

MM

Workshop Manual

A BMC SERVICE PUBLICATION



MINI

**SALOON and MOKE
COUNTRYMAN and TRAVELLER
VAN and PICK-UP
COOPER and COOPER 'S'**

WORKSHOP MANUAL

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INTRODUCTION

This Manual has been prepared to provide service operators with the necessary information for the correct maintenance and repair of the Mini and Mini-Cooper. The Manual also serves as a ready-reference book for service supervision and covers items of procedure for guidance of both the fully qualified and the less-experienced mechanic.

Where a Section has a capital letter and a small letter 'a' at the top of the page i.e. Aa, this section refers specifically to the Mini fitted with automatic transmission.

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GENERAL DATA

ENGINE

Type	..	..	..	..	..	..	..	8MB.
Number of cylinders	..	..	..	..	..	..	..	4.
Bore	..	..	..	..	..	..	..	2.478 in. (62.94 mm.).
Stroke	..	..	..	..	..	..	..	2.687 in. (68.26 mm.).
Capacity	..	..	..	..	..	..	..	51.7 cu. in. (848 cc.).
Firing order	..	..	..	..	..	..	..	1, 3, 4, 2.
Compression ratio	..	..	..	..	..	..	..	8.3 : 1.
Capacity of combustion chamber (valves fitted)	..	..	..	..	..	..	..	1.49 cu. in. (24.5 cc.).
Valve operation	..	..	..	..	..	..	..	Overhead by push-rod.
B.M.E.P.	..	..	..	..	..	..	..	128 lb./sq. in. (9 kg./cm. ²) at 2,900 r.p.m.
Torque	..	..	..	..	..	..	..	44 lb. ft. (6.08 kg. m.) at 2,900 r.p.m.
Compression pressure	..	..	..	..	..	..	..	150 lb./sq. in. (10.5 kg./cm. ²).
Engine idle speed (approx.)	..	..	..	..	..	..	..	500 r.p.m.
Oversize bore: 1st	..	..	..	..	..	..	..	+ .010 in. (.254 mm.).
Max.	..	..	..	..	..	..	..	+ .040 in. (1.016 mm.).

CRANKSHAFT

Main journal diameter	..	..	..	..	..	..	..	1.7505 to 1.751 in. (44.46 to 44.47 mm.).
Minimum regrind diameter	..	..	..	..	..	..	..	1.7105 in. (43.45 mm.).
Crankpin journal diameter	..	..	..	..	..	..	..	1.6254 to 1.6259 in. (41.28 to 41.29 mm.).
Crankpin minimum regrind diameter	..	..	..	..	..	..	..	1.5854 in. (40.27 mm.).

Main bearings

Number and type	..	..	..	..	..	..	..	3 shell type.
Material	..	..	..	..	..	..	..	Steel-backed white metal.
Length	..	..	..	..	..	..	..	1.187 in. (30.16 mm.).
End-clearance	..	..	..	..	..	..	..	.0002 to .003 in. (.051 to .076 mm.).
End-thrust	..	..	..	..	..	..	..	Taken on centre main bearing.
Running clearance	..	..	..	..	..	..	..	.0005 to .002 in. (.013 to .051 mm.).

CONNECTING RODS

Length between centres	..	..	..	..	..	..	..	5.75 in. (14.605 cm.).
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Big-end bearings

Material	..	..	..	..	..	..	..	Steel-backed lead-bronze with lead-indium-plated surface, or steel-backed copper-lead with lead-tin-plated surface.
Bearing side-clearance	..	..	..	..	..	..	..	.008 to .012 in. (.203 to .305 mm.).
Bearing diametrical clearance	..	..	..	..	..	..	..	.001 to .0025 in. (.025 to .063 mm.).

PISTONS

Type	..	..	..	..	..	..	..	Split skirt.
Clearances: Bottom of skirt	..	..	..	..	..	..	..	.0006 to .0012 in. (.015 to .030 mm.).
Top of skirt	..	..	..	..	..	..	..	.0026 to .0032 in. (.066 to .081 mm.).
Oversizes	..	..	..	..	..	..	..	+ .010 in., + .020 in., + .030 in., + .040 in. (.254 mm., .508 mm., .762 mm., 1.016 mm.).

PISTON RINGS

Compression: Plain	..	..	..	..	..	..	..	Top ring.
Tapered	..	..	..	..	..	..	..	Second and third rings.
Width	..	..	..	..	..	..	..	.069 to .070 in. (1.75 to 1.78 mm.).
Thickness	..	..	..	..	..	..	..	.095 to .101 in. (2.41 to 2.56 mm.).
Fitted gap	..	..	..	..	..	..	..	.007 to .012 in. (.178 to .305 mm.).
Clearance in groove	..	..	..	..	..	..	..	.0015 to .0035 in. (.038 to .089 mm.).

GENERAL DATA — *continued*

Oil control type	Slotted scraper.
Width	.124 to .125 in. (3.15 to 3.175 mm.).
Thickness	.095 to .101 in. (2.41 to 2.56 mm.).
Fitted gap	.007 to .012 in. (.178 to .305 mm.).
Clearance in groove	.0015 to .0035 in. (.038 to .089 mm.).

GUDGEON PIN

Type	Clamped in little-end.
Fit in piston	Hand push-fit.
Diameter (outer)	.624 in. (15.86 mm.).

VALVES AND VALVE GEAR

Valves

Seat angle: Inlet	45°.
Exhaust	45°.
Head diameter: Inlet	1.093 to 1.098 in. (27.76 to 27.89 mm.).
Exhaust	1.000 to 1.005 in. (25.40 to 25.53 mm.).
Stem diameter: Inlet	.2793 to .2798 in. (7.096 to 7.109 mm.).
Exhaust	.2788 to .2793 in. (7.081 to 7.096 mm.).
Valve lift	.285 in. (7.24 mm.).
Valve stem to guide clearance: Inlet	.0015 to .0025 in. (.038 to .064 mm.).
Exhaust	.002 to .003 in. (.051 to .076 mm.).
Valve rocker clearance: Running	.012 in. (.305 mm.) (cold).
Timing	.019 in. (.48 mm.).
Timing markings	Dimples on timing wheels, marks on flywheel.
Chain pitch and number of pitches	$\frac{3}{8}$ in. (9.525 mm.). 52.
Inlet valve: Opens	5° B.T.D.C.
Closes	45° A.B.D.C.
Exhaust valve: Opens	40° B.B.D.C.
Closes	10° A.T.D.C.
Valve rocker bush bore (reamed)	.5630 to .5635 in. (14.30 to 14.312 mm.).

VALVE GUIDES

Length: Inlet and exhaust	1.687 in. (42.86 mm.).
Diameter: Outside: Inlet and exhaust	.469 in. (11.91 mm.).
Inside: Inlet and exhaust	.2813 to .2818 in. (7.145 to 7.257 mm.).

VALVE SPRINGS

Free length: Inlet and exhaust	1.625 in. (41.27 mm.).
Number of working coils	4 $\frac{1}{2}$.
Pressure: Inlet and exhaust: Valve open	70 lb. (31.8 kg.).
Valve closed	37.5 lb. (17.027 kg.).

TAPPETS

Type	Barrel type.
Diameter	.812 in. (20.64 mm.).
Length	1.5 in. (38.10 mm.).

CAMSHAFT

Journal diameters: Front	1.6655 to 1.666 in. (42.304 to 42.316 mm.).
Centre	1.62275 to 1.62325 in. (41.218 to 41.231 mm.).
Rear	1.3725 to 1.3735 in. (34.862 to 34.887 mm.).

GENERAL DATA—continued

End-float ..	..	..	..	..	..	..	..	.003 to .007 in. (.076 to .178 mm.).
Bearings: Type: Front ..	..	..	..	..	..	..	..	White-metal-lined, steel-backed.
Centre and rear ..	..	..	..	..	..	..	..	Plain (running in block).
Inside diameter (reamed in position) ..	..	..	..	..	..	..	..	1.667 to 1.6675 in. (42.342 to 32.355 mm.).
Clearance: Front ..	..	..	..	..	..	..	..	.001 to .002 in. (.025 to .051 mm.).
Centre and rear ..	..	..	..	..	..	..	..	.00125 to .00275 in. (.0317 to .0698 mm.).

ENGINE LUBRICATION SYSTEM

Oil pump

Type	..	..	..	..	..	..	..	Hobourn-Eaton or Burman.
Relief pressure valve opens	..	..	..	..	..	..	..	60 lb./sq. in. (4.2 kg./cm. ²).
Relief valve spring: Free length	..	..	..	..	..	..	..	2 $\frac{5}{8}$ in. (72.63 mm.).
Fitted length	..	..	..	..	..	..	..	2 $\frac{5}{8}$ in. (54.77 mm.).

Oil filter

Type	..	..	..	..	..	..	..	Full-flow.
Capacity	..	..	..	..	..	..	..	1 pint (1.2 U.S. pints, .57 litre).

Oil pressure

Normal running	..	..	..	..	..	60 lb./sq. in. (4.22 kg./cm. ²).
Idling (minimum)	..	..	..	..	..	15 lb./sq. in. (1.05 kg./cm. ²).

COOLING SYSTEM

[illegible]

IGNITION SYSTEM

Coil	..	..	..	..	..	..	Lucas LA12.
Resistance at 20° C. (68° F.): primary winding	..	..	..	..	..	..	3.2 to 3.4 ohms (cold).
Distributor: Early type	..	..	..	..	..	..	DM2.
Later type	..	..	..	..	..	..	Lucas 25D4.
Rotation of rotor arm	..	..	..	..	..	..	Anti-clockwise.
Contact point gap setting	..	..	..	..	..	..	.014 to .016 in. (.35 to .40 mm.).
Condenser capacity	..	..	..	..	..	..	.18 to .24 mF.
Cam closed period	..	..	..	..	..	..	60°±3°.
Cam open period	..	..	..	..	..	..	30°±3°.
Automatic advance	..	..	..	..	..	..	Centrifugal and vacuum.
Serial number	..	..	..	..	..	..	40768A.

						<i>Premium fuel distributor</i>	<i>Regular (commercial) fuel distributor</i>
Automatic advance commences*	..	..	..	..	..	500 r.p.m.	1,250 r.p.m.
Maximum advance*	..	..	..	..	..	30° to 34° at 3,400 r.p.m.	22° to 26° at 5,000 r.p.m.
Vacuum advance: Commences	..	..	..	..	..	7 in. (17.7 cm.) Hg.	
Ends	..	..	..	..	..	10° at 13 in. (33 cm.) Hg.	
Decelerating check*	..	..	..	..	..	24° to 28° at 2,500 r.p.m.	22° to 26° at 5,000 r.p.m.
						21° to 25° at 2,000 r.p.m.	15° to 19° at 3,900 r.p.m.
						14° to 18° at 1,000 r.p.m.	1° to 5° at 1,700 r.p.m.
						4° to 11° at 800 r.p.m.	
Static ignition timing	..	..	..	..	..	T.D.C.	7° B.T.D.C.
Stroboscopic ignition timing*	..	..	..	..	..	3° B.T.D.C. at 600 r.p.m.	10° B.T.D.C. at 600 r.p.m.

* Crankshaft degrees and r.p.m.

GENERAL DATA — *continued*

Timing marks	..	..	..	..	..	..	..	Dimples on timing wheels, marks on flywheel.
Sparking plugs	..	..	..	..	..	..	..	Champion N5.
Size	..	..	..	..	..	..	..	14 mm., $\frac{3}{4}$ in. (19 mm.) reach.
Gap	..	..	..	..	..	..	..	.025 in. (.625 mm.).

FUEL SYSTEM

Carburettor

Make and type	..	..	..	..	..	..	..	S.U. Type HS2.
Diameter	..	..	..	..	..	..	..	1 $\frac{1}{4}$ in. (31.75 mm.).
Jet	..	..	..	..	..	..	..	.090 in. (2.29 mm.).
Needle	..	..	..	..	..	..	..	Standard EB. Rich M. Weak CG.

AIR CLEANER

Type	..	..	..	..	..	..	..	Paper element.
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FUEL PUMP

Make and type: Early cars	..	..	..	..	..	..	..	S.U. electric. PD.
Later cars	..	..	..	..	..	..	..	S.U. electric. SP.
Delivery rate: PD type	..	..	..	..	..	..	..	45 pints/hr. (25.5 litres/hr.).
SP and AUF 201 type	..	..	..	..	..	..	..	56 pints/hr. (32 litres/hr.).
Delivery pressure: PD type	..	..	..	..	..	..	..	2 to 3 lb./sq. in. (.14 to .21 kg./cm. ²).
SP and AUF 201 type	..	..	..	..	..	..	..	2 $\frac{1}{2}$ to 3 lb./sq. in. (.17 to .21 kg./cm. ²).

CLUTCH

BMC single dry plate

Diameter	..	..	..	..	..	..	..	7 $\frac{1}{8}$ in. (180.9 mm.).
Facing material	..	..	..	..	..	..	..	Wound yarn.
Pressure springs	..	..	..	..	..	..	..	6.
Colour	..	..	..	..	..	..	..	Red spot.
Damper springs	..	..	..	..	..	..	..	Nil.

Diaphragm-spring clutch

Make	..	..	..	..	..	..	..	Borg and Beck.
Diameter	..	..	..	..	..	..	..	7 $\frac{1}{8}$ in. (180.9 mm.).
Facing material	..	..	..	..	..	..	..	Wound yarn.
Damper springs	..	..	..	..	..	..	..	Nil.
Diaphragm-spring colour code	..	..	..	..	..	..	..	Brown.

GEARBOX

Number of forward speeds	..	..	..	..	..	..	..	4.
Synchromesh	..	..	..	..	..	..	..	Second, third, and fourth gears.
Ratios: Top	..	..	..	..	..	..	..	1.0 : 1.
Third	..	..	..	..	..	..	..	1.412 : 1.
Second	..	..	..	..	..	..	..	2.172 : 1.
First	..	..	..	..	..	..	..	3.627 : 1.
Reverse	..	..	..	..	..	..	..	3.627 : 1.
Overall ratios: Top	..	..	..	..	..	..	..	3.765 : 1.
Third	..	..	..	..	..	..	..	5.317 : 1.
Second	..	..	..	..	..	..	..	8.176 : 1.
First	..	..	..	..	..	..	..	13.657 : 1.
Reverse	..	..	..	..	..	..	..	13.657 : 1.
Speedometer	..	..	..	..	..	..	..	6/17.

DIFFERENTIAL

Ratio	..	..	..	..	..	..	..	3.765 : 1.
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GENERAL DATA — *continued*

DRIVE SHAFTS

Type	..	..	..	..	..	..	..	..	..	Solid shaft, reverse spline.
Make and type of joint	..	..	..	..	..	..	..	..	..	Hardy Spicer, hemispherical joint.

STEERING

Type	..	..	..	..	..	..	..	..	..	Rack and pinion.
Steering-wheel turns—lock to lock	..	..	..	..	..	..	..	..	..	2½.
Steering-wheel diameter	..	..	..	..	..	..	..	..	..	15½ in. (40 cm.).
Camber angle	..	..	..	..	..	..	..	..	..	1° positive to 3° positive.
Castor angle	..	..	..	..	..	..	..	..	..	3°
King pin (swivel hub) inclination	..	..	..	..	..	..	..	..	..	9° 30'
Toe-out	..	..	..	..	..	..	..	..	..	½ in. (1.6 mm.)
Lock angle: outer wheel at 20°, inner wheel	..	..	..	..	..	..	..	..	..	23°

with vehicle in an
unladen condition.

FRONT SUSPENSION

Early models, 1959–1964	..	..	..	..	..	..	..	..	..	Rubber cone spring.
Front	..	..	..	..	..	..	..	..	..	Levers of unequal length.
Rear	..	..	..	..	..	..	..	..	..	Trailing radius arms.
Later models	..	..	..	..	..	..	..	..	..	Hydrolastic displacers.
Front	..	..	..	..	..	..	..	..	..	Levers of unequal length.
Rear	..	..	..	..	..	..	..	..	..	Trailing arms.
Fluid capacity	..	..	..	..	..	..	..	..	..	4 pints (5 U.S. pints, 2.27 litres).
Fluid pressure: Early models (unladen)	..	..	..	..	..	..	..	..	..	263 lb./sq. in. (18.49 kg./cm. ²).
Later models (unladen)	..	..	..	..	..	..	..	..	..	282 lb./sq. in. (19.74 kg./cm. ²).

(Car Nos. given in Section H.10)

REAR SUSPENSION

Type	..	..	..	..	..	..	..	..	..	Rubber cone spring.
Toe-in	..	..	..	..	..	..	..	..	..	½ in. (3.18 mm.).
Camber	..	..	..	..	..	..	..	..	..	1° positive.
Radius arm bushes (reamed bore)	..	..	..	..	..	..	..	..	..	.8125 to .8130 in. (20.63 to 20.65 mm.).

HYDRAULIC DAMPERS (Rubber suspension only)

Type: Front and rear	..	..	..	..	..	..	..	..	..	Tubular telescopic.
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BRAKES

Lockheed hydraulic	..	..	..	..	..	..	..	..	..	Single-leading shoe.
Drum size	..	..	..	..	..	..	..	..	..	7 in. (17.8 cm.) diameter.
Lining dimensions: Front or rear	..	..	..	..	..	..	..	..	..	6.75 in. × 1.25 in. (17.14 cm. × 3.17 cm.).
Lining area: Front or rear	..	..	..	..	..	..	..	..	..	33.75 sq. in. (217.7 cm. ²).
Lining material	..	..	..	..	..	..	..	..	..	Don 202.
Lockheed hydraulic	..	..	..	..	..	..	..	..	..	Two-leading-shoe.
Lining dimensions	..	..	..	..	..	..	..	..	..	6.75 × 1.5 in. (17.4 × 3.8 cm.).
Lining area total	..	..	..	..	..	..	..	..	..	40.5 sq. in. (261.29 cm. ²).
Lining material	..	..	..	..	..	..	..	..	..	Don 202.

WHEELS

Type: ventilated disc	..	..	..	..	..	..	..	..	..	3.50B × 10.
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GENERAL DATA — *continued*

TYRES

Size:

Standard	5.20—10 tubeless.
Optional (Radial ply)	145—10 tubeless.

Pressures:

Standard—normal conditions	Front 24 lb./sq. in. (1.7 kg./cm. ²). Rear 22 lb./sq. in. (1.55 kg./cm. ²).
fully loaded	Front and rear 24 lb./sq. in. (1.7 kg./cm. ²).
Optional (Radial ply), all conditions:	Front 28 lb./sq. in. (1.97 kg./cm. ²). Rear 26 lb./sq. in. (1.83 kg./cm. ²).

TORQUE WRENCH SETTINGS

Cylinder head stud nuts	40 lb. ft. (5.5 kg. m.).
Connecting rod big-end bolts	35 lb. ft. (4.8 kg. m.).
Main bearing set screws	60 lb. ft. (8.3 kg. m.).
Flywheel centre-bolt	110 to 115 lb. ft. (15.2 to 15.9 kg. m.).
Gudgeon pin clamp screws	25 lb. ft. (3.4 kg. m.).
Rocker shaft bracket nuts	25 lb. ft. (3.4 kg. m.).
Transmission case to crankcase	6 lb. ft. (.8 kg. m.).
Transmission drain plug	40 to 50 lb. ft. (5.5 to 6.9 kg. m.).
Cylinder side cover	2 lb. ft. (.28 kg. m.).
Second type—deep pressed cover	5 lb. ft. (.7 kg. m.).
Timing cover— $\frac{1}{4}$ in. UNF. bolts	6 lb. ft. (.8 kg. m.).
Timing cover— $\frac{5}{16}$ in. UNF. bolts	14 lb. ft. (1.9 kg. m.).
Water pump	17 lb. ft. (2.3 kg. m.).
Water outlet elbow	8 lb. ft. (1.1 kg. m.).
Oil filter bowl	10 to 15 lb. ft. (1.4 to 2 kg. m.).
Oil pump	9 lb. ft. (1.2 kg. m.).
Manifold to cylinder head	15 lb. ft. (2.1 kg. m.).
Rocker cover	4 lb. ft. (.56 kg. m.).
Crankshaft pulley nut	70 lb. ft. (9.6 kg. m.).
Transmission case studs— $\frac{3}{8}$ in. dia. UNC.	8 lb. ft. (1.1 kg. m.).
Transmission case studs— $\frac{5}{16}$ in. dia. UNC.	6 lb. ft. (.8 kg. m.).
Transmission case stud nuts— $\frac{3}{8}$ in. UNF.	25 lb. ft. (3.45 kg. m.).
Transmission case stud nuts— $\frac{5}{16}$ in. UNF.	18 lb. ft. (2.5 kg. m.).
Bottom cover set screws— $\frac{1}{4}$ in. dia. UNC. (change speed tower)	6 lb. ft. (.8 kg. m.).
First motion shaft nut	150 lb. ft. (20.7 kg. m.).
Third motion shaft nut	150 lb. ft. (20.7 kg. m.).
Flywheel housing bolts and stud nuts	18 lb. ft. (2.5 kg. m.).
Set screw, driving strap to flywheel	16 lb. ft. (2.2 kg. m.).
Set screw, clutch spring housing to pressure plate	16 lb. ft. (2.2 kg. m.).
Distributor clamp bolt: Fixed nut type	50 lb. in. (.576 kg. m.).
Fixed bolt type	30 lb. in. (.345 kg. m.).
Final drive	
Driven gear to differential cage	60 lb. ft. (8.3 kg. m.).
Nut, driving flange to differential	70 lb. ft. (9.6 kg. m.) (and align to next split pin hole).
End cover bolts (differential housing)	18 lb. ft. (2.5 kg. m.).
Suspension and steering	
Steering-column/rack pinion clamp bolt	8 to 9 lb. ft. (1 to 1.2 kg. m.).
Steering lever to hub bolts	35 lb. ft. (4.8 kg. m.).
Steering lever ball joint nut	20 to 24 lb. ft. (2.77 to 3.32 kg. m.).
Steering knuckle ball pin bottom nut	35 to 40 lb. ft. (4.8 to 5.5 kg. m.).
Steering knuckle ball pin top nut	35 to 40 lb. ft. (4.8 to 5.5 kg. m.).
Steering knuckle ball pin retainer	70 lb. ft. (9.6 kg. m.).
Front hub nut (drive shaft)	60 lb. ft. (8.3 kg. m.).
Rear suspension stub axle nut	60 lb. ft. (8.3 kg. m.) (align to next slot).
Front suspension upper arm pivot pin nut	26 to 28 lb. ft. (3.6 to 3.87 kg. m.).
Steering-wheel nut	41 lb. ft. (5.76 kg. m.).
Road wheel nuts	42 lb. ft. (5.8 kg. m.).

GENERAL DATA — *continued*

Alternator

Brush box fixing screws	..	..	..	..	..	10 lb. in. (.115 kg. m.).
Diode heat sink fixings	..	..	..	..	..	25 lb. in. (.288 kg. m.).
Through-bolts	..	..	..	..	..	45 to 50 lb. in. (.518 to .576 kg. m.).

ELECTRICAL EQUIPMENT

System	..	..	..	..	..	12-volt, positive earth.
Charging system	..	..	..	..	..	Compensated voltage control.
Battery	..	..	..	..	..	Lucas BLT7A, BLTZ7A, BT7A, BTZ7A.
Capacity: BLT7A, BLTZ7A	..	..	..	..	..	34 amp.-hr. at 20-hr. rate.
BT7A, BTZ7A	..	..	..	..	..	43 amp.-hr. at 20-hr. rate.
Starter motor	..	..	..	..	..	Lucas M35G.
Dynamo	..	..	..	..	..	Lucas C40.
Maximum output	..	..	..	..	..	22 amps. at 2,250 r.p.m.
Cut-in speed	..	..	..	..	..	1,450 r.p.m. at 13.5 volts.
Control box	..	..	..	..	..	Lucas RB106/2.
Cut-out: Cut-in voltage	..	..	..	..	..	12.7 to 13.3.
Drop-off voltage	..	..	..	..	..	8.5 to 11.0.
Reverse current	..	..	..	..	..	5.0 amps. (max.).

Regulator (at 3,000 r.p.m. dynamo speed):

Open-circuit setting at 20° C. (68° F.) .. 16.0 to 16.6 volts.

For ambient temperatures other than 20° C. (68° F.) the following allowances should be made to the above setting:
For every 10° C. (18° F.) above 20° C. (68° F.) subtract .1 volt.

For every 10° C. (18° F.) below 20° C. (68° F.) add .1 volt.

Alternator	..	..	..	..	..	Lucas 11AC (12 volts).
Maximum output	..	..	..	..	..	43 amperes.
Rotor windings: Resistance	..	..	..	..	..	3.8 ± .2 ohms at 20° C. (68° F.).
Current	..	..	..	..	..	3.2 amps. at 12 volts.
Minimum brush length	..	..	..	..	..	$\frac{5}{8}$ in. (3.97 mm.).
Brush spring pressure:						
$\frac{35}{64}$ in. (19.84 mm.) compressed length	..	..	..	..	..	4 to 5 oz. (113 to 142 gm.).
$\frac{13}{32}$ in. (10.32 mm.) compressed length	..	..	..	..	..	7½ to 8½ oz. (212 to 241 gm.).

Control unit

Type	..	..	..	..	..	Lucas 4TR.
Voltage setting at 3,000 alternator r.p.m.	..	..	..	..	..	13.9 to 14.3 volts.
Circuit resistance (max.)	..	..	..	..	..	.1 ohm.

Fields isolating relay .. Lucas 6RA.

Warning light control .. Lucas 3AW.

GENERAL DIMENSIONS

Wheelbase: Saloon	..	..	..	..	..	6 ft. 8 $\frac{5}{16}$ in. (2.036 m.).
Van, Pick-up, Traveller, and Countryman	..	..	..	..	..	7 ft. 0 $\frac{5}{16}$ in. (2.138 m.).
Moke	..	..	..	..	..	6 ft. 8 $\frac{5}{16}$ in. (2.036 m.).
Overall length: Saloon	..	..	..	..	..	10 ft. 0 $\frac{1}{4}$ in. (3.05 m.).
Van, Traveller, and Countryman	..	..	..	..	..	10 ft. 9 $\frac{7}{8}$ in. (3.259 m.).
Pick-up	..	..	..	..	..	10 ft. 10 $\frac{1}{2}$ in. (3.315 m.).
Moke	..	..	..	..	..	10 ft. 0 in. (3.04 m.).
Overall width	..	..	..	..	..	4 ft. 7 $\frac{1}{2}$ in. (1.41 m.).
Moke	..	..	..	..	..	4 ft. 3 $\frac{1}{2}$ in. (1.36 m.).
Overall height: Saloon	..	..	..	..	..	4 ft. 5 in. (1.35 m.).
Van	..	..	..	..	..	4 ft. 6 $\frac{1}{2}$ in. (1.38 m.).
Traveller, Countryman, and Pick-up	..	..	..	..	..	4 ft. 5 $\frac{1}{2}$ in. (1.36 m.).
Moke	..	..	..	..	..	4 ft. 8 in. (1.242 m.).

GENERAL DATA — *continued*

Ground clearance..	..	..	..	..	..	6 $\frac{5}{32}$ in. (15.63 cm.).
Moke	..	..	..	..	..	6 $\frac{1}{2}$ in. (16.2 cm.).
Turning circle: Saloon	..	..	..	..	..	31 ft. 7 in. (9.63 m.).
Van, Pick-up, Traveller, and Countryman	..	..	..	..	..	32 ft. 9 in. (9.893 m.).
Moke	..	..	..	..	..	31 ft. (9.4 m.).
Track: Front	..	..	..	..	..	47 $\frac{7}{8}$ in. (1.205 m.).
Rear	..	..	..	..	..	45 $\frac{7}{8}$ in. (1.164 m.).
Kerbside weight: Saloon (Rubber suspension models)	..	..	..	..	..	1,294 lb. (587 kg.).
Saloon (Hydrolastic suspension models)	..	..	..	..	..	1,398 lb. (634.5 kg.).
Van	..	..	..	..	..	1,334 lb. (605 kg.) approx.
Traveller and Countryman	..	..	..	..	..	1,456 lb. (660 kg.) approx.
Pick-up	..	..	..	..	..	1,328 lb. (603 kg.) approx.
Moke	..	..	..	..	..	1,240 lb. (562 kg.).
Maximum permissible towing weight (suitable for 1 in 8 gradient in bottom gear):						
Saloon and Moke	..	..	..	..	..	8 cwt. (406.4 kg.).
Van, Pick-up, Traveller, and Countryman	..	..	..	..	..	6 cwt. (304.7 kg.).

WEIGHT OF COMPONENTS

Engine and transmission assembly	..	..	..	..	..	333 lb. (151 kg.).
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CAPACITIES

Transmission casing (including filter)	..	..	..	..	..	8 $\frac{1}{2}$ pints (10.2 U.S. pints, 4.83 litres).
Cooling system	..	..	..	..	..	5 $\frac{1}{4}$ pints (6.3 U.S. pints, 3 litres).
With heater	..	..	..	..	..	6 $\frac{1}{4}$ pints (7.5 U.S. pints, 3.55 litres).
Fuel tank: Saloon	..	..	..	..	..	5 $\frac{1}{2}$ gallons (6.6 U.S. gallons, 25 litres).
Van and Pick-up	..	..	..	..	..	6 gallons (7.2 U.S. gallons, 27.3 litres).
Traveller and Countryman: Early models	..	..	..	..	..	6 $\frac{1}{2}$ gallons (7.8 U.S. gallons, 29.6 litres).
Later models with underfloor tank	..	..	..	..	..	6 gallons (7.2 U.S. gallons, 27.3 litres).

GENERAL DATA

(MINI-COOPER)

The following information is applicable to the Mini-Cooper and should be used in conjunction with the preceding specification for the Mini Saloon.

ENGINE

Type	..	..	..	..	..	..	..	9F.
Number of cylinders	..	..	..	..	..	..	..	4.
Bore	..	..	..	..	..	..	..	2.458 in. (62.43 mm.).
Stroke	..	..	..	..	..	..	..	3.20 in. (81.28 mm.).
Capacity	..	..	..	..	..	..	..	60.87 cu. in. (997 c.c.).
Compression ratio: High compression	..	..	..	..	..	..	..	9 : 1.
Low compression	..	..	..	..	..	..	..	8.3 : 1.
B.M.E.P.: High compression	..	..	..	..	..	..	..	134 lb./sq. in. (9.42 kg./cm. ²) at 3,500 r.p.m.
Low compression	..	..	..	..	..	..	..	129 lb./sq. in. (9.07 kg./cm. ²) at 3,500 r.p.m.
Torque: High compression	..	..	..	..	..	..	..	54 lb. ft. (7.46 kg. m.) at 3,600 r.p.m.
Low compression	..	..	..	..	..	..	..	53 lb. ft. (7.32 kg. m.) at 3,500 r.p.m.

CRANKSHAFT

Main bearings

Material	..	..	..	..	..	..	..	Steel-backed copper-lead; thin wall.
Length	..	..	..	..	..	..	..	1.0625 in. (26.99 mm.).
Running clearance	..	..	..	..	..	..	..	.001 to .0027 in. (.025 to .069 mm.).

CONNECTING RODS

Big-end bearings

Material	..	..	..	..	..	..	..	Steel-backed copper-lead; thin wall.
Bearing length	..	..	..	..	..	..	..	.875 in. (22.22 mm.).

PISTONS

Type	..	..	..	..	..	..	..	Solid skirt.
Clearance: Bottom of skirt (pressure face)	..	..	..	..	..	..	..	.0016 to .0022 in. (.041 to .056 mm.).

PISTON RINGS

Compression: Top	..	..	..	..	..	..	..	Plain, chrome-faced.
Second and third	..	..	..	..	..	..	..	Tapered.
Width	..	..	..	..	..	..	..	.0615 to .0625 in. (1.563 to 1.588 mm.).

VALVES AND VALVE GEAR

Valves

Head diameter: Inlet	..	..	..	..	..	..	..	1.156 in. (29.4 mm.).
Exhaust	..	..	..	..	..	..	..	1.000 in. (25.40 mm.).
Throat diameter: Inlet	..	..	..	..	..	..	..	1.0312 in. (26.2 mm.).
Exhaust	..	..	..	..	..	..	..	.098 in. (23.06 mm.).
Valve lift	..	..	..	..	..	..	..	.312 in. (7.92 mm.).
Inlet valve: Opens	..	..	..	..	..	..	..	16° B.T.D.C.
Closes	..	..	..	..	..	..	..	56° A.B.D.C.
Exhaust valve: Opens	..	..	..	..	..	..	..	51° B.B.D.C.
Closes	..	..	..	..	..	..	..	21° A.T.D.C.

with .019 in. (.48 mm.) valve rocker clearance (for checking purposes only).

GENERAL DATA — *continued*

(MINI-COOPER — *continued*)

VALVE SPRINGS

Free length: Inlet and exhaust	..	..	..	..	1.750 in. (44.45 mm.).
Number of working coils	..	..	..	..	4½.
Pressure: Inlet and exhaust: Valve open	..	..	..	..	90 lb. (40.8 kg.).
Valve closed	..	..	..	..	55 lb. (24.9 kg.).

CAMSHAFT

Journal diameters: Front	..	..	..	..	1.6655 to 1.666 in. (42.304 to 42.316 mm.).
Centre	..	..	..	..	1.62275 to 1.62325 in. (41.218 to 41.231 mm.).
Rear	..	..	..	..	1.3725 to 1.3735 in. (34.862 to 34.887 mm.).
End-float	..	..	..	..	.003 to .007 in. (.076 to .178 mm.).
Bearings: Number and type	..	..	..	..	3. Steel-backed white metal.
Inside diameter (reamed in position): Front	..	..	..	..	1.667 to 1.6675 in. (42.342 to 42.355 mm.).
Centre	..	..	..	..	1.6245 to 1.6255 in. (41.261 to 41.287 mm.).
Rear	..	..	..	..	1.3748 to 1.3755 in. (34.914 to 34.937 mm.).

ENGINE LUBRICATION SYSTEM

Oil pump

Type	..	..	..	..	Hobourn-Eaton.
Relief pressure valve operates	..	..	..	..	70 lb./sq. in. (4.92 kg./cm. ²).
Relief valve spring: Free length	..	..	..	..	2 ³ / ₈ in. (66.28 mm.).
Fitted length	..	..	..	..	2 ⁵ / ₃₂ in. (54.77 mm.).

Oil pressure

Normal running	..	..	..	..	70 lb./sq. in. (4.92 kg./cm. ²).
Idling (minimum)	..	..	..	..	15 lb./sq. in. (1.05 kg./cm. ²).

FUEL SYSTEM

Carburettors

Make and type	..	..	..	..	Twin S.U. Type HS2.
Diameter	..	..	..	..	1½ in. (31.75 mm.).
Jet	..	..	..	..	.090 in. (2.29 mm.).
Needle	..	..	..	..	Standard GZ.

Fuel pump

Make and type	..	..	..	..	S.U. electric. Type SP.
Delivery rate	..	..	..	..	56 pts./hr. (67.2 U.S. pts./hr., 32 litres/hr.).
Delivery pressure	..	..	..	..	2½ to 3 lb./sq. in. (.18 to .21 kg./cm. ²).

AIR CLEANERS

Type	..	..	..	..	Oil-wetted gauze.
Later models	..	..	..	..	Paper elements.

COOLING SYSTEM

Thermostat setting	..	..	..	..	83° C. (180° F.).
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IGNITION SYSTEM

Coil	..	..	..	..	HA12.
Timing: High compression	..	..	..	..	7° B.T.D.C. (Premium fuel).
Low compression	..	..	..	..	5° B.T.D.C. (91 to 96 octane rating fuel, Research Method).

GENERAL DATA — *continued*

(MINI-COOPER — *continued*)

CLUTCH

Pressure springs—colour ..	..	..	..	..	..	Black enamel with white spot.
Diaphragm spring colour code ..	..	..	..	..	..	Light green.

GEARBOX

Ratios: Top	..	..	..	..	..	..	1·0 : 1.	
Third	..	..	..	..	..	..	1·357 : 1.	
Second	..	..	..	..	..	..	1·916 : 1.	
First	..	..	..	..	..	..	3·2 : 1.	
Reverse	..	..	..	..	..	..	3·2 : 1.	
							<i>Standard</i>	<i>Available alternative</i>
Overall ratios: Top	..	..	..	..	..	..	3·765 : 1.	3·444 : 1.
Third	..	..	..	..	..	..	5·11 : 1.	4·674 : 1.
Second	..	..	..	..	..	..	7·213 : 1.	6·598 : 1.
First	..	..	..	..	..	..	12·05 : 1.	11·03 : 1.
Reverse	..	..	..	..	..	..	12·05 : 1.	11·03 : 1.

DIFFERENTIAL

Ratio	..	..	..	..	..	..	3·765 : 1 standard; 3·444 : 1 optional (available from BMC Service only).
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BRAKES

Front

Type	..	..	..	..	..	..	Disc.
Disc diameter	..	..	..	..	..	..	7 in. (177·8 mm.).
Pad material	..	..	..	..	..	..	DA3.

Rear

Lining material	..	..	..	..	..	..	Don 202.
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TORQUE TIGHTENING FIGURES

Calliper retaining bolts	..	..	..	..	..	..	35 to 40 lb. ft. (4·84 to 5·53 kg. m.).
Steering lever ball joint	..	..	..	..	..	..	25 to 30 lb. ft. (3·46 to 4·15 kg. m.).

GENERAL DIMENSIONS

Kerbside weight: Rubber suspension models	..	..	..	..	..	1,400 lb. (635 kg.).
Hydrolastic suspension models	..	..	..	..	..	1,433 lb. (650 kg.).

GENERAL DATA — *continued*

(MINI-COOPER — *continued*)

The following information is applicable to the 998-c.c. engine and should be used in conjunction with the preceding specifications.

ENGINE

Type	..	..	..	..	..	..	9FA.
Number of cylinders	..	..	..	..	..	..	4.
Bore	..	..	..	..	..	..	2.543 in. (64.588 mm.).
Stroke	..	..	..	..	..	..	3.00 in. (76.2 mm.).
Capacity	..	..	..	..	..	..	60.96 cu. in. (998 c.c.).
Compression ratio: High	..	..	..	..	..	..	9 : 1.
Low	..	..	..	..	..	..	7.8 : 1.
B.M.E.P.: High compression	..	..	..	..	..	..	142 lb./sq. in. (10 kg./cm. ²) at 3,000 r.p.m. -
Low compression	..	..	..	..	..	..	135 lb./sq. in. (9.5 kg./cm. ²) at 3,000 r.p.m.
Torque: High compression	..	..	..	..	..	..	57 lb. ft. (7.881 kg. m.) at 3,000 r.p.m.
Low compression	..	..	..	..	..	..	56 lb. ft. (7.74 kg. m.) at 2,900 r.p.m.
Compression pressures	..	..	..	..	..	..	165 lb./sq. in. (11.6 kg./cm. ²).
Engine idle speed (approx.)	..	..	..	..	..	..	500 r.p.m.
Oversize bores: 1st	..	..	..	..	..	..	+ .010 in. (.254 mm.).
2nd	..	..	..	..	..	..	+ .020 in. (.508 mm.).

CRANKSHAFT

Main bearings

Material	..	..	..	..	..	..	Steel-backed copper-lead or aluminium-tin; thin wall.
Running clearance	..	..	..	..	..	..	.001 to .0027 in. (.025 to .069 mm.).

CONNECTING RODS

Big-end bearings

Material	..	..	..	..	..	..	Steel-backed copper-lead or aluminium-tin; thin wall.
Bearing length	..	..	..	..	..	..	.875 in. (22.22 mm.).

PISTONS

Type	..	..	..	..	..	..	Solid skirt.
Clearance: Bottom of skirt (pressure face)	..	..	..	..	..	..	.0005 to .0011 in. (.013 to .028 mm.).
Oversizes: 1st	..	..	..	..	..	..	+ .010 in. (.254 mm.).
2nd	..	..	..	..	..	..	+ .020 in. (.508 mm.).

PISTON RINGS

Compression: Top	..	..	..	..	..	..	Plain, chrome-faced.
Second and third	..	..	..	..	..	..	Tapered.
Width	..	..	..	..	..	..	.0620 to .0625 in. (1.574 to 1.588 mm.).
Thickness (all rings)	..	..	..	..	..	..	.106 to .112 in. (2.692 to 2.835 mm.).

GUIDEON PIN

Type	..	..	..	..	..	..	Fully floating, with circlip location.
Fit in piston	..	..	..	..	..	..	.0001 in. (.0025 mm.) tight to .00035 in. (.0089 mm.) slack.
Fit in small end	..	..	..	..	..	..	.0002 in. (.005 mm.) slack, to size.
Diameter	..	..	..	..	..	..	.6244 in. (15.86 mm.) to .6247 in. (15.867 mm.).

GENERAL DATA — *continued*

(MINI-COOPER — *continued*)

VALVES AND VALVE GEAR

Valves

Throat diameter: Inlet	..	..	..	..	..	1.172 in. (29.77 mm.).
Exhaust	..	..	..	..	..	.908 in. (23.06 mm.).
Head diameter: Inlet	..	..	..	..	..	1.219 in. (30.86 mm.).
Exhaust	..	..	..	..	..	1.00 in. (25.4 mm.).
Valve lift	..	..	..	..	..	.312 in. (7.92 mm.).
Inlet valve: Opens	..	..	..	..	..	5° B.T.D.C.
Closes	..	..	..	..	..	45° A.B.D.C.
Exhaust valve: Opens	..	..	..	..	..	51° B.B.D.C.
Closes	..	..	..	..	..	21° A.T.D.C.

VALVE SPRINGS

Free length: Inner	..	..	..	..	..	1.672 in. (42.47 mm.).
Outer	..	..	..	..	..	1.75 in. (44.45 mm.).
Pressure: Inner: Valve closed	..	..	..	..	..	18 lb. (8.17 kg.).
Valve open	..	..	..	..	..	30 lb. (13.6 kg.).
Outer: Valve closed	..	..	..	..	..	55½ lb. (25.13 kg.).
Valve open	..	..	..	..	..	88 lb. (39.9 kg.).

FUEL SYSTEM

Carburettor

Needle	..	..	..	..	..	Standard GY.
Spring	..	..	..	..	..	Blue.

IGNITION SYSTEM

Coil	..	..	..	..	..	Lucas HA12.
Resistance at 20° C. (68° F.) primary winding	..	..	..	..	..	3.1 to 3.5 ohms (cold).
Distributor	..	..	..	..	..	Lucas 24D4.
Serial number	..	..	..	..	..	40955A.
Static ignition timing: High compression	..	..	..	..	..	5° B.T.D.C. (Premium fuel).
Low compression	..	..	..	..	..	5° B.T.D.C. (91 to 96 octane [Research Method] fuel).
Stroboscopic ignition timing*	..	..	..	..	..	7° B.T.D.C. at 600 r.p.m.
Automatic advance commences*	..	..	..	..	..	500 r.p.m.
Maximum advance*	..	..	..	..	..	30° to 40° at 6,600 r.p.m.
Vacuum advance: Commences	..	..	..	..	..	3 in. (7.62 cm.) Hg.
Ends	..	..	..	..	..	8 in. (20.32 cm.) Hg.
Decelerating check*	..	..	..	..	..	30° to 34° at 6,600 r.p.m.
						20° to 24° at 4,000 r.p.m.
						12° to 16° at 1,800 r.p.m.
						1° to 5° at 600 r.p.m.

* Crankshaft degrees and r.p.m.

GENERAL DATA

(MINI-COOPER 'S')

The following information is applicable to the Mini-Cooper 'S' and should be used in conjunction with the preceding specifications.

ENGINE

Number of cylinders	..	..	..	..	..	4.
Bore (all models)	..	..	..	..	..	2.780 in. (70.6 mm.).
Stroke: 970 c.c.	..	..	..	..	..	2.4375 in. (61.91 mm.).
1071 c.c.	..	..	..	..	..	2.687 in. (68.26 mm.).
1275 c.c.	..	..	..	..	..	3.2 in. (81.33 mm.).
Cubic capacity: 970 c.c.	..	..	..	..	..	59.1 cu. in. (970 c.c.).
1071 c.c.	..	..	..	..	..	63.35 cu. in. (1071 c.c.).
1275 c.c.	..	..	..	..	..	77.9 cu. in. (1275 c.c.).
Compression ratio: 970 c.c.	..	..	..	..	..	10 : 1.
1071 c.c.	..	..	..	..	..	9.0 : 1.
1275 c.c.	..	..	..	..	..	9.75 : 1.
Capacity of combustion chamber (valves and sparking plug fitted)	..	..	..	..	..	1.306 cu. in. (21.4 c.c.).
B.M.E.P.: 970 c.c.	..	..	..	..	..	142 lb./sq. in. (9.98 kg./cm. ²) at 4,500 r.p.m.
1071 c.c.	..	..	..	..	..	143 lb./sq. in. (10.05 kg./cm. ²) at 4,500 r.p.m.
1275 c.c.	..	..	..	..	..	153 lb./sq. in. (10.76 kg./cm. ²) at 3,000 r.p.m.
Torque: 970 c.c.	..	..	..	..	..	57 lb. ft. (7.88 kg. m.) at 5,000 r.p.m.
1071 c.c.	..	..	..	..	..	62 lb. ft. (8.58 kg. m.) at 4,500 r.p.m.
1275 c.c.	..	..	..	..	..	79 lb. ft. (10.92 kg. m.) at 3,000 r.p.m.
Compression pressure	..	..	..	..	..	190 to 200 lb./sq. in. (13.36 to 14.07 kg./cm. ²) at 500 r.p.m.
Engine idle speed	..	..	..	..	..	500 r.p.m. approx.

CRANKSHAFT

Main journal diameter	..	..	..	..	..	2.0005 to 2.0010 in. (50.81 to 50.82 mm.).
Minimum regrind diameter	..	..	..	..	..	1.9805 to 1.9810 in. (50.30 to 50.31 mm.).
Main bearings						
Material	..	..	..	..	..	Steel-backed copper-lead; thin wall.
Length	..	..	..	..	..	1.000 in. (25.4 mm.).
Running clearance	..	..	..	..	..	.001 to .0027 in. (.025 to .068 mm.).

CONNECTING RODS

Little-end bore diameter	..	..	..	..	..	.8110 to .8115 in. (20.60 to 20.61 mm.).
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PISTONS

Type	..	..	..	..	..	Solid skirt.
Clearance: Bottom of skirt (pressure face)	..	..	..	..	..	.0019 to .0025 in. (.048 to .063 mm.).
Top of skirt	..	..	..	..	..	.025 to .0283 in. (.63 to .72 mm.).

PISTON RINGS

Compression: Plain	..	..	..	..	..	Top ring.
Tapered	..	..	..	..	..	Second and third ring.
Width	..	..	..	..	..	.0459 to .0469 in. (1.16 to 1.19 mm.).
Thickness	..	..	..	..	..	.116 to .122 in. (29.4 to 30.9 mm.).
Fitting gap	..	..	..	..	..	.008 to .013 in. (.20 to .33 mm.).
Clearance in groove	..	..	..	..	..	.0015 to .0035 in. (.04 to .09 mm.).
Oil control type	..	..	..	..	..	
Width	..	..	..	..	..	.1153 to .1563 in. (3.94 to 3.96 mm.).
Thickness	..	..	..	..	..	.116 to .122 in. (29.4 to 30.9 mm.).
Fitted gap	..	..	..	..	..	.008 to .013 in. (.20 to .33 mm.).
Clearance in groove	..	..	..	..	..	.0015 to .0035 in. (.04 to .09 mm.).

GENERAL DATA — *continued*

(MINI-COOPER 'S' — *continued*)

GUDGEON PIN

Type	Pressed in connecting rod.
Fit in piston	Hand push-fit.
Diameter (outer)	·8123 to ·8125 in. (20·63 to 20·64 mm.).
Fit in connecting rod	·0008 to ·0015 in. (·020 to ·038 mm.) interference.

VALVES AND VALVE GEAR

Valves

Head diameter: Inlet	1·401 to 1·406 in. (35·58 to 35·71 mm.).
Exhaust	1·214 to 1·219 in. (30·83 to 30·96 mm.).
Valve lift	·318 in. (8·08 mm.), nominal.
Stem diameter: Exhaust	·2788 to ·2793 in. (7·08 to 7·09 mm.).
Inlet	·2793 to ·2798 in. (7·09 to 7·11 mm.).
Valve rocker clearance: Standard	·012 in. (·30 mm.) cold.
Competition	·015 in. (·38 mm.) cold.
Timing	·021 in. (·53 mm.).
Inlet valve: Opens	5° B.T.D.C.
Closes	45° A.B.D.C.
Exhaust valve: Opens	51° B.B.D.C.
Closes	21° A.T.D.C.

} with ·021 in. (·53 mm.) valve
rocker clearance (for checking
purposes only).

VALVE SPRINGS

Free length: Inner	1·705 in. (43·31 mm.).
Outer	1·740 in. (44·19 mm.).
Number of working coils: Inner	6½.
Outer	4½.
Pressure: Inner: Valve closed	26·6 lb. (12·065 kg.).
Valve open	46 lb. (20·865 kg.).
Outer: Valve closed	49·6 lb. (22·498 kg.).
Valve open	94 lb. (42·638 kg.).

CAMSHAFT

Journal diameter: Rear	1·37275 to 1·3735 in. (34·87 to 34·88 mm.).
Inside diameter (reamed in position): Rear	1·3745 to 1·3750 in. (34·91 to 34·92 mm.).
Running clearance: Rear	·001 to ·00225 in. (·025 to ·057 mm.).
Bearing length: Rear	⅞ ± ·010 in. (19·45 ± ·25 mm.).

ENGINE LUBRICATION SYSTEM

Oil pressure (normal running)	60 lb./sq. in. (4·22 kg./cm. ²) at 70° C. (158° F.) oil temperature.
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COOLING SYSTEM

Thermostat setting	82° C. (180° F.).
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FUEL SYSTEM

Carburettor needle: 970 c.c.	AN.
1071 c.c.	H6.
1275 c.c.	M.

GENERAL DATA — *continued*

(MINI-COOPER 'S' — *continued*)

IGNITION SYSTEM

Sparking plugs	..	..	..	..	..	..	Champion N9Y.
Coil	..	..	..	..	..	..	HA 12.
Distributor	..	..	..	..	..	..	23D4.
Serial number	..	..	..	..	..	..	40819B.
Static ignition timing: 970 c.c.	..	..	..	..	..	..	12° B.T.D.C.
1071 c.c.	..	..	..	..	..	..	3° B.T.D.C.
1275 c.c.	..	..	..	..	..	..	2° B.T.D.C.
Stroboscopic ignition timing*: 970 c.c.	..	..	..	..	..	..	14° B.T.D.C. at 600 r.p.m.
1071 c.c.	..	..	..	..	..	..	5° B.T.D.C. at 600 r.p.m.
1275 c.c.	..	..	..	..	..	..	4° B.T.D.C. at 600 r.p.m.
Centrifugal advance*: 970 c.c.	..	..	..	..	..	..	24° at 1,500 r.p.m., 32° at 4,000 r.p.m.
1071 c.c.	..	..	..	..	..	..	15° at 1,500 r.p.m., 23° at 4,000 r.p.m.
Maximum advance*: 1275 c.c.	..	..	..	..	..	..	27° to 31° at 7,000 r.p.m.
Decelerating check*: 1275 c.c.	..	..	..	..	..	..	22° at 4,000 r.p.m.
							11° to 15° at 2,000 r.p.m.
							14° at 1,500 r.p.m.
							0° to 2° at 600 r.p.m.

* Crankshaft degrees and r.p.m.

CLUTCH

Make and type: Early type	..	..	..	..	..	BMC single dry plate.
Later type	..	..	..	..	..	Diaphragm spring.
Diameter	..	..	..	..	..	7.125 in. (180.9 mm.).
Facing material: Standard	..	..	..	..	..	Wound yarn, riveted.
Optional	..	..	..	..	..	Wound yarn, cemented and riveted.
Pressure springs (early type): Inner	..	..	..	..	..	6.
Outer	..	..	..	..	..	6.
Colour: Inner	..	..	..	..	..	Green spot.
Outer	..	..	..	..	..	White spot.

GEARBOX

						<i>Standard</i>	<i>Optional</i>
Ratios: Top	..	..	..	..	..	1.0 : 1	1.0 : 1
Third	..	..	..	..	..	1.357 : 1	1.242 : 1
Second	..	..	..	..	..	1.916 : 1	1.78 : 1
First	..	..	..	..	..	3.200 : 1	2.57 : 1
Reverse	..	..	..	..	..	3.200 : 1	2.57 : 1

Overall gear ratios (as applicable):

Standard gearbox

<i>Final drive ratio</i>						<i>1st and reverse</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>
3.765	..	..	..	..	..	12.05 : 1	7.21 : 1	5.11 : 1	3.765 : 1
3.444	..	..	..	..	..	11.02 : 1	6.60 : 1	4.67 : 1	3.444 : 1
3.939	..	..	..	..	..	12.06 : 1	7.54 : 1	5.34 : 1	3.939 : 1
4.133	..	..	..	..	..	13.27 : 1	7.92 : 1	5.61 : 1	4.133 : 1
4.267	..	..	..	..	..	13.65 : 1	8.18 : 1	5.79 : 1	4.267 : 1

Optional gearbox

<i>Final drive ratio</i>						<i>1st and reverse</i>	<i>2nd</i>	<i>3rd</i>	<i>4th</i>
3.765	..	..	..	..	..	9.66 : 1	6.70 : 1	4.68 : 1	3.765 : 1
3.444	..	..	..	..	..	8.84 : 1	6.13 : 1	4.28 : 1	3.444 : 1
3.939	..	..	..	..	..	10.12 : 1	7.02 : 1	4.89 : 1	3.939 : 1
4.133	..	..	..	..	..	10.61 : 1	7.35 : 1	5.13 : 1	4.133 : 1
4.267	..	..	..	..	..	10.90 : 1	7.61 : 1	5.30 : 1	4.267 : 1

GENERAL DATA — *continued*

(MINI-COOPER 'S' — *continued*)

Road speed in top at 1,000 r.p.m.

Ratio

3.765	..	..	..	..	..	..	..	14.7 m.p.h. (23.52 km.p.h.).
3.444	..	..	..	..	..	..	..	16.07 m.p.h. (25.71 km.p.h.).
3.939	..	..	..	..	..	..	..	14.06 m.p.h. (22.5 km.p.h.).
4.133	..	..	..	..	..	..	..	13.4 m.p.h. (21.44 km.p.h.).
4.267	..	..	..	..	..	..	..	12.96 m.p.h. (20.74 km.p.h.).

DIFFERENTIAL

Ratio—standard: 970 c.c.	..	..	..	..	..	3.765 : 1.
1071 c.c.	..	..	..	..	..	3.765 : 1.
1275 c.c.	..	..	..	..	..	3.444 : 1.
Alternative ratios	..	..	..	..	..	3.939, 4.133 and 4.267 : 1.

BRAKES

Type	..	..	..	..	..	..	Lockheed hydraulic with vacuum servo.
Front							
Type	..	..	..	..	..	..	Disc.
Disc diameter	..	..	..	..	..	..	7½ in. (190.5 mm.).
Pad material	..	..	..	..	..	..	DA6.
Minimum pad thickness	..	..	..	..	..	..	$\frac{1}{16}$ in. (1.6 mm.).

FRONT HUBS

Bearings	..	..	..	..	..	..	Timkin taper roller.
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WHEELS

Type: Ventilated disc	..	..	..	..	..	..	3.50B×10 or 4.5J×J10.
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TYRES

Size: Standard	..	..	..	..	..	..	145—10 SP, tubed, or 5.20—10 C41 tubed.
Optional	..	..	..	..	..	..	500L—10, tubed.
Tyre pressures (145—10SP and 5.20—10 C41 only):							
Front	..	..	..	..	..	..	28 lb./sq. in. (1.969 kg./cm. ²).
Rear	..	..	..	..	..	..	26 lb./sq. in. (1.828 kg./cm. ²).

TORQUE WRENCH SETTINGS

Cylinder head nuts (10 off)	..	..	..	..	..	42 lb. ft. (5.807 kg. m.).
Cylinder head bolt (front, 1 off)	..	..	..	..	..	25 lb. ft. (3.456 kg. m.).
Connecting rod big-end bolts	..	..	..	..	..	46 lb. ft. (6.221 kg. m.).
Main bearing set screws (early type)	..	..	..	..	..	67 lb. ft. (9.263 kg. m.).
Main bearing nuts (later type)	..	..	..	..	..	57 lb. ft. (7.88 kg. m.).
Drive shaft nut	..	..	..	..	..	150 lb. ft. (20.74 kg. m.).

DIMENSIONS

Track: Front: 3.5 in. rim	..	..	..	..	..	47 $\frac{17}{32}$ in. (1.207 m.).
4.5 in. rim	..	..	..	..	..	48 $\frac{17}{32}$ in. (1.233 m.).
Rear: 3.5 in. rim	..	..	..	..	..	46 $\frac{5}{16}$ in. (1.176 m.).
4.5 in. rim	..	..	..	..	..	47 $\frac{5}{16}$ in. (1.202 mm.).
Kerbside weight: Rubber suspension models	..	..	..	..	..	1,411 lb. (640 kg.) approx.
Hydroelastic suspension models	..	..	..	..	..	1,540 lb. (698 kg.) approx.

GENERAL DATA

MINI MK. II (998-c.c.)

The following information is applicable to the Mini Mark II (998-c.c. engine) and should be used in conjunction with the preceding specification.

ENGINE

Type	..	..	..	..	..	..	..	99H.
Number of cylinders	..	..	..	..	..	..	..	4.
Bore	..	..	..	..	..	..	..	2.543 in. (64.588 mm.).
Stroke	..	..	..	..	..	..	..	3.00 in. (76.2 mm.).
Capacity	..	..	..	..	..	..	..	60.96 cu. in. (998 cc.).
Compression ratio	..	..	..	..	..	..	..	8.3 : 1.
B.M.E.P.	..	..	..	..	..	..	..	130 lb./sq. in. (9.14 kg./cm. ²) at 2,700 r.p.m.
Torque	..	..	..	..	..	..	..	52 lb. ft. (7.28 kg. m.) at 2,700 r.p.m.
Compression pressure	..	..	..	..	..	..	..	150 lb./sq. in. (10.5 kg./cm. ²).
Engine idle speed (approx.)	..	..	..	..	..	..	..	500 r.p.m.
Oversize bores: 1st	..	..	..	..	..	..	..	+ .010 in. (.254 mm.).
2nd	..	..	..	..	..	..	..	+ .020 in. (.508 mm.).

CRANKSHAFT

Main bearings

Material	..	..	..	..	..	..	..	Steel-backed copper-lead; thin wall.
Running clearance	..	..	..	..	..	..	..	.001 to .0027 in. (.025 to .069 mm.).

CONNECTING RODS

Big-end bearings

Material	..	..	..	..	..	..	..	Steel-backed copper-lead; thin wall.
Bearing length	..	..	..	..	..	..	..	.875 in. (22.22 mm.).

PISTONS

Type	..	..	..	..	..	..	..	Solid skirt.
Clearance: Bottom of skirt (pressure face)	..	..	..	..	..	..	..	.0005 to .0011 in. (.013 to .028 mm.).
Oversizes: 1st	..	..	..	..	..	..	..	+ .010 in. (.254 mm.).
2nd	..	..	..	..	..	..	..	+ .020 in. (.508 mm.).

PISTON RINGS

Compression: Top	..	..	..	..	..	..	..	Plain, chrome-faced.
Second and third	..	..	..	..	..	..	..	Tapered.
Width	..	..	..	..	..	..	..	.0620 to .0625 in. (1.574 to 1.588 mm.).
Thickness (all rings)	..	..	..	..	..	..	..	.106 to .112 in. (2.692 to 2.835 mm.).

GUDGEON PIN

Type	..	..	..	..	..	..	..	Fully floating, with circlip location.
Fit	..	..	..	..	..	..	..	Hand push fit.

VALVES AND VALVE GEAR

Valves

Throat diameter: Inlet	..	..	..	..	..	..	..	.969 in. (24.61 mm.).
Exhaust	..	..	..	..	..	..	..	.908 in. (23.06 mm.).
Valve lift	..	..	..	..	..	..	..	.28 in. (7.14 mm.).

CAMSHAFT

Journal diameters: Front	..	..	..	..	..	..	..	1.6655 to 1.666 in. (42.304 to 42.316 mm.).
Centre	..	..	..	..	..	..	..	1.62275 to 1.62325 in. (41.218 to 41.231 mm.).
Rear	..	..	..	..	..	..	..	1.3725 to 1.3735 in. (34.862 to 34.887 mm.).
End-float	..	..	..	..	..	..	..	.003 to .007 in. (.076 to .178 mm.).

GENERAL DATA—continued

MINI MK. II (998-c.c.)—continued

Bearings: number and type	..	..	..	..	..	3. Steel-backed white metal.
Inside diameter (reamed in position): Front	..	..	..	..	..	1.667 to 1.6675 in. (42.342 to 42.355 mm.).
		Centre	..	..	..	1.6245 to 1.6255 in. (41.261 to 41.287 mm.).
		Rear	..	..	..	1.3748 to 1.3755 in. (34.914 to 34.937 mm.).
Running clearance	..	..	..	..	..	.001 to .002 in. (.025 to .051 mm.).

FUEL SYSTEM

Carburettor

Needles	..	..	..	..	..	Standard GX. Rich M. Weak GG.
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IGNITION SYSTEM

Coil	..	..	..	..	..	Lucas LA12.
Resistance at 20° C. (68° F.): primary winding	..	..	..	..	..	3.2 to 3.4 ohms (cold).
Distributor	..	..	..	..	..	Lucas 25D4.
Rotation of rotor arm	..	..	..	..	..	Anti-clockwise.
Contact point gap setting	..	..	..	..	..	.014 to .016 in. (.35 to .40 mm.).
Condenser capacity	..	..	..	..	..	.18 to .24 mF.
Cam closed period	..	..	..	..	..	60°±3°.
Cam open period	..	..	..	..	..	30°±3°.
Automatic advance	..	..	..	..	..	Centrifugal and vacuum.
Serial number	..	..	..	..	..	40931E.
Automatic advance commences*	..	..	..	..	..	600 r.p.m.
Maximum advance*	..	..	..	..	..	26° at 5,000 r.p.m.
Vacuum advance: Commences	..	..	..	..	..	5 in. (12.7 cm.) Hg.
Ends	..	..	..	..	..	11 in. (27.9 cm.) Hg.
Decelerating check*	..	..	..	..	..	24° at 5,000 r.p.m.
						18° at 3,400 r.p.m.
						8° at 1,300 r.p.m.
						2° at 900 r.p.m.
Timing marks	..	..	..	..	..	Dimples on timing wheels, marks on flywheel.
Static ignition timing	..	..	..	..	..	5° B.T.D.C. (91-octane fuel and above (Research Method)).
Stroboscopic ignition timing*	..	..	..	..	..	8° B.T.D.C. at 600 r.p.m.
* Crankshaft degrees and r.p.m.						
Sparking plugs	..	..	..	..	..	Champion N5.
Size	..	..	..	..	..	14 mm., $\frac{3}{4}$ in. (19 mm.) reach.
Gap	..	..	..	..	..	.025 in. (.625 mm.).

CLUTCH

Pressure springs—colour	..	..	..	..	..	Black enamel with white spot.
Diaphragm spring colour code	..	..	..	..	..	Light green.

DIFFERENTIAL

Ratio	..	..	..	..	..	3.44 : 1 (18/62).
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BRAKES

Front

Wheel cylinder bore	..	..	..	..	..	$\frac{15}{16}$ in. (23.81 mm.).
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Rear

Wheel cylinder bore	..	..	..	..	..	$\frac{3}{4}$ in. (19.05 mm.).
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GENERAL DIMENSIONS

Turning circle	..	..	..	..	..	28 ft. 6 in. (8.55 m.).
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GENERAL DATA

MINI AUTOMATIC (848-c.c.)

The following information is applicable to the Mini Automatic and should be used in conjunction with the preceding specification for the Mini Saloon.

ENGINE

Type	..	..	..	..	..	..	..	8AH.
Compression ratio	..	..	..	..	..	..	..	9 : 1.
Torque	..	..	..	..	..	..	..	44 lb. ft. (6.08 kg. m.) at 2,500 r.p.m.
Engine idle speed (approx.)	..	..	..	..	..	..	..	650 r.p.m.
B.h.p.	..	..	..	..	..	..	..	39 at 5,250 r.p.m.

LUBRICATION SYSTEM

Oil pump

Type	..	..	..	..	..	..	..	Hobourn-Eaton.
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Oil filter

Type	..	..	..	..	..	..	..	Full-flow.
Capacity	..	..	..	..	..	..	..	1 pint (1.2 U.S. pints, .57 litre).

Oil pressure

Normal running speed and temperature	..	..	..	..	..	..	..	50 lb./sq. in. (4.22 kg./cm. ²).
Idling (minimum) at normal running temperature	..	..	..	..	..	..	..	15 lb./sq. in. (1.05 kg./cm. ²).

FUEL SYSTEM

Carburettor

Make and type	..	..	..	..	..	..	..	S.U. Type HS4.
Diameter	..	..	..	..	..	..	..	1½ in. (38.1 mm.).
Needle	..	..	..	..	..	..	..	AN (Standard), EB (Weak), H6 (Rich).

IGNITION SYSTEM

Distributor	..	..	..	..	..	..	..	Lucas 25D4.
Serial number	..	..	..	..	..	..	..	H.C. 41134A.
Timing marks	..	..	..	..	..	..	..	Dimples on timing wheels, marks on converter.
Timing: Static	..	..	..	..	..	..	..	3° B.T.D.C.
Stroboscopic	..	..	..	..	..	..	..	6° B.T.D.C. at 600 r.p.m.

DIFFERENTIAL

Ratio	..	..	..	..	..	..	..	3.27 : 1.
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AUTOMATIC TRANSMISSION

Ratios: Top	..	..	..	..	..	..	..	1.0 : 1.
Third	..	..	..	..	..	..	..	1.46 : 1.
Second	..	..	..	..	..	..	..	1.845 : 1.
First	..	..	..	..	..	..	..	2.69 : 1.
Reverse	..	..	..	..	..	..	..	2.69 : 1.
Overall ratios: Top	..	..	..	..	..	..	..	3.76 : 1.
Third	..	..	..	..	..	..	..	5.49 : 1.
Second	..	..	..	..	..	..	..	6.94 : 1.
First	..	..	..	..	..	..	..	10.11 : 1.
Reverse	..	..	..	..	..	..	..	10.11 : 1.
Speedometer	..	..	..	..	..	..	..	7/17.

TORQUE CONVERTER

Type	..	..	..	..	..	..	..	3-element.
Ratio	..	..	..	..	..	..	..	2 : 1 maximum.
Converter output gear ratio	..	..	..	..	..	..	..	1.15 : 1.
End-float	..	..	..	..	..	..	..	.0035 to .0065 in. (.089 to .164 mm.).

GENERAL DATA—*continued*

MINI AUTOMATIC—*continued*

DRIVE SHAFTS

Make and type of joint Hardy Spicer, flange joint.

TORQUE WRENCH SETTINGS

Governor to auxiliary pump housing bolts	..	..	..	10 to 15 lb. ft. (1.4 to 2 kg. m.).
Converter centre bolt	..	..	..	110 to 115 lb. ft. (15.2 to 15.9 kg. m.).
Converter (six central bolts)	..	..	..	22 to 24 lb. ft. (3.04 to 3.32 kg. m.).
Converter drain plugs	..	..	..	18 to 20 lb. ft. (2.5 to 2.77 kg. m.).
Converter housing bolts	..	..	..	18 lb. ft. (2.5 kg. m.).
Differential driving flange securing bolts	..	..	..	40 to 45 lb. ft. (5.53 to 6.622 kg. m.).
Gear train bearing caps	..	..	..	12 lb. ft. (1.66 kg. m.).
Gear train carrier strap	..	..	..	12 lb. ft. (1.66 kg. m.).
Input shaft nut	..	..	..	70 lb. ft. (9.6 kg. m.).
Servo unit securing bolts	..	..	..	17 lb. ft. (2.35 kg. m.).
Top and reverse clutch hub nut	..	..	..	150 lb. ft. (20.7 kg. m.).
Transmission to engine securing nut	..	..	..	12 lb. ft. (1.66 kg. m.).
Valve block securing bolts	..	..	..	10 lb. ft. (1.4 kg. m.).
Valve block bolts (securing three sections)	..	..	..	7 lb. ft. (.97 kg. m.).
Oil filter bowl	..	..	..	10 to 15 lb. ft. (1.4 to 2 kg. m.).
$\frac{5}{16}$ -in. UNF. bolts	..	..	..	18 to 20 lb. ft. (2.5 to 2.77 kg. m.).
$\frac{3}{8}$ -in. UNF. bolts	..	..	..	30 lb. ft. (4.15 kg. m.).

CAPACITIES

Transmission casing (including filter)	..	..	..	13 pints (7.38 litres, 16 U.S. pints).
Refill capacity (approx.)	..	..	..	9 pints (5 litres, 11 U.S. pints).

GENERAL DIMENSIONS

Kerbside weight: Saloon (Automatic)	..	..	..	1,390 lb. (630.8 kg.).
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WEIGHT OF COMPONENTS

Engine and transmission assembly	..	..	..	357 lb. (162 kg.).
Automatic transmission	..	..	..	112 lb. (50.8 kg.).

GENERAL DATA

MINI MK. II AUTOMATIC (998-c.c.)

The following information is applicable to the Mini Mk. II Automatic (998-c.c.) and should be used in conjunction with the preceding specification for the Mini Automatic (848-c.c.).

ENGINE

Type	..	..	..	..	..	..	..	9AG.
Compression ratio	..	..	..	..	..	..	..	8.9 : 1.
Engine idle speed (approx.)	..	..	..	..	..	..	..	650 r.p.m.
B.H.P.	..	..	..	..	..	..	..	41 at 4,850 r.p.m.
B.M.E.P.	..	..	..	..	..	..	..	130 lb./in. ² (9.14 kg./cm. ²) at 2,750 r.p.m.
Torque	..	..	..	..	..	..	..	52 lb. ft. (7.19 kg. m.) at 2,750 r.p.m.

FUEL SYSTEM

Carburettor

Make and type	..	..	..	..	..	..	S.U. Type HS4.
Diameter	..	..	..	..	..	..	1½ in. (38.1 mm.).
Needle	..	..	..	..	..	..	AC (Standard), HA (Weak), M1 (Rich).

IGNITION SYSTEM

Distributor	..	..	..	..	..	..	Lucas 25D4.
Serial number	..	..	..	..	..	..	H.C.41134A.
Timing marks	..	..	..	..	..	..	Dimples on timing wheels, marks on converter.
Timing: Static	..	..	..	..	..	..	4° B.T.D.C.
Stroboscopic	..	..	..	..	..	..	6° B.T.D.C. at 600 r.p.m.

GENERAL DIMENSIONS

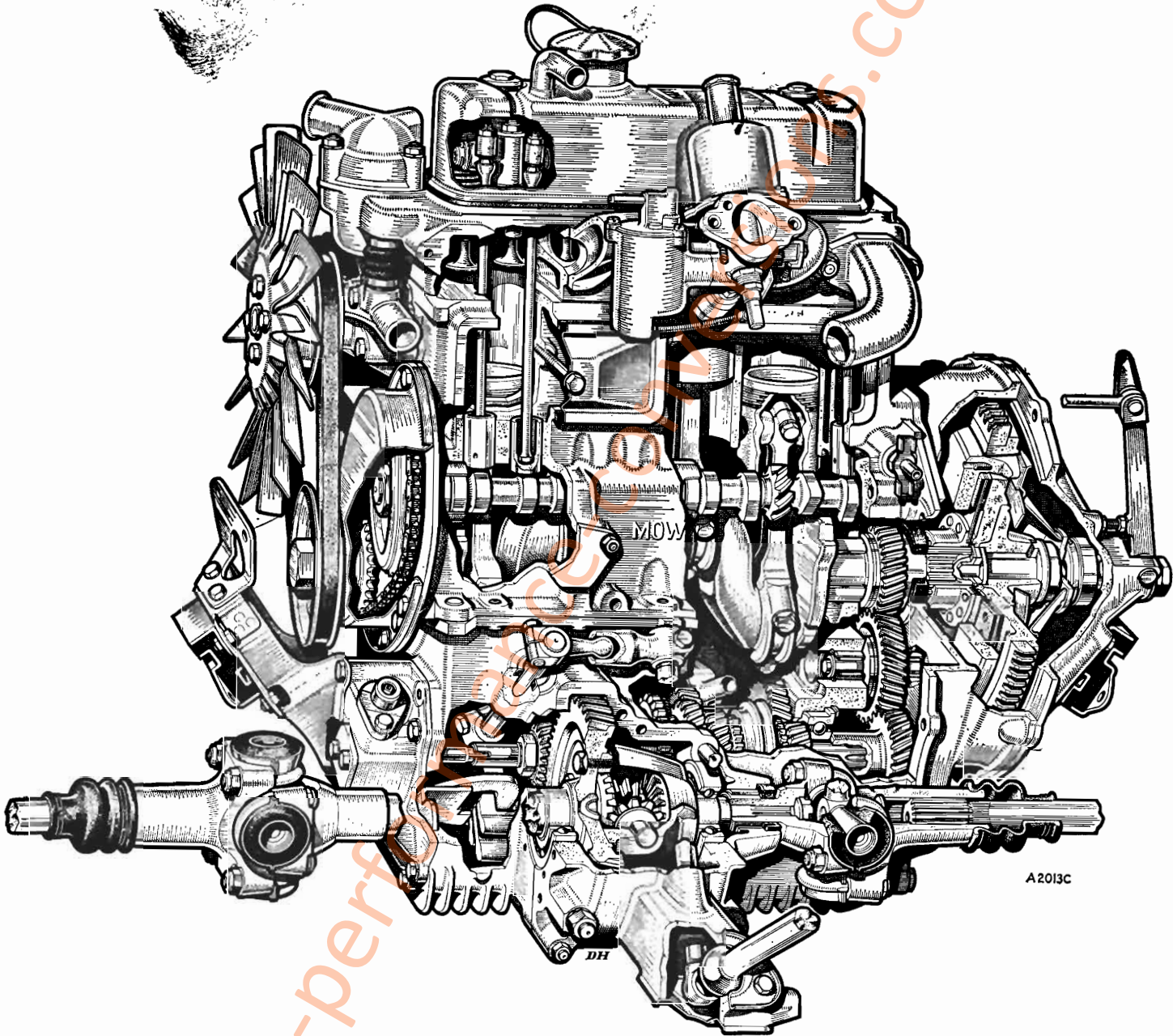
Kerbside weight: Saloon..	..	..	..	..	..	1442 lb. (654 kg.).
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SECTION A

THE ENGINE

	<i>Section</i>
Air cleaner	A.1
Camshaft	A.23
Carburettor	A.2
Crankcase closed-circuit breathing	A.27
Crankshaft and main bearings	A.25
Cylinder head	A.6
Decarbonizing	A.7
Distributor spindle	A.10
Engine and sub-frame	A.12
Engine and transmission	A.13
Engine mountings	A.14
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THE POWER UNIT AND SYNCHROMESH TRANSMISSION ASSEMBLY



Section A.1

AIR CLEANER

Removing

- (1) Disconnect the breather hose from the rocker cover, unscrew the wing nut and lift off the cleaner.

COOPER

Removing

- (1) Disconnect the breather pipe from the rocker cover.
- (2) Remove the four securing screws to remove the gauze-type cleaner, unscrew the two wing nuts to remove the paper-element-type cleaner.

Section A.2

CARBURETTER

Removing

- (1) Remove the air cleaner.
- (2) Disconnect the mixture and throttle cables.
- (3) Disconnect the suction advance pipe.
- (4) Disconnect the fuel delivery hose.
- (5) Unscrew the two nuts and lift off the carburetter cable abutment plate and two gaskets.

When refitting, make sure the gaskets are in good condition.

COOPER

Removing

- (1) Remove the bonnet and disconnect the battery.
- (2) Disconnect the choke and throttle cables and the main flexible feed pipe.
- (3) Disconnect the interconnecting pipe support clip.
- (4) Unhook the three return springs.
- (5) Disconnect the vacuum advance pipe.
- (6) Remove the nuts and withdraw both carburetters together.

Refitting

Reverse the removing instructions and adjust the linkage as in Section D.6 (35).

Section A.3

EXHAUST PIPE

Removing

Slacken the exhaust pipe to manifold clamp and disconnect the fixing points on the gear change extension and the rear sub-frame.

Refitting

- (1) Disconnect the engine tie-rod from the cylinder block.
- (2) Assemble the exhaust pipe to the engine leaving the fixing bolts and the manifold clamp loose.
- (3) Push the engine forward to line up the tie-rod bolt holes and wedge it in position with a wooden block. If necessary, slacken the two engine to sub-frame bolts and then retighten them.
- (4) Reconnect the tie-rod.
- (5) Insert slip packings, as required, between the transmission case and the pipe bracket, and then tighten the bolt, the sub-frame fixings, and the manifold clamp.
- (6) Remove the wooden block.

COOPER

Removing

- (1) Remove the screw securing the exhaust pipe to manifold clamp from the front end of the gear change extension.
- (2) Unscrew the nuts and bolts at the intermediate and rear mountings and withdraw the pipe.

Refitting

Reverse the removing instructions.

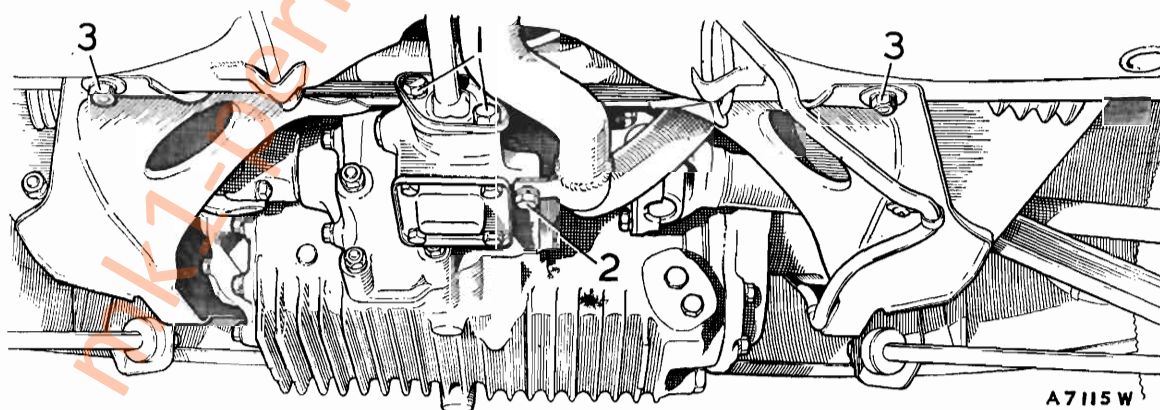


Fig. A.1

The front sub-frame and transmission casing viewed from beneath the car, showing (1) the gear change lever retaining screws, (2) the exhaust system fixing point, (3) the front sub-frame rear mounting point (four set screws)

Section A.4

EXHAUST MANIFOLD

Removing

- (1) Carry out instructions in Sections A.1 and A.2.
- (2) Slacken the pipe clamp, unscrew the six nuts and withdraw the manifold.

COOPER

- (3) Jack up the vehicle and remove the bonnet.
- (4) Remove the exhaust pipe assembly, Section A.3, and carburettors, Section A.2.
- (5) Remove the inlet manifold.
- (6) Unscrew the 'U' bolts and withdraw them from the right-hand universal joint.
- (7) Remove the right-hand wheel and disconnect the steering tie-rod.
- (8) Disconnect the top and bottom swivels, partly withdraw the hub and drive shaft.
- (9) Support the hub to avoid damage to the brake hose.
- (10) Turn the differential flange until it is upright, withdraw the exhaust manifold from the studs, manoeuvre it to the right to clear the sub-frame and transmission casing and lift upwards.

Refitting

Reverse the removing instructions.

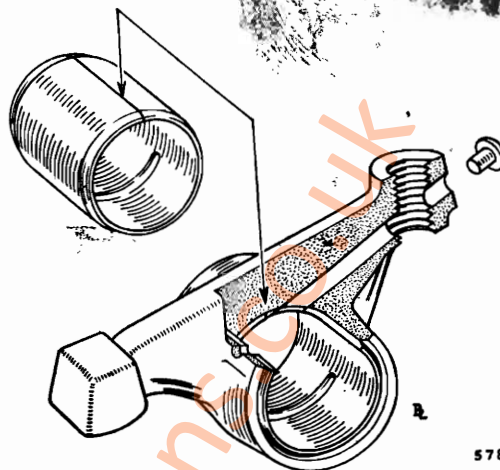


Fig. A.3

The forged-type valve rocker

- (5) Remove the shaft locating screw from the front bracket.
- (6) Withdraw the split pin and washers from the front end of the shaft.
- (7) Slide the rockers, brackets and springs from the shaft, noting their relative positions for correct refitting.
- (8) Unscrew the plug from the front end of the shaft and clean out the oilways.

Rockers and bushes

Check the rockers for wear. Two types of rocker are in use—pressed steel or forged; if the forged type is fitted the rockers can be rebushed, but worn pressed-steel rockers must be renewed.

To fit new bushes

- (9) Remove the old and press in new bushes with Service tool 18G 226 and 18G 226 A.
- (10) Locate the joint of the bush at the top as shown in Fig. A.3.
- (11) Remove the adjuster screw.
- (12) Drill out the plug in the end of the rocker with a No. 43 drill (2.26 mm.) and continue the oilway through the bush.
- (13) Replug the end hole with a rivet welded in position.
- (14) Continue the hole in the top of the rocker barrel with a No. 47 drill (1.98 mm.).
- (15) Burnish-ream the bush to the dimension given in 'GENERAL DATA'.

Reassembling

- (16) Reverse the dismantling procedure.
- (17) Fit the plugged end of the shaft and the tapped bracket at the front of the engine.
- (18) Tighten the cylinder head and rocker shaft nuts to the recommended torque and in the order shown in Fig. A.4.

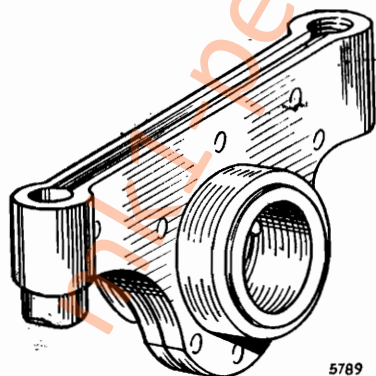


Fig. A.2

The pressed-steel type of valve rocker

Disassembly

(19) Remove the sparking plugs, engage top gear and push the car forward to rotate the crankshaft. This operation can be also effected by jacking up one side of the front suspension until the road wheel can be rotated, and thus turn the crankshaft to the required position.

(20) Rotate the crankshaft until the valve being checked has its tappet resting opposite the peak on the camshaft, i.e. valve completely closed. This cannot be observed accurately, therefore if checking is carried out according to the adjustment chart, this will avoid turning the crankshaft more than is necessary. The valve rocker clearance is given in 'GENERAL DATA'.

(21) Hold the adjusting screw against rotation while slackening the locknut, insert the feeler gauge and turn the adjustment screw until the gauge is a sliding fit, tighten the locknut and recheck the clearance.

(22) Refit the rocker cover with a new joint washer if necessary, and lower the car (if jacked up).

Adjust No. 1 rocker with No. 8 valve fully open

"	"	3	"	"	"	6	"	"	"
"	"	5	"	"	"	4	"	"	"
"	"	2	"	"	"	7	"	"	"
"	"	8	"	"	"	1	"	"	"
"	"	6	"	"	"	3	"	"	"
"	"	4	"	"	"	5	"	"	"
"	"	"	"	"	"	2	"	"	"

Section A.6

CYLINDER HEAD

Removing

- (1) Remove the bonnet.
- (2) Drain the cooling system (Section C.1).
- (3) Disconnect the battery.
- (4) Remove the air cleaner (Section A.1), carburettor (Section A.2), and exhaust manifold (Section A.4).

(5) Remove the rocker cover, rocker shaft, push-rods, sparking plugs, and the three screws securing the radiator tie-plate to the thermostat housing.

(6) Disconnect the radiator to cylinder head hose, the suction advance pipe from the clip on the water inlet pipe and the heater hose from the water valve at the rear of the cylinder head.

(7) Slacken the water by-pass hose.

(8) Remove the remaining cylinder head nuts.

NOTE.—The Cooper 'S' has an additional bolt at the front of the cylinder head.

(9) Lift the head squarely. If the joint sticks, tap each side of the head with a wooden or hide mallet. Lift the gasket from the studs.

Refitting

Reverse the removing procedure, noting the following points.

(10) Thoroughly clean the faces of the cylinder head and the top of the block, and fit a new gasket without jointing compound or grease. The gasket is marked 'TOP' and 'FRONT'.

(11) Tighten the cylinder head and rocker shaft nuts to the correct torque and in the order shown in Fig. A.4. The additional bolt on the Cooper 'S' must be tightened last. **Do not overtighten.**

(12) Adjust the valve rocker clearances, start the engine and when warm re-check.

Section A.7

DECARBONIZING

- (1) Remove the cylinder head and gasket (Section A.6) and the valves (Section A.8).
- (2) Scrape the carbon from the piston crowns, cylinder head, valves, and cylinder block, leaving a ring of carbon around the periphery of each piston and the top of each bore. Blow all deposits of carbon from the head and block.
- (3) Refit the cylinder head (Section A.6).

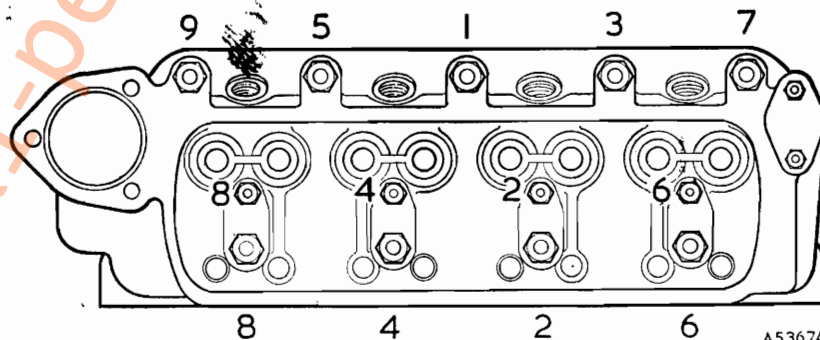


Fig. A.4

The order of slackening and tightening the cylinder head retaining nuts

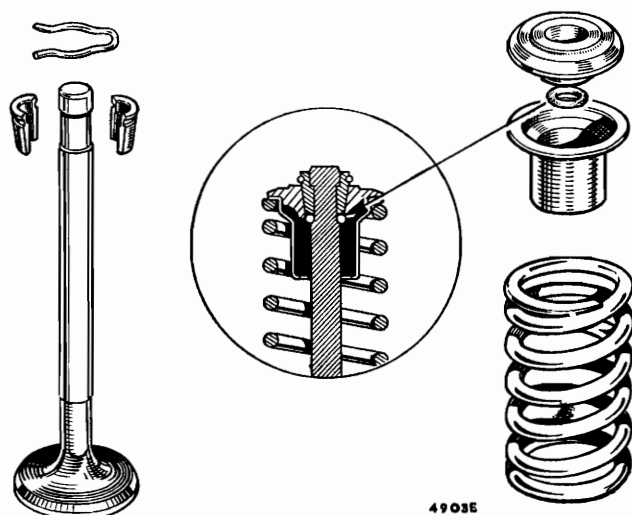


Fig. A.5

The component parts of the valve assembly

Section A.8

VALVES

Removing

- (1) Remove the cylinder head and gasket (Section A.6).
- (2) Withdraw the cotter clip.
- (3) Compress the spring and extract the two halves of the cotter.
- (4) Slowly release the spring, remove the spring compressor and withdraw the retaining cap, shroud valve spring, and rubber seal.
- (5) Remove the valve. If the heads of the valves are not numbered, store them in such a way that they can be replaced in their original positions.

The Cooper 'S' has no cotter clips or shroud, and the rubber seal is fitted over the valve guide. Double valve springs are fitted.

Grinding

Clean the valves and seatings and examine them for pitting and unevenness. If the valves are in a very poor condition, fit new, otherwise reface them on a valve grinder.

Seats can be re-cut with special cutters available from BMC Service. Confine seat and valve grinding to the minimum and finally grind the valves onto the seatings with fine grinding paste.

Valve seat inserts

When it becomes necessary to fit inserts, machine the cylinder head to the dimensions given in Fig. A.7. The inserts should have an interference fit of .0025 to .0045 in. (.063 to .11 mm.) and must be pressed, not driven, into the cylinder head.

Valve guides

Remove by driving downwards into the combustion chambers. Drive new guides into position until they

protrude $\frac{3}{8}$ in. (15.08 mm.) above the machined spring seats (Fig. A.6). Fit the inlet guides with the largest chamfer at the top, and the exhaust with the counterbore at the bottom.

Refitting

Reverse instructions (1) to (5) above.

Section A.9

TAPPETS

Removing

- (1) Remove the air cleaner(s) and carburetter(s) (Sections A.1 and A.2).
- (2) Remove the rocker cover and shaft assembly (Section A.5).
- (3) Remove the manifold (Section A.4) and the push-rods.
- (4) Remove the tappet covers and tappets.
- (5) Fit new tappets by selective assembly so that they just fall into their guides under their own weight, when lubricated.

Refitting

Reverse the dismantling operations, taking care to replace the tappets in their original positions.

Section A.10

DISTRIBUTOR SPINDLE

Removing

- (1) Remove the distributor (Section D.1).
- (2) Take out the screw securing the distributor housing to the cylinder block and carefully withdraw the housing to avoid damage to the 'O' ring seal (later models only). The upper end of the spindle is drilled and tapped with a $\frac{1}{8}$ -in. UNF. thread; screw in a suitable bolt and withdraw the spindle.

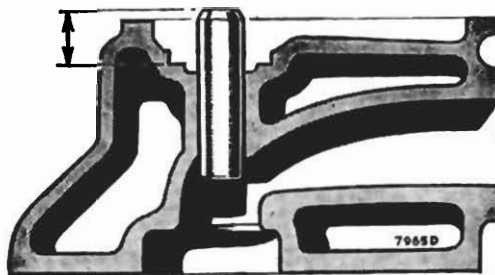


Fig. A.6

The fitting position for the valve guide

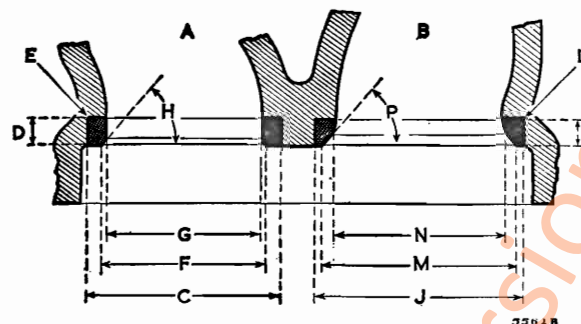


Fig. A.7

Valve seat machining dimensions

EXHAUST 'A'							INLET 'B'					
	C	D	E	F	G	H	J	K	L	M	N	P
MINI	1.124 to 1.125 in. (28.55 to 28.58 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	Maximum radius .015 in. (.38 mm.)	1.0235 to 1.0435 in. (25.99 to 26.50 mm.)	.844 in. (21.43 mm.)	45°	1.187 to 1.188 in. (30.16 to 30.17 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	Maximum radius .015 in. (.38 mm.)	1.0855 to 1.1055 in. (27.58 to 28.07 mm.)	1.000 to 1.006 in. (25.4 to 25.55 mm.)	45°
997-c.c. COOPER	1.124 to 1.125 in. (28.55 to 28.58 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.0235 to 1.0435 in. (25.99 to 26.50 mm.)	.906 to .912 in. (23.01 to 23.16 mm.)	45°	1.3075 to 1.3085 in. (33.21 to 33.23 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.116 to 1.136 in. (28.34 to 29.2 mm.)	1.066 to 1.072 in. (27.07 to 27.22 mm.)	45°
998-c.c. COOPER	1.124 to 1.125 in. (28.58 to 28.58 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.0235 to 1.0435 in. (25.99 to 26.50 mm.)	.906 to .912 in. (23.01 to 23.16 mm.)	45°	1.3745 to 1.3755 in. (34.90 to 34.95 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.206 to 1.226 in. (30.60 to 31.15 mm.)	1.066 to 1.072 in. (27.07 to 27.22 mm.)	45°
970-c.c. COOPER 'S'	1.2465 to 1.2475 in. (31.66 to 31.7 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.2065 to 1.2265 in. (30.65 to 31.16 mm.)	1.121 to 1.141 in. (28.47 to 28.98 mm.)	45°						
1071-c.c. COOPER 'S'	1.2465 to 1.2475 in. (31.66 to 31.7 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.2065 to 1.2265 in. (30.65 to 31.16 mm.)	1.121 to 1.141 in. (28.47 to 28.98 mm.)	45°						
1275-c.c. COOPER 'S'	1.2465 to 1.2475 in. (31.66 to 31.7 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.2065 to 1.2265 in. (30.65 to 31.16 mm.)	1.121 to 1.141 in. (28.47 to 28.98 mm.)	45°	1.4365 to 1.4375 in. (36.5 to 36.52 mm.)	.186 to .188 in. (4.72 to 4.77 mm.)	.015 in. (.38 mm.)	1.3935 to 1.4135 in. (35.41 to 35.91 mm.)	1.308 to 1.328 in. (33.21 to 33.73 mm.)	45°

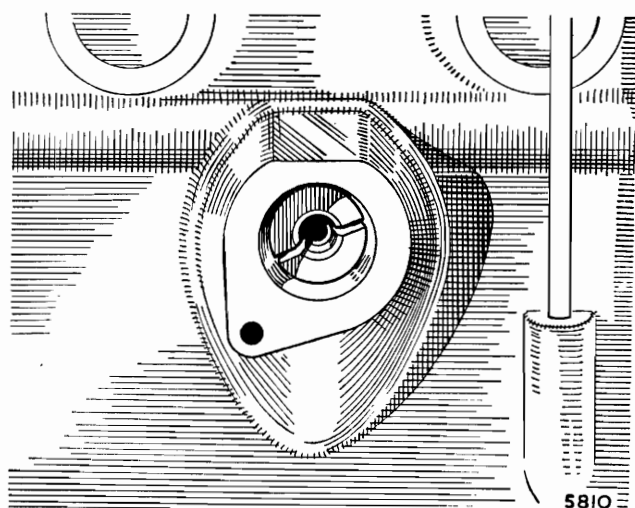


Fig. A.8

The distributor drive with the slot in the correct position and the large offset uppermost

Refitting

- (3) Turn the crankshaft until No. 1 piston is at T.D.C. on the compression stroke (No. 4 cylinder exhaust and inlet valves rocking and the 1/4 mark on the flywheel against the pointer).
- (4) Hold the spindle so that the drive slot is in the position shown (Fig. A.8) with the large offset uppermost, and enter the gear. As the gear engages the camshaft the spindle will turn anti-clockwise.
- (5) Refit the distributor (Sections B.1 and B.2).

Section A.11

FLYWHEEL AND CLUTCH

Removing

- (1) Disconnect the coil (or solenoid) leads and remove the coil (or solenoid).
- (2) Remove the starter (Section N.3).
- (3) Unhook the clutch lever spring, withdraw the lever pivot pin, pull the push-rod from the slave cylinder and remove the lever from the clutch housing.
- (4) Take off the slave cylinder.
- (5) Disconnect the exhaust pipe/manifold clamp.
- (6) Detach the radiator support bracket from the thermostat housing.
- (7) Unscrew the two nuts and set screws securing the right-hand engine mounting to the sub-frame side-member.
- (8) Take out the clutch cover screws.
- (9) Raise the engine just enough to allow the removal of the clutch cover. Do not let the fan blades damage the radiator.
- (10) Remove the three nuts and the clutch thrust plate

A.8

from the pressure spring housing. When a diaphragm clutch is fitted, release the spring retainer to detach the thrust plate.

- (11) Bring Nos. 1 and 4 pistons to T.D.C. to prevent the primary gear 'C' washer from falling and being wedged behind the flywheel. With the crankshaft in any other position this could happen and result in damage as the flywheel is withdrawn.
- (12) Tap up the locking washer and slacken the flywheel retaining screw three or four threads. Use Service tools 18G 304 and 18G 304 M to free the flywheel from the taper on the crankshaft. Remove the tool as soon as the flywheel is free.
- (13) Unscrew the flywheel retaining screws and take off the driving washer.
- (14) Withdraw the flywheel and clutch together.
- (15) Dismantle the clutch as described in Section E.1.

NOTES:

- (A) As the flywheel is pulled from the shaft, oil from the annulus behind the flywheel oil seal may spill down the face of the flywheel onto the clutch driven plate. Look out for this when dismantling to avoid assuming that the oil has passed the seal during normal running.
- (B) In early engines a rubber plug was fitted into the rear end of the crankshaft as an added precaution against oil leaking past the normal brass taper plug. An improved brass plug is now fitted and the rubber is discontinued.
- (C) Later engines have non-lubricated bushes in the crankshaft primary gear and the flywheel oil seal is not fitted.

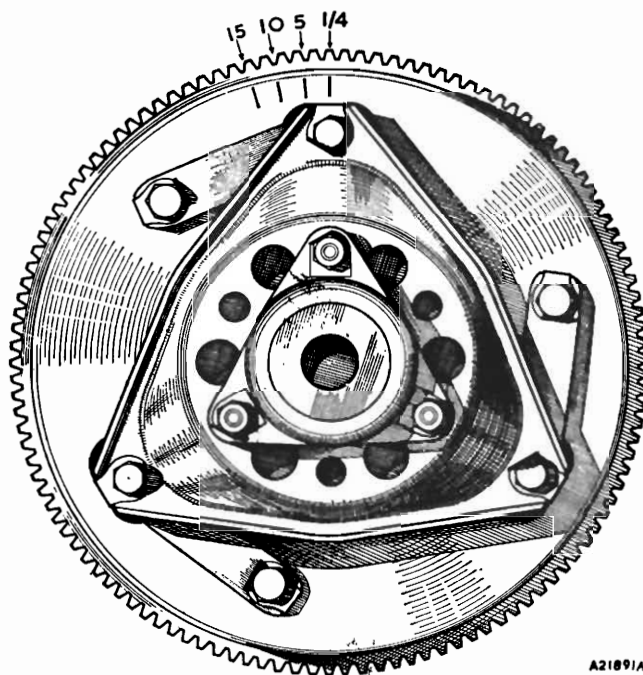


Fig. A.9

The flywheel and clutch assembly

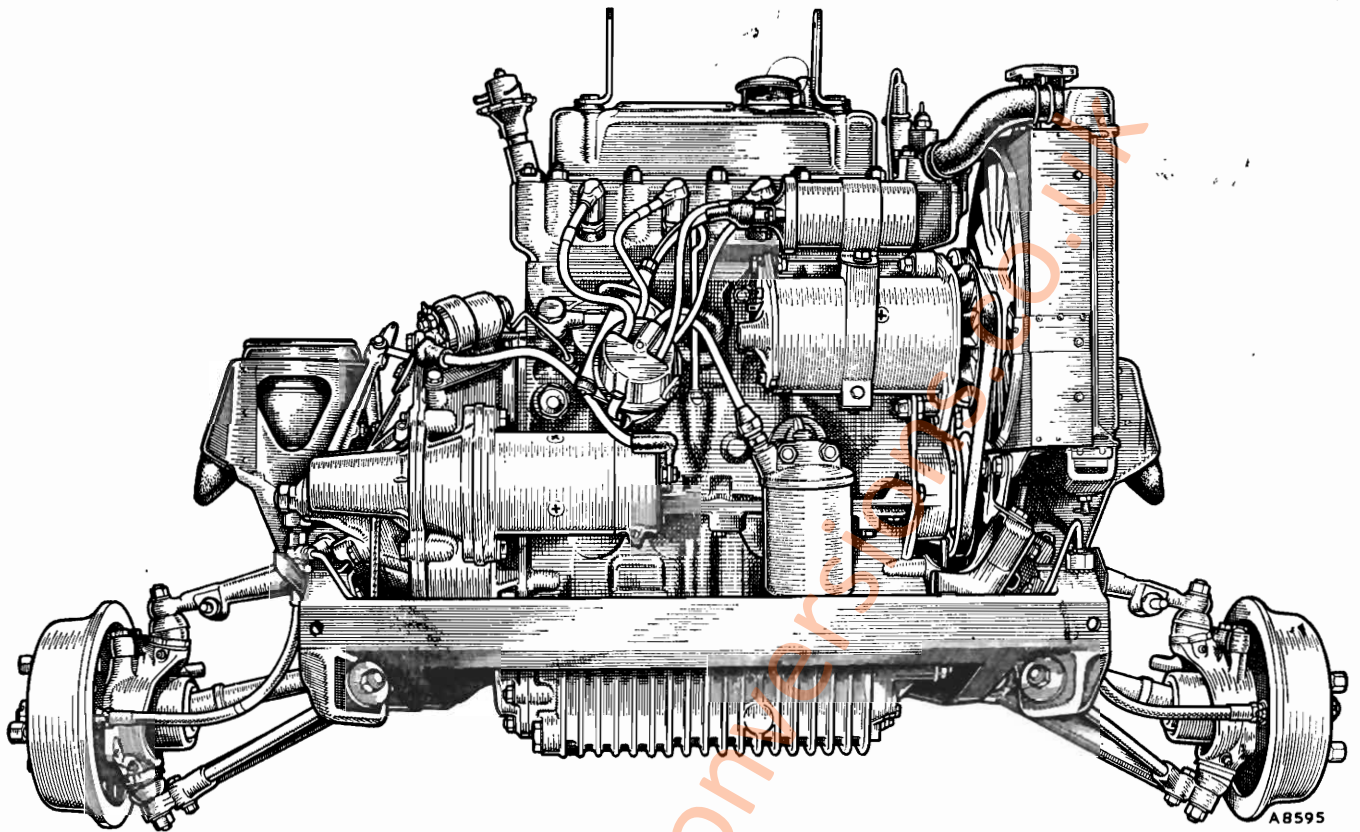


Fig. A.10

The engine and front suspension assembly

Starter ring

If a new starter ring is needed, split the old one with a cold chisel. Clean the bore of the new ring and the mating surface of the flywheel, heat the ring to a temperature of 300 to 400° C. (575 to 752° F.), indicated by a light blue colour, and fit it to the flywheel with the lead of the teeth towards the flywheel register. Allow it to cool naturally.

Refitting

- (16) Assemble the clutch.
- (17) Lubricate the flywheel oil seal (if fitted).
- (18) Ensure that the 'C' washer is correctly positioned and then turn the crankshaft to bring Nos. 1 and 4 pistons to T.D.C.
- (19) The crankshaft primary gear splines should be lightly wiped with Duckham's M-B grease.
- (20) Clean and dry the crankshaft and flywheel tapers; they must be assembled dry.
- (21) Fit the flywheel and clutch assembly to the shaft, replace the washer and retaining screws.
- (22) Tighten the screw to the recommended torque and tap over the locking washer.
- (23) Refit the clutch thrust plate.
- (24) Lower the engine and carry out the removal operations 1 to 8 in reverse order.

Section A.12

ENGINE AND SUB-FRAME ASSEMBLY

Removing

- (1) Remove the bonnet, drain the cooling system and remove the front grille.
- (2) Disconnect the battery.
- (3) Disconnect the electrical connections from the engine.
- (4) Disconnect the speedometer cable from the instrument.
- (5) Disconnect the heater hoses.
- (6) Disconnect the pipes at the three-way union.
- (7) Use Service tool 18G 1063 and disconnect the steering-rack ball joints.
- (8) Disconnect the engine tie-rod.
- (9) Detach the servo vacuum pipe from the inlet manifold (Cooper 'S').
- (10) Remove the right-hand and disconnect the left-hand drive shaft (Section C).
- (11) Remove the exhaust pipe (Section A.3).
- (12) Remove the air cleaner and carburetter (Sections A.1 and A.2).
- (13) Remove the hexagon plug with the anti-rattle spring and plunger from the gear change extension.
- (14) Remove the gear lever retaining plate; pull the lever out of the casing into the car.

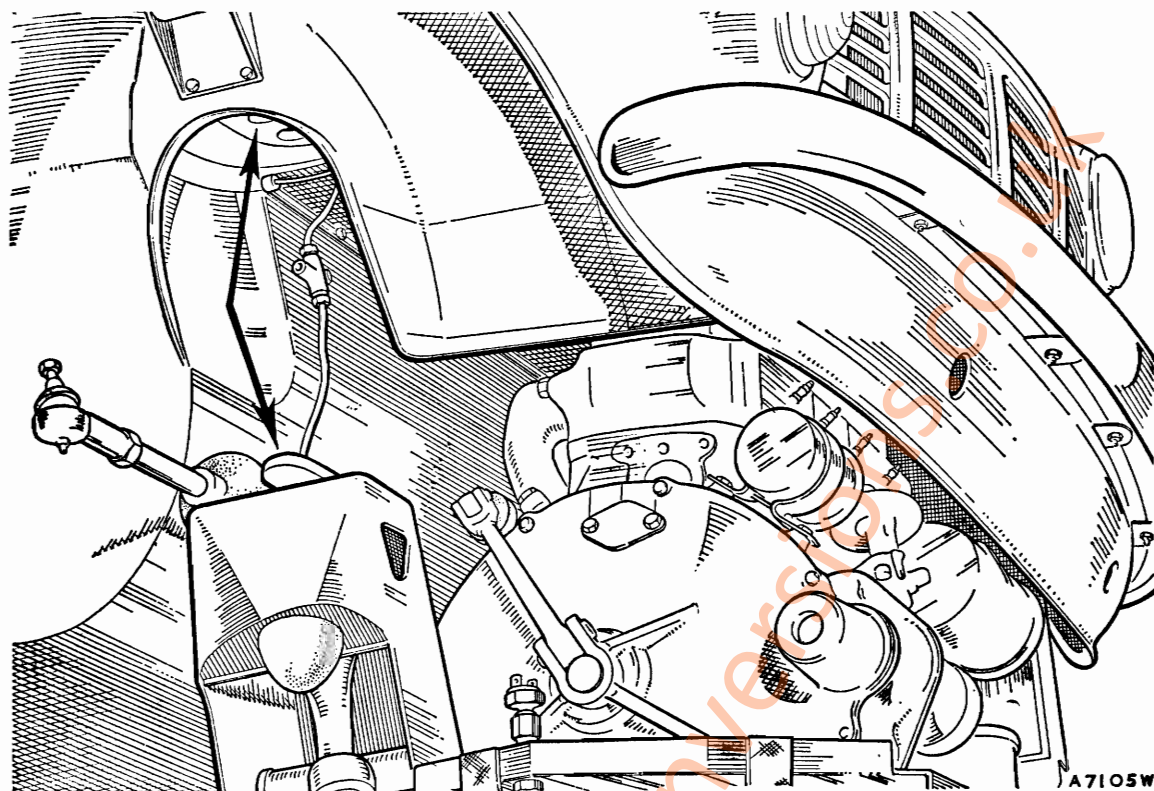


Fig. A.11

The front sub-frame and engine disconnected, and the body raised to enable the engine and sub-frame to be removed as a complete assembly

- (15) Remove the slave cylinder securing bolts and attach the unit to the bulkhead (do not disconnect the hose).
- (16) Depressurize and evacuate the models fitted with Hydrolastic suspension (Section H.7) and disconnect both hoses.
- (17) Support the body with slings under the front wings, and the engine below the transmission casing.
- (18) Knock back the locking tabs and withdraw the four body to sub-frame bolts (nuts if studs are fitted), two on each side of the bulkhead cross-member. Take out the four set screws securing the rear of the sub-frame to the front floor and the two screws securing the front of the frame to the bottom of the grille panel.
- (19) Lift the body clear of the engine and withdraw the sub-frame and engine assembly.

Removing engine from sub-frame

- (20) Drain the oil. Disconnect the drive shafts at the differential (Section G).
- (21) Support the sub-frame under both side-members and take the weight of the engine on the lifting equipment. Take out the two screws securing each engine mounting to the sub-frame.

- (22) Lift the engine out of the frame.

Refitting

- (23) Reverse the removal instructions.

NOTE.—The gear lever must be pulled up into the interior of the car before the body is lowered onto the frame. Bleed the brakes and clutch.

Section A.13

ENGINE AND TRANSMISSION

Removing

- (1) The engine and transmission assembly can be taken out through the bonnet aperture as follows:
- (2) Refer to Section A.12 and carry out instruction Nos. (1) to (6), and (11) to (15).
- (3) Remove the windscreen washer bottle and bracket, and the rocker cover and gasket.
- (4) Disconnect the drive shafts at the differential.
- (5) Fit lifting eyes to the second and fourth cylinder head studs at the front of the engine.
- (6) Take the weight of the engine on the lifting equipment and unscrew the two set screws securing each engine mounting to the sub-frame and lift out the engine.

Refitting

- (7) Reverse the removal instructions.

NOTES.—Pull the gear lever up into the interior of the car before the engine is lowered into position. Keep the sliding joints pushed well onto the drive shaft splines while the flexible couplings are moved into position.

COOPER**Removing**

- (1) Carry out the instructions (1) to (10) and (15) in Section A.12.
- (2) Remove the fresh-air motor (when fitted).
- (3) Disconnect the oil gauge pipe.
- (4) Take off the distributor cap.
- (5) Remove the carburetters and air cleaners (Sections A.1 and A.2).
- (6) Remove the exhaust pipe assembly (Section A.3).
- (7) Remove the three bolts securing the rear extension mounting to the floor (Fig. A.12).
- (8) Unscrew the gear lever knob and take out the screws with the rubber cover and plate.
- (9) Remove the gear-change extension. Disconnect the hydraulic and vacuum pipe and remove the brake servo (Cooper 'S').

