Automatic Gearbox

Testing

Before starting work on the automatic gearbox, carry out the 'TEST PROCEDURE'. After repairs or rectification, repeat the 'TEST PROCEDURE' to ensure that the gearbox is satisfactory.

Automatic Gearbox

DESCRIPTION

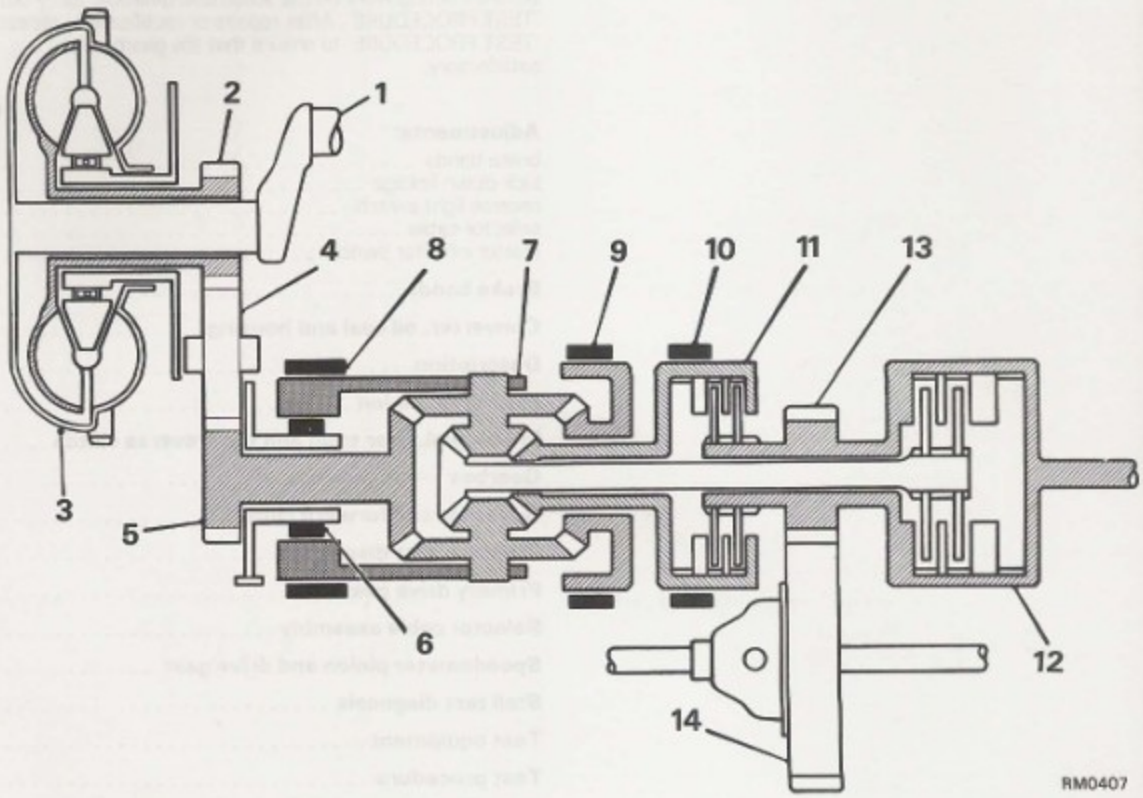

Fig. 1

Mechanical power train (diagrammatic)

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

The automatic gearbox, driven through a fluid torque converter, provides four forward gears and reverse. It is controlled by a floor-mounted lever which has seven positions marked on its quadrant:

'P' for park
—no gear selected and the transmission output shaft locked.

'R' for reverse
—reverse gear selected and held.

'N' for neutral
—no gear selected and no lock applied to transmission output.

'1' for first gear
—first gear selected and held; this is a freewheel gear on overrun so should not be used for engine braking.

'2' for second gear
—second gear selected and held.

'3' for third gear
—third gear selected and held.

'D' for drive
—automatic drive using all forward gears; rapid down changes can be obtained by pressing the accelerator pedal down quickly.

The gear ratios are provided by a spiral bevel epicyclic gear train, various components of which are brought into use by the following mechanical devices:

Freewheel
—prevents rotation of the gear carrier in one direction, thereby providing a reaction when the forward clutch is engaged and so giving first gear drive.

