arm to the mounting bracket on the chassis frame and remove the bolts, nuts and washers.

Support the steering column assembly and remove the bracket holding the steering column to the rear of the facia panel. The assembly is withdrawn through the front door, care being taken to avoid damage to the enamelled column or the upholstery. The rocking shaft nut must be screwed onto the end of the rocking shaft to prevent accidental damage to the threads.

Steering Column and Steering Box — to dismantle

Clamp the mounting arm of the steering assembly in a vice having protective grips.

Remove the three screws retaining the horn push plate assembly to the steering wheel and withdraw the assembly; disconnect the horn wire snap connector.

Unscrew the five setscrews securing the retaining nut lockplate. Unscrew the steering wheel retaining nut, remove the nut and the plain washer; replace the retaining nut to prevent damage to the threaded end of the tube when withdrawing the steering wheel.

Indicate the wheel hub-to-shaft position with a scribed line or centre dot to simplify re-assembly.

Using Special Tool RH.593, withdraw the steering wheel; care should be taken to ensure that the horn

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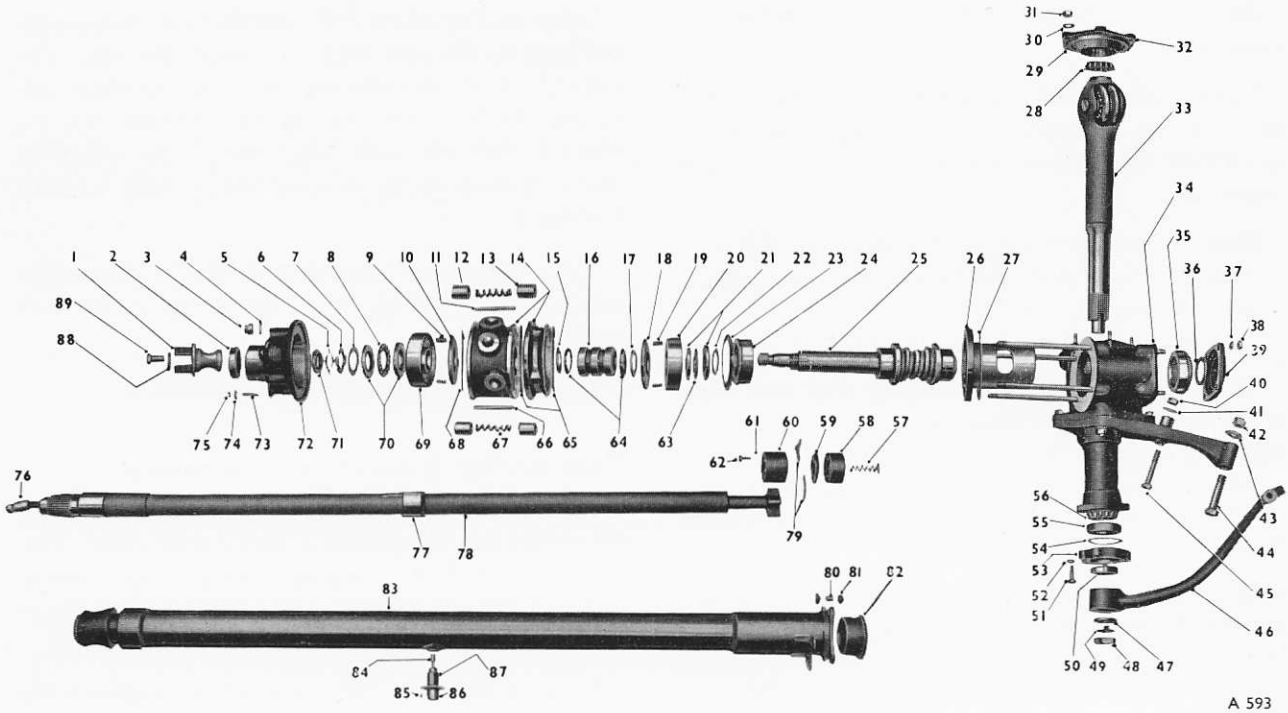


Fig. N23 Steering column details

1. COUPLING DOG
2. OIL SEAL
3. CAP NUT
4. ALUMINIUM WASHER
5. TAB WASHER
6. KEY WASHER
7. ADJUSTING WASHER (No. 5)
8. THRUST BEARING
9. SECONDARY SPRING
10. THRUST WASHER
11. SPACING PIN
12. PLUNGER — UPPER — 4 OFF
13. PLUNGER — LOWER — 4 OFF
14. VALVE HOUSING AND DISTANCE PIECE
15. ADJUSTING WASHER (4V)
16. SPOOL VALVE
17. ADJUSTING WASHER (3V)
18. THRUST WASHER
19. SECONDARY SPRING
20. SECONDARY SPRING HOUSING
21. THRUST RACES
22. ADJUSTING WASHER (2C)
23. RETAINING DISC
24. CAM ROLLER RACE ASSEMBLY
25. LOWER CAM TUBE ASSEMBLY
26. ECCENTRIC ADJUSTING SLEEVE
27. SEALING RING
28. ROCKING SHAFT BEARING
29. BEARING CUP
30. PLAIN WASHER
31. NUT
32. TOP COVER
33. ROCKING SHAFT
34. STEERING BOX ASSEMBLY
35. CAM ROLLER RACE ASSEMBLY
36. ADJUSTING WASHER (1C)
37. WASHER
38. NUT
39. END COVER
40. NUT
41. PLAIN WASHER
42. NUT
43. PLAIN WASHER
44. MOUNTING BOLT
45. MOUNTING BOLT
46. PENDULUM LEVER
47. RECESSED WASHER
48. NUT
49. TAB WASHER
50. OIL SEAL
51. SETSCREW
52. PLAIN WASHER
53. ROCKING SHAFT END COVER
54. ADJUSTING WASHER
55. BEARING CUP
56. ROCKING SHAFT BEARING
57. HORN EARTHING SPRING
58. RUBBER COUPLING
59. RUBBERISED DISC
60. COUPLING COVER
61. PLAIN WASHER
62. SET SCREW
63. THRUST BEARING
64. SPHERICAL WASHERS
65. SEALING RINGS
66. SPACING PIN
67. PRIMARY SPRING
68. SEALING RING
69. SECONDARY SPRING HOUSING
70. THRUST RACES
71. LOCK-NUT
72. VALVE HOUSING END COVER
73. STUD
74. PLAIN WASHER
75. NUT
76. HORN WIRE
77. HORN SLIP RING
78. INNER STEERING TUBE
79. COUPLING SPLIT WASHER
80. SLEEVE
81. BUSH
82. BUSH
83. OUTER STEERING TUBE
84. HORN BRUSH
85. 5 B.A. SCREW
86. HOUSING — BRUSH BUSH
87. BRUSH BUSH
88. PLAIN WASHER
89. SETSCREW

wire is not trapped between the inner steering tube and the extractor. Remove the extractor and the retaining nut and lift off the steering wheel.

Mask the splined ends of the rocking shaft and inner steering tube to prevent accidental damage.

Remove the outer steering tube.

Disconnect and remove the inner steering tube complete with the rubber coupling.

Unscrew the setscrew from the centre of the coupling dog and remove the setscrew and washer; withdraw the coupling dog (this is a sliding fit).

Remove the cap nuts, washers and end cap from the valve body.

Unlock the tabwasher and remove the slotted locknut from the cam tube, thereby giving access to the spool valve and its associated parts, which can then be removed.

Note: When removing the secondary springs or housing, or any part of the spool valve assembly, mark all parts to ensure that they are refitted in their previous positions; this is important.

Mark the position of the rocking shaft end thrust cover and remove the cover, taper roller bearing and adjusting washer. Mark the position of the lower cover and remove the cover containing the oil seal, the taper roller bearing and the adjusting washer. Push the rocking shaft out by hand.

Mark the position of the cam tube end cover and remove the cover, adjusting washer and needle roller bearing. Also mark the position of the eccentric sleeve to ensure accurate alignment on assembly.

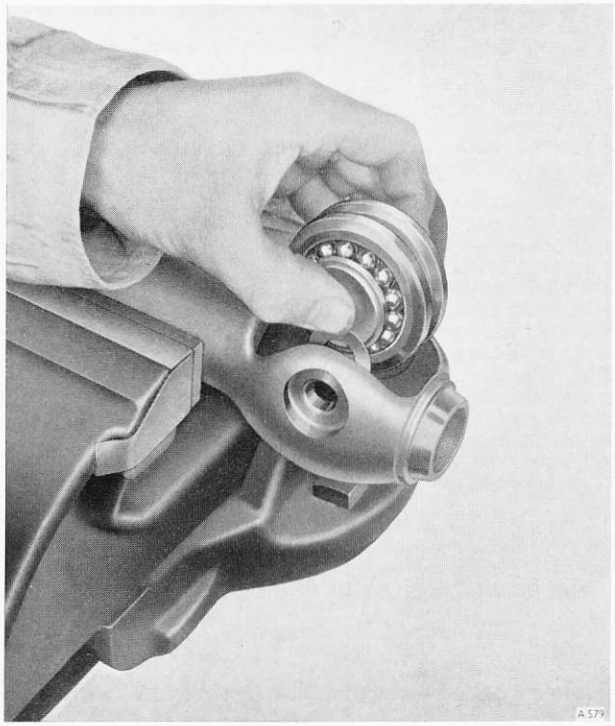


Fig. N24 Inserting pre-load washer

Using an aluminium drift, tap the lower thrust race and pull on the cam tube to remove the cam tube assembly from the steering box. An eccentric adjusting sleeve, roller bearing and retainer will be released with the cam tube, but if the adjusting sleeve remains in the steering box, a light tap will dislodge it.

The rocking shaft assembly should be dismantled only if there is evidence of roughness in the ball bearings and races.

Thoroughly clean all parts for examination.

Cam Roller Assembly — to renew

To dismantle the rocking shaft assembly, remove the slotted nut by splitting it with a cold chisel. File the end of the bolt to prevent damaging the locating hole and tap out the bolt with a drift; collect all the parts.

Before a new cam roller assembly is fitted into the rocking shaft, it will be necessary to determine the thickness of the adjusting washer by the following method.

Insert a new bolt through the bore of the replacement roller assembly and add a distance piece or sufficient flat washers to bring the inner races into contact when the nut is tightened to a torque loading of 60 to 70 lb.ft. (8·3 to 9·6 kg.m.). The distance piece or washers should be a close fit in the bolt and the faces parallel and square to the bore. When the inner races are in contact, the roller has a pre-load of 2 to 5 oz. (57 to 142 gm.) at 4 in. (10·2 cm.) radius; this pre-load is determined in manufacture and is not adjustable.

A measurement should then be taken of the overall width of the roller assembly inner races.

On early S1 cars, this measurement should be approximately 1·490 — 0·004 in. (3·785 — 0·01 cm.).

On late S1 cars, this measurement should be approximately 1·446 — 0·008 in. (3·673 — 0·02 cm.).

On all S1 cars, the width across the inner machined faces of the rocking shaft jaw is 1·495 + 0·005 in. (3·797 + 0·013 cm.) and should be checked to obtain the actual dimension.

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The difference between the two measurements should be noted and equal or near-equal adjusting washers selected to total this dimension.

Remove the nut and distance piece or flat washers from the roller assembly, then install the roller assembly and adjusting washers between the rocking shaft jaws; a 'G' clamp may be used to grip the roller assembly in order to facilitate entry into the jaws.

On early S1 cars, the adjusting washers should be placed away from the head of the securing bolt.

On late S1 cars, the adjusting washers should be placed on each side of the bearing assembly.

On all S1 cars, if adjusting washers of the correct thickness have been selected, it will be noted that a good hard push will be necessary to position the roller assembly in the rocking shaft.

Insert the new bolt and tighten the nut, using two spanners, RH.640. It is most important that measurement of the shaft jaw and roller assembly and choice of the adjusting washer be accurate; if the adjusting washer is too thin, the outer edges of the jaw will close up when the nut is tightened, resulting in misalignment of the taper rollers.

The adjusting washers are 1 in. (2·54 cm.) diameter, and have a bore diameter of 0·515 in. (1·308 cm.); they are supplied in a range of thicknesses from 0·002 in. (0·051 mm.) to 0·010 in. (0·254 mm.), excepting 0·004 in. (0·102 mm.) for **early S1 cars** and from 0·022 in. (0·559 mm.) to 0·027 in. (0·686 mm.) for **late S1 cars**.

On early S1 cars, while it is desirable to use only one adjusting washer to give the required setting, any combination of the range may be used.

Outer Steering Tube Oilite Bush — to renew

An Oilite bush is pressed into the housing at the top of the outer steering tube, which is slightly tapered at the lower end. When renewing this bush, care must be taken to leave the bush 0·125 in. (0·317 cm.) proud of the top of the sleeve. Any tight spots on the bush should be relieved by reaming. Lubricate the bush with engine oil before fitting the outer steering tube.

Steering Column and Steering Box — to assemble

Pre-loads

Rocking Shaft Bearings

6 to 10 oz. (170 to 283 gm.)

Effort applied to pendulum lever horizontally as shown in Figure N22.

Steering Cam Bearings

No pre-load

Mesh Adjustment

Total friction in steering box at central position of steering wheel 16 to 20 oz. (453 to 567 gm.).

Effort applied at rim of steering wheel.

Rocking Shaft Bearings Pre-load — to set

The setting of the rocking shaft bearings pre-load should be carried out before the oil seal is placed in the rocking shaft housing.

Bolt the lower cover on the rocking shaft housing with the adjusting washer in position and tighten the three setscrews; a new gasket should be used between the joint faces.

Place the lower tapered roller bearing and rocking shaft in position. Place the tapered roller bearing on the upper face of the rocking shaft. Fit a new gasket and the top cover, align the markings and tighten down the six setscrews evenly.

Fit the pendulum lever to the rocking shaft in the marked position, tightening the nut just sufficiently to hold the lever firmly in position. The rocking shaft must be in a vertical position during the pre-load setting, as shown in Figure N22. Ensure that the outer taper races are pressed right home and rotate the rocking shaft to ensure correct seating of the taper rollers; check the pre-load, using the method given below.

Attach a suitably calibrated spring balance to the pendulum lever eye and note the pull required to move the rocking shaft through an arc of approximately 92 deg.; this arc represents the rotation of the shaft required to move the steering geometry from lock to lock.

A pre-load of 6 to 10 oz. (170 to 283 gm.) is permissible for both new and used parts.

Should the pre-load be lower than that required, a thicker adjusting washer should be fitted; if the pre-load is higher, a thinner adjusting washer should be fitted. Adjusting washers are provided in a range of thicknesses (see Spares Schedule).

When an alteration to pre-load is required, it can be calculated by assuming that a difference of 0·001 in. (0·025 mm.) in the thickness of the adjusting washer will alter the pre-load by approximately 8 oz. (227 gm.).

On completion of the pre-load operation, remove the pendulum lever, top cover, gasket and bearing. Withdraw the rocking shaft and remove the lower cover, taking care not to misplace the adjusting washer. Fit a new oil seal into the cover and fit the cover complete with the oil seal, adjusting washer and outer race.

Spool Valve

On dismantling the spool valve and steering box it will have been noted that there are five adjusting washers. Those at the lower and upper ends of the cam are etched '1C' and '2C' respectively. Similarly the adjusting washers and seatings at the lower and upper ends of the valve housing are etched '3V' and '4V' respectively. The distance washer at the top of the cam tube is etched 'No. 5'. It is essential that these are re-assembled in the correct order (see Fig. N25).

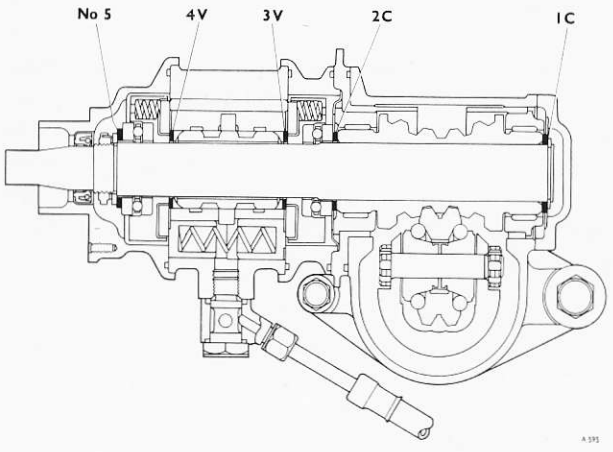


Fig. N25 Position of adjusting washers

If the cam requires renewal, it will be necessary also to renew the cam tube as these parts are supplied as an assembly.

Before re-assembly, ensure that all parts are perfectly clean and lubricated with approved automatic transmission fluid.

Fit a new sealing ring onto the plug, insert the plug in the end of the cam tube and secure it with a circlip.

Place the '1C' adjusting washer on the cam tube and retain it with the circlip; the thickness of this washer should be zero to 0·001 in. (0·025 mm.) less than the gap between the end of the cam and the circlip.

Fit the top needle roller race into the adjusting sleeve and insert the needle rollers, retaining them with Retinax 'A' grease.

Place the cam tube into the adjusting sleeve and insert the assembly into the steering box noting that the large cut out in the adjusting sleeve should face towards the rocking shaft; fit a new sealing ring between the steering box casing and the adjusting sleeve.

Fit the needle rollers into the bottom race, retaining them with Retinax 'A' grease. Insert the bearing into the adjusting sleeve, fit a new gasket and secure the end cover, tightening the nuts evenly.

Fit the rocking shaft, gasket and top cover.

Position the retaining disc on the adjusting sleeve and fit the '2C' adjusting washer. If this washer is worn or if the cam assembly has been renewed, it will be necessary to select a new adjusting washer.

The '2C' washer affects the positioning of the 'tight-spot' due to the mesh between the steering cam and roller, and can only be selected after the steering gear has been completely assembled as follows.

After fitting any '2C' adjusting washer, fit the thrust race, secondary spring housing, secondary springs and thrust washer onto the cam tube.

Fit the distance piece complete with new sealing rings.

Check the fit of the spool valve in the valve housing. The spool valve must not drop through the housing under its own weight, but should require a weight of not more than 8 oz. (227 gm.) to force it through the housing.

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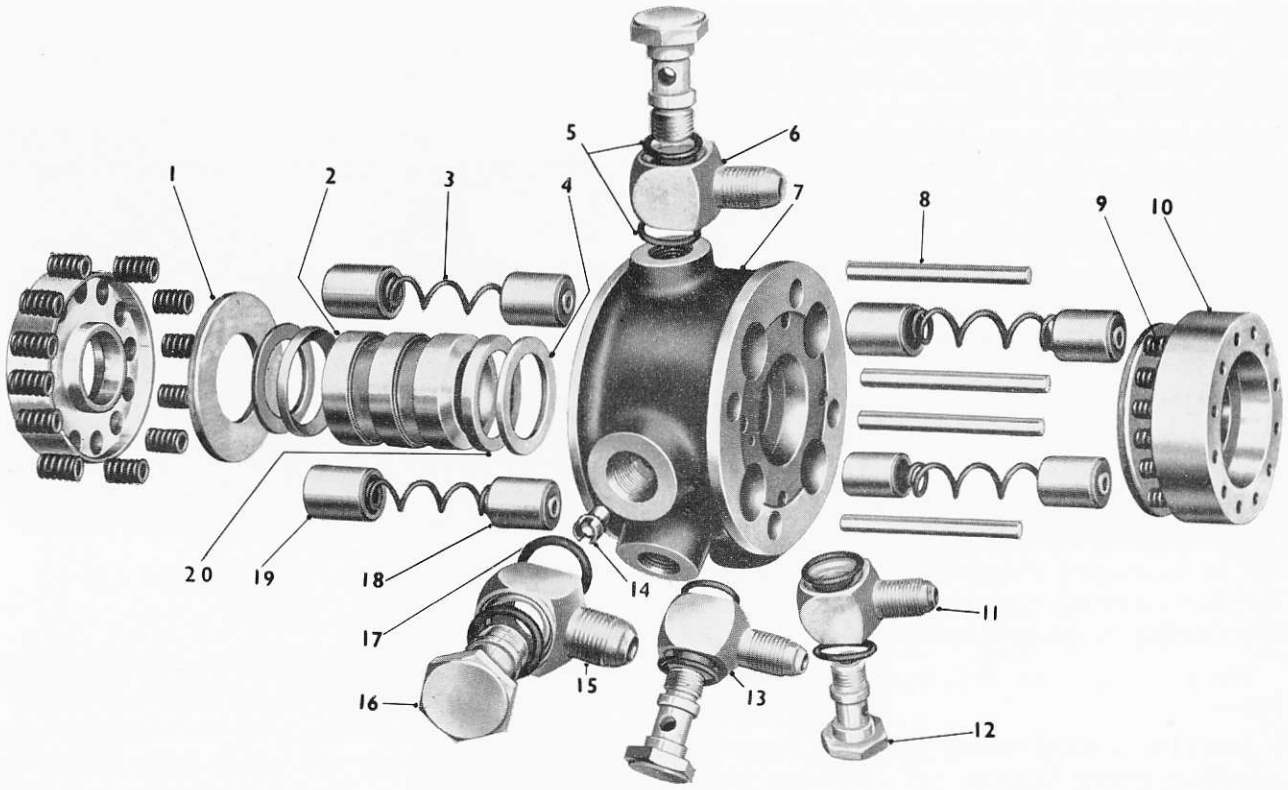


Fig. N26 Spool valve details

1. THRUST WASHER
2. SPOOL VALVE
3. PRIMARY SPRING
4. ADJUSTING WASHER
5. SEALING RING
6. BANJO — PIPE TO PISTON END OF CYLINDER
7. SPOOL VALVE HOUSING
8. SPACING PIN
9. SECONDARY SPRING
10. SECONDARY SPRING HOUSING
11. BANJO — PIPE TO PIVOT END OF CYLINDER
12. BANJO BOLT
13. BANJO — PRESSURE FROM PUMP
14. NON-RETURN VALVE
15. BANJO — RETURN TO RESERVOIR
16. BANJO BOLT
17. SEALING RING
18. REACTION PLUNGER
19. REACTION PLUNGER
20. SPHERICAL WASHER

Assemble the valve housing, fitting the spool valve, spherical washers and '3V' and '4V' adjusting washers. Insert the reaction plungers, four primary springs and four spacing pins into the valve housing. The spacing pins should be 0·0005 to 0·001 in. (0·013 to 0·025 mm.) longer than the valve housing.

Fit the complete valve housing assembly onto the steering box, taking care that the '3V' adjusting washer does not drop out of the valve housing. Fit a new sealing ring on the valve housing.

Fit the thrust washer, secondary springs and housings, thrust race, a 'No. 5' adjusting washer of maximum thickness, key washer and tab washer and tighten the slotted nut; do not lock the nut at this stage. To prevent the cam tube from turning when tightening the slotted nut, fit the coupling dog onto the cam tube and place an aluminium bar through the jaws. Remove the coupling dog.

Renew the oil seal in the housing, fit the housing onto the steering box studs and tighten the nuts.

Fit the coupling dog onto the cam tube, fit the bolt and washer then tighten the bolt.

Fit the inner steering tube, the outer steering tube and steering wheel; do not tighten the steering wheel retaining nut.

To check whether the correct '2C' adjusting washer has been fitted, find the 'tight-spot' in the steering gear; this should be when the steering wheel is in the straight ahead or central position. Using a dial test indicator on the pendulum lever, the 'tight-spot' may be found by obtaining an equal amount of slack, measured at the two minimum positions. These positions are approximately one turn away from the centre position in each direction; it must be stressed that these minimum positions must be found by experiment and are not exactly one turn away from the centre position.

If the 'tight-spot' is to the right of the central position a thinner '2C' adjusting washer must be fitted **on left-hand drive cars,** and a thicker '2C' adjusting washer fitted **on right-hand drive cars.**

After selecting the correct '2C' adjusting washer it will be necessary to dismantle the assembly down to the '2C' adjusting washer in order to check the cross-loading on the spool valve.

The spool valve cross-loading may be checked as follows.

Assemble in the following order the thrust race, secondary spring housing, '3V' adjusting washer, spherical washer, spool valve, second spherical washer, '4V' adjusting washer, secondary spring housing and the thrust race. Fit the correct size 'No. 5' adjusting washer, key washer, tab washer and tighten the slotted nut.

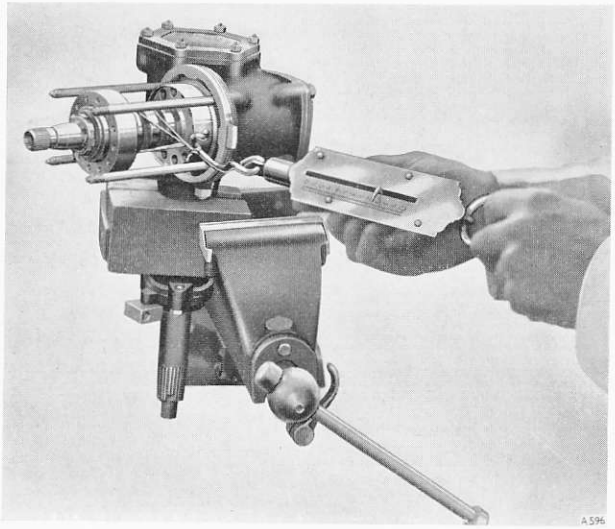


Fig. N27 Checking cross-load on spool valve

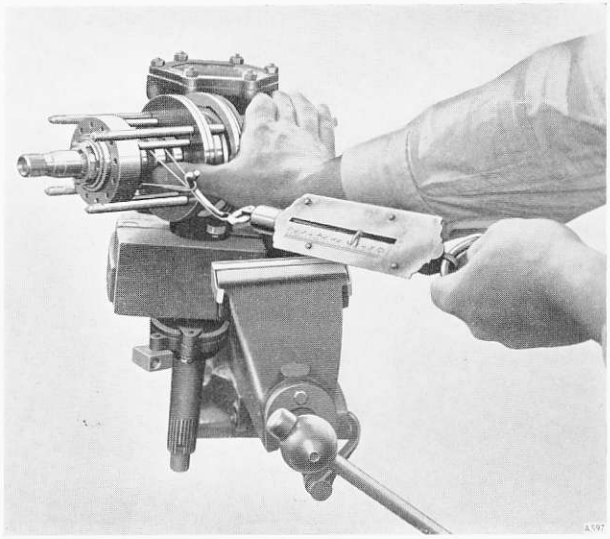


Fig. N28 Re-checking cross-load on spool valve

Check the cross-loading required to move the spool valve as shown in Figure N27, this should be between 1 to 3 lb. (0·453 to 1·36 kg.). If this loading is not obtained, the spherical radii of the spool valve, the bronze seatings and adjusting washers should be examined for wear. If signs of wear are apparent it will be necessary to renew the spool valve assembly.

Should the cross-loading be correct, a further check should be made by assembling the cam tube as stated above, together with the twenty-four secondary springs, two thrust washers and four spacing pins. The spacing pins must be located by means of a suitable jig, i.e. two locating plates (RH.643). Ensure that the cross-loading required to move the spool valve does not decrease; it must not increase by more than 1 lb. (0·453 kg.).

Should the cross-loading increase, the length of the spacing pins should be checked and renewed if they are not at least 0·0005 in. (0·013 mm.) longer than the valve housing. The distance between the outer diameter of 'No. 3V' and '4V' bearing housings should be 2·416 + 0·004 in. (6·136 + 0·01 cm.).

Check that the spool valve can tilt in the spherical seatings and will not 'ride' up the seatings and jam on the spherical washers. Incorrect action will necessitate renewal of the assembly.

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New spool valve assemblies as supplied consist of the valve housing, spool valve, primary springs and plungers, spacing pins, spherical and adjusting washers.

These units have been rig tested and the adjusting washers have been carefully selected to give the correct centralisation of the valve in the valve housing; it is essential that these components are kept as a unit.

If a new spool valve assembly is fitted, it will be necessary to select a new 'No. 5' adjusting washer to obtain the required cross-loading of 1 to 3 lb. (0·453 to 1·36 kg.) when the slotted nut is tightened onto the shoulder of the cam tube.

Adjusting Cam to Roller Mesh

The steering column should be assembled as previously described, ensuring that the slotted nut on the cam tube and the steering wheel retaining nut are tightened and locked.

Fit the pendulum lever in the position marked when dismantling but do not tighten the locking nut at this stage; it is necessary to remove the lever at a later stage in order to install the steering assembly.

It is then necessary to adjust the cam-to-roller mesh as follows.

Centralise the cam and roller by turning the steering wheel to the straight ahead position.

Release the four nuts securing the eccentric adjusting sleeve and rotate the sleeve by means of the lug provided, until the backlash is just eliminated; a forward and backward movement of the pendulum lever by hand, will indicate when this point is reached. Turning the eccentric sleeve anti-clockwise **on right-hand drive cars** or clockwise **on left-hand drive cars** when viewed from the steering wheel end, moves the cam closer to the roller and so reduces the mesh.

After setting the cam-to-roller mesh, tighten the four nuts securing the eccentric sleeve.

When the mesh is correctly adjusted, the effort applied at the rim of the steering wheel should be 16 to 20 oz. (453 to 567 gm.) with the steering in the straight ahead position.

Remove the pendulum lever and fit an oil resisting rubber sleeve onto the rocking shaft to prevent contact between the coiled oil line and the rocking shaft. Fit the coiled oil line.

To assemble the remaining parts reverse the procedure for removal, noting the following points.

To prevent occasional squeaking when rotating the steering wheel, the horn earth return brush and slip ring should be lubricated with a good quality grease. It is permissible to chamfer the edge of the brush if the squeaking persists.

Fit the steering gear assembly, reversing the procedure for removal.

Fill and prime the system with the approved automatic transmission fluid as described in Section N2 and check for leaks.

SECTION N7 — STEERING COLUMN AND STEERING BOX — S2 CARS

Servicing

Every 20,000 miles (32,000 kilometres) it will be necessary to adjust the oil level in the transfer gearbox. Remove the filler plug and the oil level plug. The filler plug is positioned on top of the driven gear casing; the oil level plug is positioned at the front of the driving gear casing, adjacent to the eccentric adjuster. If necessary, the transfer gearbox should be topped-up with the approved oil to the edge of the oil level hole. Fit the filler and level plugs.

A detectable click, occurring when the steering wheel is turned rapidly prior to the system warming-up, may be caused by backlash in the transfer gears. To set the backlash, release the lock-nut on the eccentric adjuster fitted at the front of the driving gear casing and rotate the shaft to obtain zero backlash. Tighten the lock-nut.

The cam and roller assembly is lubricated together with the valves etc., under pressure from the oil pump.

The oil pump reservoir should be topped-up as necessary with the approved automatic transmission fluid as described in Section N2.

Steering Column — to remove

It is possible to remove the steering column without disturbing the steering box, the division taking place between the transfer gearbox and the valve housing adaptor joint.

Disconnect the battery leads.

Remove the front seat and carpet, then remove the setscrews securing the insulating panel and gas seal plate to the bulkhead. Remove the brake fluid pipe clip attached to one of the setscrews securing the insulating panel.

Remove the foot brake pedal from the brake pedal lever and slide the insulator panel, together with the gas seal plate, along the steering column.

Disconnect the horn and earthing wires situated midway along the steering column.

Disconnect the ride control and flasher indicator wires at the junctions behind the facia panel.

Disconnect the micro-switch wires.

Unscrew and remove the pinch bolt and nut from the gear operating lever at the lower end of the control rod.

Remove the two screws which secure the ride control switch to the steering column.

Unscrew the two Allen screws securing the gear range quadrant to the steering column. Remove the quadrant and withdraw the control rod from the operating lever. Remove the control rod from the steering column, taking care not to misplace the locating key fitted at the lower end of the control rod.

Unscrew and remove the four setscrews and washers securing the transfer gear casing to the valve housing adaptor. Place a container beneath the transfer gear casing to collect the oil which will drain from it.

Support the steering column while removing the two Allen screws from the column support bracket. Withdraw the steering column from the car, through the front door, taking great care not to damage or stain the upholstery or mark the enamelled outer tube.

Steering Box — to remove

The steering box may be removed without removing the steering column, as follows:

Disconnect the battery leads.

Apply the hand brake and jack up the car, positioning the jack under the front pan. Care should be taken when positioning the jack to avoid contact with the power cylinder or its support bracket.

Remove the driver's side front wheel and the valance plate panel to gain access to the steering box.

On right-hand drive cars, it is necessary also to remove the undersheet on the right-hand side of the car.

Remove the nut, lock-washer and plain washer securing the pendulum lever to the splined end of the rocking shaft. Mark the position of the pendulum lever in relation to the rocking shaft to assist in re-assembly, then withdraw the pendulum lever using extractor tool RH.321.

On left-hand drive cars, if difficulty is experienced in fitting the extractor tool owing to the lack of space between the end of the rocking shaft and the engine exhaust pipe, the pendulum lever should be withdrawn when the steering box mountings have been removed.

Disconnect the oil pipes from the spool valve housing and mask the ends to prevent oil leakage and dirt entering.

Remove the four setscrews and washers securing the transfer gear casing to the valve housing adaptor. Place a container beneath the transfer gear casing to collect the oil which will drain from it.

On right-hand drive cars, slacken the two Allen screws securing the steering column clamp to the bracket on the facia, lift the steering column assembly about one inch and re-tighten the two screws.

Remove the nut, bolt and washers securing the steering box mounting arm to the bracket on the chassis frame.

Support the steering box and remove the four setscrews, washers and two mounting brackets securing the mounting tube in position on the chassis frame. Carefully remove the steering box and screw the rocking shaft nut on the end of the rocking shaft to prevent accidental damage to the threads.

Steering Column — to dismantle

Remove the three screws retaining the horn push plate assembly to the steering wheel. Disconnect

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the horn wire snap connector and withdraw the assembly. Unlock and remove the steering wheel retaining nut and the tab washer.

A scribed line or centre punch dot should be used to mark the wheel hub position in relation to the shaft for convenient assembly.

Replace the nut loosely to prevent damage to the threaded end of the tube.

Using Special Tool RH.593 in conjunction with the pressure pad RH.7271, withdraw the steering wheel; care should be taken not to trap the horn wire between the steering tube and the extractor.

Remove the extractor and the retaining nut and lift off the steering wheel.

Unscrew and remove the two nuts and washers at the base of the column and withdraw the column from the transfer gear casing. Remove the indicator cancelling ring from the top of the inner tube, first marking its position in relation to the tube. Remove the inner steering tube.

Mark the position of the transfer gear in relation to the tube. The rubber coupling can be removed from the inner tube by detaching the snap ring; draw off the transfer gear and coupling.

Examine the bearings in the driving transfer gear and renew if necessary; these are a light push fit in the gear.

Outer Steering Tube Bush — to renew

The outer steering tube is fitted with an Oilite bush which is pressed into the housing at the upper end of the tube. This can be removed either by tapping it out from the lower end using a suitable drift or by cutting a thread in the bush and pulling it out from the top.

The new Oilite bush is pressed into the outer steering tube until the leading edge abuts the end of the counterbore.

Steering Column — to assemble

Using a new rubber coupling at the end of the inner steering tube, assemble the transfer gear to the inner tube and secure with the snap ring. Fit the inner tube into the column and replace the indicator cancelling ring.

The steering wheel can then be replaced, using a careful reversal of the dismantling procedure.

Steering Box — to dismantle

Clamp the steering box in a vice, holding it by the mounting tube.

Unscrew and remove the six nuts from the top of the steering box and remove the cover.

Mask the splines on the end of the rocking shaft and withdraw the shaft by hand. A small quantity of oil may still be present in the steering box at this time and a suitable container should be placed beneath the box to collect this.

Remove the three setscrews from the lower bearing housing and remove the housing.

Remove the setscrew and washer securing the driven transfer gear in position. Mark the position of the driven gear to the shaft, then, using extractor RH.7226, draw off the gear.

Remove the adaptor from the shaft and tap out the oil seal.

Remove the cam tube as follows:

Unlock and remove the nut, tab washer, slotted washer and distance washer from the tube. Remove the two thrust races, thrust bearing, secondary spring housing and large thrust washer.

Note: When removing the secondary springs or housings, or any part of the spool valve assembly, mark all parts to ensure that they are refitted in their previous positions; this is important.

Remove the nuts and washers from the studs securing the spool valve housing to the steering box.

Remove the housing from the steering box and dismantle and collect all associated parts. Remove the two adjusting washers, two spherical washers and the spool valve from the tube.

Remove the large thrust washer, secondary spring housing, two thrust races, thrust bearing, adjusting washer and bearing retaining disc.

Unscrew the nuts and washers securing the end cover to the steering box; remove the cover.

Remove the circlip and adjusting washer then, using a mallet, tap out the shaft, together with the end needle roller bearing. Tap out the remaining

needle roller bearing from the steering box, using a mallet and suitable drift. Remove the cam tube assembly.

Dismantle the spool valve housing, taking particular note of the positions of the reaction plungers.

Steering Box — to inspect

Examine the cam and cam follower for signs of wear and pitting; if damage is evident, replacement parts should be fitted. It should be noted however that the cam is supplied only as a complete assembly with the tube due to the difficulty in pressing the new cam accurately into position.

Inspect all bearings for pitting or wear and renew where necessary.

Examine the spool valve and housing for signs of wear or damage. Check the fit of the spool valve in its housing. The spool valve must not drop through

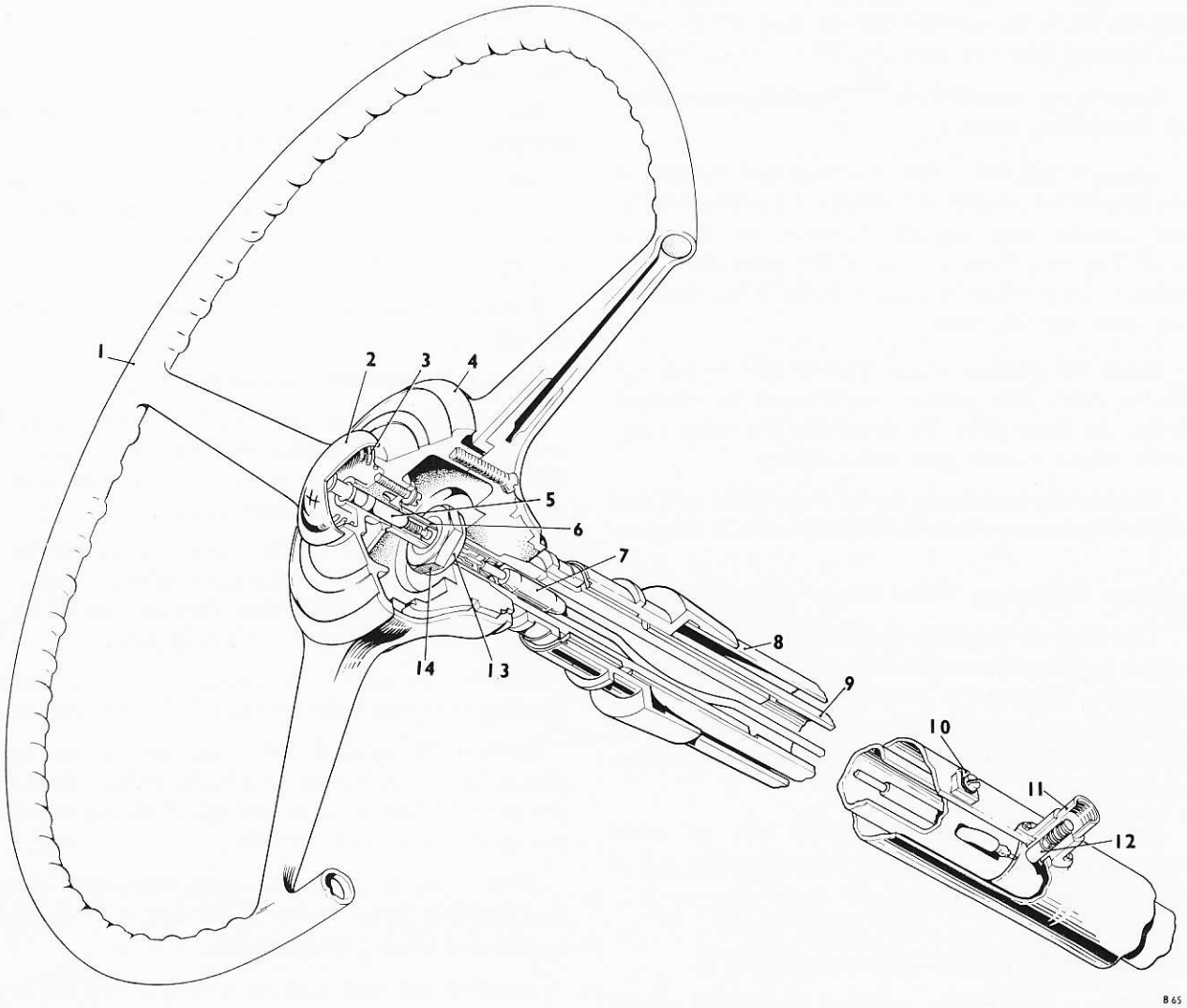


Fig. N29 Cut-away view of steering column

1. STEERING WHEEL
2. HORN BUTTON
3. SPRING
4. HORN BUTTON HOUSING
5. INSULATOR
6. HOUSING
7. SNAP CONNECTOR
8. OUTER STEERING TUBE
9. INNER STEERING TUBE
10. EARTH CONTACT
11. HORN CONTACT BRUSH HOUSING
12. HORN CONTACT BRUSH
13. LOCK-WASHER
14. NUT

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the housing under its own weight, but should require a weight of not more than 8 oz. (227 gm.) to force it through the housing.

Check the washers '3V' and '4V' for wear by assembling them onto the spool valve; the total length of the assembly should be exactly equal to that of the valve housing.

Cam Roller Assembly — to renew

To dismantle the rocking shaft assembly, remove the slotted nut by splitting it with a cold chisel. File the end of the bolt to prevent damaging the locating hole, and tap out the bolt with a drift; collect all the parts.

Before the new cam roller assembly is fitted into the rocking shaft, it will be necessary to determine the thickness of the adjusting washer by the following method.

Insert a new bolt into the bore of the replacement roller assembly and add a distance piece or sufficient flat washers to bring the inner races into contact when the nut is tightened to a torque loading of 60 to 70 lb.ft. (8·3 to 9·6 kg.m.). The distance piece or washers should be a close fit on the bolt and the faces parallel and square to the bore. When the inner races are in contact, the roller has a pre-load of 2 to 5 oz. at a 4 in. radius (56 to 141 gm. at a 10 cm. radius); this pre-load is determined in manufacture and is not adjustable.

A measurement should then be taken of the overall width of the roller assembly inner races; this measurement should be 1·446 — 0·008 in. (36·72 — 0·203 mm.).

The width across the inner machined faces of the rocking shaft jaw is 1·495 + 0·005 in. (37·97 + 0·127 mm.) and should be checked to obtain the actual dimension.

The difference between the two measurements should be noted and two equal or near-equal adjusting washers selected to total this dimension.

Remove the nut and distance piece or flat washers from the roller assembly, then install the roller assembly and adjusting washers between the rocking shaft jaws; the adjusting washers should be placed one in either side of the roller. A 'G' clamp may be used to grip the roller assembly in order to facilitate entry into the jaws.

If adjusting washers of the correct thickness have been selected, it will be noted that a good hard push will be necessary to position the roller assembly in the rocking shaft.

Insert the new bolt and tighten the nut in position using two spanners RH.640.

Note: It is most important that measurement of the shaft jaw and roller assembly and choice of the adjusting washers be accurate; if the adjusting washers are too thin, the outer edges of the jaw will close up when the nut is tightened, resulting in misalignment of the taper rollers.

The adjusting washers are supplied in thicknesses of 0·022 to 0·027 in. (0·558 to 0·686 mm.).

Finally, peen over the end of the bolt.

Steering Box — to assemble

Setting the rocking shaft bearings pre-load

Having removed the oil seals from the bearing housings, fit the lower housing and pre-load adjusting washer in position, setting the pointer mid-way along the scale engraved on the mounting arm.

Place the taper roller bearing in position and insert the rocking shaft. Place the upper taper roller bearing in position on the top of the rocking shaft. Fit the top cover, setting the pointer mid-way between the divisions on the top of the steering box.

The rocking shaft should be moved several times in each direction, to ensure that the rollers are in contact with the thrust faces on the inner races, before attempting to measure the pre-load.

Adjust the pre-load of the rocking shaft bearings to between 6 and 10 oz. (170 and 280 gm.) measured at the end of the pendulum lever. A thicker adjusting washer should be fitted if the pre-load is below the stated value or the adjusting washer ground if the pre-load is above that stated.

It should be noted when grinding the washer that 0·001 in. (0·025 mm.) reduction in thickness will reduce the pre-load by 8 oz. (226 gm.).

Remove the cap from the housing and remove the rocking shaft, also the lower cover, adjusting washer and bearing, taking care not to misplace the adjusting washer.