Refitting

Reverse the removing instructions.

Section A.14**ENGINE MOUNTINGS****Removing****Left-hand**

- (1) Remove the radiator (Section C.3).
- (2) Support the engine to take the weight off the mounting.

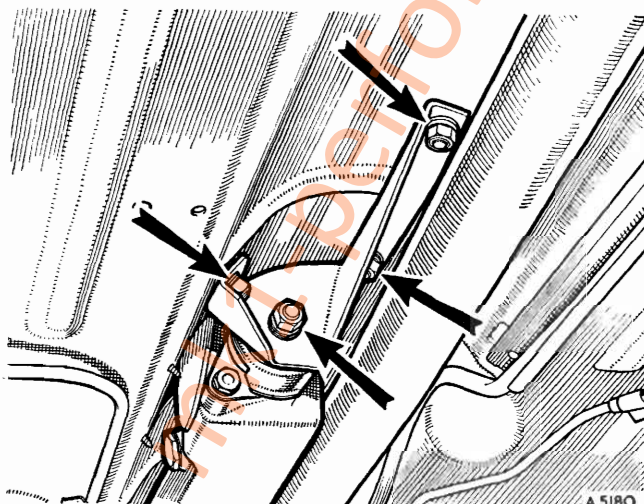


Fig. A.12

The securing points for the Cooper gear-change extension

- (3) Remove the nuts securing the mounting bracket to the transmission casing and the two set screws securing the mounting to the sub-frame side-members; withdraw the bracket and mounting assembly.

Right-hand

- (4) Remove the clutch cover and engine mounting together as detailed in Section A.11.

Refitting

Reverse the removing instructions.

Section A.15**TIMING COVER****Removing**

If the fan cowl is not the later split-type the engine will have to be removed as in Section A.12; otherwise proceed as follows.

- (1) Remove the radiator (Section C.3).
- (2) Slacken the dynamo bolts and remove the fan belt.
- (3) Withdraw the crankshaft pulley.
- (4) Remove the cover securing screws and lift off the cover.

Refitting

- (5) Reverse the removing instructions when refitting the cover. The oil seal in the cover must be renewed if it shows signs of deterioration, using Service tool 18G 134 together with adaptor 18G 134 BD.
- (6) The oil thrower behind the crankshaft pulley must be fitted with the face marked 'F' away from the engine. Fill the annular groove of the seal with grease and use Service tool 18G 1044 to centralize the cover to the crankshaft.

NOTE.—The early type front cover and oil thrower must only be used together. The oil thrower must be fitted with its concave side facing away from the engine.

Use Service tool 18G 138 to centralize the seal to the crankshaft or use the crankshaft pulley.

- (8) Fill the groove of the seal with grease, lubricate the pulley hub and rotate the hub through the cover oil seal.
- (9) To ensure correct centralization the cover and hub should now be fitted together, aligning the keyway in the pulley with the key in the crankshaft.
- (10) Insert the cover retaining screws and tighten them evenly.
- (11) Refit and tighten the crankshaft pulley bolt to the torque figure given in 'GENERAL DATA' and tap over the locking washer.

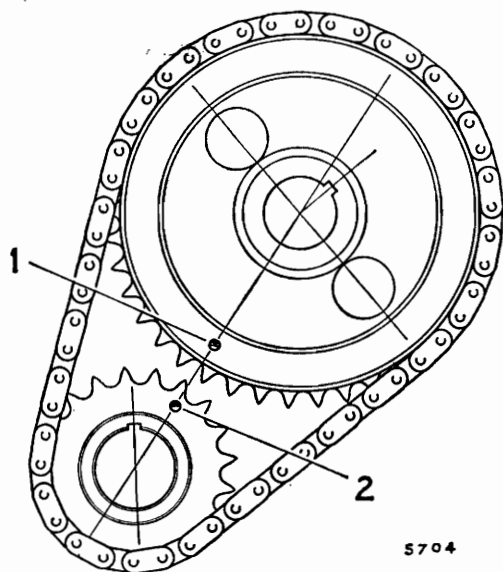


Fig. A.13

The timing gears assembled into the timing chain with the two marks on the gears opposite each other

Section A.16

TIMING GEARS AND CHAIN

Removing

- (1) Remove the timing cover (Section A.15).
- (2) Withdraw the oil thrower.
- (3) Unlock the camshaft chain wheel, nut, unscrew and remove the nut and lock washer.
- (4) Pull both chain wheels, with the chain at the same time. Note the thickness of the packing washer behind the crankshaft wheel.
- (5) Extract the wheels from the chain.

Refitting

- (6) Place the crankshaft gear packing washers in position and turn the shaft to bring the key to the top.
- (7) Bring the camshaft keyway to the position shown in Fig. A.13 (approx. 1 o'clock).
- (8) Assemble the two wheels in the chain with the marks opposite each other as in Fig. A.13. Push the wheels onto the shafts, turning the camshaft slightly as required to line up the key. Push the wheels as far as they will go and secure the camshaft gear with the lock washer and nut.
- (9) Check the alignment of the wheels by placing a straight-edge across the teeth of the camshaft and crankshaft gears and measuring the gap between the straight-edge and the crankshaft gear. Adjust with washers behind the crankshaft gear as required.
- (10) Refer to Section A.15 'Refitting', items (5) to (11).

A.12

Section A.17

VALVE TIMING

Checking

- (1) Adjust the rocker clearance of No. 1 inlet valve to .019 in. (.48 mm.), .021 in. (.53 mm.) Cooper 'S', and turn the crankshaft until the valve is about to open.
- (2) Take off the flywheel inspection hole cover. The pointer should now be opposite the 5° mark on the flywheel.
- (3) After checking, reset the rocker clearance of No. 1 inlet valve to .011 in. (.28 mm.)—engine hot.

Section A.18

FLYWHEEL HOUSING AND PRIMARY GEAR

Removing

- (1) Remove the engine (Section A.12).
- (2) Remove the flywheel and clutch assembly (Section A.11).
- (3) Remove the screws and nuts securing the housing; note their positions for correct replacement.

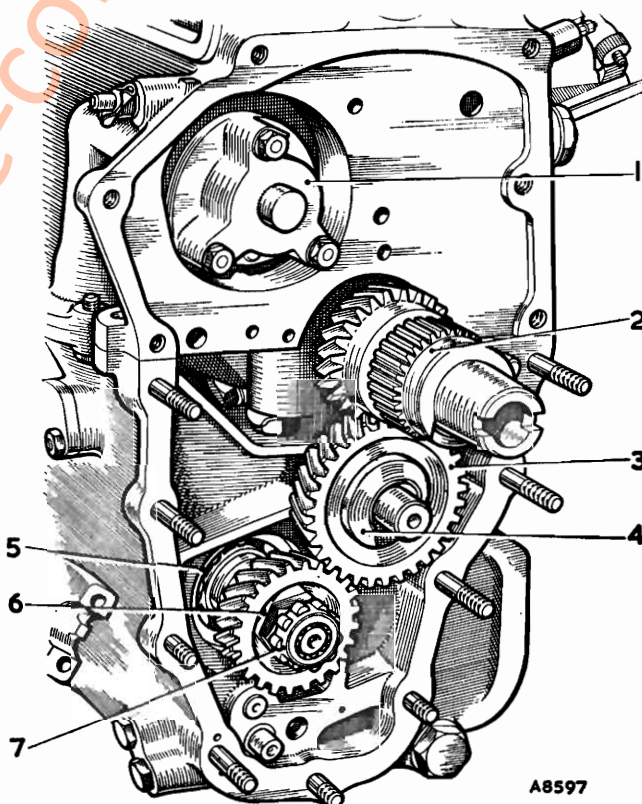


Fig. A.14

The engine and transmission assembly with the flywheel housing removed, showing the gear train to the first motion shaft

- | | |
|------------------------------|-------------------------------------|
| 1. Oil pump. | 5. First motion shaft bearing. |
| 2. Crankshaft primary gear. | 6. First motion shaft driving gear. |
| 3. Idler gear. | 7. Roller bearing. |
| 4. Idler gear thrust washer. | |

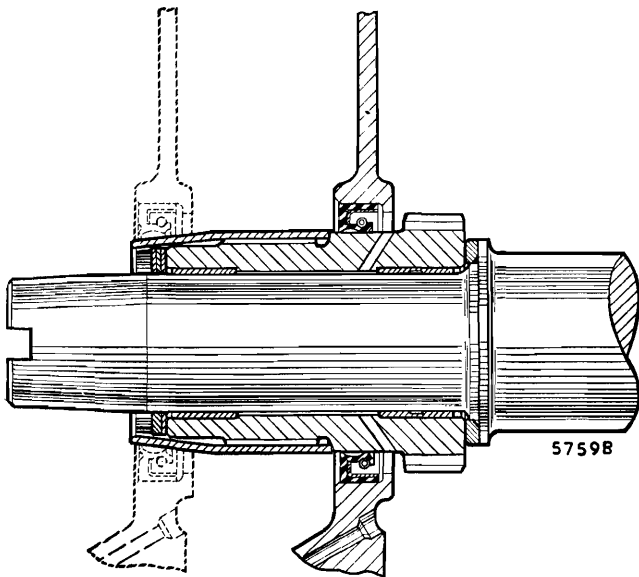


Fig. A.15

The Service tool 18G 1043 positioned over the clutch splines of the crankshaft primary gear to prevent damage to the lip of the oil seal

(4) When withdrawing the housing and to avoid damage to the oil seal use Service tool 18G 570, or 18G 1043 if a red silicon rubber oil seal is fitted (Fig. A.15).

(5) Extract the circlip and remove the primary gear.

Refitting

(6) Check the primary gear running clearance (Fig. A.16). Fit the inner thrust washer with its chamfered bore against the crankshaft flange.

(7) Renew the crankshaft primary gear oil seal if it shows signs of damage or oil leakage, using Service tool 18G 134 and adaptor 18G 134 BC.

This seal can also be renewed without removing the housing or draining the engine/transmission unit (see Section A.30).

(8) Refit the housing, using 18G 1043 to protect the red silicon rubber oil seal. Service tool 18G 570 must only be used for assembly with the old-type oil seal. Lubricate the oil seal before assembly. Fit a new joint washer.

(9) Tighten the nuts and set screws to the recommended torque. It is important to return the set screws to the positions from which they were removed.

Later engines were fitted with non-lubricated bushes in the primary gear. No oil feed is provided from the crankshaft and no oil seal is fitted in the flywheel.

(10) Remove the primary gear as described in Section A.18.

(11) When refitting, check the running clearance (Fig. A.17).

(12) Adjust by fitting the appropriate thrust washer.

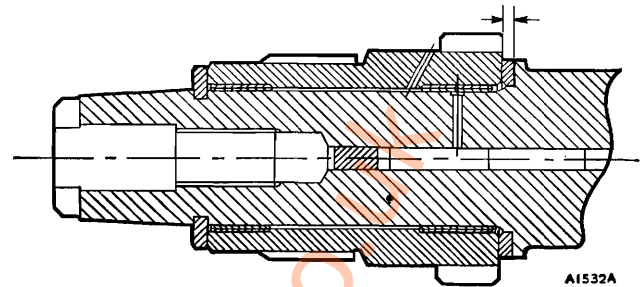


Fig. A.16

The crankshaft primary gear with lubricated bushes must be assembled with the correct running clearance of between .003 and .006 in. (.076 and .152 mm.). Measure the gap indicated and use the following table to determine the correct thickness of the thrust washer required to obtain this clearance

When gap is	Use washer thickness
.1295 to .1315 in. (3.27 to 3.34 mm.)	.125 to .127 in. (3.17 to 3.22 mm.)
.1315 to .1335 in. (3.34 to 3.39 mm.)	.127 to .129 in. (3.22 to 3.27 mm.)
.1335 in. to .1345 in. (3.39 to 3.42 mm.)	.129 to .131 in. (3.27 to 3.32 mm.)

Primary gear bushes

If new bushes are fitted, line-ream them to the dimensions given in Fig. A.18.

First motion shaft outer race

Removing

- (1) Extract the spring ring from above the outer race
- (2) Expand the housing by immersion in very hot water. Do not use other methods of heating the housing.

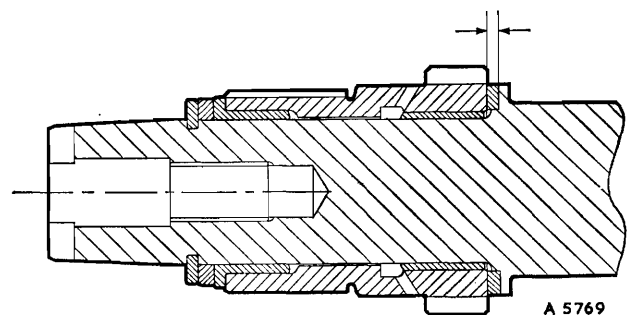


Fig. A.17

The correct running clearance is .0035 to .0065 in. (.0885 to .1645 mm.). Measure the gap indicated and fit the appropriate thrust washer as given below to obtain this clearance

When gap is	Use washer thickness
.1175 to .119 in. (2.875 to 3.025 mm.)	.112 to .114 in. (2.848 to 2.898 mm.)
.119 to .121 in. (3.025 to 3.076 mm.)	.114 to .116 in. (2.898 to 2.949 mm.)
.121 to .123 in. (3.076 to 3.127 mm.)	.116 to .118 in. (2.949 to 3.000 mm.)
.123 to .125 in. (3.127 to 3.18 mm.)	.118 to .120 in. (3.000 to 3.051 mm.)

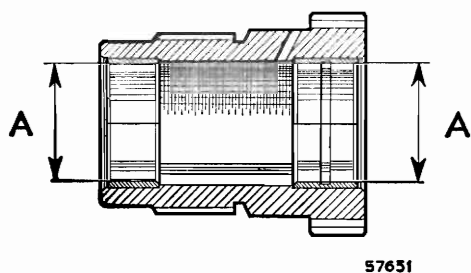


Fig. A.18

A section through the crankshaft primary gear. The bushes (A) must be line-reamed to 1.3775 to 1.3780 in. (34.98 to 35.00 mm.) after fitting (lubricated bushes only)

- (3) Withdraw the race with Service tool 18G 617 A. This operation may also be carried out using Service tool 18G 617 B with the sleeve from the original Service tool 18G 617.

Refitting

- (4) Reverse the removal instructions, driving the race into position with Service tool 18G 617 A.

Section A.19

TRANSMISSION HOUSING

Removing

- (1) Remove the engine from the car (Section A.12).
- (2) Remove the flywheel and clutch (Section A.11), and the flywheel housing (Section A.18).
- (3) Remove the starter motor.
- (4) Lift the engine to separate it from the transmission.

Dismantling

See Section F.

Refitting

Reverse the removing instructions.

NOTE.—It is important to insert the short transmission housing to crankcase screw before the crankcase is lowered onto the transmission housing and to screw it in as far as possible before the two housings are finally brought together.

Section A.20

OIL PRESSURE

The differential pressure switch fitted to the oil filter head on later models gives an indication when an oil change is required. If the warning light in the instrument

panel appears and continues to glow when the engine is running at or above idling speed, both the engine oil and the filter element must be changed as soon as possible within a maximum of the next 300 miles (500 km.).

If the oil pressure falls appreciably, check:

- (1) The quantity of oil in the sump.
- (2) The condition of the pump.
- (3) The union on the suction side of the pump.
- (4) The pick-up filter for sludge.
- (5) The condition of the bearings.

Section A.21

OIL PRESSURE RELIEF VALVE

To examine, unscrew the hexagonal domed nut and remove the folded copper washer, the valve and the spring. Check the length of the spring against the dimension given in 'GENERAL DATA'.

If the valve cup is worn reseal it using metal polish with Service tool 18G 69.

Section A.22

OIL PUMP

Removing

- (1) Remove the engine as detailed in Section A.13.
- (2) Remove the flywheel and clutch assembly and the flywheel housing as detailed in Sections A.11 and A.18.
- (3) Bend back the lock washers, remove the bolts securing the pump to the crankcase, and withdraw the pump.

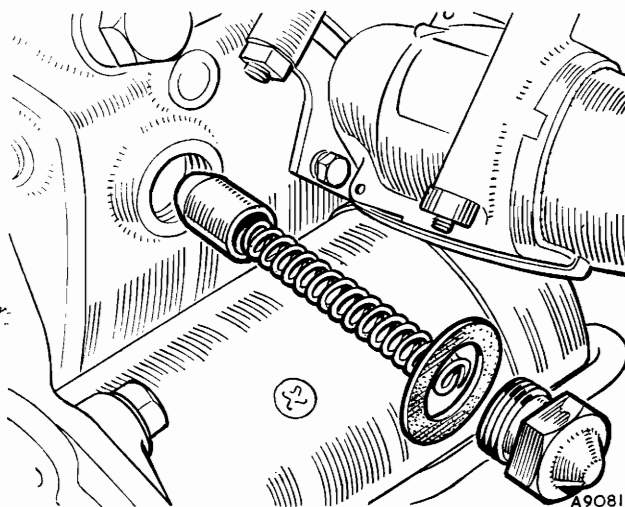


Fig. A.19

The oil pressure relief valve

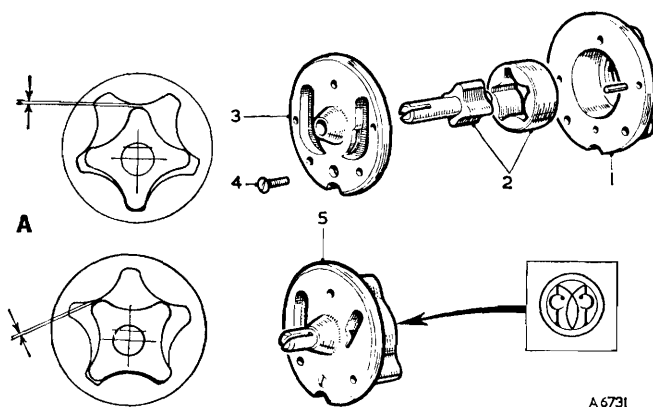


Fig. A.20

Two types of oil pump which may be fitted to this engine. 'A' indicates the lobe positions for checking clearances

Hobourn-Eaton

1. Body.
2. Shaft and rotor.
3. Cover.
4. Screw—cover to body.

Concentric (Engineering) Ltd.

5. Pump (serviced as an assembly only).

Dismantling and reassembling (Hobourn-Eaton)

- (4) The pump cover is located on the pump body by two dowels and a machine screw. When the screw is removed the pump can be separated for examination and replacement where necessary.
- (5) Install the rotors in the pump body.
- (6) Place a straight-edge across the joint face of the pump body, and measure the clearance between the top face of the rotors and the underside of the straight-edge. The clearance should not exceed .005 in. (.127 mm.). In cases where the clearance is excessive this may be remedied by removing the two cover locating dowels and lapping the joint face of the pump body.
- (7) Install the rotors in the pump body and measure the clearance between the rotor lobes when they are in the position shown in Fig. A.20. If the clearance is in excess of .006 in. (.152 mm.) the rotors must be renewed.
- (8) Reassembly is a reversal of the dismantling procedure.
- (9) After reassembling, check the pump for freedom of action.

Refitting

The refitting of the pump to the cylinder block is a reversal of the removal procedure; ensure that the intake and delivery ports are not obstructed when fitting a new paper joint washer.

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Section A.23

CAMSHAFT

Removing

- (1) Remove the engine (Section A.12), the rocker shaft assembly (Section A.5), the push-rods and tappets (Section A.9), and the distributor (Section A.10).
- (2) Unscrew the camshaft locating plate and withdraw the camshaft.
- (3) If the camshaft bearings are worn, remove the flywheel housing and transmission case (Sections A.18 and A.19).

Front liner

Extract worn liners and fit new with Service tool 18G 124 A and adaptor 18G 124 K. Line ream the new liners with Service tools 18G 123 A, 18G 123 AH, 18G 123 AJ.

COOPER

Front and rear liners

Extract worn liners and fit new using Service tools 18G 124 A with adaptor 18G 124 K for the front liner, and adaptor 18G 124 M for the rear liner. Line ream the new liners with Service tools 18G 123 A, 18G 123 BA, 18G 123 AP, 18G 123 AT, 18G 123 AN, and 18G 123 AQ.

Centre liner

Use Service tool 18G 124 A with adaptors 18G 124 K and 18G 124 B to extract the worn liner and fit a new one. Line ream the new liner, using Service tools 18G 123 A, 18G 123 BB, 18G 123 B, and 18G 123 BC.

Refitting

Reverse the dismantling and removing instructions.

Section A.24

PISTONS AND CONNECTING RODS

Pistons and bores are stamped with a number in a diamond and the number on the piston must be the same as that on the bore to which it is fitted.

Oversize pistons are marked on the crown with the oversize; this is the boring dimension and running clearance has been allowed for. Pistons are available in the sizes shown in 'GENERAL DATA'.

Removing

- (1) Remove the engine (Section A.12), the flywheel and clutch (Section A.11), the flywheel housing (Section A.18), the transmission (Section A.19), and the cylinder head (Section A.6).
- (2) Unlock and unscrew the big-end bolts; remove the bearing caps and push the connecting rod assemblies upwards through the bores.

Dismantling

- (3) Lift the rings out of their grooves and slide them off the piston. Always remove the refit rings over the top of the piston.
- (4) Hold the gudgeon pin in a vice between two plugs and unscrew the clamp bolt. Push out the gudgeon pin.

Reassembling

- (5) With the piston and gudgeon pin cold, the pin must be thumb push-fit for three-quarters of its travel and finally be tapped in with a hide mallet. Tighten the clamp bolt to the recommended torque (see 'GENERAL DATA').
- (6) Use new locking plates and tighten the connecting rod bolts to the recommended torque (see 'GENERAL DATA').

NOTE.—The second and third rings are tapered and the upper sides are marked 'T'.

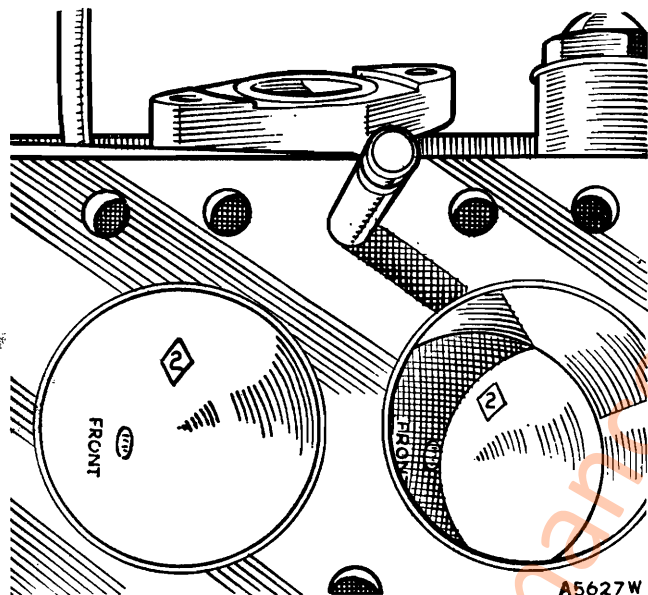


Fig. A.21

The piston markings

COOPER

(998-c.c. engine)

The gudgeon pins are fully floating with a bush in the small end of the connecting rod. The pins are retained in the piston by a circlip at either end. Should damage or wear occur, the gudgeon pin must not be renewed independently of the piston, and the small-end bush must not be renewed on its own, but only as a new connecting rod assembly.

Cooper 'S'

The gudgeon pin is a press fit in the small end of the connecting rod, and the bearing surfaces for the pin are in the piston bosses. The interference fit of the pin in the small end is the only method used to retain the gudgeon pin in its correct relative position. It is essential that the specified interference fit is maintained (see 'GENERAL DATA').

Service tool 18G 1002 must be used to remove and replace the gudgeon pin and great care is necessary to

avoid damage to the piston. Mark the piston and pin before dismantling to ensure that the pin is replaced in the same side of the piston from which it was removed.

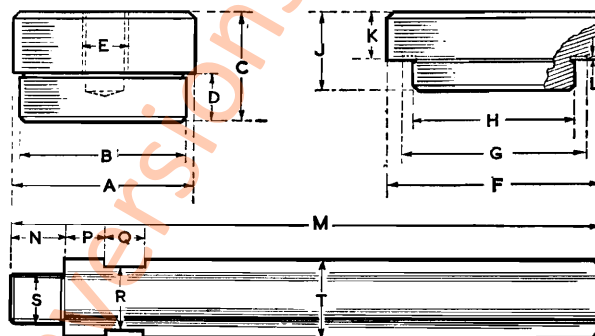
Refitting

Reverse the removal instructions, items (1) and (2).

Cylinder liners

Dry liners may be fitted and machining dimensions are given below.

A press capable of 3 tons (3000 kg.) is required to fit new liners, and of 8 tons (8000 kg.) to press out old. The dimensions of the pilots needed are given in Fig. A.22.



5563a

Fig. A.22

Cylinder liner pilots should be made to the above dimensions from case-hardening steel and case-hardened. The pilot extension should be made from 55-ton hardening and tempering steel, hardened in oil, and then tempered at 550° C. (1,020° F.)

Pressing-out pilot

- A. $\left\{ \begin{array}{l} 848\text{-c.c. engine: } 2\frac{3}{4} \pm \begin{smallmatrix} +0.005 \\ -0 \end{smallmatrix} \text{ in. } (65.48 \pm \begin{smallmatrix} +.127 \\ -0 \end{smallmatrix} \text{ mm.}) \\ 997\text{-c.c. engine: } 2\frac{1}{2} \pm \begin{smallmatrix} +0.005 \\ -0 \end{smallmatrix} \text{ in. } (65.88 \pm \begin{smallmatrix} +.127 \\ -0 \end{smallmatrix} \text{ mm.}) \\ 998\text{-c.c. engine: } 2\frac{1}{2} \pm \begin{smallmatrix} +0.005 \\ -0 \end{smallmatrix} \text{ in. } (66.68 \pm \begin{smallmatrix} +.127 \\ -0 \end{smallmatrix} \text{ mm.}) \end{array} \right.$
- B. $\left\{ \begin{array}{l} 848\text{-c.c. engine: } 2.465 \pm \begin{smallmatrix} +0 \\ -.005 \end{smallmatrix} \text{ in. } (62.61 \pm \begin{smallmatrix} -0 \\ +.127 \end{smallmatrix} \text{ mm.}) \\ 997\text{-c.c. engine: } 2.452 \pm \begin{smallmatrix} +0 \\ -.005 \end{smallmatrix} \text{ in. } (62.28 \pm \begin{smallmatrix} +0 \\ -.127 \end{smallmatrix} \text{ mm.}) \\ 988\text{-c.c. engine: } 2.537 \pm \begin{smallmatrix} +0 \\ -.005 \end{smallmatrix} \text{ in. } (64.44 \pm \begin{smallmatrix} +0 \\ -.127 \end{smallmatrix} \text{ mm.}) \end{array} \right.$
- C. All engines: $1\frac{1}{2}$ in. (44.45 mm.).
- D. All engines: $\frac{3}{4}$ in. (19.05 mm.).
- E. All engines: $\frac{3}{4}$ B.S.W. thread.

Pressing-in pilot

- F. $\left\{ \begin{array}{l} 848\text{-c.c. and } 997\text{-c.c. } 3 \text{ in. } (76.20 \text{ mm.}) \\ 998\text{-c.c. engine: } 3\frac{1}{8} \text{ in. } (77.79 \text{ mm.}) \end{array} \right.$
- G. $\left\{ \begin{array}{l} 848\text{-c.c. and } 997\text{-c.c.: } 2\frac{1}{2} \text{ in. } (66.68 \text{ mm.}) \\ 998\text{-c.c. engine: } 2\frac{1}{4} \text{ in. } (69.26 \text{ mm.}) \end{array} \right.$
- H. $\left\{ \begin{array}{l} 848\text{-c.c. engine: } 2.455 \pm \begin{smallmatrix} +0 \\ -.050 \end{smallmatrix} \text{ in. } (62.35 \pm \begin{smallmatrix} +0 \\ -.127 \end{smallmatrix} \text{ mm.}) \\ 997\text{-c.c. engine: } 2.430 \pm \begin{smallmatrix} +0 \\ -.005 \end{smallmatrix} \text{ in. } (61.72 \pm \begin{smallmatrix} +0 \\ -.127 \end{smallmatrix} \text{ mm.}) \\ 998\text{-c.c. engine: } 2.515 \pm \begin{smallmatrix} +0 \\ -.005 \end{smallmatrix} \text{ in. } (63.88 \pm \begin{smallmatrix} +0 \\ -.127 \end{smallmatrix} \text{ mm.}) \end{array} \right.$
- J. All engines: $1\frac{1}{2}$ in. (31.75 mm.).
- K. All engines: $\frac{3}{4}$ in. (19.05 mm.).
- L. All engines: .015 in. (.38 mm.).

Pilot extension

- M. $10\frac{1}{2}$ in. (31.75 cm.).
- N. $\frac{7}{8}$ in. (22.22 mm.).
- P. $\frac{3}{8}$ in. (15.87 mm.).
- Q. $\frac{3}{8}$ in. (15.87 mm.).
- R. 1 in. (25.4 mm.) flats.
- S. $\frac{3}{4}$ in. B.S.W. thread.
- T. $1\frac{1}{2}$ in. (31.75 mm.).

Engine type	Liner Part No.	Machine bores of cylinder block to this dimension before fitting liner	Outside diameter of liner	Interference fit of liner in cylinder block bore	Machine liner bore to this dimension after fitting
'A' (848 c.c.)	2A 784	2.6035 to 2.604 in. (66.128 to 66.14 mm.)	2.606 to 2.60675 in. (66.19 to 66.21 mm.)	.002 to .00325 in. (.05 to .08 mm.)	2.477 to 2.4785 in. (62.915 to 62.954 mm.)
997 c.c. (9F)	12A 391	2.6035 to 2.604 in. (66.128 to 66.14 mm.)	2.606 to 2.60675 in. (66.19 to 66.21 mm.)	.002 to .00325 in. (.05 to .08 mm.)	2.4570 to 2.4585 in. (62.408 to 62.445 mm.)
998 c.c. (9FA)	12G 164	2.64075 to 2.64125 in. (67.076 to 67.099 mm.)	2.64325 to 2.644 in. (67.139 to 67.158 mm.)	.002 to .00325 in. (.05 to .08 mm.)	2.542 to 2.5435 in. (64.571 to 64.608 mm.)

Section A.25

CRANKSHAFT AND MAIN BEARINGS

Removing

- (1) Carry out the operations described in Section A.24, items (1) and (2), and remove the timing cover (Section A.16).
- (2) Check the crankshaft end-float.
- (3) Prise out the circlip and slide the primary gear from the shaft.
- (4) Note that the main bearing caps and crankcase are numbered; withdraw the caps and bearing shells. Do not interchange caps and shells. The bottom halves of the two thrust washers will be removed with the centre bearing cap.
- (5) Lift out the crankshaft with the remaining halves of the thrust washer and the top half-shells of the main bearings.
- (6) Inspect the crankpins and journals, and the bearing shells; regrind the shaft and renew the bearings as necessary. Permissible regrind dimensions and undersize bearing sizes are given in 'GENERAL DATA'. Ensure that all oilway countersinks are machined to their original dimensions.

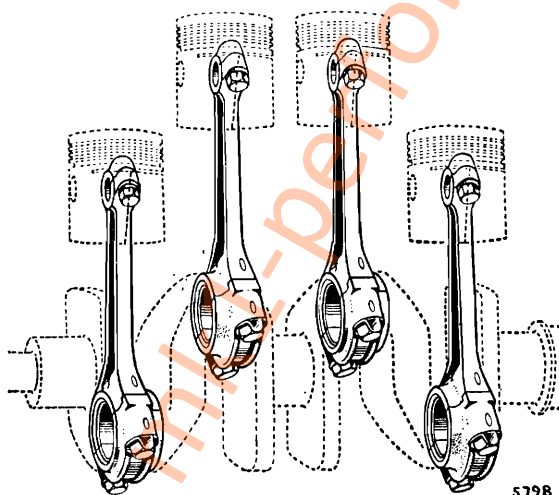


Fig. A.23

The correct assembly of connecting rods to the pistons and crankshaft

(7) Inspect the thrust washers, and fit new if necessary.

(8) Thoroughly clean the crankshaft and bearings.

Refitting

Reverse the removal instructions.

Section A.26

CRANKSHAFT AND PRIMARY GEAR

See Section A.18.

Section A.27

CRANKCASE CLOSED-CIRCUIT BREATHING

(When fitted)

Fresh air enters the engine through two holes and a filter in the filler cap on the rocker cover. The air then passes to the crankcase down the push-rod drillings. The crankcase fumes leave the engine through a breather outlet pipe on the front engine side cover. Oil droplets and mist are trapped in an oil separator before the fumes pass through a breather control valve and to the intake manifold, thus providing closed-circuit crankcase breathing.

Testing

With the engine at normal running temperature, run it at idling speed. Remove the oil filler cap. If the valve is functioning correctly the engine speed will increase by approximately 200 r.p.m. as the cap is removed, the change in speed being audibly noticeable. If no change in speed occurs, service the valve as follows.

Servicing

The crankcase breather unit should be serviced at the periods recommended in the Driver's Handbook or the Passport to Service.

Oil filler cap

- (1) Remove the combined oil filler cap and breather filter and fit a replacement at the recommended servicing period.

Breather control valve

- (2) Remove the retaining clip (1) and dismantle the valve.
- (3) Clean all metal parts with solvent (trichlorethylene, fuel, etc.). If deposits are difficult to remove, immerse in boiling water before applying the solvent. Do not use an abrasive.
- (4) Clean the diaphragm (3) with detergent or methylated spirit.
- (5) Replace components showing signs of wear or damage.
- (6) Reassemble the valve, ensuring the metering needle (4) is in the cruciform guides (6) and the diaphragm is seated correctly.

NOTE.—The 1st type valve assembly (without the cruciform guides) is serviced as an assembly.

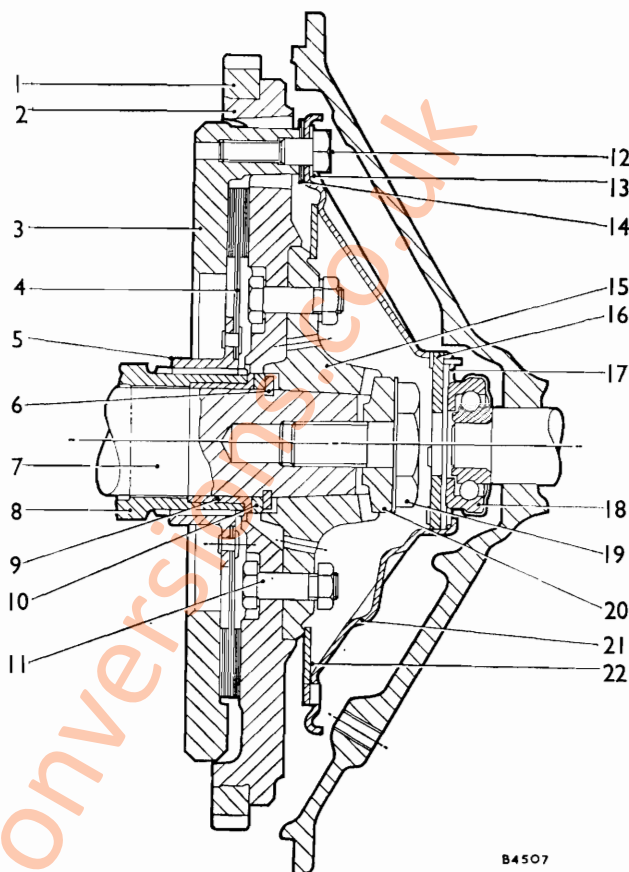


Fig. A.25

A section through the flywheel and diaphragm clutch assembly

Section A.28

FLYWHEEL AND CLUTCH
(Diaphragm Spring Clutch)

Removing

- (1) Remove the engine as in Section A.13.
- (2) Remove the clutch cover.

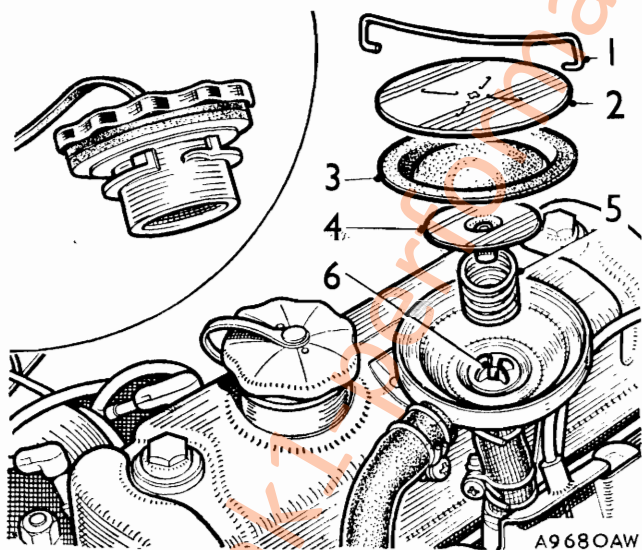


Fig. A.24

The crankcase 4-circuit breathing installation.
(In conjunction with oil filler cap filter)

1. Retaining clip.
2. Cover.
3. Diaphragm.
4. Metering needle.
5. Spring.
6. Cruciform guide.

1. Starter ring.
2. Flywheel.
3. Pressure plate.
4. Driven plate.
5. Driven plate hub.
6. Circlip.
7. Crankshaft.
8. Crankshaft primary gear.
9. Primary gear bearing.
10. Thrust washer.
11. Flywheel hub bolt.
12. Driving pin.
13. Lock washer.
14. Driving strap.
15. Flywheel hub.
16. Thrust plate.
17. Plate retaining spring.
18. Thrust bearing.
19. Flywheel screw.
20. Keyed washer.
21. Cover.
22. Diaphragm spring.

- (3) Mark the pins and the cover to ensure refitting in their original positions.
- (4) Slacken the three clutch driving pins evenly to release the spring pressure. Replace the pins as they are removed one at a time with three $\frac{5}{16}$ in. UNF. $\times 2$ in. studs to prevent the pressure plate moving out of alignment.
- (5) Remove the cover and spring assembly.
- (6) Bring Nos. 1 and 4 pistons to T.D.C. to prevent the primary gear 'C' washer falling and being wedged behind the flywheel. With the crankshaft in any other position this could happen and result in damage as the flywheel is withdrawn.
- (7) Knock up the locking washer and slacken the flywheel retaining screw three or four threads.

- (8) Use Service tools 18G 304 with adaptor set 18G 304 N (cadmium-plated) to remove the flywheel.

NOTE.—The black screws from set 18G 304 M must not be used on the diaphragm clutch.

- (9) Screw the three adaptor screws into the flywheel and fit the plate of tool 18G 304 over the screws with the retaining nuts screwed on evenly to keep the plate parallel with the flywheel.
- (10) Screw the centre bolt of adaptor set 18G 304 N through the plate of tool 18G 304. Hold the flywheel from turning and tighten the centre bolt against the flywheel retaining screw until the flywheel is released from the crankshaft taper.
- (11) Unscrew and remove the flywheel retaining screw and keyed washer and withdraw the flywheel.

Inspecting

- (12) Inspect the cover for elongation of the driving pin holes.
- (13) Inspect the driving pins for ridging and wear; fit three new pins if any are worn.
- (14) Inspect the driving straps; fit three new ones if any are worn.

Refitting

Reverse the removing instructions and carry out the following:

- (15) If the driving straps have been removed from the flywheel ensure that the spacing washers are fitted between the straps and the flywheel face.
- (16) Make certain Nos. 1 and 4 pistons are at T.D.C. to prevent the primary gear 'C' washer falling out of position.
- (17) Locate the cover and spring assembly with the clutch balance mark 'A' adjacent to the 1/4 timing mark on the flywheel (see Fig. E.2). Fit the driving pins in their original positions, tightening each a turn at a time by diametrical selection to the torque figure given in 'GENERAL DATA'.
- (18) Tighten the flywheel retaining screw to the torque figure given in the 'GENERAL DATA', and tap up the locking washer.

Section A.29

OIL COOLER

(Cooper 'S')

Removing

- (1) Remove the front grille, taking care not to lose the spacers used for each securing screw.
- (2) Hold each union on the cooler from turning and disconnect both hoses from the cooler unit.
- (3) Complete removal of both hoses is effected in this manner—holding each union in turn on the oil

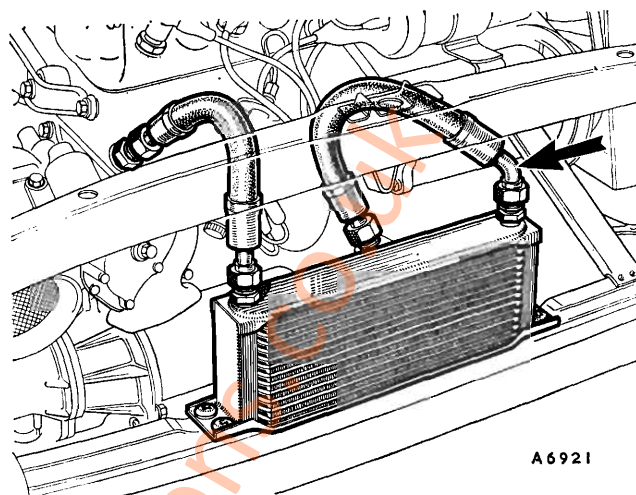


Fig. A.26

The 13 tube oil cooler fitted to the Cooper 'S'. The arrow indicates the angled hose connection

filter head and the crankcase whilst releasing the hoses.

- (4) Remove the cooler unit securing screws and remove the unit through the grille aperture.

Refitting

- (5) Refit the cooler unit and tighten the securing screws.
- (6) Connect each hose to its respective position on the oil cooler. If replacement hoses are fitted connect the hose with the angled connection to the oil cooler with its other end connected to the filter head. Ensure that the hoses are not under stress from twist—hold each union with a spanner whilst tightening the hose connections.
- (7) Start and run the engine and check for oil leakage.
- (8) Top up the engine oil to the 'MAX' level on the dipstick.
- (9) Refit the front grille, see item (1).

Section A.30

PRIMARY GEAR OIL SEAL REPLACEMENT

Removing

- (1) Remove the engine as in Section A.13.
- (2) Remove the flywheel and clutch, Section A.11 (coil spring type) or Section A.28 (diaphragm spring type).
- (3) Remove the primary gear 'C' washer.
- (4) Screw the centre bolt of Service tool 18G 1068 securely into the crankshaft.
- (5) Pull the primary gear outwards as far as possible. Pass the body of Service tool 18G 1068 over the centre bolt until the groove in the primary gear is visible inside the tool body. Fit the two half collars

of the tool into the groove on the gear and unscrew the winged nut anti-clockwise to withdraw the primary gear and oil seal clear of the housing.

Refitting

- (6) Liberally lubricate the new oil seal, and using protector sleeve Service tool 18G 1043 over the primary gear fit the oil seal onto the gear.
- (7) Ensure that the primary gear thrust washer is correctly positioned on the crankshaft shoulder and fit the primary gear onto the crankshaft making sure that the gear teeth are starting to engage with the idler gear.
- (8) Check also that the oil seal, whilst contacting the flywheel housing bore, is still seated on the sealing surface of the gear.
- (9) Pass the body of Service tool 18G 1068 over the crankshaft and screw the winged nut down the centre bolt until the base of the tool contacts the lip of the housing bore, whereby the seal is correctly fitted.
- (10) Remove the Service tool and refit the flywheel and clutch.
- (11) Refit the engine as in Section A.13.

Section A.31

FLYWHEEL RETAINING SCREW THREAD

The flywheel retaining screw thread in the end of the crankshaft is ~~not~~ Standard Whitworth but is Whitworth form:

Diameter $\frac{1}{2}$ in. 16 T.P.I. $1\frac{1}{8}$ in. full thread.

If it is found necessary to clean up the thread, the operation must be confined to cleaning up. This thread is highly stressed and must always be up to full size.

Section A.32

GEAR CHANGE REMOTE CONTROL ASSEMBLY

Removing

- (1) Remove the front floor covering, the gear lever knob, and the rubber gaiter.
- (2) From beneath the car, remove the securing screws and nuts from the extension rear support bracket (see Fig. A.12).
- (3) Remove the four bolts securing the extension to the transmission casing and detach the extension.

Dismantling

- (4) Remove the rubber dust cover, and slacken the lever locating pin.
- (5) Remove the screws securing the change speed lever retainer and withdraw the lever, retainer, and spring.
- (6) Lift out the distance piece and spring flange.
- (7) Remove the remote control shaft damper assembly and the screw securing the remote control shaft to the primary shaft lever. Withdraw the shaft and the lever from the housing.

Inspection

Clean and examine all components for wear, and fit new parts as required.

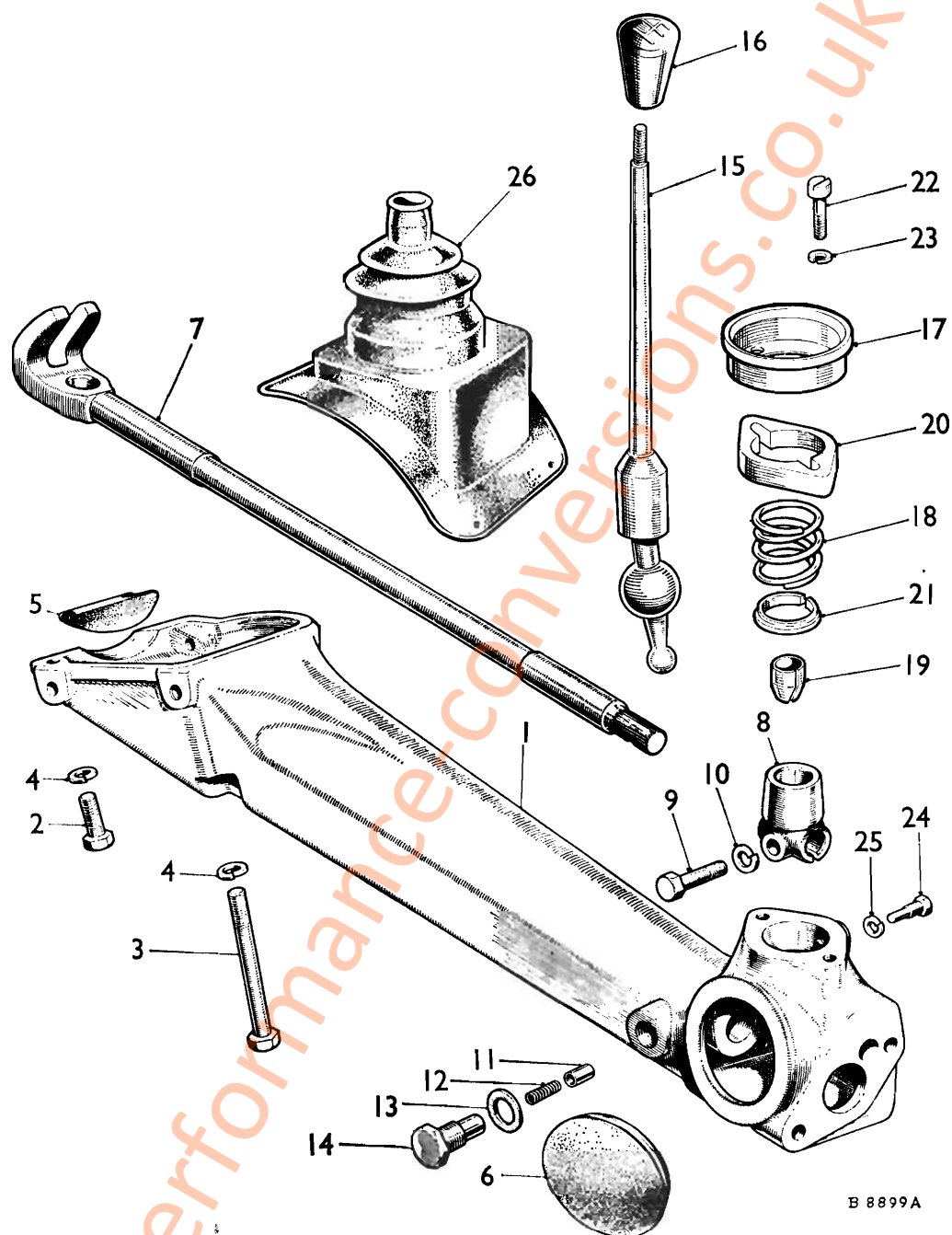
Reassembling

- (8) Reassemble all components in the reverse order of dismantling. Lubricate the operating surfaces of all components with grease.

Refitting

- (9) Reverse the removing procedure, ensuring that the rubber plug is correctly located between the extension and the transmission casing.

GEAR CHANGE REMOTE CONTROL COMPONENTS



B 8899A

No. Description

1. Housing.
2. Securing screw—short.
3. Securing screw—long.
4. Spring washers.
5. Rubber plug.
6. Rubber dust cover.
7. Primary shaft.
8. Primary shaft lever.
9. Lever—screw.
10. Spring washer.
11. Damper plunger.
12. Plunger spring.
13. Washer.

No. Description

14. Cap nut—spring retainer.
15. Change speed lever.
16. Lever knob.
17. Retainer.
18. Spring.
19. Bush—split.
20. Distance piece.
21. Flange.
22. Screw—retainer to housing.
23. Spring washer.
24. Locating pin.
25. Spring washer.
26. Gaiter—change speed lever.

SECTION Aa

THE ENGINE

The information given in this Section refers specifically to engines fitted with automatic transmission and must be used in conjunction with Section A

											<i>Section</i>
Camshaft	..	..	..	..	..	..	..	..	..	..	Aa.9
Converter output gear	..	..	..	..	..	..	..	..	..	..	Aa.13
Converter housing oil seal replacement	..	..	..	..	..	..	..	..	..	..	Aa.15
Crankshaft and main bearings	..	..	..	..	..	..	..	..	..	..	Aa.11
Cylinder liners	..	..	..	..	..	..	..	..	..	..	Aa.14
Distributor driving spindle	..	..	..	..	..	..	..	..	..	..	Aa.6
Engine and transmission	..	..	..	..	..	..	..	..	..	..	Aa.3
Engine mountings	..	..	..	..	..	..	..	..	..	..	Aa.12
Exhaust system	..	..	..	..	..	..	..	..	..	..	Aa.5
Lubrication	..	..	..	..	..	..	..	..	..	..	Aa.1
Oil filter	..	..	..	..	..	..	..	..	..	..	Aa.2
Oil pump	..	..	..	..	..	..	..	..	..	..	Aa.8
Pistons and connecting rods	..	..	..	..	..	..	..	..	..	..	Aa.10
Transmission unit	..	..	..	..	..	..	..	..	..	..	Aa.4
Valve timing	..	..	..	..	..	..	..	..	..	..	Aa.7

Section Aa.1

LUBRICATION

Engine/transmission oil level

- (1) Start the engine and run for 1-2 minutes. Switch off the ignition and wait for 1 minute.
- (2) Check the oil level with the dipstick and top up if necessary with the recommended oil to the 'MAX' mark on the dipstick.

Changing the engine/transmission oil

The oil should be drained at the periods recommended in the Driver's Handbook and whilst it is warm and fluid.

- (3) Remove the magnetic drain plug from the right-hand side of the transmission casing and allow the oil to drain. Clean (using non-fluffy cloth) and refit the drain plug.
- (4) Refill the engine/transmission unit with the recommended oil to the 'MAX' mark on the dipstick.
- (5) Carry out items (1) and (2).

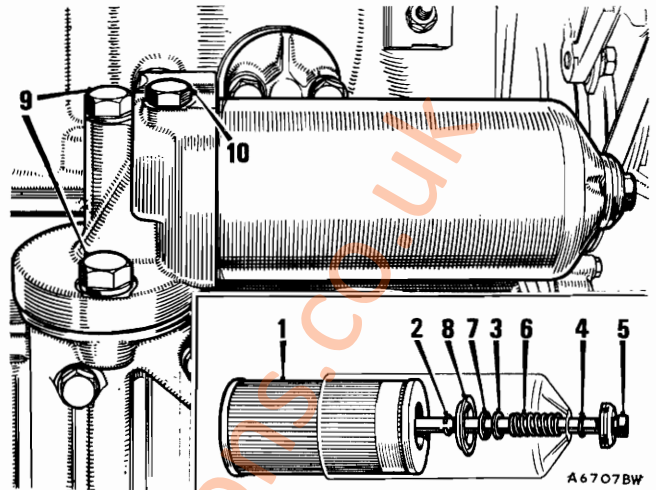


Fig. Aa.1

The engine/transmission oil filter. (Inset) the filter components

- | | |
|--------------------|---------------------------------|
| 1. Filter element. | 6. Spring. |
| 2. Circlip. | 7. Sealing washer. |
| 3. Steel washer. | 8. Sealing plate. |
| 4. Sealing ring. | 9. Filter head retaining bolts. |
| 5. Centre bolt. | 10. Oil pressure check plug. |

Section Aa.2

OIL FILTER

Element replacement

Removing

- (1) Remove the front grille.
- (2) Place a suitable container beneath the oil filter.
- (3) Unscrew the central retaining bolt and remove the bowl and element assembly.

Cleaning

- (4) Thoroughly clean the filter bowl with petrol (fuel) and dry off.
- (5) Wipe the filter head clean and fit a new sealing ring in the filter head recess.

Refitting

- (6) Reassemble the filter bowl with a new element and the internal components fitted in the order shown in Fig. Aa.1. Ensure that the internal seating washer is in good condition and a snug fit on the retaining bolt.
- (7) Refit the filter bowl assembly and tighten the central retaining bolt to the torque figure given in 'GENERAL DATA'.
- (8) Check for oil leakage immediately the engine is started.
- (9) Top up the engine oil level following the instructions in Section Aa.1.
- (10) Refit the front grille.

Filter head and bowl assembly

Removing

- (11) Release the distributor cap.
- (12) Unscrew the filter head retaining bolts and remove the assembly.

NOTE.—The oil filter head to front cover joint washer (with copper inserts) fitted to later units is **not** interchangeable with those fitted to the earlier units. The two 'O' ring oil seals are not used on the later units (see Fig. Aa.2 for correct location of the later-type joint washer).

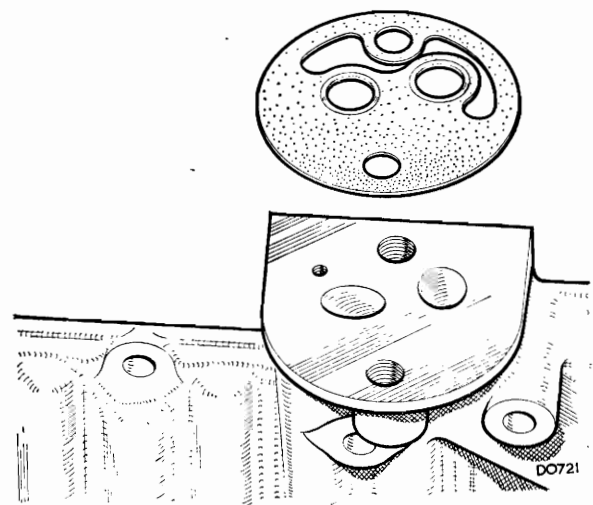
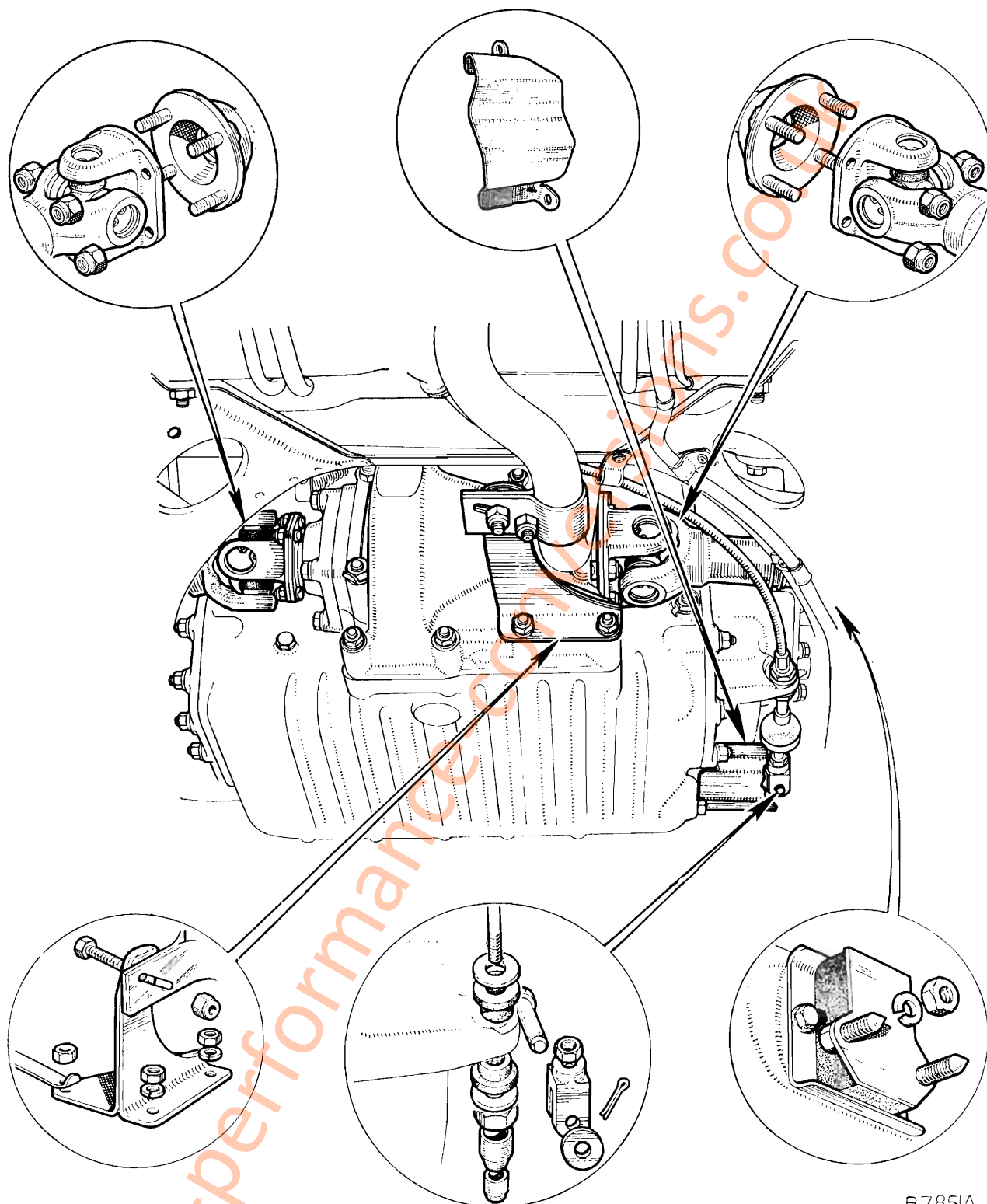


Fig. Aa.2

The correct location of the later-type filter head/front cover joint washer



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Fig. Aa.3

The main components to be disconnected or removed from below the car before removing the engine and transmission unit

Refitting

- (13) Reverse the removal instructions, fitting a new joint washer and seals (if fitted). Tighten the securing bolts to the torque figure in 'GENERAL DATA.'
- (14) Carry out items (8) and (9).

Section Aa.2**ENGINE AND TRANSMISSION****Removing**

- (1) Disconnect the battery earth cable and remove the bonnet.

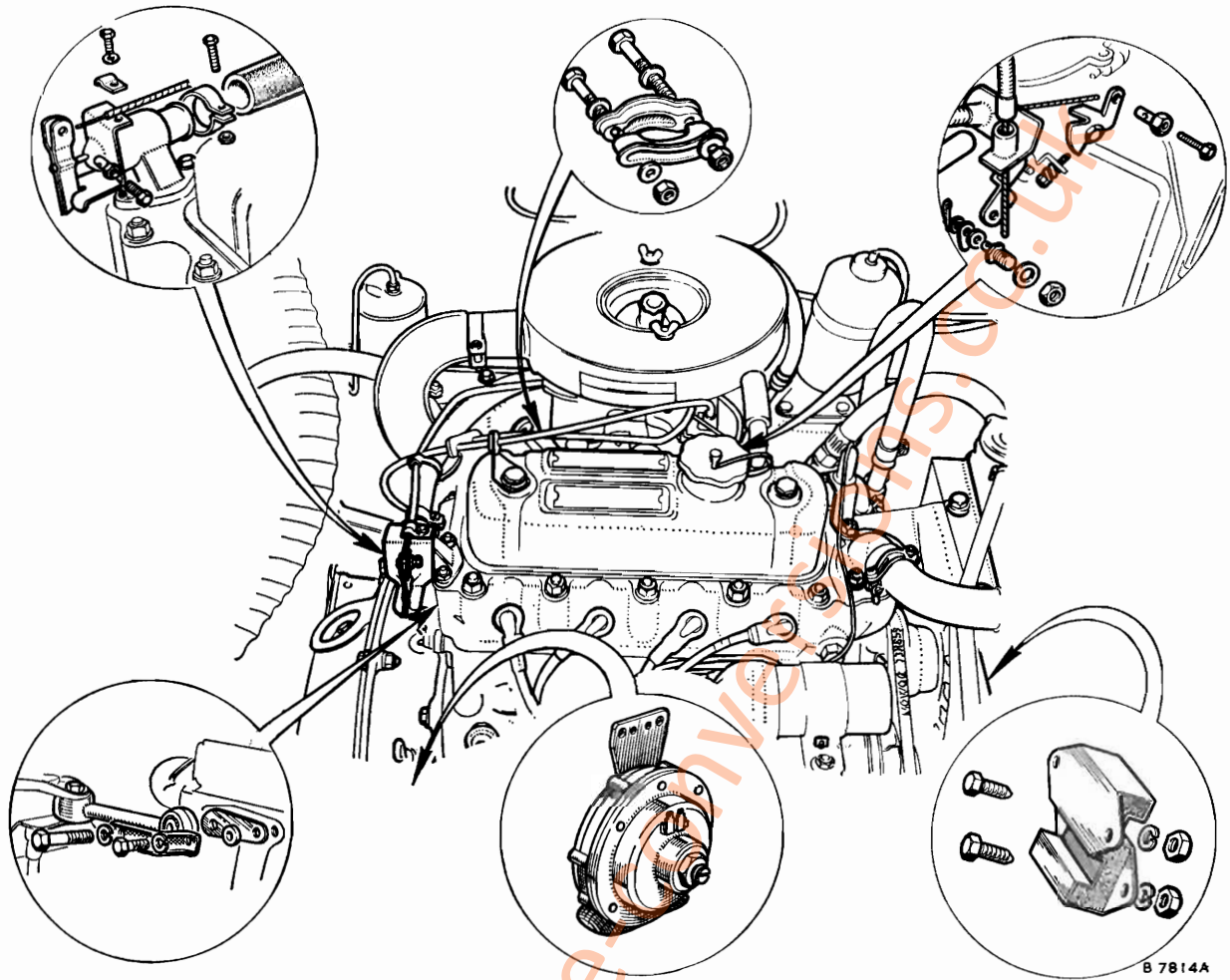


Fig. Aa.4

The main components to be disconnected or removed from above the car before removing the engine and transmission unit

- (2) Raise the front of the car until the wheels are free to rotate and remove the drive shaft flange securing nuts.
- (3) Remove the weather protection cover (if fitted) or pull back the rubber sleeve and disconnect the

gear selector cable by removing the clevis pin. Slacken the yoke clamp nut and remove the yoke, nut, and rubber ferrules and sleeve. Remove the cable front adjusting nut from the outer cable and pull the cable clear of the transmission.

- (4) Remove the exhaust bracket from the final drive cover. The larger nut is secured by a locking tab (see Fig. Aa.3).
- (5) Drain the cooling system as in Section C.2.
- (6) Disconnect the heater hoses and the water control valve cable. Slacken the fixing clips on the heater fresh air tube connections on the grille and the wing valance and swing the tube clear of the engine bay.
- (7) Disconnect all electrical connections from the engine.
- (8) Remove the distributor cap.
- (9) Remove the air cleaner as in Section Da.1.
- (10) Remove the carburettor as in Section Da.2.
- (11) Disconnect the speedometer cable from the rear of the instrument.
- (12) Disconnect the oil pressure gauge hose.
- (13) Disconnect and remove the horn.

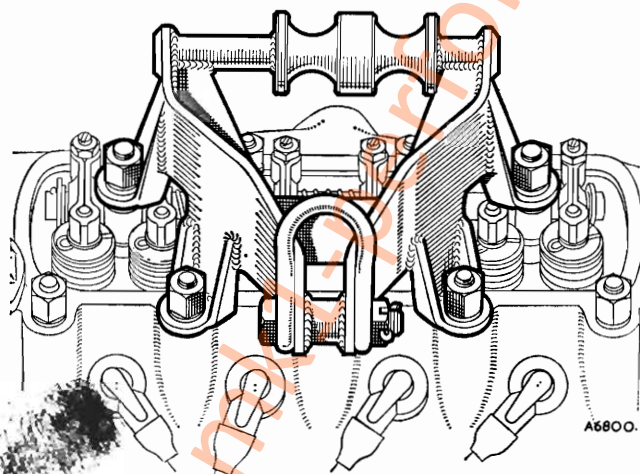


Fig. Aa.5

Use the individual front lifting eye of the attachment to give an angled lift when removing and refitting the power unit

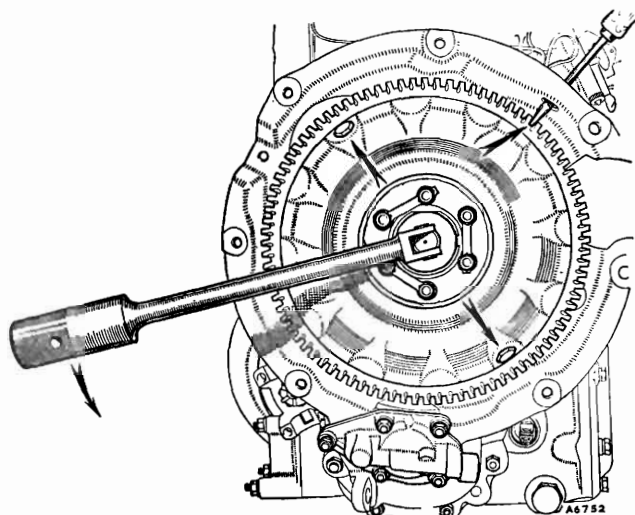


Fig. Aa.6

Removing the converter centre bolt, using Service tool 18G 587. A suitable screwdriver inserted through the converter housing to stop the converter turning, and the converter drain plugs, are indicated by arrows

- (14) Disconnect the exhaust pipe from the manifold and secure the pipe against the bulkhead.
- (15) Disconnect the tie-rod from the cylinder block and swing the rod away from the engine.
- (16) Remove the rocker cover nuts and fit the engine lifting bracket (Fig. Aa.5).
- (17) Remove the set screws securing each engine mounting to the sub-frame.
- (18) Lift the engine sufficiently to release the drive shafts from the driving flanges, and remove the engine/transmission unit from the car.

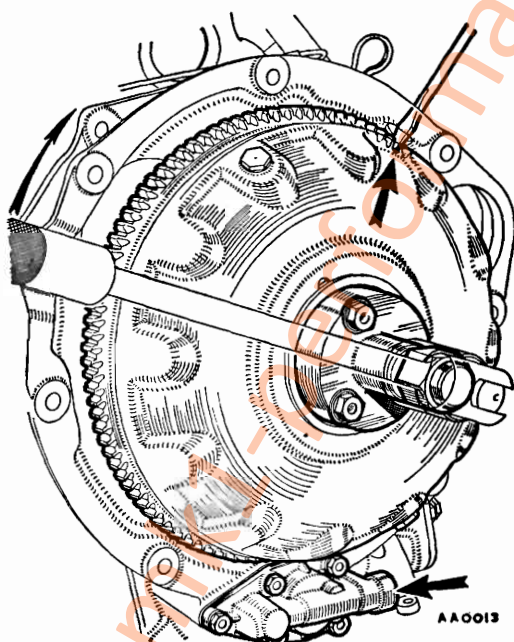


Fig. Aa.7

Removing the converter using Service tool 18G 1086. A screwdriver to stop the converter turning, and the low pressure valve, are indicated by the arrows

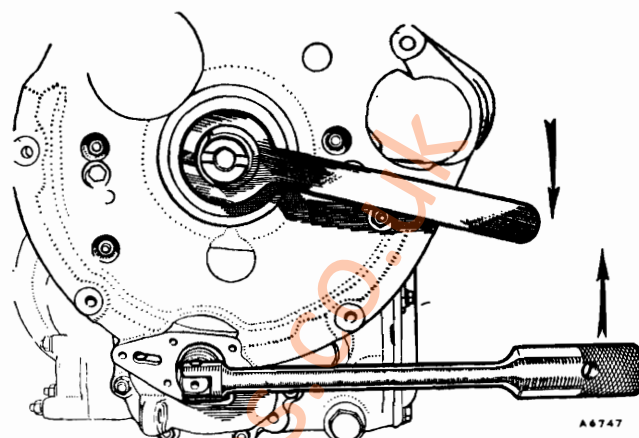


Fig. Aa.8

Using Service tool 18G 1088 to hold the converter output gear when removing the input gear nut

Refitting

- (19) Reverse the removal instructions with particular attention to the following points.
- (20) Lower the engine/transmission unit to a position where the drive shafts can engage the driving flange studs and screw the securing nuts on approximately four threads. Lower the unit completely into the car.
- (21) Adjust the gear selector rod and cable as in Section Fa.2.
- (22) Top up the engine with oil as described in Section Aa.1.

Section Aa.4

TRANSMISSION UNIT

Removing

- (1) Remove the engine and transmission (see Section Aa.3).

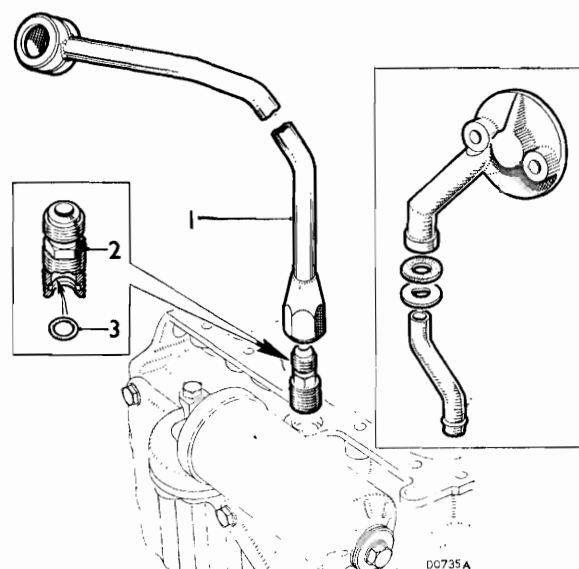


Fig. Aa.9

The engine oil feed pipe (1), adaptor (2) with the internal 'O' ring seal (3). Inset shows the early type pipe assembly

- (2) Remove the radiator mounting bracket from the transmission case.
- (3) Remove the starter motor and converter cover.
- (4) Drain the transmission.
- (5) Knock back the lock washer on the converter centre bolt. Hold the converter from turning with a suitable screwdriver inserted through the hole in the converter housing. Using Service tool 18G 587, remove the centre bolt (Fig. Aa.6).
- (6) Knock back the locking tabs and remove three equally spaced set screws from the converter centre. Ensure that the slot in the end of the crankshaft is horizontal. Using Service tool 18G 1086 with the adaptor correctly positioned, remove the converter (Fig. Aa.7). Remove the Service tool and refit the three screws.
- (7) Remove the low-pressure valve from the converter housing.
- (8) Fit Service tool 18G 1088 onto the converter output gear and remove the input gear self-locking nut (Fig. Aa.8).
- (9) Remove the gear change bell-crank lever clevis pin and nut and lift off the bell-crank lever. Remove the bell-crank lever pivot.
- (10) Fit the nylon protector sleeve Service tool 18G 1098 over the converter output gear.
- (11) Remove the nuts and set screws securing the converter housing to the transmission and lift away the housing. Remove the converter oil outlet pipe from the housing.
- (12) Lever the main oil feed pipe from the transmission and oil pump.

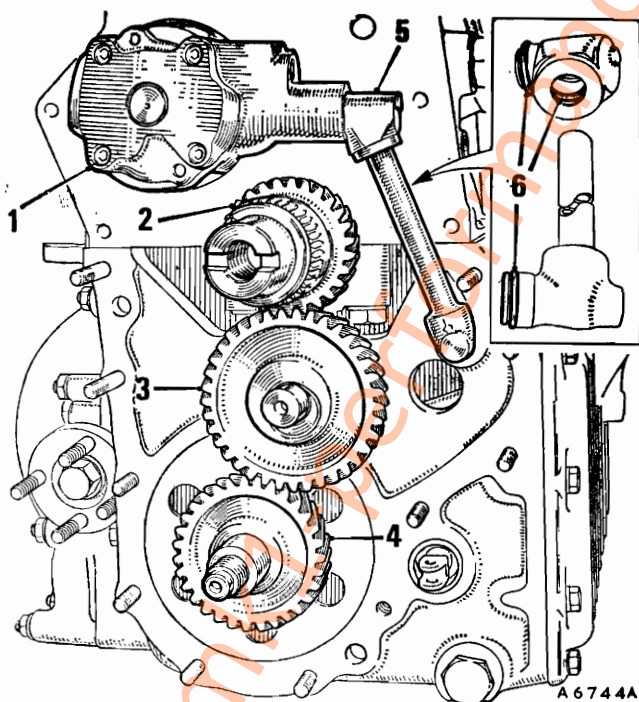


Fig. Aa.10

The converter housing removed showing:

- | | |
|---------------------------|-------------------|
| 1. Main oil pump. | 4. Input gear. |
| 2. Converter output gear. | 5. Oil feed pipe. |
| 3. Idler gear. | 6. Sealing rings. |

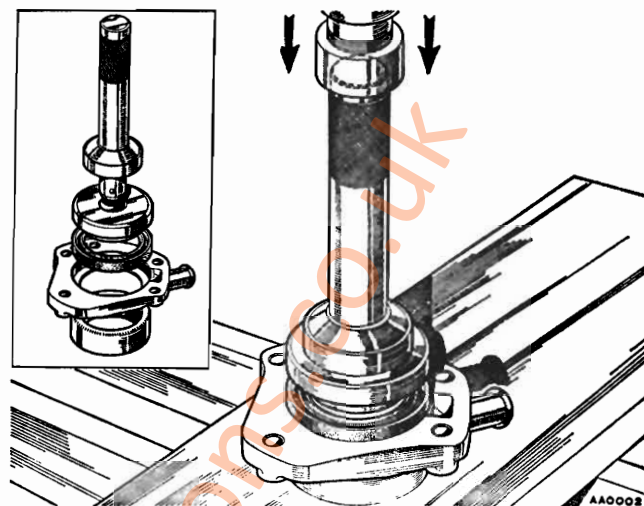


Fig. Aa.11

Replacing the converter output gear oil seal. Pressing the seal in, using Service tools 18G 134 and adaptor 18G 134 CN, with (inset) showing exploded view

- (13) Remove the idler gear, thrust washers, and the converter output gear assembly.
- (14) Remove the oil filter assembly and disconnect the engine oil feed pipe together with, (on early units) its rubber seal and spring washer (see Fig. Aa.9).
- (15) Remove the nuts and set screws securing the engine to the transmission and with suitable lifting equipment lift away the engine from the transmission.

Inspecting

Ensure that the oil rings fitted to the main oil pipe, oil filter, transmission to engine oil feed pipe, and the main oil strainer pipe are in perfect condition. All joint faces must be free from burrs and new joint washers should be used.

Inspect the idler gear bearings and renew if necessary, using Service tool 18G 581 to remove the bearings from the casings. Inspect the input gear bearing and renew if necessary by removing the circlip and pressing the bearing from the housing.

Check the main oil seals and renew if necessary. If it is necessary to renew the converter housing oil seal this operation is detailed in Section Aa.15. To renew the converter output gear oil seal, remove the rear case assembly and carefully remove the seal. Lubricate the new seal and press into the casing, using Service tools 18G 134 and 18G 134 CN (Fig. Aa.11).

Refitting

- (16) Immerse the front main bearing cap moulded rubber oil seal in oil and fit with the lip facing the rear of the engine.
- (17) Fit the rubber sealing ring on to the main oil strainer pipe and fit new gaskets to the transmission case.
- (18) Lower the engine on to the transmission. Ensure that the moulded rubber seal is correctly located. Tighten the set screws and nuts as the transmission is being lowered in position.

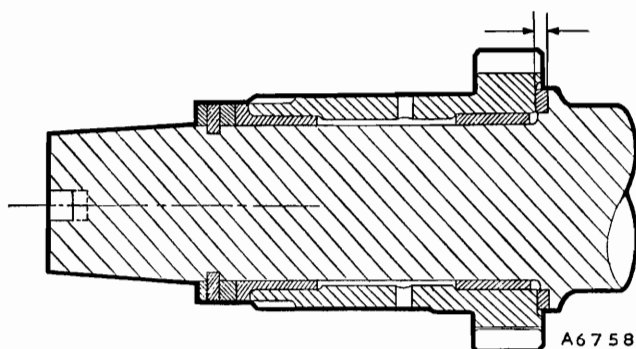


Fig. Aa.12

The converter output gear. Measure the gap indicated and fit the appropriate thrust washer

- (19) Refit the transmission to engine oil feed pipe, with the spring beneath the rubber seal and refit the oil filter assembly.
- (20) Refit the main oil pump to transmission oil pipe.
- (21) Trim off any excess transmission joint from the rear of the unit. Clean the surfaces and fit a new converter housing gasket.
- (22) Refit the converter output gear. When refitting, make certain that the correct running clearance of .0035 to .0065 in. (.089 to .165 mm.) is maintained between the inner thrust washer and the converter output gear. If the clearance is outside these limits, select and fit the appropriate washer from the size range, with the chamfered inner edge of the washer to face the crankshaft.

Converter output gear thrust washers

- .112 to .114 in. (2.848 to 2.898 mm.)
- .114 to .116 in. (2.898 to 2.949 mm.)
- .116 to .118 in. (2.949 to 3.0 mm.)
- .118 to .120 in. (3.0 to 3.051 mm.)

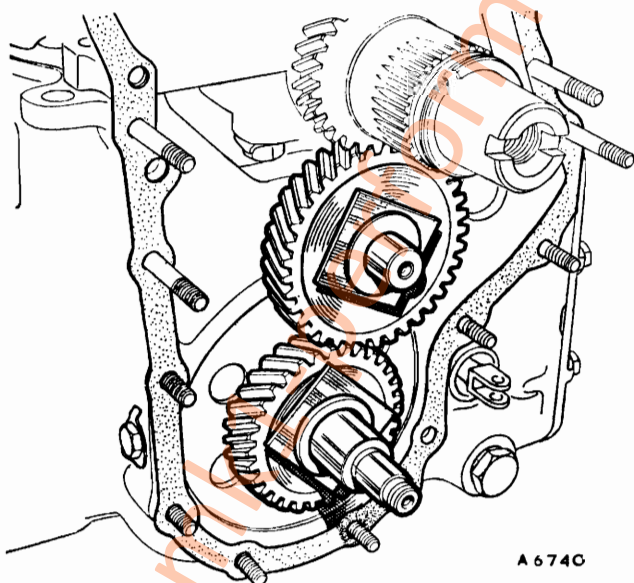


Fig. Aa.13

The idler and input gears fitted with the Service tool, 18G 1089 (two sets of special washers, each set interposed with a wax washer)

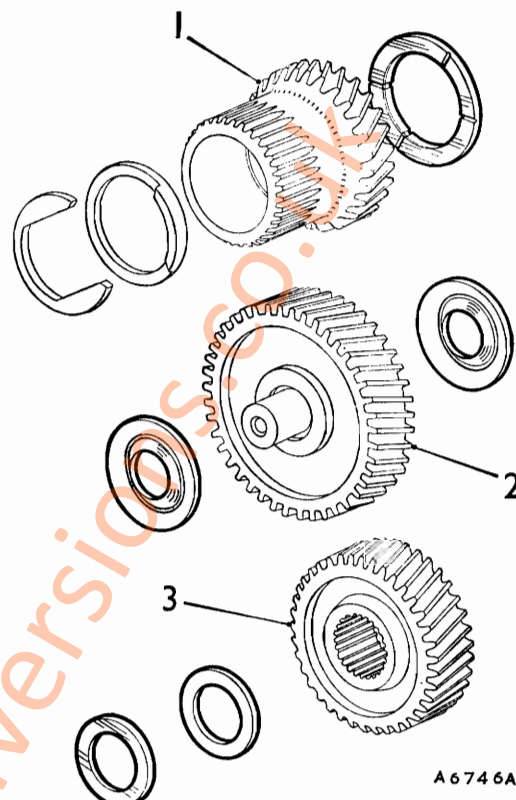


Fig. Aa.14

The converter output (1), idler (2), and input gear (3) with their respective thrust washers

NOTE.—Two types of input gears have been used, those fitted to earlier units have two thrust washers (Fig. Aa.14). The later gear (of increased hub thickness) has a number of thin shims fitted to the outer hub face of the gear for adjustment (see Fig. Aa.19).

Idler and input gear adjustment (Early Models)

- (23) Assemble the idler gear to the transmission with a nominal washer (from the range fitted), on the

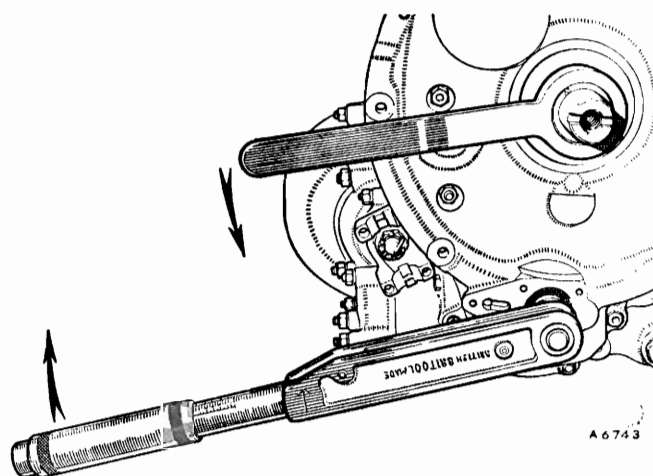


Fig. Aa.15

Using Service tools 18G 1088 to hold the converter output gear and 18G 592 to tighten the input gear nut to the correct torque figure

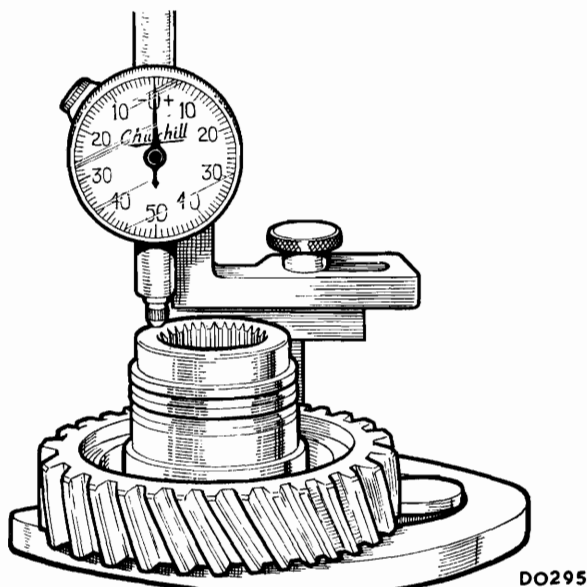


Fig. Aa.16

Using Service tools 18G 191 and 18G 191 A, with the dial test indicator set at zero

transmission side of the idler gear. Assemble Service tool 18G 1089 with a dental wax washer interposed on to the converter housing side of the idler gear. To cut the holes in the wax strip, place the larger washers of 18G 1089 one on either side of the wax, opposite each other, and press together.

- (24) Fit input Service tool 18G 1089 interposed with a dental wax washer (Fig. Aa.13).

NOTE.—If the input gear will not fully mesh with the idler gear, this indicates that the third speed reaction gear thrust washer has become displaced. Therefore it is necessary to remove, dismantle, and reassemble the gear train as detailed in Section Fa.7 (all items except (1)).

- (25) Screw the two pilot bars of Service tool 18G 1043 into the two bottom tapped holes in the crankcase. Fit the nylon protector sleeve Service tool 18G 1098 over the converter output gear and refit the converter housing; tighten into position to the correct torque figure given in 'GENERAL DATA'. The input shaft nut must not be fitted.
- (26) Remove the converter housing.
- (27) Measure the thickness of the idler gear thrust washer plus the thickness of the Service tool 18G 1089 and its dental wax washer. From this figure subtract .004 to .007 in. (.102 to .178 mm.) to give the total thickness of the thrust washers to be fitted to provide the correct idler gear end-float.

Idler gear thrust washers

- .132 to .133 in. (3.35 to 3.37 mm.)
- .134 to .135 in. (3.40 to 3.42 mm.)
- .136 to .137 in. (3.45 to 3.47 mm.)
- .138 to .139 in. (3.50 to 3.53 mm.)

- (28) Measure the thickness of the input gear Service

tool 18G 1089 plus its dental wax washer. Add .001 to .003 in. (.025 to .076 mm.) to this figure to give the total thickness of the thrust washers to be fitted to provide the required 'nip' on the input gear bearing.

Input gear thrust washers

- .128 to .130 in. (3.25 to 3.30 mm.)
- .132 to .134 in. (3.35 to 3.40 mm.)
- .140 to .142 in. (3.55 to 3.61 mm.)
- .148 to .150 in. (3.76 to 3.81 mm.)
- .152 to .154 in. (3.86 to 3.91 mm.)

- (29) (a) Fit one washer on each side of the idler gear as calculated in item (27).
- (b) Fit two washers to make up the calculated thickness onto the input gear shaft. Both washers must be fitted to the outside of the input gear (see Fig. Aa.14), with the chamfered inside edge of one washer towards the gear.

Idler and input gear adjustment (Later Models)

- (30) Carry out item (23).
- (31) Place the input gear on a surface plate or onto Service tool 18G 191 A and use a dial test indicator gauge, Service tool 18G 191, to take a mean reading. Set the dial gauge to zero as shown in Fig. Aa.16.
- (32) Fit Service tool adaptor 18G 1089 A over the input shaft. Use Service tool 18G 1089/1 to cut a dental wax washer, and fit the wax washer with Service tool 18G 1089/1 over the input shaft (see Fig. Aa.17).
- (33) Carry out items (25) and (26).
- (34) Fit a new converter housing joint washer and ensure that NO shims are sticking to the input gear bearing. Lubricate the oil seal lip, refit the housing and tighten to the torque figure given in

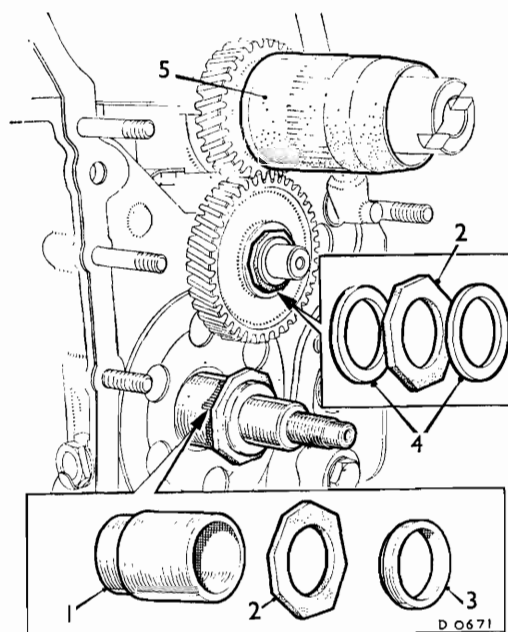


Fig. Aa.17

1. Service tool 18G 1089 A.
2. Wax washer.
3. Service tool 18G 1089/1.
4. Service tool 18G 1089 with wax washer interposed.
5. Service tool 18G 1098.

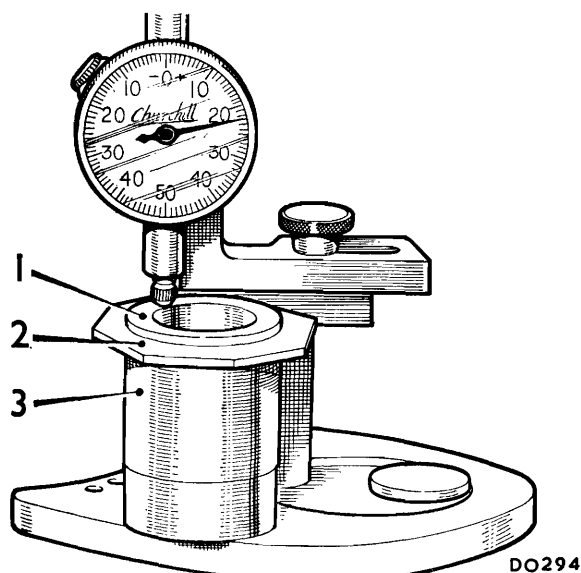


Fig. Aa.18

Measuring the adaptor assembly

1. Service tool 18G 1089/1.
2. Wax washer.
3. Service tool 18G 1089 A.

'GENERAL DATA'. The input shaft nut must not be fitted.

- (35) Remove the converter housing and withdraw the adaptor assembly 18G 1089 A, wax washer, and 18G 1089/1. Substitute this complete assembly for the input gear on the surface plate (see Fig. Aa.18).
- (36) Use the dial test indicator gauge, Service tool 18G 191, and measure the thickness of this assembly (see Fig. Aa.18). The mean reading obtained indicates the total thickness of shims required to eliminate end-float. To this figure add shims to the value of .001 to .003 in. (.025 to .076 mm.) to give the required input bearing preload.

Input gear adjustment shims

- .003 in. (.076 mm.).
- .012 in. (.305 mm.).

- (37) Measure the thickness of the idler gear thrust washer plus the thickness of the Service tool 18G 1089 and its dental wax washer. From this figure subtract .004 to .007 in. (.102 to .178 mm.) to give the total thickness of the thrust washers to be fitted to provide the correct idler gear end-float.

Idler gear thrust washers

- .132 to .133 in. (3.35 to 3.37 mm.)
- .134 to .135 in. (3.40 to 3.42 mm.)
- .136 to .137 in. (3.45 to 3.47 mm.)
- .138 to .139 in. (3.50 to 3.53 mm.)

- (38) (a) Fit the required thickness of shims as calculated in item (36) onto the outside of the input gear (see Fig. Aa.19).
- (b) Fit one washer on each side of the idler gear (see Fig. Aa.19) as calculated in item (37).

Refitting

- (39) Refit and align the converter outlet pipe.

- (40) Discard the converter housing joint washer used during the idler and input gear adjustment operations. Refit the converter housing with a new joint washer, remove the pilot bars of Service tool 18G 1043 and tighten the securing nuts and set screws to the torque figures given in 'GENERAL DATA'.

- (41) Refit the input gear shaft nut and tighten to the correct torque figure (see 'GENERAL DATA'), using Service tools 18G 1088 and 18G 592.

- (42) Remove each pair of bolts in turn from the converter and fit new locking plates. Tighten the bolts to the torque figure given in 'GENERAL DATA', and tap up the locking tabs.

NOTE.—Do not remove all six screws from the converter centre at one time.

- (43) Lubricate the converter oil seal and refit the converter. Refit the washer (offset pegs) and the centre bolt with its lock washer. Tighten the bolt to the correct torque figure (see 'GENERAL DATA') with Service tools 18G 587 and 18G 592 and lock up the lock washer.

- (44) Refit the low pressure valve and gasket.

- (45) Refit the gear selector bell-crank lever, clevis pin, and rubber boot.

- (46) Refit the converter cover, the starter motor, and the rear engine mounting.

- (47) For refitting the engine and transmission to the car (see Section Aa.3).

Section Aa.5**EXHAUST SYSTEM****Removing**

- (1) Slacken the exhaust pipe to manifold clamp.

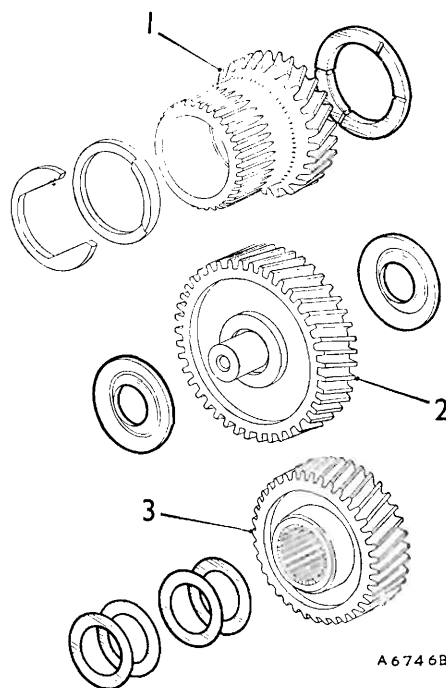


Fig. Aa.19

The converter output (1), idler (2), and input gear (3) with their respective thrust washers and shims

- (2) Release the pipe from the bracket on the final drive casing (Fig. Aa.3) and from the two locations on the rear sub-frame.

Refitting

- (3) Refit the exhaust system to the car with the intermediate and rear support clips loose to allow articulation at the manifold spherical flange.
- (4) Align the pipe flange with the manifold, refit and tighten the manifold clamp.
- (5) Ensure correct alignment of the system and tighten the remaining fixing points.

Section Aa.6

DISTRIBUTOR DRIVING SPINDLE

Removing

- (1) Remove the distributor and driving spindle as detailed in Section A.10.

Refitting

- (2) Refitting is described in Section A.10 with the following exceptions.
- (3) To rotate the crankshaft, insert a screwdriver through the aperture (adjacent the oil dipstick) on the converter housing, and turn the converter starter ring gear to the position described in Section A.10.
- (4) Check that the 1/4 timing mark on the converter is in line with the pointer on the converter housing (Fig. Ba.1).

Section Aa.7

VALVE TIMING

- (1) Follow the instructions given in Section A.17 with the following exceptions.
- (2) Rotate the crankshaft as described in Section Aa.6 until the 5° B.T.D.C. timing mark on the converter is opposite the pointer on the converter cover.

Section Aa.8

OIL PUMP

Removing

- (1) Remove the engine and transmission as detailed in Section Aa.3.
- (2) Remove the converter and converter housing as detailed in Section Aa.4, items (3) to (12).
- (3) Remove the pump securing screws and withdraw the pump.

Dismantling and reassembling

- (4) Follow the instructions given in Section A.22 for the Hobourn-Eaton pump.

Refitting

- (5) Reverse the removal instructions fitting new joint washers as required.

Aa.10

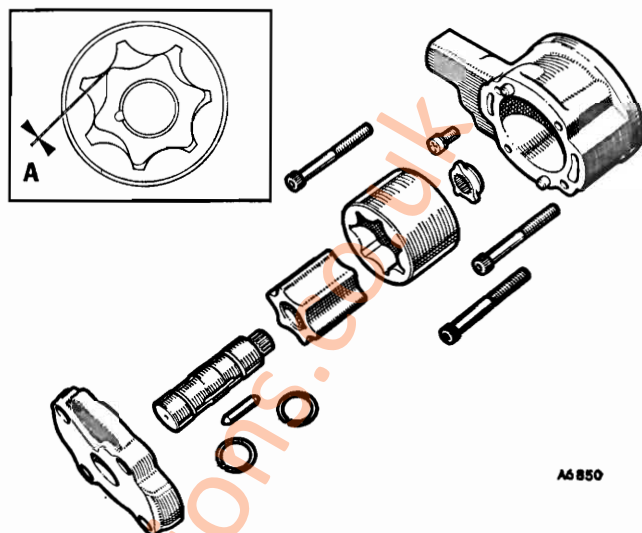


Fig. Aa.20

The oil pump components. A indicates the lobe positions for checking clearances

Section Aa.9

CAMSHAFT

NOTE.—Extreme care is necessary when removing the camshaft. The oil pump drive coupling may stick by oil adhesion to the camshaft and possibly fall into the transmission unit. Ensure therefore when refitting the camshaft that this drive coupling is fully located on the splined oil pump spindle.

Removing

- (1) Follow the instructions given in Section A.23 with the following exceptions.
- (2) Remove the engine and transmission as detailed in Section Aa.3.
- (3) Should the front camshaft bearing clearance be excessive, a new bearing liner must be fitted and as this will entail line-reaming after fitting, both the converter, converter housing, and the transmission unit must be removed as in Section Aa.4.
- (4) For removing, fitting, and reaming a new liner follow the instructions in Section A.23.

Refitting

- (5) Refitting is a reversal of the removal procedure given in Section A.23.

Section Aa.10

PISTONS AND CONNECTING RODS

Removing

- (1) Follow the instructions given in Section A.24 with the following exceptions.
- (2) Remove the engine and transmission unit as detailed in Section Aa.3.

- (3) Remove the converter, converter housing, and the transmission unit from the engine as detailed in Section Aa.4.

Refitting

- (4) Refitting is a reversal of the removing procedure (see Sections A.24 and Aa.3-4).

Section Aa.11

CRANKSHAFT AND MAIN BEARINGS

Removing

- (1) Follow the instructions given in Section A.25 with the following exceptions.
- (2) Remove the engine and transmission unit as detailed in Section Aa.3.
- (3) Remove the converter, converter housing, and the transmission unit from the engine as detailed in Section Aa.4.

Refitting

- (4) Follow the refitting instructions for installation of the crankshaft and bearings given in Section A.25
- (5) Carry out the inspection and refitting of the transmission unit as detailed in Section Aa.4.

Section Aa.12

ENGINE MOUNTINGS

Removing

Left-hand mounting

- (1) Follow the instructions in Section A.14.

Right-hand mounting

- (2) Disconnect the battery earth cable.
- (3) Disconnect the electrical connections from the starter solenoid and remove it from the wing valance.
- (4) Disconnect the engine tie-rod from the rear of the cylinder block and the exhaust down pipe from the manifold flange.
- (5) Remove the two nuts and set screws securing the mounting to the sub-frame.
- (6) Lift the rear of the engine sufficiently to remove the securing nuts and bolts from the converter cover and the starter motor. Turn the cover slightly anti-clockwise and remove the cover complete with the engine mounting.
- (7) Unscrew the set screws to release the mounting from the cover.

Refitting

- (8) Refitting is a reversal of the removal procedure.

Section Aa.13

CONVERTER OUTPUT GEAR

Removing

- (1) Remove the engine and transmission as detailed in Section Aa.3.
- (2) Carry out the removing instructions as detailed in Section Aa.4, items (3) to (11) and (13).

Adjusting

- (3) Carry out the instruction given in Section Aa.4, item (22).

Refitting

- (4) Refitting is a reversal of the removal procedure.

Section Aa.14

CYLINDER LINERS

Follow the instructions in Section A.24 with the following exceptions.

- (1) Remove the engine and transmission from the car as detailed in Section Aa.3.
- (2) Remove the transmission unit from the engine as detailed in Section Aa.4.

Section Aa.15

CONVERTER HOUSING OIL SEAL REPLACEMENT

Removing

- (1) Remove the engine from the car as detailed in Section Aa.3.
- (2) Remove the starter motor and converter cover.

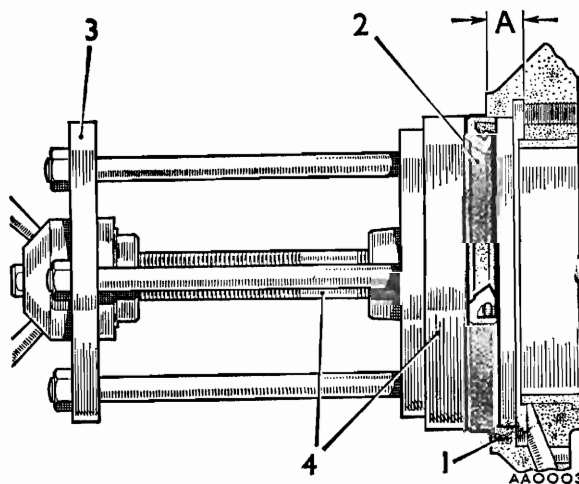


Fig. Aa.21

A section through of fitting the converter housing oil seal. A = the depth measurement to be taken

- | | |
|-----------------------|--|
| 1. Converter housing. | 3. Service tool 18G 1068. |
| 2. Oil seal. | 4. Service tool adaptor set 18G 1068A. |

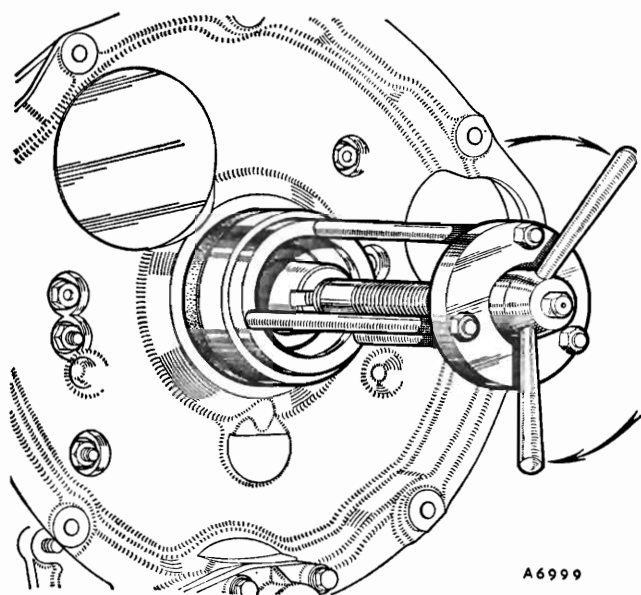


Fig. Aa.22

Fitting the converter output gear oil seal, using Service tool 18G 1068 with adaptor 18G 1068 A

- (3) Remove the converter (Section Aa.4, items (5) and (6)).
- (4) Remove the old seal, using Service tool 18G 1087. Hook the tool into the oil seal groove and tap outwards on the tool, working round the seal until it is removed.

Refitting

The new seal must be fitted to the correct depth in order that the oil drain hole behind the seal remains open.

- (5) Take a depth measurement from any convenient point on the periphery of the housing bore of the front face of the housing to the undercut face (see Fig. Aa.21). This measurement will be approximately $\frac{3}{8}$ in. (9.5 mm.), but should it be more or less than this measurement this must be taken into account and either added to or subtracted from $\frac{3}{8}$ in. (9.5 mm.).

Example: If measurement is $\frac{3}{8}$ in. (9.5 mm.) fit the new seal to be flush with the front face of the converter housing. If measurement is less than $\frac{3}{8}$ in. (9.5 mm.) fit the seal proud of the face by the difference of measurement obtained.

NOTE.—The converter housing face is not machined, therefore, the initial measurement position and that used when fitting a new seal must always be taken from the same position on the housing.

- (6) Screw in the short threaded end of Service tool 18G 1068 A securely into the crankshaft.
- (7) Liberally lubricate the new oil seal.
- (8) Assemble the new seal together with Service tool 18G 1068 into position (see Fig. Aa.22).
- (9) Screw in the wing nut of the tool until the seal is pressed in to the depth of the measurement (see item (5)).
- (10) The remainder is a reversal of the removing procedure.
- (11) Check and top up oil level (Section Aa.1).

SECTION B

THE IGNITION SYSTEM

												<i>Section</i>
Capacitor	..	..	..	..	..	..	..	..	..	..	..	B.4
Distributor	..	..	..	..	..	..	..	..	..	..	..	B.1
Sparking plugs	..	..	..	..	..	..	..	..	..	..	..	B.3
Timing	..	..	..	..	..	..	..	..	..	..	..	B.2

Section B.1

DISTRIBUTOR

Removing

- (1) Turn the crankshaft until Nos. 1 and 4 pistons are at T.D.C., the rotor arm is pointing to No. 1 segment in the cap and the points are just breaking.
- (2) Disconnect the low-tension lead from the terminal on the side of the distributor, and the suction advance pipe from the union.
- (3) Take out the two set screws securing the clamp plate and pull out the distributor. Do not loosen the clamp plate pinch bolt.

NOTE.—The position of the driving dog slot. The distributors on later models have an 'O' ring oil seal fitted to the mounting shank.

Dismantling

Contact breaker only

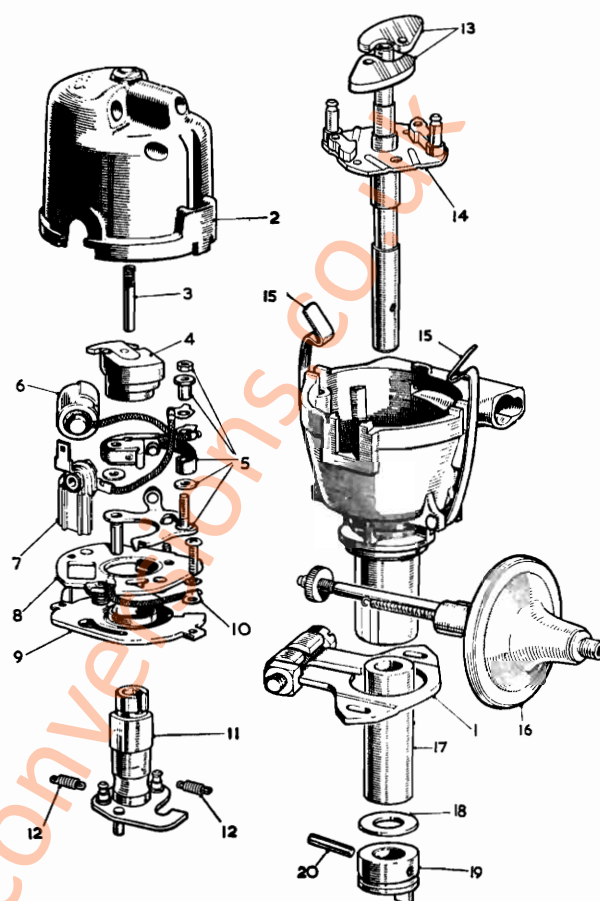
- (4) Remove the rotor arm and the slotted nylon low-tension terminal insulator from the distributor body.
- (5) Take out the two screws, ease up the contact breaker plate and unhook the flexible actuating link.

Distributor assembly

- (6) Pull off the rotor arm.
- (7) Unscrew the nut and remove the nut and washer from the moving contact anchor pin.
- (8) Withdraw the insulating sleeve from the capacitor and low-tension connectors. Lift off the moving contact and the large insulating washer from the anchor pin.
- (9) Take out the screw and spring and flat washers securing the fixed contact plate and remove the plate.
- (10) Remove the capacitor.
- (11) Take out the two screws securing the base plate (one also carries the earth lead) and lift out the base plate.
- (12) Unhook the flexible actuating link connecting the diaphragm of the suction advance unit.
- (13) Take out the cam retaining screw, disconnect the toggle springs and remove the cam.

Note the relative positions of the drive slot in the cam spindle and the offset driving dog to ensure that the timing is not 180° out when the cam spindle is re-engaged with the centrifugal weights during reassembly.

- (14) Lift out the centrifugal weights.
- (15) Remove the circlip, adjusting nut and springs, and withdraw the suction advance unit.
- (16) Drive out the pin passing through the collar of the driving dog member at the lower end of the spindle; withdraw the spindle from the body.



A2426B

Fig. B.1

The components of the distributor

- | | |
|-------------------------------------|--------------------------------|
| 1. Clamping plate. | 12. Automatic advance springs. |
| 2. Moulded cap. | 13. Weight assembly. |
| 3. Brush and spring. | 14. Shaft and action plate. |
| 4. Rotor arm. | 15. Cap-retaining clips. |
| 5. Contacts (set). | 16. Vacuum unit. |
| 6. Capacitor. | 17. Bush. |
| 7. Terminal and lead (low-tension). | 18. Thrust washer. |
| 8. Moving contact breaker plate. | 19. Driving dog. |
| 9. Contact breaker base plate. | 20. Taper pin. |
| 10. Earth lead. | |
| 11. Cam assembly. | |

NOTE.—The Cooper 'S' distributor is not fitted with a suction advance device; therefore items (12) and (15) are not applicable.

Inspecting

- (17) Clean the cap and examine for cracks and signs of tracking; renew if necessary.
- (18) Make sure that the carbon brush moves freely in the cap.
- (19) If the metal electrode on the rotor arm is slack or badly burned, fit a new arm.
- (20) Clean the contact breaker points, or fit a new set if they are badly pitted or burnt.
- (21) Check the fit of the movable contact arm, balance weights, cam assembly, and the shaft in the body; fit new where necessary.

NOTE.—Before fitting a new shaft bush immerse it in engine oil for 24 hours, or for two hours in oil heated to 100° C. (212° F.).

Reassembling

- (22) Reverse the dismantling procedure with the following additional work.
 - (23) Refers to items (13) and (14). Lubricate with thin engine oil.
 - (24) Refers to item (14). When engaging the cam driving pins with the centrifugal weights, make sure they are in their original positions. When seen from above the small offset of the driving dog must be on the right, and the driving slot for the rotor arm in the six o'clock position.
 - (25) Check the oil sealing ring on the mounting shank and fit a new seal if necessary (later models only).
 - (26) Refers to item (15). Turn the suction control adjusting nut to the half-way position when refitting.
- If the clamp bolt has been slackened for any reason, when refitting the distributor to the engine, to ensure correct alignment, screw in the two clamp plate securing screws finger-tight only, tighten the clamp bolt to the correct torque tightness (see 'GENERAL DATA'), then tighten the securing screws fully.

Section B.2

TIMING

If the distributor has been removed, refer to Section A.10.

Setting

- (1) Remove the sparking plugs and the flywheel inspection cover.
- (2) Turn the manual adjuster to the central position.