Forward clutch
—hydraulically operated, multi-disc, single piston; used for forward gears.

Top and reverse clutch
—hydraulically operated, multi-disc, tandem pistons; used for top gear, a single piston provides the clamping load. When used for reverse, both pistons operate, increasing the clamping pressure to provide for the additional torque.

Brake bands
—three brake bands are provided and are operated by hydraulic servos. One brake band is used for second gear, one for third gear and one for reverse. The clamping load of each brake band is applied to different members of the gear train to provide a variety of ratios.

Governor
—mechanical, sensitive to road speed and to throttle position; the governor controls all gear changes while 'D' is selected.

The gearbox is operated by hydraulic pressure provided by the engine oil pump, this pressure being directed to the required mechanical component by a valve block containing the following valves.

Regulator valve
—controls the main line pressure.

Selector valve
—directs oil to the governor valve for automatic gear changes or to the appropriate clutch or servo for manual changes.

Governor valve
—operated by the mechanical governor and directs oil to the appropriate clutch or servo for automatic gear changes.

Shuttle valves
—direct oil to the appropriate clutch or servo from either the selector or governor valve when changing from second to third and third to top. Additional pistons ensure that during upward changes the old ratio is released simultaneously with new ratio engagement.
First gear does not use a shuttle valve.

Engagement control valve
—eliminates harsh engagement when selecting a forward gear while stationary. The selector valve directs oil, through shuttle valves, to third and reverse servos when a forward gear is selected. This applies gentle braking to the gear train and allows smooth engagement when the engagement control valve directs oil to the forward clutch. The engagement control valve then directs oil behind the shuttle valves which allow the third and reverse servos to exhaust.

TEST EQUIPMENT

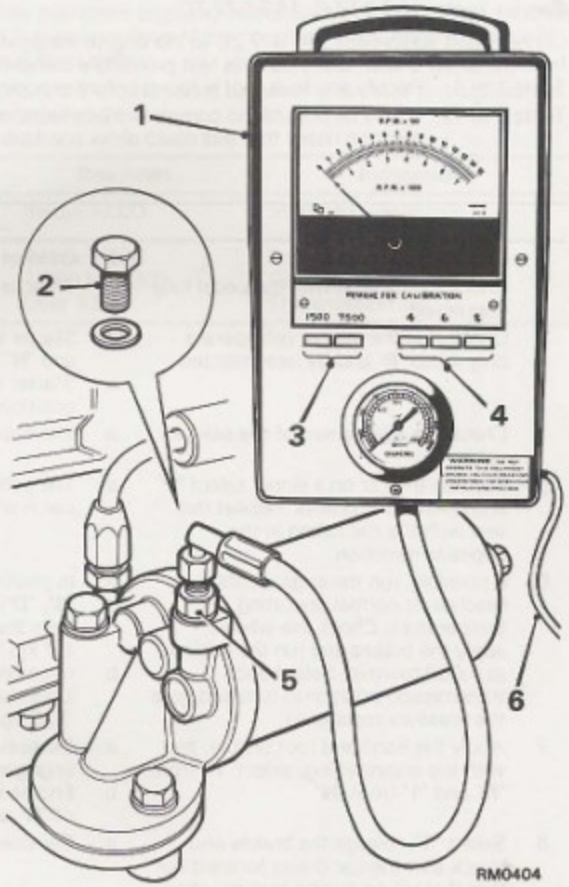

Fig. 2

Connecting test equipment

1 Service tool 18G 677 ZC
2 Plug
3 Scale selector buttons
4 Engine type selector buttons
5 Service tool adaptor 18G 677 C
6 Tachometer connections

Connecting

Service tools: 18G 677 C, 18G 677 ZC

1. Remove the screwed plug from the oil filter head.
2. Fit tool adaptor 18G 677 C into the filter head and connect the pressure pipe union of tool 18G 677 ZC onto the adaptor.
3. Connect the tachometer connections of tool 18G 677 ZC as follows:
   a. Red connection to ignition coil (+).
   b. Black connection to battery earth (−).
4. Set tool 18G 677 ZC to '4 CYL' and '× 1000'.

