LEYLAND

P-76

Workshop Manual

LEYLAND
AUSTRALIA

A LEYLAND AUSTRALIA
SERVICE PUBLICATION

LEYLAND MOTOR CORPORATION OF AUSTRALIA LIMITED

LEYLAND

P-76

Workshop Manual

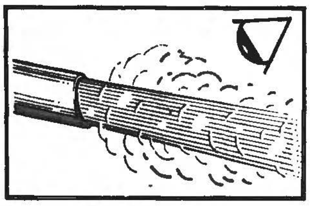
— The Leyland P76 is a medium sized four door sedan and is available in different versions.

— Two engines available — 2623 cc E6 and 4416 cc V8.

— Three or four speed manual gearbox.
— Three speed automatic transmission.

— Four trim levels — Level 1 — Basic
Level 2 — Deluxe
Level 3 — Super
Level 4 — Executive

IMPORTANT. This vehicle has been designed with engine emission control in accordance with legislation requirements. All maintenance checks and adjustments should be entrusted to a LEYLAND DEALER.



This manual is based on the latest information available at the time of compilation, however the right to make changes at any time is reserved.

Registered at the G.P.O. Sydney for transmission by post as a book.

A LEYLAND AUSTRALIA SERVICE PUBLICATION
PART No. TP854

SECTION INDEX

LEYLAND AUSTRALIA
Service

LEYLAND MOTOR CORPORATION OF AUSTRALIA LIMITED
893-931 South Dowling Street, Waterloo. Box 6, P.O. Waterloo,
N.S.W. 2017

MANUAL ARRANGEMENT

This manual has been compiled for use as a reference book for the competent mechanic. It will also serve the needs of the less experienced because the sections contain step by step instructions for each repair operation.

Emphasis has been placed on correct method and sequence in all repair operations so that the work may be carried out in the least possible time. The appropriate special service tools are listed for each job.

Complete vehicle specifications and data are grouped in the one section at the front of the book. (Section B).

Each manual section is provided with its own table of contents. Page numbers follow the section letters for easy identification.

e.g. Page F-5 is the 5th page of Section F.

Illustration numbers follow the same procedure. e.g. Fig. H-4 is the 4th illustration in Section H.

The following terminology has been adopted.

Left and Right Hand	As viewed from the driving position.
Power Unit	Refers to the complete engine, clutch and transmission assembly.
Removing and Replacing	Refers to the removal of a complete unit or assembly and its replacement to the vehicle. It does not include overhauling of the unit.
Overhauling	Refers to the dismantling and assembling of a unit or component and any necessary adjustments or reconditioning incurred in the operation.

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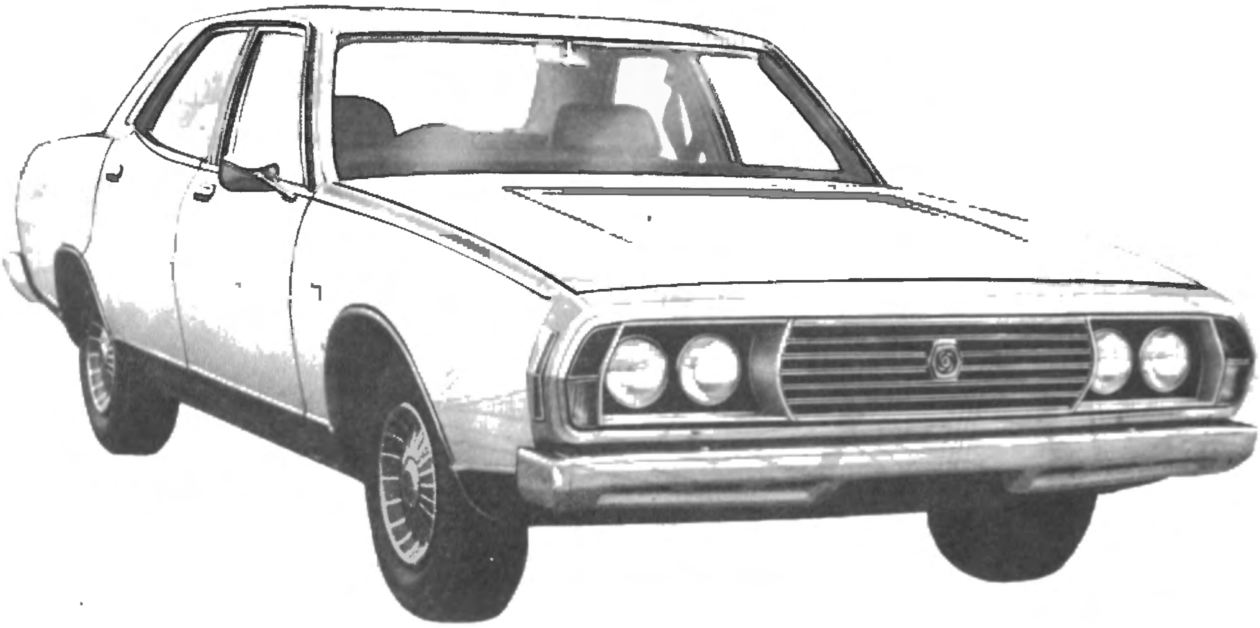


SUPER AND EXECUTIVE

DELUXE

INTRODUCED JUNE 1973

SERIAL NUMBERS AND IDENTIFICATION PLATES

When ordering replacement parts it is essential that the vehicle be correctly identified by quoting complete the type code, serial number and engine number.

In some cases it may also be necessary to quote the transmission and/or rear axle code and serial number.

TYPE CODE AND SERIAL NUMBERS

This information will be found on the Compliance Plate.

EMISSION CONTROL

Particulars related to engine adjustment for emission control are found on a sticker situated alongside the paint identification on the left hand valance, near the front suspension housing. Fig. A-1-3.

WARNING

THE CARBURETTOR ON THIS VEHICLE HAS BEEN SET TO COMPLY WITH AUSTRALIAN VEHICLE EMISSION LEGISLATION

REFER TO YOUR DEALER FOR ADJUSTMENT

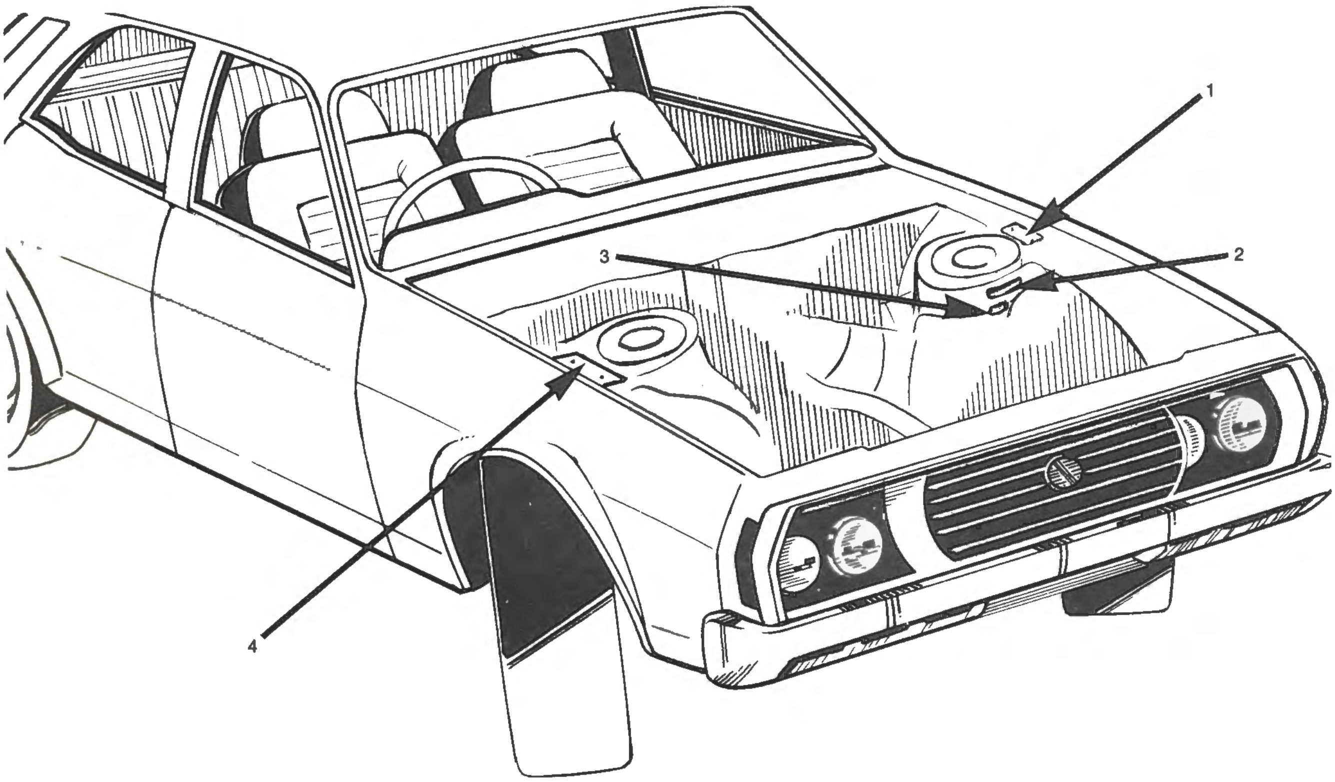


Fig. A-1

COMPLIANCE PLATE

The vehicle type, serial number, date of manufacture, seating capacity and the number of Australian Design Rules incorporated in the vehicle are shown on this plate; it is located adjacent to the top of the front suspension housing, left hand valance. Fig. A-1-1.

THIS VEHICLE WAS MANUFACTURED BY
LEYLAND MOTOR CORPORATION OF AUSTRALIA LTD.
TO COMPLY WITH AUSTRALIAN DESIGN RULE Nos.

1 2 3 4 5A 6 7 8 9 10B 11 12 14 15 16 18 20 21
22 24 25 26

P76 076B4S4A44/1234
5-73 SEATING CAP. 5

THIS PLATE IS AFFIXED WITH THE APPROVAL OF THE
AUSTRALIAN MOTOR VEHICLE CERTIFICATION BOARD

PAINT IDENTIFICATION

Details of paint finish and colour are indicated on a pressure sensitized sticker attached to the forward face of the front suspension housing, left hand valance. Fig. A-1-2.

LEYLAND AUTOMOTIVE FINISH
REFINISH WITH:—
DURACRYL® ACRYLIC LACQUER
BERGER
CHRYSTAL WHITE HM 5919
A BERGER PAINTS PRODUCT

TYRE DETAILS

A sticker showing full details of size and relative pressures for tyres is attached to the horizontal surface of the right hand side of the air plenum chamber. Fig. A-1-4.

ENGINES TYPE AND SERIAL NUMBER

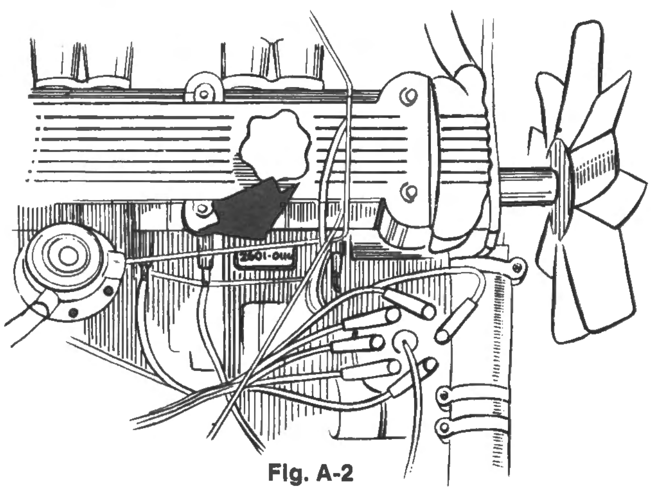


Fig. A-2

6 Cylinder

Stamped into the metal on the right hand side of the cylinder block just below the cylinder head joint face, adjacent to the distributor. Fig. A-2.

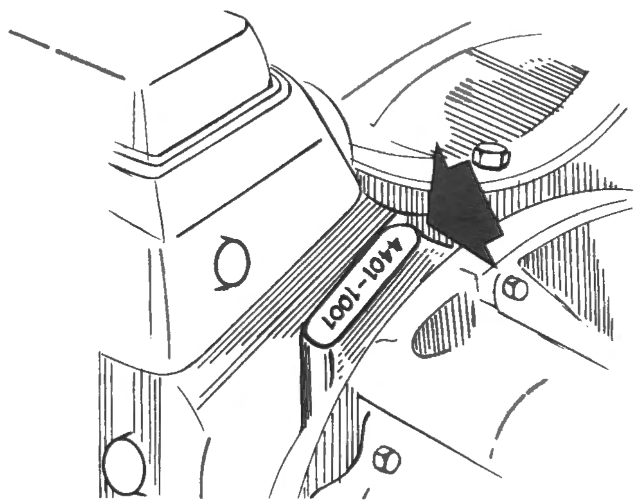


Fig. A-3

8 Cylinder

This is stamped into the metal adjacent to the rear of the left hand bank on flywheel housing. Fig. A-3.

TRANSMISSIONS TYPE AND SERIAL NUMBER

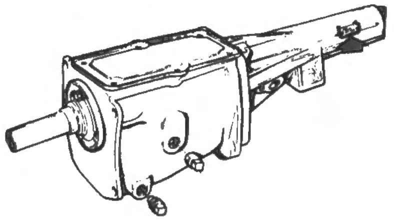


Fig. A-4

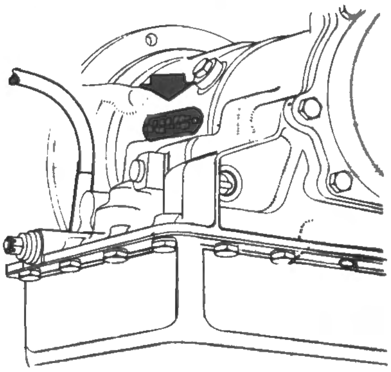


Fig. A-5

Manual Transmission

The manual transmission type and serial number is stamped on the left hand side of the rear extension housing. Fig. A-4.

Automatic Transmission

The automatic transmission type and serial number is stamped on a plate attached to the left hand side centre of the main casing. Fig. A-5.

TYRE DATA			LEYLAND P.76		
RIM PROFILE			5.00 JJ x 14	6.00 JJ x 14	6.00 JJ x 14
TYRE SIZE			6.95S14	E78S14	185SR14
RECOMMENDED PRESSURES	NORM. LOAD	FRONT	138 kPa - 20 psi	138 kPa - 20 psi	152 kPa - 22 psi
		REAR	165 kPa - 24 psi	165 kPa - 24 psi	152 kPa - 22 psi
	FULL LOAD	FRONT	152 kPa - 22 psi	152 kPa - 22 psi	152 kPa - 22 psi
		REAR	180 kPa - 26 psi	180 kPa - 26 psi	180 kPa - 26 psi
TYRE MAX. LOAD AT FULL LOAD PRESSURE		FRONT	1,000 lbs.	1,130 lbs.	1,100 lbs.
		REAR	1,100 lbs.	1,240 lbs.	1,210 lbs.
TYRE LOAD RATING AT MAXIMUM INFLATION PRESSURE 220kPa 32psi			1,230 lbs.	1,400 lbs.	1,360 lbs.
INCREASE NORM.AND FULL LOAD TYRE PRESSURES BY 4 P.S.I. FOR SUSTAINED HIGH SPEED DRIVING					

REAR AXLE SERIAL NUMBER

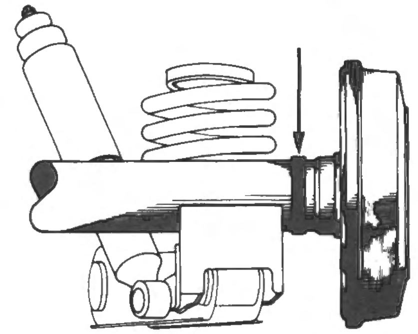


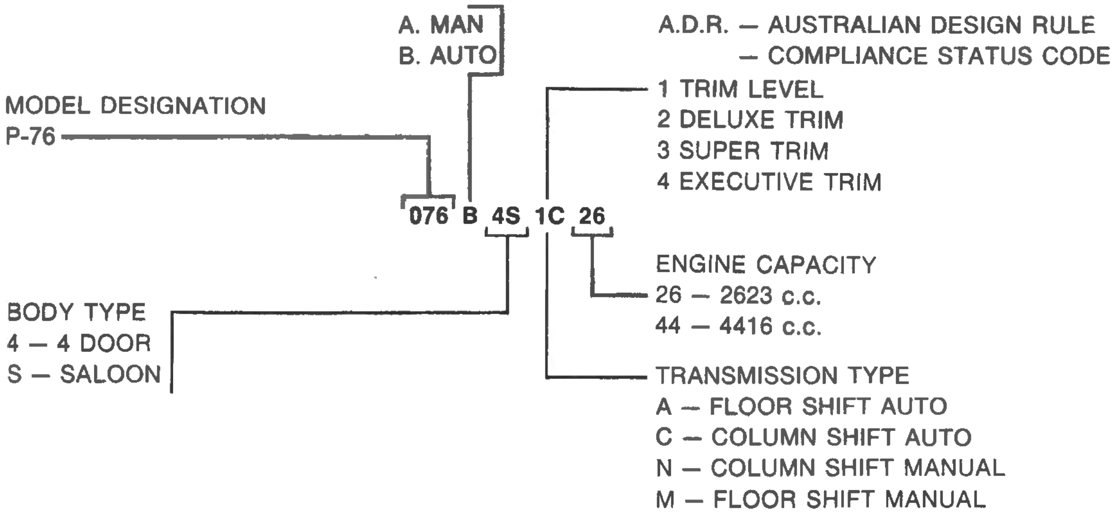
Fig. A-6

The rear axle type and serial number is stamped on a band attached to the right hand side axle tube. Fig. A-6.

VEHICLE CODE

BODY CODE NUMBERING SYSTEM

The first three digits will designate the model the fourth digit is compliance status code. The fifth and sixth digits denote the body type — the number of doors and style, digit number seven indicates the quality level, the eighth digit the transmission type, and the last two indicate the engine capacity.



6 CYLINDER ENGINE — CAPACITY 2.623 LITRES

VERSION	NAME	TYPE	BODY OR CAR SERIAL NUMBER	ENGINE NUMBER	
				PREFIX	SERIAL No.
Column Shift Automatic	Leyland	076X4S1C26	1001	2600	1001
Column Shift Manual	Leyland	076X4S1N26	1001	2601	1001
Column Shift Automatic	Deluxe	076X4S2C26	1001	2600	1001
Floor Shift Manual — 4 Speed	Deluxe	076X4S2M26	1001	2603	1001
Column Shift Manual	Deluxe	076X4S2N26	1001	2601	1001
Floor Shift Automatic	Super	076X4S3A26	1001	2600	1001
Column Shift Automatic	Super	076X4S3C26	1001	2600	1001
Floor Shift Manual — 4 Speed	Super	076X4S3M26	1001	2603	1001

8 CYLINDER ENGINE — CAPACITY 4.416 LITRES

VERSION	NAME	TYPE	BODY OR CAR SERIAL NUMBER	ENGINE NUMBER				
				PREFIX STANDARD	PREFIX WITH P.S.	PREFIX WITH A.C.	PREFIX WITH P.S. & A.C.	SERIAL No.
Column Shift Automatic	Deluxe	076X4S2C44	1001	4400	4404	4408	4412	1001
Floor Shift Manual — 4 Speed	Deluxe	076X4S2M44	1001	4401	4406	4409	4413	1001
Column Shift Manual	Deluxe	076X4S2N44	1001	4402	4407	4410	4414	1001
Floor Shift Automatic	Super	076X4S3A44	1001	4400	4404	4408	4412	1001
Column Shift Automatic	Super	076X4S3C44	1001	4400	4404	4408	4412	1001
Floor Shift Manual — 4 Speed	Super	076X4S3M44	1001	4401	4406	4409	4413	1001
Floor Shift Automatic	Executive	076X4S4A44	1001	—	4404	—	4412	1001

ABBREVIATIONS P.S. — POWER STEERING; A.C. — AIR CONDITIONING

GENERAL DATA

The following data is taken from the latest manufacturing specification and drawings available at the time of publication. The manufacturers reserve the right to vary their specifications with or without notice, and at such times and in such manner as they think fit.

Major as well as minor changes may be involved in accordance with the manufacturers policy of constant product improvement.

Where tolerances are not shown the figures quoted must be regarded as nominal.

Whilst every effort is made to ensure the accuracy of information neither the Manufacturers nor the Distributor or Dealer, by any circumstances, shall be held liable for any inaccuracy or the consequences thereof.

Metric Units and Symbols

Quantity	Metric Unit	Symbol	Approx. conversion factor		
Length	millimetre	mm	25.4	=	1 in
	centimetre	cm	30.5	=	1 ft
	metre	m	0.914	=	1 yd
	kilometre	km	1.61	=	1 mile
Mass	grams	g	28.3	=	1 oz
	kilogram	kg	1	=	2.20 lb
Area	square centimetres	cm^2	6.45	=	1 in^2
Volume	cubic centimetre	cm^3	16.4	=	1 in^3
	cubic decimetre	dm^3	28.3	=	1 ft^3
	cubic metre	m^3	0.765	=	1 yd^3
Volume (fluids)	millilitre	ml	28.4	=	1 fl oz
		ml	586	=	1 pt
	litre	l	1	=	1.76 pt
	litre	l	4.55	=	1 gal
Volume (flow)	litre/second	l/s	4.546	=	1 gal/sec
Force	Newton	N	4.45	=	1 lbf
Moment of force	Newtonmetre	Nm	0.11298	=	1 lbf/in
(Torque)			1.35582	=	1 lbf/ft
Pressure	kilopascal	kPa	6.89	=	1 lbf/in^2
Velocity	kilometres per hour	km/h	1.61	=	1 mph
Temperature	Celsius Temperature	°C	°C		5/9(°F-32)
Power	kilowatt	kW	0.746	=	1 hp

GENERAL DATA

ENGINE:

	6-CYLINDER	8-CYLINDER
Type Symbol — basic	2600	4400
Number of Cylinders and Valve Operation	6-cylinder — in-line overhead camshaft with inverted bucket type tappets.	8-cylinder — Vee configuration, overhead valves with Hydraulic tappets.
Bore	76.2 mm (3.000 in)	88.9 mm (3.50 in)
Stroke	95.76 mm (3.77 in)	88.9 mm (3.50 in)
Capacity	2.623 litres (160.8 in^3)	4.414 litres (269.7 in^3)
Firing Order	153624	18436572
Combustion Chamber Capacity	39.5 ml (2.42 in^3)	36.8 ml (2.24 in^3)
Compression Ratio	9.0:1	9.0:1
Torque (S.A.E. Gross)	224 Nm (165 lb.f.ft) @ 2000 rpm	338 Nm (285 lb.f.ft) @ 2500 rpm
Maximum Power (Brake) (S.A.E. Gross)	90 kW (121 BHP) @ 4500 rpm	143 kW (192 BHP) @ 4250 rpm
R.A.C. Rating	21.6 hp	39.2 hp
Engine Idle Speed — Manual Transmission	550 rpm	650 rpm
Engine Idle Speed — Automatic Transmission	550 rpm in 'P'	700 rpm in 'P'
Compression Pressure — Cranking (Hot)	1170 — 1290 kPa (170-187 psi)	1290-1340 kPa (187-195 psi)
Oversize Bore — First	0.254 mm (0.010 in)	0.508 mm (0.020 in)
Oversize Bore — Maximum	0.508 mm (0.020 in)	1.016 mm (0.040 in)

CRANKSHAFT:

	6-CYLINDER	8-CYLINDER
Material and Type	Forged Steel, Counter Balanced — 7 Main Bearings	Nodular Cast Iron — 2 Plane Integral Counter Weights — 5 Main Bearings
Main Journal Diameter — Standard	60.353-60.371 mm (2.3761-2.3768 in)	64.770 -64.757 mm (2.5495-2.5000 in)
Maximum Regrind Diameter	60.096-60.121 mm (2.3661-2.3668 in)	64.503 -64.516 mm (2.5395-2.5400 in)
Minimum Regrind Diameter	56.797 mm (2.3361 in)	63.741 -63.754 mm (2.5095-2.5100 in)
Crankpin Journal Diameter — Standard	47.643-47.66 mm (1.8757-1.8764 in)	50.8000-50.8125 mm (2.0000-2.0005 in)
Maximum Regrind Diameter	47.389-47.407 mm (1.8657-1.8664 in)	50.546 -50.558 mm (1.9900-1.9905 in)
Minimum Regrind Diameter	47.135-47.153 mm (1.8557-1.8564 in)	50.292 -50.317 mm (1.9800-1.9805 in)
Crankshaft End Float	0.152 mm (0.006 in)	0.05 - 0.25 mm (0.002 -0.010 in)
Crankpin Width	22.50 -22.55 mm (0.886-0.888 in)	43.12 mm (1.698 in)

MAIN BEARINGS:

	6-CYLINDER	8-CYLINDER
Number and Type	7 — Replaceable Thin Wall Shell Type	5 — 2 piece replaceable
Bearing Material	Steel Backed Reticular Tin Aluminium	Sintered Copper Lead
Bearing Width	20.60-20.85 mm (0.811-0.821 in)	20.37 mm (0.802 in)
Thrust Washer Thickness — Standard	2.310-2.36 mm (0.091-0.093 in)	2.34 mm (0.092 in)
Side Clearance between Thrust Washers and Crankshaft	0.152 mm max. (0.006 in)	0.05-0.25 mm (0.002-0.010 in)
Thrust taken at	Centre Main Bearing	Centre Main Bearing
Diametrical Clearance	0.023-0.69 mm (0.0009-0.0027 in)	0.023-0.0637 mm (0.0009-0.0025 in)
Undersize Bearings Available (10-20-30-40)	0.254 mm (0.010 in) 0.508 mm (0.020 in)	0.762 mm (0.030 in) 1.016 (0.040 in)

BIG END BEARINGS:

Number and Type	6 — Replaceable thin wall shell	8 — 2 piece Replaceable Sintered
Bearing Material	Aluminium Tin	Copper Lead
Bearing Width	16.8 mm (0.66 in)	18.71 mm (0.737 in)
Diametrical Clearance	0.0254-0.0635 mm (0.0010-0.0025 in)	0.01-0.05 mm (0.0006-0.0022 in)
Undersize Bearings	0.254 mm (0.010 in) 0.508 mm (0.020 in)	0.254 mm (0.010 in) 0.508 mm (0.020 in)

CONNECTING RODS:

Type	Horizontally split big end, interference fit small end	Horizontally split big end, interference fit small end
Length between centres	148.03 -148.13 mm (5.828-5.832 in)	158.75 mm (6.25 in)
Side clearance — rod to c'shaft	0.152- 0.254 mm (0.006-0.010 in)	0.254 mm (0.010 in)
Small end bore diameter	20.599- 20.612 mm (0.8110-0.8115 in)	22.17 mm (0.8739 in)
Big end bore diameter	51.333- 51.346 mm (2.0210-2.0215 in)	53.94 mm (2.124 in)
Width	22.33 mm (0.88 in)	21.48 mm (0.846 in)

PISTONS:

Type	Solid Skirt 'W' Slot Aluminium Alloy	Solid Skirt 'W' Slot Aluminium Alloy
Clearance — bottom of skirt	0.0203-0.0330 mm (0.0008-0.0013 in)	0.0203-0.0304 mm (0.0008-0.0012 in)
Piston crown capacity	8.45-8.85 ml (0.515-0.54 in^3)	26.08 ml (1.59 in^3)
Gudgeon Pin bore diameter	20.645-20.650 mm (0.8128-0.8130 in)	22.22 mm (0.8755 in)
Pistons — Oversize available	0.254 mm (0.010 in) 0.508 mm (0.020 in)	0.508 mm (0.020 in) 1.016 mm (0.040 in)
Compression height — centre of gudgeon to top of piston	35.63-35.84 mm (1.403-1.411 in)	48.06 mm (1.892 in)

PISTON RINGS:

Number per Piston	3	3
Top Ring — type	Torsional Molybdenum	Torsional Chromal
Second Ring — type	Plain Torsional	Plain Torsional
Oil Control Ring — type	Composite — Circumferential Expander and Segments	Composite — Circumferential Expander and Segments
Top Ring width	1.587 mm (0.0625 in)	1.974 mm (0.0775 in)
Second Ring width	1.587 mm (0.0625 in)	1.974 mm (0.0775 in)
Groove Clearance — Top ring	0.38 mm (0.0015 in)	0.05 mm (0.002 in)
— Second ring	0.38 mm (0.0015 in)	0.05 mm (0.002 in)
Ring gap fitted — Top ring	0.203-0.432 mm (0.008-0.017 in)	0.25-0.48 mm (0.010-0.019 in)
— Second ring	0.203-0.432 mm (0.008-0.017 in)	0.25-0.48 mm (0.010-0.019 in)

GUDGEON PINS:

Type	Interference fit in connecting rod	Interference fit in connecting rod
Fit in connecting rod (interference)	0.023- 0.038 mm (0.0009-0.0015 in)	0.015-0.030 mm (0.0006-0.0012 in)
Fit in piston (clearance)	0.012- 0.015 mm (0.0005-0.0006 in)	0.008-0.015 mm (0.0003-0.0006 in)
Outside diameter	20.635-20.638 mm (0.8124-0.8125 in)	22.22 mm (0.875 in)

GENERAL DATA

	6-CYLINDER	8-CYLINDER
CAMSHAFT:		
Material	Cast iron — 4 bearing	Hardenable iron — 5 bearings
Journal Dia. — front	49.200-49.213 mm (1.9370-1.9375 in)	45.36 mm (1.786 in)
— second	49.995-50.008 mm (1.9683-1.9688 in)	44.60 mm (1.756 in)
— third	50.787-50.800 mm (1.9995-2.0000 in)	43.84 mm (1.726 in)
— fourth	51.582-51.595 mm (2.0308-2.0313 in)	43.07 mm (1.696 in)
— fifth	N/A	42.31 mm (1.666 in)
Diametrical Bearing Clearance	0.0254-0.0508 mm (0.001-0.002 in)	4 off—0.013-0.089 mm (0.0005-0.0035 in) 1 off—0.013-0.064 mm (0.0005-0.0025 in)
End Float	0.18 mm max. (0.007 in)	0.99 mm max. (0.039 in)
Camshaft Sprocket Fit	0.0102-0.0508 mm clearance (0.0004-0.002 in)	Slide Fit
Timing markings	Hole in sprocket hub and groove on camshaft carrier	Indent on crankshaft gear and raised tip on camshaft gear
TAPPETS:		
Material	Forged Steel — Hardened	Various
Type	Inverted Bucket	Hydraulic
Outside diameter	47.294-47.447 mm (1.862 -1.868 in)	21.39 mm (0.842 in)
Clearance between Tappet and bore	0.0177-0.0533 mm (0.0007-0.0021 in)	0.02-0.058 mm (0.0008-0.0023 in)
Leakdown test	N/A	12-60 secs. for 3.17 mm (0.125 in) travel under 223 N (50 lbf.) load.
Fluid for leakdown test	N/A	PS1008 Viscosity 33 @ 38°C (100°F) Caltex leakdown oil or equivalent
VALVES:		
Head Diameter — Inlet (Nominal)	38.1 mm (1.500 in)	38.1 mm (1.500 in)
— Exhaust (Nominal)	31.71 mm (1.217 in)	33.32 mm (1.312 in)
Stem Diameter — Inlet (Standard)	7.912-7.925 mm (0.3115-0.3120 in)	8.66 mm (0.341 in)
— Exhaust (Standard)	7.912-7.925 mm (0.3115-0.3120 in)	8.64 mm (0.34 in)
Inlet and Exhaust — Oversize	0.127 mm (0.005 in) 0.254 mm (0.010 in)	Nil Nil
Stem to guide clearance — Inlet	0.025-0.051 mm (0.001-0.002 in)	0.025-0.076 mm (0.001 -0.003 in)
— Exhaust	0.025-0.051 mm (0.001-0.002 in)	0.063-0.0889 mm (0.0025-0.0035 in)
Seat angle — inlet and exhaust	45½° (Cylinder Head 45°)	45° (Cylinder Head 46°)
Valve Timing — Inlet Opens	9° 4′ B.T.D.C.	30° B.T.D.C.
— Inlet Closes	52° 56′ A.B.D.C.	75° A.B.D.C.
— Exhaust Opens	48° 56′ B.B.D.C.	68° B.B.D.C.
— Exhaust Closes	13° 4′ A.T.D.C.	37° A.T.D.C.
Stem Height above Cylinder Head	N/A	44.86-46 mm (1.766-1.811 in)
Top of collet to top of Stem Minimum Dimension — Inlet	N/A	2.54 mm (0.100 in)
— Exhaust	N/A	1.90 mm (0.075 in)
Valve clearance at tappets/rockers — Inlet	0.406 mm (0.016 in)	N/A
— Exhaust	0.457 mm (0.018 in)	
Adjustment	By shims 2.08-3.5 mm (0.80-0.138 in) in 0.50 mm (0.002 in) increments.	N/A

VALVE SPRINGS:

Type	Single Wound — Left hand	Coil
Free Length — Inlet & Exhaust (Outer)	45.64 mm (1.797 in)	52.53 mm (2.068 in)
— Inlet & Exhaust (Inner)	N/A	48.74 mm (1.919 in)
Number of Working Coils — Inlet & Exhaust	5½	Inner 7 Outer 5
Fitted length — Inlet and Exhaust	34.92 mm (1.375 in)	41.4 mm (1.63 in) 40.6 mm (1.60 in)
Load at fitted Length	231 N (52 lb)	107 N ± 11 N (24 lb ± 2.5 lb) 187 N ± 13 N (42 lb ± 3 lb)
Length full lift — Inlet & Exhaust	25.78 mm (1.015 in)	31.22 mm (1.23 in) 30.65 mm (1.20 in)
Load at full lift	427 N (96 lb)	302 N ± 13 N (68 lb ± 3 lb) 418 N ± 18 N (94 lb ± 4 lb)

VALVE GUIDES:

Type	Integral with Cylinder Head	Pressed in Cylinder Head
Outside diameter	—	15.01 mm (0.595 in)
Inside diameter	7.950-7.963 mm (0.3130-0.3135 in)	8.69 mm (0.342 in)
Distance Spring Seat to top of guide —		
— Inlet	28.2 mm (1.11 in)	19 mm (0.750 in)
— Exhaust	25.4 mm (1.00 in)	19 mm (0.750 in)

ENGINE LUBRICATION SYSTEM:

Oil Pump:		
— Type	Eccentric Rotor	Gear Type
— Relief Valve	Sealed Unit	Spring Loaded Piston
Oil Filter — Make	Tecalemit	G.U.D.
— Type	Full Flow Sealed Unit	Full Flow Sealed Unit
— By pass valve Open	48-69 kPa (7-10 psi)	55 kPa (8 psi)
Oil Pressure — Normal running	425 kPa (60 psi) @ 4000 engine rpm	300 kPa (44 psi) @ 2000 engine rpm
— Idling Minimum	140 kPa (20 psi) @ 500 engine rpm	165 kPa (24 psi) @ 600 engine rpm

COOLING SYSTEM:

Type	Pressurised-Impeller Assisted	Pressurised-Impeller Assisted
Radiator Cap — Blow off Pressure	90 kPa (13 psi)	90 kPa (13 psi)
Thermostat — Type	WESTERN THOMPSON	WESTERN THOMPSON
— Crack open temperature	82°C (180°F)	79-83°C (174-182°F)
— Fully open temperature	94°C (202°F)	93-96°C (199-204°F)
Radiator — Capacity (with heater)	8.4 litres (14.4 pints)	10.4 litres (18.3 pints)
Fan Belt	V Wedge Raw edge design	V Wedge Raw Edge Design
Fan Type	Moulded Polypropylene	Pressed Steel-Moulded Nylon
Fan Diameter	318 mm x 8 blades (12.5 x 8 blades)	432 mm (17 in) x 4 blades — 419 mm (16.5 in) x 13 blades — Variable
Ratio — Fan to engine Revs.	1.06:1	1.04:1

GENERAL DATA

	6-CYLINDER	8-CYLINDER
FUEL SYSTEM:		
Carburetter:		
Make	Single — SU HS6	Stromberg — WW
Type	20° Semi downdraught	2 throat downdraught
Choke Diameter	44.45 mm (1.75 in)	30.16 mm (1.1875 in)
Throttle Diameter	44.45 mm (1.75 in)	36.51 mm (1.4375 in)
Float Level	4.76 mm (0.1875 in)	4.3 mm (0.17 in)
Jet Sizes (Stromberg)		
Venturi		30.16 mm (1.1875 in)
Main Discharge Jets		36-36
High Speed Bleeder		No. 70
Main Metering Jet		1.32 mm (0.052 in)
Power By Pass Jet: 1st		0.812 mm (0.032 in)
2nd		1.50 mm (0.059 in)
Pump Discharge Jet		No. 71
Float Needle Valve Seat		2.56 mm (0.101 in)
Idle Tube Feed Hole		No. 69
Idle Air Bleed (Main Body)		No. 40
Idle Air Bleed (Air Horn)		No. 50
Idle Discharge Holes: 1st		No. 46
2nd		No. 64
3rd		No. 68
4th		No. 68
Vacuum Spark holes (2)		No. 58
Vacuum Heat Hole: Manual		1.905-1.828 mm (0.0750-0.0725 in)
Vacuum Heat Hole: Automatic		1.651-1.600 mm (0.0655-0.0633 in)
Jet Diameter (SU)	2.54 mm (0.100 in)	
Needle type	XN 67	
Spring Colour	Red	
Damper Oil	SAE 20 or 10/30 Multigrade	
Air Cleaners — type	Moulded Plastic	Pressed metal Box with tapered tube
Element	Impregnated Paper	Impregnated Paper
Fuel Pump:		
Make and type	Goss — Mechanical	Goss — Mechanical
Delivery pressure	35 kPa 5 psi	40 kPa 6 psi
Delivery rate — maximum	68 l/hr (120 pts/hr) @ 6000 rpm (engine)	80 l/hr (140 pts/hr) @ 5000 rpm (engine)
Push rod length	38.3-38.6 mm (1.51-1.52 in)	—
Type of filler cap	Non-Vented	Non-Vented

IGNITION SYSTEM:

Coil	Lucas ABA7 — Oil filled	Lucas ABA7 — Oil filled
Distributor	Lucas 29D6	Lucas 29D8 phII
Contact — Point Gap	0.36-0.41 mm (0.014-0.016 in)	0.38 mm (0.015 in)
Cam Dwell Angle	34°-38°	26°-29°
Condenser Capacity	0.18-0.25 MF	0.18-0.25 MF
Distributor Test Data (decelerating rpm)	Distributor rpm Degrees	Distributor rpm Degrees
Centrifugal Advance	3000 8.5°-10.5°	2600 11½°-13½°
	2750 8.5°-10.5°	2500 11½°-13½°
	2000 6.3°-8.3°	1650 9°-11°
	1000 3.6°-5.6°	800 6½°-8½°
	625 2.5°-4.5°	650 4°-6°
	425 0.0°-2°	400 0°-2°
	375 No Advance	350 No Advance
Vacuum Advance	68 kPa (20 in Hg) 6°	68 kPa (20 in Hg) 10°
	57 kPa (17 in Hg) 6°	61 kPa (18 in Hg) 10°
	51 kPa (15 in Hg) 5°	51 kPa (15 in Hg) 8°
	34 kPa (10 in Hg) 2°	34 kPa (10 in Hg) 4.8°
	23 kPa (7 in Hg) 0°	26 kPa (7.5 in Hg) 3°
		17 kPa (0.5 in Hg) 1.5°
Stroboscope ignition timing with vacuum advance disconnected	10° B.T.D.C. @ 550 rpm	0° T.D.C. @ 650 rpm
Spark plug type	CHAMPION N9Y	CHAMPION L10
Spark plug gap	0.58-0.66 mm (0.023-0.026 in)	0.58-0.71 mm (0.023-0.028 in)

FLYWHEEL AND DRIVE PLATE ASSEMBLIES:

Number of teeth — ring gear	156	156
Flywheel Outside diameter	323 mm (12.72 in)	323 mm (12.72 in)
Ring gear inside diameter	321 mm (12.28 in)	321 mm (12.28 in)
Flywheel run-out when assembled to crankshaft at 120.65 mm (4.75 in) radius on clutch face surface	0.254 mm (0.010 in) max	0.254 mm (0.010 in) max
Flywheel weight	10.49 kg (22.9 lb)	16.2 kg (35.75 lb)
Minimum thickness for reconditioning	33 mm (1.3 in)	33 mm (1.3 in)

CLUTCH:

Make and Type	**AUTOMOTIVE AND GIRLING DIAPHRAGM SPRING**	
Clutch Plate Lining Material	**VEE LOCK 1133-C**	**H. K. PORTER 219-120**
Clamping Load	**8010 N (1800 lbf)**	**9790 N (2200 lbf)**
Max Variation in Finger Height	1.5 mm (0.06 in)	
Release Lever Ratio — Pedal to Bearings	10.6:1	
Thrust Bearing — Type	BALL BEARING R & M 6/W1 5057	
Clutch Diameter	241.3 mm (9.5 in)	
Number of Damper Springs	6	
Actuating Mechanism	MECHANICAL	
Free Travel at Release Lever	2.54 mm (0.100 in)	

GENERAL DATA

	6-CYLINDER	8-CYLINDER
CONVERTER:		
Make	BORG WARNER MODEL 35	
Diameter	279.4 mm (11.00 in)	
Max Torque Multiplication	2:1	
Identification	Serial Number Stamped on Periphery of Converter	
Prefix	011/73/000	003/73/000

TRANSMISSIONS:						
Gearbox — Make	BORG WARNER					
Type	3 Speed Manual	4 Speed Manual		3 Speed Automatic		3 Speed Manual
Synchromesh on	All forward gears	All forward gears				All forward gears
Gearbox	6 Cyl.	6 Cyl. & 8 Cyl.		6 Cyl. & 8 Cyl.		8 Cyl.
GEARBOX RATIOS:						
First	2.95:1	2.82:1		2.39:1		2.71:1
Second	1.69:1	1.84:1		1.45:1		1.55:1
Third	1.00:1	1.32:1		1.00:1		1.00:1
Fourth		1.00:1				
Reverse	3.67:1	2.56:1		2.09:1		3.37:1
OVERALL RATIOS:	6 Cyl.	6 Cyl.	8 Cyl.	6 Cyl.	8 Cyl.	
First	11.82:1	11.12:1	8.25:1	9.30:1	6.95:1	7.92:1
Second	6.55:1	7.24:1	5.39:1	5.65:1	4.24:1	4.53:1
Third	3.89:1	5.23:1	3.86:1	3.89:1	2.92:1	2.92:1
Fourth		3.89:1	2.92:1			
Reverse	14.21:1	9.93:1	7.49:1	8.10:1	6.30:1	9.85:1

Road Speed per 1000 rpm:						
Tyres — Crossply Tubeless — E78-S14						
First — km/hr	10.6	10.8	14.5	12.9	17.5	15
— (mph)	(6.6)	(6.7)	(9.0)	(8.0)	(10.7)	(9.3)
Second — km/hr	18.2	16.4	22.2	21.2	29.8	26.6
— (mph)	(11.3)	(10.2)	(13.8)	(13.2)	(18.5)	(16.5)
Third — km/hr	30.3	22.5	31.0	30:3	40	40
— (mph)	(19.0)	(14.0)	(19.3)	(19.0)	(25)	(25)
Fourth — km/hr		30.3	40.0			
— (mph)		(19.0)	(25.0)			
Reverse — km/hr	8.7	12.1	16.1	14.8	19	12.1
— (mph)	(5.4)	(7.5)	(10.0)	(9.2)	(11.8)	(7.5)

TRANSMISSIONS—MANUAL:

	6 Cylinder — 3 Speed	4 Speed	8 Cylinder — 3 Speed
TOLERANCES:			
1st speed gear end float	0.15-0.48 mm (0.006-0.019 in)	0.05-0.68 mm (0.002-0.027 in)	0.15-0.48 mm (0.006-0.019 in)
2nd speed gear end float	0.15-0.48 mm (0.006-0.019 in)	0.15-0.43 mm (0.006-0.017 in)	0.15-0.48 mm (0.006-0.019 in)
3rd speed gear end float	N/A	0.13-0.51 mm (0.005-0.020 in)	N/A
Mainshaft bearing end float	0.00-0.10 mm (0.000-0.004 in)	0.00-0.10 mm (0.000-0.004 in)	0.00-0.10 mm (0.000-0.004 in)
Input Shaft bearing end float	0.00-0.10 mm (0.000-0.004 in)	0.00-0.10 mm (0.000-0.004 in)	0.00-0.10 mm (0.000-0.004 in)
Laygear end float	0.15-0.46 mm (0.006-0.018 in)	0.15-0.46 mm (0.006-0.018 in)	0.15-0.46 mm (0.006-0.018 in)
SNAP RINGS:			
Mainshaft and input shaft Bearing Snap Ring thicknesses (selective to maintain bearing end float)	2.18-2.23 mm (0.086-0.088 in) 2.26-2.31 mm (0.089-0.091 in) 2.34-2.39 mm (0.092-0.094 in) 2.41-2.46 mm (0.095-0.097 in)	2.18-2.23 mm (0.086-0.088 in) 2.26-2.31 mm (0.089-0.091 in) 2.34-2.39 mm (0.092-0.094 in) 2.41-2.46 mm (0.095-0.097 in)	2.18-2.23 mm (0.086-0.088 in) 2.26-2.31 mm (0.089-0.091 in) 2.34-2.39 mm (0.092-0.094 in) 2.41-2.46 mm (0.095-0.097 in)
1st & 2nd Synchronizer Hub Snap Ring Thickness (selective to maintain 2nd gear end float)	N/A	2.16-2.21 mm (0.085-0.087 in) 2.23-2.28 mm (0.088-0.090 in) 2.31-2.36 mm (0.091-0.093 in) 2.39-2.44 mm (0.094-0.096 in)	N/A
Number of rollers in reverse idler gear bore	Nil (Bush)	Nil (Bush)	22
Number of rollers in laygear bore	3 sets of 22	4 sets of 27	3 sets of 22
Number of rollers in input shaft bore	15	15	15
Laygear needle roller thrust washers	5	6	5
Laygear thrust washers	1 front 2 rear	1 front 2 rear	1 front 2 rear

PROPELLER SHAFT:

	6 CYLINDER		8 CYLINDER	
	3 Speed Man and Auto	4 Speed Man	3 Speed Man and Auto	4 Speed Man
Length between Centres of Universal Joints	1337.43 mm (52.65 in)	1264.82 mm (49.79 in)	1333.50 mm (52.50 in)	1264.82 mm (49.79 in)
Sliding Yoke outside diameter	39.7 mm (1.563 in)	42.8 mm (1.685 in)	39.7 mm (1.563 in)	42.8 mm (1.685 in)
Universal Journal outside diameter	25.34 mm (0.998 in)	25.34 mm (0.998 in)	27.3 mm (1.078 in)	27.3 mm (1.078 in)

REAR AXLE:

	6 CYL.	8 CYL.
Type	BW MODEL 78 SALISBURY —	SEMI FLOATING HYPOID
Ratio	3.89:1	2.92:1
Backlash crown wheel to pinion	0.127-0.177 mm	(0.005-0.007 in) at tightest point
Bearing Pre-Load		
New bearings — differential	1.13-2.82 Nm	(10-25 in lb) without Axles or Pinion
— hypoid pinion	1.7 -3.4 Nm	(15-30 in lb) with Oil Seal
— hypoid pinion	1.7 -2.82 Nm	(15-25 in lb) without Oil Seal
Used bearings — differential	0.565-1.141 Nm	(5-12.5 in lb) without Axles or Pinion
— hypoid pinion	0.85 -1.7 Nm	(7.5-15 in lb) with Oil Seal
— hypoid pinion	0.85 -1.141 Nm	(7.5-12.5 in lb) without Oil Seal

GENERAL DATA

6-CYLINDER | **8-CYLINDER**

REAR AXLE (Continued)

Run out of:		
Differential case hypoid gear mating face	0.0508 mm max	(0.002 in) max
Hypoid gear rear face — gear assembled	0.1270 mm max	(0.005 in) max
Side Bearings — Shim Washer Thickness	6.4643 mm to 7.2303 mm	(0.2545-0.2845 in) in 0.0508 mm (0.002 in) increment
Pinion Head-Shim Washer Thickness	2.0487 mm to 2.6837 mm	(0.0805-0.1005 in) in 0.0508 mm (0.002 in) increment
Pinion Bearing Adjusting Shims	1.8542 mm to 2.6924 mm	(0.073 -0.106 in) in 0.0254 mm (0.001 in) increment
Pinion Pre-Load	1.7-3.4 Nm	(15-30 in lb)
Axle — Shaft Length:		
— Right Hand	785.368-786.384 mm	(30.920-30.960 in)
— Left Hand	690.880-691.896 mm	(27.200-27.240 in)

STEERING — MANUAL:

Type	RACK AND PINION	
Steering Wheel Turns — Lock to Lock	4.92	
Steering Wheel Diameter	400 mm	(16 in)
Rack Damper Setting	Shim to give clearance of 0.05-0.13 mm	(0.002-0.005 in) between cover plate and yoke
Pinion Pre-Load	Shim to give Pre-Load of 0.02-0.13 mm	(0.001-0.005 in)
Lubricant and Capacity	0.188 litres (⅓ pint) EP 90 Oil	

STEERING — POWER:

Rack Assembly	
Type	RACK AND PINION
Steering Wheel Turns — Lock to Lock	3.3
Steering Wheel Diameter	400 mm (16 in)
Rack Damper Setting	Shim to give clearance of 0.05-0.13 mm (0.002-0.005 in) between cover plate and yoke
Lubricant and Capacity	Rack Boots: 0.188 litre (⅓ pint) SAE 40 equally distributed in boots Pump and Rack: Automatic Transmission Fluid OAT F3 0.85 litres (1.5 pints)

POWER STEERING PUMP:

Type	THOMPSON VANE TYPE
Drive Ratio	1.15:1
Pressures: Test Data	
Maximum	5860 kPa (850 psi) at 1200 pump rpm — relief valve pressure
Minimum Flow	5.5 litres/min (1.2 galls/min) at 4136 kPa (60 psi) at 550 pump rpm

FRONT SUSPENSION:

Type	MacPHERSON STRUT
Free Height of Coil	408.2 mm (16.07 in)
Static Laden Length	209.6 mm (8.25 in)
Number of Free Coils	6.42
Mean Coil Diameter	140 mm (5.5 in)
Shock Absorber Make	ARMSTRONG YORK
Stroke	101.6 mm (4 in)
Fluid and Capacity	ARMSTRONG GRADE 788 340 ml (0.598 pts)
Fill to:	127-133.5 mm (5.00-5.25 in) from top of Strut Outer Tube with Piston Rod fully down and inner pressure cylinder completely full
Camber Angle Unladen	—¼ to +¾ Degree
Caster Angle Unladen	+½ to +1½ Degree → AIM FOR +1° to +1¼°
Toe-in — Unladen	0 to ⅛ in
King pin inclination	11° 20'
Turning Circle Between Kerbs	11 m 31 mm 37 feet
Lock angle of outer front wheel	The outer wheel at 40° with the inner wheel at 36°
Wheel Bearing End Float	0.025-0.127 mm (0.001-0.005 in) No Pre-Load

REAR SUSPENSION:

Type	Coil Spring
Free Height of Coil	294.6 mm (11.60 in)
Static Laden Length	196.8 mm (7.75 in)
Number of Free Coils	6.52
Mean Coil Diameter	122.4 mm (4.82 in)
Shock Absorbers	Armstrong York Telescopic type

BRAKES:

Make and Type	P.B.R. Hydraulic — front and rear
Type — Front	Disc — Single Piston Sliding Caliper
— Rear	Drum
Disc Diameter	273.00 mm (10.75 in)
Disc Thickness	25.4 mm (1.0 in)
Disc permissible run-out when assembled on suspension at 133.350 mm (5.250 in) radius	0.10 mm (0.004 in)
Disc face minimum thickness after regrind	22.74 mm (0.895 in)
Minimum Pad thickness	1.6 mm (0.06 in)
Total disc pad area — four pads	235.3 cm^2 (36.48 in^2)
Disc pad material	B.M.7133
Drum diameter — rear	230.00 mm (9.10 in)
Drum surface — width	53.3 mm (2.10 in)
Rear Brake lining material	Leading Shoe:— BMRD Trailing Shoe:— BRME
Brake lining area — four brake shoes	337 cm^2 (52.26 in^2)
Master Cylinder Bore diameter	Non-Boosted:— 20.3 mm (0.8 in) Boosted:— 25.4 mm (1.0 in)
Master Cylinder Stroke — Max	Non-Boosted:— 32.0 mm (1.25 in) Boosted:— 29.0 mm (1.14 in)

	6-CYLINDER	8-CYLINDER
BRAKES (Continued)		
Caliper Bore Diameter	63.00 mm (2.5 in)	
Rear Wheel Cylinder — Bore Dia.	20.62 mm (0.812 in)	
Brake Fluid Specification	Leyland Australia HBF-6	
Handbrake	On Floor on right hand side of seat	
Handbrake Cables	Polyethylene lined — no lubrication required	
BRAKE SERVO UNIT:		
Make and Type	P.B.R. Master — Vac VH244	
Diameter	200 mm (8 in)	
ELECTRICAL:		
System	12 Volt	
Polarity	Negative Earth	
Battery Plates per cell	Standard 7 Air conditioned 9	
Capacity — Standard	48 amp-hour	
— Air Conditioned	61 amp-hour	
ALTERNATOR:	Standard	Air Conditioned
Type	Lucas 14ACR 4D	Lucas 14ACR 6D
Maximum Output	38 amps @ 14.2 V	55 amps @ 14.2 V
Cut in Speed (Alternator/rpm)	1200 rpm	1000 rpm
Resistance in Rotor Windings	3.3 ohms ± 5% @ 20°C	3.0 ohms ± 5% @ 20°C
Resistance in Stator Windings	0.23 ohms ± 5% @ 20°C	0.15 ohms ± 5% @ 20°C
Slip Ring Brushes Length (min)	12.7 mm (0.5 in)	12.7 mm (0.5 in)
Voltage Regulator — Integral	13 ATR	
STARTER MOTOR:		
Make and Type	Lucas M40 — 15AK PRE ENGAGED	
Lock Torque	20.3 Nm (15 lb.f.ft.) Minimum	
Current Draw	(430 amps)	
Lock Voltage	7.0 volts ± 0.1 volts	
Running torque @ 1000 rpm	9.5 Nm (7 lb.f.ft.) Minimum	
Brushes — Length	9.5 mm (0.375 in) Minimum	
— Spring Tension	8.9 N (32 oz.f.)	
WIPER MOTOR AND WASHER:		
Type	Preslite 2 Speed, Washers Incorp	
Drive	Link Drive	
Armature End Float	Nil	

HORNS:

Type	R.V.B. 2000
Current Consumption — Max	4 amps

LAMPS AND FUSES:

Number of Fuses	8 + Line Fuses 15 amp	
Rating —	4 x 8 amp	
—	4 x 16 amp	
Circuit — Fused	Head & Side Lights, Ignition & All Accessories	
Headlamps — Single	12 Volts	75/60 Watts
— Twin	12 V	37½/50 + 50 Watts
Side Lamps	12 V	4 Candle Power
Stop, Tail	12 V	32/4 C.P.
No Plate Lamp	12 V	6 Watts
Reverse/Flasher	12 V	32/32 C.P.
Ignition Warning Light	12 V	2.2 W
Direction Indicator Warning Light	12 V	2.2 W
Oil Pressure Warning Light	12 V	2.2 W
Main Beam Warning Light	12 V	2 C.P.
Panel Illumination	12 V	2 C.P.
Boot Illumination Lamp	12 V	6 W
Roof Lamp	12 V	10 W
Courtesy Lamp Rear Quarter	12 V	6 W
Flasher — Front	12 V	32 C.P.
Brake Failure Warning Light	12 V	2.2 W
Glove Box Lamp	12 V	3 W
Under Bonnet Lamp	12 V	5 W
Ash Tray Lamp	12 V	2 C.P.
Arm Rest Lamp	12 V	5 W

WHEELS:

Type	Pressed Steel	Cast Alloy
Size	14 x 6 JJ 14 x 5 JJ	14 x 6 JJ
Stud P.C.D.	114.3 mm	(4.5 in)

TYRES:

Cross Ply (Alternative to Radial Ply)	E 78-14	6.95-14
Tyre Pressures Normal Load — Front	138 kPa	(20 psi)
— Rear	165 kPa	(24 psi)
Tyre Pressures Max Load — Front	152 kPa	(22 psi)
— Rear	180 kPa	(26 psi)
Radial Ply (Alt. to Cross Ply)	185-SR-14	
Tyre Pressures Normal Load — Front	152 kPa	(22 psi)
— Rear	152 kPa	(22 psi)
Tyre Pressures Max Load — Front	152 kPa	(22 psi)
— Rear	180 kPa	(26 psi)

GENERAL DATA

	6-CYLINDER		8-CYLINDER	
CAPACITIES:	**6-Cylinder**		**8-Cylinder**	
Fuel Tank	73.0 litres	16.00 gallons	73.0 litres	16.00 gallons
Engine oil including filter	4.0 litres	7.00 pints	3.5 litres	6.25 pints
Engine oil filter	0.56 litres	1.00 pints	0.56 litres	1.00 pints
Transmission — Manual 3 speed	1.7 litres	3.00 pints	1.7 litres	3.00 pints
Transmission — Manual 4 speed	1.7 litres	3.00 pints	1.7 litres	3.00 pints
Transmission — Auto Initial	7.0 litres	12.25 pints	7.0 litres	12.25 pints
Transmission — Auto Refill	3.25 litres	5.00 pints	3.25 litres	5.00 pints
Rear Axle	1.5 litres	2.50 pints	1.5 litres	2.50 pints
*Cooling System including heater	8.25 litres	14.50 pints	10.25 litres	18.00 pints
*Note: Capacities include inhibitor	165 ml	(5.5 fl oz)	205 ml	(7 fl oz)
Equivalent of	20 ml/litre (3 fl oz/gallon)			
Suspension strut fluid (single unit fill from dry)	340 ml (12 fl oz)		340 ml (12 fl oz)	

DIMENSIONS:	6-Cylinder	8-Cylinder
Track — Front	1485.9 mm (58.5 in) 14 x 5 JJ wheels	1511.2 mm (59.5 in) 14 x 6 JJ wheels
— Rear	1490.98 mm (58.7 in) 14 x 5 JJ wheels	1516.28 mm (59.7 in) 14 x 6 JJ wheels
Turning circle between kerbs	9.45 mm (37 ft)	
Wheel Base	2825.49 mm (111.24 in)	
Overall Height	1394.7 mm (54.11 in)	
Width	1910.08 mm (75.2 in)	
Length	4878.07 mm (192.05 in)	4935.22 mm (194.3 in) Exec only
Ground clearance	172 mm (6.75 in)	
	Approach Angle 27° 45′	
	Departure Angle 14°	
	Ramp Angle 166° 30′	

WEIGHTS — Registration:	**6-Cylinder**		**8-Cylinder**	
MODEL				
Column Auto	1230 kg	2716 lbs		
Column Manual	1222 kg	2698 lbs		
Deluxe Column — Auto	1238 kg	2734 lbs	1233 kg	2722 lbs
Deluxe Floor Manual	1236 kg	2729 lbs	1235 kg	2727 lbs
Deluxe Column Manual	1230 kg	2716 lbs	1230 kg	2716 lbs
Super Floor Auto	1259 kg	2778 lbs	1250 kg	2760 lbs
Super Column Auto	1258 kg	2277 lbs	1251 kg	2762 lbs

Super Floor Manual	1256 kg	2773 lbs	1256 kg	2773 lbs
Executive Floor Auto			1284 kg	2835 lbs
ENGINE — Auto	221 kg	486 lbs	199.5 kg	467 lbs
— Manual	216 kg	474.62 lbs	190.9 kg	464 lbs
TRANSMISSION — Auto	43.5 kg	96 lbs		
— Manual 3 speed	34.9 kg	77 lbs		
— Manual 4 speed	43.36 kg	95.6 lbs		
Roof rack load	45.5 kg	100 lbs		
Towing Weights — Maximum (subject to existing regulations)	1272 kg	2800 lbs		

TORQUE FIGURES

ENGINE — 6-Cylinder:	Nm	lb.f.ft.
Oil Filter Adaptor Bolt	47.5	35
Cylinder Head Bolts	81.5	60
Cam Carrier to Cylinder Head	27.0	20
Camshaft Sprocket	47.5	35
Camshaft Cover	8.0	6
Thermo Housing to Cylinder Head	11-13.5	8-10
Water Outlet Elbow		
Manifold to Cylinder Head (Bolts & Nuts)	24.5-27	18-20
Carburetter Studs	8-11	6-8
Water Pump Set Screw	24.5-27	18-20
Pulley (Water Pump)	24.5	18
Front Cover Bolts	27	20
Petrol Pump Bolts	20.5-24.5	15-18
Crankshaft Pulley Bolt	81.5-95	60-70
Timing Chain Guide Strips	24.5-27	18-20
Timing Cover		
Pivot Pin		
Big End Nuts	42-47.5	31-35
Main Bearing Bolts	75-81.5	55-60 oiled
Flywheel Bolts	81-88	60-65
Oil Pump Mounting Bolt	11-13.5	8-10
Block 5/16" Bolt	8-11	6-8
Oil Reservoir Drain Plug	27-34	20-25
ENGINE — 8-Cylinder:		
Inlet Manifold Bolts	34-41	25-30
Inlet Manifold Gasket Clamp Bolts	11-13.5	8-10
Rocker Pivot Retaining Nuts	12-15	9-11
Cylinder Head Bolts	88-95	65-70
Exhaust Manifold Bolts	13.5-20.5	10-15
Centre Bolt Camshaft	54.5-61	40-45
Connecting Rod Cap Bolts	41-47.5	30-35

AUTOMATIC TRANSMISSION:	Nm	lb.f.ft.
Drive Plate to Crankshaft	68-75	50-55
Converter to Drive Plate Bolts	47.5	35
Transmission Case to Converter Housing Bolts	11-17	8-13
Rear Extension to Trans, Case Bolts	41-75	30-55
Oil Pan to Gear Box Bolts	12-16	9-12
Front Servo Bolts	11-17.5	8-13
Rear Servo Bolts	17.5-37	13-27
Pump Adaptor to Housing Screw	2.5-4	2- 3
Pump Adaptor to Housing Bolts	23-45	17-32
Pump Adaptor to Trans Case Bolts	11-24.5	8-18
Manual Shaft Locknut	9.5-15	7- 9
Pressure Adaptor Plug	5.5- 7	4- 5
Drain Plug	11-13.5	8-10
Upper Valve Body to Lower Valve Body Screws	2.5-3.5	20-30 lb.f.in.
Lower Valve Body to Upper Valve Body Screws		
Oil Tube and End Plate to Valve Body Screws		
Valve Bodies to Trans Case Bolts	6-15	4.5-9
Cam Bracket Screws	2.5-4.5	20-40 lb.f.in.
Governor to Counter-weight screws	5.5-7	4-5
Governor to Cover Plate screws	2.5-5.5	20-48 lb.f.in.
Front Servo Adj Screw Locknut	20-27	15-20
Rear Servo Adj Screw Locknut	41-54.5	30-40
Centre Support Bolts	13.5-24.5	10-18
Downshift Cable Adaptor	11-15	8-9
PROPELLER SHAFT:		
Flange Retaining Bolt Nuts	16-19	12-14
Universal Joint Attach Nut	27-30	20-22

Rear Main Bearing Cap Bolts	88-95	65-70
Other Main Bearing Cap Bolts	68-75	50-55
Oil Pump Cover Bolts	11-13.5	8-10
Pressure Relief Valve Cap	41-47.5	30-35
By pass valve cap	41-47.5	30-35
Starter Motor to Crankcase	41-47.5	30-35
Torsional Vibration Damper Hub Centre Bolt	190-217	140-160
T.V. Damper Retaining Bolts	24.5-30	18-22
Timing Chain Cover to Crankcase	24.5-30	18-22
Water Pump & Timing Chain Cover to Crankcase	24.5-30	18-22
Water Pump to Timing Cover ¼ UNC	8-11	6- 8
Water Pump to Timing Cover (Alt Mtng) ⅜	27-34	20-25
Torque Converter Housing to Crankcase	34-41	25-30
Flywheel Housing to Crankcase	34-41	25-30
Flywheel to Crankshaft Bolts	81.5-88	60-65
Fan and Spacer to Pulley Hub	24.5-30	18-22
Viscous coupling to hub (Air conditioned only)	34-41	25-30
Plastic fan to coupling (Air conditioned only)	20-27	15-20
Rocker Cover Bolts	11-13.5	8-10
Water outlet elbow	12-15	9-11
Carburetter Mounting Nuts	12-15	9-11
Fuel Pump Mounting Bolts	24.5-30	18-22
Oil Reservoir Bolts 5/16	11-13.5	8-10
Oil Reservoir Drain Plug	16-20	12-15
Baffle Plate to Main Bearing Caps 5/16	24.5-30	18-22
Oil Pick up to Crankcase ¼	11-13.5	8-10
Alternator locking bolt 5/16	24.5-30	18-22
Alternator mounting bolt ⅜	34-41	25-30
Compressor Mounting to Crankcase ½	75-81.5	55-60
Mounting Bracket to Compressor ⅜	34-41	25-30
Mounting Plate to Power Steering Pump ⅜	34-41	25-30
Power Steering Pump pivot bolt 5/16	27-34	20-25
Power Steering Pump Mounting to Crankcase 5/16	27-34	20-25
Power Steering Pump Mounting to Crankcase ⅜	34-41	25-30

MANUAL TRANSMISSION:

Extension Housing Bolts	54.5-61	40-45
Transmission Cover Retaining Bolts	11-16	8-12
Bearing Retaining Bolts	27-34	20-25
Operating Lever Retaining Bolts	27-34	20-25
Drain Plug	27-34	20-25
Filler Plug	27-34	20-25
Case to Clutch Housing Bolts	27-34	20-25
Speedo Drive Pinion Retaining Screw	12-16	9-12
Reverse Light Switch	17 max	12.5 max

REAR AXLE:

Crown wheel bolts	61-68	45-50
Bearing Cap Bolts	47.5-61	35-45
Rear Cover Bolts	23-30	17-22
Filler Plug	41-47.5	30-35
Pinion Nut	326-380	240-280
Breather	11-16	8-12
Brake Backing Plate Bolts	41-50	30-37
Wheel Nuts	81.5	60

STEERING:

Tie Rod Ball Pin Nuts	41-47.5	30-35 or next split
Flexible Joint Pinch Bolt Nut 5/16	11-16	8-12 pin hole
Pinion End Cover Retaining Bolts	20-24.5	15-18
Pinion Pre-Load	1.35-1.6	1-1.17
Rack Yoke Cover Bolts	20-24.5	15-18
Tie Rod Housing Locknut	45-50	33-37
Tie Rod Ball Spheres Pre-Load	3.6-5.8	2.7-4.3
Steering Column Mounting Screw ⅜	27-32.5	20-24
Flexible Joint Coupling Bolts	24.5-27	18-20
Steering Column Lock Bolt ⅜	27-32.5	20-24
Steering Column Nut	41	30
Steering Wheel Screws	11	8

FRONT SUSPENSION:

Tie Rod Fork Nut	54.5-61	40-45
Strut to Pivot Assy Nut	54.5-61	40-45
Lower Arm Ball Joint Pin Nuts	68-75	50-55
Gland Nut	49-60	36-44

REAR SUSPENSION:

Upper Link Nuts 7/16	47.5-54.5	35-40
Lower Link Nuts ½	75-81.5	55-60
Shock Absorber to Spring Bracket ⅜	38-41	28-30
Shock Absorber to Body Bracket ½	38-41	28-30

BRAKES:

Bleed Screw	5.5-8	4- 6
Master Cylinder Retaining Nuts	19-28.5	14-21
Caliper Retaining Bolts	68-75	50-55
Wheel Cylinder Retaining Bolts	5.5-7	4- 5
Front Hose to Brake Caliper	13.5-16	10-12

ELECTRICAL:

Distributor Clamp Retaining Screw	2.3-2.7	1.7-2
Alternator Pulley Retaining Screw	34-41	25-30

SECTION C
REGULAR MAINTENANCE
AND
SPECIFIED LUBRICANTS

AFTER SALES FREE SERVICE (1500 km/1000 miles)

Prior to delivery of the new vehicle, a comprehensive pre-delivery service is carried out and following this, an after-sale service is recommended at or before 1500 km (1000 miles).

LUBRICATING OILS AND LEVELS

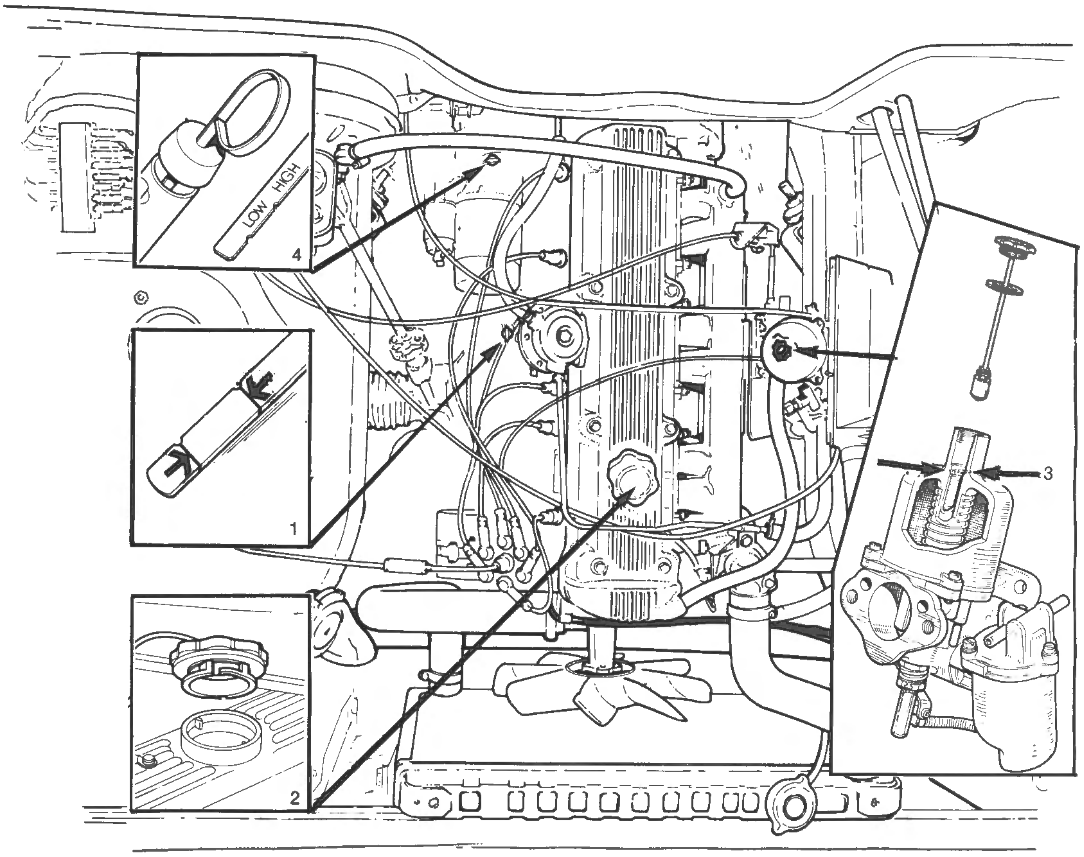
Both the six and eight cylinder engines carry their lubricating oil in a reservoir or sump mounted below the crankcase.

Deterioration also occurs as a result of oxidation which tends to form sludge or varnish.

Manual transmissions require full lubrication and corrosion protection but the lubricant must not inhibit the action of the synchromesh or produce excessive foaming.

In the automatic transmission, the oil has to perform the functions of transmitting power in the torque converter and of operating the hydraulic control system.

The preceding paragraphs emphasise the need for using oils to the correct specification only and for changing at recommended intervals.



1 ENGINE OIL LEVEL
2 ENGINE OIL FILLER
3 CARBURETTER
4 AUTOMATIC TRANSMISSION

Fig. C-1

6 CYLINDER ENGINE

Engine lubricating oils perform the exacting tasks of lubricating, sealing and cooling. The thin oil film separates fast moving parts thereby preventing metal to metal contact and excessive friction. Piston rings are required to seal the high pressure combustion gases in the cylinder, and without the sealing effect of lubricating oil this would not be possible. Lubricating oil carries heat away from engine components as it is circulated through the engine.

Lubricating oils must have resistance to oxidation at high operating temperatures and the ability to maintain correct viscosity under a wide range of operating conditions.

After a period of use, oils tend to deteriorate due to contamination by the products of combustion, water, acids, unburnt fuel, metallic and dust particles.

ENGINE OIL LEVEL

Maintaining the correct oil level is very important. The oil level indicator (dipstick) is marked as shown in the illustrations. The oil level must be maintained between the two markings. Do not fill above the upper mark or allow the level to fall below the lower mark.

6 CYLINDER ENGINE: It requires approximately 1.2 litres (2 pints) to raise the level from the lower mark to the upper mark. Fig. C-1.1.

8 CYLINDER ENGINE: It requires approximately .9 litre (1½ pints) to raise the oil level from the "MIN" mark to the "MAX" mark. Fig. C-2.1.

Too much oil can cause frothing and excessive splash on to the cylinder walls which the piston rings cannot control. Correct reading cannot be obtained immediately after stopping the engine, such as when purchasing petrol at a service station. In these circumstances oil will be suspended in the upper regions of the hot engine.

Dipstick readings must be taken with the vehicle standing on level ground.

Dipstick location

6 CYLINDER ENGINE: On right hand side of cylinder block just ahead of starter motor. Fig. C-1.

Draining the oil

The engine oil should be changed when hot.

6 CYLINDER ENGINE: The drain plug is located at the right hand side rear of the sump. Fig. C-3.

8 CYLINDER ENGINE: The drain plug is located at the left hand side rear of the sump. Fig. C-4.

When replacing the drain plug it should be tightened securely.

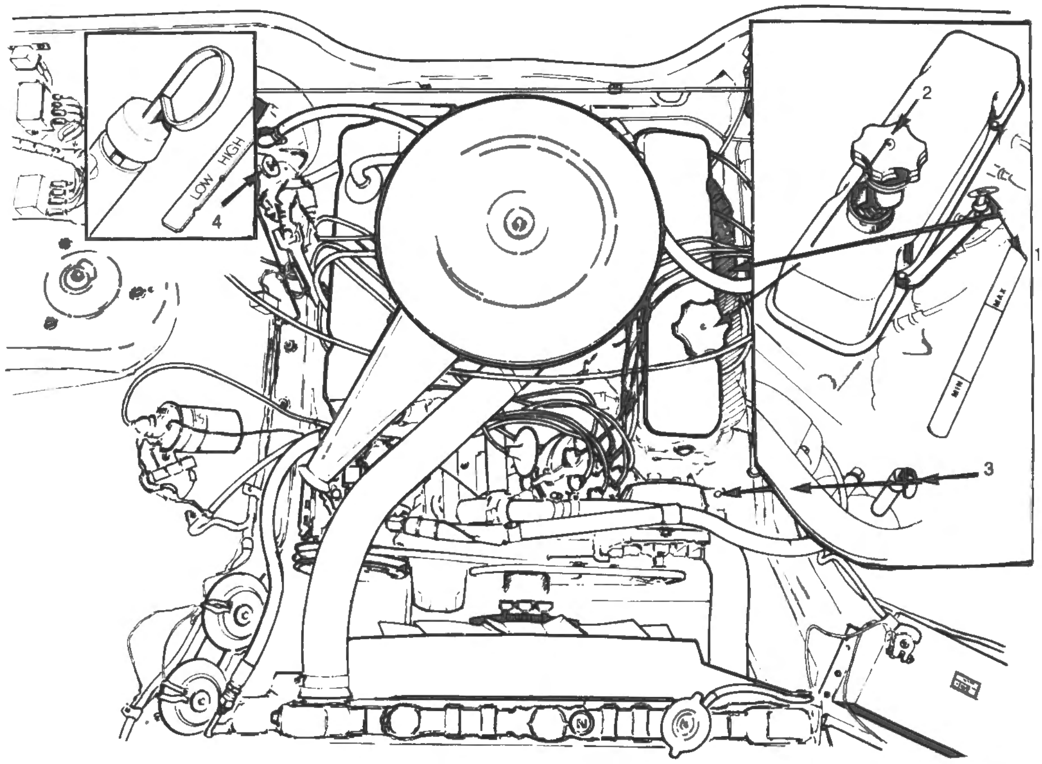


Fig. C-2

8 CYLINDER ENGINE

1 ENGINE OIL LEVEL
2 ENGINE OIL FILLER
3 POWER STEERING OIL RESERVOIR DIPSTICK AND FILLER
4 AUTOMATIC TRANSMISSION

8 CYLINDER ENGINE: On left hand side of cylinder block between second and third cylinders. Fig. C-2.

It is important when replacing the dipstick that it be pushed home fully so that it forms part of the sealed breathing system and eliminates dust entry into the power unit.

Oil Changing

The engine oil should be changed every 10,000 km (6000 miles) or 6 months whichever is the earlier, under normal operating conditions. More arduous operation such as stop-start running, slow heavy traffic or very dusty atmospheres demand more frequent oil changes. The advice of the Leyland Dealer should be taken on this aspect.

Engine Oil Filler Cap location

6 CYLINDER ENGINE: Mounted near the front of the camshaft cover. Fig. C-1.

8 CYLINDER ENGINE: Located near the front of the left hand side valve cover. Fig. C-2.

Both filler caps are removed by turning in an anti-clockwise direction.

Oil Filters

CAUTION: The oil filter elements for 6 cylinder and 8 cylinder engines appear to be similar, but they are DEFINITELY NOT INTERCHANGEABLE. Under no circumstances must the 6 cylinder engine filter element be fitted to the 8 cylinder engine or vice versa.

The oil filter should be changed every 10,000 km (6000 miles). It is a full flow, throw away canister assembly.

Location

6 CYLINDER ENGINE: Mounted on the left hand side front of the cylinder block. Fig. C-3.

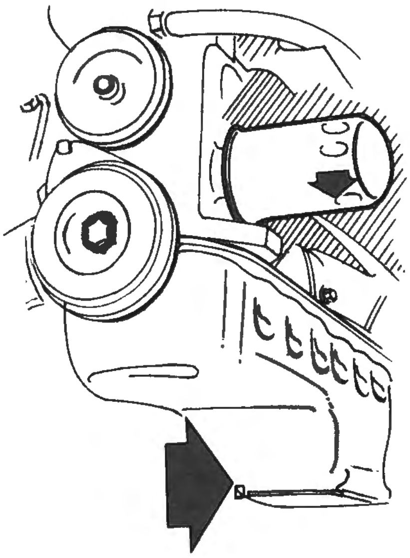


Fig. C-3

6 CYLINDER ENGINE DRAIN PLUG AND OIL FILTER

8 CYLINDER ENGINE: Mounted on the base of the oil pump housing in the front of the engine. Fig. C-4.

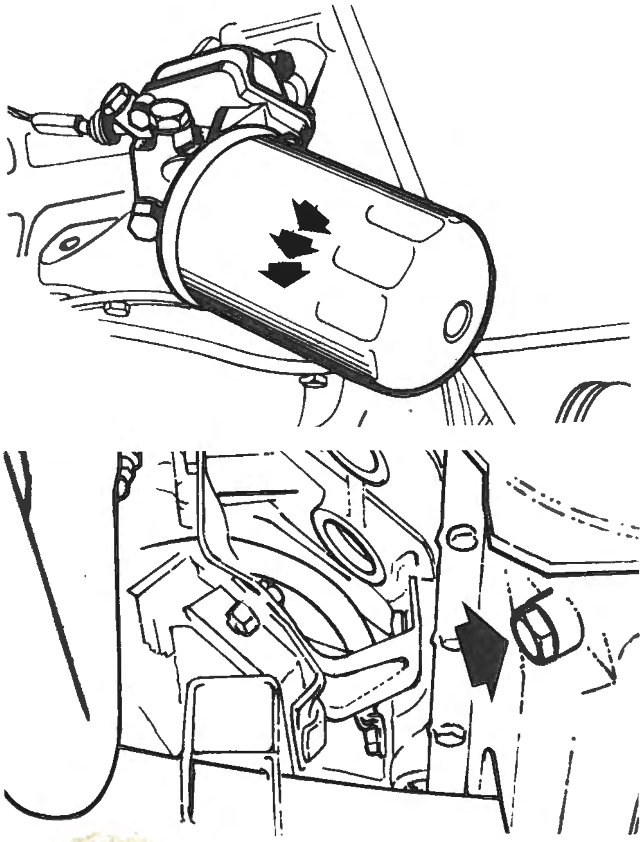


Fig. C-4

8 CYLINDER ENGINE DRAIN PLUG AND OIL FILTER

To remove the filter, unscrew it (anti-clockwise) from the base using a universal removing and replacing tool. When fitting a new filter, lubricate the sealing rings with engine oil, screw on the canister by hand until firm contact is made between seals and base plate. Mark the position of the canister and tighten a further ½ turn approximately using the tool. Check for oil leaks immediately the engine is started.

Should the oil filter be changed at some time when the engine oil is not changed, it will be necessary to add approximately .6 litre (1 pint) of oil to the crankcase of the engine.

Manual transmission

Under normal operating conditions it is not necessary to change the lubricating oil. The level is checked every 10,000 km (6000 miles). Do not overfill. Fig. C-5.

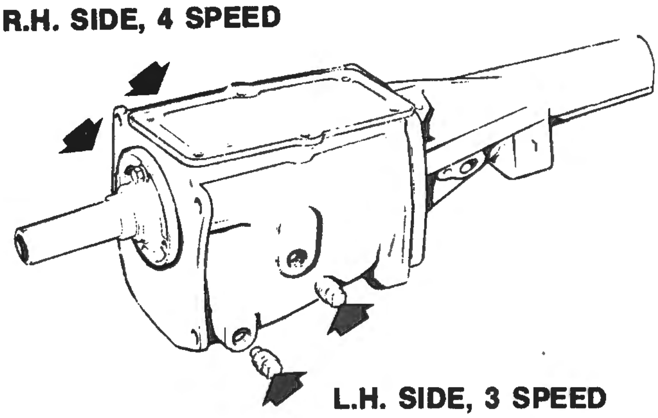


Fig. C-5

MANUAL TRANSMISSIONS

OIL LEVEL AND DRAIN PLUGS

Automatic Transmission

Under normal operating conditions it is not necessary to change the fluid in the transmission. The fluid level should be checked every 10,000 km (6000 miles), using the following procedure: Fig. C-1.

1. Start and run the engine. With the footbrake firmly applied, pass the selector through the complete range to ensure that the transmission is fully primed.
2. Place transmission into the 'P' (Park) position and apply handbrake.
3. Switch off engine.
4. Wipe dipstick with clean, non-fluffy cloth and dip immediately.
5. After topping up, repeat steps 1 to 4.

Rear Axle

Under normal operating conditions it is not necessary to change the lubricating oil. The level is checked every 10,000 km (6000 miles). Fig. C-6.

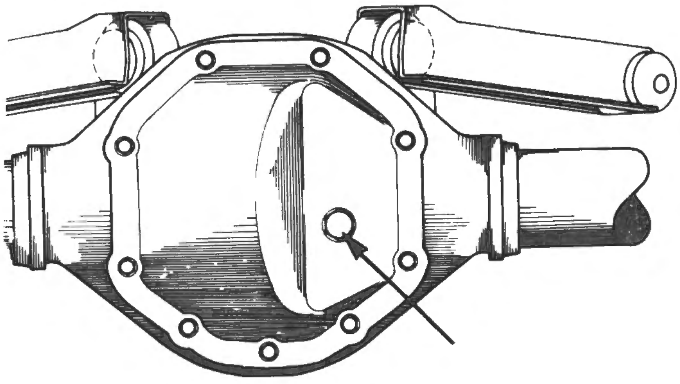


Fig. C-6

OIL LEVEL PLUG REAR AXLE

The vehicle must be standing on level ground. The correct level is when the oil is level with the BOTTOM of the plug aperture. Allow sufficient time for any surplus oil to run out before replacing the plug.

RECOMMENDED LUBRICANTS

General

Lubricants for engines, synchromesh transmission and rear axles are not listed under brand names due to the complexity of companies throughout the world.

To establish a recommendation suitable for all brands, the main lubricants listed are specified by SAE and API ratings.

These lubricants are recommended for Australian Production vehicles and must be used.

Oil additives must not be used in any circumstances in automatic transmissions, synchromesh transmissions or rear axles, and are not normally necessary or desirable in the engine oil.

Brake Fluid

1 At all times use the recommended brake fluid — Leyland Australia specification HBF6.

2 Never leave brake fluid in unsealed containers as it will absorb moisture from the atmosphere. If used in this condition, corrosion of operating parts will result. In addition there would be a reduction of the fluid's boiling point which could cause brake failure.

3 Fluid drained from the system or used for bleeding is best discarded.

4 The necessity for absolute cleanliness cannot be overemphasised.

5 Brake fluid should be changed completely every 30,000 km (18,000 miles) or 18 months whichever is the sooner.

Vehicle Raising and Support Locations

It is important that the vehicle be raised and supported only at the locations shown in Fig. C-7.37. If the vehicle is raised using a single post contact hoist, the front adjustable lifting pads should contact the front chassis member at a point immediately behind the tie-bar mounting.

The rear pads should contact the rear chassis member at a point immediately in front of the rear lower link front mounting. These lifting points should also be used when the vehicle is being raised by means of a mobile garage jack.

Care must be exercised at all times when raising the vehicle to avoid personal injury or damage to the vehicle.

Cooling system

NOTE: Never fill or top up the aluminium 8 cylinder model engines with water only. To avoid damage to the engine, the recommended mixture of inhibitor and water must be used at all times — refer to Capacities — Recommended Lubricants Section.

COOLANT INHIBITORS

It is essential to use a high quality chemical inhibitor in the coolant to obviate the formation of rust and corrosive deposits in the system.

NOTE: Soluble oil types of additives must not be used.

CAUTION: The cooling system inhibitor concentrate and the coolant solution, is toxic and must not be consumed under any circumstances.

ANTI-FREEZE FLUID

When a vehicle is operating in conditions where the prevailing ambient temperatures are below freezing, an anti-freeze solution must be added to the coolant. These should conform to the specifications outlined in Recommended Lubricants Section and the manufacturers' instructions for application strictly adhered to.

NOTE: When anti-freeze solution is not required, the system should be drained and thoroughly flushed as soon as possible, then filled with the approved inhibitor solution.

RECOMMENDED LUBRICANTS CHART

Engine	Multi-grade 20W-50 to A.P.I. Service Classification SE	
Carburetter dashpot	20W-50	
Cooling system inhibitor	Leyland Australia approved inhibitor Spec. SQ36 Part No. XXX1002 500 ml (1 pt) Part No. XXX1003 5 litres (1 gall)	Renew 12 monthly intervals. Note: Soluble oil types must not be used.
Anti-freeze 8-Cylinder engine	Solution to Specification BS3150 Type A	Note: 1 This type is essential for all alloy engines. 2 When anti-freeze is not required the system should be drained, flushed and refilled as soon as possible with approved corrosion inhibitor.
6-Cylinder engine	Solution to Specification BS3150, BS3151 or BS3152.	Note: Renew each winter if using BS3150, BS3151 or BS3152 anti-freeze the system should be thoroughly flushed to prevent sludging before refilling with inhibitor.
Manual Transmission	SAE 30-40 to Classification A.P.I. SC	
Manual Steering Rack and Hypoid Rear axle	Hypoid gear oil SAE90 to A.P.I. Service Classification GL-5	or Specification MIL-L-2105B
Automatic Transmission and Power Steering reservoir	Caltex Dexron (B-1033); Shell Dexron (B-10378); Castrol Dexron (B-10599); Esso Dexron (B-10664); Mobil Dexron (B-10101); Golden Fleece Dexron (B-10314); B.P. Dexron (B-10800); Valvoline Dexron (B-10671); Total Dexron (B-10791); Ampol Dexron (B-10673). Note: The power steering rack ball socket joints located within the rubber boots are lubricated independently of the rack using SAE40 oil.	
Grease — Prop Shaft Front Hubs	E.P. Lithium Base Multi-Purpose Grease No. 2 or 3 consistency.	
Brake Fluid	Leyland Australia Fluid HBF-6	In countries where HBF-6 is not available use fluid to SAE Spec J1703d. Minimum dry equilibrium reflux boiling point 260°C (500°F).
Handbrake linkage	Zinc Oxide filled Lithium Base grease.	
Door locks	'Dri Lube'	
Leakdown test fluid (Hydraulic Tappet)	Caltex 'Leakdown' fluid	
Windscreen washer Anti-freeze	33% solution of ISOPROPANOL	or Commercial equivalent.
Front suspension Strut	Armstrong 788 fluid	Leyland Aust. Part No. HYL4757.

The following is a summary of regular maintenance operations as laid down in the LEYLAND AUSTRALIA MAINTENANCE SYSTEM. These services are normally carried out at 5000 km (3000 miles). Should a vehicle be operated under arduous conditions, more frequent servicing will be required.

MAINTENANCE SCHEDULE

	5000 km 3000 miles	10000 km 6000 miles	20000 km 12000 miles
Underbody			
Examine underside of vehicle for damage and deterioration, including exhaust system for leaks, and report. Tighten all loose bolts and fittings.	X	X	X
Lubrication and hydraulics			
Grease and oil, as specified, all nipples and controls.	X	X	X
Examine all oil and grease retaining boots for damage or leaks, reporting as necessary.	X	X	X
Examine for oil, fuel or water leakage at all joints, seals, unions, hydraulic hoses, etc., reporting as necessary.	X	X	X
Change engine oil, and filter element.		X	X
Check/top up engine oil level.	X		
Check/top up gearbox oil level.	X	X	X
Check/top up rear axle oil level.	X	X	X
Check/top up power steering reservoir.	X	X	X
Clean air filter element.	X	X	
Fit new air filter element.			X
Replace engine breather filter.			X
Lubricate distributor drive spindle, cam and advance mechanism.		X	X
Check/top up brake master cylinder.	X	X	X
Check/top up battery cells.	X	X	X
Remove battery terminal clamps, clean and lightly smear with petroleum jelly. Replace clamps.			X
Check/top up windscreen washer reservoir.	X	X	X
Power unit			
Check condition and tension of all driving belts. Adjust as necessary.	X	X	X
Visually check condition of radiator pressure cap, reporting as necessary.	X	X	X
Drain, flush and refill cooling system, renew inhibitor.			X
Check condition of hoses and tension of hose clips, reporting as necessary.	X	X	X
Clean breather control valve.			X
Clean, examine and adjust spark plugs and examine high tension leads. Replace as necessary.		X	X
Check/rectify distributor contact points resistance, dwell angle, mechanical and vacuum advance.		X	X
Check/adjust ignition timing.		X	X
Check/top up carburetter piston damper (6 cylinder only).	X	X	
Remove carburetter suction chamber and piston, clean, re-assemble and refill piston damper.			X
Check/adjust carburetter idle, fast idle, mixture settings and automatic choke operation in accordance with emission control requirements. Report if overhaul required.		X	X
Suspension and steering			
Check tyre condition for wear, imbalance and steering mis-alignment, reporting as necessary.	X	X	X
Check/adjust tyre pressures, including spare.	X	X	X
Check steering and suspension components, including hubs, for wear or looseness, reporting as necessary.	X	X	X
Check/adjust torque of road wheel nuts.	X	X	X
Check vehicle suspension heights and report as necessary.	X	X	X
Check toe-in of front wheels and report as necessary.		X	X
Check shock-absorbers for leaks and general condition, reporting as necessary.	X	X	X
Brakes			
Remove brake drums, examine linings for wear and wheel cylinders for leaks, reporting as necessary.			X
Check disc brake calipers for leaks and pad wear, reporting condition and extent of wear.	X	X	X
Check/adjust handbrake.	X	X	X
Check brake effort and pedal travel, reporting as necessary.	X	X	X
Electrical			
Check electrical circuits and instruments functionally, including all lights and warning systems, reporting as necessary.	X	X	X
Check/adjust headlight beam setting.		X	X
Check operation of windscreen washer and wipers, including blade condition. Report as necessary.	X	X	X
Body			
Check condition and correct securing of all safety belt tightening attachment bolts to 27/34 Nm (20/25) lbs ft torque. Report as necessary.	X	X	X
Check operation of all movable windows and seat adjusters, reporting as necessary.	X	X	X
Clean, adjust and/or tighten and lubricate all locks, hinges and striker plates.	X	X	X
Road test			
Check for correct operation of all equipment and controls. Report as necessary.	X	X	X
Air conditioned cars			
Check/tighten air conditioning hose fittings.			X
Check operating controls in all positions and report as necessary.			X
Check/clean as necessary, condenser fins.			X
Observe receiver dryer sight glass for air bubbles in refrigerant, reporting as necessary.			X

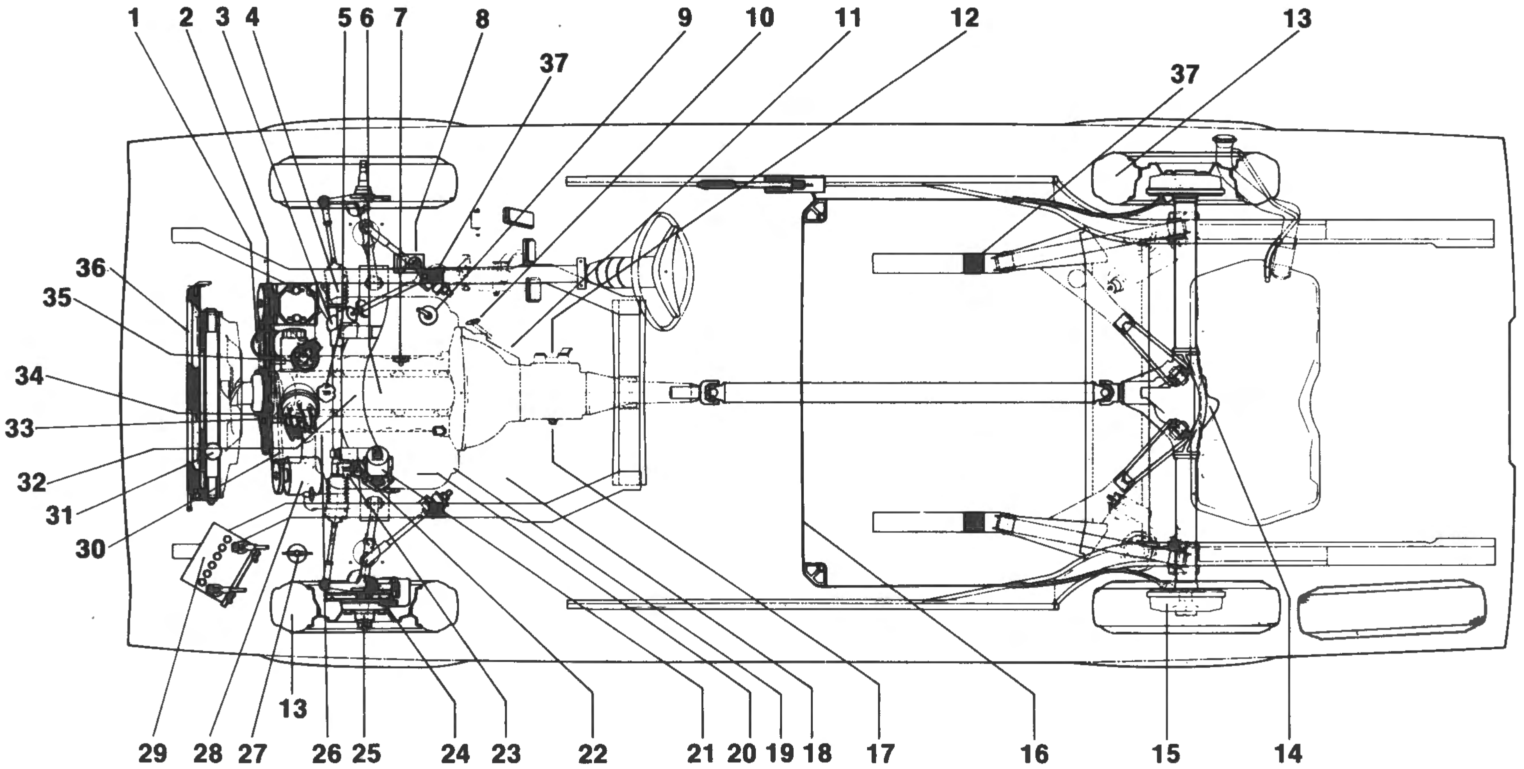
LUBRICATION and MAINTENANCE POINTS

8 CYLINDER *6 CYLINDER

#1. OIL FILTER
#2. COMPRESSOR BELT (AIR CONDITIONER)
#3. RACK AND PINION HOUSING
4. STEERING RACK BALL JOINTS

*5. OIL FILLER
#6. CARBURETTER
*7. OIL DIPSTICK
8. BRAKE MASTER CYLINDER
#9. PCV VALVE

10. AUTOMATIC TRANSMISSION
11. CLUTCH ADJUSTMENT
12. MANUAL TRANSMISSION (3 SPEED)
13. TYRES



14. REAR AXLE
15. REAR BRAKES
16. HANDBRAKE CABLE
17. MANUAL TRANSMISSION (4 SPEED)
18. WINDSCREEN WASHERS
*19. CRANKCASE BREATHER
*20. AIR FILTER

*21. CARBURETTER
#22. OIL DIPSTICK
#23. OIL FILLER
24. BRAKE PADS
25. FRONT HUBS
*26. OIL FILTER
#27. RECEIVER DRYER (AIR CONDITIONER)
#28. STEERING PUMP RESERVOIR

29. BATTERY
#30. STEERING PUMP BELT
31. RADIATOR
#32. AIR FILTER
#33. DISTRIBUTOR
34. FAN BELT
*35. DISTRIBUTOR
#36. CONDENSER (AIR CONDITIONER)
37. VEHICLE SUPPORT LOCATIONS

Fig. C-7

SECTION D

'442 O.H.V. V8'

LEYLAND '442' OHV V8 ENGINE

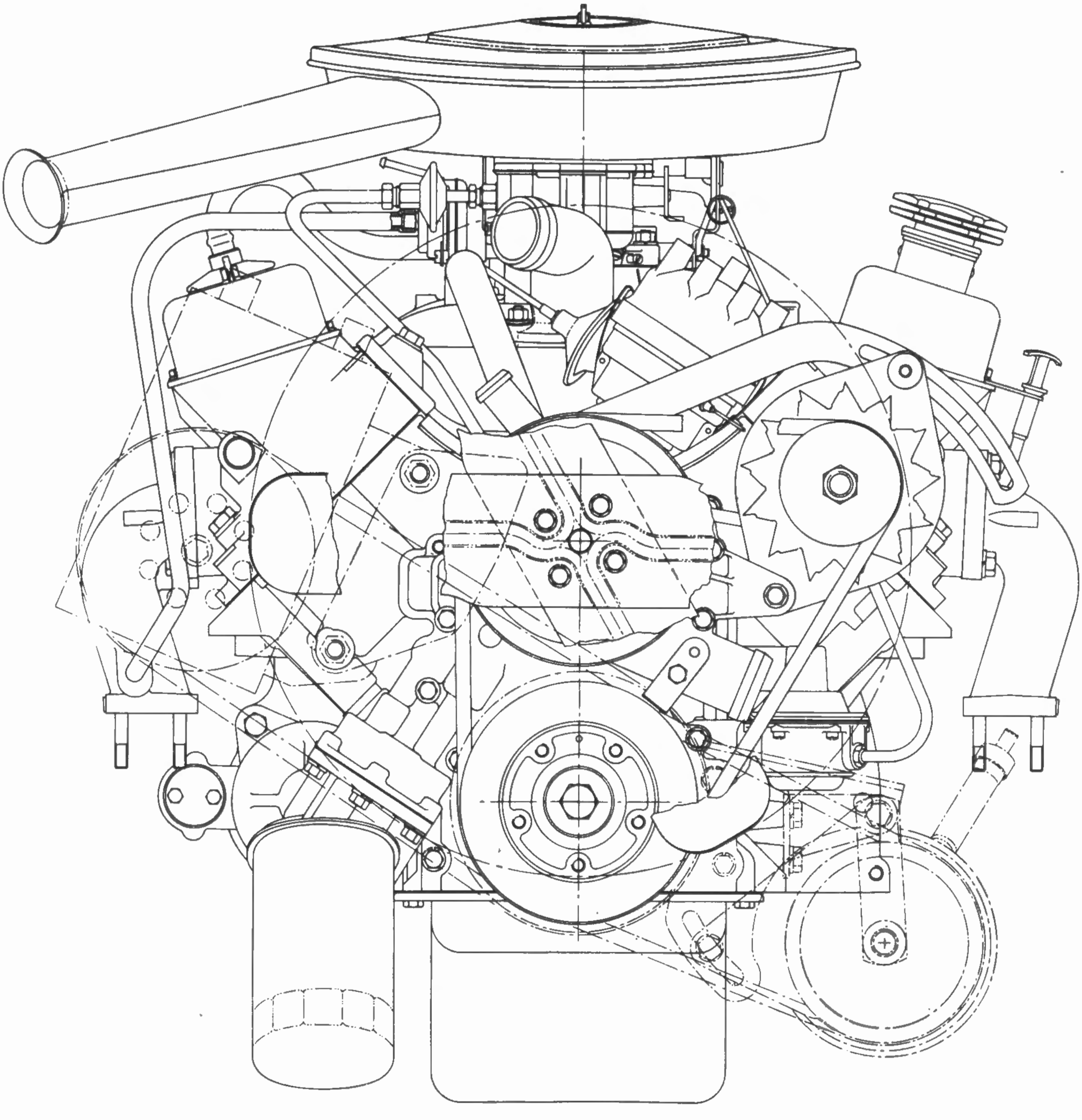


Fig. D-1

FRONT VIEW

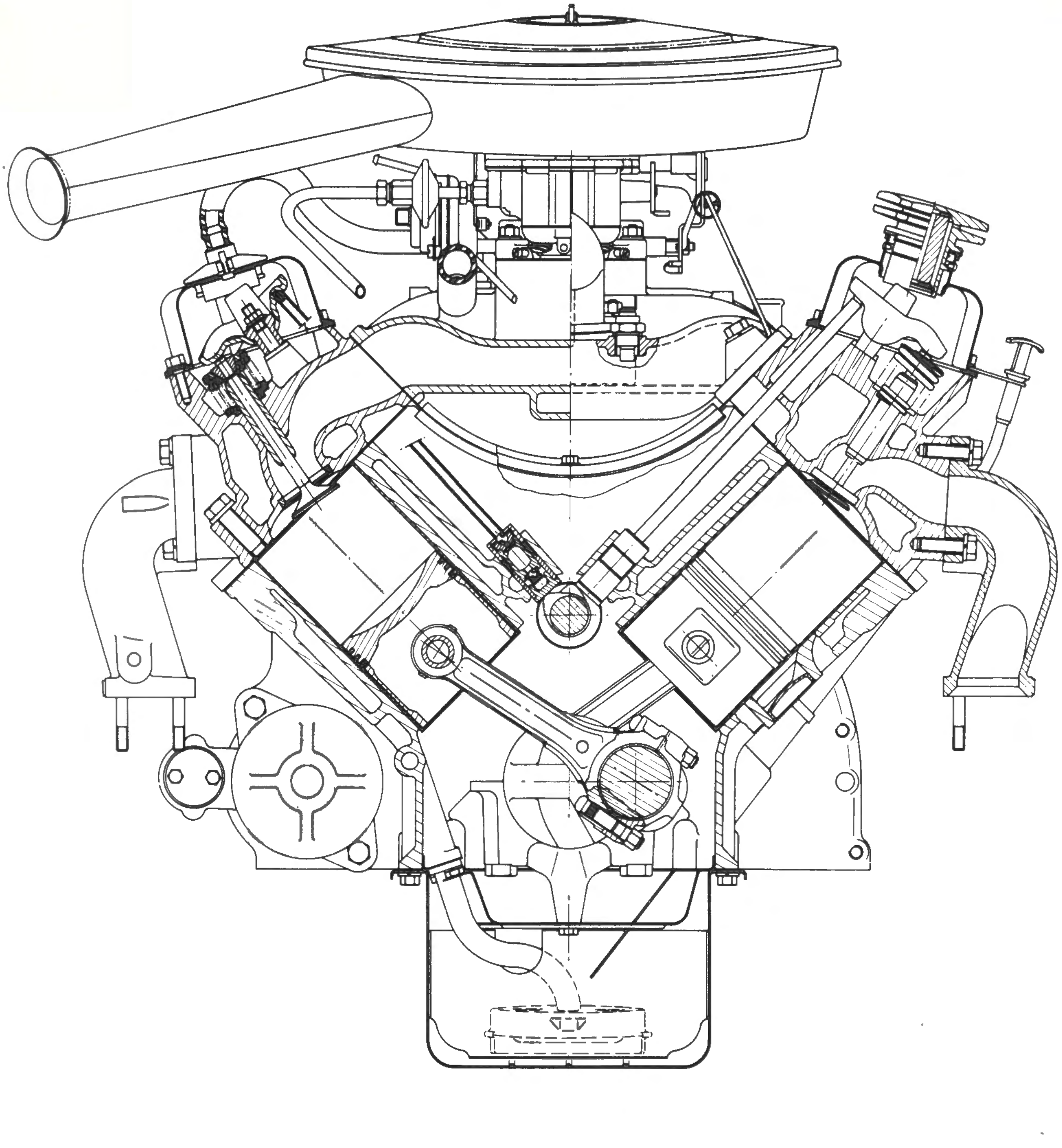


Fig. D-2

TRANSVERSE SECTION

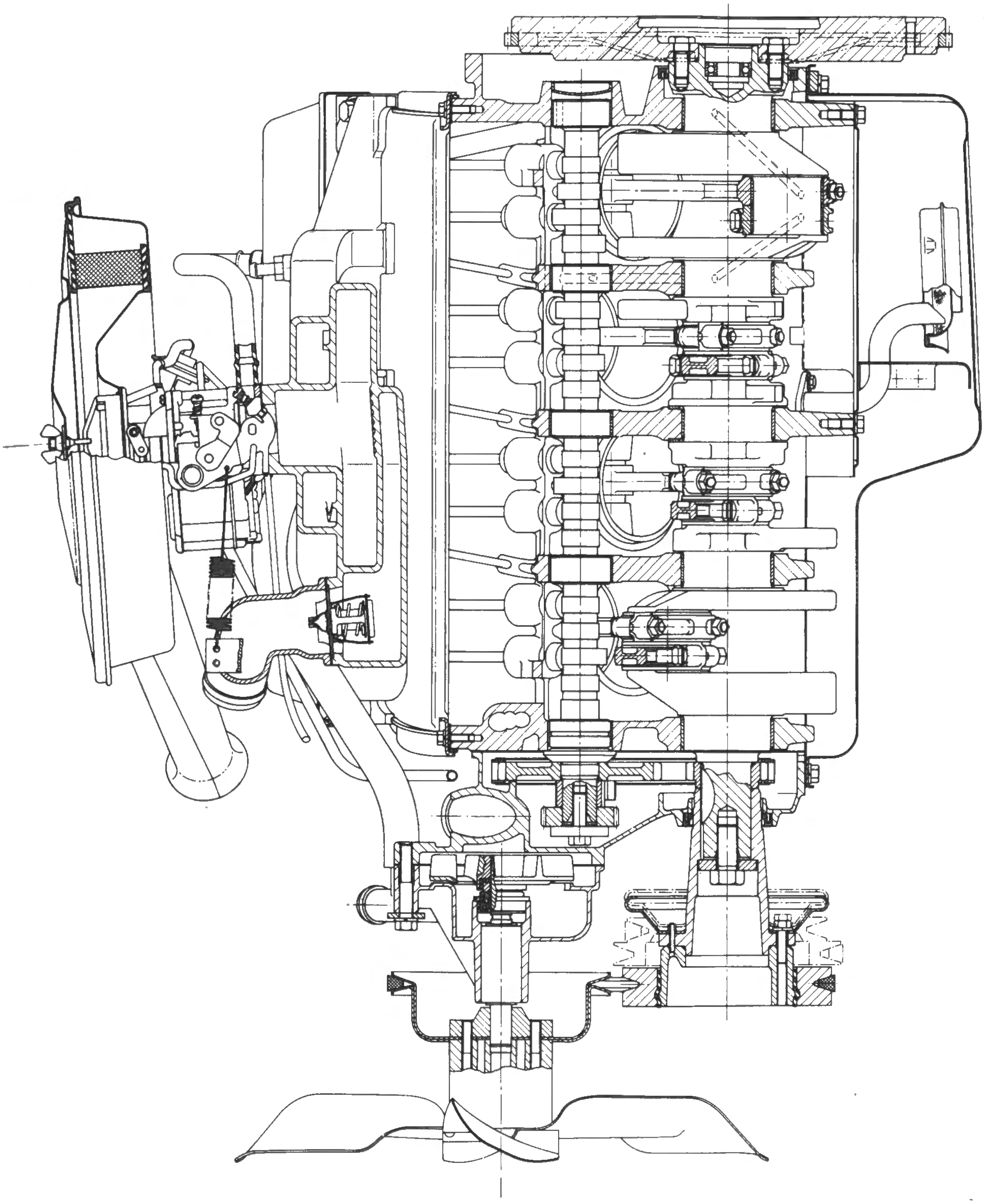


Fig. D-3

LONGITUDINAL SECTION

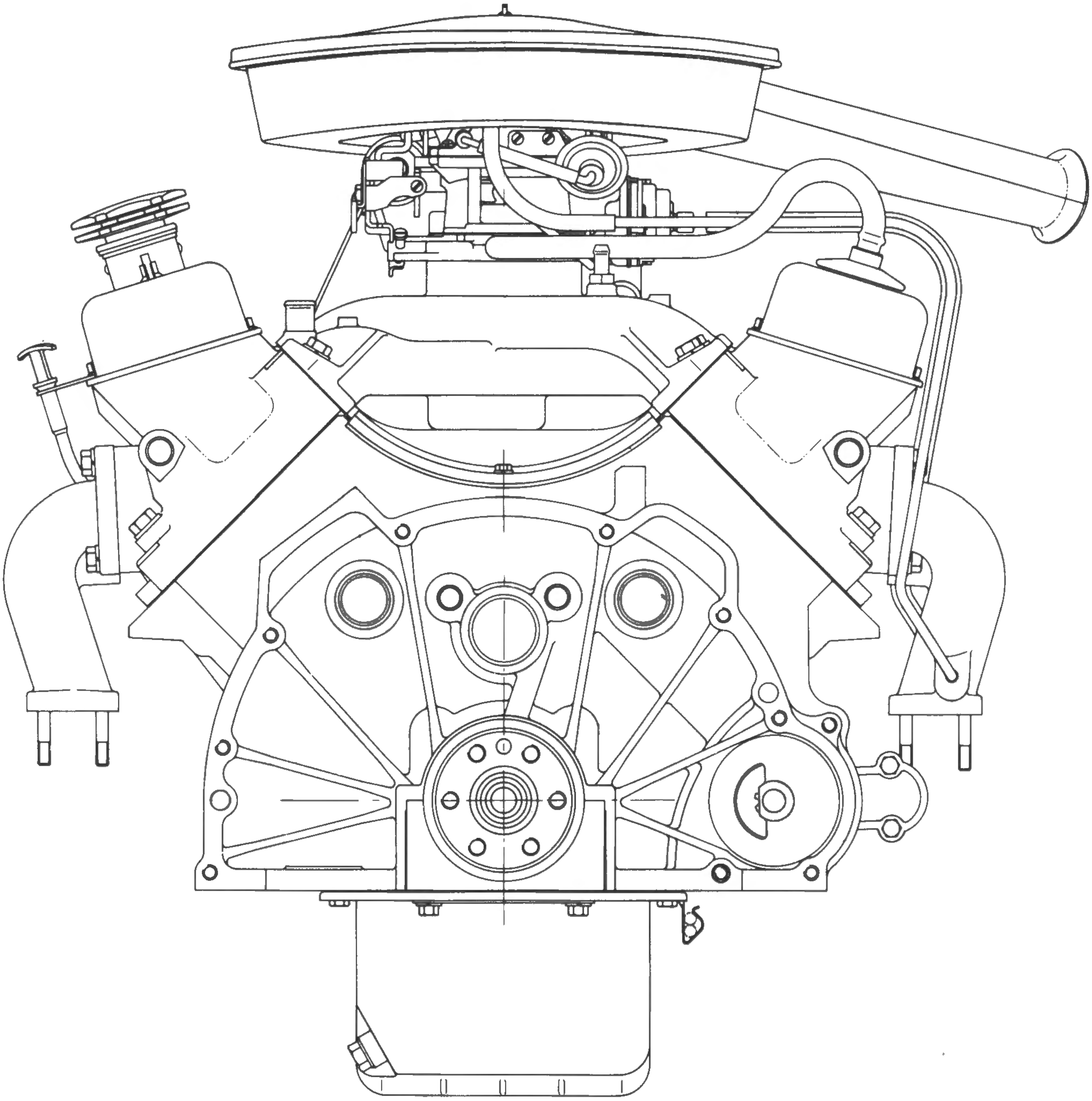


Fig. D-4

REAR VIEW

GENERAL DESCRIPTION

The Leyland '442' engine is a lightweight 8 cylinder overhead valve unit of Vee configuration. The cylinders are arranged in two banks of four at an included angle of 90°. A total cylinder capacity of 4.4 litres (269^3 in) is achieved by square design using a bore of 88.9 mm (3.5 in).

The cast aluminium alloy cylinder block is heat treated and incorporates dry cast iron cylinder liners which can be reconditioned by boring and honing.

The nodular iron crankshaft is carried in five sintered copper lead, steel backed precision bearings and the thrust is taken on two copper lead, steel backed washers, located one each side of No. 3 main bearing crankcase web.

The connecting rods are drop forged to 'I' beam section and are of the two piece horizontally split blade type. They are fitted with steel backed sintered copper lead, precision connecting rod bearings and operated side by side, two to a crankpin.

The die cast tin plated, aluminium alloy pistons are of W-slot design and fitted with two compression and one segmental oil control ring. They are coupled to the connecting rod by gudgeon pins which are a press fit in the rods.

The single camshaft is carried in the crankcase in five steel backed, line bored alloy bearings. Drive is from a steel crankshaft sprocket through a high velocity chain to a nylon toothed alloy camshaft sprocket. Mounted on the camshaft forward of the sprocket is the fuel pump cam and the distributor and oil pump drive gear.

The thrust produced by the camshaft and the driving of the ancillary equipment is transmitted via the camshaft thrust flange, to the front face of the crankcase.

The two cylinder heads are also cast, heat treated aluminium alloy and incorporate cast iron valve seat inserts and valve guides. Valves and guides are arranged in line and positioned at an angle of 10° above the cylinder bore centre line. The valves, one inlet and one exhaust per cylinder, have tapered stems, and employ dual springs which are retained by spring cap and tapered split collets.

Operation from the camshaft is by hydraulic tappets, tubular hollow push rods, and rocker arms which are mounted in pairs on tandem pivot brackets.

Full pressure lubrication is provided from a wet sump and an externally mounted gear type oil pump driven by the distributor shaft. The system incorporates a non-drain disposable, external filter canister; a filter fail safe system, low pressure warning control and a relief valve and strainer. All systems except the low pressure warning control are housed in the oil pump base assembly.

SERVICING INFORMATION

ALLOY ENGINE

The heat treated aluminium alloy castings used in the '442' cylinder heads and block have a high resistance to corrosion and have a hard surface.

However, care should be exercised when carrying out service operations, particularly in regard to the protection of, and operations on joint faces. Avoid breaking metal surfaces.

Ensure that all threads and bolt holes are free of foreign materials and sealers prior to refitting bolts and studs, etc.

CYLINDER HEADS

Overhaul

To ensure the correct and efficient operation of the valve mechanism, the following points should be noted prior to servicing the cylinder heads.

1 The valve stems on both inlet and exhaust valves are tapered and the valve guide bores are parallel. Refer GENERAL DATA.

2 Service replacement valve guides are prefinished and are plus 0.025 mm (0.001 in) on the outside diameter. The standing height of the guide is determined by the service fitting tool. Chilling the guides with dry ice will assist fitting.

3 The fitted position of the valves in the head is important to ensure correct operation of the hydraulic valve lifters and maintain valve spring pressures. The fitted position of the valve is gauged by service tool from the valve spring seat face to the valve steam tip. The 'Fitted Height' is controlled by the position of the valve on its seat, grinding the seat and/or the valve face increases the 'Fitted Height'.
The 'Fitted Height' can be lowered by:

(a) Fitting a new valve

(b) Fitting a new seat

(c) Grinding the valve stem tip within specified limits. Refer cylinder head inspection item 8.

(d) Combinations of (a), (b) and (c).

4 The valve seats are replaceable and are available finished in standard plus 0.25 mm (0.010 in) and 0.51 mm (0.020 in) oversize on the outside diameter. They can be fitted with standard workshop tooling modified as shown in Fig. D-50 provided that the facility is available to heat the entire head from 80°C to 100°C (176°F-212°F). DO NOT USE LOCALISED HEATING.

NOTE: Care should be exercised when removing and refitting seats, to maintain squareness and correct interference. Any angularity at the start of fitting the recess will cause broaching and loss of interference. Chilling of the inserts with dry ice will assist fitting.

When fitted, the insert should blend with the combustion chamber contours and the seat face must be concentric within 0.051 mm (0.002 in) Total Indicated Reading to ensure correct valve seating and minimise the possibility of valve mechanism noise — Refer Hydraulic Valve Lifter Diagnosis.

5 The cylinder head gasket faces may be reconditioned by machining. The maximum allowable amount of material than can be removed from original is 0.25 mm (0.010 in). To ascertain the amount of material that can be removed, measure the depth of the end combustion chambers from the gasket face to the spot faced projection, on the side of the combustion chamber adjacent to the spark plug hole, Fig. D-5.
The standard of original measurement is 6.73 mm (0.265 in).
After machining, permissible face deviation is: 0.01 mm (0.004 in) per 25.4 mm (inch) length.
Flatness: 0.051 mm (0.002 in).

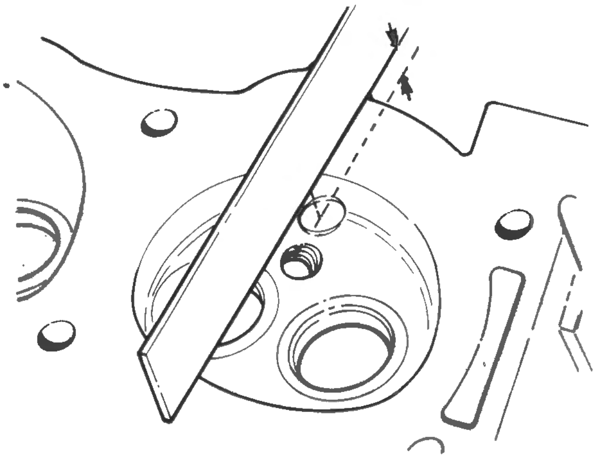


Fig. D-5

CHECKING THE COMBUSTION CHAMBER DEPTH

ENGINE BALANCE

All the basic rotating and reciprocating components of the engine are graded and balanced on special equipment during manufacture.

The crankshaft, flywheel and clutch are balanced individually then assembled and balanced as a unit.

When a Service Parts replacement engine is purchased it is supplied complete with flywheel. However, individual components can be replaced without unduly affecting the basic balance.

A design feature of this engine is its smoothness of operation. This is achieved in manufacture by balancing the engine while running. The correction to the balance being made by the attachment of weights to a balance ring attached to the crankshaft pulley on the front of the engine; and by weighted 'TUF-LOK' bolts screwed to the flywheel at the rear of the engine.

NOTE: Should it be necessary to replace a flywheel, drive plate assembly or balance ring in service, the original factory balance weights or replacements of equivalent weight should be fitted to the new parts in the same relative positions.

FIXING TENSIONS

It is of the utmost importance that the specified tightening torques for all fixings be strictly adhered to. (Refer GENERAL DATA).

Use only genuine component fixings to maintain design strengths and correct thread engagement.

Use only the approved thread lubricant.

Torque all fixings and plugs when engine is cold.

MAJOR BOLT REPLACEMENT RECOMMENDATIONS

Cylinder Head

After four reassembly operations renew all bolts.

Main Bearing Bolts

After three reassembly operations replace all bolts.

Connecting Rod Bolt

After three reassembly operations replace all bolts. Replace nuts each time.

GENERAL

Bolt heads should always be marked to indicate usage. When inspecting or reassembling at any time renew all bolts if more than two bolts exhibit evidence of elongation. If one or two bolts are elongated they must be replaced.

THREAD SALVAGE INSTRUCTIONS CYLINDER HEADS AND BLOCK

Stripped or damaged thread in the cylinder block or cylinder heads may be recovered by the 'Heli-Coil' insert method.

An exception to the above is the spark plug thread. Although inserts are available, attempts at reclaiming with normal workshop tools could result in rendering the head unserviceable due to proximity of the water jacket.

A Heli-Coil thread insert is a wire of diamond section formed into a spring-like coil and used to line a tapped hole, thereby providing a precision thread which is resistant to corrosion, scaling and heat.

It is manufactured from austenitic nickel chrome stainless steel and is fitted by winding it into a tapped hole by means of a tool which engages with a driving tang on the leading end of the coil. The last turn of the coil is notched

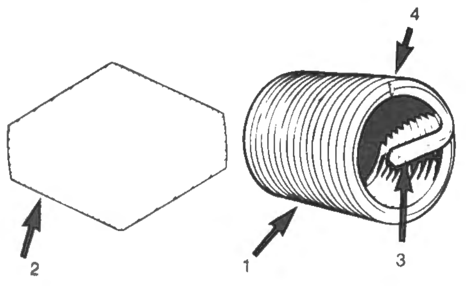


Fig. D-6

HELI-COIL NOTCHED INSERT

1 INSERT
2 SECTION VIEW
3 DRIVING TANG
4 NOTCH

which permits the drive tang to be broken off to allow bolts to pass through the insert.

In all respects Heli-Coil drilling and tapping procedures follow standard workshop practice. The most important factor is the strict adherence to the specification for diameters, depths and fits.

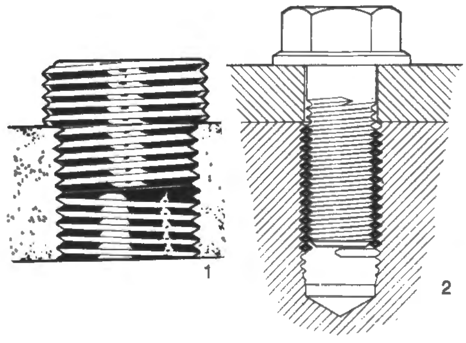


Fig. D-7
HELI-COIL INSTALLATION

1 PARTIALLY INSTALLED INSERT
2 COMPLETED REPAIR

NOTE: The fit of all threads is class 2B and plug gauges are available to check the fit prior to installing the insert.

All threaded holes which are not counter bored are counter sunk 90° x 0.76 mm (0.030 in). The drilling and tapping depths for the particular thread have been calculated to allow the installed insert to be quarter to half thread pitch below the counter sink or counter bore as the case may be.

Standard size drills are used for all holes and the calculated hole depth does not include the drill point. Therefore drill angles should not exceed 118°. Tapping is carried out with a single straight fluted plug finishing tap. Roughing and machine taps are available when required.

TOOLS AND METHOD

HELI-COIL SCREW THREAD GAUGES

These are required for checking the tapped hole before installing the insert. They are available for checking class 2B fits.

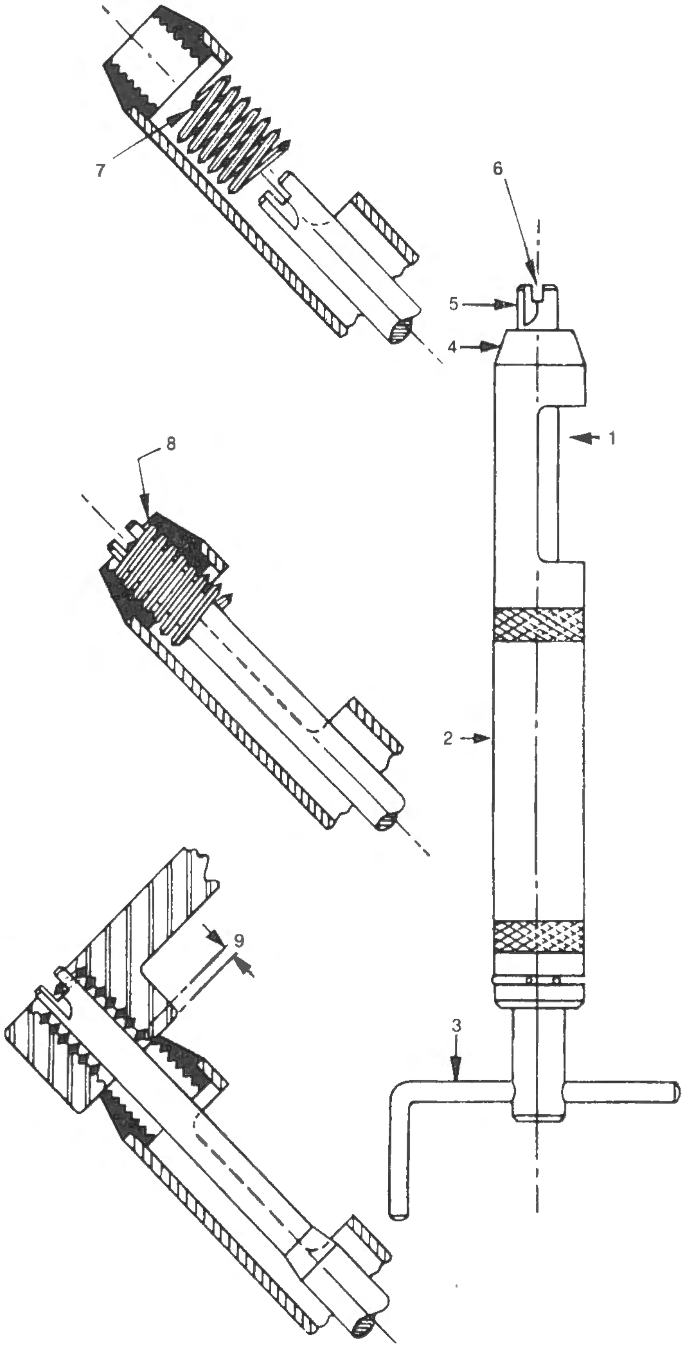


Fig. D-8

HELI-COIL INSERTING TOOL

(PRE-WINDER TYPE FOR REGULAR USE)

1 CHAMBER
2 BODY
3 HANDLE
4 NOZZLE
5 MANDREL
6 SLOT
7 TANG
8 FACE 'X'
9 ¼ TO ½ PITCH

Operating

1. Withdraw mandrel and place Insert in chamber as above.

NOTE: Tang end of Insert must lie towards nozzle.

2. Push mandrel forward through Insert to engage tang in slot.
3. Rotate mandrel clockwise and push forward gently until Insert engages in nozzle.
4. Continue winding until first coil of Insert is just about to emerge at face X.
5. Place tool squarely over tapped hole in work piece. Continue winding until Insert is transferred from tool. No forward pressure whatsoever should be used.

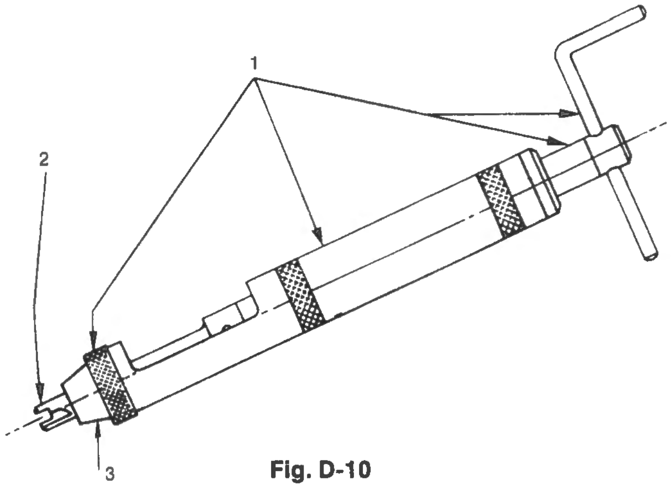


Fig. D-10

HELI-COIL UNIVERSAL INSERTING TOOL

1 BASIC TOOL 2 INTERCHANGEABLE MANDREL
3 INTERCHANGEABLE NOZZLE

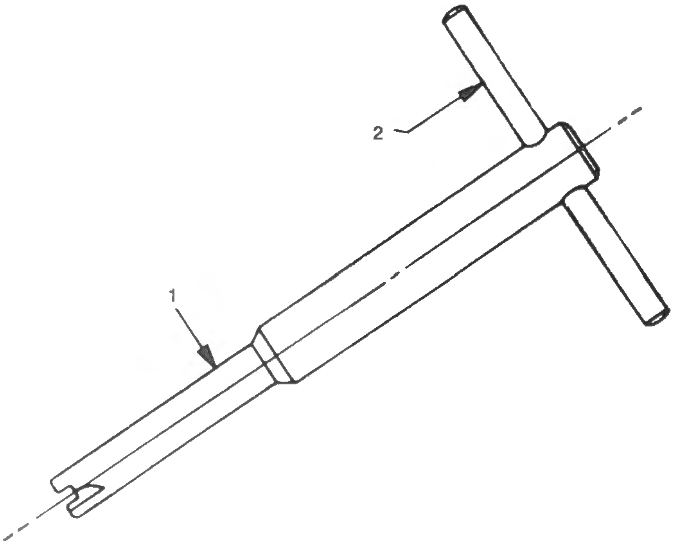


Fig. D-9

HELI-COIL HAND INSERTING TOOL

(FOR OCCASIONAL USE)

1 MANDREL 2 HANDLE

Operating

1. Push mandrel through Insert to engage tang in slot. Place squarely over tapped hole in work piece.
2. Rotate mandrel clockwise and push forward gently until Insert engages.
3. Continue winding until Insert is transferred.

Available as:
Universal Inserting Tool U.I.P. — 1 suitable for ¼ in — ½ in inserts.

Operation

1. Apply blade to top coil of Insert in position indicated in view 'A.A.'.
2. Apply pressure in direction of Arrow 'B' and turn extracting tool anti-clockwise. The Insert will wind out of the hole easily. The Insert should be discarded and a new one fitted.

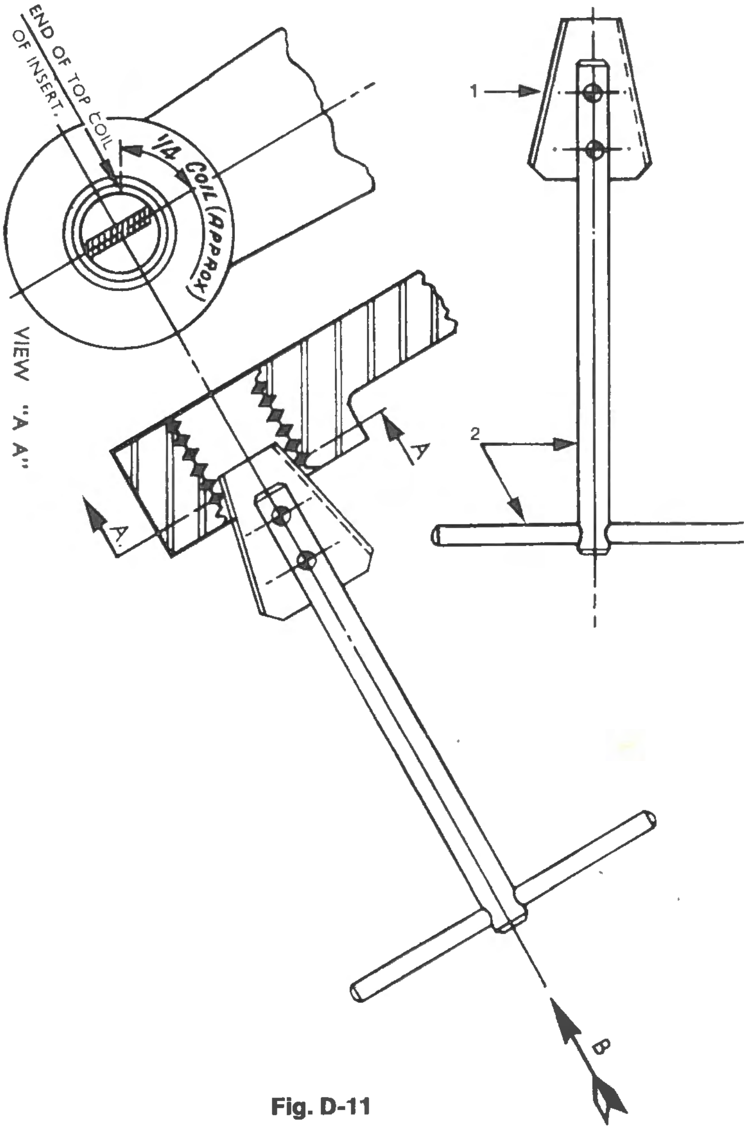


Fig. D-11

HELI-COIL EXTRACTING TOOL

1 BLADE 2 SHAFT AND HANDLE

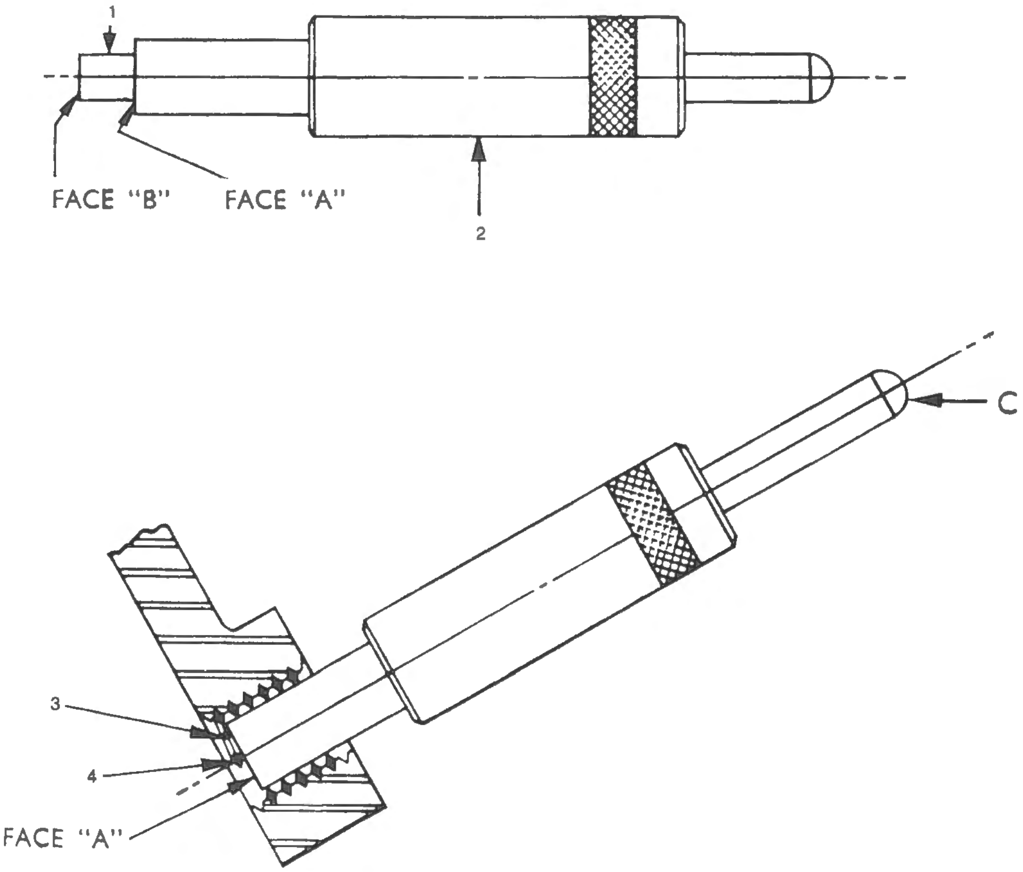


Fig. D-12

HELI-COIL TANG BREAK-OFF TOOL

1	PUNCH	3	NOTCH
2	SLEEVE	4	TANG

Operation

1 Introduce reduced portion of sleeve into minor diameter of Insert so that face 'A' rests on tang. Face 'B' of punch should also rest on tang.

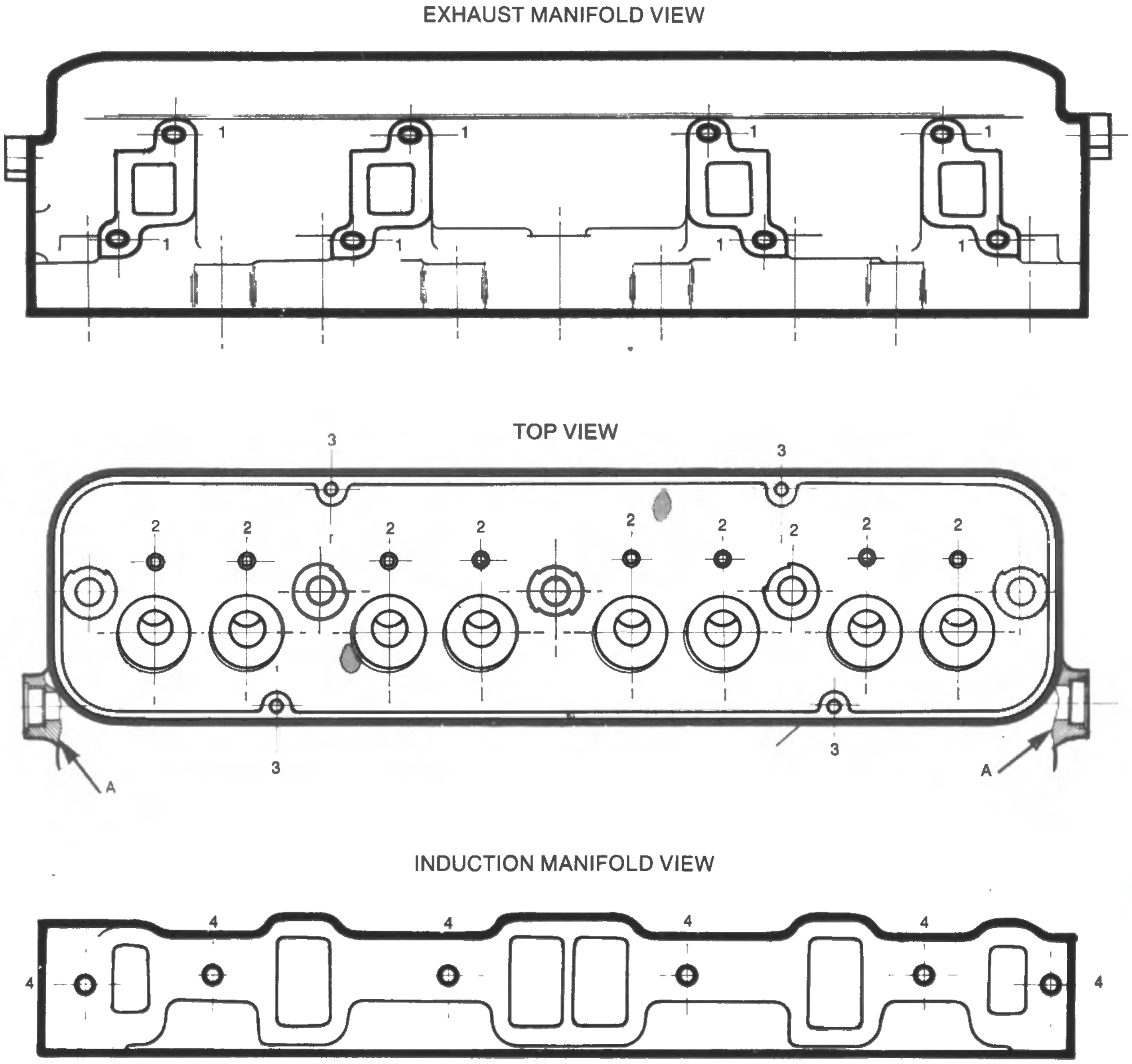
2 Hold sleeve firmly with left hand and deliver a sharp hammer blow at 'C'.
The tang will break off cleanly at the notch.

NOTE: Tang break-off tools can only be used with NOTCHED Inserts.

CYLINDER HEAD THREAD POSITIONS

Refer Fig. D-13

1. 8 Holes 'Exhaust Manifold Mounting' Drill 9.91 dia x 18.28 + 1.01 mm (0.390 x 0.72 + 0.04) deep. Tap with Heli-Coil tap No. 6 CPB to a minimum tap depth 15.06 mm (0.593 in). Use ⅜ UNC x 1D Insert.
2. 8 Holes 'Rocker Pivot Studs' drill 8.33 dia x 18.28 + 1.01 mm (0.328 x 0.72 + 0.04 in) deep. Tap with Heli-Coil tap No. 5 CPB to a minimum tap depth 16.81 mm (0.662 in). Use 5/16 UNC x 1½D Insert.
3. 4 Holes 'Rocker Cover' drill 6.62 dia x 17.27 + 1.01 mm (0.261 x 0.68 + 0.04) deep tap with Heli-Coil tap No. 4 CPB to a minimum tap depth 13.97 mm (0.550 in). Use ¼ UNC x 1½D Insert.
4. 6 Holes 'Induction Manifold Mounting' drill 9.90 dia x 26.92 + 1.01 mm (0.390 x 1.06 + 0.04 in) deep. Tap with Heli-Coil tap No. 6 CPB to a minimum tap depth 26.18 mm (1.031 in). Use ⅜ UNC x 2D Insert.



EXHAUST MANIFOLD VIEW

TOP VIEW

INDUCTION MANIFOLD VIEW

Fig. D-13

CYLINDER HEAD BOLT

THREAD AND PLUG LOCATIONS

A CORE PLUG LOCATION

CYLINDER BLOCK THREAD POSITIONS

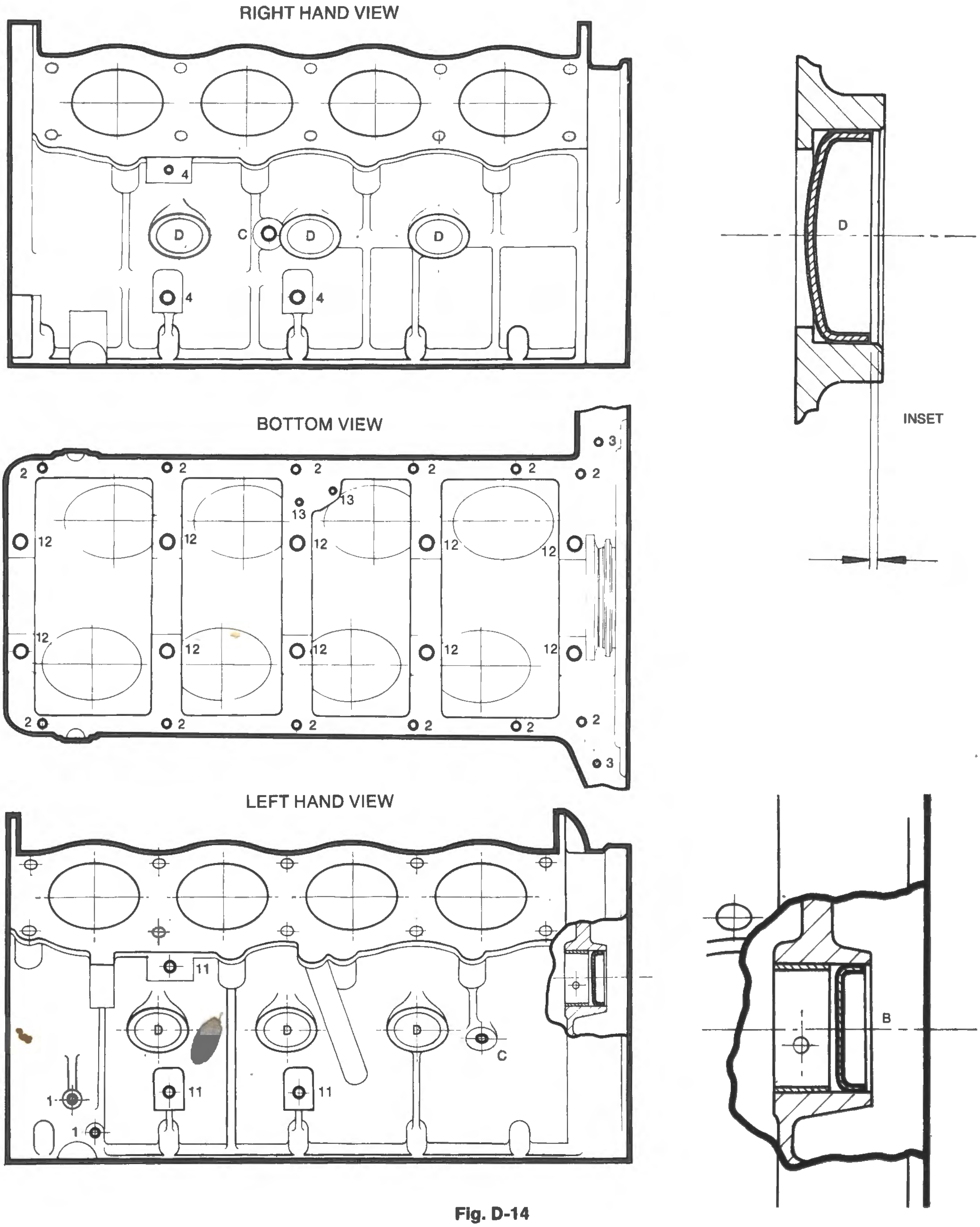


Fig. D-14

CYLINDER BLOCK BOLT THREAD AND PLUG LOCATIONS

(THREADS SEE SEPARATE KEY)

'B' INSET CAMSHAFT CUP PLUG

'C' ¼ 18TPI NPS.F. DRAIN PLUG

'D' CYLINDER BLOCK CUP PLUGS (INSET) FITTED POSITION

Refer Figs. D-14, 15 and 16

1 2 Holes drill 8.33 dia x 22.35 + 1.01 mm (0.328 x 0.88 + 0.04 in) deep. Tap with Heli-Coil tap No. 5 CPB or 5 CBB to a minimum tap depth of 20.82 mm (0.82 in). Use 5/16 UNC x 2D Inserts.

2 12 Holes Oil Reservoir 8.33 dia x 18.28 + 1.01 mm (0.328 x 0.72 + 0.04 in) deep. Tap with Heli-Coil tap No. 5 CPB to a minimum tap depth 16.76 mm (0.66 in). Use 5/16 UNC x 1½D Insert.

3 2 Holes drill 8.33 mm dia (0.328 in) through tap with Heli-Coil No. 5 CPB or 5 CS. Use Insert 5/16 UNC x 1½D.

4 3 Holes 'Engine Mounts' R.H. drill 9.90 dia x 25.4 + 1.01 mm (0.390 x 1.00 + 0.04 in) deep. Tap with Heli-Coil tap No. 6 CPB to a minimum tap depth 19.81 mm (0.78 in). Use ⅜ UNC x 1½D Insert.

5 9 Holes 'Front Cover Drill' 8.33 dia x 23.36 + 1.01 mm (0.328 x 0.92 + 0.04 in) deep. Tap with Heli-Coil tap No. 5 CPB to a minimum tap depth 7.11 mm (0.28 in). Use 5/16 UNC x 2D Insert.

6 10 Holes 'Head Bolts R.H.' drill 9.90 dia x 26.18 + 1.01 mm (0.390 x 1.31 + 0.04 in) deep. Tap with Heli-Coil tap No. 6 CPB to a minimum tap depth 24.6 mm (0.97 in). Use ⅜ UNC x 2D Insert.

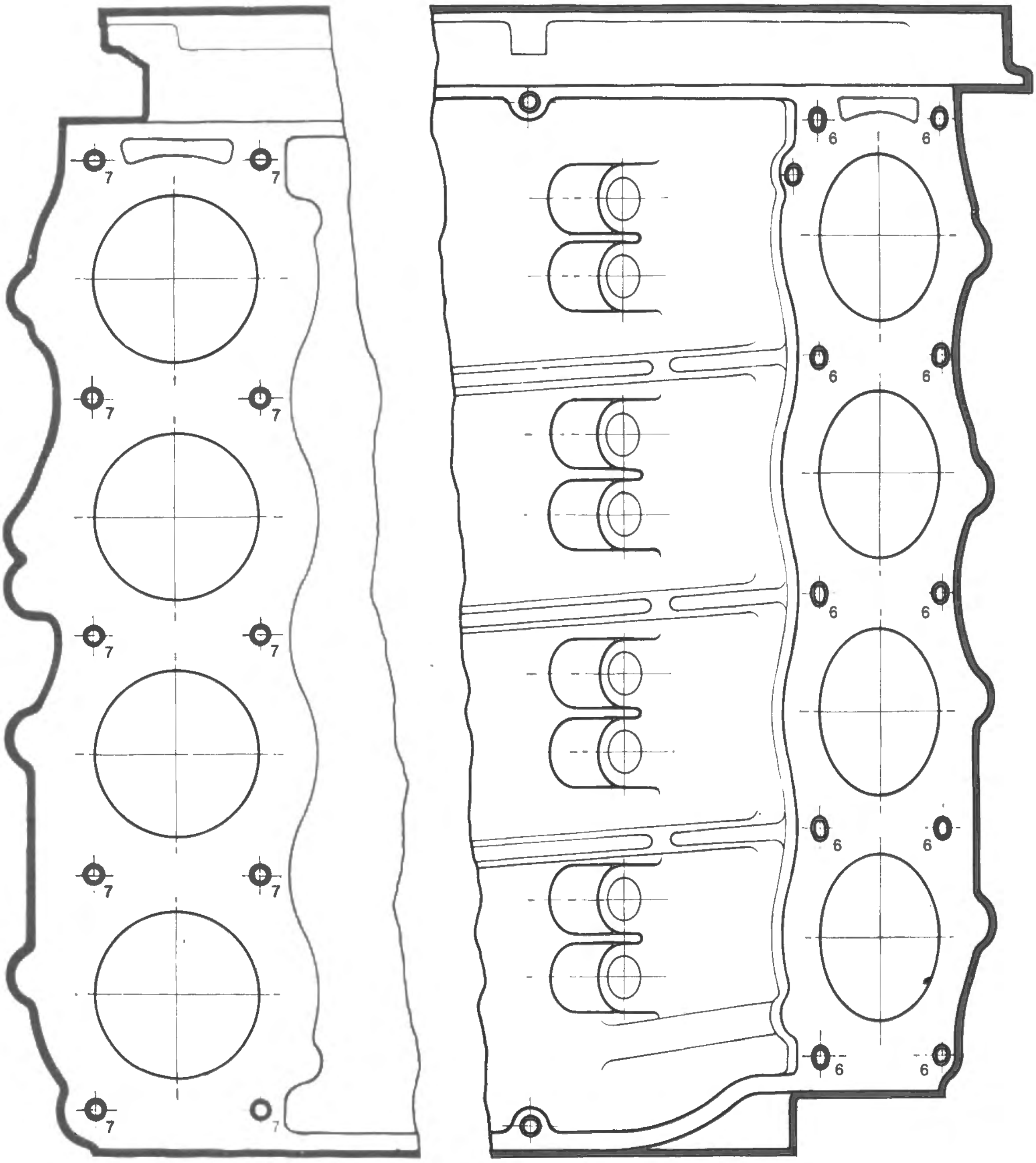


Fig. D-15

TOP VIEW

CYLINDER BLOCK THREAD LOCATIONS

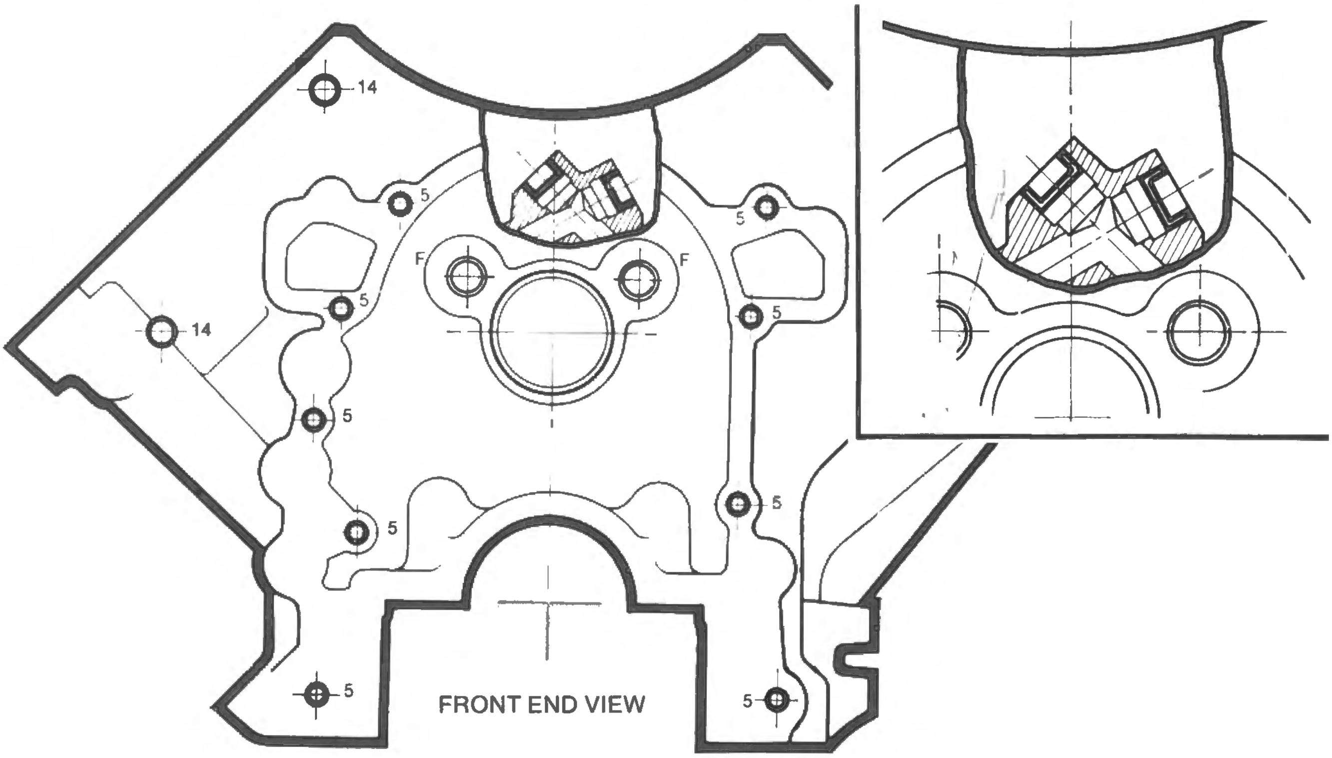
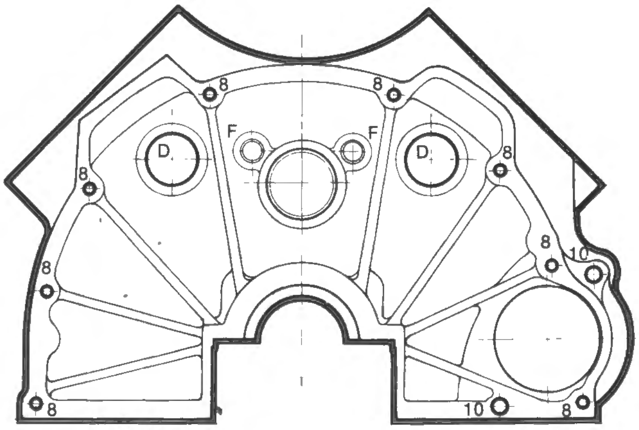


Fig. D-16

CYLINDER BLOCK BOLT THREAD AND PLUG LOCATIONS

(THREAD SEE SEPARATE KEY)

CYLINDER BLOCK CUP PLUGS 'F' OIL GALLERY CUP PLUGS



REAR END VIEW

7 10 Holes 'Head Bolts L.H.' drill 9.90 dia x 25.41 + 1.01 mm (0.390 x 1.31 + 0.04 in) deep. Tap with Heli-Coil Tap No. 6 CPB to a minimum tap depth 24.63 mm (0.97 in). Use ⅜ UNC x 2D Insert.

8 8 Holes 'Transmission Mounting' drill 9.90 dia x 25.41 + 1.01 mm (0.390 dia x 1.00 + 0.04 deep) Tap with Heli-Coil tap No. 6 CPB to a minimum tap depth 19.81 mm (0.78 in). Use ⅜ UNC x 1½D Insert.

9 2 Holes 'Manifold Gasket Valley' Drill 6.62 dia x 17.7 + 1.01 mm (0.261 x 0.70 + 0.04 in) deep. Tap with Heli-Coil tap No. 4 CPB to a minimum tap depth 13.97 mm (0.55 in). Use ¼ UNC x 1½D Insert.

10 2 Holes 'Starter Motor Mounting' drill 9.90 mm (0.390 in) through. Tap with Heli-Coil tap No. 6 CPB through. Use ⅜ UNC x 2D Insert.

11 3 Holes 'Engine Mounting L.H.' Refer item No. 4.

12 10 Holes main 'Bearing Bolts' drill 13.08 dia x 35.05 + 1.01 mm (0.515 x 1.38 + 0.04 in) deep. Tap with Heli-Coil tap No. 8 CPB to a minimum tap depth 26.08 mm (1.27 in). Use ½ UNC x 2D Insert.

13 2 Holes 'Oil Pickup' drill 6.62 mm (0.261 in) dia through. Tap with Heli-Coil tap No. 4 CPB through. Use ¼ UNC x 2D Insert.

14 2 Holes 'Compressor Mountings' drill 13.08 dia x 29.46 + 1.01 mm (0.515 x 1.06 + 0.04 in) deep. Tap with Heli-Coil tap No. 8 CPB to a minimum tap depth 25.90 mm (1.02 in). Use ½ UNC x 1½D Insert.

THREAD LUBRICANTS AND SEALERS

The use of a thread lubricant and sealer is essential to ensure correct tightening torque on fixings and prevention of corrosion. Use only Permatex Aviation Form-A-Gasket No. 3 Solvent Industrial Alcohol. Clean threads on all fixings before applying new sealant. Apply only sufficient sealer to cover engagement section of threads.

All blind holes have a cavity below the thread, ensure this is free of foreign material and liquids or hydraulicing may occur causing thread damage.

Should it be necessary to replace coolant or oil gallery plugs Refer Fig. D-13 to 16, install with:

(1) Loc-Tite plastic gasket or

(2) 3B Seal Pact by 'BESTOBELLS'.

JOINTING COMPOUNDS

Permatex Jointing compound may be used sparingly for general gasket applications such as timing case, oil reservoir, water pump, back plate etc. This compound is non-hardening and therefore extreme care should be taken with its application in areas where excess could cause blockage of oil passages.

Do not use jointing compounds on the cylinder head or inlet manifold gaskets.

COOLING SYSTEM INHIBITORS AND ANTI-FREEZE

The coolant used in the engine cooling system consists of a solution of clean fresh water and an inhibitor or Anti-freeze.

It is imperative that only the recommended anti-freeze or inhibitor be used.

Inhibitor

Leyland Australia Inhibitor to Specification SQ36.
Use 205 ml (7 fl. oz.)

Anti-freeze

To Spec. BS3150 Type A 25% by volume = –12°C (10°F).

Never top up or fill the cooling system with plain water except in an emergency. Refer Section J for detailed information.

AIR CONDITIONING EQUIPMENT

CAUTION: All work involving the handling of heater/cooler unit system requires special equipment, a knowledge of its correct use and attention to safety measures. Refer Section X.

LUBRICATION

DESCRIPTION

The distributor driven externally mounted oil pump draws lubricating oil from the crankcase mounted sump, through a gauze strainer and pickup pipe, to the cylinder block lower right hand gallery which aligns with a port through the timing case cover.

From the outlet port in the pump cover, the oil is fed through a strainer to the relief valve and also to the filter.

The flow through the filter is external to internal. The oil enters the filter through a series of radial ports which are covered internally by a hinged synthetic rubber washer permitting flow one-way only, thus preventing drain back.

The relief valve exhaust is channelled back to the inlet side of the pump.

From the centre of the filter the oil passes through the centre of the filter adaptor into the upper part of the front cover.

A port containing a spring loaded valve connects the filter inlet side of the pump cover to the outlet side.

The valve is kept shut by a pressure balance across the filter plus spring pressure. Should the filter become blocked, pressure will build up on the inlet side and drop on the outlet side. When there is sufficient pressure differential to overcome the spring pressure, the valve will open allowing unfiltered oil to reach the main galleries minimising the possibility of engine failure.

From the pump cover the oil is channelled up through the right hand side of the timing case cover to the front end of the upper right hand main gallery and across to the left hand. From the right hand gallery five drillings down through the crankcase webs carry oil to the main bearings.

The angle of the drillings is such that they pass through the edge of the camshaft tunnels to align with the camshaft bearing oil holes.

From the main bearings oil is channelled to the connecting rod bearings via drillings between the main bearing journals and the crankpins as follows.

No. 1 (Front) main bearing supplies No. 1 connecting rod on No. 1 crankpin.

No. 2 main supplies No. 2 connecting rod on No. 1 crankpin and No. 3 connecting rod on No. 2 crankpin.

No. 3 main supplies No. 4 connecting rod on No. 2 crankpin and No. 5 connecting rod on No. 3 crankpin.

No. 4 main supplies No. 6 connecting rod on No. 3 crankpin and No. 7 connecting rod on No. 4 crankpin.

The rear main supplies No. 8 connecting rod on No. 4 crankpin.

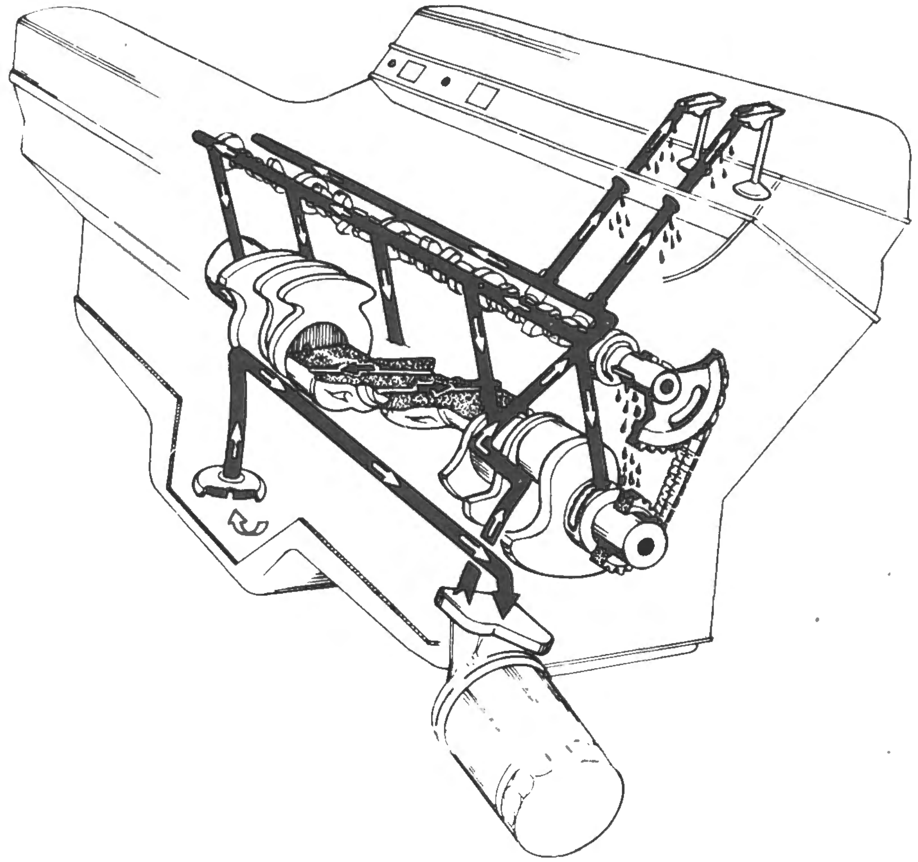


Fig. D-17

LUBRICATION SYSTEM

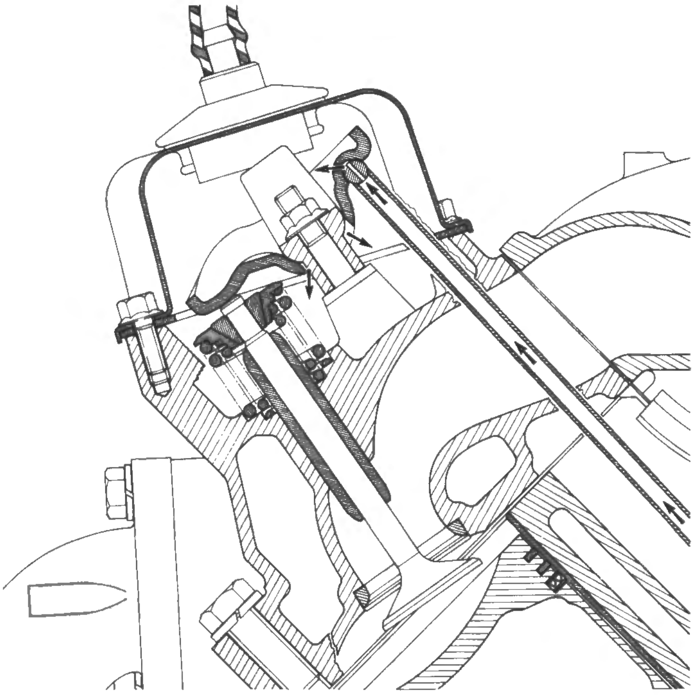


Fig. D-18

OVERHEAD VALVE GEAR LUBRICATION

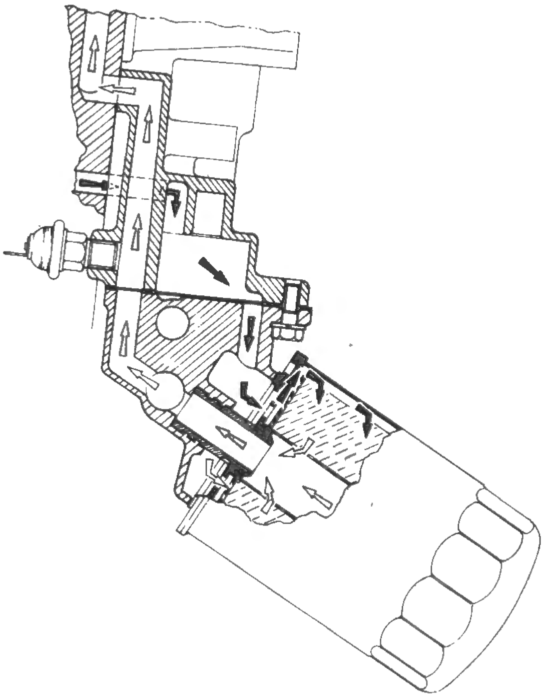


Fig. D-19

SECTION THROUGH OIL FILTER AND PUMP COVER

Cylinder wall lubrication is by jet from the connecting rod. Ref. Fig. D-19A. Oil from the crankshaft drilling passes through a notch in the bearing shell joint face and is channelled around the connecting rod bolt at the cap joint to the jet drilling.

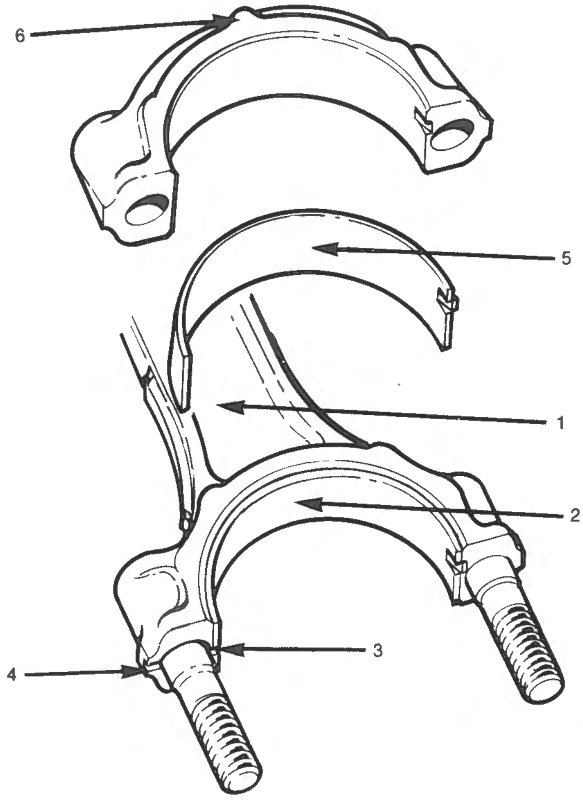


Fig. D-19A

CYLINDER WALL LUBRICATION

1	CONNECTING ROD	4	JET SLOT
2	UPPER BEARING SHELL	5	LOWER BEARING SHELL
3	SLOT IN SHELL	6	CONNECTING ROD CAP

Oil feed to the hydraulic valve lifters, and subsequently to valve rockers via the lifter metering valves and hollow push rods, is also from the main galleries.

The arrangement of both galleries is such that they pass through the side of the lifter bores on both banks making them subject to full gallery pressure.

Lubrication of the camshaft thrust flange is from the front camshaft bearing. A metering hole is drilled through the thrust flange into a groove around the timing gear journal. The back of the timing gear boss is chamfered taking in the gear keyway, permitting oil to traverse the keyways, the resultant leakage due to component fits lubricating the timing chain, distributor drive gear and fuel pump cam.

OIL FILTER

The oil filter is a full flow throw-away canister assembly which screws onto an adaptor in the oil pump cover assembly. Refer Figs. D-20 and 2.

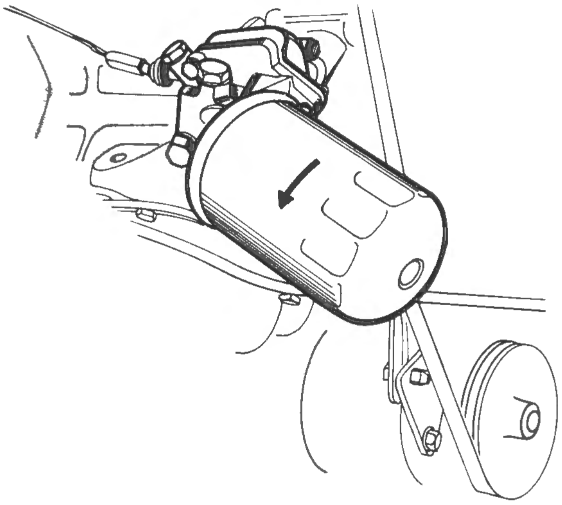


Fig. D-20

OIL FILTER REMOVAL

Removing

1 Unscrew the canister anti-clockwise and discard. Note: If the canister is difficult to remove, use a universal strap type tool.

CAUTION: Do not delay in fitting a new filter, otherwise the oil pump may drain and would require priming before starting the engine.

Refitting

1 Smear clean engine oil on the sealing washer of the new filter.

2 Screw filter on clockwise until the sealing washer touches the oil pump cover face. Then tighten a further half turn by hand. Do not overtighten.

OIL PUMP COVER

Removing

1 Disconnect the battery.

2 Remove the oil filter canister.

NOTE: If the by pass valve or the relief valve is to be removed, slacken the plugs at this point.

3 Remove the six set screws and spring washers retaining the cover.

NOTE: On the removal of the cover the pump gears may drop down. Prevent this from happening and mark the tooth mesh so that they can be reinstalled in their original running position.

4 Remove gears as necessary.

5 Remove cover gasket and discard.

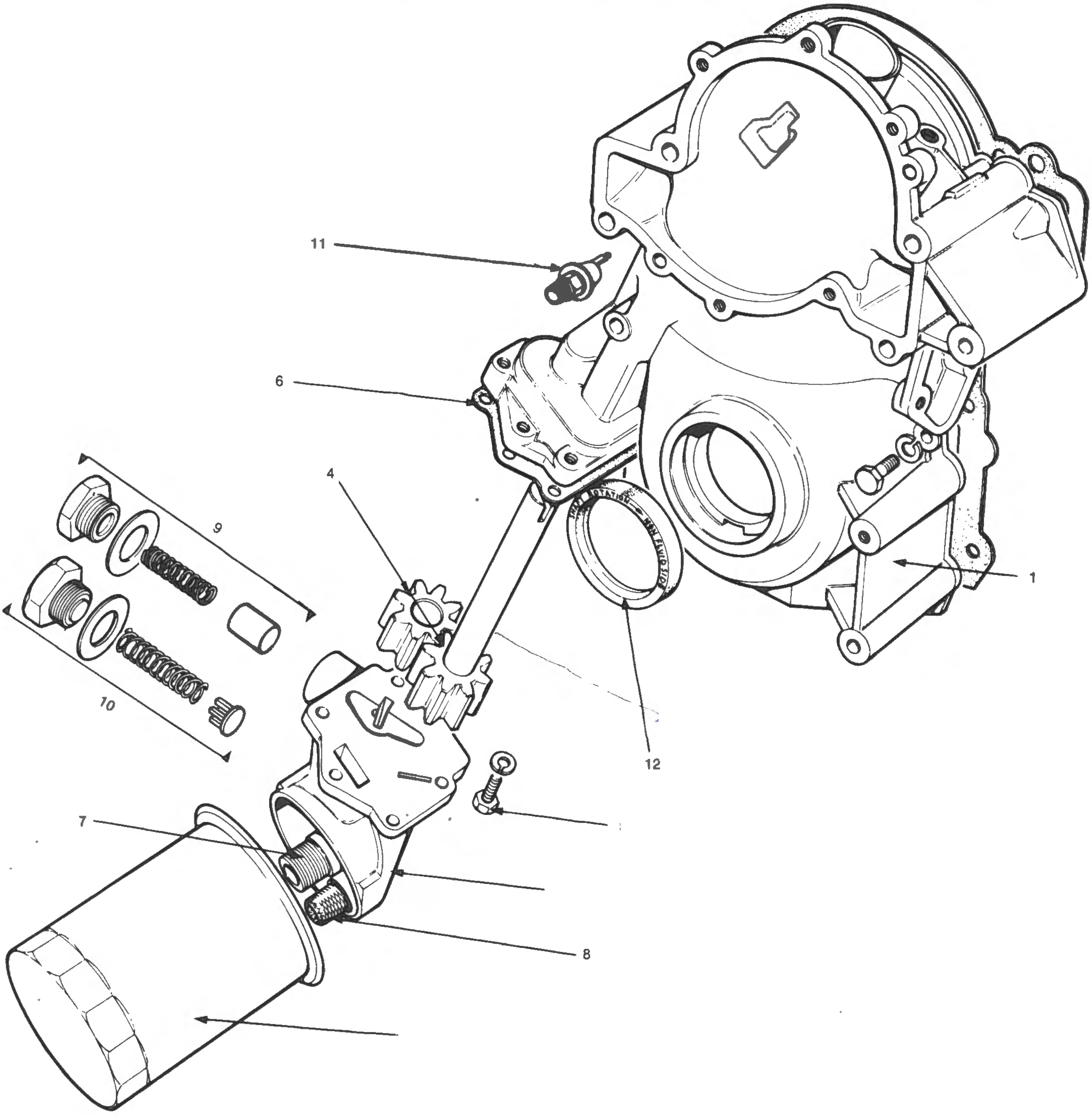


Fig. D-21

LAYOUT OF OIL PUMP AND FRONT COVER

1 FRONT COVER
2 OIL FILTER CANISTER
3 PUMP COVER TO FRONT COVER SCREWS AND SPRING WASHERS
4 PUMP GEARS
5 PUMP COVER
6 PUMP COVER GASKET
7 FILLER CANISTER ADAPTOR
8 RELIEF VALVE STRAINER
9 RELIEF VALVE COMPONENTS
10 FILTER BY PASS VALVE COMPONENTS
11 LOW PRESSURE WARNING LAMP SWITCH
12 FRONT COVER CRANKSHAFT OIL SEAL

Refitting

1. Fully pack the oil pump gear housing with petroleum jelly, no other grease is suitable.
2. Fit the oil pump gears in their original meshed position, and so that petroleum jelly is forced into every cavity between the teeth.

NOTE: If the by pass valve or the relief valve is to be jelly it may not prime itself when the engine is started.

3. Place a new gasket on the pump cover.
4. Locate the oil pump cover in position.
5. Refit the 6 screws and spring washers and tighten alternately to 11 to 13.5 Nm (8 to 10 lb.f.ft.)
6. Refit or fit new filter canister.
7. Check the oil level in the engine reservoir and replenish as necessary.
8. Connect battery lead.
9. Start engine, check for oil pressure and oil leaks.
10. Stop engine. Check engine oil level and top up as necessary.

OIL PUMP OVERHAUL

Dismantling

1. Slacken valve plugs.
2. Remove the oil pump cover.
3. Unscrew the plug from the pressure relief valve and remove the copper sealing washer.
4. Withdraw the relief valve and spring.
5. Unscrew the filter by pass valve plug and remove the copper sealing washer.
6. Withdraw the by pass valve and spring.
7. Remove the relief valve strainer as necessary by cutting away the metal from the filter washer at the three staking points. Fig. D-22.

Inspecting

1. Clean all components.
2. Check the pump gears for wear and scoring.
3. Refit the gears to the cover in their original meshed position.
4. Place a straight edge across the gears and measure the clearance between the straight edge and the surface of the front cover. Fig. D-23. The clearance should be between 0.05 mm and 0.15 mm (0.002 to 0.006 in). If the clearance is less than 0.05 mm (0.002 in) check the gear pocket in the front cover for wear.
5. Check gear backlash as shown in Fig. D-24. If clearance is in excess of 0.25 mm (0.010 in) replace gears.
6. Check the radial clearance between the gears and the pocket walls, clearance should not be in excess of 0.25 mm (0.010 in) total.
7. Remove the oil pump drive gear and check for excessive clearance.
8. Check the oil pressure relief valve for wear or scoring. The valve must be a free sliding fit in its bore with no perceptible side movement.
9. Check the relief valve spring for wear on outside diameter of the coils and signs of collapse.
10. Check the oil filter by pass valve for cracks, indentations and scoring.

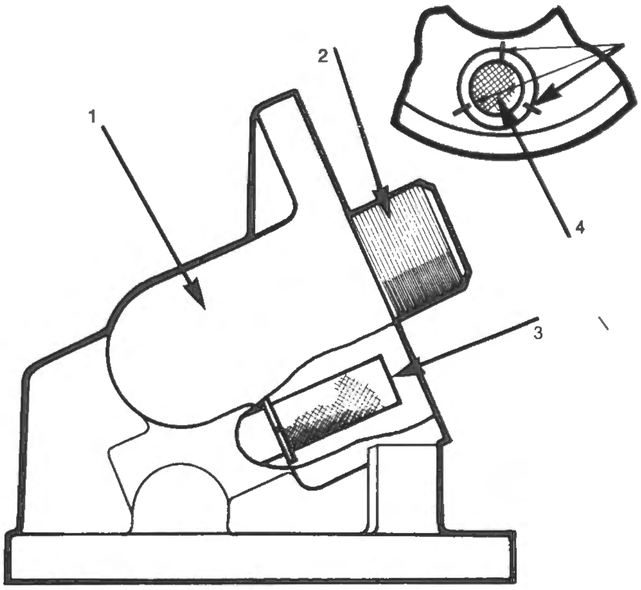


Fig. D-22

RELIEF VALVE STRAINER

1 OIL PUMP COVER
3 STRAINER
2 FILTER CANISTER ADAPTOR
4 STAKING POINTS

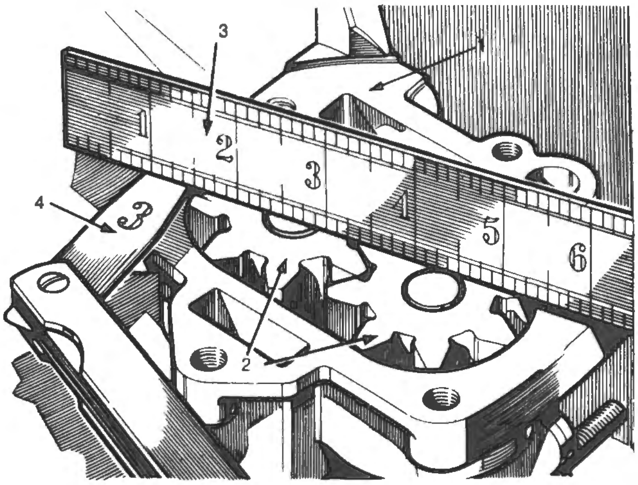


Fig. D-23

CHECKING PUMP GEAR TO COVER CLEARANCES

1 FRONT COVER
3 STRAIGHT EDGE
2 GEARS
4 FEELER GAUGE

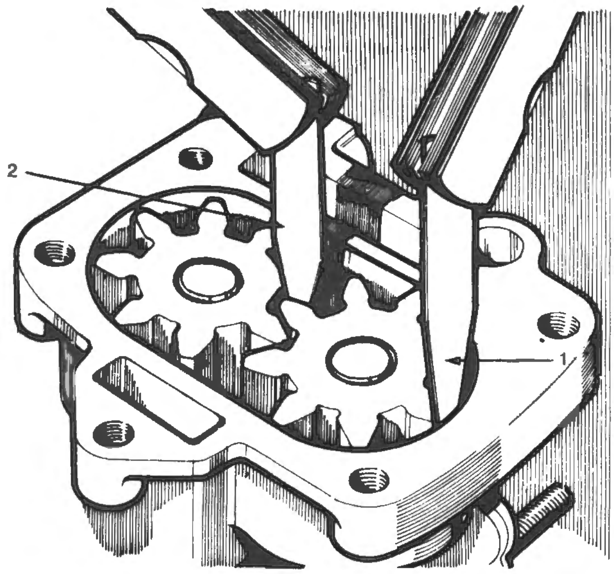


Fig. D-24

CHECKING PUMP GEAR TO WALL CLEARANCE AND GEAR BACKLASH

1 WALL CLEARANCE 2 BACKLASH

Assembling

1 Stake the relief valve strainer in place if removed.

2 Lubricate the pressure relief valve and fit into its bore.

3 Insert the relief valve spring.

4 Fit a new copper washer to the plug, fit the plug.

5 Fit the by pass valve to its spring and fit the assembly to its bore.

6 Fit a new copper washer to the plug and fit the plug to its bore.

7 Carry out operations 1 to 10 of Oil Pump Cover refitting noting the following:
When the cover screws are tightened, torque the relief valve plug to 41 to 47.5 Nm (30-35 lb.f.ft.)

OIL PRESSURE CHECK

1 Operate the engine until coolant and oil temperatures are stabilized at the figures quoted in GENERAL DATA.

2 Remove the oil light switch and using a suitable adaptor connect and bleed an oil gauge. The thread in the front cover is ¼ x 18 threads N.P.S.F.

3 Connect tachometer to engine.

4 Check pressures at rpm and temperatures as quoted in GENERAL DATA.

OIL RESERVOIR

Removing

1 Drain oil.

2 Remove screws from fan cowl and allow to rest on fan (Automatic).

3 Disconnect cooling pipes from clip on oil reservoir right hand side (Automatic).

4 Remove dipstick.

5 Turn engine until the TDC mark on pulley is at approximately 3 o'clock position.

6 Remove nuts and bolts from both front mounts.

7 Fit engine lifting hooks and lift engine until flywheel housing contacts floor pan.

8 Remove bolts from reservoir.

9 Remove reservoir to the rear.

Refitting

1 Refitting is the reversal of the removing procedure, noting the following:

(a) Apply jointing compound to the timing case to crankcase joint as shown in Fig. D-25.

(b) Fit a new oil reservoir gasket.

(c) Torque the retaining screws to the figures quoted in GENERAL DATA.

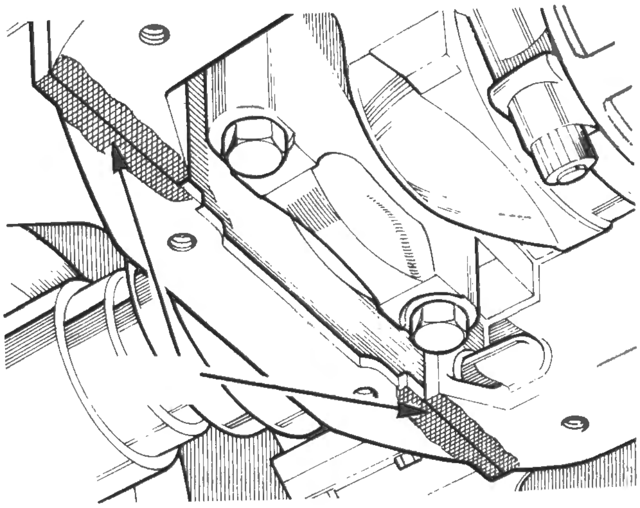


Fig. D-25

SEALING FRONT COVER TO CRANKCASE JOINT

CRANKCASE OIL BAFFLE PLATE

Removing

1. Remove the oil reservoir.
2. Remove the two screws securing the baffle to the rear and number three main bearing cap and remove the baffle.

Refitting

1. Clip the baffle into position and reverse the removal procedure.

OIL PICK UP PIPE AND STRAINER ASSEMBLY

Removing

1. Remove the oil reservoir.
2. Remove the crankcase oil baffle plate.
3. Remove the two screws and washers securing the assembly to the crankcase.
4. Remove and discard the gaskets.

Refitting

1. Refitting is the reversal of the removing procedure noting the following:
   (a) Fit a new gasket and torque the screws to the figures quoted in GENERAL DATA.

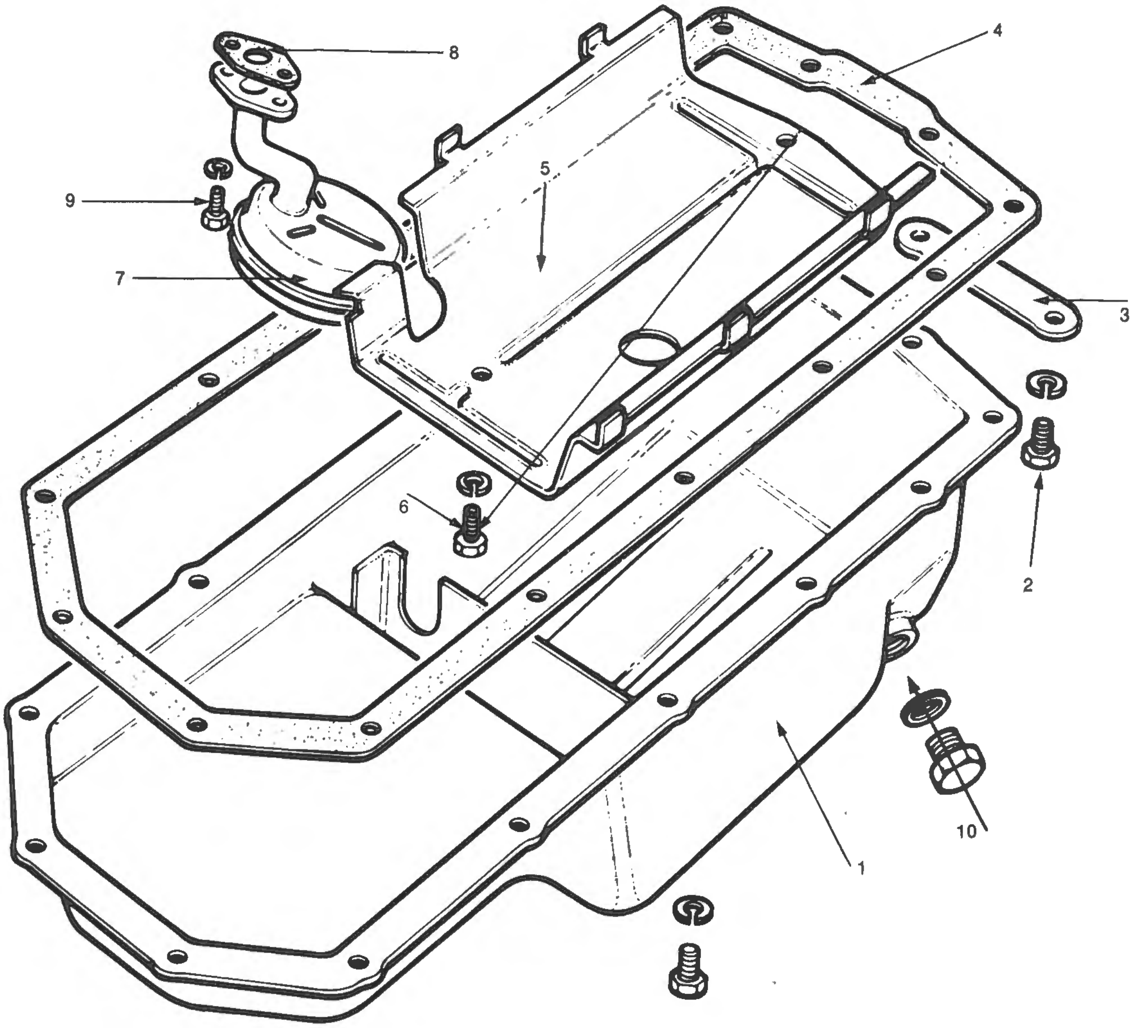


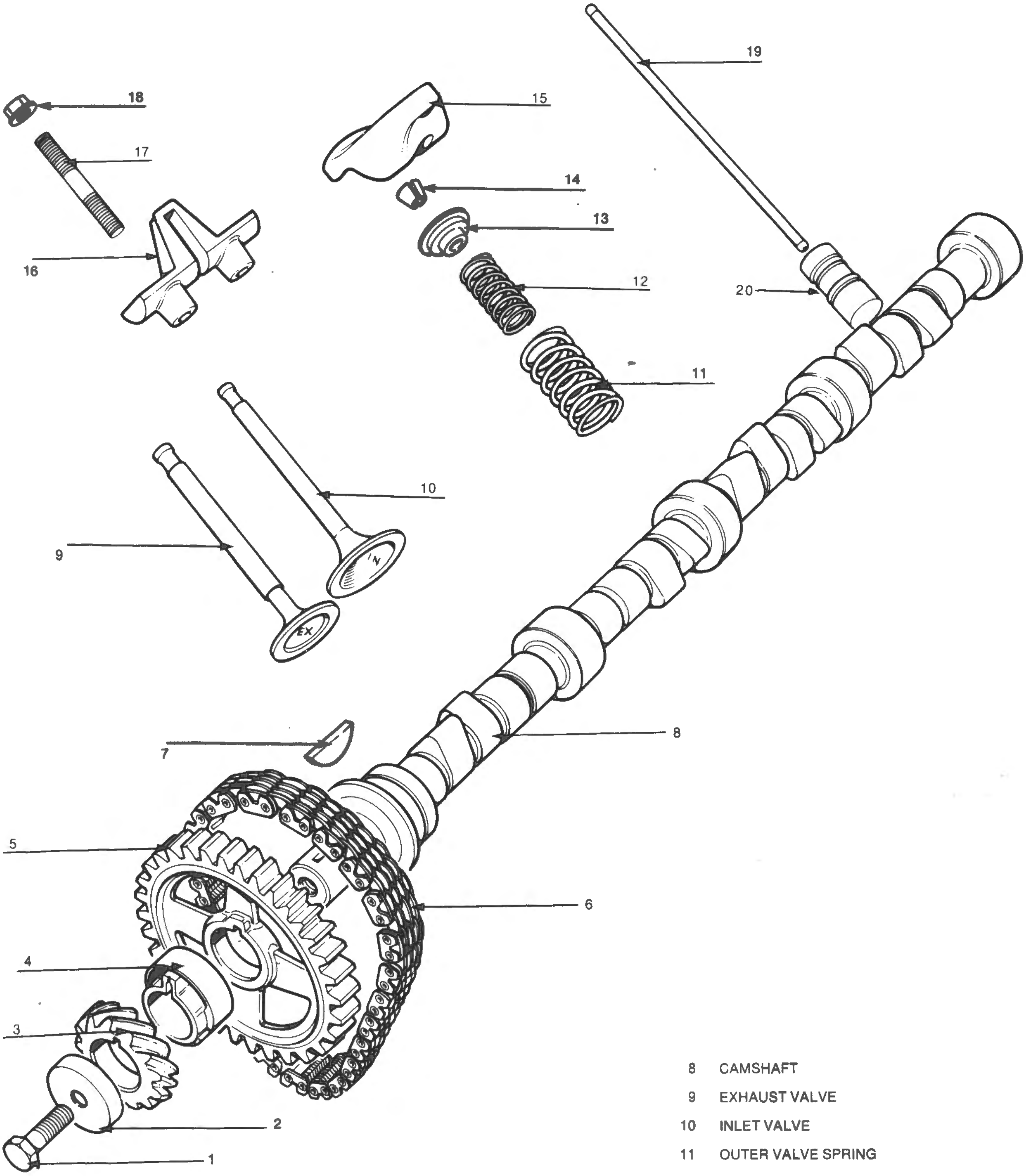
Fig. D-26

LAYOUT OF OIL RESERVOIR AND ASSOCIATED COMPONENTS

1 RESERVOIR
2 ATTACHING SCREWS FLANGE SUPPORT PLATE
3 RESERVOIR FLANGE SUPPORT PLATE
4 RESERVOIR GASKET
5 BAFFLE
6 SCREWS AND WASHERS BAFFLE TO MAIN BEARING CAPS
7 OIL PICK UP PIPE AND STRAINER ASSEMBLY
8 FLANGE GASKET
9 SCREWS PICK UP TO CRANKCASE
10 SCREW RESERVOIR TO CRANKCASE

Fig. D-27

LAYOUT OF VALVE MECHANISM COMPONENTS



1	BOLT
2	WASHER
3	DISTRIBUTOR DRIVE GEAR
4	FUEL PUMP DRIVE COVER
5	CAMSHAFT GEAR
6	TIMING CHAIN
7	KEY
8	CAMSHAFT
9	EXHAUST VALVE
10	INLET VALVE
11	OUTER VALVE SPRING
12	INNER VALVE SPRING
13	VALVE SPRING CAP
14	VALVE COTTERS
15	ROCKER ARM
16	ROCKER PIVOT
17	ROCKER PIVOT STUD
18	FLANGE NUT
19	PUSH ROD
20	HYDRAULIC VALVE LIFTER

VALVE MECHANISM

A single centre mounted camshaft operates the inclined overhead valves in both cylinder heads through hydraulic valve lifters, hollow push rods and pedestal mounted rocker arms.

CYLINDER PRESSURES

To ascertain the general condition of the engines, and to assist with the diagnosis of problems with the wear of material components a cylinder pressure check should be carried out using a compression gauge. The compression gauge should be used in accordance with the manufacturer's instructions.

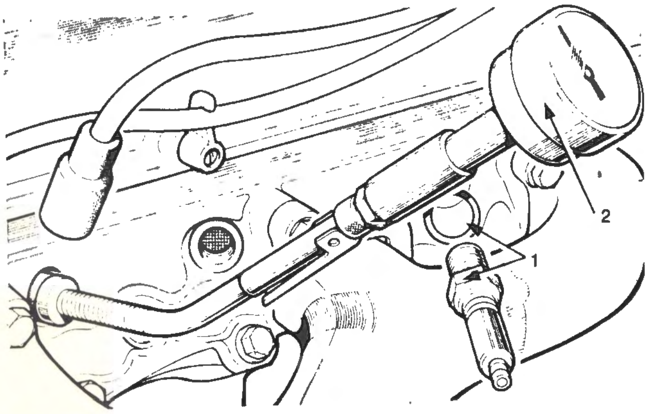


Fig. D-28

CHECKING CYLINDER PRESSURES

1 SPARK PLUG AND GASKET 2 COMPRESSION GAUGE

Check the readings against the figures given in GENERAL DATA. The average variation above the figure quoted should not exceed one low reading. If the compression readings are satisfactory on all but one cylinder and that one shows an abnormal low reading, this is indicative of broken or worn rings, burnt valves or leaking head gasket. To pinpoint which, add a quantity of engine oil to the cylinder and carry out the test again. If the reading shows a substantial gain the problem is piston rings. However, if there is little or no gain the valve or seating should be suspect.

A leaking head gasket can also cause low compression figures. This can show up as low pressure in adjacent cylinders, indicating a leak between the two combustion chambers. A leak between combustion chamber and water jacket will show low pressure in that cylinder and excessive water in the exhaust.

NOTE: Oil may also be found in the cooling system. For more positive testing refer Cooling System Section.

All Low Readings:

If after checking all cylinders, the reading is well below that quoted but stays within a 10% variation between cylinders it can usually be assumed that the valves will give further service but piston rings could need attention, this being emphasised by excessive oil consumption and lack of power.

All High Readings:

If all readings are high but within the 10% variation it is a sign that carbon has built up reducing the volume of the combustion chamber increasing the combustion pressures which can be a detrimental effect on engine performance and components.

ROCKER COVERS

Removing — Right Hand

1 Remove the automatic choke control pipe.

2 Remove the spark plug leads from plugs.

3 Remove the plug leads from their rocker cover support noting their position for replacement.

4 Disconnect the emission control hose from the cover.

5 Remove four screws securing the cover to the cylinder head.

6 Remove the gasket.

Refitting

1 Refitting is the reversal of the removing procedure noting the following:

(a) Ensure the gasket locating tags are correctly located in the cover flange.

Removing — Left Hand

1 Carry out items 2, 3, 5 & 6 for right hand cover.

Replacing

1 Replacing is the reversal of the removing procedure noting position of dipstick bracket.

VALVE ROCKERS

The pressed steel rocker arms are mounted in pairs and locate on a die cast alloy tandem pivot bracket which is secured to the cylinder head by two 5/16 x 18 U.N.C. combination studs and 5/16 U.N.F. flanged nuts. Fig. D-2, 3 & 27.

The brackets must only be fitted one way, as the mounting pedestals of the bracket are unequal in length.

The long one faces the rear of the engine on the right bank and the front of the engine on the left bank.

Removing

1 Remove the rocker cover/s.

2 Unscrew the flange nuts evenly to remove valve spring tension.

3 Remove the nuts and lift off the pivot bracket complete with rocker arms.

NOTE: All items removed from the engine valve mechanism should be refitted in their original running position if replacement is not intended.

INSPECTING:

Check rocker arm for cracks, through hardening wear and scuffing on push rod seat and rocker pivot face.

Check the bracket pivot face for excessive wear and off square operation.

Off square operation will show pattern on rocker tip as indicated in Fig. D-30.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

(a) Liberally coat the operating surfaces with engine oil.

(b) Torque the bracket nuts down evenly to 12-15 Nm (9-11 lb.f.ft.).

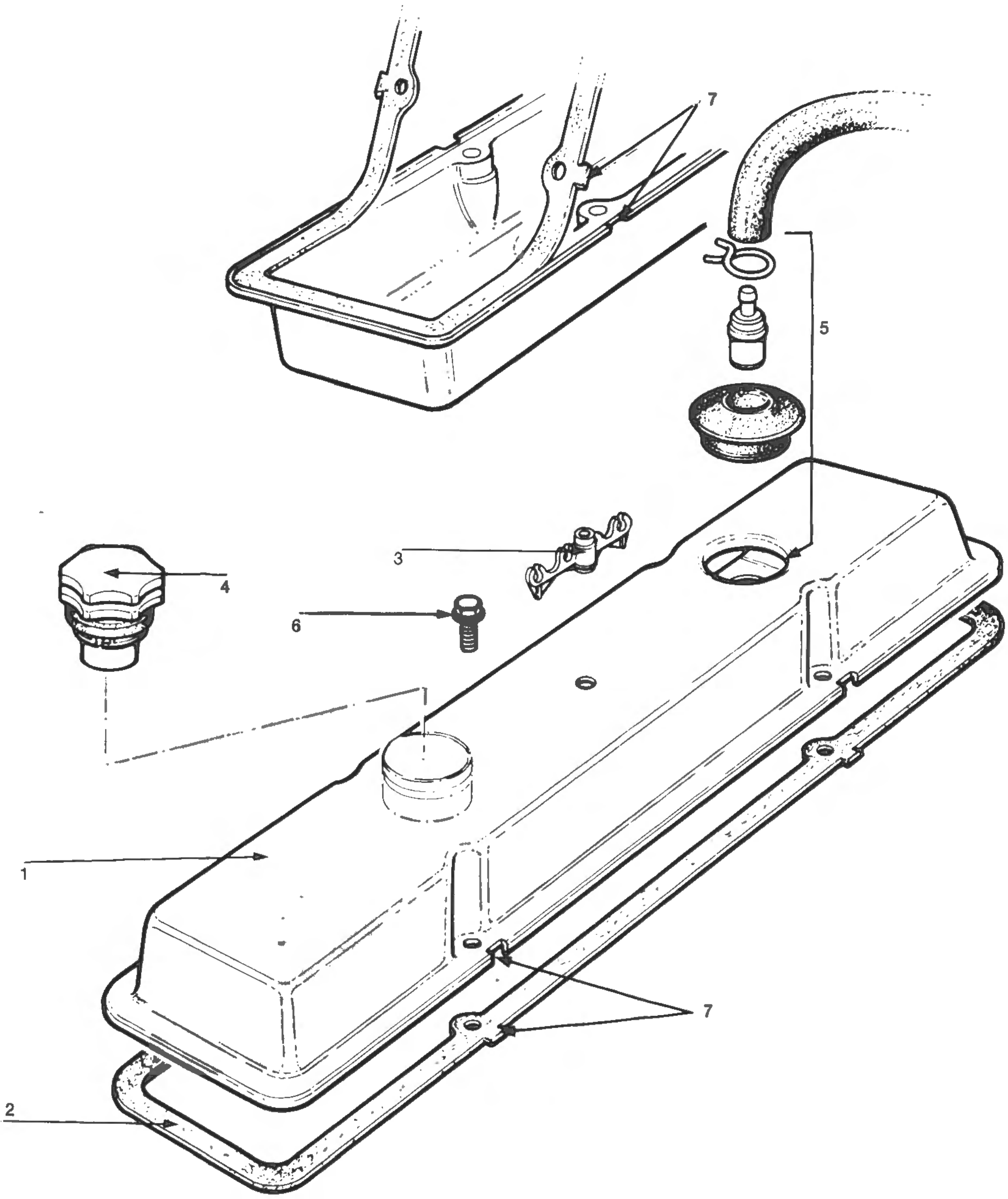


Fig. D-29

ROCKER COVER ASSEMBLIES

1 ROCKER COVER
2 GASKET
3 IGNITION CABLE HOLDER
4 OIL FILLER/FILTER CAP L.H. COVER ONLY
5 E.E.C. CONNECTOR R.H. COVER
6 SCREWS COVER TO CYLINDER HEADS
7 INSERT GASKET FITTING AND TAB LOCATION

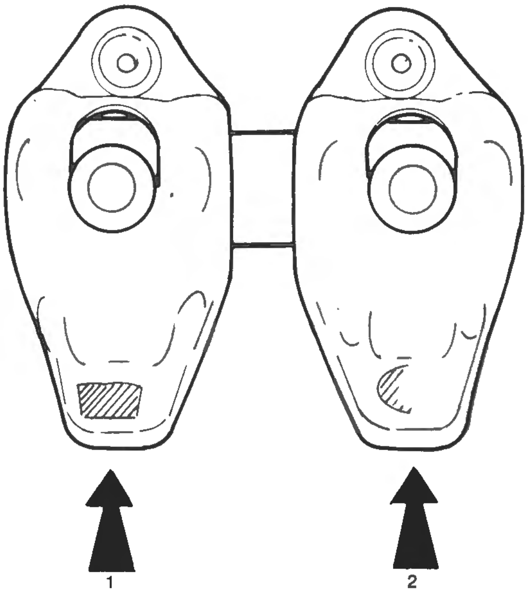


Fig. D-30

OFF SQUARE ROCKER WEAR

1 NORMAL WEAR PATTERN
2 OFF SQUARE WEAR PATTERN

CHECKING VALVE TIMING
(Without removing front cover)

Checking

1 Disconnect the battery.

2 Mark the positions of No. ~~4~~ cylinder lead on the distributor body.

3 Remove distributing cap.

4 Remove right valve cover.

5 Remove No. 4 intake and exhaust rocker arms and pivots.

6 Turn the engine till the rotor is in line with No. ~~4~~ plug lead position. No. 3 ~~4~~ piston will be approximately at top of cylinder.

7 Measure from the pedestal mounting face on the head to the top of the inlet push rod and record measurement.

8 Slowly turn engine 1¾ revolutions in direction of rotation until the rotor approaches No. 1 plug position. Continue to turn engine until T.D.C. on the crankshaft fully aligns with the timing case pointer (T.D.C. No. 1 piston).

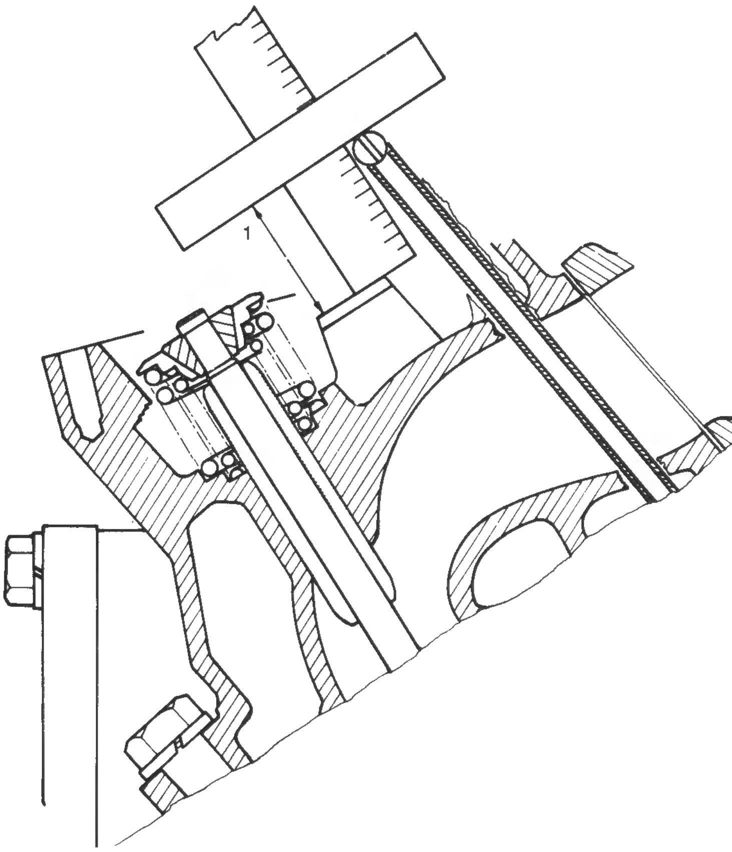
9 Again measure the distance from the pedestal mounting face to the top of the inlet push rod on No. 3 ~~4~~ cylinder.

10 The measurement should increase over the first taken by 6.35 mm (0.250 in).

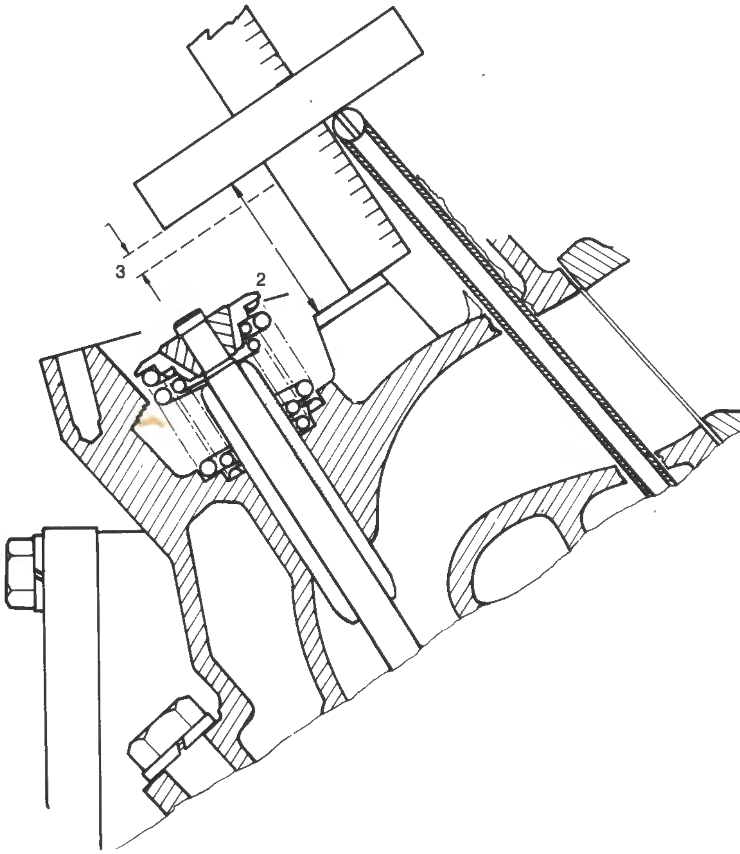
11 If the measurement is not within 0.79 mm (0.31 in) the camshaft is advanced or retarded.

Fig. D-31

CHECKING VALVE TIMING



1 FIRST MEASUREMENT WITH NO. ~~4~~ CYLINDER AT T.D.C.



2 SECOND MEASUREMENT ON NO. 2 ~~4~~ CYLINDER WITH NO. 1 AT T.D.C.

3 DIFFERENCE

PUSH RODS

Removing

1 Remove the valve rocker cover/s.

2 Remove the valve rockers and bracket/s assembly/s.

3 Lift the push rods out taking care not to pull the valve lifter out of its bore.

4 Arrange the removed rods so that they can be refitted in their original positions.

INSPECTION:

1 Check the ball ends for excessive wear.

2 Check that the oil passage through the rod is unobstructed.

3 Check rod is straight by rolling along a flat surface.

Refitting

1 Refitting is a reversal of removing procedure.

INDUCTION MANIFOLD

Removing

1 Disconnect the battery.

2 Drain the cooling system.

3 Remove the air intake filter assembly complete.

4 Disconnect the accelerator linkage.

5 Disconnect the speedo cable clip from L.H. valance.

6 Disconnect the automatic choke pipe.

7 Disconnect the fuel line and vapour separator line from the carburetter.

8 Remove the electrical lead from the thermal transmitter.

9 Disconnect the heater pipes from the manifold.

10 Disconnect the emission control pipe from the carburetter.

11 Disconnect the brake servo pipe at the manifold.

12 Disconnect the top radiator hose and hose between water pump and manifold.

13 Remove the twelve screws and washers securing the manifold to the cylinder head, noting the position of relevant bracketing.

NOTE: It may be necessary to remove the distributor cap and move it aside to gain access to the front left hand screw.

14 Lift off the manifold.

15 Ensure there is no coolant lying on the manifold gasket, then remove the 2 ¼ U.N.C. screws securing the gasket clamp Fig. D-32 & 33.

16 Lift off the gasket and seals.

Refitting

1 Using new inlet manifold gasket seals, apply a smear of silicon-grease to both sides of the seals and fit them in position ensuring that the ends of the seals are fitted correctly in the notches formed between the cylinder head and cylinder block.

2 Apply sealing compound on the four corners only of the cylinder head, inlet manifold gasket and inlet manifold around the water passage joints.

3 Place the induction manifold gasket in position so that the locating slot is toward the "front" of the left hand head, 'A' Fig. D-32.

4 Fit the gasket clamps and bolts but do not fully tighten at this stage.

5 Position the inlet manifold on the cylinder heads and connect up the water hoses.

6 Check to ensure that the manifold and gasket clamps are properly positioned and fit all the bolts to the cylinder head, using a little thread lubricant/sealant, the two longer bolts are installed at the front (Refer 16 Fig. D-32), and the bracket for the throttle return spring is located under the second bolt from the front on left hand head.

CAUTION: As the bolt holes are not at right angles to the inlet manifold cylinder head faces there may be an illusion of misalignment.

7 Tighten the bolts evenly on alternate sides, working from the centre as shown in Fig. D-34. All bolts should be finally tightened to a torque of 34 to 41 Nm (25-30 lb.f.ft.).

8 Ensure that all water hoses are located correctly and fully tighten all hose clips, this is of the utmost importance, as the cooling system of the engine is pressurised to 89.7 kPa (13 lb.f.in.^{2}).
Reverse the removal procedure for the remaining items. Before fitting the air filter adjust the throttle cable. See Section M.

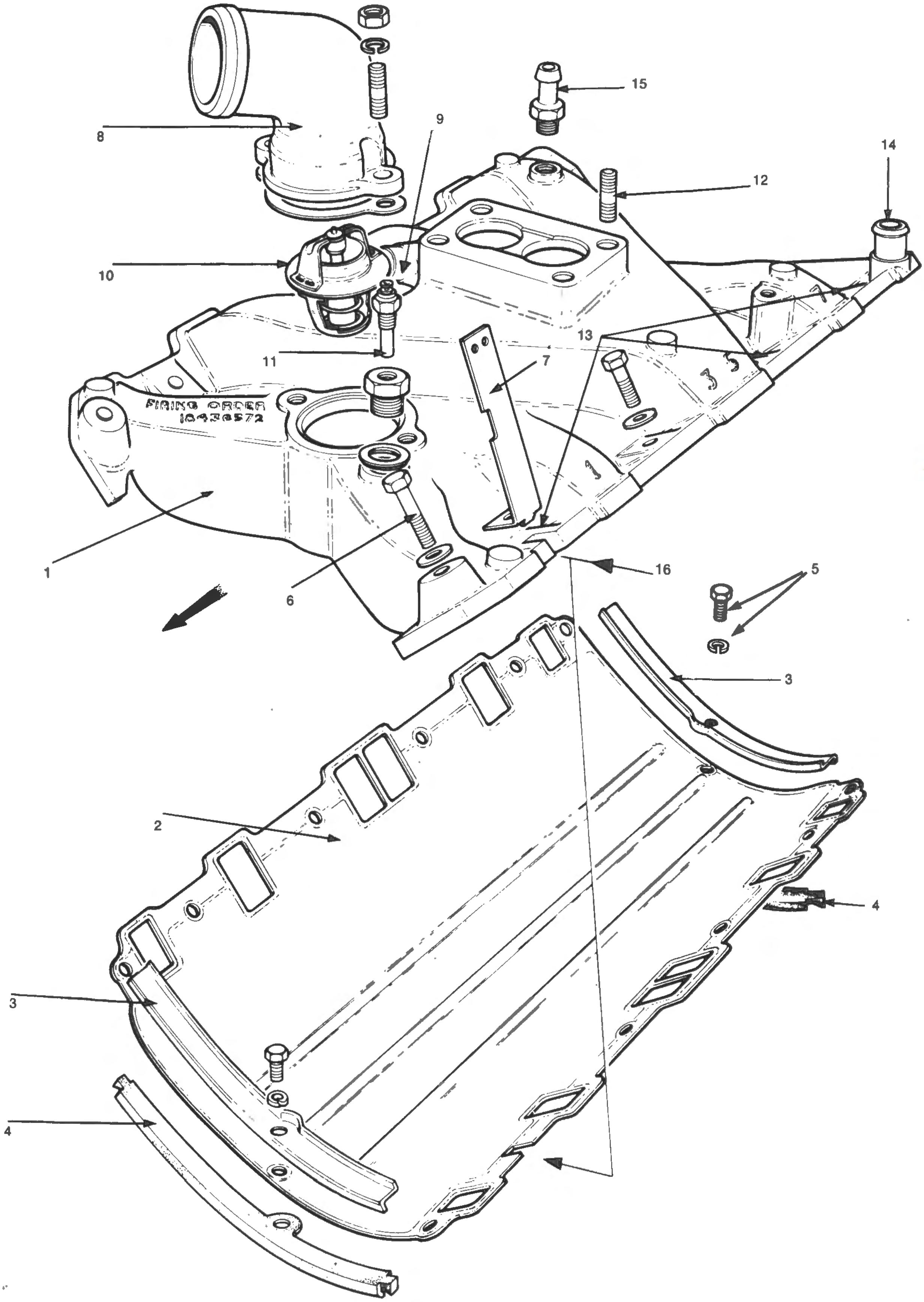


Fig. D-32

LAYOUT OF INDUCTION MANIFOLD COMPONENTS

KEY TO FIG. D-32

1 INDUCTION MANIFOLD
2 INDUCTION MANIFOLD GASKET KV 494
3 GASKET CLAMP
4 GASKET SEAL
5 SCREW AND WASHER CLAMP, SEAL AND GASKET TO BLOCK
6 BOLT FLAT WASHER MANIFOLD TO HEAD 2 x 2 ins 3/8" 1" THD
7 THROTTLE SPRING BRACKET
8 WATER OUTLET ELBOW
9 BY PASS HOSE CONNECTION POINT
10 THERMOSTAT
11 THERMAL TRANSMITTER
12 STUDS CARBURETTER MOUNT
13 BOLT FLAT WASHER MANIFOLD TO HEAD 8 x 1½ ins 3/8" 1" THD
14 HEATER HOSE CONNECTION POINT
15 VACUUM TAKE-OFF POINT
16 MANIFOLD AND GASKET LOCATION SLOT

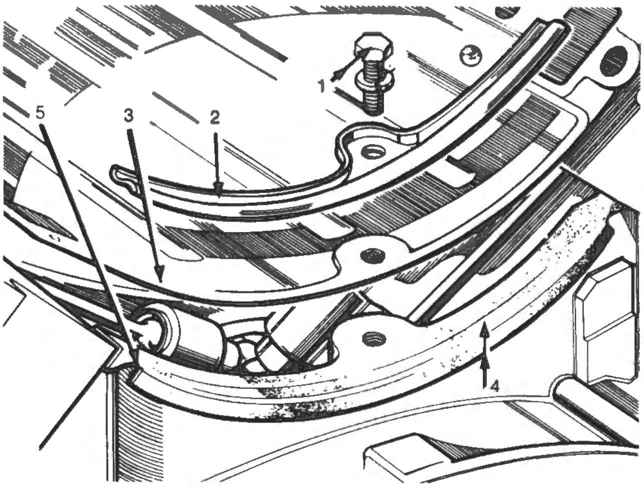


Fig. D-33

FITTING INDUCTION MANIFOLD GASKET SEAL

1 SCREW AND WASHERS, CLAMP SEAL AND GASKET TO BLOCK
2 CLAMP
3 GASKET
4 SEAL
5 CORRECTLY LOCATED SEAL

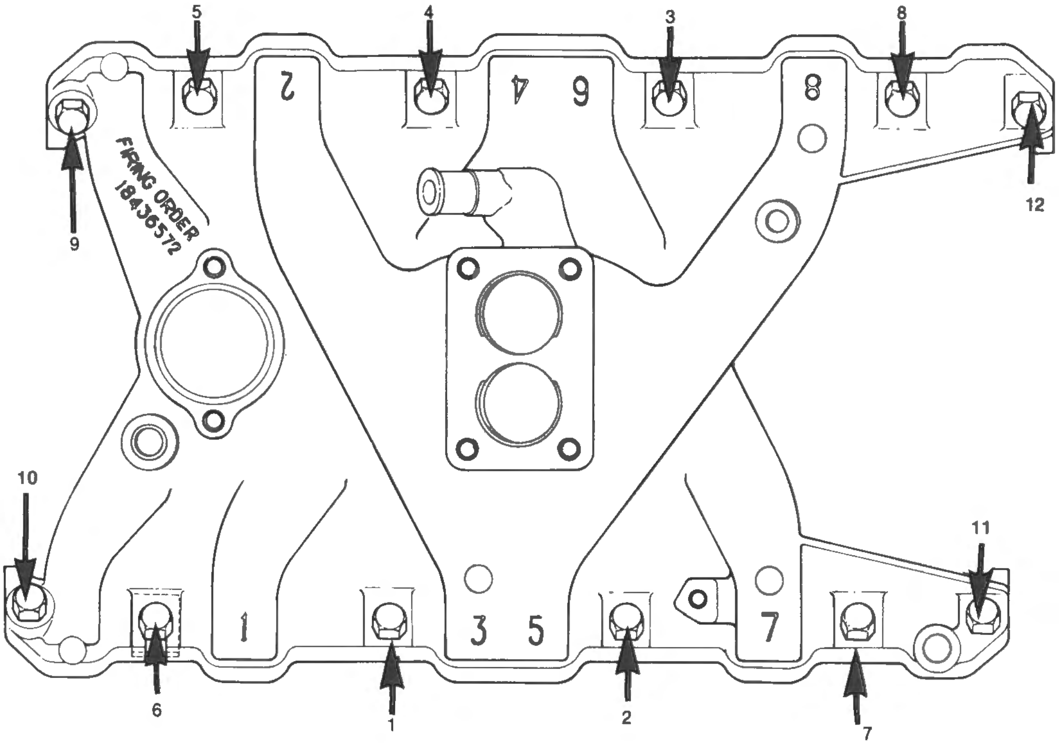


Fig. D-34

INDUCTION MANIFOLD TIGHTENING SEQUENCE

HYDRAULIC VALVE LIFTERS

Operation

Oil is supplied from the main gallery to the lifter through a hole in the lifter body which indexes with a lower groove within the body. This in turn indexes with the waisted section of the plunger and a cross channel in the push rod seat, filling the entire lifter.

When the lifter begins to ride up the cam lobe, the ball check is held against the seat in the plunger by the ball check spring which traps the oil in the base of the lifter body below the plunger. The plunger and lifter then raise as a unit pushing up the push rod to open the valve. The force of the valve springs is exerted on the plunger through the rocker arm and push rod causes a slight amount of leakage, between the plunger and lifter body.

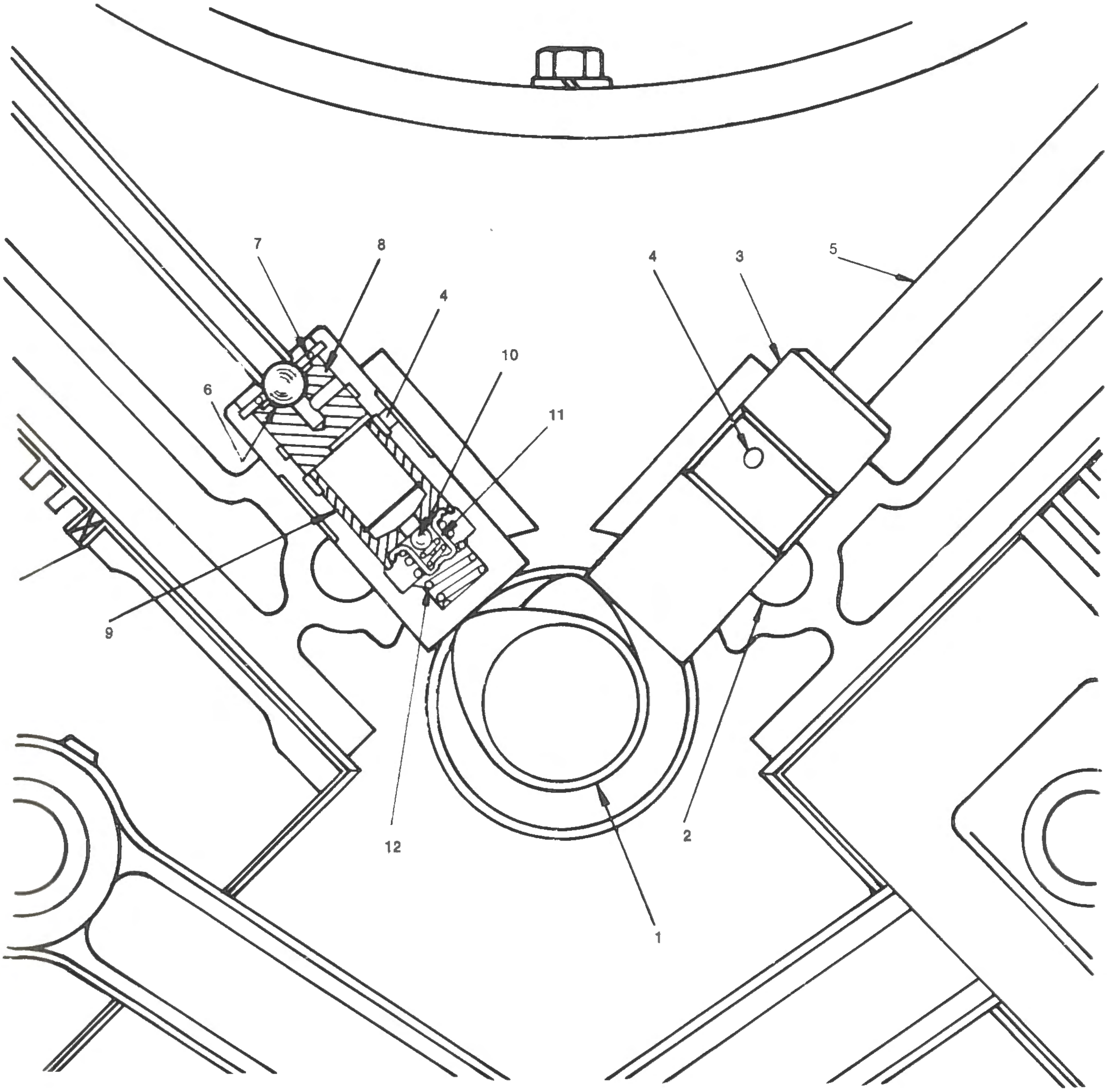


Fig. D-35

HYDRAULIC VALVE LIFTER OPERATION

1	CAM LOBE	7	RETAINER CLIP
2	OIL GALLERY	8	PUSH ROD SEAT
3	LIFTER BODY	9	PLUNGER
4	OIL FEED HOLE	10	CHECK VALVE BALL AND SPRING
5	PUSH ROD	11	VALVE RETAINER
6	PUSH ROD BALL END	12	PLUNGER SPRING

This 'leakdown' allows a slow escape of trapped oil in the base of the lifter body. As the lifter rides down the other side of the cam lobe and reaches the base circle or 'valve closed' position, the plunger spring moves the plunger back up to its original position.

This movement causes the ball check to open against the spring and oil from within the plunger is drawn into the base of the lifter. This restores the lifter to zero lash.

Lubrication to the rocker gear is provided by leakage from the lower body groove and plunger recess into the upper body groove which indexes with a port in the side of the push rod seat. This port connecting with the vertical drilling in the centre of the hemispherical rod seat.

DIAGNOSIS

Before dismantling engine components for the rectification of tappet noise, ensure the engine oil is at the correct level and carry out an engine oil pressure check.

1 LIFTERS MOMENTARILY NOISY WHEN ENGINE IS STARTED: This condition is normal. Oil drains from the lifters which are holding the valves open when the engine is not running.

2 INTERMITTENTLY NOISY ON IDLE ONLY: Disappearing when engine speed is increased. Intermittent clicking may be an indication of a flat or pitted ball, or it may be caused by dirt.

Correction

Strip clean and inspect. If ball is defective — replace the lifter.

3 NOISY AT SLOW IDLE OR WITH HOT OIL, QUIET WITH COLD OIL OR AS ENGINE SPEED IS INCREASED: Insert a 0.25 mm (0.010 in) feeler gauge between the rocker arm and the valve stem. If noise momentarily disappears and then re-appears after a few seconds with the feeler gauge still inserted, it is an indication that the lifter 'leakdown' rate is too fast.

Correction

Replace the lifter.

4 NOISY AT HIGH ENGINE SPEEDS AND QUIET AT LOWER SPEEDS.

(a) HIGH OIL LEVEL: — Oil level above the 'full' mark and above crankcase baffle allowing crankshaft to churn up oil into foam. Foam or aerated oil reaching the lifters will cause noise as a solid column of oil is required for proper operation.

Correction

Drain oil till correct level is obtained. Refer Maintenance Schedule.

(b) LOW OIL LEVEL: — Oil level below the low mark could allow air to be drawn into the system at speed, during braking, or when negotiating steep gradients.

Correction

Top up engine oil to correct level. Refer Maintenance Schedule.

5 NOISY AT IDLE BECOMING LOUDER AS ENGINE SPEED IS INCREASED, APPROXIMATELY 1500 RPM: This noise is usually not connected with lifter malfunction and could be described as a 'harsh' sound, which may be audible within the vehicle at low road speeds. At slow-idle speed the noise may be completely gone, noticeable only as a light ticking noise in one or more valves.
It is caused by one or more of the following:

(a) Badly worn or scuffed valve tip and rocker arm pad.

(b) Excessive valve stem to guide clearance.

(c) Excessive valve seat run out.

(d) Off square valve springs.

(e) Off square rocker arm pad.

(f) Excessive valve face run out.

(g) Inner valve spring distorted, collapsed.

INVESTIGATION:

Remove valve covers and locate noisy valves with a stethoscope, increasing the engine speed between idle and approximately 1500 rpm on each valve.
With a gloved hand push sideways on valve spring, noise will change, either becoming louder or disappearing altogether. Some noise will be present at all valve locations. It is necessary to determine which are actually responsible for the noise.
Occasionally by rotating the valve springs and valve this noise can be eliminated.

(i) Crank engine until noisy valve is off its seat. Rotate the spring and valve. Repeat until valve becomes quiet or greatly reduced. If correction is obtained, check for off square outer valve spring. If noise is greatly reduced but still audible, check the inner spring. Springs should not be off square more than 1.61 mm (1/16 in) in free state.
Check for indications of springs rubbing together.
(ii) Replace springs.
(iii) Observe rocker arm pad for excessive wear or off square. Replace as required.
(iv) Check for excessive valve stem to guide clearance.

NOTE: Guides have parallel bore. Valve stems are tapered.

6 VALVES NOISY REGARDLESS OF ENGINE SPEED: This condition can be caused by foreign particles or excessive 'lash' or worn lifter body.

Correction

(a) With the engine idling strike the appropriate rocker arm over the push rod with a mallet.
This method has proven successful in dislodging foreign particles which could be preventing ball valve from seating.

(b) Check for valve 'lash' by turning the engine so that the piston on the cylinder concerned is at T.D.C. on compression stroke. Hold the rocker arm against the valve and check up and down movement of the push rod. If movement (lash) exists, remove the rocker arm assembly and check the following:
  (i) Worn push rod
  (ii) Worn rocker arm
  (iii) Lifter plunger stuck down due to sludge varnish
  (iv) Defective lifter.

(c) Observe the upper end of the push rod. Excessive wear of ball surface indicates one of the following:
  (i) Worn through hardening

Correction

Replace arm and push rod.
  (ii) Lack of lubrication

Correction

Check and rectify cause lack of lubrication and replace push rod, rocker arm and lifter (as necessary).

If push rod and rocker arm are in good condition, refit them and check the lash.

Should lash still be present the problem will be a defective lifter.

Worn Lifter Body — refer inspection.

Removing

1 Disconnect the battery.

2 Drain the cooling system.

3 Remove the rocker covers.

4 Remove the rocker assemblies.

5 Remove the push rods.

6 Remove the induction manifold.

7 Remove the lifters keeping them in their correct sequence and with their mated push rods and rocker assemblies.

NOTE: If a lifter is known to be noisy and becomes difficult to remove toward the end of its travel, do not use undue force or extractors to remove it as a damaged cylinder block may result. Remove the camshaft and remove the lifter from the bottom.

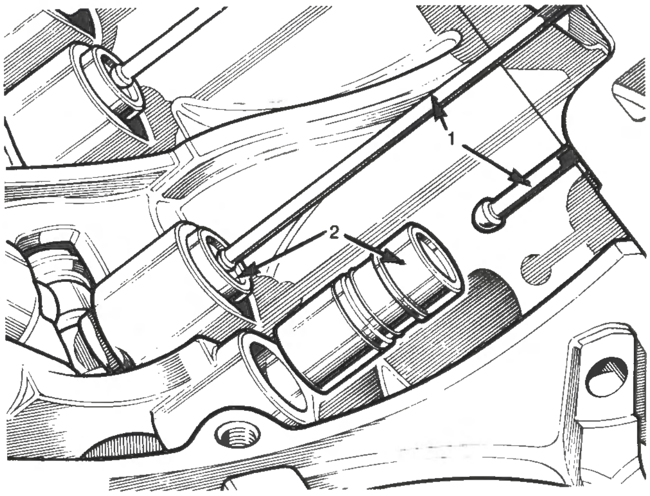


Fig. D-36

REMOVING VALVE LIFTER

1	PUSH ROD	2	LIFTER ASSEMBLY

Dismantling

1 Hold the push rod seat down and lever out the retainer clip.

2 Remove the push rod seat.

3 Remove the plunger and spring. Should the plunger be tight, soak the lifter in cleaning solvent.

4 Remove the ball check retainer from the plunger as shown in Fig. D-38 and recover the ball and spring.

5 Thoroughly clean all components in carburetter cleaning solvents.

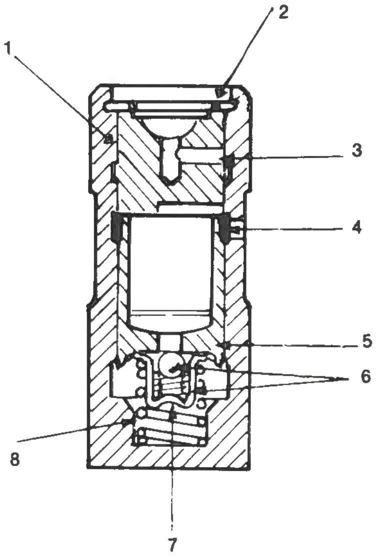


Fig. D-37

HYDRAULIC VALVE LIFTER SECTION

1	LIFTER BODY	5	PLUNGER
2	RETAINER CLIP	6	CHECK VALVE BALL AND SPRING
3	PUSH ROD SEAT	7	VALVE RETAINER
4	OIL FEED HOLE	8	PLUNGER SPRING

Fig. D-38

REMOVING BALL CHECK VALVE

Inspection

The prominent wear pattern just above the lower end of the body should not be considered a defect, unless it is definitely grooved or scored or worn to a point where if measured, its running clearance exceeds specifications. The particular wear pattern is produced by side thrust of the cam against the body while tappet is rotating and moving vertically, in its bore.

(a) Refer to Fig. D-39. Inspect the cam contact face of the lifter for excess wear or surface damage.
Lifters must rotate during normal operation and the circular wear pattern show at (1) is normal. A lifter showing this pattern can be put back into service provided the pattern does not extend to the outer circumference indicating the face is concaved — new lifters are convexed slightly. Where a lifter has not been rotating the pattern will be square as in (2). Correction: Replace lifter and check cam shaft lobes for wear.

NOTE: Wear pattern in the centre of cam face is normal. The camshaft should not be replaced unless wear is present across full width of cam face.

(a) Check the plunger bore for indications of scuffing, scoring and pitting which could cause seizure or excessive leak down times.

(b) Check the ball check valve assembly, for spring failure, corrosion pitting or roughness of the ball and seat plunger.
Check push rod seat for wear and blockage of push rod lubrication passage.

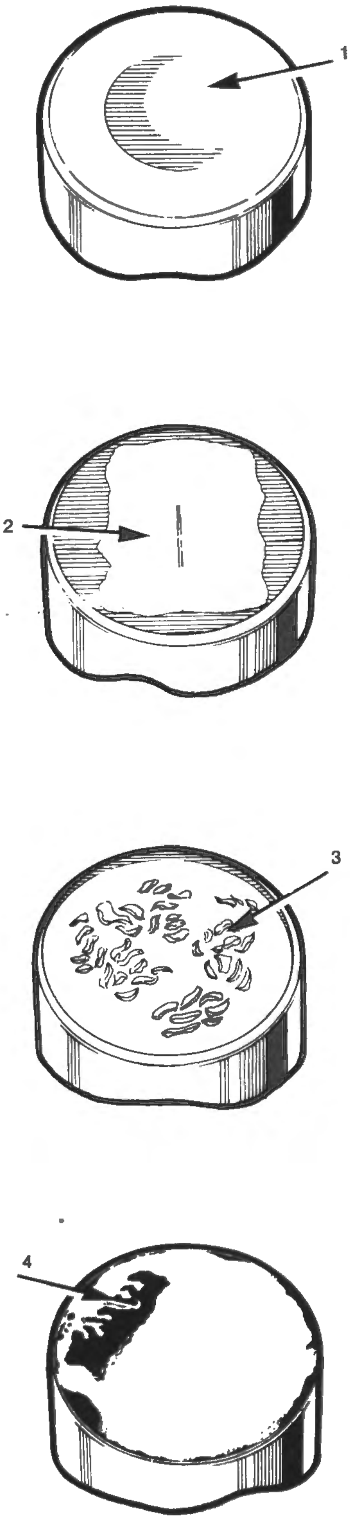


Fig. D-39

LIFTER BASE WEAR PATTERNS

1 NORMAL ROTATING PATTERNS
2 NON-ROTATING PATTERN
3 EXCESSIVELY WORN
4 SOFT WORN

Assembling

Assemble all components while immersed in clean Hydraulic Test Fluid.

1 Assemble the check valve assembly to the plunger as shown in Fig. D-40.

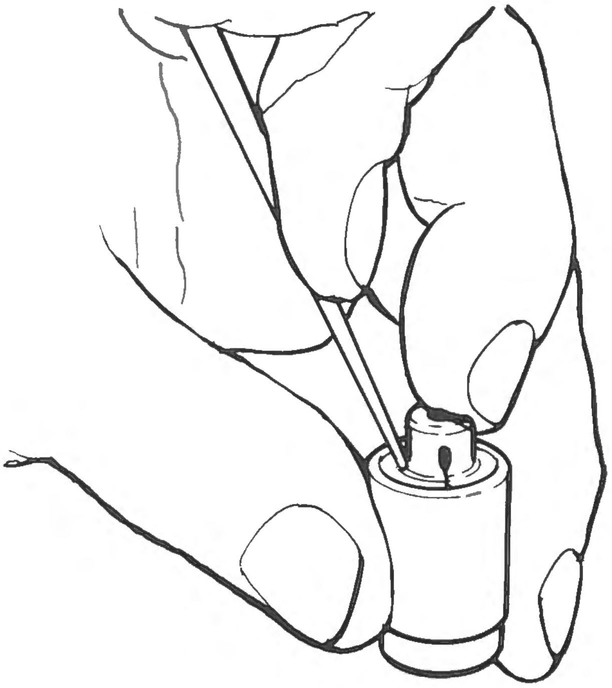


Fig. D-40

FITTING CHECK VALVE ASSEMBLY

2 Fit the plunger to the body by depressing the ball check valve with a 1.6 mm (1/16th in), drift as shown in Fig. D-41.

3 Insert 3 mm (⅛ in), drift through the oil feed hole to hold the plunger down while the push rod seat and retainer clip is fitted. Fig. D-41.

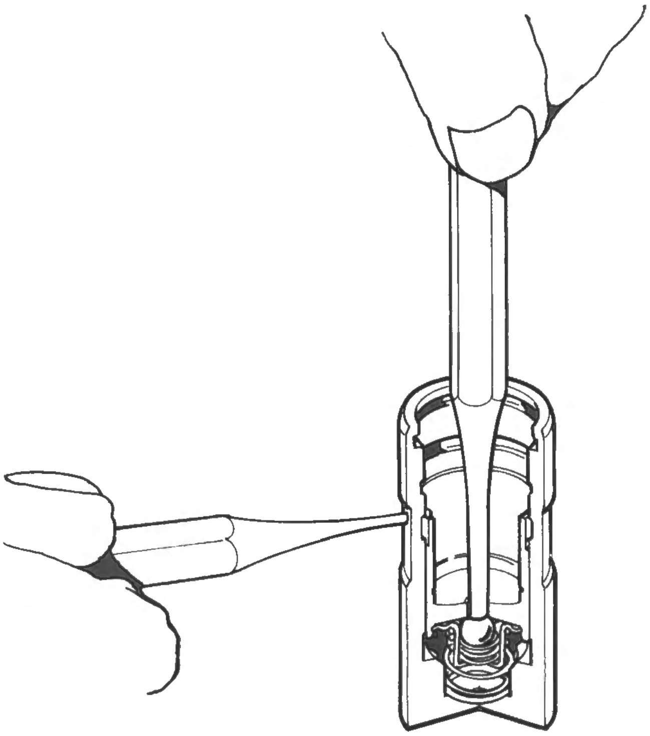


Fig. D-41

FITTING PLUNGER ASSEMBLY

Testing

1 Mount the test fixture 18GA057 in a bench vice.

2 Fill reservoir with hydraulic test fluid to specification quoted in GENERAL DATA.

3 Locate the assembled, fluid filled lifter on the location plate in the reservoir.

4 Place a 8 mm (5/16 in) bar between the reservoir outer edge and the arm of the test fixture as shown in Fig. D-42.

5 Adjust forcing bolt until it just contacts the push rod seat.

6 Position a dial indicator over the forcing bolt so that a downward travel in excess of 5 mm (0.200 in) will register. Fig. D-42.

7 Set the indicator so that approximately 6.3 mm (0.025 in) travel can occur before needle reaches the zero point.

NOTE: To avoid damaging the lifter internally the fixture should be adjusted so that the arm will contact the reservoir side at 'A'. Total travel not exceeding 5 mm (0.2 in).

8 Release the bar from under the arm and allow the lifter to collapse under the weight of the arm only.

9 Time the travel or 'leakdown' rate from the zero point through to 3.2 mm (0.125 in) and record the result. A lifter may be put back into service if its 'leakdown' time is between 12 and 60 seconds.

Refitting

1 Refitting is the reversal of the removing procedure noting the following:— Lifters charged with the correct test fluid may be refitted to the engine without removing the fluid.

CAUTION: Valve noise will be apparent when the engine is started. Do not operate engine in excess of normal fast idle revolutions until mechanism becomes quiet.

CYLINDER HEADS

Removing

1 Disconnect the battery.

2 Remove engine air intake filter assembly complete.

3 Drain the cooling system.

4 Remove the valve rocker covers.

5 Remove the valve rocker gear and push rods.

6 Remove induction manifold and gaskets.

7 Disconnect the exhaust pipes at manifold flange.

8 Remove exhaust manifold as necessary.

9 Slacken cylinder head bolts evenly in reverse to the tightening sequence. Fig. D-44.

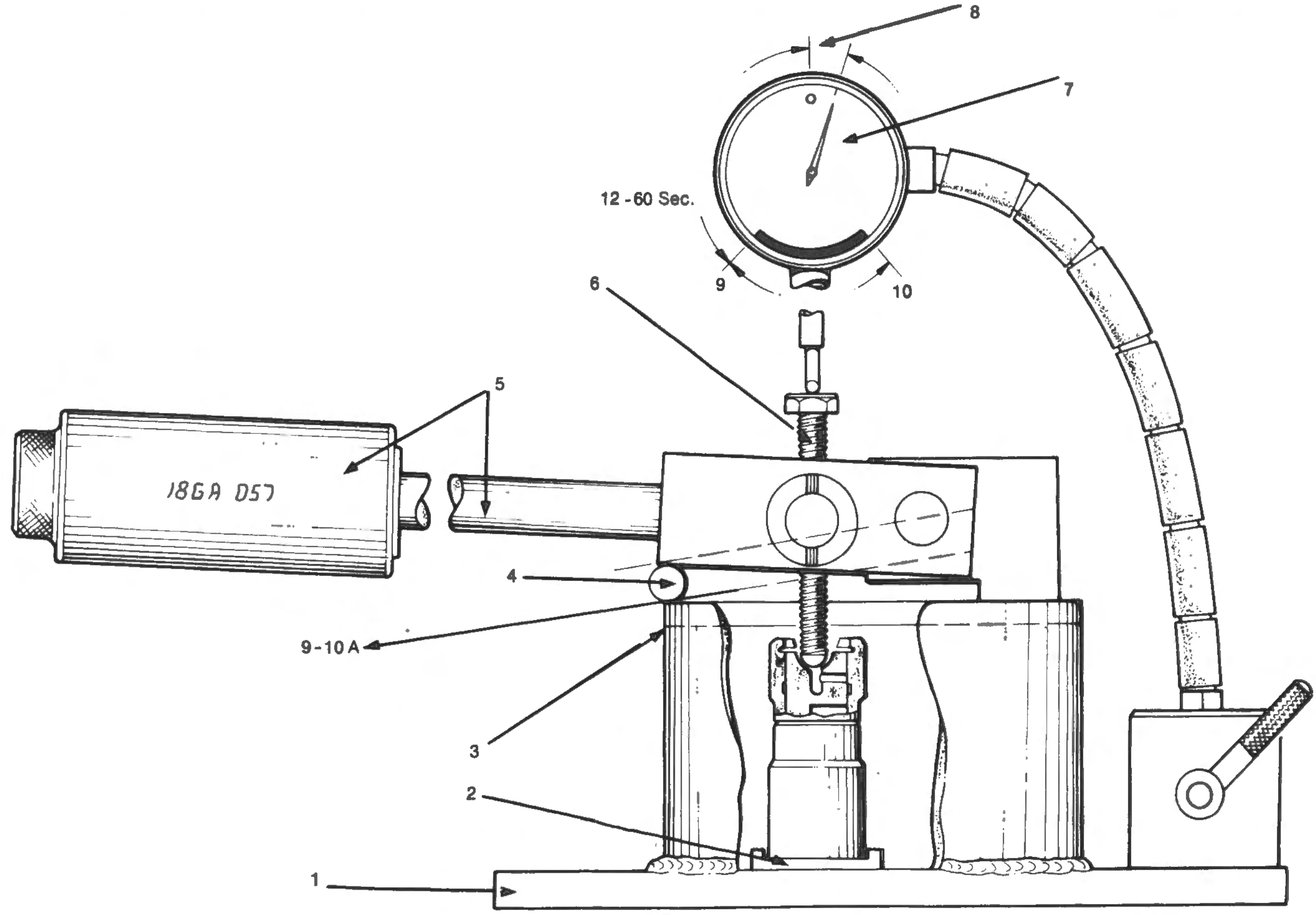


Fig. D-42

TESTING HYDRAULIC LIFTER 'LEAKDOWN'

1	BASE	6	FORCING SCREW
2	LOCATION RECESS	7	DIAL INDICATOR
3	FLUID LEVEL	8	PRE-TIME TRAVEL 63 mm (0.025 in)
4	5/16 in SET UP BAR	9	TEST TRAVEL 3.2 mm (0.125 in)
5	ARM WEIGHT	10	LIMITS OF AFTER TEST TRAVEL TO 5 mm (0.20 in)

NOTE: If both heads are to be removed mark them relative to the Left hand and Right hand banks.

10 Remove and clean bolts.

11 Remove cylinder head/s.

12 Remove and discard gaskets.

Dismantling

1 Remove exhaust manifolds. For detail refer page D-66.

2 Using a suitable valve spring compressor, compress the valve spring, remove the split collets, spring caps, springs and valves. Arrange the components in order relative to their mating operating components.

Inspecting

1 Remove carbon from valve, clean and dry.

2 Clean and dry springs, collets and caps.

3 Remove carbon from the combustion chambers and ports with suitable soft wire brushes.

4 Clean the valve guide bores.

5 Clean all threads, holes and gasket faces including cylinder block.

6 Examine all thread holes for damage.

7 Examine cylinder head bolts for stretch (See Servicing Information).

8 Examine valve for

(a) Stem tip wear and height.

(b) Seat face condition and available margin.

(c) Stem and guide wear.

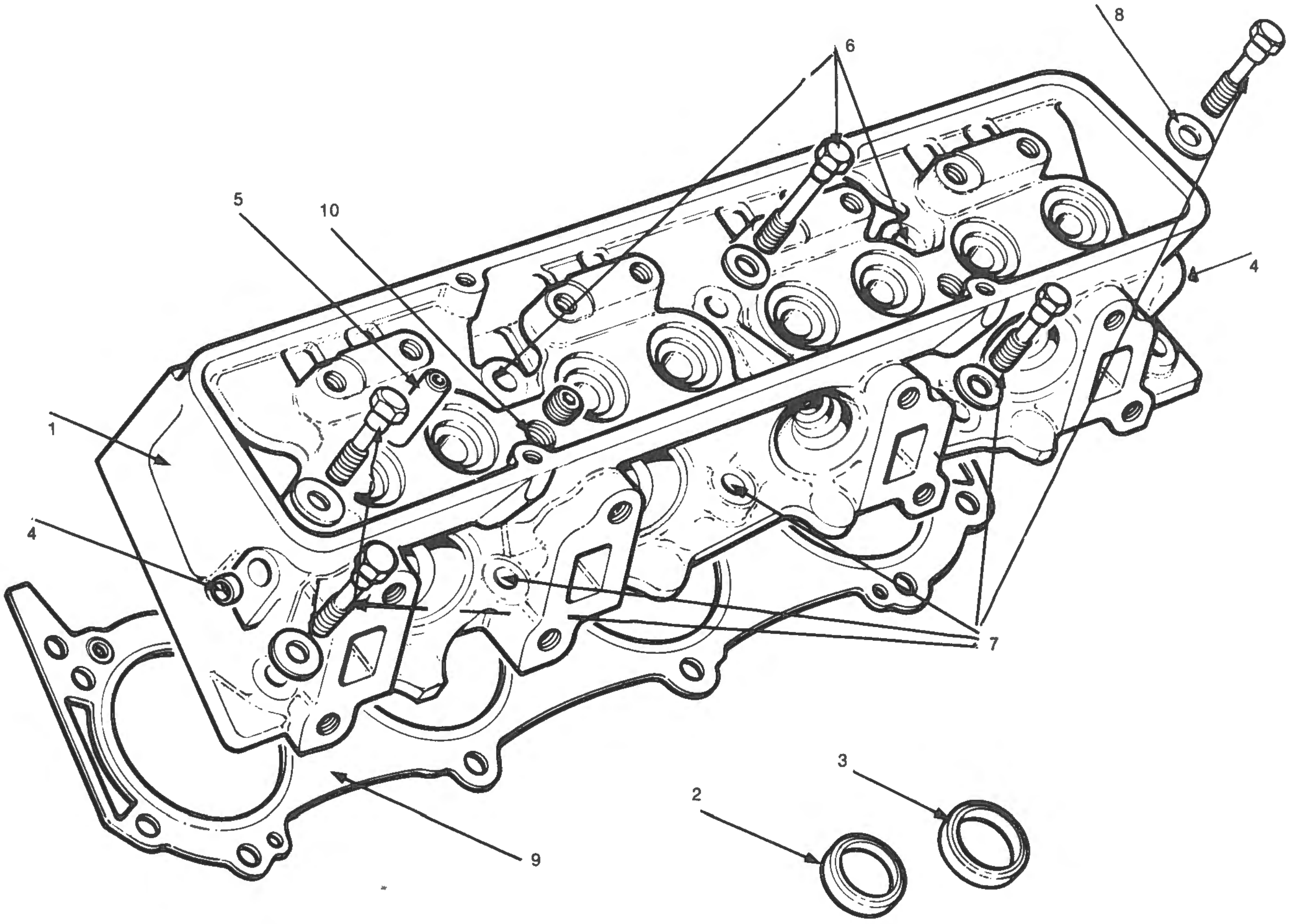


Fig. D-43

LAYOUT OF CYLINDER HEAD COMPONENTS

1 L.H. CYLINDER HEAD
2 EXHAUST VALVE INSERT
3 INLET VALVE INSERT
4 COOLANT GALLERY CUP PLUGS
5 EXHAUST AND INLET VALVE GUIDES
6 CYLINDER HEAD BOLTS, 1, 2 AND 4, 100 mm (3-15/16 in) 7/16" 3
7 CYLINDER HEAD BOLTS 3, 5, 6, 7, 8, 9 and 10, 70 mm (2¾ in) 7/16" 7
8 WASHERS FOR HEAD BOLTS (FLAT)
9 HEAD GASKET
10 SCREWED GALLERY PLUGS

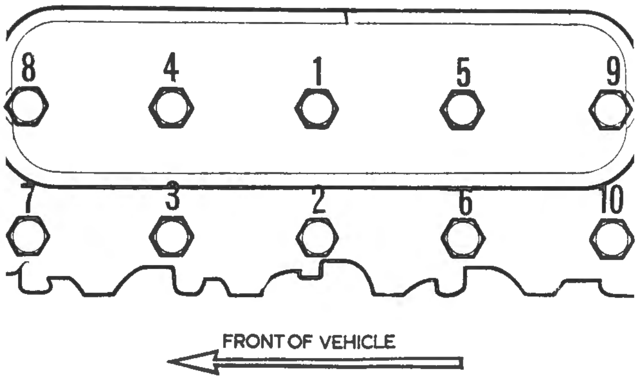


Fig. D-44

CYLINDER HEAD TIGHTENING SEQUENCE

(L.H. HEAD SHOWN)

STEM TIP HEIGHT:

A minimum stem tip height is essential to prevent weakening of the end of the valve in the collet groove area and minimise the possibility of braking through the tip hardening. To measure the height assemble the valve with its collets and cap as shown in Fig. D-46.

Place gauge 18GA056 over the valve stem tip (thick end of gauge for inlet valves, stepped end for exhaust valves). If the tip of the valve is below, flush or only just projecting above gauge, replace the valve. Fig. D-46(6). If the tip is well above gauge, place a straight edge across the valve tip and measure and record the height. Fig. D-46(7).

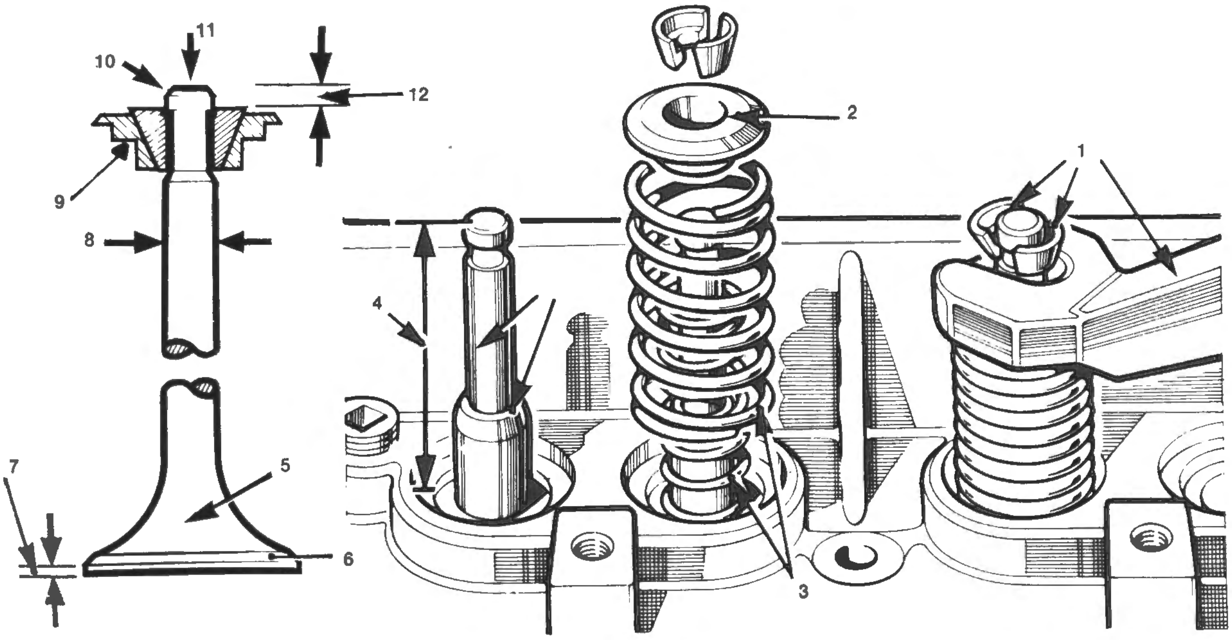


Fig. D-45

VALVE REMOVAL AND TERMINOLOGY

1 COMPRESS SPRING REMOVE COLLETS
2 VALVE SPRING CAP
3 INNER AND OUTER VALVE SPRING
4 VALVE FITTED HEIGHT
5 VALVE HEAD
6 FACE
7 MARGIN
8 TAPERED STEM
9 SPLIT COLLETS
10 CHAMFER 45° x 0.010-0.020
11 TIP
12 TIP HEIGHT

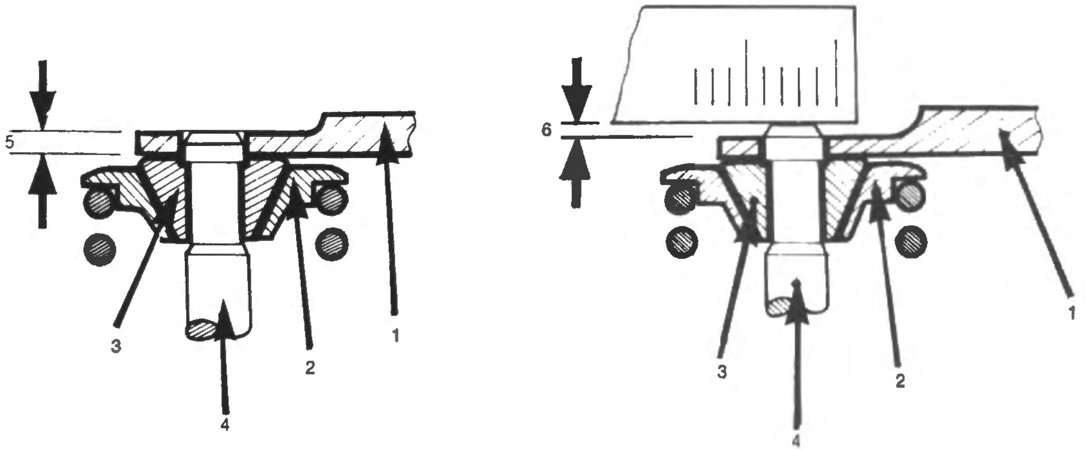


Fig. D-46

GAUGING VALVE STEM TIP HEIGHT

1 GAUGE 18GA056 EXHAUST VALVE END SHOWN
2 CAP
3 COLLETS
4 VALVE STEM
5 MINIMUM TIP HEIGHT
6 ALLOWABLE MATERIAL REMOVAL FOR OBTAINING VALVE 'FITTED HEIGHT'

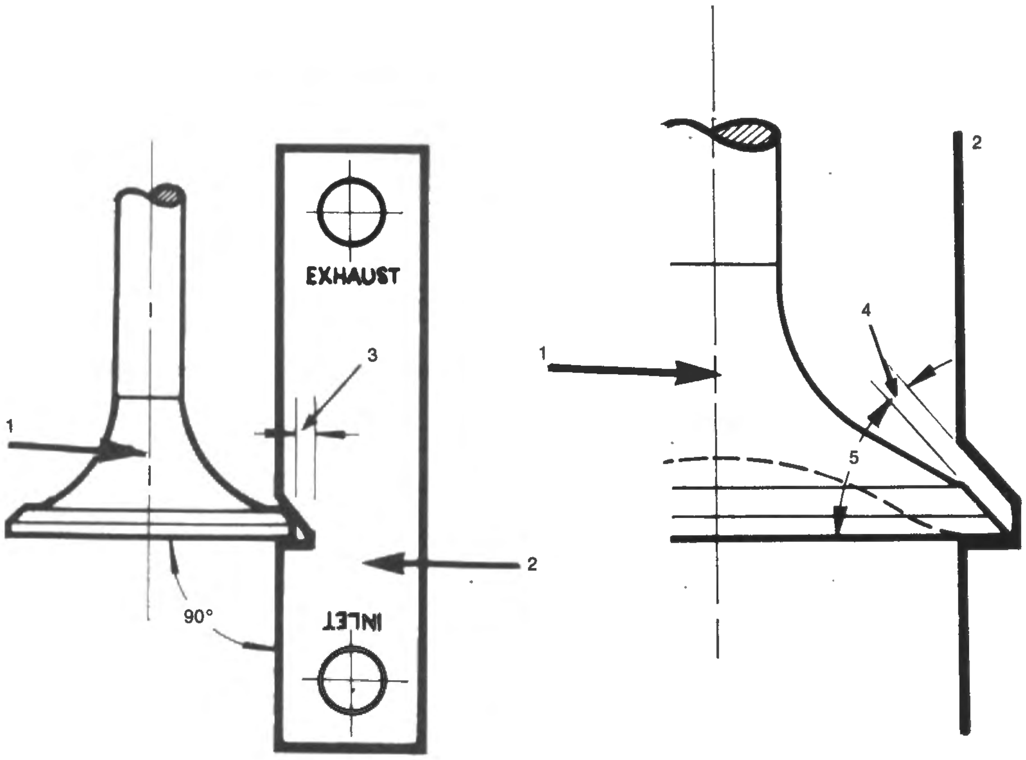


Fig. D-47

CHECKING VALVE MARGIN

1	VALVE
2	GAUGE 18GA056
3	VISIBLE CLEARANCE ON SERVICEABLE VALVE
4	VISIBLE CLEARANCE BETWEEN VALVE FACE AND GAUGE. REPLACE THE VALVE
5	FACE ANGLE 45°

SEAT FACE CONDITION AND MARGIN:

Check the face for pitting, burning etc. and check the available margin with tool 18GA056 as shown in Fig. D-47. If the condition of the valve face is such that the face would not clean up before the valve bottoms in the gauge. Replace the valve.

STEM WEAR GUIDE:

Check the stem for scuffing or scoring and measure to ensure taper exists. Check the guide bore for scoring and wear.

NOTE: Minimum operating clearances should be present when the valve is in its full open position.

9 Examine valve spring for:

(a) 'Off square' and indications of inner and outer springs rubbing together.

(b) Loss of pressure.
Valve springs should not vary more than 1.6 mm (1/16 in) while rotating spring. Refer Fig. D-48.

10 Examine valve seat inserts for indications of pitting, burning and cracking.

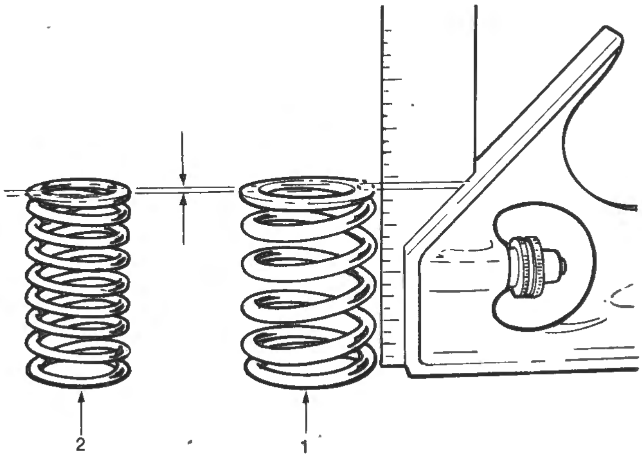


Fig. D-48

CHECKING VALVE SPRINGS FOR 'OFF SQUARE'

1 OUTER VALVE SPRING 2 INNER VALVE SPRING

VALVE GUIDES

Removal

1 Ensure that all carbon is removed from the guide and that it is not unduly damaged on visible outside diameter.

2 Using service tool 18GA050 drift the guide out from the spring seat side as shown in Fig. D-49.

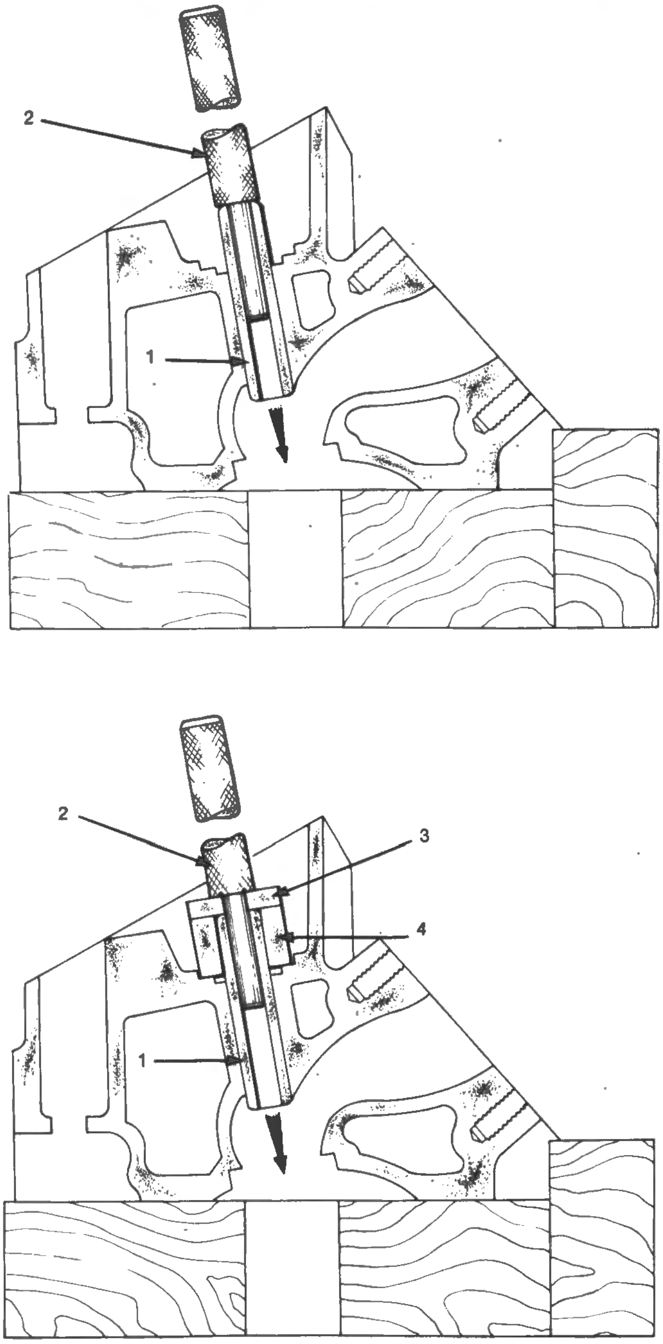


Fig. D-49

REMOVING AND REPLACING VALVE GUIDES

(EXHAUST SHOWN)

1 VALVE GUIDE
2 18GA050 DRIFT
3 18GA050/1 REPLACE WASHER
4 18GA050/2 DISTANCE PIECE

Refitting

1. Fit distance piece 18GA050/2 to the valve spring seat.
2. Lubricate the guide and install it in the distance piece and locate the assembly in the guide bore.
3. Drift in the guide with service tool 18GA050 and 18GA050/1.
   The tool is designed to bottom when guide is correctly positioned at 19 mm (0.75 in) above the valve spring face of the head.