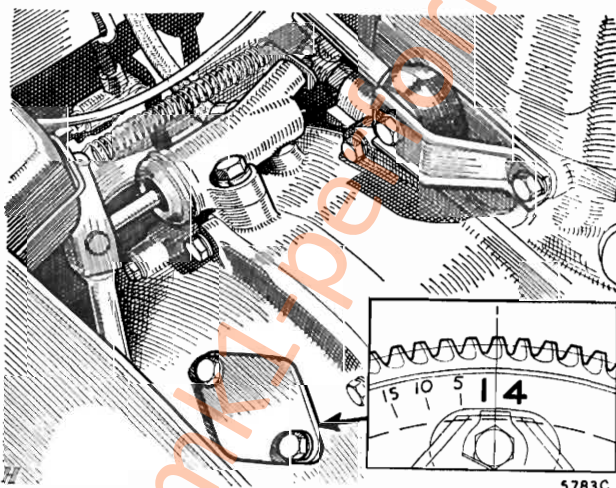


Fig. B.2

The timing marks on the flywheel, and the indicator, may be seen with the aid of a mirror after removing the inspection plate on the clutch cover

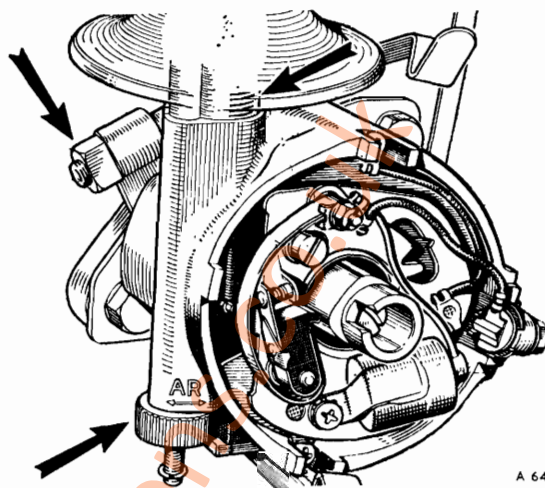


Fig. B.3

The distributor clamp plate pinch-bolt and vernier scale. The lower arrow indicates the ignition firing point adjusting nut

- (3) Remove the distributor cap.
- (4) Adjust the gap at the points.
- (5) Turn the flywheel in the direction of engine rotation until the correct timing mark on the flywheel is opposite the indicator. The No. 1 piston is on compression and the rotor pointing to No. 1 segment in the cap. For the correct timing mark see 'GENERAL DATA'.
- (6) With the indicator opposite the correct timing mark, the distributor contact points are just about to break.
- (7) Turn the knurled adjuster towards 'R' if the points break before, and towards 'A' if they break after the timing mark. Each graduation on the adjuster spindle is equal to about 5° of flywheel movement and 55 clicks on the adjuster.
- (8) If further adjustment is required, slacken the distributor clamp bolt and turn the distributor clockwise to retard and anti-clockwise to advance the firing point.
- (9) Tighten the clamp and check.

Checking points opening—electrical

Connect a 12-volt battery and bulb in parallel with the contact points: when the bulb lights the points have just opened.

Stroboscopic check

If this method is used do not run the engine fast enough to operate the centrifugal weights.

When the vacuum advance take-off is directly from the induction manifold disconnect it before checking.

Section B.3

SPARKING PLUGS

Remove, clean, and adjust the sparking plugs at the recommended intervals and if they are suspected to be the cause of poor performance:

- (1) Blow all dirt from around the plugs before unscrewing them; remove the plugs and gaskets.
- (2) Clean the plugs with abrasive blasting equipment.
- (3) Adjust the gaps with a Champion Sparking Plug Tool, bending the side electrode only.
- (4) Clean the gasket seatings in the cylinder head and screw the plugs with gaskets into position. If the original gaskets have been compressed to less than half their thickness, fit new. Tighten the plugs to the recommended torque (see 'GENERAL DATA').

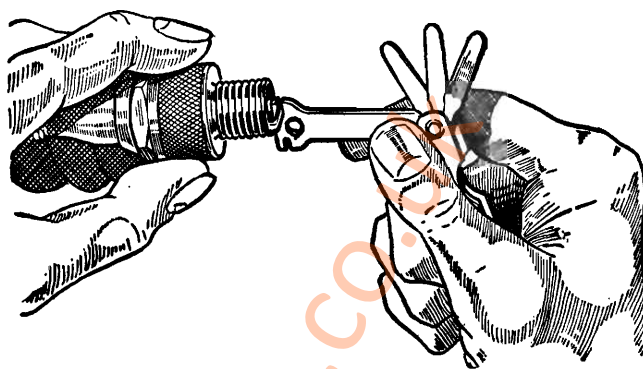


Fig. B.4

Reset the gap, using a Champion special gap setting tool shown above

Section B.4

CAPACITOR

If the capacitor is suspected check by substitution of a new one and note the difference, if any, in the engine running.

SECTION Ba

THE IGNITION SYSTEM

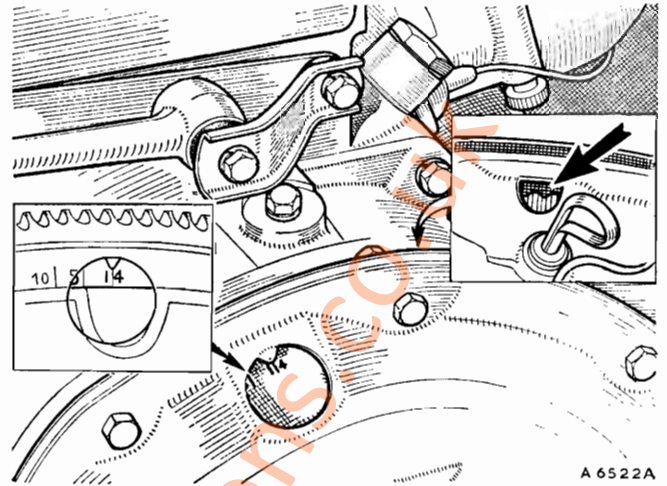
The information in this Section refers specifically to engines fitted with automatic transmission and must be used in conjunction with Section B

Timing the ignition	<i>Section</i> Ba.1
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Section Ba.1

TIMING THE IGNITION

- (1) Follow the instructions given in Section B.2 with the following exceptions.
- (2) To rotate the crankshaft, insert a screwdriver through the aperture (adjacent to the oil dipstick) on the converter housing, and turn the starter ring gear in the direction of engine rotation to the position described in Section B.2, item (5).
- (3) The three timing marks can be seen on the converter (Fig. Ba.1) after removal of the rubber grommet on the converter end cover.

**Fig. Ba.1**

The timing marks on the converter, T.D.C. position is indicated by the 1/4 shown inset; 5° and 10° marks are also provided. The hole in the converter housing (shown inset) used for inserting a suitable tool to turn the converter

SECTION C

THE COOLING SYSTEM

													<i>Section</i>
Fan belt	..	..	..	..	..	..	..	..	..	..	..	..	C.2
Frost precautions	..	..	..	..	..	..	..	..	..	..	..	..	C.4
Radiator	..	..	..	..	..	..	..	..	..	..	..	..	C.1
Thermostat	..	..	..	..	..	..	..	..	..	..	..	..	C.5
Water pump	..	..	..	..	..	..	..	..	..	..	..	..	C.3

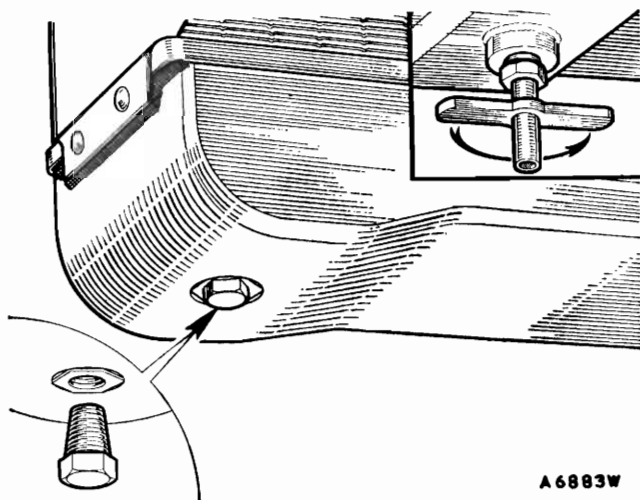


Fig. C.1

The radiator drain plug or tap

Section C.1

RADIATOR

The cooling system is under considerable pressure when hot.

Take off the cap slowly, turning it anti-clockwise until you feel the tongues engage the lobes on the end of the filler cam. Allow the pressure to fall before turning further and removing the cap.

Draining

- (1) Drain the system, using the taps (or plugs if fitted) at the base of the radiator and at the rear of the cylinder block.

Flushing

- (2) Flush the system periodically by running water through until it comes out clear. If the radiator is excessively furred up, remove it and flush through in the reverse direction (in through the bottom hose connection) using the reverse flush adaptor 18G 187 with a 1 in. (25 mm.) hose.

Filling

- (3) Close the drain tap(s) or refit the drain plug(s). Fill to the level indicator in the radiator top tank. Use only the recommended anti-freeze when necessary.

Removing

- (4) Remove the bonnet and drain the system.
- (5) Remove the cowl upper support bracket and the two bolts securing the lower support bracket to the engine mounting.

C.2

One-piece cowl

- (6) Disconnect the top hose and completely remove the lower.
- (7) Take out the four screws securing the radiator to the cowl and lift off the radiator and cowl.

Two-piece cowl

- (8) Disconnect the top and bottom hoses.
- (9) Take out the six screws securing the radiator to the cowl and remove the top half of the cowl.
- (10) Bend the lower hose to the outside of the cowl and lift out the radiator.

COOPER

Removing

- (11) Drain the system and remove the bonnet and grille.
- (12) Disconnect the top hose.
- (13) Detach the upper mounting bracket.
- (14) Remove the top half of the cowl.
- (15) Take out the two screws in the bottom half of the cowl securing the lower mounting bracket.
- (16) Disconnect the heater hose from the bottom radiator hose and the radiator hose.
- (17) Remove the fan and lift out the radiator.

Refitting

Reverse the removal instructions.

Section C.2

FAN BELT

Removing

- (1) Slacken the dynamo pivot and adjusting link bolts.
- (2) Lift the dynamo and run the belt off the crankshaft pulley.
- (3) Manoeuvre the belt between the fan blades and the right-hand top of the cowl.

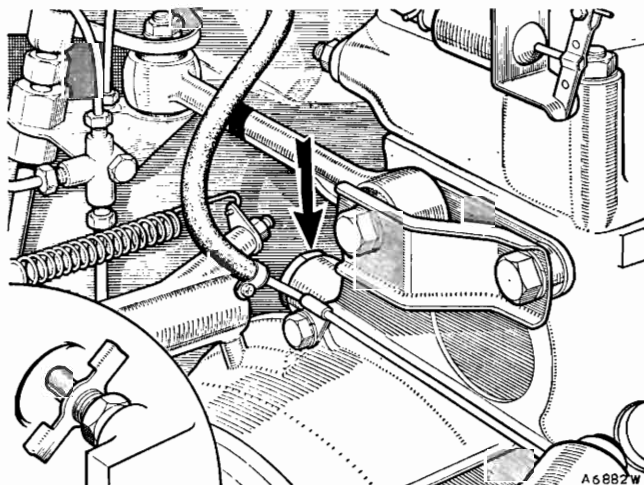


Fig. C.2

The cylinder block drain plug or tap

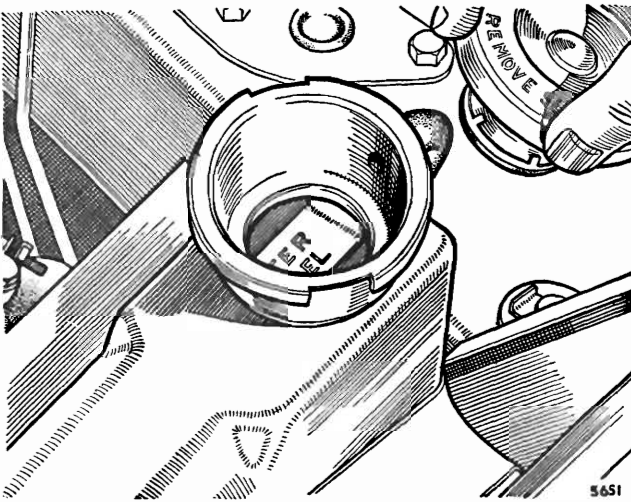


Fig. C.3

The filler cap of the sealed cooling system removed, showing the water level indicator

- (4) If the fan is 16-bladed, feed the belt between individual blade tips and the cut-out in the cowl flange.

Refitting

Reverse the removing instructions.

Adjusting

Adjust the tension by moving the dynamo so that the belt can be moved 1 in. (25 mm.) at the centre of its longest run.

Section C.3

WATER PUMP

Removing

- (1) Drain the system and remove the radiator.
- (2) Disconnect the hose from the water pump inlet connection and slacken the top clip of the by-pass hose.
- (3) Unscrew four set screws and lift off the pump.

Dismantling

- (4) Withdraw the bearing locating wire through the hole in the top of the pump body.
- (5) Tap the spindle backwards to extract the spindle and bearing assembly.
- (6) Pull the vane from the spindle and remove the seal.

Reassembling

Reverse the dismantling instructions.

Refitting

Reverse the removing instructions.

Section C.4

FROST PRECAUTIONS

Damage due to freezing can be prevented by draining the system when the car is not in use, or by the addition of anti-freeze. When a heater is fitted anti-freeze must be used as there is no provision for satisfactorily draining the heater matrix.

Use only an anti-freeze of the ethylene glycol type: Bluecol is recommended. Also, any anti-freeze to B.S.3151 or B.S.3152 is approved.

Quantity of anti-freeze required

Anti-freeze %	Commences to freeze		Frozen solid		Amount of anti-freeze		
	° C.	° F.	° C.	° F.	Pts.	U.S. Pts.	Litres
25	-13	9	-26	-15	1½	1.8	.85
33½	-19	-2	-36	-33	2	2.5	1.18
50	-36	-33	-48	-53	3½	3.75	1.8

Section C.5

THERMOSTAT

Removing

- (1) Drain the cooling system (Section C.1.).
- (2) Disconnect the top hose and remove the cowl upper support bracket.
- (3) Remove the securing nuts and spring washers from the thermostat cover and the cover from its studs.
- (4) Remove the paper joint washer and lift out the thermostat.

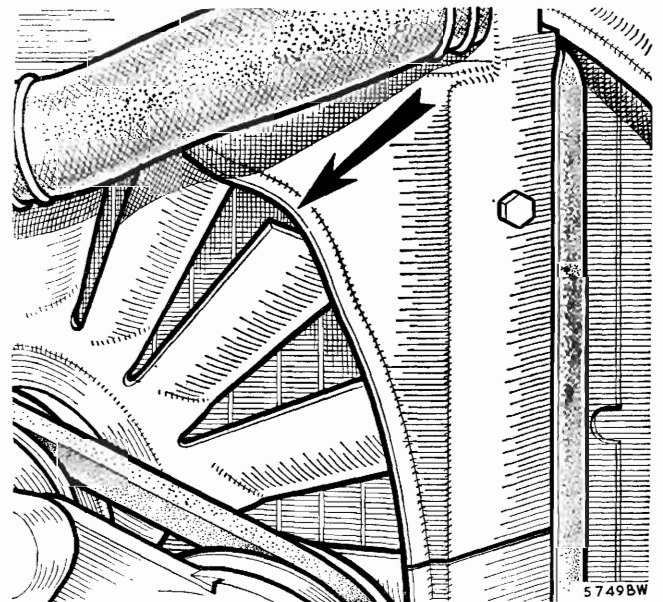


Fig. C.4

Turn the fan blades to the position indicated where the fan belt can be extracted through the recess provided in the radiator cowl

Testing

- (5) Test the thermostat opening temperature by immersing it in water and raising the temperature of the water to the thermostat opening temperature as given under 'GENERAL DATA'. If the thermostat valve fails to open or sticks in the fully open position, fit a new one; do not attempt to repair it.

Refitting

- (6) Installation of the thermostat assembly is the reverse of the removal procedure. Fit a new joint washer if the existing one is damaged.
- (7) A wax-element-type thermostat together with a modified thermostat water outlet cover is fitted to later vehicles.
- (8) When refitting this type of thermostat it is essential that the threaded stem faces upwards.

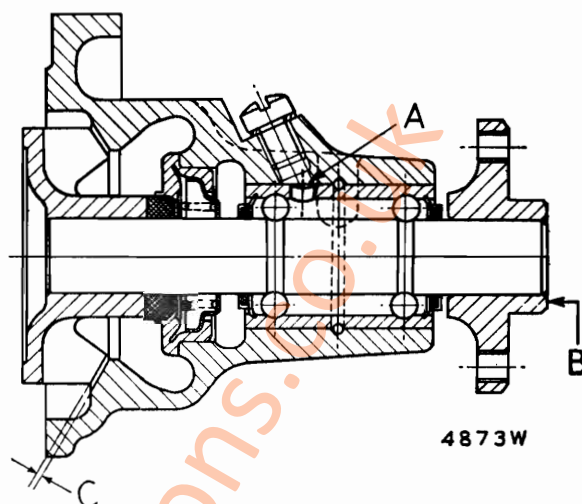


Fig. C.5

A section through the water pump showing the location of the components. When assembled, the hole (A) in the bearing must coincide with the lubricating hole in the water pump and the face of the hub (B) must be flush with the end of the spindle. The clearance at (C) must be .020 to .030 in. (.508 to .762 mm.)

SECTION D

THE FUEL SYSTEM

													<i>Section</i>
Air cleaner	..	..	..	..	..	..	..	..	..	..	..	..	D.7
Carburetter	..	..	..	..	..	..	..	..	..	..	..	..	D.6
Fuel pump (Moke)	..	..	..	..	..	..	..	..	..	..	..	..	D.8
Fuel pump:													
Type PD	..	..	..	..	..	..	..	..	..	..	..	..	D.3
Type SP	..	..	..	..	..	..	..	..	..	..	..	..	D.4
Testing	..	..	..	..	..	..	..	..	..	..	..	..	D.5
Fuel tank	..	..	..	..	..	..	..	..	..	..	..	..	D.1
Fuel tank (Moke)	..	..	..	..	..	..	..	..	..	..	..	..	D.9
Tank gauge unit	..	..	..	..	..	..	..	..	..	..	..	..	D.2
Twin fuel tanks (Cooper 'S')	..	..	..	..	..	..	..	..	..	..	..	..	D.10

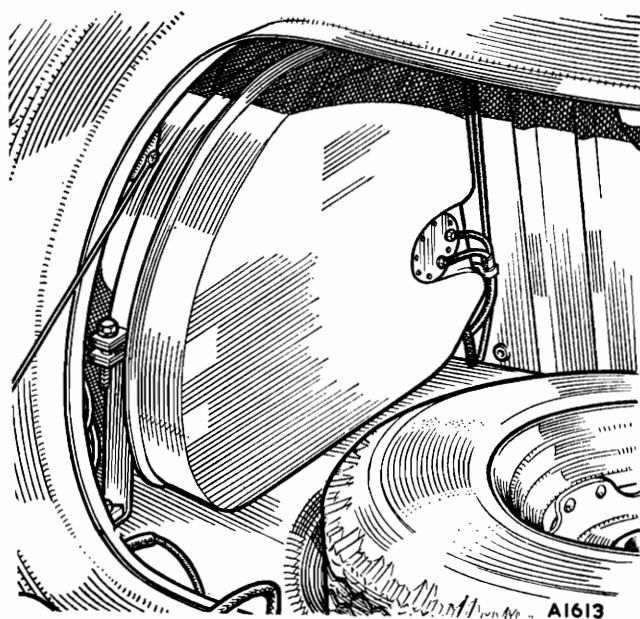


Fig. D.1

The fuel tank located on the left-hand side of the luggage compartment

Section D.1

FUEL TANK

Removing

- (1) Drain the tank. In earlier models, disconnect the flexible hose from the pump connection. In later models, unscrew the drain plug approximately three turns.
- (2) Take off the filler cap, disconnect the lead from the gauge unit and unscrew the bolt from the securing strap. Release the vent pipe clip and remove the tank from the luggage compartment, at the same time drawing the fuel and vent pipes through the floor. Note the locating plate fitted below the tank.

VAN, PICK-UP, AND LATER TRAVELLER

- (3) Remove the six flange screws and spacers and lower the tank.

TRAVELLER (EARLY MODELS)

- (4) Remove the trim liner from the body above the tank, and the metal finishers from the rear seat squab support.
- (5) Lift out the luggage platform, disconnect the battery and ease the trim panel away from the tank.
- (6) Drain the tank and disconnect the drain and fuel delivery pipes. Take off the filler cap.
- (7) Disconnect the fuel gauge lead and pull the breather pipe from the tank.
- (8) Unscrew the support bracket screws and lift the tank from the vehicle.

Refitting

SALOON

- (9) Reverse the removal instructions. Note that the vent pipe passes through the same hole as the wiring harness. The seal between the drain pipe housing and the body must be watertight. Refit the locating strip before the strap is tightened.

VAN, PICK-UP, AND TRAVELLER

Reverse the removal instructions.

Section D.2

TANK GAUGE UNIT

Removing

- (1) Disconnect the battery earth cable and the electrical connection from the fuel gauge tank unit.
- (2) Ensure that the fuel level in the tank is below that of the fuel gauge unit aperture.
- (3) Remove the six securing screws to remove the unit. On later models remove the tank unit locking ring with Service tool 18G 1001 and carefully remove the unit from the tank.

Refitting

- (4) When refitting the gauge unit, use a new joint washer coated with a suitable sealing compound.
- (5) On later models fit a new rubber sealing ring and tighten the unit locking ring with the Service tool.

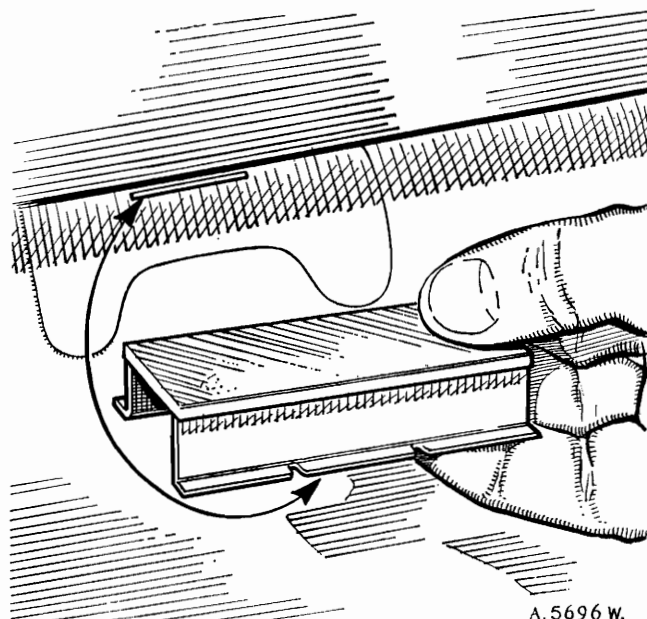


Fig. D.2

The tongue of the fuel tank locating plate must be secured in the slot in the luggage compartment floor

Section D.3

FUEL PUMP—TYPE PD

Apart from cleaning the filter and contact points, no servicing is possible; if the pump fails a new one must be fitted.

Removing

- (1) Disconnect the leads, slacken the clamp screws, and pull off the fuel pipes. Unscrew the bracket screws and remove the pump and bracket.

Cleaning the filter

- (2) Remove the pump and take off the bottom cover plate. Extract the filter and clean it with a brush and petrol (fuel). Fit a new cover gasket.

Points

- (3) Lift off the top cover and clean the points by drawing a piece of clean paper between them.
- (4) Check that the points make good contact and that the gap between the end of the upper blade and its stop face is not less than .015 in. (.4 mm.).

Refitting

- (5) Reverse the removing instructions.

Section D.4

FUEL PUMP—TYPE SP AND AUF 201

The pump is mounted on the lower left-hand flange of the rear sub-frame.

Removing

- (1) Disconnect the battery, the pump leads, and both hoses.
- (2) Unscrew the nut securing the pump clamp to the bracket and lift off the pump and clamp.

Refitting

- (3) Reverse the removing instructions.

Dismantling

- (4) Screw the inlet nozzle from the pump body and withdraw the filter and fibre washer.
- (5) Unscrew the six screws securing the coil housing to the body, separate the housing, diaphragm, and body.
- (6) Withdraw the retainer screw, retainer, and valves.
- (7) Unscrew the armature from the inner rocker trunnion and remove the brass rollers, feed spring and impact washer from the armature.
- (8) Remove the terminal nut, Lucar connector and washer from the terminal screw and take off the bakelite cap.

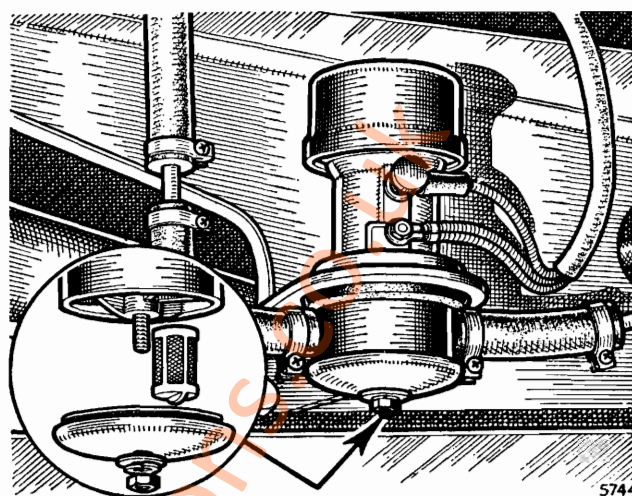


Fig. D.3

The PD-type fuel pump

- (9) Unscrew the spring blade securing screw and disconnect the coil lead. Remove the terminal screw retaining nut; cut the lead washer.
- (10) Unscrew the two pedestal retaining screws and disconnect the braided copper earth lead.
- (11) Remove the remaining coil lead from the terminal screw and the screw from the pedestal.
- (12) Push the rocker pivot pin from the pedestal and remove the rocker assembly. Do not remove the toggle spring.

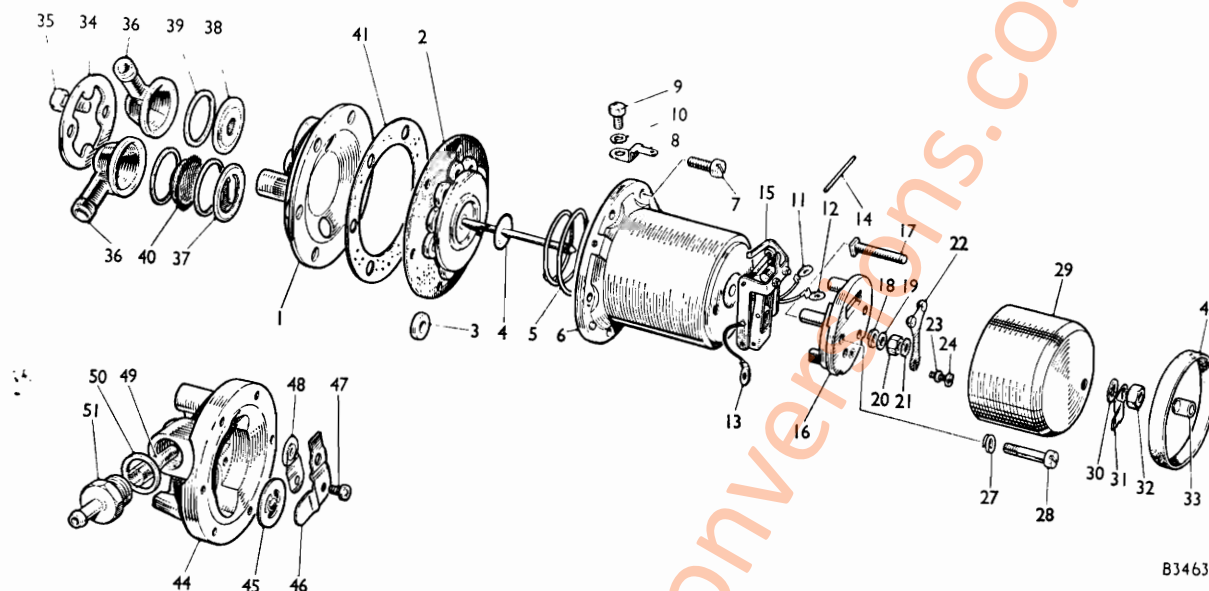
Inspecting

- (13) Clean and examine all parts.
- (14) Check the feed spring; test figures are given in 'GENERAL DATA'.
- (15) Check the condition of the valves and springs.
- (16) If the points are pitted or burnt, fit a new rocker assembly.

Assembling

- (17) Refit the valves and retainer.
- (18) Screw the nozzle, with a new washer, into the body.
- (19) Refit the rocker assembly.
- (20) Refit the terminal screw, spring washer, short coil lead, new lead washer and nut.
- (21) Connect the braided copper earth lead to the nearest pedestal screw with the tag next to the head of the screw; screw the pedestal to the coil housing.
- (22) Refit the remaining coil lead and the spring blade. The blade must bear against the small rib on the top face of the pedestal, and the tag of the solenoid lead must be on top of the blade.
- (23) Adjust the spring blade so that the points are making good contact and the points on the blade wipe over the centre line of the other points when the rocker arm is moved up and down. Tighten the spring blade screw.

THE AUF 201 and SP FUEL PUMP COMPONENTS



B3463

No.	Description	No.	Description	No.	Description
1.	Pump body (AUF 201 only).	17.	Terminal stud.	35.	Set screw.
2.	Diaphragm and spindle assembly.	18.	Spring washer.	36.	Inlet and outlet nozzles.
3.	Armature centralizing roller.	19.	Lead washer.	37.	Inlet valve.
4.	Impact washer.	20.	Terminal nut.	38.	Outlet valve.
5.	Armature spring.	21.	End-cover seal washer.	39.	Sealing washer.
6.	Coil housing.	22.	Contact blade.	40.	Filter.
7.	Set screw.	23.	Washer.	41.	Gasket.
8.	Earth connector.	24.	Contact blade screw.	43.	Sealing band.
9.	Set screw.	27.	Spring washer.	44.	Pump body.
10.	Spring washer.	28.	Screw.	45.	Outlet valve.
11.	Terminal tag.	29.	End-cover.	46.	Valve retainer.
12.	Terminal tag.	30.	Shakeproof washer.	47.	Screw.
13.	Earth tag.	31.	Connector.	48.	Inlet valve.
14.	Rocker pivot pin.	32.	Nut.	49.	Filter.
15.	Rocker mechanism.	33.	Insulating sleeve.	50.	Washer.
16.	Pedestal.	34.	Clamp plate (AUF 201 only).	51.	Inlet nozzle.

AUF 201 only.

SP type only.

- (24) The free end of the spring blade must be deflected away from the rib on the pedestal so that a gap exists between the under-side of the blade and the rib.
- (25) Refit the impact washer and the spring to the armature spindle, pass the spindle through the centre of the coil housing and screw it into the trunnion on the inner rocker.
- (26) Screw the spindle into the trunnion until a steady pressure on the armature just fails to cause the outer rocker to snap over. Then unscrew the spindle seven holes (for body and coil housing screws).
- (27) Position the rollers, fit the body to the coil housing and tighten the securing screws.
- (28) Refit the bakelite cap, spring washers, Lucar connector, nut and terminal screws.
- (29) Refit the rubber sleeve, and the dust excluders to the inlet and outlet connections.

AUF 201 type pump

This type of pump is fitted to later vehicles. The instructions given for the SP pump apply, with the exception of items (4), (6), and (18); for item (4) substitute instructions (30) and (31).

- (30) Unscrew the two screws securing the spring clamp plate which holds the inlet and outlet nozzles. Remove the nozzles, filter and valve assemblies, being careful to note their correct positions for replacement.

Rocker finger settings (AUF 201)

- (31) After reassembly the spring blade of the contacts should rest against the ridge of the pedestal mounting when the outer rocker is pressed onto the coil housing and a gap of $\cdot 030$ in. ($\cdot 76$ mm.) should exist between the points. When the outer

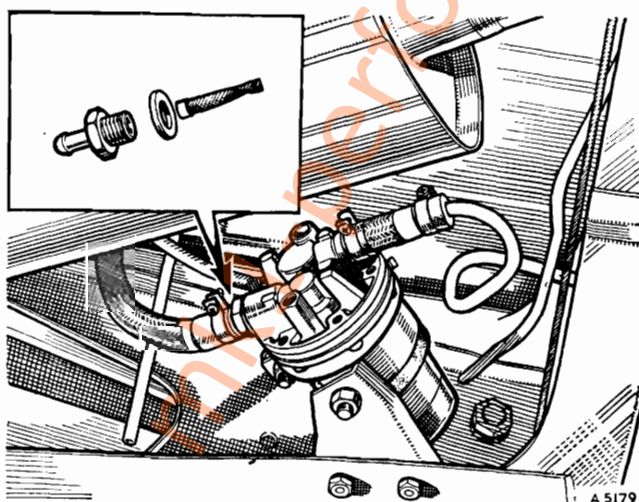
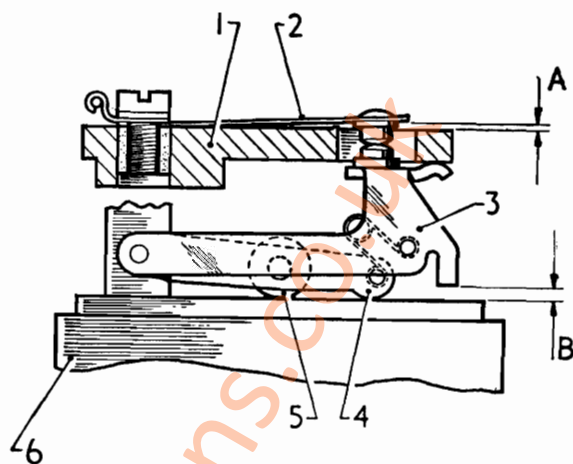


Fig. D.4

The SP-type fuel pump



A.9300

Fig. D.5

The rocker finger settings

- | | |
|---|------------------|
| A. $\cdot 035$ in $\pm$ $\cdot 005$ in. ($\cdot 89$ mm. $\pm$ $\cdot 12$ mm.). | |
| B. $\cdot 070$ in. $\pm$ $\cdot 005$ in. ($1\cdot 78$ mm. $\pm$ $\cdot 12$ mm.). | |
| 1. Pedestal. | 4. Inner rocker. |
| 2. Contact blade. | 5. Trunnion. |
| 3. Outer rocker. | 6. Coil housing. |

rocker is released the spring blade should be deflected away from the ridge. If necessary, set the blade and/or rocker fingers to achieve this position.

Section D.5

FUEL PUMP TESTING

- (1) Fit the SP adaptor set to a test rig, and a cut-away cap to the pump. Connect the pump to a 12-volt battery with a voltmeter and resistance in circuit.

Priming

- (2) The pump should prime from dry in 10 to 15 seconds and the paraffin (kerosene) should rise in the glass container until it runs from the overflow drain pipe. If the level does not rise above the small hole in the drain pipe, the pump is faulty. Initial air bubbles should cease after a minute or two; if they do not, there is an air leak on the suction side.

Valves

- (3) Run the pump for about 10 minutes and turn off the fuel tap. If the pump beats within 12 seconds, the inlet valve is not seating correctly.

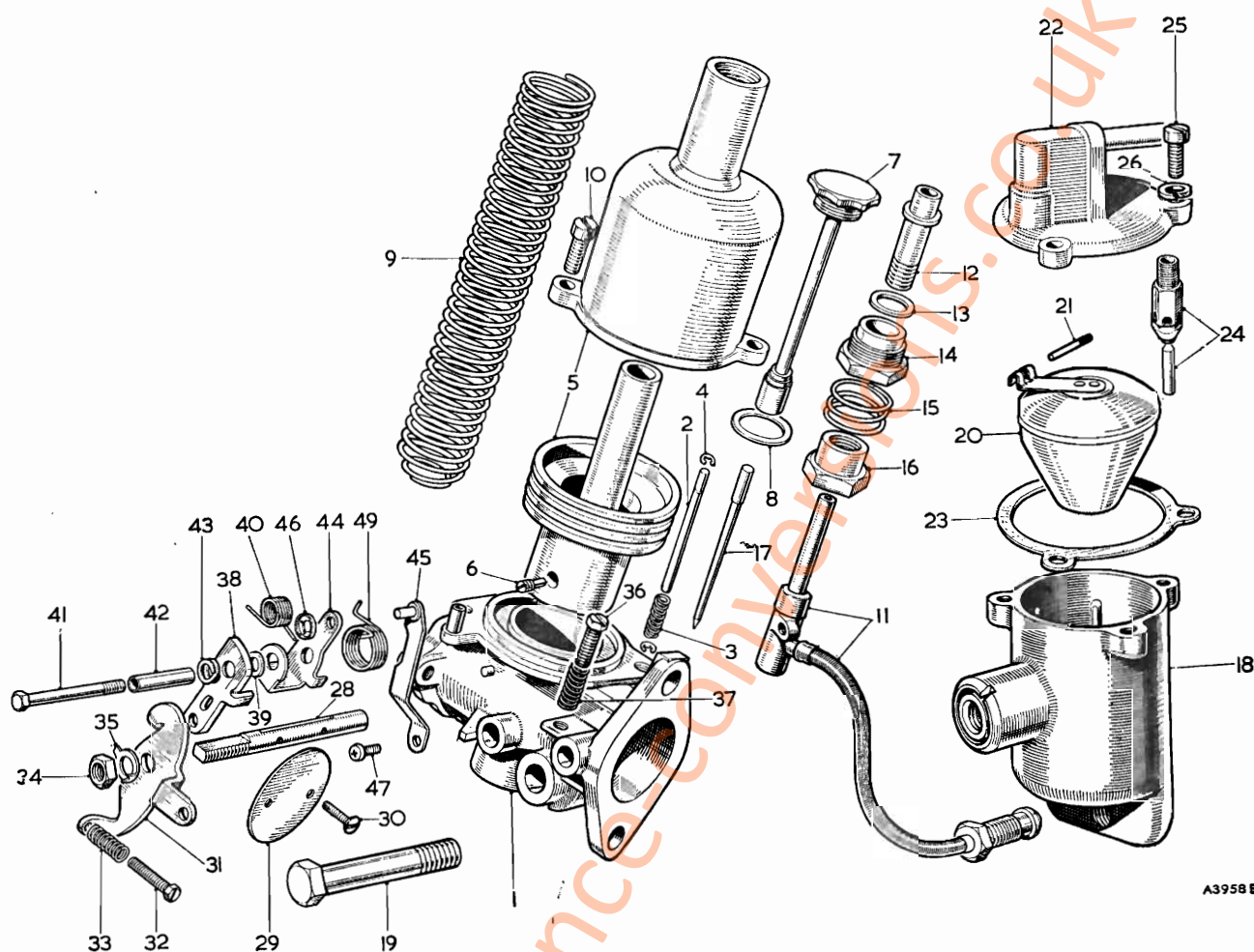
Minimum delivery

- (4) Partly open the fuel tap and gradually depress the spring blade to reduce the stroke. The pump should continue working with increasing frequency until it stops owing to the lack of a gap between the points.

Reduced voltage

- (5) The pump should work satisfactorily at a minimum of 9.5 volts.

THE CARBURETTOR COMPONENTS



A3958 E

No.	Description
-----	-------------

- | | |
|---|--------------------------------------|
| 1. Body. | 17. Jet needle. |
| 2. Piston lifting pin. | 18. Float-chamber body. |
| 3. Spring for pin. | 19. Float-chamber securing bolt. |
| 4. Circlip for pin. | 20. Float and lever assembly. |
| 5. Suction chamber and piston assembly. | 21. Lever hinge pin. |
| 6. Needle locking screw. | 22. Float-chamber lid assembly. |
| 7. Piston damper assembly. | 23. Washer for lid. |
| 8. Washer for damper cap (fibre). | 24. Needle and seat assembly. |
| 9. Piston spring. | 25. Screw—float-chamber lid to body. |
| 10. Screw—suction chamber to body. | 26. Spring washer. |
| 11. Jet assembly. | 28. Throttle spindle. |
| 12. Jet bearing. | 29. Throttle disc. |
| 13. Washer for jet bearing (brass). | 30. Screw—throttle disc. |
| 14. Lock screw for jet bearing. | 31. Throttle lever. |
| 15. Lock spring. | 32. Cam stop screw. |
| 16. Jet adjusting screw. | 33. Spring for stop screw. |

No.	Description
-----	-------------

- | | |
|----------------------------|-------------------------------|
| 34. Throttle spindle nut. | 41. Cam lever pivot bolt. |
| 35. Tab washer for nut. | 42. Pivot bolt tube. |
| 36. Idling stop screw. | 43. Spring washer. |
| 37. Spring for stop screw. | 44. Pick-up lever assembly. |
| 38. Cam lever. | 45. Jet link. |
| 39. Washer. | 46. Jet link retaining clip. |
| 40. Cam lever spring. | 47. Jet link securing screw. |
| 41. Cam lever pivot bolt. | 49. Spring for pick-up lever. |

No.	Description
-----	-------------

- | | |
|----------------------------|-------------------------------|
| 34. Throttle spindle nut. | 41. Cam lever pivot bolt. |
| 35. Tab washer for nut. | 42. Pivot bolt tube. |
| 36. Idling stop screw. | 43. Spring washer. |
| 37. Spring for stop screw. | 44. Pick-up lever assembly. |
| 38. Cam lever. | 45. Jet link. |
| 39. Washer. | 46. Jet link retaining clip. |
| 40. Cam lever spring. | 47. Jet link securing screw. |
| 41. Cam lever pivot bolt. | 49. Spring for pick-up lever. |

Section D.6

CARBURETTER

Dismantling

- (1) Unscrew the plug and withdraw the piston damper.
- (2) Take out the two suction chamber securing screws, lift off the suction chamber and withdraw the piston and jet needle.
- (3) Disconnect the rod from the bottom of the jet, and the nylon feed tube from the base of the float-chamber; pull out the jet and tube.
- (4) Unscrew and remove the jet adjusting nut and the spring.
- (5) Unscrew the jet bearing locking nut.
- (6) Remove the float-chamber securing bolt and the float-chamber.
- (7) Take out three screws and lift off the top of the float chamber; withdraw the float.
- (8) Screw out the needle valve assembly.

Inspecting

- (9) Note the condition of the needle valve and seating; fit a new needle and seating if necessary.
- (10) If the jet needle is bent or otherwise damaged, withdraw the locking screw in the piston and fit a new needle. Push the needle in until the shoulder is flush with the lower face of the piston.
- (11) Clean and dry the piston assembly; lubricate the piston rod only with thin oil.

Reassembling

Reverse the dismantling instructions and centre the jet.

Jet centring

- (12) Screw the jet adjusting nut up as far as possible, lift the piston with the lifting pin and allow it to drop; it should drop freely onto the bridge with a soft metallic click. Repeat with the adjusting nut screwed fully down. If the piston does not fall freely in either of the tests, proceed as follows.
- (13) Carry out instructions (3) and (4) above.
- (14) Refit the adjusting nut without the spring and screw it up as far as possible.
- (15) Slacken the jet bearing lock nut until the bearing can be turned with the fingers.
- (16) Remove the piston damper and press the piston down onto the bridge. Tighten the lock nut.
- (17) Lift the piston and note whether it falls freely; fully lower the adjusting nut and check again. If the second check produces a sharper click than the first, repeat the centring.
- (18) Refit the parts that have been removed, pour thin oil into the hollow rod of the piston damper to within .5 in. (12.7 mm.) of the top of the rod.

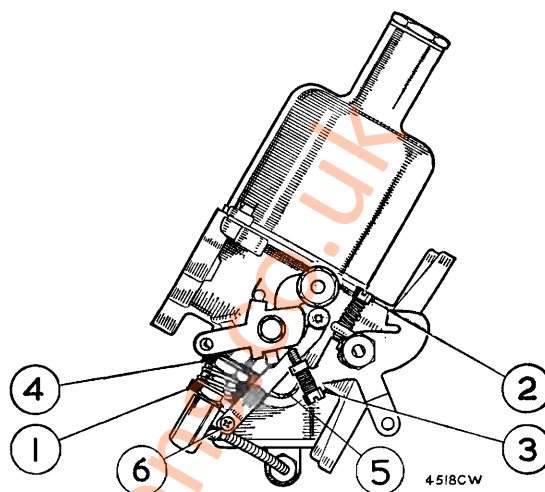


Fig. D.6

The carburettor adjusting screws

- | | |
|--------------------------------|-----------------------------|
| 1. Jet adjusting nut. | 4. Jet locking nut. |
| 2. Throttle adjusting screw. | 5. Float-chamber bolt. |
| 3. Fast-idle adjustment screw. | 6. Jet link securing screw. |

Adjustments

Slow running

- (19) Turn the throttle adjusting screw as necessary.

Mixture

- (20) Run the engine until it is at its normal temperature.
- (21) Disconnect the choke cable.
- (22) Unscrew the throttle adjusting screw until the throttle is fully closed and then screw it up about one turn.
- (23) Hold the jet up against the adjusting nut and then turn the nut until the engine runs smoothly without missing or hunting.
- (24) Raise the piston about $\frac{1}{32}$ in. (1 mm.). If there is a momentary increase in speed the adjustment is correct; if the engine stops the mixture is too weak; and if it continues to increase even when the piston is raised $\frac{1}{4}$ in. (7 mm.) the mixture is too rich.
- (25) Adjust the idling speed as required.
- (26) Set the fast idling screw so that there is a clearance of about $\frac{1}{16}$ in. (.4 mm.) between the cam and the end of the screw when the engine is warm and idling with closed throttle. Alteration may be needed after the mixture has been adjusted. Reconnect the choke cable.
- (27) Fuel starvation or flooding may be caused by an incorrect float level. To check the level, insert a $\frac{5}{16}$ in. (8 mm.) bar between the lip of the float chamber and the hinged lever. Adjust by bending the lever where the curved portion meets the shank. On carburettors fitted with a nylon float use a test bar of $\frac{1}{4}$ in. (3.18 mm.) diameter.

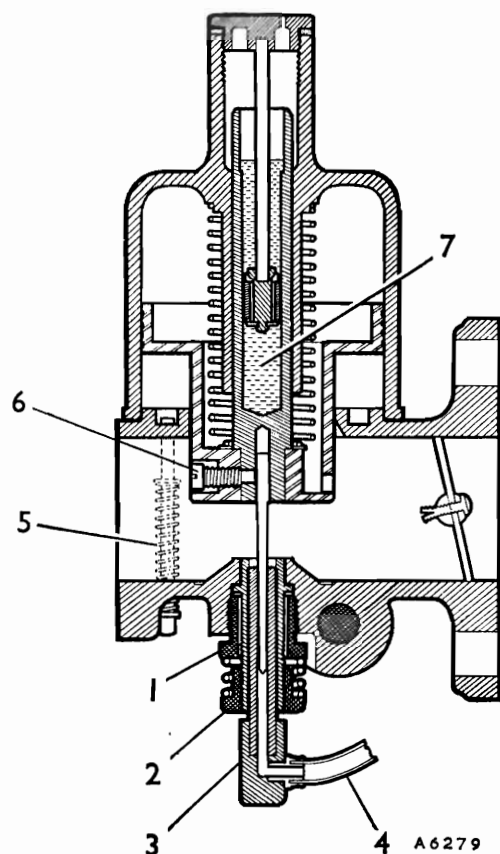


Fig. D.7

A section through the carburettor showing:

- | | |
|-----------------------|----------------------------|
| 1. Jet locking nut. | 5. Piston lifting pin. |
| 2. Jet adjusting nut. | 6. Needle securing screw. |
| 3. Jet head. | 7. Piston damper oil well. |
| 4. Nylon fuel pipe. | |

Flooding

This may be caused by an incorrect float level or by a faulty needle valve.

- (28) Remove, clean, and inspect the needle valve and seating; fit a new assembly if necessary.
- (29) Check the float level.

COOPER

Slow-running

- (30) As instruction (19) but turn both screws an equal amount. Listen to the hiss at the carburettor intake and adjust the screws until the intensity of the hiss at each is the same.

Mixture

- (31) Carry out instructions (20) to (23) on each carburettor moving both nuts the same number of turns.
- (32) Raise the piston on the left-hand carburettor about $\frac{1}{8}$ in. (·8 mm.). If the engine speed increases the mixture is too rich; if the engine speed immediately

decreases the mixture is too weak; if the engine speed momentarily increases very slightly the mixture is correct.

- (33) Repeat (32) on the right-hand carburettor.

- (34) Re-adjust the slow-running speed as necessary.

Linkage adjustment, Fig. D.8

- (35) Disconnect the choke cable. With the throttle shaft levers free on the shaft, put a .012 in. (·30 mm.) feeler between the shaft stop and the choke interconnecting spindle. Move each throttle lever downwards until the pin rests lightly on the lower arm of the fork in the carburettor throttle lever. Tighten the clamp of the throttle shaft lever. When both carburettors are adjusted the pins on the throttle levers should then have the correct clearance in the forks. Re-connect the choke cable and ensure that the jet heads return against the jet adjusting nuts when the choke knob is pushed fully in. Adjust the fast idling screws.

Section D.7

AIR CLEANER

Renew the filter element at the recommended periods.

Removing

- (1) Unscrew the wing nut at the top of the cleaner, remove the cover and extract the element.

Refitting

- (2) Reverse the removal procedure

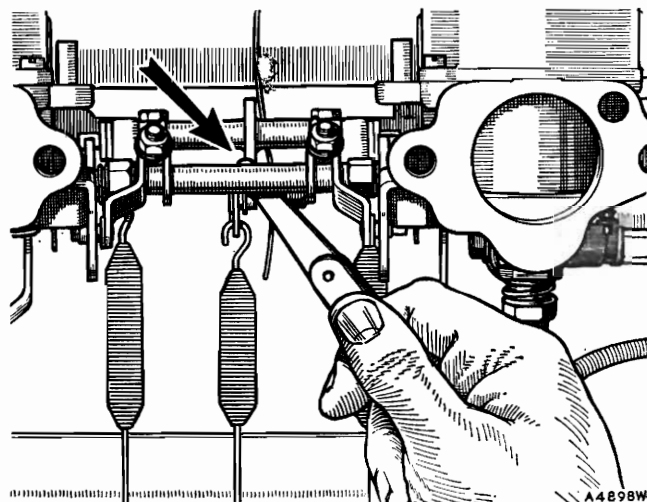


Fig. D.8

The feeler between the throttle shaft stop and the choke interconnecting spindle

COOPER

Gauze filters

Removing

- (3) Detach the breather hose and remove the four retaining screws to remove the air cleaners.

Cleaning

- (4) Wash the gauzes thoroughly in fuel, dry and re-oil with engine oil.

Refitting

- (5) Reverse the removal procedure, fitting new joint washers if necessary.

COOPER

Dry element filter

Renew the filter elements at the recommended periods.

Removing

- (6) Remove the two wing nuts and washers and remove the cover, lift out the paper elements and wipe the inside of the container to remove all dust deposit. The container may also be removed if required by careful manoeuvring over the carburettors, after releasing the throttle lever return spring and the breather hose (if fitted).

Refitting

- (7) Reverse the removal procedure, ensuring that the air manifold rubber seals are correctly positioned if the container has been removed.

Section D.8

FUEL PUMP

(Moke)

The fuel pump is located in the pannier of the left-hand side-member (Fig. D.9).

Removing

- (1) Disconnect the battery.
- (2) Remove the pannier side cover (two quick-release fasteners).
- (3) Disconnect the lead from the pump terminal.
- (4) Slacken the clips and pull the hose from the delivery pipe, and the suction hose from the pump.
- (5) Remove two nuts to release the mounting bracket.

Dismantling and assembling

- (6) Follow the instructions in Section D.4.

Refitting

- (7) Reverse the removing instructions, tighten all clips, and secure the earth lead with one of the mounting bracket nuts.

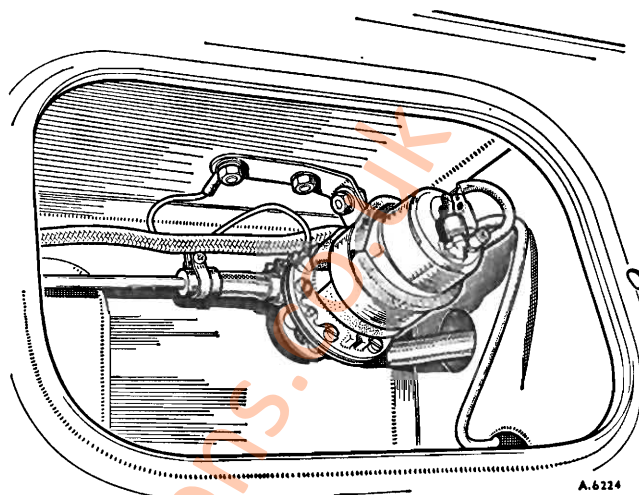


Fig. D.9

The fuel pump location in the left-hand side-member

Section D.9

FUEL TANK

(Moke)

The fuel tank is located in the left-hand side-member. Remove the tank for access to the gauge unit.

Removing

- (1) Remove the forward pannier side cover and disconnect the lead from the fuel gauge unit terminal.
- (2) Drain the fuel tank (see Fig. D.10).
- (3) Disconnect the suction hose from the fuel pump.
- (4) Remove the bottom cover-plate from the side-member.
- (5) Extract the tank-retaining screw from the top face of the side-member.
- (6) Remove the support bracket and lower the tank.

Refitting

- (7) Reverse the removal instructions.

Section D.10

TWIN FUEL TANKS

(Cooper 'S')

Removing

Both tanks

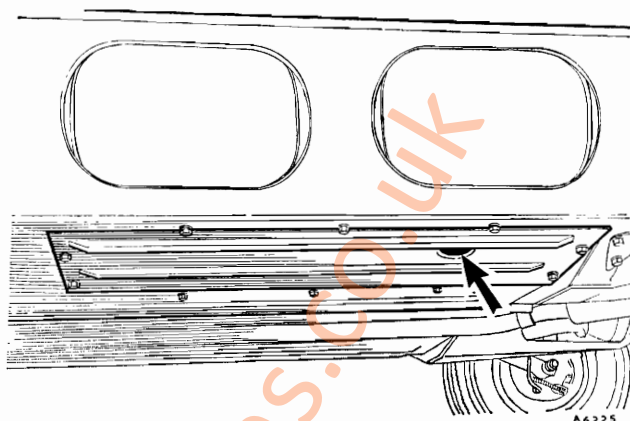
- (1) Remove the trimmed floorboard.
- (2) Disconnect the battery earth cable.
- (3) Remove the spare wheel.
- (4) Remove the fuel filler caps.
- (5) Unscrew the drain plug on the left-hand tank approximately three turns and allow the fuel to drain from both tanks.

Left-hand tank

- (6) Disconnect the electrical connections from the tank gauge unit.
- (7) Remove the tank strap securing bolt.
- (8) Disconnect the flexible fuel pipe and the vent pipe from the tank.
- (9) Ease the tank to the centre of the luggage compartment and withdraw it.

Right-hand tank

- (10) Disconnect and remove the battery.
- (11) Carry out instruction (7) and disconnect the flexible hose from the left-hand tank.
- (12) Move the tank slightly from its mountings, taking care not to damage the flexible fuel pipes. The tank will still retain a small amount of fuel which should be drained off into a small container when the flexible fuel pipe is disconnected.
- (13) Disconnect the flexible fuel pipe.
- (14) Release the vent pipe from the tank and withdraw the tank from the luggage compartment.

**Fig. D.10***The fuel tank drain plug access***Refitting**

- (15) Reverse the removal instructions.
- (16) Ensure that the seal around the drain plug housing is watertight.

SECTION Da

THE FUEL SYSTEM

The information in this Section refers specifically to engines fitted with automatic transmission and must be used in conjunction with Section D

														<i>Section</i>
Air cleaner	..	..	..	..	..	..	..	..	..	..	..	..	..	Da.1
Carburetter	..	..	..	..	..	..	..	..	..	..	..	..	..	Da.2

Section Da.1

AIR CLEANER

Cars equipped with automatic transmission are fitted with a larger paper-element-type air cleaner.

Removing

- (1) Unscrew the wing nuts.
- (2) Disconnect the breather hose.
- (3) Lift the air cleaner from the carburetter.

Element replacement

- (4) Remove the cover from the container and lift out the paper element.
- (5) Wipe all dust deposit from inside the container.
- (6) Fit the new element and refit the cover.

Refitting

- (7) Reverse the removal procedure.

NOTE. The air cleaner intake should be positioned adjacent to the exhaust manifold during winter operating conditions in order that the possibility of carburetter icing is reduced to the minimum. It is advisable to move the intake away from the manifold in warmer weather.

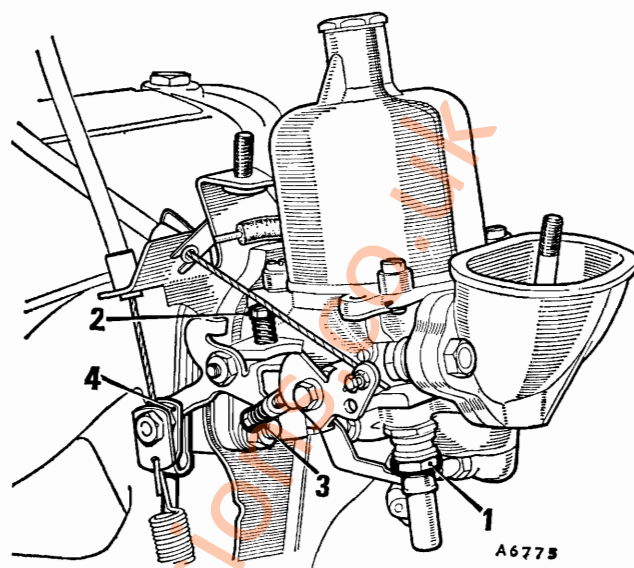


Fig. Da.1

The HS4 carburetter

- | | |
|------------------------------|-------------------------------|
| 1. Jet adjusting nut. | 3. Fast idle adjusting screw. |
| 2. Throttle adjusting screw. | 4. Governor control rod. |

Refitting

- (5) Reverse the removal instructions, fitting new joint washers between the manifold face and the abutment plate and carburetter flange if any have been damaged during removal.

Adjustments

The method of adjusting the jet and slow running is as described in Section D.6 with the following exceptions.

- (6) Connect a tachometer.
- (7) Select 'N' on the gear lever quadrant and apply the hand brake.
- (8) Run the engine until it attains its normal running temperature and adjust the jet as described in Section D.6.
- (9) With the carburetter correctly tuned, adjust the throttle adjusting screw (2) (Fig. Da.1) until a maximum idling speed of 650 r.p.m. is obtained.
- (10) Pull out the choke control to the maximum fast idle position. Check, and adjust if necessary, the fast idle adjustment screw (3) (Fig. Da.1), to obtain a maximum fast idle speed of 1,050 r.p.m. Push in the choke control and re-check the idling speed.
- (11) Adjust the governor control rod as detailed in Section Fa.2.

Section Da.2

CARBURETTER

(Type HS4)

Description

The HS4 carburetter is fitted to an engine equipped with automatic transmission

The dismantling and reassembling of the carburetter is as described for the HS2 type in Section D.6.

Removing

- (1) Remove the air cleaner as detailed in Section Da.1.
- (2) Disconnect the mixture and throttle control cables, the suction advance pipe, and the fuel delivery hose from the carburetter.
- (3) Disconnect the governor control rod fork end from the throttle lever.
- (4) Remove the securing nuts and spring washers and lift off the carburetter and the cable abutment plate.

SECTION E

THE CLUTCH

Adjustments	Section E.2
Overthrow	
Pedal movement	
Throw-out stop	
Drag	E.3
Master cylinder	E.4
Overhaul (coil pressure spring type)	E.1
Removal (diaphragm spring type)	E.6
Slave cylinder	E.5

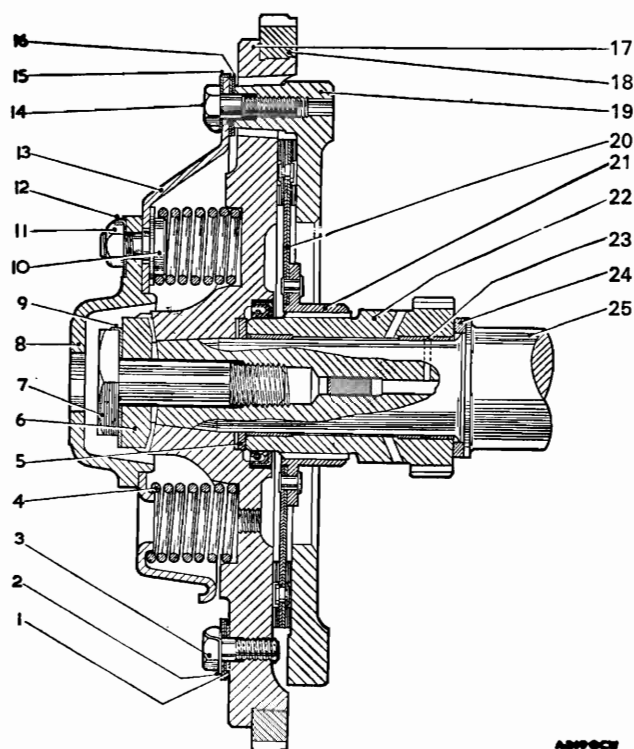


Fig. E.1

A section through the clutch assembly

- | | |
|------------------------------|------------------------------|
| 1. Driving strap. | 14. Driving pin. |
| 2. Lock washer. | 15. Lock washer. |
| 3. Driving pin. | 16. Driving strap. |
| 4. Pressure spring. | 17. Flywheel. |
| 5. Circlip. | 18. Starter ring. |
| 6. Keyed washer. | 19. Pressure plate. |
| 7. Flywheel screw. | 20. Driven plate. |
| 8. Thrust plate. | 21. Driven plate hub. |
| 9. Locking washer. | 22. Crankshaft primary gear. |
| 10. Pressure spring guides. | 23. Primary gear bearing. |
| 11. Guide nut. | 24. Thrust washer. |
| 12. Lock washer. | 25. Crankshaft. |
| 13. Pressure spring housing. | |

Section E.1

OVERHAUL (Coil Pressure Spring Type)

Removing

- (1) See Section A.11.

Dismantling

- (2) Mark the driving pins, driving straps, and the housing so that these parts can be refitted in their original positions. Note the clutch balance mark (Fig. E.2).
- (3) Insert the three screws (Service tool 18G 304 M) through the recessed holes in the pressure spring housing and screw them into the flywheel.
- (4) Screw the nuts down against the housing with the fingers and then tighten them one turn at a time until the load is off the driving pins.

- (5) Unscrew the three driving pins.
- (6) Unscrew the nuts of the Service tool 18G 304 M, gradually releasing the housing. Remove the housing and the springs.

Inspecting

- (7) Inspect the housing for elongation of the driving pin holes.
- (8) Inspect the driving pins for ridging and wear; fit three new pins if any are worn.
- (9) Inspect the driving straps; fit three new ones if any are worn.

Reassembling

NOTE.—When reassembling, fit the pressure plate to the clutch cover with the marks 'A' adjacent to each other and fit the clutch unit to the flywheel as shown in Fig. E.2.

- (10) Centralize the driven plate and the flywheel hub with Service tool 18G 571.
- (11) Locate the springs, housing and driving straps, and tighten the nuts evenly (Service tool 18G 304 M).
- (12) Insert and tighten the driving pins. If the driving straps have been removed from the flywheel, ensure that the spacing washers are refitted between the straps and the flywheel face.

Refitting

- (13) Reverse the removing instructions (Section A.11).

Section E.2

ADJUSTMENTS

Pedal movement

- (1) Pull the operating lever outwards until all free movement is taken up, then check the clearance between the lever and the stop.

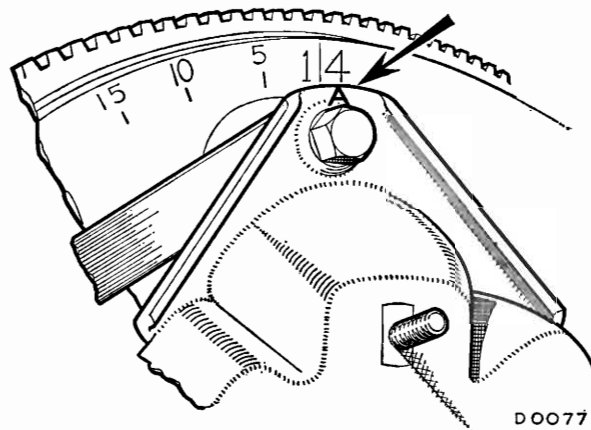


Fig. E.2

The fitted position of the clutch cover, with the balance mark 'A' adjacent to the 1/4 timing mark on the flywheel

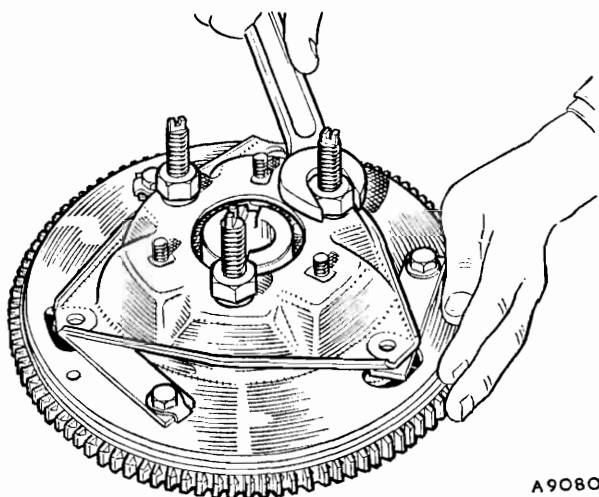


Fig. E.3

The clutch pressure springs being compressed with the aid of Service tool 18G 304 M, with Service tool 18G 571 used to keep the driven plate and flywheel hubs centralized during the operation

- (2) If necessary, adjust the stop to give a clearance of $\cdot 060$ in. (1.5 mm.). On later models with the throw-out stop, adjust to give a clearance of $\cdot 020$ in. ($\cdot 50$ mm.).

Throw-out stop (later models)

Adjustment is normally only necessary if the stop has been removed during overhaul.

- (3) Screw the stop and locknut away from the clutch housing to the limit of its travel.
- (4) Fully depress the pedal.
- (5) Screw the stop up against the housing, release the pedal and screw up another $\cdot 007$ to $\cdot 010$ in. ($\cdot 20$ to $\cdot 25$ mm.), approximately one flat of the locknut.
- (6) Re-check the pedal movement (items (1) and (2)).

Clutch over-throw

To test

- (7) Run the engine at its normal temperature and at about 500 r.p.m.
- (8) Depress and release the pedal three or four times; if the engine stalls or slows down appreciably, over-throw is occurring.

To rectify

- (9) Check the pedal movement and test for over-throw.
- (10) Adjust the pedal movement to a maximum of $\cdot 075$ in. (2.0 mm.) and test for over-throw.
- (11) Fit a stronger lever return spring and test for over-throw.
- (12) If over-throw persists, fit new pressure springs.

Section E.3

DRAW

With the car stationary, run the engine and hold the clutch out for several seconds; if drag persists, carry out the following test in sequence.

- (1) Check for air leaks in the hydraulic system.
- (2) Check the pedal movement.
- (3) Check the crankshaft end-float (Section A.25).
- (4) Dismantle the clutch and fit a new flywheel oil seal (if fitted).

Section E.4

MASTER CYLINDER

Removing

- (1) Disconnect the pedal lever from the push-rod.
- (2) Unscrew the pipe union from the cylinder.
- (3) Remove the two bolts securing the unit to the bulkhead.

Dismantling

- (4) Drain out the fluid.
- (5) Pull back the rubber dust cover.
- (6) Extract the circlip, dished washer, and push-rod.
- (7) Withdraw the piston cups and spring from the barrel.
- (8) Use only the fingers to remove the secondary cup from the piston.

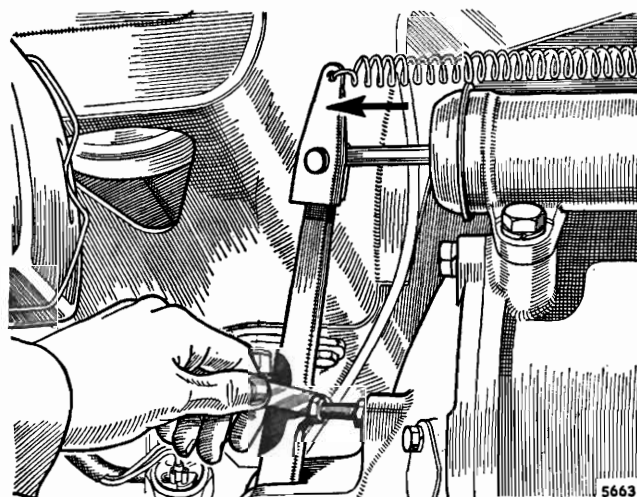


Fig. E.4

A clearance of $\cdot 060$ in. (1.52 mm.) or $\cdot 020$ in. ($\cdot 50$ mm.) on later models must exist between the adjustable clutch return stop and the operating lever

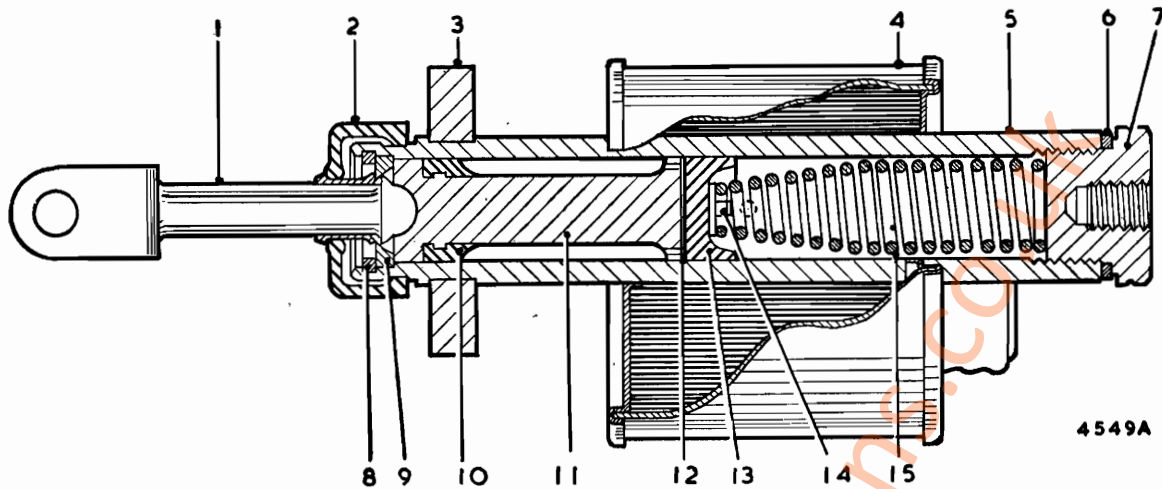


Fig. E.5

A section through the clutch master cylinder

- | | | |
|---------------------|--------------------|----------------------|
| 1. Push-rod. | 6. Washer. | 11. Piston. |
| 2. Rubber boot. | 7. End plug. | 12. Piston washer. |
| 3. Mounting flange. | 8. Circlip. | 13. Main cup. |
| 4. Supply tank. | 9. Stop washer. | 14. Spring retainer. |
| 5. Body. | 10. Secondary cup. | 15. Return spring. |

Reassembling

- (9) Clean all rubber parts with brake fluid and remove all traces of petrol (fuel), kerosene, and trichloroethylene from the metal parts.
- (10) Fit new rubbers and assemble the internal components lubricated with brake fluid.
- (11) Stretch the secondary cup over the end flange of the piston with the lip of the cup towards the opposite end of the piston; work it round to ensure correct sealing.
- (12) Insert the return spring, largest coils first. Make sure the spring seat is positioned on the small end of the spring.
- (13) Insert the main cup, lip first, and press it down onto the spring seat.
- (14) Push the piston down the bore and refit the push-rod, circlip, and rubber dust cover.

Refitting

- (15) Reverse the removing instructions and fill up with Lockheed Super Heavy Duty Brake Fluid, or (COOPER), Lockheed Disc Brake Fluid. Bleed the system.

- (3) Disconnect the push-rod from the clutch lever.
- (4) Unscrew the two securing bolts and remove the cylinder from the housing.

Dismantling

- (5) Clean the exterior before stripping.
- (6) Withdraw the rubber boot and push-rod.
- (7) Remove the circlip, piston, piston cup, cup filler, and return spring.
- (8) Renew all rubber parts: examine the remainder and renew as required.

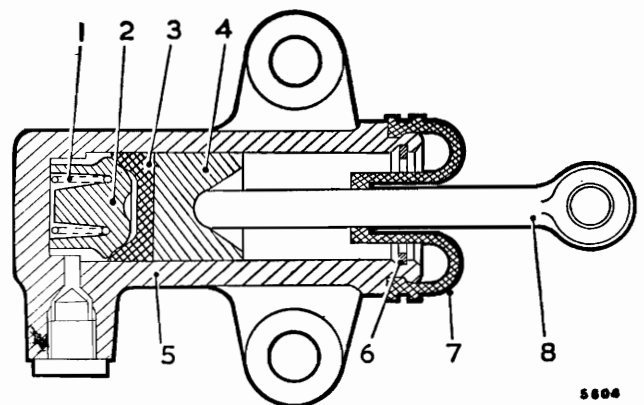


Fig. E.6

A section through a clutch slave cylinder

- | | |
|----------------|-----------------|
| 1. Spring. | 5. Body. |
| 2. Cup filler. | 6. Circlip. |
| 3. Cup. | 7. Rubber boot. |
| 4. Piston. | 8. Push-rod. |

Section E.5

SLAVE CYLINDER

Removing

- (1) Attach a bleed tube to the cylinder bleed nipple and a container, pump the pedal and drain out the fluid.
- (2) Disconnect the pressure pipe.

Reassembling

Carry out items (5) to (8) in the reverse order.

Refitting

Reverse the removal procedure items (1) to (4) and bleed the system.

Section E.6**CLUTCH
(Diaphragm Spring Type)**

A diaphragm spring replaces the six conventional coil pressure springs on this clutch assembly.

Remove and refit the flywheel and clutch as detailed in Section A.28.

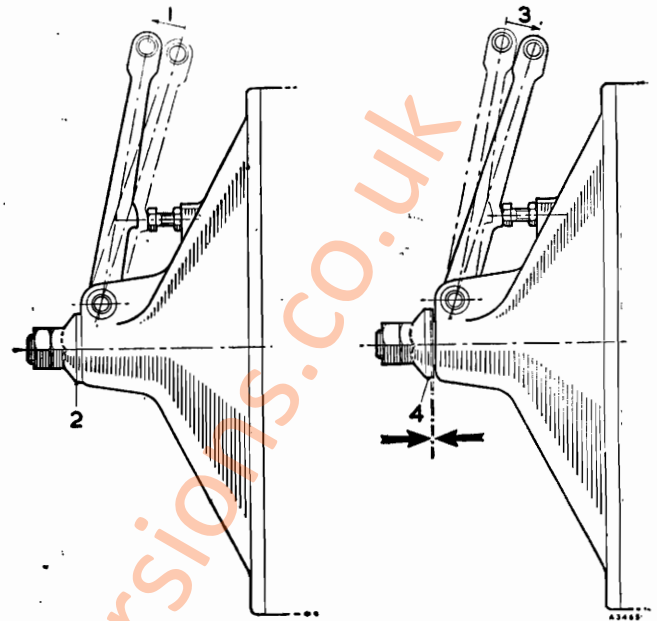


Fig. E.7

(1) The clutch fully released, with (2) the throw-out stop screwed up to the cover boss. (3) The clutch fully engaged and the stop (4) screwed up a further .007 to .010 in. (.178 to .254 mm.) towards the cover boss

SECTION F

THE TRANSMISSION

												<i>Section</i>
Differential assembly	..	..	..	..	..	..	..	..	..	..	..	F.3
Synchronizing cones	..	..	..	..	..	..	..	..	..	..	..	F.4
Third motion shaft ..	..	..	..	..	..	..	..	..	..	..	..	F.2
Transmission..	..	..	..	..	..	..	..	..	..	..	..	F.1

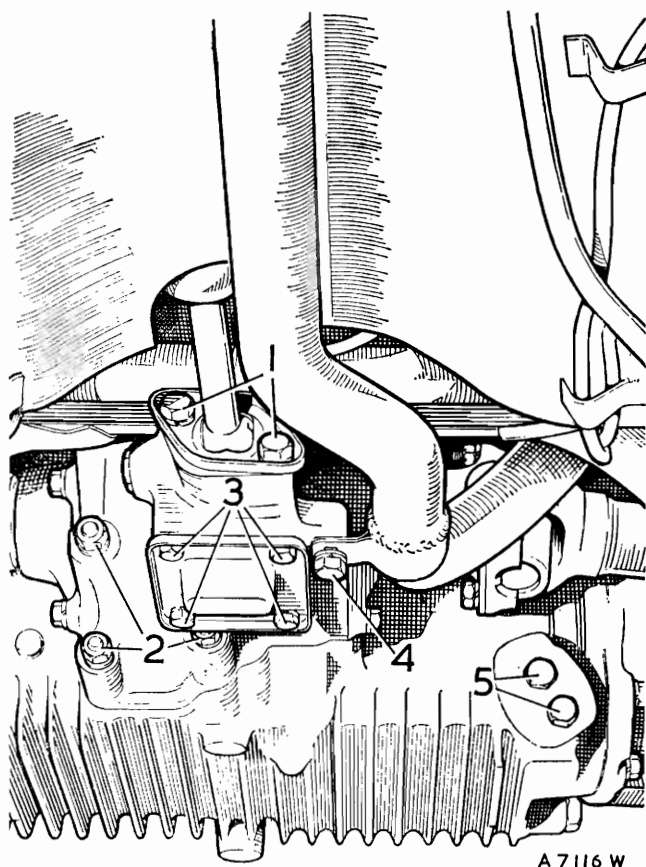


Fig. F.1

The rear of the transmission assembly from beneath the car

1. Change speed lever retaining screws.
2. Three of the four differential stud nuts.
3. Extension cover-plate screws.
4. Exhaust pipe front fixing point.
5. Plugs, interlocking plungers, and spring.

Section F.1

TRANSMISSION

Dismantling

- (1) Remove the transmission (Section A.19).
- (2) Withdraw the idler gear with its thrust washers, and pull the bearings with Service tool 18G 581.
- (3) Remove the differential assembly (Section F.3).
- (4) Withdraw the reverse detent plug, plunger, and spring.
- (5) Remove the clamp and key from the inner end of the gear change operating shaft and pull out the shaft.
- (6) Withdraw the speedometer pinion housing and pinion.
- (7) Remove the speedometer gear retaining plate and the gear.
- (8) Take off the transmission casing and cover.
- (9) Disconnect the oil suction pipe from the bracket and flange and withdraw the pipe from the strainer.
- (10) Unscrew four screws and remove the locking plate, the third motion shaft bearing retainer, and packing shims.

- (11) Unscrew the nut and remove the final drive pinion and locking washer.
- (12) Extract the circlip and the roller bearing from the first motion shaft.
- (13) Knock up the locking washer tabs, unscrew the nut and withdraw the drive gear.
- (14) Remove the layshaft and reverse shaft locking plates, push the layshaft out of the casing and remove the laygear and thrust washers.
- (15) Unscrew the plugs from the outside of the casing and withdraw the selector rod interlocking plungers and springs.
- (16) Withdraw the first motion shaft bearing circlip and withdraw the bearing from the casing with Service tools 18G 284 and 18G 284 B.
- (17) Withdraw the first and second speed selector fork rod and fork.
- (18) Drift the third motion shaft backwards until Service tool 18G 613 can be placed between the first speed gear and the bearing. Drift the shaft forwards to push the bearing from the web. Lift the shaft from the casing.
- (19) Remove the strainer assembly.
- (20) Withdraw the third and fourth speed selector fork rod and fork.
- (21) Withdraw the reverse shaft, gear, and selector fork. Remove the circlip from the reverse gear shifter lever pivot pin and remove the lever.

Reassembling

- (22) Reverse the dismantling instructions, noting the following points.
- (23) Refers to item (18). Replace the third motion shaft assembly with the slotted end passing through the centre web of the casing. Engage the first and second sliding hubs with the selector forks.
- (24) Refers to items (16) and (18). Fit the ball race onto the first motion shaft and the shaft into the casing. Position the third motion shaft bearing in the centre web of the casing. Drift the two bearings into position together; use Service tool 18G 579 with the distance collar for the third motion shaft bearing and the same tool without the collar for the first motion shaft.
- (25) Refers to item (14). Refit the layshaft using Service tool 18G 471 to hold the thrust washer in position as the shaft is inserted. The end clearance must be between .002 and .006 in. (.05 and .15 mm.) and a range of thrust washers of various thicknesses is available for adjustment. Turn the layshaft and the reverse shaft to line up their slotted ends. Replace the third motion shaft bearing retainer with shims between the bearing outer race and the retainer (Fig. F.3).
- (26) Refers to item (9). Grease the sealing ring between the strainer and bracket to help in preventing the pipe from displacing it. Insert the suction pipe.

- (27) Refers to item (2). Use Service tool 18G 581 to refit the idler bearing.

With the housing nuts tight, idler gear end-float must be .003 to .008 in. (.08 to .20 mm.) and range of thrust washers of various thicknesses are available.

Section F.2

THIRD MOTION SHAFT

Remove the shaft assembly from the transmission as detailed in Section F.1.

Dismantling

- (1) Withdraw the top and third gear synchromesh hub from the front end of the shaft.
- (2) Press the front thrust washer plunger and turn the washer until the splines register with those on the shaft. Remove the plunger and spring.

- (3) Withdraw the third speed gear and bush, the rear thrust washer, and the first speed gear and hub.
- (4) When separating the second, third, and fourth striking dog from the hub and cone assemblies take care not to lose the balls and springs in each hub.

Reassembling

- (5) Refers to item (3). Fit the cone side of the hub on the same side as the plain side of the first gear teeth.
- (6) Refers to item (2). Fit the third speed gear, plain side first, and insert the spring and locking plunger. Depress the plunger and fit the thrust washer in position. The essential interference fit of the bushes will have been destroyed on removal. Fit new bushes by heating them to 180 to 200° C. (356 to 392° F.), and sliding on the shaft. Natural cooling will establish a permanent shrink-fit.
- (7) Second and third speed gear end-float must be between .0035 and .0055 in. (.09 and .14 mm.).

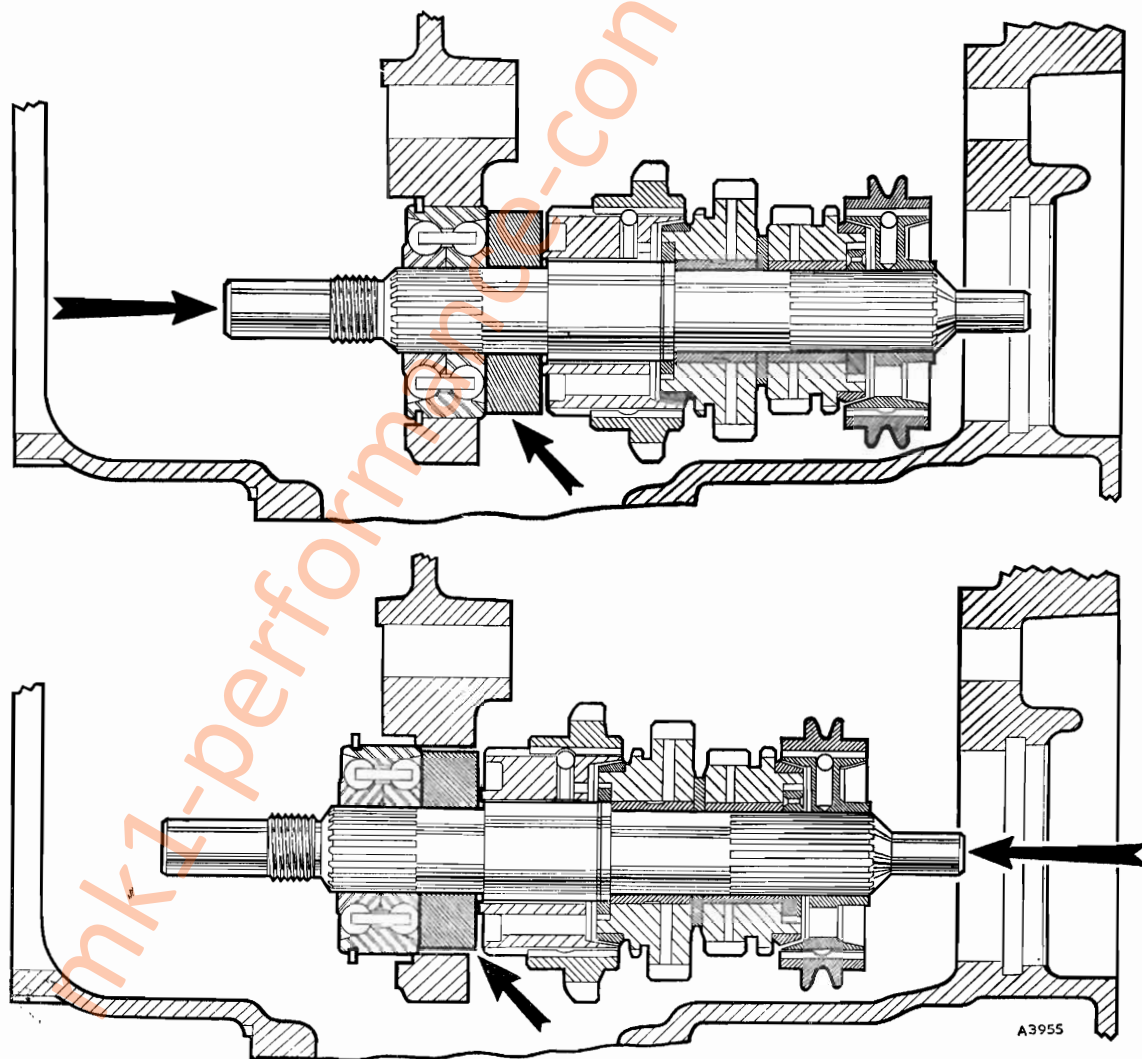


Fig. F.2

Shows the method of removing the third motion shaft bearing using Service tool 18G 613

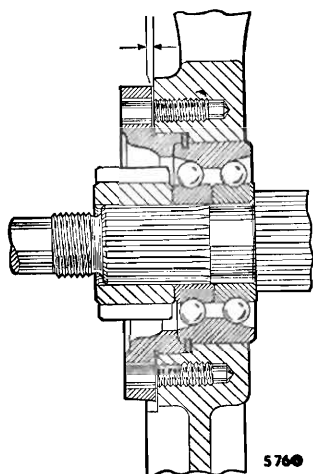


Fig. F.3

A section through the third motion shaft bearing and bearing retainer. It is essential that the correct thickness of shim is used to take up the gap indicated in the illustration. Use the following table to ensure that the correct shim thickness is used

When the gap is	Use shims totalling
·005 to ·006 in. (·127 to ·152 mm.)	·005 in. (·127 mm.)
·006 to ·008 in. (·152 to ·203 mm.)	·007 in. (·178 mm.)
·008 to ·010 in. (·203 to ·254 mm.)	·009 in. (·229 mm.)
·010 to ·012 in. (·254 to ·304 mm.)	·011 in. (·279 mm.)
·012 to ·014 in. (·304 to ·356 mm.)	·013 in. (·330 mm.)
·014 to ·015 in. (·356 to ·381 mm.)	·015 in. (·381 mm.)

- (8) Refit the assembly to the transmission as in Section F.1, item (24).

When baulk-ring synchromesh is fitted, the dismantling and reassembling sequences are the same, but second, third, and top gear synchronizers are fitted with baulk rings. If the first and second speed gear assembly has been dismantled, ensure that the plunger in the hub aligns with the cut-away tooth in the gear on assembly. It will be impossible to select first gear otherwise.

Section F.3

DIFFERENTIAL ASSEMBLY

Removing

- (1) Remove the transmission (Section A.19).
- (2) Remove the gear-change extension bottom cover plate.
- (3) Remove the clamp screw and withdraw the remote-control shaft. Take out the nylon seating and the tension spring from the remote-control shaft and the shaft lever.
- (4) Withdraw the driving flanges from the differential shafts. Hold the flanges with Service tool 18G 669 while unscrewing the nuts.

- (5) Remove the two end covers. Note the number of shims between the housings and the bearings.
- (6) Unscrew the nuts and remove the differential assembly.

Dismantling

- (7) Withdraw the two differential bearings with Service tool 18G 2.
- (8) Remove the differential cage from the driving gear and extract the gear and thrust washer from the bore of the driving gear.
- (9) Tap out the taper pin to release both pinions and thrust washers, pinion spacer, and the remaining differential gear and washer.

Reassembling

- (10) Reverse the dismantling procedure.

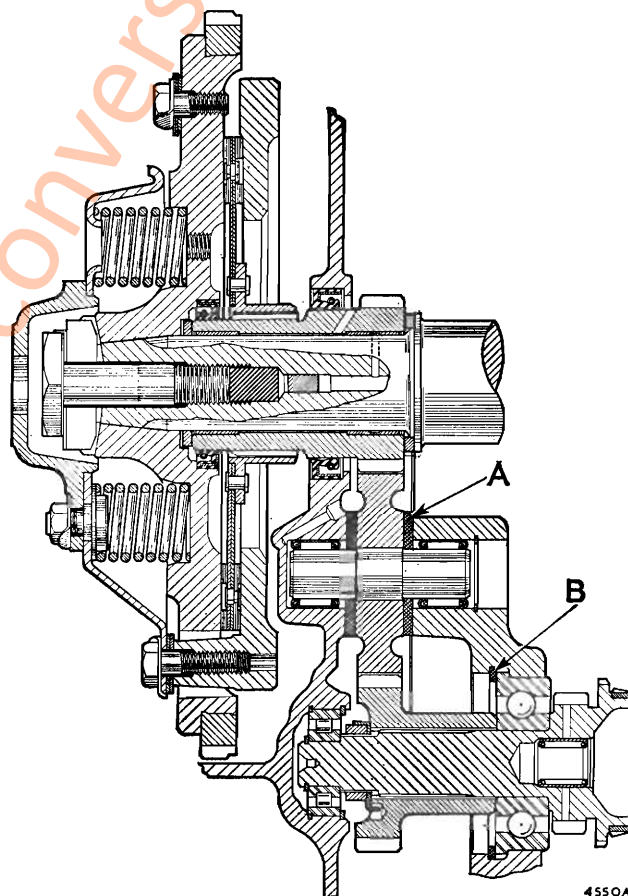


Fig. F.4

A section through the idler gear and the first motion shaft

- The idler gear must have from ·003 to ·008 in. (·076 to ·20 mm.) end-float.
- Take the measurement between the first motion shaft bearing face and the bearing register. Use Service tool 18G 569 for this purpose.

For measurements (B)	Use circlip Part No.
·096 to ·098 in. (2·43 to 2·48 mm.)	2A 3710
·099 to ·100 in. (2·51 to 2·54 mm.)	2A 3711

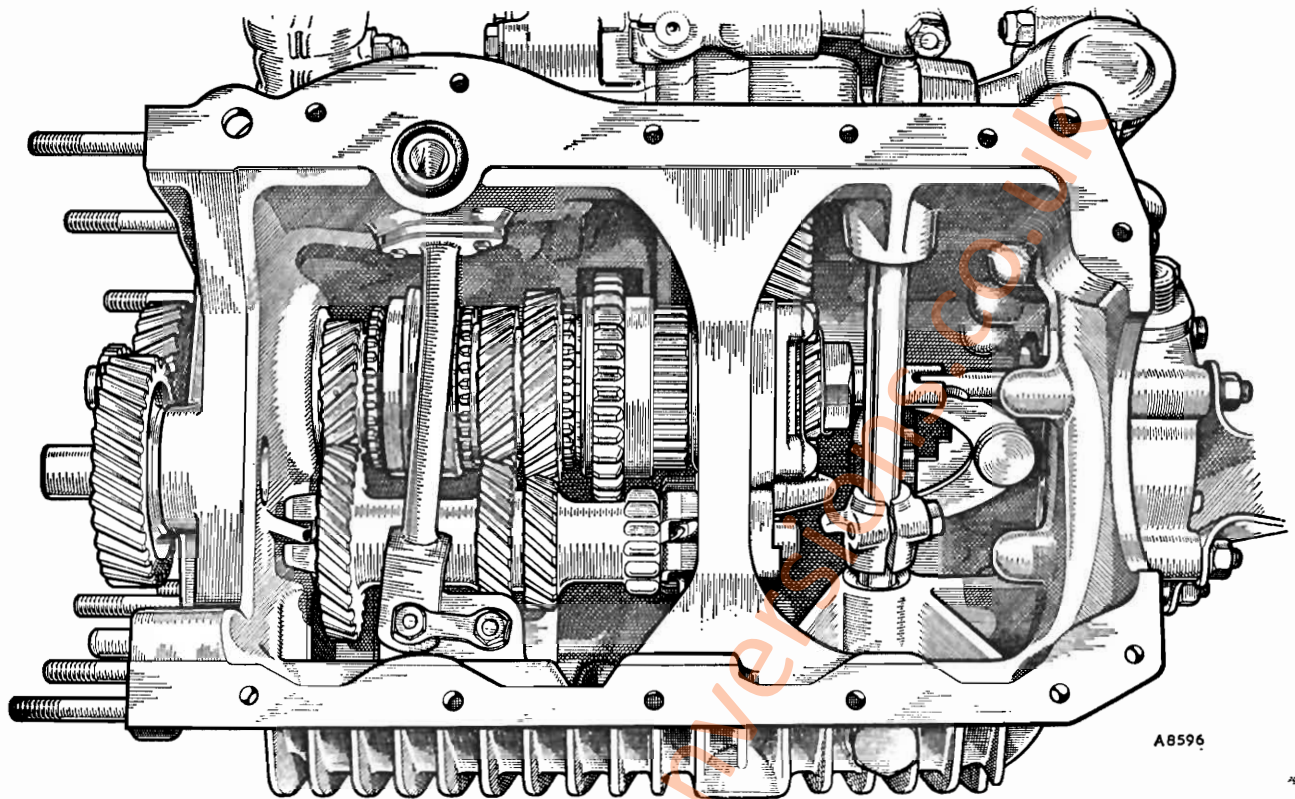


Fig. F.5

A view of the transmission assembly with all the gears assembled into the casing

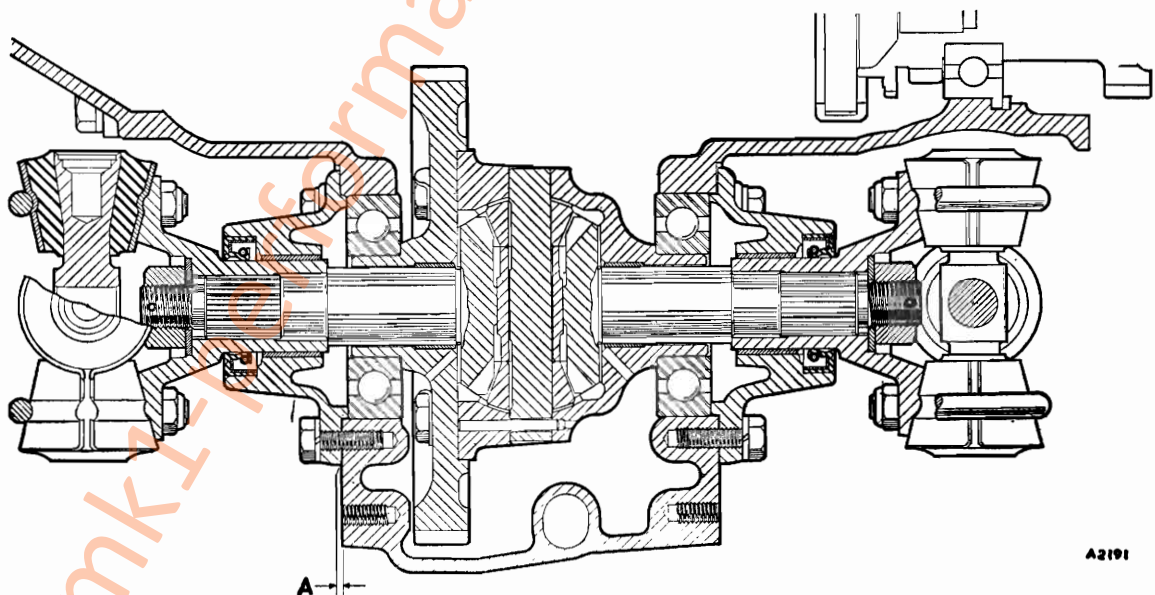


Fig. F.6

A section through the differential assembly and final drive end covers. In order to obtain the correct preload on the differential bearings a feeler gauge measurement must be taken at point (A), indicated in the above illustration with the left-hand final drive cover fitted without its joint washer

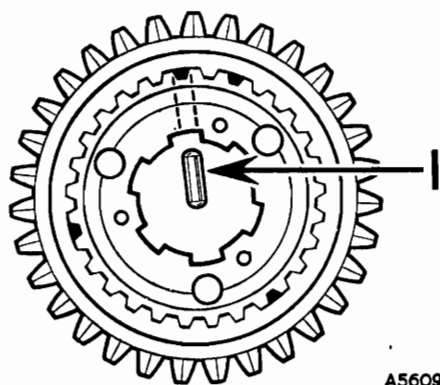


Fig. F.7

The first and second speed gear assembly, showing the gear and hub correctly assembled. The plunger is shown at (1)

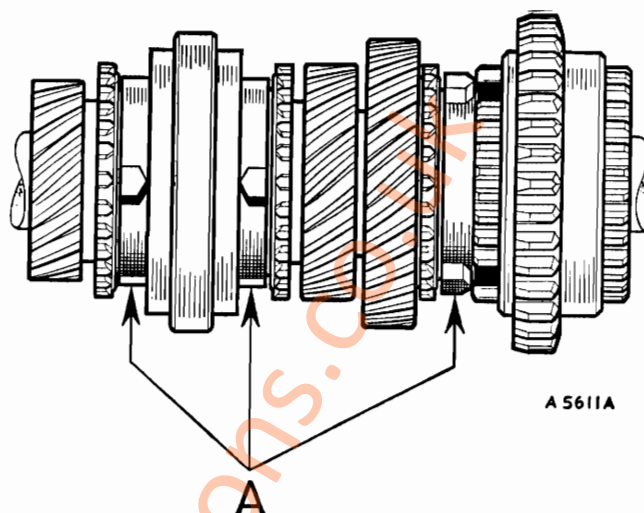


Fig. F.8

The third motion shaft assembly, showing the position of the baulk-rings (A)

Refitting

- (11) Place the differential assembly in the transmission, slightly towards the flywheel.
- (12) Refit the housing with its joint washers and tighten the nuts firmly yet not too tight, to allow the assembly being displaced when the right-hand end cover is fitted.
- (13) Refit the right-hand end cover with its washer. Tighten the screws evenly; as they are tightened the differential assembly will be pushed slightly away from the flywheel.
- (14) Fit the left-hand end cover without its washer and tighten the screws just enough to nip the bearing outer race. Measure the gap between the end cover and the housing in several places and tighten or loosen the screws to even the gap at all positions where measurements are taken.

- (15) Add shims between the register in the end cover and the bearing outer race to give a gap between the end cover flange and the housing of $\cdot008$ to $\cdot009$ in. ($\cdot20$ to $\cdot23$ mm.).
- (16) Remove the end cover, refit the washer and the cover and fully tighten the screws.
- (17) Tighten the differential housing nuts.
- (18) Reverse the operations (1) to (4) under 'Removing'.

Section F.4

SYNCHRONIZING CONES (Non-baulk-ring Transmission)

Cones may be shrunk onto the second, third, and fourth gears by heating in oil to 121°C . (250°F .) and quenching in cold water when in position.

See Fig. F.9 for machining dimensions.

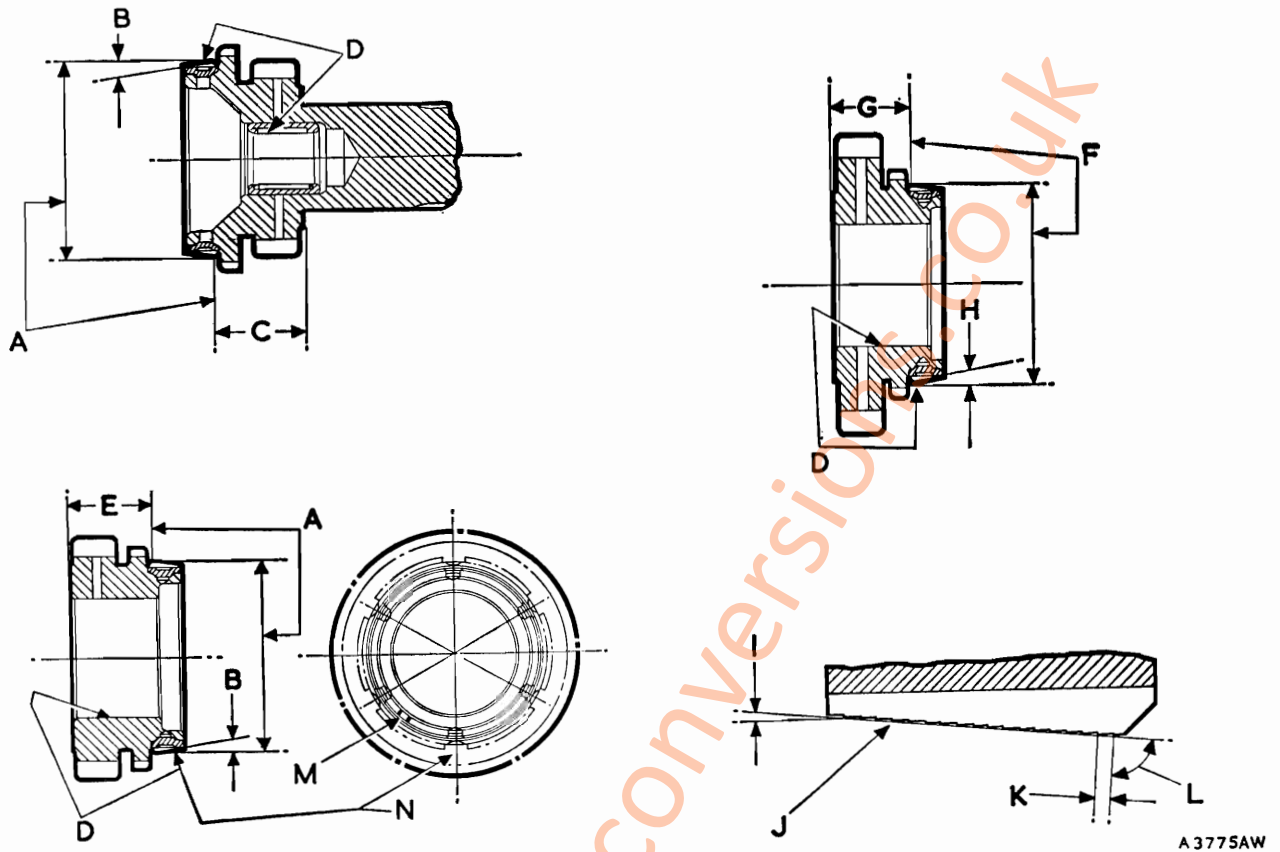


Fig. F.9

Top left: first motion shaft. Lower left: third speed mainshaft gear. Top right: second speed mainshaft gear.
Lower right: Cone

Dimensions

- | | |
|---|--|
| A. Taper 2.150 in. (54.61 mm.) dia. at this line to gauge. | I. 6°. |
| B. Taper 10° 30', to be true and concentric with bore to .001 in. (.025 mm.). | J. Coarse turning may be either right or left-hand. |
| C. .909/.912 in. (23.09/23.16 mm.). | K. .015 in. (.38 mm.). |
| D. Taper to be true and concentric with bore to .001 in. (.025 mm.). | L. 90°. |
| E. .862/.865 in. (21.8/21.9 mm.). | M. One notch to be ground in position shown relative to grooves with indentations. |
| F. Taper 2.150 in. (54.61 mm.) dia. at this line to gauge. | N. Synchronizing cone to be heated in oil, shrunk onto gear, and punched into holes as shown with centre-line of holes and spaces in cone in line. |
| G. .837/.840 in. (21.254/21.335 mm.). | |
| H. 8° 30'. | |

SECTION Fa

THE AUTOMATIC TRANSMISSION

	<i>Section</i>
General description	
Power flow diagrams (Mechanical)	
Line pressure and lubrication diagrams	
Adjustments	Fa.2
Inhibitor switch	
Gear-change cable and selector rod	
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Servo assembly	Fa.8
Top and reverse clutch	Fa.10
Transmission unit	Fa.3
Valve block	Fa.4

GENERAL DESCRIPTION

The automatic transmission incorporates a three-element fluid torque converter with a maximum torque conversion ratio of 2 : 1 coupled to a bevel gear train which provides four forward gears and reverse.

Engine power is transmitted from the crankshaft converter output gear through an idler gear to the input gear which drives the bevel reduction gears in the gear train assembly.

The final drive is transmitted from a drive gear to a conventional-type differential unit (similar to that fitted to a synchromesh transmission unit), which in turn transmits engine power through two flange-type coupling drive shafts employing constant velocity joints to the road wheels.

The complete gear train assembly, including the reduction gear and differential units, runs parallel to, and below, the crankshaft and is housed in the transmission casing which serves also as the engine sump.

The system is controlled by a selector lever within a gated quadrant marked with seven positions, and mounted centrally on the floor of the car. The reverse, neutral, and drive positions are for normal automatic driving, with the first, second, third, and fourth positions used for manual operation or over-ride as required. This allows the system to be used as a fully automatic four-speed transmission, from rest to maximum speed with the gears changing automatically according to throttle position and load. If a lower gear is required to obtain greater acceleration, an instant full throttle position, i.e. 'kick-down' on the accelerator, immediately produces the change.

Complete manual control of all four forward gears by use of the selector lever provides rapid changes. However, it is very important that downward changes are effected at the correct road speeds otherwise serious damage may result to the automatic transmission unit. The second, third, and top gears provide engine braking whether driving automatic or manual; in first gear a free-wheel condition exists when decelerating. Manual selection to third or second gear gives engine braking and also allows the driver to stay in a particular lower gear to suit road conditions or when descending steep hills.

The hydraulic system

Oil is drawn from the transmission casing through the main gauze strainer and pick-up pipe by the main oil pump which has a high potential output and serves both the engine lubrication and transmission systems with a common oil supply. The oil passes through drillings in the cylinder block and a pipe to the external full-flow filter and thence to the valve block.

The valve block assembly controls pressures to the transmission. Separate valves control the converter and engine pressures. The oil passes from the valve block through a long connecting pipe to the converter stator unit. Three short interconnecting pipes take the necessary line pressure to each of the servos which control brake band operation in manual and automatic selector positions.

Fa.2

The power flow through the bevel reductions gear is coupled to the final drive gear pinion by means of two multi-disc clutch assemblies operated hydraulically in manual and the automatic selector positions.

In the event of tow-starting the engine, an auxiliary oil pump of low capacity is employed which is responsive to vehicle speed only; immediately the engine starts the main pump automatically takes over.

The governor system

The governor is driven by the auxiliary pump gears and is of the spring-loaded mechanical type, with its bobweights mounted on short links. A rod linkage transfers the movement to the governor valve incorporated in the valve block chest.

A spring-loaded rod connected to the carburetter provides an over-ride device. The spring tends to be compressed by accelerator pedal operation, and transfers this load by levers to the governor. The effect is to delay travel of the governor, which in turn delays gear shifts more as the accelerator is depressed.

The torque converter

This is fitted onto a taper on the rear of the crankshaft. Basically it comprises three elements, i.e. an impeller, a turbine, and a stator, but it is only serviced as a unit.

There is a continuous supply of oil circulating through the unit; this assists in dissipating the heat generated, and the out-flow passes through a low-pressure valve which maintains a 30 lb./sq. in. (2.1 kg./cm.²) pressure within the converter to improve efficiency.

The brake bands and servos

Three brake bands are used. One is for reverse and the others provide second and third speed reactions. The clamping load is applied by three hydraulic servos in a common casing.

The multi-disc clutches

For forward motion a single-piston multi-disc clutch carries the drive and is engaged at all times during forward motion of the car. This forward clutch unit is fitted on one side of the final drive pinion and on the other side is a top and reverse clutch assembly which has a tandem piston arrangement. This feature is necessary because the clutch is also engaged for reverse and since a greater torque capacity is required in this case both pistons are pressurized.

The valve block

This assembly is constructed of three sections, i.e. the lid, valve chest, and pipe chest.

A linkage arrangement locates the selector valve and this in turn is controlled by the selector rod, externally connected by cable to the gear selector lever in the car. The function of the various valves is as follows:

The selector valve, directs oil from the main supply to either the governor valve for automatic gear-shifting or alternatively to the appropriate clutch or servo for manual selection.

The regulator valve controls the main line pressure, a secondary piston on the valve boosts this pressure when reverse is selected.

The governor valve movement is controlled by the mechanical governor and it directs the oil flow to the appropriate clutch or servo for automatic gear-shifts.

The relay valves are used for shifts from second to third and third to top. They enable the clutch or servo required to be supplied either from the selector valve in 'manual' control or the governor valve in 'automatic'. In addition, pistons are fitted in front of the second and third relay valves to ensure that on up-shifts the engagement of the new ratio and release of the old occur simultaneously to prevent engine overspeeding between shifts. A relay valve is not required for the first gear as the torque reaction is controlled mechanically by a one-way clutch.