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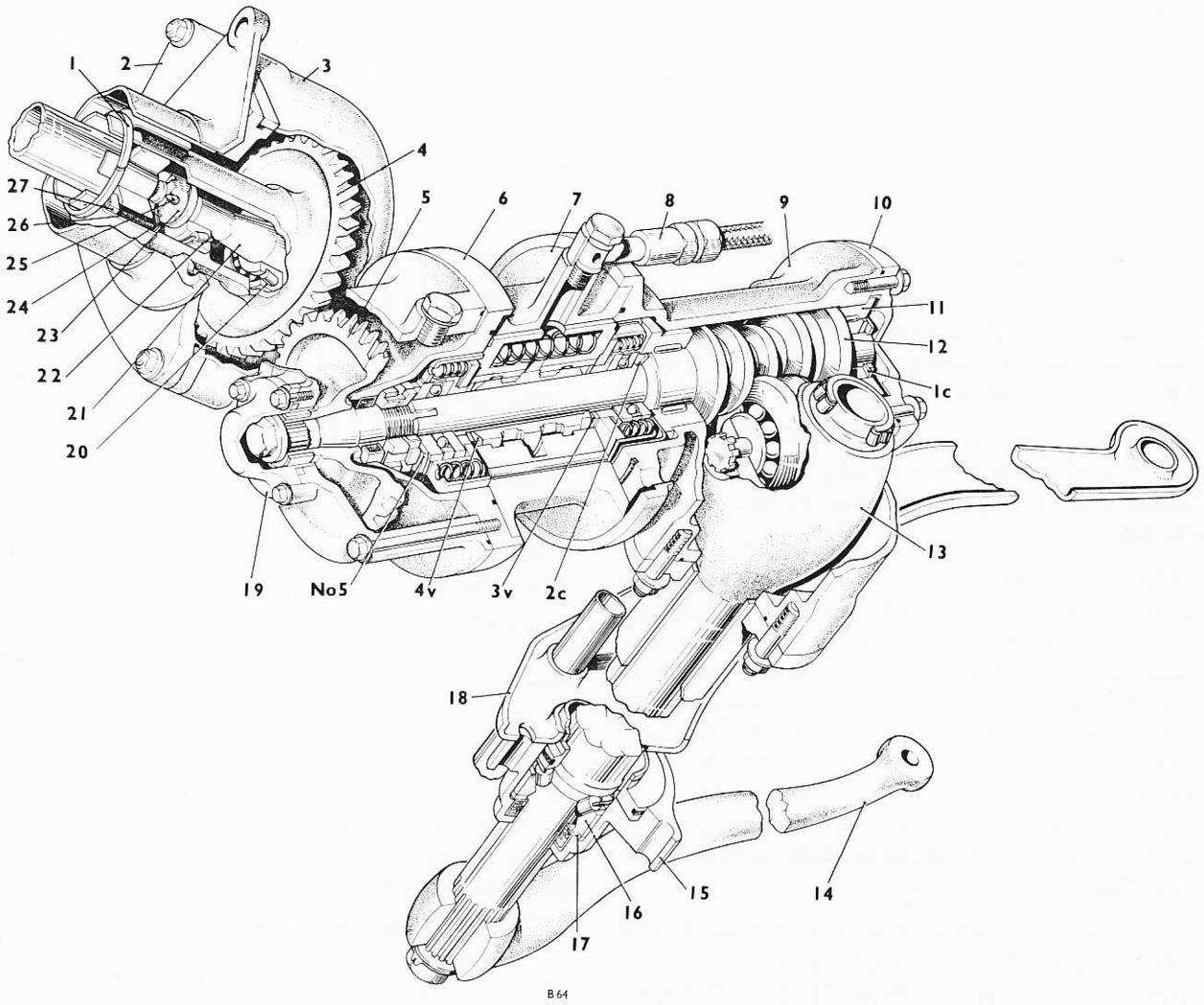


Fig. N30 Cut-away view of transfer box and steering box

1. SNAP RING
2. TOP COVER
3. TRANSFER GEAR CASING
4. DRIVING GEAR
5. DRIVEN GEAR
6. ADAPTOR VALVE HOUSING
7. SPOOL VALVE HOUSING
8. ADAPTOR
9. STEERING BOX
10. END COVER
11. OUTER RACE
12. STEERING CAM
13. ROCKING SHAFT
14. PENDULUM LEVER
15. BEARING HOUSING
16. OUTER RACE
17. ADJUSTING WASHER
18. MOUNTING ARM
19. BEARING HOUSING
20. BEARING
21. ECCENTRIC PIN
22. BEARING
23. NUT
24. DISTANCE PIECE
25. SPLIT PIN
26. COUPLING
27. DISTANCE PIECE

1C. LOWER CAM ADJUSTING WASHER

2C. UPPER CAM ADJUSTING WASHER

3V. LOWER SPOOL VALVE ADJUSTING WASHER

4V. UPPER SPOOL VALVE ADJUSTING WASHER

No. 5. SPOOL VALVE CROSS-LOAD ADJUSTING WASHER

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If the old cam is considered suitable for replacement then a new oil seal should be fitted onto the plug in the end of the cam tube. This can be done by removing the circlip from the inside of the tube and pushing out the bung with a suitable piece of bar, from the splined end of the shaft.

When a part bearing an etched number is to be renewed due to either wear or re-adjustment, the number should be etched on the new part.

Select a '1C' adjusting washer and secure it to the end of the cam tube with its circlip; if necessary, grind the washer to give a clearance of zero to 0·001 in. (0·025 mm.) between the circlip and the cam.

Place needle roller race No. 11 (see Fig. N30) into position and insert the needle rollers, retaining them with Retinax 'A' grease. Place the cam in position in the bearing.

Insert the needle rollers into the opposing race, retaining them with Retinax 'A' grease. Place the bearing on the end of the cam tube and push it into position.

Place a new sealing ring in the annular groove in the cover and secure the cover to the steering box with four nuts.

Fit new oil seals in the bottom and top covers and assemble the rocking shaft into position as previously described.

Insert the pressed steel retaining plate into the housing.

Place a '2C' washer in position on the steering tube.

Position the '2C' thrust bearing on the shaft, followed by the bearing housing, secondary springs and thrust washer.

Measure the overall length of the spool valve, the two spherical seats and the '3V' and '4V' washers. This should be exactly equal to the length of the valve housing.

If either the housing or valve is worn, a new unit must be fitted.

Replacement spool valve units as supplied, consist of the valve housing, primary springs and plungers, spacing pins, valve, seating and adjusting washers.

These units have been rig tested and the adjusting washers carefully selected to give the correct centralisation of the valve in the housing. It is essential therefore that these parts be retained as a unit.

Fit the non-return valve to the spool valve housing.

Assemble the spool valve, lightly oiling the parts with automatic transmission fluid. The end of the valve marked '3V' should be placed at the same end as the small plungers in the housing.

Insert the eight reaction plungers together with the four springs and spacing pins. Check that the four pins are 0·0005 to 0·001 in. (0·013 to 0·025 mm.) longer than the housing.

Fit onto the spool valve the spherical and plain washers marked '3V', retaining them with Retinax 'A' grease. Assemble the spool valve and components into the housing and tighten the nuts.

Fit the spherical and plain washers marked '4V' onto the back of the spool valve.

Assemble the secondary springs into the spring housing and add the thrust washer. Fit the assembly to the housing complete with the '4V' thrust bearing.

Fit a 'No. 5' washer of maximum thickness, followed by the key washer, lock-washer and nut. Tighten the nut with spanner RH.641, holding the cam tube with tool RH.642.

Press the oil seal into the valve housing adaptor. Position the adaptor on the cam tube together with its sealing ring; secure the cover with four bolts.

It will now be necessary to check that the '2C' washer thickness is correct.

Number '2C' washer controls the position of the 'tight-spot' due to the mesh of the steering cam and roller and can only be selected when the box is completely assembled.

The 'tight-spot' should occur when the steering wheel is in the straight ahead position and should be adjusted as follows:

Fit spanner RH.642 on the rearward end of the cam tube. Rotate the cam tube to establish the straight ahead position of the cam. Rotate the cam (using spanner RH.642) approximately one complete revolution from the straight ahead position.

Measure the free movement of the pendulum lever using a dial test indicator.

Repeat the procedure with the wheel turned in the opposite direction.

The side on which the check reveals the least free movement is the side to which the 'tight-spot' has moved.

On right-hand drive cars, if the 'tight-spot' is to the right of the straight ahead position, it will be necessary to fit a '2C' washer of increased thickness; if the 'tight-spot' is to the left, the washer thickness must be reduced.

On left-hand drive cars, if the 'tight-spot' is to the left of the straight ahead position, a '2C' washer of increased thickness must be fitted; if the 'tight-spot' is to the right, the washer thickness must be reduced.

The steering box should be dismantled and the washer thickness adjusted until the 'tight-spot' occurs in the straight ahead position.

When the correct size '2C' washer has been determined, the 'No. 5' washer should be selected as follows:

The adaptor plate and spool valve housing should be removed, leaving on the cam tube the following pieces: the '2C' washer, the thrust race, secondary spring housing, '3V' adjusting washer and spherical washer, the spool valve, and the '4V' spherical washer, adjusting washer, secondary spring housing and thrust race.

Select a 'No. 5' adjusting washer which requires the application of a cross-load of 1 to 3 lb. (0·45 to 1·4 kg.) to move the spool valve (see Fig. N27) when the nut is tightened onto its shoulder on the cam tube.

As a check it is then desirable to assemble the cam tube as above, but together with the twenty-four secondary springs, two thrust washers and four spacing pins. Locate the pins using Special Tool RH.7217. The cross-loading should not have increased when re-checked as shown in Figure N28. If an increase is revealed, the length of the pins should be checked, and the pins discarded if they are not 0·0005 to 0·001 in. (0·013 to 0·025 mm.) longer than the valve housing.

Re-assemble the steering box, using the correct washers; tighten the nut and lock the tab washer.

Adjust the mesh of the cam and cam follower by rotating the top and bottom covers. It should be noted that both covers should be rotated an equal amount to ensure correct alignment of the rocking shaft.

The mesh should be adjusted to give a pre-load of 6 oz. (170 gm.) at a radius of 8·5 in. (21·59 cm.) on the cam tube as the steering is rotated through the straight ahead position.

Fit the adaptor plate, using a new sealing ring.

Fit the transfer gear onto the cam tube (aligning the centre 'pop' marks where the original cam and gear are being refitted).

Note: The transfer gears are supplied in pairs and must not be separated.

Using Special Tool RH.7235 to hold the gear, tighten the securing bolt.

Fit the transfer gear casing, using a sealing ring, then secure the small bush housing in position, using four 2 B.A. nuts. Coat the transfer gear teeth with Retinax 'A' grease and assemble the steering column onto the steering box; ensure that the correlation marks on the transfer gear teeth are aligned.

Adjust the transfer gear mesh to obtain zero backlash by rotating the eccentric pin. The lock-nut must be tightened before making the check.

Re-check the radial load required at a radius of 8·5 in. (21·59 cm.) to turn the wheel; this should be 12 to 18 oz. (340 to 510 gm.) at the centre position and 6 to 12 oz. (170 to 340 gm.) off centre.

Steering Column and Box — to fit

Before fitting the assembly into the car, it will be necessary to separate the column from the steering box as described under 'Steering Column — to remove'.

Fit the steering box in the mounting bracket and clamp the mounting arm to the frame, using new rubber bushes if these show signs of deterioration.

Refit the steering column to the car, carefully reversing the procedure given for removal. Before clamping the column to the facia, slacken the four nuts which secure the valve housing to the steering box casting. It will then be possible to rotate the rear part of the steering box and column so that the outer steering tube is correctly aligned with the clamp under the facia. Re-tighten the nuts.

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When the column and steering box are in position, remove the transfer box level and filler plugs and add a quantity of the recommended lubricant until a flow is observed from the level plug hole. This will require approximately $\frac{5}{8}$ pint (0·355 litres).

Prime and fill the steering system as described in Section N2.

Thoroughly clean the chassis frame adjacent to the steering box, and road test the car to check for oil leaks.

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CHAPTER N

STEERING

SECTION N1 — DATA AND DESCRIPTION

Data
(Page N1 in Workshop Manual)

S3 cars only

Steering wheel diameter	17 in. (43·18 cm.)
Steering box gear ratio	18·7 : 1
Number of turns of steering wheel lock to lock	4¼

On S2 cars
(Page N3 in Workshop Manual)

For S3 cars the first paragraph to read

The connecting shaft at the lower end of the steering tube enters a rubber coupling: the coupling transmits steering wheel movement to a gear mounted on two taper roller bearings on an eccentric shaft in the transfer gearbox. The function of the transfer gearbox is to offset the drive from the lower end of the steering column to the steering box which is positioned outboard of the chassis sidemember. The cast iron casing contains two helical gears mounted on 3·758 in. (94·45 mm.) centres and having a gear ratio of 1 : 1. Splines in the bore of the driven transfer gear locate on splines at the rear end of the cam tube which carries the steering cam.

On S1 and S2 cars
(Page N 5 in Workshop Manual)

For S3 cars the first paragraph to read

The power assistance unit provides a variable proportion of assistance controlled by the effort required at the steering wheel. When maximum assistance is required for low speed manoeuvring, such as shunting or parking the car it is provided at full pump pressure automatically.

For S3 cars the following five paragraphs should be read in place of the sixth and seventh.

By axial movement of a spool valve in the housing situated between the transfer box and the steering box: causing annular grooves in the valve to communicate with passages in the spool valve housing which direct oil to the appropriate side of the hydraulic ram. Movement of the spool valve is effected by the reaction of a normal steering cam against the roller when the steering wheel is turned. The spool valve is normally held in the central or no load position by a disc spring washer at each end of the spool valve housing. Any load applied at the steering wheel rim is sufficient to displace the spool valve from the central position, thus causing oil to be directed to the appropriate side of the hydraulic ram.

The pressure at which oil is delivered is dependent upon the resistance encountered at the ram. As the resistance on the ram increases, the pump rapidly builds up pressure in the system until it is delivering at the maximum controlled pressure of approximately 750 lb/sq.in.

Figure N1 (S) of this Supplement shows the oil circulating diagram when the steering is in straight ahead or no load position. The delivery pressure from the pump is approximately 80 lb/sq.in. The pressure in the steering box is approximately 60 lb/sq.in. and the pressure of the return flow to the reservoir is approximately 5 lb/sq.in.

Figure N2 (S) of this Supplement shows the condition when commencing a normal right-hand turn on the open road. The assistance is automatically regulated by the load applied at the steering wheel rim and the position of the spool valve in the valve housing.

Figure N3 (S) of this Supplement shows the condition when parking on left-hand lock under very heavy load conditions. The spool valve is fully opened and the oil pressure has built up to the maximum allowed by the pump relief valve.

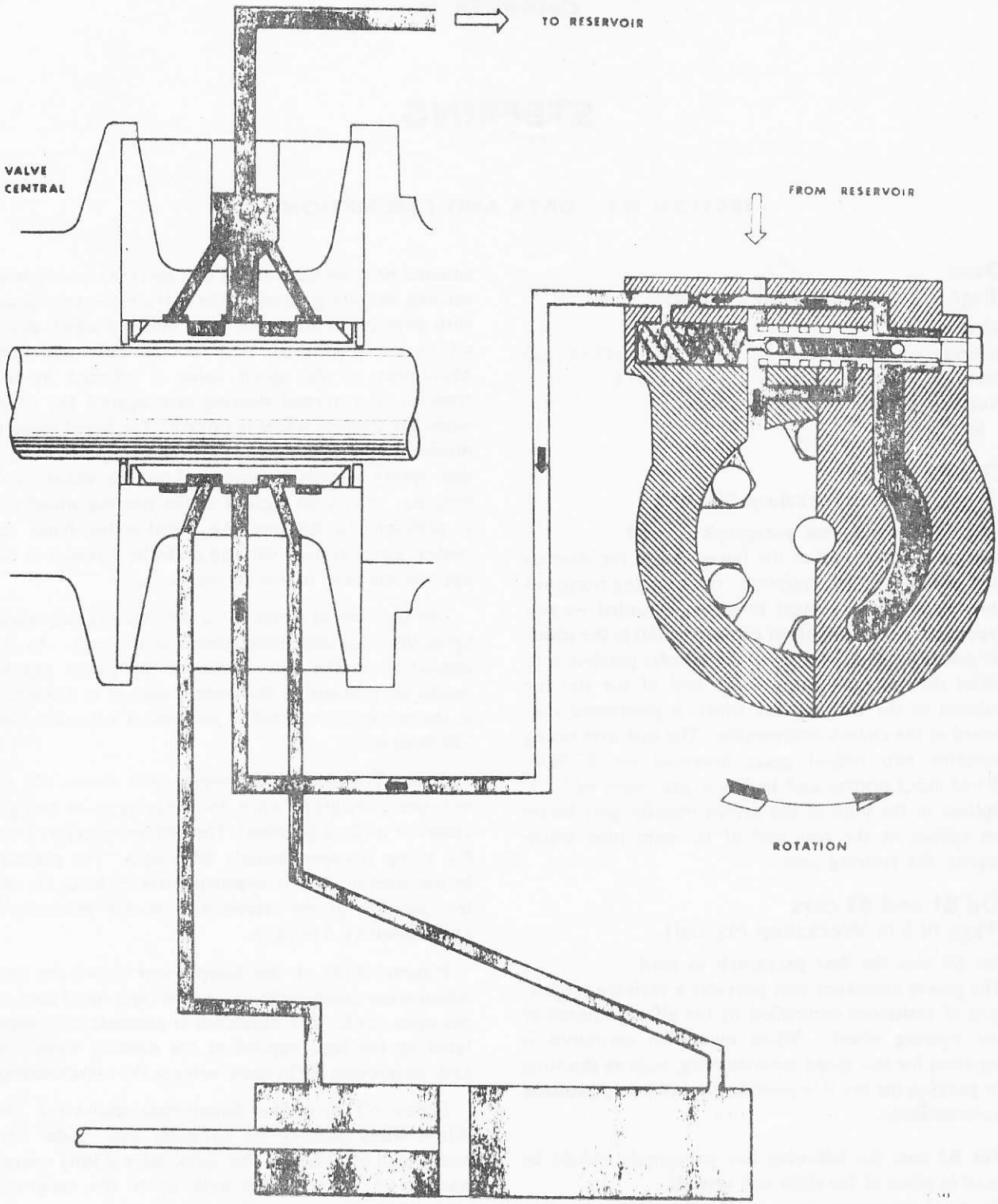


Fig. N1 (S) Circulation diagram – steering straight ahead conditions – no load

The flow control valve and pressure relief valve

On S3 cars the flow control valve is situated in a bore alongside the pump discharge port; its function is to control the flow of oil leaving the pump.

On leaving the pump the oil has to pass through a metering hole situated in the outlet port. As the speed of the pump increases the volume of oil which has to pass through the metering hole also increases, causing a pressure build up on the end of the flow control valve; this pressure forces the valve along the valve housing until it uncovers a by-pass port, which directs oil in excess of 1·4 gals. to 1·7 gals. (6·47 litres to 7·7 litres) per minute back to the inlet side of the pump.

When the pressure in the system exceeds approximately 750 lb/sq.in. (52·73 kg/sq.cm.) the relief valve inside the flow control valve is forced back, compressing its spring and uncovering a bore through which oil in excess of this pressure is returned to the inlet side of the pump.

SECTION N 2 — OIL PUMP — POWER ASSISTED STEERING

Description — S3 cars

Basically the power assisted steering pump consists of a ring of rollers axially disposed around a rotor which operates within a cam ring. The rotor, rollers and cam ring are mounted inside a split pump body, the rotor is keyed to a shaft which is driven by the engine. As soon as the rotor begins to revolve, centrifugal force causes the rollers to move outward into contact with the cam; this action forms a working chamber between the cam ring and the rotor, the roller acting as a seal between the two. As the pump rotates this working chamber increases and decreases in volume relative to the position of the cam and rotor. During the phase when the volume is increasing, oil is drawn into the pump from the reservoir via the inlet port. Further rotation of the pump results in a decrease in the volume of the working chamber and consequent pressurising of the oil in the chamber; thus oil is forced under pressure out into the discharge port of the pump and on into the system.

After passing through the system, the oil returns to the reservoir through the main filter. For technical reasons it is necessary to position the filter in the return flow to the reservoir and any foreign matter must find its way through the system before being filtered. The circulation of oil is maintained at a constant flow by the flow control valve described in 'The flow control valve and pressure relief valve' of this Supplement.

Servicing (Page N7 in Work-shop Manual)
Oil level — To check

S3 cars only

Every 6000 miles (10,000 Kms.), the oil level in the steering pump reservoir should be checked and if necessary topped-up with one of the recommended fluids until the level of the fluid is just above the top of the filter.

Note It is important that only clean oil should be used to top-up the steering pump reservoir.

Filter element — To renew
(Page N9 in Workshop Manual)

For S3 cars the first paragraph to read

The oil filter element must be changed every 24,000 miles (40,000 Kms.).

Priming and filling the system
(Page N9 in Workshop Manual)

S3 cars only

To ensure that the steering system operates smoothly and free from judder it is essential that all air is expelled from the system, it is therefore recommended that the following priming procedure is adhered to.

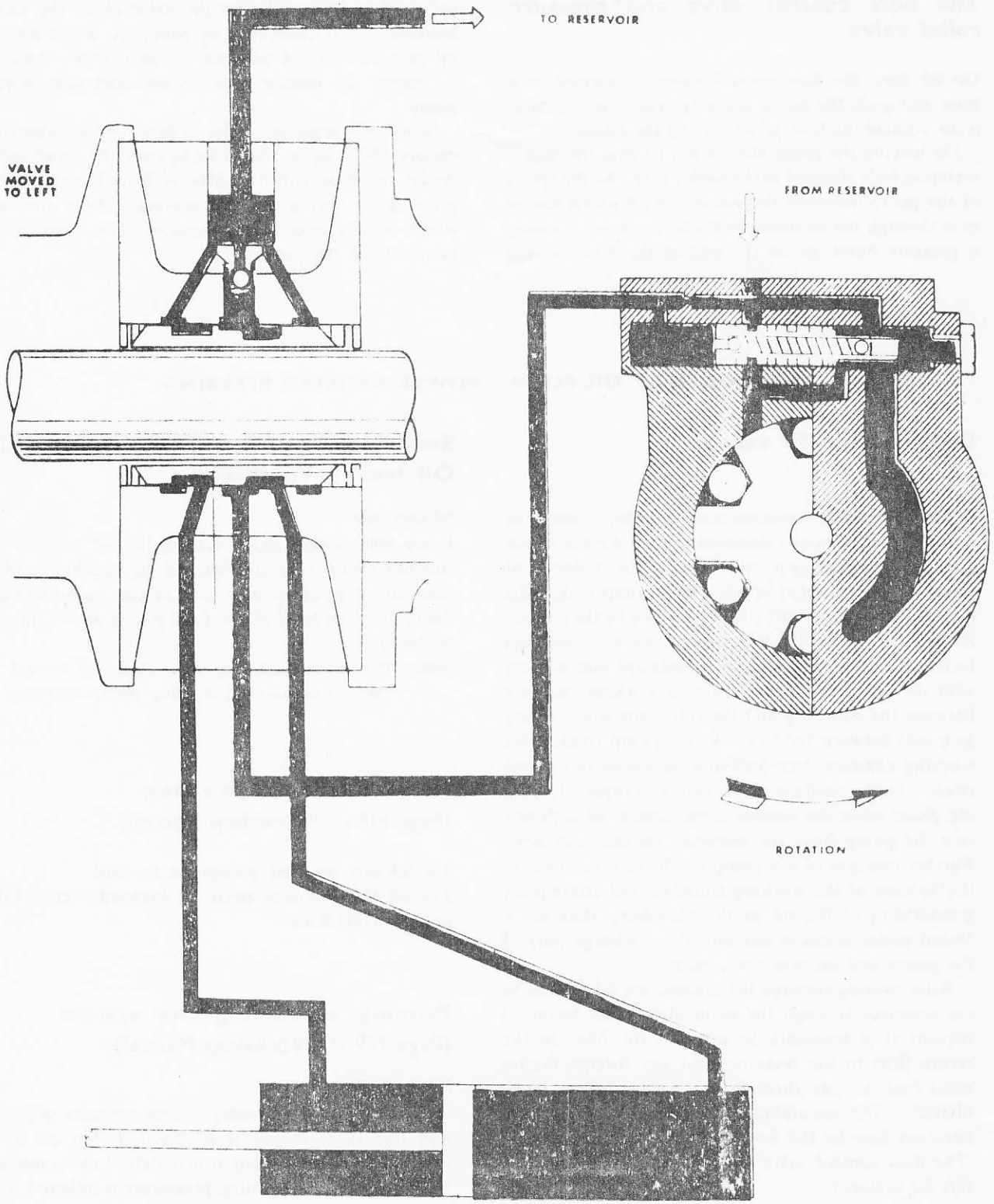


Fig. N2 (S) Circulation diagram—normal turning condition right-hand lock — light load

Fill the steering pump reservoir until the fluid is just above the top of the filter.

Start the engine and allow it to idle.

Set the steering system so that the piston in the hydraulic ram is in its most forward position, i.e. on right-hand drive cars the steering should be set on full left-hand lock; on left-hand drive cars the steering should be set on full right-hand lock.

Remove the protective cap, fit a bleed tube to the hydraulic ram bleeder nipple and insert the free end of the tube into a clean glass jar.

Unscrew the bleeder nipple sufficiently to allow fluid to pass into the jar.

During the previous operations the level of the fluid in the steering pump reservoir should be constantly checked and topped-up to the correct level.

Continue bleeding until air bubbles no longer issue from the bleed tube.

Tighten the bleeder nipple, remove the bleed tube and refit the protective cap.

Finally return the steering wheel to the central position and recheck the level of the fluid in the steering pump reservoir.

On later S3 cars a bleeder nipple is fitted also in the top of the rocking shaft bearing housing.

To bleed from this nipple carry out the same procedure as employed when bleeding the hydraulic ram, but with the steering wheel in the straight ahead position.

Oil pump — To test

To follow 'Oil pump — To remove'

(Page N9 in Workshop Manual)

If facilities exist it is advisable to test the pump to ensure that it is delivering the correct pressure and flow.

Test data

S3 cars only

Flow 1·4 gals. to 1·7 gals. (6·47 litres to 7·7 litres) per minute at 3000 (Pump) r.p.m.

Pressure 700 lb/sq.in. to 750 lb/sq.in. at 900 (Pump) r.p.m.

If the steering pump is not delivering the correct pressure and flow, ensure that the flow control valve is not sticking. If the flow control valve is found to be operating satisfactorily, it will be necessary to dismantle and inspect the pump.

Oil pump — To dismantle and inspect

(Page N10 in Workshop Manual)

For S3 cars the third paragraph onwards to read

For identification of detail components refer to Figure N4 (S) of this Supplement.

Remove the reservoir cover, lift off the spring and filter retaining washer and withdraw the filter.

Screw a $\frac{5}{16}$ in. UNF nut onto a $\frac{5}{16}$ in. UNF setscrew; screw the setscrew into the centre pedestal, tighten the nut and remove the pedestal.

If the previous method is not successful, a pair of grips may be used to remove the pedestal.

Remove the filter support plate.

Remove the setscrew and the $\frac{3}{4}$ in. UNF blanking plug, then withdraw the clamping plate (7). See Figure N4 (S) of this Supplement.

Lift off the reservoir body taking care not to misplace the rubber sealing rings and distance plate located beneath the body.

Withdraw the sleeve from the inlet port of the pump.

Remove the pump pulley, if necessary using a suitable extractor; take care not to misplace the Woodruff key.

Using an Allen key unscrew the six setscrews which secure the two halves of the pump body together.

Separate the pump from the cover and collect the sealing ring (14) shown in Figure N4 (S) of this Supplement.

Before removing the rotor, rollers and cam ring, **take note** of the direction in which the rotor is fitted.

Using a straight edge across the body of the pump, check with a feeler gauge, the end clearance of the rotor and rollers. This should be within the range 0·001 in. to 0·0018 in.

Remove the rotor, rollers and cam ring from the pump body, taking care not to misplace the rotor driving key from the shaft.

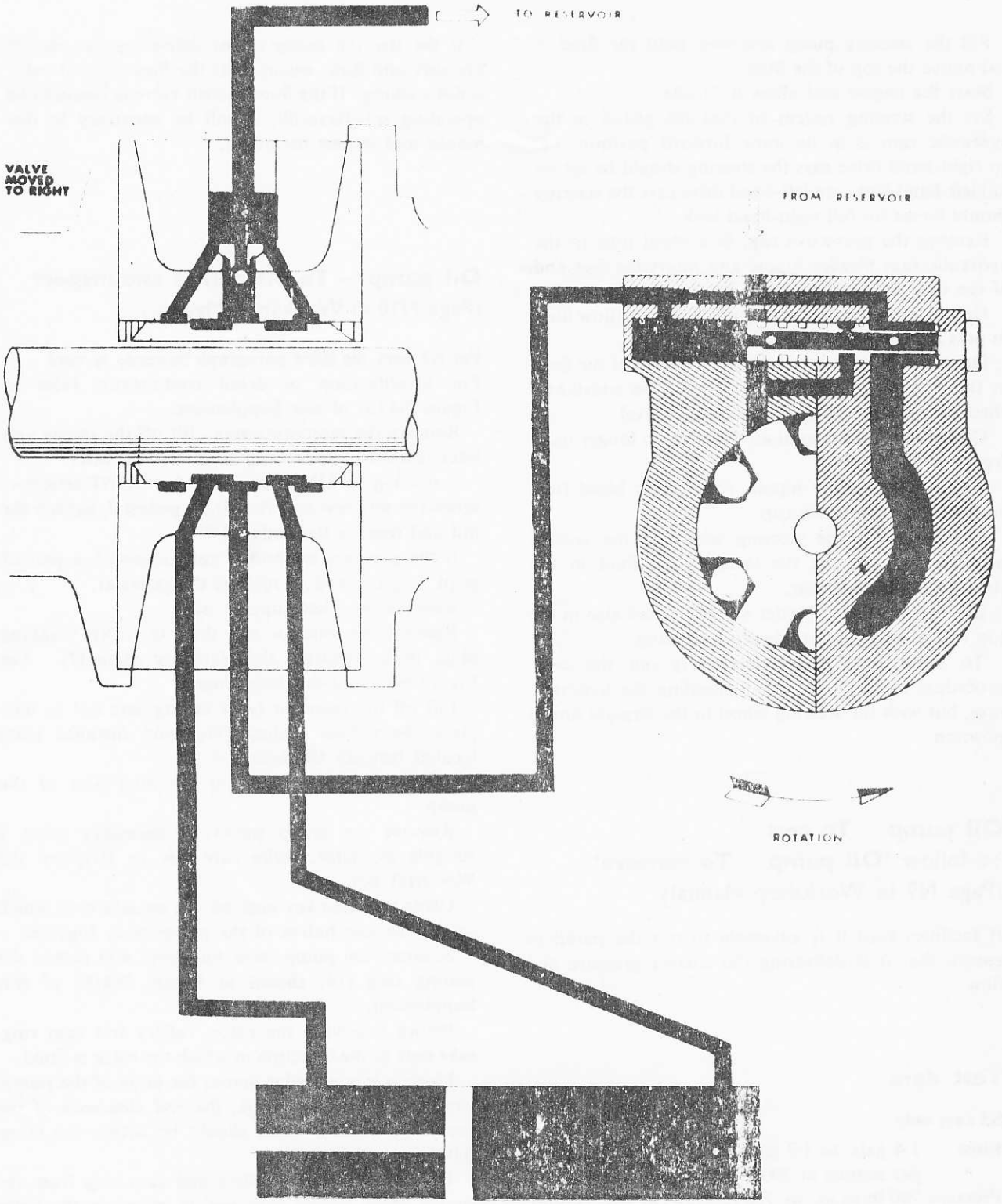


Fig. N3 (S) Circulation diagram—parking condition—left-hand lock—very heavy load

Unscrew the four countersunk headed screws and remove the bearing retaining plate.

Remove the shaft from the housing, then gently tap the oil seal out of the housing.

Inspect the bearing for wear or damage, if excessively worn the bearing should be removed from the shaft and a new one fitted.

Remove the flow control valve plug (30) (see Figure N4 (S) of this Supplement) from the side of the pump body and withdraw the combined flow control and relief valve, taking care not to misplace the flow control valve spring.

Inspect the pump body and cover, for wear or scoring by the rotor; if excessive wear or scoring has taken place and the end clearance of the rotor in the body exceeds 0·0018 in., the body and cover should be renewed and a new matched set of rotor, rollers and cam ring fitted.

Oil pump — To assemble
(Page N11 in Workshop Manual)

For S3 cars the second paragraph onwards to read
Coat the outside of the new oil seal with a thin layer of Wellseal, then after greasing the lip of the new seal, insert it into the pump body. Care should be taken not to damage the seal.

Insert the drive-shaft, at the same time turning it so as to minimise the risk of damage to the oil seal. Tap the bearing into the body, then using the four countersunk headed screws, fit the bearing retaining plate.

Fit the cam ring, ensuring that it is located correctly on the pin in the pump body.

Fit the key and slide the rotor on to the shaft. The rotor should be fitted so that when viewed from the rear of the pump, the leading edge of the rotor blades should face anti-clockwise.

Insert the six rollers into the spaces between the rotor blades. Fit new rubber sealing rings in the annular groove formed on the end of the cam ring and in the recess formed in the flow control by-pass port. Fit the six Allen setscrews to secure the cover to the pump body. Whilst tightening the setscrews rotate the shaft to ensure that no binding takes place.

Fit the flow control valve spring and the combined flow control and relief valve into the pump body, ensuring that it moves freely in its bore.

Fit the flow control valve cap using a new 'O' ring.

Fit the reservoir to the pump body ensuring that new sealing rings are fitted to each side of the distance plate. Fit the sleeve into the inlet port of the pump, then using the $\frac{3}{4}$ in. UNF blanking plug and the $\frac{5}{16}$ in. UNF setscrews secure the reservoir firmly to the pump body.

Fit the filter support plate and the centre pedestal, then tighten the pedestal in a similar manner to that described for removal.

Fit the filter, filter retaining washer, spring and reservoir cap ensuring that the reservoir cap seal and the securing screw seal are in good condition.

Fault diagnosis
(Page N12 in Workshop Manual)

For S3 cars the fourth paragraph to read
The pump delivery pressure should be approximately 750 lb/sq.in. (52·73 kg/sq.cm.), with the engine idling and the wheels against the stops.

Steering judder

On S3 cars a probable cause of steering judder is the presence of air in the system. This can be removed by priming the steering system as described on Page N3(S) in this Supplement; ensure that the correct fluid level is maintained in the reservoir.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

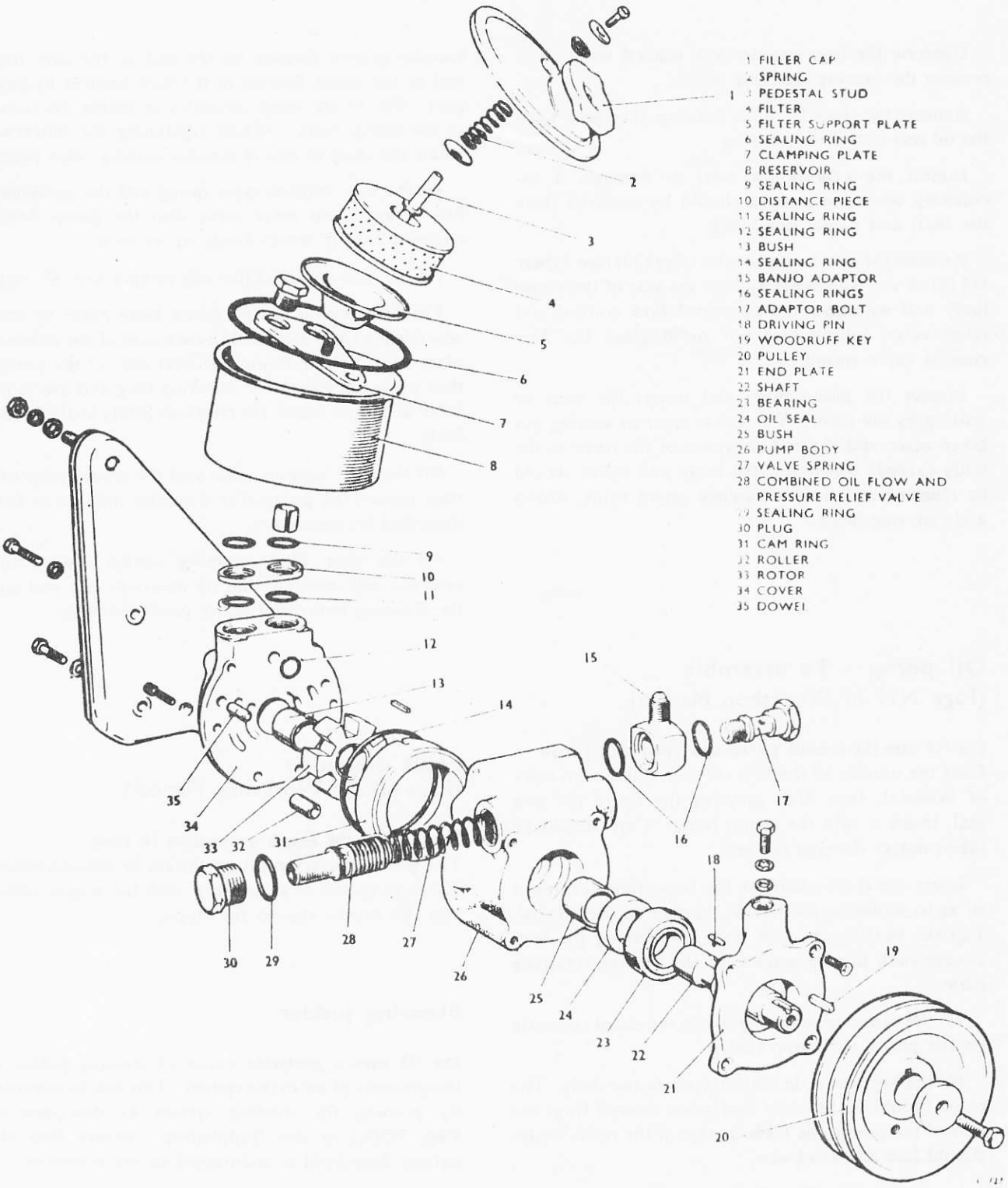


Fig. N4 (S) Exploded view of steering pump

SECTION N 3 — POWER CYLINDER AND HOSES

Hoses
Right-hand drive — S2 cars
(Page N14 in Workshop Manual)

For S3 cars the second paragraph to read

The delivery hose from the pump to the valve housing, sweeps down from the pump to a clip at the centre of the front pan; it then passes through a clip on the right-hand damper top. From this point it runs alongside the power cylinder rear hose and is connected to the higher of the two remaining ports. The return hose from the valve housing to the pump is connected to the remaining port in the valve housing, it then sweeps downwards from the valve housing through a clip on the steering box mounting arm; from the mounting arm the hose rises and passes over the front of the engine crankcase and is connected by a worm drive clip to the inlet pipe on the pump reservoir.

Hoses
Left-hand drive — S2 cars
(Page N14 in Workshop Manual)

For S3 cars the first paragraph to read

From the valve housing, the two power cylinder hoses sweep inwards and down to a clip on the inner surface of the chassis side member, then rise to a clip on the left-hand damper top and a clip at the lower corner of the valance before leading down behind the stabilizer bar to the power cylinder. The return hose from the valve housing sweeps in and down to the clip on the inner surface of the chassis side member, from where it rises to another clip on the engine crankcase. From the clip on the crankcase the hose sweeps underneath and behind the pump to connect to the inlet union.

SECTION N 7 — STEERING COLUMN AND STEERING BOX

Servicing
(Page N35 in Workshop Manual)

For S3 cars the following two paragraphs should be read in place of the first

Every 24,000 miles (40,000 Kms.) check the oil level in the transfer gearbox. Remove the filler plug and the oil level plug. The filler plug is positioned on top of the driven gear casing; the oil level plug is positioned at the front of the driving gear casing, adjacent to the eccentric adjuster. If necessary, the transfer gearbox should be topped-up with the approved oil to the oil level hole. Fit the filler and level plugs.

If when checking the oil level in the transfer gearbox, it is found that an excess of oil is present, this may be due to a fault in the oil seal situated in the transfer gearbox adaptor plate which is positioned between the transfer gearbox and the steering box spool valve housing; in this case it will be necessary to renew the oil seal as described in 'Steering box oil seals To renew' of this Supplement.

Steering column and steering box — To remove

S3 cars

If the steering column and steering box are required to be removed as separate assemblies, follow the procedure described in 'Steering column To remove' and 'Steering box To remove' (Page N36 in Workshop Manual).

It is possible to remove the steering column and steering box as a complete assembly as follows.

Disconnect the battery leads.

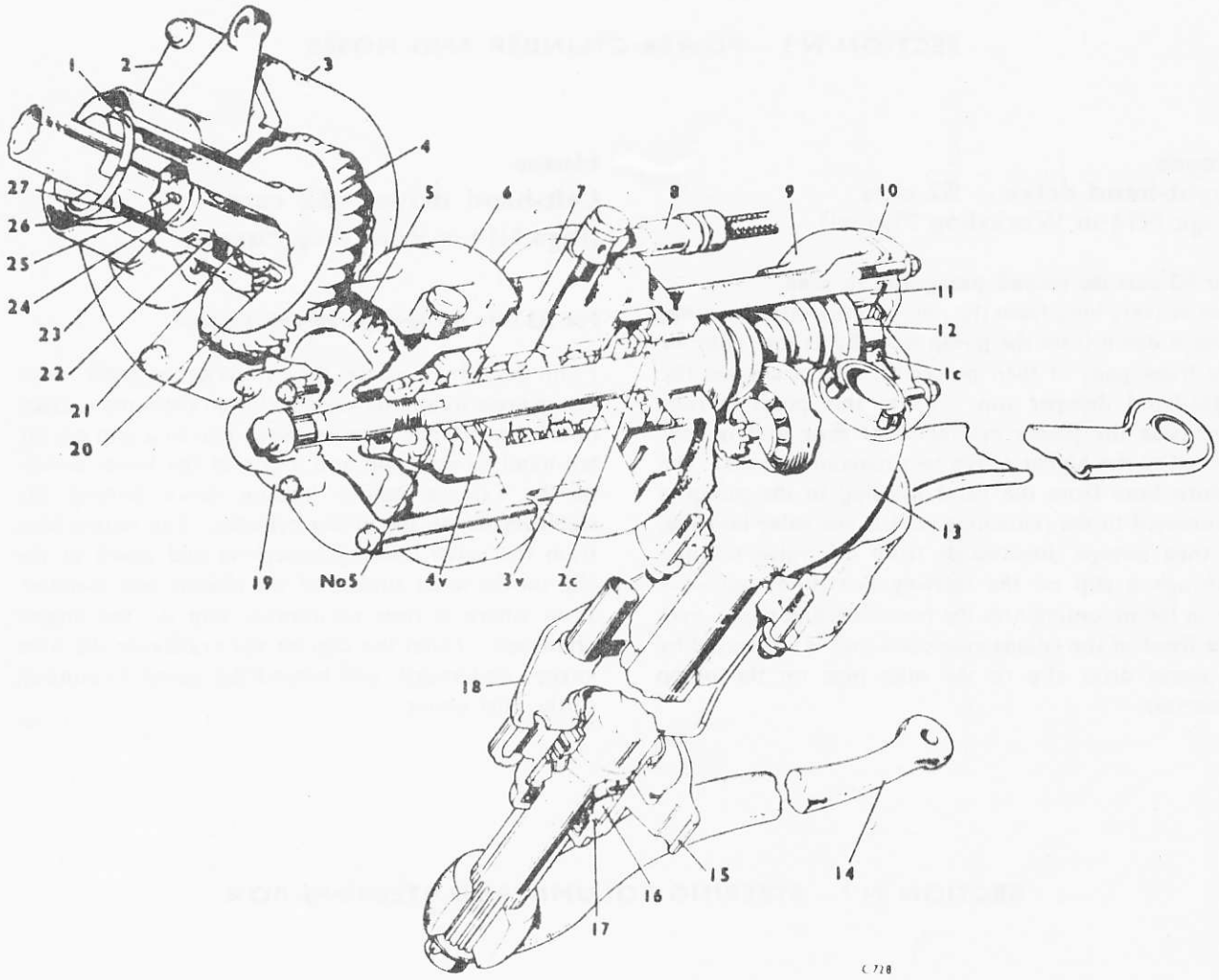


Fig. N5 (S) Cut-away view of steering box

1 SNAP RING	10 END COVER	19 BEARING HOUSING
2 TOP COVER	11 OUTER RACE	20 BEARING
3 TRANSFER GEAR CASING	12 STEERING CAM	21 ECCENTRIC PIN
4 DRIVING GEAR	13 ROCKING SHAFT	22 BEARING
5 DRIVEN GEAR	14 PENDULUM LEVER	23 NUT
6 ADAPTOR VALVE HOUSING	15 BEARING HOUSING	24 DISTANCE PIECE
7 SPOOL VALVE HOUSING	16 OUTER RACE	25 SPLIT PIN
8 ADAPTOR	17 ADJUSTING WASHER	26 COUPLING
9 STEERING BOX	18 MOUNTING ARM	27 DISTANCE PIECE

1C LOWER CAM ADJUSTINGWASHER

2C UPPER CAM ADJUSTING WASHER

3V LOWER SPOOL VALVE ADJUSTING WASHER

4V UPPER SPOOL VALVE ADJUSTING WASHER

No. 5 SPOOL VALVE CROSS-LOAD ADJUSTING WASHER

Apply the hand brake and carefully position a jack under the front pan; ensure that the jack head cannot contact and so damage the power steering cylinder as it is raised. Jack up the front of the car and position supports under the stabilizer rod chassis mountings.