VALVE SEAT INSERTS

Removing

1. Carefully grind away inserts until they are thin enough to be cracked and prised out.

Refitting

1. Check the size of the recess and outside diameter of the insert to ensure correct interference.
2. Heat the cylinder head evenly to between 80°C to 100°C (176°F to 212°F) by immersion or oven heating.
3. Using a standard workshop insert fitting tool with collar modified as shown in Fig. D-50 carefully press or drift in the insert.

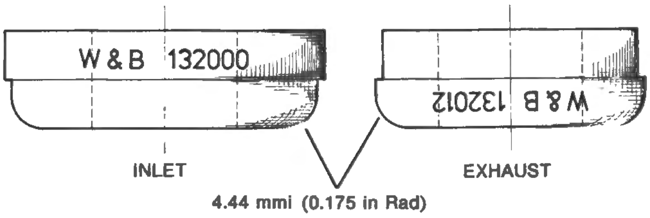


Fig. D-50

MODIFICATION TO STANDARD INSERT COLLARS

VALVE SEATS

Reconditioning

Should it be necessary to true up or grind the valve seats their width for both inlet and exhaust valve is 1.5 mm (0.062 in) the seat angle being 46° + ¼°.

If after the desired finish has been achieved the seat width exceeds 2.00 mm (5/64 in) reduce the width by using a 70° stone and a stone modified as shown in Fig. D-52 to blend with combustion chamber wall.

VALVES

Refinishing

Valve faces may be refinished by grinding at an angle of 45° to a minimum margin of 0.38 mm (0.015 in) using service tool 18GA056. Fig. D-47.

FITTED HEIGHT CHECK:

(a) Fit the valve to its correct position in the cylinder head and hold it against its seat.

(b) Fit the gauging sleeve 18GA055 over the stem and seat it into the valve spring recess.

(c) The tip of the valve stem must fall between the top of the sleeve and the bottom of the slot. Use the side of service tool 18GA056 as straight edge to check height.

The bottom of the slot is 19.71 mm (1.766 in) above the spring seat face. This is the ideal height for new components.

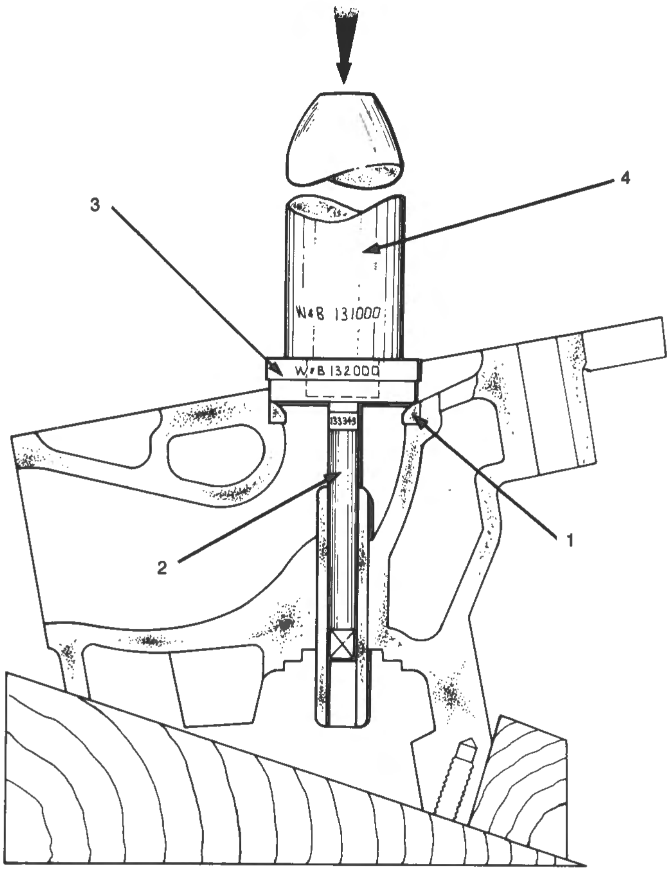


Fig. D-51

FITTING VALVE SEAT INSERT

(INLET SHOWN)

1 VALVE SEAT INSERT INLET
2 PILOT W & B 133343
3 COLLAR W & B 132000
4 HANDLE W & B 131000

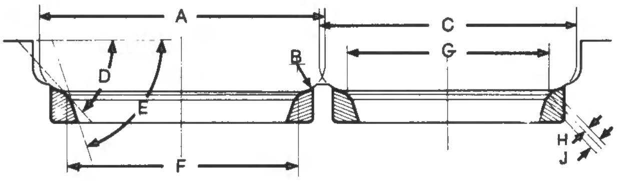


Fig. D-52

VALVE SEAT INSERT REFINISHING

A STONE DIAMETER INLET 45.2 mm (1.781 in)
B STONE RADIUS INLET AND EXHAUST 4.4 mm (0.175 in)
C STONE DIAMETER EXHAUST 40.6 mm (1.6 in)
D SEAT ANGLE INLET AND EXHAUST 46¼°
E ANGLE FOR SEAT WIDTH REDUCTION 70°
F DATUM SEAT DIAMETER INLET 36.52 mm (1.438 in)
G DATUM SEAT DIAMETER EXHAUST 31.75 mm (1.250 in)
H SEAT LOCATION INLET AND EXHAUST 0.63 mm (0.025 in)
J SEAT WIDTH INLET AND EXHAUST 1.6-2.0 mm (0.062-0.078 in)

Should the tip of the valve protrude past top of sleeve measure the gap between the straight edge and the sleeve. Fig. D-53(6). Provided the measurement taken does not exceed the figure recorded during Inspection (Stem Tip Height) the tip may be ground to achieve gauge height.

NOTE: The same method applies using the straight edge in the slot if it is desired to achieve ideal height. When a stem tip is ground always re-grind the chamfer 45° 0.13 to 0.51 mm (0.005 to 0.020 in).

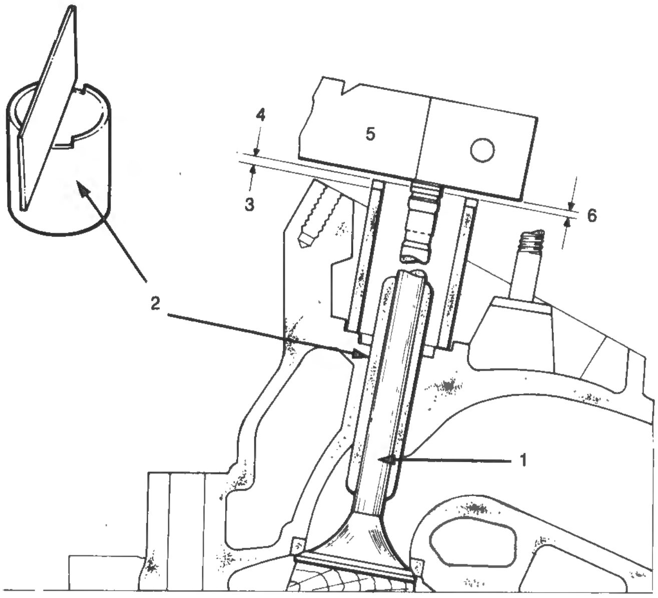


Fig. D-53

CHECKING VALVE FITTED HEIGHT

1 INLET VALVE
2 GAUGING SLEEVE 18GA055
3 VALVE FITTED HEIGHT LOW LIMIT
4 VALVE FITTED HEIGHT HIGH LIMIT
5 GRINDING GAUGE 18GA056
6 TIP MAY BE GROUND DOWN TO 4 IF MEASUREMENT DOES NOT EXCEED THAT RECORDED IN (6) Fig. D-46

Valve lapping and seat testing

1. Lightly lap the valves into the seats with fine grinding compound. The refacing and reseating operations should leave the finished surfaces smooth and true so that a minimum of lappings is required. Excessive lapping will groove the valve face preventing a good seat when hot.

2. Test valve for concentricity with seat and for correct sealing using prussion blue, coat the valve face with a thin coat of blue and turn it against its seat. If the valve seat is concentric with the valve guide a mark will be made all around the seat, while if the seat is not concentric with the guide, a mark will be made only on one side of the seat. Next, coat the valve seat lightly with prussion blue.

Rotate the valve against the seat to determine if the valve face is concentric with the valve stem, and if valve is seating all the way around. The angular difference between the face of the valve and the seat result in a narrower and therefore more accurate seating, and the seat witness on the valve seat should be on the outer edge of the 1.5 mm (1/16 in) seat width as shown in Fig. D-54.

NOTE: Both prussion blue tests are necessary to prove correct seating is obtained.

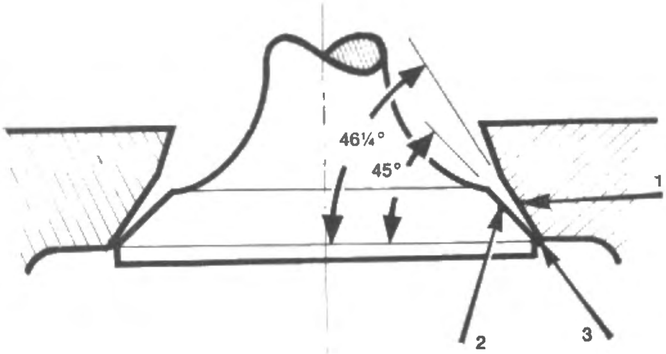


Fig. D-54

RELATION OF VALVE AND SEAT ANGLES

1 CYLINDER HEAD INSERT VALVE SEAT
2 VALVE FACE
3 INTERFERENCE

Assembling

1 Clean prussion blue from valves.

2 Liberally coat the valves with engine oil and reverse the dismantling procedures.

Refitting

1 Ensure cleanliness of cylinder block.

2 Fit a new head gasket/s to the cylinder block ensuring that the word 'Top' that is printed on the gasket faces up and gasket locates on the block dowels.

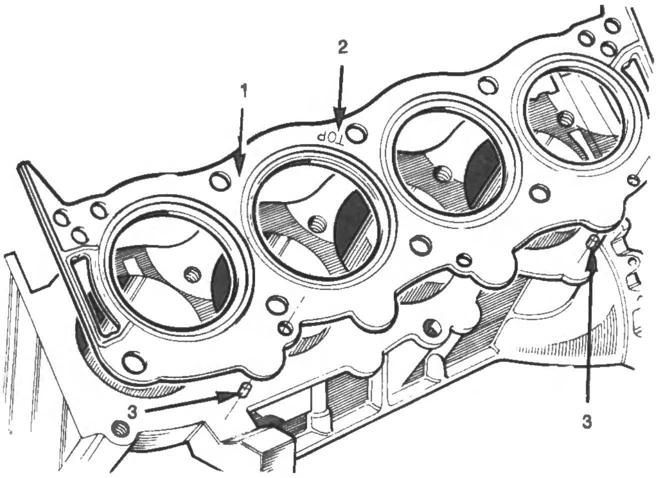


Fig. D-55

CYLINDER HEAD GASKET FITTING

1 GASKET LEFT HAND BANK
2 TOP
3 DOWEL

DO NOT USE SEALER ON THE GASKETS.
If difficulty is experienced in retaining gaskets on the dowels employ two 9.5 mm (3.8 in) U.N.C. slave studs.

3 Locate the head on the block dowels.

4 Apply thread lubricant sealer to bolt threads.

5 Locate correct length bolts in position.

(a) Refer Fig. D-43.

(b) Bolts 1, 2 & 4 long 100 mm (3 15/16 in).

(c) Bolts 3, 5, 6, 7, 8, 9 and 10 short 70 mm (2¾ in).

6 Tighten bolts a little at a time in the sequence shown in Fig. D-44 making approximately three passes over the bolts. Then finally tighten in the same sequence to a torque of 88 to 95 Nm (65 to 70 lb.f.ft.).

NOTE: No further torquing of the head bolts is required between head removals.

CAUTION: Uneven or over torquing of bolts could cause bore distortion leading to compression loss and excessive oil consumption.

7 Reverse removing operation 1 to 8.

CRANKSHAFT PULLEY AND TORSIONAL VIBRATION DAMPER

Removing

1 Remove ancillary equipment drive belts.

2 Place the vehicle on suitable stands or hoist.

3 Remove the dust shield from the torque converter housing on Automatic models and the starter motor on Manual models.

4 Prevent the engine from turning by locking the ring gear with a suitable tool.

5 Remove the retaining screw and washer from the centre of the pulley assembly using a 15/16 in A.F. socket.

6 Remove the assembly from under the vehicle.

NOTE: DO NOT DAMAGE THE BALANCE RING. Manual vehicles fitted with 6 blade metal fan (remove fan).

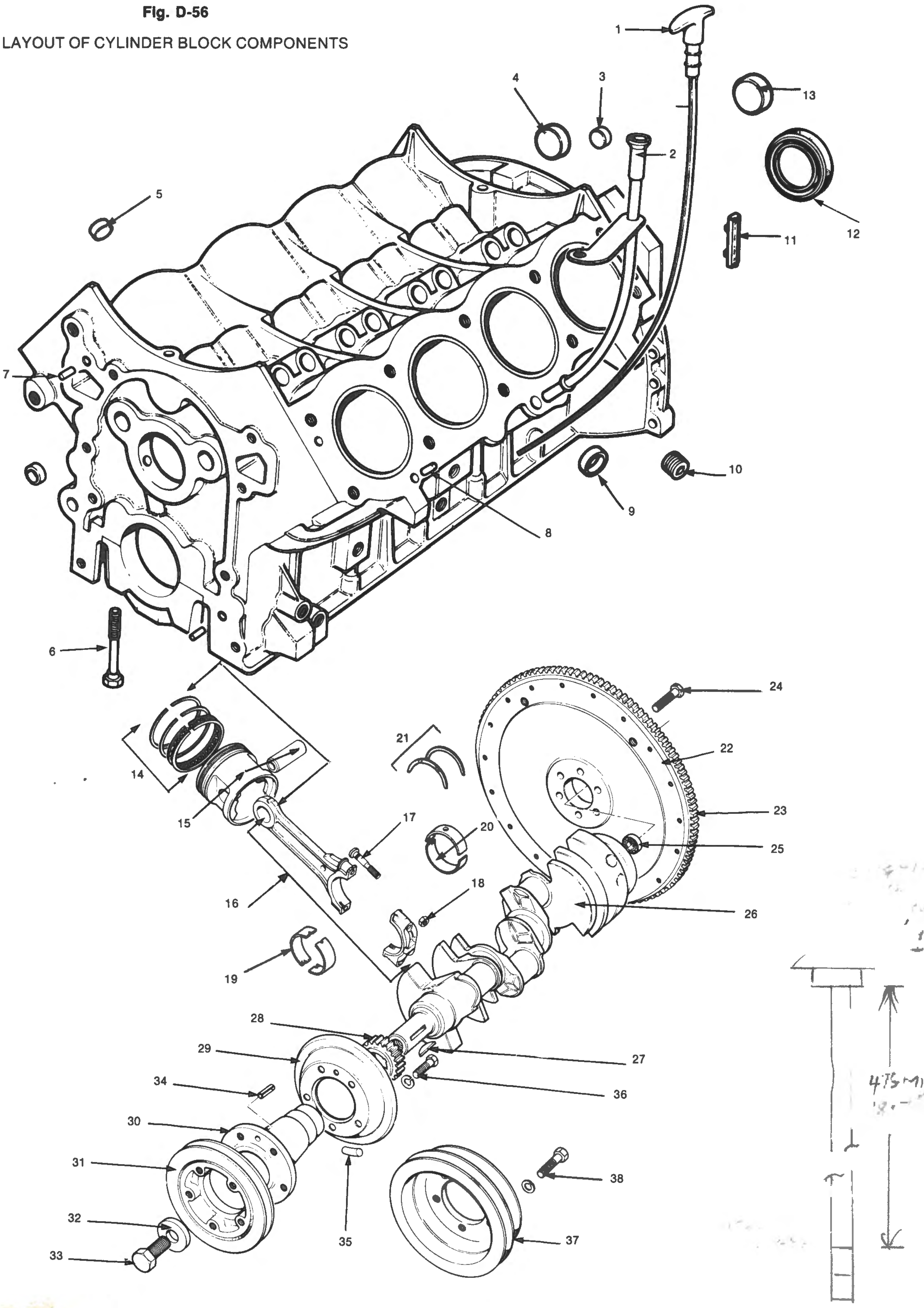
Dismantling

1 Knock out the locating roll pin.

2 Remove the five screws securing the damper, pulleys and balance ring to the crankshaft pulley adaptor flange.

Fig. D-56

LAYOUT OF CYLINDER BLOCK COMPONENTS



KEY TO FIG. D-56

1. ENGINE OIL DIP STICK
2. DIPSTICK TUBE
3. OIL GALLERY PLUGS (4)
4. WATER GALLERY PLUGS (1)
5. OIL GALLERY PLUGS (2)
6. MAIN BEARING CAP BOLTS (10) 1/2" x 3 7/6" UNC
7. DOWEL (2)
8. DOWEL HEAD GASKET (4)
9. WATER GALLERY PLUGS (6)
10. CYLINDER BLOCK DRAIN PLUGS (2)
11. MAIN BEARING CAP SIDE SEALS (2)
12. CRANKSHAFT OIL SEAL
13. CAMSHAFT PLUG
14. PISTON RINGS
15. PISTON AND GUDGEON PIN
16. CONNECTING ROD ASSEMBLY (8)
17. CONNECTING ROD BOLTS (16)
18. CONNECTING ROD NUTS (16)
19. CONNECTING ROD BEARING PAIR (8)
20. MAIN BEARING PAIRS (5)
21. THRUST WASHER PAIR (1)
22. FLYWHEEL AND RING GEAR (1)
23. STARTER RING GEAR
24. BALANCE SCREW
25. PILOT BEARING
26. CRANKSHAFT
27. KEY
28. CRANKSHAFT TIMING GEAR
29. BALANCE RING
30. ADAPTOR DAMPER ASSEMBLY
31. TORSIONAL VIBRATOR DAMPER AND PULLEY ASSEMBLY
32. WASHER
33. CRANKSHAFT BOLT
34. ROLL PIN (1)
35. BALANCE WEIGHT
36. SCREW AND WASHER (5)
37. POWER STEERING AND AIR CONDITIONING PULLEYS
38. SCREWS AND WASHERS FOR PULLEYS (5)

Assembling

Ensure mating faces of components are undamaged and free of foreign materials.

1. Align the dowel pin hole in all components.
2. Refit all six screws and springs and finger tighten.
3. Fit a new dowel pin.
4. Torque screws to figure quoted in GENERAL DATA.

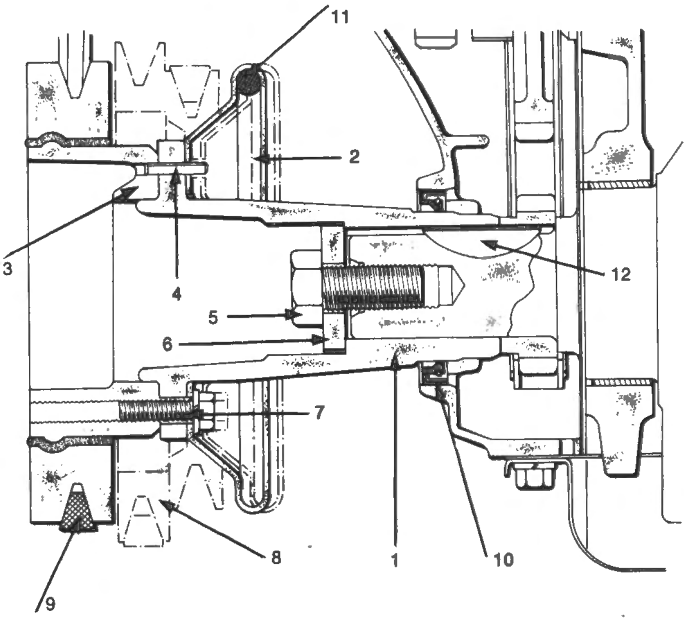


Fig. D-57

SECTION THROUGH CRANKSHAFT PULLEY AND TORSIONAL VIBRATION DAMPER

1. ADAPTOR
2. BALANCE RING
3. DAMPER ASSEMBLY
4. ROLL PIN
5. BOLT
6. WASHER
7. SCREW AND SPRING WASHERS (5)
8. AIR CONDITIONING AND POWER STEERING PULLEYS
9. FAN BELT
10. TIMING CASE OIL SEAL
11. BALANCE WEIGHT
12. KEY

Balance

Should it be necessary to replace a balance ring, mark the position of the weights relative to the dowel pin hole and the crankshaft centre line. Mark the same positions on the new rim. Fig. D-58. Remove the balance weight from original rim and fit to new rim.

L ±0.254 mm 0.010 in	Weight in grammes and oz
13.20 mm — 0.520 in	6.3 g — 0.177 oz
26.41 mm — 1.040 in	9.6 g — 0.355 oz
39.62 mm — 1.560 in	15.3 g — 0.532 oz
52.83 mm — 2.080 in	20.0 g — 0.710 oz

Refitting

1. Refitting is reversal of removal procedure noting the following:
    - (a) Ensure timing case oil seal is in good condition.
    - (b) Lubricate the seal face on the assembly with engine oil.
    - (c) Torque the retaining screw to the figure quoted in GENERAL DATA.

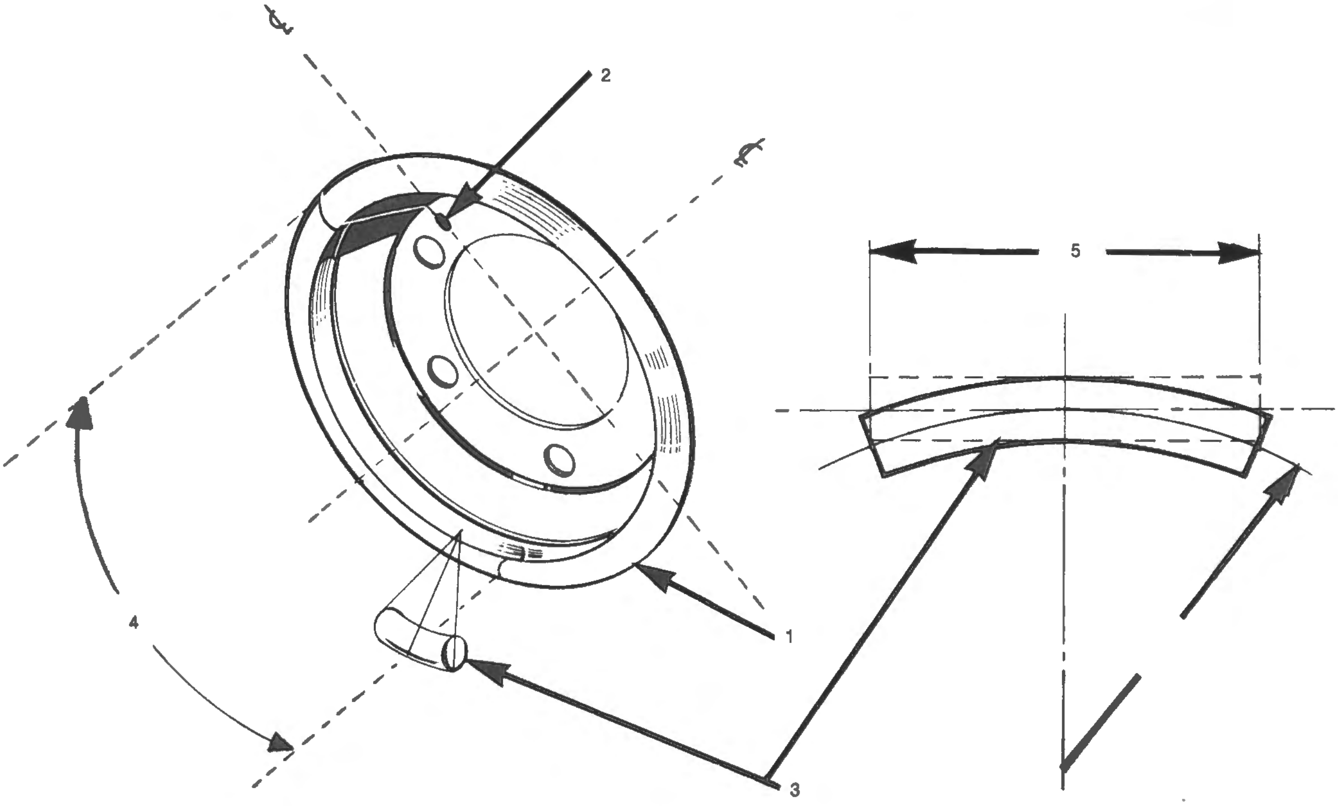


Fig. D-58

FITTING BALANCE WEIGHTS

1 BALANCE RING 2 DOWEL HOLE 3 BALANCE WEIGHT 4 POSITION CENTRE OF WEIGHT RELATIVE TO DOWEL PIN CENTRE 5 SEE CHART 'L'

TIMING CASE OIL SEAL

Removing

1. Remove the crankshaft pulley and damper assembly.
2. Extract seal with 18G1087. Fig. D-59.

Refitting

1. Seat the seal squarely in the housing and tap in using a suitable drift.
2. Lubricate the seal lips and refit the pulley and damper assembly.

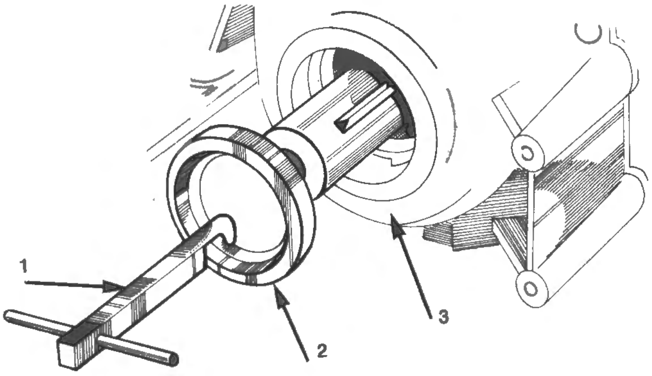


Fig. D-59

REMOVING TIMING CASE OIL SEAL

1 REMOVE 18G1087 2 OIL SEAL 3 TIMING CASE

TIMING CASE/COVER ASSEMBLY

NOTE: This procedure covers engines fitted with optional equipment. Delete items not applicable.

Removing

1. Disconnect battery.
2. Drain cooling system by removing bottom radiator hose complete. Drain engine block.
3. Remove top radiator hose complete.
4. Loosen alternator adjusting bolts and move alternator in at top and remove fan belt.
5. Disconnect alternator wires.
6. Remove bolt from water pump holding top alternator bracket.
7. Remove bottom alternator fixing bolt and spacer washers and remove alternator.
8. Remove four bolts between fan viscous coupling and water pump pulley and remove assembly.
9. Remove fan shield from radiator.
10. Remove heater inlet hose from water pump.
11. Remove hose from water pump.

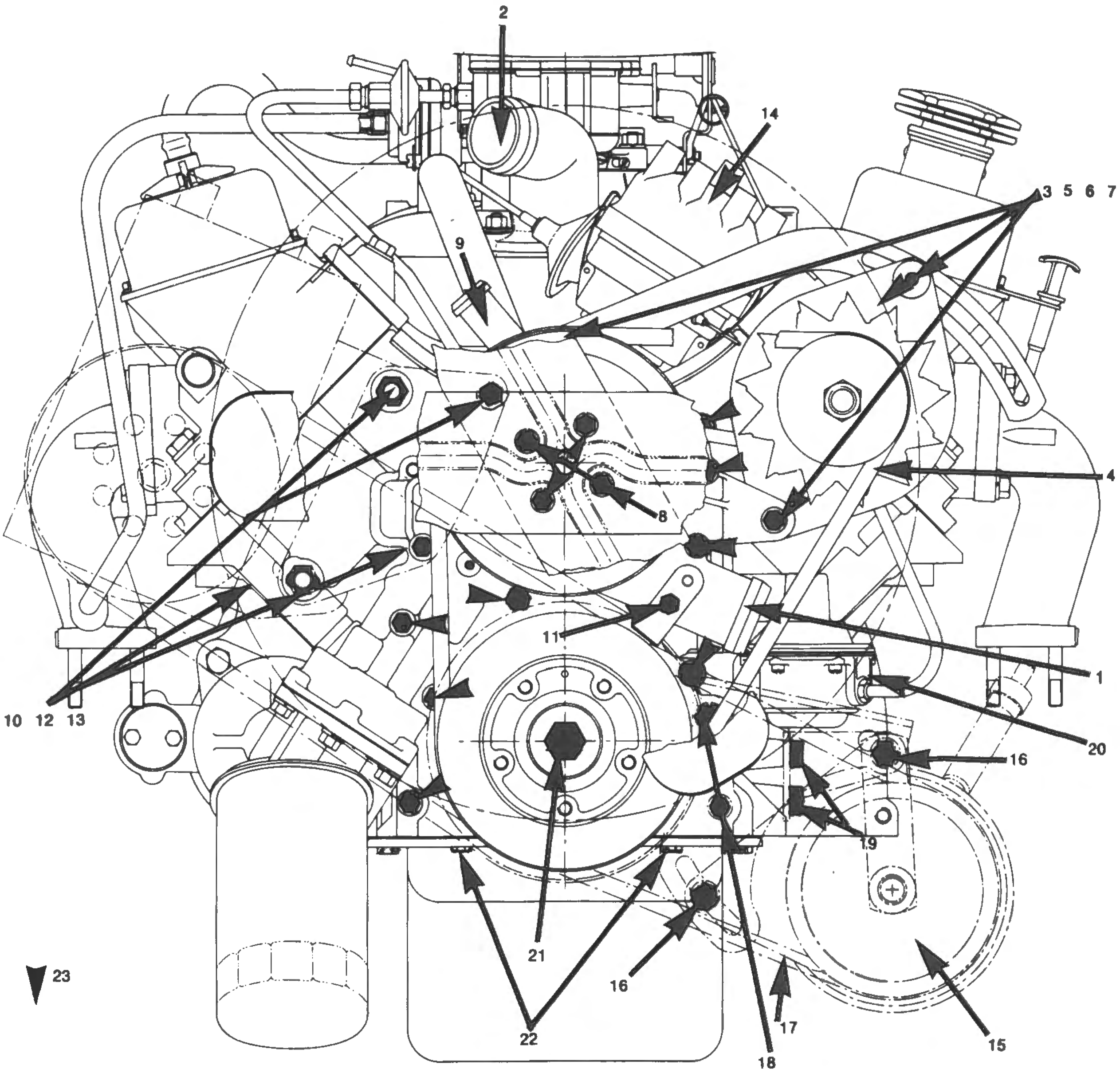


Fig. D-60

LOCATION OF TIMING CASE/FRONT COVER FIXINGS

1	BOTTOM RADIATOR HOSE CONNECTION
2	TOP RADIATOR HOSE CONNECTION
3	ALTERNATOR ADJUSTING BOLTS
4	FAN BELT
5	ALTERNATOR ADJUSTING BRACKET BOLT
6	ALTERNATOR MOUNTING BOLT
7	ALTERNATOR
8	FAN MOUNTING SCREWS
9	HOSE CONNECTION
10	COMPRESSOR ADJUSTMENT JACK
11	TIMING POINTER
12	COMPRESSOR MOUNTING BOLTS
13	COMPRESSOR MOUNTING BRACKET BOLTS
14	DISTRIBUTOR CAP
15	POWER STEERING PUMP
16	PUMP BELT ADJUSTMENT
17	PUMP DRIVE BELT
18	BOLTS PUMP BRACKET TO COVER
19	BOLTS PUMP MOUNTING TO BLOCK
20	FUEL PUMP
21	CRANKSHAFT PULLEY BOLT
22	OIL RESERVOIR TO COVER SCREWS
23	BOLTS COVER TO BLOCK

12 Loosen air conditioning compressor adjusting bolts and move unit in at bottom. Remove timing mark pointer and remove belt.

13 Remove the two long bolts holding the unit to the block and then sit the compressor unit on top of the bonnet platform and support with wire.

14 Remove the compressor mounting bracket from water pump. Two long bolts go right through pump, timing cover and screw into block. The other short one only goes through water pump.

15 Set No. 1 cylinder at T.D.C. on compression stroke.

16 Remove distributor cap and mark position in relation with rotor button.

17 Remove distributor holding and locking bolt and plate. Disconnect distributor secondary lead from coil.

18 Remove distributor unit.

19 Disconnect power steering pump mounting bolts and let pump rest on sway bar or floor.

20 Disconnect oil light switch wire from oil pump.

21 Disconnect the fuel lines from the pump and remove pump.

22 Remove the crankshaft pulley assembly.

23 Loosen engine oil reservoir all round and remove the two bolts from front of sump which go through timing cover. The bolts should be loosened sufficiently to allow the oil reservoir to be lowered approximately 3 mm (⅛ in) so that the reservoir gasket can be moved away from timing cover.

24 Remove the rest of the bolts through water pump and timing cover and remove unit as one assembly, and lift up and over radiator.

25 Remove the gasket.

Refitting

1 Refitting is the reversal of the removing procedure noting the following:

(a) Prime the oil pump by injecting oil through the suction port if filter has not been removed, otherwise grease prime the pump.

(b) Set ignition timing.

(c) Adjust belts in accordance with section 'C'.

DISTRIBUTOR DRIVE GEAR

Removing

1 Remove the timing case cover.

2 Remove the bolt and washer securing the gear to the camshaft.

3 Mark the gear face for replacement purposes.

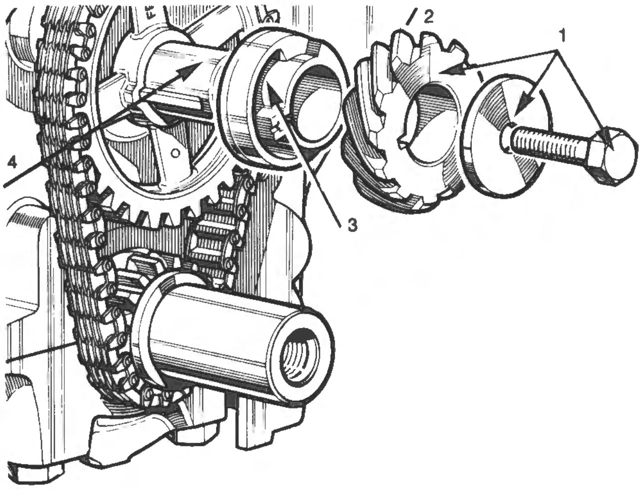


Fig. D-61

REMOVING DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM

1 RETAINING BOLT AND WASHER
2 GEAR 3 CAM 4 CAMSHAFT KEY

4 Remove the gear from the shaft.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

(a) If the gear is to be re-used refit it in its original running position.

(b) Torque the retaining bolt to the figure quoted in GENERAL DATA.

FUEL PUMP DRIVE CAM

Removing

1 Remove the distributor drive gear.

2 Remove the fuel pump drive cam.

Refitting

1 Refitting is reversal of the removing procedure noting the following:

(a) The cam is fitted with the 'F' mark facing out.

TIMING CHAIN AND GEARS

Removing

1 Set the engine at T.D.C. No. 1 cylinder.

2 Remove the timing case.

3 Check timing chain stretch as follows:

(a) Position a suitable scale as shown in Fig. D-62.

(b) Using a torque wrench and socket on the distributor drive gear retaining bolt. Apply a torque of 41 Nm (30 lb.f.ft.) in direction of engine rotation.. Ensure crankshaft is still locked at the ring gear.

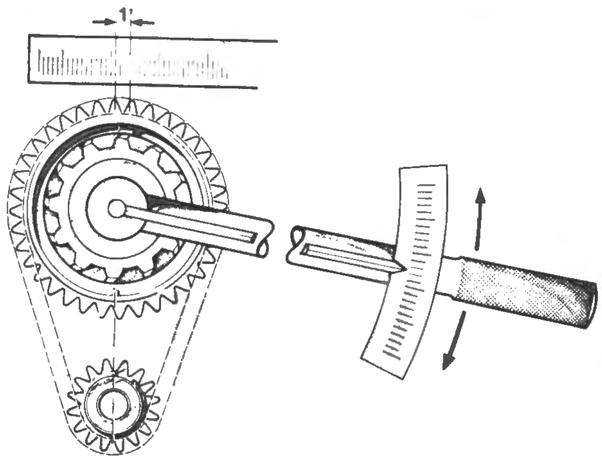


Fig. D-62

CHECKING TIMING CHAIN STRETCH

1 MAXIMUM TRAVEL WITH LOCKED CRANKSHAFT 4.7 mm (3/16 in)

NOTE: Use a torque figure of 20 Nm (15 lb.f.ft.) if cylinder heads have been removed.

(c) Line up the scale with a suitable point on the chain.

(d) Using a suitable tension wrench apply the torque to the bolt in the opposite direction and check the travel on the scale.

(e) Replace the chain if travel exceeds 4.7 mm (3/16 in).

4 Remove the distributor drive gear and fuel pump cam.

5 Remove the chain and gear assembly complete.

CAUTION: Do not rotate the engine if the valve mechanism is intact or damage to the pistons may result.

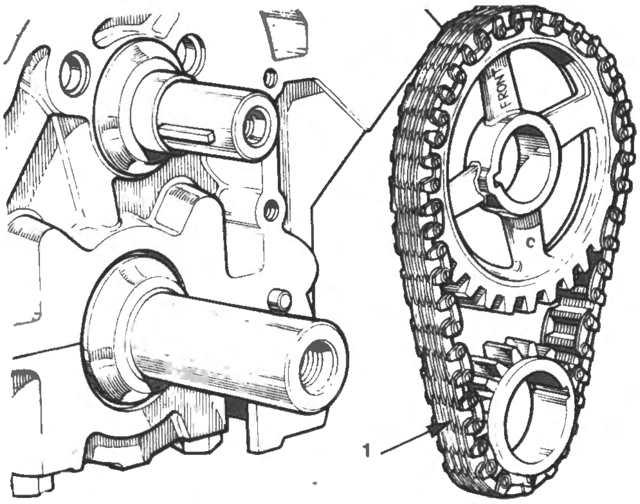


Fig. D-63

TIMING CHAIN REMOVAL

1 REMOVE AS ASSEMBLY

Refitting

NOTE: If the crankshaft and or camshaft have not been rotated commence at item 1. If they have been rotated commence at item 5.

1 Remove the rocker arms.

2 Set the engine — No. 1 cylinder T.D.C.

3 Temporarily fit the camshaft gear with the marking 'FRONT' outwards.

4 Turn the camshaft until the mark on the gear is at the six o'clock position. Refer Fig. D-64 then remove the gear without moving the shaft.

5 Locate the timing chain to the gears with their marks aligned.

6 Engage the assembly on the crankshaft and camshaft keys.

7 Check that the timing marks are in line.

8 Refit the fuel pump drive cam.

9 Refit the distributor drive gear, washer and bolt.

10 Refit the valve rockers as necessary.

11 Refit the timing case.

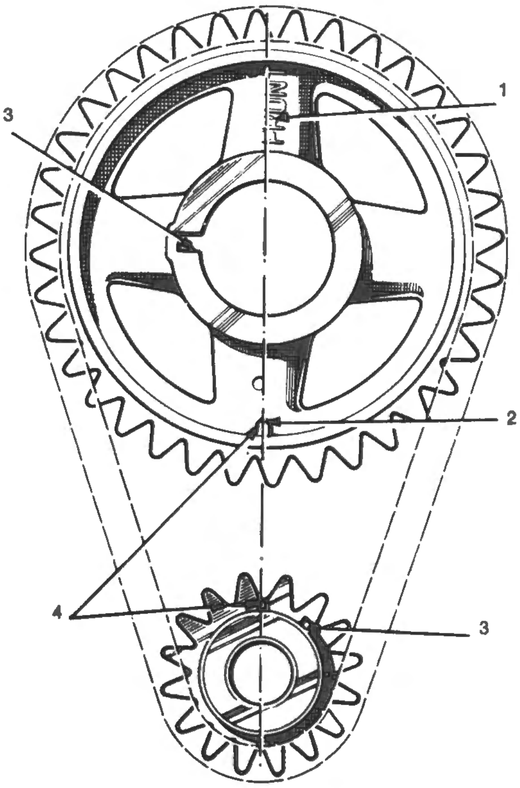


Fig. D-64

SETTING THE VALVE TIMING

1 FRONT

2 6 O'CLOCK POSITION CAMSHAFT GEAR

3 POSITION OF CAMSHAFT AND CRANKSHAFT KEYS

4 POSITION GEAR MARKINGS

CAMSHAFT

Removing

1 Remove hydraulic valve lifters. Refer Valve Mechanism Section.

2 Remove the cooling system radiator and grill. See note 2.

3 Remove the timing case, timing chain and gear assembly.

4 Carefully extract the camshaft from the cylinder block, keeping it centred in the bearings.

NOTE: The bearing journals are reduced in diameter progressively toward the rear of the engine. Refer GENERAL DATA. On air conditioned vehicles it will be necessary to remove the condenser from in front of the radiator. See Air conditioning Section.

Refitting

Refitting is the reversal of the removing procedure.

CAMSHAFT BEARINGS

The camshaft bearings are steel backed alloy type. They are fitted and 'line bored' by special process within the factory and are not serviced.

FLYWHEEL AND STARTER RING GEAR

Removing

1 Remove the transmission and flywheel housing. Section L.

2 Remove clutch assembly. Section K.

3 Mark the position of the flywheel in relation to the crankshaft.

NOTE: The flywheel is not doweled to the crankshaft. Two items are number stamped only.

4 Remove the screws securing the flywheel to the crankshaft.

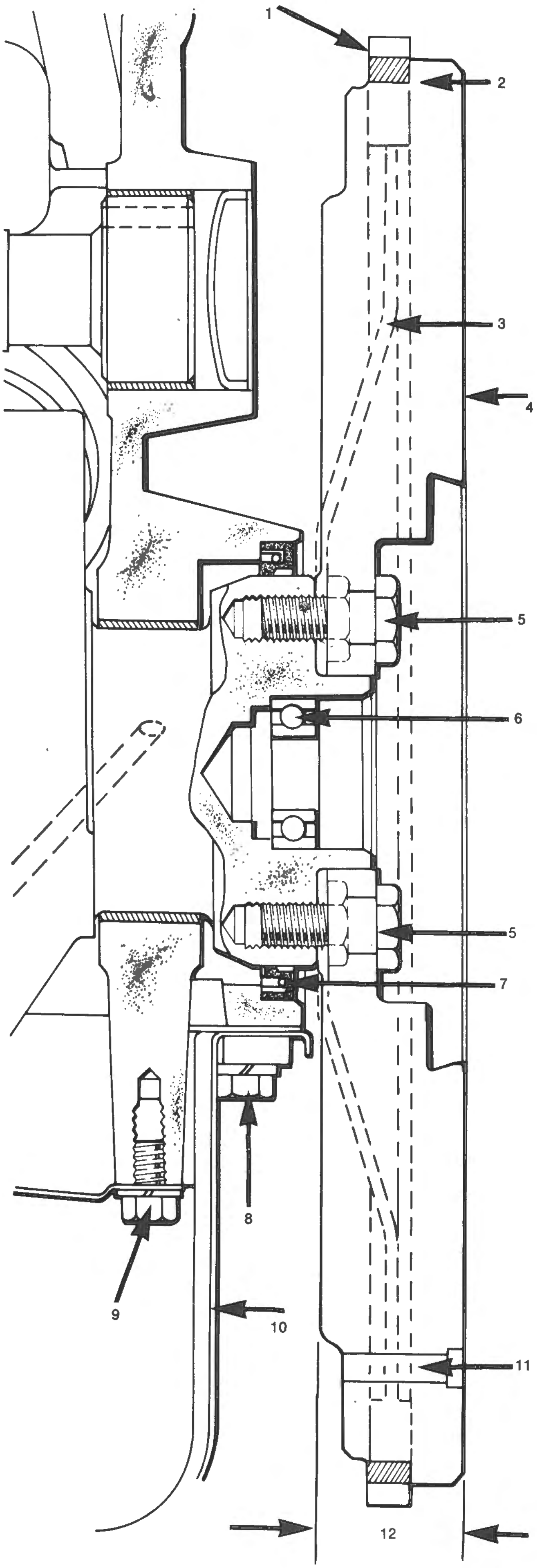


Fig. D-65

SECTION THROUGH FLYWHEEL AND STARTER RING GEAR ASSEMBLY

1 RING GEAR HARDENED SIDE
2 FLYWHEEL
3 CONVERTER DRIVE PLATE (AUTOMATIC) MODELS
4 CLUTCH PLATE FACE
5 BOLTS FLYWHEEL TO CRANKSHAFT
6 PILOT BEARING (MANUAL MODELS)
7 CRANKSHAFT OIL SEAL
8 ATTACHING SCREWS, RESERVOIR AND SUPPORT PLATE TO CRANKCASE
9 SCREW OIL BAFFLE TO MAIN BEARING CAP EXTENSION
10 OIL RESERVOIR
11 BALANCE SCREW HOLES
12 FLYWHEEL THICKNESS

Inspecting

1. Check the clutch plate face for indications of scoring, overheating, surface cracking.
2. Check mounting bolt holes and bolts for indications of looseness.
3. Check condition of starter ring gear.

Overhauling

1. The clutch plate surface may be reconditioned by machining the entire flywheel face, provided the overall thickness is not less than 33.5 mm (1.320 in) on completion.
   The face must be parallel to the rear mounting face. Tolerance 0.050 mm (0.002 in) wide.

NOTE: See Balancing.

2. **Ring Gear replacement. Refer Fig. D-66.**
   (a) Drill a 3.17 mm (0.125 in) hole axially between the root of any tooth and the inner diameter of the starter ring sufficiently deep to weaken the starter ring.
   Do not allow the drill to enter the flywheel.

   (b) Secure the flywheel in a vice fitted with soft jaws.

   (c) **Place cloth over the flywheel for protection from flying fragments.**

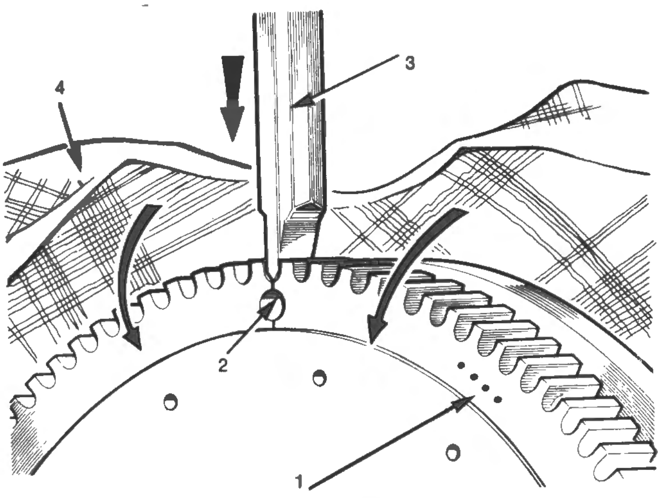


Fig. D-66

STARTER RING GEAR REMOVAL

1 HARDENING IDENTIFICATION
2 DRILLED HOLE
3 CHISEL
4 PROTECTIVE COVER

(d) Place a chisel immediately above the drilled hole and strike it sharply to split the starter ring gear.

(e) Remove the gear and clean up the seating face and flange.

(f) Place the flywheel flanged side down on a flat surface.

(g) Identify the hardened side of the replacement ring gear.
The starter ring gear is rectangular in section and it has no chamfered edges or tooth engagement leads.
The hardened side of the gear faces toward the front of the engine and is identified by 4 equally spaced dots on the face. Fig. D-65-66.

(h) Heat the gear uniformly to a temperature not exceeding 260°C (500°F) and locate it on the flywheel.

(i) Press the gear firmly against the flange.

(j) Allow the flywheel to cool gradually, DO NOT hasten the cooling in any way, as internal stresses may be set up within the gear leading to failure.

Balancing

Initial factory balance will not be affected greatly by machining of the clutch plate face.
However, the original factory fitted balance bolts screwed to the flywheel must be refitted in their original position.

NOTE: If the break away torque is below 36 Nm (12 lb.f.in.) replace the bolt.
Should it be necessary to replace a bolt ensure one of the correct weight is used.
The four available weights are as follows:

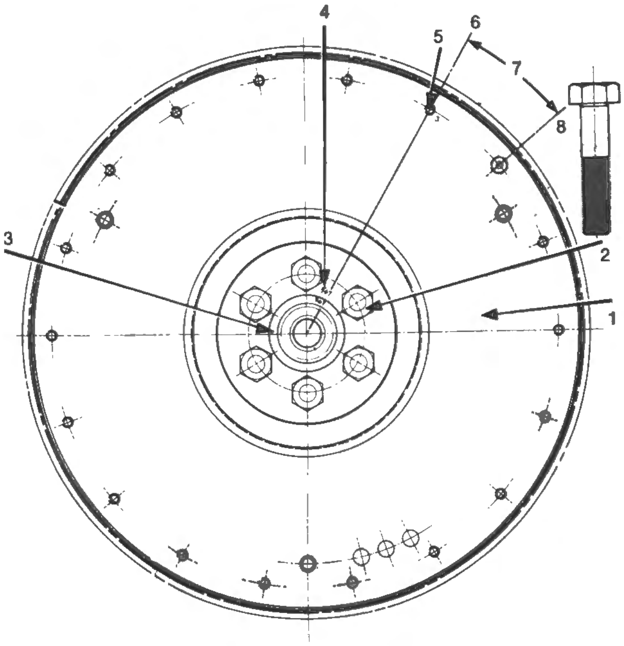


Fig. D-67

RE-LOCATION OF BALANCE BOLTS

1 FLYWHEEL/DRIVE PLATE
2 BOLTS TO CRANKSHAFT 6EA 7/16" x 3/4" UNF.
3 CRANKSHAFT
4 CRANKSHAFT TO FLYWHEEL IDENTIFICATION
5 BALANCE BOLT HOLES
6 DATUM FOR BOLT POSITIONING
7 DISTANCE OF ORIGINAL AND LOCATION OF NEW BOLT
8 BALANCE BOLT

Grade	Weight	Part No.
1	1.37 gm (0.370 oz)	MYH 0962
2	0.65 gm (0.185 oz)	MYH 0963
3	0.87 gm (0.249 oz)	MYH 0964
4	0.46 gm (0.122 oz)	MYH 0965

If a new flywheel is being fitted, temporarily fit it to the crankshaft and mark it in relation to the original crank stamping. Mark the balance hole on both flywheels which correspond with a line through the stamping and the centre of the flywheel. Using this balance screw hole as a datum, transfer the balance bolts to their corresponding positions on the new assembly. Torque the bolts to a maximum of 3.5 Nm (30 lb.f.in.).

Refitting

1 Refit the flywheel assembly to the crankshaft using new screws and torquing them in diagonal sequence to the figure quoted in GENERAL DATA.

2 Using a suitable dial gauge check the Total Indicated Run Out which should not exceed 0.08 mm (0.003 in).

3 Refit remainder of components in the reverse order to which they were removed.

CONVERTER DRIVE PLATE AND STARTER RING GEAR ASSEMBLY

This component is serviced as an assembly only.

Removing and Refitting

Refer Section M.

Balancing

Carry out the procedure given for Manual Transmission Flywheel assembly.

CRANKSHAFT REAR OIL SEAL

Removing

1 Remove transmission Sections L or M.

2 Remove the clutch and flywheel assembly. Section D and K or Converter and Drive Plate Section M.

3 Extract the seal from the cylinder block using service tool 18GA031. Fig. D-68.

CAUTION: Exercise care when extracting the seal to avoid damage to the crankshaft.

Refitting

1 Liberally lubricate the seal lip and the surface of the crankshaft with engine oil.

NOTE: The direction of crankshaft rotation is indicated on the seal by an arrow.

2 Carefully fit the seal to the crankshaft journal, turning it in the opposite direction to the arrow (clockwise).

3 Secure the seal replacer adaptor 18GA044 to the end of the crankshaft as shown in Fig. D-69.

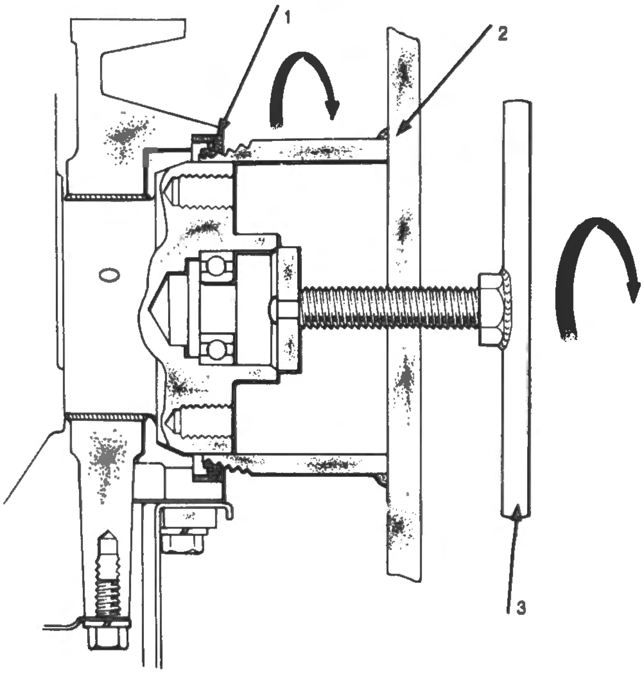


Fig. D-68

REMOVING CRANKSHAFT REAR OIL SEAL

1 OIL SEAL

2 18GA031 SCREWED INTO OIL SEAL CLOCKWISE VIEWED FROM REAR OF ENGINE

3 REMOVE BY TURNING FORCING SCREW CLOCKWISE

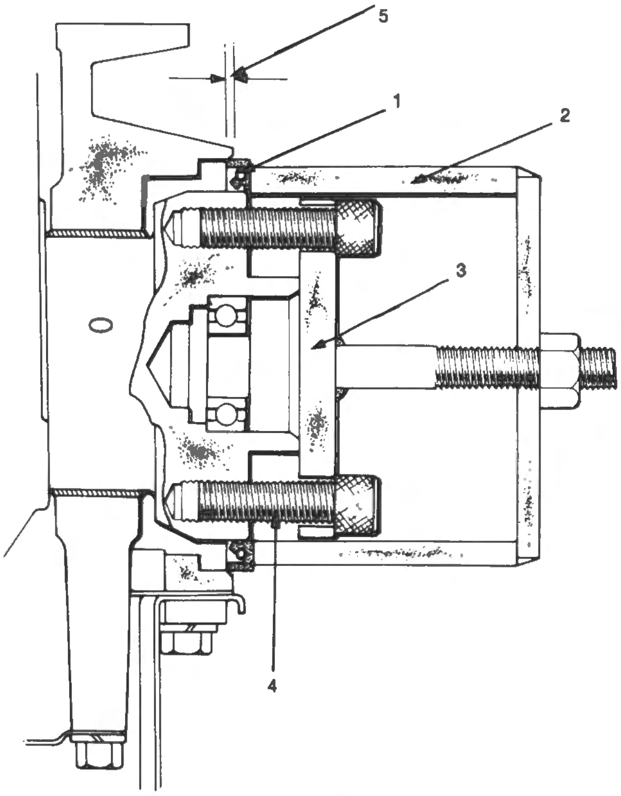


Fig. D-69

INSTALLING CRANKSHAFT REAR OIL SEAL

1 OIL SEAL

2 18GA044 REPLACE SLEEVE

3 18GA044 ADAPTOR

4 SCREW ADAPTOR TO CRANKSHAFT

5 FITTED POSITION OF SEAL

4 Lubricate the inside of the seal replacer and fit it over the crankshaft against the seal.

5 Fit the nut to the adaptor and wind up till seal enters its housing.

6 Continue to wind in seal until it is flush or just clear of the crankcase face.

NOTE: Clearance must exist between the seal and the flywheel mounting face on the crankshaft.

FRONT ENGINE MOUNTS

Removing

1 Place suitable support under the oil reservoir.

2 Remove two nuts, bolts and washers from the mount.

3 Remove nut and washer from stud on mount.

4 Raise engine sufficiently to remove mount.

Refitting:

1 Refitting is the reversal of the removing procedure.

POWER UNIT REMOVAL (Manual Transmission)

NOTE: This procedure covers engines fitted with optional equipment. Delete items not applicable.
For expediency the engine is removed with the transmission attached.

Removing:

1 Disconnect battery.

2 Remove bonnet.

3 Disconnect bottom radiator hose at radiator to drain cooling system.

4 Remove air cleaner assembly.

5 Disconnect accelerator linkage.

6 Remove screws from radiator cowl and lay cowl back onto fan.

7 Disconnect bottom radiator hose at water pump and remove hose.

8 Disconnect top radiator hose at thermostat housing elbow.

9 Remove the radiator.

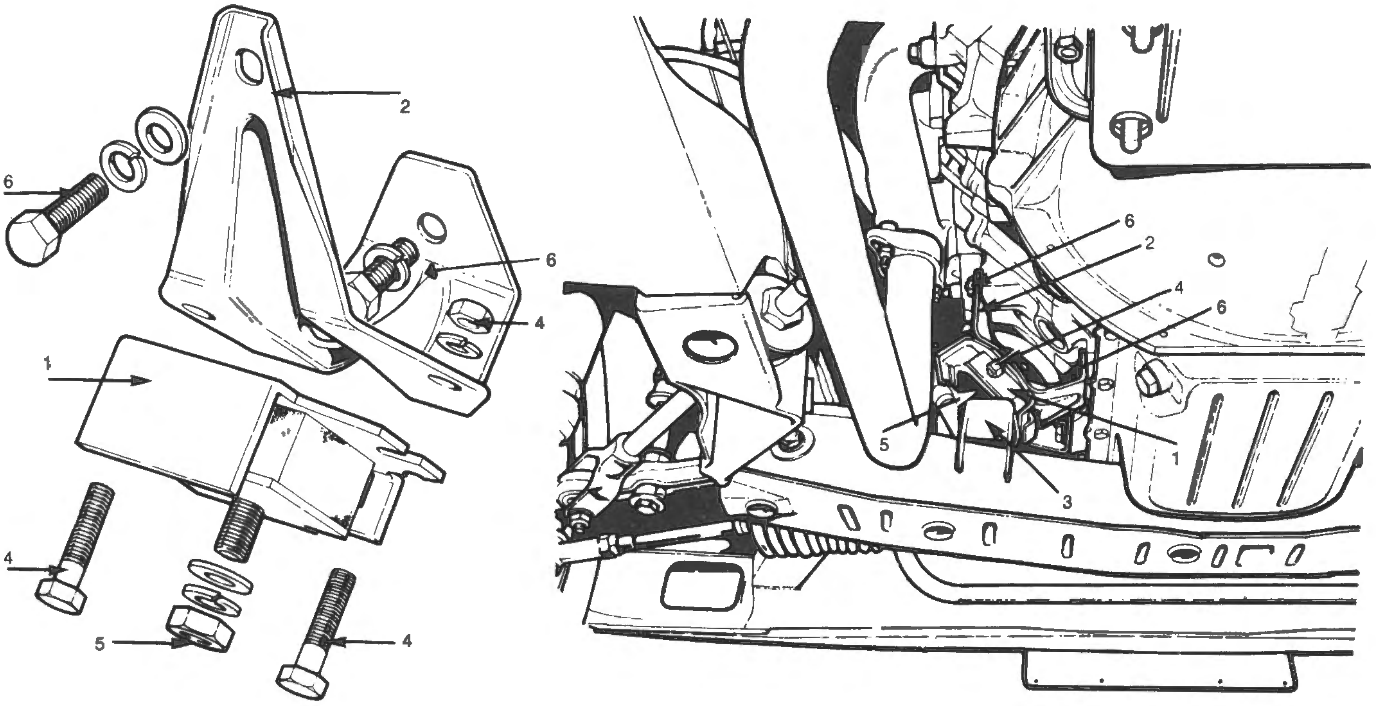


Fig. D-70

ASSEMBLY FRONT ENGINE MOUNTING COMPONENTS

(LEFT HAND SHOWN)

1 ENGINE MOUNT
2 BRACKET MOUNT TO ENGINE
3 FRONT SUSPENSION CROSS-MEMBER
4 BOLTS, NUTS AND WASHERS MOUNT TO BRACKET
5 NUT AND WASHERS MOUNTING TO CROSS-MEMBER BRACKET
6 SCREWS AND WASHERS BRACKET TO BLOCK 3/8 x 7/8" UNC w/3/4 F.

10 Remove bolt from centre of viscous unit and remove fan and viscous unit with cowl.

11 Disconnect heater hoses from inlet manifold and water pump housing.

12 Disconnect inlet hose to fuel pump and plug pipe to prevent fuel spillage.

13 Remove two mounting bolts from compressor and lay compressor aside.

14 Disconnect coil H/T lead, oil warning light with wire, wires to alternator and water temperature gauge wire.

15 Disconnect vacuum hose from manifold.

16 Disconnect vapour lock return line.

17 Disconnect earth strap from engine.

18 Remove draught excluder securing plate and draught excluder from gear lever (4 speed).

19 Unscrew gear lever retaining cap and remove gear lever.

20 Raise front of vehicle and place on stands.

21 Drain engine oil and gearbox oil (or plug extension housing).

22 Disconnect both hoses from power steering pump, plug openings to prevent oil spillage.

23 Disconnect wires from starter solenoid.

24 Disconnect exhaust pipes at manifold flanges.

25 Remove clutch adjusting rod from clutch release arm and remove clutch lever return spring.

26 Disconnect gear shift linkage from cross shaft levers to selector levers (3 speed).

27 Remove the two bolts securing the clutch cross shaft bearing to flywheel housing and press cross shaft into body side member bearing, clear of flywheel housing.

28 Remove the two bolts securing the gear shift cross shaft bearing to flywheel housing and press cross shaft into side member bearing. Leave upper gear shift rods attached to cross shaft arms.

29 Remove bolt and securing plate and remove speedo cable from extension housing.

30 Remove four bolts and two plates from rear universal joint and remove propeller shaft.

31 Fit engine lifting hooks and chain and support weight of power unit. Refer Fig. D-71.

32 Remove two nuts, bolts and spring washers on each front engine mount, leaving mount on front cross member.

33 Place floor jack under transmission and take the weight.

34 Remove two bolts securing rear mount to cross member and two bolts securing cross member to body and remove cross member Lower rear of power unit and remove jack.

35 Raise power unit to clear sump from front cross member, then bring power unit forward and lift again turning front of engine to the right and clear oil filter from front panel. Continue to lift making sure transmission clears body work and remove power unit completely.

Refitting

Reverse removal procedure refilling engine and transmission with oil. Refill cooling system with water and inhibitor and checking for leaks.

Top up power steering reservoir.

POWER UNIT (Automatic Transmission)

NOTE: This procedure covers engines fitted with optional equipment. Delete items not applicable.
For expediency the engine is removed with the transmission attached.

Removing

1 Disconnect battery.

2 Remove bonnet.

3 Disconnect bottom radiator hose at radiator to drain cooling system.

4 Remove air cleaner assembly.

5 Disconnect accelerator linkage.

6 Remove screws from radiator cowl and cowl back onto fan.

7 Disconnect bottom radiator hose at water pump and remove hose.

8 Disconnect top radiator hose at thermostat housing elbow.

9 Disconnect both transmission cooling pipes from radiator.

10 Remove the radiator.

11 Remove bolt from centre of viscous unit and remove fan and viscous unit with fan cowl.

12 Disconnect heater hoses from inlet manifold and water pump housing.

13 Disconnect inlet hose to fuel pump and plug pipe to prevent fuel spillage.

14 Remove two mounting bolts from compressor and lay compressor aside.

15 Disconnect coil H/T lead, oil warning light with wire, wires to alternator and water temperature gauge wires.

16 Disconnect vacuum hose from manifold.

17 Disconnect vapour lock return line.

18 Disconnect kickdown cable.

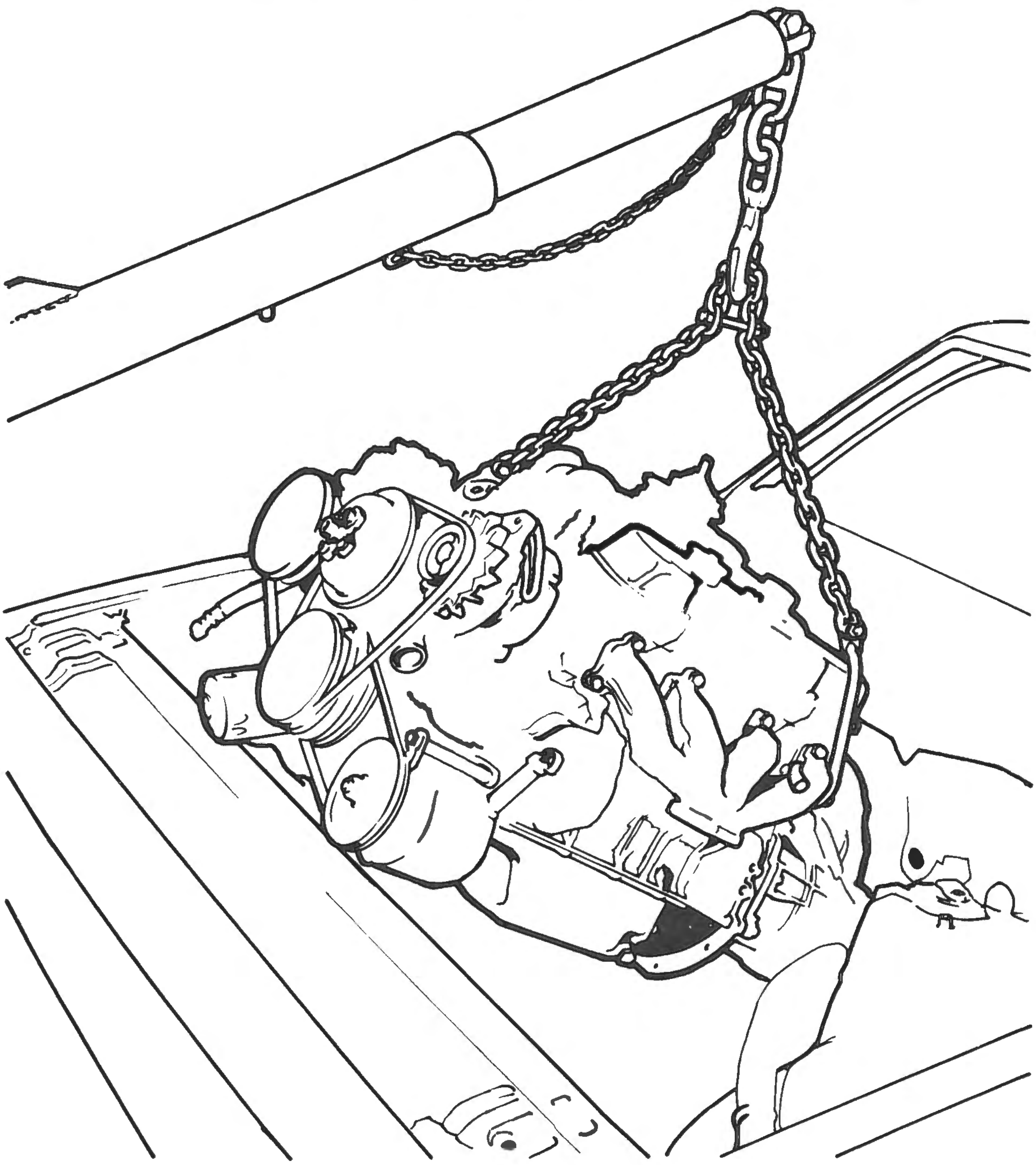


Fig. D-71

REMOVING AND REPLACING THE POWER UNIT

ILLUSTRATION SHOWS THE ACTUAL POSITION OF THE LIFTING HOOK, TO OBTAIN THE CORRECT ANGLE FOR REMOVAL AND INSTALLATION OF THE HEAVIEST POWER UNIT IN THE RANGE

19 Disconnect earth strap from engine.

20 Raise front of vehicle and place on stands.

21 Drain engine oil and transmission fluid.

22 Disconnect both hoses from power steering pump, plug openings to prevent oil spillage.

23 Disconnect wires from starter solenoid.

24 Disconnect exhaust pipes at manifold flanges.

25 Disconnect transmission cooling pipes at transmission, unclip pipes from securing clip and remove both pipes.

26 Disconnect selector lever from transmission.

27 Unplug inhibitor switch wires from transmission case.

28 Remove bolt and securing plate and remove speedo cable from extension housing.

29 Remove four bolts and two plates from rear universal and remove the propeller shaft.

30 Fit engine lifting hooks and chain (Refer Fig. D-71) support weight of power unit.

31 Remove two nuts, bolts and washers on each front engine mount, leaving mounts on front cross member.

32 Place floor jack under transmission and take the weight.

33 Remove two bolts securing rear mount to cross member and two bolts securing cross member to body and remove cross member. Lower rear of power unit and remove jack.

34 Raise power unit to clear oil reservoir from front cross member, then bring power unit forward and lift again turning front of engine to the right to clear oil filter from front panel. Continue lifting making sure transmission clears body work and remove power unit completely.

Refitting

Reverse removal procedure refilling engine and transmission with oil and adjusting kickdown cable. Refill cooling system with water and inhibitor and check for leaks. Top up power steering reservoir.

PISTON RINGS AND CONNECTING ROD ASSEMBLIES

Removing

1 Remove the power unit.

2 Remove the transmission as necessary and place engine on suitable working stand.

3 Remove cylinder heads and valve mechanism including valve lifters.

4 Remove oil reservoir, baffle plate and oil pick up pipe assembly.

5 Remove the carbon from the top of the bore on each cylinder.

6 Examine the cylinder bores above ring travel. If a ridge exists, remove it with a suitable ridge reamer.

7 Turn the engine till No. 1 or 4 crankpin is at approximately B.D.C. Check the connecting rod side clearance and record the figures. 0.15-0.35 mm (0.006-0.014 in), or up to 0.457 mm (0.018 in) if crankshaft journals have been previously reconditioned by grinding.

8 Mark the connecting rod and cup assemblies in relation to its cylinder.

NOTE: The cylinders are numbered from the front 1-3-5-7 left bank, and 2-4-6-8 right bank.

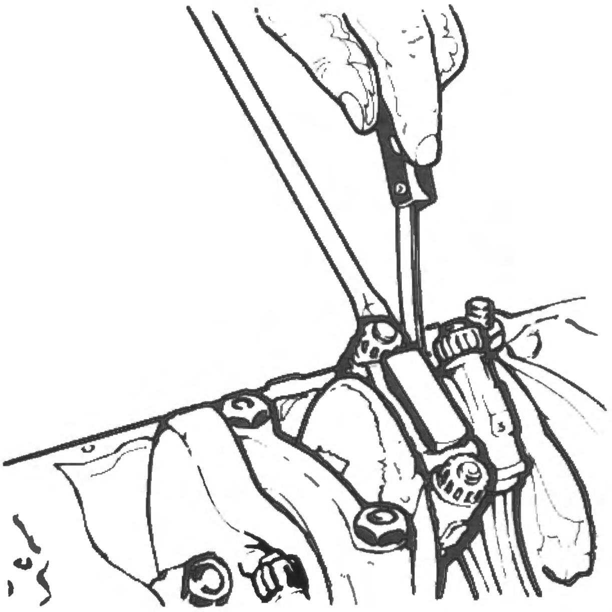


Fig. D-72

CHECKING CONNECTING ROD SIDE CLEARANCE

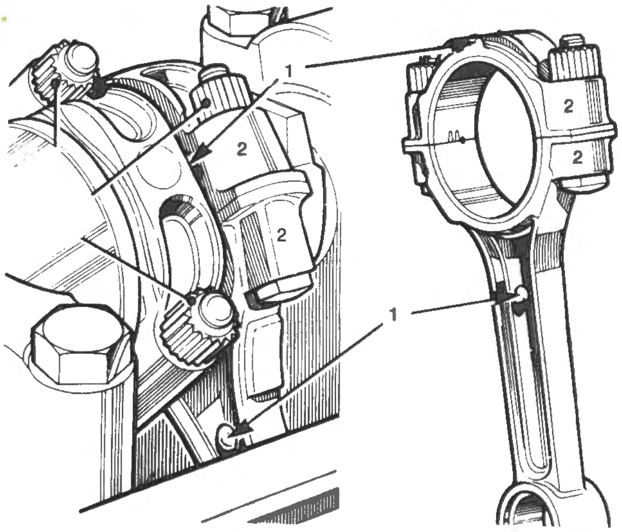


Fig. D-73

MARKING CONNECTING ROD AND CAP ASSEMBLIES

1 CAP AND ROD MUST BE ASSEMBLED WITH DIMPLE AND FACE MATING ASSEMBLY NUMBERS

2 MARK ON THE SAME SIDE OF THE ROD

CONN ROD SHELLS #8B2226 - STD (A

9 Remove two connecting rod caps one at a time and retain them in their order for reassembly.

10 Push the assemblies up the bore and remove them from the top.

11 Temporarily refit the caps to the rods and identify the assemblies with their cylinders for replacement.

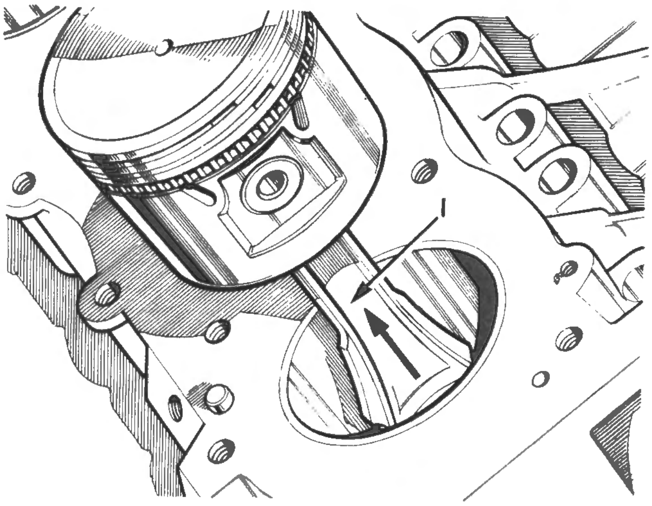


Fig. D-74

REMOVING A PISTON AND CONNECTING ROD ASSEMBLY

1 REMOVE IN DIRECTION OF ARROW

Dismantling

1 Clamp the flat section of the gudgeon pin remover/replacer 18GA054 in a vice, long post uppermost.

2 Remove the screw from the top and push it through the gudgeon pin until the shoulder of the large diameter contacts the end of the gudgeon pin.

3 Position the piston and connecting rod assembly against the end of the long post of the tool and attach the nut and thrust bearing assembly to the screw.

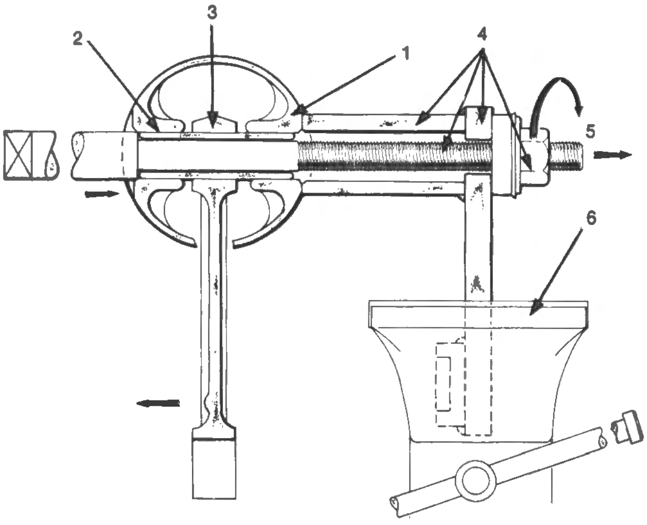


Fig. D-75

REMOVING GUDGEON PIN

1 PISTON
2 GUDGEON PIN
3 CONNECTING ROD
4 SERVICE TOOL 18GA054 POSITIONED FOR REMOVAL
5 DIRECTION OF REMOVAL
6 BENCH VICE

NOTE: Ensure the flat section of the piston is squarely mounted against the tool post; with the post cutaway positioned directly below the ring land.

4 Identify the gudgeon pin, piston and connecting rod so that they can be replaced in their original positions.

NOTE: The gudgeon pins are offset in the piston and pistons are marked 'FRONT'.

5 Withdraw the gudgeon pin by turning the nut until the pin is fully retracted out of the piston and connecting rod into the tool post. Note the direction in which the pin is withdrawn so that it can be drawn through in the same direction when refitted.

6 Refit the gudgeon pin to the piston from which it was removed.

7 Remove the piston rings.

Inspecting/Checking and Overhauling

1 If the same pistons are to be refitted to the engine, any carbon should be cleaned from the piston surfaces, particularly from the ring grooves and any gum or varnish deposits should be removed using suitable solvent.

2 Carefully examine pistons for rough or scored bearing surfaces. Check for cracks in the skirts or in the head of the piston, broken ring lands, worn grooves or chipping and uneven wear which would cause the rings to seat improperly, or to have excessive clearance in the groove. Check thrust faces for uneven wear pattern caused by misalignment.

3 Check the pistons for wear by measurement:

(a) Measure the piston at right angles to the gudgeon pin immediately below the oil ring.

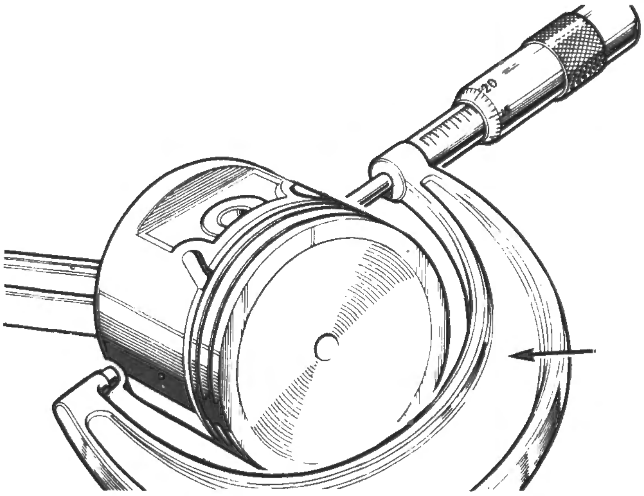


Fig. D-76

MEASURING THE PISTON SKIRT

(b) Measure the piston skirt as shown. This diameter should be from 0.007-0.017 mm (0.003-0.007 in) larger than the previous measurement. However 0.000-0.025 mm (0.000 to 0.001 in) taper is acceptable.

The standard sizes are:

Grade	Size	
1	88.870 — 88.862 mm	(3.4988 — 3.4985 in)
2	89.380 — 89.372 mm	(3.4992 — 3.4989 in)
3	89.390 — 89.382 mm	(3.4996 — 3.4993 in)
4	89.400 — 89.392 mm	(3.5000 — 3.4997 in)

4 Check piston to cylinder bore clearance. In order to check this clearance the cylinder bore size must be measured, and the taper and ovality of the cylinder taken into consideration.

In production there are four grades for pistons in the standard bore. The bore grade is stamped on a casting lug adjacent to the end cylinders on each bank.

The stamping is in the form of a triangle i.e. grade 1 — 1 triangle, grade 4 — 4 triangles and there are two cylinders consecutively marked on each lug.

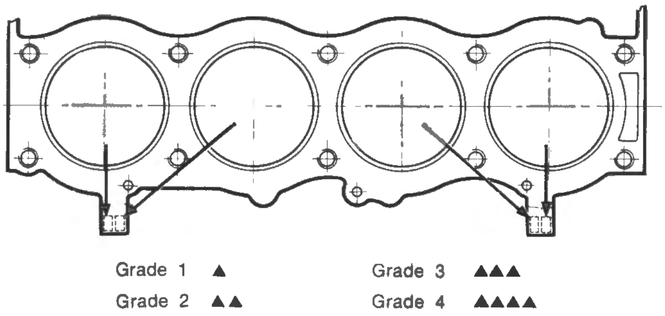


Fig. D-77

BORE GRADE IDENTIFICATION

(LEFT BANK SHOWN)

Bore Sizes

Grade	Bore Diameter	
1	89.410 — 89.400 mm	(3.5005 — 3.5000 in)
2	89.420 — 89.410 mm	(3.5008 — 3.5004 in)
3	89.430 — 89.420 mm	(3.5012 — 3.5008 in)
4	89.440 — 89.430 mm	(3.5016 — 3.5012 in)

(a) Measure the cylinder bore at right angles to the gudgeon pin and between 38 to 50 mm (1½ to 2 in) from the top. Most of the wear will occur at top of ring travel.

(b) Measure the cylinder at the same height and at 90° to determine ovality.

(c) Check bore size at bottom to determine taper. Check measurements obtained against the bore grade.

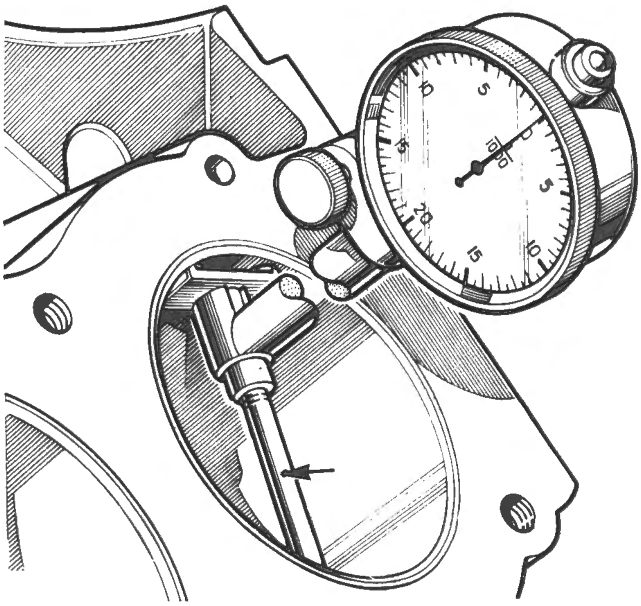


Fig. D-78

CHECKING CYLINDER BORES FOR TAPER AND OVALITY

NOTE: The maximum cylinder bore taper and ovality is 0.076 mm (0.003 in).

The piston clearance or the cylinder diameter minus the piston diameter must be within the range of 0.131 mm (0.005 in) at the top and 0.025 mm (0.0010 in) at the bottom.

It is found that the clearance is excessive yet the bore taper and ovality is under 0.254 mm (0.003 in) check the ring clearance using grade 4 piston dimensions. Should a clearance below that be required it is permissible to hone the cylinders to the correct clearance and fit the new pistons.

NOTE: Service replacement pistons, standard size are supplied in grade 4 only.

Should grade 4 pistons be fitted as original equipment it will be necessary to bore and hone the cylinders to one of the two oversizes.

When boring the cylinders, leave 0.025 mm (0.001 in) on the diameter for finished honing.

CYLINDER HONING AND DEGLAZING:

When cylinder bores are to be honed after boring or deglazing for the fitting of new piston rings, the instructions given by the manufacturer regarding operation, cleaning and lubrication should be followed. The actual cylinder finish to be achieved is as follows:

The hone should be moved up and down in the cylinder at sufficient speed to obtain a fine uniform surface finish marking in a cross hatch pattern of 45° to 90° included angle, uniformly cut in both directions, with cuts free of folded metal and impeded particles.

Suitable abrasive stones to achieve the desired result for finishing and deglazing would be to Australian Abrasive Specification 37 C 120 N/8V — 22T used in conjunction with a straight sulphurised cutting oil.

Thoroughly clean the bores with hot water and detergent prior to entering a piston or measuring bores. On completion of cleaning operation swab bore with light engine oil and wipe out with clean cloth.

NOTE: When carrying out measurements to obtain piston clearances both components should be as near as possible to the same temperature. A difference of 5.60°C (10°F) is sufficient to produce variations of 0.012 mm (0.0005 in). Quoted clearances and fits are at 20°C (68°F).

6 Check the gudgeon pins for wear and fit in piston. The correct piston pin fit in the piston is 0.0076 to 0.015 mm (0.0003 to 0.0006 in) loose.
If the pin to piston clearance is to the low limit 0.015 mm (0.0006 in), the pin could be a thumb push fit and will fall through under its own weight. If the pin to piston clearance is on the high limit 0.0076 mm (0.0003 in) it will be a palm push fit and will not fall out.
The piston and pin should be clean and free of oil.

7 Check piston ring grooves for wear. Refer Piston Rings.

8 Check the connecting rod gudgeon pin bore for size and ovality to maintain correct interference fit of the pin in the rod. The low limit interference is 0.015 mm (0.0006 in) and the high limit 0.005 mm (0.0002 in).
Torque the connecting rod cap nuts to the specified tension and check the connecting rod tunnel bore.

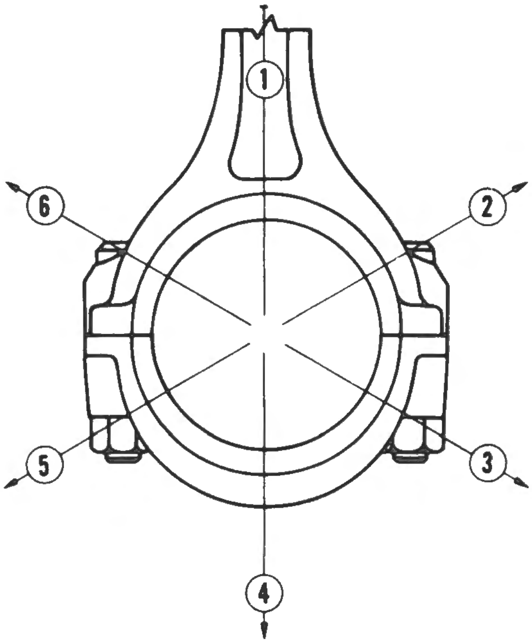


Fig. D-79

CONNECTING ROD TUNNEL BORE CHECK

The bore should be to the specified diameter, parallel and concentric to within the figures quoted in GENERAL DATA. Maximum eccentricity is 0.013 mm (0.0005 in). Check the connecting rod blade widths to ascertain slide wear. Check the rod and cap to determine taper.
Excessive wear will be indicated by excessive clearance, between mating rods on the one pin (refer step 7 — Removal). Replace rods as necessary. Fig. D-72.

9 When new piston rings are to be fitted the ring gap and the side clearance in the piston must be checked. Two compression and one segmented oil control ring is used on each piston. Gap checking of the oil control ring is not necessary.

(a) **Compression Ring Gap:** Deglaze the cylinder bore. Insert the ring in the bore approaching in its normal operating position. Insert appropriate piston head down in the bore and push the ring down below the normal ring travel. Measure the gap with feeler gauge as shown in Fig. D-80.

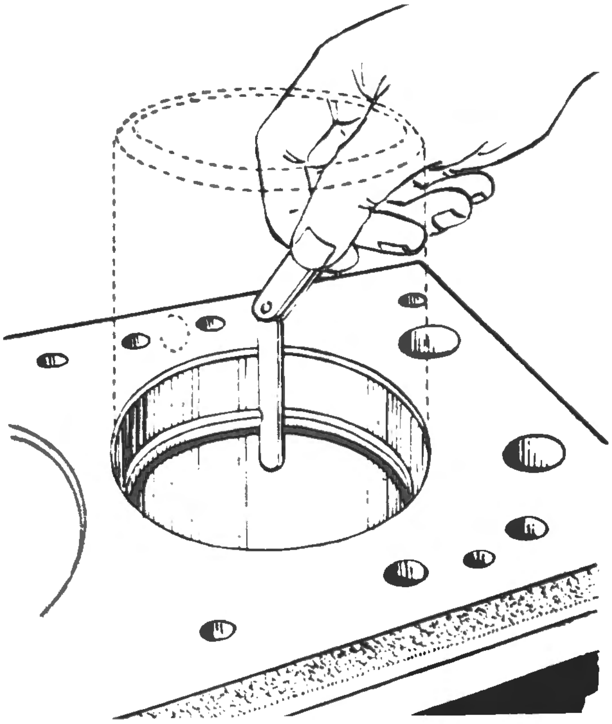


Fig. D-80

MEASURING PISTON RING GAP

(b) **Side Clearance**

(i) **Oil Control Ring** — Fit the bottom rail of the ring to the piston and position it below the cover ring groove. Fit the expander into the bottom groove, move the bottom rail up into the bottom groove. Fit the top rail into the top of the bottom groove and check that the ends of the expander butt and do not over-lap. Arrange the ring gaps around the piston so that they are not in line or over the thrust or non thrust sides of the piston.

Refer Fig. D-81.
Rotate the ring assembly around the piston and check rings are correctly seated on the expander. If assembly is tight it may be necessary to use a ring compressor to settle the assembly. Check the side clearance with feeler gauge as shown in Fig. D-82.

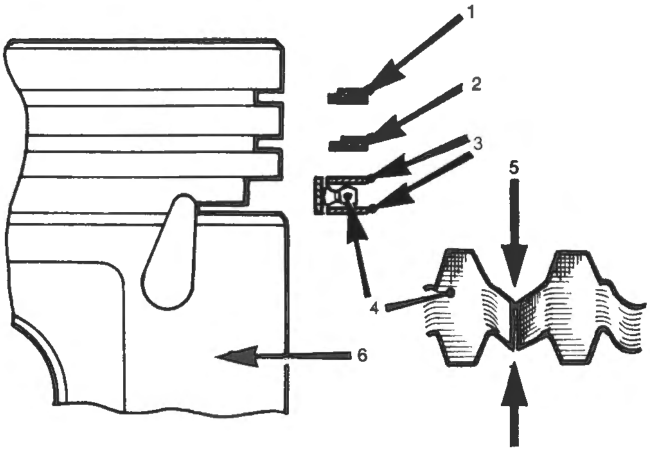


Fig. D-81

FITTING PISTON RINGS

1 TOP COMPRESSION RING — CHROME
2 SECOND COMPRESSION RING — PLAIN
3 OIL CONTROL RING — RAILS
4 OIL CONTROL RING — EXPANDER
5 EXPANDER ENDS BUTT WHEN CORRECTLY ASSEMBLED
6 PISTON

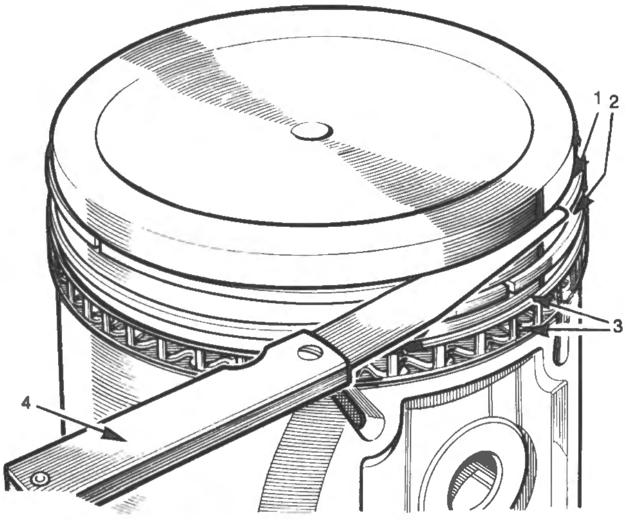


Fig. D-82

CHECKING PISTON RING SIDE CLEARANCE

1 TOP COMPRESSION RING
2 SECOND COMPRESSION RING
3 OIL CONTROL RING ASSEMBLY
4 FEELER GAUGE

PISTON RING SET. A.C.L. #M1479

(ii) **Compression Rings** — Fit the second black compression ring with its step facing piston top.
Fit the top chrome compressor ring with its step facing piston top and check side clearances as previously described.

Assembling

1 Identify the connecting rod assembly with its related piston and cylinder.

2 Lubricate the gudgeon pin with light engine oil and enter it in the piston rear gudgeon pin bore.

NOTE: Chilling of the pin with dry-ice pellets will assist fitting.

3 Position the gudgeon pin remover/replacer 18GA054 in a vice with the short boss uppermost.

4 Position the connecting rod in the piston.

NOTE: The dome shape boss on the connecting rod faces the 'Front' for the pistons in the right bank (2-4-6-8) and to the rear of the piston for the left bank (1-3-5-7).

5 Position the tool screw (threaded end) through the gudgeon pin, connecting rod and the short boss of the tool and fit the nut and thrust bearing assembly to the screw. Refer Fig. D-83.

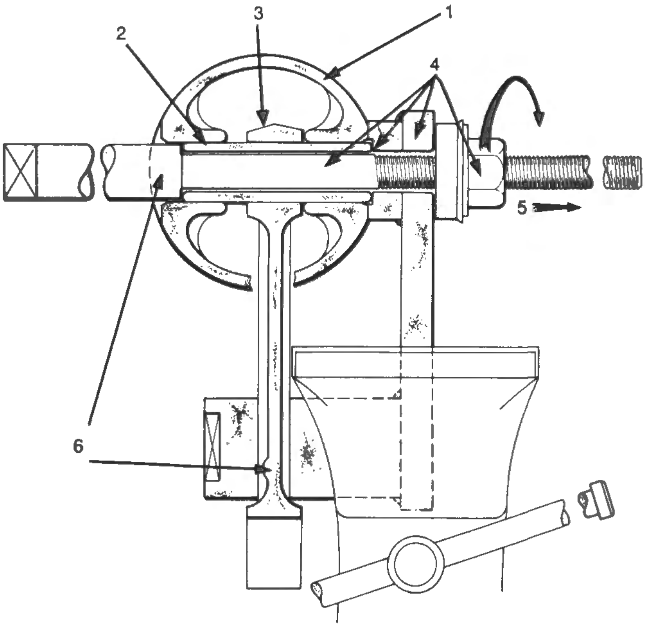


Fig. D-83

FITTING GUDGEON PIN

1 PISTON
2 GUDGEON PIN
3 CONNECTING ROD
4 SERVICE TOOL 18GA054 SHOWING POSITION OF FITTED PIN
5 DIRECTION FOR FITTING
6 IDENTIFICATION BOSS TO 'FRONT' ON CYLINDERS 2, 4, 6 AND 8 AND TO REAR ON CYLINDERS 1, 3, 5 AND 7

6 Screw the nut up by hand until resistance is felt and check that the gudgeon pin is squarely aligned with the connecting rod. Also ensure that the face of the tool is squarely aligned on the flat face of the piston.

7 Using a suitable spanner on the nut draw the pin through the rod and piston, until the pin abuts with the counter bore in face of the tool.

8 Remove the tool from the assembly and ensure piston moves freely on the pin.

9 Check the connecting rod alignment on a suitable aligner.

Refitting

1 Fit new connecting rod bolts to the rod as necessary.

2 Fit the upper half of the connecting rod bearing to the rod. (Refer page 60 for connecting rod bearing fitting.)

3 Fit suitable lengths of hose over the connecting rod bolts as shown in Fig. D-84. The hoses will keep the bearing shell in place and protect the crankshaft journal when fitting the assembly to the block.

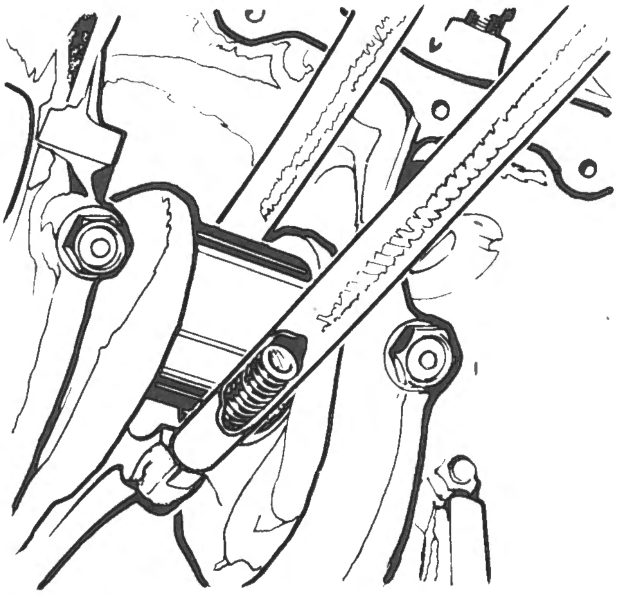


Fig. D-84

PROTECTOR FITTED TO CONNECTING ROD BOLTS

4 Space the piston ring gaps around the piston and liberally coat with light engine oil, and compress rings with a suitable ring compressor. Fig. D-85.

NOTE: Piston installation best carried out with the engine vertical, 'FRONT UP'.

5 Turn the crankshaft until the appropriate crankpin is accessible near B.D.C.

6 Lubricate the crankpin.

7 Install the assembly in its respective cylinder with the piston marking 'FRONT' facing the front of the engine.

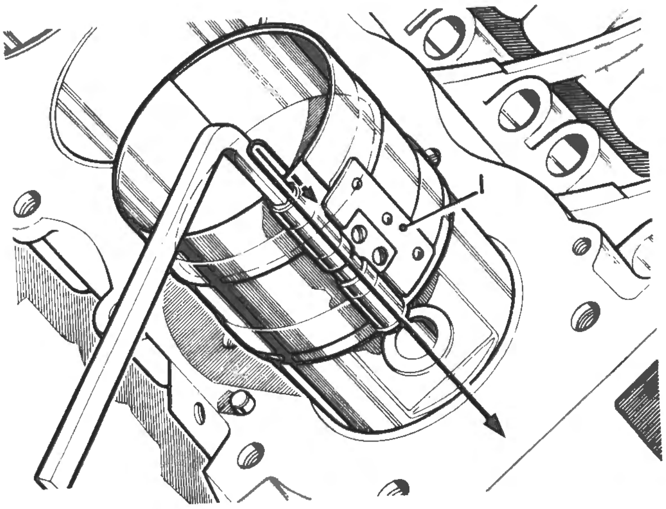


Fig. D-85

INSTALLING PISTON ASSEMBLY

1 PISTON RING COMPRESSOR

8 Fit the bottom bearing shell to the cap and fit the cap to the rod ensuring assembly numbers line up.

9 Fit new nuts to the connecting rod bolts and torque to the figure given in GENERAL DATA.

10 Select and fit the mating piston and rod assembly for the same crankpin.

NOTE: When fitted the dimple boss on the rods should face each other on any one crankpin.

11 Turn the engine through a full turn and check for binding.

12 Check the connecting rod side clearance. Refer removing item.

13 Refit the remainder of components removed in accordance with previous methods.

CONNECTING ROD BEARINGS

The connecting rod bearings are sintered copper lead steel backed insert type. They can be replaced without removing the crankshaft after removal of the engine from the vehicle.

Removing

1 Remove the power unit.

2 Remove the transmission as necessary and any other accessory equipment necessary to allow the engine to be placed in a suitable working position.

3 Remove the oil reservoir, oil baffle plate, oil pick up pipe, and strainer assembly.

4 Turn the crankshaft till the appropriate crankpin is approaching B.D.C. and the cap nuts are accessible.

5 Remove the nuts and the caps noting their identification markings for their re-assembly.

Inspection

1 Remove the bearing shells from their respective rods and caps noting the fit. To function satisfactorily the bearing must be seated firmly, within its housing to enable heat to dissipate and to overcome bearing to housing movement.

2 Check the bearing shells for indications.

(a) Scratches or foreign materials imbedded on the bearing surfaces due to dirty oil.

(b) Bearing metal wiped out due to lack of oil.

(c) Bright or polished spots caused by improper seating and foreign particles between bearing and housing.

(d) Bearing material worn from entire surface due to tapered crankpin.

(e) Bearing worn heavily on one side edge from bent connecting rod or incorrectly ground crankshaft.

(f) Breaking up of the bearing surface due to fatigue and or pounding due to excessive clearances.

(g) Movement of the bearing in housing due to insufficient 'crush'.

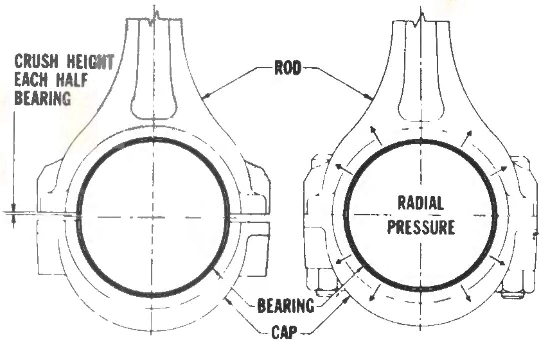


Fig. D-86

BEARING CRUSH

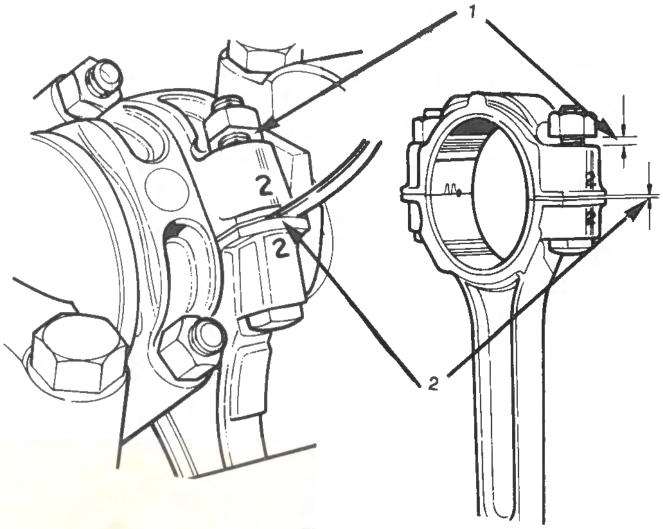


Fig. D-87

CHECKING BEARING FALSE CRUSH

1 TENSION RELEASED FROM BOLT 2 MEASURE GAP

NOTE: If a bearing problem is indicated diagnose the cause and rectify as necessary.

3 Inspect the crankpins for visible damage and check for sizes and wear with a micrometer. The maximum allowable 'out of round' of a crankpin is 0.038 mm (0.0015 in).

Refitting

1 Select the correct size and type of bearing shell.

NOTE: The size is stamped on the steel backing of the bearing STD — 010 etc. and both upper and lower shells are interchangeable when new.

2 Clean the oil and any protective coating from the bearing halves and their mating surfaces in the connecting rod and cap.

3 Check the bearing 'false crush'.

(a) Tape the crankpin to avoid damaging the surface.

(b) Fit the connecting rod cap to its rod without the bearing shells. Fit the nuts and torque to figure quoted in GENERAL DATA.

(c) Remove the nut from the connecting rod bolts on the side of the rod on which the cap joint is most accessible.

(d) Measure and record any gap at the cap joint.

4 Remove the connecting rod cap and tape from crankpin.

5 Fit a bearing shell to both connecting rod and cap ensuring tangs are correctly positioned.
There should be sufficient 'spread' in the bearing shell to allow it to seat firmly without using undue force, and the contact area with the rod or cap should be at least 90%.

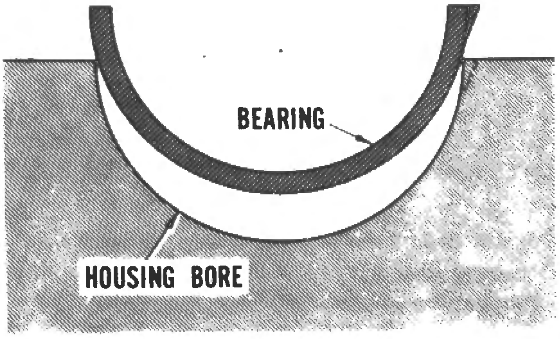


Fig. D-88

BEARING SPREAD

Should a condition of excessive or insufficient spread exist, it can be corrected by placing the bearing on a flat surface and tapping lightly with a rubber mallet as shown. Fig. D-89.

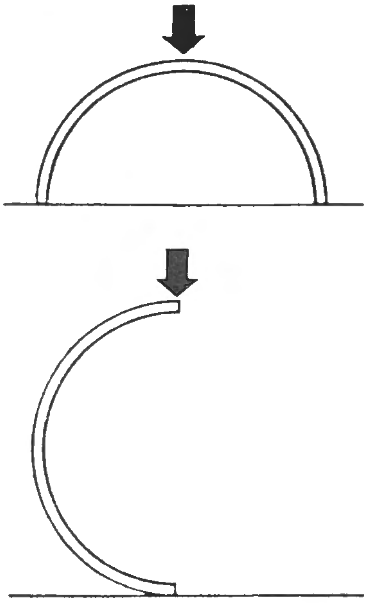


Fig. D-89

ADJUSTING BEARING SPREAD

6 Check the 'bearing crush' and bearing clearance. These two operations are best carried out at the same time to minimise the number of bolt torquing operations. The clearance check is carried out using 'Plastigauge'.

(a) Pull the appropriate connecting rod assembly up on to the crankpin and place a length of 'Plastigauge' across the pin as shown in Fig. D-90.

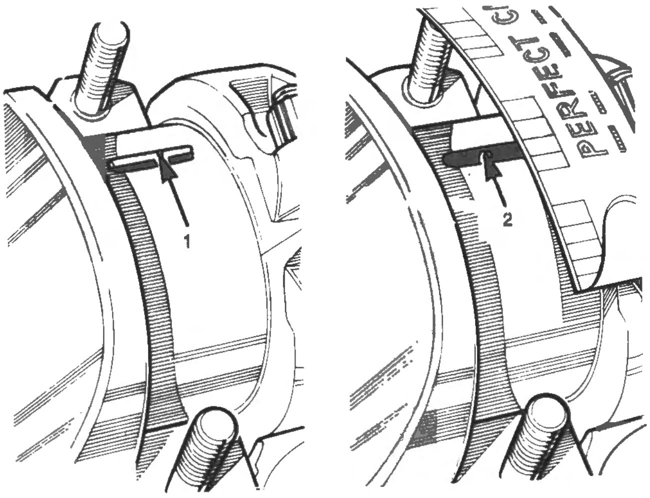


Fig. D-90

CHECKING BEARING CLEARANCE

1 'PLASTIGAUGE' POSITION ON CRANKPIN

2 MEASURING FLATTENED 'PLASTIGAUGE'

(b) Fit the bearing cap and nuts and torque to the figure quoted in GENERAL DATA.
DO NOT TURN THE CRANKSHAFT.

(c) Release one nut as in item 3C (false crush) and measure the gap between the joint faces. Subtract the false crush reading previously recorded and the resultant figure is the bearing 'crush'.
This figure should be not less than 0.07 mm (0.003 in) or greater than 0.15 mm (0.006 in). If the bearing does not lift the cap, crush does not exist. This indicates that the bearing housing is oversize and corrective action should be taken where 'crush' is found to be excessive, it indicates the rod or cap has been filed or the bearings are not sitting correctly due to foreign material.

(d) Remove the bearing cap and determine the clearance by comparing the width of the flattened 'Plastigauge' at its widest point with graduations on the 'Plastigauge' envelope.
The number within the graduation on the envelope indicates the clearance in millimeters and thousandths of an inch as the case may be.
Close tolerances within the specification can only be achieved by selective assembly of bearing on pairs. Clean 'Plastigauge' from shaft and bearings, lubricate the crankshaft, refill the bearing cap using new nuts.

NOTE: If the condition of the crankshaft is such that the original or new connecting rod bearings can be fitted, the condition of the main bearings and their clearance should be checked while the engine is removed.

MAIN BEARINGS AND THRUST WASHERS

The main bearings are steel backed copper lead insert type and may be fitted without removal of the crankshaft after the engine has been removed from the vehicle. Main bearing clearances must not exceed 0.89 mm (0.0035 in). This clearance is permissible only if the engine is dismantled for other than a bearing noise condition. If bearings are noisy or if a visual inspection indicates defective bearings, they should be replaced after first diagnosing and rectifying the cause of the defect.

If clearance is still outside factory specifications 0.023 — 0.063 mm (0.0009 — 0.0025 in) with new bearings fitted it is an indication that the journals are out of round and the crankshaft should be removed for further investigation.

Crankshaft thrust washers are steel backed copper lead. There are two half washers only, one located either side of the upper half of number 3 main bearing and are retained by the cap.

The permissible crankshaft end float is 0.05 mm to 0.25 mm (0.002 — 0.010 in). Oversize thrust washers of + 0.12 mm and + 0.25 mm (0.005 and 0.010 in) are available for crankshaft reconditioning. This clearance is measured with a dial gauge on the end of the crankshaft as shown in Fig. D-91.

CHECKING MAIN BEARING CLEARANCES

The main bearing clearances can be checked after the power unit has been removed from the vehicle.

1 Remove the power unit.

2 Place unit on suitable stand.

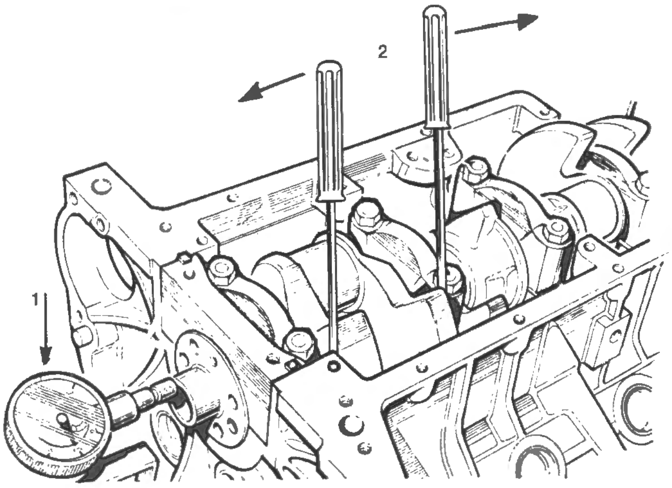


Fig. D-91

MEASURING CRANKSHAFT END FLOAT

1 DIAL GAUGE

2 LEVER BETWEEN CRANKSHAFT WEBS AND MAIN BEARING CAP AT POINTS SHOWN

3 Remove the transmission.

4 Remove the clutch and flywheel converter and driveplate.

5 Invert engine so that crank is parallel to the floor.

6 Remove the oil reservoir, baffle plate oil pickup strainer assembly and crankshaft rear oil seal.

7 Slacken accessory drive belts.

8 Check and record the crankshaft end float.

9 Turn the crankshaft until the ignition pointer is approximately 51 mm (2 in) past TDC on No. 1 cylinder.

NOTE: It may be necessary to use a thin wall socket for access to the right hand bolt on the rear main bearing.

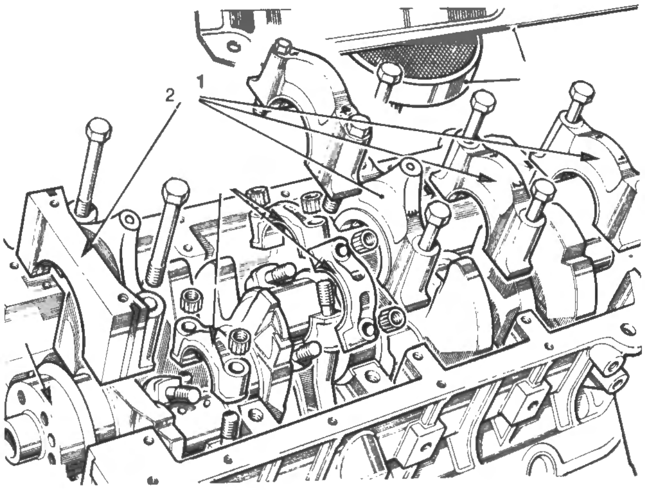


Fig. D-92

BEARING REPLACEMENT

1 MAIN BEARING CAP

2 CONNECTING ROD CAPS

10 Remove the bolts and the rear main bearing cap.

11 Clean and inspect the bolts and remove the side seals from the cap.

12 Note the location number on the remainder of the bearing caps. The caps must only be fitted one way, that is with the cast 'arrow' head on the cap facing the front of the engine. The caps are also number 1 through 5 from the front.

13 Remove the bolts and caps.

14 Clean bolts.

15 Clean oil from the crankshaft journals.

16 Check condition of bearings, clean oil from front and rear of the stalls and check the bit in the caps.

17 Place a piece of 'Plastigauge' across the journals as shown in Fig. D-93.

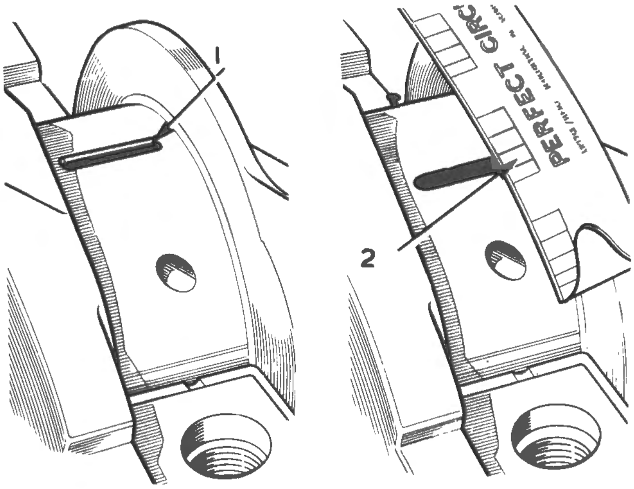


Fig. D-93

CHECKING MAIN BEARING CLEARANCES

1 POSITIONING 'PLASTIGAUGE'

2 MEASURING FLATTENED 'PLASTIGAUGE'

18 Refit the bearings and caps in their correct sequence.

19 Fit the bolts and torque to the figures quoted in GENERAL DATA noting the higher torque on the rear mains.
DO NOT TURN THE CRANKSHAFT.

20 Remove the bearing caps and determine the bearing clearance by comparing the width of the flattened 'Plastigauge' envelope. The number within the graduations on the envelope indicates the clearance in millimeters or thousandths of an inch.

Bearing Replacement

Provided the crankshaft is serviceable, the main bearing shells may be replaced without removal of the crankshaft.

NOTE: When replacing bearing shells the complete set must be installed.

WARNING: The upper main bearing shell only has oil supply hole and a radial lubrication groove. The plain undrilled bearing shells must only be fitted to the bearing caps.

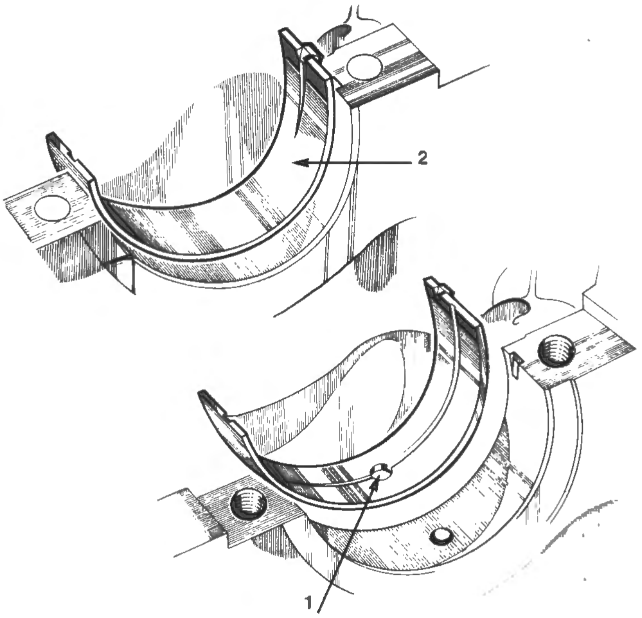


Fig. D-94

MAIN BEARING SHELL IDENTIFICATION

1 UPPER SHELL WITH OIL FEED HOLE AND GROOVE

2 CAP SHELL PLAIN WITH GROOVE RUN OUT

MAIN BEARING SHELL A.C.L# 5M 2227–010

21 Remove the 'Plastigauge' from the journals or the shells.

22 Clean any protective coating from the new bearing shells.

23 Allocate a plain bearing shell to a cap and check the spread.

24 Allocate the upper shells (with hole and groove) to a housing and check the spread.

25 FOR THE PURPOSES OF CHECKING SPREAD ONLY fit the upper shell to its mating cap. Adjust the spread as necessary. Remove the upper shell, and refit the mating lower shell to the cap, starting at the rear main.

26 Insert a 'roll out' pin in the oil supply hole in the crankshaft, then rotate the crankshaft in the direction of opposite rotation. The pin will contact the upper shell and roll it. Fig. D-95.

27 Select the previously allocated upper bearing shell and roll it into position.

NOTE: During these operations ensure the two thrust washers are not displaced.

28 Temporarily refit the rear main bearing cap with its new bearing shell. Run up the bolts evenly but do not torque down.

29 Carry out operations 26 to 28 on the remainder of the bearings except No. 3.

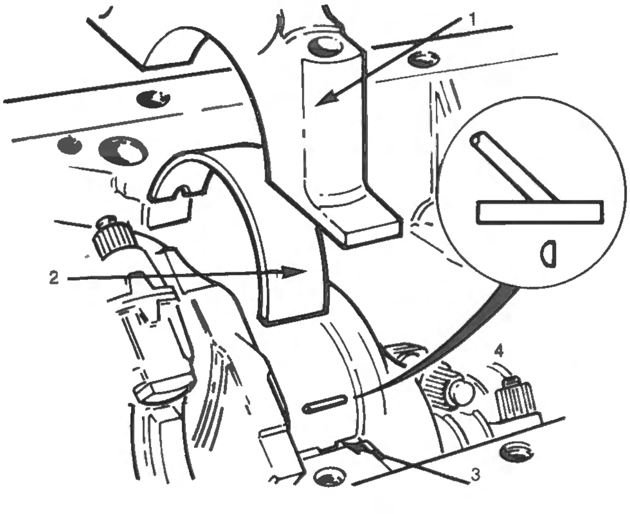


Fig. D-95

REMOVING AND REPLACING MAIN BEARING SHELLS

1 MAIN BEARING CAP

2 LOWER BEARING SHELL

3 UPPER BEARING SHELL

4 ROLL PIN

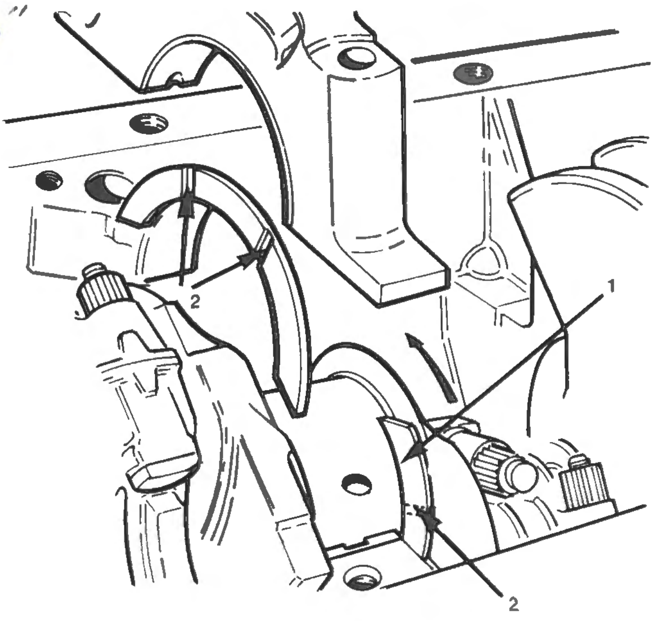


Fig. D-96

REMOVING CRANKSHAFT THRUST WASHERS

1 PARTIALLY REMOVED WASHER

2 OIL GROOVES TO CRANKSHAFT THRUST FACES

THRUST WASHER A.C.L # 1T 2219

30 Remove the thrust washers from No. 3 main bearing.

NOTE: The most wear will occur on the rear of the two washers, which when new are 2.3 mm (0.092 in).

31 Check using previously recorded crankshaft end float figure establishing the correct size thrust washers to bring crankshaft end float toward the lower end of the tolerance.

32 Roll in the top main bearing shell and the thrust washers.

33 Remove the remainder of the bearing caps and carry out items 17 to 20 'checking clearance'.

34 Clean off the 'Plastigauge', lubricate the bearings, install caps and lubricated bolts on bearings 1 through 4. Do not fully tighten bolts.

35 Fit No. 5 cap with new side seals and install as follows:

(a) Fit the seals into the grooves, so that approximately 0.8 mm (1/32 in) is protruding from the joint face of the cap, when the spigots on the seals are located in the cap drillings.

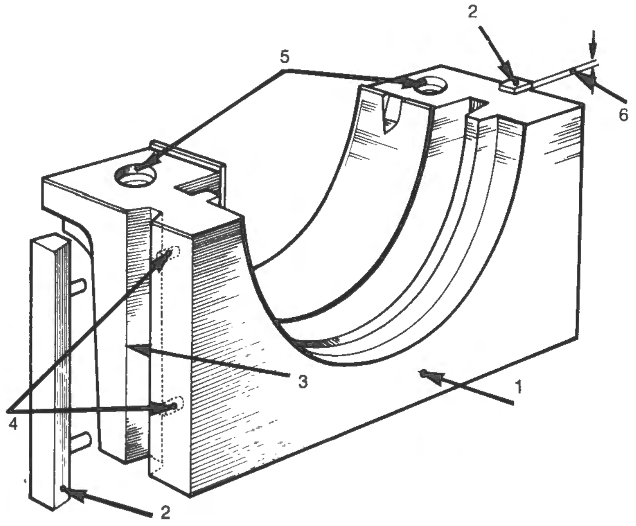


Fig. D-97

FITTING REAR MAIN BEARING CAP SIDE SEALS

1 REAR MAIN BEARING CAP
2 SIDE SEALS
3 SEAL GROOVE
4 SEAT LOCATING DRILLING
5 CAP JOINT FACE
6 SEAL PROTRUSION

(b) Apply a very thin coating of sealer to the block as shown in Fig. D-99.

NOTE: DO NOT TRIM THE SEALS TO LENGTH.

(c) Smear a light coat of engine oil over the face of the seals.

(d) To prevent the seals riding up when the cap is installed; use two plates 30 x 19 mm (13/16 x ¾ in) with a suitably placed 0.37 mm (⅜ in) hole or two flat washers as shown in Fig. D-98.

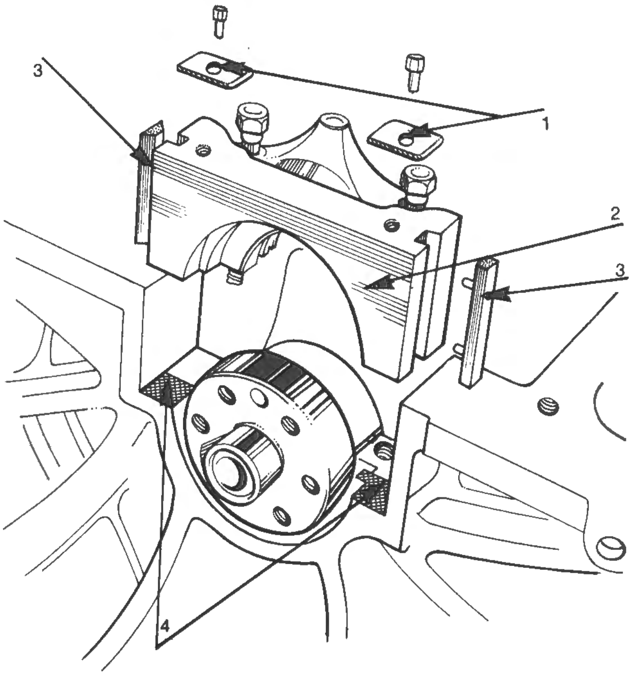


Fig. D-98

SEALING REAR MAIN BEARING CAP

1 SEAL FITTING PLATES
2 CAP
3 SIDE SEALS
4 AREA FOR SEALER APPLICATION

(e) Carefully feed the cap assembly into the cylinder block keeping it as square as possible. Stop when the cap reaches the locating step in the cylinder block.

(f) Fit the cleaned and lubricated cap bolts at the same time aligning the cap.

(g) Back off the seal holding plates to relieve some of the tension on the side seals.

(h) Screw the cap bolts down and at the same time align the cap. Check oil seal recess, with its mating recess in the block, and ensure by visual examination that the side seals are flush with the cap joint face.

(j) Remove the retainer plates, when correctly fitted the side seals will stand proud of the cap top by approximately 0.8 to 1.6 mm (1/32 to 1/16 in).

36 Torque down the main bearing cap bolts, 1 through 4 to figures quoted in GENERAL DATA.

37 Torque down the rear main bearing cap bolts to figure quoted.

38 Check the crankshaft end float previously detailed and rotate the engine to ensure the shaft is not binding.

39 Lubricate the crankshaft rear oil seal surface and fit a new seal.

40 Rebuild the power unit in accordance with instructions given in previous methods.

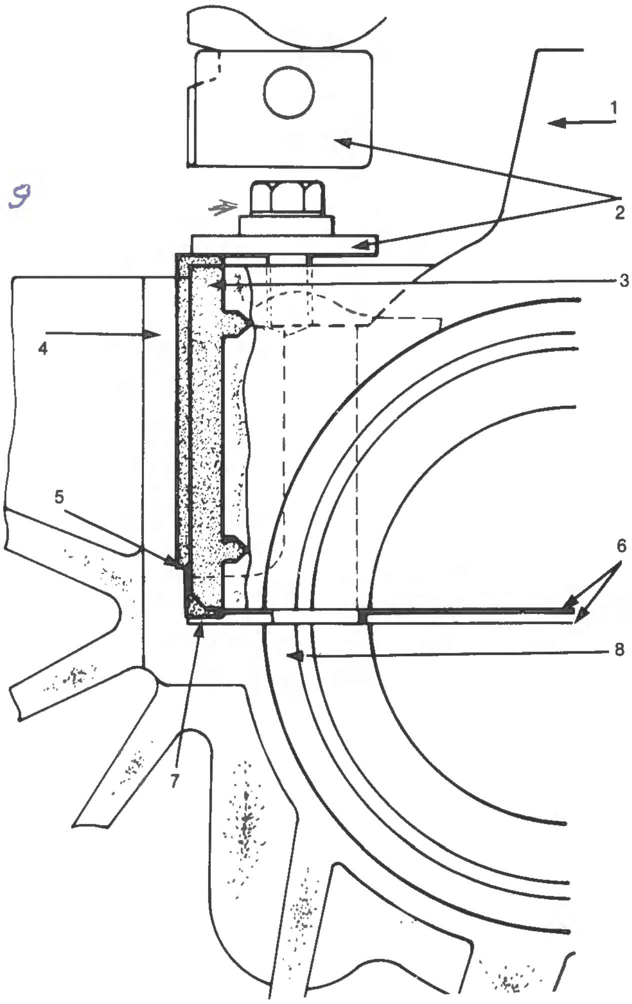


Fig. D-99

INSTALL REAR MAIN BEARING CAP SIDE SEALS

1 BEARING CAP

2 SEAL FITTING PLATE

3 SIDE SEAL

4 CYLINDER BLOCK

5 CAP LOCATING STEP

6 JOINT FACES

7 VISIBLE SEAL CONTACT PRIOR TO FINAL TIGHTENING

8 SEAL RECESS ALIGN, ELIMINATING STEPS AT JOINTS ON FINAL TIGHTENING

9 BOLTS 1/2" × 3 7/16" UNC 10 EA

CRANKSHAFT

Should it be necessary to remove the crankshaft it can be accomplished without removing the cylinder heads.

Removing

1 Remove the power unit.

2 Remove the transmission.

3 Remove the clutch, flywheel or converter and drive plate.

4 Remove the crankshaft rear oil seal.

5 Remove ancillary equipment at front of engine as necessary.

6 Remove the oil reservoir, baffle plate, oil pick up and strainer.

7 Remove timing case cover.

8 Rotate the engine and slacken the connecting rod bolts.

9 Turn engine until No. 1 cylinder is at TDC on compression stroke.

10 Remove the timing chain and gears.

11 Position the crankshaft so that all connecting rod cap nuts are accessible with a minimum of crankshaft oscillation (i.e. Nos. 3 and 4 connecting rods fully extended).

12 Remove the connecting rod bearing caps and fit protector sleeves over the bolts. Note the position of the crankshaft key so that the shaft can be refitted in the same position.

13 Remove the main bearing caps.

14 Lift the crankshaft from the block.

Inspection

1 Rest the crankshaft on vee blocks at numbers one and five main bearing journals.

2 Using a dial indicator, check the run-out at numbers two, three and four main bearing journals.

3 The total indicator reading at each journal should not exceed 0.08 mm (0.0003 in) while checking the run-out at each journal.

NOTE: The point of maximum eccentricity on each journal in relation to the others. The maximum on each journal should be very near the same angular location. If the crankshaft fails to meet the foregoing tests, it is bent and will be unfit for service.

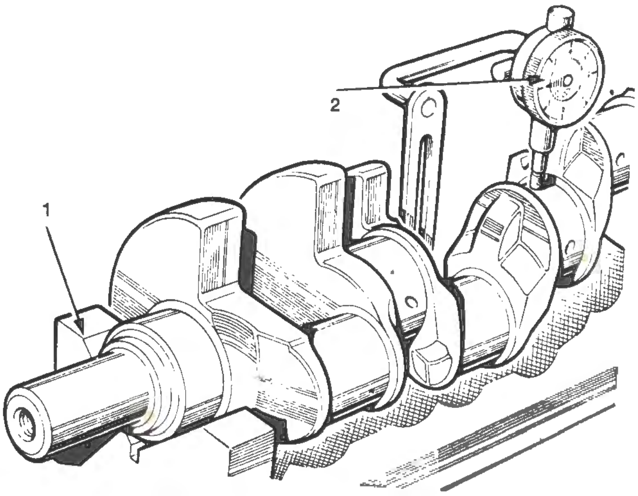


Fig. D-100

CHECKING CRANKSHAFT FOR OVALITY AND STRAIGHTNESS

1 VEE BLOCK

2 DIAL INDICATOR

4 Check each journal for ovality. If it exceeds 0.040 mm (0.0015 in) recondition by grinding or replace the shaft.

RECONDITIONING

When reconditioning the crankshaft by grinding, the grinding wheel and the crankshaft must be turned anti-clockwise when viewed from the front end of the shaft. When polishing, the shaft must be turned in the direction of engine rotation.

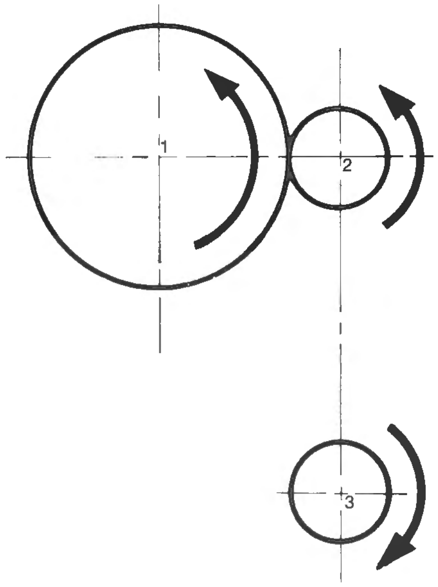


Fig. D-101

CRANKSHAFT GRINDING
VIEW FROM FRONT OF CRANKSHAFT

1 GRINDING WHEEL ANTI-CLOCKWISE
2 CRANKSHAFT ANTI-CLOCKWISE
3 JOURNAL, PLUSHING, CRANKSHAFT CLOCKWISE

The fillet radius for all journals except the rear of the rear main must be 1.90 to 2.28 mm (0.075 to 0.90 in) x 0.00 to 0.254 mm (0.00 to 0.010 in) under cut.

Rear main flange fillet radius must be 3 mm (0.120 in) x 0.00 to 0.25 mm (0.00 to 0.010 in) under cut.

The specific surface finish for journals is 0.254 μm (10 micro in).

The crankpin journal width of 43.12 + 0.10 mm (1.698 + 0.004 in) should not be exceeded.

Oversize thrust washers are supplied in two sizes; plus 0.13 mm (0.005 in) and plus 0.25 mm (0.010 in).

They should be fitted in pairs by grinding 0.13 mm or 0.25 mm (0.005 or 0.010 in) off each thrust face of the crankshaft.

The width between the faces for the standard washer is 26.87 + 0.05 mm (1.059 + 0.002 in).

Break all sharp edges on oil holes shaft and oil passages.

Replace pilot bearing as necessary. Refer Section K.

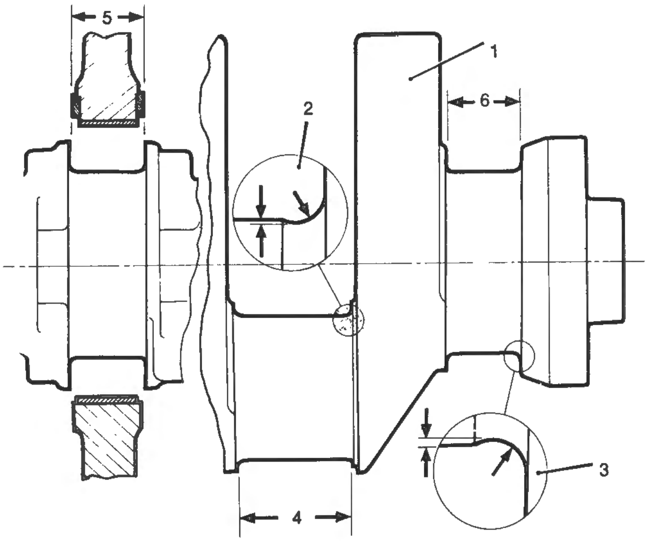


Fig. D-102

CRANKSHAFT RECONDITIONING DETAIL *

1 CRANKSHAFT
2 CRANKPIN FILLET RADIUS
3 REAR MAIN JOURNAL REAR FILLET RADIUS
4 CRANKPIN WIDTH
5 CENTRE MAIN JOURNAL THRUST WASHER FACES
6 MAIN JOURNAL WIDTH

* SEE BOTT

Refitting

1 Check main bearing tunnel bores as necessary.

2 Check bearing 'spread' and 'crush'. Ensure that the upper main bearing shells are those having the oil feed hole and radial groove.

3 Install the crankshaft with the key in the same position as it was when removed.

4 Refit bearings and thrust washers and check clearances.

5 Rebuild the engine in accordance with previous methods and instructions.

EXHAUST SYSTEM

EXHAUST MANIFOLDS

Removing

1 Disconnect the battery.

2 Remove the nuts securing the down pipe clamp plate to the manifold.

3 RIGHT HAND MANIFOLD ONLY. Disconnect the heated air pipe for the automatic choke at the carburetter and slide the other end out of the manifold 'Oven' Pipe.

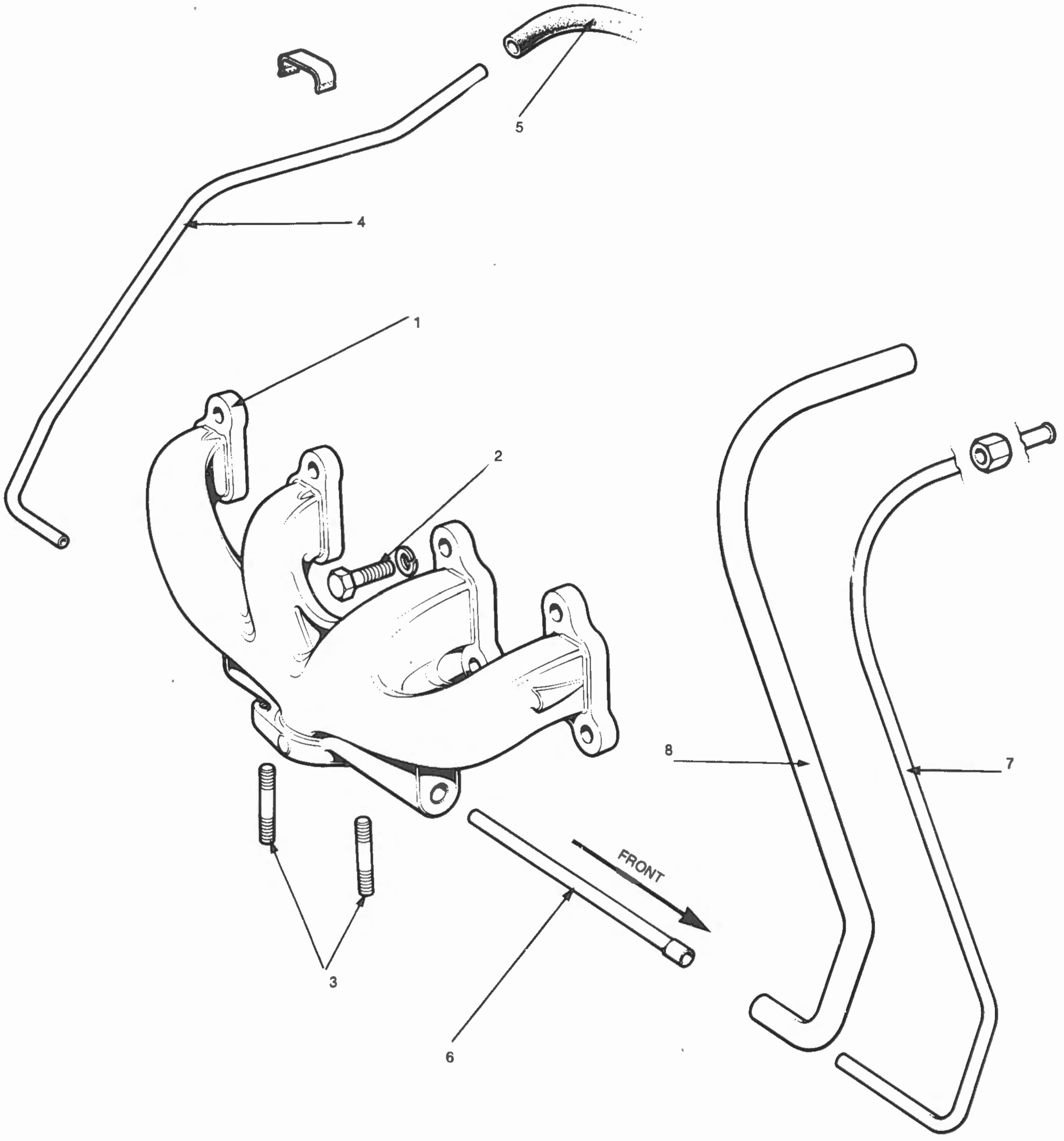


Fig. D-103

GENERAL ARRANGEMENT OF EXHAUST MANIFOLD COMPONENTS

1 EXHAUST MANIFOLD RIGHT HAND

8 EA 2 BOLTS AND WASHERS MANIFOLD TO HEAD 3/8" x 1 1/4" UNC.

3 STUDS EXHAUST PIPE CLAMP TO MANIFOLD

4 AIR INTAKE PIPE, CARBURETTER AIR HORN TO MANIFOLD 'OVEN' PIPE (AUTOMATIC CHOKE CONTROL)

5 FLEXIBLE HOSE PIPE TO AIR HORN ADAPTOR

6 MANIFOLD 'OVEN' PIPE (AUTOMATIC CHOKE CONTROL)

7 HEATED AIR PIPE, MANIFOLD 'OVEN' TO CARBURETTER AUTOMATIC CHOKE

8 ASBESTOS LAGGING FOR PIPE

4 RIGHT HAND MANIFOLD ONLY. Disconnect the air intake pipe for automatic choke at the carburetter air horn adaptor and slide the other end of the pipe from the manifold.

5 Loosen the eight manifold bolts evenly.

NOTE: On automatic models the transmission oil filler tube is mounted on the rear manifold bolt. Loosen this bolt first and reposition the filler.

6 Remove the bolts from manifold and remove the manifold out and upward to brake the seal at the down pipe joint and clear dipstick tube on left hand manifold.

NOTE: The cast iron manifolds fit directly to the cylinder head, no gaskets or jointing compounds are required. Exhaust flange sealing is by steel asbestos pipe sealing rings.

Refitting

Reverse the removal procedure noting the following:

1 Use thread lubricant on bolts.

2 Torque bolts to the head evenly, prior to refitting the clamp plate and nuts.

3 Tighten clamp plate nuts evenly.

MANIFOLD 'OVEN' PIPE

(Automatic Choke Control)

Removing

1 Disconnect battery.

2 Remove air cleaner.

3 Disconnect front heated air pipe from carburetter and manifold and remove.

4 Disconnect rear air in-take pipe from carburetter and 'Oven' pipe and remove.

5 Raise car on hoist.

6 Using tool 18GA051 inserted in rear end of hot box, tap gently forward until free and remove 'Oven' pipe from manifold.

Refitting

1 Place new 'Oven' pipe in manifold from the front of manifold.

2 Using service tool 18GA051 as a guide from the rear of manifold, guide the oven pipe in until it contacts the rear drilling in manifold then tap gently in until properly seated.

3 Reverse procedure 5-1.

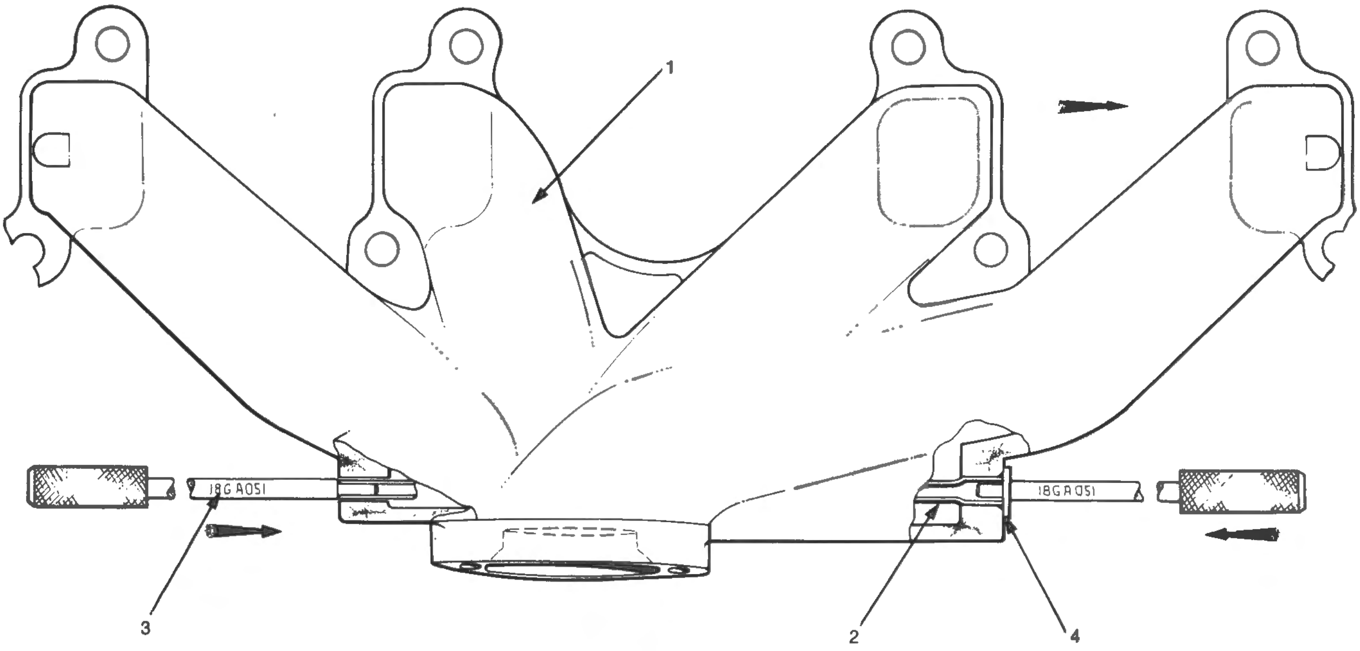


Fig. D-104

REMOVING AND REFITTING 'OVEN' PIPE

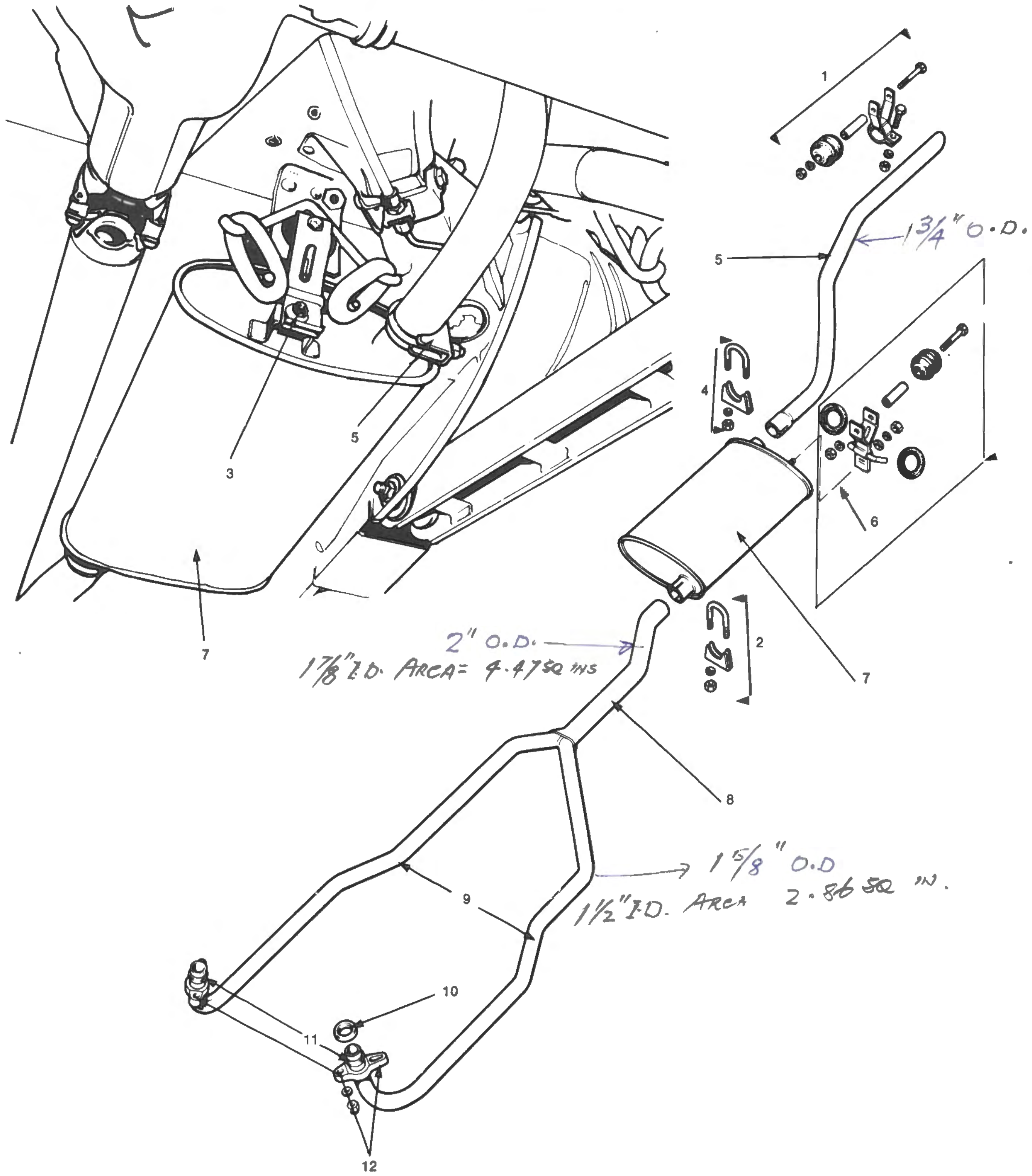
(AUTOMATIC CHOKE CONTROL)

1 RIGHT HAND EXHAUST MANIFOLD

2 'OVEN' PIPE

3 SERVICE TOOL 18GA051 USE IN DIRECTION OF ARROW FOR REMOVAL AND AS A GUIDE AT START OF RE-INSTALLATION

4 ¼ in FLAT WASHER USED IN CONJUNCTION WITH 18GA051 FOR INSTALLING PIPE IN DIRECTION OF ARROW



1 3/4" O.D.

2" O.D.

1 7/8" I.D. AREA= 4.47 SQ INS

1 5/8" O.D

1 1/2" I.D. AREA 2.86 SQ IN.

Fig. D-105

GENERAL ARRANGEMENT OF EXHAUST SYSTEM

1	REAR FAIL SAFE MOUNT	7	MUFFLER
2	FRONT MUFFLER CLAMP	8	FRONT PIPE ASSEMBLY
3	NUT AND WASHERS MUFFLER MOUNTING	9	BRANCH PIPES
4	REAR MUFFLER CLAMP	10	SEALING RINGS
5	TAIL PIPE	11	PIPE FLANGES
6	MUFFLER MOUNTING	12	CLAMPING PLATES AND NUTS TO MANIFOLDS

NOTE: If service tool 18GA051 is not used for guiding hot box in, it is possible for oven tube to be driven up the rear branch of the manifold and become lodged there quite securely.

EXHAUST PIPES AND MUFFLER

The exhaust pipes, muffler and mounting arrangement for both manual and automatic vehicles is as depicted in Fig. D-105. The components are serviced as shown. When assembled the system should be under the minimum of stress and correctly aligned to minimise the possibility of component failures and the transference of noise.

When the assembly is correct the muffler should be parallel to the ground in the horizontal plane in both directions and the tail pipe well clear of all components.

EXHAUST TAIL PIPE

Removing

1. Disconnect the rear fail-safe mount (1).
2. Slacken rear muffler clamp (4).
3. Remove the pipe (5).

Refitting

Refitting is the reverse of the removing procedure noting the following:

1. Fit the new pipe into the muffler so that the clamping slots are covered.

MUFFLER

Removing

1. Disconnect the rear fail-safe mount (1).
2. Loosen the rear muffler clamp (4) and remove the tail pipe (5).
3. Remove nut washer (3) from the mounting assembly (6).
4. Loosen the front muffler clamp (2).
5. Remove the muffler (7) from the front pipe system.

Refitting

1. Refitting is the reverse of the removing procedure.

FRONT EXHAUST PIPE ASSEMBLY

Removing

1. Disconnect the rear mounting (1).
2. Slacken the front muffler clamp (2).
3. Disconnect the muffler from the mounting assembly.
4. Carefully remove the muffler (7) and tail pipe assembly from the front pipe (8).
5. Support the front pipe assembly (8) at rear and disconnect the branch pipe (9) at the right and left hand exhaust manifolds.

Refitting

1. Support the front pipe assembly at the rear.
2. Fit new sealing rings (10) to the pipe flanges (4).
3. Locate both sides of the pipe assembly in their manifolds and loosely fit the clamping plates and nuts (12).
4. Locate the muffler and tail pipe assembly.
5. Fit the assembly to the front pipe.
6. Assemble the rear mount and locate components (1).
7. Line up the system.
8. Secure the front and rear clamps.
9. Check alignment and secure all mounting points.

Should it be necessary to replace components of the intermediate mounting assembly (6), refer Inset Fig. D-105 for correct assembly.

REAR CRANKSHAFT OIL SEAL GACO 47 INA 40277
DIMENSIONS 3·500 x 4·125 x ·375" REPCO PP 4978

REPLACED CRANKSHAFT REAR OIL SEAL AT 13,300 KM ON 22/1/88
✓ ✓ ✓ ✓ ✓ AT 18,800 " ✓ 7/9/88

FROM 20/9/74 C21/74 IN FUTURE CRANKSHAFTS WILL, IF NECESSARY BE GROUND IN PRODUCTION
TO 0·010" UNDER THE NORMAL SIZE. ENGINES FITTED WITH THESE SHAFTS WILL BE
IDENTIFIED BY THE ENGINE NUMBER PREFIX 'M' FOR MAIN UNDERSIZE
'P' CRANK PIN UNDER SIZED BEARINGS OR 'MP' IF BOTH MAIN
BEARING OR
AND CON ROD BEARINGS ARE UNDERSIZE

SECTION E

'262' O.H.C. E6 ENGINE

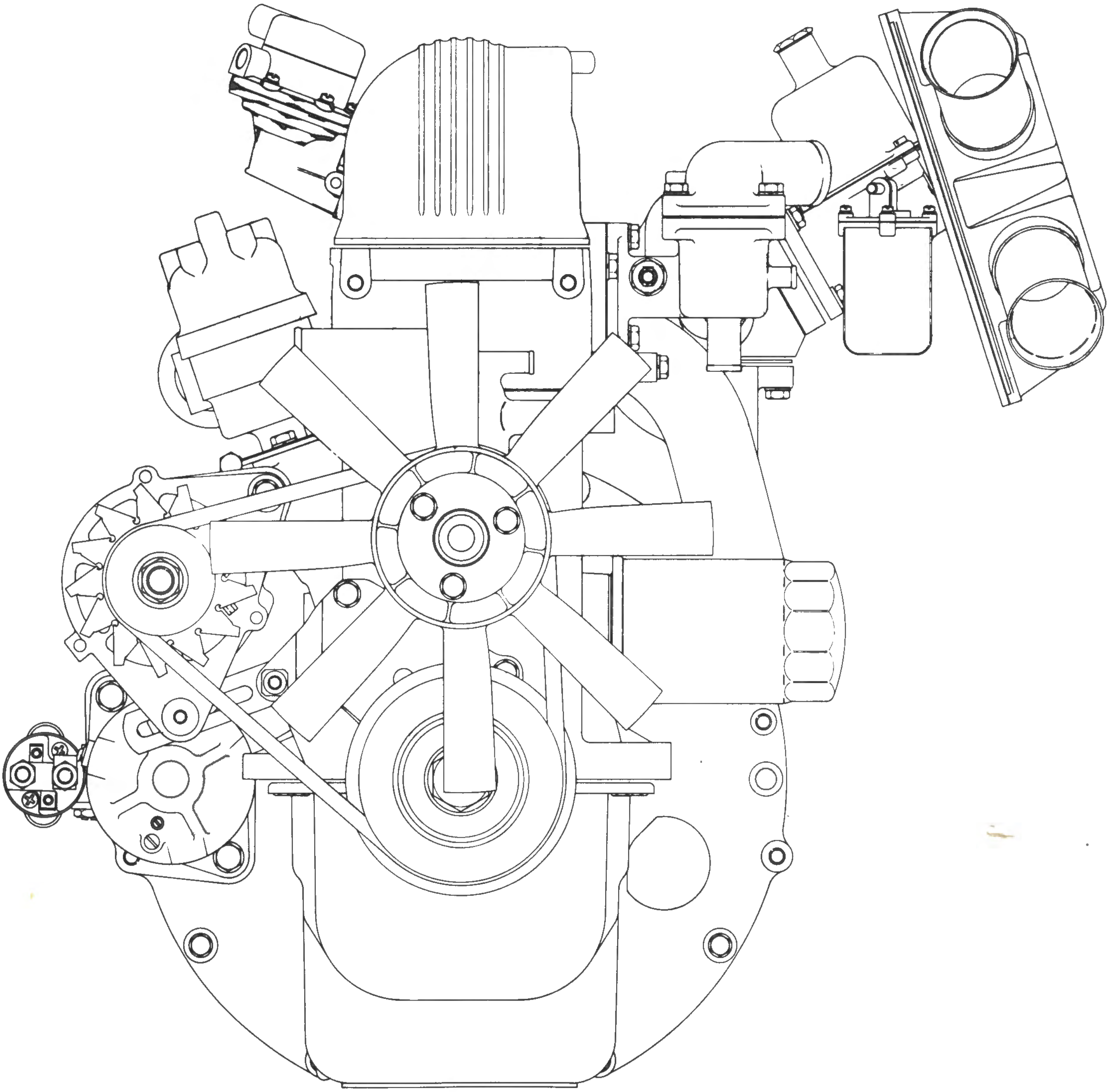


Fig. E-1

GENERAL ARRANGEMENT

FRONT VIEW

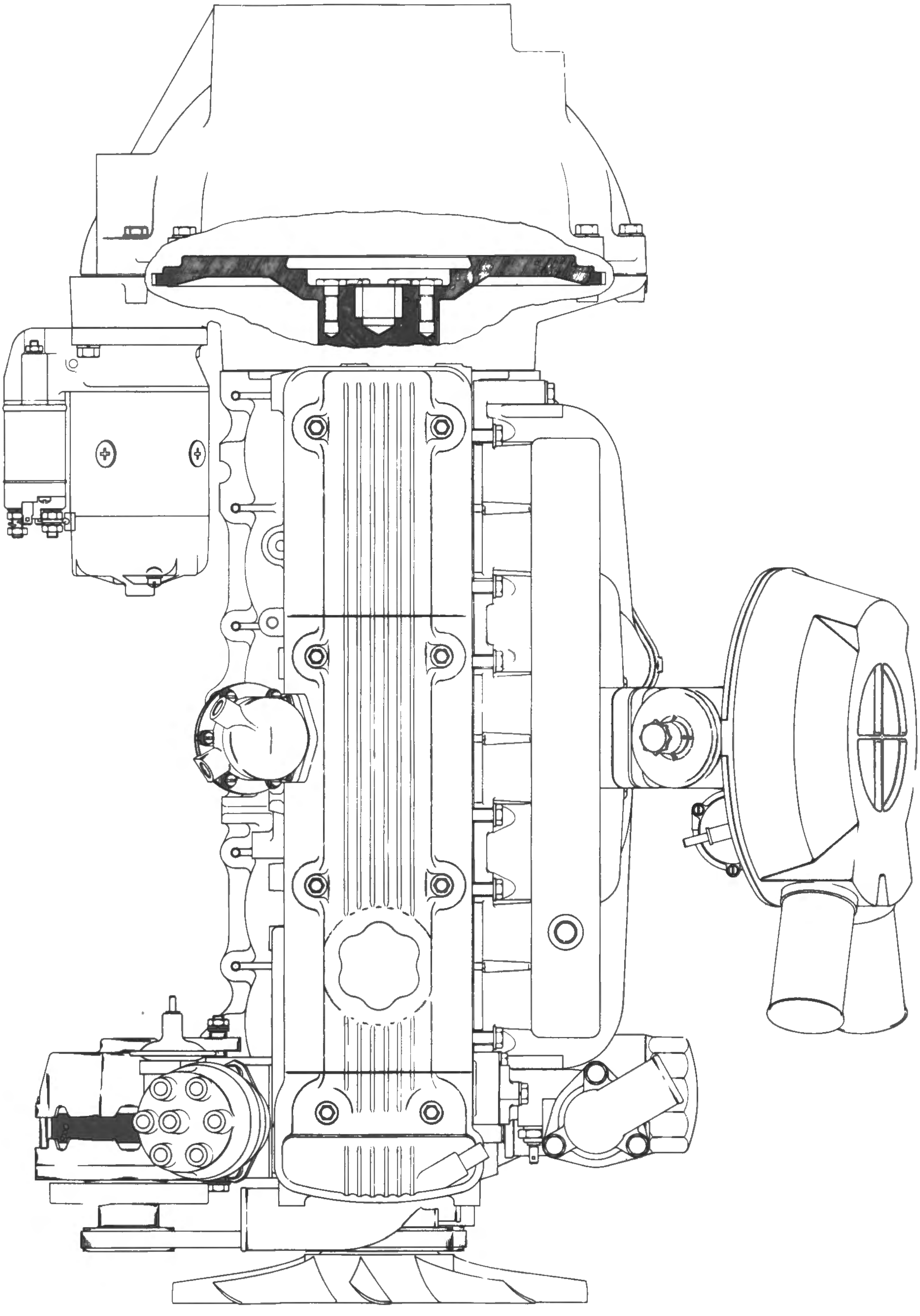


Fig. E-2

GENERAL ARRANGEMENT

TOP VIEW

GENERAL DESCRIPTION

The Leyland '262' E6 Engine is a 6 cylinder inline single overhead camshaft unit of 2.6 litre (160^3 in) capacity.

The camshaft runs in a detachable four bearing carrier bolted directly to the cylinder head and is driven from the front end of the crankshaft by sprockets and an endless single row roller chain.

Tensioning and quiet operation is achieved by a hydraulic tensioner and adjustable neoprene lined chain guides.

The valves 1 inlet and 1 exhaust per cylinder operate in non-removable guides on the detachable cast iron cylinder head. They are inclined at 5½° and set in a staggered line and retained on their seats by a coil spring, cap and split collets. Operation from the camshaft is through inverted bucket type cam followers which locate over the valve spring assemblies, and slide in the carrier.

Adjustment of operating clearance is affected by interposing hardened steel shims between the top of the valve stem and the internal base of the followers. The seven main bearing forged steel crankshaft runs in replaceable steel backed reticular aluminium/tin precision bearings and end thrust is taken on thrust washers located both sides of number four main bearing housing.

A helical gear is fitted behind the chain sprocket on the forward end of the crankshaft. This gear drives a hollow inclined vertical shaft, the upper end of which incorporates a slot to drive the distributor.

Full pressure lubrication is provided by an internally mounted eccentric rotor type oil pump mounted on the forward end of the crankcase, and driven by a square sectioned quill shaft, the end of which locates in a female square below the distributor drive slot in the hollow vertical shaft.

Pistons are of the solid skirt type and carry two compression rings and one segmental oil control ring above the gudgeon pin. Gudgeon pins float in the piston and are a press fit in the connecting rods. The connecting rods are horizontally split at the big end and are fitted with steel backed replaceable aluminium tin precision bearings.

LUBRICATION

DESCRIPTION

The lubricating oil for the engine is carried in a reservoir beneath and attached to the engine crankcase, and is replenished through a filler aperture in the camshaft cover. Oil is drawn from the rear of the reservoir, through a gauze strainer and pick up pipe to the intake side of the pump, at the front end of the engine. From the rotor outlet port the oil passes to the pump outlet via a passage containing the sealed pressure relief valve assembly, which exhausts back into the reservoir. From the pump outlet (which is sealed to the crankcase with an 'O' ring) the oil passes up through a vertical drilling in the left hand side of the crankcase to the filter intake cavity, which surrounds the filter adaptor. The disposable full flow filter canister screws to the hollow filter adaptor and a rubber ring on the filter seals it to the crankcase. Oil enters the filter from the cavity through radial ports, which are covered internally by a hinged synthetic rubber washer, permitting flow one way only, thus preventing drain back. A pressure balance type filter by pass valve is incorporated in the canister.

Passage of the oil from the filter is via the centre of the adaptor through a transverse drilling between cylinders to the main oil gallery on the right hand side of the engine. From the main gallery oil passes through drillings to each of the main bearings and on to the connecting rod bearings, through drillings in the crankshaft. The cylinder walls are lubricated by a jet from the connecting rod bearings. Oil supply for the timing chain tensioner and the camshaft bearings is taken from the front main bearing channel. A vertical drilling up through the block and cylinder head connects with a channel in the base of the camshaft carrier. From the channel, drillings carry the oil to the camshaft journals. Oil leakage from the journals fills the cam carrier trough in which the cam followers operate.

To provide noise dampening and adequate lubrication of followers immediately behind the two centre bearing journals, two jet drillings are made from the channel to points adjacent to followers No. 5 and 9.

The excess oil is returned to the reservoir via the chain aperture at the front of the engine and by an external drain from the right hand side of the cylinder head. Oil pressure warning control take off point is provided midway along the main gallery.

OIL FILTER

The oil filter is a full flow throw away canister assembly which screws on to a filter adaptor on the left hand side of the crankcase. Refer Fig. E-3 and 4.

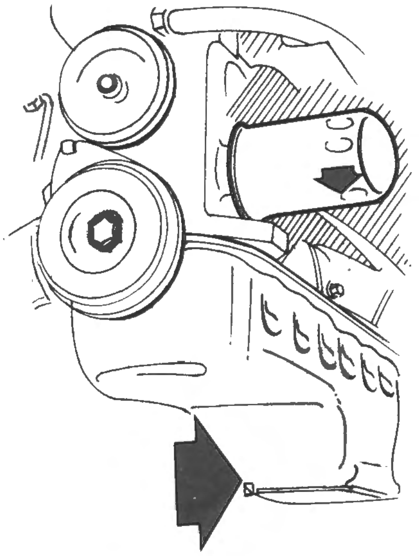
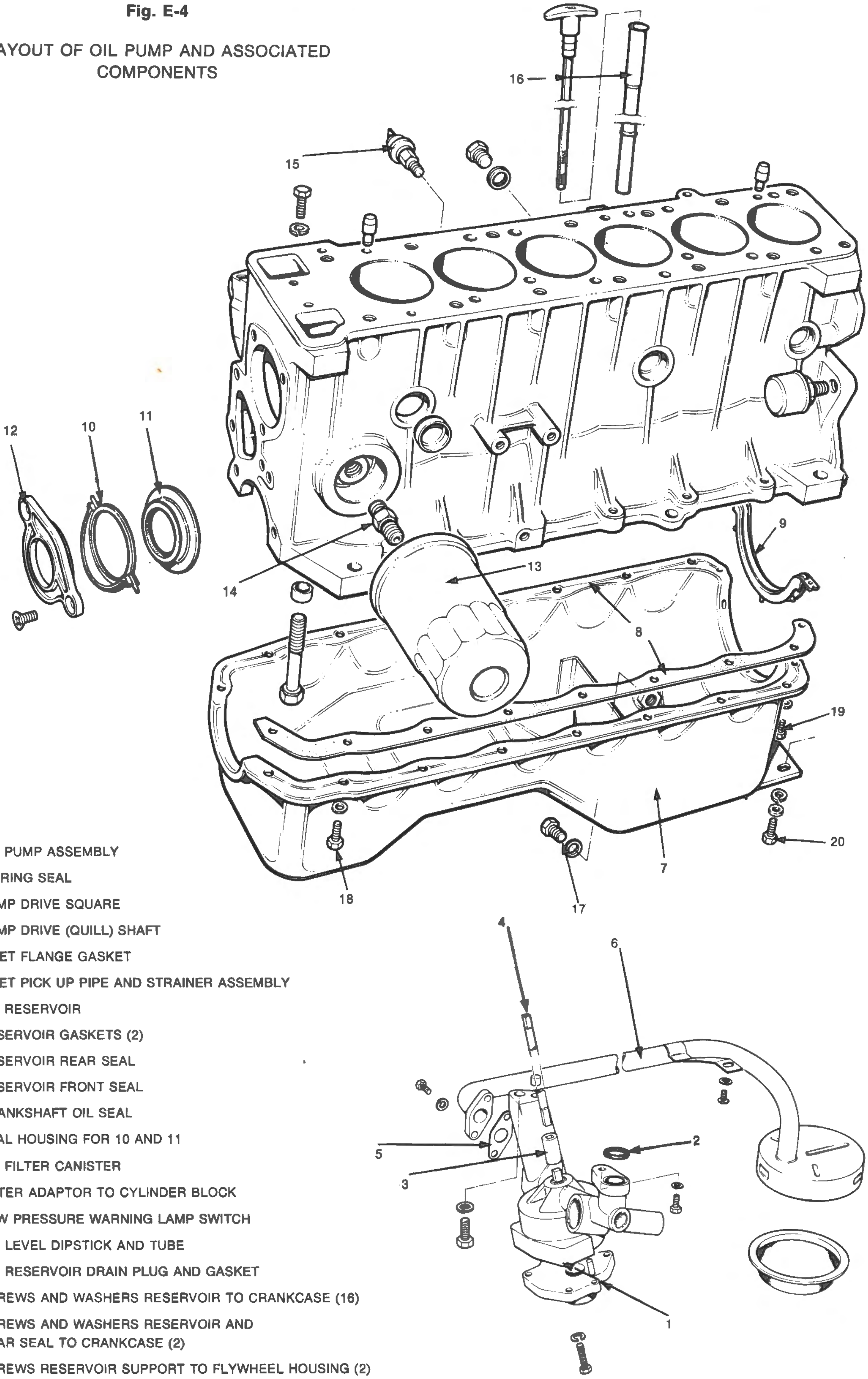


Fig. E-3

RESERVOIR DRAIN PLUG AND OIL FILTER

Fig. E-4

LAYOUT OF OIL PUMP AND ASSOCIATED COMPONENTS



1 OIL PUMP ASSEMBLY
2 'O' RING SEAL
3 PUMP DRIVE SQUARE
4 PUMP DRIVE (QUILL) SHAFT
5 INLET FLANGE GASKET
6 INLET PICK UP PIPE AND STRAINER ASSEMBLY
7 OIL RESERVOIR
8 RESERVOIR GASKETS (2)
9 RESERVOIR REAR SEAL
10 RESERVOIR FRONT SEAL
11 CRANKSHAFT OIL SEAL
12 SEAL HOUSING FOR 10 AND 11
13 OIL FILTER CANISTER
14 FILTER ADAPTOR TO CYLINDER BLOCK
15 LOW PRESSURE WARNING LAMP SWITCH
16 OIL LEVEL DIPSTICK AND TUBE
17 OIL RESERVOIR DRAIN PLUG AND GASKET
18 SCREWS AND WASHERS RESERVOIR TO CRANKCASE (16)
19 SCREWS AND WASHERS RESERVOIR AND REAR SEAL TO CRANKCASE (2)
20 SCREWS RESERVOIR SUPPORT TO FLYWHEEL HOUSING (2)

Removing

1 Unscrew the canister anti-clockwise and discard.

NOTE: If the canister is difficult to remove, use a universal strap type tool.

Refitting

1 Smear clean engine oil on the sealing washer of the new filter.

2 Screw filter on clockwise until the sealing washer touches the sealing face on the crankcase. Then tighten a further half turn by hand. Do not over tighten.

OIL RESERVOIR

Removing

1 Disconnect the battery.

2 Raise front of vehicle until front wheels are clear of the ground; and place stands under body side members.

3 Disconnect stabiliser bar links at their upper end (where fitted).

4 Remove two bolts and two clamps which anchor the stabiliser bar to sub-frame and remove bar.

5 Remove two bolts from steering column flange to disconnect the column from the rack.

6 Disconnect the steering tie-rod joints at the steering arm end, both sides.

7 Attach lifting bracket 18GA041 to front of engine, attach lifting equipment and take the weight of the engine.

8 Remove the two bolts and washers securing engine mounts to the cross member.

9 Place a mobile jack under the centre of the cross member and remove the four nuts, washers and bolts securing cross member to side members.

10 Lower the cross member down as far as possible and remove the jack.

11 Remove the bolt and nut securing each lower suspension arm to the cross member and withdraw the cross member.

12 Drain oil from the reservoir.

13 Remove two bolts, flat and spring washers securing support plate to the adaptor plate.

14 Remove the two 3/16 UNC screws and flat washers securing the reservoir, rear seal and gasket to the adaptor plate.

15 Remove the remaining 16 screws and spring washers securing the reservoir to the crankcase, and remove the reservoir.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

(a) Check the condition of the front and rear reservoir seals and replace as necessary.

(b) Fit new reservoir gaskets as follows:
  (i) Apply a thin coat of Permatex No. 3 jointing compound to the side rails of the crankcase and allow to become tacky.
  (ii) Apply a thin coat of jointing compound to the underside of each gasket and allow to become tacky.
  (iii) Position the gasket on the side rails so that all holes line up, and the end of the gasket at the front abuts with the lug on the front seal, while at the same time it is positioned on top of the sealing rib. Refer Fig. E-5.

NOTE: It is not necessary to use jointing compound on the rubber seals.

(c) Locate all screws in position and torque to 10.8 to 13.5 Nm (8 to 10 lb.f.ft.).

(d) Refill the reservoir with the specified lubricant to the correct level.

OIL RESERVOIR REAR SEAL

Removing

1 Remove the oil reservoir.

2 Detach the seal from its locating points in the reservoir.

Refitting

1 Clean and dry the reservoir.

2 Fit the seal over the reservoir flange, dry, and position the locating legs in the holes of the flange. Fig. E-6.

3 Align the holes in the seal rings with the two screw holes in the reservoir flange.

4 Refit the reservoir.

CRANKSHAFT PULLEY AND TORSIONAL VIBRATION DAMPER ASSEMBLY

Removing

1 Disconnect the battery.

2 Slacken the alternator belt and remove the bolt.

3 Unlock the crankshaft pulley bolt lock washer.

4 Remove the pulley retaining bolt.

5 Remove the pulley assembly.
Should the pulley assembly be difficult to remove the two 5/16 UNF tapped holes are provided for attachment of a puller to the centre hub.
Leyland Service Tools 18GA015, 18GA015B and 18GA1014B together with two 5/16 in UNF bolts may be used.
DO NOT use universal pullers of the type which attach legs to the outer circumference of the pulley as these will destroy the vibration damper.

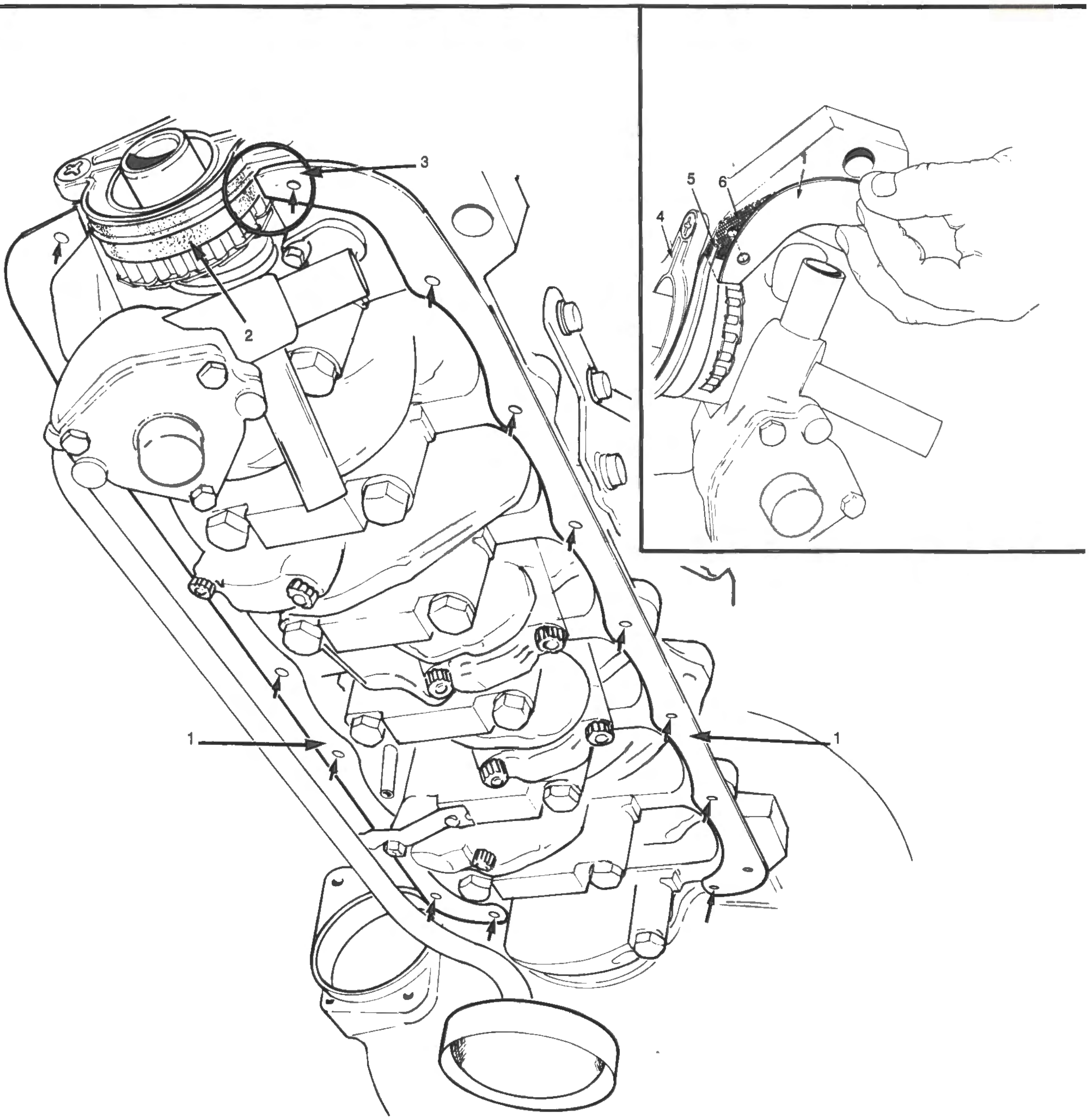


Fig. E-5

FITTING OIL RESERVOIR SIDE GASKETS

1	RESERVOIR SIDE RAIL GASKETS
2	RESERVOIR FRONT SEAL
3	INSET — CORRECT LOCATION OF SIDE RAIL GASKETS AND FRONT SEAL
4	SEAL HOUSING
5	SEAL LUG
6	JOINTING COMPOUND

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

   1 Lubricate the seal surface with engine oil.

   2 Fit a new lock washer.

   3 Torque the bolt to the figures quoted in GENERAL DATA.

OIL RESERVOIR FRONT SEAL, SEAL HOUSING AND CRANKSHAFT OIL SEAL

Removing

1 Remove the oil reservoir.

2 Remove the reservoir gaskets.

3 Remove the crankshaft pulley damper assembly.

4 Remove the two counter sunk head screws and washers securing the seal housing to the crankcase and detach the housing.

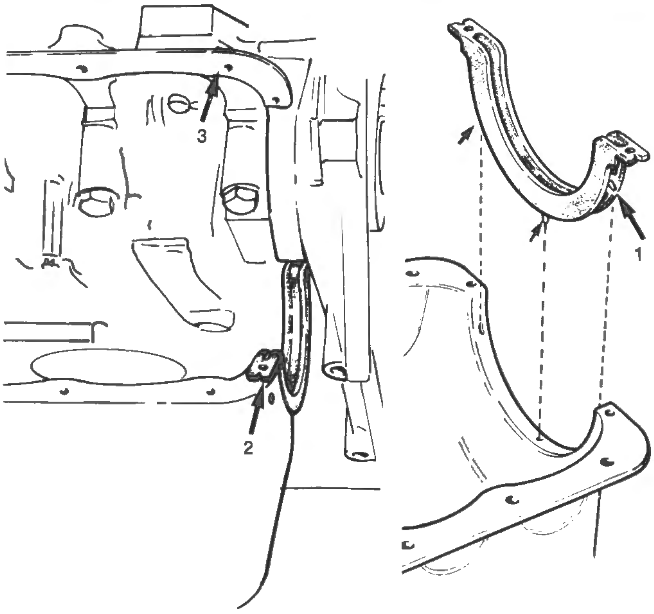


Fig. E-6

FITTING RESERVOIR REAR SEAL

1 SEAL LOCATING LUGS (3)
2 FITTED POSITION OF SEAL ON RESERVOIR
3 RESERVOIR SIDE GASKET

5 Detach the reservoir seal from its groove in the housing.

6 Carefully drift out the crankshaft oil seal as necessary or alternatively replace the seal and housing as a unit.

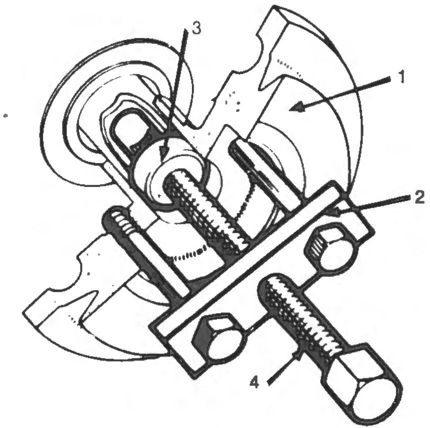


Fig. E-7

REMOVING THE TORSIONAL VIBRATION DAMPER AND PULLEY ASSEMBLY

1 PULLEY
2 SERVICE TOOL 18GA015B
3 SERVICE TOOL 18GA1014B
4 BOLT ⅝ in UNF

Refitting

1 Carefully press a new crankshaft oil seal into the housing as necessary.

2 Locate the housing in position on the crankcase and align the attaching screw holes.

3 Using a lead pencil mark the position of the end of the crankcase rails on the housing. Refer Fig. E-8.

4 Remove the housing.

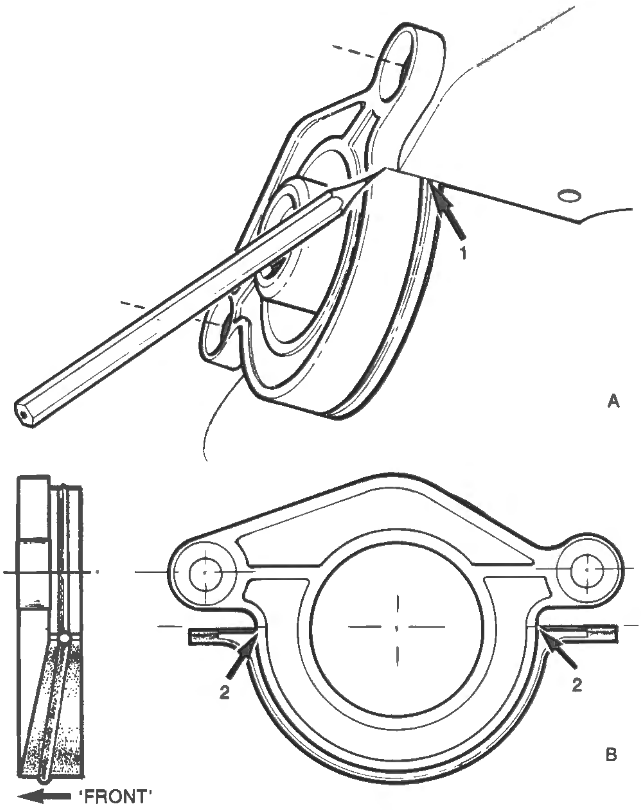


Fig. E-8

FITTING THE RESERVOIR SEAL TO THE HOUSING

1 MARKING THE FITTED POSITION OF THE SEAL ON THE HOUSING
2 SEAL FITTED WITH LUGS ALIGNED TO HOUSING

5 Fit the seal in the groove in the housing, so that the under side of the lugs align with the pencil lines on the housing; and the hooded part of the seal faces to the front and away from the engine.

6 Install the seals and housing assembly, over the crankshaft maintaining fitted horizontal alignment of the counter sunk holes and the threaded holes in the crankcase.

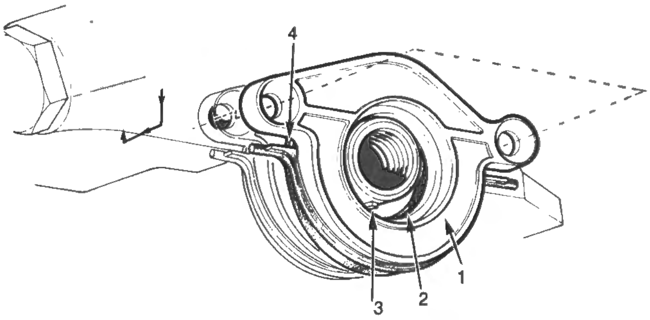


Fig. E-9

FITTING HOUSING AND SEAL ASSEMBLIES IN POSITION

1 SEAL HOUSING
2 CRANKSHAFT SEAL
3 CRANKSHAFT KEY POSITION
4 ENSURE THIS SECTION OF THE SEAL IS NOT DAMAGED ON CRANKCASE SIDE RAIL EDGE

7 Keeping the housing assembly in the same horizontal alignment, position the whole assembly vertically away from the engine so that the crankshaft oil seal lips are resting on the crankshaft.

8 Push the assembly toward the crankcase and engage the 'O' ring section on the aperture and at the same time lower the assembly to align the retaining screw holes and bring the seal lugs in contact with the crankcase side rails.

NOTE: Exercise care when carrying out this part of the operation, to avoid stretching and damaging the seal on the edges of the crankcase rails at the point of maximum diameter of the seal housing.

9 Apply Permatex sealing compound No. 3 to the thread and counter sink of the left hand housing attaching screw.

10 Fit both screws and torque to the figures quoted in GENERAL DATA.

11 Refit the crankshaft pulley, oil reservoir and gaskets in accordance with previous instructions.

OIL PICK UP PIPE AND STRAINER ASSEMBLY

Removing

1 Disconnect the battery.

2 Remove the oil reservoir.

3 Remove the screw spring and flat washer securing the support bracket to number five main bearing cap.

4 Remove the two screws and spring washers securing the pipe flange to the oil pump.

5 Remove the assembly, detach and discard the flange gasket.

Refitting

1 Using a new flange gasket, fit the assembly to the oil pump. Do not fully tighten the screw.

2 Check for clearance between the support bracket and the mounting face on the main bearing cap and alignment of the holes.

3 Should clearance or misalignment be present remove the assembly and adjust the bracket. There should be no strain on the flange, when all three screws are torqued to the figures quoted in GENERAL DATA.

4 Refit the oil reservoir and gaskets in accordance with previous instruction.

OIL PUMP

Removing

1 Disconnect the battery.

2 Remove the oil reservoir.

3 Remove the oil pick up pipe and strainer assembly.

4 Remove the bolt clamping the oil pump outlet sealing ring flange to the crankcase. Left hand side of engine.

5 Remove the bolt securing the oil pump to the crankcase. Right hand side of engine.

6 Lift the oil pump assembly off the locating dowels and recover the outlet sealing ring.

NOTE: If the pump is removed with the engine in situ the square ended quill shaft may disengage from its driving square and drop out.

Dismantling

1 Remove the three screws and spring washers securing the pump cover to body.

2 Remove the cover by tapping with a suitable drift on the area adjacent to the dowel bosses, as shown in Fig. E-10.

3 Identify the rotor lobe with its mating cavity in the outer ring, to facilitate correct assembly.

4 Remove the outer ring, clean and dry all components.

5 Only remove the drive square if it is to be replaced. Grip the square at the driving end and drift out the rotor shaft.

Inspecting

NOTE: The only serviceable components of the oil pump are the drive square and relief valve assembly. The oil pump must be renewed as an assembly if the rotor lobe clearance is in excess of 0.14 mm (0.005 in).

1 Check the drive square for looseness and position on the shaft. A clearance of 0.76 mm (0.030 in) must exist between the bottom of the square and the shoulder on the shaft.

2 Check for indications of flaring or splitting of the square at the drive end.

3 Fit the outer ring in its original running position and check the rotor lobe clearance 'B' Fig. E-11 using feeler gauges 0.089 to 0.127 mm (0.0035-0.005 in).

NOTE: The outer ring to body clearance 'C' will be Nil when checking rotor lobe clearance.

4 Check outer ring to body clearance 'C' 0.28 mm (0.011 in) max.

5 Check the outer ring end float 'A' 0.10-0.12 mm (0.004-0.005 in).

6 Check the rotor end float 0.11 to 0.14 mm (0.0045-0.0055 in).

Assembling

1 Lubricate the rotor and shaft assembly if removed.

2 Mount the pump vertically under a press ram with the rotor shaft end on the press bed.

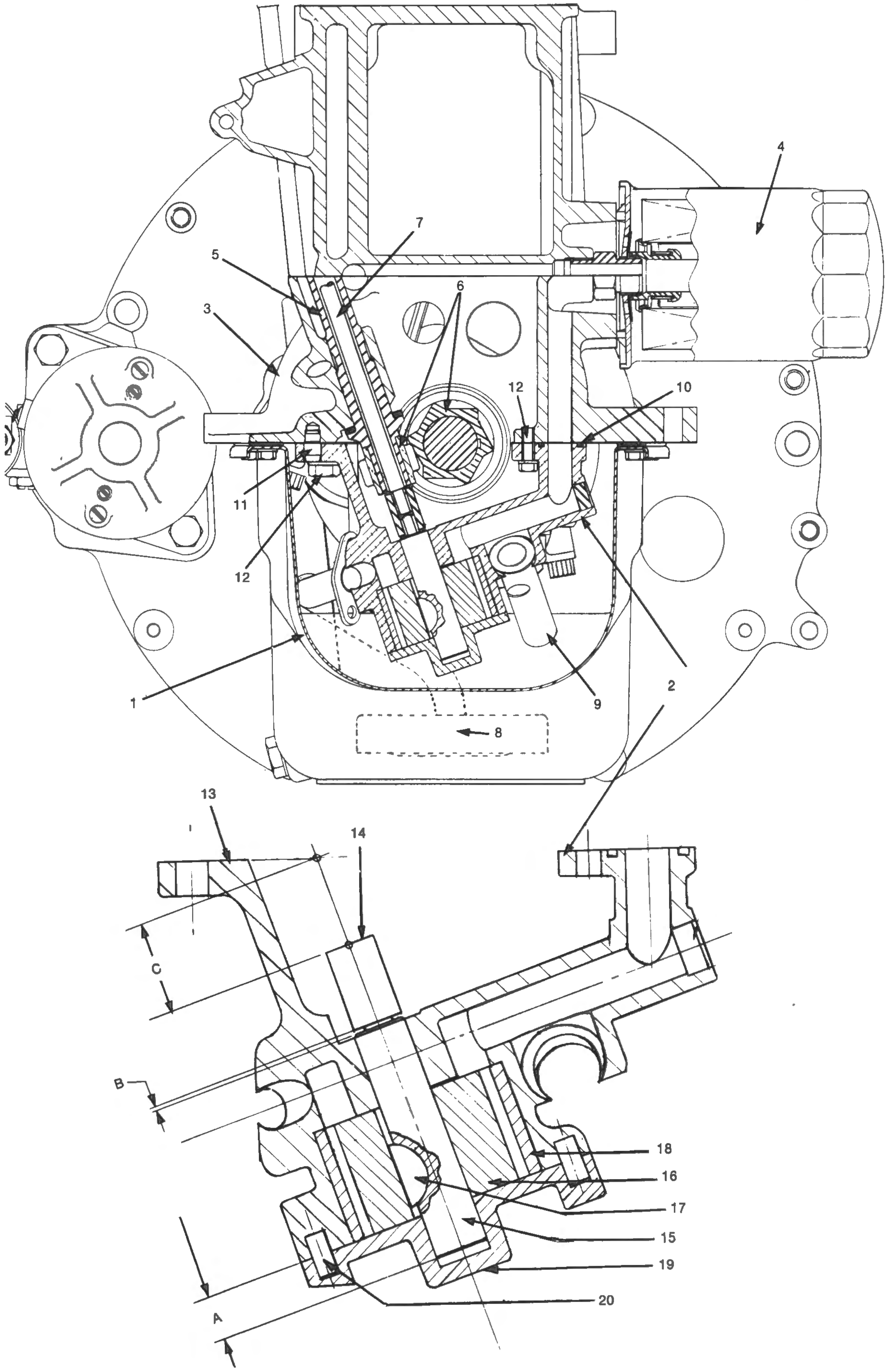


Fig. E-10

SECTION THROUGH OIL PUMP AND FILTER ASSEMBLIES

KEY TO FIG. E-10

1	OIL RESERVOIR
2	OIL PUMP ASSEMBLY
3	CRANKCASE
4	OIL FILTER
5	DISTRIBUTOR/OIL PUMP/DRIVE SHAFT
6	SHAFT DRIVE GEARS
7	OIL PUMP DRIVE (QUILL) SHAFT
8	OIL PICK UP PIPE AND STRAINER ASSEMBLY
9	PRESSURE RELIEF VALVE
10	'O' RING SEAL PUMP OUTLET TO CRANKCASE
11	DOWEL PUMP TO CRANKCASE
12	MOUNTING SCREWS PUMP TO CRANKCASE
13	PUMP MOUNTING FACE
14	DRIVE SQUARE
15	ROTOR SHAFT
16	ROTOR
17	KEY
18	OUTER RING
19	PUMP AND COVER
20	DOWEL COVER TO BODY
'A'	Shaft to Rotor Location 12.32 to 12.57 mm (0.485 to 0.495 in)
'B'	Shaft shoulder to Drive square clearance 0.76 mm (0.03 in)
'C'	Assembly check dimension 25.65 to 25.9 mm (1.10 to 1.02 in)

3 Locate the square drive and press on until it is 0.76 mm (0.030 in) from the shoulder.

NOTE: The chamfer on the shaft at the shoulder should be visible when the rotor assembly is seated in the body. If the chamfer is not visible check the fitted dimension of the rotor and shaft as shown in Fig. E-10.

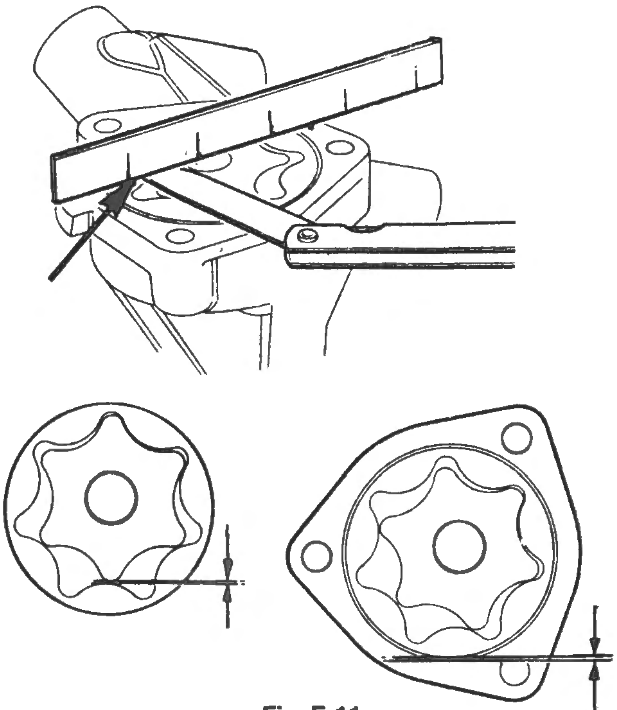


Fig. E-11

CHECKING OIL PUMP CLEARANCES

4 Refit the outer ring with the chamfer toward the pump body and the correct cavity with its mating rotor lobe.

5 Fit the bottom cover, spring washers and screws.

6 Torque the screws to the figures quoted in GENERAL DATA and check that the pump shaft turns freely.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

(a) Ensure that the pump quill shaft is fitted.

(b) Should the pump assembly not sit evenly on both mounting faces due to zero end float between the drive square and the distributor drive shaft, check that the shaft has not disengaged from the distributor at the drive tang. Normal shaft end float should be approximately 2.54 mm (0.1 in).

(c) Use a new sealing ring on outlet flange.

(d) Prime the engine before starting by cranking with the starter motor having first removed the coil lead and the spark plugs.

OIL PRESSURE RELIEF VALVE

The oil pressure relief valve is a sealed non-adjustable assembly pressed into the oil pump body. Should a valve be suspect it must be replaced. The replacement operation can only be carried out twice on any one pump.

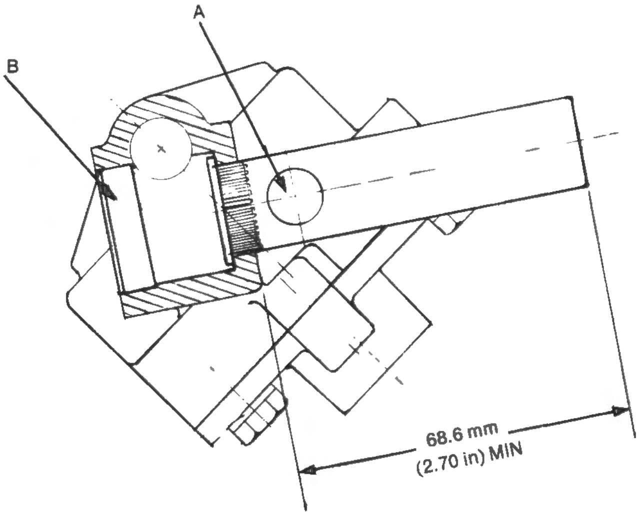


Fig. E-12

FITTING THE OIL PRESSURE RELIEF VALVE

1 THE PRESS FIT VALVE MUST BE POSITIONED SO THAT THE OIL DISCHARGE HOLE 'A' IS PARALLEL TO THE PUMP MOUNTING FACE

2 THE PRESS FIT AND PLUG 'B' MUST BE 'STAKED' IN 3 PLACES — EQUALLY SPACED

Removing

1 Remove the oil pump.

2 Carefully cut away material from the three staking points that retain the relief valve plug.

3 Press the relief valve and plug from the pump body noting the position of the valve ports.

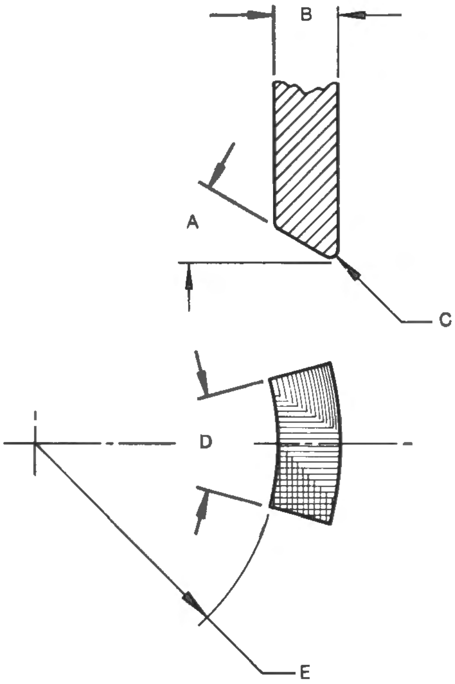


Fig. E-13

STAKING TOOL DIMENSIONS

A	PUNCH ANGLE 35°
B	PUNCH SECTION 3.04 mm (0.12 in)
C	0.254 to 0.508 mm (0.01 to 0.02 RADIUS)
D	6.35 mm (0.25 in)
E	14.48 mm (0.57 in) RADIUS

NOTE: Service replacement valves incorporate a knurled spline below the flange, to ensure a tight fit in the pump housing.

Refitting

1 Enter the valve in the housing and position it so that the port is parallel to the pump mounting face.

2 Ensure the valve is square in the housing and press in until the locating flange bottoms in the housing.

3 Press in the plug with its chamfered edge out.

4 Stake the plug in three positions using a tool ground to the dimensions given in Fig. E-13. To ensure positive retention under pressure the staking must be as shown in Fig. E-14.

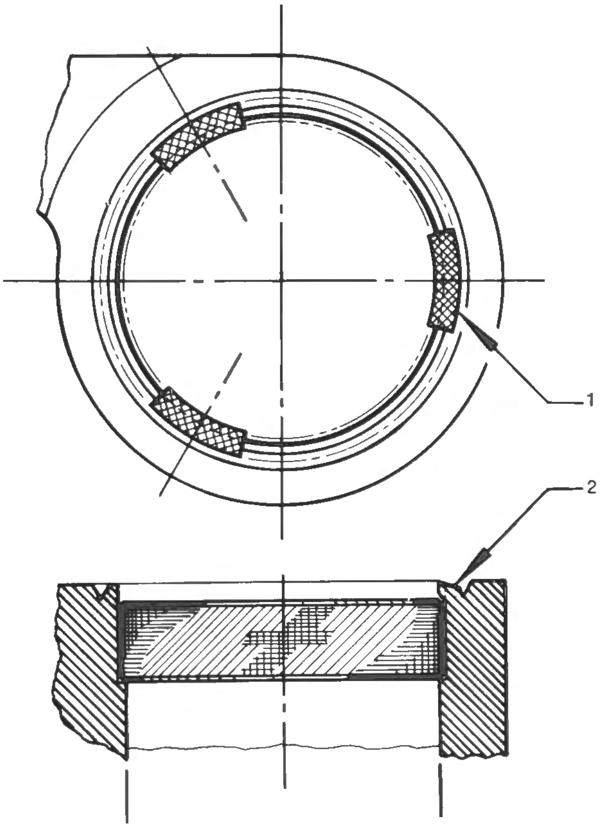


Fig. E-14

CORRECT 'STAKING'

1 STAKE IN 3 POSITIONS

2 APPROXIMATE FINAL PROFILE

VALVE MECHANISM

DESCRIPTION

A single carrier mounted camshaft on top of the cylinder head operates the inclined valves through inverted bucket type camfollowers.

CAMSHAFT COVER

Removing

1 Disconnect the battery.

2 Disconnect the vacuum advance pipe at the distributor.

3 Disconnect the breather hose from the front of the cover.

4 Remove the fuel pump (Refer Section F) spacer block and push rod.

5 Starting from the centre of the cover slacken the eight flanged bolts securing the cover.

6 Remove the bolts and seals.

7 Detach the cover and gasket assembly from the head.

8 Lift up over the camshaft carrier and under the choke and accelerator cables.

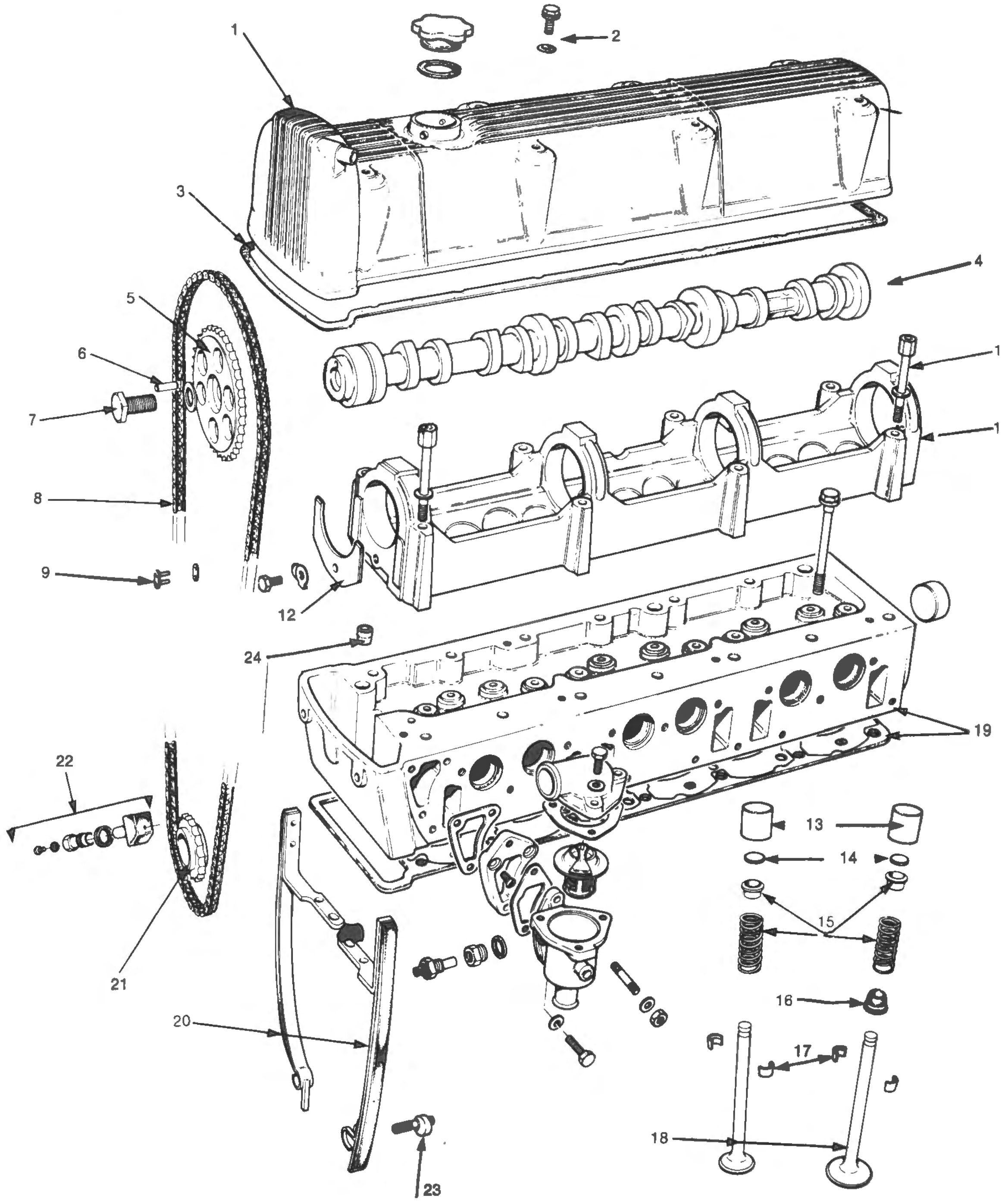


Fig. E-15

LAYOUT OF VALVE MECHANISM COMPONENTS

1	CAM COVER
2	COVER SCREWS AND 'O' RING SEAL
3	COVER GASKET
4	CAMSHAFT
5	CAMSHAFT SPROCKET
6	SPROCKET LOCATING PIN
7	SPROCKET RETAINING SCREW AND WASHER
8	TIMING CHAIN
9	CHAIN JOINING LINK
10	CAMSHAFT CARRIER
11	CARRIER RETAINING BOLTS AND WASHERS (8)
12	CAMSHAFT RETAINER PLATE
13	CAM FOLLOWERS
14	ADJUSTING SHIM
15	VALVE SPRINGS AND CAPS
16	VALVE STEM SEAL – INLET VALVE ONLY
17	VALVE COTTERS
18	EXHAUST AND INLET VALVES
19	CYLINDER HEAD AND GASKET
20	TIMING CHAIN GUIDES
21	CRANKSHAFT SPROCKET
22	TIMING CHAIN TENSIONER
23	CHAIN GUIDE ADJUSTER
24	DOWEL CAM CARRIER TO CYLINDER HEAD

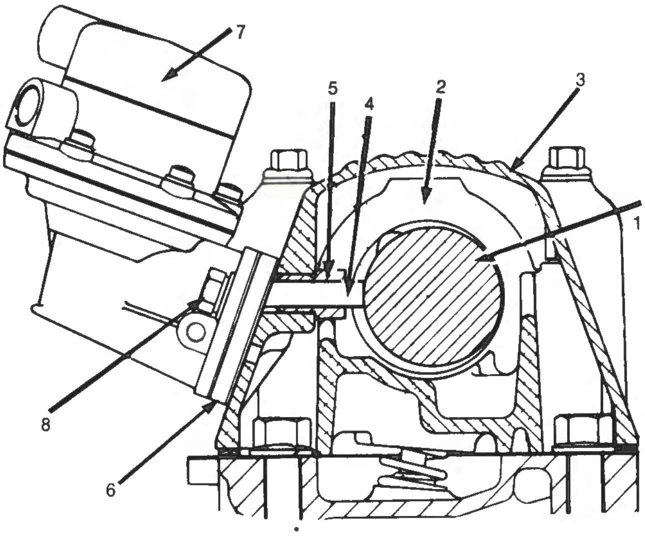


Fig. E-16

SECTION THROUGH FUEL PUMP MOUNTING

1 CAMSHAFT
2 CAMSHAFT CARRIER
3 CAM COVER
4 PUSH ROD
5 BEARING SLEEVE FOR PUSH ROD
6 SPACER AND GASKET ASSEMBLY
7 FUEL PUMP
8 PUMP RETAINING SCREWS

Refitting

1 Refitting is the reversal of the removing procedure noting the following:
   (a) Fit new cover gaskets.
   (b) Check the condition of the 'O' ring seals. They must stand proud of the bolt flange when fitted.
   (c) Tighten the bolts evenly working diagonally from the centre out.

NOTE: Do not over tighten. A bolt flange which touches the alloy cover will promote noise from the valve mechanism.

CHECKING VALVE CLEARANCES

1 Disconnect the battery.

2 Remove the camshaft cover.

3 Turn the engine in the direction of rotation using a suitable socket bar assembly fitted with 1 5/16 in A.F. socket.

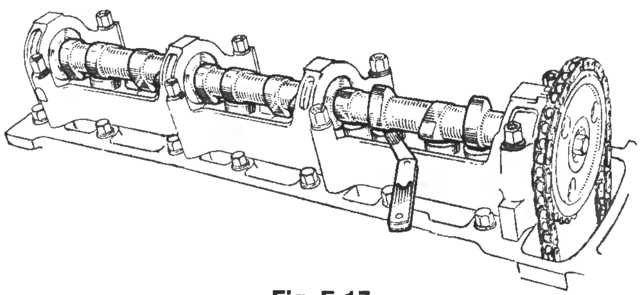


Fig. E-17

CHECKING VALVE CLEARANCES

4 Using a feeler gauge or a dial indicator check and record the cam to follower clearance in the following sequence.

Check No. 1 follower with No. 12 valve fully open.
Check No. 7 follower with No. 6 valve fully open.
Check No. 9 follower with No. 4 valve fully open.
Check No. 2 follower with No. 11 valve fully open.
Check No. 5 follower with No. 8 valve fully open.
Check No. 10 follower with No. 3 valve fully open.
Check No. 12 follower with No. 1 valve fully open.
Check No. 6 follower with No. 7 valve fully open.
Check No. 4 follower with No. 9 valve fully open.
Check No. 11 follower with No. 2 valve fully open.
Check No. 8 follower with No. 5 valve fully open.
Check No. 3 follower with No. 10 valve fully open.

NOTE: It is not necessary to adjust valve clearances to the figures quoted in GENERAL DATA until any one clearance has closed to 0.229 mm (0.009 in) or:

(a) New components have been fitted.

(b) Valve faces or seats have been re-ground.

CHECKING VALVE TIMING

1 Remove the cam cover.

2 Mark the relative position of No. 1 spark plug on the distributor and remove the cap.

3 Turn the crankshaft in the direction of rotation until No. 1 piston is at TDC on the compression stroke, with the distributor rotor pointing to No. 1 lead and the crankshaft pulley mark aligned with the pointer on the front of the crankcase.

4 With the crankshaft set as above, check that the hole in the camshaft sprocket boss is aligned with the groove in the cam carrier, Fig. E-18.
Should it be found that adjustment is not necessary assemble and reconnect the components by reversing the checking procedure — Do not apply jointing compound to the cam cover gasket.

VALVE TIMING

1 Ensure the timing marks are aligned as detailed in item 3 of checking procedure.

2 Retract and lock the timing chain tensioner. Refer Fig. E-19.

3 Remove the camshaft sprocket, ensuring that the timing marks remain aligned.

4 Disengage the sprocket from the chain.

5 Refit the camshaft sprocket to the camshaft and rotate the camshaft until the hole in the sprocket is aligned with the groove in top of the camshaft carrier, Fig. E-18.

6 Remove the sprocket taking care not to move the camshaft.

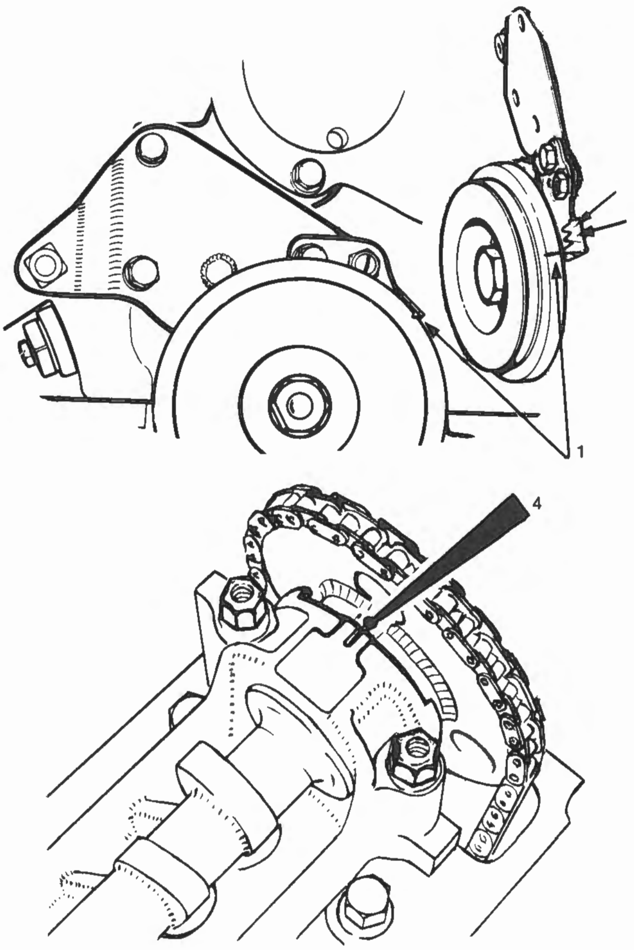


Fig. E-18

CHECKING VALVE TIMING

1	CRANKSHAFT AT TDC NO. 1 CYLINDER
4	CAM SPROCKET HOLE ALIGNED WITH CARRIER MARK

7 Position the sprocket in the timing chain with the chain tight on the guides, and the dowel hole in the sprocket lined up with the camshaft dowel. During this operation it is imperative that the camshaft and the crankshaft are not rotated.

8 Fit the sprocket to the camshaft with the chain engaged keeping the chain taut on the fixed guide side.

9 Release the chain tensioner.

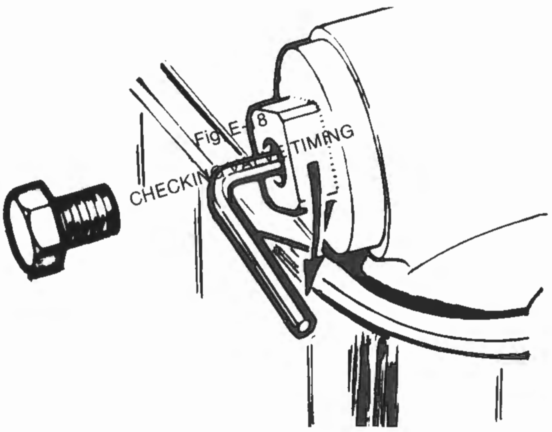


Fig. E-19

RETRACTING TIMING CHAIN TENSIONER

10 Check the tension of the chain. Any degree of slackness evident on the drive side of the chain must be removed by the adjustable chain guide. Refer 'Timing chain guides'.

11 Recheck timing by turning engine in direction of rotation until crankshaft timing marks are again aligned at TDC No. 1 cylinder of compression stroke.

12 Refit the components in the reverse order they were removed.

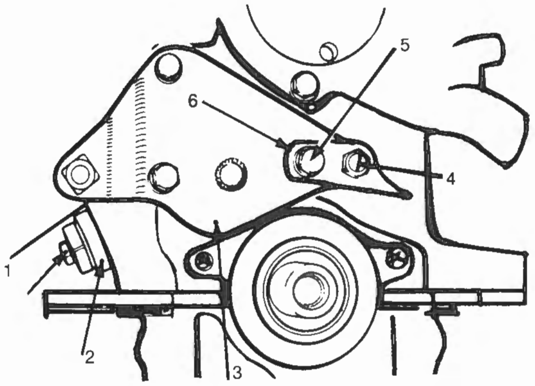


Fig. E-20

TIMING CHAIN ADJUSTING COMPONENTS

1	SET SCREW	4	CAM ADJUSTER AND LOCKNUT
2	TENSIONER BODY	5	DOWEL BOLT
3	FRONT ENGINE PLATE	6	TIMING POINTER PLATE

TIMING CHAIN GUIDES

Removing

1 Disconnect the battery.

2 Raise vehicle on hoist.

3 Remove the cam cover.

4 Set timing at No. 1 TDC.

5 Release the chain tensioner.

6 Remove the camshaft sprocket.

7 Remove the guide and retaining bolts Fig. E-21.

8 Remove the crankshaft pulley and damper assembly.

9 Slacken all the oil reservoir retaining screws and lower the reservoir approximately 4.7 mm (3/16 in).

10 Remove the two screws securing the oil seal retainer to the crankcase.

11 Carefully separate the reservoir gasket from the seal housing gasket with a knife or suitable blade.

12 Remove the seal housing.

13 Remove the front cover.

14 Release RH guide from the engine.

15 Release the LH guide from the adjuster at the bottom and remove the guide by lifting and turning through 90° anti-clockwise.

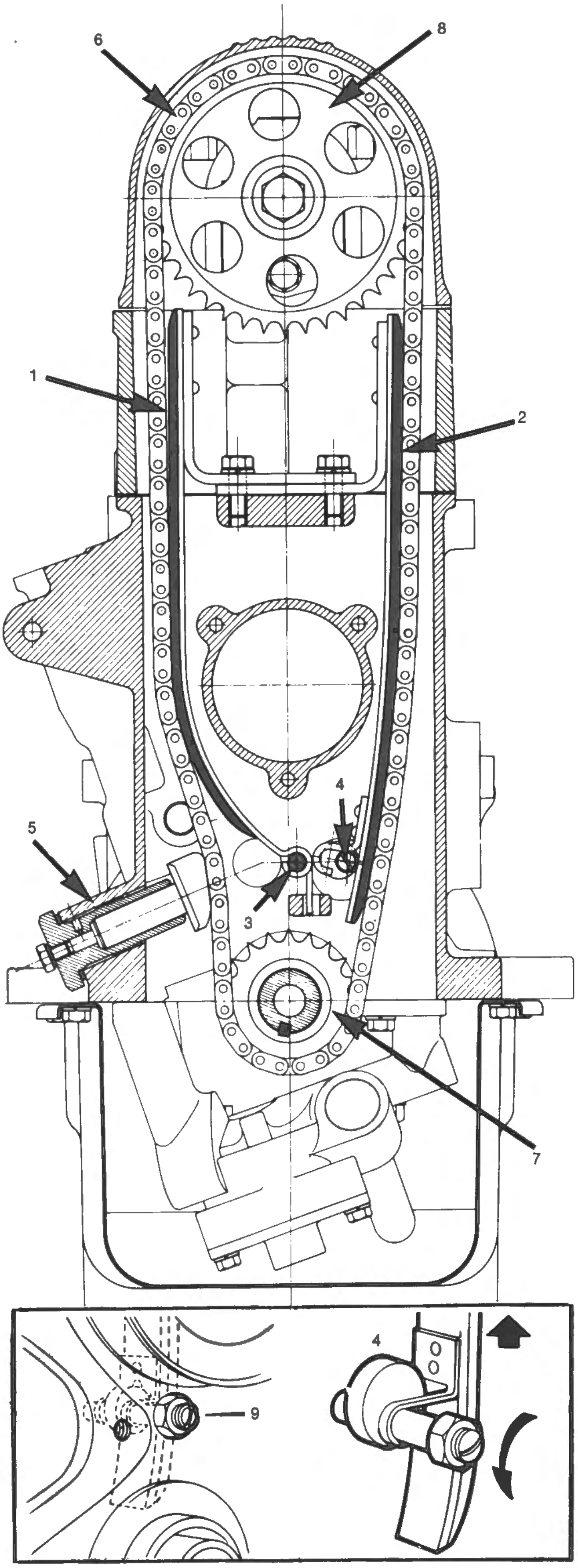


Fig. E-21

TIMING CHAIN GUIDES AND TENSIONER

KEY TO FIG. E-21

1	CHAIN GUIDE – FIXED
2	CHAIN GUIDE – ADJUSTABLE
3	DOWEL BOLT
4	CAM ADJUSTER
5	CHAIN TENSIONER ASSEMBLY
6	TIMING CHAIN
7	CRANKSHAFT SPROCKET
8	CAMSHAFT SPROCKET
9	CAM ADJUSTER LOCKNUT

Refitting

1 Reverse items 1 to 6.

2 Adjust the guides.

(a) Turn cam adjuster sufficiently to ensure that the guide is vertical.

(b) Adjust the guide so that a slight tension is placed on the chain.

(c) Lock the adjuster in this position. DO NOT OVERTENSION THE CHAIN.

3 Engage the chain tensioner.

4 Check the valve timing and reverse items 1 to 3 of removing.

5 Start the engine and check for correct operation and oil leaks.

TIMING CHAIN

Removing

1 Disconnect the battery.

2 Remove the cam cover and fuel pump.

3 Align the timing marks.

4 Release the chain tensioner.

5 Remove the camshaft sprocket taking care not to move the crankshaft or camshaft.

6 Leaving a section of the timing chain accessible place a piece of lint free cloth in the timing chain aperture to prevent the ingress of dirt or foreign material.

7 Split the chain using timing chain link remover, Renold Part No. 311006.

TO OPERATE THE TOOL

(a) Open the jaws of the tool by squeezing the two handles together, place it over the chain at one bearing pin and close the jaws against the roller by releasing the handles. Fig. E-22.

(b) Turn the screw clockwise until the tip contacts the chain bearing pin end.

(c) Continue turning the screw until the bearing pin end is forced just through the side plate.

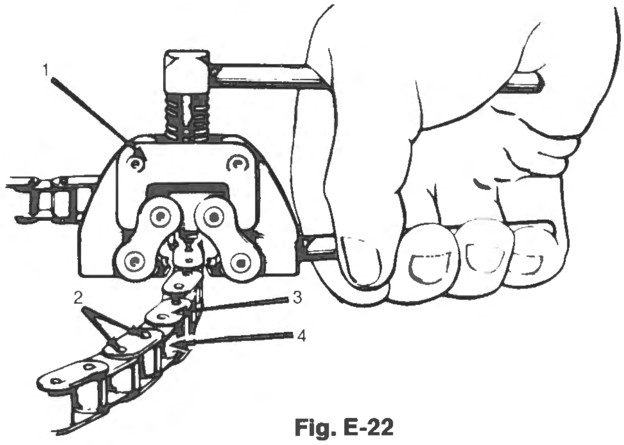


Fig. E-22

SPLITTING TIMING CHAIN

1	LINK REMOVER	3	SIDE PLATE
2	BEARING PIN	4	ROLLER

(d) Unscrew the tool and release it from the chain.

(e) Repeat the operation on the bearing pin at the opposite end of the side plate, thus detaching the outer side plate completely.

CAUTION: Ensure both free ends of the chain are secured so they will not drop through the aperture.

NOTE: As this operation destroys the fit of the chain parts, no attempt should be made to rivet a link removed in this manner. The chain link and plate should always be renewed.

8 Remove the crankshaft pulley.

9 Slacken the oil reservoir screws and lower the reservoir approximately 4.76 mm (3/16 in).

10 Remove the front oil seal housing gasket assembly.

Refitting

1 Remove the cloth from the aperture, attach the replacement chain to the old chain with a piece of wire so the old chain will act as a 'pull through' to locate the new chain around the guides, tensioner and crankshaft sprocket.

2 Replace the cloth in the aperture, to ensure that the chain links, tools, etc., do not fall into the oil reservoir.

3 Secure the anvil of the timing chain link replacer, 18GA017 to the camshaft carrier bolts, using the bolts supplied with the tool.

4 Connect the two ends of the chain with a link and position the chain on the anvil as shown in Fig. E-23.

5 Fit the link side plate in position over the link bearing pins and tap the plate to ensure the full protrusion of the pins through the plate, using the hollow punch.

6 Using the centre punch, spread the end of the pins and finally pein the ends with the concave punch.

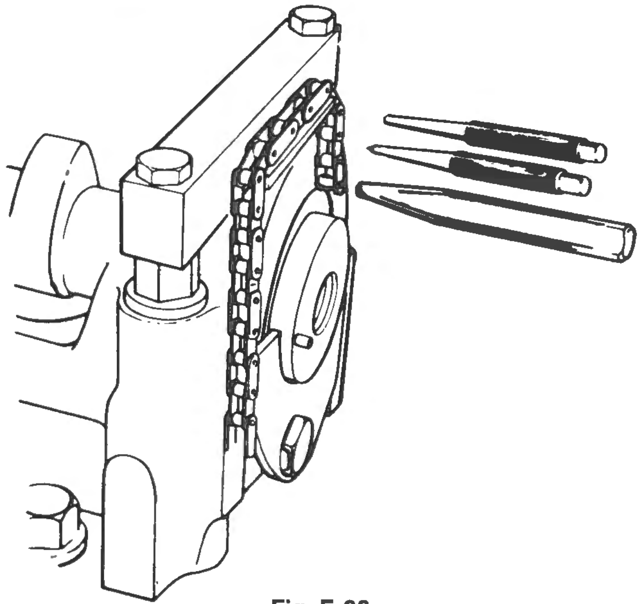


Fig. E-23

REPLACING TIMING CHAIN LINK

NOTE: It is essential that the link just riveted has sufficient side clearance to obviate binding. This must be physically checked by moving the chain by hand and if any resistance is felt, gently tap the link side plates to produce face movement.

7 Remove the anvil of the timing chain link replacer from the camshaft carrier and remove the cloth from the cylinder head aperture.

8 Adjust the valve timing.

9 Replace the remaining components in the reverse order to which they were removed, referring to the GENERAL DATA section for correct torque settings. Do not use jointing compound on the cam cover gasket.

TIMING CHAIN TENSIONER

Removing

1 Raise vehicle on hoist or stands.

2 Disconnect the battery.

3 Slacken the alternator belt and remove the bolt.

4 Release the chain tensioner.

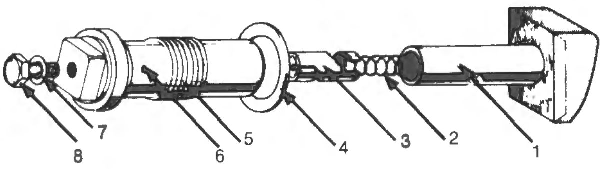


Fig. E-24

CHAIN TENSIONER COMPONENTS

1	SLIPPER ASSEMBLY	5	TENSIONER BODY
2	SPRING	6	OIL HOLE
3	PLUNGER	7	COPPER WASHER
4	WASHER	8	SET SCREW

5 Remove the cam cover.

6 Align the timing marks.

7 Remove the camshaft sprocket.

8 Remove crankshaft pulley and damper.

9 Slacken the oil reservoir screws and lower the reservoir approximately 4.76 mm (3/16 in).

10 Remove the seal housing screws and carefully separate the housing gasket from the reservoir gasket with a suitable blade or knife and remove the housing.

11 Remove the front cover.

12 Remove the tensioner body.

13 Turn adjuster to obtain maximum slack in chain.

14 Lever the chain away from the tensioner and turn the tensioner through 180°. Finally push the chain inwards and remove the tensioner through the front plate aperture.

NOTE: In some cases it may be necessary to remove the camshaft sprocket to obtain sufficient chain movement.

Refitting

1 Offer up the tensioner as illustrated in Fig. E-25. Push chain inwards and place tensioner in position.

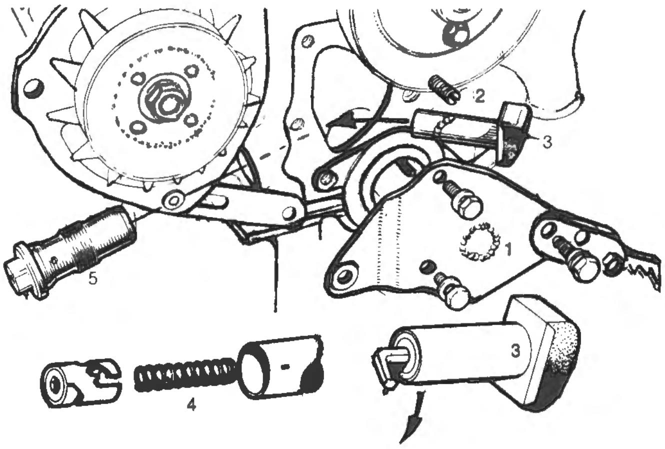


Fig. E-25

REMOVING CHAIN TENSIONER

1 ENGINE FRONT PLATE
2 CHAIN GUIDE ADJUSTER
3 SLIPPER ASSEMBLY
4 SLIPPER COMPONENTS
5 TENSIONER BODY
6 TIMING POINTER PLATE

2 Move the adjuster to tension the chain correctly.

3 Fit the spring and plunger in the tensioner and lock them in place with a ⅛ in Allen key by turning plunger clockwise.

4 Screw the tensioner body whilst holding the tensioner against the chain.

5 Remove the set screw (8) Fig. E-24 and release the plunger by turning the key anti-clockwise.

6 Reverse the remainder of the removing operations.

CAMSHAFT AND FOLLOWERS

Removing

1 Carry out operations 1 to 5 of Timing Chain Removal.

2 Evenly slacken the camshaft carrier bolts in a diagonal sequence until the valve spring pressure is released.

3 Remove the camshaft carrier bolts.

4 Raise the camshaft carrier sufficiently to allow the followers to clear the engine valves.

5 Push the followers into the camshaft carrier until they contact the camshaft.

6 Continue to remove the carrier assembly by easing it away from the cylinder head and quickly revolve it to prevent the followers from falling out.

7 On the bench remove the cam followers with their adjusting shims, maintaining them in the order in which they were removed.

8 Remove the camshaft in the direction of arrow. Fig. E-26.

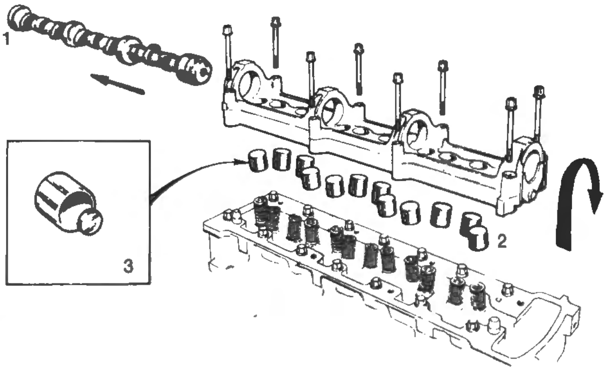


Fig. E-26

REMOVING CAM CARRIER ASSEMBLY

1 CAMSHAFT
2 CAM CARRIERS AND FOLLOWERS
3 INSET — CAMFOLLOWER AND VALVE CLEARANCE ADJUSTING SHIM

Refitting

1 Fit camshaft locating plate to the carrier if previously removed.

2 Lubricate the cam bearings and fit the camshaft in opposite direction to arrow. Fig. E-26.

3 Lay the carrier on its side, lubricate the followers and fit them to their respective bores. Ref. Fig. E-27.

4 Turn carrier upside down, smear one side of adjusting shims with petroleum jelly and fit them to their respective followers.

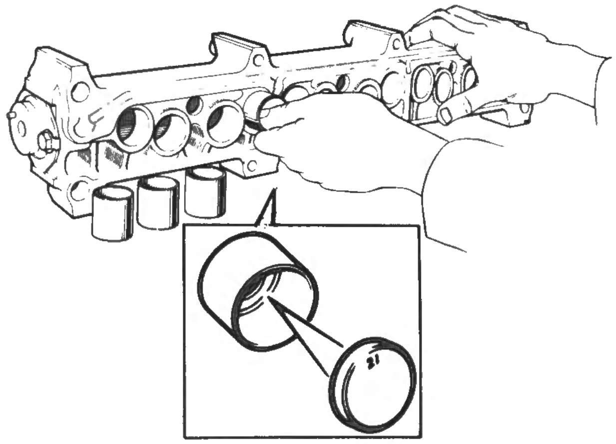


Fig. E-27

REPLACING CAMFOLLOWERS

5. Check the bottom face of carrier for burrs or damage, as any protrusions will affect valve clearance. Also check that the carrier bolt thread and the respective threads in the cylinder head are free of foreign material.
6. Position the carrier over the two locating dowels in the cylinder head, taking care not to dislodge the adjusting shims.
7. Fit the carrier bolts and gradually tighten them in a diagonal sequence to 27 Nm (20 lb.f.ft).

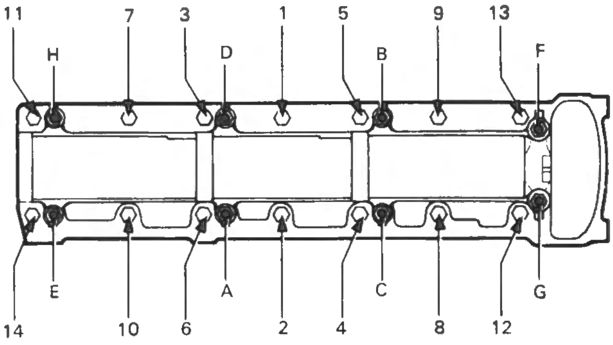


Fig. E-28

CYLINDER HEAD AND CAM CARRIER
BOLT TIGHTENING SEQUENCE

8. Revolve the camshaft several times.
9. Check the valve clearances and adjust as necessary.
10. Set and check valve timing.
11. Replace and reconnect the remaining components by reversing the removing procedure where necessary.

VALVE CLEARANCE ADJUSTMENT

1. Remove the camshaft carrier.
2. Individually remove from the carrier the followers of the valves that require adjustment.
3. Remove and check the thickness of the adjusting shims on the particular valves.
4. Using previously recorded clearance, calculate the shim thickness required to give the correct clearance.

Example:

Standard clearance of Exhaust Valve	0.46 mm	(0.018 in)
Actual clearance previously measured and recorded	0.25 mm	(0.010 in)
Difference being	0.21 mm	(0.008 in)
The shim removed from tappet	2.54 mm	(0.100 in)
Less difference	0.21 mm	(0.008 in)
Shim required	2.33 mm	(0.092 in)

Shims are available in steps of 0.05 mm (0.002 in) from 2.03 mm (0.080 in) to 3.50 mm (0.138 in).

5. Select the shim required, smear one side with petroleum jelly and fit to appropriate cam follower.
6. Refit follower to its original bore.
7. Repeat operations for other valves requiring adjustment.
8. Carry out balance of operation as detailed under Camshaft.

CYLINDER HEAD

Removing

1. Disconnect battery by removing earth lead from thermostat housing.
2. Remove radiator cap. Drain cooling system by removing bottom hose at radiator. Drain engine block by removing plug from right hand side of engine near dipstick.
3. Remove air cleaner assembly from carburetter.
4. Disconnect choke cable and accelerator cable from carburetter mounting points.
5. Remove plastic clip holding cables together at fuel pump. Remove fuel inlet hose from pump.
6. Disconnect brake booster vacuum hose at inlet manifold.
7. Disconnect distributor vacuum pipe at carburetter.
8. Remove complete breather pipe carburetter to cam cover.
9. Disconnect fuel pipe from carburetter float bowl, remove clip from thermostat housing and remove pipe from fuel pump.
10. Remove accelerator return spring from carburetter and remove four nuts and spring washers securing carburetter to inlet manifold.
11. Remove carburetter spacer block and heat shield from inlet manifold.
12. Disconnect exhaust pipe front flange at manifold by removing two nuts and flat washers, also remove bolt, nut and spring washer at mounting near bell housing.

13 Remove two bolts and spring washers from clips holding battery cable to cylinder head.

14 Remove top radiator hose complete from thermostat housing and radiator.

15 Remove heater pipes and by pass hose and temperature gauge wire.

16 Remove fuel pump and spacer block from tappet cover, two bolts and spring washers.

17 Remove eight bolts and 'O' ring from tappet cover and remove cover and gasket.

18 Remove distributor cap and leads from spark plugs. It may be necessary to move distributor by rotating it so that it does not foul cylinder head when being removed.

19 Remove oil return hose cylinder head to engine block — RHS (rubber hose push fit).

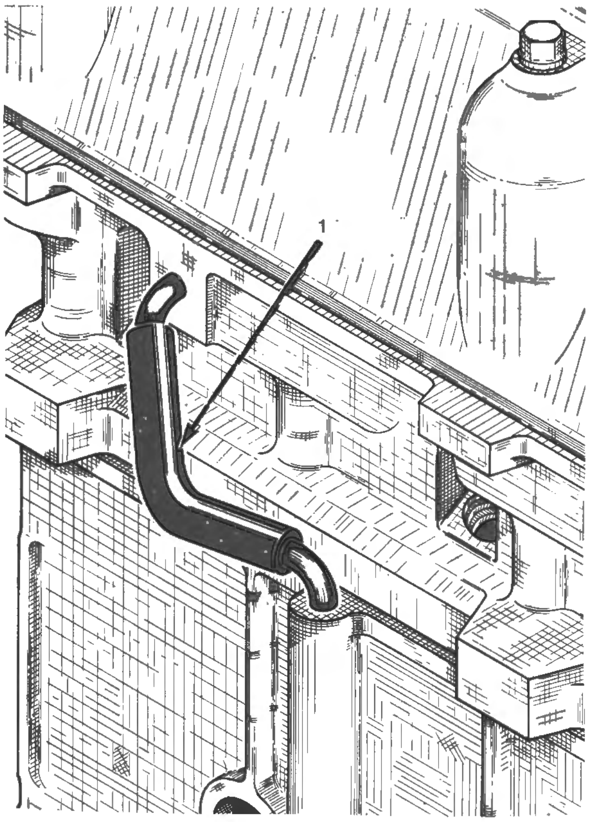


Fig. E-29

CYLINDER HEAD OIL RETURN (EARLY MODELS)

1 CONNECTING HOSE

20 Lock timing chain tensioner.

21 Rotate engine to TDC No. 1 cylinder.

22 Remove camshaft sprocket.

23 Slacken the head bolts evenly in diagonal sequence.

24 Remove cylinder head assembly.

NOTE: Two dowels locate the cylinder head to the block. The dowels are located on the right hand side of the block adjacent to cylinders Nos. 1 and 6.

Dismantling

1 Remove the thermostat housing.

2 Remove the camshaft carrier.

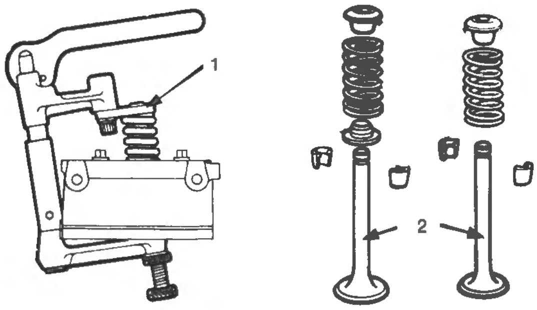


Fig. E-30

VALVE REMOVAL

1 VALVE LIFTER

2 INLET AND EXHAUST VALVE ASSEMBLIES

3 Compress the valve springs and remove the valve cotters.

4 Remove the valve spring cups, springs and spring seat seal assemblies.

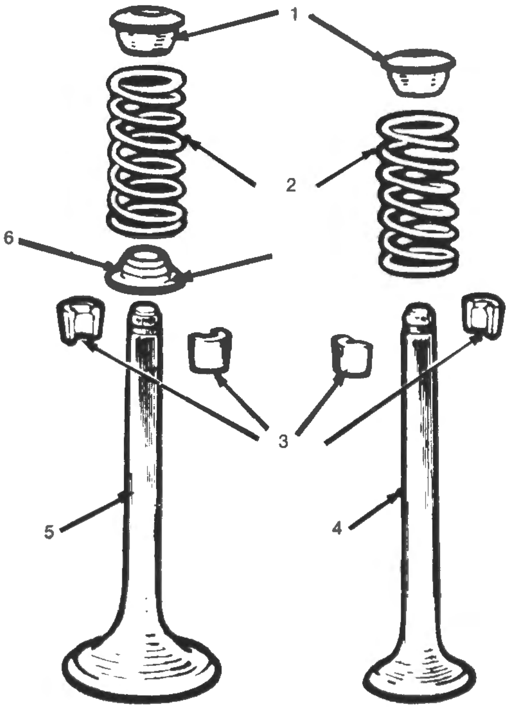


Fig. E-31

VALVES AND VALVE COMPONENTS

1 SPRING CUP

2 VALVE SPRINGS

3 VALVE COTTERS

4 EXHAUST VALVE

5 INLET VALVE

6 SPRING SEAT AND SEAL ASSEMBLY

Decarbonising

1 Plug the water passage holes with clean cloth.

NOTE: The engine may be rotated freely as the chain is disengaged from the crankshaft pulley.

2 Clean the carbon deposit from the piston crowns, cylinder block, cylinder head, combustion chambers, and valve ports, using a carbon removing brush or blunt scraper.

NOTE: Exercise care when cleaning the aluminium alloy pistons as grooving may lead to piston failure. Clean the valve stems and heads with a wire buff.

3 Remove all traces of carbon dust with compressed air then thoroughly clean all parts with an air drying cleaning solvent.
Inspect the cylinder head and valve seats for cracking, burning, pitting and distortion.

VALVES

Examine the valves for stem wear or damaged, cracked or burnt heads, and pitting of faces. Valves in a pitted condition must be refaced or renewed.

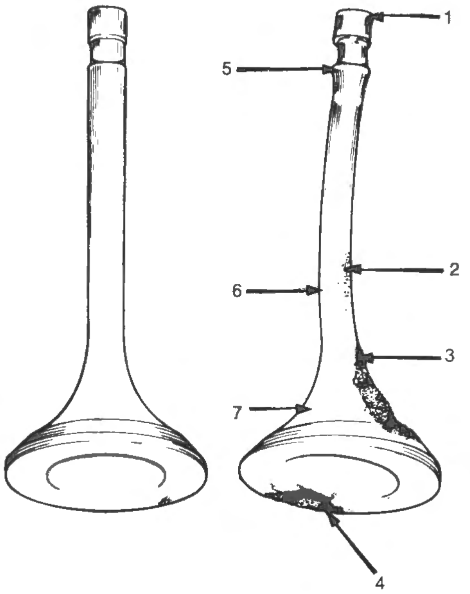


Fig. E-32

ADVERSE ENGINE VALVE CONDITIONS

1 HAMMERED TIP
2 CORROSIVE PITTING
3 CARBON
4 BURNED SEATING
5 HAMMERED COTTER GROOVE
6 BENT STEM
7 BENT HEAD

Check the fit of the valve stems in their respective bores. Excessive or insufficient clearance will affect engine operation and performance.

If the valve stem to bore clearance is excessive, check the clearance using a new valve, and if the clearance is still outside that quoted in the GENERAL DATA Section, then valves with oversize stems should be fitted. Fitting of valves with oversize stems is accomplished with the use of guide reamers.

Worn valve guides will not permit correct centering of the valve seat reconditioning equipment or the valve itself.

Check the valve spring compression.

VALVE SEATS

If the valve seats show signs of pitting or unevenness they should be trued by the use of seat cutters or valve seat grinding equipment.

There are a number of suitable valve seat grinders available and the recommendation of the equipment manufacturer should be carefully followed to obtain the proper results. Prior to refacing the seats ensure that the valve guides and seats are thoroughly clean. Any carbon deposits remaining in the valve guide will not allow correct centering of the grinding or cutting equipment pilot.

Worn valve seats usually have a glass-hard surface and a glaze breaker should be used to prepare the valve seat surface when using seat cutters.

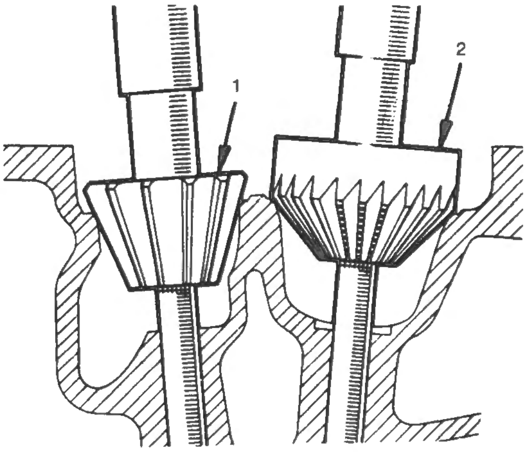


Fig. E-33

CUTTING AND NARROWING VALVE SEATS

1 CUTTING THE SEAT 2 NARROWING THE SEATS

Remove only enough metal to eliminate pits and true the surface. Check the width of the seats after refacing and narrow them if there is excess of the specified width. Use 20 deg. and 10 deg. cutters and ensure that the seat remains in a positive position relative to the centre of the valve face. Refer Fig. E-33.

If the valve seats cannot be restored by cutting or grinding, valve seat inserts should be fitted.

VALVE SEAT INSERTS

1 Machine the head to the dimension given in Fig. E-34.

2 Press in the special inserts.

3 Cut new seats on the inserts to the dimensions given. Ensure that the throats of the inserts blend to those of the cylinder head.

VALVE LAPPING AND SEAT TESTING

1 Lightly lap the valves into the seats with fine grinding compound. The refacing and reseating operations should leave the finished surfaces smooth and true so that minimum lapping is

required. Excessive lapping will groove the valve face preventing a good seat when hot.

2 Test valve for concentricity with seats and for correct sealing using prussian blue coat the valve face with a thin coat of blue and turn it against its seat. If the valve seal is concentric with the valve guide a mark will be made all around the seat, while if the seat is not concentric with the guide, a mark will be made only on one side of the seat. Next, coat the valve seat lightly with prussian blue. Rotate the valve against the seal to determine if the valve face is concentric with the valve stem, and if the valve is seating all the way around.

NOTE: Both prussian blue tests are necessary to prove correct seating is obtained.

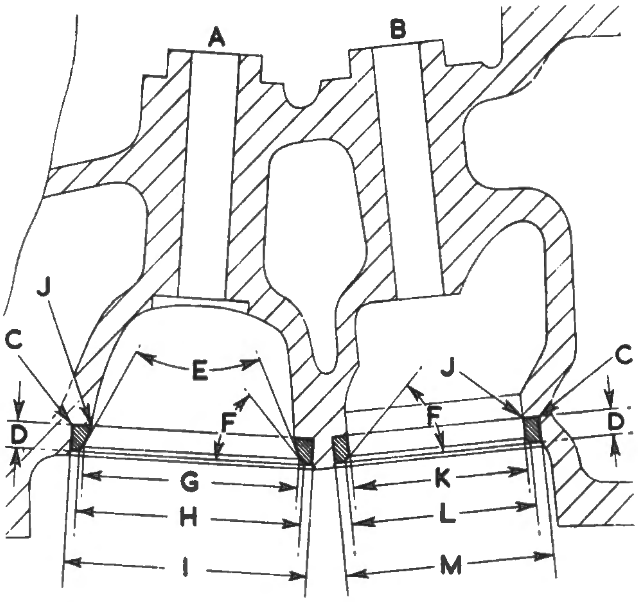


Fig. E-34

VALVE SEAT INSERT MACHINING DIMENSIONS

INLET (A)

C	Maximum radius 0.25 mm (0.010 in)
D	4.43-4.455 mm (0.1744 to 0.1754 in)
E	Included angle 50 deg.
F	45 deg.
G	35.44-35.69 mm (1.395 to 1.405 in)
H	38.05-38.13 mm (1.498 to 1.501 in)
I	41.135-41.16 mm (1.6195 to 1.6205 in)
J	Blend insert to throat diameter

EXHAUST (B)

C	Maximum radius 0.25 mm (0.010 in)
D	4.43-4.455 mm (0.1744 to 0.1754 in)
E	45 deg.
J	Blend insert to throat diameter
K	28.19-28.7 mm (1.11 to 1.13 in)
L	30.86-30.94 mm (1.215 to 1.218 in)
M	34.20-34.23 mm (1.3465 to 1.3475 in)

Assembling the Cylinder Head

1 Lubricate the valve stems with E.P. 140 oil and fit the valves to their respective seats.

2 Fit new valve spring seat and seal assemblies to the inlet valves.

3 Fit the valve spring cups and cotters.

Refitting the Cylinder Head

Refitting is the reversal of the removing procedure noting the following:

(a) Ensure that the cylinder head bolt holes on the cylinder block are free of foreign material.

(b) Check the cylinder block face for damage, burrs and abrasions, particularly check the area around the bolt holes. Rectify as necessary.

(c) Position the cylinder head gasket over the dowels in the cylinder block.

(d) The gasket must be installed dry.

(e) Tighten the head bolts gradually in diagonal sequence. Refer Fig. E-28.

(f) Refit camshaft carrier assembly.

(g) Check and adjust the valve clearances and valve timing.

FLYWHEEL AND STARTER RING GEAR (MANUAL TRANSMISSION)

The removing, overhaul and replacement of these components is the same as the '442' Engine with the exception that the balance bolts are not used. Refer Section D.

CONVERTER DRIVE PLATE AND STARTER RING GEAR ASSEMBLY

This component is serviced as an assembly only.
Removing and Refitting Refer Section M.

CRANKSHAFT REAR OIL SEAL

The removing and refitting of the crankshaft rear oil seal is the same as the '442' engine with the exception that it is necessary to remove the starter motor to avoid it fouling the handle of the removing tool. Refer Section D. Figs. D-68 and 69.

FRONT ENGINE MOUNTINGS (BOTH SIDES)

Removing

1 Disconnect the battery.

2 Fit the front engine lifting bracket.

3 Support the weight of the engine with lifting equipment.

4 Refer Fig. E-35. Remove nut spring washers and flat washer (1), securing the mounting to the front cross member.

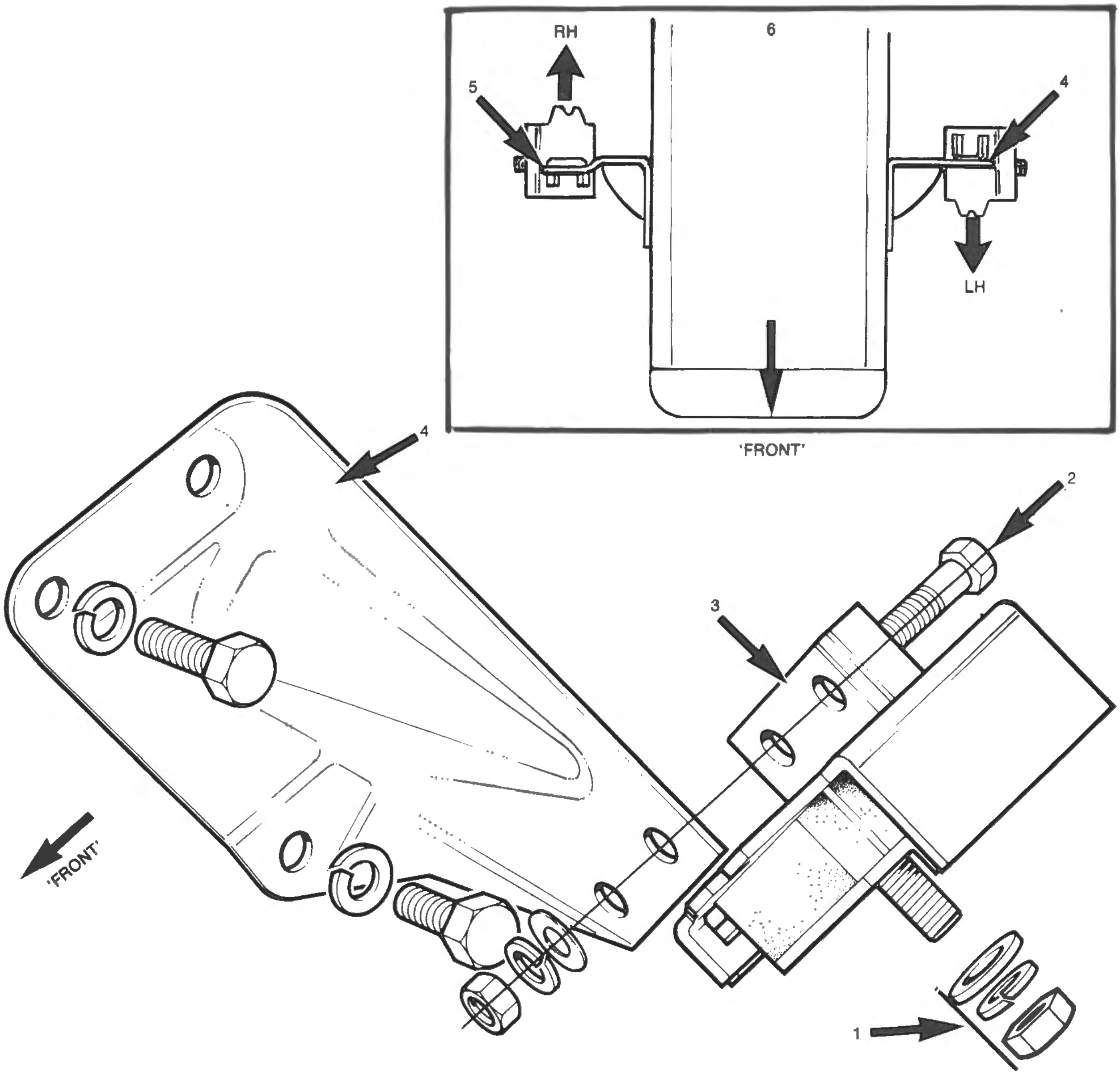


Fig. E-35

ARRANGEMENT FRONT ENGINE MOUNTS

1 NUTS AND WASHERS MOUNTINGS TO CROSS MEMBER
2 BOLTS, NUTS AND WASHERS MOUNTING CHANNEL TO ENGINE BRACKETS
3 MOUNTING ASSEMBLY RH AND LH — LH SHOWN
4 ENGINE BRACKET LH
5 ENGINE BRACKET RH
6 CORRECT POSITION OF BRACKETS INSET

5 Remove the two bolts, nuts and spring washers (2) securing the mountings (3) to the engine bracket (4).

6 Raise the engine and remove the mounting.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

(a) The engine mounting bracket (4) is positioned outside the channel on the mounting on Left Hand side and inside the channel on the Right Hand side. Fig. E-35.

(b) The mounting holes in the front cross member brackets are elongated. Ensure the power unit is situated vertically on final tightening of nut-washer assembly (1).

(c) Should a mounting be replaced on one side only slacken nut-washer assembly (1) on opposite mounting to assist centralising of the unit.

POWER UNIT REMOVAL
(Manual Transmission)

The power unit assembly can be removed through the bonnet aperture and the following basic method refers to the column shift models. Refer to Section 'L' for details of the floor shift selector mechanism.

End of section refers to items on the Automatic Models and Section 'M' refers to the floor shift selector.

Removing

1. Disconnect battery.
2. Remove the bonnet.
3. Drain the cooling system by removing the bottom radiator hose and cylinder block drain plug.
4. Disconnect the engine wiring: coil, starter motor, thermal transmitter, oil light switch.
5. Disconnect the power brake vacuum unit pipe, fuel hose from inlet pipe and top radiator hose from thermostat housing.
6. Unclip the radiator overflow hose, remove the bracket bolts and remove the radiator.
7. Remove the fan and extension.
8. Disconnect the heater hose from the thermostat housing and water pump.
9. Remove the air cleaner cover and element.
10. Disconnect the choke and accelerator control cables and place to one side.
11. Disconnect the exhaust manifold flange.
12. Fit the engine lifting brackets.
13. Raise the front of the vehicle and support it on stands.
14. Drain the engine and transmission oils.
15. Remove the bolt from the exhaust bracket and lower the exhaust pipe.
16. Remove the clutch adjusting rod from the release lever and remove the return spring.
17. Disconnect the gear shift linkage from the cross-shaft levers to selector levers.
18. Remove the two bolts securing the clutch cross-shaft bearing to flywheel housing and press the shaft into the body side member bearing to clear the flywheel housing.
19. Remove the two bolts securing the gear shift, cross-shaft bearing to the flywheel housing and press the cross-shaft into the side member bearing. Leave the upper gear shift rods attached to the cross-shaft arms.

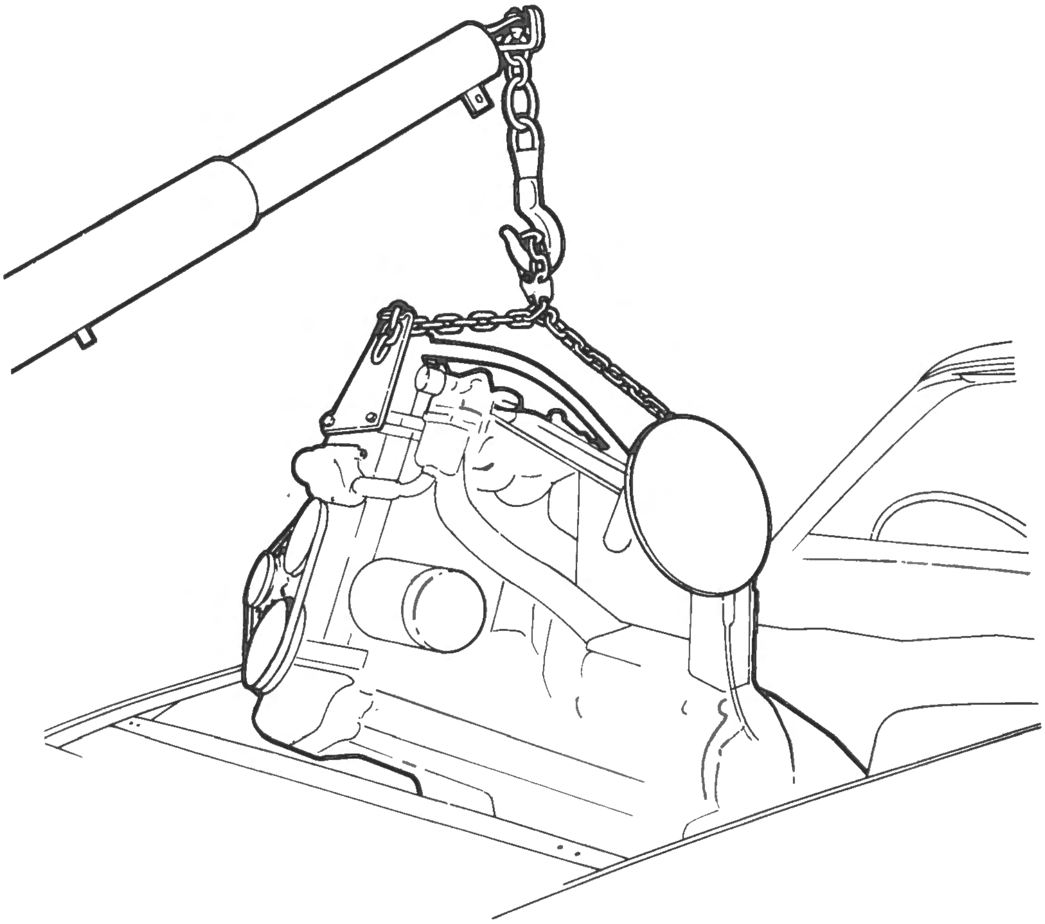


Fig. E-36

REMOVING POWER UNIT

20 Disconnect the speedometer drive cable from the extension housing.

21 Disconnect the wiring from the reverse light switch.

22 Remove the four bolts and two clamps from the rear universal joint and remove the propeller shaft.

23 Take the weight off the power unit.

24 Support the transmission, remove the bolts securing the rear mounting, the bolts securing the cross member to body and remove the cross member.

25 Remove the nut and washers from the RH engine mounting and the two bolts from the LH mounting.

26 Lift the power unit, raise the transmission with a jack until the sump is clear of the front cross member and ease forward, lower the jack and continue lifting the power unit until it is clear of the engine compartment.

POWER UNIT REMOVAL (Automatic Transmission)

1 Disconnect the transmission cooling pipes from the lower radiator tank.

2 Disconnect the cooling pipes from the transmission, unclip from the sump bracket and remove the pipes.

3 Remove the two bolts securing the selector cross-shaft mounting bracket to the transmission. Disconnect the selector rod at the transmission and remove the cross-shaft from the body pivot mounting. Loosen the top selector adjusting nut (top) and turn the cross-shaft assembly to one side.

4 Disconnect the wiring from the inhibitor and reverse light switch.

Refitting

1 Lift the power unit to clear the front panel, lowering and manoeuvring it into position with the transmission supported so that the RH front mounting can be located in the support on the cross member and the LH mounting can then be fitted into position.

2 Reverse the removing procedure, refill the engine and transmission with the recommended lubricant and refill the cooling system with coolant.

3 Start the engine and check correct functioning of all indicator lights and oil and coolant connections. Stop the engine and check oil and coolant levels and top up where necessary.

4 Adjust the automatic transmission pressures, clutch and gear shift mechanism where applicable.

5 Road test.

ENGINE ADAPTOR PLATE

Removing

1 Remove the power unit.

2 Remove the transmission.

3 Remove the flywheel/converter drive plate.

4 Remove the starter motor.

5 Remove the oil reservoir.

6 Remove the eight bolts, spring and flat washers securing the plate to the engine.

7 Remove the plate from the locating dowels and gasket.

8 Place the plate on a flat surface and carefully drift out the crankshaft rear oil seal.

Refitting

1 Clean and inspect the plate for damage.

2 Check that the engine crankcase breather passage is clear. Ref. Fig. E-37.

3 Clean the gasket faces on the back of the engine.

4 Apply a coat of Permatex No. 3 jointing compound to the gasket surfaces on the plate.

5 Locate the new gasket on the plate ensuring it is correctly positioned over the dowels.

6 Fit the plate to the engine and locate the eight bolts, flat and spring washers.

7 Tighten all bolts evenly.

8 Fit a new crankshaft rear oil seal using service tool 18GA044 as detailed in Section D. Fig. D-69.

9 Reverse items 1 to 5 of removing in accordance with previous methods.

PISTON RINGS AND CONNECTING ROD ASSEMBLIES

Removing

1 Remove the power unit.

2 Remove the transmission as necessary.

3 Remove the cylinder head.

4 Remove the oil reservoir oil pick up pipe assembly and oil pump.

5 Remove any traces of carbon from around the top of the cylinder bores.

6 Check the top of the bores for wear. If a ridge is present it should be removed prior to withdrawing the piston assemblies or damage to the piston could result.

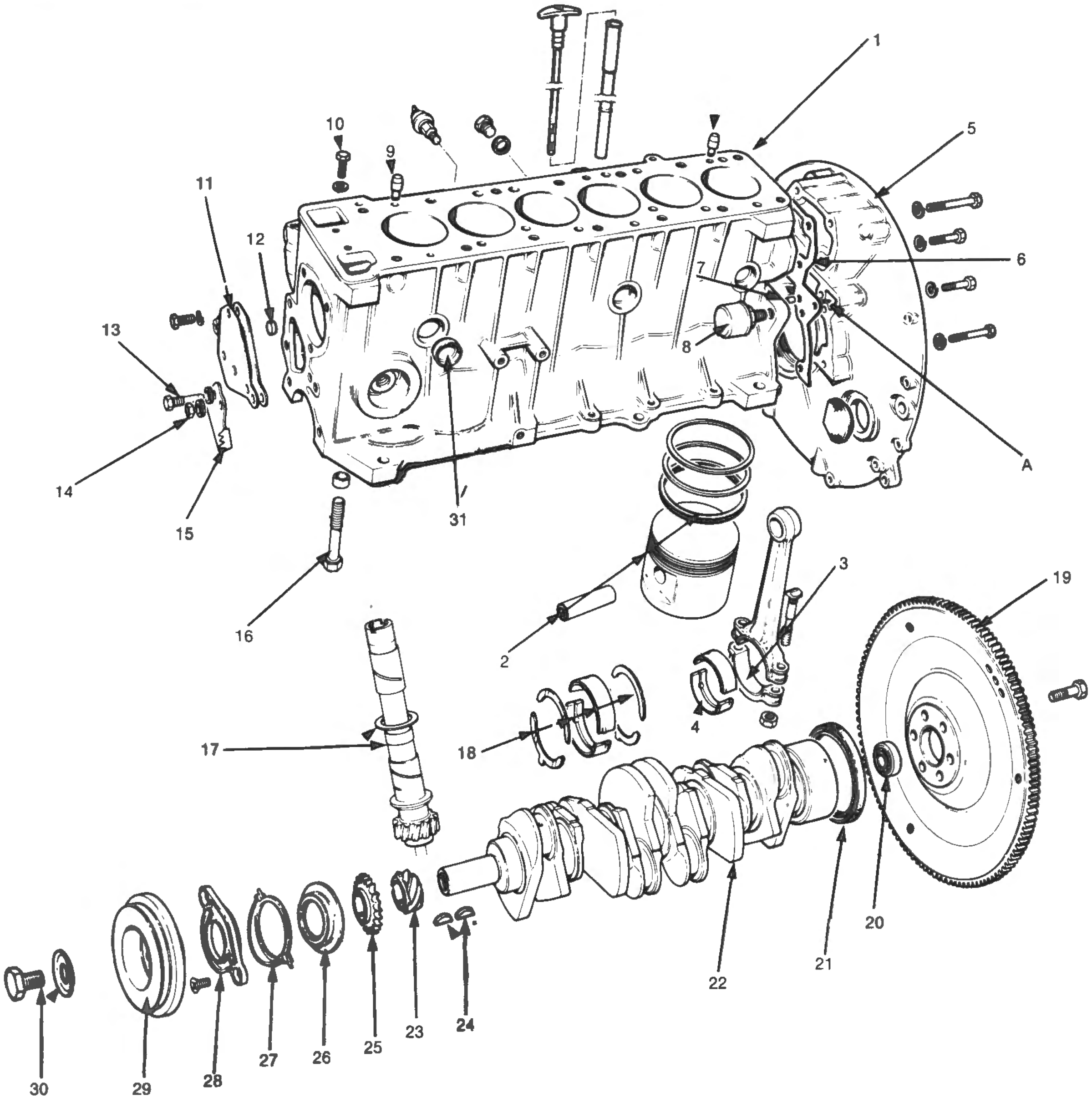


Fig. E-37

LAYOUT OF CYLINDER BLOCK AND ASSOCIATED COMPONENTS

1	CYLINDER BLOCK AND CRANKCASE	17	DISTRIBUTOR/OIL PUMP DRIVE SHAFT AND THRUST WASHER
2	PISTON AND RING ASSEMBLY	18	MAIN BEARING AND CRANKSHAFT THRUST WASHERS
3	CONNECTING ROD AND CAP ASSEMBLY	19	FLYWHEEL AND STARTER RING GEAR ASSEMBLY
4	CONNECTING ROD BEARING	20	SPIGOT BEARING
5	ADAPTOR PLATE	21	CRANKSHAFT REAR OIL SEAL
6	GASKET ADAPTOR PLATE	22	CRANKSHAFT
7	DOWEL'S PLATE TO CYLINDER BLOCK	23	CRANKSHAFT GEAR
8	CRANKCASE VENTILATOR FILTER	24	CRANKSHAFT KEYS
9	DOWELS CYLINDER HEAD LOCATION	25	CRANKSHAFT SPROCKET
10	SCREWS CHAIN GUIDES	26	FRONT OIL SEAL
11	FRONT ENGINE PLATE AND GASKET	27	OIL RESERVOIR OIL SEAL
12	GALLERY PLUG	28	SEAL ADAPTOR
13	DOWEL BOLT CHAIN GUIDE	29	CRANKSHAFT PULLEY AND DAMPER ASSEMBLY
14	GUIDE ADJUSTER LOCKNUT AND WASHER	30	PULLEY RETAINING BOLT AND LOCKNUT
15	TIMING POINTER PLATE	31	CORE PLUGS
16	MAIN BEARING CAP BOLTS AND RING DOWELS	'A'	FILTER PORT

7 Carefully remove carbon from the top of the piston crowns.

8 Mark each piston by number in its forward position.

NOTE: The pistons have offset gudgeon pin bosses and can only be fitted one way; to the 'FRONT' of the engine as shown in Fig. E-38.