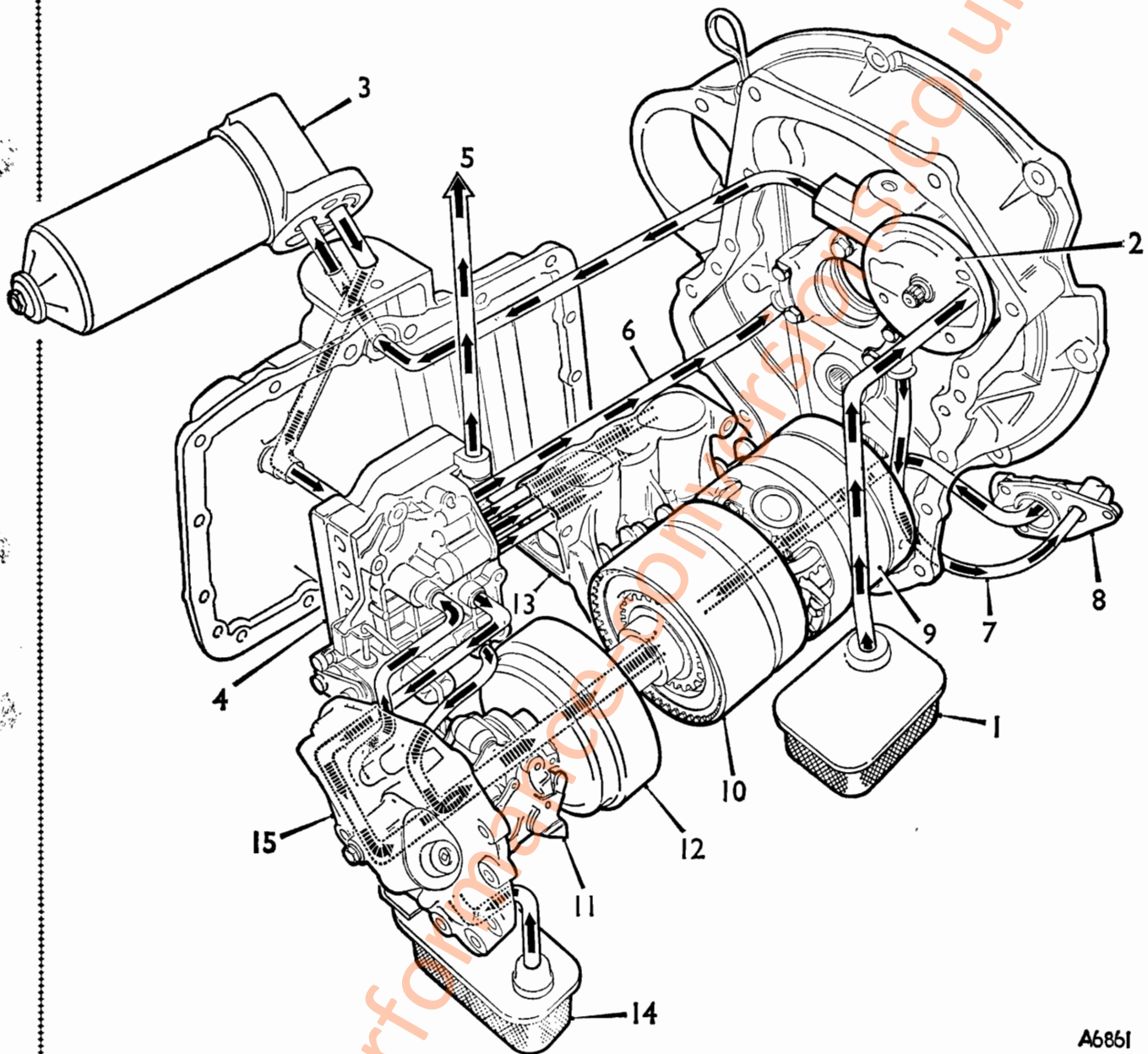
The tow-start valve short-circuits the auxiliary pump under all normal driving conditions but supplies the required line pressure for tow-starting. Immediately the engine starts the main pump automatically takes over.

The low-pressure valve

This valve controls the pressure in the converter to 30 lb./sq. in. (2.1 kg./cm.²). When the engine is stopped the valve is seated, preventing the converter draining. This avoids difficulties in checking the combined engine/transmission oil level and prevents a noisy and inefficient converter when restarting the engine.

The auxiliary pump

This unit is used for tow-starting. It is of limited capacity and is responsive to road speed only.



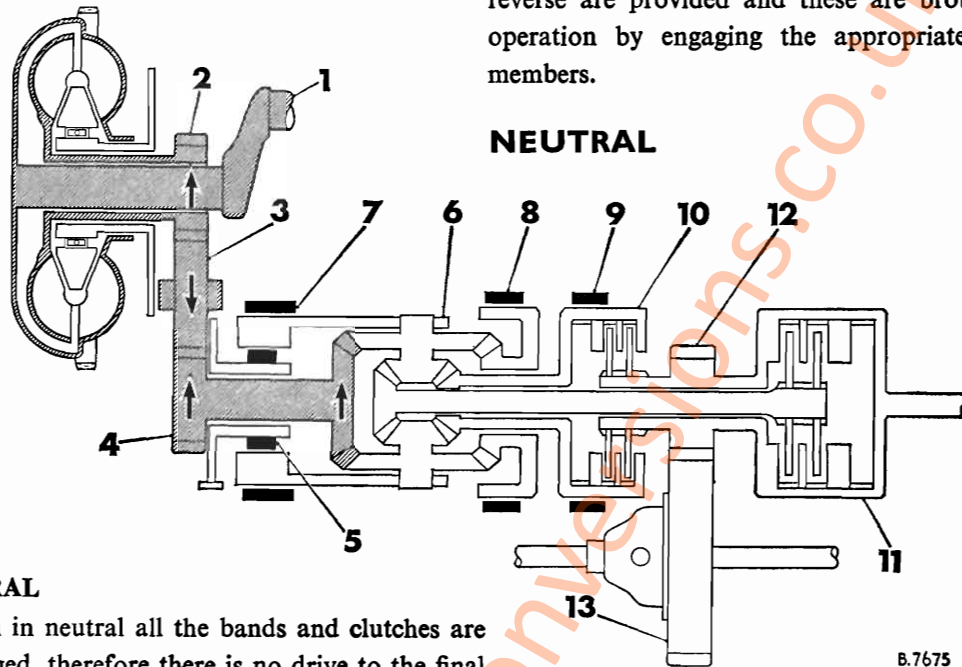
A686I

The components of the automatic transmission with the lubrication system and 'power flow' indicated by arrows to the various components

- | | | |
|-------------------------|--|----------------------------------|
| 1. Main oil strainer. | 6. Converter feed pipe. | 11. Governor. |
| 2. Oil pump. | 7. Converter to low pressure valve feed. | 12. Forward clutch. |
| 3. Oil filter assembly. | 8. Low pressure valve. | 13. Servo unit. |
| 4. Valve block. | 9. Gear train. | 14. Auxiliary pump oil strainer. |
| 5. Engine oil feed. | 10. Top and reverse clutch. | 15. Auxiliary pump. |

POWER FLOW DIAGRAMS (MECHANICAL)

The power flow diagrams indicate how the various ratios are obtained. Four speeds and reverse are provided and these are brought into operation by engaging the appropriate friction members.



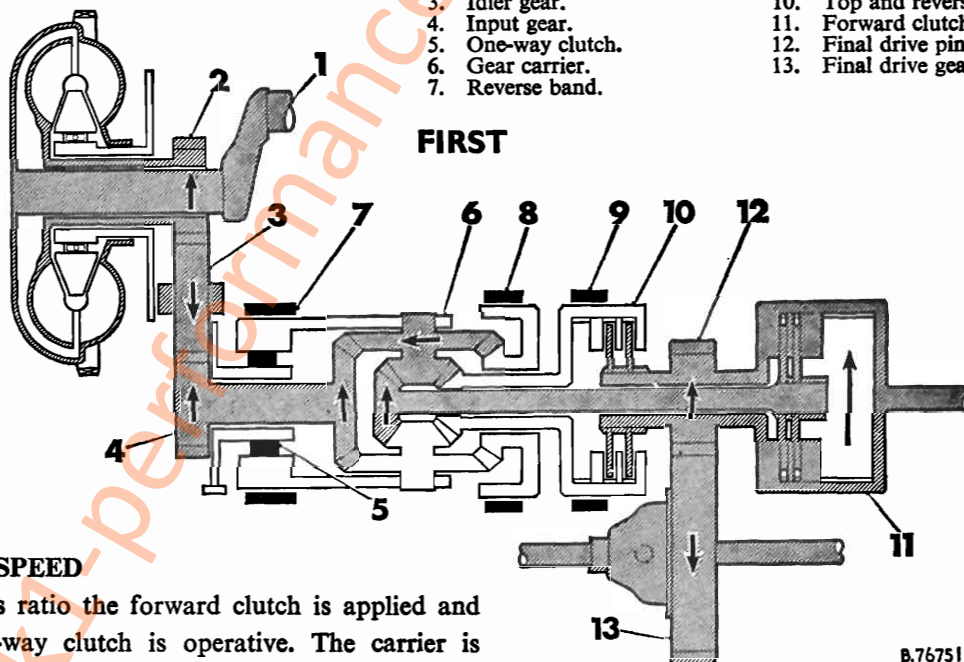
B.7675

NEUTRAL

When in neutral all the bands and clutches are disengaged, therefore there is no drive to the final drive pinion.

KEY TO COMPONENTS

- | | |
|---------------------------|-----------------------------|
| 1. Crankshaft. | 8. Third gear band. |
| 2. Converter output gear. | 9. Second gear band. |
| 3. Idler gear. | 10. Top and reverse clutch. |
| 4. Input gear. | 11. Forward clutch. |
| 5. One-way clutch. | 12. Final drive pinion. |
| 6. Gear carrier. | 13. Final drive gear. |
| 7. Reverse band. | |



B.76751

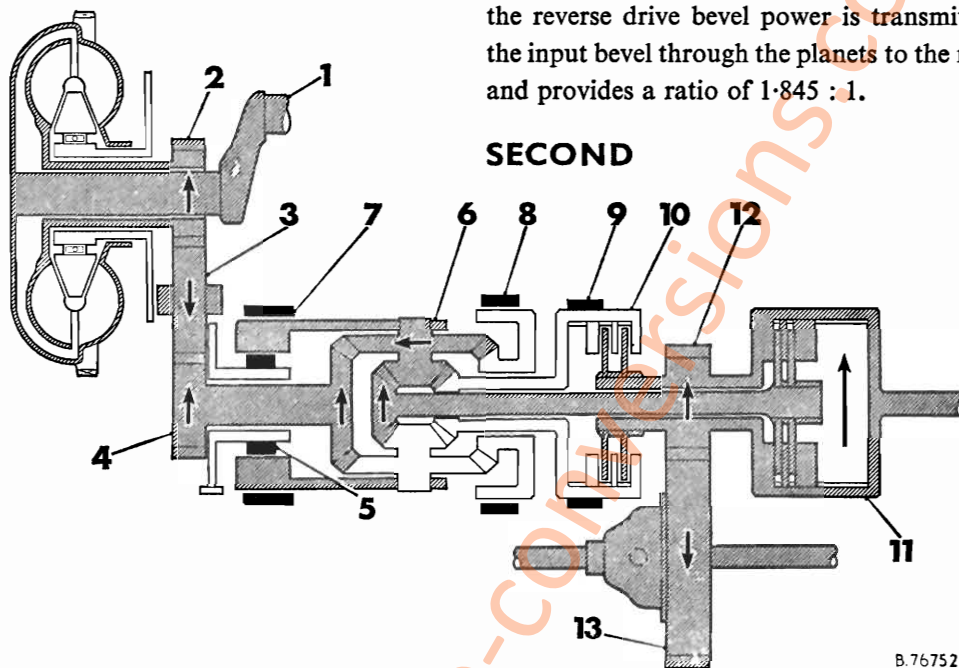
FIRST SPEED

In this ratio the forward clutch is applied and the one-way clutch is operative. The carrier is stationary, its reaction being controlled by the one-way clutch. The input bevel drives the planet wheels and the planet pinions drive the forward output pinion and shaft. Thus power is transferred through the planet assemblies to the mainshaft, forward clutch, and the output gear, providing a ratio of 2.69 : 1.

POWER FLOW DIAGRAMS (MECHANICAL)

SECOND SPEED

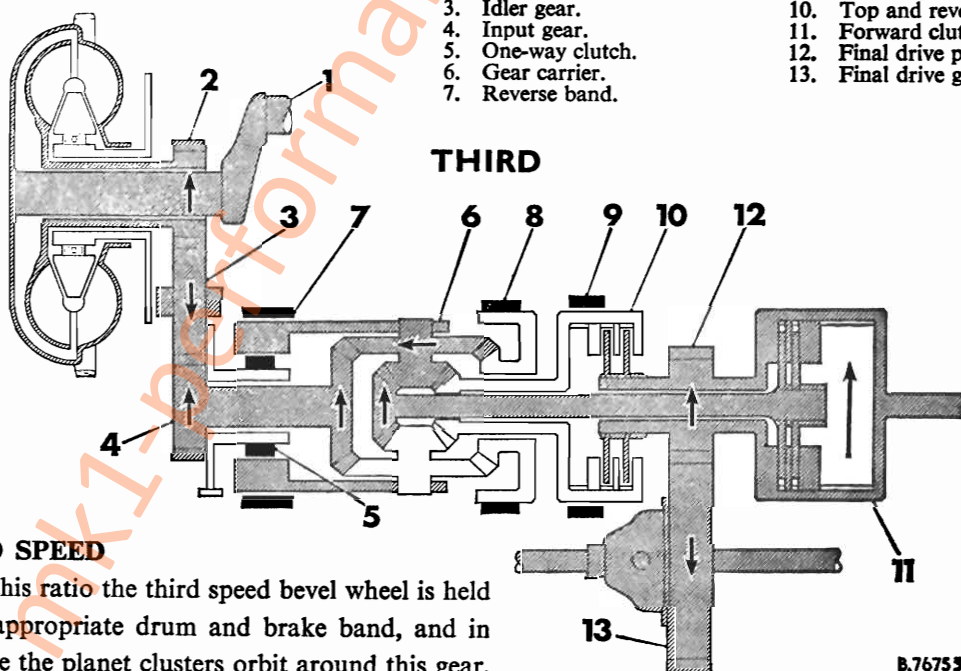
As for all forward gears the forward clutch remains engaged, and in addition the second speed brake band applied. This controls the reaction which is imposed on the reverse drive bevel when in this ratio. With the planet cluster orbiting around the reverse drive bevel power is transmitted from the input bevel through the planets to the mainshaft and provides a ratio of 1.845 : 1.



B.76752

KEY TO COMPONENTS

- | | |
|---------------------------|-----------------------------|
| 1. Crankshaft. | 8. Third gear band. |
| 2. Converter output gear. | 9. Second gear band. |
| 3. Idler gear. | 10. Top and reverse clutch. |
| 4. Input gear. | 11. Forward clutch. |
| 5. One-way clutch. | 12. Final drive pinion. |
| 6. Gear carrier. | 13. Final drive gear. |
| 7. Reverse band. | |



B.76753

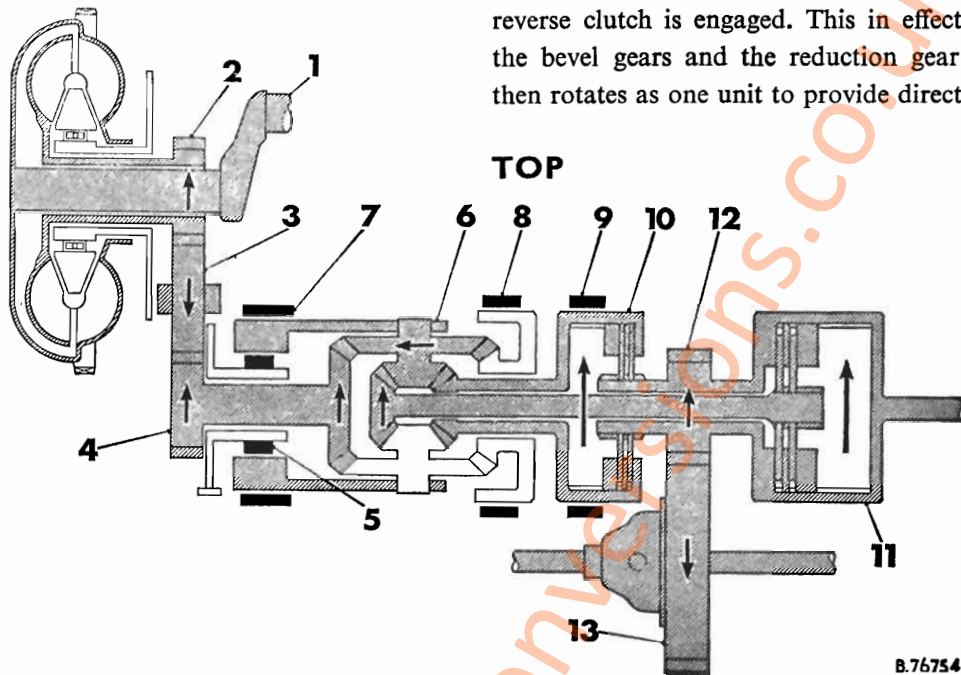
THIRD SPEED

For this ratio the third speed bevel wheel is held by its appropriate drum and brake band, and in this case the planet clusters orbit around this gear. Like second speed, power is transmitted from the input bevel through the planets to the mainshaft and in this case provides a ratio of 1.46 : 1.

POWER FLOW DIAGRAMS (MECHANICAL)

TOP SPEED

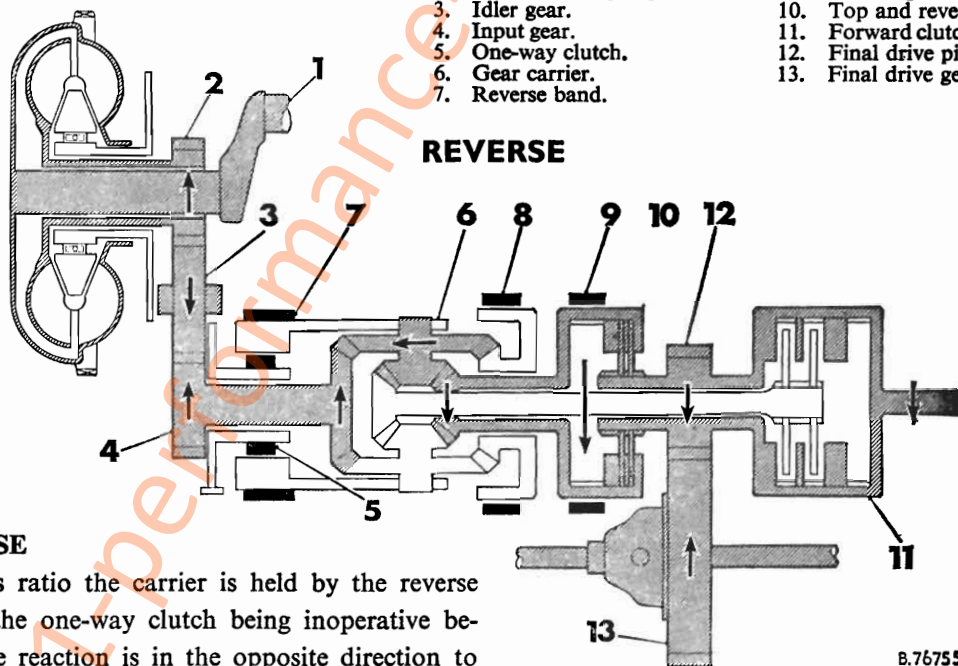
In addition to the forward clutch, the top and reverse clutch is engaged. This in effect locks up the bevel gears and the reduction gear assembly then rotates as one unit to provide direct drive.



KEY TO COMPONENTS

- | | |
|---------------------------|-----------------------------|
| 1. Crankshaft. | 8. Third gear band. |
| 2. Converter output gear. | 9. Second gear band. |
| 3. Idler gear. | 10. Top and reverse clutch. |
| 4. Input gear. | 11. Forward clutch. |
| 5. One-way clutch. | 12. Final drive pinion. |
| 6. Gear carrier. | 13. Final drive gear. |
| 7. Reverse band. | |

REVERSE



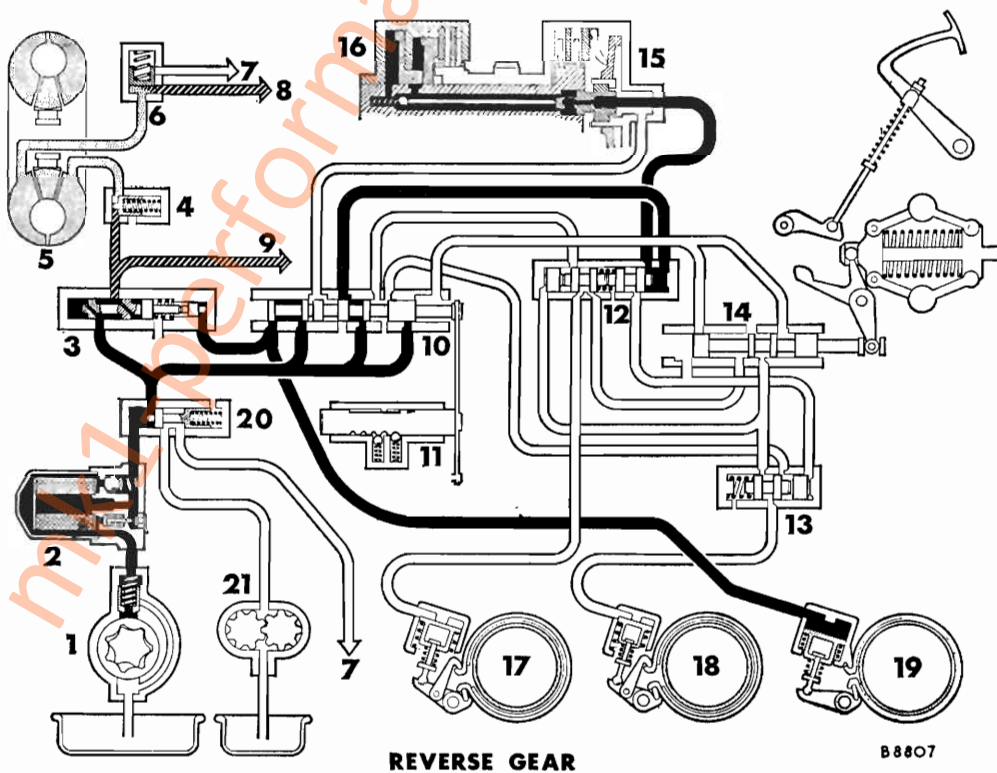
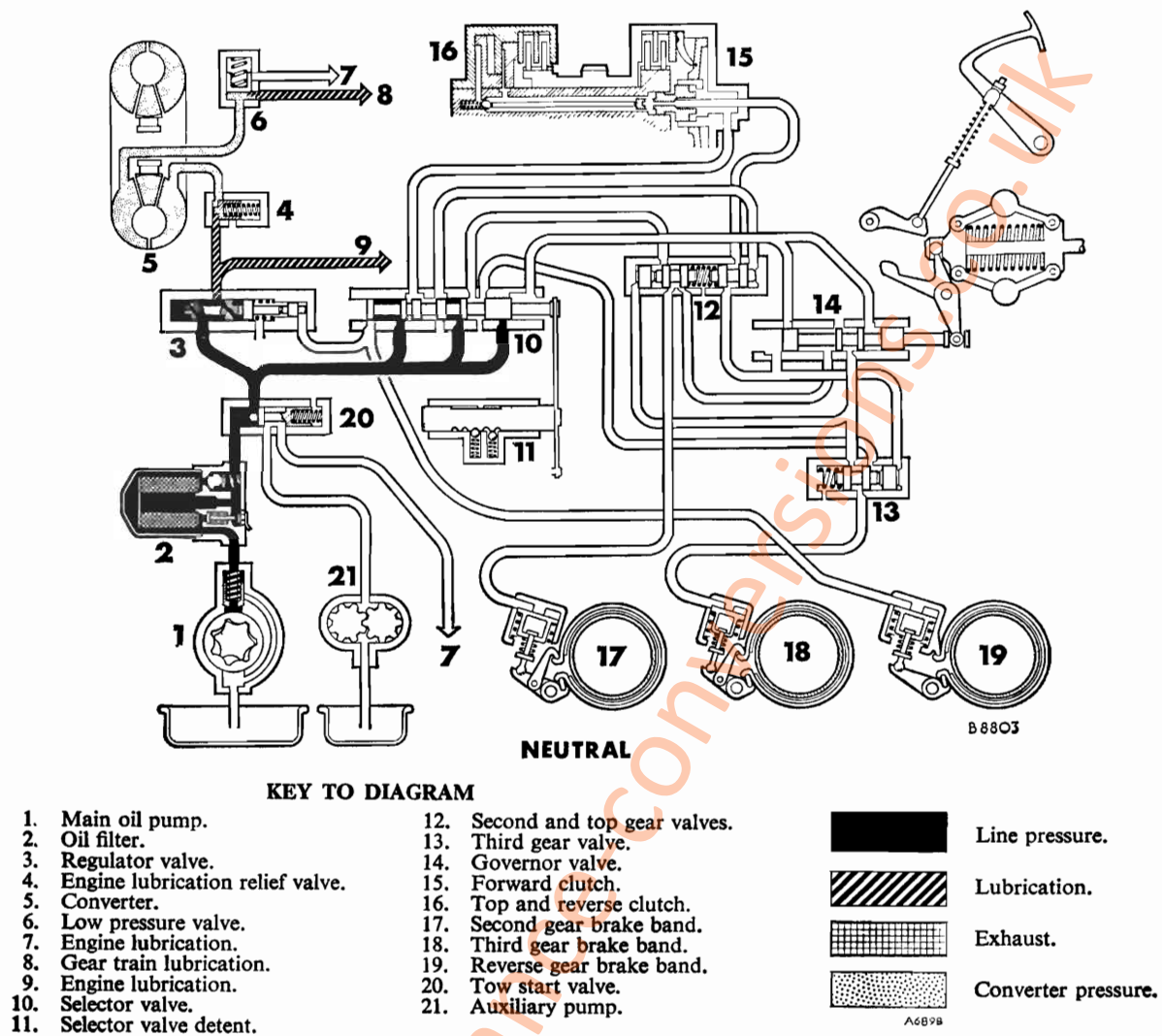
REVERSE

In this ratio the carrier is held by the reverse band—the one-way clutch being inoperative because the reaction is in the opposite direction to first speed).

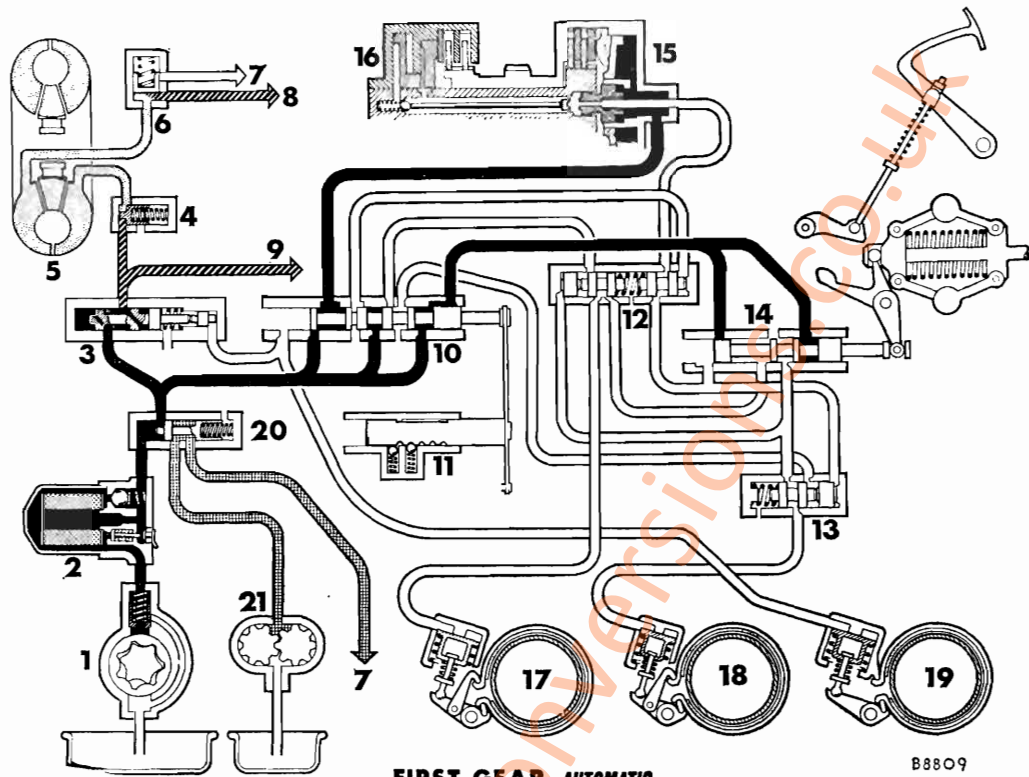
In addition the top and reverse clutch is engaged.

The input bevel wheel drives the planet wheel and the planet pinion drives the reverse drive gear. Thus power is transmitted through the planet assemblies to the top and reverse clutch and thence to the final drive pinion to provide a ratio of 2.69 : 1.

LINE PRESSURE AND LUBRICATION DIAGRAMS



LINE PRESSURE AND LUBRICATION DIAGRAMS

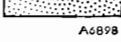


FIRST GEAR AUTOMATIC

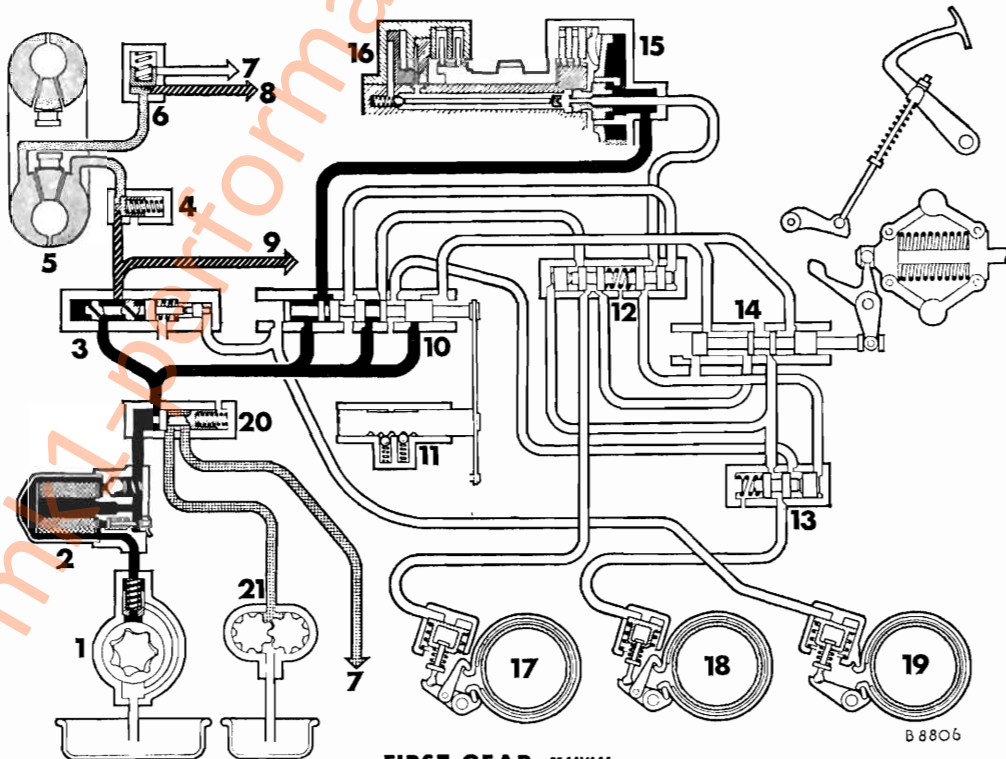
KEY TO DIAGRAM

1. Main oil pump.
2. Oil filter.
3. Regulator valve.
4. Engine lubrication relief valve.
5. Converter.
6. Low pressure valve.
7. Engine lubrication.
8. Gear train lubrication.
9. Engine lubrication.
10. Selector valve.
11. Selector valve detent.

12. Second and top gear valves.
13. Third gear valve.
14. Governor valve.
15. Forward clutch.
16. Top and reverse clutch.
17. Second gear brake band.
18. Third gear brake band.
19. Reverse gear brake band.
20. Tow start valve.
21. Auxiliary pump.

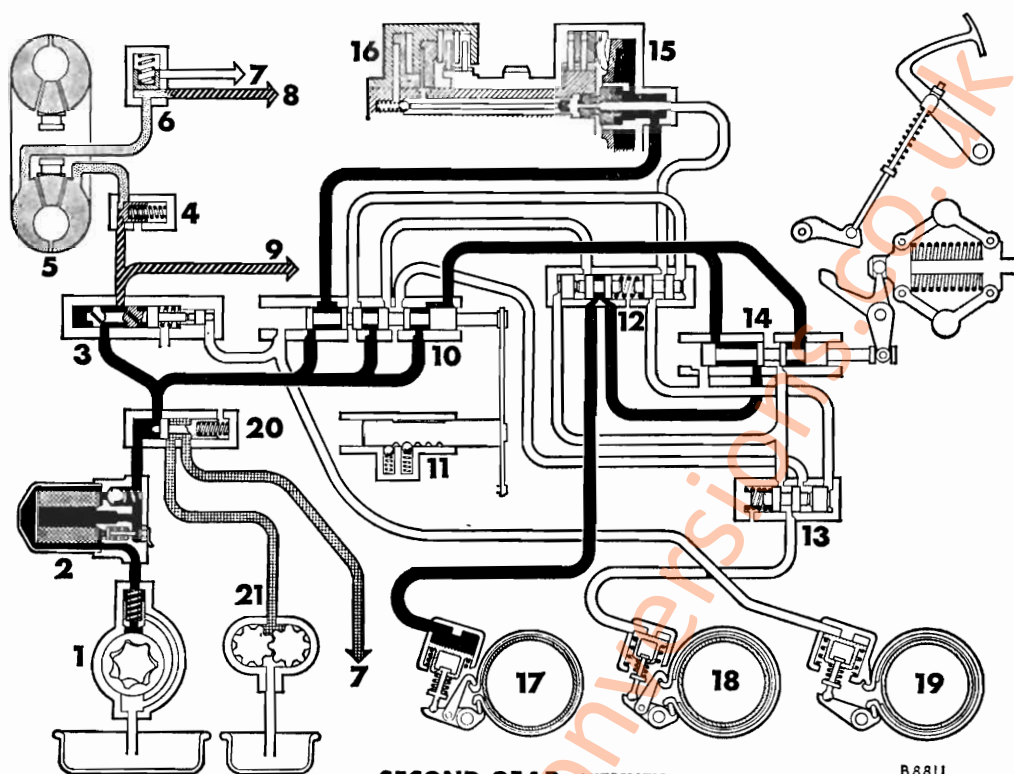
-  Line pressure.
-  Lubrication.
-  Exhaust.
-  Converter pressure.

A6898



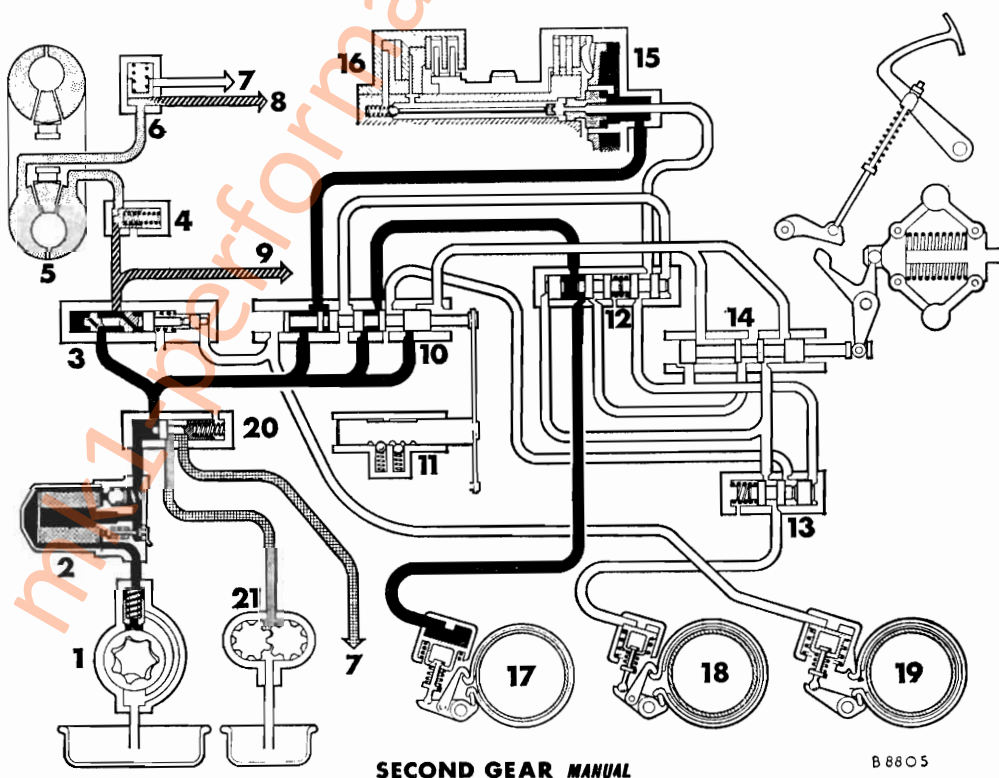
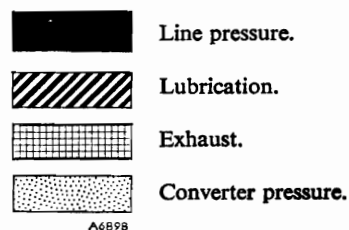
FIRST GEAR MANUAL

LINE PRESSURE AND LUBRICATION DIAGRAMS

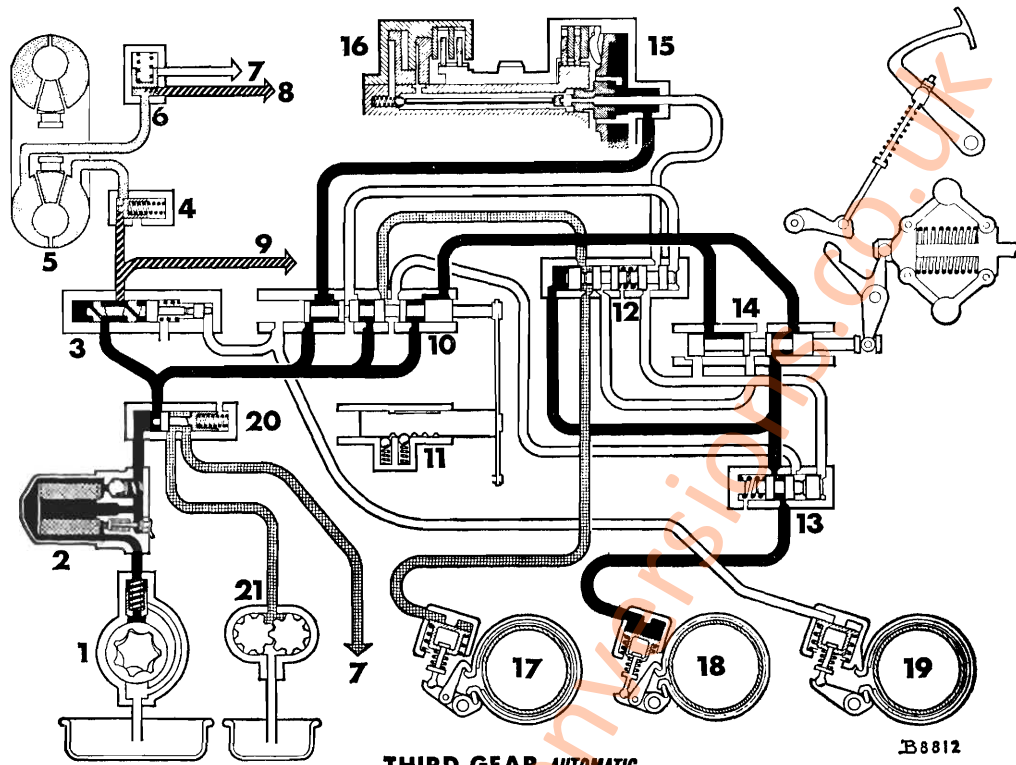


KEY TO DIAGRAM

- | | |
|-------------------------------------|---------------------------------|
| 1. Main oil pump. | 12. Second and top gear valves. |
| 2. Oil filter. | 13. Third gear valve. |
| 3. Regulator valve. | 14. Governor valve. |
| 4. Engine lubrication relief valve. | 15. Forward clutch. |
| 5. Converter. | 16. Top and reverse clutch. |
| 6. Low pressure valve. | 17. Second gear brake band. |
| 7. Engine lubrication. | 18. Third gear brake band. |
| 8. Gear train lubrication. | 19. Reverse gear brake band. |
| 9. Engine lubrication. | 20. Tow start valve. |
| 10. Selector valve. | 21. Auxiliary pump. |
| 11. Selector valve detent. | |



LINE PRESSURE AND LUBRICATION DIAGRAMS

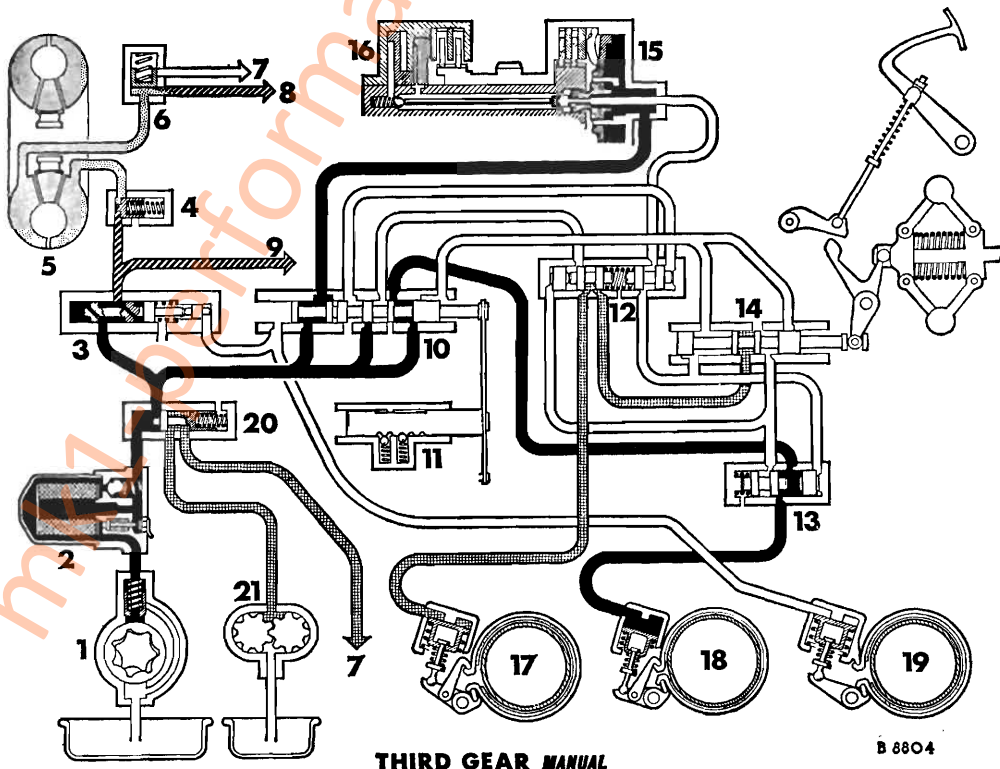


KEY TO DIAGRAM

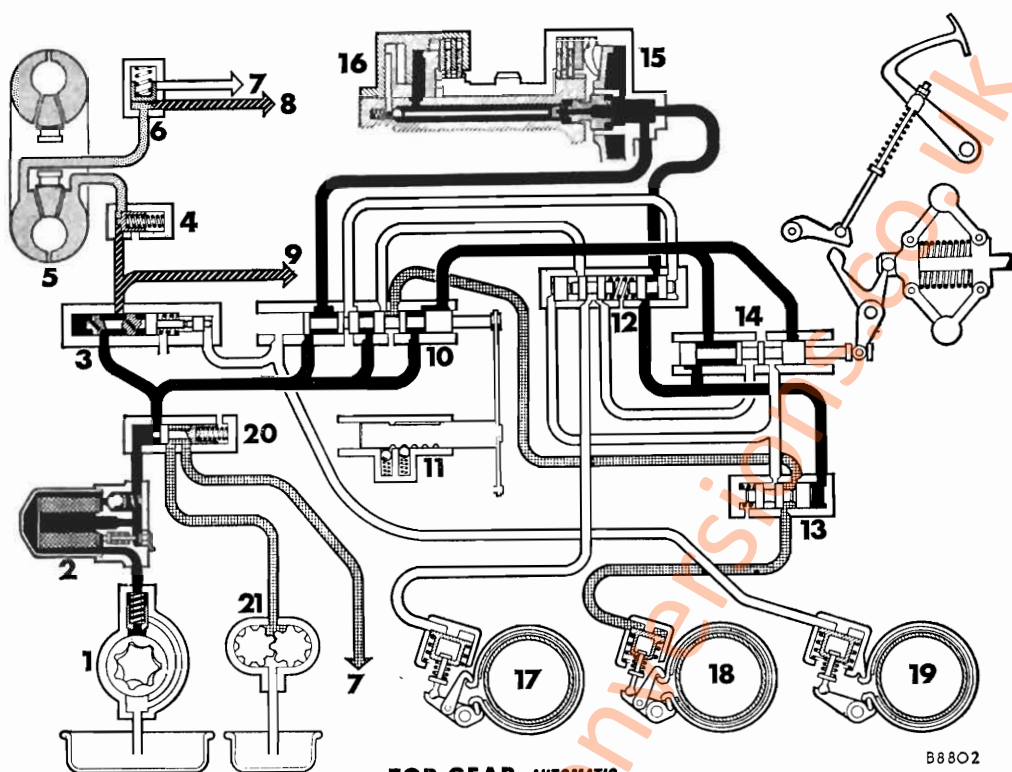
1. Main oil pump.
2. Oil filter.
3. Regulator valve.
4. Engine lubrication relief valve.
5. Converter.
6. Low pressure valve.
7. Engine lubrication.
8. Gear train lubrication.
9. Engine lubrication.
10. Selector valve.
11. Selector valve detent.

12. Second and top gear valves.
13. Third gear valve.
14. Governor valve.
15. Forward clutch.
16. Top and reverse clutch.
17. Second gear brake band.
18. Third gear brake band.
19. Reverse gear brake band.
20. Tow start valve.
21. Auxiliary pump.

- Line pressure.
- Lubrication.
- Exhaust.
- Converter pressure.



LINE PRESSURE AND LUBRICATION DIAGRAMS



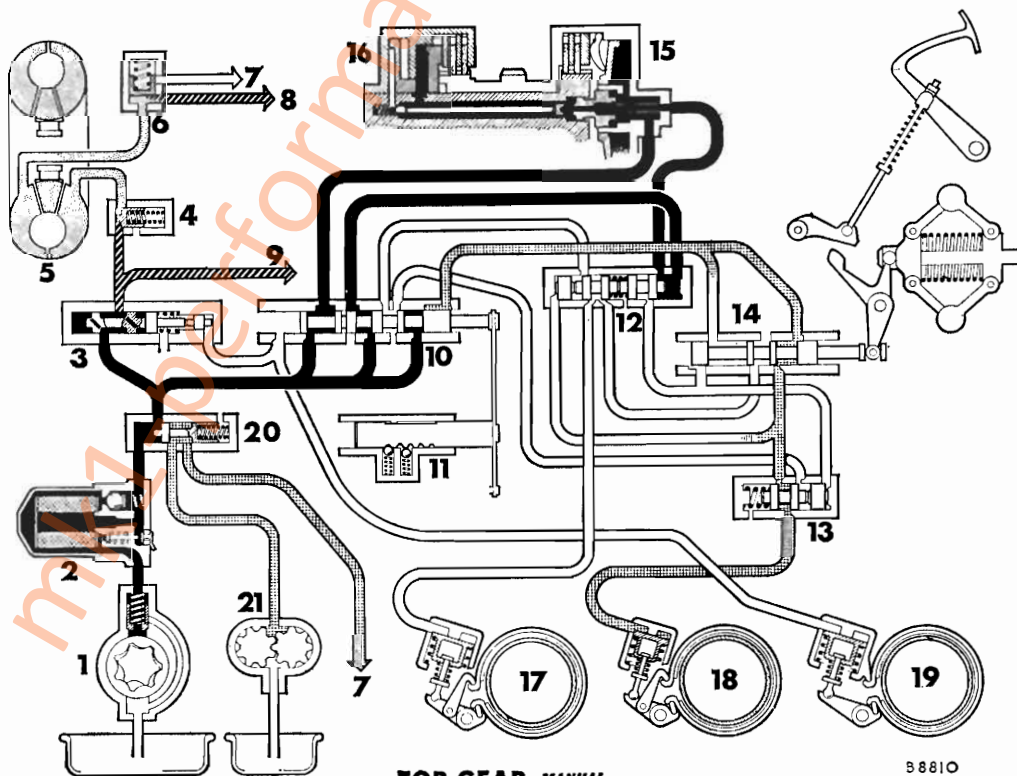
TOP GEAR AUTOMATIC

KEY TO DIAGRAM

- | | |
|-------------------------------------|---------------------------------|
| 1. Main oil pump. | 12. Second and top gear valves. |
| 2. Oil filter. | 13. Third gear valve. |
| 3. Regulator valve. | 14. Governor valve. |
| 4. Engine lubrication relief valve. | 15. Forward clutch. |
| 5. Converter | 16. Top and reverse clutch. |
| 6. Low pressure valve. | 17. Second gear brake band. |
| 7. Engine lubrication. | 18. Third gear brake band. |
| 8. Gear train lubrication. | 19. Reverse gear brake band. |
| 9. Engine lubrication. | 20. Tow start valve. |
| 10. Selector valve. | 21. Auxiliary pump. |
| 11. Selector valve detent. | |

- | | |
|--|---------------------|
| | Line pressure. |
| | Lubrication. |
| | Exhaust. |
| | Converter pressure. |

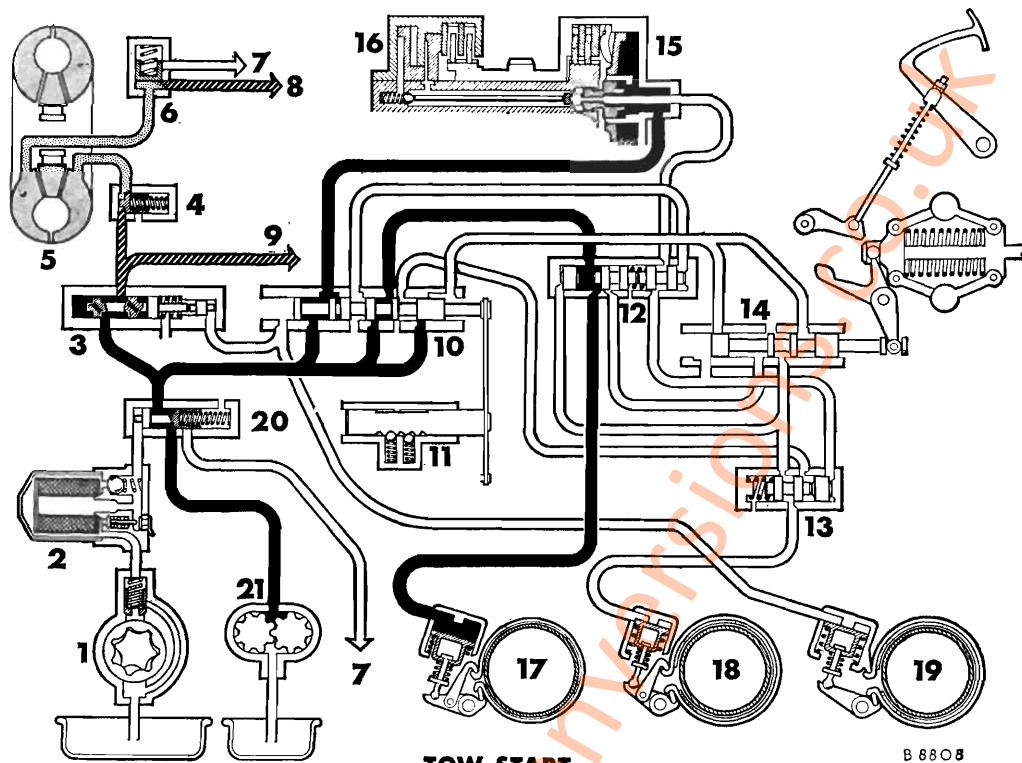
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TOP GEAR MANUAL

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LINE PRESSURE AND LUBRICATION DIAGRAMS



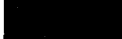
TOW START

B 6808

KEY TO DIAGRAM

1. Main oil pump
2. Oil filter.
3. Regulator valve.
4. Engine lubrication relief valve.
5. Converter.
6. Low pressure valve.
7. Engine lubrication.
8. Gear train lubrication.
9. Engine lubrication.
10. Selector valve.
11. Selector valve detent.

12. Second and top gear valves.
13. Third gear valve.
14. Governor valve.
15. Forward clutch.
16. Top and reverse clutch
17. Second gear brake band.
18. Third gear brake band.
19. Reverse gear brake band.
20. Tow start valve.
21. Auxiliary pump.

-  Line pressure.
-  Lubrication.
-  Exhaust.
-  Converter pressure.

A 6808

Section Fa.1

FAULT DIAGNOSIS

Road test procedure

It is important to carry out a road test in all cases of suspected faults in order to confirm which component(s) of the automatic transmission are faulty or require adjustment.

In suspected cases of slip or poor acceleration a converter stall speed test should be carried out as detailed in Section Fa.2.

Check the performance in all seven selector positions as given below:

Neutral

Check that there is key start in this position only, and not in the drive positions.

Manual 1

Confirm that there is drive with NO engine braking.

Manual 2, 3, 4

Confirm that there is drive WITH engine braking.

Drive (automatic)

Check the speeds at which all up-and down-shifts are changing (these are detailed below on the 'CHANGE SPEED CHART').

Reverse

Confirm that there is drive WITH engine braking.

NOTE.—In suspected cases of faulty transmission gears and/or clutch units, a stall speed test should be carried out in all gears to determine which of the clutch units and/or brake bands are faulty. The mechanical power flow diagrams indicate the components in use for each gear. If there is slip in all gears a low oil pressure is indicated which should be confirmed by a pressure check as detailed in Section Fa.2.

CHANGE SPEED CHART

<i>Selector Position</i>	<i>Throttle Position</i>	<i>Gear Shift</i>	<i>M.P.H.</i>	<i>Km.P.H.</i>
'D'	Light	1-2 2-3 3-4	10-14 15-19 20-24	16-22 24-30 32-39
'D'	Kick-down	1-2 2-3 3-4	25-33 37-45 49-57	40-53 60-72 78-91
'D'	Kick-down	4-3 3-2 2-1	43-39 35-31 22-18	70-64 56-50 35-29
'D'	Closed (roll out)	4-3 3-2 2-1	20-16 14-10 8-4	32-26 22-16 12-6

FAULT DIAGNOSIS

<i>Faults</i>	<i>Diagnosis and Rectification Sequence</i>
Faulty gear selection, possibly with tie-up in 'D' position on kick-down	1
Slip or no drive in forward gears	2, 3
Slip in reverse	4, 5, 6
Slip or no drive in all gears	7, 8, 13, 20, 23
Difficult or bumpy selection and shifts possibly with squawk on selection and with lubrication warning light on or low gauge pressure	7, 8, 9, 13, 20
Erratic automatic shifts	7, 10
Incorrect shift speeds	11
Excessive creep or engine stalls when selecting gear	12
Unable to tow-start	13, 14
Gear whine consistent with road speed but not in 'top' gear (4)	15
Continual whine consistent with engine speed	16
No drive in 'first' gear (1) automatic and manual	17, 18
Slip or no drive in 'second' gear (2) automatic and manual	19
No drive in 2, 3, or 4 positions manual but drives in these gears on automatic 'D'	13
No drive in 2, 3, or 4 automatic 'D' positions, but drives in these gears on manual selection	13
Poor acceleration	21
Reduced maximum speed in all gears with severe converter overheating	22

DIAGNOSIS AND RECTIFICATION CHART

1	Check gear change cable and selector rod adjustment (Section Fa.2).
2	Check the fitting of forward clutch feed pipe (Section Fa.3).
3	Check the forward clutch and/or the shaft rings (Section Fa.6).
4	Check the reverse gear band adjustment or remove the valve block and check the reverse servo feed pipe 'O' ring seals (Section Fa.4).
5	Remove the valve block and clean; regulator valve or reverse booster piston faulty (Section Fa.4).
6	Check the top and reverse clutch booster piston or shut-off valve (Section Fa.10).
7	Check engine/transmission oil level (Section Aa.1).
8	Carry out pressure check (Section Fa.2).
9	Check oil filter head 'O' ring seals or fitting of joint washer (Section Aa.2).
10	Remove and examine governor unit for sticking (Section Fa.5).
11	Check governor control rod adjustment (Section Fa.2).
12	Check carburettor adjustment—incorrect idle speed (Section Da.2).
13	Remove and clean valve block (Section Fa.4).
14	Check auxiliary pump, pipes, and seals (Section Fa.5).
15	Check gear train adjustment (Section Fa.7).
16	Check converter housing bush (Section Aa.4).
17	Check free-wheel support dowel bolt—sheared (Section Fa.3).
18	Check the one-way clutch unit (Section Fa.11).
19	Remove the valve block and check the servo feed pipe 'O' ring seals and check the second gear band adjustment (Section Fa.4).
20	Check main oil pump and flow valve, the supply and feed pipe seals, and main oil strainer seals (Sections Aa.8 and Fa.3).
21	Carry out stall speed check (Section Fa.2).
22	Change the torque converter unit (Section Aa.4).
23	Check the low pressure valve.

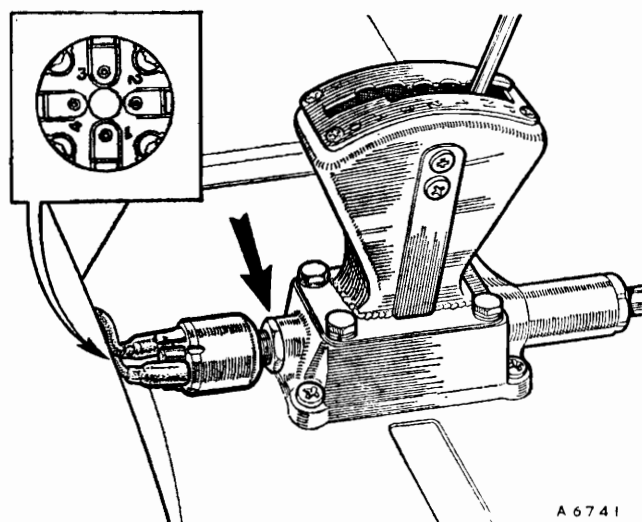


Fig. Fa.1

The inhibitor switch on the gear-change lever housing. Inset, the 1 and 3, 2 and 4 connections marked on the switch. The locking nut is indicated by an arrow

Section Fa.2

ADJUSTMENTS

Inhibitor switch

The switch is located on the rear of the gear selector housing (Fig. Fa.1).

It has four terminals, two of which are connected through the ignition/starter circuit. This ensures that the engine will only start when the gear selector is in the 'N' position.

The switch terminals marked 2 and 4 are used in the ignition/starter circuit, and both the electrical leads are interchangeable to the 2 and 4 positions on the switch.

The terminals marked 1 and 3 are used for reversing light connections (when fitted).

Check the gear-change cable and selector rod adjustment before adjusting the inhibitor switch.

Adjustment

- (1) Select 'N'.
- (2) Disconnect the electrical connections from the switch.
- (3) Slacken the locknut and screw the switch in as far as possible.
- (4) Connect a test lamp or meter across the switch terminals 2 and 4. Screw the switch into the housing until the circuit is made and mark the switch body. Continue screwing in the switch and note the number of turns required until the circuit breaks. Remove the test equipment and unscrew the switch from the housing **half** the number of turns counted.
- (5) Tighten the locknut and refit the electrical leads to the appropriate terminals.

- (6) Verify that the starter operates only when the gear selector lever is in 'N', also that the reversing light (when fitted) operates only when 'R' is selected.

NOTE.—If the switch cannot be adjusted to operate correctly it must be renewed.

Gear-change cable and selector rod

It is most important to carry out the adjustment procedure detailed below and refer to Fig. Fa.2.

Adjustment

- (7) Pull back the rubber boot (1) and remove clevis pin (2). Ensure that the selector rod (3) is screwed in tightly and push it fully into the transmission case.

NOTE.—Never start the engine with the selector rod disconnected.

- (8) Refit the clevis pin (2) into the selector rod yoke (4) and check the measurement given in Fig. Fa.2; adjust if necessary.

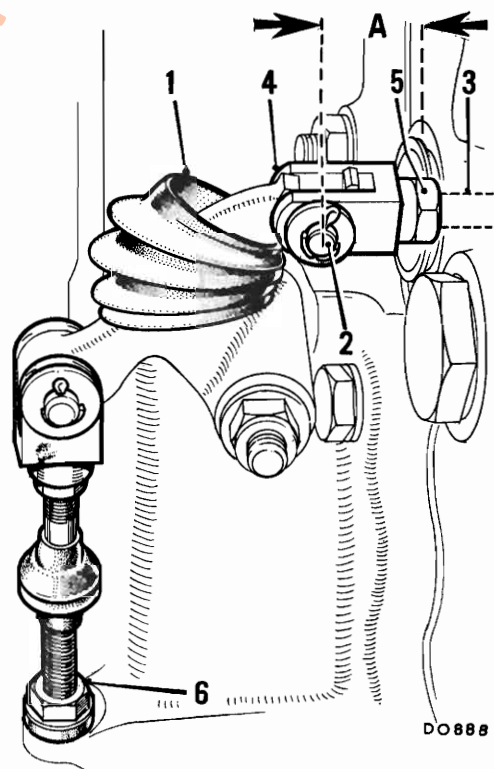


Fig. Fa.2

The gear-change cable and selector rod adjustment

- | | |
|------------------|-------------------------------|
| 1. Rubber boot. | 4. Selector rod yoke. |
| 2. Clevis pin. | 5. Selector rod yoke locknut. |
| 3. Selector rod. | 6. Cable adjusting nuts. |

Shown inset: the selector rod checking dimension.

A = $\frac{3}{8}$ in. (20 mm.)

- (9) Slacken the locknut (5) behind the selector rod yoke and turn the yoke (4) until the correct measurement of $\frac{3}{8}$ in. (20 mm.) is effected (see Fig. Fa.2). Tighten the locknut (5), ensuring that the yoke is set squarely to the bell-crank lever arm.
- (10) Select 'N' in the transmission unit by pulling the selector rod fully out and then pushing it back in one detent.
The measurement 'A' in Fig. Fa.2 should now be 1.45 in. (37 mm.).
- (11) Select 'N' on the quadrant with the gear lever, and adjust the outer cable using the adjusting nuts (6) (see inset to Fig. Fa.2). The adjustment is correct when the clevis pin (2) can be easily refitted.

NOTE.—Ensure that the yoke ends on the selector cable and rod are square to the bell-crank lever, before reconnecting.

Testing adjustment

- (12) Apply the hand and foot brakes, and ensure that the starter operates only in the 'N' position; if this is not correct, adjust the inhibitor switch as detailed in items (1) to (6).
- (13) Start the engine, and move the gear lever to the 'R' position and check that reverse is engaged. Slowly move the lever back towards the 'N' position, checking that the gear is disengaged just before or as soon as the lever drops into the 'N' position on the quadrant. Repeat this procedure in the first gear '1' position. Re-adjust the outer cable slightly if necessary to obtain the above conditions.

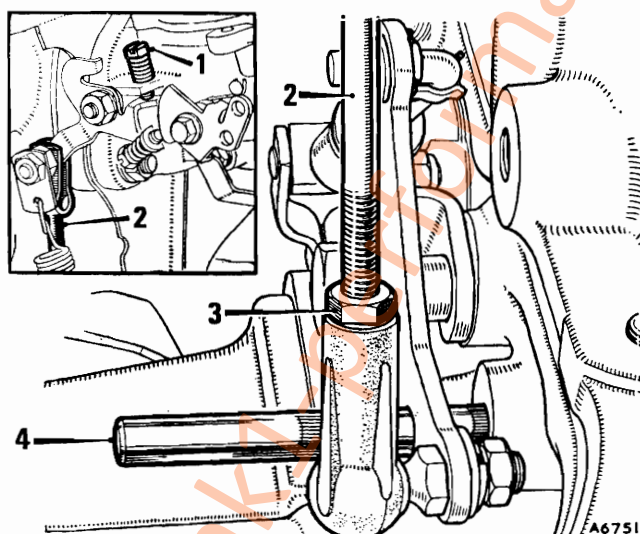


Fig. Fa.3

The governor control rod adjustment showing:

- | | |
|-------------------------------|--|
| 1. Throttle adjustment screw. | 3. Locknut. |
| 2. Governor control rod. | 4. $\frac{1}{4}$ in. (6.4 mm.) diameter rod. |

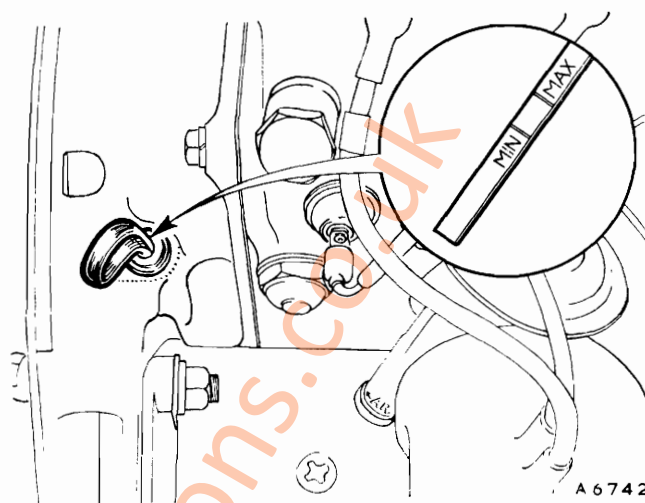


Fig. Fa.4

The oil level dipstick with the level markings shown inset

- (14) Ensure that all adjustment/locking nuts are tight and the clevis pins are secured. Pack the rubber boots with Duckham's Lammol grease. Refit the boots and the weather protection shield (if fitted).
- (15) Carry out a road test, checking the operation in each gear lever position.

Governor control rod adjustment

- (16) Run the engine to its normal working temperature.
- (17) Disconnect the governor control rod at the carburetter.
- (18) With the carburetter correctly tuned, adjust the throttle adjusting screw to give a tachometer reading of 650 r.p.m. at tickover.
- (19) Insert a $\frac{1}{4}$ in. (6.4 mm.) diameter rod through the hole in the governor control rod bell-crank lever and into the hole in the transmission case (Fig. Fa.3).
- (20) Slacken the locknut (3) (Fig. Fa.3) and adjust the length of the rod to suit the carburetter linkage in the tick-over position.
- (21) Reconnect the governor control rod to the carburetter. Tighten the ball joint locknut and remove the checking rod from the bell-crank lever.

Stall speed check

- (22) Start and run the engine until it reaches its normal working temperature and check the oil level.
- (23) Connect a suitable tachometer or that of Service tool 18G 677 or 18G 677 Z (see Fig. Fa.5).

Service tool electrical connections:

18G 677—Green to ignition coil CB.

Red to battery positive.

Black to battery negative.

18G 677 Z—Red to ignition coil CB.

Black to earth connection.

- (24) Apply the hand and foot brakes, select any gear position except 'N' or 1, apply maximum throttle for not more than 10 seconds and note the tachometer reading. Compare the figure obtained with the chart below.

Model	R.P.M.	Condition	Rectification
848 c.c.	1,300-1,400	Satisfactory	Nil
998 c.c.	1,400-1,500	Satisfactory	Nil
	Under 1,000	Stator free wheel slip	Change torque converter
	Over 1,500	Transmission slip	Check transmission unit (see Road Test note)
848 c.c. and 998 c.c.	Under 1,300	Engine down for power	Check engine

- (25) Disconnect the tachometer.

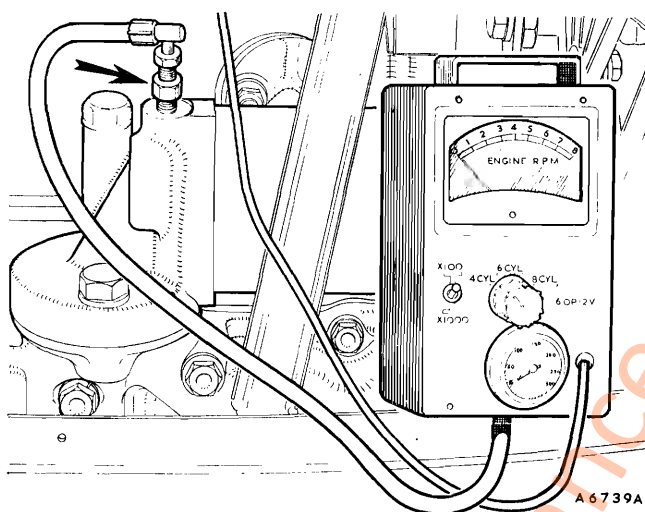


Fig. Fa.5

Checking the pressures and the stall speed with Service tool 18G 677 and adaptor 18G 677 C (arrowed)

Pressure check

- (26) Check and top up the oil level (see Section Aa.1).
- (27) Remove the pressure point plug on the engine oil filter, fit Service tool adaptor 18G 677 C, and connect Service tool 18G 677 Z (see Fig. Fa. 5) or use pressure gauge (Service tool 17G 502 A with pipe and adaptor 18G 502 K).
- (28) Start and run the engine until the oil temperature is 80° C. (176° F.) (check with a thermometer inserted into the dipstick hole). Re-start and run the engine at 1000 r.p.m. and check the following approximate pressures:
- In all gear positions except 'R' a pressure of between 75 and 85 lb./sq. in. (5.3 and 6 kg./cm.²) should register on the gauge.
 - In 'R' the pressure should be between 115 and 125 lb./sq. in. (8 and 8.8 kg./cm.²).

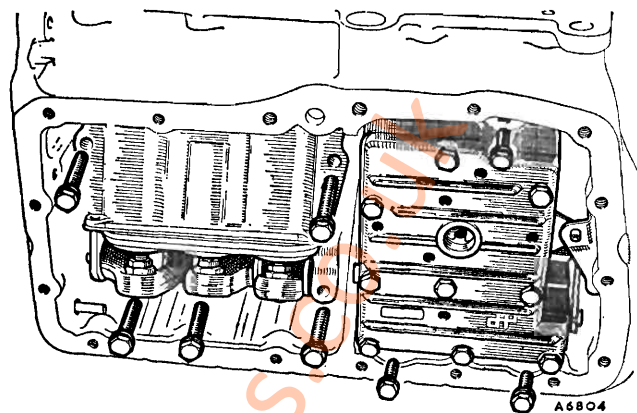


Fig. Fa.6

Removing the valve block and servo bolts

NOTE.—Should the approximate pressures given above not be obtainable, see Section Fa.1, 'FAULT DIAGNOSIS'.

- (29) Remove the pressure test equipment and refit the plug.

Section Fa.3

TRANSMISSION UNIT

Dismantling

- Remove the engine and transmission from the car, see Section Aa.3.
- Remove the transmission from the engine as detailed in Section Aa.4 **only** if fitting a replacement engine, transmission case, or if it is necessary to remove the main oil strainer pick-up pipe and seals.
- Remove the converter and converter housing as detailed in Section Aa.4, items (1) to (11) and (13).

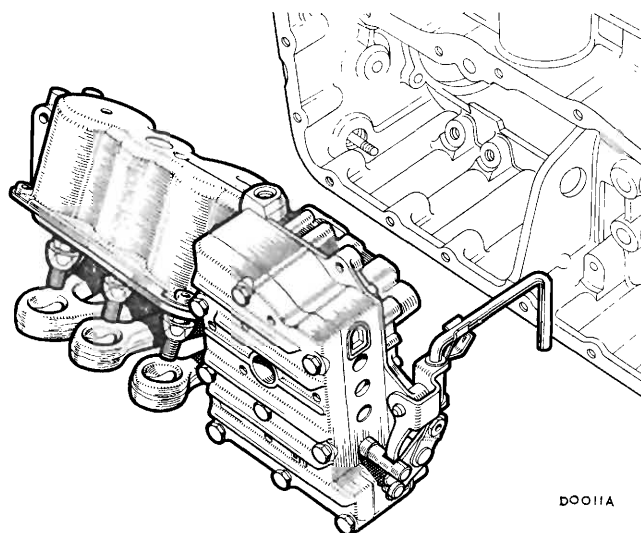


Fig. Fa.7

Removing the valve block and servo unit as an assembly

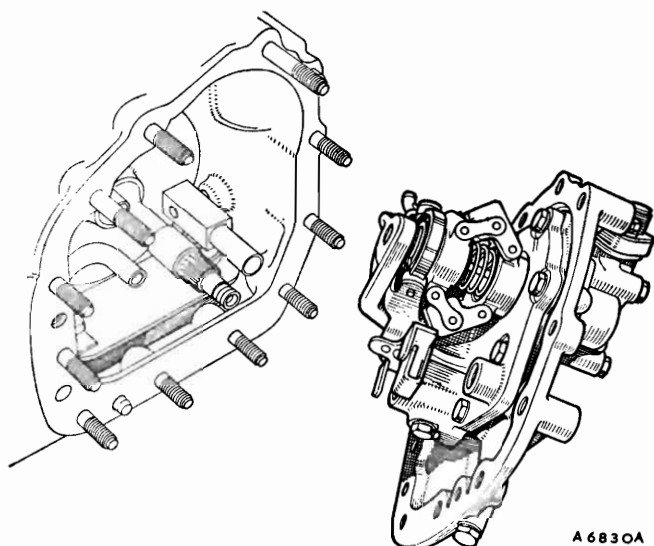


Fig. Fa.8

Removing the auxiliary pump and governor assembly

- (3) Unscrew and withdraw the gear selector rod and remove the front cover (the connecting bobbin is pressed into the later-type cover).
- (4) Remove the governor control assembly from the transmission case and fit Service tool 18G 1097 (see Fig. Fa.19).
- (5) Remove the securing nuts and pull the auxiliary pump and governor assembly from the transmission case.

NOTE.—For auxiliary pump and governor dismantling and reassembling see Section Fa.5.

- (6) Remove the dowel bolt and pull out the auxiliary pump filter outlet pipe.
- (7) Pull out the auxiliary pump outlet and the forward clutch apply pipes.

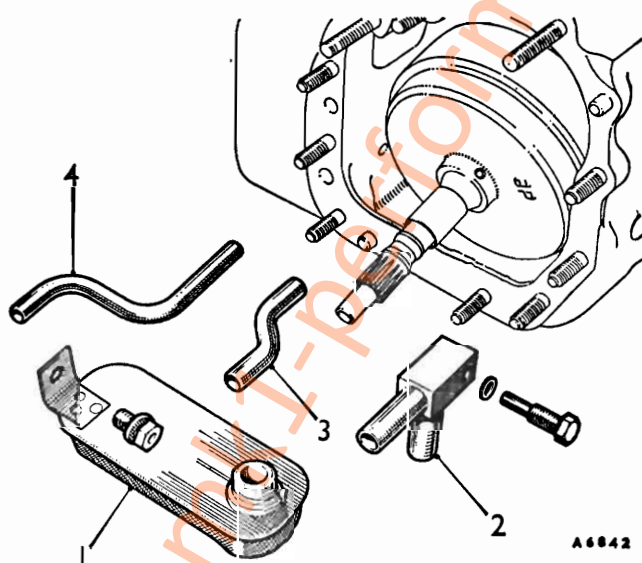


Fig. Fa.9

Removing the auxiliary oil pump strainer (1) and pipe (2), with (3) the outlet pipe, and (4) the forward clutch apply pipe

- (8) Remove the set screw and lift out the auxiliary pump filter.
- (9) Remove Service tool 18G 1097 and withdraw the forward clutch from the casing.

NOTE.—For forward clutch dismantling and reassembling see Section Fa.6.

- (10) Withdraw the forward output shaft and tap out the reverse shut-off valve. Insert the dummy output shaft Service tool 18G 1093 or 18G 1093 A.
- (11) Slacken off the servo band adjusters.
- (12) Remove the dowel bolt (Fig. Fa.11) and remove the gear train which includes the top and reverse clutch with its Torrington needle thrust bearing and steel washer, and the first gear free-wheel assembly.

NOTE.—For gear train dismantling and re-assembling see Section Fa.7.

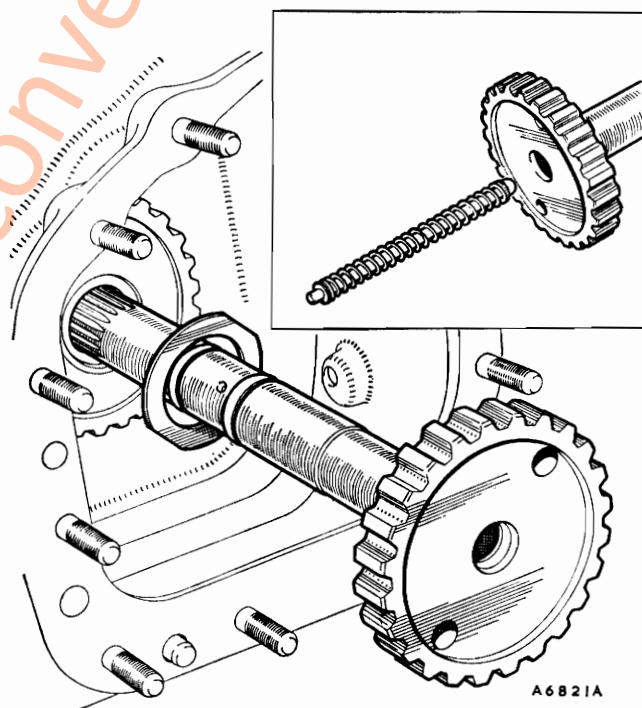


Fig. Fa.10

The forward output shaft with (inset) the reverse shut-off valve

- (13) Remove the valve block and servo unit securing bolts, and on later models unscrew and remove the engine oil feed pipe adaptor and withdraw the valve block connecting pipe through the adaptor hole. Depress the tops of the bands and unhook them from the servos and lift out the valve block and servo unit as an assembly (Fig. Fa.7).

NOTE.—For valve block dismantling and re-assembling see Section Fa.4. For servo unit dismantling and reassembling see Section Fa.8.

- (14) Remove the bands from the transmission case.

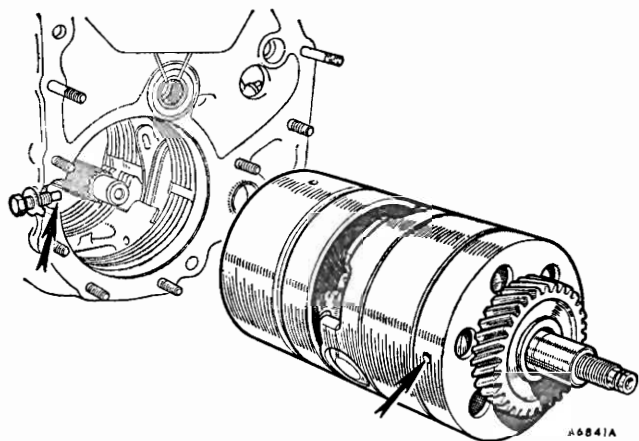


Fig. Fa. 11

Removing the gear train assembly. The arrows indicate the dowel bolt and its location in the free-wheel support

- (15) Remove the governor control assembly from the transmission case. Knock back the lock washers and remove the nuts from the differential housing and the differential end cover set screws. Remove the differential and housing assembly.

NOTE.—For differential dismantling and re-assembling see Section Fa.9.

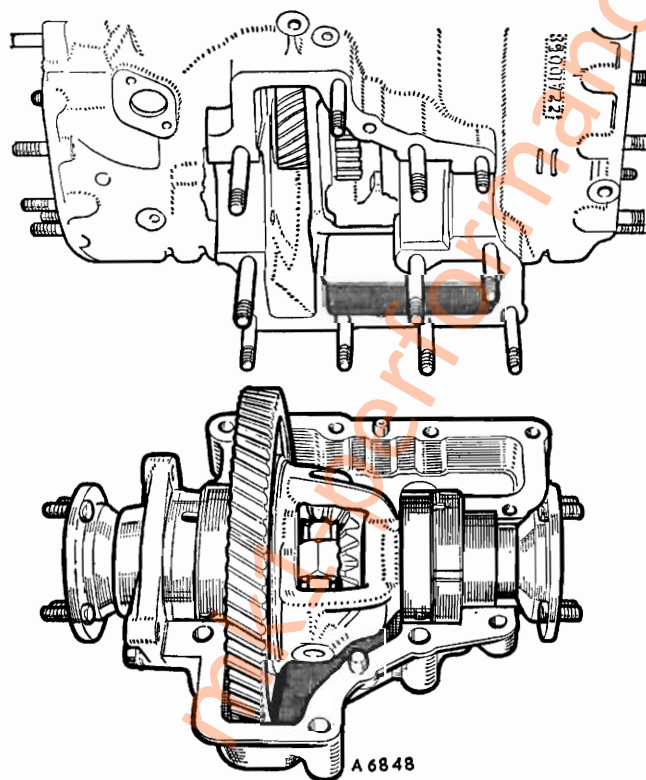


Fig. Fa.12

Removing the differential assembly

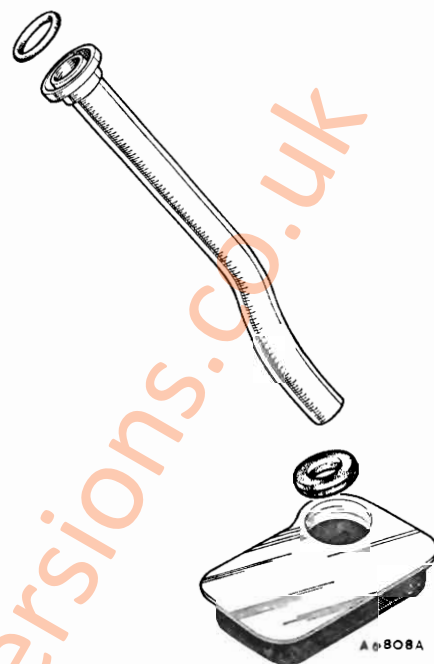


Fig. Fa.13

The main oil strainer, pick-up pipe and seals

- (16) Remove the main oil feed pipe and strainer (see item (2a)).
- (17) Knock back the lock washer on the nut on the forward clutch splines and use Service tool 18G 1095 to hold the top and reverse clutch hub (Fig. Fa.14) and remove the nut with 18G 1096 (Fig. Fa.15). Drift out the top and reverse clutch hub and lift out the piston assembly.

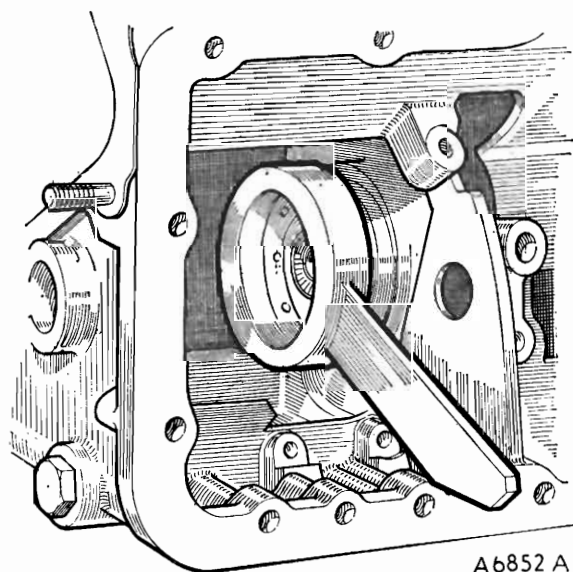


Fig. Fa.14

Using Service tool 18G 1095 to hold the top and reverse splines when removing the forward clutch hub nut

- (18) Remove both the bearings from the centre webs of the transmission case; each bearing must be drifted out on its outer race and from opposing sides of the webs.

Reassembling the transmission unit

Absolute cleanliness is essential, use fuel (petrol) or paraffin (kerosene) where necessary for cleaning. Dry the components with an air pressure line or use non-fluffy rag.

Clean all joint faces and fit new joint washers and oil seals.

After reassembly of each dismantled unit the complete transmission can now be rebuilt.

Lubricate all components with a recommended automatic transmission lubricant. This is particularly important when fitting new 'O' rings and seals.

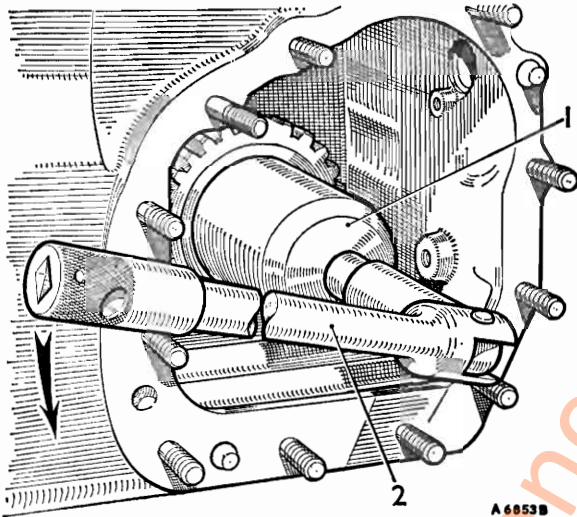


Fig. Fa.15

Removing the forward clutch hub nut

1. Service tool 18G 1096. 2. Socket handle.

- (19) Refit the top and reverse clutch hub bearings to the centre webs of the transmission casing. Drift each bearing on its outer cage into the web until the bearing register contacts the face of the web.
- (20) Refit the top and reverse clutch hub, together with the final drive gear pinion but without the selective washer. Lightly tighten the forward clutch hub nut until light friction is felt on the bearings when rotating the hub.
- (21) Check the gap existing between the final drive gear and the forward clutch hub bearing face.
- (22) Subtract .002 in. (.05 mm.) from the gap measurement and select a washer of this thickness from the range available.
- (23) Remove the hub and refit the assembly with the selected washer and with the chamfer on the final drive pinion facing the gear train (see Fig. Fa.16).

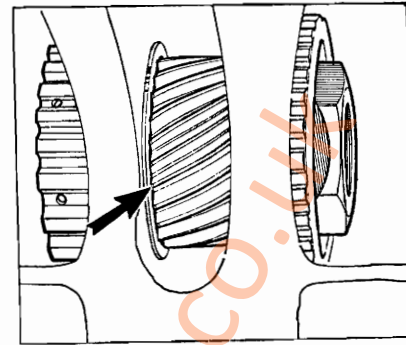


Fig. Fa.16

1. Forward clutch splines. 3. Final drive pinion.
2. Selective thrust washer. 4. Top and reverse splines.

Shown (inset) correctly assembled with the arrow indicating the chamfer on the pinion

- (24) Use Service tool 18G 1095 to hold the top and reverse clutch splines (see Fig. Fa.17) and tighten the forward clutch hub nut with Service tool 18G 1096 and 18G 592 (see Fig. Fa.18), to the torque figure given in 'GENERAL DATA'.
- (25) Check that there is light friction on the bearings when rotating the hub, i.e. the bearings should have a preload of .002 in. (.05 mm.).

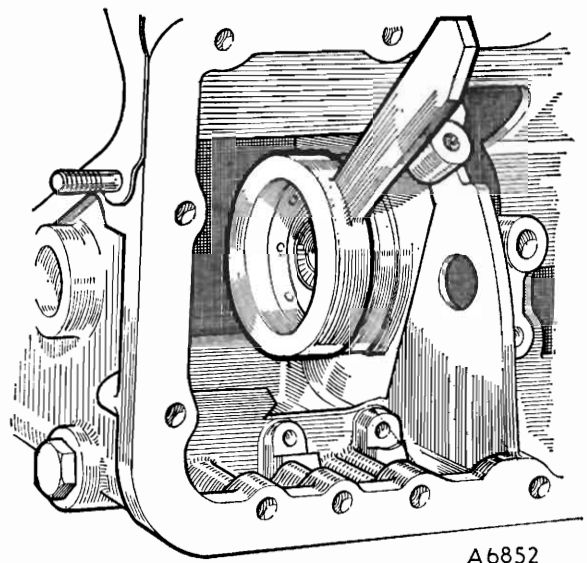


Fig. Fa.17

Using Service tool 18G 1095 to hold the top and reverse splines when tightening the forward clutch hub nut

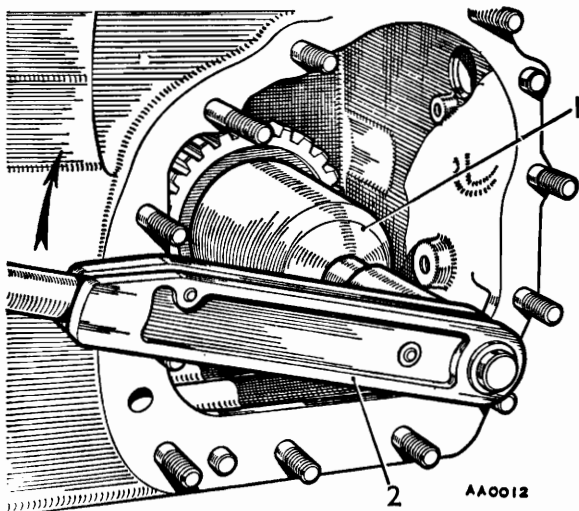


Fig. Fa.18

Tightening the forward clutch hub nut with Service tools 18G 1096 (1) and 18G 592 (2)

- (26) Tap up the locking washer.
- (27) Insert the forward output shaft with its bi-metal washer (see Fig. Fa.10) through the output gear assembly. Ensure that the reverse shut-off valve is located in the end of the shaft, and that the rings on the shaft are in good condition.
- (28) Position the plastic sleeve over the rings on the forward clutch shaft and refit the forward clutch unit. Fit Service tool 18G 1097 to retain the correct position of the forward clutch unit (see Fig. Fa.19).
- (29) Fit new seals to the three valve block bobbins and fit them into their locations in the transmission casing.

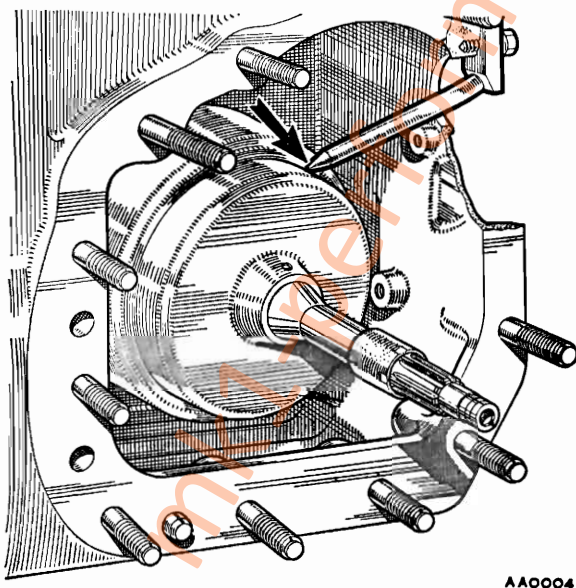


Fig. Fa.19

Holding the forward clutch in position with Service tool 18G 1097

- (30) Reassemble the valve block and servo unit as an assembly, fitting new seals to the inter-connecting pipes.
- (31) Refit the valve block and the servo unit as an assembly into the transmission case, ensuring correct location of the valve block with the bobbins in the case and that the governor linkage is positioned over the web in the transmission casing. Tighten the valve block and the servo unit securing bolts to the torque figure given in 'GENERAL DATA'.
- (32) Refit the second, third, and reverse gear bands into the transmission casing.
- (33) Locate the bands on the servo struts.

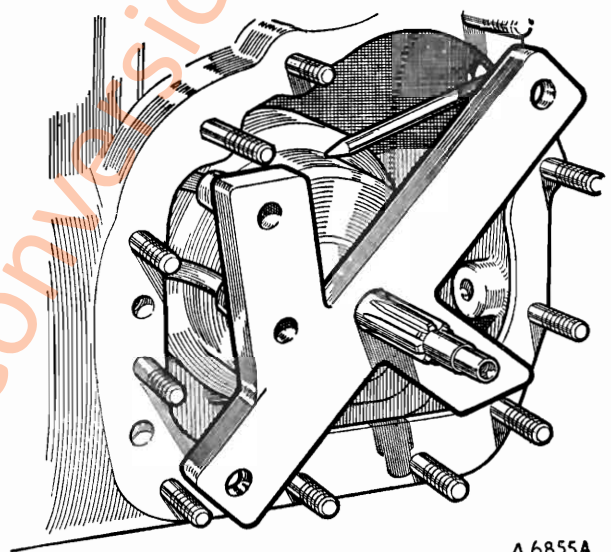


Fig. Fa.20

Using the positioning fixture Service tool 18G 1094 to ensure correct alignment of the pipes

- (34) Refit the forward clutch apply pipe into its location in the transmission casing.
- (35) Refit the auxiliary pump pick-up strainer and pipe; secure the pipe with the dowel bolt (fitted with a copper sealing washer). Refit and tighten the strainer securing screw.
- (36) Fit a new joint washer to the transmission casing. Fit Service tool 18G 1094 and align the pipes (Fig. Fa.20) and remove the tool.
- (37) Refit the auxiliary pump and governor assembly and engage the valve block linkage with the later-type governor unit as shown in Fig. Fa.21, also ensuring correct alignment with the oil pipes and the forward shaft. The plastic sleeve fitted over the rings on the shaft is for assembly purposes, and will become safely displaced along the forward clutch shaft. Tighten the securing nuts to the torque figure given in 'GENERAL DATA'.
- (38) Remove the forward clutch retainer—Service tool 18G 1097.

- (39) Refit the top and reverse clutch hub washer and the Torrington needle thrust bearing into position with grease.
- (40) Ensure that the top and reverse clutch friction plates are free to drop before refitting the gear train assembly into the transmission. Correctly position the second, third, and reverse gear bands in the case and refit the gear train, using hand pressure only to push it into position. Quick rotation of the input gear will assist in engaging the top and reverse clutch friction plates. When correctly reassembled the dowel bolt will engage easily in the freewheel support (Fig. Fa.11).
- (41) Refit the dowel bolt with a new lock washer.

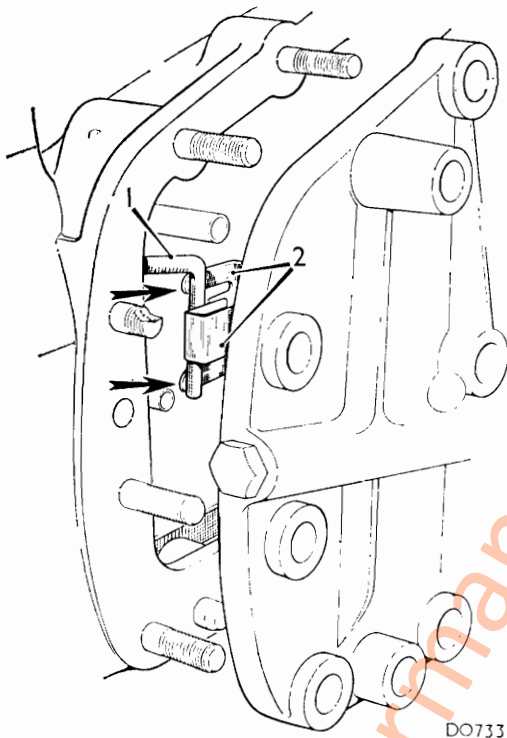


Fig. Fa.21

Engaging the valve block linkage (1) with the spring clip drive mechanism (2) of the later-type governor

- (42) Screw the gear change selector rod fully into the valve block linkage. Check and reset if necessary the selector rod adjustment (see Section Fa.2).
- (43) Adjust the second, third, and reverse servos (see Fig. Fa.23). Slacken the locknut (1) and the spherical adjuster (2) until each brake band (3) is in contact with the transmission casing stops (4). Adjust each adjuster (2) until the clearance 'A' is obtained, and tighten the locking nut (1).
- (44) Fit a new seal to the front cover bobbin, and refit the cover using a new joint washer.
On early units the front cover connecting bobbin can be removed and requires two oil seals.

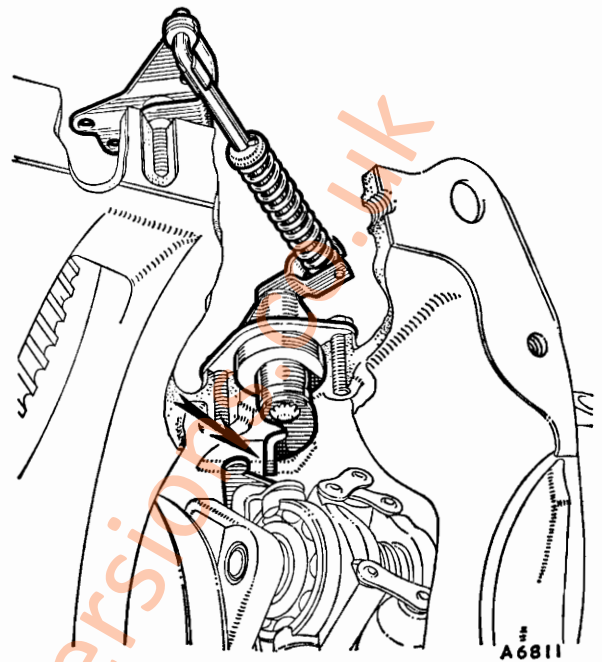


Fig. Fa.22

The correct position of the kick-down rod assembly

- (45) Refit the main oil strainer and pick-up pipe using new seals (if these items were removed), see item (2a).
- (46) Refit the differential assembly as detailed in Section Fa.9.
- (47) Refit the engine to the transmission as detailed in Section Aa.4 (if removed see item (2a)).
- (48) Refit the converter and components removed in item (2b).
- (49) Refit the engine/transmission unit to the car as detailed in Section Aa.3.

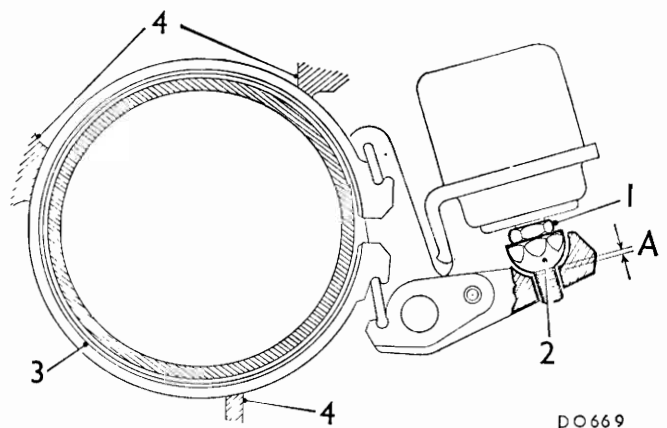


Fig. Fa.23

The servo unit band adjustment

A = .040 to .080 in. (1.02 to 2.03 mm.)

Section Fa.4

VALVE BLOCK

Early models

The valve block can be removed from the transmission unit with the power unit *in situ* by removing the unit as three individual sections.

It is necessary to clean thoroughly the area around the transmission front cover before any dismantling is commenced. Absolute cleanliness is essential at all times and especially so whilst servicing this unit.

Later 848-c.c. and 998-c.c. models

The valve block assembly cannot be removed from the transmission unit with the power unit *in situ* but the lid and valve chest can be removed for dismantling and cleaning. If it is necessary to examine and/or fit new seals to the valve block/servo unit interconnecting pipes or to remove the pipe chest, it is necessary to remove the power unit from the car and remove the converter and housing (see items (25) to (32)).

Removing (early models)

- (1) Remove the front grille.
 - (2) Remove the filter assembly as detailed in Section Aa.2.
 - (3) Remove the engine oil feed pipe.
 - (4) Drain the engine/transmission unit.
 - (5) Remove the transmission front cover and valve block bobbin.
 - (6) Place the gear selector lever in the 'R' position on the quadrant.
 - (7) Remove the bell-crank lever clevis pin. Unscrew and pull out the selector rod sufficiently to remove the valve block.
 - (8) Loosen the servo unit securing bolts.
 - (9) Remove the valve block assembly as individual components, i.e. the lid, valve chest, and finally (if necessary) the pipe chest (Fig. Fa.25).
- The valve block can only be removed as an assembly with the power unit removed from the car.

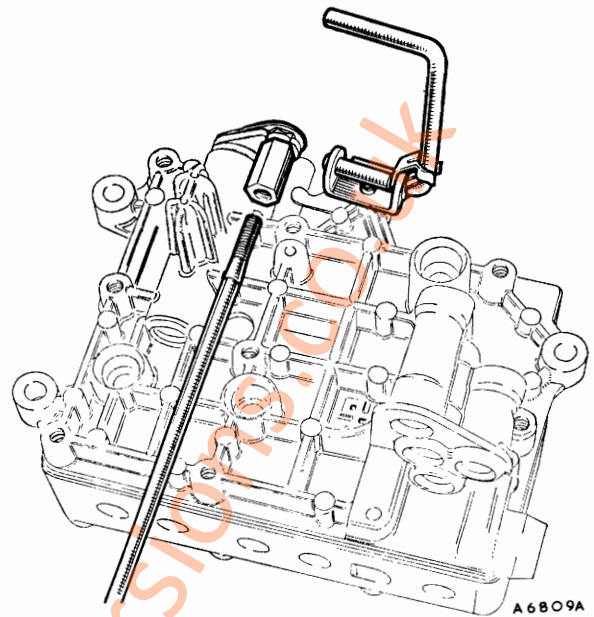


Fig. Fa.24

The gear selector rod and the governor valve linkage

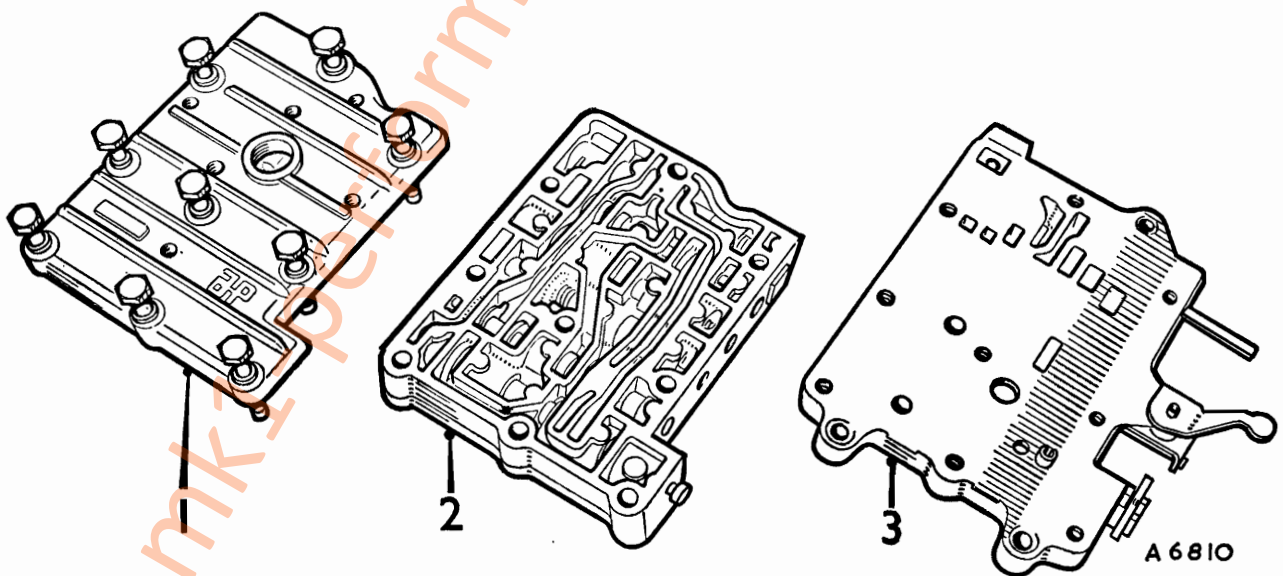


Fig. Fa.25

The valve block assembly

1. Lid.

2. Valve chest.

3. Pipe chest.

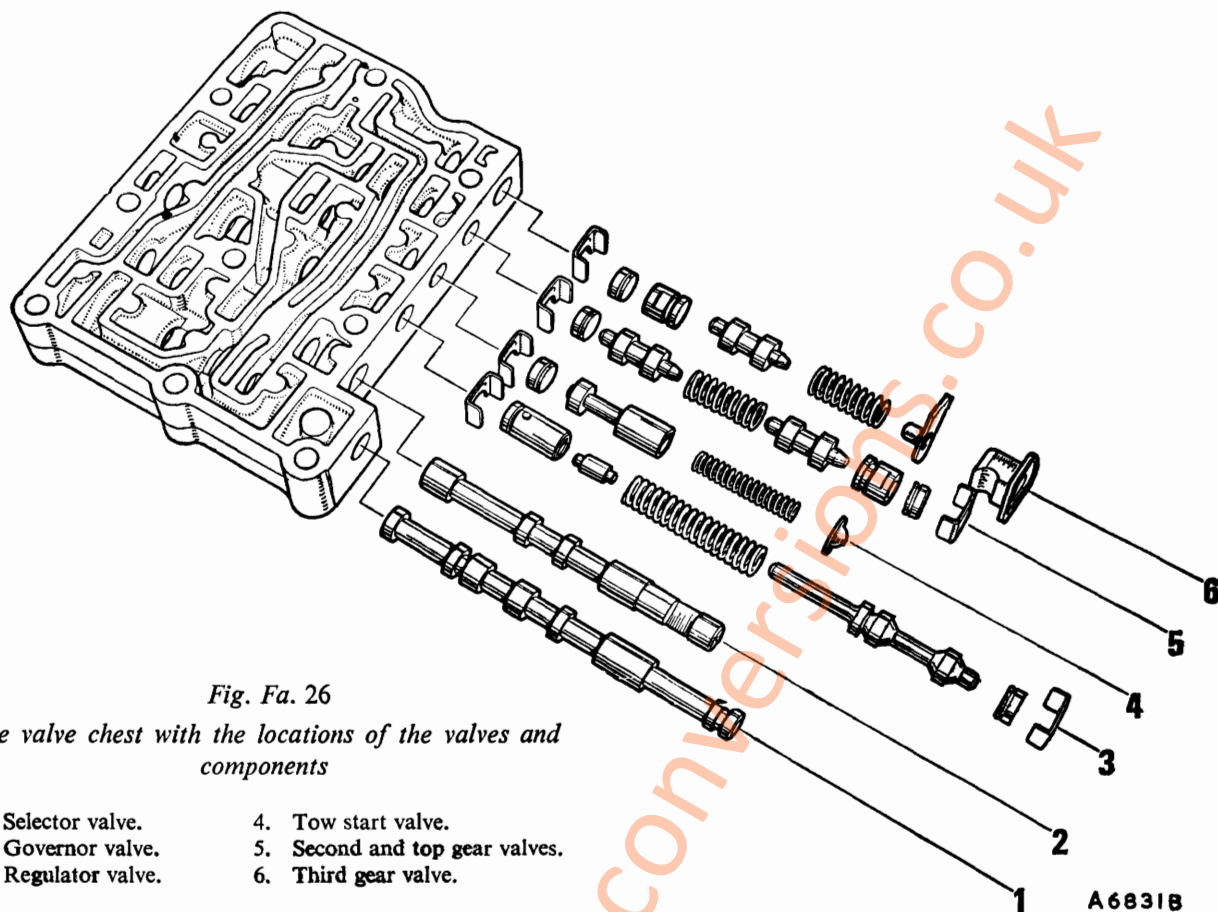


Fig. Fa. 26

The valve chest with the locations of the valves and components

- | | |
|---------------------|--------------------------------|
| 1. Selector valve. | 4. Tow start valve. |
| 2. Governor valve. | 5. Second and top gear valves. |
| 3. Regulator valve. | 6. Third gear valve. |

VALVE CHEST ONLY—'POWER UNIT IN SITU'

Removing (later 848-c.c. and 998-c.c. models)

- (10) Carry out items (1), (2), and (4).
- (11) Disconnect the engine oil feed pipe and remove the adaptor. Withdraw the valve block connecting pipe through the adaptor hole.
- (12) Remove the transmission front cover and manoeuvre the cover upwards and out through the grille aperture.
- (13) Remove the valve block lid and the valve chest.

NOTE.—Before dismantling the valve block it must be remembered that the valves are selected for each bore. It is of the utmost importance therefore to reassemble each valve into its original bore and position. Cleanliness is essential at all times.

Dismantling

- (14) Remove the lid and valve chest from the pipe chest (if removed as a unit), see Fig. Fa.25.
- (15) Remove the selector and governor valves.
- (16) Remove the 'C' clips and the plugs. Remove the regulator valve, spring, and reverse booster piston assembly.
- (17) Remove the 'C' clip and the plug. Remove the tow-start valve, spring, and spring retainer.

- (18) Remove the 'C' clips and the plugs. Remove the second and fourth gear valves, spring, and booster piston.

- (19) Remove the 'C' clip and tap out the plug. Remove the third gear valve booster piston, spring, spring retainer, and the plastic plug.