To gain access to the steering box; remove the front wheel and the valance plate panel from the driver's side of the car.

On right-hand drive cars, it is necessary also to remove the undersheet on the right-hand side of the car.

Remove the three screws retaining the horn push plate assembly to the steering wheel. Disconnect the horn wire snap connector and withdraw the assembly. Unlock and remove the steering wheel retaining nut and tab washer.

A scribed line or centre punch dot should be used to mark the wheel hub position in relation to the shaft for convenient assembly.

Refit the nut a few threads to prevent damage to the threaded end of the tube.

Using Special tool RH 593 in conjunction with the pressure pad RH 7271, withdraw the steering wheel; care should be taken not to trap the horn wire between the steering tube and extractor.

Remove the extractor and the retaining nut and lift off the steering wheel.

Remove the front seats and carpet, then remove the setscrews securing the insulating panel and gas seal plate to the bulkhead. Remove the brake fluid pipe clip attached to one of the setscrews securing the insulating panel.

Remove the foot brake pedal from the brake pedal lever and slide the insulator panel, together with the gas seal plate, along the column.

Disconnect the horn and earthing wires situated midway along the steering column.

Remove the two screws and withdraw the horn brush housing.

Disconnect the ride control and flasher indicator wires at the junction behind the facia panel.

Disconnect the micro-switch wires.

Unscrew the pinch bolt and nut from the gear operating lever at the lower end of the control rod.

Remove the two screws which secure the ride control switch to the steering column.

Unscrew the two Allen screws securing the gear range quadrant to the steering column. Remove the quadrant and withdraw the control rod from the operating lever. Remove the control rod from the steering column, taking care not to misplace the locating key fitted at the lower end of the control rod.

Remove the micro-switches from the lower end of the steering column.

Remove the nut, lock-washer and plain washer securing the pendulum lever to the splined end of the rocking shaft. Mark the position of the pendulum lever in relation to the rocking shaft to assist in re-assembly, then withdraw the pendulum lever using extractor tool RH 321.

On left-hand drive cars, if difficulty is experienced in fitting the extractor tool owing to lack of space between the end of the rocking shaft and the exhaust pipe, the pendulum lever should be withdrawn when the steering box mountings have been removed.

Disconnect the oil pipes from the spool valve housing and mask the ends to prevent oil leakage and the ingress of dirt.

Unscrew the two Allen screws and remove the steering column clamp from the bracket on the facia.

Remove the nut, bolt and washers securing the steering box mounting arm to the bracket on the chassis frame.

Support the steering box and remove the four set-screws, washers and mounting brackets securing the mounting tube in position on the chassis frame.

At this point a second operator is required to assist in the removal of the steering box and column from the chassis.

Support the steering box and remove the insulating panel and gas seal plate from the steering column. To facilitate this, wrap the steering column with masking tape, particularly around the tube which normally contains the wires for the ride control and direction indicator switches. A light coating of a rubber lubricant will also assist the removal of the panel and gas seal plate.

Carefully remove the steering column and steering box, taking care not to damage or mark the enamelled outer tube of the column.

Steering column and box — To dismantle

S3 cars only

Unscrew and remove the four setscrews and washers securing the transfer gearbox to the valve housing adaptor. Place a suitable container beneath the transfer gearbox to collect the oil which will drain from it.

The steering column may then be dismantled following the procedure described in 'Steering Column — To dismantle' (Page N36 in Workshop Manual) noting that the first six paragraphs are not applicable if the steering column and steering box have been removed as a complete assembly.

Steering box — To dismantle
(Page N37 in Workshop Manual)

S3 cars only

It should only be necessary to dismantle the steering box for the renewal of the transfer gears, the cam tube oil seal and the rocking shaft oil seal.

No attempt should be made to remove the valve housing assembly, the steering cam tube assembly or the rocking shaft assembly from the steering box.

Should faults or damage occur in these assemblies the complete steering box should be returned to

CREWE SERVICE DEPARTMENT
ROLLS-ROYCE LIMITED
Pym's Lane, Crewe
Cheshire England.

To remove the driven transfer gear from the steering cam tube, remove the setscrew and washer securing the gear whilst holding the gear by means of the special tool RH 7235. Mark the position of the driven gear to the cam tube, then withdraw the gear using extractor RH 7226.

Remove the transfer gearbox adaptor plate and tap out the oil seal.

Steering box oil seals — To renew

S3 cars only

To remove the steering cam tube oil seal carry out the procedure as described in 'Steering box — To dismantle' in this Supplement.

Smear the new oil seal outer casing with a small amount of Wellseal then fit the new oil seal into the adaptor plate.

Fit the adaptor plate to the steering box as described in 'Steering box — To assemble' of this Supplement.

To renew the rocking shaft oil seal, remove the lower bearing housing from the steering box, taking note of the position of the pointer in relation to the scale engraved on the steering box mounting arm.

Remove the taper roller bearing and the adjusting washer, then tap out the oil seal.

Smear the new oil seal outer casing with a small amount of Wellseal then fit the new oil seal into the bearing housing; replace the adjusting washer and refit the taper roller bearing. Fit a new 'O' ring into the groove in the steering box mounting arm. Mask the splines of the rocking shaft to avoid damaging the oil seal. Refit the bearing housing to the steering box ensuring that the position of the pointer is in its original position.

Steering box — To assemble
(Page N39 in Workshop Manual)

S3 cars only

Having renewed the steering cam tube oil seal, fit a new 'O' ring into the transfer gearbox adaptor plate, then fit the adaptor plate to the steering box.

Fit the driven transfer gear onto the cam tube, ensuring that the correlation marks are in alignment.

Fit the setscrew and washer, then tighten the setscrew by holding the driven gear by means of the special tool RH 7235.

Note The transfer gears are supplied in pairs and must not be interchanged with other gears; there is also a correlation mark on each gear to provide the best meshing on assembly.

Fit a new 'O' ring into the transfer gear casing, then fit the casing to the steering box.

Fit a new 'O' ring inside the transfer gear casing, then fit the transfer drive gear assembly. Ensure that the correlation marks on the teeth of the transfer gears are aligned.

Coat the transfer gear teeth with Retinax 'A' grease and adjust the gear mesh to obtain zero backlash by rotating the eccentric pin. The lock-nut must be tightened before making the check.

Fit a new 'O' ring into the steering column adaptor plate and if necessary renew the eight rubber mounting bushes. Fit the adaptor plate to the transfer gearbox; tighten the four nuts progressively to avoid distorting the plate.

Fit the steering column assembly to the steering box assembly.

Fit a new 'O' ring to the rear end of the transfer gearbox and fit the small driven gear bush housing.

Whilst tightening the four 2 BA nuts on the bush housing the steering wheel should be continually rotated in each direction in order to ensure that the bush housing is centralized correctly.

Steering column and box — To fit
(Page N42 in Workshop Manual)

S3 cars only

Refit the steering column and steering box as a complete assembly to the car, carefully reversing the procedure given for removal in 'Steering column and steering box — To remove' of this Supplement. If necessary renew the rubber bushes on the steering box mounting arm.

When the steering column and steering box are in position remove the transfer gearbox level and filler plugs and add a quantity of the recommended lubricant until a flow is observed from the oil level plug hole. This will require approximately ⅛ pint (0·355 litres). Refit and tighten both plugs.

Prime and fill the steering system as described in 'Priming and filling the system' of this Supplement.

Thoroughly clean the chassis frame adjacent to the steering box, then road test the car and check for oil leaks.

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CHAPTER P

CHASSIS FRAME

SECTION P1 — GENERAL DESCRIPTION

On all S1 and S2 cars, the chassis frames are of exceptional stiffness yet light in weight. A notable feature of their design is the use of light gauge steel pressings, arc welded to form box section assemblies. On S1 and S2 cars with the exception of the coach-built cars, the steel in general use for the pressings is 16 S.W.G. (0·064 in., 1·626 mm.) with angle stiffeners of 14 S.W.G. (0·080 in., 2·032 mm.) steel.

S1 and S2 chassis frames comprise two side members, a front crossmember or pan, a cruciform centre section, a rear crossmember and a transverse tubular member to which the rear spring shackle brackets are welded.

Bentley Continental S1 cars with the synchromesh gearbox have a chassis frame which is stiffer than the other S1 frames and which has a supporting strut for the gearbox rear mounting. This strut is welded in position diagonally between the front left-hand cruciform member and the left-hand side member.

On all chassis frames, the side members comprise two lengths of channel plate, reinforced on the inside and arc welded along the seams to form an airtight box section assembly (see inset, Fig. P1). An angle stiffener plate is spot welded inside the front half of each side member, between a point just ahead of the front crossmember and the point where the cruciform assembly is arc welded to the inner side member.

On all chassis frames except the Phantom V, construction of the cruciform member is similar to the construction of the side members. The point of intersection of the members of the cruciform structure is reinforced above and below by plates, shaped like a Maltese Cross, which are arc welded along their edges. Lugs are welded to the inner sides of the cruciform structure to provide a mounting for the gearbox rear supporting bracket.

The Phantom V chassis frame (see Fig. P4) differs from all other S1 and S2 cars in chassis frame length and cruciform construction. The cruciform structure consists of two 'Vee'-shaped members, the apexes of which are welded to a tube, 8 in. (20·320 cm.) in diameter and 18 in. (45·720 cm.) long. The tube is supported at the centre by a box section crossmember. An additional feature of the Phantom V chassis frame is the provision of arc welded stub tubes to support the rear of the fuel tank (see Fig. P4).

Later Phantom V chassis frames are provided with angled tunnels through the left-hand side member and the rear left-hand cruciform member to accommodate the 'through-the-frame' exhaust pipe run (see inset, Fig. P4). These tunnels are lined with seamed steel tubing arc welded into position in the frame. The rear silencer front support bracket is positioned immediately behind the tunnel in the rear left-hand cruciform member.

The front and rear crossmembers are of similar construction to that of the side members in that they are of arc welded box section.

A 1½ in. (3·810 cm.) diameter stiffening tube to which the rear spring shackle brackets are welded passes through both side members approximately 20½ in. (52·070 cm.) from the rear of the frame [in the case of the **Phantom V chassis frame,** this distance is approximately 12 in. (30·480 cm.)]. The tube is arc welded to the inner and outer faces of the side members and steel discs are welded in position to seal the ends of the tube.

A jacking bracket and two adjacent stiffeners are arc welded to each side member; the stiffeners prevent 'springing' and subsequent damage to the chassis frame around the jacking points.

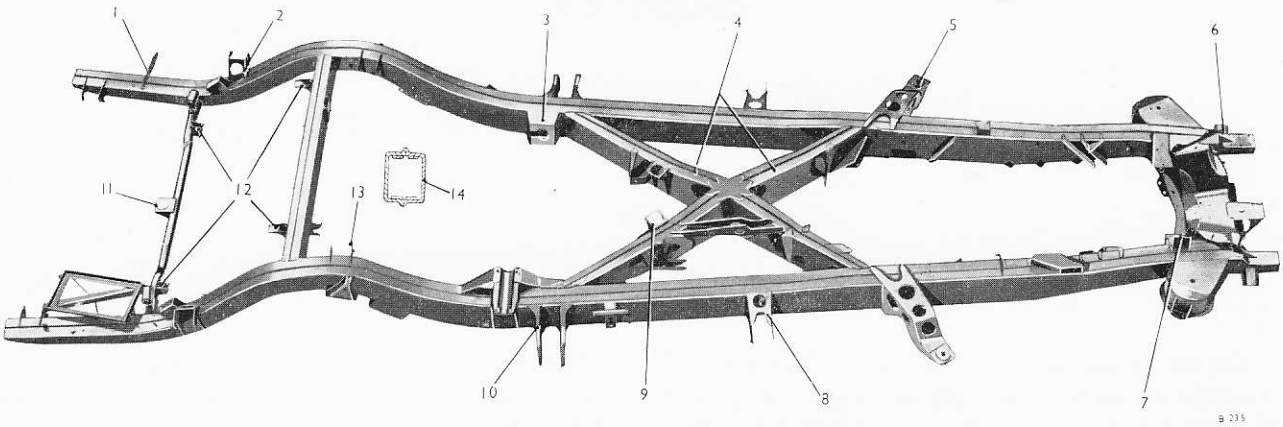


Fig. P1 S1 chassis frame (early)

1. TAIL PIPE SUPPORT
2. BODY MOUNTING BRACKET
3. REAR SHACKLE ANCHORAGE
4. CRUCIFORM
5. BODY MOUNTING BRACKET
6. STABILISER ROD BRACKET
7. ENGINE MOUNTING
8. BODY MOUNTING BRACKET
9. BODY MOUNTING BRACKET
10. BODY MOUNTING AND JACKING SUPPORT
11. BODY MOUNTING BRACKET
12. FUEL TANK MOUNTING
13. BODY MOUNTING BRACKET
14. INSET SHOWING REINFORCED 'BOX' CONSTRUCTION

There are fifteen body mounting brackets welded to the chassis of all cars except the **Phantom V,** which has thirteen only. Ten of the mountings are adjustable as described in Chapter S (Body Section).

Special attention has been paid to bumper bar mountings at both ends of the chassis frame. In order to prevent collapse of the box structure at these points when tightening the mounting bolts, steel distance tubes are welded in position in the side members.

On early S1 chassis frames, six distance tubes are used for mounting the front bumper bar and four tubes are used in the rear mounting.

With the introduction of the Refrigeration System as an optional extra on later S1 and all subsequent cars, the front bumper bar mountings have been splayed out at an angle from the front pan (see Fig. P2) and indentations have been made in the pan to accommodate components of the Refrigeration Unit.

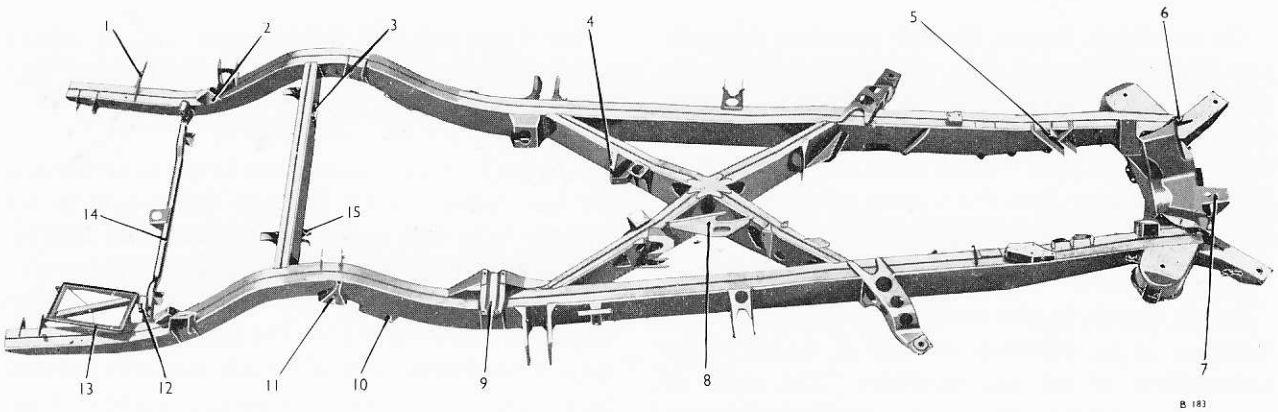


Fig. P2 S1 chassis frame (late)

1. TAIL PIPE SUPPORT
2. REBOUND BRACKET
3. REAR SILENCER MOUNTING
4. DRIVE SHAFT CENTRE BEARING SUPPORT
5. STEERING MOUNTING
6. FRONT SHOCK DAMPER MOUNTING
7. RADIATOR SUPPORT
8. MASTER CYLINDER BRACKET
9. 'Z' BAR BRACKET
10. REAR SHOCK DAMPER
11. BUMP STOP BRACKET
12. REAR SHACKLE EYE
13. BATTERY CARRIER
14. TUBULAR MEMBER
15. FUEL FILTER MOUNTING

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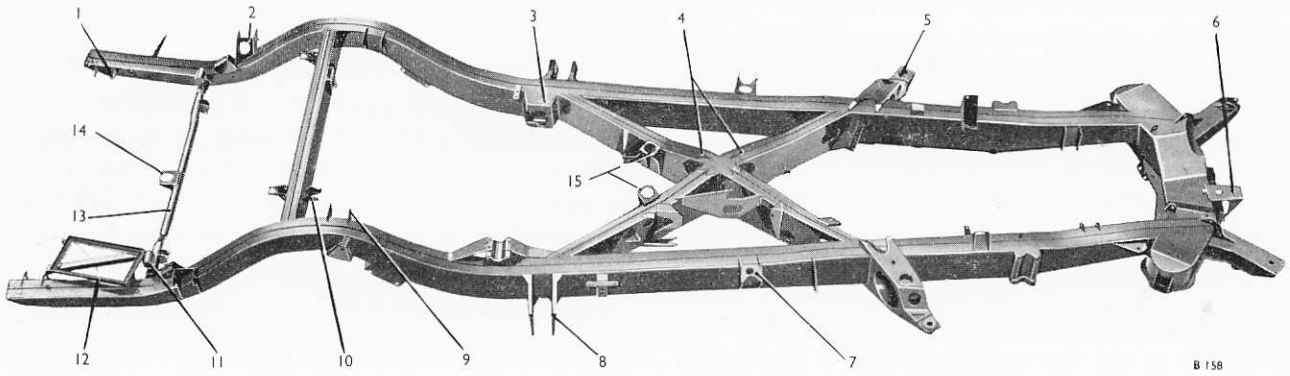


Fig. P3 S2 chassis frame

1. BODY MOUNTING BRACKET
2. BODY MOUNTING BRACKET
3. REAR SHACKLE ANCHORAGE
4. CRUCIFORM
5. BODY MOUNTING BRACKET
6. RADIATOR SUPPORT BRACKET
7. BODY MOUNTING BRACKET
8. BODY MOUNTING BRACKET
9. BODY MOUNTING BRACKET
10. FUEL FILTER MOUNTING
11. REAR SHACKLE EYE
12. BATTERY CARRIER
13. TUBULAR MEMBER
14. BODY MOUNTING BRACKET
15. BODY MOUNTING BRACKET

Four distance tubes are used in the front bumper bar mountings on these cars; the rear mountings remain unchanged.

Rubber bump stops are fitted to the rear of each side member; compression of the rubber provides an increasing rate of resistance to movement of the rear axle towards the end of its travel, so preventing damage to the suspension or chassis frame.

Rubber bump stops are also bolted to the front crossmember to act on the lower triangle levers and restrain excessive movement of the front suspension.

The Long Wheelbase chassis frame is identical to the standard frame except that the wheelbase is 4 in. (10·16 cm.) longer; the additional length is obtained between the rear end of the cruciform structure and the centre of the rear wheel arch.

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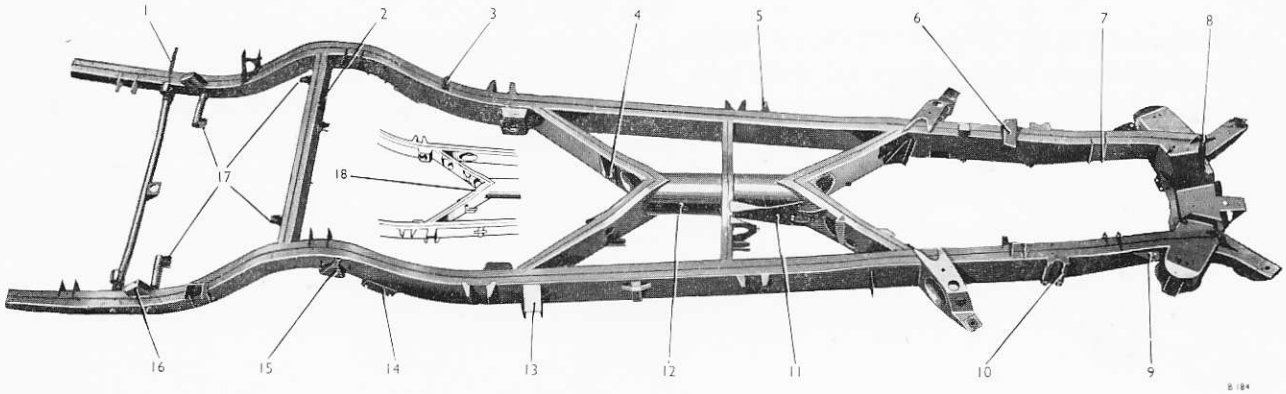


Fig. P4 Phantom V chassis frame

1. TAIL PIPE SUPPORT BRACKET
2. REAR SILENCER MOUNTING
3. EXHAUST LINE SUPPORT BRACKET
4. DRIVE SHAFT CENTRE BEARING SUPPORT BRACKET
5. EXHAUST LINE SUPPORT BRACKET
6. ENGINE MOUNTING BRACKET
7. ENGINE MOUNTING BRACKET
8. FRONT SHOCK DAMPER MOUNTING
9. STEERING MOUNTING ARM BRACKET
10. STEERING MOUNTING
11. MASTER CYLINDERS SUPPORT BRACKET
12. CENTRE TUBE
13. JACKING SUPPORT
14. REAR SHOCK DAMPER MOUNTING BRACKET
15. BUMP STOP BRACKET
16. REBOUND BRACKET
17. FUEL TANK MOUNTINGS
18. 'THROUGH-THE-FRAME' EXHAUST LINE APERTURES

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On S2 chassis frames, mountings to accommodate the V-eight cylinder engine are arc welded to the side members (see Fig. P3). Mounting brackets for the power-assisted steering box are similarly welded to the outside of the side members.

Mounting brackets for such components as the gearbox and shock dampers are arc welded to the chassis frame at the appropriate points.

On all cars except the Phantom V, the battery carrier is welded to the rear right-hand side of the chassis frame. The battery on **Phantom V cars** is fitted in a recess in the boot floor.

Nuts and studs are welded at various points on the chassis frame to provide securing positions for pipes, hose clips and wiring looms.

The electrical system earthing points are tinned to ensure a good electrical connection; they should be masked before enamel is applied to the chassis frame.

The chassis frame should also be masked wherever components fit directly to the frame. If components were fitted directly to an enamelled surface, it is probable that the components would become loose as the enamel peeled from beneath the securing nuts and bolts, etc.

On completion, the chassis frame is finished in black enamel containing corrosion inhibitors.

Chassis Frame Serial Number

The chassis frame serial number will be found on the identification plate fixed to the front of the bulkhead. The number is also stamped on the left-hand side frame member, just forward of the bulkhead.

SECTION P2 — CHASSIS FRAME AND BODY MOUNTING CHECKING DIMENSIONS

Should damage occur to the chassis frame as the result of an accident and this damage is not so severe as to necessitate renewal of the frame, the body mounting brackets should be checked to the dimensions as shown in Figures P5 to P8 inclusive.

The tabulated figures given are measured across a horizontal plane.

A tolerance of $\frac{1}{8}$ in. (0·125 in., 0·3175 cm.) is acceptable in measurements taken between the front body mountings and each of the body mounting brackets on their respective sides.

The diagonal dimensions are given as a check of the relative positions of the side members to one another.

On all S2 chassis frames, with the exception of the Phantom V, it should be noted that the No. 2 body mountings are not symmetrical about the centre line of the chassis frame; the diagonal checking dimensions from No. 1 to No. 2 and from No. 2 to No. 3 mountings should therefore only be checked as shown in Figure P7.

Phantom V and all S1 chassis frames are symmetrical and therefore the diagonal dimensions may be checked from the left-hand to the right-hand side as shown (and vice versa).

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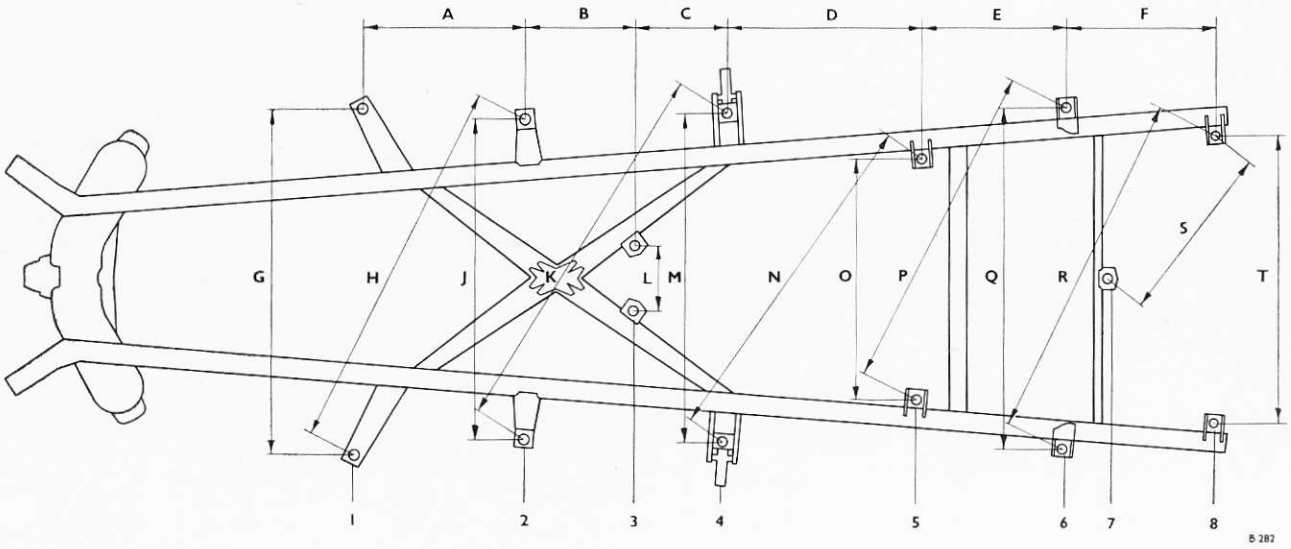


Fig. P5 Chassis frame and body checking dimensions for all S1 cars except Long Wheelbase

DIMENSION	SILVER CLOUD BENTLEY SI		BENTLEY CONTINENTAL SI	
	INCHES	CENTIMETRES	INCHES	CENTIMETRES
A	26·775	68·0085	26·775	68·0085
B	15·975	40·5765	15·975	40·5765
C	15·250	38·7350	15·250	38·7350
D	29·875	75·8825	29·875	75·8825
E	22·625	57·4675	19·375	49·2125
F	24·000	60·9600	17·250	43·8150
G	53·750	136·5250	53·750	136·5250
H	58·180	147·7772	58·180	147·7772
J	49·550	125·8570	49·550	125·8570
K	59·450	151·0030	59·450	151·0030
L	9·500	24·1300	9·500	24·1300
M	51·625	131·1275	51·625	131·1275
N	52·905	134·3787	52·905	134·3787
O	35·700	90·6780	35·700	90·6780
P	49·520	125·7808	49·910	126·7714
Q	52·400	133·0960	56·300	143·0020
R	53·400	135·6360	51·850	131·6990
S	26·130	66·3702	21·310	54·1274
T	43·000	109·2200	41·500	105·4100

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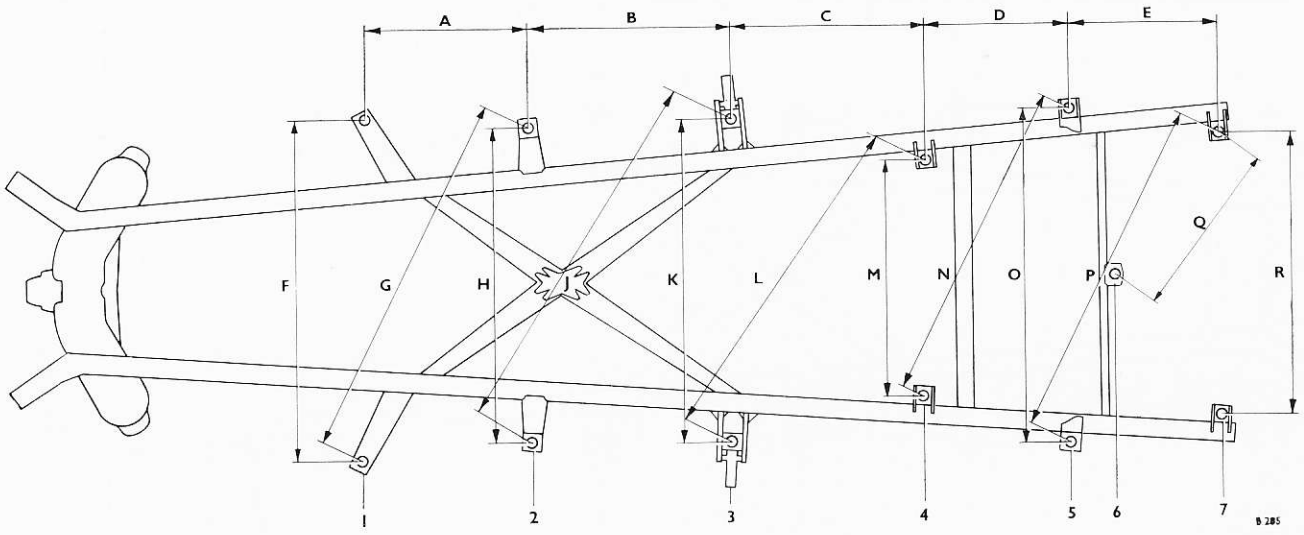


Fig. P6 Chassis frame and body checking dimensions S1 Long Wheelbase cars

DIMENSION	SILVER CLOUD L.W.B. BENTLEY S1 L.W.B.	
	INCHES	CENTIMETRES
A	26·750	67·9450
B	35·250	89·5350
C	29·875	75·8825
D	22·625	57·4675
E	24·000	60·9600
F	53·750	136·5250
G	58·145	147·6883
H	49·500	125·7300
J	61·880	157·1752
K	52·225	132·6515
L	53·420	135·6868
M	36·350	92·3290
N	50·080	127·2032
O	53·000	134·6200
P	53·935	136·9949
Q	26·380	67·0052
R	43·600	110·7440

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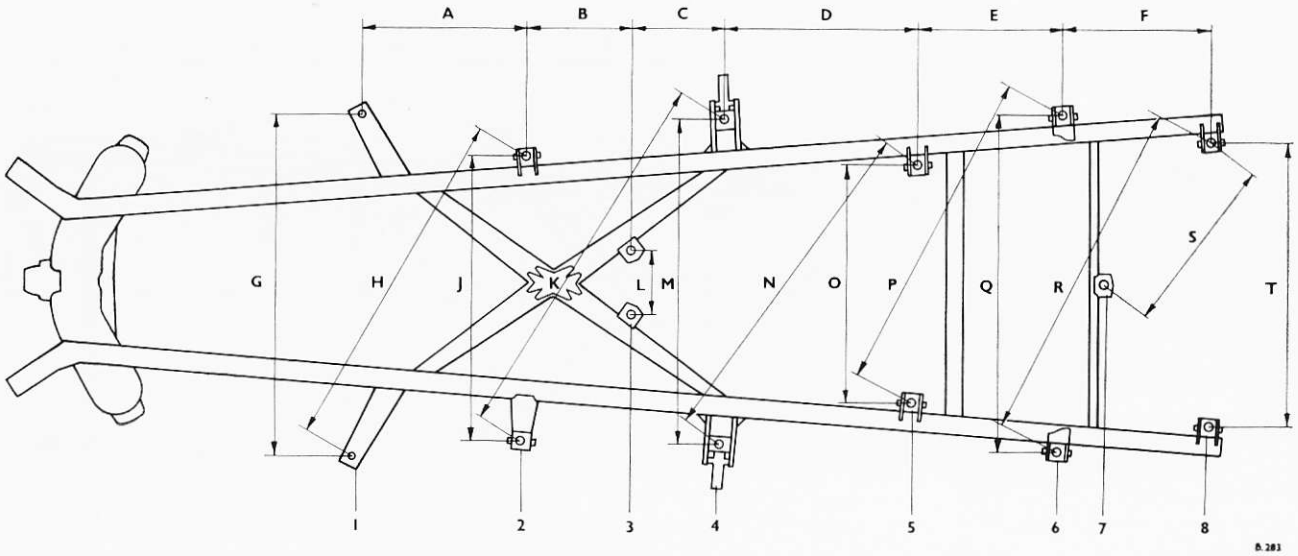


Fig. P7 Chassis frame and body checking dimensions for all S2 cars except Phantom V

DIMENSION	SILVER CLOUD II BENTLEY S2 BENTLEY CONTINENTAL S2		SILVER CLOUD II L.W.B. BENTLEY S2 L.W.B.	
	INCHES	CENTIMETRES	INCHES	CENTIMETRES
A	26·750	67·9450	26·750	67·9450
B	16·000	40·6400	16·000	40·6400
C	15·250	38·7350	19·250	48·8950
D	29·875	75·8825	29·875	75·8825
E	22·625	57·4675	22·625	57·4675
F	24·000	60·9600	24·000	60·9600
G	53·750	136·5250	53·750	136·5250
H	53·780	136·6012	53·780	136·6012
J	44·530	113·1062	44·530	113·1062
K	59·440	150·9776	61·880	157·1752
L	9·500	24·1300	9·500	24·1300
M	51·625	131·1275	52·225	132·6515
N	52·925	134·4295	53·420	135·6868
O	35·750	90·8050	36·350	92·3290
P	49·540	125·8316	50·080	127·2032
Q	52·400	133·0960	53·000	134·6200
R	53·400	135·6360	53·935	136·9949
S	26·130	66·3702	26·380	67·0052
T	43·000	109·2200	43·600	110·7440

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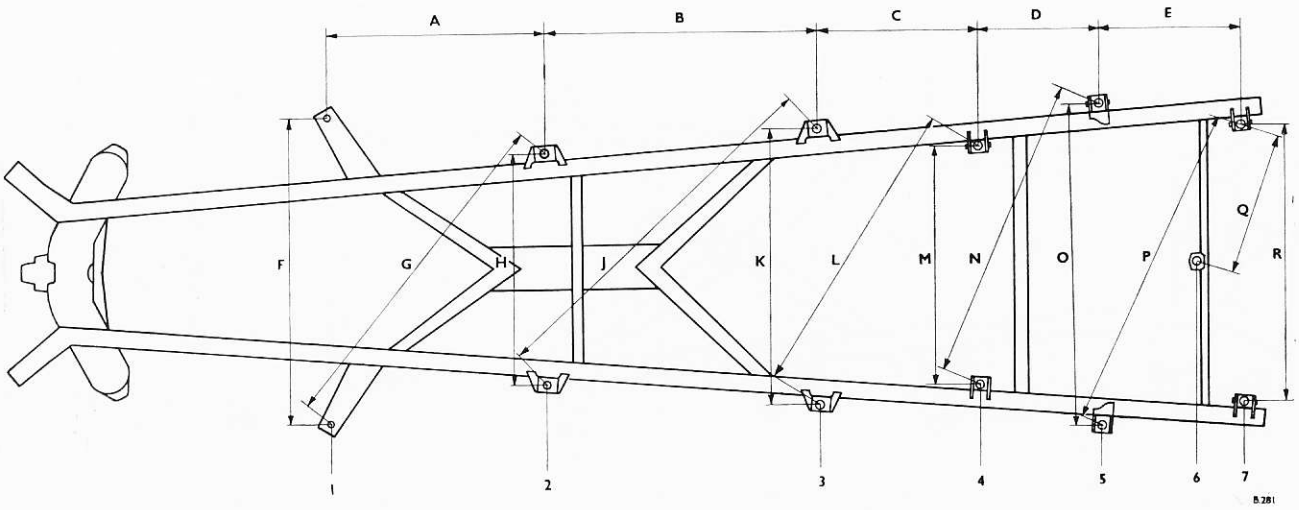


Fig. P8 Chassis frame and body checking dimensions for Phantom V cars

DIMENSION	PHANTOM V	
	INCHES	CENTIMETRES
A	37·875	96·2025
B	47·625	120·9675
C	26·250	66·6750
D	20·750	52·7050
E	23·875	60·6425
F	53·750	136·5250
G	60·810	154·4574
H	41·400	105·156
J	65·520	166·4208
K	48·590	123·4186
L	51·220	130·0988
M	39·375	100·0125
N	51·900	131·8260
O	55·780	141·6812
P	56·340	143·1036
Q	25·080	63·7032
R	46·280	117·5512

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CHAPTER P

CHASSIS FRAME

SECTION P 1 — GENERAL DESCRIPTION

(Page P1 in Workshop Manual)

For S3 cars the following three paragraphs should be read in place of the seventh.

All S3 chassis frames are provided with angled tunnels through the left-hand side member and the rear left-hand cruciform member to accommodate the 'through-the-frame' exhaust pipe run (see Figure P1 (S) of this Supplement). These tunnels are lined with seamed steel tubing, arc welded into position in the frame.

The rear silencer front support bracket is positioned immediately behind the tunnel in the rear left-hand cruciform member.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

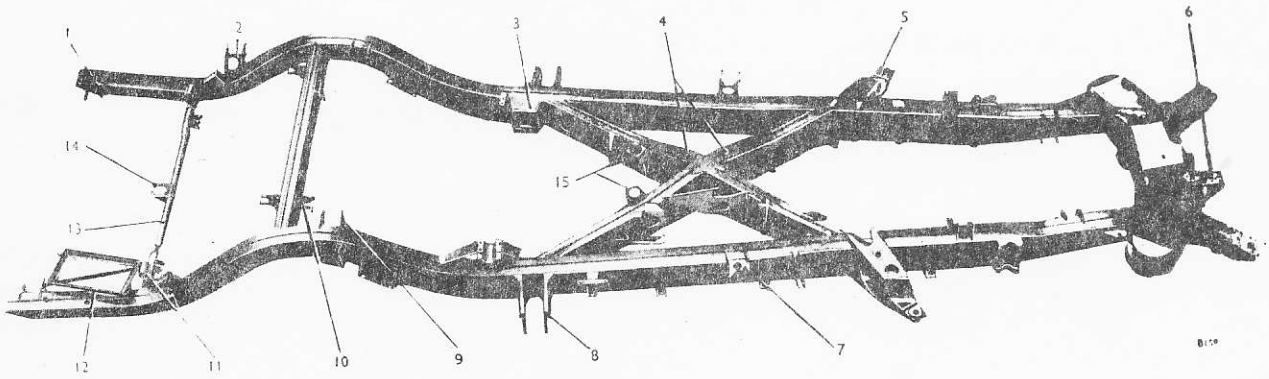


Fig. P1 (S) S3 chassis frame

1 BODY MOUNTING BRACKET
2 BODY MOUNTING BRACKET
3 REAR SHACKLE ANCHORAGE
4 CRUCIFORM
5 BODY MOUNTING BRACKET
6 RADIATOR SUPPORT BRACKET
7 BODY MOUNTING BRACKET
8 BODY MOUNTING BRACKET
9 BODY MOUNTING BRACKET
10 FUEL FILTER MOUNTING
11 REAR SHACKLE EYE
12 BATTERY CARRIER
13 TUBULAR MEMBER
14 BODY MOUNTING BRACKET
15 BODY MOUNTING BRACKETS

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CHAPTER Q

THE EXHAUST SYSTEM

SECTION Q1 — DESCRIPTION

On early S2 cars, Long Wheelbase S1 and all Bentley Continental S1 and S2 cars, the exhaust system is of the fully acoustic type. **On all other S1 and S2 cars**, the exhaust system is semi-acoustic.

On all cars, the exhaust gases pass from the engine through two cast-iron manifolds and two downtake pipes to enter a single pipe through a welded breeches piece. **On S1 cars**, the downtake pipes are of $1\frac{7}{8}$ in. outside diameter and **on S2 cars**, they are of 2 in. outside diameter.

On later S2 cars, and in cases of complaint of exhaust pipe 'titter' **on early S2 cars**, a twenty inch length of lagging is fitted immediately forward of the breeches piece. This lagging reduces 'titter', which is a high frequency vibration amplified and transmitted by the exhaust pipe.

The single exhaust pipe from the breeches piece to the front silencer passes along the outside of the chassis frame and is of $2\frac{1}{2}$ in. outside diameter.

On cars fitted with a semi-acoustic system, the front silencer is of the non-acoustic type. In this silencer the exhaust gases flow through three concentric perforated tubes. The gases flow along the inlet tube to the rear compartment of the silencer, back inside the intermediate tube into the front compartment, then out of the silencer through the third tube. The silencer is almost rectangular in shape and its approximate external dimensions are $23\frac{1}{2}$ in. $\times$ 8 in. $\times$ 6 in.

On cars fitted with an acoustic front silencer, the exhaust gases flow through a single perforated tube approximately $15\frac{3}{4}$ in. in length. The silencer is cylindrical in shape and is $23\frac{1}{2}$ in. long and $5\frac{7}{8}$ in. in diameter.

The underside of the floor above the front silencer and exhaust pipe is protected against heat by an aluminium–asbestos shield.

The exhaust gases leave the outlet of the front silencer and pass through an intermediate pipe into the rear silencer.

On all cars, the outer surface of the front silencer is lagged with $\frac{1}{8}$ in. thick asbestos sheet enclosed within a welded aluminium casing; this is the only lagged silencer in the system.

On all cars, the rear silencer is of the acoustic type and is cylindrical in shape; it is fitted inside the frame, forward of the rear axle.

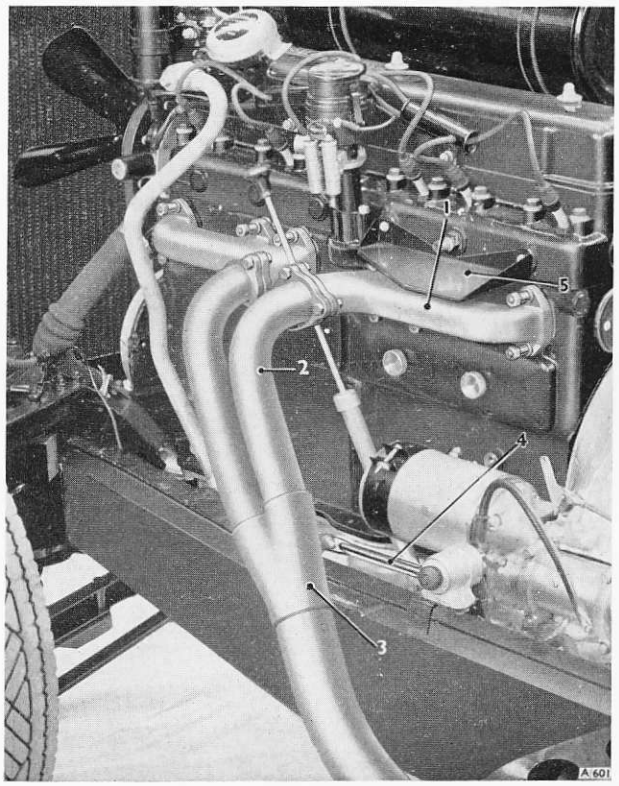


Fig. Q1 Exhaust manifolds and down pipes — S1 cars

1. MANIFOLD
2. DOWN PIPE
3. BREECHES PIECE
4. TUBULAR STAY
5. HEAT SHIELD

On S1 cars, the rear silencer is approximately 12 in. long and 8 in. in diameter.

On S2 cars, the rear silencer is approximately 22 in. long and $5\frac{1}{2}$ in. in diameter.

An aluminium–asbestos heat shield is also fitted below the floor of the rear compartment.

The exhaust gases finally pass from the rear silencer through a high frequency damper and out of the exhaust tail pipe. The damper is cylindrical in shape and is approximately $8\frac{1}{4}$ in. long and 4 in. in diameter. The damper consists of mineral wool packed around a perforated tube. **On S1 cars**, the damper contains 1 lb. 10 oz. of 'Stillite' wool and **on S2 cars,** the damper contains $7\frac{1}{2}$ oz. of 'Rocksil' wool.

The silencers and damper are 'stone clad' before assembly as a protection against condensation corrosion.