9 Mark the connecting rods and caps so that they may be assembled in their correct order. Ref. Fig. E-38.

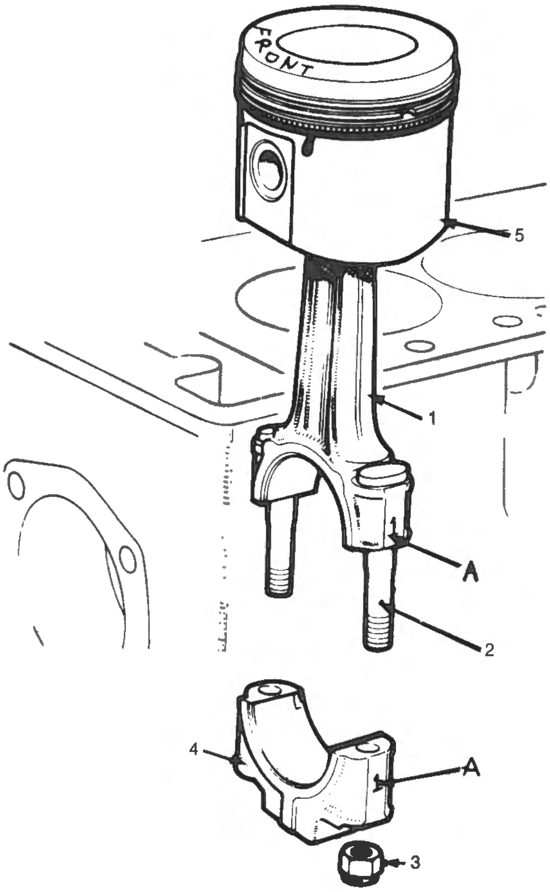


Fig. E-38

PISTON AND CONNECTING ROD MARKING

1 CONNECTING ROD
2 CONNECTING ROD CAP BOLT
3 CONNECTING ROD CAP NUT
4 CONNECTING ROD CAP PISTON
5 PISTON

10 Remove the self locking connecting rod cap nuts.

NOTE: It is advisable that these nuts only be used for checking purposes. New nuts must be used on final assembly.

11 Remove the connecting rod caps and bearings.

12 Remove the pistons and connecting rods out through the top.

13 Temporarily refit the connecting rod caps and bearing shells to their respective rods.

Dismantling

1 Clamp the flat section bar of the gudgeon pin remover-replacer 18GA06 in a vice long post uppermost.

2 Remove the screw from the tool and push it through the gudgeon pin until the shoulder of the large diameter contacts the end of the gudgeon pin. Refer 'A' Fig. E-39.

3 Position the piston and connecting rod assembly against the end of the long post of the tool and attach the nut and thrust bearing assembly to the screw.

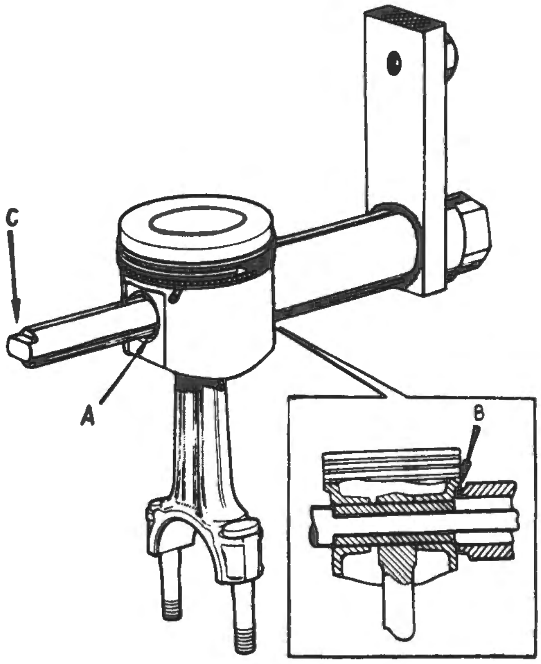


Fig. E-39

REMOVING THE GUDGEON PIN

NOTE: Ensure that the flat section of the piston is squarely mounted against the tool post with the post cutaway positioned directly below the ring land. Refer 'B', Fig. E-39.

4 Mark the piston, gudgeon pin, and connecting rod so that they can be assembled in their original positions.

5 Withdraw the gudgeon pin by turning the nut until the pin is fully retracted out of the piston and connecting rod into the tool post.

NOTE: Support the connecting rod during the operation to prevent it falling when the pin is removed. Should the screw begin rotating when turning the nut hold the end 'C' (Fig. E-39) with a spanner.

6 Refit the gudgeon pin to the piston from which it was removed.
Avoid mixing gudgeon pins and pistons.

7 Remove the piston rings.

Checking

1 Carefully clean the carbon deposits from the piston to ensure the ring grooves are clean.

2 Wash all parts in cleaning solvent.

3 Inspect the cylinder bores for ridging, excessive wear and distortion.

4 Check the wear pattern on the thrust faces of the piston for indications of incorrect connecting rod alignment, incorrect piston shape, scuffing, scoring or seizing.

5 Check piston sizes with a micrometer and measure the piston clearance.

6 Check the piston ring gaps at the lower ends of the cylinder bores, Fig. E-40.

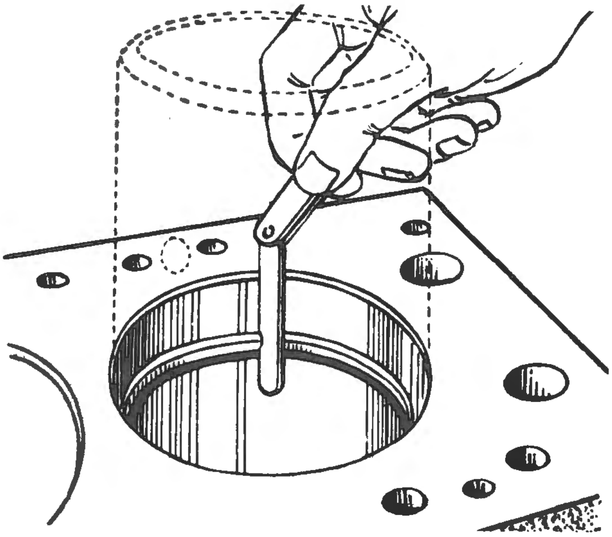


Fig. E-40

CHECKING PISTON RING GAP

7 Check the piston ring to groove clearance, Fig. E-41.

8 Check the big end and gudgeon pin bores of the connecting rods for indications of out of roundness and fretting and distortion of the connecting rod cap.

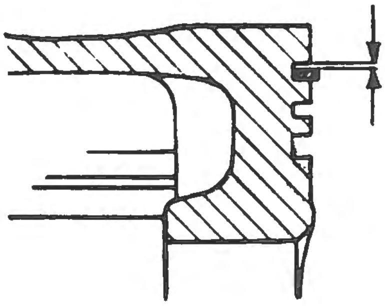


Fig. E-41

CHECKING PISTON RING TO GROOVE CLEARANCE

Assembling

1 Lubricate the gudgeon pin with thin oil and fit it into the bore on one side of the piston.

2 Clamp the gudgeon pin remover/replacer 18GA06, in a vice with a small length boss uppermost.

3 Position the tool screw through the gudgeon pin, connecting rod and tool and fit the nut and thrust bearing assembly to the screw. Refer Fig. E-39.

NOTE: Ensure that the cutaway portion of the tool post is positioned directly below the ring land and that the connecting rod is positioned in the piston: so that the squirt hole in the big end faces the right hand side of the engine.

4 Screw the nut up with the fingers until resistance is felt and check that the gudgeon pin is squarely aligned with the connecting rod. Ensure that the face of the tool is also squarely aligned on the flat face of the piston.

5 Set a suitable tension wrench to 13.5 Nm (10 lb.f.ft.) This represents the minimum load for an acceptable fit between the gudgeon pin and connecting rod.

6 Using the tension wrench on the nut, and holding the screw, pull the gudgeon pin in until the shoulder of the tool screw is 1.59 mm (1/16 in) below the piston face. Refer Fig. E-42. When correctly fitted with the connecting rod midway between the piston bosses, the ends of the gudgeon pin should be flush with the flat faces of the piston.

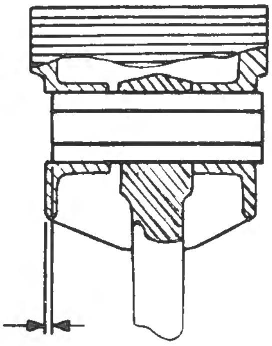


Fig. E-42

POSITION OF CORRECTLY FITTED GUDGEON PIN

NOTE: If the tension wrench has not broken throughout the pull, the fit of the gudgeon pin to the connecting rod is not acceptable and necessitates the renewal of components. The nut and screw of the tool should be kept well lubricated with engine oil to avoid excessive friction resulting in false tension wrench action.

7 Check that the piston pivots freely on the pin and is free to slide sideways. If stiffness exists, wash the assembly in fuel or kerosene, lubricate the gudgeon pin and recheck. If stiffness persists, dismantle and check for ingrained dirt or damage.

8 Check the piston and connecting rod for alignment.

9 Lubricate the gudgeon pin.

10 Fit the bottom rail of the oil control ring to the piston and position it below the bottom groove.

11 Fit the oil control expander into the bottom groove.

12 Move the bottom oil control ring rail up into the bottom groove.

13 Fit the top oil control rail into the bottom groove.

14 Check that the ends of the expander are butting but not overlapping.

15 Set the gaps of the rails and the expander at 90 degrees to each other.

16 Fit the second compression ring with the scalloped face of the ring towards the bottom of the piston.

17 Fit the top compression ring to the groove with the inner shouldered face towards the top of the piston. Refer Fig. E-43.

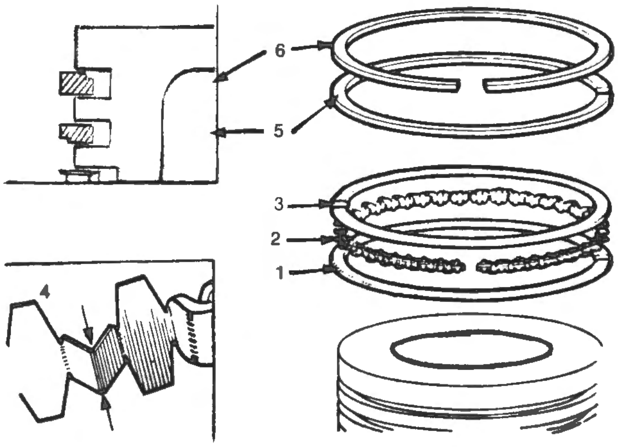


Fig. E-43

FITTING PISTON RINGS

1	OIL RING BOTTOM RAIL	4	EXPANDER ENDS BUTTED
2	OIL RING TOP RAIL	5	SECOND COMPRESSION RING
3	OIL RING EXPANDER	6	TOP COMPRESSION RING

Replacing (see Main and Connecting Rod Bearings)

1 Ensure that the connecting rod big end bores are clean and free from burrs or marks.

2 Clean the bearing shells and fit them to the connecting rods and caps. The shells are notched to fit the recesses machined in the rods and caps.

NOTE: Any foreign material between the bearing shells and connecting rod or cap will affect clearance and result in bearing failure.

3 Liberally lubricate the cylinder bores, pistons and connecting rod bearings with engine oil.

4 Compress the piston rings using a suitable ring compressor.

5 Enter the piston and connecting rod assembly to the cylinder bores from the top, ensuring that the oil jet holes in the connecting rods are facing the distributor side of the engine.

6 Gently tap the piston into the cylinder at the same time checking that the connecting rods centre on the crankpin.

7 With the connecting rod positioned on the crankshaft, fit the connecting rod cap and lower half bearing.

8 Fit NEW self-locking nuts to the connecting rod bolts and tighten them to the figure specified in the GENERAL DATA section.

NOTE: Connecting rod assemblies are weight graded and fitted to engines in sets. The grade is indicated by a letter stamped on the rod. Should a single rod replacement be necessary it is essential that a rod of the same letter grade is used.

9 Replace the remainder of the components removed, reassemble the engine.

MAIN AND CONNECTING ROD BEARINGS

General

To achieve maximum bearing service life the following conditions must apply.

1 Crankshaft journals to be parallel and concentric to within factory specifications.

2 Bearing housing bores to be parallel, and concentric to within the factory specifications. In the case of the main bearing housings correct alignment is essential.

3 Correct diametral clearances.

4 Steel backed reticular aluminium tin replacement bearings are used for the main and connecting rods, and are accurately bored to size in precision fixtures. To function satisfactorily a bearing must be seated firmly within its housing to enable heat to dissipate and overcome bearing to housing movement.

Bearing Housing

Remove all burrs from the bearing housing butt faces, assemble the housing and tighten to the specified torque. Measure the bearing housing at each end, vertically and horizontally and at an angle of 45°. Refer Fig. E-44.

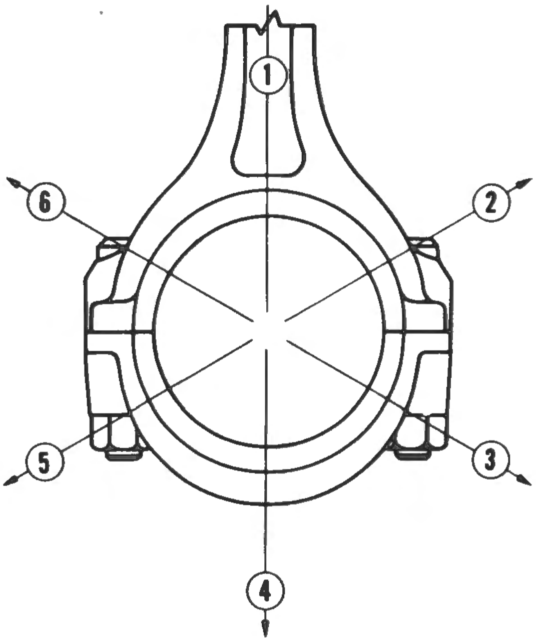


Fig. E-44

CHECKING CONNECTING ROD HOUSING

Main bearing housings must be checked for alignment with a straight edge. A housing that is not within the factory specified limits must be reconditioned by closing the butt face and re-machining the housing to standard specifications. Connecting rods that have been filed, must be replaced.

Bearing Spread

The bearing shell should seat firmly in its housing with effective shell pressure. The spread should be sufficient to enable the shell to be snapped into place without undue force. Refer Fig. E-45.

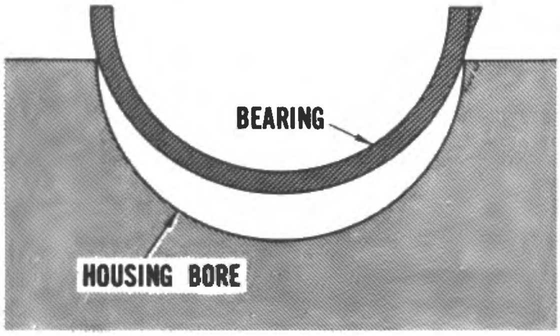


Fig. E-45

BEARING SPREAD

The bearing shell should snap into position and provide at least a 90% contact with the bearing housing.

Should a condition of excessive or insufficient bearing spread exist, it can be corrected by placing the bearing on a flat surface and lightly tapping it with a rubber mallet as indicated in Fig. E-46.

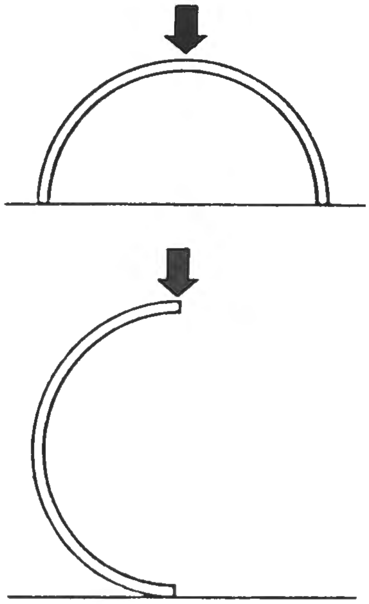


Fig. E-46

BEARING SPREAD ADJUSTMENT

Bearing shell spread may be adjusted by tapping with a rubber mallet as indicated. Top insufficient spread. Bottom excessive spread.

Bearing False Crush

Remove one bearing cap retaining nut or bolt. If movement of the butt is observed measure the gap with feeler gauge and retain the reading for further reference. This measurement is carried out without bearing shells fitted.

Bearing Crush

With the bearing shells fitted and the bearing caps torqued to the specified figure, release one side of the cap and measure the gap between the butt faces. Subtract the false crush reading – if any – and the resultant figure is the BEARING CRUSH. This figure should not be less than 0.07 mm (0.003 in) or greater than 0.15 mm (0.006 in).

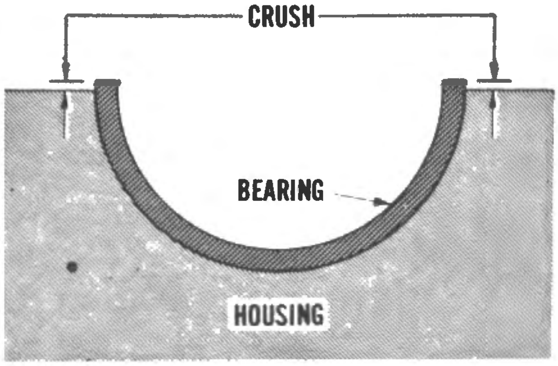


Fig. E-47

BEARING SHELL 'CRUSH HEIGHT'

Under no circumstances should the bearing shell be faced to bring it flush with the housing.

If the bearing does not lift the cap, this means that bearing crush does not exist, which indicates that the bearing housing is oversize, or that the bearing shells have been filed. Corrective action should be taken as found necessary.

Where the crush is found to be excessive, it indicates that the bearing cap has been filed, or the bearing itself has excessive height, probably due to burrs or dirt.

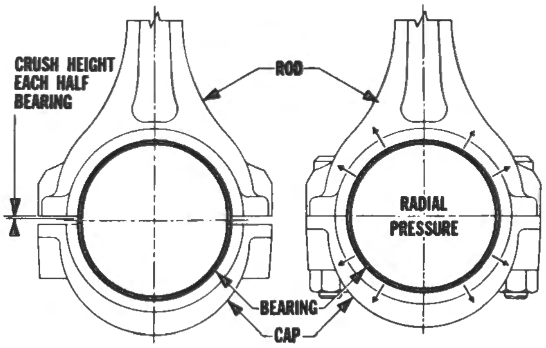


Fig. E-48

BEARING 'CRUSH'

Bearing Clearances

After the bearings have been correctly fitted, the running and side clearance should be checked. A quick method of checking all bearing clearances is by the use of 'Plastigauge'.

1 Remove the bearing cap and wipe any oil from the bearing journal.

2 Place a piece of 'Plastigauge' the full width of the bearing approximately 6.35 mm (¼ in) off centre.

3 Rotate crankshaft approximately 30° from BDC and refit the bearing cap. Tighten to the correct torque.

4 Remove the bearing cap. The flattened 'Plastigauge' will be found adhering to either the bearing or crankshaft journal.

5 Compare the width of the flattened 'Plastiguage' at its widest point with the graduations on the 'Plastigauge' envelope. The number within the graduation on the envelope indicates the bearing clearance in thousandths of an inch, or millimeters depending which side of the envelope is used.

New Bearings

Before fitting the bearings ensure that the replacement bearings are the correct size and type. The oil groove, oil holes, and bearing locating tongue are identical with those of the old bearings.

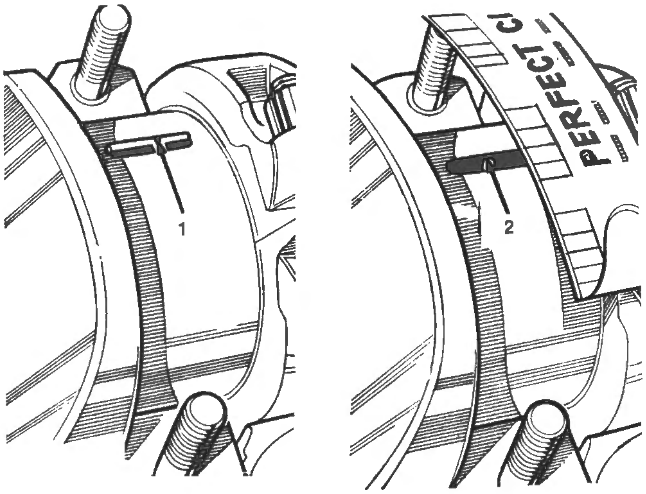


Fig. E-49

CHECKING BEARING CLEARANCE

1 'PLASTIGAUGE' IN POSITION 2 MEASURING

DISTRIBUTOR AND OIL PUMP DRIVE SHAFT

Removing

1 Disconnect the battery.

2 Raise vehicle on hoist or stands.

3 Release timing chain tensioner.

4 Remove cam cover.

5 Loosen harmonic balancer bolt.

6 Set timing marks to 1 TDC.

7 Remove camshaft sprocket.

8 Remove distributor.

9 Slacken alternator belt.

10 Fit engine support.

11 Remove harmonic balancer.

12 Remove sump and front seal.

13 Remove oil pump and quill shaft.

14 Move sprocket and drive gear forward.

15 Remove distributor shaft.

Refitting

1 Fit the thrust washer to the drive shaft.

2 Check that No. 1 piston is at TDC.

3 Fit the drive shaft with the drive slot positioned at 10 o'clock with the large offset segment uppermost, Refer B Fig. E-50.

4 Fit the distributor drive gear. As the teeth mesh the shaft will turn anti-clockwise through 90 degrees to bring the slot to 2 o'clock with the large offset segment uppermost, giving the correct position for No. 1 cylinder firing. Refer Fig. E-50.

5 Refit the distributor and check that the rotor arm is set for No. 1 cylinder with contact breaker points just opening.

6 Replace the remaining parts in the reverse order to which they were removed, check the valve timing and ignition timing.

CRANKSHAFT

Removing

1 Remove the power unit.

2 Remove the transmission.

3 Remove the clutch and flywheel or converter and drive plate.

4 Remove the engine back plate.

5 Remove oil pump, pick up assembly and drive shaft.

6 Remove the crankshaft pulley and damper assembly.

7 Remove the crankshaft oil seal retainer.

8 Remove the distributor drive shaft assembly.

9 Remove the connecting rod caps maintain them in their correct order for replacement.

10 Remove the main bearing caps. They are numbered 1 through 7 and arrowed to the 'FRONT'.

11 Lift the crankshaft from the engine and recover the thrust washers from both sides of No. 4 main bearing housing.

12 Remove the gear and sprocket keys as necessary.

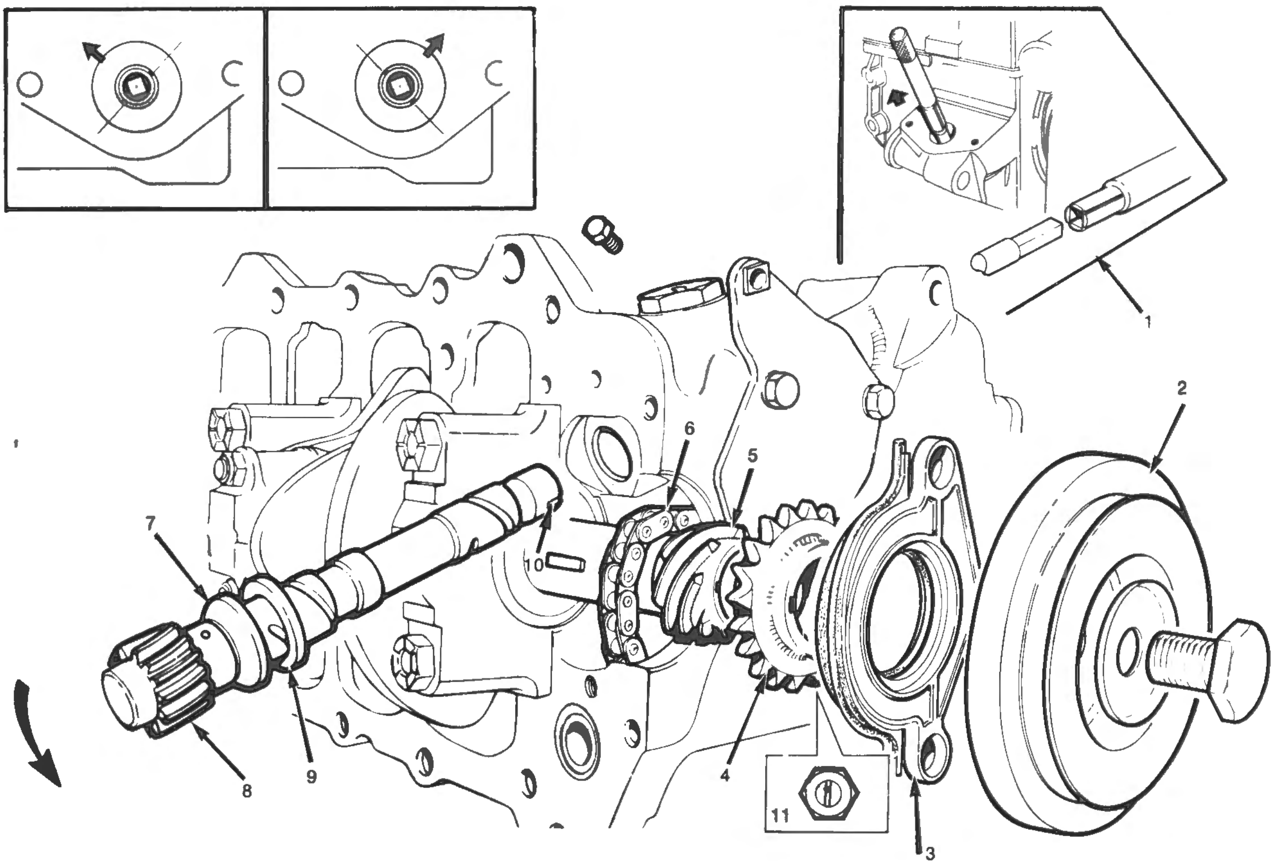


Fig. E-50

REMOVING DISTRIBUTOR/OIL PUMP
DRIVE SHAFT ASSEMBLY

1 OIL PUMP 'QUILL SHAFT' REMOVING
2 CRANKSHAFT PULLEY AND DAMPER ASSEMBLY
3 CRANKSHAFT/RESERVOIR OIL SEAL ADAPTOR ASSEMBLY
4 CRANKSHAFT SPROCKET
5 CRANKSHAFT GEAR (DISTRIBUTOR AND OIL PUMP SHAFT DRIVE)
6 TIMING CHAIN
7 DISTRIBUTOR/OIL PUMP DRIVE SHAFT ASSEMBLY
8 SHAFT DRIVEN GEAR
9 SHAFT THRUST WASHER
10 SHAFT 'OFFSET' DISTRIBUTOR DRIVE SLOT
11 CHAIN GUIDE ADJUSTER

Checking

1 Thoroughly clean the crankshaft ensuring that there is no foreign material remaining in the oil way.

2 Check the main and connecting rod journals for size and wear.

3 Check the condition of the thrust faces at No. 4 main journal.

4 Check the condition of the spigot bearing (Refer Section K).

Refitting

1 Fit bearing shells to their respective housings.

2 Lubricate the crankshaft journals and install the shaft in the crankcase.

3 Fit the upper half thrust washers in position in the crankcase at No. 4 main bearing web.

4 Install No. 4 main bearing cap with its thrust washers.

NOTE: The oil grooves in the thrust washers face the crankshaft.

5 Install the remainder of the main bearing caps and check the bearing clearances.

6 Torque the main bearing bolts to the figures quoted in GENERAL DATA.

7 Fit the connecting rod bearing shells and assemble the connecting rods to their shaft journals using new self-locking nuts on the bolts. Tighten the nuts to the figures quoted in GENERAL DATA.

8 Check and adjust as necessary the crankshaft end float.

9 Ensure the crankshaft turns freely.

10 Replace the remaining components by reversing the removing procedure and in accordance with previous methods. Note the following points:

(a) Clean the engine oil reservoir and oil pump pick up strainer.

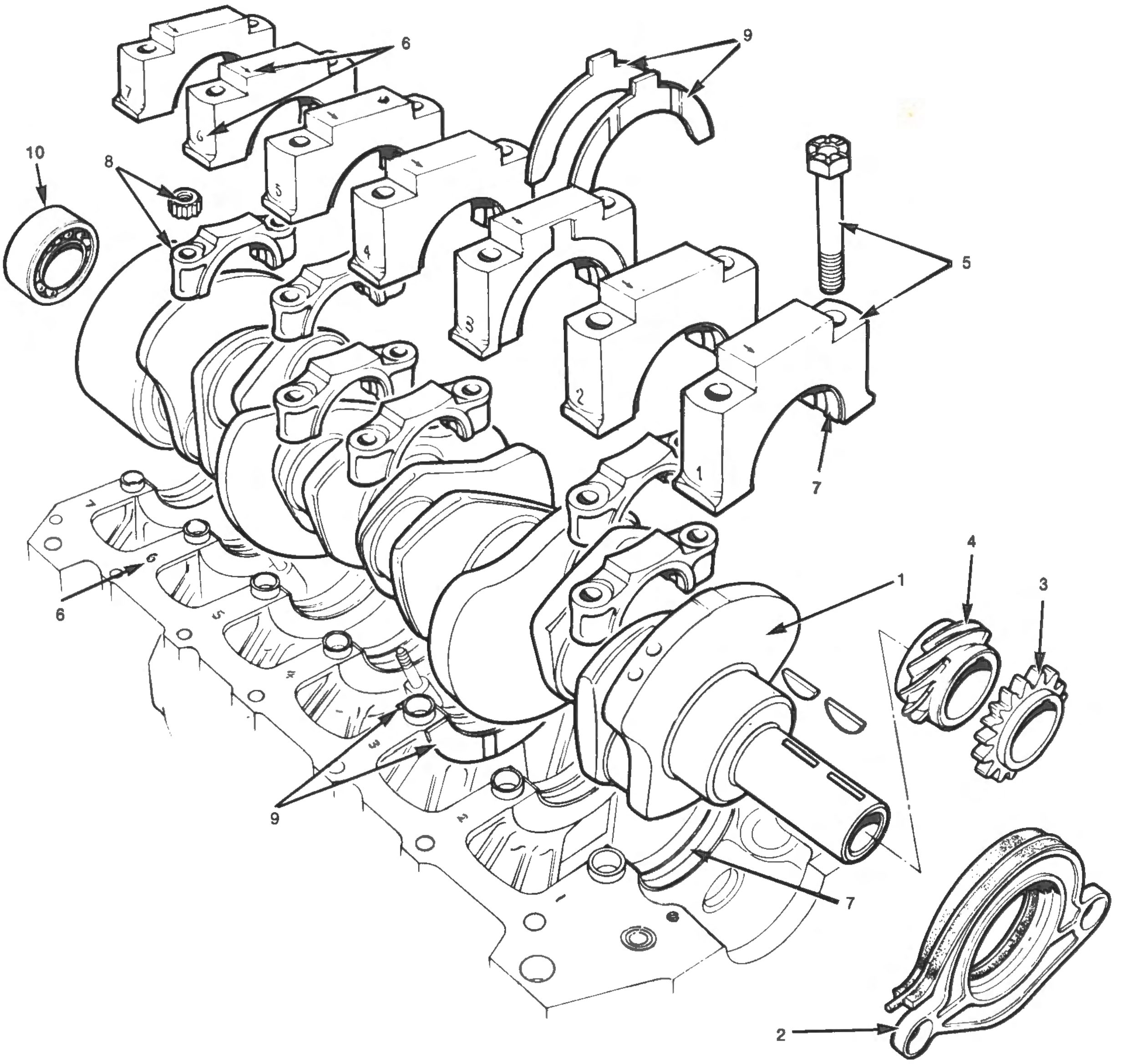


Fig. E-51

REMOVING CRANKSHAFT

1 CRANKSHAFT
2 CRANKSHAFT/RESERVOIR OIL SEAL ADAPTOR ASSEMBLY
3 CRANKSHAFT SPROCKET
4 CRANKSHAFT GEAR (DISTRIBUTOR AND OIL PUMP DRIVE SHAFT)
5 MAIN BEARING CAP AND BOLTS
6 CAP MARKINGS
7 MAIN BEARING SHELLS
8 CONNECTING ROD CAPS AND NUTS
9 THRUST WASHERS
10 SPIGOT BEARING

(b) Fit a new oil filter.

(c) Prime the lubrication system prior to starting the engine.

Fill the oil reservoir to the level indicated on the dipstick, disconnect the main coil lead, remove the spark plugs and crank the engine on the starter until the oil warning light is extinguished. Start the engine and check for leaks. Stop engine and top up oil reservoir as necessary.

(d) Check engine tune.

MANIFOLDS AND EXHAUST SYSTEM

MANIFOLD ASSEMBLY

A two piece manifold assembly is employed. The two piece induction and exhaust are bolted together with a heat riser or hot spot plate and gaskets between them, as shown in Fig. E-53.

Under normal service conditions it should not be necessary to separate the induction from the exhaust manifold. However, should dismantling be found necessary the following points should be noted on reassembly.

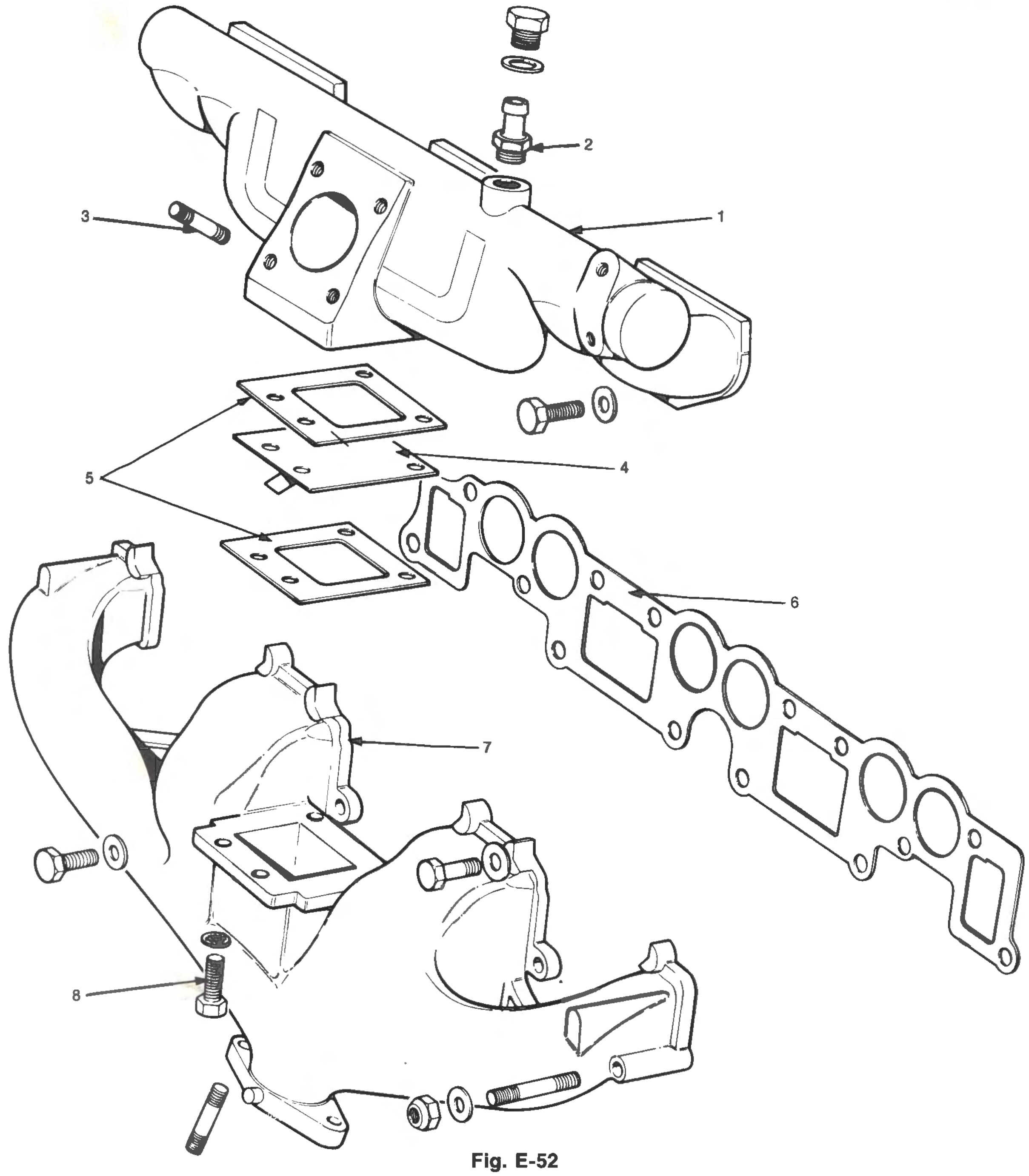


Fig. E-52

LAYOUT OF INDUCTION AND EXHAUST MANIFOLDS

1 INDUCTION MANIFOLD
2 VACUUM CONNECTION — BRAKE SERVO
3 STUDS CARBURETTER MOUNTING
4 'HOT SPOT' PLATE
5 GASKETS PLATE TO MANIFOLDS
6 MANIFOLDS GASKET
7 EXHAUST MANIFOLD
8 SCREWS — HOT SPOT — INDUCTION TO EXHAUST MANIFOLD

1 Use a new gasket each side of the hot spot plate.

2 Ensure that the plate is fitted with its deflector downwards into the exhaust stream.

3 The cylinder head face of both manifolds must be in the same plane when assembled.

4 Torque the induction manifold to exhaust manifold bolts to 4.06-5.42 Nm (3-4 lb.f.ft.). At this torque the gap separating the two manifolds should be 4.4 to 4.1 mm (0.175 to 0.160 in) constant.

Removing

1 Disconnect battery.

2 Remove air cleaner cover and element.

3 Remove carburetter spring, remove accelerator linkage, remove fuel line from float bowl, remove breather complete carburetter to tappet cover, disconnect choke cable, disconnect vacuum advance line from carburetter. Remove four nuts and spring washers holding carburetter to induction manifold. Remove carburetter.

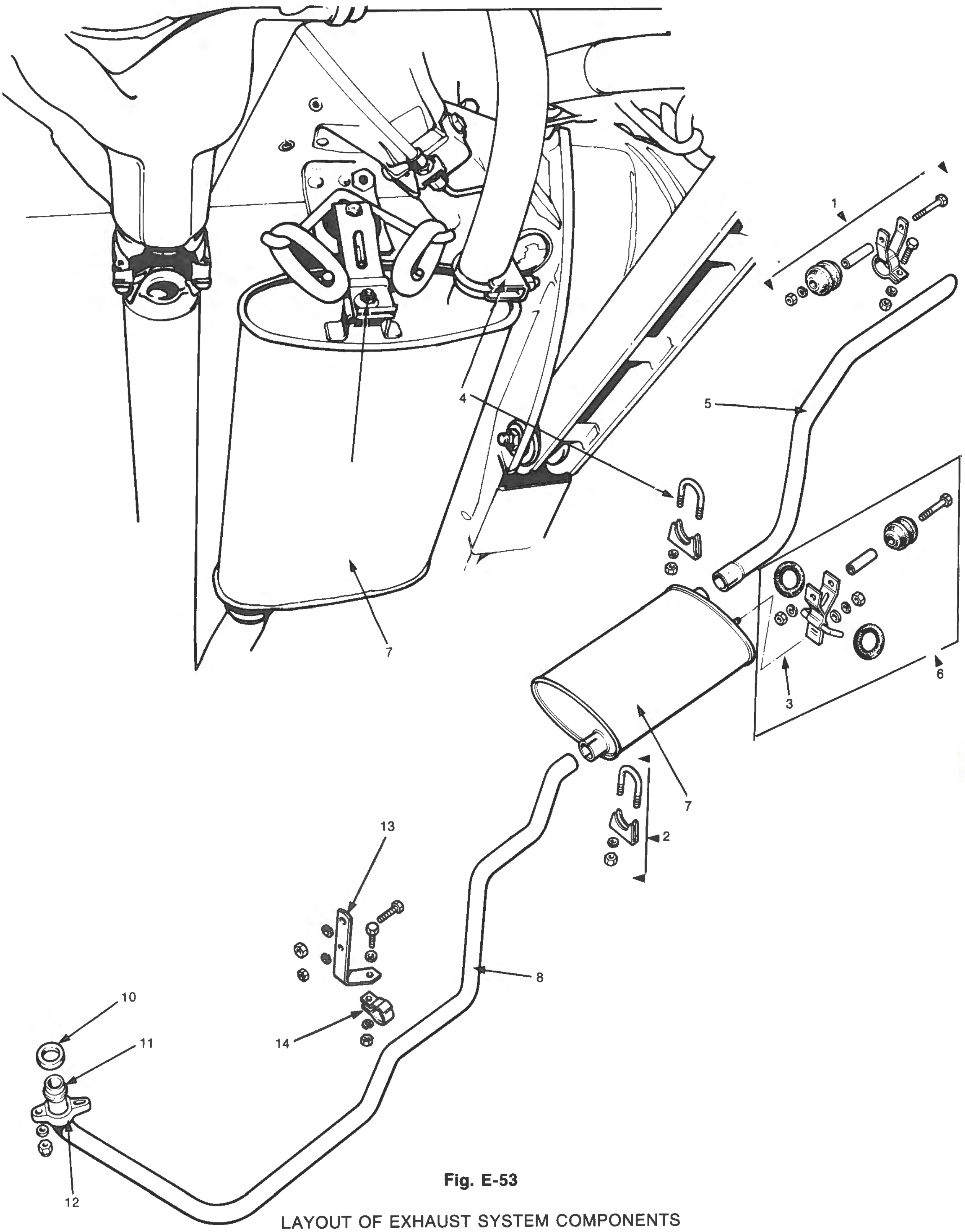


Fig. E-53

LAYOUT OF EXHAUST SYSTEM COMPONENTS

1	REAR FAIL SAFE MOUNT	8	FRONT PIPE
2	FRONT MUFFLER CLAMP	9	N.A.
3	NUT – WASHERS MUFFLER MOUNT	10	SEALING RING
4	REAR MUFFLER CLAMP	11	PIPE FLANGE
5	REAR PIPE	12	CLAMPING PLATES AND NUTS TO MANIFOLD
6	MUFFLER MOUNTING ASSEMBLY	13	BRACKET ADAPTOR PLATE TO CLAMP
7	MUFFLER	14	CLAMP EXHAUST PIPE TO BRACKET

4 Remove carburetter heat shield and adaptor block and gaskets from manifold (clean off gaskets).

5 Remove brake booster hose from induction manifold.

6 Remove two nuts, flat washers holding exhaust flange and pipe to exhaust manifold.

7 Remove exhaust pipe mounting at pipe leaving bracket fixed to flywheel housing.

8 Remove induction and exhaust manifold complete, noting the bolt length and location for replacement.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

 (a) Clean gasket face and fit new gasket.

 (b) Check the alignment of the exhaust system prior to final tightening of manifold and flywheel housing clamp.

EXHAUST PIPES AND MUFFLER

The exhaust pipe mountings and muffler arrangement for both manual and automatic vehicles is as depicted in Fig. E-53.

The components are serviced as shown. When assembled the system should be under the minimum of stress and correctly aligned to minimise the possibility of component failures and the transference of noise.

When the assembly is correct the muffler should be parallel to the ground in the horizontal plane in both directions, and the tail pipe well clear of all components.

From the front of the muffler for removing and replacing, to the rear of the tail pipe, the system and methods are identical to those in Section D-105 with the exception of the front pipe.

FRONT PIPE

(Refer Fig. E-53.)

Removing

1 Place the vehicle on hoist over pit or on stands.

2 Disconnect the battery.

3 Remove bolt and nut from centre of rear pipe mount (1).

4 Remove nut (3) and mounting from rear of muffler.

5 Remove front muffler clamp (2).

6 Twist muffler assembly to break seal on front pipe.

7 Remove the nut and flat washers from the clamping plates (12).

8 Remove the bolt and nut spring washer securing the front clamp (13) to the engine bracket (14).

9 Lower the front pipe down clear of the cross member twisting and drawing clear of the muffler.

Refitting

1 Refitting is the reverse of the removing procedure noting the following:

 (a) Fit new sealing ring to pipe flange.

 (b) Run engine and check for leaks.

SECTION F
FUEL SYSTEM

CARBURETTOR GASKET KIT — BENDIX Z-ST-10
NEEDLE & SEAT — BENDIX 388592

FUEL SYSTEM

GENERAL DESCRIPTION

The fuel system comprises a fuel tank equipped with a fuel gauge unit, incorporating a fine gauze filter, a mechanical diaphragm type fuel pump, a carburetter (different models for 8 and 6 cylinder engines) and air cleaners.

Fuel of 98 octane rating is required for both engines.

The fuel tank is mounted underneath the boot, completely isolated from the passenger compartment, and located well forward to reduce the possibility of rupture due to rear end collision. Tank capacity is 73 litres (16 Imp. gallons).

The fuel filler is flush fitting having an exposed cap located on the right hand side of vehicle, just to the rear of the rear wheel.

The fuel pump is a mechanically operated diaphragm type, located on the left hand side of the engine timing case and driven from the camshaft on the 8 cylinder engine, while the 6 cylinder engine has the pump mounted on the right hand side of the camshaft cover and driven from the camshaft by a short push rod.

The 8 cylinder engine is fitted with a Stromberg WW twin choke downdraught, automatic choke type carburetter. The 6 cylinder engine is equipped with an S.U. HS model 44.45 mm — 1¾ ins choke diameter 20° semi-downdraught type, employing a manual choke and an economy device.

Both engines employ dry, replaceable paper element type air filters.

AIR FILTERS

Air filters used on the 6 cylinder and 8 cylinder engines employ dry type chemically impregnated elements. The element requires no attention during its life, but a new element must be fitted at every 20,000 km (12,000 miles) service. It is recommended that the filter element is not disturbed during this period.

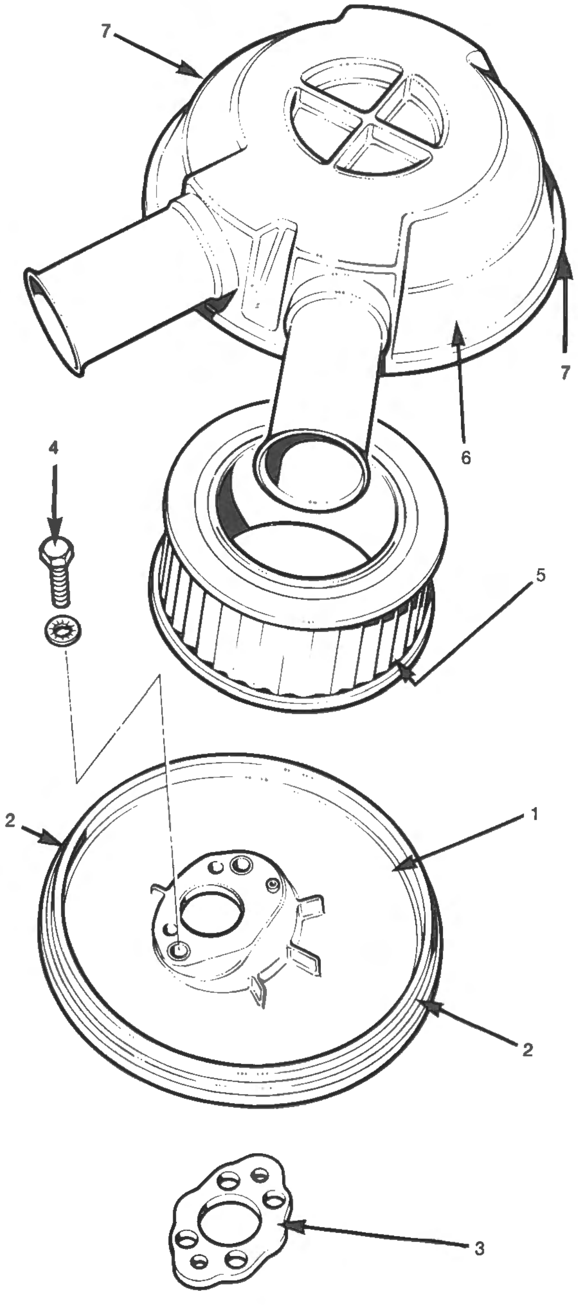
RENEWING THE ELEMENT

6 Cylinder Engine

1. Using a broad blade screwdriver, prise the plastic cover off the filter base, and remove the filter element.
2. Thoroughly clean the inside of the filter body and fit new filter element.
3. Replace the plastic cover.

8 Cylinder Engine

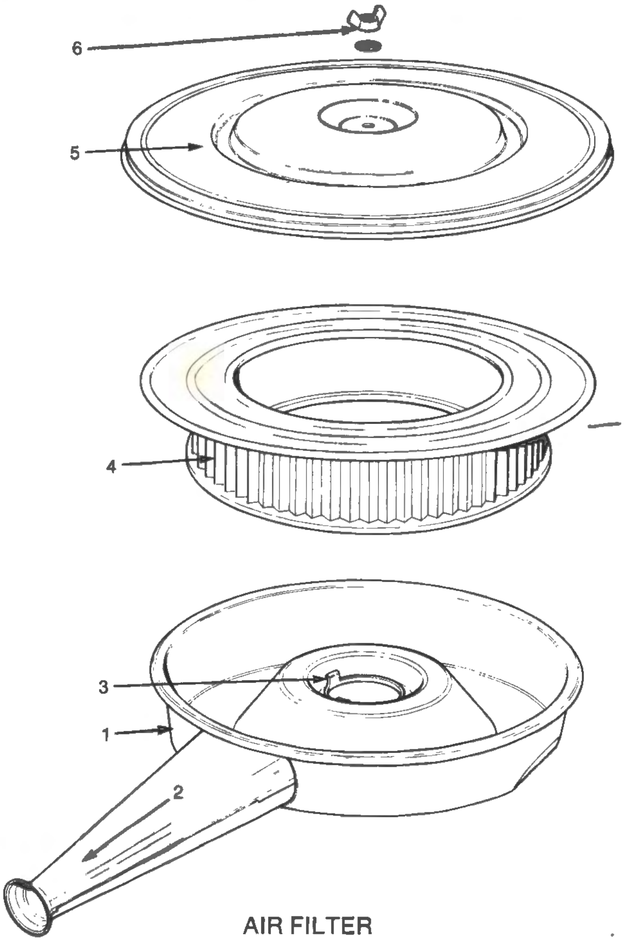
1. Remove the wingnut and flat washer retaining the filter cover and remove cover.
2. Lift out filter element and thoroughly clean base.
3. Fit new element, replace cover and tighten wingnut.



AIR FILTER

6 CYLINDER ENGINE

1	FILTER BASE
2	COVER LOCATING SLOTS
3	GASKET
4	BASE RETAINING BOLT
5	FILTER ELEMENT
6	COVER
7	COVER LOCATING LUGS



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AIR FILTER

8 CYLINDER ENGINE

1	FILTER BASE
2	AIR HORN
3	LOCATING LUGS
4	FILTER ELEMENT
5	COVER
6	WING NUT AND WASHER

CARBURETTER STROMBERG WW SERIES

DESCRIPTION

The Stromberg WW Series carburetter fitted to the 8 cylinder engine has the identification in the form of a code number stamped on the air horn, adjacent to the fuel inlet fitting. This number should be quoted when obtaining service parts and kits.

This type of carburetter is a dual barrel downdraught unit, with each barrel having its own main metering, idle system and throttle valve. A common float, accelerating and power systems is shared by the two barrels, while each barrel has its own main and auxiliary venturi (choke tube).

A choke valve located in the throttle body is automatically controlled by a thermostat spring unit mounted on the outside of the carburetter body. Heated air is conducted to the choke control unit, by a pipe, from the exhaust manifold.

The float chamber is vented to the atmosphere to the carburetter air inlet pressure through a passage and vent tube in the air horn, at all throttle positions.

The distributor vacuum advance connection is mounted on the outside of the carburetter and is connected by passages in the main body and throttle body to transmit the vacuum from the vacuum ignition holes located in the throttle body.

A fitting for the attachment of the positive crankcase ventilation hose is located in the carburetter throttle body.

OPERATION

Fuel enters the carburetter at the fuel inlet fitting, flowing through the float needle valve and seat into the float chamber. When the fuel reaches a pre-determined level, the float closes the needle valve against its seat, shutting off the fuel supply.

Float System

Fig. F-2

The needle valve is equipped with a vitron rubber tip to increase service life and greater tolerance of any dirt particles that may enter with the fuel.

The float chamber is vented internally through a passage and vent tube whenever the engine is running. Internal venting ensures that any reduction of air pressure in the air horn, due to a restricted air cleaner, is balanced by a reduction in the air pressure acting on the fuel in the float chamber. The fuel/air mixture ratio will therefore remain unchanged under these conditions.

Idle System

Figs. F-2 and 3

Identical idle systems supply each barrel with the correctly proportioned fuel/air mixture required for idling operation.

The throttle valves are held open to the correct slow idle position by the slow idle adjustment screw (Fig. F-11). By turning this screw the throttle valve opening is varied, thereby controlling the amount of air entering the engine and regulating the idle speed. The following description will refer to a single barrel only.

When the throttle valve is closed to the idle position, engine depression is concentrated on the idle discharge holes below the throttle valve. Consequently fuel flows from the base of the main discharge jet through the idle tube (slow running jet) where it is metered by a calibrated orifice in the base of the tube. Fig. F-3.

The metered fuel mixes with air taken in through the idle air bleed, and the resulting air/fuel emulsion passes down the idle channel where it mixes with additional air passing through the secondary air bleed and through the two upper idle discharge holes. The mixture finally passes from the idle discharge nozzle into the air passing the partly opened throttle.

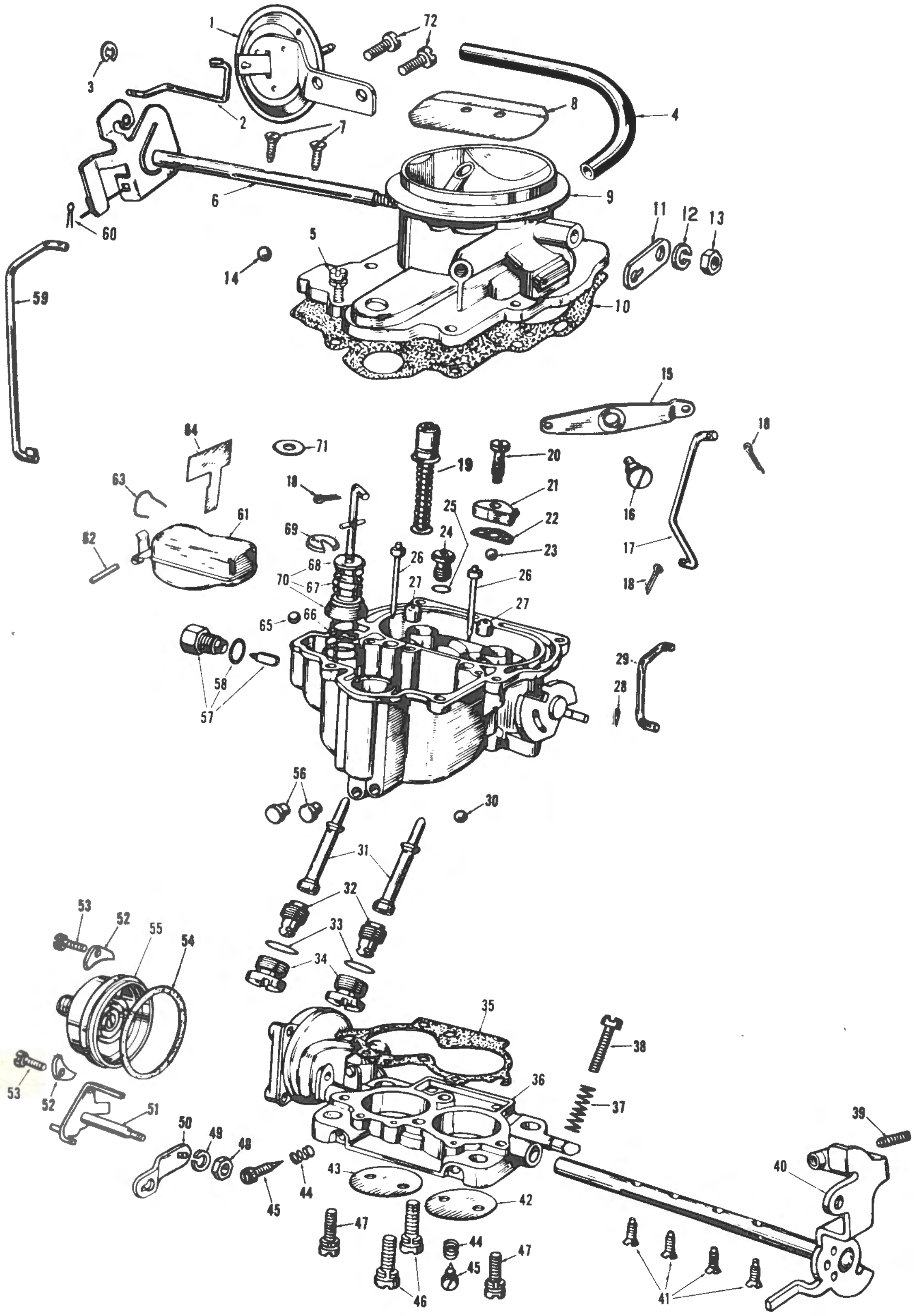


Fig. F-1

STROMBERG WW SERIES CARBURETTER

CARBURETTER COMPONENTS 8 CYLINDER ENGINE

KEY TO CARBURETTER COMPONENTS

1 DIAPHRAGM ASSY. — CHOKE KICK
2 ROD — CHOKE KICK
3 RETAINER — CHOKE KICK ROD
4 HOSE — VACUUM
5 SCREW AND LOCKWASHER — AIR HORN
6 LEVER AND SHAFT — CHOKE
7 SCREW — CHOKE VALVE
8 VALVE — CHOKE
9 AIR HORN
10 GASKET — AIR HORN
11 LEVER
12 LOCKWASHER
13 NUT — FAST IDLE LEVER
14 LEAD BALL
15 LEVER — ACCELERATING PUMP
16 SCREW — PUMP LEVER FULCRUM
17 ROD — PUMP
18 COTTER PIN
19 PISTON — VACUUM POWER
20 SCREW — PUMP NOZZLE
21 PUMP NOZZLE
22 GASKET — PUMP NOZZLE
23 BALL — PUMP OUTLET CHECK
24 JET — POWER BY PASS
25 GASKET — POWER BY PASS JET
26 IDLE TUBE
27 BLEEDER — HIGH SPEED
28 CLIP — FAST IDLE ROD
29 ROD — FAST IDLE
30 LEAD BALL — MAIN BODY
31 JET — MAIN DISCHARGE
32 JET — MAIN METERING
33 GASKET — METERING JET PLUG
34 PLUG — MAIN METERING JET
35 GASKET — MAIN BODY TO THROTTLE BODY
36 THROTTLE BODY
37 SPRING — SLOW IDLE SCREW
38 SCREW — SLOW IDLE
39 SCREW — FAST IDLE
40 LEVER AND SHAFT — THROTTLE
41 SCREW — THROTTLE VALVE
42 VALVE — THROTTLE
43 VALVE — THROTTLE
44 SPRING — IDLE NEEDLE VALVE
45 VALVE — IDLE
46 SCREW — THROTTLE BODY
47 SCREW — THROTTLE BODY
48 NUT — THERMOSTAT LEVER
49 LOCKWASHER
50 LEVER — THERMOSTAT SHAFT
51 LEVER AND SHAFT — THERMOSTAT
52 WASHER — THERMOSTAT COVER SCREW
53 SCREW — THERMOSTAT COVER
54 GASKET — THERMOSTAT COVER
55 COVER ASSEMBLY — THERMOSTAT
56 PLUGS
57 NEEDLE AND SEATING ASSEMBLY
58 WASHER — NEEDLE AND SEATING ASSEMBLY
59 ROD — CHOKE
60 COTTER PIN — CHOKE ROD
61 FLOAT AND LEVER ASSEMBLY
62 PIN — FLOAT FULCRUM
63 SPRING — FLOAT FULCRUM PIN
64 BAFFLE — FLOAT CHAMBER
65 BALL PUMP INLET CHECK
66 SPRING — PUMP BOTTOM
67 SPRING — PUMP DURATION
68 WASHER — SPRING RETAINER
69 WASHER — SPRING CLIP
70 PISTON ASSEMBLY — PUMP
71 WASHER — IDLE VENT OR SEAL
72 SCREW — CHOKE KICK DIAPHRAGM

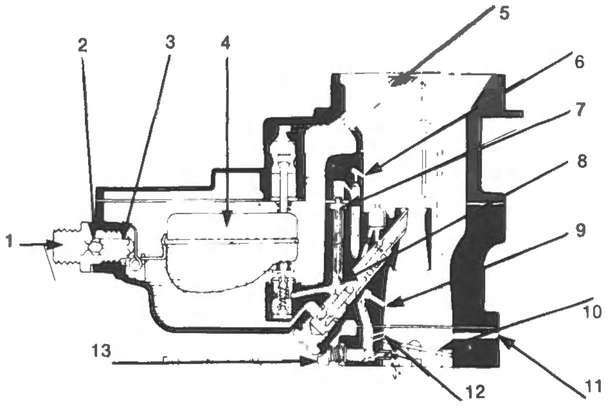


Fig. F-2

FLOAT SYSTEM

1 FUEL INLET
2 NEEDLE VALVE SEAT
3 NEEDLE VALVE SEAT
4 FLOAT
5 VENT TUBE
6 IDLE AIR BLEED
7 IDLE TUBE
8 IDLE TUBE METERING ORIFICE
9 SECONDARY IDLE AIR BLEED
10 THROTTLE VALVE (CLOSED)
11 VENT
12 IDLE DISCHARGE HOLES
13 IDLE NEEDLE VALVE

The quantity of mixture discharged through the nozzle is controlled by an adjustable needle valve. Turning this needle valve 'IN' weakens the idle mixture and turning it 'OUT' enriches the mixture.

As the throttle valve is opened slightly the upper discharge holes come under engine depression and supply the additional fuel required for increased engine speed. Fig. F-3.

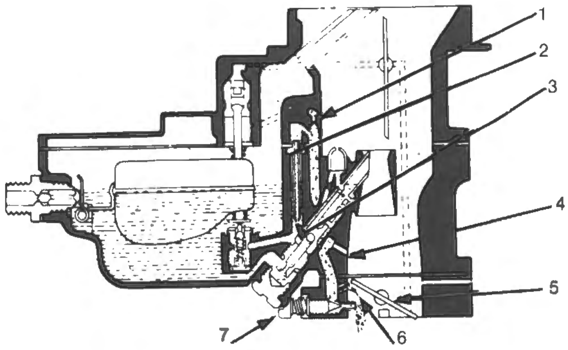


Fig. F-3

IDLE SYSTEM

1 IDLE AIR BLEED
2 IDLE TUBE
3 IDLE TUBE METERING ORIFICE
4 SECONDARY IDLE AIR BLEED
5 THROTTLE VALVE (PARTIALLY OPEN)
6 IDLE DISCHARGE HOLES
7 IDLE NEEDLE VALVE

Main Metering System

Fig. F-4

The main metering system supplements the idle system and provides the additional fuel required during the intermediate or part throttle range of operation.

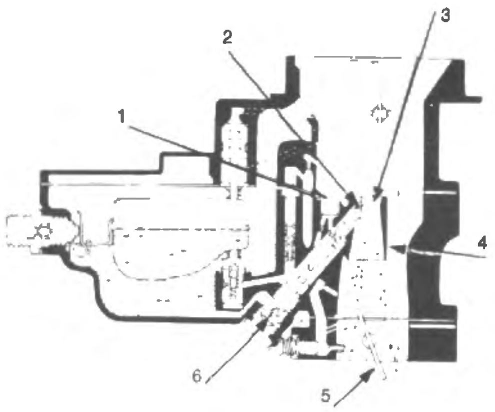


Fig. F-4

MAIN METERING SYSTEM

1 HIGH SPEED BLEEDER
2 MAIN DISCHARGE JET
3 AUXILIARY VENTURI
4 MAIN VENTURI
5 THROTTLE VALVE
6 MAIN METERING JET

As explained previously, each barrel is equipped with its own metering system, and the operation of the two systems are identical, therefore a single barrel only will be described in this section.

When the throttle valve is partially opened, air flow through the main and auxiliary venturies (choke tubes) produces a vacuum at the main discharge jet outlet. This results in fuel flowing from the float chamber through the main metering jet and into the main discharge jet, where it mixes with air taken in through the high speed bleeder. This fuel/air emulsion then discharges into the air stream passing through the main and auxiliary venturies.

Power System

Fig. F-5

A single power system supplies each main metering discharge system with the additional fuel required for the development of maximum engine power.

This additional fuel is provided by the action of a vacuum piston located in the air horn which automatically controls the opening of the power by pass jet in accordance with throttle opening and engine load. Inlet manifold vacuum is maintained above the piston through a vacuum passage which leads to the mounting flange of the carburetter.

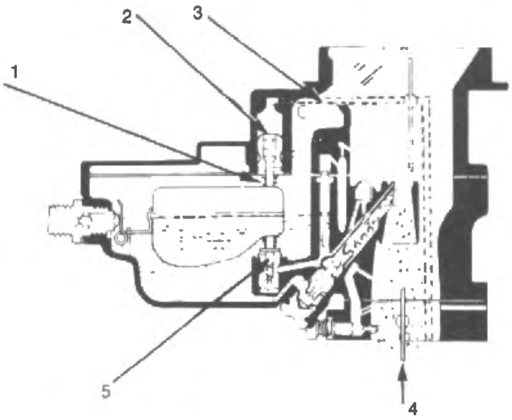


Fig. F-5

POWER SYSTEM

1 SPRING
2 VACUUM PISTON
3 VACUUM CHANNEL
4 THROTTLE VALVE
5 POWER BY PASS JET (OPEN)

During idle and part throttle operation, inlet manifold vacuum is sufficient to retain the vacuum piston in the 'UP' position against spring pressure. The power by pass jet is closed and all fuel mixture is supplied by the main metering and idle systems.

When the throttle valves are opened beyond a certain position the manifold vacuum is reduced to a lower value than spring force resulting in a 'DOWN' movement of the piston, opening the power by pass jet and allowing additional fuel to flow into the two main metering discharge systems.

Accelerating System

Fig. F-6 and F-7

To ensure smooth acceleration, additional fuel must be supplied to the engine during the period of acceleration.

The supply of additional fuel is achieved by the use of an accelerating pump, operated by the throttle linkage. As the throttle valves are opened, the pump lever compresses the pump piston duration spring, and the pump piston is forced down, producing a pressure which closes the inlet ball check valve, and forces a quantity of fuel through the outlet ball check valve and pump discharge nozzle.

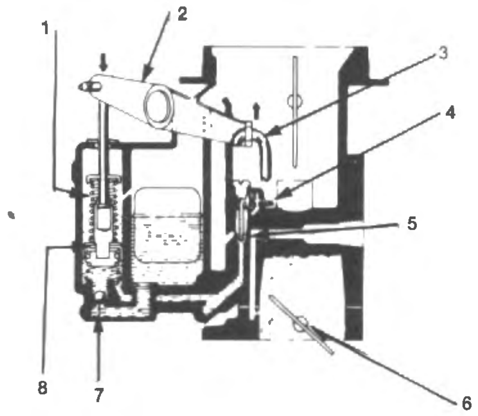


Fig. F-6

ACCELERATING SYSTEM

1	DURATION SPRING	5	OUTLET BALL CHECK (OPEN)
2	PUMP LEVER	6	THROTTLE VALVE
3	PUMP ROD	7	INLET BALL CHECK (CLOSED)
4	PUMP DISCHARGE NOZZLE	8	PUMP PISTON

The pump piston duration spring ensures that the discharge of fuel is spread over a predetermined period of time.

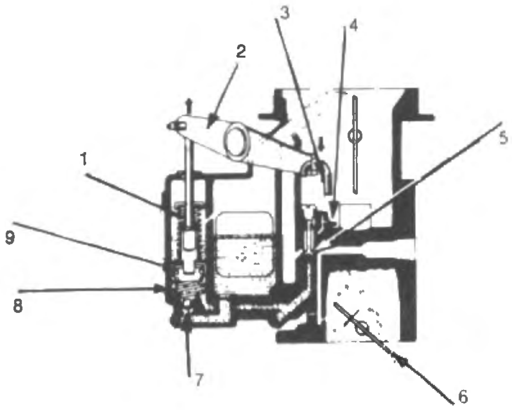


Fig. F-7

ACCELERATING SYSTEM

1	DURATION SPRING	6	THROTTLE VALVE
2	PUMP LEVER	7	INLET BALL CHECK (OPEN)
3	PUMP ROD	8	PUMP CYLINDER
4	PUMP DISCHARGE NOZZLE	9	PUMP PISTON
5	OUTLET BALL CHECK (CLOSED)		

When the accelerator pedal is released the pump piston is drawn upwards and the outlet ball check valve closes preventing the entry of air into the pump system, while the now open inlet ball check valve allows a fresh charge of fuel to be drawn into the pump cylinder.

The pump discharge nozzle is vented through the float chamber vent tube to prevent loss of fuel from the pump circuit at high engine speeds when a low depression is produced at the nozzle outlet by the high air flow through the carburetter.

AUTOMATIC CHOKE

DESCRIPTION

The automatic choke control is attached to the outside of the carburetter air horn. The choke valve is controlled by a thermostat spring actuated by heated air drawn through pipes from the exhaust manifold.
Fig. F-8

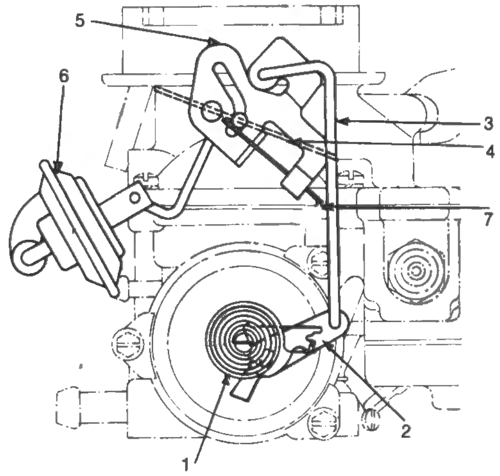


Fig. F-8

AUTOMATIC CHOKE

1	THERMOSTAT SPRING	5	CHOKE LEVER
2	THERMOSTAT LEVER	6	CHOKE KICK DIAPHRAGM
3	CHOKE ROD	7	CHOKE MODULATION SPRING
4	CHOKE VALVE		

This is achieved by three pipes forming a circuit to conduct filtered air from the carburetter air horn, through the exhaust manifold oven where it is heated, then via the asbestos covered pipe to the thermostat unit. The air is then bled off into the carburetter base just below the throttle valves.

NOTE: The pipes and exhaust manifold are shown in Fig. D-103 8 cylinder engine section.

The thermostat spring is connected to the offset choke valve through the thermostat lever, choke rod and choke lever. Other parts in the choke system are the choke kick diaphragm and the fast idle mechanism which operate in conjunction with the automatic choke control to provide the correct throttle opening during the warm up period and to prevent stalling. Incorporated in the choke lever is a modulation spring which provides additional choke valve control at low temperatures.

OPERATION

When the engine is cold, the thermostat spring is also cold and rotates the choke valve towards the closed position.

When starting a cold engine, it is necessary to depress the accelerator pedal to approximately the half open position, then release the pedal. This action allows the fast idle screw to contact the highest step of the fast idle cam and both throttle valves are opened sufficiently to start the engine and also prevent stalling during the warm up period. Fig. F-9.

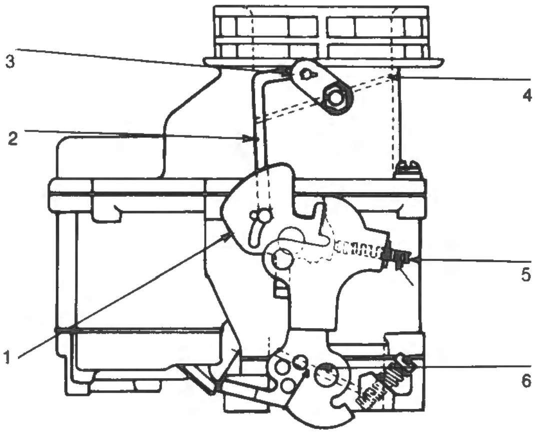


Fig. F-9

FAST IDLE ON CHOKE

1	FAST IDLE CAM	4	CHOKE VALVE (CLOSED)
2	FAST IDLE ROD	5	FAST IDLE STOP SCREW
3	FAST IDLE LEVER	6	THROTTLE VALVES

When the engine starts, vacuum in the intake manifold exerts sufficient pull on the choke kick diaphragm to open the choke valve a small amount to supply enough air for smooth running. After the engine has started, the accelerator pedal should be depressed and released to allow the fast idle cam to rotate and assume its normal fast idle position in relation to the choke opening. Fig. F-10.

As the engine warms up the choke valve opening is balanced by the pressure of air against the choke valve and as the heat from the exhaust manifold increases the thermostat spring rotates and increases the amount of choke valve opening. When the engine reaches normal operating temperature, the choke valve should be fully opened.

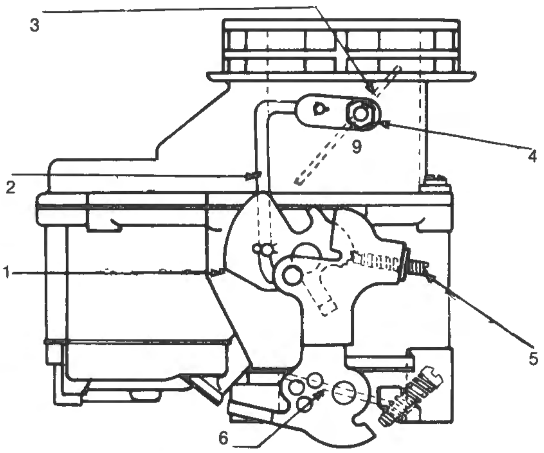


Fig. F-10

AUTOMATIC CHOKE PROGRESSIVE OPENING

1	FAST IDLE CAM	4	FAST IDLE LEVER
2	FAST IDLE ROD	5	FAST IDLE STOP SCREW
3	CHOKE VALVE (PARTIALLY OPEN)	6	THROTTLE VALVES

During the engine warm up period, the choke will progressively open and the fast idle screw will be in contact with successively lower steps of the fast idle cam.

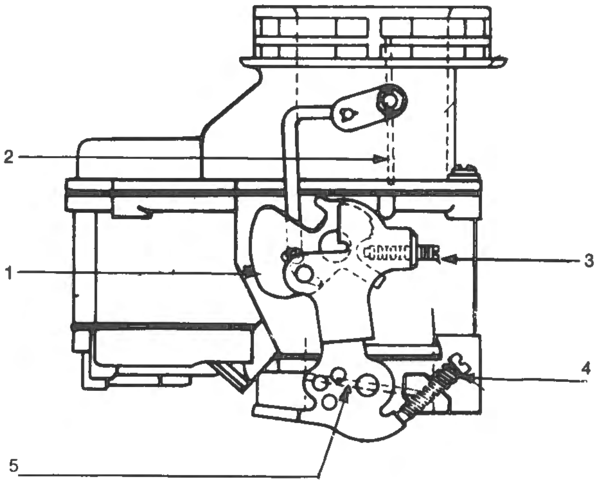


Fig. F-11

AUTOMATIC CHOKE FULLY OPEN

1	FAST IDLE CAM	4	SLOW IDLE ADJUSTMENT SCREW
2	CHOKE VALVE (OPEN)	5	THROTTLE VALVE (CLOSED)
3	FAST IDLE STOP SCREW		

Removing Carburetter

1 Remove battery earth terminal.
2 Remove air cleaner.
3 Disconnect fuel line at carburetter.
4 Disconnect vapour separator pipe (if fitted).
5 Remove the vacuum advance pipe from vacuum unit.

6 Remove choke air circulation pipe from carburetter.

7 Remove hot air pipe from exhaust manifold to choke, at the choke connection.

8 Disconnect accelerator return spring at the carburetter.

9 Disconnect the accelerator linkage at carburetter.

10 Remove PCV pipe at carburetter base.

11 Remove the four nuts and washers securing the carburetter to the intake manifold and remove carburetter.

12 Cover the opening in the inlet manifold to prevent entry of dirt and foreign matter.

Refitting

1 Refitting is the reverse of procedures 1 to 12 after checking the carburetter flange gasket and renewing if necessary.

OVERHAULING CARBURETTER

After removing the carburetter from the engine, clean the exterior to facilitate handling and dismantling. Cleanliness of hands, bench and tools is essential for efficient carburetter servicing.

Separate the carburetter into its three basic sub-assemblies, namely air horn, main body and throttle body.

Dismantle each sub-assembly into its component parts, using the following special tools in addition to normal workshop tools.

STROMBERG TOOL PART NO. 73605 — for bending float lever when adjusting the float level.

STROMBERG TOOL PART NO. 73606 — for removal and replacement of main metering jets.

STROMBERG TOOL PART NO. 73608 — for removal and replacement of main discharge jets.

NOTE: Unless damage is evident or suspected the main discharge jets should not be disturbed.

Dismantling

The throttle valves in the open position extend below the throttle body flange and it is not advisable to stand the carburetter upright on the mounting flange as damage may occur to the throttle valves. It is recommended that a suitable holding fixture be made and used when servicing these units.

NOTE: All figures in brackets refer to Fig. F-1.

1 AIR HORN
Remove vacuum power piston (19) using a block of wood and a small open end wrench as a lever. This item is staked in position.

NOTE: The pump lever fulcrum screw (16) has a left hand thread.

The screws (7) securing the choke valve to the shaft are staked and it will be necessary to file off the flared ends of screws before unscrewing.

2 MAIN BODY
The idle tubes (26) are removed by lifting out of their recesses in the main body of the carburetter. Care must be taken to remove the pump inlet check ball (65) from the pump cylinder after the pump piston (70) has been removed. Place palm of hand over pump cylinder and invert main body. The check ball will fall into palm of hand.
Place hand over float chamber and prise out the spring clip (63) retaining the float fulcrum pin (62) and lift float from carburetter.
After pump nozzle (21) is removed, invert main body and catch outlet check ball as it drops from channel.

3 THROTTLE BODY

NOTE: The throttle shaft and valves are a very accurate production fit and should not be removed unless excessive wear is evident.
The throttle valve securing screws (41) are staked in the shaft. The flared ends of these screws should be filed off before unscrewing.

Inspection

After each sub-assembly is dismantled, all castings and metal parts should be thoroughly cleaned in a suitable solvent. All passages and tubes should be blown with compressed air at moderate pressure. Inspect castings for damage, excessive wear, burrs and warpage. Ensure that all carbon deposits are removed from the throttle body.

All jets should be cleaned by washing in solvent and blowing through with air. Do not clean or size these parts with drills and wires as this will affect the metering ability of the jets.

All old gaskets and washers should be discarded and replaced. New gasket sets and repair kits are available and contain the necessary components for a normal overhaul.

Assembly

Refer to Fig. F-1.
Re-assemble each sub-assembly. All components showing damage or excessive wear should be replaced. Particular attention should be paid to the following points.

1 AIR HORN
The vacuum piston (19) is staked in place after installation. The piston should be checked for free movement in its cylinder. The piston or cylinder bore should not be lubricated.
Before tightening choke valve securing screws (7) close the valve and check the valve for proper fit in the air horn against a light. Stake the hollow ends of securing screws after tightening. Support the choke shaft (6) during the staking operation to prevent bending of the shaft.

After the air horn is assembled, the choke valve and shaft should be checked for free movement throughout its full range of travel.

2 MAIN BODY

Should the main discharge jets (31) be removed, each jet must be installed with the bevelled side of the jet tip parallel to the sides of the small auxiliary venturi.

The Stromberg tool 73608 should be used for this operation.

Replace the main metering jets (32) using Stromberg tool 73606. Screw the jets home firmly but avoid overtightening as this may result in damage to the jets.

The pump inlet check ball (65) is located in the central seat in the base of the pump cylinder. The pump outlet check ball (23) drops into the channel under pump nozzle (20) screw.

Place the float fulcrum pin (62) in float lever and install float in float chamber. Place ends of fulcrum pin spring (63) against ledges in float chamber and press loop of spring under boss to secure spring.

SETTING FLOAT LEVEL

Fig. F-12

With the main body held in an inverted position and with only the weight of float holding the needle valve shut, the float level is measured from the main body (with gasket removed), to centre of float, using Stromberg float gauge No. 73725, or a depth gauge. Refer to specifications for correct level dimension.

The float level is adjusted by bending the float lever close to the float, using Stromberg tool 73605.

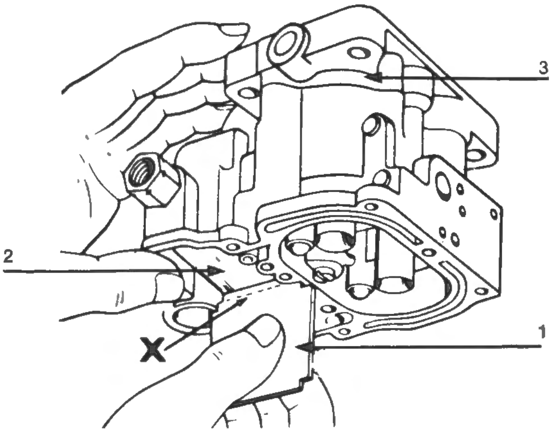


Fig. F-12

SETTING FLOAT LEVEL

1 FLOAT LEVEL GAUGE
3 CARBURETTER BODY
2 FLOAT
X GAUGE HEIGHT 4.32 mm (0.17 in)

CAUTION: The lip of float lever must be held away from needle valve when bending float lever to prevent damaging the rubber needle tip.

After the float setting is completed, the carburetter main body is turned to an upright position. Install the idle tubes (26) and place pump inlet check ball (65) on its seat in bottom of pump cylinder. Place pump bottom spring (66) on pump piston and insert pump piston in its cylinder ensuring that the piston leather is not creased, and that it bears evenly on its complete circumference. Apply a few drops of light engine oil to the piston leather before installing.

Where a float setting gauge is not available, or it is not desirable to remove the carburetter, the fuel level in the float bowl may be checked in the following manner.

(a) Start the engine and allow to idle for thirty seconds.

(b) Stop the engine and remove air cleaner.

(c) Remove the split pin securing the accelerating pump rod to the operating lever.

(d) Remove the split pin securing the link from the throttle to the accelerating pump operating lever.

(e) Remove the split pin securing the choke operating link to choke valve lever.

(f) Remove the six screws securing the air horn to the carburetter body and remove air horn.

(g) Check the level of the fuel below the top surface of the float chamber. The measurement should be 16.637 mm to 15.113 mm (0.655 in to 0.595 in).

(h) If it is necessary to correct the fuel level bend the float lever the required amount. Hold the lip of the float lever to avoid damaging the rubber tip of float needle.

3 THROTTLE BODY

Assembly of the throttle shaft and valves should be carried out in the following manner:

Insert the throttle shaft in throttle body and assemble throttle valves in same position and barrels that the valves were removed from, leaving the securing screws loose. Screw the slow idle adjusting screws out far enough to allow the throttle valves to completely close. Check the closing of the valves against a light, gradually tightening screw. After tightening, the hollow screw ends should be staked. Support throttle shaft and valves during staking operation to avoid bending throttle shaft.

Install idle needle valves (45) and springs (44). Turn each needle valve lightly against its seat, then back out each valve one and a half turns. Install the thermostat lever (50) on its shaft (51) and replace lockwasher and nut. Tighten nut. Install slow idle stop screw (38) and spring (37) also replace fast idle screw (39) if removed.

NOTE: The thermostat cover is not installed until the thermostat lever positioning setting has been carried out.

Final Assembly

Locate air horn gasket (10) on main body then carefully guide air horn body over pump piston stem, align holes in air horn (9) gasket (10) and main body, then replace and tighten air horn attaching screws (5).

NOTE: The air horn must be held in an exact vertical position when assembling to avoid the possibility of the vacuum piston stem (19) becoming wedged between the power by pass jet (24) and the main body. It is also essential to ensure that the upper ends of the idle tubes (26) engage in their respective passages in the air horn.

Invert the carburetter and place main body gasket (35) in position on the main body. Place the throttle body (36) on gasket, align holes, install and tighten the attaching screws.

Install keyed end of fast idle rod (29) into lever (11) and fit opposite end of rod in slot of fast idle cam. Secure with retainer clip (29), assembling straight side of clip in the rod hole.

Attach pump stem to pump lever (15) with cotter pin (18). Secure pump lever to air horn with fulcrum screw (16).

NOTE: This screw is left hand thread. Assemble upper end of pump rod (17) to pump lever (15) and install lower end of pump rod in hole of throttle lever, according to specifications. Replace split pin (18). Assemble keyed end of choke rod (59) in thermostat shaft lever (50) and install opposite end of rod in choke lever using split pin (60).

ADJUSTMENT

BASIC SETTINGS

NOTE: REFER SPECIFICATION CHART PAGE F-12.

After the carburetter has been completely assembled it should be installed on the engine and the following adjustments carried out in the recommended sequence.

1 Fast Idle Speed and Cam Position
Figs. F-13A & B
Turn the slow idle screw outwards far enough to clear the throttle lever ear when the throttle valves are fully closed against their bores.
Hold throttles in fully closed position and turn fast idle screw on to 4th step of cam (Fig. F-13A). Turn the fast idle stop screws 4¼ turns as given in the specifications.
Place the fast idle stop screw on the second step of cam (Fig. F-13B) and apply light closing pressure to choke valve to take up any slack in linkage. Measure choke valve opening 'G'. Fig. F-13B.
The opening should be 4.826 mm-4.318 mm (0.190-0.170 in) as given in specifications, if not, bend the fast idle rod at the point illustrated.

2 WIDE OPEN KICK (SETTING 'C')
Fig. F-14
Apply light closing pressure to choke valve, then move the throttle valves to wide open position. At this point the choke valve should just open sufficiently to allow the insertion of drill gauge 'C' (as per specifications) between the choke valve and wall of air horn. Bend the ear on throttle lever as necessary to obtain correct opening.

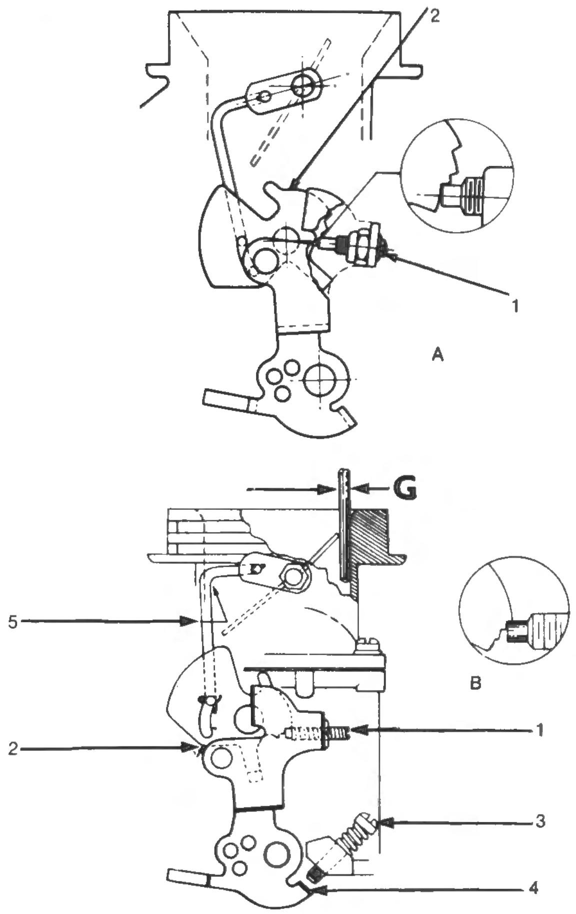


Fig. F-13

FAST IDLE SPEED AND CAM POSITION

1 FAST IDLE STOP SCREW
2 FAST IDLE CAM
3 SLOW IDLE ADJUSTMENT SCREW
4 THROTTLE LEVER EAR
5 FAST IDLE ROD

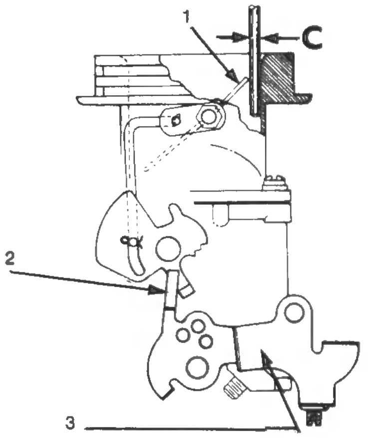


Fig. F-14

WIDE OPEN KICK SETTING

1 CHOKE VALVE
2 THROTTLE LEVER EAR (BEND AS REQUIRED)
3 THROTTLE LEVER (IN WIDE OPEN POSITION)

STROMBERG SPECIFICATIONS AND SETTINGS

Code No.	Stromberg Carb Part No.	Main Metering Jet	High Speed Bleeder	Idle Tube	Idle Air Bleeder	Idle Discharge Holes	Power By-Pass Jet	Pump Discharge Nozzle	Needle Seat Valve	Float Setting
A1	2375074 (Manual)	.052″	No. 70	No. 69	No. 40 M.B. No. 50 A.H.	1st—No. 46 2nd—No. 64 3rd—No. 68 4th—No 68	1st Stage .032″ 2nd Stage 059″	No. 71	.101″	.170″
A2	2375133 (Automatic)	″	″	″	″	″	″	″	″	″

ABBREVIATIONS: M.B. — Main Body
A.H. — Air Horn

	"C"	"D"	"E"	"G"	"J"	"M"	"TL"
A1	.235″ to 265″	.190″ to 210″	TOO LEAN	4¼ Turns .170″ to 190″	.590″ to .630″ *	.020″ to 040″	1.084″ to 1 104″
A2	″	″	DEAD CENTRE	″	″	″	″

Column C — Wide Open Kick Setting
Column D — Vacuum Kick Setting
Column E — Thermostat Adjustment
Column G — Fast Idle Speed and Cam Position
Column J — Accelerating Pump Stroke
Column M — Choke Modulation Spring Setting
Column TL — Thermostat Lever Setting
* — Set pump rod in middle hole of throttle lever.

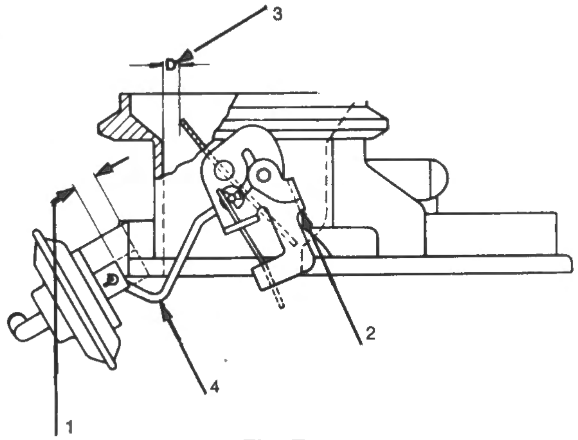


Fig. F-15

VACUUM KICK SETTING

1 DIAPHRAGM FULL TRAVEL LIMIT
2 APPLY LIGHT UPWARD PRESSURE
3 CHECK DISTANCE D
4 BEND LINKS AS REQUIRED

3 VACUUM KICK (SETTING 'D')

Fig. F-15

Depress the diaphragm pull rod to the full limit of its travel and apply light upward pressure to choke lever to take up any slack in the linkage also to deflect the modulation spring so that the choke link is at the end of its slot in the choke lever.

Hold in this position and check choke valve opening 'D' with a drill of the size given in specifications 4.572 mm (0.180 in). Should the opening vary to the specifications, bend the choke link at the point indicated to obtain correct setting. After bending link, ensure that the choke valve does not bind in any position.

4 CHOKE MODULATION SPRING (SETTING 'M')

Fig. F-16

Insert a drill gauge 'M' in slot under choke modulation spring free end. With the drill gauge placed at right angles to choke lever, the spring should contact gauge. The modulation spring tension is adjusted by bending in area shown near clamped end of spring. Diameter of drill gauge is given in specifications.

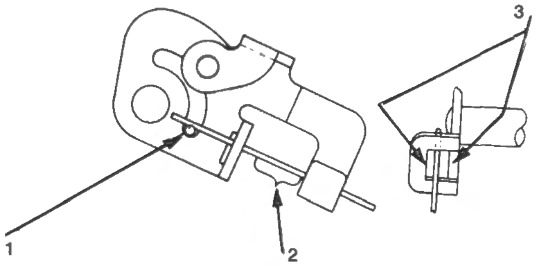


Fig. F-16

CHOKE MODULATION SPRING SETTING

1 INSERT DRILL GAUGE M PERPENDICULAR TO LEVER
2 ADJUST BY BENDING SPRING — SPRING MUST NOT RUB ON GUARD

5 THERMOSTAT LEVER POSITIONING (SETTING 'TL')

Fig. F-17

Close the choke valve by applying light upward pressure on thermostat lever pick-up ear in direction shown by arrow. The dimension 'TL' is measured from centre of upper right cover screw holes to thermostat lever pick-up ear and should be the same as given in the specifications, if not, rectify by bending choke rod at point indicated.

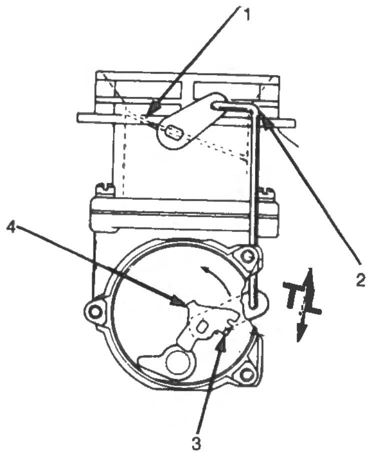


Fig. F-17

THERMOSTAT LEVER POSITIONING

1 CHOKE VALVE (CLOSED)
2 CHOKE ROD (BEND AS REQUIRED)
3 THERMOSTAT LEVER
4 THERMOSTAT LEVER PICK-UP EAR

6 THERMOSTAT ADJUSTMENT (SETTING 'E')

Fig. F-18

The indicator mark on the thermostat cover should be set as instructed in the specifications.

When the thermostat linkage adjustments have been completed, place a new gasket on the thermostat cover and install the cover on its housing with hook of the thermostat spring 'DOWN'. Rotate the cover counter clockwise and set indicator mark on cover as instructed in the specifications.

Replace and tighten screws (53) and lug washers (52). (Fig. F-1.)

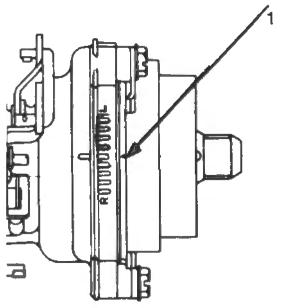


Fig. F-18

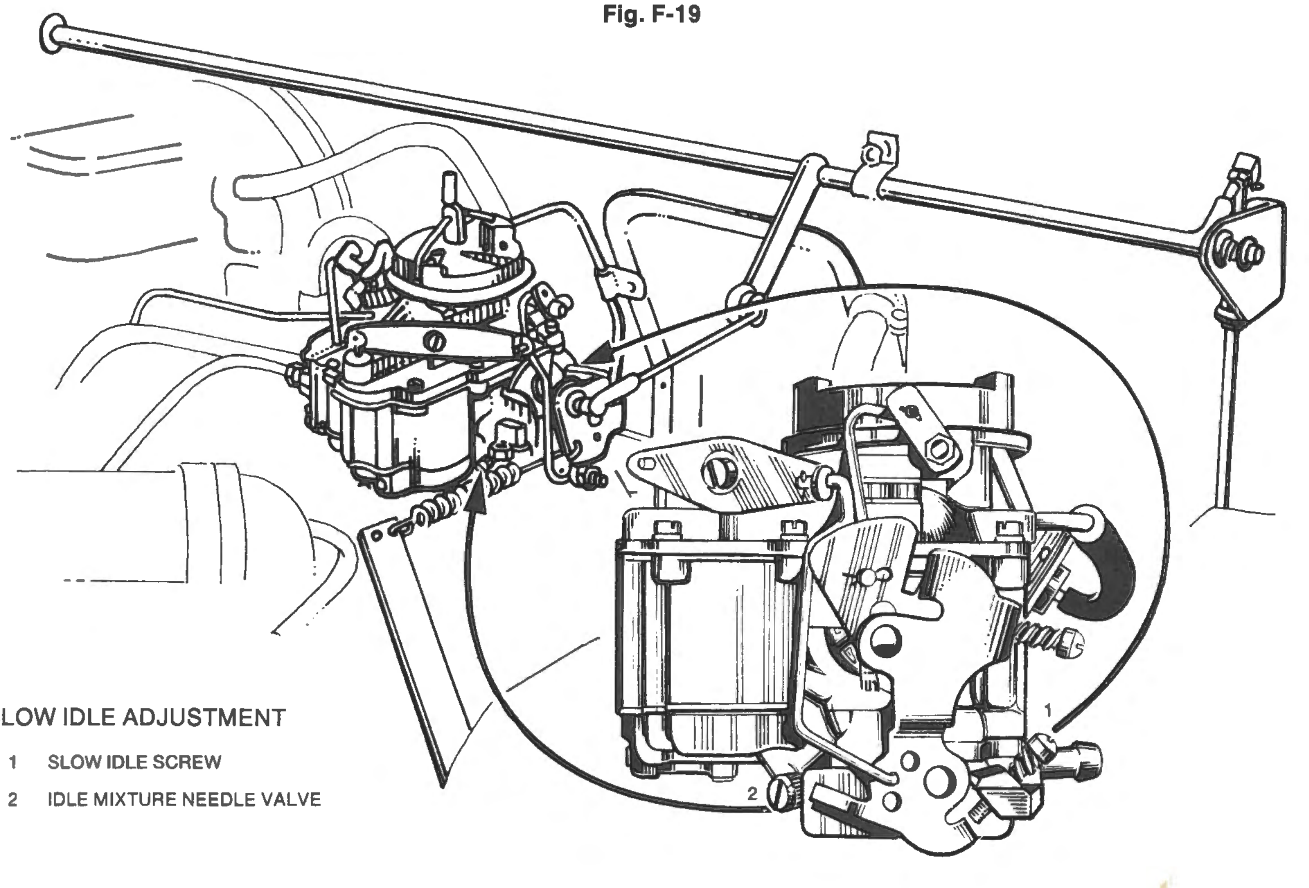
THERMOSTAT ADJUSTMENT

1 INDICATOR MARK

MANUAL TRANSMISSION — 2 LEAN

AUTOMATIC TRANSMISSION — CENTRE

Fig. F-19



SLOW IDLE ADJUSTMENT

1 SLOW IDLE SCREW
2 IDLE MIXTURE NEEDLE VALVE

7 SLOW IDLE ADJUSTMENT

Fig. F-19

The engine idling speed mixture must be adjusted to reduce carbon monoxide emission to a reading not exceeding 4.5%. Refer Emission Control Section.

After the mixture has been set, the only adjustment allowable is the engine idle speed.

NOTE: The idle adjustments must be carried out with the air cleaner fitted to the carburetter.

Before any worthwhile results can be obtained from carburetter tuning, the engine must be in good general condition, having even compression on all cylinders, distributor points correctly adjusted, spark plugs of the recommended type and correctly gapped. The ignition timing must be correctly set.

CARBURETTER S.U. TYPE H.S.6

DESCRIPTION

The S.U. H.S. type carburetters are of the automatically expanding choke type in which the sizes of the main air passage (or choke) over the jet, and the effective area of the jet, are variable according to the degree of throttle opening used on the engine against the prevailing load, which may differ widely from light cruising to heavy pulling.

This type of unit is sometimes called a 'constant vacuum' carburetter and ensures a good atomization of the fuel at all speeds, making multiple jets unnecessary.

To serve the complete throttle range a single jet only is used, which is varied in effective area by a tapered fuel metering needle sliding into it, the exact profile of the taper being altered to suit different engines, running conditions or climates. A rich mixture for cold starting is obtained by moving the jet downwards.

KEY TO FIG. F-20

1	CARBURETTER ASSEMBLY
2	CARBURETTER BODY
3	PISTON LIFTING PIN
4	SPRING AND PIN
5	NEOPRENE WASHER
6	BRASS WASHER
7	CIRCLIP PIN
8	CHAMBER AND PISTON ASSEMBLY
9	NEEDLE LOCATING SCREW
10	PISTON DAMPER
11	FIBRE WASHER
12	PISTON SPRING
13	SCREW — CHAMBER TO BODY
14	JET ASSEMBLY
15	NUT
16	WASHER
17	GLAND
18	FERRULE
19	JET BEARING
20	BRASS WASHER — JET BEARING
21	JET LOCKING NUT
22	JET LOCKING SPRING
23	JET ADJUSTING SCREW
24	NEEDLE
25	FLOAT CHAMBER
26	ADAPTOR
27	PLAIN WASHER
28	SPRING WASHER
29	BOLT — FLOAT CHAMBER TO BODY
30	FLOAT
31	HINGE PIN — FLOAT TO LID
32	———
33	FLOAT CHAMBER LID GASKET
34	NEEDLE AND SEAT ASSEMBLY
35	SCREW
36	SPRING WASHER
37	———
38	THROTTLE SPINDLE
39	THROTTLE DISC
40	SCREW — DISC TO SPINDLE
41	BRASS WASHER — SPINDLE
42	THROTTLE RETURN LEVER
43	CAM STOP SCREW
44	SPRING — SCREW
45	THROTTLE SPINDLE NUT
46	TAB WASHER — NUT
47	THROTTLE ADJUSTING SCREW
48	SPRING—SCREW
49	PICK-UP LEVER AND LINKS
50	SCREW — LINK TO JET
51	CAM LEVER
52	WASHER — CAM LEVER
53	CAM LEVER SPRING
54	PICK-UP LEVER SPRING
55	PIVOT BOLT
56	PIVOT BOLT TUBE
57	OUTER TUBE
58	DISTANCE WASHER
59	———
60	NEEDLE
61	———
62	———
63	FLOAT CHAMBER LID
64	THROTTLE LINKAGE

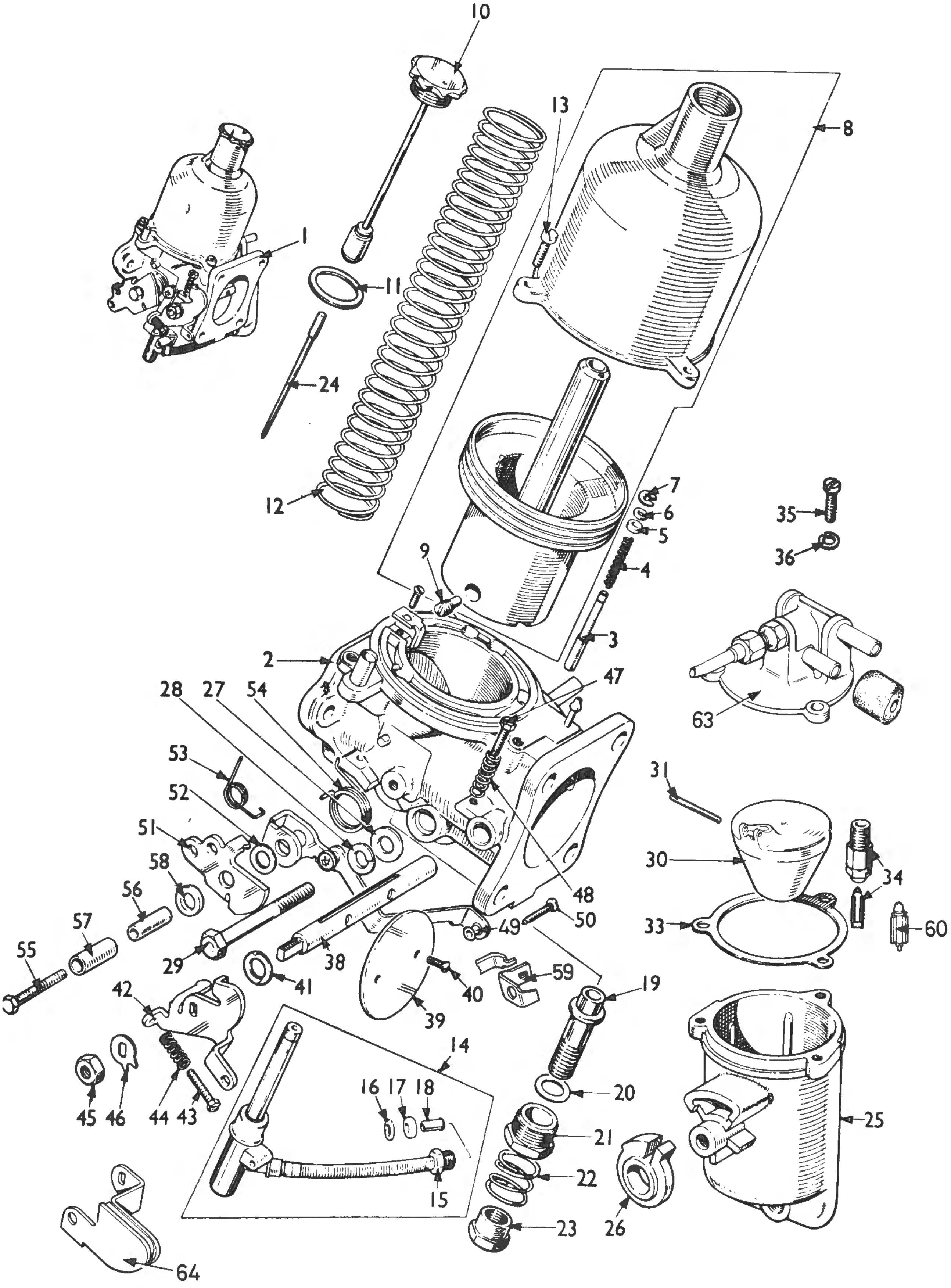


Fig. F-20

CARBURETTER COMPONENTS SIX CYLINDER ENGINE

As the needle size is determined during the engine development to meet the requirements of the Transport Authorities regarding carbon monoxide exhaust emissions, and at the same time, providing optimum engine performance. Tuning is confined to slow running setting, when this is correctly adjusted, the mixture will be satisfactory over the whole range of throttle openings.

The fuel metering needle used in the carburetter fitted to this engine is of a spring loaded type, which gives improved atomization. The carburetter is equipped with an additional weakening device attached to the float chamber lid.

ADDITIONAL WEAKENING DEVICE

Description

The additional weakening device fitted to the S.U. carburetter is designed to give a leaner mixture and greater fuel economy with a partially shut throttle. Fig. F-21.

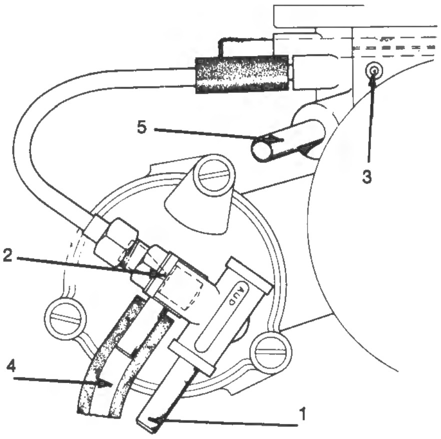


Fig. F-21

ADDITIONAL WEAKENING DEVICE

1 FUEL FEED
2 VENTURI AIR BLEED
3 VACUUM TAKE OFF
4 ATMOSPHERIC BREATHER CONNECTION
5 ENGINE BREATHING SYSTEM CONNECTION

This effect known as 'mixing ratio spread,' is also effected by the design of the air intake and induction passages.

The rate of fuel discharge from the jet is governed by the difference in air pressure between that existing over the fuel in the float chamber and that over the jet.

The weakening device is a fitting attached to the float chamber lid, designed to reduce air pressure (produce a depression) in the float chamber when the throttle is partly shut, thereby reducing the rate of fuel discharge from the jet. The lid is otherwise sealed by a gasket between the lid and bowl.

The fitting on the lid consists of a venturi which is connected at one end to a drilling in the carburetter body close to the throttle disc edge. The other end, which contains a calibrated air bleed, is connected to the air intake passage by a flexible tube. A central drilling communicates with the float chamber.

General

The size of the venturi is standard.

The flexible tube connecting the air bleed union to the air intake passage has a substantial effect on mixture strength. As air velocity through the air intake increases, a depression is communicated to the float chamber, the effect of which is compensated for in the jet needle design, thus the removal of the connecting tube would cause some alteration to mixture strength.

Servicing

Servicing is confined to keeping the device clean internally and maintaining the connecting pipes and washers in good condition.

Operation

1 IDLING
With the throttle in the normal idling position, the drilling in the body emerges on the carburetter side of the disc and is only subjected to the slight depression exerted in that condition. This will cause a flow of air through the venturi, but the effect of this on the float chamber air pressure is negligible.

2 FULL THROTTLE
At full throttle a similar effect to that of idle speed is produced, thus the depression is slight and any effect on air pressure in the float chamber is compensated for in the designs of the jet needle.

3 CRUISING
When the throttle is partly open, the drilling is on the engine side of the disc and the high manifold depression causes air to be drawn through the venturi. The use of a venturi (instead of a plain orifice) ensures that the air velocity through it will reach a maximum value which remains constant once the predetermined depression figure has been attained.
The air bleed admits air into the system and the resultant float chamber depression produces the required reduction in fuel discharge.

This arrangement allows the maximum weakening effect to be produced when the throttle disc is closed a small amount from the full open position (when only a slight increase in manifold depression is obtained) and ensures that further closing of the throttle does not increase the weakening effect to the point at which misfiring may occur.

MAINTENANCE

The maintenance of S.U. carburetters is most important yet comparatively simple. Failure to carry out this maintenance may result in higher fuel consumption, greater carbon monoxide exhaust emission and a reduction in engine performance.

Piston Damper

Remove piston damper from the top of suction chamber and pour in sufficient SAE 20 grade engine oil, to bring level about 12.7 mm (½ in) above the top of hollow piston rod. Fig. F-22. Refit damper, ensure the fibre washer is installed. Do not overtighten.

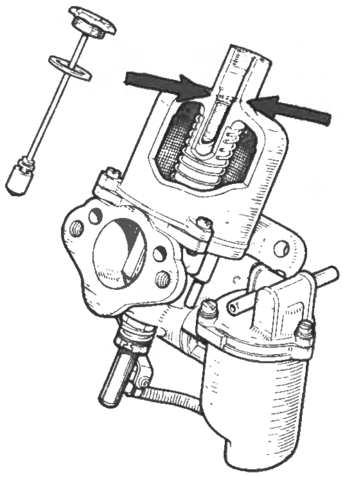


Fig. F-22

PISTON DAMPER OIL LEVEL

Piston and Suction Chamber

Smooth, free operation of the piston in the suction chamber is essential for good engine performance. The removing and cleaning of the piston is carried out in the following sequence:

1 Remove the three screws retaining the suction chamber to the carburetter body.

2 Remove the piston and suction chamber as a unit and dismantle. Take care not to damage the needle during removal.

3 Use a petrol moistened cloth to clean the inside bore of the suction chamber and the two diameters of the piston. Ensure that the piston grooves are clear.

4 Dry off the piston edges and suction chamber bore.

CAUTION: Do not use any abrasive materials for cleaning these parts.

5 Clean out the base of the oil well and ensure that no dirt accumulation remains.

6 Using SAE 20 engine oil, lightly oil the piston rod only (Fig. F-23) and assemble piston and spring into suction chamber.

7 Replace the piston and suction chamber unit to the carburetter body, ensuring that the piston is correctly located in its guide. Replace the three retaining screws and tighten evenly.

8 Refill the piston rod with the specified oil to the correct level.

9 Clean the piston damper and check that the hole in the breather is free.

10 Replace the damper assembly.

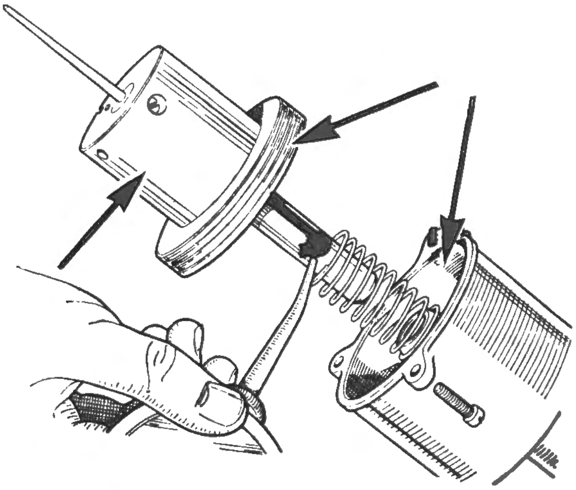


Fig. F-23

PISTON AND SUCTION CHAMBER CLEANING

Carburetter Removing

1 Disconnect the battery earth lead.

2 Remove air cleaner complete with intake pipe by removing the two securing nuts.

3 Release the choke and accelerator cables.

4 Release the petrol feed pipe, crankcase emission control pipe, and vacuum advance pipe.

5 Disconnect the throttle cable (Automatic transmission models).

6 Remove curburetter securing nuts and washers.

7 Remove the carburetter.

Refitting

1 Refitting is a reversal of the removing procedure, noting the following:
   - (a) Make sure that all mating surfaces are clean.
   - (b) Renew all gaskets.
   - (c) Check and adjust choke and accelerator cables.
   - (d) Check throttle cable (Automatic transmission models).

CARBURETTER OVERHAUL

Remove carburetter from the engine and thoroughly clean exterior.

Dismantling

Refer Fig. F-24.

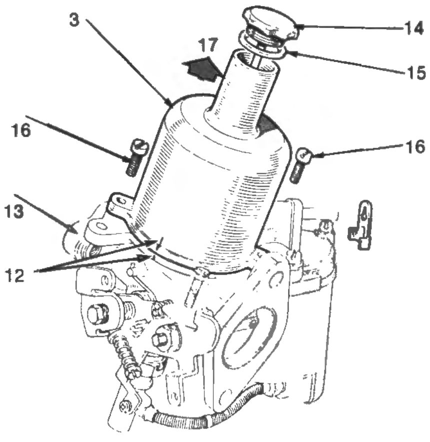


Fig. F-24
REMOVING SUCTION BELL

1. Remove the damper (14) and its washer (15). Unscrew the suction chamber securing screws (16).
2. Lift off the suction chamber in the direction of arrow (17) (Fig. F-24) without tilting.
3. Remove the piston spring (18).
4. Carefully lift out the piston assembly (19) and empty the damper oil from the piston rod (20). Refer Fig. F-25.

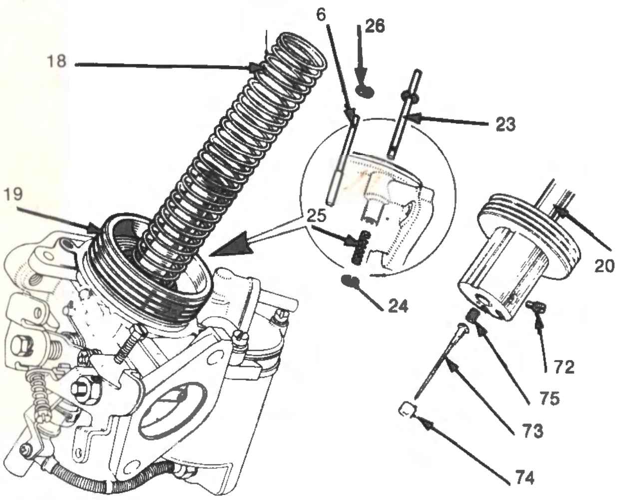


Fig. F-25
REMOVING SUCTION BELL PISTON

5. Remove the guide locking screw (72) withdraw the needle assembly (73) support guide (74) and spring (75) taking care not to bend the needle.
6. Withdraw the needle from the guide and remove the spring from the needle assembly.
7. Should the piston lifting pin (23) be fitted with an external spring, remove the spring retaining circlip (24) and spring (25) then push the lifting pin upwards to remove it from its guide. With the concealed spring type (6) press the pin upwards, detach the circlip (26) from the upper end and withdraw the pin and spring downwards.
   Refer Fig. F-26.

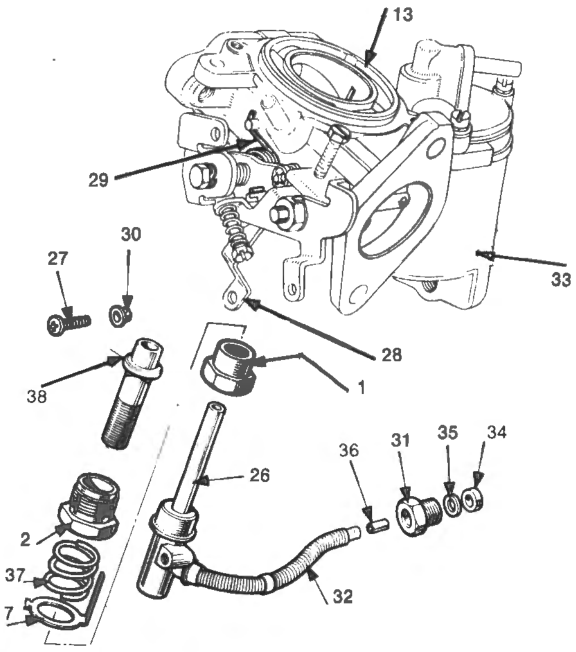


Fig. F-26
REMOVING JET

8. Support the moulded base of the jet (26) and slacken the screw (27), retaining the jet pick-up link (28).
9. Relieve the tension of the pick-up lever return spring (29) from the screw and remove screw and brass bush (30) when fitted.
10. Unscrew the brass sleeve nut (31) retaining the flexible jet tube (32) to the float chamber (33) and withdraw the jet assembly (26) from the carburetter body (13). Note the gland (34) washer (35) and ferrule (36) at the end of the jet tube.
11. Remove the locking clip to clear the jet adjusting nut, and remove the jet adjusting nut (1) and spring (37).
    Unscrew the jet locking nut (2) and detach the nut and jet bearing (38). Withdraw the bearing from the nut.
    Refer Fig. F-27.

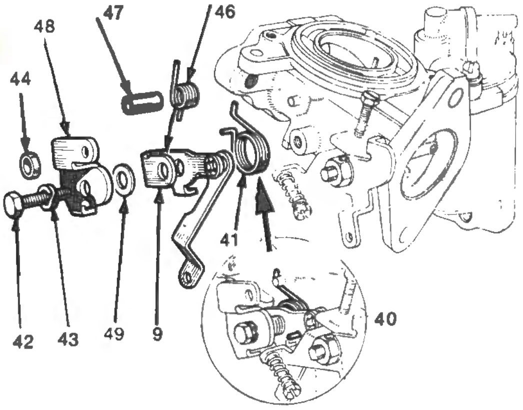


Fig. F-27
REMOVING THROTTLE LEVER AND SPRING

12 Note the location points (inset 40) for the two ends of the pick-up lever return spring (41). Unscrew the lever pivot bolt (42) together with the double coil spring washer (43) or spacer (44). Detach the lever assembly (9) and return spring.

13 Note the location (inset 45) of the two ends of the cam lever spring (46) and push out the pivot bolt tube (47) taking care not to lose the spring. Lift off the cam lever (48) noting the skid washer (49) between the two levers.
Refer Fig. F-28.

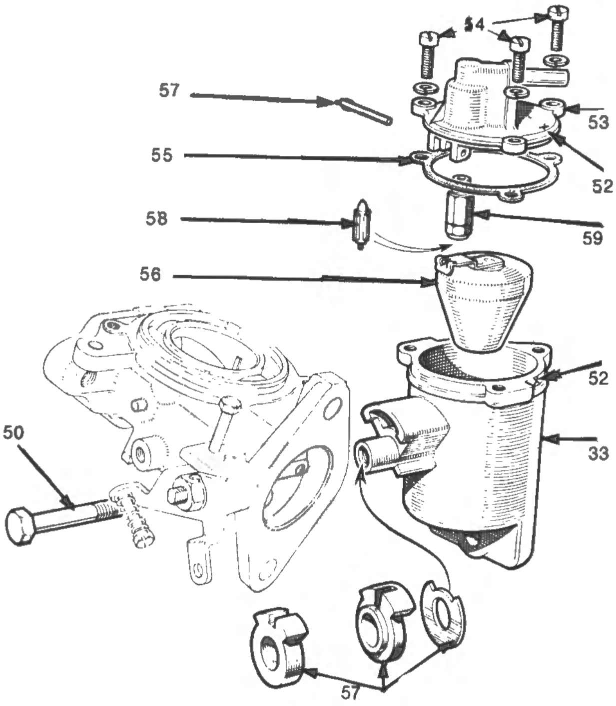


Fig. F-28
REMOVING FLOAT CHAMBER

14 Slacken and remove the bolt (50) retaining the float chamber (33) to the carburetter body. Note the component sequence of the flexibly mounted chambers (33) and (51).

15 Mark the location (52) of the float chamber lid (53). Unscrew the lid retaining screws (54) and detach the lid and its gasket (55) complete with the float assembly (56).

16 Push out the float hinge pin (57) from the end opposite its serrations and detach the float.

17 Extract the float needle (58) from its seating (59) and unscrew the seating from the lid using a wrench 8.58 mm (0.338 in) across the flats. Take care not to distort the seating.
Refer Fig. F-29.

18 Close the throttle and mark the relative positions (60) of the throttle disc (61) and the carburetter flange (62).

19 Unscrew the two disc retaining screws (64). Open the throttle and ease out the disc from its slot in the throttle spindle (65). The disc is oval and will jamb if care is not taken. Place the disc in a safe place until required for assembly.

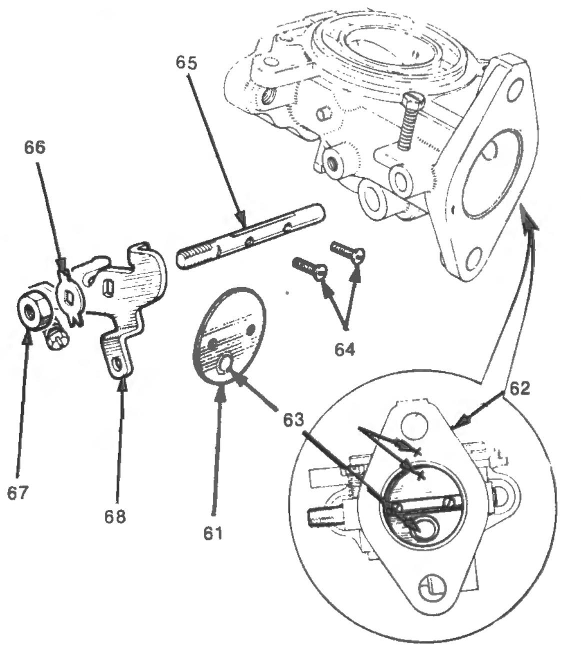


Fig. F-29
REMOVING THROTTLE

20 Tap back the tabs of the tab washer (66) securing the throttle spindle nut (67). Note the location of the lever arm (68) in relation to the spindle and the carburetter body. Remove the nut and detach the arm.

Assembling

NOTE: Before assembling the carburetter, examine all components for wear and damage. Renew unserviceable parts, ensure that all replacements are of the correct specifications.

1 Examine the throttle spindle and its bearings in the carburetter body. Check for excessive clearance, and renew parts as necessary.

2 Refit the spindle to the body. Assemble the operating lever with tab washer and spindle nut, to the spindle. Ensure that when the stop on the lever is against the abutment on the carburetter body (throttle closed position) the countersunk ends of the holes in the spindle face outwards. Tighten the spindle nut and lock with the tab washer.

3 Insert the throttle disc into the spindle, ensuring that it is in its original position as marked. Manoeuvre the disc in the spindle slot until the throttle can be closed. Snap the throttle open and closed several times to centralize the disc in the bore of the carburetter. Fit two new disc retaining screws, but do not finally tighten. Check visually that the throttle completely closes, and adjust its position as necessary. With the throttle closed there must be clearance between the throttle lever and the carburetter body. Tighten the screws fully and spread their split ends just enough to prevent turning.

4 Examine the float needle and seating for damage. If the spring loaded plunger in the end of the plastic bodied needle is fitted, ensure that it operates freely.

5 Screw the float needle seating into the float chamber lid carefully. Do not overtighten. Replace the needle in the seating, conical end first. Test the assembly for leakage with air pressure.

6 Refit the float and lever to the lid, insert the hinge pin and invert the float chamber lid. With the needle valve held in the shut-off position by the weight of the float only, there should be 3.17 mm to 4.76 mm (⅛ to 3/16 in) gap, arrowed Fig. F-30, between the float and the rim of the float chamber lid.

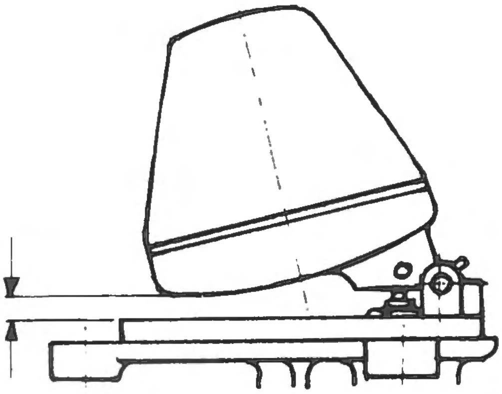


Fig. F-30

METHOD OF CHECKING THE FLOAT LEVEL
3.17 to 4.76 mm (⅛ to 3/16 in)

NOTE: The all nylon float used in this carburetter does not permit the raising or lowering of the fuel level by the usual method of bending the metal crank attached to the float as used in other models. To raise the fuel level, add an extra gasket under the float chamber lid, after ensuring that only one gasket exists between the float needle seat and the float chamber lid. To lower the fuel level, insert an additional washer between the float needle seat and the float chamber lid, after making sure that there is only one gasket between the float chamber and the lid.

7 Examine the float chamber lid gasket for re-use. Assemble the gasket on the lid and refit lid to the float chamber in the position marked when dismantling. Tighten the screws evenly.

8 Refit the float chamber assembly to the carburetter body and tighten the retaining bolt fully, making sure that the registers on the body and the chamber engages correctly.

9 Refit the piston lifting pin, spring and circlip.

10 Examine the piston assembly for damage on the piston rod and the outside surface of the piston. The piston assembly must be scrupulously clean. Use a suitable alcohol solvent as a cleaning agent. DO NOT USE ABRASIVES. Wipe the piston dry using a clean cloth.
Refer Fig. F-31.

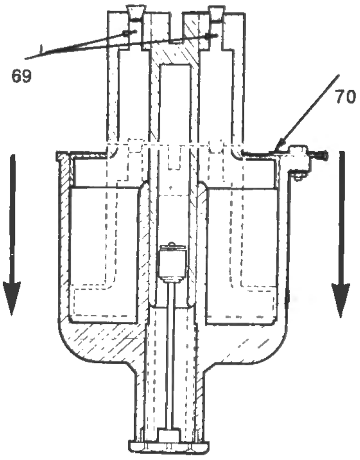


Fig. F-31

CHECKING PISTON DROP TIME

11 Clean inside the suction chamber and piston rod and wipe dry. Refit the damper and washer. Temporarily plug the piston transfer holes (69) and fit the piston into the suction chamber. Fit a nut and screw with a large flat washer under the head of the screw into one of the suction chamber fixing holes, positioning the washer (70) so that it overlaps the suction chamber bore. Check that the piston is fully home in the suction chamber and invert the assembly to allow the chamber to fall away from the piston, until the piston contacts the flat washer. Check the time taken for the suction chamber to fall the full extent of the piston travel. The time taken should be 5-7 seconds. If this time is exceeded, check the piston and suction chamber for cleanliness and mechanical damage. If after checking the time taken is still not within the limit, renew the suction chamber and piston assembly.

12 Refit the jet bearing, fit and tighten the jet locking nut. No jet centering is necessary with the spring loaded type jet needle.

13 Fit the jet nut spring. Fit the jet adjusting nut and screw it up as far as possible.

14 Feed the jet into the jet bearing. Fit the sleeve nut, washer and gland to the end of the flexible tube. The tube must project a minimum of 4.762 mm (3/16 in) beyond the gland. Tighten the sleeve nut until the gland is compressed. Over-tightening can cause leakage.

15 Refit the spring to the jet needle assembly, ensuring that it locates completely in the groove of the needle support.
Fig. F-32.

16 IMPORTANT:
Spring loaded needles are supplied complete with shouldered spring seats. No attempt must be made to alter the position of the spring seat, or convert to a fixed needle type. The raised pip in the needle guide ensures that the needle is correctly located. Under no circumstances must

the pip be removed or repositioned. Fit the needle assembly into its guide and fit the assembly into the piston. The lower edge of the guide (76) (Fig. F-32) must be flush with the face of the piston and the guide positioned so that the etched locating mark (77) on the lower face is adjacent to and in line with the midway point between the two piston transfer ports as illustrated in Fig. F-32. Alternative needle guides have a flat machined on the guide which must be positioned so that the guide locking screw tightens down onto the flat. Fig. F-33. If the guide is incorrectly positioned so that the guide locking screw has not tightened down on the flat, the head of the screw will protrude from the piston.

17 Fit a new guide locking screw.

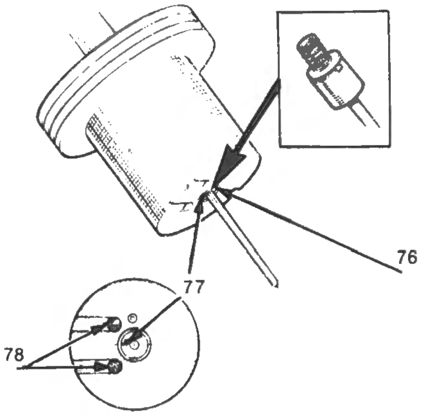


Fig. F-32

FITTING JET NEEDLE

CAUTION: Guide locking screws for spring loaded needles are shorter than the locking screws used with fixed needles. Ensure that the correct locking screw is used.

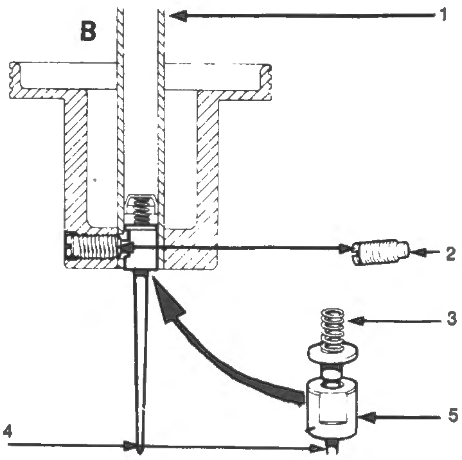


Fig. F-33

SPRING LOADED NEEDLE

1 PISTON ROD
2 GUIDE LOCKING SCREW
3 SPRING
4 NEEDLE
5 NEEDLE SUPPORT GUIDE

18 Check the piston key for security in the carburetter body.

19 Fit the suction chamber, spring and retaining screws, taking care not to wind-up the spring during installation. Tighten the securing screws evenly.

20 Refit the damper and washer.

21 Reassemble the pick-up lever, cam lever, cam lever spring, skid washer and pivot bolt tube in the positions noted on dismantling.

22 Place the pick-up lever return spring in position over its boss and secure the lever assembly to the carburetter body with the pivot bolt. Ensure that the double coil spring washer or spacer fits over the projecting end of the pivot bolt tube.

23 Register the angled end of the return spring in the groove in the pick-up lever, and hook the other end of the spring around the moulded peg on the carburetter body.

24 Fit the brass ferrule to the hole in the end of the pick-up link. Relieve the tension of the return spring and fit the link to the jet with its retaining screw. When finally tightening the screw, support the moulded end of the jet.

25 Without removing the suction chamber, screw the jet adjusting nut until the top face of the jet is flush with the bridge of the carburetter.

26 Turn down the adjusting nut to the initial jet setting of 12 flats.

27 Refit the carburetter to the engine.

NOTE: Final adjustment must be carried out in accordance with the Tuning procedures Emission Control Section.

FUEL PUMPS

DESCRIPTION

Both the 6 and 8 cylinder engines are equipped with mechanical type fuel pumps driven from the camshaft. The pump on the 8 cylinder engine is located on the left hand side of the timing case and actuated by an eccentric attached to the front of the camshaft, while the pump on the 6 cylinder engine is located on the right hand side of the camshaft cover and actuated by an eccentric on the camshaft through a short push rod, having a sliding fit in the camshaft cover, to the fuel pump rocker arm.

A vapour separator fitted to the fuel line adjacent to the carburetter, allows the continuous return of a small volume of fuel to the fuel tank to prevent vapour locks occurring in the fuel lines and carburetter (fitted to certain models).

Operation

Although the linkage transmitting the motion from the camshaft eccentric to the fuel pump diaphragm varies on the 6 and 8 cylinder engines, the operation of both fuel pumps is identical.

As the engine camshaft rotates, the fuel pump eccentric actuates the diaphragm through the linkage, downwards against spring pressure, producing a vacuum in the pumping chambers.

Petrol is drawn into the sediment chamber through the inlet valve. When the cam lobe passes the push rod or rocker arm the diaphragm moves upwards by the pressure of the diaphragm spring and forces fuel through the outlet valve to the carburetter.

When the carburetter float rises and closes the needle valve, the diaphragm stops its upwards travel until the float is lowered and the needle valve opens again. The rocker arm continues to operate while the diaphragm is stationary as motion will not be transferred through the link to the diaphragm until more fuel is able to enter the carburetter.

TESTING

Testing Without Gauges

1 Disconnect the fuel line at the carburetter.

2 Disconnect the low tension lead from the coil to distributor.

3 Crank the engine with the starter. A solid flow of fuel should be evident at each working stroke of the pump.

4 If no fuel is delivered, disconnect the inlet line to the pump, and test for fuel flow from the tank to pump. If fuel is delivered to the pump, check the following points before removing the pump for overhaul.

  (a) Check the domed cover retaining screw for tightness.

  (b) Check condition of the fibre washer under the head of the retaining screw.

  (c) Check the condition of cover gasket.

  (d) Check for foreign matter in sediment chamber.

Testing With Gauges

1 INLET
A minimum gauge reading of 0.150 mm Hg (6 in Hg) must be held for 15 seconds without dropping more than 0.50 mm Hg (2 in Hg).

2 OUTLET
A maximum gauge reading of 5 psi must be registered and held for 15 seconds without dropping more than 0.5 psi. Should pressure be too high or too low, replace the diaphragm spring with one of the correct strength.

NOTE: Fuel pressure — 6 cyl engine 34.45 kPa (5 psi).
8 cyl engine 41.34 kPa (5 psi).

Testing after Overhaul

An overhauled pump should be tested before installation on the engine, using the following procedures:

1 Seal the inlet pipe fitting with a finger.

2 Operate the diaphragm through three full strokes.

3 Wait 15 seconds and remove finger. A noise caused by suction should be heard.

4 Seal the outlet pipe fitting with a finger.

5 Operate the diaphragm one complete stroke.

6 The pressure should be retaining for 15 seconds.

FUEL PUMP 6 CYLINDER ENGINE

Removing

1 Disconnect battery.

2 Disconnect the fuel inlet hose from the fuel pipe.

3 Disconnect the fuel outlet pipe.

4 Remove the two bolts securing the fuel pump to the camshaft cover, and withdraw the fuel pump taking care to retain the short push rod.

Refitting

1 Refitting is the reverse of procedures 1 to 4 noting the following:

  (a) Install a new gasket between fuel pump body and camshaft cover, making sure that it is the same thickness as the original gasket.

  (b) Ensure that the fuel pump arm is correctly located on the push rod.

NOTE: Whenever fuel lines are removed the connecting hoses and clips should be inspected and renewed if necessary.

OVERHAULING

Dismantling

Refer Fig. F-34.

1 Remove fuel pump from engine and clean exterior.

2 Remove the bolt and fibre washer securing the sediment bowl cover from pump body.

3 Mark the two halves of the fuel pump body for correct assembling.

4 Remove the six screws securing both halves of pump and separate the two parts.

NOTE: The inlet and outlet valves are located in the upper half of body.

5 Prise out both inlet and outlet valves noting their respective locations.

6 Prise the return spring from the rocker arm and remove.

7 Twist the diaphragm 90° to release it from the operating link and remove from pump with its spring.

8 Remove one circlip from the rocker arm and drive the pin from the pump body with a suitable punch.

9 Remove the diaphragm operating link and pump rocker arm together with the two flat washers

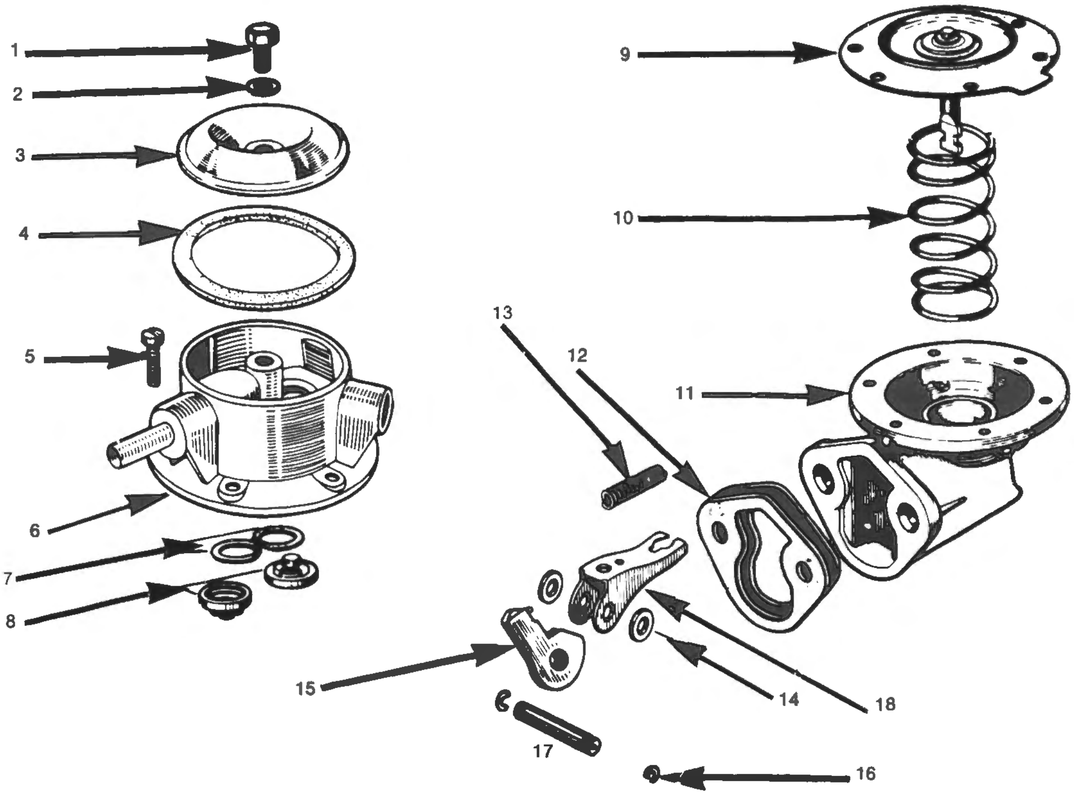


Fig. F-34

FUEL PUMP 6 CYLINDER ENGINE

1	FILTER COVER SCREW	10	DIAPHRAGM SPRING
2	FILTER COVER SCREW WASHER	11	LOWER CASTING
3	FILTER COVER	12	FLANGE SPACER BLOCK
4	BOWL GASKET	13	ROCKER ARM SPRING
5	COVER SCREW	14	SPACER WASHER
6	UPPER CASTING	15	ROCKER ARM
7	VALVE GASKET	16	ROCKER ARM PIN CLIP
8	VALVE ASSEMBLY	17	ROCKER ARM PIN
9	DIAPHRAGM ASSEMBLY	18	LINKAGE

located one each side of the rocker arm and link.

10 Discard all gaskets and seals and renew. Major or Minor repair kits are available for overhauling.

Inspection

1 Clean all parts thoroughly to ascertain their condition.

2 The diaphragm and pull rod assemblies must be of sound condition, without any signs of cracking or hardening, otherwise they should be replaced.

3 Inspect the mating flanges of both upper and lower sections of the pump, and reface if they are scored or distorted.

4 All linkage should be replaced if showing wear that would reduce the movement of the diaphragm.

NOTE: The push rod length is 38.3 mm to 38.6 mm (1.51 to 1.52 in). A worn push rod will reduce the diaphragm movement.

Assembling

Refer Fig. F-34.

1 Replace the valve gaskets and valves, using a centre punch to restake the valves in their seats. Check the firmness of the valves by inserting a small screw driver in the forks of valve and try to rotate with a firm pressure, replace bowl gasket, filter cover and filter cover washer and screw.

2 Insert the rocker arm spring, followed by the link, rocker arm, and spacer washers, then place a suitable dummy pin through the casting to hold the rocker arm and link assembly and drive the new rocker arm pin into the casting. When driving the rocker arm pin into the casting, it will be found easier to place the pump mounting flange in a vice.

3 Replace the rocker arm pin clips on the rocker arm pin.

4 Place a diaphragm spring in position. The flat section at the base of the pull rod on the diaphragm must run parallel with the link. When the slot in the pull rod is felt to be in contact with the link, turn the diaphragm 90°. A correctly fitting diaphragm should measure 9/16" from the diaphragm flange of the casting to the diaphragm leaf in a level position, if the diaphragm is fitted incorrectly, the measurement would be 3/16".

5 It is important to flex the diaphragm correctly as over pressure may result if the following procedure is not adopted:

(a) Push the rocker arm until the diaphragm is level with the flange surface.

(b) Hold position, align the diaphragm leaf holes with their corresponding casting holes, place the top casting in position with the file marks (which were outlined in Paragraph 2 of the dismantling procedure) in alignment and screw the diaphragm screws finger tight.

(c) Actuate the rocker arm several times to allow the diaphragm to settle and tighten while the rocker arm is at rest.

6 When installing the pump on to the engine, take care to ensure the correct spacer or mounting gasket is used.

FUEL PUMP 8 CYLINDER ENGINE

Removing

1 Disconnect battery.

2 Disconnect the fuel inlet hose from fuel pump.

3 Disconnect the fuel outlet pipe.

4 Remove the two bolts securing the fuel pump to the timing case, and withdraw pump.

Refitting

1 Refitting is the reverse of procedures 1 to 4 noting the following:

(a) Install a new gasket of the same thickness between the fuel pump and timing case.

(b) Ensure that the fuel pump operating lever is correctly located on its eccentric on the front of camshaft.

OVERHAULING

Dismantling

Refer Fig. F-35.

1 Remove the pump from the engine. Steps 2, 3, 4 and 5 are identical to the procedures given for the pump used on the 6 cylinder engine.

6 To remove the diaphragm, press downwards and tilt the pull rod inward away from the operating link. Lift the diaphragm assembly and spring from the housing.

7 Remove one sealing plug covering the rocker arm pivot pin, and using a suitable punch drive out the pivot pin and opposite sealing plug.

8 Discard all gaskets and seals and renew. Major or Minor repair kits are available for overhauling.

Inspection

Follow the procedures given for the pump used on the 6 cylinder engine.

Assembling

Refer Fig. F-35.

1 Replace the valve gaskets and valves, using a centre punch to restake the valves in their seats. Check the firmness of the valves by inserting a small screw driver in the forks of valve and try to rotate with a firm pressure, replace bowl gasket, filter cover and filter cover washer and screw.

2 Insert link and rocker arm, then place suitable dummy pin through the casting to hold the rocker arm and link assembly, drive the new rocker arm pin into the casting.
When driving the rocker arm pin into the casting, it will be found easier to place the pump mounting flange in a vice.

3 Replace the two rocker arm pin plugs.

4 Fit rocker arm spring.

5 Place diaphragm spring in position, hold the link in the 'up' position, depress diaphragm to hook on to the link.

6 It is important to flex the diaphragm correctly as over pressure may result if the following procedure is not adopted.

(a) Push the rocker arm until the diaphragm is level with the flange surface.

(b) Hold position, align the diaphragm leaf holes with their corresponding casting holes, place the top casting in position with the file marks (which were outlined in Paragraph 2 of the dismantling procedure) in alignment and screw the diaphragm screws finger tight.

(c) Actuate the rocker arm several times to allow the diaphragm to settle and tighten while the rocker arm is at rest.

7 When installing the pump on to the engine, take care to ensure the correct spacer or mounting gasket is used.

Testing

Testing the fuel pump before installation is identical with the procedure given for the pump on the 6 cylinder engine.

FUEL PUMP KIT LEYLAND V8. HYL 4857 M

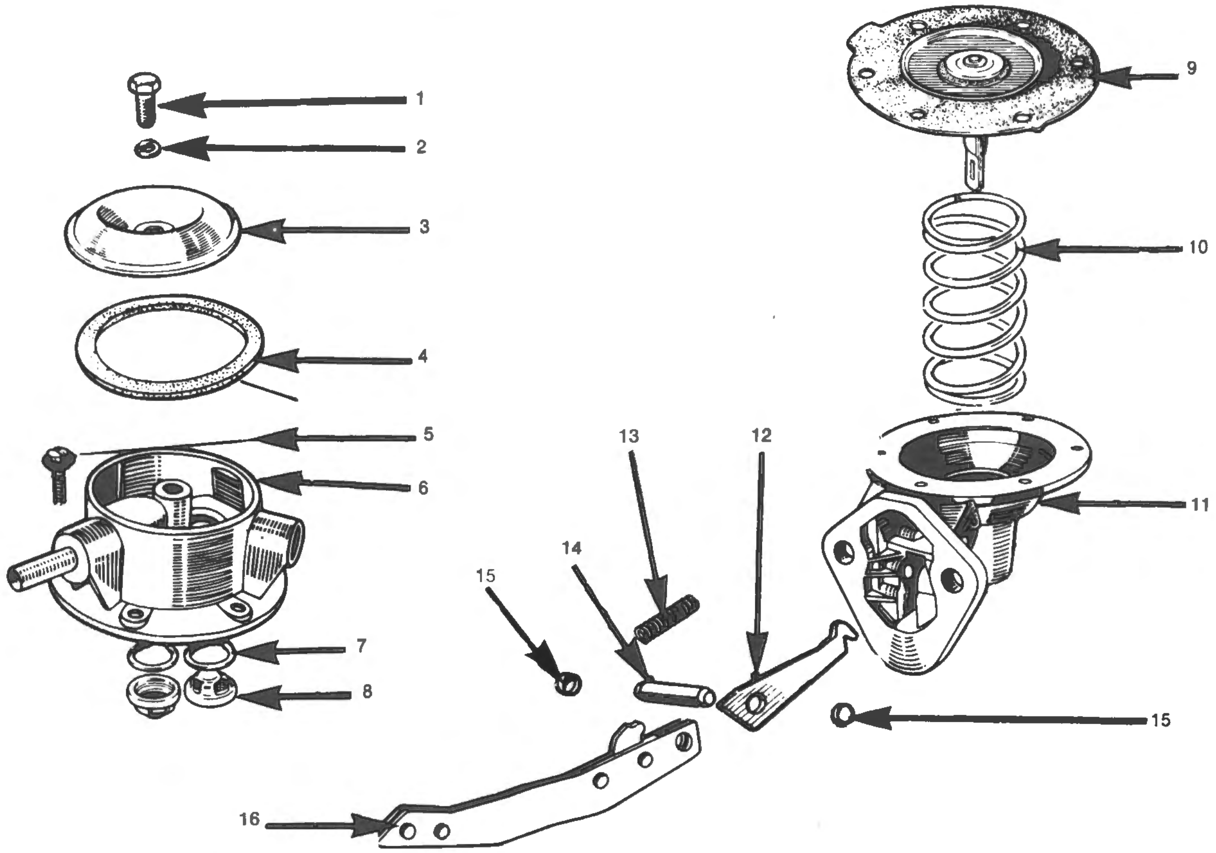


Fig. F-35

FUEL PUMP 8 CYLINDER ENGINE

1	FILTER COVER SCREW	9	DIAPHRAGM ASSEMBLY
2	FILTER COVER SCREW WASHER	10	DIAPHRAGM SPRING
3	FILTER COVER	11	LOWER CASTING
4	BOWL GASKET	12	LINK
5	COVER SCREW	13	ROCKER ARM SPRING
6	UPPER CASTING	14	ROCKER ARM PIN
7	VALVE GASKET	15	ROCKER ARM PIN PLUG
8	VALVE ASSEMBLY	16	ROCKER ARM

FUEL TANK

Removing

Refer Fig. F-36.

1. Disconnect battery earth lead.
2. Raise rear of vehicle and place stands under rear axle.
3. Remove sufficient fuel from tank to ensure easy handling.
4. Disconnect gauge unit sender wire and rubber hoses from gauge unit.
5. Disconnect filler pipe hose, breather and vent pipe connections.
6. Support the weight of tank and remove the 8 bolts securing tank to underside of floor.
7. Lower tank to ground and remove from under vehicle.

Refitting

1. Refitting is the reverse of procedures 1 to 7.

FUEL TANK GAUGE UNIT

Removing

Refer Fig. F-37.

1. Disconnect the battery.
2. Raise rear of vehicle and place suitable stands under rear axle.
3. Remove sufficient fuel from the tank to avoid spillage when the gauge unit is removed. Mark the tank and fuel gauge unit for correct replacement.
4. Remove wire from fuel gauge unit.
5. Disconnect clips from fuel line hose and remove hose from fuel gauge unit.
6. Disconnect clips from fuel return line hose and remove hose from fuel gauge unit.

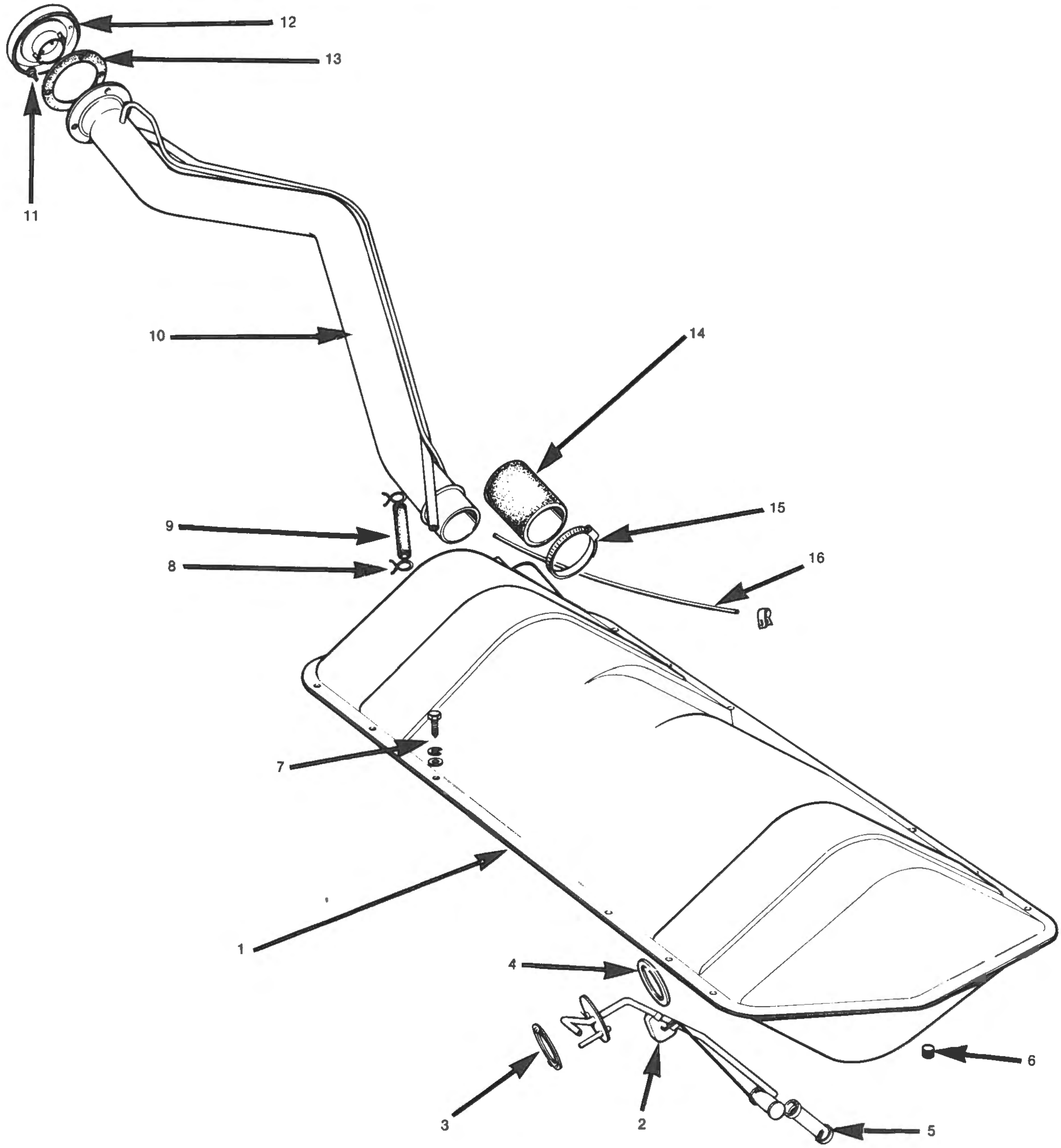


Fig. F-36

FUEL TANK AND COMPONENTS

1	FUEL TANK	9	HOSE — VENT PIPE TO TANK
2	SENDER UNIT	10	FUEL FILLER PIPE
3	LOCK RING	11	FUEL FILLER RETAINING SCREW
4	GASKET	12	PETROL FILLER CAP
5	FILTER	13	FILLER CAP GASKET
6	DRAIN PLUG	14	FILLER PIPE HOSE
7	FUEL TANK SECURING BOLTS AND WASHERS	15	HOSE CLIP
8	HOSE CLIP	16	VENT PIPE

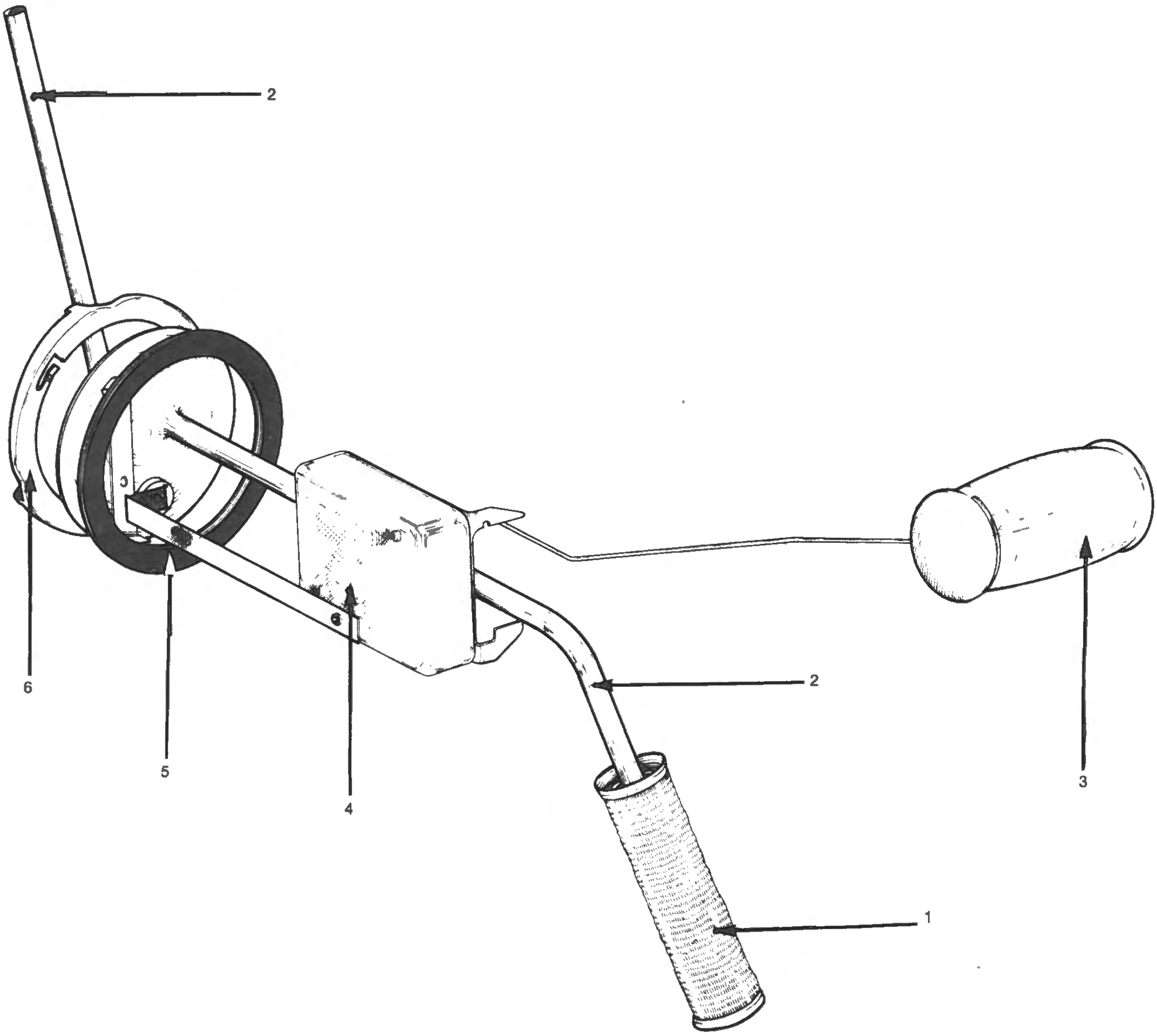


Fig. F-37

FUEL TANK GAUGE UNIT

1	FUEL FILTER	4	FUEL GAUGE UNIT
2	FUEL PIPE	5	SEALING RING
3	FLOAT	6	LOCK RING

7 Remove fuel gauge unit from the tank by turning the locking plate in an anti-clockwise direction using a suitable tool.

8 Remove the fuel gauge unit from the tank by turning it sufficient for the gauge arm, float, and fuel pick-up pipe to be withdrawn without interference.

Refitting

1 Refitting is the reverse of the procedures 1 to 8 noting the following:

(a) Ensure that the rubber seal between tank and gauge unit is in sound condition.

(b) Install the gauge unit in its correct location.

(c) Ensure that the rubber hoses and clips are in sound condition. Renew if necessary.

FUEL VAPOUR SEPARATOR

(Refer Fig. F-38)

A fuel and vapour separator is installed in the fuel line adjacent to the carburetters of the 6 and 8 cylinder engines. This unit prevents the formation of vapour locks in both the fuel pump and carburetter by the fitting of an additional pipe of reduced diameter to return excess fuel and any vapour that may be generated back to the fuel tank.

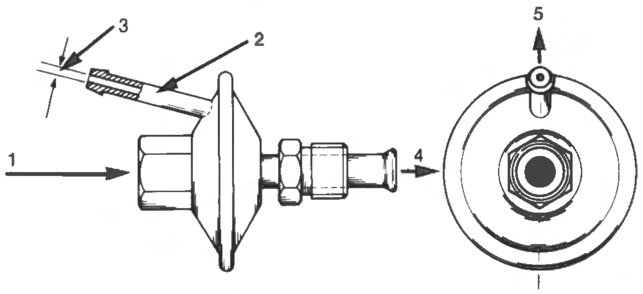


Fig. F-38

FUEL VAPOUR SEPARATOR * See below

1 FUEL INLET
2 RETURN PIPE
3 RESTRICTOR 1.58mm (1/16 in.)
4 CARBURETTER CONNECTION
5 RETURN PIPE CONNECTION

Removing

1 Remove air cleaner.

2 Disconnect the rubber tube connecting the return pipe to carburetter.

3 Undo the unions on both sides of vapour separator and remove separator.

Refitting

1 Refitting is the reverse of removing procedures 1 to 3.

FUEL LINE/S

PUMP TO VAPOUR SEPARATOR

Removing

1 Disconnect battery earth lead.

2 Disconnect fuel line at fuel pump.

3 Disconnect fuel line at vapour separator.

4 Remove fuel line.

Refitting

1 Refitting is the reverse of removing procedures 1 to 4.

TANK FILLER

Removing

1 Disconnect the battery.

2 Remove sufficient fuel from the tank to avoid spillage.

3 Loosen clips on filler hose and move hose downwards on fuel tank neck.

4 Disconnect air vent hose and leave hose attached to fuel tank.

5 Remove fuel tank cap and remove the four screws retaining the filler to rear guard.

6 Remove the filler and air vent pipe from their connecting hoses and withdraw the filler pipe from underneath the rear guard.

Refitting

1 Refitting is the reverse of removing procedures 1 to 6.

* IF FUEL STARVATION OCCURS, CHECK FINE FILTER BY LOOKING THROUGH FROM INLET PIPE TO OUTLET PIPES

TANK TO FUEL PUMP

Fig. F-39.

The fuel pipe connecting the fuel tank to the fuel pump is in two pieces, and connected by a rubber hose. The pipe is fastened to the body by clips.

REAR

Removing

1 Disconnect battery.

2 Remove clips retaining hose connecting fuel line to gauge unit pipe and remove hose. Plug gauge unit pipe to prevent spillage of fuel.

3 Disconnect the hose connecting the front and rear pipes.

4 Remove the pipe from securing clips on body and remove pipe.

Refitting

1 Refitting is the reverse of removing procedures 1 to 4.

FRONT

Removing

1 Disconnect and remove the hose connecting the front and rear pipes. Plug rear pipe to prevent spillage of fuel.

2 Disconnect and remove the hose connecting the front pipe to fuel pump.

3 Unclip pipe from securing clips and remove pipe.

Refitting

1 Refitting is the reverse of removing procedures 1 to 3.

FUEL TANK VENT PIPE

Removing

1 Disconnect battery.

2 Remove clips from vent pipe hoses sliding them together at the centre.

3 Disconnect vent pipe from fuel tank end first and plug opening in tank to prevent loss of fuel.

4 Disconnect the vent pipe from steel vent tube located above the filler pipe hose.

5 Disconnect the hose connecting the vent pipe from tank to the vent tube welded to the upper part of the filler pipe.

6 Remove the upper part of filler pipe as described.

Refitting

1 Refitting is the reverse of removing procedures 1 to 6.

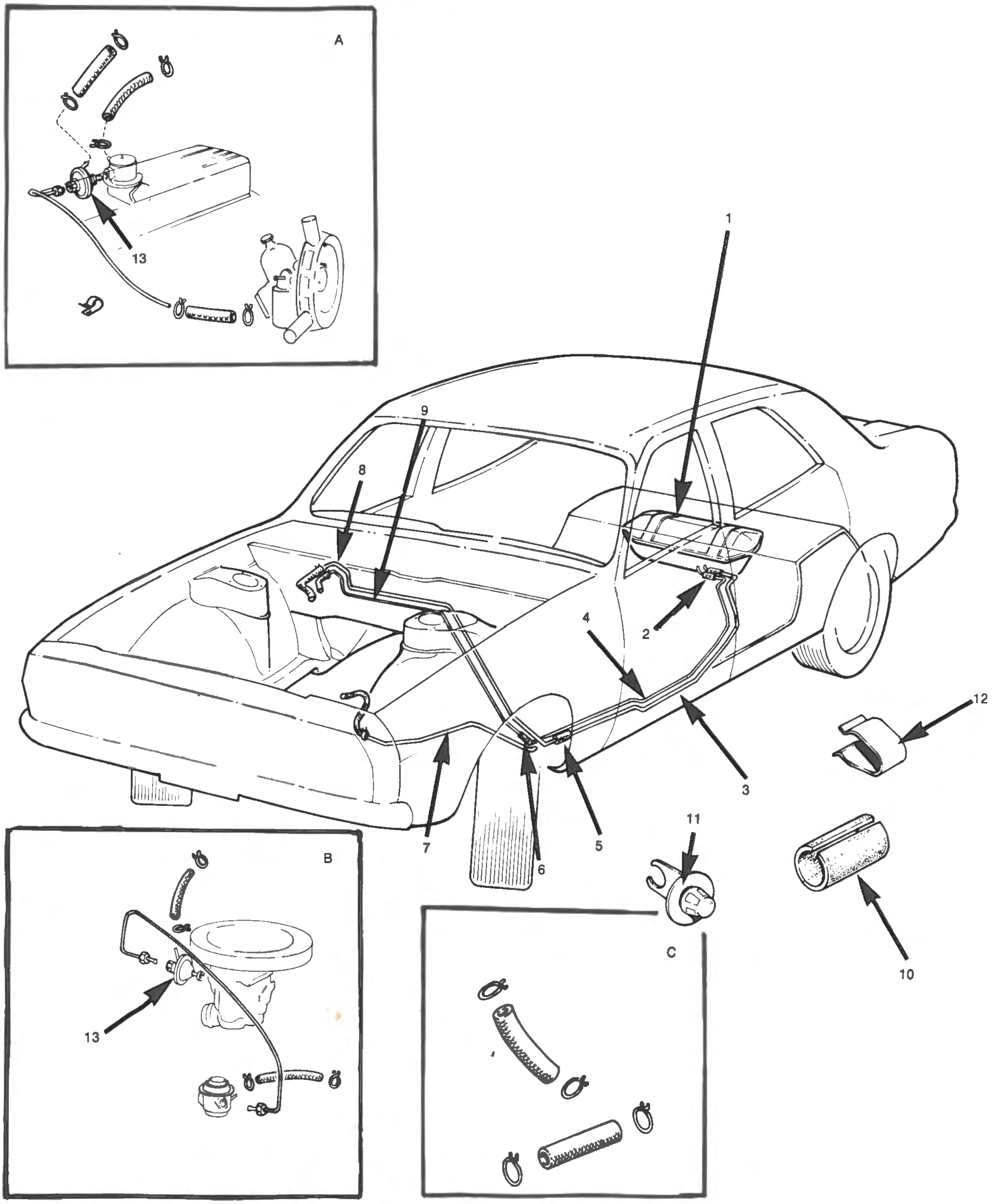


Fig. F-39

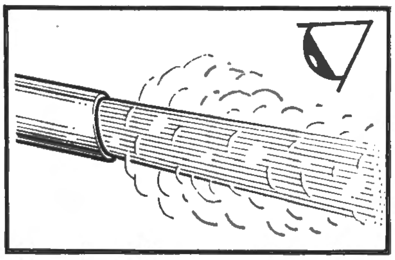
FUEL LINES

1 FUEL TANK
2 RETURN PIPE JOINING HOSE
3 FUEL FEED PIPE
4 FUEL RETURN PIPE
5 FUEL FEED PIPE JOINING HOSE
6 FUEL RETURN PIPE JOINING HOSE
7 FUEL FEED TO PUMP 8 CYL

INSET A FUEL FEED — PUMP TO CARBURETTER 6 CYL
INSET B FUEL FEED — PUMP TO CARBURETTER 8 CYL
INSET C JOINING HOSES AND CLIPS

8 FUEL FEED TO PUMP 6 CYL
9 FUEL RETURN PIPE
10 FUEL RETURN PIPE SLEEVE
11 FUEL PIPE CLIP 6 CYL AND 8 CYL
12 FUEL PIPE CLIP 8 CYL ONLY
13 VAPOUR SEPARATOR

SECTION G
EMISSION CONTROL



GENERAL

ENGINE EXHAUST — The limits of carbon monoxide (CO) emissions from the exhaust of vehicles at engine idle speed are defined in the Australian Design Rule No. 26. This rule is endorsed by the Australian Transport Advisory Council and is applicable to all passenger cars manufactured on and after 1st January, 1972.

A considerable overall decrease in the CO content of the exhaust gas can be achieved by driving in a reasonable manner.

At all times avoid:

1 Sudden acceleration.

2 Running at high engine rpm in the intermediate gears when not necessary.

3 Maintaining a wide open throttle when the engine is pulling heavily at reduced engine rpm.

These factors not only increase the CO in the exhaust gas, but also increase fuel consumption and may result in increased engine wear.

ENGINE CRANKCASE (Positive Crankcase Ventilation System PCV). Primarily the PCV System removes from the crankcase the waste products produced by the natural operation of the engine.

Removal of the waste is achieved by manifold vacuum extraction and their disposal is by burning in the combustion chamber.

Therefore a system which is operating efficiently will:—

Extend the service life of the engine by minimising contamination of the lubricating oil; and assist in preventing pollution by non dumping of the waste to atmosphere.

FUEL SYSTEM

CARBURETTER TUNING

Description

All models of this range of vehicles are factory tuned to meet the exhaust emission regulations laid down by the Transport Authorities to give less than 4.5% carbon monoxide (CO) content in the exhaust gas under idling conditions.

The emission control tuning procedure is outlined on a plate mounted in the engine compartment.

The detailed carburetter tuning procedure is given in two sections. Initial setting, and tuning, to ensure that the CO emission is less than the required 4.5% under idling conditions.

Before any carburetter tuning can be carried out (this applies to both 8 and 6 cylinder engines) it is essential that the ignition system, including distributor points, spark plug gap, (the correct type and heat range of spark plug must be fitted) and ignition timing are correct, also that the valve clearances are within the figures given in GENERAL DATA. Compression pressures on each cylinder must be within the specified figures otherwise it will not be possible to obtain satisfactory results.

Air cleaners must be clean or the element replaced if undue restriction is evident. The crankcase emission control equipment must be installed and operating efficiently.

The exhaust system must be in good condition without leakage at any point, or excessive back pressure.

NOTE: The exhaust system must not be altered from the original equipment as it may be detrimental to the engine and affect the CO content of the exhaust gases.
Before attempting to carry out the carburetter tuning procedure, it is essential that all other carburetter checks and adjustments have been carried out, particularly in respect to the float level and the height of fuel in the float bowl, jet sizes, fuel pressure, air leaks through throttle shaft or mounting flange gaskets and the mixture weakening device.

Tuning Conditions

1 To ensure that the engine temperature and mixture requirements are stabilized, tuning must be carried out in accordance with the following setting procedure.

2 Connect an accurate tachometer and CO type gas analyser to the engine. Place the gas analyser probe in the exhaust tail-pipe, located so that any condensation is unable to contact the probe.

NOTE: It is essential that the probe and connecting tube of the analyser are in good condition, as any leaks would lead to an incorrect reading.

3 Run the engine at a fast idle speed until the normal operating temperature has been reached. The vehicle should preferably be standing in an ambient temperature of between 20°C and 30°C (68°F to 86°F). Run the engine for at least five minutes after the thermostat has opened; the thermostat opening point can be detected by the sudden rise in temperature at the top tank of radiator.

4 Set the engine speed at 2500 rpm at no load and run for one minute.

5 On vehicles equipped with automatic transmissions the carburetter is adjusted with the transmission selector in the Park position.

6 Tuning operations must be commenced and carried out in the shortest possible time. If the time for tuning exceeds a three minute period, open the throttle and run the engine at 2500 rpm for one minute, then resume tuning. Repeat this operation if further periods of three minutes are exceeded.

STROMBERG CARBURETTER WW SERIES

Description

While the actual procedure for emission control tuning of the WW Stromberg carburetter used on the 8 cylinder engine differs from that of the S.U. carburetter used on the 6 cylinder engine, the checking of all factors having influence on the CO content in the exhaust gas is most important.

The pre-tuning checks and warm-up procedures as described in this section must be adhered to if satisfactory results are to be achieved.

Tuning Procedure

1 Run the engine until it reaches normal operating temperature.

2 Adjust the engine idle speed and the idle air/fuel mixture to give smooth idling at 20 rpm above the specified idle speed.

3 Lean off the idle fuel/air mixture screws by turning an equal amount in a clockwise direction until the engine rpm is reduced to the specified idle speed.
650 rpm — Manual Transmission
700 rpm — Automatic Transmission

4 Should the CO reading be above 4.5%, the carburetter adjustments described in the tuning section should be checked and further tests carried out until a reading of less than 4.5% is obtained.

5 Remove the tachometer and gas analyser.

S.U. CARBURETTER

Initial Setting

1 Disconnect the choke cable (1) Fig. G-2.

2 Unscrew the fast idle screw until it is well clear of the cam.

3 Unscrew the throttle adjusting screw until it is just clear of its stop and the throttle is closed.

Tuning Procedure

1 Top up the piston damper with the recommended engine oil until the level is 12.7 mm (½ in) above the top of the hollow piston rod and ensure that the piston is not sticking in its chamber.

2 Run the engine until it reaches normal operating temperature as described in 'Tuning Conditions'.

3 Turn the throttle adjusting screw until an idling speed of 600 rpm is obtained.

4 Remove the lock clip and turn the jet adjusting nut, up to weaken, down to richen, until the fastest speed is recorded on the tachometer. Turn the jet adjusting nut very slowly.

5 The adjusting nut should only be turned half a flat at a time, making a pause each time the nut is moved and observing the tachometer reading.

6 The engine speed will increase and once a certain point is reached, it will then fall. From the point of maximum engine speed (LEAN BEST IDLE) the nut should be wound down a maximum of one eighth turn (¾ of a flat) REFER TO GRAPH Fig. G-1.

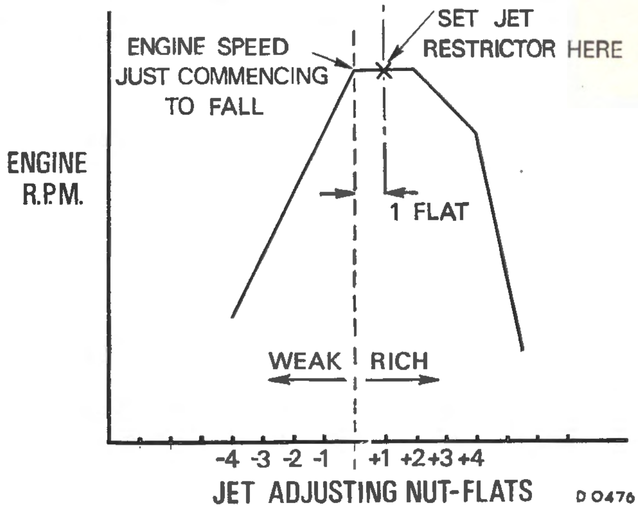


Fig. G-1

MIXTURE ADJUSTMENT

7 Check the idling speed and adjust to 600 rpm using the throttle adjusting screw.

8 When using the exhaust gas analyser, check that the percentage CO reading is below 4.5%.

9 If the reading falls outside the limit, reset the jet adjusting nut by the minimum amount necessary to bring the reading just within the limit.

10 If an adjustment exceeding two flats is required to achieve this, the carburetter should be checked as previously described.

11 Hold the jet adjusting nut to prevent it turning and refit the lock clip around the nut.

12 Reconnect the choke cable (1) with approximately 1/16 in free movement before it starts to pull on the jet lever (2). Fig. G-2.

13 Pull the choke knob until the linkage is about to move the carburetter jet and adjust the fast idle screw (3) to give an engine fast-idle speed of 1000 to 1100 rpm with the engine at normal operating temperature.

14 Remove the tachometer and gas analyser.

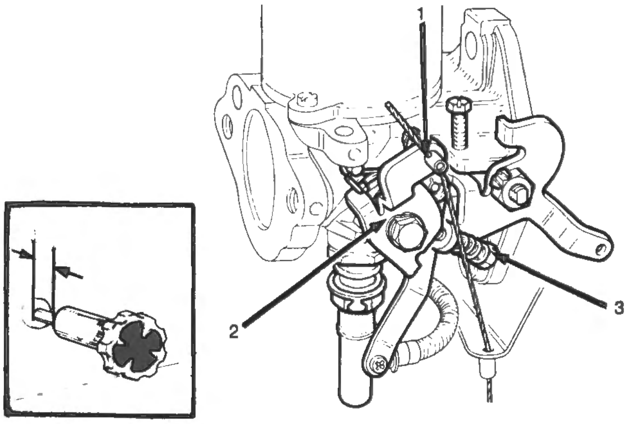


Fig. G-2

FAST IDLE ADJUSTMENT

1 CHOKE CABLE
2 JET LEVER
3 FAST IDLE SCREW

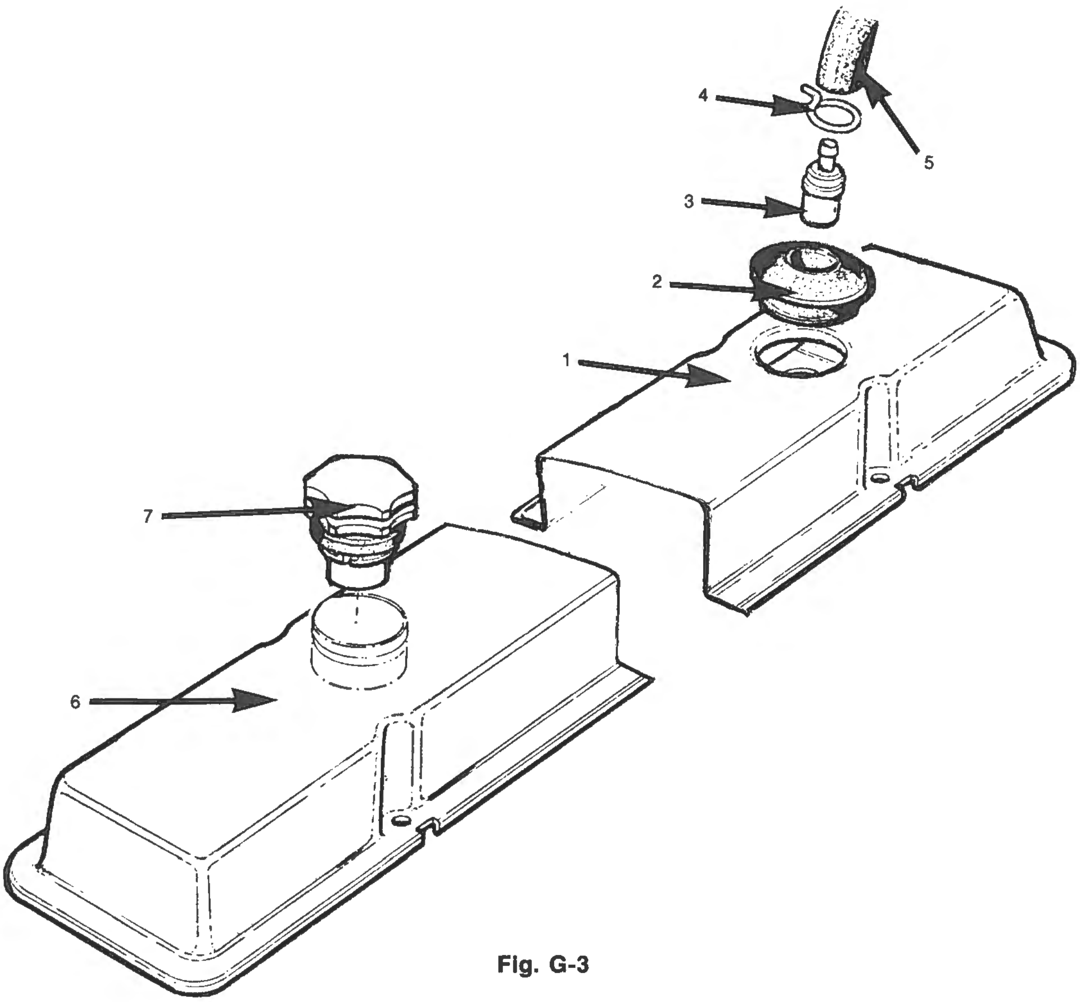


Fig. G-3

PCV SYSTEM COMPONENTS 8 CYLINDER ENGINE

1	VALVE COVER R.H.	5	HOSE TO CARBURETTER
2	PCV VALVE SEAL	6	VALVE COVER L.H.
3	PCV VALVE	7	OIL FILLER/AIR FILTER CAP
4	HOSE CLIP		

POSITIVE CRANKCASE VENTILATION

8 CYLINDER ENGINE

Fig. G-3.
Positive crankcase ventilation is achieved by utilizing the vacuum produced in the intake manifold. Air is drawn into the engine through the combined oil filler cap — air filter, into the engine and through the ventilation valve and hose into the intake manifold. The ventilation valve controls the amount of air being drawn through the engine under varying operating conditions.

As the air circulates through the engine it draws the crankcase fumes into the intake manifold where it mixes with the fuel-air mixture and is burnt in the combustion chamber.

Maintenance

The PCV valve must be kept clean and operate efficiently at all times. Ensure that the hose connections are kept tight and that the hose does not show signs of collapsing.

If excessive sludging of the valve occurs it will not operate and the valve may be closed. This could cause excessive crankcase pressure at high engine speeds resulting in oil being forced through the engine seals and gaskets.

The PCV valve and filter are replaced at 20,000 km (12,000 miles) refer Section C. However, a blocked valve will definitely cause the engine to idle roughly and the following method will enable a quick check to be made on the operation of the PCV unit.

TESTING

(a) Connect a tachometer to the engine.

(b) Start the engine.

(c) Block off the hose from the PCV valve to the carburetter base.

(d) If the PCV valve unit is operating correctly the engine rpm will change 50 to 60 rpm. The PCV valve should be heard to click when the hose is unblocked and blocked several times.

(e) There will be no change in engine rpm if the valve or hose are sludged up and restricted.

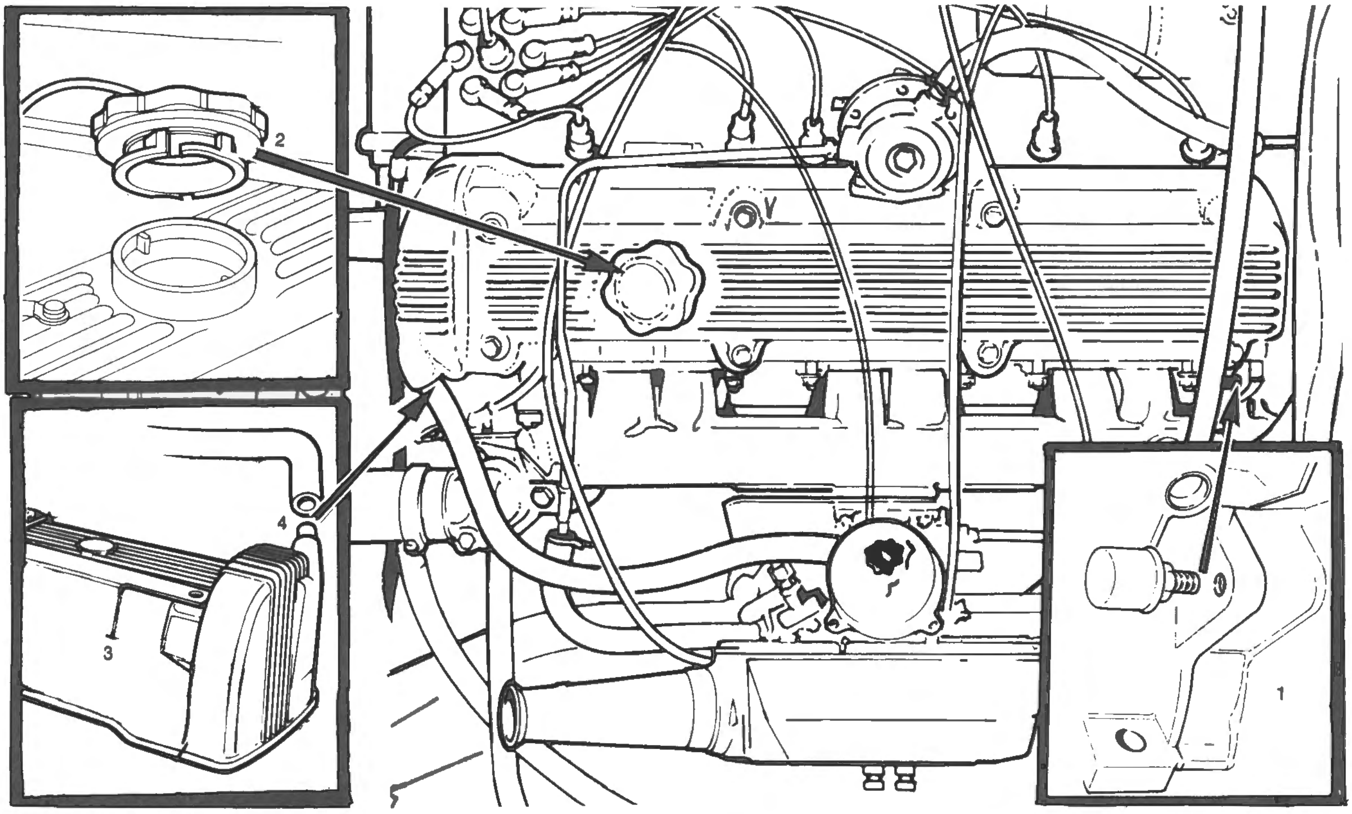


Fig. G-4

PCV SYSTEM COMPONENTS 6 CYLINDER ENGINE

1 CRANKCASE FILTER
2 NON VENTED OIL FILLER CAP
3 CAMSHAFT COVER WITH OIL SEPARATOR
4 HOSE COVER TO CARBURETTER BODY

6 CYLINDER ENGINE

Description

Positive crankcase ventilation is achieved on the 6 cylinder engine by the use of a breather mounted on the rear of the crankcase and a flexible tube running from the camshaft cover to the carburetter.

The amount of air being drawn through the engine under varying operating conditions is controlled by the throttle valve opening. The flexible tube connection enters the carburetter before the throttle valve, and at idle speed very little air circulates through the engine.

When the throttle valve is opened, greater quantities of fuel and air are drawn into the engine. This has the effect of producing a partial vacuum in the flexible tube connecting the camshaft cover and carburetter. The partial vacuum has the effect of drawing an increased volume of air into the crankcase which mixes with the crankcase fumes and drawn into the combustion chamber via the carburetter and intake manifold and burnt.

No PCV valve is used in this system and the sole method of control is the throttle valve.

Maintenance

Maintenance is confined to replacement of the air filter each 20,000 km (12,000 miles) or earlier if operating in dusty conditions. Refer Section C.

TESTING

Run the engine at idle speed until it reaches normal operating temperature. Remove the oil filler cap, and if the oil filter element is functioning the engine speed will decrease noticeably. If the engine speed remains constant, the filter element must be renewed.

FIREFLY TO + COIL.
WHITE FRO[illegible] B[illegible] TO [illegible]
FIRE[illegible] TO [illegible] L. T. BL[illegible]K

SECTION H
IGNITION SYSTEM

IGNITION H.T. CABLES — OVERALL LENGTH

No. 1	24¼"	615 MM	No. 2	28¼"	820 MM
No. 3	23 3/4"	605 MM	No. 4	30"	765 MM
No. 5	26 3/8"	670 MM	No. 6	30¼"	770 MM
No. 7	26 ½"	670 MM	No. 8	32"	815 MM

COIL TO DISTRIBUTOR 38¼" 970 MM

GENERAL DESCRIPTION

The ignition system used on the 6 cylinder and 8 cylinder engines is the conventional battery-coil-distributor unit and consists of two circuits — primary and secondary. The primary circuit includes the battery, ignition switch, low tension circuit of the coil, contact points and condenser. The secondary circuit includes the high tension circuit of the coil, distributor rotor arm and distributor cap segments, high tension cables and spark plugs.

Both the Lucas 29D6 distributor fitted to the 6 cylinder engine and the Lucas 29D8 distributor fitted to the 8 cylinder engine, employ independent centrifugal and vacuum advance and retard mechanisms to ensure that the correct ignition timing is maintained over a wide range of speeds and loads.

The centrifugal mechanism regulates the ignition advance according to engine speed, while the vacuum control varies the timing according to engine load. The vacuum operated unit is connected by a tube to the inlet manifold via a port in the carburetter which is located on the atmospheric side of the throttle disc at engine idle speed.

DISTRIBUTOR LUBRICATION AND CLEANING

LUBRICATION

Regular lubrication is required each 10,000 km (6000 miles) Fig. H-1.

Cam Bearing

Lift the rotor off the top of the spindle by pulling it squarely and add a few drops of oil to the cam bearing.

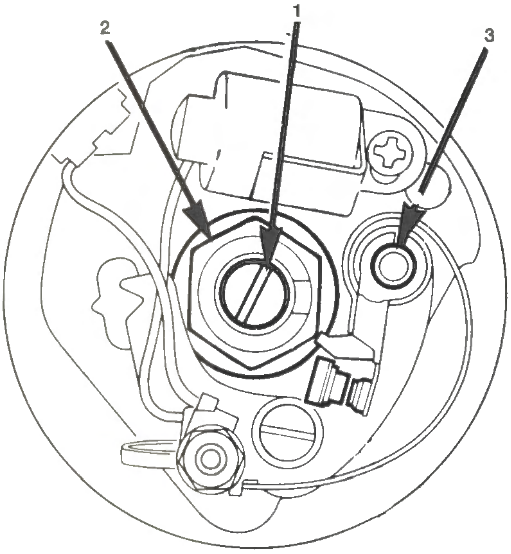


Fig. H-1

DISTRIBUTOR LUBRICATION POINTS

1 CAM BEARING
2 CAM
3 MOVING CONTACT

Cam

Lightly smear the cam with a multi-purpose grease.

Moving Contact

Apply one drop of oil to the pivot pin.

CLEANING

The distributor cap, leads, coil and spark plugs must be kept free of oil and dust contamination to avoid high tension current leakage and misfiring.

FAULT DIAGNOSIS

MISFIRING

Rough running of an engine is mostly caused by misfiring on one or more cylinders. To locate the fault carry out the following procedure:

1. Start the engine and set it to run at a fairly fast idling speed.
2. Short circuit each plug in turn by placing the blade of a screwdriver between the terminal and the cylinder head. No difference in the engine performance will be noted when short circuiting the plug in the defective cylinder. Shorting the other plugs will make uneven running more pronounced.
3. Having located the cylinder which is at fault, stop the engine and remove the cable from the terminal of the spark plug. Restart the engine and hold the end of the cable about 5 mm (3/16 in) from the cylinder head.
4. If the sparking is strong and regular, remove the plug and check the compression pressure (see Engine Section). If this test is satisfactory, service the plug (see Spark Plug Section) or renew it.
5. If there is no spark or if it is weak and irregular examine the cable from the spark plug to the distributor. After a long period of service the insulation may be cracked or perished in which case the cable should be renewed.
6. Finally, examine the distributor moulded cap and wipe the inside and outside with a clean, dry cloth; see that the carbon brush moves freely in its holder and examine the moulding closely for signs of breakdown. After long service it may become tracked — that is, a conducting path may have formed between two or more of the electrodes or between one of the electrodes and some part of the distributor in contact with the cap. Evidence of a tracked cap is shown by the presence of a thin black line and a replacement distributor cap must be fitted. The air gap between rotor and cap segments should be kept to a minimum by renewing both components when signs of burning become evident.

NOTE: When connecting the wires to the low tension terminals on the coil, the wire from the switch is placed on + terminal and the wire to the contact breaker is placed on the — terminal.

TESTING THE LOW TENSION CIRCUIT

1 Spring back the securing clips on the distributor and remove the moulded cap and rotor. If the rotor is a tight fit it can be levered off carefully with a screwdriver.

2 Check that the contacts are clean and free from pits, burns, oil or grease. Turn the crankshaft and check that the contact points are opening and closing freely and that the clearance between them is correct when they are fully opened.

3 Test the spring tension which should be between 567-680 gm (20-24 oz) measured at the contacts.

4 Reset the gap if necessary to the figure given in GENERAL DATA.

5 Connect a 3 watt test lamp between the distributor terminal and earth. Switch on the ignition and rotate the engine with the starter. If the lamp lights when the contacts open and goes out when the contacts close, the low tension circuit is in order. Should the lamp fail to light, the contacts are dirty, or there is a broken or loose connection in the low tension wiring. The procedure for isolating the fault is detailed below.

Locating a fault in the wiring

1 Having determined, by testing as previously described, that the fault lies in the low tension circuit, turn the crankshaft until the contact breaker points are fully opened or place a piece of heavy paper between the points. Turn on the ignition. Trace the current flow with a volt-meter (0-20 volts) or 3 watt test lamp to isolate the defective portion of the circuit. If the circuit is in order the reading on the volt-meter should be approximately 12 volts between the following points of the circuit and the battery earth.

NOTE: Before carrying out the following tests it is essential to check that current is flowing to the ignition switch from the + terminal on the solenoid.

(a) Check the current flow through the wire connecting the solenoid to the ignition switch, no reading could indicate a faulty switch or an open circuit.

(b) Disconnect the wire connecting the ignition switch direct to + side of coil, at the coil and check current flow. No reading could indicate an open circuit or a defective switch.

NOTE: The switch must be placed in the start position for this test. Should (b) test prove satisfactory, proceed to test (c).

(c) Disconnect the wire connecting the ignition switch to the ballast resistor at the resistor. Switch the ignition on and test current flow. No reading could indicate an open circuit in this wire. Reconnect the wire to the resistor and remove the wire from the + side of the coil. With the ignition switch on, test the current flow. No reading could indicate a faulty ballast resistor or an open circuit in the short lead from the resistor to the + side of the coil.

HIGH TENSION IGNITION CABLES

1 The high tension leads are of the copper cable type. The high tension lead from the coil to distributor cap incorporates a radio suppression unit.

2 Always replace the rubber sheaths over the ends of the high tension leads and spark plugs to prevent the short circuiting of the spark plugs in wet weather.

3 When disconnecting cables from spark plugs or distributor cap note their position and pull only on the spark plug terminals or on the end entering the distributor cap.

4 Check the insulation of the high tension leads for cracks and deterioration. Renew the leads if necessary.

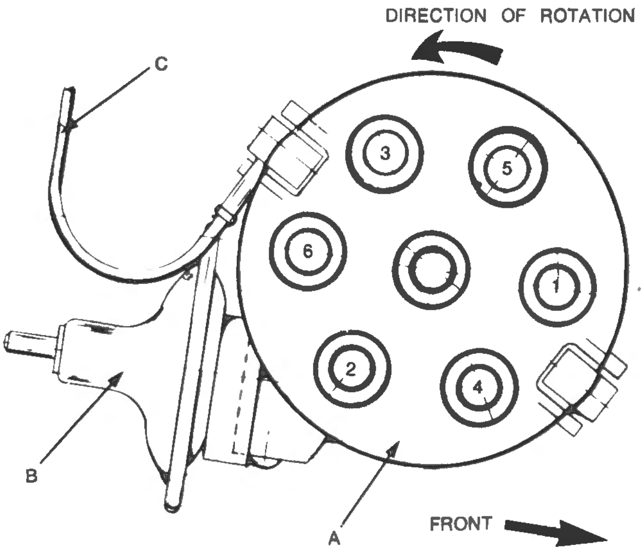


Fig. H-2

HIGH TENSION LEAD SEQUENCE

6 CYLINDER ENGINE

A DISTRIBUTOR CAP
B VACUUM ADVANCE UNIT
C LOW TENSION LEAD TO COIL

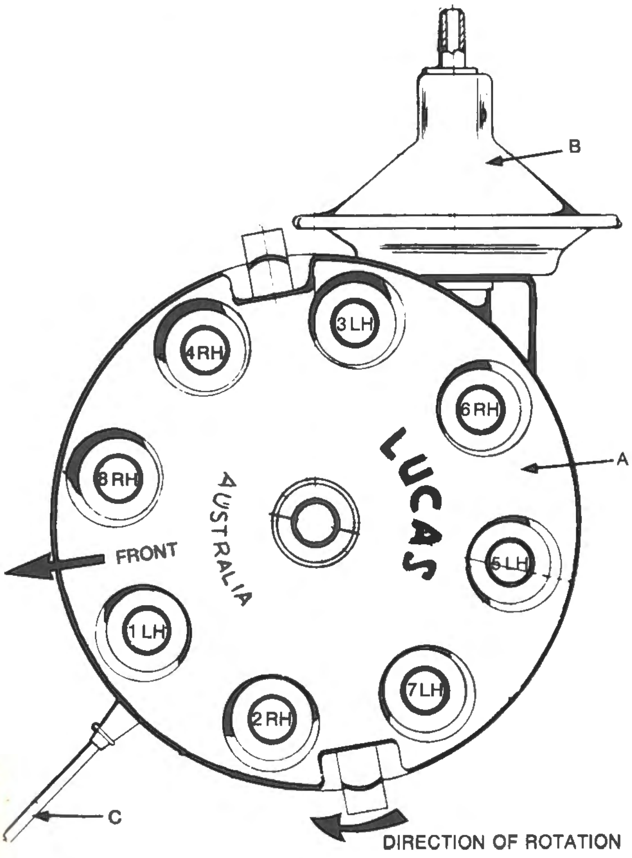


Fig. H-3

HIGH TENSION LEAD SEQUENCE

8 CYLINDER ENGINE

A DISTRIBUTOR CAP
C LOW TENSION LEAD FROM COIL
B VACUUM ADVANCE UNIT

SPARK PLUGS

1 It is recommended that the spark plugs be removed from engine, inspected and tested every 10,000 km (6000 miles). It is advisable to identify each spark plug with the number of the cylinder from which it was removed so that any faults revealed by examination can be traced back to the cylinder concerned.

2 A spark plug of the correct type and heat range from an engine in good condition, should show brown or greyish tan deposits and slight electrode wear. However, some colour variations may be experienced but this could be attributable to different petrols.

3 CARBON DEPOSITS — Factors such as excessive idling, slow speeds, stop and go driving can keep spark plug temperatures so low that normal carbon deposits are not burned off. These are dry, black and fluffy in appearance.

4 OILY DEPOSITS — are caused by excessive amounts of oil entering the combustion chamber. Oil fouling may be experienced during the running in period, before the piston rings are fully seated. Spark plugs showing fouling of this type should be thoroughly cleaned, regapped and properly reinstalled.

5 OVERHEATED SPARK PLUGS — may have a white or blistered insulator nose and badly worn electrodes. Clogged water passages or excessive carbon deposits in the combustion chamber can cause general overheating. Should only a few spark plugs be overheating, the cause may be air leaks in the manifold, producing excessively lean mixtures. Incorrect ignition timing or the use of low octane fuel may also cause detonation and overheating.

SERVICING

1 When examining a spark plug for further use, compare it with a new one and check the relative condition of the used spark plug. If the spark plugs appear to be suitable for further service, clean and test them before installing.

2 Cleaning and regapping the spark plugs should restore engine performance. If replacement is necessary, spark plugs of the correct type and heat range must be installed.

NOTE: When cleaning spark plugs in a sandblasting machine it is essential to remove all traces of abrasive grit from inside the spark plug and the thread. Any abrasive grit adhering to the thread may cause damage to the threads in the alloy cylinder head when the spark plugs are next removed.

3 After cleaning, the insulator should be carefully checked for cracks and general deterioration, renew the spark plugs if they are not considered satisfactory for further service.

4 The thread section of the spark plug body should be checked for carbon deposits and damaged threads. Clean threads are essential for good heat dissipation, and also prevents binding on the threads in the cylinder head.

5 File the sparking surfaces of the electrodes with a points file until they are bright, clean and parallel. For best results hold the spark plug in a vice by clamping on the hexagon section. Do not apply any pressure on the centre electrode as insulator fracture may occur. Reset the spark plug gap with a Champion plug setting tool. Fig. H-4.

6 The recommended spark plug gap settings listed in GENERAL DATA have been found to give the best overall performance under all service conditions.

7 Spark plugs must be tightened to the correct torque and if not tightened enough may overheat and produce pre-ignition resulting in loss of power and short spark plug life.

CHAMPION L92YC
KLG F65P

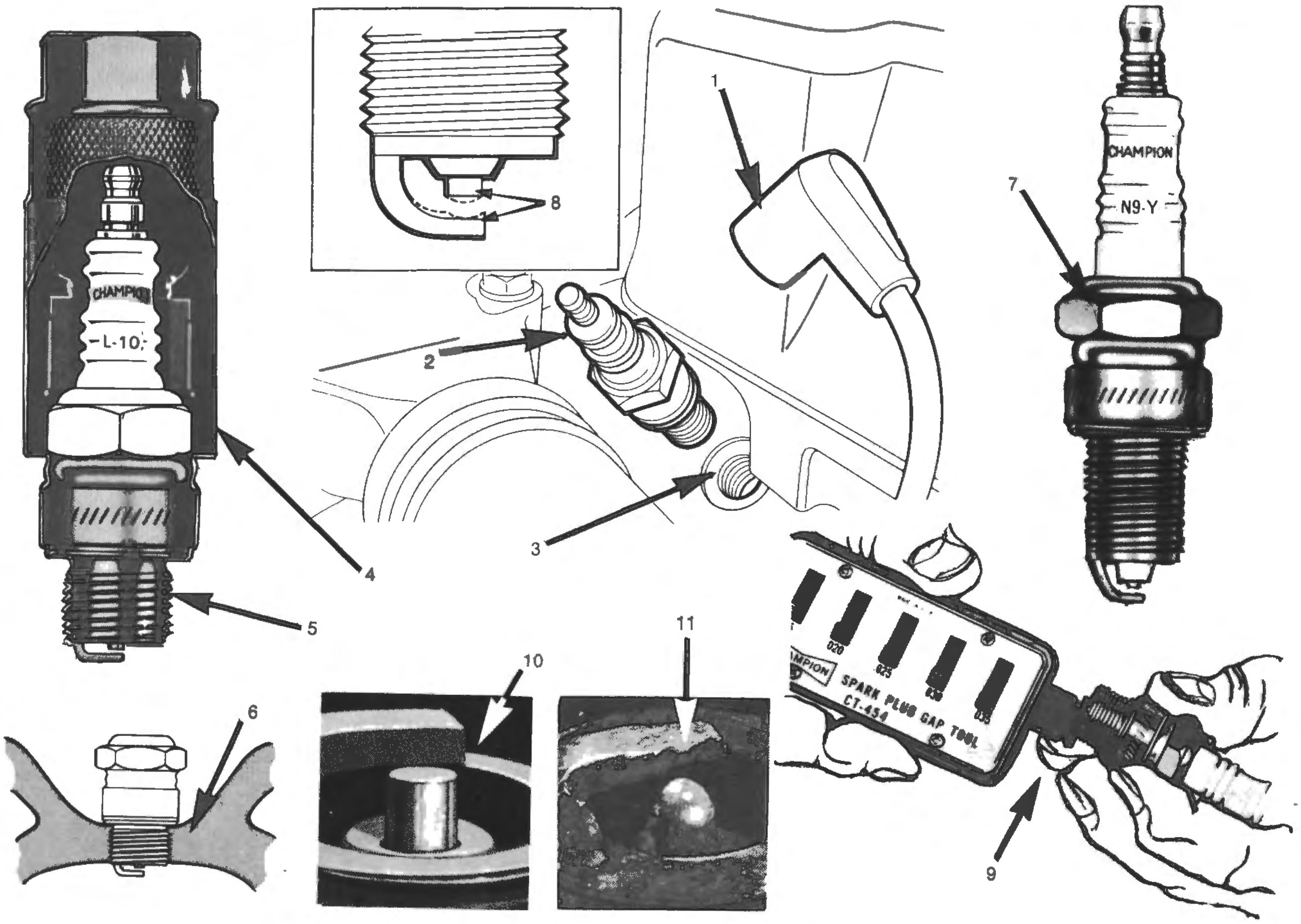


Fig. H-4

SERVICING SPARK PLUGS

1	HIGH TENSION LEAD
2	SPARK PLUG
3	CYLINDER HEAD PLUG SEAT
4	SPARK PLUG SOCKET
5	SPARK PLUG — 8 CYLINDER ENGINE 023 TO 028 THOUS.
6	CORRECTLY SEATED PLUG
7	SPARK PLUG — 6 CYLINDER ENGINE
8	CLEANING THE ELECTRODES
9	SETTING THE GAP
10	NEW PLUG APPEARANCE
11	WORN OUT PLUG APPEARANCE

8 It is detrimental to overtighten spark plugs as it may result in cracked insulators, crushed gaskets or damaged threads. It is recommended that a torque wrench be used to tighten the spark plugs to a torque of 40.6 Nm (30 lb.f.ft.) in the 6 cylinder engine and 18.97 Nm to 24.35 Nm (14-18 lb.f.ft.) in the 8 cylinder engine.

COIL

1 The ignition coil is an 8 volt unit. The wiring between ignition switch and coil incorporates a ballast resistor which reduces the 12 volt current from the battery to 8 volts for the coil operation. When starting the ballast resistor is eliminated from the circuit while the starter motor is in operation. This ensures that the coil will receive a minimum of 8 volts and provide a normal high voltage spark for starting. Both the 6 cylinder and 8 cylinder engines use the same type of coil.

2 The coil does not require any attention beyond seeing that the terminal connections and the coil mounting bolts are tight and that the exterior is kept clean and dry, particularly between the terminals.
It is essential that correct polarity of the coil is maintained. Connect the negative (—) terminal to the distributor.

CONDENSER

1 A metallised condenser is fitted which is completely sealed and has the property of being self healing in the event of a breakdown, so that trouble arising from this source should be very infrequent.

2 The eyelet on the cable connected to the contact breaker terminal post is squared and slotted to prevent it twisting round and short circuiting against the distributor.

3 The best method of testing the condenser is by substitution. Disconnect the original condenser and connect a new one between the low-tension terminal of the distributor and earth.

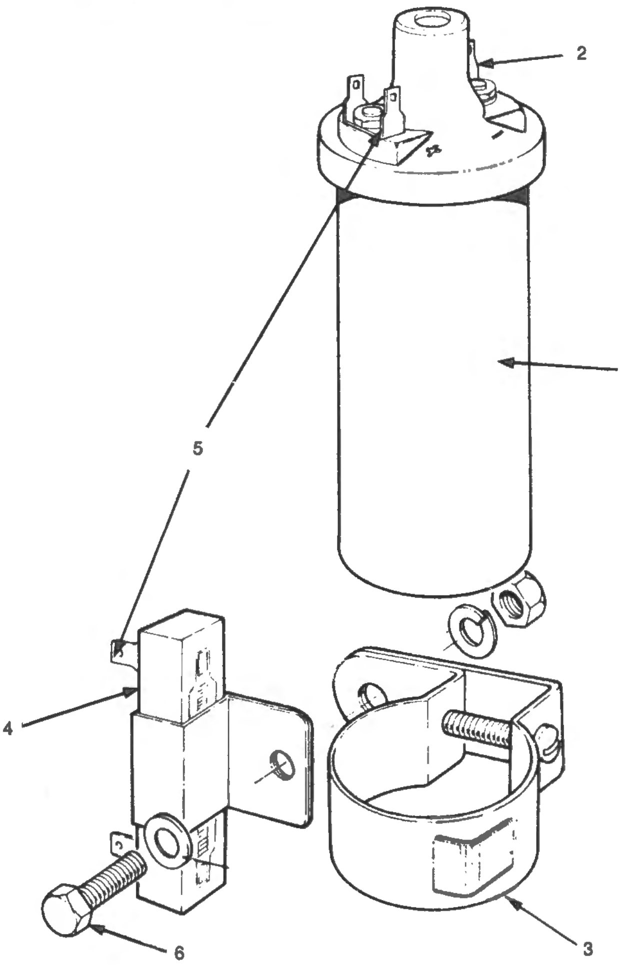


Fig. H-5

COIL AND BALLAST RESISTOR ASSEMBLY

1 COIL
2 NEGATIVE CONNECTION TO DISTRIBUTOR
3 MOUNTING BRACKET TO RH VALANCE
4 BALLAST RESISTOR ASSEMBLY
5 CONNECTION TO COIL POSITIVE
6 MOUNTING BOLT

4 It is suggested that condenser testing as a routine matter is unnecessary and may be misleading. The possible cause of condenser trouble, and the symptoms by which each can be recognised are:—

(a) Open circuit, indicated by excessive burning at the contacts.

(b) Short circuit indicated by no interruption of primary current when the contacts are opened.

(c) Abnormally low insulation resistance is indicated by poor high speed performance.

CONTACT POINTS

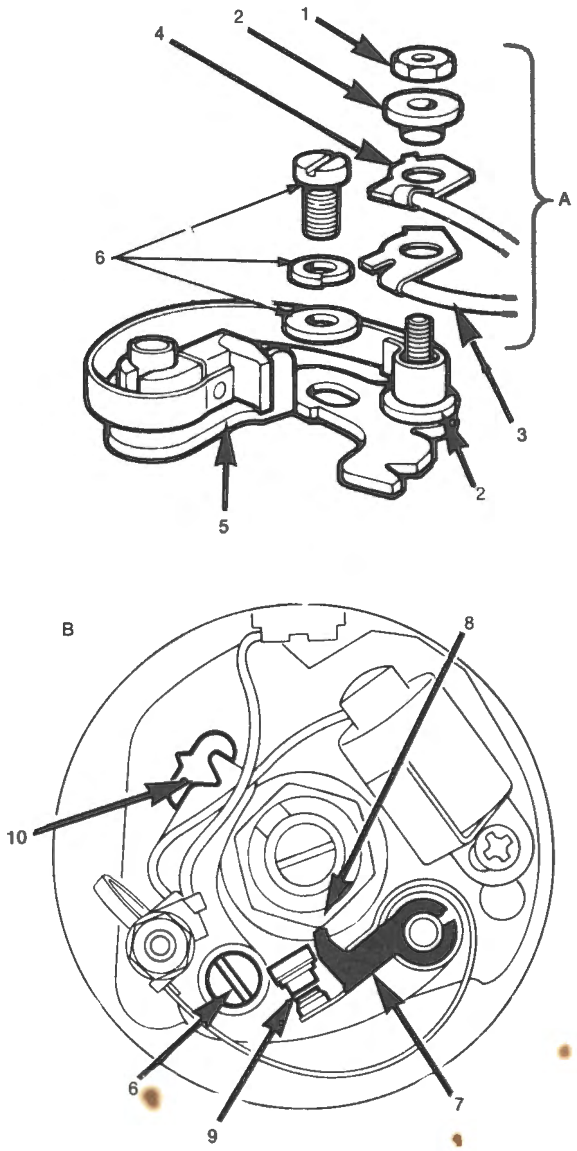
Removing

1 Remove the distributor cap.

2 Remove the rotor arm from the cam spindle.

3 Remove the nut and nylon insulating sleeve from the post retaining the contact points spring and remove the low tension and condenser leads, noting their relative positions for replacement. Refer 'A' sequence illustration.

4 Remove the screw, spring and flat washer securing the contact points to the base plate and remove contact points set. Refer 'B' sequence illustration.



REPLACING AND ADJUSTING DISTRIBUTOR CONTACTS

1 NUT
2 INSULATING SCREW
3 CONDENSER LEAD
4 LOW TENSION LEAD
5 POINTS ASSEMBLY
6 POINTS RETAINING SCREW AND WASHERS
7 POINTS RUBBING BLOCK
8 CAM PEAK
9 POINTS GAP
10 ADJUSTING SLOT

Refitting

1 Refitting is the reverse of the removing procedures 1 to 4 noting the following points:

(a) Remove any protective coating from the contact surfaces of the points.

(b) Ensure that the low tension and condenser leads are correctly positioned with the nylon insulating sleeve.

(c) Adjust the contact points to the specifications given in GENERAL DATA.

(d) Check ignition timing and reset if necessary.

DISTRIBUTOR

Removing

Before removing the distributor, turn the engine to TDC No. 1 piston on compression stroke.

1 Remove the distributor cap, the low tension lead and vacuum pipe.

2 Mark the relation of the distributor housing to cylinder block as a guide to replacement.

3 Loosen the distributor clamp bolt and withdraw distributor.

Refitting

If the ignition timing has been lost through some action such as turning the crankshaft when the distributor has been removed, it is necessary to retime the ignition using the following procedure:

6 CYLINDER DISTRIBUTOR

1 Remove the camshaft cover.

2 Turn the engine until No. 1 piston is at TDC on the compression stroke. The TDC mark on the crankshaft pulley will be aligned with the timing pointer. Fig. H-7.

NOTE: The valves of No. 6 cylinder will be rocking, that is exhaust closing — inlet opening.

3 Insert the distributor with the vacuum advance unit facing rearward.

4 Turn the cam spindle until the drive dog engages with the drive shaft and drops into position. Tighten clamp bolt sufficiently to enable the distributor to just be turned by hand.

5 Turn the distributor body anti-clockwise until the points are closed. Rotate the distributor clockwise until the points are just opening. Tighten the clamp bolt.

6 Fit the rotor and ensure that it is in line with No. 1 segment. Fit the distributor cap and ensure that the spark plug cables are in their correct sequence. Fig. H-2.

7 Final ignition timing is set dynamically by means of a timing light as described in 'Setting the Ignition Timing.'

8 CYLINDER DISTRIBUTOR

1 Remove the Left hand side rocker cover.

2 Turn the engine until No. 1 piston is at TDC on the compression stroke. The TDC mark on the crankshaft pulley will be aligned with the timing pointer. Fig. H-10.

NOTE: Both valves of No. 6 cylinder will be rocking, that is, exhaust valve closing and inlet valve opening.

3 Insert the distributor with the vacuum advance unit facing the right hand side of vehicle.

4 Locate the rotor in line with No. 1 segment, then turn it approximately 30° in an anti-clockwise direction before entering the distributor drive gear with the camshaft gear. As the two gears mesh the rotor will progressively turn until the distributor is fully seated. The rotor should be in the No. 1 position if the distributor is timed correctly.

NOTE: The tongue on the distributor shaft must enter the slot in the oil pump shaft before the distributor can be fully seated.

5 Final ignition timing is set with the engine running at the correct idling speed, by means of a timing light as described in the section 'Setting the Ignition Timing.'

Dismantling

6 CYLINDER DISTRIBUTOR

1 Remove the distributor as previously described.

2 Clean exterior of distributor, taking care not to damage the 'O' ring oil seal.

3 Remove the rotor arm from the cam spindle.

4 Remove the nut and nylon insulating sleeve from the contact points securing the low tension and condenser leads.

5 Remove the screw, spring and flat washer securing the contact points to base plate and remove contact point set.

6 Remove the screw retaining condenser and remove condenser.

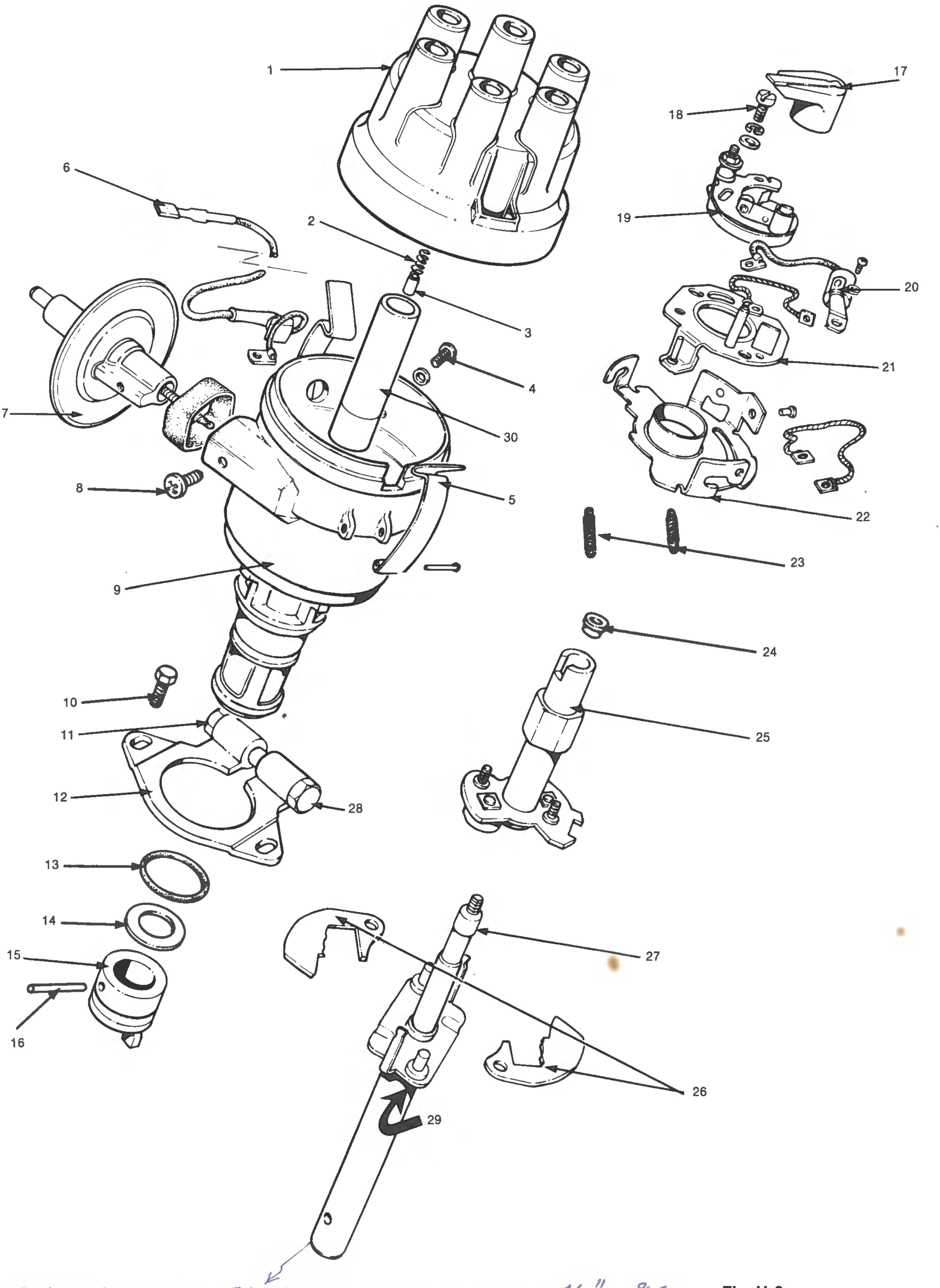
7 Remove the screw securing the vacuum advance unit to the distributor, disconnect the link from the base plate and remove vacuum unit.

8 Remove the low tension lead and grommet through the opening in the distributor body.

9 Remove the three screws securing the base plate and lift base plate from distributor.

10 Check the end-float between driving dog and thrust washer. This should be 0.102 to 0.203 mm (0.004 to 0.008 in).

11 Insert a screwdriver through the low tension lead opening in the distributor body and lever the cam upward to force the nylon retainer from the top of the distributor shaft.



LENGTH OF SHAFT FROM THRUST WASHER 6 1/4" 8 CYL

Fig. H-6

LAYOUT OF DISTRIBUTOR COMPONENTS
6 CYLINDER ENGINE

KEY TO FIG. H-6

1 DISTRIBUTOR CAP
2 SPRING
3 CARBON BRUSH
4 BASE PLATE SCREW
5 CLIPS
6 LOW TENSION LEADS
7 VACUUM ADVANCE UNIT
8 RETAINING SCREW
9 DISTRIBUTOR BODY
10 CLAMP RETAINING SCREWS
11 CLAMP BOLT NUT
12 CLAMP
13 'O' RING SEAL
14 THRUST WASHER
15 DRIVING DOG
16 PARALLEL PIN
17 ROTOR
18 POINTS ASSEMBLY SCREW
19 POINTS ASSEMBLY
20 CONDENSER
21 POINTS ASSEMBLY PLATE
22 BASE PLATE
23 CENTRIFUGAL ADVANCE SPRINGS
24 NYLON RETAINING CLIP
25 CAM AND SPINDLE
26 CENTRIFUGAL ADVANCE WEIGHTS
27 SHAFT AND ACTION PLATE
28 CLAMP PLATE BOLT
29 NYLON THRUST WASHERS
30 SHAFT BUSH

12 Mark the driving dog and shaft in relation to the driving pin hole for replacement purposes.

13 Drive out the locating pin from driving dog and shaft. Remove dog and thrust washer from the shaft.

14 Remove any burrs and roughness from lower end of drive shaft and slide out from top of distributor.

15 Remove nylon washer from distributor, noting concave side upward.

16 Check the relative location of the advance springs and remove.

17 Check the position of the cam lobe to the drive shaft and lever it from the shaft together with the nylon retainer.

18 Remove weights from the drive shaft.

19 Remove the 'O' ring oil seal from distributor body.

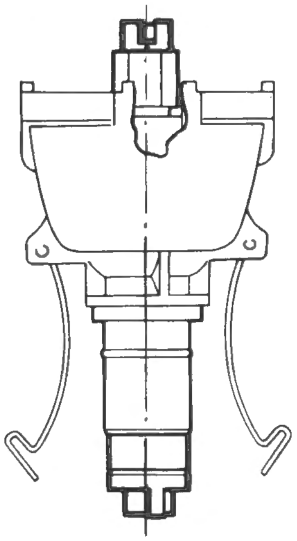


Fig. H-7

ALIGNING THE DRIVE DOG

8 CYLINDER DISTRIBUTOR

1 Remove the distributor as previously described.

2 Clean exterior of distributor, taking care not to damage the 'O' ring oil seal.

3 Remove the rotor arm from the cam spindle.

4 Remove the nut and nylon insulating sleeve from the contact points securing the low tension and condenser leads.

5 Remove the screw, spring and flat washer securing the contact points to base plate and remove contact point set.

6 Remove the screw retaining condenser, and remove condenser.

7 Remove the screw retaining the earth wire to base plate.

8 Remove the spring clip retaining the breaker plate to base plate of distributor and remove breaker plate.

9 Remove the two screws securing the vacuum unit to the distributor, remove vacuum unit and rubber grommet.

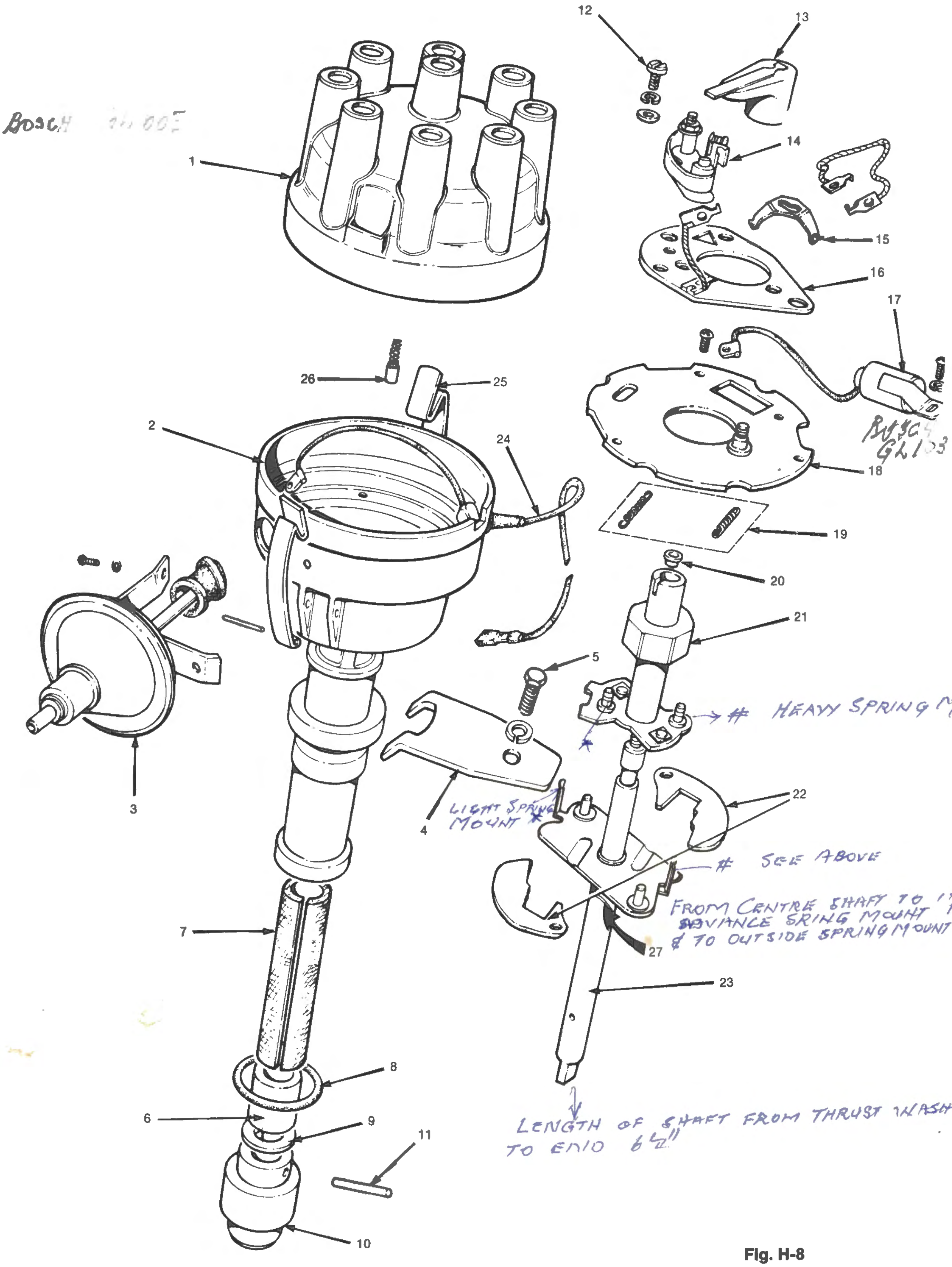
10 Remove the two screws retaining the base plate to distributor body and remove base plate.

11 Remove low tension lead from distributor body.

12 Check the end-float between driving dog and thrust washer. This should be 0.152 to 0.254 mm (0.006 to 0.010 in).

13 Drive out the locating pin from drive gear and shaft. Remove gear and thrust washer from the shaft.

14 Remove any burrs and roughness from lower end of drive shaft and slide out from top of distributor body.



BOSCH 04 00E

BOSCH GL103

→ # HEAVY SPRING MOUNT

LIGHT SPRING MOUNT *

SEE ABOVE

FROM CENTRE SHAFT TO INSIDE
ADVANCE SRING MOUNT 13/16"
& TO OUTSIDE SPRING MOUNT 15/16"

LENGTH OF SHAFT FROM THRUST WASHER
TO END 6½"

Fig. H-8

LAYOUT OF DISTRIBUTOR COMPONENTS
8 CYLINDER ENGINE

LUCAS 29D8 DISTRIBUTOR

KEY TO FIG. H-8

1 DISTRIBUTOR CAP
2 DISTRIBUTOR BODY
3 VACUUM ADVANCE UNIT
4 DISTRIBUTOR CLAMP
5 CLAMP SCREW
6 SHAFT BUSHES (2)
7 LUBRICATION SLEEVE-FELT
8 'O' RING SEAL
9 THRUST WASHER
10 DRIVING GEAR
11 PIN GEAR TO SHAFT
12 POINTS RETAINING SCREW
13 ROTOR BOSCH GL 661 LUCAS BD 257

LUCAS L20V
14 POINTS ASSEMBLY BOSCH GL 27
15 SPRING CLAMP
16 POINTS BASE PLATE
17 CONDENSER
18 BASE PLATE
19 CENTRIFUGAL ADVANCE SPRINGS
20 NYLON RETAINING CLIP
21 CAM ASSEMBLY
22 CENTRIFUGAL ADVANCE WEIGHTS
23 SHAFT AND ACTION PLATE
24 LOW TENSION LEAD
25 CLIPS
26 SPRING AND CARBON BRUSH
27 NYLON THRUST WASHERS

15 Remove nylon washer from distributor, noting concave side upward.

16 Check the relative location of the advance springs and remove.

17 Check the position of the cam lobe to the drive shaft and lever it from the shaft together with the nylon retainer.

18 Remove weights from the drive shaft.

19 Remove the 'O' ring oil seal from distributor body.

Inspecting

1 Inspect the contact point faces for excessive pitting or signs of overheating, and replace if necessary.

2 Inspect the leads for damage or deterioration and replace if necessary.

3 Check the contact breaker for free movement and sufficient spring loading.

4 Check the centrifugal weight springs for distortion or stretch.

5 Check the vacuum unit for leaks by applying suction to the vacuum unit and observing the movement of the contact breaker assembly.

6 Check the distributor cap and leads for cracks or evidence of tracking.

7 Check the distributor shaft and body bushing for excessive wear.

8 Replace the thrust washer and/or distributor shaft, if the shaft end float is excessive.

NOTE: 6 CYLINDER — If the distributor body bush is to be removed it must be driven out from the bottom of the distributor towards the top.
8 CYLINDER — The upper distributor body bush is retained by a washer staked into the body. The lower bush is driven out towards the bottom.

Assembling

1 Assembling is the reverse of the dismantling procedure noting the following:

(a) Lubricate the distributor drive shaft with engine oil.

(b) Renew nylon cam retainer.

(c) Lightly lubricate the cam with general purpose grease.

(d) Adjust contact points to correct gap as specified.

2 Should a distributor test bench be available, test the distributor to ensure that the centrifugal and vacuum advance units are operating to specification.

Refitting

1 Refitting is the reversal of removing procedure noting the following:

(a) Reset the ignition timing as described in 'Setting the Ignition Timing.'

SETTING THE IGNITION TIMING

1 Using a cam dwell meter, check that the dwell angle is adjusted to the specifications given in GENERAL DATA for both 6 cylinder and 8 cylinder engines.

2 Connect a timing light between the No. 1 spark plug cable and No. 1 spark plug.

3 Disconnect the vacuum pipe to distributor and plug the pipe to the carburetter.

4 Start the engine and adjust the idle running to the specified rpm.

5 Observe the timing light flash on the crankshaft pully rim mark and the timing pointer located on the engine plate. 6 cylinder engines, Fig. H-9 or the pointer located on the water pump housing. 8 cylinder engines, Fig. H-10 and check with the specifications given in GENERAL DATA.

6 To adjust the setting, slacken the distributor clamp bolt and move the distributor body until the correct setting is obtained. To advance the timing turn the distributor body clockwise on the 6 cylinder engine and anti-clockwise on the 8 cylinder engine.

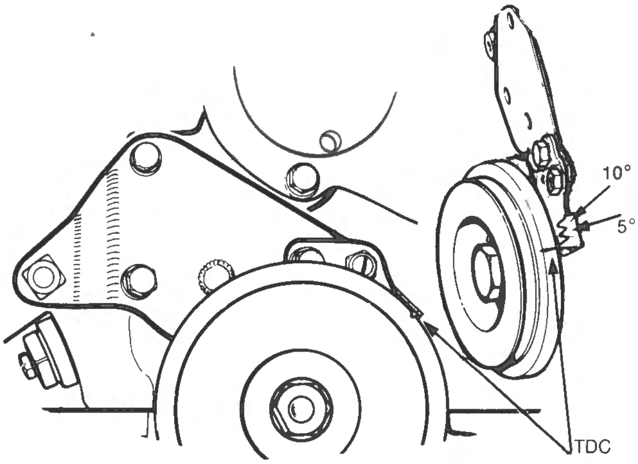


Fig. H-9

TIMING MARKS

6 CYLINDER ENGINE

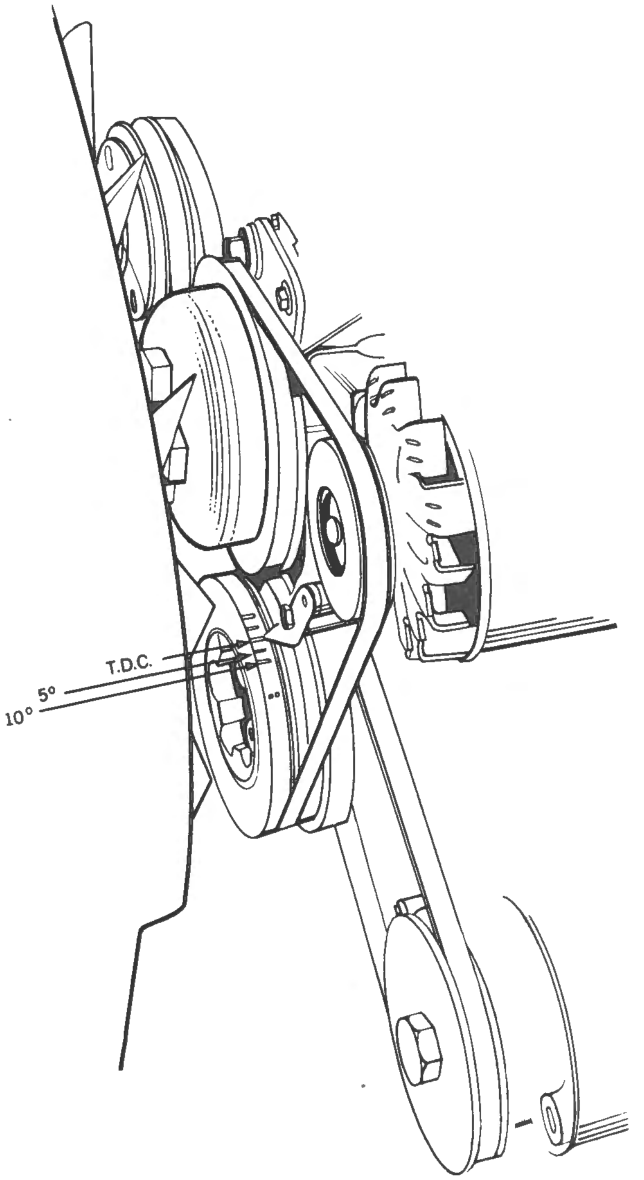


Fig. H-10

TIMING MARKS

8 CYLINDER ENGINE

FITTED NEW LG F05 [illegible] 9/4/90

SET POINTS TO 26°– 29° DWELL SETTING 9/4/90 ·013"

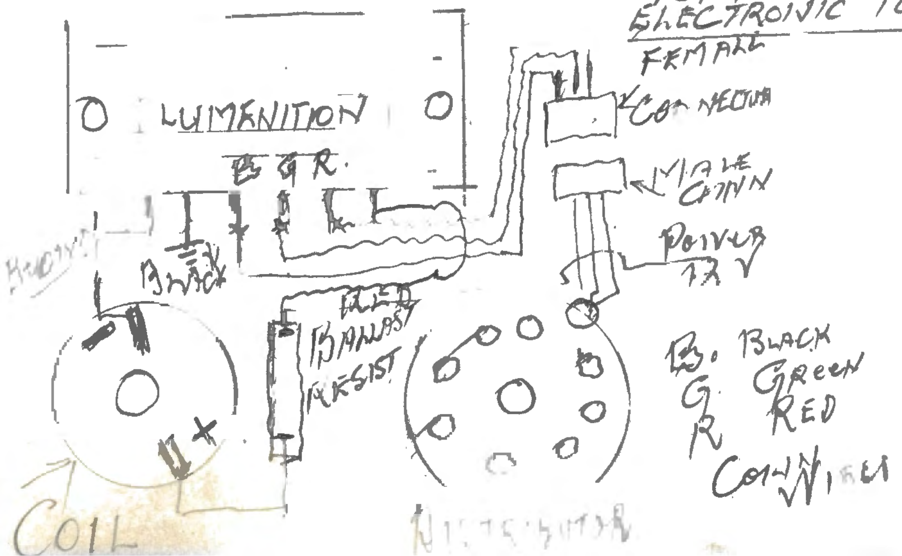
RESET POINTS TO CONTACT GAP TO ·015 42907 12/5/90

25/5/91 RESET PLUG GAPS TO ·025" & POINTS TO ·015" 63000

+ DISTRIBUTOR SHAFT OIL PUMP DRIVE END CHEWED OFF [illegible]

6/11/92 77840 KM

28/6/95 10,280 KM FITTED LUMENITION ELECTRONIC IGNITION.



SECTION J
COOLING SYSTEM

GENERAL DESCRIPTION

6 CYLINDER ENGINE

The pressurised cooling system employs a tubular finned, vertical core radiator, having a top and bottom tank. A pressure of 90 kPa (13 psi) is maintained throughout the system, by a relief valve incorporated in the radiator cap. Water circulation is by thermo-syphon action assisted by an impeller type water pump, belt driven from the engine crankshaft pulley.

Water is circulated from the bottom radiator tank, through the water pump to the cylinder block and cylinder head and then via the thermostat to the top radiator tank. Air is drawn through the radiator core by a fan mounted on the water pump pulley.

As the system cools, a partial vacuum is created in the system. Atmospheric pressure is permitted to enter the top tank by a valve in the centre of the radiator cap, this balances the internal/external pressure difference preventing damage to the top radiator tank.

The water pump is equipped with pre-packed, permanently sealed bearing assemblies, eliminating any further lubrication during service.

8 CYLINDER ENGINE

The cooling system follows a similar pattern to that of the 6 Cylinder Engine and is also pressurised to 90 kPa (13 psi).

The circulation is from the bottom radiator tank to the water pump, then into the front of the cylinder block where the coolant is diverted around both banks of cylinders and cylinder heads. From the cylinder heads the coolant is forced through passages in the induction manifold via the thermostat into the radiator top tank, through the top hose.

The circulation of coolant through the induction manifold ensures a constant temperature of the fuel-air mixture and assists in maintaining stable operation of the engine. The water pump is mounted on the front cover and is belt driven from the crankshaft pulley.

NOTE: On all models fitted with automatic transmission, an oil cooler is incorporated in the lower radiator tank to cool the transmission fluid. The radiators used with 6 cylinder and the 8 cylinder engines have the same coolant capacity. The radiator used with the 6 cylinder engine has a 9 gills per inch radiator core, whilst the 8 cylinder engine has a 12 gills per inch radiator core. Air conditioned models have a 15 gills per inch radiator core.

SERVICING INFORMATION

Water alone must not be used in the alloy engine as this could have a detrimental effect on the cooling passages. It is essential that cooling inhibitor conforming to Specification SQ36 or anti-freeze mixture to Specification BS3150, Type A be used as instructed.

COOLANT CAPACITIES

8 Cylinder models	10.25 litres	(18.0 pints)
6 Cylinder models	8.25 litres	(14.5 pints)

COOLANT INHIBITOR MIXTURE

The inhibitor SQ36 provides protection for the coolant passages against corrosion and must be used where anti-freeze mixtures are not required.

A mixture of 20 mls per litre (3 fl oz per gallon) in water should be used.

8 Cylinder	205 mls	(7 fl oz)
6 Cylinder	165 mls	(5.5 fl oz)

NOTE: Soluble oil types must not be used.

ANTI-FREEZE MIXTURE

Anti-freeze mixtures conforming to BS3150, Type A Specification, in addition to protecting the engine against frost, contain inhibitors to protect the coolant passages of the engine.

A 25 per cent mixture 250 ml per litre (2 pts per gallon) will provide protection against freezing for coolant temperatures to —12°C (10°F).

Filling Procedure

1. Ensure that the cooling system is drained and thoroughly flushed before addition of anti-freeze.
2. Anti-freeze/coolant mixture must be replaced every 12 months.
3. After removal of anti-freeze the coolant system must be thoroughly flushed then refilled with clean water to which the coolant corrosion inhibitor has been added.

WARNING: The coolant system inhibitor and anti-freeze mixture is toxic and must not be consumed under any circumstances.

CHECKING THE COOLING SYSTEM

1. To check the cooling system for leakage, a pump type cooling system analyser should be connected to the radiator filler neck.
2. Run the engine until it reaches operating temperature.
3. Pump the analyser until the gauge reaches 90 kPa (13 psi). Do not exceed this figure otherwise components which are in a satisfactory condition could be damaged.
4. If the analyser gauge does not hold a steady pressure, a leak in the cooling system is indicated. The radiator, water pump, hoses, heater, core plugs and all connections must be inspected for signs of leakage.
5. Check the radiator filler cap blow-off pressure as detailed by the manufacturers of the cooling system analyser.

DRAINING AND REFILLING

Draining

1 Remove radiator pressure cap.

WARNING: Do not remove the radiator pressure cap while the system is hot.

2 To drain radiator remove bottom radiator hose.

3 To drain cylinder block on 6 cylinder engines remove drain plug adjacent to the oil dipstick tube. With the 8 cylinder engine using a ¼ in Allen key, remove the two drain plugs, one on the left bank adjacent to No. 7 cylinder and one on the right bank adjacent to No. 4 cylinder.

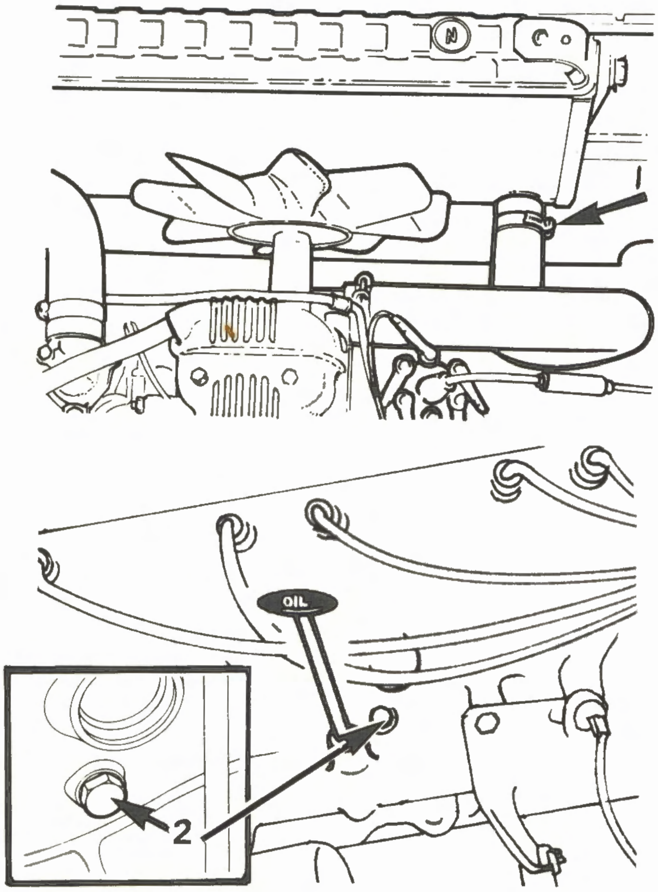


Fig. J-1

COOLING SYSTEM DRAIN POINTS 6 CYLINDER

1 LOWER RADIATOR HOSE

2 CYLINDER BLOCK PLUG

Refilling

6 CYLINDER ENGINE

1 Refit cylinder block drain plug.

2 Refit bottom radiator hose and ensure all hose connections are tight.

3 Fill the system through the filler neck in the radiator header tank until the level of the water can just be seen. Run the engine until it is warm and then add sufficient water to raise the level within 25 mm (1 in) of the bottom of the filler neck.

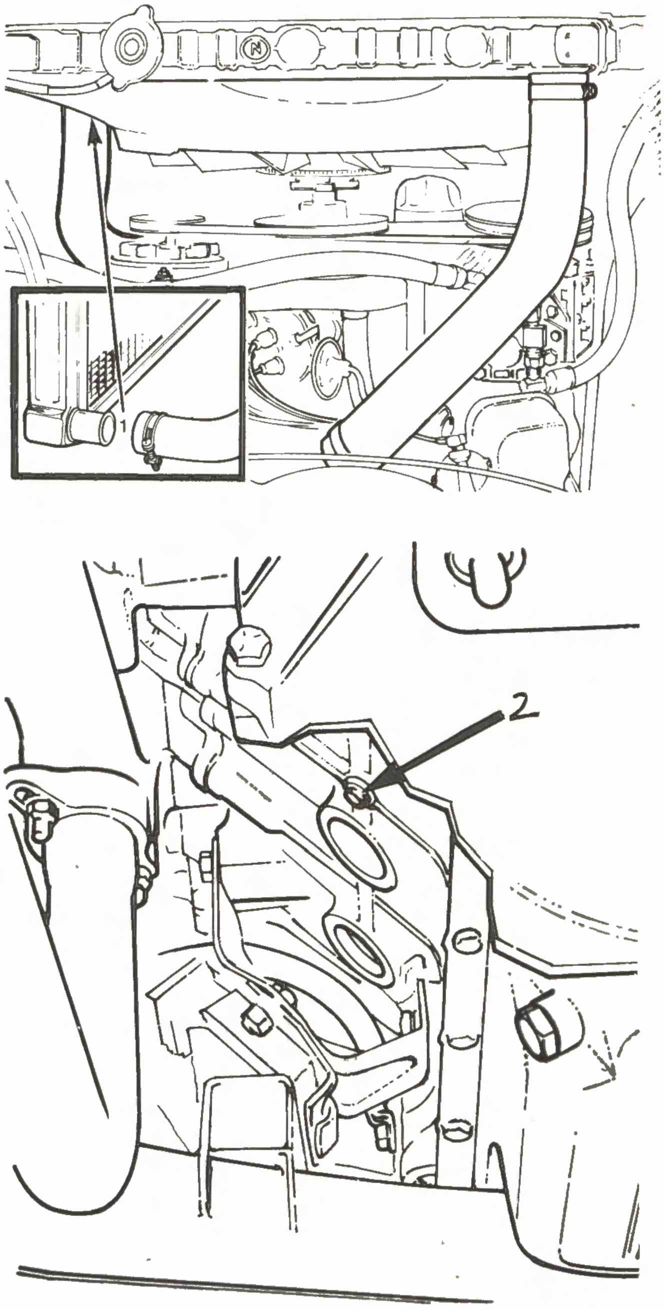


Fig. J-2

COOLING SYSTEM DRAIN POINTS 8 CYLINDER

1 LOWER RADIATOR HOSE

2 CYLINDER BLOCK PLUG LEFT HAND

3 CYLINDER BLOCK PLUG RIGHT HAND ADJACENT TO NO. 2 CORE PLUG. NOT ILLUSTRATED

4 When using anti-freeze, avoid overfilling to prevent loss due to expansion.

5 Replace the filler cap.

8 CYLINDER ENGINE

Use the same procedure as for the 6 cylinder engine.

NOTE: Never fill or top up the 8 cylinder engine with plain water. To avoid damage to the engine, the recommended mixture of inhibitor and water or anti-freeze and water must be used at all times.

FLUSHING

To ensure sufficient circulation of the coolant and to reduce the formation of scale and sediment in the radiator the system should be periodically flushed with clean water. The need for this will be evident by heavy discoloration of the coolant. When flushing the water should be allowed to run through the radiator until it becomes clear. Where scale is excessive in the radiator it should be removed and flushed through the radiator in the reverse direction to the normal flow i.e. turn the radiator upside down and let the water flow in through the bottom hose connection and out through the top. The use of a radiator reverse flush adaptor with a 25 mm (1 in) diameter water hose is recommended for this purpose.

THERMAL TRANSMITTER

6 CYLINDER ENGINE

The thermal transmitter is located in the thermostat housing below the thermostat. It is connected to the temperature gauge in the instrument panel by a cable in the ignition circuit.

8 CYLINDER ENGINE

In this application the thermal transmitter is situated on the top of the induction manifold beside the thermostat housing.

In both cases before removal ensure that pressure is relieved from system.

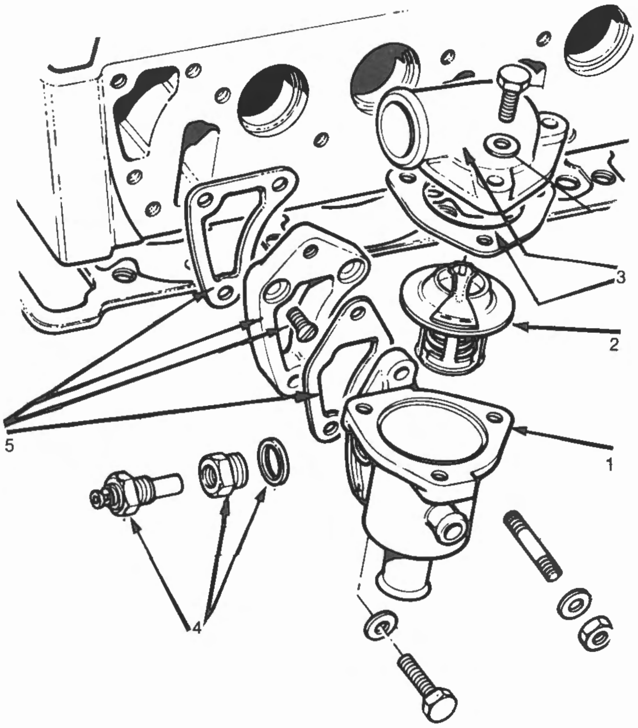


Fig. J-3

THERMOSTAT HOUSING ASSEMBLY 6 CYLINDER

1 THERMOSTAT HOUSING
2 THERMOSTAT PAYEN WT/B14A
3 COOLANT OUTLET ELBOW AND GASKET
4 THERMAL TRANSMITTER, ADAPTOR AND GASKET
5 ADAPTOR AND GASKETS HOUSING TO CYLINDER HEAD

THERMOSTAT

Removing

1. Drain the cooling system.
2. Disconnect the top radiator hose.
3. Remove the thermostat housing.
4. Remove the joint gasket and lift out the thermostat.

Inspecting

1. Suspend the thermostat in a suitable container of water ensuring that the thermostat is fully immersed and not touching the sides or bottom of the container.
2. Heat the water, then using a reliable thermometer check the temperature at which the thermostat operates. It should begin to open at 79-83°C (174-181°F) and be fully open at 93-96°C (199-205°F).

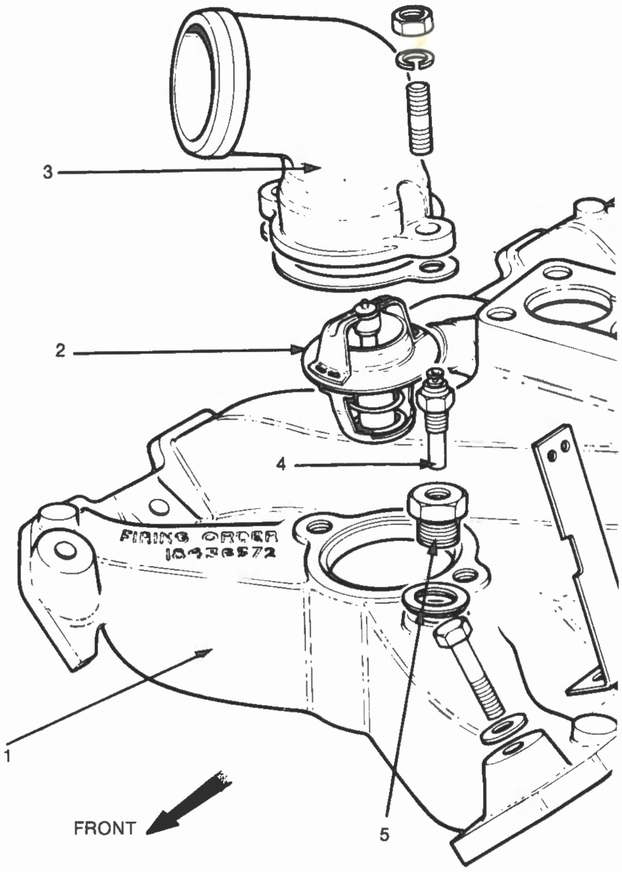


Fig. J-4

1 INDUCTION MANIFOLD
2 THERMOSTAT
3 COOLANT OUTLET ELBOW
4 THERMAL TRANSMITTER
5 ADAPTOR AND WASHER FOR TRANSMITTER

3 If the thermostat does not start to open or if the valve sticks in the fully open position, renew the thermostat. Under no circumstances should any attempt be made to repair it. It is unwise to operate the vehicle for any prolonged period without a thermostat fitted.

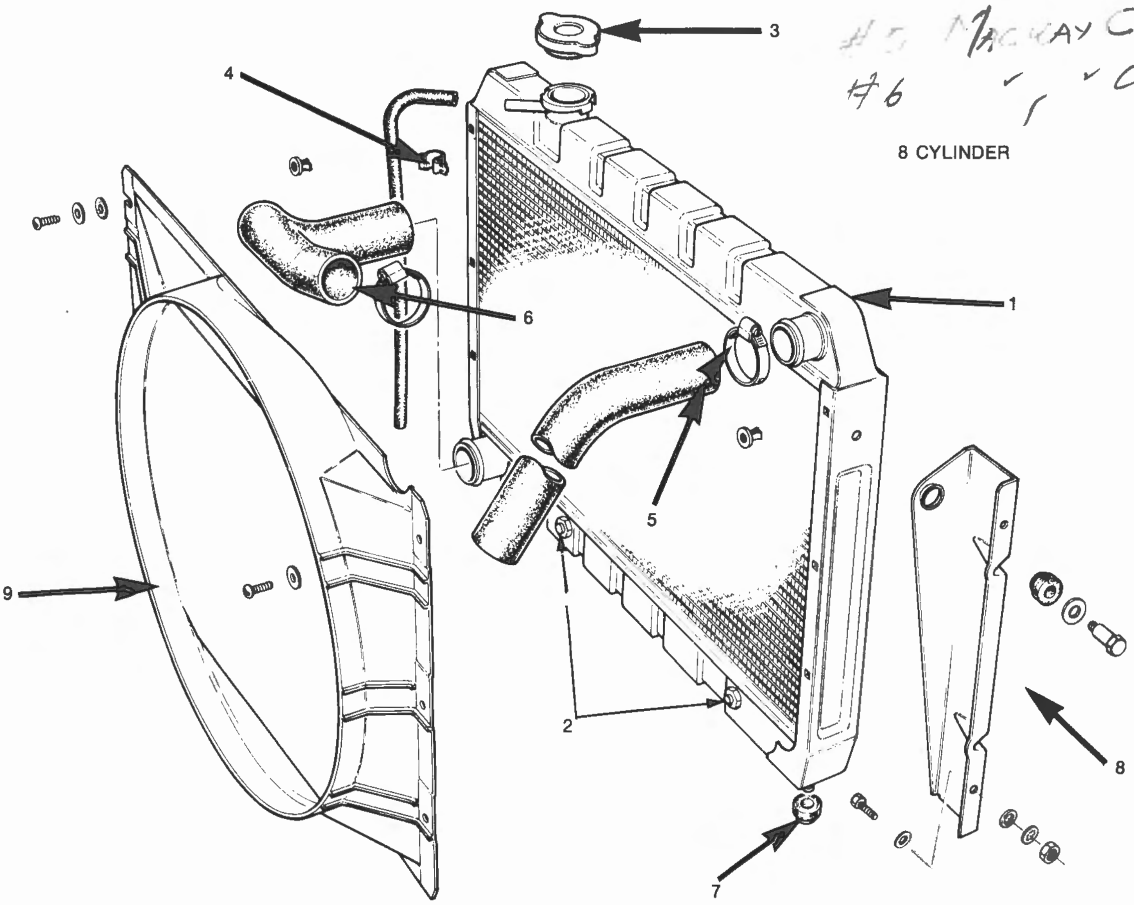
Refitting

1 Refitting is a reversal of the removing procedure.

NOTE: Ensure that the thermostat is correctly positioned with the side marked 'TO RAD' facing directly towards the radiator.

#5 Mackay CH 1037

#6 ✓ ✓ CH 1008



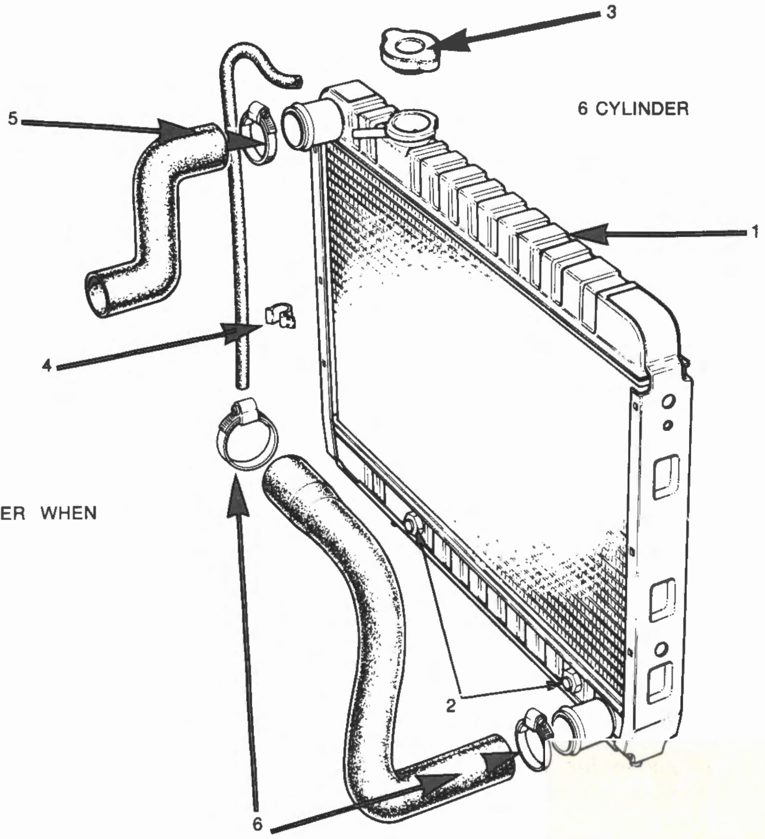


Fig. J-5

RADIATOR COMPONENTS

1 RADIATOR ASSEMBLY INCORPORATES FLUID COOLER WHEN AUTOMATIC TRANSMISSION FITTED

2 COOLER CONNECTION

3 PRESSURE CAP

4 OVERFLOW HOSE AND CLIP

5 TOP HOSE AND CLIP

6 BOTTOM HOSE AND CLIP

7 LOWER MOUNTING

8 MOUNTING BRACKET ASSEMBLY

9 FAN COWL

RADIATOR

Removing

1 Drain the radiator and remove top radiator hose.

2 Remove transmission oil cooler pipes from lower radiator tank (automatic models only).

3 Remove cowling (8 cylinder models only).

4 Remove the two securing bolts, one each side of the top tank.

5 Lift radiator clear of the bottom mountings and remove from vehicle.

Refitting

1 Reverse the removing procedures 1-5 making sure that the radiator is correctly installed on the bottom mountings.

FAN BELT

Removing

1 Slacken the alternator mounting bolt.

2 Slacken the alternator adjusting link screws.

3 Disconnect the drive belt from the alternator and crankshaft pulleys.

4 Withdraw the drive belt.

Inspecting

1 Inspect the belt for wear, cuts and cracking. Renew if necessary.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

ADJUSTING

(a) Slacken the alternator mounting bolt.

(b) Slacken the adjusting link screw.

(c) Adjust the belt tension by applying leverage on the alternator drive and bracket only — not on any other part of the alternator. The belt should be adjusted to obtain a deflection of 12 mm (½ in) on the longest run of the belt between the pulleys.

(d) With the alternator held in the adjusted position, tighten the adjusting link screw.

(e) Tighten the alternator mounting bolt.

FAN

6 CYLINDER ENGINE

This fan is an eight blade plastic unit, mounted on the water pump pulley.

Removing

1 Remove the 3 bolts securing the fan and hub extension to water pump pulley.

2 Remove assembly from vehicle.

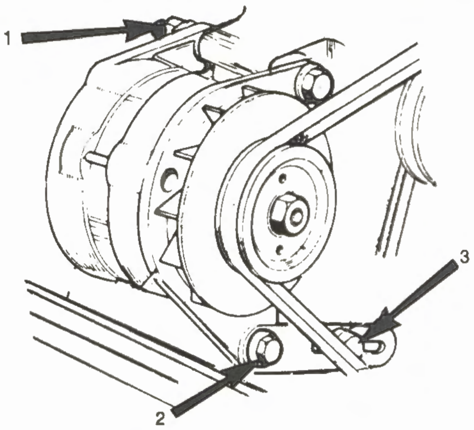


Fig. J-6

FAN BELT ADJUSTING POINTS 6 CYLINDER

1 ALTERNATOR MOUNTING BOLT

2 SCREW LINK TO ALTERNATOR

3 LOCK SCREW — ADJUSTING LINK TO CYLINDER BLOCK

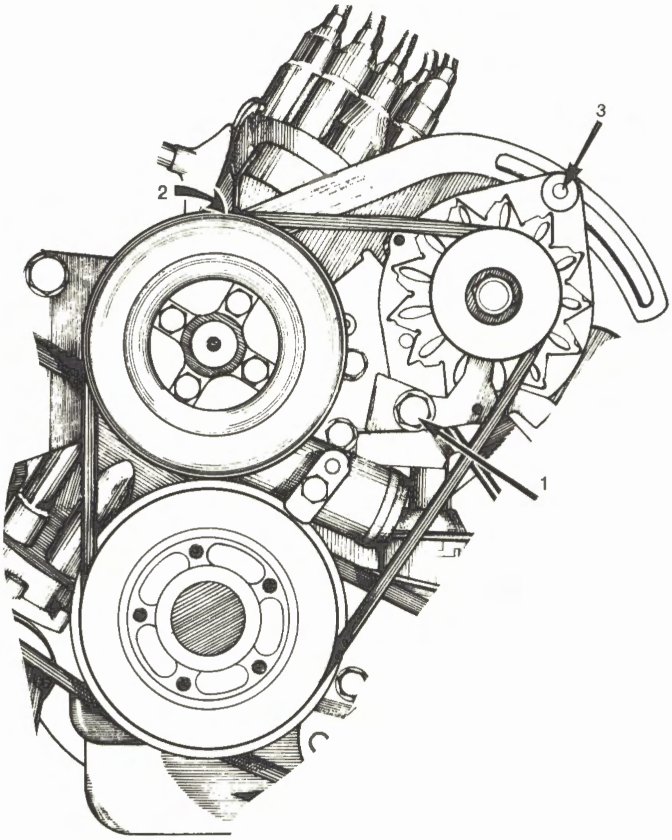


Fig. J-7

FAN BELT ADJUSTING POINTS 8 CYLINDER

1 ALTERNATOR MOUNTING SCREW

2 SCREW LINK TO CYLINDER BLOCK

3 LOCK SCREW ADJUSTING LINK TO ALTERNATOR

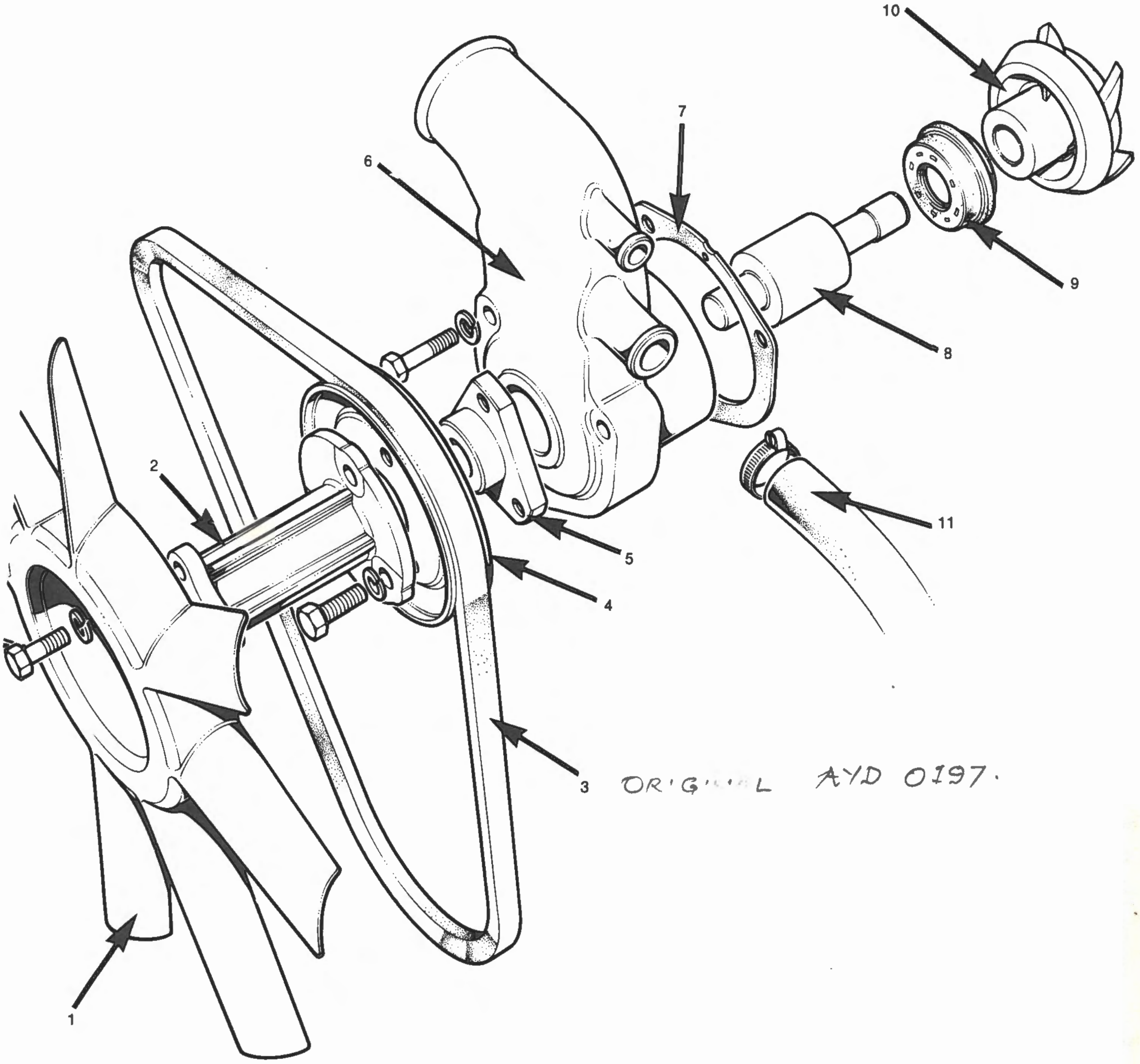
3 Remove the four bolts retaining fan to the hub extension and separate units.