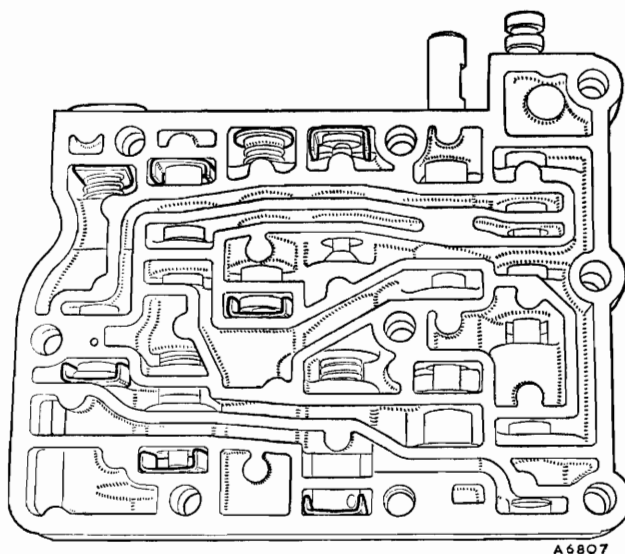


Fig. Fa.27

The valve chest with the 'C' clips correctly positioned

Inspecting

Clean all parts thoroughly in clean fuel (petrol) or paraffin (kerosene) and dry off using an air pressure line.

Check for burrs on the valves and valve chest and for sticking valves. Place all components in automatic transmission oil before reassembling to the valve block.

Reassembling

- (20) Reassemble each valve assembly in the reverse order of dismantling (see Fig. Fa.26). Check that the 'C' clips and plugs are correctly located in the valve chest (see Fig. Fa.27).

Refitting

- (21) Refitting is a reversal of the removal procedure; take care to locate the selector valve with the linkage and the governor rod with the governor. The flat on the governor valve must face inwards. Tighten all securing bolts to the torque figures given in 'GENERAL DATA'.

- (22) Ensure that the new joint washer fitted to the filter head/transmission front cover is correctly fitted.
- (23) Check and adjust if necessary the gear change cable and selector rod adjustment (see Section Fa.2).
- (24) Refill the engine/transmission unit with the recommended oil to the 'MAX' mark on the dipstick (see Section Aa.1).

VALVE BLOCK ASSEMBLY REPLACEMENT 'POWER UNIT REMOVED'

Removing (later 848-c.c. and 998-c.c. models)

- (25) Remove the engine/transmission unit from the car (Section Aa.3).
- (26) Remove the converter cover, converter and converter housing as detailed in Section Aa.4, items (3) to (11).
- (27) Carry out items (10) and (11) and remove the front cover.
- (28) Remove all the servo unit securing bolts.
- (29) Remove the bell-crank lever clevis pin. Unscrew and pull out the selector rod.
- (30) Carry out operations (2) and (3) in Section Fa.5.

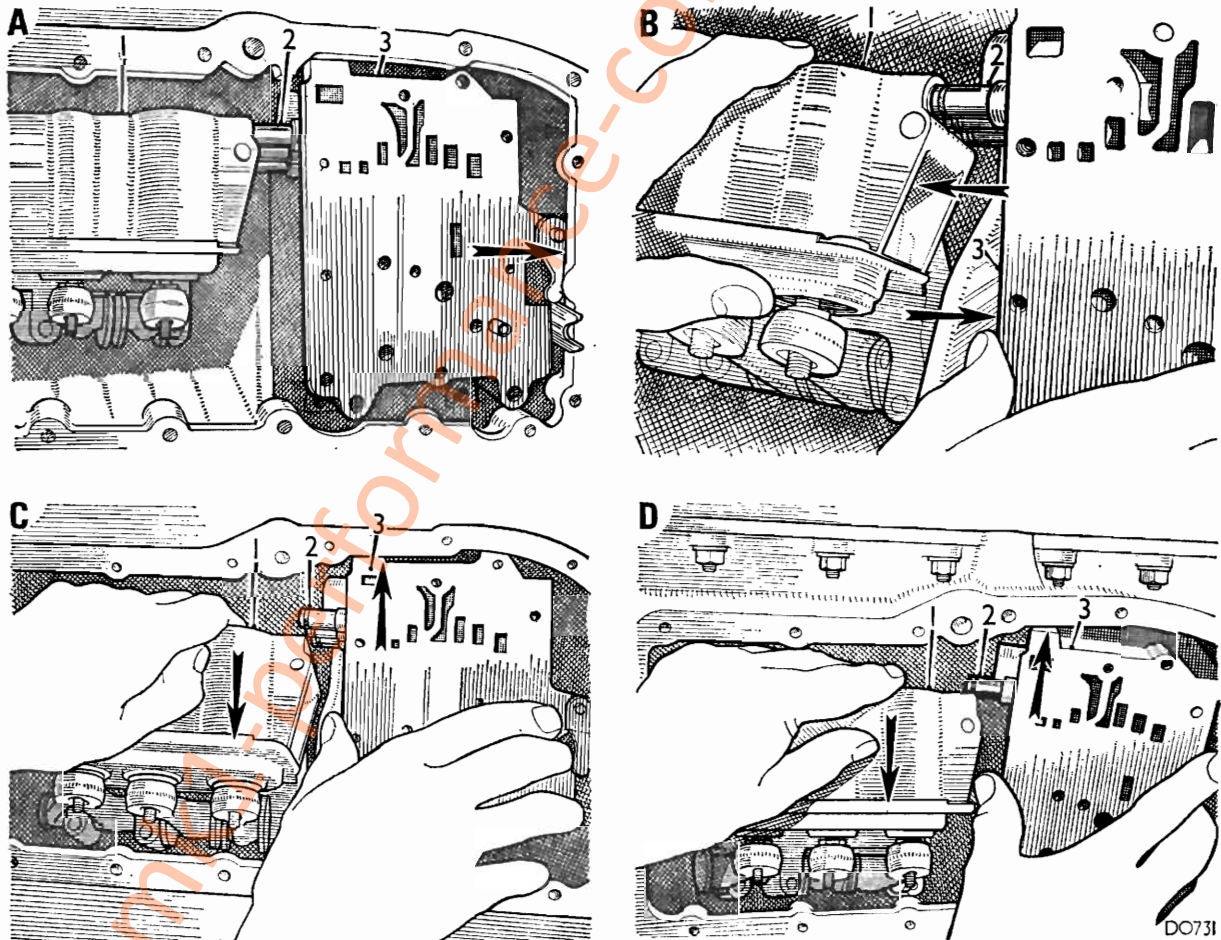


Fig. Fa.28

The removing and refitting sequence of the pipe chest section of the valve block

1. Servo unit.
2. Connecting pipes.
3. Pipe chest.

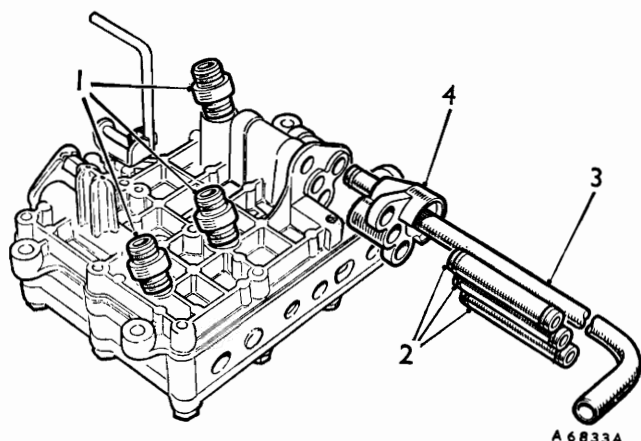


Fig. Fa.29

The valve block assembly showing

1. Three connecting bobbins.
2. Valve block to servo pipes.
3. Valve block to converter feed pipe.
4. Pipe assembly guide.

- (31) Remove the valve block lid and valve chest.
- (32) Remove the pipe chest as shown in the operation sequence in Fig. Fa.28 after pulling it outwards to release it from the bobbins and to disconnect the governor linkage.
- (33) Refer to Fig. Fa.28.
 - (a) Push the pipe chest fully against the casing.
 - (b) Move the servo unit in the opposite direction until the three pipes are clear of the servo unit.
 - (c) Pull the servo unit outwards and downwards; lift the pipe chest upwards and (when clear), move it so that the pipes are over the top of the servo and the regulator valve lever is clear of the transmission casing.
 - (d) Hold the servo unit down and withdraw the pipe chest after lifting the linkage over the web in the casing.

Fitting replacement unit

- (34) Remove the lid and valve chest from the pipe chest of the new unit. Refit these as individual components in the reverse order of the removing procedure, noting the following points:
- (35) Fit the three bobbins into their locations in the transmission case.
- (36) Assemble the three pipes into the pipe chest (together with the nylon guide) before refitting the unit to the transmission casing.
- (37) Carry out operation (21).
- (38) Position the plastic sleeve over the rings on the forward clutch shaft.
- (39) Carry out operations (36) to (38) in Section Fa.3.
- (40) The remainder is a reversal of the removal procedure.

Section Fa.5

AUXILIARY PUMP AND GOVERNOR

Removing

- (1) Remove the engine/transmission unit from the car as detailed in Section Aa.3.

- (2) Remove the governor control assembly from the transmission case and fit Service tool 18G 1097 (see Fig. Fa.19).
- (3) Remove the securing nuts and pull the auxiliary pump and governor assembly from the transmission case.

Dismantling

- (4) Remove the speedometer drive assembly.
- (5) Remove the set screws and bolt. Pull out the governor centre shaft, and lift away the governor assembly together with one of the auxiliary pump gears.
- (6) Remove the circlip, lift off the auxiliary pump gear, and remove the governor.
- (7) Lift out the governor bearing trunnions and washer.
- (8) Remove the second auxiliary pump gear from the auxiliary pump casing together with its bi-metal washer.

Reassembling

- (9) Reassemble the auxiliary pump gear with its bi-metal washer to the pump casing.
- (10) Refit the governor auxiliary pump gear and circlip. Ensure that both gears are seating correctly and will rotate freely after assembly.
- (11) Refit the governor assembly to the auxiliary pump and refit the centre shaft.
- (12) Use Service tool 18G 1106 to centralize the auxiliary pump and governor unit with the end cover, tighten the securing bolts to the torque figure given in 'GENERAL DATA' and remove the Service tool.
- (13) Refit the speedometer drive assembly, with a new joint washer.

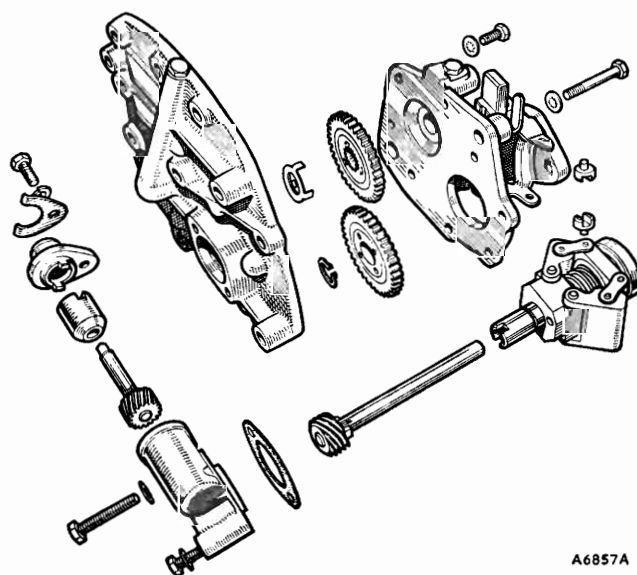


Fig. Fa.30

The speedometer drive and governor assembly components

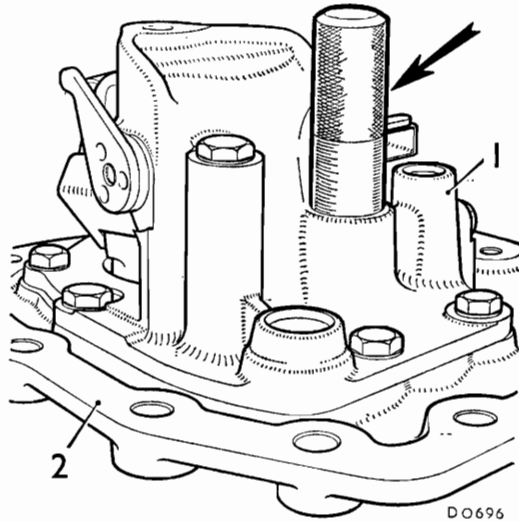


Fig. Fa.31

Centralizing the pump and governor unit (1) with the end cover (2) using Service tool 18G 1106 (arrowed)

Refitting

- (14) Carry out the instructions given in Section Fa.3, items (36) and (38).

NOTE. — See 'GENERAL DATA' for all torque figures.

Section Fa.6

FORWARD CLUTCH

Two types of clutch assembly are in use; the earlier type having 47 teeth is shown in Fig. Fa.34. This unit is now replaced by the 30-tooth clutch as shown in Fig. Fa.35. The two clutch assemblies are not interchangeable; when a replacement unit is required only the identical unit to that removed must be fitted.

Removing

- (1) Carry out the operations given in Section Fa.3, items (1), and (5) to (9).

Dismantling

- (2) Remove the circlip.

NOTE.—Mark the retainer plate and steel clutch plate to assist when reassembling.

- (3) Remove the retainer plate and clutch plates (two paper, one steel).
- (4) Lift out the piston return springs and pressure plate.
- (5) Remove the spring ring (if fitted) and toggles (see Fig. Fa.34).
- (6) Use an air pressure line to blow out the piston.
- (7) Remove the circlip and lift out the reverse shut-off valve.

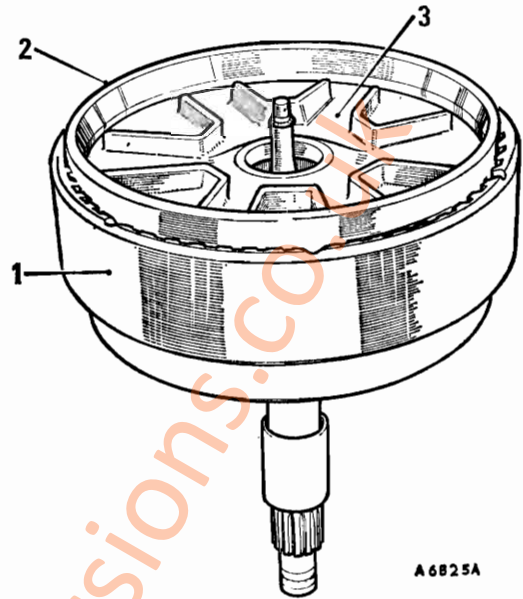


Fig. Fa.32

Fitting the forward clutch piston using Service tool 18G 1102

1. Forward clutch
2. Service tool 18G 1102.
3. Forward clutch piston.

Inspecting

Check all parts for wear and renew if necessary. Check the reverse shut-off valve oil seals and renew if necessary.

Reassembling

- (8) Refit the reverse shut-off valve and fit a new circlip.

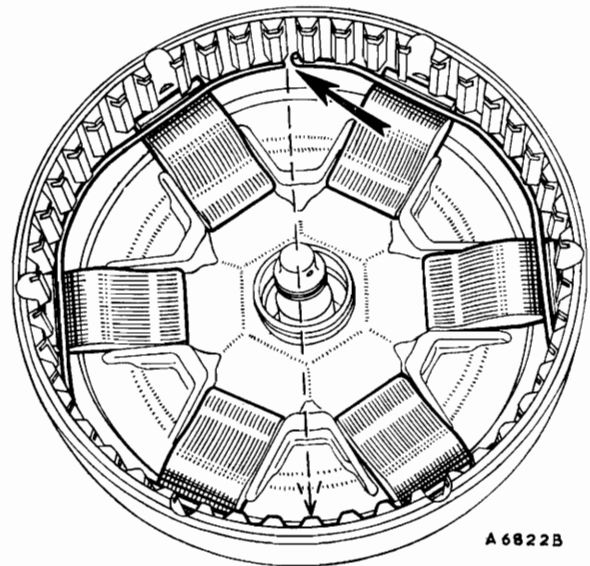
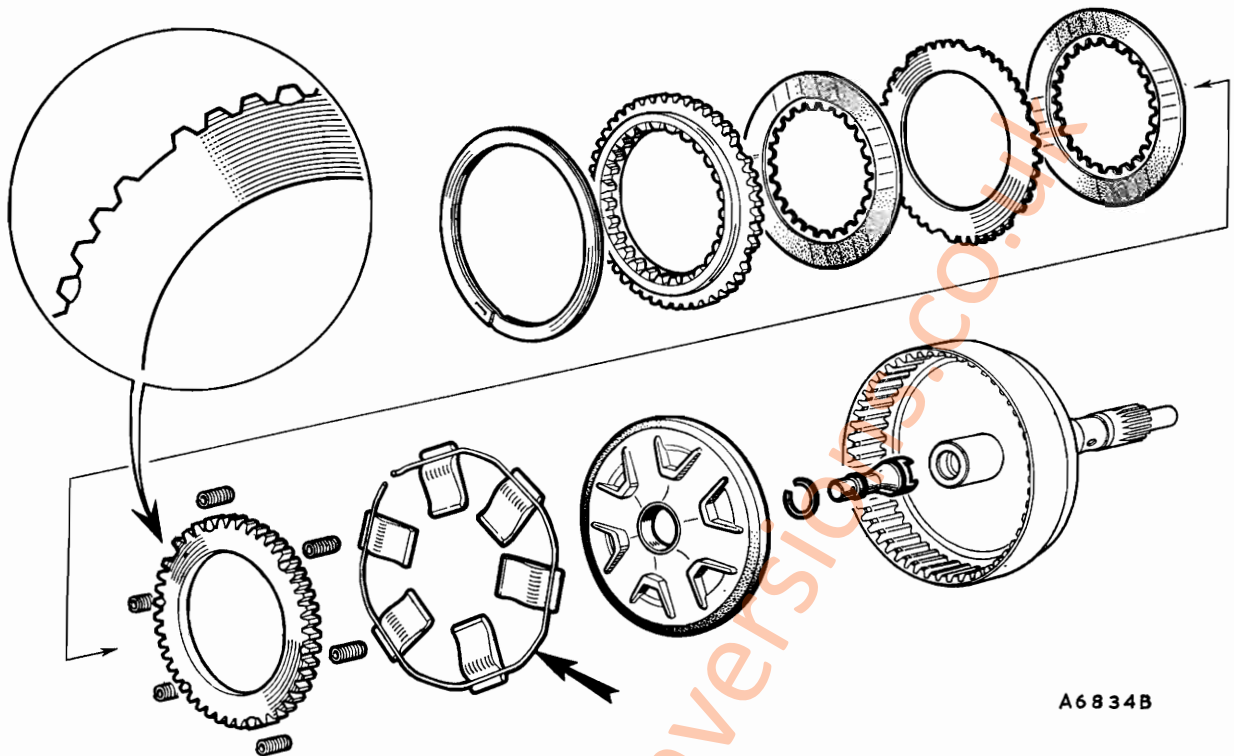


Fig. Fa.33

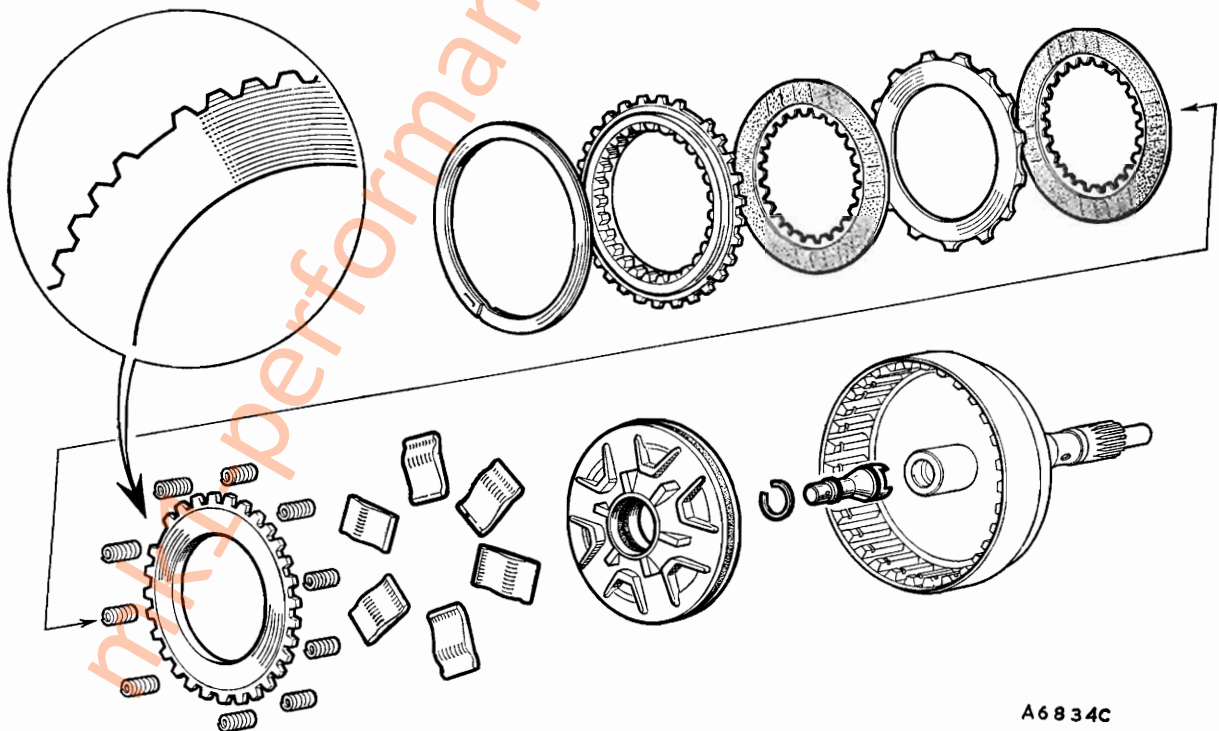
The fitted position of the toggles and spring ring (fitted to very early units). The arrow indicates location of spring ends exactly opposite the only five tooth section of the clutch unit



A6834B

Fig. Fa.34

The early-type (47-tooth) forward clutch components. The arrow indicates the spring ring fitted to very early units only



A6834C

Fig. Fa.35

The (30-tooth) forward clutch components

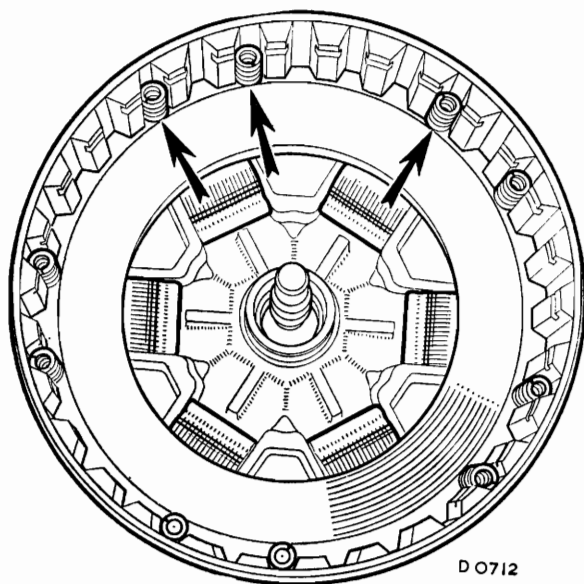


Fig. Fa.36

The fitted position of the toggles and springs of the 30-tooth clutch

- (9) Using Service tool 18G 1102, assemble the piston with the lips of the seal facing inwards and lubricated with transmission oil.
- (10) **47-tooth clutch.** Assemble the toggles and spring ring (early units) with the ends of the spring ring located as shown in Fig. Fa.33, and with the cut-out tooth on the pressure plate in the relative position to the ends of the spring ring (Fig. Fa.34). Assemble the clutch plates and the piston return springs.
- (11) **30-tooth clutch.** Assemble the toggles, pressure plate, and the piston return springs as shown in Fig. Fa.36. Refit the clutch plates and the retainer plate (see Fig. Fa.35).

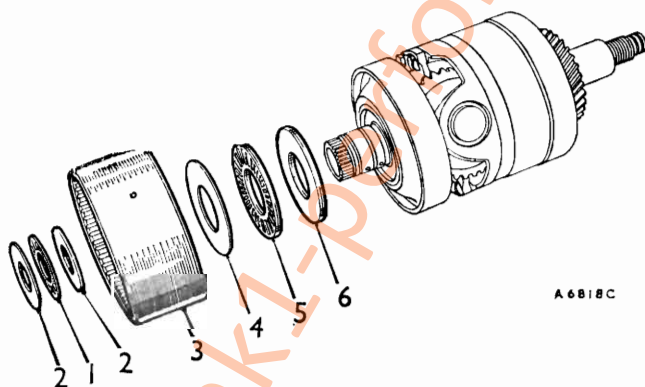


Fig. Fa.37

Removing the top and reverse clutch

- | | |
|--------------------------------------|--------------------------------------|
| 1. Torrington needle thrust bearing. | 4. Thrust washer. |
| 2. Thrust washers. | 5. Torrington needle thrust bearing. |
| 3. Top and reverse clutch. | 6. Selective washer. |

Fa.30

- (12) Refit the retainer plate with its six recessed teeth positioned relative to the piston return springs.
- (13) Refit the circlip.

Refitting

- (14) Carry out the operations given in Section Fa.3 items (28) and (34) to (38).
- (15) Refit the governor linkage.

Section Fa.7

GEAR TRAIN

The gear train is accurately assembled with special equipment to obtain the correct backlash on the various gears and it is not possible to assemble this unit to factory standard without this special equipment. In the event of failure of any part of this unit a new complete gear train assembly must be fitted. The only washer in the gear train which can be renewed is the forward output gear bi-metal washer (8) (see Fig. Fa.42); this is not a selective size washer.

Removing

- (1) Carry out the operations given in Section Fa.3, items (1) to (2b) and (12).

Dismantling

- (2) Remove the top and reverse clutch.

NOTE.—For top and reverse clutch dismantling and reassembling see Section Fa.10.

- (3) Remove the thrust race and washers (Fig. Fa.37).

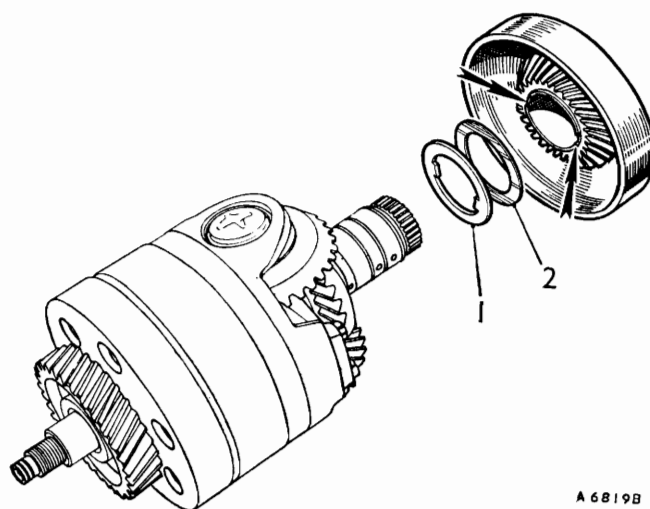


Fig. Fa.38

Removing the third speed reaction gear. The arrows indicate the bi-metal washer locations

- | | |
|---------------------|----------------------|
| 1. Bi-metal washer. | 2. Shim (if fitted). |
|---------------------|----------------------|

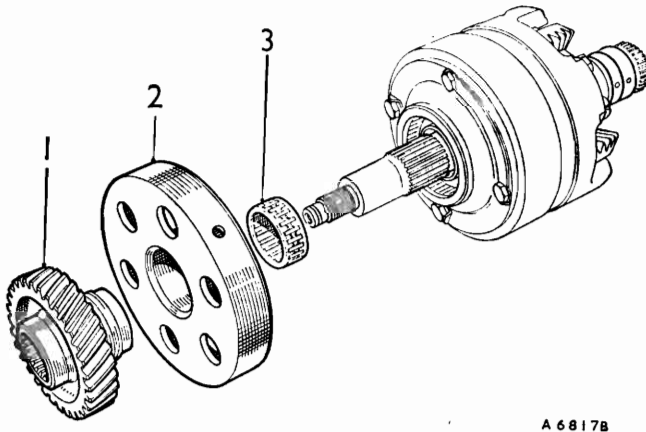


Fig. Fa.39

Removing the input gear (1), the first gear free-wheel reaction member (2), and the needle-roller bearing (3)

- (4) Remove the third gear reaction member together with its thrust washer and shim (if fitted) (Fig. Fa.38).
- (5) Remove the input gear, and pull off the first gear free-wheel reaction member and needle-roller bearing (Fig. Fa.39).
- (6) Knock back the lock washers and remove the first gear free-wheel housing set screws.
- (7) Pull out the first gear free-wheel assembly, input gear, Torrington thrust race, and washer (Fig. Fa.40).

NOTE.—For first gear free-wheel assembly dismantling and reassembling see Section Fa.11.

Dismantling of the gear train is necessary only if the forward output gear bi-metal washer is to be replaced.

- (8) To dismantle the early-type gear train assembly as shown in Fig. Fa.42, refer to items (16) to (19), with the reassembly sequence given in items (33) to (36).

Dismantling of the later gear train assembly is given below in items (9) to (15), with the reassembly sequence in items (20) to (32).

Dismantling gear train (later-type)

- (9) Remove the spindle end cover circlips and covers; remove the small locking circlip and unscrew the spindle locking screws.
- (10) Hold the unit on its side until the locking ball rolls out from the hole in the planetary gear spindle. Repeat this operation on the other side.
- (11) Insert Service tool 18G 1093 A into the forward output gear and through the complete assembly to assist the dismantling procedure.
- (12) Screw the Service tool adaptor 18G 284 AJ into one of the planetary gear spindles and using Service tool 18G 284 pull the spindle from the gear. Repeat this operation with the other spindle and withdraw the needle-roller bearings.
- (13) Knock back the locking tabs and remove the strap securing bolts.
- (14) Ease the strap off the dowels and lift the complete assembly from the carrier.
Retain the respective positions of each planetary gear thrust washer with the carrier.
- (15) Dismantle the assembly, ensuring that all components are retained in their respective positions for reassembly (see Fig. Fa.43).

Dismantling gear train (early-type)

- (16) Check the markings on the carrier and the bearing caps, i.e. marked NIL or with the letter 'O'. These are reference marks to fitting dimensions and the caps must be refitted in their original positions as indicated by the markings on reassembly of the unit.
- (17) Knock back the locking tabs and remove the bearing cap bolts and the strap securing bolts. Lift out the forward output gear, reverse output gear, and the pinions.
- (18) Lift off the thrust bearings, pinions, and thrust washers.
- (19) Lift off the forward output gear and thrust washer, the reverse output gear, thrust washer, and thrust race.

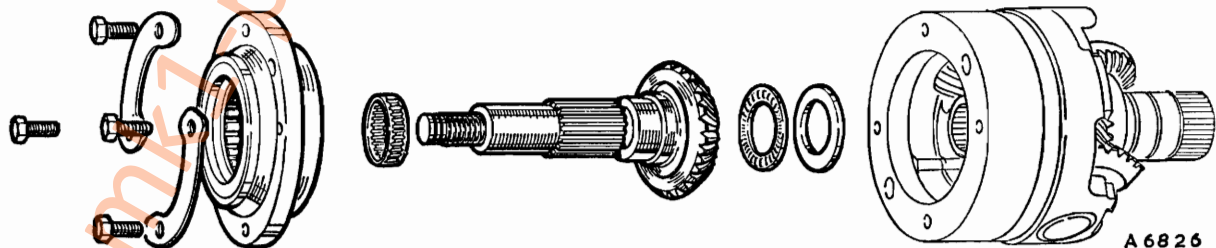


Fig. Fa.40

Removing the one-way clutch and the input gear with its Torrington needle thrust bearing and washer

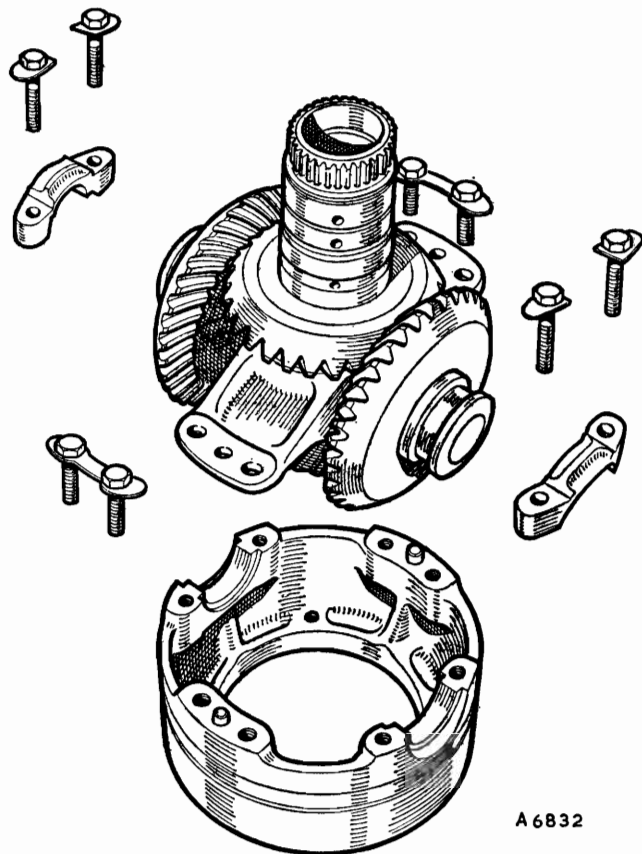


Fig. Fa.41

Removing the forward and reverse output gears, and the planetary gears from the carrier

Inspecting

Clean and examine all parts for wear. Fit a new bi-metal washer to the forward output gear if required and renew if necessary the Torrington needle-thrust races.

Fit new rubber seals and replace the locking plates.

NOTE.—Use petroleum jelly when reassembling to secure the various thrust washers and needle thrust races in position.

Reassembling gear train (later-type)

- (20) Assemble the forward output gear with its bi-metal washer and the .004 in. (.10 mm.) shim (if fitted) interposed between the bi-metal washer and the carrier (see Fig. Fa.44).

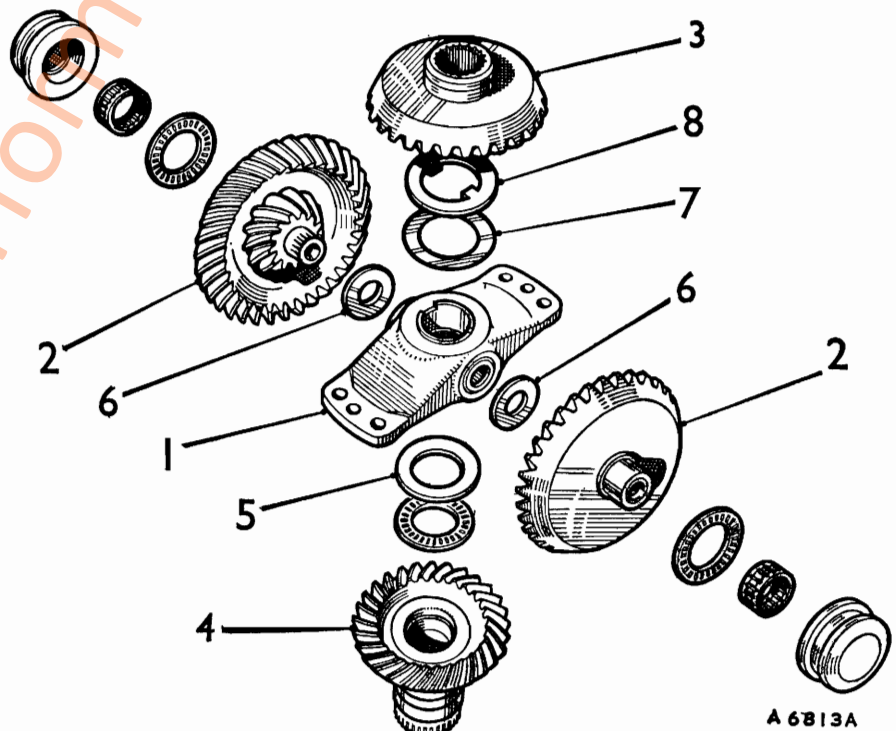
Assemble the reverse output gear with its Torrington needle thrust bearing and steel washer.

- (21) Insert Service tool 18G 1093 A through the forward output gear and the assembly to ensure correct alignment.
- (22) Check and reset the timing of the gear train (see Fig. Fa.45) by rotating the planetary gears until the timing marks are in alignment.
- (23) Retain the timed position of the gear train and refit to the carrier ensuring that both timing marks align with the dowel surface of the carrier.
- (24) Refit the planetary gear needle-roller bearings and tap in the spindles (with the hole on the centre of the spindle facing downwards).
- (25) Insert a ball into each spindle and screw in the locking screws. Refit the locking screw circlips, end covers, and the cover circlips.

Fig. Fa.42

The early-type gear train completely dismantled

1. Gear carrier.
2. Planetary gears.
3. Forward output gear.
4. Reverse output gear.
5. Steel washer (reverse output gear).
6. Planetary gear washers.
7. Steel shim (forward output gear).
8. Bi-metal washer (forward output gear).



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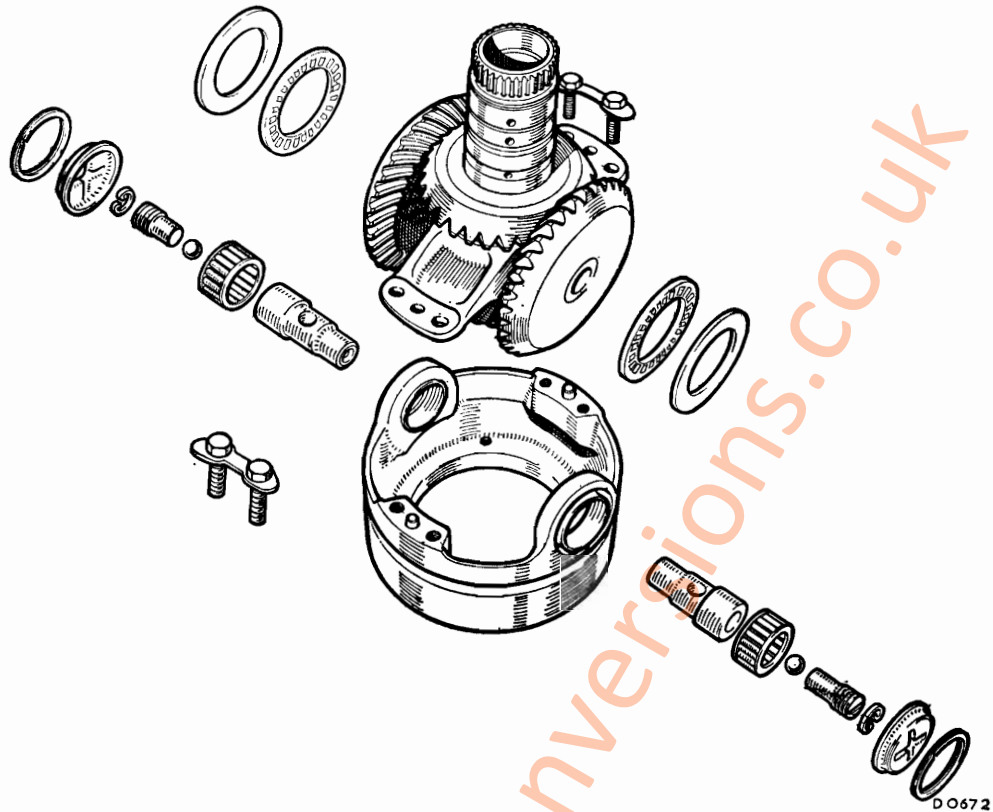


Fig. Fa.43

The later-type gear train, with the forward and reverse output gears and the planetary gears removed from the carrier

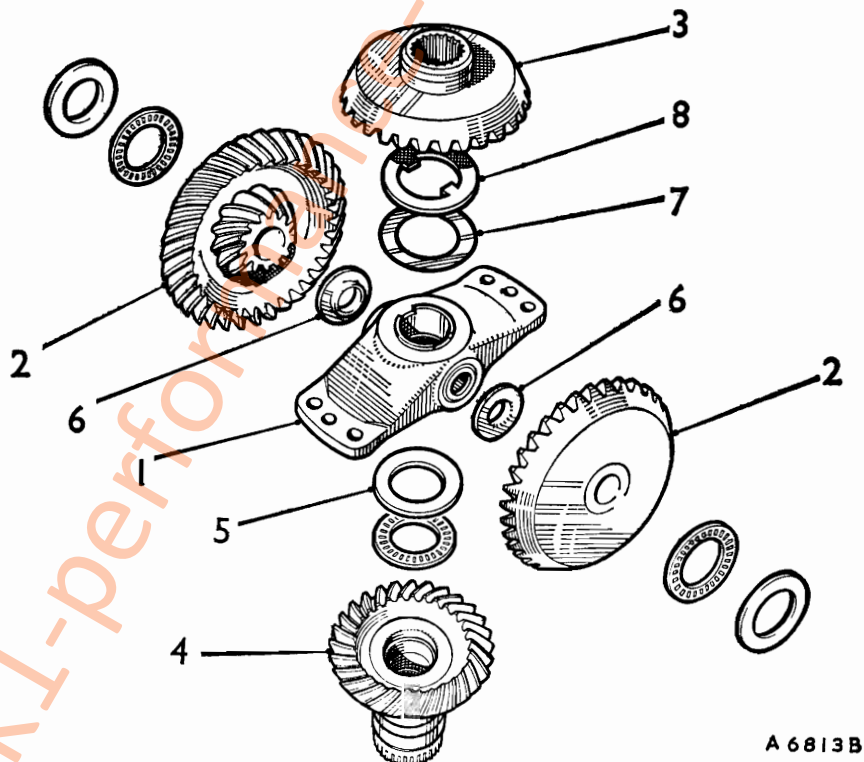


Fig. Fa.44

A dismantled view of the later-type gear train assembly

- | | |
|-------------------------|---|
| 1. Gear carrier. | 5. Steel washer (reverse output gear). |
| 2. Planetary gears. | 6. Planetary gear washers. |
| 3. Forward output gear. | 7. Steel shim (forward output gear). |
| 4. Reverse output gear. | 8. Bi-metal washer (forward output gear). |

- (26) Assemble the third speed reaction gear with its bi-metal washer fitted with the white metal face towards the reverse output gear (see Fig. Fa.46) and with the steel shim(s) located between the bi-metal washer and the gear.

Retain each washer and shim in position with petroleum jelly and refit the assembly to the gear train (see Fig. Fa.46).

- (27) Assemble the bevel input shaft with its Torrington needle thrust bearing and selective steel washer (see Fig. Fa.40).
- (28) Refit the one-way clutch to the gear train housing (Fig. Fa.40), tighten the securing bolts, and tap up the locking plate tabs.
- (29) Refit the free-wheel support.

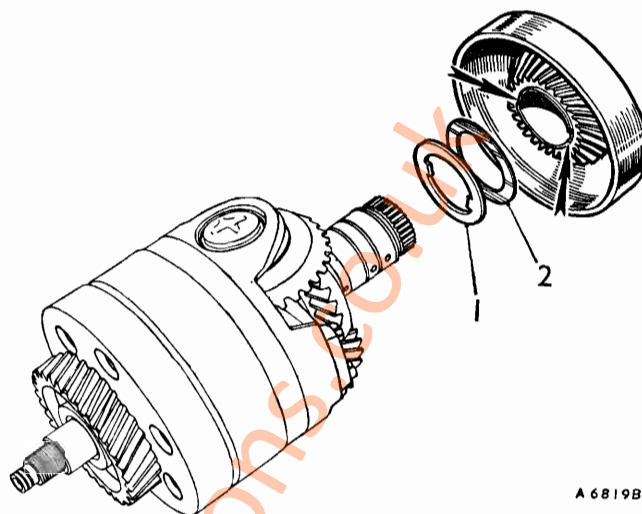


Fig. Fa.46

Refitting the third speed reaction gear with its bi-metal washer, locations indicated by arrows

1. Bi-metal washer. 2. Shim (if fitted).

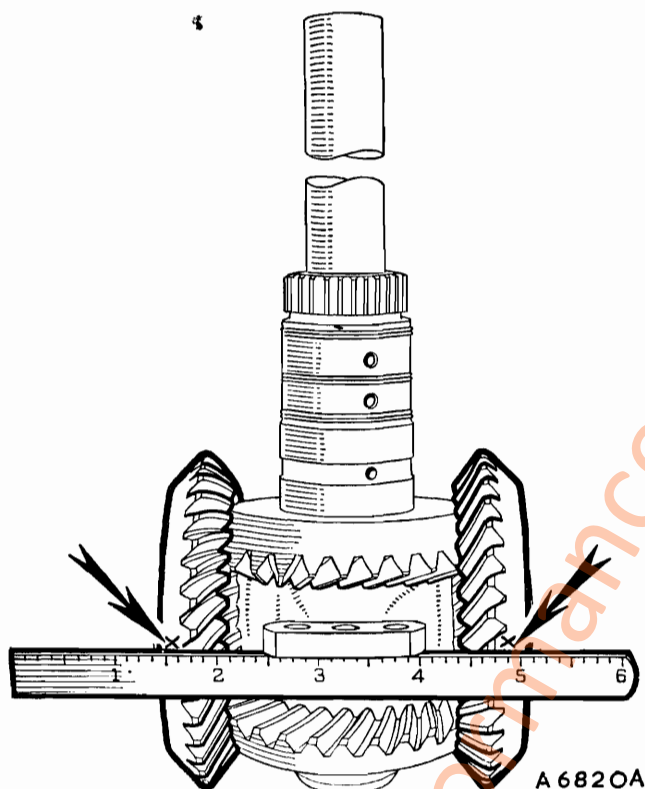


Fig. Fa.45

Timing the gear train

- (30) Refit the input gear and needle-roller bearing (see Fig. Fa.47).
- (31) Refit the top and reverse clutch with its selective steel washer and Torrington needle thrust bearing onto the reverse output shaft (see Fig. Fa.48).
- (32) Check across the splined end of the reverse output shaft and the adjacent face of the top and reverse clutch (Fig. Fa.49). Both faces must be exactly level with no gap, to ensure that the third speed reaction gear has no end-float and the correct backlash is maintained. If both faces are not level, remove and measure the thickness of the selective steel washer fitted in item (31) and fit the correct selective washer from the range available (see washer chart below).

Selective Washer Sizes

·076 to ·078 in. (1·93 to 1·98 mm.)
·072 to ·074 in. (1·83 to 1·88 mm.)
·068 to ·070 in. (1·73 to 1·78 mm.)
·064 to ·066 in. (1·63 to 1·68 mm.)

Part Nos.

22G 748
22G 749
22G 750
22G 751

Reassembling gear train (early-type)

- (33) Carry out items (20) to (23) with the following exceptions: Refer to Fig. Fa.42, and use Service tool 18G 1093 when reassembling this early-type gear train.
- (34) Refit the bearings caps to their respective positions (see markings) and using new locking plates, refit and tighten the bearing cap and carrier bolts to the torque figure given in 'GENERAL DATA'.

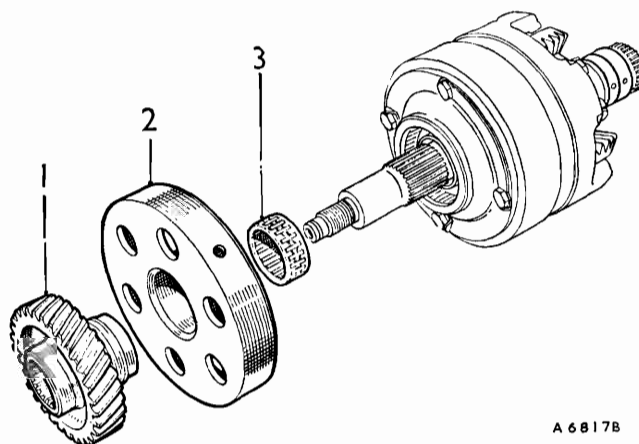


Fig. Fa.47

Refitting the input gear (1), the first gear free-wheel reaction member (2), and the needle-roller bearing (3)

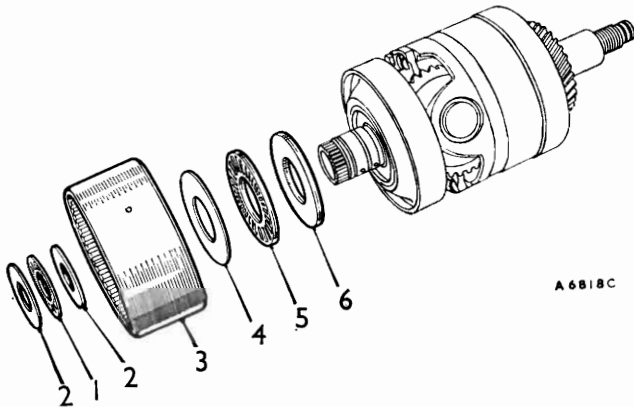


Fig. Fa.48

Refitting the top and reverse clutch

1. Torrington needle thrust bearing.
2. Thrust washers.
3. Top and reverse clutch.
4. Thrust washer.
5. Torrington needle thrust bearing.
6. Selective washer.

(35) Carry out items (26) to (31).

(36) Carry out item (32) and note the 'example' and selective washer chart below.

The selective washers for the early units are not interchangeable with those fitted to later units.

Example: If the selective washer fitted in operation (23) was .0365 in. (.93 mm.) thick and after checking there was a gap, fit the correct selective washer from the range available (see washer chart below).

Gap	Washer required
.000 to .0035 in. (.000 to .08 mm.)	.1185 in. (3 mm.)
.0035 to .0075 in. (.08 to .19 mm.)	.1135 in. (2.88 mm.)
.0075 to .0115 in. (.19 to .29 mm.)	.1095 in. (2.78 mm.)
.0115 to .0150 in. (.29 to .38 mm.)	.1055 in. (2.67 mm.)

Refitting

- (37) Carry out the operations given in Section Fa.3, items (40) and (41). The remainder is a reversal of the removal procedure.
- (38) Refit the power unit to the car as detailed in Section Aa.3.

Section Fa.8

SERVO ASSEMBLY

Removing

- (1) Carry out the operations given in Section Fa.3 items (1) to (13).
- (2) Remove the servo unit from the valve block assembly.

Dismantling

- (3) Remove the centre shaft and lift out the servo levers, reaction levers, washers, and struts.

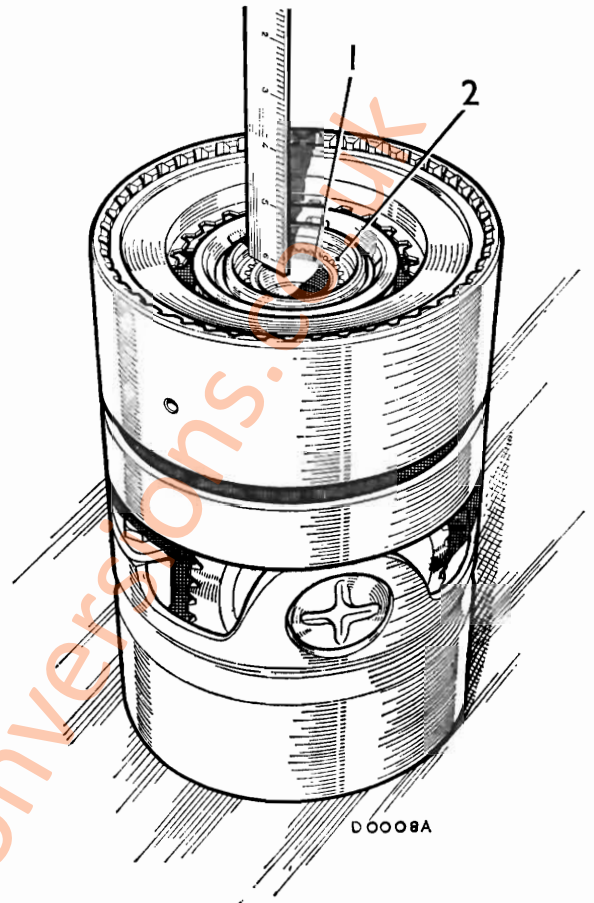


Fig. Fa.49

Checking that the end of the reverse output shaft (1) is level with the internal face of the top and reverse clutch (2)

- (4) Hold the servo cover and release the securing screws and the cover.
- (5) Lift out the springs and pistons.

Inspecting

Check all parts for wear and renew if necessary.

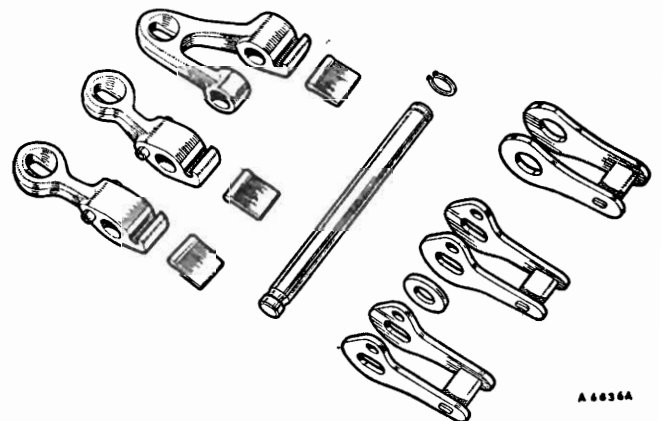
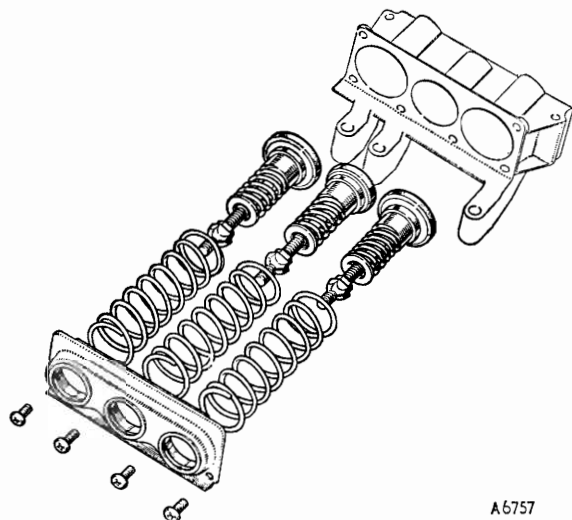


Fig. Fa.50

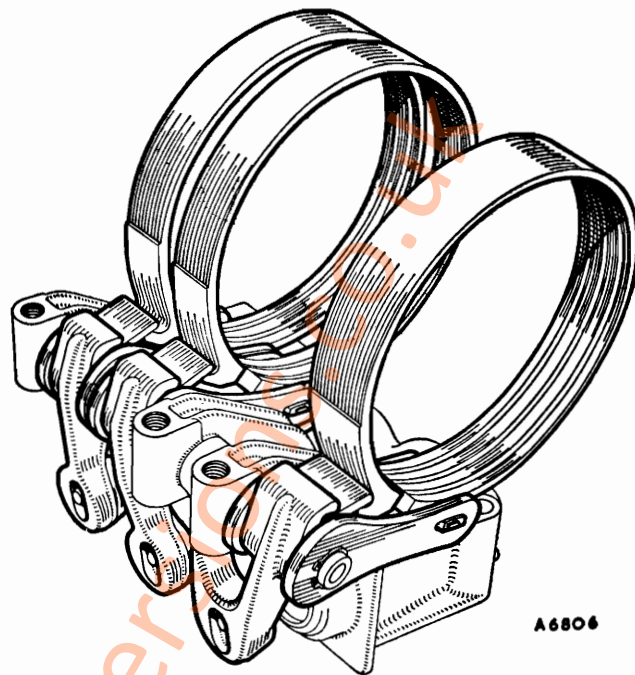
The fitting relationship of the servo levers with the reaction levers and struts



A6757

Fig. Fa.51

The servo unit components



A6806

Fig. Fa.53

The brake band and struts correctly positioned

Reassembling

- (6) Lubricate the seals and fit the pistons into the correct bores (lips of seals facing downwards).
- (7) Assemble the springs and cover.
- (8) Hold the cover in position and fit the drive screws.
- (9) Assemble the struts, washer(s), reaction levers, and servo levers in the reverse order of dismantling (Figs. Fa.50, 52 and 53).
- (10) Insert the centre shaft with the cutaway in the shaft correctly positioned.

Refitting

- (11) Carry out the operations detailed in Section Fa.3, items (30) to (44), (48), and (49).

Section Fa.9

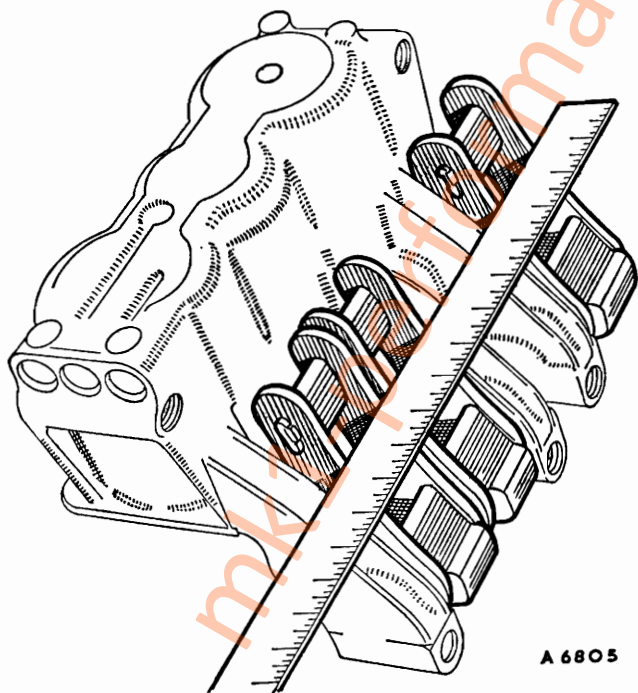
DIFFERENTIAL ASSEMBLY

Removing

- (1) Remove the engine and transmission from the car (see Section Aa.3).
- (2) Drain the engine/transmission unit.
- (3) Use Service tool 18G 1100 to hold the driving flanges and remove the centre securing bolts. Withdraw the flanges from the splined shafts.
- (4) Knock back the lock washers and remove the nuts from the final drive housing.
- (5) Remove the securing screws and pull the kick-down linkage assembly clear of the transmission case.
- (6) Remove the two set screws securing the end cover to the transmission, and remove the final drive and housing assembly (Fig. Fa.12).
- (7) Remove the remaining securing bolts from the end cover and remove the cover and the adjustment shims.

Dismantling

- (8) Remove the differential unit from its casing.
- (9) Withdraw the oil seal housing, remove the bearings using Service tool 18G 2.



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Fig. Fa.52

The correct fitted position of the servo reaction levers

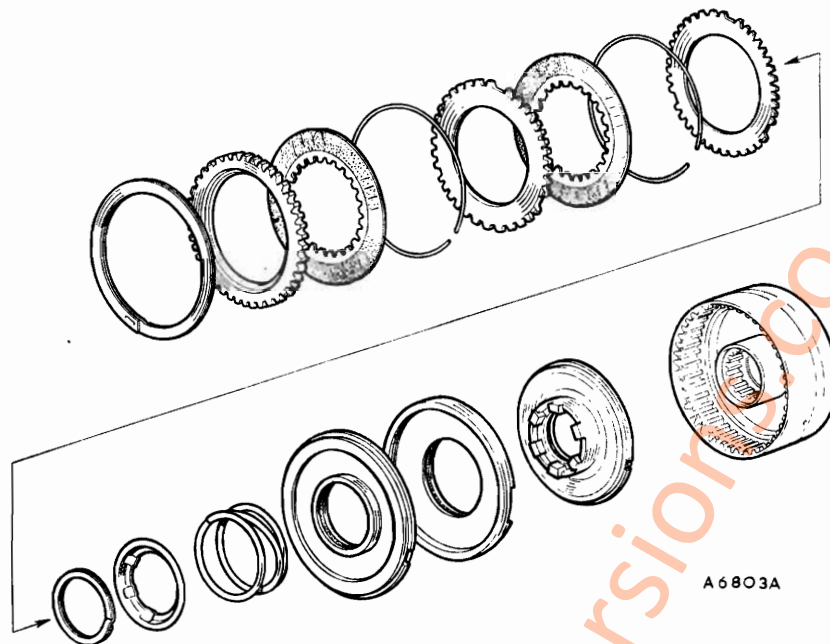


Fig. Fa.55
The top and reverse clutch components

- (2) Remove the top and reverse clutch from the gear train together with the Torrington needle thrust bearing and the steel washer.

Dismantling

- (3) Remove the double spring circlip.
- (4) Remove the retainer plate.
- (5) Lift out the paper plate, spring ring, steel plate, paper plate, spring ring, and the thin steel plate.
- (6) Remove the circlip, spring retainer, and the piston return coil spring.
- (7) Lightly shock the assembly against a flat surface to remove the top gear piston and cylinder.
- (8) Refit the reverse (booster) piston into the bore, easing the piston ring into the bore with a screwdriver.
- (9) Fit Service tool 18G 1103 into the clutch unit and holding these together, lightly shock the assembly against a flat surface to remove the reverse booster piston.

Inspecting

Check all parts for wear and renew if necessary. Renew the oil seals in the pistons. Check the piston ring gap which must be .016 to .020 in. (.4 mm. to .51 mm.), for both rings when fitted in their respective bores.

Reassembling

- (10) Refit the reverse gear booster piston with the boss facing outwards, using Service tool 18G 1103 (see Fig. Fa.56).

- (11) Refit the top gear piston into its cylinder with the boss facing outwards.
- (12) Fit the top gear piston and cylinder into the clutch housing, with the cut-aways on the rear outer edge of the cylinder opposite the holes in the clutch housing.
- (13) Refit the top gear piston return spring, spring retainer, and circlip.

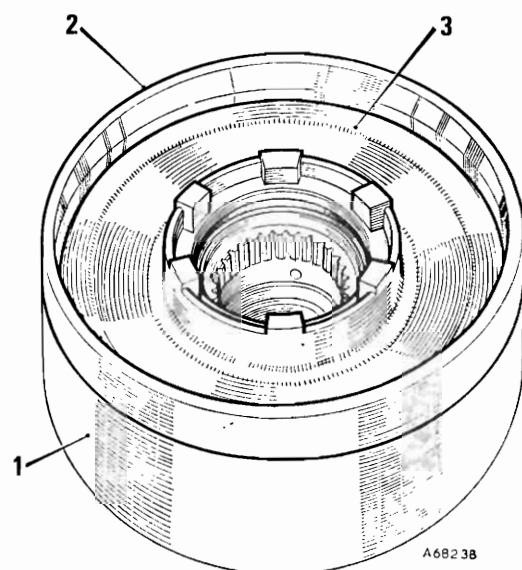


Fig. Fa.56

Using Service tool 18G 1103 (2) to remove or refit the reverse gear piston (3) to the top and reverse clutch unit (1)

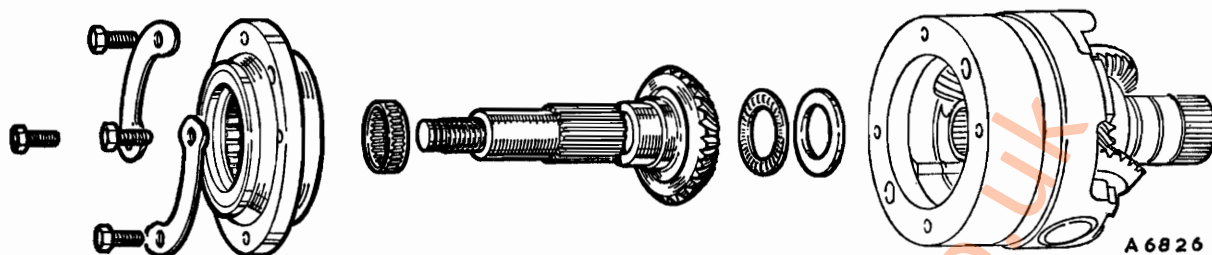


Fig. Fa.57

The one-way clutch removed from the gear train, with the input gear, bearings and thrust washer shown in assembly sequence

- (14) Refit the clutch plates, aligning the cutaway in the steel plates (thin steel, spring ring, paper, steel, spring ring, paper).

- (15) Refit the retainer plate and circlip.

NOTE.—Before refitting the clutch unit, ensure that the friction plates are free to drop.

Refitting

- (16) Carry out the operations given in Section Fa.7, items (31) and (32).
- (17) The remainder is a reversal of the removal procedure.

Inspecting

Check all parts for wear and renew if necessary.

Reassembling

- (6) Reassemble the thrust bearing, intermediate spring ring, first gear free-wheel (lip facing outwards, see Fig. Fa.59), spring ring, and refit the circlip.

Refitting

- (7) Refitting is a reversal of the removing procedure.

Section Fa.11

FIRST GEAR FREE-WHEEL ASSEMBLY (ONE-WAY CLUTCH)

Removing

- (1) Carry out the operation given in Section Fa.3, items (1), (2b), and (12).
- (2) Remove the first gear free-wheel reaction member.
- (3) Knock back the locking plate tabs and remove the retaining bolts and the first gear free-wheel (one-way clutch) from the housing.

Dismantling

- (4) Remove the circlip.
- (5) Lift out the spring ring, first gear free-wheel, intermediate spring ring, and thrust bearing (see Fig. Fa.58).

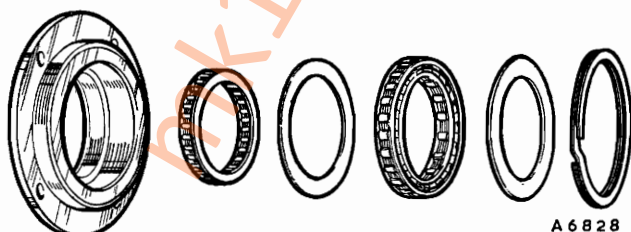


Fig. Fa.58

The components of the one-way clutch

Section Fa.12

GEAR-CHANGE CABLE

Removing

- (1) Remove the weather protection cover (if fitted) from the converter housing. Pull back the rubber sleeve and disconnect the gear-change cable by removing the clevis pin. Slacken the yoke clamp nut and remove the yoke, nut, rubber ferrules, and sleeve (see Fig. Fa.60). Remove the adjusting nuts from the outer cable and pull the cable clear of the transmission.
- (2) Release the cable clip from the floor panel.
- (3) Remove the front floor covering.
- (4) Disconnect the electrical leads from the inhibitor switch.

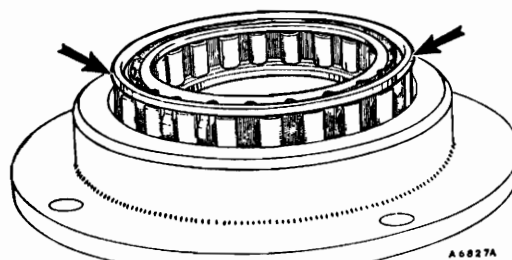


Fig. Fa.59

Fitting the one-way clutch with the lip (arrowed) correctly positioned, uppermost

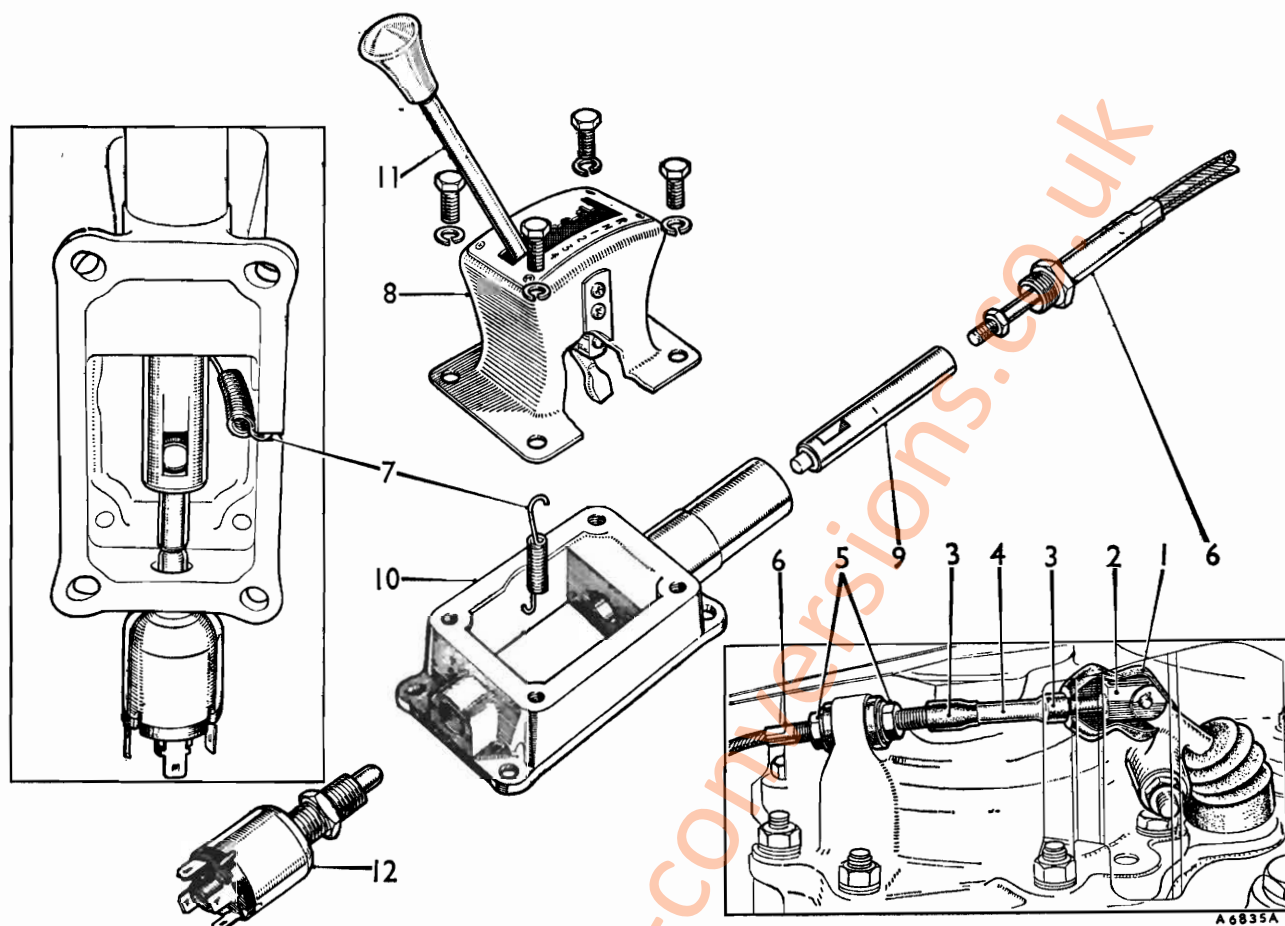


Fig. Fa.60

The gear-change housing and cable components. Insets show the reverse return spring location and the cable connections

- | | | |
|---------------------|---------------------------|--------------------------|
| 1. Rubber sleeve. | 5. Cable adjusting nuts. | 9. Lever plunger. |
| 2. Yoke. | 6. Cable. | 10. Gear-change housing. |
| 3. Rubber ferrules. | 7. Reverse return spring. | 11. Gear selector lever. |
| 4. Cable sleeve. | 8. Quadrant. | 12. Inhibitor switch. |

Dismantling

- (5) Remove the screws securing the gear change housing, carefully pull the cable through the rubber dust excluder, and remove the housing and cable assembly.
- (6) Hold the assembly in a vice and remove the set screws securing the quadrant to the housing. Release the reverse return spring from the base of the housing and remove the quadrant and lever assembly.
- (7) Unscrew the cable securing nuts from the front of the housing, pull the cable from the housing and release it from the gear change lever plunger.

Inspecting

- (8) Clean and inspect moving parts for wear.

Reassembling

- (9) Lubricate all moving parts with grease.
- (10) Reassembly is a reversal of the dismantling procedure.

Refitting

- (11) Refitting is a reversal of the removing procedure.
- (12) Adjust the inhibitor switch and the gear change cable and selector rod as detailed in Section Fa.2.

SECTION G

THE DRIVE SHAFTS

												<i>Section</i>
General description												
Removing	..	..	..	..	..	..	..	..	..	..	..	G.1
Servicing	..	..	..	..	..	..	..	..	..	..	..	G.2

GENERAL DESCRIPTION

Each of the two drive shafts employed has two principle members incorporating a Hardy Spicer constant-velocity bell joint. The hemispherical interior of the bell joint and the exterior of the inner ball race have six grooves machined in line with the shaft axis, and a ball cage carrying six steel balls is interposed between the two. The steel balls engage the grooves of both members to key them together and at the same time allow the members to hinge freely upon each other.

The joint is packed with special grease and the unit is enclosed in a sealed rubber boot. The inner end of the drive shaft is splined and has a pre-lubricated sliding joint sealed with a rubber boot.

Section G.1

DRIVE SHAFTS

Removing

To remove the drive shaft assembly from the vehicle follow the removing instructions given for swivel hubs in Section K.3.

The constant-velocity bell joint may be removed from the drive shaft for replacement as a unit or to have a Service kit fitted. Under no circumstances must individual components be replaced in the bell joint assembly.

Should a rubber boot enclosing the joint be damaged with a consequent loss of lubricant, it is necessary to remove the joint from the shaft for dismantling and inspection of the components.

If a rubber boot is damaged in the workshop and dirt has not entered the joint, a new boot may be fitted after first repacking the joint with the recommended grease.

To fit a new boot the drive shaft must be removed from the vehicle.

Constant-velocity (bell) joint

The bell joint can be removed from the drive shaft for dismantling and inspection of the components.

Service kits are available which include the required amount of lubricant to service a bell joint.

When servicing of the joint becomes necessary, the procedure given in Section G.2 must be followed.

Sliding joint flange

On later models the sliding joint is prepacked with $\frac{3}{4}$ oz. (21 gm.) of Duckham's M.B. grease (BMC pack AKF 1457) and sealed with a rubber housing seal, early models were fitted with lubricating nipple. When servicing the sliding joint or fitting a new seal, refer to Section G.2.

Section G.2

SERVICING

Dismantling the shaft assembly

- (1) Clean the shaft of road dirt and grease and mount the shaft centrally in a vice fitted with soft jaws.
- (2) Prise off the boot and housing seal clips or cut the soft iron wire, turn back the housing seal and slide off the joint flange. Remove the housing seal and the rubber boot, if they are worn or damaged replacements must be fitted on reassembly.
- (3) The bell joint can only be dismantled after removal of the shaft; a round-section spring ring located in a deep groove in the extreme end of the shaft is expanded into the chamfered end of the inner race bore, and for shaft removal this must be contracted into the groove.
- (4) Hold the shaft and joint vertically, the bell joint downwards, and give the edge of the outer race a sharp tap with a soft faced mallet (see Fig. G.1). This should contract the spring ring so that the joint can be drawn off the shaft. It should not be necessary to use heavy blows for this operation.

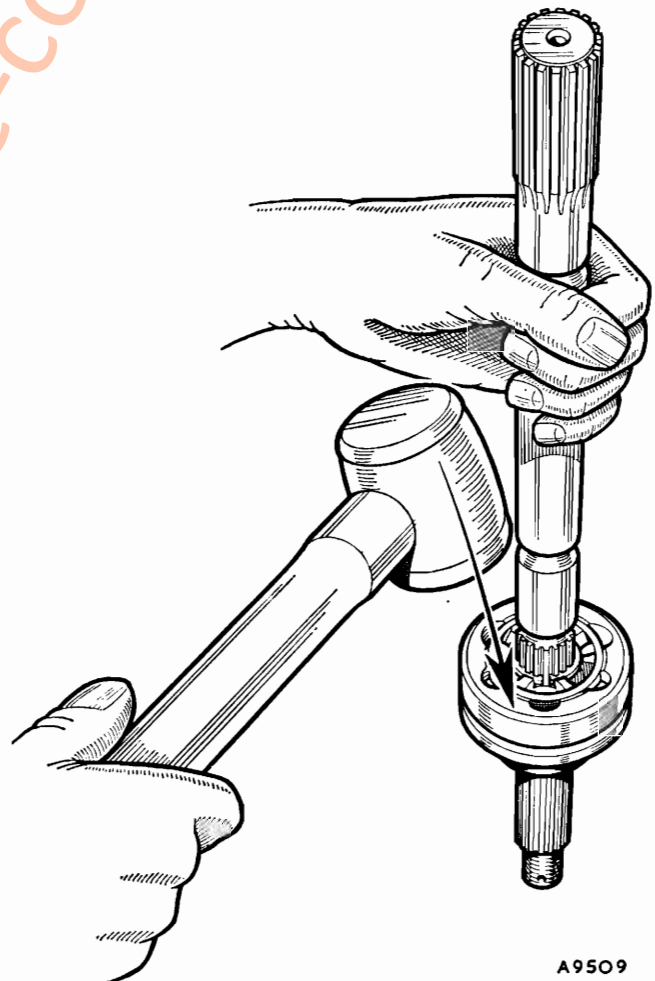


Fig. G.1

Drive the bell joint from the shaft at the point indicated

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Dismantling the joint

- (5) The joint should be dismantled only if there is reason to believe that it is still serviceable.
- (6) As the components are mated and have operated together, they must be kept in the same mating relationship. The relative positions of the inner and outer races and the cage should be marked with blue marker or a paint which will not wash off when the parts are cleaned.
- (7) With the shaft withdrawn the inner race can swivel freely, tilt the inner race until one ball is released (Fig. G.2). Note that the cage swivels through half the angle of the inner race. If the joint is sticky with grease each ball may be eased out in turn with a pointed tool.
- (8) Swivel the cage into line with the axis of the joint and turn it until two opposite elongated windows coincide with two lands of the bell joint. One land will drop into a window, allowing the cage and race assembly to be lifted out (Fig. G.3).
- (9) Swivel the inner race at right angles to the cage and turn it until two of the lands between the inner race tracks are opposite elongated windows in the cage. One land will drop into a window, allowing the inner race to be extracted from the cage (Fig. G.4).

Inspecting

- (10) Clean all parts thoroughly in petrol (fuel), paraffin (kerosene), or white spirit and dry off. In normal service, wear should be distributed fairly evenly over all components and the joint will remain serviceable until the amount of end-float exceeds the acceptable wear maximum of .025 in. (.64 mm.).

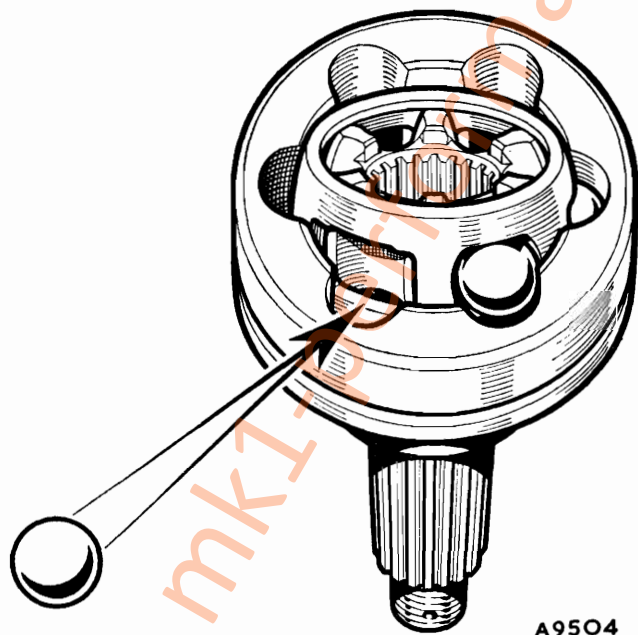


Fig. G.2

Tilt the inner race to remove or replace each ball in turn

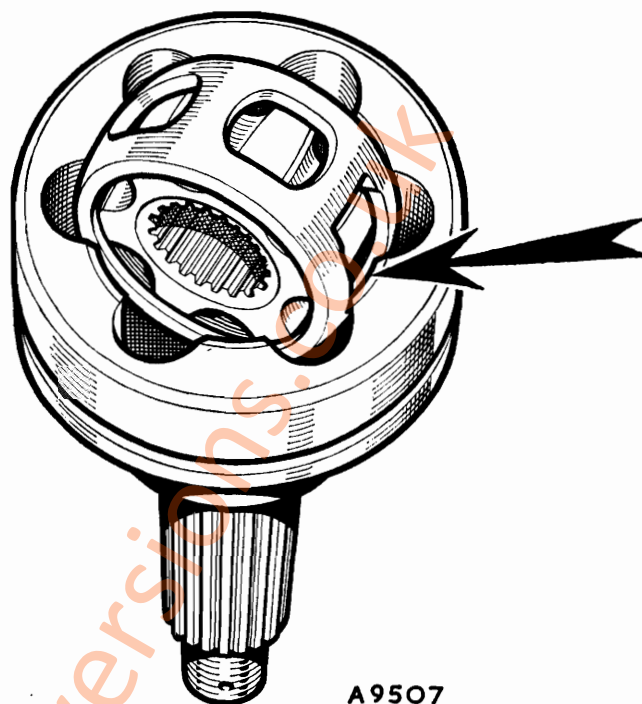


Fig. G.3

Removing the cage and inner race assembly, from the bell joint

- (11) Examine the six balls and if worn, rust-pitted or bearing evidence of flattening, the joint assembly must be replaced.
- (12) Inspect the inner and outer race tracks, these will be marked on the flanks where the balls roll, but should be free from indentation and the marking should be consistent.
- (13) Inspect the inner and outer spherical surfaces of the cage and the corresponding surfaces of the inner and outer races; these will be polished by contact but must be free from any sign of 'picking-up'. The edges of the cage windows may show signs of wear towards the outer side. Wear at these points may cause knocking when the joint is operated at high angles.
- (14) Carefully examine the shaft for cracks, and ensure that the square-section outer circlip is firmly in its groove.

Replacing the ball cage

The majority of cages used in the original assembly are of a standard size, although on some shafts two other non-standard oversize cages have also been used, and all three may be encountered in Service.

It is important to note that a joint will only accept a replacement cage of the same size as the original.

To effect easy identification of cage sizes use Service tool 18G 1012. The fitting of a Service kit must not be attempted without this tool.



Fig. G.4

Manœuvre the inner race in the cage to the required position to allow it to be extracted

The three kits available are as follows:

- Kit 'A', Part No. 18G 8000 (Standard)
- Kit 'B', Part No. 18G 8002 (·004 in. oversize)
- Kit 'C', Part No. 18G 8001 (·010 in. oversize)

It is extremely difficult to check the ball cage internal dimensions and a gauge, Service tool 18G 1012, must be used to determine the size of the cage fitted.

- (15) The small bore of the gauge is a clearance fit over a standard inner race but will not accept an inner race ·004 in. (·100 mm.) oversize. The larger bore of the tool is a clearance fit over a standard cage but will not accept a cage ·010 in. (·25 mm.) oversize.
- (A) If the inner race passes through the small bore of the gauge, and the cage passes through the larger bore, the joint is size 'A'.
- (B) If the inner race will not pass through the gauge, the joint is size 'B'. The cage should also be checked, but must be accepted by the gauge.
- (C) If the inner race passes through the gauge, but the cage will not pass through, the joint is size 'C'.

NOTE.—Should the gauge 18G 1012 not accept the inner race or cage, the joints must be replaced as a unit.

Reassembling the joint

- (16) This is an exact reversal of the dismantling procedure. All components should be lightly lubricated with Duckham's M-B grease (BMC pack AKF 1457). The components should go together easily and no force should be required.

- (17) Insert the inner race into the cage by introducing one of the lands into an elongated window in the cage (Fig. G.4).
- (18) Insert the cage and inner race assembly into the bell joint by fitting one of the elongated windows over one of the lands in the outer race (Fig. G.3). The three parts can now be turned or swivelled freely in relation to each other.
- (19) Locate the cage and inner race in their original position relative to the bell joint (as marked before dismantling).
- (20) Keeping this relationship between the parts, tilt the cage until one ball can be inserted in a window. Repeat this operation with the remaining balls (Fig. G.2).
- (21) Ensure that the inner race articulates freely with the cage in the bell joint, but care must be taken not to release the balls.
- (22) The joint should be filled with the remainder of the pack of Duckham's M-B grease, before inserting the shaft.
- (23) Fit a new rubber boot if necessary, smearing the inside with Duckham's M-B grease, take care when easing the boot over the circlip on the shaft.

Assembling the shaft to the joint

- (24) Replace the round-section spring ring with a new one (Fig. G.5). If replacing the shaft, fit a new circlip.

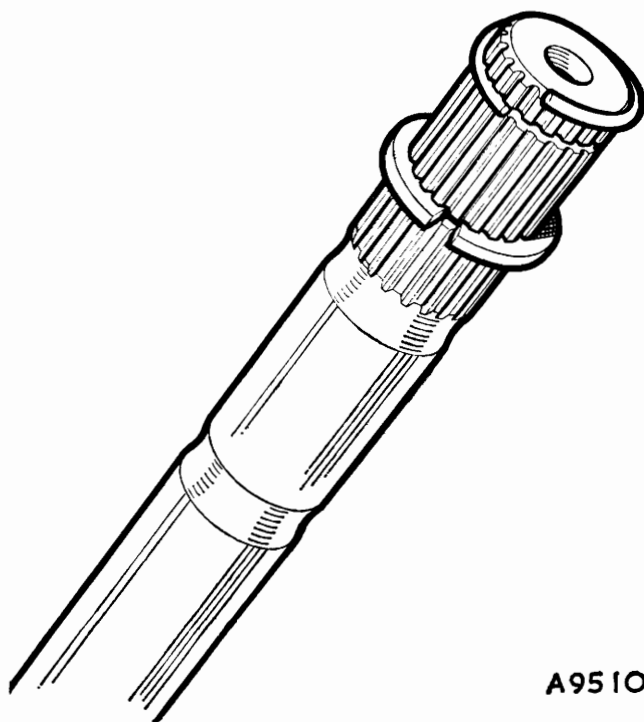


Fig. G.5

The splined bell joint end of the drive shaft showing the circlip and the round-section spring ring

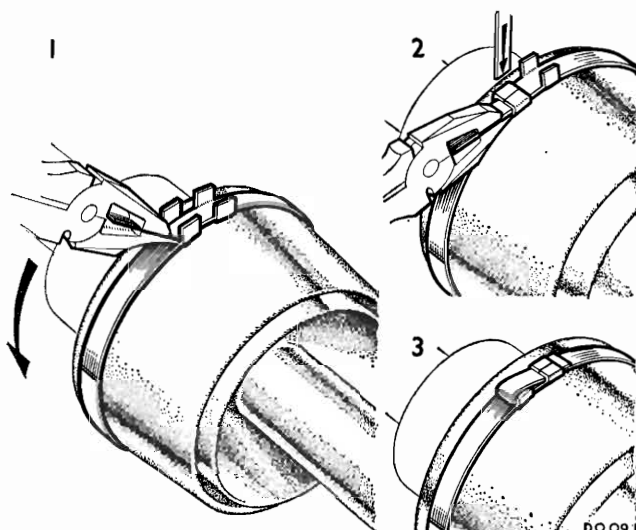


Fig. G.6

Fitting the clinching clips using Service tool 18G 1099. Pull the clip tightly between the tabs and secure in the order shown

- (25) Hold the shaft in a vice and locate the inner race on the shaft. Press the joint assembly against the spring ring whilst locating the ring centrally and contracting it in the chamfer of the inner race with screwdrivers. With the spring ring centralized, a sharp tap on the end of the stub shaft with a soft faced mallet will close up the ring, and the assembly can then be tapped on to the drive shaft. Make sure that the shaft is fully engaged, with the inner race against the circlip and that the inner ring has expanded inside the joint.
- (26) Slide the rubber boot over the bell joint until the radiused rib registers in the locating groove, and secure it with the large clinching clip using Service tool 18G 1099 (Fig. G.6). This is fitted with the tab pulled through away from the direction of forward rotation. Locate the other end of the boot in the groove in the drive shaft and secure it with the small clinching clip using pliers 18G 1099.

- (27) Lubricate the yoke end of the drive shaft and the inside of the yoke housing seal and slide the seal onto the shaft. Fill the cavity in the sliding joint yoke with $\frac{3}{4}$ oz. (21 gm.) of Duckham's M-B grease and fit the yoke to the shaft. Locate the seal into the groove on the shaft and the other end over the sleeve location. Push the shaft to the bottom of the yoke so that grease is driven into the seal. Hold the outer lip of the seal open to allow air and surplus grease to escape, ensure that the diameter of the bellows does not exceed 1.75 in. (44.5 mm.). Secure the yoke seal with clinching clips using pliers 18G 1099.

Refitting

- (28) Refitting is a reversal of the removing procedure given in Section K.3.
- (29) When fitting a replacement drive shaft assembly (of the type fitted with a rubber boot on the sliding joint) to the left-hand side of an early model, it will also be necessary to fit a modified lower arm inner pivot pin to ensure sufficient clearance for the rubber boot. Reference should be made to Fig. G.7 for the dimension of the modified pivot pin.

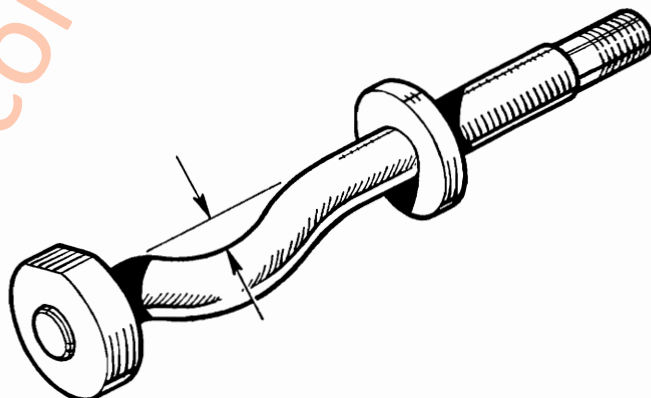


Fig. G.7

The lower arm pivot pin. The measurement at the position indicated must be .312 in. (7.9 mm.) to accommodate the rubber boot of later drive shaft assemblies

SECTION H

THE REAR SUSPENSION

	<i>Section</i>
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Hydrolastic suspension	H.6
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Displacer units	H.8
Radius arms	H.10
Schrader valve extension housing	H.14
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Radius arms (Moke)	H.13
Spring units	H.3
Sub-frame	H.1
Sub-frame (Moke)	H.12
Sub-frame mountings	H.4

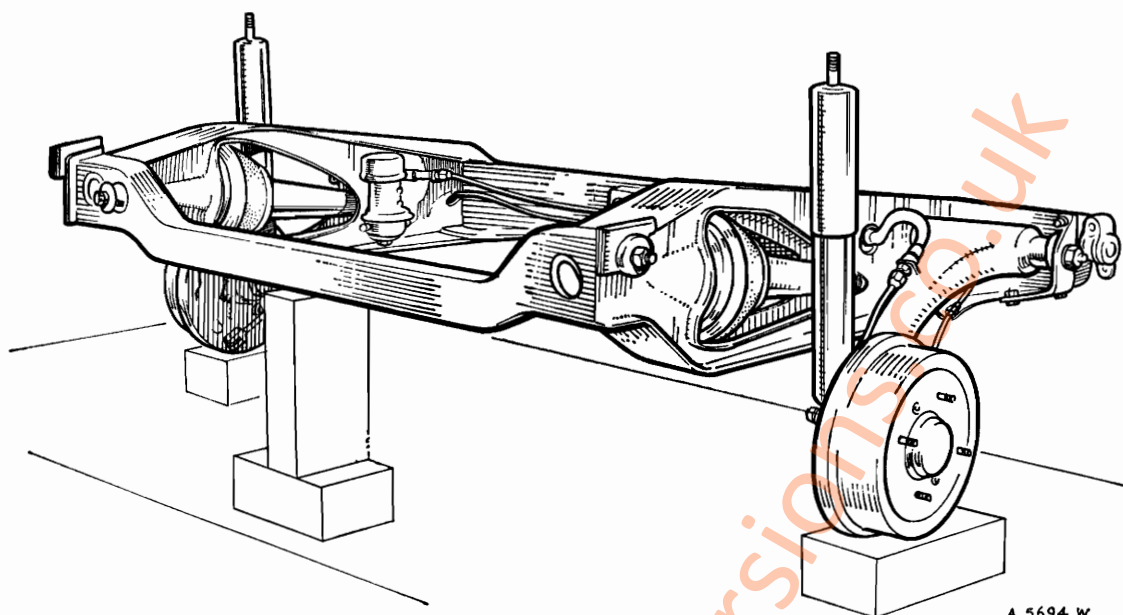


Fig. H.1

The rear sub-frame assembly (rubber suspension)

Section H.1

SUB-FRAME

Removing

- (1) Disconnect the battery.
- (2) Remove the exhaust pipe (Section A.3).
- (3) Disconnect the hydraulic pipe from the pressure regulating valve.
- (4) Remove the end finishers from the sill panels.
- (5) Release the rear dampers from inside the luggage compartment as in Section L.1.
- (6) Release the hand brake cable fairleads and disconnect the cables from the lever trunnion. Pull the cables downwards through the floor.
- (7) Lift the body with padded hooks under the wings.
- (8) Unscrew the eight sub-frame mounting bolts and withdraw the sub-frame.

Refitting

Reverse the removing instructions.

Section H.2

RADIUS ARMS

Removing

- (1) Release the rear damper(s) as in Section L.1.
- (2) Raise the car and support it under the sub-frame side-member.
- (3) Remove the road wheel.
- (4) Disconnect the brake hose from the bracket on the radius arm.

- (5) Prise out the strut assembly (Fig. H.2). The nylon cup may remain in the boss on the radius arm and, unless damaged, it can be removed with the fingers.
- (6) Disconnect the hand brake cable from the lever on the backplate, prise the guide tube from the clip on the arm and pull the tube away from the arm.
On later models remove the nut from the cable sector pivot and withdraw the selector and pivot.
- (7) Remove the end finisher from the sill panel.
- (8) Unscrew the nut and remove the washer from the radius arm pivot shaft and lift the arm away from the car.

Dismantling and overhauling

- (9) Slide the dust seal and washer from the ends of the pivot.
- (10) If new bearings are necessary, withdraw the outer bronze bush with Service tool 18G 585 and fit the new bush with Service tool 18G 584.
- (11) Remove the needle-roller bearing from the inner end with Service tools 18G 583 and 18G 583 B and ream the outer bronze bush with Service tools 18G 588 and 18G 588 A.
- (12) Refit the needle-roller bearing with Service tool 18G 620, the marked end of the bearing faces outwards.
- (13) Lubricate all parts with grease.

Refitting

- (14) Reverse the removal instructions, but note:
- (15) Refers to item (5). Repack the nylon cup and dust seal with Dextragrease Super G.P. Lip the dust seal over the edge of the cup.

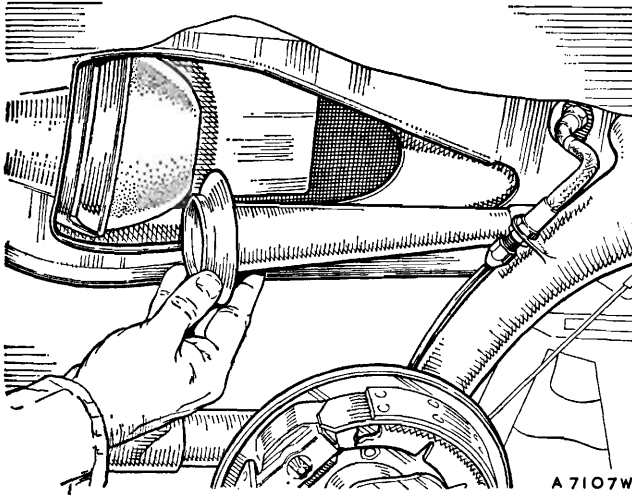


Fig. H.2

Extract the strut from the spring unit and pull it rearwards to disengage the ball end from the radius arm

Section H.3

SPRING UNITS

Removing

- (1) Carry out instructions (1) to (3) and (5) in Section H.2.
- (2) Remove the spring unit.
- (3) Prise out the nylon seating.

Refitting

- (4) Reverse the removing instructions, but note:
- (5) Make sure that the spring unit and spring strut are correctly located in their spigots while the radius arm is being raised to connect the upper end of the damper.

Section H.4

SUB-FRAME MOUNTINGS

Removing

- (1) Jack up the car at a point near the bumper and the rear body panel.

Front

- (2) Remove the radius arm (Section H.2).
- (3) Unscrew and remove the nut securing the mounting support pin to the sub-frame (Fig. H.3). Withdraw the mounting block to body screws. Prise the body and sub-frame apart sufficiently to allow the support pin, blocks, and rubbers to be extracted.

Rear

- (4) Jack up the car at a point between the bumper and the rear body panel.
- (5) Withdraw the mounting block to body screws and remove the nut from the end of the mounting support pin.
- (6) Prise the body and frame apart sufficiently to allow the block and rubbers to be removed.

Refitting

- (7) Reverse the removing instructions. Insert the mounting block to body screws before tightening the support pin nut.

Section H.5

HUB

Removing

- (1) Jack up the car and remove the road wheel and the brake-drum.
- (2) Prise off the hub cap.
- (3) Extract the split pin and screw the nut from the end of the stub shaft.
- (4) Withdraw the hub assembly.

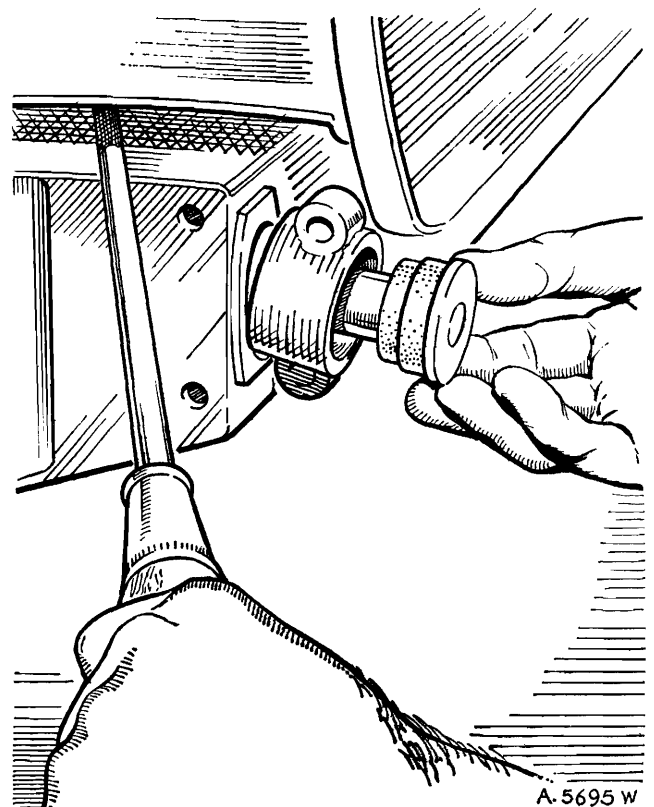


Fig. H.3

Removing the rear sub-frame front mounting support pin assembly

Dismantling

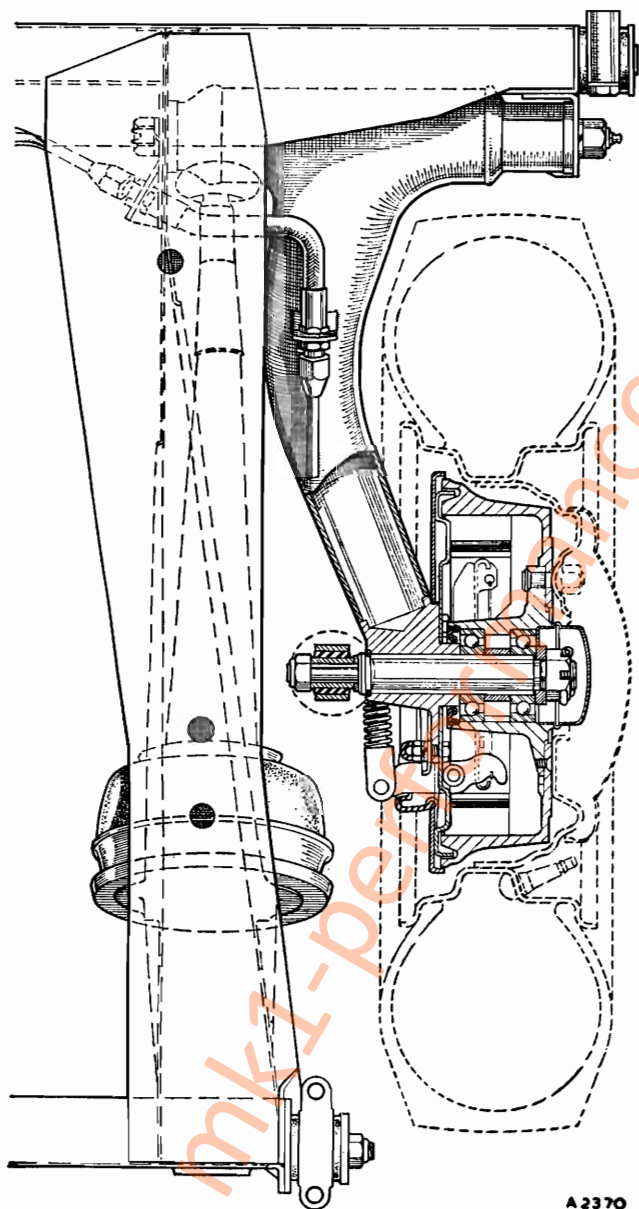
- (5) Drift the inner races of both bearings from the hub.
- (6) Remove the seal.
- (7) Extract the outer bearing races with Service tool 18G 260 and adaptor 18G 260 C.

Reassembling

- (8) Reverse the dismantling instructions and pack the bearings only with grease.

Refitting

- (9) Reverse the removing instructions, taking care to fit the chamfered bore of the thrust washer on the stub shaft towards the bearing.



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Fig. H.4.

The rear radius arm, showing a section through the hub assembly

Section H.6**HYDROLASTIC SUSPENSION**

The system consists of two front and two rear displacer units intercoupled longitudinally. Each is made of sheet steel and rubber and consists of a piston, a diaphragm, a lower and upper chamber housing, and a conical spring of compressed rubber.

Contact of the front wheels with a road irregularity forces the piston to push the diaphragm up; increased pressure displaces some of the fluid from the bottom chamber to the top chamber. The rubber springs deflect due to the pressure increase and fluid displacement, and the resultant pressure increase causes fluid to discharge through the interconnecting pipe into the rear displacer unit.

The fluid entering the rear displacer forces the diaphragm to react against the piston, resulting in the car height at the rear being raised. These events are virtually simultaneous and the car therefore rides an obstruction without pitch motion of the body. The action of the suspension is similar when the rear wheels negotiate the irregularity.

The fluid used in the system is a mixture of water and alcohol into which an anti-corrosive agent has been introduced.

The front suspension also comprises upper and lower arms of unequal length located in the side-members of the front sub-frame with their outer ends attached by ball joints to the swivel hubs.

The rear suspension, in addition to the Hydrolastic units, consists of independent trailing arms with auxiliary coil springs.

Section H.7**DEPRESSURIZING, EVACUATING, AND PRESSURIZING THE HYDROLASTIC SYSTEM**

Before any major work can be carried out on the suspension and its components the Hydrolastic system must be depressurized and in some cases evacuated. For this operation Service equipment Part No. 18G 703 or 18G 682 must be connected to the pressure valves on the rear sub-frame.

Before using Service equipment 18G 703 check that the pressure/vacuum tank is filled to the level indicated at the rear of the unit. The vacuum and pressure valves are identified by colour only; vacuum (yellow) and pressure (black).

Early service equipment (18G 682) has separate fillers for the pressure and vacuum tanks and are filled to the level shown on the dipstick. One side of the dipstick shows the level in the pressure tank and the other side the level in the vacuum tank.

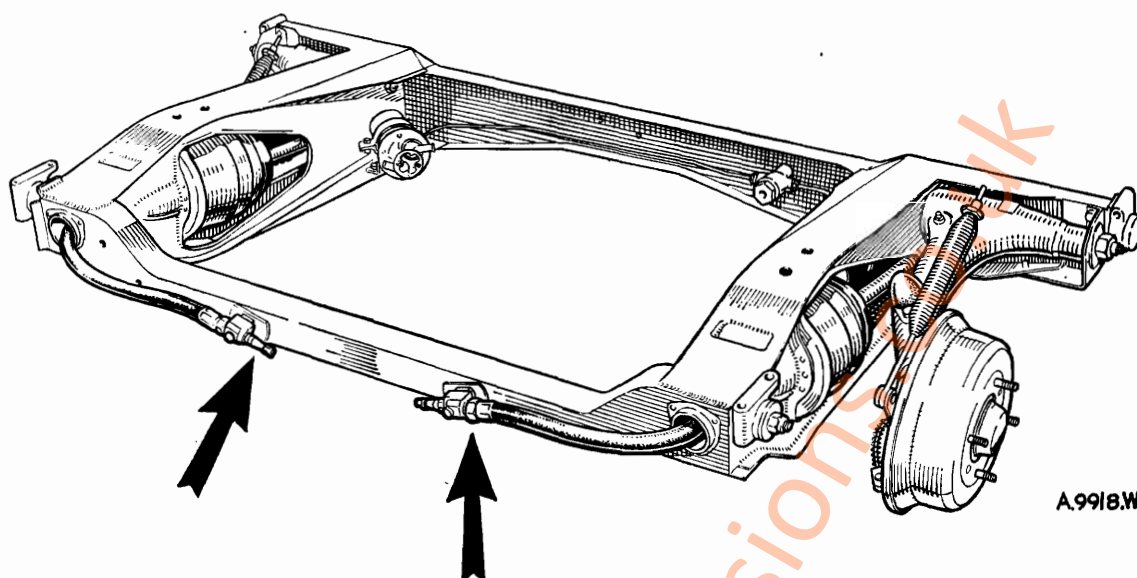


Fig. H.5

The Hydrolastic system pressure valves on the rear sub-frame

Top up to the correct levels with Hydrolastic Fluid, BMC Part No. 97H 2801.

The vacuum and pressure valves are identified by number or colour; vacuum (1) yellow, and pressure (2) black.

Depressurizing

- (1) Remove the pressure valve dust cap and connect the black connector to the valve with the knurled knob unscrewed.
- (2) Open the black valve (valve 2) and screw in the knurled knob to release the fluid from the suspension system into the unit's pressure tank.
- (3) Close the black valve (valve 2). The gauge should read zero if all the pressure has been released.
- (4) Remove the black connector and replace the pressure valve dust cap, and the plug in the black connector.
- (5) Repeat the above procedure on the second valve to depressurize the other side of the system.

Evacuating

After fitting new interconnecting pipes or displacer units it is essential that the air is evacuated from the system and a partial vacuum created. Service equipment 18G 703 or 18G 682 must be used for this purpose as follows:

- (6) Remove the pressure valve dust cap and connect the yellow connector to the valve on the sub-frame.
- (7) Close the yellow valve (valve 1) on the service unit.
- (8) Operate the vacuum pump until a reading of 27 in. (68.6 cm.) of mercury is obtained on the

vacuum gauge and all movement of fluid in the tube has stopped. Subtract .5 in. (1.27 cm.) of mercury for every 500 ft. (152 m.) above sea-level.

- (9) Open the yellow valve (valve 1). Wait one or two minutes until any further movement in the tube has stopped and remove the yellow connector.
- (10) Replace the connector plug.

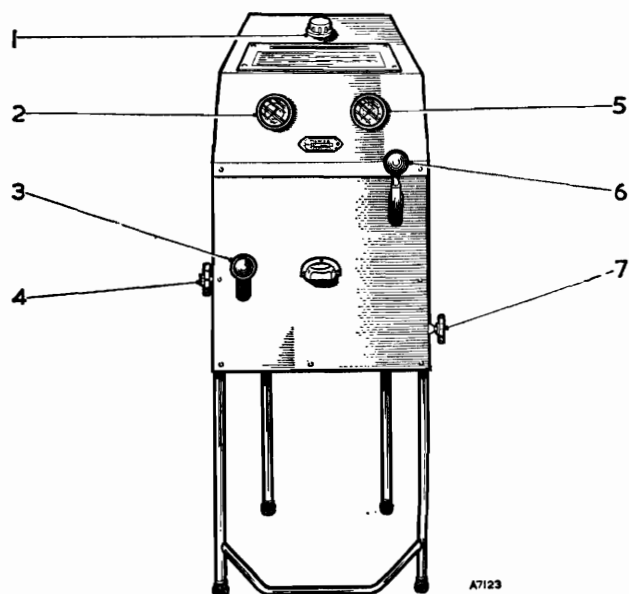


Fig. H.6

The suspension service unit

- | | |
|-----------------------------------|----------------------------|
| 1. Combined vacuum/pressure tank. | 4. Black valve (valve 2). |
| 2. Pressure gauge. | 5. Vacuum gauge. |
| 3. Pressure pump handle. | 6. Vacuum pump handle. |
| | 7. Yellow valve (valve 1). |

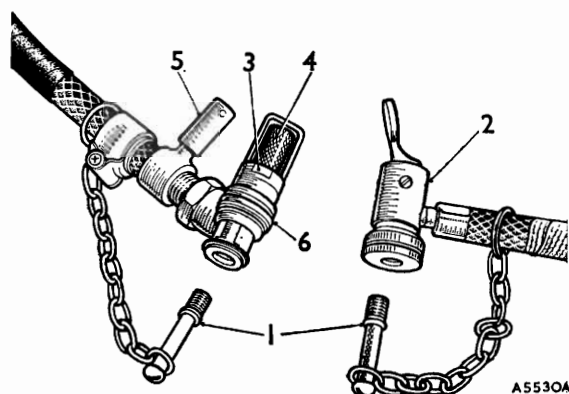


Fig. H.7

The suspension service unit connectors

- | | |
|---|--------------------|
| 1. Sealing plugs. | 4. Knurled knob. |
| 2. Evacuating connector. | 5. Bleeding screw. |
| 3. Depressurizing and pressurizing connector. | 6. Locking slide. |

Pressurizing

Having carried out repairs and evacuated to ensure that all air is out of system, the pressurization should be carried out as follows with the car in the condition given in Section H.9 and resting on all four wheels.