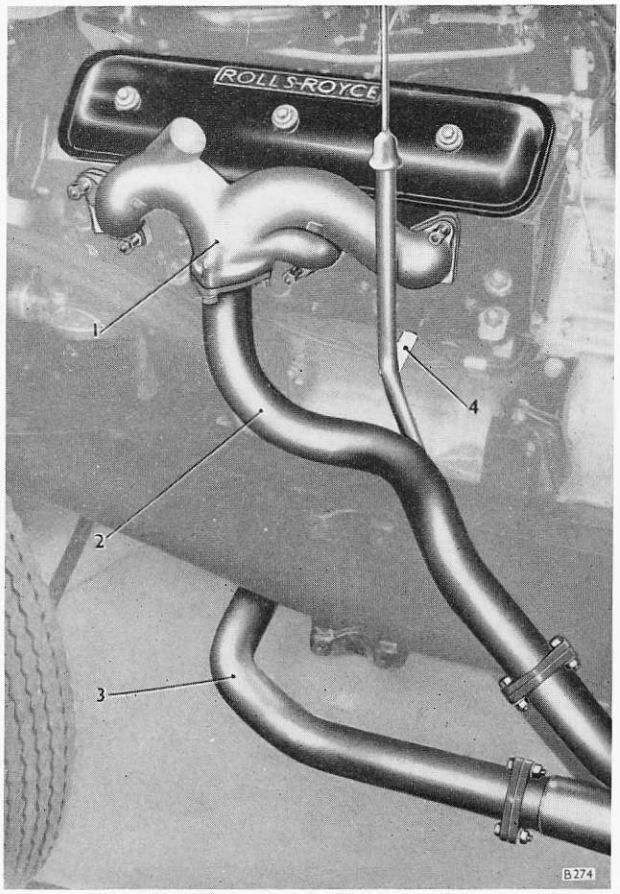


Fig. Q2 Exhaust manifold and down pipes — S2 cars

1. MANIFOLD
2. LEFT-HAND DOWN PIPE
3. RIGHT-HAND DOWN PIPE
4. DIPSTICK TUBE SUPPORT BRACKET

On all cars, the exhaust system is secured to the chassis in four places by moulded strips of rubberised material.

On the S1 exhaust system, a tubular strut $9\frac{3}{4}$ in. long (see Fig. Q1) is attached between a lug on the breeches piece and a lug on the crankcase. This strut reduces bending loads on the joints between the exhaust manifolds and breeches piece.

On the S2 exhaust system, the down pipe from the 'A' bank exhaust manifold, positioned on the right-hand side of the car, sweeps under the engine and is fastened to the rear engine mounting before joining the breeches piece on the outside of the chassis frame (see Fig. Q4).

On S1 cars, copper–asbestos joints are fitted between the exhaust manifolds and cylinder block and **on S2 cars**, between the exhaust manifolds and cylinder heads. The exhaust manifolds are secured by $\frac{5}{16}$ in. diameter extension nuts.

On all cars, cupro–nickel joints are fitted between all other joint faces in the exhaust system.

Earlier Phantom V cars are fitted with an exhaust system similar to the one fitted to S2 cars. The difference between the systems is in the greater length of the intermediate exhaust pipe which connects the front and rear silencers of Phantom V cars.

On later Phantom V cars and in cases of complaint of excessive heating of the floor of the rear compartments of earlier Phantom V cars, a modified exhaust system is fitted as shown in Figure Q5. The front silencer has a flanged outlet pipe. The intermediate pipe is a separate flanged pipe which passes through the chassis frame, i.e. through the rear left-hand cruciform member and side member, and connects the front and rear silencers. The inlet pipe of the rear silencer enters the front of the silencer, whereas on earlier Phantom V cars the pipe enters the silencer at a point along its side. In the modified system, the exhaust pipe No. 2 mounting bracket is positioned at the point where the intermediate pipe leaves the rear cruciform member (see Fig. Q5).

The modified exhaust system increases the clearance between the top of the rear silencer and the car body floor, thus reducing the floor temperature.

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SECTION Q2 — TO REMOVE AND FIT

Joints — Exhaust Manifolds to Exhaust Ports — to renew

S1 cars

Remove and retain the special bolt and aluminium washer holding the breather pipe to the rocker cover and slacken the clip pinch bolt. Move aside the breather pipe to facilitate access to the extension nuts on the front manifold.

Remove the oil level dipstick and cover the dipstick entry hole with adhesive tape to ensure that no small parts or foreign matter can drop into the sump during work on the manifold.

Disconnect the down pipe flanges from the exhaust manifold by removing three nuts, bolts and plain steel washers from each flange.

Remove the nut, bolt and washer securing the tubular stay to the breeches piece (see Fig. Q1).

Withdraw the down pipes from the exhaust manifold.

The cupro–nickel joints fitted between the flanges should be discarded.

Remove the two 2 BA nuts retaining the heat shield to the cylinder head, above the rear manifold. This shield is positioned so as to deflect the heat from the rear manifold away from the rubber hose leading to the underwing heat exchanger (see Fig. Q1).

Remove the twelve extension nuts from the exhaust manifolds and withdraw the manifolds from the studs.

The copper–asbestos joints between the manifolds and the exhaust port faces should be discarded. All traces of carbon should be removed from the exhaust port faces of both the manifolds and the cylinder block.

Each of the two manifolds has two flanges which have slotted holes $\frac{1}{2}$ in. in length. The other two flanges have clearance holes to accept the steel studs positioned in the cylinder block. The slotted holes permit the flanges to expand and contract without causing distortion. The slots are 0·325 in. wide and the drilled holes are 0·325 in. in diameter.

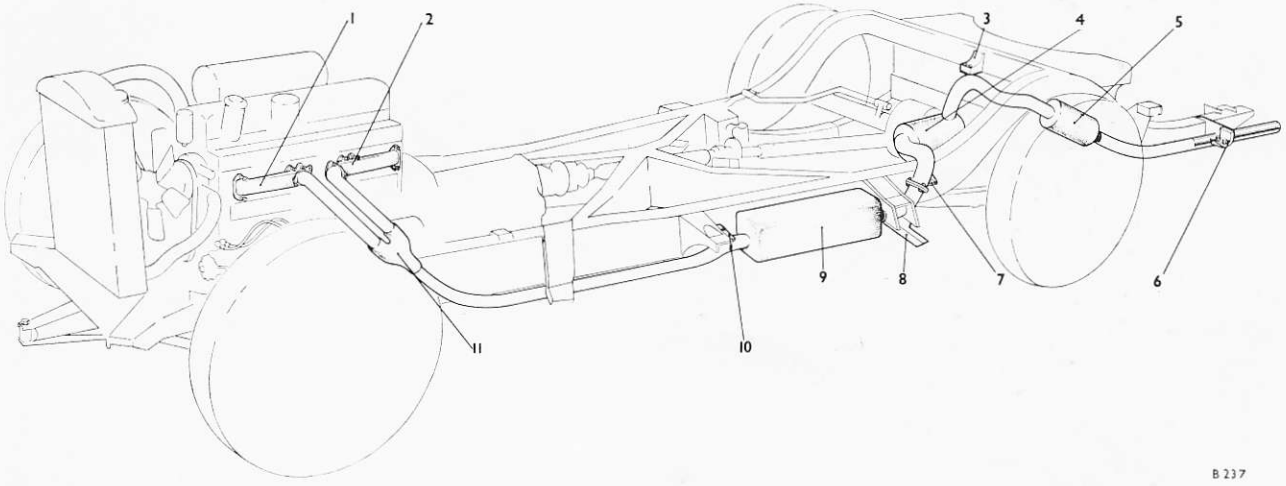


Fig. Q3 Exhaust system — S1 cars

1. FRONT EXHAUST MANIFOLD
2. REAR EXHAUST MANIFOLD
3. No. 3 MOUNTING BRACKET
4. REAR SILENCER
5. DAMPER BOX
6. No. 4 MOUNTING BRACKET
7. No. 2 MOUNTING BRACKET
8. JACKING BRACKET
9. FRONT SILENCER
10. No. 1 MOUNTING BRACKET
11. BREECHES PIECE ASSEMBLY

The exhaust manifolds should be checked for distortion by applying a straight edge across the joint faces. If any small irregularities are evident a surface grinding machine should be used for re-facing the manifolds. If such a machine is not available, any scale which is found on the faces of the manifold should be removed with a medium cut file prior to re-surfacing. The manifold may be re-faced by passing the manifold joint face back and forth across a sheet of medium grade emery cloth laid on a flat surface.

The importance of the manifold faces being flat and square cannot be over-emphasised.

Assembly

A new copper–asbestos joint should be fitted. No jointing compound should be used but the nuts should be oiled to ensure that no binding of the threads occurs.

To avoid straining the tubular stay, the bolt securing the stay to the lug on the crankcase should be slackened before the bolt securing the stay to the breeches piece is re-fitted.

The remaining assembly procedure is the reverse of the procedure described above for removing the manifolds.

S2 cars

Remove the oil level dipstick, then remove the bolt from the dipstick tube support bracket, together with the two setscrews and washers securing the dipstick tube to the engine sump; remove the dipstick tube. This procedure prevents accidental damage to the dipstick and tube and improves access to the exhaust manifolds.

Cover all entries to the engine sump with adhesive tape to prevent small parts and foreign matter dropping into the sump during work on the exhaust manifold.

Remove the two union nuts attaching the choke stove pipes to the right-hand side exhaust manifold (see Fig. Q4).

Disconnect the down pipe flanges from the exhaust manifold by removing the three nuts and washers from each flange.

Remove the nut, bolt and washer from the 'A' bank down pipe mounting which is positioned on the left-hand side of the engine sump. Access to this mounting is facilitated by raising the car on a ramp.

Withdraw the down pipes from the exhaust manifolds.

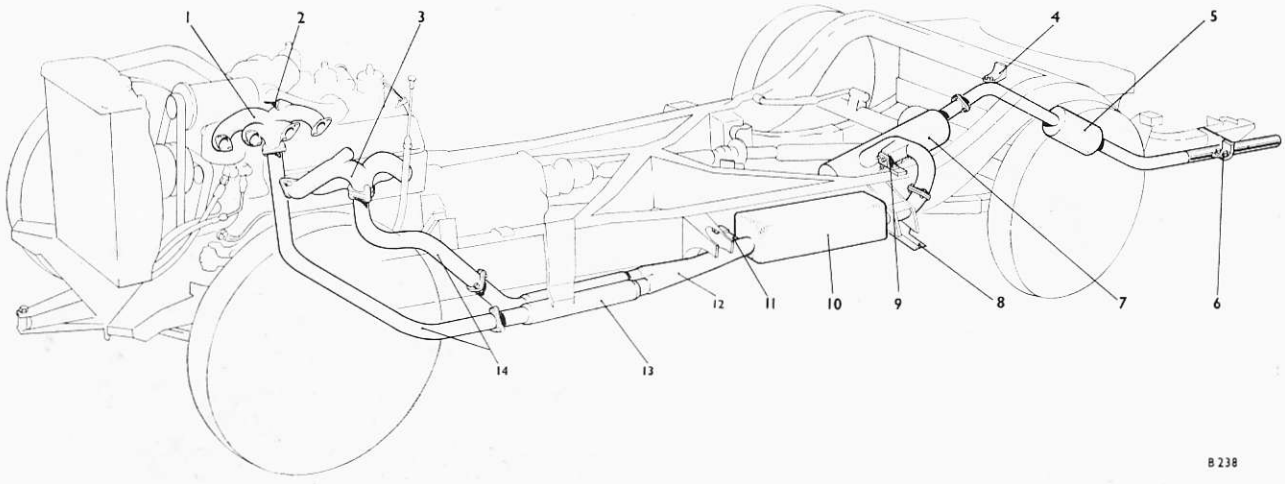


Fig. Q4 Exhaust system — S2 cars (except later Phantom V)

1. RIGHT-HAND MANIFOLD
2. CHOKE STOVE PIPES
3. LEFT-HAND MANIFOLD
4. No. 3 MOUNTING BRACKET
5. DAMPER BOX
6. No. 4 MOUNTING BRACKET
7. REAR SILENCER
8. JACKING BRACKET
9. No. 2 MOUNTING BRACKET
10. FRONT SILENCER
11. No. 1 MOUNTING BRACKET
12. BREECHES PIECE ASSEMBLY
13. EXHAUST PIPE LAGGING
14. DOWN PIPES

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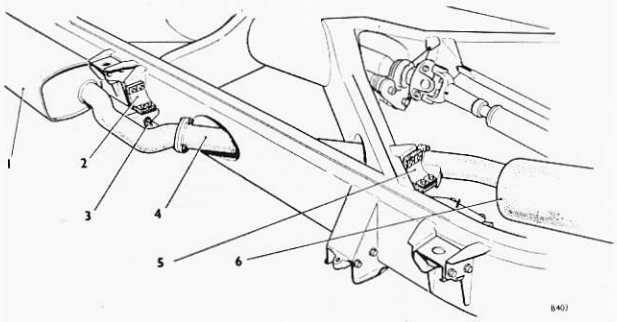


Fig. Q5 'Through the frame' exhaust system (later Phantom V cars)

1. FRONT SILENCER
2. SUSPENSION STRIP
3. EARTHING STRIP
4. INTERMEDIATE PIPE
5. SUSPENSION STRIP
6. REAR SILENCER

Remove the sixteen extension nuts from the exhaust manifolds, and lift the manifolds from the studs (see Fig. Q2).

The manifolds have slotted holes on Nos. 1, 2 and 4 exhaust ports, counting from the front of the engine. The slotted holes allow normal expansion and contraction without distortion of the manifolds. The slots are 0·325 in. wide and the drilled holes are 0·325 in. in diameter.

The exhaust manifold joint faces should be checked for distortion and re-faced if necessary, using the method described for S1 exhaust manifolds.

Assembly

No jointing compound should be used on any of the joints but the extension nuts should be oiled to ensure that no binding of the threads occurs during re-assembly.

Assembly is the reverse of removal but it should be remembered that the re-connecting of the right-hand side down pipe support should be carried out last.

All cars

Remove all adhesive tape masking from the sump before fitting the oil level dipstick and tube.

All nuts and bolts should be evenly tightened.

After the engine has run sufficiently to reach its normal operating temperature, the nuts and bolts should again be evenly tightened.

Silencer or Exhaust Pipe — to renew

S1 cars

The front silencer and exhaust pipe is renewed as an assembly including the down pipes and breeches piece (see Fig. Q3).

Removal of the front silencer assembly is a comparatively simple operation and should be carried out as follows:

Remove the down pipes from the exhaust manifolds as previously described.

Remove the five screws retaining the engine access plate on the valance panel. With this plate removed, the aperture is large enough to permit easy withdrawal of the down pipes without removing the valance.

Disconnect the front silencer outlet pipe by removing the three nuts, bolts and washers from the outlet pipe flange.

Remove the six nuts, bolts and washers retaining the jacking bracket to the body support bracket to allow the silencer assembly to be lowered, guiding the down pipes through the aperture in the valance.

Assembly

A flexible tinned copper earthing strip is fitted at all suspension points of the exhaust system. When renewing any exhaust system component, care must be taken to ensure that these strips are fitted directly between two metal points and never between the bolts and fabric suspension strips.

The fabric suspension strips should be examined and renewed if they are torn or perished.

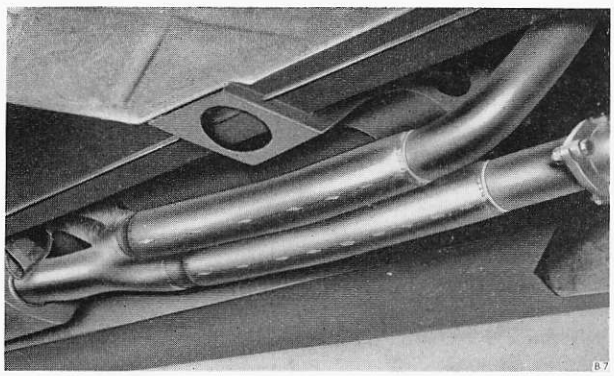


Fig. Q6 Position of exhaust pipe lagging

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Whenever flanges on the exhaust system are separated, the cupro–nickel joints must be renewed in order to prevent leakage of exhaust gases.

The procedure for re-fitting the front silencer and exhaust pipe assembly is the reverse of the removal procedure, care being taken to ensure that the assembly is in its correct position before tightening any nuts.

S2 cars

On S2 cars, the front silencer and exhaust pipe is renewed as one assembly, including the breeches piece but not the down pipes (see Fig. Q4). Remove the assembly as follows:

Remove the down pipes from the breeches piece by removing three nuts, bolts and washers from each of the two flanges.

Disconnect the front silencer outlet pipe by removing the three nuts, bolts and washers from the outlet pipe flange.

Remove the six nuts, bolts and washers retaining the jacking bracket to the body support bracket to allow the silencer assembly to be lowered.

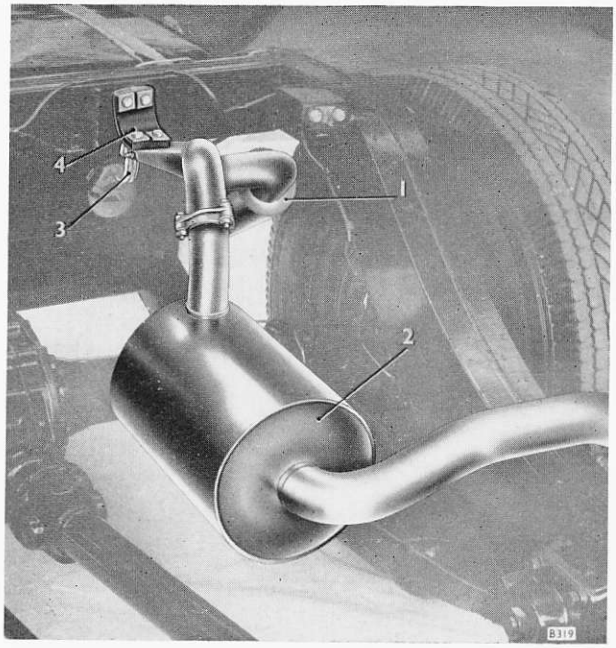


Fig. Q7 Rear silencer and damper box — S1 cars

1. DAMPER BOX
2. REAR SILENCER
3. EARTHING STRIP
4. SUSPENSION STRIP

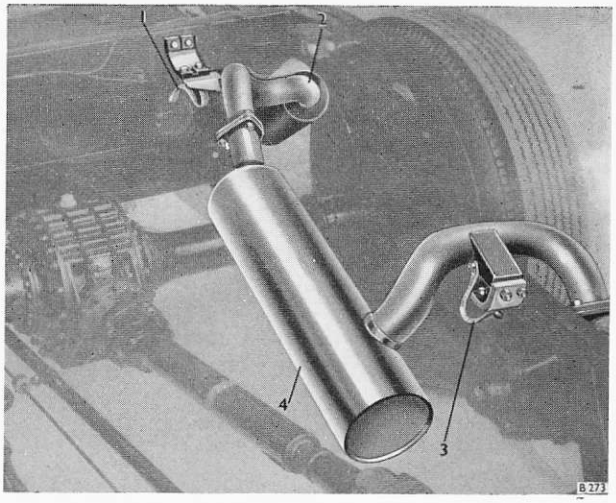


Fig. Q8 Rear silencer and damper box — S2 cars

1. EARTHING STRIP
2. DAMPER BOX
3. EARTHING STRIP
4. REAR SILENCER

Remove the nut and bolt attaching the earthing strip to the silencer front mounting.

Support the silencer while removing the two nuts, bolts and washers connecting the moulded, rubberised fabric strip to the exhaust pipe. Lower and remove the silencer assembly.

The flexible tinned copper earthing strips are connected to each of the suspension points by a nut and bolt.

On S2 cars, a modification has been introduced to reduce exhaust pipe 'titter' and should be fitted whenever it is necessary.

The modification consists of lagging the two down pipes for a distance of approximately 20 in. immediately forward of the breeches piece (see Fig. Q6).

Dampen the asbestos lagging and wrap it around the exhaust pipes. Fit the aluminium covers over the lagging and secure them in position with worm drive clips. The longitudinal joints should then be tack-welded at intervals of 2 in. while held in position.

The clips should then be removed and the ends of the covers sealed by crimping. On completion the covers should be painted with heat resisting paint.

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Rear Silencer — to renew

Disconnect the flanges in front of and behind the silencer by removing the six retaining nuts, bolts and washers (see Figs. Q7 and Q8).

Remove the two nuts, bolts and washers from the supporting bracket at the front end of the rear silencer (**on S2 cars,** remove the additional nut and bolt securing the earthing strip). Remove the silencer.

The method of installing the rear silencer is the reverse of the removal procedure except that new cupro–nickel flange joints must be fitted.

Damper Box — to renew

Remove the nuts, bolts and washers from the flange behind the rear silencer.

Support the damper box and release the two suspension strips by removing the securing nuts, bolts and washers.

The damper box can then be removed and a replacement fitted.

The method of fitting the damper box to the exhaust system is the reverse of the removal procedure, care being taken to ensure that the earthing strips are correctly located. New cupro–nickel flange joints must be used.

Intermediate Pipe — Phantom V Cars — to renew

On Phantom V cars fitted with the 'through the frame' exhaust system, the removal procedure is as follows:

Disconnect the front flange of the rear silencer from the intermediate pipe by removing the three nuts, bolts and washers.

Remove the rear silencer and damper box assembly after disconnecting the assembly from the two suspension strips.

Lower the assembly from the chassis.

Disconnect the forward end of the intermediate pipe by removing the three nuts, bolts and washers from the flange.

Withdraw the intermediate pipe from the tunnels in the chassis frame.

The method of assembly of the new pipe and the fitting of the rear silencer and damper box assembly is the reverse of the removal procedure. Fit the new cupro–nickel flange joints and ensure that the earthing strips are correctly located.

The route of the exhaust system should be such that there is no possibility of the intermediate pipe touching the sides of the tunnels through which it passes.

Down Pipes of S2 Cars — to renew

Remove the right-hand down pipe as follows:

Remove the three nuts and washers securing the down pipe to the exhaust manifold flange.

Remove the three nuts, bolts and washers securing the down pipe to the breeches piece flange (see Fig. Q2).

Support the down pipe and remove the nut, bolt and washer securing the pipe to the rear engine mounting. Withdraw the down pipe from the manifold flange studs; the pipe may then be removed and a replacement fitted.

The procedure for the removal of the left-hand side down pipe is similar to that described above, a difference being that no supporting stay is fitted to the left-hand pipe.

Assembly is the reverse of removal but new cupro–nickel flange joints must be fitted.

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CHAPTER Q

EXHAUST SYSTEM

SECTION Q1 DESCRIPTION

(Page Q1 in Workshop Manual)

S3 cars

The information in this Section which applies to S2 cars is also applicable to S3 cars with the following Chassis Nos.

Rolls-Royce Silver Cloud III From SAZ1 to SAZ61 inclusive.

Bentley S3 From B2AV to B26AV inclusive.

On all other S3 cars the exhaust system is of the acoustic type.

The exhaust gases pass from the engine through two cast-iron manifolds and down two downtake pipes to enter a single pipe through a welded breeches piece.

The two downtake pipes are of 2 in. outside diameter.

The single exhaust pipe from the breeches piece to the front silencer passes along the outside of the chassis frame and is of 2½ in. outside diameter.

The exhaust gases flow through the front silencer along two perforated tubes, one being the inlet and one being the outlet. The tubes are set at an angle inside the silencer shell and are supported by a centrally situated plate which also acts as a stiffener for the silencer shell.

The silencer is almost rectangular in shape and its approximate external dimensions are 16 in. × 8½ in. × 8 in.

The underside of the car floor, above the front silencer and exhaust pipe is protected against heat by aluminium-asbestos shields.

The exhaust gases on leaving the front silencer flow through a single exhaust pipe, which passes through the chassis frame side member, through the rear left-hand cruciform member and into the rear silencer.

The rear silencer is cylindrical in shape and is approximately 21½ in. long and 5½ in. in diameter.

The underside of the car floor above the rear silencer is protected against heat by an aluminium-asbestos shield.

The exhaust gases finally pass from the rear silencer through a high frequency damper and out through the exhaust tail pipe.

The damper is cylindrical in shape and is approximately 8 in. long and 4 in. in diameter. It consists of a perforated tube, around which is packed 7½ oz. of 'Rocksil' wool.

The outer surface of the front silencer is lagged with ⅛ in. thick asbestos sheet enclosed within a welded aluminium casing; this is the only lagged silencer in the system.

The silencers and the damper are manufactured from stainless steel as a protection against condensation corrosion.

The exhaust system is secured to the chassis frame in four places by 'Vibrashock' mountings.

The down pipe from the 'A' bank exhaust manifold, positioned on the right-hand side of the car, sweeps under the engine and is secured to a bracket on the left-hand side of the engine mounting, before joining the breeches piece on the outside of the chassis frame.

Copper-asbestos joints are fitted between the exhaust manifolds and the cylinder heads, the exhaust manifolds being secured to the cylinder heads by ⅜ in. diameter extension nuts.

Cupro-nickel joints are fitted between the exhaust downtake pipes and the exhaust manifolds.

All the other exhaust pipe joints are fitted with steel spherical sealing rings which are held in position by bridge type clamps.

SECTION Q2—TO REMOVE AND FIT

Exhaust manifolds — To renew

S3 cars only

Remove the oil level dipstick from the engine, then remove the bolt from the dipstick tube support bracket, together with the two setscrews and washers securing the dipstick tube to the engine sump; remove the dipstick tube. This procedure prevents accidental damage to the dipstick and tube and improves access to the exhaust manifold. Mask the dipstick hole in the sump to prevent the entry of foreign matter.

Remove the two union nuts attaching the choke stove pipes to the right-hand side exhaust manifold (see Fig. Q1 (S) of this Supplement).

Disconnect the down pipe flanges from the exhaust manifold by removing the three nuts and washers from each flange.

Remove the nut, bolt and washer from the 'A' bank down pipe mounting which is positioned on the left-hand side of the engine sump. Access to this mounting is facilitated by raising the car on a ramp.

Withdraw the down pipes from the exhaust manifolds.

Remove the sixteen extension nuts from the exhaust manifolds, then lift the manifolds from the studs (see Fig. Q2 (S) of this Supplement).

The manifolds have slotted holes in Nos. 1, 2 and 4 exhaust port flanges, counting from the front of the engine. The slotted holes allow for normal expansion and contraction without distortion of the manifolds. The slots are 0·325 in. wide and the drilled holes are 0·325 in. in diameter.

The exhaust manifolds should be checked for distortion using a straight edge across the joint faces; if necessary, the joint face should be re-faced.

The importance of the manifold faces being flat and square cannot be over-emphasised.

Assemble the exhaust manifolds by reversing the procedure given for their removal noting the following points.

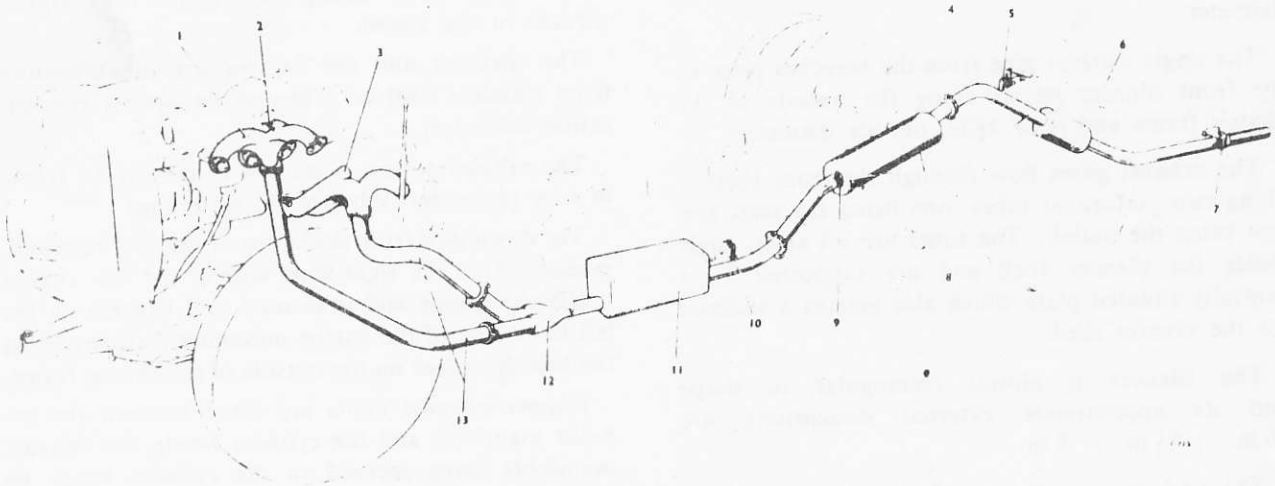


Fig. Q1 (S) Exhaust system — S3 cars (except Phantom V)

1 RIGHT-HAND MANIFOLD
2 CHOKE STOVE PIPES
3 LEFT-HAND MANIFOLD
4 BRIDGE CLAMP
5 DAMPER MOUNTING BRACKET
6 DAMPER
7 TAILPIPE MOUNTING BRACKET
8 REAR SILENCER
9 REAR SILENCER MOUNTING BRACKET
10 FRONT SILENCER MOUNTING BRACKET
11 FRONT SILENCER
12 BREECHES PIECE
13 DOWN PIPES

Fit new copper-asbestos joints between the exhaust manifolds and the cylinder heads and fit new cupro-nickel joints between the exhaust manifolds and the exhaust down pipes.

No jointing compound should be used on any of the joints but the extension nuts should be lubricated to ensure that no binding of the threads occurs during re-assembly.

The re-connecting of the right-hand side down pipe support should be carried out last.

Remove all adhesive tape masking from the sump and refit the oil level dipstick and tube.

All nuts and bolts should be evenly tightened.

After the engine has run sufficiently to reach its normal operating temperature, the nuts and bolts should again be evenly tightened.

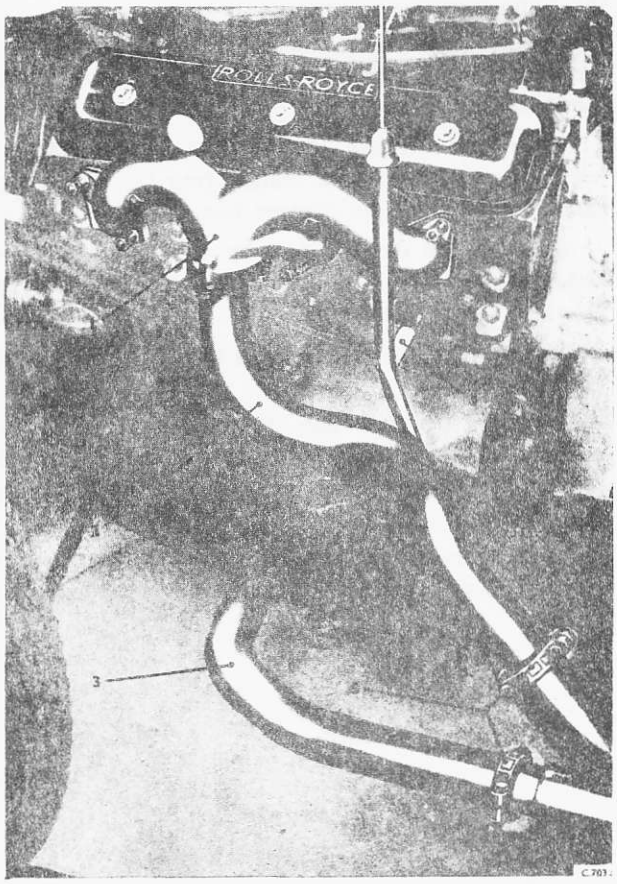


Fig. Q2 (S) Exhaust manifold and down pipes — S3 cars

1 MANIFOLD
2 LEFT-HAND DOWN PIPE
3 RIGHT-HAND DOWN PIPE
4 DIPSTICK TUBE SUPPORT BRACKET
5 CLAMPS

Exhaust down pipes — To renew

S3 cars only

Remove the right-hand down pipes as follows

Remove the three nuts and washers securing the down pipe to the exhaust manifold flange.

Remove the two nuts, bolts and bridge clamps securing the down pipe to the breeches piece (see Fig. Q2 (S) of this Supplement).

Support the down pipe and remove the nut, bolt and washer securing the pipe to the engine mounting.

Withdraw the down pipe from the manifold flange studs; the pipe may then be removed and the spherical steel sealing ring retained for use when a replacement down pipe is fitted.

The procedure for the removal of the left-hand side down pipe is similar to that described above, a difference being that no supporting bracket is fitted to the left-hand pipe.

Assemble the exhaust down pipes by reversing the procedure given for their removal noting the following points.

New cupro-nickel flange joints must be fitted between the exhaust manifold flanges and the down take pipe flanges.

The spherical steel sealing rings should be clean and free from scale.

Smear the spherical faces of the sealing rings and the grooves in the clamps with a suitable graphite lubricant to ensure correct alignment of pieces on re-assembly.

All the nuts should be lubricated to ensure that no binding of the threads occurs during re-assembly.

Front silencer — To renew

S3 cars only

Remove the nuts, bolts and bridge clamps securing the down pipes to the breeches piece (see Fig. Q2 (S) of this Supplement).

Remove the bridge clamps from the outlet pipe of the front silencer (see Fig. Q1 (S) of this Supplement).

Remove the 2 BA nut, bolt and washer securing the flexible earthing strip to the front silencer mounting bracket.

Support the silencer while removing the setscrew securing the outlet pipe bracket to the 'Vibrashock' mounting.

Lower and remove the silencer assembly. Retain the spherical steel sealing rings for use when fitting the replacement silencer.

Assemble the front silencer by reversing the procedure given for its removal noting the following points.

Do not tighten any one bridge clamp securing the down pipes to the breeches piece until both bridge clamps are in position on the pipes.

The spherical steel sealing rings should be clean and free from scale.

Smear the spherical faces of the sealing rings and the grooves in the clamps with a suitable graphited lubricant to ensure correct alignment of the pieces on re-assembly.

All the nuts should be lubricated to ensure that no binding of the threads occurs during re-assembly.

Rear silencer — To renew

S3 cars only

Remove the nuts, bolts and bridge clamps from the rear silencer inlet and outlet pipes, then remove the 2 BA nut, bolt and washer securing the flexible earthing strip to the rear silencer mounting bracket.

Support the rear silencer while removing the setscrew securing the silencer bracket to the 'Vibrashock' mounting (see Fig. Q1 (S) of this Supplement).

Lower and remove the silencer; retain the spherical steel sealing rings for use when fitting the replacement silencer.

Assemble the rear silencer by reversing the procedure given for its removal noting the following points.

The spherical steel sealing rings should be clean and free from scale.

Smear the spherical faces of the sealing rings and the grooves in the clamps with a suitable graphited lubricant to ensure correct alignment of the pieces on re-assembly.

All the nuts should be lubricated to ensure that no binding of the threads occurs during re-assembly.

Damper box — To renew

S3 cars only

Remove the nuts, bolts and bridge clamps from the damper box inlet pipe, then remove the 2 BA nuts, bolts and washers securing the flexible earthing strips to the damper box and the tailpipe mounting bracket.

Remove the setscrew securing the tailpipe bracket to the 'Vibrashock' mounting (see Fig. Q1 (S) of this Supplement).

Support the damper box while removing the setscrew securing the damper box mounting bracket to the 'Vibrashock' mounting.

Lower and remove the damper box assembly; retain the spherical steel sealing ring for use when fitting the replacement damper box.

Assemble the damper box by reversing the procedure given for its removal noting the following points.

The spherical steel sealing ring should be clean and free from scale.

Smear the spherical faces of the sealing ring and the grooves in the clamps with a suitable graphited lubricant to ensure correct alignment of the pieces on re-assembly.

All the nuts should be lubricated to ensure that no binding of the threads occurs during re-assembly.

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CHAPTER R

WHEELS AND TYRES

Data

Wheels

Rim diameter	15·00 in.
Rim width	6·00 in.

Tyres sizes

Silver Cloud Silver Cloud II	8·20 in. × 15·00 in.
Bentley S1 Bentley S2	8·20 in. × 15·00 in.
Bentley Continental S1 (early)	7·60 in. × 15·00 in.
Bentley Continental S1 (late) Bentley Continental S2	8·00 in. × 15·00 in.
Phantom V	8·90 in. × 15·00 in.

Wheels

The steel well-base wheel is secured to the hub by five nuts ($\frac{1}{2}$ in. U.N.F. 20 t.p.i.).

Left-hand nuts secure the wheels on the left-hand side of the car and right-hand nuts secure the right-hand wheels; an arrow stamped on the crown of each nut indicates whether it has a left-hand or right-hand thread.

A small hole is drilled through the crown of the nuts to prevent 'air pocketing' when tightening.

Care should be taken to ensure that the spherical seatings of the nuts are not damaged and a light coating of grease should be applied to the threads of the nuts before fitting.

The wheel embellishing disc assembly comprises the disc, claw ring and outer painted ring.

To remove the wheel discs, insert a tommy bar between the disc and the tyre.

To fit the wheel discs, locate the valve stem through the hole provided in the disc and tap around the edge of the disc with a hide mallet.

Care should be taken to avoid damaging the chrome or painted surfaces when removing or re-fitting the discs.

Wheel Balancing

The wheels are both statically and dynamically balanced on initial assembly and it is advisable to check the balance every 5000 miles.

When wheels are to be re-balanced, it is essential that the weight of the car is removed from the tyres as soon as possible, as failure to do so will cause temporary 'flats' to form on the tyres; this is especially so with nylon tyres.

It is pointless to re-balance wheels when the tyres are in this condition, as the static balance may be affected by as much as 10 in./oz.

Special equipment is required to balance road wheels and it is essential that only balance weights obtained from Rolls-Royce Service Departments are fitted.

The standard weights generally available are intended only for fitting to 12 gauge rims and should not be fitted to heavier gauge wheels. Insecurity of the weights when the car is travelling at high speeds could result in considerable damage.

The recommended balance weights are identified by the letters HG stamped on the outer face. These can be obtained from Rolls-Royce Service Departments in the following range:

UG.1460	...	½ oz.
UG.1461	...	1 oz.
UG.1462	...	1½ oz.
UG.1463	...	2 oz.
UG.1464	...	2½ oz.
UG.1465	...	3 oz.

The approved weights incorporate a strengthened spring clip of larger dimensions to accommodate the heavier gauge wheel. The weights can be removed or re-fitted with a special tool supplied by the manufacturer of the wheel balancing machine.

When fitting the weights to the rim, use only sufficient force to secure them in position; too much force will tend to slacken them.

It is essential, when balancing wheels on these machines, that the maker's instructions are fully observed.

Tyres

Information regarding the latest approved tyres for Rolls-Royce and Bentley cars can be obtained from Service Bulletins which will be issued when necessary.

When the fitting of new tyres is being contemplated, reference should be made to the latest Bulletin.

When new tyres have been fitted, the speed of the car must not exceed 90 m.p.h. for the first 100 miles; heat generated by a new tyre until it is sufficiently flexed makes it unsafe for really fast driving.

After fitting a new tyre it is necessary to re-balance the wheel.

Pressures

The recommended tyre pressures are:

Silver Cloud and Bentley S1 — 8·20 × 15 tyres

Power-assisted steering:

Front	21 lb/sq.in.	(1·48 kg/sq.cm.)	Cold	
Rear	26 lb/sq.in.	(1·83 kg/sq.cm.)		

Manual steering:

Front	19 lb/sq.in.	(1·33 kg/sq.cm.)	Cold	
Rear	26 lb/sq.in.	(1·83 kg/sq.cm.)		

Silver Cloud and Bentley S1 Long Wheelbase — 8·20 × 15 tyres

Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold	
Rear	28 lb/sq.in.	(1·97 kg/sq.cm.)		

Bentley Continental S1 (early) — 7·60 × 15 tyres

Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold	for normal speed running
Rear	24 lb/sq.in.	(1·70 kg/sq.cm.)		
Front	30 lb/sq.in.	(2·1 kg/sq.cm.)	Cold	for maximum speed running
Rear	35 lb/sq.in.	(2·46 kg/sq.cm.)		

Silver Cloud II and Bentley S2 — 8·20 × 15 tyres

Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold
Rear	27 lb/sq.in.	(1·90 kg/sq.cm.)	

Silver Cloud II and Bentley S2 Long Wheelbase — 8·20 × 15 tyres

Front	23 lb/sq.in.	(1·62 kg/sq.cm.)	Cold
Rear	29 lb/sq.in.	(2·04 kg/sq.cm.)	

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Bentley Continental S1 (late) and S2 — 8·00 × 15 tyres

Front	20 lb/sq.in.	(1·41 kg/sq.cm.)	Cold	for normal speed running
Rear	25 lb/sq.in.	(1·76 kg/sq.cm.)		
Front	25 lb/sq.in.	(1·76 kg/sq.cm.)	Cold	for maximum speed running
Rear	30 lb/sq.in.	(2·11 kg/sq.cm.)		

Bentley Continental S2 Park Ward Convertible Coupe

Front	20 lb/sq.in.	(1·41 kg/sq.cm.)	Cold	for normal speed running
Rear	28 lb/sq.in.	(1·97 kg/sq.cm.)		
Front	25 lb/sq.in.	(1·76 kg/sq.cm.)	Cold	for maximum speed running
Rear	33 lb/sq.in.	(2·33 kg/sq.cm.)		

Phantom V — 8·90 × 15 tyres

Front	22 lb/sq.in.	(1·55 kg/sq.cm.)	Cold
Rear	27 lb/sq.in.	(1·90 kg/sq.cm.)	

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It is essential when checking tyre pressure that the tyre be cold; a hot tyre **must not** be deflated in order to obtain the required pressure, for as a tyre cools, so the pressure decreases.

Snow Tyres

The approved tyres for winter driving are Dunlop 'Weathermaster' and Firestone 'Town and Country'; these tyres are designed to provide adequate traction in snow and mud. The sustained speed on these tyres must be limited to 80 m.p.h. The correct pressure for these tyres is 30 lb/sq.in. (2·11 kg/sq.cm.).

Tyre Service

Interchanging wheels

Every 5000 miles the wheels should be interchanged in order to equalise wear between the front and rear tyres. This should be so arranged that the best tyres of the set are used on the front wheels.

When interchanging the wheels, the tread of the tyres should be examined for uneven wear due to steering geometry faults. Excessive wear on the front tyres indicates the necessity for checking the steering geometry; any apparent faults should be rectified immediately.

Remove any flint or pebbles embedded in the tyre tread.

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Tubeless tyres

Rolls-Royce and Bentley cars are fitted with tubeless tyres when delivered, unless the customer specifically requests 'tubed' equipment.

Before servicing tubeless tyres, dealers should make certain that appropriate tools are available and that personnel are familiar with the procedure for fitting and removal.

It is essential, when fitting tubeless tyres, that the bead is correctly seated in order to obtain an efficient seal, if necessary with the assistance of a tyre bead lubricant. This lubricant can be obtained from Rolls-Royce Service Departments in London or Crewe either in 1 gallon tins (Part No. RH.652) or in 5 gallon drums (Part No. RH.653); it is also suitable for fitting 'tubed' tyres.

A puncture in a tubeless tyre can be repaired with a Dunlop 'Reddiplug' repair outfit. This method of repair is quite simple and can be carried out without removing the tyre from the rim; full instructions are provided with each outfit.

'Tubed' tyres

'Butyl' inner tubes, although manufactured from synthetic rubber, can be repaired in the same manner as tubes of natural rubber.

When installing an inner tube, ensure that it is free from 'kinks' when placed inside the cover. Unlike

tubes of natural rubber, synthetic tubes retain their extended size when deflated.

Tyres — to remove

Remove the tyre in the usual manner, ensuring that the narrow bead seating is uppermost. A liberal amount of lubricant should be applied to the tyre levers and the tyre beads when removing the tyre.

A special tool for removing and fitting the valve is manufactured by the Dunlop Rubber Co. Ltd.

Lubricate the valve and remove it by means of the special tool. If the tool is not available, a thin pointed screwdriver may be used by gently forcing it between the shoulder of the valve and the hole in the rim at the same time pushing the valve inward.

The valve must then be discarded and a new one fitted.

Tyres — to fit

Remove any burrs, high spots and scale from the wheel, particular attention being given to the tyre bead seating.

A specially designed Schrader air valve is fitted for use with tubeless tyres. Smear the valve with tyre bead lubricant and press it into the hole in the rim, using the special tool.

If this tool is not available, the valve can easily be installed as follows:

Smear the valve with tyre bead lubricant and insert it into the hole from inside the rim, hold the outer end of the valve and whilst working it from side to side, press on the spherical end with a piece of wood.

If tyre bead lubricant is not available, a solution of soap and water may be used; industrial soft soap must not be used.

Lubricate the tyre beads, rim flanges and the area of the bead ledge and carry out the normal fitting procedure, ensuring that the narrow edge of the rim is uppermost.

Inflate the tyre to a maximum pressure of 50 lb/sq.in.

Note: It is important that the initial inflation pressure of 50 lb/sq.in. is not exceeded.

If the beads are not correctly seated at this pressure, deflate the tyre and lubricate further, then centralise the tyre and again inflate to the maximum pressure.