Refitting

1 Refitting is a reversal of the removing procedure.

8 CYLINDER ENGINE

This unit is a four blade metal fan, mounted on to the water pump pulley hub with 4 securing bolts.



ORIGINAL AYD 0197.

Fig. J-8

COOLANT PUMP AND FAN COMPONENTS
6 CYLINDER ENGINE

1	FAN
2	ADAPTOR
3	BELT
4	PULLEY
5	FLANGED HUB
6	PUMP BODY
7	GASKET
8	BEARING ASSEMBLY
9	SEAL
10	IMPELLER
11	HOSE TO THERMOSTAT HOUSING

Removing

1 Remove fan belt.

2 Remove 4 bolts securing fan, hub and pulley to water pump. These bolts cannot be withdrawn.

3 Move fan, hub and pulley assembly forward so as to clear water pump pulley and angle assembly and remove from vehicle.

4 Separate fan from hub and pulley.

Refitting

1 Refitting is a reversal of the removal procedure.

VISCOUS COUPLING

The viscous coupling unit fitted to vehicles with air conditioning, is designed to limit fan speed when the engine is operating at high speed. Due to the amount of air passing through the radiator at high road speed, fan cooling is unnecessary. The coupling operates on fluid drive principles with the slip period commencing at a fan speed of 2500 rpm. The unit is sealed during manufacture and requires no maintenance. A faulty unit cannot be repaired but must be replaced. The fan fitted with this unit has 13 blades and is of plastic construction.

In the case of engine overheating during slow car speed or idle operation, increase the engine speed to approximately 1000 rpm with the gear lever in neutral. If the condition is not rectified by increasing engine speed, the viscous coupling unit may not be operating correctly. Other causes of this condition should not be overlooked.

Removing

1 Remove radiator cowl.

2 Remove four nuts and washers securing fan to viscous coupling and remove fan.

3 Remove centre bolt retaining viscous coupling to pulley and remove coupling.

Refitting

1 Refitting is a reversal of the removal procedure noting the following:

(a) Ensure viscous coupling is engaged in keyway on pulley hub.

(b) Ensure that the fan is fitted the correct way round. The front is identified by the fixing bosses moulded into the fan hub, the larger diameter faces to the front.

WATER PUMP

6 CYLINDER ENGINE

Removing

1 Disconnect the battery.

2 Drain the cooling system.

3 Withdraw radiator hoses.

4 Remove alternator drive belt.

5 Remove fan and pulley.

6 Remove by pass hose from the water pump to the thermostat housing.

7 Disconnect the heater hose from the water pump.

8 Remove securing bolts and remove water pump.

Dismantling

1 Support the pump body evenly under a press, with the impeller uppermost.

2 Press the spindle out of the pump housing.

3 Lift away the impeller and remove the seal from the body.

4 If the bearing and spindle assembly is to be replaced press the drive hub from the impeller.

Assembling

1 Press the drive hub onto the spindle if removed.

2 Press the spindle assembly into the housing until the distance between the edge of the bearing to the face of the seal seat is 9.65 to 9.90 mm (0.380 to 0.390 in). Refer Fig. J-9.

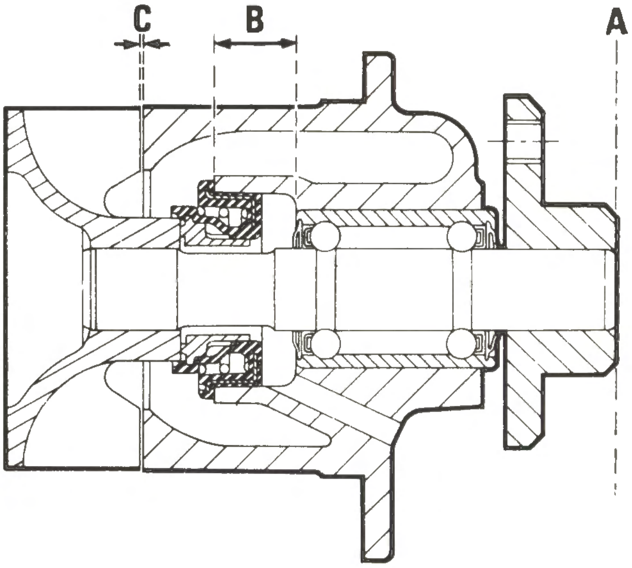


Fig. J-9

SECTION THROUGH COOLANT PUMP 6 CYLINDER

A HUB FLUSH WITH SHAFT END

B EDGE OF BEARING TO FACE OF SEAL

C CLEARANCE BETWEEN IMPELLER AND HOUSING

3 Fit the seal to the pump body, checking that the seal is seating correctly.

4 Press the impeller onto the spindle until a 0.25 to 0.51 mm (0.010 to 0.020 in) clearance between the impeller and the housing exists. Ensure that the impeller is pressed on straight as cracking can easily occur.

Refitting

1 Refitting is a reversal of the removing procedure.

COMPRESSER MTG PLATE ON WATER PUMP TO CYLINDER BLOCK THRU TIMING COVER 5/16" x 6 1/4" NC (2)
〃 〃 〃 〃 〃 〃 TO TIMING CASE 1/4" x 2 3/4" N.C. (1).

WATER PUMP TO CYLINDER BLOCK THRU TIMING CASE 5/16" x 6 1/4" NC (2)
ALTERNATOR BKT THRU WATER PUMP TO TIMING CASE 3/8" x 2 1/2" NC.
WATER PUMP TO TIMING COVER 1/4" x 2 3/4" NC
〃 〃 〃 〃 〃 1/4" x 2 1/2" NC

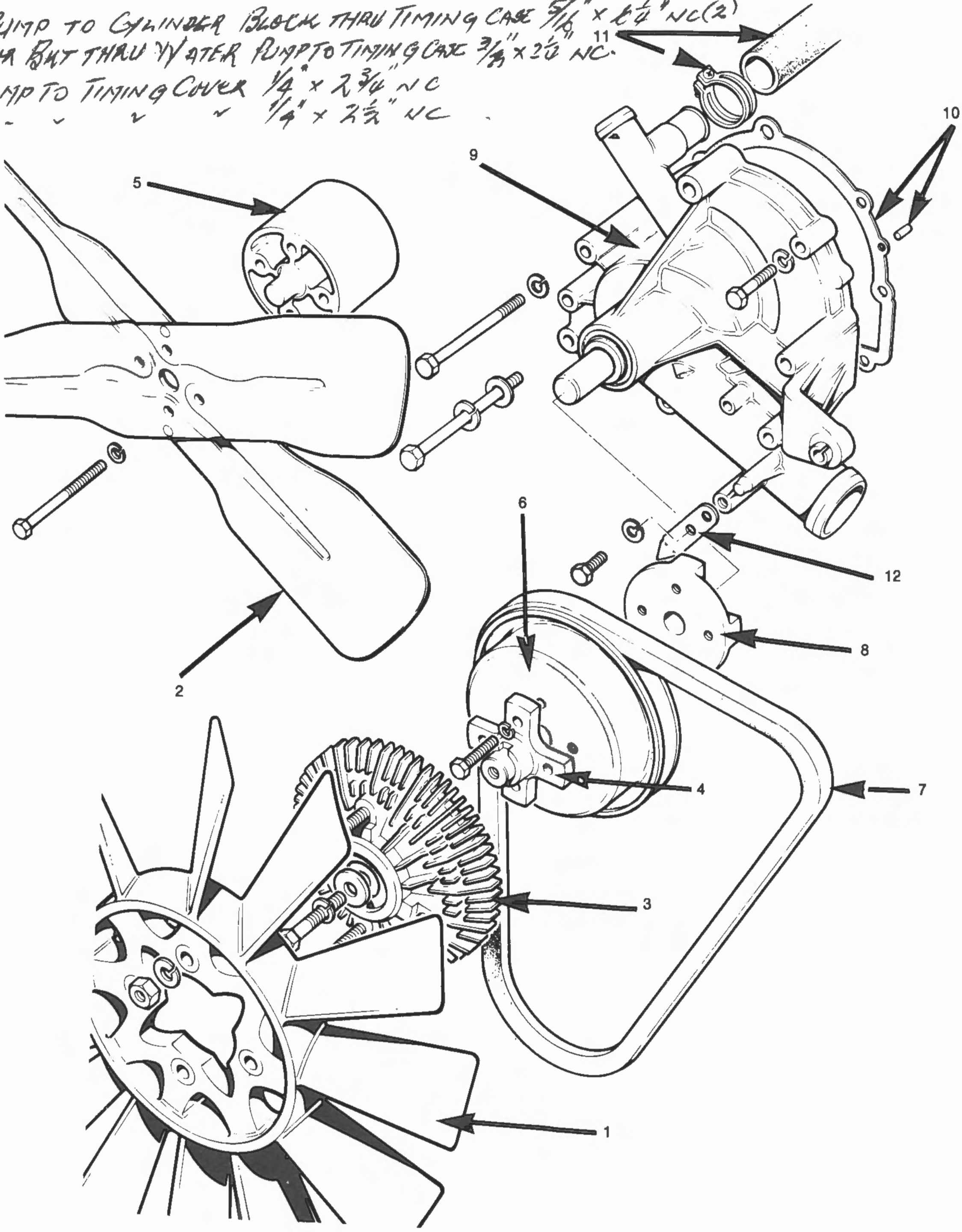


Fig. J-10

COOLANT PUMP AND FAN COMPONENTS
8 CYLINDER ENGINE

1 FAN AUTOMATIC MODELS
2 FAN MANUAL MODELS
3 VISCOUS COUPLING AIR CONDITIONED VEHICLES
4 ADAPTOR FOR COUPLING
5 FAN ADAPTOR MANUAL MODELS
6 PULLEY
7 BELT
8 PUMP FLANGED HUB
9 COOLANT PUMP ASSEMBLY
10 GASKET AND DOWEL TO CYLINDER BLOCK
11 HOSE AND CLIP MANIFOLD THERMOSTAT BY PASS
12 TIMING POINTER

8 CYLINDER ENGINE

The water pump is situated on the front timing cover.

Removing

1. Disconnect battery and remove alternator connections.
2. Drain cooling system.
3. Remove fan belt and remove alternator and adjusting link.
4. Remove radiator cowl.
5. Remove fan and pulley. On models fitted with air conditioning, after fan is removed, remove viscous coupling then pulley.
6. Remove bottom radiator hose, heater hose and manifold hose.
7. Remove bolts securing water pump and remove pump.
8. Remove timing pointer on bottom radiator hose connection.

Refitting

1. Ensure the fitting faces of the water pump and the front timing cover are clean.
2. Lightly grease a new joint washer and position it on the face of the timing cover.
3. Reverse the removal procedure making sure that all the threads are cleaned and lubricated (Refer Service Information Section).
4. Ensure fan belt is adjusted correctly.
5. Refill radiator.

NOTE: When fitting fan on air conditioned models ensure it is fitted the correct way round. The front is identified by the fixing bosses moulded into the fan hub, the larger diameter faces to the front. Tighten all bolts to the correct torque.

[illegible]

TO REVERSE FLUSH COOLING SYSTEM
INSTALL A TEE IN THE HEATER INLET HOSE I.E THE HOSE
FROM THE FIREWALL TO THE ENGINE BLOCK
THE OUTLET HOSE CONNECTS TO THE WATER PU

SECTION K
CLUTCH

DESCRIPTION

A diaphragm type clutch having a single dry driven plate of 241.3 mm (9.5 in) is fitted to both the 6 cylinder and 8 cylinder engines. The diaphragm exerts a clamping pressure of 8010 N (1800 lbf) through the pressure plate to the clutch facings on the 6 cylinder engine and 9790 N (2200 lbf) on the 8 cylinder engine. The clutch facings used with the 6 cylinder engine are VEE-LOCK 1133C and H-K-PORTER 219-120 with the 8 cylinder engine, otherwise both clutch assemblies are identical.

Six damper springs are incorporated in the clutch plate hub to absorb shock loads on the clutch and transmission assemblies.

The clutch operation is mechanical. The mechanism consists of a release lever supported by an adjustable anchor pin mounted in the flywheel housing and a ball thrust bearing and sleeve. The clutch pedal is connected to the release lever by a cable and an adjustable rod.

SERVICE DIAGNOSIS

It is indicative of good workmanship to diagnose a fault before dismantling any unit of the vehicle. Most clutch faults can be diagnosed before removing by carrying out the following tests.

1 SLIPPING:
To test for clutch slippage, start and warm-up engine. Apply handbrake firmly, depress clutch pedal and select top gear, accelerate the engine and at the same time slowly engage the clutch. Engine should stall immediately the clutch is fully engaged, otherwise the clutch is slipping.

Possible Causes

(a) The pedal free play — check sufficient free play exists as insufficient free play will prevent complete engagement of the clutch.

(b) Clutch plate — facings oil soaked, glazed or worn.

(c) Pressure plate spring — weak or broken.

2 JUDDER:
Clutch judder is excessive vibration that occurs during engagement of the clutch.

(a) Oil or grease on clutch disc facings.

NOTE: It is essential that the source of oil or grease contamination be rectified before installing a new clutch disc.

(b) Pressure plate engagement uneven due to faulty diaphragm.

(c) Weak clutch damper springs.

(d) Worn splines in clutch hub and/or transmission input shaft.

NOTE: Many causes of clutch judder are found in other units outside the clutch, namely loose or defective engine mountings, worn universal joints, excessive play in differential gears, worn rear suspension control arm bushes and bolts.

3 CLUTCH PEDAL STIFF OR BINDING:

Possible Causes

(a) Pedal pivot pin and bush tight.

(b) Linkage bent or mis-aligned.

4 DRAGGING:
The clutch may not completely disengage, making it difficult to engage gears without clashing.

Possible Causes

(a) Excessive pedal free play reducing the movement of the pressure plate to a point where the clutch disc is not freed from contact with the flywheel and pressure plate.

(b) Warped or distorted clutch plate.

(c) Clutch plate hub does not slide freely on input shaft splines.

(d) Clutch release bearing not contacting the diaphragm evenly owing to wear or distortion of the release lever.

(e) Misalignment between flywheel housing and crankshaft.

ALIGNMENT

Should alignment be suspect, the following checking procedure should be carried out.

DISMANTLING

(i) Remove the transmission and flywheel housing.
(ii) Remove clutch assembly from flywheel.
(iii) Remove clutch release lever and release bearing from flywheel housing.
(iv) Remove flywheel housing from transmission and clean the face of the flywheel housing removing any burrs or raised metal around the bolt bosses. The surface should be cleaned of any paint or sealant.
(v) The bore of the housing should be free of burrs and roughness. Replace flywheel housing on engine.

CHECKING

(i) Mount the dial indicator pilot into the end of the crankshaft, and attach the dial indicator, adjusting it until the button will contact a circumference just inside of the transmission mounting bolt holes. Fig. K-1.
(ii) The flywheel must be pushed forward to remove crankshaft end play, the dial indicator face must be set to read zero.

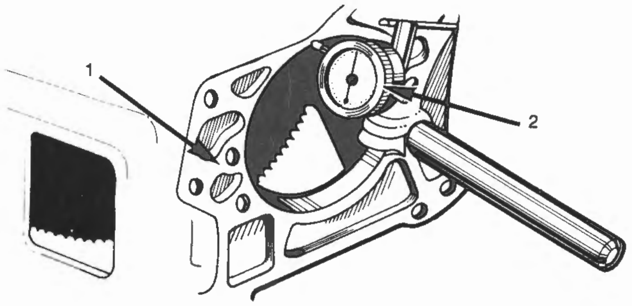


Fig. K-1

CHECKING FLYWHEEL HOUSING FACE

1 FLYWHEEL HOUSING 2 DIAL INDICATOR

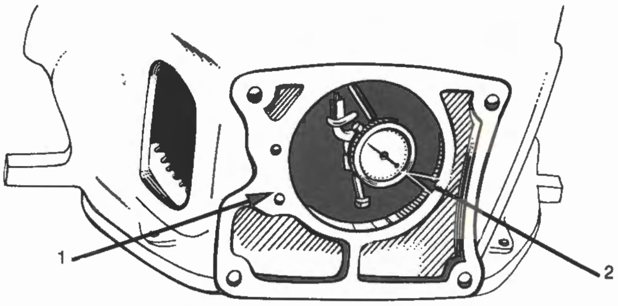


Fig. K-2

CHECKING FLYWHEEL HOUSING BORE

1 FLYWHEEL HOUSING 2 DIAL INDICATOR

(iii) Remove all spark plugs to eliminate compression, thus allowing the engine to turn smoothly.

(iv) Maintain the crankshaft in the forward position and slowly rotate it through one revolution noting the point of maximum runout and mark this point on the face of the housing. Maximum permissible runout is 0.152 mm (0.006 in).

(v) Position the dial indicator to check the housing bore. Fig. K-2.

(vi) Rotate the crankshaft through one revolution, check the indicator reading, and mark the point of maximum runout on the face of the housing. Runout should not exceed 0.23 mm (0.008 in).

(vii) Remove the dial indicator and pilot from the crankshaft.

ASSEMBLING

(i) Replace clutch release lever and bearing assembly.

(ii) Replace clutch assembly.

(iii) Replace transmission.

(iv) Replace spark plugs.

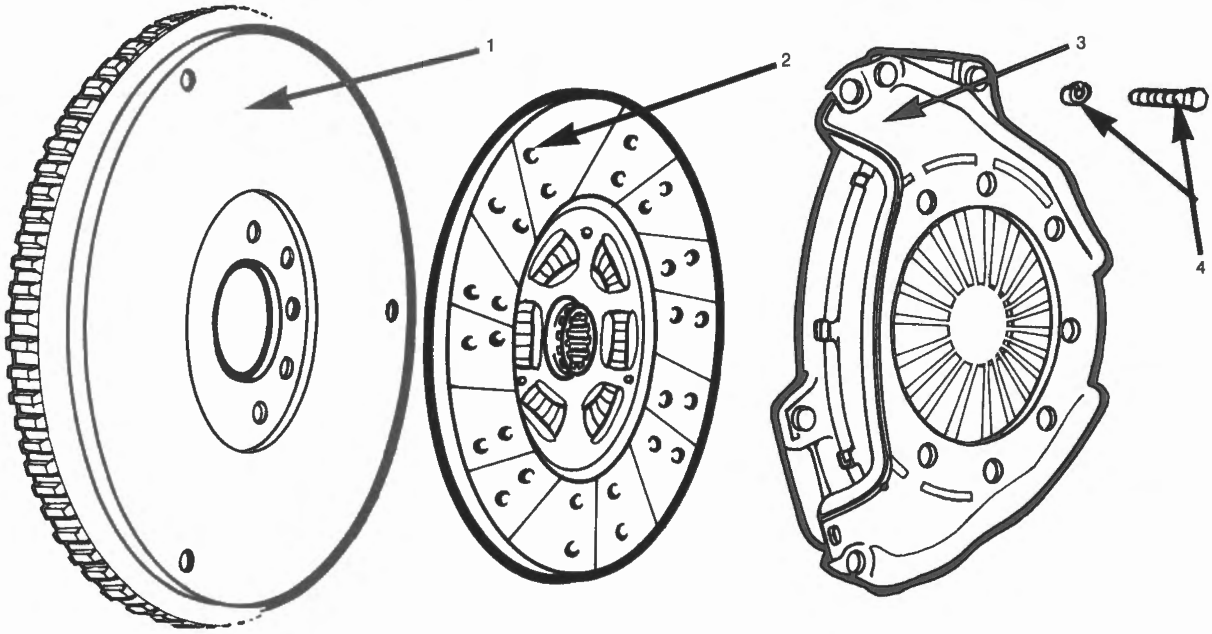


Fig. K-3

FLYWHEEL CLUTCH ASSEMBLY

1 FLYWHEEL

2 CLUTCH PLATE

3 PRESSURE PLATE ASSEMBLY

4 COVER PLATE RETAINING BOLT AND WASHER

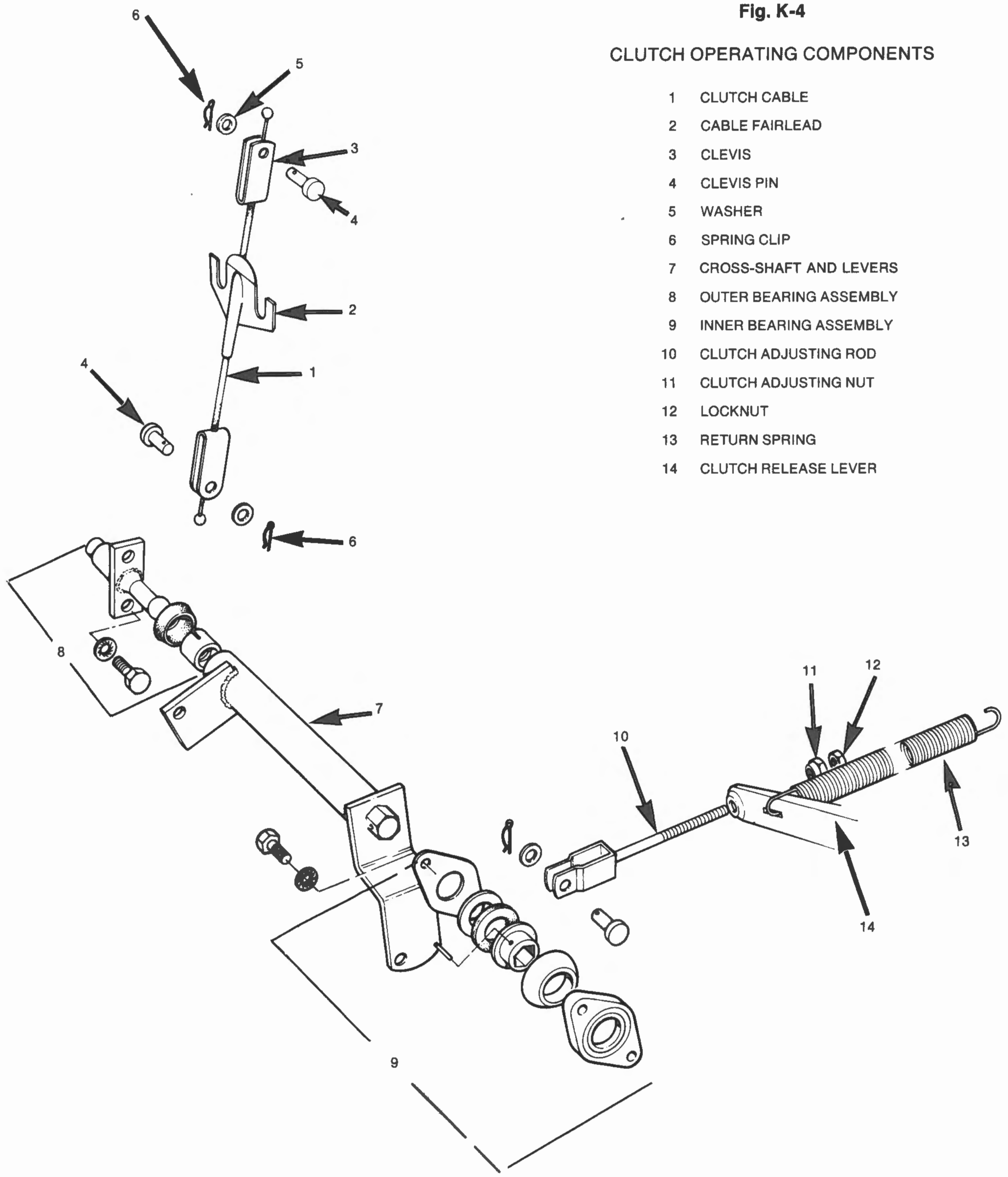


Fig. K-4

CLUTCH OPERATING COMPONENTS

1	CLUTCH CABLE
2	CABLE FAIRLEAD
3	CLEVIS
4	CLEVIS PIN
5	WASHER
6	SPRING CLIP
7	CROSS-SHAFT AND LEVERS
8	OUTER BEARING ASSEMBLY
9	INNER BEARING ASSEMBLY
10	CLUTCH ADJUSTING ROD
11	CLUTCH ADJUSTING NUT
12	LOCKNUT
13	RETURN SPRING
14	CLUTCH RELEASE LEVER

OPERATING CABLE

The clutch operation is by means of pedal and a flexible cable incorporating a 'fairlead' mounting on the bulkhead. The cable is attached to a lever on the outer end of the cross-shaft, Fig. K-4.

Attached to the inner end of the cross-shaft is another lever which transmits the motion through an adjustable rod to the clutch release lever, Fig. K-4.

Removing

1. Remove the lock pin and remove clevis pin securing cable to pedal.
2. Remove the lock pin and remove clevis pin securing cable to clutch cross-shaft lever.
3. Remove two bolts and nuts securing the 'fairlead' to the bulk head and remove the cable.

NOTE: The 'fairlead' is not detachable from the cable.

Refitting

1 Refitting is the reversal of procedures 1 to 3.

2 Adjust the clutch release lever.

CLUTCH ADJUSTMENT

Clutch facings wear during normal operating conditions. This in turn, reduces the clearance between the clutch release bearing and the diaphragm necessitating adjustment.

Should this adjustment be neglected, the release bearing will be in constant contact with the diaphragm, resulting in release bearing failure and possible clutch slippage.

Two adjustments are provided:

1 On the adjusting rod at the outer end of the release lever.

2 At the release lever pivot adjustor at the inner end of the release lever.

When clutch adjustment is required — that is when the free travel at the outer end of the release lever is reduced below 0.51 mm (0.020 in) — it is only necessary to make the adjustment at 1 to the point where no further thread is available on the rod.

Adjustment 2 can now be carried out, provided that all other linkage and components are in a serviceable condition.

ADJUSTMENT

1 MINOR:

(a) Loosen locknut on adjusting rod.

(b) Disconnect the release lever return spring.

(c) Push the clutch operating lever forward until the resistance of the clutch release bearing contacting the diaphragm fingers is felt.

(d) Hold the operating lever in this position and screw the adjusting nut on the threaded rod until the rounded end just seats in the operating lever.

(e) Unscrew the adjusting nut four turns and lock at this setting with the locknut.

(f) Connect the return spring to the clutch lever.

2 MAJOR

(a) Disconnect the release lever spring.

(b) Loosen the pivot pin locknut, hold the release lever forward so that the release bearing is in contact with the diaphragm.

(c) Screw the pivot bolt out (anti-clockwise) until the outer end of the release lever is approximately half way along the threaded position of the adjusting rod.

(d) Lock the pivot bolt locknut.

(e) Unlock the adjusting nut on the rod.

(f) Repeat items (c) to (f) of Minor Adjustment.

ENGINE REAR MOUNTING CROSS MEMBER

Refer Fig. K-6

Removing

1 Remove the two bolts securing the rear engine mounting to the cross member.

2 Raise the engine and transmission as high as possible without fouling the floor pan, and support on blocks.

3 Remove the nut and bolt securing the rear of the muffler to the rear support bracket and allow the muffler to drop a few inches. This will facilitate the removal of the cross member.

4 Remove the two bolts securing the cross member to the sub frame and remove the cross member.

Refitting

1 Refitting is the reversal of procedures 1 to 4. Ensure that all bolts and nuts are tightened to their specified torque.

OVERHAUL

Removing

1 Disconnect battery.

2 Remove the propeller shaft and plug the rear of the extension housing to prevent loss of lubricant.

3 Remove the clutch adjusting rod from the clutch release lever.

4 Remove the clutch release lever return spring.

5 Remove speedometer cable and reversing switch wires.

6 Disconnect the gear shift linkage connecting cross-shaft levers to selector shaft levers (3 speed transmission).

7 Remove the two bolts securing the clutch cross-shaft bearing to flywheel housing and press the cross-shaft into the side member bearing until it is clear of the flywheel housing.

8 Remove the two bolts securing the gear shift cross-shaft bearing to the flywheel housing and press the cross-shaft into the side member bearing until it is clear of the flywheel housing. Leave the upper gear shift rods attached to the cross-shaft levers (3 speed transmission).

9 Remove the gear lever (4 speed transmission).

10 Remove the dust cover from front of flywheel housing (8 cylinder engine).

11 Remove the bolts securing the rear engine mounting to cross member.

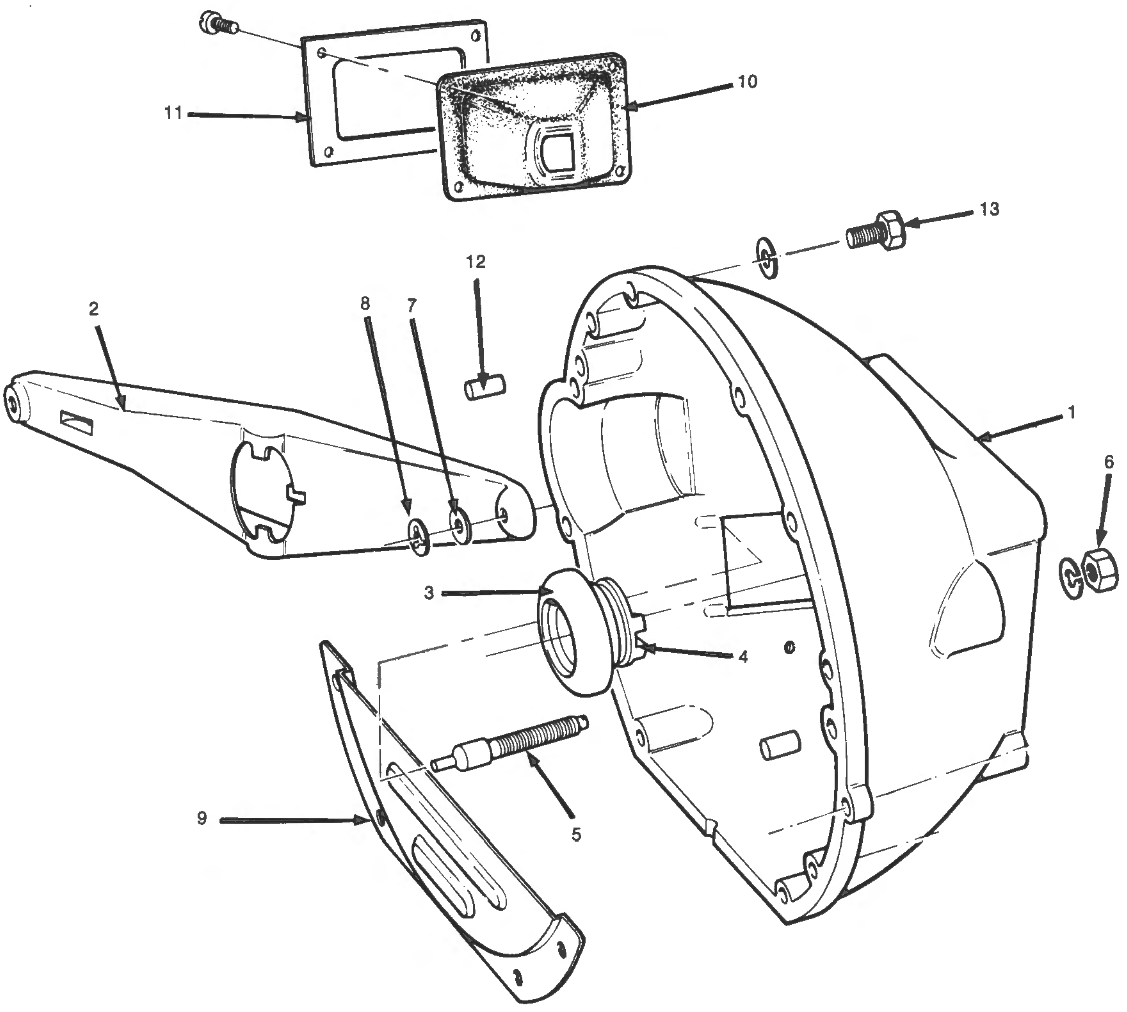


Fig. K-5

FLYWHEEL HOUSING COMPONENTS

1	FLYWHEEL HOUSING
2	CLUTCH RELEASE LEVER
3	CLUTCH RELEASE BEARING
4	RELEASE BEARING SLEEVE
5	PIVOT BOLT
6	PIVOT BOLT NUT AND WASHER
7	RELEASE LEVER WASHER
8	RELEASE LEVER RETAINING CLIP
9	FLYWHEEL HOUSING COVER
10	RELEASE LEVER COVER
11	GASKET
12	DOWEL
13	FLYWHEEL HOUSING RETAINING BOLTS

12 Support the engine and remove the bolts securing the cross member to side members and remove cross member.

13 Remove the bolts securing the flywheel housing to engine.

14 Carefully ease the flywheel housing from the two dowels and withdraw the housing and transmission taking care not to allow any weight to be taken on the clutch plate.

15 Mark the clutch cover and flywheel to ensure correct replacement if the original unit is to be refitted.

16 Loosen the bolts securing the clutch cover to the flywheel, approximately one turn at a time until the pressure is released on the cover, then remove the bolts.

17 Lift the clutch cover and plate from flywheel.

Inspecting

Refer Fig. K-3

1 Check the clutch plate for burned, worn or oil soaked facings, also inspect damper springs and hub splines for wear.

NOTE: The clutch plate must be replaced when the facings have worn within 0.8 mm (0.30 in) of the rivet heads.

2 Inspect the diaphragm for cracks, distortion and correct pressure.

3 Check the pressure plate for scoring, overheating, cracking and distortion.

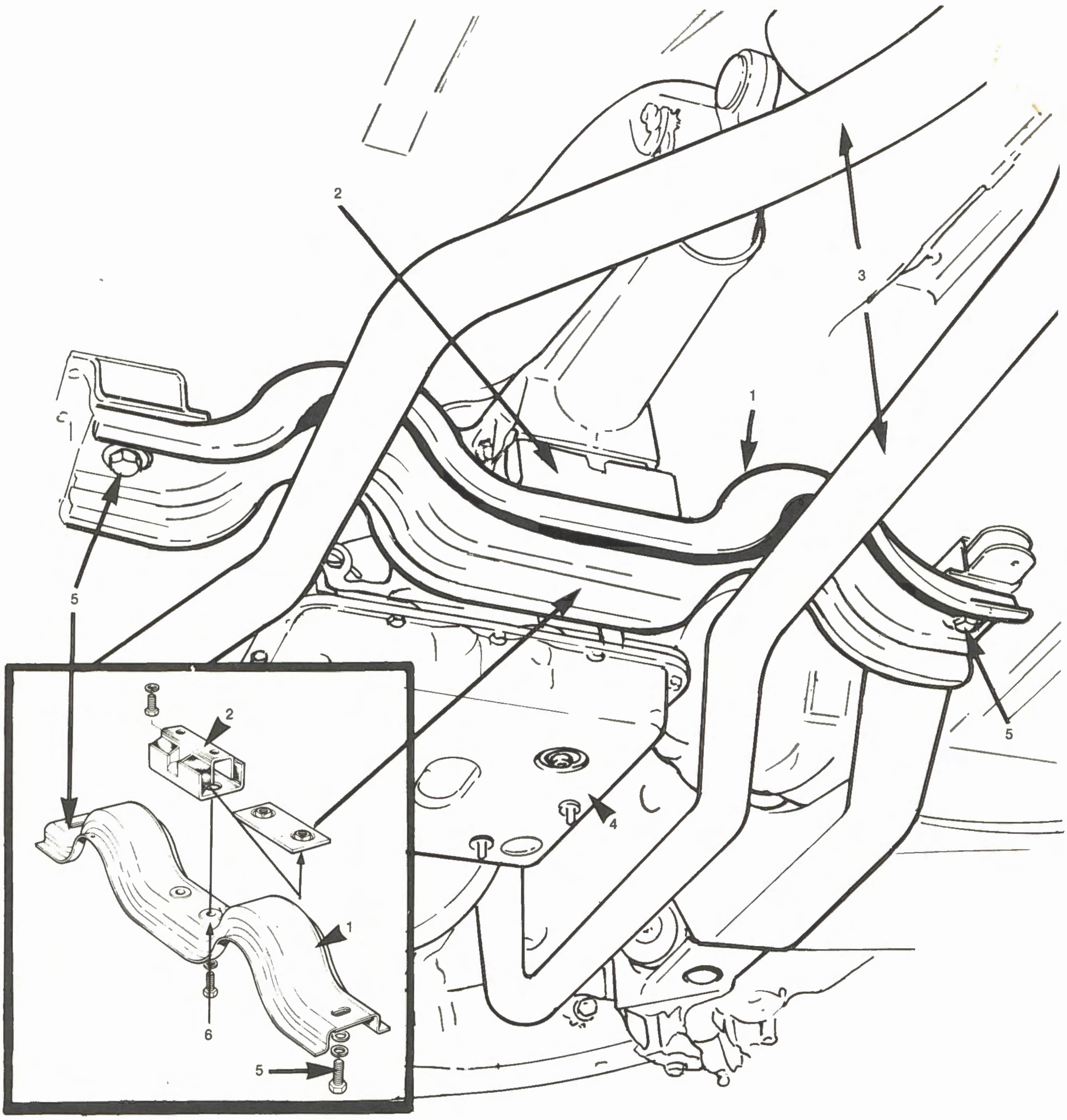


Fig. K-6

REAR CROSS MEMBER

1	REAR CROSS MEMBER	4	TRANSMISSION
2	REAR ENGINE MOUNTING	5	CROSS MEMBER SECURING BOLTS
3	EXHAUST PIPES	6	ENGINE MOUNTING BOLTS

4 Inspect the clutch driven plate contact area on the flywheel for scoring, overheating and surface cracking. The flywheel may be resurfaced — refer to Section D — Flywheel and Starter ring gear.

5 Check the clutch release bearing for roughness and renew if necessary. Do not wash the bearing in solvent as the lubricant retained in the bearing may be removed.

6 Check the internal bore of the release bearing sleeve for any roughness which may cause the sleeve to drag or stick on the front transmission extension housing. Any roughness should be removed with fine emery cloth.

7 Check the spigot bearing located in the crankshaft flange and renew if worn. Refer Page K-8.

NOTE: When fitting a new clutch plate always check the fit of the hub splines of the transmission input shaft. The clutch hub should slide freely on the splines, and any tightness may cause 'clutch drag' and difficulty in engaging gears.

Refitting

NOTE: It is important that all parts are clean, and that no grease or oil comes in contact with the clutch facings or contact faces on flywheel.

1 Position the clutch driven plate assembly on the flywheel with the hub damper springs facing the pressure plate.

2 Centralise the plate using Service Tool No. 18GA052 which fits the splined hub of the driven plate and the spigot bearing in the flywheel. As an alternative, a spare input shaft can be used. Refer Fig. K-7.

3 Locate the clutch cover assembly on the flywheel, aligning the marks if the original assembly is being replaced and insert the securing bolts.

4 The clutch cover securing bolts should only be tightened one turn at a time, until they are all tightened to the correct torque. Remove clutch aligning tool.

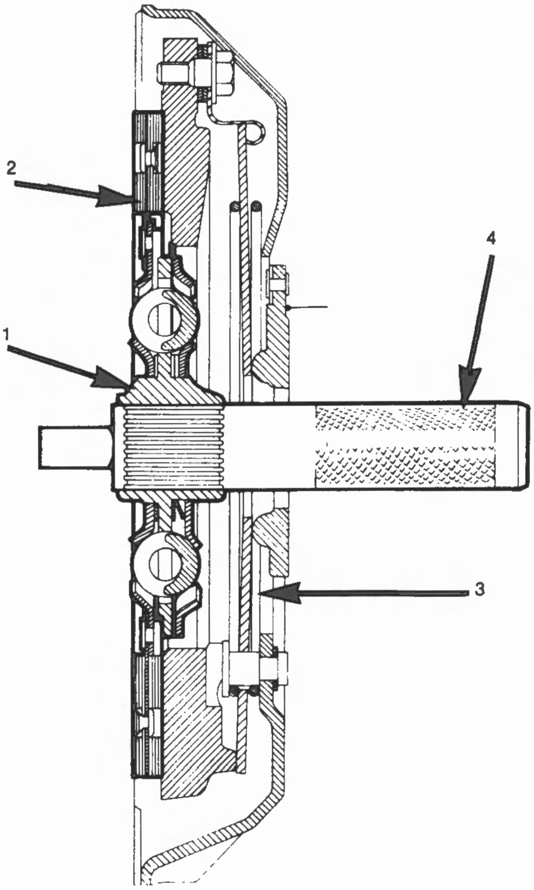


Fig. K-7

CLUTCH PLATE ALIGNING TOOL

1	CLUTCH PLATE HUB	3	CLUTCH DIAPHRAGM
2	CLUTCH FACING	4	ALIGNING TOOL

5 Apply a smear of grease to the clutch release bearing face, also lightly lubricate the splines of the input shaft with Bentone GB-2 grease wiping off any excess.

6 Raise the transmission and flywheel housing (preferably using a mobile jack) until the input shaft will enter the clutch plate hub, then slide forward. It may be necessary to engage top gear and slightly turn the main shaft to line up the input shaft and clutch plate splines. Ensure that the flywheel housing is correctly located on the dowels.

CAUTION: Do not allow the weight of the transmission to be taken by the clutch plate hub during installation. Insert and progressively tighten the flywheel housing bolts.

7 Raise the engine and transmission and refit the rear engine mountings and cross member.

8 Refit the clutch and gear shift linkage, both cross-shafts (gear lever on 4 speed transmission) and speedometer cable. Replace reverse light wires.

9 Refit propeller shaft.

10 Connect battery terminal.

11 Adjust the clutch as described in previous section.

INPUT SHAFT SPIGOT BEARING

Removing

1 Remove the transmission and clutch assembly.

2 Using the tool 18GA069 in conjunction with 18GA284 AB & D remove the spigot bearing.

3 Remove all traces of old lubricant from bearing bore.

4 Using the tool 18GA053 drive the new bearing into the crankshaft flange.

NOTE: The bearing is pre-packed with grease and requires no further lubrication.

Refitting

1 Refit the clutch and transmission assembly as previously described.

CLUTCH RELEASE BEARING

Removing

1 Remove the transmission from flywheel housing.

2 Remove clutch adjusting nut and locknut from threaded rod and remove release bearing and sleeve from release lever.

3 Place the release bearing and the sleeve in a vice or press and carefully press the sleeve from the bearing using tool 18GA042.

4 Position a new bearing on the end of sleeve and using tool No. 18GA042 press the new bearing on, ensuring that the bearing is correctly seated on the flange of the sleeve.

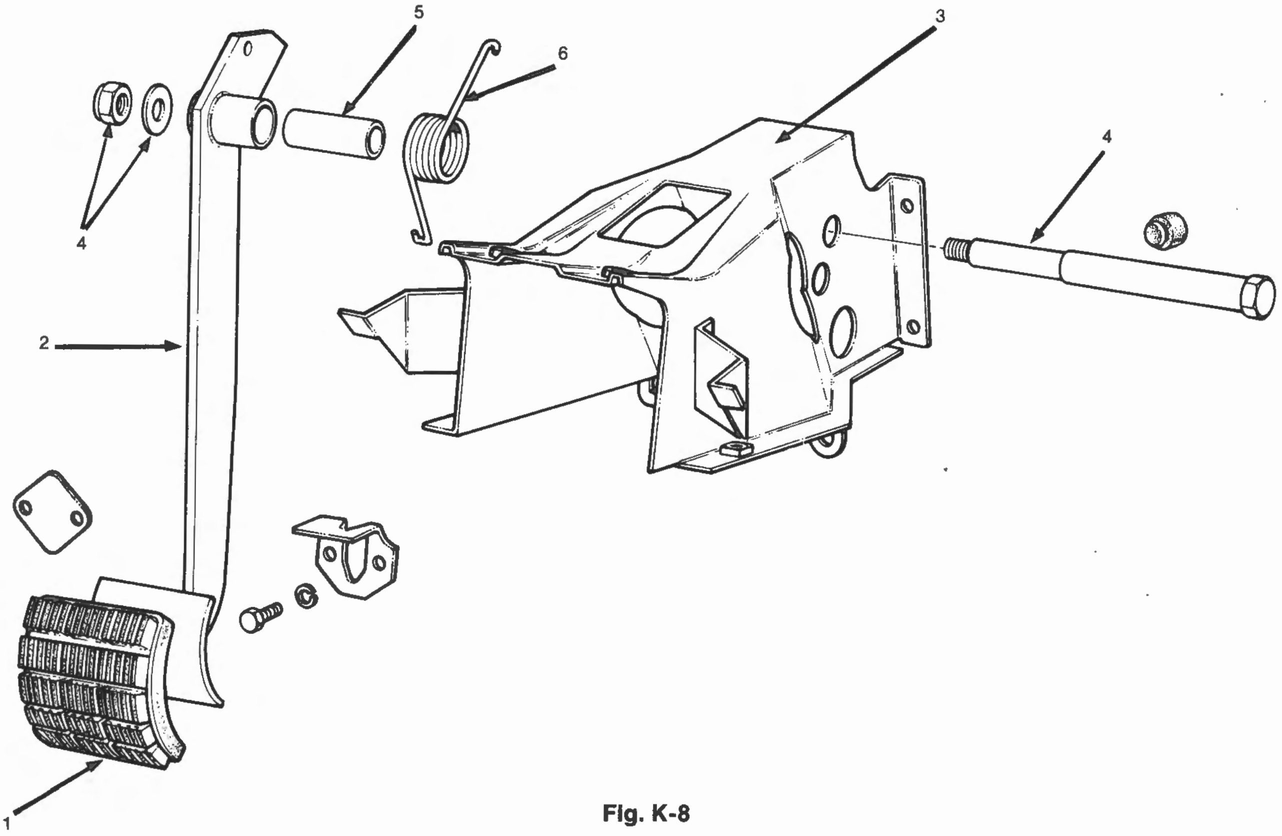


Fig. K-8

CLUTCH PEDAL ASSEMBLY

1	CLUTCH PEDAL RUBBER	4	PIVOT BOLT NUT AND WASHER
2	CLUTCH PEDAL	5	PIVOT BOLT BUSH
3	PEDAL BRACKET	6	PEDAL RETURN SPRING

5 Care must be taken to avoid damage to the new bearing. Never drive the bearing on the sleeve with a hammer. When pressing the new bearing on the sleeve turn it several times to ensure that it is not binding.

Refitting

1 Replace the release bearing and sleeve assembly on the clutch release lever.

2 Lightly grease the sleeve and release bearing contact surfaces.

3 Replace the transmission as previously described.

CLUTCH PEDAL

Removing

Refer Fig. K-8

1 Remove spring clip, washer and clevis pin securing clutch cable to clutch pedal.

2 Prise clutch pedal return spring from pedal.

3 Remove nut and washer from clutch pedal pivot bolt.

4 Slide clutch pedal from pivot bolt.

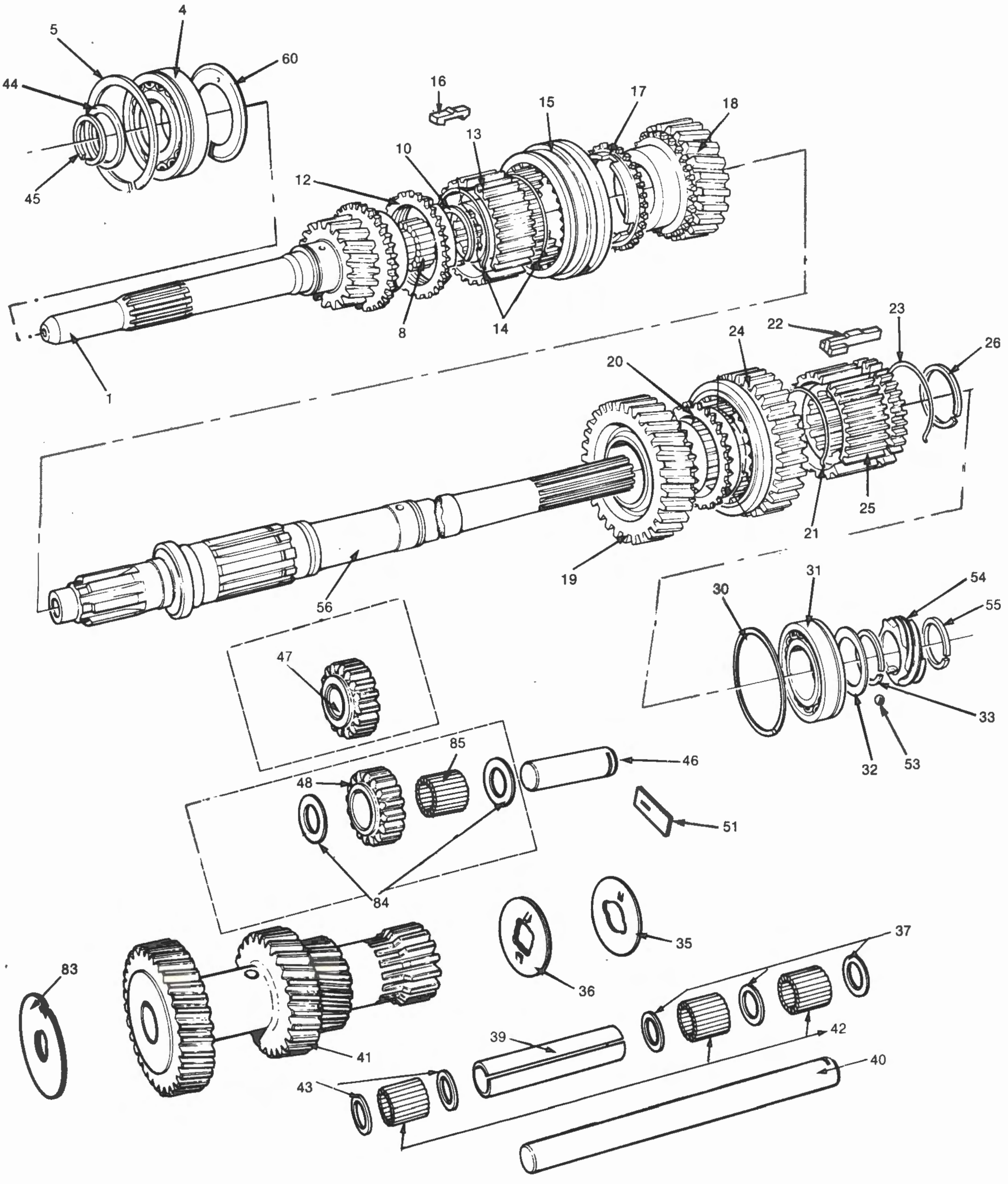
Refitting

1 Refitting is the reverse of removing procedures 1 to 4.

SECTION L

SYNCHROMESH TRANSMISSION

THE THREE SPEED SYNCHROMESH TRANSMISSION



LAYOUT OF THE TRANSMISSION COMPONENTS

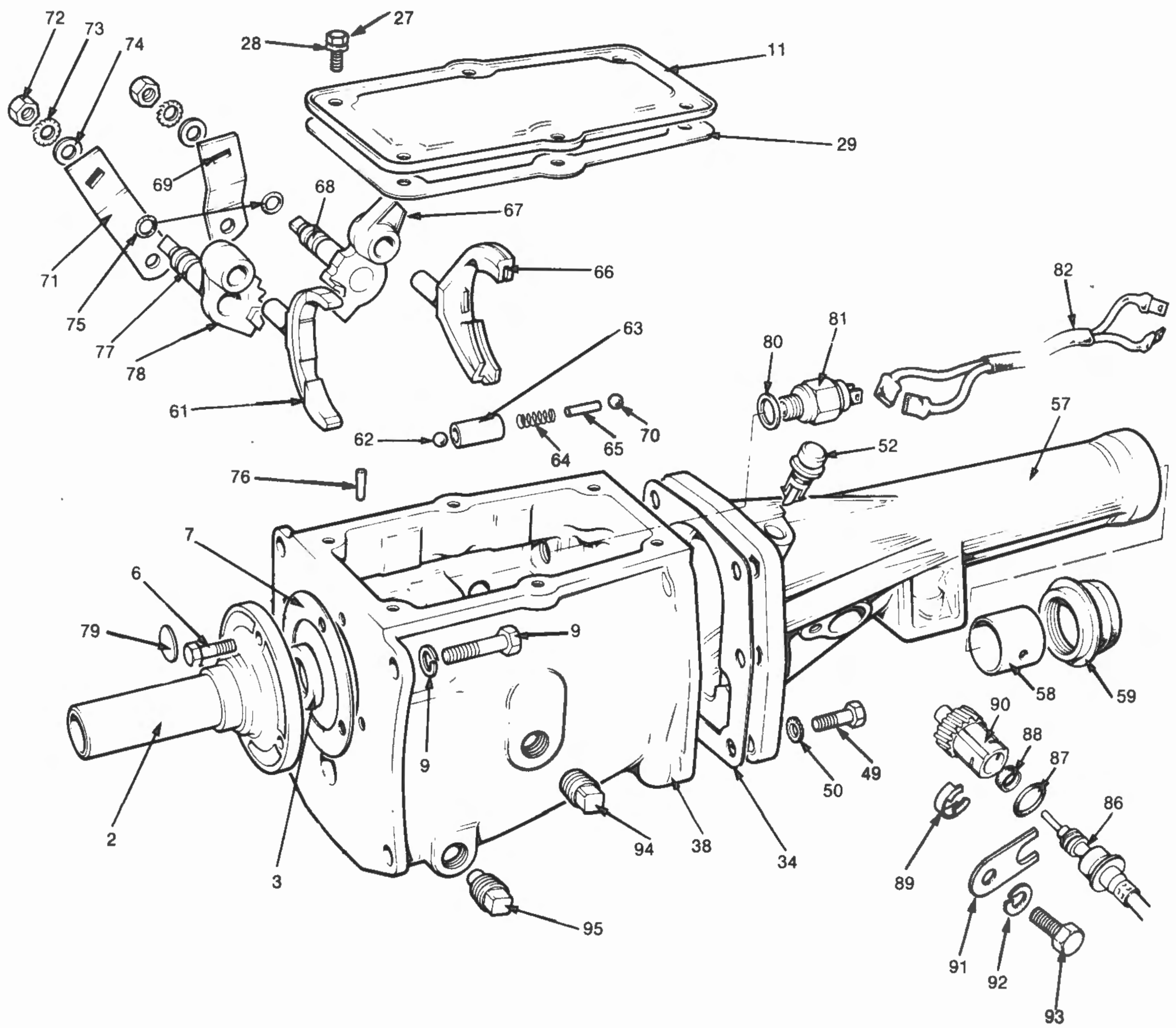


Fig. L-1

LAYOUT OF THE TRANSMISSION COMPONENTS

1	INPUT SHAFT
2	INPUT SHAFT BEARING RETAINER
3	BEARING RETAINER OIL SEAL
4	INPUT SHAFT BEARING
5	BEARING O.D. SNAP RING
6	BEARING RETAINER SCREWS AND WASHERS (3)
7	BEARING RETAINER GASKET
8	INPUT SHAFT NEEDLE ROLLERS (14) 15 HEAVY DUTY
9	BOLT AND WASHER
10	SNAP RING SELECTIVE
11	TOP COVER
12	THIRD SPEED SYNCHRONISER BAULK RING
13	SECOND AND THIRD SPEED SYNCHRONISER INNER HUB
14	SYNCHRONISER SPRINGS
15	SECOND AND THIRD SPEED SYNCHRONISER SLEEVE
16	SECOND AND THIRD SPEED SHIFT PLATES (3)
17	SECOND SPEED SYNCHRONISER BAULK RING
18	SECOND SPEED GEAR
19	FIRST SPEED GEAR
20	FIRST SPEED SYNCHRONISER BAULK RING
21	SYNCHRONISER SPRING
22	FIRST SPEED SYNCHRONISER SHIFT PLATES (3)
23	SYNCHRONISER SPRING
24	REVERSE GEAR AND FIRST SPEED SYNCHRONISER SLEEVE
25	FIRST AND REVERSE INNER HUB
26	SNAP RING
27	COVER BOLTS
28	COVER BOLT LOCK WASHER
29	COVER GASKET
30	MAINSHAFT BEARING O.D. SNAP RING
31	MAINSHAFT BEARING
32	SPACER
33	SNAP RING SELECTIVE
34	EXTENSION HOUSING GASKET
35	THRUST WASHER REAR OUTER
36	THRUST WASHER REAR INNER

KEY TO TRANSMISSION COMPONENTS

37	NEEDLE ROLLER THRUST WASHER (3)	66	FIRST AND REVERSE SHIFT FORK
38	GEAR CASE	67	FIRST AND REVERSE SHIFT CAM
39	LAYSHAFT BEARING SPACER	68	FIRST AND REVERSE CAMSHAFT
40	LAYSHAFT	69	FIRST AND REVERSE SHIFT LEVER
41	LAYGEAR	70	INTERLOCK BALL
42	LAYGEAR NEEDLE ROLLERS	71	SECOND AND THIRD SPEED SHIFT LEVER
43	THRUST WASHERS FRONT	72	NUTS — LEVERS TO SHAFTS
44	SPACER	73	SHAKE PROOF WASHERS
45	SNAP RING SELECTIVE	74	PLAIN WASHERS
46	REVERSE IDLER SHAFT	75	SHIFT CAMSHAFT 'O' RING SEALS
47	REVERSE IDLER BRONZE BUSHED or	76	TAPER PIN (2)
48	REVERSE IDLER — NEEDLE ROLLER TYPE HEAVY DUTY	77	SECOND AND THIRD SPEED SHIFT CAMSHAFT
		78	SECOND AND THIRD SPEED SHIFT CAM
49	EXTENSION HOUSING SCREWS (6)	79	WELSH PLUG
50	WASHERS FOR SCREWS (6)	80	WASHER FOR REVERSE LIGHT SWITCH
51	LOCKING PLATE	81	REVERSE LIGHT SWITCH
52	BREATHER	82	WIRES FOR REVERSE LIGHT SWITCH
53	SPEEDOMETER RETAINING BALL	83	THRUST WASHER
54	SPEEDOMETER GEAR	84	REVERSE IDLER GEAR THRUST WASHERS
55	SNAP RING	85	REVERSE IDLER GEAR NEEDLE ROLLERS
56	MAINSHAFT	86	SPEEDOMETER CABLE
57	EXTENSION HOUSING	87	SPEEDOMETER CABLE 'O' RING OIL SEAL
58	EXTENSION HOUSING BUSH	88	SPEEDOMETER INNER CABLE OIL SEAL
59	EXTENSION HOUSING OIL SEAL	89	SPEEDOMETER GEAR RETAINING CLIP
60	OIL SLINGER	90	SPEEDOMETER CABLE DRIVEN GEAR
61	SECOND AND THIRD SPEED SHIFT FORK	91	SPEEDOMETER CABLE RETAINING PLATE
62	INTERLOCK BALL	92	WASHER
63	INTERLOCK SLEEVE	93	SPEEDOMETER CABLE RETAINING SCREW
64	INTERLOCK SPRING	94	FILLER PLUG
65	INTERLOCK PIN	95	DRAIN PLUG

GENERAL DESCRIPTION

The 6 and 8 cylinder models are available with two transmissions.

1 Three speed — all synchomesh with column shift only. The 8 cylinder transmission is a heavy duty unit.

2 Four speed all synchromesh with floor shift only.

THREE SPEED TRANSMISSION

Description

The transmission provides three forward speeds with synchronisers on all gears to give rapid silent gear changes. All gears are the helical type.

The reverse gear train is of the spur type. The reverse idler gear is in constant mesh with the laygear and is engaged by the rearward movement of the first and reverse sliding gear assembly.

The input gear is carried on a ball bearing in the front of the transmission case. The mainshaft is supported at the front by needle rollers located in the hub of the input shaft and by a ball bearing positioned in the rear of the transmission case. The rear end of the mainshaft is supported by the sliding yoke of the propeller shaft running in a bush located in the outer end of the rear extension housing.

The laygear is carried on three rows of roller bearings running on a hardened layshaft. Two rows of roller bearings are located at the rear of the laygear and a single row at the front.

NOTE: The heavy duty three speed transmission fitted to the 8 cylinder model differs from the standard unit in the following respects — Heavy duty front and rear ball bearings. 22 needle rollers replacing the bush in the reverse idler gear. The gear ratios are also different. Refer to Specifications.

Gear selection is accomplished by means of two gear-shift forks, camshaft assemblies and interlock mechanism located in the transmission case. The gearshift forks are actuated by levers coupled to the column gearshift lever by means of rods, cross-shaft and intermediate levers.

REAR EXTENSION HOUSING

Removing

1 Disconnect battery.

2 Raise vehicle on hoist or place on stands.

3 Drain oil from transmission.

4 Remove propeller shaft.

5 Remove speedometer cable.

6 Disconnect reverse light switch wires.

7 Disconnect clutch release lever return spring from cross member.

8 Disconnect clutch adjusting rod by removing spring clip and clevis pin.

9 Remove the two bolts retaining the clutch cross-shaft bearing on the flywheel housing and ease bearing from housing.

10 Remove the two bolts retaining the gearshift cross-shaft bearing to the flywheel housing and ease bearing from housing.

11 Remove clevis pins from both selector shaft levers.

12 Remove nut and washer from rear muffler mounting and allow rear of muffler to hang down.

13 Support the weight of the power unit under the transmission case and remove cross member from vehicle.

14 Lower the power unit and transmission just sufficiently to allow removal of extension housing.

15 Remove the six bolts and spring washer securing extension housing to transmission and remove housing from transmission.

Refitting

1 Refitting is the reverse of the procedures 1 to 15 noting the following points:

   (a) Clean extension housing and rear of transmission mating surfaces.

   (b) Install new gasket on rear of transmission.

   (c) Tighten all nuts and bolts to specified torque.

   (d) Check clutch and gearshift operation and adjust if necessary.

OIL SEAL

Removing

1 Remove propeller shaft.

2 Prise the seal from the extension housing using a suitable lever.

Refitting

1 Using tool No. 18GA047/1 replace the oil seal. Lightly grease the seal lip to prevent burning during the initial running period.

2 Carefully inspect the seal bearing surface on the sliding yoke and replace yoke if badly scored or grooved. Replace propeller shaft.

BUSH

Removing

1 Remove the rear extension housing as previously described.

2 Extract the rear extension oil seal by prising out of housing.

3 Using tool No. 18GA068 drive the extension housing bush into the housing where it can be removed.

Refitting

1 Using tool No. 18GA068 drive the rear bush into the extension housing from the rear.

2 Using tool No. 18GA047 drive the oil seal into the extension housing.

3 Refit the extension housing.

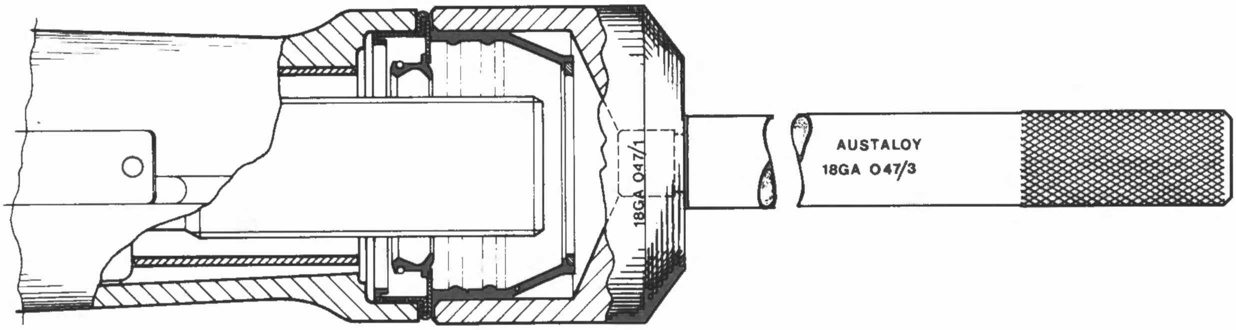


Fig. L-2

FITTING REAR EXTENSION HOUSING OIL SEAL

1 18GA047/1 THREE SPEED TRANSMISSION

2 18GA047/2 FOUR SPEED TRANSMISSION

3 18GA047/3 HANDLE

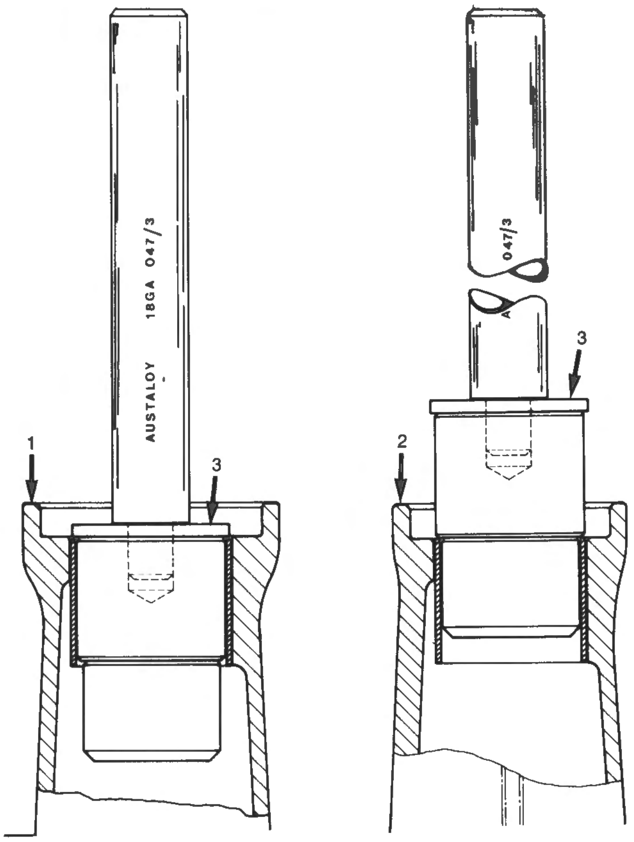


Fig. L-3

REMOVING AND REFITTING THE REAR EXTENSION HOUSING BUSH

1 REAR EXTENSION HOUSING — FOUR SPEED
2 REAR EXTENSION HOUSING — THREE SPEED
3 BUSH REMOVER REPLACER — 18GA063

TRANSMISSION (REMOVING AND REFITTING)

NOTE: This description covers both three and four speed transmissions. Delete items not applicable.

Removing

1 To remove transmission housing, carry out procedures 1 to 10 of Rear Extension Housing removal.

2 Remove the split pins and clevis pin from both transmission selector levers and remove rods (3 speed transmission).

3 Remove gear lever (4 speed transmission) using the following procedure:

(a) Place gear lever in neutral.

(b) Remove the screws from the gearshift boot retainer plate and remove plate and boot from lever.

(c) Remove the circlip located on top of conical spring.

(d) Remove the spring, seat and spherical washer.

(e) Using a screw driver, unlock the bent tab on the pivot ball seat and unscrew the gear lever ball seat.

(f) Remove the gear lever, seat and pivot assembly.

4 Place jack under transmission and raise slightly.

5 Remove the two bolts securing rear mounting to cross member.

6 Remove the two bolts securing the cross member to side members.

7 Remove the nut securing the rear of muffler to support bracket and allow muffler to drop as far as other brackets will permit.

8 Remove cross member.

9 Lower engine on to blocks placed under rear of the sump.

10 Remove the four bolts securing the transmission to the flywheel housing.

11 Carefully ease the transmission from the flywheel housing and withdraw transmission taking care not to allow any weight to be taken on the clutch plate hub.

12 Remove transmission from under vehicle.

Refitting

1 Refitting is the reversal of procedures 1 to 12 noting the following points:

(a) Clean input shaft splines and lightly smear splines with Bentone Base grease. Wipe off any excess grease.

(b) Line up splines on input shaft and clutch plate hub (it may be necessary to place transmission in top gear and slightly turn the mainshaft).

(c) Do not allow any weight to be taken on clutch plate hub during refitting of transmission.

(d) Tighten all bolts and nuts to specified torque.

(e) Fill transmission with specified lubricant to the correct level.

(f) Check operation of clutch and gearshift mechanism and adjust if necessary.

COLUMN GEARSHIFT LINKAGE

Adjusting

1 Move the gear lever into the first gear position and hold firmly against the column stop.

2 Remove the split pin and clevis pin from first and reverse gear selector lever and ensure that first gear is fully engaged.

3 Adjust the first and reverse gearshift rod until the clevis pin can be replaced without interference.

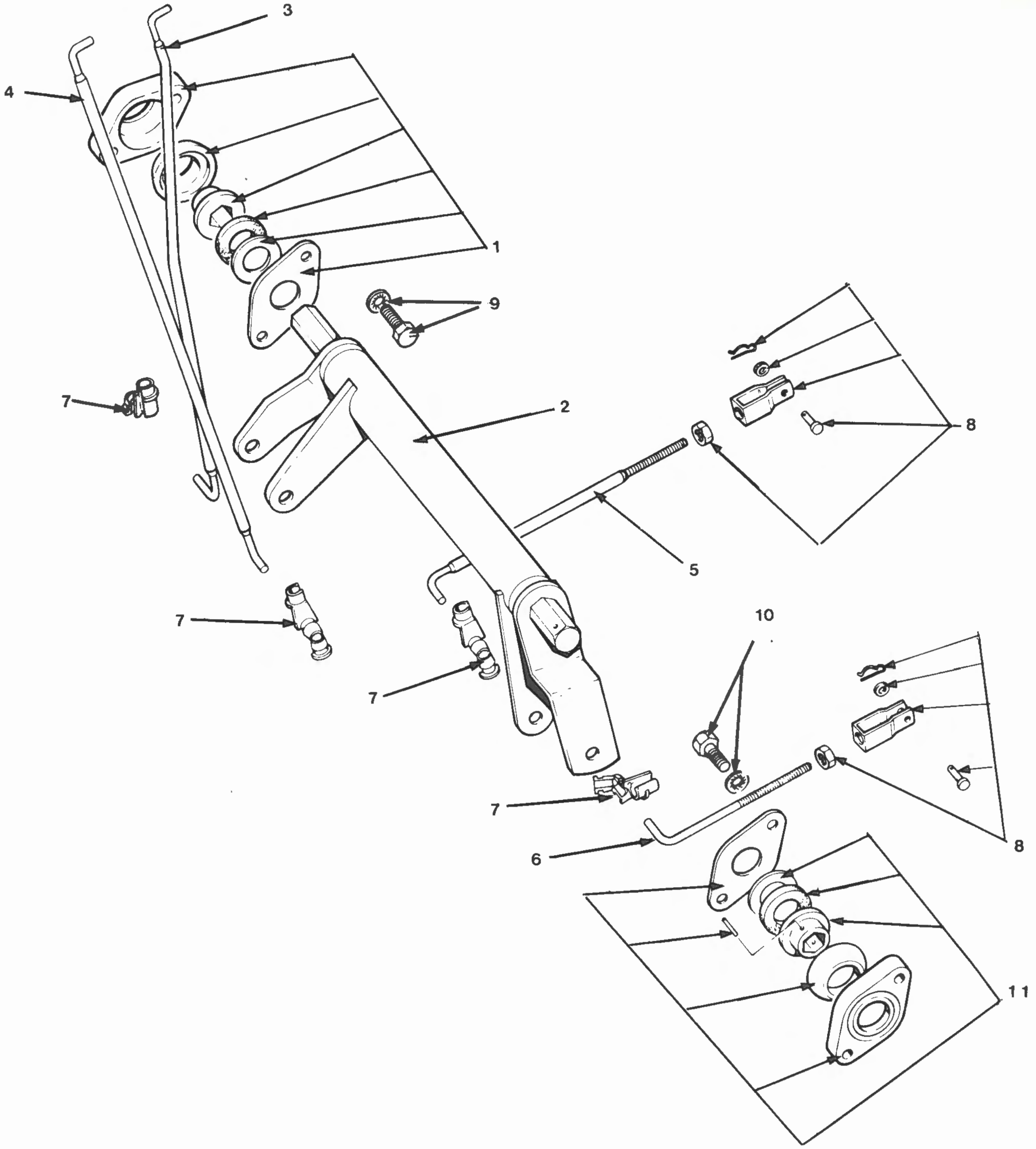


Fig. L-4

LAYOUT OF COLUMN GEARSHIFT LINKAGE

1	OUTBOARD (RH) BEARING ASSEMBLY
2	CROSS-SHAFT ASSEMBLY
3	ROD — CRANKSHAFT RIGHT OUTER LEVER TO COLUMN — 2-3 SHIFT
4	ROD — CROSS-SHAFT, RIGHT INNER LEVER TO COLUMN — 1ST/REVERSE SHIFT
5	ROD — CROSS-SHAFT, LEFT INNER LEVER TO FRONT LEVER ON TRANSMISSION — 1ST/REVERSE SHIFT
6	ROD — CROSS-SHAFT, LEFT OUTER LEVER TO REAR SHIFT LEVER ON TRANSMISSION — 2-3 SHIFT
7	CLIPS — RODS TO CROSS-SHAFT ASSEMBLY
8	CLEVIS COMPONENTS — RODS TO TRANSMISSION SHIFT LEVERS
9	SCREWS AND WASHERS — OUTER (RH) BEARING ASSEMBLY TO FRONT LONGITUDINAL MEMBER (RH)
10	SCREWS AND WASHERS INNER (LH) BEARING ASSEMBLY TO FLYWHEEL HOUSING
11	INBOARD (LH) BEARING ASSEMBLY

4 Move gear lever into neutral position.

5 Hold the gear lever up against spring pressure and insert tool 18GA071 between the two gear levers at the bottom of the upper steering column straddling the bridge piece. Fig. L-5.

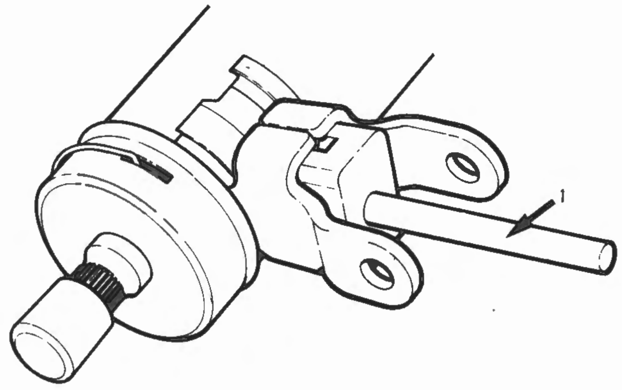


Fig. L-5

SETTING THE COLUMN LEVERS

1 GEAR SELECTOR SETTING GAUGE 18GA071

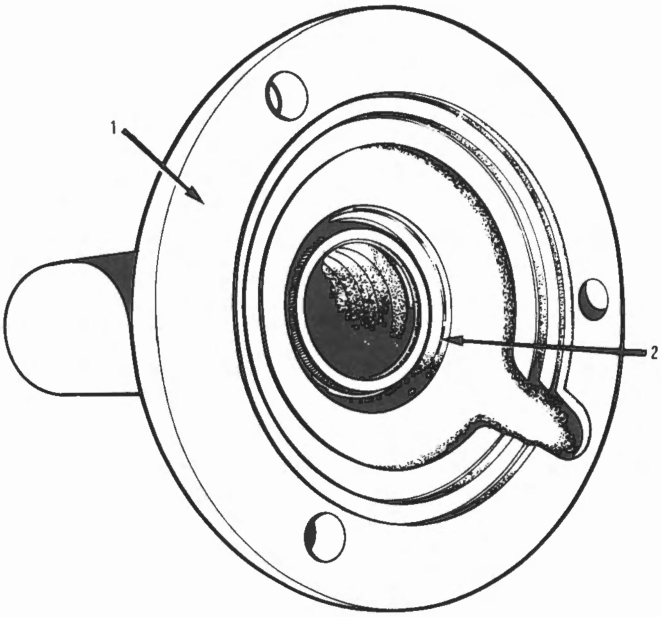


Fig. L-6

CORRECT LOCATION OF INPUT SHAFT OIL SEAL

1 INPUT BEARING RETAINER 2 OIL SEAL

6 Remove split pin and clevis pin from second and third gear selector lever and ensure that it is clearly in neutral position.

7 Adjust second and third gear selector rod until the clevis pin can be replaced without interference.

8 Replace clevis pin and split pin. Remove tool from gearshift lever.

INPUT SHAFT OIL SEAL (REMOVING AND REFITTING)

Removing

1 Remove transmission from vehicle as previously described.

2 Remove the bolts securing the input shaft bearing retainer to transmission case and remove bearing retainer.

3 Prise the oil seal from bearing retainer.

4 Remove old sealer from oil seal seating and ensure that it is smooth and clean to receive the new seal.

Refitting

1 Coat the outside of the new seal with sealer and drive into bearing retainer.

2 Lightly smear lip of seal with grease to avoid burning during initial running and replace bearing retainer on transmission.

3 Coat the threads of securing bolts with sealer, replace bolts and tighten to specified torque.

4 Replace transmission.

OVERHAULING

Removing

1 Drain lubricating oil, replace drain plug and remove transmission from vehicle.

2 Thoroughly clean exterior of transmission and mount on a suitable stand.

Dismantling

1 Remove the six screws securing the top cover to the transmission housing and remove cover and gasket.

2 Remove the six screws securing the rear extension housing to the transmission case and remove housing.

3 Remove the snap ring securing the speedometer drive gear and slide speedometer drive gear off the mainshaft. Remove speedometer gear drive ball from the mainshaft. Fig. L-7.

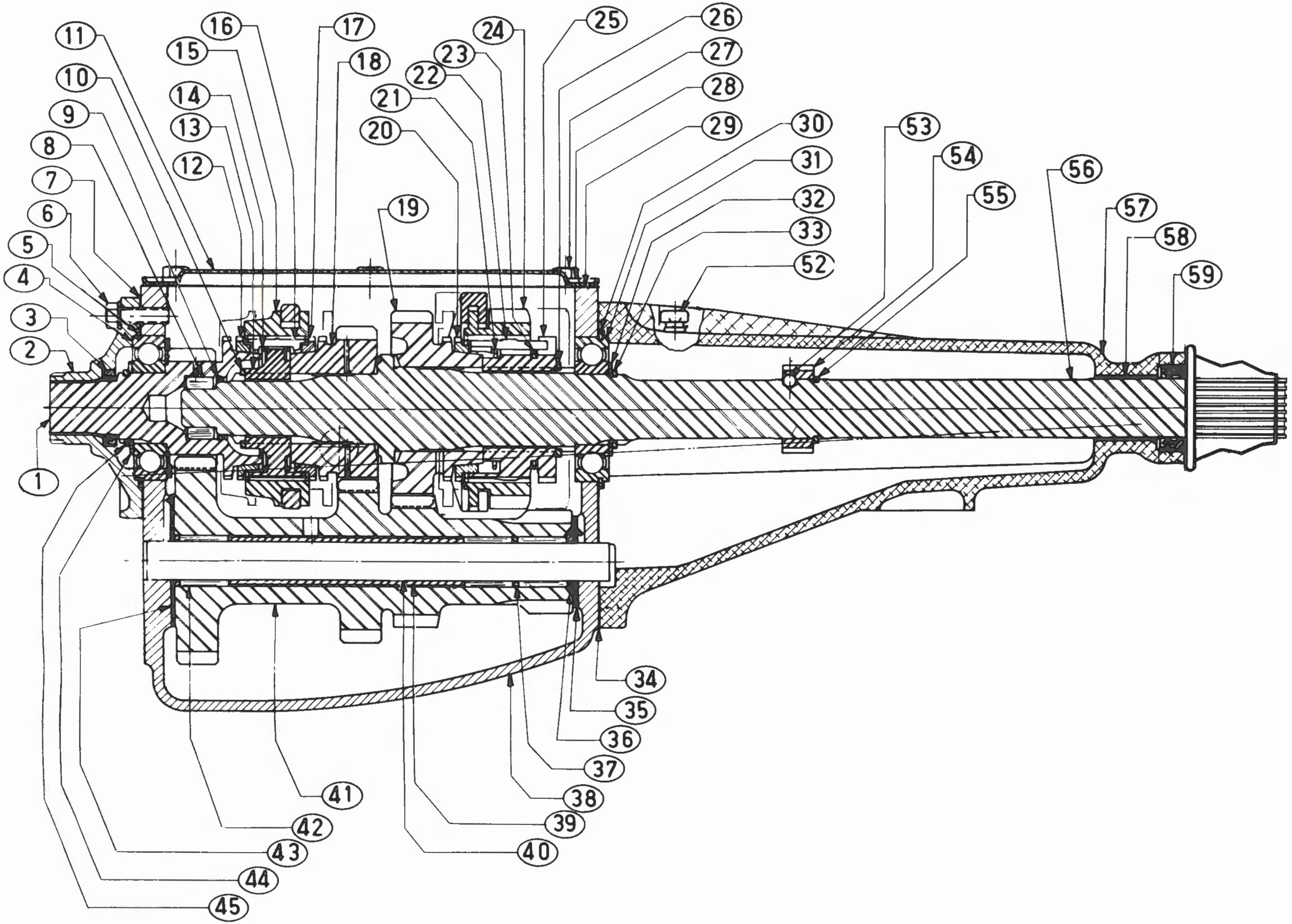
4 Remove the three screws securing the front bearing retainer to transmission case and remove retainer.

5 Using a soft drift, drive the layshaft from the front just sufficient to release the lock plate. Remove lock plate. Fig. L-8.

6 Using a dummy layshaft tool No. 18GA073 drive out the layshaft through the rear of the transmission case. Lower the laygear and dummy shaft to the bottom of the case. Fig. L-9.

7 Withdraw the input shaft and bearing from the front of transmission, tool No. 18GA048, and remove third speed baulk ring. Fig. L-10.

THE THREE SPEED TRANSMISSION ASSEMBLY



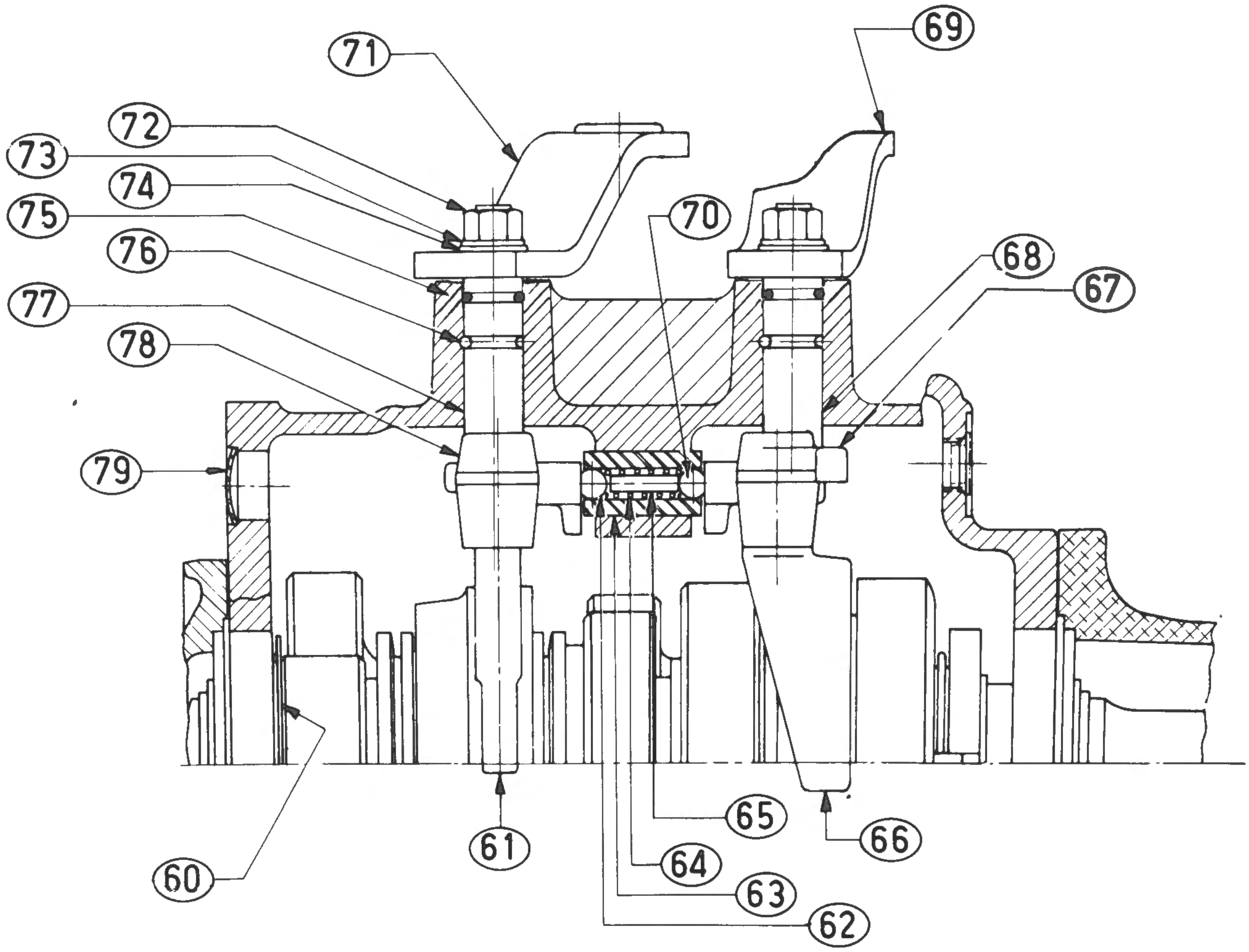


Fig. L-7

TRANSMISSION CROSS SECTIONAL VIEWS

Fig. L-1 LEGEND REFERS

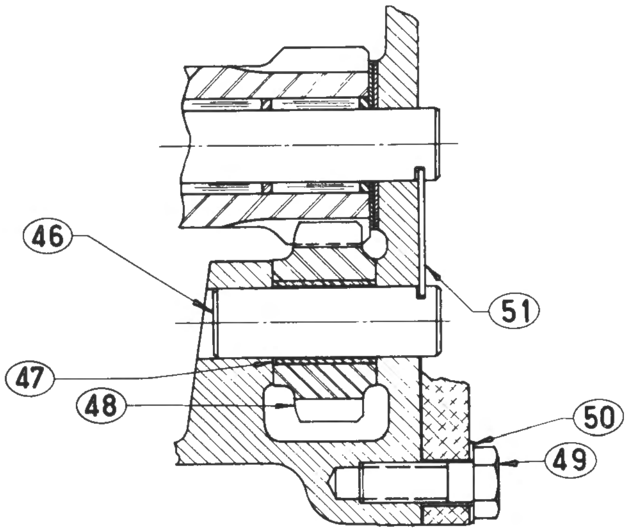


Fig. L-7A

SECTION THROUGH LAYSHAFT/REVERSE IDLER SHAFT

Fig. L-1 LEGEND REFERS

8 Remove rear bearing retaining circlip.

9 Select third gear.

10 Remove both gearshift levers from camshafts. From the underside of the gearshift camshaft boss on the transmission housing, drive out the taper pins from each gearshift camshaft. Fig. L-11.

11 Pull both gearshift cam and shaft assemblies against the inside of the transmission case.

12 Using a soft hammer tap the mainshaft assembly forward so that the mainshaft bearing moves through into the housing. Move the mainshaft assembly away from the gearshift forks.

13 Move the first and reverse sleeve and gear forward into first speed position, (do not move first and reverse gearshift fork out of neutral position, but tilt top of fork forward).

14 Remove first and reverse gearshift fork.

15 Remove second and third speed gearshift fork.

16 Move the second and third speed synchroniser outer sleeve rearwards into second speed position.

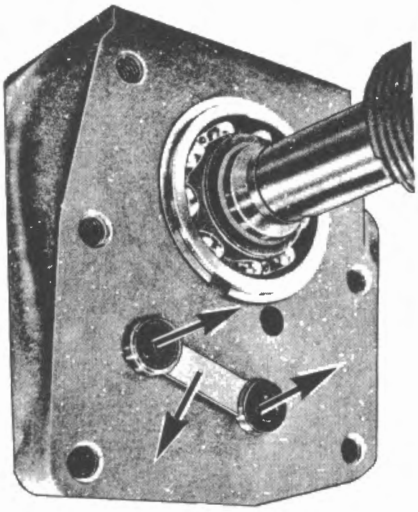


Fig. L-8

REMOVING THE LOCK PLATE

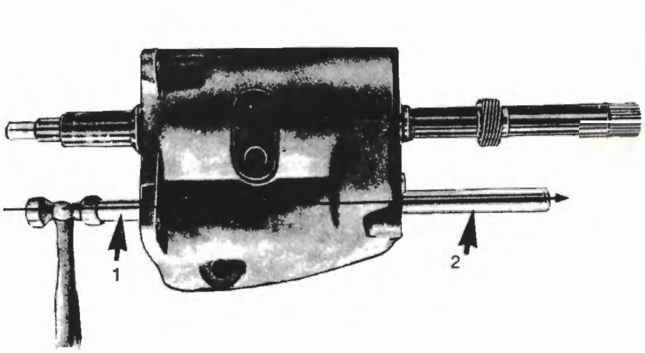


Fig. L-9

REMOVING THE LAYSHAFT

1 DUMMY LAYSHAFT 18GA073

2 LAYSHAFT

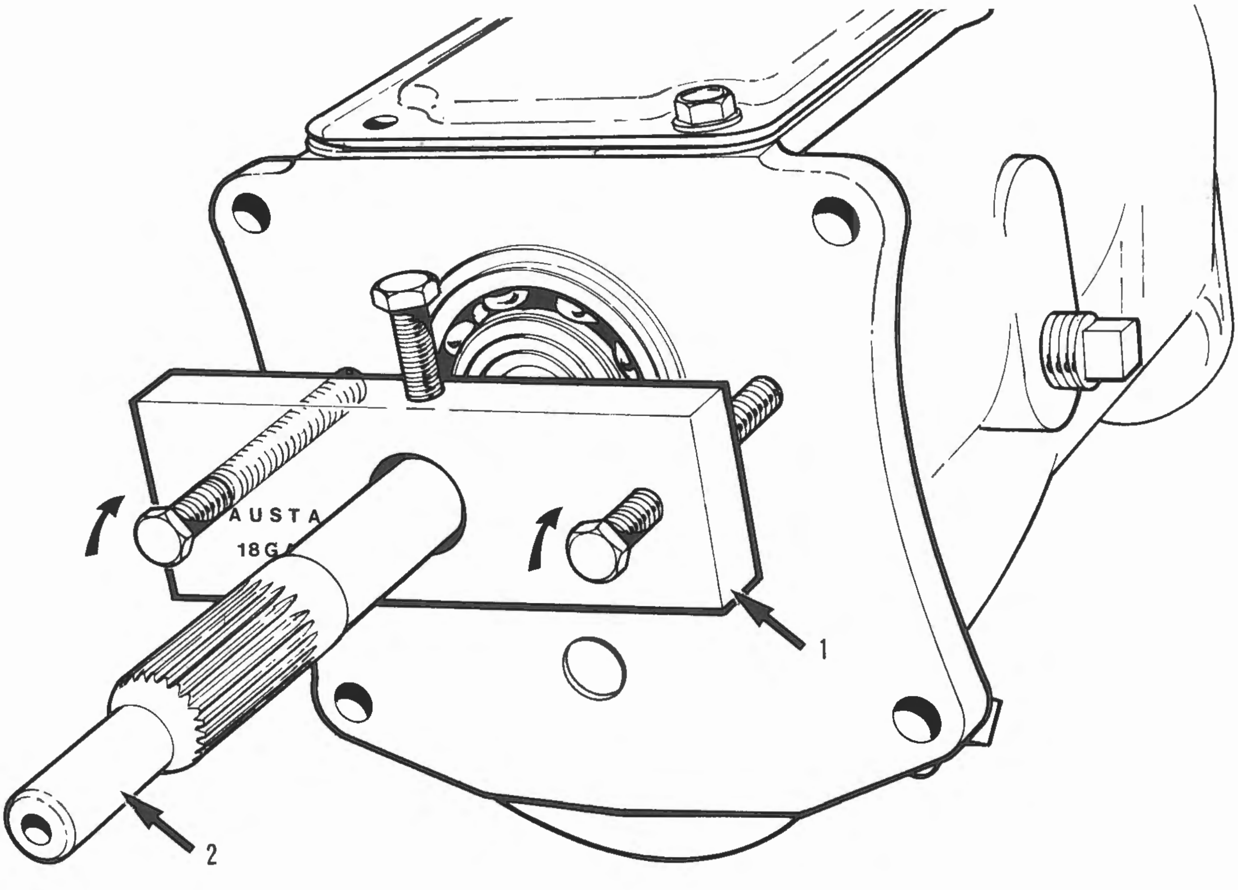


Fig. L-10

REMOVING THE INPUT SHAFT ASSEMBLY

1 INPUT SHAFT REMOVER 18GA048

2 INPUT SHAFT

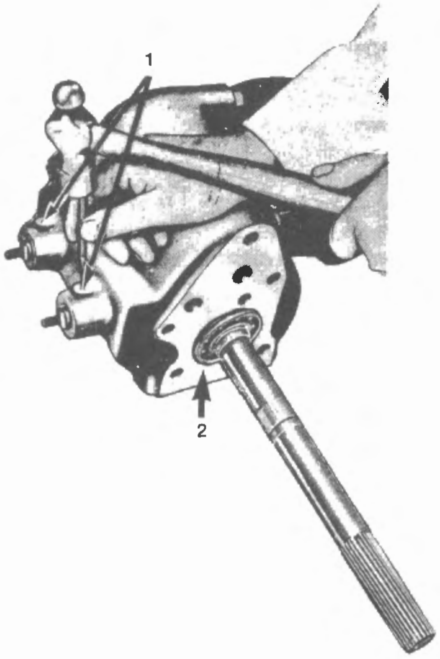


Fig. L-11

REMOVING THE SHIFT CAMSHAFT PINS

1 TAPER PINS 2 INVERTED TRANSMISSION

17 Remove mainshaft assembly through top of transmission housing.

18 Drive out the reverse idler shaft and remove the reverse idler gear assembly, needle rollers and thrust washers from transmission housing.

NOTE: The heavy duty transmission uses 22 needle roller bearings. Take care to retain them.

19 Refit layshaft and check end float of laygear which if greater than shown in specifications, should be corrected on assembly with new thrust washers. Drive out layshaft with dummy shaft, which is left in laygear to retain needle roller bearings.

20 Lift out the laygear and dummy shaft from the bottom of transmission case complete with thrust washers.

21 Using a soft hammer, drive the second and third speed cam and shaft towards the inside of the case and separate the detent balls and spring from the plunger. Remove reverse light switch, filler and drain plugs.

22 MAINSHAFT
Before commencing to dismantle the mainshaft assembly, the end float of both first speed and second speed gears should be checked with the aid of feeler gauges. Second gear end float is checked by inserting a feeler gauge between second gear and the shoulder of the mainshaft.
To check first gear end float, insert feeler gauge between first and reverse inner hub snap ring. The end float in each case should be within the specifications of 0.152 to 0.482 mm (0.006 to 0.019 in).

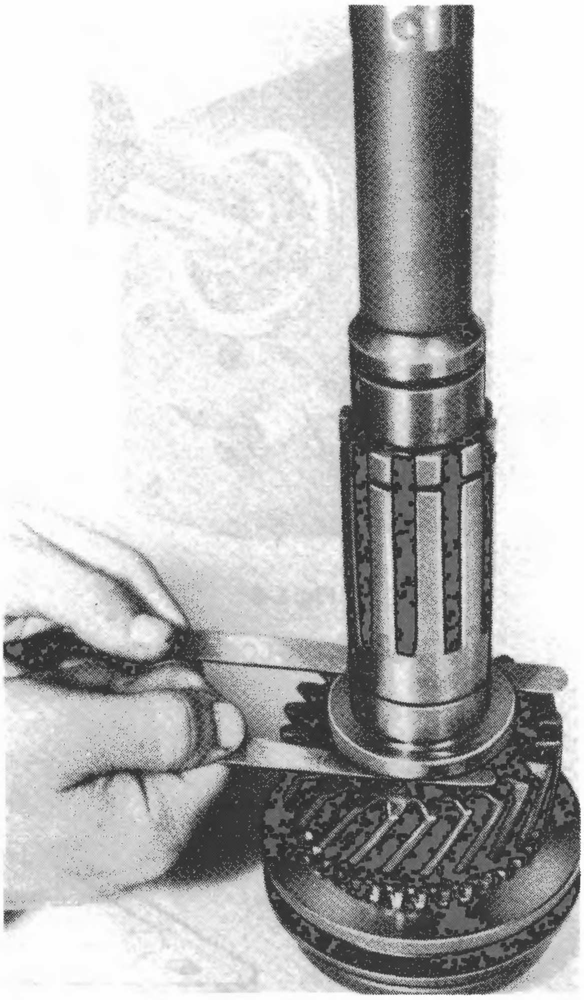


Fig. L-12

CHECKING THE SECOND GEAR END FLOAT

NOTE: Should the end float of one or both gears fall outside the above limits, the following dimensions must be checked after dismantling, in order to determine which component must be replaced to bring the end float within specifications.

23 Remove the synchroniser snap ring from the front of the mainshaft and slide off the second and third speed synchroniser assembly and the second gear with its baulk ring. Fig. L-14.

24 Remove the mainshaft rear bearing snap ring and spacer from the mainshaft. Remove the rear bearing using a universal type puller.

25 Remove the first speed synchroniser and reverse gear assembly snap ring from the mainshaft. Remove the synchroniser gear assembly and first gear baulk ring from the mainshaft. Fig. L-15.

26 LAYGEAR
Remove dummy layshaft, thrust washers, needle rollers, washers and spacer tube from laygear.

COMPONENT	SIZE
Second Speed Gear Width	42.484 to 42.408 mm (1.712 to 1.709 in)
Second and Third Gear Inner Synchroniser Hub Width	22.580 to 22.379 mm (0.889 to 0.885 in)
First Speed Gear Width	44.526 to 44.450 mm (1.753 to 1.750 in)
First Speed Gear Inner Synchroniser Hub Width	36.296 to 36.398 mm (1.429 to 1.433 in)

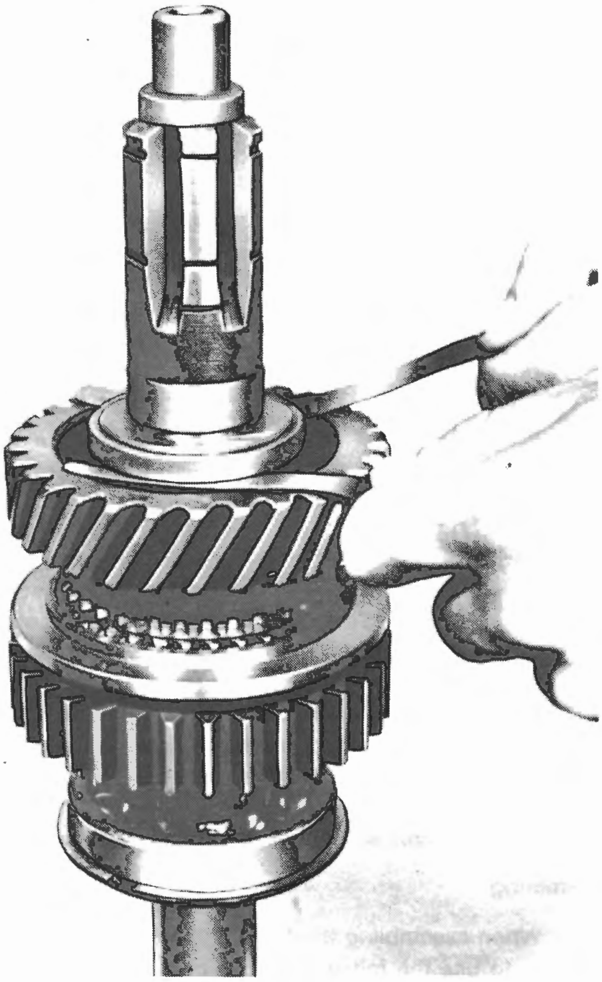


Fig. L-13

CHECKING THE FIRST GEAR END FLOAT

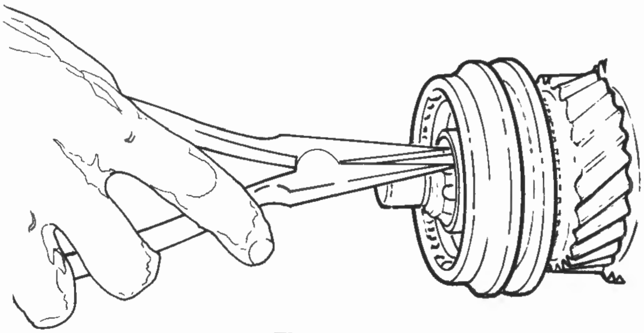


Fig. L-14

REMOVING THE SECOND AND THIRD SPEED SYNCHRONISER SNAP RING

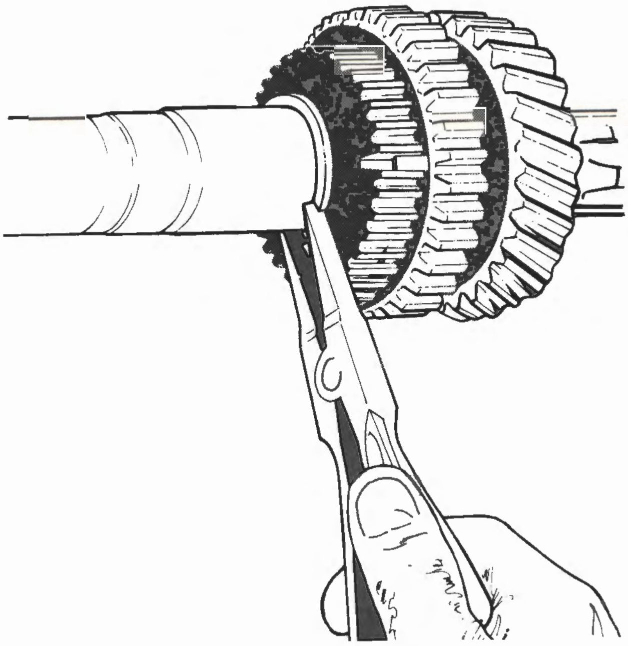


Fig. L-15

REMOVING THE FIRST SPEED SYNCHRONISER AND REVERSE GEAR SNAP RING

27 INPUT GEAR

(a) Remove needle rollers from bore of input gear. Fig. L-16.

(b) Remove circlip and spacer from input shaft. Fig. L-17.

(c) Remove input shaft seal from the front bearing retainer.

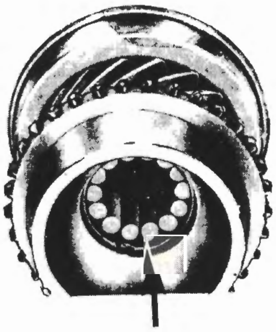


Fig. L-16

INPUT GEAR NEEDLE ROLLERS IN POSITION

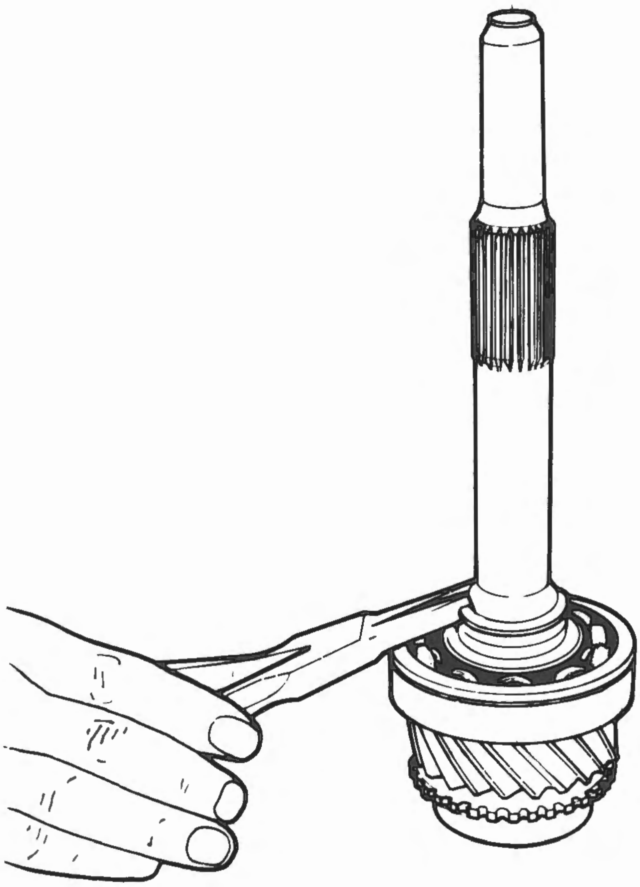


Fig. L-17

REMOVING THE INPUT SHAFT CIRCLIP AND SPACER

28 SYNCHRONISER ASSEMBLIES

To dismantle synchroniser units, push inner hub from outer sleeve using thumb pressure.

CLEANING AND INSPECTION

(a) Clean all parts including the transmission case in a suitable solvent and blow dry with compressed air.

(b) Immerse ball and roller bearings in clean solvent and rotate by hand until clean.

(c) Lubricate the bearings with light oil and rotate to test for roughness, looseness or wear.

(d) Check all bearings for fit on their respective shaft and in their respective bores.

(e) Inspect needle roller bearings used in the laygear and input shaft gear and their bearing surface for scoring or wear.

(f) Inspect the mainshaft splines, bearing surfaces and grooves for wear and scoring and remove light scores and burrs by honing.

(g) Inspect all gears and synchronisers for wear, pitting and scoring. Check synchroniser springs for distortion and loss of tension.

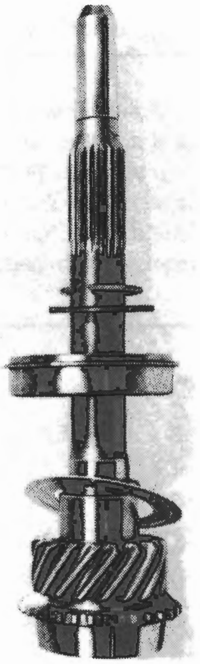


Fig. L-18

THE INPUT SHAFT ASSEMBLY COMPONENTS

(h) Carefully inspect the transmission case and extension housing for cracks and casting faults. All mating and gasket surfaces should be smooth and free from scores and scratches.

(i) Check both selector forks for wear and distortion. Inspect selector cams and shafts for wear and detent balls for brinelling. Examine the interlock sleeve and pin for free movement and check the spring tensions.

Assembling

NOTE: When assembling the transmission it is necessary to use the following lubricants:
Oil — SAE 30 Engine Oil.
Grease — Lithium Base Multi-purpose automotive grease.

1 SYNCHRONISERS

Lubricate the first speed synchroniser sleeve and reverse gear and fit to the inner hub with the teeth of the gear and the synchroniser spring groove of the inner hub located at the same end.

NOTE: Bracketed numerals in assembly operations refer to components illustrated in Figs. 1 and 7.

2 Install the synchroniser spring into the groove end of the inner hub.

3 Slide the three shift plates (22) into the hub, ensuring that the plates pass over springs. Fit synchroniser spring into recessed end of inner hub so that it forces the three shift plates outwards against the outer sleeve.

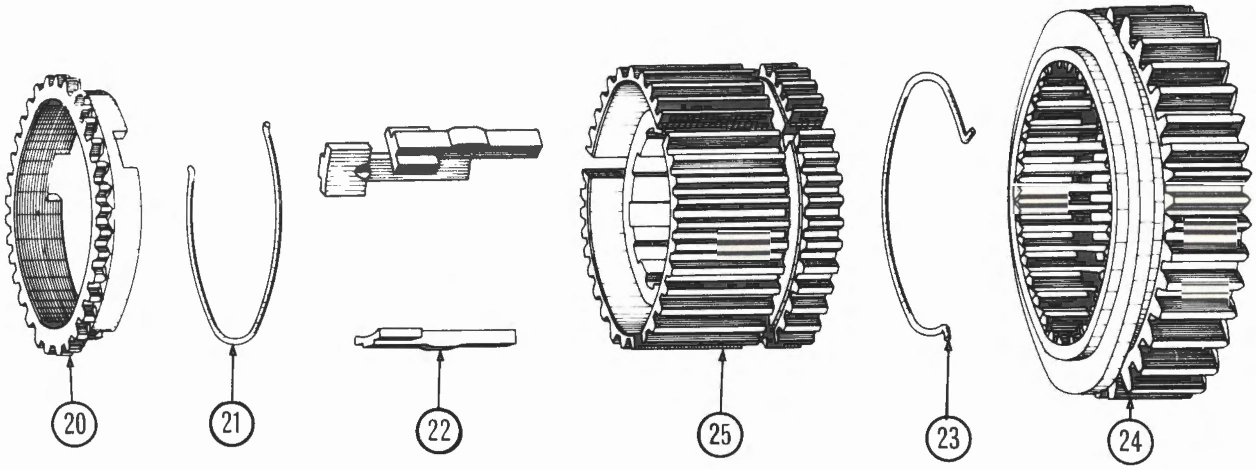


Fig. L-19

FIRST SPEED SYNCHRONISER AND REVERSE GEAR COMPONENTS

Fig. L-1 LEGEND REFERS

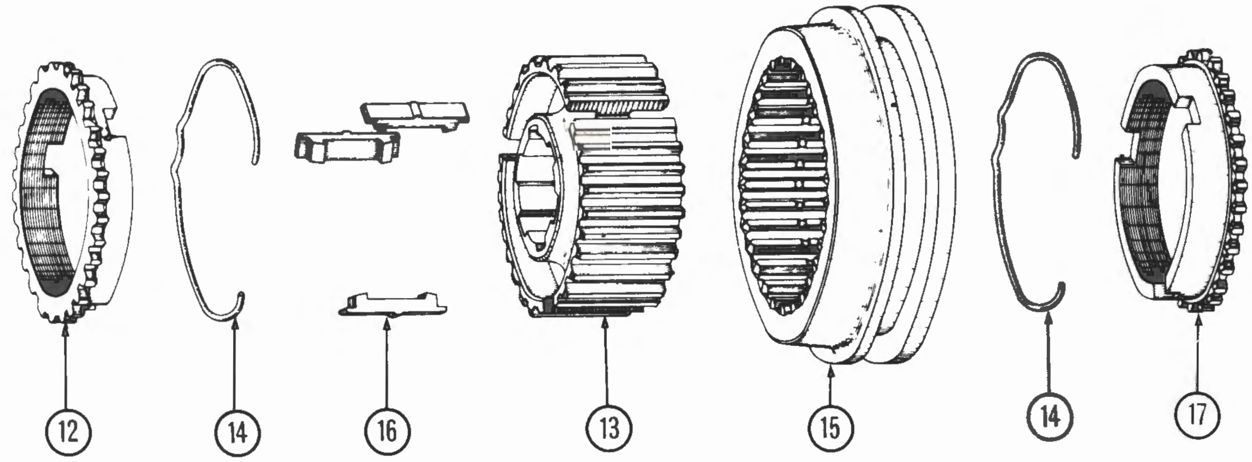


Fig. L-20

SECOND AND THIRD SPEED SYNCHRONISER ASSEMBLY

Fig. L-1 LEGEND REFERS

NOTE: The synchroniser springs are not identical. Figs. 19 and 20. The spring tangs should be located on opposite sides of the same shift plate, so that the openings do not line up.

4 Assembly of the second and third speed synchroniser is carried out in the following sequence. Lubricate and fit the synchroniser sleeve (15) to the inner hub (13) with the selector groove and hub inner spline protrusion at opposite ends.

5 Slide the sleeve across the hub until the three shift plates (16) can be fitted into the slots in the inner hub.

6 Fit the two synchroniser springs behind the shift plates forcing them outwards against the outer sleeve on opposite sides so that the spring openings do not line up.

NOTE: Ensure that springs and plates are correctly located.

7 Lubricate first speed gear bore and install (19) together with the baulk ring (20) to the mainshaft (56).

NOTE: The first speed baulk ring slots are 16.037 to 16.291 mm (0.631 to 0.641 in) wide compared with the second speed baulk rings slots of 9.042 to 9.143 mm (0.356 to 0.360 in) wide.

8 Install the first speed and reverse gear assembly and snap ring (26) to the mainshaft with the reverse sleeve gear teeth towards the rear of the mainshaft.

NOTE: At this point it is necessary to recheck first gear end float as described in the dismantling procedure. Fig. L-13.

9 Install the mainshaft bearing (31) (8 cylinder transmission uses heavy duty bearing) spacer (32) and snap ring (33). Select a snap ring to ensure that the end float within the limits of 0.000 to 0.1016 mm (0.000 to 0.004 in). Do not install snap ring (30) to the outside diameter of the mainshaft bearing.

10 Lubricate the second speed gear bore (18) and install it with baulk ring (17) to the mainshaft so that the back face of the gear is against the front face of the mainshaft shoulder.

11 Lubricate and install the second and third speed synchroniser assembly on the mainshaft with the inner hub spline protrusion to the front of the shaft. Install snap ring.

NOTE: At this point it is necessary to recheck second gear end float as described in the dismantling procedure.

12 Move the second and third speed synchroniser sleeve to engage second gear and the first and reverse synchroniser sleeve to engage reverse gear. The mainshaft assembly is now ready for installation in the transmission case.

13 INPUT SHAFT
Install oil slinger (60) and press on input shaft bearing. Fit spacer (44) to the input shaft. Select a snap ring (45) to keep end float to the prescribed figure 0.000 to 0.1016 mm (0.000 to 0.004 in) and assemble to the bearing. Apply a liberal coating of grease to inside of input gear and install the needle roller bearings.

14 LAYGEAR
Apply a liberal coating of grease to the internal bearing surfaces of the laygear, insert dummy layshaft and spacer tube. Install a set of 22 needle rollers and washers at the front of the laygear (large gear end).

15 Install two sets of needle rollers (42) at the rear end of the laygear. Each set is separated by a thrust washer (37) and install washer at outer end.

16 Install two thrust washers (25-36) at the rear of the laygear (small gear end) and one thrust washer (43) at the front end. A liberal coating of grease will retain the washers during installation in the transmission case.

17 GEARSHIFT SELECTOR CAMS ASSEMBLY
Grease one interlock ball (70) to hold it in the rear of the interlock sleeve (63) and install the sleeve into the transmission case.

18 Lubricate the first and reverse gear camshaft and install the camshaft assembly into the transmission case, pushing the cam against the inside of case while holding in neutral position. This ensures that the interlock sleeve ball is in the extended notch of the cam. Fit a new 'O' ring seal to the shaft from the outside of the transmission case.

19 Lubricate the second and third gear camshaft and install the camshaft assembly pushing the cam against the inside of the transmission case ensuring that the interlock sleeve hole is not blocked.
Fit a new 'O' ring seal to the shaft from the outside.

20 Install the interlock pin (65), spring (64) and second interlock sleeve ball (62). Move the cam and shaft assembly into third gear position, so that the extended detent notch of the cam retains the ball and spring.

INSTALLATION OF ASSEMBLIES INTO TRANSMISSION CASE

1 Place the laygear with thrust washers attached into bottom of transmission case, ensuring that the tabs of the thrust washers are located in the grooves in the ends of transmission case.

2 Lubricate and install the reverse idler gear (48) assembly and shaft (46). Heavy duty transmission needle roller bearings. Use grease to retain the needle rollers and thrust washers.

NOTE: The longer boss of the gear must be toward the front of the transmission case.
The shaft must be installed with the lock plate slot flush with the outside face of transmission case and towards the layshaft orifice.

3 Insert the mainshaft assembly through the top of the transmission case with the splined end passing through the rear bearing bore; but do not press the mainshaft bearing into the case.

4 Push the gearshift camshafts against the side of the transmission case, ensuring that the two cams are still in the neutral and third gear positions. Tilt the mainshaft assembly away from the camshafts.

5 Place the second and third gearshift fork, branded 'T' upwards, onto second and third speed synchroniser outer sleeve. Move fork down and engage in camshaft assembly. Push the camshaft assembly into its operating position and install the taper pin after coating with sealer.

6 Place the first and reverse gearshift fork (flat side of fork to rear) on the first and reverse synchroniser sleeve. Move fork down and engage into camshaft assembly. Push the camshaft assembly into operating position and install the taper pin after coating it with sealer.

7 Tap the mainshaft assembly rearwards, fitting the bearing into the rear of the transmission case until the snap ring groove is visible, then install snap ring.

8 Place the third gear baulk ring onto the hub of the third gear synchroniser and enter the input shaft through the front of the transmission case. At the same time line up the front of mainshaft to ensure that it enters the needle roller bearings located in the hub of the input gear.

9 Press the oil seal into the input shaft bearing retainer and coat the outside of seal with sealer.

10 Position the bearing retainer gasket (7) with a light coating of grease and install the bearing retainer with three self locking bolts after coating the threads with sealer. Tighten to the specified torque 28.2 Nm-33.975 Nm (20-25 lb.f.ft.).

NOTE: Take care not to damage the seal when replacing over input shaft splines.

11 Engage the laygear into mesh by carefully turning the transmission case upside down and allowing the laygear to drop into place. It may be necessary to turn the mainshaft and input shaft to ensure that the gears mesh.

12 Using the layshaft (40) drive out the dummy shaft from the rear of the transmission case until the locking plate slot in the layshaft is flush with the outside rear face of the case. The slots in both layshaft and reverse idler shaft must be parallel and adjacent.

13 Install the locking plate (51) to the layshaft and reverse idler shaft tapping both shafts to bring the plate firmly against the case. Fig. L-7A.

14 Fit the speedometer gear retaining ball (53) to the mainshaft and slide on the speedometer gear (54). Install the speedometer drive gear snap ring (55).

15 Check the fit of the propeller shaft sliding yoke in the extension bush. If excessive clearance exists, renew the bush using tool No. 18GA068. Fit a new oil seal using tool No. 18GA047.

16 Carefully fit the extension housing to avoid damage to the bush and oil seal on the end of the mainshaft splines.

17 Retain the extension housing gasket (34) with a light coating of grease and refit the extension housing with six bolts (49) and lock washers, tightening the bolts to the specified torque, 60.97 Nm-74.52 Nm (45-55 lb.f.ft.).

18 Replace reverse light switch.

19 Refit both gearshift levers (69-71) using the plain and shakeproof washers and nuts tightening to the specified torque 27.1 Nm-33.87 Nm (20-25 lb.f.ft.), and check operation of gear selection.

20 Position the gearbox top cover (11) and gasket (29), install and tighten the six bolts and lock washers (28) to the specified torque 10.8 Nm-16.26 Nm (8-12 lb.f.ft.).

21 Replace transmission in the vehicle and fill with the specified lubricant to the correct level.

FOUR SPEED TRANSMISSION

Description

The transmission provides four forward speeds with sychronisers on all gears which are in constant mesh with the laygears, thus eliminating a sliding action to secure engagement. The reverse gear is of the sliding spur type.

The input shaft and gear is carried on a ball bearing located in the front of the transmission case. The mainshaft is supported at the front by roller bearings located in the input shaft bore and in the centre by a ball bearing located in the rear of the transmission case. The rear of the main shaft is supported by the propeller shaft sliding yoke running in a bush located in the rear of the extension housing.

The laygear runs on four rows of roller bearings, supported by the layshaft. The reverse idler gear is bushed and runs on the reverse idler shaft. First gear is bushed and runs on the mainshaft, while the second and third gears run directly on the mainshaft.

The gear lever is mounted on the side of the rear extension housing and is connected to the single selector rail by means of a short shaft and a roll pin. The first-second and third-fourth speed selector forks slide on the single selector rail and are actuated by a pin pressed into the rail which is moved longitudinally and rotated by the gearshift lever.

The interlock mechanism consists of a slotted spool which slides on the selector rail and prevents simultaneous engagement of two gears.

This is achieved by rotational movement of the spool which has projections to engage the selectors not being shifted.

REAR EXTENSION HOUSING

Removing

1 Follow procedures 1 to 10 and 13-14-15 used for removing rear extension housing from three speed transmission.

2 Remove the roll pin connecting the selector rail to the gearshift lever rod.

3 Remove the six bolts securing the rear extension housing to the transmission case and remove extension housing taking care not to damage the selector rod oil seal.

Refitting

1 Refitting is the reverse of the procedures 1 to 3 of removing procedure noting the following points:

   (a) Tighten all bolts to their specified torque.

   (b) Refill transmission to correct level with the specified lubricant.

THE FOUR SPEED SYNCHROMESH TRANSMISSION

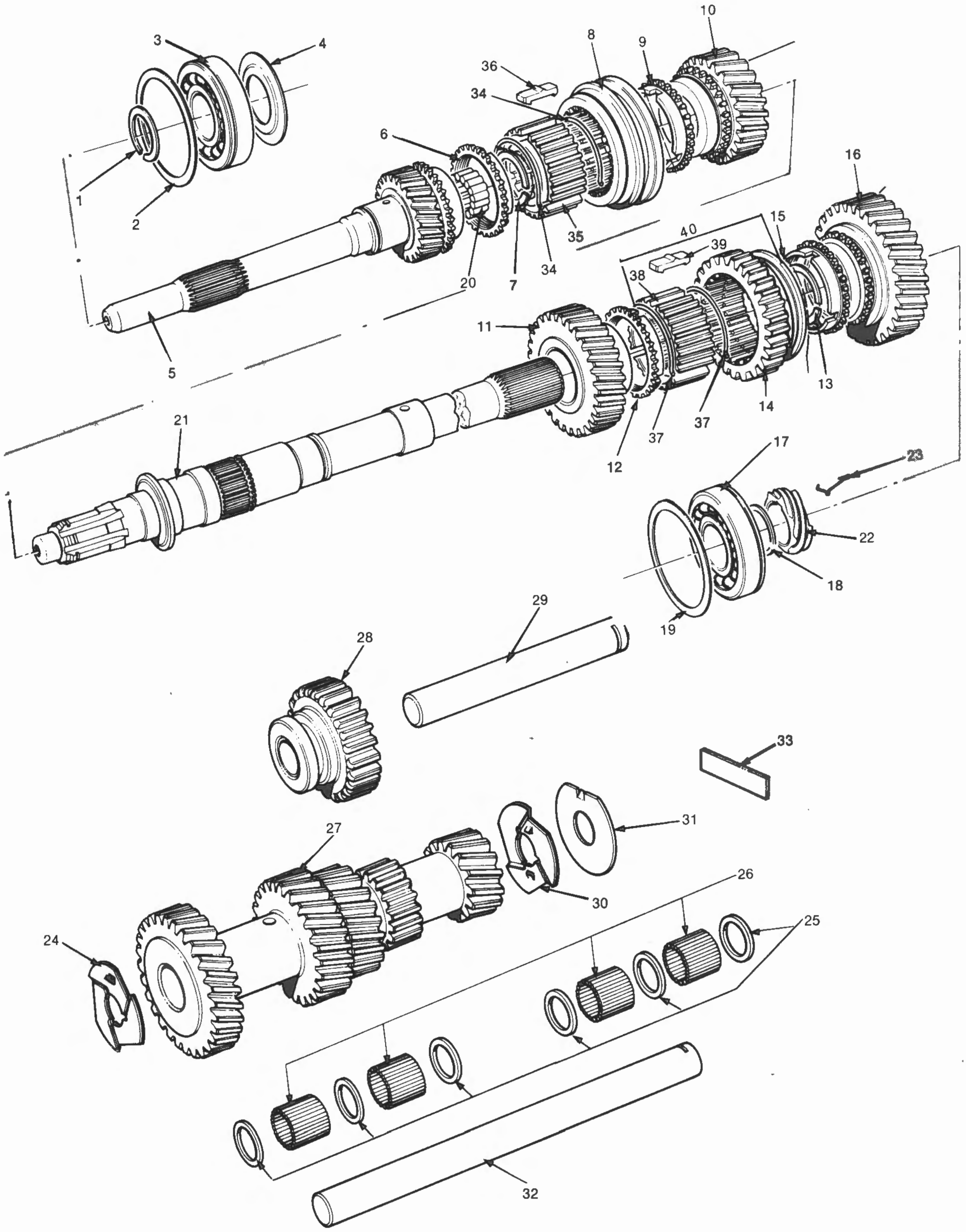


Fig. L-21

LAYOUT OF THE FOUR SPEED TRANSMISSION COMPONENTS

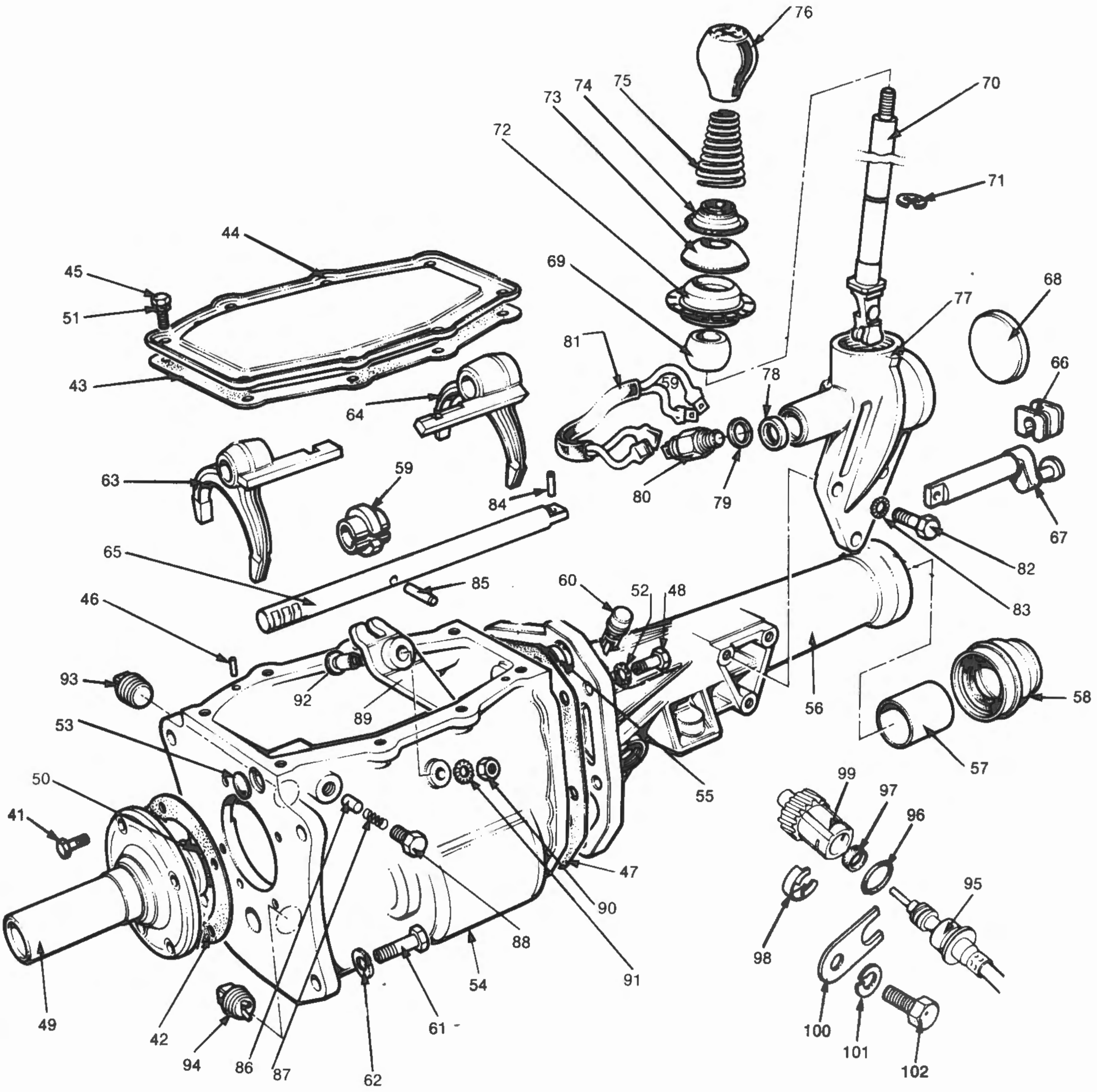


Fig. L-21

LAYOUT OF THE FOUR SPEED TRANSMISSION COMPONENTS

1 SNAP RING
2 BEARING O.D. SNAP RING
3 INPUT SHAFT BEARING
4 OIL SLINGER
5 INPUT SHAFT
6 FOURTH SPEED SYNCHRONISER BAULK RING
7 SNAP RING
8 THIRD AND FOURTH SPEED SYNCHRONISER SLEEVE
9 THIRD SPEED SYNCHRONISER BAULK RING
10 THIRD SPEED GEAR
11 SECOND SPEED GEAR
12 SECOND SPEED SYNCHRONISER BAULK RING
13 SNAP RING
14 REVERSE SPEED GEAR
15 FIRST SPEED SYNCHRONISER BAULK RING
16 FIRST SPEED GEAR
17 MAINSHAFT BEARING
18 SNAP RING SELECTIVE
19 MAINSHAFT BEARING O.D. SNAP RING
20 INPUT SHAFT NEEDLE ROLLERS
21 MAINSHAFT
22 SPEEDOMETER DRIVE GEAR
23 SPEEDOMETER GEAR RETAINING CLIP
24 THRUST WASHER FRONT
25 NEEDLE ROLLER THRUST WASHERS
26 LAYGEAR NEEDLE ROLLERS
27 LAYGEAR

KEY TO FIG. L-21 AND FIG. L-22

28	REVERSE IDLER GEAR AND BRONZE BUSH
29	REVERSE IDLER GEAR SHAFT
30	THRUST WASHER REAR INNER
31	THRUST WASHER REAR OUTER
32	LAYSHAFT
33	LOCKING PLATE
34	SYNCHRONISER SPRINGS
35	THIRD AND FOURTH SPEED SYNCHRONISER INNER HUB
36	THIRD AND FOURTH SPEED SHIFT PLATES
37	SYNCHRONISER SPRINGS
38	FIRST AND SECOND SPEED SYNCHRONISER INNER HUB
39	FIRST AND SECOND SPEED SHIFT PLATES
40	FIRST AND SECOND SYNCHRONISER ASSEMBLY
41	BEARING RETAINER SCREW
42	BEARING RETAINER GASKET
43	COVER GASKET
44	TOP COVER
45	COVER BOLT
46	DOWEL PIN
47	EXTENSION HOUSING GASKET
48	EXTENSION HOUSING SCREW
49	INPUT SHAFT BEARING RETAINER
50	BEARING RETAINER OIL SEAL
51	COVER BOLT WASHER
52	EXTENSION HOUSING SCREW WASHER
53	WELSH PLUG
54	GEAR CASE
55	SELECTOR RAIL OIL SEAL
56	EXTENSION HOUSING
57	EXTENSION HOUSING BUSH
58	EXTENSION HOUSING OIL SEAL
59	GEARSHIFT INTERLOCK SPOOL
60	BREATHER
61	GEARBOX HOUSING SCREW
62	GEARBOX HOUSING SCREW WASHER
63	THIRD AND FOURTH SPEED SHIFT FORK
64	FIRST AND SECOND SPEED SHIFT FORK
65	GEARSHIFT SELECTOR RAIL
66	SELECTOR BLOCK
67	GEARSHIFT LEVER TO SELECTOR OR RAIL LINK
68	CUP PLUG
69	GEARSHIFT LEVER BALL PIVOT
70	GEARSHIFT LEVER
71	CIRCLIP
72	GEARSHIFT LEVER BALL SEAT
73	BALL SEAT THRUST WASHER
74	GEARSHIFT LEVER SPRING SEAT
75	GEARSHIFT LEVER SPRING
76	GEARSHIFT LEVER KNOB
77	GEARSHIFT LEVER HOUSING
78	REVERSE LIGHT SWITCH OIL SEAL
79	REVERSE LIGHT SWITCH WASHER
80	REVERSE LIGHT SWITCH
81	REVERSE LIGHT SWITCH WIRE
82	GEARSHIFT HOUSING SCREW
83	GEARSHIFT HOUSING SCREW WASHER
84	ROLL PIN
85	SELECTOR RAIL PIN
86	DETENT PLUNGER
87	DETENT SPRING
88	DETENT SCREW
89	REVERSE GEARSHIFT LEVER
90	ECCENTRIC PIN LOCKNUT
91	ECCENTRIC PIN LOCKNUT WASHER
92	ECCENTRIC PIN
93	FILLER PLUG
94	DRAIN PLUG
95	SPEEDOMETER CABLE
96	SPEEDOMETER CABLE 'O' RING OIL SEAL
97	SPEEDOMETER INNER CABLE OIL SEAL
98	SPEEDOMETER GEAR RETAINER CLIP
99	SPEEDOMETER CABLE DRIVEN GEAR
100	SPEEDOMETER CABLE RETAINING PLATE
101	WASHER
102	SPEEDOMETER CABLE RETAINING SCREW

OIL SEAL

Removing

1. Remove the propeller shaft.
2. Prise the seal from the extension housing using a suitable lever.

Refitting

1. Using tool No. 18GA047/2 replace the oil seal. Lightly grease the oil seal lip to prevent burning during the initial running period. Fig. L-2 typical.
2. Carefully inspect the seal bearing surface on the sliding yoke for scores and grooves. Renew if necessary. Replace propeller-shaft.

BUSH

Removing

1. Remove propeller shaft.
2. Remove rear extension housing.
3. Extract the rear extension housing oil seal.
4. Using tool No. 18GA068 drive the extension housing bush into the housing where it can be removed. Fig. L-3 refers.

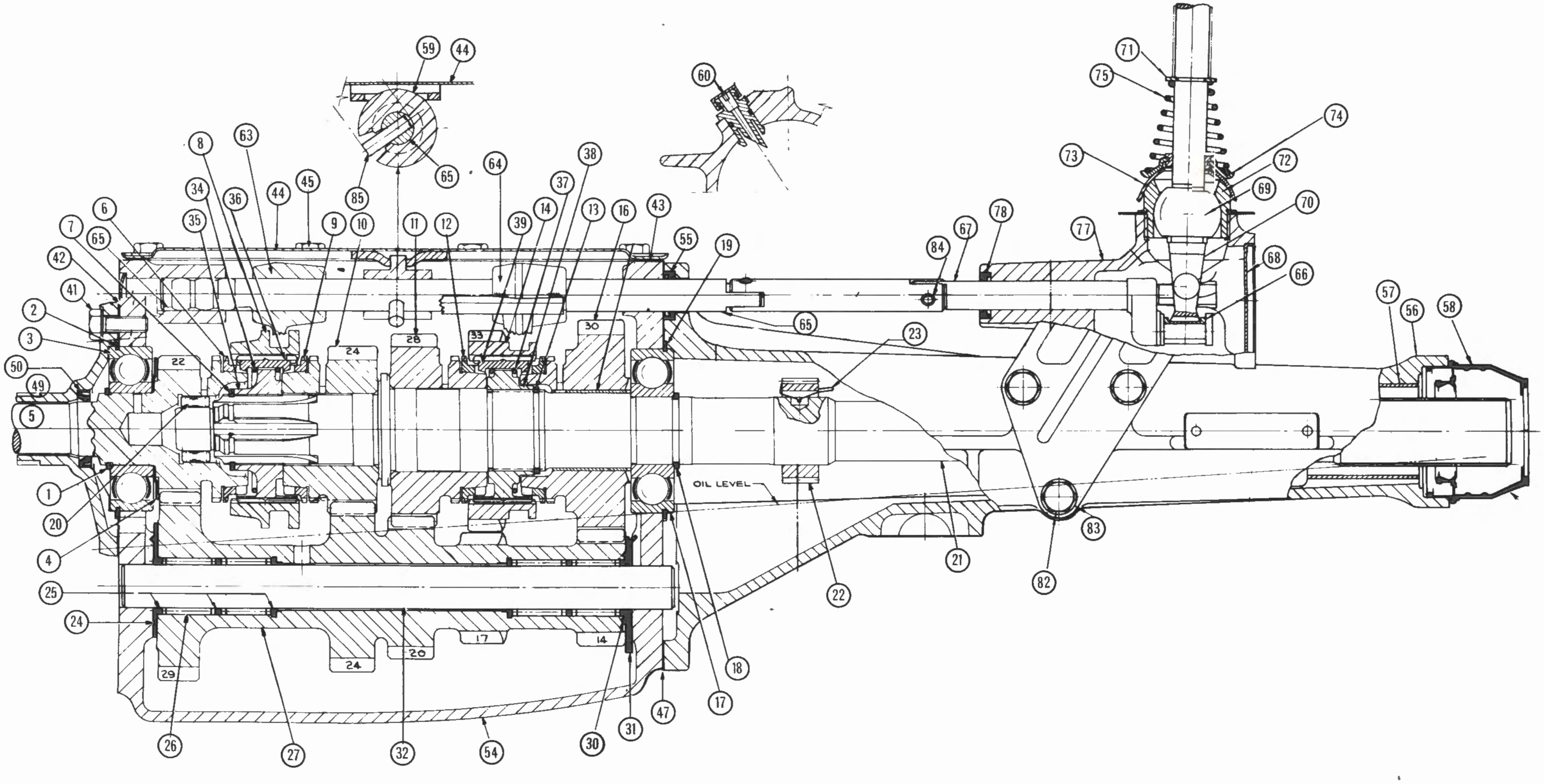


Fig. L-22

SECTION THROUGH THE TRANSMISSION ASSEMBLY

Fig. L-21 LEGEND REFERS

Refitting

1 Using tool No. 18GA068 drive the new bush into the extension housing from the rear.

2 Using tool No. 18GA047 drive the oil seal into the extension housing.

3 Refit the extension housing and ensure that the selector rod oil seal and washer are correctly located.

4 Refit the propeller shaft.

OVERHAULING

Removing

1 Drain lubricating oil and remove transmission from vehicle.

2 Thoroughly clean exterior of transmission and mount in a suitable stand.

Dismantling

1 Remove roll pin from selector rail and gearshift lever rod. Remove the six bolts securing the rear extension housing to the transmission case and remove extension housing.

2 Remove oil seal and washer from selector rail and extension housing gasket from the transmission case.

3 Remove the four bolts securing the front bearing retainer and remove the retainer and gasket.

4 Remove the eight bolts retaining the transmission case cover — remove cover and discard the gasket.

5 Using a soft drift, drive the layshaft and reverse idler shaft slightly to the rear of the transmission to allow the lock plate to be removed.

6 Using a dummy layshaft tool No. 18GA074 to drive the layshaft out the rear of the transmission case. The dummy layshaft is left in the laygear to retain the needle roller bearings. Lower laygear into bottom of case.

7 Remove selector rail detent screw. Fig. L-21. Turn the transmission on its side and allow the detent spring and plunger to fall out.

8 Rotate the selector rail and move it rearwards sufficiently to clear the operating pin from the interlock spool.

9 Using tool No. 18GA049 remove the operating pin by the following method. Fig. L-23.

(a) The long end of the adaptor pin supplied with this tool should be fitted against the end of the operating pin that is flush with the selector rail.

(b) Turn the handle of the tool in a clockwise direction to press the operating pin out of the selector rail and through the bottom of the tool.

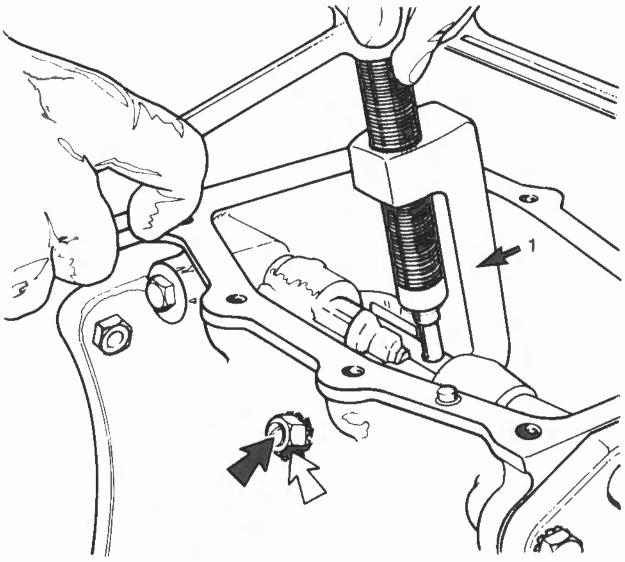


Fig. L-23

REMOVING SHIFT RAIL PIN

1 REMOVER/REPLACER 18GA049

(c) Ensure that the operating pin is not pressed against any of the gears.

NOTE: Do not press on the end of the operating pin protruding from the selector rail.

CAUTION: Do not attempt to drive the operating pin out of the selector rail using a hammer and punch as the selector rail may be bent by this method.

10 Remove the selector rail from the rear of the transmission case withdrawing it through the selector forks and interlock spool.

11 Remove the selector forks and interlock spool.

12 Invert the transmission case onto the top face and withdraw the input shaft using tool No. 18GA048. Inverting the transmission prevents the roller bearings located in the input shaft bore from falling into transmission and interfere with the checking of laygear end float.

13 Using a soft drift, drive the mainshaft slightly rearwards and remove the mainshaft rear bearing outer snap ring.

14 Move the third and fourth speed synchroniser sleeve rearwards to engage third gear.

15 Push the mainshaft assembly forward so that the mainshaft bearing is moved out of its bore in the transmission case.

16 Remove the mainshaft assembly through the top of the transmission case.

17 Remove the locknut retaining the reverse lever eccentric pin and remove pin, Fig. L-23, then lift the reverse lever from the transmission case.

18 Drive out the reverse idler shaft and remove the reverse idler gear.

19 Insert layshaft and check end float which should be 0.10 to 0.46 mm (0.004 to 0.018 in). Select new washers for assembly if necessary. Drive out layshaft with dummy shaft and lift the laygear with thrust washers from transmission (with dummy shaft installed) noting location of thrust washers.

20 Should it be necessary to dismantle the subassemblies the following procedure should be adopted.

21 MAINSHAFT
Before commencing to dismantle the mainshaft assembly, the first speed, second speed and third speed gear end floats should be checked with the aid of feeler gauges inserted between the shoulder of the mainshaft or bearing and the respective gear as shown in Figs. L-24-25-26.

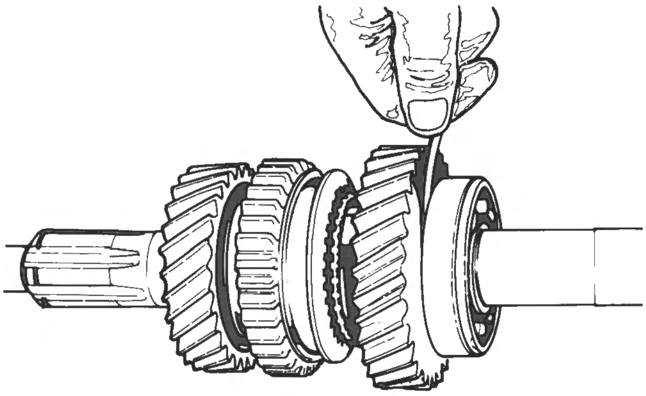


Fig. L-24

CHECKING FIRST GEAR END FLOAT

22 The end float for each gear is as shown:

(a) Third Speed Gear 0.13 to 0.51 mm (0.005 to 0.020 in).

(b) Second Speed Gear 0.15 to 0.43 mm (0.006 to 0.017 in).

(c) First Speed Gear 0.051 to 0.69 mm (0.002 to 0.027 in).

NOTE: Should the end float of any gear fall outside the limits specified, the following dimensions must be checked after dismantling in order to determine which component has to be replaced to bring the end float within specifications.

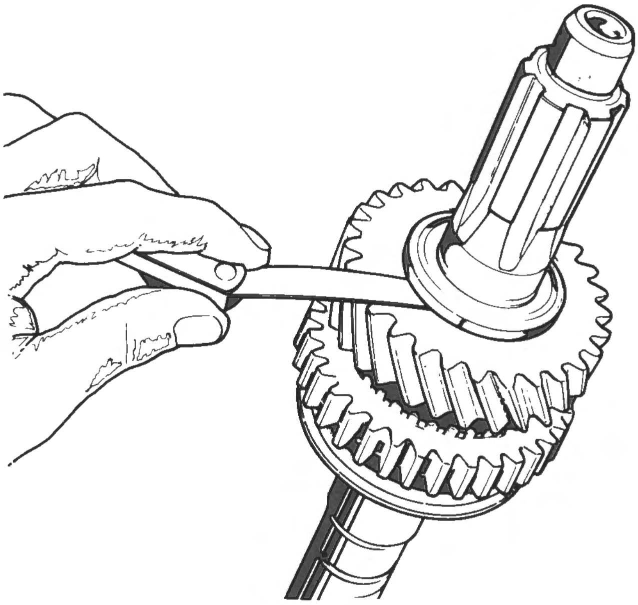


Fig. L-25

CHECKING SECOND GEAR END FLOAT

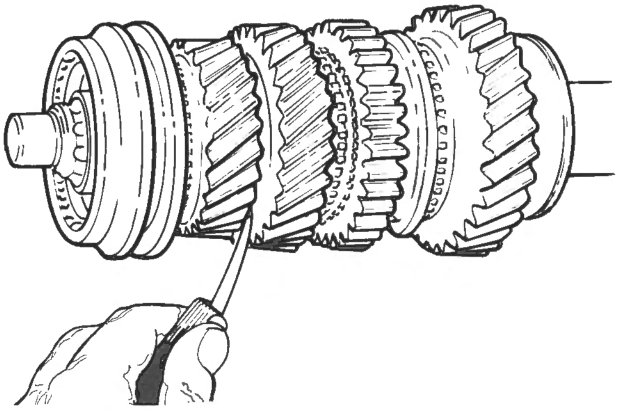


Fig. L-26

CHECKING THIRD GEAR END FLOAT

COMPONENT	SIZE
First Speed gear width	53.47 to 53.54 mm (2.105 to 2.108 in)
Synchroniser Hub first and second width to first speed thrust face	15.316 to 15.417 mm (0.603 to 0.607 in)
From second gear thrust face to snap ring thrust face	22.479 to 22.58 mm (0.885 to 0.889 in)
Second speed gear width	46.634 to 46.710 mm (1.836 to 1.839 in)
Third speed gear width	46.355 to 46.710 mm (1.825 to 1.828 in)
Third and fourth synchroniser hub width	22.479 to 22.58 mm (0.885 to 0.889 in)

23 Press down on the rear of the speedometer drive gear retaining clip and withdraw the drive gear over the clip then remove the clip.

24 Remove snap ring from front of mainshaft. Fig. L-27.

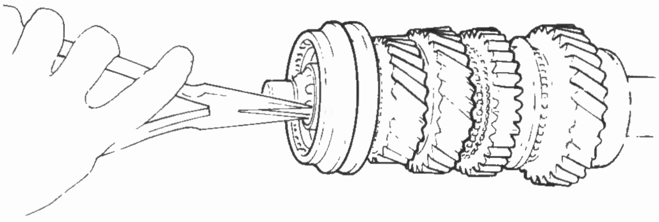


Fig. L-27

REMOVING MAINSHAFT FRONT SNAP RING

25 Remove third and fourth synchroniser assembly from mainshaft.

26 Remove third speed baulk ring and third speed gear from mainshaft.

27 Remove the rear bearing snap ring. Fig. L-28.

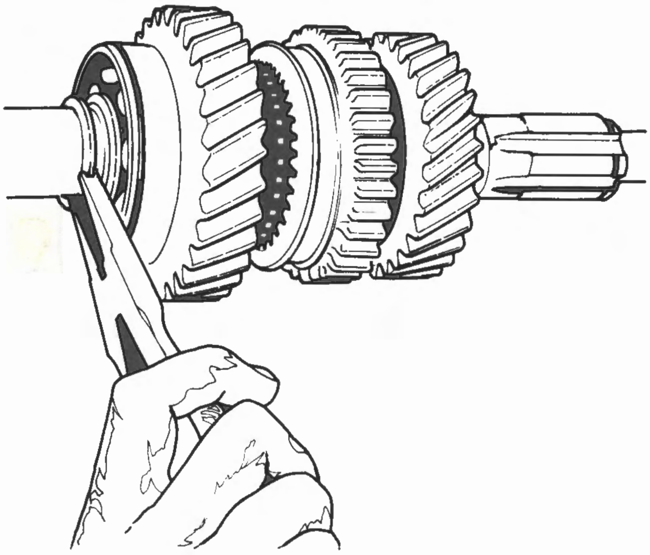


Fig. L-28

REMOVING THE MAINSHAFT REAR BEARING SNAP RING

NOTE: It is necessary to use a universal type puller to remove the rear bearing from the mainshaft.

28 Place the taper jaws of the puller between the first gear and the bearing. Press on the end of mainshaft to remove the rear bearing. Remove first speed gear.

CAUTION: Do not press on the front face of the second speed gear at this stage as damage will result. A snap ring out of sight when the mainshaft is assembled holds the second speed gear and the first and second synchroniser in place on the mainshaft.

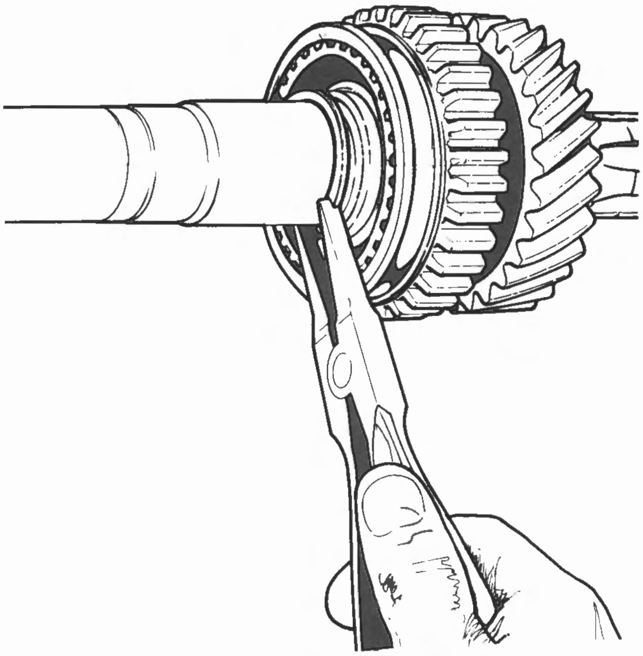


Fig. L-29

REMOVING FIRST AND SECOND SPEED SYNCHRONISER SNAP RING

29 Remove the first and second synchroniser hub snap ring from the mainshaft. Fig. L-29.

30 Remove the first and second synchroniser inner hub and sliding gear, the second speed gear and baulk ring.

31 Slide the third and fourth synchroniser sleeve from the synchroniser hub and remove springs and shift plates.

32 Slide first and second speed synchroniser sleeve from synchroniser hub, remove springs and shift plates.

33 LAYGEAR
Remove dummy shaft, needle rollers and the needle roller thrust washers.

NOTE: There are 54 needle rollers and three needle roller thrust washers at each end of the laygear.

34 INPUT SHAFT
Remove the 15 needle rollers from the bore of the input gear. Remove snap ring, input shaft bearing and oil slinger from input shaft. Fig. L-30.

35 GEARSHIFT HOUSING
Remove reverse light switch, nylon damping block and cup plug in rear of housing. Fig. L-21.

NOTE: The reverse thrust block should not be removed. Should it show signs of damage or excessive wear, the complete gearshift housing must be replaced.

Cleaning

Clean all parts in a suitable solvent and blow dry with compressed air.

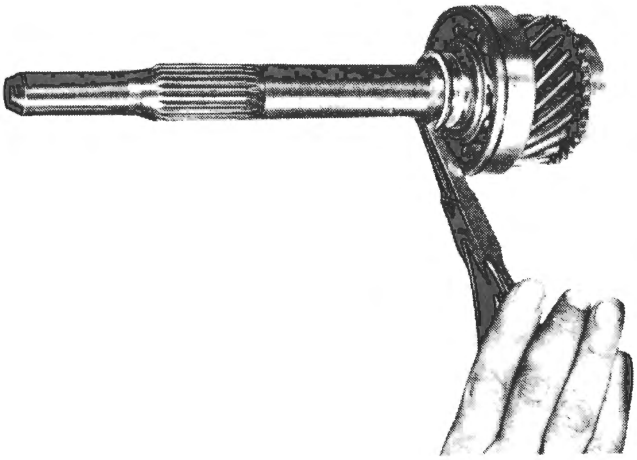


Fig. L-30

REMOVING THE INPUT SHAFT SNAP RING

CAUTION: Do not spin bearings with compressed air as they are likely to score due to absence of lubricant.

Inspecting

1. After drying bearings, lubricate with light oil. Rotate by hand and check for roughness, wear and looseness. All bearings must be checked for fit on their respective shafts and the bores.
2. Examine needle roller bearings and their bearing surfaces for excessive wear or damage. Renew worn bearings, bushes and shafts.
3. Check all thrust washers for wear and renew as necessary to obtain correct end float.
4. Examine all gear teeth for excessive wear, pitting and damage. When renewing a gear it is advisable to renew its mating gear.
5. Examine all synchromesh units for wear and test with their mating tapers on the gears. Check all synchroniser springs for tension and renew if necessary.
6. Check the splines on both input and mainshafts for wear also examine the gear and bearing mating surfaces for wear, scores and roughness.
7. Examine the transmission case and extension housing for cracks, stripped or damaged threads and mating surfaces.

Assembling

1. MAINSHAFT
   Lubricate the first and second speed synchroniser unit, the synchroniser sleeve and reverse gear, fit to the inner hub with the teeth of the gear and the inner hub spline protrusion at opposite ends. Fig. L-31.
2. Move the sleeve through the hub until the three shift plates can be fitted into the slots in the inner hub.

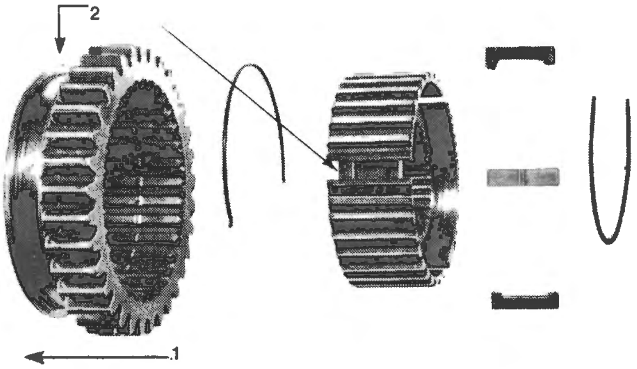


Fig. L-31

FIRST AND SECOND SPEED SYNCHRONISER ASSEMBLY

1 REAR

2 TEETH OF GEAR AND HUB BOSS AT OPPOSITE ENDS

3. Install two synchroniser springs under the shift plates behind the pads with the long lug of each spring in the same shift plate.

NOTE: The spring tangs should be located on opposite sides of the same shift plate so that the spring openings do not line up.

4. The third and fourth speed synchroniser unit is assembled in a similar manner to the first and second speed unit with the exception that the sleeve is assembled to the hub with the sleeve selector groove and inner hub spline protrusion at opposite ends. Fig. L-32.

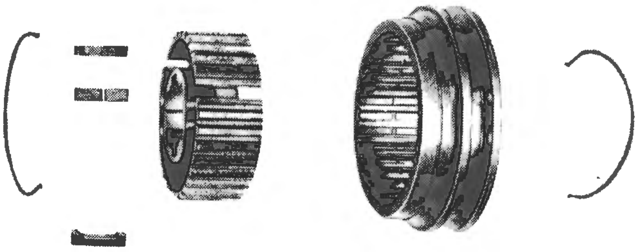


Fig. L-32

THIRD AND FOURTH SPEED SYNCHRONISER ASSEMBLY

HUB BOSS AND SELECTOR FORK GROOVE AT OPPOSITE ENDS

5. Lubricate the bore of the second speed gear and with the baulk ring fitted, assemble to the mainshaft.
6. Install the first and second speed synchroniser assembly to the mainshaft with the reverse gear sleeve teeth towards the front of the mainshaft.
7. Install first and second speed synchroniser hub snap ring to the mainshaft and check hub end float which must be within the specified 0.00 to 0.1 mm (0.000 to 0.004 in).
8. Lubricate bore of the first speed gear and with the baulk ring fitted assemble to the mainshaft.

9 Install the mainshaft bearing on the shaft and select a snap ring to keep the end float within the specifications of 0.000 to 0.10 mm (0.000 to 0.004 in). DO NOT install snap ring to the outside diameter of the mainshaft bearing.

10 The bore of the third speed gear is lubricated and the unit installed with its baulk ring on the mainshaft.

11 The third and fourth speed synchroniser assembly is lubricated and installed to the mainshaft with the inner hub spline protrusion to the front of the mainshaft. Install the snap ring on the mainshaft.

12 When all the gears have been assembled on the mainshaft, recheck their end float to ensure that the measurements are as specified.

13 Engage the third and fourth speed synchroniser with third gear and the first and second synchroniser sleeve with second gear. The main drive shaft is completely assembled with the gears correctly located for installation into the transmission case.

14 LAYGEAR (Refer Figs. L-21-22)
Assemble the laygear assembly, dummy layshaft and needle roller bearings in the following sequence. Liberally coat the bore of the laygear with soft grease and insert the dummy layshaft.

15 Insert a needle roller thrust washer into each end of the laygear bore, followed by two sets of needle rollers (27 needle rollers at each end) separating each row by a roller bearing thrust washer.

16 Place a needle roller thrust washer at each end of the dummy layshaft. Place two thrust washers at the small gear (rear) end of the laygear and one thrust washer at the large gear (front) end of laygear. Retain the thrust washers with a coating of grease.

NOTE: The two thrust washers placed at the rear of laygear consist of one bronze and one steel. The steel washer is placed against the thrust face of the transmission case, with the tang of the washer inserted in the slot in the transmission case. The bronze washers are individual front and rear and are not interchangeable. The rear bronze washer has two small tangs which fit into grooves in the laygear. The front bronze washer has one large tang which fits into a groove in the front of the transmission case.

17 INPUT SHAFT GEAR
Install oil slinger with the step in the centre of slinger contacting the bearing. Fit the bearing to the shaft, ensuring that it is seated firmly. Select a snap ring to maintain the correct end float of 0.000 to 0.10 mm (0.000 to 0.004 in). Place the fourth speed synchroniser baulk ring on the input gear.

18 Install the 15 needle roller bearings into the bore of the input gear and retain with a liberal coating of grease.

19 GEARSHIFT HOUSING
Install a new gearshift housing oil seal into the housing. Fill bottom of reverse light switch hole with grease.

20 Install the gearshift operating rod into the damper block.

21 Fit a new cup plug to the housing ensuring that bottom of plug is against the machined shoulder in the housing. Centre punch the housing flange at three equally spaced points to ensure retention of the cup plug.

22 Refit the roll pin connecting the selector rail to the gearshift lever rod.

NOTE: The gearshift lever is not fitted until the transmission is installed in the vehicle.

INSTALLING ASSEMBLIES INTO TRANSMISSION CASE

1 Place the reverse idler gear into the transmission case with the gear fork groove toward the front of case, and insert the idler gear shaft with the locking plate groove at the rear of the transmission case and in the correct location in relation to the layshaft locking plate groove.

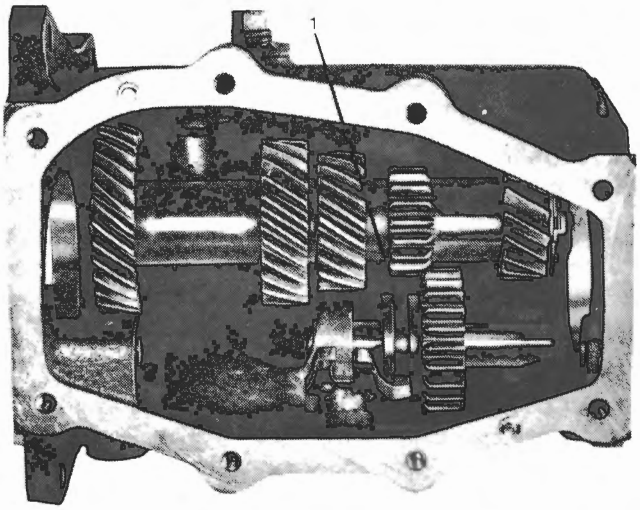


Fig. L-33

INSTALLED LAY AND REVERSE IDLER GEARS

1 REVERSE IDLER FORK GROOVE TO FRONT

2 Install the reverse gear lever assembly into position, fitting the eccentric pin through the lever and case.

3 Insert eccentric pin with centre punch mark at threaded end towards the top of the transmission case. Fit the lock washer and nut. The nut is left only finger tight at this stage.

4 Place the laygear in the bottom of the transmission case, ensuring that the tangs of the thrust washers are located in their respective grooves in the case.

5 Install the mainshaft assembly into the transmission case. The splined end (rear) is passed through the rear bearing bore from the inside of the case. Hold the assembly level and tap the front end of the mainshaft with a soft hammer until the rear bearing is in a position where the snap ring can be installed on the outside of the transmission case.

6 Install the input shaft and gear with the fourth speed baulk ring attached, into the transmission case, from the front, ensuring that the mainshaft needle rollers are not dislodged. Tap the front end of the input shaft with a soft hammer until the snap ring on the bearing is in contact with the front of the case.

7 Press a new oil seal into the front bearing retainer after coating the outside diameter of the seal with a suitable sealer.

8 Apply a light coating of grease to the bearing retainer gasket and install the retainer with four bolts, which should be tightened to 27.1 Nm to 33.8 Nm (20-25 lb.f.ft.). Coat the bolt threads with thread sealer.

9 To locate the laygear, carefully turn the transmission case upside down and allow the laygear to fall into mesh. It may be necessary to turn the input shaft slightly to allow the gears to mesh.

10 Drive out the dummy layshaft through the front of the transmission case using the layshaft. The layshaft is correctly positioned when its locking plate slot is flush with the rear face of transmission case and parallel with the idler shaft slot. Both slots must be adjacent to each other.

11 Place the locking plate into the slots of the layshaft and reverse idler shaft and tap both shafts to bring the plate firmly against the transmission case.

12 Fit the speedometer drive gear and retaining clip to the mainshaft.

13 Place both synchroniser sleeves in the neutral position and fit gearshift forks into sleeve grooves. Check that the slots in the fork arms and the slot in the reverse lever are in alignment.

14 Locate the interlock spool between the two fork bosses with the flange positioned in the fork arm slots. Insert the selector rail through the rear extension housing and transmission case taking care not to damage the oil seal. Guide the selector rail through the first and second gear selector fork, the interlock spool and third and fourth gear selector fork towards the front of transmission case until the shift pin hole is vertical and midway between the first and second gear fork and the interlock spool.

CAUTION: When the selector rail is rotated with the shift pin hole vertical, the detents at the end of the rail must face towards the top of the transmission, otherwise when the detents are rotated back to their correct position, the shift pin will not operate the gearshift forks.

15 Press the shift pin into the selector rail using the service tool No. 18GA049. The pin must be pressed through the shaft until it protrudes 26.8-26.63 mm (1.055-1.045 in).

16 Rotate the interlock spool until the slot in the spool and the shift pin are aligned.

17 Push the selector rail forward through the slot until the pin is in alignment with the interlock spool flange.

18 Rotate the pin to enable it to engage into the fork arm slot of one of the gearshift forks.

19 Place the detent pin, spring and screw into the detent hole at the side of the transmission case. Tighten retaining screw to 33.8 Nm to 40.6 Nm (25-30 lb.f.ft.) torque.

20 Should excessive wear exist in the rear extension housing bush, it should be removed and replaced with a new bush using the tool No. 18GA068 as shown in Fig. L-3. Fit a new oil seal using tool No. 18GA047.

21 Install a new selector rail oil seal and washer into front flange of rear extension housing if necessary.

22 Install the rear extension housing gasket using a light coating of grease.

23 Place the rear extension housing over the mainshaft.

CAUTION: Care must be taken to avoid damage to the extension housing bush and oil seal when replacing extension housing over the splines on end of mainshaft.

24 Insert six retaining bolts and washers, tighten to 33.8 Nm-40.6 Nm (25-30 lb.f.ft.).

25 Install gearshift housing on rear extension housing with three bolts and lock washers. Tighten bolts to 60.9 Nm-74.5 Nm (45-55 lb.f.ft.) torque. Fill the gearshift housing with wheel bearing grease.

26 Install the top cover gasket and top cover to transmission case, tighten the eight bolts and lock washers to 10.8 Nm-16.25 Nm (8-12 lb.f.ft.) torque.

27 Adjust position of reverse idler gear against location face in the transmission case in the following sequence:

(a) Selector rail to be in neutral position.

(b) Ensure that the centre punch mark on the eccentric pin is towards the top.

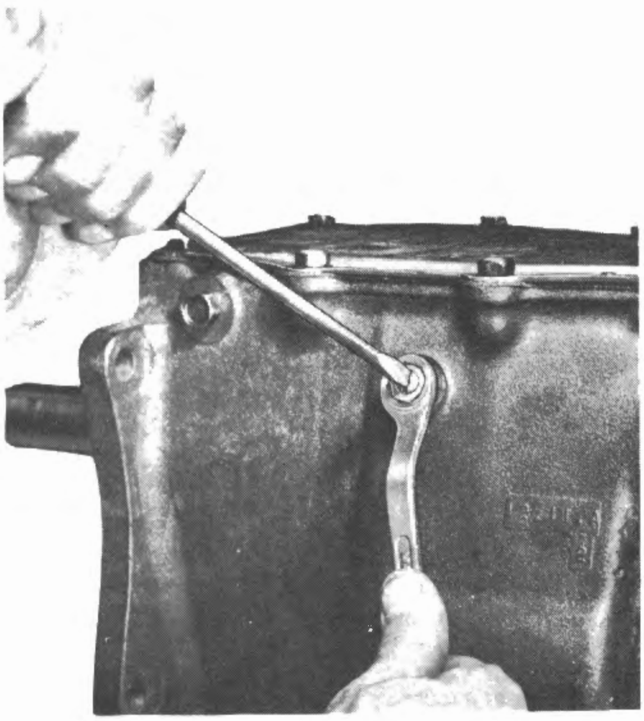


Fig. L-34

ADJUSTING LOCATION OF REVERSE IDLER GEAR

(c) Using a screwdriver turn the eccentric pin in a clockwise direction until it becomes tight. Back off sufficiently to allow the selector rail to rotate freely whilst in neutral position.

(d) Tighten locknut to 27.1 Nm-33.8 Nm (20-25 lb.f.ft.) torque.

(e) Check for free rotation of the selector rail. Readjust if necessary.

28 Refit roll pin connecting selector rail and gearshift lever rod.

NOTE: The gearshift lever is not fitted permanently until the transmission is installed in the vehicle.

29 Install the gearshift lever with pivot ball into gearshift housing and screw down the nylon ball seat, tighten to 20.32 Nm-24.35 Nm (15-18 lb.f.ft.) torque. Secure by bending locking tab against the rib.

30 Assemble the ball seat thrust washer, spring seat assembly and conical spring onto the gearshift lever. Compress the spring and fit the circlip.

31 Test the gearshift operation to ensure that all gears can be selected.

32 Install the drain and filler plugs and tighten to 27.1 Nm-33.8 Nm (20-25 lb.f.ft.).

33 Fit the breather in the rear extension housing.

34 Replace transmission in vehicle and fill with the specified lubricant to the correct level.

SECTION M

AUTOMATIC TRANSMISSION

AAF-029.

Model #

Ser No A 8520

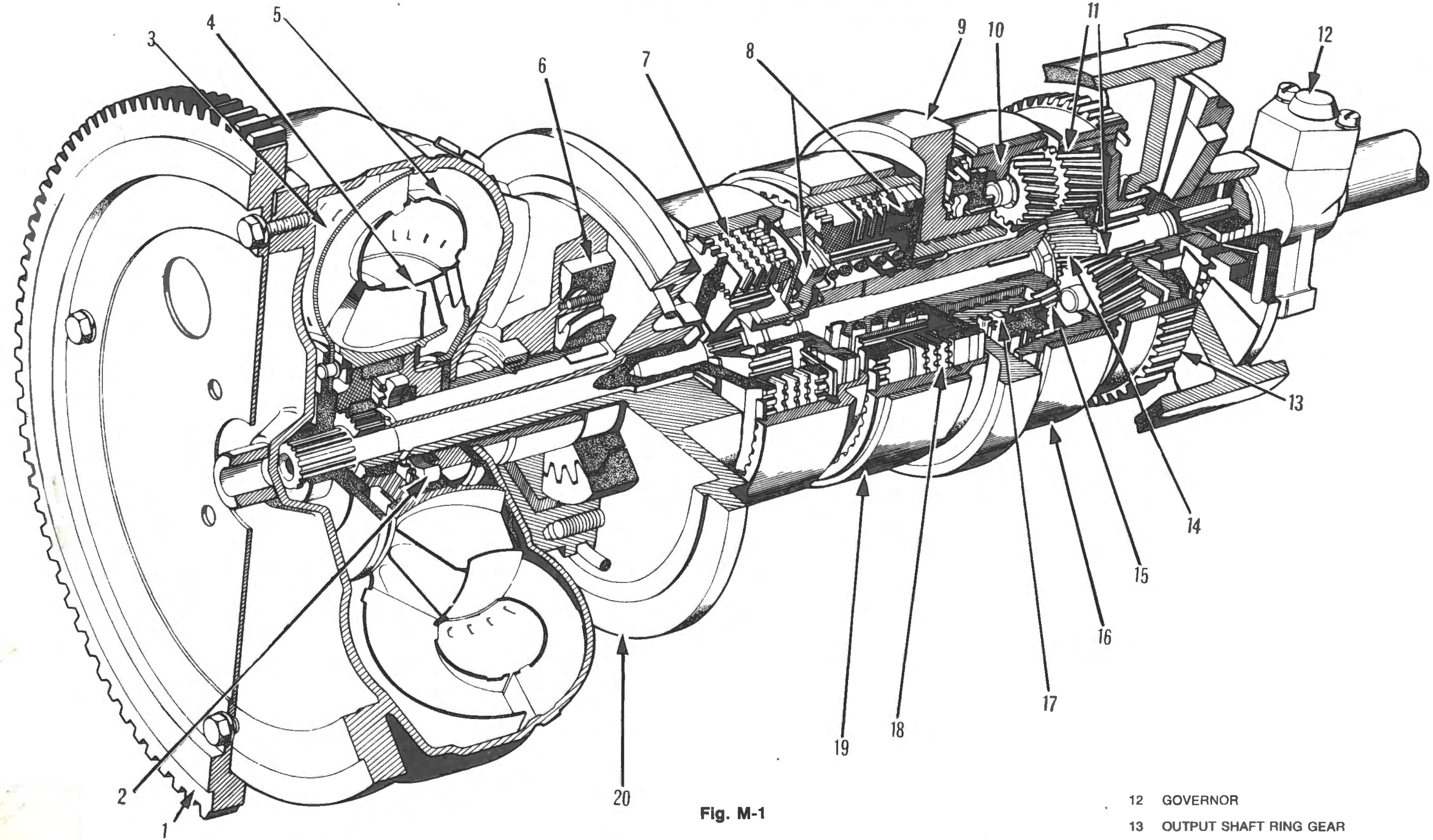


Fig. M-1

CUTAWAY VIEW OF A TYPICAL TRANSMISSION

1	CONVERTER DRIVE PLATE AND STARTER RING GEAR ASSEMBLY
2	ONE WAY CLUTCH
3	TORQUE CONVERTER TURBINE
4	TORQUE CONVERTER STATOR
5	TORQUE CONVERTER IMPELLER
6	PUMP
7	FRONT CLUTCH
8	FRONT AND REAR CLUTCH PISTONS
9	CENTRE SUPPORT
10	PLANETARY PINION CARRIER
11	PLANETARY PINIONS
12	GOVERNOR
13	OUTPUT SHAFT RING GEAR
14	PRIMARY SUN GEAR
15	SECONDARY SUN GEAR
16	REAR BAND
17	ONE WAY CLUTCH
18	REAR CLUTCH
19	FRONT BAND
20	PUMP ADAPTOR

DESCRIPTION AND OPERATION

GENERAL DESCRIPTION

The automatic transmission incorporates a fluid torque converter coupling in place of the flywheel and clutch. The converter is coupled to a hydraulically operated planetary gearbox which provides three forward ratios and reverse. All forward ratios are automatically engaged in accordance with accelerator position and speed of the car.

Over-riding control with appropriate engine braking is available for the first and second gear ratios by manual selection of 1 or 2.

TORQUE CONVERTER

The torque converter is mounted on the rear end of the crankshaft by means of a sheet metal converter drive plate assembly.

The converter comprises three elements i.e. a driving member (sometimes called an impeller), a driven member (sometimes called a turbine), and a stator, but it is only serviced as a unit.

There is a continuous supply of oil circulation through the unit. This assists in dissipating the heat generated. Oil pressure in the torque converter is regulated at 276-344 kPa (40-50 psi).

The torque converters used on both the 6 cylinder and 8 cylinder appear the same externally, but internally they differ. They are identified by serial numbers stamped on the periphery of the converter.

THE GEAR TRAIN

The planetary gear train comprises two sun gears, an internal ring gear and a planet carrier containing six pinions. All gears are in constant mesh and the three forward speeds and reverse are obtained by the hydraulic application of brake bands and clutches.

THE BRAKE BANDS AND SERVOS

Two brake bands are used. The 'Front' band is used for intermediate ratio whilst the 'Rear' band is applied in reverse gear — 'R' and low gear in '1'. The clamping load is applied by two separate hydraulic servos.

THE MULTI-DISC CLUTCHES

In all forward ratios, the 'front' clutch is applied hydraulically. The 'rear' clutch is used for Reverse and Top gear operation.

THE HYDRAULIC SYSTEM

Oil is drawn from the oil reservoir through a gauze strainer and pick up pipe by the transmission oil pump which provides a pressurised oil supply for the torque converter, the application of bands, clutches and lubrication of the transmission.

The valve block assembly controls and distributes pressures throughout the transmission.

GOVERNOR

The hydraulic governor mounted on the output shaft produces governor pressure which varies with road speed and in conjunction with throttle opening, brings about automatic shifting at appropriate speeds.

DRIVING

Selector Positions — The positions for manual selection are marked 'P', 'R', 'N', 'D', '2' and '1' on the selector lever quadrant plate. The stop (1) provided between 'N' and 'R' is to minimise accidental selection of 'P' or 'R' while the car is moving.

P-PARK — In this position the transmission is mechanically locked. Use this position when parked, starting or when the car is stationary with the engine running for tuning or adjustment. DO NOT SELECT 'P' when the car is moving and always apply the handbrake before selecting 'P'.

R-REVERSE — DO NOT select 'R' when the car is moving forward. The reverse lights operate automatically when 'R' is selected with the ignition switched on.

N-NEUTRAL — The handbrake must be applied at all times when the lever is in 'N'. This position may also be used for starting.

D-DRIVE — This position is used when driving in normal traffic and road conditions. Changes of all forward ratios are automatic.

2 LOCK-UP SECOND RATIO — Automatic changes are confined to first and second ratios only. This position is used when rapid acceleration or engine braking is required. DO NOT select '2' at speeds above:

6 CYLINDER — 96 km/h (60 mph)
8 CYLINDER — 99 km/h (62 mph)

1 LOCK-UP FIRST RATIO — This position may be selected at any road speed below 96 km/h (60 mph) but the first ratio will not engage until the road speed is below 32 km/h (20 mph).

Starting the Engine — The procedure given for synchromesh transmissions for starting the engine also applies to cars fitted with automatic transmission. The following points should be noted.

The starter will only operate when the selector lever is in the 'P' or 'N' positions.

Driving with a cold engine may result in engine stalling. To overcome this condition, ensure that the engine is warmed sufficiently before driving off. Take care not to drive with the mixture control in the fast idle position as this may cause sudden acceleration when the brakes are released.

Driving — Select a driving position when stationary. Always release the accelerator pedal and apply the foot brake before moving the selector lever to the required position. This will prevent the car from 'creeping' (i.e. a tendency for the car to move very slowly forward if 'D', '2' or '1' is selected backwards when 'R' is selected). This creeping feature can be used to advantage when manoeuvring in a confined space.

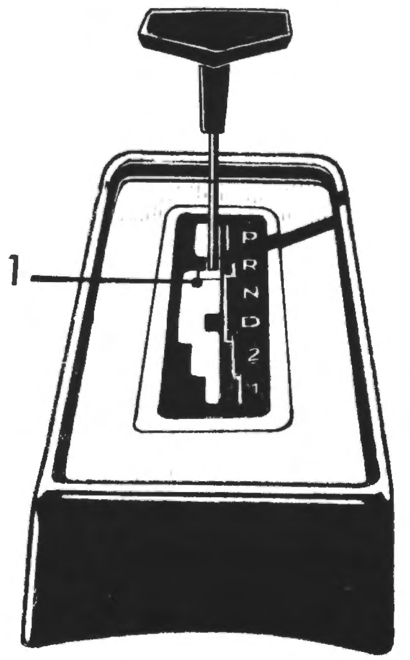


Fig. M-2

SELECTOR LEVER AND CONSOLE ASSEMBLY
(Floor Change)

Moving Off — The selector can be in any one of the forward positions 'D', '2' or '1'. Selection of the position being dependent on prevailing circumstances. After releasing the brakes, moving off will be smooth regardless of how much the accelerator pedal is depressed. Discretion in the use of the accelerator must be exercised when in slippery road conditions or if optimum fuel economy is to be achieved.

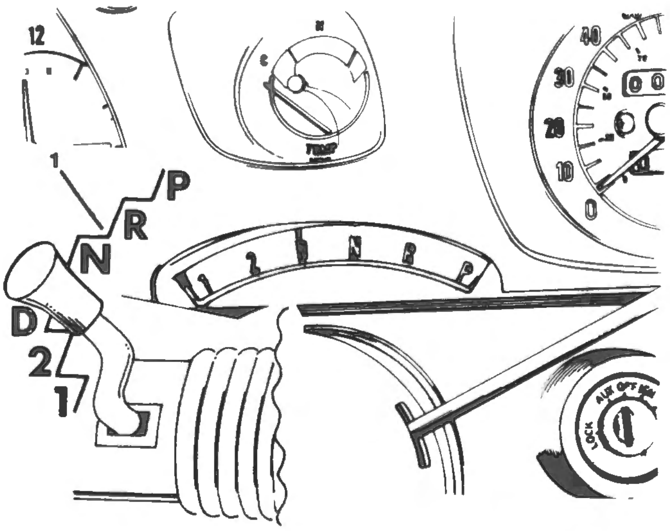


Fig. M-2A

SELECTOR LEVER AND QUADRANT
(Column Change)

Selector in 'D' — The automatic selection of all forward ratios takes place progressively up or down in accordance with changes in road speed, accelerator position and road load.

Selector in '2' — Selection of first and second ratios only will occur automatically in accordance with changing conditions. Appropriate engine braking is available when the accelerator pedal is released.

Manual selection of '2' can be made when driving in 'D' at any speed below:

6 CYLINDER — 96 km/h (60 mph)
8 CYLINDER — 99 km/h (62 mph)

Use '2' when road conditions demand rapid acceleration or full engine braking for example, when overtaking, approaching or negotiating bends or gradients.

Selector in '1' — When starting from rest the transmission will remain in first ratio irrespective of changes in road or driving conditions. This position provides full engine braking and full engine power, for example, when starting off on or ascending very steep gradients, avoid overspeeding the engine. Manual selection of '1' can be made at any road speed below 96 km/h (60 mph) but the first ratio will not engage until the road speed is below 32 km/h (20 mph).

Selector Illumination — The lamp for illuminating the selector lever and quadrant is controlled by the main lighting switch and instrument panel switch.

Stopping — Release the accelerator and apply the brakes.

Soft Surfaces — When the rear wheels fail to grip in conditions such as mud or snow, the car may be rocked backwards and forwards by alternately selecting 'R' and 'D' while using light accelerator pressure.

Increased Acceleration — When lower gear acceleration is required for overtaking or hill climbing etc., downchange speeds are preset to given optimum performance without overspeeding the engine.

A feature of the gearbox is the 'part throttle' and 'full throttle' down-shifts. With the selector in 'D' between speeds of 17 to 51 km/h (13-32 mph) a part throttle 3-2 down-shift can be made by a partial depression of the accelerator pedal (1) (Fig. M-3) the actual amount being progressive and dependent on the road speed.

Full throttle down-shifts (termed 'kick-down') may be made by depressing the pedal fully (2) (Fig. M-3). The speed below which 'kick-down' can be made are:

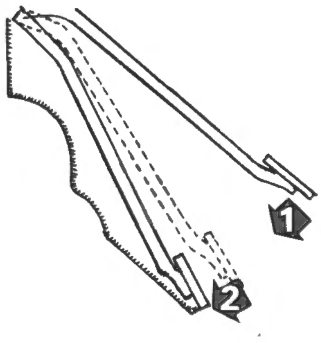


Fig. M-3

ACCELERATOR PEDAL POSITIONS

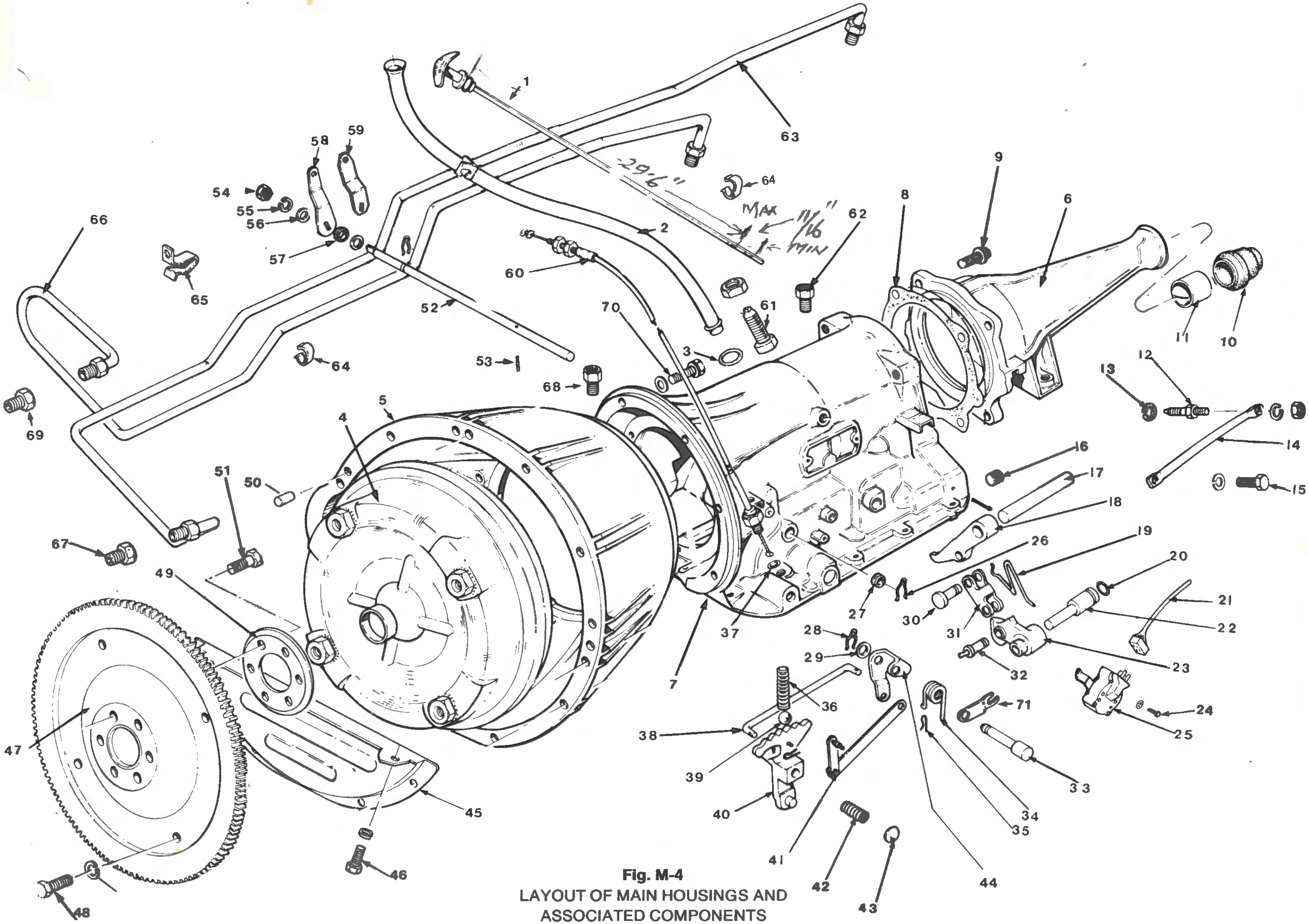
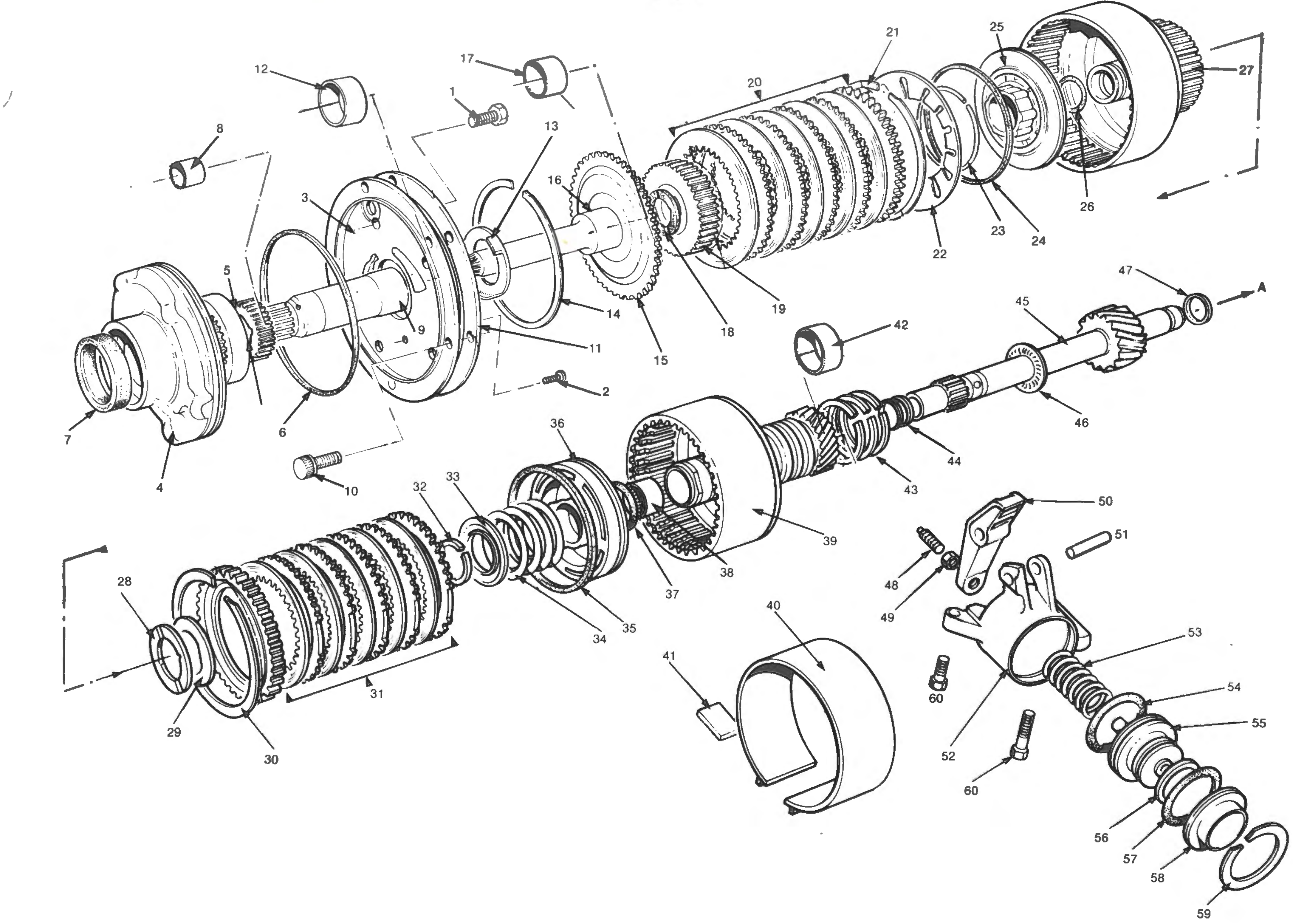


Fig. M-4
LAYOUT OF MAIN HOUSINGS AND
ASSOCIATED COMPONENTS

KEY TO FIG. M-4

1	FLUID DIPSTICK
2	FLUID FILLER TUBE
3	TUBE 'O' RING SEAL
4	TORQUE CONVERTER
5	TORQUE CONVERTER HOUSING
6	REAR EXTENSION HOUSING
7	TRANSMISSION CASING
8	REAR EXTENSION HOUSING GASKET
9	BOLT EXTENSION HOUSING TO TRANSMISSION CASE
10	EXTENSION HOUSING OIL SEAL
11	EXTENSION HOUSING BUSH
12	CENTRE SUPPORT BOLT
13	LOCK WASHER
14	STRUTS TRANSMISSION TO CONVERTER HOUSING
15	SCREW AND WASHER STRUT TO HOUSING
16	PRESSURE TAKE-OFF PLUG
17	PARKING BRAKE ANCHOR PIN
18	PARKING BRAKE PAWL
19	RELEASE SPRING
20	TOGGLE PIN 'O' RING SEAL
21	INHIBITOR SWITCH WIRING HARNESS
22	PARKING BRAKE TOGGLE PIN
23	TOGGLE LEVER
24	SCREW AND WASHER — INHIBITOR SWITCH
25	INHIBITOR SWITCH
26	CIRCLIP INHIBITOR SWITCH SHAFT
27	OIL SEAL FOR SHAFT
28	CIRCLIP TORSION LEVER SHAFT
29	WASHER FOR SHAFT
30	TOGGLE LINK PIN
31	TOGGLE LINK
32	TOGGLE PIN
33	PIVOT SHAFT TORSION LEVER
34	TORSION SPRING
35	CIRCLIP
36	MANUAL DEDENT SPRING
37	SEAL DOWN SHIFT CABLE
38	MANUAL LINKAGE ROD
39	MANUAL DEDENT BALL
40	MANUAL DEDENT LEVER
41	INHIBITOR SWITCH OPERATING LEVER AND SHAFT ASSEMBLY
42	MANUAL CONTROL SHAFT SPRING
43	PLUG
44	TORSION LEVER
45	TORQUE CONVERTER HOUSING FRONT COVER
46	SCREWS AND WASHER COVER TO HOUSING (WHERE FITTED)
47	CONVERTER DRIVE PLATE ASSEMBLY
48	SCREWS AND WASHERS PLATE TO CONVERTER
49	REINFORCING PLATE (6 CYLINDER ENGINE)
50	DOWEL — CONVERTER HOUSING TO ENGINE
51	BOLT DRIVE PLATE TO CRANKSHAFT
52	MANUAL CONTROL SHAFT
53	ROLL PIN
54	NUT SHIFT LEVER TO SHAFT
55	WASHER SHIFT LEVER
56	SPACER
57	SHAFT OIL SEAL
58	SHIFT LEVER — COLUMN SHIFT
59	SHIFT LEVER — FLOOR SHIFT
60	DOWN SHIFT CABLE (6 CYLINDER ENGINE)
61	REAR BAND ADJUSTING SCREW AND LOCKNUT
62	UNION-FLUID COOLER RETURN TO CASING
63	FLUID RETURN PIPE FROM COOLER
64	CLIP
65	CLIP
66	FLUID SUPPLY PIPE TO COOLER
67	UNION
68	UNION
69	UNION
70	BOLT TRANSMISSION TO CONVERTER HOUSING
71	TOGGLE ARM

Fig. M-5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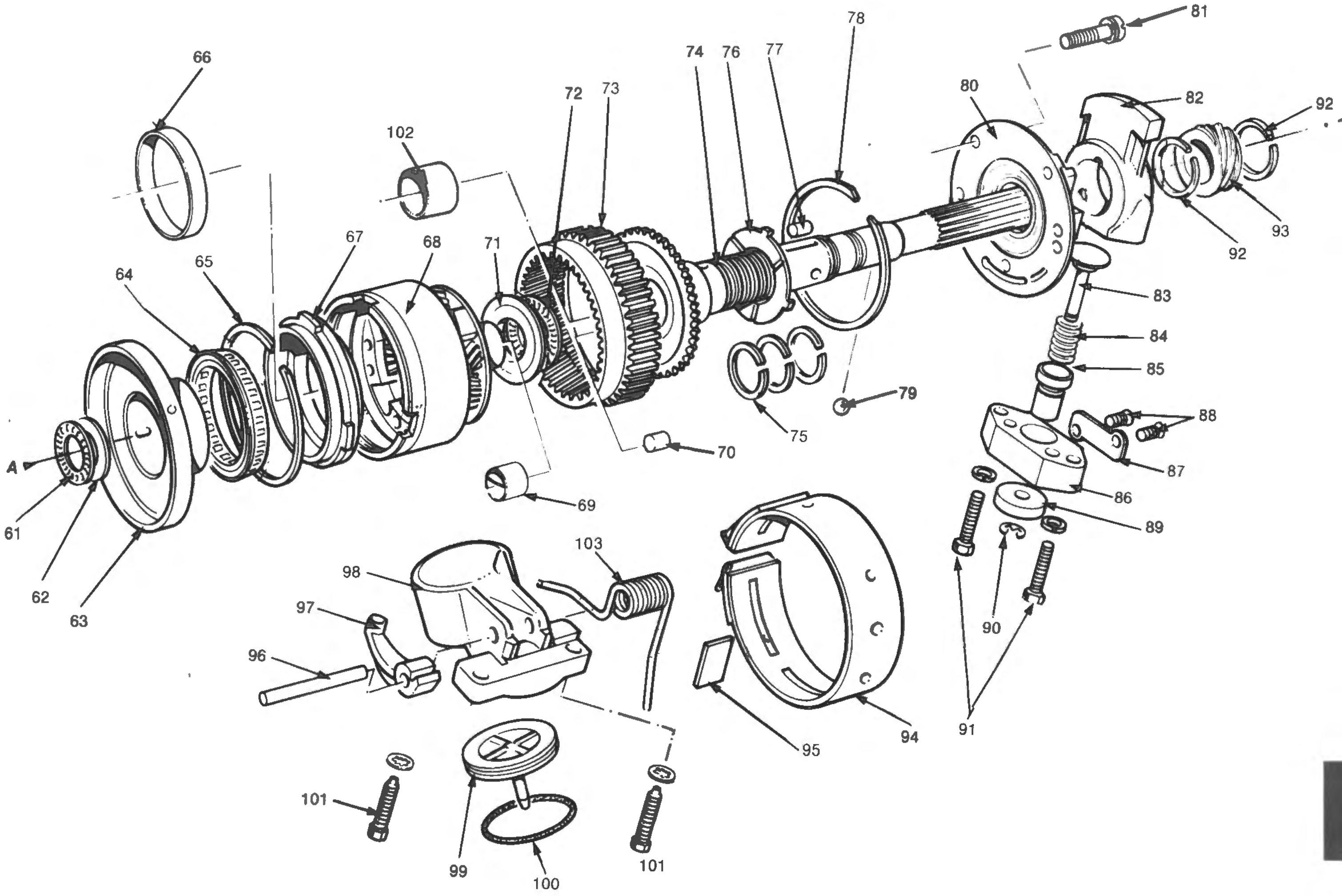


Fig. M-5

LAYOUT OF INTERNAL COMPONENTS

1 BOLTS (5) STATOR SUPPORT TO PUMP
2 LOCATING SCREW
3 STATOR SUPPORT
4 PUMP BODY ASSEMBLY
5 PUMP GEARS
6 SEALING RING (PUMP)
7 PUMP/CONVERTER SEAL
8 DRIVE GEAR BUSH
9 DRIVE GEAR BEARING JOURNAL
10 BOLTS (6) PUMP ASSEMBLY TO TRANSMISSION CASE
11 GASKET
12 INPUT SHAFT BUSH
13 THRUST WASHER
14 SNAP RING
15 INPUT SHAFT
16 INPUT SHAFT BEARING JOURNAL
17 SUN GEAR SHAFT BUSH (FRONT)
18 CLUTCH HUB THRUST WASHER
19 CLUTCH HUB
20 FRONT CLUTCH PLATE KIT
21 PISTON SPRING SNAP RING
22 PISTON SPRING
23 SPRING BEARING RING
24 SEALING RING (PISTON)
25 PISTON
26 'O' RING CLUTCH DRUM
27 FRONT CLUTCH DRUM
28 BRONZE THRUST WASHER
29 STEEL THRUST WASHER
30 SNAP RING
31 REAR CLUTCH PLATE KIT — 6 and 8 CYLINDER SHOWN
32 SNAP RING
33 SPRING RETAINER
34 SPRING
35 SEALING RING (PISTON)
36 PISTON
37 'O' RING CLUTCH DRUM
38 REAR CLUTCH DRUM NEEDLE ROLLER ASSEMBLY
39 REAR CLUTCH DRUM
40 FRONT BRAKE BAND

KEY TO FIG. M-5 (cont.)

41 STRUT FOR FRONT SERVO
42 SUN GEAR SHAFT BUSH (INTERMEDIATE)
43 SEALING RINGS (REAR CLUTCH)
44 SEALING RINGS (FRONT CLUTCH)
45 SUN GEAR SHAFT
46 TORRINGTON THRUST BEARING
47 SEALING RING (FRONT CLUTCH AND GOVERNOR FEED)
48 FRONT SERVO ADJUSTER
49 LOCKNUT FOR ADJUSTER
50 FRONT SERVO LEVER
51 PIVOT PIN FOR LEVER
52 FRONT SERVO BODY
53 PISTON SPRING
54 PISTON SEAL
55 FRONT SERVO PISTON
56 PISTON SEAL
57 PISTON SEAL
58 FRONT SERVO SLEEVE
59 SNAP RING
60 BOLTS SERVO TO TRANSMISSION CASE
61 TORRINGTON THRUST BEARING
62 TORRINGTON THRUST BEARING PLATE
63 CENTRE SUPPORT
64 INNER RACE (ONE WAY CLUTCH)
65 SNAP RING
66 BUSH (ONE WAY CLUTCH)
67 OUTER RACE (ONE WAY CLUTCH)
68 PLANET CARRIER AND REAR DRUM ASSEMBLY
69 SUN GEAR SHAFT BUSH (REAR)
70 PLUG (OUTPUT SHAFT)
71 TORRINGTON THRUST BEARING PLATE
72 TORRINGTON THRUST BEARING
73 RING GEAR
74 OUTPUT SHAFT
75 SEALING RINGS (FRONT CLUTCH AND GOVERNOR FEED)
76 THRUST WASHER
77 GOVERNOR DRIVE DOWEL
78 SNAP RING
79 SPEEDOMETER GEAR DRIVE BALL
80 ADAPTOR PLATE
81 BOLTS (5) ADAPTOR PLATE TO TRANSMISSION CASE
82 COUNTER WEIGHT
83 VALVE AND SPINDLE
84 VALVE SPRING
85 VALVE
86 VALVE BODY
87 COVER PLATE
88 SCREWS (2) COVER PLATE TO VALVE
89 WEIGHT
90 CIRCLIP
91 SCREWS AND WASHERS (2) VALVE BODY TO COUNTER WEIGHT
92 SNAP RINGS (2)
93 SPEEDOMETER DRIVE GEAR
94 REAR BRAKE BAND
95 STRUT FOR REAR SERVO
96 PIVOT PIN FOR LEVER
97 REAR SERVO LEVER
98 REAR SERVO BODY
99 REAR SERVO PISTON
100 PISTON SEAL
101 BOLTS AND WASHERS (2) SERVO TO TRANSMISSION CASE
102 PLANET CARRIER BUSH — OUTPUT SHAFT
103 SPRING — SERVO PISTON RETURN

KEY TO FIG. M-6

1 PUMP INLET TUBE
2 'O' RING (PUMP INLET TUBE)
3 TRANSMISSION FLUID INLET COOLER TUBE
4 CONVERTER TUBE
5 PUMP OUTLET TUBE
6 VALVE BODY ASSEMBLY
7 SCREWS (2) REVERSE PRESSURE BOOST ASSEMBLY TO VALVE BODY (8 CYLINDER)
8 REVERSE PRESSURE BOOST ASSEMBLY (8 CYLINDER)
9 SCREWS (2) DOWNSHIFT AND THROTTLE VALVE CAM ASSEMBLY TO VALVE BODY
10 DOWNSHIFT AND THROTTLE VALVE CAM ASSEMBLY
11 NUTS (4) DOWNSHIFT AND THROTTLE VALVE CAM ASSEMBLY TO VALVE BODY (WHERE FITTED)
12 LOCK WASHER NUT TO DOWNSHIFT AND THROTTLE VALVE CAM ASSEMBLY (WHERE FITTED)
13 BOLT AND WASHER (2) VALVE BODY TO TRANSMISSION CASE
14 BOLT AND WASHER VALVE BODY TO TRANSMISSION CASE
15 TRANSMISSION FLUID RESERVOIR GASKET
16 TRANSMISSION FLUID RESERVOIR
17 FRONT SERVO RELEASE TUBE
18 FRONT SERVO APPLY TUBE

LAYOUT OF VALVE BODY COMPONENTS ON FLUID RESERVOIR

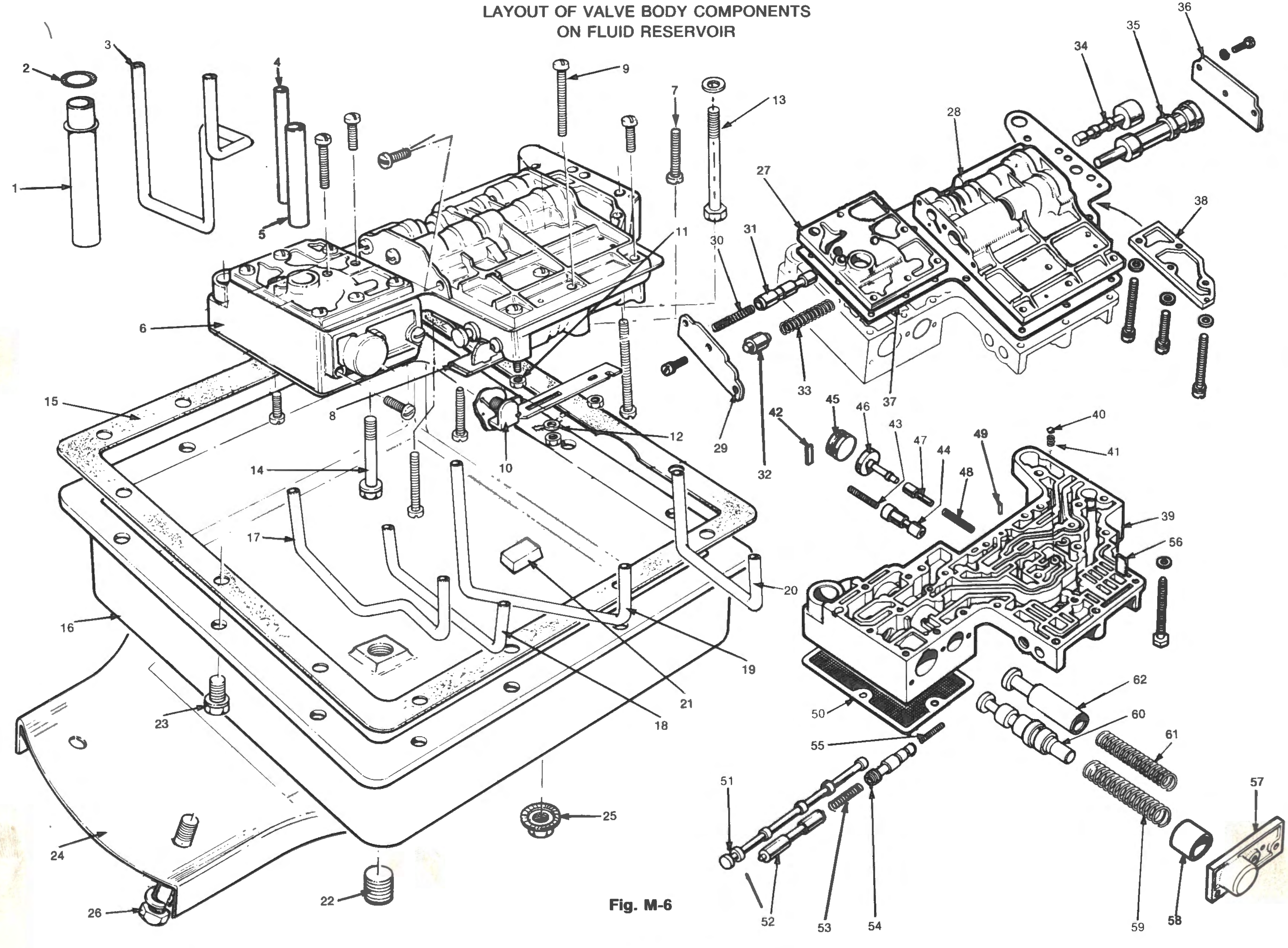


Fig. M-6

KEY TO FIG. M-6 (cont.)

19	REAR CLUTCH TUBE
20	REAR SERVO TUBE
21	MAGNET
22	DRAIN PLUG
23	BOLT AND WASHER (13) OIL RESERVOIR TO TRANSMISSION CASE
24	STRUT TRANSMISSION FLUID RESERVOIR TO CONVERTER HOUSING
25	NUT (4) STRUT TO TRANSMISSION FLUID RESERVOIR
26	BOLT AND WASHER (2) STRUT TO CONVERTER HOUSING
27	TRANSMISSION FLUID TUBE COLLECTOR PLATE
28	UPPER VALVE BODY
29	FRONT END BODY
30	SPRING (1-2 SHIFT VALVE)
31	PLUNGER (1-2 SHIFT VALVE)
32	PLUNGER (2-3 SHIFT VALVE)
33	SPRING (2-3 VALVE)
34	VALVE (1-2 SHIFT)
35	VALVE (2-3 SHIFT)
36	REAR END PLATE
37	SEPARATING PLATE
38	GOVERNOR LINE PLATE
39	LOWER VALVE BODY
40	BALL VALVE (STEEL) 3-2 SHIFT VALVE EXHAUST
41	SPRING 3-2 SHIFT VALVE EXHAUST
42	SERVO ORIFICE CONTROL VALVE STOP
43	SPRING (SERVO ORIFICE CONTROL VALVE)
44	SERVO ORIFICE CONTROL VALVE
45	MODULATOR VALVE RETAINER
46	MODULATOR VALVE
47	MODULATOR VALVE PLUG
48	SPRING (MODULATOR VALVE)
49	MODULATOR VALVE RETAINER DOWEL
50	TRANSMISSION FLUID STRAINER
51	MANUAL CONTROL VALVE
52	DOWNSHIFT VALVE
53	SPRING (THROTTLE VALVE)
54	THROTTLE VALVE
55	SPRING (THROTTLE VALVE RETURN)
56	STOP (THROTTLE VALVE)
57	LOWER BODY END PLATE
58	PRIMARY REGULATOR VALVE SLEEVE
59	SPRING (PRIMARY REGULATOR VALVE)
60	PRIMARY REGULATOR VALVE
61	SPRING (SECONDARY REGULATOR VALVE)
62	SECONDARY REGULATOR VALVE

	6 CYLINDER	8 CYLINDER
From third to second gear:	82-96 km/h (51-60 mph)	85-99 km/h (53-62 mph)
From third to first gear:	42-55 km/h (26-34 mph)	38-53 km/h (24-33 mph)

Towing — The car may be towed with the selector lever at 'N'. The car should be towed no faster than 48 km/h (30 mph) and for a distance not exceeding 8 km (5 miles). If the transmission is inoperative, remove the propeller shaft or lift the rear wheels.

NOTE: The car cannot be tow-started. Before commencing a towing operation, ensure that the ignition/steering lock is in 'AUX' position.

TORQUE CONVERTER

Description

The 279.4 mm (11 in) diameter torque converter is bolted to the drive plate attached to the crankshaft while the driven member is splined internally to accept the converter out-put shaft. The stator is mounted on a one-way sprag clutch, the hub of which is splined to a fixing on the oil pump housing.

Oil is supplied to the torque converter under pressure and returns by way of the oil cooler to the transmission sump. The position of the oil cooler prevents the converter from draining whilst the vehicle is not operating. The secondary regulator valve maintains torque converter pressure at 276-344 kPa (40-50 psi).

Operation

With the car stationary and in gear, the driven member will be stationary. The driving member will, however, be turning with the engine. As engine speed is increased, oil will be thrown to the outside by centrifugal force. The vanes of the driving member then direct the oil flow against the outer vanes of the driven member with considerable force, causing it to rotate and drive the transmission.

After the oil has passed through the vanes of the driven member, it tends to be directed back against the inner vanes of the driving member contrary to engine rotation. To overcome this, the stator mounted between the driving and driven members on its one-way clutch changes the direction of the flow to engine-wise, thus assisting the driving member to drive the car. This provides torque multiplication up to a maximum of approximately 2:1 (at stall).

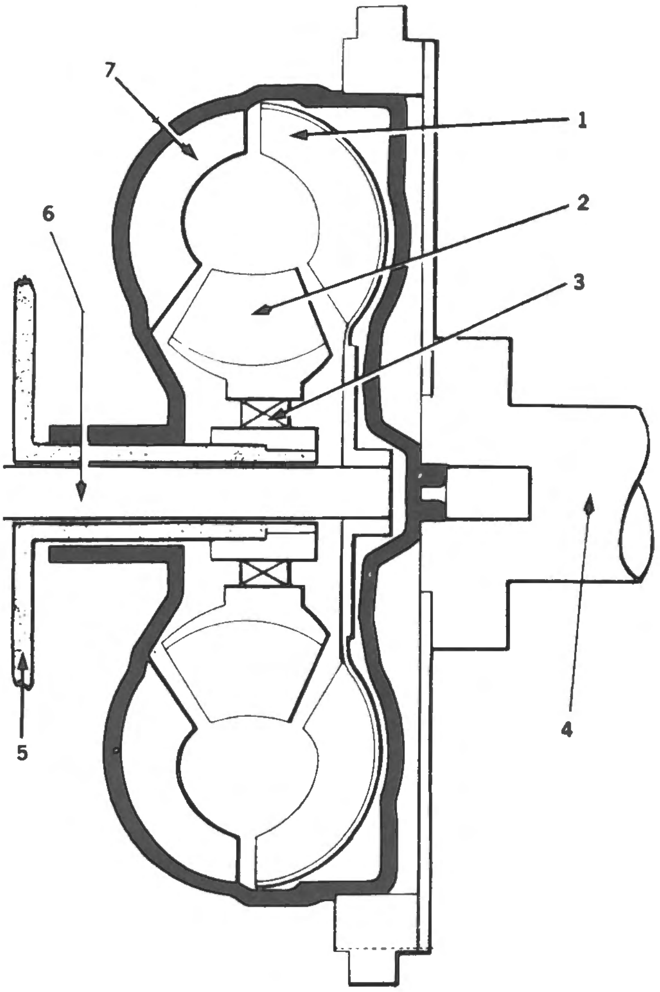


Fig. M-7

SECTIONAL VIEW OF TORQUE CONVERTER SHOWING PRINCIPLE OF OPERATION

1	DRIVEN MEMBER
2	STATOR
3	ONE WAY CLUTCH
4	CRANKSHAFT
5	OIL PUMP CASTING
6	CONVERTER OUTPUT SHAFT
7	DRIVING MEMBER

As the vehicle moves away, the speed of the driven member approaches that of the driving member and the rate of flow through the vanes is reduced, resulting in less force being applied to the stator. With increased speed or reduction in load, the force with which the oil is thrown up against the back of the stator blades will increase and when a certain point is reached, the stator will free-wheel on its one-way clutch. This is known as coupling point. Torque multiplication now ceases and the unit operates as a fluid coupling with a torque multiplication ratio of 1:1.

THE GEAR TRAIN ASSEMBLY

The planetary gear train consists of two sun gears, two sets of pinions, a pinion carrier and a ring gear. Helical involute tooth form is used throughout. Power enters the gear train via the sun gears.

In all forward gears power enters through the primary sun gears. In reverse, power enters through the secondary sun gear. Power leaves the gear train by the ring gear. The pinions are used to transmit power from the sun gears to the ring gear. In reverse, a single set of pinions is used which causes the ring gear to rotate in the opposite direction to the sun gear. In forward gears, a double set of pinions is used to cause the ring gear to rotate in the same direction as the sun gear. The carrier locates the pinions in their proper positions relative to the sun gears and the ring gear (and also forms a reaction member for certain conditions). The various mechanical ratios of the gear set are obtained by the engagement of hydraulically operated multi-disc clutches and brake bands.

Fig. M-8 shows the relationship of the various components of the gear train assembly with the exception of the planet carrier which is omitted so that the pinions can be seen.

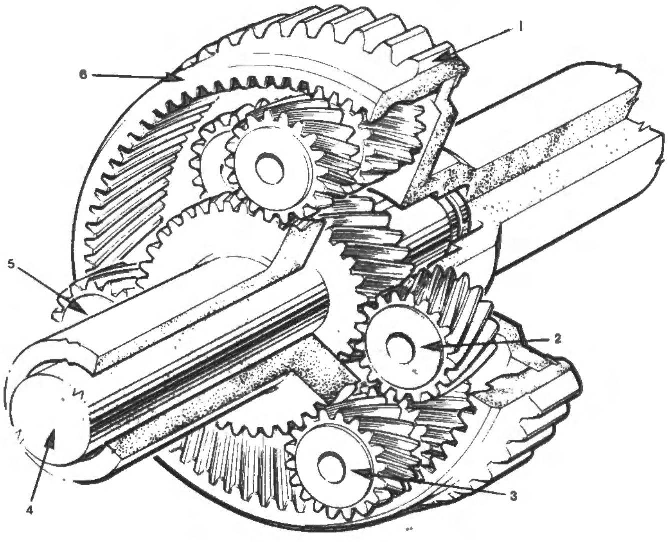


Fig. M-8

THE GEAR TRAIN ASSEMBLY

1	PARK GEAR
2	PRIMARY PINIONS (SHORT)
3	SECONDARY PINIONS (LONG)
4	PRIMARY SUN GEAR
5	SECONDARY SUN GEAR
6	RING GEAR

A parking pawl engages with the external teeth of the ring gear to provide positive locking of the gear train in 'P'.

The two multi-disc clutches, the two bands and the 'sprag' type one-way clutch operate with the gear train to provide the three forward ratios, neutral and reverse.

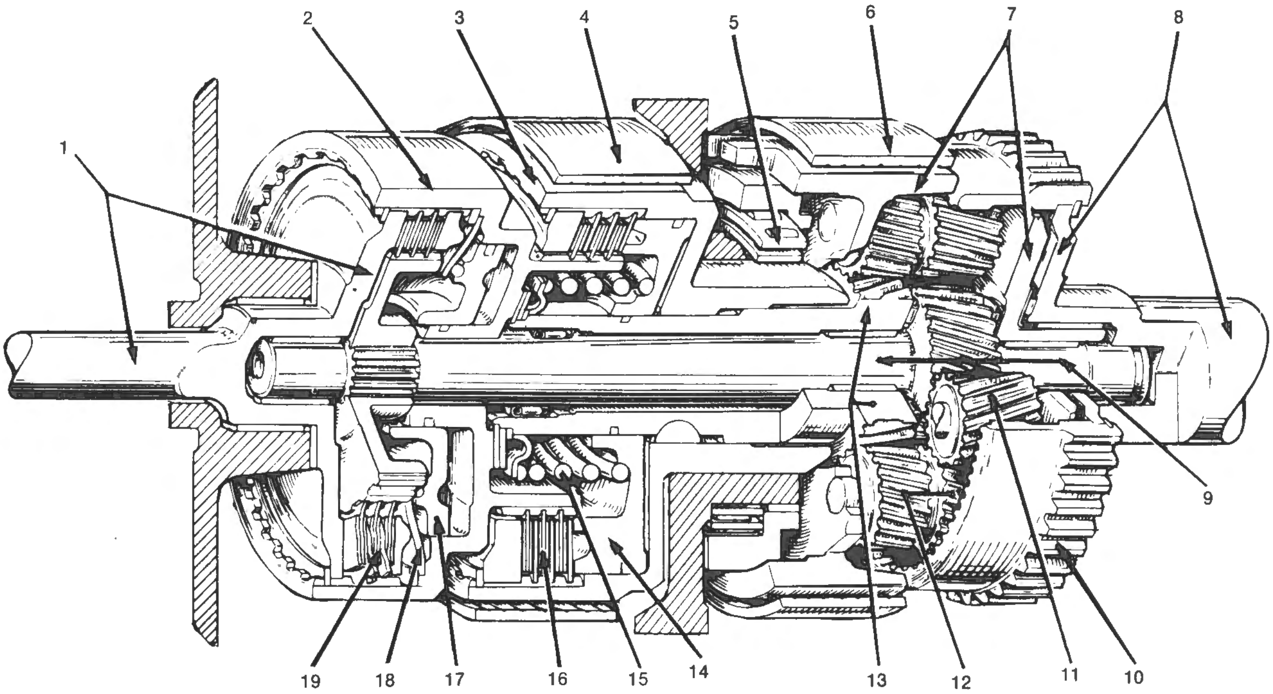


Fig. M-9

SCHEMATIC VIEW OF TRANSMISSION AND CUT-AWAY VIEW OF THE CLUTCHES AND PLANETARY GEARS

1 TRANSMISSION INPUT SHAFT
2 FRONT CLUTCH
3 REAR CLUTCH
4 FRONT BAND
5 ONE-WAY CLUTCH (SPRAG TYPE)
6 REAR BAND
7 PLANET CARRIER
8 RING GEAR AND OUTPUT SHAFT
9 PRIMARY SUN GEAR AND SHAFT
10 PARKING PAWL TEETH
11 SHORT PINION
12 LONG PINION
13 SECONDARY SUN GEAR
14 REAR CLUTCH OPERATING PISTON
15 REAR CLUTCH PISTON RETURN SPRING
16 REAR CLUTCH PLATES
17 FRONT CLUTCH OPERATING PISTON
18 FRONT CLUTCH PISTON RETURN SPRING (DIAPHRAGM TYPE)
19 FRONT CLUTCH PLATES

Engine braking occurs in all ratios except low gear in the 'D' and '2' ranges.

Details of transmission ratios are set out in the table below.

Fig. M-9 shows a sectional view of the gear train assembly.

MECHANICAL POWER FLOW

The following series of power flow tables indicate how the various ratios are brought into operation by the engagement of appropriate bands and clutches. Refer table.

P-PARK — The front and rear clutches are off, and no power is transmitted from the converter to the gear train. The front and rear bands are also released. For constructional reasons the rear band is applied as long as the engine is running.

Positive locking of the rear wheels is ensured by the engagement of the parking pawl with the teeth on the periphery of the ring gear.

R-REVERSE — The rear clutch is applied, connecting the converter to the secondary sun gear. The rear band is applied holding the pinion carrier stationary; the gear train provides the reduction of 2.09:1 in the reverse direction.

Selector Position	Ratio	Front Clutch	Front Band	Rear Clutch	Rear Band	One-way Clutch
P	—				*	
R	Reverse			*	*	
N	—					
D	Low	*				*
D	Inter.	*	*			
D	High	*		*		
2	Low	*				*
2	Inter.	*	*			
1	Low	*			*	
1	Inter.	*	*			

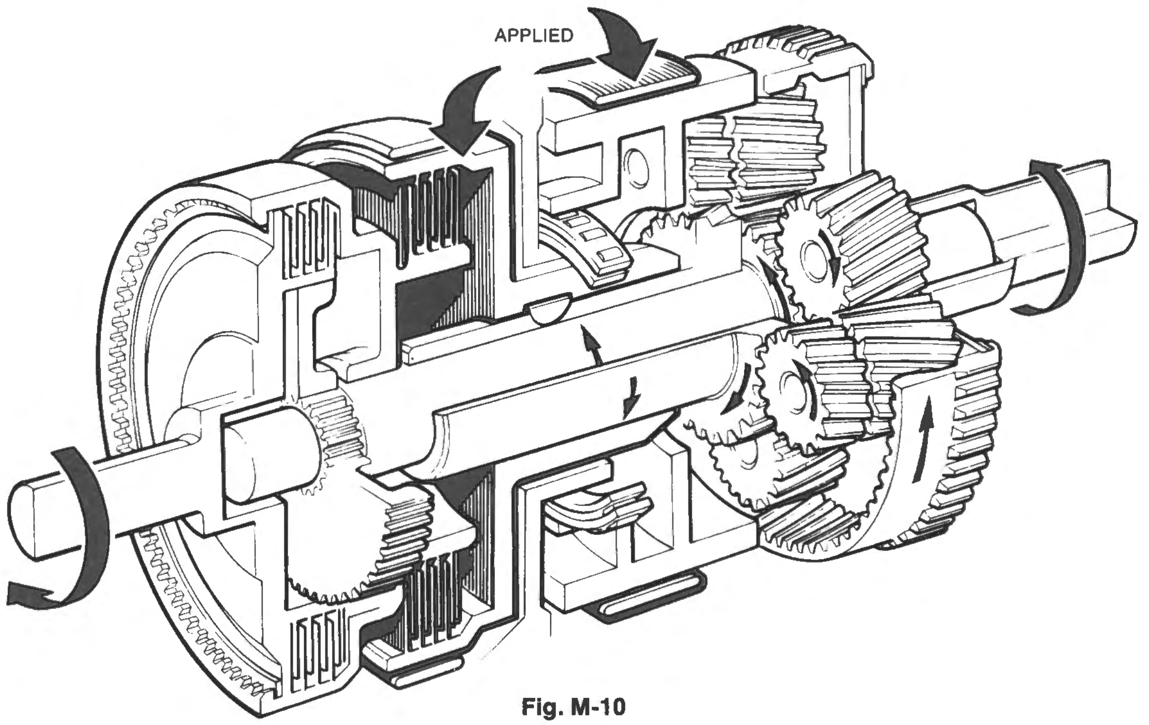


Fig. M-10

REVERSE

POWER ENTERS THROUGH THE SECONDARY SUN GEAR. THE LONG PINIONS CAUSE THE RING GEAR TO ROTATE IN THE OPPOSITE DIRECTION TO THE SUN GEAR.

DRIVING: SECONDARY SUN GEAR AND LONG PINIONS

IDLING: PRIMARY SUN GEAR AND SHORT PINIONS

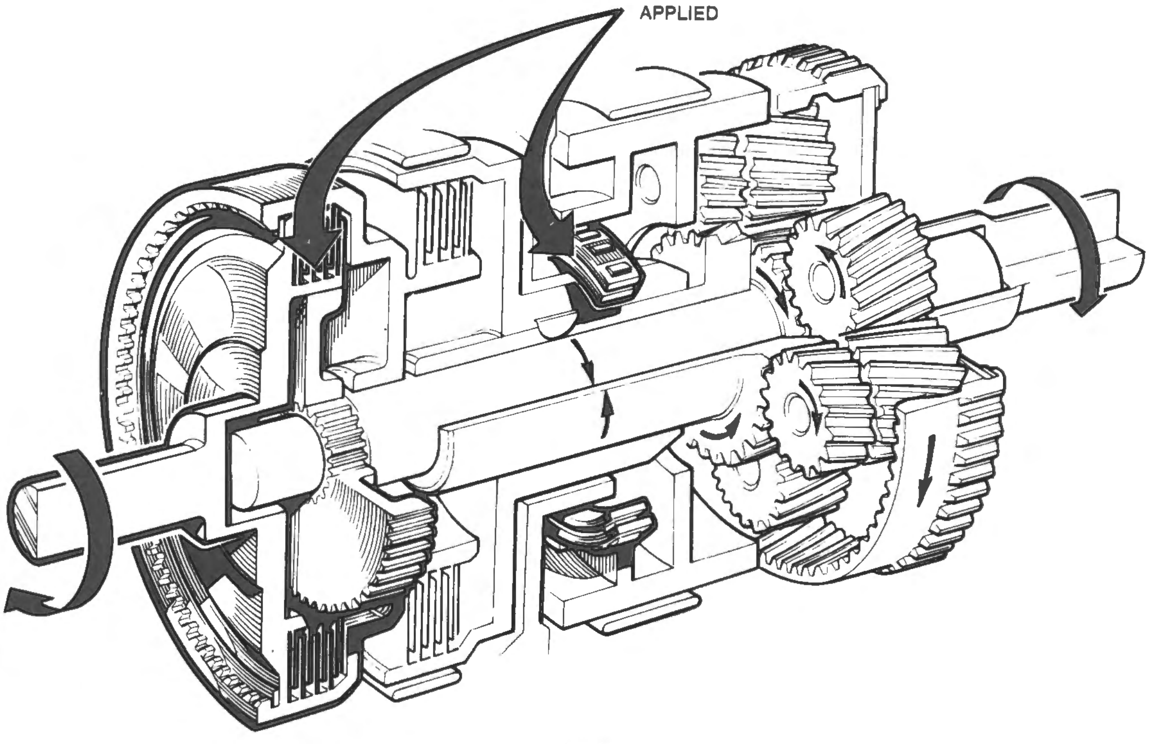


Fig. M-11

LOW RATIO ('D' and '2')

POWER ENTERS THROUGH THE PRIMARY SUN GEAR. THE SHORT AND LONG PINIONS CAUSE THE RING GEAR TO ROTATE IN THE SAME DIRECTION AS THE SUN GEAR.

DRIVING: PRIMARY SUN GEAR, SHORT AND LONG PINIONS

IDLING: SECONDARY SUN GEAR

N-NEUTRAL — All clutches and bands are released, so no transmission of power is possible.

D-DRIVE — LOW RATIO — The front clutch is applied, connecting the converter to the primary sun gear. The one-way clutch is in operation, preventing the pinion carrier from rotating counter engine-wise; the gear train provides the reduction of 2.39:1. When the vehicle is coasting the one-way clutch over runs and the gear train free-wheels.

D-DRIVE — INTERMEDIATE RATIO — Again the front clutch is applied, connecting the converter to the primary sun gear. The front band is applied, holding the secondary sun gear stationary. The gear train provides a reduction of 1.45:1. Power flow through the gears is the same as in low ratio except that the planet carrier is made to rotate engine-wise because the long pinions have to 'walk' around the held secondary sun gear. The speed imparted to the planet carrier increases the output shaft speed giving a ratio higher than previously i.e. Intermediate ratio.

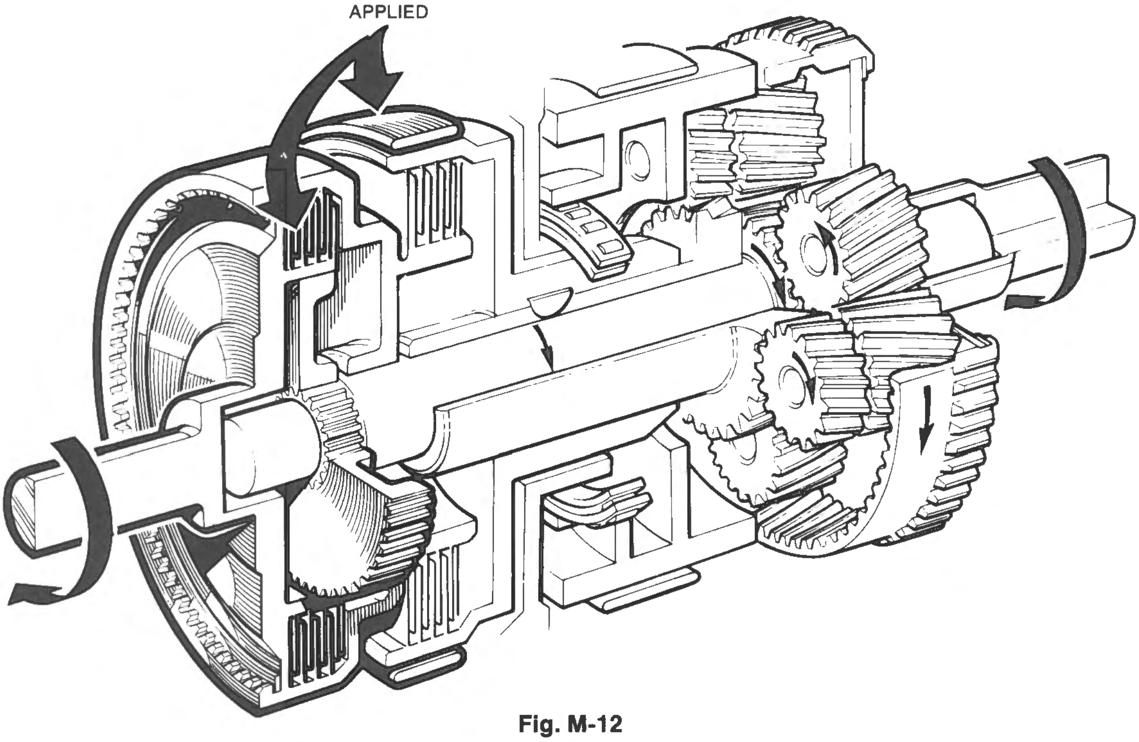


Fig. M-12

INTERMEDIATE ('D' or '2')

TRANSMISSION RATIOS

	GEAR	GEAR TRAIN RATIO	FINAL DRIVE RATIO	OVERALL RATIO (Converter at 1:1 ratio)	ROAD SPEED AT 1000 RPM
6 CYLINDER	REVERSE	2.09:1	3.89:1	8.10:1	km/h mph
	LOW	2.39:1		9.30:1	
	INTERMEDIATE	1.45:1		5.65:1	
	TOP	1.00:1		3.89:1	30 19
8 CYLINDER	REVERSE	2.09:1	2.92:1	6.30:1	
	LOW	2.39:1		6.95:1	
	INTERMEDIATE	1.45:1		4.24:1	
	TOP	1.00:1		2.92:1	40 25

D-DRIVE — HIGH RATIO — The front clutch is applied, connecting the converter to the primary sun gear. The rear clutch is applied, connecting the converter also to the secondary sun gear. Thus both sun gears are locked together and the gear set rotates as a unit providing a ratio of 1:1.

2-INTERMEDIATE RATIO — The operation of the gear train is mechanically identical to that applying in the D-Intermediate ratio. The hydraulic system precludes the availability of high ratio 1-2 and 2-1 changes occurring as in D.

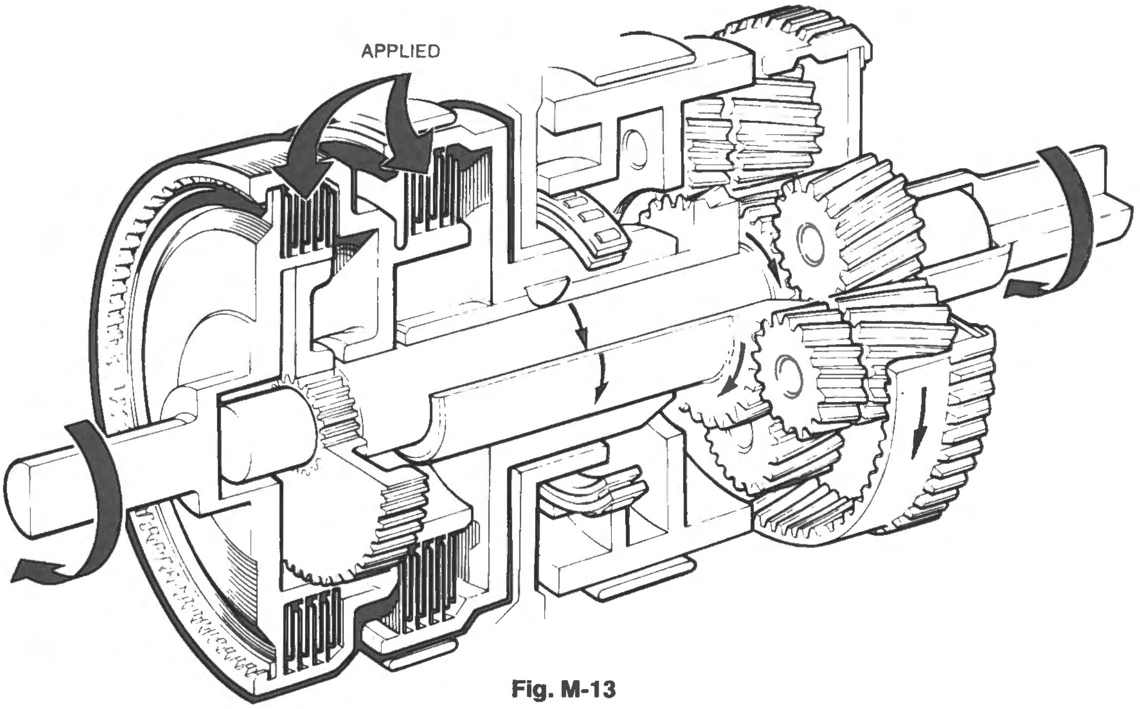


Fig. M-13

HIGH RATIO ('D')

2-LOW RATIO — The operation of the gear train is mechanically identical to that applying in D-Low ratio. The hydraulic system will permit 1-2 and 2-1 changes as in D.

1-INTERMEDIATE RATIO — The mechanical operation of the gear train is the same as in 'D' or 2-Intermediate. The hydraulic system precludes the availability of high ratio. A down-shift will occur into low ratio at approximately 14 km/h (9 mph) at zero throttle or up to 42-55 km/h (26-34 mph) for the 6 cylinder or 38-53 km/h (24-33 mph) for the 8 cylinder by kicking down.

1-LOW RATIO — The mechanical operation of the gear train is the same as in D or 2 except that the rear band is applied to provide engine breaking in low ratio. If this range is selected at some speed, top ratio will be precluded and the transmission will hold intermediate ratio until the speed of the vehicle has reduced to 34 km/h (21 mph) at zero throttle — when a 2-1 down-shift will occur. The 2-1 down-shift can also be obtained up to 42-55 km/h (26-34 mph) on the 6 cylinder or 38-53 km/h (24-33 mph) on the 8 cylinder by kicking down.

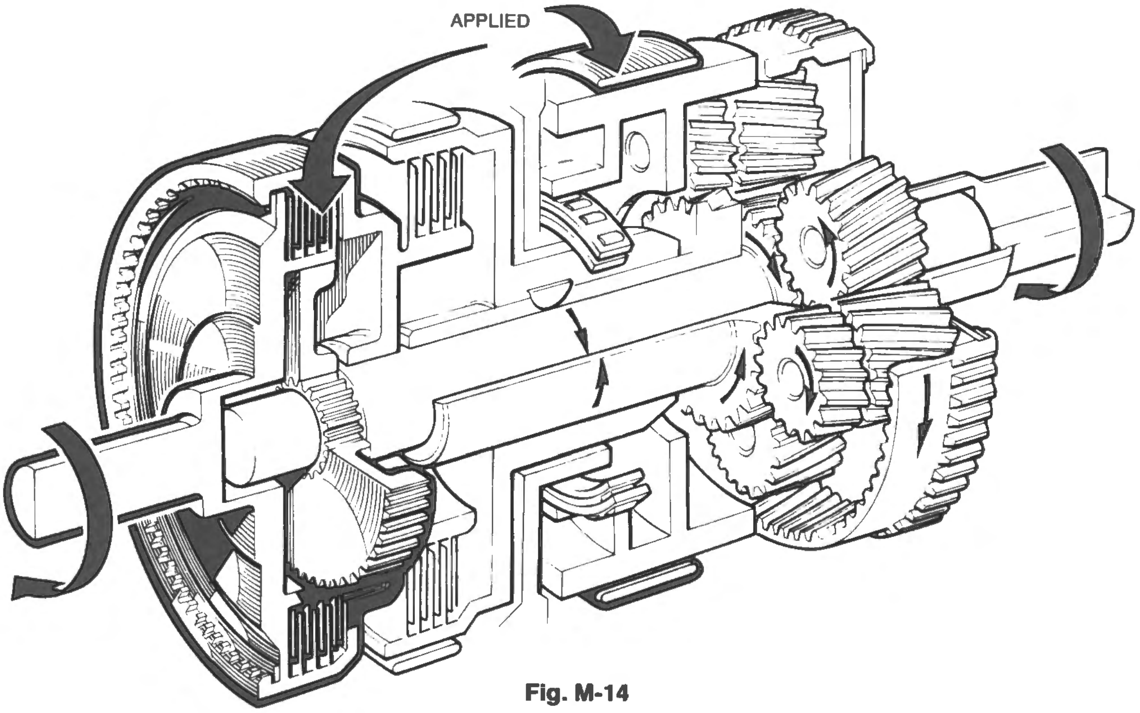


Fig. M-14

LOW RATIO ('1')

SERVOS AND BANDS

Refer Fig. M-15.

The front 'Flexwrap' type band (1) encircles a drum attached to the secondary sun gear assembly. One end of the band is anchored against the abutment (2). The other end of the band engages a strut (4) between the band and the servo actuating lever (5).

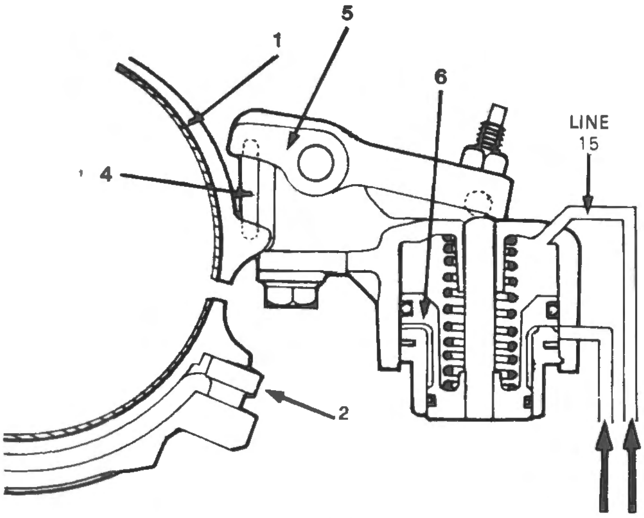


Fig. M-15

THE FRONT BAND AND SERVO

The front servo piston (6) exerts a force against the servo actuating lever which acts through the strut on to the end of the band. Under certain conditions, the servo is released by directing fluid pressure to the opposite side of the piston via line 15. This is the larger side of the servo piston and consequently a larger force can be produced. This, together with the release spring pressure will release the servo.

Refer Fig. M-16.

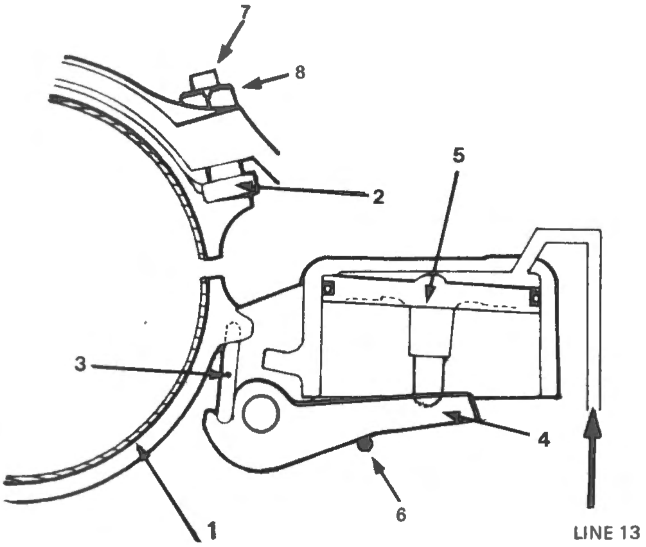


Fig. M-16

THE REAR BAND AND SERVO

The rear band (1) encircles a drum formed on the planet carrier. One end of the band contacts the adjusting screw head (2) in the transmission housing. The other end of the band engages a strut (3) between the band and the servo actuating lever (4).

The band is applied by the application of fluid pressure from line 13 to the piston (5) and released by means of a 'hairpin' spring (6). Band clearance is adjusted by adjusting screw (7) and locknut (8).

Band adjustments are covered in the 'Adjustments' section.

FRONT CLUTCH ASSEMBLY

Refer Fig. M-17.

The front clutch is operated by fluid pressure against the front clutch piston (1). The piston is moved against a diaphragm spring (2) which increases the 'apply' force through lever action to lock the multi-disc clutch.

The piston is returned to the release position by the diaphragm spring when fluid pressure is released.

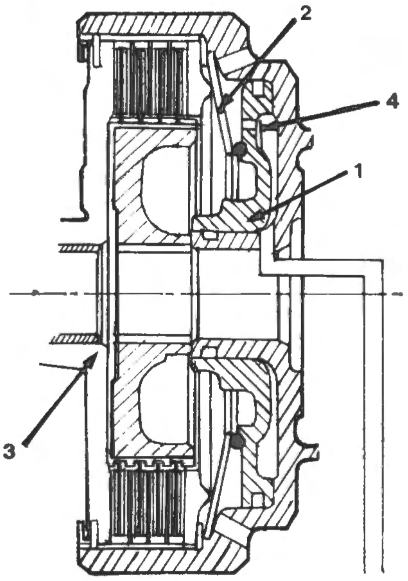


Fig. M-17

THE FRONT CLUTCH ASSEMBLY

1 PISTON
2 DIAPHRAGM SPRING
3 TRANSMISSION INPUT SHAFT (FLANGE ONLY SHOWN)
4 REED VALVE

In 'N' the front clutch drum and steel plates are being driven while the fibre faced plates are stationary.

In 'R' the clutch is not applied but both steel and fibre faced plates are being driven.

The front clutch piston is fitted with a ball type relief valve (4) to prevent oil remaining behind the piston and being acted on by centrifugal force which may tend to partly apply the clutch and so make it bind at high rpm in neutral or reverse.

When fluid pressure is applied behind the piston, the reed valve seats over a hole in the piston preventing loss of fluid. When fluid pressure is released, the reed valve springs slightly away from the hole thus allowing any oil remaining in the assembly to escape.

THE REAR CLUTCH ASSEMBLY

Refer Fig. M-18.

The rear clutch is operated by fluid pressure against the rear clutch piston (4) which compresses the return spring (1) and applies the clutch.

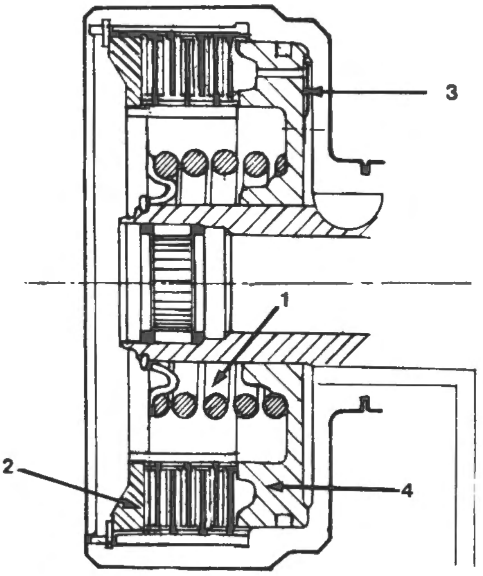


Fig. M-18

THE REAR CLUTCH ASSEMBLY

1	RETURN SPRING	3	REED VALVE
2	END PLATE	4	PISTON

In 'N' the fibre faced clutch plates are being driven while the steel plates are free. In intermediate the fibre faced plates are driven but the steel plates are stationary.

The rear clutch also incorporates a reed valve (3) to prevent the possibility of partial engagement at high rpm in low.

HYDRAULIC SYSTEM

The hydraulic system contains a pump of the internal/external gear type, picking up fluid from the oil reservoir through a pick up pipe and gauze strainer. Shift control is provided by a centrifugally operated hydraulic governor on the transmission output shaft. The governor works in conjunction with valves in the valve body assembly located in the base of the transmission. The valve body assembly regulates fluid pressure and directs it to appropriate transmission components.

Pump

The pump driven by two tangs on the torque converter is in operation whenever the engine is running and supplies all oil pressure requirements for the application of bands and clutches for the pressurising and circulation of the torque converter oil and for lubrication of the whole transmission.

Governor

Refer Figs. M-19-22.

The governor revolving with the output shaft is basically a pressure regulating valve which reduces line pressure to a valve that varies with output shaft (i.e. vehicle) speed. This variable pressure is utilized in the control system to effect up and down shifts through the 1-2 and 2-3 shift valves. Rotation of the governor at low speeds causes the governor weight and valve to produce a centrifugal force.

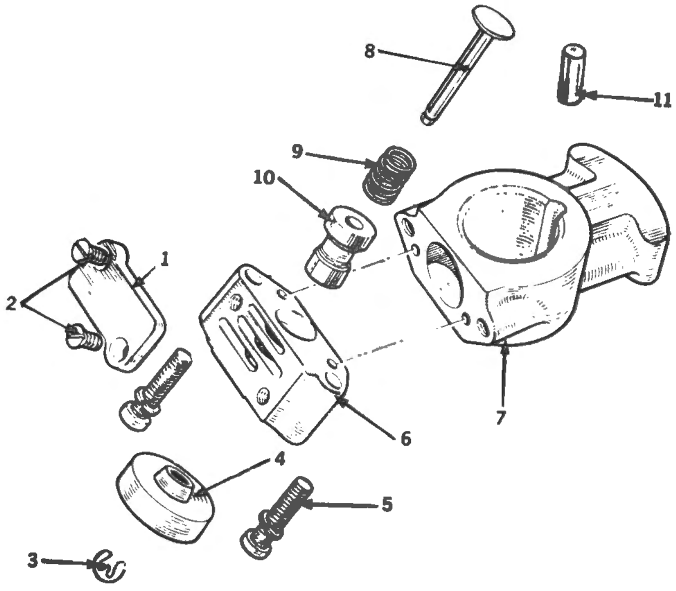


Fig. M-19

THE GOVERNOR COMPONENTS

1	COVER PLATE	7	COUNTER WEIGHT
2	COVER PLATE SCREWS	8	VALVE SPINDLE
3	CIRCLIP	9	SPRING
4	WEIGHT	10	VALVE
5	VALVE BODY SCREWS	11	DRIVE DOWEL
6	VALVE BODY		

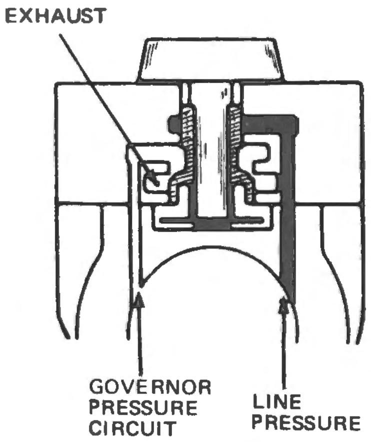


Fig. M-20

GOVERNOR AT REST. LINE PRESSURE IS BLANKED OFF BY THE GOVERNOR VALVE. THE GOVERNOR PRESSURE CIRCUIT IS OPEN TO EXHAUST

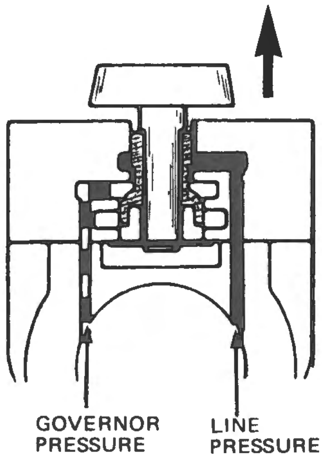


Fig. M-21

DURING ACCELERATION. CENTRIFUGAL FORCE HAS MOVED THE VALVE AND WEIGHT OUT. LINE PRESSURE IS ENTERING THE GOVERNOR PRESSURE CIRCUIT THUS INCREASING GOVERNOR PRESSURE. THE EXHAUST PORT IS BLANKED OFF BY THE GOVERNOR VALVE

This outward force is opposed by an equal and opposite hydraulic force produced by governor pressure acting upon a small area of the governor valve. Because the governor valve is a regulating valve and will attempt to remain in equilibrium, governor pressure will rise in accordance with the increase in centrifugal force caused by increased rotational speed.

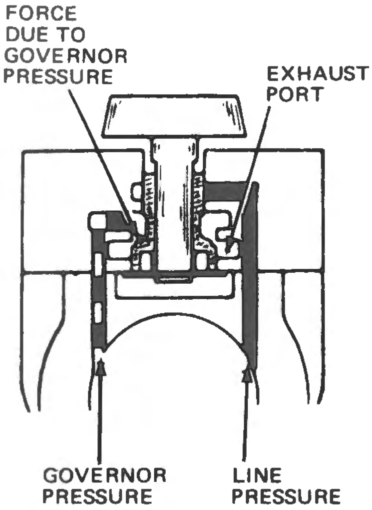


Fig. M-22

DURING DECELERATION. CENTRIFUGAL FORCE ON THE WEIGHT AND VALVE IS REDUCING. GOVERNOR PRESSURE ACTING ON THE SHOULDER OF THE VALVE CAN NOW OVERCOME CENTRIFUGAL FORCE ACTING ON THE VALVE AND CAUSE EXHAUSTING OF GOVERNOR PRESSURE UNTIL EQUILIBRIUM IS RESTORED

As speed increases, the governor weight moves outwards to a stop in the governor body when it can move no further. When this occurs a spring located between the weight and the governor valve becomes effective. The constant force of this spring then combines with the centrifugal force of the governor valve, the total then being opposed by governor pressure, thus rendering governor pressure less sensitive to output shaft speed variations.

Thus, the governor provides two distinct phases of regulation, the first being used for accurate control of the low-speed shift points.

Control System

The control system utilizes three basic types of valves; regulating valves, shuttle valves and a manual valve.

Pressure control is provided by the primary and secondary regulator valves, the former operating in conjunction with throttle pressure acting upon the spring end, and modulated throttle pressure acting on the opposite end.

Shift control is provided by 1-2 and 2-3 shift valves operated by governor pressure acting on one end, and throttle pressure acting on the spring end, line pressure acting upon differential areas providing shift speed hysteresis.

Manual control is provided by the manual valve, which according to the position of the selector, directs fluid to or provides an exhaust for clutch and servo pistons.

For ease of reference all lines in the hydraulic circuits are identified by numbers. Valves and other components are referred to by letters. Refer Fig. M-23.

Primary Regulator Valve (K)

This valve regulates line pressure (sometimes called control pressure) which serves to apply bands and clutches as required. Line pressure varies according to road speed and throttle opening.

Line pressure (line 1), operating on a small area of the valve can be decreased by modulated throttle pressure (8) (described later) operating on one end of the valve.

These forces are opposed by the primary regulator valve spring and throttle pressure (9) (described later) operating on the spring end of the valve. The line pressure thus produced varies with accelerator position as well as vehicle speed and provides the correct clutch and brake band capacity under all operating conditions. This line pressure (1) is directed to the manual valve and throttle valve.

Secondary Regulator Valve (I)

This is a regulating valve which controls the values of converter pressure (21) and lubrication (23) for the components of the gear train. Converter pressure operating on one end of the valve is opposed by spring force on the other end. When the pump capacity increases due to increased engine speed, the valve moves to open a port that directs fluid (24) to the sump.

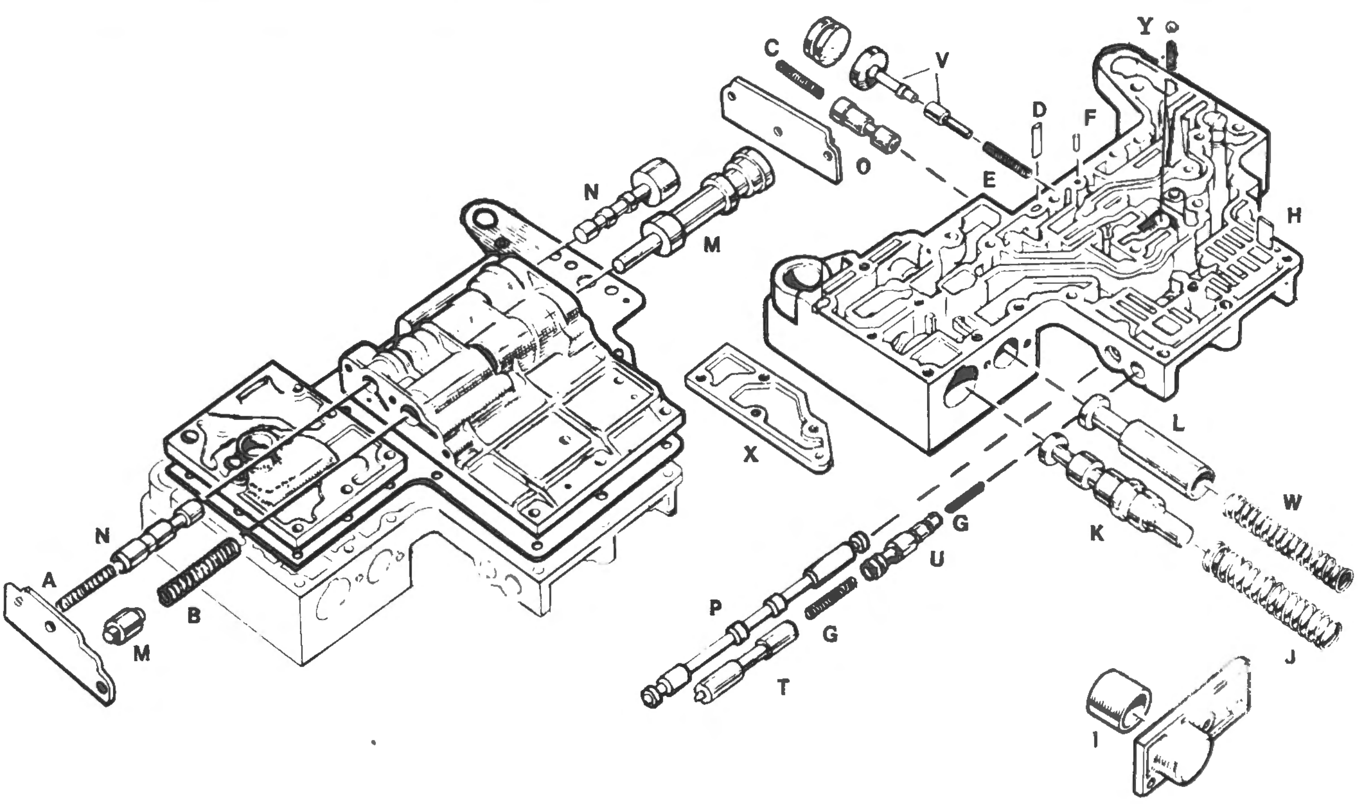


Fig. M-23

IDENTIFICATION OF VALVES AND ASSOCIATED COMPONENTS

A	1-2 SHIFT VALVE SPRING
B	2-3 SHIFT VALVE SPRING
C	ORIFICE CONTROL VALVE SPRING
D	ORIFICE CONTROL VALVE SPRING RETAINER
E	MODULATOR VALVE SPRING
F	MODULATOR VALVE RETAINER
G	THROTTLE VALVE SPRINGS
H	THROTTLE VALVE SPRING RETAINER
I	PRIMARY REGULATOR VALVE BUSH
J	PRIMARY REGULATOR VALVE SPRING
K	PRIMARY REGULATOR VALVE
L	SECONDARY REGULATOR VALVE
M	2-3 SHIFT VALVE AND PLUG
N	1-2 SHIFT VALVE
O	ORIFICE CONTROL VALVE
P	MANUAL VALVE
T	DOWNSHIFT VALVE
U	THROTTLE VALVE
V	MODULATOR VALVE AND PLUG
W	SECONDARY REGULATOR VALVE SPRING
X	BLANKING PLATE
Y	BALL CHECK VALVE 2-3 SHIFT VALVE

Downshift (T) and Throttle Valve (U)

The down-shift valve is connected to the carburetter linkage via a cable actuated cam. Movement of the down-shift valve compresses the throttle valve spring located between the down-shift valve and the throttle valve. This spring is opposed by the throttle return spring combined with throttle pressure (9) acting (at low vehicle speed) on one area of this regulating valve and at high vehicle speed on two areas (9 and 9A). Thus a throttle pressure is produced that is related to both engine torque and vehicle speed. This pressure (9) is directed to the spring end of the primary regulator valve to vary the basic line pressure (1) accordingly thus providing correct clutch and brake band pressure capacities and appropriate shift quality under all operating conditions.

Full movement of the down-shift valve, which is a shuttle valve directs throttle pressure (11) to additional areas on the shift valves to further delay up-shifts or effect 3-2 or 3-1 down-shift at pre-set maximum vehicle speeds.

Throttle pressure (9) is directed also to the 2-3 shift plunger, which at part-throttle openings reduces the value of throttle pressure by a fixed amount. This reduced pressure (10) is directed to the 1-2 and 2-3 shift valves to render the low speed shift points less sensitive to throttle pressure and therefore accelerator position.

Modulator Plug and Valve (V)

The modulator plug is a regulating valve that reduces throttle pressure (9) by a fixed amount. This modulated pressure (8) operating on one end of the plug, assisted by the modulator valve spring, is opposed by throttle pressure (9) operating on the opposite end. Modulated throttle pressure (8) is directed to the primary regulator valve to vary the rate of increase of line pressure (1) relative to throttle pressure.

The modulator valve is a shuttle valve. Governor pressure (2) operating on the large end is opposed by the modulator valve spring. As governor pressure rises the valve moves, preventing the plug from regulating and modulated throttle pressure (8) then becomes equal to throttle pressure (9). However, this movement directs throttle pressure (9 and 9A) to a second area of the throttle valve, opposing throttle valve spring force. This arrangement permits high throttle and line pressure under stall (and high throttle) conditions with a reduction in these pressures after 'cut-back'.

Servo Orifice Control Valve (O)

A common line (15) supplies fluid to or exhausts fluid from the rear clutch and the release area of the front servo to effect the 2-3 and 3-2 shifts.

The servo orifice control valve is a shuttle valve interposed in the front servo release circuit. Governor pressure (2) operating on an area of the valve is opposed by the valve spring. At a 2-3 shift with low governor pressure, (i.e. low vehicle speed), fluid goes without restriction to the release side of the front servo piston. At a 2-3 shift with higher governor pressure, however, the valve moves and fluid is directed through an orifice to this side of the piston.

During up-shifts, with the servo orifice in circuit, the front band does not release too quickly relative to rear clutch engagement thus avoiding 'run-up' during the transition from 2 to 3. During down-shifts the orifice in circuit ensures that the front band does not engage before the rear clutch releases, thus avoiding 'tie-up' on the 3-2 shift.

The servo orifice control valve, therefore, affects the relationship between the rear clutch and front servo to provide correct shift timing under all operating conditions.

1-2 Shift Valve and Plunger (N)

Both are shuttle valves and operate in unison in 'D' selector position. Governor pressure (2), operating on the large end of the valve is opposed by reduced throttle pressure (10, 10A) from the 2-3 shift plunger as well as the spring operating on the opposite end of the plunger. When governor force exceeds the spring force, the valve moves to the second gear position and line pressure (5) is directed to the apply side of the front servo piston (19). Movement of the valve also introduces line pressure (5) to a differential area on the valve to further assist governor force. This allows the 2-1 down-shift to occur at a lower speed than the 1-2 up-shift. The difference between the up-shift and down-shift speed is known as 'shift point hysteresis'. When governor pressure plus line pressure are less than the spring force combined with the reduced throttle pressure force, the valve moves to the first gear position and the apply side of the front servo (19) is opened to exhaust.

In '1' with low governor pressure (2), the valve also moves to the first gear position; line pressure (6) thus directed to the rear servo (13) latches the valve hydraulically in the first gear position, preventing an up-shift.

2-3 Shift Valve and Plunger (M)

The 2-3 shift valve plunger is a regulating valve that reduces the value of throttle pressure (9) by a fixed amount and therefore is inoperative when throttle pressure is below this fixed amount. Throttle pressure (9) operating on one end of the plunger is opposed by this reduced throttle pressure (10) and the 2-3 shift valve spring located between the plunger and valve. This reduced pressure is directed to the 2-3 shift valve and the 1-2 shift plunger as described under 'down-shift valve and throttle valve'.

The 2-3 shift valve is a shuttle valve. In the second gear position and before the plunger begins regulating, governor pressure (2) operating on the large end of the valve is opposed by line pressure (3) operating on an area of this valve as well as the 2-3 shift valve spring. Once the plunger begins regulating, the spring no longer exerts force on the valve but relays the force of the plunger to the valve. Under these conditions, governor pressure (2) operating on the large end of the valve, reduced throttle pressure (10) operating on the small end of the valve and throttle pressure (9) operating on the end of the plunger. This last force is relayed to the 2-3 shift valve by the valve spring.

Movement of the shift valve to the third gear position directs fluid via the common line (15) to the rear clutch, and via the servo orifice control valve to the release side of the front servo. This pressure causes the rear clutch to be applied. In addition, because the release area of the front servo is larger than the apply area it causes the front band to be released. The movement also results in an area of the valve being no longer subjected to line pressure (3); this prevents regulation of the plunger forced to the end of the valve bore. Thus reduced throttle pressure (10) is replaced by throttle pressure (9). This change in forces effects the shift point hysteresis and causes the 3-2 shift point to occur at a lower governor pressure (i.e. vehicle speed) than the 2-3 up-shift.

When the manual valve is moved to the '1' position, line pressure (15) which was directed to the 2-3 shift valve and consequently to the rear clutch and front servo release is exhausted through a port at the opposite end of the manual valve collar. This inevitably results in an immediate down-shift to second gear regardless of the position of the 2-3 shift valve and no third gear is possible. The ball check valve 'Y' fitted in line 3 permits a quicker release of the rear clutch and front servo release when selecting '2' or '1' from 'D'.

In 'R' line pressure (7) is directed to an area of the shift valve, latching it hydraulically and hence to the rear clutch and front servo release (15).

Manual Control Valve (P)

This valve actuated by movement of the selector, directs line pressure to or exhausts from the appropriate valves or components in accordance with control requirements.

Park

Movement of the selector mechanically engages the parking pawl with the externally toothed ring gear on the output shaft, effectively immobilizing the vehicle. No fluid is directed to the front clutch or 2-3 shift valve for the rear clutch, therefore the gear set is disconnected from the converter and no engine power is transmitted to the rear wheels. Because of the arrangement of the manual control valve ports for other selector positions, line pressure (6) is directed to the rear servo (13).

Reverse

Line pressure (6) is directed to the rear servo (13) via the 1-2 shift valve and also (7) to the rear clutch (15) via the 2-3 shift valve. No pressure is directed to the governor.

Neutral

Both clutches and servos are exhausted because circuits (3) and (5) are open to a port nearest to the manual valve collar. Therefore, the gear train is disconnected from the converter and no engine power is transmitted to the wheels.

Drive

Line pressure (5) is directed to the front clutch, governor and 1-2 shift valve. Line pressure is directed also to the 2-3 shift valve (3).

'1'

Line pressure (5) is directed to the front clutch, governor and 1-2 shift valves so that second gear is available.

No line pressure is directed to the 2-3 shift valve, therefore up-shifts to third gear cannot occur. When in first gear, line pressure (6) is directed to a differential area of the 1-2 shift valve (to lock it in position) and then to the rear servo (13).

'2'

Line pressure (5) is directed to the front clutch, governor and 1-2 shift valve. No line pressure is directed to the 2-3 shift valve, therefore up-shifts to third gear cannot occur. 1-2 and 2-1 shifts occur as in 'D'.

Identification of Valves

Fig. M-23 shows the location of the valves and associated components.

HYDRAULIC CIRCUITS

The following series of hydraulic circuits indicate the distribution of line pressure, converter pressure, throttle, governor and lubrication pressure in each ratio and selector position.