- (11) Connect the servicing unit black connector to the pressure valve on the rear sub-frame with the knurled knob unscrewed.
- (12) Close the black valve (valve 2) and open the bleed valve.
- (13) Operate the pressure pump until air is evacuated from the connecting tube and fluid appears at the bleed valve.
- (14) Close the bleed valve and screw in the knurled knob.
- (15) Increase the pressure until the normal operating pressure is obtained (see 'GENERAL DATA').

If a new displacer unit has been fitted pressurize to 350 lb./sq. in. (24.6 kg./cm.²).

- (16) Unscrew the knurled knob and open the black valve (valve 2) to release the pressure in the connecting pipe.
- (17) Remove the black connector and refit the sealing plug.
- (18) When pressurizing above the normal pressure as item (15), wait 30 minutes to allow the vehicle to settle. Reconnect the black connector with the knurled knob unscrewed, close black valve (valve 2), screw in the knurled knob, open black valve (valve 2) until the normal pressure is shown on the gauge.
- (19) Unscrew the knurled knob, open the black valve (valve 2) to release the pressure in the connecting pipe.
- (20) Remove the black connector, replace the connecting sealing plug and the valve dust cap.

H.6

Servicing unit maintenance

Should the service equipment be used continuously, it may be necessary to carry out the following maintenance.

Service tool 18G 682

- (21) Remove the front panel.
- (22) Remove the drain plug from the vacuum pump, drain the fluid.
- (23) Refill with the recommended vacuum oil S.A.E. 10 through the top of the pump. Replace the plug immediately the fluid commences to flow from the drain hole.
- (24) Lubricate the service unit mechanism periodically.

Service tool 18G 703

- (25) Remove the front panel and fill the vacuum pump with recommended vacuum oil S.A.E. 10 through the filler hole in the top of the pump. Fill only when the level is at the end of its downward stroke.
- (26) Lubricate the service unit mechanism periodically.

IMPORTANT.—When the equipment is not in use both valves should be left open.

Section H.8

DISPLACER UNITS

Removal

- (1) Remove the road wheel and release the helper spring from the radius arm.
- (2) Raise the car and support it beneath the sub-frame member.

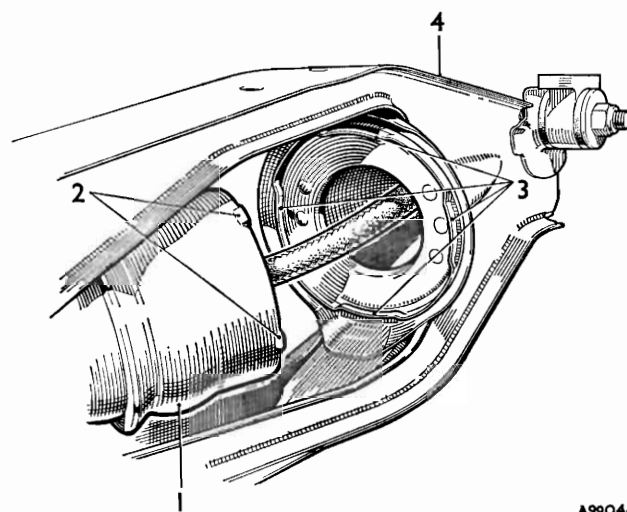


Fig. H.8

A rear displacer unit separated from the locating plate

- | | |
|--------------------|--------------------|
| 1. Displacer unit. | 3. Locating plate. |
| 2. Locating lugs. | 4. Sub-frame. |

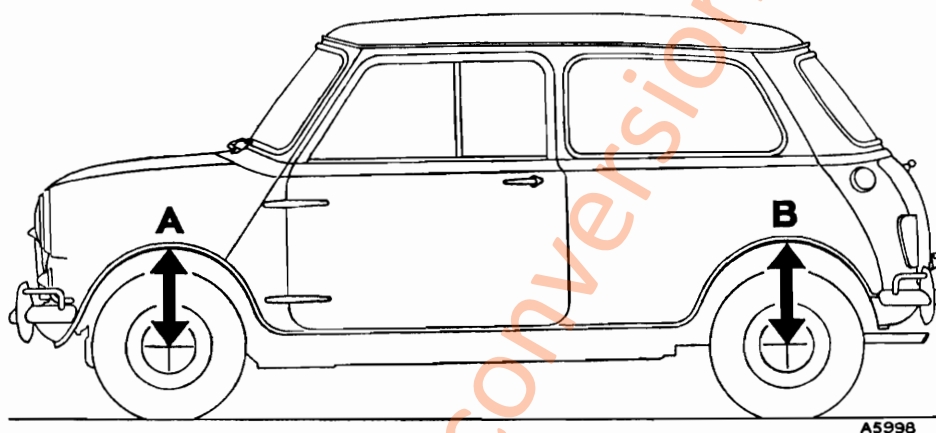
- (3) Remove the bump rubber from the sub-frame.
- (4) Depressurize the Hydrolastic system (see Section H.7).
- (5) Disconnect the flexible Hydrolastic hose from its union on the rear face of the sub-frame.
- (6) Remove the displacer strut and turn the unit anti-clockwise and withdraw it from the frame.

Refitting

- (7) Reverse the removal instructions.
- (8) Rotate the displacer clockwise to lock it into the registers on the locating plate.
- (9) Lubricate the strut ball and the nylon seat with Dextragease G.P. and make sure the dust seal is fitted over the lip of the nylon cup.
- (10) Evacuate and pressurize the system (Section H.7).

Section H.9

SUSPENSION PRESSURE AND WING HEIGHTS



A5998

CONDITION OF CAR

Water; oil; petrol (max.) 4 Imp. gal. (4.8 U.S. gal., 18.2 litres)

Wing heights (early models)		Wing heights (later models)	
A	B	A	B
13±½ in. (330±6.35 mm.)	13½±½ in. (343±6.35 mm.)	12½±½ in. (320.7±6.35 mm.)	13½±½ in. (333.4±6.35 mm.)

NOTE.—It is most important that the Hydrolastic suspension system be pressurized to the figures given in 'GENERAL DATA'.

During the initial assembly, or subsequently if a new displacer unit is fitted, the system should be pressurized for a period of 30 minutes to 350 lb./sq. in. (24.6 kg./cm.²) on early models, and to 400 lb./sq. in. (28.1 kg./cm.²) on later models (see chart for commencing car numbers).

On all later cars, modified displacer units, helper springs and rear suspension struts are fitted. These components are not interchangeable individually with those fitted to earlier cars. The suspension pressure is also increased to suit the modified units (see 'GENERAL DATA').

Commencing car numbers:

Austin	Morris	R.H.D.	L.H.D.
Mini		830899	832055
	Mini	370004	370197
Cooper		830061	829417
	Cooper	830127	829490
Cooper 'S'		820487	820514
	Cooper 'S'	820705	820706

To check and adjust pressures

- (1) Ensure that the car is resting on all four wheels and that the load condition is as described above.
- (2) Use Service equipment 18G 703 and fit the black connector with the knurled knob unscrewed. Close valve 2 (black valve) and open the bleed valve. Use the pressure pump until air is evacuated from the connection tube and fluid appears. Close the bleed valve, operate the pressure pump until the working pressure is reached (see 'GENERAL DATA'), and then screw in the knurled knob. If the pressure reading is low, operate the pressure pump until the correct working pressure is reached (see 'GENERAL DATA'). If the pressure gauge reading is high, adjust to the correct working pressure by opening valve 2 (black valve). When the pressure reading is correct unscrew the knurled knob, open valve 2 (black valve), and remove the black connector. Replace the sealing plug in the black connector and the pressure dust cap on the suspension unit inter-connecting pipe valve.
- (3) A check can also be made on the suspension pressure, using Service tool 18G 685. The tool must first be adjusted in the following manner. Connect the pump to a pressure gauge fitted with a Schrader valve from which the core has been removed. Fill the tool with Hydrolastic fluid and operate the hand lever of the tool, noting the pressure registered on the gauge. Adjust the valve seat until the working pressure of the system is registered on the gauge (see 'GENERAL DATA'). Tighten the lock screw and replace the washer and screw.

Fit the connector to the suspension unit inter-connecting valve and operate the hand lever until the relief valve in the tool commences to operate. The suspension will now be at its correct working pressure.

Checking wing heights

- (4) Ensure that the load condition is as described above.
- (5) Measure the wing heights as illustrated.

NOTE.—Should the Hydrolastic suspension system suffer damage and the fluid be lost, the suspension arms on the damaged side of the vehicle will contact the bump rubbers at both front and rear. In this condition the car may be driven with complete safety at 30 m.p.h. (50 km.p.h.) over metalled roads.

Section H.10

RADIUS ARMS (Hydrolastic Suspension)

Removing

- (1) Depressurize the Hydrolastic system (see Section H.7).

H.8

- (2) Remove the road wheel and release the helper spring from the radius arm.
- (3) Raise the vehicle and support it beneath the sub-frame side-member.
- (4) Disconnect the brake hose from the radius arm.
- (5) Disconnect the hand brake cable and release the cable sector from the arm.
- (6) Remove the bump rubber from the sub-frame and the end finisher from the sill panel.
- (7) Remove the displacer strut.
- (8) Remove the nut and washers from the arm pivot shaft and the four set screws to release the outer bracket.
- (9) Lift the radius arm assembly away from the vehicle, taking care not to lose the thrust washers and rubber seal fitted between the arm and the sub-frame side-member.

Dismantling is described in Section H.2.

Refitting

- (10) Reverse the removing instructions.
- (11) Lubricate the strut ball end and the nylon seas with Dextragrease Super G.P. and make sure the dust seal is fitted over the lip of the nylon cup.
- (12) Bleed the hydraulic brake system.
- (13) Pressurize the Hydrolastic system (see Section H.7).

Section H.11

SUB-FRAME (Hydrolastic Suspension)

Remove and refit the sub-frame as in Section H.1, with the following additional operations:

- (1) Depressurize and evacuate the Hydrolastic system prior to any dismantling, follow the instructions in Section H.7.
- (2) Disconnect both helper springs from the radius arms.
- (3) Disconnect the pressure valves from the sub-frame.
- (4) Evacuate and re-pressurize the Hydrolastic system when reassembly is complete, following the instructions in Section H.7.

Section H.12

SUB-FRAME (Moke)

Remove and refit the sub-frame as in Section H.1 with the following exceptions:

Fuel tank and pump removal not necessary.

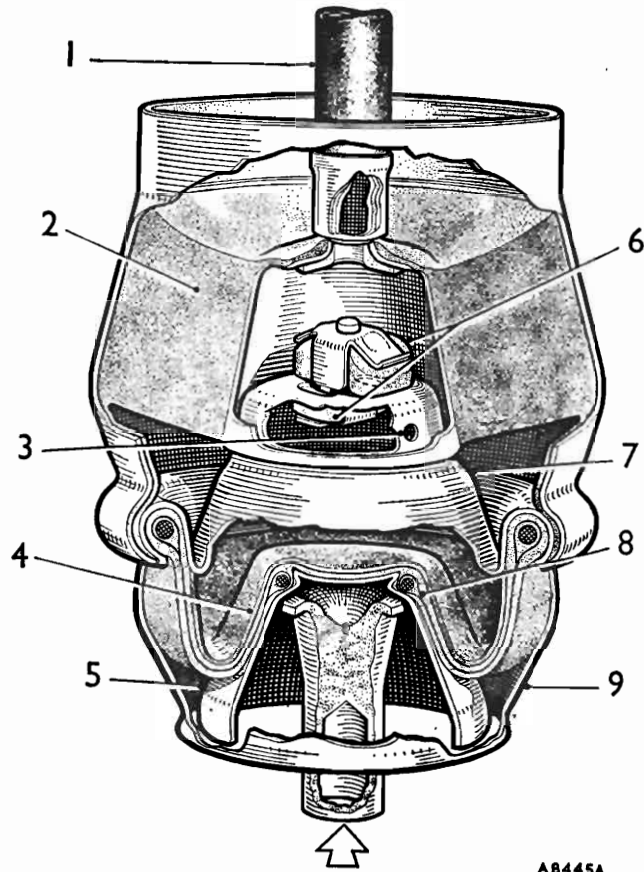


Fig. H.9

The Hydrolastic displacer unit

- | | |
|--------------------------|-----------------------------|
| 1. Interconnecting pipe. | 6. Damper valve. |
| 2. Rubber spring. | 7. Fluid separating member. |
| 3. Damper bleed. | 8. Rubber diaphragm. |
| 4. Butyl liner. | 9. Tapered cylinder. |
| 5. Tapered piston. | |

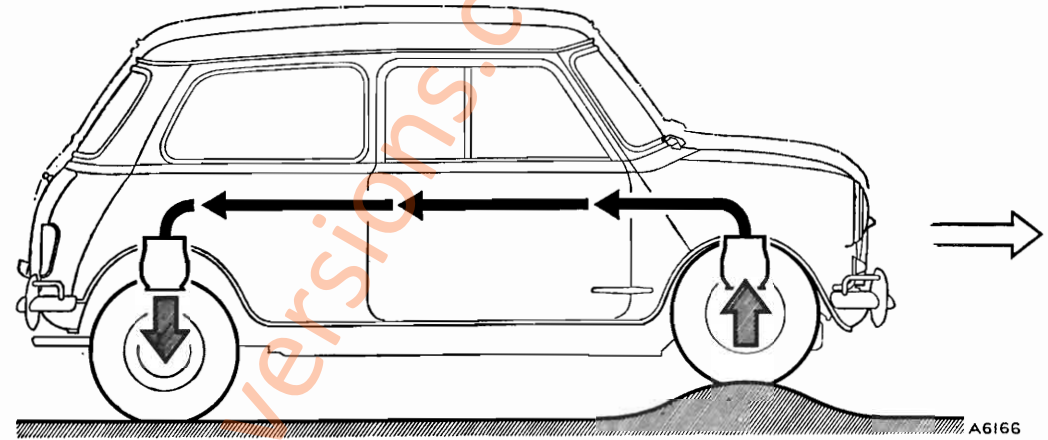


Fig. H.10

The tail rises in response to upward motion of the front wheel

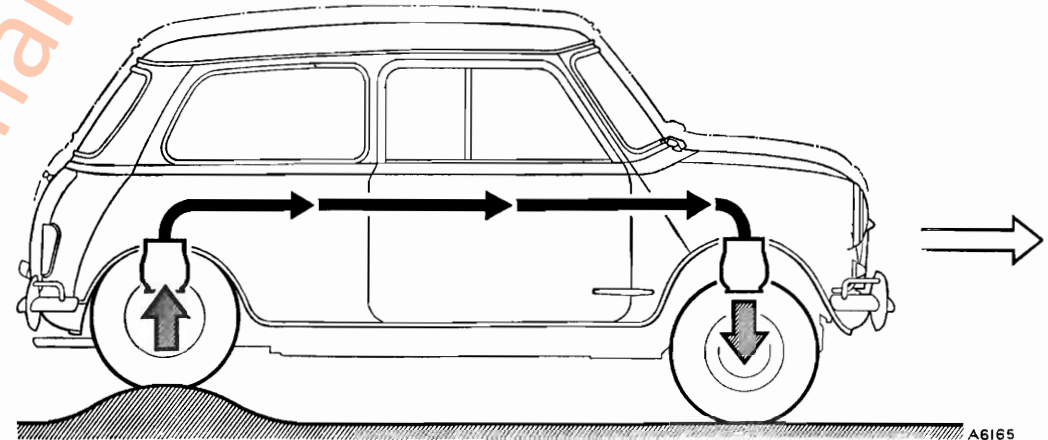


Fig. H.11

The nose rises in response to upward motion of the rear wheel

Section H.13**RADIUS ARMS
(Moke)**

Remove and refit as in Section H.2 with the following exceptions:

Fuel tank and pump removal not necessary.

Section H.14**SCHRADER VALVE EXTENSION HOUSING
(Hydrolastic Suspension)**

To rectify fluid leakage from the Schrader valve extension housing to the pipe elbow:

(1) Depressurize the Hydrolastic system (see Section H.7).

- (2) Remove the Schrader valve extension housing from the pipe elbow and clean the threads of both the valve extension housing and the elbow.
- (3) The threads of the valve extension housing must be lightly coated with Loctite Grade A after the housing has been re-started on its threads in the elbow. Under no circumstances must Loctite be applied to the valve extension housing before inserting it in the elbow.
- (4) Tighten the valve extension housing to a torque of 16 to 20 lb. ft. (2.2 to 2.8 kg. m.) and leave for 24 hours at room temperature before pressurizing the system.
- (5) Evacuate and pressurize the system (see Section H.7).

SECTION J

THE STEERING

												<i>Section</i>
Front wheel alignment	..	..	..	..	..	..	..	..	..	..	..	J.4
Nylon tie-rod ball ends	..	..	..	..	..	..	..	..	..	..	..	J.6
Steering-column	..	..	..	..	..	..	..	..	..	..	..	J.2
Steering rack assembly	..	..	..	..	..	..	..	..	..	..	..	J.3
Steering-rack lubrication	..	..	..	..	..	..	..	..	..	..	..	J.5
Steering-wheel	..	..	..	..	..	..	..	..	..	..	..	J.1

Section J.1

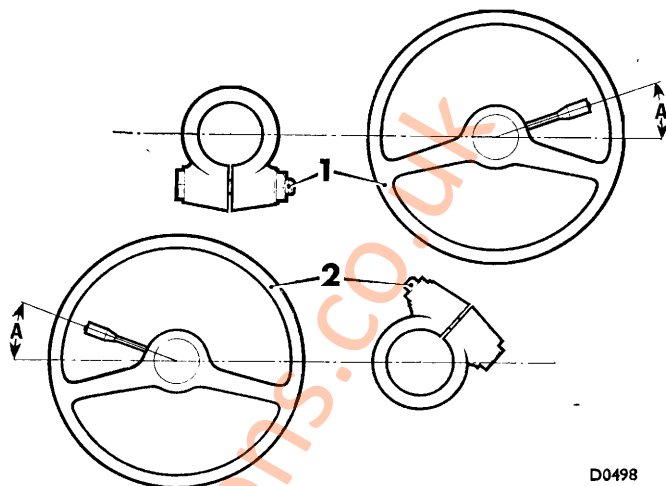
STEERING-WHEEL

Removal

- (1) Disconnect the battery.
- (2) *Early models.* Withdraw the grub screw in the wheel hub and lift up the horn switch.
- (3) *Mk. II models.* Carefully prise off the wheel hub centre cover.
- (4) Unscrew the wheel retaining nut and pull off the wheel.

Refitting

Reverse the above removing instructions. Tighten the nut to the recommended torque (see 'GENERAL DATA').



D0498

Fig. J.2

The position of the clamp bolt and direction indicator lever, $A = 20^\circ$

1. Right-hand-drive models. 2. Left-hand-drive models.

Section J.2

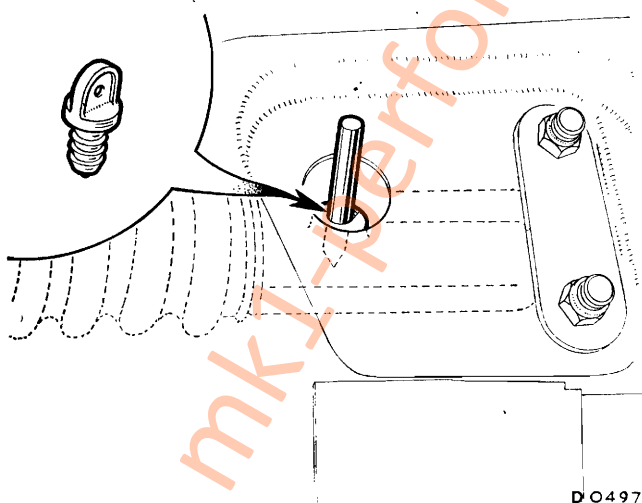
STEERING-COLUMN

Removing

- (1) Disconnect the column switch wiring connectors located below the parcel shelf.
- (2) Remove the bolt from the lower column clamp/steering rack pinion shaft.
- (3) Remove the column upper support clamp bolt.
- (4) Mark the fitted position of the outer column with the upper support bracket.
- (5) Pull the column assembly upwards and out of the car.

Dismantling

- (6) Remove the steering-wheel as described in Section J.1.
- (7) Remove both halves of the column cowl.
- (8) Remove the direction indicator switch and screw out the cancelling stud from the column.
- (9) *Early models.* Remove the horn connection slipping assembly.



D0497

Fig. J.1

Using a locator pin to centralize the rack, with (inset) the plastic plug

- (10) Withdraw the inner column from the lower end of the outer column tube.
- (11) Extract the upper and lower bushes from the outer column tube.

Inspection

- (12) Check the inner column alignment and rectify if required to ensure that when rotated the upper bearing face does not exceed $\frac{1}{8}$ in. (3 mm.) run-out.
- (13) Examine the upper and lower felt bushes and use replacements if necessary. Cylindrical polythene upper bushes are now fitted to all later models.

Reassembling

- (14) Soak the lower felt bush in oil.
- (15) Lubricate the polythene bush with a graphite-based grease and insert it fully into the upper end of the outer column tube.
- (16) Insert the inner column into the outer column, and at the same time roll the lower felt bush around its fitted position on the inner column until both joint faces butt together, then carefully enter the assembly into the outer column.
- (17) Reverse the removing procedure for the other components.
- (18) Before refitting the assembly to the car ensure that the inner column turns freely (see instruction (12)).

Refitting

- (19) Slacken the rack 'U' bolts to allow the rack pinion to align with the column.
- (20) Slacken the column fascia bracket bolts to allow sideways movement.
- (21) Align the road wheels to the straight-ahead position and refit the assembly to the car.
- (22) *Early models.* Engage the marked spline of the pinion shaft with the split portion of the inner column clamp. Push down the assembly until the clamp bolt can be easily inserted. The clamp must be positioned as follows:

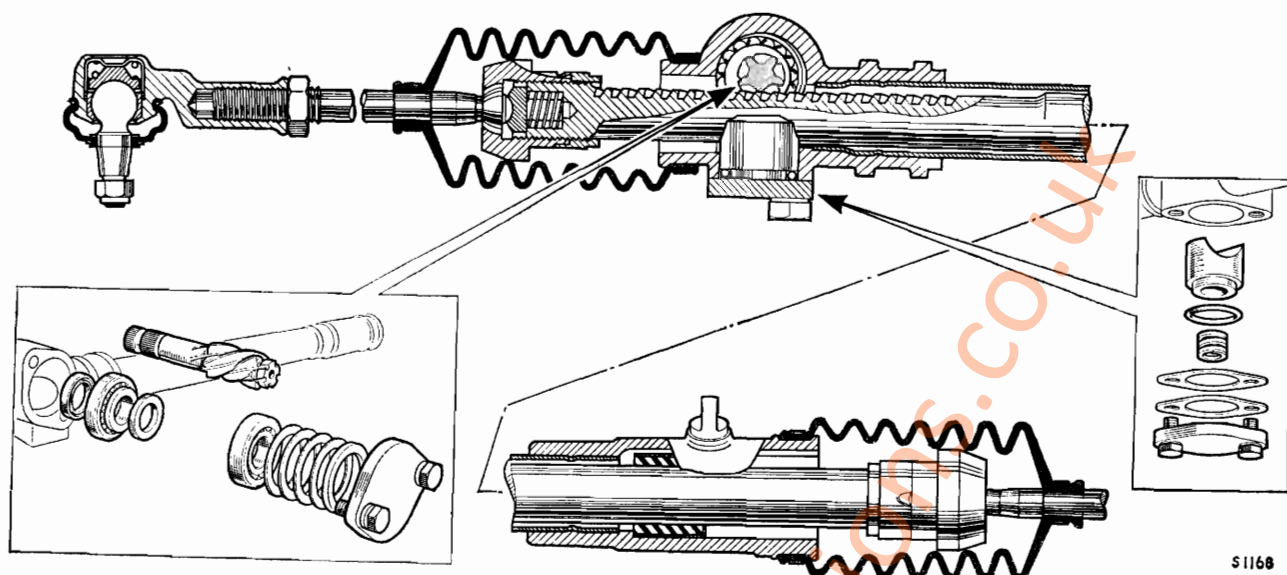


Fig. J.3

A section through the Mk. II steering-rack assembly, with the damper and pinion components shown inset

Left-hand-drive. The clamping bolt axis must be above the steering-column at an angle of 16° to the rack housing.

Right-hand-drive. The clamping bolt axis must be below and parallel to the rack axis.

Tighten the clamping bolt to the correct torque figure (see 'GENERAL DATA').

- (23) *Mk. II models.* Pull out the plastic plug from the rack casing and insert a locator pin, i.e. a $\frac{1}{4}$ in. (6 mm.) diameter bolt approximately 2 in. (50 mm.) long into the hole. Centralize the rack until the locator pin fully engages in the rack shaft to lock the centralized assembly in position (see Fig. J.1).
- (24) *Mk. II models.* Refit the column onto the pinion with the clamp bolt positioned as shown in Fig. J.2, and tighten to the torque figure given in 'GENERAL DATA'.
- (25) Lift the column and insert the clip into the support bracket, moving the bracket to meet the clip and **not** vice versa, so that the column remains free of load. Tighten the bracket to fascia rail securing bolts.
- (26) Refit and adjust the indicator trip stud until the combined measurement of the column and the stud is between 1.176 and 1.195 in. (29.87 and 30.35 mm.). Ensure that the longitudinal head of the stud is parallel to the column and tighten the lock-nut. Tighten the column clip to the fascia bracket.
- (27) Ensure that the outer column and direction indicator lever is positioned as shown in Fig. J.2, i.e. with the indicator trip stud exactly between the two cancelling mechanisms of the switch.
- (28) Tighten each of the rack 'U' bolts nuts as a pair, turning each nut alternately a half-turn at a time until secure.
- (29) *Mk. II models.* Remove the locator pin and refit the plastic plug.
- (30) The remainder is a reversal of the removing procedure.

Section J.3

STEERING RACK ASSEMBLY

The rack fitted to the Mk. II models is not interchangeable as a unit or as individual components with those racks fitted to earlier vehicles. Together with the new rack, modified steering levers are fitted and combine to provide the vehicle with a smaller turning circle. Correct wheel alignment is vitally important (see Section J.4).

Removing

- (1) Remove the air cleaner(s).
- (2) Slacken the column clamp bolt.
- (3) Remove the nut, bolt, and spring washer securing the column to the pinion shaft.
- (4) Mark the lower edge of the column shroud at the clamp bracket so that they can be refitted in line.
- (5) Pull the column upwards to free it from the pinion shaft.
- (6) Jack up the front sub-frame and remove the wheels and dampers. Remove the rack ball end retaining nuts and release the ball ends with Service tool 18G 1063.
- (7) Unscrew the four nuts and bolts securing the rear of the sub-frame to the body.
- (8) Remove the four bolts securing the sub-frame towers to the bulkhead cross-member.
- (9) Disconnect the exhaust pipe from the manifold and gear-change extension.
- (10) Disconnect the engine tie-rod.
- (11) Slacken the front sub-frame mounting bolts.
- (12) Remove the nuts from the steering rack 'U' bolts.
- (13) Support the body and remove the jack from the sub-frame; allow the sub-frame to drop and give clearance for the removal of the steering rack.
- (14) *Mk. II models.* Disconnect the remote-control gear lever extension from the floor (see Fig. A.12).

COOPER

Carry out the instructions detailed above and also:

- (15) Disconnect the gear lever extension from the floor.
- (16) Remove the exhaust pipe and silencer (Section A.3).

Dismantling

- (17) Disconnect the tie-rods from the steering-arms.
- (18) Remove the rubber gaiters.
- (19) Remove the damper cover plate, yoke, and spring(s).
- (20) Remove the pinion shaft tail bearing retaining plate, shims, thrust washer, bearing and bearing race, and withdraw the pinion. Extract the top bearing race, bearing, and thrust washer from behind the rack teeth.
- (21) Extract the pinion shaft oil seal.
- (22) Use Service tool 18G 707 to unscrew the ball housing and release the tie-rod, ball seat and tension spring. Remove the second tie-rod.
- (23) Withdraw the rack from the pinion end of the rack housing to obviate damage to the felt or 'Vulkollan' bush fitted in the opposite end of the rack housing.
- (24) Remove the bush securing screw from the rack housing, lever the felt bush at its joint and extract it. The felt bush metal sleeve must be removed if a plastic ('Vulkollan') bush is to be fitted as a replacement for the felt bush.

Inspecting

- (25) Clean all parts and examine for wear, particularly the rack and pinion teeth, and the rubber gaiters. Fit new parts where necessary.

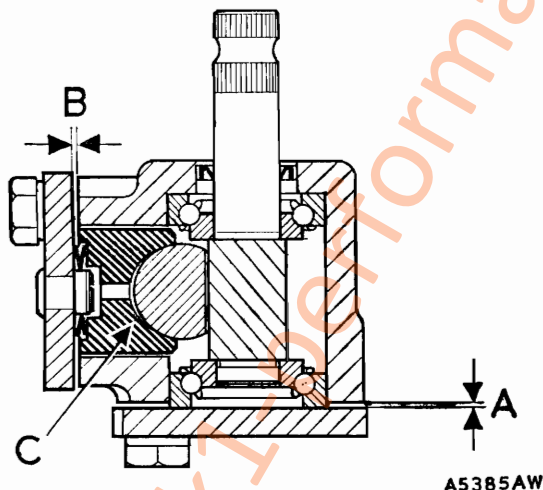


Fig. J.4

A section through the steering pinion and rack damper (1st type)

- A. Take a feeler gauge measurement and fit the pinion end cover with shims to the value of the measurement minus .001 to .003 in. (.025 to .076 mm.) before fitting the damper yoke (c).
- B. Measure the gap and fit shims.
- C. Damper yoke.

J.4

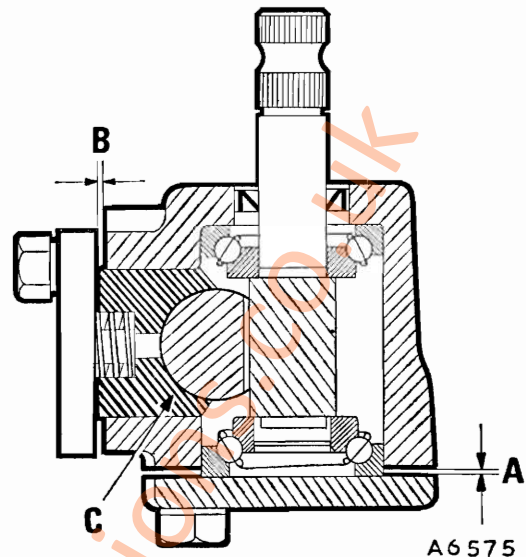


Fig. J.5

A section through the steering pinion and rack damper (2nd type)

- A. Take a feeler gauge measurement and fit the pinion end cover with shims to the value of the measurement minus .001 to .003 in. (.025 to .076 mm.) before fitting the damper yoke (c).
- B. Measure the gap and fit shims.
- C. Damper yoke.

Reassembling

- (26) Reverse the dismantling sequence but note: If fitting a new felt bush (early models), soak the bush in E.P. S.A.E. 140 oil.
- (27) The plastic bush may be used as a replacement for the felt bush and is used together with a steel sleeved bush and spacer. Insert the spacer (plain end first) into the rack housing. Fit the plastic bush into the steel sleeve and insert it into the rack housing (plain end first), with the flats on the plastic bush positioned offset to the retaining screw hole in the rack housing. Ensure that the spacer and bush are correctly positioned and drill through the retaining screw hole and the bush with a $\frac{7}{8}$ in. (.27 mm.) drill. Remove all swarf; coat the retaining screw with a jointing compound and refit to secure the bush. Check that the screw does not project into the bore of the plastic bush.
- (28) *Pinion adjustment (early models)*. Refit the cover without the shims, but do not over-tighten the screws. Measure the gap between the cover and the housing. Remove the cover and add shims to the thickness of the measurement minus .002 in. (.05 mm.). Refit the cover with jointing compound.
- (29) *Pinion adjustment (Mk. II models)*. Refit the pinion and bearings as shown in Fig. J.3. Add sufficient shims together with the spacer washer to provide a clearance of approximately .010 in. (.25 mm.) between the rack housing and the cover plate. Fit and lightly tighten the cover plate. Take a feeler gauge measurement of the clearance (A) and reduce the shimming by the measurement taken,

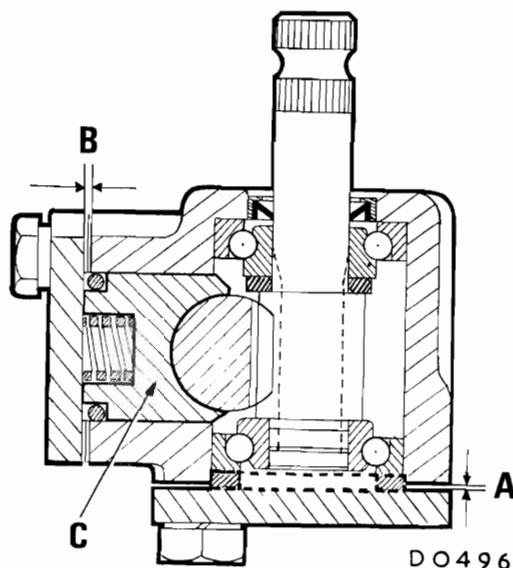


Fig. J.6

A section through the steering pinion and rack damper (Mk. II models)

- A. Take a feeler gauge measurement and fit the pinion end cover with shims to the value of the measurement minus .002 to .005 in. (.05 to .13 mm.) before fitting the damper yoke (c).
- B. Measure the gap and fit shims.
- C. Damper yoke.

less .002 to .005 in. (.05 to .13 mm.), to give the required pre-load.

- (30) Refers to item (22). Screw the ball housing locking ring onto the rack end as far as it will go and refit the lock washer. On models not fitted with a lock washer, fit a new locking ring. Refit the seat spring, seat, tie-rod and ball housing, and tighten up until the tie-rod is pinched. Slacken the housing one-eighth of a turn and tighten the locking ring to the recommended torque. Punch the lock washer into the slots of the housing and locking ring. If no lock washer is fitted, punch the lips of the locking ring into the slots of the ball housing and rack.
- (31) *Damper adjustment (1st type)*. Refit the yoke with the disc springs but without the packing shims.

With the rack in the straight-ahead position, tighten the cover screws until it is just possible to rotate the pinion with the pre-load gauge, 18G 207 and 18G 207 A set at 15 lb. in. (.17 kg. m.). Measure the gap between the damper housing flange and the rack housing. Remove, and then refit the damper with shims to the thickness of the measurement minus .002 in. (.05 mm.).

- (32) *Damper adjustment (2nd type and Mk. II models)*. Refit the yoke and cover plate without the spring.

Follow the measurement checking procedure giving in item (31) and refit the yoke with its 'O' ring seal (Mk. II models), together with the spring and cover plate, with shims to the value of the measurement plus .002 in. to .005 in. (.05 to .13 mm.).

- (33) Refit the rubber gaiters to the housing and the tie-rods. Before securing the gaiter clip on the tie-rod

at the pinion end, stand the assembly upright and pour in approximately $\frac{1}{2}$ pint (.4 U.S. pint, .19 litre) of Extreme Pressure S.A.E. 90 oil through the end of the gaiter. Refit and tighten the gaiter clip.

- (34) Check that the tie-rods have an equal number of threads visible behind each locknut, i.e. approximately eight threads on early racks and 11 threads on the Mk. II racks.
- (35) *Early models*. Centralize the rack in the housing. The full travel of the rack in each direction is 1.75 in. (44.5 mm.).

Refitting

ALL MODELS

Reverse the removal instructions, but note:

- (36) Refit the rack to the body with the 'U' bolts lightly tightened to allow the pinion to accept the column alignment.
- (37) Align the road wheels to the straight-ahead position.
- (38) Carry out the operations (20), and (22) to (30) in Section J.2.
- (39) Check and reset the wheel alignment (see Section J.4).

Section J.4

FRONT WHEEL ALIGNMENT

Checking

When checking or adjusting the front wheel alignment it is essential to use equipment designed to work at the specified height and diameter, and preferably a gauge which measures the angles involved rather than the difference in distance between the wheels in front of and behind the centres.

With the car unladen, tyres at the correct pressures, and the steering in the straight-ahead position, each wheel should make an angle of 7° 30' with the longitudinal axis

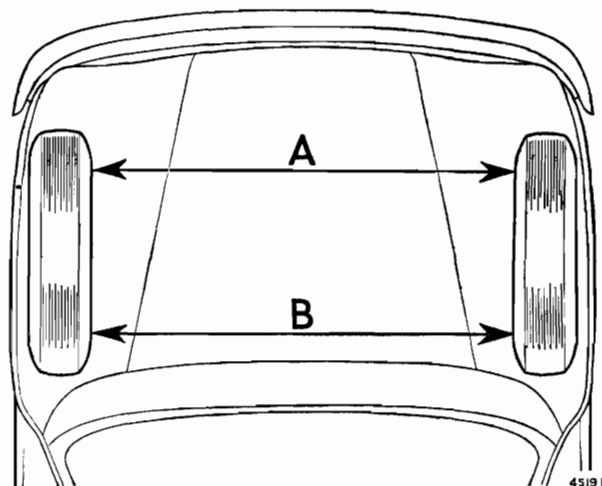


Fig J.7

The front wheel alignment check must be taken with the front wheels in the straight-ahead position. Dimension (A) must be $\frac{1}{16}$ in. (1.6 mm.) greater than (B)

of the car. When this angle is correct the distance between the front of the wheels will be $\frac{1}{16}$ in. (1.6 mm.) greater than that at the rear (see Fig. J.7).

When measuring distances rather than angles the measurements must be made on a $14\frac{1}{2}$ in. (368.3 mm.) diameter on the side wall of the tyre at a distance of 9.4 in. (239 mm.) above the ground.

If a base-bar alignment gauge is used, take two measurements; take a measurement at the front, mark the point on the tyres with chalk, push the car forward half a road wheel revolution and take the second measurement at the same points on the tyres and behind the centres.

With an optical gauge, take two readings with the car moved forward 180° and three with it moved forward 120° . The average figure should then be calculated.

Adjustment (Early models)

To adjust the track, slacken the tie-rod ball joint lock-nuts and the rubber gaiter clips, and turn each tie-rod the same number of turns until the adjustment is correct.

The tie-rods must be exactly the same length.

MK. II MODELS

The later steering-rack provides a smaller turning circle and it is vitally important that the wheel alignment is checked, and adjusted if necessary, following the correct procedure. Incorrect adjustment could result in excess articulation of the drive shaft constant velocity joints, and subsequent fouling of the suspension tie-rods by the road wheels when on full lock. Checking and adjustment must only be carried out when the vehicle is at 'kerbside' trim, i.e. fully equipped but without occupants or excess luggage.

Checking

- (1) With the vehicle resting on its wheels, turn the steering on each lock and check the clearance between the road wheel and the suspension tie-rod. The minimum clearance should not be less than $\frac{3}{4}$ in. (19 mm.), or with the suspension at full rebound, not less than $\frac{1}{4}$ in. (6.5 mm.).

Correct adjustment on each tie-rod will be indicated by the clearance figures given above being approximately the same on each side. Check the wheel alignment with an optical gauge, see item (6).

Adjustment

- (2) Slacken the rack tie-rod locknuts and the gaiter clips. Disconnect the ball joints from the steering levers, using Service tool 18G 1063.
- (3) Lift the floor covering and remove the rubber grommet from the floor panel (opposite side to the rack pinion).
- (4) Pull out the plastic plug from the rack body and insert a locator pin, i.e. $\frac{1}{4}$ in. (6 mm.) diameter bolt into the hole (see Fig. J.1).

- (5) Centralize the rack until the locator pin fully engages with the rack, to lock the centralized assembly.
- (6) Use an optical setting gauge and align the road wheels to the straight-ahead position, i.e. $\frac{1}{16}$ in. (1.6 mm.) toe out, and in alignment with the centre line of the car.
- (7) Adjust the tie-rods until each ball pin will correctly locate its steering lever without disturbing the alignment given in item (6), and secure in position.
- (8) Recheck the setting and adjust equally each tie-rod until the setting is obtained and tighten the lock-nuts. Ensure that the rubber gaiters are not under stress from twist and tighten the securing clips.
- (9) Remove the locator pin and refit the plastic plug.
- (10) Recheck the adjustment as detailed in item (1).
- (11) Refit the floor grommet and covering.

NOTE.—The hole in the rack from which the plastic plug was removed **MUST NOT** be utilized for the purpose of 'topping up' with lubricant.

Section J.5

STEERING RACK LUBRICATION

Lubricating nipples are not provided and rack lubrication is only necessary if leakage is evident from the rack housing or the rubber gaiters.

The following procedure should be followed provided the leakage can be rectified without the assembly being removed.

- (1) Centralize the steering rack.
- (2) Remove the gaiter retaining clip on the driver's side.
- (3) Inject $\frac{1}{2}$ pint (·2 litre) of E.P. S.A.E. 90 oil into the rubber gaiter.
- (4) Refit the gaiter clip and turn the steering from side to side to distribute the oil through the housing.

WARNING.—If the vehicle is hoisted with its front wheels clear of the ground care should be taken to avoid forceful movement of the wheels from lock to lock, otherwise damage may occur within the steering mechanism.

Section J.6

NYLON TIE-ROD BALL ENDS

Later ball joints have nylon seats sealed for life and protected by rubber boots; no lubrication is required.

The rubber boots must be maintained in good condition, and if it is found that a boot has become damaged in service both boot and joint must be renewed. However, if a boot is damaged in the workshop during the removal of a joint which has therefore not become contaminated by road dirt, the boot alone may be renewed.

Before fitting a new boot smear the area adjacent to the joint with a little Dextragrease Super G.P. lubricant.

SECTION K

THE FRONT SUSPENSION

												Section
Hydrolastic suspension												
Description	..	..	..	..	..	..	..	..	..	..	..	H.6
Depressurizing, evacuating, pressurizing	..	..	..	..	..	..	..	..	..	..	..	H.7
Displacer units	..	..	..	..	..	..	..	..	..	..	..	K.7
Upper suspension arms	..	..	..	..	..	..	..	..	..	..	..	K.8
Rubber suspension												
Lower arm	..	..	..	..	..	..	..	..	..	..	..	K.5
Spring units	..	..	..	..	..	..	..	..	..	..	..	K.1
Struts	..	..	..	..	..	..	..	..	..	..	..	K.6
Upper arm	..	..	..	..	..	..	..	..	..	..	..	K.4
Swivel hub ball joints	..	..	..	..	..	..	..	..	..	..	..	K.3
Swivel hub outer oil seal	..	..	..	..	..	..	..	..	..	..	..	K.9
Swivel hubs	..	..	..	..	..	..	..	..	..	..	..	K.2

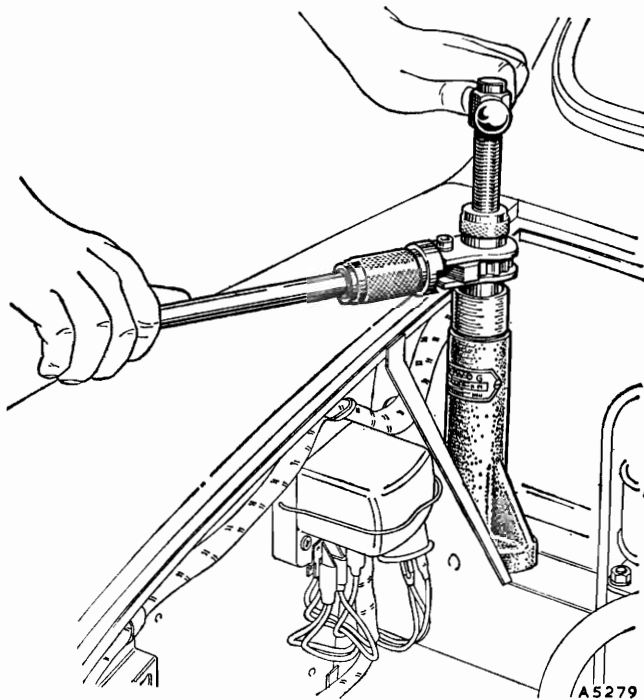


Fig. K.1

Compressing the spring unit using Service tool 18G 574 B

Section K.1

SPRING UNITS (Rubber Suspension)

Compressing

- (1) Slacken one bolt (or nut) and remove the other securing the sub-frame towers to the engine bulk-head cross-member.
- (2) Move the locking plate to one side to expose the access hole in the cross-member. Replace the bolt (or nut) and tighten both.
- (3) Insert Service tool 18G 574 B through the cross-member, locate the body of the tool over the two sub-frame bolts (or nuts), and screw the centre of the tool nine complete turns into the spring unit. Use the ratchet handle to turn the centre nut and make contact with the body of the tool. Hold the centre screw to prevent further rotation and then turn the ratchet handle clockwise to compress the spring sufficiently to allow removal of the spring strut from the tower. Do not over-compress the spring.

Removing

- (4) Jack up the car after compressing the spring, and remove the road wheel.
- (5) Remove the bump rubber from the tower.
- (6) Remove the retaining nut and release the upper suspension arm with Service tool 18G 1063.

- (7) With the spring unit compressed, lever the strut from the spring unit.
- (8) Detach the hydraulic damper, dismantle the upper arm pivot and remove the upper arm.
- (9) Hold the centre screw of the tool to prevent it turning, screw the ratchet handle upwards to release the spring compression, remove the tool, and extract the spring unit from the tower.

Refitting

- (10) Reverse the removing instructions.

Section K.2

SWIVEL HUBS

Removing

- (1) Jack up and remove the road wheel.
- (2) Remove the steering ball joint nut; to release the ball joint from the steering lever use Service tool 18G 1063.
- (3) Disconnect the drive shaft at the inner flexible joint undoing only the four outer 'U'-bolts and after marking the flange and joint for correct reassembly.
- (4) Disconnect the brake hose from the backplate.
- (5) Remove the upper suspension arm retaining nut and spring washer and release the arm from the pin using Service tool 18G 1063.
- (6) Disconnect the tie-rod from the lower arm; to release the hub from the arm use Service tool 18G 1063.
- (7) Withdraw the hub and drive shaft.

Dismantling

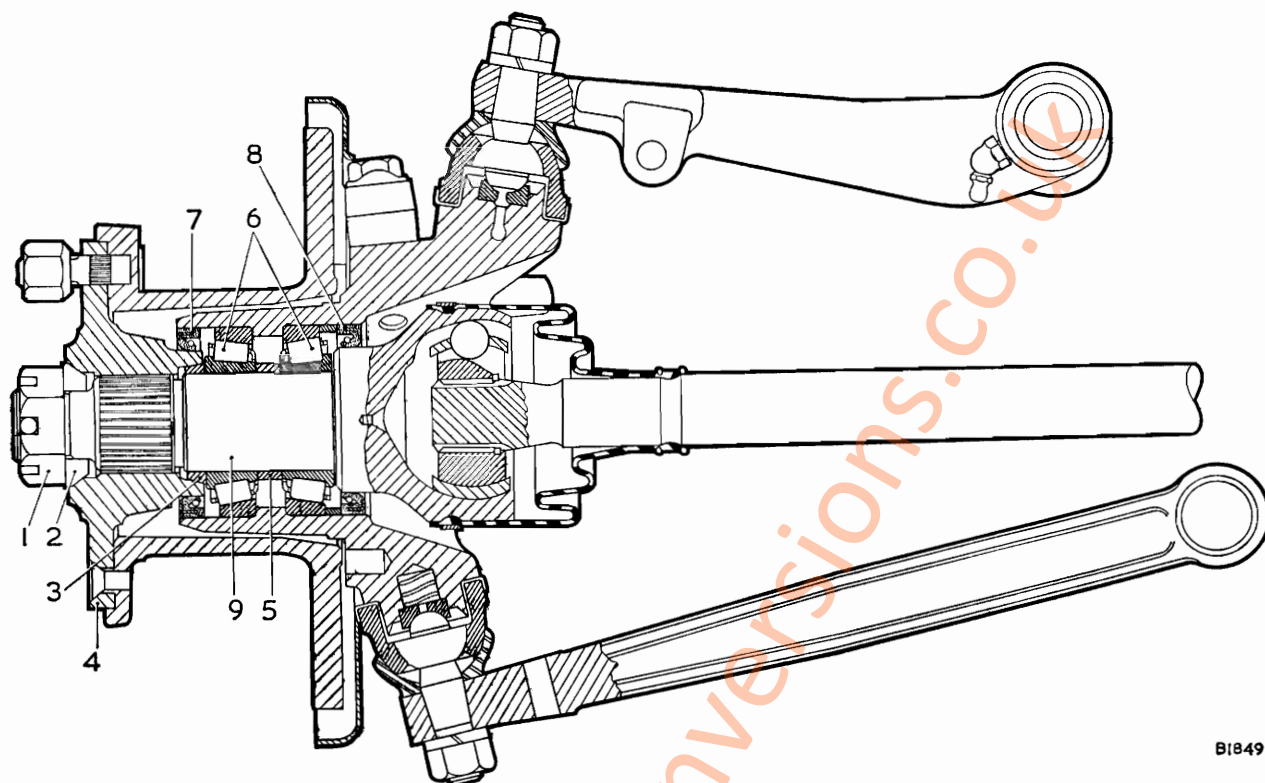
- (8) Remove the brake-drum.
- (9) Remove the split pin, nut, and distance washer and drive the shaft from the flange and hub.
- (10) Remove the drive shaft with Service tool 18G 304, using adaptor bolts 18G 304 F. Remove the driving flange from the hub with Service tool 18G 575.
- (11) Remove the inner and outer seal and the outer bearing spacer.
- (12) Drift out the inner race of each bearing, and use Service tools 18G 260 H to withdraw the outer races.

Reassembling

- (13) Reverse the dismantling instructions. Pack only the bearings with grease.

Refitting

- (14) Reverse the removing instructions.



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Fig. K.2

The front hub assembly (Cooper 'S')

- | | | |
|--|----------------------------|--------------------|
| 1. Drive shaft nut. | 4. Hub and disc assembly. | 7. Outer oil seal. |
| 2. Outer tapered collar. | 5. Bearing distance piece. | 8. Inner oil seal. |
| 3. Inner tapered collar (early models only). | 6. Taper-roller bearings. | 9. Drive shaft. |

COOPER AND COOPER 'S'

Carry out the instructions given in Section K.2 with the following modifications.

Removing

- (4) Remove the disc brake calliper (Section M.7).

Dismantling**COOPER**

- (8) This instruction is not applicable.

COOPER 'S'

For items (8) to (12) substitute the following.

- (15) Remove the split pin and unscrew the drive shaft nut. Tap the end of the shaft with a hide mallet and pull off the driving flange and brake disc assembly, with the inner and outer split taper collars. Remove the drive shaft, the inner and outer bearing and distance piece from the hub.
- (16) Remove the inner and outer oil seals, drive out the inner and outer bearing cups using a brass drift. The shoulder of the hub has recesses to allow this. Take great care not to damage the bore of the hub.

Refitting**COOPER 'S'**

- (17) Tighten the drive shaft nut to the correct tightness (see 'GENERAL DATA') and check for run-out on the periphery of the disc. If this exceeds .006 in. (.15 mm.), reposition the driving flange assembly on its splines until the run-out is within this limit.

Section K.3**SWIVEL HUB BALL JOINTS****Removing**

- (1) Compress the spring unit as in Section K.1 or depressurize the Hydrolastic system as in Section H.7.
- (2) Jack up and support the car under the sub-frame side-member.
- (3) Remove the road wheel.
- (4) Disconnect the tie-rod from the lower arm.

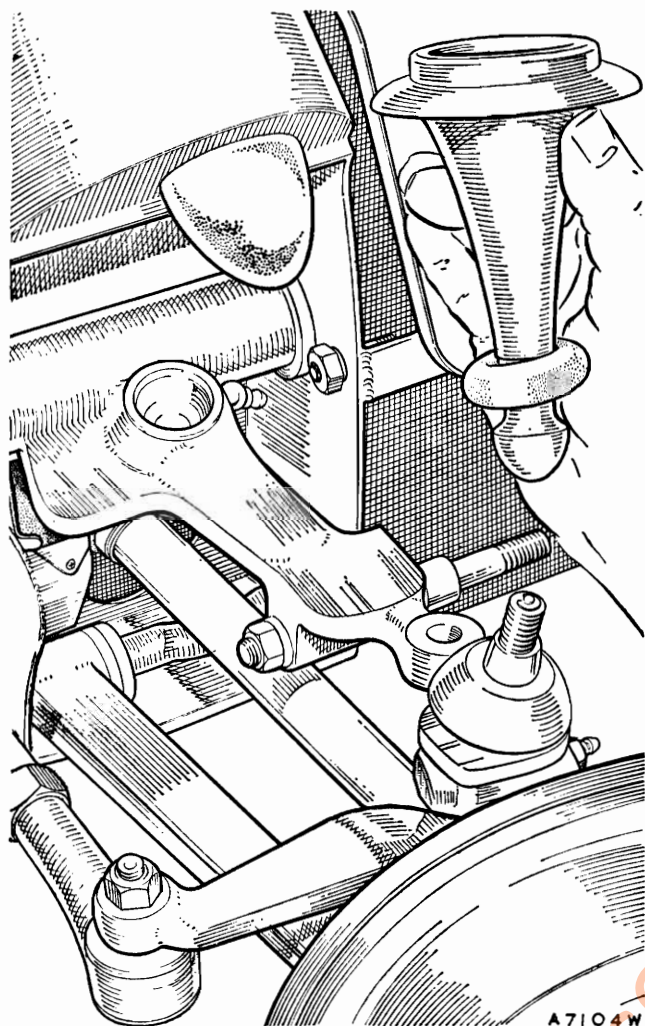


Fig. K.3

The method of removing the spring strut with the spring unit compressed and the upper support arm removed from the hub ball pin

- (5) Remove the upper suspension arm retaining nut and spring washer and release the arm from the pin using Service tool 18G 1063.
- (6) Remove the ball housing dust seal and the lubricator.
- (7) Knock up the lock washer and unscrew the housing to release the ball and seat.
- (8) Remove the lower ball joint in the same manner noting the spring fitted under the seat.

Refitting

- (9) Clean all components.
- (10) Refit the ball pin seat, pin, and housing (and spring in the lower assembly) without the packing shims and locking washer.
- (11) Screw down the housing until there is no free movement between the ball and seating and measure the gap between the housing and the swivel hub.
- (12) Remove the housing and ball pin, fit the shims to a thickness of the measurement minus the thickness

of the locking washer, .036 in. (.9 mm.). Add an additional shim so that the final assembly has no nip to .003 in. (.076 mm.) end-float. Pack the joint with grease, replace the locking washer and refit the assembly to the hub.

- (13) If with the housing tightened there is excessive end-float or tightness, the shims must be adjusted accordingly.
- (14) Use Service tool 18G 372 with adaptor 18G 587 to tighten the ball pin retainer to the correct torque figure (see 'GENERAL DATA'). Tap up the locking washer on three flats, with one flat adjacent to the brake disc (on Cooper models) to secure the housing.
- (15) Replace the dust seal, refit the suspension arm and tighten the ball pin nut to the correct torque figure (see 'GENERAL DATA'). Reconnect the tie-rod to the lower arm.
- (16) Release the rubber spring unit from compression or pressurize the Hydrolastic system as in Section H.7.
- (17) Refit the road wheel and lower the car.

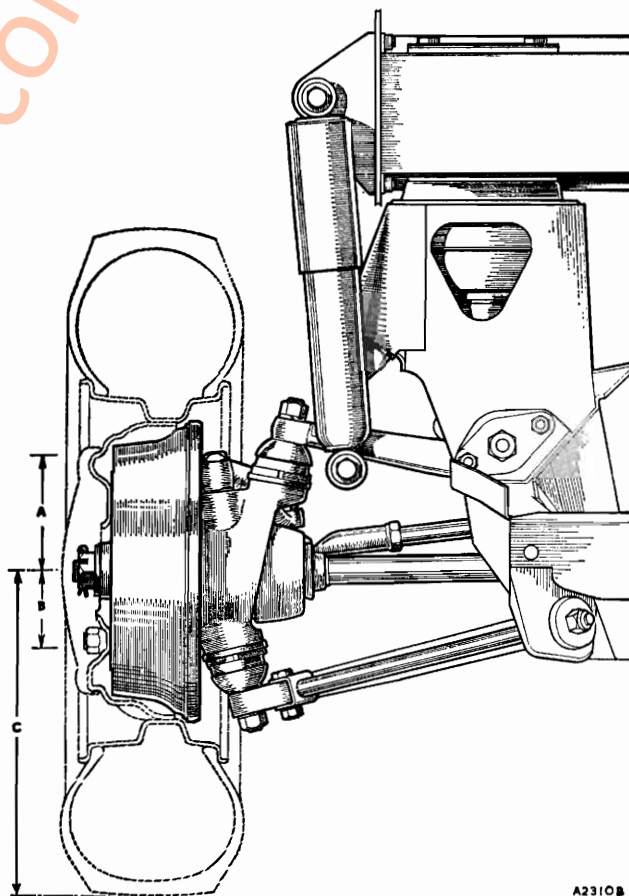


Fig. K.4

The general arrangement of the front suspension: (A) indicates the maximum upward deflection from normal, 3 1/2 in. (84.93 mm.)" (B) the rebound figure, 2 9/32 in. (57.94 mm.)" (C) the normal distance above ground surface

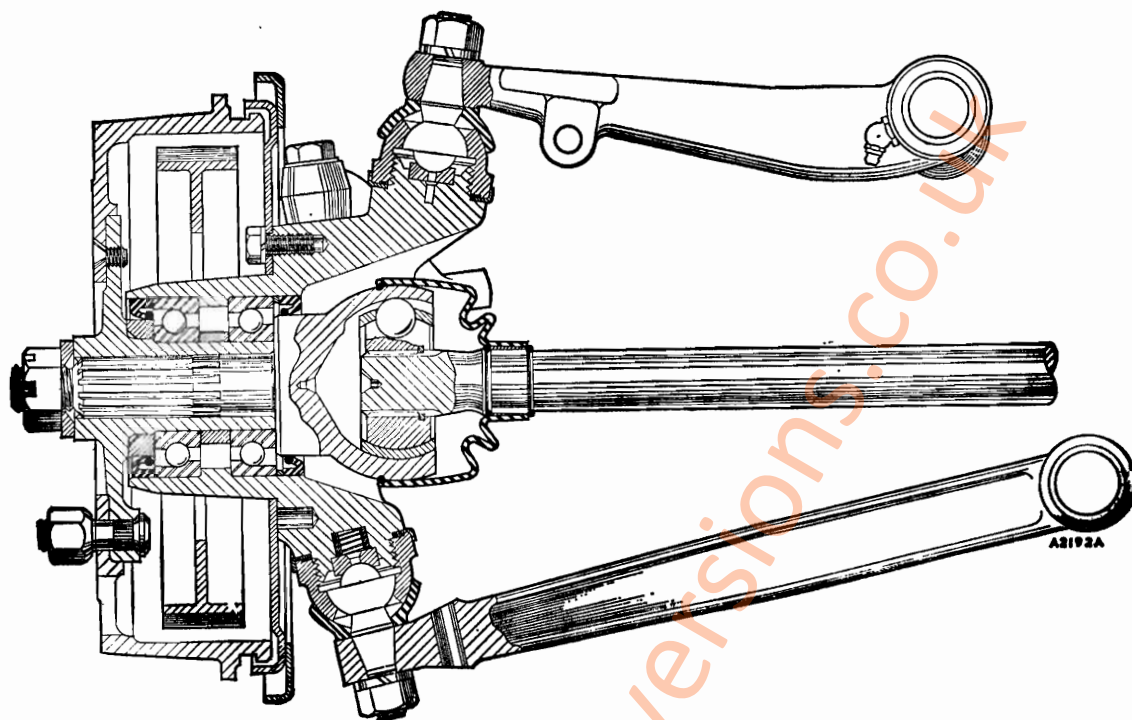


Fig. K.5

A section through the front suspension assembly

Section K.4

UPPER ARM (Rubber Suspension)

Removing

- (1) Compress the spring as in Section K.1.
- (2) Jack up, remove the road wheel and damper, and remove the strut.
- (3) Remove the retaining nut and release the upper suspension arm with Service tool 18G 1063.
- (4) Remove the nut and washer from each end of the shaft.
- (5) Remove the front thrust collar retaining plate, the collar and the seal and push the shaft forward.
- (6) Remove the rear thrust washer and seal and manoeuvre the arm from the frame.
- (7) Extract the needle-roller bearings from the arm with Service tool 18G 581.

Refitting

Reverse the removing instructions, but note:

- (8) Lubricate all parts with grease.
- (9) Fit the needle-roller bearings with the marked ends outwards, using Service tool 18G 582 and adaptor 18G 582 A to push them into position.
- (10) Lubricate the spring unit strut nylon cup with Dextragrease Super G.P.

Section K.5

LOWER ARM

Removing

- (1) Jack up and remove the road wheel and damper.
- (2) Support the suspension with a jack under the brake-drum.
- (3) Disconnect the tie-rod from the lower arm.
- (4) Release the lower arm from the swivel hub with Service tool 18G 1063.
- (5) Remove the nut and washer from the rear end of the shaft and withdraw the shaft.

Refitting

Reverse the removing instructions, but note:

- (6) Support the lower arm in the normal position when the shaft nut is locked up to prevent pre-loading of the rubber bushes.

Section K.6

SUSPENSION STRUTS (Rubber Suspension)

Some cars have been fitted with struts having a circular-section washer between the body of the suspension strut and the knuckle end. When fitting a new strut to these vehicles, make sure the washer is included.

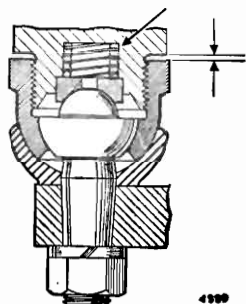


Fig. K.6

A section through the swivel hub ball joints. Take feeler gauge measurements at the positions indicated without the locking washers fitted and without the seat spring fitted to the lower ball joint

Section K.7

DISPLACER UNITS (Hydrolastic Suspension)

Removing

- (1) Jack up the car and remove the road wheel.
- (2) Depressurize and evacuate the Hydrolastic system (see Section H.7).
- (3) Release the displacer strut dust seal from the nylon seat and extract the strut from the displacer unit.
- (4) Disconnect the displacer hose from the union on the engine bulkhead.
- (5) Remove the suspension top arm (see Section K.4).
- (6) Push the displacer upwards and remove two screws to release the displacer bracket from inside the sub-frame tower.
- (7) Rotate the displacer anti-clockwise and withdraw it from the sub-frame.

Refitting

- (8) Reverse the removal instructions.
- (9) Rotate the displacer clockwise to lock it into the registers on the locating plate.
- (10) Lubricate the strut ball end and the nylon seat with Dextragrease Super G.P. and make sure the dust seal is fitted over the lip of the nylon cup.
- (11) Evacuate and pressurize the system (see Section H.7).

Section K.8

UPPER SUSPENSION ARMS (Hydrolastic Suspension)

Removal

Depressurize the Hydrolastic system as in Section H.7 and follow the instruction in K.4 for arm removal.

K.6

Section K.9

SWIVEL HUB OUTER OIL SEAL

The following instructions will permit a leaking outer seal to be replaced when the driving flange is removed.

NOTE.—A bearing overhaul will still require swivel hub removal as in Section K.3.

Removing

- (1) Remove the hub cover, extract the split pin, and slacken the drive shaft nut.
- (2) Slacken the wheel nuts and jack up the vehicle.
- (3) Take off the road wheel and remove the brake-drum.
- (4) Remove the drive shaft nut and assemble the Service tool 18G 304 and 18G 304 F to the drive flange.
- (5) Replace the Service tool centre screw with adaptor 18G 304 P and use the impulse extractor 18G 284 to remove the flange.
- (6) Should the outer bearing inner race come away with the driving flange, it can be removed with Service tool 18G 705 and adaptor 18G 705 B.

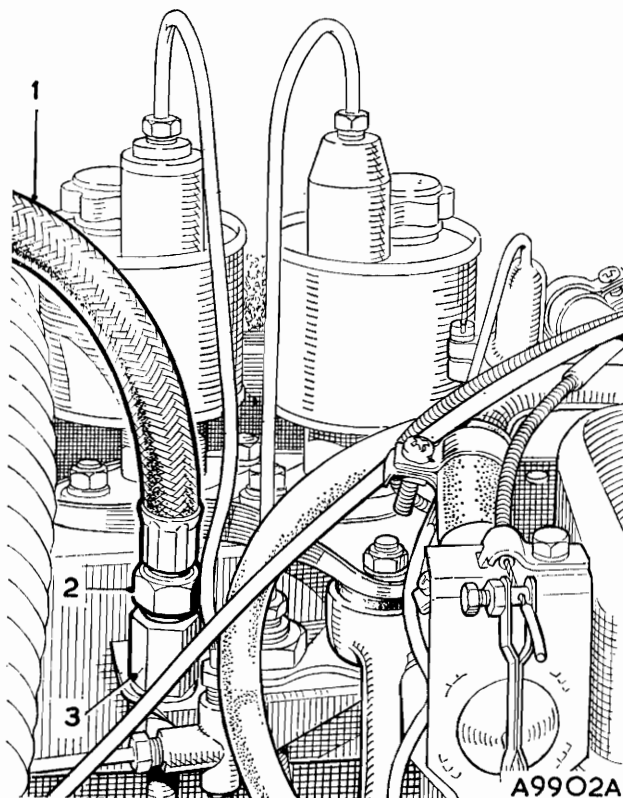


Fig. K.7

The right-hand front displacer hose connector

- | | |
|--------------------|--------------|
| 1. Displacer hose. | 2. Hose nut. |
| 3. Connector. | |

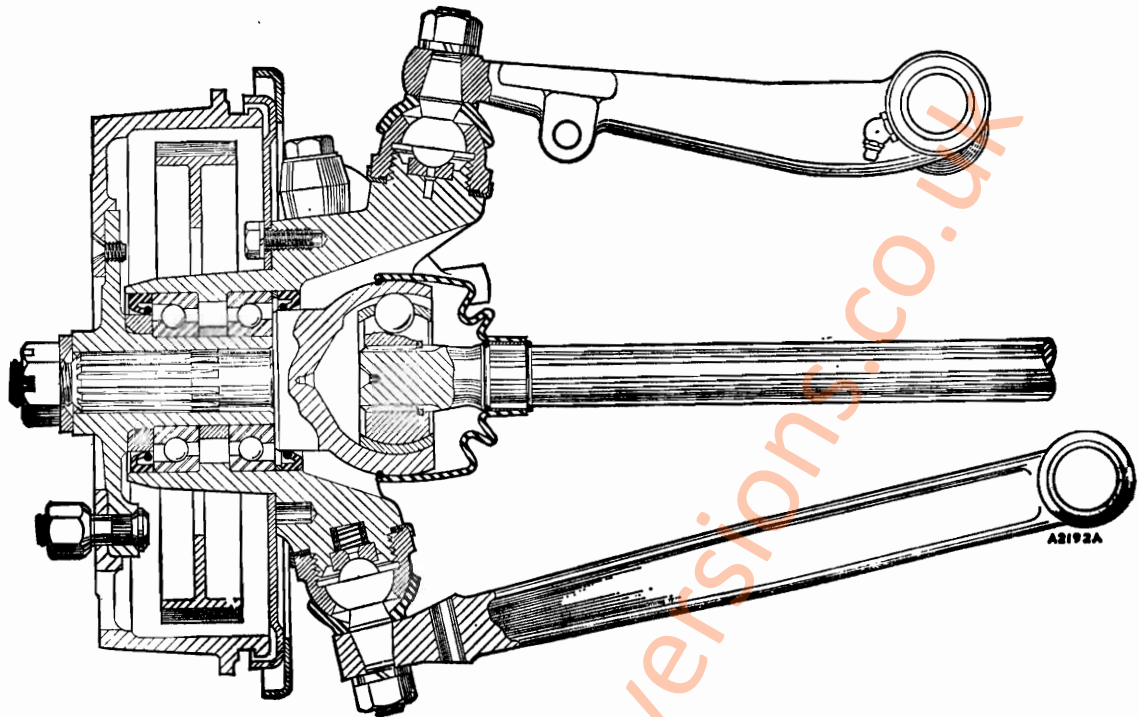


Fig. K.5
A section through the front suspension assembly

Section K.4

UPPER ARM (Rubber Suspension)

Removing

- (1) Compress the spring as in Section K.1.
- (2) Jack up, remove the road wheel and damper, and remove the strut.
- (3) Remove the retaining nut and release the upper suspension arm with Service tool 18G 1063.
- (4) Remove the nut and washer from each end of the shaft.
- (5) Remove the front thrust collar retaining plate, the collar and the seal and push the shaft forward.
- (6) Remove the rear thrust washer and seal and manoeuvre the arm from the frame.
- (7) Extract the needle-roller bearings from the arm with Service tool 18G 581.

Refitting

Reverse the removing instructions, but note:

- (8) Lubricate all parts with grease.
- (9) Fit the needle-roller bearings with the marked ends outwards, using Service tool 18G 582 and adaptor 18G 582 A to push them into position.
- (10) Lubricate the spring unit strut nylon cup with Dextragrease Super G.P.

Section K.5

LOWER ARM

Removing

- (1) Jack up and remove the road wheel and damper.
- (2) Support the suspension with a jack under the brake-drum.
- (3) Disconnect the tie-rod from the lower arm.
- (4) Release the lower arm from the swivel hub with Service tool 18G 1063.
- (5) Remove the nut and washer from the rear end of the shaft and withdraw the shaft.

Refitting

Reverse the removing instructions, but note:

- (6) Support the lower arm in the normal position when the shaft nut is locked up to prevent pre-loading of the rubber bushes.

Section K.6

SUSPENSION STRUTS (Rubber Suspension)

Some cars have been fitted with struts having a circular-section washer between the body of the suspension strut and the knuckle end. When fitting a new strut to these vehicles, make sure the washer is included.

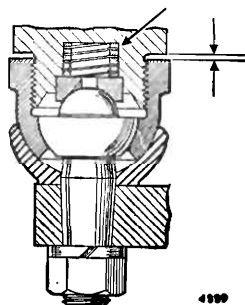


Fig. K.6

A section through the swivel hub ball joints. Take feeler gauge measurements at the positions indicated without the locking washers fitted and without the seat spring fitted to the lower ball joint

Section K.7

DISPLACER UNITS (Hydrolastic Suspension)

Removing

- (1) Jack up the car and remove the road wheel.
- (2) Depressurize and evacuate the Hydrolastic system (see Section H.7).
- (3) Release the displacer strut dust seal from the nylon seat and extract the strut from the displacer unit.
- (4) Disconnect the displacer hose from the union on the engine bulkhead.
- (5) Remove the suspension top arm (see Section K.4).
- (6) Push the displacer upwards and remove two screws to release the displacer bracket from inside the sub-frame tower.
- (7) Rotate the displacer anti-clockwise and withdraw it from the sub-frame.

Refitting

- (8) Reverse the removal instructions.
- (9) Rotate the displacer clockwise to lock it into the registers on the locating plate.
- (10) Lubricate the strut ball end and the nylon seat with Dextragrease Super G.P. and make sure the dust seal is fitted over the lip of the nylon cup.
- (11) Evacuate and pressurize the system (see Section H.7).

Section K.8

UPPER SUSPENSION ARMS (Hydrolastic Suspension)

Removal

Depressurize the Hydrolastic system as in Section H.7 and follow the instruction in K.4 for arm removal.

K.6

Section K.9

SWIVEL HUB OUTER OIL SEAL

The following instructions will permit a leaking outer seal to be replaced when the driving flange is removed.

NOTE.—A bearing overhaul will still require swivel hub removal as in Section K.3.

Removing

- (1) Remove the hub cover, extract the split pin, and slacken the drive shaft nut.
- (2) Slacken the wheel nuts and jack up the vehicle.
- (3) Take off the road wheel and remove the brake-drum.
- (4) Remove the drive shaft nut and assemble the Service tool 18G 304 and 18G 304 F to the drive flange.
- (5) Replace the Service tool centre screw with adaptor 18G 304 P and use the impulse extractor 18G 284 to remove the flange.
- (6) Should the outer bearing inner race come away with the driving flange, it can be removed with Service tool 18G 705 and adaptor 18G 705 B.

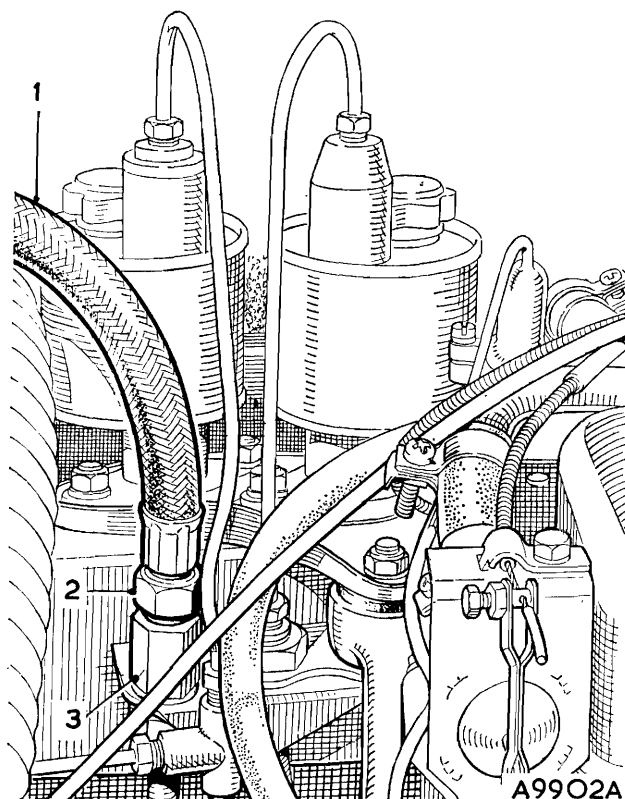


Fig. K.7

The right-hand front displacer hose connector

- | | |
|--------------------|--------------|
| 1. Displacer hose. | 2. Hose nut. |
| 3. Connector. | |

Refitting

- (7) Refit the inner bearing race (if extracted).
- (8) Fit the new seal and apply a suitable amount of lubricant to the lip to prevent burning.
- (9) Insert the outer bearing distance piece into the seal with the chamfered bore to the outside.
- (10) Assemble the drive flange to the hub, drifting it into position gently, turning the flange 180 degrees several times to align the bearing distance piece with the flange boss.
- (11) Refit the brake-drum.
- (12) Refit the drive shaft washer, chamfered bore facing inward and replace the nut.
- (13) Tighten the shaft nut to the torque figure given in 'GENERAL DATA' and secure with the split pin.

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SECTION L

THE HYDRAULIC DAMPERS

													<i>Section</i>
Priming	..	..	..	..	..	..	..	..	..	..	..	..	L.2
Removal and refitting	..	..	..	..	..	..	..	..	..	..	..	..	L.1
Rear (Moke)	..	..	..	..	..	..	..	..	..	..	..	..	L.3

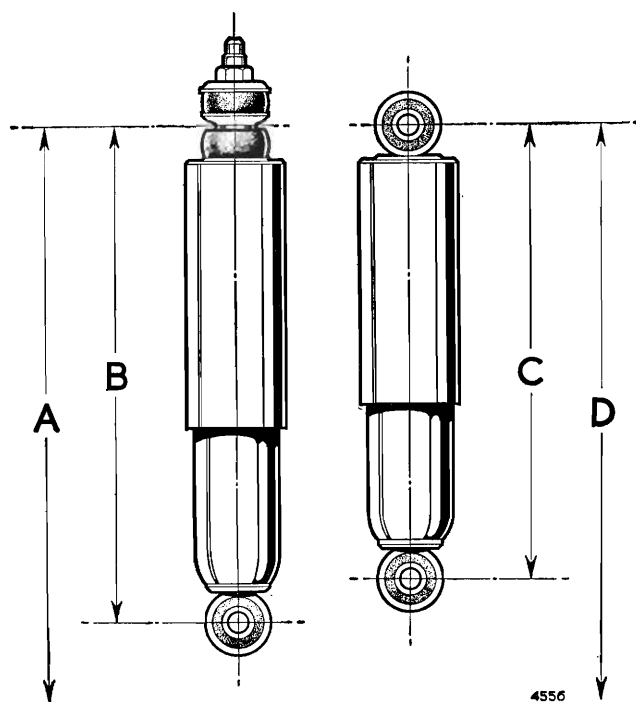


Fig. L.1

The hydraulic dampers

Rear

- A. Extended length $15\frac{3}{16}$ in. (385.76 mm.).
 Van only $16\frac{1}{8}$ in. (409.6 mm.).
 B. Compressed length $9\frac{3}{16}$ in. (242.89 mm.).
 Van only 10 in. (254 mm.).

Front

- C. Compressed length $8\frac{1}{4}$ in. (215.90 mm.).
 D. Extended length $12\frac{3}{4}$ in. (323.85 mm.).

- (9) Retain the damper in an upright position after removal from the car.
- (10) Make certain that the rubber bushes are in good condition; fit new bushes if they are worn or damaged.
- (11) Before refitting a damper to the vehicle it must be primed (see Section L.2).
- (12) When refitting the rear dampers make certain that the rubber cone spring and the spring strut are correctly located on their individual spigots whilst the radius arm is being raised to reconnect the upper end of the damper.

Left-hand damper (rear)

Access to the damper upper fixing nuts can only be obtained after the fuel tank has either been completely removed, or (as on most cars) it is only necessary to release the tank from its mounting position. On cars produced having a fuel tank with a rigid tube the tank must be drained and removed (see Section D.1).

To release the fuel tank

- (13) Remove the fuel filler cap and release the tank securing strap.
- (14) Pivot the tank around the tank front hose connection, taking care not to damage the hose, and lift the rear of the tank towards the centre-line of the car until access to the damper is obtained.
- (15) Remove and refit a damper as operation sequence (7) to (12) for right-hand damper.

Section L.1**REMOVAL AND REFITTING****Front**

- (1) Jack up and remove the road wheel.
- (2) Support the suspension under the brake-drum.
- (3) Remove the upper and lower securing nuts and pull the damper from the mounting spigots.
- (4) Hold the damper upright in a vice and compress and extend it six times to expel air. Retain the damper upright until refitted.
- (5) Fit new rubber bushes as required.
- (6) Refit.

Right-hand damper (rear)

- (7) Remove the upper damper mounting nuts from inside the luggage boot.
- (8) Jack up the vehicle and remove the road wheel. Take off the lower mounting nut and washer, collapse the damper, and remove it from its anchorage point on the radius arm.

Section L.2**PRIMING**

If air is suspected in a hydraulic damper, remove the damper from the vehicle and stand it in a vertical position for approximately five hours, then prime as follows.

Armstrong

Hold the damper vertically, extend to its full travel and then compress slowly. Continue to extend and compress until there is no free travel when changing direction of stroke.

Girling

Hold the damper, with the dust shield uppermost, at an angle of 15° to 20° to the vertical. Extend the damper about 76 mm. very slowly and then compress fully. Rotate the dust shield at the same time. Repeat until all free play has disappeared. Do not fully extend the damper during this process.

New dampers need only be held in their vertical position for a few minutes before priming. After priming, always store dampers in a vertical position.

Section L.3**REAR DAMPERS****(Moke)****Removing**

- (1) Jack up and remove the road wheel.
- (2) Remove the cover from the upper mounting point inside the vehicle.
- (3) Remove the nuts from the upper and lower mounting points, collapse the damper, and pull it from its anchorage on the radius arm.

SECTION M

THE BRAKING SYSTEM

	<i>Section</i>
Adjustment	M.2
Bleeding	M.8
Disc brake calliper	M.7
Intensifier	M.6
Master cylinder	M.1
Pressure regulating valve	M.5
Shoe assemblies (and disc friction pads)	M.3
Vacuum servo (Cooper 'S')	M.9
Wheel cylinders	M.4
Two-leading-shoe front brakes	M.10
Preventive maintenance	M.11

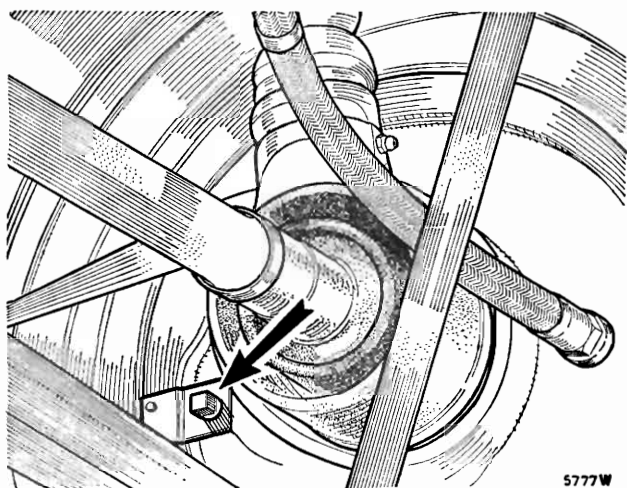


Fig. M.1

The front brake-shoe adjuster. One square-headed adjuster is provided on each of the four brake back-plates

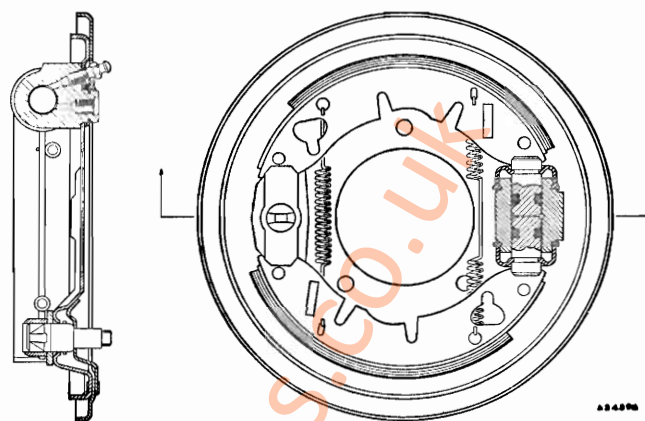


Fig. M.2

The right-hand front brake assembly, showing the fitted positions of the leading and trailing brake-shoes, with the pull-off springs anchored in the correct holes in the shoe web

Section M.1

MASTER CYLINDER

See Section E.4, but note the non-return valve fitted in this cylinder.

Section M.2

ADJUSTMENT

Early models have one square-headed adjuster screw projecting from each brake backplate. For adjustment on cars having two-leading-shoe brakes see Section M.10.

Jack up the car and turn the adjuster in a clockwise direction until the wheel is locked and then slacken the screw until the shoes are just free of the drum.

COOPER

Front disc brakes are not adjustable.

The rear brakes are adjusted as above.

Hand brake

ALL MODELS

- (1) Adjust the brake-shoes as detailed above.
- (2) Apply the hand brake to the third notch on the ratchet.
- (3) Take up excessive cable movement, turning the nuts at the lever trunnion until the wheels can only just be turned by heavy hand pressure.
- (4) Ensure that the wheels rotate freely when the hand brake is released.

Section M.3

SHOE ASSEMBLIES

Removing (front)

- (1) Jack up and remove the road wheel.
- (2) Unscrew the two retaining screws and pull off the drum.
- (3) Note the position of each spring; release them from the shoe webs and remove the springs and shoes.

NOTE.—Do not press the pedal when the shoes and springs have been removed.

Removing (rear)

As for the front shoes.

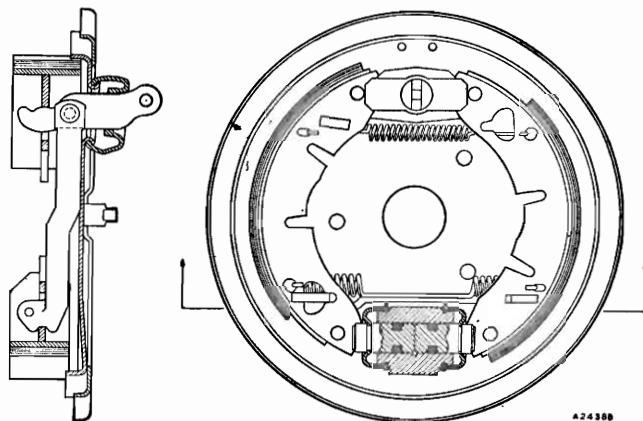


Fig. M.3

The right-hand rear brake assembly, showing the pull-off springs anchored in the correct holes in the shoe web

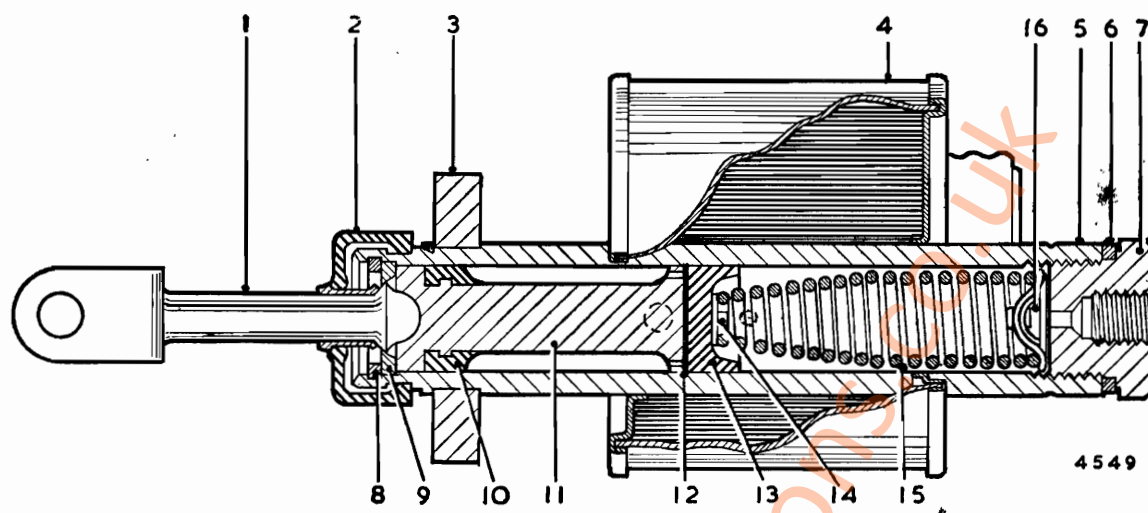


Fig. M.4

A section through the brake master cylinder

- | | | |
|---------------------|--------------------|-----------------------|
| 1. Push-rod. | 7. End plug. | 12. Piston washer. |
| 2. Rubber boot. | 8. Circlip. | 13. Main cup. |
| 3. Mounting flange. | 9. Stop washer. | 14. Spring retainer. |
| 4. Supply tank. | 10. Secondary cup. | 15. Return spring. |
| 5. Body. | 11. Piston. | 16. Non-return valve. |
| 6. Washer. | | |

Refitting (front and rear)

Reverse the removing instructions.

(9) Refit the spring, press it down and insert the split pins.

(10) Press the pedal several times to adjust the brakes.

COOPER

Removing disc brake friction pads

- (1) Jack up, remove the wheel.
- (2) Depress the pad retaining spring and withdraw the split pins (Fig. M.6).
- (3) Remove the spring and withdraw the pads from the calliper.
- (4) Thoroughly clean the exposed face of each piston and the recesses in the calliper.

On later cars the pads are retained in the callipers by means of split pins only. The pins pass through the calliper body and the pads, and no pad retaining springs are fitted. To remove the pads, it is only necessary to remove the split pins and extract the pads with a direct pull. Pads for the earlier- and later-type callipers are NOT INTERCHANGEABLE.

Refitting

- (5) Press the pistons back into the calliper with Service tool 18G 672.
- (6) Check that the cut-away edge of each piston is facing upwards and that anti-squeak shims are correctly placed.
- (7) Insert the new pads and check that they move easily in the calliper.
- (8) Remove any high spots from the pressure plate by careful filing.

Section M.4

WHEEL CYLINDERS

Removing front and rear

- (1) Carry out instructions (1), (2), and (3) in Section M.3.
- (2) Thoroughly clean the backplate.
- (3) Disconnect the flexible hose.
- (4) Unscrew and remove the bleed screw.
- (5) Remove the circlip and dished washer from the cylinder boss protruding through the backplate and withdraw the cylinder.

COOPER

Removing (rear only)

As instructions (1) to (5) above.

Dismantling

- (6) Remove the dust seals from the ends of the cylinder and extract both pistons.
- (7) Remove the piston seals with the fingers only.
- (8) Clean all parts with brake fluid.

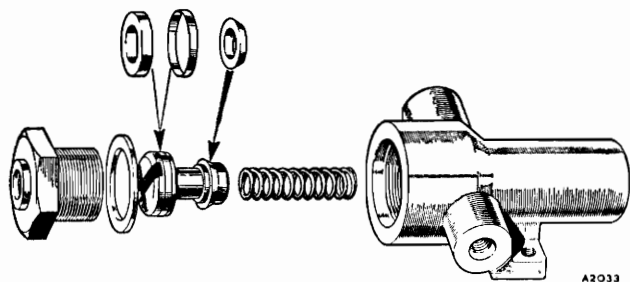


Fig. M.5

The hydraulic pressure regulating valve components

Reassembling

- (9) Fit new parts as required and then reverse the dismantling procedure.

Refitting

Reverse the removal instructions and bleed the system.

Section M.5

PRESSURE REGULATING VALVE

Removing

- (1) Disconnect the three pressure lines, unscrew the securing nut and withdraw the assembly from the rear sub-frame cross-member.

Overhauling

- (2) Clean the exterior.
- (3) Remove the end plug and sealing washer.
- (4) Extract the valve assembly and return spring.
- (5) If the rubber seals are not in good condition, fit a new piston and seal assembly.
- (6) Clean all parts with brake fluid, reassemble and refit.

Section M.6

INTENSIFIER

COOPER (Early models)

The brake intensifier is only fitted on early models. Later models have a pressure regulating valve incorporated in the system (see Section M.5).

Removing

- (1) Slacken the top pipe union, remove the nuts and washers and take out the mounting bolts.
- (2) Completely unscrew the top union and withdraw the pipe and union.

M.4

- (3) Unscrew the bottom pipe union and withdraw the pipe and union.

- (4) Remove the intensifier.

Dismantling

- (5) Hold the intensifier in a vice and unscrew the large hexagon plug.

NOTE.—The plug is under spring pressure.

- (6) Extract the piston assembly and springs.

- (7) Thoroughly clean all parts with brake fluid and examine for wear.

Reassembling

- (8) Renew all worn or damaged parts. If the rubber seals have deteriorated, renew the piston assembly.

Refitting

Reverse the removing instructions.
Bleed the system.

Section M.7

DISC BRAKE CALLIPER

COOPER

Removing and dismantling

Do not separate the two halves of the calliper; each piston assembly must be dealt with individually.

- (1) Disconnect the tie-rod from the steering-arm.
- (2) Remove the locking plate from the dust cover.

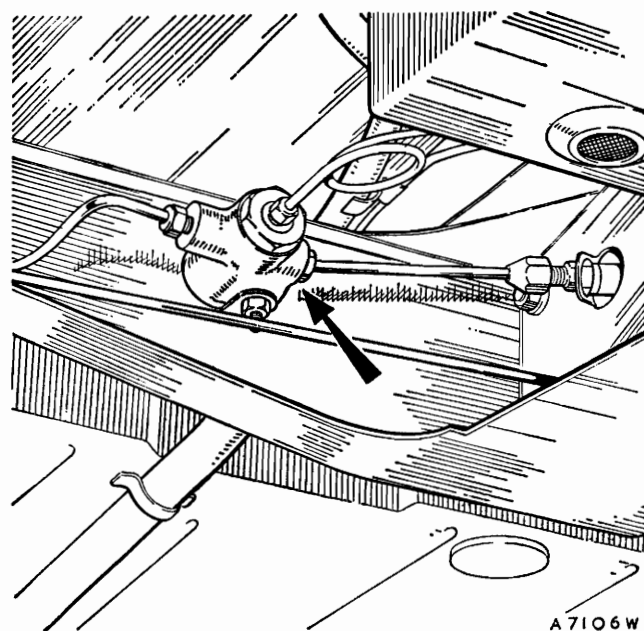


Fig. M.6

The hydraulic pressure regulating valve

- (3) Unscrew the two bolts securing the calliper to the hub, detach both parts of the dust cover and remove the calliper without disconnecting the brake pipe.
- (4) Withdraw the pads.
- (5) Clean the outside of the calliper.
- (6) Clamp the piston in the mounting half of the calliper.
- (7) Apply the brake pedal gently to force the other piston from the calliper.
- (8) Withdraw the fluid seal and the dust seal.

Reassembling

- (9) Coat a new fluid seal with Lockheed Disc Brake Lubricant and then ease it into its groove.
- (10) Slacken the bleeder screw one complete turn.
- (11) Coat the piston with Lockheed Disc Brake Lubricant, insert it into the bore with the cut-away face facing upwards and press it in with Service tool 18G 672 until about $\frac{5}{16}$ in. (8 mm.) remains protruding.
- (12) Coat a new, dry dust seal with Lockheed Disc Brake Lubricant, fit it to the retainer and position the seal and retainer on the protruding part of the piston with the seal innermost.
- (13) Press home the piston and seal.
- (14) Retighten the bleeder screw.
- (15) Clamp the piston in the rim half of the calliper and then repeat instructions (7) to (12).
- (16) Disconnect the hose and then repeat (13) and (14).
- (17) Reconnect the hose and refit the calliper and the two parts of the dust cover to the hub.

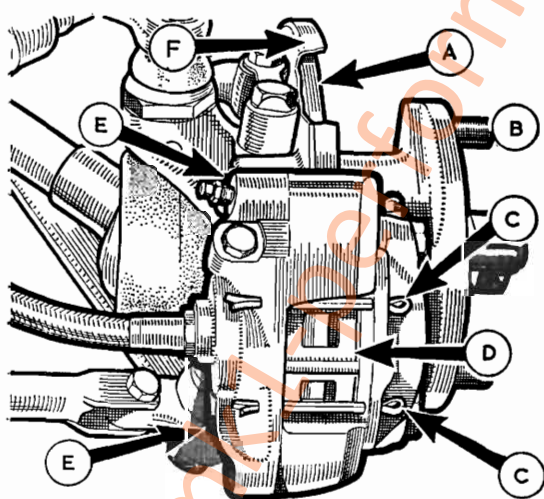


Fig. M.7

The disc brake assembly

- | | |
|----------------|-----------------------------|
| A. Brake disc. | D. Pad retaining spring. |
| C. Split pins. | E. Calliper mounting bolts. |
| F. Dust cover. | |

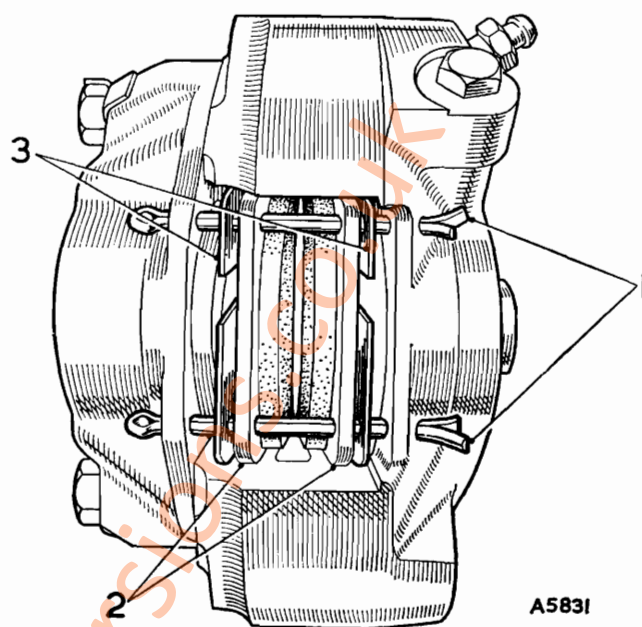


Fig. M.8

The modified calliper assembly

- | | |
|------------------------------|----------------|
| 1. Pad-retaining split pins. | 2. Brake pads. |
| 3. Anti-squeak shims. | |

- (18) Refit the dust cover locking plate.
- (19) Reconnect the tie-rod.
- (20) Tighten the calliper mounting bolts.
- (21) Fit the pads.
- (22) Bleed the brakes.
- (23) Apply the brakes several times to adjust.

Section M.8

BLEEDING

- (1) Adjust the brakes.
- (2) Slacken the bleeder screw on the intensifier (COOPER, when fitted) and pump the pedal until fluid comes out free from air.
- (3) Tighten the bleeder screw and top up the master cylinder.
- (4) Bleed the wheel cylinders. (Remove the front wheels—early COOPER).

Section M.9

VACUUM SERVO (Cooper 'S')

Removing

- (1) Disconnect the heater hose from the grille, release the clip retaining the hose to the slave cylinder and secure the hose out of the way.
- (2) Disconnect the hydraulic pipes from the slave cylinder, and plug the open ends of the pipes.

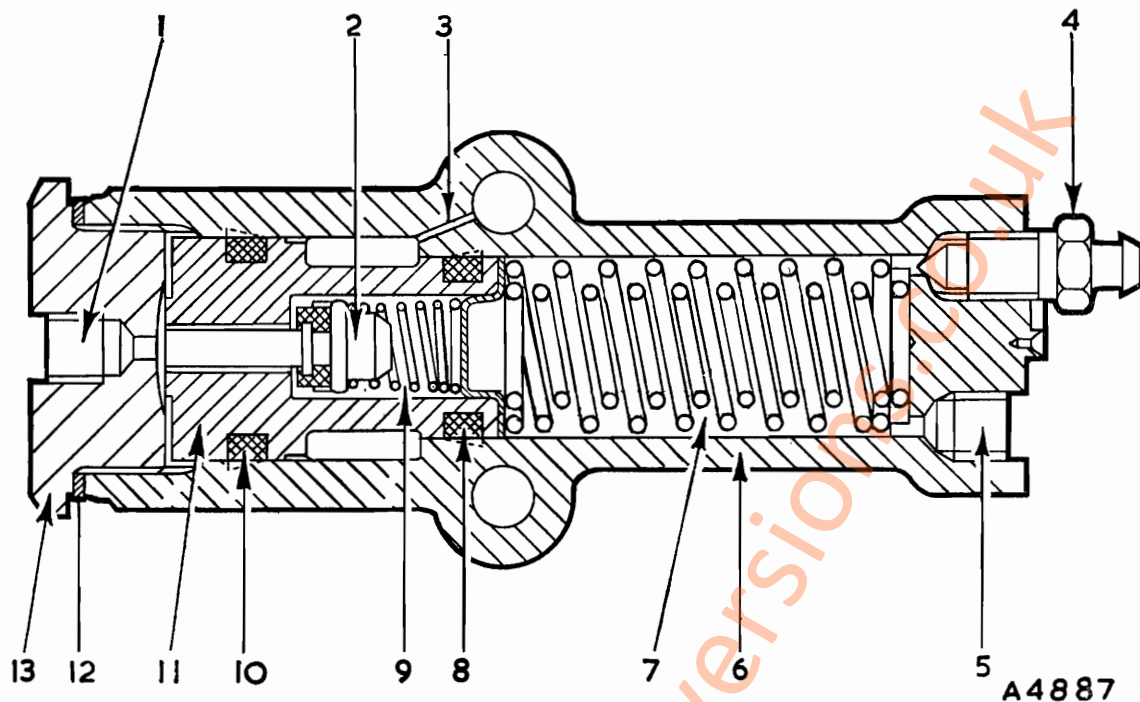


Fig. M.9

The brake cylinder intensifier

- | | | | |
|------------------------|-------------------------------|--------------------------|-----------------------|
| 1. Fluid inlet. | 5. Fluid outlet. | 8. Piston seal (small). | 11. Piston. |
| 2. Valve. | 6. Intensifier cylinder body. | 9. Valve return spring. | 12. Copper gasket. |
| 3. Air relief passage. | 7. Piston return springs. | 10. Piston seal (large). | 13. Hexagon end plug. |
| 4. Bleed screw. | | | |

- (3) Release the rubber vacuum pipe from the slave cylinder.
- (4) Remove the two retaining nuts and spring washers from the rear mounting bracket, release the servo unit from the front mounting bracket, and lift the unit from the vehicle.
- (5) Refitting is a reversal of removing. Bleed the brakes as described in Section M.8.

Dismantling

- (6) Remove the five screws and detach the air valve cover, disengaging the pipe from the rubber elbow. Pull the elbow off the pipe in the end cover, and lift out the control valve diaphragm.
- (7) Remove the four screws and lift off the valve housing and gasket. Expel the valve piston by closing the end connection with the thumb and applying a low air pressure at the smaller connection on the side of the cylinder. Ease the rubber cup off the piston.
- (8) Remove the bolts from the clamping ring, remove the end cover and diaphragm assembly, and disengage the return spring from the locking plates. Hold the push-rod by its hexagon centre-piece, ease off the rubber buffer and unscrew the nut to dismantle the diaphragm assembly.
- (9) Bend back the locking tabs, remove the four securing bolts, and detach the vacuum shell from

the slave cylinder. Extract the guide piece, push-rod cup, cup spreader and spring from the cylinder. Depress the piston with a suitable brass rod and extract the circlip. Gradually release the spring pressure on the piston, and remove the remaining components from the slave cylinder bore.

- (10) Unscrew the non-return valve from the side of the slave cylinder.

Cleaning

- (11) Wash all parts in industrial methylated spirit (not the air valve cover). Blow compressed air at a low pressure past the air valve and into the filter chamber. Dry all components thoroughly.

Reassembling

Reassembly is a reversal of the dismantling procedure, noting the following points.

- (12) Renew all metal parts showing signs of damage or wear.
- (13) New rubber seals, cups, and diaphragm should be used throughout.
- (14) Make an assembly sleeve to the following dimensions: length: 1.61 to 1.62 in. (40.89 to 41.15 mm.); outer diameter: .746 to .748 in. (18.95 to 19.00 mm.); inner diameter: .625 to .627 in. (15.87 to 15.92 mm.). Insert this sleeve in the end of the slave cylinder bore to refit the cap and piston.

- (15) Take extreme care not to damage the surface finish of the push-rod when reassembling the diaphragm. Lock the securing nut by punching the threads in two opposed places.
- (16) Do not tighten the end cover clamp bolt fully until the air valve cover has been fitted and the pipe in the end cover is lined up with the pipe and rubber elbow on the air valve cover.
- (17) Check that the diaphragm spring has its smaller end engaged under the locking plate tabs.

Section M.10

TWO-LEADING-SHOE FRONT BRAKES

Each front brake has two squared adjusters projecting from the rear face of the backplate, one adjuster for each brake-shoe.

Adjusting

- (1) Jack up the car and deal with one adjuster at a time.
- (2) Turn the adjuster in the same direction as the forward rotation of the front wheel until the drum is locked, then back off the adjuster the minimum amount necessary to allow the drum to rotate freely.
- (3) Spin the wheel and apply the foot brake firmly to centralize the shoe.
- (4) Re-check the adjustment, and repeat the complete operation with the other adjuster.
- (5) Carry out the same sequence on the other front wheel.

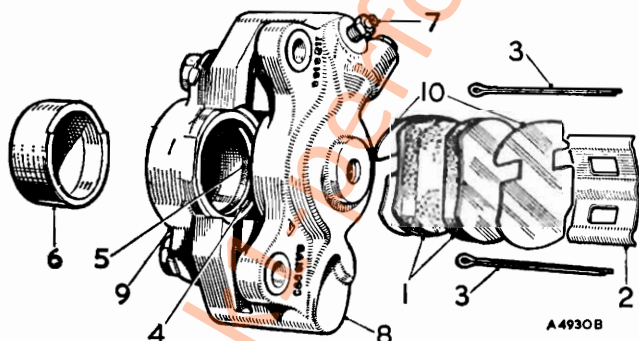


Fig. M.10

The calliper components

- | | |
|--------------------------|-------------------------------------|
| 1. Friction pads. | 6. Piston, showing cut-away at top. |
| 2. Pad retaining spring. | 7. Bleeder screw. |
| 3. Retaining split pins. | 8. Mounting half calliper. |
| 4. Piston dust seal. | 9. Rim half calliper. |
| 5. Piston fluid seal. | 10. Anti-squeak shim. |

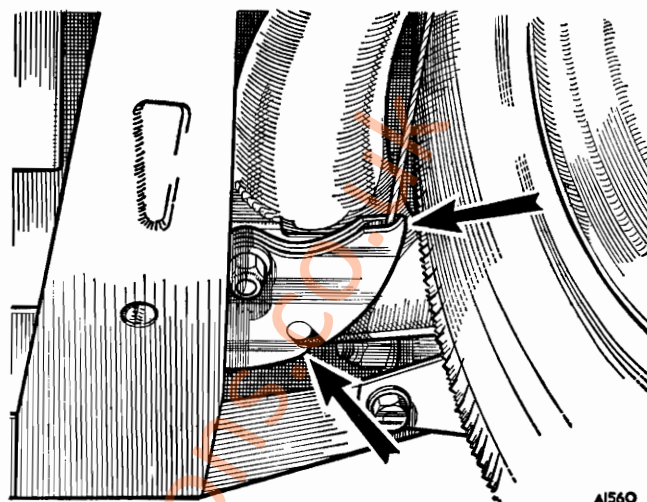


Fig. M.11

The hand brake cable sector mounted on the rear radius arms. Only the corners indicated must be 'nipped' to position the cable

Dismantling

- (6) Jack up the car and remove the front road wheel.
- (7) Back off both adjusters completely, extract the two retaining screws, and remove the brake-drum.
- (8) The tips of the brake-shoes are retained on the wheel cylinder pistons by spring-loaded hooks, one to each shoe. Withdraw the hooks from their registers in the pistons and turn them to one side.

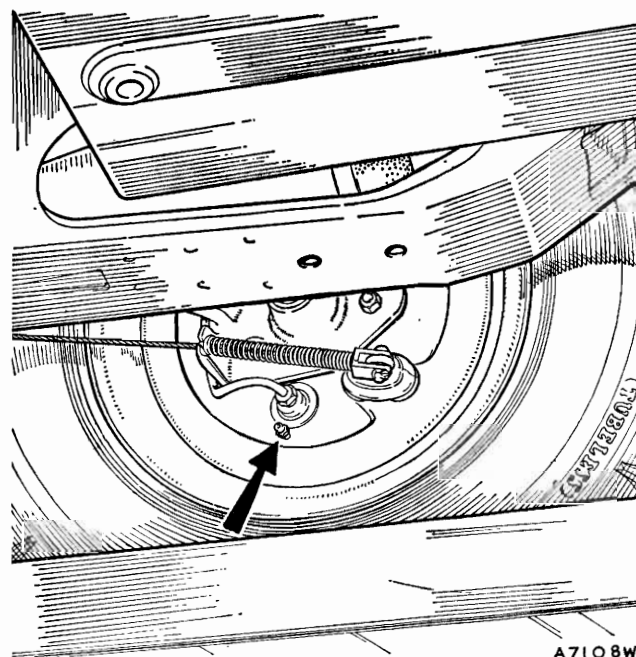


Fig. M.12

A rear wheel cylinder bleeder screw. One bleeder screw is provided on each of the four brake back-plates

- (9) Mark the position of the shoe return springs in the shoes, and note which end of the shoe is fitted to the wheel cylinder.
- (10) Lift out one shoe from the recesses in the wheel cylinder, and pivot against the pressure of the return spring. Manoeuvre the assembly of the shoes and springs over the front hub.
- (11) Wire the pistons to the wheel cylinder castings to prevent them from being accidentally pushed out.

Reassembly

- (12) Reassembly is a reversal of the dismantling procedure.
- (13) Ensure that the shoes are replaced the correct way round and the return springs are fitted in their correct positions.
- (14) The shoes must register correctly in the grooves in the pistons and pivot points.

Wheel cylinder removal

- (15) Remove the brake-shoes as described under 'Dismantling'.
- (16) Disconnect the flexible brake hose from the front wheel cylinder. Unscrew the two union nuts and detach the pipe bridging the two wheel cylinders.
- (17) Remove the two hexagon screws retaining each wheel cylinder to the backplate and detach the wheel cylinders.
- (18) Note, on replacement, that the piston of the wheel cylinder faces in the same direction as the forward rotation of the brake-drum and that the bleed screw is fitted to the rearmost wheel cylinder.