Ascertain that the beads are correctly seated, then deflate the tyre to the required pressure.

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CHAPTER R

WHEELS AND TYRES

Data
(Page R 1 in Workshop Manual)

Wheels — S3 cars only

Rim diameter	15·00 in.
Rim width	6·00 in.

Tyre sizes

Silver Cloud III	8·20 in. × 15·00 in.
Bentley S3	8·20 in. × 15·00 in.
Bentley Continental S3	8·00 in. × 15·00 in.
Phantom V	8·90 in. × 15·00 in.

Wheel balancing
(Page R1 In Workshop Manual)

For S3 cars the first paragraph to read
The wheels are both statically and dynamically balanced on initial assembly and it is advisable to check the balance every 6000 miles (10,000 Kms.).

Pressures
(Page R2 in Workshop Manual)

On S3 cars the recommended tyre pressures are:
Silver Cloud III and Bentley S3 – 8·20 in. × 15·00 in. tyres

Front	22 lb/sq.in. (1·55 kg/sq.cm.)	Cold
Rear	27 lb/sq.in. (1·90 kg/sq.cm.)	

Silver Cloud III and Bentley S3 Long Wheelbase 8·20 in. × 15·00 in. tyres

Front	23 lb/sq.in. (1·62 kg/sq.cm.)	Cold
Rear	29 lb/sq.in. (2·04 kg/sq.cm.)	

Bentley Continental S3 8·00 in. × 15·00 in. tyres	Front 20 lb/sq.in. (1·41 kg/sq.cm.) Rear 25 lb/sq.in. (1·76 kg/sq.cm.)	Cold for normal speed running
	Front 25 lb/sq.in. (1·76 kg/sq.cm.) Rear 30 lb/sq.in. (2·11 kg/sq.cm.)	Cold for maximum speed running
Phantom V 8·90 in. × 15·00 in. tyres	Front 22 lb/sq.in. (1·55 kg/sq.cm.) Rear 27 lb/sq.in. (1·90 kg/sq.cm.)	Cold

Tyre service
(Page R3 in Workshop Manual)

Interchanging wheels

For S3 cars the first paragraph to read

Every 6000 miles (10,000 Kms.) the wheels should be interchanged in order to equalise wear between the front and rear tyres. This should be so arranged that the best tyres of the set are used on the front wheels.

The remaining information in this Section which applies to S2 cars is also applicable to S3 cars.

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CHAPTER S

BODY

SECTION S1 — DESCRIPTION AND GENERAL MAINTENANCE

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Description

On S1 and S2 cars, the standard saloon body is constructed from pressed steel and supported on the chassis frame by means of rubber mountings.

The doors, bonnet and luggage boot are made of 'Birmabright' alloy, the salient features of which are lightness combined with strength and rigidity.

Large front and rear doors are hinged to the front and centre pillars respectively and permit easy access to the front and rear seats.

Due to the ample proportions of the doors and the boot lid, assistors are provided to minimise the effort required to open and maintain them in an open position.

The front doors are provided with self-cancelling type locks and the action of closing either front door automatically releases the lock; this eliminates the possibility of being inadvertently locked outside the car whilst the key is still inside.

To enable the front doors to be locked from the outside, a lock is provided below each external door handle; the key for operating these locks is also used to turn the ignition switch.

The locks on the rear doors are not the self-cancelling type, therefore they can be locked by means of the remote control handles on the inside of the doors.

Bench type front seats are fitted having individual backs provided with adjustment for rake.

A rear luggage boot provides ample space for luggage and also has a separate compartment for stowing the spare wheel.

General Maintenance

In order to maintain the paintwork in the best possible condition the following procedure should be carried out.

Always remove dirt and mud by means of a liberal supply of clean water; tar can be removed by means of one of the many special proprietary cleaning solutions available, or by gently rubbing with a soft cloth moistened with turpentine substitute.

Under no circumstances should an attempt be made to dry clean the car: this practice can produce scratches which will only be removed by subsequent levelling down and polishing.

After thoroughly washing and drying the paintwork, it should be polished with a good quality wax polish.

Under no circumstances should a polishing compound containing ammonia be used.

Every third month, thoroughly wash the paintwork to remove traffic film and other atmospheric deposits, remove all residual wax polish by means of a suitable cleaning compound such as 'Belco' No. 7 and finally polish with a good quality wax polish.

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Leather Upholstery

The leather upholstery will be maintained in a clean and preserved condition if lightly washed with a good quality soap, such as toilet soap, then thoroughly dried with a clean cloth. An occasional application of Connolly's Hide Food will preserve the upholstery; this compound should be applied evenly with a clean soft cloth, then polished with a second clean cloth.

Floor Carpets and Head Cloth

Floor carpets should be removed from the car and cleaned with a vacuum cleaner.

Stains or grease marks may be removed from the carpets by means of a suitable cleaning solvent such as 'Drik'; this solvent can also be used to clean the head cloth.

SECTION S2 — FRONT DOORS

Doors — to remove and dismantle

Remove the split pin and withdraw the clevis pin from the check-strap.

Support the door and remove the screws securing the upper and lower hinges to the front pillar; the door can then be lifted off together with its hinges.

Cars Fitted with Electrically Operated Windows

Before removing the door from a car fitted with electrically operated windows see Section S4.

Arm Rest and Slide

To remove the arm rest, lift the release lever and slide the rest upwards.

Unscrew the two screws securing the arm rest slide and remove the slide from the door; retain the screws together with the distance washers.

Trim and Finisher

Note the angular positions of the door and window winding handles on the interior of the door to ensure that they may be returned to their original positions when refitting.

Unscrew the escutcheons with a 'C' spanner and remove the handles by drawing them off their splines.

Using a screwdriver, carefully ease the trim from the door, taking care not to damage the trim, the paintwork or the concealed spring fasteners (see Fig. S1).

On S2 cars, a grab handle is fitted to the finisher on the passenger side of the car and must be removed before unscrewing the finisher securing screws. To remove the grab handle, insert a $\frac{5}{16}$ in. U.N.F. spanner

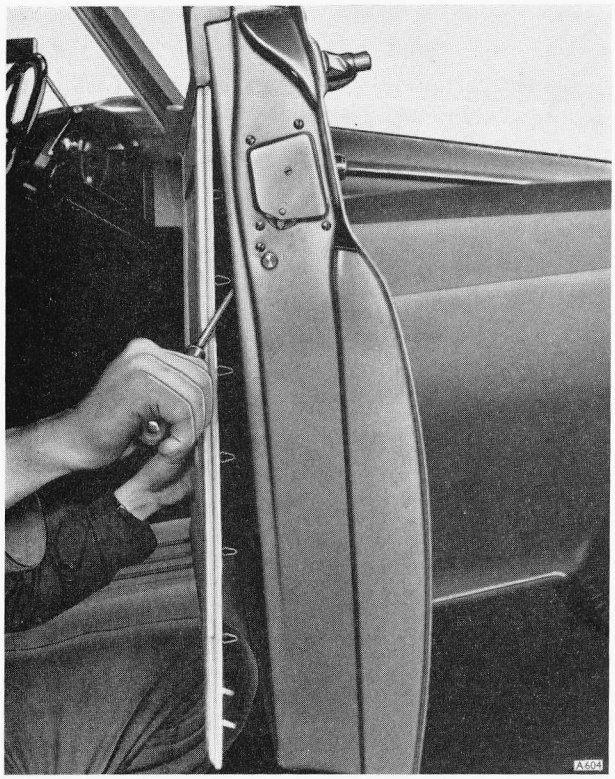


Fig. S1 Removing the trim from the front door

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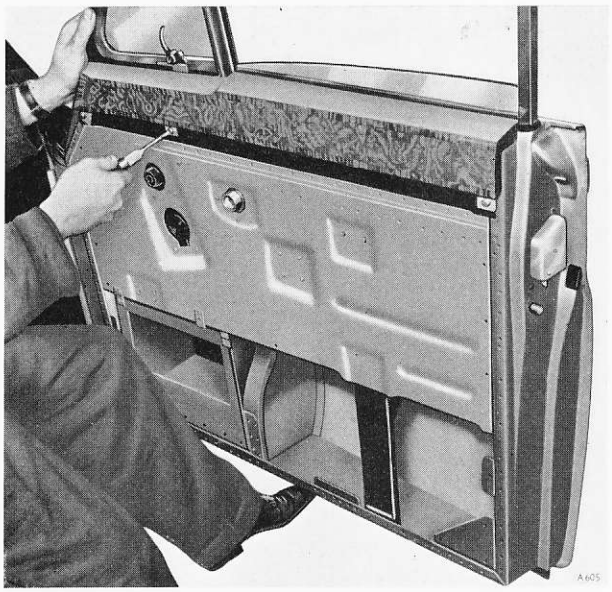


Fig. S2 Removing the finisher from the front door

between the metal trim panel and the finisher and alternately unscrew the captive nut at each end of the handle, half a turn at a time. Lightly pull on the handle whilst releasing the captive nuts until the handle can be withdrawn; retain the distance pieces.

Slightly open the ventilating window and lower the drop window; remove the retaining screws (see Fig. S2) and carefully ease off the finisher and plate.

Carefully remove the plastic cover from the door inner panel.

Ventilating Window

Having removed the door finisher and plate, the lower pivot and friction device of the ventilating window will then be exposed (see Fig. S3).

Unscrew the nuts from the lower pivot and withdraw the washers, discs and spring (see Fig. S4). Withdraw the ventilating window stop pin to enable the window to be lifted off the upper pivot; retain the $\frac{1}{4}$ in. (6·35 mm.) diameter steel ball.

Drop Window and Winder Mechanism

It will assist disengagement of the runner if the window winder mechanism is in the fully raised position.

Unscrew the screws marked 8 and 9 shown in Figure S5, then withdraw the winder mechanism.

If a new window is to be fitted, it is not necessary to remove the winder mechanism; in this case proceed as follows.

On early S1 cars, remove the five screws marked 11 shown in Figure S5 and withdraw the stop bracket.

On late S1 and all S2 cars, remove the twelve screws securing the support bracket brace. Withdraw the support bracket brace and stop bracket as an assembly.

On all cars, remove the two screws at the lower end of the forward channel and withdraw the channel, leaving the felt on the glass.

To permit disengagement and removal of the rubber, lower the glass to its fullest extent.

Window Frame

Should it be necessary to remove the window frame, note the position of the packing pieces in order that they may be refitted correctly, thus avoiding upsetting the frame adjustment in relation to the body sealing.

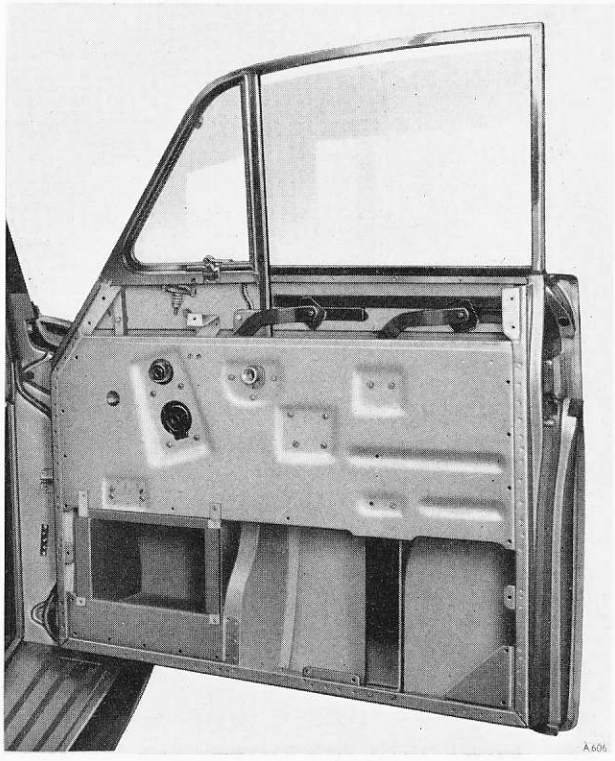


Fig. S3 Front door with the trim and finisher removed

To withdraw the window frame, remove the screws marked 5 and 7 in Figure S5, also the screws securing the window frame at the rear (these screws are not illustrated in Figure S5). Drill out the rivets marked 1, shown in Figure S5, using a $\frac{1}{8}$ in. (0·317 cm.) drill.

Chromium Plated Finishing Strip

The waist finisher strips are retained by spring clips and can be removed without further dismantling being necessary.

Door Locks and Locking Mechanism

To remove the external lock, detach the lock clip (fitted to **later S1 and all S2 cars**), screw back the locking nut as far as possible, insert the key and rotate the lock a few times; it should then be possible to remove the nut.

The door locking mechanism should be removed by unscrewing the screws marked 12 in Figure S5.

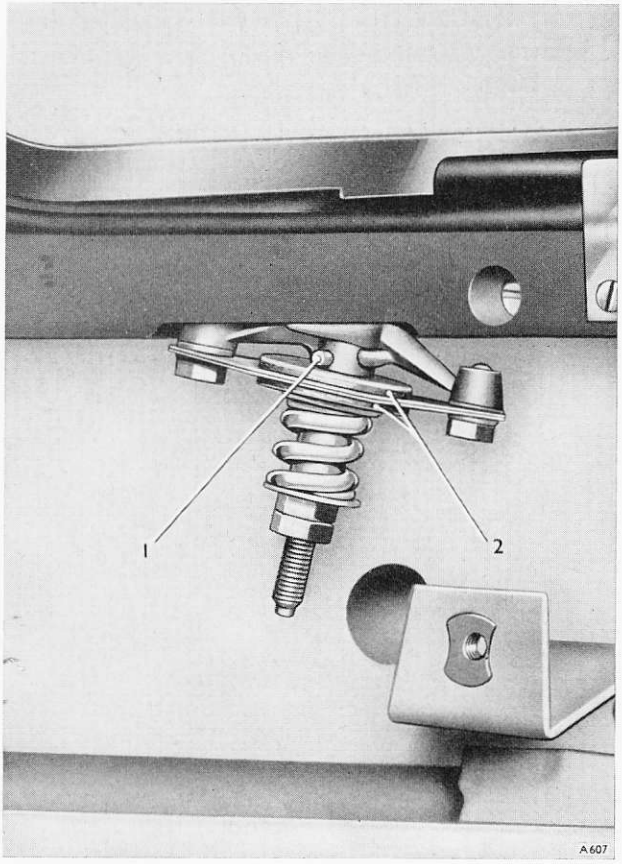


Fig. S4 Ventilating window bottom pivot

1. STOP PIN 2. FRICTION DISCS

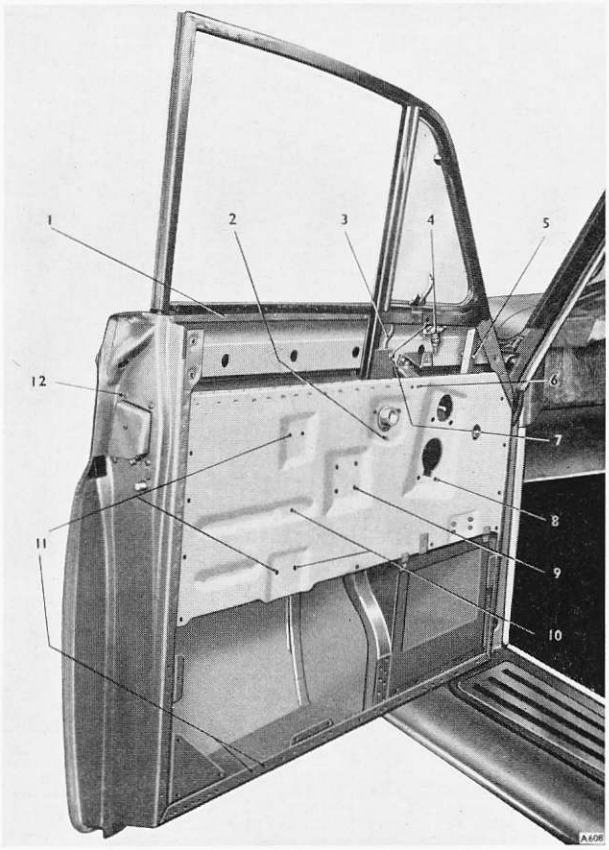


Fig. S5 Front door dismantled showing bolt holes

1. WINDOW FRAME RIVETS
2. BOLT HOLES FOR REMOTE CONTROL DOOR LOCK
3. VENTILATING WINDOW DRAIN PIPE
4. VENTILATING WINDOW LOWER PIVOT
5. WINDOW FRAME BOLTS
6. STIFFENER BRACKET BOLT
7. WINDOW FRAME BOLTS
8. WINDOW WINDER BOLT HOLES
9. WINDOW WINDER CENTRE BRACKET BOLT HOLES
10. ARM REST SLIDE BOLT HOLES
11. WINDOW STOP BRACKET BOLT HOLES
12. DOOR LOCK SCREWS

Door Assistor

Before removing the front door assistor, it will be necessary to detach the glove compartment (see Fig. S3).

On early S1 cars, it is necessary to drill out the rivets securing the glove compartment, using a $\frac{1}{8}$ in. (0·317 cm.) drill, before removing the compartment.

Remove the clevis pin, unscrew the retaining screws and withdraw the assistor through the glove compartment aperture.

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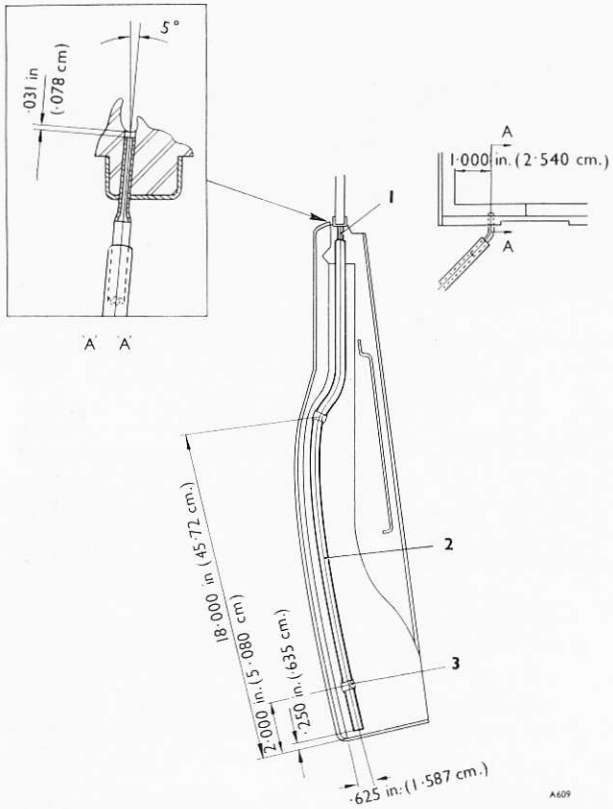


Fig. S6 Method of fitting drain to the ventilating window

1. COPPER TUBE 2. RUBBER TUBE 3. FIXING CLIPS

Doors — to assemble and fit

To assemble and fit the front doors, reverse the procedure given for removal and dismantling. Whilst carrying out this procedure ensure that reference is made to Section S8 and that particular note is made of the following points.

Ventilating Window

When assembling the lower pivot, the nut should be tightened until the distance piece is securely clamped, otherwise the friction discs will not operate effectively.

On early S1 cars, complaints of water leaks may be due to pressure build-up at the rear corner of the ventilating window. If necessary this can be relieved by providing a drain 1 in. (2·54 cm.) forward of the rear lower corner as illustrated in Figure S6.

Drill a hole $\frac{1}{4}$ in. (0·635 cm.) diameter through the rubber seal and the door frame; enlarge the hole in the door frame to $\frac{5}{16}$ in. (0·792 cm.) diameter to give clearance for a 3 in. (7·620 cm.) length of copper tube, $\frac{1}{4}$ in. (0·635 cm.) outside diameter.

Slightly flatten one end of the copper tube to avoid bulging the rubber seal, then attach a 24 in. (60·96 cm.) length of $\frac{1}{4}$ in. (0·635 cm.) diameter rubber tube to the other end and secure it with 'Bostik' adhesive No. 1261.

Insert the flattened end of the copper tube into the rubber seal so that it is $\frac{1}{32}$ in. (0·079 cm.) below the sealing face, then secure the tube with 'Bostik' adhesive No. 1261.

Attach the rubber hose to the door at the points shown in Figure S6.

When carrying out the above modification, ensure that the drain holes in the bottom of the door are clear.

Drop Window and Winder Mechanism

When assembling the drop window and winder mechanism, all working parts should be lubricated with 'Molytone' 265 grease.

On early S1 cars, failures have occurred due to fracture of the lower channel lugs; if new parts are not available, a fractured channel may be repaired in the manner shown in Figures S7 and S8. **On later cars** the lower channel lugs have been strengthened accordingly.

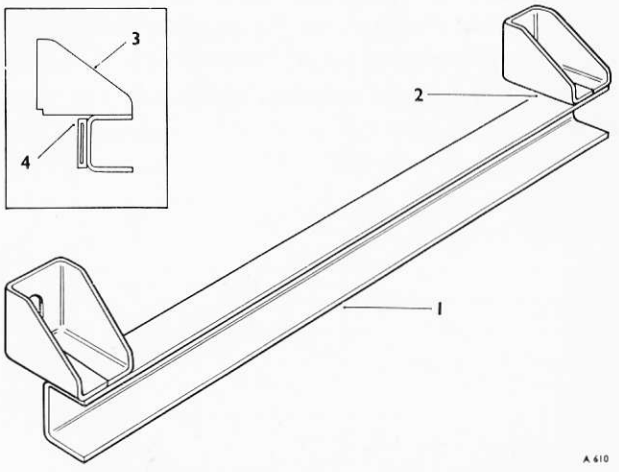


Fig. S7 Method of repairing window channel

1. WINDOW CHANNEL WITH NEW BRACKETS WELDED ON
2. WELD ALL AROUND AT THIS POINT ON BOTH BRACKETS
3. SCRAP VIEW OF NEW BRACKET
4. EXISTING BRACKET TO BE CUT OFF HERE

Door Locks and Locking Mechanism

When fitting the lock, make certain to position the lock in order that the same amount of movement is obtained when the key is turned either clockwise or anti-clockwise; this should be ascertained before toggling the intermediate lever.

Fit the locking mechanism but do not tighten the remote control assembly; this is operated by the interior handle.

Insert the handle and move it to the locked position; slide the control assembly back until the bellcrank lever on the lock contacts the backplate, then tighten the screws securing the remote control assembly.

If adjusted correctly, the push-button should have $\frac{1}{32}$ in. (0·079 cm.) free movement before it strikes the contactor and the adjusting screw tongue should be set horizontally rearwards.

Before fitting the trim, check the locking and releasing action by operating both the interior and the exterior controls.

Striker Plate

Should adjustment to the striker plate be necessary, slacken the three retaining screws and reposition the plate to obtain the desired result.

The striker plate should first be adjusted horizontally to provide satisfactory door closure and then adjusted for striker pin relationship. If correct adjustment has been obtained, the striker pin should travel along the centre line of the striker plate slot.

Check whether the optimum adjustment has been obtained by closing the door whilst depressing the button in the door handle.

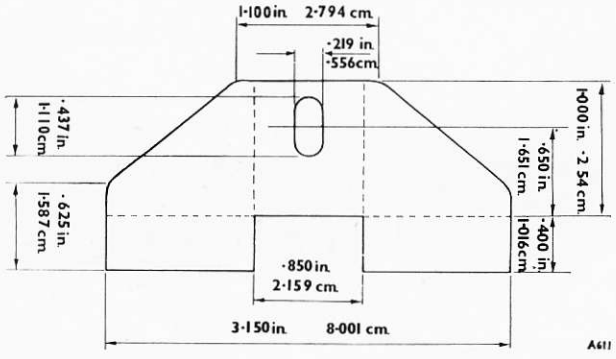


Fig. S8 Dimensions for new window channel brackets

BEND UP ALONG DOTTED LINES

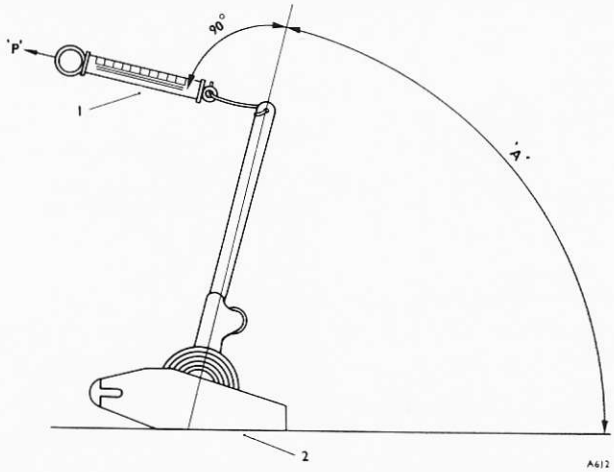


Fig. S9 Method of checking door assistor poundage

1. SPRING BALANCE 2. BODY OF ASSISTOR CLAMPED IN POSITION

FRONT DOORS

'A' ANGLE 9 deg. 'P' PULL 7·25 lb (3·288 kg.)
'A' ANGLE 74 deg. 'P' PULL 12·25 lb. (5·556 kg.)

REAR DOORS

'A' ANGLE 10·5 deg. 'P' PULL 4 lb. (1·814 kg.)
'A' ANGLE 80 deg. 'P' PULL 10·75 lb. (4·877 kg.)

Lubricate the spring for the dovetail wedge with 'Molytone' 265 grease.

Front Door Assistor

To check the assistor poundage for opening the door, first ensure that the car is standing on level ground. Attach a spring balance to the interior door handle with the door in the open position; a load of approximately 5 lb. (2·268 kg.) should then be required to close the door.

Checking the assistor poundage on the bench should be carried out at angles equivalent to the door being in both the open and the closed position as shown in Figure S9.

A positive door stop is incorporated in the upper hinge and a cushioned stop is provided by the assistor when opening the door; under normal operating conditions the positive stop does not operate, as the load is absorbed by the cushioned stop of the assistor.

It should be noted that the door must be initially opened at least 10 deg. before the assistor commences to operate.

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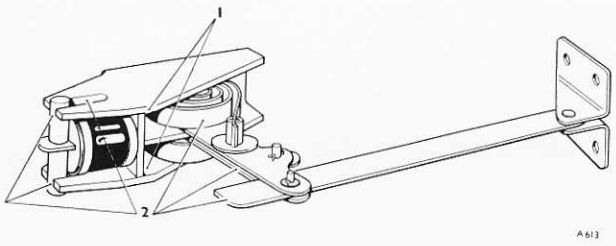


Fig. S10 Lubrication of door assistors

1. FILE FILLETS HERE 2. LUBRICATE AT THESE POINTS

When checking the door stop adjustment, the door should be allowed to open and come to rest **only by the action of the assistor.**

If the adjustment is correct, there should be a clearance of 0·025 in. (0·635 mm.) between the faces of the positive stop when the door is in the open position as stated above.

Should it be necessary to adjust the clearance between the faces of the positive stop, remove the door trim, then slacken the assistor retaining screws and reposition them to obtain the desired result.

Having made the necessary adjustment and before fitting the door trim, lubricate the door assistor with 'Molytone' 265 grease at the points shown in Figure S10.

SECTION S3 — REAR DOORS

Doors — to remove and dismantle

The procedure for removing and dismantling the rear door is similar to that adopted for the front door, the following points being noted.

Drop Window

To enable the drop window to be removed from the rear door, withdraw the rear channel and window stop. Lower the window to clear the channels, then raise it again and lift out.

Quarter Light Glass

To remove the quarter light glass, withdraw the frame, then remove the felts from the upper and rear channels; this allows access to the screws securing the quarter light channel. Remove the screws and draw the channel downwards to enable the glass to be withdrawn.

Doors — to assemble and fit

The procedure for assembling and fitting the rear door is similar to that adopted for the front door, therefore reverse the procedure given for removal and dismantling but note the following.

Door Assistor

The rear door assistor is not intended to open the door entirely on its own, therefore when checking the assistor poundage, with the door in the open position, a spring balance reading of 4 lb. (1·814 kg.) is adequate to close the door.

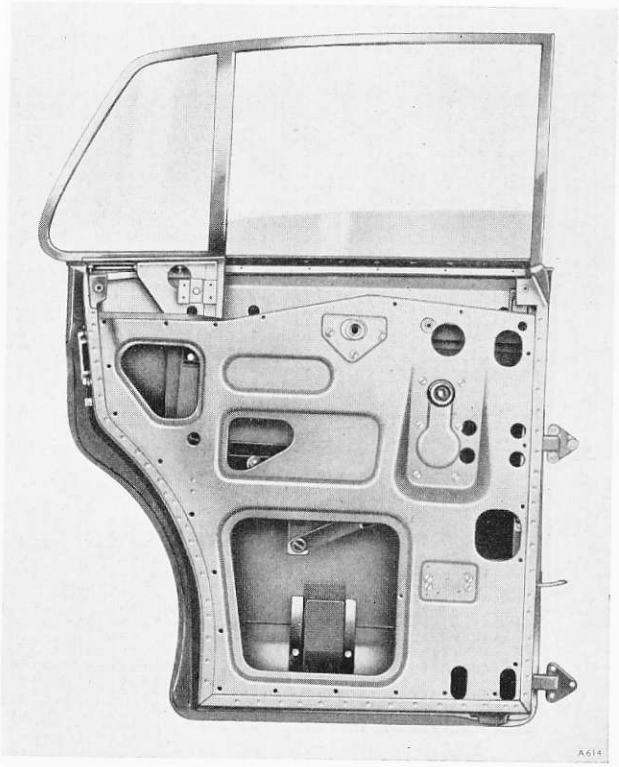


Fig. S11 Rear door with trim and finisher removed

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SECTION S4 — ELECTRICALLY OPERATED WINDOWS

The electrically operated windows, introduced on Rolls-Royce and Bentley cars, enable the windows to be raised or lowered, by both the passengers and the driver, with the minimum amount of effort.

This feature is offered as an extra and will be installed if specified when ordering, but cannot be fitted retrospectively.

Control Switches

Self-centering toggle switches, which are conveniently mounted on each door, control the up and down movement of the windows (see Fig. S12); any desired window position may be obtained, as movement of the windows will cease immediately on releasing the switch.

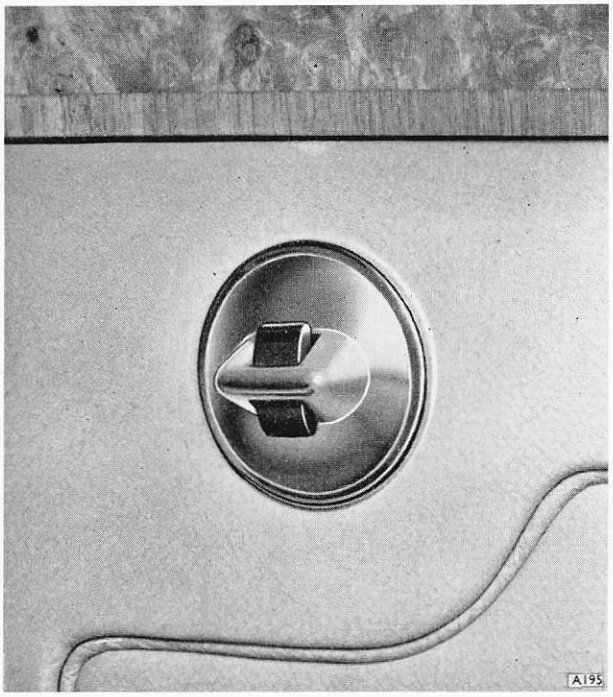


Fig. S12 Passenger switch for electrically operated window

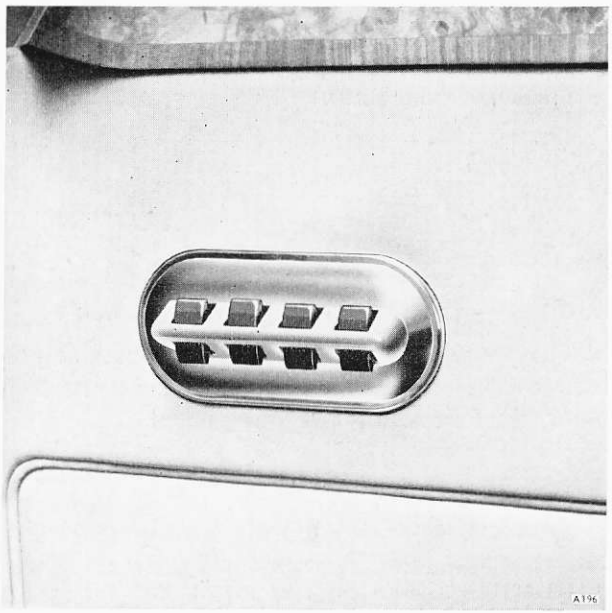


Fig. S13 Driver's switches for electrically operated windows

To enable all windows to be operated by the driver, four switches are mounted on the driver's door (see Fig. S13).

Raising or lowering the window normally takes 2 to 3 seconds, but this time may vary slightly due to prevailing conditions of the window channel felt. When the window reaches the end of its travel it is stopped by 'stalling' against rubber buffers; the top buffer is incorporated in the window seal and the lower buffers are bolted to the chain casing.

Electric Motor

The window mechanism is actuated by means of an electric motor which is enclosed together with the drive and the brake mechanism inside a protective casing.

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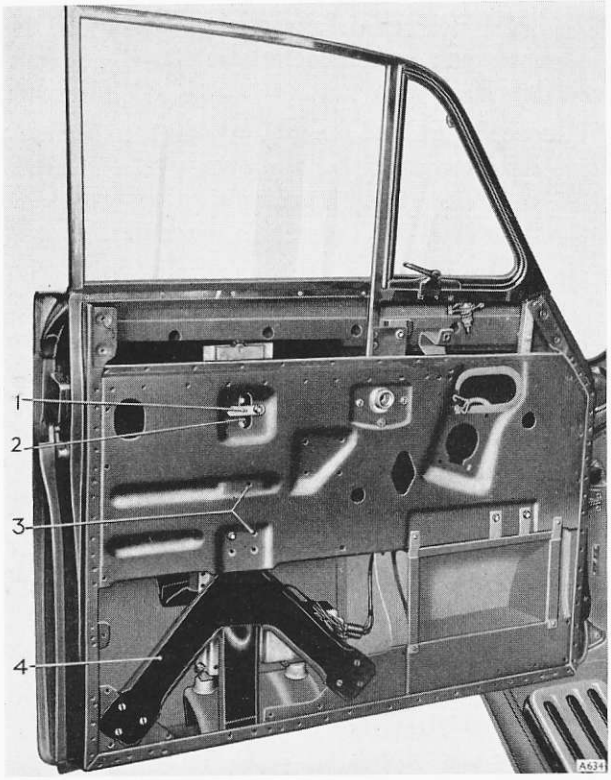


Fig. S14 Left-hand front door with trim removed

1. MECHANISM STOP
2. MECHANISM STOP TONGUE
3. SCREW HOLES FOR ARM REST SLIDE
4. DOOR BRACE

The electric motor is a reversible type unit, the direction of rotation being provided by dual field windings; incorporated in the motor is a thermostatically controlled cut-out. This cut-out is provided to safeguard the motor against possible damage due to overloading. Should a window switch be held in the operating position after the window has reached the fully open or fully closed position, the motor will heat up and the thermostatically controlled cut-out will break the circuit. After a delay of several seconds the circuit is automatically restored and the switch may again be effectively operated.

Further protection for the motors is provided by four fuses in a fuse box mounted on the left-hand side of the bulkhead.

No relay is necessary in the electrical circuit as the current for the motors is taken directly by the switches (see Fig. S20).

Transmission

The drive from the motor is transmitted to the mechanism through a flexible coupling which in turn drives a steel worm and nylon reduction gear.

A driving sprocket attached to the reduction gear spindle and an idler sprocket mounted on the upper end of the chain casing carry an endless chain. The chain is secured by means of a 'pick-up' link which is bolted to the window support channel; this link forms part of the chain and is secured by two 90 deg. links (see Fig. S18).

A tensioning spring is secured to the 'pick-up' link to take up any slackness in the chain and to prevent chain rattle.

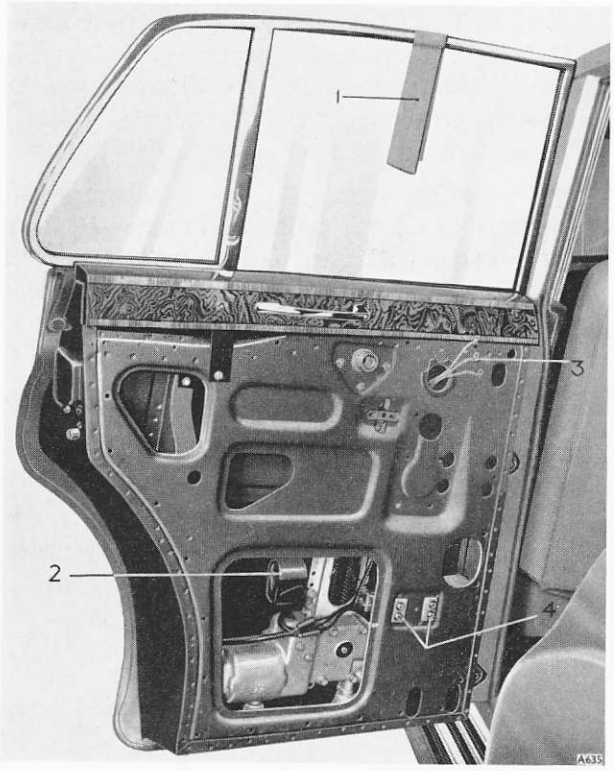


Fig. S15 Left-hand rear door with trim removed

1. MASKING TAPE FOR SECURING WINDOW
2. LOWER BUFFER STOP
3. CABLES FOR SWITCH
4. RETAINING NUTS FOR CHECK-STRAP

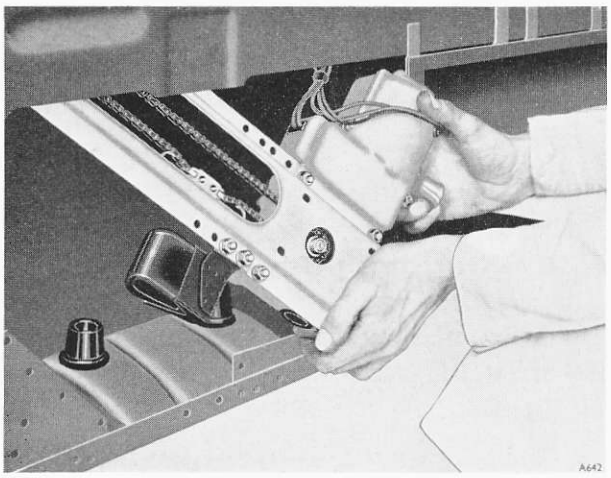


Fig. S16 Method of removing the mechanism assembly from the left-hand front door

Brake

A brake is built into the motor assembly to prevent the window moving once the operating switch has been released. The brake mechanism consists of a solenoid, a coil spring and plunger and a brake drum; the brake drum forms an integral part of the flexible coupling.

When a switch is applied and the motor is operating, the solenoid, which is connected in parallel with the motor, becomes energised and the brake is released; on releasing the switch, the solenoid becomes de-energised and the brake is applied by means of the coil spring and plunger (see Fig. S24) which contacts the brake drum.

Electric Motor and Drive Unit — to remove

Should it be necessary to remove the motor and drive unit from the car, it is advisable to disconnect the leads from the battery.

Front Doors

Remove the arm rest by lifting the release lever and sliding the arm rest upwards. Unscrew the two screws securing the arm rest slide and remove the slide from the door; retain the screws together with the distance washers.

Note the angular position of the handle on the interior of the door, to ensure that it is returned to its original position when refitting. Unscrew the escutcheon with a 'C' spanner and draw the handle from its splines.

Using a screwdriver, carefully ease the trim from the door, taking care not to damage the trim, paintwork or the concealed spring fasteners, then disconnect the cables from the switch and remove the trim.

On S2 cars, a grab handle is fitted to the finisher on the passenger side of the car and must be removed before unscrewing the finisher securing screws. To remove the grab handle, insert a $\frac{5}{16}$ in. U.N.F. spanner between the metal trim panel and the finisher and progressively unscrew the captive nut at each end of the handle, half a turn at a time. Lightly pull on the handle whilst releasing the captive nuts until the handle can be withdrawn; retain the distance pieces.

Remove the retaining screws and ease off the finisher and its plate.

Carefully remove the plastic cover from the door inner panel.

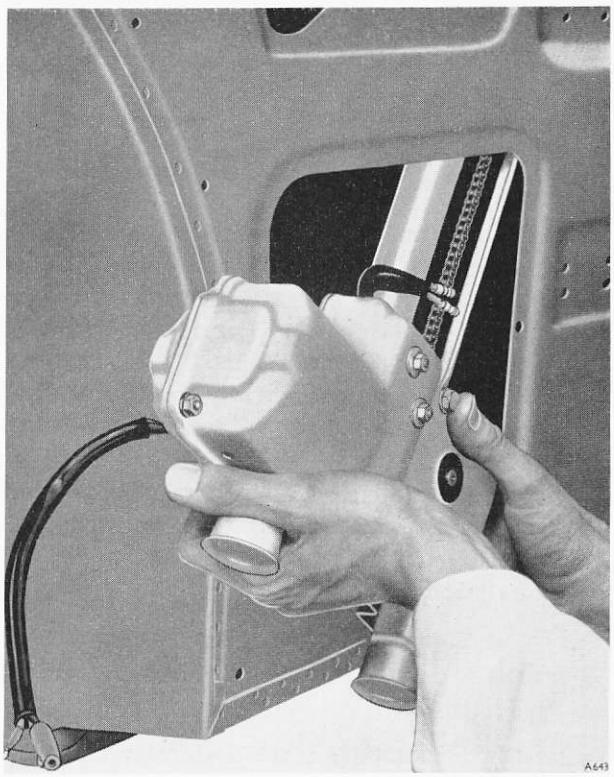


Fig. S17 Method of removing the mechanism assembly from the left-hand rear door

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Disconnect the cables to the electric motor and solenoid at the snap connectors.

If it is necessary to remove the door, pull the loom for the electric motor downwards from the conduit fastened to the front pillar; the loom is held in the conduit by spring clips. Unscrew the three screws securing the conduit to the front pillar and remove the conduit. Carefully withdraw the loom from the door.

Remove the split pin and withdraw the clevis pin from the check-strap.

Support the door and remove the screws securing the upper and lower hinges to the front pillar; the door can now be lifted off together with its hinges.

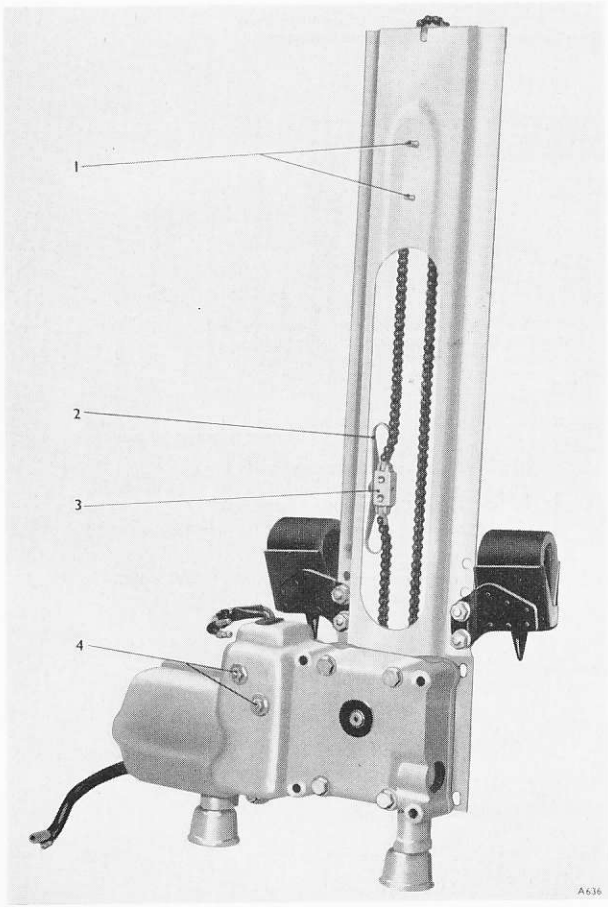


Fig. S18 Motor and mechanism assembly for left-hand rear door

1. STUDS FOR UPPER FLEXIBLE MOUNTING
2. CHAIN TENSION SPRING
3. PICK-UP LINK
4. SOLENOID RETAINING NUTS

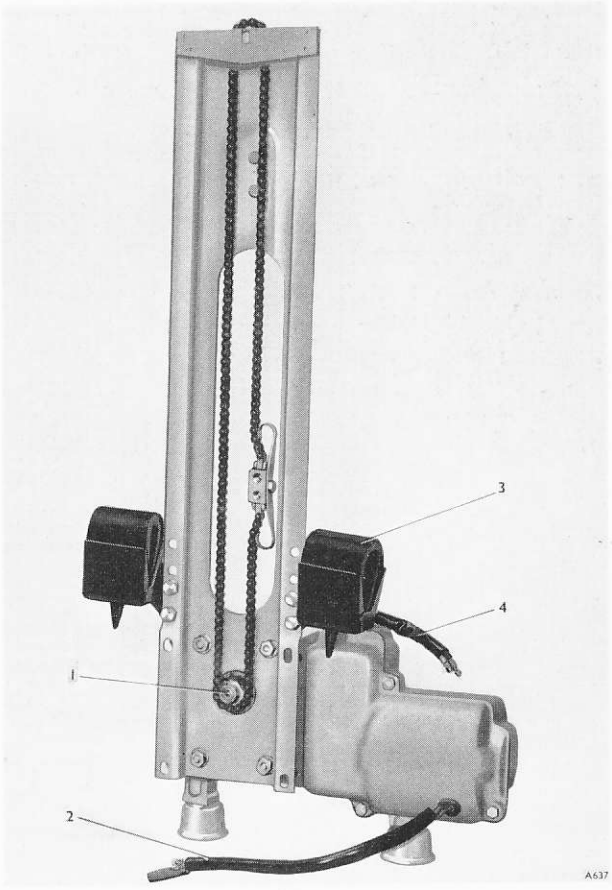


Fig. S19 Reverse side of motor and mechanism assembly for left-hand rear door

1. CHAIN DRIVING SPROCKET
2. CABLES TO ELECTRIC MOTOR
3. LOWER BUFFER STOP
4. CABLES TO SOLENOID

If there is no reason for removing the door, proceed as follows.