TABLE OF HYDRAULIC LINES

Circuit No.	Name of pressure	From	To
1	Line pressure	Pump	Primary regulator valve Manual control valve Throttle valve
2	Governor pressure	Governor	Modulator valve according to road speed 1-2 shift valve 2-3 shift valve
3	Directed line pressure	Manual control valve	2-3 shift valve
5	Directed line pressure	Manual control valve	Front clutch and governor feed in '1', '2' and 'D' 1-2 shift valve
6	Directed line pressure	Manual control valve	1-2 shift valve in '1', 'R' and 'P'
7	Directed line pressure	Manual control valve	2-3 shift valve in 'R'
8	Modulated throttle pressure	Modulator valve	Primary regulator valve (piston end)
9	Throttle pressure	Throttle valve	Modulator valve Primary regulator valve (spring end) 2-3 shift valve and shift valve plug
9A	Throttle pressure controlled by modulator valve	Modulator valve	Throttle valve doubles throttle pressure before cut-back and increases line pressure under part-throttle acceleration
10	Shift valve plunger pressure	Shift valve plunger	2-3 shift valve 1-2 shift valve
10A	Shift valve plunger pressure	Shift valve plunger	1-2 shift valve in first ratio only
11	Forced throttle pressure	Down-shift valve	1-2 shift valve 2-3 shift valve
13	Line pressure	1-2 shift valve	Rear servo apply
15	Line pressure	2-3 shift valve	Rear clutch and front servo release
19	Line pressure	1-2 shift valve	Front servo apply Front servo release through servo orifice or valve
21	Converter pressure	Primary regulator valve	Secondary regulator valve and converter
23	Lubrication pressure	Secondary regulator valve	Sump
24	Exhaust	Secondary regulator valve	Sump

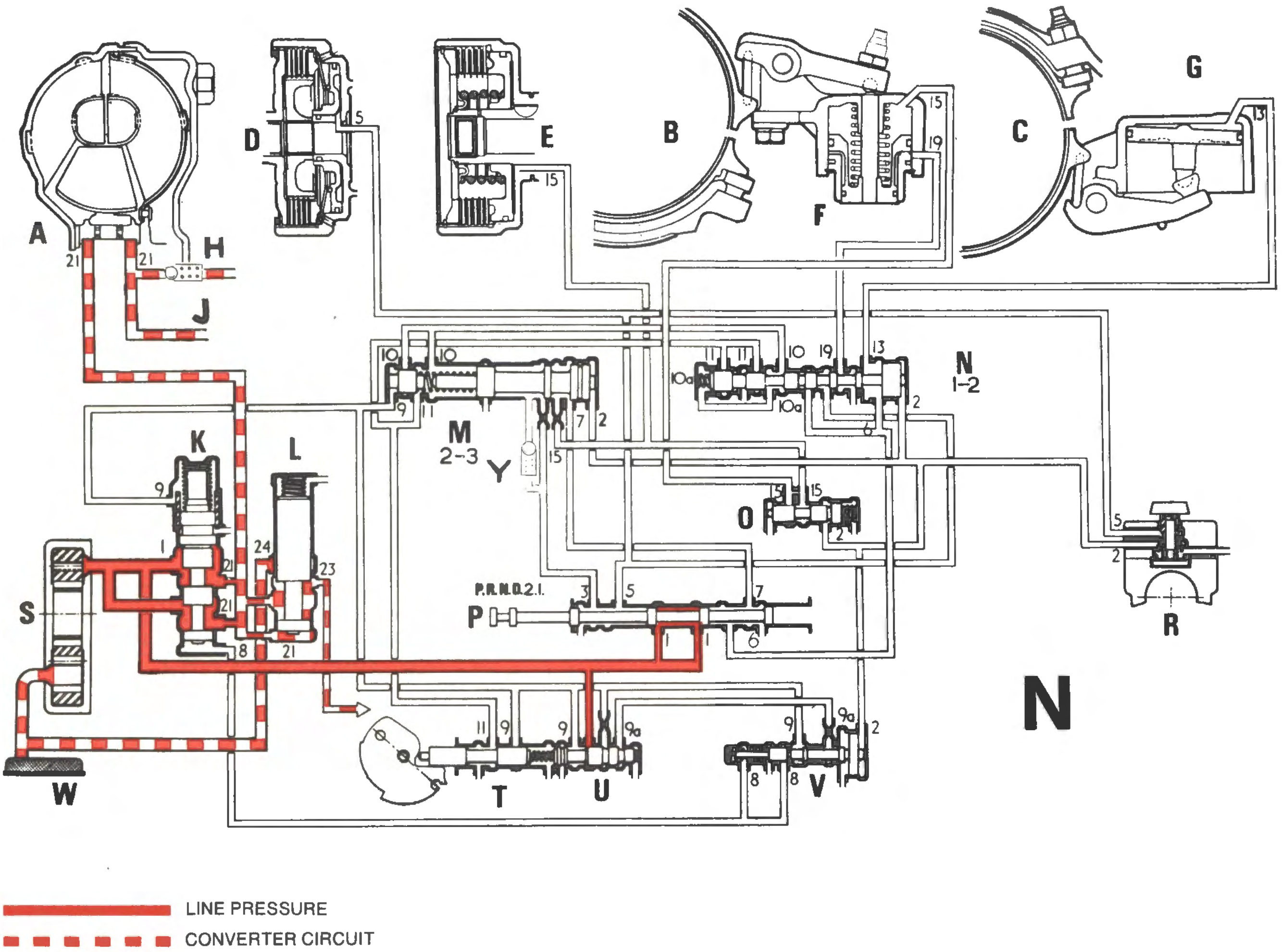


Fig. M-24

OPERATION IN 'N' — ENGINE IDLING

A	CONVERTER	H	LUBRICATION VALVE	R	GOVERNOR
B	FRONT BAND	K	PRIMARY REGULATOR VALVE	S	PUMP
C	REAR BAND	L	SECONDARY REGULATOR VALVE	T	DOWNSHIFT VALVE
D	FRONT CLUTCH	M	2-3 SHIFT VALVE	U	THROTTLE VALVE
E	REAR CLUTCH	N	1-2 SHIFT VALVE	V	MODULATOR VALVE
F	FRONT SERVO	O	SERVO ORIFICE CONTROL VALVE	W	STRAINER
G	REAR SERVO	P	MANUAL VALVE	Y	BALL CHECK VALVE 2-3
				J	TO OIL COOLER

'N' — Neutral

With the engine running, the primary regulator valve regulates line pressure (1) which is directed to the manual valve and throttle valve. It also permits fluid to reach the secondary regulator valve.

The secondary regulator valve regulates pressure to the converter and lubrication feed to the input end of the gear train (21). Identical pressure (23) is directed to the output end of the gear train. The valve returns excess flow (24) to the oil reservoir.

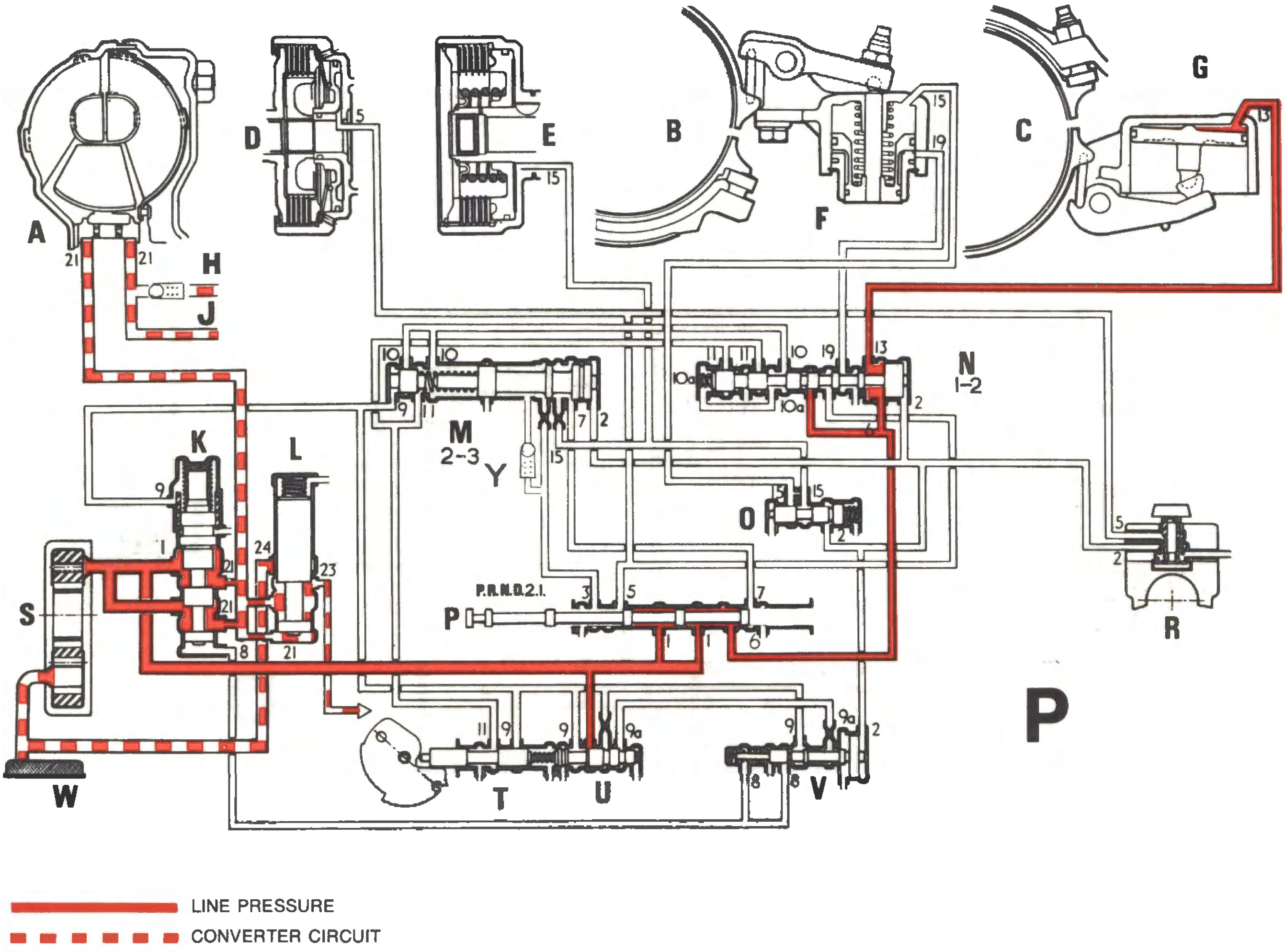


Fig. M-25

OPERATION IN 'P' — ENGINE IDLING

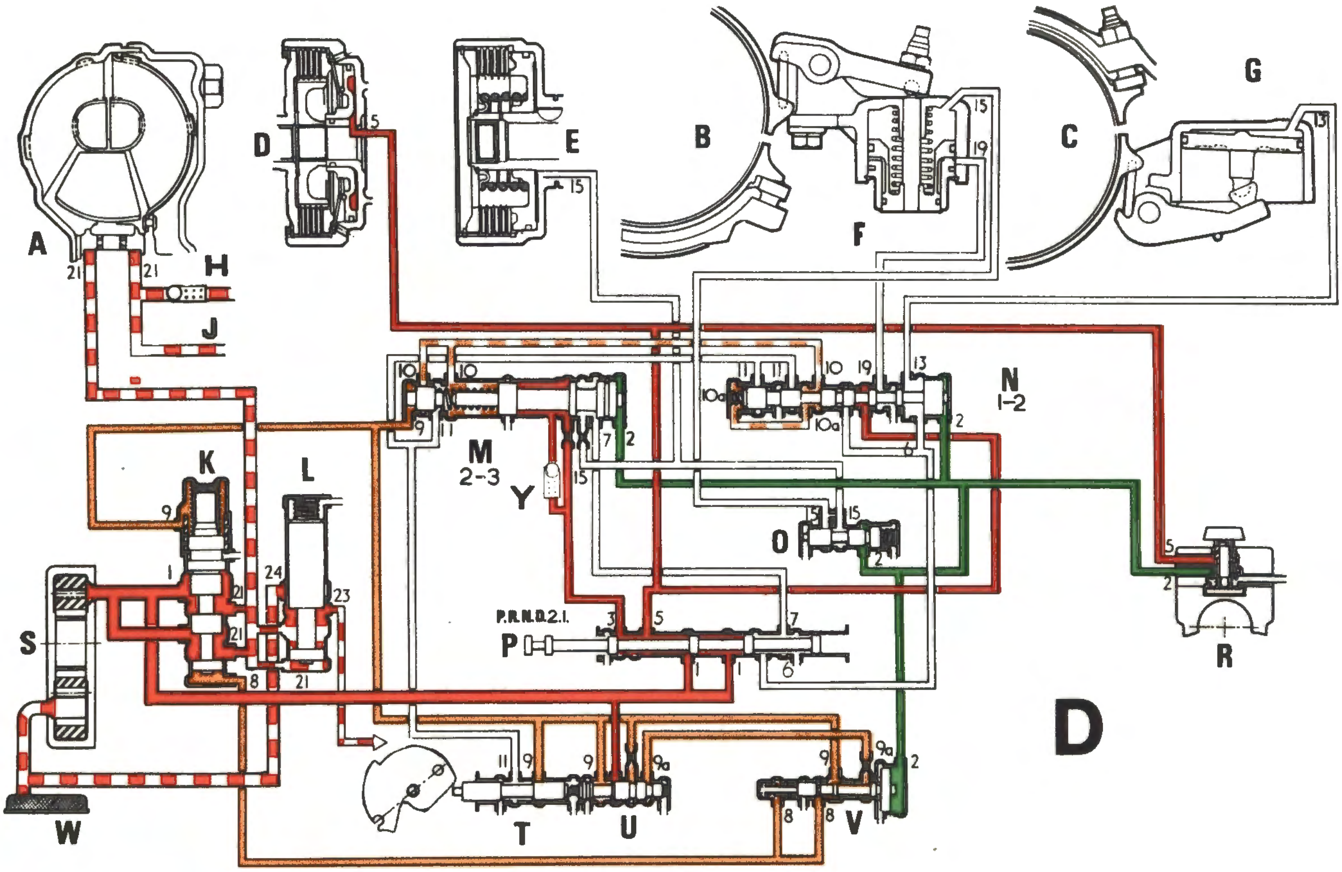
A	CONVERTER
B	FRONT BAND
C	REAR BAND
D	FRONT CLUTCH
E	REAR CLUTCH
F	FRONT SERVO
G	REAR SERVO
H	LUBRICATION VALVE
J	TO OIL COOLER
K	PRIMARY REGULATOR VALVE
L	SECONDARY REGULATOR VALVE
M	2-3 SHIFT VALVE
N	1-2 SHIFT VALVE
O	SERVO ORIFICE CONTROL VALVE
P	MANUAL VALVE
R	GOVERNOR
S	PUMP
T	DOWNSHIFT VALVE
U	THROTTLE VALVE
V	MODULATOR VALVE
W	STRAINER
Y	BALL CHECK VALVE 2-3

'P' — Park

Engages the parking pawl with teeth formed on the output shaft ring gear.

With the engine running, the operation of the hydraulic system is identical to 'N' except that the manual valve directs line pressure (6) to the rear servo (13).

This arrangement is based on the design of the manual valve without the rear servo or band performing any function in this selector position.



🟥 LINE PRESSURE

▬ ▬ ▬ CONVERTER CIRCUIT

🟧 THROTTLE PRESSURE

▬ ▬ ▬ REDUCED THROTTLE PRESSURE

🟩 GOVERNOR PRESSURE

Fig. M-26

OPERATION IN 'D' — LOW RATIO
(FULL THROTTLE)

A	CONVERTER	H	LUBRICATION VALVE	P	MANUAL VALVE
B	FRONT BAND	J	TO OIL COOLER	R	GOVERNOR
C	REAR BAND	K	PRIMARY REGULATOR VALVE	S	PUMP
D	FRONT CLUTCH	L	SECONDARY REGULATOR VALVE	T	DOWNSHIFT VALVE
E	REAR CLUTCH	M	2-3 SHIFT VALVE	U	THROTTLE VALVE
F	FRONT SERVO	N	1-2 SHIFT VALVE	V	MODULATOR VALVE
G	REAR SERVO	O	SERVO ORIFICE CONTROL VALVE	W	STRAINER
				Y	BALL CHECK VALVE 2-3

'D' — Drive (Low Ratio)

Pressure control is as in 'R' but, with the throttle valve in the full-throttle position as illustrated, throttle pressure (9) regulated by the modulator valve plunger (8), acts on the primary regulator valve opposing throttle pressure (9) thus modulating line pressure in the interests of shift quality.

The manual valve directs line pressure (5) to the front clutch, governor feed and 1-2 shift valve for the subsequent 1-2 shift. Line pressure (3) also reaches the 2-3 shift valve for the subsequent 2-3 shift.

The front clutch thus applied in conjunction with the one-way clutch permits the car to move off from rest in first gear.

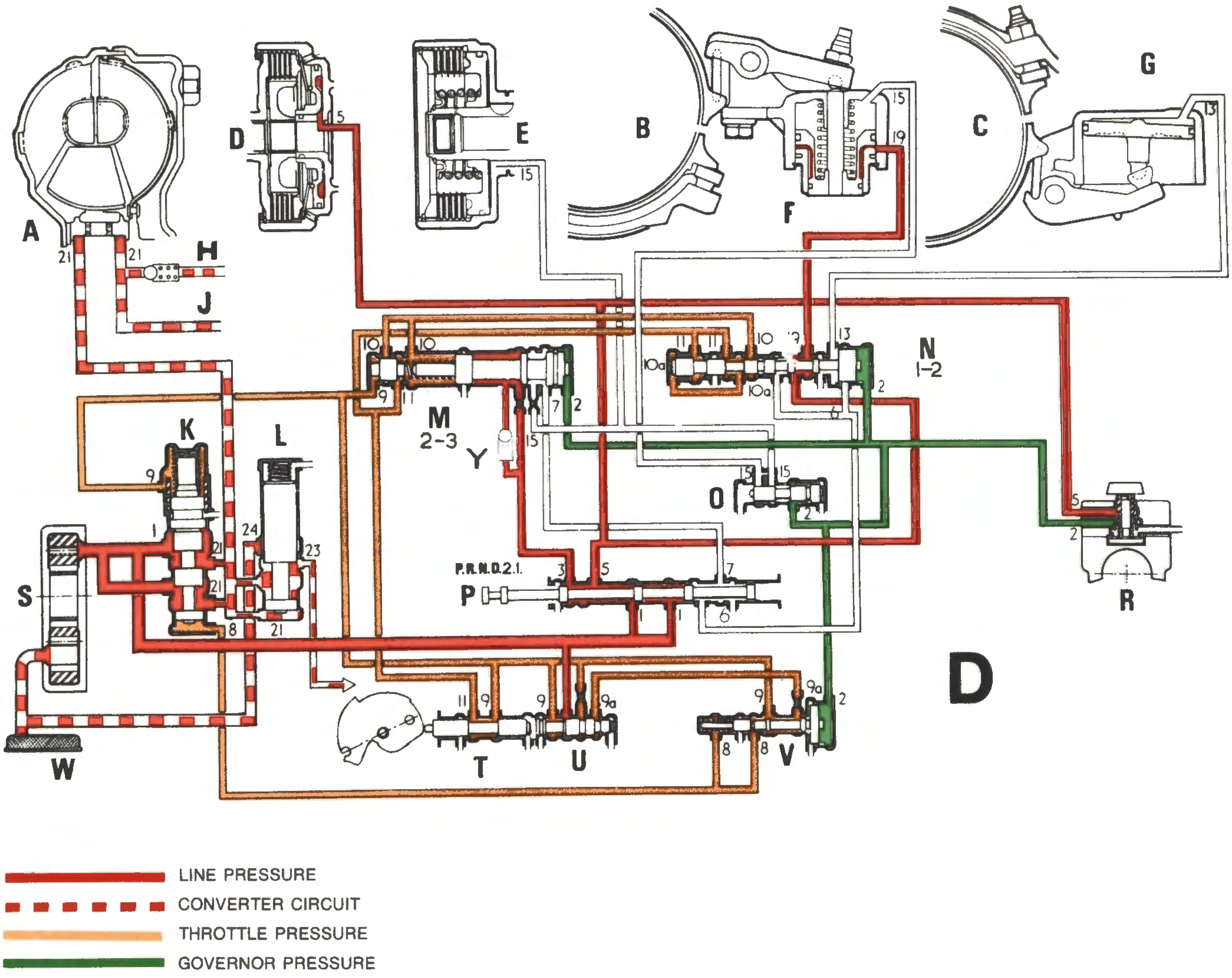


Fig. M-27

OPERATION IN 'D' — INTERMEDIATE RATIO
(KICKDOWN CONDITION)

A	CONVERTER	H	LUBRICATION VALVE	P	MANUAL VALVE
B	FRONT BAND	J	TO OIL COOLER	R	GOVERNOR
C	REAR BAND	K	PRIMARY REGULATOR VALVE	S	PUMP
D	FRONT CLUTCH	L	SECONDARY REGULATOR VALVE	T	DOWNSHIFT VALVE
E	REAR CLUTCH	M	2-3 SHIFT VALVE	U	THROTTLE VALVE
F	FRONT SERVO	N	1-2 SHIFT VALVE	V	MODULATOR VALVE
G	REAR SERVO	O	SERVO ORIFICE CONTROL VALVE	W	STRAINER
				Y	BALL CHECK VALVE 2-3

'D' — Drive (Intermediate Ratio)

Pressure control is as in 'D' (low ratio) with modulated throttle pressure (8) acting on the primary regulator valve.

Shift control is provided by the 1-2 shift valve moving against spring pressure under the influence of governor pressure (2). This permits line pressure (5) to reach the apply side of the front servo (19). The front band thus applied in conjunction with the front clutch provides second gear.

With the down-shift valve in the forced throttle position as illustrated, forced throttle pressure (11) acts on the 1-2 and 2-3 shift valves in addition to throttle pressure (10), thus further delaying up-shifts or providing a 2-1 down-shift at speeds when there is little governor pressure (2).

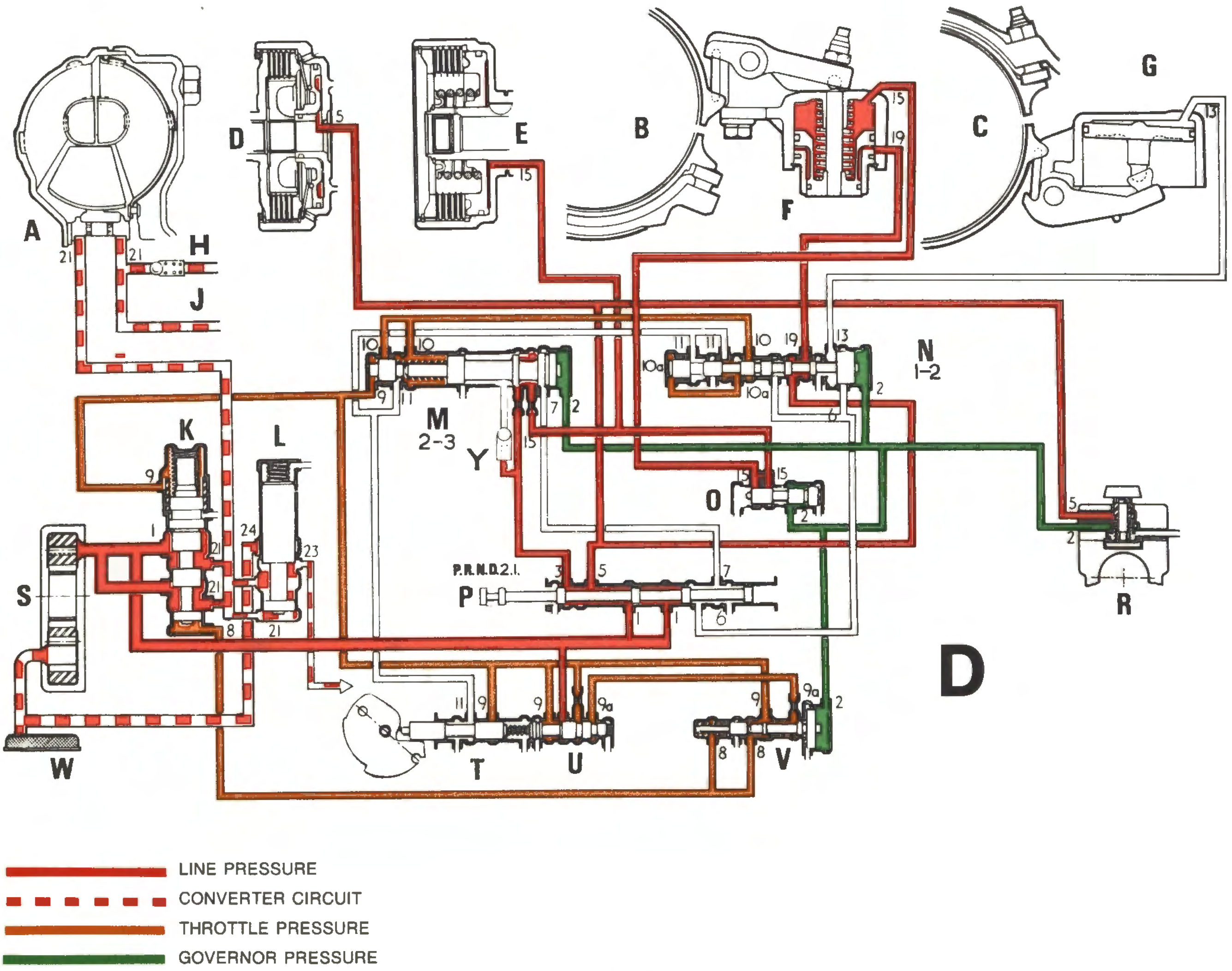


Fig. M-28

OPERATION IN 'D' — HIGH RATIO
(CLOSED THROTTLE)

A	CONVERTER	H	LUBRICATION VALVE	P	MANUAL VALVE
B	FRONT BAND	J	TO OIL COOLER	R	GOVERNOR
C	REAR BAND	K	PRIMARY REGULATOR VALVE	S	PUMP
D	FRONT CLUTCH	L	SECONDARY REGULATOR VALVE	T	DOWNSHIFT VALVE
E	REAR CLUTCH	M	2-3 SHIFT VALVE	U	THROTTLE VALVE
F	FRONT SERVO	N	1-2 SHIFT VALVE	V	MODULATOR VALVE
G	REAR SERVO	O	SERVO ORIFICE CONTROL VALVE	W	STRAINER
				Y	BALL CHECK VALVE 2-3

'D' — Drive (High Ratio)

Pressure control is as in 'D' (intermediate ratio), except that in the throttle valve position shown (minimum throttle) no throttle pressure or modulated throttle pressure acts on the two ends of the primary regulator valve.

Shift control is provided by the 2-3 shift valve moving against spring pressure under the influence of governor pressure (2). This permits line pressure (3) to reach the rear clutch, direct (15) together with front servo release pressure directed through the servo orifice control valve. When governor pressure (2) is apparent, the servo orifice control valve closes, forcing front servo release pressure through a regulating orifice which affects the relationship between rear clutch apply and front servo release in accordance with road speed.

Because the release side of the front servo has a larger area than the apply side, the front servo will disengage the band. The rear clutch now engaged in conjunction with the front clutch provides third gear.

The absence of throttle pressure as mentioned above, will cause the 2-3 shift valve to move early under the influence of governor pressure, thus providing a low speed 2-3 shift.

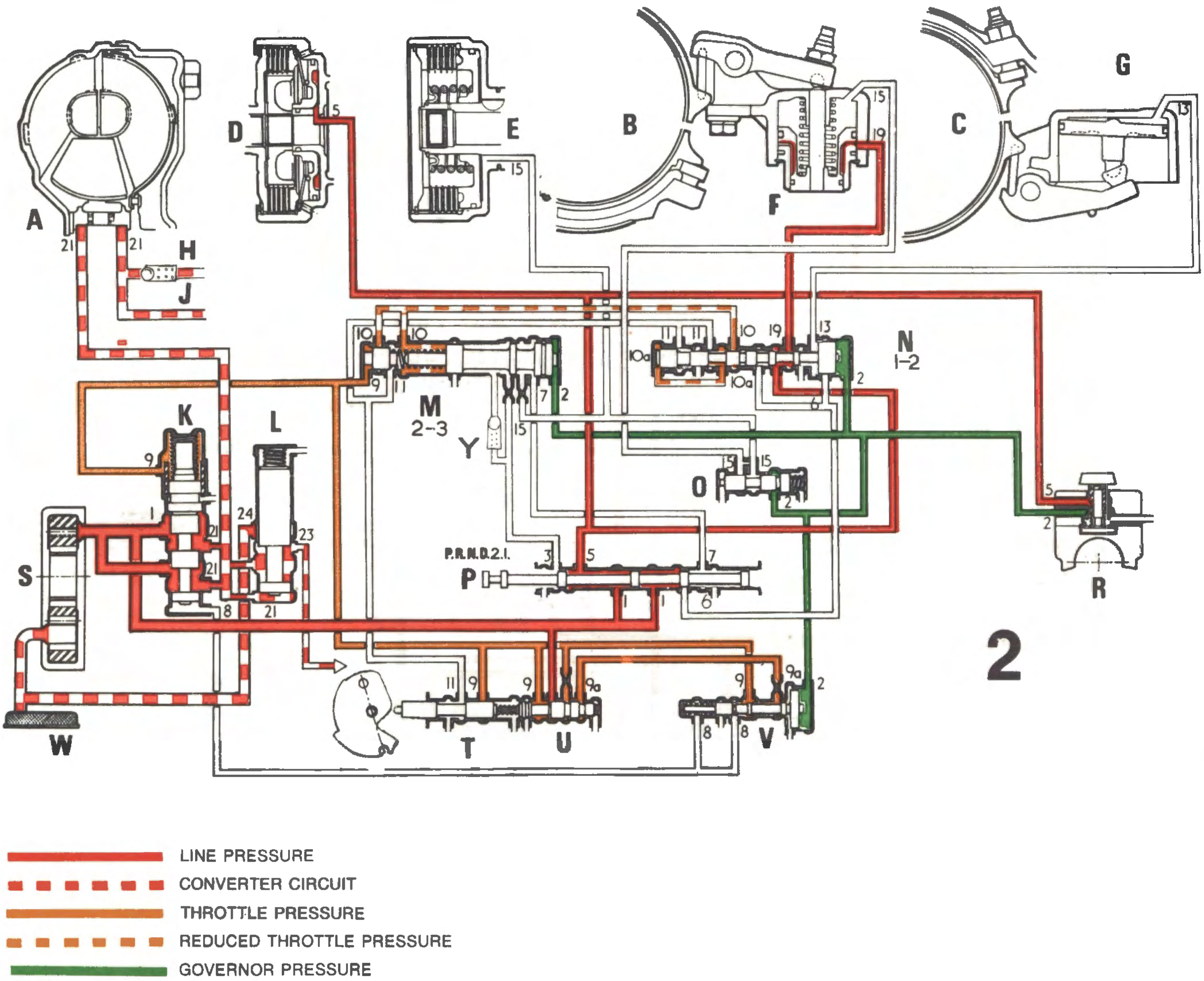


Fig. M-29

OPERATION IN '2' — INTERMEDIATE
RATIO SHOWN
(MEDIUM THROTTLE)

A	CONVERTER	H	LUBRICATION VALVE	P	MANUAL VALVE
B	FRONT BAND	J	TO OIL COOLER	R	GOVERNOR
C	REAR BAND	K	PRIMARY REGULATOR VALVE	S	PUMP
D	FRONT CLUTCH	L	SECONDARY REGULATOR VALVE	T	DOWNSHIFT VALVE
E	REAR CLUTCH	M	2-3 SHIFT VALVE	U	THROTTLE VALVE
F	FRONT SERVO	N	1-2 SHIFT VALVE	V	MODULATOR VALVE
G	REAR SERVO	O	SERVO ORIFICE CONTROL VALVE	W	STRAINER
				Y	BALL CHECK VALVE 2-3

'2' — (Intermediate and Low Ratio available)

In this selector position, the manual valve directs line pressure as in 'D' range with the exception that line (3) is no longer fed.

Because of this, no pressure is available for the application of the rear clutch and front servo release as would be the case in 'D' when the 2-3 shift valve moves to the third gear position. The operation of the hydraulic circuit is identical to that occurring in 'D' with the exception that third ratio is not available.

The circuit above shows operation in the intermediate ratio condition.

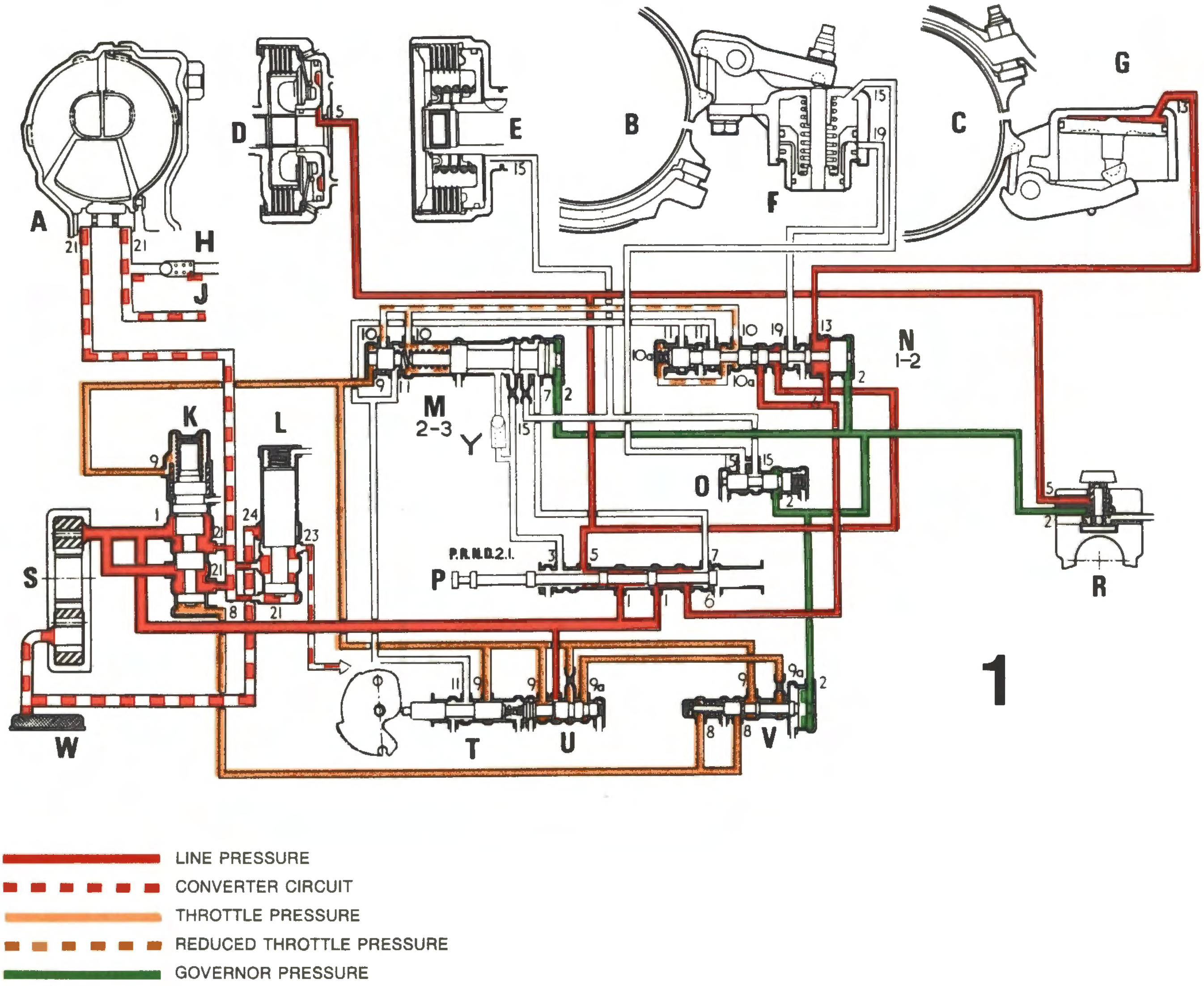


Fig. M-30

OPERATION IN '1' — LOW RATIO SHOWN
(MEDIUM THROTTLE)

A	CONVERTER	H	LUBRICATION VALVE	P	MANUAL VALVE
B	FRONT BAND	J	TO OIL COOLER	R	GOVERNOR
C	REAR BAND	K	PRIMARY REGULATOR VALVE	S	PUMP
D	FRONT CLUTCH	L	SECONDARY REGULATOR VALVE	T	DOWNSHIFT VALVE
E	REAR CLUTCH	M	2-3 SHIFT VALVE	U	THROTTLE VALVE
F	FRONT SERVO	N	1-2 SHIFT VALVE	V	MODULATOR VALVE
G	REAR SERVO	O	SERVO ORIFICE CONTROL VALVE	W	STRAINER
				Y	BALL CHECK VALVE 2-3

'1' — Lock-up

Pressure control is as in 'D'. The manual valve directs line pressure (5) to the front clutch and governor feed and 1-2 shift valve. In the condition illustrated the 1-2 shift valve is subjected to insufficient governor pressure (2) to overcome spring pressure. The result is that the valve prevents line pressure (5) from reaching the apply side of the front servo, but pressure (6) is open to the rear servo (13).

The manual valve opens to exhaust the rear clutch and front servo release circuit from the 2-3 shift valve. This causes a down-shift from third gear whenever '1' is selected at speed. In this condition governor pressure (2) will have moved the 1-2 shift valve over, the result being that line pressure (6) will be blocked from the rear servo (13) but open (5) to the apply side of the front servo (19) as in 'D' — intermediate ratio.

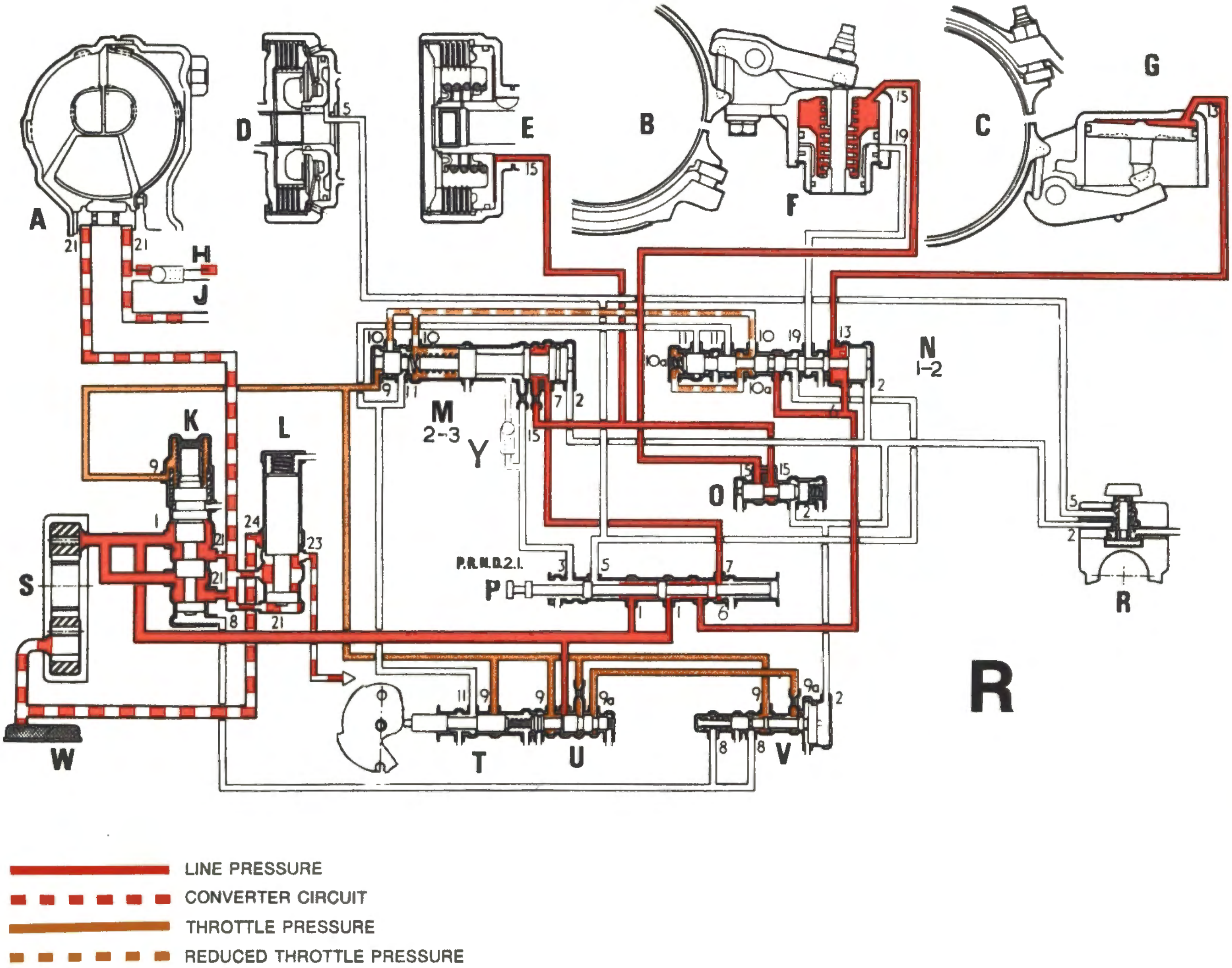


Fig. M-31

OPERATING IN 'R' — LIGHT THROTTLE OPENING

A	CONVERTER	H	LUBRICATION VALVE	P	MANUAL VALVE
B	FRONT BAND	J	TO OIL COOLER	R	GOVERNOR
C	REAR BAND	K	PRIMARY REGULATOR VALVE	S	PUMP
D	FRONT CLUTCH	L	SECONDARY REGULATOR VALVE	T	DOWNSHIFT VALVE
E	REAR CLUTCH	M	2-3 SHIFT VALVE	U	THROTTLE VALVE
F	FRONT SERVO	N	1-2 SHIFT VALVE	V	MODULATOR VALVE
G	REAR SERVO	O	SERVO ORIFICE CONTROL VALVE	W	STRAINER
				Y	BALL CHECK VALVE 2-3

'R' — Reverse

Pressure control of the pump is as in 'P' or 'N' but in accordance with accelerator pedal depression, throttle pressure (9) is directed to the spring end of the primary regulator valve thus increasing line pressure (1) in accordance with torque capacity requirements.

The manual valve directs line pressure (6) through the 1-2 shift valve to the rear servo (13) and line pressure (7) through the 2-3 shift valve to the rear clutch and front servo release (15). Due to the absence of governor pressure, the shift valves and servo orifice control valve performs no function in this selector position. The fluid passages (13) and (15) from the manual valve are utilized in 'R' to simplify the hydraulic circuit.

NOTE: 8 cylinder models only.

In the transmission fitted to the 8 cylinder models, a mechanism is situated on the lower valve body to increase line pressure on initial engagement of reverse ratio.

As reverse is selected the reverse boost cam comes into contact with a pin located on the side of the throttle valve cam. This pin rides up onto the peak of the cam, rotating the throttle valve cam against spring tension, applying increased throttle pressure to the primary regulator valve thereby increasing line pressure. This increase in line pressure overcomes any tendency for transmission slip at low engine speed.

As the throttle opening is increased, the throttle valve cable gradually overtakes the reverse boost cam to further increase throttle valve pressure in accordance with torque requirements.

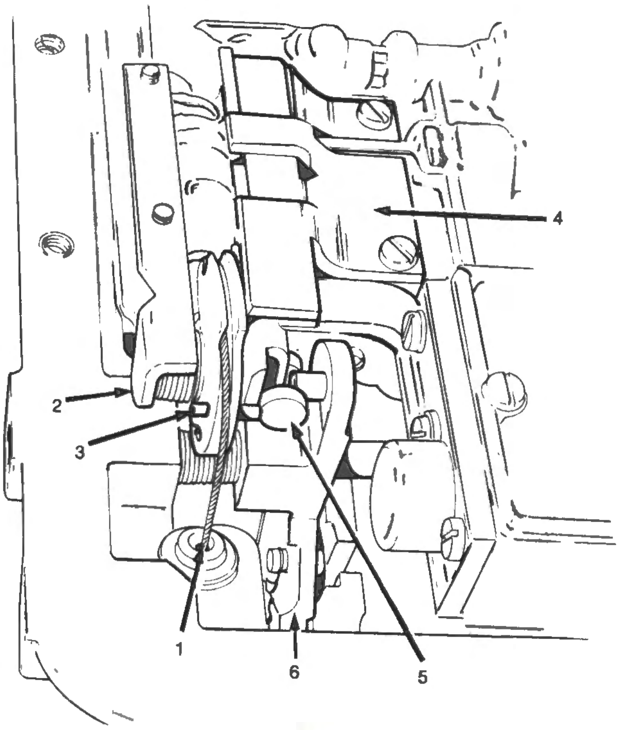


Fig. M-31A

REVERSE PRESSURE BOOST MECHANISM (8-CYLINDER MODELS)

1	THROTTLE CABLE
2	DOWNSHIFT AND THROTTLE VALVE CAM ASSEMBLY
3	ROLL PIN
4	REVERSE BOOST CAM ASSEMBLY
5	MANUAL VALVE
6	MANUAL DEDENT LEVER (REVERSE) SELECTED

TESTING AND DIAGNOSIS

TEST SPECIFICATIONS

SHIFT PATTERN
6 CYLINDER

Throttle Position	Selector Position	1-2 Shift	2-3 Shift	3-2 Shift	3-1 Shift	2-1 Shift
Minimum	D	9-19 km/h (6-12 mph)	13-23 km/h (8-14 mph)	—	8-14 km/h (5-9 mph)	—
Kickdown	D	58-72 km/h (36-45 mph)	96-110 km/h (60-69 mph)	82-96 km/h (51-60 mph)	42-55 km/h (26-34 mph)	42-55 km/h (26-34 mph)
Zero	1	—	—	—	—	17-33 km/h (11-21 mph)
Minimum	2	9-19 km/h (6-12 mph)	—	—	—	17-33 km/h (11-21 mph)
Kickdown	2	58-72 km/h (36-45 mph)	—	—	—	42-55 km/h (26-34 mph)

8 CYLINDER

Minimum	D	14-19 km/h (9-12 mph)	19-24 km/h (12-15 mph)	—	8-14 km/h (5-9 mph)	—
Kickdown	D	61-72 km/h (38-45 mph)	104-115 km/h (65-74 mph)	85-99 km/h (53-62 mph)	38-53 km/h (24-33 mph)	38-53 km/h (24-33 mph)
Zero	1	—	—	—	—	19-33 km/h (12-21 mph)
Minimum	2	14-19 km/h (9-12 mph)	—	—	—	19-33 km/h (12-21 mph)
Kickdown	2	61-72 km/h (38-45 mph)	—	—	—	38-53 km/h (24-33 mph)

TRANSMISSION LINE PRESSURES
6 CYLINDER

Selector Position	Engine Idling	Max Pressure at Stall	Max Pressure after cutback
All Positions	344-455 kPa (50-66 psi)	1310-1655 kPa (190-240 psi)	550-725 kPa (80-105 psi)

8 CYLINDER

ALL POSITIONS except 'R'	400-510 kPa (58-74 psi)	1310-1585 kPa (190-230 psi)	760-895 kPa (110-130 psi)
'R'	620-895 kPa (90-130 psi)	—	—

The above pressures are for transmissions at normal operating temperature 104°C (220°F).

IDLING SPEED	6 CYLINDER MODELS 550 rpm in 'N' or 'P'.	8 CYLINDER MODELS 700 rpm in 'N' or 'P'.

ROAD TEST PROCEDURE

In order to isolate and determine faults it is essential to gain as much information as possible on the precise nature of any defective performance and to follow test procedure through to completion before any dismantling is attempted. This applies particularly to road testing, stall testing, pressure testing etc.

One hour spent in diagnosing the problem correctly may save doing the job twice at high cost or unnecessary replacement of parts or assemblies.

Look for the easy things first — they are usually the cause of the trouble (e.g. oil level, external adjustments etc.).

Ensure engine and transmission are at normal running temperature before commencing tests.

Stationary Tests

1. Check operation of starter which should occur only in 'P' and 'N'.
2. Check that reverse lights operate only in 'R'.
3. Select 'N-D', 'N-2', 'N-1' and 'N-R'. Transmission engagement should be felt with each selection.
4. Select 'N' and ensure that 'creep' does not occur either at idling or at faster engine speeds.

Driving Tests

NOTE: When checking shift speeds, the accuracy of the speedometer should be considered as a possible variable.

CAUTION: Do not select '2' or '1' from 'D' at speeds higher than 96 km/h (60 mph) on the 6 cylinder and 99 km/h (62 mph) on the 8 cylinder to avoid overspeeding of the engine.

NOTE: 'Kickdown' is obtained by depressing the accelerator fully down to position A (Fig. M-32). Slight resistance will be felt as the pedal passes through the normal full throttle position B.

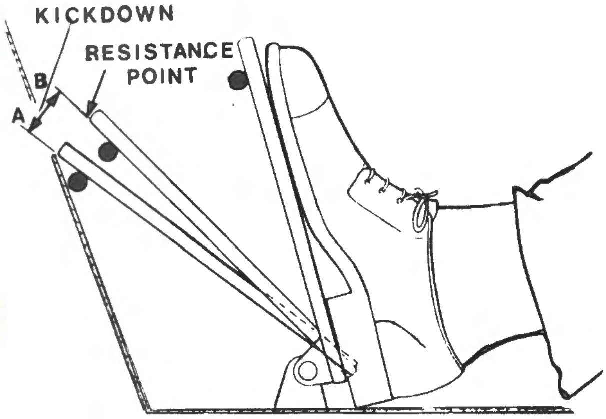


Fig. M-32

ACCELERATOR POSITIONS

1. Select 'D' use kickdown acceleration and check for a 1-2 shift and 2-3 shift in accordance with the table given on page M-33. If there is no drive in 'D' (1st ratio not operative) select '1' accelerate to 30 km/h (20 mph) and select 'D' to verify drive in 2nd and 3rd ratios.
2. Between 82-96 km/h (51-60 mph) on 6 cylinder and 85-99 km/h (53-62 mph) on the 8 cylinder in third ratio, kickdown and check down-shift to 2nd ratio.
3. Between 42-55 km/h (26-34 mph) on the 6 cylinder and 38-53 km/h (24-33 mph) in 3rd ratio, kickdown and check down-shift to 1st ratio.
4. Using minimum throttle check for a 1-2 shift and 2-3 shift in accordance with the table given on page M-33.
5. At 48 km/h (30 mph) in 3rd ratio, release accelerator and select '1'. Check for 3-2 engagement and a subsequent 2-1 down-shift occurring at approximately 33 km/h (21 mph), come to rest.
6. Leave '1' selected, accelerate to approximately 35 km/h (24 mph) release accelerator and verify that up-shift does not occur and engine braking is felt.
7. Select 'D' accelerate to 48 km/h (30 mph) release accelerator to ensure 3rd ratio and select '1' (this gives intermediate) kickdown between 42-55 km/h (26-34 mph) on the 6 cylinder and 38-53 km/h (24-33 mph) on the 8 cylinder and check for 2-1 down-shift.
8. Repeat (7) but select '2'. Check for immediate 3-2 down-shift. Check for 2-1 and 1-2 shifts in accordance with shift pattern table on page M-33.
9. At rest, select 'R', reverse using full throttle if possible, release throttle and confirm engine braking.
10. Stop on steep gradient, select 'P', check that vehicle is held and selector trapped by gate. Repeat with vehicle facing other way.

STALL TESTING

The test provides a rapid check of torque converter operation where poor acceleration is apparent. It is also very useful where transmission slip is suspected.

The stall speed is the maximum speed at which the engine can drive the torque converter while its driven member is held stationary. As the stall speed is dependent both on engine and torque converter characteristics, it will vary with the condition of the engine as well as with the condition of the transmission. It will be necessary, therefore, to determine the condition of the engine in order to correctly interpret a low stall speed.

To obtain the stall speed ensure the transmission oil level is correct, connect an electric tachometer to the engine and place it where it can easily be read from the driver's seat. Allow the engine and the transmission to attain normal working temperature, apply the handbrake, chock the wheels and apply foot brake. Select '1' or 'R' and fully depress the accelerator, note the reading on the tachometer.

NOTE: To avoid overheating, the period of stall test must not exceed 10 seconds.

STALL SPEED

6 and 8 CYLINDER MODELS

RPM	CONDITON
2000-2200	Normal
1800-1900	Engine low on power
1400	Stator one-way clutch not locking
2300	Transmission slip

TORQUE CONVERTER DIAGNOSIS

A stall speed up to 400-500 rpm below normal indicates in general that the engine is not producing its normal power output or is not at operating temperature. Difficulty in starting on steep gradients combined with poor acceleration from rest indicates that the converter stator one-way clutch may not be locking.

This condition permits the stator to rotate in an opposite direction to the driven member and torque multiplication cannot occur. Check the stall speed and if it is below 1400 rpm the converter assembly should be renewed.

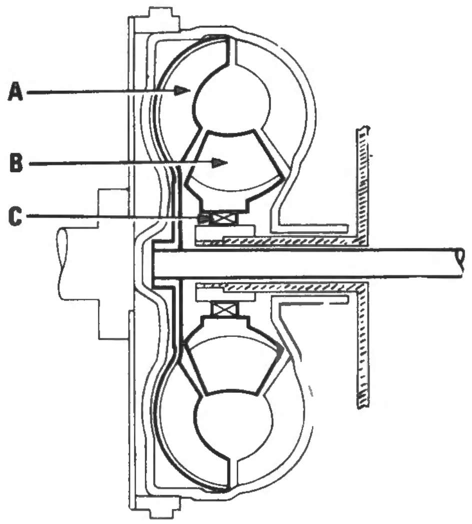


Fig. M-33

A TURBINE — HELD STATIONARY

B STATOR

C FREE-WHEEL — ONE-WAY CLUTCH

Below standard acceleration in high ratio above 48 km/h (30 mph) combined with a substantially reduced maximum speed, indicates that the stator one-way clutch has locked in the fixed condition. The stator will not rotate with the driving and driven members, therefore the fluid flywheel phase of the converter performance cannot occur. This condition will also be indicated by excessive overheating of the transmission although the stall speed will remain normal. The converter assembly should be replaced.

A stall speed higher than normal indicates that the converter is not receiving its required fluid supply or that slip is occurring in the transmission.

Torque converters are sealed by welding in manufacturing and are serviced by replacement only. No drain plug is provided as replenishment of fluid is not necessary since oil is supplied to the converter from the transmission.

PRESSURE TESTING

Using adaptor special tool Part No. 18GA677B connect an 0-2000 kPa (0-300 psi) pressure gauge to the line pressure take-off point at the bottom rear of the transmission case. Refer Fig. M-34.

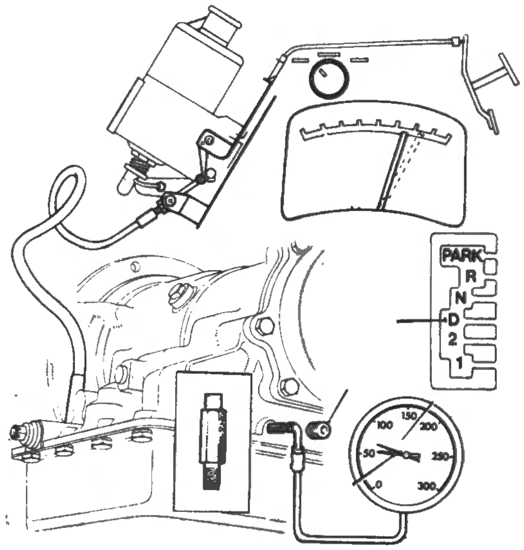


Fig. M-34

PRESSURE TESTING

Ensure that the oil level in the transmission is correct and bring the engine and transmission to operating temperature.

Assuming that the throttle cable is correctly adjusted, pressures as per the transmission line pressure chart page M-33, should be indicated with the transmission at normal operation temperature, 104°C (220°F).

At 500 rpm above the normal idling speed, a minimum pressure increase of 68 kPa (10 psi) should be recorded.

On road test, accelerating from the stall condition (i.e. full throttle, vehicle at rest in 'D' or '2') the pressure gauge should read between 1310-1655 kPa (190-240 psi) for the 6 cylinder models and between 1310-1585 kPa (190-230 psi) for the 8 cylinder models up to the point of 'cutback' which occurs just before the 1-2 up-shift.

At cutback, the pressure should drop to approximately half the original reading.

If these figures are not obtained the adjustment of the throttle cable should be checked.

FAULT DIAGNOSIS CHART

Test Results	**Action Sequence**
Stationary test findings	
Starter will not operate in 'P' or 'N' or operates in all positions	22
Faulty operation of reverse light (when fitted)	22
Excessive bump on engagement of 'D', '1', '2' and 'R'	3, 4
Drives in 'N' also giving judder or no drive in 'R' depending on degree of front clutch seizure	9
Stall test findings	
Stall test shows over 2200 rpm (transmission slip) with possible squawk in '1' and 'R'	4
(a) only in '1'	9
(b) only in 'R'	6, 8, 10, 21, 15
Stall tests show under 1200 rpm (slipping stator)	20
Driving test findings	
Selection faults	
Parking pawl does not hold vehicle	16
Ratio faults	
No drive in 'D', '1', '2' or 'R' but 'P' operates	1, 4
No drive in 'D' or '1'	12, 13, 9
No drive in 'D' — low ratio	17
No drive in 'D' — low ratio and transmission binding during shift from '1' to 'D'	23
No second ratio (in 'D', '1' or '2')	5, 7, 11
No high ratio (reverse O.K., indicating rear clutch normal)	11
Drag in intermediate and high ratios	6
Drag in low, high and reverse but not in intermediate	5
No engine braking in '1' and no drive in reverse	6, 8, 15
Moves off in 2nd ratio in 'D' and '1' and no drive in reverse or engine braking in '1'	11
Shift point faults	
Incorrect or erratic 'kickdown' and/or light throttle shift points	4, 12, 13
1-2 shift only incorrect	11
2-3 shift only incorrect	11
No up-shifts	12, 13
Moves off in high ratio in 'D' indicated by lack of 'up-shifts' and no reverse ratio	11
Moves off in high ratio in 'D' with possible transmission slip	12
Reduced maximum speed in all ratios, more so in high ratio, and severe converter over heating	20
Shift quality faults	
Bumpy and possibly delayed shifts	14
Slip (engine 'flare up') shifting into and out of second ratio	5, 7, 11, 14
Slip (engine 'flare up') on 2-3 and 3-2 shifts	10, 11, 21
Noise faults	
Whining noise from converter area, continuous whenever the engine is running	18
Irregular (possibly grating) noise from gearbox but not in high ratio	19

KEY TO ACTIONS

1 Check fluid level.
2 Check manual selector cable adjustment.
3 Set engine idle speed to specification.
4 Check down-shift throttle cable adjustment. If pressure cannot be corrected, dismantle and clean valve bodies. For low pressure also check strainer.
5 Check front band adjustmemt.
6 Check rear band adjustment.
7 Check front servo seals and fit of pipes.
8 Check rear servo seals and fit of pipes.
9 Examine the seals on the front clutch, support housing and forward sun gear shaft.
10 Check rear clutch feed pipe.
11 Strip valve bodies and clean.
12 Strip governor valve and clean.
13 Examine output shaft rings and governor.
14 Check front band for wear.
15 Check rear band for wear.
16 Adjust/examine parking pawl, linkage and gear.
17 Renew one-way clutch.
18 Examine pump gears and converter nose bush.
19 Strip and examine gear train.
20 Replace torque converter.
21 Examine rear clutch and sealing rings.
22 Test inhibitor switch and circuit.
23 Check one-way clutch (possibly fitted backwards or incorrect type).

SELECTION CHECKS

It is possible to obtain an indication as to whether a clutch or band is operating effectively by driving the vehicle in each selector position and ratio in turn. The table on page M-14 indicates which components are in operation in each ratio and selector position.

If a clutch or band functions in one selector position, that component is normal and the fault is likely to be elsewhere. If a clutch or band is tried in two positions and fails to drive in both, that component or hydraulic feed is suspect. Confirm fault by using 'Air pressure test' to check for mechanical operation.

AIR PRESSURE TESTS

Drain the transmission oil, remove the oil reservoir and release the oil tubes. To test the front clutch, remove the valve body assembly. Apply air pressure to the following points referring to Fig. M-35.

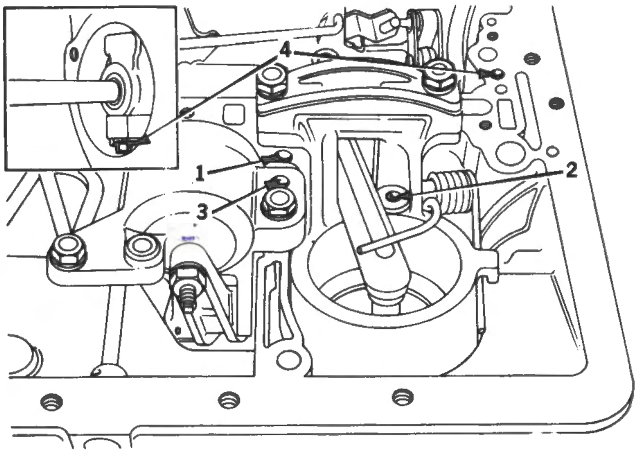


Fig. M-35

AIR PRESSURE TEST POINTS

1 REAR CLUTCH
2 REAR SERVO
3 FRONT SERVO
4 FRONT CLUTCH AND GOVERNOR FEED

Rear Clutch

Apply pressure to 1 and listen for a thump as clutch engages.

Rear Servo

Apply pressure at 2 and observe movement of servo lever.

Front Servo

Apply air pressure at 3 and observe movement of the piston pin. Use oil tube as adaptor.

Front Clutch

Apply air pressure at 4 and listen for thump, indicating that the clutch is moving.

ADJUSTMENTS

Under normal operating conditions no periodic adjustments are required.

IDLE SPEED ADJUSTMENT

Correct idling speed adjustment is essential to avoid stalling in traffic or an excessive thump on engagement of gear from 'N'. A high idling speed will cause excessive 'creep'. Set to 550 rpm (700 rpm on 8 cylinder) when at operating temperature using an electric tachometer. The selector must be in 'N' when the setting is made. It is normal for the idle speed to drop 50-70 rpm when a gear is selected.

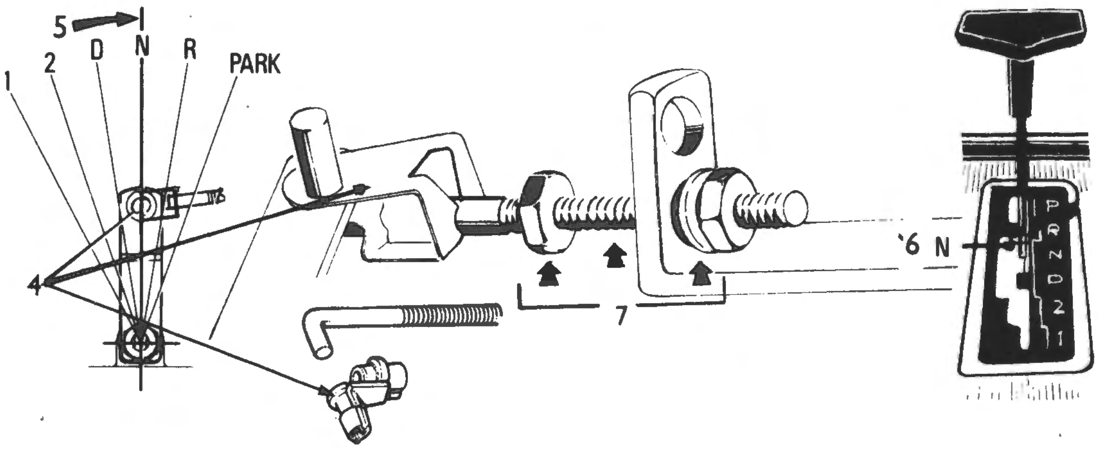


Fig. M-36

SELECTOR ROD ADJUSTMENT

SELECTOR ROD ADJUSTMENTS

Checking

1 Apply the handbrake.

2 Set the selector lever in the 'N' position and allow it to be positioned by the manual control valve detent.

3 Select 'P', release the handbrake and rock the car back and forth. The pawl should hold the vehicle.

Adjusting

Refer Sequence Fig. M-36.

1 Disconnect the selector rod at the manual lever.

2 Move the manual lever back (towards rear of car) and move it forward two detents (clicks) to the neutral position.

3 With the selector lever held in the 'N' position, the end of the selector rod should freely enter the hole in the manual lever.

4 Adjust the length of the selector rod if necessary. Check the selector lever in all positions, ensuring that control valve detent is not over-ridden.

THROTTLE CABLE ADJUSTMENT

6 CYLINDER MODELS

Refer Sequence Fig. M-37.

1 Connect pressure gauge 0-2000 kPa (0-300 psi) to transmission using adaptor 18GA677B.

2 Connect tachometer.

3 Select 'D' and apply brakes.

4 At 550 rpm a pressure of 344-415 kPa (50-60 psi) should exist.

5 Check to see that a minimum rise of 68.9 kPa (10 psi) is achieved with an increase of 500 rpm.

6 If the increase in pressure is:

(a) Low — increase the effective length of the outer cable by slackening locknut (7) (Fig. M-37) and screwing, adjusting, adjusing nut (8) down.

(b) High — decrease the effective length of the outer cable.

8 CYLINDER MODELS

1 Procedure the same as for the 6 cylinder engine, with the exception of the pressure readings. They are as follows:
At 700 rpm 400-510 kPa (58-74 psi) should exist.

NOTE: Incorrect setting of the throttle cable can cause the following effects:

(a) If pressure is low:
- abnormally low speed shifting
- slippage with resultant failure of clutches
- loss of kickdown.

(b) If pressure is high:
- abnormally high speed shifting
- harsh shifting
- kickdown available at less than full throttle.

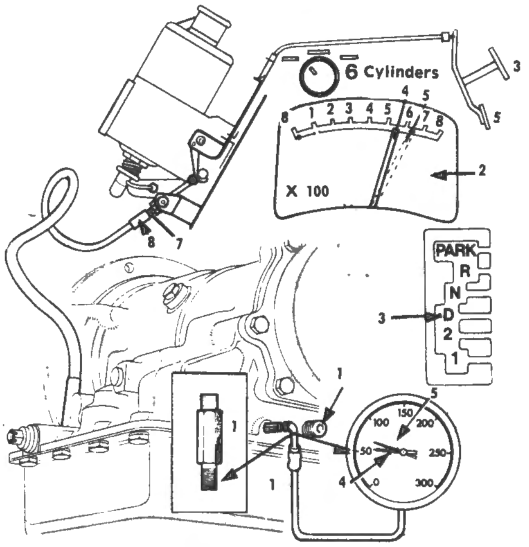


Fig. M-37

ADJUSTING THROTTLE CABLE

BAND ADJUSTMENTS

Band adjustments are not required as a periodic service operation.

Front Band

1 Select park and apply the handbrake.

2 Drain the transmission fluid.

(a) Remove drain plug (1) Fig. M-38.

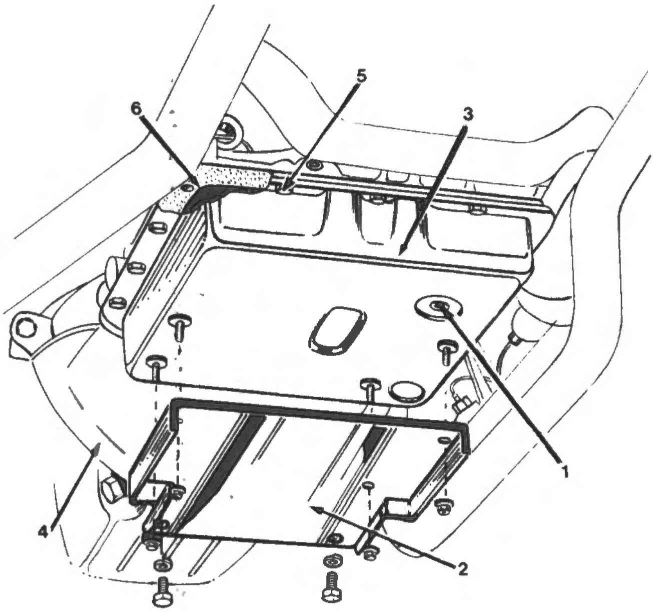


Fig. M-38

TRANSMISSION OIL PAN AND DRAIN PLUG

1	DRAIN PLUG
2	STRUT
3	RESERVOIR
4	CONVERTER HOUSING
5	BOLTS, WASHERS
6	GASKET

NOTE: The converter circuit will still contain oil.

(b) Refit drain plug and tighten.

3 Remove the strut (2) from the reservoir (3) and converter housing (4). Remove the fluid reservoir bolts and washers (5) and detach the reservoir and gasket(6).

4 Move the servo lever (1) Fig. M-39 outward and using gauge BWA34 fitted (2) between the adjuster and the servo body.

5 Release the locknut (3).

6 Tighten the adjusting screw (4) to 1.1 Nm (10 lb.f.in.) using adaptor (5) BW548/2 and a suitable tension wrench W & B 320300.

7 Tighten the locknut and remover gauge.

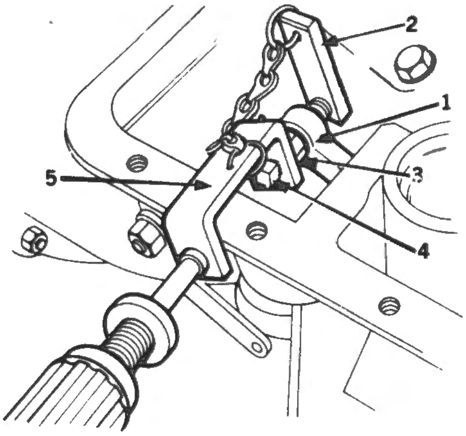


Fig. M-39

ADJUSTING FRONT BAND

8 Refit the oil pan using a new gasket and tighten the bolts to 12-16 Nm (9-12 lb.f.ft.).

9 Refill the transmission with the specified fluid and check level as detailed in Section C.

Rear Band

Refer Fig. M-40.
Using adaptor BWA7196 and tension wrench W & B 320300.

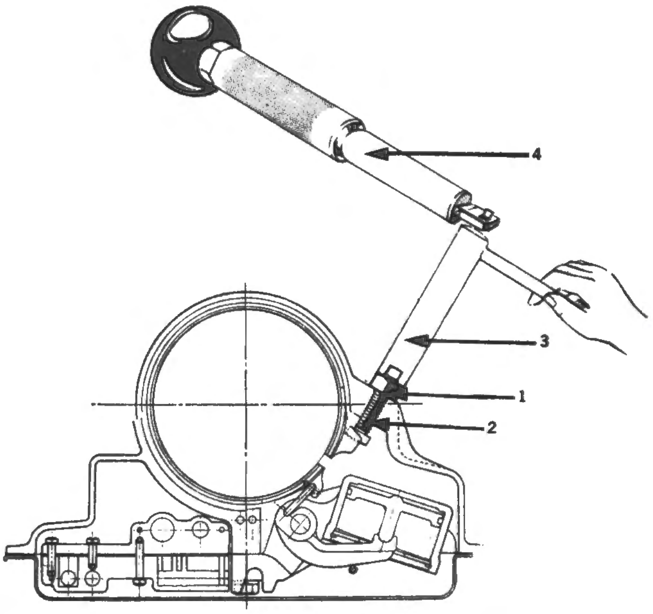


Fig. M-40

ADJUSTING REAR BAND

1	LOCKNUT
2	ADJUSTING SCREW
3	ADAPTOR BWA 7196
4	TENSION WRENCH W&B 320300

1 Slacken the locknut (1).

2 Tighten adjusting screw (2) to 13 Nm (120 lb.f.in.) and back off ¾ of a turn.

3 Tighten the locknut.

STARTER INHIBITOR AND REVERSE LIGHT SWITCH

This switch is non serviceable and non adjustable. It is attached to the transmission case with two screws and is operated by flats on a shaft extending from the transmission case.

Should the switch be suspect disconnect the appropriate circuit and join leads together isolating the switch.

If the circuit operates replace the switch. Refer Figs. M-85, M-87.

White wire with Red trace ignition circuit.
Green wire feed to reverse terminal.
Green wire with Brown trace: Switch to reverse lamp.

NOTE: Ensure that the new switch is not turned 180 degrees when fitted as the starter switch may operate when position other than N and P is selected and reversing lamps may be illuminated when not required.

DISMANTLING AND ASSEMBLING

General

Fully road test and diagnose faults before dismantling.

Prior to removal of any component, clean the outside of the transmission casing.

Components that can be removed with the transmission in place include:

Selector Mechanism
Starter Inhibitor and reversing light switch
Transmission throttle cable
Valve body
Front Servo
Rear Servo
Rear Extension Housing
Speedometer drive
Governor
Rear Adaptor Plate and Sealing rings
Rear Mountings.

For assembly, high standards of cleanliness are required. Clean all parts with kerosene or industrial solvent and use clean lint-free rags, preferably nylon.

Lubricate all parts with Automatic Transmission Fluid.

Use new gaskets. All screws, bolts and nuts must be tightened to the correct torque figures — Refer GENERAL DATA.

OPERATIONS WITH TRANSMISSION UNIT IN PLACE

SELECTOR CONTROL MECHANISM

COLUMN CHANGE

Refer Fig. M-41

Removing

1. Remove steering column and gearshift assembly. (Refer Section Q).

Dismantling

1. Using a suitable tool gently lever out the hub of the trafficator cancelling ring.
2. Engage hazard warning switch and remove the three screws retaining the trafficator control mechanism to the housing.
3. Unscrew and remove trafficator lever. Remove trafficator assembly angling over inner column taking care not to damage unit, withdraw wiring harness through shroud assembly.
4. Withdraw inner column into interior of vehicle.
5. Slacken off the two nuts securing the upper shroud to the outer steering column. Remove shroud.

NOTE: Do not remove nuts completely as bolts will fall into lower shroud and gearshift mechanism.

Refitting

1. Assembling and refitting is the reversal of the dismantling and removing procedure.

FLOOR CHANGE

Refer Fig. M-42

Removing

1. Remove the screws securing the console to the floor panel and remove console.
2. Disconnect the illuminating lamp wiring.
3. Disconnect the control rod from the selector lever by removing clevis pin.
4. Remove the four screws retaining selector assembly to tower.
5. Withdraw assembly into interior of vehicle.

Dismantling

1. Remove the selector lever handle.
2. Remove the indicator plate.
3. Remove shutter, shutter guides and shutters blanking plate.
4. Remove the screw securing the control lever to the selector rod and remove the control lever.
5. Remove the four screws and open the control box.
6. Remove the selector rod and spring.

Refitting

1. Assembling and refitting is the reversal of the dismantling and removing procedure.

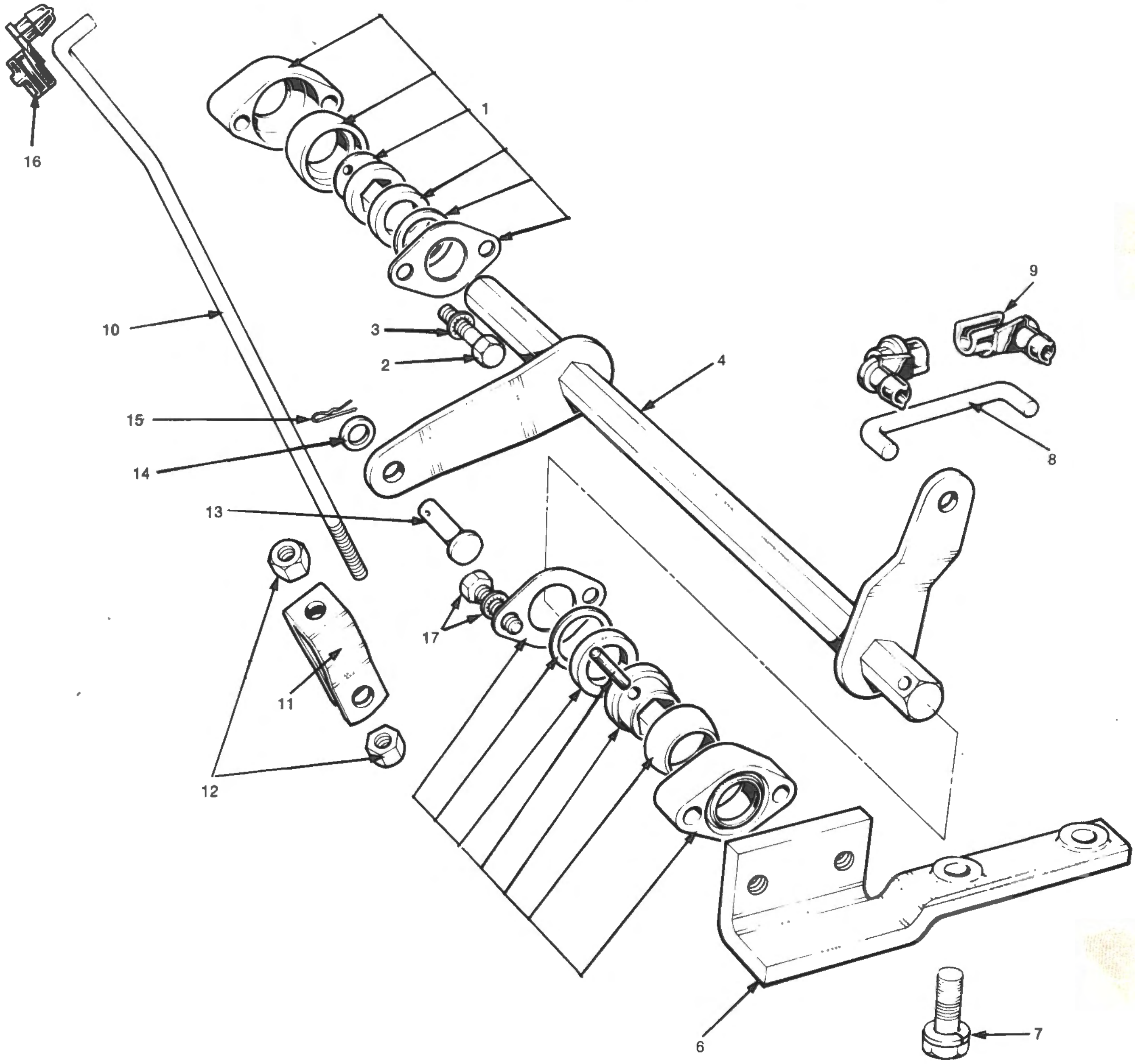


Fig. M-41

LAYOUT OF MANUAL SELECTOR LINKAGE
COLUMN CHANGE

1 OUTBOARD BEARING ASSEMBLY (RH)
2 BOLTS — BEARING ASSEMBLY TO LONGITUDINAL MEMBER
3 WASHER FOR BOLT
4 CROSS-SHAFT ASSEMBLY
5 INBOARD BEARING ASSEMBLY (LH)
6 BRACKET — BEARING ASSEMBLY TO TRANSMISSION
7 SCREWS AND WASHERS, BRACKET AND FLUID RESERVOIR TO TRANSMISSION
8 LINK — CROSS-SHAFT LEVER TO TRANSMISSION MANUAL LEVER
9 CLIPS FOR LINK
10 ROD STEERING COLUMN LEVER TO CLEVIS/AND CROSS-SHAFT LEVER
11 CLEVIS
12 NUTS — ROD/CLEVIS ADJUSTING
13 PIN — CLEVIS TO CROSS-SHAFT LEVER
14 WASHER FOR PIN
15 CLEVIS PIN CLIP
16 CLIP ROD TO COLUMN LEVER
17 SCREWS AND WASHERS INBOARD BEARING ASSEMBLY TO BRACKET

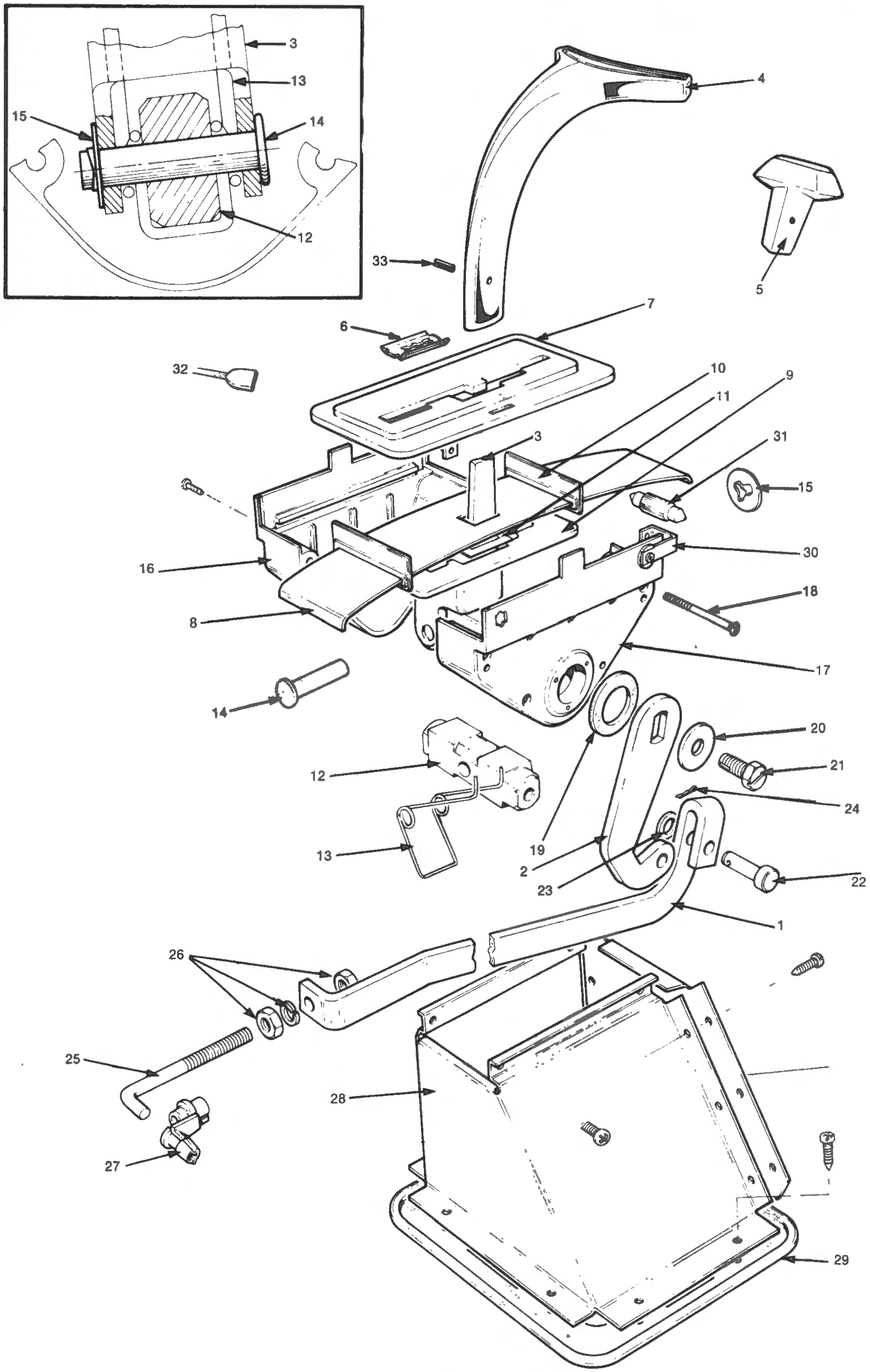


Fig. M-42

LAYOUT OF MANUAL SELECTOR LINKAGE FLOOR CHANGE

KEY TO FIG. M-42

1. PUSH ROD
2. DRIVE LEVER
3. SELECTOR LEVER
4. SELECTOR HANDLE
5. SELECTOR HANDLE ALTERNATIVE
6. PUSH ON FIX
7. INDICATOR PLATE
8. SHUTTER
9. GATE
10. SHUTTER GUIDES
11. SHUTTER BLANKING PLATE
12. SELECTOR PIVOT
13. SELECTOR PIVOT SPRING
14. PIN — SELECTOR PIVOT TO LEVER
15. PUSH ON FIX FOR PIN
16. HALF BOX ASSEMBLY (RH)
17. HALF BOX ASSEMBLY (LH)
18. BOX SCREWS
19. FELT WASHER
20. WASHER — DRIVE LEVER TO PIVOT
21. SCREW FOR LEVER
22. PIN — SELECTOR LEVER TO DRIVE LEVER
23. WASHER FOR LEVER
24. CLIP FOR PIN
25. ROD — DRIVE LEVER TO TRANSMISSION MANUAL LEVER
26. NUTS AND WASHERS FOR RODS
27. CLIP ROD TO LEVER
28. SELECTOR MOUNTING BOX
29. GASKET
30. ILLUMINATION LAMP CONTACTS
31. ILLUMINATION LAMP BULB
32. ILLUMINATION LAMP WIRING
33. ROLL PIN SELECTOR HANDLES

TRANSMISSION THROTTLE CABLE

Removing

6 CYLINDER MODELS
Refer Fig. M-43.

1. Remove the nut (1) securing the cable trunnion to the carburetter heat shield (2).
2. Remove the cable nipple (3) from the carburetter throttle lever and remove the cable assembly from the bracket.
3. Drain the transmission oil.
4. Remove the oil reservoir (5).
5. Remove the throttle inner cable from the down-shift cam (6).
6. Release the screw (7) securing the cable to the transmission casing and remove the assembly.

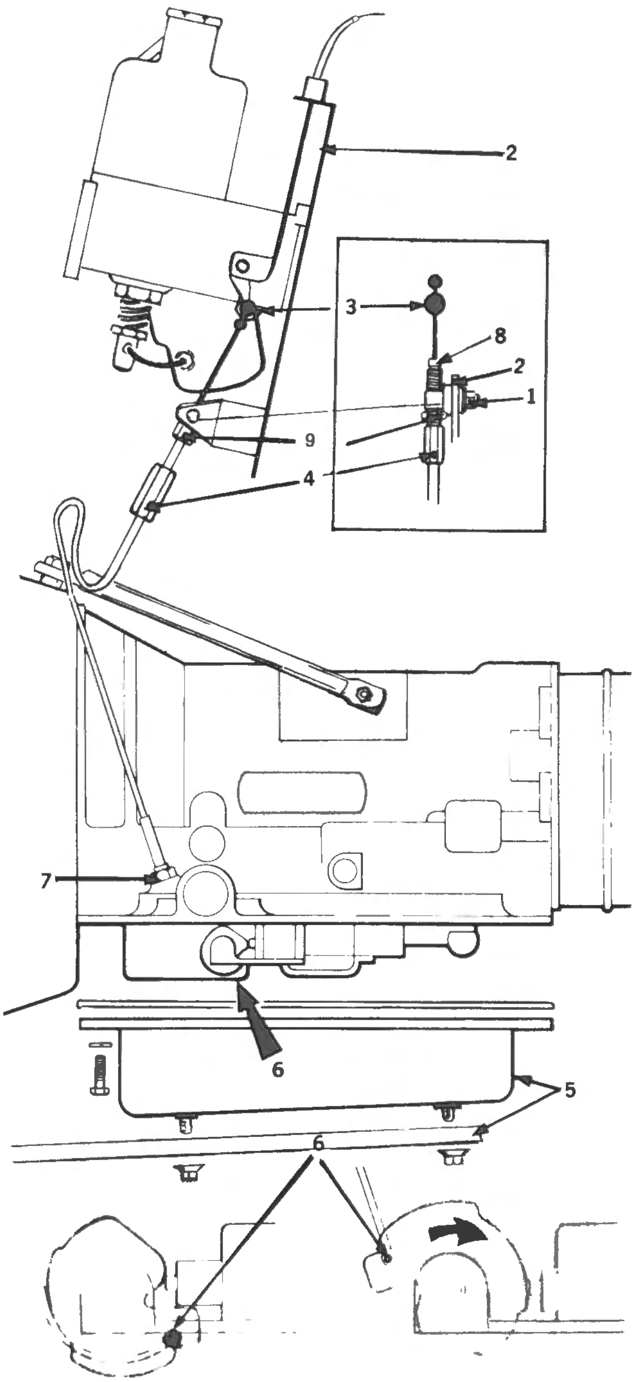


Fig. M-43

THROTTLE CABLE

1. TRUNNION NUT
2. HEAT SHIELD
3. CABLE NIPPLE
4. CABLE ADJUSTING SCREW
5. STRUT AND FLUID RESERVOIR
6. VALVE CAM
7. CABLE SCREW
8. CABLE STOP
9. LOCKNUT

8 CYLINDER MODELS
Refer Fig. M-43.

1. Remove the nut securing the cable trunnion to the accelerator linkage support bracket.
2. Remove the clip from the accelerator linkage and remove the cable assembly from the bracket.
3. Drain the transmission oil.
4. Remove the oil reservoir (5).
5. Remove the throttle inner cable from the valve cam (6).
6. Release the screw (7) securing the cable to the transmission casing and remove the assembly.

Inspecting

1. Ensure that the inner cable moves freely within the outer cable. If resistance is felt, clean and lubricate the inner cable and if the inner cable does not move freely replace the cable assembly.
2. Check that the crimped cable stop (8) at the carburetter end of the inner cable is correctly located and has not moved.
3. Check the outer cable for kinks or sheathing damage and repair or replace the cable assembly as necessary.

Refitting

1. Refitting is a reversal of the removing procedure noting the following:
   (a) Adjust the cable as detailed under 'Throttle Cable Adjustments'.

VALVE BLOCK

General

The valve body in the 8 cylinder models incorporates several alterations making it non-interchangeable with that of the 6 cylinder models.

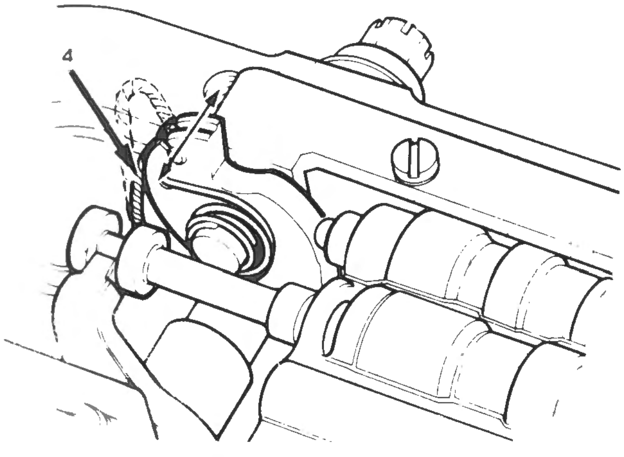


Fig. M-44

THROTTLE CABLE — REMOVE

Removing

1. Drain the transmission fluid.
2. Remove vibration plate between the bell housing and the oil reservoir.
3. Remove the bolts with spring washers and detach the oil reservoir from the casing.
4. Release the throttle inner cable from the downshift cam. Fig. M-44.
5. Remove the magnet attached to one of the bolt heads.
6. Pull out the oil connector pipes. Sequence Fig. M-45.
   '5A' Rear Servo
   '5B' Rear Clutch
   '5C' Front Servo Release
   '5D' Front Servo Apply
7. Remove the three bolts with spring washers.
8. Remove the valve block assembly.

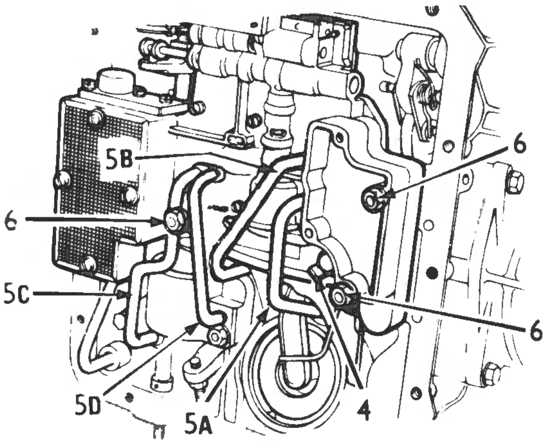


Fig. M-45

VALVE BODY OIL CONNECTION PIPES
AND RETAINING BOLTS

Refitting

1. Refitting is a reversal of the removing procedure noting the following:
   (a) Ensure that oil pipes (8) Fig. M-46 are in position.
   (b) Ensure that all oil pipes are pushed fully into place.
   (c) Use a new gasket and tighten the oil reservoir bolts to 12.2-16.3 Nm (9-12 lb.f.ft.).
   (d) Refill the transmission with fluid.

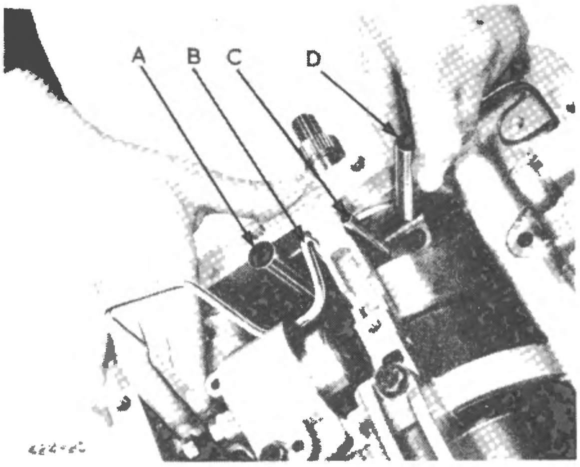


Fig. M-46

OIL PIPES, FRONT PUMP TO VALVE BODY

A	PUMP INLET 'O' RING ON TUBE
B	CONVERTER TO OIL COOLER
C	CONVERTER INLET
D	PUMP OUTLET

VALVE BLOCK OVERHAUL

Dismantling

1 Remove the pump oil strainer. Sequence Fig. M-47. Inset oil tube plate. Fig. M-47.

2 Remove the two long screws — 2.5-3.5 Nm (20-30 lb.f.in.).

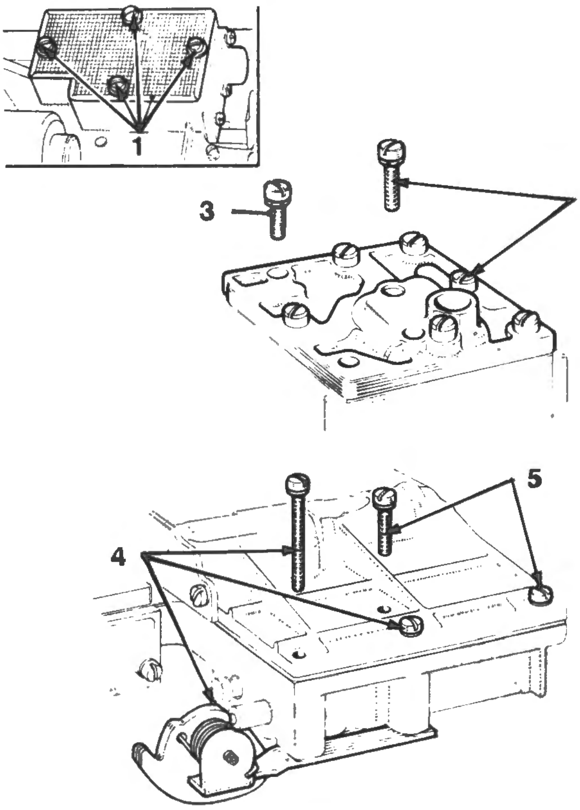


Fig. M-47

OIL TUBE PLATE AND UPPER VALVE BODY SCREWS

3 Remove the six short screws and remove the oil tube plate 2.5-3.5 Nm (20-30 lb.f.in.).

UPPER VALVE BODY ASSEMBLY, SEQUENCE FIG. M-47

4 Remove the cam assembly — 2.5-4.5 Nm (20-40 lb.f.in.).

5 Remove the two short screws from the upper side of the valve body assembly — 2.5-3.5 Nm (20-30 lb.f.in).

6 Remove the long screw 2.5-3.5 Nm (20-30 lb.f.in.). Fig. M-48.

7 Remove five short screws 2.5-3.5 Nm (20-30 lb.f.in.) on 8 cylinder models, remove reverse pressure booster mechanism.

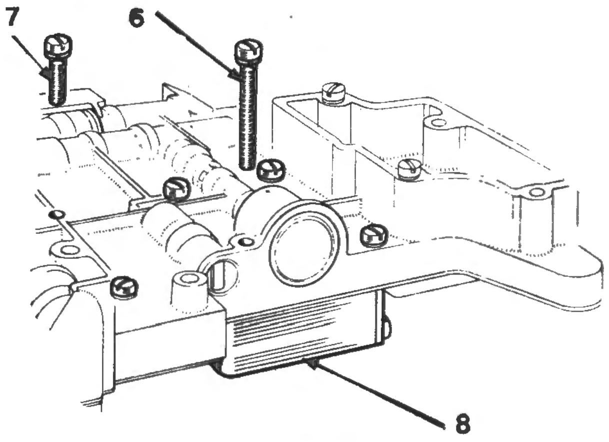
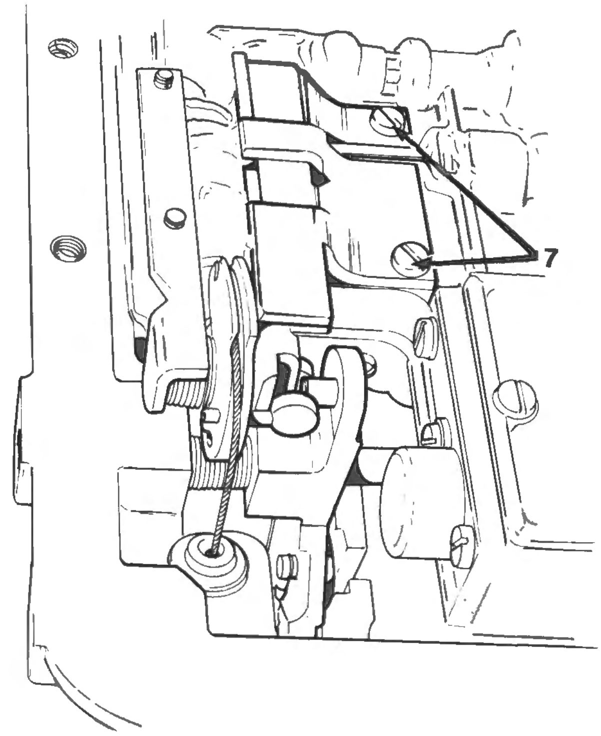


Fig. M-48

SCREWS MAIN VALVE BODY TO UPPER VALVE BODY



REVERSE BOOST MECHANISM (8-CYLINDER ENGINES)

8 Remove the upper valve body from the separator plate and valve body.

9 Remove the front end cover 2.5-3.5 Nm (20-30 lb.f.in.). Sequence Fig. M-49.

10 Remove the rear end cover 2.5-3.5 Nm (20-30 lb.f.in.).

11 Withdraw the 2-3 shift valve.

12 Withdraw the 2-3 shift valve spring.

13 Remove the 2-3 shift valve plunger.

14 Remove the 1-2 shift valve.

15 Remove the 1-2 shift valve spring.

16 Remove the 1-2 shift valve plunger.

17 Governor line plate. Sequence Fig. M-50. Remove the two long screws.

18 Remove the two short screws securing the plate. Separating plate and valves sequence Fig. M-51.

19 Carefully remove the separating plate from the lower valve body and remove 3-2 down-shift check valve (steel ball) and spring.

NOTE: Ensure that the ball and spring is placed in the correct location on assembly.

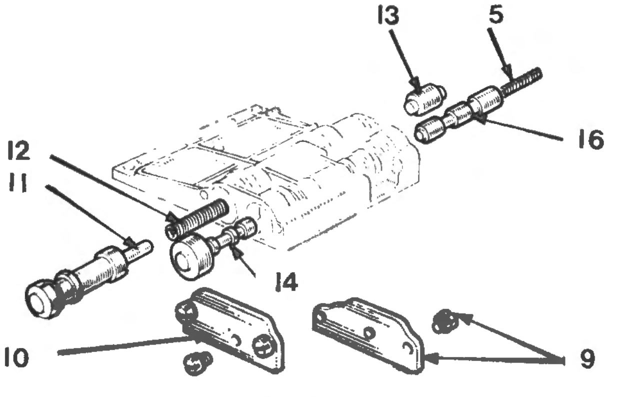


Fig. M-49

UPPER VALVE BODY 1-2 AND 2-3 SHIFT VALVES

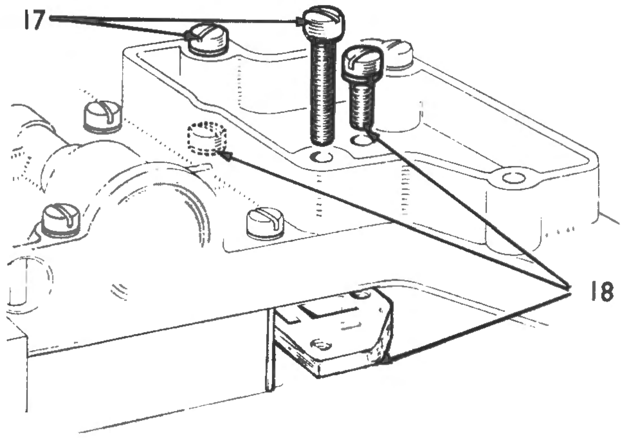


Fig. M-50

GOVERNOR LINE PLATE

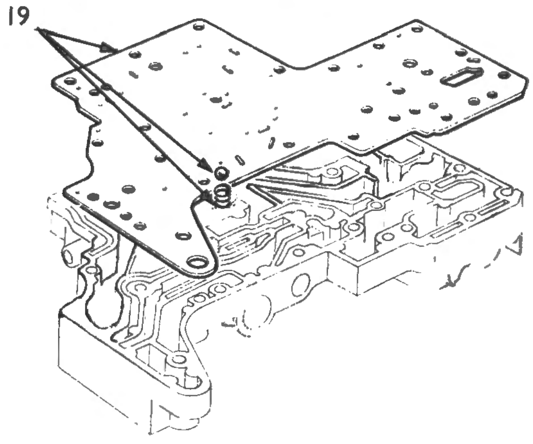


Fig. M-51

SEPARATING PLATE AND 3-2 DOWNSHIFT CHECK VALVE

LOWER VALVE BODY ASSEMBLY, SEQUENCE FIGS. M-52-53-54

20 Remove the manual control valve.

21 Remove the down-shift valve.

22 Remove the down-shift valve spring.

23 Remove the throttle valve.

24 Remove the throttle valve spring.

25 Remove the throttle valve spring retainer.

26 Remove the lower valve body plate screws 2.5-3.5 Nm (20-30 lb.f.in.).

NOTE: Plate is under spring pressure.

27 Remove the primary regulator valve spring.

28 Remove the primary regulator valve sleeve.

29 Remove the primary regulator valve.

30 Remove the secondary regulator valve spring.

31 Remove the secondary regulator valve.

32 Remove modulator valve dowel pin by tapping the top face of the valve body gently with a soft screw driver handle.

33 Remove the modulator valve assembly end plug.

34 Remove the modulator valve.

35 Remove the modulator valve plug.

36 Remove the modulator valve spring.

37 Remove the orifice control valve keeper.

38 Remove the orifice control valve spring.

39 Remove the orifice control valve.

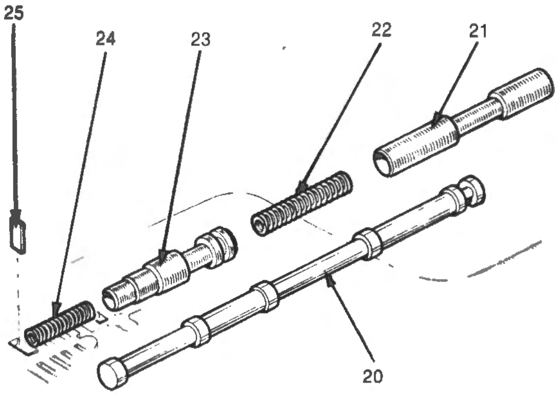


Fig. M-52

THROTTLE AND MANUAL CONTROL VALVE ASSEMBLIES

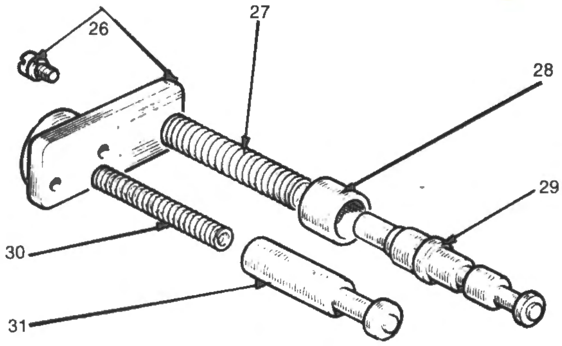


Fig. M-53

PRIMARY AND SECONDARY REGULATOR VALVE ASSEMBLY

Inspecting

1. Clean all parts in cleaning solvent, dry with compressed air.
2. Check all fluid passages for obstructions.
3. Inspect valves, bores, mating surfaces for burrs and scores.

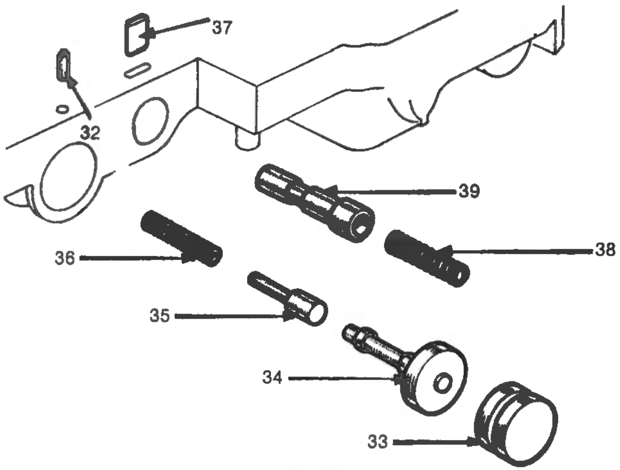


Fig. M-54

MODULATOR AND ORIFICE CONTROL VALVE ASSEMBLIES

32	MODULATOR VALVE DOWEL PIN
33	MODULATOR VALVE ASSEMBLY END PLUG
34	MODULATOR VALVE
35	MODULATOR VALVE PLUG
36	MODULATOR VALVE SPRING
37	ORIFICE CONTROL VALVE KEEPER
38	ORIFICE CONTROL VALVE SPRING
39	ORIFICE CONTROL VALVE

4. Check springs — refer Valve Body Spring Specifications.

Assembling

1. Assembling is the reverse of the dismantling procedure noting the following:
   - (a) Lubricate all components with clean transmission fluid.
   - (b) Ensure that all valves move freely in their bores.
   - (c) Tighten all screws evenly — refer Torque Figures in GENERAL DATA.

VALVE BLOCK SPRING SPECIFICATIONS

VALVE	FREE LENGTH		ACTIVE COILS	
	6 Cylinder	8 Cylinder	6 Cylinder	8 Cylinder
Primary Regulator	72.39 mm (2.85 in)	74.70 mm (2.94 in)	14½	14
Secondary Regulator	65.78 mm (2.59 in)	65.78 mm (2.59 in)	21½	21½
Down Shift Valve	45.72 mm (1.80 in)	45.72 mm (1.80 in)	18	18
Throttle Valve	20.50 mm (0.80 in)	20.50 mm (0.80 in)	28	28
1-2 Shift Valve	27.68 mm (1.09 in)	27.68 mm (1.09 in)	13½	13½
2-3 Shift Valve	40.39 mm (1.59 in)	40.39 mm (1.59 in)	22½	22½
Modulator Valve	25.19 mm (0.99 in)	25.19 mm (0.99 in)	16½	20½
Servo Orifice	25.70 mm (1.01 in)	25.70 mm (1.01 in)	17	17
3-2 Ball Check Valve	16.51 mm (0.65 in)	16.51 mm (0.65 in)	16	16

FRONT SERVO

The front servo fitted to 6 cylinder and 8 cylinder models is not interchangeable. They both vary in diameter, 6 cylinder 47.49 mm (1.87 in) and 8 cylinder 51.01 mm (2.048 in) and in spring tension, 6 cylinder 134N (30 lbf.) coloured black and the 8 cylinder 178N (40 lbf.) coloured silver.

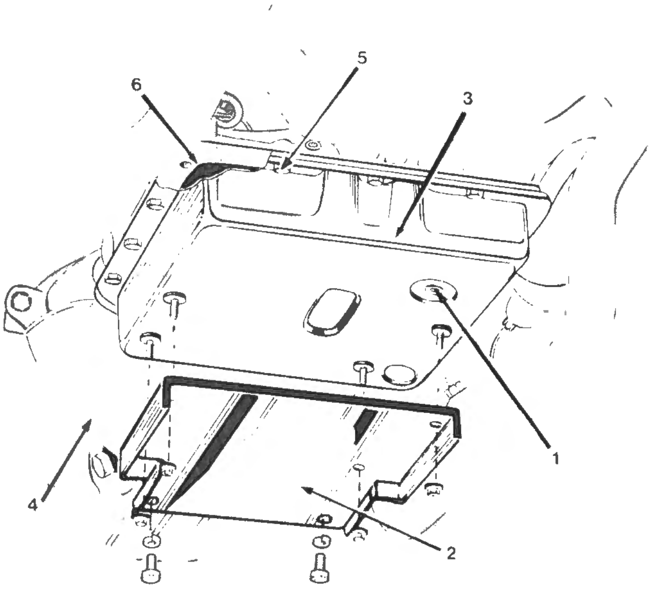


Fig. M-55

DRAINING AND OIL PAN REMOVAL

1 DRAIN PLUG
2 STRUT
3 RESERVOIR
4 CONVERTER HOUSING
5 BOLTS, WASHERS
6 GASKET

Removing

Refer Figs. M-55-56.

1. Drain the transmission fluid.
2. Remove the oil reservoir and joint washer.

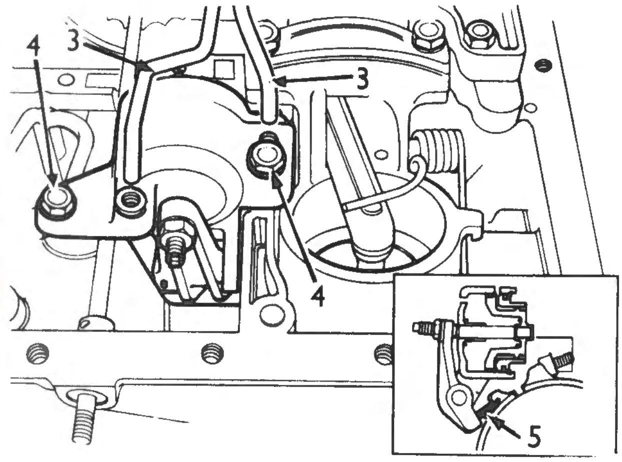


Fig. M-56

SERVO RETAINING BOLTS AND OIL PIPES

3 APPLY AND RELEASE OIL PIPES
4 RETAINING BOLTS

3. Remove the front servo, apply and release oil pipes.
4. Remove the two bolts with spring washers and take out the front servo.
5. Extract the brake band strut. Insert Fig. M-56.

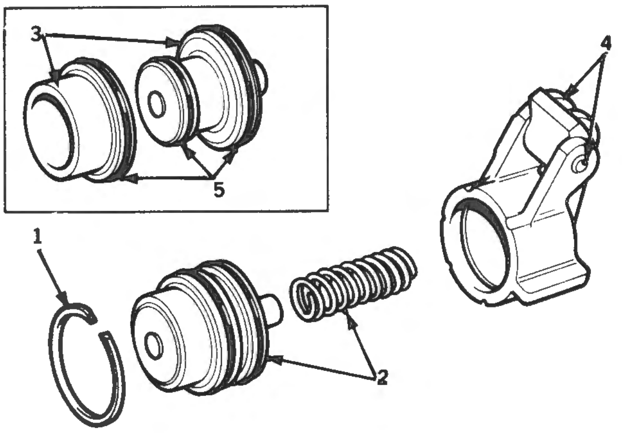


Fig. M-57

FRONT SERVO COMPONENTS

1 CIRCLIP
2 PISTON, SLEEVE AND SPRING
3 PISTON AND SLEEVE
4 LEVER PIVOT PIN

Dismantling

Refer Fig. M-57.

1. Remove the snap ring (1).
2. Remove the piston sleeve, piston and spring (2).
3. Remove the piston from the sleeve (3).
4. Press out the lever pivot pin from the body (4).
5. Remove the lever.

Inspecting

1. Check the 'O' rings and oil sealing rings for signs of deterioration or damage; renew the rings as necessary (5).
2. Examine the piston, sleeve and body for cracks, scratches and wear.

Assembling

1. Assembling is the reverse of the dismantling procedure noting the following:
   (a) Lubricate components before assembling.
   (b) Ensure that the piston and lever move freely.

Refitting

1. Locate the strut on the front brake band with petroleum jelly.
2. Refit the servo and tighten the bolts to 11-13.5 Nm (8-10 lb.f.ft.).

3 Adjust the front brake band.

4 Refit the oil pipes and the oil reservoir and tighten bolts to 12-16 Nm (9-12 lb.f.ft.).

5 Refill the transmission with fluid and check the level.

Assembling

1 Assembling is the reverse of the dismantling procedure noting the following:

(a) Lubricate components before assembling.

(b) Ensure the piston and lever move freely.

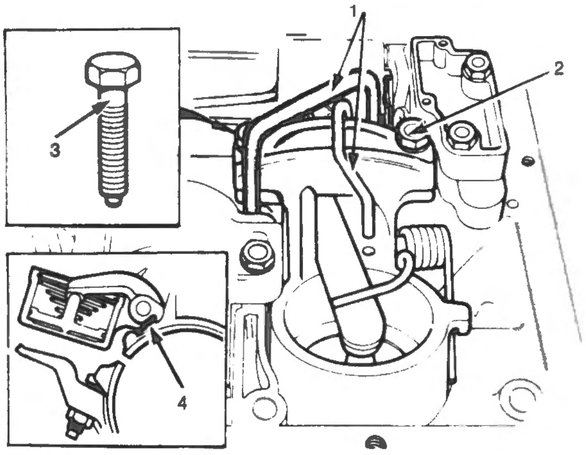


Fig. M-58

REAR SERVO REMOVAL

1 REAR SERVO AND REAR CLUTCH OIL PIPES

2 SERVO SECURING SCREW TO TRANSMISSION CASE

3 SERVO SECURING AND CENTRE SUPPORT LOCATING SCREW

4 BAND STRUT

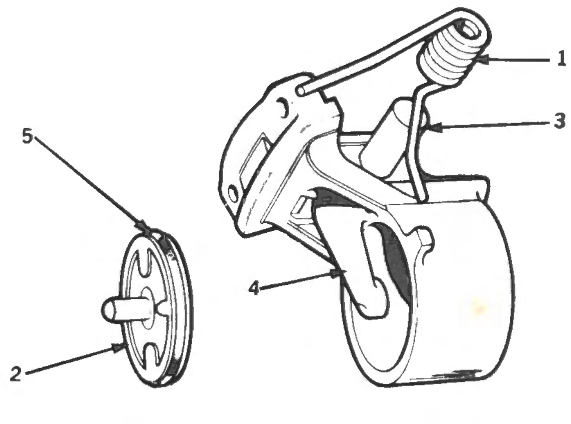


Fig. M-59

REAR SERVO COMPONENTS

1 LEVER RETURN SPRING

2 PISTON ASSEMBLY

3 LEVER PIVOT PIN

4 LEVER

5 RING SEAL

REAR SERVO

Removing

Refer Figs. M-58-59.

1 Drain the transmission fluid.

2 Remove the oil reservoir and joint washer.

3 Remove the rear servo and rear clutch apply oil pipes.

4 Remove the two bolts with spring washers and take out the rear servo. The front bolt is dowelled and also locates the centre support (3) inset.

5 Extract the brake band strut (4) inset.

Dismantling

1 Disengage and release the return spring.

2 Withdraw the piston assembly.

3 Press the lever pivot pin from the body and remove the lever.

Inspecting

1 Check the ring seal for signs of deterioration or damage; renew the ring seal if necessary.

2 Check the piston and bore for cracks, scratches and wear.

Refitting

1 Locate the strut on the rear servo lever using petroleum jelly.

2 Position the rear servo, locating the strut into the rear brake band and tighten the bolts to 17.5-37 Nm (13 to 27 lb.f.ft.).

3 Adjust the rear brake band.

4 Refit the oil pipe and the oil reservoir and tighten bolts to 12-16 Nm (9-12 lb.f.ft.).

5 Refill the transmission with fluid and check the level.

REAR EXTENSION HOUSING OIL SEAL

Removing

1 Jack up rear of vehicle and place on stands.

2 Remove the four bolts retaining the propeller shaft to differential pinion flange.

3 Remove propeller shaft by sliding out of transmission extension housing.

4 Remove the oil seal.

Fig. M-60

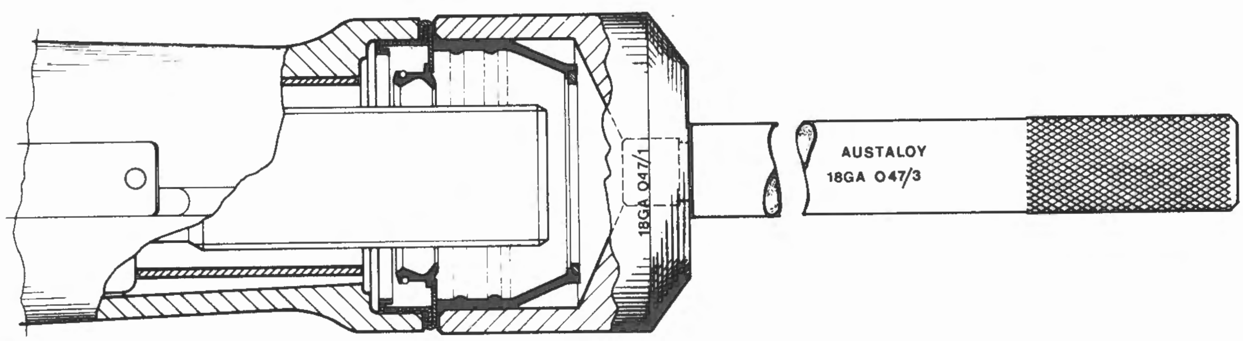


Fig. M-60

FITTING REAR EXTENSION HOUSING
OIL SEAL

18GA047/1 — REPLACER

18GA047/3 — HANDLE

Refitting

1. Lubricate oil seal with transmission fluid.
2. Tap oil seal into place using service tool 18GA047.
3. Reverse the procedure 1-3 for removing.
4. Check the transmission oil level.

Fig. M-60

REAR EXTENSION HOUSING

Removing

1. Disconnect the battery.
2. Remove speedometer drive from the extension housing.

NOTE: Drain the transmission oil if the work is to be carried out with the vehicle level, i.e. pit, hoist, etc.

3. Carry out operations 1-3 for Rear Oil Seal removal.
4. Remove the two bolts securing the rear extension mounting to the cross member.
5. Take the weight of the power unit by supporting the unit with a transmission jack.
6. Remove the two bolts securing the cross member to the sub frame. Remove cross member.
7. Remove the screws and spring washers securing the rear extension to the transmission case and withdraw the rear extension housing.

NOTE: A small quantity of transmission oil will be released.

Refitting

1. Refitting is the reverse of the removing procedures 1 to 7 noting the following:
   (a) Fit a new extension housing joint washer and tighten the screws to 41-75 Nm (30-55 lb.f.ft.).
   (b) Refill or top up transmission fluid and check the level.

SPEEDOMETER DRIVE GEAR AND GOVERNOR

Removing

Refer Fig. M-61.

1. Remove the rear extension housing as previously described.
2. Remove circlip.
3. Remove the speedometer drive gear and its driving ball.
4. Remove the clip retaining the governor using a suitable pair of flat bladed circlip pliers (Inset Fig. M-60).
5. Withdraw the governor assembly retrieving the drive ball as it becomes free.

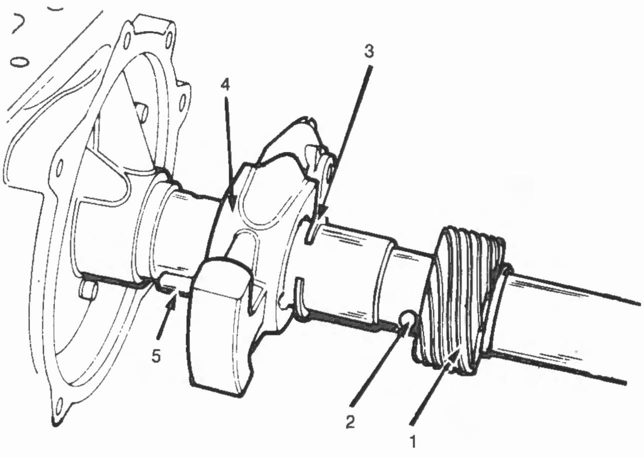


Fig. M-61

SPEEDOMETER DRIVE GEAR AND
GOVERNOR REMOVAL

1 SPEEDOMETER DRIVE GEAR
2 DRIVE BALL
3 GOVERNOR CIRCLIP
4 GOVERNOR
5 GOVERNOR DRIVE DOWEL

Dismantling

Refer Fig. M-62.

1 Remove the cover plate.

2 Remove weight retaining circlip and remove the weight.

3 Take out the two screws and separate the valve body from the counter weight.

4 Remove the valve spindle, spring and valve.

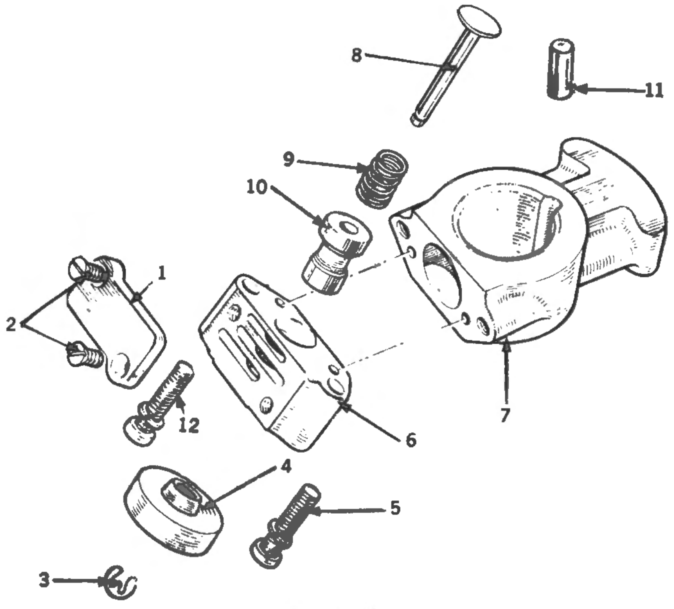


Fig. M-62

GOVERNOR COMPONENTS

1 COVER PLATE
2 COVER PLATE SCREWS
3 CIRCLIP
4 WEIGHT
5 VALVE BODY RETAINING SCREWS
6 VALVE BODY
7 COUNTER WEIGHT
8 VALVE AND SPINDLE
9 SPRING
10 VALVE
11 DRIVE DOWEL

Inspecting

1 Thoroughly clean the components and oilways, check the valve weight and body for scoring; polish or renew if necessary.

Assembling

1 Assembling is the reverse of the dismantling procedures 1 to 4 noting the following:

(a) Tighten valve body counter weight screws to 5.5-7 Nm (4-5 lb.f.ft.). Tighten cover plate screws 2.5-5.5 Nm (20-48 lb.f.in.).

(b) Check that the valve and governor weight can move freely.

Refitting

1 Select N.

2 Turn the output shaft until the detent is uppermost and locate the drive ball with petroleum jelly.

NOTE: Care should be exercised to ensure the ball is fitted to the correct (blind) hole. If the ball is inadvertently entered into the oil supply holes it can be almost impossible to remove.

3 Slide the governor assembly into position, ensuring that the cover plate faces away from the gearbox, and secure with the circlip.

4 Reverse items 1, 2 and 3 of removing procedure.

REAR ENGINE MOUNTS

Removing

Refer Fig. M-63.

1 Disconnect the battery.

2 Apply the handbrake.

3 Raise the vehicle to a convenient working height.

4 Support and take the weight of the power unit with a suitable transmission jack.

5 Remove the two bolts securing the engine mount to the cross member.

6 Remove the two bolts securing the cross member to the sub frame and slide cross member clear of mount.

7 Remove the two bolts securing the mount to the rear extension housing. Remove mount.

Refitting

1 Refitting is a reversal of the removing procedure.

OPERATIONS WITH TRANSMISSION UNIT REMOVED

TRANSMISSION

Removing

1 Disconnect the battery.

2 Remove filler tube mounting bolt and remove the dipstick and tube.

3 Disconnect the throttle cable at the heat shield and carburetter linkage.

4 Raise the vehicle to a suitable working height.

5 Drain the transmission fluid.

6 Disconnect inhibitor switch at plug connection on transmission.

7 Remove speedo cable and pinion.

8 Disconnect selector mechanism at transmission.

9 Disconnect cooling pipes at transmission.

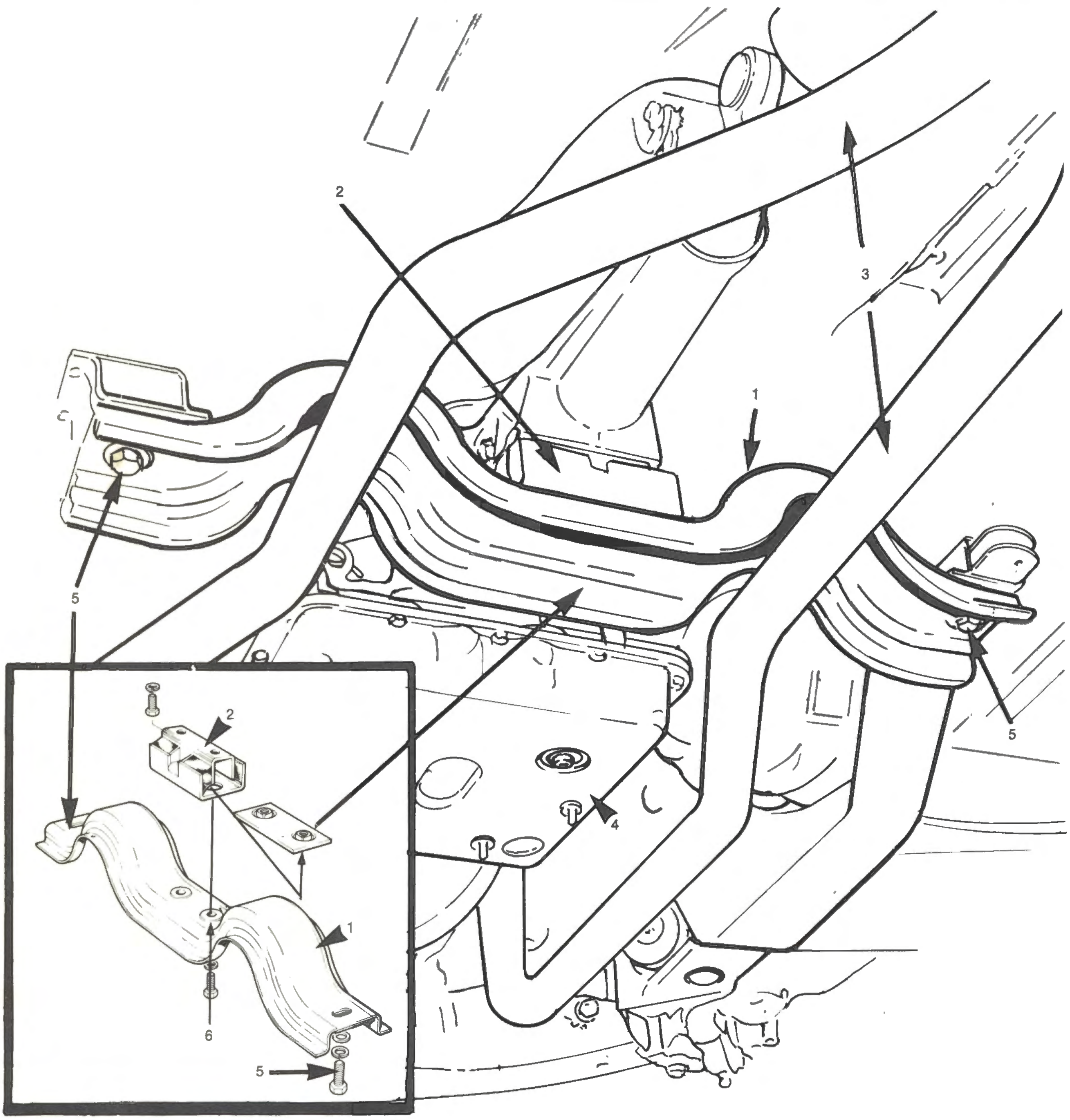


Fig. M-63

REAR MOUNTING AND CROSS ASSEMBLY

1 REAR CROSS MEMBER
2 REAR ENGINE MOUNTING
3 EXHAUST PIPES
4 TRANSMISSION
5 CROSS MEMBER SECURING BOLTS
6 ENGINE MOUNTING BOLTS

10 Remove four bolts securing propeller shaft to the differential pinion flange and withdraw propeller shaft.

11 Support the weight of the power unit under the engine sump.

CAUTION: To avoid damage to engine sump, place a block of wood between the sump and support.

12 Remove the two bolts securing rear mounting to cross member.

13 Remove mounting securing rear of muffler.

14 Remove the two bolts securing the cross member to the sub frame. Pulling down on the exhaust system remove the cross member.

15 Lower transmission approximately 51 mm (2 in).

16 Remove bolts securing dust cover at bottom front of the converter housing. Remove dust cover. (Dust cover not fitted on 6 cylinder models).

17 Remove bolts securing the converter housing to engine.

18 Slide transmission back, turning to clear exhaust pipe and withdraw transmission from vehicle.

11 3/8" + 3"

NOTE: Maintain the alignment of the transmission when removing to prevent damage to the components. Do not allow the stator support, the input shaft or the converter to take the weight of the transmission.

CAUTION: A quantity of fluid will drain from the converter as the transmission is removed.

Refitting

1 Align drive tangs on converter with the front pump.

2 Reverse removal procedure 1-18.

3 Check and adjust transmission pressure after ensuring correct oil level.

NOTE: In a situation where a fault has been diagnosed within the transmission, there is no need to remove the torque converter, the transmission can be removed leaving the torque converter and housing in place. For this operation the following procedure should be carried out.

Removing

1 Carry out operations 1-15 of transmission removal.

2 Support the transmission and remove the strut attached to the transmission fluid reservoir and converter housing.

3 Remove the two struts attached to the top of the converter housing and transmission case.

4 Remove the bolts and washers securing the transmission to the converter housing.

5 Slide transmission back and withdraw transmission from vehicle.

Refitting

1 Refitting is the reversal of the removing procedure noting the following:

  (a) Align the front pump drive slots with the drive tangs on the converter.

  (b) Exercise care when aligning and entering input shaft, stator support and pump drive tangs to prevent damage to the pump seal. Tighten securing screws to 11 to 17.5 Nm (8-13 lb.f.ft.).

  (c) Refill the transmission with fluid to the correct specification and check level.

TORQUE CONVERTER

Removing

1 Remove the transmission as previously described.

2 Remove the four bolts securing the converter to the drive plate. On the 8 cylinder models these are accessible at the area exposed by the removal of the dust cover. On the 6 cylinder models a plastic plug must be removed from the left hand of the engine back plate giving accessibility to the converter retaining bolts.

3 Remove the converter.

NOTE: The converter will still contain a quantity of fluid.

4 Drain off fluid and place a suitable covering over the sleeve to protect the seal surface and prevent ingress of foreign matter into the assembly.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

  (a) Fit new self locking bolts.

  (b) Tighten the bolts diagonally to the specified torque. See under GENERAL DATA.

DRIVE PLATE AND STARTER RING GEAR

The converter drive plate and starter ring gear is serviced as an assembly.

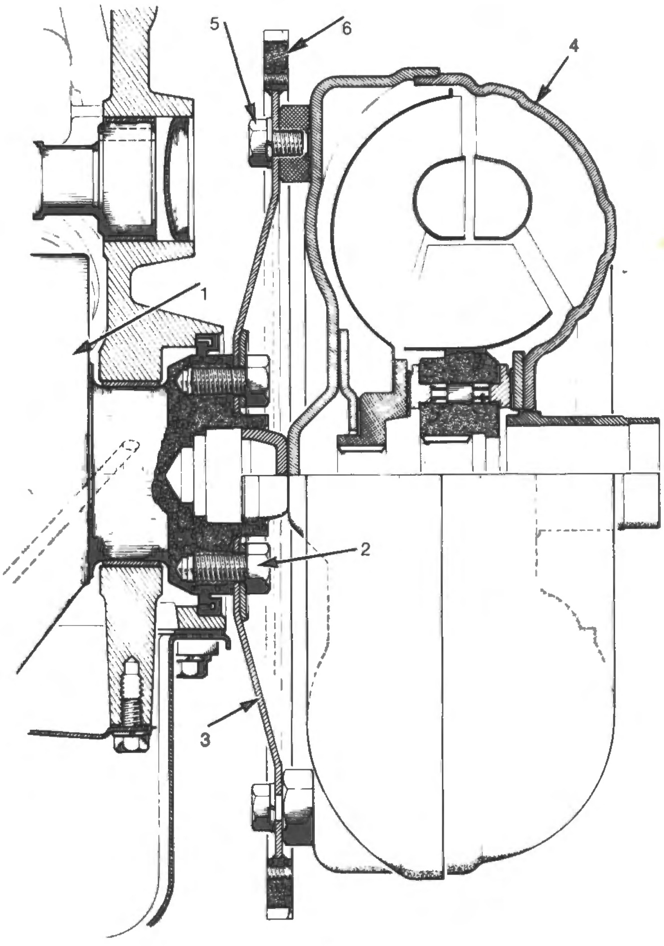


Fig. M-64

SECTION CONVERTER DRIVE PLATE

1 CRANKSHAFT
2 SELF LOCKING BOLTS (6)
3 DRIVE PLATE AND STARTER RING GEAR ASSEMBLY
4 CONVERTER
5 CONVERTER MOUNTING SELF LOCKING BOLTS
6 RING GEAR LEAD

Removing

Refer Fig. M-64.

1 Remove the converter as previously described.

2 Remove the six self locking bolts securing the drive plate to the crankshaft.

3 Remove the drive plate and centre support plate.

Inspecting

1 Check the ring gear for tooth damage and evidence of looseness on the drive plate.

2 Check the drive plate centre for evidence of cracking or movement in the area surrounding the mounting holes.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

  (a) If a new drive plate is fitted the assembly must be balanced, refer Section D.

  (b) Fit the drive plate with the concave face to the rear of the vehicle.

  (c) Fit new self locking bolts, drive plate to crankshaft and tighten diagonally to the specified torque. See GENERAL DATA.

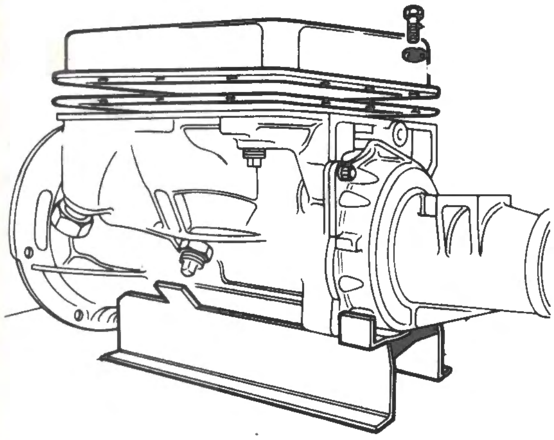


Fig. M-65

BWA 35 TRANSMISSION CRADLE

INPUT SHAFT END FLOAT

Prior to dismantling the main drive line components of the transmission, check and record the input shaft end float using service tool BWA33. Checking Refer Fig. M-66.

Checking

1 Remove the gearbox.

2 Clean the exterior casing with kerosene, invert the unit and place on stand BWA35. Fig. M-65.

3 Remove the oil reservoir and joint washer.

4 Release the throttle inner cable from the down-shift cam.

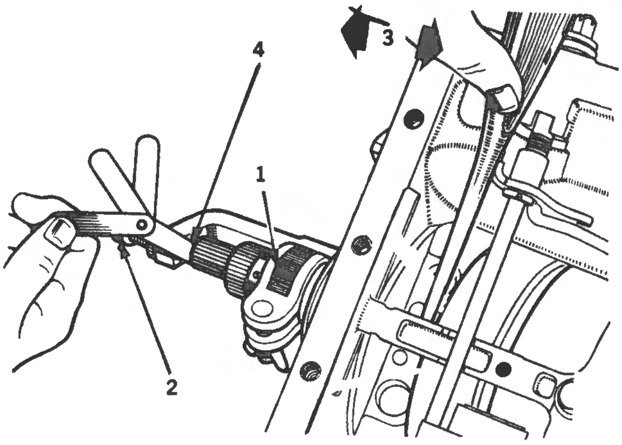


Fig. M-66

MEASURING THE TRANSMISSION END FLOAT

1 BWA 33 GAUGING TOOL
2 ADJUSTING SCREW
3 LEVERING BETWEEN PUMP AND CLUTCH
4 END FLOAT CHECK POINT

5 Remove the magnet and pull out the oil tubes. Remove the three bolts with spring washers and lift off the valve block.

6 Clamp BWA33 to the converter support shaft.

7 Gently lever the gear train forward and adjust the screw of the tool until it just contacts the end of the input shaft.

8 Lever the clutch back using light pressure and measure the gap produced between the tool and the end of the shaft, it should be between 0.25 to 0.76 mm (0.010 to 0.030 in). If the gap is excessive fit new thrust washer (4). Fig. M-66.
If the gap is zero after a repair operation check the transmission for displaced or incorrectly fitted thrust washers and bearings.

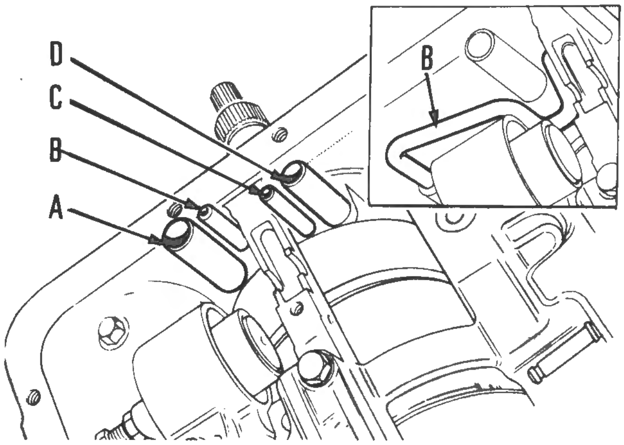


Fig. M-67

PUMP OIL PIPES

A PUMP INLET 'O' RING ON TUBE
B CONVERTER TO OIL COOLER
C CONVERTER INLET
D PUMP OUTLET

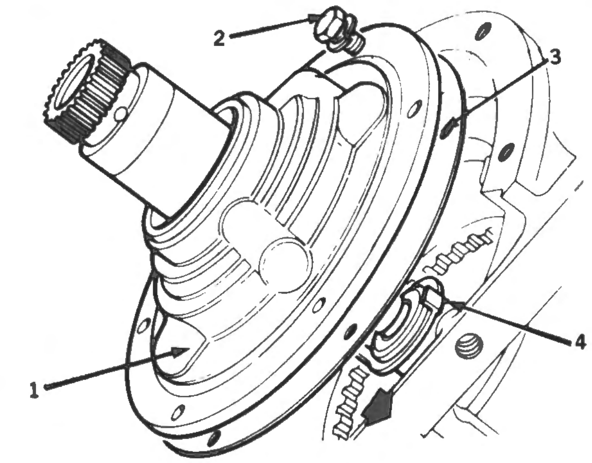


Fig. M-68
REMOVING FRONT PUMP

1	FRONT PUMP ASSEMBLY	3	GASKET
2	RETAINING BOLTS	4	THRUST WASHER 1.54 — 1.60 mm (0.061 — 0.063 in)

FRONT PUMP

Removing

Figs. M-67-68.

1. Remove the transmission.
2. Clean and place on stand.
3. Remove oil reservoir.
4. Remove the valve block.
5. Remove the pump and converter oil pipes.
6. Take out the six bolts with spring washers.
7. Remove the front pump with its joint washer and input shaft thrust washer at the same time holding the forward clutch assembly back toward the rear of the transmission.

NOTE: A quantity of fluid will be released from the transmission case when the front pump is removed.

Dismantling

Refer Fig. M-69.

1. Unscrew the five bolts securing the pump body to the stator support.
2. Take out the locating screw.
3. Separate the stator support from the pump body assembly.
4. Mark the outside faces of the gears to facilitate correct assembly 'A'.
5. Remove the gears.
6. Remove the sealing ring.
7. Extract the seal.

Inspecting

1. Check the pump body and gear teeth for scores and excessive wear; remove light scores with very fine abrasive cloth.
2. Check drive gear bush journals for excessive wear or damage.

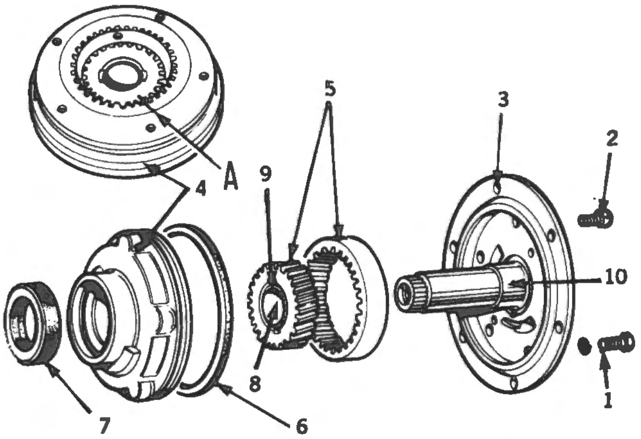


Fig. M-69
FRONT PUMP COMPONENTS

1	BOLTS (5) STATOR TO PUMP	6	SEALING RING (RUBBER)
2	LOCATING SCREW	7	PUMP/CONVERTER SEAL
3	STATOR SUPPORT	8	DRIVE GEAR BUSH
4	PUMP BODY ASSEMBLY	9	DRIVE SLOTS
5	PUMP GEARS	10	DRIVE GEAR BEARING JOURNAL

Assembling

1. Renew the seal.
2. Renew the sealing ring.
3. Fit gears to the pump body.
4. Lightly lubricate the gears and the sealing ring.
5. Refit the stator support.
6. Fit and tighten the locating screw.
7. Fit bolts with spring washers.
8. Tighten the locating screw to 2.4 Nm (2-3 lb.f.ft.).
9. Tighten bolts to 23.1-43 Nm (17-32 lb.f.ft.).

Refitting

1. Refitting is the reversal of the removing procedure noting the following:
   - (a) Retain the thrust washer on the pump assembly using petroleum jelly and ensure the forward clutch assembly is correctly positioned with its thrust washers located on the rear clutch hub.
   - (b) Using a new joint gasket, tighten the bolts to 11-24.5 Nm (8-18 lb.f.ft.).
   - (c) Check the transmission end float.
   - (d) Refill the transmission with fluid and check the level.

FRONT CLUTCH

Removing

Refer Fig. M-70.

1. Remove the transmission.
2. Remove the front pump and input shaft thrust washer.
3. Withdraw the input shaft and front clutch assembly.
4. Remove the bronze and steel thrust washers.

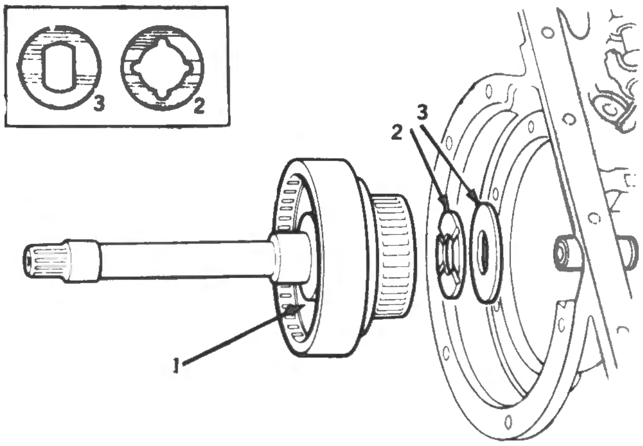


Fig. M-70

FRONT CLUTCH ASSEMBLY REMOVAL

1 FRONT CLUTCH ASSEMBLY
2 BRONZE THRUST WASHER
3 STEEL THRUST WASHER

Dismantling

1. Remove the front clutch.
2. Lever out the snap ring.
3. Withdraw the input shaft assembly.
4. Remove the clutch hub thrust washer.
5. Withdraw the clutch hub.
6. Remove the inner (fibre) and outer friction plates; retain the plates in their correct order.
7. Remove the clutch distance piece.
8. Lever out the circlip retaining the dished piston spring.
9. Remove the dished piston spring.
10. Withdraw the piston, apply air pressure to feed orifice on the internal bore whilst the second is blanked off.
11. Remove the bearing ring from the piston if worn.
12. Remove the sealing ring.
13. Remove the 'O' ring from the clutch housing boss.

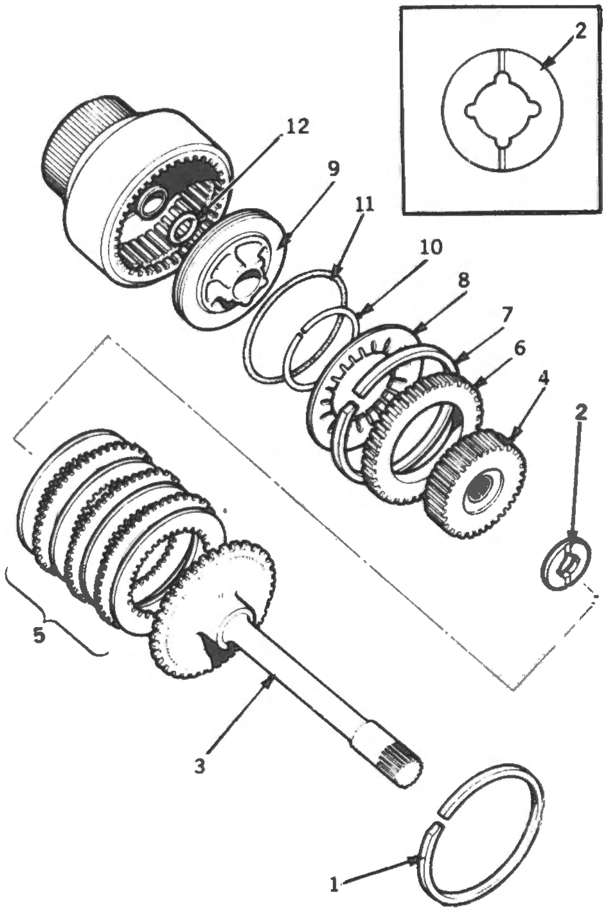


Fig. M-71

FRONT CLUTCH ASSEMBLY

1 SNAP RING
2 CLUTCH HUB THRUST WASHER
3 INPUT SHAFT ASSEMBLY
4 CLUTCH HUB
5 FRICTION PLATE PACK
6 CLUTCH DISTANCE PIECE
7 PISTON SPRING CIRCLIP
8 PISTON SPRING
9 PISTON (WITH BALL ONE-WAY VALVE)
10 SPRING BEARING RING
11 SEALING RING (PISTON)
12 'O' RING CLUTCH HUB

Inspecting

1. Renew the rubber oil seals. Check that the piston one-way valve will operate.

NOTE: If the rear clutch is not being overhauled, check the sealing rings on the forward sun gear shaft for wear and renew if necessary.

2. Check the friction plates for wear and burning. Renew as a set.
3. Check the steel plates for distortion; if the distortion exceeds 0.12 mm (0.005 in) the plates must be renewed as a set.
4. Check primary sun gear shaft bush in the input shaft for wear.

Assembling

1 Assembling is the reverse of the dismantling procedure noting the following:

(a) Refit the piston into the drum using tool BW42.

(b) Refit the inner and outer clutch plates in alternate sequence.

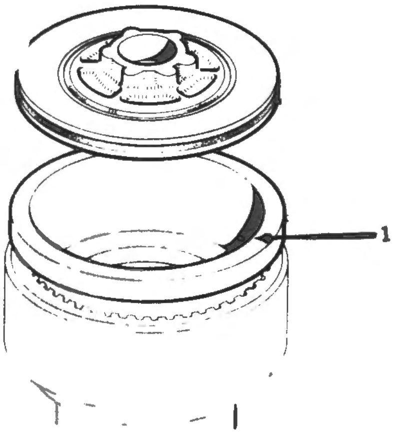


Fig. M-72

FITTING THE FRONT CLUTCH PISTON

1 BW-42 PISTON FITTING SLEEVE

Refitting

1 Retain the steel and bronze thrust washers in position on the hub of the rear clutch using petroleum jelly.

2 Refit the input shaft and front clutch assembly.

3 Refit the front pump with thrust washer; use a new joint washer and tighten bolts to 11-24.5 Nm (8-18 lb.f.ft.).

4 Refit the transmission.

5 Refill the transmission with fluid and check the level.

REAR CLUTCH

Removing

Refer Fig. M-73.

1 Remove the input shaft and front clutch assembly.

2 Remove the bronze and steel thrust washers.

3 Withdraw the rear clutch and forward sun gear assembly.

4 Remove front brake band as necessary.

5 Remove the front clutch feed sealing rings on the sun gear shaft.

6 Withdraw the forward sun gear from the rear clutch. The sun gear has a needle thrust washer fitted on either side.

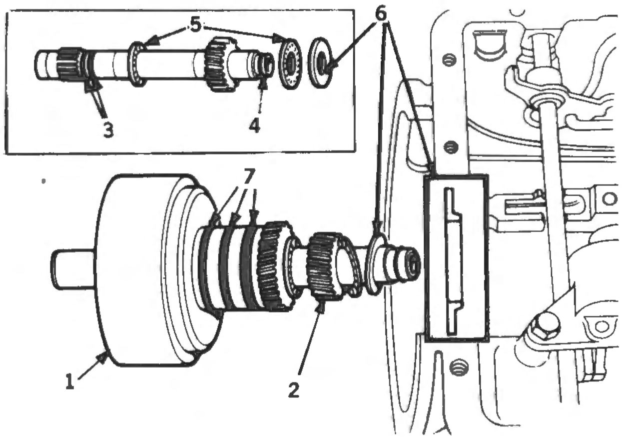


Fig. M-73

REAR CLUTCH AND SUN GEAR REMOVAL

1 REAR CLUTCH ASSEMBLY

2 SUN GEAR (PRIMARY)

3 FRONT CLUTCH FEED SEALING RINGS (2)

4 SEALING RING FRONT CLUTCH GOVERNOR FEED (1)

5 TORRINGTON THRUST BEARING

6 BEARING THRUST PLATE

7 REAR CLUTCH FEED SEALING RINGS

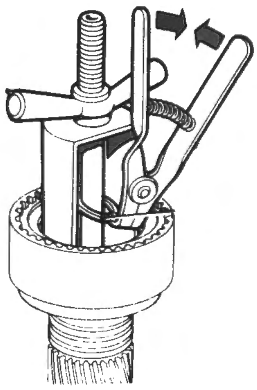


Fig. M-74

REMOVING THE CIRCLIP REAR CLUTCH SPRING RETAINER USING BW37 AND CIRCLIP PLIERS

Dismantling

1 Lever the snap ring from the front of the clutch drum.

2 Withdraw the pressure plate.

3 Remove the inner (fibre) and outer friction plates, and retain the plates in their removal order for assembly.

4 Compress the piston spring using tool BW37.

5 Remove the spring retaining circlip.

6 Withdraw the seat and spring.

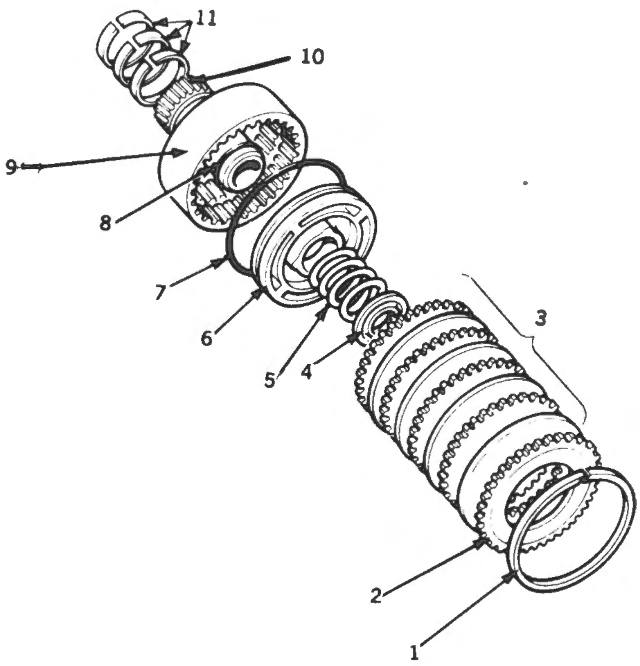


Fig. M-75

REAR CLUTCH ASSEMBLY

1 SNAP RING
2 PRESSURE PLATE
3 CLUTCH PLATE PACK
4 SPRING RETAINER AND CIRCLIP
5 SPRING
6 PISTON WITH ONE-WAY REED OR BALL VALVE
7 PISTON SEALING RING
8 'O' SEAL SUN GEAR HU
9 FRONT BAND DRUM
10 SECONDARY SUN GEAR
11 REAR CLUTCH FEED SEALING RINGS

7 Remove the piston by shocking the drum on a soft surface or apply air pressure to the hole between the two inner oil rings at the rear of the housing.

8 Remove the piston seal.

9 Remove the 'O' ring from the sun gear hub.

Inspecting

1 Renew rubber oil seals. Check that the piston one-way reed or ball valve will operate.

2 Check the friction plates for wear; the plates are coned 0.25 to 0.50 mm (0.010 to 0.020 in). Renew as a set.

3 Check the ring seals and the drum bearings for wear or damage.

4 Check spring retainer (Fig. M-76) for dimensional correctness. The surfaces should be flush within 0.50 mm (0.020 in). If beyond these limits fit a new spring seat or grind off excess material.

5 Forward sun gear shaft: Check the needle thrust washers and ring seals for wear or damage.

6 Check condition of front band.

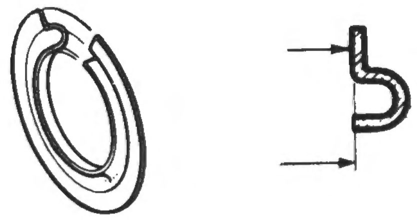


Fig. M-76

SPRING RETAINER

Assembling

1 Assembling is the reverse of the dismantling procedure 1 to 9 noting the following:

   (a) Refit the piston into the drum using tool BW41A.

   (b) Refit the inner and outer clutch plates in alternate sequence and with the coning in the same direction.

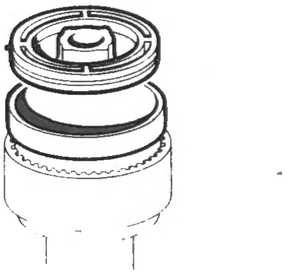


Fig. M-77

FITTING REAR CLUTCH PISTON

Refitting

1 Refitting is the reversal of the removing procedure noting the following:

   (a) Use only petroleum jelly to retain Torrington thrust bearing in position.

   (b) Refer Item 6. Fig. M-73. Ensure the bearing thrust plate is fitted as shown, thrust face toward the bearings so that the spigotted side will locate in the gear carrier.

2 Adjust the front band.

3 Refill the transmission with fluid and check the level.

FRONT BAND

Removing

1 Refer Rear Clutch Items 1 to 4.

Refitting

1 Refer Rear Clutch.

CENTRE SUPPORT AND PLANET GEAR SET

Removing

Refer Figs. M-78-79-80.

1. Remove the rear clutch and primary sun gear assembly.
2. Remove rear servo and strut.
3. Take out the two centre support bolts with lock washers.
4. Withdraw the centre support and planet gear assembly with its needle thrust washer from the casing.

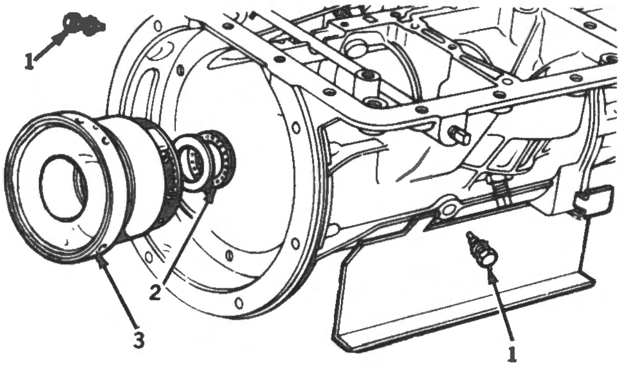


Fig. M-78

REMOVING PLANET GEAR SET

1 CENTRE SUPPORT BOLTS AND LOCK WASHERS
2 TORRINGTON THRUST WASHER AND THRUST PLATE
3 CENTRE SUPPORT AND PLANET GEAR ASSEMBLY

5. Separate the centre support from the planet gear carrier; turn the support to relax the one-way clutch.
6. Withdraw the one-way clutch.
7. Lever out the circlip.
8. Remove the one-way clutch outer race.

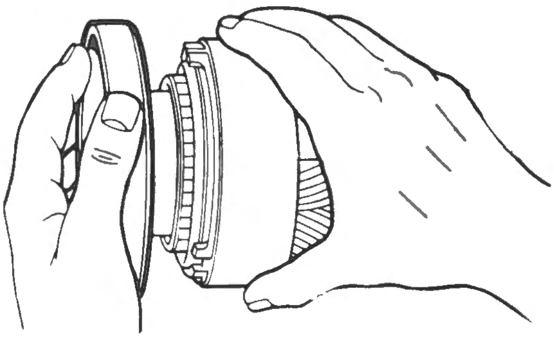


Fig. M-79

SEPARATING THE CENTRE SUPPORT

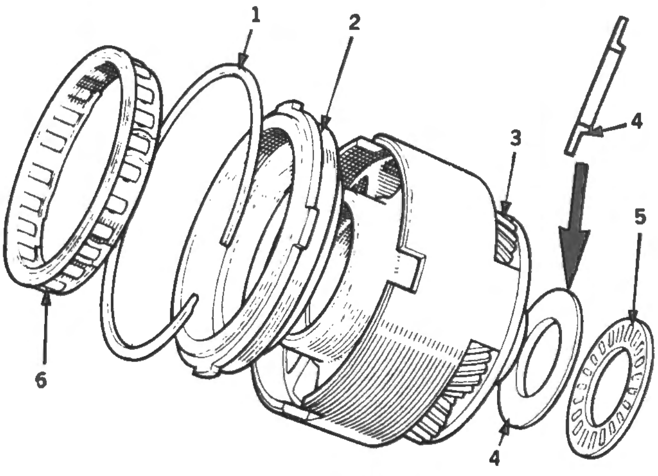


Fig. M-80

REMOVING THE ONE-WAY CLUTCH

1 CIRCLIP
2 OUTER RACE (ONE-WAY CLUTCH)
3 PLANET CARRIER ASSEMBLY
4 THRUST WASHER (CORRECT POSITION)
5 TORRINGTON BEARING
6 INNER RACE (ONE-WAY CLUTCH)

Inspecting

1. Check the gears for worn or damaged teeth; check the fit of the gear carrier pins.
2. Check the condition of one-way clutch.
3. Check condition of rear band.

Assembling

1. Locate the outer race in the planet gear carrier with the circlip and install the one-way clutch with its flange facing outwards.
2. Assemble the centre support and the planet gear carrier.
3. Retain the thrust washer and Torrington bearings plate to carrier as shown in Fig. M-80.
4. Install the centre support and planet gear carrier assembly, ensuring that the oil feed holes are uppermost (with transmission inverted) and the locating holes are aligned with those in the casing.
5. Fit and tighten the two locating bolts with washers to 13.5 to 24.3 Nm (10-18 lb.f.ft.). The washers act as a seal and must be fitted with their flat faces against the casing.

Refitting

1. Refitting is the reversal of the removing procedure noting the following:
   - (a) Tighten rear servo dowel bolt to 17.5-36.5 Nm (13-27 lb.f.ft.).
   - (b) Adjust rear band.
   - (c) Refill the transmission with the fluid and check the level.

REAR BAND

Removing

Refer Fig. M-81.

1. Carry out operations 1 to 4 for centre support and planet gear set.
2. Squeeze the ends of the band together and remove it from the casing.

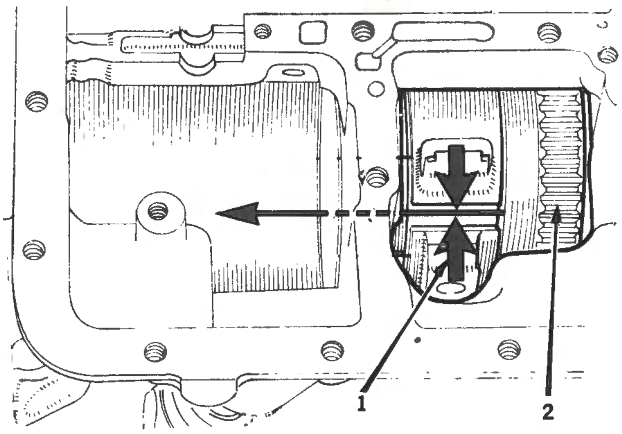


Fig. M-81

REMOVING REAR BAND

1 REAR BAND
2 OUTPUT SHAFT RING GEAR

Refitting

1. Refitting is the reversal of the removing procedure noting the following:
   (a) Adjust the rear band.
   (b) Refill the transmission with fluid and check the level.

OUTPUT SHAFT AND RING GEAR

Removing

Refer Figs. M-82-83.

1. Carry out all removing operations up to and including the rear band.
2. Remove the rear extension, speedometer drive and governor if not previously removed.
3. Remove the six adaptor plate screws and washers and remove the plate.
4. Remove the three output shaft sealing rings.
5. Withdraw the output shaft and ring gear assembly taking care not to damage the surface of the rear support bearing in the casing.
6. Remove the output shaft thrust washer.
7. Remove the snap ring.
8. Withdraw the output shaft from the ring gear.

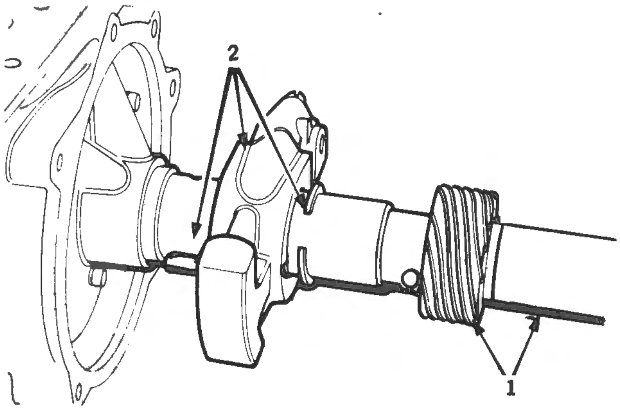


Fig. M-82

REMOVE OUTPUT SHAFT COMPONENTS

1 SPACER, GEAR AND DRIVE BALL
2 CIRCLIP, GOVERNOR AND DRIVE BALL

Inspecting

1. Check the ring gear to output shaft teeth and circlip for evidence of movement.
2. Check sealing ring grooves for wear.
3. Check planet gear carrier bush in the output shaft for wear.
4. Check the adaptor plate for wear in the sealing ring groove.

Refitting

1. Refitting is the reversal of the removing procedure noting the following:
   (a) Ensure the output shaft thrust washer is correctly located on the transmission case. Fig. 83 inset.
   (b) Tighten the adaptor plate bolts to 5.5 to 11 Nm (4-8 lb.f.ft.).
   (c) Ensure governor is fitted with its cover plate facing away from the transmission case.
   (d) Refill the transmission with fluid and check the level.

MANUAL CONTROL VALVE SHAFT AND LEVER

Removing

Refer Fig. M-84.

1. Remove the oil reservoir and valve block assemblies.
2. Remove the selector shaft operating lever (external).
3. Remove the parking brake link retaining clip from the parking pawl end of the link. Detach the inhibitor switch operating link and the parking brake link.
4. Slide the manual valve detent lever away from its pin towards the spring.
5. Remove the pin.

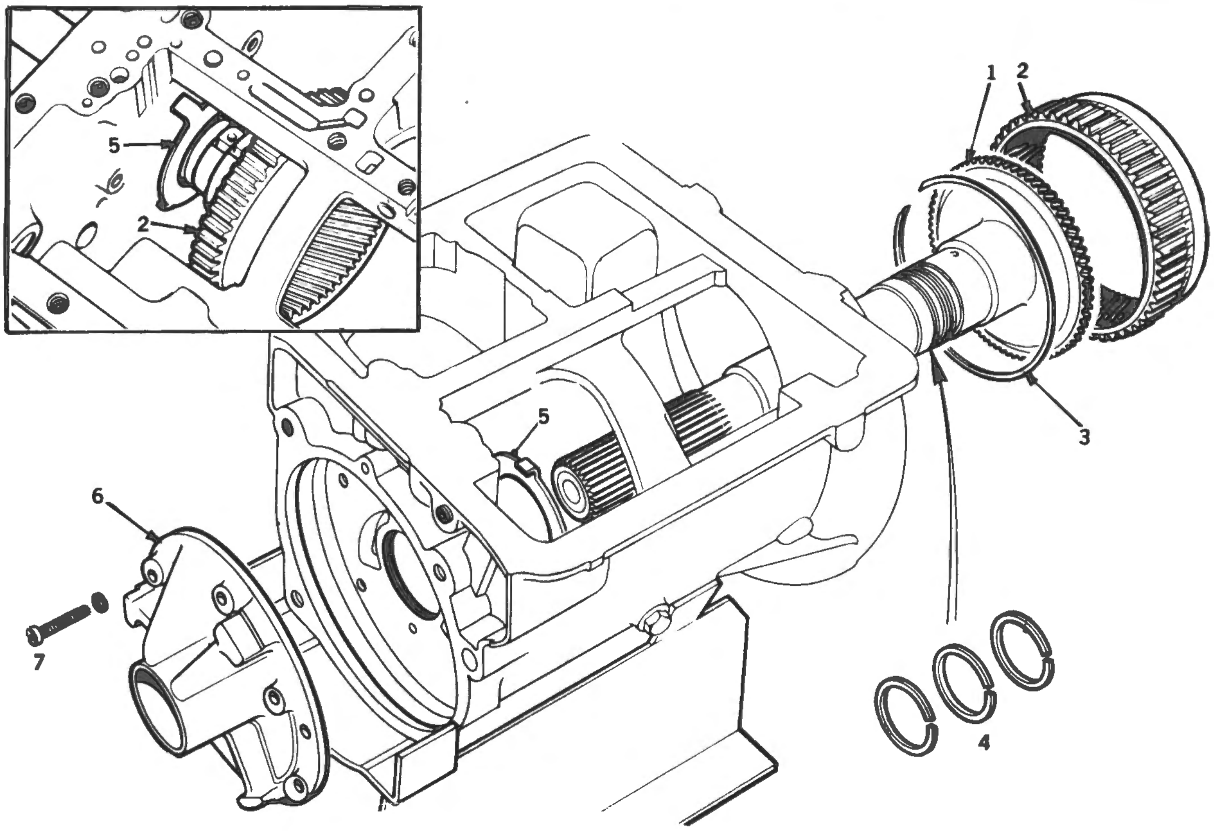


Fig. M-83

REMOVING THE OUTPUT SHAFT AND
RING GEAR ASSEMBLY

1 OUTPUT SHAFT
2 RING GEAR
3 SNAP RING
4 OUTPUT SHAFT SEALING RINGS (3) FORWARD CLUTCH AND GOVERNOR FEED)
5 OUTPUT SHAFT THRUST WASHER
6 ADAPTOR PLATE
7 ADAPTOR PLATE RETAINING SCREWS (6)

6 Slide the detent lever back and at the same time capture the detent ball and spring.

7 Remove the circlip and washer from the opposite end of the shaft.

8 Withdraw the shaft.

9 Remove the detent lever, link and spring.

Refitting

1 Refitting is the reversal of the removing procedure noting the following:

(a) Replace the shaft oil seal and welsh plug as necessary.

(b) Ensure the manual valve lever is correctly positioned in the manual valve when the valve block is replaced.

(c) Ensure the throttle cable is connected to the down-shift cam.

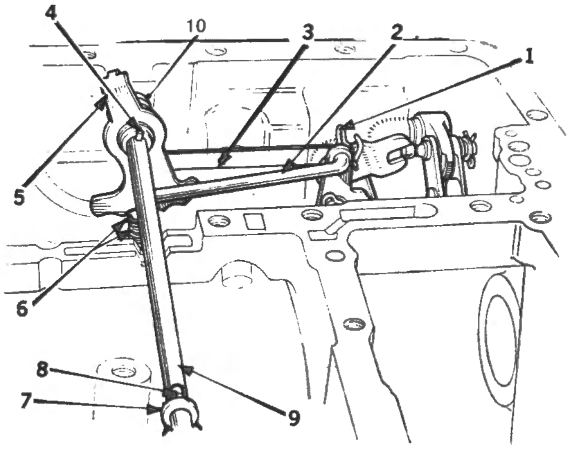


Fig. M-84

MANUAL SELECTOR VALVE MECHANISM

1 CIRCLIP
2 PARK BRAKE LINK
3 INHIBITOR SWITCH LINK
4 PIN DETENT LEVER
5 DETENT LEVER
6 DETENT BALL AND SPRING
7 WASHER
8 CIRCLIP
9 SHAFT
10 SHAFT SPRING

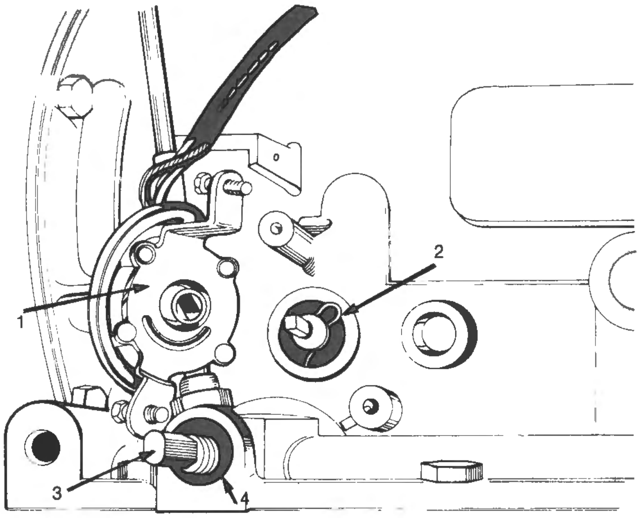


Fig. M-85

REMOVING THE INHIBITOR SWITCH

1	INHIBITOR SWITCH	3	SELECTOR SHAFT
2	SWITCH SHAFT CIRCLIP	4	SHAFT OIL SEALS

INHIBITOR SWITCH SHAFT AND LEVER

Removing

Refer Figs. M-85-86-87.

1 Remove the inhibitor switch.

2 Remove the inhibitor switch shaft circlip.

3 Remove the oil reservoir and valve block assembly.

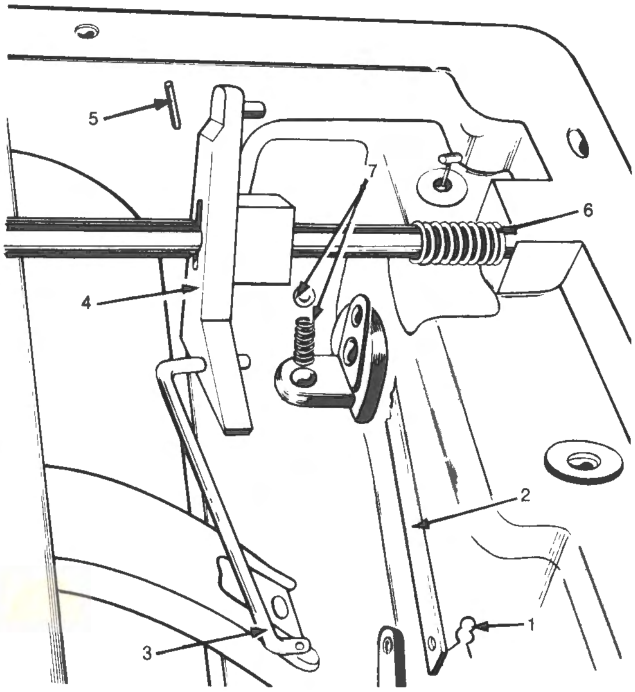


Fig. M-86

REMOVING INHIBITOR SWITCH MECHANISM

1	CIRCLIP	5	DETENT LEVER PIN
2	INHIBITOR SWITCH LINK	6	SPRING
3	PARK BRAKE LINK	7	DETENT BALL AND SPRING
4	DETENT LEVER		

4 Remove the parking brake link retaining clip from the parking pawl end of the link.

5 Detach the inhibitor switch link and park brake link.

6 Slide the detent lever away from its pin against the spring and remove the pin.

7 Remove the inhibitor switch operating shaft and lever assembly complete with link.

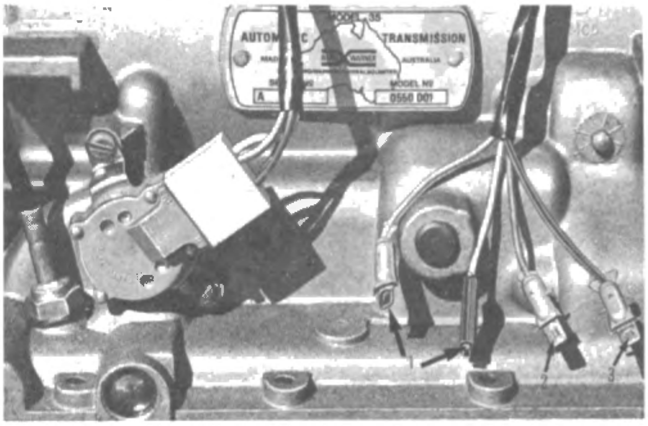


Fig. M-87

CORRECT POSITION OF INHIBITOR SWITCH AND HARNESS

1 STARTER/IGNITION SWITCH LEADS (WHITE WITH RED TRACE)

2 LEAD TO FUSE BOX (GREEN LATER)

3 LEAD TO REVERSE LAMPS (GREEN BROWN TRACE)

Refitting

1 Refitting is the reversal of the removing procedure noting the following:

(a) Check that the engine will start only in 'N' and 'P' and the reversing lights only will operate when 'R' is selected.

PARKING BRAKE

Removing

Refer Figs. M-88-89.

1 Remove the oil reservoir and valve body assembly.

2 Remove the extension housing.

3 Ease out the anchor pin.

4 Tap out the roll pin and remove the toggle pin.

5 Lift out the parking pawl assembly.

6 Remove the spring clips retaining the link rod and torsion lever assembly.

7 Release the toggle lever spring and withdraw the torsion lever assembly.

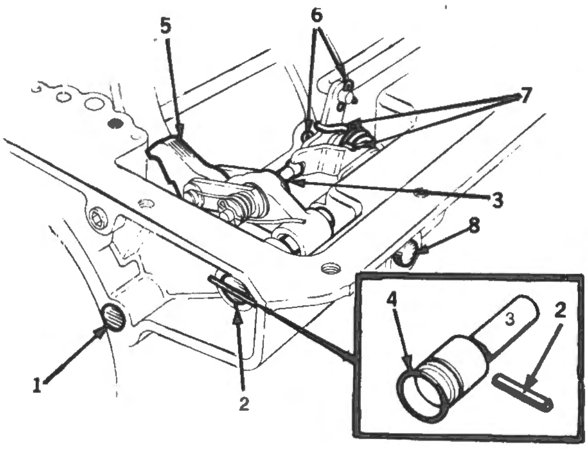


Fig. M-88

PARKING BRAKE REMOVAL

1 ANCHOR PIN
2 ROLL PIN
3 TOGGLE PIN
4 'O' RING SEAL
5 PARKING PAWL
6 CLIPS, LINK ROD AND TORSION LEVER
7 TOGGLE LEVER SPRING
8 TORSION LEVER PIN

Refitting

1 Reverse 1 to 7 of removing procedure, renew worn parts.

2 Ensure that the toggle pin and toggle lift lever are aligned. The torsion lever pin is a press fit in the case and should protrude 3.2 mm (1.125 in) approximately.

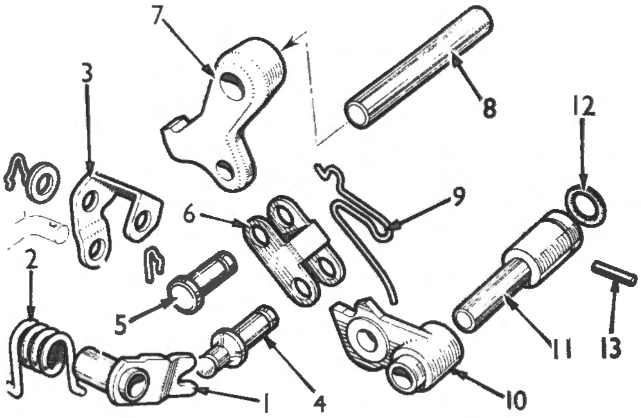


Fig. M-89

PARKING PAWL AND TORSION LEVER

1 TOGGLE LIFT LEVER
2 SPRING
3 TORSION LEVER
4 TOGGLE PIN
5 TOGGLE LINK PIN
6 TOGGLE LINK
7 PARKING BRAKE PAWL
8 ANCHOR PIN
9 TOGGLE SPRING
10 TOGGLE LEVER
11 TOGGLE PIN
12 'O' RING SEAL
13 ROLL PIN

SPEEDOMETER DRIVE PINION

Removing

Refer Fig. L-1.

1 Remove the bolt, spring washer and retaining plate.

2 Extract speedometer cable and drive pinion from transmission housing.

3 Remove circlip retaining drive pinion to cable and remove pinion.

Refitting

1 Refitting is a reversal of the removing procedure.

AUTOMATIC TRANSMISSION SERVICED AT 13,100 22. 1. 88

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SECTION N

PROPELLER SHAFT

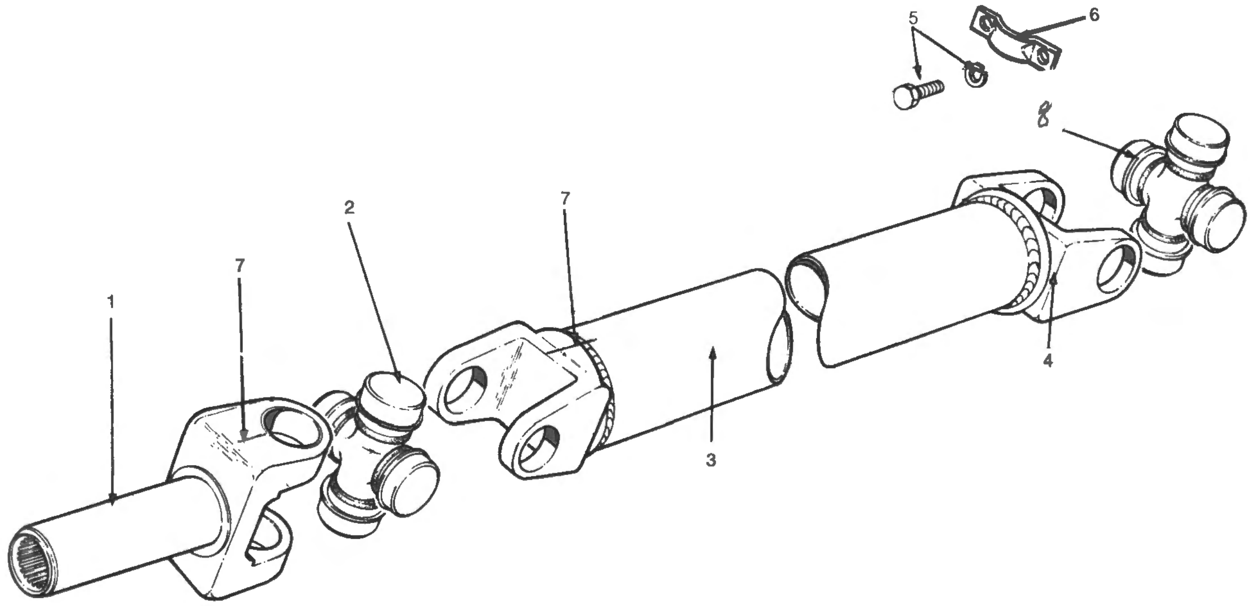


Fig. N-1

LAYOUT OF PROPELLER SHAFT ASSEMBLY

1	SLIDING YOKE	
2	UNIVERSAL JOINT BEARING ASSEMBLY	FRONT RUJ 2030
3	PROPELLER SHAFT	
4	REAR YOKE	
5	BOLT AND SPRING WASHER	
6	LOCK PLATE	
7	ALIGNING MARKS	
8	UNIVERSAL JOINT REAR RUJ 2038	

DESCRIPTION

The propeller shaft is a conventional open type tubular unit incorporating a Hooke's type universal joint at each end.

A splined yoke at the front sides on the transmission mainshaft to compensate for the varying length produced by the up and down movement of the rear axle. Fig. N-1.

The rear end of the propeller shaft is coupled to the hypoid pinion flange through a universal joint and secured by clamps and four bolts.

The universal joints or sliding splines do not require any periodic maintenance.

Removing

1. Straighten the lock plates securing the four bolts retaining the rear universal joint to the rear axle pinion yoke. Fig. N-1.
2. Loosen and remove the bolts and clamps.
3. Use a piece of wire or adhesive tape to retain the bearings on the cross journals.
4. Lower the rear of the shaft and slide rearwards to clear the splines from the transmission main shaft. It may be necessary to plug the rear of the extension housing to prevent loss of lubricant.

Refitting

1. Refitting is the reversal of the removing procedure noting the following points:
   (a) Lightly lubricate the splined yoke with chassis grease.

   (b) Tighten the retaining bolts to 16-19 Nm (12-14 lb.f.ft.).

OVERHAULING

Removing

1. Remove propeller shaft from vehicle as previously described.
2. Mark both sliding yoke and shaft so that they may be assembled in their original position to enable the balance to be retained. Fig. N-1.

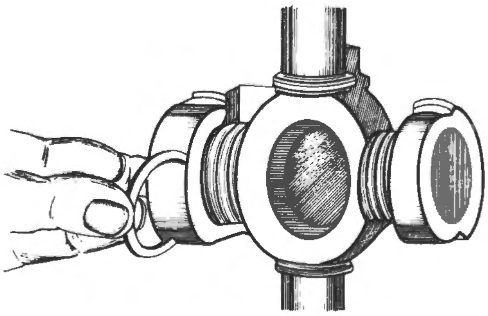


Fig. N-2

REMOVING AND REPLACING CIRCLIPS

Dismantling

1. Remove bearing retaining circlips. Fig. N-2.
2. Position the slip yoke end of propeller shaft on a vice so that the shaft yoke rests on top of the vice jaws.
3. Using a piece of tubing of sufficient inside diameter to clear the bearing, and a hammer, drive downwards on the yoke. Fig. N-3. This will drive the yoke down, causing the cross to force the bearing partially out of the yoke.

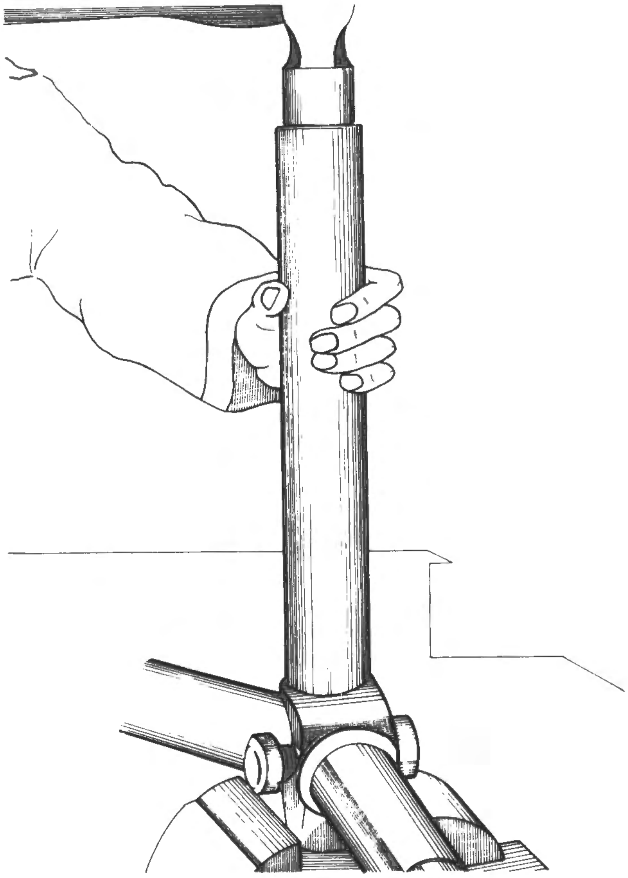


Fig. N-3

PARTIAL BEARING REMOVAL

4. Clamp the partially exposed bearing in a soft jawed vice (Fig. N-4) and drive the yoke upwards until the bearing is removed.
5. Remove the opposite bearing in the same manner and remove the slip yoke from the cross.
6. Clamp the shaft yoke in a vice.

CAUTION: Do not clamp the propeller shaft tube in the vice.

7. Using a hammer and a brass drift, drive the cross downwards until the bearing is partially forced out of the yoke.
8. Clamp the partially exposed bearing in a soft jawed vice, and drive the yoke upwards until the bearing is removed.

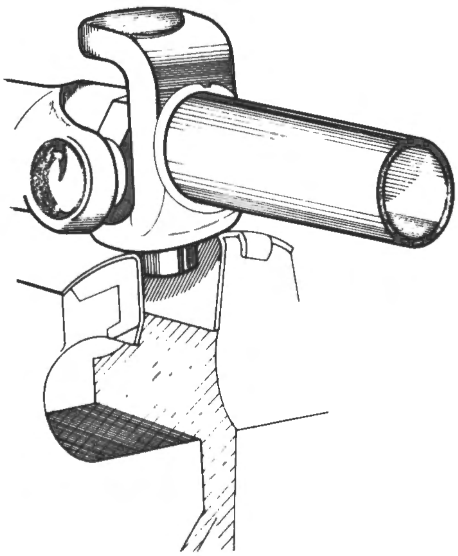


Fig. N-4

BEARING REMOVING

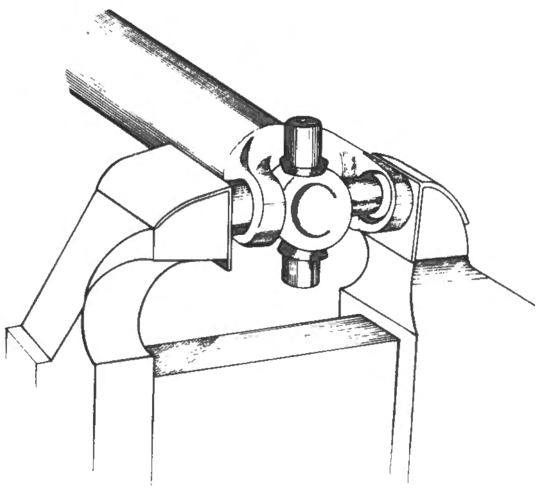


Fig. N-5

BEARING REPLACING

9 The opposite side bearing is removed in the same manner. Remove the cross.

Inspecting

1 Clean the parts in a suitable solvent and dry with compressed air.

2 Examine the bearing surfaces of the cross. All bearing surfaces should be smooth, free of pits and indentations.

3 Examine the needle rollers in the bushes. Bearings should be smooth and roll freely inside the bushes. Bearings that have been running on a worn cross must be replaced.

Assembling

1 Force grease between the rollers in all four bushes and fill the reservoirs in the cross with grease.

NOTE: New universal joint assemblies may be pre-packed with grease and no further lubrication will be necessary.

2 Place the cross in the yoke and fit the dust seals.

3 Enter one bearing into the shaft yoke and using the vice, press the bearing into the yoke, at the same time enter the journal of the cross into the bearing. Fig. N-5. The bearing is pressed into the yoke sufficiently to fit the circlip.

4 Insert the bearing on the opposite side of the yoke. Press the bearing into the yoke in the same manner as the previous one and fit the circlip. The circlip must be fitted with the gap towards the yoke. Fig. N-2.

CAUTION: Ensure that the needle rollers are not dislodged during the assembly otherwise the bush may be damaged and it will not be possible to fit the circlip.

5 To fit the sliding yoke, position the yoke over the cross and repeat procedures 2-3-4.

6 The rear universal joint is fitted in the shaft yoke in the same manner as described in procedures 2-3-4.

7 Refit the propeller shaft in the vehicle.

SHAFT VIBRATION

Shaft vibration may occur from numerous causes, most of which appear in the following diagnosis chart.

1 Worn universal joints.

2 Propeller shaft damaged.

3 Loose pinion shaft flange nut/flange run-out.

4 Rear joint bearings not seated in pinion flange.

5 Incorrect drive line angles.

92300 REPLACED BOTH FRONT & REAR UNIVERSAL JOINTS 19. 11. 93

SECTION O

REAR AXLE AND REAR SUSPENSION

REAR AXLE COMPONENTS

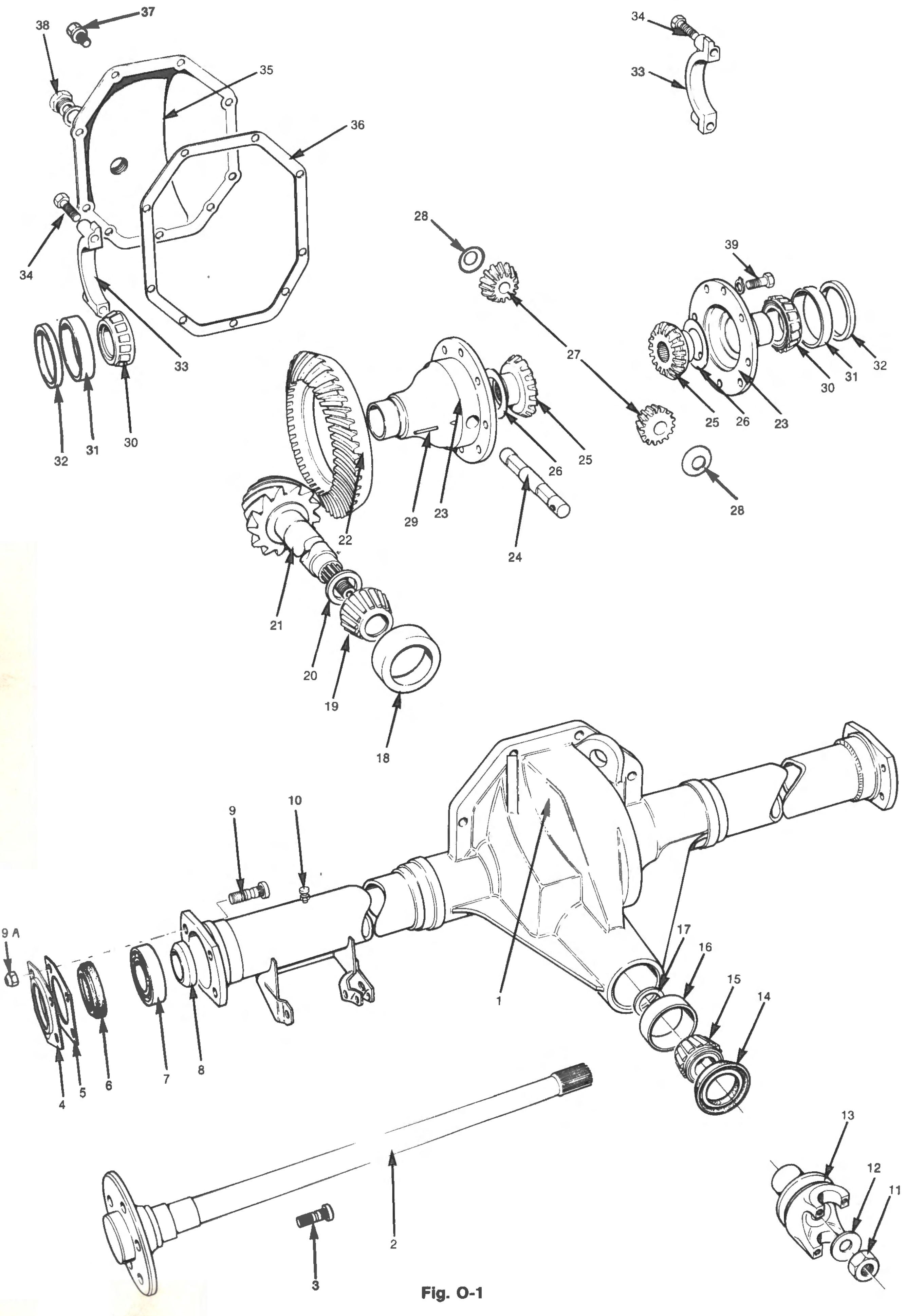


Fig. O-1

KEY TO FIG. O-1

REAR AXLE COMPONENTS

1 REAR AXLE HOUSING
2 AXLE SHAFT
3 WHEEL STUD
4 AXLE RETAINER
5 GASKET
6 OIL SEAL
7 AXLE BEARING
8 BEARING RETAINER
9 AND 9A. RETAINER BOLT AND NUT
10 BREATHER
11 PINION FLANGE NUT
12 WASHER
13 PINION FLANGE
14 PINION OIL SEAL
15 PINION BEARING CONE (OUTER)
16 PINION BEARING CUP (OUTER)
17 SPACER
18 PINION BEARING CUP (INNER)
19 PINION BEARING CONE (INNER)
20 SHIM
21 PINION
22 CROWN WHEEL
23 DIFFERENTIAL HOUSING
24 DIFFERENTIAL PIN
25 DIFFERENTIAL GEAR
26 THRUST WASHER
27 DIFFERENTIAL PINION
28 THRUST WASHER (DISHED)
29 LOCK PIN
30 DIFFERENTIAL CARRIER BEARING CONE
31 DIFFERENTIAL CARRIER BEARING CUP
32 SHIM
33 CAP
34 BOLT
35 COVER
36 GASKET
37 COVER RETAINING BOLT
38 OIL LEVEL PLUG AND WASHER
39 DIFFERENTIAL HOUSING BOLT

GENERAL DESCRIPTION

The rear axle is the hypoid gear, semi-floating type of unitized carrier construction. The differential pinions and side gears are housed in a two-piece differential case supported by two taper roller bearings in the housing. Bearing pre-load adjustments are provided by varying shim thickness behind the bearing cups. The hypoid pinion is mounted in two opposed taper roller bearings in the housing.

The axle shafts are mounted on unit-type taper roller bearings and retained by a plate housing a seal, at the axle housing outer-ends. Axle shaft end play is preset and is not adjustable.

An identification tag on the rear axle housing gives the gear ratio and part number.

The axle shafts, pinion flange, oil seals, rear cover and gasket are the only parts that should be removed when the axle housing is in situ. The axle housing should be removed from the vehicle for all other service operations.

The unit-type taper roller bearings do not require any periodic maintenance when in service.

For other than obvious mechanical failures, careful diagnosis should be made to locate rear axle troubles, since noises from the engine, transmission and wheels may all be attributed to the rear axle.

LUBRICATION

The rear axle is filled or topped up through the combined filler and level plug in the differential housing cover.

It is of utmost importance that only the specified grade of hypoid oil be used.

Inspect the oil level at the recommended mileage and top up as necessary to the level of the filler opening.

CAUTION: When filling or topping up the rear axle with lubricant, do not overfill. Allow any excess lubricant to drain out to the BOTTOM of the filler opening.

SERVICE DIAGNOSIS

Ensure that the axle lubricant is correct and at the correct level. Drive at low speed until thoroughly familiar with vehicle noises, by which time the rear axle assembly should be at operating temperature. Accelerate gradually from the lowest practical speed in top gear to 80 km/hr (50 mph), noting any noises and the speeds at which they occur. Release the accelerator and without using the brakes allow the car to lose speed, again noting noise and speed. Next allow the car to coast to rest from 80 km/hr (50 mph) with the engine switched off and the transmission in neutral. Any noises common to earlier tests may be eliminated as axle gear noise, as the axle is not under load under these conditions. Engine noise is gauged by gradually accelerating the engine with the vehicle at rest. Noises not eliminated at this stage are most probably axle gear noise and should be determined as being:

1 Objectionable — warrants further attention, or

2 Acceptable — leave as is.

SYMPTOMS AND POSSIBLE CAUSES

1 REAR WHEEL NOISE

- (a) Worn brake drum
- (b) Wheel hub bolts loose
- (c) Brinelled or scored bearings
- (d) Insufficient lubrication
- (e) Bent axle shaft or flange and wheel
- (f) Dragging brakes
- (g) Axle shaft retainer plate loose
- (h) Tyre defective

2 REAR AXLE NOISE

Rear axle noises fall into two categories: Bearing Noise and Gear Noise:

(a) Bearing Noise — is usually low pitched and fairly constant throughout the entire speed range and is frequently caused by worn bearings, which can be the results of:
  (i) Contaminants in the lubricant
  (ii) Incorrect pre-load setting
  (iii) Bearings incorrectly mounted, e.g. dirt trapped behind abutment faces during assembly.

(b) Gear Noise — is of a cyclic nature, being pronounced at various speeds on drive, float, coast and cruise conditions. If the pinion and crown wheel have been set up with too little backlash a continuous whine may be produced.
Gear noise is most commonly caused by:
  (i) Incorrect mesh of gear teeth (i.e., incorrect pinion head positioning shim or backlash setting shims).
  (ii) Scored gear teeth — usually the result of incorrect lubricant type or level.
  (iii) End play in bearings.
  (iv) Bruised or chipped teeth.
  (v) Excessive run-out of pinion head or crown wheel backface.
  (vi) Crown wheel creeping on differential housing resulting from crown wheel bolts loosening — noise from this source usually appears as a sharp metallic sound when shifting from reverse gear to first gear.

3 REAR AXLE SHAFT BREAKAGE

(a) Abnormal clutch operation

(b) Bent axle tubes

(c) Excessive vehicle loads.

4 OVERHEATING OF REAR AXLE ASSEMBLY

(a) Lubricant level incorrect

(b) Bearing pre-load too high

(c) High rate of wear in gears

(d) Incorrect lubricant type.

5 LOSS OF LUBRICANT

(a) Lubricant level too high

(b) Breather malfunction

(c) Damaged or worn oil seals

(d) Rear cover bolts loose

(e) Rear cover bolts too tight — causing cover flange to buckle

(f) Rear cover gasket damaged or incorrectly fitted

(g) Split cover or tubes

(h) Incorrect type of lubricant — can cause foaming.

6 REAR AXLE ASSEMBLY BACKLASH EXCESSIVE

(a) Worn axle shaft splines

(b) Loose wheel nuts

(c) Loose universal joint flange mountings

(d) Excessive backlash in either the differential or hypoid gears

(e) Bearings worn or incorrectly adjusted.

PINION OIL SEAL

Removing

1 Raise the rear of vehicle and place stands under rear axle.

2 Loosen rear cover bolts to drain lubricant.

3 Disconnect propeller shaft from pinion flange.

4 Remove the pinion nut using Tool 18GA046 to hold the flange.

5 Remove pinion flange.

6 Remove seal if defective, using Tool 18GA389C.

NOTE: Before installing a new oil seal examine the surface of the pinion flange on which the seal runs and remove any scores or burrs. Should this surface be irreparable or if the splines are excessively worn, a new pinion flange should be installed.

Refitting

1 Ensure that the new seal is thoroughly lubricated.

2 Install a new seal in the housing using a suitable piece of tube, drive flush to 0.254 mm (0.010 in) below surface of housing if the seal has no flange.

3 Replace pinion flange and tighten nut to the specified torque.

4 Connect propeller shaft, tighten cover bolts and refill assembly with the correct lubricant.

5 Replace filler plug and gasket and tighten to specified torque.

AXLE SHAFT

Removing

1 Raise rear of vehicle and place support stands under rear axle.

2 Remove rear wheels.

3 Remove brake drums.

4 Remove the axle retaining nuts from housing studs. The nuts are accessible through a hole in the axle flange.

5 Carefully withdraw axle shaft using tool No. 18GA045 and slide hammer to loosen bearing in housing.

NOTE: Care must be taken to avoid spilling oil on brake assembly.

Refitting

1. Lubricate the bearing assembly and seal using rear axle oil.
2. Carefully insert the axle shaft into the housing and engage the splines with the differential side gear splines.
3. Remove any surplus lubricant to prevent contamination of the brake assembly, then enter the bearing and seal into the housing, ensuring that the seal is not distorted.
4. Install the bearing retainer plate and push the axle, bearing and seal into its seated position.
5. Install the retainer nuts and tighten evenly to the specified torque. Fig. O-2.

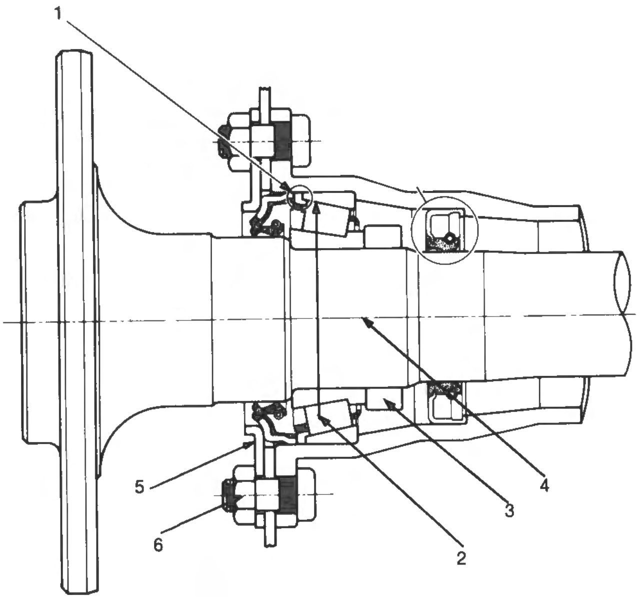


Fig. O-2

AXLE SHAFT UNIT BEARING

1	RING RIB	4	AXLE SHAFT
2	BEARING ASSEMBLY	5	AXLE RETAINING PLATE
3	BEARING RETAINER	6	RETAINER NUTS

6. Replace brake drum and wheel. Lower vehicle to the ground.

AXLE BEARING

Description

The unit bearings fitted to the rear axle shafts are single row, pre-set Timken taper roller capable of withstanding thrust in either direction and radial loads in any combination. Fig. O-3.

Basically there are five parts to the unit bearing as illustrated in Fig. O-4. When the bearing is manufactured the cup and rib ring are bonded together with an adhesive to facilitate bearing handling and installation. When the axle is removed from the housing, the bearing cup will usually be separated from the rib ring. This is not detrimental to the bearing and it may be refitted when the rib ring is installed as shown in Fig. O-2.

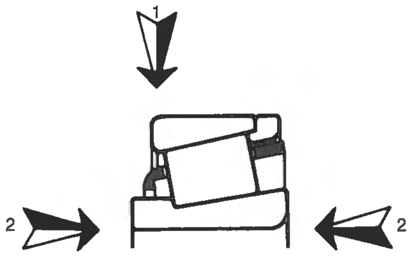


Fig. O-3

BEARING THRUST DIRECTIONS

1	RADIAL THRUSTS	2	AXIAL THRUSTS

NOTE: The Timken bearings fitted to the rear axle shafts may be re-used if not damaged during removing from the axle shaft and do not show signs of excessive wear.

When installed, the bearing end float should be within 0.025 to 0.380 mm (0.001 to 0.015 in). When end float exceeds 0.76 mm (0.030 in) the bearing should be replaced.

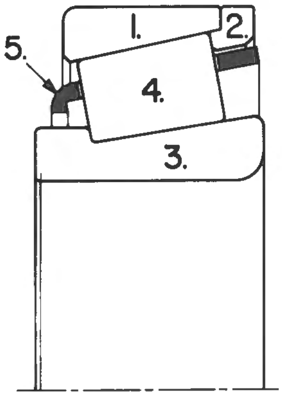


Fig. O-4

UNIT BEARING COMPONENTS.

1	CUP	4	ROLLERS
2	CUP RING RIB	5	CAGE
3	CONE		

Removing

1. Remove wheel and brake drum.
2. Remove the four nuts holding the bearing retainer, access to these nuts is through the axle shaft flange service hole.
3. Withdraw the axle shaft and wheel bearing assembly with tool No. 18GA045. Remove bearing cup if necessary using a suitable puller.
4. To remove inner bearing retainer and bearing from axle shaft (if required) drill into the bearing retainer ring perpendicular to the axle shaft, do not drill through into axle shaft, then if necessary, carefully split the retainer with a chisel at hole location. Press bearing from axle.

Inspection

Examine axle shaft bearing journal and splines for excessive wear or damage. If axle shaft is in a satisfactory condition it may be re-used.

IMPORTANT: Inner bearing retainers which have been removed from an axle shaft must not be re-used.

NOTE: Do not wash a new bearing prior to installation. The new unit bearing has a coating of protective grease which provides lubrication until the rear axle lubricating oil reaches the bearing.

If a new bearing has been washed, it must be completely lubricated with rear axle oil.

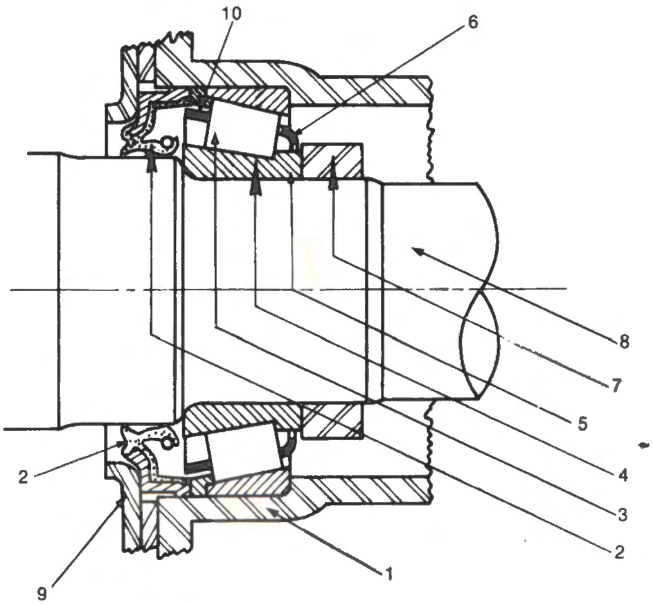


Fig. O-5

AXLE BEARING AND SEAL ASSEMBLY

1	AXLE HOUSING	6	CAGE
2	OIL SEAL	7	BEARING RETAINER
3	ROLLER	8	AXLE SHAFT
4	BEARING CONE	9	AXLE RETAINER PLATE
5	BEARING CUP	10	CUP RIB

Refitting

1 Place the bearing retainer plate on the axle shaft with the flat side towards the splined end.

2 Apply a small quantity of bearing lubricant to the cavity between the seal lips and carefully locate the seal on the shaft seal surface with the flat side towards the retainer plate.

CAUTION: Do not force the seal onto the unground surface of the shaft as it may damage the seal.

3 Install the unit bearing without removing the protective grease. Should the bearing be dry, lubricate with a recommended rear axle lubricant. New unit bearings have the cup bonded to the cup rib-ring for installation.

4 Place the lubricated bearing on the axle ensuring that the cup rib-ring is towards the retainer plate. Fig. O-2.

CAUTION: Do not omit the cup rib-ring or reverse the bearing direction.

5 Position the bearing squarely onto the axle shaft and press the bearing on until the cone is seated against the shaft shoulder.

6 Place a new bearing retaining collar (chamfer towards bearing) onto axle shaft and press it on until it is tight against the bearing cone. Make sure that the retainer is pressed squarely on the axle, as an incorrectly installed retainer may lose its interference grip.

7 Place the axle shaft through the brake backing plate and align the axle shaft and side gear splines.

8 When the splines have engaged in the side gears, the wheel bearing and oil seal may be inserted into the axle housing by tightening the backing plate bolts alternately, ensuring that the outer bearing retainer pushes squarely against the oil seal.

9 Secure the backing plate using new nuts tightened to the specified torque. Fig. O-2.

10 Replace brake drum and wheel.

11 Lower vehicle and tighten wheel nuts.

AXLE ASSEMBLY

Removing

1 Place a mobile jack under centre of rear axle housing and raise vehicle until both rear wheels are well clear of the ground.

2 Place stands under both sides of the body member just in front of lower control arm mounting points and lower vehicle onto the stands ensuring that both rear wheels are still clear of the ground and drain the lubricant.

3 Remove both rear wheels.

4 Place a jack under the centre of rear axle and raise until the coil suspension springs are compressed sufficiently to fit the retaining hooks and safety straps.

5 Remove the nuts, washers and shock absorbers from lower mounting bolts.

6 Lower axle to the full extent of its travel and remove jack.

7 Disconnect flexible brake hose and plug openings to prevent loss of fluid.

8 Disconnect handbrake cables from clips on lower control arms and disconnect cable at adjusting points.

9 Remove bolts and clamps securing propeller shaft to pinion flange and lower rear of propeller shaft to the ground. Tape the bearings to prevent them falling off their journals.

10 Place mobile jack under centre of rear axle housing and support its weight.

11 Remove the bolts and nuts securing both upper links to the mountings on axle housing and move links clear of housing.

12 Remove the bolts and nuts securing lower control arms to the axle housing brackets and allow both arms to clear the axle.

13 Lower the axle and remove from under vehicle.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 13 noting the following points:

  (a) Do not tighten bolts and nuts securing upper and lower control arms to rear axle mountings until the vehicle is lowered to the ground and bounced several times to settle bushes in position.

  (b) Bleed brakes.

  (c) Adjust handbrake.

  (d) Tighten all bolts and nuts to specified torque.

  (e) Do not refill the rear axle until the vehicle has been returned to its normal driving position.

  (f) Refill the rear axle with the specified lubricant. The correct level is the BOTTOM of the level plug hole. Allow any excess lubricant to drain off before fitting and tightening the plug.

DIFFERENTIAL ASSEMBLY OVERHAUL

The rear axle assembly should be removed from the vehicle to overhaul the differential and hypoid set.

INSPECTION BEFORE DISMANTLING

Before dismantling the unit, the following inspection procedures should be adopted.

1 Remove the rear cover and visually inspect the moving parts for chipped or scuffed surfaces.

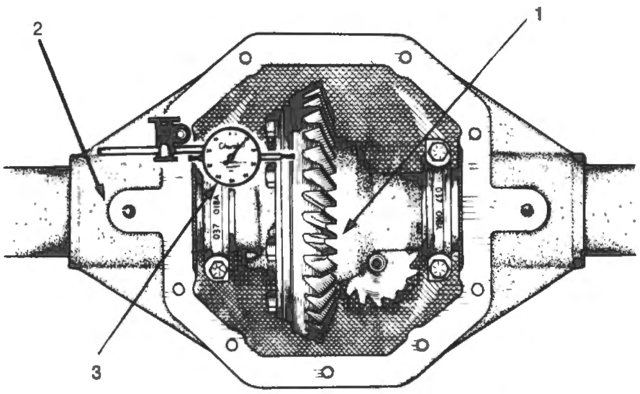


Fig. O-6

MEASURING CROWN WHEEL RUN-OUT

1 CROWN WHEEL
3 DIAL INDICATOR
2 REAR AXLE HOUSING

2 Check the crown wheel bolts, the bearing bolts and the pinion flange nut for correct torque.

3 Rotate the differential through several turns whilst holding a dial indicator gauge against the back face of the crown wheel to read the run-out. Fig. O-6.

4 Leaving the dial indicator set up as in Fig. O-6. push the crown wheel hard one way to measure the side play — no side play should be present.

5 Using a dial indicator gauge measure the crown wheel backlash at three equi-spaced positions. Backlash is the average value of these readings. Fig. O-7.

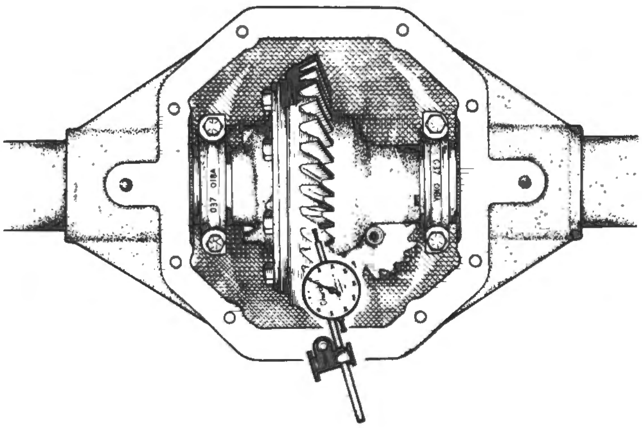


Fig. O-7

CHECKING BACKLASH

6 Check the hypoid pinion for end play, no end play should be present.

7 Clean crown wheel and pinion teeth with suitable solvent.

8 Check tooth contact pattern, paint both sides of crown wheel teeth with gear marking compound. Rotate gear several times in both directions whilst applying a load to the pinion flange. Read contact patterns and compare with examples shown in Fig. O-15 and Fig. O-16.

NOTE: See section on hypoid pinion and bearing shim selection for information on adjustments.

Removing

1 Mark bearing caps for correct replacement, then remove caps.

2 Attach the carrier spreader adaptors tool No. 18GA038. Fig. O-8.

3 Attach spreader and spread the carrier the minimum amount which will allow removal of the differential assembly. Fig. O-9. Usually 2 to 2½ turns on the spreader bolt is sufficient to allow the assembly to be prised out of the carrier.

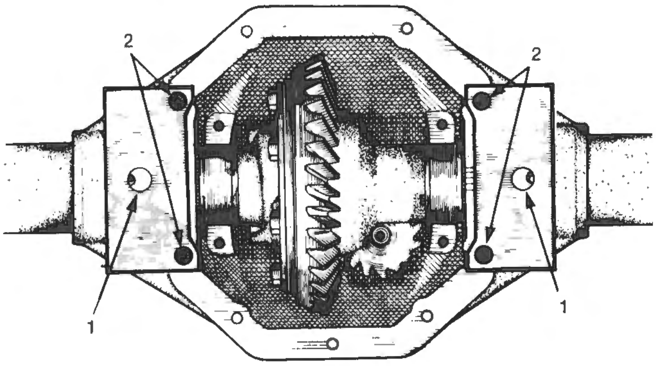


Fig. O-8

FITTING SPREADER ADAPTOR PLATES

1 ADAPTOR PLATES 2 ATTACHING BOLTS

NOTE: It is not necessary to spread the carrier sufficiently to enable the differential assembly to be lifted out by hand only.

4 Release the tension on the spreader and remove.

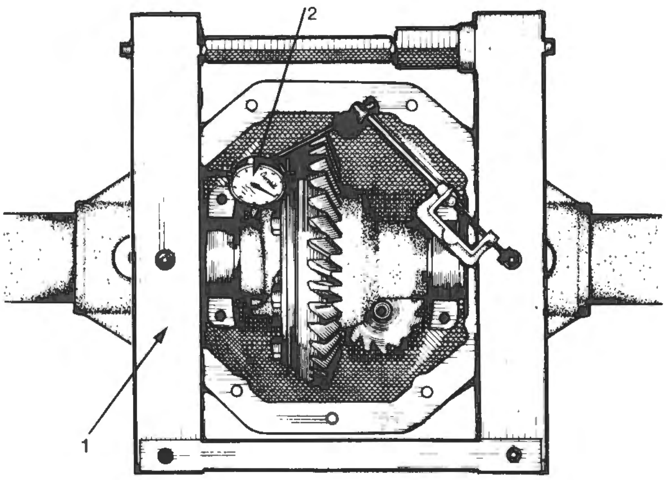


Fig. O-9

CARRIER SPREADER AND DIAL INDICATOR

1 SPREADER 2 DIAL INDICATOR

DISMANTLING DIFFERENTIAL ASSEMBLY

CASE ASSEMBLY

1 Remove crown wheel bolts and tab washers. Mark crown wheel and housing for correct assembly.

2 Using a soft-faced hammer, drive the crown wheel from differential housing.

3 Drive differential pinion shaft retaining pin through shaft with a punch.

4 Drive differential pinion shaft from housing using a soft drift.

5 Split differential case by driving against one side of gear face with a soft drift.

6 Remove differential pinions, side gears and thrust washers from housing.

7 If necessary, remove differential bearings.

PINION AND PINION BEARINGS

1 Remove pinion nut, washer and flange using tool No. 18GA046.

2 Remove the pinion by driving it out of the front pinion bearing cone and withdraw through the rear of the carrier.

3 Remove the front pinion bearing cone and pinion seal by driving against the cone from the rear of the carrier, discard the pinion seal.

4 Using a soft drift in the bearing cup knock out slots, drive cups from carrier.

5 Remove rear bearing cone from pinion.

INSPECTION AFTER DISMANTLING

All components should be thoroughly cleaned and inspected for wear, cracks, scuffed teeth, burrs and worn splines. All worn or suspect items must be renewed.

Assembling

1 Lubricate all gears and thrust washers with the recommended rear axle lubricant.

2 Place the side gear thrust washers over the side gear journals.

3 Position the side gear in the differential case large half.

4 Position the differential pinions and thrust washers in the differential case large half.

5 Drive the pinion cross-shaft through the case and pinion bores ensuring that the retaining pin hole lines up with the hole in the case. Care should be taken not to damage the differential pinion thrust washers.

6 Drive the cross-shaft retaining pin through the shaft leaving 6.35 mm (0.25 in) protruding for locating the other case half.

7 Assemble a side gear and thrust washer in the small case half.

8 Holding the side gear in position through the case bore, push the two case halves together locating on the retaining pin. Rotate the side gear, if necessary, to ensure that the gear and pinion are correctly meshing.

9 Place crown wheel in position on housing and tighten bolts to the specified torque, bend tab washers to securely retain bolts.

10 Press differential bearings on housing journals.

DIFFERENTIAL CARRIER BEARING PRELOAD SPACER SELECTION

11 Select two differential bearing spacers, which will allow positioning of the differential assembly in the carrier without having to stretch the carrier. Install differential assembly and spacers.

12 Push the assembly hard to one side of the carrier, measure and note the gap between the spacer and the carrier at the other end. Fig. O-10.

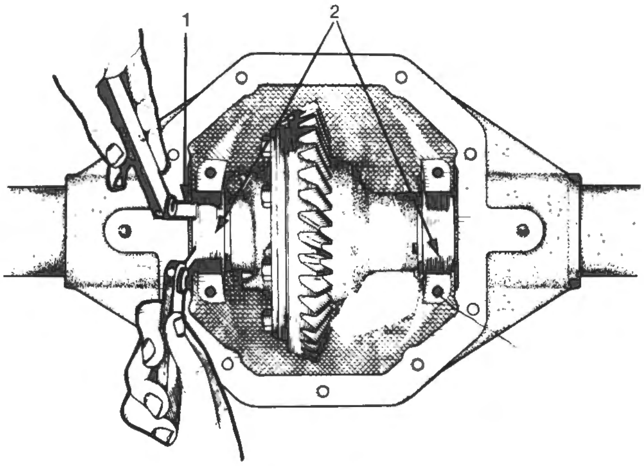


Fig. O-10

USING FEELER GAUGES TO ELIMINATE SIDE PLAY

1 EQUAL THICKNESS FEELER GAUGES

2 CARRIER BEARINGS

13 Remove assembly, measure and note spacers.

14 Initial spacer thickness is determined as follows: Total spacer thickness selected in (a) + gap measured in (13) +0.152 mm (0.006 in).

15 Select two spacers, each half the thickness of the value determined in (14).

16 Fit carrier spreading tool on the carrier.

17 Stretch carrier approximately 2 to 2½ turns and place differential assembly and spacers in position.

18 Fit bearing caps and tighten bolts to specified torque.

NOTE: Bearing caps should be in their original positions according to the marks, as they are not interchangeable.

19 Rotate bearings several times to ensure bearings are seated correctly.

20 Wrap a cord round outside diameter of differential case flange and check pre-load by pulling on end of cord with a spring balance. Fig. O-11.

21 Should the pre-load not comply to specification, adjustments are made by decreasing the spacer thickness or reducing the pre-load and by increasing the spacer thickness to increase the pre-load.

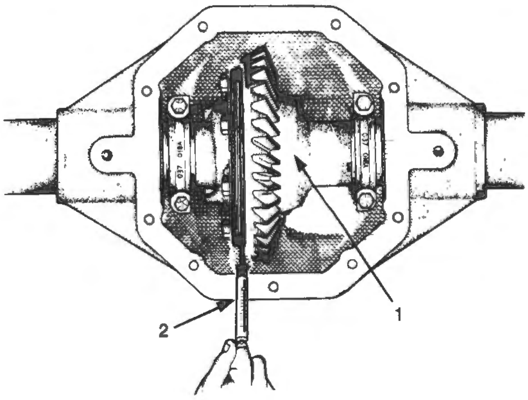


Fig. O-11

CARRIER BEARING PRELOAD CHECK

1 CARRIER 2 SPRING BALANCE

NOTE: A 0.05 mm (0.002 in) alteration to total spacer thickness will usually bring the pre-load within specifications.

22 When the correct pre-load is obtained, remove the differential assembly from the carrier and set it aside together with the selected spacers ready for final assembly and remove spreader.

HYPOID PINION AND BEARING SHIM SELECTION

23 Select pinion head positioning shim: Press front and rear pinion bearing cups in the carrier.

24 Slide the rear pinion bearing on to the dummy pinion tool No. 18GA065.

25 Install dummy pinion and rear bearing in carrier.

26 Assemble front bearing cone and spacer on to dummy pinion tool No. 18GA065.

27 Tighten nut on end of dummy pinion to 13.5-20.3 Nm (10-15 lb.f.ft.). DO NOT OVERTIGHTEN.

28 Place arbor in carrier and lightly clamp with bearing caps tool No. 18GA065.

29 Select a shim which will just slide between the arbor and the dummy pinion head. Fig. O-12.

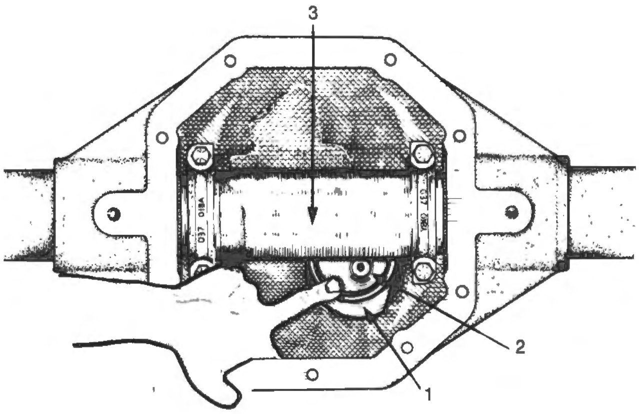


Fig. O-12

PINION SPACER SELECTION

1 GAUGE BLOCK 2 SPACER 3 ARBOR

30 This shim size is the correct one to use if the figure branded on the hypoid is 'O'. Fig. O-13. Should the hypoid pinion have a figure other than 'O' refer to shim selection chart.

SHIM SELECTION CHART

PINION BRANDING

−4	Add 0.102 mm (0.004 in)	To shim selected in paragraph 30.
−3	Add 0.076 mm (0.003 in)	
−2	Add 0.051 mm (0.002 in)	
−1	Add 0.025 mm (0.001 in)	
+1	Subtract 0.025 mm (0.001 in)	To shim selected in paragraph 30.
+2	Subtract 0.051 mm (0.002 in)	
+3	Subtract 0.076 mm (0.003 in)	
+4	Subtract 0.102 mm (0.004 in)	

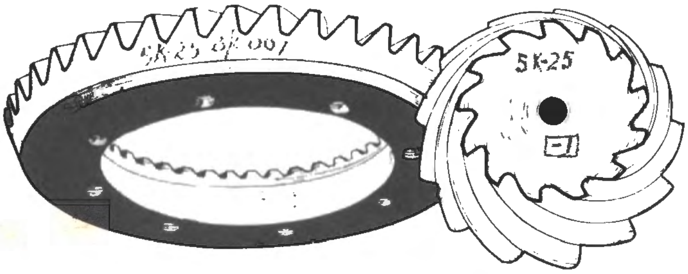


Fig. O-13

PINION AND CROWN WHEEL MARKINGS

31 Remove tools from carrier.

32 Place the pinion head positioning shim onto pinion with the chamfered side of the shim against pinion head.

33 Press rear pinion cone onto the pinion. Fig. O-14.

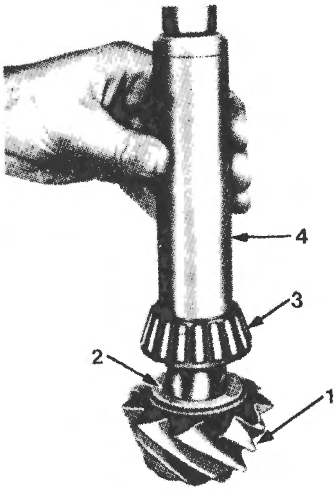


Fig. O-14

INSTALLING PINION SPACER AND REAR BEARING

1	PINION	3	INNER BEARING
2	SPACER	4	TUBE

34 Press pinion in housing.

35 Assemble the front pinion bearing cone and original pre-load shim onto pinion whilst supporting pinion under head.

NOTE: Chamfered side of shim to go against shoulder on pinion step.

36 Assemble pinion flange, nut and washer onto pinion and tighten nut to specified torque whilst rotating pinion backwards and forwards to seat bearing correctly.

NOTE: Concave side of washer to butt up against pinion flange.

37 Check pinion bearing pre-load and select shims as follows. If reading falls outside specification, adjustment to pre-load shim thickness is required. A thinner shim will be required if the pre-load is insufficient and a thicker shim is required if the pre-load is excessive. As a general guide the following shim adjustment will bring the pre-load within the specified torque.

Condition

EXCESSIVE PRE-LOAD — Increase shim thickness 0.025 mm (0.001 in) for every 1.6 Nm (15 lb.f.in.) pre-load is above the upper limit of the specification.

INSUFFICIENT PRE-LOAD BUT NO PINION END FLOAT — Decrease thickness by 0.025 mm (0.001 in).

PINION END FLOAT — Decrease shim thickness by amount of pinion end float plus 0.025 mm (0.001 in) e.g. if there is 0.05 mm (0.002 in) end float, decrease shim thickness by 0.05 mm (0.002 in) + 0.025 mm (0.001 in) = 0.076 mm (0.003 in).

HYPOID GEAR ADJUSTMENT

38 Replace differential assembly using spacers selected earlier.

39 Ensure that pinion nut and bearing cap bolts are tightened to the specified torque.

40 Check backlash on crown wheel as described in section headed (Inspection before dismantling).

41 If backlash is excessive (see specifications) decrease size of right hand spacer and increase left hand (gear side) by same amount. If backlash is insufficient increase size of right hand spacer and decrease left hand spacer by the same amount.

NOTE: Total spacer thickness should not change.

42 Paint gear with marking compound and rotate gear in both directions whilst applying a load to the pinion flange.

43 Observe contact marking and compare with contact patterns shown. Fig. O-15 and Fig. O-16.

44 Make necessary adjustment by altering pinion positioning shim and/or backlash.

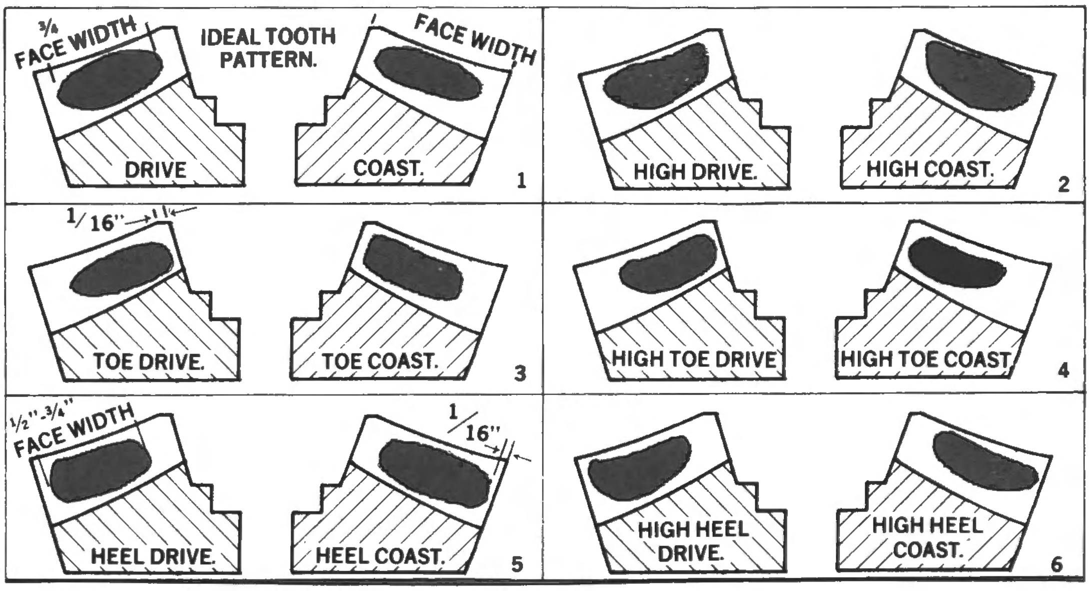


Fig. O-15

ACCEPTABLE TOOTH CONTACT PATTERNS

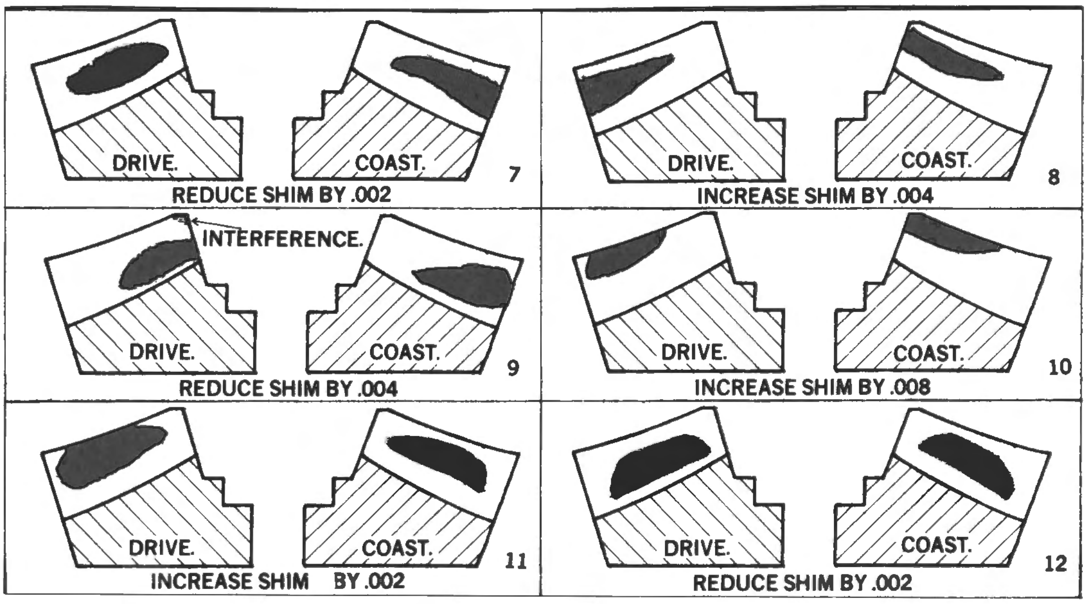


Fig. O-16

UNACCEPTABLE TOOTH CONTACT PATTERNS WITH CORRECTIONS INDICATED

NOTE: If pinion positioning shim is changed, the pinion bearing pre-load shim must be changed in exactly the same way to maintain the correct pre-load.

45 When gear backlash and tooth contact are correct, remove pinion flange and install pinion seal.

NOTE: Ensure that new seal is thoroughly lubricated then coat outside diameter with sealer before installing in housing.

46 Replace pinion flange and washer with concave face against flange, tighten nut to specified torque.

47 Fit rear cover and new gasket to housing, tighten the bolts to the specified torque.

IMPORTANT: Do not overtighten bolts as this can cause cover flange distortion resulting in oil leakage.

Refitting

1 Install rear axle assembly in vehicle as described previously.

LAYOUT OF REAR SUSPENSION COMPONENTS

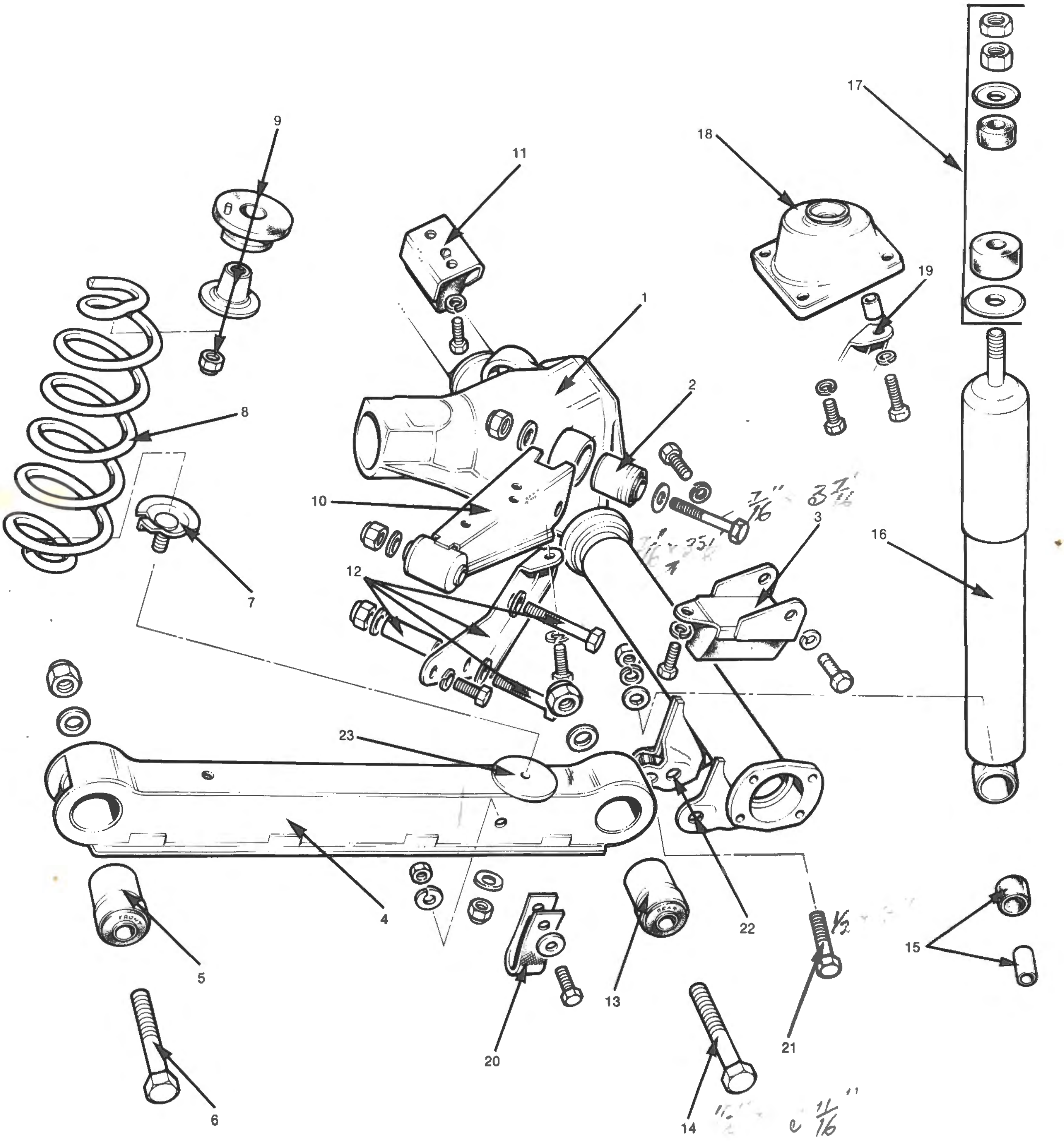


Fig. O-17

KEY TO FIG. O-17

REAR SUSPENSION COMPONENTS

1	REAR AXLE HOUSING
2	UPPER LINK BUSH — REAR
3	AXLE HOUSING BUMP RUBBER
4	LOWER LINK ASSEMBLY
5	LOWER LINK BUSH — FRONT
6	LOWER LINK RETAINING BOLT — FRONT
7	LOWER SPRING SEAT
8	SUSPENSION SPRING
9	UPPER SPRING SEAT
10	UPPER LINK ASSEMBLY
11	DIFFERENTIAL HOUSING BUMP RUBBER
12	UPPER LINK BRACKET ASSEMBLY
13	LOWER LINK BUSH — REAR
14	LOWER LINK RETAINING BOLT — REAR
15	SHOCK ABSORBER BUSH — LOWER
16	SHOCK ABSORBER
17	SHOCK ABSORBER MOUNTING RUBBERS — UPPER
18	SHOCK ABSORBER MOUNTING BRACKET
19	SHOCK ABSORBER BRACKET LEFT HAND SIDE ONLY
20	HANDBRAKE CABLE CLIP
21	LOWER SHOCK ABSORBER MOUNTING BOLT AND NUT
22	LOWER LINK MOUNTING
23	LOWER SPRING SEAT

REAR SUSPENSION

GENERAL DESCRIPTION

The rear suspension assembly consists of two coil springs, two upper and two lower links and two hydraulic tubular type shock absorbers. The lower links govern the fore and aft movement, while the upper links govern the side movement of the rear axle assembly.

The lower ends of the coil springs are attached to the spring seat brackets mounted on the lower links, while the upper spring ends are positioned on spring seats located on brackets attached to a reinforced section of the underbody structure. The springs are insulated from the upper brackets by rubber pads.

The two lower links are rubber bushed at each end. The bushes are identified by the word 'FRONT' or 'REAR' and must be installed in their correct location.

The lower control arms are attached to the rear axle mounting bracket by means of a bolt and nut. The forward end being attached to a channel type mounting bracket welded to the underside of the body structure.

The angled upper links are bushed at the forward end only. The bushed end is attached by a bolt and nut to a mounting welded to the underside of the body. The rear end is attached to a rubber bushed mounting cast into the rear axle housing.

The shock absorbers are attached to the rear axle at their lower end, and at their upper end to the underside of the body structure. Both upper and lower shock absorber attachment points are rubber insulated.

Rubber bumpers, to limit axle travel during compression of the coil springs, are mounted on reinforced brackets attached to the underside of the body structure on each side. An additional bumper is mounted on the body in a position to protect the front of the pinion housing. Fig. O-17.

REAR SPRING

Removing

1. Place a mobile jack under the centre of the rear axle and raise the vehicle until the rear wheels are approximately 152 mm (6 in) off the ground.
2. Place stands under the body just forward of the lower link front mounting. The stands should just be contacting the body.
3. Remove rear wheel.
4. Fit spring retaining hooks tool No. 18GA064 and fasten safety strap. Fig. O-18.

WARNING: Always fit the spring hooks before attempting to remove the coil spring.

5. Remove nut and washer from shock absorber lower mounting bolt and clear shock absorber from mounting.
6. Lower the vehicle onto the stands allowing the rear axle to drop to the full extent of its travel.
7. Remove securing bolt and plate from spring lower mounting.
8. Remove securing nut and plate from spring upper mounting.
9. Pull down lightly on axle and remove the spring with the upper seat through the rear wheel aperture.
10. Remove the upper seat from the spring.

To remove the spring hooks, the rear coil spring is compressed with tool No. 18GA574 and one adaptor plate illustrated in Fig. O-19. using the following method.

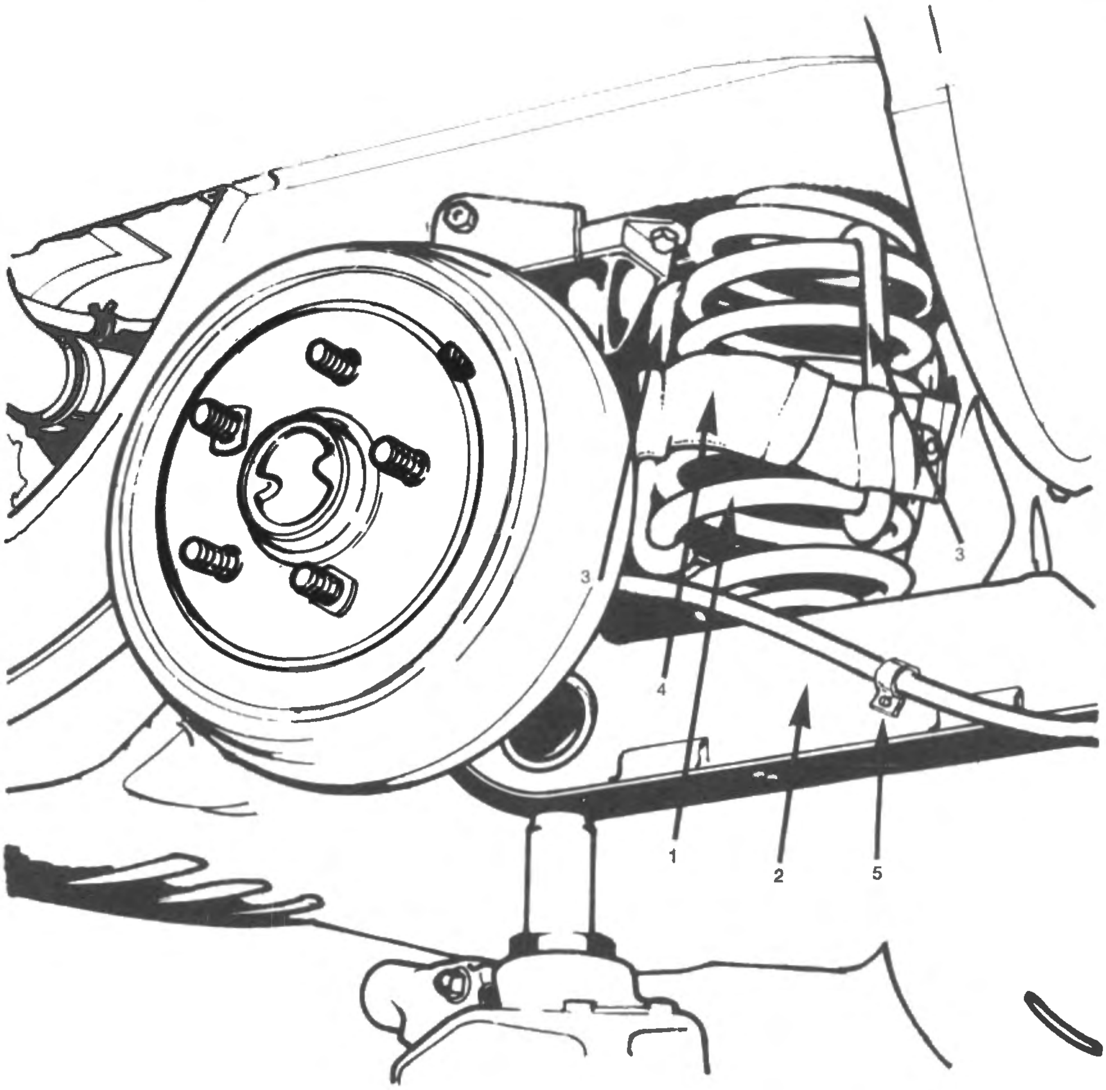


Fig. O-18

FITTING SPRING HOOKS

1 REAR COIL SPRING
2 LOWER LINK
3 SPRING HOOKS
4 SAFETY STRAP
5 HANDBRAKE CABLE CLIP

NOTE: Refer Service Tool Section Z for details of the adaptor plate.

1 Locate the body of tool No. 18GA574 on the top of the spring (Refer Fig. O-19) and place the plate having the 12.7 mm (½ in) hole on the bottom of the spring.

2 Insert the centre spindle of the tool through the spring and screw it into a nut under the bottom plate.

3 Tighten the nut on the top of the spindle and make contact with the body of the tool. Continue to tighten the top nut until the spring is compressed sufficiently to remove the spring hooks.

4 Release the spring compressor.

Inspection

1 Inspect the coil spring for correct length as given in GENERAL DATA.

Refitting

1 Compress the coil spring using the compressor tool, fit the spring hooks to secure four coils. Fit the safety straps. Refitting the spring is the reverse of removing procedures 1 to 10 noting the following.

CAUTION: Ensure that the coil spring is fitted correct end upwards, otherwise the spring may bow and foul the side of the body or fuel tank. A part number is stamped on the upper end of the coil. This end of the spring must be placed against the shoulder in the upper spring seat.

(a) Ensure that locating stem on upper spring seat is entered into locating hole in body.

(b) Ensure that both securing plates are correctly installed on the spring.

(c) Tighten all bolts and nuts to their specified torque.

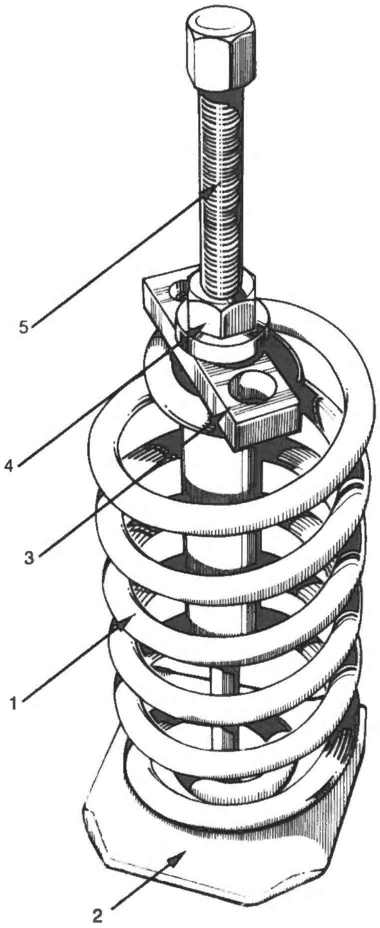


Fig. O-19

COMPRESSING COIL SPRING

1 COIL SPRING
2 LOWER SPRING PLATE
3 PLATE FROM TOOL NO. 18GA574
4 ¾ in NUT
5 SCREW FROM TOOL NO. 18GA574

LOWER LINK

Removing

1 Place a mobile jack under the centre of the rear axle and raise the vehicle until the rear wheels are approximately 152 mm (6 in) off the ground.

2 Place stands under the body just forward of the lower link front mounting. The stands should just be contacting the body.

3 Remove rear wheel.

4 Fit spring retaining hooks and fasten safety strap.

5 Remove nut and washer from shock absorber lower mounting bolt and clear shock absorber from mounting.

6 Lower the vehicle onto the stands allowing the rear axle to drop to the full extent of its travel.

7 Place a jack under the lower link adjacent to the coil spring and raise the arm slightly.

8 Remove the bolt, nut and retaining plate securing the coil spring to the link.

9 Remove the handbrake cable from clip on lower link.

10 Remove the bolt and nut securing the link to rear axle and lower the link clear of spring.

11 Remove bolt and nut securing front of link to front bracket and remove link.

Refitting

1 Refitting is the reverse of removing procedures 1 to 11 noting the following:

CAUTION: Do not tighten the front and rear link retaining bolts until the vehicle has been lowered to the ground, and the rear bounced up and down several times to reduce stress on the bushes.

LOWER LINK BUSHES

Removing

1 Remove lower links as previously described.

2 Mount the link securely in a vice taking care not to crush the link.

3 Insert the puller bolt through the sleeve, tool No. 18GA061/1 with the head of the bolt against the flat end of the sleeve.

4 Insert the puller bolt through the bush, ensuring that the sleeve is clear of the bush.

5 Install the remover adaptor tool No. 18GA061/2 on the opposite side of the link and place nut on puller bolt. Tighten the nut and continue to turn it until the bush is removed from the link.

Refitting

NOTE: The bushes are identified by the word 'FRONT' or 'REAR'. Ensure that the bushes are installed in their correct location.

1 Enter the new bush into the link.

2 Place the puller bolt through the replacer adaptor tool No. 18GA061/3 and insert puller bolt through the bush with the adaptor contacting the outer end of bush.

3 Install the sleeve tool No. 18GA061/1 on the opposite side of the link.

4 Place nut on puller bolt and continue to tighten until the bush is fully installed.

5 Both bushes are removed and replaced in the same manner.

UPPER LINK

NOTE: When removing and refitting the upper links, it is advisable to remove and refit one link at a time.

Removing

1 Raise rear of vehicle and place stands under rear axle.

2 Remove the nut and bolt securing the upper link to rear axle.

3 Remove the nut and bolt securing the upper link to body mounting.

4 Remove the upper link.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 4 noting the following:

(a) Do not tighten the front and rear link retaining bolts until the vehicle has been lowered to the ground.

(b) Bounce the rear of the vehicle up and down several times to reduce stress on the bushes and tighten the link bolts to the specified torque.

UPPER LINK REAR BUSH

Removing

1 Raise the rear of the vehicle, place stands under the body side members and allow the suspension to hang down.

2 Remove the nut and bolt from the rear end of the upper link, loosen the nut and bolt securing the front of the link and lift the rear end of the link clear of the rear axle mounting.

3 Insert the puller bolt through the sleeve tool No. 18GA062/1 with head of bolt contacting the flat end of sleeve, and install puller bolt through bush.

4 Install remover adaptor tool No. 18GA062/2 on opposite end of bush, place nut on puller bolt and continue to turn nut until bush has been removed from rear axle bracket.

Refitting

1 Install new bush from the rear of the axle housing, ensuring that the chamfered end is entered first.

2 Place the puller bolt through the replacer adaptor tool No. 18GA062/2 and install puller bolt through bush and sleeve tool No. 18GA062/1.

3 Install nut on puller bolt, and continue to turn nut until the bush is centralised in the rear axle bracket.

4 Replace upper link over bush and insert bolt and replace nut.

5 Do not tighten the front and rear link retaining bolts until the vehicle has been lowered to the ground, and the rear bounced up and down several times to reduce stress on the bushes.

REAR SHOCK ABSORBERS

RIGHT HAND SIDE

Removing

1 Raise the rear of the vehicle and place stands under the rear axle.

2 Remove nut, spring and flat washer securing lower end of shock absorber to rear axle.

3 Withdraw lower end of shock absorber from rear axle mounting.

4 Remove the four bolts securing the upper shock absorber mounting to body, and remove together with shock absorber from vehicle.

5 Remove the nut securing the shock absorber to upper mounting bracket.

Inspection

1 Inspect top and bottom mounting rubbers on both shock absorbers and replace if necessary.

Refitting

1 Refitting is the reverse of removing procedures 1 to 5 noting the following:

(a) Tighten all mounting and attaching bolts and nuts to specified torque.

LEFT HAND SIDE

Removing

1 Remove the nut, spring and flat washer securing lower end of shock absorber to rear axle.

2 Withdraw lower end of shock absorber from rear axle mounting.

3 Remove the bolt and nut securing the front of upper link to attaching bracket.

4 Remove nut, bolt, washers and spacer tube from upper link attaching bracket.

5 Remove bolt and washer securing side plate of mounting bracket to body, and remove side plate.

6 Remove the three remaining bolts securing the shock absorber mounting bracket to the body, remove shock absorber and mounting bracket together from vehicle.

7 Remove nut and washer retaining shock absorber to mounting bracket.

Refitting

1 Refitting is the reverse of removing procedures 1 to 6 noting the following:

(a) Tighten all mounting and attaching bolts and nuts to specified torque.

TESTING SHOCK ABSORBERS

The rear shock absorbers are not serviceable and must be replaced if they do not function efficiently. The units may be tested manually to determine whether they are satisfactory for further service or if they should be replaced.

1 Hold the shock absorber vertically and slowly extend and compress the unit several times. There should be appreciable and constant resistance in both directions.

NOTE: The shock absorbers should be renewed if found to have any of the following defects:

2 None or little resistance in one or both directions.

3 Excessive resistance; cannot be operated manually.

4 Areas of no resistance when reversing direction.

5 The comparison between a new unit and the one being tested can determine its efficiency after taking into consideration the initial stiffness and increased friction of a new unit.

REAR SPRINGS REPLACED 12/11/85 SPEEDO 85,000 KM
LOVELLS HEAVY DUTY 17MM THICK

[illegible] /BE
V8 UNITS HAVE A [illegible] OF [illegible] TUBE WELL
6 CYLINDER UNIT HAS A D[illegible] OF RED PAINT

SECTION P

FRONT SUSPENSION

FRONT SUSPENSION STRUT COMPONENTS

1 STRUT
2 STUB AXLE
3 STEERING ARM
4 COIL SPRING
5 BUFFER
6 UPPER SPRING SEAT
7 UPPER SWIVEL BEARING ASSEMBLY
8 FAIL SAFE CUP
9 FAIL SAFE CUP SECURING NUT
10 STRUT RETAINING NUTS, STUDS AND WASHERS
11 SEAL AND GLAND NUT ASSEMBLY
12 SHOCK ABSORBER
13 LOWER SPRING SEAT
14 BRAKE DISC
15 BRAKE SHIELD
16 GREASE SEAL
17 INNER BEARING
18 OUTER BEARING ASSEMBLY
19 HUB CAP
20 SPLIT PIN
21 UPPER SPRING SEAT RETAINING NUTS AND WASHERS

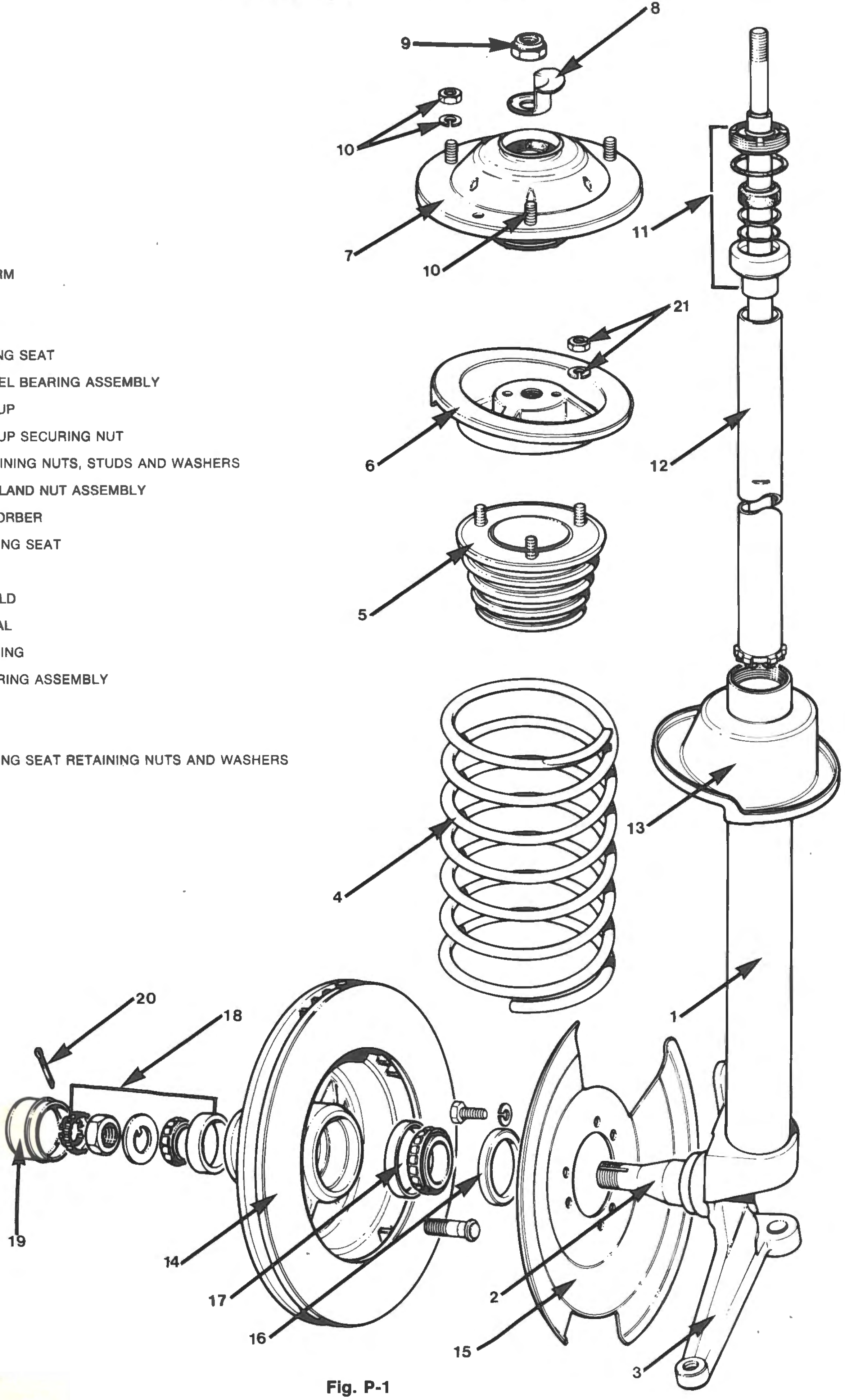


Fig. P-1

GENERAL DESCRIPTION

The front suspension consists of two vertically mounted shock absorber units, one on either side of the vehicle surrounded by a coil spring, and a suspension cross member with lower control arms.

The strut assemblies are secured at their upper end to the front guard valances, and at their lower end to lower control arms pivoted on the suspension cross member.

These two points of strut mounting determine the caster, camber and steering axis, which must be maintained at all times.

The tubular constructed struts each contain a direct acting hydraulically operated shock absorber unit, the outer tube of the strut acts as a reservoir for the operating fluid.

Located at the upper end of each strut is a rubber mounted thrust, pivot bearing unit and a coil spring. The road shocks are absorbed by the coil spring in conjunction with the hydraulic shock absorber unit, while the riding forces of the vehicle are taken by the thrust bearing unit.

The extreme downward travel of the suspension is governed by rubber buffers mounted under the upper spring seat and rebound travel is determined by a stop in the shock absorber unit.

The brake disc and hub assembly is carried on the stub axle which is integrally forged with the lower end of each strut. The struts are left hand and right hand to accommodate the brake caliper mounting flange and not interchangeable. The lower suspension arms are also left hand and right hand and not interchangeable.

The forces applied on the suspension in service are controlled by tie-bars and an anti-roll bar. The tie-bars are connected between the side members and the lower suspension arms, while the forward and rearward stresses are absorbed by the rubber mountings on the rear ends of the bars.

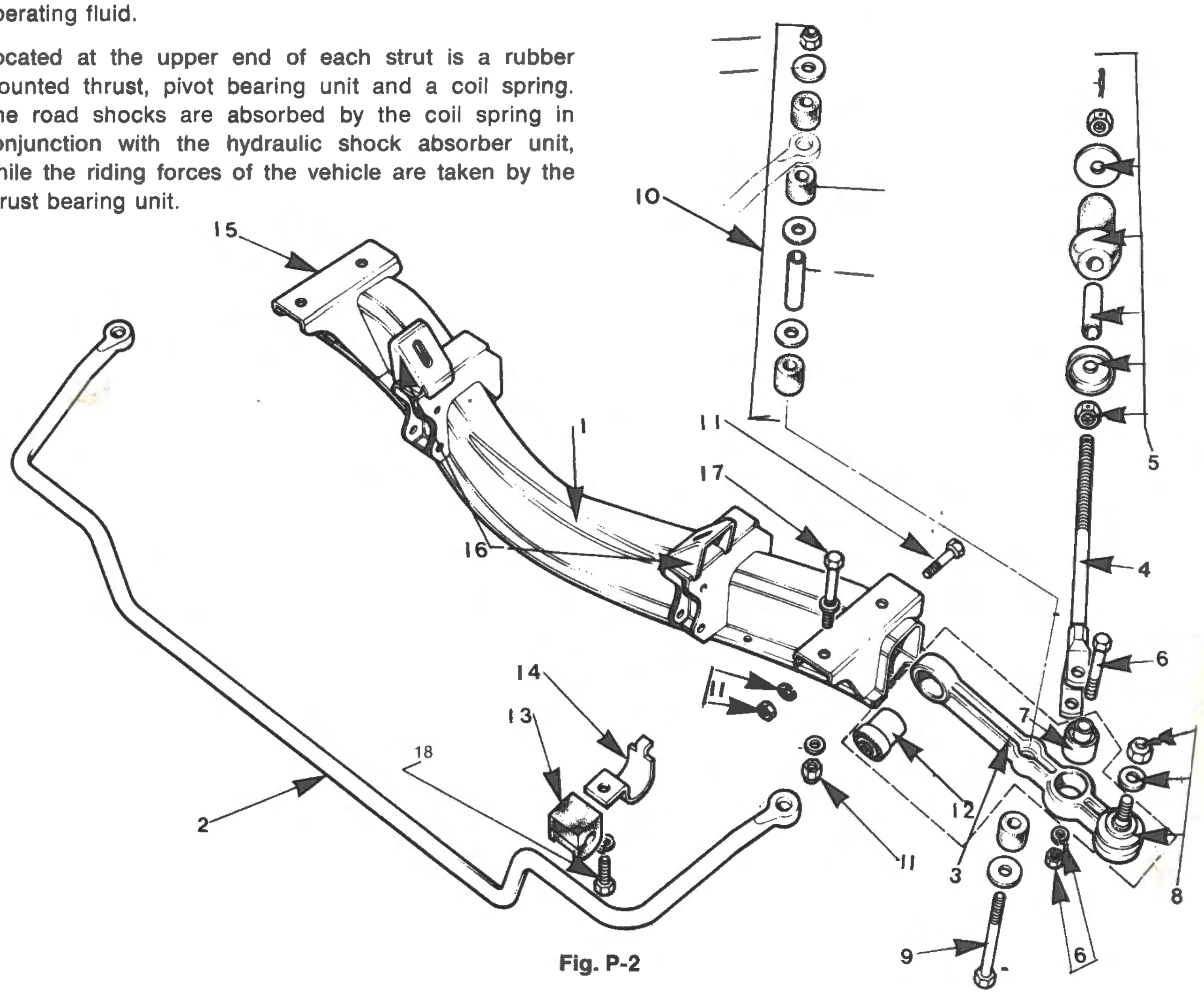


Fig. P-2

FRONT CROSS MEMBER COMPONENTS

1 FRONT CROSS MEMBER
2 ANTI-ROLL BAR
3 LOWER SUSPENSION ARM
4 TIE-BAR
5 TIE-BAR RUBBER BUSH ASSEMBLY
6 TIE-BAR BOLT
7 TIE-BAR BUSH (FRONT)
8 SWIVEL BALL JOINT (INTEGRAL WITH SUSPENSION ARM)
9 ANTI-ROLL BAR LINK BOLT

10 LINK BOLT BUSH ASSEMBLY
11 SUSPENSION ARM PIVOT BOLT AND NUT
12 PIVOT BOLT BUSH
13 ANTI-ROLL BAR INSULATOR RUBBER
14 ANTI-ROLL BAR BRACKET
15 CROSS MEMBER MOUNTING FLANGE
16 ENGINE MOUNTING BRACKETS
17 CROSS MEMBER MOUNTING BOLTS
18 SCREW AND WASHER – ANTI-ROLL BAR

Swivel Ball Joint(? Rubber Seal Kit TE6.

The anti-roll bar is attached to the front body members by insulated brackets and is connected at both ends to the lower suspension arms by vertical links. The bar stabilises the suspension and reduces the tendency of the vehicle to roll when cornering.

Front wheel control is accomplished by a rack and pinion steering assembly and two tie-rods connected to the steering arms on the lower ends of the struts. The inner ends of the tie-rods are connected by ball joints to the steering rack. The amount of left and right hand steering lock is determined by stops incorporated in the steering rack assembly.

All data referring to steering angles, adjustments, and torque wrench settings is contained in the specifications and should be referred to when adjustments are being made.

FRONT SUSPENSION UNIT

Removing

1 Jack up front of vehicle and place stands under each side of suspension cross member.

2 Remove front wheels.

NOTE: In operations that do not require the removal of the suspension coil spring from the strut assembly there is no necessity to compress the spring and fit spring hooks.

WARNING: NEVER ATTEMPT TO REMOVE THE COIL SPRING FROM THE SUSPENSION STRUT ASSEMBLY BEFORE COMPRESSING THE SPRING AND FITTING THE HOOKS AND SAFETY STRAPS.

3 Remove caliper and support to avoid strain on flexible hose.

4 Remove anti-roll bar link from lower suspension arm.

5 Remove split pin and castelated nut from tie-rod ball pin and remove the ball pin from steering arm.

6 Remove the Nyloc nut from the suspension arm ball joint taper pin and remove ball pin from lower end of strut. Push the lower suspension arm downwards to clear the strut unit.

7 Remove the three nuts and washers securing the strut unit to the front guard valance and remove the strut unit. Fig. P-3.

Refitting

1 Clean the inside of the upper strut mounting in the front guard valance. Raise the strut assembly unit; the three nuts and washers can be installed on top of the strut. Do not tighten.

2 Replace the taper pin of the suspension arm ball joint into the lower end of the strut. Install the Nyloc nut and tighten to the specified torque.

3 Tighten the three nuts securing the top of the strut to the front guard valance to the specified torque.

4 Refit the tie-rod ball pin into the steering arm, replace the castelated nut and tighten to correct torque. Insert split pin.

5 Replace caliper and refit anti-roll bar link.

6 Replace front wheel and lower vehicle to ground.

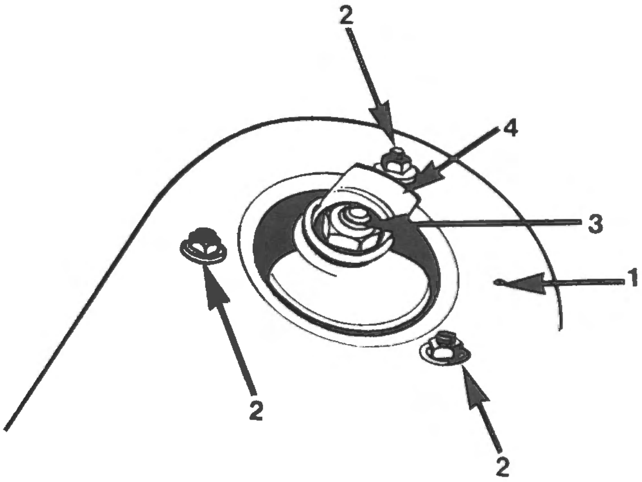


Fig. P-3

STRUT TOP MOUNTING

1	VALANCE	3	PISTON ROD NUT
2	STRUT MOUNTING NUTS	4	FAIL SAFE CUP

COIL SPRING

Removing

1 Jack up front of vehicle and place stands under each side of suspension cross member.

2 Remove front wheel.

3 Insert the spring hooks between the top and second coils of the spring.

4 Place a jack under the outer end of the lower suspension arm and raise to compress the coil spring.

5 Insert the lower ends of the spring hooks so that five coils of the spring are secured and fasten the safety straps. Fig. P-4.