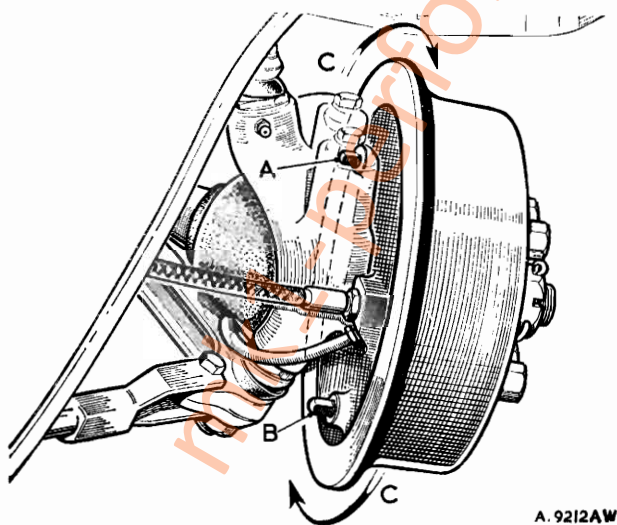


Fig. M.13

The adjusters for the two-leading-shoe front brakes

M.8

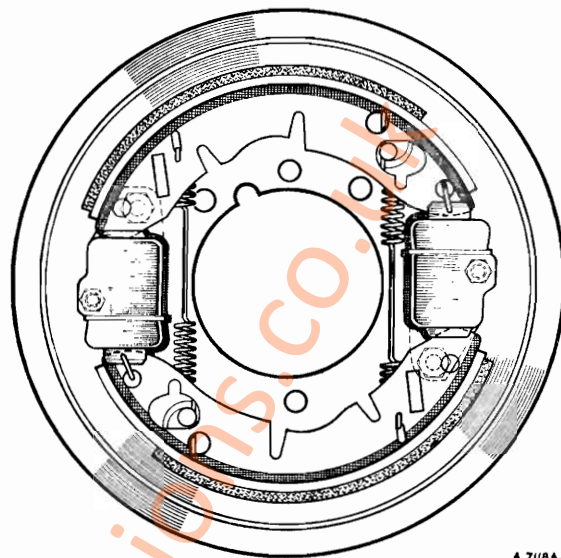


Fig. M.14

The left-hand front brake assembly, showing the fitted position of the shoes and pull-off springs

Section M.11

PREVENTIVE MAINTENANCE

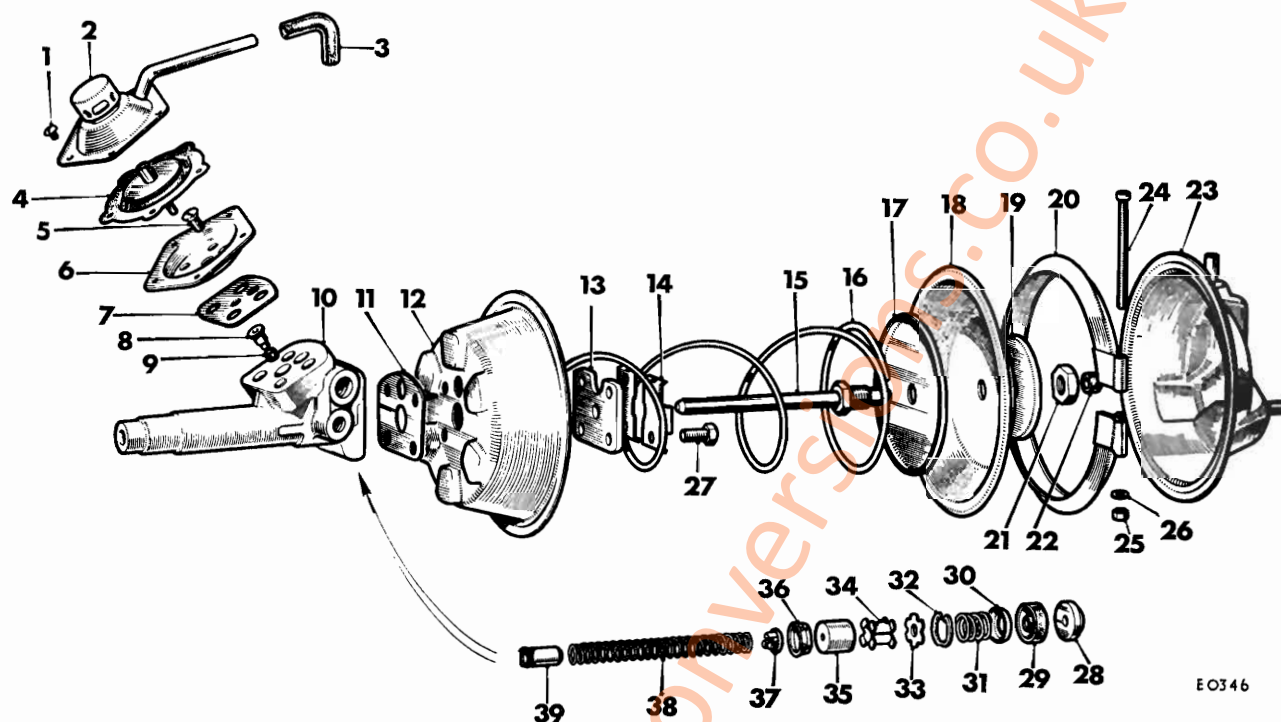
To safeguard against the possible effects of wear, or deterioration, it is recommended that:

- (1) Disc brake pads, drum brake linings, hoses, and pipes should be examined at intervals no greater than those laid down in the Passport to Service.
- (2) Brake fluid should be changed completely every 18 months or 24,000 miles (40000 km.) whichever is the sooner.
- (3) All fluid seals in the hydraulic system and all flexible hoses should be examined and renewed if necessary every 3 years or 40,000 miles (65000 km.) whichever is the sooner. At the same time the working surface of the pistons and of the bores of the master cylinder, wheel cylinders, and other slave cylinders should be examined and new parts fitted where necessary.

Care must be taken always to observe the following points:

- (a) At all times use the recommended brake fluid.
- (b) Never leave fluid in unsealed containers. It absorbs moisture quickly and this can be dangerous.
- (c) Fluid drained from the system or used for bleeding is best discarded.
- (d) The necessity for absolute cleanliness throughout cannot be over-emphasized.

THE VACUUM SERVO COMPONENTS



EO346

No.	Description	No.	Description
1.	Screw for air valve cover.	21.	Nut for diaphragm assembly.
2.	Air valve cover.	22.	Rubber buffer.
3.	Rubber elbow.	23.	End cover.
4.	Control valve diaphragm.	24.	Clamping bolt.
5.	Screw for valve housing.	25.	Nut for clamping bolt.
6.	Valve housing.	26.	Washer for nut.
7.	Housing gasket.	27.	Screw—vacuum shell to slave cylinder.
8.	Valve piston.	28.	Guide piece.
9.	Rubber cup for piston.	29.	Push-rod cup.
10.	Slave cylinder body.	30.	Cup spreader.
11.	Gasket—slave cylinder to vacuum shell.	31.	Spring.
12.	Vacuum shell.	32.	Circlip.
13.	Abutment plate.	33.	Washer.
14.	Locking plates.	34.	Distance piece.
15.	Push-rod.	35.	Piston.
16.	Return spring.	36.	Cup.
17.	Plate (large) for diaphragm.	37.	Spring guide.
18.	Diaphragm.	38.	Spring.
19.	Plate (small) for diaphragm.	39.	Spring retainer.
20.	Clamping ring.		

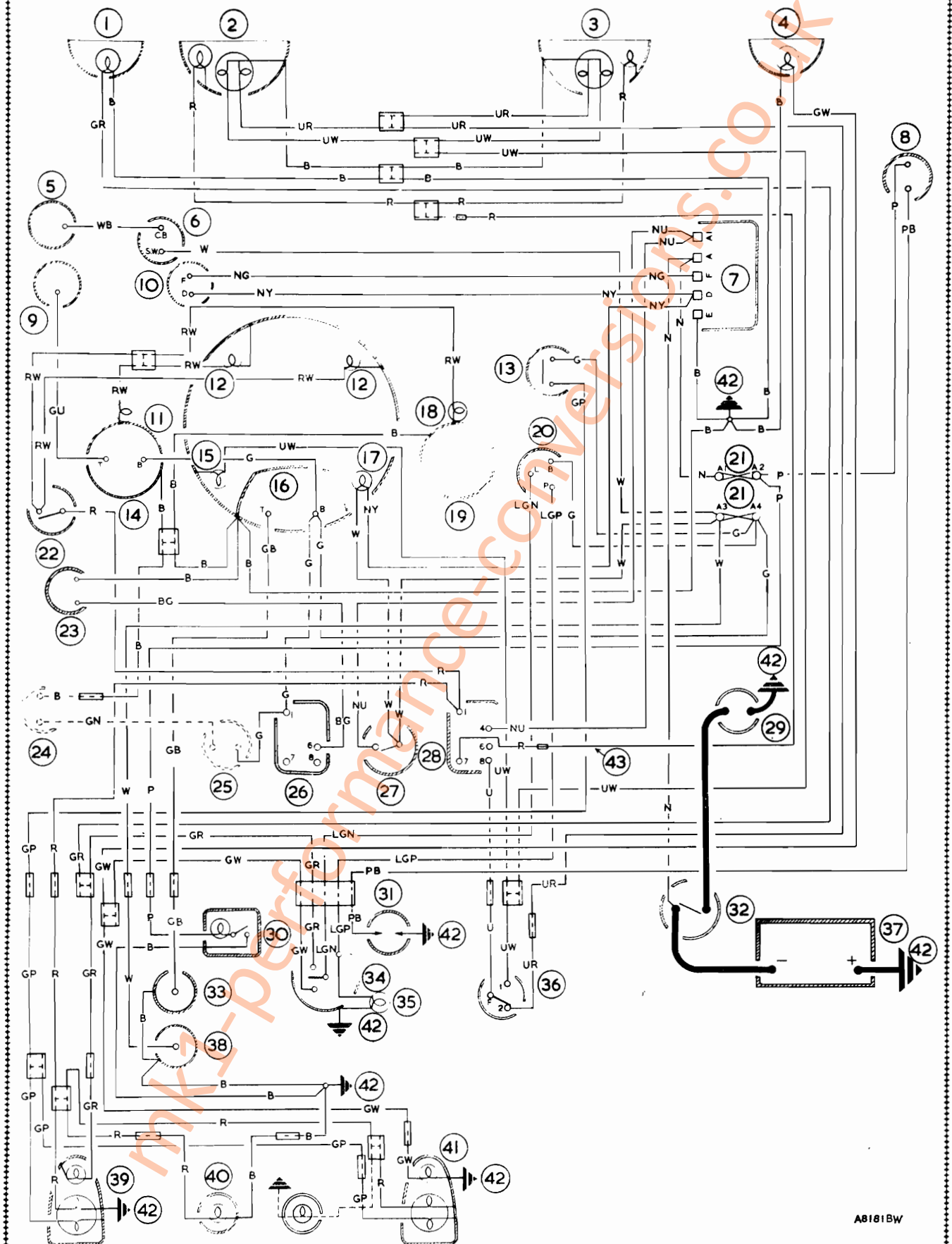
SECTION N

THE ELECTRICAL SYSTEM

	<i>Section</i>
Alternator (11AC)	
Control unit (4TR)	N.13
Dismantling and overhauling	N.12
Relay	N.14
Service precautions	N.10
Testing the charging circuit in position	N.11
Warning light control	N.15
Battery	N.1
Bi-metal resistance instrumentation	N.7
Cut-out	N.5
Dynamo	N.2
Lamps	N.6
Starter	N.3
Voltage regulator	N.4
Windscreen wiper motor (Moke)	N.8
Windscreen wiper wheelboxes	N.9
Wiring diagrams	... Beginning of Section

WIRING DIAGRAM

Super, Super De-luxe, Countryman, Traveller and Cooper (up to 1964)



A8181BW

KEY TO WIRING DIAGRAM

<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	L.H. flasher lamp.	23.	Wiper motor.
2.	L.H. headlamp and pilot lamp.	24.	Heater motor.
3.	R.H. headlamp and pilot lamp.	25.	Heater switch.
4.	R.H. flasher lamp.	26.	Wiper switch.
5.	Distributor.	27.	Ignition and starter switch.
6.	Ignition coil.	28.	Lighting switch.
7.	Voltage regulator and cut-out.	29.	Starter motor.
8.	Horn.	30.	Interior lamp.
9.	Thermo element.	31.	Horn-push.
10.	Dynamo.	32.	Starter solenoid.
11.	Thermo gauge illumination light.	33.	Tank unit.
12.	Panel illumination lights.	34.	Direction indicator switch.
13.	Stop lamp switch.	35.	Direction indicator warning light.
14.	Thermo gauge.	36.	Dipper switch.
15.	Main-beam warning light.	37.	12-volt battery.
16.	Fuel gauge.	38.	Fuel pump.
17.	Ignition warning light.	39.	L.H. stop, tail, and flasher lamp.
18.	Oil gauge illumination light.	40.	Number-plate illumination lamp.
19.	Oil gauge.	41.	R.H. stop, tail, and flasher lamp.
20.	Flasher unit.	42.	Earth connection.
21.	35-amp. fuses.	43.	Connect to terminal 6 for North America.
22.	Panel lights switch.		

NOTE.—On Export models the pilot lamps are combined with the flasher lamps.

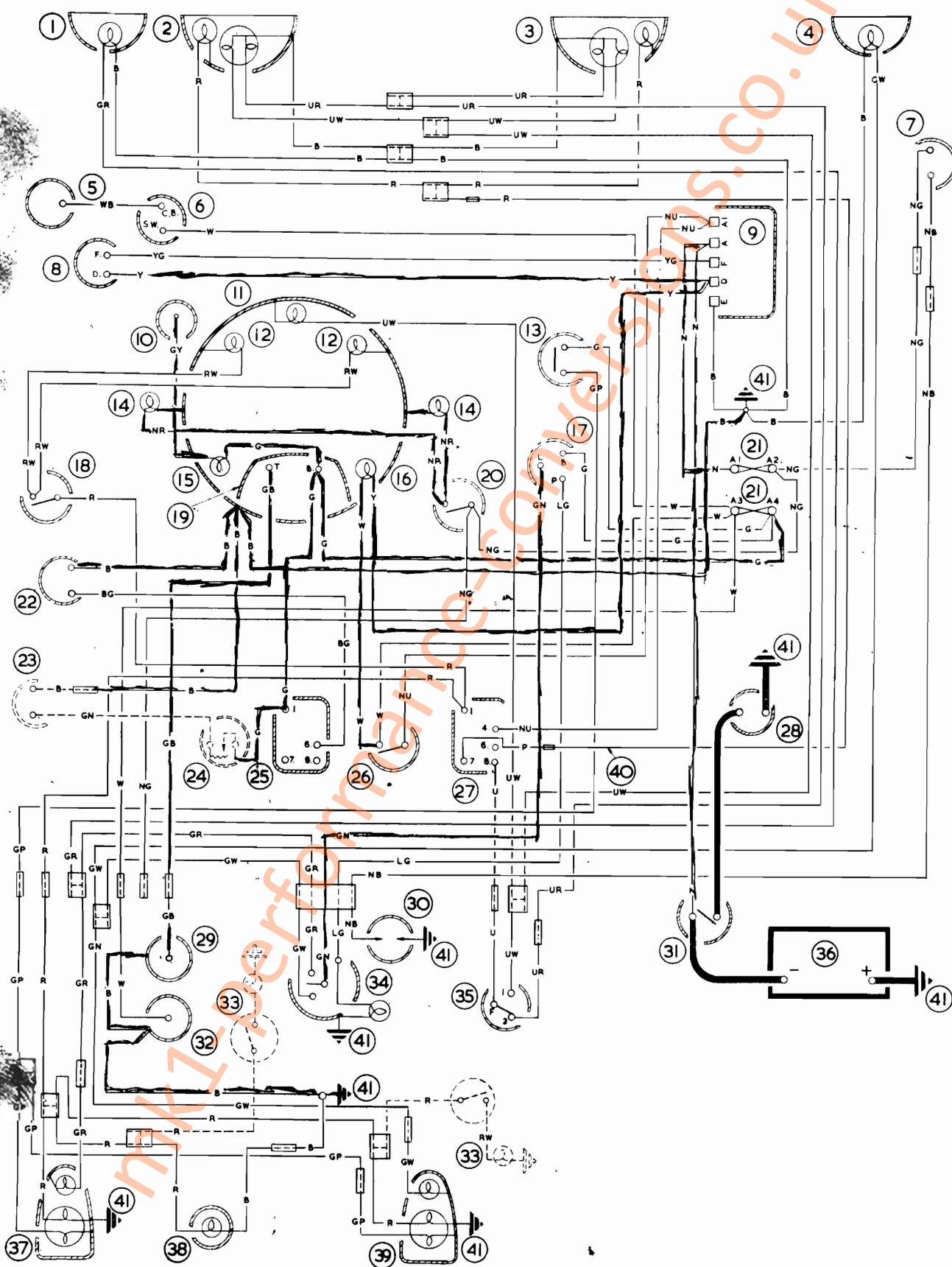
CABLE COLOUR CODE

B. Black.	P. Purple.	Y. Yellow.
U. Blue.	R. Red.	L. Light.
N. Brown.	S. Slate.	M. Medium
G. Green.	W. White.	D. Dark

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM

Standard and De-luxe (up to 1964)



A8307W

KEY TO WIRING DIAGRAM

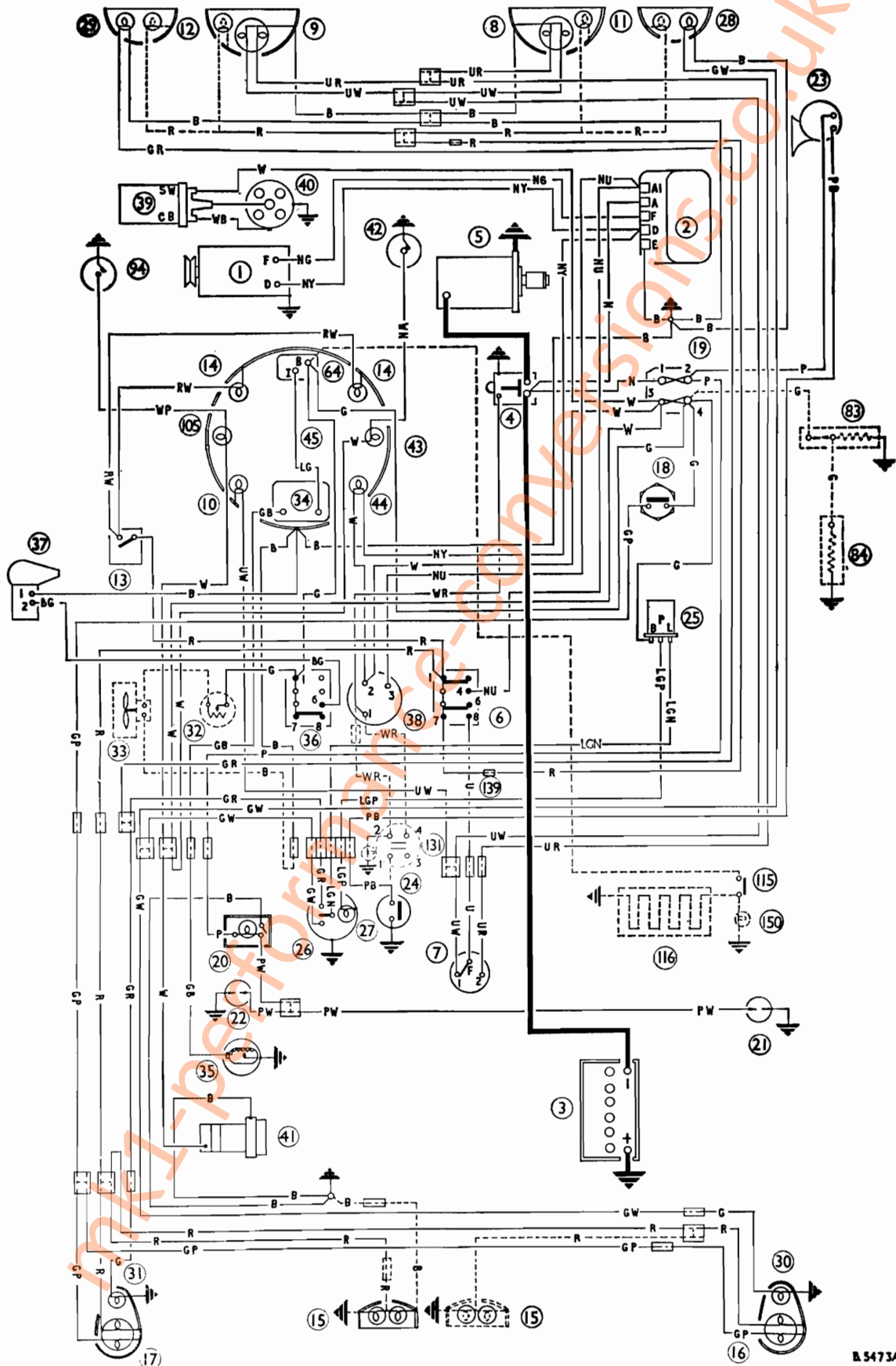
<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	L.H. flasher lamp.	22.	Wiper motor.
2.	L.H. headlamp and pilot lamp.	23.	Heater motor.
3.	R.H. headlamp and pilot lamp.	24.	Heater switch.
4.	R.H. flasher lamp.	25.	Wiper switch.
5.	Distributor.	26.	Ignition switch.
6.	Ignition coil.	27.	Lighting switch.
7.	Horn.	28.	Starter motor.
8.	Dynamo.	29.	Tank unit.
9.	Voltage regulator and cut-out.	30.	Horn-push.
10.	Oil pressure switch.	31.	Starter switch.
11.	Main-beam warning light.	32.	Fuel pump.
12.	Panel illumination light.	33.	Companion box switch and lamp.
13.	Stop light switch.	34.	Direction indicator switch and warning light.
14.	Parcel shelf illumination lamp.	35.	Dipper switch.
15.	Oil pressure warning light.	36.	12-volt battery.
16.	Ignition warning light.	37.	L.H. stop, tail, and flasher lamp.
17.	Flasher unit.	38.	Number-plate illumination lamp.
18.	Panel illumination switch.	39.	R.H. stop, tail, and flasher lamp.
19.	Fuel gauge.	40.	Connect to No. 6 terminal for U.S.A.
20.	Parcel shelf illumination switch.	41.	Earth connection.
21.	35-amp. fuse.		

CABLE COLOUR CODE

B. Black.	P. Purple.	L. Light
U. Blue.	R. Red.	D. Dark
N. Brown.	W. White.	M. Medium
G. Green.	Y. Yellow.	

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM **Saloon, Van, and Pick-up (1964 to 1967)**



B 5473A

KEY TO WIRING DIAGRAM

<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	Dynamo.	29.	L.H. front flasher lamp.
2.	Control box.	30.	R.H. rear flasher lamp.
3.	12-volt battery.	31.	L.H. rear flasher lamp.
4.	Starter solenoid.	32.	Heater switch
5.	Starter motor.	33.	Heater motor
6.	Lighting switch.		} when fitted.
7.	Headlamp dip switch.	34.	Fuel gauge.
8.	R.H. headlamp.	35.	Fuel gauge tank unit.
9.	L.H. headlamp.	36.	Windscreen wiper switch.
10.	Main-beam warning lamp.	37.	Windscreen wiper motor.
11.	R.H. sidelamp (in headlamp or flasher) lamp.	38.	Ignition/starter switch.
12.	L.H. sidelamp (in headlamp or flasher) lamp.	39.	Ignition coil.
13.	Panel lamps switch.	40.	Distributor.
14.	Panel lamps.	41.	Fuel pump.
15.	Number-plate lamp (two for Van).	42.	Oil pressure switch.
16.	R.H. stop and tail lamp.	43.	Oil pressure warning lamp.
17.	L.H. stop and tail lamp.	44.	Ignition warning lamp.
18.	Stop lamp switch.	45.	Speedometer.
19.	Fuse unit: 1-2, 35 amp.; 3-4, 35 amp.	64.	Bi-metal instrument voltage stabilizer.
20.	Interior light.	83.	Induction heater and thermostat (when fitted).
21.	R.H. door switch.	84.	Suction chamber heater (when fitted).
22.	L.H. door switch.	94.	Oil filter switch.
23.	Horn.	105.	Oil filter warning lamp.
24.	Horn-push.	115.	Rear window demister switch (when fitted).
25.	Flasher unit.	116.	Rear window demister unit (when fitted).
26.	Direction indicator switch.	131.	Combined reverse switch/automatic gearbox switch (when fitted).
27.	Direction indicator warning lamp.	139.	Connect to No. 6 for U.S.A. (alternative connection).
28.	R.H. front flasher lamp.	150.	Rear window demister warning light (when fitted).

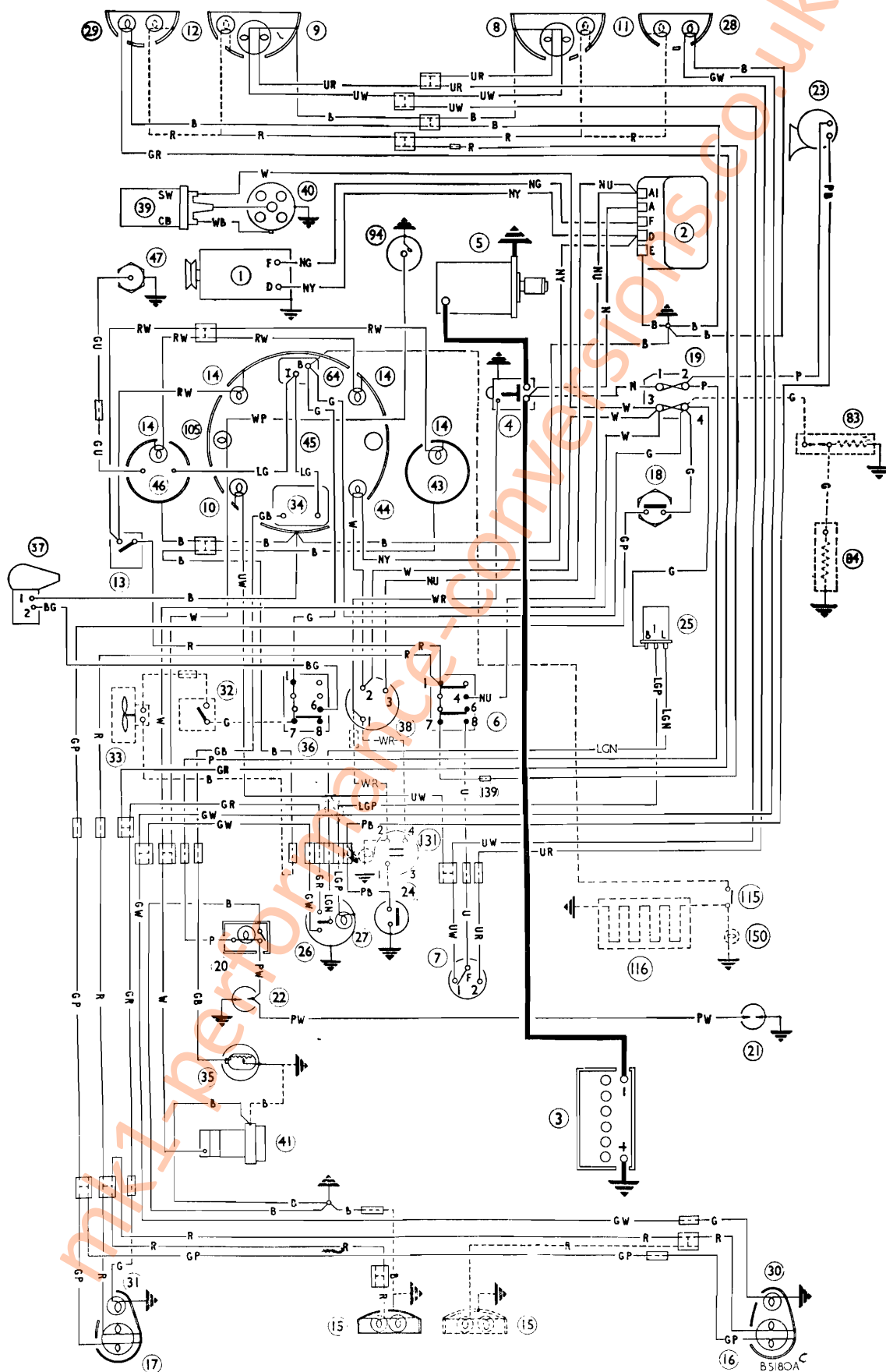
CABLE COLOUR CODE

B. Black.	G. Green.	W. White.
U. Blue.	P. Purple.	Y. Yellow.
N. Brown.	R. Red.	L.G. Light Green

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM

Cooper, Cooper 'S', Countryman, Traveller, and Super De-luxe (1964 to 1967)



KEY TO WIRING DIAGRAM

<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	Dynamo.	30.	R.H. rear flasher lamp.
2.	Control box.	31.	L.H. rear flasher lamp.
3.	12-volt battery.	32.	Heater switch
4.	Starter solenoid.	33.	Heater motor
5.	Starter motor.		} when fitted.
6.	Lighting switch.	34.	Fuel gauge.
7.	Headlamp dip switch.	35.	Fuel gauge tank unit.
8.	R.H. headlamp.	36.	Windscreen wiper switch.
9.	L.H. headlamp.	37.	Windscreen wiper motor.
10.	Main-beam warning lamp.	38.	Ignition/starter switch.
11.	R.H. sidelamp (in headlamp or flasher) lamp.	39.	Ignition coil.
12.	L.H. sidelamp (in headlamp or flasher) lamp.	40.	Distributor.
13.	Panel lamps switch.	41.	Fuel pump.
14.	Panel lamps.	42.	Oil pressure switch.
15.	Number-plate lamp (two for Countryman and Traveller).	43.	Oil pressure warning lamp.
16.	R.H. stop and tail lamp.	44.	Ignition warning lamp.
17.	L.H. stop and tail lamp.	45.	Speedometer.
18.	Stop lamp switch.	46.	Temperature gauge.
19.	Fuse unit: 1-2, 35 amp.; 3-4, 35 amp.	47.	Temperature gauge transmitter.
20.	Interior light.	64.	Bi-metal instrument voltage stabilizer.
21.	R.H. door switch.	83.	Induction heater and thermostat (when fitted).
22.	L.H. door switch.	84.	Suction chamber heater (when fitted).
23.	Horn.	94.	Oil filter switch.
24.	Horn-push.	105.	Oil filter warning lamp.
25.	Flasher unit.	115.	Rear window demister switch (when fitted).
26.	Direction indicator switch.	116.	Rear window demister unit (when fitted).
27.	Direction indicator warning lamp.	131.	Combined reverse switch/automatic gearbox switch (when fitted).
28.	R.H. front flasher lamp.	139.	Connect to No. 6 for U.S.A. (alternative connection).
29.	L.H. front flasher lamp.	150.	Rear window demister warning light (when fitted).

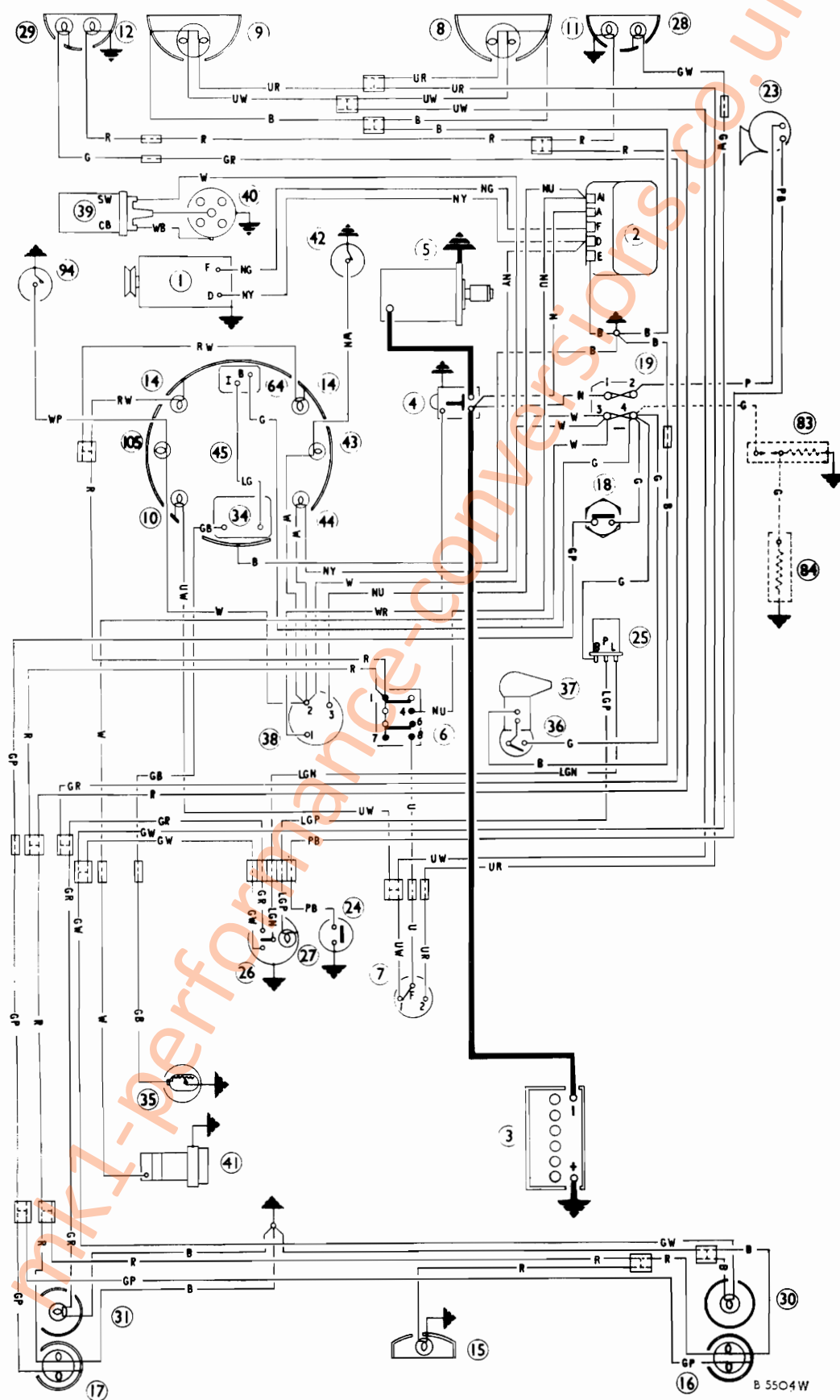
CABLE COLOUR CODE

B. Black.	G. Green.	W. White.
U. Blue.	P. Purple.	Y. Yellow.
N. Brown.	R. Red.	L.G. Light Green.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM

Mini-Moke (up to 1967)



KEY TO WIRING DIAGRAM

<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	Dynamo.	27.	Direction indicator warning lamp.
2.	Control box.	28.	R.H. front flasher lamp.
3.	12-volt battery.	29.	L.H. front flasher lamp.
4.	Starter solenoid.	30.	R.H. rear flasher lamp.
5.	Starter motor.	31.	L.H. rear flasher lamp.
6.	Lighting switch.	34.	Fuel gauge.
7.	Headlamp dip switch.	35.	Fuel gauge tank unit.
8.	R.H. headlamp.	36.	Windscreen wiper switch.
9.	L.H. headlamp.	37.	Windscreen wiper motor.
10.	Main-beam warning lamp.	38.	Ignition starter switch.
11.	R.H. sidelamp.	39.	Ignition coil.
12.	L.H. sidelamp.	40.	Distributor.
14.	Panel lamps.	41.	Fuel pump.
15.	Number-plate illumination lamp.	42.	Oil pressure switch.
16.	R.H. stop and tail lamp.	43.	Oil pressure warning lamp.
17.	L.H. stop and tail lamp.	44.	Ignition warning lamp.
18.	Stop lamp switch.	45.	Speedometer.
19.	Two-way fuse unit: 1-2, 35 amp.; 3-4, 35 amp.	64.	Bi-metal instrument voltage stabilizer.
23.	Horn.	83.	Induction heater and thermostat.
24.	Horn-push.	84.	Suction chamber heater.
25.	Flasher unit.	94.	Oil filter switch.
26.	Direction indicator switch.	105.	Oil filter warning lamp.

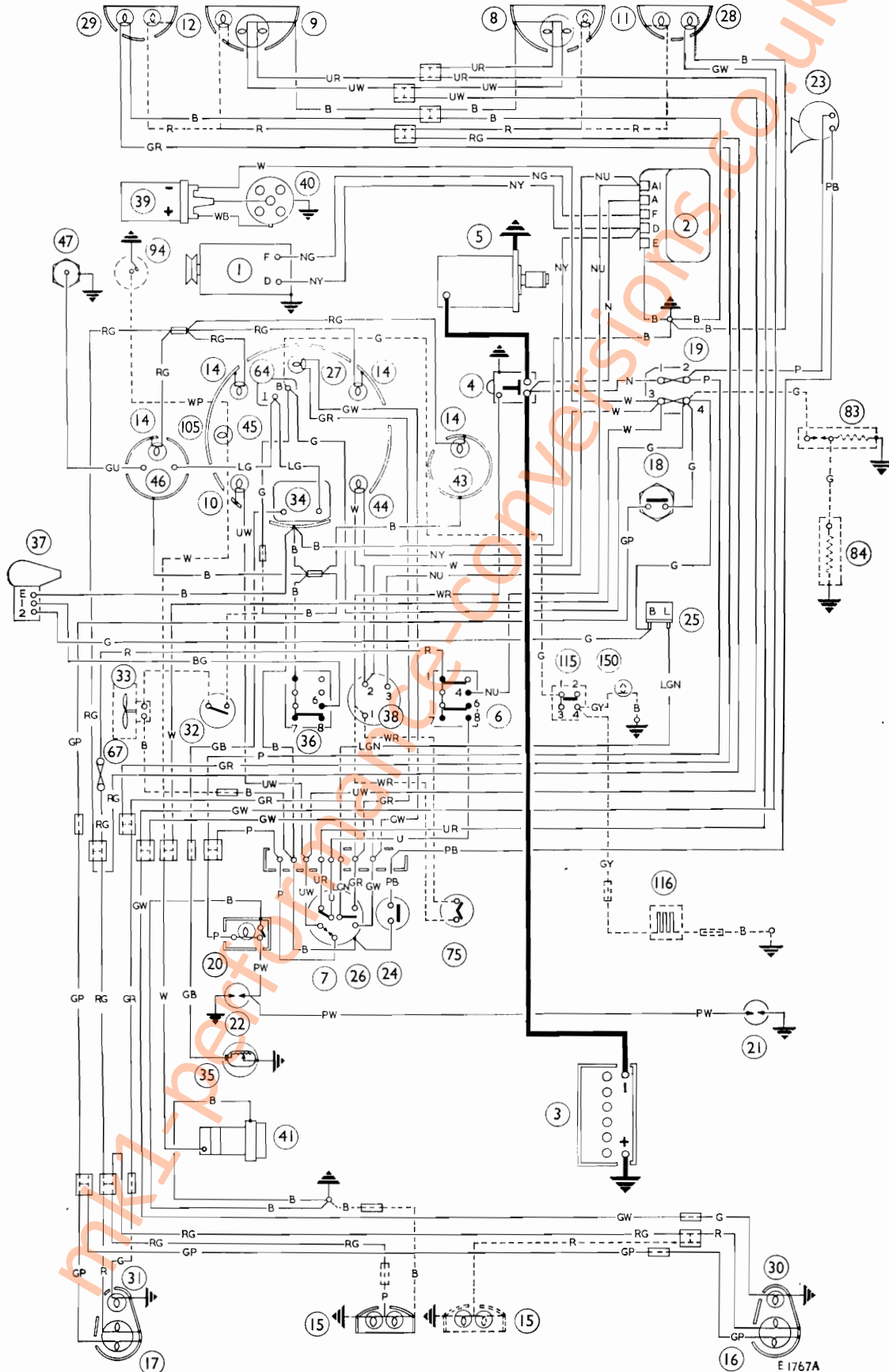
CABLE COLOUR CODE

B. Black.	G. Green.	W. White.
U. Blue.	P. Purple.	Y. Yellow.
N. Brown.	R. Red.	L.G. Light Green.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM

Super De-luxe, Countryman, Traveller, Cooper, and Cooper 'S' Mark II



KEY TO WIRING DIAGRAM

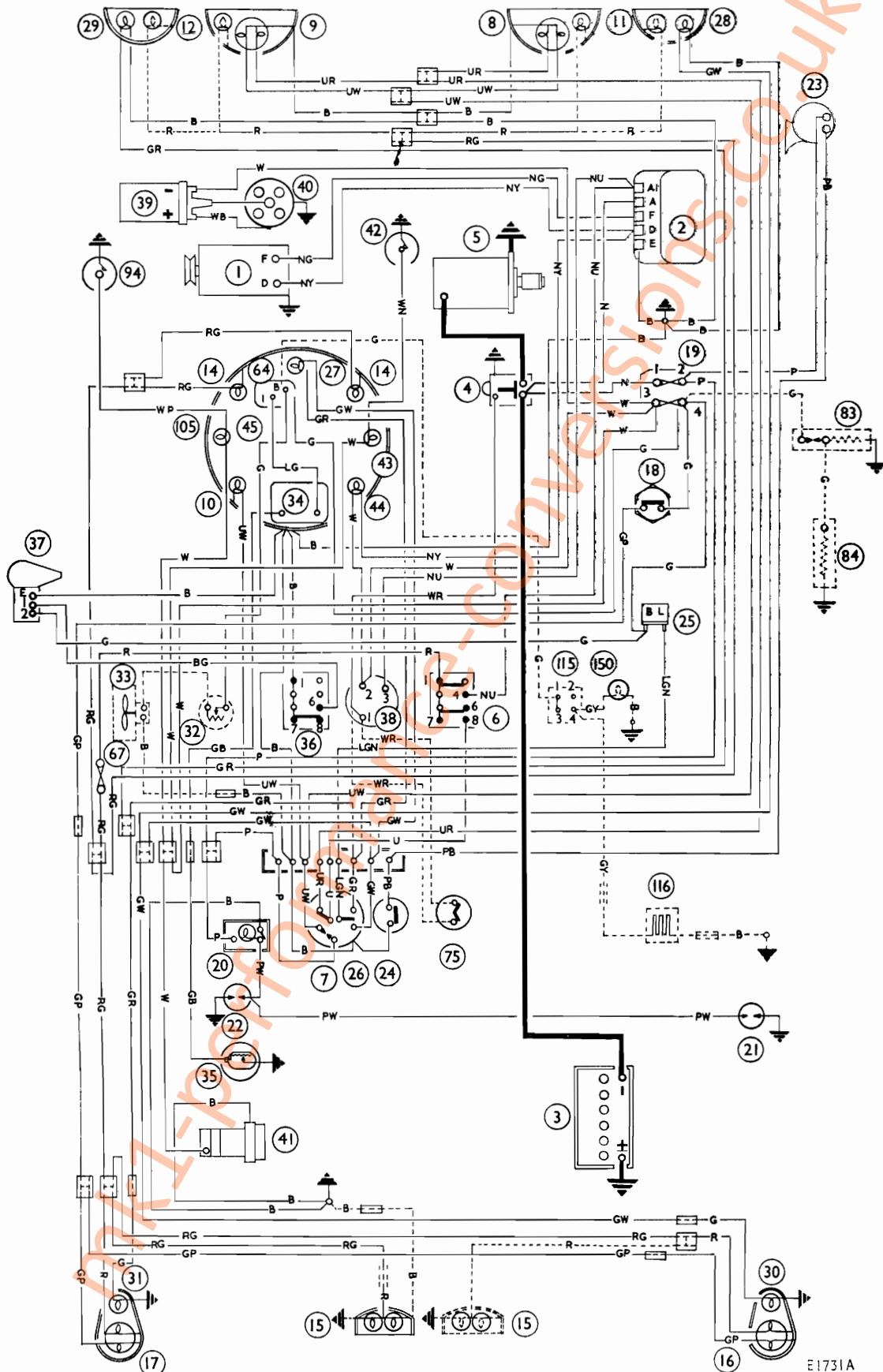
<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	Dynamo.	30.	R.H. rear flasher lamp.
2.	Control box.	31.	L.H. rear flasher lamp.
3.	12-volt battery.	32.	Heater switch
4.	Starter solenoid.	33.	Heater motor
5.	Starter motor.		} when fitted.
6.	Lighting switch.	34.	Fuel gauge.
7.	Headlamp dip switch.	35.	Fuel gauge tank unit.
8.	R.H. headlamp.	36.	Windscreen wiper switch.
9.	L.H. headlamp.	37.	Windscreen wiper motor.
10.	Main-beam warning lamp.	38.	Ignition/starter switch.
11.	R.H. sidelamp (in headlamp or flasher) lamp.	39.	Ignition coil.
12.	L.H. sidelamp (in headlamp or flasher) lamp.	40.	Distributor.
14.	Panel lamps.	41.	Fuel pump.
15.	Number-plate lamp (two for Countryman and Traveller).	42.	Oil pressure switch.
16.	R.H. stop and tail lamp.	43.	Oil pressure warning lamp.
17.	L.H. stop and tail lamp.	44.	Ignition warning lamp.
18.	Stop lamp switch.	45.	Speedometer.
19.	Fuse unit; 1-2, 35 amp.; 3-4, 35 amp.	46.	Temperature gauge.
20.	Interior light.	47.	Temperature gauge transmitter.
21.	R.H. door switch.	64.	Bi-metal instrument voltage stabilizer.
22.	L.H. door switch.	67.	Line fuse, 35-amp.
23.	Horn.	75.	Automatic gearbox safety switch (when fitted).
24.	Horn-push.	83.	Induction heater and thermostat (when fitted).
25.	Flasher unit.	84.	Suction chamber heater (when fitted).
26.	Direction indicator and headlamp flasher switch.	94.	Oil filter switch.
27.	Direction indicator warning lamp.	105.	Oil filter warning lamp.
28.	R.H. front flasher lamp.		} Not fitted on Automatic.
29.	L.H. front flasher lamp.	115.	Rear window demister switch (when fitted).
		116.	Rear window demister unit (when fitted).
		150.	Rear window demister warning light (when fitted).

CABLE COLOUR CODE

B. Black.	G. Green.	W. White.
U. Blue.	P. Purple.	Y. Yellow.
N. Brown.	R. Red.	L.G. Light Green.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

Standard Saloon, Van, and Pick-up Mark II



KEY TO WIRING DIAGRAM

<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	Dynamo.	29.	L.H. front flasher lamp.
2.	Control box.	30.	R.H. rear flasher lamp.
3.	12-volt battery.	31.	L.H. rear flasher lamp.
4.	Starter solenoid.	32.	Heater switch
5.	Starter motor.	33.	Heater motor.
6.	Lighting switch.		} when fitted.
7.	Headlamp dip switch.	34.	Fuel gauge.
8.	R.H. headlamp.	35.	Fuel gauge tank unit.
9.	L.H. headlamp.	36.	Windscreen wiper switch.
10.	Main-beam warning lamp.	37.	Windscreen wiper motor.
11.	R.H. sidelamp (in headlamp or flasher) lamp.	38.	Ignition/starter switch.
12.	L.H. sidelamp (in headlamp or flasher) lamp.	39.	Ignition coil.
14.	Panel lamps.	40.	Distributor.
15.	Number-plate lamp (two for Van).	41.	Fuel pump.
16.	R.H. stop and tail lamp.	42.	Oil pressure switch.
17.	L.H. stop and tail lamp.	43.	Oil pressure warning lamp.
18.	Stop lamp switch.	44.	Ignition warning lamp.
19.	Fuse unit: 1-2, 35 amp.; 3-4, 35 amp.	45.	Speedometer.
20.	Interior light.	64.	Bi-metal instrument voltage stabilizer.
21.	R.H. door switch.	76.	Line fuse, 35-amp.
22.	L.H. door switch.	75.	Automatic gearbox safety switch (when fitted).
23.	Horn.	83.	Induction heater and thermostat (when fitted).
24.	Horn-push.	84.	Suction chamber heater (when fitted).
25.	Flasher unit.	94.	Oil filter switch.
26.	Direction indicator and headlamp flasher switch.	105.	Oil filter warning lamp.
27.	Direction indicator warning lamp.		} Not fitted on Automatic.
28.	R.H. front flasher lamp.	115.	Rear window demister switch (when fitted).
		116.	Rear window demister unit (when fitted).
		150.	Rear window demister warning light (when fitted).

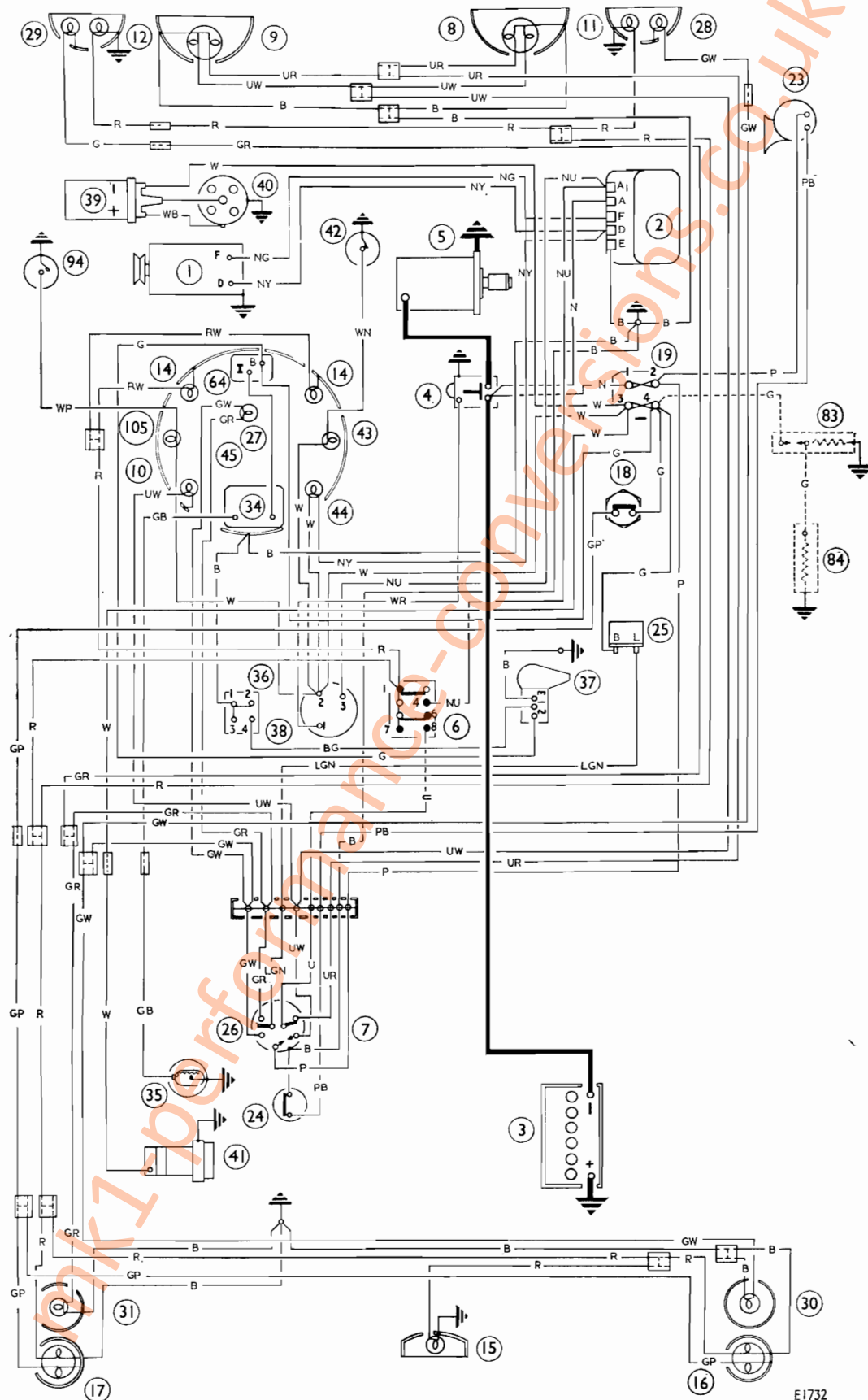
CABLE COLOUR CODE

B. Black.	G. Green.	W. White.
U. Blue.	P. Purple.	Y. Yellow.
N. Brown.	R. Red.	L.G. Light Green.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

WIRING DIAGRAM

Mini-Moke Mark II



KEY TO WIRING DIAGRAM

<i>No.</i>	<i>Description</i>	<i>No.</i>	<i>Description</i>
1.	Dynamo.	27.	Direction indicator warning lamp.
2.	Control box.	28.	R.H. front flasher lamp.
3.	12-volt battery.	29.	L.H. front flasher lamp.
4.	Starter solenoid.	30.	R.H. rear flasher lamp.
5.	Starter motor.	31.	L.H. rear flasher lamp.
6.	Lighting switch.	34.	Fuel gauge.
7.	Headlamp dip switch.	35.	Fuel gauge tank unit.
8.	R.H. headlamp.	36.	Windscreen wiper switch.
9.	L.H. headlamp.	37.	Windscreen wiper motor.
10.	Main-beam warning lamp.	38.	Ignition starter switch.
11.	R.H. sidelamp.	39.	Ignition coil.
12.	L.H. sidelamp.	40.	Distributor.
14.	Panel lamps.	41.	Fuel pump.
15.	Number-plate illumination lamp.	42.	Oil pressure switch.
16.	R.H. stop and tail lamp.	43.	Oil pressure warning lamp.
17.	L.H. stop and tail lamp.	44.	Ignition warning lamp.
18.	Stop lamp switch.	45.	Speedometer.
19.	Two-way fuse unit; 1-2, 35 amp.; 3-4, 35 amp.	64.	Bi-metal instrument voltage stabilizer.
23.	Horn.	83.	Induction heater and thermostat.
24.	Horn-push.	84.	Suction chamber heater.
25.	Flasher unit.	94.	Oil filter switch.
26.	Direction indicator switch.	105.	Oil filter warning lamp.

CABLE COLOUR CODE

B. Black.	G. Green.	W. White.
U. Blue.	P. Purple.	Y. Yellow.
N. Brown.	R. Red.	L.G. Light Green.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

Section N.1

BATTERY

Maintenance

- (1) Keep the battery clean and the vent holes in the caps free.
- (2) Clean corroded terminals with diluted ammonia and smear them with petroleum jelly.
- (3) Maintain the level of the electrolyte just above the tops of the separators.

NOTE.—Disconnect the battery earth cable before boost-charging the battery or using arc welding equipment on the body. Considerable damage to the electrical components will result if the ignition is switched on while the battery remains connected to the car electrical system.

Checking

- (4) The state of charge of the battery is indicated by hydrometer reading as follows:

For climates below 27° C. (80° F.)

Cell fully charged		1.270 to 1.290
Cell about half-charged		1.190 to 1.210
Cell completely discharged		1.110 to 1.130

For climates above 27° C. (80° F.)

Cell fully charged		1.210 to 1.230
Cell about half-charged		1.130 to 1.150
Cell completely discharged		1.050 to 1.070

These figures are given assuming an electrolyte temperature of 16° C. (60° F.). If the temperature of the electrolyte exceeds this .002 must be added to hydrometer readings for each 3° C. (5° F.) rise to give the true specific gravity. Similarly, .002 must be subtracted from hydrometer readings for every 3° C. (5° F.) below 16° C. (60° F.).

Charging (used battery)

- (5) Charge at 3.0 amps. until all cells are gassing freely and hydrometer readings of each cell have not risen in four hours. Do not allow the temperature of the electrolyte to exceed the following maximum: For climates below 27° C. (80° F.) 30° C. (100° F.). For climates above 27° C. (80° F.) 49° C. (120° F.).

Dry-charged batteries

Dry-charged batteries are supplied without electrolyte but with the plates in a charged condition. No initial charging is required.

- (6) Fill with electrolyte obtained as follows:

To obtain spe-

cific gravity Add 1 vol. of acid of
(corrected to 1.840 S.G. (corrected

<i>For climates</i>	16° C. [60° F.] of	to 16° C. [60° F.] to
Below 27° C.		
(80° F.)	1.260	3.2 volumes of water
Above 27° C.		
(80° F.)	1.210	4.3 volumes of water

Batteries filled in this way are capable of giving a starting discharge **one hour after filling**. When time permits, however, a short freshening charge at the normal recharge rate (3.0 amps.) will ensure that the battery is fully charged.

During the charge the electrolyte must be kept level with the top edge of the separators by addition of distilled water. Check the specific gravity of the acid at the end of the charge; if 1.260 acid was used to fill the battery, the specific gravity should now be between 1.270 and 1.290. If 1.210 acid was used the specific gravity should now be between 1.210 and 1.230. After filling, a dry-charged battery needs only the attention normally given to a lead-acid battery.

New, unfilled, uncharged battery

- (7) Half fill each cell with electrolyte prepared as in item (6) above and allow it to stand for six hours, fill each cell to the correct level and allow a further standing period of two hours.
- (8) Charge at 2 amps. until five successive hourly hydrometer checks show no increase in the reading; this will take from 48 to 80 hours, depending on the length of time the battery has been stored before charging. **This charge should not be broken by long rest periods.**
- (9) If the temperature of any cell rises above the maximum given in (5), the charge must be interrupted until the temperature has fallen at least 5.5° C. (10° F.) below that figure.
- (10) Maintain the level of the electrolyte during the charge.
- (11) At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 16° C. (60° F.) it lies between the specified limits. If any cell requires adjustment some of the electrolyte must be siphoned off and replaced either by distilled water or by acid of strength originally used for filling in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell.
- (12) Finally, allow the battery to cool, and siphon off any surplus electrolyte.

Section N.2

DYNAMO

Removing

- (1) Disconnect the leads, slacken the four mounting bolts, remove the fan belt from the pulley, take out the two upper and one lower mounting bolts and lift off the dynamo.



The C40/1 type dynamo

1. Commutator end bracket.
2. Felt ring.
3. Felt ring retainer.
4. Bronze bush.
5. Thrust washer.
6. Field coils.
7. Yoke.
8. Shaft collar.
9. Shaft collar retaining cup.
10. Felt ring.
11. Shaft key.
12. Shaft nut.
13. Output terminal 'D'.
14. Brushes.
15. Field terminal 'F'.
16. Commutator.
17. Through-bolts.
18. Pole-shoe securing screws.
19. Armature.
20. Bearing retaining plate.
21. Ball bearing.
22. Corrugated washer.
23. Driving end bracket.
24. Pulley spacer.

- (2) Unscrew the nut and take off the pulley.
- (3) Extract the key from the shaft.
- (4) Withdraw the two through-bolts and remove the commutator end bracket.
- (5) Lift the driving end bracket with the armature and bearing out of the yoke.
- (6) To remove the bearing, press off the end bracket.

Brushes

- (7) Clean the brushes with petrol (fuel) and, if sticking, polish them lightly with a smooth file.
- (8) Test the spring tension (**'GENERAL DATA'**).
- (9) Fit new brushes if the existing ones are worn to a length of less than $\frac{1}{4}$ in. (6.5 mm.).

(10) Clean with petrol (fuel) and cloth or polish with fine glass-paper. If it is in very poor condition it may be skimmed to a minimum diameter of 1.450 in. (37 mm.). The undercut must have the following dimensions:

Width		.040 in. (1.02 mm.)
Depth		.020 to .035 in. (.51 to .89 mm.).

Field coil replacement

- (12) Withdraw the pole-shoe securing screws (Fig. N.1), draw the shoes and coils from the yoke and remove the coils from the shoes.
- (13) Fit new coils to the shoes and refit them to the yoke with the shoes in their original positions. Refit the insulating piece at the junction of the coil windings, insert the screws, press the shoes in place with an expander, and tighten the screws (Fig. N.1).

(14) If special equipment is not available, test the armature by substitution.

(15) Screw a $\frac{5}{8}$ in. (15.8 mm.) tap into the bush at the commutator end, pull out the bush and fit a new one, using a shouldered mandrel.

NOTE.—Soak the new bush in thin engine oil for 24 hours before fitting.

- (16) Renew the bearing at the driving end as follows:
- (17) Knock out the rivets and remove the bearing retaining plate.
- (18) Press the bearing out of the bracket and remove the corrugated and felt washers.
- (19) Pack the new bearing with grease before pressing it in.

- (20) Reverse the removing and dismantling instructions.
- (21) The two upper fixing bolts must be fitted with a flat washer under the head of each bolt to register against the dynamo attachment points.

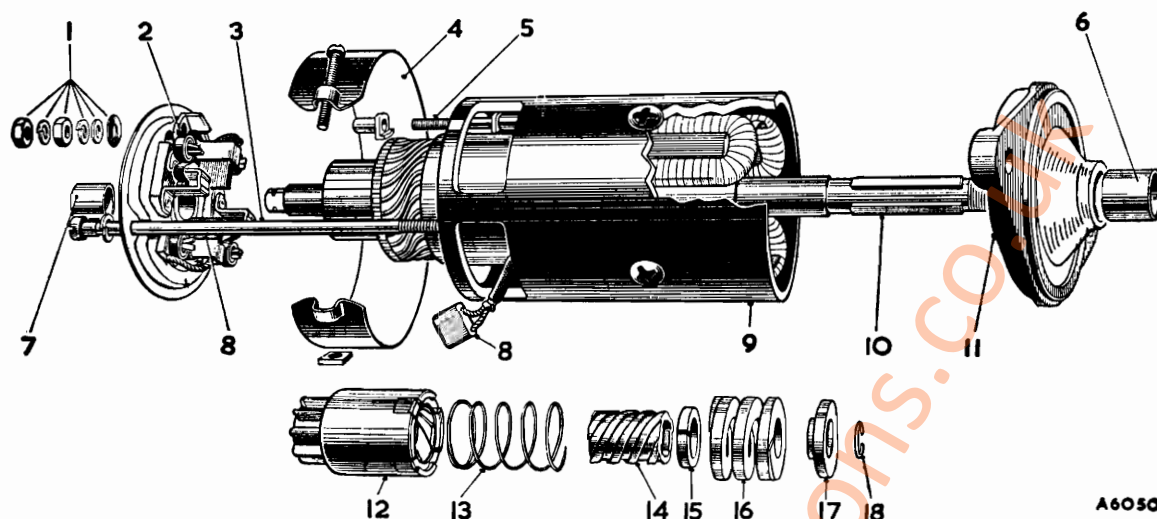


Fig. N.2

An exploded view of the starter motor and drive

- | | | |
|-------------------------------|--------------------------|-------------------------|
| 1. Terminal nuts and washers. | 7. Bearing. | 13. Restraining spring. |
| 2. Brush spring. | 8. Brushes. | 14. Sleeve. |
| 3. Through-bolt. | 9. Yoke. | 15. Impact washer. |
| 4. Band cover. | 10. Armature shaft. | 16. Main spring. |
| 5. Terminal post. | 11. Driving-end bracket. | 17. Locating washer. |
| 6. Bearing bush. | 12. Pinion assembly. | 18. Circlip. |

Section N.3

STARTER

Removing

- (1) Disconnect the cable, unscrew the three bolts and lift away.

Dismantling

- (2) Remove the cover band, withdraw the brushes, unscrew the through-bolts and take out the armature complete with drive.

Servicing

Brushes

See Section N.2, items (7) to (9).

Drive

- (3) If the pinion is tight on the sleeve, wash it in kerosene.
- (4) To dismantle, remove the shaft nut and withdraw the main spring and collar. On later types, compress the spring and remove the circlip.
- (5) Rotate the barrel, push out the sleeve and remove the barrel and pinion.
- (6) The barrel and pinion are supplied as an assembly.

Commutator

- (7) If cleaning is not effective, skim lightly removing the absolute minimum amount of metal. Do not undercut the mica.

Field coils

See Section N.2, items (11), (12), and (13).

Bearing

See Section N.2, item (15).

Armature

See Section N.2, item (14).

Reassembling and refitting

Reverse the removal and dismantling instructions.

Section N.4

VOLTAGE REGULATOR

Adjusting (cold unit)

Electrical

- (1) Disconnect the cables from the control box terminals 'A' and 'A1' and join them together.
- (2) Connect the negative lead from a voltmeter (0-20 volts) to control box terminal 'D' and the positive lead to terminal 'E'.
- (3) Slowly increase engine speed until the voltmeter needle flicks and then steadies. This should occur between 15.8 and 16.7 volts, depending on the ambient temperature.
- (4) If adjustment is required, switch off the engine and remove the control box cover.

- (5) Turn the voltage adjustment screw (1) (Fig. N.3), in a clockwise direction to raise the voltage and anti-clockwise to lower it. Turn only a fraction of a turn at a time. This adjustment should be completed within 30 seconds or the settings will be affected by heat. Do not run the dynamo at a higher speed than is necessary for the adjustment to be made.

Mechanical

- (6) Slacken the fixed contact and voltage adjusting screws until they are clear of the moving contact and the tension spring respectively. Slacken the two armature assembly securing screws.
- (7) Insert a .021 in. (.53 mm.) feeler gauge between the armature and the core shim. Press the armature squarely down against the gauge and tighten the armature assembly securing screws.
- (8) With the gauge still in position, screw the adjustable contact down until it just touches the armature contact. Tighten the locking nut.
- (9) Reset the voltage adjusting screw as in item (5).

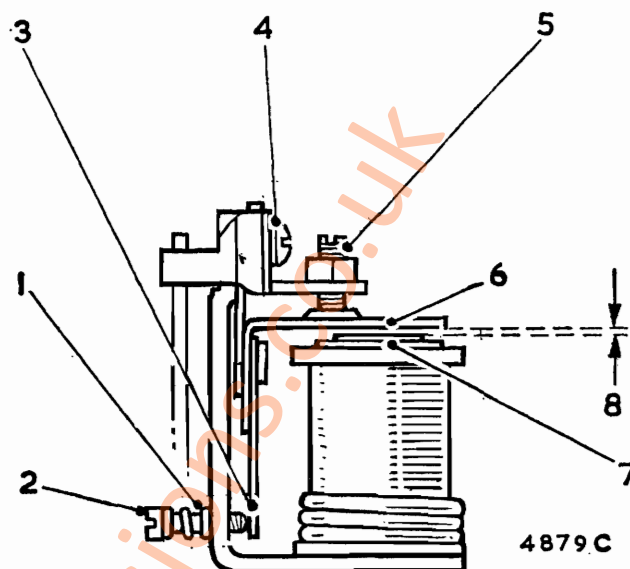


Fig. N.4

Mechanical setting of the regulator

- | | |
|------------------------------|------------------------------------|
| 1. Locknut. | 5. Fixed contact adjustment screw. |
| 2. Voltage adjusting screw. | 6. Armature. |
| 3. Armature tension spring. | 7. Core face and shim. |
| 4. Armature securing screws. | 8. .021 in. (.533 mm.). |

Section N.5

CUT-OUT

Adjustment

Electrical

- (1) To check, connect the voltmeter between terminals 'D' and 'E'. Start the engine and slowly increase the speed until the contacts close; this should occur at 12.7 to 13.3 volts.
- (2) To adjust, turn the adjusting screw clockwise to raise the voltage and anti-clockwise to reduce it. Turn only a fraction at a time. Make the adjustments as quickly as possible to avoid temperature effects.

Mechanical

- (3) Unscrew the cut-out adjusting screw until it is clear of the armature tension spring. Slacken the armature securing screws.
- (4) Press the armature down against the copper-sprayed core and tighten the securing screws.
- (5) Bend the armature stop arm until the gap between it and the tongue is .030 in. (.76 mm.) when the armature is pressed squarely against the core face (8) (Fig. N.6).
- (6) Bend the fixed contact blade so that there is a gap of .010 to .020 in. (.25 to .50 mm.) between the contact points when the armature is free.
- (7) Reset the cut-out adjusting screw.

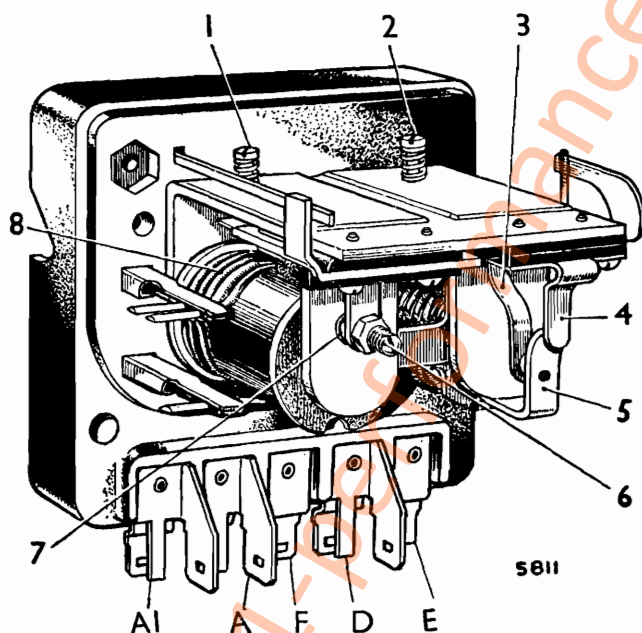


Fig. N.3

The control box

- | | |
|-------------------------------|--|
| 1. Regulator adjusting screw. | 5. Armature tongue and moving contact. |
| 2. Cut-out adjusting screw. | 6. Regulator fixed contact screw. |
| 3. Fixed contact blade. | 7. Regulator moving contact. |
| 4. Stop arm. | 8. Regulator series windings. |

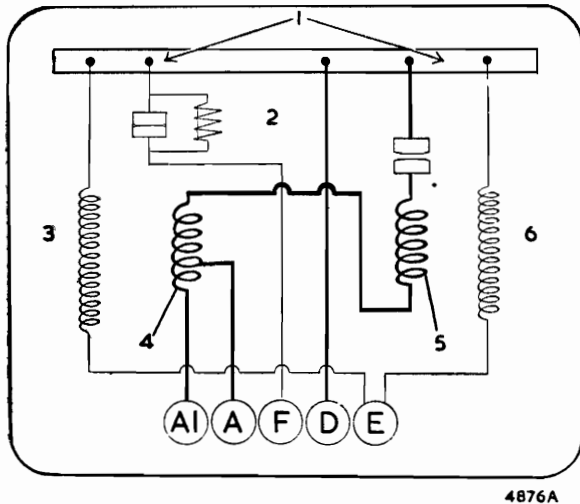


Fig. N.5

The control box (regulator and cut-out) internal connections

- | | |
|---------------------------------|------------------------|
| 1. Regulator and cut-out frame. | 4. Tapped series coil. |
| 2. Field resistance. | 5. Series coil. |
| 3. Shunt coil. | 6. Shunt coil. |

Section N.6

LAMPS

Full details of the lamps, bulbs, warning lights, etc., are given in the Driver's Handbook.

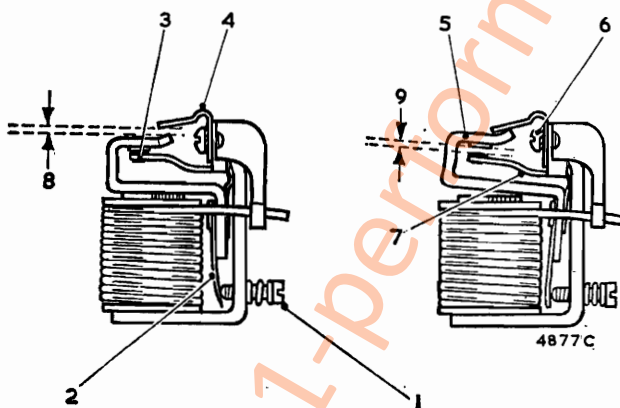


Fig. N.6

Mechanical setting of the cut-out

- | | |
|--|--|
| 1. Cut-out adjusting screw. | 5. Armature tongue and moving contact. |
| 2. Armature tension spring. | 6. Armature securing screws. |
| 3. 'Follow through'—010 to 020 in. (.25 to .51 mm.). | 7. Fixed contact blade. |
| 4. Stop arm. | 8. .030 in. (.76 mm.). |
| 9. .010 to .020 in. (.25 to .51 mm.). | |

Section N.7

BI-METAL RESISTANCE INSTRUMENTATION

General description

The bi-metal resistance equipment for fuel and temperature gauges consists of an indicator head and transmitter unit connected to a common voltage stabilizer. In both applications the indicator head operates on a thermal principle, using a bi-metal strip surrounded by a heated winding, and the transmitter unit is of a resistance type. The system by which the equipment functions is voltage-sensitive and the voltage stabilizer, which serves one or more gauges, is necessary to ensure a constant supply of a pre-determined voltage to the equipment.

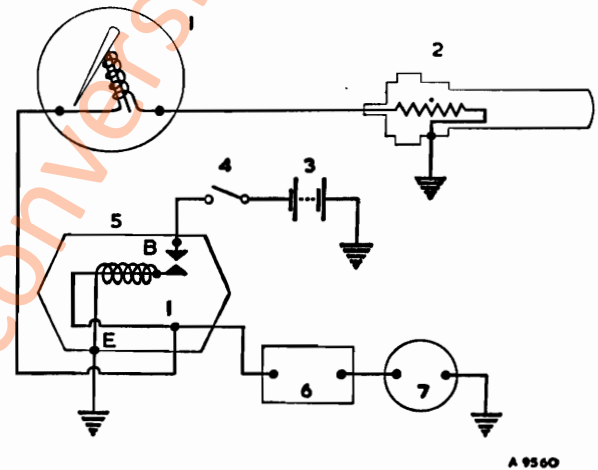


Fig. N.7

The bi-metal resistance instrumentation circuit

- | | |
|-----------------------------------|----------------------------|
| 1. Temperature gauge. | 4. Ignition switch. |
| 2. Temperature gauge transmitter. | 5. Voltage stabilizer. |
| 3. Battery. | 6. Fuel gauge. |
| | 7. Fuel gauge transmitter. |

Fault analysis

Voltage stabilizer

Check the mean voltage between the output terminal 'I' and earth, which should be 10 volts.

Substitute voltage stabilizer if faulty.

Gauges

Check for continuity between the terminals with the wiring disconnected. The gauges must not be checked by short circuiting to earth.

Substitute the gauge if faulty.

Transmitter

Check for continuity between terminal and case with lead disconnected.

Substitute transmitter if faulty.

Wiring

Check for continuity between each unit. Check for leak to earth. Check for short circuits to earth on wiring to each transmitter. Check terminal wiring for security, earth connections, and wiring continuity. Check that the voltage stabilizer and relating transmitters are earthed.

NOTE.—If the voltage stabilizer is removed it is essential to ensure that, when replacing, B and E are uppermost and not exceeding 20 degrees from the vertical.

Section N.8

WINDSCREEN WIPER MOTOR (Moke)

The wiper motor fitted to early models of this vehicle operated a single wiping blade on the driver's side only.

Later vehicles are equipped with a motor which operates twin wiper blades, and this motor will be referred to below as the (later type).

Removing (early type)

- (1) Slacken the hexagon screw and pull the blade and arm from the drive spindle.
- (2) Remove the nuts, locknuts, washers, and seals securing the motor to the scuttle.
- (3) Disconnect the leads from inside the vehicle and withdraw the motor.

NOTE.—A rubber flange with steel inserts is fitted between the wiper motor and the scuttle to prevent the insulating flange being over-compressed.

Refitting

- (4) Reverse the removal sequence.

Removing (later type)

- (5) Remove the four nuts securing the rack to the wheelboxes.
- (6) Disconnect the electrical connections from the motor.
- (7) Remove the three screws securing the motor to the bracket and remove the assembly.
- (8) Remove the gearbox cover and withdraw the retaining circlip from the cross-head connecting link pin and lift off the connecting link and rack cable assembly.

Dismantling the motor (later type)

- (9) Remove the through-bolts and the commutator housing.
- (10) Lift the brush unit clear of the commutator and withdraw it. Note the position occupied by each brush so that it may be refitted in its original setting on the commutator.
- (11) Access to the armature and field coils is obtained by withdrawing the yoke.
- (12) Clean the commutator and brushes, replacing any that are worn. Ensure that the commutator segments are clean; short-circuiting of adjacent

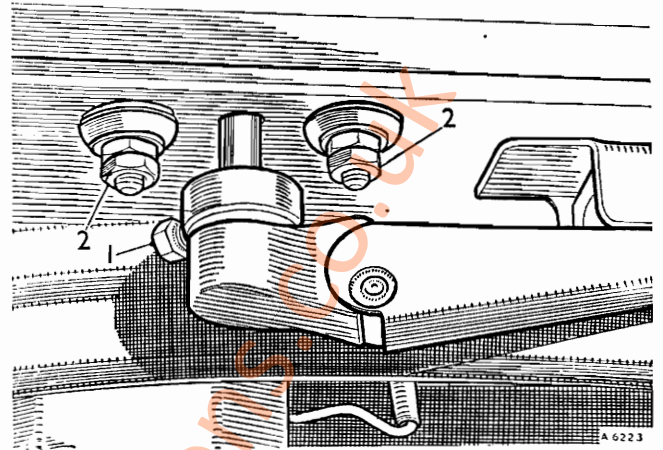


Fig. N.8

The windscreen wiper (Moke)

1. Arm-locating screw.
2. Motor mountings.

segments will cause excessive current consumption. The resistance between segments should be .29 to .35 ohms.

Dismantling the gearbox

- (13) Carry out instruction (8).
- (14) Remove the circlip and washer from the final drive gear shaft located underneath the gearbox casing, and lift out the final drive gear.
- (15) The armature can now be withdrawn for cleaning or replacement.
- (16) Examine the worm drive of the armature and the teeth of the final drive gear and fit replacements if either are damaged or excessively worn.

Reassembling

- (17) Reverse the dismantling procedures, using the following lubricants:
Use Ragosine Listate grease liberally on the cross-head, guide channel, connecting rod assembly, worm drive, and on the rack cable and wheelbox assemblies.
Use S.A.E. 20 oil sparingly on the armature and final drive gear bearings.
- (18) Ensure that the plain steel washer is placed beneath the connecting rod when assembling the final drive gear crankpin.
- (19) The armature end-float adjusting screw should be set to allow an end-float of .008 to .012 in. (.2 to .3 mm); this is approximately a quarter of a turn clear of the armature thrust pad.

Refitting

- (20) Reverse the removing procedure, but before switching on the motor remove the wiper arms from the spindles. Switch on the motor and stop it at the end of the stroke; refit the arms so that they are in the correct parking position.

Section N.9

WINDSCREEN WIPER WHEELBOXES

Removing

- (1) Withdraw the wiper arms from the wheelbox spindles, and remove the external securing nuts.
- (2) *All models except Moke.* From under the bonnet, slacken the nut securing the rack to the motor. Swivel the wheelboxes through into the engine compartment sufficiently to enable the securing nuts to be removed and release the wheelbox from the rack and cable. Note the location of the flared ends of the Bundy tubing with each wheelbox.
- (3) *Moke.* Removing is similar to item (2) except that the wheelboxes are located inside the vehicle.

Refitting

- (4) Reverse the removing procedure and fit new external sealing grommets if required. Tighten the rack securing nut on the motor.
- (5) Switch on the motor and stop it at the end of the stroke. Ensure that the arms are correctly positioned to give maximum wipe area and park at the end of the stroke.

Section N.10

ALTERNATOR SERVICE PRECAUTIONS

The following precautions must be observed when dealing with vehicles fitted with an alternator.

- (1) When fitting a replacement alternator ensure that it is of the same polarity as the original. Terminal polarity is clearly marked.
- (2) Do not reverse the battery connections. This will damage the alternator rectifiers. Connect up the earth terminal of the battery first.
- (3) If a high-rate battery charger is used to charge the battery in position in the vehicle, damage will occur to the regulator if the ignition/starter switch is switched on to the auxiliary position. Detach the connectors from the regulator as a safety measure before boost-charging. Re-connect after charging.
- (4) When starting an engine with the aid of a high-rate charger, detach the connectors from the regulator prior to using the charger. Do not re-connect the regulator until the charger is disconnected, and the engine is running at idling speed.
- (5) The battery must never be disconnected while the engine is running, nor must the alternator be run with the main output cable disconnected either at the alternator end or the battery end.
- (6) The cable connecting the battery and alternator is 'live' even when the engine is not running. Take care not to earth the alternator terminal or the cable end if removed from the terminal.

Do not make or break any connections in the alternator circuit while the engine is running.

- (7) Disconnect the alternator and regulator as a safety precaution when arc-welding on the vehicle.

Section N.11

TESTING THE ALTERNATOR CHARGING CIRCUIT IN POSITION

Before commencing the charging circuit tests given below carry out the 'Maintenance' instructions.

Maintenance

The driving belt must be tensioned so that a deflection of $\frac{1}{2}$ in. (13 mm.) can be obtained under finger pressure at the mid-point of the longest run of the belt.

DO NOT apply leverage to any point of the alternator other than the drive end bracket, or run the engine with the battery or alternator disconnected.

Keep the ventilating holes in the slip-ring end cover clean.

Alternator charging circuit

The following procedure should be adopted to locate a fault in the charging circuit using the test equipment recommended below.

Test equipment required

- (a) Moving-coil D.C. ammeter, accurate up to at least 60 amps.
- (b) Moving-coil D.C. voltmeter, scale 0-30 volts (plus one of low range if possible).
- (c) Ohmmeter—battery powered. Hand-driven generator type must never be used for testing diodes.

Testing

- (1) Check the driving belt for wear and tension (see 'Maintenance').
- (2) Check that the battery voltage is reaching the brush gear by disconnecting the two cables from the alternator field terminals, connect a voltmeter between the two cables and run the engine. The voltmeter should register battery voltage. If no reading is obtained, check the field circuit wiring.
- (3) Check alternator output.

Stop the engine and disconnect the battery earth cable (+). If an ammeter is not fitted, disconnect both connectors from the alternator main output terminal 'B' and connect up a moving-coil ammeter between the terminal and the connectors.

Withdraw the cables from the alternator field terminals and connect a pair of auxiliary cables direct between these terminals and the battery (Fig. N.9).

Re-connect the battery earth lead (+). Start the engine and gradually increase speed until the alternator is rotating at 4,000 r.p.m. At this speed the ammeter reading should be approximately 40 amps.

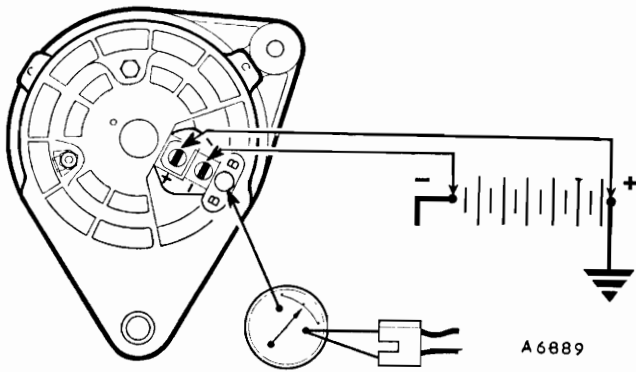


Fig. N.9

Alternator output test connections

- (a) Zero reading: Stop the engine. Remove and inspect the brush gear (see 'Inspection'). Fit new brush gear if necessary and retest. If zero reading persists, remove and dismantle the alternator for detailed inspection.

- (b) Low reading: Indicates either a faulty alternator or poor wiring circuit connections.

Stop the engine and check the wiring connections. Connect a voltmeter (low range) between the alternator output terminal 'B' and the battery negative (—) terminal, restart the engine and note the reading. Transfer the voltmeter connections to the alternator frame and the battery earth (+) terminal and note the reading.

If either reading exceeds .5 volt there is high resistance in the charging circuit which must be traced and remedied. Should the test show no undue resistance (although output is low) proceed to dismantle and inspect the alternator.

Section N.12

DISMANTLING AND OVERHAULING THE 11AC ALTERNATOR

Removing

- (1) Disconnect the battery and detach the electrical leads from the alternator.
- (2) Slacken the alternator securing bolts, push the alternator towards the engine and detach the driving belt from the alternator pulley. Remove the securing bolts and detach the alternator from the engine.

Dismantling

- (3) Remove the securing nut and detach the drive pulley, fan, and key from the armature shaft.
- (4) Mark the relative positions of the drive end bracket, the stator lamination pack, and the slip-ring end bracket for correct reassembly.

- (5) Remove the through-bolts and detach the drive end bracket and rotor.

The drive end bracket and rotor need not be separated unless the drive end bearing requires examination or the rotor is to be replaced. Remove the rotor from the drive end bracket by means of a hand press having first removed the shaft key and bearing collar.

- (6) Remove the terminal nuts, brush box retaining screws, and the heat sink bolt. Withdraw the stator and heat sink from the slip-ring end bracket.
- (7) Close the retaining tongues on the brush terminal blades and withdraw the terminals from the brush box.

Inspection

Brush gear

Brushes worn below $\frac{5}{16}$ in. (8 mm.) should be replaced.

- (a) The new brush complete with spring and 'Lucar' terminal blade is pushed into the holder until the tongue registers. To retain the terminal, carefully lever up the retaining tongue with a thin blade.
- (b) Check that the brushes move freely in their holders. If sluggish, clean brush sides with a petrol-moistened cloth or, if ineffective, lightly polish brush sides with a smooth file. Clean off and re-house.

Slip-rings

Surfaces should be smooth and free of oil or other foreign matter. Clean the surfaces if necessary, using a petrol-moistened cloth or, if there is evidence of burning, very fine glass-paper.

NOTE.—Do not attempt to machine the slip-rings.

Testing

Test equipment required:

- (a) Moving-coil D.C. ammeter, accurate up to 60 amps.
- (b) Moving-coil D.C. voltmeter, scale 0–30 volts.
- (c) Ohmmeter—battery-powered. Do not use a hand-driven generator type for testing diodes.
- (d) Mains test lamp, 110-volt A.C., 15-watt.

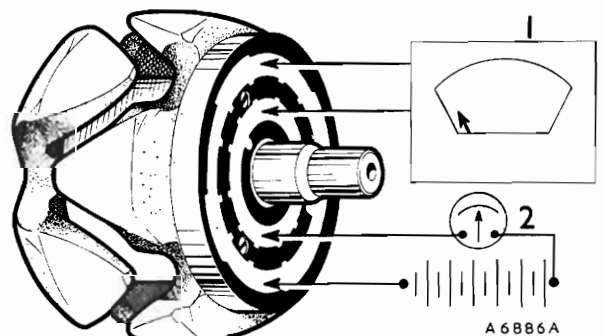


Fig. N.10

Using an ohmmeter (1) or a battery and ammeter (2) to test the resistance or current flow of the field winding

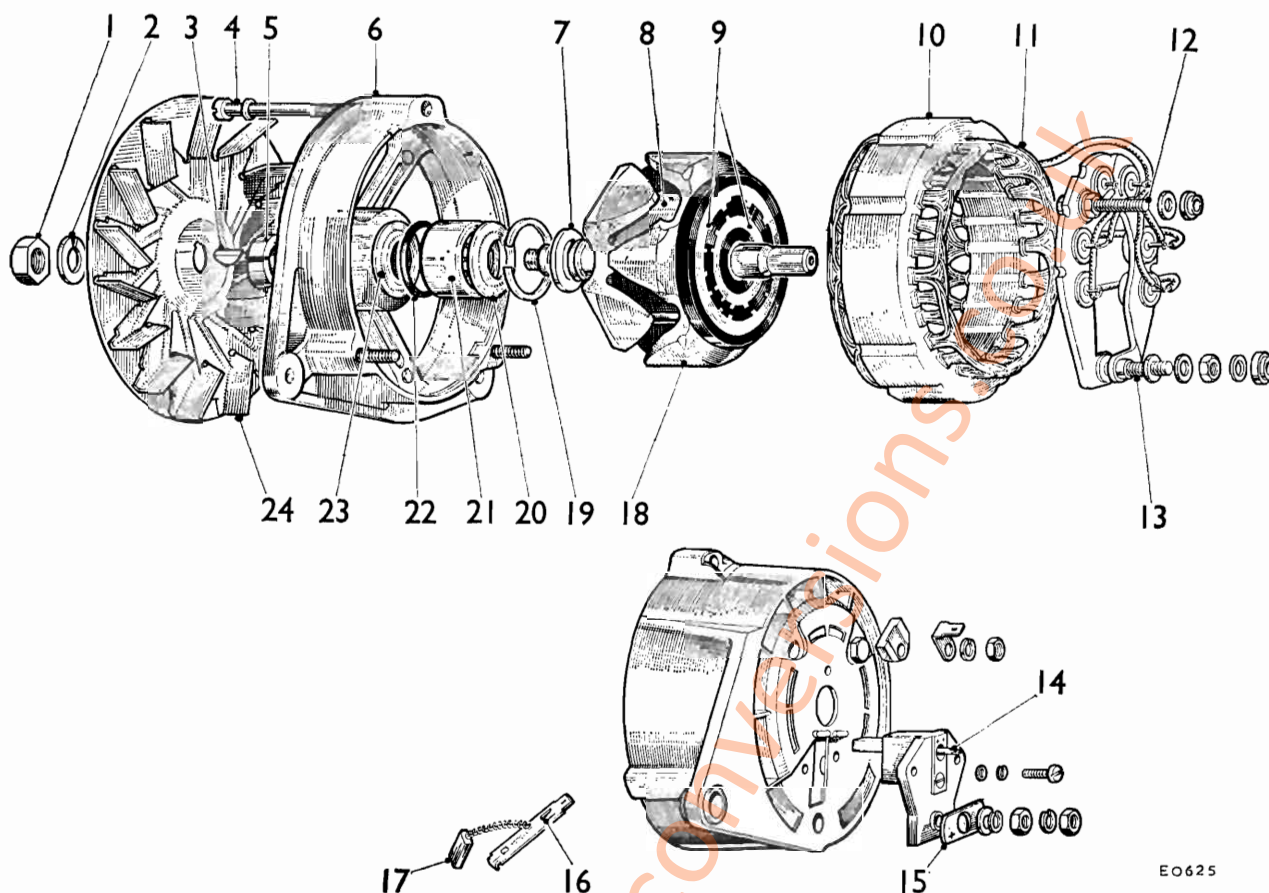


Fig. N.11

Alternator components

- | | | |
|---------------------------|--------------------------------------|--------------------------------|
| 1. Shaft nut. | 9. Slip rings. | 17. Brush. |
| 2. Spring washer. | 10. Stator laminations. | 18. Rotor. |
| 3. Key. | 11. Stator windings. | 19. Bearing circlip. |
| 4. Through-bolt. | 12. Warning light terminal. | 20. Bearing retaining plate. |
| 5. Distance collar. | 13. Output terminal. | 21. Ball bearing. |
| 6. Drive end bracket. | 14. Field terminal blade. | 22. 'O' ring oil seal. |
| 7. Jump ring shroud. | 15. Output terminal plastic strip. | 23. 'O' ring retaining washer. |
| 8. Rotor (field) winding. | 16. Terminal blade retaining tongue. | 24. Fan. |

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Rotor

- (a) Test the rotor windings by connecting an ohmmeter, or a 12-volt battery supply and ammeter in series, between the slip-rings (Fig. N.10). The resistance or current of the field coils should be as given in 'GENERAL DATA'.
- (b) Defective insulation between the slip-rings and one of the rotor poles. Use a mains test lamp (110-volt A.C., 15-watt), connect it between one of the slip-rings and rotor poles; if the lamp lights, the coil is earthing. Replace the rotor assembly.

NOTE.—Do not attempt to machine the rotor poles or true a distorted shaft.

Stator

- (a) Check for continuity of the stator windings. Unsolder the three stator cables from the heat sink assembly (see 'Replacing diode heat sink'). Connect any two of the three stator cables in

series with a 1.5-watt test lamp and a 12-volt battery. Repeat the test, replacing one of the two cables by the third. Failure of the test lamp to light in either test indicates that the stator windings are open circuit. Replace the stator.

- (b) Test insulation between stator coils and lamination pack with the mains test lamp. Connect the test probes between any of the three cable ends and the lamination pack. If the lamp lights, the stator coils are earthing. Replace the stator.

Carry out the following test before resoldering the stator cables.

Diodes

Test each diode by connecting a 12-volt D.C. supply and a 1.5-watt test lamp in series with each diode in turn as shown in Fig. N.12, and then reversing the connections. Current should flow in one direction only.

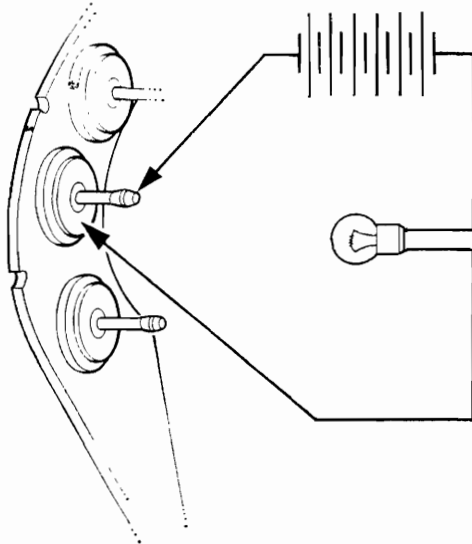


Fig. N.12
Testing the diodes

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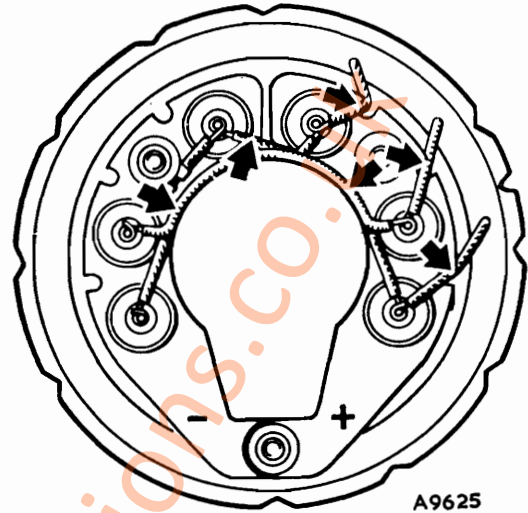


Fig. N.13

The heat sink diode internal connections

Should the bulb light up, or not light at all, in both tests the diode is defective. Replace the appropriate heat sink assembly.

The above procedure is adequate for testing. If, however, a battery-ohmmeter is used, it should be understood that no realistic readings can be obtained. A good diode will yield 'Infinity' in one direction, and a much lower, indefinite reading in the other.

Replacing diode heat sink

The heat sink assembly comprises two mutually insulated portions, one of positive polarity carries cathode-based diodes (marked red), and the other, negative, carries anode-base diodes (marked black).

- Make the interconnections with 'M' grade 45-55 tin-lead solder.
- Take great care to avoid overheating the diodes. Lightly grip the diode pins with a pair of long-nosed pliers, which will act as a thermal shunt, and carry out the soldering as quickly as possible.
- Arrange the connections neatly around the heat sinks to ensure adequate clearance for the rotor, and secure with a suitable heat-resistant adhesive (Fig. N.13). The three stator connections must pass through the appropriate notches at the edge of the heat sink.

Bearings

Renew bearings which allow excessive side play of the rotor shaft.

Bearing—slip-ring end-cover

The needle-roller bearing and slip-ring end cover should be renewed as an assembly; if however a new bearing is to be fitted, follow the procedure below.

- Check the depth to which the original bearing is pressed into its housing so that the new bearing may be positioned likewise.
- Support the bearing boss, and press the bearing to the required depth. Pack with high-melting-point grease.

Bearing—drive-end bracket

- Withdraw the rotor shaft from the drive-end bracket.
- The bearing retaining plate is secured by either screws, rivets or a circlip.
File away the rivet heads and punch out the rivets; withdraw the screws or extract the circlip.
- Press the bearing from the bracket.
- Ensure that the new bearing is clean and pack it with high-melting-point grease. Locate the bearing and press fully into the housing.
- Refit the bearing retaining plate. When circlip retained, press in enough to allow the circlip to be located.

Re-assembling

- Reverse the dismantling procedure, bending the retaining tongues of the field terminal blades out at an angle of 30 degrees before fitting.
- Align the marks on the drive-end bracket, stator lamination pack and the slip-ring end-bracket.
- Support the inner journal of the drive-end bearing on a suitable tube and press the rotor home. Do not use the drive-end bracket as a support for the bearing while fitting the rotor. Tighten the through-bolts, brushbox fixing screws, and diode heat sink fixings to the correct torque figures (see 'GENERAL DATA').

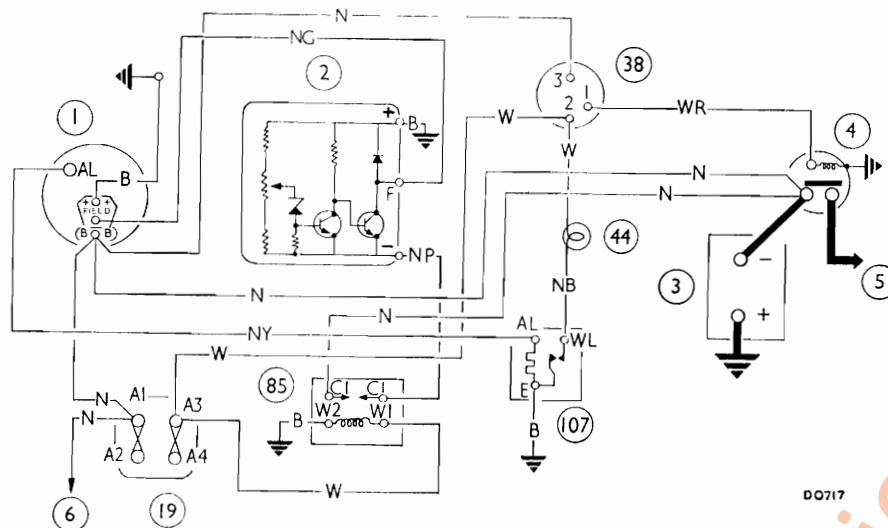


Fig. N.14

The alternator charging circuit

1. Alternator.
2. 4TR control unit.
3. 12-volt battery.
4. Starter solenoid.
5. Starter motor.
6. Lighting switch.
19. Fuse unit; 1-2, 35-amp.; 3-4, 35-amp.
38. Ignition/starter switch.
44. Ignition warning lamp.
85. Alternator field isolating relay.
107. Alternator charge indicator unit 3AW.

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Section N.13

CONTROL UNIT (4TR)

Testing

- (1) Check the resistance of the wiring circuits of the alternator, control unit, and battery to control unit, including the relay unit. The resistance should not exceed 0.1 ohm.

NOTE.—Do not use an ohmmeter of the type which incorporates a hand-driven generator when checking the rectifiers or transistors.

- (2) Check that the battery is fully charged.
- (3) Check the voltage output as follows:
 - (a) Connect an accurate voltmeter across the battery terminals and note the reading.
 - (b) Connect an ammeter between the alternator main cable and its terminal 'B' on the alternator.
 - (c) Switch on enough lights to give a load of 2 amps.

- (d) Start the engine and run for at least eight minutes at an alternator speed of 3,000 r.p.m. until the ammeter reads 10 amps.

- (e) The voltmeter reading should then be between 13.9 and 14.3 volts. If the reading is unstable or has not risen above the battery voltage, renew the control unit. If the reading is stable but outside the correct limits, adjust the control unit.

- (4) If adjustment is needed, proceed as follows:

- (a) Stop the engine, and detach the control unit from its mountings.
- (b) Scrape out the compound sealing the potentiometer adjustment at the back of the unit.
- (c) Ensure the connections on the unit are secure and re-start the engine.
- (d) Run the engine to give an alternator speed of 3,000 r.p.m., with the conditions of test as in (3).

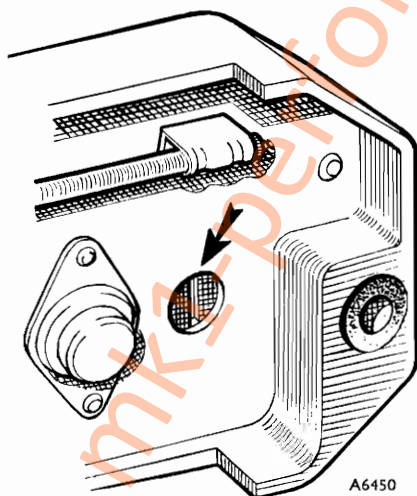


Fig. N.15

The 4TR control unit potentiometer adjuster. Turn clockwise to increase the voltage reading

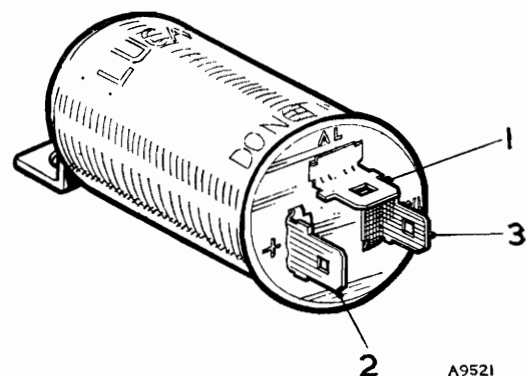


Fig. N.16

Warning light control terminals

1. Alternator 'AL'.
2. Positive '+'.
 3. Warning light 'WL'.

- (e) Turn the adjuster slot gradually until the voltmeter registers a stable reading within the correct voltage limits (see Fig. N.15). Only a small adjuster movement is needed to effect an appreciable difference in the voltmeter reading.
- (f) Re-check by stopping the engine, re-starting it and running the alternator at 3,000 r.p.m. Check the voltmeter reading, and when it is correct, refit the control unit and remove the voltmeter and ammeter. Do not attempt to re-seal the adjuster hole. Application of undue heat will damage the control unit.

Section N.14

RELAY

Description

The relay de-energizes the alternator rotor field winding when the engine is stationary by disconnecting the supply from the rotor field immediately the ignition is switched 'off'. This allows contact 'C1' and 'C2' to part and open-circuit the rotor field winding. The alternator will not generate if the contacts fail to close when the ignition is switched 'on'.

Testing

- (1) Connect an ammeter as detailed in Section N.11, item (3).
- (2) Remove the lead from terminal 'C2' and temporarily join to the 'C1' terminal, ensuring good electrical contact.
- (3) If the alternator generates its specified output with the leads connected as above, the relay is faulty and must be replaced.

Check continuity of relay operating winding, relay circuit wiring, and earth. If the relay and circuit are satisfactory (with cables 'C1' and 'C2' still joined), but no output from the alternator, check the alternator and control unit.

Section N.15

WARNING LIGHT CONTROL

The control is electrically connected to the centre point of one pair of diodes in the alternator and enables a warning light to be used to indicate that the alternator is charging when the engine is running at normal speed. If proved faulty, replace the unit.

SECTION R

THE BODY

	<i>Section</i>
Alignment	R.13–R.14
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Door locks	R.7
Glasses	
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Door	R.3
Quarter-light	R.4
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Heater assembly (recirculatory type) ..	R.5
Heater assembly (fresh-air type) ..	R.16
Instrument panel	R.11
Roof liner	R.6
Speedometer (Super De-luxe and Cooper) ..	R.12
Tilt frame and cover (Pick-up)	R.10
Windscreen (Moke)	R.15

Section R.1

WINDSCREEN GLASS

Removing

- (1) Lift the wiper blades from the glass.
- (2) Prise up the end of the locking filler and pull it from the rubber channel.
- (3) Push the glass from inside the car and ease the rubber surround from the body.

Refitting

- (4) Fit the rubber surround to the body and lubricate with soap and water.
- (5) Fit the glass into the lower channel of the rubber and lift the lip of the surround with the short peg of Service tool 18G 468, starting at one corner and working round.
- (6) Thread the locking filler through the handle and eye of the tool, insert the tool into the filler strip channel and draw the tool along the channel, feeding the filler through the tool. When cutting the filler, allow a small overlap and then force the ends into position.

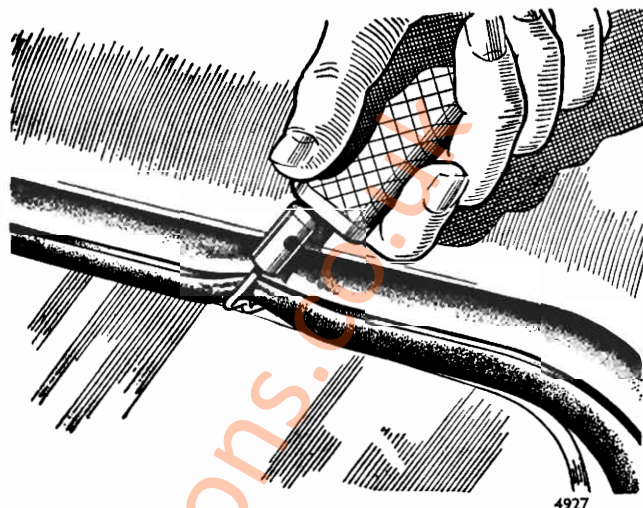


Fig. R.1

Use Service tool 18G 468 to ease the channel lip over the windscreen glass

- (4) Lubricate the body edge with soap and water, hold the glass in position, press lightly and pull the cord from inside the car to draw the lip of the rubber over the edge of the body.

Section R.2

BACK-LIGHT GLASS

As items (2) to (6) in 'Windscreen Glass'.

Section R.3

DOOR GLASSES

Removing and refitting

Take out the screws from the lower channel and remove the glass and channel. Reverse to refit.

Section R.4

QUARTER-LIGHT GLASSES

Removing

- (1) Support the outside of the glass and hit it with the palm of the hand inside at the top, then remove the glass and rubber.

Refitting

- (2) Fit the surround rubber to the glass.
- (3) Pass a length of thin cord round the outer channel of the surround, leaving the ends hanging down on the inside of the glass.

COOPER

Removing

- (5) Remove the catch from the body.
- (6) Open the quarter-light, ease up the seal on the body, unscrew the exposed screws securing the hinge and detach the window assembly.
- (7) Remove the frame from the glass after unscrewing the hinge screws at top and bottom.

Refitting

Reverse the removal instructions.

Section R.5

HEATER ASSEMBLY
(Recirculatory Type)

Initial fitting

Full instructions for fitting are contained in the heater kit.

Removing

- (1) Disconnect the battery.
- (2) Drain the cooling system.
- (3) Disconnect the motor leads.
- (4) Slacken the demister and water hose clips.
- (5) Withdraw the screws securing the unit to the parcel shelf and remove.

Refitting

- (6) Reverse the removal instructions.
- (7) Open the heater tap on the rear of the engine and refill the cooling system.
- (8) Test the heater; if the water return hose does not warm up in a few minutes, there may be an air lock.
- (9) To clear, disconnect the return hose from the lower radiator hose and plug the hole.
- (10) Extend the return hose to reach the radiator filler.
- (11) Start up and note the flow of water from the return hose; when it is free from bubbles, switch off and reconnect.

Section R.6**ROOF LINER****Removal**

- (1) Disconnect the battery and remove the roof light.
- (2) Mark the position of the rear edge of the front liner on the cant rail.
- (3) Grip the outer edges of the liner and pull it backwards and inwards.
- (4) Mark the position of the front edge of the rear liner and pull it forwards and inwards.

Refitting

Reverse the removal instructions.

Section R.7**DOOR LOCKS****Removing**

- (1) Withdraw the screw securing the lock to the inner panel and the screw from the end of the locking handle spindle.
- (2) Slacken the screw clamping the inner lever and remove the handle and escutcheon.

Refitting

Reverse the removal instructions. Ensure that the inner control cable lever is fitted upright.

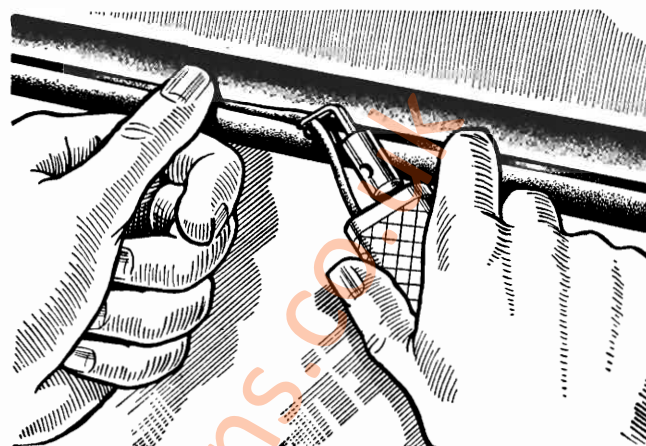
Section R.8**DOOR FRAME—REAR**

(Countryman and Traveller)

Removing

The wood frame is a complete assembly.

- (1) Remove the rear door and take off the lock.
- (2) Remove the two screws from the centre of the inner door panel.
- (3) Remove the door sealing rubber and retaining clips.



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Fig. R.2

The use of the glazing tool and eye to thread the locking filler strip into the rubber channel

- (4) Extract the self-tapping screws from the edge of the door and remove the frame assembly from the panel.

Refitting

- (5) Clean off sealing compound and remake the joints.
- (6) Refit the frame; locate all the screws before tightening any.

Section R.9**SLIDING GLASSES**

(Countryman and Traveller)

Removing

- (1) Remove the trim panel from above the sliding windows.
- (2) Remove the upper channels, support the inside and push the glass from the outside.

Refitting

- (3) Reverse the removal instructions.

Section R.10**TILT FRAME AND COVER**

(Pick-up)

The tilt frame and cover are supplied as a separate kit; the centre and rear hoop sockets, and the front attachment bracket for the struts, are fitted to the vehicle as original equipment.

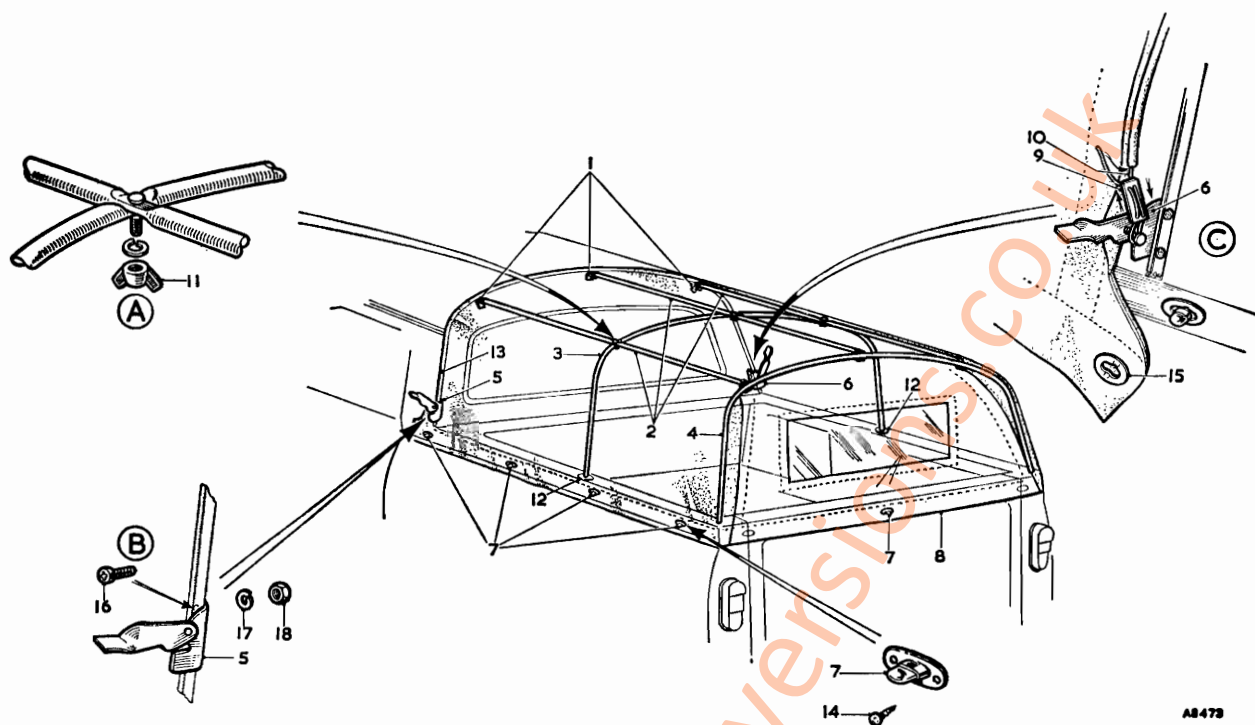


Fig. R.3

The tilt frame and cover assembly

- | | | |
|---------------------------|-----------------------------|-------------------------------------|
| 1. Front fixing brackets. | 7. Turn-button. | 13. Cover retaining channel. |
| 2. Strut. | 8. Cover assembly. | 14. Screw—turn-button to body side. |
| 3. Front hoop. | 9. Adjuster plate—cable. | 15. Eyelet—tilt cover. |
| 4. Rear hoop. | 10. Cover fixing cable. | 16. Screw—lever bracket to body. |
| 5. L.H. lever bracket. | 11. Wing nut—strut to hoop. | 17. Spring washer. |
| 6. R.H. lever bracket. | 12. Hoop housing assembly. | 18. Nut for screw. |

Fitting

- (1) Fit the rear hoop ends into the sockets at either side of the rear end of the body. Ensure that the three brackets attached to the top of the hoop face forwards.
- (2) Fit the centre hoop ends into the sockets at the centre position.
- (3) Engage the studs of one of the struts in the hole in the centre bracket at the top of the rear hoop, the centre hole pierced in the top of the centre hoop, and the hole in the centre bracket attached to the rear of the cab at the top (see Fig. R.3). Fit a spring washer and wing nut to each stud and tighten fully (inset (A) of Fig. R.3).
- (4) Repeat this operation with the other two struts, using the fixing holes in the brackets and centre hoop either side of the central fixing points.
- (5) Place the R.H. lever bracket assembly on the rear face of the channel fixed around the rear of the cab with the drilled face of the bracket against the channel, its lower edge approximately in line with the top edge of the seam (body cross-member to cab). The lever attached to the bracket must face outwards and the lever pin must face forwards.