Ensure that all cables are placed where they are not liable to impede the removal of the motor and drive unit.

Unscrew the two $\frac{3}{16}$ in. Allen screws which secure the chain 'pick-up' link to the window support channel; these screws are located behind the mechanism (see Fig. S29). If not supported, the window will now be free to drop on to the lower buffer stops; to prevent this it should be secured to the window frame by means of masking tape as shown in Figure S15.

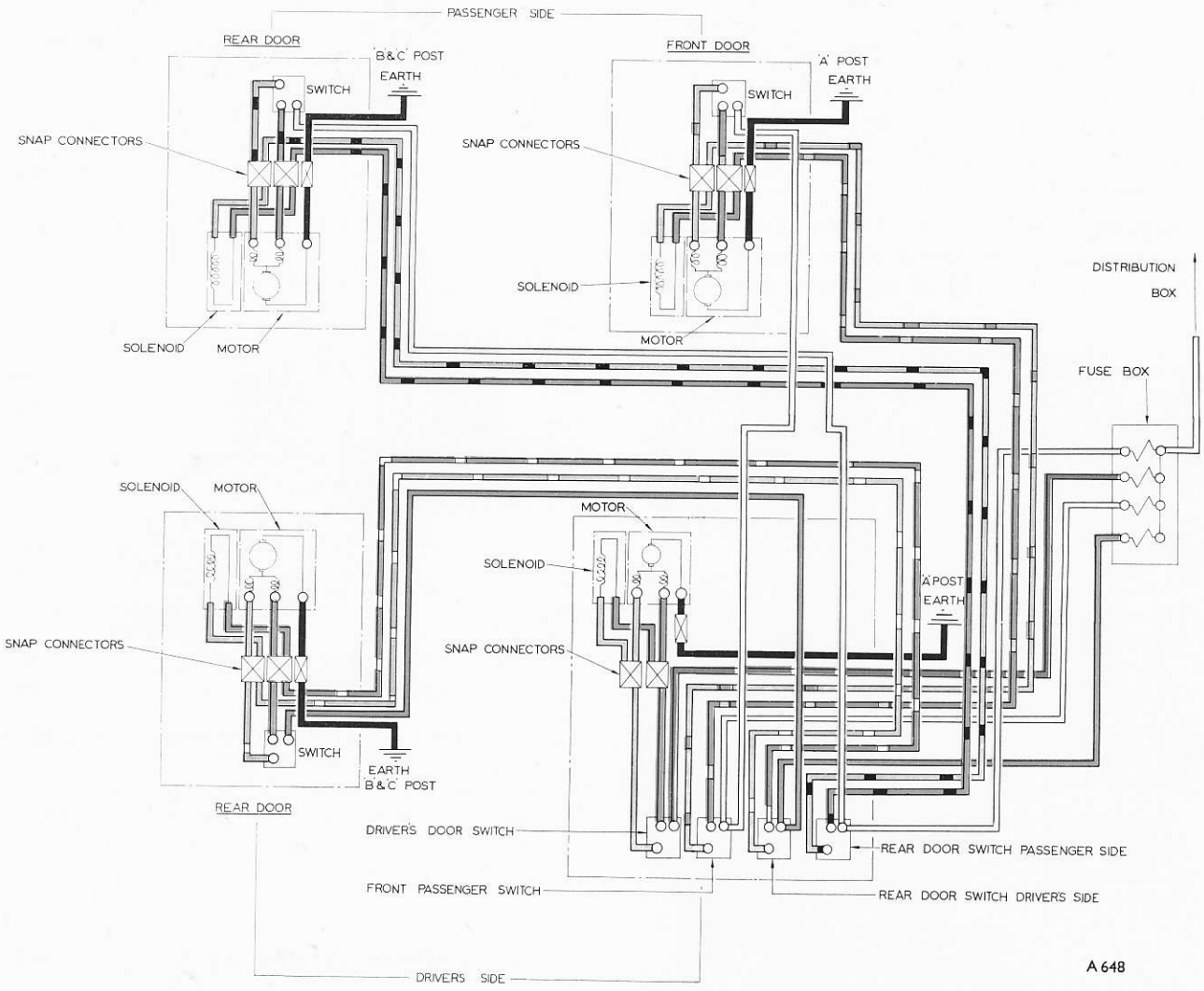


Fig. S20 Wiring diagram for electrically operated windows

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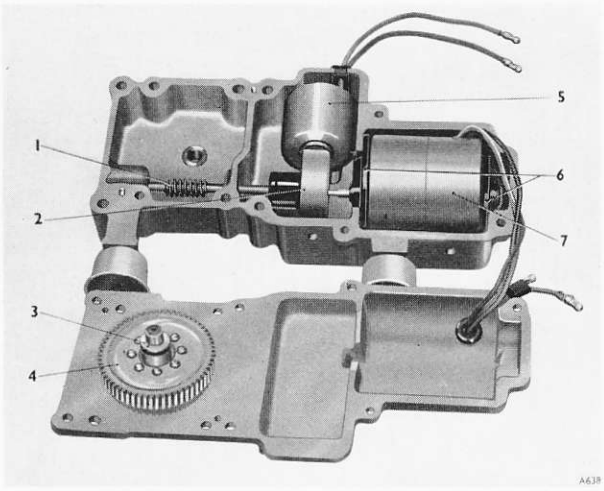


Fig. S21 Electric motor and drive assembly with cover removed

1. WORM DRIVE
2. FLEXIBLE COUPLING AND BRAKE DRUM
3. PLAIN WASHER
4. NYLON REDUCTION GEAR
5. BRAKE SOLENOID
6. RUBBER SHOCK WASHERS
7. ELECTRIC MOTOR

Unscrew the two 2 B.A. nuts and the two 2 B.A. setscrews, then remove the rubber mounting and stop tongue (see Fig. S28); note the number and position of the packing washers.

Remove the retaining screws and detach the brace from the door (see Fig. S14).

To facilitate removal of the assembly, it will be necessary to remove one of the lower buffer stops from the chain casing as shown in Figure S16. When working on the **front left-hand door,** remove the **right-hand** buffer stop, and if working on the **front right-hand door** remove the **left-hand** buffer stop, as seen when viewing the door from inside the car.

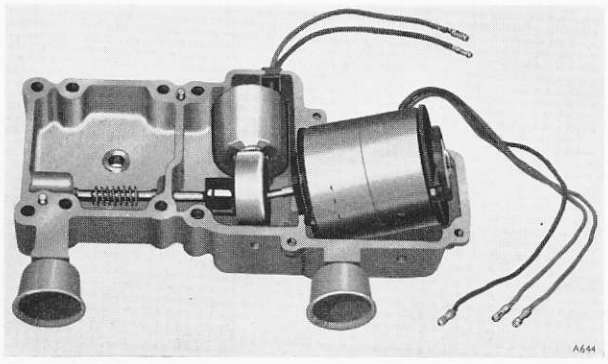


Fig. S22 Method of removing electric motor from the casing

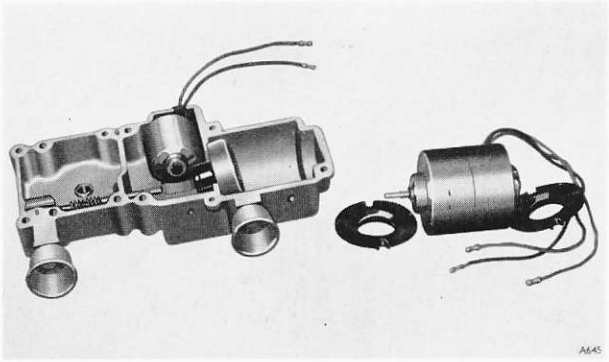


Fig. S23 Method of removing the flexible coupling from the casing

Remove the motor and mechanism assembly from the door in the manner shown in Figure S16.

Rear Doors

The procedure for removing the motor and drive unit from the rear doors is similar to that adopted for the front doors, but it is important that the following points be noted in order to facilitate removal of the assembly.

Detach the clip securing the electric cables to the door and place the cables in a position where they will not impede the removal of the assembly.

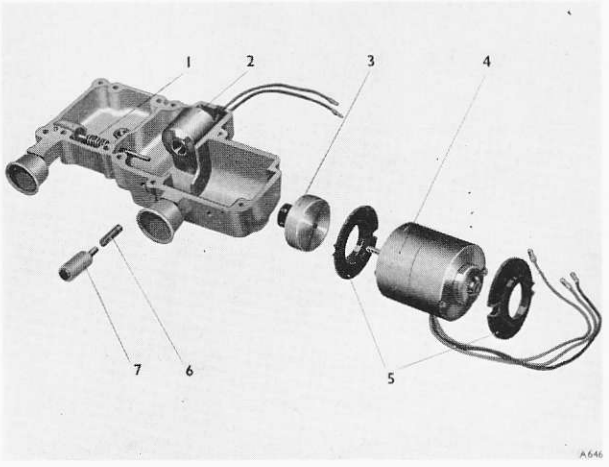


Fig. S24 Exploded view of the motor and drive assembly

1. WORM DRIVE
2. BRAKE SOLENOID
3. FLEXIBLE COUPLING AND BRAKE DRUM
4. ELECTRIC MOTOR
5. RUBBER SHOCK WASHERS
6. BRAKE PLUNGER SPRING
7. BRAKE PLUNGER

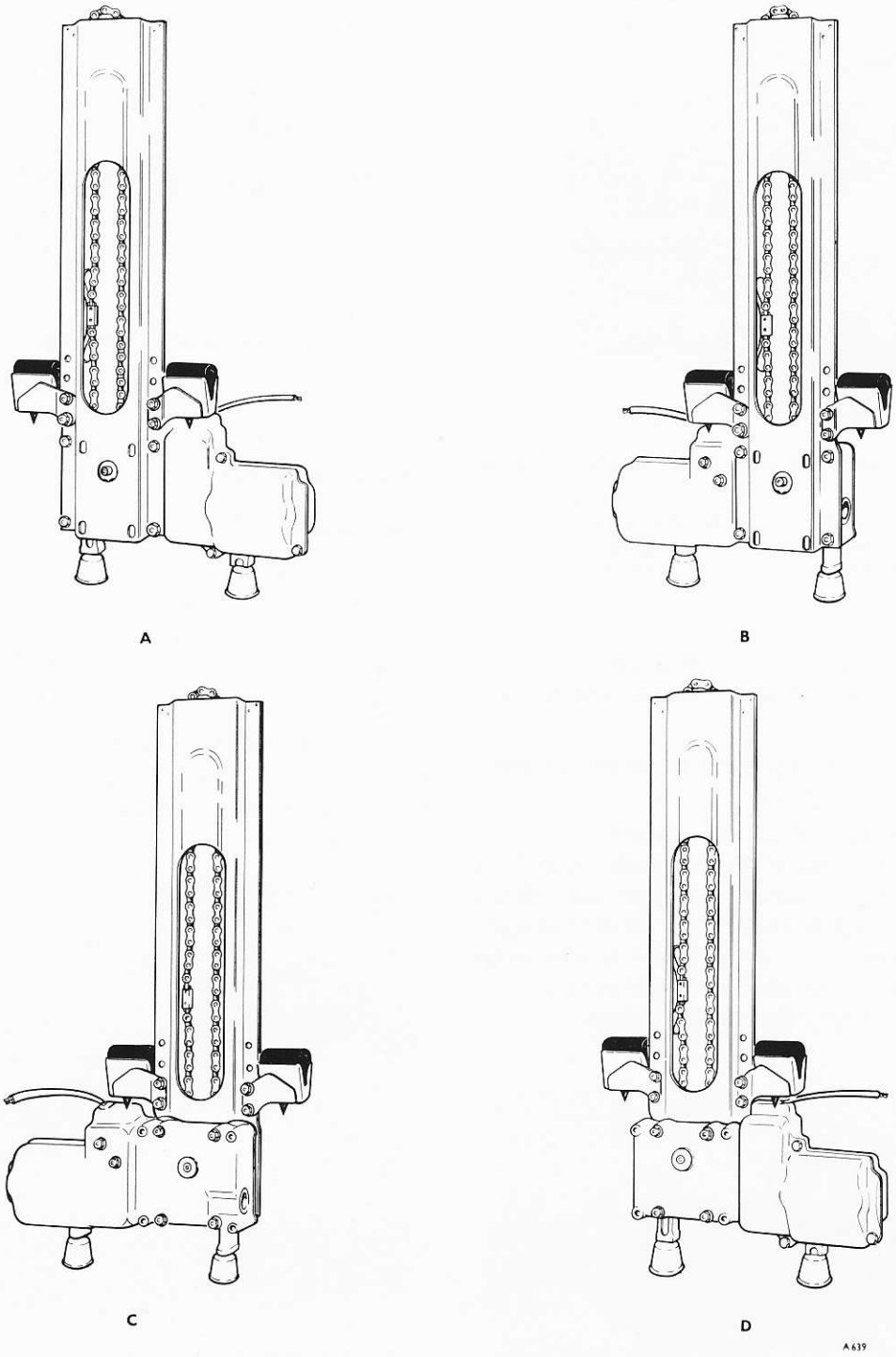


Fig. S25 Four positions for fitting chain casing to motor assembly

A. LEFT-HAND FRONT DOOR
B. RIGHT-HAND FRONT DOOR
C. LEFT-HAND REAR DOOR
D. RIGHT-HAND REAR DOOR

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Disconnect and remove the check-strap assembly from the door.

When working on the **rear left-hand door,** remove the **left-hand** buffer stop from the chain casing and if working on the **rear right-hand door,** remove the **right-hand** buffer stop, as seen when viewing the door from inside the car.

The assembly should then be removed from the door in the manner shown in Figure S17.

Drive Unit — to dismantle

In the event of failure, it may be necessary to dismantle the motor assembly. Should the fault be in the motor unit or the brake solenoid, the faulty unit should be returned for overhaul to either Rolls-Royce Service Department, Pym's Lane, Crewe, or Rolls-Royce Service Department, Hythe Road, Willesden, London, N.W.10.

The procedure for dismantling the motor assembly is as follows.

Remove the bolts securing the chain case to the motor casing, lower the chain case, remove the chain and then detach the chain case from the motor casing.

Remove the remaining bolts which secure the cover to the motor casing and separate the casing and cover as shown in Figure S21.

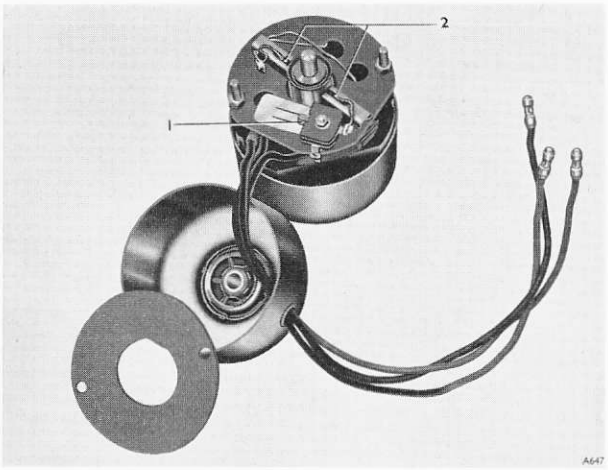


Fig. S26 Electric motor with the cover removed

1. CUT-OUT 2. BRUSHES

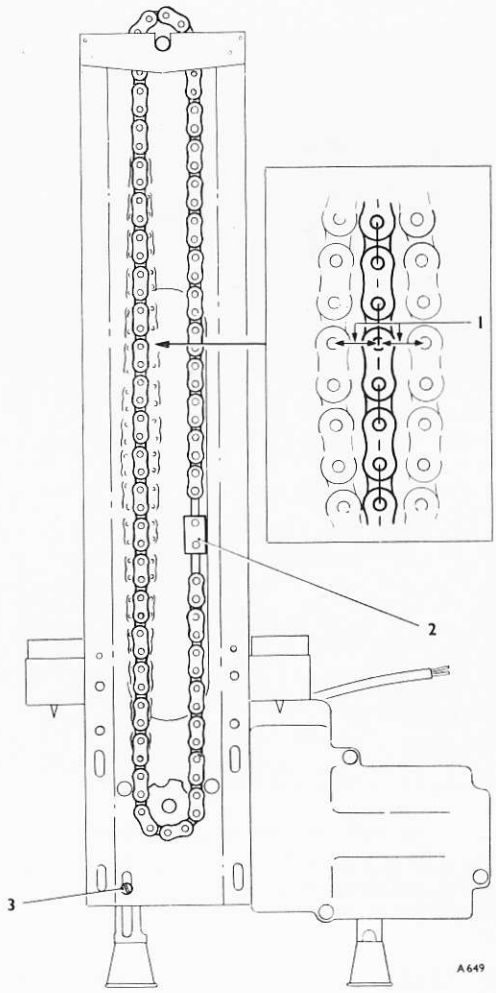


Fig. S27 Chain adjustment for electrically operated windows

1. SLACK MOVEMENT (MAXIMUM OF 0·500 in. (1·27 cm.)
2. PICK-UP LINK WITH CHAIN TENSION SPRING REMOVED
3. ELONGATED HOLE FOR OBTAINING ADJUSTMENT

Withdraw the motor unit from the casing by tilting it upwards while at the same time drawing it from the flexible coupling as shown in Figure S22; ensure that the rubber shock washers are retained.

If the flexible coupling is to be removed, ensure that the brake plunger and coil spring are not mislaid.

To remove the brake solenoid from the casing, unscrew the two nuts which secure it to the casing (see Fig. S18).

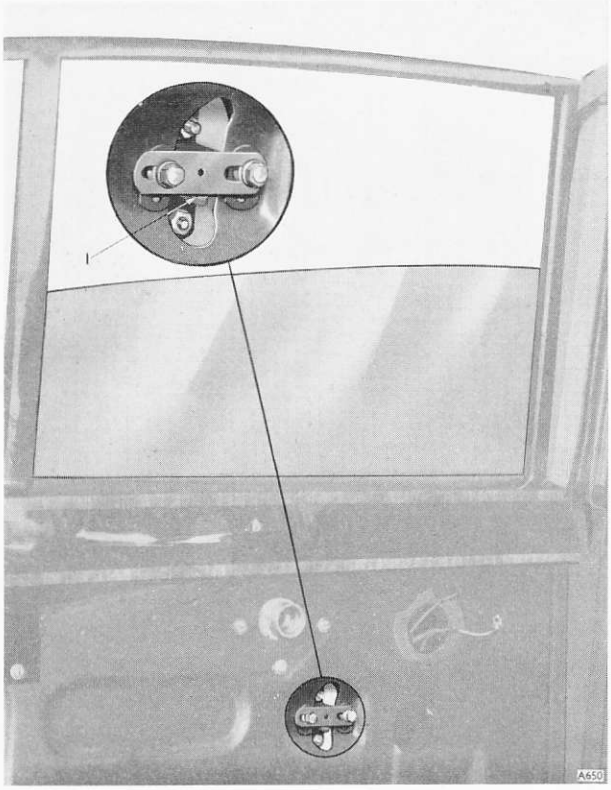


Fig. S28 Mechanism stop adjustment

ADJUST STOP TONGUE TO OBTAIN A GAP AT '1' OF BETWEEN 0·015 in. and 0·030 in. (0·381 mm. and 0·762 mm.) WITH THE WINDOW IN THE POSITION AS ILLUSTRATED

Drive Unit — to assemble and install

Reverse the procedure for removing and dismantling, noting the following points.

Lubricate the worm and reduction gear with 'Molytone' 265 grease.

The joint faces of the motor casing should be smeared with jointing compound prior to bolting the halves together.

The motor casing is bolted to the chain casing to form a unit which is mounted on rubber mountings to ensure quietness during operation; the motor casing may be attached to the chain casing in four different positions depending to which door the assembly is to be fitted (see Fig. S25).

When attaching the motor assembly to the chain casing ensure that the chain is so adjusted that it has a slack movement of 0·500 in. (1·27 cm.) each side of the chain centre line (see Fig. S27).

Remove the tension spring from the 'pick-up' link and adjust the chain tension by means of the elongated bolt holes in the chain casing (see Fig. S27). Fit the chain tension spring to the 'pick-up' link, ensuring that the two ends are seated on the rollers of the chain. The chain should be lightly smeared with 'Molytone' 265 grease.

Adjust the mechanism stop tongue, by means of the elongated fixing holes, to obtain a gap at '1' of between 0·015 in. (0·38 mm.) and 0·030 in. (0·76 mm.) with the window in the halfway position as shown in Figure S28.

Ensure that the switch cables do not foul the edges of the hole in the door inner panel, otherwise they may become damaged and result in 'shorting'.

Check that the correct gauge fuse wire is fitted in the fuse box; the specification for the fuse wire is 30 S.W.G. high conductivity tinned copper wire, diameter 0·0124 in. (0·315 mm.). For stocks of fuse wire in America, 28 American or Brown and Sharps gauge, diameter 0·0126 in. (0·320 mm.) is satisfactory.

Should further attention to the wiring be necessary, a wiring diagram is provided in Figure S20.

Before fitting the door trim, ensure that the plastic cover is fitted and secured with 'upholsterers' solution.

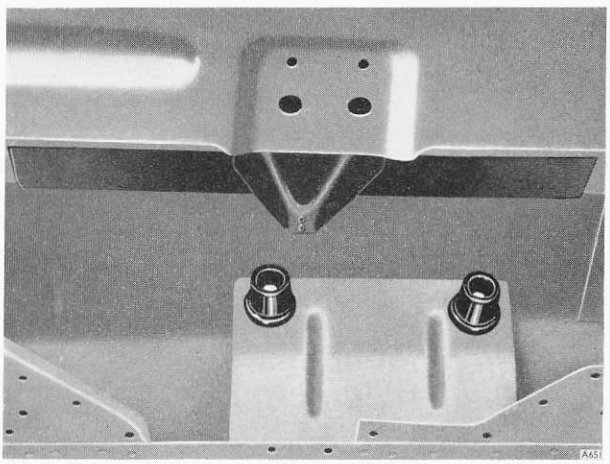


Fig. S29 Lower rubber mountings for mechanism and connection for chain pick-up link

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SECTION S5 — ELECTRICALLY OPERATED GLASS DIVISION

The electrically operated glass division is fitted to **S1 and S2 long wheelbase cars only.** The division is positioned behind the front seats and is operated by means of a 'Piper' electric motor and relay. The motor is mounted on a channel section panel fitted to the front face of the division structure.

Upward and downward movement of the division is controlled by means of two push button switches, or a single switch as shown in Figure S30, mounted on the instrument panel in the rear compartment.

Assistance for the motor is provided on initial starting by means of a spring-loaded roller on which a nylon cord is wound; the cord is also attached to two hooks fitted to the glass division bottom channel.

An endless chain, driven by the motor, is carried on two sprockets and attached to the chain is a tongue which moves up and down a guide rail (see Figs. S31 and S32). This tongue is located between two rollers attached to the glass channel, so that when the motor is operated the division will move up or down, depending on which switch is operated.

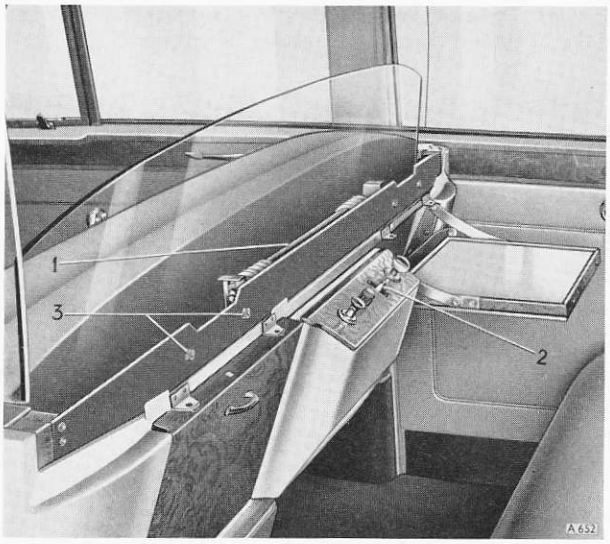


Fig. S30 Electrically operated division

1. SPRING-LOADED ROLLER AND NYLON CORD
2. OPERATING SWITCH
3. CAPTIVE RETAINING NUTS FOR GRAB HANDLES

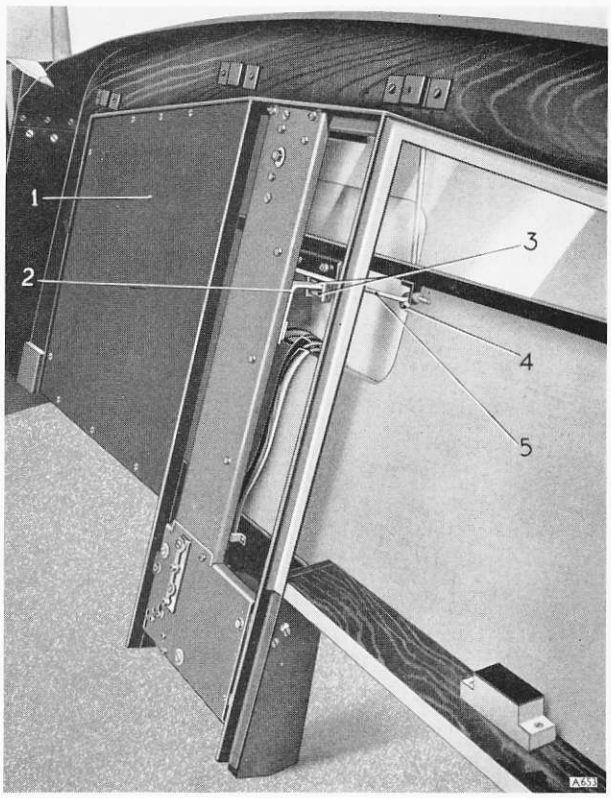


Fig. S31 View of electrically operated division with the panel removed

1. PLYWOOD PANEL
2. ACTUATING TONGUE
3. TONGUE ROLLERS
4. HOOKS FOR NYLON CORD
5. NYLON CORD

On S1 cars, trip switches are not provided, as the motor is designed to withstand stalling when the division reaches the end of its travel and until the operating switch is released.

On S2 cars, trip switches are fitted on either side of the motor. The trip switches are operated by two special links in the chain which are so placed that as the glass division reaches either end of its travel, one of the special links operates a trip switch and breaks the circuit, although the operating switch may still be depressed.

The design and construction of the division and motor is such that no maintenance is required, but should it be necessary to remove the motor assembly or the glass, proceed as follows.

Motor Assembly — to remove

To facilitate removal of the motor assembly, it will be necessary to remove the front seats.

Remove the felt covered panel by unscrewing the four wood screws, then disconnect the cables from the relay.

Remove the four bolts securing the plate at the base of the motor assembly; the top two bolts also locate the motor assembly.

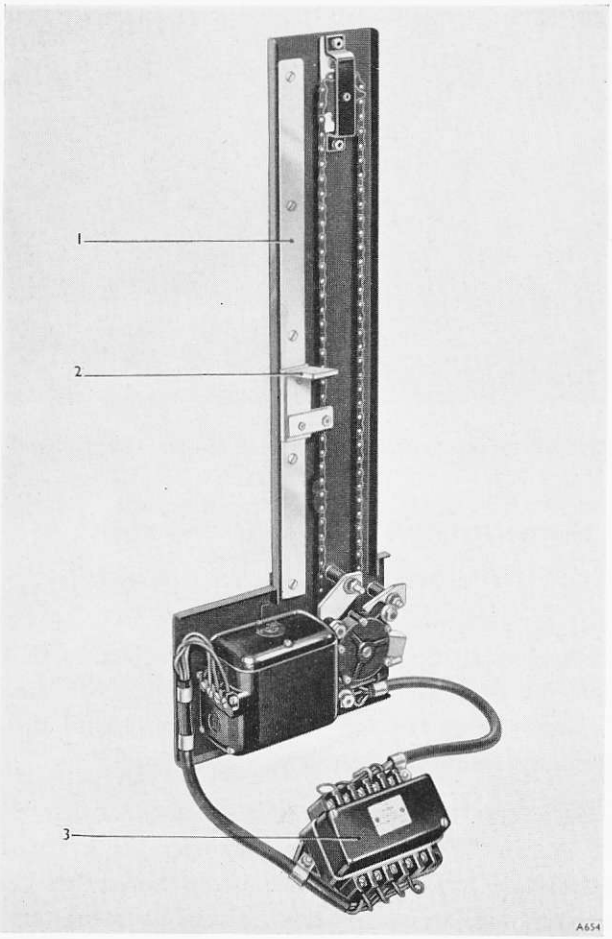


Fig. S32 Electrically operated division motor assembly

1. GUIDE FOR ACTUATING TONGUE 2. ACTUATING TONGUE
3. ELECTRIC MOTOR RELAY

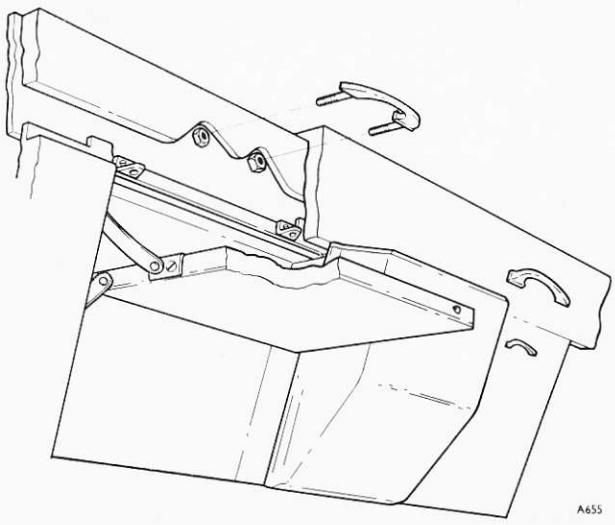


Fig. S33 View showing access to the grab handle concealed nuts

Unscrew the two self-tapping screws securing the assembly at the top, then withdraw the tongue from between the rollers and remove the motor assembly (see Fig. S31).

Division Glass — to remove

Ensure that the division is lowered and remove one of the plywood panels as shown in Figure S31.

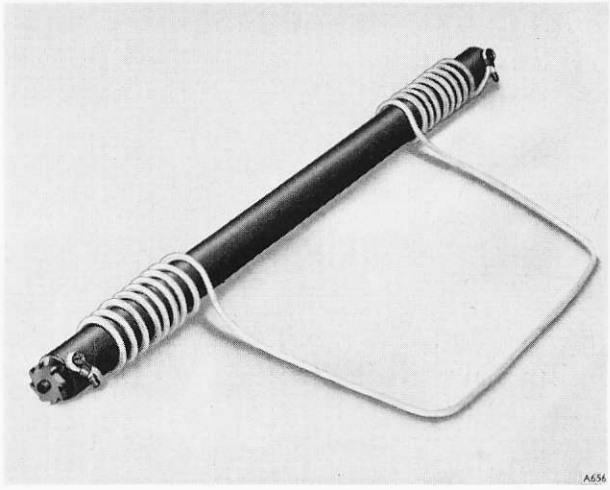


Fig. S34 Spring-loaded roller and nylon cord

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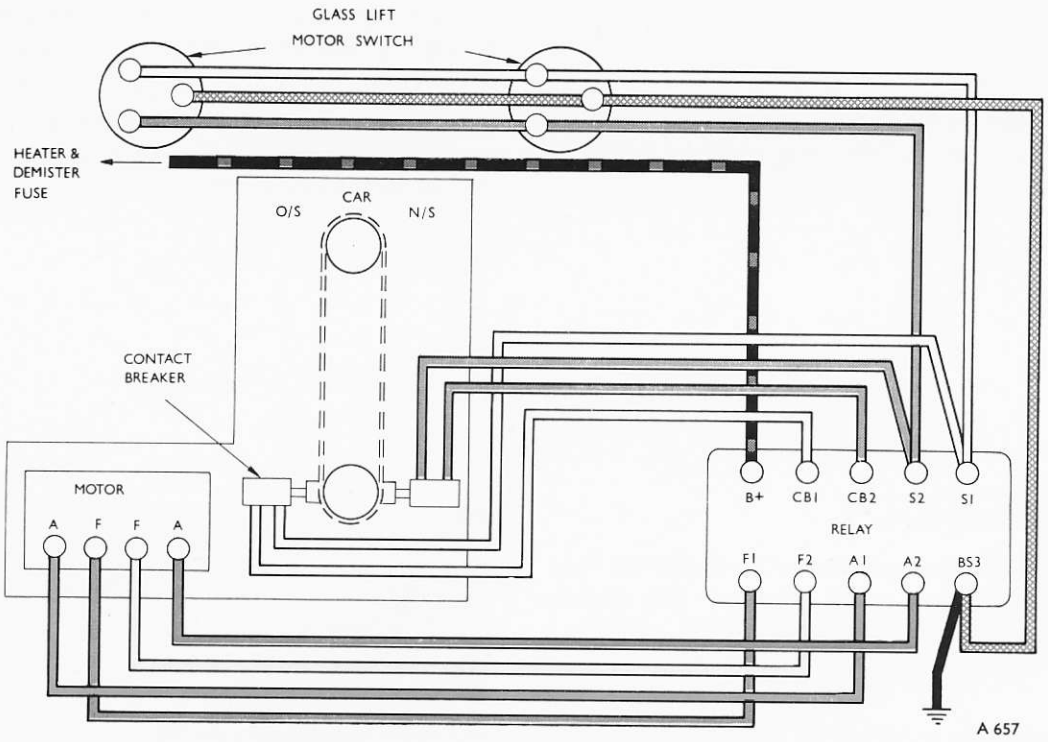


Fig. S35 Wiring diagram for the electrically operated division

To remove the finisher and capping rail it will be necessary first to remove the grab handles from the finisher, as the concealed captive nuts which retain the grab handles also secure the finisher; access to the $\frac{1}{4}$ in. U.N.F. concealed nuts is obtained from behind the picnic trays as shown in Figure S33.

Alternately unscrew the concealed nuts on each end of the grab handles, half a turn at a time. Lightly pull on each grab handle whilst unscrewing the concealed nuts until each grab handle can be withdrawn; retain the distance pieces. Remove the wood screw from each end of the capping rail, then withdraw the finisher and capping rail.

To remove the perspex side windows, ease away the trim from the top of each side window and from the side pillars; it should now be possible to remove the perspex windows.

Remove the wood screws securing the top half of each window channel at the top and bottom, then detach the channels.

To remove the spring-loaded roller, attach a length of string to the nylon cord at a point between the two hooks. Whilst holding the string taut, remove the nylon cord from the two hooks and allow the cord and the string to wind onto the roller until all spring tension is released; remove the roller assembly from the division.

Should it be necessary to renew the nylon cord, note the manner in which the cord is wound onto the roller before detaching it.

Before withdrawing the division glass, ascertain whether it is necessary to remove the centre roof light in order to avoid damaging it, then withdraw the glass whilst tilting it slightly in the process.

Division Glass and Motor Assembly—to install

When fitting the division glass and electric motor assembly, reverse the procedure for removal, noting the following points.

Care should be taken when connecting the cables from the motor to the relay and reference should be made to the wiring diagram shown in Figure S35.

If it is necessary to rewind the nylon cord onto the roller, it should be wound fourteen turns in the manner shown in Figure S34.

Insert the roller into the slots in the division and engage the ratchet so that to fit the cord over the hooks in the channel it is necessary to stretch the cord.

When the correct tension is obtained it should be possible for the glass division to be raised 4 in. (10·16 cm.) by means of the spring-loaded roller alone.

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SECTION S6 — LUGGAGE BOOT

Boot Lid Assistors

When checking the load required to operate the boot lid assistors, attach a spring balance to the luggage strap rail; a pull of approximately 7 lb. (3·17 kg.) should be required to move the lid from the fully open position.

If it is necessary to adjust the assistors, remove the trim and re-set each assistor an equal amount until the desired result is obtained.

In the case of a boot lid having been removed, the assistors may be checked individually as shown in Figure S36; the pull on the spring balance should then be between 57 and 60 lb. (25·85 and 27·22 kg.).

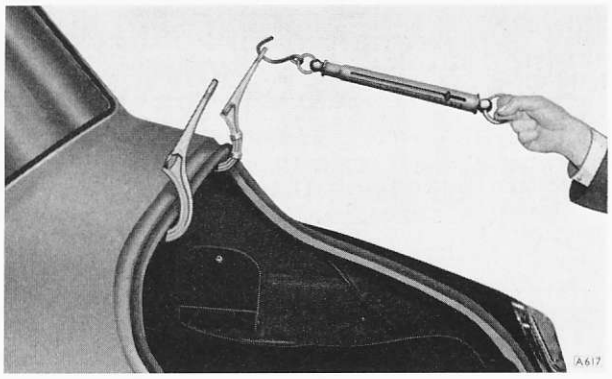


Fig. S36 Checking the luggage boot lid assistor poundage

Boot Lock

Necessary adjustment of the striker pin is affected by slackening and repositioning the retaining screws. If this does not provide sufficient adjustment, a further range of adjustment can be obtained by reversing the striker. Adjustment can then be obtained by the off-set positioning of the pin on its mounting plate.

On early S1 cars, check the operating cables to ensure that there is neither slackness nor too much tension. With the boot lid open, turn the locking cams to the locked position, slowly depress the push-button and check that both locking cams are released simultaneously; means of adjustment for the cable is illustrated in Figure S37.

On late S1 and all S2 cars, solid control rods are fitted to the locking assembly and no provision is made for adjustment.

Complaints concerning stiff operation of the push rod button may be due to corrosion at the pivots. In this case remove the corrosion to free the joints, then lubricate the pivots with 'Molytone' 265 grease. If corrosion has reached an advanced stage, the assembly should be renewed.

The private lock fitted to the luggage boot lid operates in a similar manner to the private locks fitted to the front doors; to remove the handle, which also contains the lock, proceed as follows.

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Remove the trim pad from inside the luggage boot lid, unscrew the nut on the end of the lock plunger and on each end of the handle; withdraw the handle assembly from the lid.

Locking Cam Assembly — to renew

If both locking cam assemblies are to be renewed it is advisable to complete one side at a time to ensure correct assembly.

Raise the luggage boot lid and remove the trim pad to gain access to the centre lock assembly.

On early S1 cars, release the lock-nut and unscrew and remove the left-hand cable from the centre lock assembly.

On late S1 and all S2 cars, remove the split pin from the left-hand control rod and withdraw the control rod clear of the backplate.

On all cars, unscrew and remove the six screws and washers securing the left-hand mounting bracket to the luggage boot lid and remove the bracket, complete with the locking cam assembly and control rod or cable. Care should be taken not to bend the control rod when withdrawing the assembly.

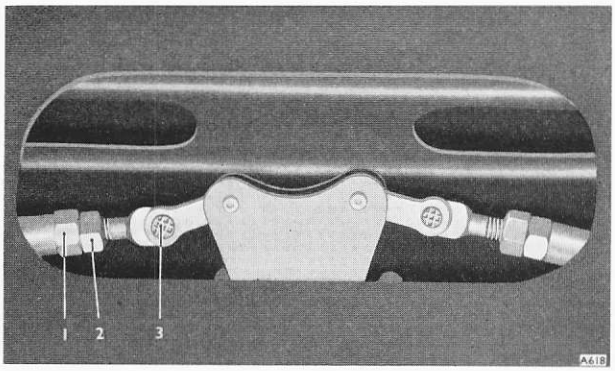


Fig. S37 Cable adjusters for the luggage boot lock — early S1 cars

1. ADJUSTING NUT 2. LOCK-NUT 3. PIVOT

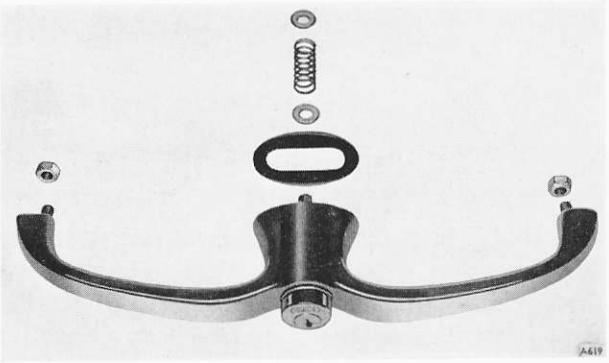


Fig. S38 Luggage boot lock and handle assembly

On early S1 cars, release the lock-nut and unscrew and remove the cable from the locking cam assembly.

On late S1 and all S2 cars, remove the split pin securing the control rod to the locking cam assembly and remove the control rod, noting its position so that it may be refitted correctly.

On all cars, remove the four screws and washers securing the locking cam assembly to the mounting bracket and withdraw the assembly.

The new locking cam assembly should be fitted by reversing the procedure given for removal, noting the following points.

Before fitting, smear a little 'Molytone' 265 grease onto the pivots and fit new split pins to the control rods.

The right-hand locking cam assembly should be fitted in a similar manner to that described for the left-hand side.

On late S1 and all S2 cars, to prevent jamming of the luggage boot lid, a locking cam assembly with a modified cam form has been introduced. This modified cam assembly has the same Part Number and replaces the old type cam assembly.

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SECTION S7 — DOORS AND LUGGAGE BOOT LID SEALING

Door and Luggage Boot Seals—to renew

Should it be necessary to renew a seal, it is most important that great care be taken to ensure satisfactory adhesion; this is only possible provided that the contact faces of the seal and the body channel are perfectly clean.

'Bostik' adhesive No. 1261 is recommended for securing the seals, but as the seals are not supplied already prepared, they should be thoroughly cleaned with 'Bostik' cleaner two hours before it is necessary to apply the adhesive.

When the contact faces have been prepared, apply the adhesive to both surfaces and allow it to air-dry for 15 minutes before fitting the seals.

The seals should be pressed firmly into position so that any trapped air is removed.

When fitting a seal to the sill, ensure that it is fitted with the lip downwards and **not** towards the door as is the case elsewhere; this rubber section has a wedge-shaped base which renders the lip invisible when the door is closed.