6 Lower the jack, ensuring that the spring hooks remain in position.

WARNING: Never attempt to remove the coil spring from the suspension strut assembly before compressing the spring and fitting the hooks and safety straps.

Follow procedures 5, 6, 7, 8 and 9 of Front Suspension Unit removal.

7 Remove the self-locking nut and washer from top of strut and lift off the fail-safe cup.

8 Remove the upper swivel bearing assembly, upper spring seat and rubber buffer.

9 Lift off the coil spring.

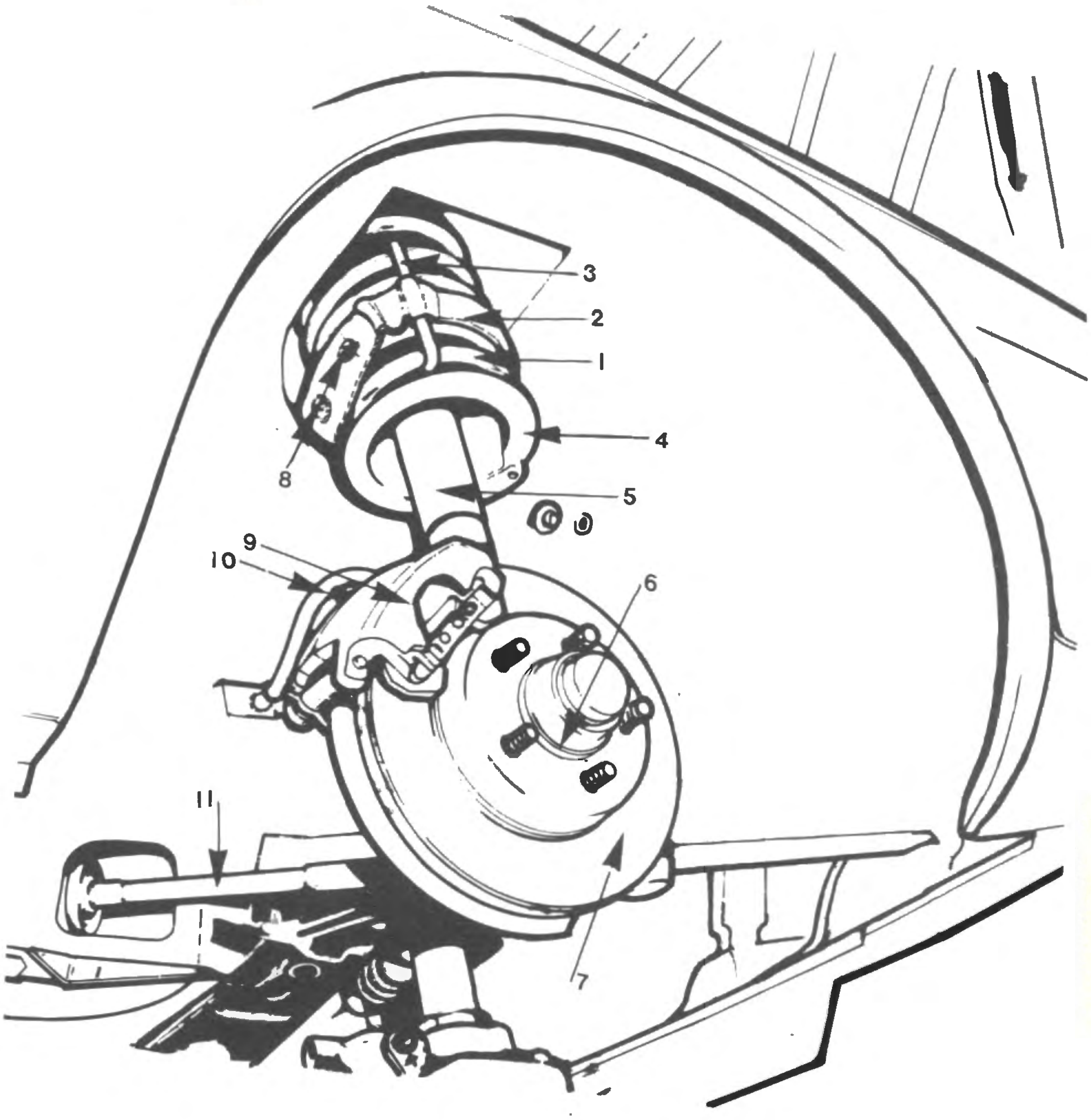


Fig. P-4

SPRING HOOKS AND SAFETY STRAP FITTED TO FRONT SPRING

1	COIL SUSPENSION SPRING	7	BRAKE DISC
2	SAFETY STRAP	8	SAFETY STRAP FASTENERS
3	SPRING HOOK	9	BRAKE CALIPER
4	LOWER SPRING SEAT	10	BRAKE HOSE
5	SUSPENSION STRUT	11	TIE-BAR
6	FRONT HUB		

10 The spring hooks are removed by using the spring compressing tool. Refer Fig. P-5.

Inspecting

1 Inspect the coil spring for correct length as given in GENERAL DATA.

Refitting

The front coil spring is compressed with the tool illustrated in Fig. P-5 using the following procedure:

1 Place the plate having the 19.050 mm (¾ in) hole over the long threaded bolt from the service tool 18GA574 with the turned-up corners facing towards the coil spring.

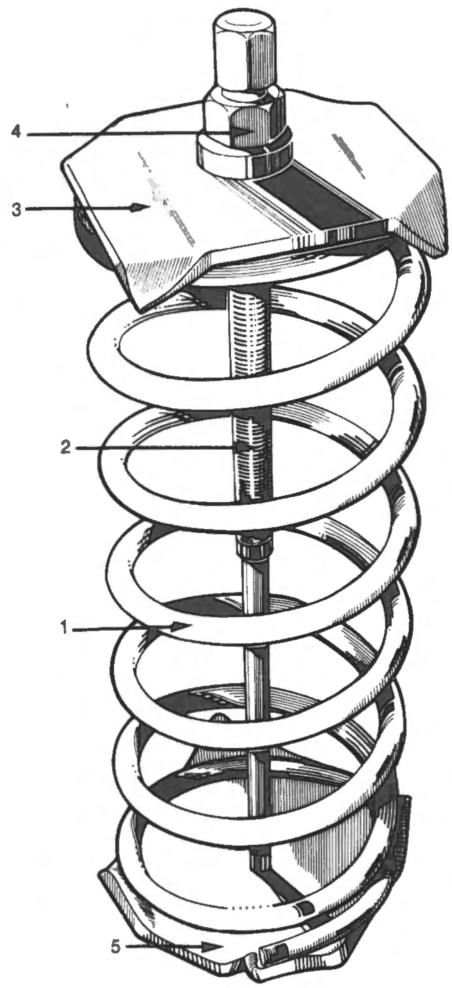


Fig. P-5

COMPRESSING COIL SPRING (FRONT)

1	COIL SPRING	4	NUT
2	BOLT FROM TOOL NO. 18GA574	5	LOWER PLATE
3	UPPER PLATE		

NOTE: Refer Service Tool Section Z for details of adaptor plates.

2 Place the coil spring over the bolt with the top of the coil (ground end) against the plate. Insert the second plate having the 12.7 mm (½ in) hole over the long threaded bolt ensuring that the end of the coil is against the stop on the plate, and secure by screwing the 12.7 mm (½ in) nut on the bolt.

3 Tighten the nut on the top of the long bolt until both plates contact the ends of the coil spring. Insert the top hook of each spring hook between the first and second coils. Continue to tighten the top nut until the spring is compressed sufficiently to insert the lower ends of the spring hooks between the sixth and seventh coils of the spring. This will secure five coils between the hooks. Fasten the safety strap, release the compressor and remove from the spring.

4 The spring may now be fitted on the strut.

NOTE: The spring must be compressed sufficiently to allow the installation of the upper spring seat without interference.

5 Locate the coil spring on the lower seat, ensuring that the lower end of the coil butts against the step in the seat.

6 Extend the piston rod to its full height. Fit the coil spring, upper spring seat and rubber buffer, placing the peak of the seat in line with the stub axle.

7 Replace the top bearing assembly on the piston rod, ensuring that the two flats engage with the two corresponding flats machined on the piston rod.

8 Fit the fail-safe cup. It must point 180° from the stub axle.

9 Fit the flat washer and Nyloc nut, tighten nut to the specified torque.

10 Replace the suspension unit as previously described.

SHOCK ABSORBER UNIT

Overhauling

When overhauling the shock absorber, absolute cleanliness of all parts and equipment is essential.

Removing

1 Remove front suspension unit and coil spring as described previously.

Testing

Examine the shock absorber unit for any of the following and replace where necessary.

(a) Fluid leakage.

(b) Loose mounting.

(c) Damaged or dented body.

(d) Bent piston rod.

To test the damping action slowly extend and compress the shock absorber several times moving it to the limit of its stroke in both directions. There should be appreciable and constant resistance in both directions.

NOTE: Shock absorbers may be serviced by fitting the parts supplied in a service kit.

Dismantling

1 Mount the strut unit in a vice at an angle of 45° to avoid spilling the fluid as the piston and sleeve are withdrawn. The unit must be held at the brake caliper mounting.

CAUTION: Do not grip the shock absorber tube in the vice, as damage may occur.

2 Push the piston rod assembly fully into the cylinder.

WARNING: Before attempting to remove the gland screw, force the staking point outwards so that the thread of the gland screw will not be damaged.

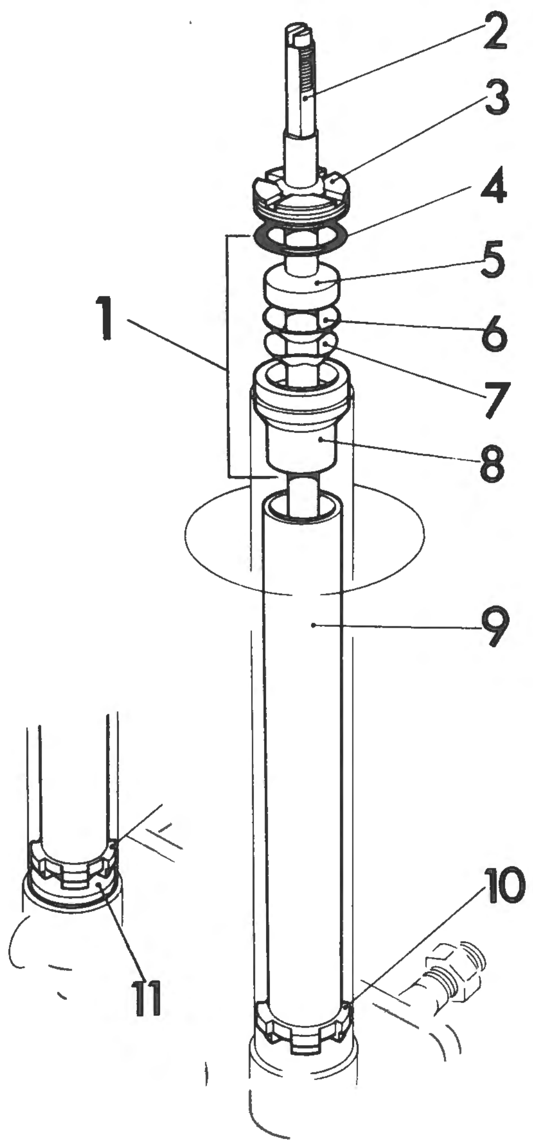


Fig. P-6

SHOCK ABSORBER UNIT

1 SEAL ASSEMBLY
2 PISTON ROD ASSEMBLY
3 GLAND SCREW
4 'O' RING
5 PISTON ROD GLAND
6 GLAND SUPPORT PLATE
7 GLAND SPRING
8 PISTON ROD GUIDE
9 CYLINDER
10 FOOT VALVE
11 FOOT VALVE SEATING PLATE

When the strut has been dismantled, all traces of the original staking should be removed to avoid damage to the gland screw thread when it is being installed. Should the thread of the gland screw be damaged during removal it should be renewed.

3 Using tool No. 18GA066 loosen and remove the gland screw (3).

4 Withdraw the piston rod sufficiently to remove 'O' ring, piston rod gland, gland support plate, gland spring and piston rod guide (5-6-7-8).

5 Completely withdraw the piston rod assembly and cylinder from the strut.

NOTE: When withdrawing the piston rod and sleeve from the strut, a quantity of fluid will be drawn from the strut which must be discarded together with the remaining fluid.

6 One valve is attached to the bottom of the piston rod, and the foot valve assembly is attached to the lower end of the cylinder. It is possible that the foot valve may remain in the bottom of the strut and it will be necessary to invert the strut to remove this valve.

7 Thoroughly clean the strut internally and externally and carefully inspect the bore of the cylinder and piston rod for scoring, pitting or corrosion. Should damage be evident a service kit should be used when the unit is assembled. Check the thread at top of strut and clean up if necessary.

NOTE: All replacement parts are supplied in the service kit and the entire kit should be used in the assembly of the unit. Individual parts are not available.

Assembling

1 Locate the strut horizontally in a vice, gripping it by the caliper mounting.

2 The service kit is fully assembled and it is necessary to remove the gland screw (3) 'O' ring (4) piston rod gland (5) gland support plate (6) gland spring (7) and piston rod guide (8). The piston rod (2) should be left in the cylinder (9).

3 Place foot valve (10) on end of the cylinder (9) the valve must be square on cylinder end.

4 Insert the cylinder (9) complete with foot valve (10) and piston rod assembly (2) into the outer tube of the strut.

5 Locate the piston rod half way down the cylinder and with the unit in an upright position pour the specified quantity of fluid into the cylinder and allow it to overflow into the strut tube.

NOTE: Checking the fluid height in the strut is accomplished before parts 3 to 8 are finally installed. Push the piston rod to the bottom of its stroke and measure the height of the fluid in the cylinder, which should be as follows. Maximum height 127.0 mm (5 in). Minimum height 135.35 mm (5¼ in). Should the fluid level be low, add sufficient Armstrong 788 fluid to bring it to the correct level.

6 Place the piston rod guide (8) over the piston rod (2) and carefully tap into the cylinder.

7 Prime the strut by holding down the piston rod guide (8) and slowly moving the piston rod (2) up and down at least six times with long strokes.

8 With cylinder full of oil and piston rod in an extended position fit the gland spring (7) and gland support plate (6).

9 Fit the piston rod gland (5) ensuring that the correct side (marked THIS SIDE DOWN) is placed to the fluid.

10 Fit the 'O' ring (4).

11 Fit gland screw (3) and using tool 18GA066 tighten to 49.00 to 60.00 Nm (36-44 lb.f.ft.).

12 Carefully stake the outer tube into one slot in the gland screw.

13 Replace the coil spring and front suspension unit as previously described.

ANTI-ROLL BAR

Anti-roll bar is mounted forward of the suspension cross member and is attached to the front body members by means of rubber insulated brackets and to the lower control arms by vertical links.

Removing

1 The vehicle should be standing on level ground. Do not raise it.

2 Remove the nuts and washers securing the ends of the bar, and disconnect the bar from the vertical links attached to the lower suspension arms.

3 Remove the bolts and nuts securing the insulated brackets to the front body members and remove anti-roll bar. Refer Fig. P-2.

Inspection

Inspect the rubber insulators and rubber buffers fitted to the vertical links. Replace if necessary.

Refitting

Refitting is the reverse of removing procedures 1 to 3, ensuring that the bolts securing the brackets to the body members, and the nuts securing the vertical links are tightened to their specified torque.

FRONT CROSS MEMBER

Removing

1 Disconnect the battery.

2 Raise front of vehicle until front wheels are clear of the ground and place stands under body side members.

3 Disconnect anti-roll bar links at their upper end.

4 Remove the two bolts securing the intermediate shaft lower universal joint to the pinion flange.

5 Disconnect a tie-rod ball joint from steering arm, right side only. Refer Fig. P-2.

6 Remove the two bolts securing the right hand side of steering rack to cross member.

7 Remove the two bolts and clamp securing the left hand side of steering rack to cross member.

8 Remove steering rack from cross member and move to one side.

9 Fit engine lifting brackets and chain tool No. 18GA041 and lift engine slightly to take its weight.

10 Loosen the two nuts securing front engine mounts to cross member brackets.

11 Remove the nut and spring washer securing the front of each tie-bar to lower suspension arm, and withdraw bolts.

12 Remove the nut and washer from each lower suspension arm pivot bolt, and withdraw both pivot bolts. Move both lower suspension arms clear of cross member.

13 Place mobile jack under cross member and support its weight. Remove the four nuts and washers from bolts securing the cross member to body side members and remove the bolts.

14 Remove the nuts and spring washers securing the engine mounts to cross member. Lower cross member and remove from jack.

15 Remove the two bolts, nuts and washers securing the steering rack mounting to cross member. Remove mounting and insulating pad.

Refitting

1 Place cross member on mobile jack and raise into position. Fit spring washers and nuts to engine mounts, but do not tighten.

2 Ensure that the cross member is in contact with the body side members, and replace the four securing bolts, nuts and washers.

NOTE: The bolts are inserted from underneath.

3 Tighten the four nuts securing the cross member and the two nuts on the engine mounts.

4 Position the lower suspension arms in the cross member and fit the pivot bolts and nuts.

NOTE: The pivot bolts are inserted from the rear of the cross member.

5 Replace tie-bars, fit securing bolts and tighten.

6 Replace steering rack mounting bracket and insulating pad; fit the bolts and tighten.

7 Replace steering rack and tighten all securing bolts and nuts.

8 Refit right hand side tie-rod, tighten castelated nut and insert split pin.

9 Centralise the steering rack and ensure that the front wheels are in the straight ahead position. Replace the two bolts securing the intermediate shaft lower universal joint to the pinion flange and tighten to the specified torque.

10 Connect anti-roll bar links.

11 Raise the front of vehicle and remove stands from under side members, and lower vehicle to the ground.

12 Bounce front of vehicle several times to normalise suspension and tighten the lower suspension arm pivot bolts.

13 Remove engine lifting brackets No. 18GA041.

14 Replace battery terminal and tighten.

LOWER SUSPENSION ARM

The lower suspension arm is a forged channel member fitted with a swivel ball joint. The inner end of the suspension arm is fitted with a stepped pivot bolt bush and a centrally located parallel bush to accommodate the tie-bar bolt. Both bushes are replaceable. The swivel ball pin is an integral part of the lower suspension arm and when excessively worn must be replaced with the arm. Refer Fig. P-2.

Removing

1 Raise the front of the vehicle and place stands under the side members.

2 Remove the front wheels.

3 Remove the Nyloc nut from the tapered pin (8).

4 Remove the tapered pin (8) from the suspension strut.

5 Remove the Nyloc nut and bolt securing the tie-bar to the lower suspension arm.

6 Disconnect the anti-roll bar link from the suspension arm.

7 Remove the pivot bolt securing the suspension arm to the cross member and remove the suspension arm.

NOTE: The suspension arm ball joint is not serviced as a separate unit. It is integral with the lower suspension arm. Should excessive wear be present in the ball joint, it will be necessary to replace the suspension arm.

Inspection

Clean all component parts and carefully inspect the lower suspension arm for straightness and condition of bearing surfaces. Check ball joint for excessive wear. Replace arm if damage or excessive wear is evident.

Refitting

1 Refitting is the reversal of the removing procedures 1 to 7.

NOTE: Both Nyloc nuts should be renewed. Do not tighten the pivot bolt (11) until vehicle has been returned to the road position and static laden. Check caster angle if adjustment on tie-bar has been altered.

LOWER SUSPENSION ARM BUSHES

Removing

1 Remove lower suspension arm from vehicle.

NOTE: The removing and replacing of both bushes requires the use of tools No. 18GA060/1/2/3 and forcing screw from No. 18GA062.

2 Place the sleeve 18GA060 over the large diameter of the pivot pin bush and sleeve 18GA060/2 against the small end of the bush. Insert the bolt 18GA060/3 and install the nut and tighten until the bush is withdrawn from the suspension arm.

3 Place the sleeve 18GA060 over the tie-bar bush and the sleeve 18GA060/2 against the bush. Insert the bolt 18GA062 through both sleeves and the bush. Fit the nut and tighten until the bush has been withdrawn from the suspension arm.

Replacing

1 Replacing both bushes is the reverse of the removing procedure using the appropriate sleeves and noting the following points.

(a) The pivot pin bush must be drawn into the arm until it bottoms against the step.

(b) The tie-bar bush must be positioned centrally in the suspension arm.

NOTE: If the adjustment of the tie-bar has been moved it will be necessary to adjust the castor angle.

TIE-BAR ASSEMBLY

The tie-bar is located in a bracket attached to the longitudinal member, a rubber bush is installed in the bracket and the tie-bar passes through the centre of the rubber bush. The fork end of the tie-bar is attached to the lower suspension arm.

Removing

1 Disconnect the battery.

2 Raise the front of the vehicle and place stands under the side longitudinal members.

3 Remove the front wheel.

4 Disconnect the tie-bar from the lower suspension arm.

5 Remove the split pin, Twinlock nut and flat washer from the tie-bar.

6 Remove the tie-bar.

7 Remove the rubber bush from the bracket.

Inspection

1 Clean all parts and carefully inspect the tie-bar for straightness, weld condition at the fork end and the condition of tie-bar threads and washers. Check tie-bar rubber for visible damage.

WARNING: When fitting the rubber bush care should be taken with the application of lubricant so that the inner end of the tie-bar rubber bush does not splay when the tie-bar is tightened. Approved lubricant is white spirit or water.

Refitting

1 Refitting is the reversal of the removing procedures 1 to 7 noting the following:

(a) Replace rubber bush if showing signs of deterioration.

(b) Tighten the Twinlock nut to the specified torque.

NOTE: The nominal length of the tie-bar is 279 mm (11 in) measured from the centre of the bolt hole at the fork end of the tie-bar to the face of the Twinlock nut as shown in Section Q Caster Angle Fig. Q-3.

(c) Check front wheel alignment and reset if necessary. (Refer Section Q.)

FRONT HUBS

The front hub and ventilated brake disc is an integral part incorporating taper roller type bearings. It is necessary to remove the brake caliper before removing the hub and disc assembly. Refer Fig. P-7.

Removing

1 Raise the front of the vehicle and place on suitable supports.

2 Remove hub cap and road wheel.

3 Remove brake caliper and support to avoid the weight being taken on brake hose.

4 Remove hub grease cup.

5 Straighten and remove hub nut split pin.

6 Remove nut retainer, nut, keyed washer and outer bearing cone.

7 Remove hub and disc assembly.

Replacing

1 Replacing is the reversal of the removing procedures 1 to 7.

NOTE: The wheel bearings must be adjusted in the following manner before replacing the brake caliper.

ADJUSTING FRONT HUB BEARINGS

1 The hub end float should be adjusted to 0.0254 to 0.127 mm (0.001 to 0.005 in) using the following procedure.

2 Spin the hub and tighten the hub nut to 6.7 Nm (5 lb.f.ft.).

3 Stop the hub spinning and slacken the nut.

4 Tighten the nut finger tight.

5 Locate the nut retainer so that half the split pin hole is covered by one of the arms of the retainer.

6 Slacken the nut and retainer until the split pin hole is fully uncovered, insert the split pin and lock by turning the legs of the split pin circumferentially around the nut retainer. Fig. P-7.

WARNING: At the maximum end float figure specified, a considerable amount of movement will be felt on the wheel. Do not reduce the end float below 0.0254 mm (0.001 in). Under no circumstances must the bearing be pre-loaded.

BEARING REPLACEMENT

Removing

1 Remove the hub.

2 Prise out the grease seal from the inner side of the hub and remove bearing cone.

3 Insert a brass drift through the hub so that the inner end rests against the inner bearing cup.

4 Lightly tap the drift, moving around the circumference of the cup until it is driven clear off its seating.

5 The outer bearing cup is removed and replaced in the same manner.

Inspecting

1 Thoroughly clean the stub axle and inside of the hub with a suitable solvent to remove all of the old lubricant.

2 Check the bearings for pits, scores and cracks.

3 Inspect the hub bolts for tightness in the hub, also for damage to the threads.

4 Check the grease seal contact surface on the stub axle, it must be smooth, free from scores and burrs.

NOTE: The inner bearing cones must be a hand press fit on to the stub axle.

Lubrication

When new front wheel bearings are fitted it is essential to pack them with the specified lubricant in the following manner.

1 Pack the bearing cone and roller assemblies with the specified wheel bearing grease, ensuring that the lubricant is worked between the rollers and cage. The bearing cup should also be completely smeared with lubricant.

2 The cavity in the hub between the inner and outer bearings should not be packed with grease, however, the stub axle may be coated with lubricant. The lips of the seal should be smeared with grease to prevent damage during the initial running period.

3 Do not place any lubricant in the grease cap.

Refitting

1 Press the cups into the hub ensuring that they are square and not tilted. Both must be fully seated against the shoulders in the hub.

2 Lubricate and insert the inner bearing cone and grease seal, ensuring that the seal is correctly located.

3 Replace hub, lubricate and insert the outer bearing cone, keyed washer, nut and locking nut, adjust bearings, fit split pin and replace hub grease cap.

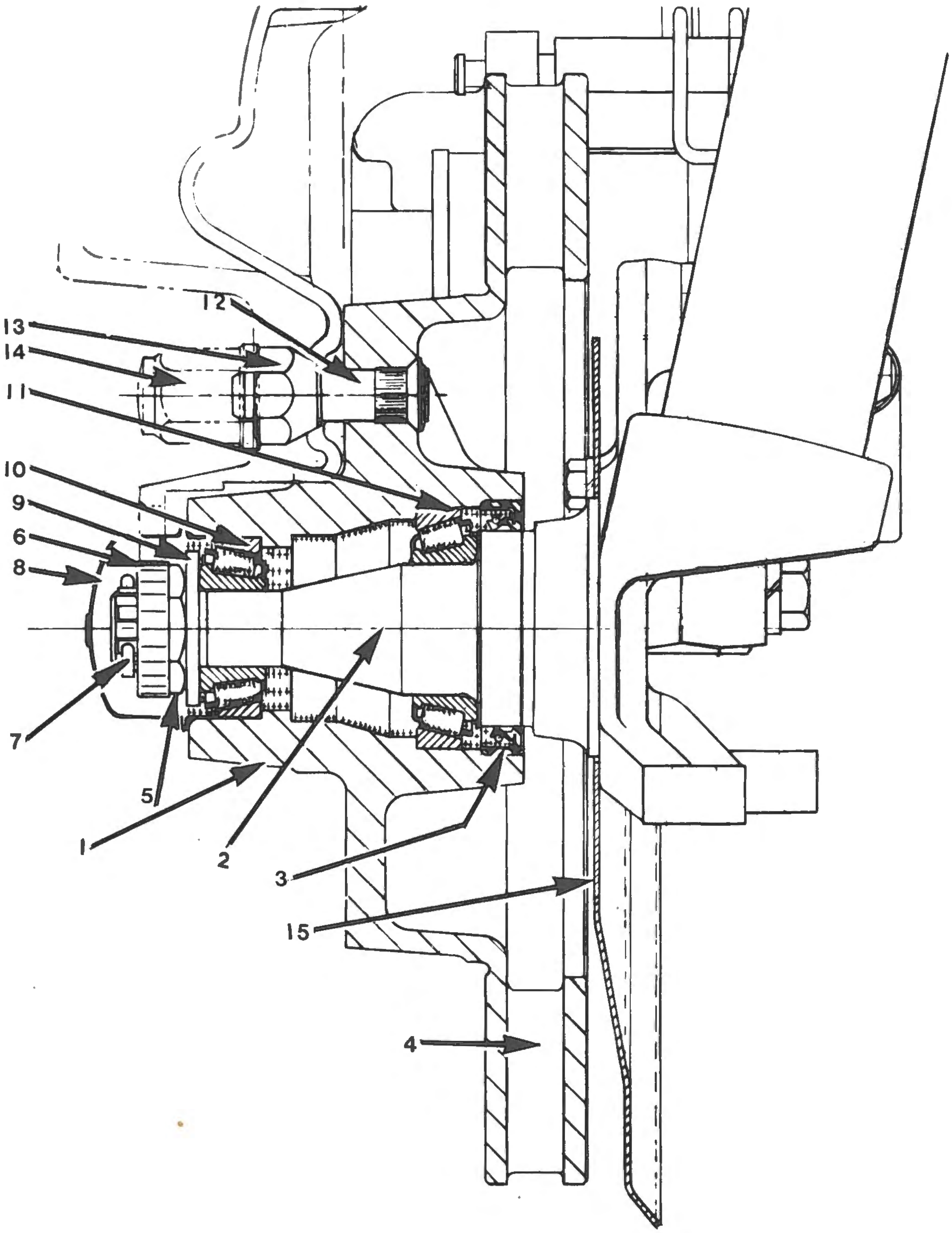


Fig. P-7

FRONT HUB

1	HUB	6	LOCKNUT	11	INNER BEARING
2	STUB AXLE	7	SPLIT PIN	12	WHEEL STUD
3	GREASE SEAL	8	GREASE CAP	13	WHEEL NUT – STEEL WHEEL
4	BRAKE DISC	9	KEYED WASHER	14	WHEEL NUT – ALLOY WHEEL
5	BEARING ADJUSTING NUT	10	OUTER BEARING	15	DUST SHIELD

SECTION Q
STEERING

GENERAL DESCRIPTION

MANUAL

The steering gear is of the direct acting rack and pinion type, providing accurate control under all conditions.

It consists of a rack bar and toothed pinion mounted on the front cross member.

POWER ASSISTED

The power-assisted steering system consists of two main components: the rack and pinion steering unit and the pump. The two units are connected by flexible hoses. The pump is an integral unit with reservoir.

In both types an intermediate steering shaft incorporating a flexible coupling engages the splined end of the rack pinion to which the flange is secured by a clamp bolt. The intermediate shaft is connected to the steering column shaft by a splined universal type coupling.

To comply with the safety regulations, an energy absorbing section is interposed between the upper inner steering column and steering wheel.

FRONT WHEEL ALIGNMENT

Before attempting to check or adjust caster or toe-in, an inspection of the following components should be made and adjustments effected if necessary.

1. The vehicle should be at kerbside weight, with the spare tyre in position and without passengers.
2. Tyre pressures must be checked and set to the recommended pressures.
3. Check all steering ball joints, upper strut bearing, lower swivel ball joint for excessive wear.
4. Check lower suspension arm bushes for excessive wear.
5. Check front wheel bearings for end float and adjust if necessary.
6. The shock absorbers must be checked for correct operation, also inspect mounting rubbers for wear and tightness.
7. Check steering rack mountings for tightness.

Unless the above checks are carried out and the necessary repairs and adjustments completed, it will not be possible to carry out a satisfactory alignment operation.

When new parts have been fitted to the front suspension it will be necessary to check and adjust the steering alignment.

TOE-IN

The correct toe-in adjustment is important, as it is designed to stabilise the steering, prevent side slipping and excessive front-tyre wear, and to offset the slight deflection outwards of the wheels when the brakes are applied.

When checking the toe-in the following points must be observed.

1. When a base-bar type gauge is used, the measurement must be taken in front and behind the wheel centre at the rim edge, move the vehicle forward half a road wheel revolution and take another measurement at the same point on the wheel rim. Toe-in is 0 to 3.175 mm (0 to ⅛ in). Fig. Q-1.

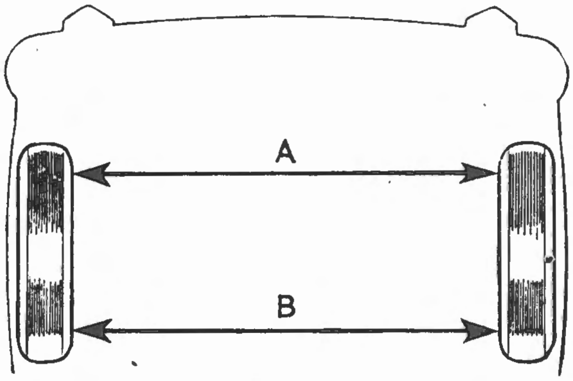


Fig. Q-1

FRONT WHEEL ALIGNMENT CHECK

THE FRONT WHEEL ALIGNMENT CHECK MUST BE TAKEN AT THE WHEEL CENTRE HEIGHT WITH THE WHEELS IN THE STRAIGHT AHEAD POSITION
DIMENSION 'A' MUST BE FROM 0 TO 3 mm (0 to ⅛ in) LESS THAN DIMENSION 'B'

2. Where an optical gauge is used, three readings must be taken, each reading at 120° of wheel rim movement. The average figure should then be calculated.

Adjusting

1. Slacken the locknut on each tie-rod.
2. Slacken the clips securing the rack boots to the tie-rods. Fig. Q-2.
3. Rotate each tie-rod in the required direction an equal amount to correct the misalignment.

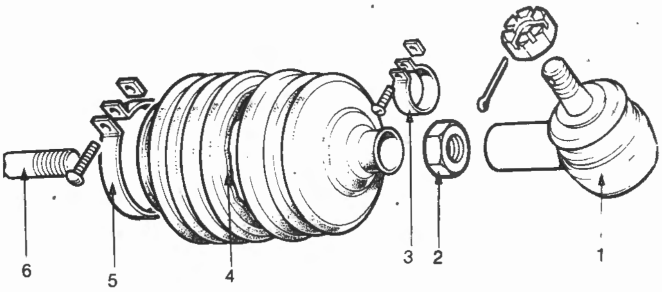


Fig. Q-2

LAYOUT OF STEERING RACK TIE-ROD COMPONENTS

1	TIE-ROD END	4	BOOT
2	TIE-ROD LOCKNUT	5	BOOT CLIP (INNER)
3	BOOT CLIP (OUTER)	6	TIE-ROD

NOTE: Both tie-rods are right-hand thread.

CAUTION: It is important that the tie-rods are adjusted to exactly equal length.

4 Tighten the tie-rod locknuts.

5 Tighten the rack boot clips.

6 Recheck the toe-in.

CASTER ANGLE

The caster angle is adjustable through the tie-bar, which is threaded on the rear end. Fig. Q-3.

To adjust the caster angle, loosen the two nuts on the rear end of the tie-bar. Shortening the tie-bar produces negative caster, while lengthening the tie-bar produces positive caster. The nuts on the tie-bar must be tightened to the correct torque before checking the caster angle.

Variations in caster angle may be caused by—

Worn or loose rubbers on tie-bar.
Weak coil springs, both front or rear.
The caster angle is + ½ to + 1½ degrees.

CAMBER ANGLE

The camber angle is not adjustable, but should be checked in the event of accident, damage or if steering malfunction is experienced.

Incorrect camber angles may result from distorted stub axle, worn or loose front wheel bearings, lower suspension arm ball joints and pivot bearing wear.

The camber angle is –¼ to + ¾ degrees.

STEERING WHEEL

Removing

1 Disconnect the battery.

2 Unclip and remove horn pad.

3 Disconnect the horn wire from the pad and remove pad completely from steering wheel.

4 Remove the four bolts securing the steering wheel to canister. Disconnect the horn wire from steering wheel and remove wheel.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4.

COLLAPSIBLE CANISTER

Removing

1 Remove steering wheel.

2 Remove locknut.

3 Remove canister retaining nut and mark the canister hub and the inner steering column to ensure replacement in the original position.

4 Using service tool 18GA067 remove canister.

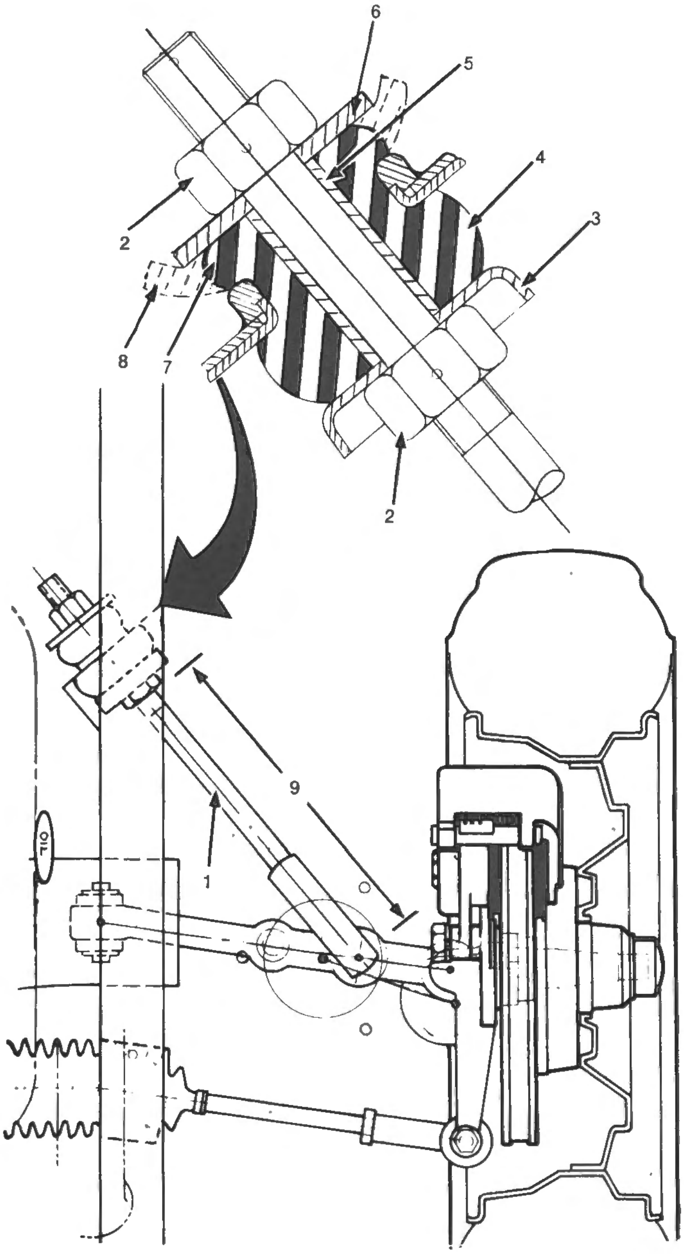


Fig. Q-3

CASTER ANGLE ADJUSTMENT AND TIE-BAR RUBBER BUSH INSTALLATION

1 TIE-BAR
2 TWINLOCK NUTS
3 DISHED WASHER
4 RUBBER BUSH
5 DISTANCE TUBE
6 FLAT WASHER
7 CORRECT INSTALLATION OF RUBBER BUSH
8 INCORRECT INSTALLATION CAUSED BY LUBRICATION OF THE RUBBER BUSH AND THE FLAT WASHER
9 NOMINAL LENGTH OF THE TIE-BAR 279 mm (11 in)
REDUCING THE NOMINAL LENGTH OF THE TIE-BAR PRODUCES NEGATIVE CASTER
INCREASING THE NOMINAL LENGTH OF THE TIE-BAR PRODUCES POSITIVE CASTER

Refitting

1 Refitting is a reversal of the removal procedures 1 to 4 noting the following:

  (a) Tighten the canister to steering column retaining nut to 41 Nm (30 lb.f.ft.).

  (b) The locknut to be hand tightened plus ½ to ⅔ turn.

  (c) The trafficator cancelling mechanism pin is to be located in the slot on the back face of the canister.

STEERING COLUMN

Removing

1 Disconnect the battery.

2 Remove steering wheel and canister assembly.

3 Disconnect gearshift linkage rod from levers at lower end of steering column. (Column change models only.)

4 Remove bolt from clamp at joint of steering column inner shaft and intermediate linkage.

5 Remove instrument cluster assembly (refer Section S).

6 Remove switch panel assembly (refer Section S).

7 Disconnect wiring harness and ignition wiring under dash.

8 Remove the three bolts and one screw securing the column mounting plate to the floor panel.

9 Remove ventilation rail along lower edge of dash assembly (refer Section W).

10 Remove the two bolts securing column mounting bracket to dash panel.

11 Remove steering column assembly and withdraw into the interior of the vehicle.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 11 noting the following:

  (a) Ensure that with column change models the gear selection is correct. For adjustment method refer to either the Manual transmission or the Automatic transmission section.

  (b) With automatic transmission ensure that the engine will not start with the transmission in gear.

Dismantling

Floor Change — Automatic and Manual

  (a) Using a suitable tool gently lever out hub of trafficator control assembly.

  (b) Loosen trafficator stalk and engage hazard warning switch.

KEY TO FIG. Q-4

1 STEERING COLUMN SHAFT
2 HORN CONTACT
3 COLLAPSIBLE CANISTER
4 CANISTER TO STEERING COLUMN SHAFT NUT
5 LOCKNUT
6 STEERING WHEEL
7 STEERING WHEEL TO CANISTER BOLTS AND LOCKWASHERS
8 HORN PLATE GROMMET
9 HORN PLATE
10 HORN PAD
11 DIRECTION INDICATOR SWITCH
12 DIRECTION INDICATOR FLANGE NUTS
13 DIRECTION INDICATOR SWITCH FLANGE
14 THRUST WASHER
15 DIRECTION INDICATOR FLANGE BOLTS (SQUARE HEADS)
16 DIRECTION INDICATOR LEVER
17 GEARSHIFT LEVER FLANGE
18 GEARSHIFT LEVER PIN AND CIRCLIP
19 GEARSHIFT LEVER RING
20 GEARSHIFT LEVER INSULATOR
21 GEAR LEVER
22 QUADRANT SELECTOR INDICATOR (AUTOMATIC TRANSMISSION)
23 GEARSHIFT TUBE BEARING (UPPER)
24 STEERING COLUMN SHAFT SUPPORT BEARING
25 STEERING COLUMN FARING
26 GEARSHIFT TUBE
27 IGNITION SWITCH/STEERING COLUMN LOCK
28 PLATE (COLUMN TO FLOOR)
29 'O' RING
30 FLOOR PLATE
31 FLOOR PLATE GASKET
32 GEARSHIFT ARM (MANUAL TRANSMISSION)
33 GEARSHIFT TUBE WASHER
34 GEARSHIFT ARM SPACER
35 GEARSHIFT TUBE (MANUAL TRANSMISSION)
36 GEARSHIFT TUBE SPRING SEAT WASHER
37 GEARSHIFT TUBE SPRING
38 GEARSHIFT TUBE SEAL
39 STEERING COLUMN LOWER BEARING
40 STEERING COLUMN LOWER BEARING SEAL
41 STEERING COLUMN LOWER CAP
42 STEERING COLUMN RETAINING CAP CLIP
43 SELECTOR GATE (AUTOMATIC TRANSMISSION)
44 GEARSHIFT TUBE (AUTOMATIC TRANSMISSION)
45 STEERING COLUMN LOWER BEARING SEAL

A — MANUAL TRANSMISSION
B — AUTOMATIC TRANSMISSION

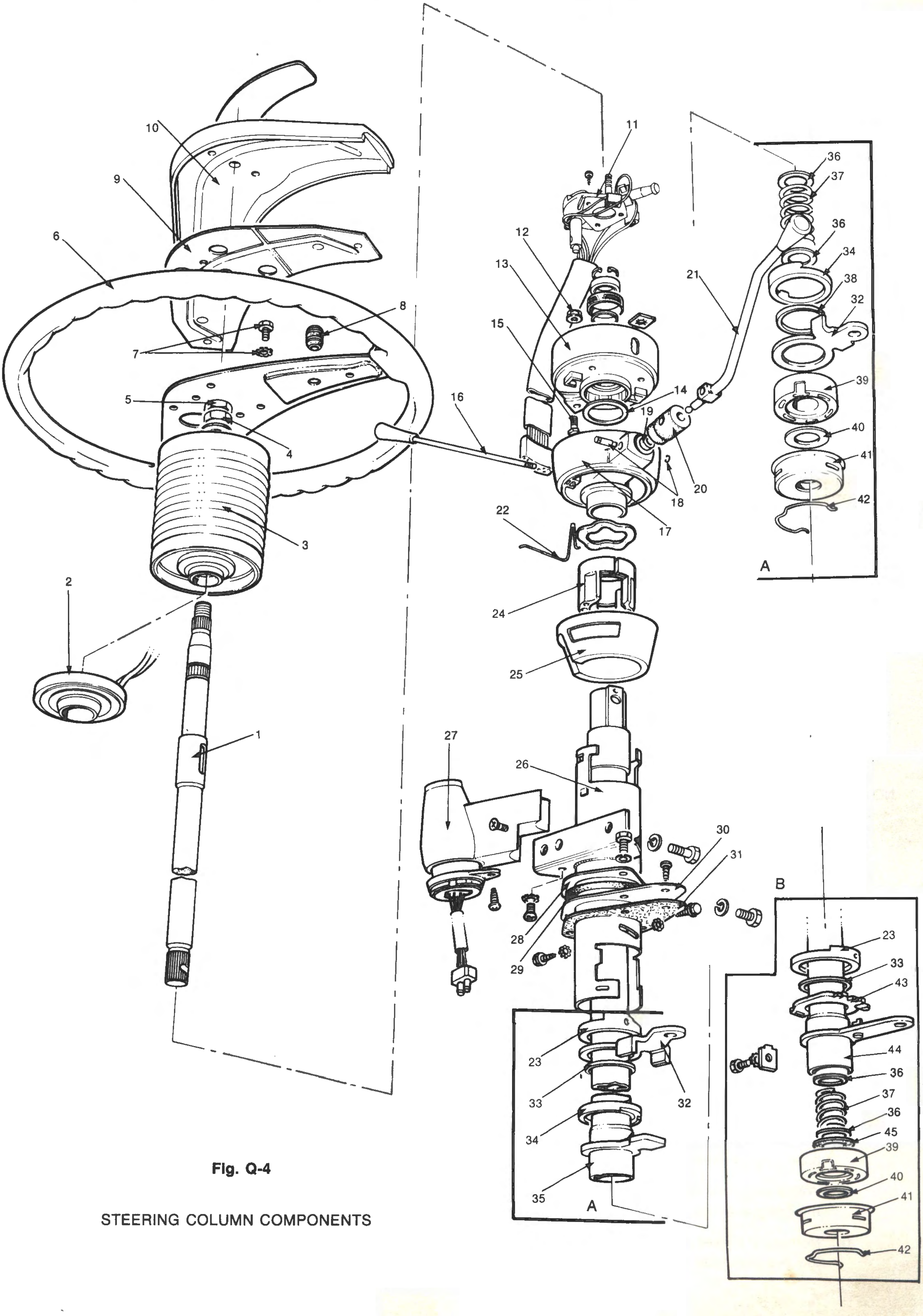


Fig. Q-4

STEERING COLUMN COMPONENTS

(c) Remove the three screws securing the trafficator assembly to the upper shroud. Withdraw the trafficator stalk.

(d) Withdraw trafficator assembly, angling over inner column, taking care not to damage unit and withdraw wiring loom through shroud assembly.

(e) Lightly tap lower end of inner column and withdraw through upper shroud.

NOTE: Ensure that the steering/ignition lock is not in the 'LOCK' position.

(f) Slacken off the two nuts securing the upper shroud to the outer steering column.

CAUTION: Do not remove nuts completely, as the bolts will fall into lower shroud.

(g) Remove upper and intermediate shrouds as an assembly.

(h) Remove steering/ignition lock and remove lower shroud.

(i) Remove nylon bush in top of outer column.

(j) Remove spring clip retaining end cup on lower end of outer column.

(k) Remove cup and withdraw lower inner column bush.

COLUMN CHANGE — MANUAL

(a) Carry out operations (a) to (f) for floor-change models.

(b) Remove upper shroud.

(c) Remove circlip and using a suitable punch tap out the gear lever retaining pin from the bottom.

NOTE: This pin is stepped. When removing, note smaller diameter towards bottom of lever, also the top section is splined.

(d) Withdraw gearshift selector lever.

(e) Remove intermediate shroud complete with washers.

(f) Remove steering/ignition lock and remove lower shroud.

(g) Remove spring clip, retaining end cup on lower end of outer column. Withdraw bush, spring and two thrust washers (one on nylon bush and one inside gearshift tube).

(h) Remove 1-2 shift lever, plastic cup and felt pad.

(i) Remove the two set screws locating the upper bush in the column.

(j) Withdraw gearshift tube through the bottom of the column simultaneously removing 2-3 lever.

(k) Remove 2-3 lever, plastic cup and felt pad from the gearshift tube.

(l) Remove upper and lower nylon bushes from the steering column.

(m) Remove circlips and bearing from the top of inner column.

COLUMN CHANGE — AUTOMATIC

(a) Carry out operations (a) to (d) for column change manual models.

(b) Remove gear indicator rod.

(c) Withdraw intermediate shroud complete with washer.

(d) Remove the two screws and withdraw the steering/ignition lock.

(e) Lever up the three locating lugs and remove lower shroud.

(f) Remove spring clip retaining end cup on lower end of outer column. Remove cup.

(g) Withdraw nylon bush and spring.

(h) Withdraw gearshift tube through the bottom of the outer column.

(i) Loosen the two screws retaining the upper bush and turn the bush away from the selector gate plate.

(j) Remove the screw retaining gate plate and remove plate.

(k) Withdraw upper and lower bushes from outer column.

(l) Remove circlips and remove bearing from top of inner steering column.

Inspecting

1 Thoroughly clean and examine all parts of the assembly, components showing signs of wear must be replaced with new parts.

2 Note the condition of the lugs on the lower shift levers, the gearshift lever socket at the top end of the shift tube and the inner end of the shift lever.

3 Inspect the steering shaft upper bearing for smooth operation. If the bearing has any signs of roughness or wear it should be replaced.

Assembling

1 Assembling is the reversal of the dismantling procedure noting the following:

(a) Ensure that all washers, bearings and thrust pads are lubricated with a Lithium-based multi-purpose grease.

(b) Ensure the two square-head bolts retaining the upper shroud to the outer steering column are located correctly.

(c) When replacing selector lever retaining pin be sure that the splined section is uppermost.

(d) Ensure all thrust pads and washers are correctly located.

(e) The column gearshift tube upper bearing No. 23 Fig. Q-4, must be adjusted so that the gearshift lever(s) have no load or end float otherwise the gearshift will be stiff or excessive end float will be present. To adjust, loosen the bearing retaining screws and rotate the bearing in the appropriate direction.

STEERING LOCK AND IGNITION/STARTER SWITCH

Removing

1 Remove steering column.

2 Remove the two screws retaining the lock and withdraw lock assembly.

Refitting

1 Refitting is a reversal of the removing procedure.

INTERMEDIATE STEERING SHAFT

Removing

1 Remove the two bolts securing the lower flexible universal to the pinion shaft coupling.

2 Remove the pinch bolt securing the upper universal to the inner column shaft.

3 Remove intermediate steering shaft.

4 Remove the pinch bolt securing the coupling to the pinion shaft and remove coupling, if necessary.

Refitting

1 Refitting is a reversal of the removing procedure, ensuring correct alignment. (Refer 'Centralising Steering'.)

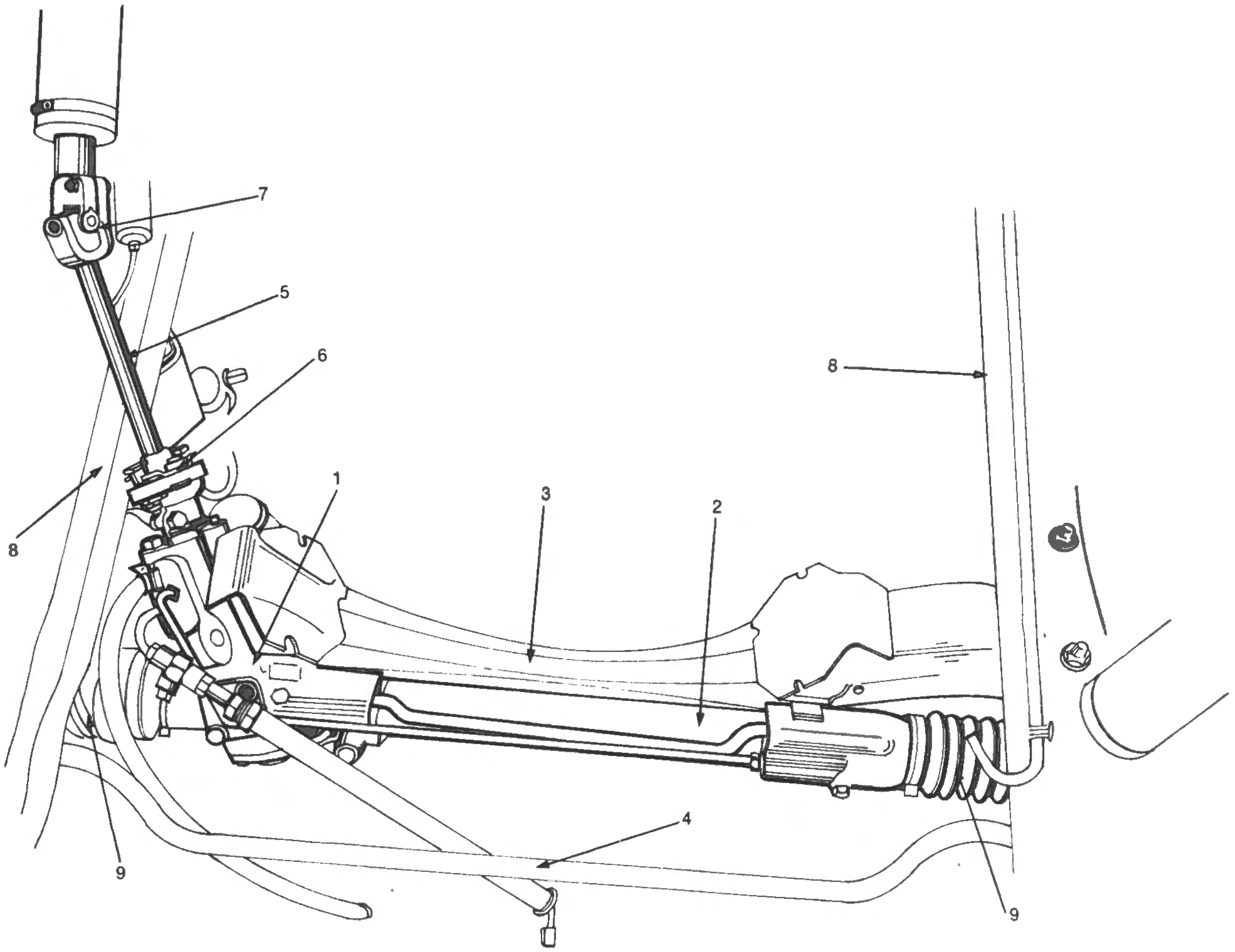


Fig. Q-5

STEERING ASSEMBLY LOCATION

1 RACK AND PINION ASSEMBLY (POWER STEERING)
2 RACK HOUSING
3 CROSS MEMBER
4 ANTI-ROLL BAR
5 INTERMEDIATE STEERING SHAFT
6 INTERMEDIATE STEERING SHAFT COUPLING
7 INTERMEDIATE STEERING SHAFT UNIVERSAL JOINT
8 FRONT LONGITUDINAL MEMBER
9 BOOT

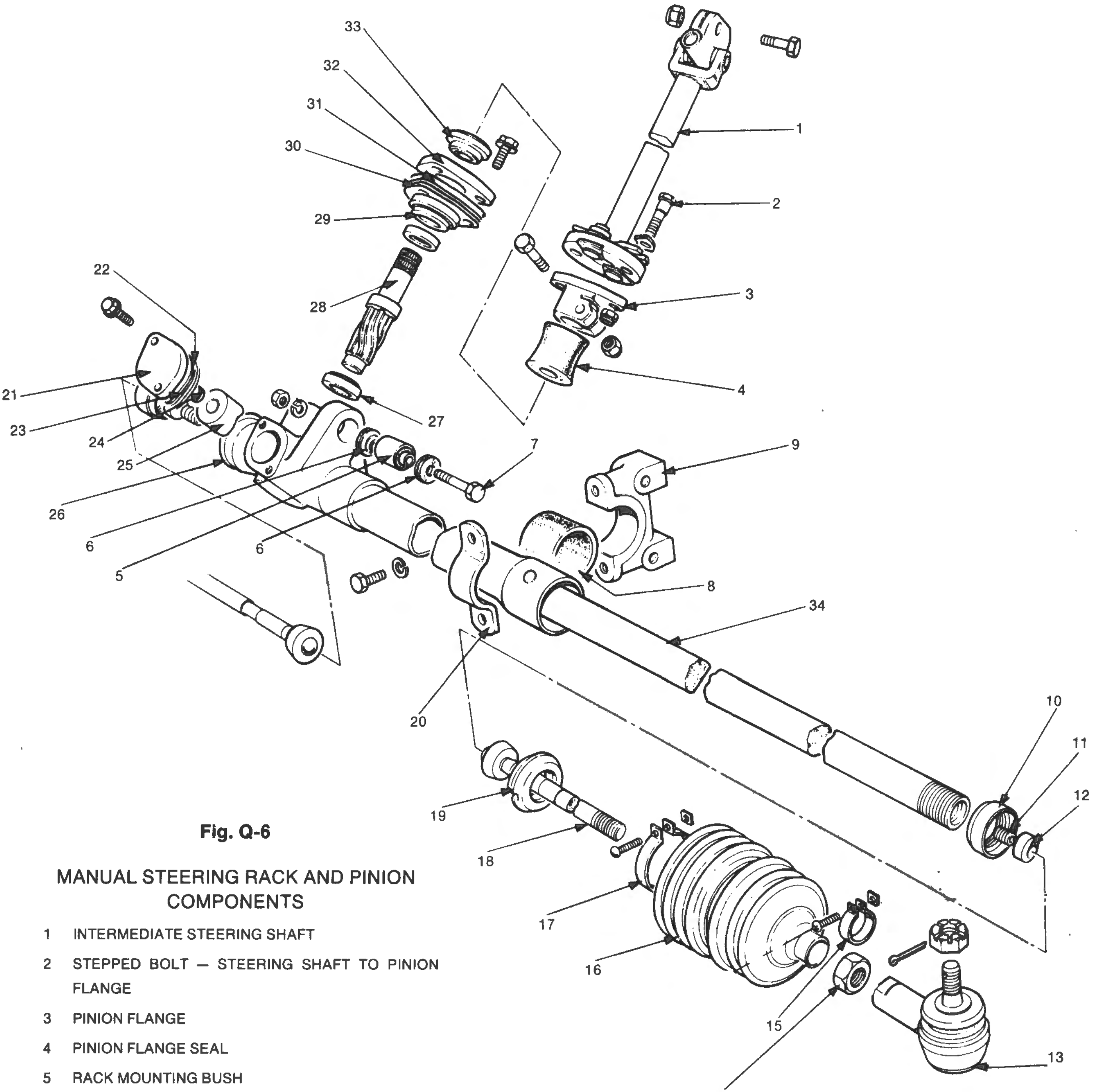


Fig. Q-6

MANUAL STEERING RACK AND PINION COMPONENTS

1 INTERMEDIATE STEERING SHAFT
2 STEPPED BOLT – STEERING SHAFT TO PINION FLANGE
3 PINION FLANGE
4 PINION FLANGE SEAL
5 RACK MOUNTING BUSH
6 RACK MOUNTING THRUST PLATE
7 RACK MOUNTING BOLT
8 RACK MOUNTING RUBBER INSULATOR
9 RACK MOUNTING ADAPTOR
10 RACK BALL JOINT LOCKNUT
11 RACK BALL JOINT THRUST SPRING
12 RACK BALL SEAT
13 TIE-ROD BALL JOINT [illegible] (MP195R)
14 TIE-ROD LOCKNUT
15 RACK BOOT CLIP (OUTER)
16 RACK BOOT
17 RACK BOOT CLIP (INNER)
18 TIE-ROD
19 TIE-ROD BALL HOUSING
20 RACK MOUNTING CLAMP
21 YOKE COVER PLATE

[illegible] Rubber Seal Kit TE 7

22 YOKE ADJUSTING SHIMS
23 GASKET
24 YOKE THRUST SPRING
25 YOKE
26 RACK HOUSING
27 PINION BEARING (LOWER)
28 PINION
29 PINION BEARING – UPPER
30 PINION BEARING ADJUSTING SHIMS
31 GASKET
32 PINION COVER
33 PINION OIL SEAL
34 RACK

STEERING RACK

MANUAL STEERING

Description

The manual steering assembly consists of a rack enclosed in a tubular housing on which a pinion is mounted and engaged with the rack at an angle of 22°.

Located at each end of the rack are tie-rods, coupled to the rack by ball joints. The outer ends of the tie-rods are connected to the steering arms by ball socket joints (tie-rod ends).

The pinion is connected to the steering wheel by upper and lower columns joined by a flexible coupling.

Pinion end-float is controlled and adjusted by shims located between the upper pinion bearing and the pinion cover plate. Backlash between pinion and rack is controlled by a support yoke, which is also adjusted by shims. The support yoke also provides the bearing for the rack at the pinion end, the other end being supported by a bush in the tubular housing.

Lubrication

No provision is made for periodic lubrication of the steering rack, replenishment is only necessary when there is evidence of loss of oil from the rack housing or rubber boots.

Provided the leakage can be rectified without the rack assembly being removed from the vehicle, the procedure is as follows:

With the rack in the straight-ahead position, remove the small boot retaining clip on the pinion side of the rack assembly. Insert an oil nozzle into the end of the rack boot and inject not more than 0.19 litres (⅓ pint) of EP 90 grade oil. Reconnect the boot retaining clip and move the rack slowly from side to side to distribute the oil throughout the housing.

Removing

1 Raise the front of vehicle and place stands under side members.

2 Remove front wheels.

3 Remove tie-rod ball pins from steering arms.

4 Remove the bolt securing the lower steering intermediate shaft flange to the steering pinion.

5 Remove the bolts and nuts securing the steering rack assembly to the front suspension cross member.

6 Remove the steering rack assembly from the cross member.

7 Remove thrust washers from mounting bushes.

Refitting

1 Refitting is the reversal of removing procedures 1 to 7 noting the following:

(a) Correct centralising of the rack and pinion assembly is essential to avoid misalignment of the steering column and unequal steering angles. The automatic cancellation of the flasher switch will also be affected if the rack and pinion assembly is not centralised.

CENTRALISING

1 Check that the tie-rods are of equal length. This may be determined by counting the number of threads visible behind the locknut, nine (9) threads on each side will give approximately the correct track when the rack is mounted on the vehicle.

2 Centralise the steering rack in the housing by measuring the total rack travel from lock to lock and dividing by two.

3 Place the front wheels in the straight-ahead position and fit the lower flexible coupling to the pinion shaft, while maintaining the front wheels and steering wheel in their correct positions.

4 Check the toe-in and adjust tie-rods if necessary, taking care to move each tie-rod an equal amount. Tighten locknuts and recheck toe-in.

OVERHAUL

Dismantling

1 Slacken the tie-rod end locknuts and remove the tie-rod ends and locknuts.

2 Slacken the large and small clips securing the boots.

3 Remove the boots and use containers to catch the oil.

4 To remove the ball joint locknut, drill or prise out the staking for the locknut.

5 Using tools 18G1030/1 and 18G1030/2 unscrew the locknut from each ball housing.

6 Using tools 18G1030/1 and 18G1030/2 unscrew the ball housing from each end of the rack and extract the tie-rods.

7 Remove the ball seat and thrust spring from each end of the rack.

8 Remove locknuts from rack.

9 Remove the bolts retaining the rack yoke cover plate.

10 Remove the cover plate, shims and gasket.

11 Remove the support yoke and thrust spring.

12 Remove the bolts retaining the pinion cover plate.

13 Remove the cover plate, shims and gasket.

14 Lift out the pinion together with the upper race and thrust washer.

15 Remove the lower pinion bearing from housing using a suitable puller.

16 Remove the rack from the steering rack tube.

NOTE: The rack must be removed from the pinion end of rack tube to avoid rack teeth damaging the sintered iron bush.

17 Remove pinion shaft oil seal from cover plate.

Inspecting

1 Thoroughly clean all components.

2 Inspect the rack and pinion for wear, cracks or damage, paying particular attention to the teeth.

3 Thoroughly examine the rubber boots for cracks, splits or signs of deterioration.

4 Renew all damaged or excessively worn components, paying particular attention to the rack ball joint assemblies.

5 Examine the rack bush and if worn the rack housing must be replaced with a new unit.

6 Ball joint assemblies (tie-rod ends) are not a serviceable item and must be replaced as a complete unit.

7 The ball joint locknuts can only be used once and must be renewed.

Assembling

1 Make sure all components are thoroughly clean.

2 Fit lower pinion bearing into housing, if removed, ensuring that it is fully seated in the bottom of the housing.

3 Refit the rack into the rack housing from the pinion end of housing.

4 Centralise the rack and insert pinion with thrust washer and upper bearing.

5 Fit the cover plate without oil seal and shims, but with gasket. Tighten the three bolts to a torque of 20.5 to 24.5 Nm (15-18 lb.f.ft.).

NOTE: All of the bolts must be at the same torque before measuring the gap.

6 Measure gap between cover and housing with a feeler gauge.

7 Remove bolts and cover plate. Fit shims and gasket to the value of the feeler gauge measurement minus 0.020 to 0.013 mm (0.001 to 0.005 in) to obtain the required pre-load.

8 Coat the bolts and cover plate with sealing compound (Permatex No. 3) and install. Tighten bolts to a torque of 20.5 to 24.5 Nm (15-18 lb.f.ft.).

9 Fit new pinion oil seal.

10 Fit damper yoke and cover plate without spring.

11 Fit the cover bolts with spring washers and tighten progressively whilst turning the pinion back and forward through 180° until it is just possible to rotate the pinion when a torque of 1.65 Nm (15 lb.f.in.) is applied using service tool 18G207. Measure the clearance between the cover and the yoke.

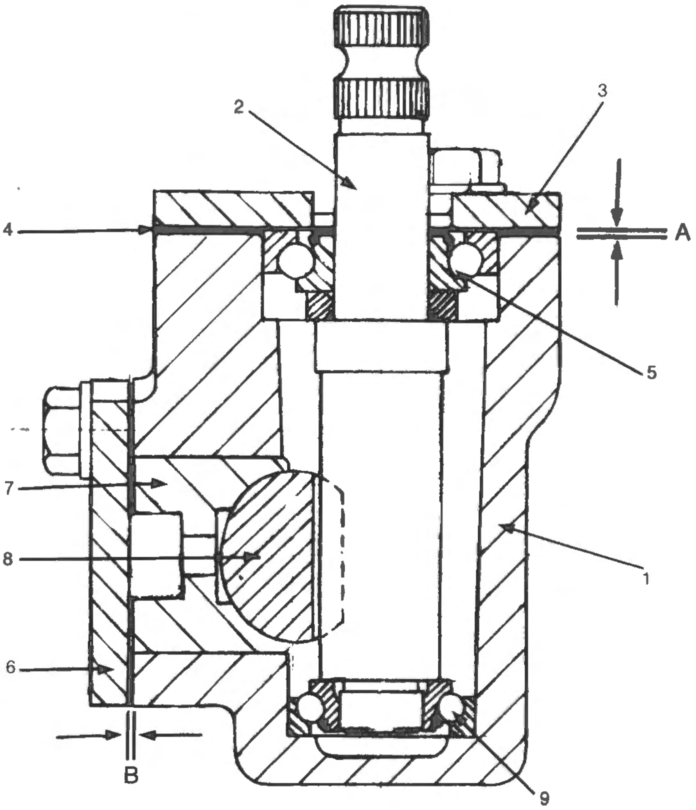


Fig. Q-7

PINION BEARING AND DAMPER ADJUSTMENT

1	RACK HOUSING	7	YOKE
2	PINION	8	RACK
3	PINION COVER PLATE	9	PINION BEARING — LOWER
4	GASKET		
5	PINION BEARING — UPPER		A — Pinion Bearing Adjustment
6	YOKE COVER PLATE		B — Damper Adjustment

12 Remove the cover and assemble, fitting the damper spring and the necessary shims to obtain the measurement previously taken plus 0.05 to 0.13 mm (0.002 to 0.005 in). The maximum torque required to rotate the pinion should not exceed 1.98 Nm (18 lb.f.in.) when the cover bolts are tightened to 20.5 to 24.5 Nm (15-18 lb.f.ft.). The bolts and cover plate should be coated with sealing compound (Permatex No. 3).

13 Screw a new ball housing locknut onto each end of the rack to the limits of the thread (a new locknut must be used).

14 Refit the two thrust springs in the rack ends.

15 Insert each tie-rod in the ball housings and position the ball seat against the thrust spring.

16 Tighten the ball housing until the tie-rod is pinched then back off ⅛ of a turn to allow full articulation of the tie-rod.

17 Screw the locknut onto the ball housing using tools 18G1030/1 and 18G1030/2. Tighten the locknut firmly and ensure that the housing does not turn.

18 Check the pre-load on the tie-rod ball spheres, when correctly adjusted the torque required to produce articulation of the tie-rod through at least 10° should be 3.5 to 5.7 Nm (32-52 lb.f.in.).

19 Punch one edge of the locking nut into the slot of the ball housing and the opposite end into the rack locking hole.

20 Refit the two rack boots and tighten two small clips on the tie-rod ends of the boot. Tighten large clip on end housing. Do not tighten clip on pinion end of housing.

21 Stand assembly upright and pour in 0.19 litres (⅓ pint) of SAE 90 EP oil.

22 Position and tighten clip.

23 Centralise the rack. The full travel of the rack from lock to lock is 4.92 turns or 155.4 mm (6.12 in) giving 77.7 mm (2.06 in) in each direction.

24 Refit locknuts and screw the tie-rod end ball joint assemblies an equal distance onto each tie-rod until the measurement between the two ball pins is 1342.6 mm (52.8 in).

25 Refit the steering rack assembly to the vehicle (see 'Aligning Steering').

26 Check wheel alignment (toe-in).

POWER STEERING

Description

The power-assisted steering system consists of two major components, namely: the rack and pinion steering unit and the pump. The pump is an integral unit with the reservoir. The steering unit and the pump unit are connected by flexible hoses.

The pump unit is mounted on the left-hand side of the 8 cylinder engine, at crankshaft level. It is driven from the crankshaft by means of a V-belt which is adjustable.

OPERATION

Oil flows from the output side of the pump to the rack and pinion steering unit via the pressure hose and from the steering unit via the return hose to the pump. The oil flow from the reservoir to the pump is through passages within the unit.

A continuous flow of oil is pumped through the system whilst the engine is running, but pressure builds up only when the steering is turned.

The steering system is basically a normal rack and pinion manual steering with a torsion bar controlled rotary valve mounted on the input shaft and a hydraulic cylinder positioned around the rack.

The Valve

This is a rotary type control valve. The valve rotor which is also the input shaft to the steering gear, has three grooves machined in it. These grooves lie between the three grooves in the valve sleeve when no load is applied to the steering wheel, the rotor being centred in the sleeve by a torsion bar.

When steering effort is applied to the wheel, this is transmitted via the torsion bar to the rotor. The torsion bar is slender and the manual effort causes it to twist, thus allowing the rotor to rotate in the sleeve. The relative movement of the grooves in the rotor to the grooves in the sleeve allows hydraulic pressure from the pump to operate on either side of the piston, thus assisting the turning of the steering.

Power Steering Pump

The pump which provides the hydraulic pressure in the system is of the constant displacement type and incorporates a combined, flow control valve and pressure relief valve.

The pump rotor has 8 slippers and springs, which rotate inside a cam insert containing two lobes 180° from each other.

The cam insert and the pump port plates, provide a sealed chamber within which the rotor and slippers rotate between the two lobes for pump operation.

As the rotor turns, the slippers are forced outward against the inner surface of the cam insert by a combination of centrifugal force, slipper spring force, and fluid pressure acting on the under side of the slipper. A pair of adjacent slippers along with the surfaces of the rotor, cam and pressure plates, form a sealed chamber within the crescent shaped cavity. As this sealed chamber moves through the crescent shaped cavity its volume changes resulting in a pumping action.

As the rotor rotates 90° (Fig. Q-9) the slipper slides outward in its slot riding on the cam and the volume of the sealed chamber increases. This creates a vacuum and sets up a suction area. With the inlet port placed in this area, the chamber will fill with fluid. As the rotor rotates from 90° to 180° the volume of the sealed chamber decreases, thus creating a pressure area. The pressure or outlet port is located in this area. While this pumping action is going on between 0° and 180° the same condition is occurring between 180° and 360°. This combination creates what is known as a balanced rotor pump. The two pressure and suction quadrants are diametrically opposite each other.

Flow Control Valve

Since the pump is a constant displacement pump, the internal flow will vary directly with the pump speed. However, a power steering gear requires a relatively high constant rate of flow in the parking zone and thereafter a lower rate of flow. This is accomplished by means of a variable orifice mechanism shown in Fig. Q-11.

All of the internal pump flow is ported from the pumping mechanism (rotor, slippers and cam insert) through a passage 'A' into the flow control zone. All of flow goes through the metering pin orifice and out into the line until the by-pass port is cracked open. This is the regulation point. The oil drops in pressure in moving through the orifice. The lower pressure is then sensed through a hole drilled in the cover communicating the rear of the control valve. The difference in pressure thus created on the control valve increases steadily and proportionally with increasing rpm and this moves the valve progressively back into its bore, thus increasing the opening of the by-pass port.

The metering pin travels with the control valve decreasing the net area of the orifice at higher speeds. This action reduces flow to the steering gear.

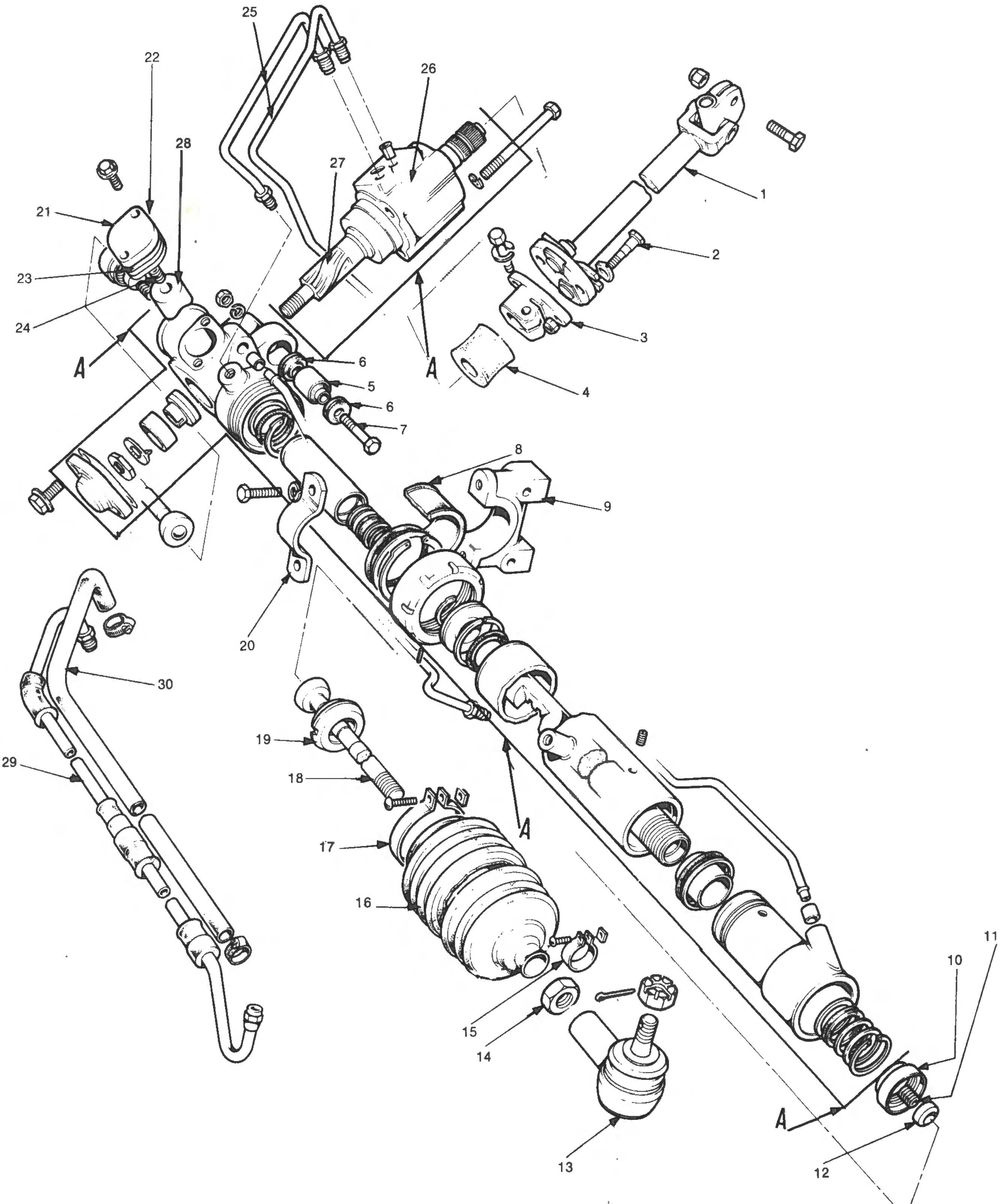


Fig. Q-8

POWER STEERING RACK AND PINION COMPONENTS

KEY TO FIG. Q-8

1	INTERMEDIATE STEERING SHAFT
2	STEPPED BOLT — STEERING SHAFT TO PINION FLANGE
3	PINION FLANGE
4	PINION FLANGE SEAL
5	RACK MOUNTING BUSH
6	RACK MOUNTING THRUST PLATE
7	RACK MOUNTING BOLT
8	RACK MOUNTING RUBBER INSULATOR
9	RACK MOUNTING ADAPTOR
10	RACK BALL JOINT LOCKNUT
11	RACK BALL JOINT THRUST SPRING
12	RACK BALL SEAT
13	TIE-ROD BALL JOINT
14	TIE-ROD LOCKNUT
15	RACK BOOT CLIP (OUTER)
16	RACK BOOT
17	RACK BOOT CLIP (INNER)
18	TIE-ROD
19	TIE-ROD BALL HOUSING
20	RACK MOUNTING CLAMP
21	YOKE COVER PLATE
22	YOKE ADJUSTING SHIMS
23	GASKET
24	YOKE THRUST SPRING
25	OIL PIPES — CONTROL VALVE TO RACK HOUSING
26	CONTROL VALVE HOUSING
27	PINION
28	YOKE
29	OIL SUPPLY PIPE
30	OIL RETURN PIPE
A —	RACK AND PINION ASSEMBLY AS AN EXCHANGE UNIT

Pressure Relief Valve

When the steering wheel is turned completely to the stop position in the right or left turn direction or in the case of a road load of sufficient magnitude, the steering gear will not accept any flow from the pump, except for a very limited volume of oil due to leakage past valve seals. Because of this resistance, excessive hydraulic pressure would be developed, if it were not limited by the pressure relief valve.

When relief pressure is reached, the pressure relief ball is forced off its seat allowing oil to pass through the spool valve and dump into the by-pass port. The relief valve will continue to limit oil pressure to the relief setting for the duration of the overload condition.

Lubrication

The rack, pinion and ball joints which are basically a normal steering unit are lubricated independently with SAE40 oil injected into each rack boot.

The hydraulic cylinder positioned round the rack and valve assembly are lubricated by hydraulic fluid in the power steering unit system.

WARNING: It is important that absolute cleanliness is observed when replenishing with oil as any foreign matter that enters may affect the hydraulic system.

FLUID LEVEL

Checking

1. Start engine and run until normal operating temperature is reached.
2. Turn steering wheel back and forth several times to expel air from the system then shut off engine.
3. Remove the filler cap and check the oil level on the attached dipstick. Oil level should be up to 'full' mark on dipstick.
4. Top up as necessary, using automatic transmission fluid. DO NOT OVERFILL.

STEERING PUMP DRIVE BELT

Removing

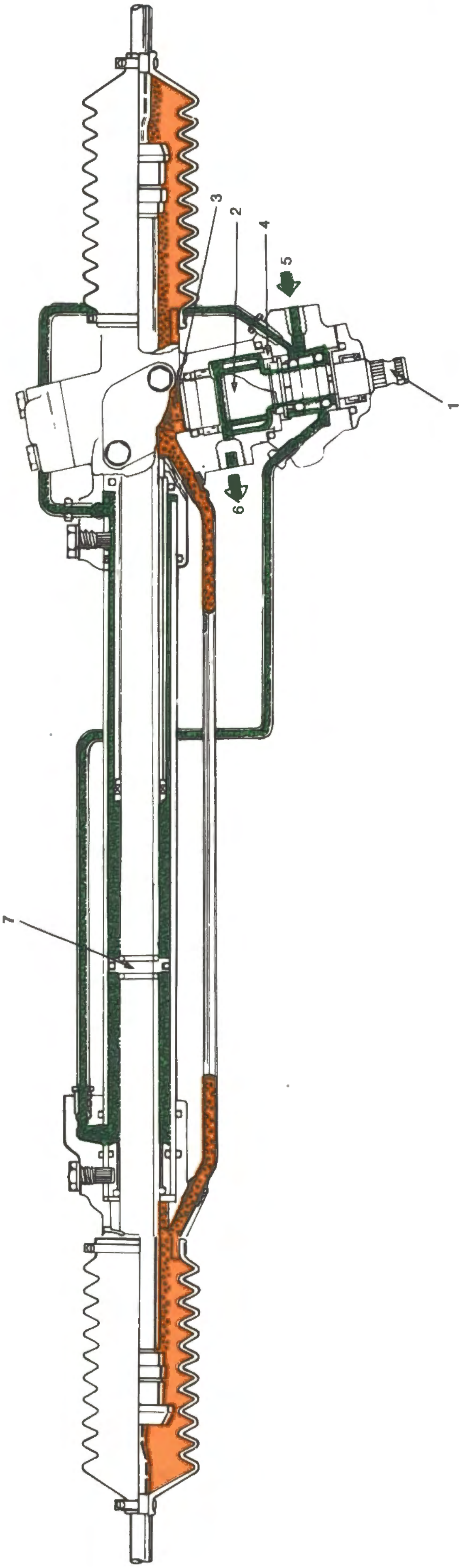
1. Remove engine fan belt.
2. Remove air conditioning drive belt, if air conditioning fitted.
3. Loosen the upper pivot bolt.
4. Loosen lower adjusting bolt and pivot the pump towards the harmonic balancer.
5. Loosen the bolts securing the fan blade assembly and pulley to the water pump flange.
6. Remove the belt from the pump pulley and feed it through the water pump pulley and harmonic balancer. Remove from vehicle.

Inspecting

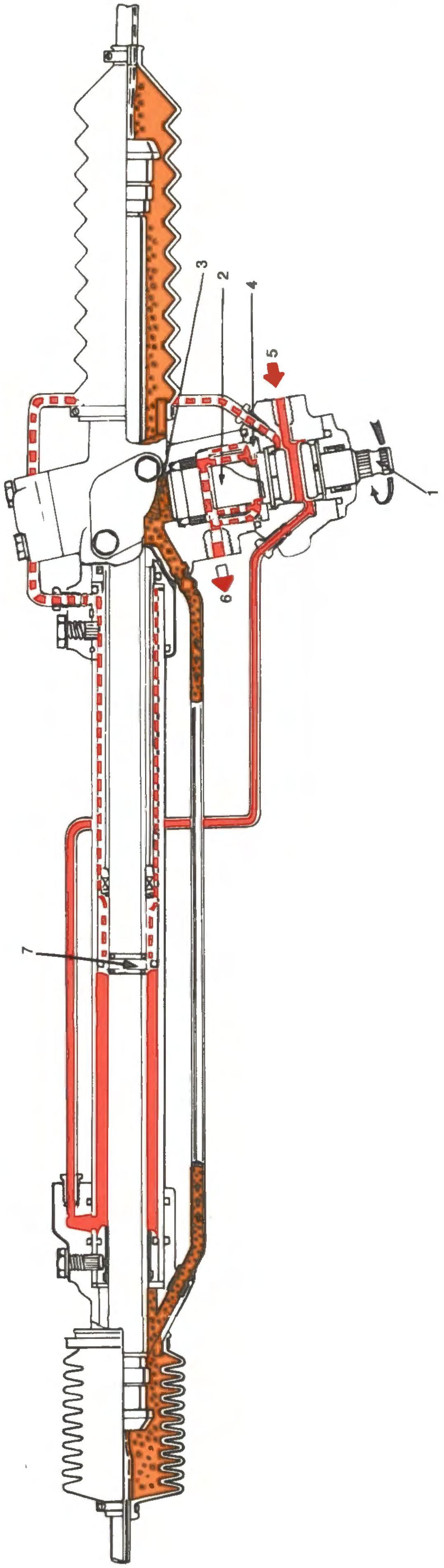
1. Inspect belt for wear, cuts and cracking. Renew if necessary.

Refitting

1. Refitting is a reversal of the removal procedures 1 to 6. Adjust drive belt tension.



A



B

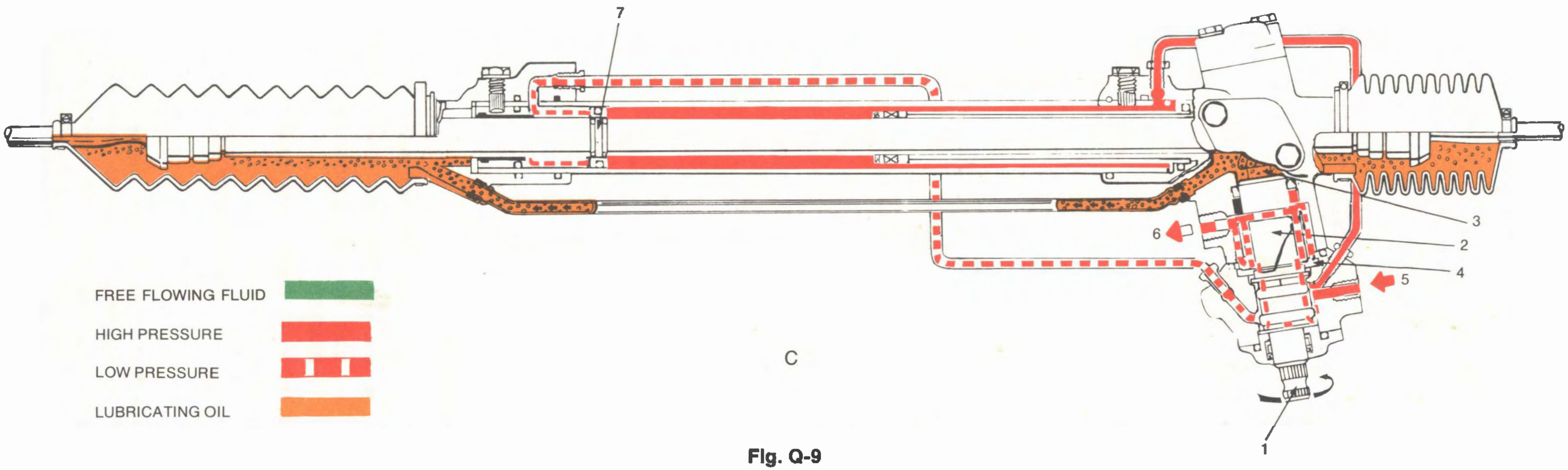


Fig. Q-9

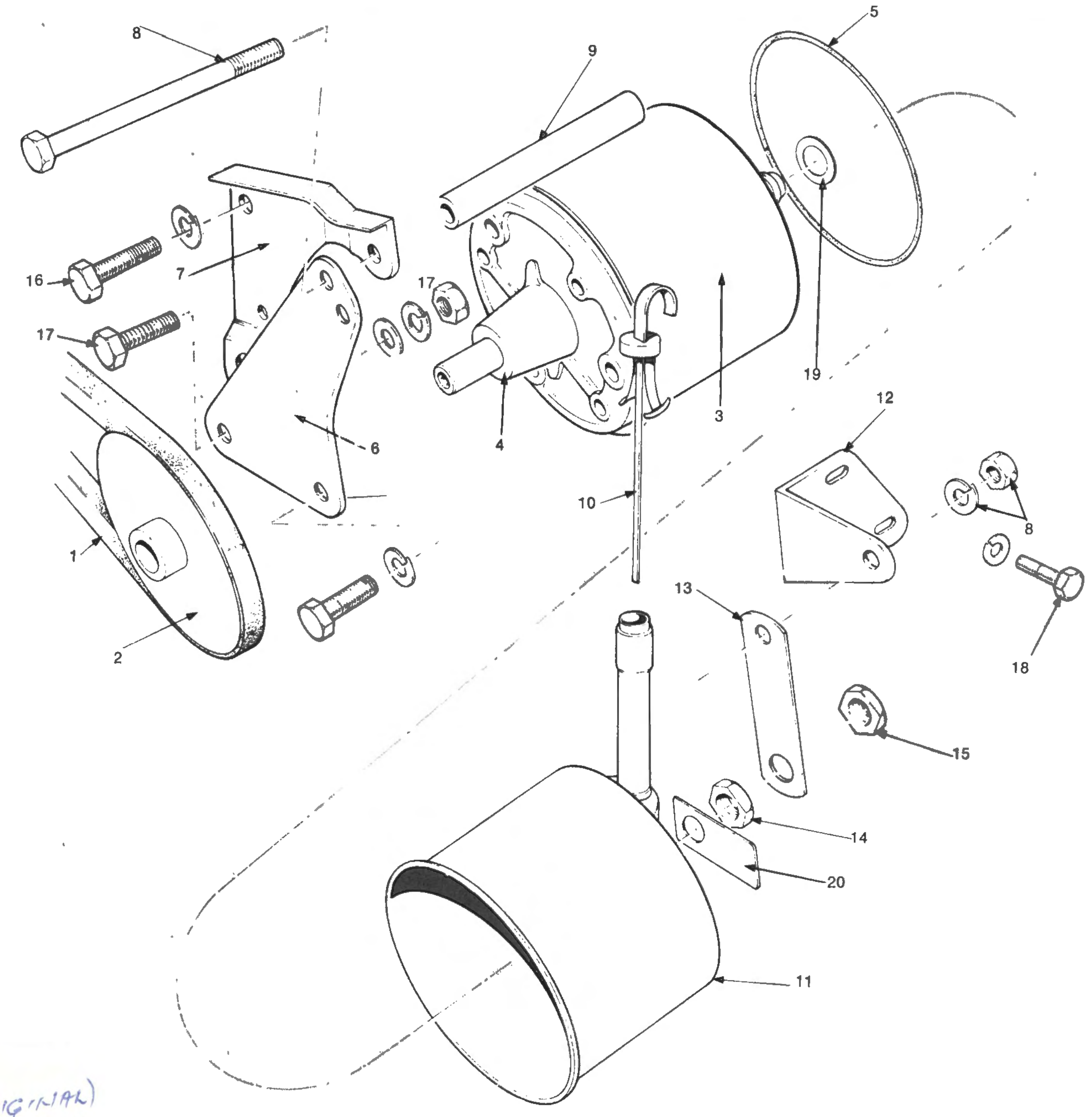
HYDRAULIC OPERATION

1 INPUT SHAFT
2 ROTOR
3 PINION
4 ROTOR SLEEVE
5 FROM PUMP
6 RETURN TO PUMP RESERVOIR
7 PISTON

A. NO STEERING EFFORT APPLIED — THE VALVE ROTOR AND SLEEVE IS IN THE NEUTRAL POSITION DUE TO NO LOAD BEING APPLIED TO THE TORSION BAR WITHIN THE INPUT SHAFT. THIS ALLOWS FLUID TO FLOW FREELY BETWEEN THE PUMP AND THE RACK ASSEMBLY.

B. STEERING EFFORT APPLIED FOR RIGHT HAND TURN — THE TORSION BAR IS TWISTED WHICH ALLOWS THE ROTOR TO ALIGN WITH PORTS IN THE ROTOR SLEEVE SO THAT HYDRAULIC PRESSURE FROM THE PUMP WILL FLOW TO THE LEFT HAND END OF THE RACK PISTON TO ASSIST IN TURNING OF THE STEERING GEAR.

C. STEERING EFFORT APPLIED FOR LEFT HAND TURN — THE TORSION BAR IS TWISTED WHICH ALLOWS THE ROTOR TO ALIGN WITH PORTS IN THE ROTOR SLEEVE SO THAT HYDRAULIC PRESSURE FROM THE PUMP WILL FLOW TO THE RIGHT HAND END OF THE RACK PISTON TO ASSIST IN TURNING OF THE STEERING GEAR.



(ORIGINAL)
AYD 0192
CM 317

Fig. Q-10

POWER STEERING PUMP COMPONENTS

1 DRIVING BELT
2 PUMP PULLEY
3 STEERING PUMP
4 FRONT OIL SEAL
5 'O' RING SEAL
6 PUMP MOUNTING PLATE
7 PUMP MOUNTING BRACKET
8 PIVOT BOLT AND NUT
9 PIVOT BOLT SLEEVE
10 DIPSTICK
11 OIL RESERVOIR
12 REAR SUPPORT BRACKET
13 REAR SUPPORT PLATE
14 NUT — RESERVOIR TO PUMP
15 NUT — REAR SUPPORT TO PUMP
16 BOLT — MOUNTING BRACKET TO FRONT COVER
17 BOLT AND NUT — FRONT PLATE TO FRONT BRACKET
18 BOLT — REAR BRACKET TO ENGINE
19 FIBRE WASHER
20 SERVICE IDENTIFICATION TAG

ADJUSTING

Pump drive belt tension can be checked by either of two methods. With a belt tension gauge or by the deflection method. Wherever possible the belt tension gauge should be used.

Belt Tension Gauge

1 Check the belt tension with a belt tension gauge.

BELT DAYCO 17343 (13A0870)

With a new belt, or one that has been run for less than 10 minutes, the tension should be within 530-670 N (120-150 lb.f.). With a belt that has been run for more than 10 minutes, the tension should be within 400-530 N (90-120 lb.f.).

2 To adjust, loosen the mounting bolt and the adjusting bolt.

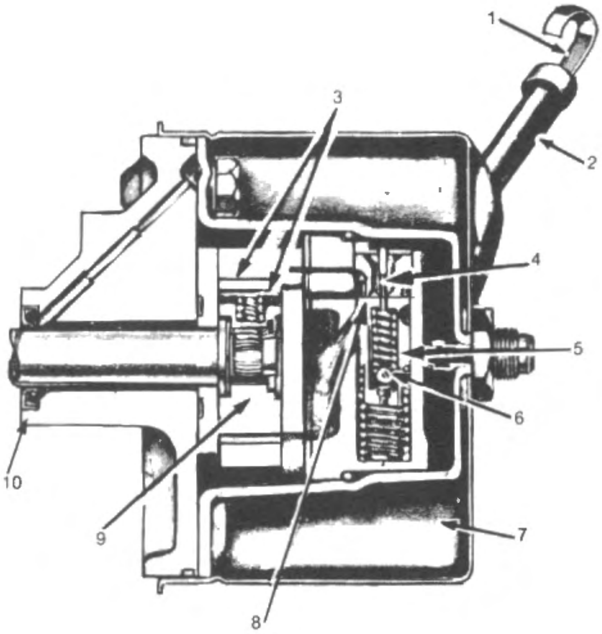


Fig. Q-11

SECTION VIEW OF POWER STEERING PUMP

1 DIPSTICK
2 FILLER TUBE
3 SLIPPER AND RING
4 METERING PIN
5 FLOW CONTROL VALVE
6 RELIEF VALVE
7 OIL RESERVOIR
8 ORIFICE PLUG
9 PUMP ROTOR
10 FRONT OIL SEAL

3 Place a 14 mm (9/16 in) open-end wrench on the projecting 12 mm (½ in) boss on the front face of the pump cover plate and pry upward to adjust belt tension.

NOTE: When adjusting the power steering pump belt tension, do not pry against the pump or reservoir to obtain the proper belt tension. The reservoir will be deformed when pried on or pressed against and a leak will result.

4 Recheck the belt tension. When the tension has been correctly adjusted, torque the bolts and the nut to specification.

Deflection Method

Follow the same procedure as for the belt tension gauge with the exception that a deflection of between 6.3-9.5 mm (¼-⅜ in) should be obtained.

NOTE: It is desirable that after fitting a new belt that the engine is run for at least 10 minutes and the belt deflection rechecked. This overcomes the initial settling and the possibility of a slipping drive belt.

PUMP PRESSURE TESTING

A number of faults in the steering system can be caused by inefficiencies in the hydraulic circuit. The following checks can be carried out without removing any components from the vehicle.

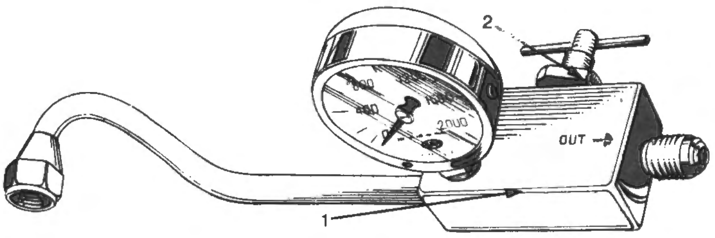


Fig. Q-12

POWER STEERING TEST UNIT

1 TEST UNIT
2 TEST UNIT VALVE

1 Inspect fluid level in reservoir. Fill to correct level if necessary.

2 Check the belt tension as outlined earlier in the section and correct if necessary.

3 Disconnect the pressure hose at the pump and in its place install the Pressure Test Unit 18GA072. Connect the pressure hose to the test unit, it may be necessary to release the hose retaining clips to allow free movement of the hose.

4 Insert thermometer in fluid reservoir, start engine and warm up fluid to a temperature between 65-76°C (150-170°F). Turning the wheels from lock to lock will aid in warming the fluid. Do not hold wheels against the stop on full lock for an extended period, as the pump will overheat.

5 With the engine at the specified idling speed and the test unit valve open, note the pressure while turning the steering wheel from lock to lock. Then turn the steering to full lock and hold momentarily, until the pressure ceases to increase. The peak pressure should lie between 5171 to 5860 kPa (750 to 850 psi).

6 If the pressure is below 5171 kPa (750 psi) there is a fault in the system.

7 To determine which unit is faulty, momentarily close the test unit valve and note the maximum pressure registered on gauge. If the pressure reads less than the maximum pressure, 5860 kPa (850 psi) the pump is faulty and should be replaced.

8 If the pressure reading of 5860 kPa (850 psi) is obtained then the steering rack is faulty.

9 When removing test equipment, be sure to re-install hoses in original position to avoid interference with engine or bodywork.

Bleeding

1 Check the drive belt tension and adjust if necessary.

2 Using automatic transmission fluid, fill the reservoir ⅔ capacity before the engine is started.

NOTE: IF BLEEDING THE SYSTEM FROM DRY FILL, BEFORE STARTING THE ENGINE ENSURE THAT SOME FLUID IS IN THE SYSTEM, DISCONNECT THE COIL WIRE AND CRANK THE ENGINE OVER WHILE TURNING THE STEERING TOWARDS EACH LOCK. IT IS MOST IMPORTANT THAT THIS PROCEDURE IS FOLLOWED TO AVOID PUMP DAMAGE.

3 Run engine at idle speed (do not rev engine at higher speeds, as this will cause foaming).

4 Rotate steering wheel lock to lock, touching stop only momentarily. Repeat for total of two cycles with engine at idle speed.

5 Place steering in the straight-ahead position.

6 With the system warm and fluid at 43°C (110°F) check that the correct level registers on the dipstick.

NOTE: Caution must be exercised to prevent foaming and excessive temperature rise, both of which will give a false indication of fluid level. The areas which must be watched in particular are SPEED (must be engine idle) and length of TIME IN RELIEF (must be on full lock for only an instant).

POWER STEERING PUMP

Removing

1 Disconnect battery.

2 Disconnect outlet and return pipes from pump and plug openings to prevent oil spillage.

3 Remove pivot bolt and adjusting bolt from pump mounting bracket.

4 Remove pump and bracket taking care not to spill any oil on the bodywork.

Refitting

1 Position pump on engine and fit retaining and adjusting bolts.

2 Install drive belt and adjust. Tighten pump bracket bolts.

3 Connect the pressure and return hoses.

4 Fill the pump reservoir to the correct level with automatic transmission fluid.

5 Bleed the system.

PULLEY

Other than pulley removal and reservoir oil seal replacement, the pump should not be dismantled but replaced as a unit.

NOTE: Do not press or hammer on the pump shaft, as the pump internal assemblies are located by relief pressure springs and damage may be caused to these parts.

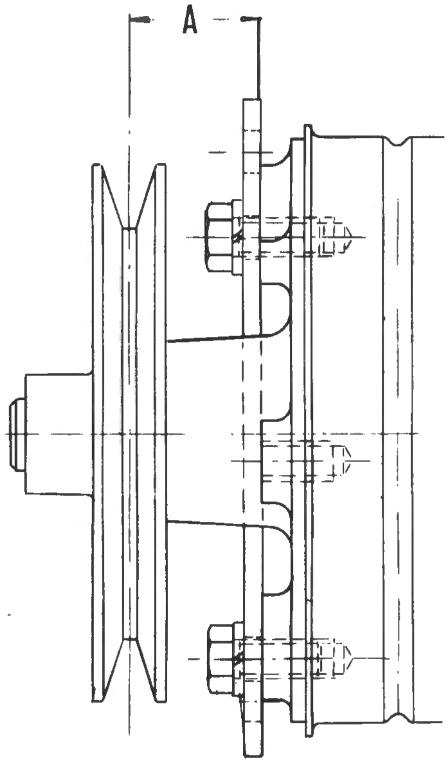


Fig. Q-13

FITTED POSITION OF POWER STEERING DRIVE PULLEY
A — 32 mm (1¼in)

Removing

1 Remove the pump from the vehicle.

2 Drain the reservoir through the filler tube and plug the inlet and outlet openings with plugs or masking tape.

3 Clean the pump exterior. (Support the unit by the bracket in a vice.)

4 Observe the location of the pulley on the shaft.

5 Install a ⅜ UNC cap screw into the end of the pump shaft to prevent damage to the end of the shaft.

6 Remove the pump pulley using a suitable universal type puller. Remove the cap screw from the shaft.

Refitting

1 Using a forcing screw ⅜ UNC 4 in long, ⅜ UNC nut, ⅜ flat washer and spacer.

2 Place the pulley squarely by hand onto the shaft.

3 Thread the forcing screw into the pump shaft.

4 Holding the screw head, tighten the nut along the screw to push the pulley onto the shaft to the original position.

5 Remove the tool and ensure that the pulley is correctly positioned. The distance from the back face of the bracket to the centre of the Vee should be 32 mm (1¼ in). Fig. Q-13.

6 Replace the pump on the engine.

DRIVE SHAFT OIL SEAL

1 Remove the pump from the vehicle.

2 Remove the pulley as previously described leaving the cap screw in place.

3 Remove the oil seal by using a suitable seal remover.

4 Examine the body and shaft for burrs or scratches and remove where necessary.

5 Install a new oil seal ensuring that the lip is towards the pump and the seal is flush with the pump body.

6 Refit the pump pulley.

7 Replace the pump on the engine.

RESERVOIR OIL SEAL

Removing

1 Remove the pump, drain the reservoir, plug the inlet and outlet openings and clean the exterior of the pump.

2 Remove the reservoir to pump nut and service identification tag.

3 Mark the position of the reservoir relative to the housing then remove the reservoir from the body by tapping lightly around the flange with a block of wood.

4 Remove the reservoir 'O' ring seal and the pressure pipe outlet fibre washer located at the rear of the pump.

Refitting

1 Fit a new fibre washer and reservoir 'O' ring oil seal to the pump housing. THE OLD WASHER AND SEAL MUST NOT BE REUSED.

2 Apply petroleum jelly (vaseline) to the reservoir 'O' ring and to the inside edge of the reservoir flange. DO NOT TWIST THE 'O' RING.

3 Place the reservoir on the body, in the relative position and push into place. Carefully tap the reservoir into position using a block of wood.

4 Inspect the assembly to ensure that the reservoir is evenly seated on the pump housing.

5 Position the service identification tag on the outlet and fit the retaining nut. Tighten the nut sufficiently to ensure a good seal.

6 Refit pump to engine.

STEERING RACK

POWER ASSISTED

Removing

1 Raise the front of the vehicle and place stands under side members.

2 Remove front wheels.

3 Remove the tie-rod ball pins from the steering arms.

4 Remove the two hydraulic hoses attached to the rack housing and plug the openings.

5 Remove the bolt securing the lower flange to the steering pinion.

6 Remove the bolts and nuts securing the steering rack assembly to the front suspension member. Take care to retain the thrust washers that prevent lateral movement of the rack and note their position for replacement.

7 Remove steering rack assembly from the suspension cross member.

Refitting

1 Refitting is the reverse of the procedures 1 to 7 noting the following:

   (a) Centralise the steering rack and place the front wheels in the straight-ahead position before replacing the bolt connecting the flange to the steering pinion. (Refer 'Centralising Steering'.)

   (b) Bleed the hydraulic system.

SERVICING INFORMATION

The power steering rack and pinion valve assembly will be available for Service replacement purposes as a complete unit only, with the exception of the tie-rod ends, the tie-rods, the rubber boots and the inner ball joints.

Dismantling

The dismantling procedure for the serviceable components of the power steering assembly is the same as for the manual steering rack overhaul. Refer manual steering rack overhaul, operation 1-8 for dismantling.

Assembling

1 Carry out manual operations 13-20.

2 Refit the two rack boots and tighten the two large clips on either end of the rack housing.

3 Inject into each end of the rack assembly 95 ml (1/6 pint) of SAE 40 grade oil.

NOTE: It is most important that the oil be evenly distributed in the boots to avoid boot damage and loss of lubricant.

4 Position and tighten small boot clips.

5 Centralise the rack.
Refit the locknuts and screw the tie-rod end ball joint assemblies an equal distance onto each tie-rod until the measurement between the ball pins is 444.25 mm (56.86 in).

7 Refit the steering rack assembly to the vehicle. (Refer 'Centralising Steering'.)

8 Check the fluid level.

9 Check wheel alignment.

SECTION R

BRAKE SYSTEM

GENERAL DESCRIPTION

The hydraulic braking system employs ventilated disc brakes on the front wheels and drum brakes on the rear wheels, incorporating a residual line pressure valve in the rear circuit.

A dual master cylinder is coupled directly to the brake pedal by a short push rod. When a Master-Vac (vacuum servo unit) is installed, the master cylinder is attached directly to the Master-Vac unit and operated by a short adjustable push rod.

The master cylinder provides separate hydraulic systems for the front disc brakes and the rear drum brake assemblies. This safety feature ensures that the vehicle can be stopped effectively in the event of a failure in either the front or rear hydraulic systems.

A pressure differential valve is incorporated in the master cylinder used in conjunction with the Master-Vac unit. Should a leak occur in either front or rear hydraulic circuits, the pressure differential valve will sense a pressure drop and activate a switch fitted into the base of the master cylinder, which causes a warning light on the facia to glow.

The hydraulic system also incorporates a pressure proportioning valve located in the rear brake line. This valve provides a balance between the front and rear brakes, which results in improved braking by reducing the possibility of rear wheel lock up when the brakes are firmly applied.

MAINTENANCE

BRAKE FLUID

1 It is recommended that the only brake fluid used in these vehicles is Leyland Australia specification HBF-6.

NOTE: In countries where HBF-6 is not available use Repco Special Disc Brake Fluid or fluid to SAE Specification J1703e. Maximum dry equilibrium reflux boiling point 260°C (500°F).

2 Modern brake fluids will absorb moisture if left in unsealed containers. Brake fluid that has been left in this state must not be used, as it may result in damage to both seals and cylinders. It may also cause a reduction of the boiling point of the fluid to a dangerous level and result in brake failure.

3 Brake fluid drained from the system or used for bleeding purposes must be discarded.

4 The necessity for absolute cleanliness cannot be over emphasised and any contamination by mineral oil or grease must be strictly avoided.

CAUTION: Extreme care must be taken to prevent spillage of brake fluid on the vehicle as it is highly detrimental to paint work. Should brake fluid be accidentally spilt on the paint work, it should be hosed off with clean water immediately. Do not attempt to wipe off with a cloth.

PREVENTIVE MAINTENANCE

In addition to the recommended periodical inspection of brake components, it is advisable as a precaution against the effects of wear and deterioration, to make a more searching inspection and renew parts as necessary. 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 maintenance service schedules.

2 Brake fluids should be changed completely every 18 months or 30,000 Km (18,000 miles) which ever is the sooner, to avoid deterioration of working parts and a breakdown of fluid.

3 All fluid seals in the hydraulic system and all flexible hoses should be examined and renewed every 3 years or 60,000 Km (36,000 miles) which ever is the sooner. At the same time the surface of all pistons and the bores of master cylinder, wheel cylinders and calipers should be examined and new parts fitted where necessary.

BLEEDING THE HYDRAULIC SYSTEM

Bleeding the braking system is not a routine maintenance job and should only be necessary when some portion of the hydraulic equipment has been disconnected or the fluid level allowed to fall so low that air has entered the system through the master cylinder.

Before commencing this operation ensure the reservoir is filled to the correct level and the level is not allowed to drop below half full throughout the operation.

Use only the specified fluid at all times.

WARNING: The brake warning light switch must be removed before bleeding boosted brakes.

To ensure that bleeding is effective, it will be necessary to use two operators and each rear cylinder and front caliper should be bled in turn using the following method:

1 Clean the bleeder valve and attach the bleeder tube and immerse the free end of the tube in a clean jar containing brake fluid. Fig. R-1.

2 Open the bleeder valve one complete turn.

3 Depress the brake pedal slowly to the full extent of its travel.

4 Close the bleeder valve and allow the pedal to return slowly to the off position.

5 Repeat this pumping operation with a slight pause before each depression of the pedal until the jar is completely free of air bubbles.

6 Hold the brake pedal down firmly against the floor and tighten the bleeder valve.

7 After bleeding top up the master cylinder reservoir to the correct level and check system for leaks.

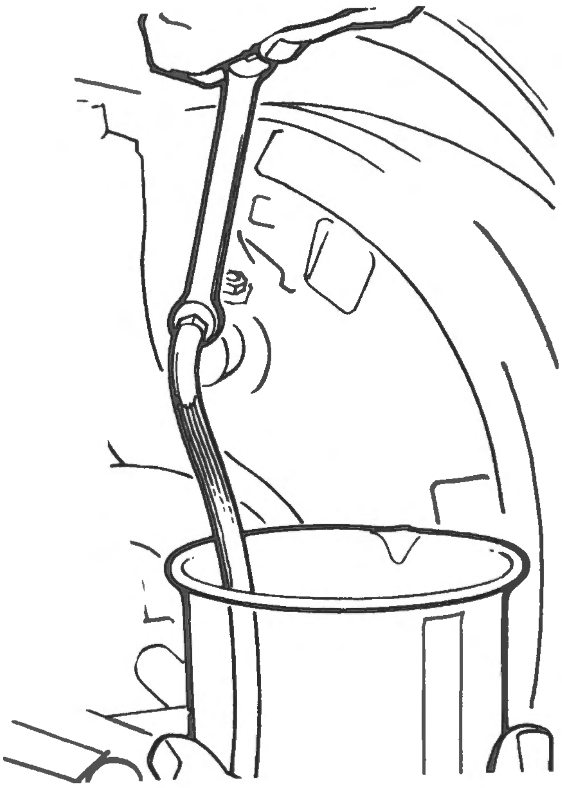


Fig. R-1

BLEEDING BRAKE SYSTEM AT WHEEL CYLINDER

HYDRAULIC BRAKE HOSES AND PIPES

Steel tubing is used throughout the braking system with the exception of the flexible hoses at the front calipers and the rear axle connection.

Should any part of the brake tubing become damaged it is essential that it be replaced with the genuine replacement part. Copper tubing should not be used in the hydraulic brake system.

All fixed brake pipes should be examined at regular intervals for leakage, abrasions and restrictions. Fluid leaks mostly occur at the connections and are usually the result of incorrect tightening of the unions or excessive side stress on the pipes causing fractures at the flared ends.

Abrasions on the brake pipes are usually the result of loose clamps or incorrect routing of the pipe that allows it to come in contact with some moving part such as brake cables, clutch pedals and linkage, suspension units and shock absorbers, etc.

CAUTION: Brake pipes and hoses must be kept clear of the exhaust system at all times.

Restrictions caused by sharp bends or flattening of the pipes may result in uneven braking and excessive pedal pressure.

FRONT HOSE

Removing

1. Remove the nut connecting the steel brake pipe to the flexible hose and plug pipe.
2. Remove the nut securing the inner end of the flexible hose to the front guard panel.
3. Unscrew the brake hose from the caliper and remove hose.

Refitting

1. Refitting is the reverse of the removing procedures 1 to 3.
2. Boosted brakes, the brake warning light switch must be removed before bleeding brake circuit.
3. Bleed the front brakes.
4. Refit the brake warning light switch and wire.

REAR HOSE

Removing

1. Remove the nut securing the steel brake pipe to the flexible hose and plug openings.
2. Remove the nut securing the brake hose to the mounting bracket.
3. Unscrew the hose from the three way connection mounted on the rear axle housing and remove hose.

Refitting

1. Refitting is the reverse of the removing procedures 1 to 3.
2. Boosted brakes, the brake warning light switch must be removed before bleeding brake circuit.
3. Bleed the rear brakes.
4. Refit the brake warning light switch and wire.

NOTE: When correctly installed the hose assumes a bowed shape. The bow should face upwards and must not contact the suspension.

MASTER CYLINDER NON BOOSTED BRAKES

DESCRIPTION

The Tandem master cylinder provides separate hydraulic systems for the front disc brake assemblies and rear drum brake assemblies. This safety feature ensures that the vehicle can be brought to a controlled stop in the event of a failure in either the front or rear hydraulic systems. Refer Fig. R-2.

Separate fluid reservoirs are provided for the front and rear hydraulic systems, the fluid level being readily visible through the transparent reservoir.

A residual line pressure valve is incorporated in the rear brake circuit.

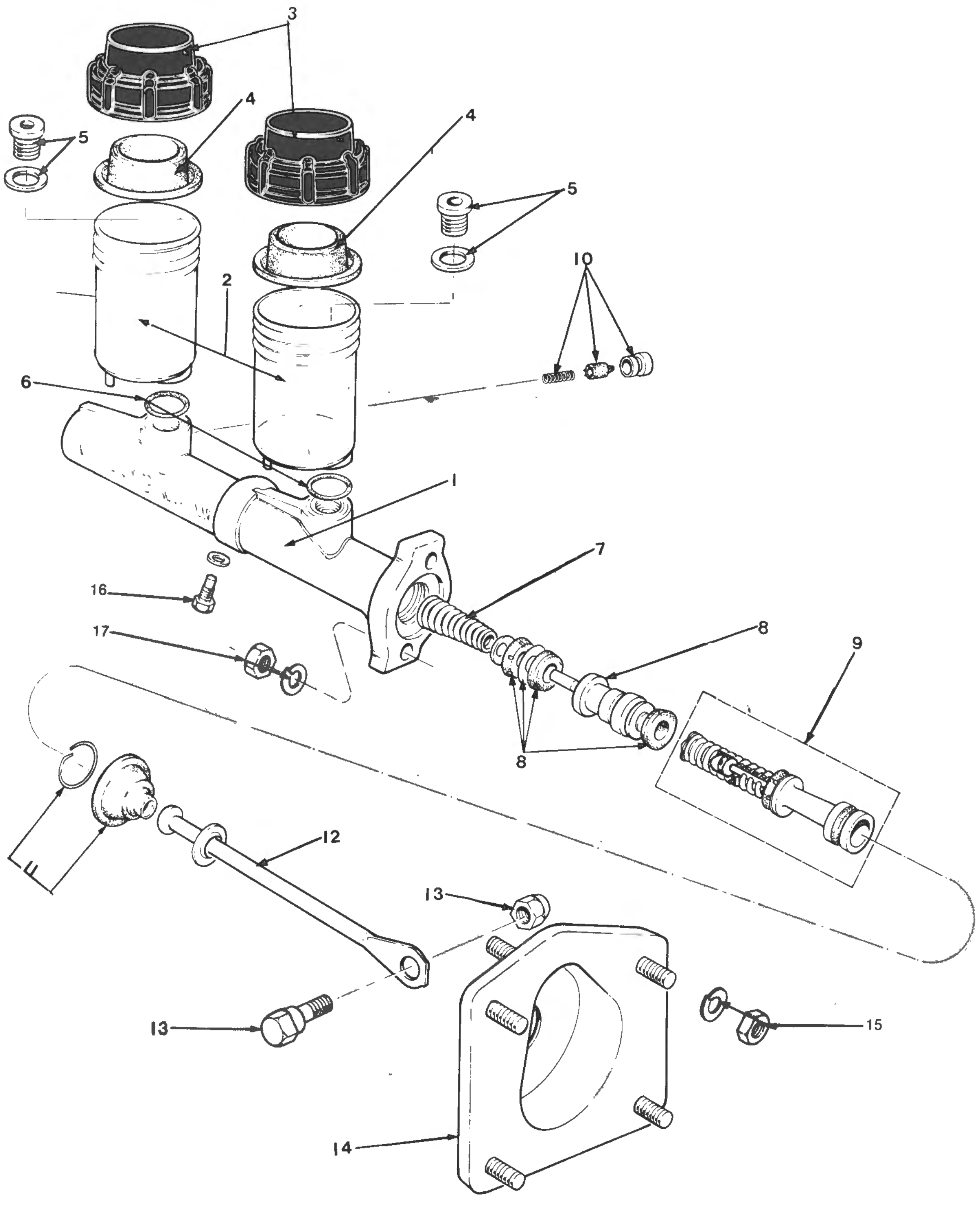


Fig. R-2

MASTER CYLINDER (NON-BOOSTED)

1 MASTER CYLINDER
2 FLUID RESERVOIRS
3 RESERVOIR CAPS
4 RESERVOIR SEALS
5 RESERVOIR RETAINER AND WASHER
6 SEALING WASHERS
7 SECONDARY PISTON RETURN SPRING
8 SECONDARY PISTON ASSEMBLY
9 PRIMARY PISTON ASSEMBLY
10 RESIDUAL PRESSURE VALVE ASSEMBLY (REAR BRAKES)
11 BOOT AND CIRCLIP
12 PUSH ROD
13 PUSH ROD PIVOT BOLT AND NUT
14 MASTER CYLINDER MOUNTING BRACKET
15 MOUNTING BRACKET NUT AND WASHER
16 SECONDARY PISTON STOP SCREW AND WASHER
17 MASTER CYLINDER RETAINING NUT AND WASHER

OPERATION

When pressure is applied to the brake pedal there is a build up of pressure between the primary and secondary pistons which starts to apply the front brakes. As the front brakes begin to apply, the pressure will increase and force the secondary piston down the bore thus applying the rear brakes. When the brakes are fully applied, pedal movement should be at a minimum because both brake systems are self adjusting. Long pedal movement would indicate malfunction of adjusters or some mechanical fault. When the bake pedal is released fluid passes back into both reservoirs. With loss of pressure in one system the other system will operate.

Removing

1 Remove the nut and eccentric bolt from the master cylinder push rod and disengage from the brake pedal assembly.

2 Clean the dirt from around both brake pipes and remove the pipes. Plug the pipes and master cylinder openings to prevent entry of dirt.

3 Remove the nuts and bolts securing the master cylinder to the bulkhead and remove master cylinder.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 3 noting the following:

(a) Bleed the brakes.

(b) Refill master cylinder.

OVERHAUL

Dismantling

1 Remove the master cylinder.

NOTE: The master cylinder has a residual line pressure valve in its outlet port to the rear drum brake line only. Remove the tube seat, which is an interference fit in the casting, by means of a self-tapping puller or extractor. The residual line pressure valve will follow the tube seat as it is backed by a spring.

2 Remove the secondary piston stop screw before removing the primary piston circlip.

3 Blow the secondary piston from the bore using an air hose, ensuring that the piston is not damaged in the process.

Inspection

1 Clean all parts thoroughly in methylated spirits. Use an air hose to blow clean all passages and bore. Inspect the master cylinder bore for grooves and corrosion and replace if necessary. Honing is not recommended.

NOTE: Before assembly, check that the correct repair kit has been purchased by comparing old master cylinder parts against the contents of the repair kit.

Assembling

IMPORTANT: Coat all internal parts and master cylinder bore with clean brake fluid before assembling. Assemble the master cylinder as illustrated in Fig. R-2 and note the following:

1 Assemble spring and residual line pressure valve into the outlet port to the rear drum brake line together with the press fit insert.

2 When the spring and secondary piston have been assembled into the bore, hold down against the spring using a soft brass rod; replace stop screw and tighten.

3 When inserting piston assemblies into master cylinder, care should be taken to ensure cups do not catch in circlip groove. It may be necessary to use an inserting guide to lead the cup into the bore.

BLEEDING PRIOR TO REFITTING MASTER CYLINDER TO VEHICLE

Fill master cylinder with the specified brake fluid. It is recommended that the master cylinder be filled and bled on the bench prior to refitting to the vehicle. Check compensating port clearance by watching for a spurt of fluid in the front (secondary side) reservoir when the pistons are slightly depressed. After bleeding, block the master cylinder outlet ports, to prevent the brake fluid from escaping.

Refitting

1 Refit the master cylinder to the vehicle.

MASTER CYLINDER BOOSTED BRAKES

DESCRIPTION

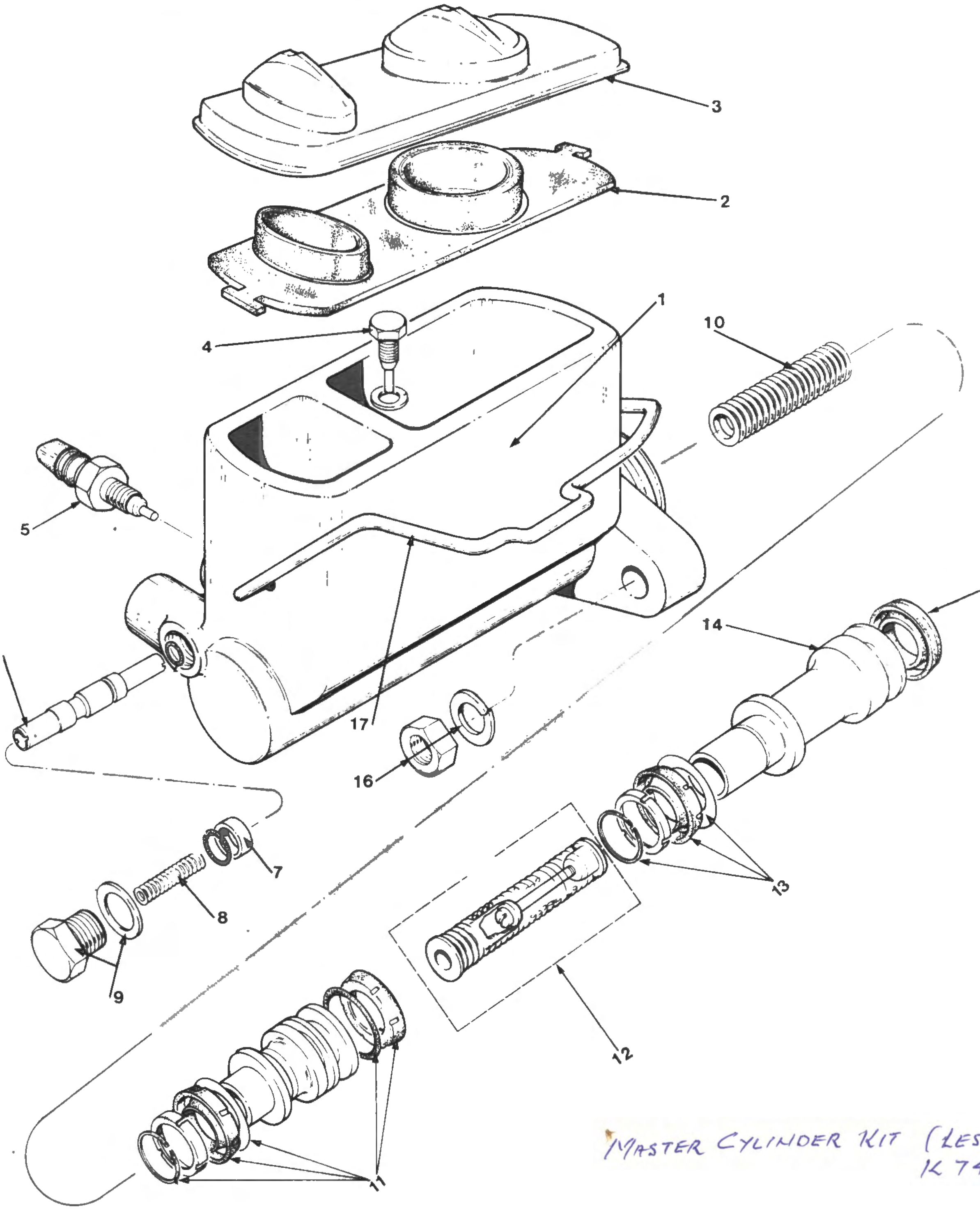
The dual master cylinder is attached directly to the Master-Vac servo unit and is actuated by an adjustable push rod. The master cylinder contains two hydraulic fluid reservoirs cast integrally with and connected to the bore by means of separate sets of compensating and fluid inlet ports.

The internal operating parts consist of a primary piston assembly, primary return spring assembly, secondary piston assembly, a return spring and retainer and piston stop screw, together with the necessary seals and cups. A residual line pressure valve is fitted to the rear brake circuit.

A pressure differential valve incorporated in the master cylinder operates a switch which causes a light on the facia to glow and give warning of front or rear brake circuit failure. Refer Fig. R-3.

OPERATION

When pressure is applied to the brake pedal, motion is transmitted through the Master-Vac diaphragm and master cylinder push rod to the primary piston, which produces a build up of pressures between the primary and secondary pistons and starts to apply the front



MASTER CYLINDER KIT (LESS PISTON)
K 7466 X

Fig. R-3

MASTER CYLINDER (BOOSTED)

1	MASTER CYLINDER
2	SEALING DIAPHRAGM
3	COVER
4	STOP SCREW
5	BRAKE FAIL SWITCH
6	DIFFERENTIAL VALVE
7	DIFFERENTIAL SWITCH SLEEVE
8	SPRING
9	PLUG AND WASHER
10	SECONDARY PISTON RETURN SPRING
11	SECONDARY PISTON ASSEMBLY
12	PRIMARY SPRING ASSEMBLY
13	PRIMARY PISTON SEAL ASSEMBLY
14	PRIMARY PISTON
15	PRIMARY PISTON SECONDARY SEAL
16	MASTER CYLINDER RETAINING NUT AND WASHER
17	RESERVOIR COVER RETAINING BAIL

brakes. As the front brakes begin to apply, the pressure will increase and force the secondary piston down the bore, thus applying the rear brakes.

When the brake pedal is released, fluid passes back into both reservoirs. With the loss of pressure in one system the other system will operate.

Removing

1 Disconnect the warning light switch connector.

2 Disconnect the front and rear brake pipes and plug the openings.

3 Remove the two nuts and washers securing the master cylinder to the Master-Vac unit and remove master cylinder.

Refitting

1 Refitting is the reverse of the removing procedures 2 and 3.

2 Bleed the brakes.

3 Refill master cylinder.

4 Refit brake warning light switch and wire.

OVERHAUL

Dismantling

1 Drain hydraulic fluid from master cylinder and reservoir.

2 Remove master cylinder from vacuum servo unit.

NOTE: There is no residual pressure check valve used in the front disc brake hydraulic circuit.

3 Remove the reservoir top cover and diaphragm.

4 Press the primary piston inwards, then unscrew and remove the secondary piston stop screw and copper washer from the bottom of the primary fluid reservoir. Refer Fig. R-3.

5 Remove the primary piston assembly followed by the secondary piston assembly and return spring.

CAUTION: Do not attempt to remove the screw attaching the return spring retainer and protector to the primary piston, as this assembly is pre-set during manufacture, and should not be dismantled.

6 Remove the warning light switch from the cylinder body. Fig. R-4.

7 Remove the plug from the end of the master cylinder and withdraw the differential valve and spring. Fig. R-4.

Inspection

1 Clean all parts thoroughly in methylated spirits. Use an air hose to blow clean all passages and bore. Inspect the master cylinder bore for grooves and corrosion and replace if necessary. Honing is not recommended.

NOTE: Before assembly, check that the correct repair kit has been purchased by comparing old master cylinder parts against the contents of the repair kit.

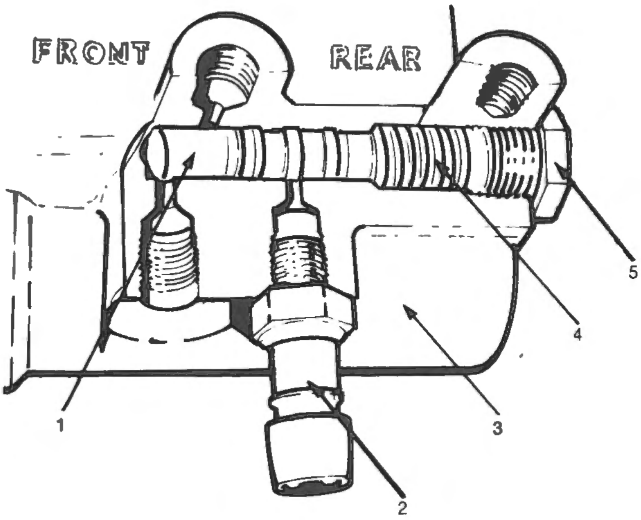


Fig. R-4

DIFFERENTIAL VALVE

1 DIFFERENTIAL VALVE
2 SWITCH
3 MASTER CYLINDER
4 SPRING
5 PLUG

Assembling

IMPORTANT: Coat all internal parts and master cylinder bore with clean brake fluid before assembling. Assemble the master cylinder as illustrated in Fig. R-3 and note the following:

1 Assemble spring and residual line pressure valve into the outlet port to the rear drum brake line together with the press fit insert.

2 When the spring and secondary piston have been assembled into the bore, hold down against the spring using a soft brass rod; replace stop screws and tighten.

3 When inserting piston assemblies into master cylinder, care should be taken to ensure cups do not catch in circlip groove. It may be necessary to use an inserting guide to lead the cup into the bore.

4 Install the differential valve and spring assembly. Replace the plug and tighten.

NOTE: Do not install the warning light switch until the bleeding of the hydraulic system has been completed, otherwise the switch may be damaged.

5 Bleed the master cylinder as previously described.

6 Replace the master cylinder, fill reservoir and replace the reservoir top cover and diaphragm.

7 Bleed the brakes.

8 Refit brake warning light switch and wire.

MASTER-VAC UNIT

GENERAL DESCRIPTION

The vacuum servo system is a Master-Vac, vacuum-hydraulic unit for power braking utilizing intake manifold vaccum and atmospheric pressure for its operation. The Master-Vâc adds to the pressure exerted physically in the master cylinder, and delivers the combined pressure to the wheel cylinders. The master cylinder is attached directly to the Master-Vac to make a self contained hydraulic and vacuum unit.

A vacuum check valve incorporated in the unit retains sufficient vacuum to provide several power brake applications in the event of loss of vacuum supply due to the engine failure or damage to hose or fittings. In the event of complete loss of vacuum the brakes will operate as a conventional hydraulic brake system, but requiring greater physical effort.

The Master-Vac unit comprises front and rear shells containing the pressure plate, diaphragm and valve body incorporating the valve rod, plunger mechanism and the large return spring. The valve rod and plunger comprises the air valve and floating control valve assembly. A hydraulic piston push rod and reaction disc complete the mechanism. An air filter element and silencer are assembled around the push rod and are located in the rear shell.

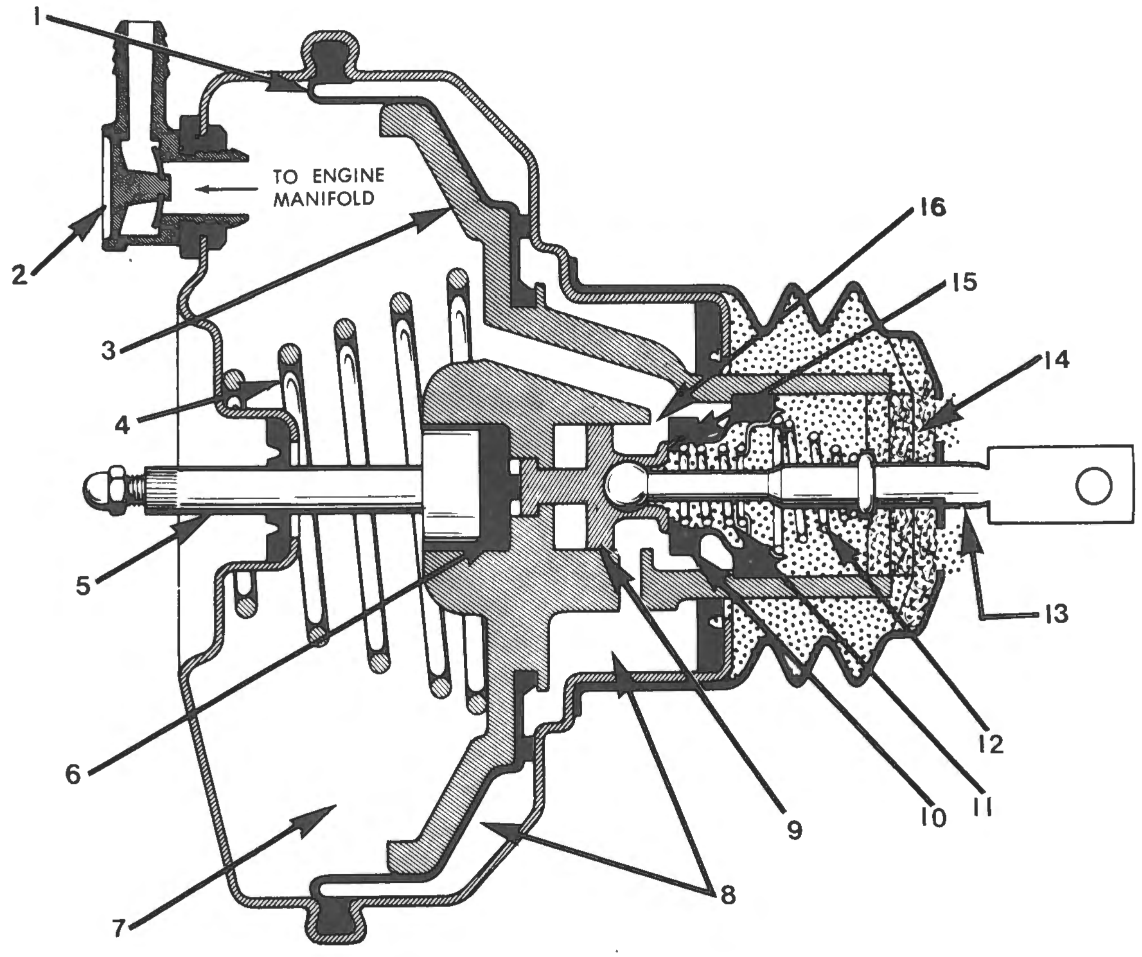


Fig. R-5

MASTER-VAC IN RELEASED POSITION

1	DIAPHRAGM	9	VALVE PLUNGER
2	VACUUM CHECK VALVE	10	POPPET VALVE
3	DIAPHRAGM SUPPORT PLATE	11	POPPET VALVE RETURN SPRING
4	DIAPHRAGM RETURN SPRING	12	VALVE ROD AND PLUNGER RETURN SPRING
5	MASTER CYLINDER PUSH ROD	13	VALVE OPERATING ROD
6	REACTION DISC	14	ATMOSPHERIC PRESSURE
7	CONSTANT VACUUM CHAMBER (FULL VACUUM)	15	ATMOSPHERIC PORT (CLOSED)
8	CONTROL VACUUM CHAMBER	16	VACUUM PORT (OPEN)

OPERATION

Released Position

With the engine running and the brakes released, vacuum from the engine intake manifold is admitted to the front chamber of the Master-Vac through the vacuum hose and check valve. When the Master-Vac is in the released position the atmospheric valve is closed and the vacuum port is open to admit vacuum through the passage in the diaphragm plate and the valve to the rear chamber of the Master-Vac. Refer Fig. R-5.

With vacuum existing in both the front and rear chambers, the diaphragm is balanced or suspended in vacuum. The diaphragm return spring holds the diaphragm in the released position.

Applied Position

When the brakes are applied, the valve rod and plunger move to the left or front in the power diaphragm to close the vacuum port and open the atmospheric port to admit air through the air cleaner and valve to the rear diaphragm chamber. With a vacuum existing in the front chamber and atmospheric pressure in the rear chamber, a force is developed to move the power diaphragm hydraulic push rod and the hydraulic pistons in the master cylinder to close the compensating ports and force fluid under pressure through the residual check valve and lines into the front caliper and rear wheel cylinders to actuate the brakes. Refer Fig. R-6.

As pressure is developed within the master cylinder a counter force acting through the hydraulic push rod and

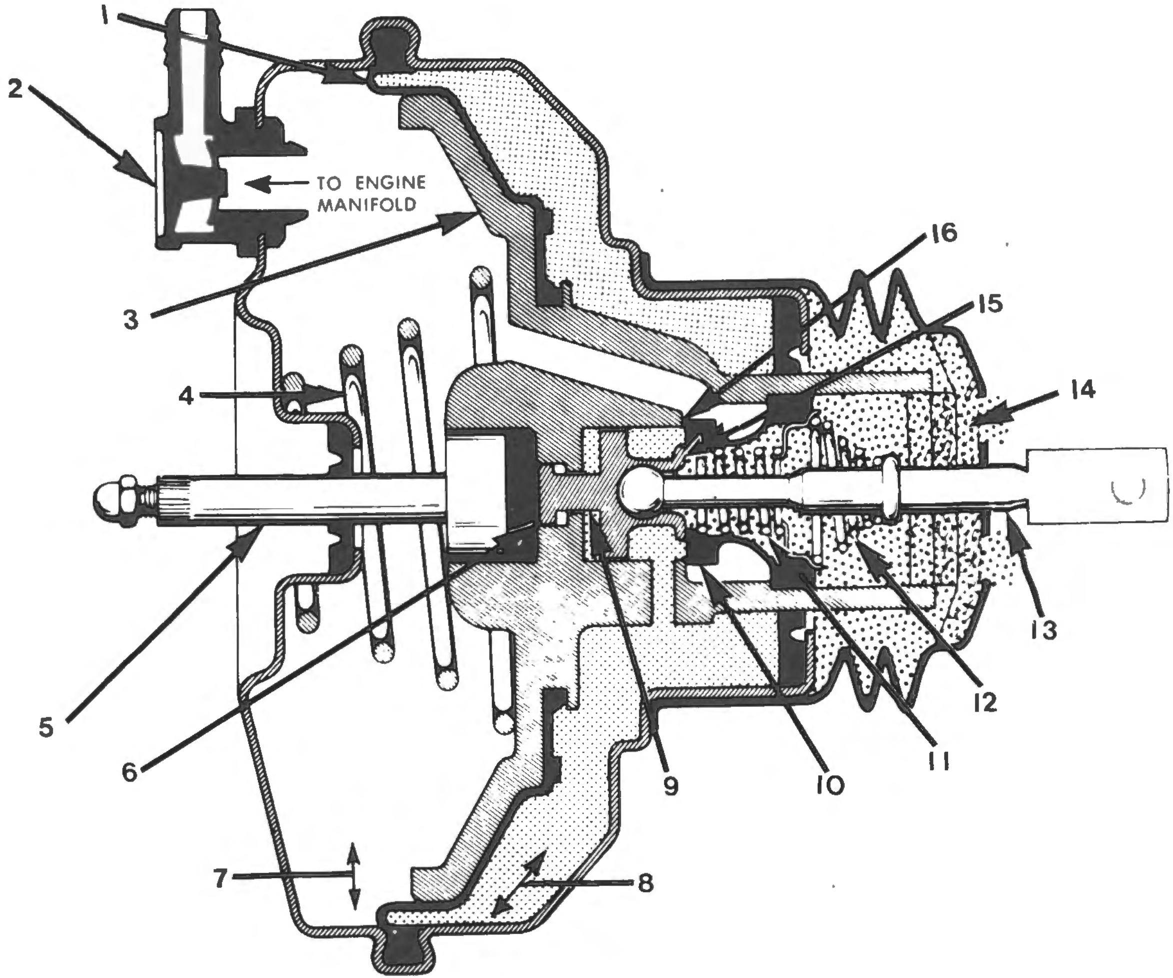


Fig. R-6

MASTER-VAC IN APPLYING POSITION

1	DIAPHRAGM	9	VALVE PLUNGER
2	VACUUM CHECK VALVE	10	POPPET VALVE
3	DIAPHRAGM SUPPORT PLATE	11	POPPET VALVE RETURN SPRING
4	DIAPHRAGM RETURN SPRING	12	VALVE ROD AND PLUNGER RETURN SPRING
5	MASTER CYLINDER PUSH ROD	13	VALVE OPERATING ROD
6	REACTION DISC	14	ATMOSPHERIC PRESSURE
7	CONSTANT VACUUM CHAMBER (FULL VACUUM)	15	ATMOSPHERIC PORT (CLOSED)
8	CONTROL VACUUM CHAMBER (PARTIAL VACUUM)	16	VACUUM PORT (CLOSED)

reaction disc against the vacuum power diaphragm and valve plunger, sets up a reaction force opposing the force applied to the valve rod and plunger. This reaction force tends to close the atmospheric port and open the vacuum port.

Since this force is in opposition to the force applied to the brake pedal by the driver, it gives the driver a 'feel' of the amount of brake applied. The proportion of reactive force applied to the valve plunger through the reaction disc is designed into the Master-Vac to ensure maximum power consistent with maintaining pedal feel. The reaction force is in direct proportion to the hydraulic pressure developed with the brake system.

Lap or Holding Position

During the brake application, the reaction against the valve plunger is constantly tending to close the atmospheric port and reopen the vacuum port. With both ports closed, the Master-Vac is said to be in the 'lap' or holding position, and any degree of brake application attained will be held until either the atmospheric port is reopened by an increase in pedal pressure to further increase brake application or by a decrease in pedal pressure to reopen the vacuum port to decrease the brake application. When the pressure applied to the brake pedal is constant, the valve returns to the 'lap' or 'holding' position. However, when full power application is attained, the atmospheric port remains open until the pressure on the pedal is reduced. Refer Fig. R-7.

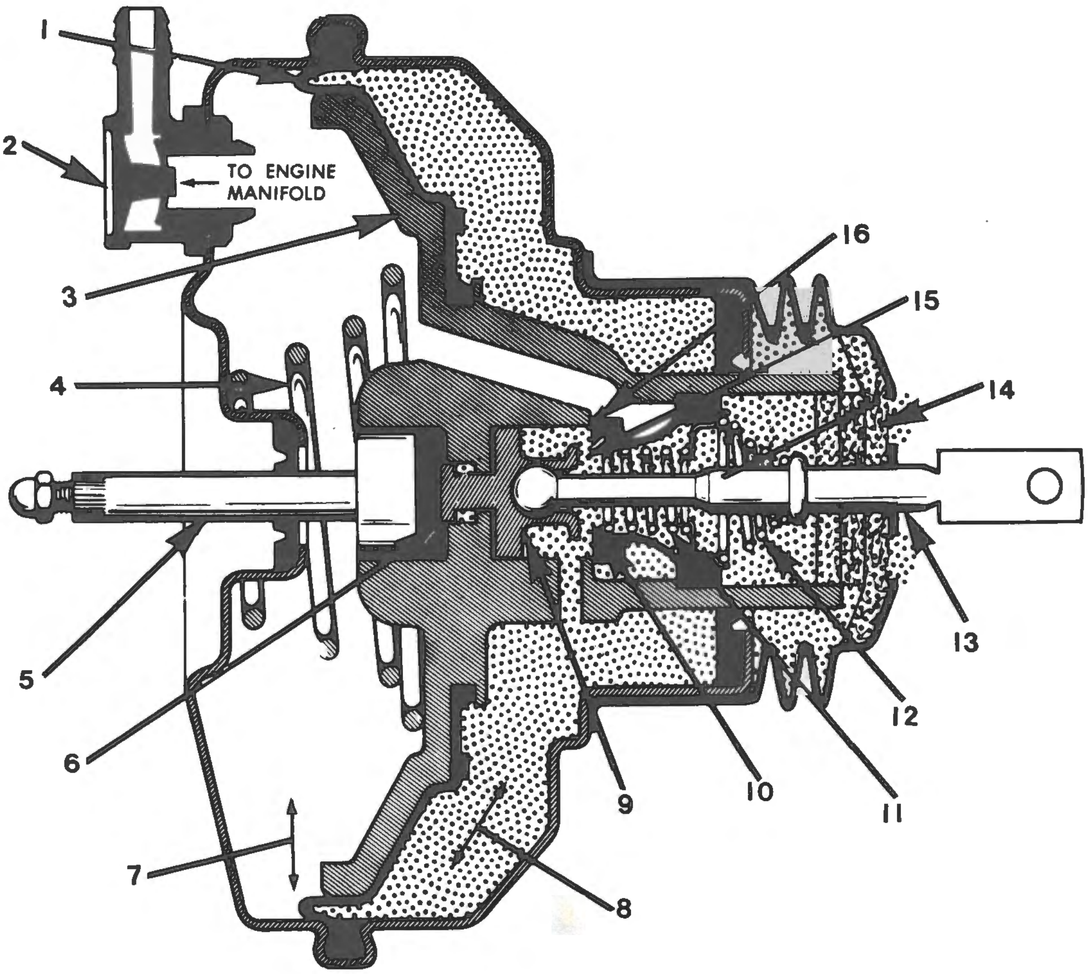


Fig. R-7

MASTER-VAC IN HOLDING POSITION

1 DIAPHRAGM
2 VACUUM CHECK VALVE
3 DIAPHRAGM SUPPORT PLATE
4 DIAPHRAGM RETURN SPRING
5 MASTER CYLINDER PUSH ROD
6 REACTION DISC
7 CONSTANT VACUUM CHAMBER (FULL VACUUM)
8 CONTROL VACUUM CHAMBER (FULL ATMOSPHERIC PRESSURE)
9 VALVE PLUNGER
10 POPPET VALVE
11 POPPET VALVE RETURN SPRING
12 VALVE ROD AND PLUNGER RETURN SPRING
13 VALVE OPERATING ROD
14 ATMOSPHERIC PRESSURE
15 ATMOSPHERIC PORT (OPEN)
16 VACUUM PORT (CLOSED)

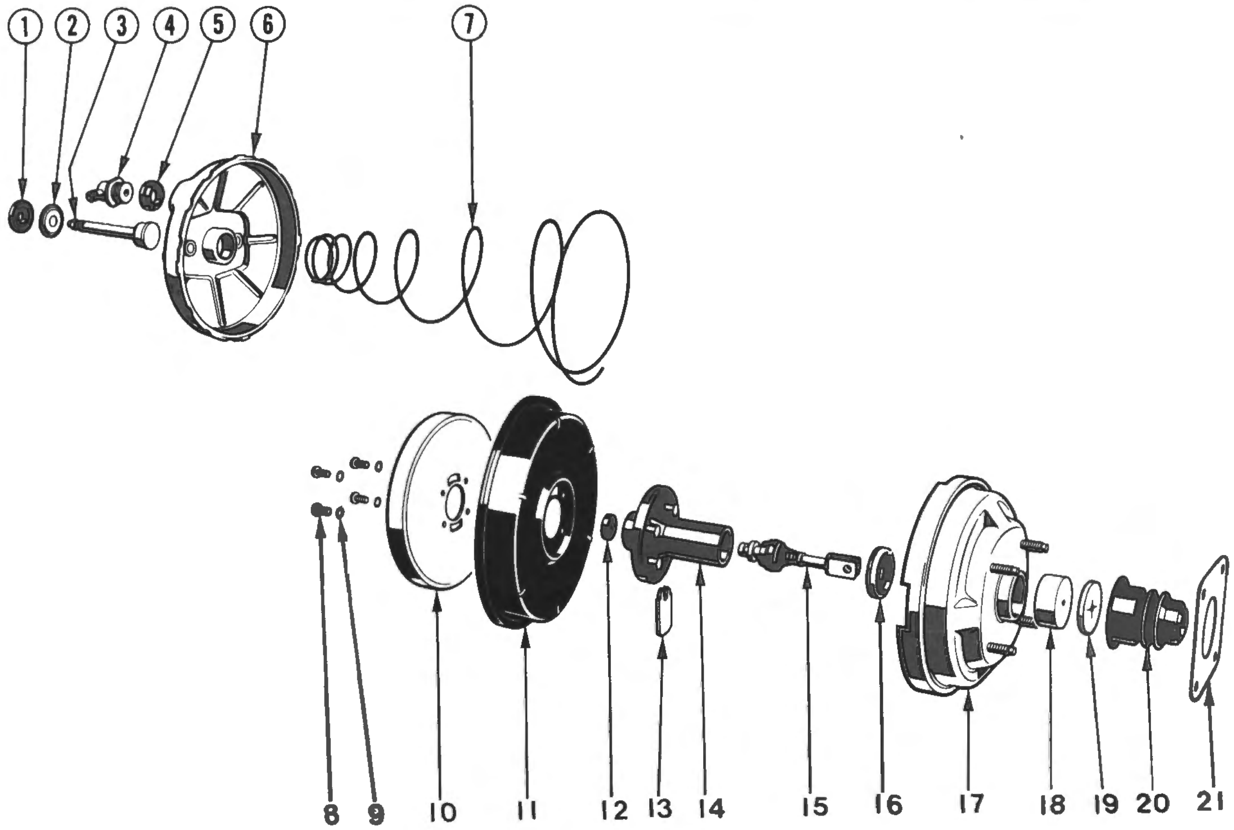


Fig. R-8

MASTER-VAC COMPONENTS

1	PUSH ROD SEAL
2	PUSH ROD SEAL SUPPORT PLATE
3	MASTER CYLINDER PUSH ROD
4	CHECK VALVE
5	GROMMET
6	FRONT SHELL
7	RETURN SPRING
8	PHILLIPS SCREWS
9	LOCK WASHERS
10	DIAPHRAGM PRESSURE PLATE
11	DIAPHRAGM
12	REACTION DISC
13	LOCKING KEY
14	VALVE BODY ASSEMBLY
15	VALVE ROD AND PLUNGER ASSEMBLY
16	REAR SHELL SEAL
17	REAR SHELL
18	AIR FILTER
19	AIR SILENCER
20	BOOT
21	BOOT RETAINING PLATE

No Power Condition

Should the engine stall or fail, it will result in complete loss of engine vacuum, however the vacuum reserve in the Master-Vac is sufficient for several brake applications to be made. When the vacuum is completely exhausted, the brakes can be applied in the conventional manner by applying more physical effort to the brake pedal.

Removing

1 Remove master cylinder as previously described.

NOTE: The master cylinder may be removed with the Power-Vac unit after the brake pipes and switch wire are removed.

2 Disconnect the vacuum hose.

3 Release retaining clip from brake clevis pin and remove clevis pin and washers from brake pedal.

4 Remove the four nuts and washers from inside the bulkhead, securing the Power-Vac unit.

5 Remove the Power-Vac unit from bulkhead.

Refitting

1 Refitting is the reverse of removing procedures 1 to 5.

2 Remove brake warning light wire and switch.

3 Bleed the brakes.

4 Refit brake warning light switch and wire.

SERVICING

The only servicing required to the Master-Vac is the cleaning of the air filter. Should the filter become clogged with dust or dirt it will only provide limited assistance to the physical effort applied to the brake pedal.

When overhauling the Master-Vac unit it is necessary to quote the unit number in order to obtain the correct repair kit.

AIR FILTER

When the vehicle is operating in dusty conditions it is essential to check the Master-Vac air filter. Should the filter become clogged with dust, a definite increase in pedal effort will become necessary for brake application.

The air filter is mounted between the valve operating rod and the valve body on the rear shell of the Master-Vac unit. Refer Fig. R-8.

Removing

1. Remove the Master-Vac and master cylinder as described in this section.
2. Remove the rubber boot from the rear end of the Master-Vac unit.
3. Remove the felt air silencer and filter.
4. Remove the dirt from the filter by shaking it or washing in soap and water, then thoroughly dry.

Refitting

1. Refit filter, silencer pad and rubber boot.
2. Install Master-Vac and master cylinder assembly.

OVERHAUL

Dismantling

The dismantling of the Master-Vac is simplified by the use of a jig made from a piece of ¼ in plate. The following sketch illustrates the jig. Fig. R-9.

1. Remove Master-Vac and master cylinder assembly from the vehicle as previously described.
2. Clean the Master-Vac and master cylinder assembly externally.
3. Scribe a line across the front and rear shells of the Master-Vac to ensure correct assembly. Refer to Fig. R-8 for the identification of the components listed in the following procedures.
4. Remove master cylinder and push rod (3) from front shell (6). The master cylinder push rod seal (1) and push rod seal support plate (2) are also removed with the push rod.
5. Remove check valve (4) and grommet (5) from the front shell (6).
6. Remove retainer plate (21) and boot (20) from rear shell (17).
7. Secure the jig firmly in a vice and place the four studs of the rear shell of the Master-Vac into the four holes in the jig. Place a bar between the studs in the front shell (6) and ensure that the bar is maintained against the plain part of the master cylinder retaining studs to avoid damage to the threads.

   Turn the bar wrench anti-clockwise sufficiently to align cut-outs on the front shell flange with the tongues in the rear shell (17). While pressing firmly downwards this will allow the front and rear shells to part.

NOTE: A suitable bar to turn the front shell can be a piece of 1½ in x ¼ in mild steel approximately 2 ft long.

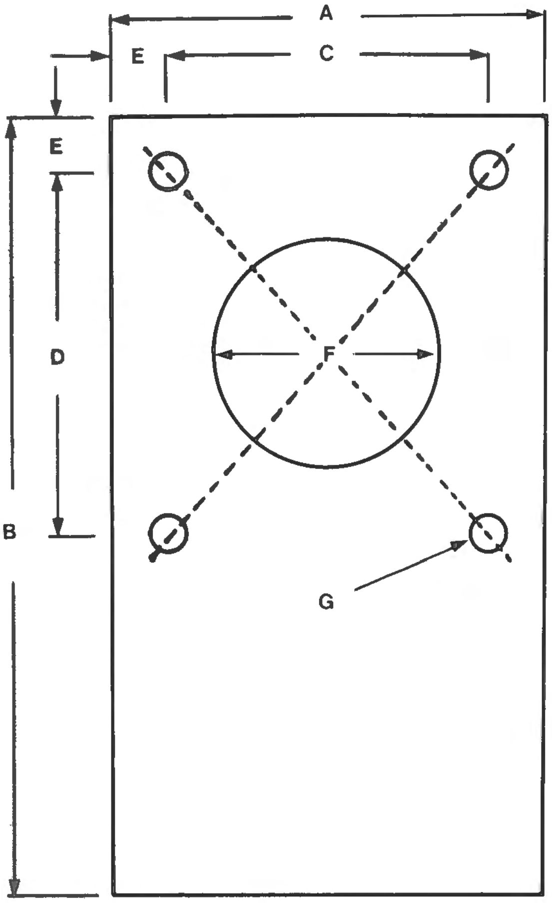


Fig. R-9

MASTER-VAC HOLDING JIG DIMENSIONS

A — 4½ in
B — 8 in
C — 3⅜ in
D — 3 11/16 in
E — 9/16 in
F — 2⅜ in Diameter
G — 13/32 in Diameter 4 Holes

8. Should the shells refuse to separate, recheck alignment of tongues with cut-outs. Tap the front shell lightly with a hammer to break the bond between the front and rear shells and the diaphragm (11).
9. Maintain a firm downward pressure while separating the front and rear shells to prevent the return spring (7) from causing the shells to fly apart.
10. Remove the rear shell from the jig.
11. Remove front shell (6) and return spring (7) from the assembly. Remove yoke from valve rod (15) checking number of turns for correct replacement and remove locknut.

12 Remove air silencer (19) and air filter (18) from the valve body assembly (14).

13 Pull the diaphragm assembly away from the rear shell.

14 Support the rear shell on wooden blocks and drive out the rear shell seal (16) noting direction of seal.

15 Remove the four screws (8) and lock washers (9) from the diaphragm pressure plate (10).

16 Separate the diaphragm pressure plate (10) and diaphragm (11) from the valve body assembly (14) noting port opening in diaphragm and valve body.

17 Lightly press downward on the valve rod and plunger assembly (15) and remove locking key (13) from the valve body (14). Fig. R-10.

18 Separate valve rod and plunger assembly (15) and reaction disc (12) from valve body (14).

NOTE: The valve rod and plunger are only serviced as a complete assembly, replacing the individual parts must not be attempted.

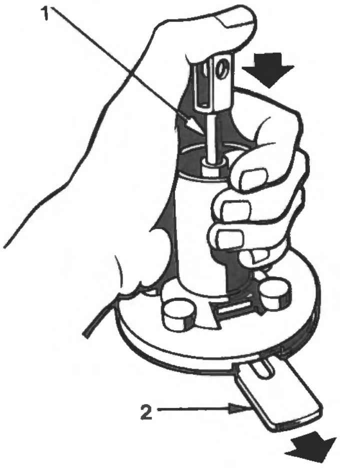


Fig. R-10

REMOVING LOCKING KEY

1 VALVE ROD AND PLUNGER ASSEMBLY 2 LOCKING KEY

Cleaning and Inspecting

1 Wash all parts in clean methylated spirits.

2 Blow out all passages, orifices and valve holes with compressed air.

3 If rust is present in the shell, remove and wash with cleaning fluid.

4 Inspect diaphragm, check valve, front and rear seals filter and valve for damage and wear, replace as necessary.

5 The air filter and silencer must be cleaned as previously described.

Assembling

NOTE: Use only specified lubricants in their appropriate areas.

CAUTION: It is essential that all rubber parts are clean at assembly. If there is any doubt of cleanliness, rewash in brake fluid of the type used in service. Take every precaution that no mineral oil or grease comes in contact with rubber components of the Master-Vac.

1 Support the rear shell (17) on wooden blocks and drive in the rear shell seal (16) using a suitable piece of tubing. Refer Fig. R-8.

2 Lightly smear the valve rod and plunger assembly (15) with a suitable lubricant such as PBR RYCON 'O' grease and assemble into valve body (14), retain with locking key (13). Fig. R-10.

3 Lightly smear reaction disc (12) with RYCON 'O' grease and press into valve body (14) with button facing inwards.

4 Assemble diaphragm (11) to diaphragm pressure plate (10) and valve body (14) retain with four screws (8) and lock washers (9) ensuring that the ports in diaphragm and valve body are aligned.

NOTE: The raised section of the diaphragm must be located in the groove of the valve body.

5 Insert the valve body assembly (14) through the rear shell seal (16) in rear shell (17). Lubricate edge of diaphragm (11) with PBR rubber grease.

6 Place the rear shell assembly (17) into assembly jig. Place large end of return spring (7) on top of diaphragm pressure plate (10) and locate the front shell (6) on top of return spring ensuring that it is correctly located.

7 Place the bar over the studs in the front shell. Make sure that the marks placed on front and rear shells will line up when the Master-Vac is assembled.

8 Press down firmly on bar until both shells are in contact and turn the bar sufficiently to lock the shells together. Check alignment marks.

9 Insert air filter (18) and air silencer (19) into valve body (14).

10 Install boot (20) and boot retainer (21) over valve body (14).

11 Install master cylinder push rod (3) into the front shell (6) making sure that the collar is correctly located in the valve body (14).

12 Fit master cylinder push rod seal support plate (2) into master cylinder push rod seal (1) and install into front shell (6) recess.

13 Insert grommet (5) into front shell (6). Fit check valve (4) into grommet (5). Replace master cylinder.

14 Replace Master-Vac on vehicle and bleed the brakes as previously described.

MASTER CYLINDER PUSH ROD ADJUSTMENTS

The master cylinder push rod is designed with a self locking adjustment screw to provide the correct relationship between the vacuum power piston of the Master-Vac and the primary piston of the master cylinder.

Whenever a push rod assembly is either removed or replaced, the distance from the end of the adjustment screw to the mounting face of the front shell should be rechecked, either with a micrometer depth gauge or a height gauge 0.635 mm (0.025 in). Fig. R-11.

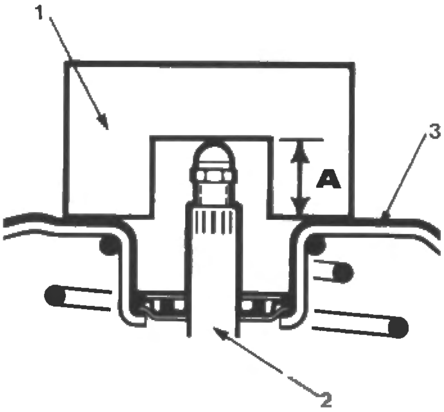


Fig. R-11

GAUGING PUSH ROD LENGTH

1 GAUGE 2 PUSH ROD 3 MASTER-VAC SHELL
A 0.635 mm (0.025 in)

TO ADJUST — Remove master cylinder from Master-Vac.

NOTE: Adjustments must be made with vacuum applied to the unit.

1 Withdraw push rod sufficiently from power unit assembly to enable the splined area of the push rod to be held with pliers.

CAUTION: Care should be taken to ensure that the reaction disc is not withdrawn and dropped into the vacuum chamber when the above adjustment is made. When holding the splined area of the push rod, care must be taken not to scratch the machined section of the shaft.

2 Using a suitable size spanner, turn adjusting nut clockwise to shorten, or anti-clockwise to lengthen push rod. When push rod adjustment is correct, install master cylinder to power unit, install spring washers and nuts. Tighten nuts to 13.5 Nm (10 lb.f.ft.).

3 After replacement of the master cylinder onto the Master-Vac unit, the primary cups of the master cylinder must clear the compensating port when the unit is in the released position. This is checked by partially filling the master cylinder reservoir and operating the valve rod and plunger assembly (if the unit is fitted to the vehicle, operate the brake pedal). If air bubbles appear or fluid spurts, the compensating ports are clear. If the primary cups overlap the compensating ports, there will be no flow of air or fluid through the ports when the Master-Vac is operated and released. When this condition exists, recheck the push rod adjustment.

When the primary cups fail to clear the compensating ports in the released position, fluid under some pressure is trapped in the hydraulic lines and wheel cylinders causing brake drag.

DISC BRAKES

DESCRIPTION

Each caliper is a single casting with the inboard side containing the cylinder bore. The single steel piston is chrome plated for anti corrosion and long wear. A hydraulic seal between the piston and cylinder is maintained by a square section rubber seal located in a machined groove in the cylinder bore. A sealing boot prevents the entry of water and dust into the hydraulic cylinder. Refer Fig. R-12.

Two pads are installed in each caliper. The inner and outer pads differ and are not interchangeable. The pads are metal with the lining moulded to them. It is necessary to remove the caliper from the stub axle to replace the brake pads.

Wear of the pads is automatically compensated for by the design of the sliding caliper which is carried on two guide pins mounted in the anchor bracket sleeves.

The hub and brake disc are cast as a single unit to ensure accurate alignment. The disc is of the fully ventilated type to provide adequate cooling of both disc and pads.

Operation

When the brakes are applied, hydraulic pressure is exerted on the piston and the piston bore. This pressure is transmitted equally through the piston and sliding caliper to force both inboard and outboard pads against the disc.

The movement of the piston and caliper is slight when the brakes are applied. When the brakes are released the pads do not retract more than a few thousandths of an inch from the disc. As the pads wear, the piston and caliper reposition themselves, resulting in self adjustment of the brake pads.

PAD INSPECTION

The brake pads should be inspected regularly (as per maintenance schedule) or any time the front wheels are removed. Both ends of the outboard pad should be checked by visual inspection, as these are the points where the greatest wear normally occurs. At the same time the thickness of the inboard pad should be checked to ensure that it has not worn excessively. Whenever the lining thickness of any pad is worn within 1.6 mm (1/16 in) of the metal base, all pad assemblies on both sides must be replaced.

ENSURE THAT SEAL RETAINER IS IN CORRECT POSITION WITH SERRATED SIDE OF RETAINER FITTED INSIDE OF SEAL.

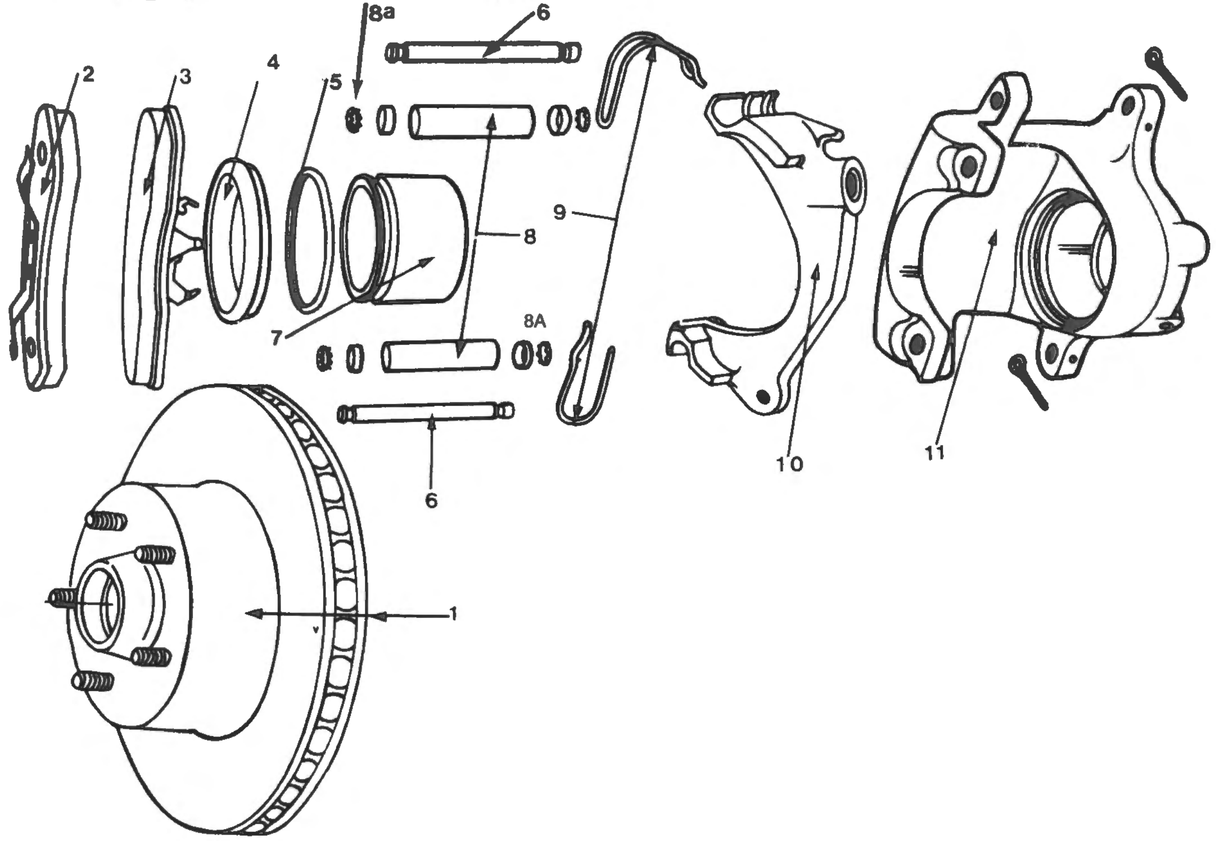


Fig. R-12

DISC BRAKE COMPONENTS

1	HUB AND DISC ASSEMBLY	5	PISTON SEAL	8A	GUIDE PIN SEAL AND RETAINER
2	OUTBOARD PAD	6	GUIDE PINS	9	ANTI-RATTLE SPRINGS
3	INBOARD PAD	7	PISTON	10	ANCHOR BRACKET
4	DUST BOOT	8	GUIDE PIN SLEEVES	11	CALIPER

NOTE: Boosted brakes only — when inspecting front brake pad linings and the pads are forced away from the disc, it is necessary to remove the brake warning light switch from the master cylinder, before pumping the brake pedal to restore the pads to their normal position, otherwise damage to the switch may occur through movement of the pressure differential piston.

CALIPER

Removing

1 Raise the front of the vehicle, support on stands and remove front wheels.

2 Remove the bolts securing the caliper assembly to the stub axle and lift the caliper off the disc. It is not necessary to disconnect the brake hose at the caliper when replacing the brake pads.

Refitting

1 Locate the caliper correctly over the disc and slide into position with the anchor bolt holes aligned with their respective holes in the stub axle.

2 Install the anchor bolts and finger tighten. Progressively tighten the bolts to the specified torque.

3 Check the master cylinder reservoir fluid level and top up if necessary.

4 Apply the brakes firmly several times to actuate the piston seals and brake pads.

5 Apply maximum brake pressure and check for fluid leaks.

6 Replace the front wheels and lower the vehicle to the ground. Tighten the wheel nuts to the specified torque.

BRAKE PADS

NOTE: It is necessary to remove approximately two thirds of the total fluid capacity from the front brake circuit master cylinder reservoir, otherwise the reservoir will overflow when the caliper piston is pushed back into the bore to allow the installation of the new brake pads. Discard the removed brake fluid — DO NOT REUSE.

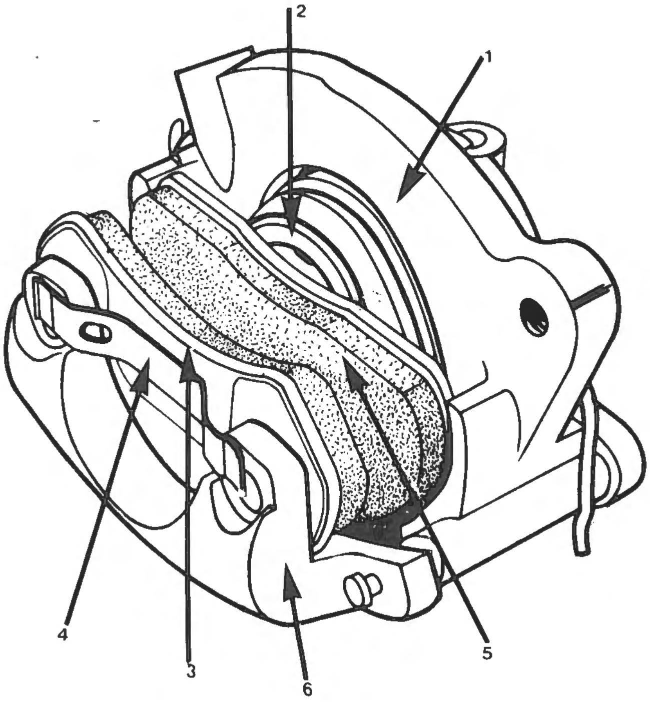
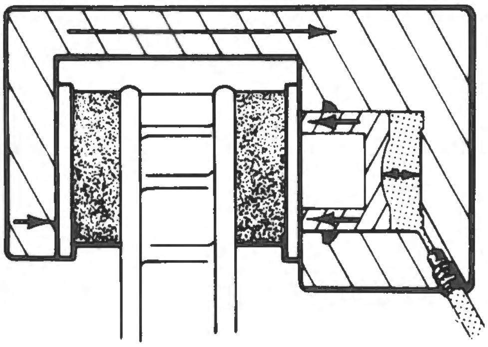


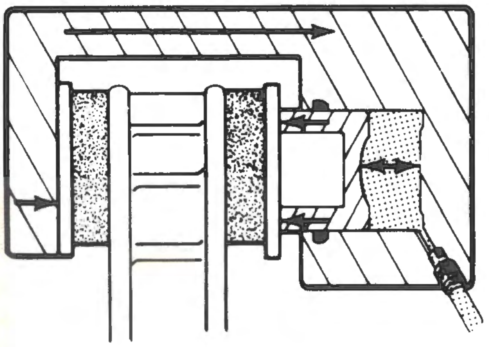
Fig. R-13

CALIPER ASSEMBLED

1	CALIPER	4	OUTBOARD PAD SPRING
2	PISTON	5	INBOARD PAD
3	OUTBOARD PAD	6	ANCHOR PLATE



NEW



WORN

Fig. R-14

SINGLE PISTON BRAKE

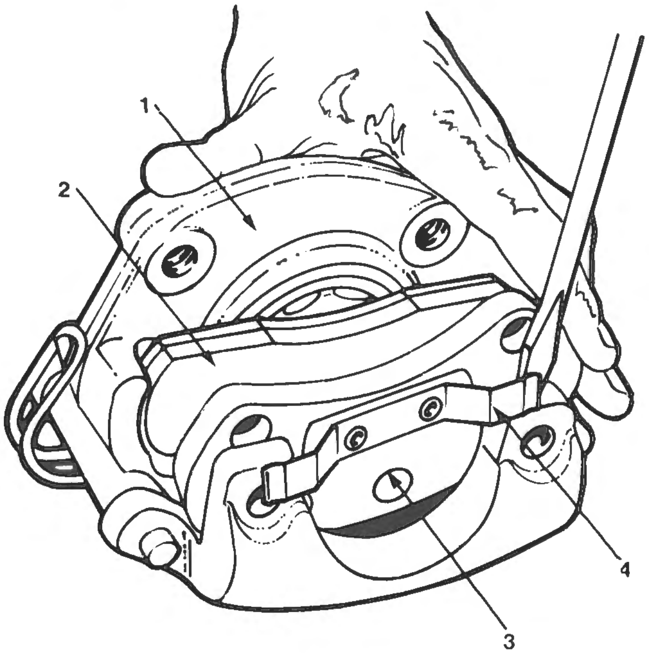


Fig. R-15

REMOVING/REPLACING OUTBOARD PAD

1	CALIPER	3	OUTBOARD PAD
2	INBOARD PAD	4	SPRING CLIP

Removing

1 Remove the caliper.

2 To remove the outboard pad, press inwards towards the inboard pad and at the same time slide the pad forward. Fig. R-15.

3 Remove the inboard pad by prising it away from the caliper piston. Some force will be required to overcome the resistance of the anti-rattle spring attached to the pad.

4 Remove the warning light switch from the master cylinder (Boosted brakes only).

Inspection

1 Carefully inspect the caliper assembly for fluid leaks or damage. If leakage is evident or the caliper is damaged it should be dismantled as detailed in the section caliper overhaul.

2 Check that the caliper is free to slide on the guide pins.

Refitting

1 Push the piston to the bottom of the caliper bore and slide caliper anchor plate to the piston side of caliper.

2 Slide inboard pad towards the caliper piston and at the same time locate anti-rattle spring inside caliper piston.

3 Using a screwdriver, raise the retaining clip and slide one end of outboard pad onto caliper housing. Install remaining end into position in the same manner ensuring that the two locating posts

locate in the two holes in caliper housing Fig. R-15. The caliper is now fully assembled and ready for replacing on the vehicle.

4 Replace caliper on vehicle and top up master cylinder with specified type of fluid.

5 Apply brakes several times to bring pads into contact with disc.

6 Replace warning light switch in master cylinder (Boosted brakes only).

7 Road test vehicle making several stops to seat the brake pads.

NOTE: The vehicle may pull to one side on the first few stops, but will quickly settle down to even braking.

CALIPER OVERHAUL

Dismantling

1 Disconnect the brake hose and plug openings.

2 Remove the caliper from the vehicle.

3 Mount the caliper in a vice equipped with copper jaws and remove both brake pads.

4 Remove the two split pins retaining the guide pins.

5 Drive out the guide pins using a pin punch and hammer. The guide pins should be driven out from the inboard side of caliper.

6 The anti-rattle spring tension will now be removed permitting its removal from the anchor bracket locating point.

7 Remove the anchor bracket and remaining guide together with the anti-rattle spring.

8 Clamp the bracket in a vice and using a screwdriver remove the anti-rattle spring from the anchor bracket and guide. Fig. R-16.

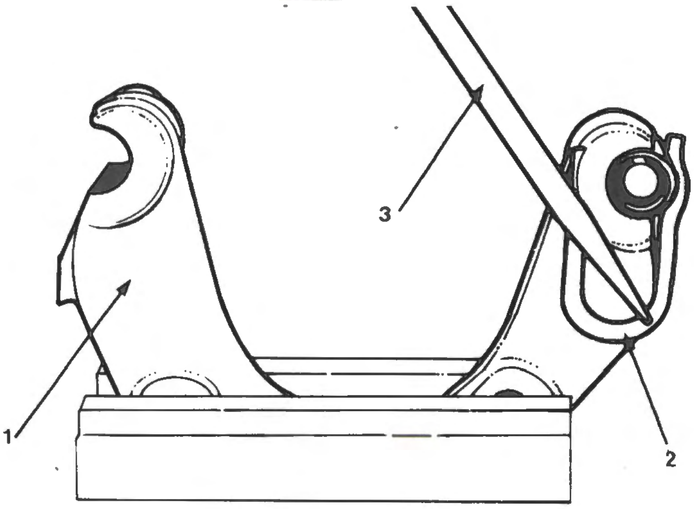


Fig. R-16

REMOVING ANTI-RATTLE SPRING

1 ANCHOR BRACKET
2 ANTI-RATTLE SPRING
3 SCREW DRIVER

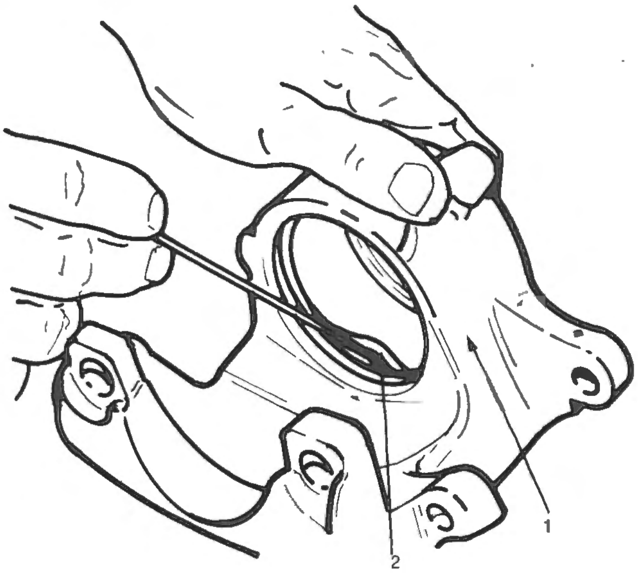


Fig. R-17

REMOVING PISTON SEAL

1 CALIPER
2 SEAL

9 Remove the four guide pin boots and discard. Check the guide pins and sleeves for wear and damage. Replace if necessary.

10 The piston is removed from the caliper by applying medium pressure compressed air to the fluid inlet port after placing a suitable piece of board in the position of the outboard pad, to prevent damage to the piston.

11 As the piston emerges from the cylinder, the inside diameter of the rubber boot in the groove of the piston should stretch out around the large portion of the piston, allowing the piston to slide out and be removed.

12 Remove the boot from the groove in the cylinder and discard.

13 Inspect the cylinder and piston for scoring, pitting and corrosion. Carefully check the chrome plating on piston and if worn in any area, the piston should be replaced.

14 The piston seal is removed from the groove in the caliper cylinder by prising out with a pointed wooden or plastic rod. Fig. R-17. Be careful not to damage the seal seat.

15 All parts should be cleaned with the specified hydraulic brake fluid. Blow out the drilled passages with compressed air.

Assembling Caliper

1 Place caliper on a clean bench with the open end of the cylinder facing upwards.

2 Lubricate the new piston seal with brake fluid and insert the seal into the cylinder groove, gently working it around the bore of the cylinder until it is properly seated. Ensure that the seal is not twisted or distorted in the groove.

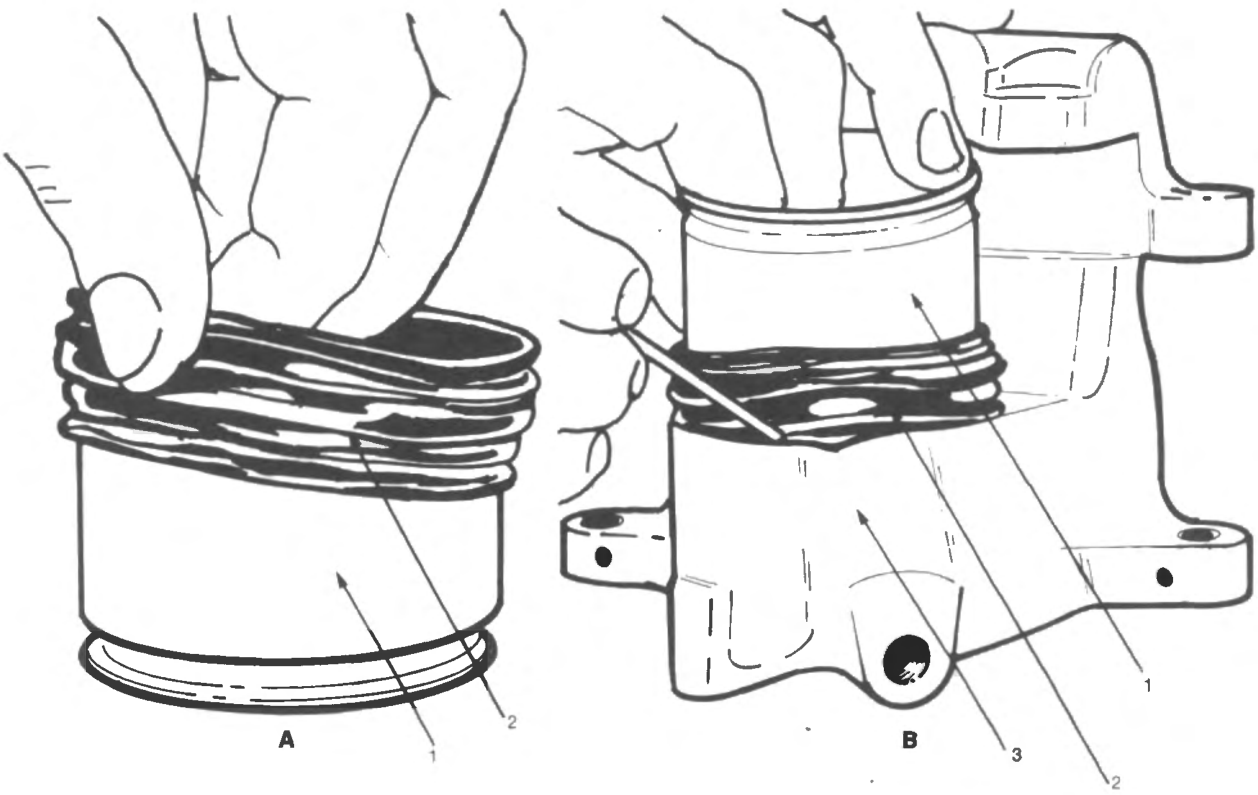


Fig. R-18

FITTING DUST SEALING BOOT

1 PISTON 2 BOOT 3 CALIPER

3 Lubricate the boot and piston with brake fluid, and place the boot over the end of the piston (Fig. R-18A) and locate the end of the boot in the groove of the caliper cylinder (Fig. R-18B).

4 Press the piston into the caliper cylinder until it bottoms. Ensure that the dust boot is correctly located in the piston groove.

5 Insert the four guide pin boots into the sleeves with the clips facing outwards.

6 Place one of the guide pin sleeves in position and line up sleeve with holes in the caliper assembly and insert the guide pin, narrow grooved end first, through the outboard hole in the caliper, this hole is not cross drilled to take a split pin. Using a soft drift, drive the pin into position.

7 Place the anchor bracket into position, with the spring hook end adjacent to the bleeder screw and insert the remaining sleeve and pin as previously detailed. Install split pins to retain guide pins from underside of caliper. Should the split pins be installed from the top, there is a possibility of the ends of the split pin fouling the flexible brake hoses.

8 Refit both brake pads.

9 Install anti-rattle spring.

10 Place a thin piece of shim material over the guide pin sleeve and install the second anti-rattle spring over the sleeve and remove shim.

11 Replace the caliper assembly as previously described and bleed the brakes.

BRAKE DISC AND HUB

Removing

1 Raise front of vehicle and place on stands.

2 Remove the front wheels.

3 Remove the caliper assembly as described in Brake Pad section (do not disconnect brake line). Suspend caliper assembly by a wire hook attached to the suspension coil spring.

4 Remove grease cap, split pin, locknut, nut, thrust washer and outer wheel bearing.

5 Withdraw disc and hub from stub axle.

Refitting

1 Slide disc and hub assembly on to stub axle.

2 Install outer wheel bearing, thrust washer and nut.

3 Adjust hub bearings as described in section 'P' — install split pin and grease cup.

4 Clean both sides of disc with methylated spirits or suitable solvent to remove any traces of grease.

5 Replace caliper assembly.

Inspection

1 To maintain front brake efficiency, it is essential to check the discs for run out, parallel surfaces and thickness. A scored disc may be reground provided suitable grinding facilities are available. The disc should be ground to a fine finish and must be flat and parallel to the mounting surface. Fig. R-19.

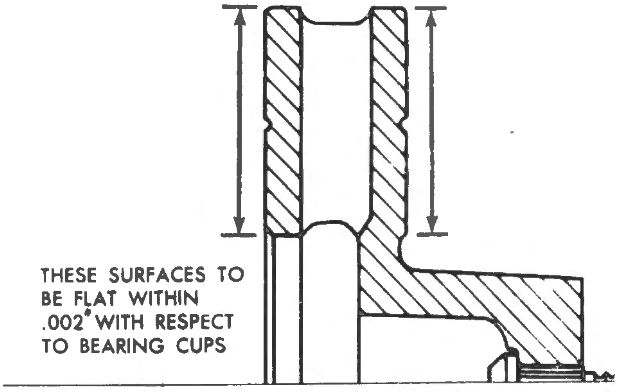


Fig. R-19

CHECKING SURFACE FLATNESS

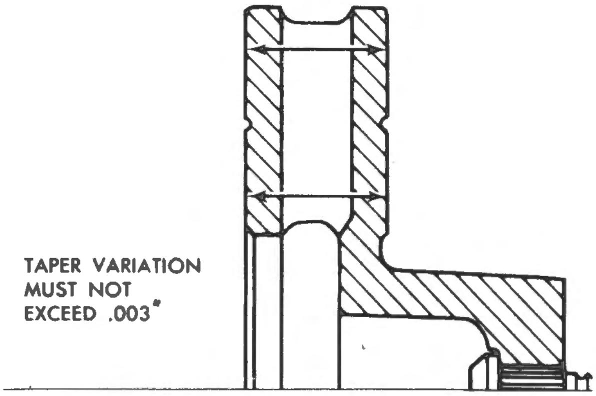


Fig. R-20

CHECKING SURFACE PARALLELISM

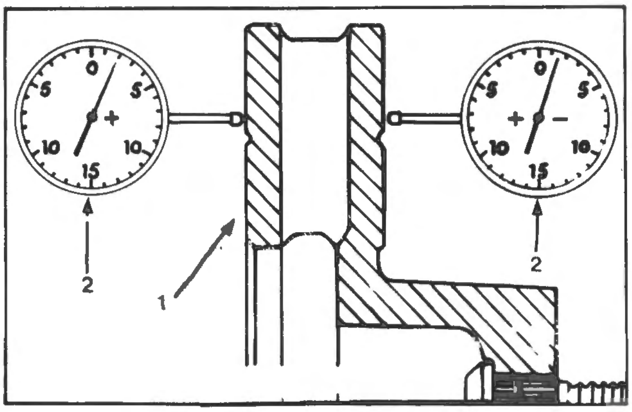


Fig. R-21

CHECKING CIRCUMFERENTIAL THICKNESS

1 BRAKE DISC 2 DIAL INDICATORS

2 Both sides of the disc must be ground equally and the thickness must not be reduced to less than 22.74 mm (0.895 in) from the original thickness of 25.4 mm (1.0 in). Fig. R-20.

3 Run out of the brake disc can be measured 'on the vehicle' and must not exceed 0.102 mm (0.004 in) at a radius of 113.350 mm (5.250 in). Fig. R-21.

NOTE: When carrying out these checks it is essential to eliminate all wheel bearing end float. After the checks have been completed the wheel bearings must be adjusted to provide the specified end float.
Excessive wheel bearing end float will cause brake pad 'knocking' resulting in increased pedal travel.

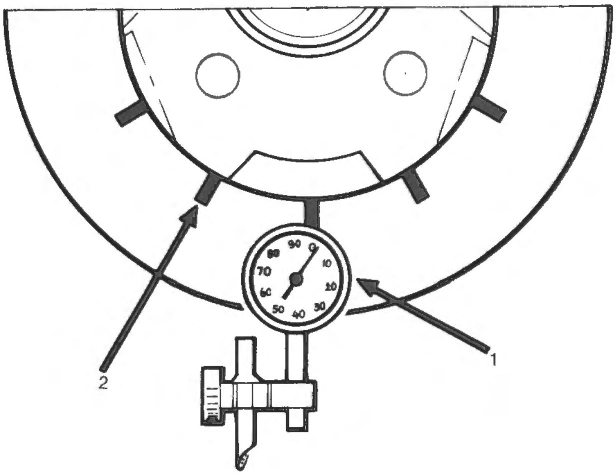


Fig. R-22

CHECKING LATERAL RUN-OUT

1 DIAL INDICATOR 2 BRAKE DISC

REAR WHEEL BRAKES

DESCRIPTION

The drum brakes fitted to the rear wheels are self adjusting, duo servo single anchor type utilising the momentum of the vehicle to assist in brake application. The self energising force is applied to both brake shoes on the rear wheels in forward and reverse direction. The brake linings are bonded to the shoes.

Wheel cylinders are of the double piston type permitting even distribution of pressure to each brake shoe.

The handbrake operates the rear wheel brakes only.

PRESSURE PROPORTIONING VALVE

The pressure proportioning valve is non-adjustable and is designed to limit the hydraulic pressure to 2067 kPa to 2321 kPa (300 to 337 psi) in the rear brakes preventing rear wheel 'lock-up'. The valve is incorporated in the rear brake circuit and is located immediately below the master cylinder.

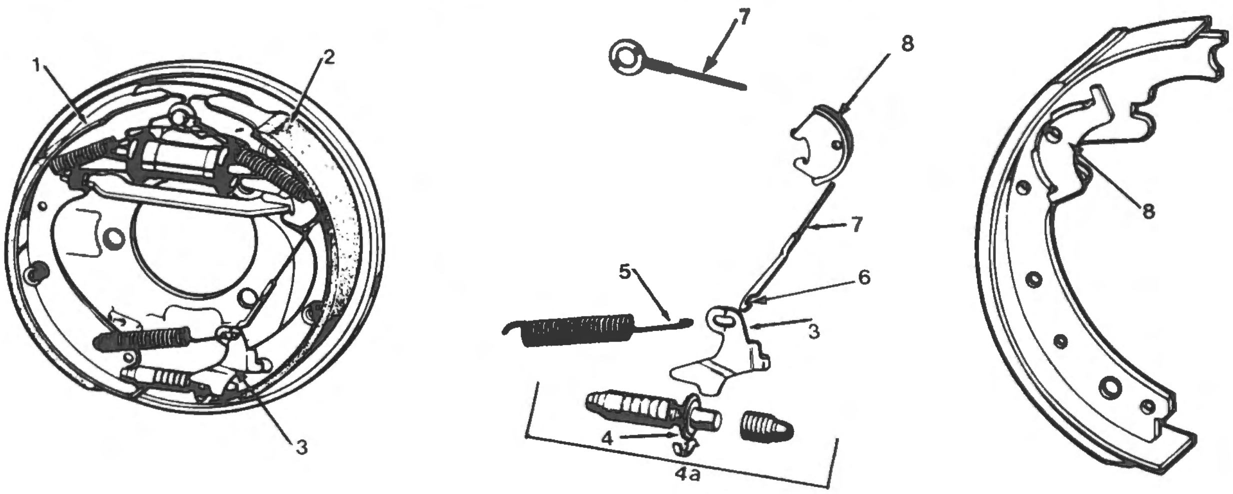


Fig. R-23

REAR BRAKE ASSEMBLY

1	PRIMARY SHOE 7¾" LONG	4	ADJUSTING SCREW	6	CABLE HOOK
2	SECONDARY SHOE 9¾" LONG	4A	ADJUSTER COMPONENTS	7	CABLE
3	ADJUSTER LEVER	5	ADJUSTER SPRING	8	CABLE GUIDE

Operation

The automatic brake adjuster is operated by movement of the secondary brake shoe during brake application with the vehicle travelling in reverse. Adjustment takes place only when sufficient lining has been worn away to permit the adjuster lever to engage the next tooth of the adjusting screw. Having adjustment take place only during brake application in reverse movement prevents over adjustment due to excessive drum expansion during repeated high speed forward brake application. Several brake applications in the reverse direction may be necessary to obtain correct adjustment.

Manual adjustment will only be necessary after brake assemblies have been disturbed in an operation such as a reline.

BRAKE SHOES

Removing

1 Raise the rear of the vehicle, support on stands and remove rear wheels.

2 When removing drums, back off the adjusting screw to provide ample shoe to drum clearance. Refer Fig. R-23.

3 Always use wheel cylinder clamps to hold wheel cylinder pistons in place during removal and assembly of brake parts.

4 Before removal of brake parts, observe location of all springs and how springs and other parts are assembled. With automatic adjusters, observe how adjuster parts are assembled.

5 Always use special brake spring tools to unhook or attach the brake shoe return springs to avoid damage to springs and linings.

6 When removing a shoe, hold down springs and pins by holding a finger against the head of the pin at the rear of the backing plate while compressing the spring and turn retainer washer 90° to release position.

Inspection

1 Inspect brake linings for wear. All linings must be replaced when any part of the lining has worn to a thickness of 1.6 mm (1/16 in).

Refitting

1 Before installing the rear brake shoes, assemble the parking brake lever to the secondary shoe and secure it with the spring washer and retaining clip. Refer Fig. R-23.

2 Apply a light coating of Bentone Base grease at the points where the brake shoes contact the backing plate and all anchor pins.

3 Position the brake shoes on the backing plate and secure them with the hold down springs. Refit the handbrake link and spring. Connect the handbrake cables to the brake lever.

4 Refit the cable guide on the secondary shoe web with the flanged hole properly fitted into the hole in the secondary shoe web. Install the secondary shoe to anchor spring.
Place the cable eye over the anchor pin with the crimped side toward the backing plate. Install the primary shoe to anchor spring.

5 Thread the cable around the cable guide groove. It is imperative that the cable be positioned in this groove and not between the guide and the shoe web. Be certain that the cable eye is not canted or binding on the anchor pin when installed. All parts should be flat on the anchor pin. Remove the brake cylinder clamp.

6 Apply grease to the threads and the socket end of the adjusting screw. Turn the adjusting screw into the adjusting pivot nut to the limit of the threads and then back off half a turn.

CAUTION: Interchanging the brake shoe adjusting screw assemblies from one side of the car to the other would cause the brake shoes to retract rather than expand each time the automatic adjusting mechanism is operated. To prevent accidental installation of the adjusting screw on the wrong side of the car, the socket end of the adjusting screw is stamped with R or L. The adjusting pivot nuts can be distinguished by the grooves machined around the body of the nut. No grooves indicate a right hand nut, one groove indicates a left hand nut.

7 Place the adjusting socket on the screw and install this assembly between the shoe ends with the adjusting screw tooth wheel nearest the secondary shoe.

8 Engage the cable hook into the hole in the adjusting lever. The adjusting levers are stamped with an R or L to indicate their installation on a right or left hand assembly.

9 Position the hooked end of the adjuster spring completely into the large hole in the primary shoe web. The last coil of the spring should be at the edge of the hole. Connect the loop end of the spring to the adjuster lever hole.

10 Pull the adjuster lever, cable and automatic adjuster spring down and toward the rear to engage the pivot hook in the large hole in the secondary shoe web.

11 After installation, check the action of the adjuster by pulling the section of the cable between the cable guide and the adjusting lever toward the secondary shoe web far enough to lift the lever past a tooth on the adjusting screw wheel.

12 The lever should snap into position behind the next tooth and release of the cable should cause the adjuster spring to return the lever to its original position. This return action of the lever will turn the adjusting screw one tooth.

13 If pulling the cable does not produce the action described or if the lever action is sluggish instead of positive and sharp, check the position of the lever on the adjusting screw tooth wheel. With the brake in the vertical position (anchor at the top), the lever should contact the adjusting wheel 4.763 mm (3/16 in) plus or minus 0.793 mm (1/32 in) above the centre line of the screw. If the contact point is below the centre line, the lever will not lock on the teeth in the adjusting screw wheel, and the screw will not be turned when the lever is actuated by the cable.

14 To determine the cause of this condition:

(a) Check the cable end fittings. The cable should completely fill or extend slightly beyond the crimped section of the fittings. If it does not meet this specification, possible damage is indicated and the cable assembly should be replaced.

(b) Check the cable length. The cable should measure 212.925 mm (8⅜ in) from the end of the cable anchor to the end of the cable hook.

(c) Check the cable guide for damage. The cable groove should be parallel to the shoe web, and the body of the guide should be flat against the web. Replace the guide if it shows damage.

(d) Check the pivot hook on the lever. The hook surfaces should be square with the body of the lever for proper pivoting. Replace the lever if the hook shows damage.

(e) Ensure that the adjusting screw socket is properly seated in the notch in the shoe web.

15 Replace brake drums and road wheels.

Adjusting

1 The following is the adjusting procedure assuming that there is correct lining to drum contact, a good drum finish and that the handbrake is free.

(a) Through the adjusting slot in the backing plate, adjust the star wheel to expand the shoes against the drums by moving the adjusting tool handle away from the axle centre line until the wheel can just be turned by hand.

(b) Insert a tool to lift the adjusting lever away from the star wheel. Fig. R-24.

(c) Moving the adjusting tool towards the axle centre, back off the star wheel 28 to 30 notches. Repeat on other brake.

(d) Make 5 or 6 reverse brake applications to complete the adjustment.

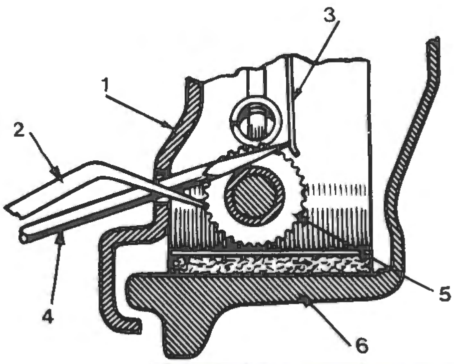


Fig. R-24

BACKING OFF BRAKE ADJUSTER

1	BACKING PLATE	4	SCREW DRIVER
2	BRAKE ADJUSTING TOOL	5	ADJUSTING SCREW
3	ADJUSTER LEVER	6	BRAKE DRUM

WHEEL CYLINDER OVERHAUL

NOTE: Always overhaul both wheel cylinders at the same time.

Removing

1 Remove wheel, back off brake adjustment and remove drum.

2 Disconnect the hydraulic line from the wheel cylinder.

3 Remove the brake shoes.

4 Remove the wheel cylinder to backing plate attachment bolts and washers, remove the wheel cylinder.

Dismantling

1 Remove the wheel cylinder clamp and remove rubber boots, pistons, cups and spring with cup expanders.

2 Remove bleeder valve.

3 Discard all rubber parts.

Inspecting

1 Wash all parts in clean methylated spirits.

CAUTION: Do not use petrol, kerosene or any other cleaning fluid that might contain a trace of mineral oil.

2 Inspect the cylinder bore for scores, deep scratches or corrosion. Light scratches and slightly corroded spots in the cylinder bore may be removed by polishing. Do not use emery cloth or sandpaper. If the scratches or corroded spots are too deep to be polished satisfactorily, the cylinder should be replaced, since honing is not recommended.

3 Check the piston for wear or damage and for clearance in the cylinder. This clearance should be within the range of 0.051 to 0.13 mm (0.002 to 0.005 in). Refer Fig. R-25.

4 Check the bleeder screws for blockage.

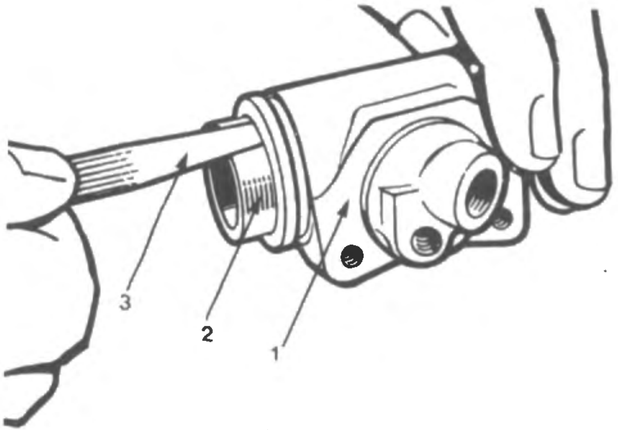


Fig. R-25

CHECKING PISTON TO BORE CLEARANCE

1 WHEEL CYLINDER
2 PISTON
3 FEELER GAUGE

Assembling

1 Coat all internal parts and cylinder bore with brake fluid before assembly. Install the components in the sequence shown in Fig. R-26 using care to avoid damaging the edges of the piston cups. When all components have been assembled install a wheel cylinder clamp to facilitate installation of wheel cylinder assembly to backing plate.

Refitting

1 Install wheel cylinder on the brake backing plate and connect the hydraulic line.

2 Connect brake shoes together with springs and install adjuster assembly between shoes. Install brake shoes as outlined in this section.

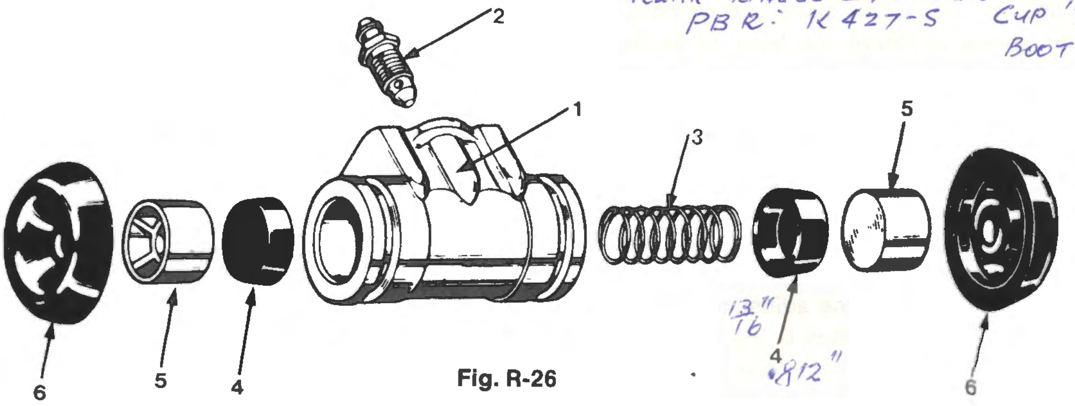
3 Install brake drum, wheel and cap.

4 Bleed the hydraulic system.

5 Check for leaks.

6 Adjust brakes. Road test vehicle for brake performance.

REAR WHEEL CYLINDER
PBR: K 427-S CUP 13/16" P12400
BOOT P16952



13/16"
.812"

Fig. R-26

WHEEL CYLINDER COMPONENTS

1 WHEEL CYLINDER
2 BLEEDER SCREW
3 SPRING
4 CUP
5 PISTON
6 BOOT

HANDBRAKE LEVER

The handbrake lever is floor mounted on the right-hand side of driver's seat. It is constructed so as to fold down almost horizontal to the floor when in the 'ON' position.

To release handbrake, pull on lever and press down on the ratchet release knob and return lever to the 'OFF' position.

Removing

1. Block both rear wheels.
2. Release handbrake to the 'OFF' position.
3. Remove the two screws retaining handbrake lever cover and remove cover.
4. Remove split pin and clevis pin from lower end of handbrake lever.
5. Remove the two bolts, spacers and plate securing the handbrake lever assembly to the body sill.
6. Remove handbrake lever assembly.

Refitting

1. Refitting is the reversal of the removing procedures 1 to 6.

HANDBRAKE CABLE

NOTE: For efficient handbrake operation, it is essential that the rear brake shoes are correctly adjusted before the cable adjustment is carried out.

Adjusting

1. Raise the rear of the vehicle until both rear wheels are clear of the ground and place stands under rear axle.
2. Release the locknut securing each rear clevis adjacent to the front of the lower control arms.
3. Apply the handbrake lever one notch.
4. Each clevis should be turned sufficiently to remove the free travel from the cables until a slight binding is felt on each rear wheel.
5. Release the handbrake to the full off position and check rear wheels for binding. Should any binding be experienced, release the clevis until the wheels turn freely.
6. Apply the handbrake several notches, until each rear wheel can just be turned by hand. Equalise the adjustment if necessary.
7. Lower the vehicle to the ground.

FRONT HANDBRAKE CABLE

Removing

1. Unscrew rear adjustment locknut.
2. Remove cable from adjusting links on both sides of vehicle.
3. Withdraw the cable through the body stiffener member, pivot cams and guide located near propeller shaft and remove cable from vehicle.

Refitting

1. Refitting is the reverse of removing procedures 1 to 3 noting the following:
   (a) Ensure that the locating olive on cable is entered into its slot in the nylon cam on both sides.
   (b) Adjust handbrake cable.

REAR HANDBRAKE CABLE

Removing

1. Securely block both front wheels.
2. Raise rear of vehicle and place stands under rear axle.
3. Place handbrake lever in the off position.
4. Slacken adjustment of handbrake cable.
5. Withdraw cable from adjusting link and anchor point. Feed cable through clip on lower control arm.
6. Remove rear wheel and brake drum.
7. Disconnect cable from lever assembly and free cable from clip on the backplate. Remove cable by withdrawing it through the backplate.

Refitting

1. Refitting is the reverse of removing procedures 1 to 7.
2. Adjust handbrake.

BRAKE PEDAL

Removing

1. Remove the brake pedal return spring by levering the end away from the brake pedal.
2. Remove split pin from brake pedal clevis pin and remove clevis pin.
3. Remove the nut and washer from brake pedal pivot bolt, and remove pivot bolt.
4. Remove brake pedal by turning it at right angles and lowering towards the floor.

Refitting

1. Refitting is the reverse of removing procedures 1 to 4.

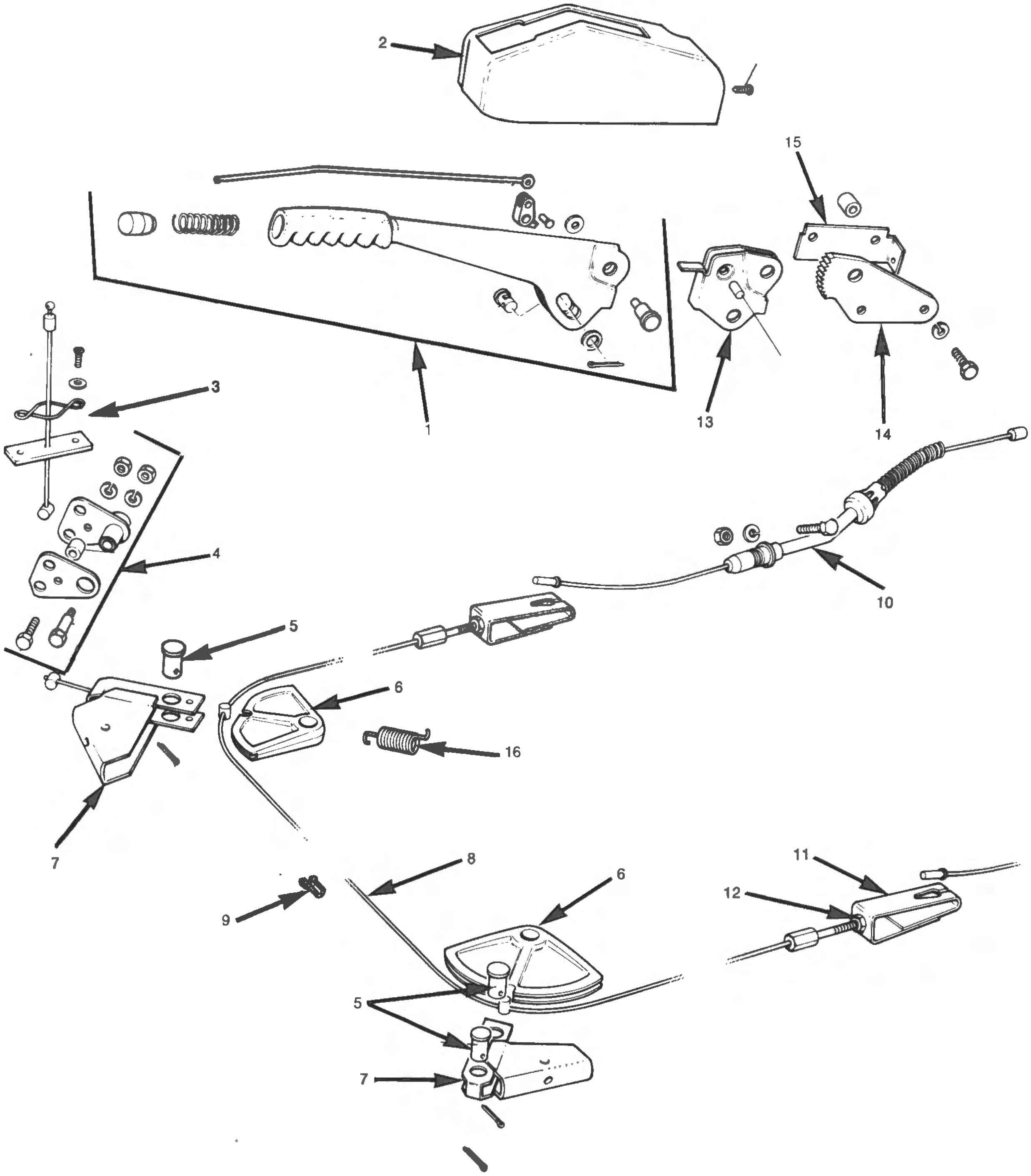


Fig. R-27

HANDBRAKE COMPONENTS

1	HANDBRAKE LEVER ASSEMBLY	9	FRONT CABLE SLIDE
2	HANDBRAKE LEVER COVER	10	REAR CABLE ASSEMBLY
3	HANDBRAKE LEVER CABLE ASSEMBLY	11	CABLE ADJUSTER
4	HANDBRAKE LEVER CABLE PIVOT ASSEMBLY	12	LOCKNUT
5	SECTOR FORK PIN	13	HANDBRAKE CABLE
6	SECTOR	14	RATCHET
7	SECTOR FORK ASSEMBLY	15	HANDBRAKE COVER BRACKET
8	FRONT CABLE	16	SECTOR FORK RETURN SPRING

DIAGNOSIS GUIDE

DISC BRAKES

CAUSE	REMEDY
EXCESSIVE/SPONGY PEDAL TRAVEL	
1 Air in hydraulic system.	Bleed hydraulic system and refill with approved fluid.
2 Wheel bearings loose or worn (causing pad assembly knockback).	Adjust wheel bearings or replace defective parts.
3 Master cylinder fluid level low.	Fill to proper level with approved fluid and check for leakage.
4 Poor quality brake fluid (low boiling point) in system.	Drain hydraulic system and fill with approved fluid.
5 Hoses soft and weak (expanding under pressure).	Replace defective hoses.
6 Disc run-out excessive.	Check disc for run-out and machine or install a new disc.
7 Caliper seals soft or swollen.	Drain and flush hydraulic system with approved brake fluid and replace all cups and seals.
HARD PEDAL	
1 Master-Vac malfunctioning.	Check and repair Master-Vac.
2 Lines, hoses or connections dented, kinked, collapsed or clogged.	Repair or replace defective parts.
3 Caliper piston seized.	Dismantle caliper and free up piston (replace if necessary).
4 Pedal push rod and linkage binding.	Free up and lubricate.
GRABBING OR PULLING	
1 Caliper loose.	Tighten caliper mounting bolts to specified torque.
2 Lines, hoses or connections dented, kinked, collapsed or clogged.	Repair or replace defective parts.
3 Pad assemblies soiled with brake fluid, oil or grease.	Replace pad assemblies and rectify oil and grease leaks.
4 Caliper cylinder seal soft or swollen.	Drain hydraulic system, flush system with approved brake fluid and replace all cups and seals in complete brake system.
5 Caliper piston seized.	Dismantle the caliper and free up piston (replace if necessary).
6 Pedal linkage binding (and suddenly releasing).	Free up and lubricate linkage.

CAUSE	REMEDY
FADING PEDAL	
1 Master cylinder primary cup worn or damaged.	Overhaul the master cylinder.
2 Master cylinder bore corroded, worn or scored.	Replace master cylinder.
3 Caliper cylinder seal worn or damaged.	Replace seal.
4 Caliper cylinder bore corroded, worn or scored.	Dismantle caliper and remove corrosion or scoring, or replace caliper.
5 Poor quality brake fluid (low boiling point) in system.	Drain hydraulic system and fill with approved fluid.
6 Hydraulic connections loose, lines or hoses ruptured (causing leakage).	Tighten or replace defective parts and bleed hydraulic system if necessary.
NOISE AND CHATTER	
1 Disc has excessive lateral runout.	Replace disc.
2 Disc has excessive thickness variations (out of parallel).	Replace disc.
3 Squeal during application.	A small amount of high-pitched squeal is inherent in disc brake design and must be considered normal.
DRAGGING BRAKES	
1 Master cylinder compensating port restricted by swollen primary cup.	Drain hydraulic system, flush system with approved brake fluid and replace all cups and seals in complete brake system.
2 Lines, hoses or connections dented, kinked, collapsed or clogged.	Replace or repair defective parts.
3 Caliper piston seized.	Dismantle caliper and free up piston (replace if necessary).
4 Residual pressure check valve in line to front wheels.	Remove residual pressure check valve from line.
5 Hydraulic push rod on Master-Vac out of adjustment or binding (causing primary cup to restrict master cylinder compensating port).	Adjust or free up and lubricate.

CAUSE	REMEDY
EXCESSIVE BRAKE PEDAL TRAVEL	
1 Leaking brake line or connection.	Replace brake line. Tighten connection.
2 Leaking wheel cylinder.	Replace cups and/or wheel cylinders.
3 Leaking master cylinder.	Replace seals and/or master cylinder.
4 Air in brake system.	Bleed brake system.
EXCESSIVE BRAKE PEDAL EFFORT	
1 Leak in vacuum system.	Replace diaphragm. Replace atmospheric valve. Tighten or replace vacuum line.
2 Restricted air passages in Master-Vac.	Clean or replace air filter.
3 Incorrectly assembled Master-Vac valves.	Correctly assemble valves.
4 Glazed brake lining.	Lightly sandpaper brake linings.
5 Incorrect type of brake linings.	Replace brake linings.
6 Oil or grease soaked brake linings.	Replace brake linings.
7 Restricted brake fluid passage.	Clear restriction or replace brake line.
BRAKES BINDING	
1 Contaminated or incorrect brake fluid.	Replace brake fluid.
2 Damaged Master-Vac.	Overhaul Master-Vac.
3 Master-Vac push rod incorrectly adjusted.	Adjust push rod.
4 Faulty automatic adjusters.	Rectify or replace adjusters.
5 Weak or incorrect brake return springs.	Fit new springs.
6 Restricted brake fluid passage.	Clear restriction or replace brake line.
7 Sticking wheel cylinder piston.	Free piston or replace wheel cylinder.
8 Incorrectly adjusted handbrake.	Re-adjust handbrake.

SECTION S

ELECTRICAL AND INSTRUMENTS

GENERAL DESCRIPTION

The electrical system is 12 volt negative earth. Two batteries are used one being 12 volt, 7 plate for normal use and the other a 12 volt 9 plate for vehicles fitted with air conditioning. The battery is maintained in a charged condition by a Lucas alternator having a built in regulator. The alternator is belt driven from the crankshaft. A charge indicator, either a warning light or a battery condition indicator is mounted on the facia panel.

The starter motor is a Lucas M40-15AK model with pre-engagement operation.

Headlights are of the sealed beam type and do not use separate bulbs.

The various circuits are protected from overload by fuses carried in one block mounted on the guard valance between the suspension tower and the plenum chamber. In addition, line fuses are fitted to heating, radio and air conditioning circuits.

BATTERY MAINTENANCE

1. Keep the battery clean, dirt and moisture should not be allowed to accumulate on the battery top.
2. Keep the terminals clean and free from corrosion. After cleaning, petroleum jelly should be smeared around the terminals when they have been connected to the battery, to prevent corrosion.
3. The battery normally generates inflammable gas. Never examine a battery with an open flame.
4. The level of the electrolyte in the battery must be maintained by the addition of distilled water whenever necessary. This will vary with operating and climatic conditions.
5. It is essential that good electrical connections are maintained at all times. Battery terminals, earth connections, battery cables to the starter motor, switch and output terminals at the alternator are particularly important.

SERVICE PRECAUTIONS

It is important to observe the following precautions when servicing vehicles fitted with alternator charging systems.

1. The correct polarity must be observed at all times when fitting a battery. Positive to positive, negative to negative.
2. When an additional battery is connected into the circuit, the normal 12 volts of the system must be maintained and the connecting leads must be connected in parallel e.g. positive to positive, negative to negative.
3. When it is necessary to charge the battery care must be taken to ensure that the charger is connected correctly and that the battery terminals are removed.

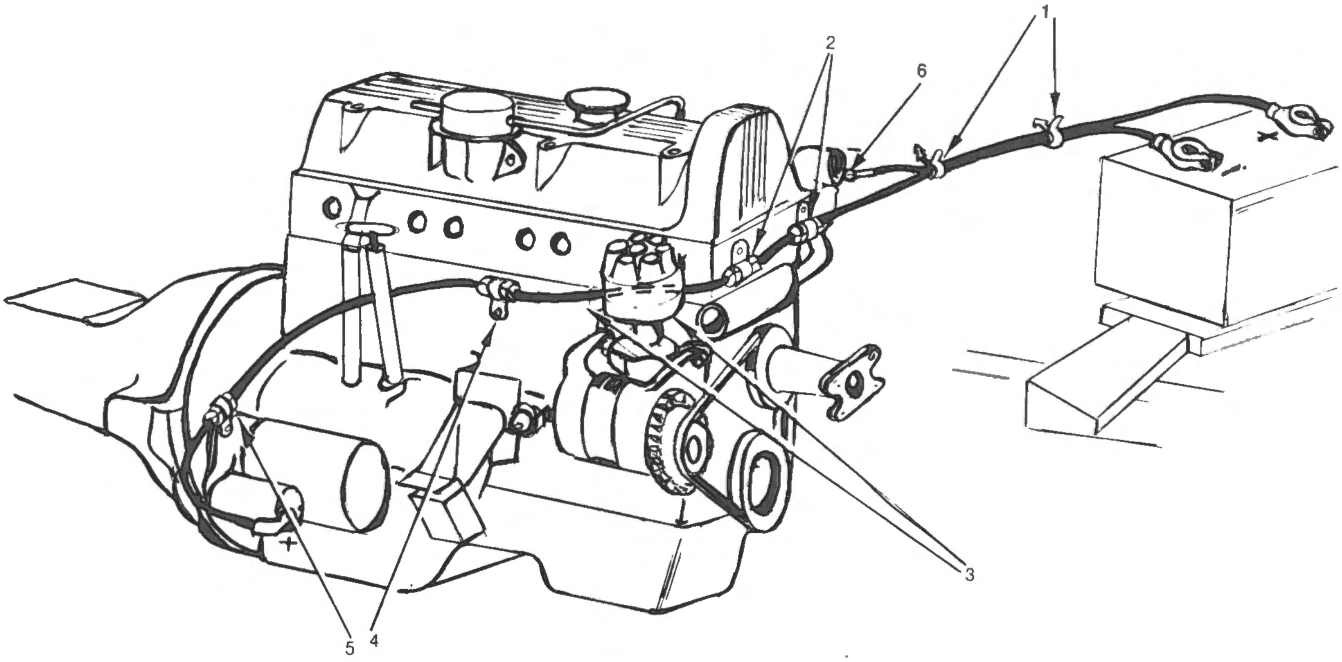


Fig. S-1

INSTALLATION OF BATTERY CABLES (6 CYLINDER)

1 CABLE TIES

2 CLIPS AND PROTECTION SLEEVES — CABLE TO CYLINDER HEAD

3 ROUTE CABLE BEHIND DISTRIBUTOR

4 CLIP AND SLEEVE — CABLE TO CYLINDER BLOCK

5 CLIP AND SLEEVE — CABLE TO STARTER MOTOR SECURING BOLT

6 BATTERY NEGATIVE CABLES TO ENGINE THERMOSTAT HOUSING SCREW

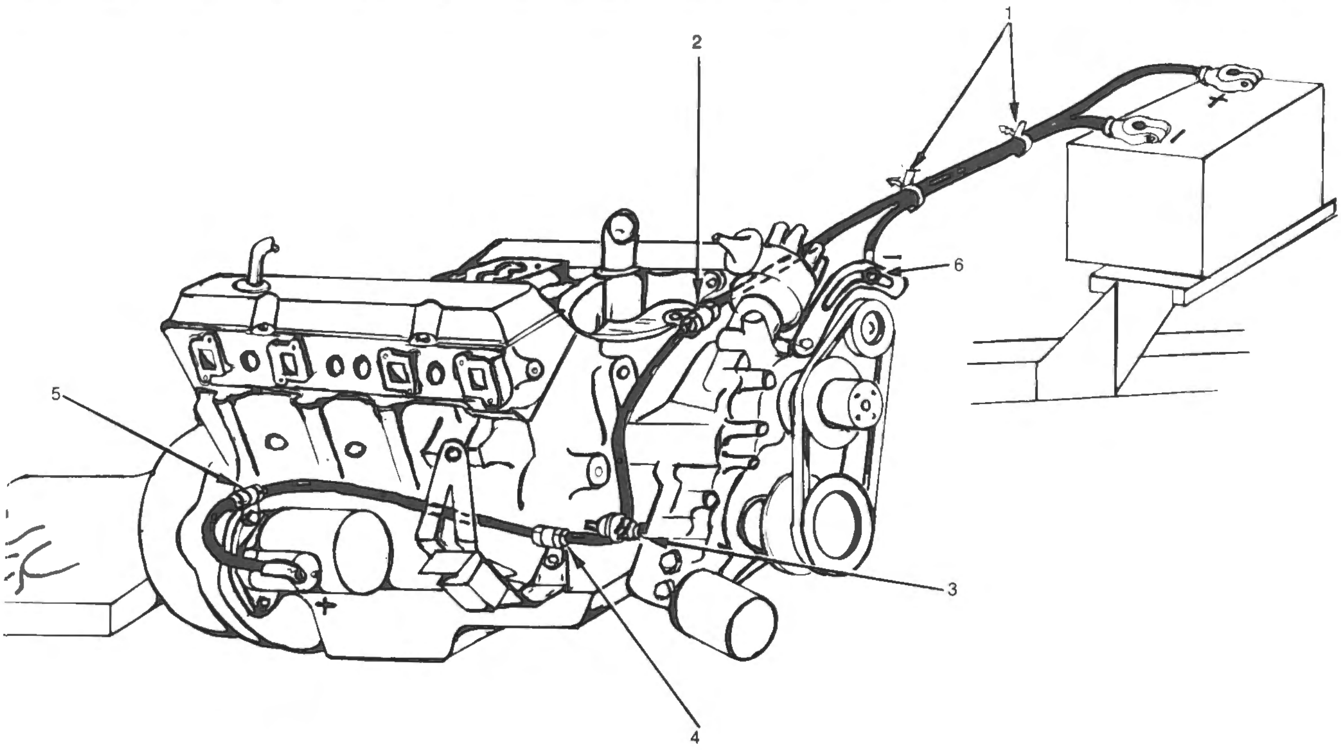


Fig. S-2

INSTALLATION OF BATTERY CABLES (8 CYLINDER)

1 CABLE TIES

2 CLIP AND SLEEVE – CABLE TO VALLEY COVER

3 ROUTE CABLE BEHIND OIL LOW PRESSURE WARNING LAMP SWITCH

4 CLIP AND SLEEVE – CABLE TO RH ENGINE MOUNTING BRACKET

5 CLIP AND SLEEVE – CABLE TO STARTER MOTOR SECURING BOLT

6 BATTERY NEGATIVE (–) CABLE TO ALTERNATOR END BRACKET AND ADJUSTING LINK

4 Do not short across or ground any terminal connected in the charging circuit.

5 Do not disconnect the battery terminals or make and break any connections in the charging circuit while the engine is running.

6 Remove the battery leads and alternator connections prior to carrying out electric welding on the vehicle.

ALTERNATOR

DESCRIPTION

There are three Lucas alternators used in conjunction with this range of vehicles.

15ACR-3D Alternator – 6 Cylinder Models
14ACR-4D Alternator – 8 Cylinder Models
14ACR-6D Alternator – 8 Cylinder Air Conditioned Models. Also available as an option on other models.

NOTE: When the 14ACR-6D unit is specified for the 6 cylinder model it is not directly interchangeable with the 8 cylinder unit due to the different pulley and mounting bracket arrangements.

The alternators are 9 diode units and incorporate integral 9/13 ATR transistorised voltage regulators.

A laminated stator carries a three phase star connected output winding. A twelve pole rotor carries the field winding.

The rotor shaft is supported in ball race bearings located in the case end brackets Fig. S-3.

The diodes and stator windings are cooled by air flow through the alternator, induced by a ventilating fan mounted on the rotor shaft at the drive end.

No cut-out is required since the diodes incorporated in the alternator prevent reverse currents flowing from the battery to the alternator. No current regulator is required as the inherent self regulating properties of the alternator limit the output current to a safe value.

Design features include temperature compensation without the use of a thermistor and radio frequency interference suppression which requires no adjustment in service.

The voltage regulator is isolated from the battery when the engine is stationary by means of the ignition switch.

Maintenance

1 Cleaning
Wipe away any dirt or oil which may collect around the slip ring end bracket ventilating aperture.

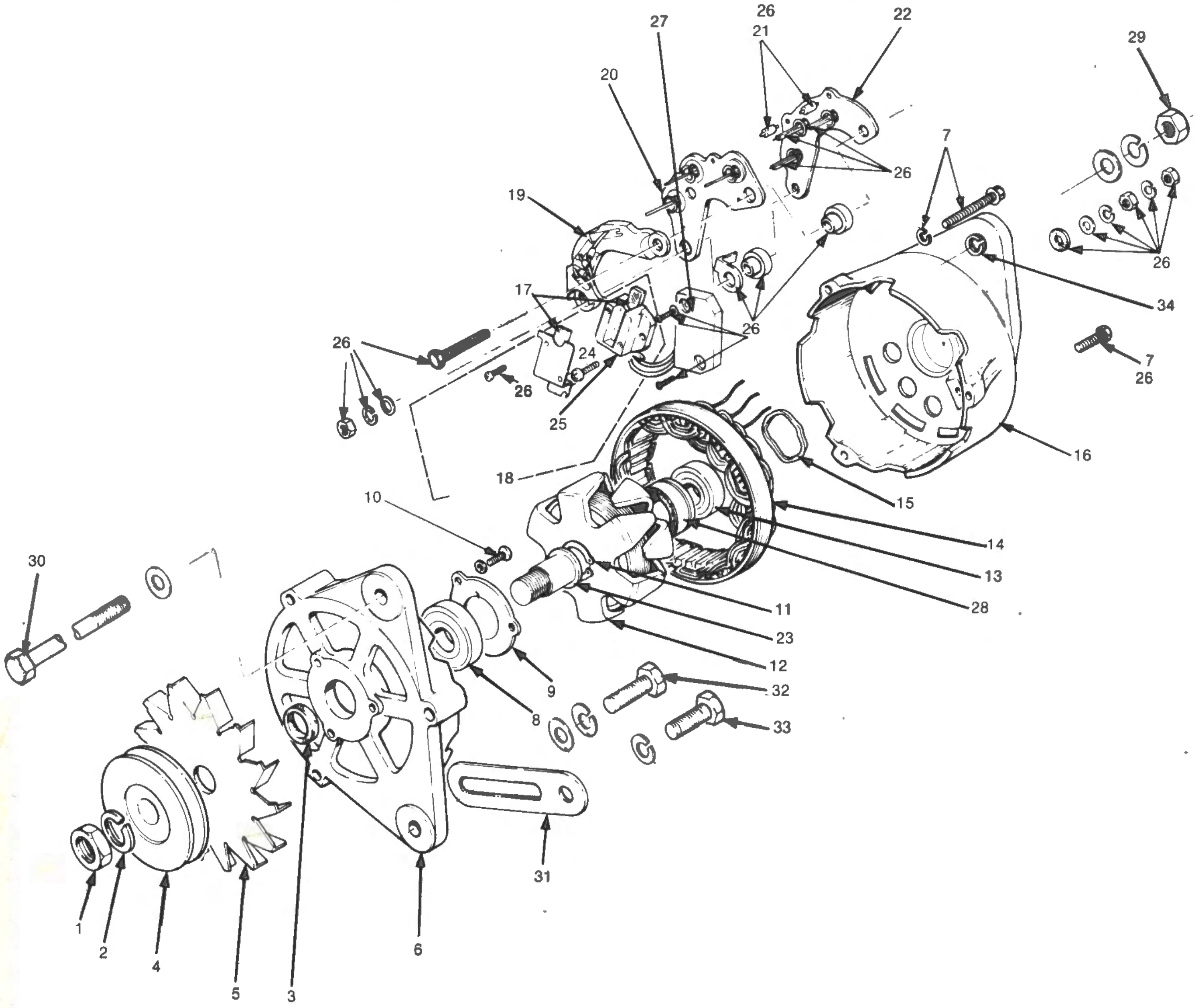


Fig. S-3

THE LUCAS 15ACR ALTERNATOR

1 NUT — PULLEY TO SHAFT
2 WASHER FOR NUT
3 DISTANCE COLLAR
4 PULLEY
5 FAN
6 DRIVE END BRACKET
7 THROUGH BOLT
8 DRIVE END BALL RACE
9 PLATE — BEARING RETAINING
10 SCREW AND WASHER — PLATE RETAINER
11 CIRCLIP — ROTOR TO SHAFT
12 ROTOR
13 BALL RACE — SLIP RING END
14 STATOR
15 WAVY WASHER
16 SLIP RING END BRACKET
17 BRUSH SET
18 BRUSH BOX ASSEMBLY
19 FIELD DIODE AND TERMINAL ASSEMBLY
20 POSITIVE HEAT SINK ASSEMBLY
21 INSULATORS
22 NEGATIVE HEAT SINK ASSEMBLY
23 SUPPORT WASHER — ROTOR SHAFT DRIVE END
24 SCREW — BRUSH BOX FIXING
25 BRUSH BOX MOULDING
26 SUNDRY PARTS KITS ITEMS
27 REGULATOR
28 SLIP RING
29 NUTS AND WASHERS — MOUNTING BOLT
30 WASHER
31 ADJUSTING LINK
32 SCREW AND WASHERS — LINK TO ALTERNATOR
33 SCREW AND WASHERS — LINK TO ENGINE FRONT PLATE
34 ADJUSTING SLEEVE

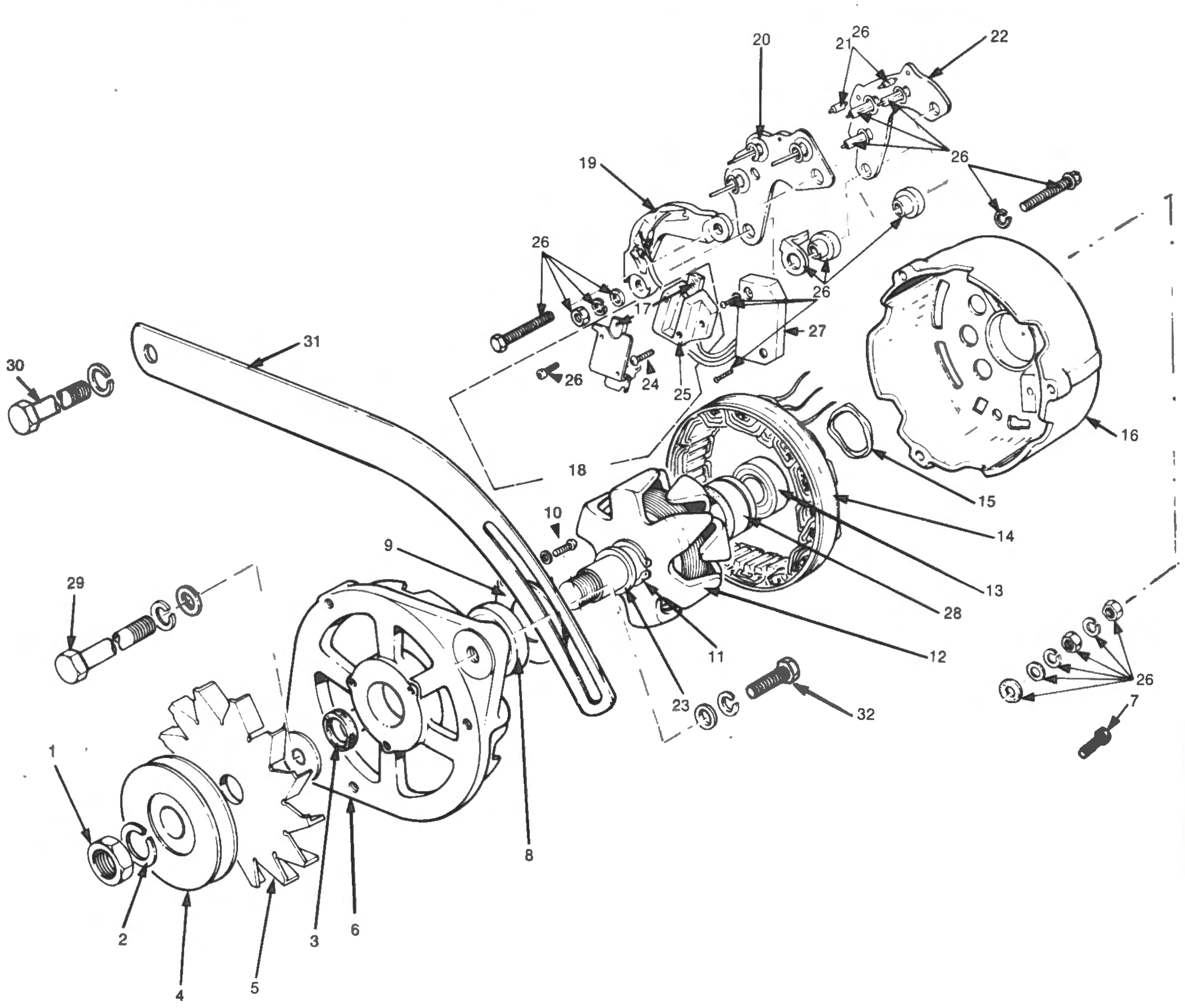


Fig. S-4

THE LUCAS 14ACR ALTERNATOR LUCAS. 62021262

1 NUT — PULLEY TO SHAFT
2 WASHER FOR NUT
3 DISTANCE COLLAR
4 PULLEY
5 FAN
6 DRIVE END BRACKET
7 THROUGH BOLT
8 DRIVE END BALL RACE
9 PLATE — BEARING RETAINING
10 SCREW AND WASHER — PLATE RETAINER
11 CIRCLIP — ROTOR TO SHAFT
12 ROTOR
13 BALL RACE — SLIP RING END
14 STATOR
15 WAVY WASHER
16 SLIP RING END BRACKET
17 BRUSH SET
18 BRUSH BOX ASSEMBLY
19 FIELD DIODE AND TERMINAL ASSEMBLY
20 POSITIVE HEAT SINK ASSEMBLY
21 INSULATORS
22 NEGATIVE HEAT SINK ASSEMBLY
23 SUPPORT WASHER — ROTOR SHAFT DRIVE END
24 SCREW — BRUSH BOX FIXING
25 BRUSH BOX MOULDING
26 SUNDRY PARTS KIT ITEMS
27 REGULATOR
28 SLIP RING
29 MOUNTING THROUGH BOLT AND WASHERS
30 BOLT AND WASHERS — ADJUSTING LINK TO COOLANT PUMP
31 ADJUSTING LINK
32 SCREW AND WASHERS — ADJUSTING LINK TO DRIVE END BRACKET

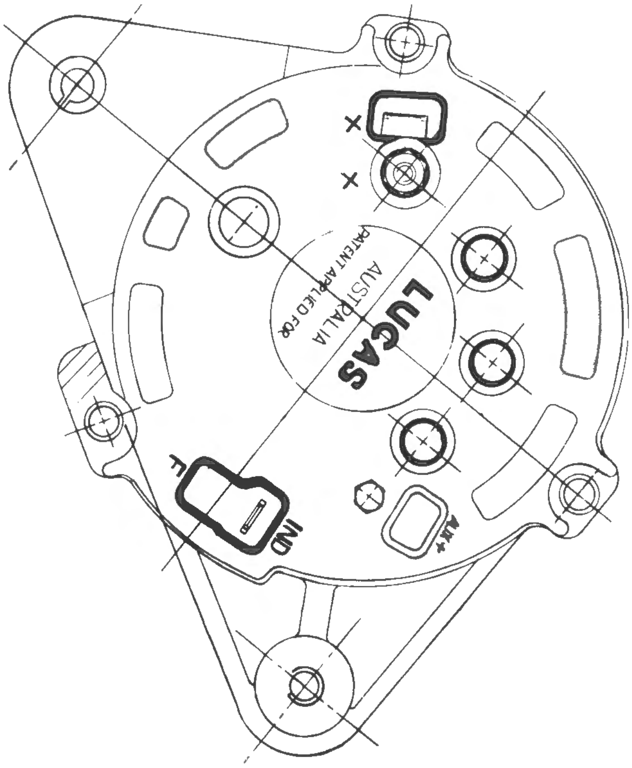


Fig. S-5

LUCAS 15ACR-3D ALTERNATOR
REAR VIEW

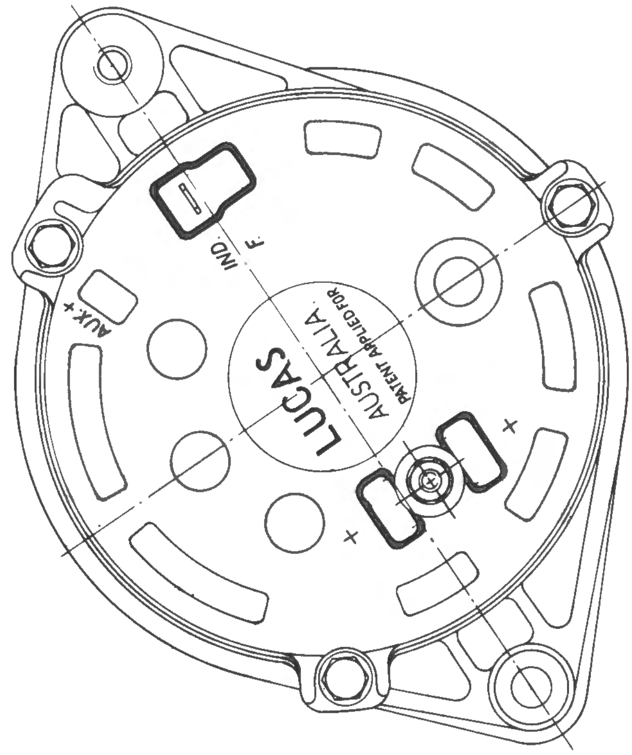


Fig. S-6

LUCAS 14ACR-4D/6D ALTERNATOR
REAR VIEW

2 Driving Belt Adjustment

Occasionally inspect the driving belt for wear and tension. The use of an approved replacement belt is essential on alternator installations.

A slipping belt whether caused by oil contamination or insufficient tension will result in reduced alternator output and excessive wear on belts and pulleys.

An overtight belt could result in premature failure of the alternator and water pump bearings.

ALTERNATOR DRIVE BELT ADJUSTMENT

1. Loosen the mounting bolt.
2. Loosen the bolt securing the alternator to the adjusting link. Fig. S-7 and S-8.
3. Move the alternator by hand and tighten the adjusting link bolts.
4. Check the belt tension by applying firm finger pressure at the mid-point of the longest run of the belt. Deflection should be 12.7 mm (½ in).

Lubrication

The ball race bearings in both end brackets are packed with grease during assembly and will normally require no further lubrication except during major overhaul.

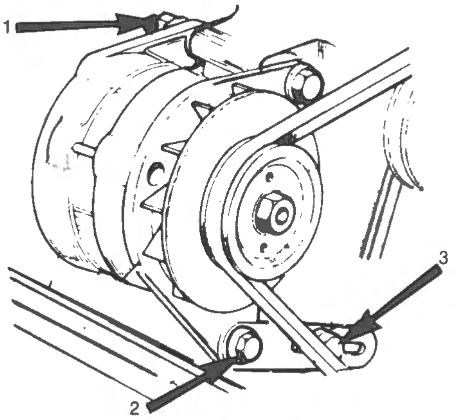


Fig. S-7

ALTERNATOR BELT ADJUSTING POINTS
6 CYLINDER

1 ALTERNATOR MOUNTING BOLT

2 SCREW – LINK TO ALTERNATOR

3 LOCK SCREW – ADJUSTING LINK TO ENGINE FRONT PLATE

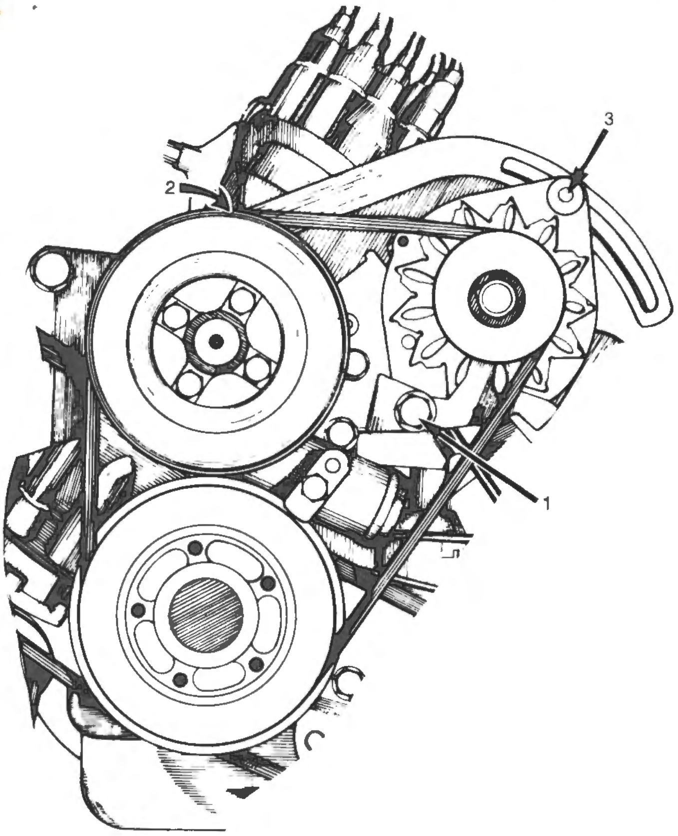


Fig. S-8

ALTERNATOR BELT ADJUSTING POINTS
8 CYLINDER

1 ALTERNATOR MOUNTING THROUGH BOLT
2 SCREW – ADJUSTING LINK TO COOLANT PUMP
3 LOCK SCREW – LINK TO ALTERNATOR

Removing

The alternator on the 8 cylinder engine is situated on the left hand side of the engine and on the 6 cylinder engine the alternator is situated on the right hand side of the engine.

1. Disconnect the battery.
2. Detach the terminal connectors from the alternator and note the positions.
3. Slacken the alternator securing bolts and move the alternator to remove the drive bolt.
4. Remove the bolt from the alternator adjusting link.
5. Withdraw the mounting bolt and remove the alternator.

Refitting

1. Refitting is the reverse of the removing procedures 1 to 5.
2. Adjust the tension of the belt as previously described.

TESTING

Alternator Charging Lamp

The charging system warning lamp is normally extinguished at all speeds once the engine is started. However, it will glow if any of the following conditions occur in the charging system.

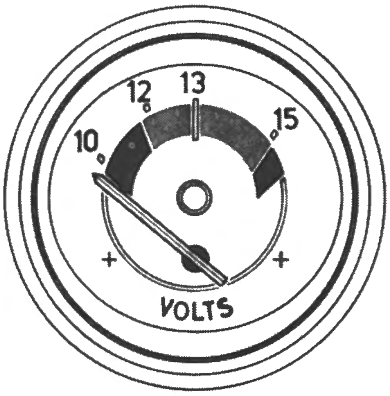
1. No output from the charging system.
2. Open circuit exciter diode/s — Output below normal.
3. Short circuited exciter diode/s — Output approximately only 30 per cent of full capacity.
4. Open or shorted negative power diodes.

TESTING

Test Data	15ACR-3D	14ACR-4D	14ACR-6D
Nominal D.C. Output	35 Amps	40 Amps	55 Amps
Stator Phases	3	3	3
Stator winding connections	Star	Star	Star
Number of Poles	12	12	12
Resistance of rotor winding	3.5 ohms ± 5% @ 20°C	3.3 ohms ± 5% @ 20°C	3.0 ohms ± 5% @ 20°C
Resistance of stator winding	0.198 ohms per phase	0.23 ohms per phase	0.15 ohms per phase
Slip ring bushes length (min.)	6.35 mm (0.25 in)	12.7 mm (0.50 in)	12.7 mm (0.50 in)
Alternator to engine 6 Cyl.	1.84:1	1.84:1	—
Speed Ratio 8 Cyl.	—	2.0:1	2.0:1
Earth Polarity	Negative	Negative	Negative
Nominal Voltage	12V	12V	12V
Voltage Regulator	Non-adjustable pre-set during manufacture.		

Battery Condition Indicator

The battery condition indicator applicable to some models indicates the state of battery charge, charging voltage too high or too low as shown in the following chart.



ENGINE NOT RUNNING			ENGINE RUNNING ABOVE IDLE		
Battery charge extremely low	**Battery charge low**	**Battery well charged**	**Charging voltage low**	**Charging voltage satisfactory**	**Charging voltage too high**
If with the ignition and electrical equipment, e.g. headlights, etc., switched on, but with the engine not running the indicator settles in this section, your battery requires attention.		Ideally, the indicator should settle in this section when the ignition and electrical equipment, e.g. headlights, etc., are switched on and engine is not running.	This condition may be indicated when the headlights and other equipment are in use.	The indicator should point to this section when the engine is running above idle.	If the indicator continues to point to this section after 10 minutes' running, either your voltage regulator requires attention or some other fault has developed.

Testing Alternator on the Engine

Check the condition of the battery and ensure that it is fully charged before making the necessary tests.

Equipment Requirements

The alternator and voltage regulator test procedures on the vehicle or on the bench are as follows:

0.60 amp Moving Coil Ammeter
0.20 Volt Moving Coil Voltmeter
Fully charged 12 volt battery
Carbon pile resistance or lamp load to carry 55 amps (min).

The following tests will indicate the condition of the alternator.

1 Check the driving belt for condition and tension as a slipping belt will not permit accurate results to be obtained.

2 Start and run the engine until the alternator reaches normal operating temperature and check the battery to ensure that it is in a fully charged condition.

Output Test with Regulator Inoperative

(a) Connect an external test circuit as shown in Fig. S-9.

(b) Earth the output transistor casing to the slip ring end bracket.

(c) Run the engine at 1500 alternator rpm at which point the ignition warning light should be extinguished.

(d) Increase the alternator speed to 6000 rpm and adjust the lamp load or resistance until the voltmeter maintains a reading of 13.4-13.6 volts.

(e) The ammeter reading at the above speed and voltage should be approximately equal to the rated output of 35 amperes for the 15 ACR-3D, 40 amperes for the 14 ACR-4D and 55 amperes for the 14 ACR-6D.

3 Any appreciable deviation from these figures will necessitate the alternator being removed from the engine for further examination.

4 Failure of one or more of the diodes will be indicated in the above test by the effect on the alternator output and also in some instances by abnormally high alternator temperature and noise level.

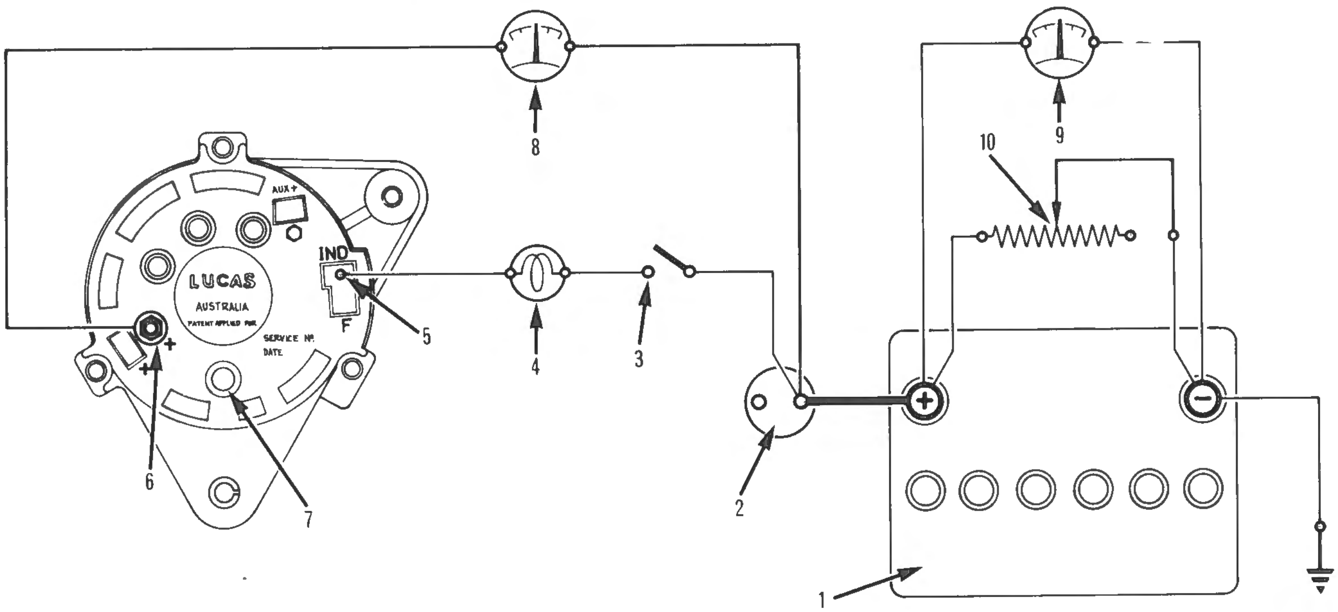


Fig. S-9

TESTING ALTERNATOR IN POSITION

6 AND 8 CYLINDER ENGINES
OUTPUT TEST

1 BATTERY
2 STARTER SOLENOID
3 IGNITION SWITCH
4 IGNITION WARNING LAMP
5 NEGATIVE CONNECTOR 'IND'
6 POSITIVE CONNECTOR '+'
7 OUTPUT TRANSISTOR
8 AMMETER 0-60 AMP
9 VOLTMETER 0-20 VOLT
10 LOAD RESISTANCE

Testing Regulator

After carrying out the preceding alternator full load tests in which the alternator has proved satisfactory, the following regulator tests may be carried out:

1. Remove the earthing link from the output transistor casing and the slip ring end bracket.
2. With the remainder of the test circuit connected as for the alternator output test, start the engine and increase the speed until the alternator is running at approximately 6000 rpm. Adjust the lamp load or resistance to maintain a current absorption of approximately 11 amperes combined with a voltmeter reading of 14.3 volts _ 0.2 volts.
3. Any appreciable variation from this voltage indicates that the regulator is not functioning correctly and must be replaced. (The regulator is non adjustable).
4. If both tests show the alternator and regulator to be functioning correctly, remove the test equipment and reconnect the charging circuit as normal.

Checking for High Resistance

1. Connect a low range voltmeter between the alternator positive terminal and the battery positive terminal. Fig. S-9. Switch on the headlamps, start the engine and increase speed to 6000 alternator rpm. Note the voltmeter reading.
2. Transfer the voltmeter connections to the alternator body and battery negative terminal Fig. S-9 and note the voltmeter reading.
Should the voltmeter reading exceed 0.5 volt on the positive side or 0.25 volt on the negative side, there is a high resistance in the charging circuit which must be located and rectified.

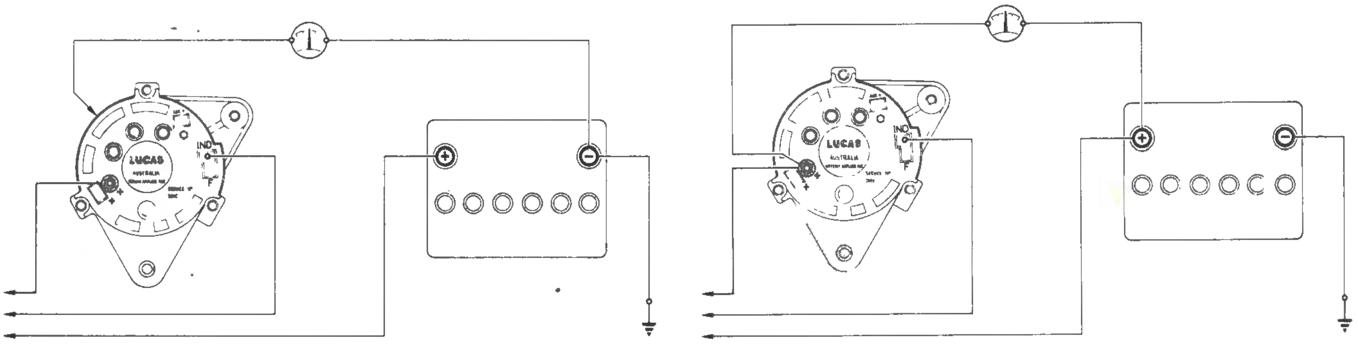


Fig. S-10

HIGH RESISTANCE TESTS

Noise Diagnosis

Excessive noise developed within the engine compartment by a glazed drive belt is often falsely diagnosed as noisy alternator bearings.

A glazed belt may be easily recognised by the hard polished appearance on the driving or 'V' section face of the belt. As material fractures are likely to occur in a glazed belt, it is recommended that it be carefully inspected to determine whether replacement is necessary.

Should the noise still be present after restarting the engine, proceed with tests of the water pump and alternator as outlined in the following section.

With engine stationary, remove drive belt, restart engine and listen for the noise. Do not run the engine for longer than twenty seconds.

If noise persists, the alternator and engine water pump assembly may be disregarded as the cause of the noise.

If operation of the engine without the drive belt eliminates the noise, the source is quite likely either in the alternator or engine water pump or both; or is possibly being caused by a faulty drive belt.

A light smear of 'Dri' lubricant or soap on the contact surfaces of the drive belt (whilst the engine is stationary) will provide a quick means of determining whether the noise can be attributed to the belt.

Prior to re-installing the drive belt, briskly spin first the alternator pulley and then the water pump pulley by hand, to establish if there is an obvious indication of roughness in either of these units.

If these tests by hand do not assist as a guide in determining which of the two is causing the noise, fully inspect the drive belt and renew if frayed, cracked or worn, refit to engine and adjust to correct tension.

Before conducting further noise tests check the following:

(a) Alternator mounting bolt must be tight.

(b) BOTH alternator tension bracket bolts must be tight.

Run the engine at various speeds between idle and approximately 2000 rpm listening carefully for the noise using a 'sounding rod' or an automotive type stethoscope.

Correct belt tension is essential for efficient operation of the alternator and vehicle cooling system but must not be excessive, otherwise damage to the bearings of driven components can result.

STARTER MOTOR

DESCRIPTION

The starter motor is a Lucas 12 volt M40-15 AK model, equipped with a solenoid operated pre-engaged drive assembly. The commutator is mounted on the end face of the armature and the four spring loaded brushes move longitudinally to maintain contact with the commutator. Refer Fig. S-11.

Removing

6 CYLINDER ENGINE

1. Disconnect battery.
2. Disconnect leads from solenoid.
3. Remove the two bolts securing the starter motor to the engine adaptor plate.
4. Withdraw the starter motor.

8 CYLINDER ENGINE

1. Disconnect battery.
2. Raise vehicle to suitable working height supporting on stands.
3. Disconnect leads from solenoid.
4. Remove the two bolts securing starter motor to the flywheel housing.
5. Withdraw the starter motor.

NOTE: On models equipped with automatic transmissions, it may be necessary to angle the starter motor to clear the transmission oil cooler pipes.

Refitting

6 CYLINDER AND 8 CYLINDER ENGINES

1. Refitting is a reversal of the removing procedure.

Maintenance

Routine maintenance is not necessary, but an occasional check should be made on the tightness of the solenoid and the vehicle battery terminal connections.

Dismantling

1. Disconnect the flexible lead from the solenoid 'STA' (starter) terminal.
2. Remove the nuts and washers securing the solenoid to the starter motor drive end bracket and withdraw the solenoid plunger (the plunger is hooked over the pinion actuating lever).
3. Remove the starter yoke through-bolts, withdraw the drive end bracket and armature as an assembly.

NOTE: There is a thrust washer at the commutator end of the armature.

4. Separate the armature from the drive end bracket.
5. Remove the two brush box retaining screws located on the rear face of the commutator end bracket. Brushes and brush springs can now be removed for detailed inspection.

Inspecting

1. After dismantling the starter motor, examine individual items. Each of the four brushes should be free to move in the brush box moulding. Sticking brushes can usually be freed by cleaning the brushes and moulding with a petrol moistened

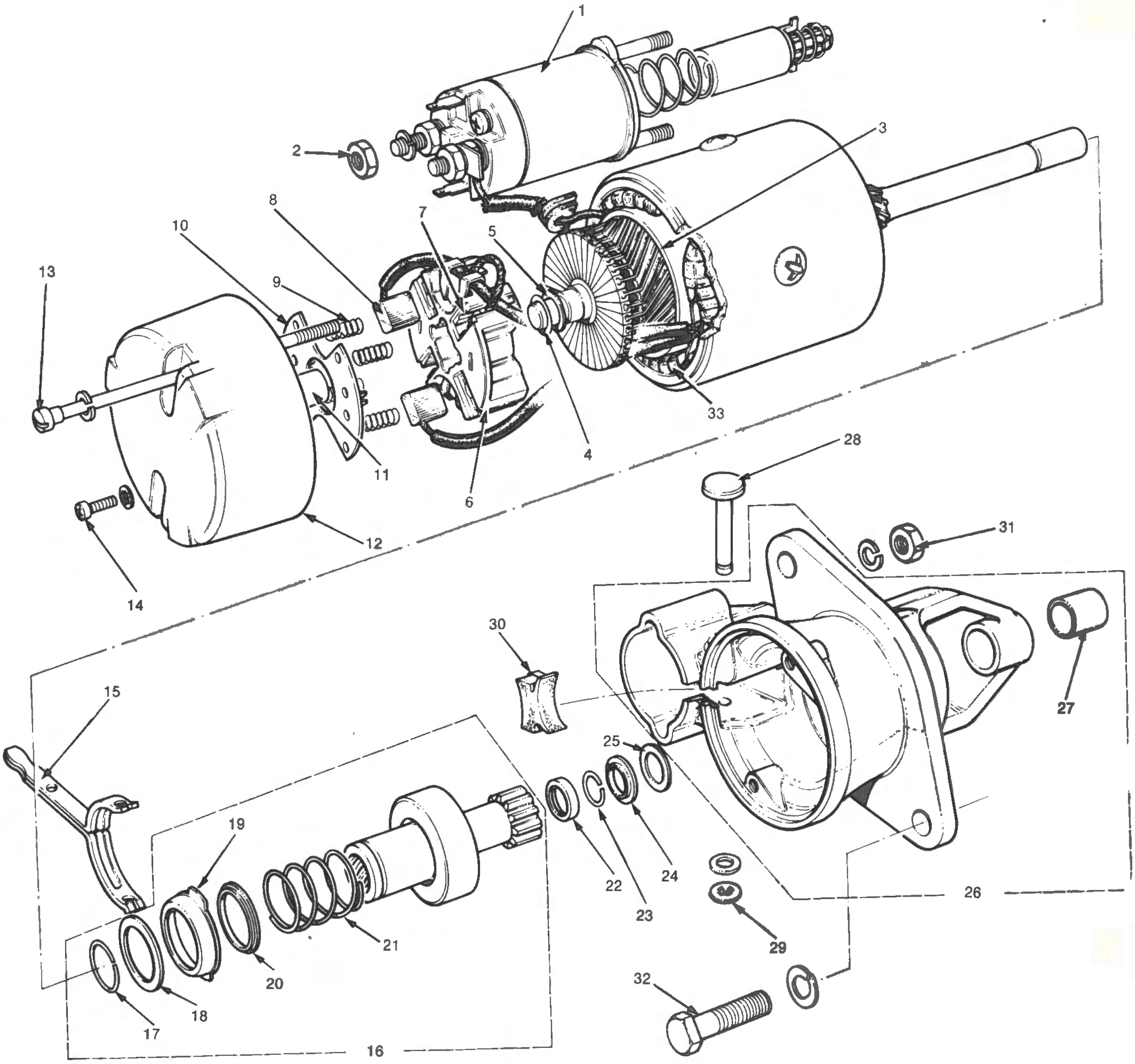


Fig. S-11

LUCAS M40-15AK STARTER MOTOR 62923078 A

LAYOUT OF STARTER MOTOR COMPONENTS 6 AND 8 CYLINDER

1 SOLENOID LUCAS 62964009A
2 TERMINAL NUTS AND WASHERS
3 ARMATURE
4 SHIM WASHER
5 SPACER
6 BRUSH BOX MOULDING
7 ARMATURE BRUSHES (2)
8 FIELD BRUSHES (2)
9 BRUSH SPRINGS
10 SPRING SEAT
11 ARMATURE BRUSH — CE
12 END BRACKET — CE
13 FIXING THROUGH BOLT AND WASHER
14 SCREW AND WASHER — BRUSH BOX FIXING
15 LEVER — PINION ENGAGING
16 DRIVE ASSEMBLY
17 RETAINING RING
18 WASHER
19 OPERATING PLATE
20 SPRING SEAT
21 SPRING
22 RETAINING RING SLEEVE
23 RETAINING RING
24 RETAINING RING COLLAR
25 SPACER
26 DRIVE END BRACKET ASSEMBLY
27 BUSH
28 PIVOT — PINION ENGAGING LEVER, EARLY MODELS — SCREWED ECCENTRIC PIVOT
29 PUSH-ON-FIX AND WASHER FOR PIVOT, EARLY MODELS — LOCKNUT
30 SEAL
31 NUTS, WASHERS SOLENOID TO END BRACKET
32 BOLTS AND WASHERS STARTER MOTOR TO FLYWHEEL HOUSING
33 FIELD COILS

SPARE STARTER MOTOR No 684m

cloth. Brushes which are worn to or are approaching 9.5 mm (⅜ in) in length must be renewed as a set.

Replacing the Brushes

1 The two earth brushes, flexible connectors and fixing plates are serviced as complete assemblies.

2 To replace the field coil brushes, cut off their flexible leads 6.35 mm (¼ in) from the field winding joint. Solder the new long and short brush flexible leads to the ends of the original brush leads.

NOTE: Note the positions of the long and short brush flexibles in relation to the commutator end bracket and field winding location, before cutting off leads.

3 Ensure that the insulated sleeves on the new flexible leads provide the maximum coverage consistent with satisfactory soldering.

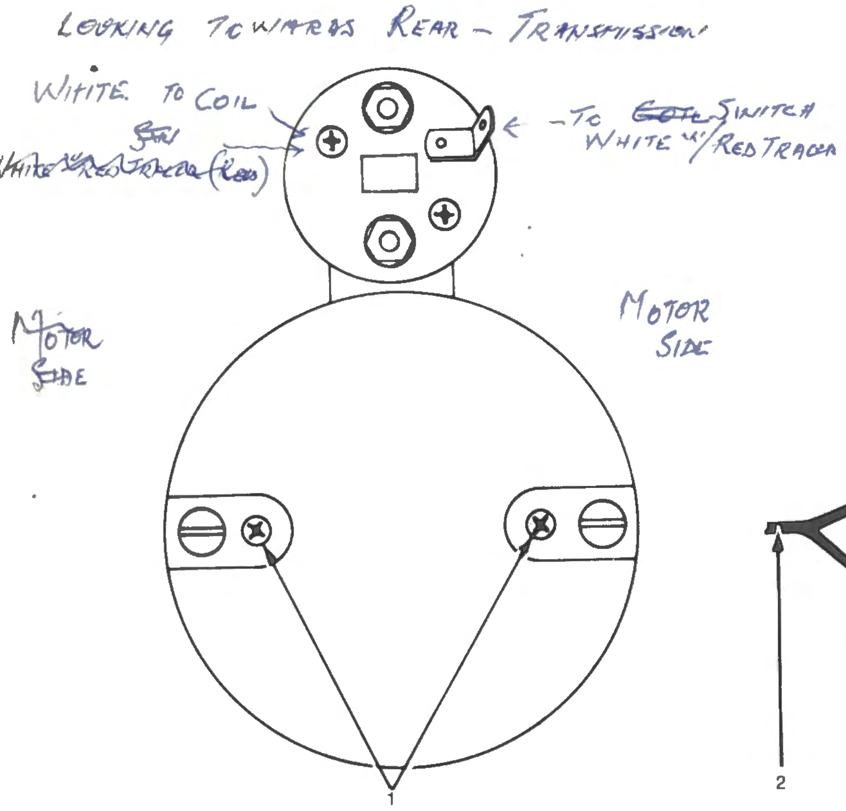


Fig. S-12

COMMUTATOR END BRACKET

1 BRUSH GEAR RETAINING SCREWS

Commutator

1 A commutator in good condition will be burnished and free from pits and burned spots. Clean the commutator with a petrol moistened cloth.