Mark off the position of the two holes in the

drilled face of the bracket onto the body and drill two holes $\frac{11}{16}$ in. (5.16 mm.) diameter. Fix the bracket to the channel with two of the No. 10 pan-head screws, nuts, and spring washers, the heads of the screws facing outwards (see inset (B) of Fig. R.3). Repeat this operation with the L.H. bracket on the L.H. side of the channel.

- (6) Lay the tilt cover, smooth face upwards, over the tilt frame with the fixing cable at the front.

Arrange the centre longitudinal seam to run centrally along the central strut and the centre transverse seam to be central about the centre hoop.

Lift the levers on the bracket to their fullest extent and hook the fixed loop in one end of the fixing cable over the pin of the corresponding lever.

Ensure that the cable running through the tilt cover is forwards of the rear edge of the channel round the outer edge of the cab for its full length. Adjust the loop at the other end of the cable until it will engage over the pin on its lever without undue slackness in the cable. The adjuster consists of a rectangular plate pierced with four holes. The cable is fed up through one hole from the rear of the plate, and then passed down through the hole below and in line along the length of the plate. The loop is formed below the plate, and the free end of the cable is then threaded through the lower vacant hole

from the bottom face of the plate, and returns down through the corresponding hole at the top. By adjusting the position of the cable in the plate the length of the cable can be varied as necessary (see inset [c] of Fig. R.3).

With both loops engaged over their respective lever pins, press down each lever in turn until it toggles over into its locked position. The cable should now be holding the front of the tilt cover firmly, and must fit snugly down in the retaining channel throughout its length.

When the adjustment of the cable is satisfactory and the cable and tilt cover are seating correctly in the channel, tuck the free end of the cable back into the tilt cover alongside the cable.

- (7) Arrange the tilt cover so that it lies evenly and smoothly over the tilt frame. The fixing position of the turn-buttons can be marked off, using the eyelets in the lower edges of the cover as templates.

Beginning with the extreme front eyelets, adjust the cover so that it takes its natural position and mark around the inside of the eyelet on the vertical face of the body. Hold the base of the turn-button against the body in the position so marked and mark and drill the two fixing holes, using a $\frac{7}{8}$ in. (2.78 mm.) diameter drill. Attach the turn-button to the body with two of the No. 6 countersunk self-tapping screws provided.

Repeat this operation on the remaining turn-button positions, working from front to rear, attaching the cover to the body as the work proceeds. Repeat on the opposite side of the body, then lower the rear flap and mark off, fit the turn-button in the centre of the tailboard in the same manner.

- (8) Loop the short centre strap attached to the under side of the top of the cover around the central strut, and fasten the ends together with the turn-button and eyelet provided. Attach the corners of the rear flap to the side of the cover by means of the turn-buttons and eyelets provided. The two long straps at the top of the cover are for securing the rear flap when it is rolled and out of use.

Section R.11

INSTRUMENT PANEL

(Super De-luxe, Traveller, and Countryman)

COOPER

Removing

- (1) Remove four screws from the front face of the shroud.
- (2) Withdraw the shroud and disconnect the panel light switch wires.

- (3) Disconnect the oil gauge pipe and the temperature gauge wires.
- (4) Remove four screws and withdraw the panel with oil and temperature gauges.
- (5) Unscrew the knurled nuts and remove the gauges.

Refitting

Reverse the removal instructions.

Section R.12

SPEEDOMETER

(Super De-luxe and Cooper)

Removing

- (1) Remove the panel.
- (2) Unscrew two screws and remove the speedometer instrument panel brackets and distance pieces.
- (3) Disconnect the cable from the speedometer.
- (4) Disconnect the fuel gauge cable.
- (5) Pull out the bulb holders from the speedometer.
- (6) Withdraw the speedometer into the engine compartment.

Section R.13

CHECKING BODY ALIGNMENT

(Without Checking Jig)

- (1) Raise the vehicle and support it parallel to a level floor using the comparative measurements given on page R.11 (vertical alignment check).
- (2) Check the relative heights of all the intermediate points for distortion of the vehicle in the vertical plane.
- (3) Chalk the floor below the points shown on page R.12 (horizontal alignment check).
- (4) With a plumb-line, project the checking points from the vehicle onto the floor and mark the position with a pencil.
- (5) Mark the central points between each pair of checking points on the floor.
- (6) Mark the diagonals between any two pairs of points and intersections.
- (7) Stretch a length of chalk-covered cord so that it passes through as many of the marked central points and intersections as possible.
- (8) While the cord is held taut by two operators, a third should raise the cord and allow it to spring back and leave a white line on the floor. Any points through which the resulting white line does not pass will indicate the point where the underframe is out of alignment.

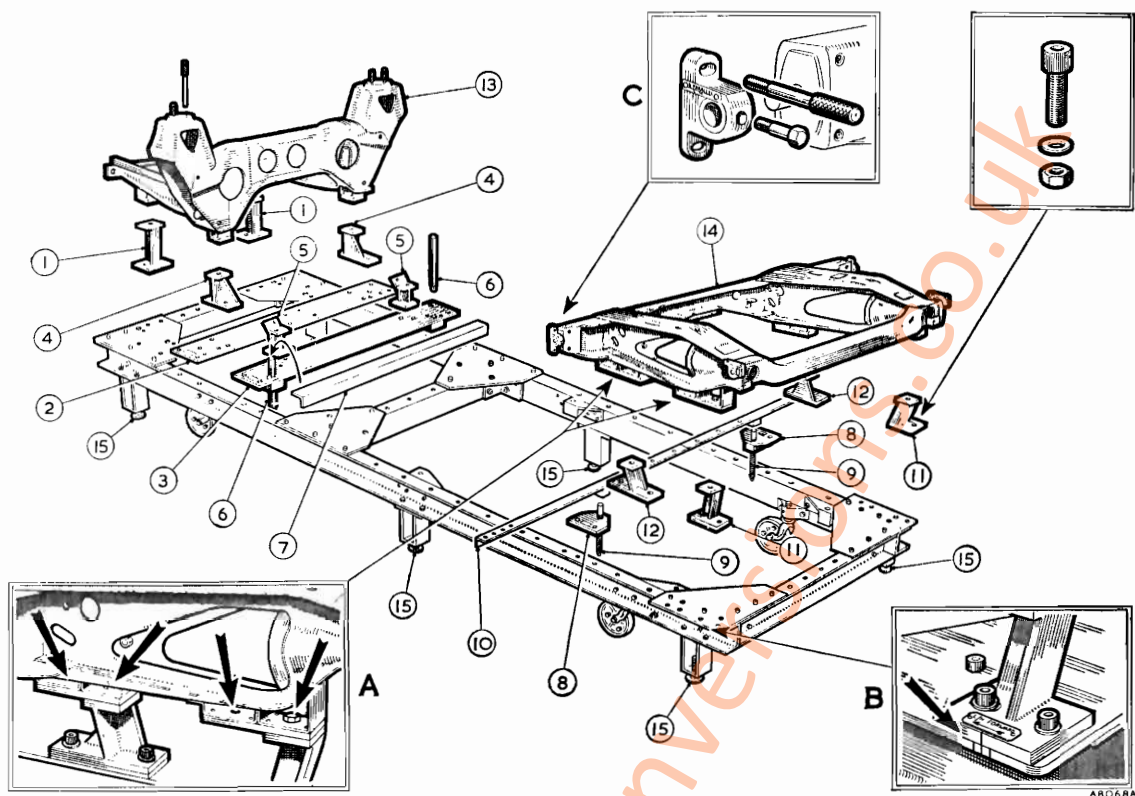


Fig. R.4

The assembly of the jig components

- (9) Considerable deviations in the measurements given on pages R.11 and R.12 confirm body misalignment. Allowance must be made for normal manufacturing tolerances and a reasonable departure from nominal dimensions can be permitted without detriment to performance.

Section R.14

CHECKING BODY ALIGNMENT

(With Checking Jig)

The equipment required for checking the body alignment consists of the basic body checking jig Service tool 18G 560, and adaptor set 18G 560 E used in conjunction with basic adaptor set 18G 560 A.

This equipment is intended to be used solely as a checking fixture, and under no circumstances must any welding or repair work be carried out on the body while it is still in position on the jig.

Assembling the jig

Where item numbers are quoted in this sub-section refer to Fig. R.4.

Remove the two inner socket screws from each corner plate on the front cross-member of the basic jig. Attach the two tall support pedestals (1) from adaptor set 18G 560 E to the cross-member at these points. Each

pedestal is clearly labelled to show its correct location directionally. Fit the plate marked 'Forward 1' (2) from the basic adaptor set 18G 560 A and the plate marked 'Forward 2' (3) from the adaptor set 18G 560 E to the basic jig at the points indicated on the inside of the left hand side-member.

Attach the shorter pair of support pedestals (4) from adaptor set 18G 560 E to the rear of the front checking frame (13). Mount the frame with the rear pedestals on plate 1 (2) and attach the frame to the front pedestals and the rear pedestals to the plate.

Fit the two checking adaptors (5) and the two jacking screws (6) from 18G 560 E to plate 2 (3). Place the short jacking bar (7) from adaptor set 18G 560 in position on the jacking screws.

Attach the two jacking screw brackets (8) from 18G 560 E to the side-member of the basic jig at the position marked 'OX' on the top of the left-hand side member and at the corresponding position on the right-hand side-member.

Screw in the two longer jacking screws (9) from adaptor set 18G 560 A. Assemble the long jacking bar (10) from 18G 560 A and place in position on the screws.

Fit the two support pedestals (11) from 18G 560 E to the rear of the jig corner plates.

Attach the other pair of pedestals (12) from 18G 560 E to the front of the rear checking frame (14) and mount the checking frame on the rear pedestals and the side-member

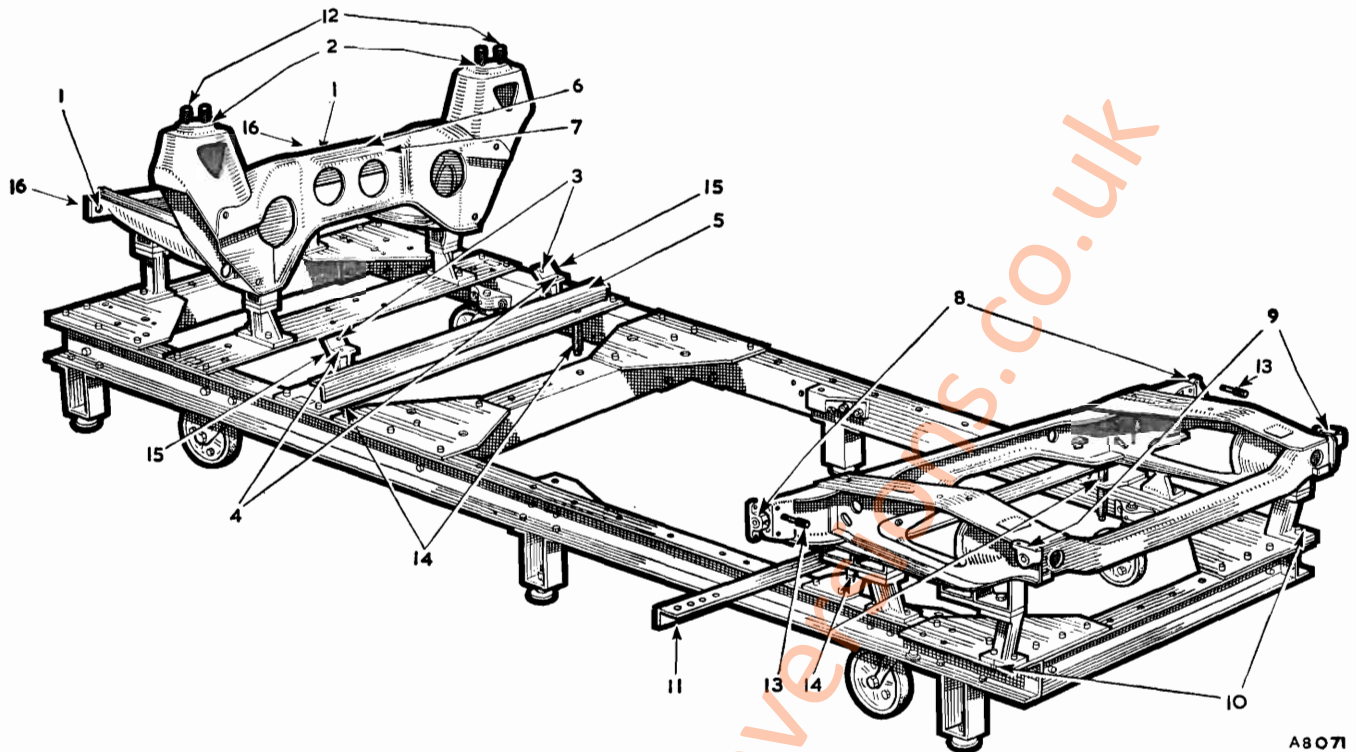


Fig. R.5

The jig checking points

of the basic jig. Do not tighten completely the pedestal to jig fixing bolts.

NOTE.—The rear checking frame has two alternative pairs of holes each side for attachment to the pedestals. The forward pair are for use when checking the body of a Van, Countryman or Traveller, the rear pair are for use when checking a Saloon body (see inset [A]).

When the assembly of the jig and adaptor sets is complete, adjust the basic jig by means of its six adjustable feet (15) (one at each corner, one on each side) until the weight is taken from the castors and the jig is level. Levelling indicators are provided, one on each side-member and one on the front cross-member.

If a fixed-position hoist is to be used to lift the body onto the jig, the jig must be levelled up in a central position under the hoist with the body already raised.

Checking alignment

All item numbers quoted in the following description refer to Fig. R.5.

Remove the four pins with knurled heads (12) from the top checking faces (2) of the front checking frame.

Move the rear checking frame to its most rearward position by means of the slotted holes in the base of the pedestal supports.

Lower the body squarely over the checking frames until it rests on the jacking bars.

At no time must the weight of the body be taken by the checking frames.

Lower the jacking bars equally, keeping the body

square with the jig, until the body is lightly in contact with the top faces (2) of the front checking frame.

Insert the four pins (12) through the holes in the body and into the holes in the top faces of the front checking frame. Check the relation of the holes in the body to the plain shank of the checking pins. The ideal position is when each of the holes in the body is concentric with the shank of its checking pin (see Fig. R.6). Adjust the body on the jig until this position, or the nearest possible approach to it, has been attained.

Line up the top holes in the front checking brackets (8) of the rear checking frame with the corresponding holes in the body. Insert one of the threaded checking pins (13) in each side to check this alignment.

Move the rear checking frame forward until a parallel clearance of $\frac{1}{8}$ in. (3.18 mm.) is obtained between the forward faces of the front checking brackets (8) and the body (a drill shank is a convenient gauge to use when checking these clearances).

Tighten down the pedestal fixing bolts, and check the relative positions of the lines scribed on the outer edge of each rear pedestal and the lines scribed on either outer edge of the jig rear corner plates (10). The ideal position is when the lines on the pedestals coincide with the central lines on the corner plates (see inset [B], Fig. R.4). The lines scribed either side of each central line show the maximum permissible limits of adjustment, and the correct clearance between the checking bracket and the body must be obtained with the adjustment set within these limits.

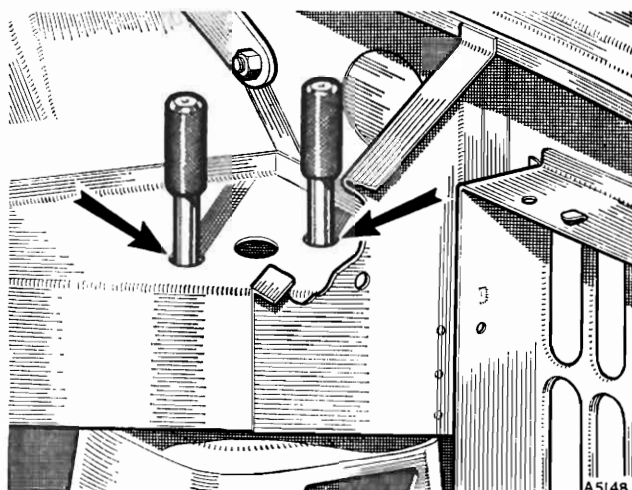


Fig. R.6

Showing an equal clearance around the checking pins with the body correctly aligned

Should the body be damaged in such a way that it is impossible to lower the body on the checking jig with all of the checking brackets on the rear checking frame in position, it is possible to detach either bracket by removing the hexagon-headed dowel bolt passing through the bracket, which can then be pulled off its mounting point.

After the correct location of the body on the jig has been established at the top checking faces on the front frame (2), and at the top holes of the front checking brackets (8) on the rear frame, the remaining alignment points and clearances can be checked.

The two checking holes (1) on the front member of the front checking frame, the four holes on the checking adaptors (3 and 4), and the eight holes in the front and rear checking brackets (8 and 9) on the rear checking frame should all line up by sight with their corresponding holes in the body.

A parallel clearance of $\frac{1}{4}$ in. (6.35 mm.) must exist between the checking faces (16) on the front member of the checking frame and the body and between both faces of each checking adaptor (15) and the under side of the body floor.

Examine the clearance between the body and the front checking frame at all points, including around the sides of the frame towers. If there is a foul at any point, the body must be dressed back until a clearance is obtained.

The face of the cross-member at the rear of the front frame must have a clearance to the body on its top vertical face (6) of $\frac{1}{8}$ in. (3.18 mm.) and $\frac{1}{16}$ in. (1.6 mm.) clearance at the inclined face (7). Should these clearances not be present, the body must be dressed back until the requisite clearance is obtained.

A parallel clearance of $\frac{1}{8}$ in. (3.18 mm.) must exist between the body and the checking faces of the four checking brackets (8 and 9) on the rear checking frame.

R.8

Section R.15

WINDSCREEN

(Moke)

Removal

- (1) Remove the windscreen wiper arm and blade.
- (2) Remove four nuts and screws.
- (3) Slacken the bottom retaining screws.
- (4) Lift the frame and glass from the vehicle.
- (5) Remove two screws, detach the bottom channel, and remove the glass from the frame.

Section R.16

HEATER ASSEMBLY

(Fresh-air Type)

Removing

- (1) Disconnect the battery and drain the cooling system.
- (2) Remove the front floor covering to avoid damage by coolant when removing the heater pipes.
- (3) Disconnect the two electrical snap connectors below the parcel shelf and the blower switch connection from the ignition switch.
- (4) Remove the demister tube covers, pull off the demister tubes and release the fresh-air intake hose.
- (5) Release the heater water hose clips and pull the hoses from the heater unit.
- (6) Slacken the nut securing the rear of the unit to the bracket, and remove the two screws beneath the parcel shelf securing the front of the heater (Fig. R.7). Lift the unit from the slotted rear brackets, hold the fingers over the matrix pipes and lift the unit out of the car. Drain the coolant from the unit.

On early models the heater unit is secured by four nuts. Lift the parcel shelf trimming and remove the nuts to withdraw the unit; distance pieces are fitted on the mounting studs.

Heater matrix replacement

- (7) Slacken the screws securing the control panel, remove the end cover screws and lift off the cover complete with the blower motor.
- (8) Lift out the heater matrix and fit the replacement unit.
- (9) Reverse the procedure given in item (7).

Heater motor replacement

- (10) Carry out operations (1) to (7).
- (11) Drill out the three Pop rivets securing the motor unit to the end cover and remove the motor.
- (12) Locate the replacement motor in the end cover with the wiring positioned to the top of the heater box when reassembled, and Pop rivet in position.

- (13) Refitting the end cover is a reversal of the removal procedure. Ensure that the flap valve is located on the end cover pivot and operated correctly before refitting the heater to the car.

Blower switch replacement

- (14) Remove the heater control panel and the switch securing nut. Pull the flap valve outwards, withdraw the switch and pull off the wiring connections.
- (15) Fitting a replacement switch is a reversal of item (14).

Refitting

- (16) Reverse the removal procedure and refill the radiator with coolant. Start and warm up the engine, check for leaks and correct operation of the heater assembly. Top up the coolant in the radiator to the correct level.

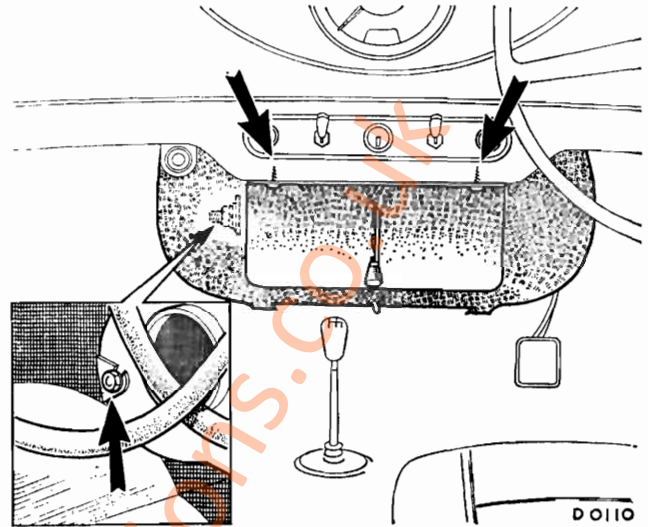
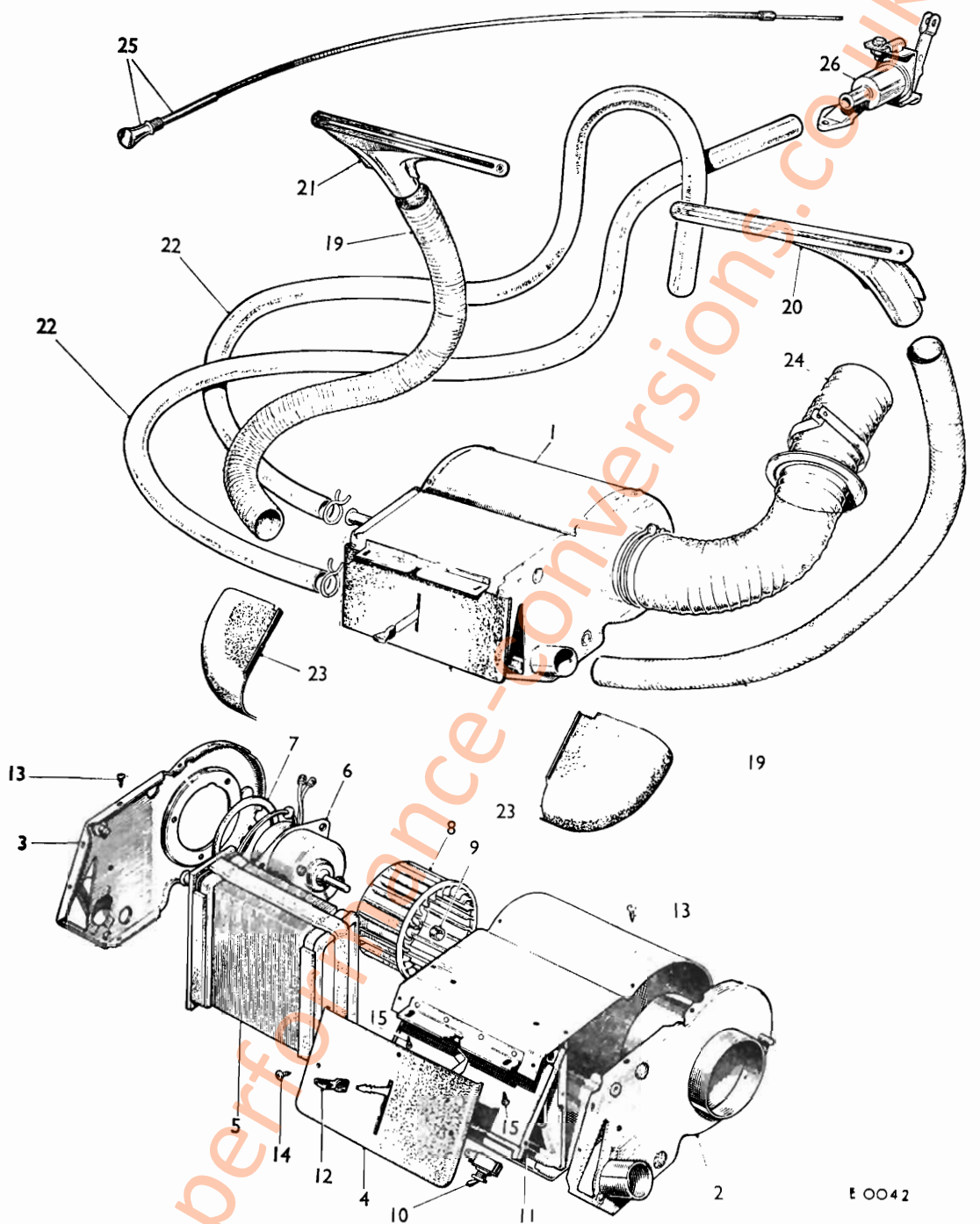


Fig. R.7

The fresh-air heater assembly securing points (arrowed)

THE HEATER ASSEMBLY COMPONENTS (Fresh-air Heater)



No. Description

1. Heater unit.
2. Cover—air intake side.
3. Cover—motor side.
4. Control panel.
5. Matrix.
6. Motor.
7. Seal.
8. Rotor (fan).
9. Rotor securing ring.

No. Description

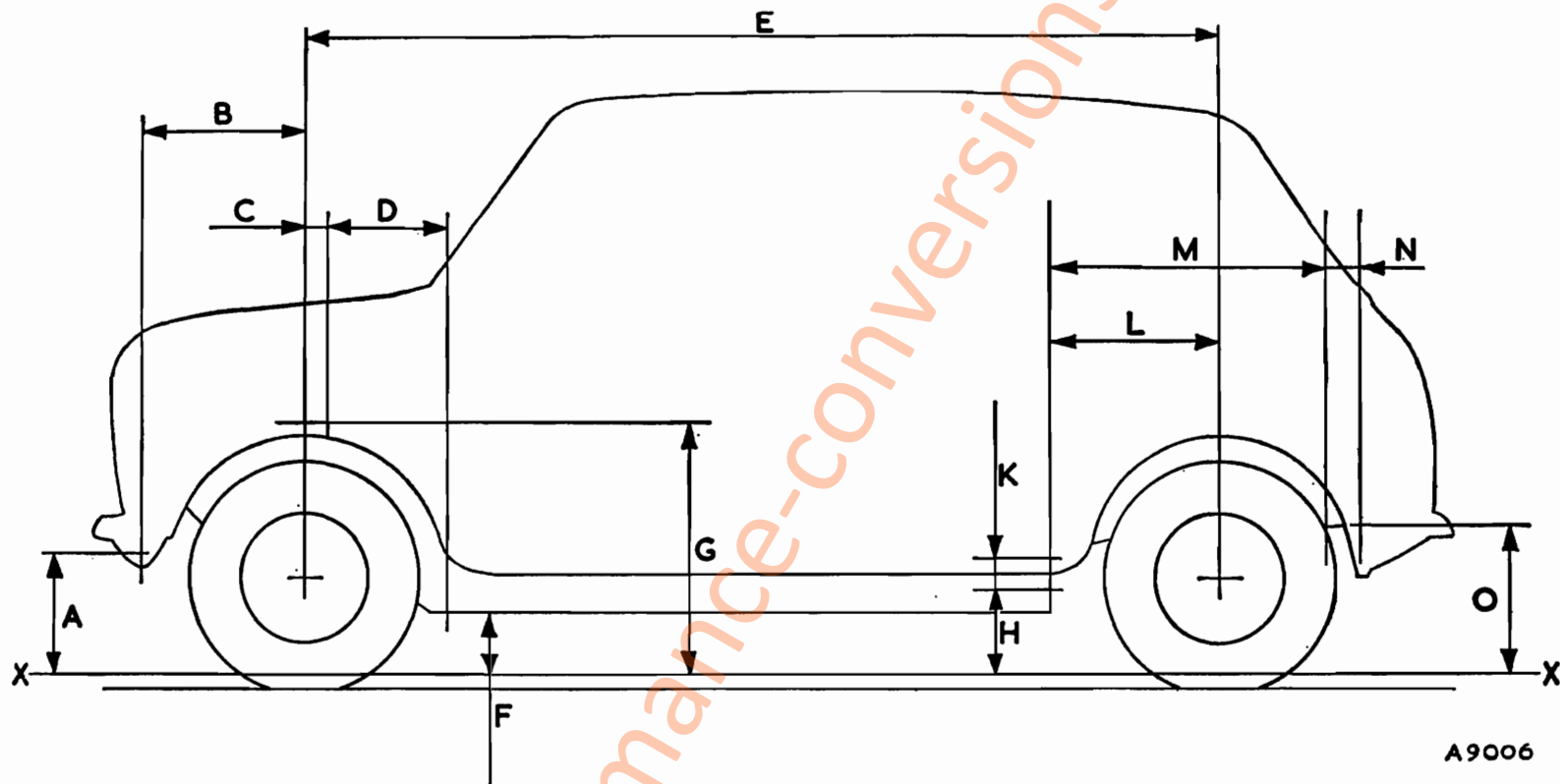
10. Blower switch.
11. Flap valve.
12. Control knob.
13. Securing screws—side cover.
14. Securing screws—control panel.
15. Securing screws—heater assembly.
16. Securing nut—heater assembly.
17. Plain washer.
18. Spring washer.

No. Description

19. Demister tubes.
20. Demister duct—R.H.
21. Demister duct—L.H.
22. Water hoses.
23. Covers—demister tube.
24. Air intake hose.
25. 'Heat' control cable.
26. Valve—water control.

E 0042

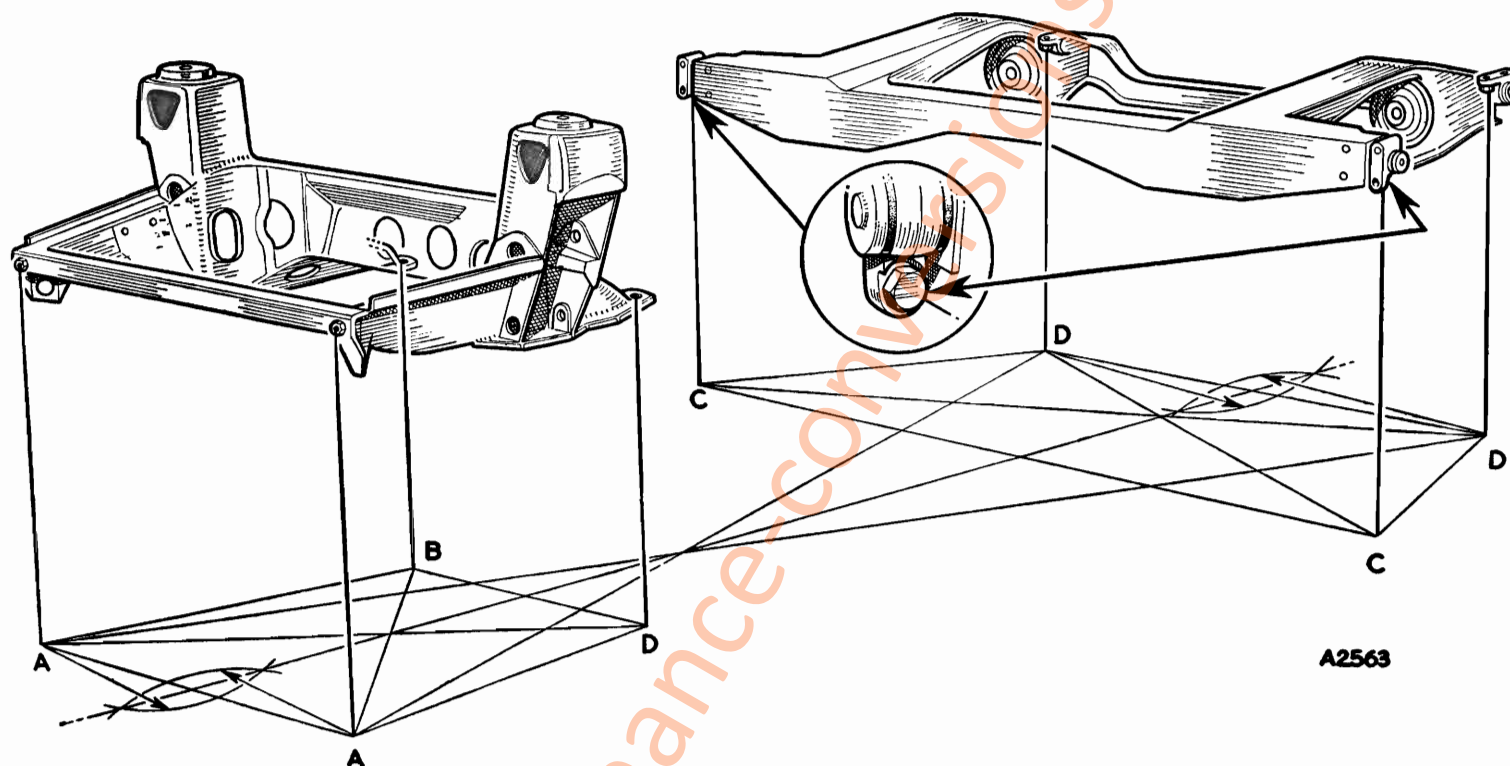
VERTICAL ALIGNMENT CHECK



Code Letter	Dimension	Location
A	10 $\frac{13}{16}$ in. (274.64 mm.)	Front sub-frame mounting (front)
B	16 $\frac{13}{16}$ in. (423.86 mm.)	Front sub-frame mounting (front) to wheel centre
C	1 $\frac{35}{32}$ in. (45.24 mm.)	Wheel centre to tower mounting
D	10 $\frac{7}{32}$ in. (259.56 mm.)	Front sub-frame mounting (tower) to front sub-frame mounting (extreme rear)
E	80 $\frac{1}{8}$ in. (2036.37 mm.) 84 $\frac{1}{8}$ in. (2137.97 mm.)	Saloon Van, Countryman, Traveller, and Pick-up } wheel-base
F	5 $\frac{37}{32}$ in. (148.43 mm.)	Body sill to datum line
G	20 $\frac{31}{32}$ in. (523.08 mm.)	Tower mounting (sub-frame) to datum line

Code Letter	Dimension	Location
H	8 $\frac{3}{4}$ in. (212.72 mm.)	Lower rear sub-frame mounting (front) to datum line
K	2 $\frac{1}{4}$ in. (57.15 mm.)	Mounting hole centres—rear sub-frame mounting (front)
L	14 $\frac{23}{32}$ in. (367.11 mm.)	Rear sub-frame mounting (front)—body face to wheel centre
M	23 $\frac{3}{4}$ in. (599.28 mm.)	Rear sub-frame mounting (front)—body face to rear sub-frame mounting (rear) forward fixing hole
N	2 $\frac{1}{4}$ in. (57.15 mm.)	Rear sub-frame mounting (rear) fixing hole centres
O	12 $\frac{11}{16}$ in. (310.75 mm.)	Rear sub-frame mounting (rear)—body face to datum line

HORIZONTAL ALIGNMENT CHECK



TRANSVERSE DIMENSIONS

AA
Width between centres of the front sub-frame front mounting set screws
26 in. (660.4 mm.)

BB
Width between centres of the front sub-frame rear mounting set screws
16½ in. (412.75 mm.)

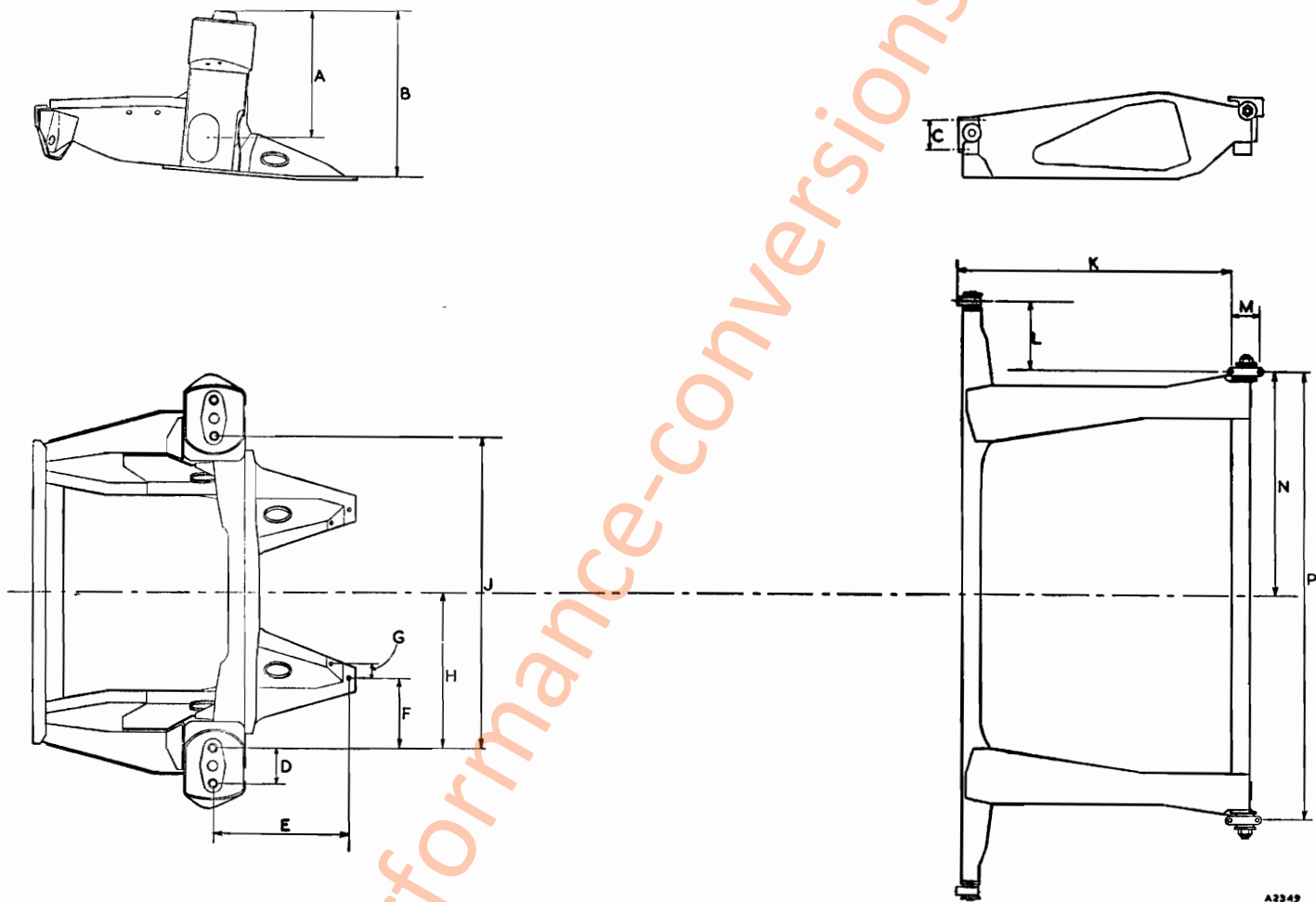
CC
Width between centres of the rear sub-frame front mounting block lower set screws
50½ in. (1282.7 mm.)

DD
Width between centres of the rear sub-frame rear mounting block set screws
38½ in. (977.9 mm.)

A preliminary check of the alignment can best be carried out by the system of diagonals and measurement checks from points projected onto a level floor by means of a plumb-bob.

A centre-line can then be established by means of a large pair of compasses and any deviation from correct alignment will be evident by failure of the diagonals to intersect on the centre-line or by considerable deviations in the measurements.

SUB-FRAME ALIGNMENT DIAGRAM



KEY TO DIMENSIONS

- | | | |
|--|---|--|
| A. $10\frac{3}{4}$ in. $\pm\frac{1}{8}$ in. (276.62 mm. $\pm\frac{1.6}{0}$ mm.). | F. $5\frac{1}{2}$ in. $\pm\frac{1}{16}$ in. (139.7 mm. $\pm\frac{1.6}{0}$ mm.). | L. 6 in. $\pm\frac{1}{16}$ in. (152.4 mm. $\pm\frac{1.6}{0}$ mm.). |
| B. $14\frac{3}{4}$ in. $\pm\frac{1}{8}$ in. (374.45 mm. $\pm\frac{1.6}{0}$ mm.). | G. $1\frac{1}{2}$ in. (38.10 mm.). | M. $2\frac{1}{4}$ in. $\pm\frac{1}{16}$ in. crs. (57.15 mm. $\pm\frac{1.6}{0}$ mm.). |
| C. $2\frac{1}{4}$ in. $\pm\frac{1}{16}$ in. crs. (57.15 mm. $\pm\frac{1.6}{0}$ mm.). | H. $13\frac{3}{8}$ in. $\pm\frac{1}{16}$ in. (346.08 mm. $\pm\frac{1.6}{0}$ mm.). | N. $19\frac{1}{4}$ in. $\pm\frac{1}{16}$ in. (488.75 mm. $\pm\frac{1.6}{0}$ mm.). |
| D. 3 in. $\pm\frac{1}{16}$ in. crs. (76.20 mm. $\pm\frac{1.6}{0}$ mm.). | J. $27\frac{1}{4}$ in. $\pm\frac{1}{16}$ in. (692.55 mm. $\pm\frac{1.6}{0}$ mm.). | P. $38\frac{1}{2}$ in. $\pm\frac{1}{16}$ in. (977.5 mm. $\pm\frac{1.6}{0}$ mm.). |
| E. $10\frac{7}{8}$ in. $\pm\frac{1}{16}$ in. (259.56 mm. $\pm\frac{1.6}{0}$ mm.). | K. $23\frac{3}{4}$ in. $\pm\frac{1}{16}$ in. (598.88 mm. $\pm\frac{1.6}{0}$ mm.). | |

SECTION S

SERVICE TOOLS

This Section includes all Service tools for the Mini range of vehicles including the Mini-Cooper and Mini-Cooper 'S'. The tools which are applicable to the Cooper and Cooper 'S' only are shown in brackets after the 'Operation' description

	Operation	Tool No.	Page No.
ENGINE			
Camshaft liner reaming		{ 18G 123 A S.7 18G 123 AH S.8 18G 123 AJ S.8 18G 123 AN S.8	
Camshaft liner reaming (Cooper and Cooper 'S')		{ 18G 123 A S.7 18G 123 B S.8 18G 123 AN S.8 18G 123 AP S.8 18G 123 AT S.8 18G 123 AQ S.8 18G 123 BA S.8 18G 123 BB S.8 18G 123 BC S.8	
Camshaft liner removing and replacing		{ 18G 124 A S.8 18G 124 K S.9	
Camshaft liner removing and replacing (Cooper and Cooper 'S')	..	{ 18G 124 A S.8 18G 124 B S.9 18G 124 K S.9 18G 124 M S.9	
Circlip removing and refitting		{ 18G 257 S.10 18G 1004 S.17	
Crankshaft and camshaft gear removing		{ 18G 2 S.7 18G 98 S.7	
Crankshaft primary gear oil seal removing and replacing		{ 18G 134 S.9 18G 134 BC S.9 18G 1043 S.18 18G 1068 S.18	
Flywheel and clutch removal (coil spring clutch)		{ 18G 304 S.11 18G 304 M S.11 18G 587 S.15	
Flywheel and clutch removal (diaphragm spring clutch)		{ 18G 304 S.11 18G 304 N S.11 18G 587 S.15	
Flywheel housing bearing removing and replacing		18G 617 A S.16	

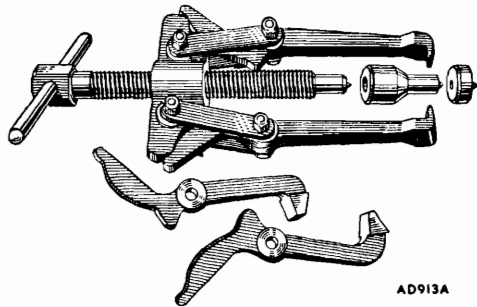
<i>Operation</i>								<i>Tool No.</i>	<i>Page No.</i>
Flywheel oil seal replacing	..	..	..	..	..	..	..	18G 134 18G 134 BH	S.9 S.9
Oil pump relief valve seat grinding	..	..	..	..	..	..	..	18G 69	S.7
Piston refitting	..	..	..	..	..	..	..	18G 55 A	S.7
Piston refitting (Cooper and Cooper 'S')	..	..	..	..	..	..	..	18G 55 A 18G 1002	S.7 S.17
Timing cover oil seal replacing	..	..	..	..	..	..	..	18G 134 18G 134 BD	S.9 S.9
Timing cover refitting	..	..	..	..	..	..	..	18G 138 18G 1044	S.9 S.18
Torque setting nuts and bolts	..	..	..	..	..	..	..	18G 372 18G 536 18G 537 18G 592	S.11 S.12 S.12 S.15
Valve removing and refitting	..	..	..	..	..	..	..	18G 45	S.7
Valve grinding-in	..	..	..	..	..	..	..	18G 29	S.7
Valve seat cutting	..	..	..	..	..	..	..	18G 27 18G 167 18G 167 A 18G 167 B 18G 167 C 18G 167 D	S.7 S.9 S.9 S.1 S.1 S.1
FUEL SYSTEM									
Fuel tank gauge unit removing and refitting	..	..	..	..	..	..	..	18G 1001	S.17
CLUTCH									
Clutch dismantling and reassembling (coil spring clutch)	..	..	..	..	..	..	..	18G 304 M 18G 571	S.11 S.12
Clutch dismantling and reassembling (coil spring clutch—Cooper)	..	..	..	..	..	..	..	18G 304 M 18G 684	S.11 S.16
Clutch dismantling and reassembling (diaphragm spring clutch)	..	..	..	..	..	..	..	18G 304 N 18G 571	S.11 S.12
Clutch dismantling and reassembling (diaphragm spring clutch—Cooper and Cooper 'S')	..	..	..	..	..	..	..	18G 304 N 18G 684	S.11 S.16

<i>Operation</i>	<i>Tool No.</i>	<i>Page No.</i>
TRANSMISSION UNIT		
Change speed shaft oil seal replacement	18G 573	S.13
Circlip removing and refitting	18G 257	S.10
	18G 1004	S.18
Final drive gear removing and refitting	18G 586	S.15
	18G 587	S.15
First and third motion shaft bearing replacement	18G 579	S.14
First motion shaft and bearing removing	18G 284	S.11
	18G 284 B	S.11
First motion shaft bearing circlip—checking for correct thickness circlip	18G 569	S.12
First motion shaft needle-roller bearing removing and replacing	18G 581	S.14
	18G 581 B	S.14
	18G 589	S.15
Idler gear bearing removing and replacing	18G 581	S.14
	18G 582	S.14
Laygear needle-roller bearing replacement	18G 194	S.10
Layshaft reassembly	18G 471	S.12
Synchromesh unit assembling	18G 572	S.13
Third motion shaft bearing removing (3-speed synchromesh)	18G 613	S.15
Third motion shaft bearing removing (4-speed synchromesh)	18G 1127	S.20
Torque setting nuts and bolts	18G 372	S.11
	18G 536	S.12
	18G 537	S.12
DIFFERENTIAL UNIT		
Differential bearing removing and replacement	18G 2	S.7
	18G 578	S.4
Drive shaft coupling flange removing and refitting	18G 669	S.16
Torque setting nuts and bolts	18G 372	S.11
	18G 537	S.12
AUTOMATIC TRANSMISSION		
Auxiliary pump and governor assembly removing and refitting	18G 1094	S.19
	18G 1097	S.20
	18G 1106	S.20
Converter housing oil seal replacing	18G 1068	S.18
	18G 1068 A	S.18
	18G 1087	S.19

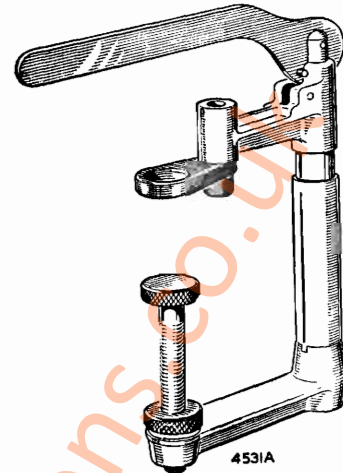
<i>Operation</i>	<i>Tool No.</i>	<i>Page No.</i>
Converter housing removing and refitting	{ 18G 1088 18G 1098	S.19 S.20
Converter removing and refitting	{ 18G 587 18G 1086	S.15 S.19
Differential drive shaft coupling removing	18G 1100	S.20
Forward clutch dismantling and reassembling	18G 1102	S.20
Forward clutch hub nut removing and refitting	{ 18G 1095 18G 1096	S.19 S.19
Gear carrier assembly dismantling and reassembling (early-type units)	18G 1093	S.19
Gear carrier assembly dismantling and reassembling (later-type units)	18G 1093 A	S.19
Idler and input gears—checking adjustment	{ 18G 1089 18G 1089 A	S.19 S.19
Pressure and stall checks	{ 18G 677 C 18G 677 Z	S.16 S.16
Converter output gear oil seal removing and replacing	{ 18G 134 18G 134 CN	S.9 S.9
Top and reverse clutch dismantling and reassembling	18G 1103	S.20
Top and reverse clutch hub removing and refitting	{ 18G 1095 18G 1096	S.19 S.19
Torque setting	{ 18G 372 18G 537 18G 592	S.11 S.12 S.15
DRIVE SHAFTS		
Constant velocity joint—checking ball cage and inner race	{ 18G 1012 18G 1099	S.18 S.20
Drive shaft removing and refitting	{ 18G 1063 18G 304 or 18G 304 Z 18G 304 F	S.18 S.11 S.11 S.11
Torque setting	18G 372	S.11
REAR SUSPENSION		
Displacer unit or strut removing and refitting	18G 703	S.17
Hub bearing outer race removing	{ 18G 260 18G 260 C	S.10 S.10
Hub removing	{ 18G 304 or 18G 304 Z 18G 304 F	S.11 S.11 S.11

<i>Operation</i>	<i>Tool No.</i>	<i>Page No.</i>
Hydrolastic suspension—checking pressure	[18G 685 18G 703	S.17 S.17
Hydrolastic suspension—depressurizing, evacuating, and pressurizing	18G 703	S.17
Radius arm bush reaming	[18G 588 18G 588 A	S.15 S.15
Radius arm bushes removing and replacing	[18G 583 18G 584	S.14 S.15
Radius arm needle bearing removing and replacing	[18G 583 18G 583 B 18G 620	S.14 S.15 S.16
Radius arms (Hydrolastic suspension) removing and refitting ..	18G 703	S.17
Sub-frame (Hydrolastic models) removing and refitting	18G 703	S.17
STEERING GEAR		
Steering rack dismantling and reassembling	[18G 207 18G 207 A 18G 707	S.10 S.10 S.17
Steering rack tie-rod ball joint removal	18G 1063	S.18
Torque setting	[18G 372 18G 537	S.11 S.12
FRONT SUSPENSION		
Displacer unit or strut removing and refitting	18G 703	S.17
Hydrolastic suspension—checking pressure	[18G 685 18G 703	S.17 S.17
Hydrolastic suspension—depressurizing, evacuating, and pressurizing	18G 703	S.17
Lower arm removal	18G 1063	S.18
Spring unit or strut (Rubber suspension models) removing and refitting	[18G 574 B 18G 1063	S.13 S.18
Swivel hub joint removing and replacing	[18G 587 18G 1063	S.15 S.18
Swivel hub dismantling, fitting bearings, and reassembling	[18G 304 or 18G 304 Z 18G 304 F 18G 575 18G 260 18G 260 H	S.11 S.11 S.11 S.14 S.10 S.10

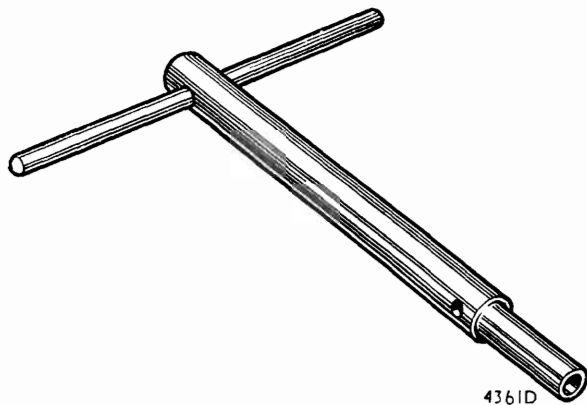
<i>Operation</i>	<i>Tool No.</i>	<i>Page No.</i>
Swivel hub driving flange removing (without dismantling the swivel hub)	18G 284	S.11
	18G 304 or	S.11
	18G 304 Z	S.11
	18G 304 F	S.11
	18G 304 P	S.11
Swivel hub outer oil seal replacing	18G 284	S.11
	18G 304 or	S.11
	18G 304 Z	S.11
	18G 304 F	S.11
	18G 304 P	S.11
	18G 705	S.17
	18G 705 B	S.17
Swivel hub removing and refitting	18G 1063	S.18
Torque setting nuts and bolts	18G 372	S.11
	18G 537	S.12
Upper arm (Hydrolastic suspension models) removing, dismantling, and reassembling	18G 581	S.14
	18G 582	S.14
	18G 582 A	S.14
	18G 703	S.17
	18G 1063	S.18
Upper arm (rubber suspension models) removing, dismantling, and reassembling	18G 574 B	S.13
	18G 581	S.14
	18G 582	S.14
	18G 582 A	S.14
	18G 1063	S.18
BRAKING SYSTEM		
Brake adjusting	18G 619 A	S.16
Disc brake piston seal replacing (Cooper and Cooper 'S')	18G 672	S.16
BODY		
Body alignment checking	18G 560	S.13
	18G 560 A	S.13
	18G 560 E	S.13
Body alignment checking (not illustrated)	Churchill 7/700	
Windscreen and back-light glass refitting.. .. .	18G 468	S.12
	18G 468 A	S.12



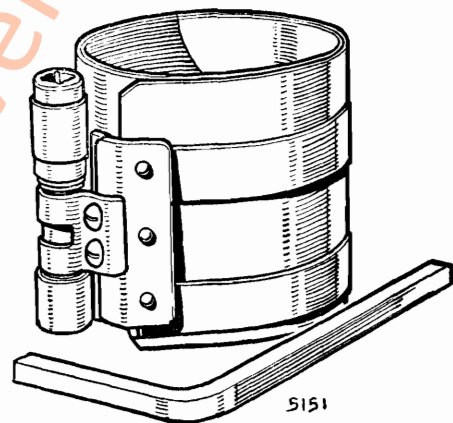
18G 2. Crankshaft Gear and Pulley Remover



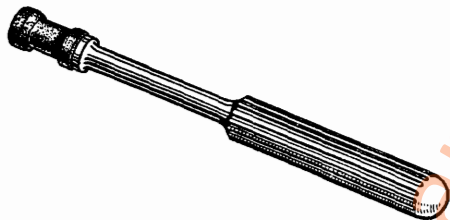
18G 45. Valve Spring Compressor



18G 27. Valve Seat Cutter Handle



18G 55 A. Piston Ring Compressor



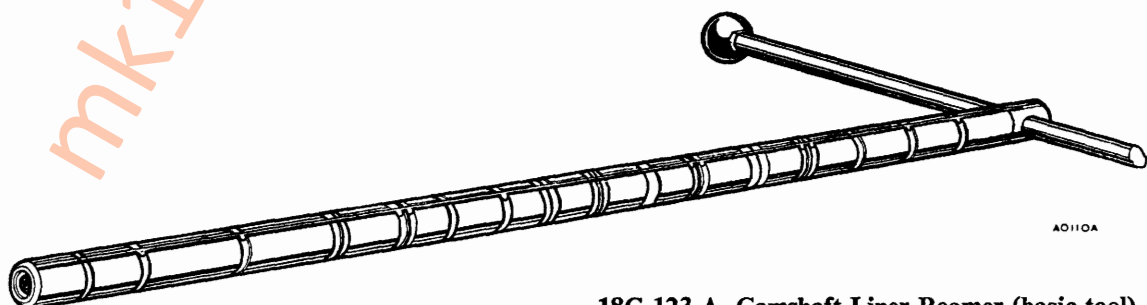
18G 29. Valve Suction Grinder



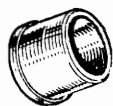
18G 98. Shock Spanner



18G 69. Oil Pump Release Valve Grinding-in Tool

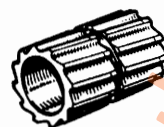


18G 123 A. Camshaft Liner Reamer (basic tool)



A1039

18G 123 AH. Camshaft Liner Reamer Pilot—Centre



A4964

18G 123 B. Camshaft Liner Reamer Cutter



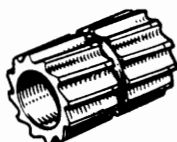
A1039

18G 123 AJ. Camshaft Liner Reamer Pilot—Rear



A4963

18G 123 BA. Camshaft Liner Reamer Pilot—Rear



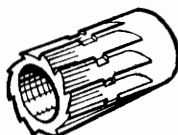
A1039

18G 123 AN. Camshaft Liner Reamer Cutter—Front



A4963

18G 123 BB. Camshaft Liner Reamer Pilot—Rear



4946A

18G 123 AP. Camshaft Liner Reamer Cutter—Rear



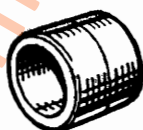
A4963

18G 123 BC. Camshaft Liner Reamer Pilot—Front



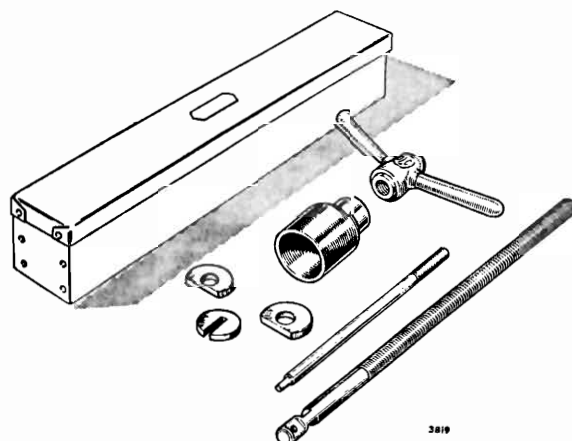
A4963

18G 123 AQ. Camshaft Liner Reamer Pilot—Front



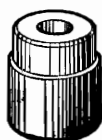
A4963

18G 123 AT. Camshaft Liner Reamer Pilot—Centre



3819

18G 124 A. Camshaft Liner Remover and Replacer (basic tool)



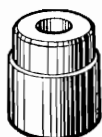
A4933

18G 124 B. Camshaft Liner Remover Adaptor



A1429A

18G 134 BH. Flywheel and Front Hub Oil Seal Replacer Adaptor



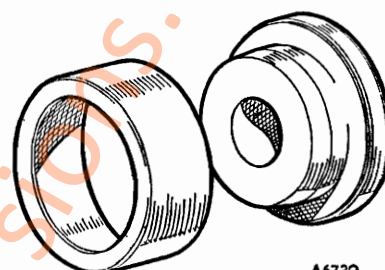
A4933

18G 124 K. Camshaft Liner Remover Adaptor



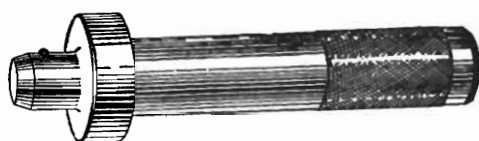
A4138

18G 124 M. Camshaft Liner Remover Adaptor



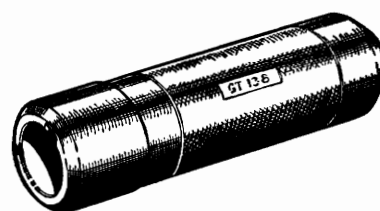
A6720

18G 134 CN. Replacer Oil Seal Stator Carrier



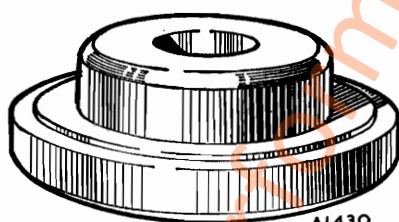
829XX

18G 134. Bearing and Oil Seal Replacer (basic tool)



8138

18G 138. Crankshaft Gear and Pulley Replacer



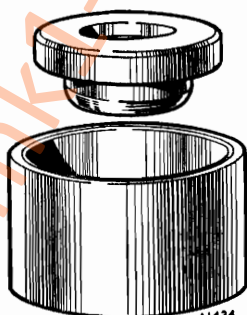
A1430

18G 134 BC. Crankshaft Primary Gear Oil Seal Replacer Adaptor



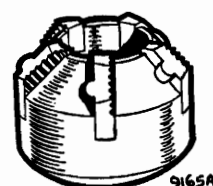
8118

18G 167. Valve Seat Finishing Cutter



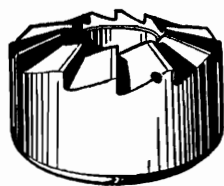
A1424

18G 134 BD. Timing Case Oil Seal Replacer Adaptor

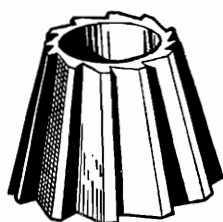


9165A

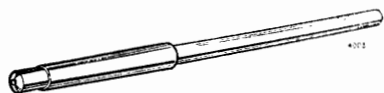
18G 167 A. Valve Seat Glaze Breaker



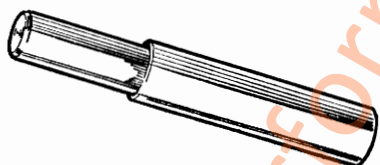
9021B

18G 167 B. Valve Seat Narrowing Cutter—Top

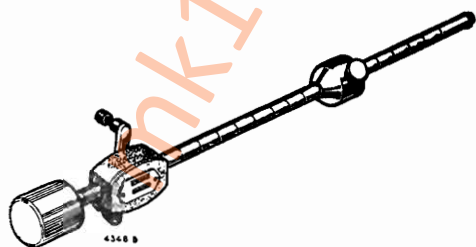
9021A

18G 167 C. Valve Seat Narrowing Cutter—Bottom

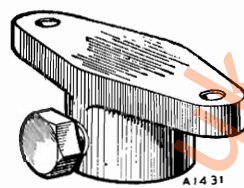
4002

18G 167 D. Valve Seat Cutter Pilot

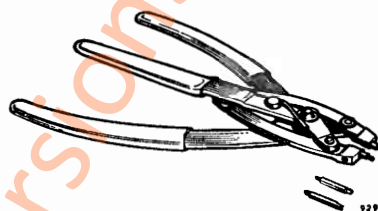
9172

18G 194. Laygear Needle-roller Bearing Replacer

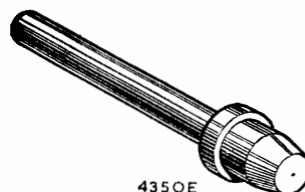
4348 B

18G 207. Bearing Preload Gauge

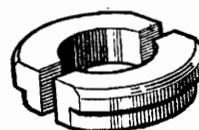
A1431

18G 207 A. Steering Rack Pinion Preload Adaptor

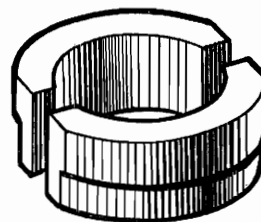
9297

18G 257. Circlip Pliers—Large

4350E

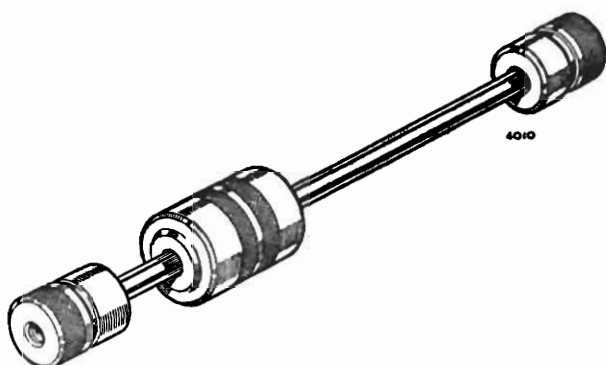
18G 260. Hub Bearing Outer Race Remover (basic tool)

4349E

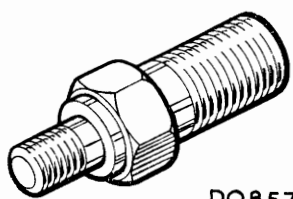
18G 260 C. Hub Bearing Outer Race Remover Adaptor

A1423

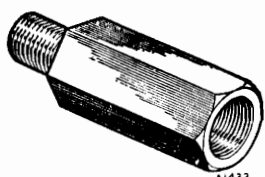
18G 260 H. Front Hub Drive Flange Bearing Outer Race Remover Adaptor



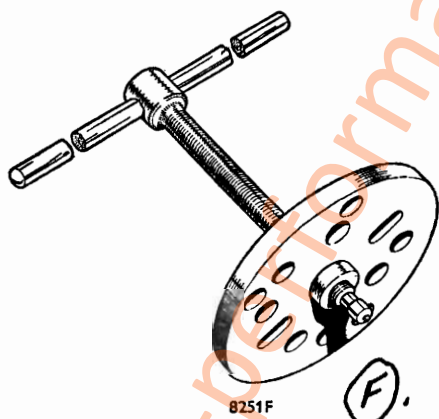
18G 284. Impulse Extractor (basic tool)



18G 284 AJ. Planetary Gear Spindles Remover Adaptor



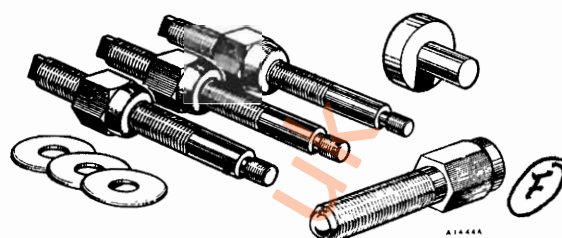
18G 284 B. First Motion Shaft Remover Adaptor



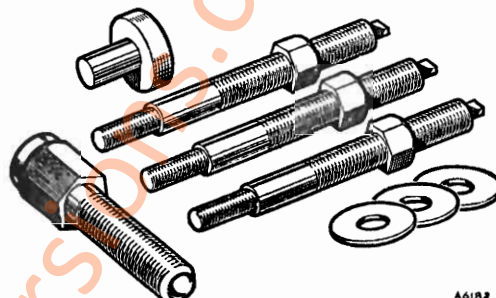
18G 304. Front and Rear Hub Remover (basic tool)



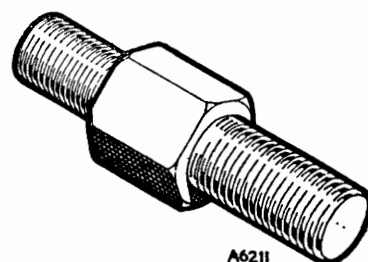
18G 304 F. Front and Rear Hub Remover Bolt Adaptor



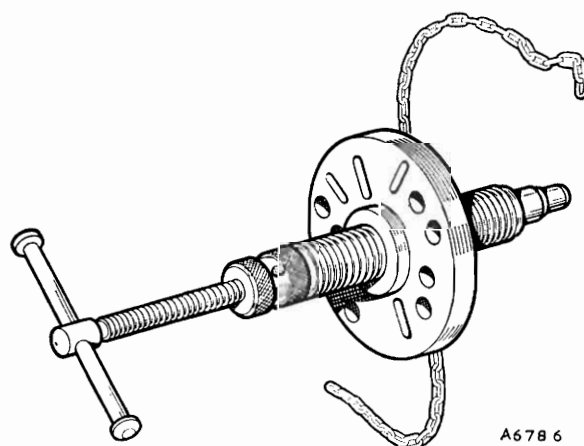
18G 304 M. Flywheel and Clutch Remover Adaptor



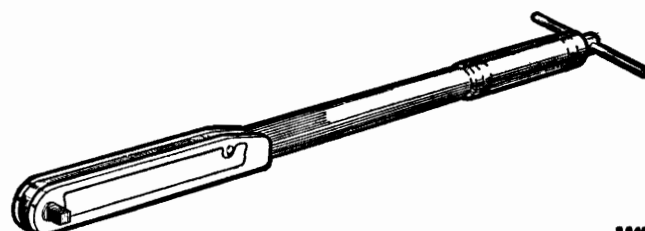
18G 304 N. Flywheel and Clutch Remover Adaptors



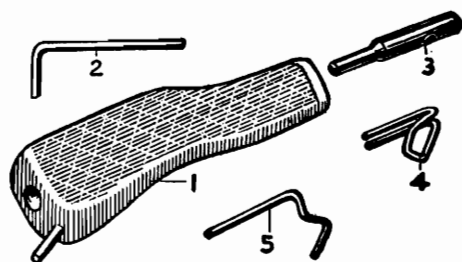
18G 304 P. Drive Flange Remover Adaptor



18G 304 Z. Hub Remover—Hydraulic (basic tool)



18G 372. Torque Wrench—30 to 140 lb. ft. (4 to 20 kg.m.)

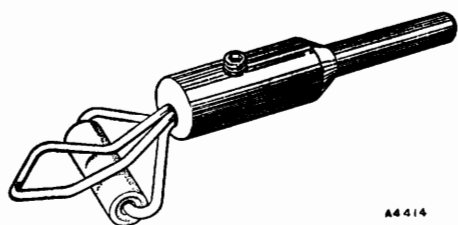


AD994

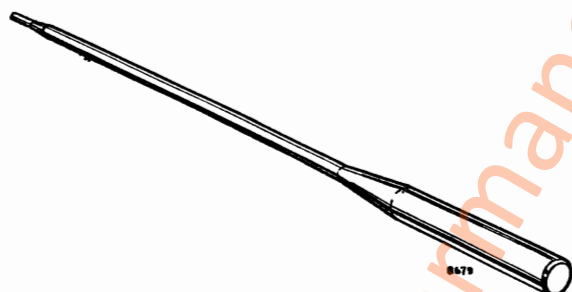
18G 468. Rubber Moulding Glazing Tool

The tool comprises:

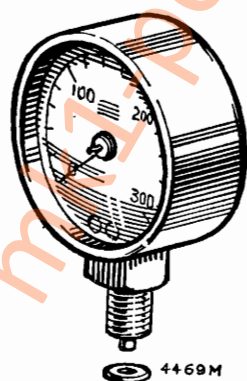
- | | | |
|------------|----------|----------|
| 1. Handle. | 3. Post. | 5. Hook. |
| 2. Key. | 4. Eye. | |



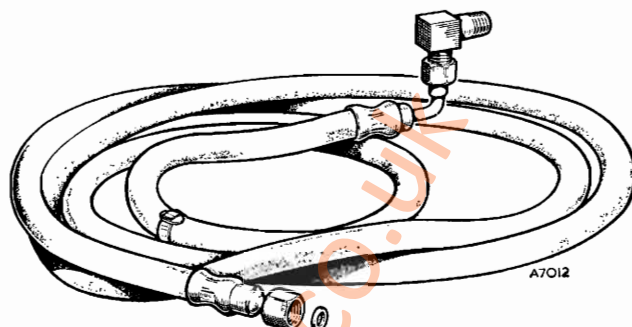
A4414

18G 468 A. Rubber Moulding Glazing Tool Adaptor

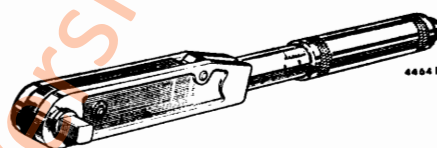
8679

18G 471. Dummy Layshaft

4469M

18G 502 A. Hydraulic Pressure Gauge
S.12

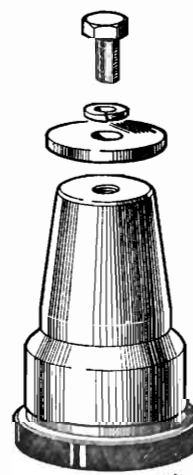
A7012

18G 502 K. Pressure Hose (8 ft.) with Adaptor

4404 K

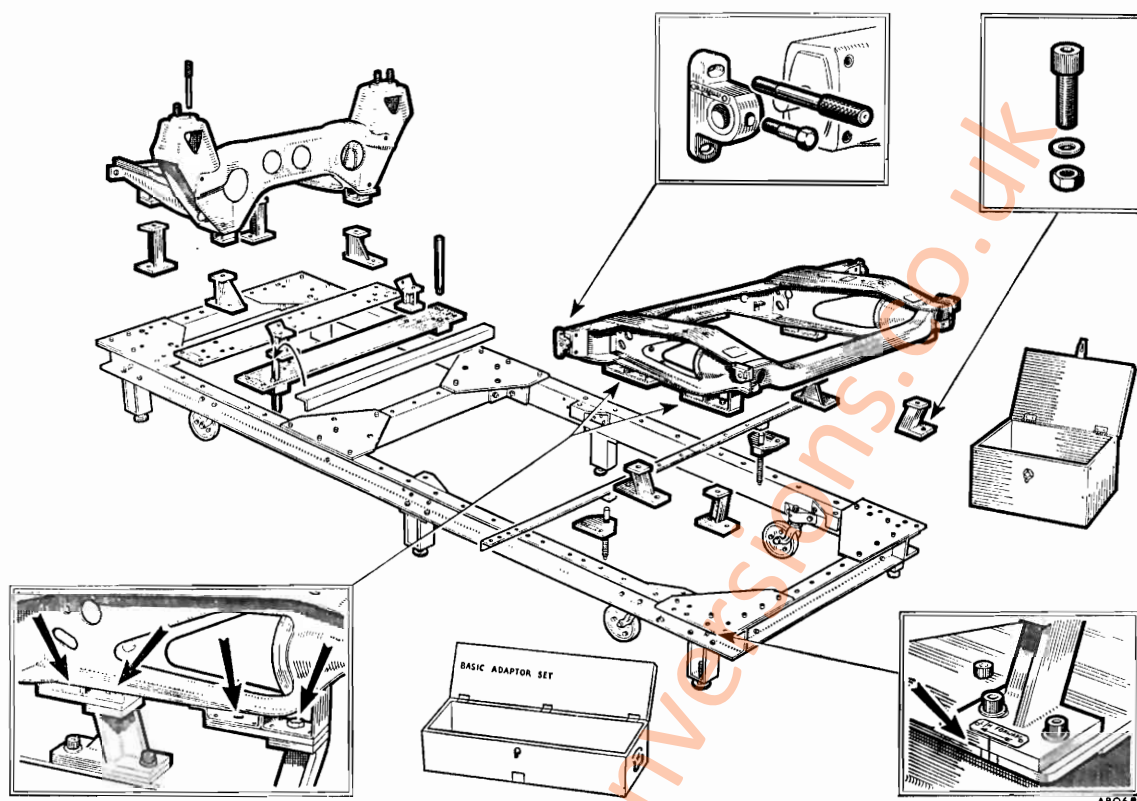
18G 536. Torque Wrench—20 to 100 lb. in. (2 to 8 lb. ft.)
(300 to 1200 gm.m.)**18G 537. Torque Wrench—10 to 50 lb. ft. (2 to 7 kg. m.)**

A1437

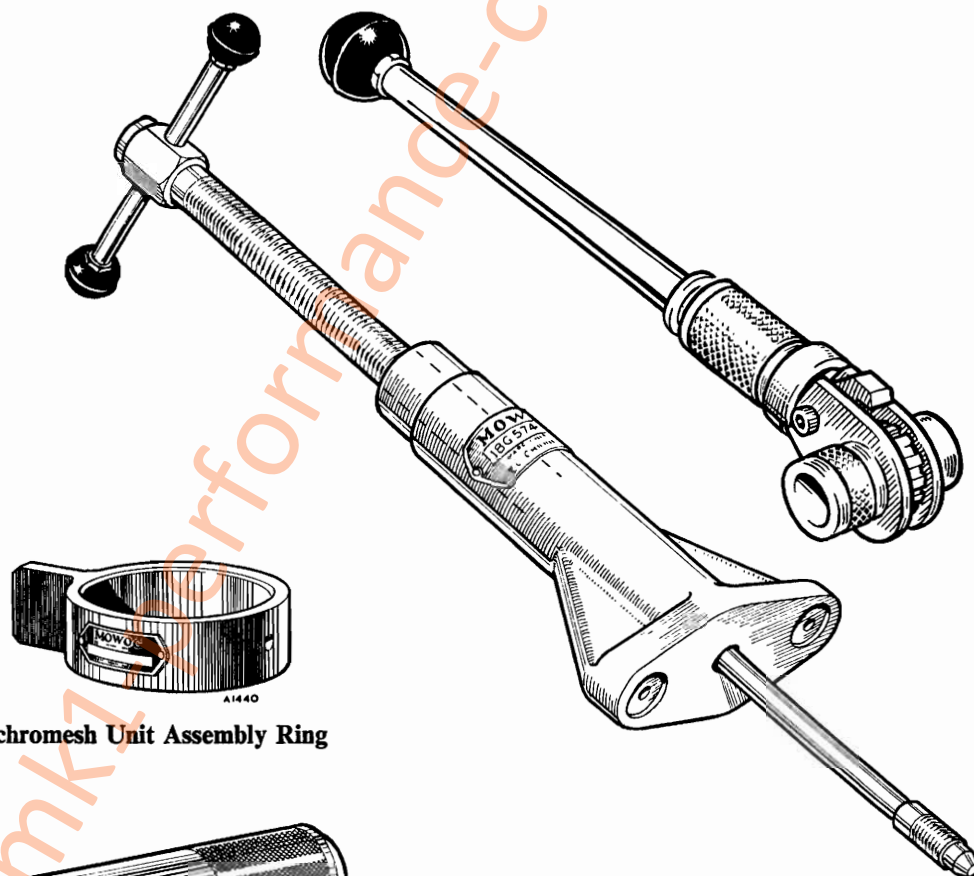
18G 569. First Motion Shaft Bearing Circlip Gauge

A1443

18G 571. Clutch Centralizer



18G 560 E. Body Checking Jig Adaptor Set



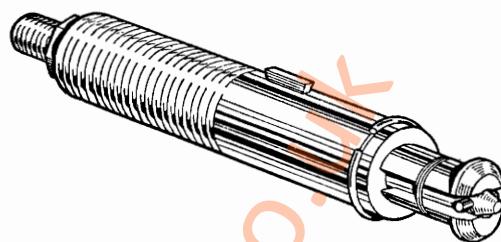
18G 572. Synchromesh Unit Assembly Ring

18G 574 B. Suspension Rubber Spring Compressor

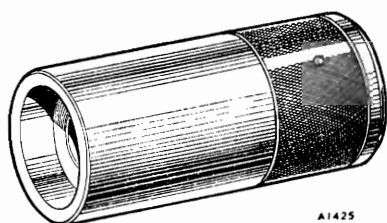
18G 573. Change Speed Shaft Oil Seal Replacer



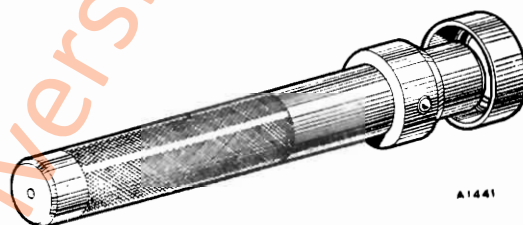
A1427

18G 575. Front Hub Drive Flange Remover

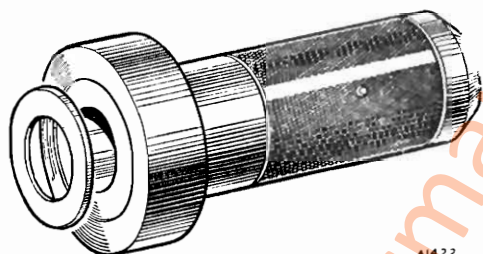
A4464

18G 581 B. First Motion Shaft Spigot Bearing Remover Adaptor

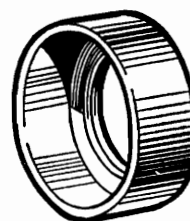
A1425

18G 578. Differential Bearing Replacer

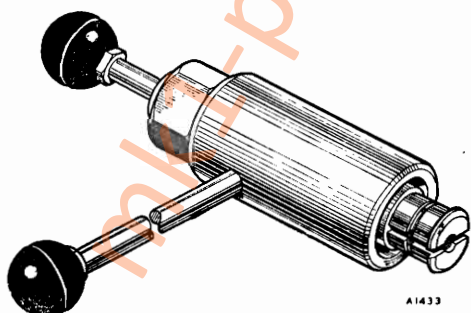
A1441

18G 582. Front Suspension and Idler Gear Bearing Replacer

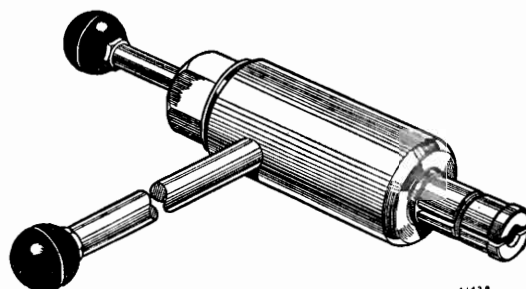
A1422

18G 579. First and Third Motion Shaft Bearing Replacer

A1439

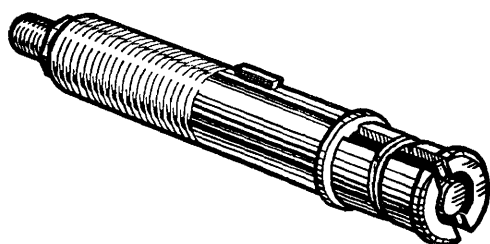
18G 582 A. Front Suspension and Idler Gear Needle Bearing Replacer Adaptor

A1433

18G 581. Front Suspension and Idler Gear Needle-bearing Remover

A1438

18G 583. Rear Radius Arm Bush Remover



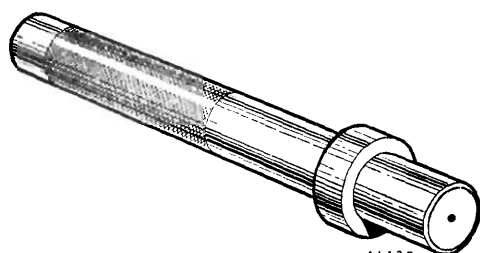
A 4464A

18G 583 B. Rear Radius Arm Needle Bearing Remover Adaptor



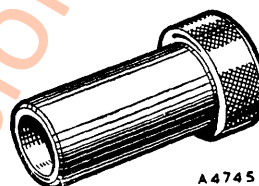
A4468

18G 588. Rear Radius Arm Bush Reamer



A1428

18G 584. Rear Radius Arm Bush Replacer



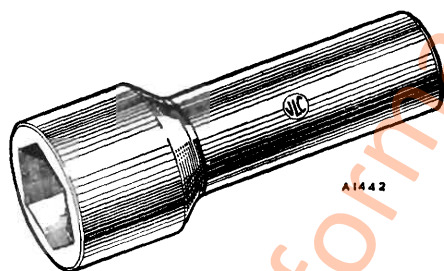
A 4745

18G 588 A. Reamer Guide Bush



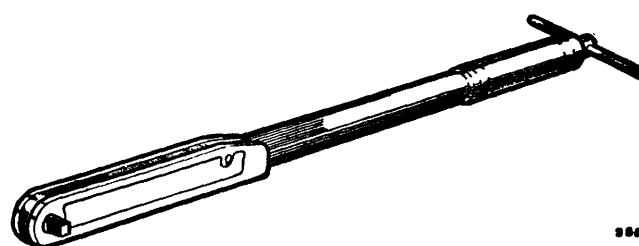
A1822

18G 589. First Motion Shaft Spigot Bearing Replacer



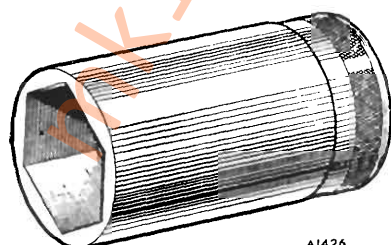
A1442

18G 586. Final Drive Gear Nut Spanner



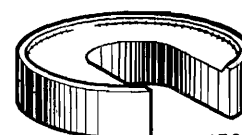
3809

18G 592. Torque Wrench—50 to 225 lb. ft. (5 to 30 kg. m.)



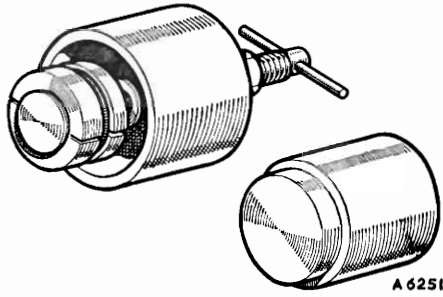
A1426

18G 587. Swivel Hub Ball Pin Nut Spanner

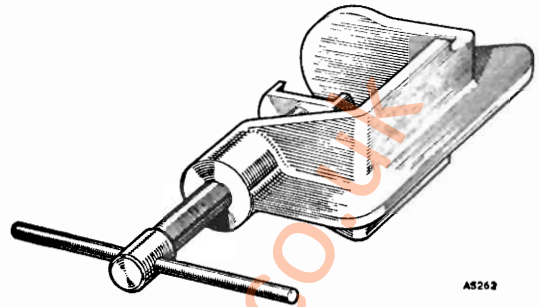


A 4725

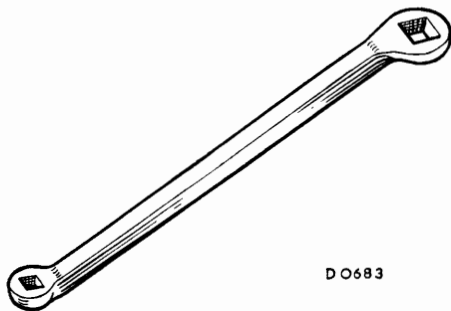
18G 613. Third Motion Shaft Bearing Remover



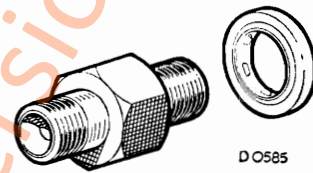
18G 617 A. Flywheel Housing Bearing (First Motion Shaft) Outer Race Remover/Replacer



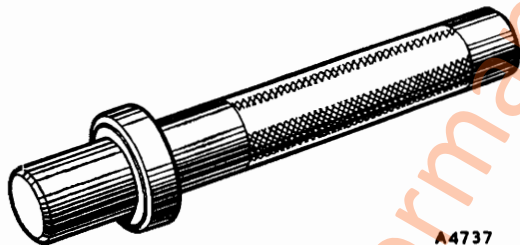
18G 672. Disc Brake Piston Seal Replacer



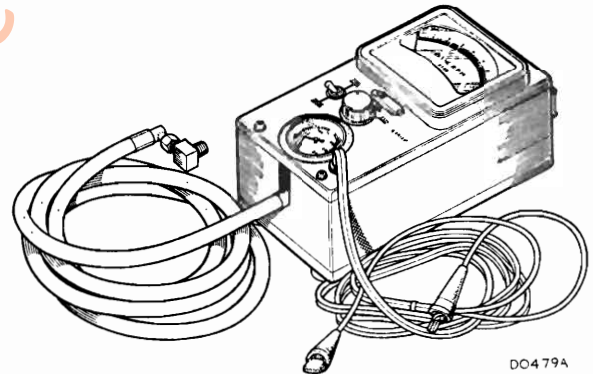
18G 619 A. Brake Adjusting Spanner



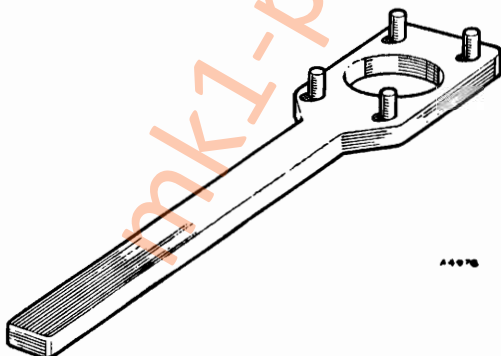
18G 677 C. Pressure Test Equipment Adaptor



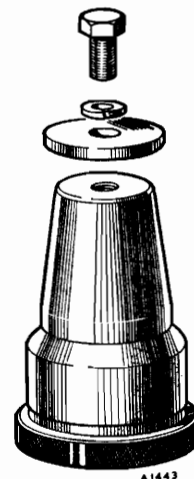
18G 620. Rear Radius Arm Needle Bearing Replacer



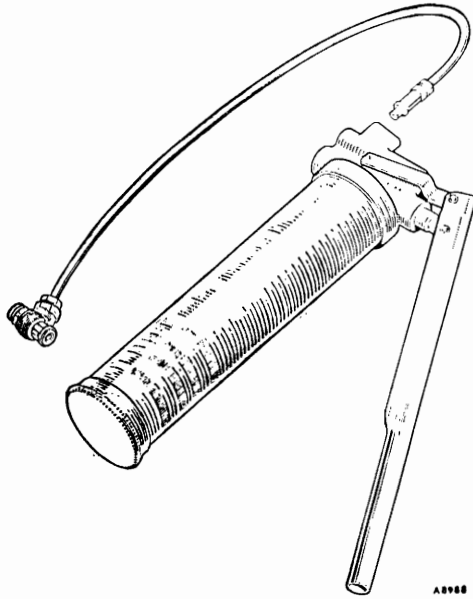
18G 677 Z. Pressure Test and Tachometer Equipment



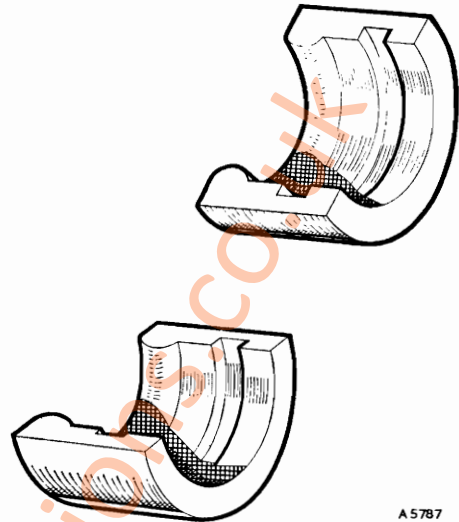
18G 669. Drive Shaft Coupling Flange Wrench
S.16



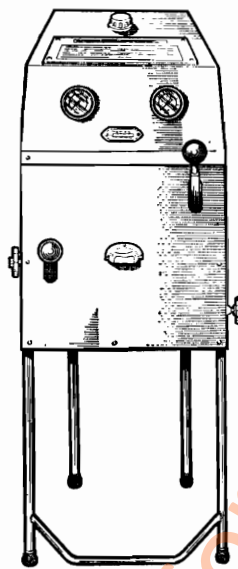
18G 684. Clutch Centralizer



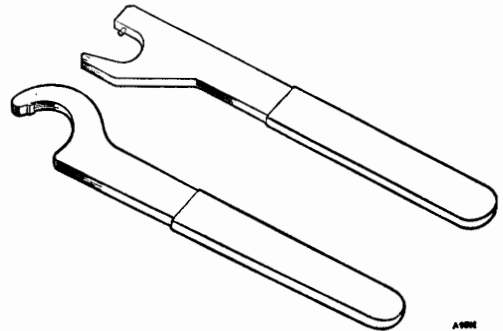
18G 685. The Hydrolastic Hand Pump



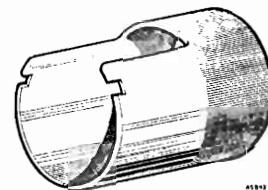
18G 705 B. Bearing Centre Race Remover Adaptor



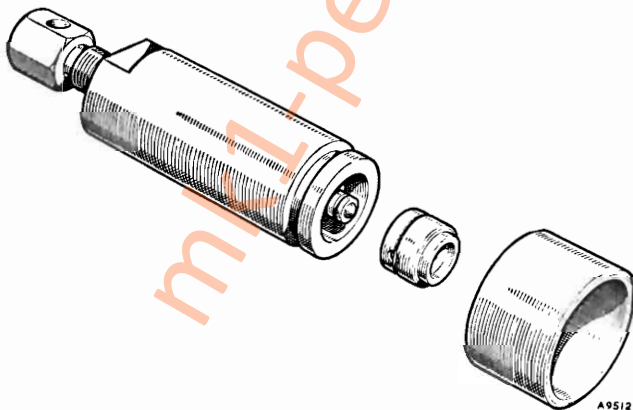
18G 703. The Hydrolastic Suspension Service Unit



18G 707. Steering Rack Ball Joint Spanners

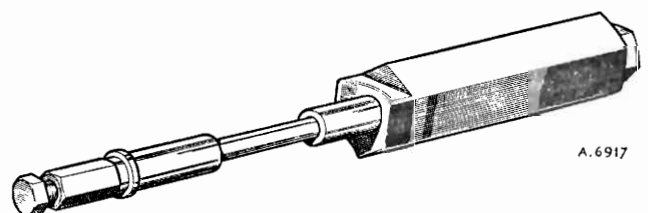


18G 1001. Gauge Locking Ring

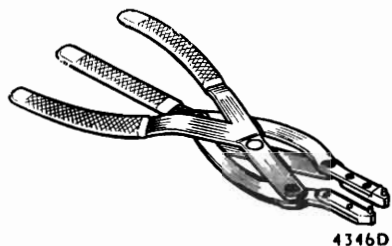


18G 705. Bearing Centre Race Remover (basic tool)

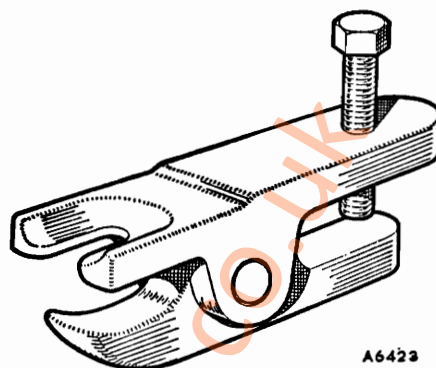
MINI. Issue 1. 4908



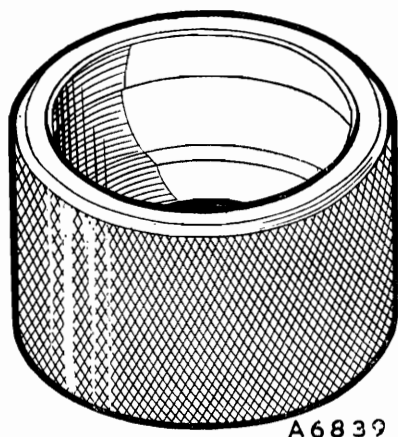
18G 1002. Gudgeon pin removing and replacing tool



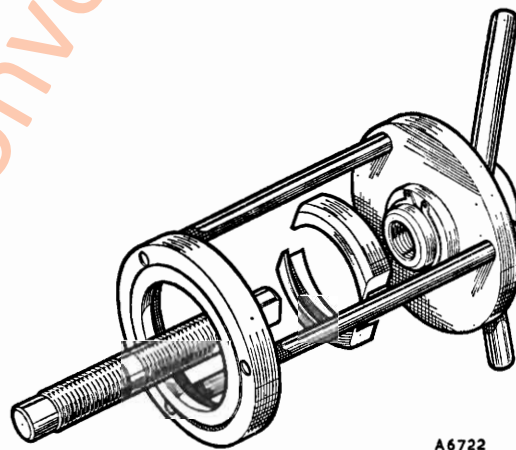
18G 1004. Circlip Pliers



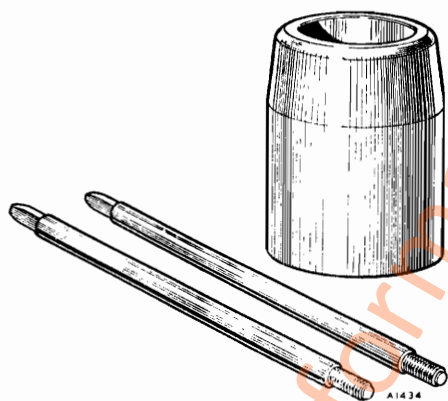
18G 1063. Steering Arm and Swivel Hub Ball Pin Remover



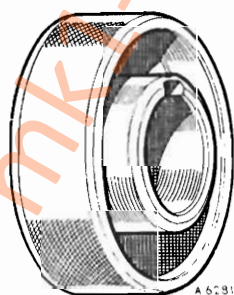
18G 1012. Selection Gauge—Constant Velocity Joint



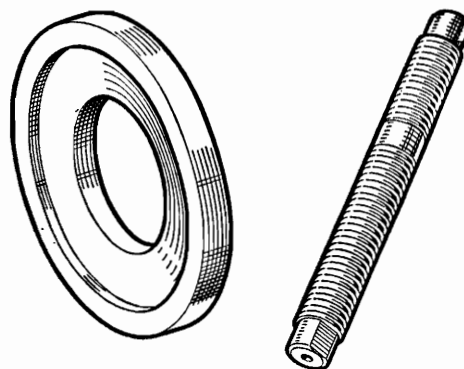
18G 1068. Remover and Replacer (basic tool)



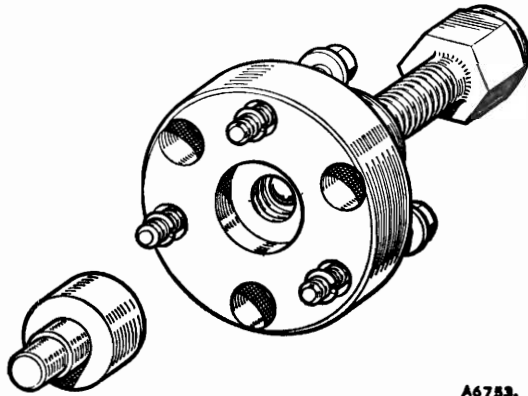
18G 1043. Crankshaft Primary Gear Oil Seal Protector Sleeve



18G 1044. Engine Front Cover Centralizer
S.18

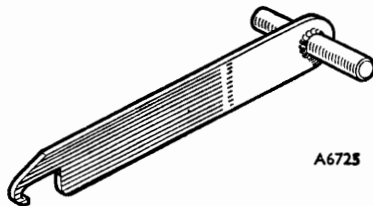


18G 1068 A. Adaptor Set—Replacer Converter Housing Oil Seal. Use with 18G 1068



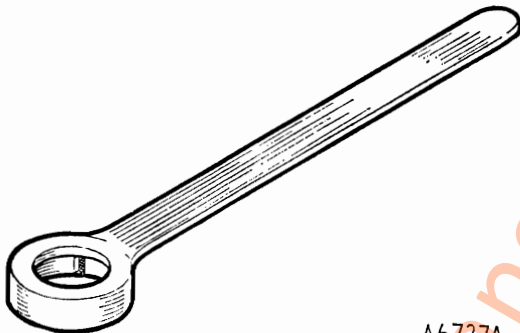
18G 1086. Converter Remover

A6753.



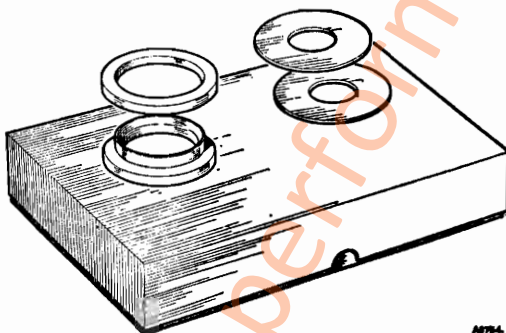
18G 1087. Converter Housing Oil Seal Remover

A6725



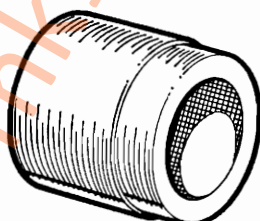
18G 1088. Converter Output Gear Holding Tool

A6727A



18G 1089. Idler and Input Gear Gauge Kit

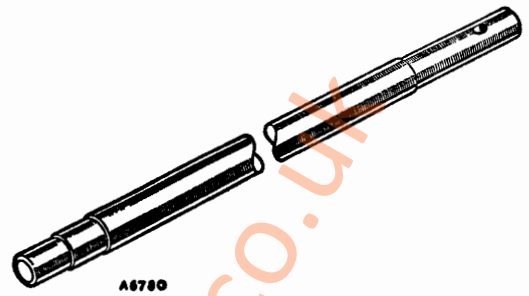
A6764.



D 0309

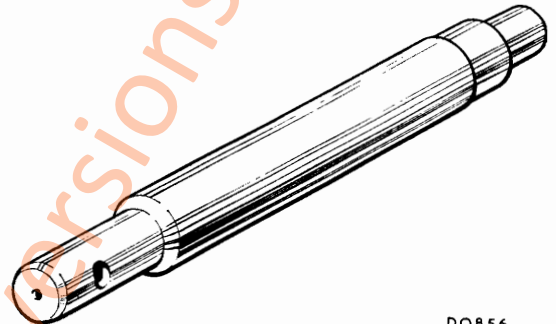
18G 1089 A. Input Gear Gauge Kit Adaptor

MINI. Issue 2. 16495



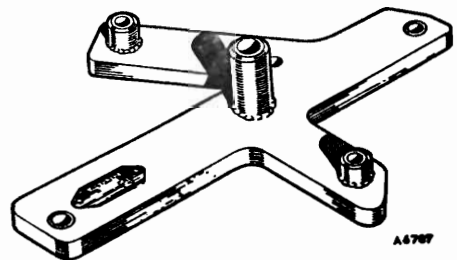
A6780

18G 1093. Dummy Shaft—Forward Gear Carrier Assembly



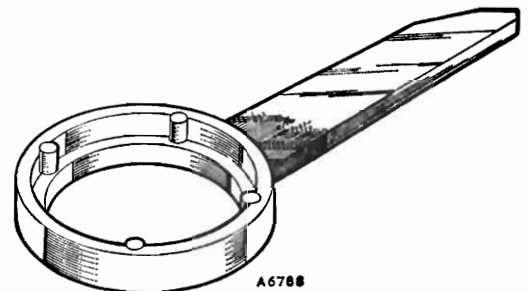
DO856

18G 1093 A. Dummy Shaft—Forward Gear Carrier



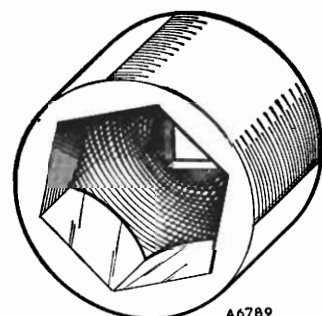
A6787

18G 1094. Positioning Fixture—Oil Pump Pipes



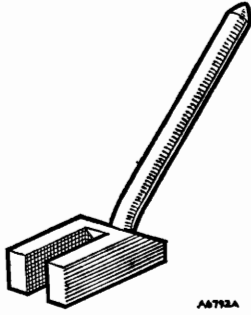
A6788

18G 1095. Holder—Top and Reverse Clutch Hub

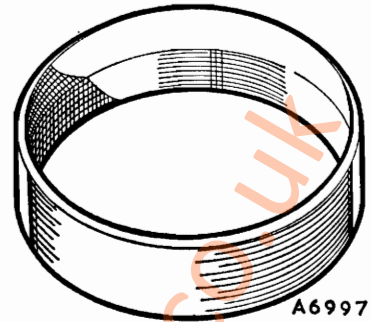


A6789

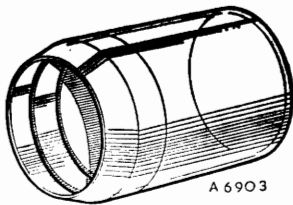
18G 1096. Socket Spanner—Forward Clutch Hub Nut



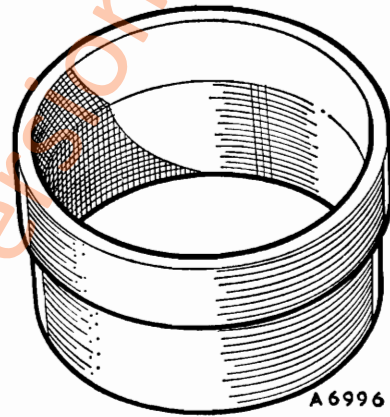
18G 1097. Retainer—Forward Clutch



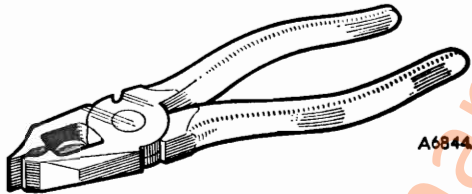
18G 1102. Replacer—Forward Clutch Piston Seal



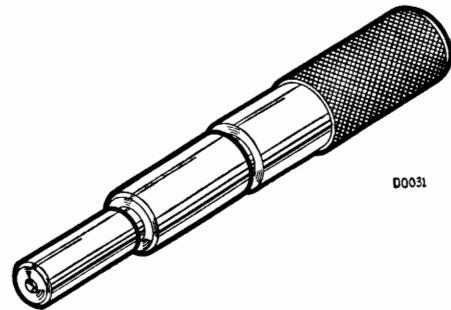
18G 1098. Protector Sleeve—Converter Output Gear Oil Seal



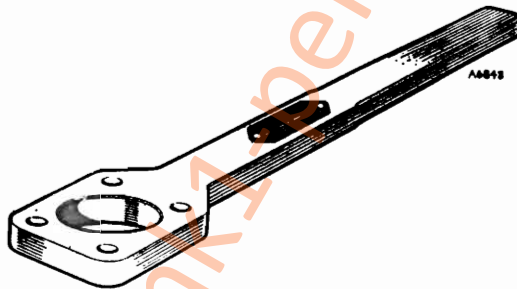
18G 1103. Replacer—Reverse Clutch Piston Seal



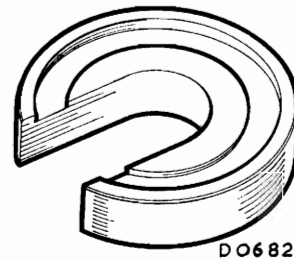
18G 1099. Pliers—Retaining Clip—Drive Shaft Boots



18G 1106. Centralizer—Governor Housing



18G 1100. Wrench—Drive Shaft Coupling Flange



18G 1127. Third Motion Shaft Bearing Remover
(Use on four-speed synchromesh transmission.)

RECOMMENDED LUBRICANTS

RECOMMENDED LUBRICANTS

Component	Engine/Transmission Unit, Oil-can and Carburetter(s)			Grease Points	Upper Cylinder Lubrication
Climatic conditions	All temperatures above -12° C. (10° F.)	Temperatures -18° to -7° C. (0° to 20° F.)	All temperatures below -18° C. (0° F.)	All conditions	All conditions
BP	BP Super Visco-Static 20W/50	BP Super Visco-Static 10W/40	BP Super Visco-Static 5W/20	BP Energrease L. 2	BP Upper Cylinder Lubricant
CASTROL	Castrol XL (20W/50) or Castrol GTX	Castrolite or Castrol Super	Castrol CR 5W/20	Castrolase LM	Castrollo
DUCKHAMS	Duckhams Q20-50	Duckhams Q5500	Duckhams Q5-30	Duckhams L.B. 10 Grease	Duckhams Adcoild Liquid
ESSO	Esso Extra Motor Oil 20W/50	Esso Extra Motor Oil 10W/30	Esso Extra Motor Oil 5W/20	Esso Multipurpose Grease H	Esso Upper Cylinder Lubricant
FILTRATE	Filtrate 20W/50	Filtrate 10W/30	Filtrate 5W/20	Filtrate Super Lithium Grease	Filtrate Petroyle
MOBIL	Mobiloil Special 20W/50	Mobiloil Super 10W/40	Mobiloil 5W/20	Mobilgrease M.P.	Mobil Upperlube
SHELL	Shell Super Motor Oil 100 (20W/50)	Shell Super Motor Oil 101 10W/30	Shell Winter Special Motor Oil or Shell Super Motor Oil 5W/30	Shell Retinax A	Shell Upper Cylinder Lubricant
STERNOL	Sternol W.W. Multigrade 20W/50	Sternol W.W. Multigrade 10W/40	Sternol W.W. Multigrade 5W/20	Ambroline L.H.T.	Sternol Magikoyl

In no circumstances must any additive be introduced into the lubricants recommended for the automatic transmission.

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