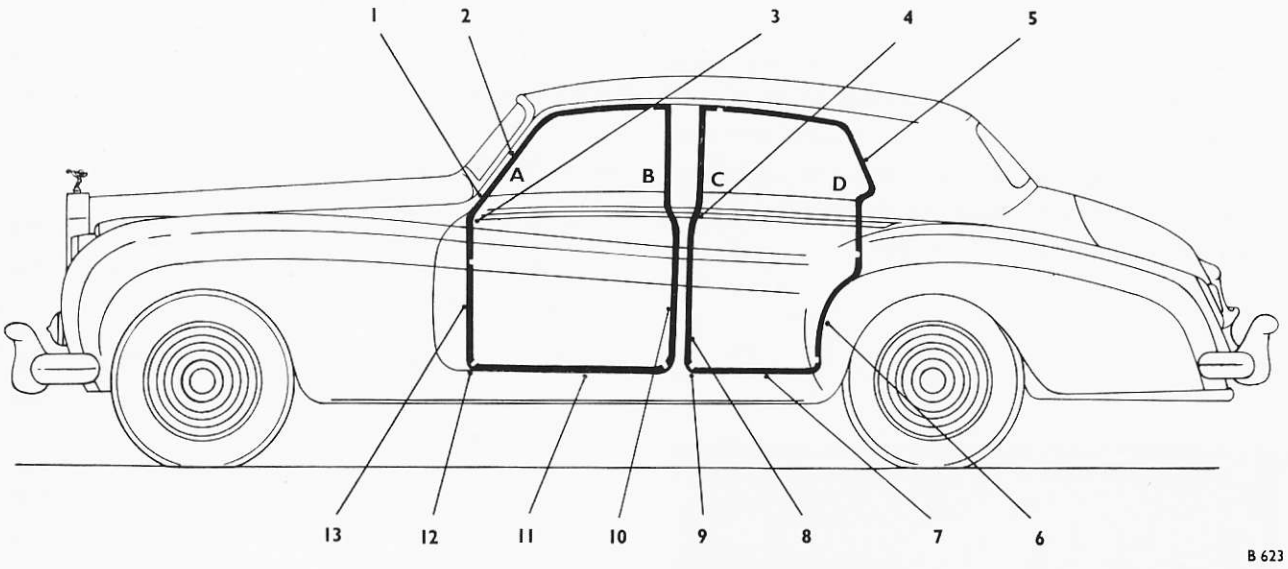


Fig. S39 Method of fitting door seals

A. 'A' POST B. 'B' POST C. 'C' POST D. 'D' POST

1. SEAL REINFORCED BY SPONGE RUBBER UB 2595
2. RIGHT AND LEFT-HAND SEALS UB 2229
3. TWIST THE SEAL AT THIS POINT
4. TWIST THE SEAL AT THIS POINT.
5. RIGHT-HAND SEAL UB 2225, LEFT-HAND SEAL UB 2226
6. RIGHT-HAND SEAL UB 2594, LEFT-HAND SEAL UB 2593
7. RIGHT AND LEFT-HAND SEAL UB 2230
8. FRONT RIGHT-HAND AND REAR LEFT-HAND SEALS UB 2227
9. RIGHT-HAND SEAL UB 2764, LEFT-HAND SEAL UB 2763 — EXPORT CARS
10. FRONT LEFT-HAND AND REAR RIGHT-HAND SEALS UB 2228
11. RIGHT AND LEFT-HAND SEALS UB 2230
12. RIGHT-HAND SEAL UB 2762, LEFT-HAND SEAL UB 2761 — EXPORT CARS
13. PORTION OF SEAL UB 2229

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Sponge cord is used for reinforcement on the front pillar for a distance of 2 to 3 in. (5·08 to 7·62 cm.) at the waistline.

In order to follow the body contour, twist the seal on the forward edge of both front and rear doors immediately above the waist rail.

When attaching the seal to the front pillar, cut the rubber obliquely at the base to ensure complete seating of the seal to the body.

If the car is constantly used on dusty roads it may be necessary to fit additional seals to the bottom corners of the 'A' and 'C' door posts; this is provided for by means of moulded rubber seals as shown in Figure S40.

When fitting these corner seals, trim the existing seals fitted to posts 'A' and 'C' and along the sills, so that they butt against the corner seals (see Fig. S40).

In order to obtain optimum results, it may be necessary to trim the back edge of the corner seals, which should be secured in position by means of 'Bostik' adhesive No. 1261.

To check whether the seals are effective, place a piece of paper against the seal and close the door or boot lid. If the sealing is efficient the paper should be firmly held by the seals; this check should be made around the complete seal.

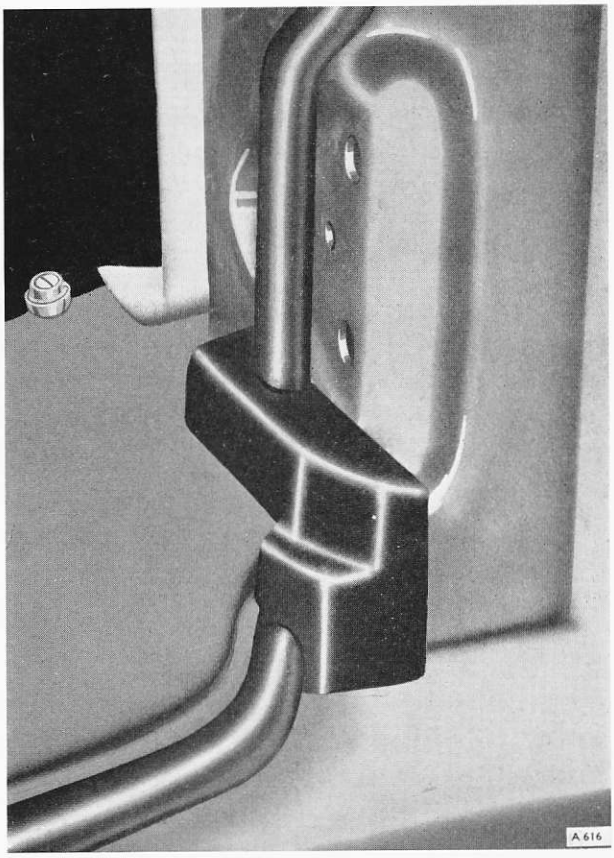


Fig. S40 Corner seal shown in position

FRONT SEALS	*REAR SEALS*
LEFT-HAND UB 2761	LEFT-HAND UB 2763
RIGHT-HAND UB 2762	RIGHT-HAND UB 2764

SECTION S8 — VIBRATIONS AND RATTLES

On late S1 and all S2 cars, special provision has been made to stop body rattles and creaks, but **on early S1 cars** where no such special provision has been made, rattles and creaks may develop during service. The following information deals with the method of overcoming this trouble. A list of anti-rattle felts is available and the Part Numbers may be obtained from the Spares Schedule.

Arm Rest and Slide

In the event of rattle from the arm rest or slide, this fault may be due to the arm rest not being securely attached to the door trim.

If this is the case, the fault may be rectified by reducing the length of the distance pieces and the retaining screws which secure the arm rest slide to the door trim.

Door Check-strap

Creaking noises from the check-straps during opening or closing of the doors may be caused by the spiral spring in the check-strap assistor fouling the fillet welds on the check-strap body; in this case sufficient clearance for the spring should be obtained by filing the fillet welding.

File the fillet welding sufficiently to ensure that a minimum clearance of 0·050 in. (1·27 mm.) is obtained around the periphery of the spring, when the check-arm is at any point of its travel (see Fig. S10).

When this operation is completed and before assembling the check-strap, the spiral spring should be lubricated, while in its free slate, with 'Molytone' 265 grease (see Fig. S10).

Window Regulator Arm

To prevent the window regulator arm rattling against the window channel, felt washers should be fitted between the regulator and the button.

These washers should be cut from $\frac{1}{8}$ in. (3·17 mm.) thick black art felt and should be 2 in. (5·08 cm.) square with a central cut $\frac{3}{4}$ in. (1·90 cm.) long to enable it to fit over the regulator arm buttons.

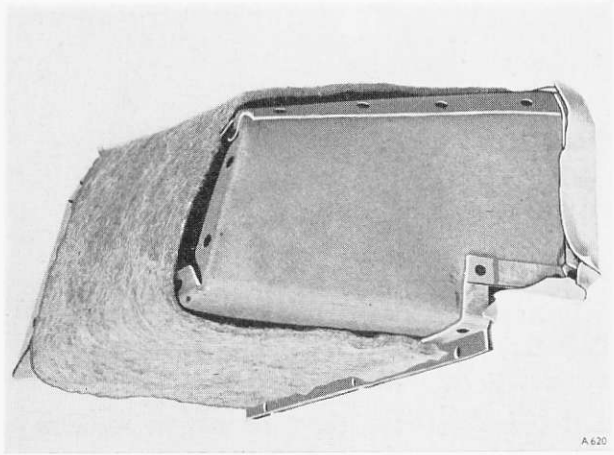


Fig. S41 Method of attaching anti-rattle felt to the cubby box

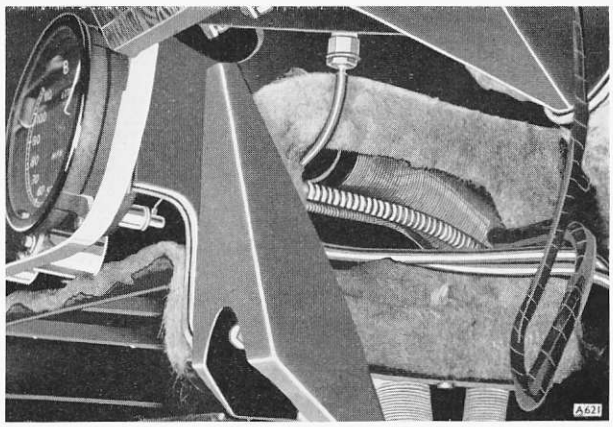


Fig. S42 Method of attaching anti-rattle felts to the instrument panel side plates and radio loudspeaker duct

Care should be taken to ensure that each window regulator is fitted with 3 'wave' washers and that the regulator is adequately lubricated with 'Molytone' 265 grease, particularly at points where the 'wave' washers are fitted.

It is also necessary to ensure that the fit between the regulator buttons and their slides is of a reasonable standard.

Garnish Rail

Rattle may be caused by the garnish rail contacting the window frame.

In this case, ensure that the garnish rail does not foul the ventilator window striker plate, then attach small pieces of headcloth to the back of the garnish rails on the front and rear doors, using 'Bostik' A adhesive.

Door Trim Panel

In order to prevent the trim panel vibrating between the waist finisher and the garnish rail, a strip of 'Aeroprene' $1\frac{3}{4}$ in. (4·445 cm.) wide should be fitted to the door trim panel.

Fit the 'Aeroprene' over the top edge of the door trim panel and fold it under the leather.

Door Lock Remote Control Links

Rattles caused by the door lock remote control links may be overcome by attaching black art felt, $\frac{1}{4}$ in. (6·35 mm.) thick, to the inner panels of the door;

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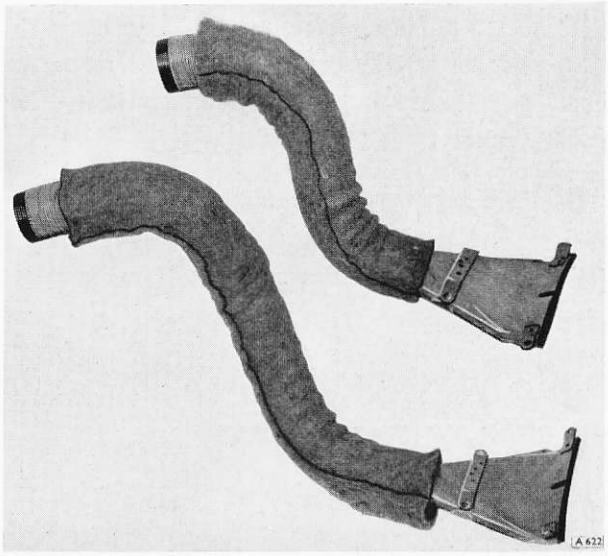


Fig. S43 Method of attaching anti-rattle felts to the de-mister ducts

the felt should be secured by means of 'Bostik' adhesive.

To avoid bending the control bar whilst fitting, it is advisable that this modification be carried out before the door lock is fitted.

Door Inner Panel Stiffener bracket

On early S1 cars, the door inner panel stiffener brackets are secured by means of countersunk headed screws; these have a tendency to become loose and on later cars the countersinking has been deleted and binding head screws fitted in place of the countersunk headed screws.

On early S1 cars, in order to replace the countersunk headed screws, it is necessary to fit the binding head screws with plain washers.

Rattles from Behind Facia

Before proceeding to fit the felts it will be necessary to remove the facia panel assembly; in order to simplify location when refitting it is advisable that the panel should be removed complete with its fixing brackets.

Cubby Boxes

Felt should be attached to the cubby boxes by means of 'Bostik' A adhesive, so that the top, back and bottom of the boxes are covered as shown in Figure S41.

Instrument Panel Side Plates

Before attaching the felts to the side plates, cut a hole in the centre of each felt, leaving sufficient of the material to turn over and cover the sharp edge of the side plate (see Fig. S42).

Attach the felt to the side plate and secure it with 'Bostik' A adhesive.

It is important that the felt completely covers the sharp edge, particularly at the bottom of the hole, as the speedometer trip has a tendency to contact the side plate at this point. If the edge is not covered, it is liable to cause rattles or even cut through the felt covering the speedometer trip.

Radio Loudspeaker Duct

The radio need not be removed in order to fit the felt to the loudspeaker duct; fit the felt by sliding it over the top of the duct as shown in Figure S42.

Care must be taken to ensure that the felt is fitted well to the rear of the loudspeaker duct, in order to prevent the various wires and cables from tapping against the back edge of the duct.

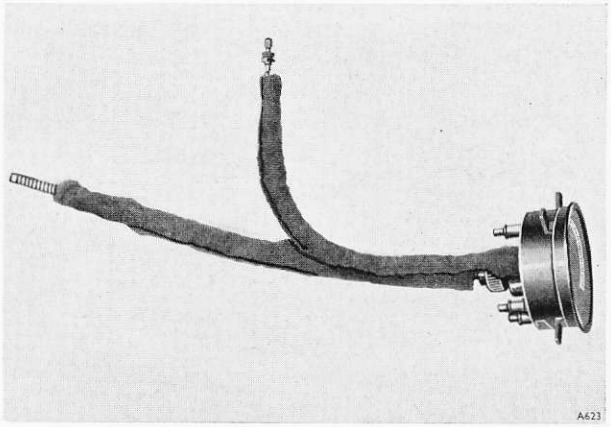


Fig. S44 Method of attaching anti-rattle felts to the speedometer cable and trip winder

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Speedometer Cable, Trip Winder and Clock Winder

In order to attach the felt sleeve to the speedometer cable, after detaching the cable from the gearbox, unclip the cable from the bulkhead and draw it into the saloon.

To permit easy fitting of the felt sleeves, they should be cut down the length of the sleeve wrapped around the cable or trip, then sewn up again (see Fig. S44).

De-mister Ducts

In order to simplify the removal of the de-mister ducts, it is essential that the de-mister cross-tube be dismantled.

The de-mister duct felts should be sewn together to produce four sleeves; these should then be fitted by sliding them into position over the ducts (see Fig. S43).

SECTION S9 — WINDSCREEN AND REAR WINDOW GLASS

Windscreen — to remove

Before attempting to remove the windscreen, it is necessary to adopt the following procedure.

Cover the bonnet in the vicinity of the windscreen with thick felt to ensure against possible damage to the paintwork when removing the windscreen.

Remove the instrument panel by unscrewing the four retaining screws situated at the top and under the lower edge of the panel.

On S1 cars, detach the trafficator switch and unscrew the serrated nut at the rear of the capping rail.

On all cars, remove the retaining screws and detach the upper and side windscreen finishers.

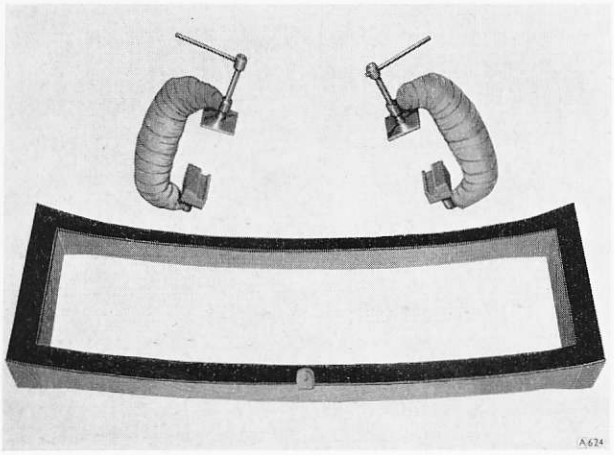


Fig. S45 Jig for pressing in the windscreen

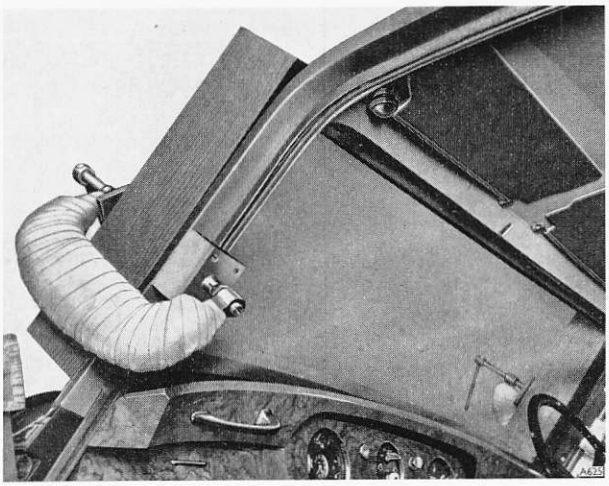


Fig. S46 Clamp positions for fitting the windscreen

Remove the trim pads from beneath the capping rail at each end; each trim pad is secured by three 2 B.A. screws and four self-tapping screws.

On all S1 cars and S2 Long Wheelbase cars without the division, remove the grab handles by releasing the two securing nuts.

On S2 cars, unscrew the two screws from the capping rail lamp and remove the green screen.

On all cars, unscrew the four 2 B.A. nuts at each end of the capping rail; these are located at the rear of the capping rail.

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Remove the two 2 B.A. setscrews securing the interior mirror support; these are situated underneath the capping rail. Withdraw the capping rail with the mirror attached.

Note: Special care must be taken to ensure that the packing behind the capping rail is maintained in its original position to ensure correct adjustment when refitting.

Slacken the screws and bolts which secure the metal strip at the base of the windscreen aperture.

Ensure that the wiper blades are clear of the windscreen and do not obstruct the removal operation.

The windscreen, together with the chromium-plated finisher, is held in position by the rubber seal and should be pressed out of its aperture in the body by two operators, working one at each end of the screen from the outside of the car.

New Windscreen — to fit

The roof radio aerial (if fitted) should be removed from the car to enable the windscreen fitting jig to be placed correctly in position.

Clean off all traces of the old sealing compound from the windscreen aperture, then apply a thin coating of 'Secomastic' sealing compound about $\frac{1}{8}$ in. (3·17 mm.) thick to the outer edge of the aperture; this is to prevent the ingress of water into the saloon.

Examine the rubber seal. If the seal is in a serviceable condition it can be used with the new windscreen; if it is not serviceable, a new seal should be fitted.

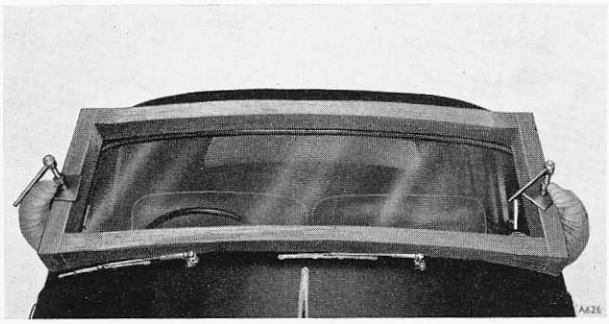


Fig. S47 Jig clamped in position

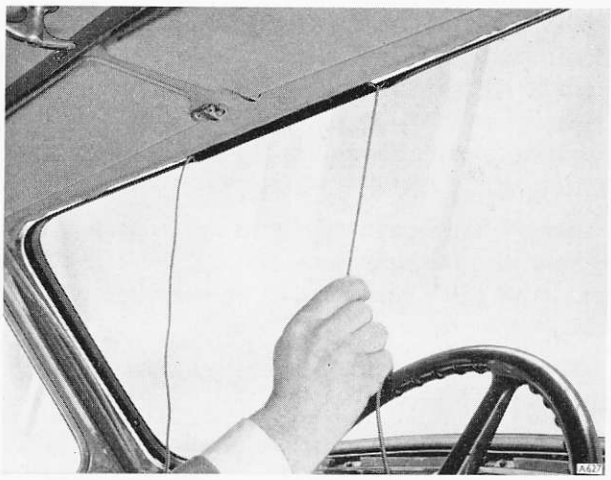


Fig. S48 View of windscreen showing cord in position for fitting the rubber seal

If the original seal is to be fitted, ensure that it is perfectly clean and free from old sealing compound.

Before fitting the seal to the glass, apply a thin coating of sealing compound in the channel of the seal, into which the glass is to fit.

Examine the chromium plated finisher and if in a serviceable condition, fit it into the seal; if the finisher is distorted, it should be renewed.

It is essential that the finisher be fitted to the seal before the windscreen is fitted to the car.

Fit a length of cord around the inside lip of the rubber seal, leaving the two ends free at the top of the windscreen (see Fig. S48).

Working from the outside of the car, carefully ease the windscreen assembly squarely into position as far as possible by hand, ensuring that the ends of the cord are inside the car and not trapped.

Fit the jig (RH.343) shown in Figure S45 and clamp it into position by means of the clamps and blocks, as shown in Figures S46 and S47.

Care should be taken when tightening the clamps to ensure that an even pressure is exerted on the wooden frame; an uneven pressure may dislodge the chromium-plated finisher or even break the glass.

When the windscreen is firmly in position, carefully pull one end of the cord at an angle to the windscreen

so that the lip of the rubber seal is drawn into position. Continue this operation around the screen to the bottom corner, then repeat the procedure for the opposite side of the screen. Pull both ends of the cord together to guide the rubber lip into position at the bottom of the screen.

Remove the jig and check that the screen assembly is flush with the body at the front; if not, refit the jig and apply further pressure until the desired result is obtained.

Test the windscreen for leaks by means of water applied under pressure.

Parts removed to enable the windscreen to be renewed should be fitted by reversing the procedure for their removal.

Rear Window Glass — to remove

Unscrew the retaining screws and withdraw the finisher.

Remove the upper front trim from the luggage boot, then disconnect the two de-mister cables; one lead to the de-mister switch and the other to earth.

The glass should be pressed evenly towards the interior of the car by one operator so that a second operator inside the car can remove the glass.

Rear Window Glass — to fit

Clean off all traces of the old sealing compound from the rear window aperture, then apply a thin coating of sealing compound, approximately $\frac{1}{8}$ in. (3·17 mm.) thick, to the inner edge of the aperture; this is to prevent the ingress of water into the saloon.



Fig. S49 Method of fitting clamps for pressing in the rear window glass

Examine the rubber seal. If the seal is in a serviceable condition it may be used with the new glass; if it is unserviceable, then a new seal must be fitted.

Before fitting the seal to the glass, apply a thin coating of sealing compound to the channel of the seal into which the glass is to be fitted.

Fit a length of cord around the inside lip of the rubber seal, leaving the ends free at the top of the glass.

Carefully ease the glass assembly into its aperture from inside the car, then fit the four wooden fixing blocks as shown in Figure S49; care should be taken to ensure that the cord or the de-mister cables are not trapped during this operation.

Working from the centre towards the ends of the glass, screw up the adjusting nut on each block evenly and in succession, until slight pressure is exerted on the lip of the seal.

Pressure on the seal should be evenly applied around the complete inner edge of the aperture; uneven pressure may result in a broken glass.

Carefully pull one end of the cord at an angle to the glass so that the lip of the rubber seal is drawn into position. Continue this operation around the glass to the bottom corner, then repeat the procedure with the other end of the cord for the opposite side of the glass.

Pull both ends of the cord together to guide the rubber lip into position at the bottom of the glass.

Make certain that the lip of the rubber seal is in position completely around the aperture, then carefully apply further pressure by means of the blocks until the glass is fully registered in the aperture.

Remove the wooden blocks and fit the finisher to the rear window.

Connect the de-mister leads and refit the trim to the luggage boot.

Remove all traces of superfluous sealing compound, then test the rear window for leaks by means of water applied under pressure.

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SECTION S10 — FRONT AND REAR SEATS

Front Seat — to remove

Depress the catch in the centre of the front seat valance and slide the seat forward to the limit of its travel.

Remove the two Allen screws from the rear end of each slide, then move the seat back and unscrew the two Allen screws from the front end of each slide.

It will then be possible to remove the front seat from the car, through the front door opening.

Care should be taken to ensure that the distance pieces at each end of the slides are retained.

Front Seat — to fit

To fit the front seat, reverse the procedure for removal, noting the following points.

On early S1 cars, complaints of front seat rattles may be due to one or both of the following causes.

(i) Shrinkage of the hardboard mounting which causes the woodscrews and setscrews to become loose.

(ii) Settling of the leather trim around the screw holes in the hardwood blocks, which causes the set-screws securing the slides to the floor to become loose.

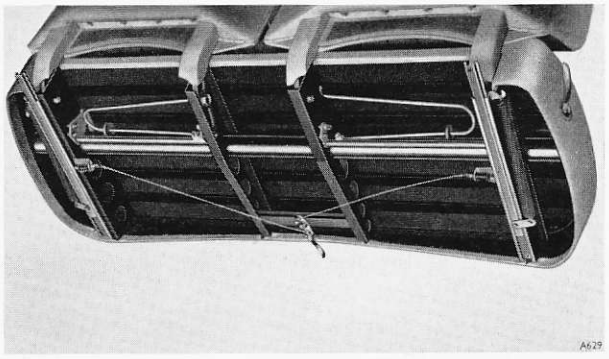


Fig. S50 Front seat showing the slide release and individual backrest rake

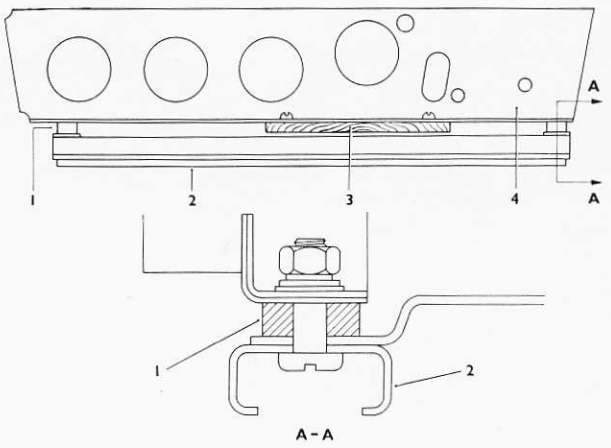


Fig. S51 Method of fitting hardwood block to eliminate front seat rattles — early S1 cars

1. ALUMINIUM DISTANCE PIECE
2. SEAT RUNNER
3. HARDWOOD MOUNTING BLOCK (UW 1634)
4. SEAT

To rectify these faults proceed as follows.

(i) Remove the existing mount and in its place fit a short hardwood block and aluminium distance pieces as shown in Figure S51, then refit the runners.

(ii) Open out the holes in the existing hardboard mounting to $\frac{1}{2}$ in. (12·7 mm.) dia., then press mild steel bushes into the holes, so that when the floor slides are tightened down they bear on the bushes instead of the leather-trimmed hardwood (see Fig. S52).

When re-fitting the seat slides, use $\frac{1}{4}$ in. U.N.F. Allen screws in place of the existing setscrews.

Rattles may also be detected from the spring-loaded locking bolts in the slides; in this case the fault can be rectified by building up to obtain a sliding fit in the bracket and the slide.

The slide release and the individual back-rest rake adjusters are illustrated in Figure S50.

It is seldom possible to cure internal rattles from the slides and, in such cases, it is recommended that a replacement unit be fitted.

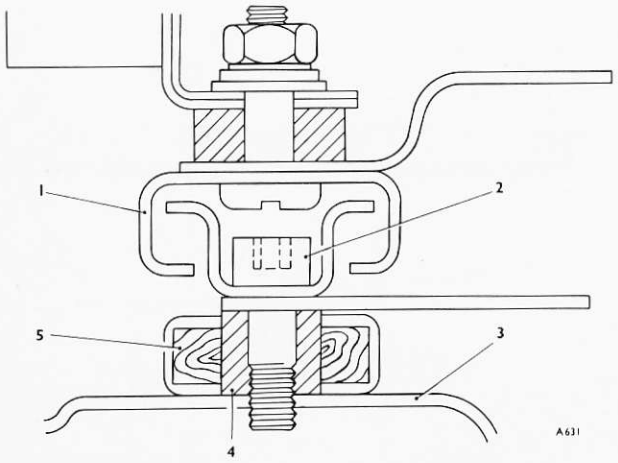


Fig. S52 Method of fitting bushes in the hardwood blocks for securing the front seat slides to the floor — early S1 cars

1. SEAT RUNNER
2. ALLEN SCREW (UG 1422)
3. CAR FLOOR
4. MILD STEEL BUSH (UB 1935)
5. HARDWOOD MOUNTING BLOCK

Should it be necessary to adjust the front seat catch, re-position the 2 B.A. bolts and the nipples situated on the seat slide cables to obtain the desired result.

Rear Seats and Squabs — to remove

The rear seat cushion can be removed by lifting the front of the seat cushion out of the well and pulling it out through the rear door.

The rear seat back rest is secured by eight Phillips screws to which access can be gained from inside the luggage boot.

On cars fitted with the Boot Refrigeration Unit, access is a little more difficult and is gained by removing the back-board from inside the luggage boot. No attempt should be made to disturb the refrigeration pipes.

Each head squab is secured by three Phillips screws; access to these screws is gained from inside the luggage boot.

Rear Seats and Squabs — to fit

To fit the rear seat and squabs, reverse the procedure given for their removal.

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SECTION S11 — RADIATOR GRILLE

Radiator Grille — to remove

Should it be necessary to remove the radiator grille, proceed as follows.

Remove the bonnet top, then remove the nuts and bolts which secure the grille to the radiator header tank and to the top edge of the wing valance.

Unscrew the nuts securing the front bumper to the chassis frame brackets and remove the front bumper.

Unscrew the retaining screws and bolts, then remove the front apron.

Remove the retaining screws and detach the stone-guard situated at the rear of the front apron, then remove the grille from the car.

Radiator Grille — to fit

When re-fitting the grille to the car, reverse the procedure given for its removal.

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SECTION S12 — BODY REMOVAL AND MOUNTING

Body — to remove

Disconnect the leads at the battery and remove the battery.

Remove the front doors as described in Sections S2 and S4.

Disconnect the leads for the fog/flasher lamps at the lamps and remove the lamps.

Disconnect and remove the bonnet top, front apron and side fairings, radiator grille and front bumper as described in Section S11.

Disconnect the leads for the headlamps, side lamps and blower motors where fitted, at the snap connectors at the front end of each valance plate.

Disconnect the horn leads at the snap connectors adjacent to the horns.

On late S2 cars, disconnect the fresh air duct support bracket from the left-hand side wing stiffener.

On all S2 cars, remove the metal front undersheet and the fibreglass or metal rear undersheet from the right-hand side of the car.

On all cars, remove the self-tapping screws and the single bolt which secure the stainless steel strip to the lower edge of each wing.

Disconnect the wing stiffeners at the valance plate and mounting bracket on each side of the car.

Before removing the wings from a car fitted with a wing mounted aerial, disconnect the leads and remove the unit.

Supporting the weight of the right-hand wing, remove the setscrews securing the wing to the valance plate; the left-hand wing should then be removed in a similar manner.

After removing the wings, disconnect the following components at the connecting points on the component — generator, choke solenoid, stop lamp switch, oil pressure transmitter, coolant temperature transmitter, oil sump rheostat, starter relay switch and fuel pump. Disconnect the lead from the SW or +ve terminal of the ignition coil.

Disconnect the plastic pipe at the top of the screenwasher reservoir; **on S1 cars,** it will also be necessary to disconnect the vacuum pipes between the screenwasher switch and the inlet manifold, and the switch and the screenwasher reservoir.

On standard S2 cars, disconnect the leads at the heater flap actuator and fresh air flap actuator which are positioned at the rear of the right-hand valance plate. Also disconnect the leads to the water tap actuator positioned at the front of the right-hand valance plate.

On all S2 cars, disconnect the leads to the screenwasher motor.

After disconnecting the above leads, unclip each loom on the engine and valance plates so that they are only secured at the bulkhead.

On all cars, drain the coolant from the radiator and crankcase as described in Chapter L.

Remove the matrices and ducting for the Air Conditioning System from the valance plates, referring to Chapter C for the standard systems and to the Air Conditioning Manual TSD.723 and TSD.744 for refrigeration systems.

After discharging the refrigerant and removing the matrices and ducting from cars fitted with refrigeration systems, disconnect the refrigerant pipes and fit blanking plugs to all pipes and connections.

Disconnect the coolant connections between the engine and the valance plates.

On late S1 cars, S2 Long Wheelbase and Continental S2 cars, remove the clip securing the manually operated Summer/Winter tap(s) to the left-hand valance plate; disconnect the coolant hose from the cylinder head to the tap(s). Disconnect the coolant hose between the vacuum operated tap and the left-hand valance plate. Disconnect the rubber vacuum pipes between the control switches and the induction manifold, between the control switches and the vacuum operated water taps and between the control switches and the inlet air flap actuators.

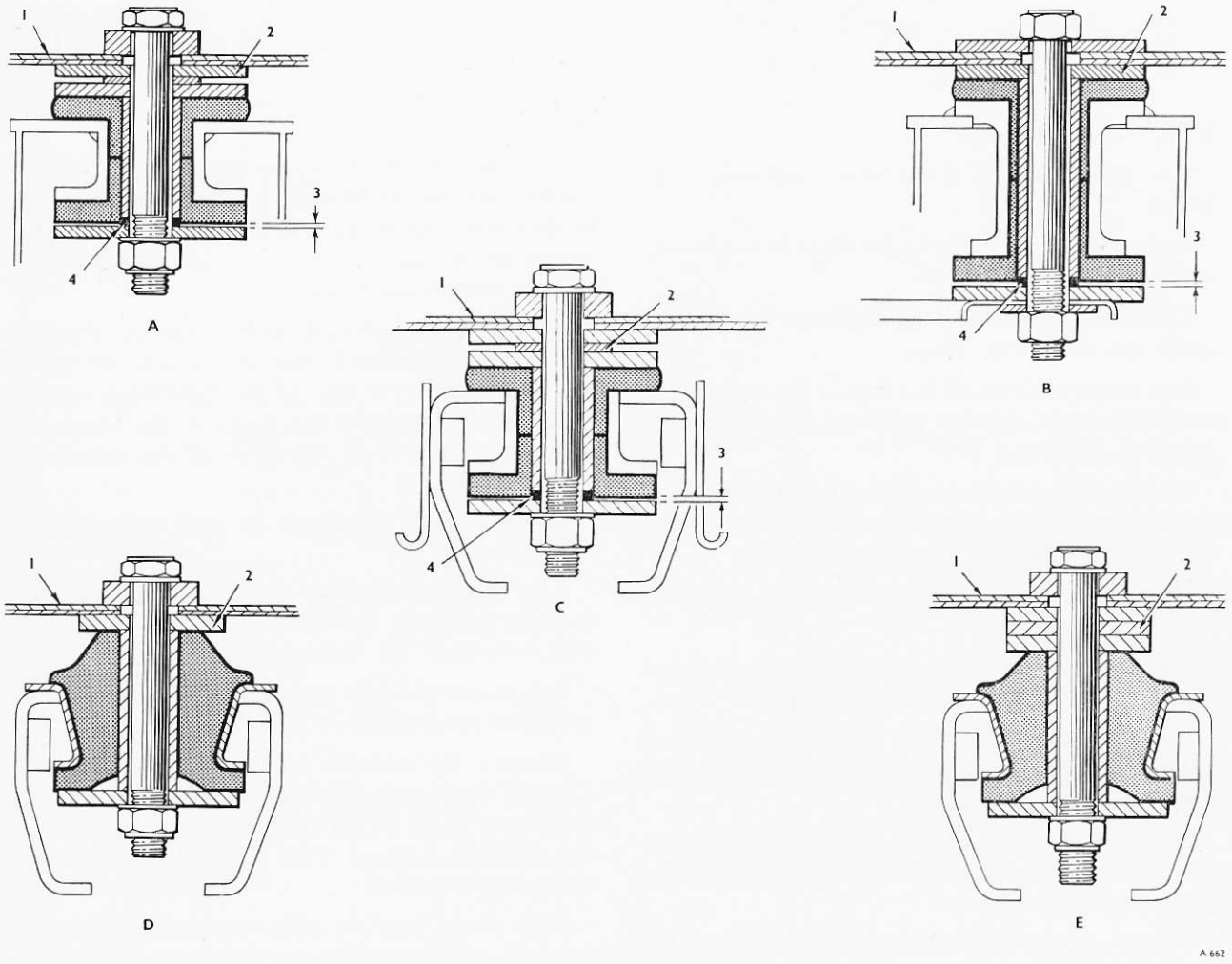


Fig. S53 Body mountings for standard steel body

A. No. 1 MOUNTINGS — EARLY S1 CARS
B. No. 1 MOUNTINGS — LATE S1 AND ALL S2 CARS
C. No. 2 AND 4 MOUNTINGS
D. No. 3 AND 5 MOUNTINGS
E. No. 6 MOUNTING

1. BODY
2. WASHERS
3. VERTICAL FREEDOM 0·010 in. (0·254 mm.)
4. SHIM

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On all cars, drain the brake fluid, remove the pipes between the master cylinder and the reservoirs and remove the handbrake and cable as described in Chapter G. Care should be taken when draining the brake fluid to ensure that it does not come into contact with the paintwork.

Disconnect and remove the accelerator pedal.

Remove the steering column as described in Chapter N.

Unscrew the lock-nut on each bonnet lock control rod, remove the split pin securing each locking handle to its control rod and remove both of the rods.

Disconnect the earthing strip between the front of each valance plate and the chassis frame.

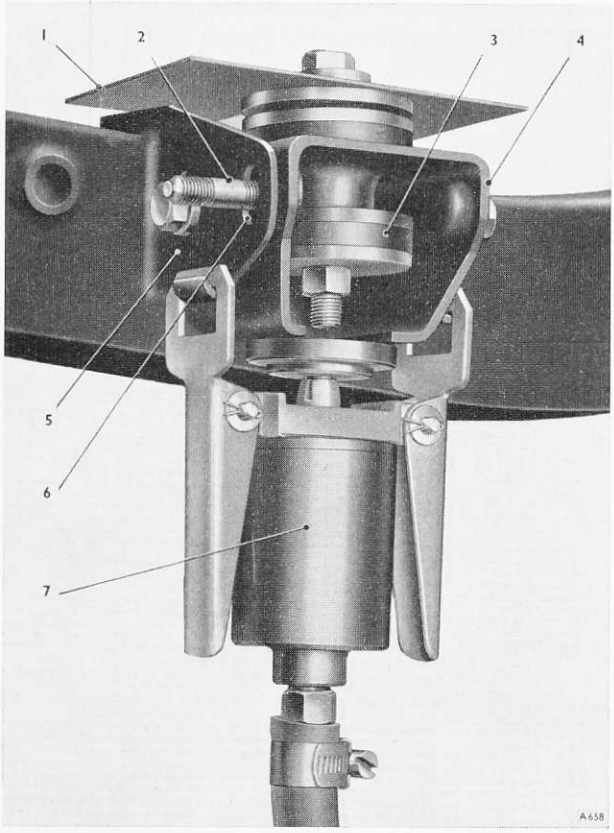


Fig. S54 Body mounting ram in position

1. BODY FLOOR
2. INDICATOR STUD
3. BODY MOUNTING RUBBER
4. CRADLE
5. MOUNTING BRACKET
6. ELONGATED HOLE
7. PNEUMATIC RAM

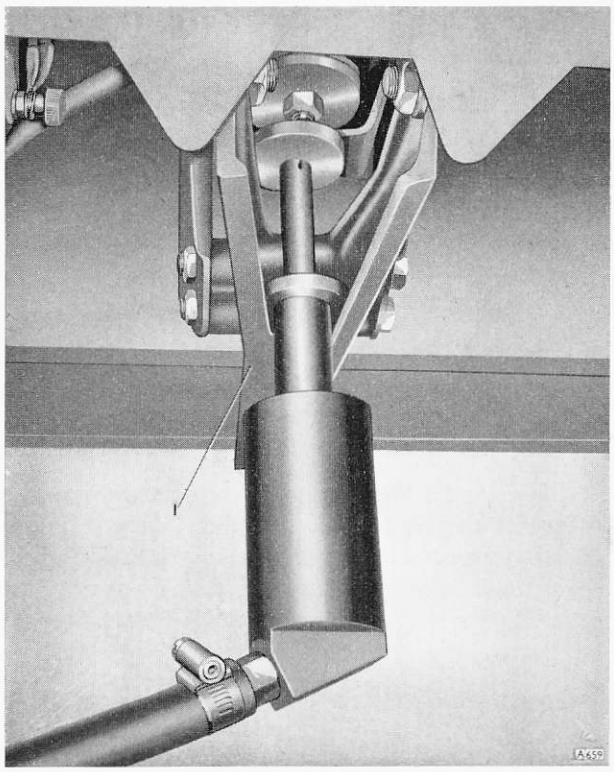


Fig. S55 Body mounting ram for jacking slide mounting

1. JACKING SLIDE

Unscrew and remove the setscrews securing each valance plate and remove the valance plates.

Disconnect the speedometer cable at the gearbox.

Disconnect the earthing strip between the voltage regulator and the chassis frame at the connection on the chassis frame.

On S1 cars, disconnect the oil pipe between the Centralised Chassis Lubrication pump fitted to the bulkhead and the junction box on the chassis frame.

On all cars, remove the screws securing the rear wheel arch extensions to the wheel arch and remove the extensions.

Disconnect the leads to the shock damper solenoids and the fuel level indicator unit at the snap connectors adjacent to these components.

Remove each body mounting bolt and lift off the body, taking care not to damage the paintwork, trim or fittings.

If a new body is to be fitted it will be necessary to remove from the old body all the components and fittings which can be used again, and to fit them to the new body.

Description of Body Mounting

Each fully floating rubber mounting, on which the standard saloon body is supported, must carry the proportion of weight for which it is designed.

A body mounting carrying more than its share of weight is liable to give a metal-to-metal effect, while an underloaded body mounting causes additional weight to be carried by the other mountings.

It is essential that the body be correctly mounted, otherwise excessive noise and vibrations will be produced. Care should be taken to ensure that lubricant does not contact the mounting rubbers at any time otherwise the mechanical properties of the rubber will be destroyed.

On some early S1 cars, when doors have not fitted correctly, it has been necessary to adjust the body mounting below the door pillar. **On later cars** however, it is most important that the body mounting is not disturbed, unless the complete mounting procedure is carried out.

The mounting procedure consists mainly of attaching pneumatic rams to the body mountings and ensuring that the body is free to pivot axially about No. 1 mountings.

The pneumatic rams are connected in series to a compressed air supply, thereby ensuring that an equal load is applied to each body mounting; this enables it to assume its correct position within the vertical limits of the slots in the chassis brackets.

The mountings are then locked in position by means of setscrews, the rams removed and the centre mounting bolts tightened.

Body — to mount

Attach the rubber mounting assemblies to the frame, using only three setscrews for each assembly; do not tighten the setscrews. In place of the fourth setscrew insert a short stud to serve as an indicator as shown in Figure S54.

Ensure that the cradles are free to move in the chassis brackets, then lower the body onto the frame so

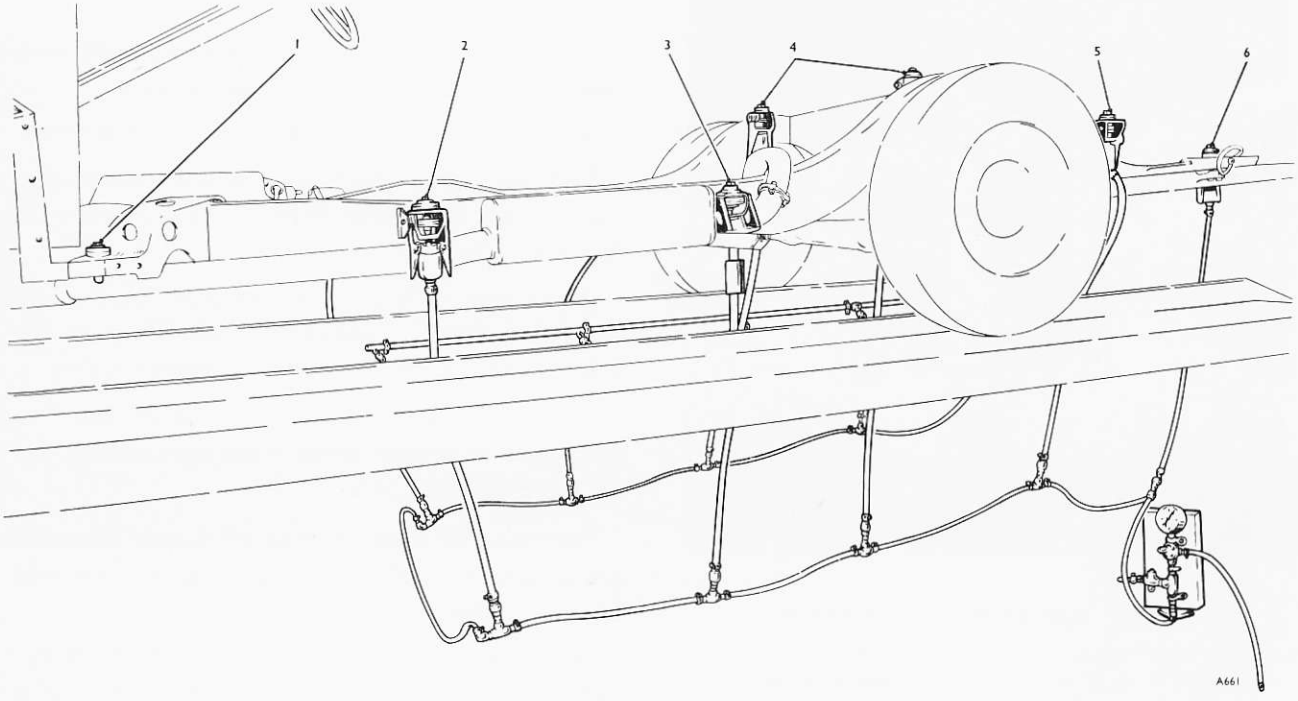


Fig. S56 Pneumatic rams in position

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that the pedal gap plate is centralised with the steering column.