2 If the commutator is badly worn, mount the armature between centres in a lathe, rotate at high speed and take a light cut with a very sharp tool, removing no more metal than necessary and finally polish with very fine glass paper. DO NOT undercut the commutator segments.

Bearing Replacement

1 Both end brackets are fitted with self-lubricating porous bronze bearing bushes. New bushes must be immersed in clean engine oil (SAE 30/40 Grade) for a minimum of 24 hours before fitting and they must not be reamed after fitting otherwise the self lubricating qualities will be impaired.

2 Bushes should be replaced on the occasion of major engine overhaul or when the starter motor is to be fitted to a replacement engine.

3 The bush in the drive end bracket can be pressed out while supporting the bracket.

4 Remove the bush in the commutator end bracket by inserting a 14 mm (9/16 in) tap for a few turns into the bush and withdraw the bush with the tap.

Assembling

1 Assembling is a reversal of the dismantling procedure, noting the following:

(a) When assembling the commutator end bracket it is important the long and short field brush flexible leads are fitted into their original brush holders and that the long field brush lead is laced through the arch of its adjoining earth brush fixing plate.

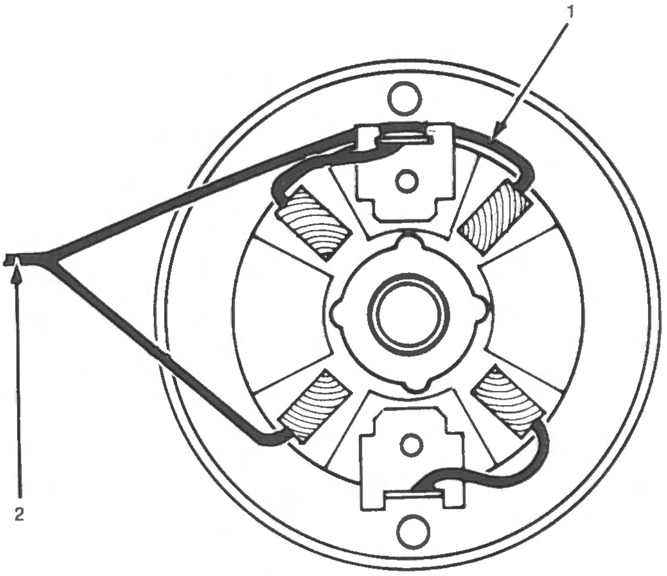


Fig. S-13

COMMUTATOR END BRACKET
FRONT INSIDE VIEW

1 LONG FIELD BRUSH LEAD THREADED THROUGH EARTH BRUSH TERMINAL

2 LEADS TO FIELD COILS

STARTER MOTOR SOLENOID

Removing

1 Disconnect battery.

2 Disconnect terminals and leads from solenoid.

NEW WIRES FITTED TO END CONNECTIONS TO SOLENOID (DUE TO BEING BURNT)
WHITE: STILL WHITE WITH GREEN STAINS
WHITE W/ RED TRACER NOW RED
BOTH BROWN ON ONE CONNECTION NOW BLACK W/ YELLOW TRACER & BLUE W/ BLACK TRACER

3 Remove the four nuts retaining exhaust pipes to manifolds. (This operation is required on the 8 cylinder engine model only). Let exhaust pipes hang down.

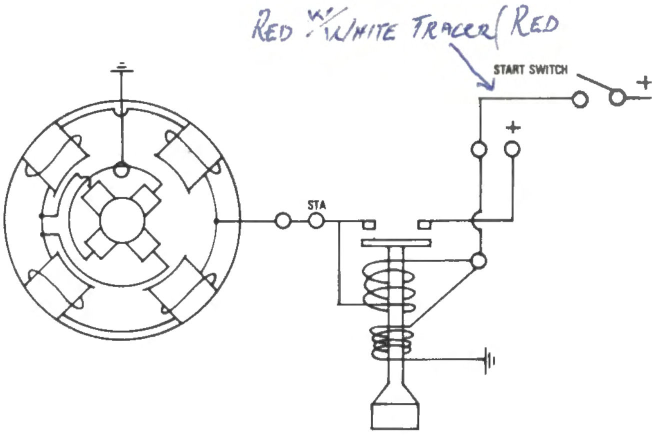


Fig. S-14

STARTER MOTOR WIRING DIAGRAM

4 Remove the solenoid retaining nuts.

5 Withdraw the solenoid.

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

(a) Ensure all terminals are tightened correctly.

(b) Ensure that the drive operating lever is positioned correctly on the operating plate and solenoid plunger assembly.

(c) Ensure that the internal thrust washer is fitted on the commutator end of the armature shaft.

(d) Tighten solenoid retaining nuts to 6.1 Nm (4.5 lb.f.ft.).

TEST DATA

Pull in voltage	7.5 volts maximum
Current Draw 2 coils	60 amps maximum
Hold in Winding	12 amps
Resistance Series Winding	0.225 ± 0.017 ohms
Resistance Shunt Winding	0.95 ± 0.07 ohms
Solenoid fixing nuts	Torque 6.1 Nm (4.5 lb.f.ft.)
Terminal nut	Torque 2.20-2.70 Nm (20-24 lb.f.in.)

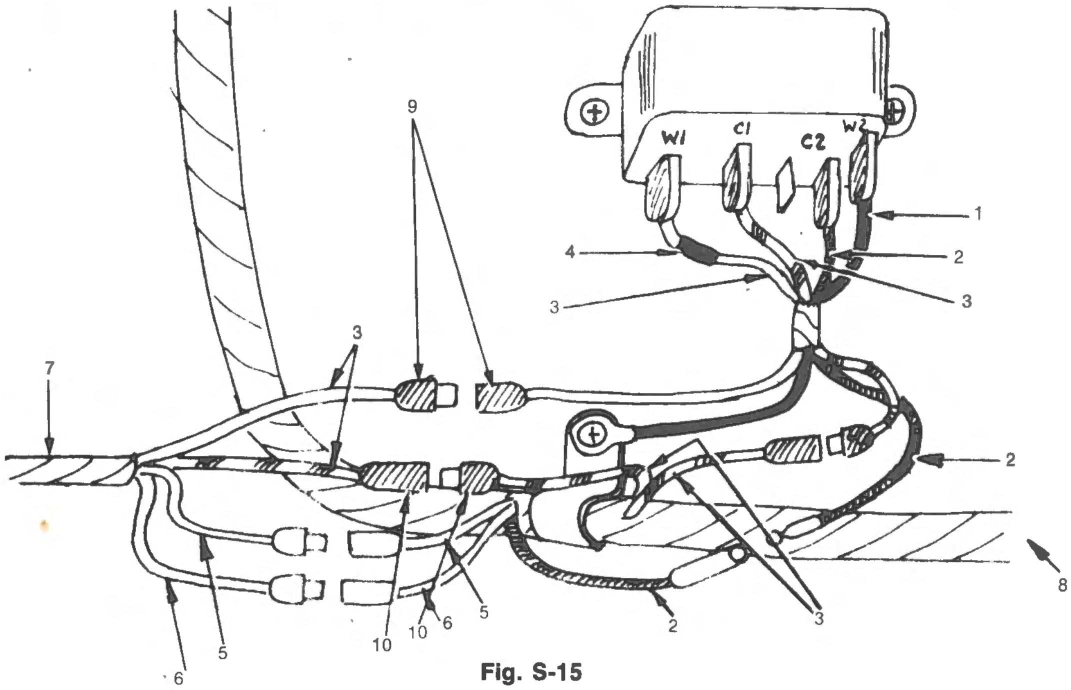


Fig. S-15

STARTER RELAY INSTALLATION AUTOMATIC MODELS

1 BLACK
2 BROWN
3 WHITE WITH RED
4 IDENTIFICATION TAG
5 GREEN
6 GREEN WITH BROWN
7 INHIBITOR SWITCH HARNESS
8 MAIN HARNESS
9 MALE BLADE TERMINAL OF INHIBITOR HARNESS (WHITE/RED) MUST BE CONNECTED TO FEMALE TERMINAL OF RELAY HARNESS (WHITE/RED IDENTIFIED)
10 MALE BLADE TERMINAL OF MAIN HARNESS (WHITE/RED) MUST BE CONNECTED TO FEMALE TERMINAL OF INHIBITOR HARNESS (WHITE/RED)

STARTER MOTOR RELAY

On cars fitted with automatic transmission a relay is fitted to overcome voltage drop caused by the inhibitor switch being fitted. The unit is not serviceable except by replacement.

Roller Clutch Drive

The roller clutch drive is a freewheeling device which prevents the armature from being rotated at an excessive speed in the event of the starter pinion remaining in mesh with the flywheel ring gear after the engine has started.

Should the roller clutch drive prove faulty, a replacement unit must be fitted.

Removing

1 Remove starter motor.

2 Remove armature from the starter motor.

3 Mount the armature pinion end upwards in a press and apply pressure to the thrust collar.

4 Remove jump ring and remove drive unit from armature shaft.

Refitting

1 Reverse the removing procedures 1 to 4 noting the following points:

(a) Fit a new jump ring when assembling drive unit.

(b) Lightly lubricate all moving parts with Molybond CS10 or equivalent.

(c) Ensure that the drive unit moves freely around and along the armature shaft splines.

WINDSCREEN WIPER MOTOR AND WASHER ASSEMBLY

DESCRIPTION

The Preslite two speed wiper motor comprises a self switching power unit driving two wiper arm pivot assemblies, by means of a linkage.

The motor has a permanent magnetic field consisting of two ceramic magnets housed in a cylindrical yoke, a work gear formed in the extended armature shaft drives a moulded gear wheel within the die cast gearbox. Motion is imparted to the linkage by a crank located on the gearwheel and shaft assembly. The washer motor assembly is integral with the windscreen wiper motor assembly.

Maintenance

1 All bearings are adequately lubricated during manufacture and require no maintenance.

2 Oil, tar or similar deposits should be removed from the windscreen with methylated spirits. Silicone or wax polishes must not be used for this purpose.

KEY TO FIG. S-16

1 WASHER PUMP ASSEMBLY
2 SCREWS WASHER PUMP TO GEAR HOUSING
3 GEAR AND SHAFT ASSEMBLY
4 DISTANCE WASHER
5 GEAR HOUSING
6 COLLECTOR PLATE
7 TERMINAL BLOCK
8 ARMATURE
9 MOUNTING PLATE
10 ARMATURE THRUST CONE AND SCREW
11 MOUNTING GROMMET
12 NUT WASHERS AND SLEEVE FOR MOUNTING
13 DISTANCE WASHER
14 WAVE WASHER
15 DRIVE DOG
16 WAVE WASHER
17 MOTOR CRANK ASSEMBLY
18 CLAMPING PLATE
19 CLAMPING NUT AND LOCK WASHER
20 CAM FOLLOWER ASSEMBLY
21 CONICAL SPRING
22 WASHER AND CIRCLIP
23 WIPER CONNECTING LINK
24 PIVOT ASSEMBLY — DRIVEN
25 GASKET FOR PIVOT ASSEMBLY
26 NUT AND WASHER PIVOT ASSEMBLY
27 LINK — WIPER DRIVE
28 PIVOT ASSEMBLY — WIPER DRIVE
29 GASKET FOR PIVOT
30 MOTOR THROUGH BOLT AND WASHER
31 MOTOR HOUSING ASSEMBLY
32 ARMATURE THRUST PAD
33 ARMATURE THRUST BALL
34 LINKAGE CLIPS
35 BRUSH AND SPRING ASSEMBLY
36 WIPER ARM ASSEMBLY
37 WIPER BLADE ASSEMBLY
38 WASHER JETS
39 WASHER JET HOSE
40 HOSE WASHER PUMP TO RESERVOIR
41 WASHER RESERVOIR
42 RESERVOIR SECURING SCREWS AND WASHER
43 PICK-UP FILTER
44 SCREWS AND WASHERS — WIPER TO MOUNTING BRACKET

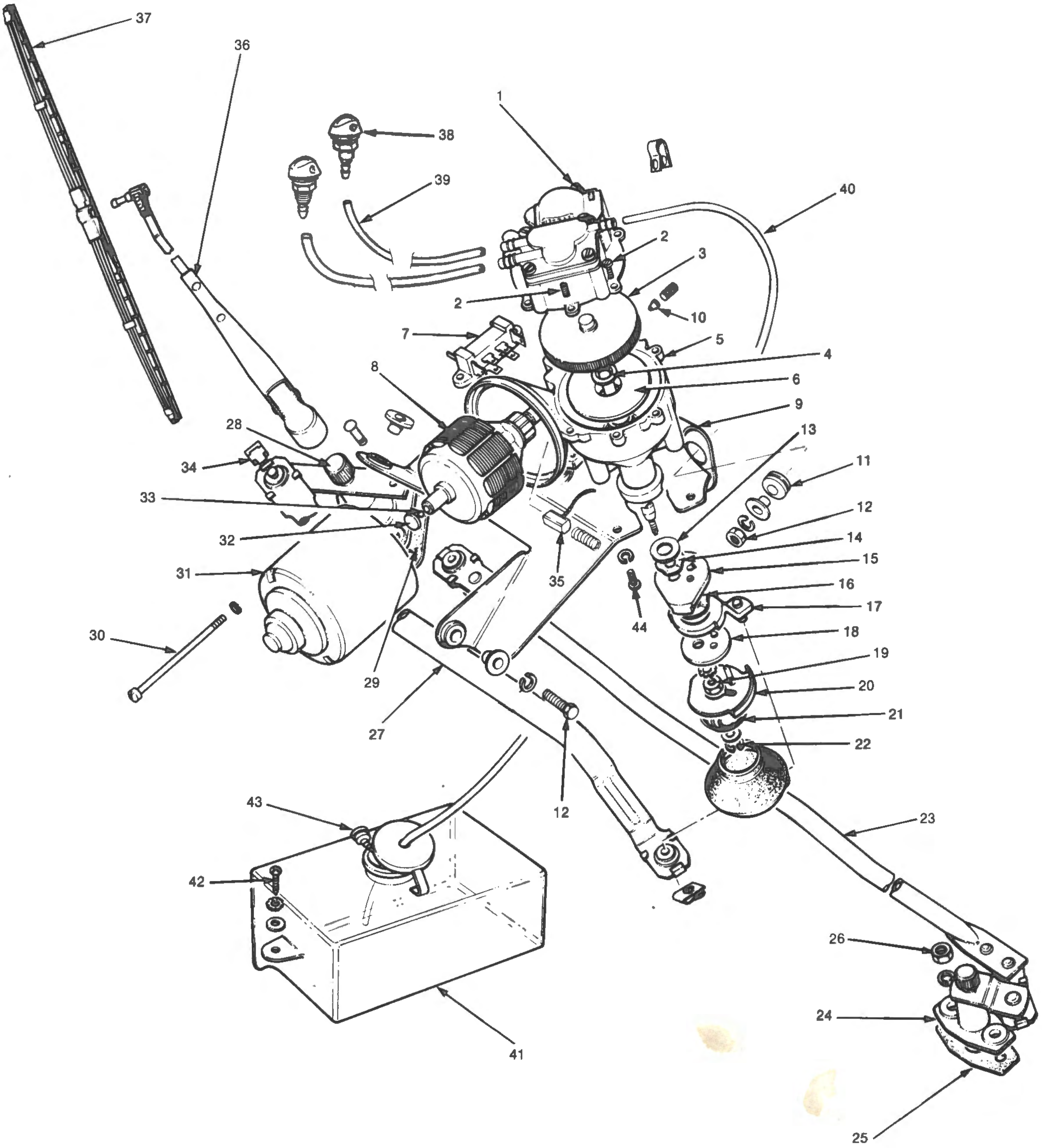


Fig. S-16

LAYOUT OF WINDSCREEN WIPER AND WASHER COMPONENTS

WIPER MOTOR AND WASHER ASSEMBLY

Removing

1 Disconnect the battery.

2 Disconnect the wiper motor and washer motor leads.

3 Remove the three tubes from the washer unit.

4 Remove clip retaining wiper linkage to the right hand side pivot assembly.

5 Remove the two bolts and a nut securing the assembly to the plenum chamber.

6 Remove assembly from vehicle.

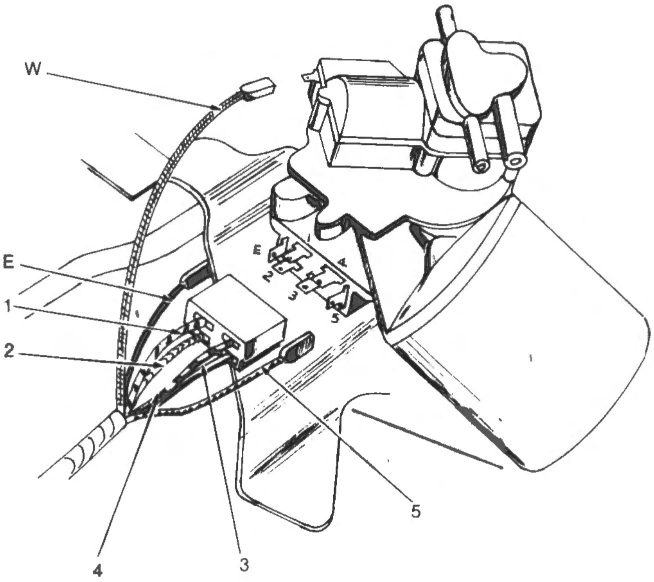


Fig. S-17

WINDSCREEN WIPER EXTERNAL WIRING CONNECTIONS

E	BLACK
1	RED/LT. GREEN
2	BROWN/LT. GREEN
3	BLACK/GREEN
4	BLUE/LT. GREEN
5	WHITE/BLUE
W	LT. GREEN/BLACK

Refitting

1 Refitting is a reversal of the removing procedure noting the following:

(a) Before refitting unit ensure linkage is in correct relation to the pivot arm.

(b) Ensure correct connection of windscreen wiper wires and washer hoses.

WINDSCREEN WIPER BLADES

When fitting windscreen wiper arms it is essential that they be installed correctly otherwise one of the following malfunctions may occur.

(a) Jamming of the linkage which in time will cause the motor to burn out.

(b) Incorrect parking of the blades.

(c) Damage of the wiper blades on the windscreen pillar or blade stops.

Removing

1 Insert a screwdriver blade between the wiper arm and the wiper blade and prise apart.

Refitting

1 To refit locate the wiper blade on to the pivot pin attached to the wiper arm and firmly press together.

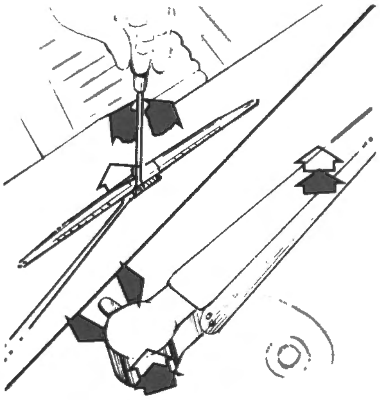


Fig. S-18

REMOVING THE WIPER BLADES AND ARMS

WINDSCREEN WIPER ARMS

Removing

1 Raise the bonnet.

2 Lift the wiper arm away from the windscreen and move the locking plate clear of the drive shaft.

3 Prise the wiper arm clear of the drive shaft.

Refitting

1 Raise the bonnet.

2 Turn on the windscreen wiper switch.

3 Turn the ignition switch on 'IGN'.

4 Apply load to the linkage by holding the right hand side drive shaft between thumb and forefinger. (This ensures that the system is in the correct operating arc.)

5 Turn the ignition switch to the off position when the drive shaft is at the full extent of its travel towards the right hand side windscreen pillar.

6 Position the right hand side wiper arm and blade on the drive shaft so that a small clearance exists between the wiper blade and the windscreen pillar.

7 Switch the ignition on and check the traverse of the wiper blade, which should give the maximum sweep without interference with the windscreen pillar or blade stop.

8 Turn the wiper switch to the 'OFF' position and check the 'Park' action and if correct lock the wiper arm in position.

9 Assemble the left hand side wiper arm and blade parallel to the right hand side arm and blade when in the park position.

10 Finally check the operation of both arms and blades at both speeds.

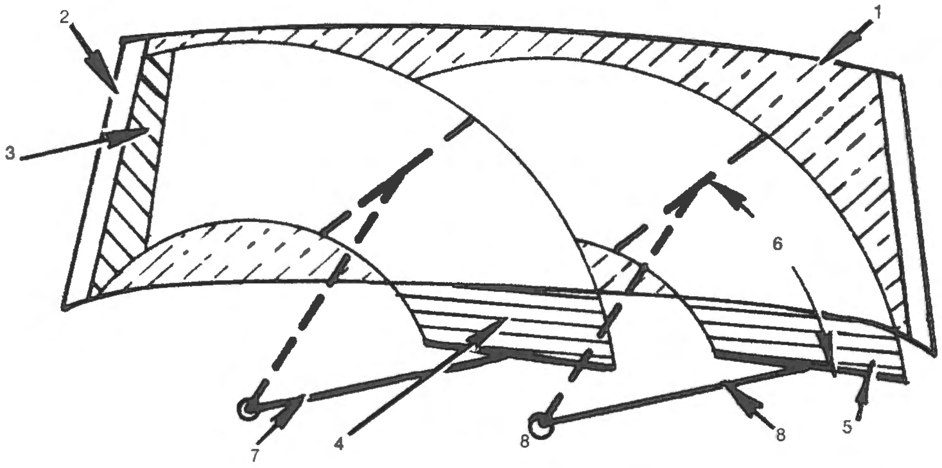


Fig. S-19

CORRECT WIPER ARM BLADE AND BLADE INSTALLATION

1 WINDSCREEN GLASS
2 'A' PILLAR
3 OVER RUN AREA
4 HIDDEN PARK AREA
5 PARK POSITION
6 OPERATING ARC — ARMS PARALLEL
7 RH ARM AND BLADE ASSEMBLY
8 LH ARM AND BLADE ASSEMBLY

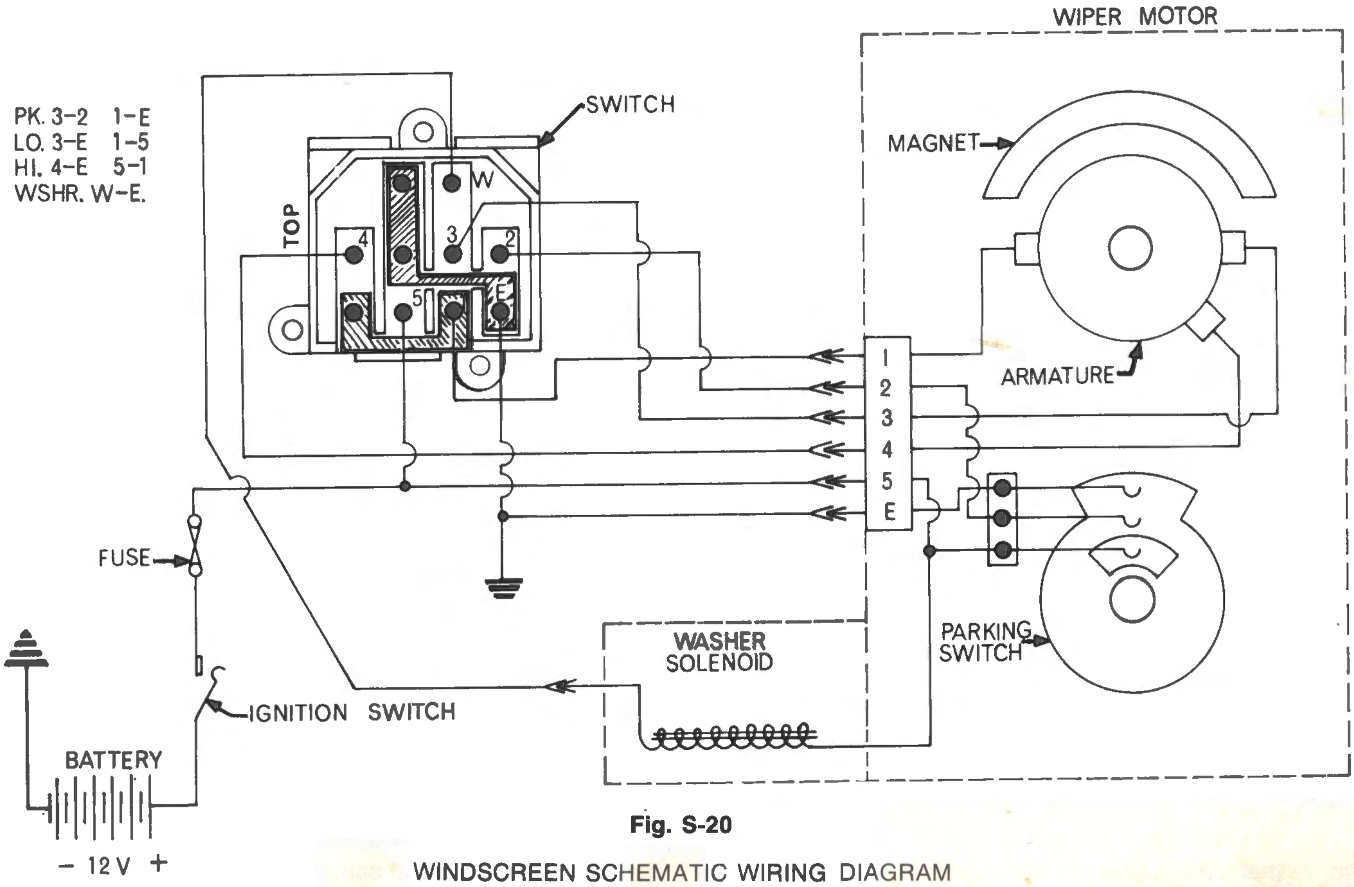


Fig. S-20

WINDSCREEN SCHEMATIC WIRING DIAGRAM

WINDSCREEN WIPER MOTOR

Dismantling

1 Remove wiper motor assembly as previously described.

2 Remove the three screws securing mounting bracket to motor assembly.

3 Remove the rubber dust cover from the motor crank assembly.

4 Remove the circlip and washer retaining cam follower and conical spring assembly from gear shaft.

5 Remove the nut and washer retaining crank arm and drive plate assembly.

6 Remove the two armature housing retaining screws and washers.

WARNING: Do not use force when removing the housing assembly as this may cause damage to the ceramic magnets.

7 Remove the ball and thrust pad from the motor housing.

NOTE: The ball may be dislodged and become attracted to the magnets during the dismantling operation, and it is essential that the ball is located and removed.

8 Retract the brushes and withdraw the armature assembly and thrust cone.

9 Remove the screws retaining the washer pump assembly to the die cast gear wheel housing.

10 Disconnect the lead to terminal block and remove the washer pump assembly.

11 Remove the gear and shaft assembly, distance washer and collector plate from gear housing.

12 Remove the two screws securing terminal block assembly and remove the soldered wires from housing.

Inspecting

1 Cover motor housing bearings and blow dust from interior with compressed air.

NOTE: Do not use any solvents for internal cleaning.

2 Inspect for damage to the ceramic magnets. Replace motor housing assembly if necessary.

3 Inspect the armature assembly for burnt commutator bars, pitted armature shaft bearing area and the worm gear for scoring. Check thrust ball for pitting or discoloration due to heat. Replace if necessary.

4 Test for grounded armature.

5 Inspect the brush holder plate for cracks or damage. Ensure that brush boxes are secure and that connections are not burned or corroded.

6 Replace the motor brushes that are worn down to 6 mm (¼ in) long. Examine brush springs for distortion, burning or collapse. Nominal brush spring length is 38 mm (1½ in) minimum. Replace if necessary.

7 Examine the gear housing for cracks or distortion, and the bearings for excessive wear. (Bearings are not replaceable.) Examine the parking fingers for loss of tension, burning or pitting. Replace if necessary.

8 Examine the gear and shaft assembly for worn or damaged teeth. Check cam for wear on face. Replace if necessary.

Assembling

1 Apply grease to the centre drilled holes in each end of the armature shaft and light oil to bearings. Assemble the thrust cone to the worm end of the shaft and the 4.7 mm (3/16 in) diameter ball to the other end of the shaft.

2 Assemble brush springs and brushes to the gear housing.

3 Retract the brushes and assemble the armature to the gear housing.

4 Apply heavy grease to the back face of the thrust pad and locate in the recess in the bottom of the motor housing.

5 Assemble the motor housing to the gear housing. Ensure that the wiring to the brushes does not foul the motor housing. Assemble the two screws and washers.

6 Adjust armature shaft thrust screw in until resistance is felt and then back off screw a quarter turn.

7 Apply grease to collector plate finger contact surface, install collector plate assembly, distance washer, gear and shaft assembly to gear housing.

NOTE: Do not apply grease between gear and collector plate.

8 Install the distance spacer, wave washer, drive dog assembly, second wave washer, motor crank assembly, clamp plate, washer and clamp nut. Torque clamp nut to 8-10 Nm (72-90 lbs.in.). Lubricate these parts with Molybdenum — Disulphide Grease, 5% Graphite.

NOTE: That the gear shaft flat end incorporates a master flat to facilitate attachment of drive dog assembly.

9 Install the cam follower assembly, conical spring, washer and circlip to motor crank assembly.

10 Install the rubber dust cover to the motor crank assembly.

11 Connect washer lead connector to wiper motor terminal, assemble washer pump assembly and four self-tapping screws. Re-locate self tapping

screws carefully in existing threads to avoid stripping. Torque screws to 2.2-2.8 Nm (20-25 lbs.in.).

WINDSCREEN WASHER PUMP

Dismantling

1. Carry out operations 9 and 10 of the Wiper Motor dismantling procedure.
2. Remove the screws attaching valve cover to housing assembly and remove cover.
3. Withdraw valve seal, valve seat, suction cap, trim cup and plunger.
4. Remove solenoid assembly with the wire and plunger from housing assembly.
5. Remove plunger and lever assembly from solenoid.
6. Remove brush and spring from gear side of housing assembly.

Inspecting

1. Check operation of inlet and outlet valves in valve assembly.
2. Check suction cap for damage, cracks or deterioration.
3. Examine trim cap, solenoid lever and plunger for damage or wear.
4. Check solenoid winding for continuity or short circuit.
5. Examine housing bush for damage and excessive wear.
6. Check compression spring for damage.
7. Examine washer housing and latch for cracks and distortion. Examine timing gear for worn or damaged teeth.

NOTE: Timing gear should rotate only when latch is retracted.

Assembling

1. Lubricate latch mechanism with a light multi-purpose grease.
2. Install spring and guide bush into housing.
3. Install plunger and lever to solenoid assembly.
4. Install solenoid to housing, taking care that the lever engages with the slot in the latch. Ensure that the solenoid is located in the receiving slot in the housing and the solenoid wire is correctly positioned in the housing assembly.
5. Install trim cup and plunger to suction cap.
6. Install solenoid cover over location pin.
7. Install suction cap assembly and ensure the plunger is located in the guide bush.
8. Install valve seat assembly and valve seal.
9. Install valve cover and tighten screws evenly.

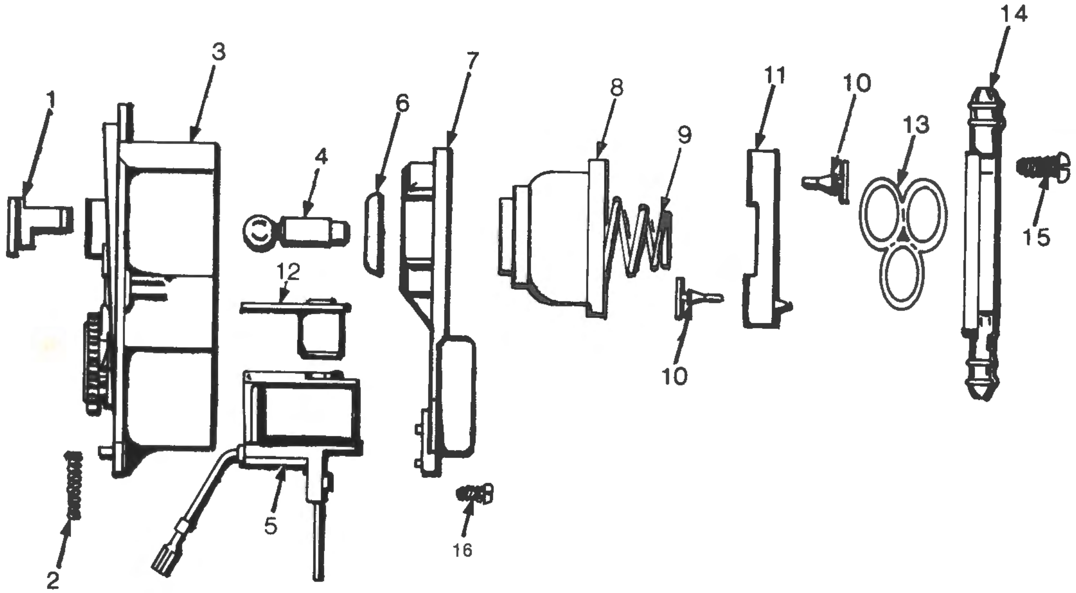


Fig. S-21

LAYOUT OF WINDSCREEN WASHER PUMP COMPONENTS

1 BUSH
2 SPRING
3 HOUSING ASSEMBLY
4 PLUNGER
5 SOLENOID ASSEMBLY
6 TRIM CUP
7 COVER
8 SUCTION CUP
9 CONICAL SPRING
10 VALVE RUBBER
11 VALVE SEAT
12 PLUNGER AND LEVER ASSEMBLY
13 VALVE SEAL
14 VALVE COVER
15 SCREW
16 SCREW

10 Replace the washer pump to the washer motor as previously described in wiper motor assembling procedure item 11.

11 Washer pump base and gear housing must be sealed with lacquer after installation.

12 Seal the lead outlet holes in the gear housing and washer pump with Bostik 1261.

WIPER PIVOT SHAFT AND LINK

Removing

1 Remove windscreen wiper and arm assembly.

2 Disconnect the clips retaining linkage to pivot arm, remove linkage.

3 Remove nuts and washers retaining pivot shaft assembly to plenum chamber and remove assemblies.

Refitting

1 Refitting is the reverse of the removing procedure noting the following:

(a) Check the seal between pivot shaft and plenum chamber. Renew if necessary.

(b) Ensure that the wiper blades are correctly positioned.

IGNITION SWITCH AND STEERING LOCK

DESCRIPTION

The vehicle is equipped with a combined steering column lock, ignition and starter switch, operated by a key.

The lock face is marked: LOCK, AUX (Auxiliary), OFF, IGN (Ignition), ST (Start).

To remove the key from the lock, turn the key to the auxiliary position, press in, and while maintaining pressure continue turning anticlockwise to the lock position and withdraw the key.

NOTE: To remove the key on column-shift models it is necessary to:

(a) Manual transmission — select reverse gear.

(b) Automatic transmission — select 'P' park.

The steering lock is set during withdrawal of the key and rotation of the steering wheel engages the lock pin, making it impossible to steer the car.

NOTE: When the steering column is in the locked position it will be necessary to release the load on the locking mechanism by moving the steering wheel to enable the key to be turned to the start position.

The steering column lock works in conjunction with and is integral with the ignition starter switch. The designed operating sequence prevents the engine being started with the steering locked. Serious consequences may result from alteration or substitution of the ignition-start switch which would allow the engine to be started with the lock engaged. Under no circumstances must the ignition switch or the ignition-start function be separated from the steering lock.

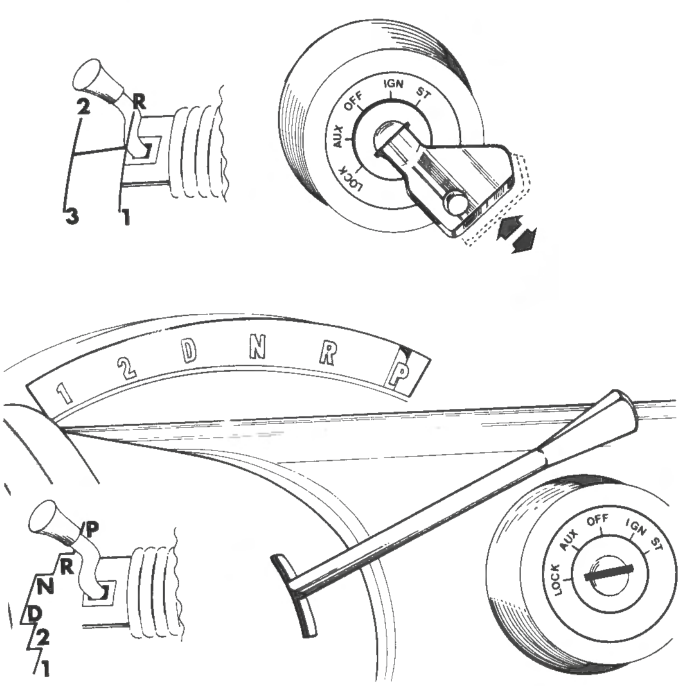


Fig. S-22
GEAR CHANGE LEVER POSITIONS FOR IGNITION KEY REMOVAL

Removing and replacing the switch and steering lock is included in Section Q Steering.

FUSE UNIT

DESCRIPTION

The fuse holder is mounted on the valance panel of the engine compartment, between the suspension tower and the plenum chamber.

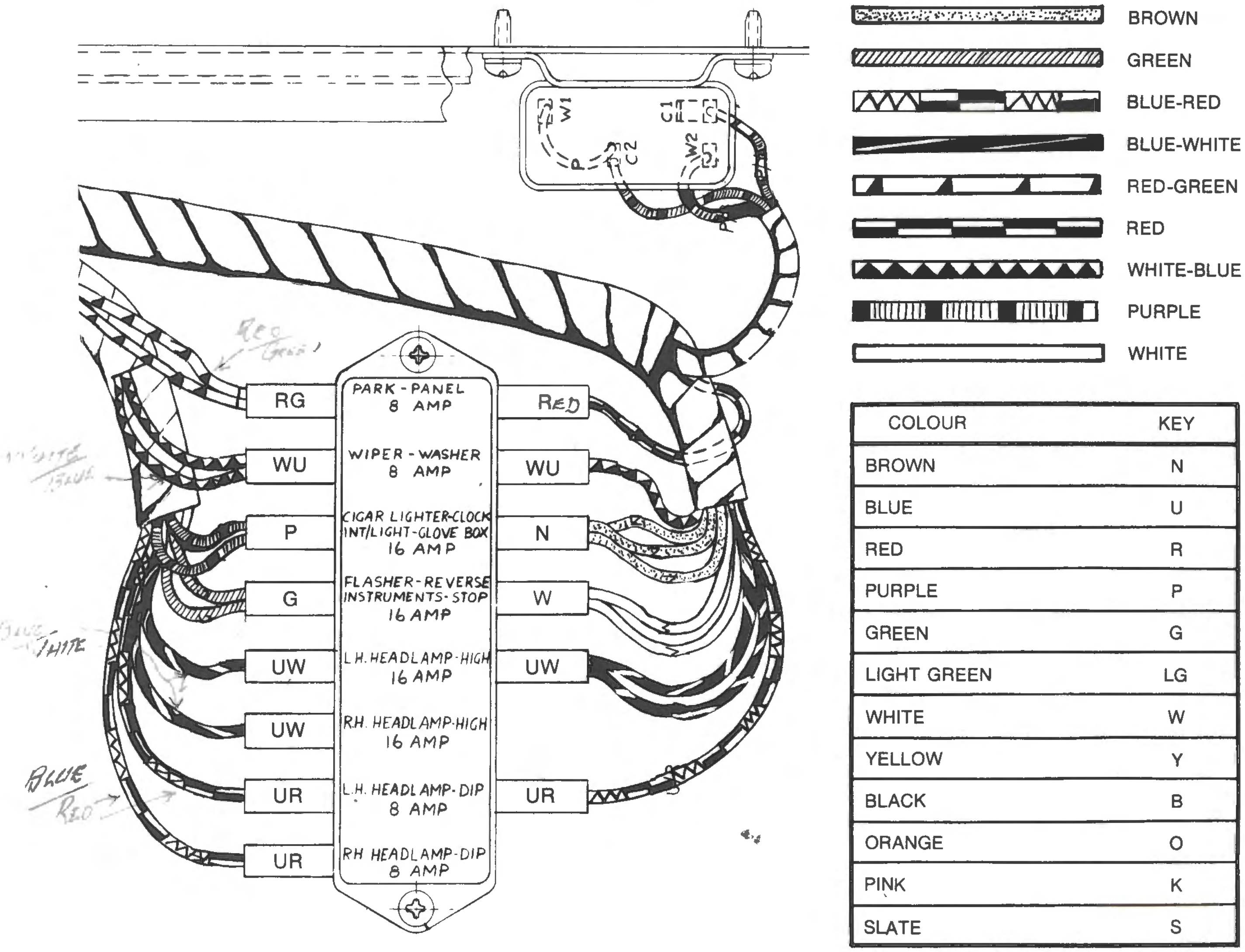
There are eight ceramic type fuses in the main fuse block. These fuses have two different ratings, the white coloured fuse is 8 amp rating and the red coloured fuse is 16 amp rating.

The 15 amp line fuse used to protect the heater motor is located under the instrument panel. Individual line fuses also protect the radio, power aerial and air-conditioning unit when fitted.

Two spare fuses are provided, one 8 amp (white) and one 16 amp (red). It is important to use only the correct replacement.

A blown fuse is indicated by the failure of all the units protected by it. The fuse in question should be removed from its spring clips. If the fuse has blown, the separated and fused state of the wire will be visible. Before renewing a blown fuse, inspect the wiring of all the circuits protected by the fuse for evidence of a short circuit or other fault which may have caused the fuse to blow.

The units protected by each fuse may be identified by referring to the wiring diagram Fig. S-23 and Fig. S-24 illustrating the fuse holder.



COLOUR	KEY
BROWN	N
BLUE	U
RED	R
PURPLE	P
GREEN	G
LIGHT GREEN	LG
WHITE	W
YELLOW	Y
BLACK	B
ORANGE	O
PINK	K
SLATE	S

Fig. S-23

FUSE UNIT AND HORN RELAY CONNECTIONS

LAMPS AND BULBS

HEADLIGHTS

The headlights are of the sealed beam type and must be replaced when the failure of either filament occurs.

Removing

1 Remove the four screws retaining centre section of grille, remove grille.

2 Remove headlight surround, retaining nuts accessible from under bonnet.

3 Remove the three screws securing the sealed beam rim.

4 Remove the sealed beam unit and detach wiring socket.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4.

Setting the Headlamps

1 The headlamp beams should be set slightly below horizontal or in accordance with local regulations.

2 Vertical adjustment is made by turning the screw at the top of the lamp and horizontal adjustment made by turning the screw at the side of the lamp. A headlamp beam-setting gauge should be used for this operation. If this is not available a headlamp aiming chart or setting board should be used. The car must be at kerbside weight, i.e. with oil and water in the engine, spare wheel and no passengers. Tyres are to be at recommended pressures.

3 The beams are affected by the load carried in the car and consequent deflection, and should therefore only be set on a flat, level surface, with the car normally loaded as for night driving. The beams must never be set above horizontal, as this will result in the drivers of oncoming traffic being dazzled and also give inferior road illumination.

HEADLIGHT DIPPER SWITCH

The headlight dipper switch is situated on the floor panel on the left hand side of the steering column. The headlights are changed from high beam to low beam and vice versa, by pressing the switch with the left foot.

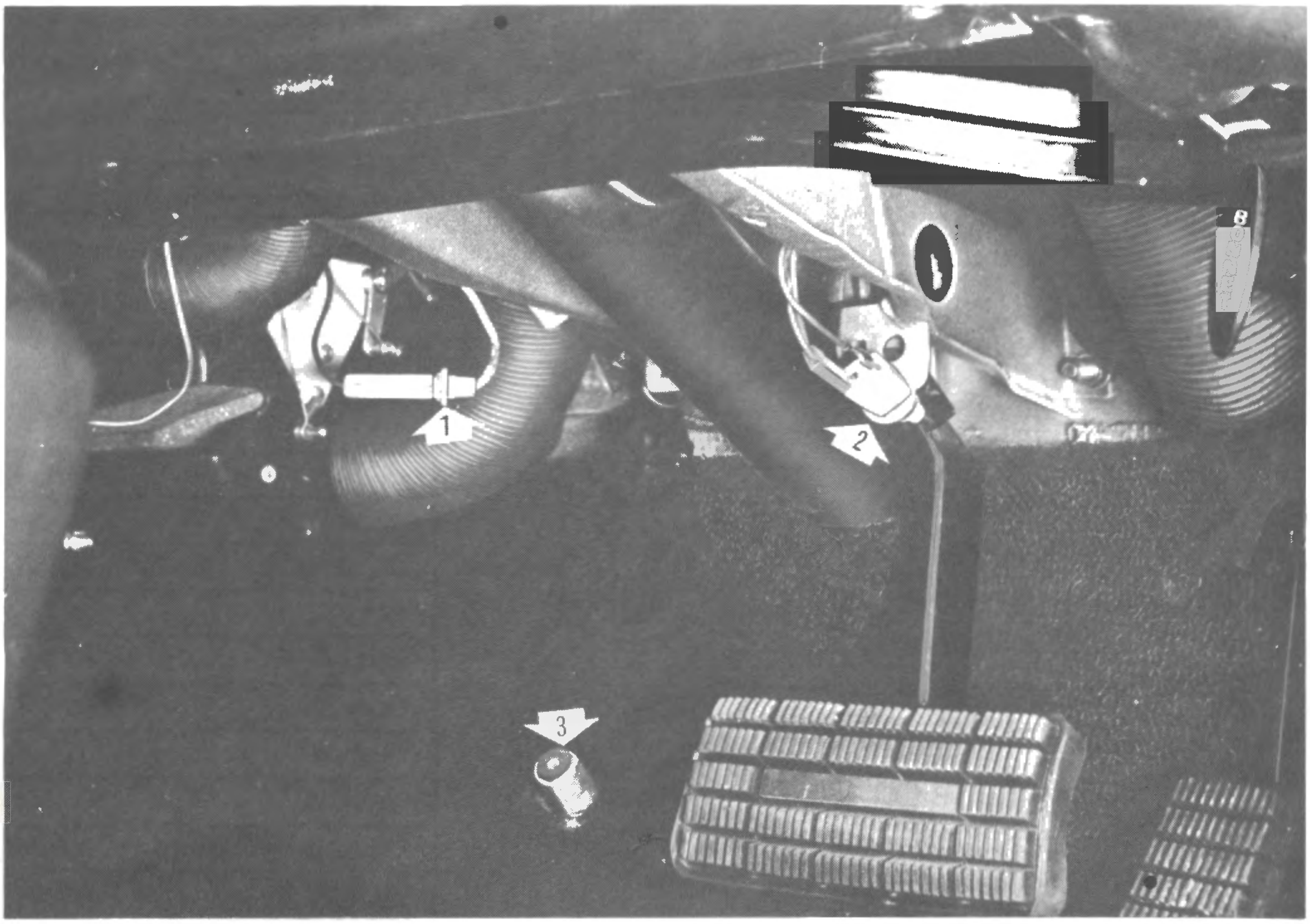


Fig. S-24

LINE FUSE LOCATION

1 LINE FUSE HEATER/AIR CONDITIONER (RADIO AND POWER AERIAL FUSES ALSO LOCATED IN IMMEDIATE VICINITY)

2 BRAKE STOP LAMP SWITCH

3 HEADLAMP DIP SWITCH

Removing

1 Disconnect battery.

2 Lift floor covering.

3 Disconnect wiring leads.

4 Remove two retaining screws and remove dipper switch.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4.

FRONT PARKING AND DIRECTION INDICATOR LAMPS

1 The combined front parking and indicator lamps are situated beside the headlights on either side of the vehicle. The parking lamp has a white lens and the direction indicator lens is amber.

2 The replacement of the bulb can be carried out by removing the bulb holder, which is accessible from under the bonnet, and removing the bulb from the holder. The bulb can now be replaced and the holder refitted.

3 The lens may be replaced by noting the following procedure.

Removing

1 Remove the four screws retaining the centre section of the grille and remove grille.

2 Remove headlight surround, retaining nuts accessible from under bonnet.

3 Remove the two nuts retaining lens.

4 Withdraw lens sliding it towards centre of vehicle and angle lens to clear aperture.

TAIL, STOP, DIRECTION INDICATOR AND REVERSING LAMPS

1 The combined tail, stop, direction indicator and reversing lamps are enclosed in a single unit mounted on each side at the rear of the body.

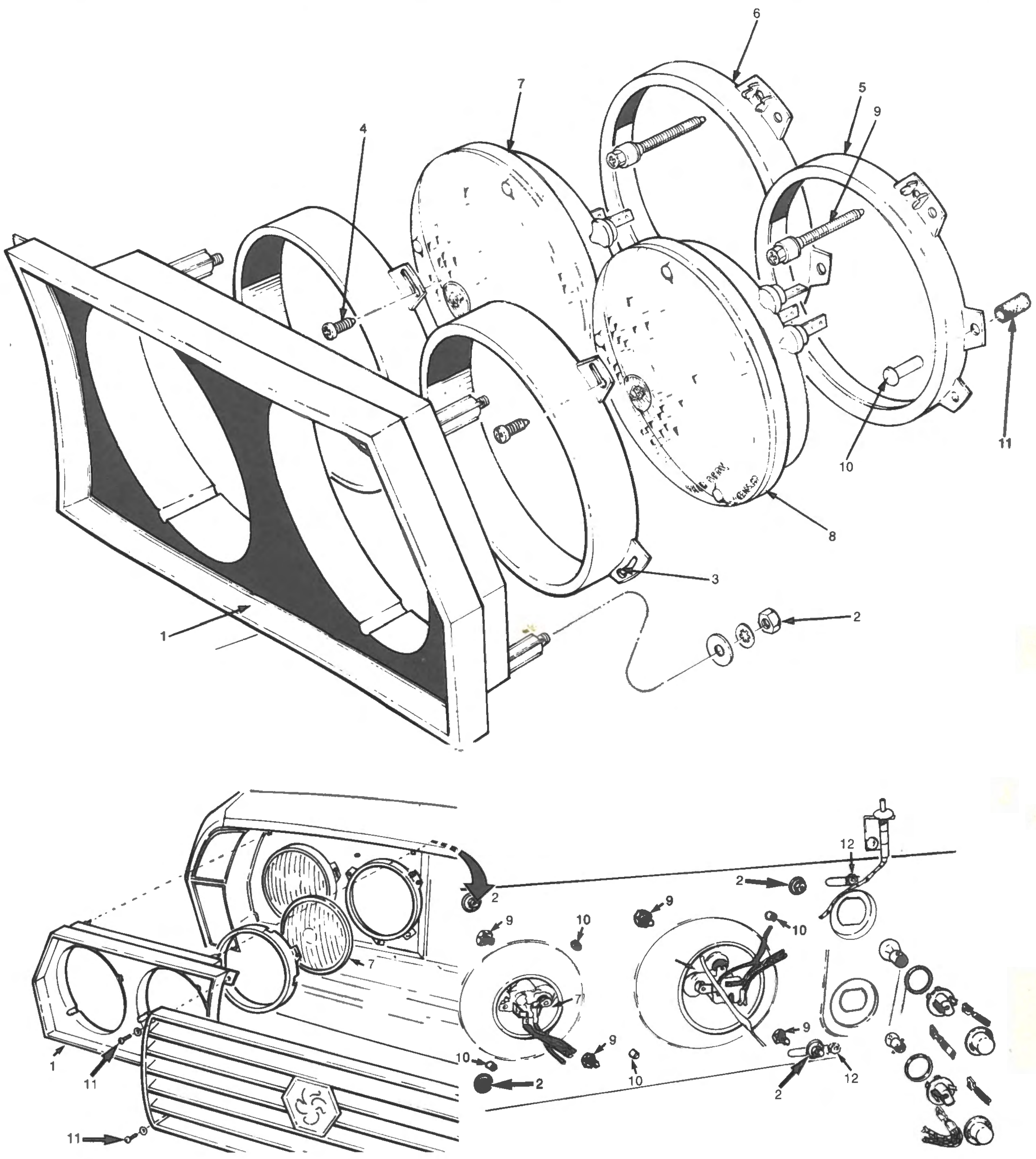


Fig. S-25

LAYOUT OF TWIN HEADLIGHT COMPONENTS

HELLA No YC1210
QUARTZ HALOGEN 12V 100W. H3

1 HEADLIGHT SURROUND
2 NUTS AND WASHERS SURROUND TO FRONT PANEL
3 SEALED BEAM LIGHT UNIT OUTER
4 RETAINING RIM SCREW
5 SEALED BEAM UNIT SEAT OUTER
6 SEALED BEAM UNIT SEAT INNER
7 SEALED BEAM UNIT — INNER SINGLE FILAMENT
8 SEALED BEAM UNIT — OUTER TWIN FILAMENT
9 BEAM ADJUSTING SCREWS (4)
10 RIVET LIGHT ASSEMBLY TO BODY (4)
11 BUSH FOR RIVET (4)
12 PARK AND DIRECTION INDICATOR LAMP LENS RETAINING NUTS

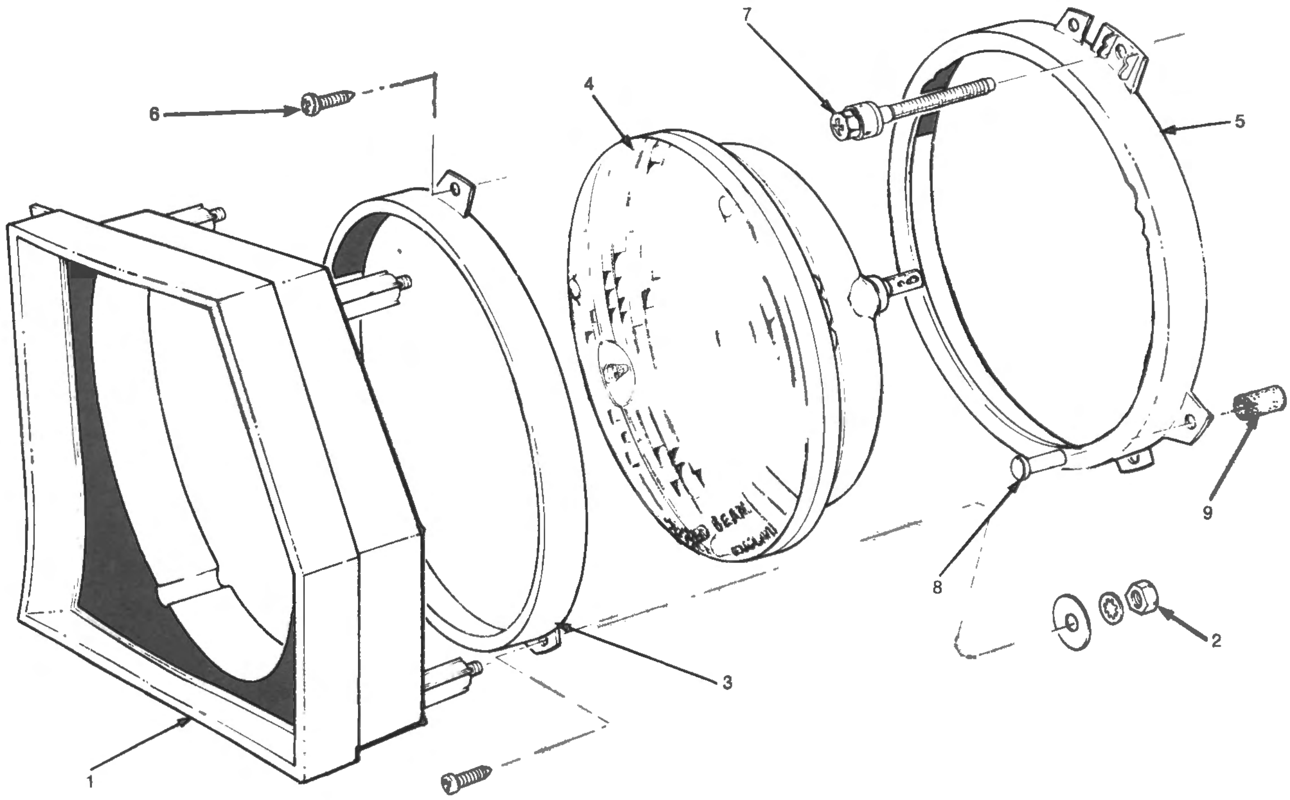


Fig. S-26

LAYOUT OF SINGLE HEADLAMP COMPONENTS

1 HEADLIGHT SURROUND
2 NUTS — WASHERS SURROUND TO FRONT PANEL
3 RETAINER RIM — SEALED BEAM LIGHT UNIT
4 SEALED BEAM LIGHT UNIT ASSEMBLY TWIN FILAMENT
5 SEALED BEAM LIGHT UNIT SEAT
6 SCREWS — RIM TO SEAT (3)
7 BEAM ADJUSTING SCREWS (2)
8 RIVET — LAMP ASSEMBLY TO FRONT PANEL
9 RUBBER BUSH — FOR RIVET

2 The unit is so designed, that the direction indicator light is visible from both the rear and the side of the vehicle.

3 Bulb replacement can be carried out in the same manner as for the front lamps, by removing the bulb holder and replacing the bulb. These units are accessible from within the boot.

The lens may be replaced noting the following procedure:

Removing

1 Lift the luggage compartment lid.

2 Pull out the bulb holders from the rear of the lamp.

3 Remove the securing nuts retaining lens assembly to vehicle and withdraw assembly.

Refitting

1 Refitting is a reversal of the removing procedure 1 to 3.

INTERIOR LIGHT

The interior light is mounted in the roof near the centre of the vehicle. The executive model has two extra interior lights, situated on the rear quarter panels. These lights incorporate a three position switch.

Removing

1 Disconnect the battery.

2 Lift off the cover.

3 Lift out the festoon type bulb.

4 Remove the two screws retaining the light body.

5 Remove the lamp body and disconnect the wires.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 5.

* SEE BELOW TO RECONDITION FLASHING LENSE.

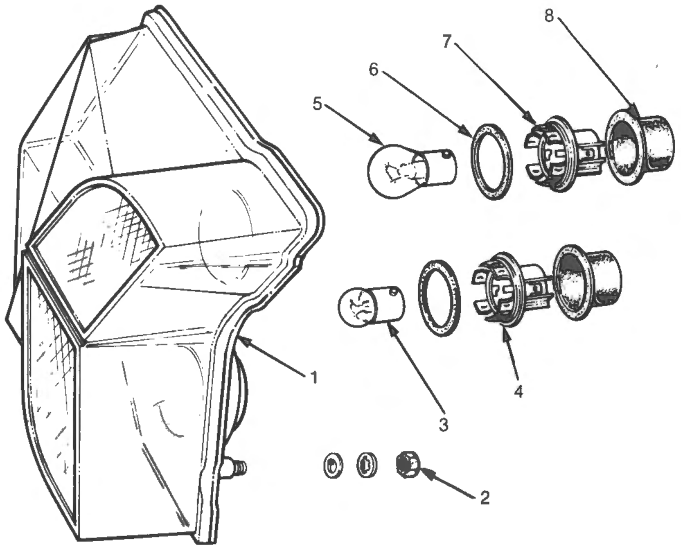


Fig. S-27

LAYOUT OF FRONT PARK AND DIRECTION INDICATOR LAMPS (RH SHOWN)

1 LENS
2 NUTS AND WASHERS LENS TO FRONT PANEL
3 PARK LAMP BULB
4 BULB HOLDER
5 DIRECTION INDICATOR BULB
6 GASKET
7 BULB HOLDER
8 BOOT

REAR NUMBER PLATE BULBS

There are two bulbs in this assembly, each located under a separate lens in the rear bumper bar. To replace the bulb use a suitable tool to pry the lens out of its aperture being careful not to damage lens. Lift out the bulb. Replace the bulb and refit the lens with the arrow towards the number plate.

BONNET LAMP

This lamp is located in the centre of the bonnet. It is operated when the bonnet is opened, by a switch in the right hand front corner of the bonnet.

BOOT LAMP

This lamp is located in the centre of the luggage compartment and is operated when the boot is opened, by a switch on the right hand hinge.

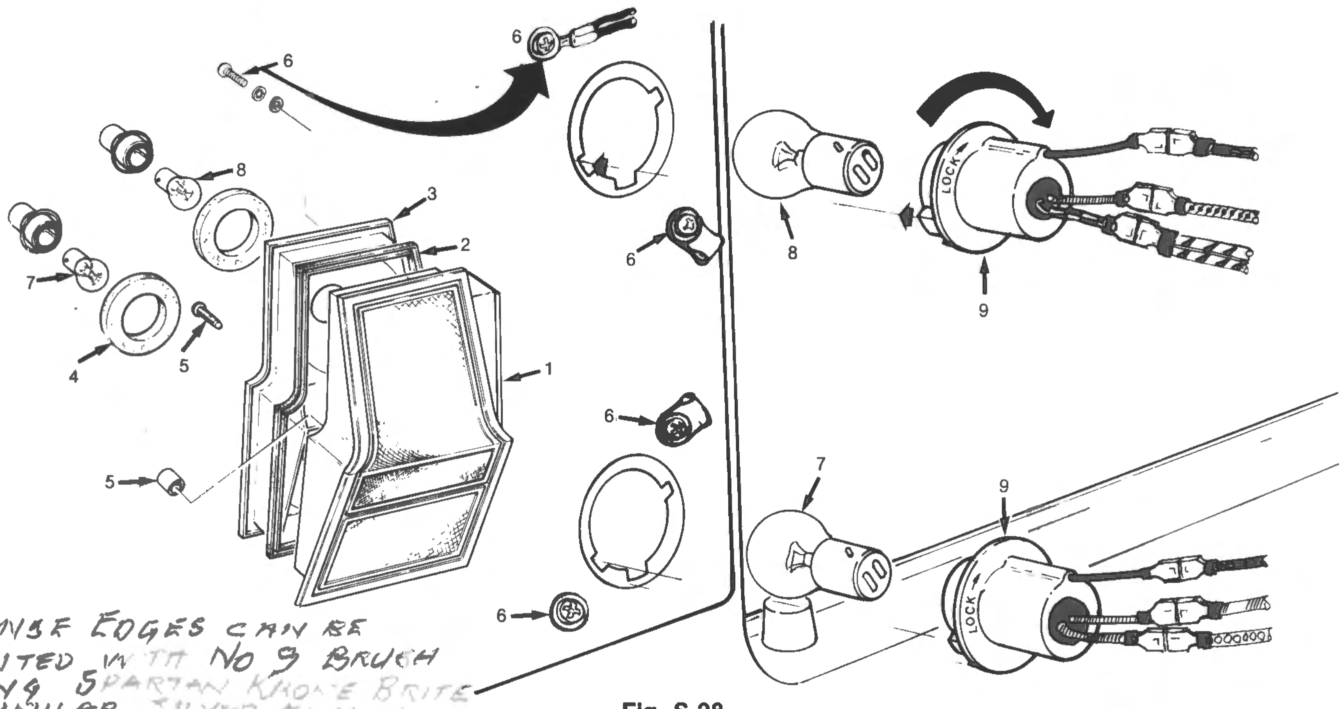
Access to the bulb is gained by removing the two screws and lowering the cover and bulb complete.

GLOVE BOX LAMP

This lamp is located in the glove box and is operated by a switch when the glove box is opened.

ASHTRAY LAMP

This lamp is positioned to illuminate the ashtray and is operated in conjunction with the instrument lights.



* LENSE EDGES CAN BE PAINTED WITH No 9 BRUSH USING SPARTAN KROME BRITE OR SIMILAR SILVER FINISH THIN WITH 50% FOR HAND PAINTING

Fig. S-28

LAYOUT OF REAR STOP, TAIL, REVERSE AND DIRECTION INDICATOR LAMPS (RH SHOWN)

1 LENS
2 SEAL
3 BASE
4 SEAL — LAMP APERTURE TO BODY
5 SCREW AND FERRULE — LENS TO BASE
6 SCREWS AND WASHERS LAMP ASSEMBLY TO BODY
7 REVERSE AND DIRECTION INDICATOR BULBS 32/32 CP
8 STOP AND TAIL LAMP BULB 32/4 CP
9 BULB HOLDERS

WARNING: Ensure bulbs 7 and 8 are in their correct location

* TO RECONDITION FRONT FLASHER LENSES.
MIX 25% DULON RED GOLD ACRYLIC LACQUER — A TYPE TINTER 51512672
& 75% DULON ULTRA CLEAR ACRYLIC LACQUER — A TYPE 515 30900
AND 100% ACRYLIC LACQUER THINNER — A TYPE 922 34178 SPRAY 2 OR 3 CO

31/10/94 REPLACED LIGHT SWITCH AT 1760 km

LOCATION OF ANCILLARY LAMPS AND SWITCHES

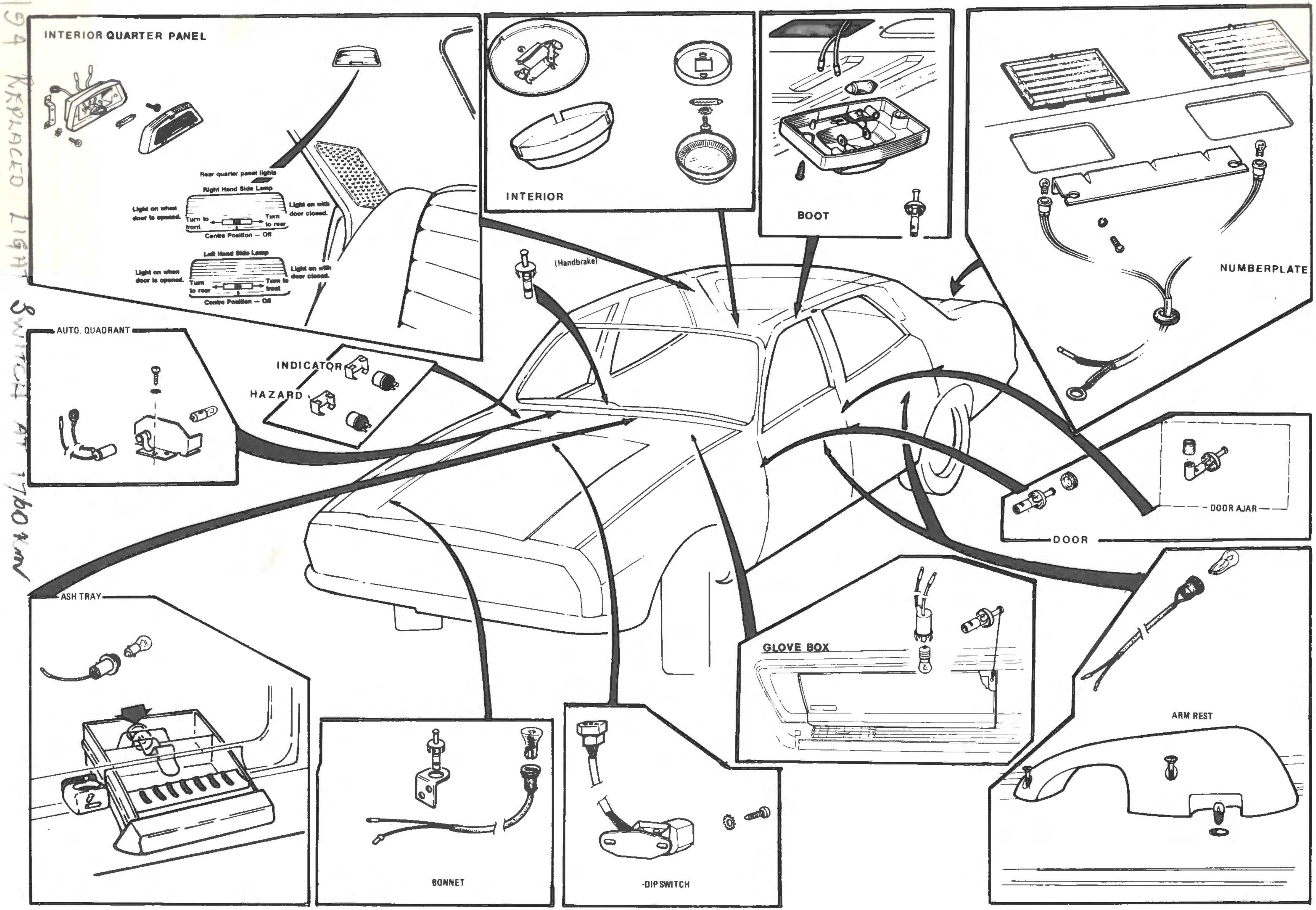


Fig. S-29

KERBSIDE ILLUMINATION LAMP

In this application a lamp is located under the door arm rests and operated independently by a switch as each door is opened.

INSTRUMENT HOUSING ASSEMBLY

There are two basic instrument housing assemblies, they consist of:

(a) Leyland 6 and Deluxe
Six warning lamps arranged around two large circular dials, one incorporating the fuel and the temperature gauge and the other housing a speedometer.

(b) Super and Executive
Six warning lamps arranged around two large dials and three smaller gauges. The two larger dials consisting of a clock in one and a speedometer in the other. The three smaller gauges are; battery condition gauge, temperature gauge and fuel gauge.

Removing

1 Disconnect battery.

2 Disconnect speedometer cable.

3 Remove two screws retaining assembly in place.

4 Tilt assembly forward, exposing the rear of the unit.

5 Disconnect wiring leads.

6 Withdraw assembly from vehicle.

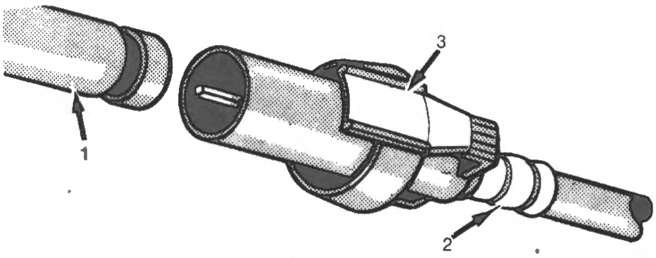


Fig. S-30

SPEEDOMETER CABLE CONNECTION

1 CABLE ASSEMBLY

2 SPEEDOMETER PINION SHAFT

3 PRESS FLAT SURFACE AND PULL CABLE ASSEMBLY AWAY FROM SPEEDOMETER HEAD

NOTE: To remove any of the instruments from the assembly, unscrew the two self-tapping screws, turn instrument clockwise and withdraw from assembly.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 6. Ensure all instruments and warning lights are functioning correctly.

PANEL AND WARNING LAMPS

The panel and warning lamps are situated in the rear of the dash panel. Access to these lamps can be obtained by following steps 1 to 4 of the removal procedure for the instrument housing assembly.

PANEL SWITCHES

The panel switches are located either side of the steering column. On the left hand side there is the windscreen washer and windscreen wiper switch, on the right hand side the panel light rheostat and the lighting switch.

1 Windscreen Washer
Water is directed onto the windscreen when the hold-down type switch is operated. The windscreen wiper switch is operated in conjunction with the washer switch, when the washer switch is operated the wiper switch is engaged in the slow speed position.

2 Windscreen Wiper
A two position switch situated beside the windscreen washer switch. The first position is for slow speed while the second is for fast speed.

3 Rheostat
The rheostat is situated on the right hand side of the steering column, beside the ignition switch. This unit has a rotary action to regulate the brightness of the panel and instrument lights and also operates the interior light.

4 Light Switch
The lighting switch is situated on the right hand side of the rheostat. This is a two position switch which operates the parking lights on the first position, and the headlights on the second position.

Removing

1 Disconnect the battery.

2 Remove the instrument housing as previously described.

3 Remove the four screws securing switch panel to mounting and partly remove panel from fixture.

4 Disconnect the wiring and light sockets from rear of switches.

5 Remove the switch panel from the dash.

6 Remove the nylon clips retaining the switch to dash assembly.

7 Withdraw the switch from front of panel.

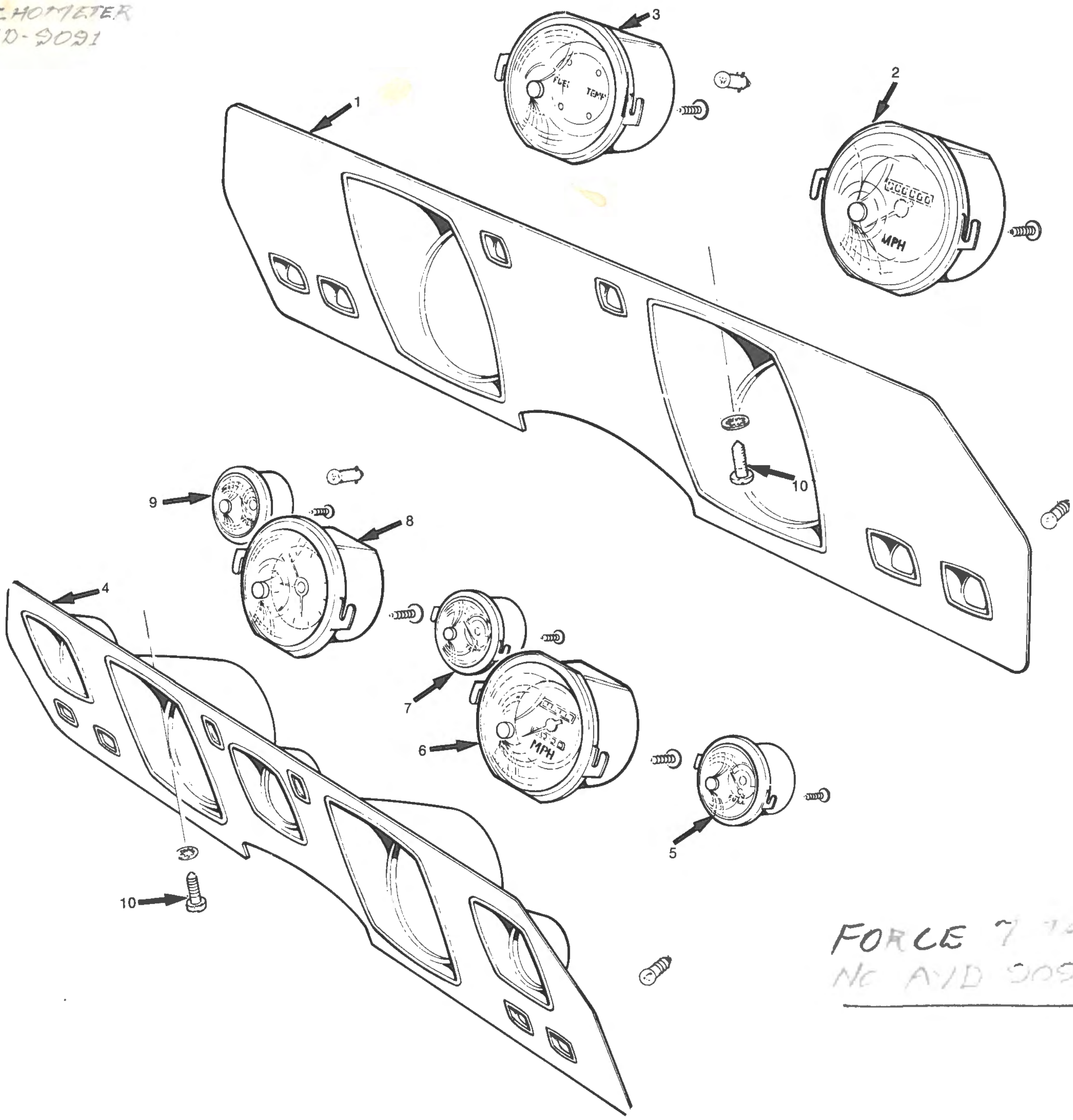
Refitting

1 Refitting is a reversal of the removing procedures 1 to 7.

BRAKE WARNING LIGHT SWITCHES

Two brake warning light switches are installed on all vehicles having boosted brakes. One switch is activated by application on the handbrake while the ignition is switched on. Releasing the handbrake allows the switch to return to the off position.

TACHOMETER
AYD-9091



FORCE 7 TACH
No AYD 9093

Fig. S-31

LAYOUT OF INSTRUMENTS

1 PANEL LEYLAND AND DELUXE
2 SPEEDOMETER
3 FUEL AND TEMPERATURE GAUGE
4 PANEL SUPER AND EXECUTIVE
5 FUEL GAUGE
6 SPEEDOMETER WITH TRIP
7 TEMPERATURE GAUGE
8 CLOCK
9 BATTERY CONDITION GAUGE
10 SCREWS AND WASHERS PANEL TO DASH

The other switch is activated when a failure occurs in either the front or rear hydraulic circuit. This switch is attached to the master cylinder. Refer to Braking System — Section R.

Removing

1 Disconnect battery.

2 Remove two screws securing cover to handbrake lever assembly and remove cover.

3 Remove switch from bracket and disconnect wire from switch.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 3.

REVERSING LIGHT SWITCH

The reversing light switch is mounted on the synchromesh transmission housing and operated by the gear selector shift rod.

Removing

1 Remove the two wires from the switch.

2 Unscrew the switch assembly from the gear box housing.

NOTE: The switch must be replaced if found to be faulty.

Refitting

1 Refitting is a reversal of the removing procedures 1 and 2.

AUTOMATIC TRANSMISSION

The reversing light switch is a part of the inhibitor switch mounted on the left hand side of the automatic transmission housing.

OIL PRESSURE WARNING LIGHT SWITCH

DESCRIPTION

The switch is located in the rear of the oil filter housing on the 8 cylinder engine and on the lower right hand side of the block on the 6 cylinder engine. The switch contacts open at approximately 48 to 62 kPa (7 to 9 psi).

Removing

1 Disconnect the battery.

2 Disconnect the electrical lead from the switch.

3 Unscrew and withdraw switch.

Refitting

1 Clean thread of switch.

2 Screw in switch and tighten sufficiently to prevent leakage. DO NOT OVERTIGHTEN.

3 Connect the lead.

4 Connect the battery.

DIRECTION INDICATOR SWITCH AND HAZARD WARNING SWITCH

Removing

1 Disconnect battery.

2 Remove horn pad from steering wheel and disconnect horn contact wire.

3 Remove the four bolts retaining steering wheel to the collapsible canister.

4 Remove steering wheel and disconnect horn lead.

5 Remove locknut and retaining nut securing collapsible canister to the inner steering column.

6 Using service tool 18GA067 remove canister and horn contact.

7 Disconnect the wiring harness under dash.

8 Using a suitable tool gently pry out the cancelling hub of the trafficator assembly.

9 Unscrew and remove trafficator stalk.

10 Remove the three screws securing assembly to shroud.

11 Engage hazard warning switch and remove trafficator switch assembly, angling so as to clear inner column.

Refitting

1 Refitting is a reversal of the removing procedure, ensure that the trafficator/hazard switch cancels correctly.

FLASHER UNIT

FUNCTIONS OF THE WARNING LAMP

The warning lamp indicates the operation of the flasher unit, and also warns of bulb failure occurring in the external direction indicator lamps. In the event of a bulb failure there will be no audible click from the flasher unit, the parallel bulb and the warning lamp in that circuit will remain 'ON' and not flash.

CHECKING FAULTY OPERATION

In the event of a failure, carry out the following tests:

1 Check the bulbs are of the correct type and have not failed.

2 Refer to the wiring diagram and check all relevant connections.

3 Check the appropriate fuse.

4 With the ignition 'ON', check that the voltage is present between terminal 'B' of the flasher unit and earth.

5 Connect flasher unit terminals 'B' and 'L' to each other and operate the direction indicator switch. If the lamps now operate, the flasher unit is defective and should be replaced.

HAZARD UNIT

In case of an emergency all four flasher lamps are operated together. A special switch is used in conjunction with the normal flasher switch. Refer wiring diagram.

The flasher and hazard warning units are located on the upper 'A' post closing panel at the right hand side of the dash.

HORNS AND RELAY UNIT

All vehicles are fitted with R.V.B. horns. The Leyland 6 and Deluxe models have a single horn, whilst the Super and Executive models have dual horns. In all installations they are located on the right hand forward longitudinal member. The horn relay is mounted on the front of the plenum chamber above the fuse block. The unit is not serviced except by replacement.

LAYOUT OF INSTRUMENT PANEL WIRING

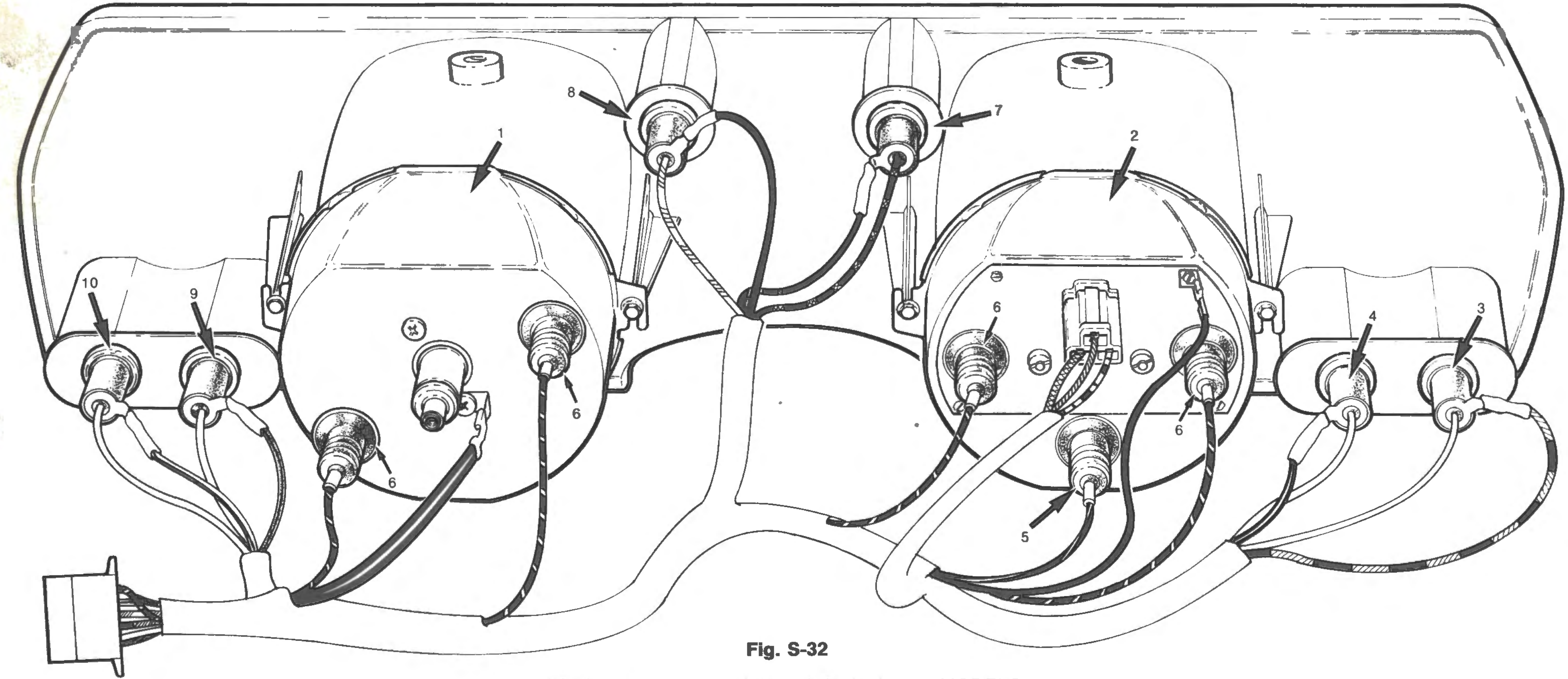


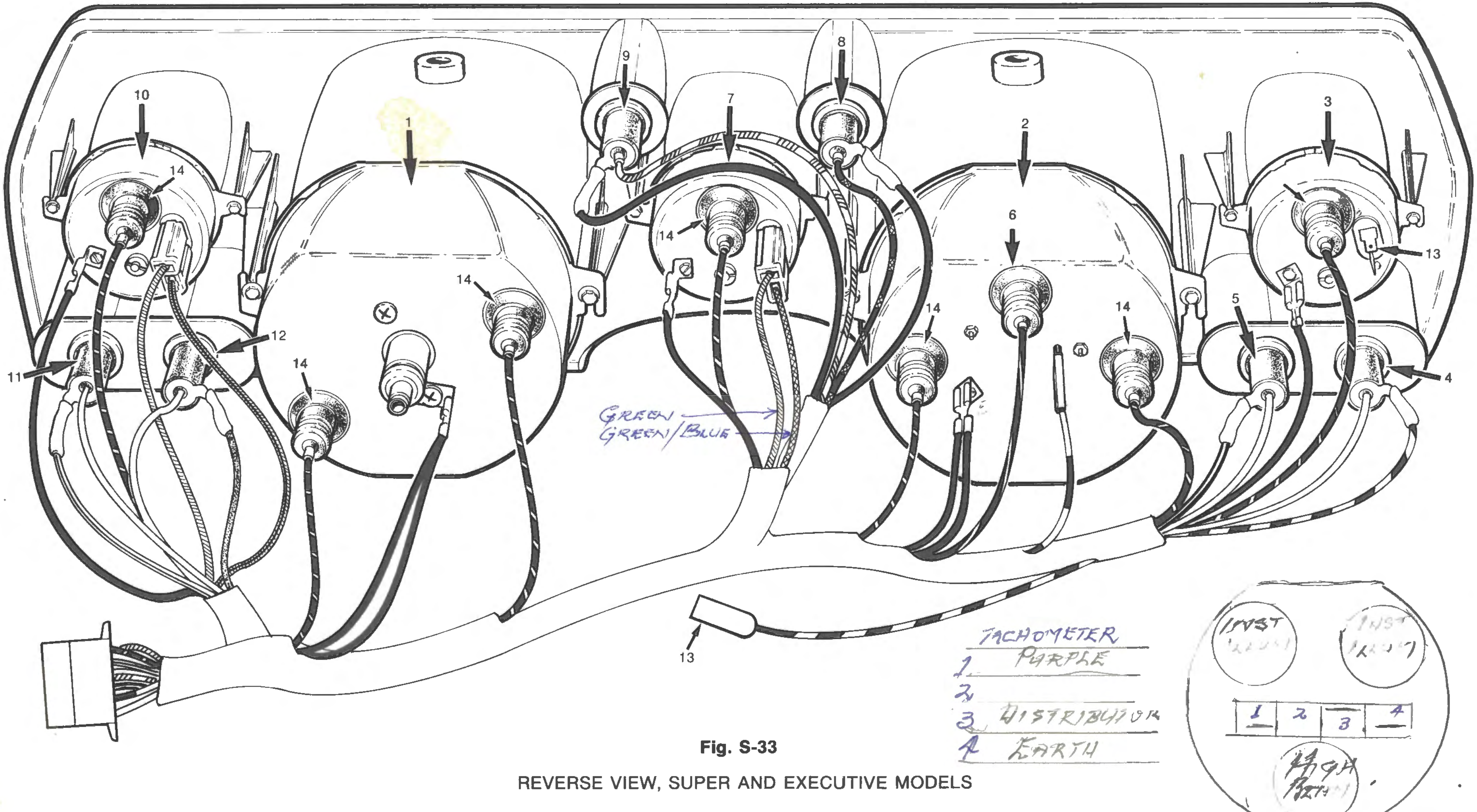
Fig. S-32

REVERSE VIEW, LEYLAND AND DELUXE MODELS

1 SPEEDOMETER
2 FUEL AND TEMPERATURE GAUGE
3 HANDBRAKE WARNING LAMP
4 BRAKE FAIL WARNING LAMP
5 HIGH BEAM INDICATOR LAMP
6 INSTRUMENT ILLUMINATION
7 DIRECTION INDICATOR LAMP — LH
8 DIRECTION INDICATOR LAMP — RH
9 IGNITION WARNING LAMP
10 OIL PRESSURE WARNING LAMP

COLOUR CODE FOR FIGS. S-32, S-33

WHITE	□
WHITE-BROWN	□
BROWN	░
BLACK	■
RED-WHITE	▨
GREEN-WHITE	▨
GREEN-RED	▩
BLUE-WHITE	■
BLACK-WHITE	■
ORANGE	▨
GREEN-BLACK	▦
PINK	▨
GREEN	▨
GREEN-BLACK	▤
MAUVE	■
GREEN-BLUE	▩



TACHOMETER
1 PURPLE
2
3 DISTRIBUTOR
4 EARTH

Fig. S-33

REVERSE VIEW, SUPER AND EXECUTIVE MODELS

VDO
12.73

1	SPEEDOMETER
2	CLOCK
3	BATTERY CONDITION GAUGE
4	DOOR AJAR WARNING LAMP EXECUTIVE
5	BRAKE FAIL WARNING LAMP
6	HIGH BEAM INDICATOR LAMP
7	TEMPERATURE GAUGE
8	DIRECTION INDICATOR — LH
9	DIRECTION INDICATOR — RH
10	FUEL GAUGE
11	OIL PRESSURE WARNING LAMP
12	IGNITION WARNING LAMP
13	CONNECTOR TO SWITCH HARNESS Fig. S-34
14	INSTRUMENT ILLUMINATION

LAYOUT OF FACIA SWITCH WIRING

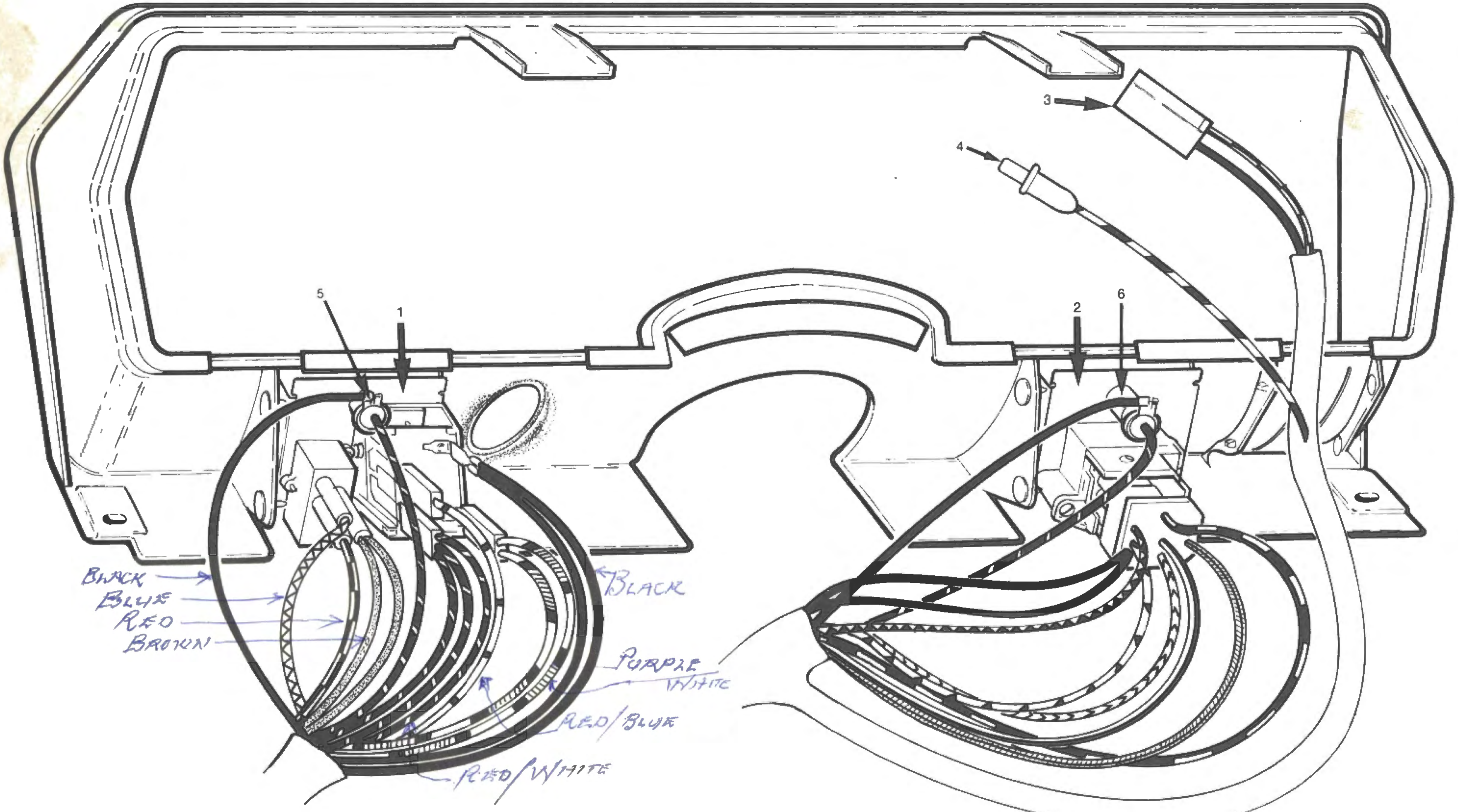


Fig. S-34

REVERSE VIEW ALL MODELS

1 LIGHTING SWITCH

2 WINDSCREEN WIPER AND WASHER SWITCH

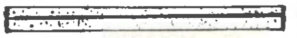
3 SOCKET — BATTERY CONDITION GAUGE Fig. S-33 (13)

4 BLADE CONNECTION — INSTRUMENT HARNESS Fig. S-33

5 ILLUMINATION LAMP

6 ILLUMINATION LAMP

WIRE COLOUR

BASIC	TRACE	ILLUSTRATED AS
WHITE		
WHITE	BROWN	
BROWN		
BLACK		
RED	WHITE	
PINK		
GREEN		
LT. GREEN	BLACK	
MAUVE		
GREEN	BLUE	
BLUE	RED	
GREEN	WHITE	
GREEN	RED	
BLUE	WHITE	
BLACK	WHITE	
ORANGE		
GREEN	BLACK	
GREEN	BROWN	
GREEN	PURPLE	
BLUE		
BROWN	LT. GREEN	
RED	GREEN	
BLACK	GREEN	
PURPLE	WHITE	
RED	BLUE	
RED		
WHITE	BLUE	
BLUE	GREEN	
PURPLE		
PURPLE	BLACK	
BROWN	YELLOW	

MAINTENANCE

If a horn fails or operates in an unsatisfactory manner, carry out the following external checks.

1. Examine the cable of the horn circuit, renewing any that are badly worn or chafed. Ensure that all connections are clean and tight.
2. Check that all the bolts securing the horn do not foul any other fixtures.
3. Check that the horn button contacts are clean.
4. Check the operation of the horn relay.
5. Should the horn fail to operate after these tests have been carried out, it will be necessary to fit a replacement.

CIGAR LIGHTER

Removing

1. Disconnect battery.
2. Disconnect lead from rear of lighter barrel.
3. Unscrew and remove barrel sleeve.
4. Withdraw lighter through front of dash assembly.

Refitting

1. Refitting is a reversal of the removing procedures 1 to 4.

RADIO

Removing

1. Disconnect battery.
2. Remove radio control knobs.
3. Remove escutcheon panel retaining nuts and remove panel.
4. Remove nuts and washers securing radio to front mounting bracket.
5. Remove nut, bolt and washers securing rear mounting bracket to the body. Support weight of radio.
6. Remove radio from mounting brackets and angle radio towards heater box and down past glove box.
7. Disconnect the aerial lead, speaker and radio feed leads.
8. Remove radio from vehicle.

Refitting

1. Refitting is a reversal of the removing procedures 1 to 8.

NOTE: To adjust the radio follow this procedure:

(a) Fully extend the aerial.

(b) Tune radio to 1500 KHz, a mark approximately 12.7 mm (½ in) from the right hand end of dial scale but not on a station.

(c) With the volume set at a comfortable level, adjust and set the aerial trimmer for maximum noise.

POWER AERIAL

Removing

1 Disconnect battery.

2 Disconnect aerial lead and feed wires at connection in boot.

3 Remove the nut, cup washer and grommet securing aerial to body panel.

4 Disconnect drain tube from aerial motor.

5 Remove bolt and washer securing aerial assembly to mounting bracket.

6 Withdraw aerial from the inside of luggage compartment.

Refitting

1 Refitting is a reversal of the removing procedure, ensuring that correct contact is made between the metal mount on the top of the aerial tube and the underside of the body panel.

POWER AERIAL SWITCH

Removing

1 Disconnect the battery.

2 Remove the screws securing the right front tread plate to the body panel.

3 Disconnect the aerial switch wires at snap connectors.

4 Remove the screws and nylon press clip securing right front kick pad to body panel.

5 Remove the instrument housing assembly as previously described.

6 Disconnect the aerial switch feed wire at the line fuse holder.

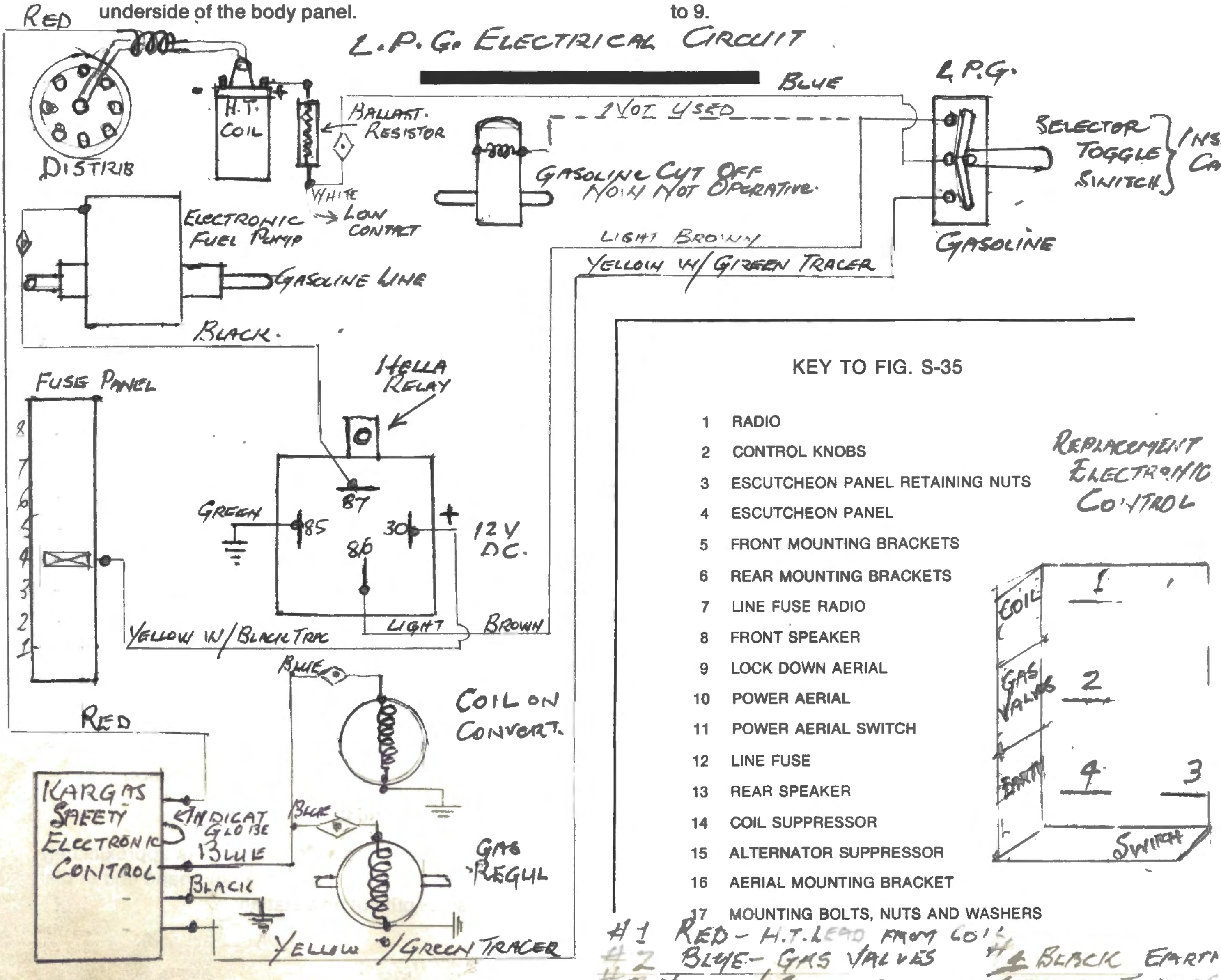
7 Disconnect the aerial switch earth wire from the dash panel.

8 Remove the knurled nut, washer and mounting plate from the facia panel.

9 Withdraw the aerial switch from the facia panel and feed the wires and switch from the dash area.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 9.



KEY TO FIG. S-35

1 RADIO
2 CONTROL KNOBS
3 ESCUTCHEON PANEL RETAINING NUTS
4 ESCUTCHEON PANEL
5 FRONT MOUNTING BRACKETS
6 REAR MOUNTING BRACKETS
7 LINE FUSE RADIO
8 FRONT SPEAKER
9 LOCK DOWN AERIAL
10 POWER AERIAL
11 POWER AERIAL SWITCH
12 LINE FUSE
13 REAR SPEAKER
14 COIL SUPPRESSOR
15 ALTERNATOR SUPPRESSOR
16 AERIAL MOUNTING BRACKET
17 MOUNTING BOLTS, NUTS AND WASHERS

#1 RED - H.T. LEAD FROM COIL
#2 BLUE - GAS VALVES
#4 BLACK EARTH
#3 YELLOW/GREEN TRACER TO SELECTOR TOGG

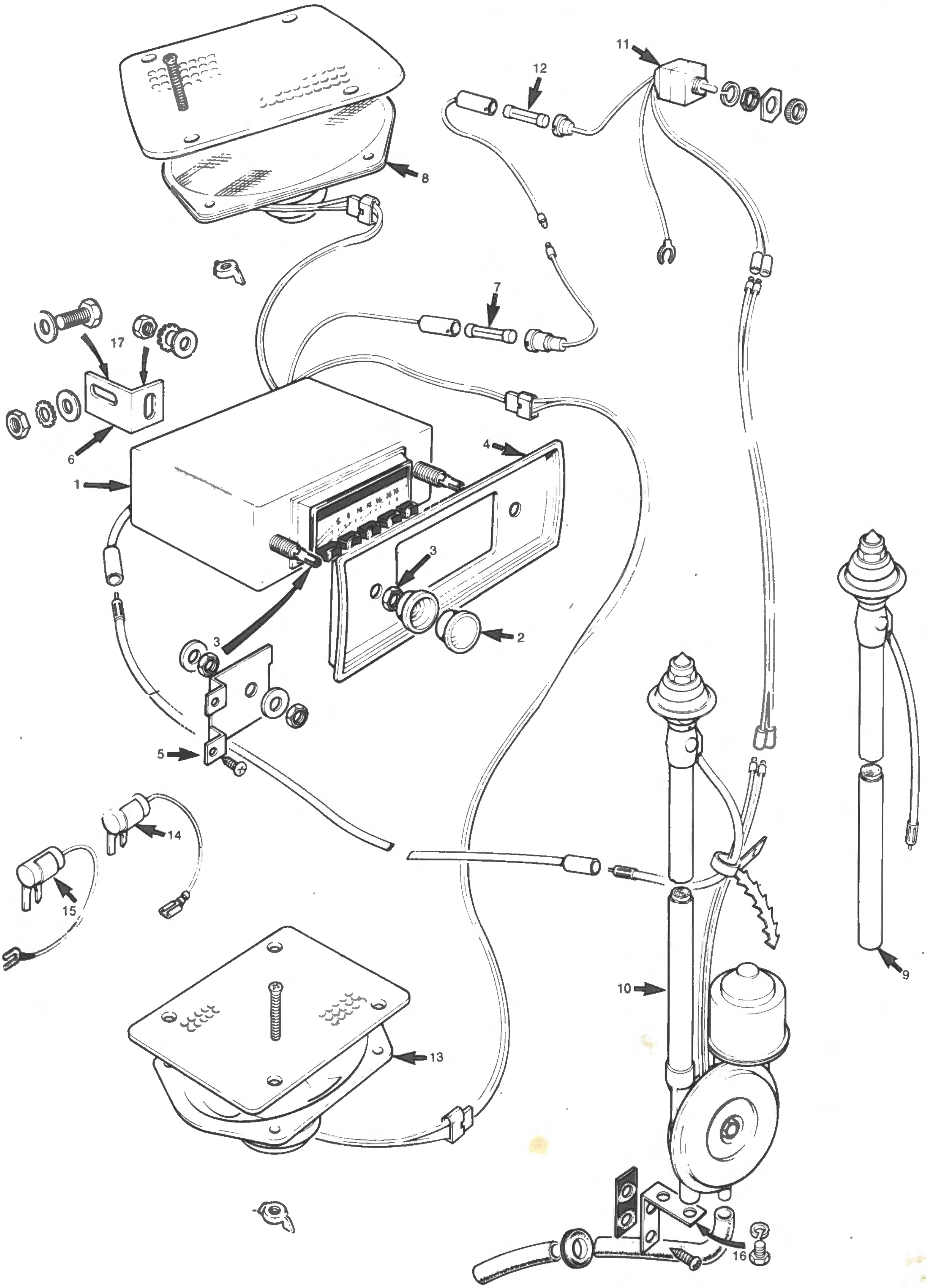
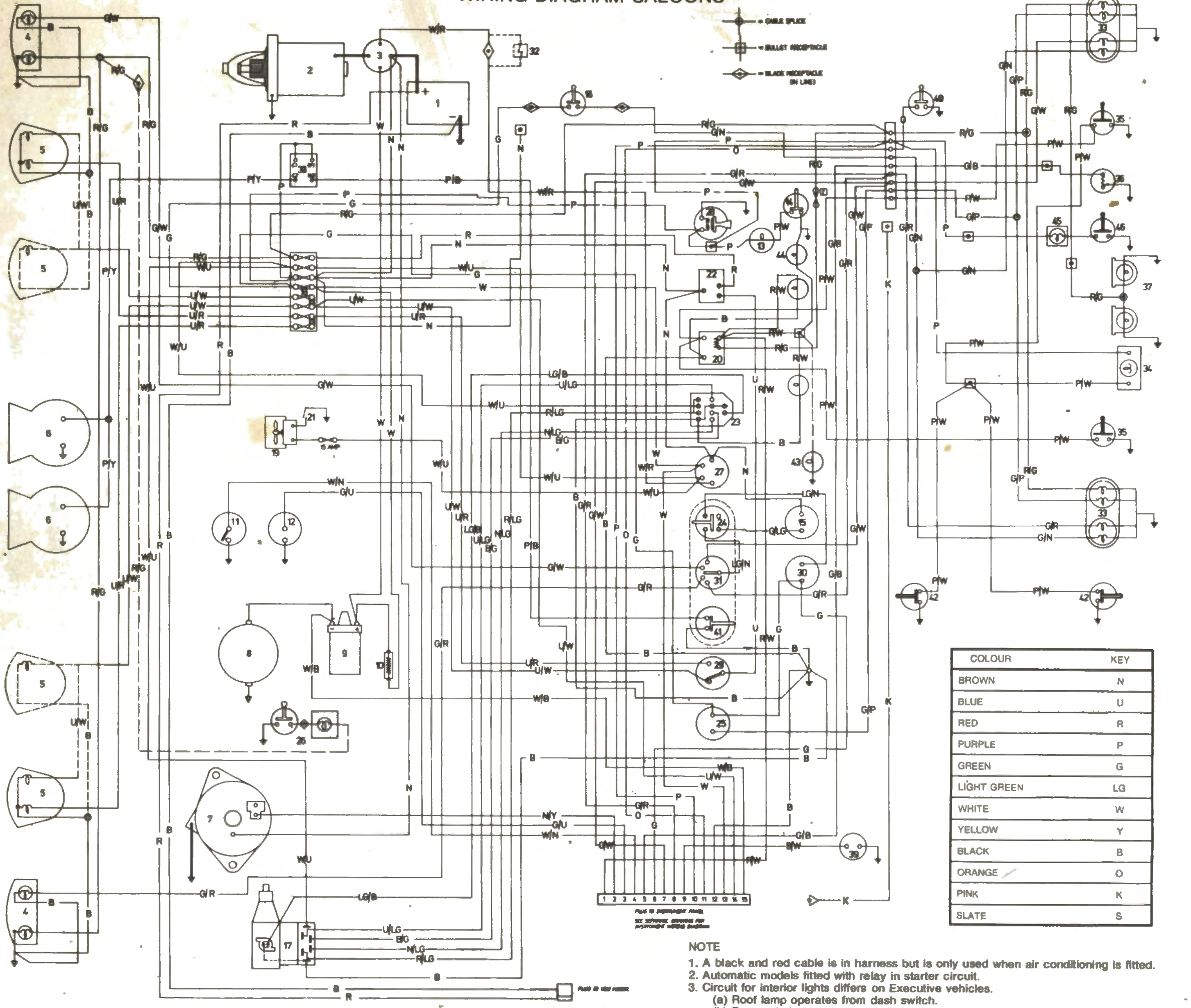


Fig. S-35

LAYOUT OF RADIO AND AERIAL COMPONENTS

WIRING DIAGRAM SALOONS



COLOUR	KEY
BROWN	N
BLUE	U
RED	R
PURPLE	P
GREEN	G
LIGHT GREEN	LG
WHITE	W
YELLOW	Y
BLACK	B
ORANGE	O
PINK	K
SLATE	S

NOTE
1. A black and red cable is in harness but is only used when air conditioning is fitted.
2. Automatic models fitted with relay in starter circuit.
3. Circuit for interior lights differs on Executive vehicles.
   (a) Roof lamp operates from dash switch.
   (b) Door switches operate armrest lights and quarter lights. Fitted in rear.
   (c) Door ajar warning system fitted on all doors.

Fig. S-36

No	UNIT
1	BATTERY
2	STARTER
3	STARTER SOLENOID
4	SIDE-FLASHER LAMP
5	HEADLAMP
6	HORN
7	ALTERNATOR
8	DISTRIBUTOR
9	IGNITION COIL
10	BALLAST-RESISTOR
11	OIL-PRESSURE SWITCH
12	TEMPERATURE SWITCH
13	GLOVE BOX LIGHT
14	GLOVE BOX LIGHT SWITCH
15	HAZARD UNIT
16	REVERSE LIGHT SWITCH
17	WIPER-WASHER MOTOR
18	FUSE BOX
19	HEATER MOTOR
20	PANEL/INTERIOR LIGHT SWITCH
21	HEATER SWITCH
22	LIGHTING SWITCH
23	WIPER-WASHER SWITCH
24	HAZARD SWITCH
25	STOPLIGHT SWITCH
26	BONNET LIGHT
27	IGNITION-START SWITCH
28	CIGARETTE LIGHTER
29	DIP SWITCH
30	FLASHER UNIT
31	FLASHER SWITCH
32	INHIBITOR SWITCH
33	STOP/TAIL/FLASHER/REV LIGHT
34	INTERIOR LIGHT
35	DOOR SWITCHES-FRONT
36	FUEL TANK UNIT
37	NUMBER PLATE LAMP
38	RELAY-HORNS
39	SPLIT BRAKE SWITCH
40	HANDBRAKE W/LIGHT SWITCH
41	HORN PUSH
42	REAR DOOR LIGHT SWITCHES
43	QUADRANT LAMP (AUTO ONLY)
44	ASH TRAY LAMP
45	BOOT LAMP
46	BOOT LAMP SWITCH

ACCESSORY CIRCUITS FOR EXECUTIVE MODELS

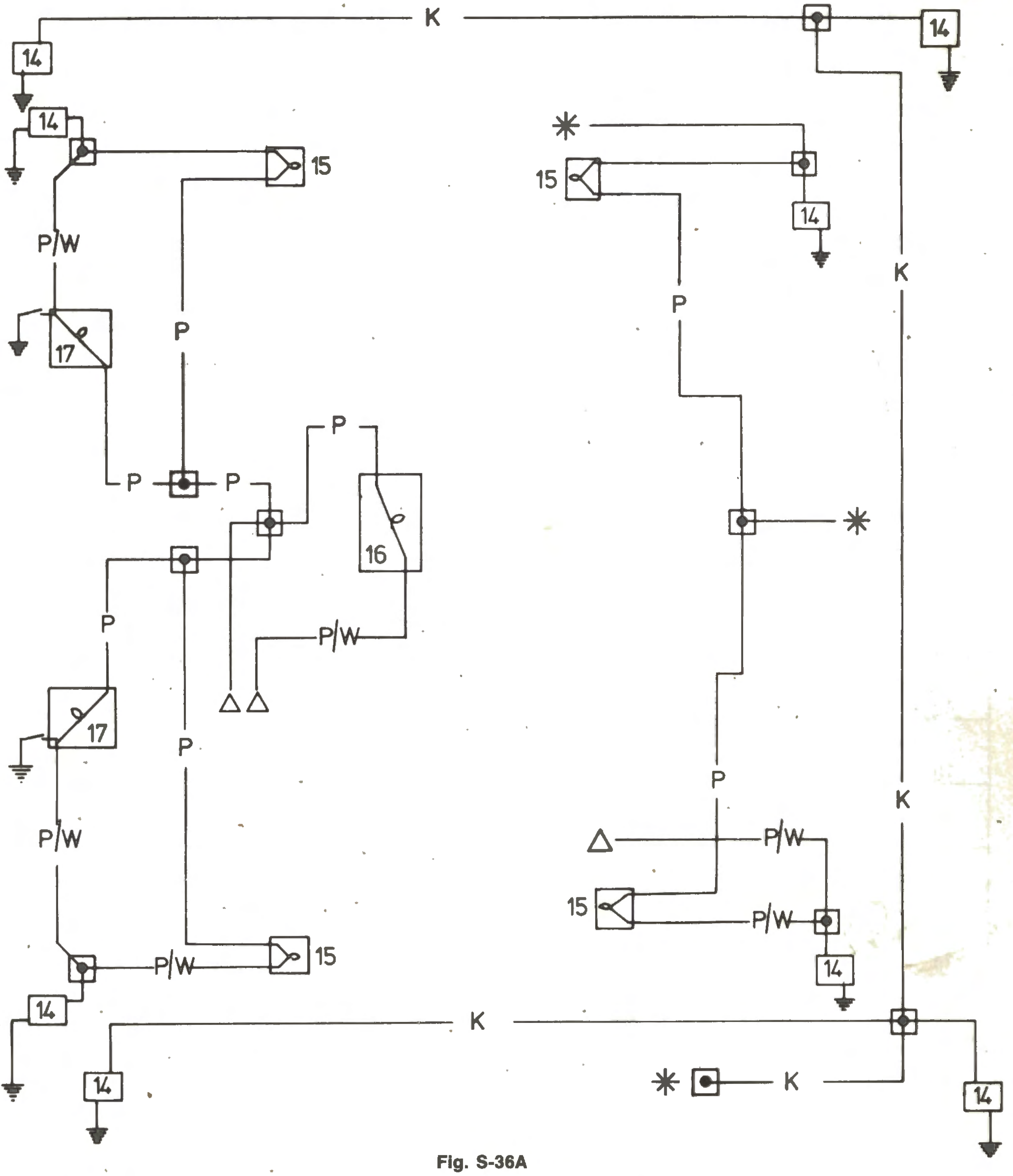


Fig. S-36A

NOTE: THIS LEGEND COVERS FIGS. S-36A-B-C

1 PANEL LIGHT
2 NO CHARGE WARNING LIGHT
3 TEMPERATURE GAUGE
4 OIL PRESSURE WARNING LIGHT
5 FUEL GAUGE
6 RH FLASHER WARNING LIGHT
7 LH FLASHER WARNING LIGHT
8 BRAKE FAIL WARNING LIGHT
9 HANDBRAKE WARNING LIGHT
10 HIGH BEAM WARNING LIGHT
11 TACHOMETER
12 DOOR AJAR WARNING LIGHT
13 CLOCK
14 DOOR SWITCH
15 ARM REST LIGHT
16 DOME LAMP
17 QUARTER LAMP

CABLES NOTED THUS ✳ ARE PART OF MAIN HARNESS

CABLES NOTED THUS △ ARE PART OF BODY HARNESS

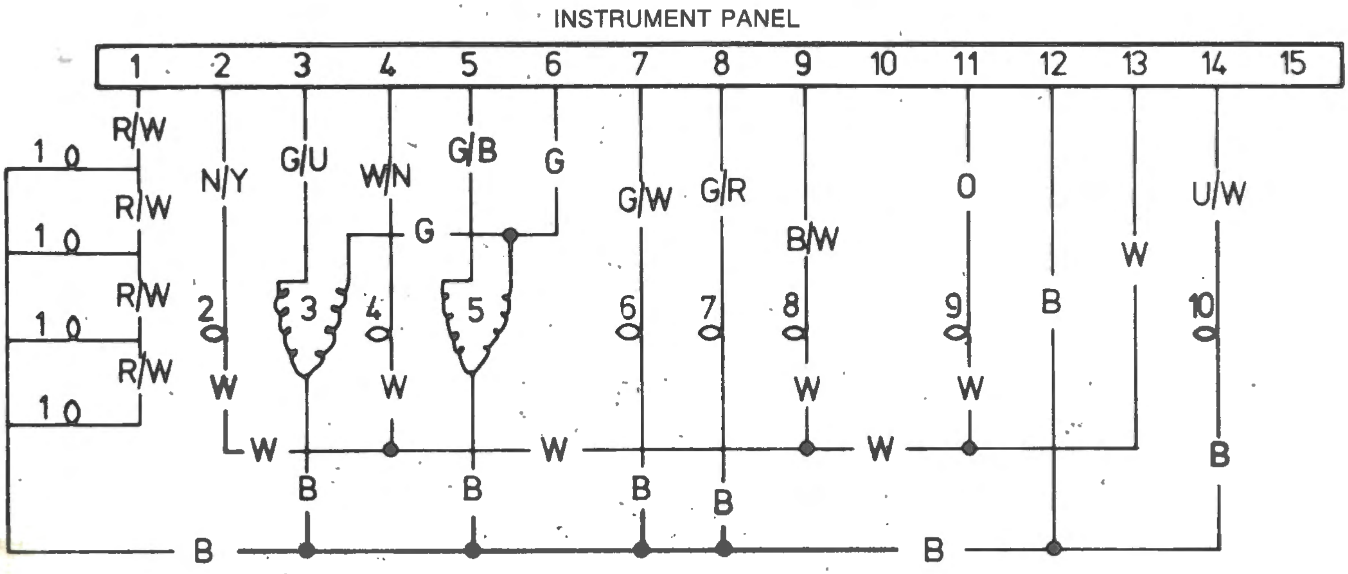


Fig. S-36B
LEYLAND AND DELUXE

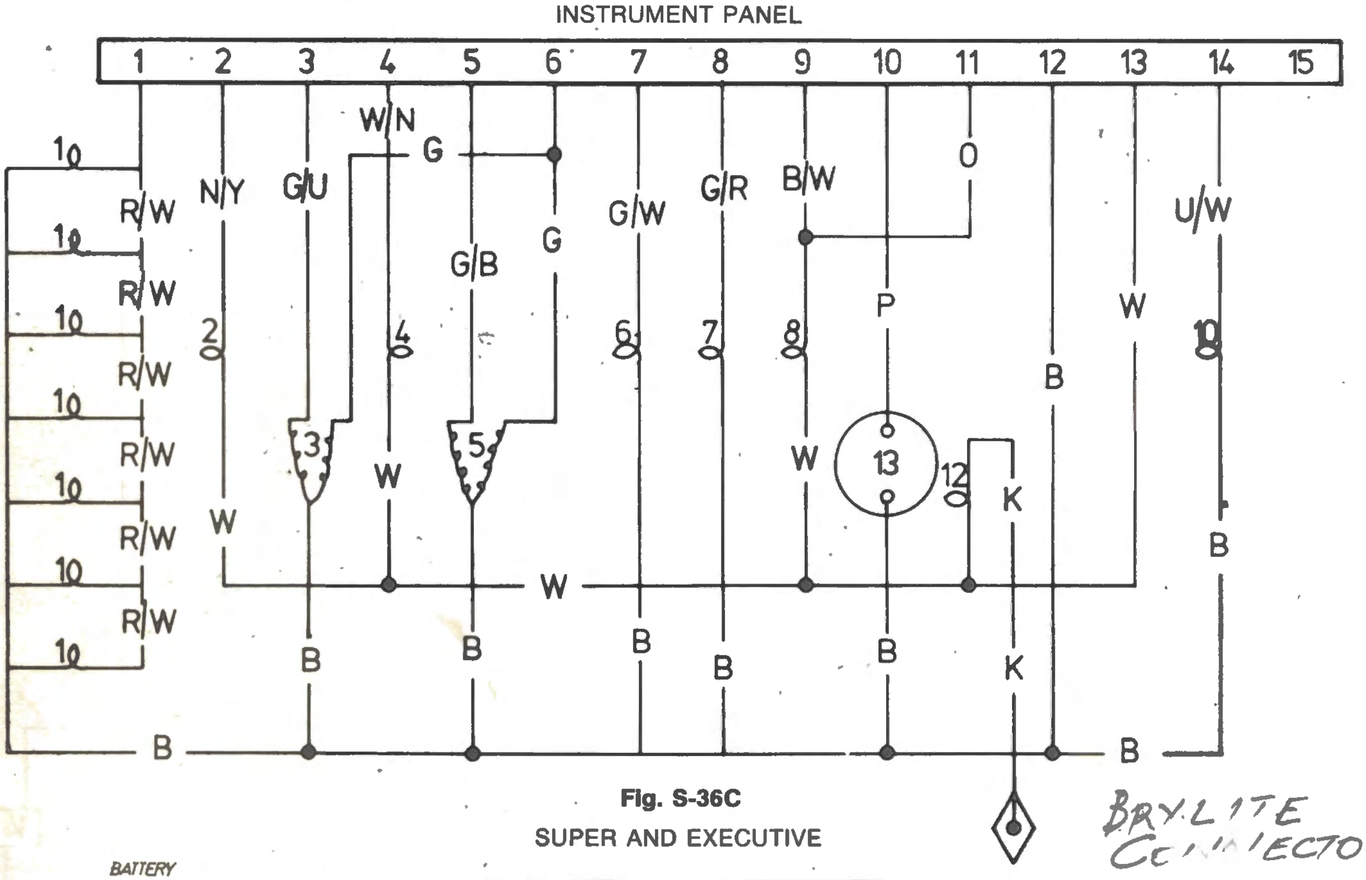
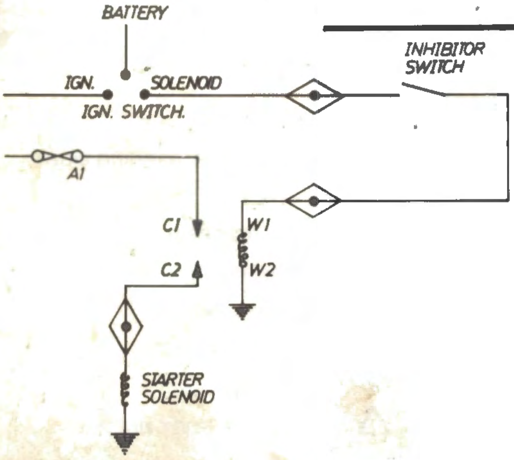


Fig. S-36C
SUPER AND EXECUTIVE

BRYLITE CONNECTOR



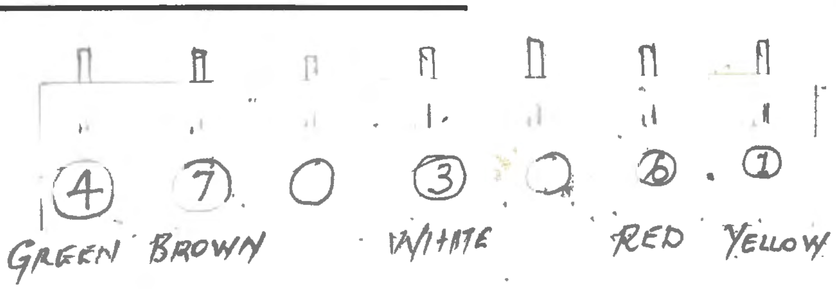


Fig. S-36D
STARTER CIRCUIT RELAY
AUTOMATIC MODELS

CONNECTION INSTRUCTION. AUSTRALIA STANDARD 2513. WIRE CODE

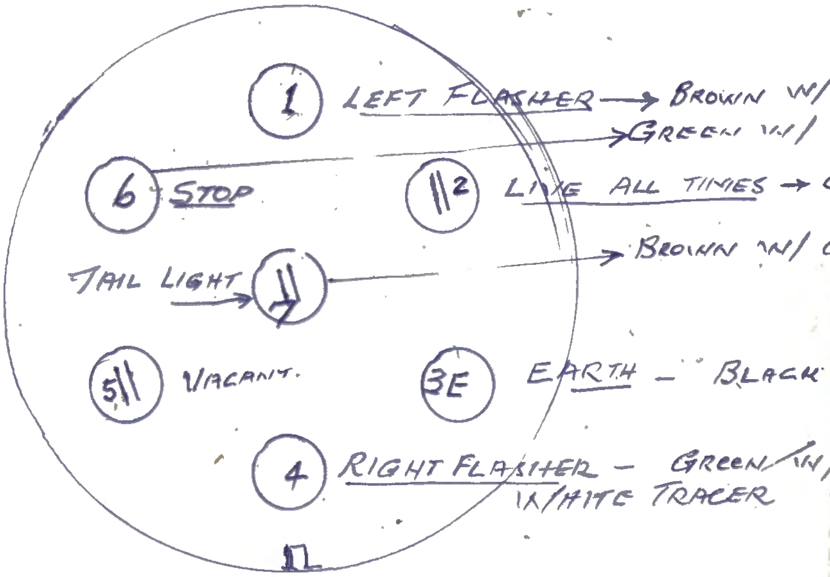
COLOUR	NAME	NO
YELLOW	LEFT HAND TURN	1
BLACK	REVERSING SIGNAL	2
WHITE	COMMON RETURN	3
GREEN	RIGHT HAND TURN	4
BLUE	SERVICE BRAKES	5
RED	STOP LAMPS	6
BROWN	REAR LAMPS, CLEARANCE & SIDE MARKER LAMPS	7

SECTION T

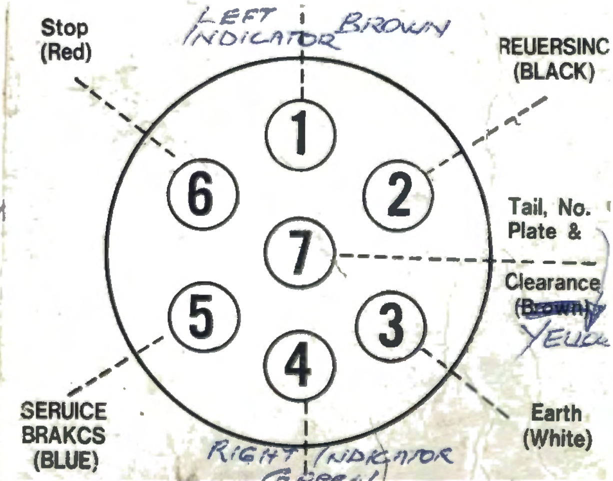
WHEELS AND TYRES

TOP.

EXTENSION LIGHTS BASE ON P76 – SOCKET. ON AAF-029



TRAILER PLUG



GENERAL DESCRIPTION

There are several types and sizes of tyres and wheels available. Refer to the GENERAL DATA for the wheel and tyre equipment fitted to the various models.

SPARE WHEEL LOCATION

The spare tyre and wheel is located in the left hand side of the luggage compartment and held in place by a rubber strap. Fig. T-1.

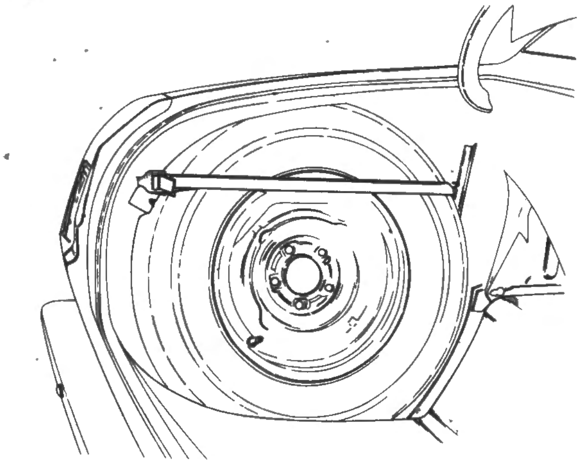


Fig. T-1

SPARE WHEEL LOCATION

JACKING POSITIONS

Two jacking positions are provided on each side of the vehicle. These consist of plates attached to the underside of the sill panel. Each plate has a locating hole to receive the top of the jack. Fig. T-2.

CAUTION: Do not work under the vehicle while it is supported by the jack only, ensure that it is supported on a rigid stand.

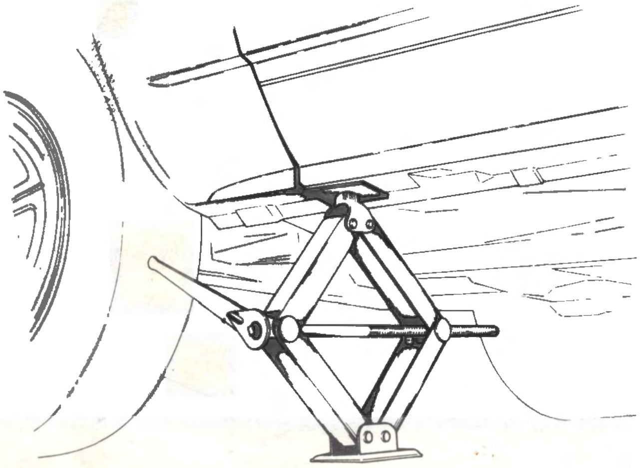


Fig. T-2

JACKING POSITIONS

WHEELS

WHEEL NUTS

The five nuts securing the road wheel to the hub are ½ in U.N.F. right hand thread.

NOTE: It is important that the correct wheel nut is used in conjunction with each type of wheel. Refer Fig. T-3.

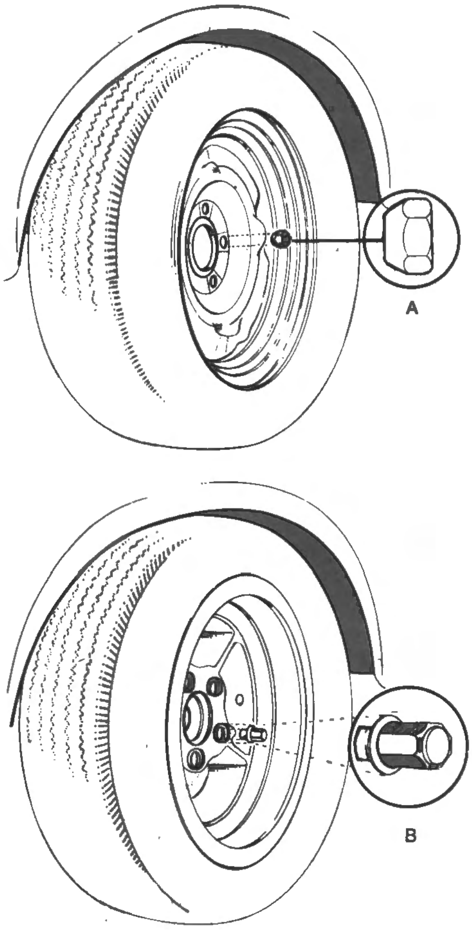


Fig. T-3

WHEEL NUTS

A — NUT — STEEL WHEEL B — NUT — ALLOY WHEEL

The wheel nuts should be tightened to the specified torque of 81 Nm (60 lb.f.ft.) in the correct sequence. Refer Fig. T-4. The nuts should be moderately tightened whilst the vehicle is supported on a jack then finally tightened to the specified torque when the wheel is on the ground.

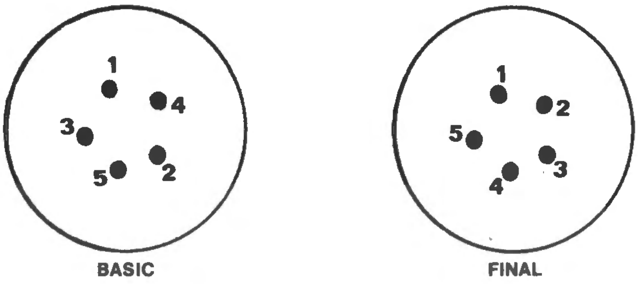


Fig. T-4

WHEEL NUT TIGHTENING SEQUENCE

SAFETY RIM

The safety rim type wheels fitted to these models conform to Australian Design regulations. The design provides a safety feature giving added protection in case of tyre blow-out or rapid deflation while the car is in motion. The shape of the rim is such that if sudden deflation occurs the tyre beads are pressed outwards against the wheel rim flanges, rather than inwards and away from the rims. Fig. T-5.

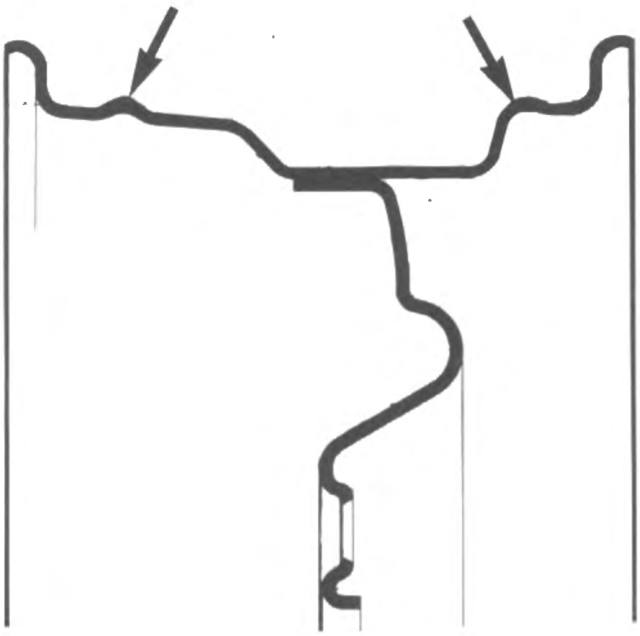


Fig. T-5

SAFETY TYPE WHEEL RIM
(Arrows indicate the Safety Flange)

TYRES

Modern cars are fitted with either cross-ply or radial-ply tyres. Because of the differences in construction of cross-ply and radial-ply tyres, they have vastly different cornering characteristics.

RADIAL-PLY TYRES

Radial-ply tyres have their textile casing cords running radially from bead to bead and a belt of textile or steel cords under the tread.

CROSS-PLY TYRES

Cross-ply tyres have textile cords running diagonally from bead to bead.

The wrong combination of radial and cross-ply tyres on a car can be dangerous and both types cannot be mixed. Do not under any circumstances have radial-ply tyres on the front wheels with cross-ply on the rear. Do not mix cross-ply and radial-ply tyres on the same axle. Should it be necessary to fit the spare tyre and it results in 'mixed' tyres on either front or rear axle, the vehicle should be driven at low speed and for the minimum distance necessary to obtain assistance.

For the best performance and safety use cross-ply tyres all round or radial-ply tyres all round. Mixed tyres must not be used for high speed operation.

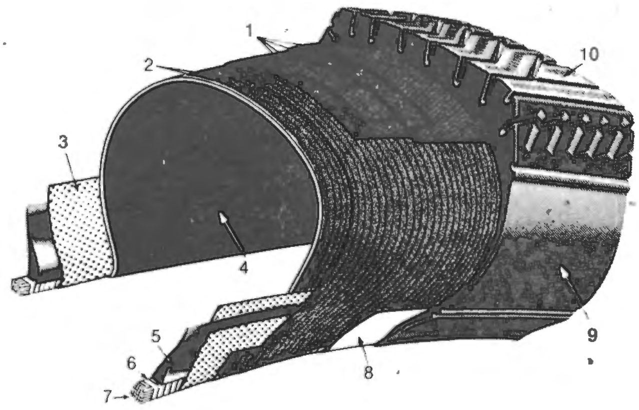


Fig. T-6

RADIAL-PLY TYRE CONSTRUCTION

1	TREAD BRACING LAYERS	6	BEAD WRAP
2	RADIAL PLIES	7	BEAD WIRES
3	FABRIC FILLER	8	CHAFER
4	INNER LINING	9	WALL RUBBER
5	FILLER	10	TREAD

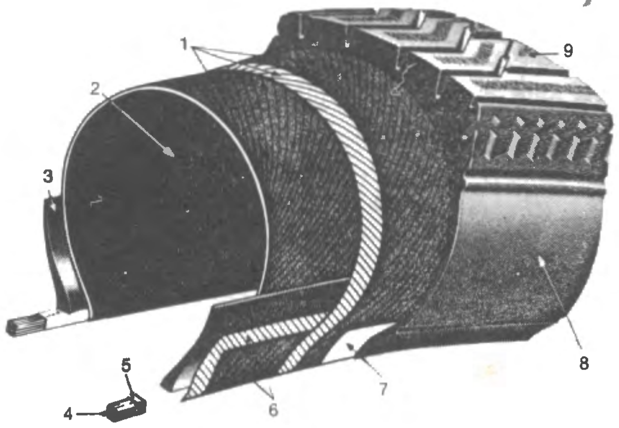


Fig. T-7

CROSS-PLY TYRE CONSTRUCTION

1	CASING PLIES	6	CASING PLIES
2	INNER LINER	7	CHAFER
3	FILLER	8	WALL RUBBER
4	BEAD WIRES	9	TREAD
5	BEAD WRAP		

TYRE CLASSIFICATION

Current production tyres are marked to indicate the size, construction, speed and load ratings. The classifications must be adhered to when selecting tyres for each application.

The tyre marking system is designed to assist all those concerned namely; the tyre engineer, the car manufacturer, the various standards authorities responsible for tyres, rims and safety, the tyre dealer, and most important the customer. These markings are on the side wall which indicate the shape, dimensions, load and speed at which the tyre was designed to operate.

Details of the tyre specifications are in the GENERAL DATA section, to comply with the Design Regulations a label showing all relevant tyre informaton is affixed to the right hand front valance reference Fig. A-1-4.

TYRE WEAR

Bad driving habits possibly contribute as much to excessive tyre wear as any other single cause. Wear caused by cornering and turning at acute angles can be identified by rounded shoulders on the tyre and small rough abrasions and small fins raised by the cornering friction against the road.

High speed cornering may also cause front tyre scuffing across the tread and rear tyre inside edge wear, although the wheel alignment factors are within the specifications and the tyres correctly inflated.

TYRE PRESSURES

One of the most important aspects of tyre maintenance is the correct pressure at all times. Not only is correct tyre pressure essential for riding comfort, but it has considerable influence on the handling characteristics of the vehicles. Details of tyre pressures are in the GENERAL DATA section.

Under-inflation

Under-inflation produces abnormal deflection of tyres resulting in excess wear in the shoulder area, also excessive heat build-up. The extra strain increases the risk of separation failure. Reference Fig. T-8.

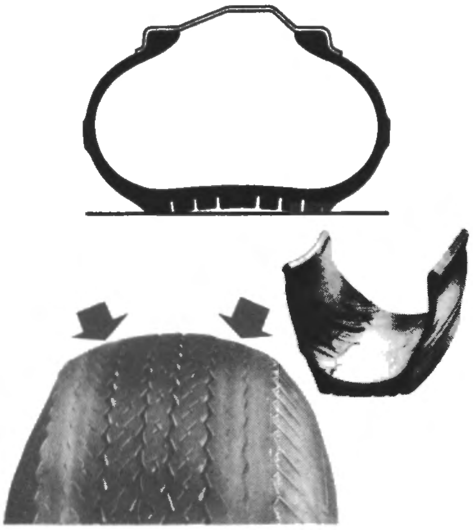


Fig. T-8
UNDER-INFLATION

Over-inflation

Over-inflation reduces the normal flexing of tyres resulting in undue wear in the centre of the tread. Over-inflation makes the fabric plies more susceptible to impact damage. Reference Fig. T-9.

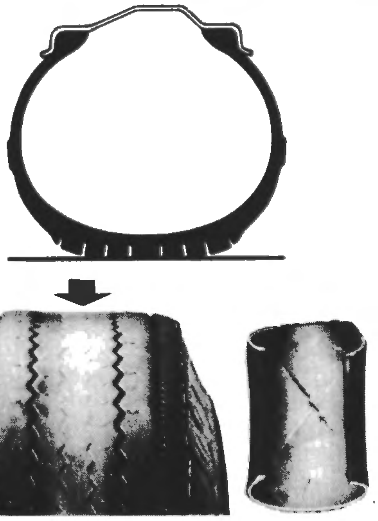


Fig. T-9
OVER-INFLATION

CAUTION: Do not bleed air from tyres when hot to reduce increased pressure. Tyre pressures should always be checked when the tyres are cold.

Valve caps should always be replaced and firmly tightened by hand. Valve caps prevent the ingress of dirt and water which will contribute to valve leakage and under-inflation.

TYRE INTERCHANGE

It is recommended that cross-ply tyres be interchanged as shown in Fig. T-10 so that even wear and maximum tyre life may be attained.

Radial-ply tyres should not be rotated other than to exchange front and rear on the same side.

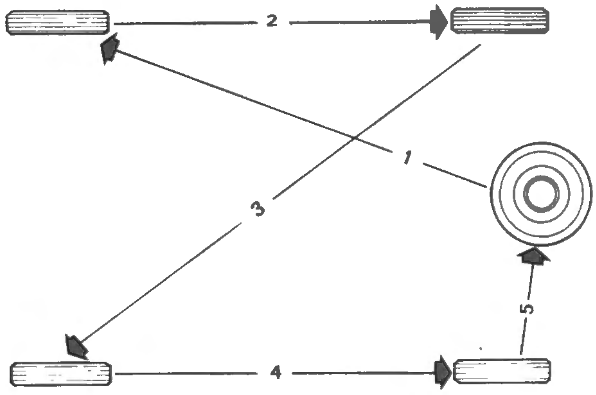


Fig. T-10
TYRE INTERCHANGE

VALVES

A mushroom-head valve is used with tubeless tyres. The valve is secured by a stepped flange and the air pressure inside the tyre.

A Universal tool with a brass dust cap soldered in the end will ease fitting of valves. To fit the valve follow the manufacturers' recommendations.

INSPECTION

In the interest of safety a simple check should be made of tyres at least once a week and particularly before long fast runs.

Remove stones and any other objects embedded in the tread.

WARNING: Tyres which are at an advanced state of wear offer less resistance to punctures, but the main danger is their reduced gripping power particularly on wet roads.

CAUTION: Tyre wear must not exceed the minimum tread thickness of 1.5 mm (1/16 in) as specified by the Transport Authorities.
It is an offence to run tyres where the tread pattern of the tyre does not have sufficient depth.

REPAIRS

If the tyre has been damaged have it repaired by means of a vulcanized repair, otherwise the damage may extend and ruin the tyre. A minor penetration of the tread of a tubeless tyre, cross-ply or radial-ply, by a nail or small screw can be plugged using a tubeless tyre repair kit. Such a repair should be regarded as a temporary 'GET YOU HOME' expedient only and should be completely repaired with a patch vulcanized on the inside of the casing as soon as possible afterwards. Under no circumstances should a plug repair be made to the sidewall of a tyre.

AIR LEAKS

Leaks at tyre beads and wheel flanges may be corrected by straightening visible dents and by smoothing tyre-to-rim contact areas using coarse clean steel wool to remove surface irregularities. Any rust should be removed with a wire brush.

CAUTION: Do not attempt to correct air leaks by soldering or brazing the wheel flange. If the rim metal is porous, fit a new wheel.

WHEEL RUN-OUT

Wheel run-out or eccentricity is the product of numerous causes, such as warped wheels, worn or incorrectly adjusted wheel bearings, bent rear axle shaft, incorrectly mounted wheel, warped hub.

When run-out is evident, checks of the above components should be made to locate the actual causes and rectifications carried out.

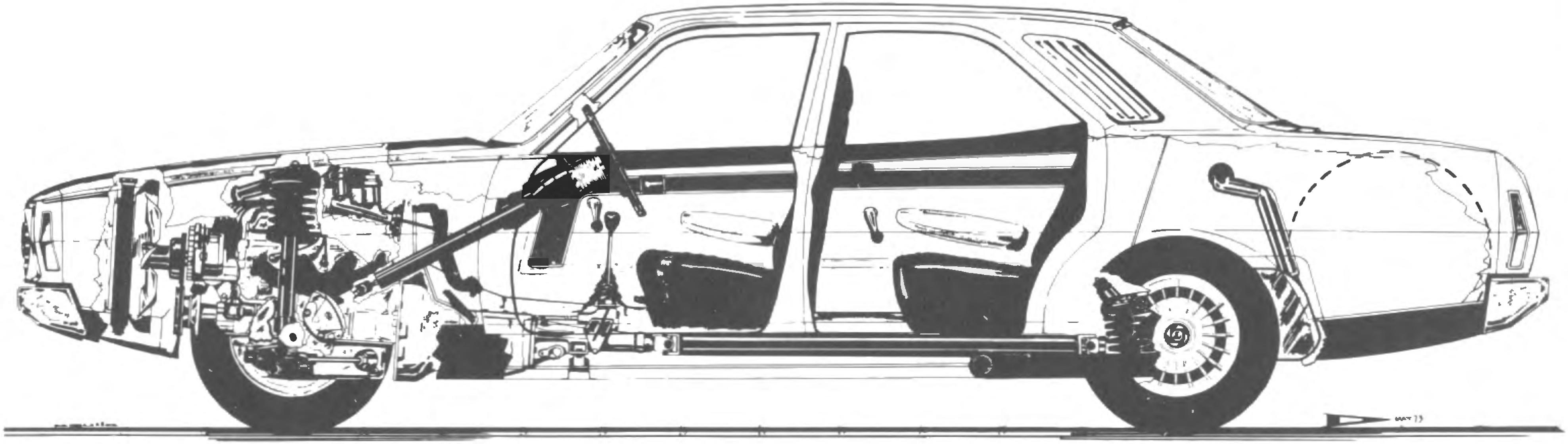
BALANCING

See that tyre and wheel assemblies are correctly balanced, particularly if frequently travelling at high speeds. Vibration felt at the steering wheel may be an indication that the wheel assemblies are out of balance. The balance should be checked from time to time using accurate and reliable balancing equipment and carefully following the manufacturers' instructions.

A wheel weight of 57 g (2 oz) is available for alloy wheels. The weight is of the adhesive type and available in 14 g (½ oz) sections, allowing it to be attached in weights of 14 g (½ oz) increments to 57 g (2 oz).

FITTED NEW ELITE TYRES 18000 KM 1/8/88 · EAD DEPTH 8MM-5/16'
FITTED NEW ELITE II TYRES 215/65 HR14 TO REAR WHEELS 38340 KM 18/4/90
TYRES AT 2500 KM 26 94
[illegible]
[illegible]
19/5/95 FITTE 2 NEW 195/75-14 STEELFLEX TYRES ON FRONT & RELOCATES FRONT
58000 KM 205/70 TYRES TO REAR
18/8/95 145?0KM FITTED S/H INCT 205/70 HR14 (DEVINK) & S/H DUNLOP 205/70 HR14

SECTION U
BODY



4 DOOR SALOON

BODY FINISH

PAINT

The bodies of the P76 models are finished in baked enamel, having first been treated in the special Leyland Australia Roto-dip process.

The special Roto-dip anti rust treatment protects all surfaces of the vehicle body, inside and outside, prior to the colour coats being applied.

The body of the car is fully immersed and rotated in a phosphating dip, dried in heated ovens, dipped in a rust inhibiting priming paint bath and finally passed through a baking oven.

The final result is a fully proofed body requiring the minimum of maintenance in achieving a high gloss and long life paint finish.

Touch up paint should be ordered in accordance with the paint identification reference attached to the vehicle. This will ensure correct colour match with the original factory finish.

To obtain the best results and colour match, it is recommended that Acrylic paint be used in preference to a nitro-cellulose lacquer, as the fade rate of the former is more comparable with that of the original finish.

Paint finish touch-up should be avoided whenever possible since a better finish will be achieved by repainting an entire panel thus avoiding possible detection of paint demarcation lines between old and new finishes.

WASHING AND POLISHING

Regular care of the body finish is necessary if the new appearance of the car exterior is to be maintained against the effects of air pollution, rain and mud.

Wash the bodywork frequently using a soft sponge and plenty of water. Do not rub the surface, large deposits of mud must be softened with water before using the sponge.

Smears should be removed by a second wash in warm water liberally applied with a soft sponge. Dry the surface with a chamois leather. In addition to the regular maintenance, special attention is required if the car is driven in extreme conditions such as sea spray or salted roads. In these conditions and with other forms of severe contamination an additional washing operation is necessary which should include underbody hosing.

NOTE: It is essential that all body drainage points are free from blockage.

To remove spots of tar or grease use petrol or white spirits.

An application of a high quality wax is all that is required to remove traffic film and to ensure retention of the new appearance.

BRIGHT TRIM

Never use an abrasive on stainless, chromium, aluminium or plastic bright parts and on no account clean them with metal polish. Remove spots of grease or tar with petrol or white spirits. When the dirt has been removed apply a high quality wax polish.

INTERIOR

The seat covering materials require a certain amount of attention and ordinary soiling is easily removed with warm soapy water applied on a damp cloth. Bad soiling can be removed with a medium stiff nylon brush.

NOTE: Fabric type seat covers being specially treated to repel stains should only require occasional cleaning by sponging with warm water containing a mild detergent. On no account should a volatile type of cleaning fluid be used.

Whenever soaps or detergents are used it is important that the upholstery be rinsed clean and wiped dry.

DOORS

DOOR TRIMS AND INTERIOR HANDLES

Removing

1. Remove the screw retaining the window winder handle and remove handle. Refer Fig. U-2.
2. Remove the arm rest (if fitted).
3. Remove the screw securing the inner door handle plate and remove assembly.
4. Insert a broad blade screw driver between the trim panel and door frame adjacent to the retaining clips and prise the clips out of the door frame around the edge of the door trim.
5. When all clips have been freed, remove the trim panel.

Refitting

1. Reverse the removing procedure ensuring that all the door lock parts are adequately greased. If the dust sealing tapes on the doors have been disturbed, they must be replaced.
2. When refitting the door trims, offer up the liner clips to their respective holes, and force home with sharp taps, using the palm of the hand.

FRONT DOOR GLASS

Removing

1. Remove the door trim and interior handles.
2. Remove the dust sealing tapes.
3. Remove the two screws retaining the glass front channel and place channel in the bottom of the door.

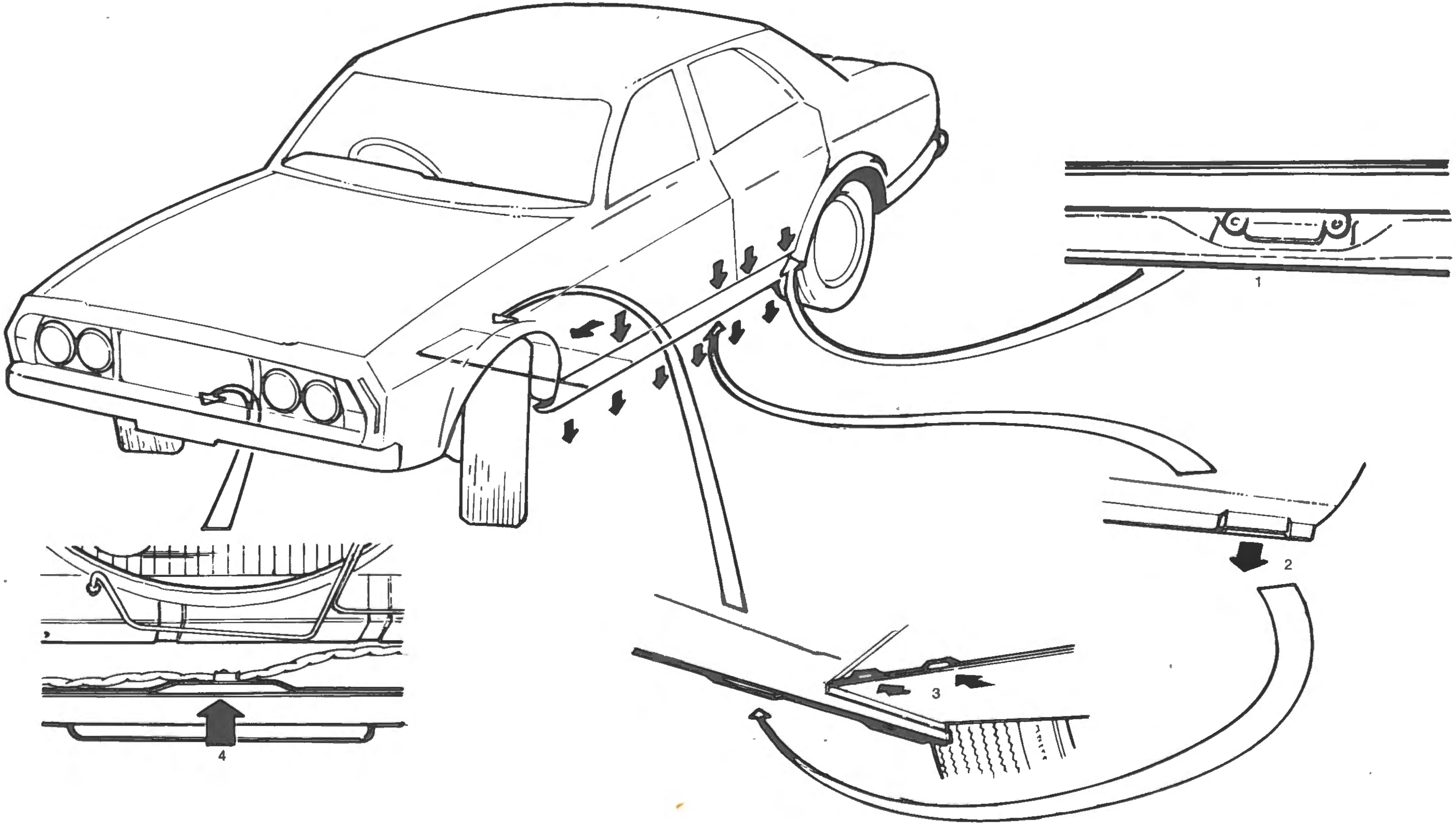


Fig. U-1

BODY DRAIN POINTS

1 DOOR DRAIN SEALS (2)
2 SILL DRAINS (7) INCLUDES 'A' POST
3 SECTION LONGITUDINAL MEMBER TO INNER SILL PANEL (2)
4 FRONT LOWER PANEL

LAYOUT OF FRONT DOOR COMPONENTS

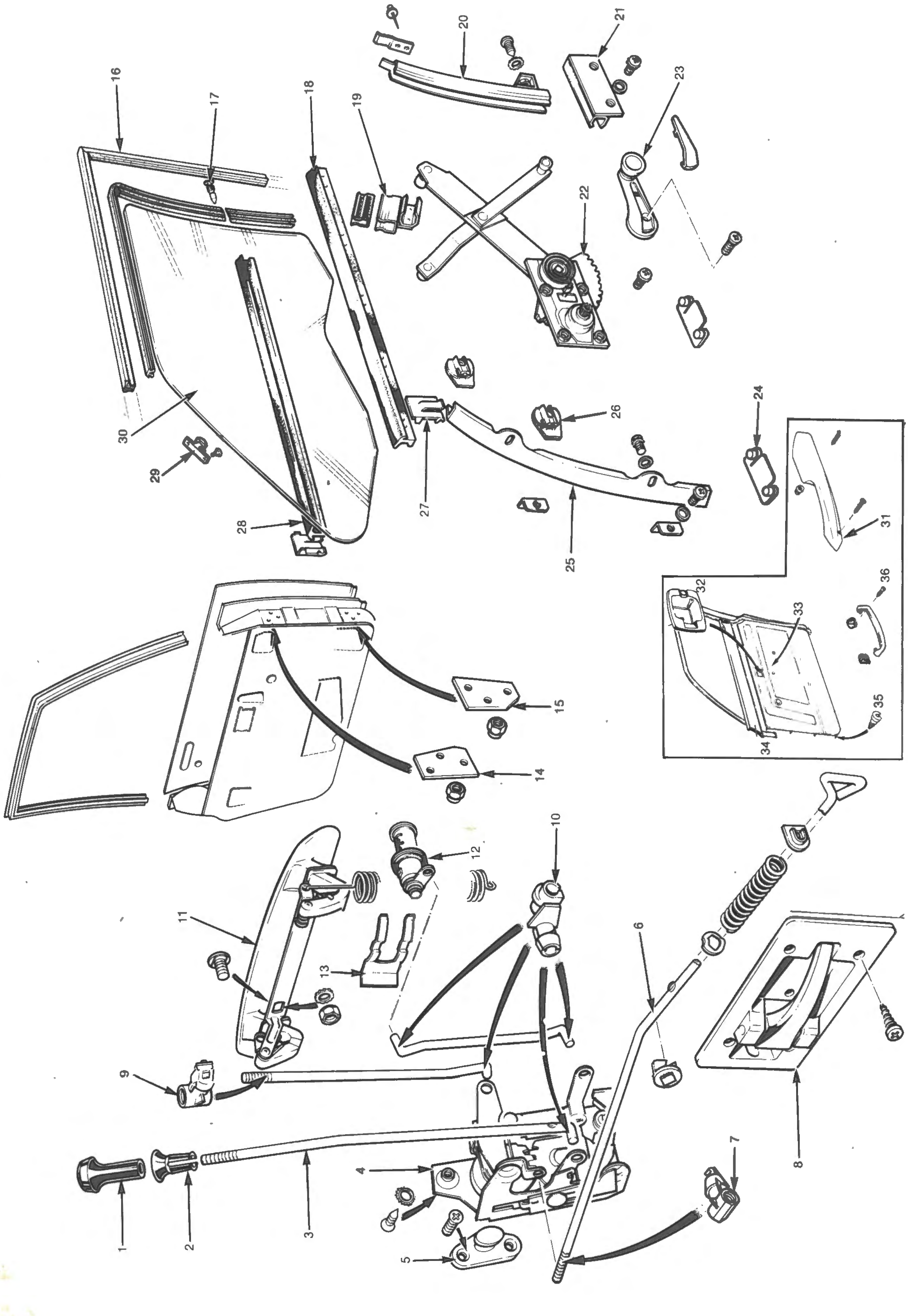


Fig. U-2

KEY TO FIG. U-2

1 DOOR LOCKING BUTTON
2 ESCUTCHEON DOOR LOCKING BUTTON
3 LOCKING BUTTON ROD
4 DOOR LOCK ASSEMBLY FRONT
5 LOCK STRIKER
6 REMOTE CONTROL ROD
7 ROD END CLIP
8 REMOTE CONTROL HANDLE ASSEMBLY
9 DOOR LOCK OPERATING ROD AND END CLIP
10 ROD END CLIPS
11 OUTER DOOR HANDLE
12 PRIVATE LOCK AND KEY ASSEMBLY
13 PRIVATE LOCK RETAINING CLIP
14 DOOR HINGE PLATE — UPPER
15 DOOR HINGE PLATE — LOWER
16 DOOR SEAL
17 DOOR SEAL CLIP
18 DOOR INNER WAIST SEAL
19 GLASS LIFTING CHANNEL
20 DOOR GLASS CHANNEL ASSEMBLY — REAR LOWER
21 DOOR GLASS SLIDE
22 WINDOW GLASS REGULATOR
23 REGULATOR HANDLE
24 DOOR DRAIN SEALS
25 GLASS CHANNEL ASSEMBLY — FRONT
26 DOOR GLASS GUIDE
27 DOOR WAIST RAIL SEAL CLIP
28 DOOR WAIST RAIL SEAL — OUTER
29 GLASS CHANNEL GUIDE
30 DOOR WINDOW GLASS
31 ARM REST
32 REMOTE CONTROL HANDLE ESCUTCHEON
33 TRIM PANEL
34 WAIST TRIM CAPPING
35 TRIM CLIP
36 DOOR CLOSING HANDLE (WHERE FITTED)

4 Lower the glass to the bottom of the door.

5 Remove the weather strips from the door sill.

6 Remove the four screws retaining the regulator unit and remove the regulator from the bottom of the door.

7 Raise the window glass and tilt inwards as it is removed from the door.

8 Remove the regulator channel and protective rubber from the glass.

Refitting

1 Refit the channel to the bottom of the glass.

2 Install window glass into door from the top and replace the two weather strips in the door sill.

3 Replace the regulator into the door and insert the four retaining screws, but do not tighten.

4 Insert both regulator arm rollers into their respective channels, and tighten regulator retaining screws.

5 Replace the front channel but do not tighten retaining screws.

6 Raise the window and adjust the front channel to obtain smooth operation of the window. Tighten the channel retaining screws.

7 Renew dust sealing tapes.

8 Refit the door trims and interior handles.

REAR DOOR GLASS

Removing

Follow procedures 1 to 6 for the front door glass and continue in this sequence. Refer Fig. U-3.

1 Remove by tilting the rear of the glass upwards and inwards as it is raised, and withdraw inside the door.

2 Remove the regulator channel and protective rubber from the glass.

Refitting

1 Replace the regulator channel to the glass.

2 Replace the glass by inserting into the door sill from the top inside of the door, tilting the rear edge upwards then lower into place.

3 Replace both weather strips in door sill.

4 Install the regulator and insert the roller into the channel. Replace the four retaining screws but do not tighten.

5 Replace the rear window channel and insert the two retaining screws, but do not tighten.

6 Tighten regulator screws, raise and lower window several times, at the same time adjust the channel for smooth operation. Tighten the channel retaining screws.

7 Renew dust sealing tapes.

8 Refit door trim and interior handles.

LAYOUT OF REAR DOOR COMPONENTS

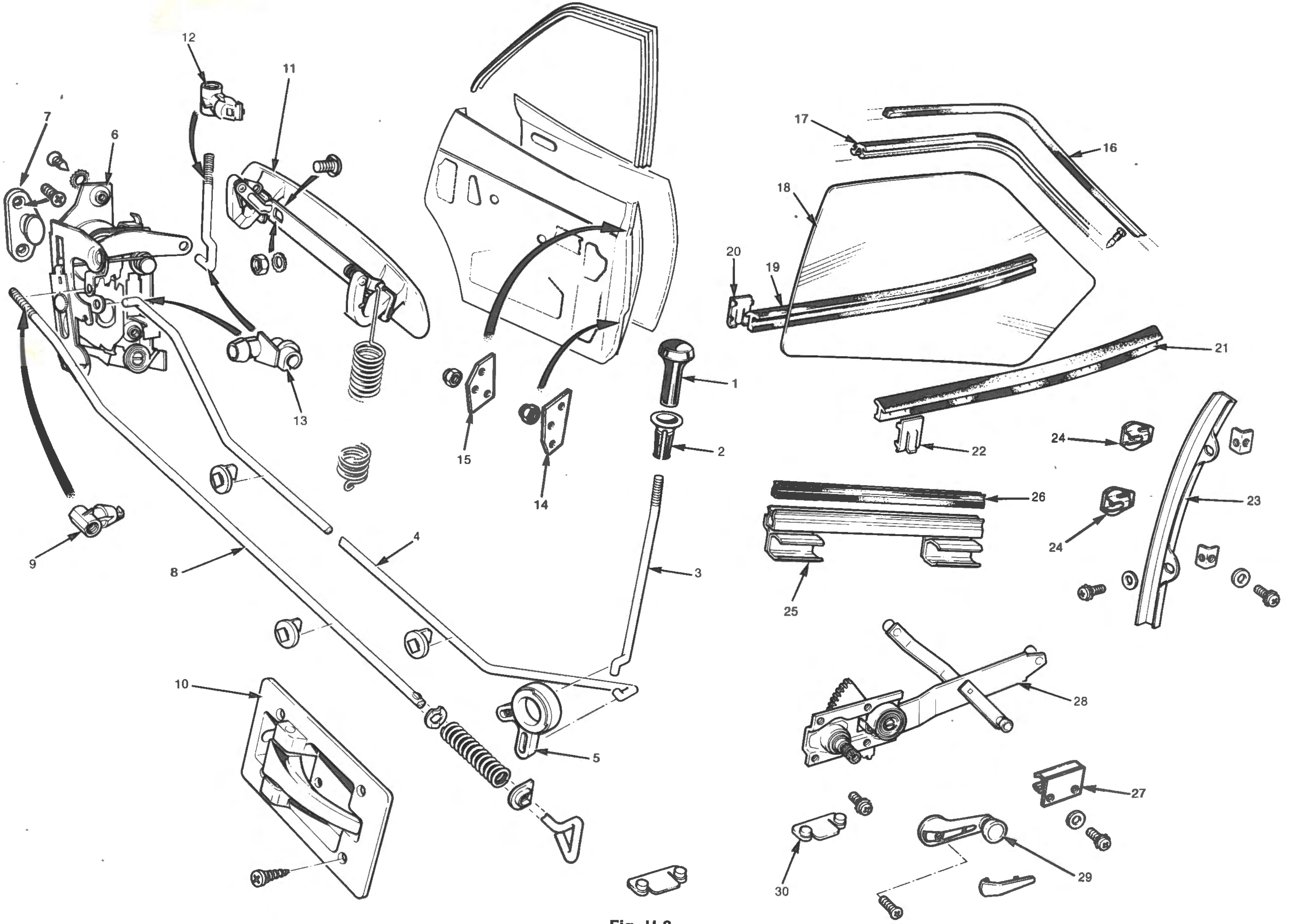


Fig. U-3

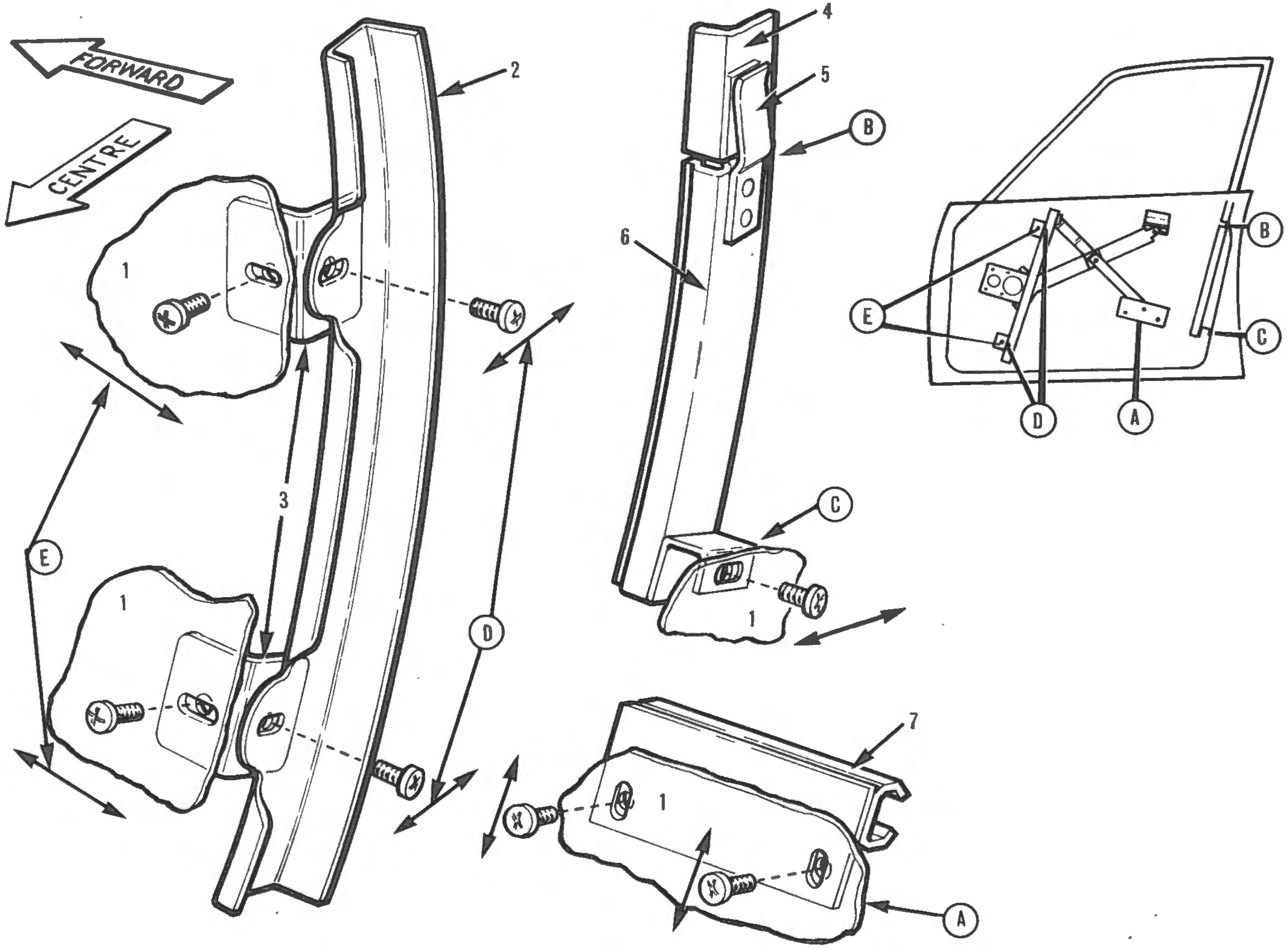


Fig. U-4

DOOR GLASS ADJUSTING POINTS
(FRONT SHOWN)

1 INNER PANEL
2 GLASS CHANNEL ASSEMBLY
3 CHANNEL BRACKETS
4 LOWER END OF DOOR TOP FRAME
5 SPRING CLIP
6 LOWER GLASS CHANNEL ASSEMBLY
7 FIXED SLIDE

KEY TO FIG. U-3

1 DOOR LOCKING BUTTON
2 ESCUTCHEON DOOR LOCKING BUTTON
3 LOCKING BUTTON ROD
4 REMOTE CONTROL ROD LOCKING BUTTON
5 LEVER REMOTE/LOCKING ROD
6 LOCK ASSEMBLY
7 LOCK STRIKER
8 REMOTE CONTROL ROD
9 ROD END CLIP
10 INNER DOOR HANDLE
11 OUTER DOOR HANDLE
12 DOOR LOCK ROD AND CLIP
13 ROD END CLIPS
14 DOOR HINGE PLATE — LOWER
15 DOOR HINGE PLATE — UPPER
16 DOOR SEAL
17 GLASS CHANNEL
18 DOOR WINDOW GLASS
19 DOOR OUTER WAIST SEAL
20 CLIP — OUTER WAIST SEAL
21 DOOR INNER WAIST SEAL
22 CLIPS FOR SEAL
23 DOOR GLASS CHANNEL ASSEMBLY
24 GLASS GUIDES
25 GLASS LIFTING CHANNEL
26 GLAZING RUBBER
27 DOOR GLASS SLIDE
28 WINDOW GLASS REGULATOR
29 REGULATOR HANDLE
30 DOOR DRAIN SEALS

DOOR GLASS REGULATORS

Removing

1 Remove the front door trims.

2 Remove the sealing tape.

3 Remove the four screws retaining the door glass regulator, and slide the regulator arm clear of the channel attached to the lower edge of the glass.

4 Remove the regulator through the aperture in the inner door panel.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 4 noting the following:

(a) Determine that the glass counter weight spring is installed correctly; the spring should 'wind-up' when the glass is being lowered, otherwise excessive effort will be required to raise the window.

(b) Ensure that the sealing tape is replaced in its original position. Refer Fig. U-17.

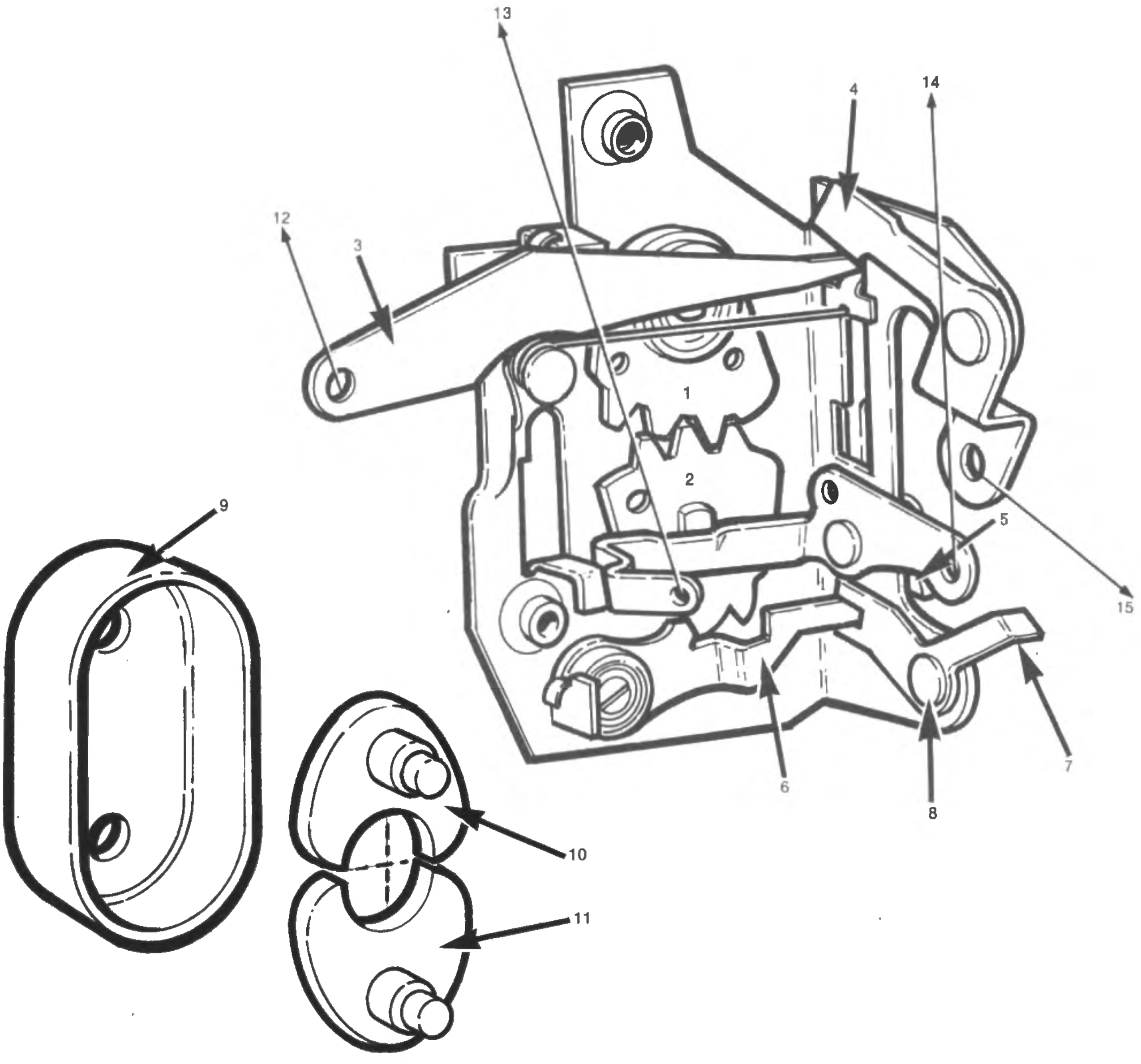


Fig. U-5

FRONT DOOR LOCK ASSEMBLY
(RH SHOWN)

1	TOP CLAW GEAR	7	TOGGLE LEVER	
2	LOWER CLAW GEAR AND RATCHET	8	RIVET (FRONT ONLY)	
3	ROCKER LEVER	9	COVER PLATE	HIDDEN IN MAIN VIEWS
4	BELL CRANK LEVER	10	TOP CLAW	
5	PUSH LINK	11	BOTTOM CLAW	
6	PAWL			

DOOR LOCKS

DESCRIPTION

The lock is a double claw lock, used in conjunction with an oval striker pin. A head on the striker provides the anti-burst feature in the fully and semi-latched position, as required by the safety regulations.

The drawer type handle movement is transferred via rod, rocker and push link to a pawl, which releases a ratchet gear attached to a common shaft, with the lower claw. The upper claw also has a gear, which is in mesh with the ratchet gear on the lower claw shaft, ensuring that both claws operate simultaneously, in opposite directions, so releasing the striker.

Inside handle operation is provided by a bellcrank lever, adjacent to the inner end of the rocker lever, so that the finger-type remote lever's motion is converted to the downward movement of the push link necessary to rotate the pawl and free the latch.

Locking is provided by moving the lower end of the push link clear of the pawl tail, this allows the system to 'free wheel', making it futile to use force to overcome the locked condition. Neither the interior nor exterior handles will operate the latch, until reset to the unlocked position. This ensures protection against inadvertent opening by the interior handle.

Locking of all doors is provided internally by vertical moving locking buttons, which are depressed to set in 'lock' position.

Front door locking buttons can be operated externally, by a key operated device, attached to the outer panel. The barrel is a seven ward lock, using the identical key to the ignition/steering ten ward device. All keys are of the double entry type.

Rear doors set in the locked condition while open, and then slammed, will remain locked.

If it were possible to do this on front doors, the chances of slam locking all doors, with the keys still inside the car, would be high. To reduce this possibility, the front door locks are designed to automatically reset themselves to the unlocked condition, during slamming, unless a deliberate sequence of handle operation is undertaken by the operator throughout the closing cycle.

When a front door is slammed with the latch set in 'lock' position, the ratchet teeth on the lower gear plate cause the pawl to oscillate. This movement is transferred to the toggle lever via the pawl tail. A lug on the toggle lever contacts the heel of the push link, returning the link to the 'unlock' position. This ensures that the door will not be inadvertently locked.

However, when it is intended to deliberately preset the locking button to 'lock' position, and then slam the door, it is possible to override this fail-safe feature by holding the outer handle to the full release position while the door is slammed.

This will cause a downward movement of the push link, positioning the heel of the push link clear of the path of the lug on the toggle lever, as it is actuated by the tail of the pawl during closing. The push link will then remain in the position set for it to miss the pawl tail when inner or outer handles are operated.

Locking buttons on the rear doors are set at the extreme front end of the waist area, where they cannot be reached by children wearing a safety harness.

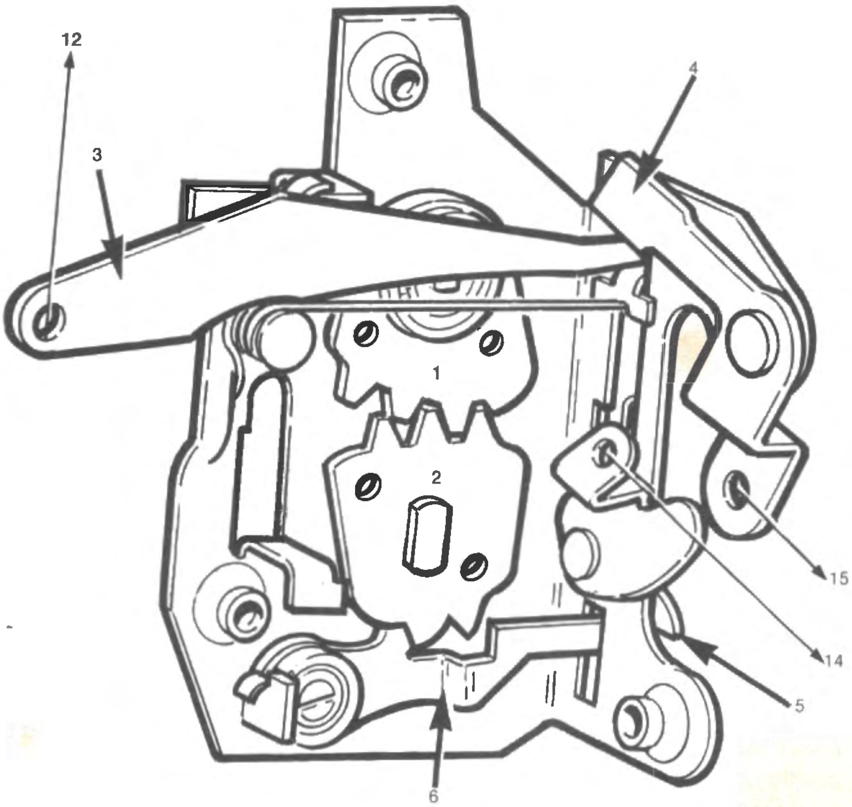


Fig. U-6

REAR DOOR LOCK ASSEMBLY
(RH SHOWN)

12 TO OUTER HANDLE
13 TO KEY LOCK DEVICE
14 TO WAIST LOCKING BUTTON
15 TO REMOTE CONTROL

Checking

1 Lower the window and close the door.

2 Push the safety locking button down to the locked position.

3 Check that the outside lever is inoperative and the door is locked.

4 Front door only, unlock the door by turning the key.

5 Rear door only, lift the safety locking button.

6 Open the door by operating the outside release lever.

7 Close the door and reopen it using the inside release lever.

Adjusting — Outside Handle

1 Remove the door trim pad.

2 Close the door, partially operate the outside release lever and check that there is free movement of the lever prior to moving the transfer lever and screwed rod.

3 Operate the outside release lever fully and check that the latch disc is released from the door striker before the lever is fully open. Disconnect the screwed rod and screw in or out to achieve the correct setting. Refer Figs. U-2 — U-3.

Adjusting — Remote Control

1 Ensure that there is free movement in the lever.

2 Disconnect the rod clip from the lever and screw in or out to achieve the correct setting.

FRONT DOOR LOCK

Removing

1 Raise the window to the top of the door.

2 Remove arm rest, window winder handle and remote control handle assembly.

3 Remove door trim and sealing tapes.

4 Disconnect the door lock remote control link, the outside handle link, the lock to cylinder link and lock button link from their respective lock levers. All rods are prised from their levers. Refer Fig. U-2.

5 Remove the screw from the bottom of the window rear channel.

6 Remove the three screws retaining the lock to door frame. Push lock inwards, hold window channel to one side and slide lock downwards and remove from bottom of door.

Refitting

1 Insert lock into bottom of door and raise into position, holding the window rear channel to one side, replace screws but do not tighten.

2 Replace the four rods on to their respective levers and tighten the lock retaining screws.

3 Replace screw retaining bottom of window channel and adjust channel for smooth operation. Tighten screw.

4 Replace dust sealing tape, door trim, door and winder handles and arm rest.

REAR DOOR LOCK

Removing

1 Raise window to the closed position.

2 Remove regulator, door handles, arm rest (where fitted) door trim and sealing tape.

3 Disconnect the external handle link, remote control link and lock button link from their respective levers on the lock.

4 Remove the three screws retaining the lock to door frame. Push the lock into the inside of door and remove through opening in top of the door.

Refitting

1 Refitting is the reversal of the removing procedures 1 to 4.

STRIKER PLATE — ADJUSTING

IMPORTANT: Ensure that the latch discs are in the open position. Do not slam the door while making adjustments.

1 Tighten the striker plate screws just enough to allow the door to close and latch.

2 Press the door inwards, or pull it outwards, without operating the release lever, until it lines up with the body.

3 Open the door and draw a line around the striker plate.

4 Position the striker plate by trial and error until the door can be closed easily without rattling, lifting or dropping.

5 Close the door, and check by pressing on the door, that the striker plate is not set too far in, a fractional movement should be possible with the seals compressed.

6 Tighten the striker plate screws.

DOOR OUTSIDE HANDLE

Removing

CAUTION: Before removing any part of the door lock mechanism, because of unsatisfactory operation, first check that the condition is not caused by incorrect adjustment.

1 Remove the interior handles, arm rest, door trim and sealing tape.

2 Disconnect the outside handle link and return spring.

3 Disconnect handle to lock link rod.

4 Remove the two nuts and washers retaining the handle assembly.

5 Withdraw handle from outside of vehicle angling to clear linkage.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 5.

DOOR REMOTE CONTROL

Removing

1 Remove the interior handles, arm rest, door trim and sealing tape.

2 Disconnect remote control linkage and return spring from the lock. Refer Figs. U-2 — U-3.

3 Remove the four screws retaining the remote control assembly.

4 Withdraw assembly through the door panel.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4.

FRONT DOOR PRIVATE LOCK

Removing

1 Wind window to the up position.

2 Remove the interior handles, arm rest, door trim and sealing tape.

3 Disconnect door lock linkage.

4 Remove the spring clip retaining lock barrel in place. Refer Fig. U-2.

5 Withdraw private lock from outside of door panel.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 5.

DOORS

Removing

1 Remove the interior handles and arm rest.

2 Remove the door trim.

3 Remove sealing tape adjacent to the hinges, and mark hinges for refitting.

NOTE: When removing both front and rear doors from Executive model vehicles, it is necessary to disconnect the kerbside courtesy and door ajar warning lamp wires.

4 Remove the three nuts and lock washers from each hinge.

5 Lift the door from vehicle.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 5, ensuring that the door is correctly adjusted.

NOTE: Ensure that the door seal retaining clips are pushed fully into the door panel.

BONNET

Removing

1 Release the bonnet catch, disengage the safety catch and raise the bonnet.

2 Disconnect the under bonnet light if fitted.

3 Mark the hinges for refitting.

4 Slightly close the bonnet and release both bonnet torsion bars from the tracks.

5 Holding the bonnet open undo and remove the bolts holding the two brackets in place.

6 Remove the bonnet, taking care not to damage the paintwork.

7 Remove the torsion bars.

Refitting

1 Position the bonnet and refit retaining bolts and torsion bars.

2 Align the markings and tighten the bolts sufficiently to stabilise the hinge brackets.

3 Close the bonnet ensuring that the bonnet striker pin and lock are correctly aligned before finally tightening the bracket bolts.

4 Connect the bonnet light cable where fitted.

BONNET LOCK

Removing

1 Pull the bonnet release knob, press back the safety catch and raise the bonnet.

2 Mark the lock assembly position for refitting.

3 Slacken the nut and bolt securing the outer cable and remove from the clip.

4 Remove the two bolts retaining the lock body in the bracket.

5 Lift the lock body clear of housing and release inner cable from trunnion.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 5.

Adjusting

1 Lower the bonnet and check the alignment of the striker pin to lock catch assembly. Adjust if necessary by slackening the fixing bolts.

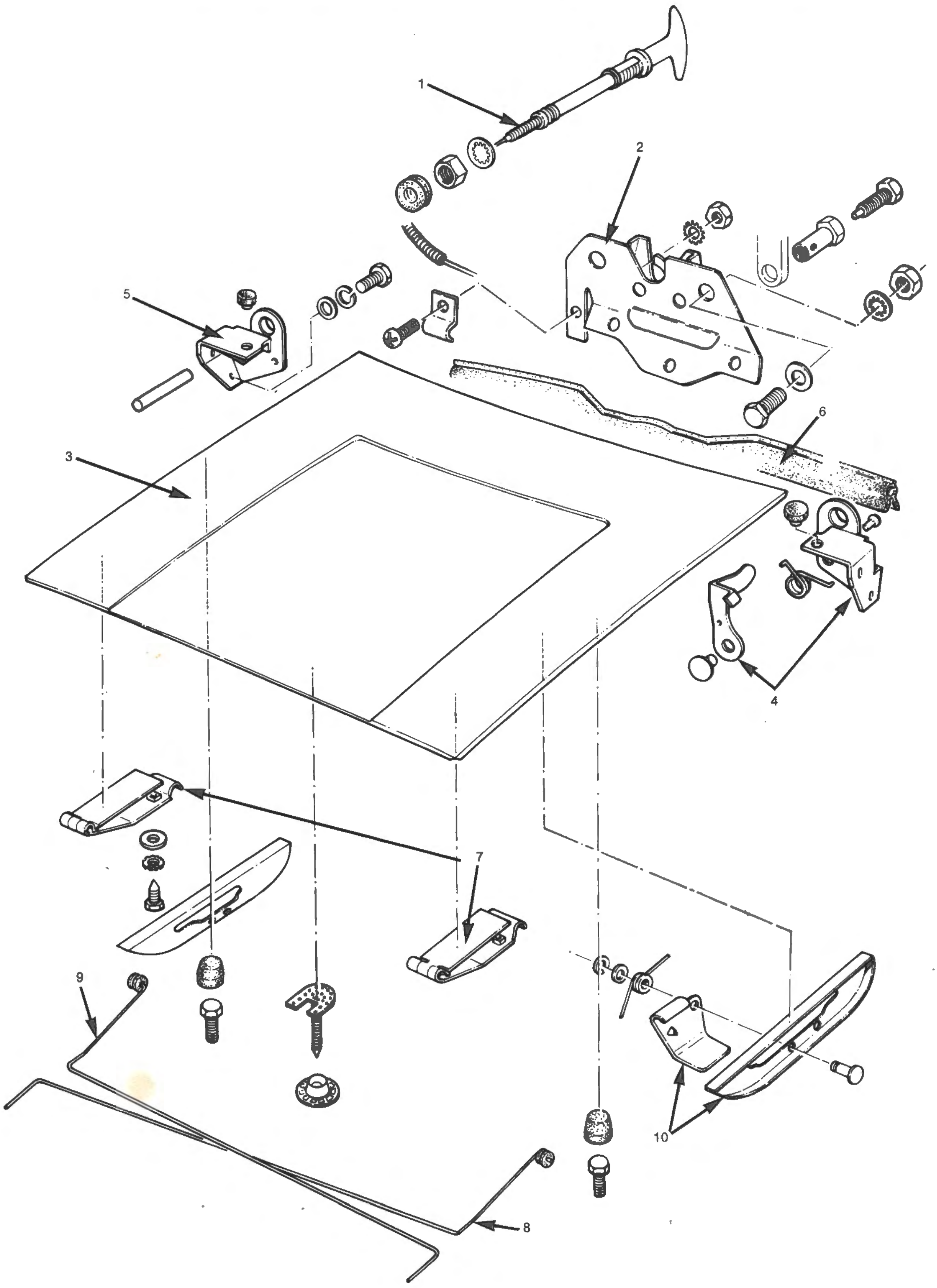


Fig. U-7
LAYOUT OF BONNET COMPONENTS

1 BONNET RELEASE CABLE ASSEMBLY
2 BONNET LOCK ASSEMBLY
3 BONNET
4 SAFETY CATCH AND IMPACT SUPPORT BRACKET ASSEMBLY
5 IMPACT SUPPORT BRACKET RH
6 BONNET TO DASH SEAL
7 HINGES
8 TORSION BAR LH
9 TORSION BAR RH
10 TORSION BAR BRACKETS AND SAFETY CATCH ASSEMBLY

2 Close the bonnet and check the alignment with the body wing panels; if incorrect, readjust the lock catch assembly.

3 Check that the bonnet contacts the rubber stops; and adjust if necessary by screwing the stops in or out as required.

4 Check the bonnet release operation.

BONNET LOCK CONTROL CABLE

Removing

1 Pull the bonnet release knob and open the bonnet.

2 Slacken the nut and detach the release cable from the trunnion at the lock lever.

3 Disconnect the outer cable from its clamp.

4 Remove the nut and shake-proof washer securing the outer cable to the body side bracket below the facia panel.

5 Withdraw the assembly through the body grommet.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 5.

Adjusting

1 Push the release knob fully in and check that the lock release lever is not pre-loaded by the release lever.

2 A minimum movement of 12.7 mm (0.5 in) is required prior to the release of the bonnet. To adjust, slacken the cable trunnion nut and readjust the cable.

SAFETY CATCH

Removing

1 Release the bonnet catch, disengage the safety catch and raise the bonnet.

2 Remove the two bolts securing the safety catch to the body panel and remove the catch assembly.

Refitting

1 Refitting is the reverse of the removing procedures.

LUGGAGE COMPARTMENT LID

Removing

1 Mark the hinge positions on the lid.

2 Remove the four bolts, plain and spring washers retaining the hinges to the lid.

3 Remove the lid taking care not to damage the paintwork.

Refitting

1 Reverse the removing procedures 1 to 3, partially tightening the hinge bolts.

2 Close the lid and adjust the position if necessary to ensure correct body alignment.

3 Raise the lid and tighten the hinge bolts. DO NOT OVERTIGHTEN.

LOCK

Removing

1 Mark the position of the lock catch plate on the lid under panel.

2 Remove the bolts, spring and plain washers retaining the lock catch.

3 Disconnect the clip retaining the link to the lock barrel.

4 Remove the lock catch assembly. Refer Fig. U-8.

5 Remove the locking barrel retaining clip and remove the assembly and sealing gasket from the lid.

6 Mark the position of the striker on the body panel.

7 Remove the two bolts, spring and plain washers retaining the striker and remove the striker plate.

Refitting

1 Reverse the removing procedures 1 to 7, fitting a new spring retaining clip on the barrel housing, if it is required. Ensure the electrical earth wires are reconnected to the striker plate fixing bolts.

SUN VISORS

Removing

1 Remove the screw retaining the visor bracket.

2 Remove the sun visor.

3 Remove the support clip.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 3.

GLOVE BOX

Removing

1 Open the glove box lid and remove the two screws securing the hinges.

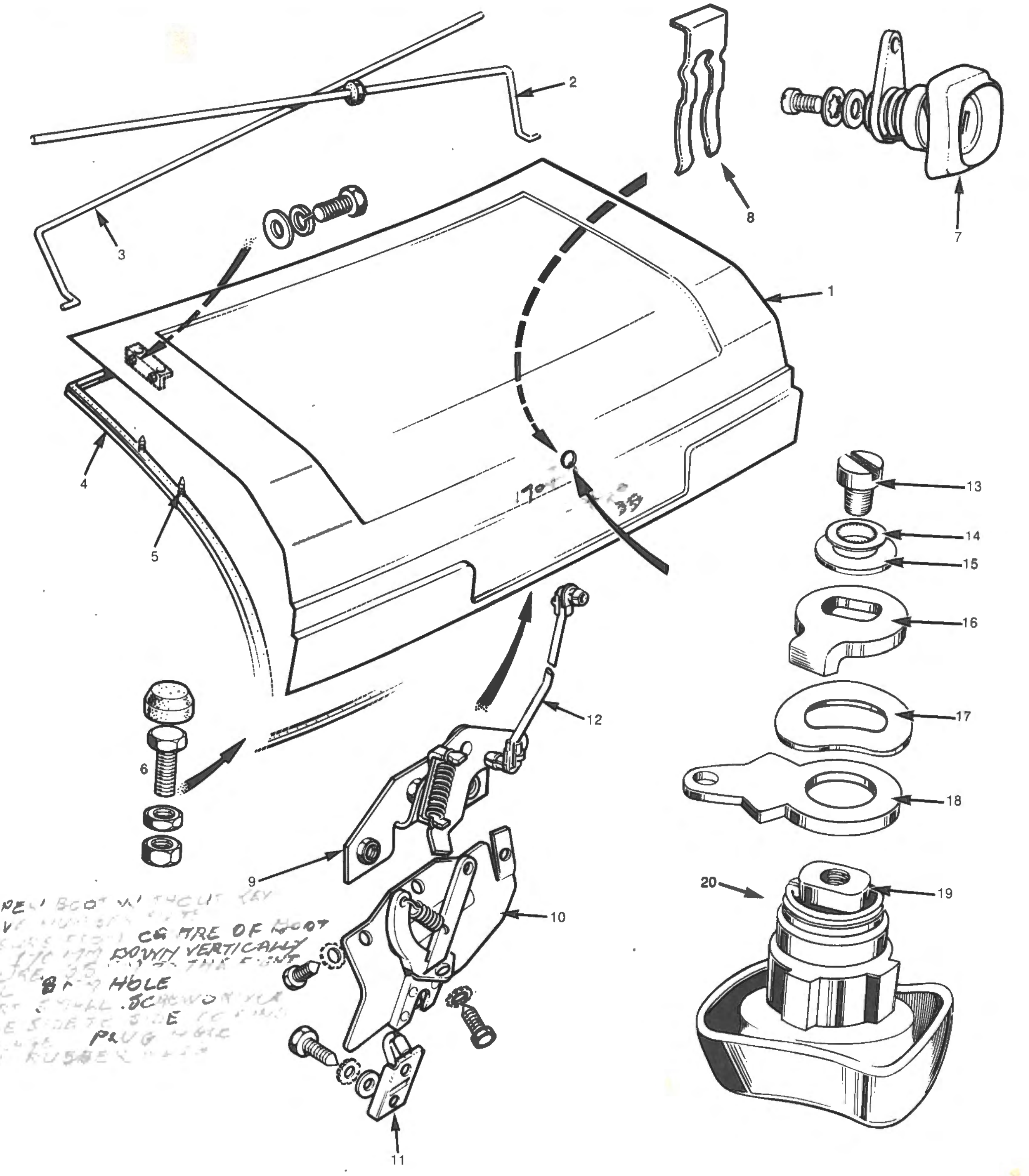
2 Remove the two screws securing the upper part of glove box to facia mounting.

3 Remove the ash tray and cigar lighter from facia.

4 Remove the six nuts securing the glove box facia panel to dash panel and remove the facia panel.

5 Remove glove box bulb from socket.

6 Remove the four screws and flat washers securing glove box to dash panel.



TO OPEN BOOT WITHOUT KEY
REMOVE NUMBER PLATE
MEASURE FROM CENTRE OF BOOT
LOCK 170 MM DOWN VERTICALLY
MEASURE 35 [illegible] TO THE FRONT
& DRILL 8 MM HOLE
INSERT SMALL SCREWDRIVER
& MOVE SIDE TO SIDE TO OPEN
LEVER [illegible] PLUG HOLE
WITH RUBBER [illegible]

Fig. U-8

LAYOUT OF LUGGAGE COMPARTMENT COMPONENTS

1	BOOT LID	8	LOCK RETAINING CLIP	14	STAR LOCK WASHER
2	TORSION BAR RH	9	BOOT LOCK OPERATING PIVOT ASSEMBLY	15	FLAT WASHER
3	TORSION BAR LH	10	BOOT LOCK ASSEMBLY	16	DRIVING LEVER
4	BOOT LID SEAL	11	LOCK STRIKER	17	CURVED WASHER
5	SEAL CLIP	12	PRIVATE LOCK ROD AND CLIPS	18	DRIVEN LEVER
6	BUFFER ASSEMBLY	13	SCREW	19	KEY DEVICE
7	PRIVATE LOCK AND KEY ASSEMBLY			20	SPRING

Ensure that end of spring is correctly installed before tightening screw 13.

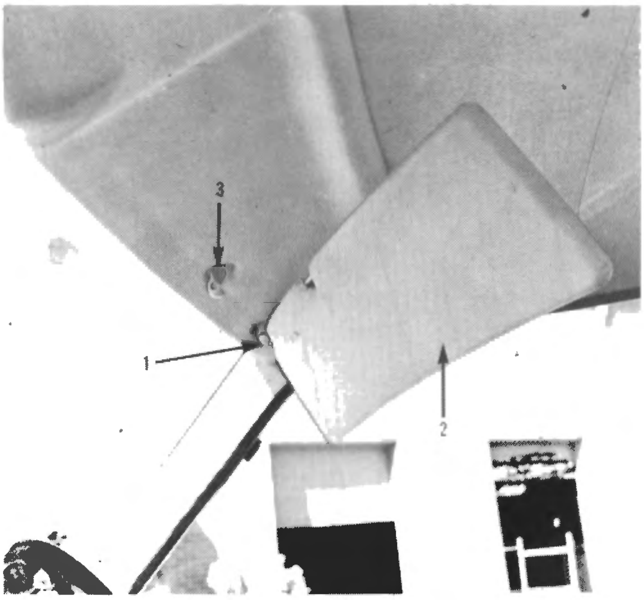


Fig. U-9

REMOVING THE SUN VISOR

1 BRACKET RETAINING SCREW
2 VISOR
3 SUPPORT CLIP

7 Remove the air ducting hose from the windscreen demister connection behind glove box.

8 Remove the glove box from the dash panel.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 8.

SEATS

FRONT BUCKET SEATS

Removing

1 Remove the locknuts and washers securing the seat and slide assembly to the floor panel. These nuts are located in the reinforcing channels and are easily accessible from under the vehicle.

2 Remove the seat and slide assembly from the vehicle.

Refitting

1 Refitting is a reversal of the removing procedures.

FRONT BENCH SEAT

Removing

1 Remove the two stepped seat belt bolts from the floor tunnel.

2 Remove the locknuts and washers securing the seat and slide assembly to the floor panel. These nuts are located in the reinforcing channels and are easily accessible from under the vehicle.

3 Remove the seat from the vehicle.

Refitting

1 Refitting is the reverse of the removing procedures 1 to 3 noting the following:

(a) Ensure that the seat will slide smoothly.

REAR CUSHION AND SQUAB

Removing

1 Remove the two screws securing the rear seat cushion to the floor.

2 Remove the cushion from the vehicle.

3 From inside the boot remove the eight nuts and washers securing the seat squab to the rear panel.

4 Remove the squab from the vehicle.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4 ensuring that all the seat squab nuts are replaced and tightened.

FRONT GRILLE AND HEADLIGHT SURROUNDS

Removing

1 Remove the four screws retaining the centre section of the grille and withdraw the grille.

2 From under the bonnet, disconnect and remove the battery.

3 Remove the four nuts retaining the headlight surrounds and remove from vehicle.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 3.

SEAT BELTS

DESCRIPTION

Models fitted with a bench type front seat are equipped with six seat belts, whereas models with front bucket seats have five seat belts.

The bench type front seat has the two outside belts of the lap and sash type while the centre is a lap type.

The individual front bucket seats are equipped with lap and sash type belts.

The rear seat in all models is equipped with three belts, the two outside being of the lap and sash type while the centre is a lap type.

MAINTENANCE

1 Inspect the belt webbing periodically for signs of abrasion, cuts and wear, paying particular attention to the anchorage points, adjusters and catches.

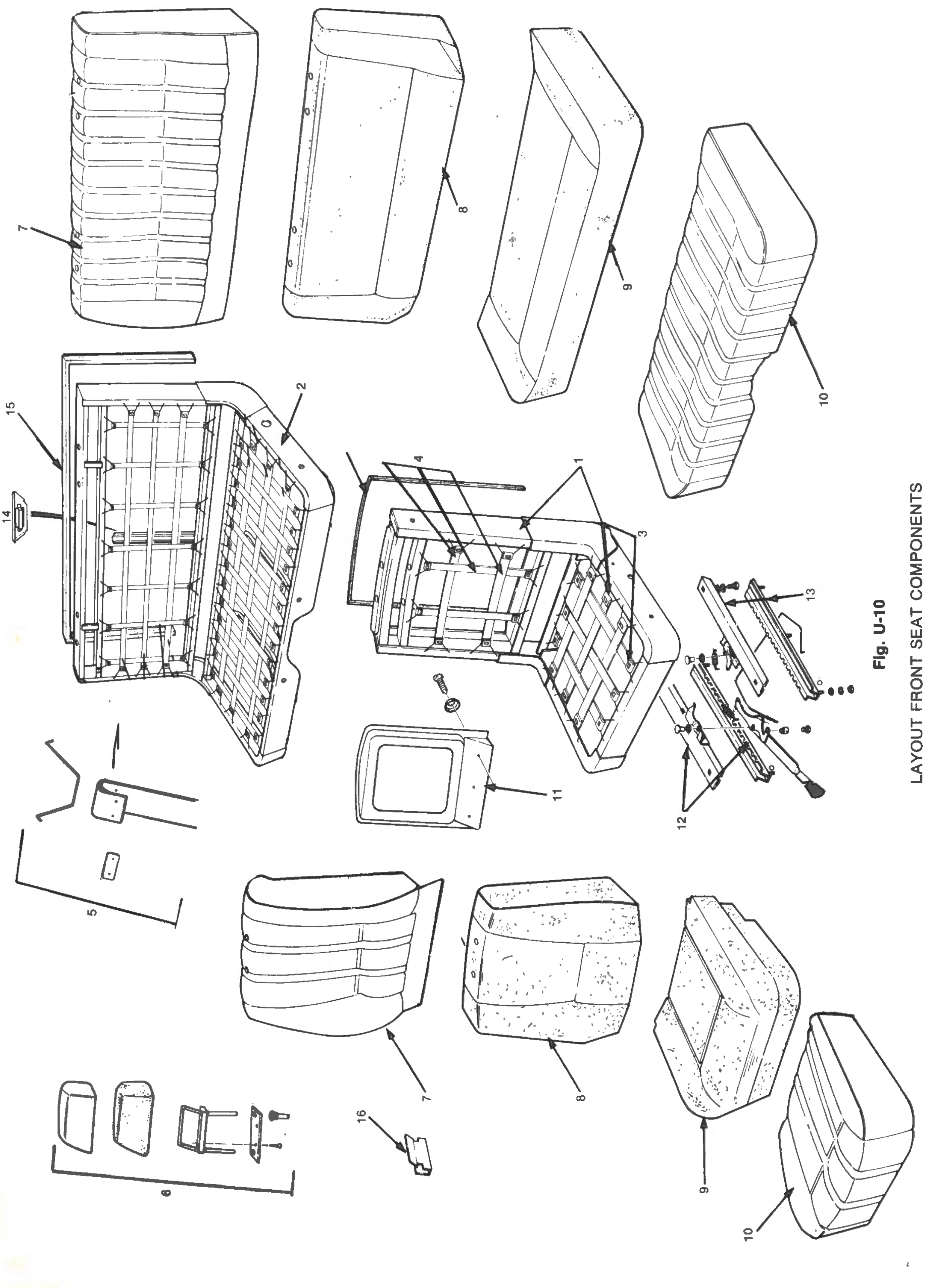


Fig. U-10
LAYOUT FRONT SEAT COMPONENTS

KEY TO FIG. U-10

1 BUCKET SEAT FRAME (NON RECLINING)
2 BENCH SEAT FRAME
3 PIRRELI STRAPPING SEAT CUSHION
4 PIRRELI STRAPPING SEAT SQUAB
5 STRAP COMPONENTS
6 HEAD RESTRAINT COMPONENTS
7 SQUAB COVER
8 SQUAB
9 CUSHION
10 CUSHION COVER
11 TRIM PANEL — BUCKET SEAT SQUAB — REAR
12 SEAT SLIDE AND ADJUSTER MECHANISM RH
13 SEAT SLIDE AND ADJUSTER MECHANISM LH
14 ASH TRAY
15 SQUAB TRIM SEAL
16 TRIM CLIP

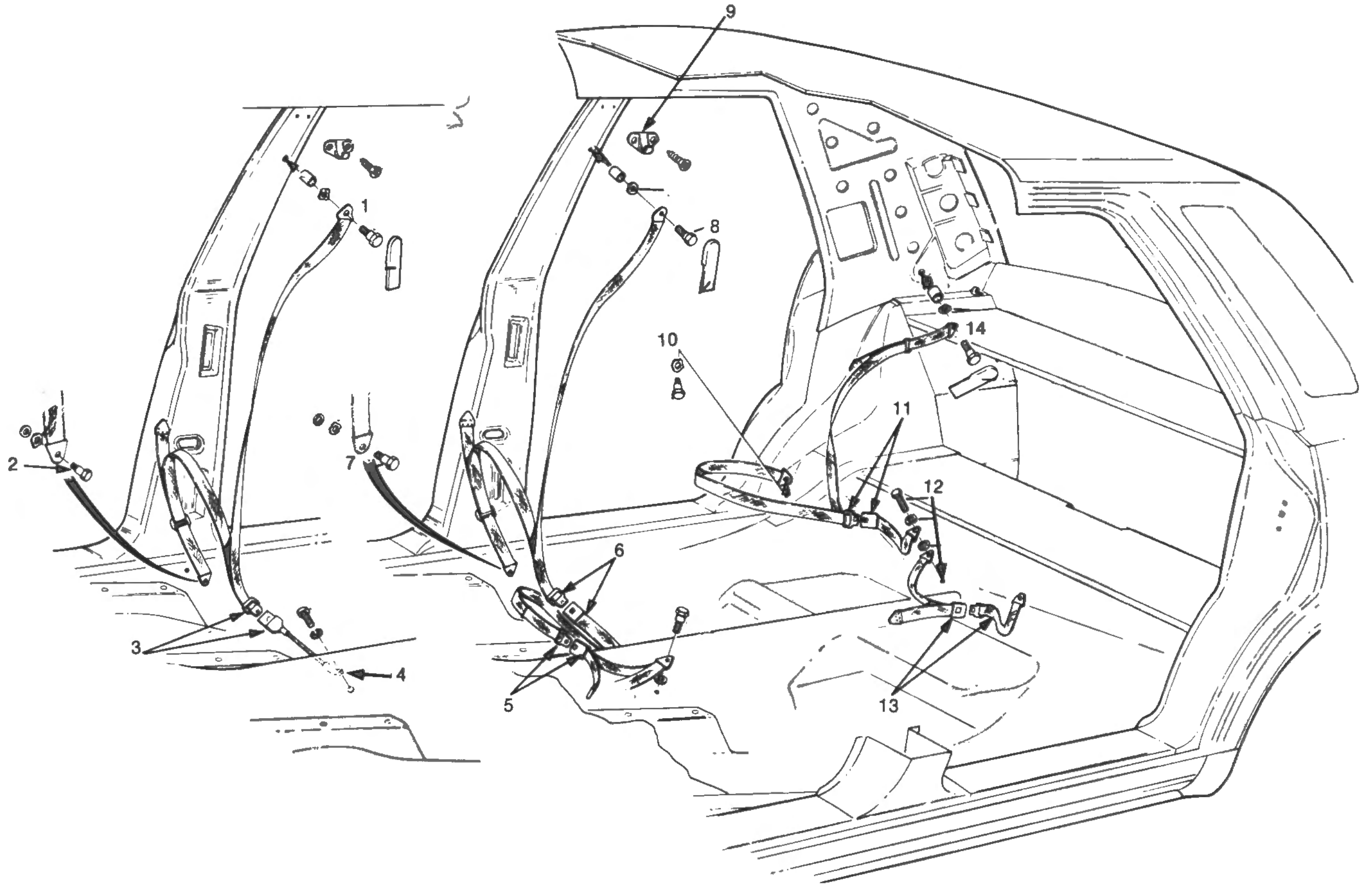


Fig. U-11

LAYOUT SEAT BELTS AND FITTINGS

1 UPPER ANCHORAGE — FRONT BELT — BUCKET SEATS
2 LOWER ANCHORAGE — FRONT BELTS — BUCKET SEATS
3 BUCKLE — FRONT — BUCKET SEATS
4 FLEXIBLE STALK ANCHORAGE FRONT BELT — BUCKET SEATS
5 BUCKLE — CENTRE SEAT BELT — BENCH SEAT
6 LOWER ANCHORAGE RH AND CENTRE BELTS (BENCH SEATS)
7 LOWER ANCHORAGE RH (BENCH SEAT)
8 UPPER ANCHORAGE (BENCH SEAT)
9 SEAT BELT HOOK
10 LOWER ANCHORAGE (RH REAR)
11 BUCKLE — (RH REAR)
12 ANCHORAGE (RH AND CENTRE REAR)
13 BUCKLE — (CENTRE REAR)
14 UPPER ANCHORAGE (RH REAR)

2 Should the belt become soiled they may be cleaned by sponging with warm water and a mild household soap. Allow to dry naturally. Do not use chemical cleaners or detergents for cleaning, do not dry with artificial heat or direct sunlight.

PRECAUTIONS

1 Do not attempt to bleach or re-dye the belt webbing.

2 Do not make any alterations to the seat belts or their anchorages.

3 Replace seat belts and anchorages that are defective or have been subjected to severe strain during an accident.

4 If a component of a seat belt or sash assembly is non-functional or damaged, the entire belt unit must be replaced.

FRONT MOUNTING POINTS

The front lap and sash type seat belts are anchored at the top by a pivot bolt attached to the centre pillar and at the bottom by a loop and ring attachment fitted to the lower part of the centre pillar, and their lower centre anchorages are attached to the floor behind the front seat on either side of the transmission tunnel.

The centre lap type belt has both anchorages located on the transmission tunnel using the anchorage points common to the lower section of the lap and sash belt.

The belts are adjustable to individual requirements.

When not in use the free ends of the outside belts are placed on a plastic hook located on the centre pillar.

REAR MOUNTING POINTS

The rear lap and sash type seat belts are anchored at the top to the rear parcel tray above the rear seat squab and their lower anchorages are attached to the wheel arch behind the rear seat cushion. The centre lap type belt has both anchorages common to the lower section of the lap and sash belt located on the floor adjacent to the outside belt lower anchor points.

HEADLINING

Removing

1 Remove the sun visors by releasing the retaining screws. Carefully prise the header crash panel from the headlining and roof panel.

2 Partly remove the door aperture finishers from the front door openings just sufficient to allow removal of the headlining.

3 Remove the 'A' post trim from both sides sufficiently to allow removal of the headlining.

4 Remove the bolts and washers securing upper end of seat belt to 'B-C' post and remove seat belts (both sides).

5 Remove the seat belt hooks from 'B-C' post (both sides).

6 Partly remove the rear door aperture finishers.

7 Remove both coat hanger hooks from the headlining above rear doors.

8 Partly remove trim from both 'B-C' posts to allow removal of headlining.

9 Remove central interior lamp assembly. Executive model — remove both side interior lamps.

10 Remove rear seat cushion.

11 Remove rear seat squab.

12 Remove the rear parcel shelf tray by prising the retaining press clips from the body panel.

13 Remove upper rear seat belt mounting from 'D' post (both sides).

14 Partly remove upper section of 'D' post trim (both sides).

15 Remove backlight trim finisher from body.

16 Remove headlining from 'A' posts and front door apertures.

17 Remove clips securing trim across front of headlining and remove trim from roof panel.

18 Remove headlining from both 'B-C' posts and both rear door apertures.

19 Remove headlining from both 'D' posts and around sides of backlight.

20 Remove headlining from the body flanges by pulling the list rails from the holes in the cant rails.

21 Remove list rails from headlining.

22 Remove the headlining from top of backlight and remove headlining from vehicle.

Refitting

1 Mark the centre of the headlining front and rear.

2 Mark the centre of the header panel and backlight flange.

3 Apply a band of non staining neoprene adhesive to the headlining.

4 Apply a similar width of adhesive to body and roof panels.

5 Fit list rails to headlining pockets. All list rails are identical.

6 Place headlining into vehicle and enter the list rails into their respective locations in the cant rail.

7 Attach the headlining to the front header panel ensuring that the marks are aligned and insert clips to hold the headlining in position.

8 Pull the headlining taut, front to rear. Do not pull it sideways as the material may stretch and form diagonal creases.

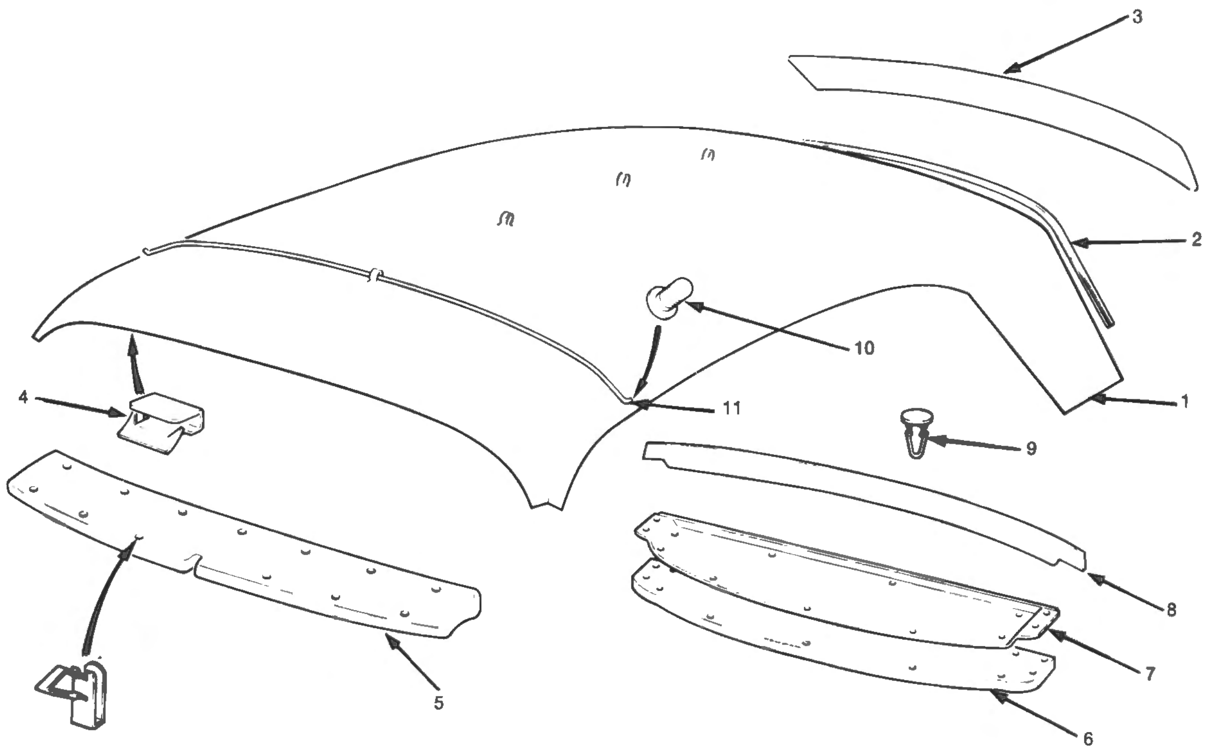


Fig. U-12

LAYOUT OF HEADLINING AND COMPONENTS

1	HEADLINING	7	PARCEL TRAY SHELF
2	FINISHER	8	PARCEL TRAY REAR
3	REAR ROOF PAD	9	CANOE CLIP
4	CLIP – HEADLINING FRONT	10	TRIM FASTENER
5	FRONT HEADER PANEL PAD	11	LIST RAIL
6	PARCEL TRAY PAD		

9 Attach the rear of the headlining to the backlight flange.

NOTE: The list rails must be vertical and in line to obtain the maximum head room.

10 Commencing at the front, stick the headlining to the roof and body panels. Trim off all excess lining, taking care to cut the headlining to fit the corners of all apertures.

11 Replace backlight trim finisher.

12 Replace all trim on posts, door apertures etc.

13 Replace all door aperture finishers.

14 Replace all seat belt mountings and coat hanger hooks.

15 Replace centre interior lamp.

16 Replace rear parcel shelf tray.

17 Replace rear seat squab and cushion.

18 Replace header crash pad and sun visors.

BUMPERS

NOTE: For removal of the front bumper, raise the bonnet and remove the battery for access to the mounting bolts.
For removal of the rear bumper, raise the luggage compartment lid and remove the spare wheel for access to the mounting bolts.

Removing

1 Remove the bolt, spring and plain washer with mounting rubber from each side.

2 Remove the bolts, spring and plain washer retaining each support bracket to the body.

3 Remove the bumper bar. On the rear bumper bar remove the plastic lens.

4 Remove the bolts, spring and plain washers retaining each bracket to the bumper.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4.

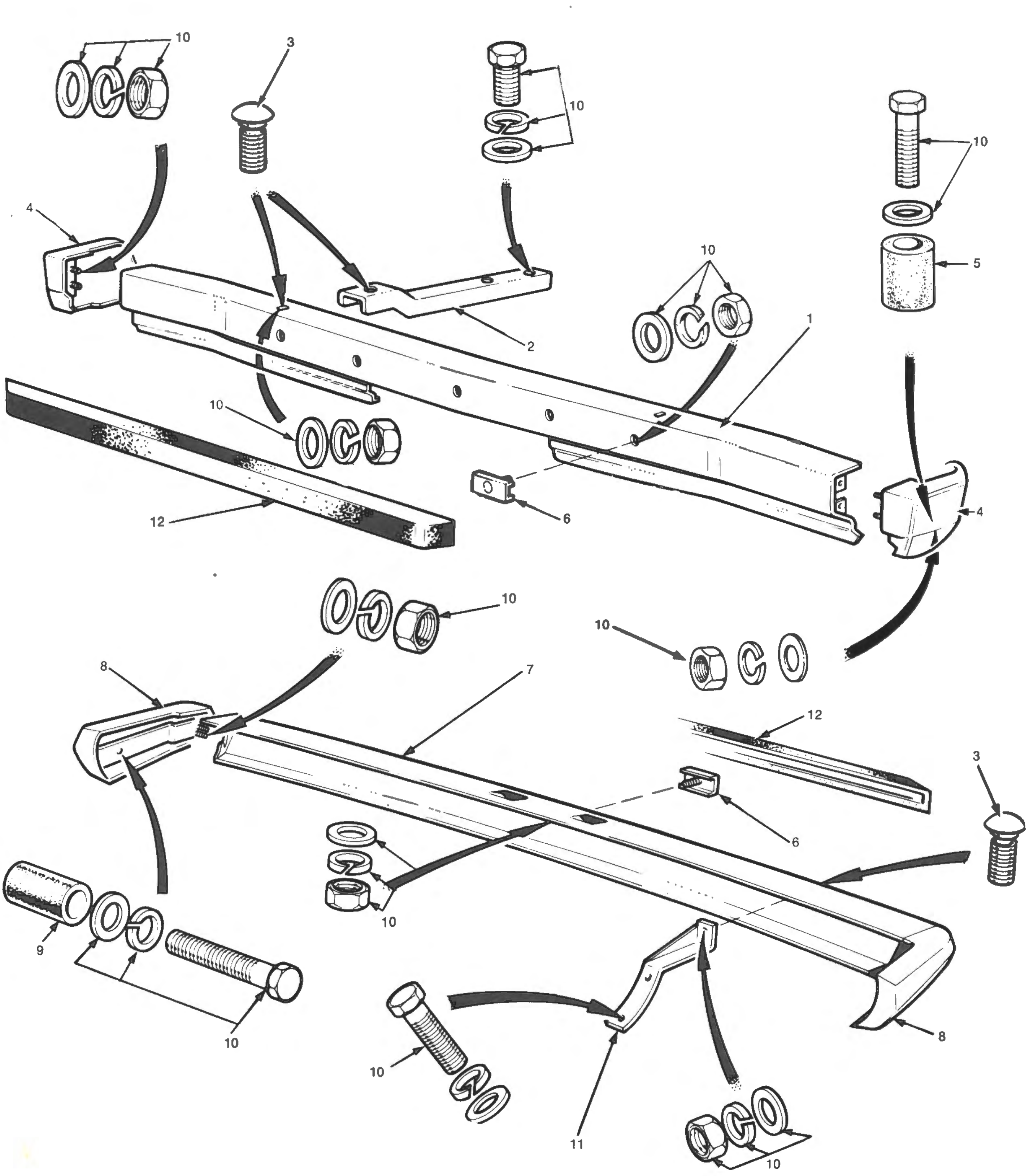


Fig. U-13

LAYOUT OF BUMPER BAR COMPONENTS

1 BUMPER BAR — CENTRE FRONT
2 SUPPORT BRACKET — FRONT
3 CAPPED BOLTS
4 BUMPER BAR — FRONT, OUTER
5 SPACER — FRONT
6 BUFFER PLATE
7 BUMPER BAR — CENTRE, REAR
8 BUMPER BAR — REAR, OUTER
9 SPACER — REAR
10 SECURING BOLTS, NUTS AND WASHERS
11 BUMPER BAR BRACKET — REAR
12 BUMPER BAR BUFFER — EXECUTIVE MODELS

WINDSCREEN AND BACKLIGHT

Removing

1. Remove the wiper arm and blade assemblies (windscreen only).
2. Remove the finisher mouldings and retaining clips.
3. Remove the 'A' post interior trim (windscreen only).
4. Pierce a hole through the sealing strip between the glass and 'Solbit' heating wire where fitted and thread a length of piano wire through the pierced hole.
5. Wrap each end of the wire around small wood dowels to allow a firm grasp and cut through the sealing compound.
6. Lift out the glass from the aperture.

NOTE: When cutting the sealer on the lower edge of the windscreen care must be taken to avoid damage to the facia.

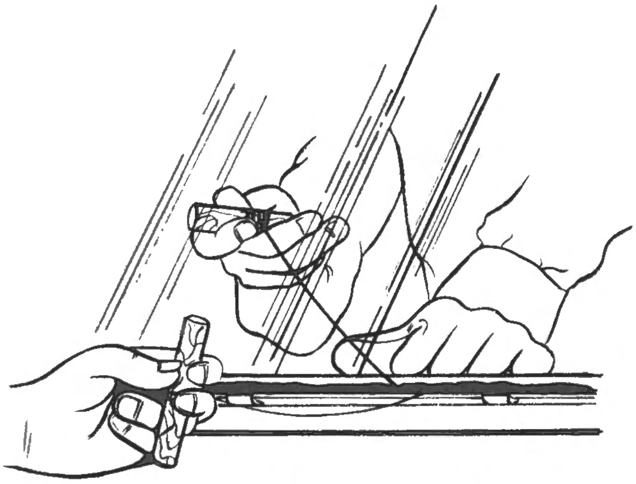


Fig. U-14

REMOVING WINDSCREEN GLASS

Refitting

Replacing the bonded windscreen and backlight using Leyland Universal Sealer and Bond Kit is carried out in the following manner.

Before refitting the screen glass, it may be necessary to remove any residue sealant. If the screen was original and 'SOLBIT' strip bonded, scrape away residual sealer using a wooden spatula to clean paint. (Solbit may be recognised by the encapsulated resistance wire running through the centre of the sealer).

Screens previously replaced with the Universal sealer need not have all the old sealer removed — up to 0.794 mm (1/32 in) may still remain on the body flange.

1. Wipe the aperture and the periphery of the replacement screen free of dirt and grease with lint free cloth and non-oily solvent such as Shell X60 (some solvents leave an oily residue which would effect bond strength).
2. After solvent has evaporated, apply a thin brush coat of the primer supplied in the kit to the painted flange and allow 20-30 mins. to dry. Replace any finisher clips damaged during removal of the finishers.
3. On the side to be bonded adhere the foam strip uniformly 6.35 mm (¼ in) from the outside edge of the glass to form a dam for the sealer.
4. Cut a plastic nozzle of the sealer cartridge on a taper and with the aid of a Selleys skeleton gun apply a uniform 6.35 mm (¼ in) diameter bead around the periphery of the glass adjacent to the foam dam. If desired, the end of the nozzle can be cut as shown in the sketch to form a guide when rested on the edge of glass.
5. Within 10 minutes, carefully offer the glass to the body aperture with the lower edge resting on support brackets or spacers to maintain vertical placement. Gently press into position to achieve a minimum 6.35 mm (¼ in) wide contact line of sealer on the glass.
   Do not allow lower edge of sealer to contact the aperture flange before the top edge.

NOTE: The sealer must make even contact when the glass is offered to the aperture.

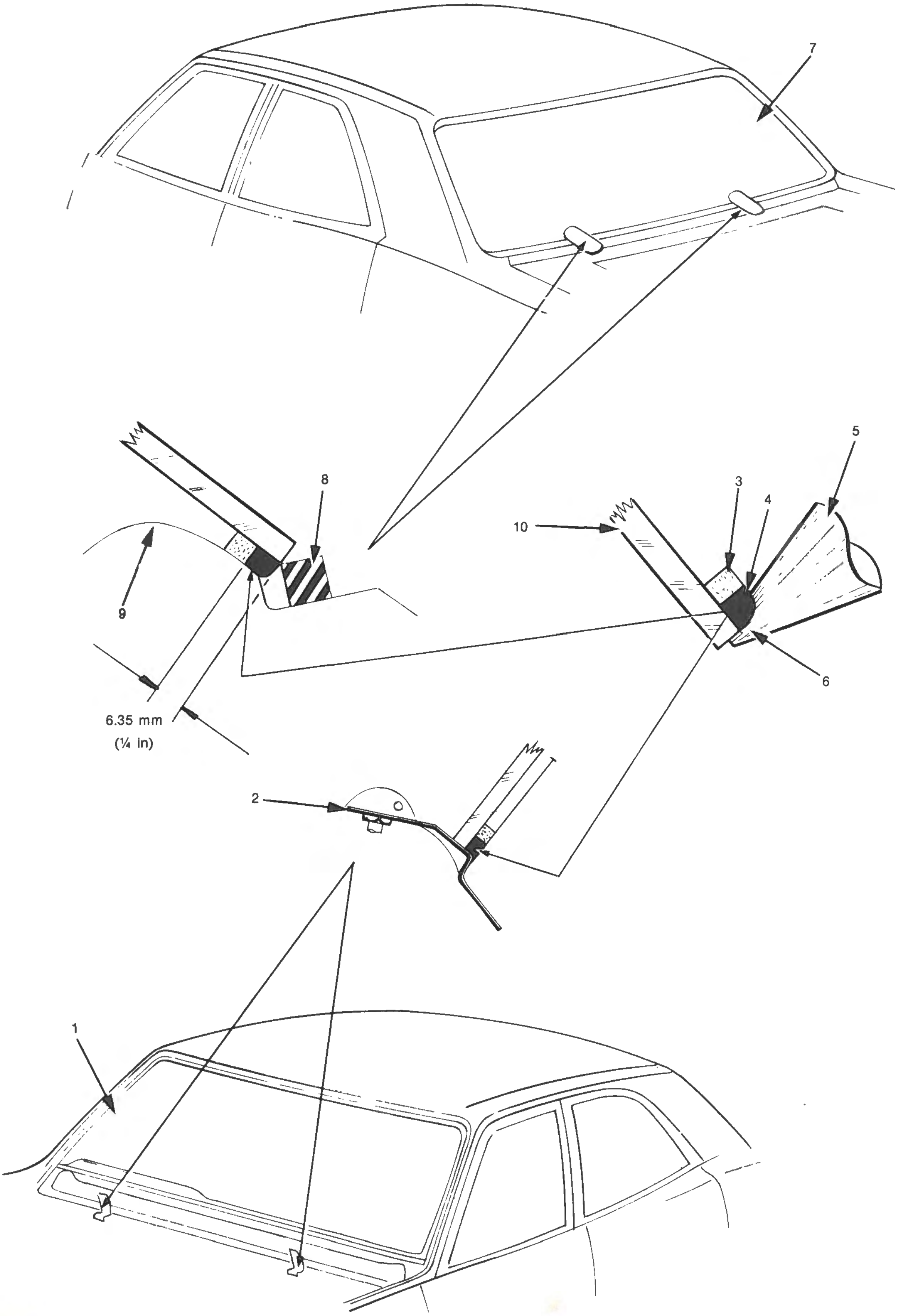
There is no built-in support for the glass in the backlight apertures, so the spacers provided in the Kit must be used between the lower edge of glass and the aperture rebate, as shown in the sketch.

6. Ensure that when the windscreen is settled in, there is sufficient clearance for the windscreen wiper linkage to operate.

NOTE: There will normally be no clean up required but methylated spirits is the recommended solvent while the sealer is uncured. Cured sealer is best removed with careful scraping.

7. Replace trim, and the vehicle may be driven away immediately. The sealer fully cures in 24 hours to form a flexible rubber seal to firmly bond glass to body.
8. Ensure that the sealant has spread sufficiently to make a complete water tight seal. Add more sealant if necessary.

NOTE: It is important that during and after fitting the new screen, at least one window be left open during the next six hours to ensure efficient curing of the sealant. This will prevent the sharp increase in cabin pressure which occurs when the doors are closed, thus removing the possibility of the sealant being displaced and causing leaks.



1 FRONT SCREEN
2 WINDSCREEN WASHER MOUNTING BRACKET
3 FOAM STRIP
4 ADHESIVE
5 NOZZLE

Fig. U-15

FITTING FRONT AND REAR WINDSCREENS

6 CUT NOZZLE AS SHOWN
7 REAR SCREEN
8 31 mm (5/16 in) SQUARE SPACER BLOCK
9 REAR PARCEL SHELF DECKING
10 GLASS

CONSOLES

The consoles are made in two parts — front and rear for ease of removal. Some vehicles may be fitted with a rear console only.

FRONT CONSOLE

Removing

1 Apply handbrake and select neutral.

2 Prise up the console cover, turn it at right angles and lift off past the transmission selector lever. (Automatic transmission).

3 Remove the gearshift lever knob (manual transmission), prise up console cover and boot. Remove cover.

4 Remove the two screws securing the front console brackets to the rear console and lift off console.

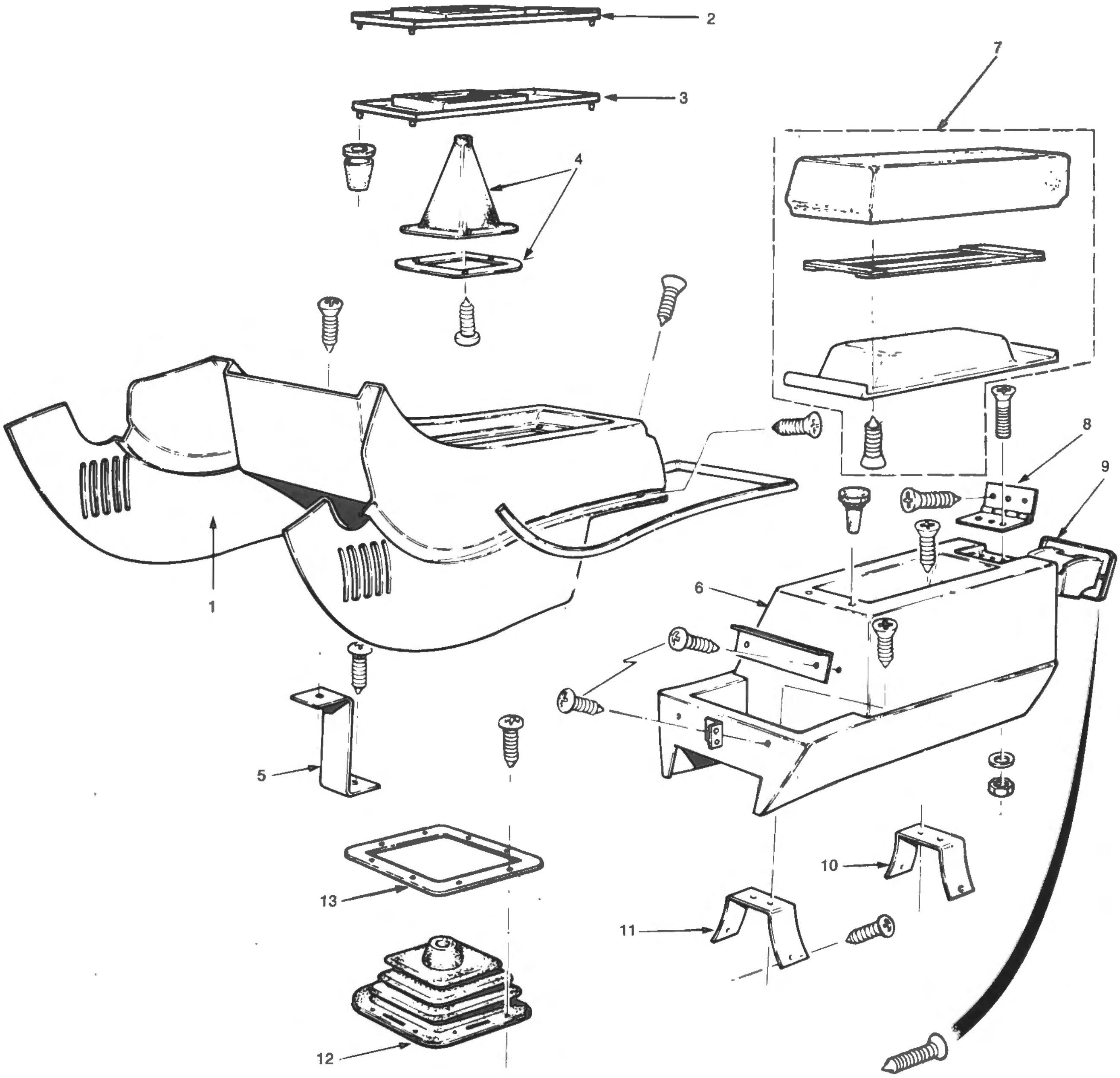


Fig. U-16

LAYOUT OF CONSOLE COMPONENTS

1 FRONT CONSOLE
2 CONSOLE COVER — AUTOMATIC
3 CONSOLE COVER — MANUAL
4 CONSOLE GEARSHIFT GAITER AND RETAINER
5 CONSOLE FRONT MOUNTING BRACKET
6 REAR CONSOLE
7 LID ASSEMBLY
8 HINGE
9 ASH TRAY
10 REAR BRACKET
11 FRONT BRACKET
12 GEARSHIFT GAITER TO FLOOR — MANUAL
13 RETAINER — GAITER TO FLOOR

Refitting

1 Refitting is the reverse of the removing procedures 1 to 4.

REAR CONSOLE

Removing

1 Raise the top of console.

2 Remove the eight screws securing the rear console to the floor and remove the console.

Refitting

1 Refitting is the reverse of the removing procedures 1 and 2.

BODY SEALING

Special attention has been paid to the effective sealing of water and dust during manufacture. The diagrams shown in this section will assist in selecting suitable materials.

A sound deadening underseal has been applied to various sections of the underside of the body.

Where it is found necessary to disturb the original sealing, e.g. in the course of replacing damaged body panels, proper attention must be paid to re-sealing.

Care must be taken to ensure that the joints and seams to which sealing material is applied are clean and dry. If the existing sealer is badly cracked or loose, it must be removed before additional sealer is applied.

'Touch up' colour should be applied to all visible areas of re-work.

NOTE: Variation between Production and Service sealing is inevitable as in Production the body is subjected to heat treatment during painting.

ADHESIVES AND SEALER

1	Internal/External seam or dust sealer	Selleys AD-SEAL (Gunnable rubber base flexible sealer suitable for after painting).
2	Inter weld seal	Non through hardening, weld through butyl sealer.
3	Caulking compound	Non hardening butyl compound (pliable compound) mastic strip or putty.
4	Windscreen sealer	Leyland Universal windscreen sealer.
5	Sound deadening	Air dry filler bituminous/rubber sealer applied by spatula or spray.
6	Sealing tape	Waterproof cloth backed tape.
7	Trim adhesive	Non staining neoprene adhesive.

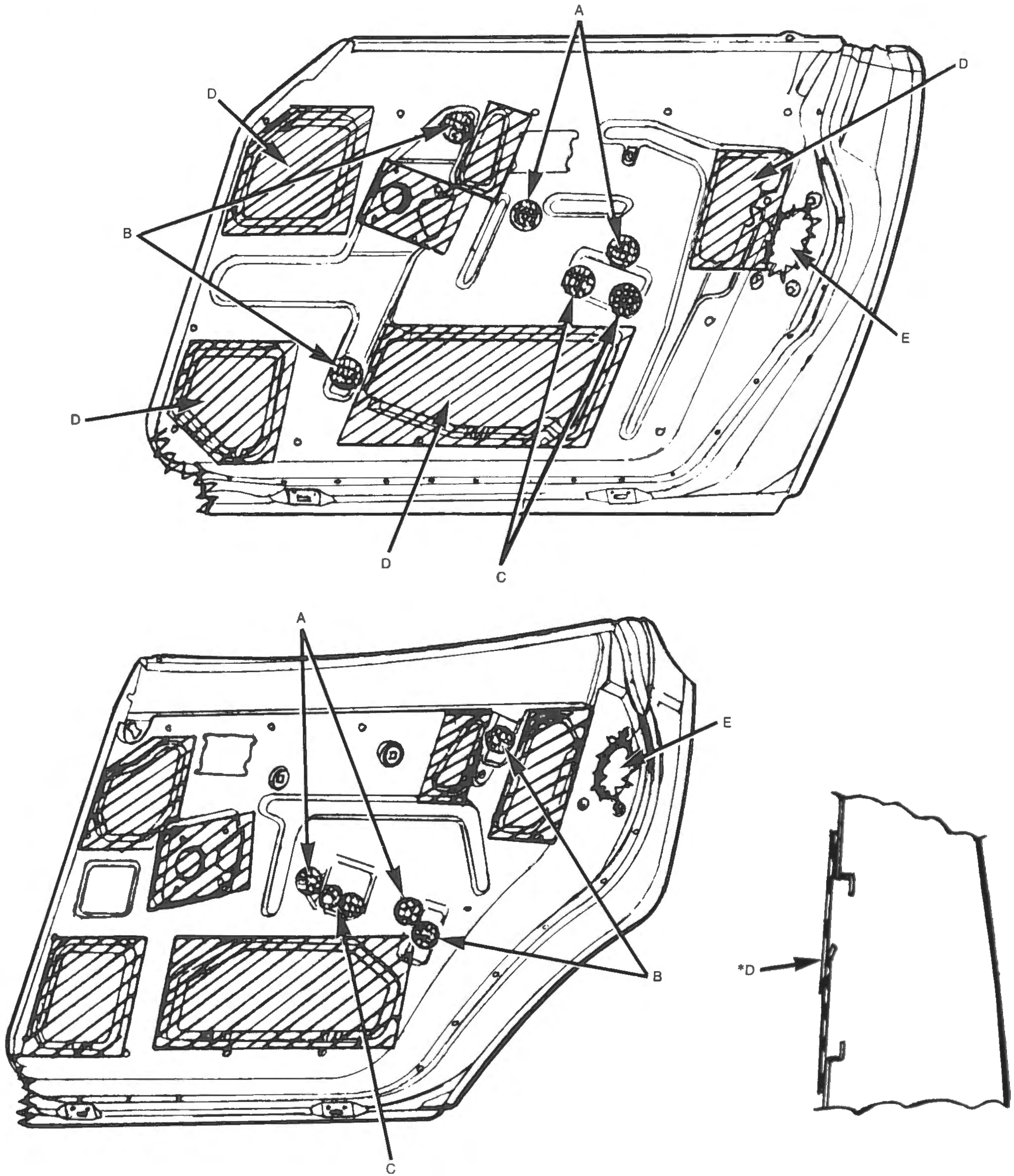


Fig. U-17

DOOR SEALING

		Type of Sealer	Refer Page
A	ARM REST	NO. 3	U-26
B	GLASS GUIDE RAIL	NO. 3	U-26
C	REGULATOR ARM SLIDE ASSEMBLY	NO. 3	U-26
*D	INNER PANEL APERTURES	NO. 6	U-26
E	LOCK TO DOOR PANEL	NO. 1	U-26

*AT OVERLAP OF SEALING TAPE THE LOWER TAPE MUST BE APPLIED OVER THE TAPE ABOVE IT TO PREVENT WATER PENETRATION.

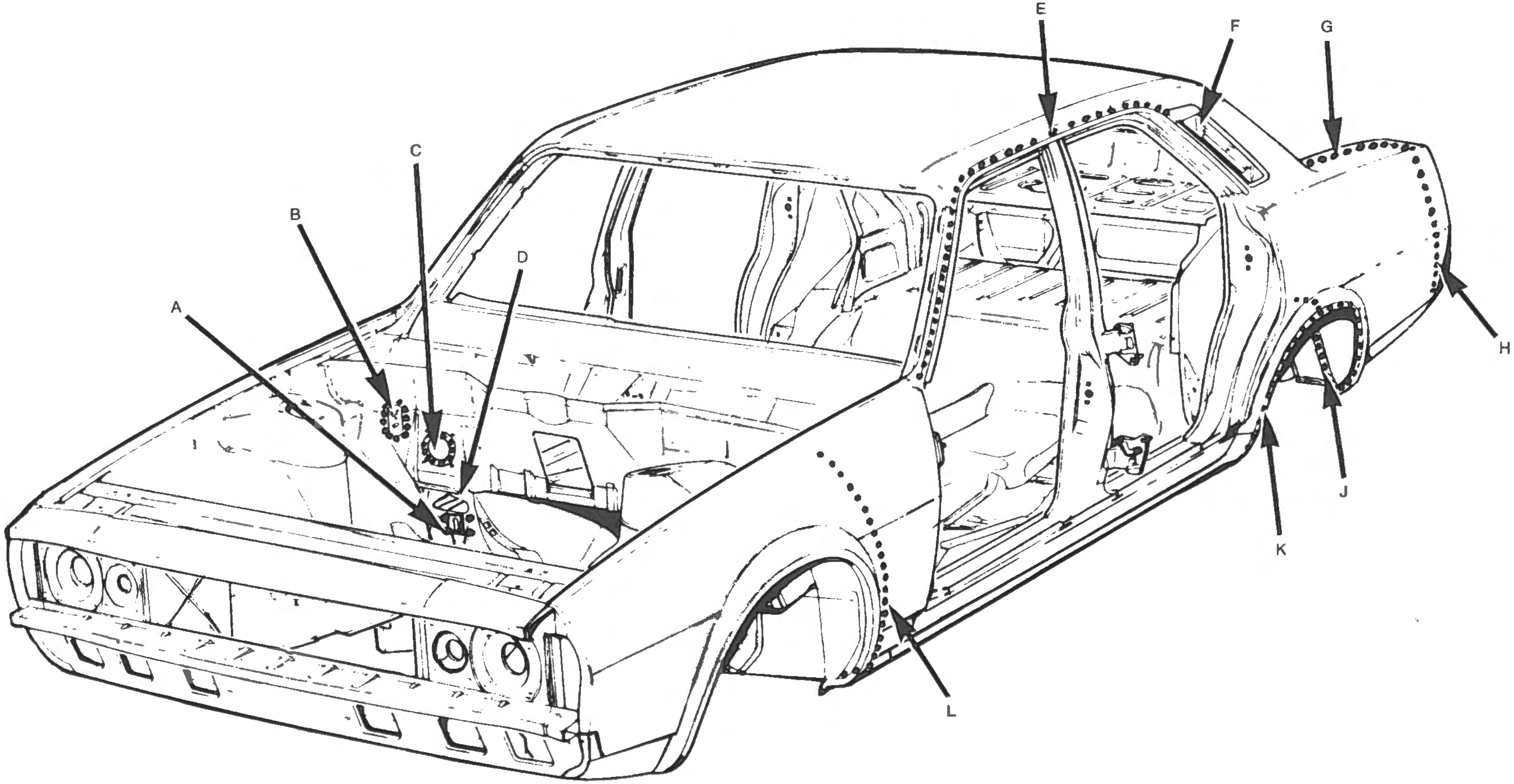


Fig. U-18

BODY SHELL

		Type of Sealer	Refer Page
A	BETWEEN CLUTCH BLANKING PLATE AND TOE BOARD (AUTOMATIC TRANSMISSION ONLY)	NO. 1	U-26
B	BETWEEN ACCELERATOR CABLE ABUTMENT AND DASH PANEL (6 CYLINDER MODELS ONLY)	NO. 1	U-26
C	BETWEEN BRAKE BOOSTER AND DASH PANEL	NO. 1	U-26
D	BETWEEN STEERING COLUMN GASKET AND TOE BOARD	NO. 1	U-26
E	ALONG FULL LENGTH OF DRIP MOULDING	NO. 1	U-26
F	REPLACE DAMAGED PLASTIC BLIND FIX SOCKETS		
G	SEAL JOINT BETWEEN TONNEAU AND REAR DECKING	NO. 1	U-26
H	BETWEEN TAIL LAMP MOUNTING AND TONNEAU, ON INSIDE OF TRUNK	NO. 1	U-26
J	BETWEEN INNER AND OUTER WHEEL ARCH PANEL	NO. 2	U-26
K	WHEEL ARCH JOINT	NO. 2	U-26
L	BETWEEN FRONT FENDER PANEL AND EXTENSION 'A' POST CLOSING	NO. 2	U-26

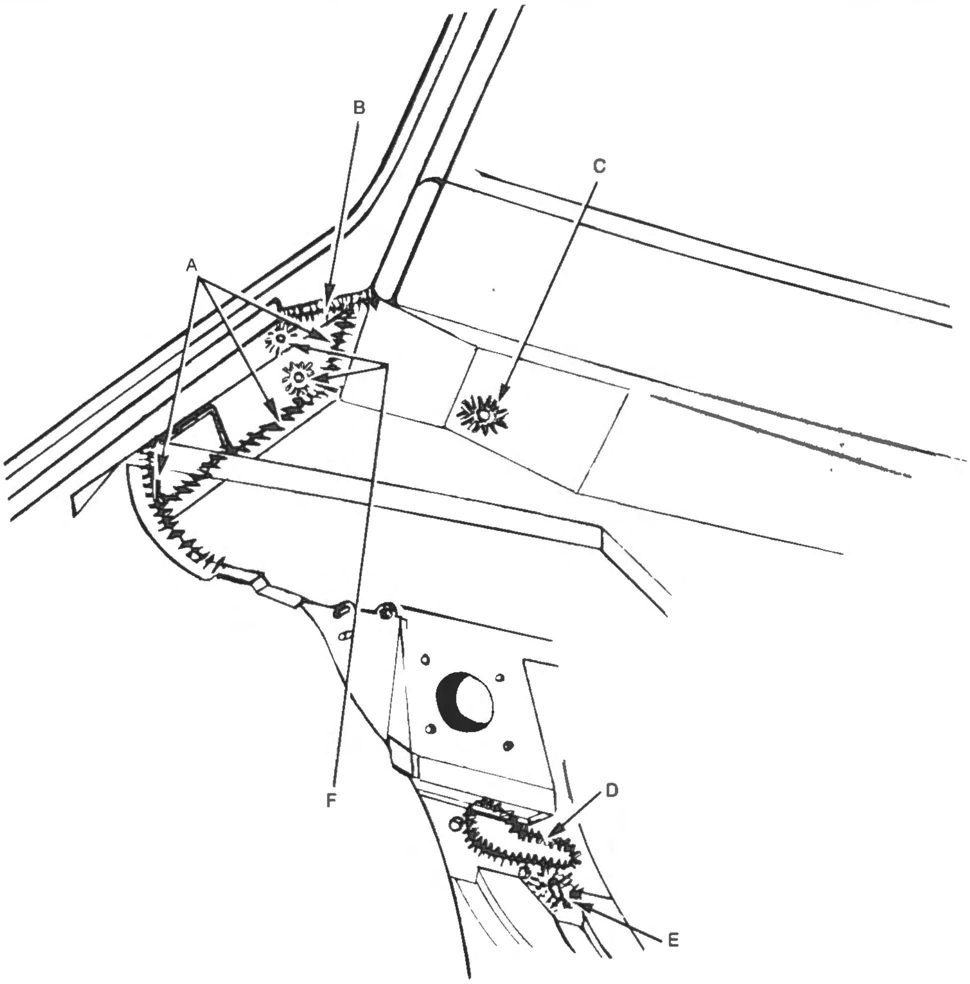


Fig. U-19

PLENUM CHAMBER DASH PANEL AND 'A' POST

		Type of Sealer	Refer Page
A	BETWEEN PANEL DASH AND 'A' POST UPPER AND LOWER FLANGE AND BASE OF WINDSCREEN	NO. 1	U-26
B	BETWEEN 'A' POST UPPER AND LOWER AT REAR OF DRAIN CHANNEL	NO. 1	U-26
C	BETWEEN WINDSCREEN WIPER PIVOT AND PANEL DASH, BOTH SIDES OF RUBBER GASKET	NO. 1	U-26
D	BETWEEN STEERING COLUMN GASKET AND TOE BOARD	NO. 1	U-26
E	BETWEEN CLUTCH COVER BLANKING PLATE AND TOE BOARD	NO. 1	U-26
F	BETWEEN BONNET CATCH BRACKET AND 'A' POST	NO. 1	U-26

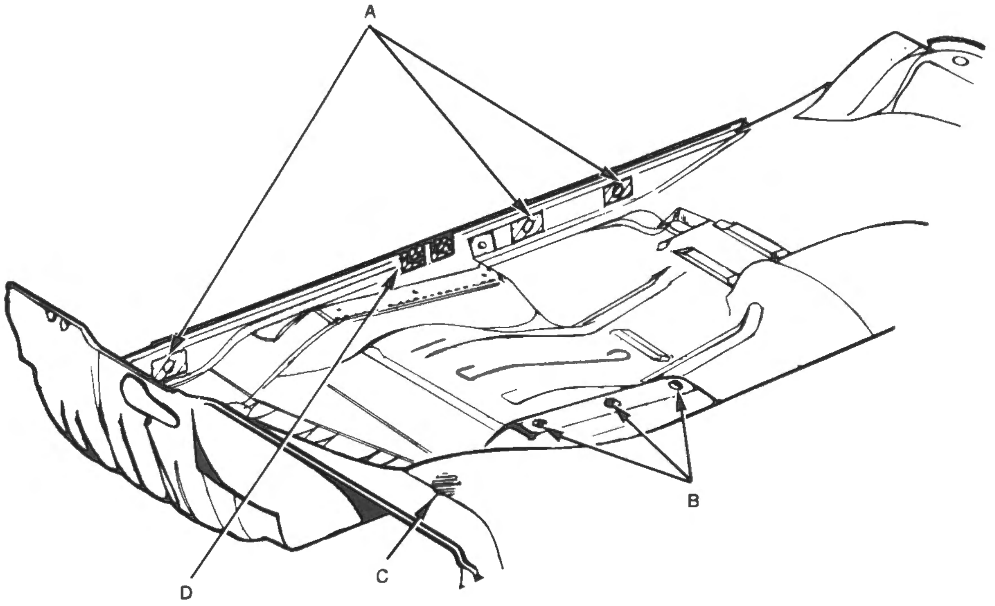


Fig. U-20

FLOOR PAN

		Type of Sealer	Refer Page
A	COVER DRAIN HOLES	NO. 6	U-26
B	COVER INNER BUCKET SEAT HOLES (BENCH SEAT MODELS ONLY)	BLIND FIX	
C	COVER AUTO TRANSMISSION ACCESS HOLE	RUBBER GROMMET	
D	COVER HANDBRAKE ATTACHING HOLES. LEFT HAND SIDE ONLY	NO. 6	U-26

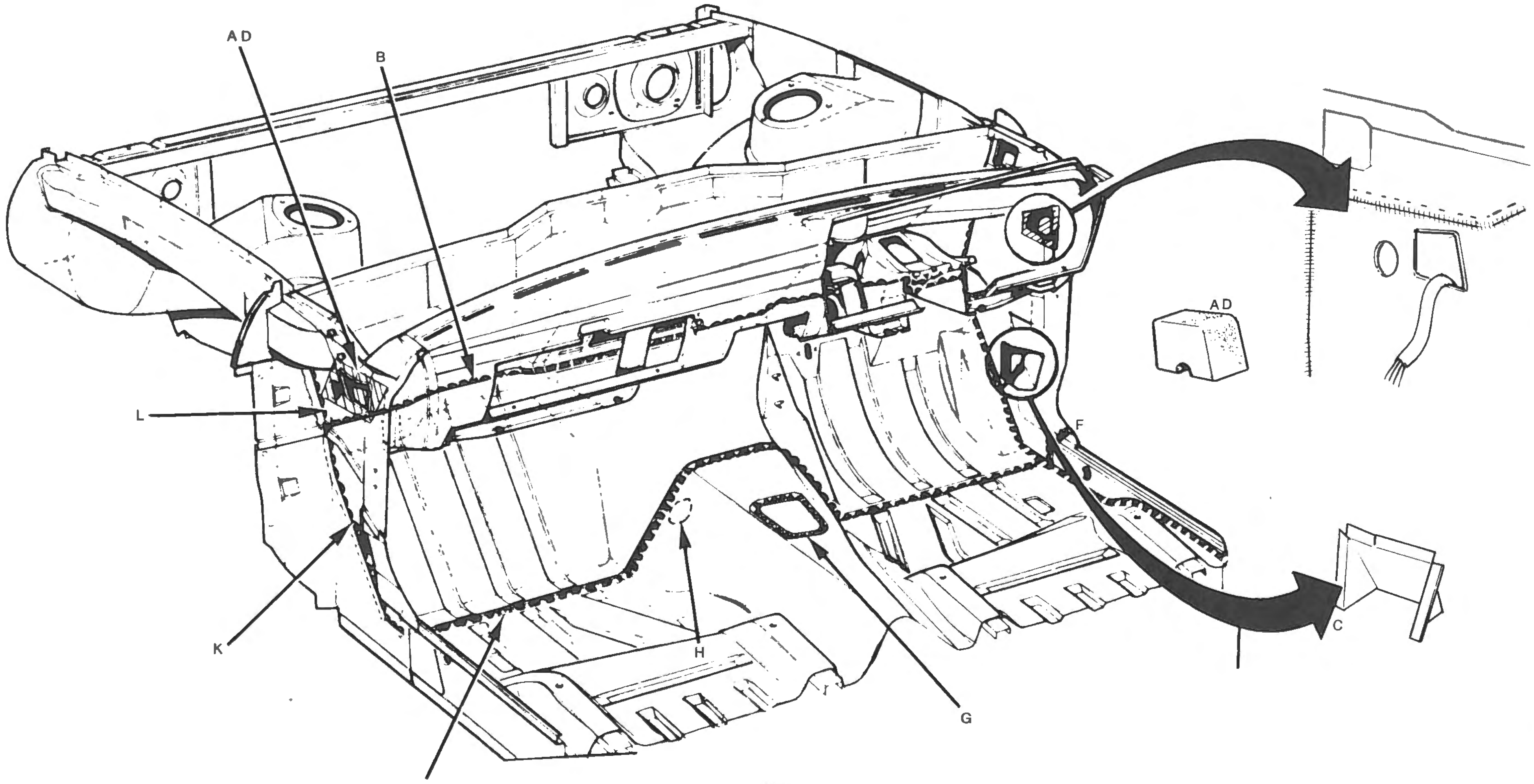


Fig. U-21

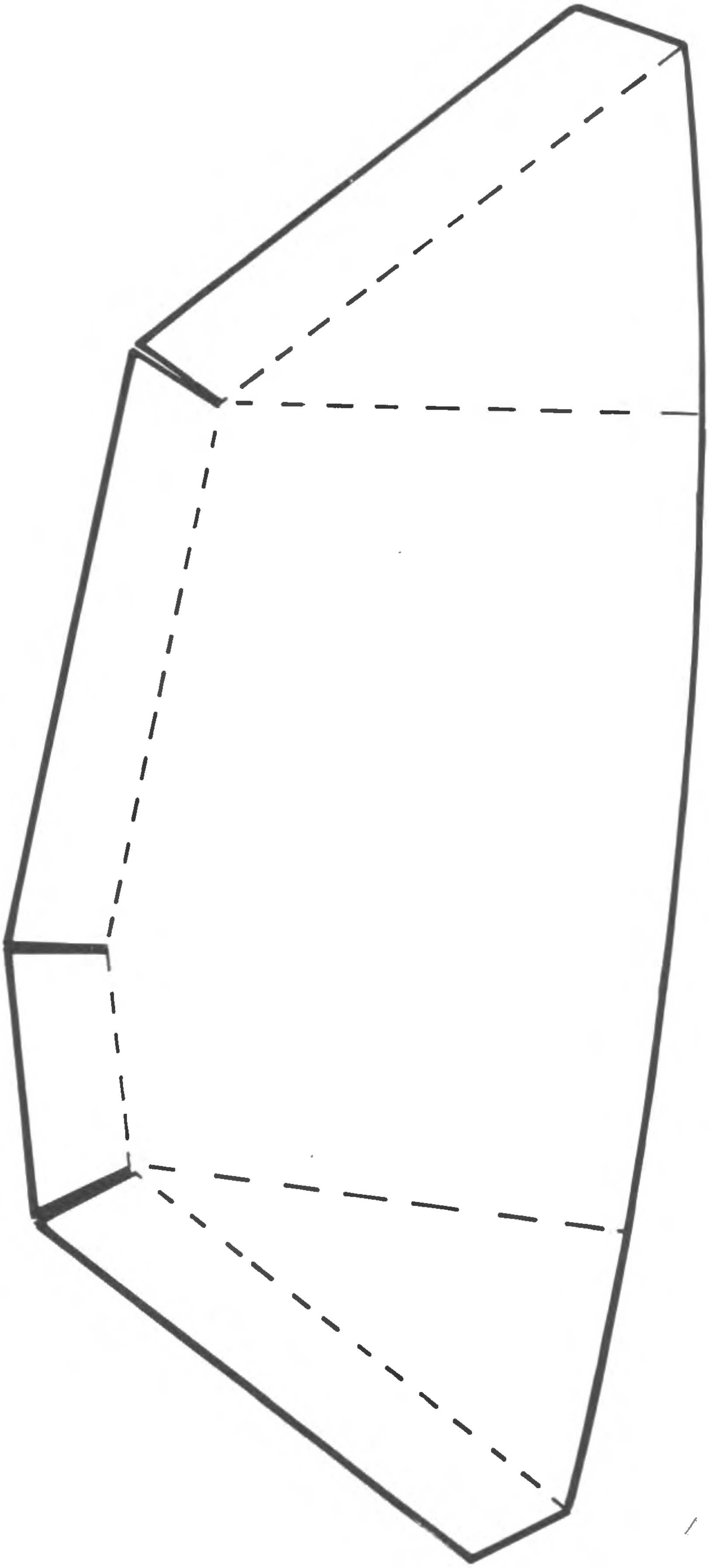
FLOOR PAN AND DASH ASSEMBLY

		Type of Sealer
A	SEAL APERTURE AROUND WIRING HARNESS WITH BLOCK OF BITUMEN IMPREGNATED POLYURETHANE FOAM 90 x 63 x 50 mm (3.50 x 2.50 x 2.00 in) NOTCH AS SHOWN	SEALING TAPE
B	BETWEEN PANEL DASH AND TOE BOARD	NO. 1
C	CONSTRUCT WATER SHIELD AS SHOWN AND GLUE TO 'A' POST FOOT VENT APERTURE	

		Type of Sealer
D	SEAL APERTURE AROUND WIRING HARNESS WITH BLOCK OF BITUMEN IMPREGNATED POLYURETHANE FOAM 90 x 63 x 50 mm (3.50 x 2.50 x 2.00 in) NOTCH AS SHOWN	NO. 1 SEALING TAPE
F	BETWEEN PANEL-SILL CLOSING AND 'A' POST LOWER	NO. 1
G	BETWEEN GEARSHIFT LEVER COVER REINFORCING AND MAIN FLOOR PANEL	NO. 1

		Type of Sealer
H	KEEP EDGE OF 38 mm (1.50 in) HOLE CLEAR OF SEALER FOR RUBBER PLUG	
J	BETWEEN MAIN FLOOR PANEL AND TOE BOARD	NO. 1
K	BETWEEN TOE BOARD AND 'A' POST	NO. 1
L	BETWEEN PANEL DASH AND 'A' POST	NO. 1

TYPE OF SEALING **Refer Page U-26**



FOOT VENT WATER SHIELD TEMPLATE

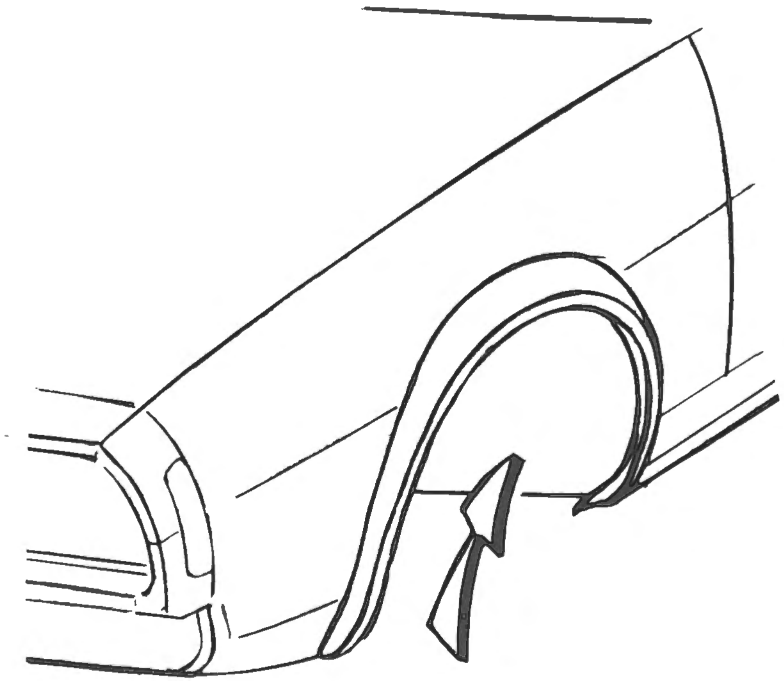


Fig. U-22

LOCATION OF FIG. U-23

A FIT A PIECE OF BITUMEN IMPREGNATED POLYURETHANE MEASURING 25 mm x 25 mm x 50 mm (APPROXIMATELY 1.00 x 1.00 x 2.00 in) TO THE RIDGE IN FENDER IMMEDIATELY IN FRONT OF GUSSET PANEL

B FIT A PIECE OF BITUMEN IMPREGNATED POLYURETHANE MEASURING 50 mm x 75 mm x 150 mm (APPROXIMATELY 2.00 x 3.00 x 6.00 in) AROUND THE UPPER LONGITUDINAL IMMEDIATELY IN FRONT OF GUSSET PANEL AND COAT WITH UNDERBODY SEALER

C FILL SQUARE HOLE IN GUSSET PANEL WITH MYHO871 BLIND FIX

D APPLY CAULKING COMPOUND TO CORNER OF GUSSET PANEL AND LONGITUDINAL

E FIT A PIECE OF BITUMEN IMPREGNATED POLYURETHANE MEASURING 25 mm x 25 mm x 67 mm (APPROXIMATELY 1.00 x 1.00 x 2.50 in) TO GAP BETWEEN LOWER FLANGE OF LONGITUDINAL AND VALANCE, AND COAT WITH UNDERBODY SEALER

NOTE: EXCEPT FOR THE FENDER RIDGE, THE BITUMEN IMPREGNATED POLYURETHANE WILL NEED TO BE COMPRESSED BEFORE FITMENT. THE FOAM WILL RETURN TO ITS ORIGINAL SIZE IN ABOUT TWO HOURS.