When mounting an untrimmed body, ballast should be used to bring the body to its final unladen weight; the ballast should be arranged to resemble the final load pattern as closely as possible.

For the standard saloon completely without trim, arrange the ballast as follows.

Junction of floor and toe board
2 @ 56 lb. (25·4 kg.) weights

In line between centre pillars
2 @ 56 lb. (25·4 kg.) weights

In line along the front edge of rear seat pan
4 @ 56 lb. (25·5 kg.) weights

On luggage boot floor immediately forward of battery and tool tray aperture
2 @ 56 lb. (25·4 kg.) weights

Bodies which are trimmed do not require ballast, but if the car is complete and remounting is necessary the following parts should be disconnected from the body before releasing the body mounting bolts.

Remove the front doors as described in Sections S2 and S4 and unscrew the setscrews which retain the wings to the body at the front door post.

Disconnect the bonnet, front wings and valances by slackening the bolts securing them at the scuttle.

Disconnect the steering column from the body and chassis frame as described in Chapter N.

The body can then be raised and pivoted freely about No. 1 body mountings as necessary.

Fit the centre bolts to No. 1 mountings but do not yet tighten them, then if necessary fit sufficient washers to obtain approximately $\frac{5}{8}$ in. (1·59 cm.) clearance between the body and the frame brackets.

Should the clearance between body and frame be greater on one side than the other, initial correction should be made at No. 1 mountings.

Assemble the remainder of the side mountings and fit the rams in position under the mountings as shown in Figures S54 and S56.

Operate the pressure release valve and check whether the rams deflate smoothly; adjust the restrictor if necessary.

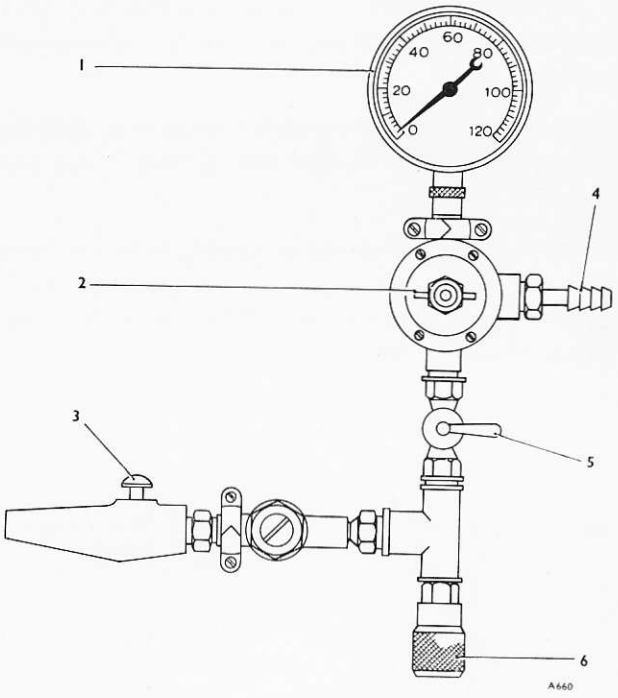


Fig. S57 Regulator for the pneumatic rams

1. PRESSURE GAUGE
2. PRESSURE REGULATOR
3. AIR RELEASE BUTTON
4. INLET FROM SUPPLY
5. STOP VALVE
6. OUTLET TO PNEUMATIC RAMS

Inflate and deflate the rams several times to ensure that the body will rise and lower freely and evenly, whilst pivoting about the No. 1 mountings.

Greater movement will be noted at the rear than at the front.

Turn the stop valve tap, on the pneumatic ram regulator, to the open (vertical) position, then adjust the air pressure by means of the regulator, to read 80 lb/sq.in. (5·625 kg/sq.cm.) on the pressure gauge; check the system for air leaks.

Note: Should attention be required to only one body mounting, it is not necessary to deflate all the rams, as each ram is provided with an air valve.

After having made an adjustment it is not necessary to alter the controls in order to compensate for loss of pressure, because air losses are automatically replaced by means of the pressure release valve.

Adjustment should be made to obtain a general clearance of $\frac{5}{8}$ in. (1·59 cm.) between the body and the frame.

On S1 cars, it is of particular importance that the clearance over the gearbox bell housing is not less than $\frac{5}{8}$ in. (1·59 cm.).

Packing washers should be used between the body and the mounting to position the indicator studs approximately in the centre of the slot in the frame bracket (see Fig. S54).

Adjustment should be made if necessary by means of shim washers.

On standard S1 and S2 cars, fit the two centre mountings positioned behind the centre of the cruciform and **on all cars,** fit the rear centre mounting, using packing washers as necessary. When the centre bolts are finally secured, the rubbers should not be under compression.

After mounting the body, remove the ballast weights

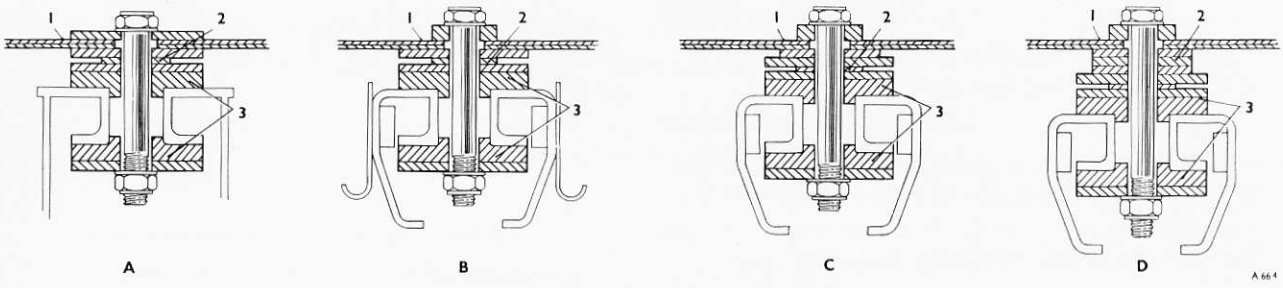


Fig. S58 Body mountings for coupe body

A. No. 1 MOUNTINGS B. No. 2 AND 4 MOUNTINGS C. No. 3 AND 5 MOUNTINGS D. No. 6 MOUNTINGS

1. BODY 2. ADJUSTING WASHERS 3. STEEL SPACING FLANGES

Should the indicator stud bear on the top of the slot, further adjusting washers are required; if the stud bears on the bottom of the slot, adjusting washers should be removed to obtain the desired result.

With the air pressure maintained at 80 lb/sq.in. (5·625 kg/sq.cm.), tighten the three setscrews in each mounting assembly, then remove the indicator stud and replace it by a setscrew.

Release the air pressure and remove the rams.

Tighten the centre bolts of all mountings and check that the vertical clearance of Nos. 1, 2 and 4 rubbers is between zero and 0·010 in. (0·254 mm.) as shown in Figure S53.

if these have been used, and fit the various components, reversing the procedure used for the removal.

Coupe Body

The mounting procedure for coupe bodies is the same as for standard bodies, but instead of rubber mountings, solid mountings are fitted (see Fig. S58).

Note: Should damage occur as the result of an accident, which is not sufficient to necessitate removal of the body, the body mounting brackets both on the chassis and the body should be corrected to the dimensions shown in Chapter P and the body mounted as previously described.

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SECTION S13 — ACCIDENT REPAIRS

The body shell fitted to **standard S1 and S2 cars** is formed from deep drawn sheet steel.

Damage to the body shell is usually of a localised nature and in such cases replacement of the appropriate section may be more satisfactory than extensive re-shaping.

Figures S59 and S60 illustrate typical cutting lines and available replacement sections; the broken lines indicate spot welding which may be drilled or cut away.

Welding repairs can be carried out using an ordinary gas torch.

A suitable filler for use after welding is lead with Fryolux flux and Russian Tallow used on the paddle to smooth the filler.

Care should be exercised when applying heat to sheet metal as prolonged heat will cause distortion.

'Birmabright' Aluminium Alloy

The luggage boot lid, doors, bonnet and fuel filler door **on standard S1 and S2 cars** are all manufactured from 'Birmal' Sheet BB-3.

This is a light, non-corrosive aluminium alloy containing magnesium.

Small welds and fillings may be carried out with excellent results, but care should be taken when applying heat, as prolonged heating is apt to cause surface distortion which cannot be beaten out satisfactorily.

Therefore when damage is extensive it is advisable to fit a new panel.

Should it be necessary to carry out small welding repairs, the following materials are required:

Welding rod	'Birmabright' No. 2
Flux	Welding flux for aluminium and its alloys
Filler	'Birmetal Filzall'
Lubricant	Aluminium powder

These materials can be obtained from Messrs. Birmabright Ltd., who also offer a complete kit containing a S.I.F. welding torch, three wooden paddles, an electric paddle and a supply of consumable materials.

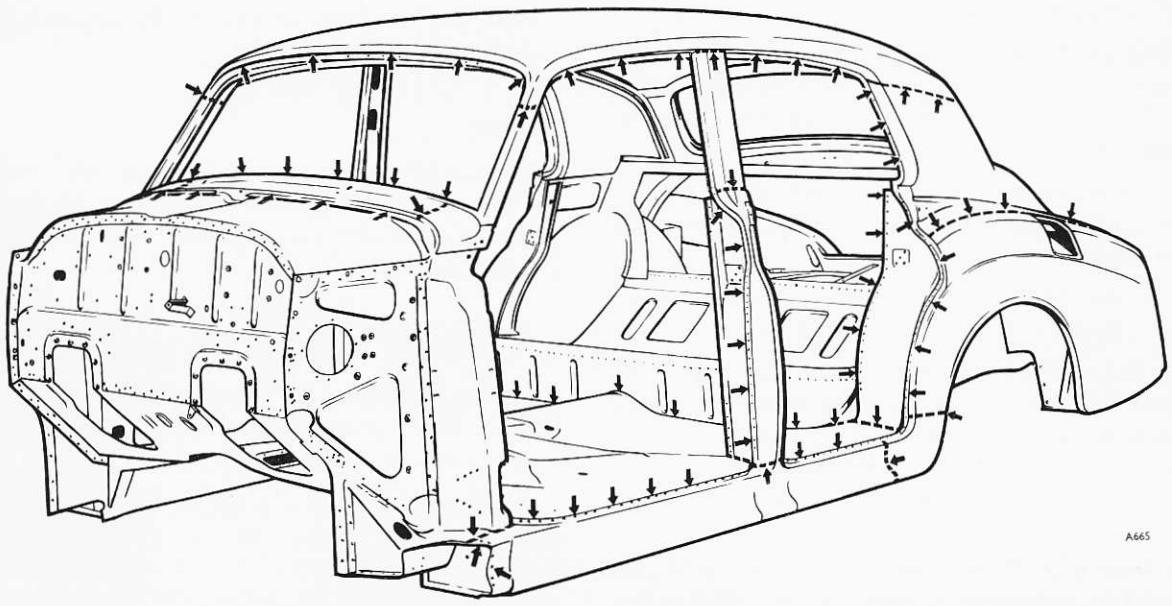


Fig. S59 Body cutting diagram — three quarter front view

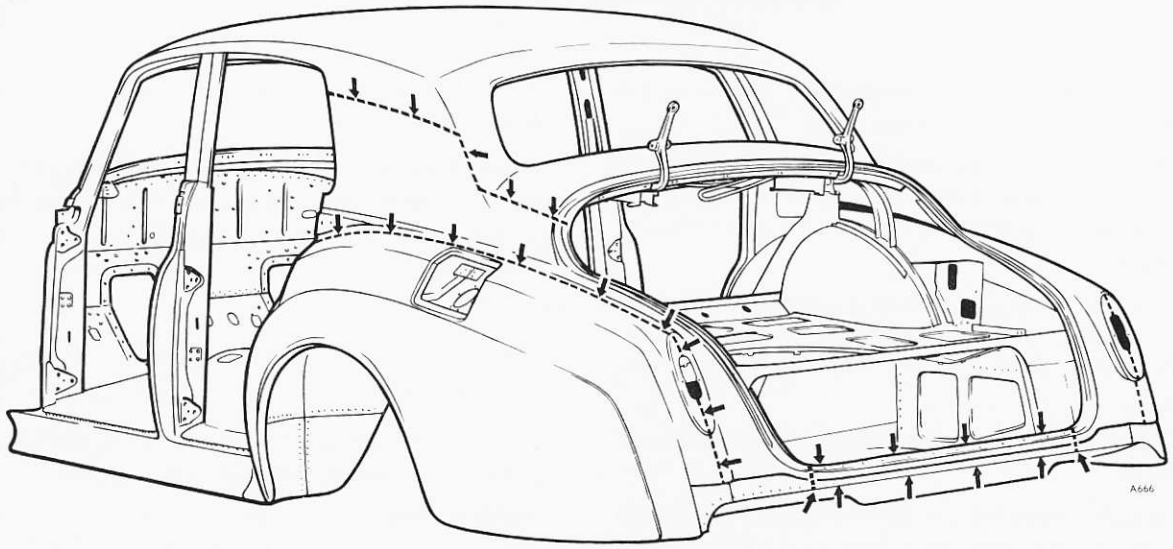


Fig. S60 Body cutting diagram — three quarter rear view

Welding

The welding procedure employed closely resembles that used for pure aluminium, but the welding rod specified above must be used.

The 'leftwards' technique should be adopted and after initial 'tacking', the weld should be completed as quickly as possible in one run.

Using a cellulose stripper, remove the paint where necessary, then clean with wire wool the edges which are to be welded, for a width of not less than $\frac{1}{2}$ in. (13 mm.) on each side.

Mix a small quantity of flux with water until a smooth stiff paste is obtained, then brush it onto the cleaned edges.

Clean the welding rod with wire wool and brush on the flux paste.

If a British Oxygen Company or a S.I.F. torch is to be used, fit a No. 2 nozzle or its equivalent if another make is to be used. Adjust the flame so that it is slightly reducing; that is, so that it has a slight excess of acetylene. The flame should also be smooth and quiet.

At intervals of 2 in. (5·08 cm.) to 4 in. (10·16 cm.) tack weld the edges then, working from right to left, complete the weld in one run.

Do not quench the weld to cool, it should be allowed to cool naturally.

When cool, wash off any surplus flux using hot water and a scrubbing brush; owing to the strong corrosive nature of the flux, it is essential that all traces are removed.

Dress the repaired part with a file, then rub down and paint in the normal way.

Filling

'Birmetal Filzall' is a thermal plastic resin containing 75 per cent aluminium powder and 25 per cent synthetic resin and has a melting point of approximately 120 deg. C.

It should be applied in a similar manner to that for normal metallic solders and little heat is required.

If heat is applied by means of an oxy-acetylene flame, it should be neutral and soft; only the tip of the outer flame should contact the metal.

In order to provide a rough surface to enable the filler to adhere, remove the paint where necessary using a cellulose stripper, then thoroughly clean the surface with coarse glasspaper; cleaning with a wire brush is not sufficient.

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Apply a thin coat of filler over the whole of the working surface; to ensure good adhesion, heat the surface then allow the 'Filzall' stick to melt by contact with the heated surface. Do not apply the flame directly onto the 'Filzall' stick.

Build up the surface with filler whilst playing the flame over the coated area.

Care should be taken not to overheat the filler, otherwise it will turn brown and small holes will appear on the surface.

Level off the filler with a wooden paddle, after covering the paddle with aluminium powder to prevent sticking.

The electric paddle enables the filling to be applied without the aid of a flame and requires no aluminium powder as a lubricant. It is possible to obtain a smooth surface which requires only a little hand dressing before painting.

When the filler is cold, feather the edges with a file and rub down in the usual way.

If a sanding disc is used for rubbing down, use the reverse face of the disc and apply light pressure with the edge of the disc to produce a glaze by friction.

A further aid to body repairs has been the introduction of certain catalytic fillers. When one of these fillers is to be used, it is advisable to adhere strictly to the manufacturer's instructions.

As a general rule the manufacturers stipulate that the paint should be stripped from the metal surface, and the metal thoroughly cleaned before applying the filler to the surface.

Paintwork

The painting of Rolls-Royce and Bentley cars is far too complex a subject for the scope of this Workshop Manual.

Due to the many varied materials available for car paintwork re-finishing, it is suggested that the choice of both materials and the method of painting be left to the people concerned.

The need for meticulous attention to detail should be stressed, in order to achieve the high quality finish expected.

Should difficulties arise, information can be obtained from the Paint and Plastics Laboratory, Rolls-Royce, Crewe.

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SECTION S14 — ACCESSORIES

Sun Visors

On early S1 cars a Belleville washer was fitted to the sun visors, this was later replaced by a wave washer.

The procedure for replacing this washer and also re-setting the friction poundage is stated below.

Care should be taken when dismantling the pivot assembly to note how the parts are fitted, as correct assembly and adjustment is most important.

Remove the sun visor from the car and dismantle the pivot assembly, discard the Belleville washer and replace it by a wave washer and a plain washer as shown in Figure S61.

Using 'Molytone' or Retinax 'A' grease, liberally smear the pivot assembly and lightly smear the Ferodo friction pad to prevent surface chafing, then assemble the unit as shown in Figure S61.

Hold the sun visor bracket in a vice and attach a spring balance to the edge of the blade, then measure the pull required to move the visor blade; the correct load on the spring balance should be $2\frac{1}{2}$ lb. (1·13 kg.).

Tighten the adjusting nut until the spring balance reads approximately 2 lb. (0·91 kg.), then further tighten the adjusting nut until the correct loading is obtained.

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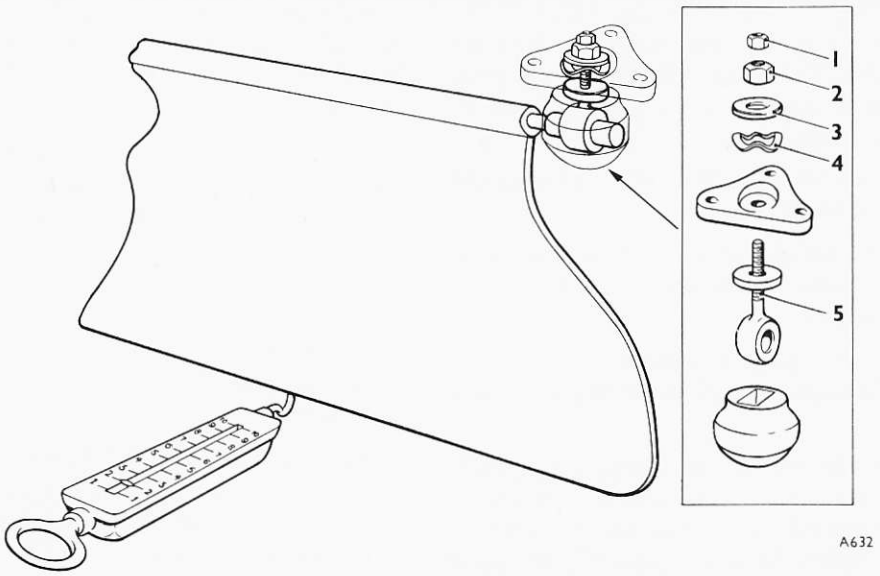


Fig. S61 Sun visor assembly and method of checking the poundage

1. LOCK-NUT
2. ADJUSTING NUT
3. PLAIN WASHER
4. WAVE WASHER
5. EYEBOLT

Companion Set Mirrors — to remove

Before proceeding to remove the mirrors, remove the bulb from each box and from the right-hand box remove also the cigar lighter, then proceed as follows.

Unscrew the three screws securing each head squab and remove the head squabs; access to these screws is obtained via the luggage boot.

Detach the door sealing sufficiently to expose the three screws which secure the trim pad, then remove the screws.

Remove the hand pull, then carefully ease off the trim which is also secured by panel pins.

The trim will then fall away sufficiently for the wires to be disconnected. It should be noted that the purple wire is connected to the companion lamp and that the black and yellow is connected to the cigar lighter.

The three screws securing the box will then be visible; remove these screws, which are situated in the forward, rear and upper faces of the box; withdraw the box.

Companion Set Mirrors — to fit

To fit the mirror and box, reverse the procedure for removal, noting the following points.

Paint around the edge of the glass with matt black enamel, then bind the back with black adhesive tape; this will provide a soft bed for the mirror and will reduce reflections of the surrounding woodwork.

Before clamping the mirror to the woodwork, seal all round with 1 in. (2·54 cm.) wide masking tape.

Complaints are occasionally received concerning oxidation of the silver and this is usually due to the 'dum-dum' which is used for dust sealing purposes; it is important that this should not be used adjacent to the mirror.

Fuel Filler Door

When fitting a new rubber seal under the fuel filler door, it may be necessary either to trim the seal or to fit packing under it, to enable the door to fit flush with the wing.

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Failures are usually attributable to heavy loading on the electrically operated bolt.

To ensure correct operation of the bolt, check the alignment of the filler door, then slowly close the door to check that light pressure is necessary in order to compress the rubber seal before the bolt engages the tag.

Check the alignment of the engagement tag and if necessary re-position the bolt aperture.

This should be done either by packing out the tag or by elongating the aperture by filing.

Information regarding electrical actuation of the fuel filler door is contained in Chapter M.

Safety Belts

'Irvin' safety belts are designed to conform to British Standard Specification 3254 and will withstand shock loads of 3000 lb. (1360 kg.). They are intended solely for fixing to cars with METAL floors and must not be attached to a wooden floor or to car seats.

On all cars the following types of 'Irvin' safety belts have been approved:

Front seats: 'Irvin' diagonal and lap safety belt.

Rear seats: 'Irvin' lap safety belt.

The safety belts can be supplied in four colours: grey, red, green or fawn. They are supplied in the form of a kit and instructions for fitting them follow later in this section.

Front Seat Belts

The 'Irvin' diagonal and lap safety belt comprises two sections of 2 in. (50·8 mm.) wide nylon or terylene webbing and attached to each section is one part of a two-piece light alloy fixing buckle. The two parts of the buckle are designed so that they can be easily connected to form a harness to hold the wearer securely in the seat, and can be quickly released either by the wearer or, in an emergency, by another person. The ends of one section of the belt are securely fixed to shackles bolted to the car floor and the centre door pillar. The other section of the belt is firmly anchored to the car floor on the opposite side of the seat.

Rear Seat Belts

The 'Irvin' lap belt is manufactured from the same material as the front seat belts and is fitted with the same type of quick-release buckle. The belt comprises two sections which can be buckled across the wearer's lap to form a continuous belt. The two sections of the belt are securely anchored to the rear seat floor.

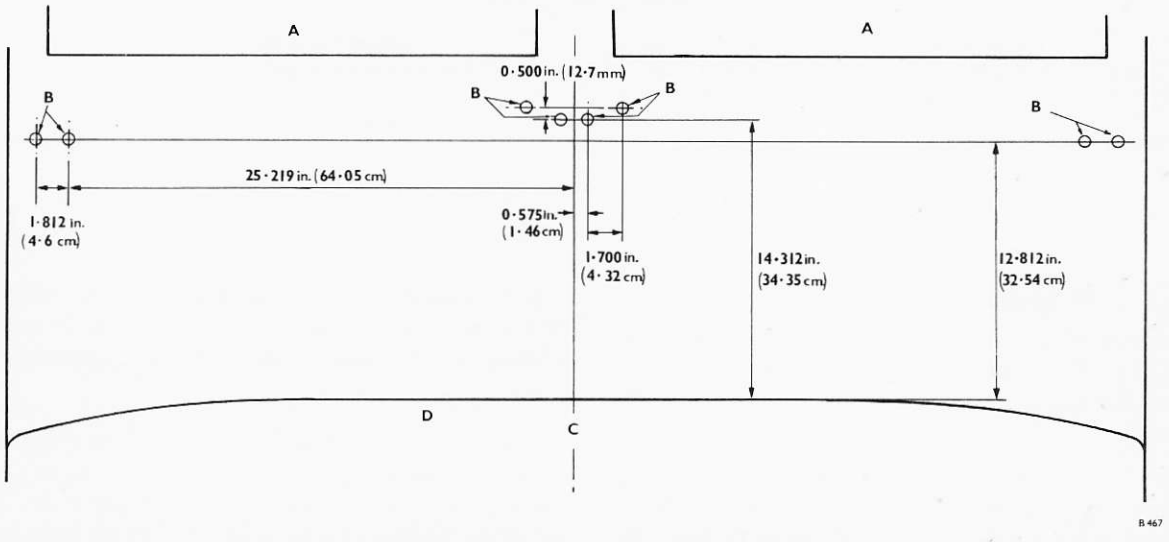


Fig. S62 Dimensions for drilling holes for front seat shackles — standard S1 and S2 cars

A. FRONT SEATS
B. 8 HOLES 0·312 in. (0·792 cm.) DIA.
C. CENTRE LINE OF CAR
D. REAR SEAT PAN

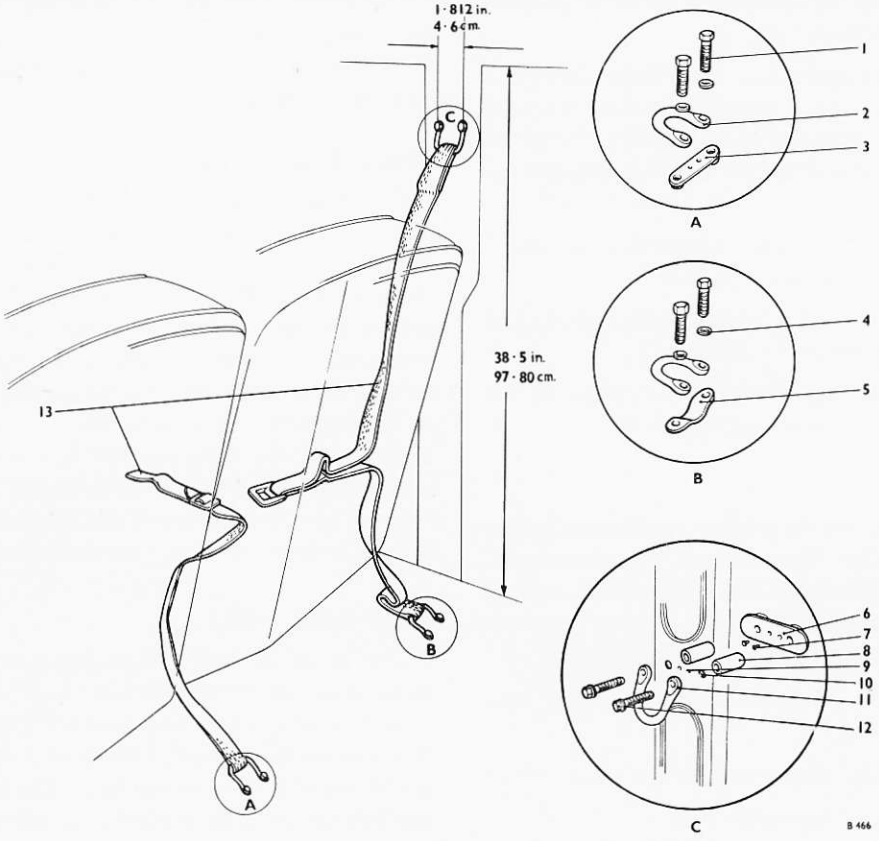


Fig. S63 Positions for front seat safety belts and shackles — standard S1 and S2 cars

1. SETSCREW
2. SHACKLE
3. ANCHOR PLATE
4. PLAIN WASHER
5. STIFFENER
6. ANCHOR PLATE
7. SELF-TAPPING SCREW
8. DISTANCE PIECE
9. 2 HOLES 0·140 in. (0·356 cm.) DIA.
10. 2 HOLES 0·328 in. (0·833 cm.) DIA.
11. SHACKLE
12. SETSCREW
13. SAFETY BELT

Front Seat Belts — to fit

Standard S1 and S2 cars. Move the front seat forward to its fullest extent and remove the rear carpet so that the positions for drilling the holes are easily accessible.

Working to the dimensions given in Figure S62 drill eight $\frac{5}{16}$ in. (7·93 mm.) dia. holes in the car floor. The two outer left-hand holes will pass through the exhaust heat shield and care should be taken not to drill through the front silencer box which is positioned directly below the heat shield.

It is necessary to drill four holes in the plate welded to the centre door post, but before this can be accomplished the trim pads must be removed as follows:

Disconnect the battery.

Prise the rubber seals from both sides of the door posts at a point approximately 4 in. (10·16 cm.) from the underside of the roof sill. Remove the two screws securing the trim pad to each side of the door post, then remove the pad. Before the right-hand trim pad can be removed it will be necessary to remove the roof lamp switch and disconnect the leads.

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Place a cloth in the centre channel of the door post to prevent swarf dropping inside the channel, then working to the dimensions given in Figure S63 drill two $\frac{21}{64}$ in. (8·334 mm.) dia. holes in the plate welded to the door post. Drill two further holes, $\frac{9}{64}$ in. (3·572 mm.) dia., at $\frac{13}{16}$ in. (20·637 mm.) centres, and equally spaced to the larger holes, so that they correspond with the holes in the anchor plate (see Fig. S63). When drilling these holes care should be taken to avoid damaging the wiring looms inside the door posts.

Place the anchor plate inside the door post channel and secure it to the welded plate on the door post with two No. 8 self-tapping screws.

The trim pad must also be drilled so that two distance pieces can be inserted between the belt shackle and the door post. Screw two short $\frac{5}{16}$ in. U.N.F. studs into the anchor plate, then fit the trim pad into position and press it against the door post and the two studs. When the trim pad is removed, a clear impression of the two studs will be seen. Using these indentations as centres, drill two holes $\frac{9}{16}$ in. (14·3 mm.) dia. through the trim pad.

To ensure that the belts are fitted in their correct positions lay them on the seats in the positions that they will occupy when in use.

Fit the six shackles through the loops formed in the belts so that when fitted the four shackles fitted to the floor will slope forwards and the two shackles fitted to the door posts will slope downwards as shown in Figure S63.

The shackle fitted to the left of the car centre line is to secure the right-hand safety belt and the shackle fitted to the right of the car centre line is to secure the left-hand safety belt; this ensures a more direct pull on the shackles.

To ensure that the shackles seat firmly on the car floor, cut the felt away from the areas around the holes.

Place the two centre shackles over the appropriate holes in the floor and insert the four $\frac{5}{16}$ in. U.N.F. fixing bolts and washers from inside the car.

Place the two anchor plates A (see Fig. S63) in position under the floor and screw in the four securing bolts.

Place the outer left-hand shackle in position then insert a $\frac{5}{16}$ in. U.N.F. bolt which is long enough to pass through the shackle, car floor and heat shield. Screw the bolt into the stiffener plate B (see Fig. S63).

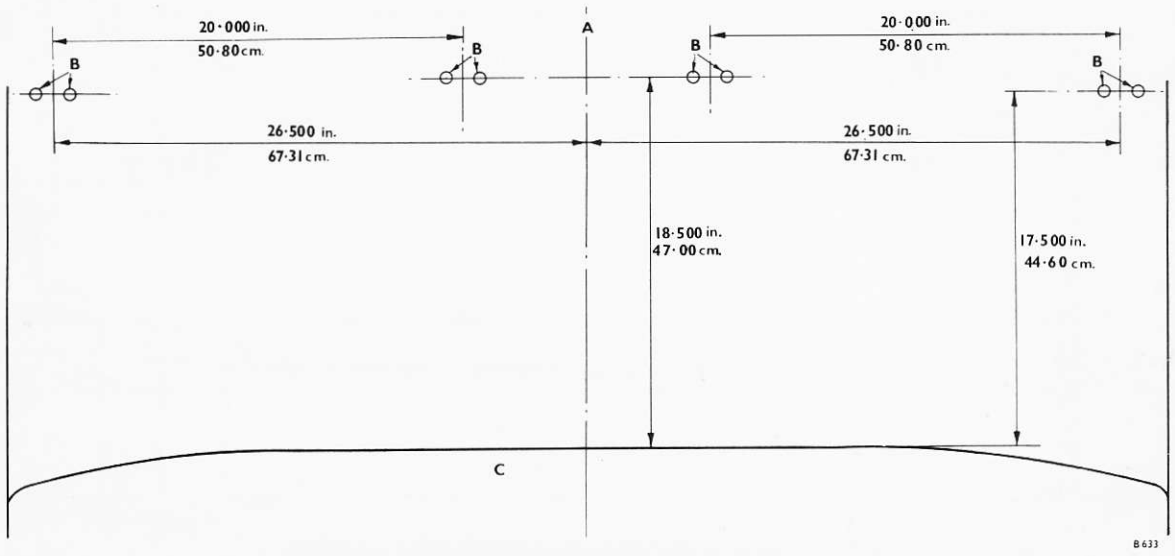


Fig. S64 Dimensions for drilling holes for front seat shackles — Long Wheelbase cars with division

A. CENTRE LINE OF CAR B. 8 HOLES 0·312 in. (0·792 cm.) DIA.
C. REAR SEAT PAN

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With the aid of the bolt, pull the stiffener upwards until the heat shield touches the underside of the floor. Line up the stiffener plate and screw in a bolt of the correct length through the other hole. Remove the long bolt and replace with a washer and bolt of the correct length.

Similarly position the outer right-hand shackle and screw the two $\frac{5}{16}$ in. U.N.F. bolts and washers into the stiffener plate. It should be noted that the two bolts used on the left-hand shackle are $\frac{1}{4}$ in. (6·35 mm.) longer than those used on the right-hand shackle.

Cut three slots in the carpet to accommodate the shackles; one for each outer shackle and one for the two inner shackles. The two outer slots should run to the edge of the carpet so that it can be removed when necessary without removing the safety belts. Bind the edges of the slots with leather to prevent the carpet from fraying.

Fit the trim pads to the door posts, reversing the procedure for their removal. Secure the rubber seals with 'Bostik' 1261 adhesive. Fit the roof lamp switch and connect the battery. Place the two distance pieces into the holes in the trim pad, then secure the shackles with two $\frac{5}{16}$ in. U.N.F. bolts. Ensure that the distance pieces are of the correct length, otherwise the wooden trim pad may be crushed when the bolts are tightened.

Long Wheelbase Cars with Division. The method of fitting safety belts to the front seats of long wheelbase cars differs very slightly to that for the standard saloons. Because of the difference another part number is used for kits supplied for use on long wheelbase cars.

Remove both the front seats, the driver's seat will slide off whereas the passenger's seat is secured by four setscrews to which access can be gained by removing the cushion.

Remove both door post trims as described in **Front Seat Belts — to fit — Standard S1 and S2 Cars.** Drill the post and fit the shackle as previously described. It will be noted that the distance pieces used on long wheelbase cars are longer than those on the standard saloons. The length of the distance pieces to be used is 1·5 in. (3·81 cm.).

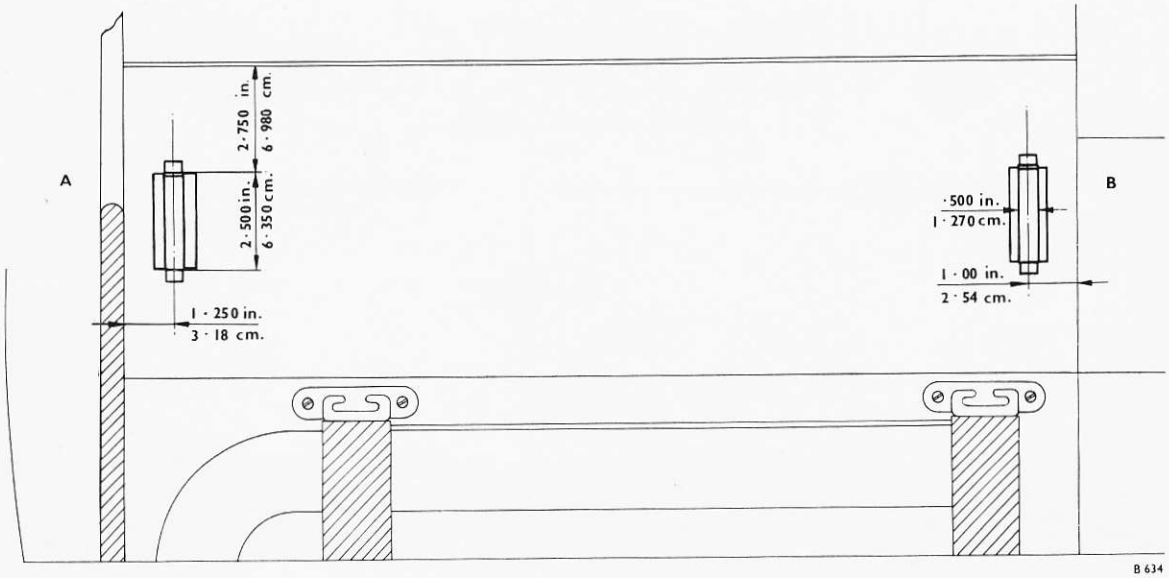


Fig. S65 Dimension for cutting slots in sloping metal panel at the rear of the front seats — Long Wheelbase cars with division

A. FRONT SEAT FINISHER
B. COVER FOR THE DIVISION ELECTRIC MOTOR

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The floor should then be drilled to the dimensions given in Figure S64.

Four slots 0·500 in. × 2·500 (1·27 cm. × 6·35 cm.) must be cut in the metal panel behind the front seats.

The dimensions for these are given in Figure S65; after cutting the slots the edges should be covered with either leather or rubber to prevent chafing of the belts.

When all holes have been drilled or cut the belts should be fitted as follows:

Ensure that the belts are fitted in the correct positions by laying them on the seats in the positions they will occupy when in use.

Fit the shackles through the loops formed in the belts so that when fitted the four shackles fitted to the floor will slope forwards and the two fitted to the door post slope downwards.

It will of course follow that due to the 1·5 in. distance pieces being used, a 2·375 in. (6·03 cm.) long bolt will also have to be used in the door post.

The shackle fitted to the left of the car centre line is to secure the left-hand safety belt. This is unlike the standard cars where the belts cross to give a more direct pull.

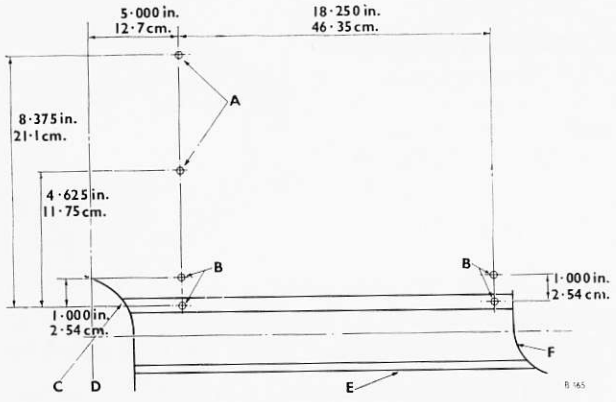


Fig. S66 Dimensions for drilling holes for rear seat 'U' bolts and stiffening brackets — S1, S2 and Long Wheelbase cars

A. 2 HOLES 0·250 in. (0·635 cm.) DIA.
B. 4 HOLES 0·312 in. (0·792 cm.) DIA.
C. DEPRESSION FOR REAR AXLE CENTRE CASING
D. CENTRE LINE OF CAR
E. SEAT PAN STIFFENER
F. REAR WHEEL ARCH

Cut the felt away from the areas around the holes in the floor to ensure that the shackles seat firmly.

Fit the shackles to the floor and post as described in **Front Seat Belts — to fit — Standard S1 and S2 Cars.**

It will also be necessary to cut four slots out to the nearest edge of the carpet to enable the carpet to be removed whilst leaving the safety belts in position. After cutting the slots, bind the edges of the carpet to prevent fraying.

Fit the trim pads to the door posts, reversing the procedure given for their removal. Secure the door seals with 'Bostik' 1261 adhesive. Place the two distance pieces into the holes in the trim pad, then secure the shackles with two $\frac{5}{16}$ in. U.N.F. bolts. Ensure that the distance pieces are of the correct length otherwise the wooden trim pad may be crushed when the bolts are tightened.

Long Wheelbase Cars without Division. The method of fitting front safety belts to cars without a division is very similar to that for standard cars, except that in Figure S62, 4 in. (10·16 cm.) should be added to the dimensions from the rear seat pan.

The run of the belts is also the same as that for standard cars, i.e. the shackle fitted to the left of the car centre line is to secure the right-hand safety belt and the shackle fitted to the right of the car centre line is to secure the left-hand safety belt; this ensures a more direct pull on the shackles.

Rear Seat Belts — to fit

Standard S1, S2 and Long Wheelbase cars. To fit the rear safety belts it is necessary to remove the rear seats, squabs and centre arm rest.

Remove the felt from the seat pan, then working to the dimensions in Figure S66 drill eight $\frac{5}{16}$ in. (7·43 mm.) dia. holes and four $\frac{1}{4}$ in. (6·35 mm.) dia. holes in the seat pan. The holes drilled slightly to the left of the car centre line will pass through the rear heat shield.

Fit the two stiffeners 2 (see Fig. S67) to the underside of the seat pan and secure them in position with four $\frac{1}{4}$ in. U.N.F. bolts, washers and nuts.

Place the safety belts in the position they will occupy when in use, then thread the four 'U' bolts through the loops in the belt.

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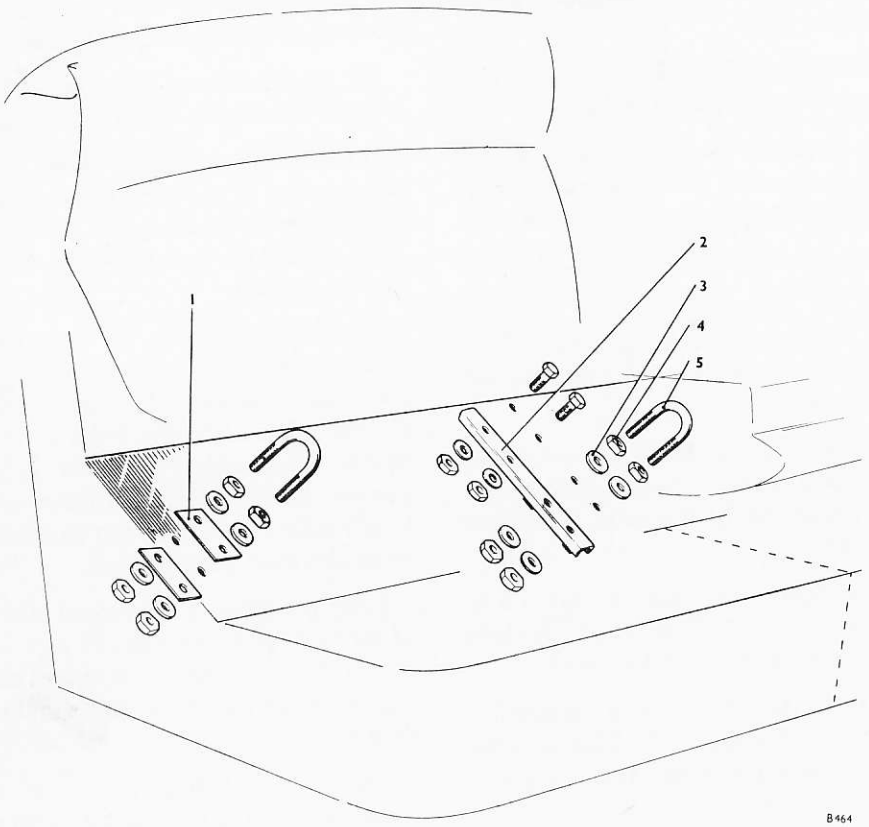


Fig. S67 Rear seat belt fixtures—S1, S2 and Long Wheelbase cars

1. RETAINING PLATE
2. STIFFENING BRACKET
3. PLAIN WASHER
4. NUT
5. 'U' BOLT

Fit nuts and washers to the 'U' bolts, then insert the two centre 'U' bolts through the seat pan and stiffener brackets. Secure them in position with further nuts and washers. Ensure that the nuts are tightened both above and below the seat pan and stiffener bracket.

Fit retaining plates 1 (see Fig. S67) to each of the outer 'U' bolts and then insert them through the appropriate holes in the seat pan. Fit further retaining plates to the 'U' bolts securing them with nuts and washers (see Fig. S67). Again ensure that the nuts are tightened both above and below the stiffener plates.

Cut slots in the felt around the 'U' bolts and stick the felt to the seat pan with 'Bostik' 87 AA adhesive.

Fit the centre arm rest seat and squabs, allowing the safety belts to pass between the base of the seat and the squabs.