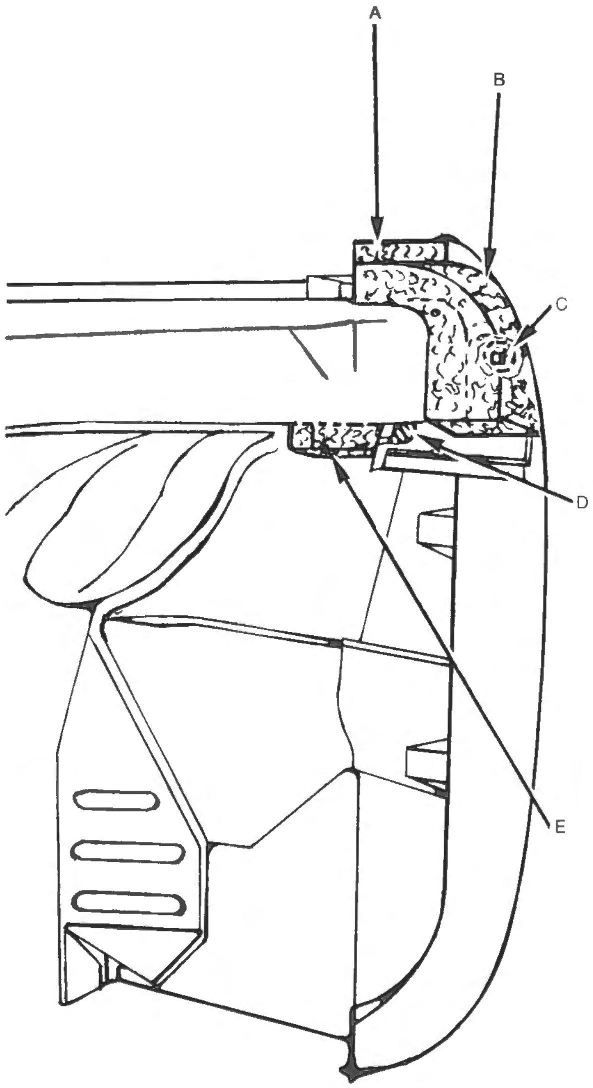


Fig. U-23

DASH — 'A' POST AND FENDER JUNCTION

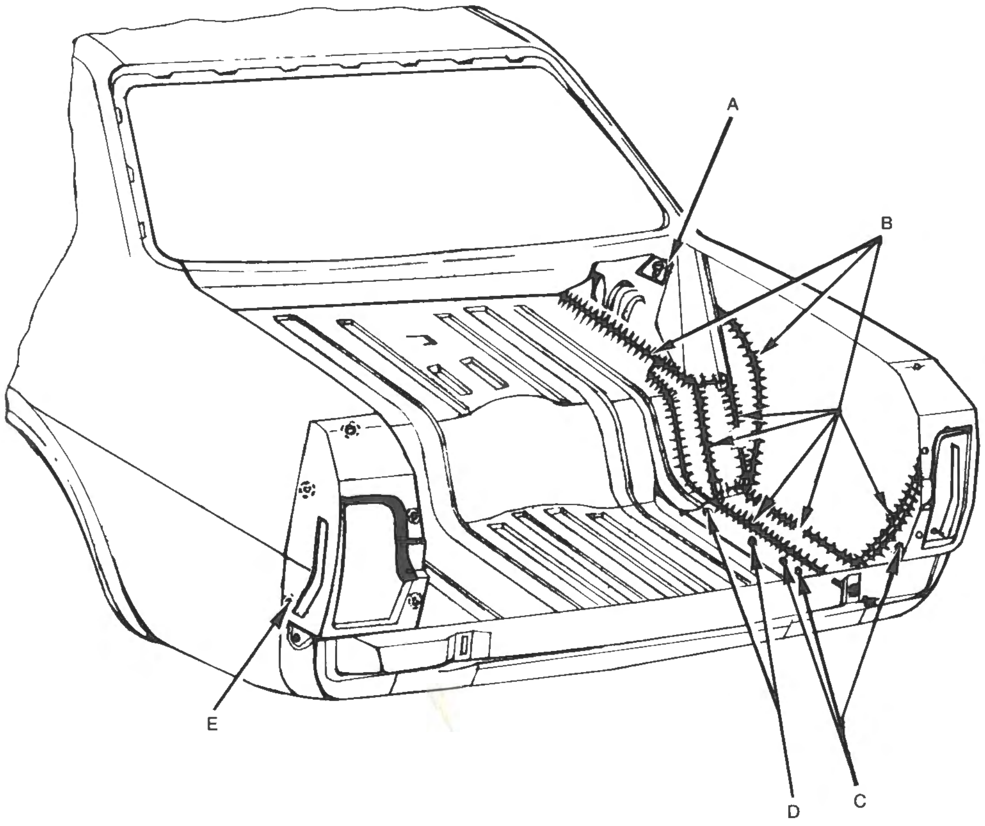


Fig. U-24

LUGGAGE COMPARTMENT — INTERIOR

		Type of Sealer	Refer Page
A	TRUNK LID MOUNTING BRACKET TO WHEEL ARCH JOINT	NO. 1	U-26
B	SEAL ALL BODY SEAMS INSIDE LUGGAGE COMPARTMENT	NO. 1	U-26
C	SEAL ALL BUMPER BAR MOUNTINGS	NO. 1	U-26
D	SEAL AROUND BLIND FIXES		
E	SEAL TAIL LAMP EXTENSIONS TO TONNEAU	NO. 1	U-26

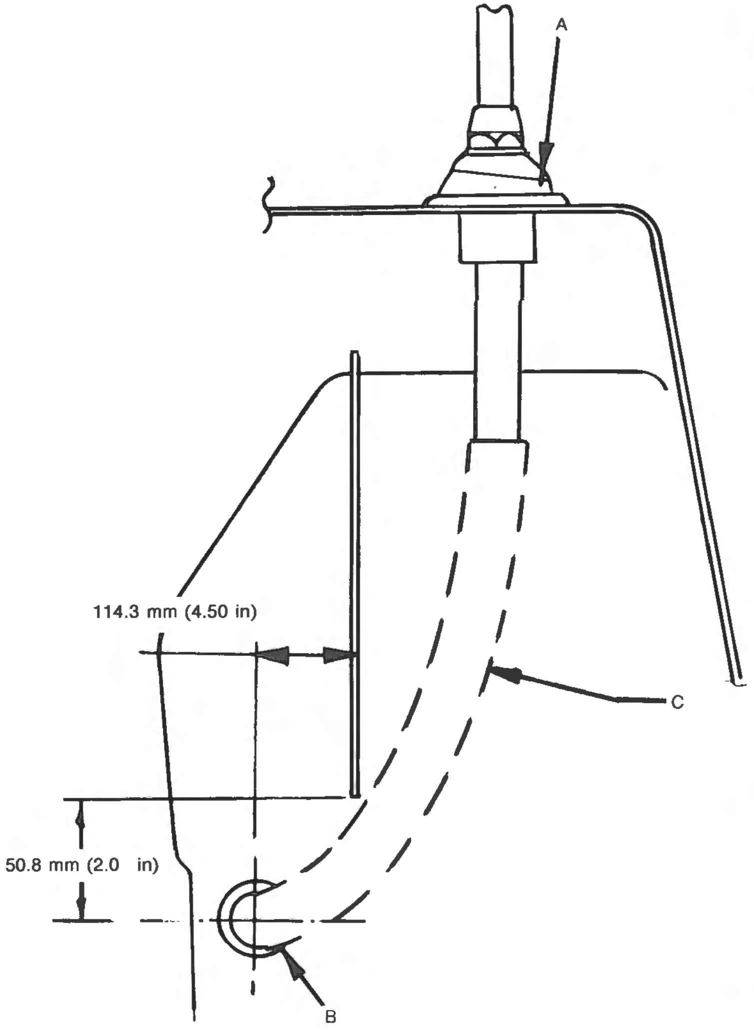


Fig. U-25

RADIO AERIAL

		Type of Sealer	Refer Page
A	BETWEEN AERIAL BASE AND BODY	NO. 3	U-26
B	BETWEEN BODY AND DRAIN TUBE RUBBER GROMMET 25.4 mm (1.0 in) HOLE		
C	DRAIN TUBE 14 mm (0.55 in) BORE x 457 mm (18 in) LONG P.V.C.		

BODY ALIGNMENT DIMENSIONS

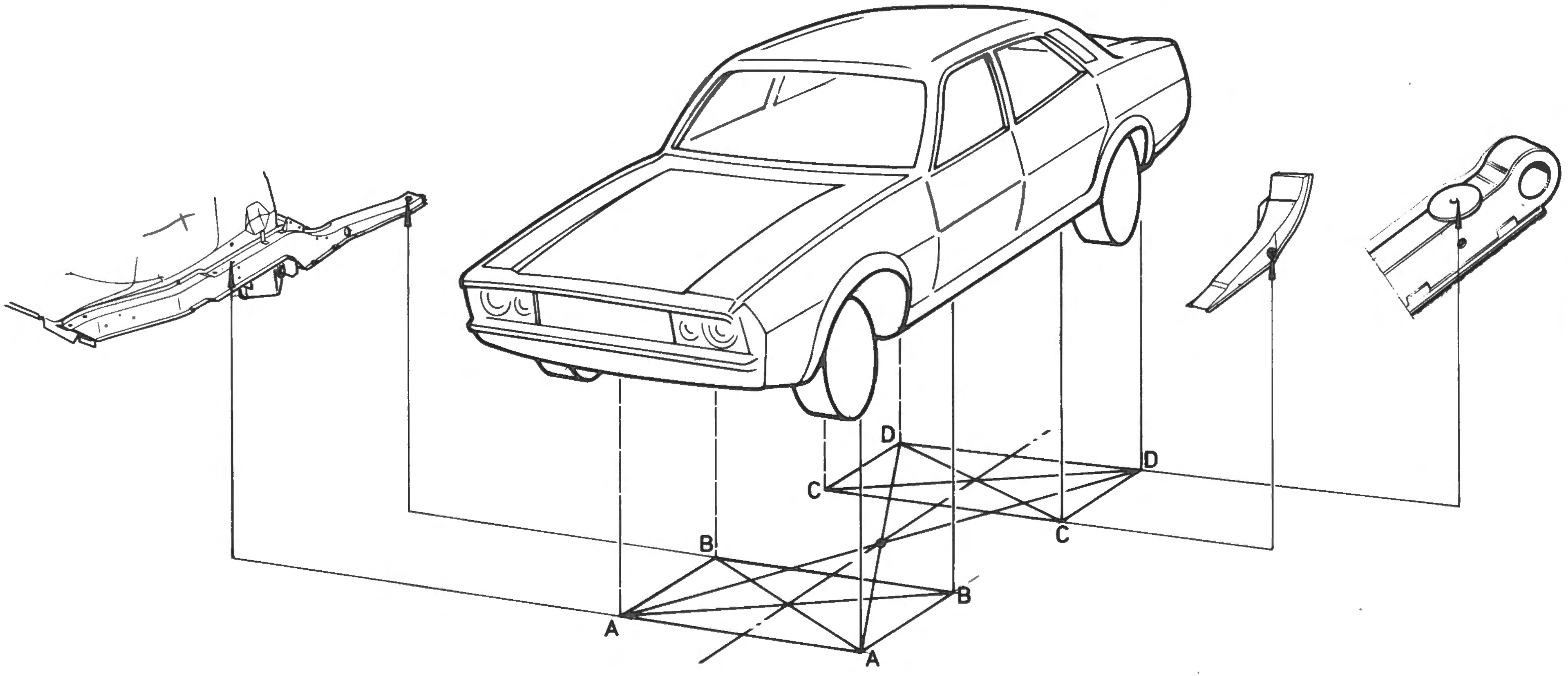


Fig. U-26

HORIZONTAL ALIGNMENT

A-A	B-B	C-C	D-D
Bottom face of valance and cross member — rear hole 812.8 mm (32.00 in)	Reinforcing longitudinal member — outside of metal 590.3 mm (23.24 in)	Lower suspension link support — inside of metal 843.3 mm (33.20 in)	Rear spring seat platform 1096.26 mm (43.16 in)

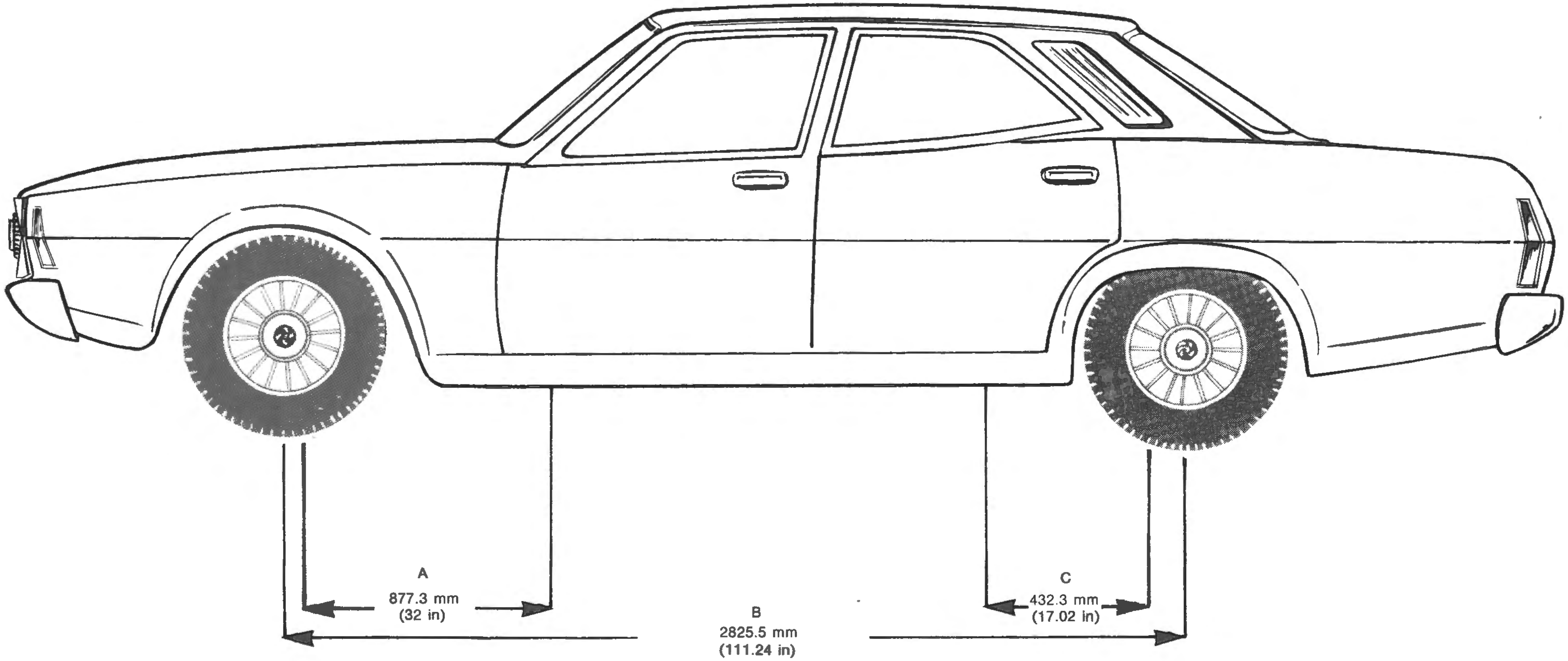


Fig. U-27

VERTICAL ALIGNMENT

SECTION W

HEATING AND VENTILATION

GENERAL DESCRIPTION

All vehicles are equipped with a heating, ventilating and demisting unit. The basic heater comprises a two speed fan, heater matrix, air mixing temperature control flap and distribution flap, housed in a moulded casing. The fan is mounted in the plenum chamber and provision is made for delivering blown ambient air to face level vents. Controls for temperature, air distribution and fan speed are mounted at the left hand side of the instrument cluster.

The Deluxe heater is similar but includes a tap to shut off the hot water flow through the heater matrix when the temperature control is moved to 'Off', this prevents radiant heat from the matrix affecting the foot well area.

Face level ventilation when fitted takes blown ambient air from the heater core (before the heater matrix) and delivers it to two vents, one either side of the facia. These vents are individually controlled for direction and air quantity.

Air extractor vents are built into the rear quarter panels for 'through flow' ventilation.

OPERATING THE SYSTEM

The temperature is controlled by moving the left hand control lever (1) towards the up position allowing engine coolant passing through the heater matrix to warm the incoming air. Position 'A' (red): maximum heat when the engine has reached normal operating temperature. Position 'B': an intermediate temperature with the engine at normal operating temperature.

The air flow is controlled by moving the centre control lever (2) progressively towards the up position, opens the air channels to the demister ducts and the car interior. Position 'C' (Screen): maximum flow to demisters. From 'C' to position 'D' (Interior), movement of the lever gradually reduces demisting and increases flow to the interior of the car.

Ventilation can be adjusted by returning the lever (1) to the 'Off' position and set lever (2) between 'C' and 'D' as required. Allow a few moments for the hot air accumulated around the heater matrix to dissipate.

Additional air flow is obtained by operation of the booster fan. Lifting the lever (3) up to the first position, (LOW) low speed and to the second position, (HIGH) high speed. The fan is for use when the vehicle is stationary or travelling at low speed or to augment the air supply during extreme weather conditions. DO NOT operate the fan with the air flow lever in the 'Off' position and the facia vent controls closed as this will cause the motor to overheat. A resistor for the two speed fan is situated inside the heater unit.

The facia vents provide additional fresh air through air ducts on the lower facia panel. The volume of air entering the car may be individually controlled by either the driver or passenger by opening or closing the valve in the vent. The control for this is a push-pull knob at the side of the vent. Air flow direction may be altered by turning the chrome knob in the centre of the vent or by rotating the vent. The air supply to these vents will be at ambient temperature and may be fan boosted.

FACIA VENT

Removing

1 Disconnect the battery.

2 Disconnect the Kopex tubing from the rear of the facia vent.

3 Remove the knob from the front of the control lever.

4 Remove the nut, spring and flat washers securing the facia vent to the lower facia rail.

5 Remove the face vent and control lever from the lower facia rail.

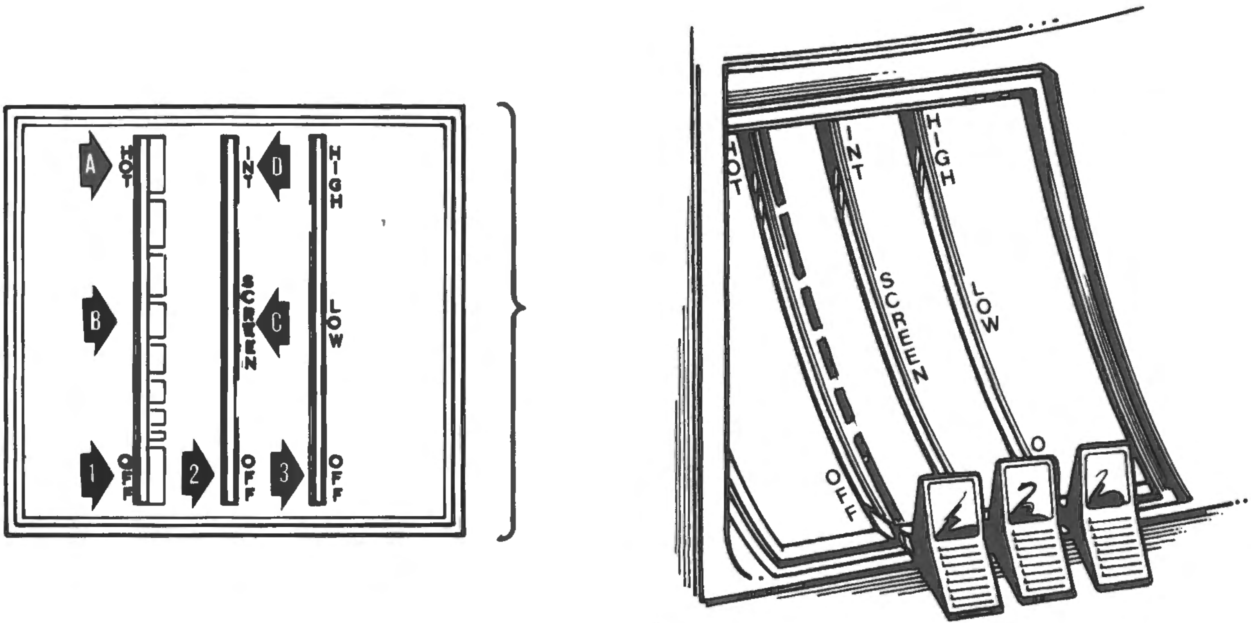


Fig. W-1

HEATING AND VENTILATING CONTROL LEVERS

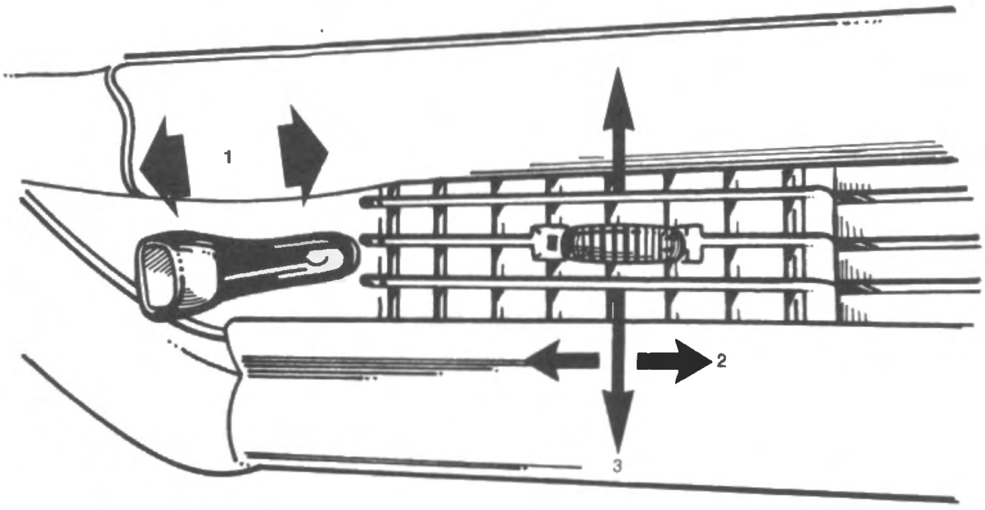


Fig. W-2

FACIA VENT

1 CONTROL LEVER 2 HORIZONTAL DIRECTION CONTROL 3 VERTICAL DIRECTION CONTROL

Refitting

1 Refitting is a reversal of the removing procedures 1 to 5.

DEMISTER VENT

The demister vent is a full width double panel welded to the scuttle panel and therefore requires no servicing. The only components that are serviceable are the Kopex tubing between the heater and the demister ducting.

FLOOR LEVEL VENT

The floor level ventilation system draws ambient air from the plenum chamber and ducts it to the front floor area via the 'A' post cavities. Separate control for air flow and shut off is provided for each side of the vehicle. To open pull the vent slide control and to close push the slide to the closed position.

Removing

1 Remove the tread plate from the door aperture.

2 Remove the 'Canoe' clip from the floor vent panel.

3 Remove the four screws securing the floor vent to the body panel.

4 Withdraw the floor vent panel.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4.

HEATER UNIT

Removing

1 Disconnect the battery and the wiring to the fan switch and motor.

2 Remove the Kopex tubing from the rear of the facia vents.

3 Remove the choke cable and the centre console if applicable.

4 Remove the screws retaining the lower facia rail and withdraw the facia rail complete with the facia vents.

5 Remove the four Kopex tubes from the heater unit.

6 Remove the three knobs from the heater control and lever mechanism.

7 Using a screw driver remove the two special nuts retaining the control assembly to the facia panel and withdraw the control assembly from the dash.

8 Drain coolant from the radiator into a clean container.

9 Remove the heater hoses from the thermostat housing and the water pump.

10 Apply low pressure air to either hose after opening the control valve and force the water from the matrix.

11 Remove the heater hoses from the heater unit.

12 Remove the plate from the front of the plenum chamber.

13 Remove the twelve nuts and bolts retaining the heater unit to plenum chamber.

14 Withdraw the heater unit and the control assembly into the vehicle.

Dismantling

1 Straighten the three lock plates, remove the screws and nuts securing the heater assembly, and separate the two halves of the casing.

2 Disconnect the heater tap by-pass hose if fitted and remove the matrix and control flaps.

3 Disconnect the wires from the heater motor, noting their position.

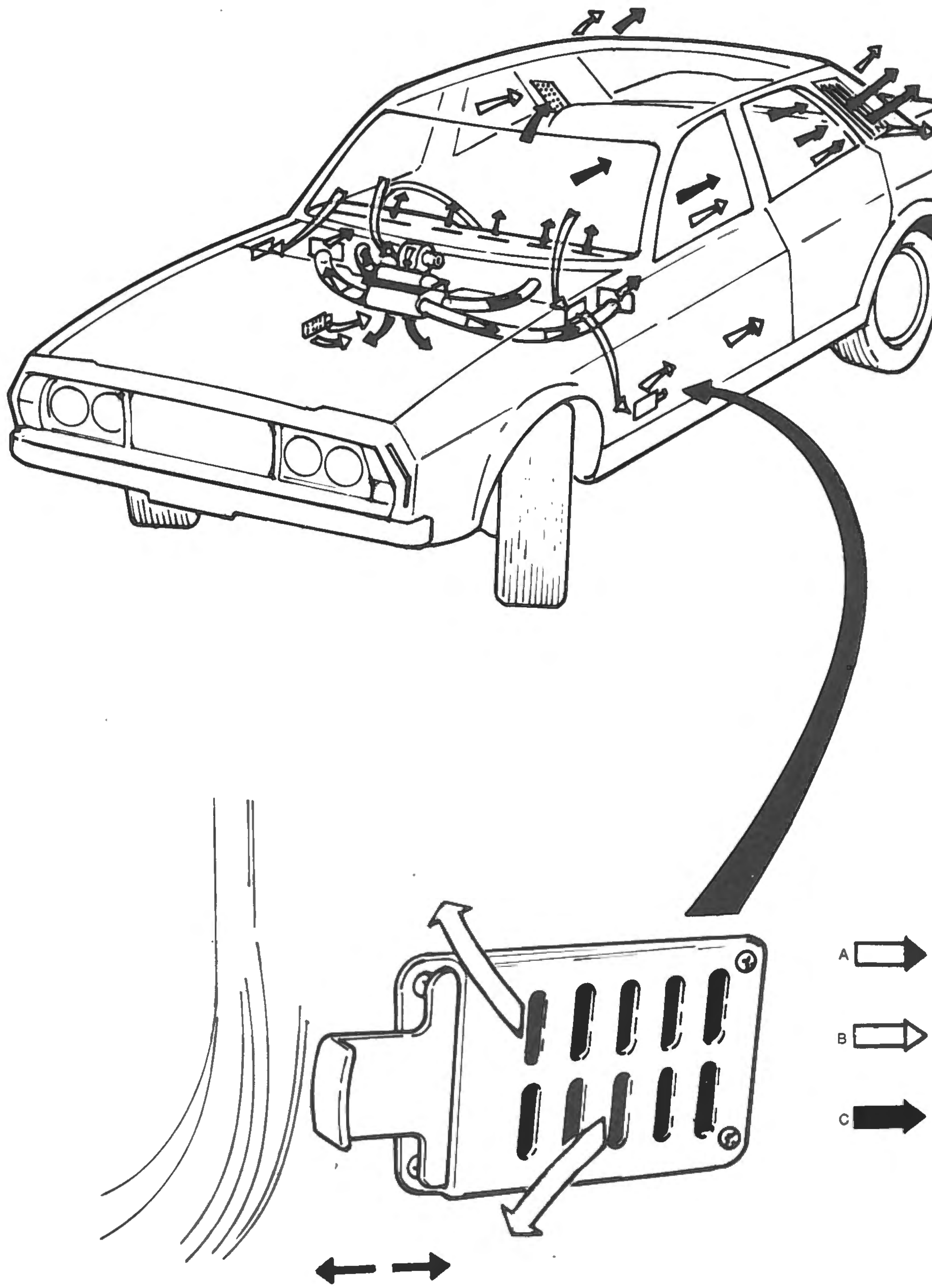


Fig. W-3

HEATING AND THROUGH FLOW VENTILATION

A AMBIENT AIR BOOSTED NON-HEATED

B AMBIENT AIR NON-BOOSTED

C HEATED OR AMBIENT AIR BOOSTED

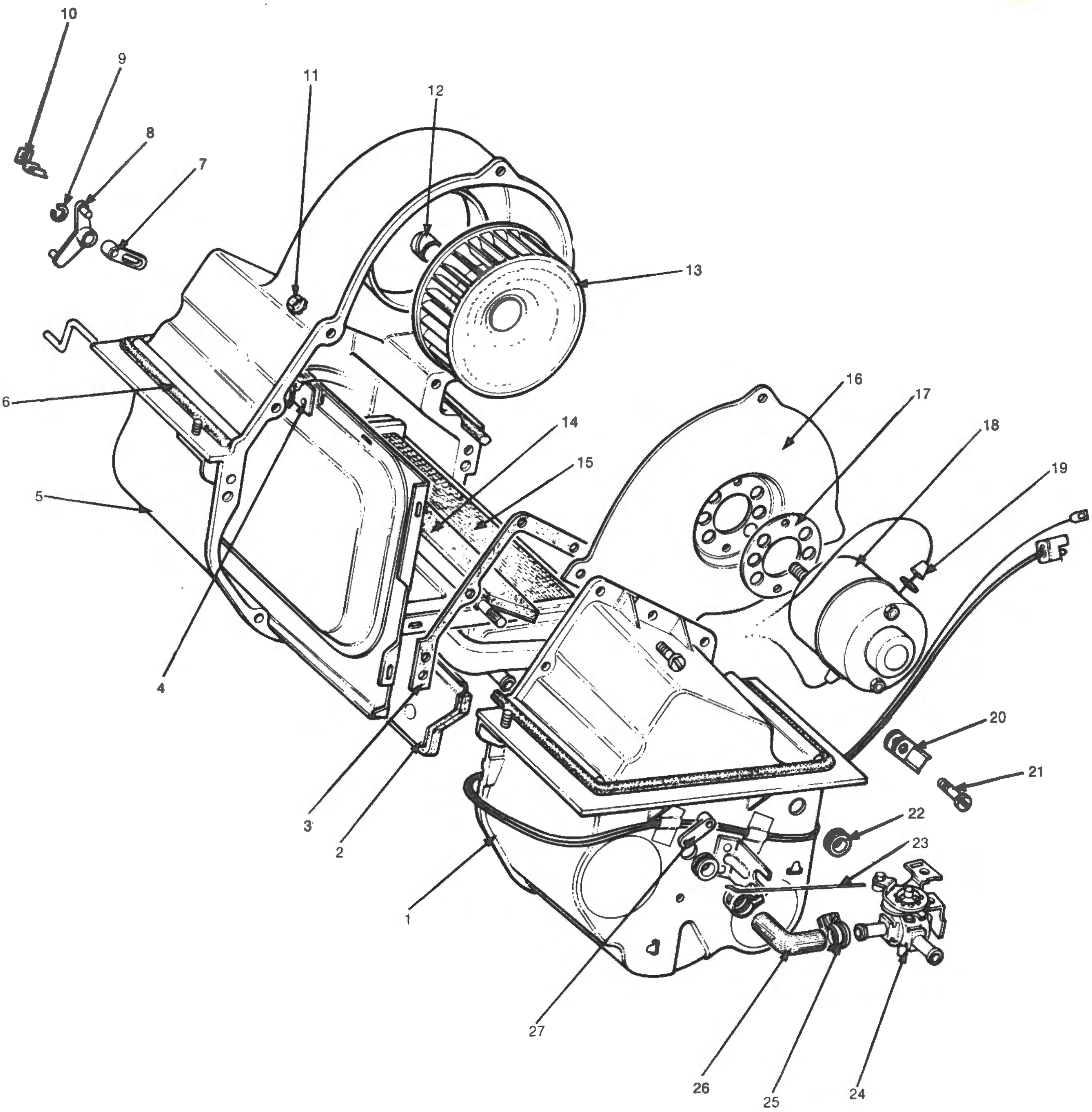


Fig. W-4

HEATER UNIT COMPONENTS

1	HEATER CASE (LEFT HAND)	10	CLIP	19	GROMMET
2	FLAP (AIR CONTROL)	11	NUT (9 OFF)	20	CLIP
3	SEAL	12	RETAINING SLEEVE	21	SCREW (9 OFF)
4	RESISTOR	13	ROTOR	22	GROMMET (2 OFF)
5	HEATER CASE (RIGHT HAND)	14	FLAP (TEMPERATURE CONTROL)	23	ROD
6	SEAL	15	MATRIX	24	TAP (WATER CONTROL)
7	CRANK	16	PLATE (MOTOR MOUNTING)	25	CLIP (2 OFF)
8	LEVER	17	SEAL	26	HOSE
9	CIRCLIP	18	MOTOR	27	CRANK

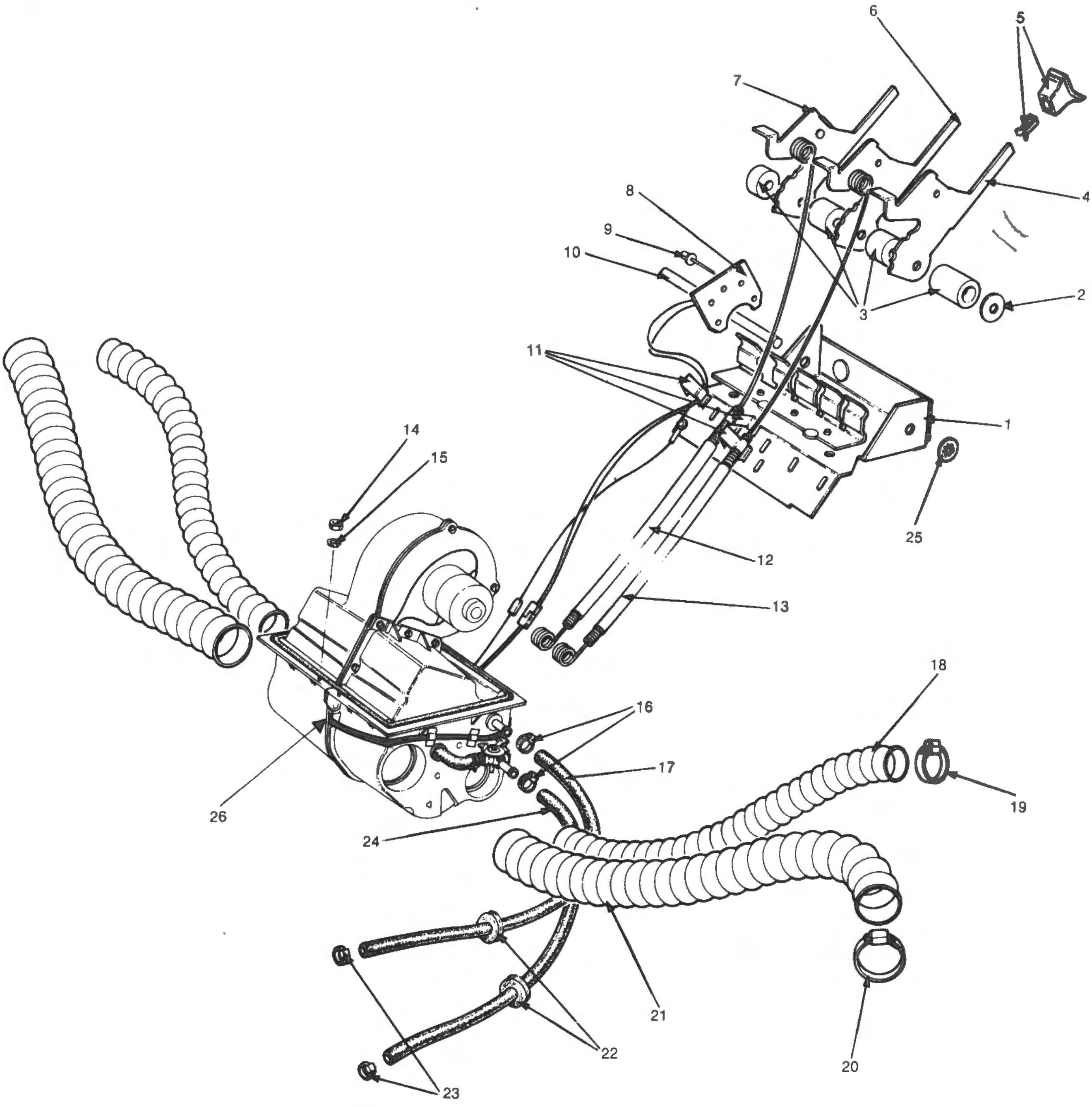


Fig. W-5

CONTROL CABLE AND LEVER MECHANISM

1	BASE PLATE ASSEMBLY	14	NUT (8 OFF)
2	WASHER (FLAT)	15	WASHER (8 OFF SPRING)
3	WASHER (SPACER)	16	CLIP (HOSE)
4	LEVER (TEMPERATURE)	17	HOSE (OUTLET)
5	KNOB AND CLIP	18	KOPEX HOSE (DEMIST)
6	LEVER (AIR)	19	CLIP (HOSE)
7	LEVER (RESISTOR)	20	CLIP (HOSE)
8	SWITCH	21	KOPEX (AIR VENT)
9	PIVOT	22	GROMMET
10	PIN (PIVOT)	23	CLIP (HOSE)
11	CLIP	24	HOSE (INLET)
12	CABLE (AIR)	25	RETAINING CLIP
13	CABLE (TEMPERATURE)	26	HEATER UNIT

4 Remove the two screws and nuts securing the motor mounting plate to the heater casing and remove the motor assembly.

5 Remove the heater control tap if fitted.

Refitting

1 Refitting is a reversal of the removing procedures noting the following:

  (a) Fill the system with a coolant and top up if necessary after engine has reached normal operating temperature.

  (b) Check for leaks.

CONTROL CABLES AND LEVER MECHANISM

Removing

1 Disconnect the battery and disconnect the wiring to the heater fan switch.

2 Disconnect the air and temperature control cables from the heater unit.

3 Remove the lever knobs.

4 Using a screw driver remove the two special nuts retaining the control assembly to the facia panel and withdraw assembly from the dash.

Refitting

1 Refitting is a reversal of the removing procedures 1 to 4.

NOTE: The air control and the temperature control cables may be adjusted by repositioning the outer cables at the retaining clips to ensure correct operation of the unit.

SECTION X

AIR CONDITIONING

COMPRESSOR BELT AYD0193 (C~~M317)~~ CM167

GENERAL DESCRIPTION

The air conditioning system fitted as optional equipment is an integral demisting, heating and cooling unit designed to give driver control over the interior environment within the normal comfort zone under all climatic conditions.

This system incorporates a mechanical compression refrigeration circuit for cooling and a heat exchanger utilising the hot coolant from the engine cooling system for heating and demisting.

Both systems are operated by a five lever control panel on the facia.

Regular inspection, maintenance and correct operation of the controls is essential to ensure maximum efficiency.

All work involving the handling of refrigerants requires special equipment, a knowledge of its correct use and attention to safety measures. Refer page X-18.

WARNING: Service work on a vehicle that requires loosening of a refrigerant line connection should be performed only by a qualified person.

NOTE: WHEN A VEHICLE IS AIR CONDITIONED; UNDER NORMAL OPERATING CONDITIONS ADDITIONAL LOAD IS PLACED ON THE VEHICLES' ELECTRICAL AND COOLING SYSTEMS. THESE SYSTEM CAPACITIES HAVE BEEN INCREASED ACCORDINGLY, FOR DETAILS REFER SPECIFICATION.

BASIC AIR CONDITIONING

To understand the operation of the air conditioning system it is essential that some of the principles of refrigeration are understood since functionally an air conditioner and refrigerator are similar.

First of all we must understand what 'COLD' is; normally we think of cold as a definite, positive condition. Actually there is no such thing as 'COLD'. The only way we can define it is simply saying 'COLD' is the lack of heat, just as darkness is the lack of light.

All substances contain 'heat' to some extent, a part of which can be removed and as a result the substance becomes cooler. Removing heat is the true function of the refrigerator or air conditioner.

Theoretically the lowest temperature that a substance could obtain is —273°C (—459°F). This may be called 'COLD' and anything warmer than this contains heat. Man has never succeeded in removing **all** the heat out of an object. We must now look at the means of removing heat from an object in order to control its temperature.

Heat will always travel from a warmer object to a cooler one, therefore, it is fair to say the only thing that will attract heat or remove heat from an object is a cooler object.

Fig. X-1

BASIC AIR CONDITIONING

HEAT FLOWS FROM A WARMER OBJECT TO A COOLER ONE

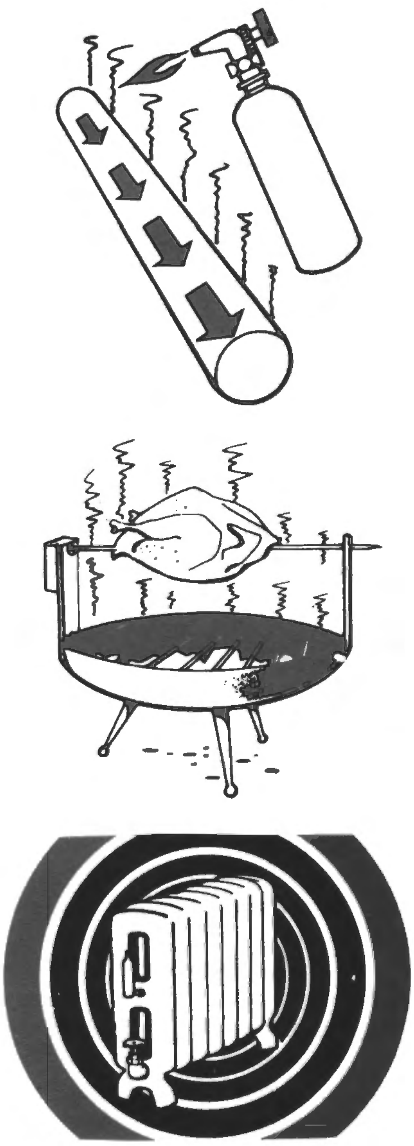


Fig. X-2

HEAT TRANSFER

1 CONDUCTION

2 CONVECTION

3 RADIATION

Heat Transfer

Heat will transfer from one object to another by conduction, convection and radiation or combinations of all three. These may be defined as follows:

1. Conduction — the heat flow through a substance.
2. Convection — the transmission of heat via currents in liquids and gases.
3. Radiation — the transmission of heat from one object to another without increasing the temperature of the intervening medium.

Measurement of Heat

If water is heated, we would expect it to get hotter and hotter until it finally boils. During the process, we can tell exactly how hot water is by means of a thermometer. However, the thermometer will show that the flame is just as hot when the water is just warm as it is when the water finally boils. Why doesn't the water boil immediately? Also, why does it take longer to boil a litre of water than a cupful? Obviously temperature isn't the only measurement of heat. For this purpose temperature may be defined as the intensity of heat and is measured with a thermometer.

Measurement of temperature is useful, however heat quantity is required to be known if it is to be removed from a substance and transferred to another place.

The unit of heat quantity is specified as the amount necessary to raise the temperature of one gramme of water through one degree Celsius and is known as a calorie.

In dealing with refrigeration, three basic types of heat are involved, these may be defined as follows:

1. Sensible Heat — that which can be measured.
2. Specific Heat — the heat absorbing capacity of a substance as compared with water.
3. Latent Heat — that heat which cannot be found with a thermometer (hidden).

Latent Heat

An example of this hidden heat can be found in the melting of ice in a food container. If a thermometer is placed in the ice pack it will indicate 0°C (32°F); at a later time a check will show the ice has diminished slightly (melted) but its temperature is still at 0°C (32°F). No matter how much heat is absorbed by the ice from the food, while the ice remains, its temperature will be 0°C (32°F). A temperature check of the melted ice water will show that it also is very close to 0°C (32°F), and it continues to get warmer as it soaks up heat, yet it will not raise the temperature of the ice above 0°C (32°F) nor does it get warm enough to account for all the heat absorbed by the ice. Therefore it can be assumed that the hidden (latent) heat is used in changing the state of the ice from a solid to a liquid.

This change of state is known as the Latent Heat of Fusion (melting).

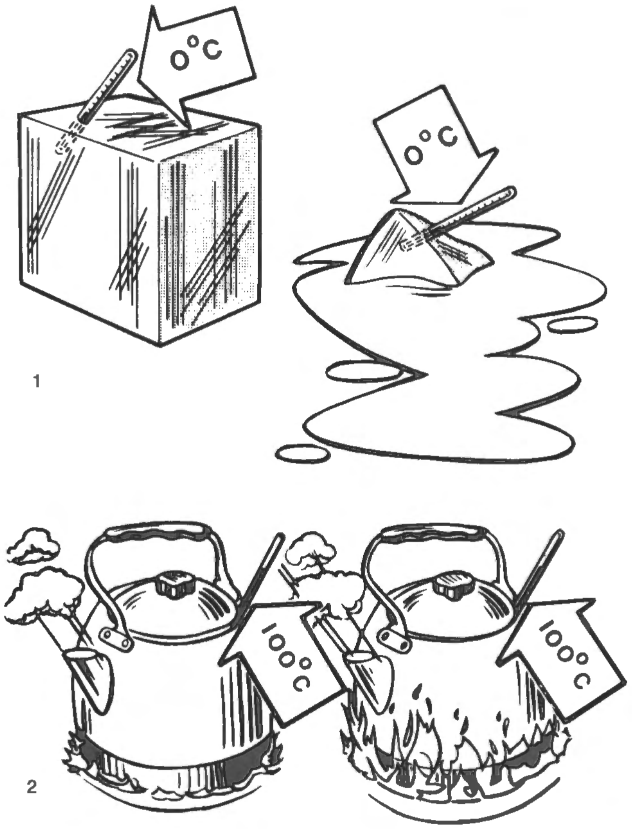


Fig. X-3

LATENT HEAT

1 MELTING ICE REMAINS AT 0°C

2 BOILING WATER NEVER EXCEEDS 100°C

If the melted ice water is placed in an open container and heated its temperature will rise to 100°C (212°F) and boiling will occur. The addition of more heat will not produce an increase in temperature but a change of state from liquid to gas occurs.

When liquids change to a gaseous state they absorb large amounts of heat without an increase in temperature.

This change in state is known as the Latent Heat of Vaporisation (evaporation) and this is when the most heat is absorbed.

Whenever boiling is mentioned it is assumed that the substance is very hot. This is not true, each substance has its own particular boiling point temperature. But regardless of whether it is high or low, they all absorb unusually larger quantities of heat without getting any warmer when changing from a liquid into a vapour.

Consequently, any liquid that will boil at a temperature below the freezing point of water will freeze water.

Refrigerant 12

Refrigerant 12 (R-12) is used in automotive applications. It boils at –29.8°C (–21.7°F).

This refrigerant would evaporate if exposed to the atmosphere at normal temperatures, it is therefore stored in containers under pressure. If the ice pack in the food container is replaced with a container of R-12 vented to atmosphere, the R-12 would boil (vaporise), drawing away heat from the surrounding contents until the temperature reaches −138°C (−217°F), which would be maintained until the R-12 is completely exhausted.

From the melting ice situation it was noted that the melted ice water was very close to 0°C (32°F). The same situation applies to the R-12, the vapours from boiling being only slightly higher temperature than the liquid. Therefore, the rising vapours from boiling do the same job as melting ice, but at a suitable temperature and by the method which absorbs the most heat.

Refrigerant 12 is very expensive and cannot be thrown away like ice water, therefore, if the heat it absorbs can be removed thus changing it back to a liquid, it can be re-used. The vapour can be changed back to a liquid by cooling or condensing it.

In condensing vapours the amount of heat required to be removed will exactly equal the amount of heat that was required to vaporise it in the first instance.

The latent heat given up during the vaporising process now reappears, when the vapours change back to a liquid.

To condense the vapour back to a liquid by straight cooling is not acceptable as too low a temperature would be required. Therefore it is necessary to raise the temperature of the vapour to a point where it would be higher than the surrounding air, thus producing a heat transfer to air, promoting condensation back to liquid.

The increase in temperature is achieved by compressing the vapour which concentrates its heat. The compression also raises the condensing point temperature to a point higher than the surrounding ambient air due to the fact that when a pressure is applied to a liquid its boiling point is raised.

The Basic System

The basic refrigeration system is as shown in Fig. X-4 and its operating cycle is as follows:

Low pressure, low temperature refrigerant vapour is drawn into the suction side of the compressor. Compression of the vapour concentrates its heat and increases its temperature. The high pressure, high temperature vapour enters the top of the condenser where heat is drawn off to the atmosphere condensing the vapour to high pressure liquid, which passes from the bottom of the condenser to the receiver/dryer. From the receiver/dryer it passes to the Thermostatic Expansion Valve (TX) at which point it is converted to a low pressure lower temperature liquid which passes into the evaporator coil.

The TX valve automatically metres the flow of the refrigerant entering the evaporator by sensing the difference in temperature between the inlet and outlet of the evaporator.

On entering the evaporator the refrigerant begins to boil (vaporises) and absorbs heat from the air passing off the evaporator fins. The low pressure vapour is drawn off into the compressor and the cycle is repeated. The cycle is split into two distinct sides, the High Pressure and the Low Pressure, the ratio between the two being approximately ten to one for automotive air conditioning. These points plus the operating cycle should be remembered as they will be of value when trouble shooting.

Although the air conditioner (cooler) is basically a refrigeration unit it differs slightly from the normal household refrigerator in so much as it controls to a certain degree the humidity, cleanliness and circulation of air as against chilling or freezing within the confines of a cabinet.

Humidity

Humidity is the moisture content of the air and to a certain degree depends on temperature. Warm air holds more moisture than cold air and when the air contains moisture to its maximum capability it is said to be saturated and the relative humidity would be 100%. Air which is holding half its maximum capacity of moisture at a given temperature would be 50%. The human body gives off heat to the atmosphere by the evaporation of perspiration, a similar action to that which takes place in the refrigeration circuit.

The ease and speed at which evaporation takes place governs the sensation of coolness. The evaporation is directly affected by the relative humidity. When the moisture content is low (dry air) perspiration will evaporate quickly and when high (damp air) perspiration will evaporate slowly resulting in less heat being carried away from the body. Therefore, a reduction in humidity as well as temperature within certain limits is essential for comfort within a motor vehicle.

The limit or recognised Comfort Zone for vehicles is within the temperature range 21°-32°C (70°-90°F) at relative humidity between 30 and 70%. However, the conditions outside will determine the actual recommended inside conditions.

Cooling in the air conditioner is achieved by normal refrigeration and in the process of cooling moisture is drawn from the air to the evaporator. In the older type household refrigerators the ice or frost which forms on the freezer (evaporator) is moisture drawn from the food and air within the compartment and frozen. The difference between the two applications is that the evaporator temperature is not permitted to fall below approximately 1°C (33°F) therefore freezing does not occur, and the moisture builds up on the evaporator. At this point any air passing over the evaporator is cleaned due to dust and fallen particles being trapped by the moisture laden surfaces. The moisture continues to build up, condensate drips off the unit and is drained away under the vehicle taking any contaminants collected with it.

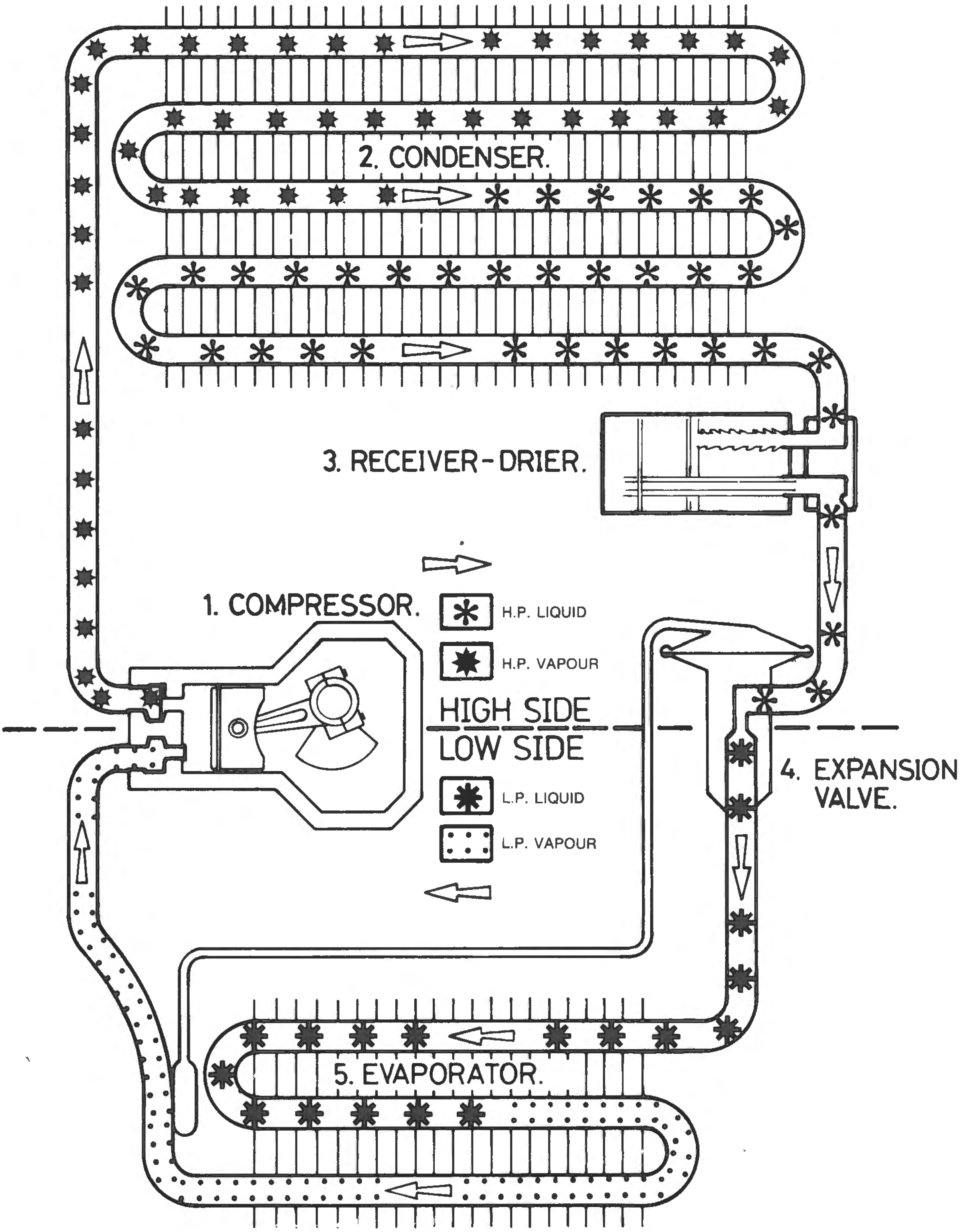


Fig. X-4

THE BASIC REFRIGERATION SYSTEM

1 COMPRESSOR — TO COMPRESS THE VAPOUR AND INCREASE ITS TEMPERATURE, IT ALSO CIRCULATES THE REFRIGERANT

2 CONDENSER — TO DISPOSE OF THE HEAT AND LIQUEFY THE REFRIGERANT

3 RECEIVER/DRYER — CONTAINER AND DRYER OF LIQUID REFRIGERANT

4 EXPANSION VALVE (TX) — PROVIDES RESTRICTION IN CIRCUIT SO THAT THE HIGH PRESSURE LIQUID IS CONVERTED TO LOW PRESSURE LIQUID

5 EVAPORATOR — REFRIGERANT BOILS IN THE EVAPORATOR AND EXTRACTS HEAT FROM WARMER OBJECTS IN THE IMMEDIATE AREA

THE VEHICLE AIR CONDITIONING SYSTEM

The vehicle air conditioning system is as shown schematically in Fig. X-7. When reading the description and operation of the components they should be read in conjunction with the figure.

DESCRIPTION OF COMPONENTS

Compressor

The compressor is a light weight high performance two cylinder double acting type and operated by power from the engine crankshaft via the single 'V' belt and the electro-magnetic clutch. Its on-off operations are controlled by means of this clutch. The unit is mounted on a hinged bracket positioned forward of, and adjacent to the right hand cylinder head.

Lubrication of the crankshaft bearings, piston valves etc. is by force feed and splash using a specific quantity and type of refrigerant oil.

NOTE: The compressor oil mixes with refrigerant and circulates throughout the whole system. Use only approved refrigerant oil.

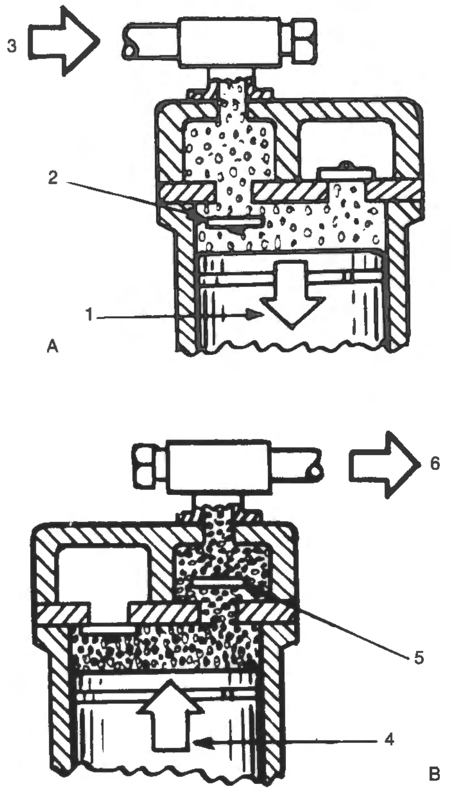


Fig. X-5

COMPRESSOR OPERATION

A	INTAKE STROKE	B	COMPRESSION STROKE
1	PISTON MOVING DOWN	4	PISTON MOVING UP
2	INTAKE VALVE OPEN	5	EXHAUST VALVE OPEN
3	FROM EVAPORATOR	6	TO CONDENSER

When the engine is running and the electro-magnetic clutch is engaged the crankshaft rotates and on the downward stroke of each piston, low pressure refrigerant vapour is drawn in to the cylinders via the suction line and plate valves. On the upward stroke the vapour is compressed and then passed as high pressure, high temperature refrigerant through the plate valves into a muffling chamber and thence through the discharge port to the condenser.

The cylinder head of the compressor is equipped with two service valves. One on the suction (low pressure) and one on the discharge side (high pressure), when only the compressor requires servicing it can be isolated from the rest of the system. With both service valves front seated, the suction and outlet lines on the compressor are sealed by the valve head and the compressor can be serviced. If necessary, such as to replace the compressor, the valves can be removed from the compressor head and will hold the refrigerant charge in the system.

Electro-magnetic Clutch

The electro-magnetic clutch functions to start and stop the compressor whilst the engine is running.

The field shell and the coil are securely attached to the compressor body and the clutch centre piece installed on the compressor crankshaft.

When the cooler unit is not in use, the pulley only is turning. If the mode selection lever is moved to cool (green) the plate spring of the clutch centre piece is engaged into the pulley by electro-magnetic force from the coil, so that the pulley and the centre piece turn together, thus turning the compressor.

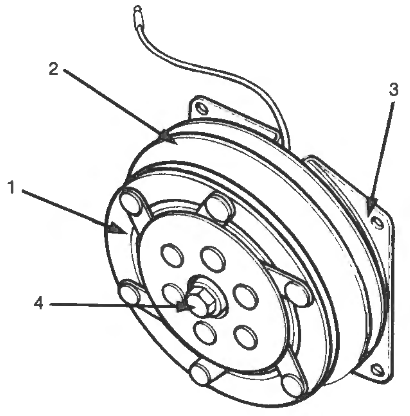


Fig. X-6

ELECTRO-MAGNETIC CLUTCH

1	ELECTRO-MAGNETIC CLUTCH
2	PULLEY
3	FIELD SHELL AND COIL
4	BOLT (CLUTCH CENTRE TO COMPRESSOR CRANKSHAFT)

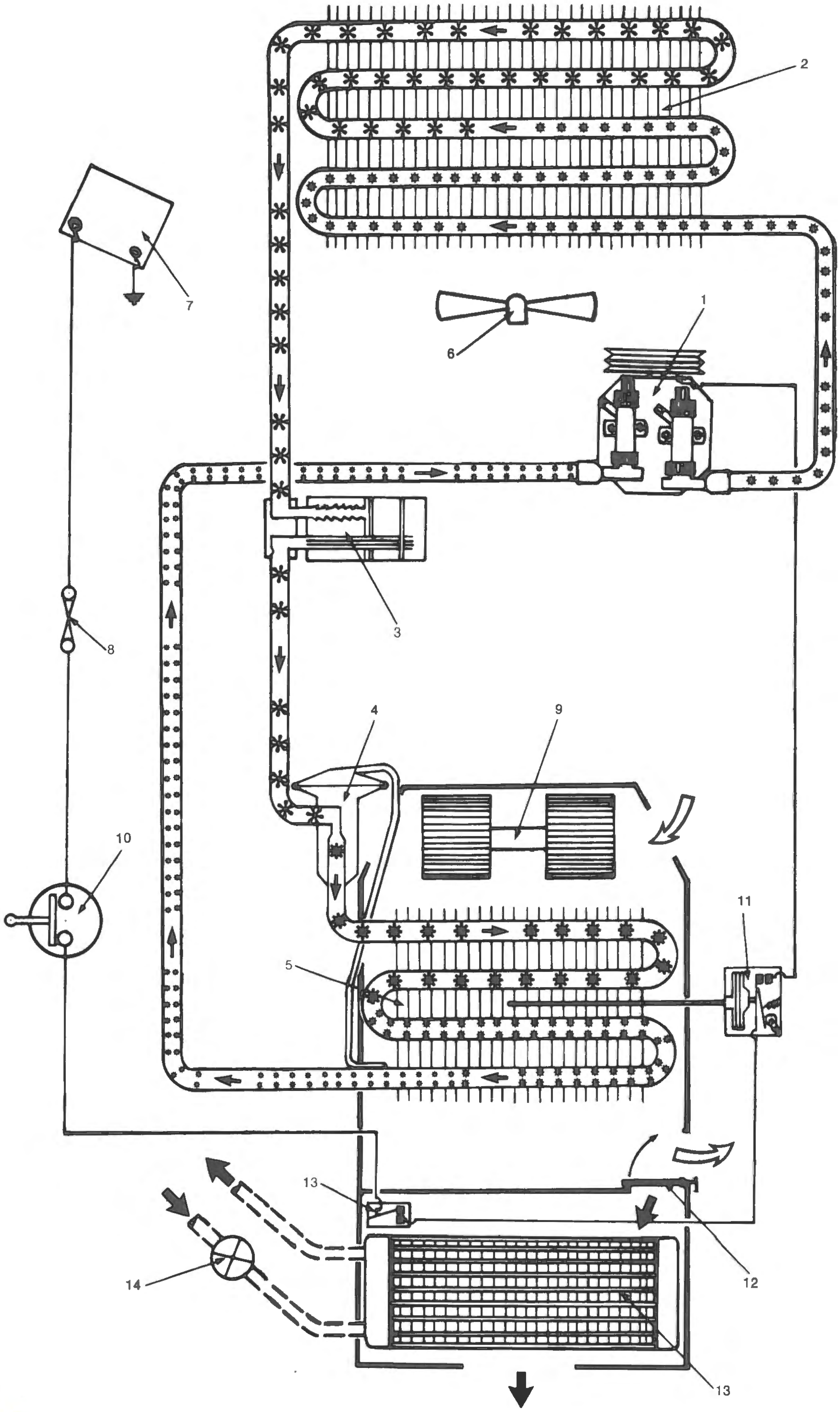
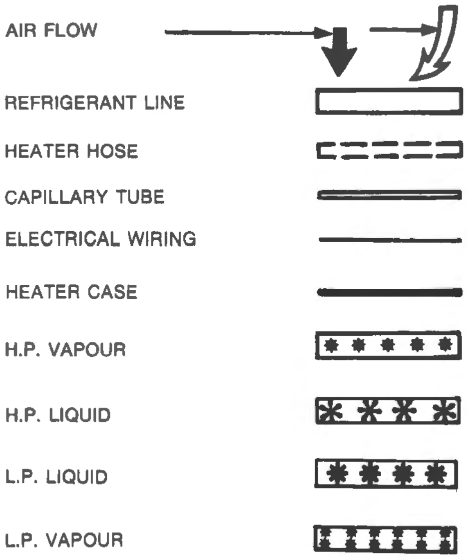


Fig. X-7
THE VEHICLE AIR CONDITIONING SYSTEM

KEY TO FIG. X-7

1 COMPRESSOR
2 CONDENSER
3 RECEIVER/DRYER
4 EXPANSION VALVE (TX)
5 EVAPORATOR
6 VISCOUS COUPLING FAN — TO DRAW AMBIENT AIR THROUGH THE CONDENSER AND RADIATOR AND PASS IT AROUND THE ENGINE. THE COUPLING LIMITS FAN SPEED TO APPROXIMATELY 2500 RPM. ASSISTANCE TO AIR FLOW IS ONLY REQUIRED AT LOW VEHICLE SPEED
7 BATTERY
8 FUSE
9 BLOWER — TO PROVIDE AMBIENT AIR FLOW WHICH MAY BE DIRECTED THROUGH THE EVAPORATOR OR THE HEATER MATRIX DEPENDING ON THE FLAP POSITIONS. THIS WILL RESULT IN AIR TRAVELLING TO THE INTERIOR AND FACIA VENTS AS REQUIRED
10 BLOWER SWITCH
11 THERMOSTAT SWITCH — AUTOMATICALLY CONTROLS THE EVAPORATION OF R-12 TO MAINTAIN THE FRESH AIR WITHIN THE VEHICLE INTERIOR TO THE DESIRED RANGE, AND ALSO PREVENTS WATER (CONDENSATE) FROM FREEZING ON THE EVAPORATOR CORE
12 FLAP VALVE
13 BI-METAL SAFETY SWITCH — TO ENSURE THAT THE WATER WITHIN THE HEATER MATRIX DOES NOT FREEZE. IF THE AIR TEMPERATURE SURROUNDING THE HEATER MATRIX FALLS BELOW 3°C (37°F) THE CONTACT POINTS OPEN THUS CAUSING THE COMPRESSOR CLUTCH TO DISENGAGE
14 HEATER TAP — TO REGULATE THE FLOW OF WATER THROUGH THE HEATER MATRIX DEPENDING UPON CONTROL LEVER POSITION
15 HEATER MATRIX



Condenser

The condenser is of the tube and fin design and is mounted behind the grille in front of the radiator where it receives a high volume of air from movement of the car and the engine fan. Its purpose is to change high pressure, high temperature refrigerant vapour to a liquid by the transfer of heat to atmosphere.

High pressure, high temperature vapour enters the condenser from the compressor. This vapour is much hotter than the air that passes over the exterior surfaces of the condenser fins. Therefore heat flows from the hot refrigerant vapour through the fins to the air, thus condensing the refrigerant into a liquid. Condenser temperatures normally range from 49°C (120°F) to 93°C (200°F) while pressures are between 1034 to 2068 kPa (150 to 300 psi) during operation.

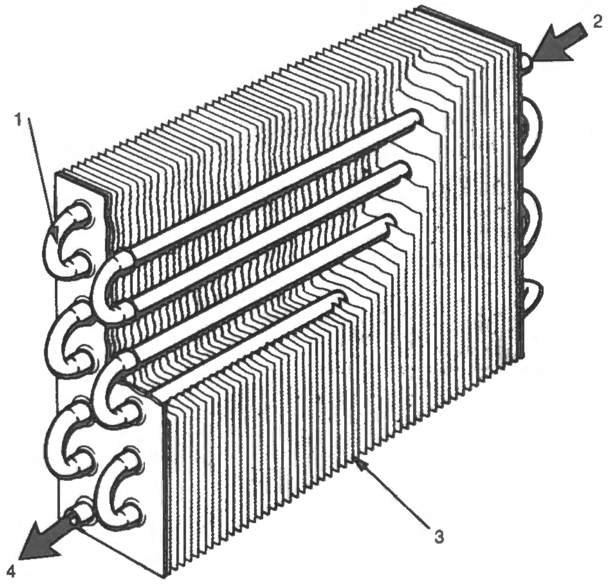


Fig. X-8

CONDENSER

1 TUBING
2 INLET
3 FINS
4 OUTLET

It is essential that the condenser be kept clean and that the fins and tubes are not damaged. If the air does not strike evenly on the condenser fins, because of the presence of an obstacle, or if the air stream is interrupted, the condenser capacity will decrease, resulting in poor cooling effect. The higher the vehicle speed, the larger the air volume will become, thus increasing the condenser capacity and accordingly increasing cooling capacity.

Receiver/dryer

The receiver/dryer is a cylindrical reservoir in which the high pressure liquid refrigerant is filtered, dried and stored prior to its delivery to the TX valve. It is located on the left hand valance panel under the bonnet between the condenser and the TX valve.

The exclusion of moisture from the system is very important. A moisture laden refrigerant in excess of 10 parts per million will cause corrosion of metal surfaces and freezing of the expansion valve (TX) leading to damage to the compressor and failure of the system.

Therefore, as the receiver contains a moisture absorbing material every effort should be made to prevent it from being contaminated.

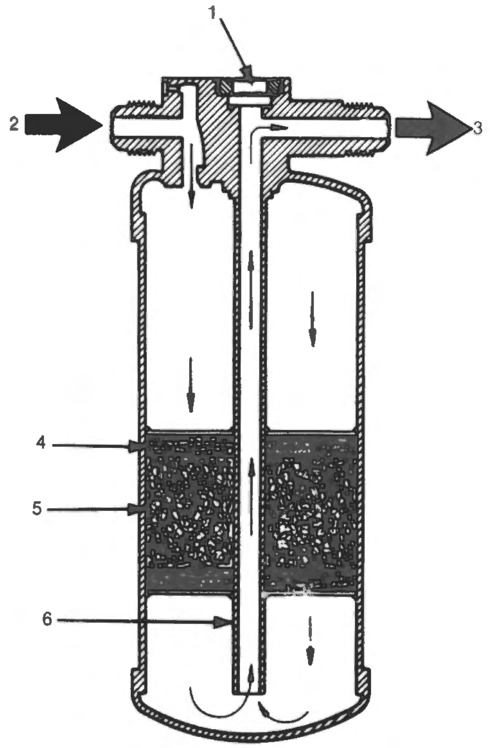


Fig. X-9

RECEIVER/DRYER

1	SIGHT GLASS	4	FILTER PADS
2	INLET	5	DESICCANT
3	OUTLET	6	PICKUP TUBE

Due to the high pressure and temperatures which can develop within the system a fusible safety plug is incorporated in the inlet side of the unit. The plug is manufactured from metal alloy which melts at a pre-determined temperature 111°-121°C (230°-250°F) to allow the system to vent to atmosphere in the event of over temperature conditions usually due to poor ventilation of the inside of the condenser which consequently will fail in the efficient liquidation of refrigerant.

A sight glass is also incorporated in the top of the unit for observation of the refrigerant flow during its cycle. If, after the system has been operating for a few minutes, bubbles appear in the window of the sight glass a shortage of refrigerant in the system is indicated i.e. there is no reserve liquid in the receiver. If bubbles are present it usually indicates the system has lost more than half of its charge. The receiver or main body of the component serves as a storage tank to balance out the refrigerant supply during periods of varying system demands.

The outlet from the condenser must be attached to the connector marked 'IN' with the 'OUT' side of the receiver/dryer connected to the TX valve. If the receiver/dryer is connected in reverse, the system will not function correctly. It must then be purged and after reconnecting the receiver/dryer in the correct manner, it can then be recharged.

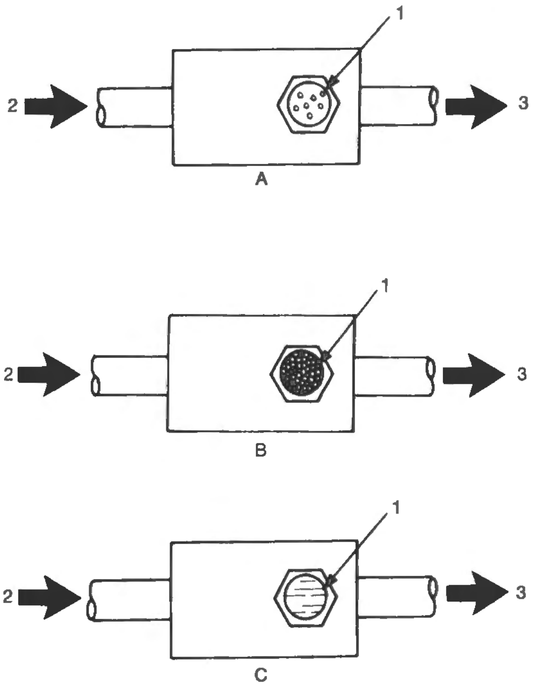


Fig. X-10

SIGHT GLASS INDICATIONS

A OCCASIONAL BUBBLES NORMAL WHEN STARTING UP SYSTEM. (REFRIGERANT SLIGHTLY LOW OR RECEIVER/DRYER SATURATED AND RELEASING MOISTURE)

B FOAM OR HEAVY STREAM OF BUBBLES (REFRIGERANT VERY LOW)

C OIL STREAKS ON GLASS (COMPLETE ABSENCE OF REFRIGERANT)

1 SIGHT GLASS
2 INLET
3 OUTLET

In operation liquid refrigerant and some vapour from the condenser enters the receiver. The liquid drops to the bottom where it passes through a primary filter assembly and enters the desiccant drying chamber.

The filters are made from fibre glass mats and are compressed in the assembly to give a fine grain structure, not only to filter fine solids but also to prevent the loss of the desiccant and still allow free passage of the refrigerant.

It then passes through a secondary filter and on to the outlet tube, the end of which is close to the bottom of the container. The tube is open at the bottom to ensure that liquid only is passed on to the TX valve and that this liquid has negotiated the filtering and drying process.

Thermostatic Expansion Valve (TX)

The purpose of this valve is to meter the high pressure liquid refrigerant and convert it to the low pressure liquid for delivery to the evaporator in the required quantity.

The valve is installed in the high pressure liquid line between the receiver/dryer and the inlet of the evaporator coil in the left hand side of the cooler unit.

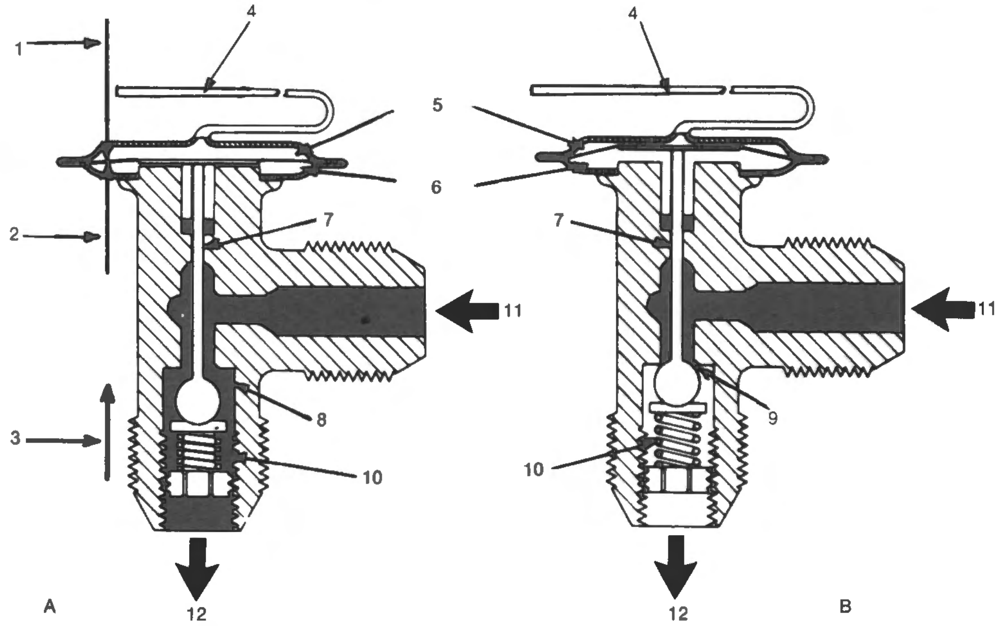


Fig. X-11

THERMOSTATIC EXPANSION VALVE (TX)

A	VALVE OPEN	B	VALVE CLOSED
1	TEMPERATURE SENSING PRESSURE	7	VALVE OPERATING PIN
2	EQUALISING PRESSURE	8	VALVE OPEN
3	VALVE SPRING PRESSURE	9	VALVE CLOSED
4	CAPILLARY TUBE	10	VALVE SPRING
5	UPPER DIAPHRAGM CHAMBER	11	INLET
6	LOWER DIAPHRAGM CHAMBER	12	OUTLET

The main components consist of a brass body, into which the high pressure line and the evaporator coil are connected, a capillary tube connected to a hermetically sealed diaphragm assembly mounted on top of the body. Below the diaphragm assembly are three push rods, a spherical valve seal and needle, a superheat spring and adjustment screw. The capillary tube which contains a small amount of refrigerant and is firmly attached to the evaporator outlet. The capillary tube and the diaphragm assembly control the valve operation. Refer Fig. X-11.

During normal operations refrigerant enters the expansion valve as a medium temperature, high pressure liquid. As it passes through the valve orifice it becomes a low temperature, low pressure liquid. As the liquid absorbs heat from the air passing over the evaporation fins, vapour is formed and leaves the evaporator at a higher temperature.

The quantity of liquid leaving the expansion valve is controlled by both the temperature of the power element bulb and the pressure of the liquid in the evaporator.

When the air conditioning unit is not in use the pressure in the capillary tube is equal to the pressure in the evaporator. Therefore, the diaphragm is pushed up by the spring to close the injection port to prevent the flow of liquid refrigerant to the evaporator.

When the compressor is operated to use the air conditioning unit the pressure in the evaporator drops and the pressure in the heat sensing tube increases enough to open the injection port and admit liquid refrigerant into the evaporator coil. This action continues until the whole evaporator coil is cooled. When the outlet line, to which the capillary tube is attached becomes sufficiently cool approx. 9°C (48°F) difference, the pressure in the tube decreases. Hence the diaphragm is pushed upwards with spring force to close the injection ports to decrease the quantity of refrigerant.

With the compressor still running and the valve shut, the low side temperature reduces until a temperature control device senses the required temperature and disconnects the electro-magnetic clutch.

Should the valve be open at a time when the compressor is switched off, the valve will close due to a build up in pressure in the low side. This prevents the liquid from flooding through to the evaporator and entering the compressor.

When the inside air in the vehicle has become too warm, the refrigerant completes evaporation on the way to the evaporator. The refrigerant temperature rises, therefore the pressure in the capillary tube increases enough to push the diaphragm thus opening the injection port to allow a flow of refrigerant.

Evaporator

The evaporator assembly is contained within the heater/cooler unit casing. The construction is tube and fin, manufactured complete with male fittings for the connection of the TX valve on the inlet and the suction line to the compressor on the outlet. The purpose of the

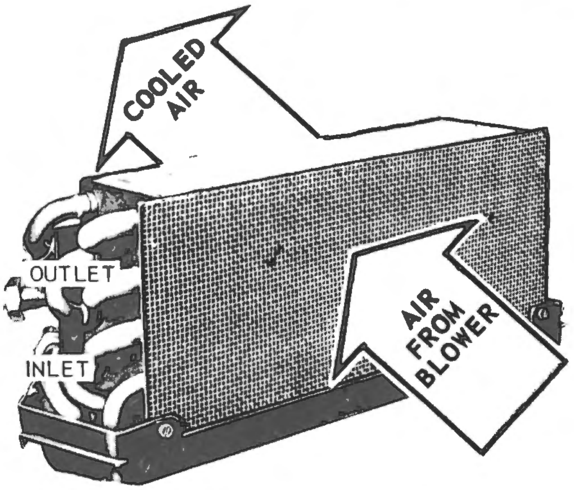


Fig. X-12

EVAPORATOR

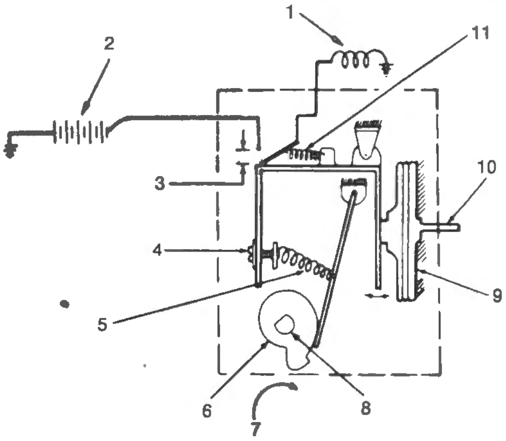


Fig. X-13

THERMOSTATIC SWITCH
(BELLOWS TYPE)

1	CLUTCH COIL	6	CAM
2	BATTERY	7	COLD
3	POINT OPENING	8	SHAFT
4	TEMPERATURE ADJUSTING SCREW	9	BELLOWS ASSEMBLY
		10	CAPILLARY TUBE
5	RANGE SPRING	11	OVER CENTRE SPRING

unit is to cool, dry and clean the air entering the passenger compartment.

Refrigerant enters the evaporator from the TX valve as a low pressure mixture of liquid and vapour. The refrigerant boils (vaporises) at this low pressure, absorbing large quantities of heat from the incoming air passing over the evaporator fins into the passenger compartment. Moisture from the air condenses on the evaporator surface and is drained off carrying dust and pollen with it.

The temperature in the evaporator must be controlled so that the water collecting on the core surface will not freeze and block off air passage. Freeze protection control on the evaporator is provided by a thermostatic switch operating independently of but in conjunction with the TX valve. Refer page X-11.

In order to control the evaporator temperature it is necessary to control the pressure inside the evaporator. To obtain maximum cooling the flow must be controlled so that the refrigerant completely vaporises. If too much or too little refrigerant is present in the core, the maximum cooling efficiency is lost.

Evaporator temperature varies from 1° to 7°C (33°F to 45°F) at engine idle. Temperature is limited to a low 1°C (33°F) during road operation.

Thermostat Switch

The thermostat switch automatically controls the evaporation of R-12 to maintain the fresh air within the vehicle interior to the desired temperature range, and also prevents water (condensate) from freezing on the evaporator core. The unit consists of a capillary tube, bellows, temperature adjusting screw, switch and manual linkage.

The capillary tube is located in the air stream as it leaves the evaporator and is connected to the bellows on the switch. In operation the capillary tube is filled with a gas charge that provides a pressure change on the bellows when the evaporator discharge air temperature rises. This closes the switch which completes the electrical circuit to engage the compressor clutch. As soon as the compressor starts and air discharge temperature begins to go down, the gas in the capillary contracts, reducing the pressure on the bellows. This opens the contacts of the switch and disengages the compressor clutch. The cycle repeats to give an average air temperature. The temperature may be varied within pre-determined limits by moving the cool air temperature control.

Bi-metal Safety Switch

The bi-metal safety switch is installed on the left hand side of the heater/cooler unit and is fitted in the same compartment as the heater matrix, on the air input side.

The switch is a non-repairable type and is inserted into the electrical supply wire to the compressor clutch. During normal operation the internal switch contacts remain closed, however, if the air temperature surrounding the heater matrix falls below —1° to 0°C (30°-32°F) the contact points open, thus causing the compressor clutch to disengage. This ensures that the water within the heater matrix does not freeze causing damage to the matrix.

Refrigerant Lines

Special hoses and lines are used to carry the refrigerant in gas and liquid states to and from the various components of the system. The lines are manufactured from reinforced synthetic rubber, steel, aluminium or copper depending on their application. The connections being made with 'O' ring type fittings or flair fittings. The major lines are as follows:

1 Suction Line (Low Pressure Vapour Line). Runs from the evaporator outlet to the compressor inlet. It is a large diameter line and is cool to the touch when the system is operating.

2 Discharge Line (High Pressure Vapour Line). Runs from the compressor outlet to the top of the condenser (inlet). It is a large diameter hose which is hot to the touch when the system is operating.

3 Liquid Line (High Pressure Liquid Line). This is the smaller line and is in two sections. It runs from the bottom (outlet) of the condenser to the inlet of the receiver dehydrator. Then from the outlet on this unit to the TX valve inlet. These lines will be warm to the touch when the system is operating.

NOTE: For tightening torque of hoses and fitting refer to page X-27.

Refrigerant

The refrigerant (R-12) used in this completely sealed system is a chemical composition developed by changing the atomic structure of the liquid carbon-tetrachloride, a fluid which is used in fire extinguishers and dry cleaning processes.

The refrigerant developed is odourless and transparent in the liquid and vapour state.

The vapour is heavier than air and is non-flammable, non-explosive, non-poisonous (except when in contact with an open flame) and non-corrosive (except when in contact with moisture). It is generally know as Refrigerant 12 and is marketed under several well known trade names. Refrigerant 12 (R-12) has a boiling point of —33°C (—27°F) and will be a vapour at normal temperatures. Therefore, it is necessary to contain it under pressure in special cylinders.

Refrigerants to R-12 specification have a definite pressure temperature relationship within a container or system. An increase in temperature of the refrigerant will cause expansion with a corresponding increase in pressure and vice versa.

WARNING: Due to the characteristics of R-12 it is essential that certain refrigeration trade practices and safety precautions are adhered to. Failure to observe these precautions and practices could result in serious personal injury and damage to vehicle and equipment.

Refrigerant Oil

A special highly refined lubrication oil is required for refrigeration systems. The oil is as free from contaminants as it is possible to obtain and this condition must be maintained when handling, particularly in regard to the exclusion of moisture.

NOTE: Conventional lubricating oils must not be used. For correct oil refer to Specifications Page X-40.

One of the characteristics of R-12 is its affinity for oil and as it circulates through the entire system any leakage of refrigerant is accompanied by a leakage of oil leading to compressor failure. This is a useful point to remember when attempting to locate system leaks visually.

OPERATING THE SYSTEM

The evaporator, heater and blower are contained in a fully integrated unit known as a heater/cooler unit. This is operated by a five lever control panel, situated in the lower section of the facia to the left of the steering column.

CONTROL PANEL

1 Mode Selection — Heating or Cooling.

2 Heater Temperature Control.

3 Cooler Temperature Control.

4 Hot Air Distribution — Windscreen or Interior.

5 Blower/Fan Speed.

The heater/cooler unit may recirculate, or draw in fresh air as required, depending upon the control lever settings. Air may be directed from the unit to the foot well, facia vents or windscreen. Two additional facia vents are provided in the centre of the facia and operate in the same manner as those fitted to non-air conditioned vehicles.

NOTE: For efficient operation of the air conditioning system the air extractor vents on the rear quarter panels must be sealed.

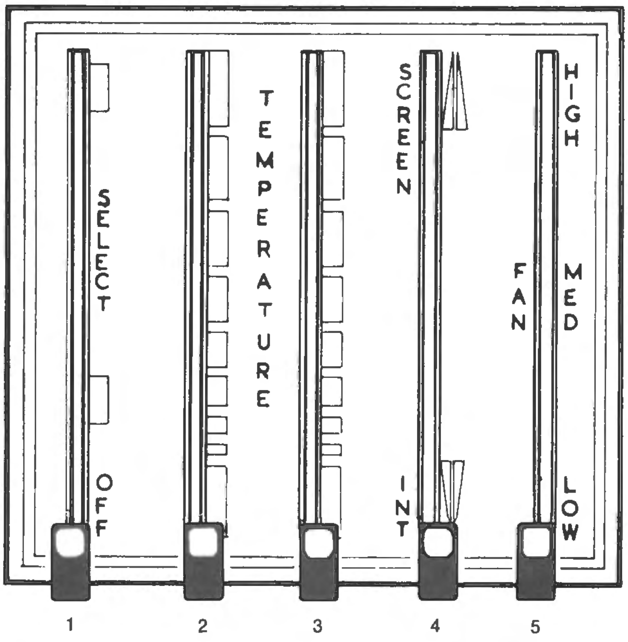


Fig. X-14

CONTROL PANEL

1 MODE SELECTION — HEATING OR COOLING

2 HEATER TEMPERATURE CONTROL

3 COOLER TEMPERATURE CONTROL

4 HOT AIR DISTRIBUTION — WINDSCREEN OR INTERIOR

5 BLOWER/FAN SWITCH

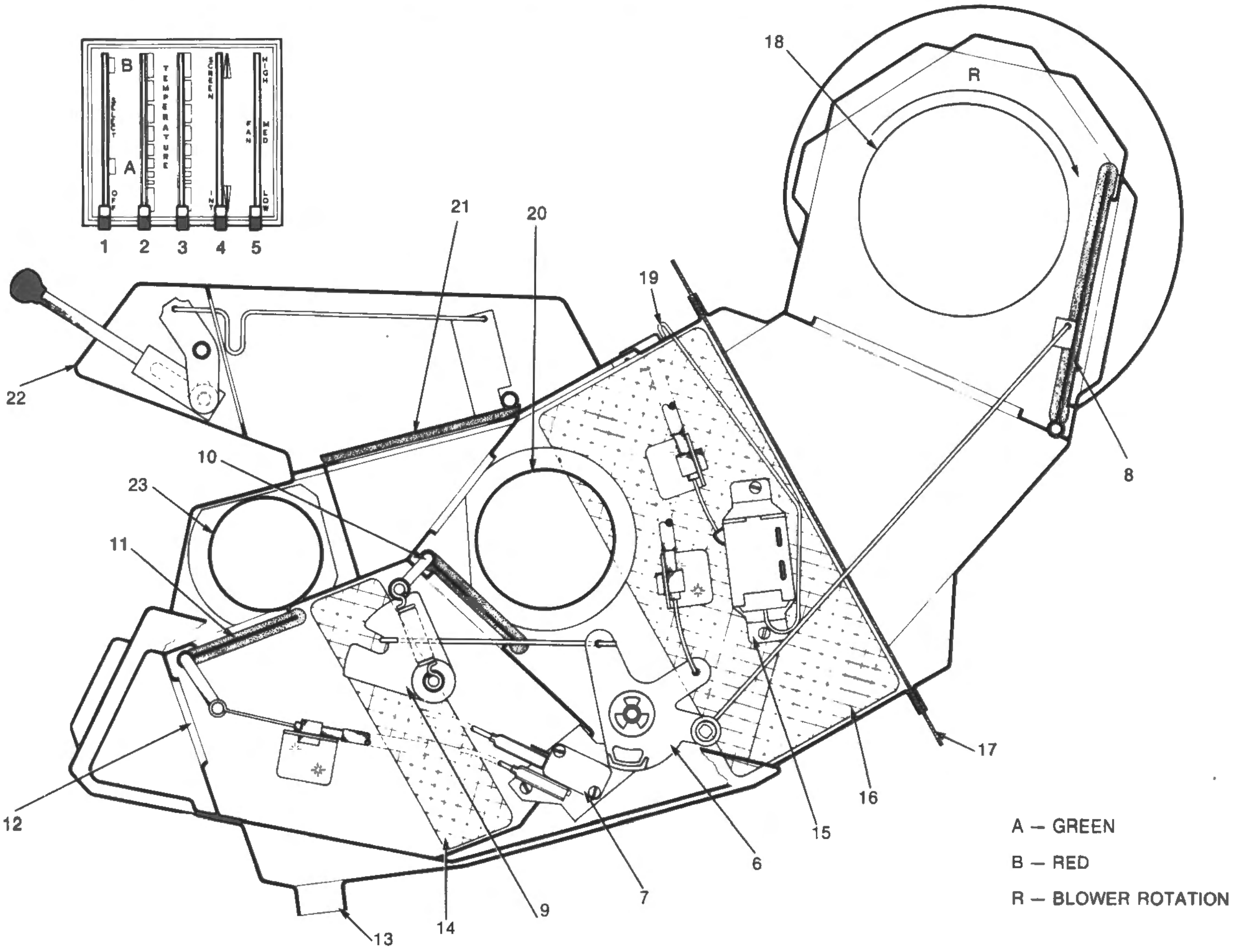


Fig. X-15

OPERATION — OFF

1 MODE SELECTION — HEATING OR COOLING
2 HEATER TEMPERATURE CONTROL
3 COOLER TEMPERATURE CONTROL
4 HOT AIR DISTRIBUTION — WINDSCREEN OR INTERIOR
5 BLOWER/FAN SWITCH
6 OPERATING CAM
7 MICRO SWITCHES
8 FRESH AIR INLET FLAP
9 HEATER FLAP OPERATING LEVER
10 HEATER FLAP
11 HEATED AIR DISTRIBUTION FLAP
12 HEATER — INTERIOR OUTLET
13 CONDENSATE DRAIN
14 HEATER MATRIX
15 THERMOSTAT SWITCH
16 EVAPORATOR
17 TRANSITION PLATE
18 BLOWER
19 THERMOSTAT — CAPILLARY TUBE
20 OUTER FACIA VENT
21 CENTRE FACIA VENT FLAP
22 CENTRE FACIA VENT
23 HEATER — SCREEN OUTLET

OPERATION — OFF

All levers are fully down isolating the electrical system, closing off the water supply to the heater and also closing the fresh air inlet aperture.

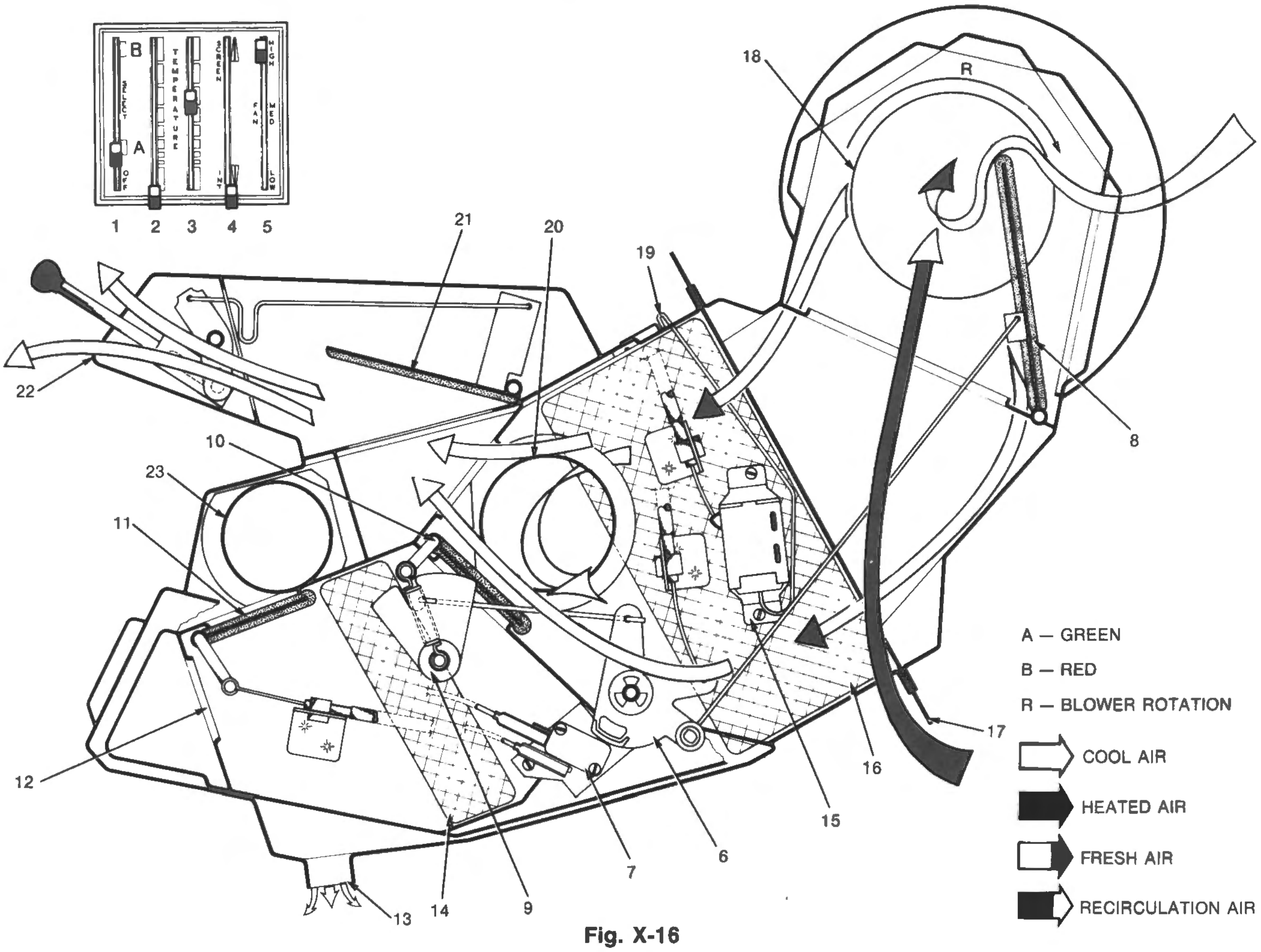


Fig. X-16

OPERATION — COOLING

1	MODE SELECTION — HEATING OR COOLING
2	HEATER TEMPERATURE CONTROL
3	COOLER TEMPERATURE CONTROL
4	HOT AIR DISTRIBUTION — WINDSCREEN OR INTERIOR
5	BLOWER/FAN SWITCH
6	OPERATING CAM
7	MICRO SWITCHES
8	FRESH AIR INLET FLAP
9	HEATER FLAP OPERATING LEVER
10	HEATER FLAP
11	HEATED AIR DISTRIBUTION FLAP
12	HEATER — INTERIOR OUTLET
13	CONDENSATE DRAIN
14	HEATER MATRIX
15	THERMOSTAT SWITCH
16	EVAPORATOR
17	TRANSITION PLATE
18	BLOWER
19	THERMOSTAT — CAPILLARY TUBE
20	OUTER FACIA VENT
21	CENTRE FACIA VENT FLAP
22	CENTRE FACIA VENT
23	HEATER — SCREEN OUTLET

OPERATION — COOLING

The mode control lever (1) is set in position 'A' (green) which rotates the cam (6) to the cool position, this causes the three micro switches (7) to make contact thus providing electrical supply for the compressor clutch and blower motor (3 speed) operation.

Cam (6) also partially opens the fresh air inlet flap (8) so that fresh air supplements the recirculation air from the vehicle cabin.

The temperature lever (3) may be moved upward to increase coldness, this lever operates the thermostat switch which will control cabin temperature within the normal comfort zone.

The blower speed may be selected by moving lever (5) to the desired position which will provide Low, Medium or High speed blower operation.

Air flow will be from the recirculation and air inlet apertures through the evaporator to the outer and centre facia vents.

Condensate that collects at the evaporator is allowed to drain from the heater/cooler unit at its lowest edge through the vehicle floor pan.

NOTE: The blower speed should always be set to maximum whenever the temperature is set to maximum coldness, to eliminate the possibility of frost forming on the evaporator fins. This setting is normally used to cool the vehicle quickly after it has been parked in the sunlight for an extended period. After a short period, temperature and blower speed may be re-adjusted.

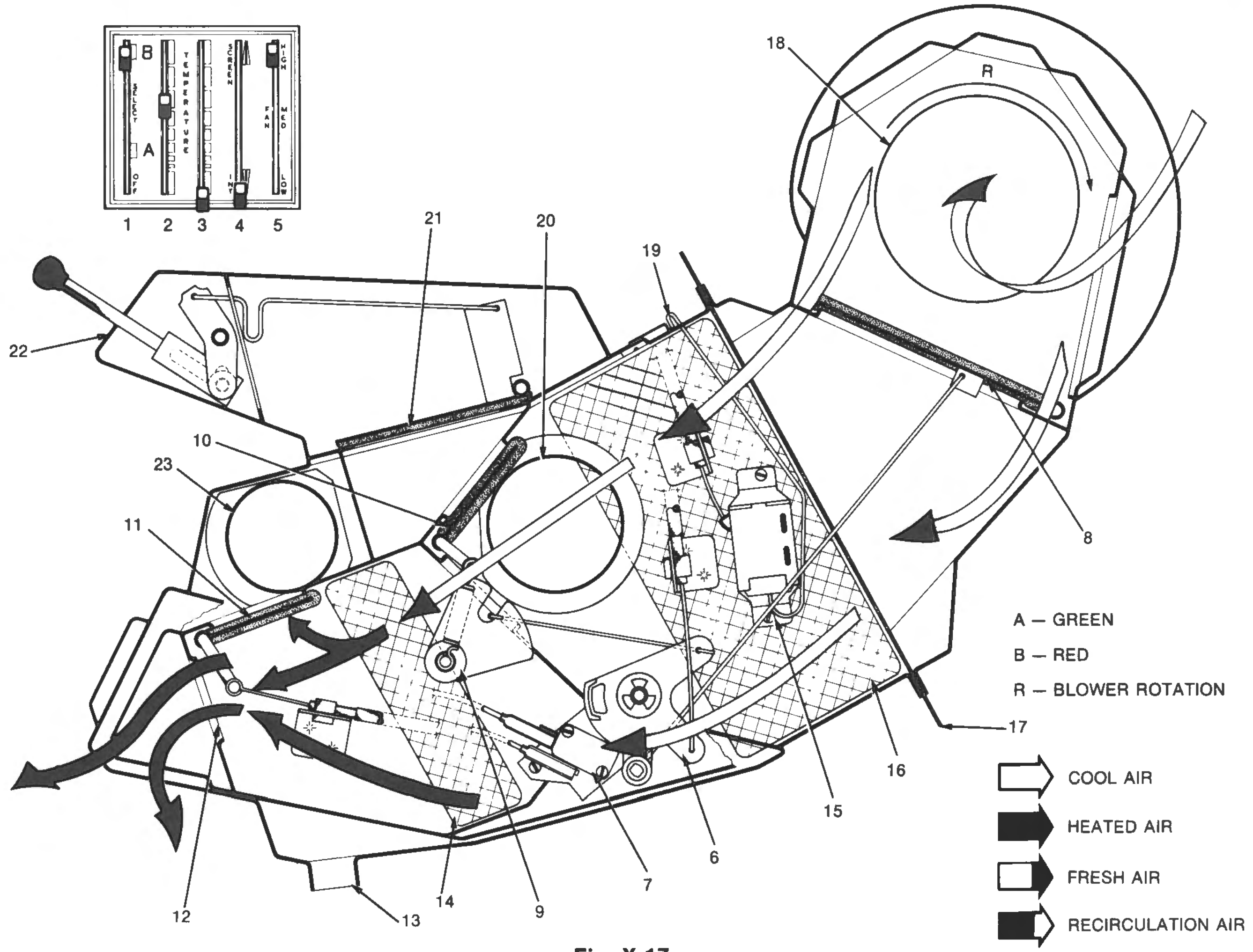


Fig. X-17

OPERATION — HEATING

1 MODE SELECTION — HEATING OR COOLING
2 HEATER TEMPERATURE CONTROL
3 COOLER TEMPERATURE CONTROL
4 HOT AIR DISTRIBUTION — WINDSCREEN OR INTERIOR
5 BLOWER/FAN SWITCH
6 OPERATING CAM
7 MICRO SWITCHES
8 FRESH AIR INLET FLAP
9 HEATER FLAP OPERATING LEVER
10 HEATER FLAP
11 HEATED AIR DISTRIBUTION FLAP
12 HEATER — INTERIOR OUTLET
13 CONDENSATE DRAIN
14 HEATER MATRIX
15 THERMOSTAT SWITCH
16 EVAPORATOR
17 TRANSITION PLATE
18 BLOWER
19 THERMOSTAT — CAPILLARY TUBE
20 OUTER FACIA VENT
21 CENTRE FACIA VENT FLAP
22 CENTRE FACIA VENT
23 HEATER — SCREEN OUTLET

OPERATION — HEATING

The mode control lever (1) is set in position 'B' (red) which rotates the cam (6) to the hot position, this causes only one of the three micro switches (7) to make contact thus preventing operation of the compressor and allowing medium and high speed blower operation only. In the hot position, cam (6) fully opens the fresh air inlet flap (8) which will also seal the air recirculating aperture. Rotation of cam (6) has also caused lever (9) to rotate flap (10) thus opening the air passage to the heater matrix.

The temperature lever (2) may be moved upward which will allow hot water to flow through the heater matrix thus providing an increase in heat as the lever is set higher.

Air flow will be from the fresh air inlet through the evaporator and heater matrix to the front foot well of the vehicle if lever (4) is set to interior position or to the windscreen for demisting if it is in the screen position. Lever (4) rotates flap (11) so that air is directed to the desired position.

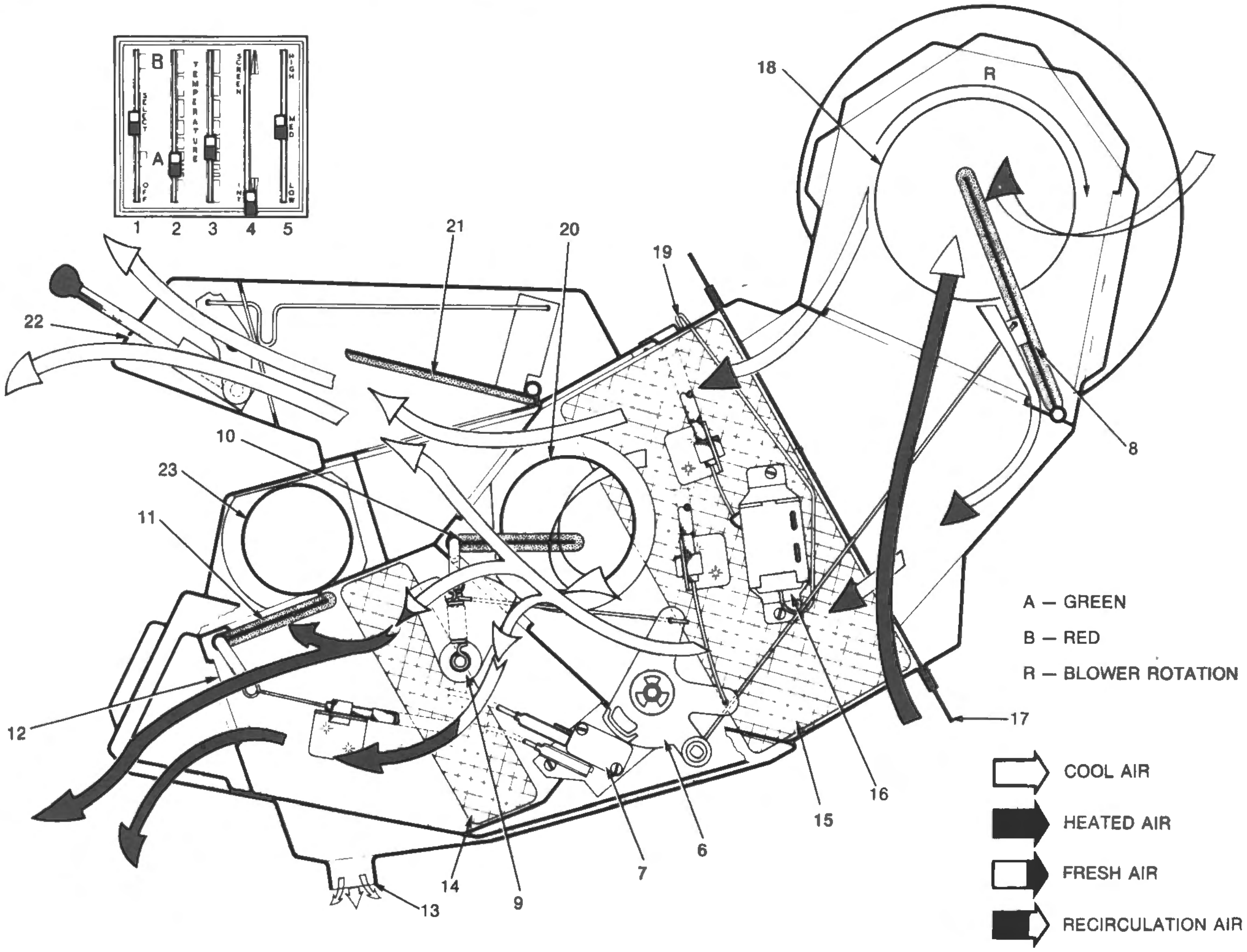


Fig. X-18

OPERATION — HEATING AND COOLING

1 MODE SELECTION — HEATING OR COOLING
2 HEATER TEMPERATURE CONTROL
3 COOLER TEMPERATURE CONTROL
4 HOT AIR DISTRIBUTION — WINDSCREEN OR INTERIOR
5 BLOWER/FAN SWITCH
6 OPERATING CAM
7 MICRO SWITCHES
8 FRESH AIR INLET FLAP
9 HEATER FLAP OPERATING LEVER
10 HEATER FLAP
11 HEATED AIR DISTRIBUTION FLAP
12 HEATER — INTERIOR OUTLET
13 CONDENSATE DRAIN
14 HEATER MATRIX
15 THERMOSTAT SWITCH
16 EVAPORATOR
17 TRANSITION PLATE
18 BLOWER
19 THERMOSTAT — CAPILLARY TUBE
20 OUTER FACIA VENT
21 CENTRE FACIA VENT FLAP
22 CENTRE FACIA VENT
23 HEATER — SCREEN OUTLET

OPERATION — HEATING AND COOLING

The mode control lever (1) is set midway between 'A' and 'B' positions which rotates cam (6) midway between the hot and cold settings. This causes the three micro switches (7) to make contact thus providing electrical supply for the compressor clutch and blower motor (3 speed) operation. Cam (6) opens the fresh air flap (8) midway between the hot and cold position. Rotation of cam (6) to the mid-position has also caused the heater flap (10) to be midway between hot and cold position.

With the unit set in this position a combination hot and cool air is available. Warm air is deflected to the foot well and demister whilst cool air is deflected to the four facia vents.

The temperature, screen and windscreen control levers operate as previously described in Figs. X-16 and X-17.

NOTE: The air travelling through the unit must first pass the cool evaporator therefore the heater will only warm the air travelling to the foot well.

GENERAL SERVICE INFORMATION

SAFETY PRECAUTIONS

The following safety measures and precautions must be observed to reduce the risk of personal injury and avoid costly damage to equipment.

Do not attempt any operations on the air conditioning equipment unless completely qualified.

Refrigerant 12 vaporises on release to the atmosphere causing freezing to exposed body tissue or skin.

Always wear safety goggles and gloves when discharging systems.

Should it be necessary to discharge a system to atmosphere, do so slowly in a well ventilated area (preferably into an exhaust collector unit) and by a method which will prevent the discharge coming into contact with:

1. A naked flame.
2. Vehicle engine air intakes (engine running).
3. Bright metal surfaces of vehicle components.

Refrigerant 12 produces a toxic gas when in contact with flame. This toxic gas is also produced by the flame type leak detecting torch.

Avoid breathing vapours from this type of torch; and exercise extreme care when using it inside a vehicle, and in areas where petroleum products or their vapours may be present.

Should a large quantity of R-12 be discharged in a reasonably confined space; it is advisable to clear the area to minimise the possibility of suffocation due to the heavier gas displacing the air.

Do not use — Blow torches, solder, steam-clean, weld or use arc lamps etc. in the immediate area of the components or lines of the system as high pressures can result due to the pressure temperature relationship of R-12.

Ensure that R-12 containers are stored and handled in accordance with local ordinances. Generally, store cylinders upright in a cool place, with their valve protection caps securely fitted. When fitting charging station cylinders always leave an expansion space. Should it be necessary to heat a cylinder during a charging operation, place the cylinder in a bucket of warm water not exceeding 52°C (125°F) or wrap with warm wet rags. Do not heat by any other method above 52°C (125°F).

When cleaning equipment externally, use an industrial alcohol dampened rag. For internal cleaning or flushing use only dry nitrogen or R-12.

FIRST AID

Should the eyes or other exposed parts of the body be subjected to a charge of refrigerant causing frost bites:

1. Flood the affected area with cold water to bring the temperature below freezing.
2. Add a few drops of mineral oil to prevent infection.
3. Wash with a weak solution of boric acid.
4. Contact a doctor or eye specialist as soon as possible for treatment.

REGULAR MAINTENANCE

Weekly

When the air conditioning system is not being operated regularly as during winter months, set the system for Maximum Cooling and operate for ten to fifteen minutes to ensure adequate lubrication of the components within the system.

5000 km (3000 miles) or 3 months Service:

1. Check compressor drive belt tension.
2. Examine all hose connections.
3. Check operation of controls in all positions.

10,000 km (6000 miles) or 6 months — Repeat 5000 km Service.
20,000 km (12,000 miles) or 12 months Service:

Repeat 5000 km service with the following additional operations:

1. Check/clean as necessary, condenser fins.
2. Observe receiver/dryer sight glass for air bubbles in refrigerant.

SYSTEM INSPECTION

Defective Hoses or Connections

Oil traces usually indicate a refrigerant leak. A refrigerant leak is always accompanied by oil loss and evidence of oil often pin points the source of leak.

For minute leaks it may be necessary to use a special leak detector preferably an electronic type. The instructions supplied with the leak detector should be followed carefully.

Component Fault

Processing a malfunctioning system differs from processing a new system in that, unless the fault is obvious — such as a broken line — performance testing must be carried out to ascertain the nature of the malfunction.

It is sometimes necessary to carry out a leak test after the operation test has indicated a refrigerant shortage, and on occasions it is necessary to purge the system before effecting repairs or recharging. (In air conditioning work the term purge means 'to remove moisture and air from a system or component by flushing with Refrigerant 12').

Once the malfunctioning component has been identified or the leak located then the system may be recharged, refer page X-26.

In the case of a malfunction —

1 DUE TO MOISTURE:
The receiver/dryer must be replaced and the components must be blown through with liquid.
The compressor oil charge must be replaced, refer page X-33. In the case of a repeat malfunction the TX valve may also have to be changed.

2 DUE TO COMPLETE LOSS OF R-12 FROM SYSTEM:
The receiver/dryer must be replaced and the compressor oil charge must be replaced.

In addition to loss of refrigerant or a moisture affected system, the most vulnerable component is the TX valve. For testing procedure refer Testing and Diagnosis. Faults which can occur in this component are:

1 BLOCKED TX VALVE INLET FILTER:
The symptoms being higher than normal evaporator discharge air temperature due to insufficient refrigerant circulating. Confirmation of this problem can be had by observing a gauge in the low pressure side of the system registering a lower than normal operating pressure.

2 TX VALVE CAPILLARY TUBE DISCHARGED:
Since it is the superheat of gas in the capillary tube which provides the force to open the valve, a discharged TX valve capillary tube would prevent the valve operating. The symptoms are continuous compressor operation and no cooling due to lack of refrigerant circulation.

3 TX VALVE JAMMED CLOSED:
Gives the same effect as (2).

4 TX VALVE JAMMED OPEN: HAS THE FOLLOWING SYMPTOMS:
Continuous compressor run, insufficient cooling due to ice formation on evaporator fins and frosted low pressure line. Confirmation may be had by observing a gauge in the low pressure side. The pressure will be higher than normal due to head pressure being passed through the valve to the low pressure side of the system.

TESTING AND DIAGNOSIS

GENERAL

In diagnosing faults in the system that usually emanate from complaints of insufficient cooling it must be decided first whether it is a refrigeration air inlet restriction or electrical fault. A diagnosis chart is provided on page X-23 to assist in diagnosing the problem.

If the problem is a refrigeration one, it may be necessary to carry out an operational test which will require specialised equipment and knowledge. Service valves are provided on the compressor head so that a gauge set may be connected to record the system pressures.

SERVICE VALVES

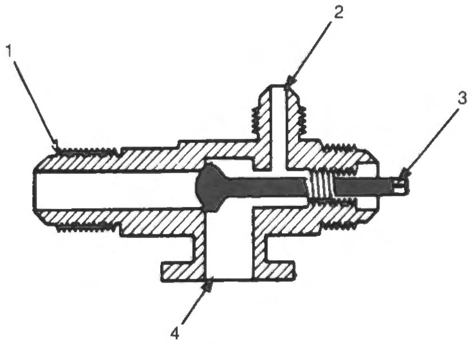
The two service stem type valves are located on the compressor cylinder head as part of the high and low pressure hose fittings.

The valve has three positions as follows:

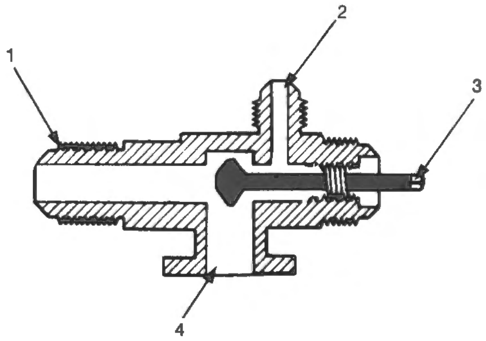
1 FRONT SEATED:
Shut-off position with valve stem rotated inward to isolate the compressor from the system. Refer Fig. X-19.

CAUTION: The compressor must never be operated with the service valves front seated. This would cause excessive head pressures and damage to the compressor would result.

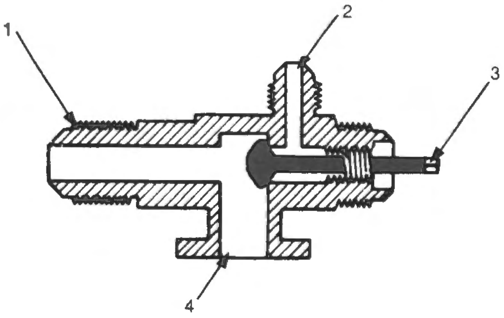
2 MID POSITION:
Test position with valve stem turned inward 1½ to 2 turns so that pressure readings may be taken with system operating. Refer Fig. X-19.



FRONT SEATED (SHUT-OFF POSITION)



MID POSITION (TEST POSITION)



BACK SEATED (OPERATING POSITION)

Fig. X-19
SERVICE VALVES

1 HOSE CONNECTION
2 SERVICE GAUGE PORT
3 VALVE STEM
4 COMPRESSOR

3 BACK SEATED:
This is the normal operating position with the valve stem rotated fully outward. Refer Fig. X-19.

Connecting the Manifold Gauge Set

In order to diagnose an internal fault in the system a manifold gauge set must be installed, this determines the general condition of the system. A typical type gauge set is shown in Fig. X-20.

One gauge is installed in the low pressure side and the other in the high pressure side of the system. For definition of high and low pressure sides of the system refer to Fig. X-7.

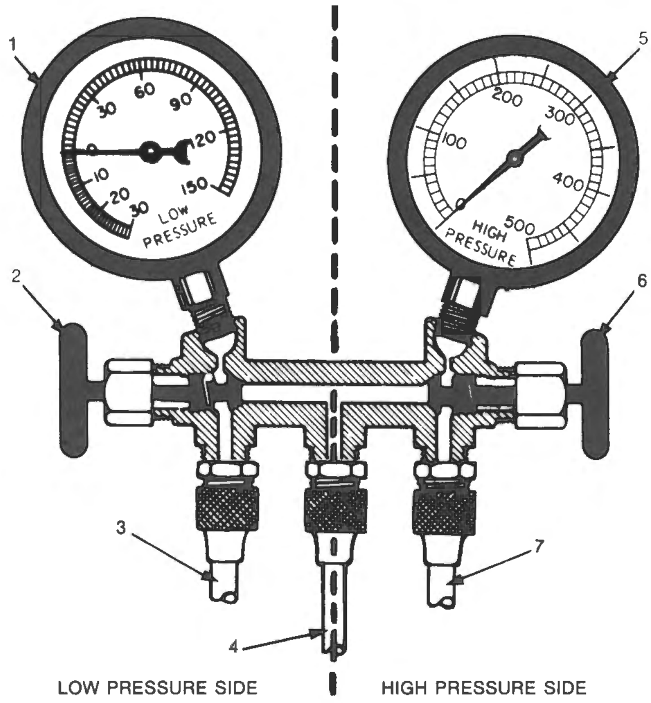


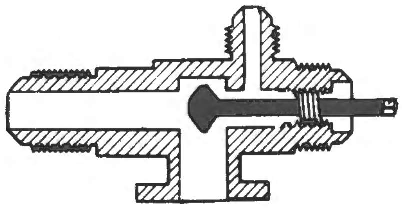
Fig. X-20

MANIFOLD GAUGE SET

1 LOW SIDE GAUGE
2 LOW SIDE HAND VALVE
3 TO LOW SIDE SERVICE CONNECTOR
4 CENTRE SERVICE HOSE
5 HIGH SIDE GAUGE
6 HIGH SIDE HAND VALVE
7 TO HIGH SIDE SERVICE CONNECTOR

Connecting the Gauge Set

1. Remove protector caps from the service gauge ports and valve stems on the compressor.
2. Connect the high pressure gauge hose to the high side service gauge port at the compressor, this is the one that is connected to the condenser hose.
3. Connect the low pressure gauge hose to the low side service gauge port at the compressor, this is the one that is connected to the evaporator hose.
4. Close both gauge taps off and set service valves to MID-POSITION.



MID-POSITION

5. Purge both gauge hoses by opening the high pressure gauge tap for 3-5 seconds followed by the low pressure gauge tap also for 3-5 seconds.
6. Gauges are now ready for use.

Stabilising the System

1. Run engine at 1500 rpm for approximately 10 minutes with transmission in Park or Neutral.
2. Operate cooler on maximum cold and maximum blower speed for approximately 10 minutes to stabilise vehicle cabin temperature.
3. Check system for full refrigerant charge by observing the sight glass.

Operational Test

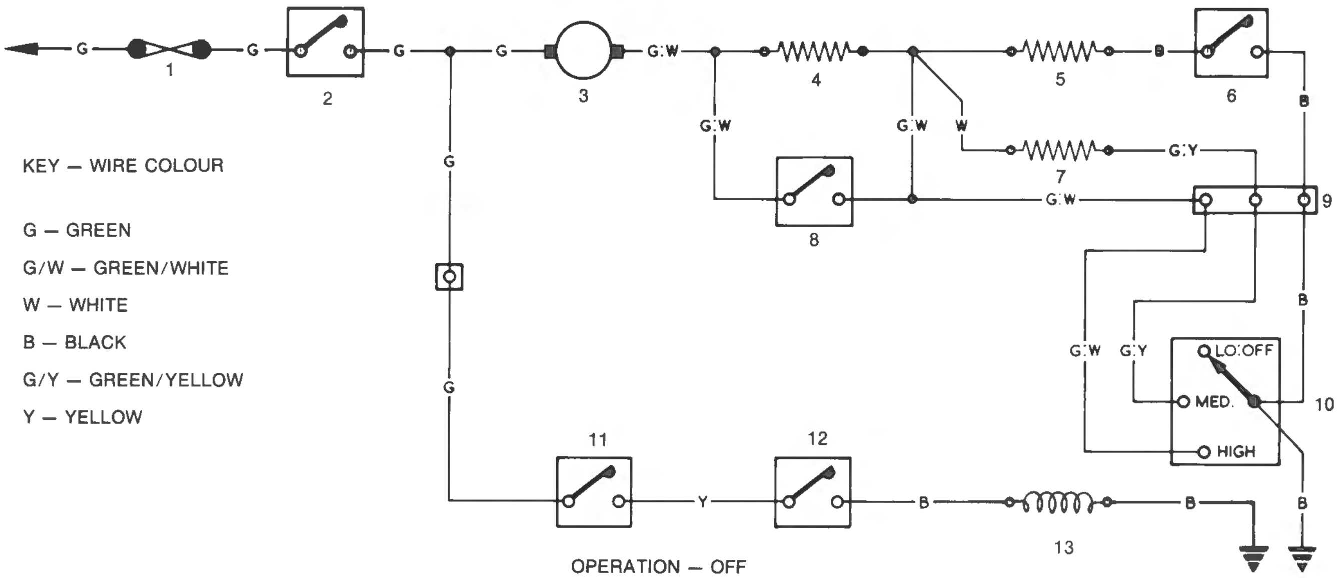
1. Stabilise the system and adjust blower speed to Low.
2. Run engine at 1500 rpm for the duration of test.
3. Read both test gauges — Normal readings at condenser air inlet temperature of 35°C (95°F) should be as follows:
   Low side pressure gauge reading: 34-124 kPa (5-18 psi).
   High side pressure gauge reading: 1275-1413 kPa (185-205 psi).
4. Evaporator discharge air temperature: 2-7°C (35°-45°F).

The temperature is measured with the thermometer inserted in the right hand centre facia vent for a depth of approximately three inches with the outer facia vents closed.

NOTE: (a) The system must contain a full refrigerant charge before an accurate check may be made. Always observe the sight glass to make sure the system is fully charged.
(b) If gauge readings are not satisfactory refer to the Diagnosis chart on page X-23.
(c) All pressures quoted are at an ambient temperature of 35°C (95°F) with a relevant humidity of 50%. For pressures at other ambient temperatures refer to the pressure temperature chart.

PRESSURE TEMPERATURE RELATIONSHIP CHART

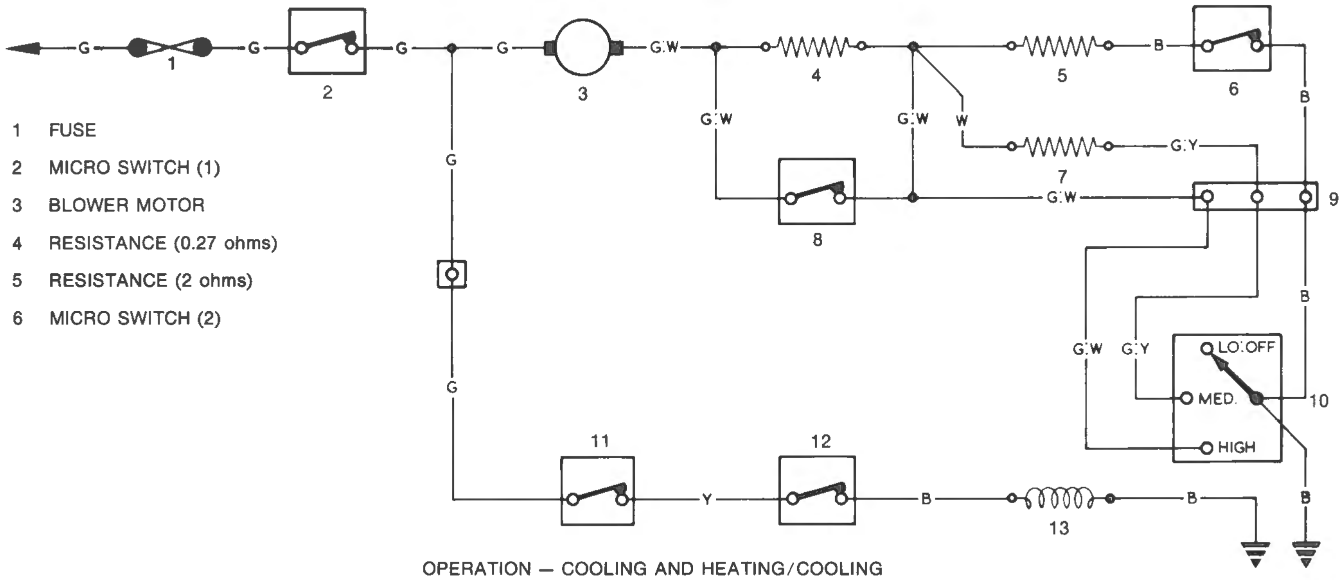
Low Pressure Gauge Reading		Evaporator Temperature		High Pressure Gauge Reading		Air Entering Condenser	
kPa	psi	°C	°F	kPa	psi	°C	°F
62	9	–18	0	380	55	–1	30
83	12	–15	5	495	72	4	40
100	15	–12	10	590	86	10	50
130	19	–9	15	725	105	16	60
145	21	–7	20	865	126	21	70
160	23	–6	22	965	140	24	75
165	24	–5	24	1100	160	27	80
170	25	–3	26	1275	185	32	90
185	27	–2	28	1345	195	35	95
200	29	–1	30	1520	220	38	100
255	37	4	40	1655	240	41	105
325	47	10	50	1790	260	43	110
400	58	16	60	1895	275	46	115
480	70	21	70	2000	290	49	120
				2100	305	52	125
				2240	325	57	135



KEY — WIRE COLOUR

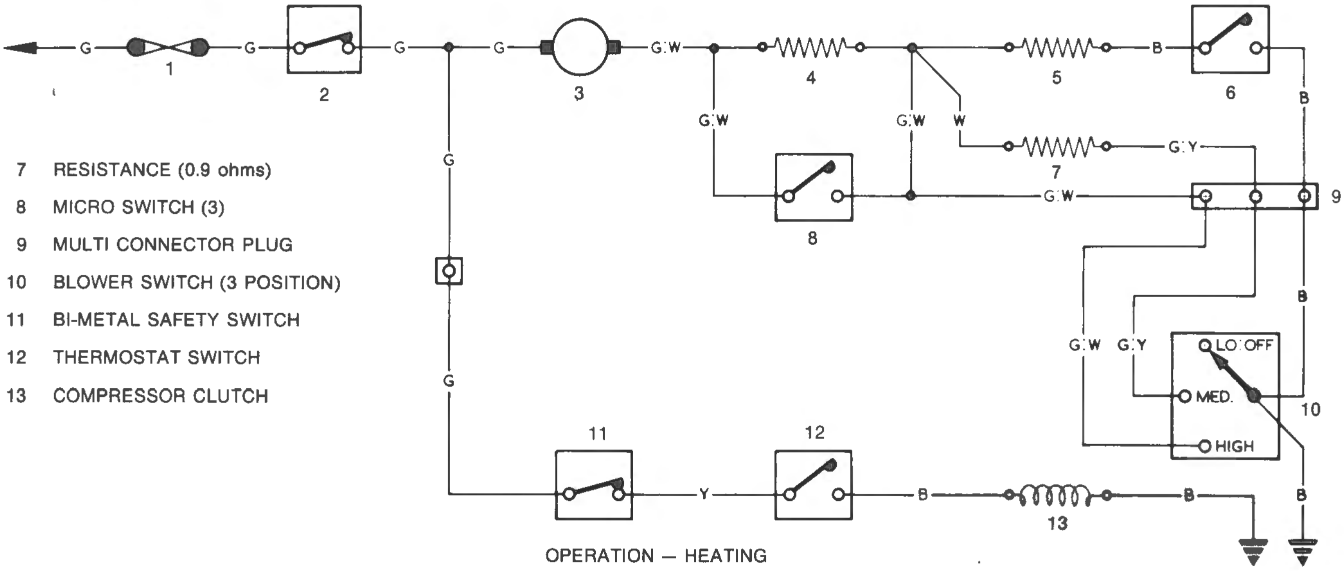
G — GREEN
G/W — GREEN/WHITE
W — WHITE
B — BLACK
G/Y — GREEN/YELLOW
Y — YELLOW

OPERATION — OFF



1 FUSE
2 MICRO SWITCH (1)
3 BLOWER MOTOR
4 RESISTANCE (0.27 ohms)
5 RESISTANCE (2 ohms)
6 MICRO SWITCH (2)

OPERATION — COOLING AND HEATING/COOLING



7 RESISTANCE (0.9 ohms)
8 MICRO SWITCH (3)
9 MULTI CONNECTOR PLUG
10 BLOWER SWITCH (3 POSITION)
11 BI-METAL SAFETY SWITCH
12 THERMOSTAT SWITCH
13 COMPRESSOR CLUTCH

OPERATION — HEATING

Fig. X-21

WIRING DIAGRAM — AIR CONDITIONING

FAULT DIAGNOSIS CHART

- INSUFFICIENT COOLING
  - INSUFFICIENT AIR VOLUME
    - Blower motor does not operate on 3 speeds
      - Blower speed control cable incorrectly set
      - Loose or disconnected wiring
      - Micro Switch (2) or (3) incorrectly set
      - Micro Switch (2) or (3) defective
    - Blower motor normal but air volume insufficient
      - Flap/operating controls incorrectly set
      - Evaporator fins are frosted
    - Blower motor does not operate
      - Faulty blower circuit or fuse
        - Micro Switch (1) defective or incorrectly adjusted
        - Mode control cable incorrectly set
        - Blown fuse
        - Loose or disconnected wiring to blower
      - Faulty blower
        - Battery terminal voltage dropped
        - Disconnected wiring or loose connection
        - Defectively grounded
        - Defective electrical resistances
        - Brush out of position
        - Motor armature layer shorted
  - NORMAL AIR VOLUME
    - Compressor rotates normally
      - Evaporator Outlet air temperature is excessively high
        - No bubbles in sight glass
          - OPERATIONAL TEST
            - High suction pressure
              - Expansion valve is excessively opened
              - Faulty contact between capillary tube and piping
              - Excessive refrigerant
              - Damaged packing or valve
            - Low suction pressure
              - Clogged expansion valve screen
              - Gas leakage from expansion valve capillary tube
              - Evaporator fins are frosted (Faulty thermostat)
              - Insufficient refrigerant
              - Overfilling of compressor oil
              - Clogging of low pressure side gas
            - High discharge pressure
              - Air mixed with the refrigerant
              - Excessive refrigerant
              - Clogging of high pressure side gas
              - Condenser fins clogged with dust
            - Low discharge pressure
              - Water has frozen at expansion valve
              - Expansion valve screen is clogged
              - Liquid tank is clogged
              - Damaged compressor valve or packing
              - Gas leakage from expansion valve capillary bulb
          - Other causes
            - Cooler temperature control cable incorrectly set
            - Defective plenum chamber seal
        - Bubbles can be seen in sight glass
          - Insufficient refrigerant
          - Clogged piping between condenser and liquid tank
      - Evaporator Outlet air temperature is normal
        - Temperature control cable incorrectly set
        - Hot water tap defective
        - Vehicle air extractor vents not fully sealed
    - Compressor does not rotate normally
      - Compressor is abnormal
        - Compressor internal trouble
      - Magnetic clutch is abnormal
        - Defective pulley
        - Coil layer shorted
        - Battery voltage dropped
        - Mode control incorrectly set
        - Thermostat defective or temperature control incorrectly set
        - Bi-metal safety switch defective
        - Disconnected wiring or loose connections
        - Defective ground
        - Disconnected coil
      - Other causes
        - Drive belt missing
        - Drive belt slipping

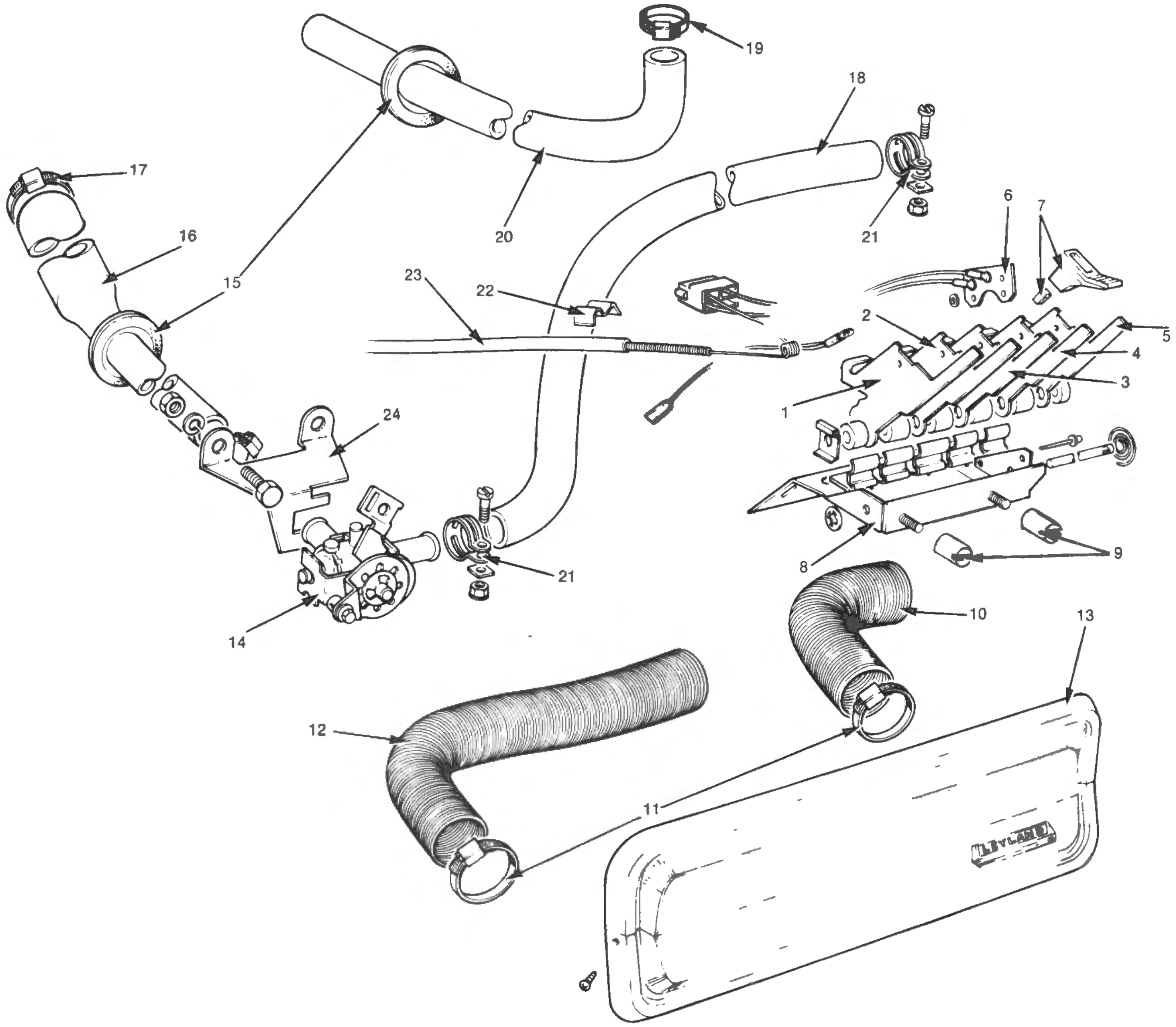


Fig. X-22

CONTROL LEVER MECHANISM AND HEATER TAP LAYOUT

1	LEVER (MODE CONTROL)	13	ESCUTCHEON ASSEMBLY
2	LEVER (TEMPERATURE CONTROL HOT)	14	TAP (WATER CONTROL)
3	LEVER (TEMPERATURE CONTROL COLD)	15	GROMMET
4	LEVER (AIR CONTROL)	16	HOSE (HEATER TAP INLET)
5	LEVER (RESISTOR CONTROL)	17	CLIP (HOSE)
6	SWITCH	18	HOSE (HEATER MATRIX INLET)
7	KNOB AND CLIP	19	CLIP (HOSE)
8	BASE PLATE ASSEMBLY	20	HOSE (HEATER MATRIX OUTLET)
9	NUT (SPECIAL)	21	CLIP (HOSE)
10	KOPEX TUBE (DEMIST)	22	CLIP (CABLE)
11	CLIP (HOSE)	23	CABLE (TEMPERATURE CONTROL HOT)
12	KOPEX (AIR VENT)	24	BRACKET (HEATER TAP TO BODY PANEL)

34¼" LON

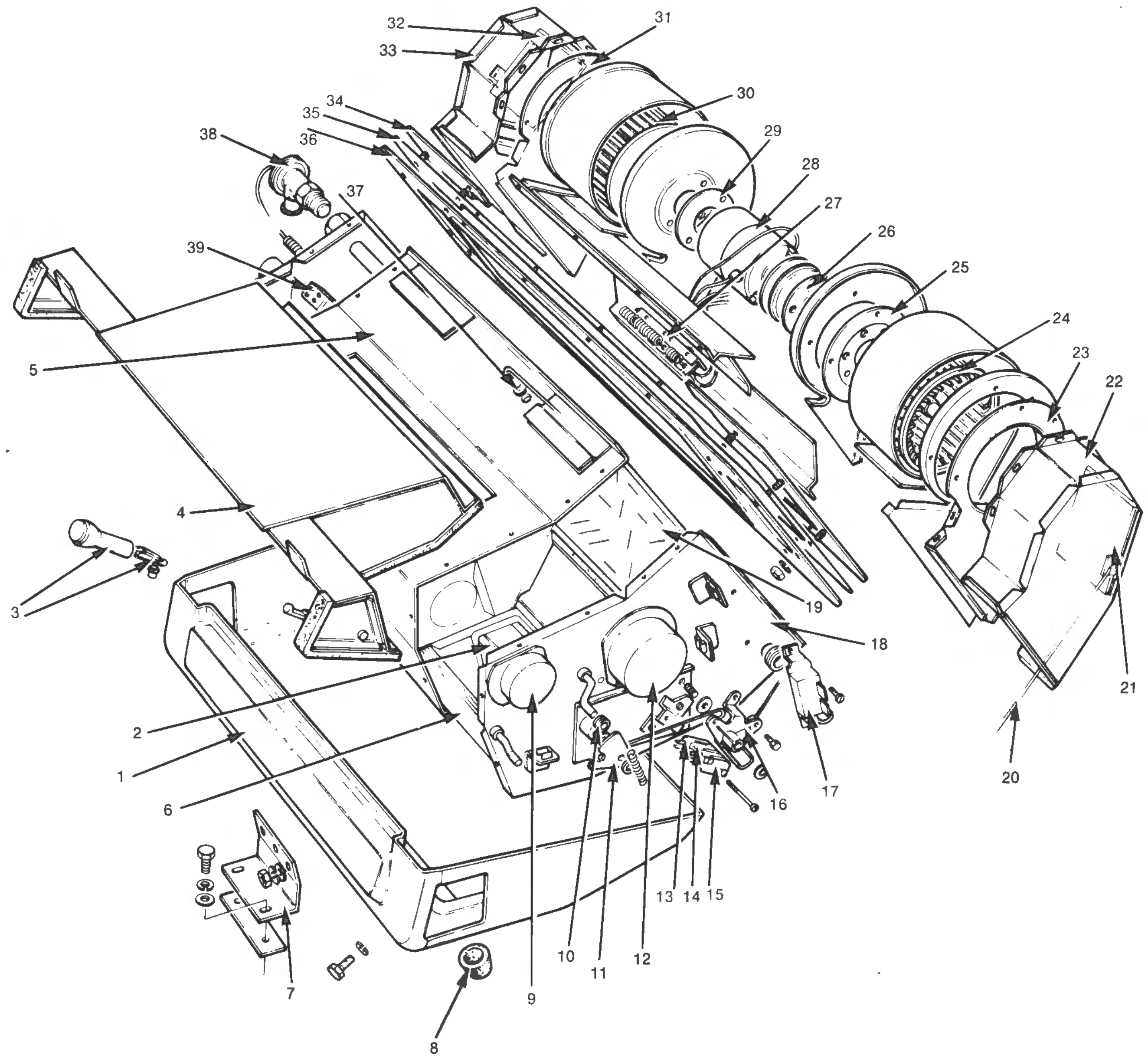


Fig. X-23

HEATER AND COOLER ASSEMBLY

1 DRIP TRAY
2 HEATER MATRIX
3 KNOB AND CLIP
4 CENTRE FACIA AIR VENT BOX
5 HEATER AND COOLER CASE
6 FLAP (INTERIOR TO DEMISTER)
7 LOWER MOUNTING BRACKET ASSEMBLY
8 DRAIN TUBE
9 DEMISTER VENT DUCT
10 ROLLER
11 LINKAGE PLATE
12 OUTER FACIA VENT DUCT
13 MICRO SWITCH (1)
14 MICRO SWITCH (2)
15 MICRO SWITCH (3)
16 OPERATING CAM
17 THERMOSTAT SWITCH
18 CASE END COVER
19 EVAPORATOR
20 ROD (FLAP TO OPERATING CAM)
21 FLAP (RECIRCULATING DUCT) (RH)
22 RECIRCULATING DUCT (RH)
23 PLATE RING (RH)
24 FAN (AIR, ANTI-CLOCKWISE)
25 PLATE (MOTOR MOUNTING)
26 SEALING WASHER (RH)
27 RESISTOR
28 HEATER AND COOLER BLOWER
29 SEALING WASHER (LH)
30 FAN (AIR, CLOCKWISE)
31 PLATE RING (LH)
32 FLAP (RECIRCULATING DUCT) (LH)
33 RECIRCULATING DUCT (LH)
34 PLATE (REINFORCING)
35 GASKET (HEATER AND COOLER TO BODY PANEL)
36 PLATE (TRANSITION)
37 GROMMET
38 VALVE (TX)
39 SWITCH (BI-METAL SAFETY)

COMPONENT SERVICING AND ADJUSTMENTS

CHARGING THE SYSTEM

A system that has had the refrigerant removed to carry out repairs, or is excessively low on charge must be evacuated before new refrigerant is installed. Moisture in the system in any quantity is extremely harmful due to the possibility of freezing resulting in blockage of components, or the reaction with R-12 to form hydrochloric acid which will cause corrosion of components.

Evacuation

1 Check compressor oil level.

2 Connect manifold gauge set to the service valves as previously described.

3 Service valves positioned to the MID-POSITION.

4 Connect centre hose of the gauge set to a vacuum pump.

5 Open both gauge hand valves fully.

6 Operate vacuum pump and observe the gauge reading on the compound gauge.

7 When the maximum vacuum is attained continue evacuation for a minimum of 30 minutes. The maximum possible will be 1000 mb (29.5 inches of Hg.) at sea level and proportionately less at higher altitudes.

8 Close both gauge valves and switch off the vacuum pump, observe the gauge reading for 3-5 minutes. It should remain static, if it does not the system must be leaking.

9 Charge the system with 170-227 g (6-8 ozs) of R-12. The system is now under pressure and must be tested for minor leakage before proceeding. This is also important to remove any contaminants.

10 Resume evacuation for further minimum time of 30 minutes.

11 Close both gauge valves, switch off and disconnect vacuum pump.

12 The system is now ready for charging.

Charging

1 Install refrigerant container on the centre hose of the gauge set.

2 Open refrigerant container valve and purge the gauge hose at the manifold for 3 seconds.

3 Open the low side gauge valve and allow the refrigerant to flow into the system with the refrigerant container in the upright position. To increase the flow of refrigerant the container may be warmed in hot water not exceeding a temperature of 40°C (104°F).

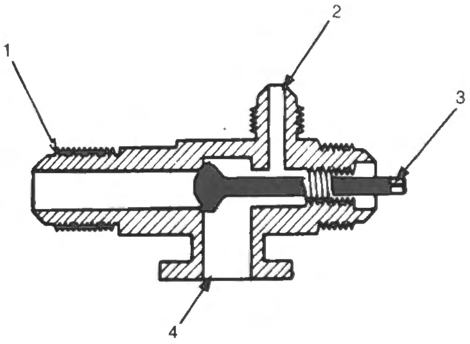
4 The system should be charged fully, refer Specifications for the capacity. The refrigerant charge may either be measured by a graduated glass or by weighing the container before and after charging.

5 Operate the system with the engine running and check the high low side gauge readings which should be as specified, refer operational tests.

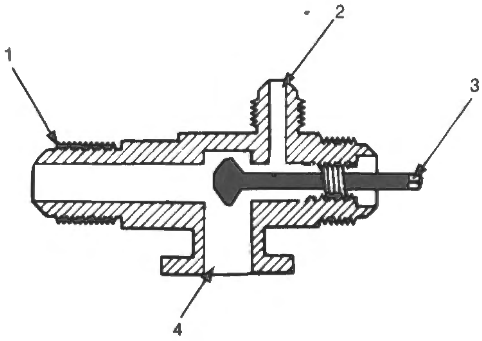
6 If gauge readings are normal, BACK SEAT the service valves and disconnect the gauge set.

NOTE: With a full refrigerant, charge the sight glass, it should be free from air bubbles and the pressure readings should be normal, a high side gauge pressure indicates an overcharge of refrigerant or air in the system.

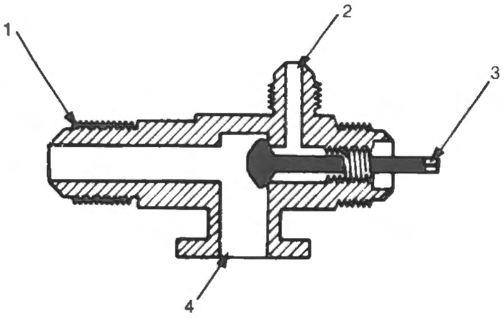
CAUTION: Never turn R-12 container into a position where liquid refrigerant will flow into the system as damage to the compressor valves will result.



FRONT SEATED (SHUT-OFF POSITION)



MID POSITION (TEST POSITION)



BACK SEATED (OPERATING POSITION)

Fig. X-24

SERVICE VALVES

1 HOSE CONNECTION
2 SERVICE GAUGE PORT
3 VALVE STEM
4 COMPRESSOR

DISCHARGING THE SYSTEM

Whenever discharging the system to the atmosphere, always make sure the correct safety precautions are observed, refer page X-18.

1 Connect the manifold gauge set to the service valves as previously described.

2 Position service valve to the MID-POSITION.

3 Allow the centre hose of the gauge set to exhaust to atmosphere.

4 Slowly open each hand valve in turn so that the system pressure is reduced gradually.

CAUTION: If the refrigerant is allowed to escape too fast the compressor oil will be carried out with it.

5 System is discharged when the gauge readings are zero.

REFRIGERANT HOSE CONNECTIONS AND FITTINGS

Two types of hose fittings may be encountered in the system.

1 Upset flange, shoulder nut type, using 'O' ring seal.

2 Flare fittings.

It is essential that these fittings be correctly handled when carrying out service operations, particularly in regard to tightening torque.

Where hexagon nuts are involved always use a back up spanner on the component to avoid twisting of hoses and lines.

NOTE: (a) Avoid using spanners in the vicinity of the safety plug on top of the receiver/dryer.
(b) 'O' ring types. Always replace the 'O' ring where a line is separated.
(c) Lubricate all fittings with clean refrigerant oil.

REFRIGERANTS, HOSE CONNECTIONS AND FITTINGS — TORQUE SPECIFICATIONS

'O' Ring Fittings

Metal Tube O.D.		Thread & Fitting Size		Steel Tube Torque		Aluminium Tube Torque	
mm	in	MM	in	Nm	lb.f.ft.	Nm	lb.f.ft.
6.35	¼	11.11	7/16	13-20	10-15	7- 9	5- 7
9.52	⅜	15.87	⅝	40-47	30-35	15-17	11-13
12.70	½	19.05	¾	40-47	30-35	20-27	15-20
15.87	⅝	22.22	⅞	40-47	30-35	29-36	21-27
19.05	¾	26.98	1 1/16	40-47	30-35	38-49	28-37

Flare Type Fittings

mm	in	Nm	lb.f.ft.
6.35	¼	9-15	7-11
9.52	⅜	19-30	14-22
12.70	½	30-39	22-29
15.87	⅝	39-48	29-36
19.05	¾	48-58	36-43

CONTROL LEVER ASSEMBLY

Removing

1. Disconnect battery.
2. Remove instrument panel.
3. Remove the two special lever assembly retaining nuts at the lower edge of the switch panel.
4. Withdraw the five control lever knobs.
5. Disconnect the blower motor wires at the multi-connector.
6. Detach the four cable retaining clips at the lever assembly with a small screw driver.

CAUTION: Note the relative positions of the four cables to assist in assembly.

7. Remove control lever assembly from the facia panel.

Refitting

1. Refitting is the reversal of the removal procedures.
2. Adjust cables, refer control cable adjustment.

CONTROL CABLES

The control cables may be adjusted independently as required. It is absolutely essential that any adjustment made is done so with care to ensure the systems operate correctly and the operation of the controls is finally checked. Adjustment is made by moving outer cable in the retaining clips to alter its effective length.

Adjusting Mode Control Lever

1. Disconnect battery.
2. Remove instrument panel.
3. Select cool (green) position.
4. Disconnect cable clip at the control lever.
5. Position the operating cam so that the heater flap rod is engaged with the slot in the operating lever. Refer Fig. X-26.
6. Connect cable clip.
7. Check operation.
8. Refit instrument panel.
9. Connect battery.

NOTE: If the adjustment is correct the compressor should NOT operate when lever is 'OFF' or in the heat (red) position, also the fresh air flap should be closed when the lever is 'OFF'.

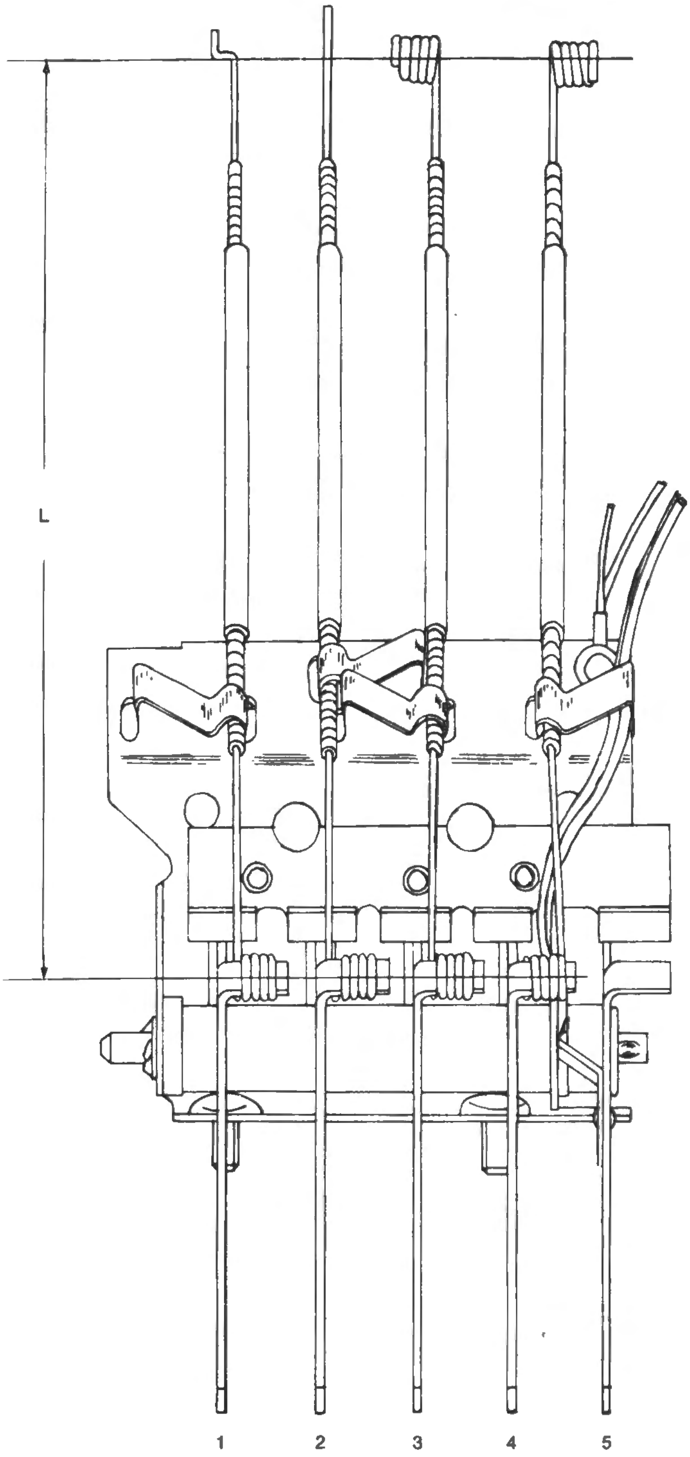


Fig. X-25

LAYOUT OF CONTROL CABLE ASSEMBLY

1 MODE SELECTION — HEATING OR COOLING 354 mm (13 & 15/16 in)

2 HEATER TEMPERATURE CONTROL 857 mm (33¾ in)

3 COOLER TEMPERATURE CONTROL 324 mm (12¾ in)

4 HOT AIR DISTRIBUTION — WINDSCREEN OR INTERIOR 533 mm (21 in)

5 BLOWER/FAN SPEED

L INDICATES THE LENGTH OF CONTROL CABLE

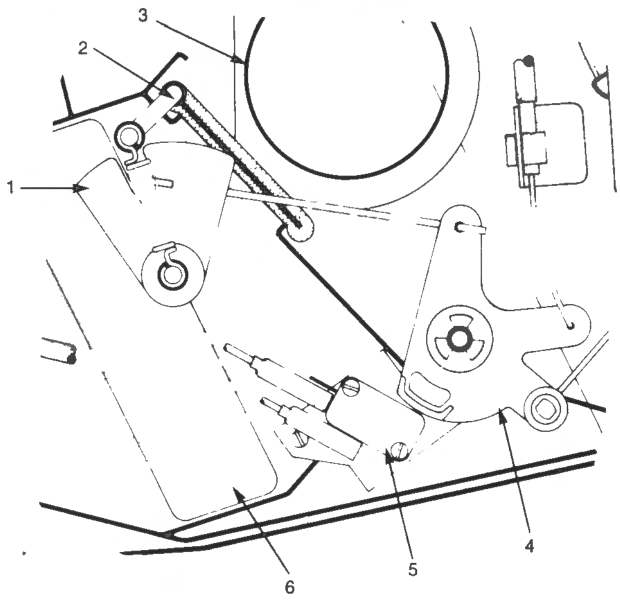


Fig. X-26

MODE CONTROL LEVER ADJUSTMENT

1 HEATER FLAP OPERATING LEVER
2 HEATER FLAP
3 OUTER FACIA VENT
4 OPERATING CAM
5 MICRO SWITCHES
6 HEATER MATRIX

Adjusting Temperature Lever — Cooler

1 Disconnect the right hand facia vent Kopex tubing from the heater/cooler unit.

2 Place control in 'OFF' position (white).

3 Disconnect cable clip on the right hand side of the heater/cooler unit (near thermostat).

4 Push thermostat operating lever fully upward.

5 Fit cable clip.

6 Check operation.

7 Refit Kopex tubing.

NOTE: If the adjustment is correct, when the lever is moved into the 'OFF' position an audible 'click' will be evident from the thermostat.

Adjusting Temperature Lever — Heater

1 Disconnect the left hand facia vent Kopex tubing from the heater/cooler unit, to gain access to the heater tap.

2 Place control in 'OFF' position (white).

3 Check security of the outer cable clip.

4 Loosen the inner cable retaining screw at the water tap.

5 Rotate the tap operating lever fully upward and tighten the screw.

6 Check operation.

7 Refit Kopex tubing.

Adjusting Hot Air Distribution Lever

The cable may be adjusted at either end.

ADJUSTING AT THE CONTROL LEVER END

1 Disconnect battery.

2 Remove instrument panel.

3 Select 'SCREEN' position.

4 Disconnect outer cable clip at the control lever.

5 Ensure the interior air outlet aperture is sealed by the flap. This is observed through the ventilation slots in the forward end of the floor console.

6 Connect cable clip.

7 Check operation.

8 Refit instrument panel.

9 Connect battery.

ADJUSTING AT THE HEATER/COOLER END

1 Disconnect battery.

2 Remove floor console.

3 Select 'SCREEN' position.

4 Disconnect outer cable clip at the heater/cooler end.

5 Ensure the interior air outlet aperture is sealed by the flap. This is observed through the interior ventilation aperture in the heater/cooler unit.

6 Connect cable clip.

7 Check operation.

8 Refit floor console.

9 Connect battery.

MICRO SWITCHES

Three micro switches are installed on the right hand side of the heater/cooler unit. These switches are operated by a cam, therefore it is essential that the switch installed clearance is corrent, refer Fig. X-27 so that the correct system operation is maintained.

The switch numbers in the figure refer to the numbers quoted in the electrical circuits, to assist in diagnosis.

Adjusting

1 Loosen the two mounting screws and position the switch so that a clearance of 0.381 — 0.762 mm (0.015 — 0.030 in) exists between the switch body and operating cam.

2 Check the system operation by moving the control levers.

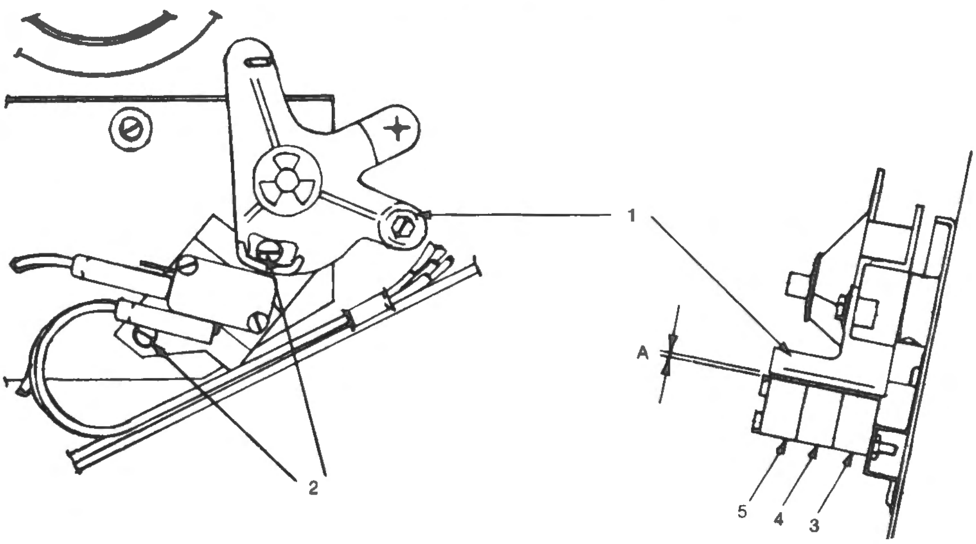


Fig. X-27

MICRO SWITCH ASSEMBLY ADJUSTMENT

1	OPERATING CAM	3	MICRO SWITCH (1)	5	MICRO SWITCH (3)
2	SCREWS (SWITCH MOUNTING)	4	MICRO SWITCH (2)	A	0.381 — 0.762 mm (0.015 — 0.030 in)

THERMOSTAT SWITCH

With the switch operating correctly and a gauge set connected to the system, movement of the cooler temperature control should result in a definite change in the low pressure gauge reading and cycling of the compressor clutch. If either or both of these faults are evident and installation and operating adjustments are correct the thermostat switch is at fault.

Installation

1. Insert the capillary tube through the grommet in the heater/cooler housing and into the evaporator core for a depth of 76 — 102 mm (3.00 — 4.00 in).
2. Secure switch body to the heater/cooler housing.
3. Connect electrical wiring.
4. Adjust control cable.
5. Check operation.

EXPANSION (TX) VALVE

A malfunction of the expansion valve will be caused by one of the following conditions: Valve seized open, valve seized closed, broken capillary tube, a restricted screen or an improperly located or installed power element. The first three conditions require valve replacement. The last two may be corrected by fitting the valve inlet screen and by properly installing the capillary tube. Attachment of the TX capillary tube valve to the evaporator outlet line is very critical. The capillary tube must be attached tightly to the line and must make good contact with the line along its entire length. A loose capillary tube will result in high low side pressures and poor cooling. Indications of expansion valve trouble provided by the Performance Test are as follows:

VALVE SEIZED OPEN
    Noisy compressor.
    No cooling — freeze up.
VALVE SEIZED CLOSED, BROKEN CAPILLARY TUBE OR BLOCKED SCREEN
    Very low suction pressure.
    No cooling.
POORLY LOCATED CAPILLARY TUBE
    Normal pressure.
    Poor cooling.

The expansion valve is factory adjusted and pre-set and cannot be adjusted after installation. A malfunctioning valve must be replaced. However, before proceeding, check all other possible causes of the trouble. Make certain that the capillary tube is correctly positioned, on the low pressure line and tightly clamped. Make certain that the liquid inlet screen is not clogged. After checking the screen and the location and mounting of the capillary tube proceed with replacement of the valve assembly.

Installation

1. Install valve so that the inlet port is turned away from the transition plate by 20°.
2. Compressor oil should be used on all fittings as a lubricant and system pressure tested for leaks after recharging.
3. Install capillary tube to the evaporator outlet ensuring that it is clean and correctly lagged.

BI-METAL SAFETY SWITCH

The switch located on the left hand side of the heater/cooler unit will, if defective, cause sluggish or non-operation of the compressor clutch.

Installation

1 Insert switch into the aperture near the heater matrix.

2 Fit retaining screw.

3 Connect wiring.

4 Check compressor operation by operating the mode and cooler temperature lever.

HEATER TAP

The heater tap is located near the left hand side of the unit and is operated by a cable from the control panel.

Removing

1 Disconnect the battery.

2 Remove radiator cap and disconnect both heater hoses at the engine.

3 Operate the heat temperature control to maximum and apply an air line to one of the disconnected hoses, so that all the water in the system is expelled.

4 Remove left hand Kopex tubing from the demister duct and facia vent.

5 Remove glove box assembly.

6 Disconnect heater tap from the mounting bracket.

7 Disconnect the two hoses from the tap.

8 Disconnect the control cable.

Refitting

1 Refitting is the reverse of the removing procedures.

2 Adjust control cable.

3 Top up cooling system with water and the correct quantity of inhibitor.

HEATER/COOLER UNIT

Removing

1 Disconnect battery.

2 Discharge refrigerant.

3 Disconnect both the heater hoses from the engine and expel water from the system.

4 Remove floor console.

5 Remove lower facia panel.

6 Remove centre facia vent air box.

7 Disconnect all Kopex tubing from the heater/cooler unit and vents.

8 Remove glove box assembly.

9 Remove instrument panel.

10 Remove the two special lever assembly retaining nuts at the lower edge of the switch panel.

11 Disconnect the electrical wiring at the line fuse and thermostat switch.

12 Disconnect refrigerant hose at the TX valve and plug connections.

13 Disconnect evaporator outlet hose at evaporator and plug connections.

14 Disconnect the water hoses, one hose from the water tap outlet, the second from the connector in the heater outlet hose.

15 Remove the two bolts from the heater/cooler lower mounting bracket.

16 Remove engine air cleaner.

17 Remove access plate from the centre front side of the plenum chamber (5 screws). Access is gained by partial removal of the insulating material.

18 Remove tape from the two access holes in the front face of the plenum chamber.

19 Remove the ten screws and the six nuts from the weld bolts on the heater/cooler unit transition plate.

20 Remove the unit toward the rear of the vehicle, lifting the lower edge of the unit upward so that the blower cowling clears the aperture in the plenum chamber.

Refitting

1 Refitting is the reversal of the removal procedures.

2 Reseal the transition plate.

3 Top up cooling system with water and the correct quantity of inhibitor.

4 Use compressor oil as a lubricant on all hose and pipe fittings.

5 Leak test the system.

Dismantling

1 Disconnect the multi connector electrical wiring.

2 Remove six screws and washers securing the fibre glass drip tray.

3 Remove drip tray.

4 Note the position of the blower motor wiring and remove.

5 Disconnect the fresh air inlet flap rod from the operating cam, noting the position of the cam on the operating rod.

6 Separate the motor assembly partly from the heater/cooler unit by removing the eight nuts and washers from the transition plate.

7 Note position of the wiring to the motor resistances and disconnect.

8 Remove motor assembly.

9 Remove the four operating cables from the heater/cooler unit by disconnecting the outer cable clips using a small screw driver.

10 Remove the two heater hoses.

11 Remove thermostat switch.

12 Disconnect and remove bi-metal safety switch.

13 Remove TX valve and plug connections.

14 Note and disconnect micro switch wiring and remove switches.

15 Remove right hand side cover by releasing the eleven retaining screws.

16 Remove evaporator and heater matrix.

Assembling

1 Assembling is the reverse of the dismantling procedures. Use compressor oil as a lubricant on all hose and pipe fittings.

2 Apply a suitable width strip caulking compound to the drip tray and transition plate.

3 Adjust the fresh air flap operating rod to the correct dimensions shown. Refer Fig. X-28.

4 Adjust micro switches and TX valve position as previously mentioned.

5 Adjust control cables.

6 Leak test the system.

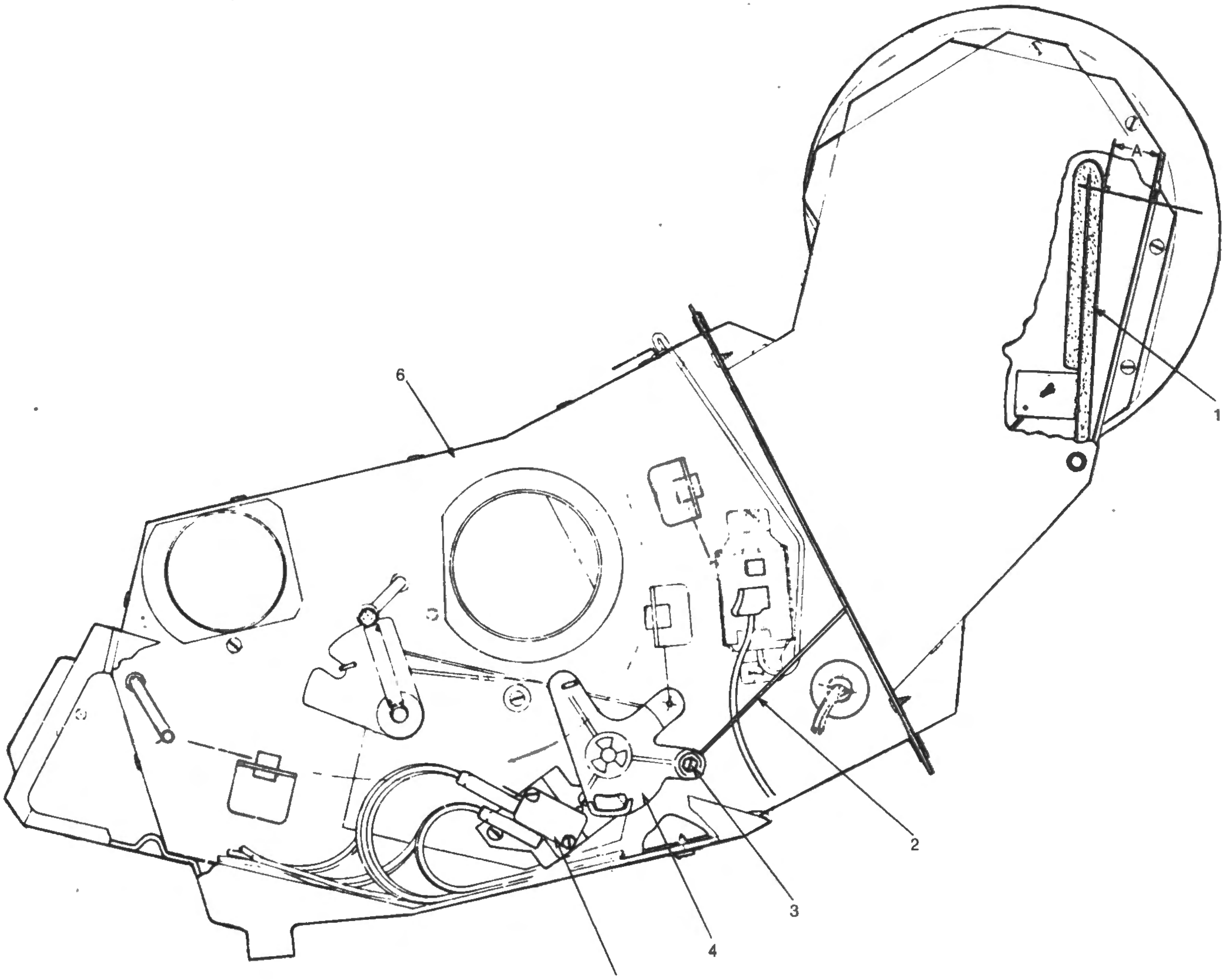


Fig. X-28

FRESH AIR FLAP OPERATING ROD ADJUSTMENT

1 FLAP (FRESH AIR — RECIRCULATING)
2 FLAP OPERATING ROD
3 SCREW (OPERATING ROD ADJUSTMENT)
4 OPERATING CAM
5 MICRO SWITCHES
6 HEATER AND COOLER ASSEMBLY
A FRESH AIR FLAP OPERATING ROD ADJUSTMENT 13 mm (½ in)

BLOWER MOTOR

Removing

1 Remove heater/cooler unit.

2 Dimantle heater/cooler unit carrying out operations 1 to 8 inclusive.

3 Remove transition plate from the heater/cooler unit and the ten retaining screws.

NOTE: It will be necessary to remove part of the neoprene casing from the transition plate to gain access to the screws.

4 Remove the blower side plates — nine screws for each plate which are located beneath the neoprene casing.

5 Extract both fans from the motor shaft.

6 Note the position of the right hand motor mounting bracket and remove the four retaining screws.

7 Note the position of the left hand motor mounting bracket and remove the two internal nuts and washers.

8 Remove motor through the right hand mounting bracket.

NOTE: It will be necessary to cut the external neoprene coating to dismantle the unit. This should be resealed with Selleys Neoprene Protective coating or 3M Anti Fall coating 6915.

Refitting

1 Refitting is the reversal of the removal procedures, use compressor oil on all hose and pipe fittings and leak test the system.

COMPRESSOR

DRIVE BELT ADJUSTMENT

The drive belt tension may be checked by either of two methods. With a belt tension gauge or by the deflection method. Whenever possible the belt tension gauge should be used.

Belt Tension Gauge

1 Check the belt tension with a gauge. With a new belt or one that has been run for less than 10 minutes, the tension should be within 530-670 N (120-150 lbf). With a belt that has been run for more than 10 minutes the tension should be within 400-530 N (90-120 lbf).

2 To adjust, loosen the two long bolts securing the compressor bracket to the engine.

3 Loosen the adjusting bolt locknut and adjust the bolt until the correct belt tension is achieved. If an adjusting bolt is not fitted, carefully lever the compressor to obtain the correct belt tension.

4 Tighten the two long bolts and tighten the adjusting bolt locknut to the correct torque.

5 Re-check belt tension.

Deflection Method

1 Follow the same procedure as for the belt tension gauge with the exception that a deflection of between 6.3 — 9.5 mm (¼ — ⅜ in) should be obtained on a belt that has run for more than 10 minutes.

ELECTRO-MAGNETIC CLUTCH

To remove the stationary field coils of the magnetic clutch it is necessary to remove the pulley section first, there is no need to discharge the regrigerant in the system.

Removing

1 Engage clutch by operating the mode selector lever to the green position with the ignition on.

2 Remove centre bolt, flat and spring washer.

3 Release drive belt tension.

4 Screw a ⅝ in U.N.C. cap screw into the hub. When the cap screw is screwed against the compressor shaft, the assembly will be forced free.

5 Disengage the clutch.

6 Remove drive belt.

7 Disconnect clutch lead wire (black).

8 Remove the four bolts and washers retaining the field coil to the compressor and remove coil.

Refitting

1 Refitting is the reverse of the removal procedures.

NOTE: When refitting the field coil and pulley it may be necessary to centralise the field coil by releasing the four retaining bolts and rotating it.

CHECKING THE OIL LEVEL

Generally, the oil level should only be checked when there is evidence of a major loss of oil from the system.

As an aid in checking the oil level a dipstick may be manufactured from 3 mm (⅛ in) dia. wire shown in Fig. X-30.

When adding or changing oil, use only the recommended oil as in the 'Specification' section. The initial fill of oil is 284 g (10 fluid ozs), after the system has been charged the oil level must be rechecked as some oil will be absorbed by the refrigerant.

To check the oil level proceed as follows:

1 The system must be either discharged or both service valves front seated and the compressor shaft key uppermost.

2 Remove high pressure valve service connection blanking cap and allow a period of at least two minutes for the gas in the compressor to escape.

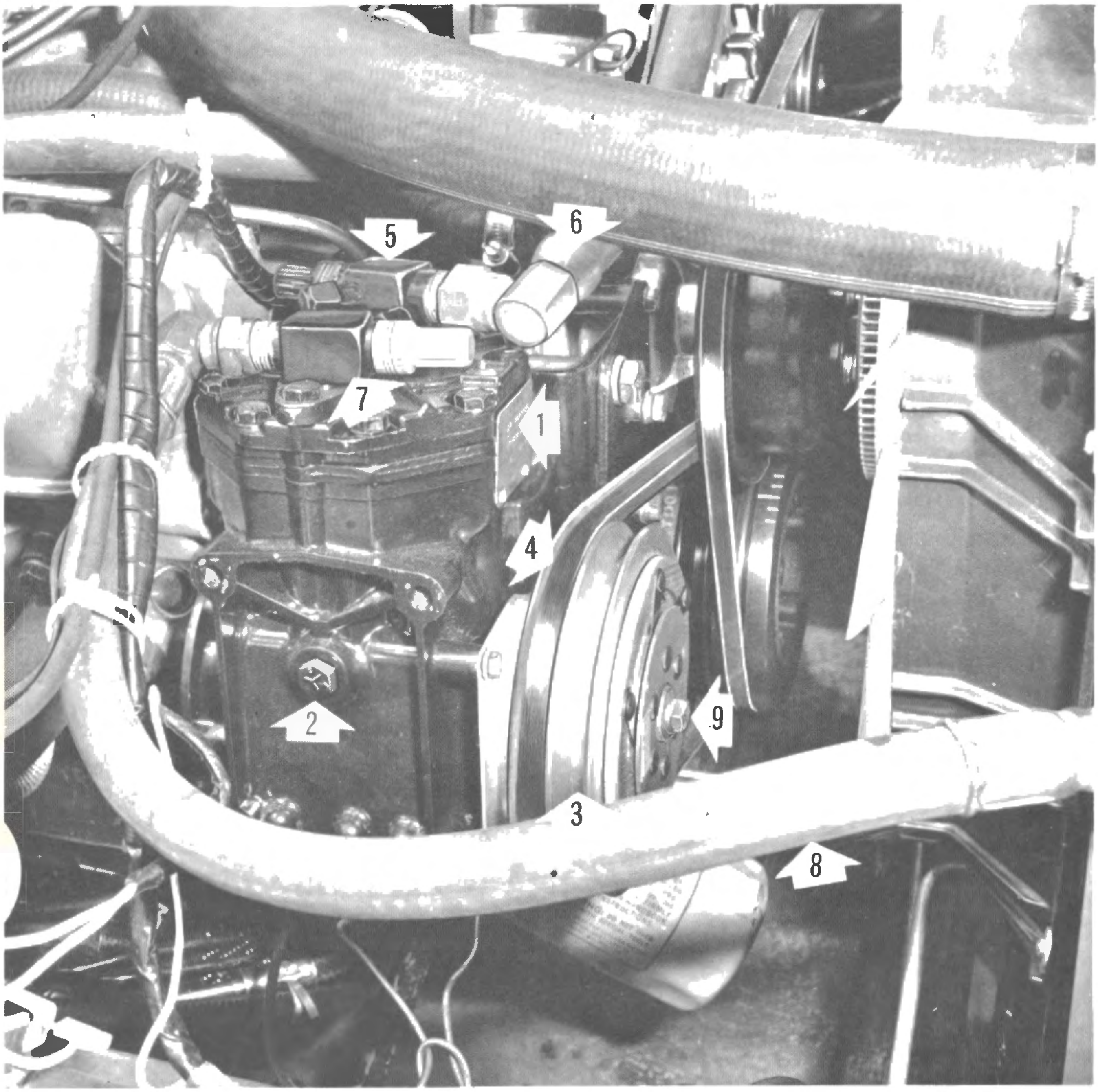


Fig. X-29

COMPRESSOR ASSEMBLY

1 COMPRESSOR ASSEMBLY
2 OIL FILLER PLUG
3 CLUTCH AND DRIVE PULLEY ASSEMBLY
4 COMPRESSOR DRIVE BELT
5 SERVICE VALVE (LP SUPPLY SIDE)
6 LOW PRESSURE HOSE (EVAPORATOR OUTLET TO COMPRESSOR INLET)
7 SERVICE VALVE (HP DISCHARGE SIDE)
8 HIGH PRESSURE HOSE (COMPRESSOR OUTLET TO CONDENSER INLET)
9 BOLT AND WASHER (CLUTCH AND DRIVE PULLEY TO CRANKSHAFT)

3 Unscrew oil filler plug five turns slowly and allow pressure to bleed off. Remove plug. Refer Fig. X-29.

4 Using a dipstick as shown in Fig. X-30 check that the level is up to the marking 28.6 mm (1⅛ in) from the bottom of the dipstick. Top up as necessary.

5 Refit the oil filler plug, tighten to a torque of 5.4 Nm-14.9 Nm (4-11 lb.f.ft.).

6 Refit the high pressure valve service connection blanking cap and tighten securely.

7 Evacuate the compressor.

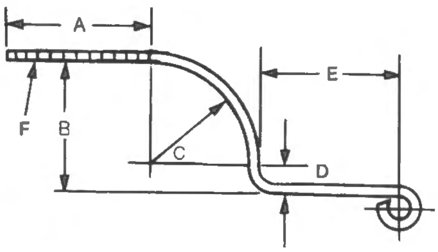
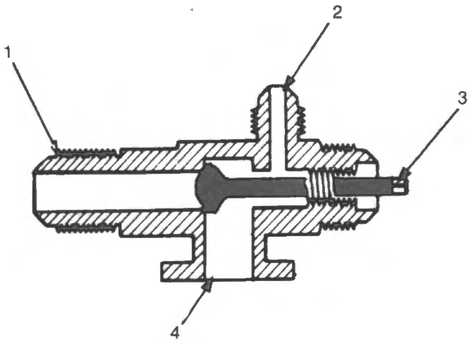


Fig. X-30

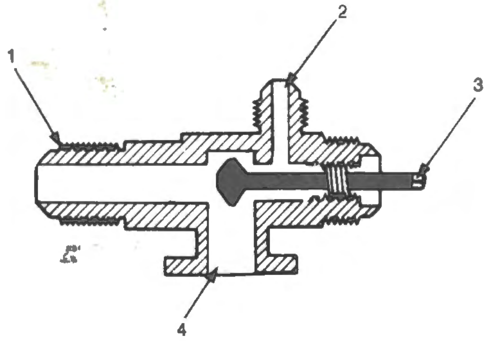
COMPRESSOR OIL LEVEL DIPSTICK

MATERIAL 3 mm (⅛ in) DIAMETER SOFT WIRE

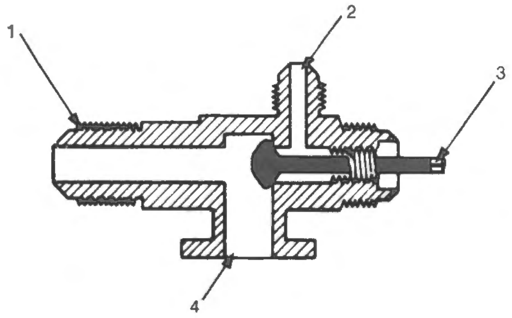
A	38 mm (1½ in)
B	51 mm (2 in)
C	38 mm (1½ in) RADIUS
D	13 mm (½ in)
E	51 mm (2 in)
F	12 NOTCHES 3 mm (⅛ in) APART



FRONT SEATED (SHUT-OFF POSITION)



MID POSITION (TEST POSITION)



BACK SEATED (OPERATING POSITION)

Fig. X-31

SERVICE VALVES

1 HOSE CONNECTION

2 SERVICE GAUGE PORT

3 VALVE STEM

4 COMPRESSOR

8 BACK SEAT BOTH SERVICE VALVES.

9 Check for leaks.

10 Start the engine and switch on the air conditioning system. Observe the sight glass to ensure the system is fully charged.

REMOVING THE COMPRESSOR

Removing

1 Disconnect battery.

2 Front seat both service valves.

3 Remove service valves from the cylinder head.

4 Disconnect the black lead wire from the electro-magnetic clutch.

5 Release drive belt tension and remove belt.

6 Remove the two long securing bolts.

7 Remove the compressor from the vehicle and detach its mounting bracket by removing the four securing bolts.

Refitting

1 Refitting is the reverse of the removal procedures.

2 BACK SEAT BOTH SERVICE VALVES.

NOTE: The compressor must be evacuated before the service valves are back seated.

OVERHAULING THE COMPRESSOR

The majority of compressor parts are made of aluminium alloys and care must be taken in handling not to mark, nick or scratch. All machined surfaces must be free of nicks and burrs to ensure proper fit and gasket seating. Bolts should all be run in until the bolt heads make contact, then tightened with torque wrench in a sequence resulting in tightening of diagonally opposite bolts until all are drawn up to specified torques.

An important factor in compressor servicing is cleanliness, and care should be exercised to prevent dirt or foreign material from entering the compressor when it is opened. All old gaskets should be removed and replaced. All gasket surfaces should be clean and all parts to be reused should be washed in a suitable petroleum base solvent.

SHAFT SEAL ASSEMBLY

The shaft seal assembly of the compressor is of a simplified design, yet tight sealing, long lasting and, when necessary, easily and quickly replaced. Seals are machined to two helium light bands of flatness. The carbon is lapped to the cast iron and the fit becomes even better as the seal assembly is 'run in' during operation.

The tendency to condemn a seal assembly because of very slight leakage is an error that is often committed. Few if any mechanical seal assemblies are 100% tight. The rubbing surfaces of the seal are separated by a very fine film of oil.

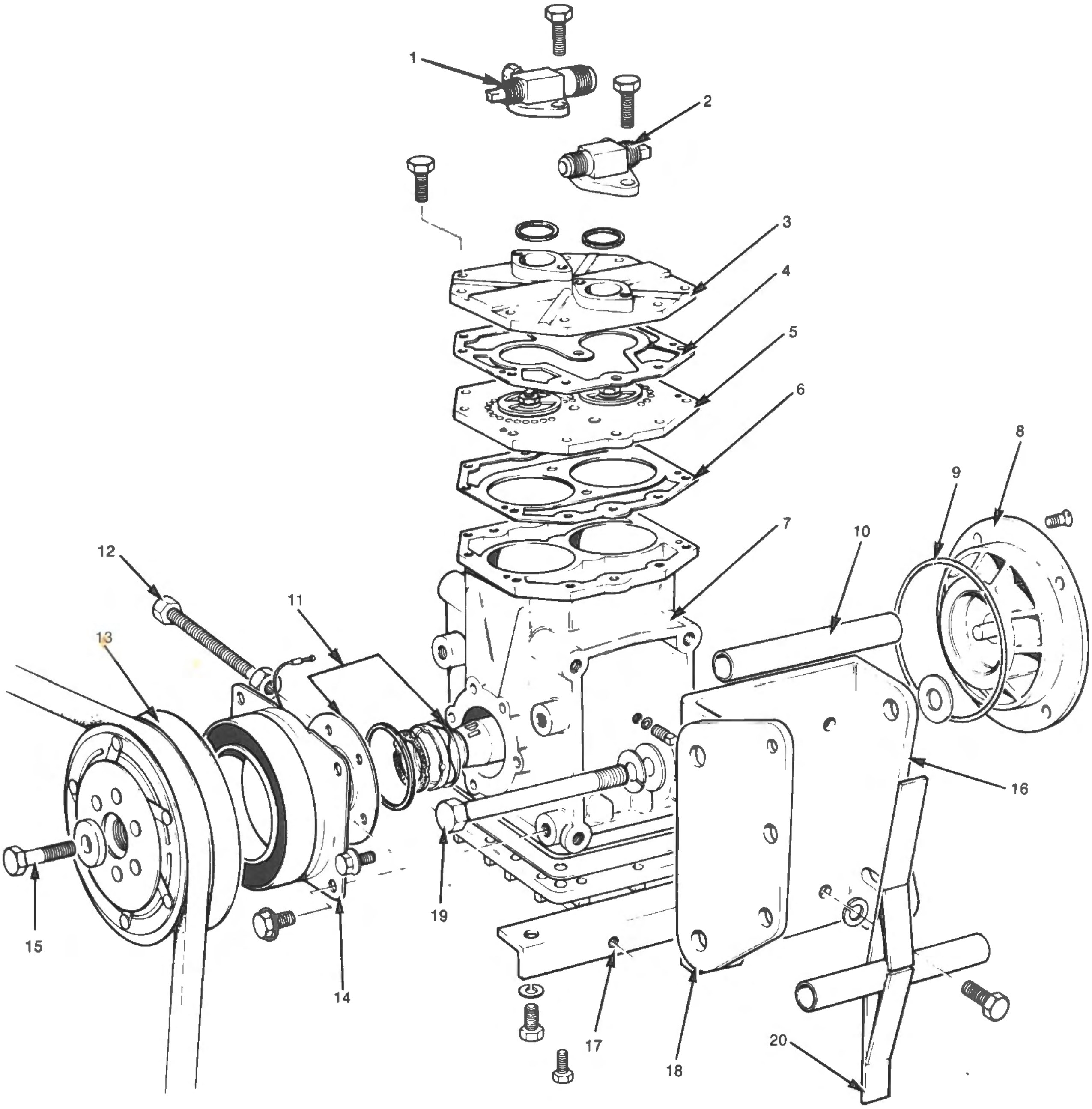


Fig. X-32

COMPRESSOR AND MOUNTING LAYOUT

1	SERVICE VALVE (H.P. DISCHARGE)
2	SERVICE VALVE (L.P. SUPPLY SIDE)
3	CYLINDER HEAD
4	CYLINDER HEAD GASKET
5	VALVE PLATE ASSEMBLY
6	VALVE PLATE GASKET
7	COMPRESSOR ASSEMBLY
8	END PLATE
9	END PLATE SEAL
10	SPACER TUBE (UPPER)
11	FRONT SEAL KIT
12	DRIVE BELT TENSIONING SCREW (LOCKNUTS)
13	CLUTCH AND DRIVE PULLEY ASSEMBLY
14	FIELD SHELL AND COIL
15	BOLT AND WASHER (CLUTCH AND DRIVE PULLEY TO CRANKSHAFT)
16	BRACKET (COMPRESSOR MOUNTING)
17	SUPPORT BRACKET (COMPRESSOR MOUNTING BRACKET TO COMPRESSOR)
18	HINGE BRACKET (COMPRESSOR MOUNTING)
19	THROUGH BOLTS (MOUNTINGS TO CYLINDER BLOCK 2)
20	BELT TENSIONING (LEVER AND SPACER TUBE ASSEMBLY)

Oil carries refrigerant and minute quantities which seep to the outside may be detected with modern ultra sensitive leak detectors which are capable of sensing leakage totalling one ounce of refrigerant over a twenty year period. Such sensitivity serves a useful purpose in critical applications but for leak testing compressor joints or seal, a leak detector will pick up any leak of sufficient magnitude to require correction.

Do not be too prone to condemn and replace a seal assembly until the seal has been given an opportunity to 'run in' and until there is definite proof that replacement is really necessary.

SHAFT SEAL REPLACEMENT

It is recommended that the compressor be removed from the vehicle for shaft seal replacement.

1. Remove clutch and pulley assembly.
2. Remove shaft key.
3. Remove the seal plate. With a suitable seal puller, pull out seal gland and discard. Discard all parts of the seal including the 'O' ring. Do not use a screw driver to pry seal gland from compressor shaft as damage to shaft may result.

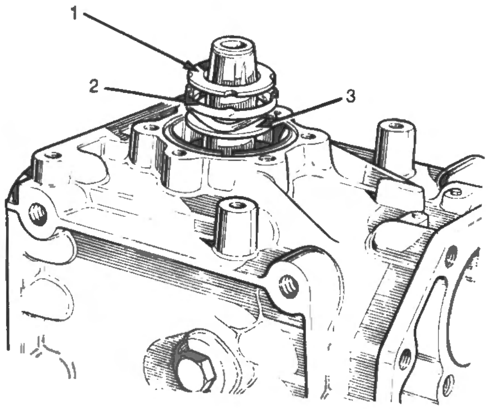


Fig. X-33

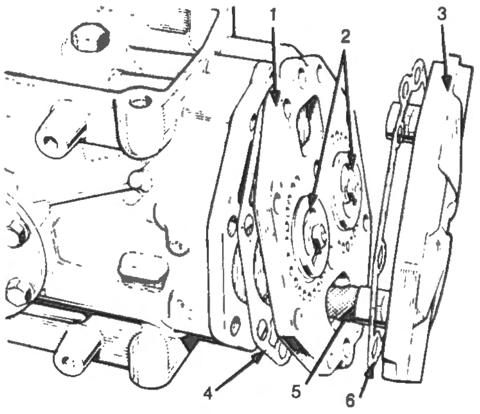
REMOVING THE SHAFT SEAL ASSEMBLY

1 CARBON RING
2 CARBON RING RETAINER
3 SEAL ASSEMBLY

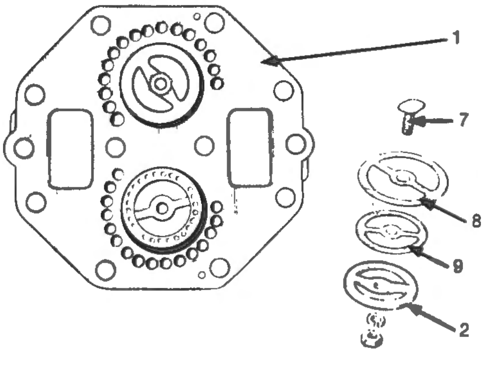
4. Clean shaft and seal cavity with clean lint-free cloth.
5. Dip seal gland in refrigerant oil.
6. Push the seal assembly, less the carbon ring, over the end of the shaft with the carbon ring retainer facing out. Use a suitable seal installer tool to move the seal assembly into position on the shaft.
7. Place the carbon ring in the ring retainer so the lapped surface is facing outward. The indentations in the outside edge of the carbon ring must engage the driving lugs and be firmly seated in the retainer.
8. Install new 'O' ring in groove of seal plate. Use refrigeration oil to make it adhere to the surface. Space seal cover plate with equal clearance around the shaft and insert cap screws, tightening them evenly to the specified torque.

HEAD AND VALVE PLATE — REMOVAL

1. Remove the compressor.
2. Remove the remaining screws in the head and remove the valve plate and head from the cylinder by prying or tapping under the ears which extend from the valve plate. If the head and valve plate adhere, hold the head and tap the valve plate ears away from the head with a soft hammer. Do not hit or tap the head to separate the head and valve plate because damage to the head may result.



HEAD AND VALVE PLATE REMOVAL



VALVE PLATE AND VALVE ASSEMBLY

Fig. X-34

HEAD AND VALVE PLATE

1 VALVE PLATE
2 REED VALVE RETAINER
3 COMPRESSOR HEAD
4 GASKET
5 SUCTION SCREEN
6 GASKET
7 VALVE BOLT
8 REED VALVE (SUCTION)
9 REED VALVE (DISCHARGE)

3 All gasket material adhering to the head, valve plate or cylinder, should be carefully removed in such a manner that the machined sealing surfaces are not scratched or nicked.

HEAD AND VALVE PLATE — INSTALLATION

Valves and valve plates are furnished only as a complete assembly.

1 Apply a thin film of clean refrigeration oil on the area of the crankcase to be covered by the cylinder gasket. Place the cylinder gasket in position on the cylinder so the dowel pins in the crankcase go through the dowel pin holes in the cylinder gasket.

2 Apply a thin film of clean refrigeration oil to the top and bottom valve plate areas to be covered by gaskets. Place the valve plate in position on the cylinder gasket so the discharge valve assemblies (i.e. the smaller diameter assemblies with the restrainer over the valve reed) are facing up and the locating dowel pins go through the dowel pin holes in the valve plate.

3 Place the head gasket in position on the valve plate so the dowel pins go through the dowel pin holes in the gasket.

4 Apply a light film of clean refrigeration oil on the machined surface of the cylinder head which matches the head gasket. Place the head on the cylinder head gasket so the dowel pins go into the dowel pin holes in the head and refit the short head bolts and lightly tighten.

5 Refit the compressor.

BOLT TORQUE FIGURES

LOCATION	THREAD	TORQUE	
		Nm	LB.F.FT.
BASE PLATE	¼ — 20 UNC	16 — 24	12 — 18
CON ROD	¼ — 20 UNC	16 — 22	12 — 16
REAR BEARING COVER PLATE	¼ — 20 UNC	12 — 23	9 — 17
CYLINDER HEAD	5/16 — 18 UNC	20 — 31	15 — 23
SEAL PLATE	10 — 24 UNC	7 — 12	5 — 7
SERVICE VALVE	5/16 — 18 UN	20 — 31	15 — 23
SEAL CAP	1 — 14 NS	12 — 13	7 — 10
ROTALOCK VALVE	1 — 14 NS	40 — 47	30 — 35
MOUNTING SCREW	⅜ — 16 UNC	19 — 23	14 — 17
OIL FILLER PLUG	⅜ — 24 UNF	5 — 15	4 — 11

CONDENSER

No repairs, such as soldering, welding or brazing should be attempted on the condenser because of its construction.

Removing

1 Discharge refrigerant from system.

2 Disconnect battery and remove from vehicle.

3 Remove radiator.

4 Disconnect high pressure hoses from the right hand and left hand of the condenser, fit plastic blanking to the exposed pipes and hoses.

5 Remove the four bolts that support the condenser.

6 Withdraw the condenser from the vehicle.

Refitting

1 Refitting is the reverse of the removal procedures.

2 Evacuate and recharge the system.

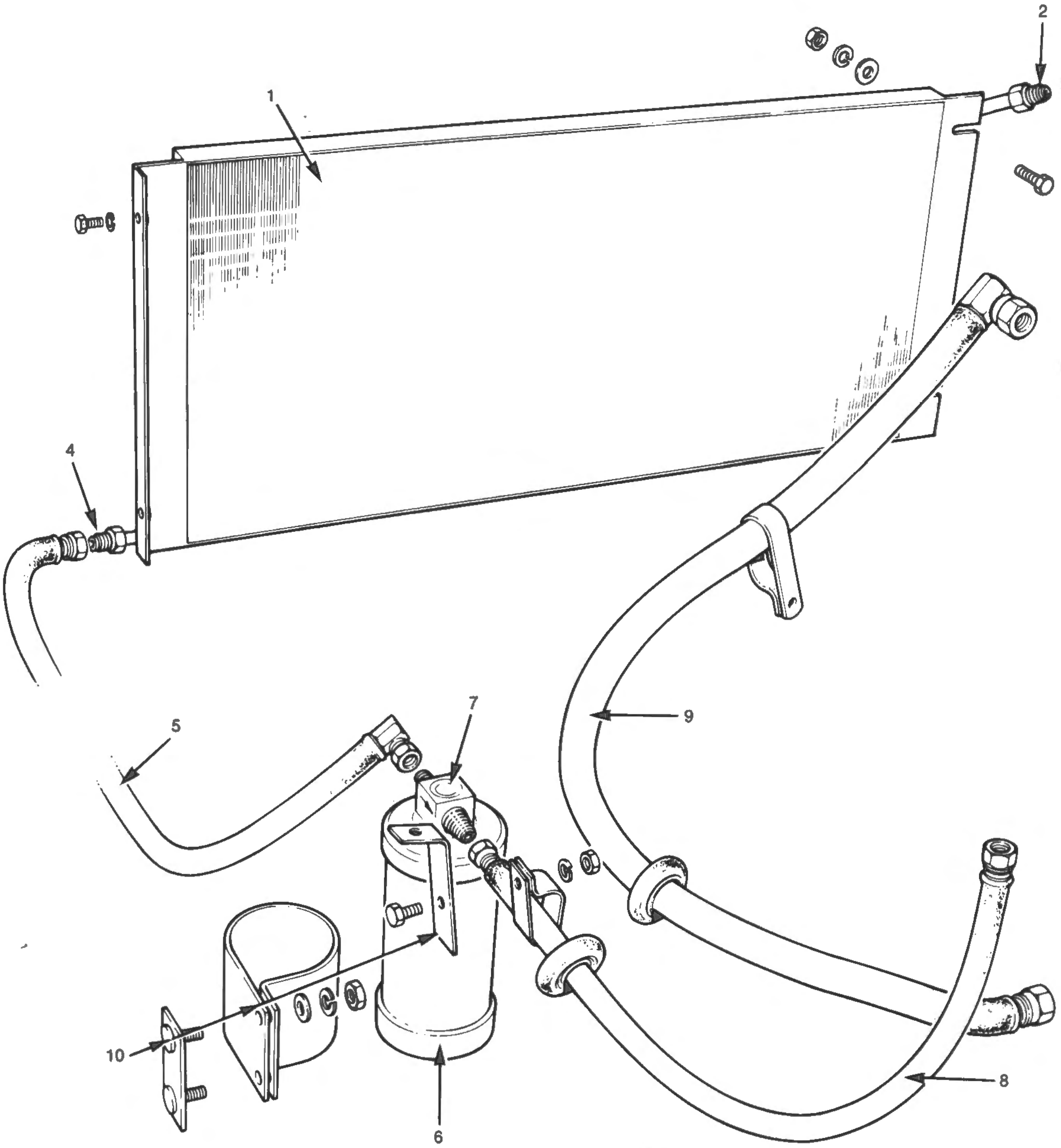


Fig. X-35

CONDENSER AND RECEIVER/DRYER LAYOUT

1 CONDENSER

2 INLET CONNECTION

3 HIGH PRESSURE HOSE (COMPRESSOR OUTLET TO CONDENSER INLET)

4 OUTLET CONNECTION

5 HIGH PRESSURE HOSE (CONDENSER OUTLET TO RECEIVER/DRYER INLET)

6 RECEIVER/DRYER

7 SIGHT GLASS

8 HIGH PRESSURE HOSE (RECEIVER/DRYER OUTLET TO TX VALVE)

9 LOW PRESSURE HOSE (EVAPORATOR OUTLET TO COMPRESSOR INLET)

10 MOUNTING BRACKETS (RECEIVER/DRYER TO LH VALANCE)

SPECIFICATIONS

COMPRESSOR:	
Make	York
Type	A209
No. of Cylinders	2
Bore X Stroke	47.625 x 39.954 mm (1.875 x 1.573 in)
Displacement/Rev	142.6 cm^3 (8.7 in^3)
Maximum Speed	6000 rpm
Lubrication	Positive Pressure
ELECTRO-MAGNETIC CLUTCH:	
Type	Dry single disc magnet type
Current Draw	3 amps at 12 volts
HEATER/COOLER UNIT:	
Evaporator Construction	Aluminium Fins and Copper Tubes
Blower	Dual Fan 3 speed on cooling 2 speed on heating
Motor-Current Draw Max. (amps at 12 volts)	Low Speed 3 Medium Speed 4¾ High Speed 6½
Thermal Expansion Valve	Internal equaliser type thermostatically controlled
BI-METAL SAFETY SWITCH:	Opening temperature 1 to 0°C (30 to 32°F) Closing temperature 2 to 3°C (35 to 37°F)
CONDENSER:	Corrugated fins and tubes
RECEIVER:	
Make	Smiths 02-2482
Type	Cylinder type incorporating drier, strainer and sight glass
Safety Plug Type	Fusible
Melting Temperature (Direct Heat)	111-121°C (232-250°F)
SYSTEM CAPACITIES:	
Refrigerant type	R-12
Refrigerant capacity	Max. 0.9 kg (2 lb) Min. 0.7 kg (1 lb 10 oz)
Compressor oil type	'SUNISO' No. 5, 'TEXACO' Capella grade E or equivalent
Compressor oil capacity	284 g (10 oz)
ELECTRICAL:	
Battery	9 plate 61 amp-hour
Alternator	14ACR-6D
Circuit Protection	35 Amp line fuse
ENGINE COOLING SYSTEM:	
Radiator	15 gills per inch
Fan	13 blades Nylon
Viscous Coupling (Maximum fan speed)	2500 rpm

COOLING PERFORMANCE:	12,300BTU/HR at air inlet conditions of 90°F dry bulb and 75°F wet bulb at 50% relative humidity Mean Refrigerant temp. of 40°F
SYSTEM PRESSURES:	At ambient temperature of 35°C (95°F) for other temperatures refer to the Pressure Temperature Relationship Chart Low Side Pressure 34-125 kPa (5-18 psi) High Side Pressure 1034-1275 kPa (150-185 psi)

SERVICE TOOLS

Typical tools are shown as examples, these tools plus alternatives are available from refrigeration equipment suppliers.

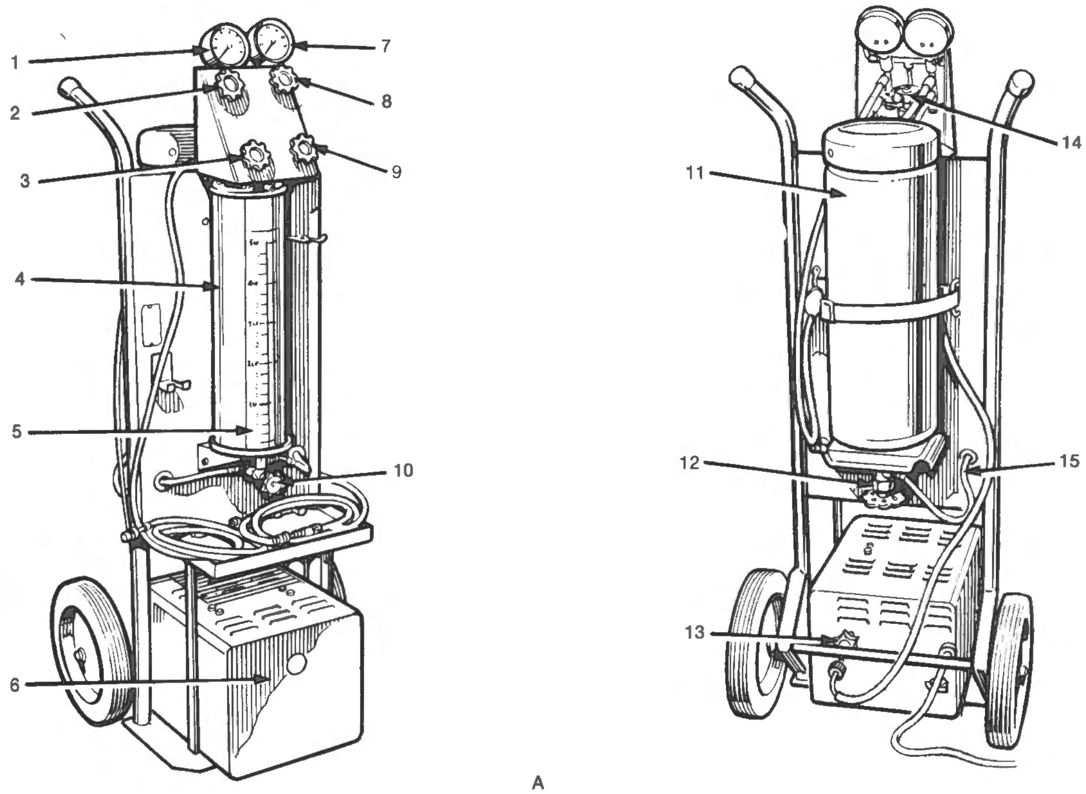
1 Charging Station. A charging station may be used or the individual components will suffice.

2 Leak Detector — Burner type.

3 Leak Detector — Electronic type. This may be used, however, they are much more sensitive than the burner type.

4 Safety Goggles.

5 Thermometers.



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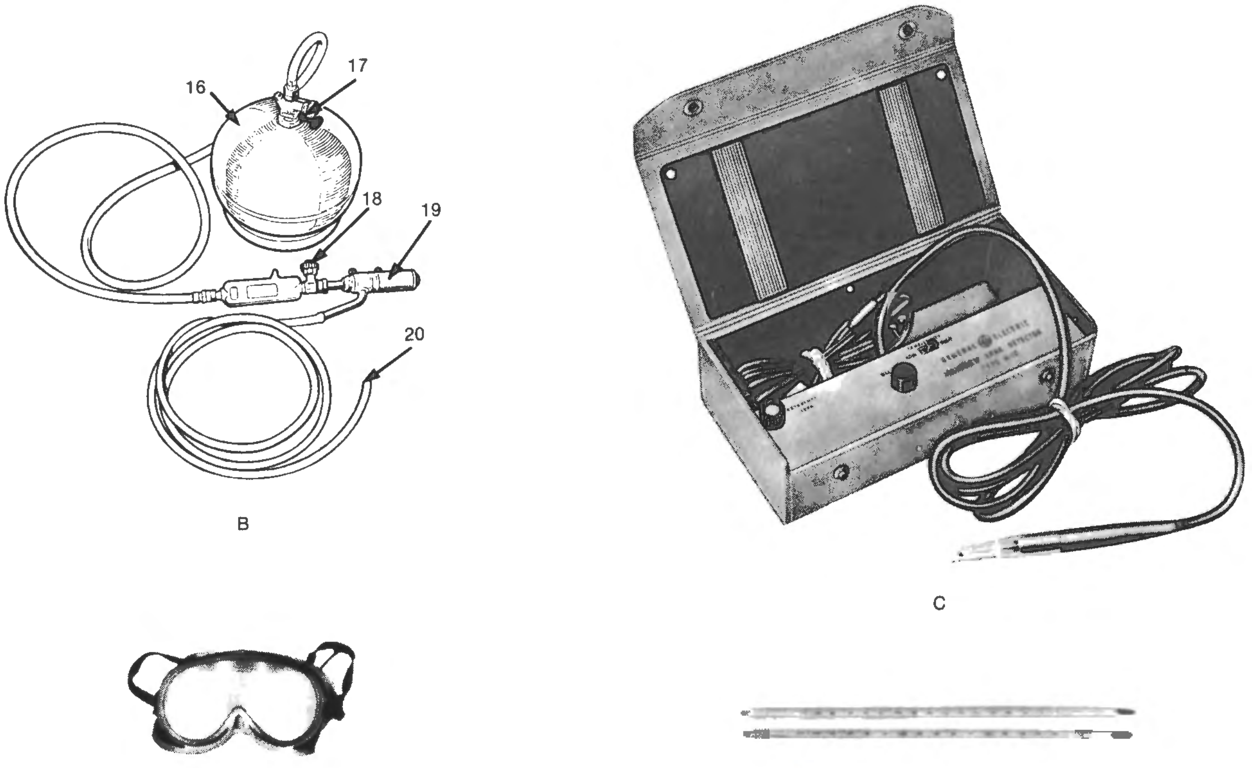


Fig. X-36

SERVICE TOOLS

1	COMPOUND GAUGE	14	TOP CYLINDER VALVE
2	LOW PRESSURE CONTROL VALVE	15	CHARGING CYLINDER HOSE
3	VACUUM CONTROL VALVE	16	GAS CYLINDER
4	CHARGING CYLINDER	17	CYLINDER SHUT-OFF VALVE
5	SIGHT GLASS	18	BURNER SHUT-OFF VALVE
6	VACUUM PUMP CASE	19	BURNER
7	HIGH PRESSURE GAUGE	20	SEARCH HOSE
8	HIGH PRESSURE CONTROL VALVE	A	CHARGING STATION (FRONT AND REAR VIEW)
9	REFRIGERANT CONTROL VALVE	B	LEAK DETECTOR (BURNER TYPE)
10	CYLINDER BASE VALVE	C	LEAK DETECTOR (ELECTRONIC TYPE)
11	REFRIGERANT DRUM	D	SAFETY GOGGLES
12	REFRIGERANT DRUM VALVE	E	THERMOMETERS
13	VACUUM PUMP VALVE		

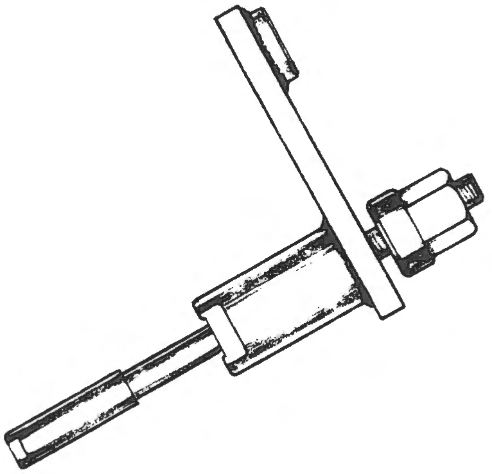
SECTION Z

SERVICE TOOLS

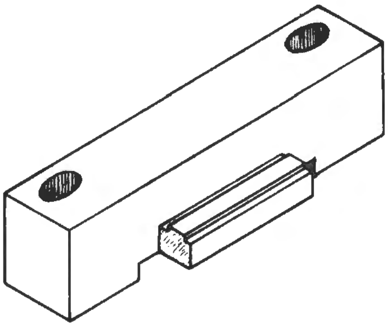
This section contains a list and illustrations of essential service tools which have been developed to prevent the possibility of component damage, ensure correct assembly and achieve minimum operation times.

	Part No.	Description	Page
ENGINE	18GA006	Gudgeon Pin Remover/Replacer (6 Cyl.)	Z-3
	18GA017	Timing Chain Replacer (6 Cyl.)	Z-3
	18GA031	Rear Crankshaft Oil Seal Remover (8 and 6 Cyl.)	Z-3
	18GA041	Engine Lifting Brackets (6 Cyl.)	Z-3
	18GA044	Rear Crankshaft Oil Seal Replacer (8 and 6 Cyl.)	Z-3
	18GA050	Valve Guide Remover/Replacer (8 Cyl.)	Z-3
	18GA051	Automatic Choke Heat Transfer Tube (8 Cyl.)	Z-4
	18GA054	Gudgeon Pin Remover/Replacer (8 Cyl.)	Z-4
	18GA055	Valve Stem Height Gauge (8 Cyl.)	Z-4
	18GA056	Valve Stem Grinding Gauge (8 Cyl.)	Z-4
	18GA057	Hydraulic Tappet Bleed Down Tool (8 Cyl.)	Z-7
	18GA059	Engine Lifting Hooks (8 Cyl.)	Z-4
	18GA98A	Front Crankshaft Nut Spanner (6 Cyl.)	Z-4
	18G1087	Timing Case Oil Seal Remover (8 Cyl.)	Z-7
	311006	Renold Timing Chain Link Remover (6 Cyl.)	Z-7
CLUTCH	18GA032	Clutch Aligning Tool (8 and 6 Cyl.)	Z-7
	18GA053	Spigot Bearing Replacer Adaptor (8 and 6 Cyl.)	Z-7
	18GA069	Spigot Bearing Remover (8 and 6 Cyl.)	Z-5
GEARBOX	18GA047	Rear Extension Housing Oil Seal Replacer with Handle (3 and 4 speed)	Z-5
	18GA048	Input Shaft Remover (3 and 4 speed)	Z-5
	18GA049	Gearshift Rail Pin Remover/Replacer (4 speed)	Z-5
	18GA068	Rear Extension Housing Bush Remover/Replacer (3 and 4 speed)	Z-6
	18GA071	Gear Selector Setting Gauge (3 speed)	Z-5
	18GA073	Dummy Layshaft (3 speed)	Z-5
	18GA074	Dummy Layshaft (4 speed)	Z-5

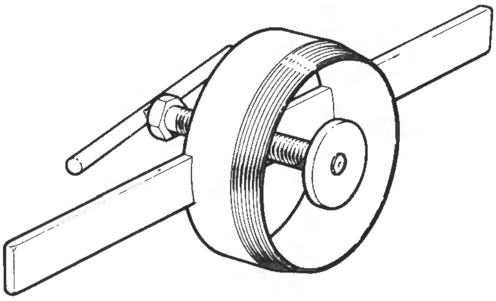
AUTOMATIC TRANSMISSION	B.W.1	Hydraulic Pressure Gauge	Z-6
	B.W.A.33	Gear Train End-Float Checking Tool	Z-8
	B.W.A.34	Front Servo Spanner and Gauge	Z-6
	B.W.A.35	Gear Box Cradle	Z-6
	B.W.37	Clutch Spring Compressor	Z-6
	B.W.38B	Pressure Hose	Z-8
	B.W.41A	Rear Clutch Piston Replacer	Z-8
	B.W.42	Front Clutch Piston Replacer	Z-8
	B.W.548/1	Adaptor — Screw Driver Bit	Z-8
	B.W.548/2A	Adaptor — Band Adjuster	Z-8
	18GA677B	Adaptor Pressure Test	Z-8
	B.W.A.7196	Rear Servo Adjuster	Z-9
	W&B320300	Torque Wrench	Z-6
REAR AXLE	18GA038	Rear Axle Housing Spreader	Z-9
	18GA045	Axle Shaft Remover	Z-9
	18GA046	Differential Pinion Flange Holder	Z-9
	18GA065	Differential Setting Gauge Set	Z-10
	18GA389C	Differential Pinion Oil Seal Remover	Z-9
STEERING	18GA067	Steering Wheel Hub Remover	Z-10
	18GA072	Power Steering Pressure Test Unit	Z-12
	18G1030/1	'C' Spanner	Z-10
	18G1030/2	'C' Spanner	Z-10
SUSPENSION	18GA060	Front Lower Arm Bush Remover/Replacer	Z-10
	18GA061	Rear Lower Link Bush Remover/Replacer	Z-11
	18GA062	Top Link Axle Housing Bush Remover/Replacer	Z-11
	18GA063	Front Spring Retaining Hooks	Z-11
	18GA064	Rear Spring Retaining Hooks	Z-11
	18GA066	Front Strut Gland Nut Spanner	Z-12
GENERAL	18GA284	Impulse Extractor	Z-12
	18GA574	Spring Compressor (Mini)	Z-12
		Spring Compressor Adaptor Plates	Z-13



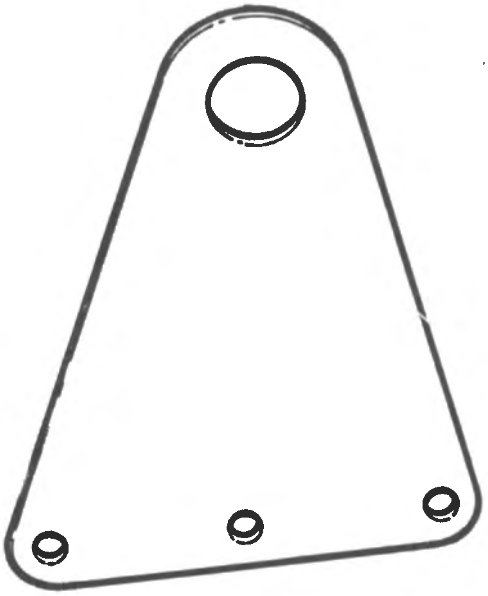
18GA06 — Gudgeon Pin Remover/Replacer (6 Cylinder)
This tool is designed to remove and replace press fit piston gudgeon pins.



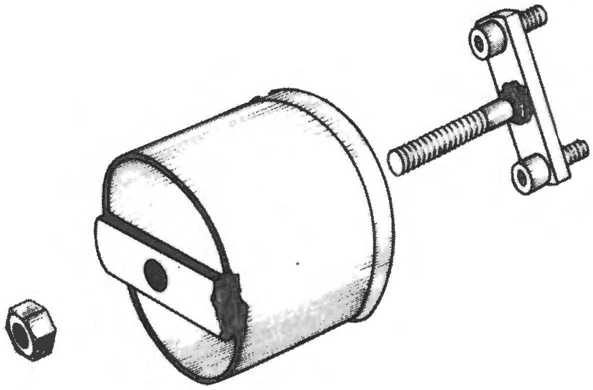
18GA017 — Timing Chain Link Replacer (6 Cylinder)
This tool consists of a block and three punches. The block is attached to the front camshaft carrier set screws with the bolts supplied and supports the chain squarely during re-riveting of the chain link. (Punches not illustrated).



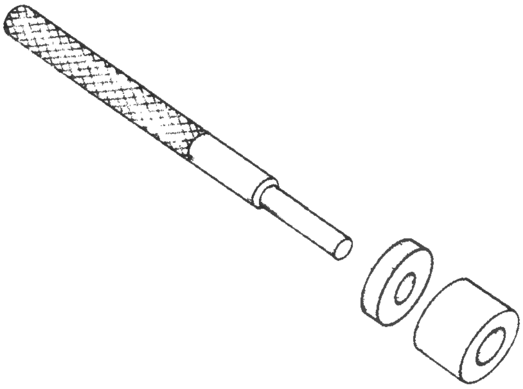
18GA031 — Crankshaft Seal Remover (6 and 8 Cylinder)
To avoid damage to the crankshaft when using this tool, operators are requested to adhere to the manufacturer's instructions supplied with the tool.



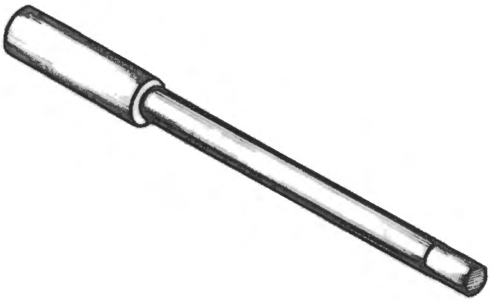
18GA041 — Engine Lifting Brackets — Pair (6 Cylinder)
To be used with a double ended lifting chain.



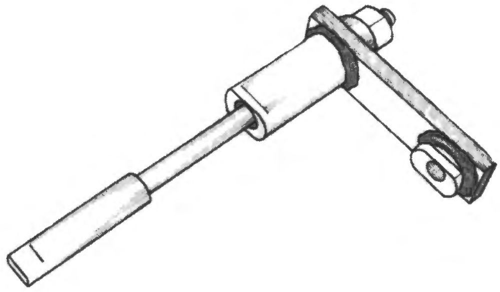
18GA044 — Rear Crankshaft Oil Seal Replacer (6 and 8 Cylinder)
A tube type replacer with a screw base which bolts to the end of the crankshaft.



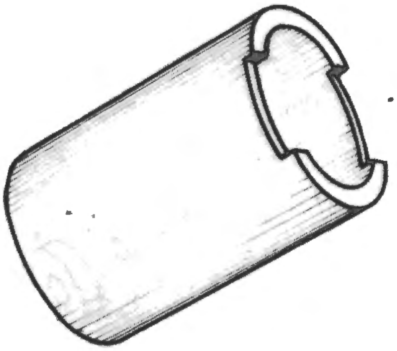
18GA050 — Valve Guide Remover/Replacer (8 Cylinder)
For removing and replacing valve guides.



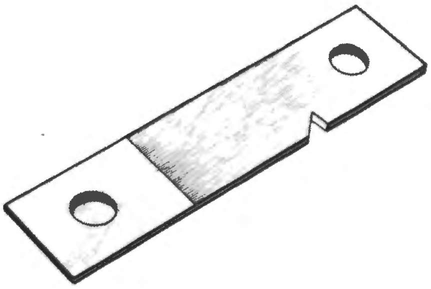
18GA051 — Auto. Choke Tube Remover/Replacer (8 Cylinder)
This tool is designed for removing the choke tube from the exhaust manifold and with the addition of a ¼" flat washer will correctly install the choke tube.



18GA054 — Gudgeon Pin Remover/Replacer (8 Cylinder)
This tool is designed to remove and replace press fit piston gudgeon pins.

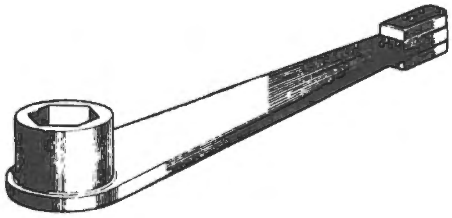


18GA055 — Valve Stem Height Gauge (8 Cylinder)
Using 18GA056 (valve stem grinding gauge) as a straight edge across the top of this tool the exact valve stem height above the cylinder head can be gauged.

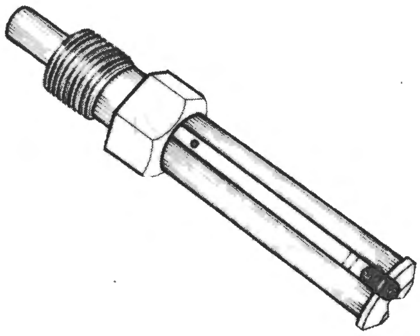


18GA056 — Valve Stem Grinding Gauge (8 Cylinder)
This tool enables the operator to make an accurate check of the amount of material which can be ground from the valve.

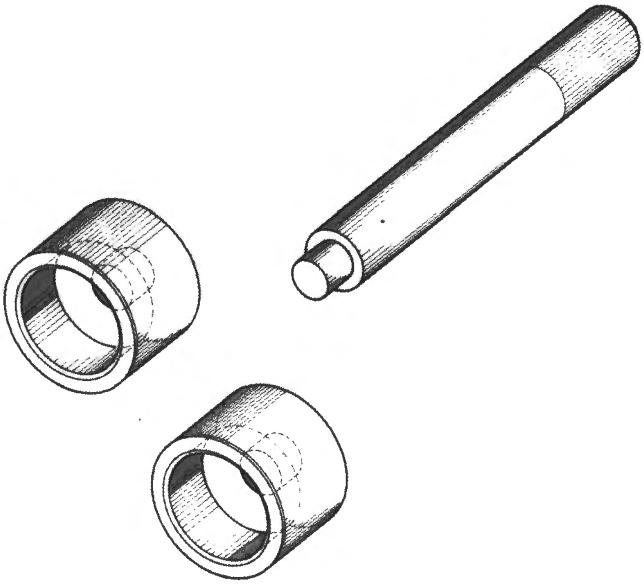
18GA059 — Engine Lifting Hooks (8 Cylinder)
To be used with a length of chain to safely lift the power unit from the vehicle.



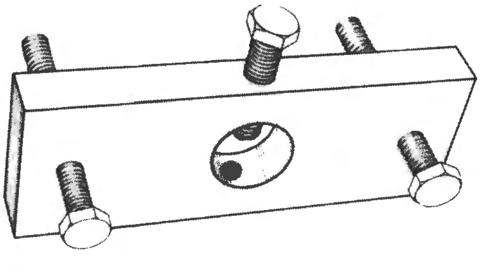
18G98A — Crankshaft Nut Spanner (6 Cylinder)
A shock type spanner designed to remove and replace the crankshaft nut without having to lock the crankshaft.



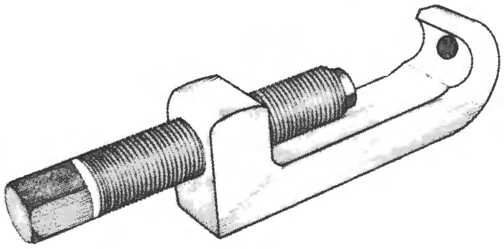
18GA069 — Spigot Bearing Remover (6 and 8 Cylinder)
Attached to 18GA284 (Impulse Extractor) for extracting the spigot bearing with minimum effort.



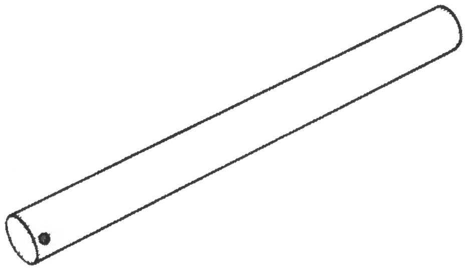
18GA047 — Rear Extension Housing Seal Replacer and Handle (3 and 4 Speed)
This tool is designed for replacing the extension housing seal squarely and without damage to the seal.



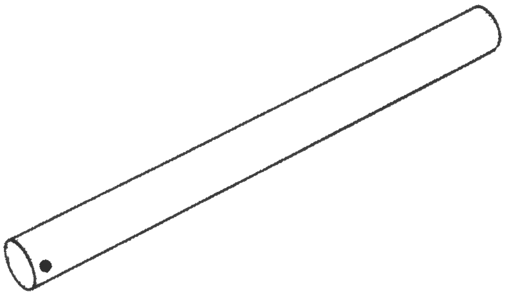
18GA048 — Input Shaft Remover (3 and 4 Speed)
With the correct use of this tool, component damage is eliminated when removing the input shaft.



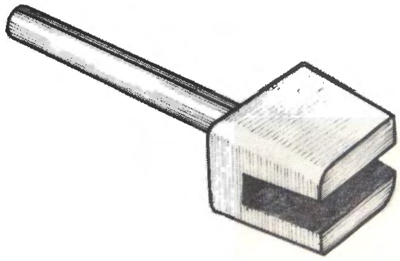
18GA049 — Gearshift Rail Pin Remover (4 Speed)
Designed for the removal of the gearshift rail pin.



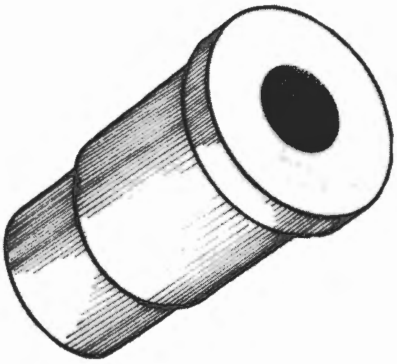
18GA073 — Dummy Layshaft (3 Speed)
Used for removing the layshaft and laygear.



18GA074 — Dummy Layshaft (4 Speed)
Used for removing the layshaft and laygear.

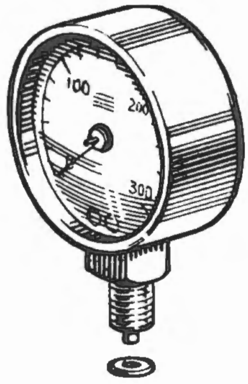


18GA071 — Gear Selector Gauge (3 Speed)
This tool is used to obtain correct gear selector adjustment after replacement of selector components.



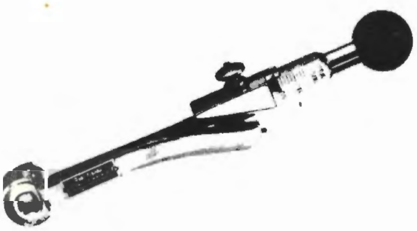
18GA068 — Rear Extension Housing Bushes Remover/Replacer (3 and 4 Speed)

Used with the handle 18GA047/3 for removing and replacing the extension housing bush.



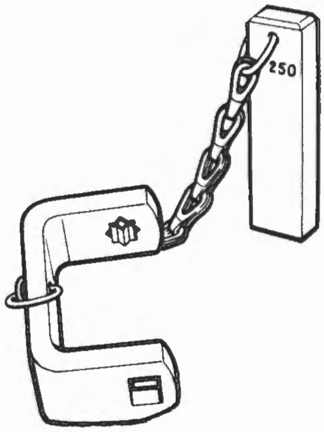
BW1 — Hydraulic Pressure Gauge

Used to record hydraulic pressure during adjustment of the down-shift valve cable and in diagnosis.

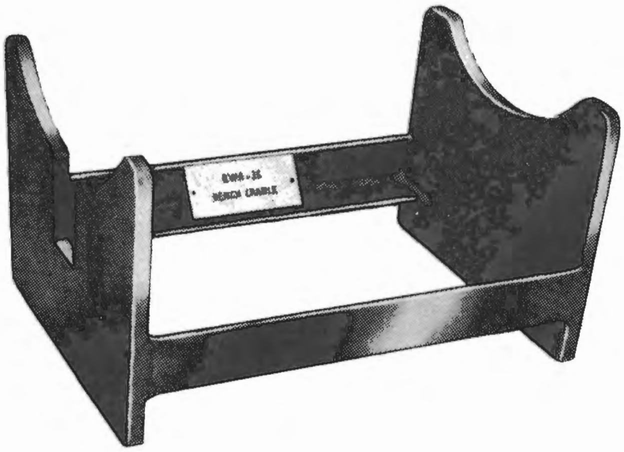


W&B 329300 — Torque Wrench

Used for adjusting bands and in conjunction with screw driver adaptor BW548/1 for torquing screws throughout the transmission.

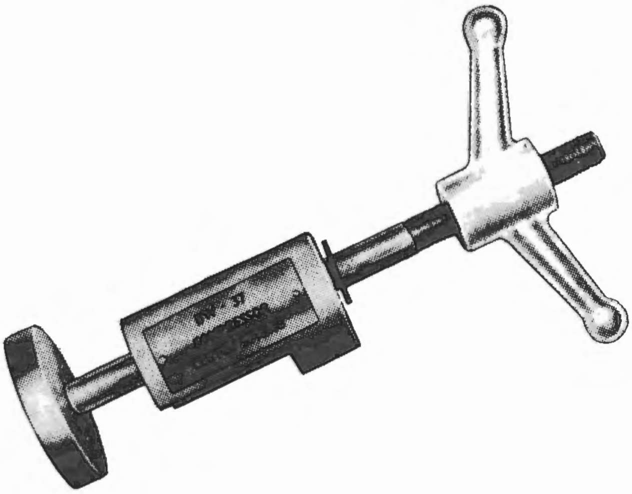


BWA 34 — Front Servo Spanner and Gauge



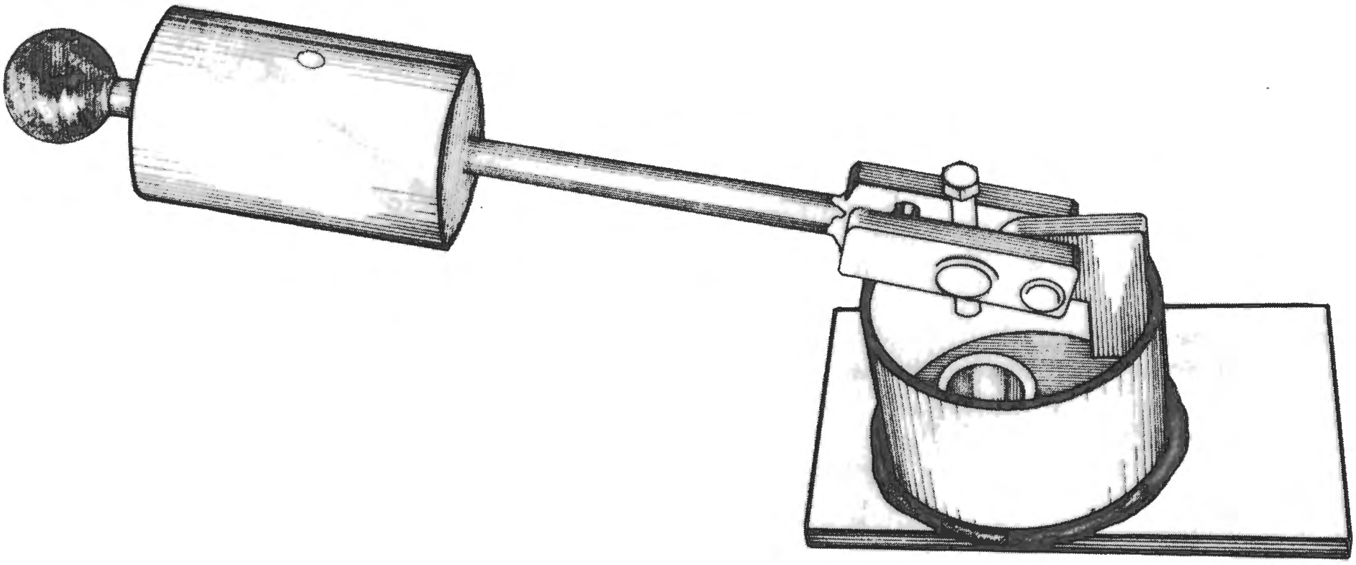
BWA 35 — Gearbox Cradle

For use when overhauling the gearbox on the bench.

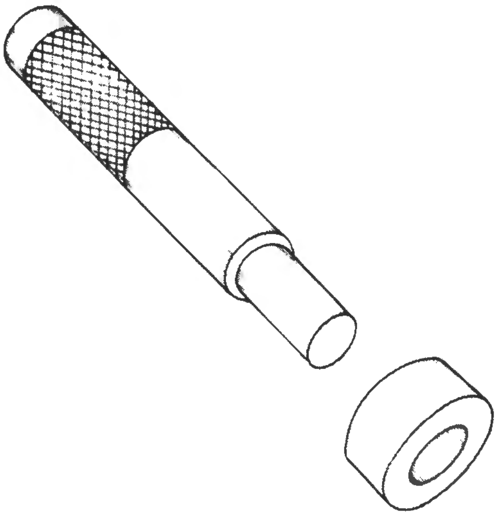


BW 37 — Clutch Spring Compressor

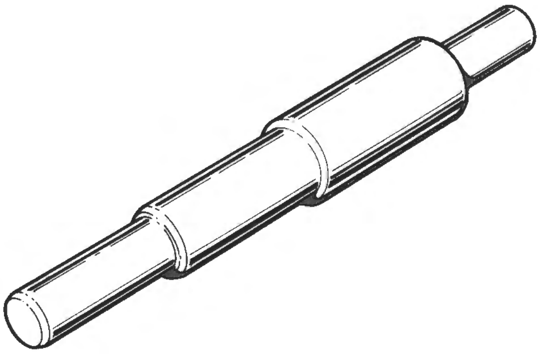
Used to compress the rear clutch spring prior to removal and replacement of the snap ring.



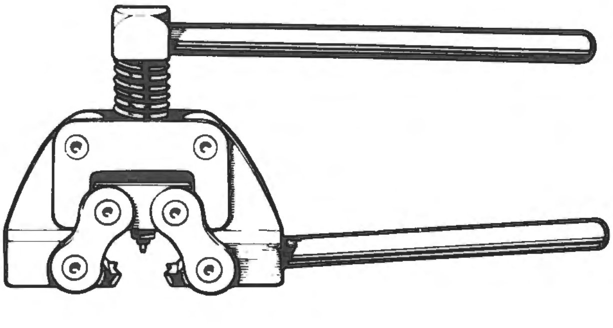
18GA057 — Hydraulic Tappet Bleed Down Tool (8 Cylinder)
This tool is used for assessing the condition of hydraulic tappets.



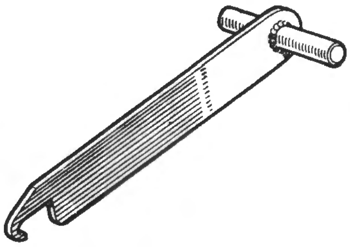
18GA053 — Spigot Bearing Replacer (6 and 8 Cylinder)
Used in conjunction with 18GA052 (clutch shaft aligner) for replacing the spigot bearing.



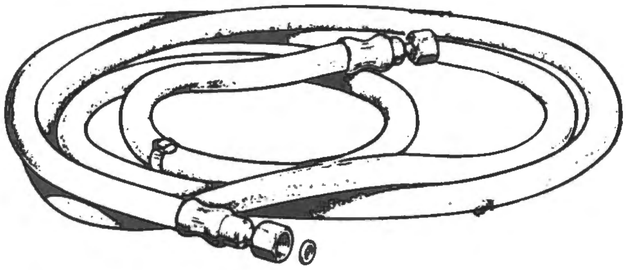
18GA032 — Clutch Shaft Aligner (6 and 8 Cylinder)
To ensure easy and accurate assembly of the clutch components.



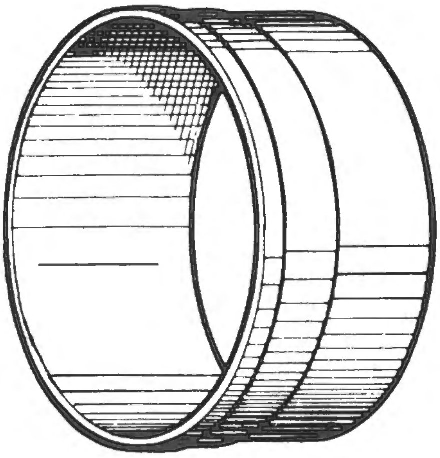
311006 — Renold Timing Chain Link Remover (6 Cylinder)
This is a Renold Special Tool designed to remove a chain side plate to permit removal of the timing chain.



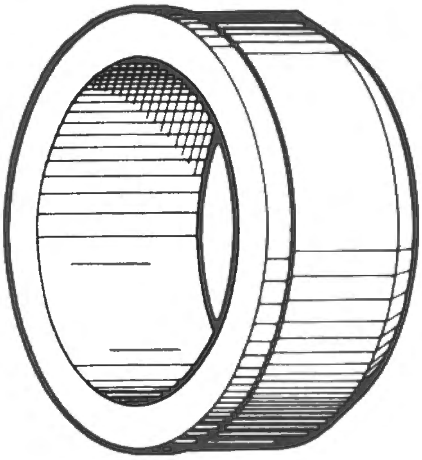
18G1087 — Oil Seal Remover (8 Cylinder)
For removing the front crankshaft oil seal.



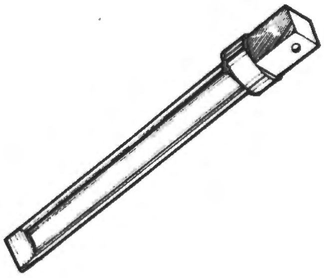
BW38B — Pressure Hose
For use with BW1 hydraulic pressure gauge.



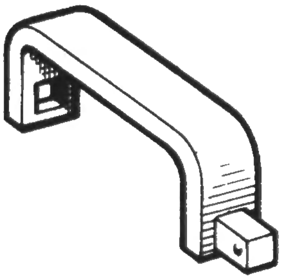
BW41A — Rear Clutch Piston Replacer
Used to provide maximum protection for the oil sealing rings during assembly.



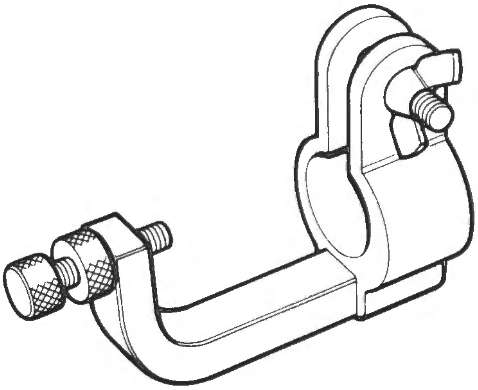
BW42 — Front Clutch Piston Replacer
Used during assembly to avoid damage to the rubber sealing rings.



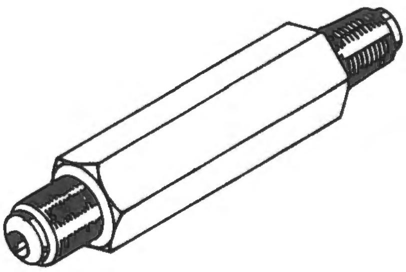
BW548/1 — Adaptor Screw Driver Bit
Used with W&B 320300 (Torque Wrench) to torque the valve block fixing screws.



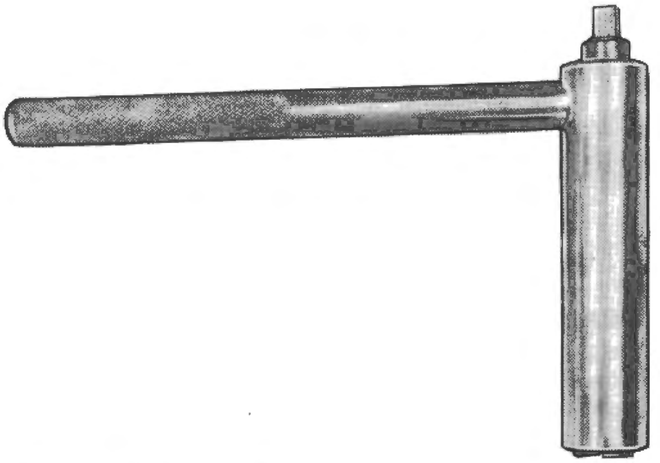
BW548/2A — Adaptor Band Adjuster
Used for correct adjustment of the servo bands in conjunction with torque wrench W&B 320300.



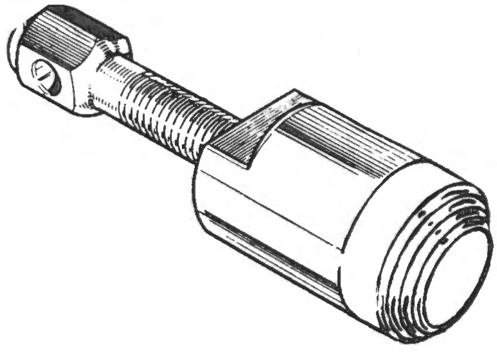
BWA33 — Gear Train End Float Checking Tool



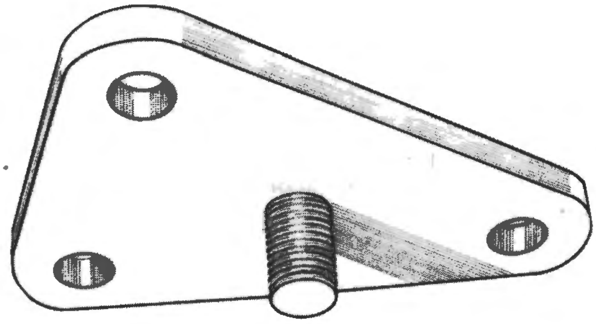
18GA677B — Adaptor — Pressure Test
This adaptor has been developed for use with the current BW38B pressure hose.



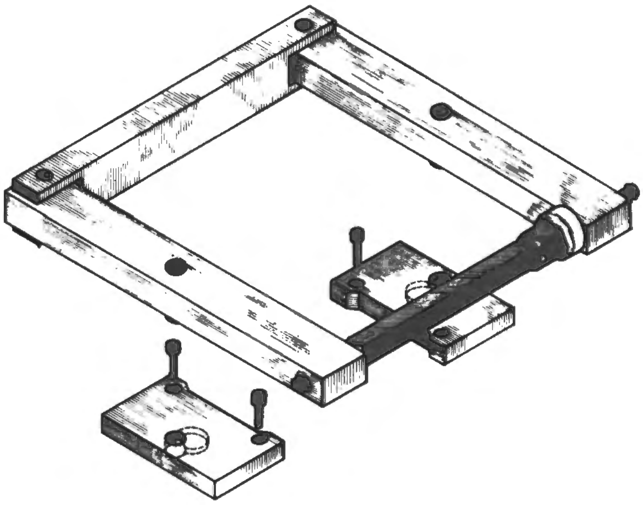
BWA 7196 — Rear Servo Adjuster



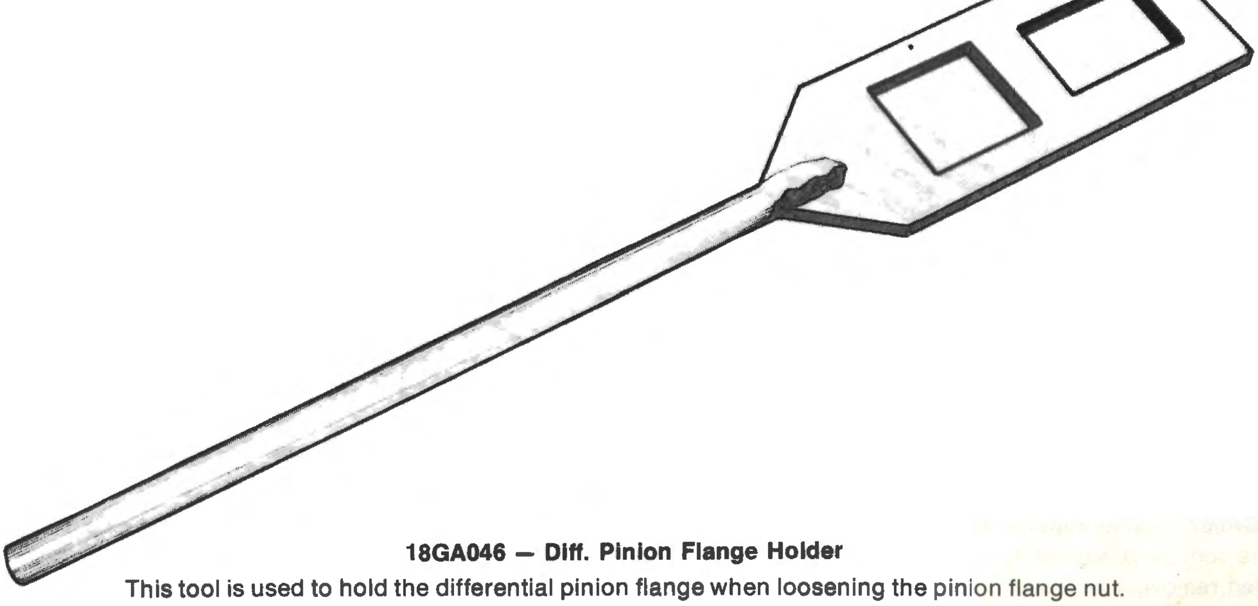
18G389C — Differential Pinion Oil Seal Remover
Used for removing the differential pinion oil seal without damaging surrounding components.



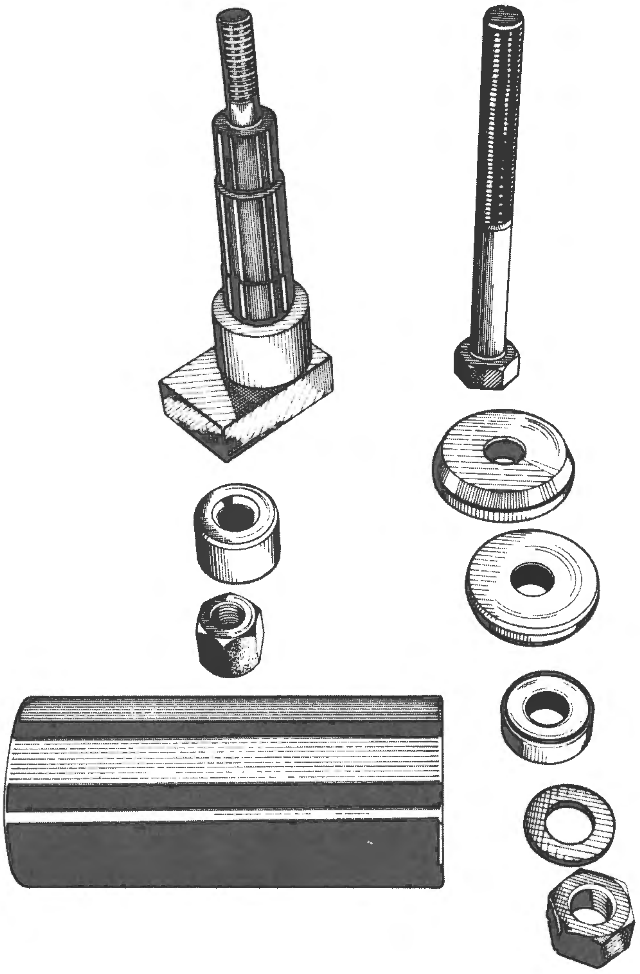
18GA045 — Axle Shaft Remover
Used in conjunction with 18GA284 (Impulse Extractor) for removing axle shafts.

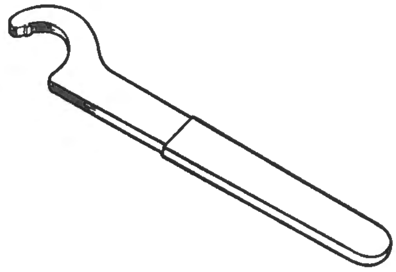


18GA038 — Rear Axle Housing Spreader
A tool designed for spreading the rear axle housing.

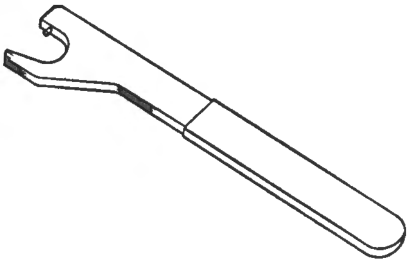


18GA046 — Diff. Pinion Flange Holder
This tool is used to hold the differential pinion flange when loosening the pinion flange nut.



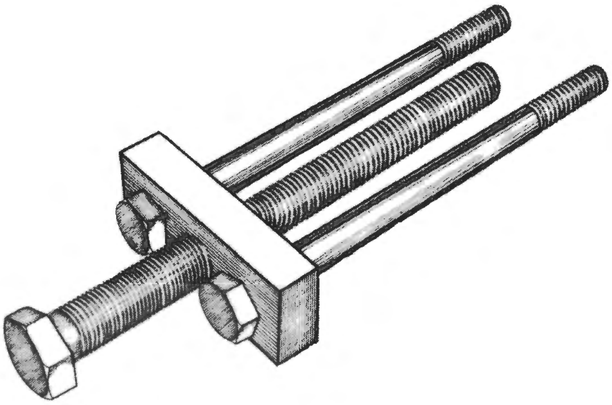


18GA1030/1 – Steering Rack Ball Joint Spanner
Designed to adjust the steering rack ball joint to the correct torque figure. Additional leverage must not be used.

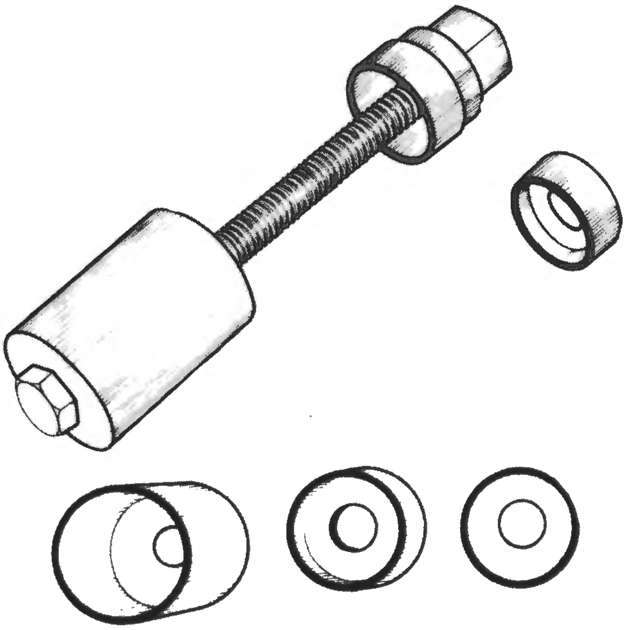


18GA1030/2 – 'C' Spanner
Designed to adjust the steering rack ball joint to the correct torque figure. Additional leverage must not be used.

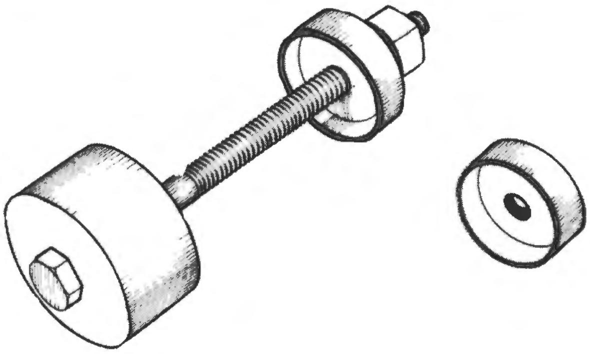
18GA065 – Differential Pinion Setting Gauge
For the correct setting of the differential pinion assembly.



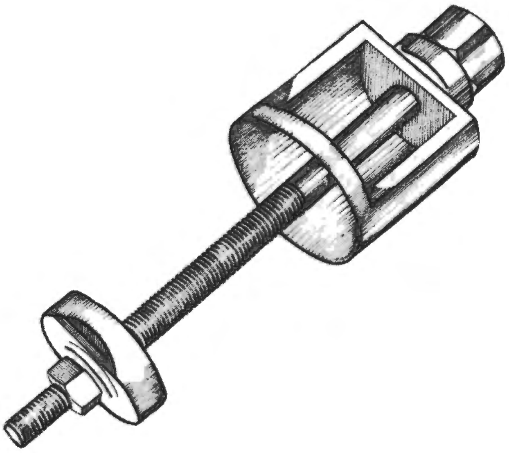
18GA067 – Steering Hub Remover
This tool is designed to prevent component damage when removing the steering hub.



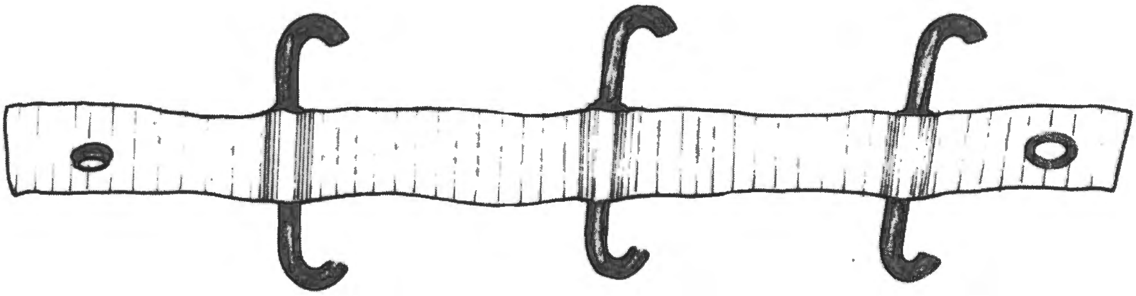
18GA060 – Front Lower Arm Bush Remover/Replacer
This tool is designed for removing and replacing the front lower arm bushes using forcing screw 18GA061.



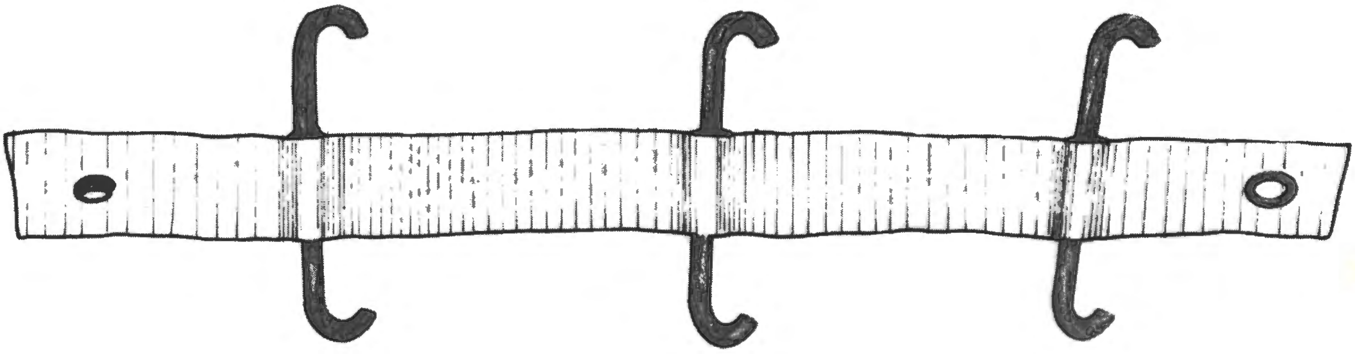
18GA061 — Rear Lower Link Bush Remover/Replacer
A tool designed for the easy removal of the rear lower link bushes.



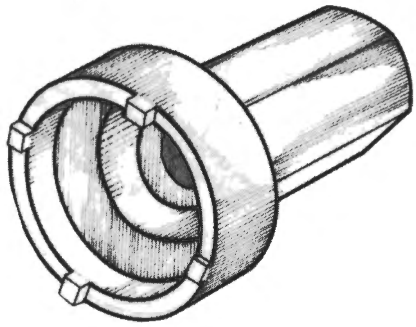
18GA062 — Top Link Axle Housing Bush Remover/Replacer
For removing top link axle housing bushes.



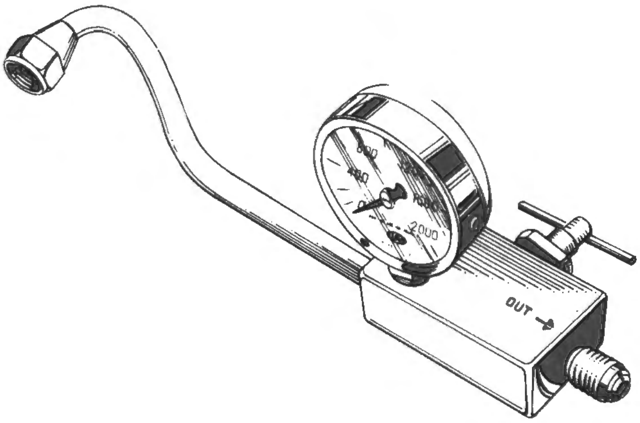
18GA063 — Front Spring Retaining Hooks
This tool is used when replacing a front spring or suspension component.



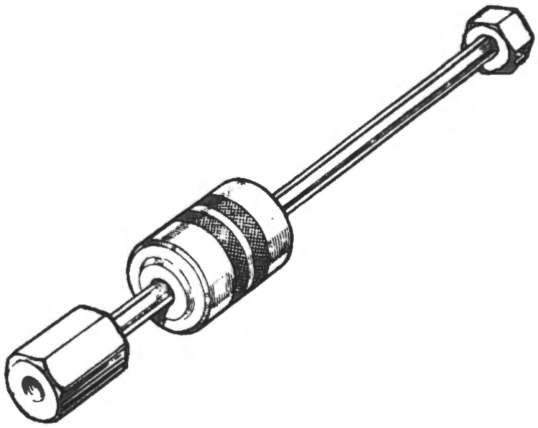
18GA064 — Rear Spring Retaining Hooks
This tool is used when replacing a rear spring suspension component or rear axle.



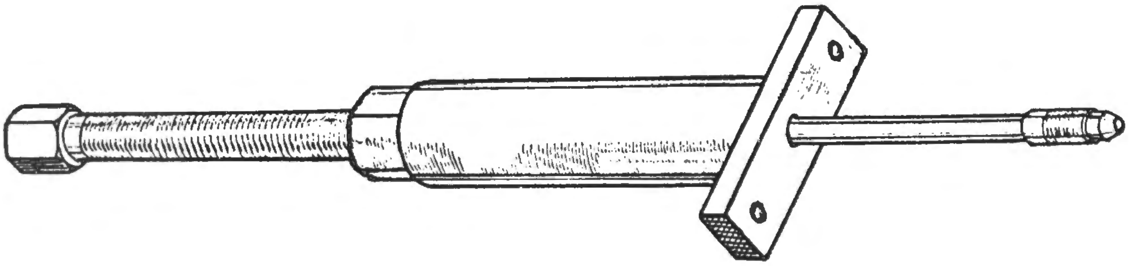
18GA066 — Front Strut Gland Nut Spanner
Used for removing the gland nut and when replacing is used with a torque wrench.



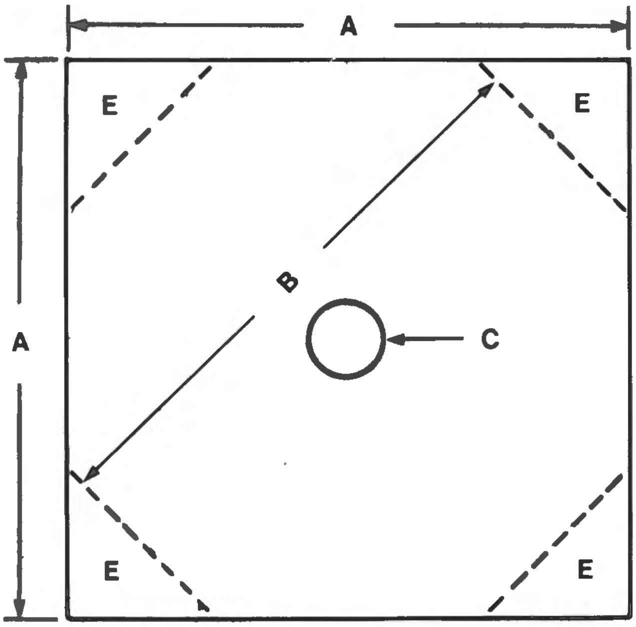
18GA072 — Power Steering Test Unit
Used to record hydraulic pressure during testing of the system.

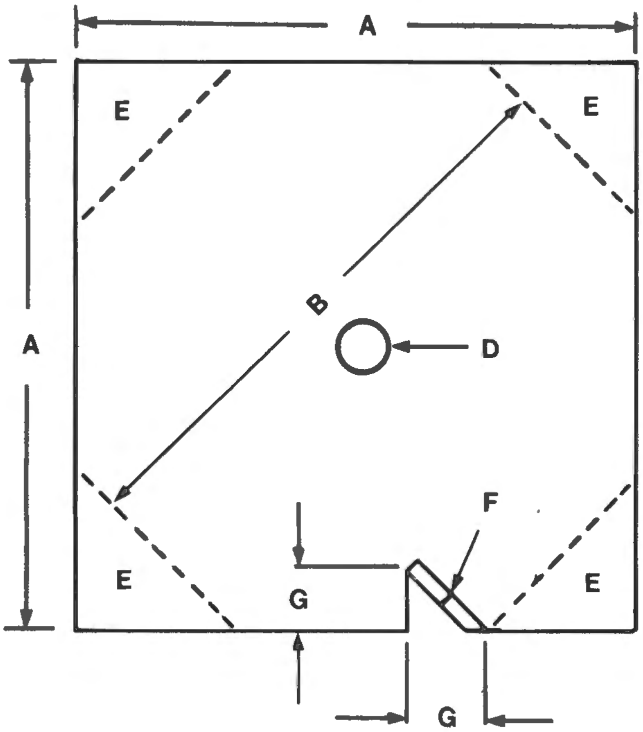


18GA284 — Impulse Extractor
A general purpose impulse extractor used with a variety of adaptors.



18GA574 — Spring Compressor (Mini)
Used in conjunction with the adaptor plates which can be manufactured in the workshop to the specifications outlined in this section.





Spring Compressor Adaptor Plates

To be used with 18GA574 (Spring Compressor) when fitting a new coil spring. Refer Front and Rear Suspension Sections.

Material: ¼" Plate

Dimensions:
- A — 5¾"
- B — 6"
- C — ¾" Clearance hole
- D — ½"
- E — Corners bent at 45°
- F — Stop bent at 90°
- G — ¾"