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TEST PROCEDURE

Service tools: 18G 677 C, 18G 677 ZC

Connect test equipment 18G 677 ZC to the engine transmission and position the equipment inside the car where it can be read from the driver's seat. Carry out this test procedure completely, in the order given, noting:

Tests 1 to 4 Rectify any fault as it is found before proceeding to the next test.

Tests 5 to 12 It may be possible to complete these tests, noting any faults in order to rectify them after the tests. However, it must be noted that this could allow one fault to mask another.

	Test		Fault		Rectification
1.	Check the oil level	a.	Oil level incorrect	1a.	Correct the oil level
2.	Check the throttle with the pedal fully depressed	a.	Throttle not fully open	2a.	Adjust the throttle cable
3.	Check that the starter will operate only when **'P'** and **'N'** are selected	a.	Starter will not operate in **'P'** and **'N'**	3a.	Adjust the inhibitor switch
		b.	Starter operates in all positions	3b.	Check the inhibitor switch and its wiring for short-circuiting
4.	Check the adjustment of the selector cable	a.	The cable is out of adjustment	4a.	Adjust the cable
5.	Position the car on a slope, select **'P'** and release the brakes. Repeat this test with the car facing in the opposite direction	a.	The park lock fails to hold the car in one or both directions	5a.	Remove and check the park lock mechanism
6.	If possible, run the engine until it reaches its normal operating temperature. Chock the wheels, apply the brakes and run the engine at 1,000 rev/min. Select each transmission position in turn and note the pressure registered	a.	In position **'P', 'N', '1', '2', '3', 'D':** Less than 6.6 bar (95 lbf/in², 6.7 kgf/cm²)	6a.	Refer to 'Pressure Test Diagnosis'
		b.	In position **'R':** Less than 10 bar (145 lbf/in², 10.0 kgf/cm²)	6b.	Refer to 'Pressure Test Diagnosis'
7.	Apply the hand and foot brakes, and with the engine idling, select **'R'** from **'N'** and **'1'** from **'N'**	a.	Excessive bump on engagement of **'R'** or **'1'**	7a.	Reduce engine idle speed
		b.	Engine stalls on engagement of **'R'** or **'1'**	7b.	Increase engine idle speed
8.	Select **'1'**, release the brakes and check that the car drives forward but that there is no engine braking when the throttle is released	a.	Car does not drive forward	8a.	Remove and check the forward clutch; if satisfactory renew the free wheel
		b.	Engine braking can be felt	8b.	Renew the free wheel
9.	Select **'1'** and drive away, using the manual gear-change to select **'2'** and **'3'** progressively as the road speed increases. When the road speed is above 25 m.p.h. (40 km/h) select **'D'** and release the throttle pedal	a.	Drive in **'1'** but not in **'2'**	9a.	Check the second gear brake band adjustment. If satisfactory, check the second gear servo
		b.	Drive in **'1'** and **'2'** but not in **'3'**	9b.	Check the third gear brake band adjustment. If satisfactory, check the third gear servo
		c.	Drive in **'1', '2',** and **'3',** but no upward gear-change (to fourth gear) on selecting **'D'**	9c.	Check the kick-down linkage adjustment. If correct, check the governor for freedom of operation. If the governor is satisfactory, remove and check the top reverse clutch
10.	Stop the car, select **'D'** and accelerate up through the gears using 'kick-down'. Check that the gear-changes occur at the following road speeds: 1–2 change at 29 to 37 m.p.h. (46 to 59 km/h) 2–3 change at 43 to 51 m.p.h. (69 to 82 km/h) 3–4 change at 61 to 69 m.p.h. (98 to 111 km/h)	a.	Gear-changes occur at low speeds	10a.	Check the kick-down linkage adjustment
		b.	Gear-changes occur at high speed	10b.	Check the kick-down linkage adjustment. If correct, check the governor for freedom of operation
11.	Stop the car, select **'R'** and drive the car backwards	a.	Car will not drive backwards	11a.	Check reverse gear brake band adjustment. If satisfactory, check the reverse servo.
12.	Chock the wheels and apply the hand and foot brakes. Select **'R'** and depress the throttle pedal fully for not more than 10 seconds. Note the highest rev/min obtained. Select **'D'** and hold full throttle for not more than 10 seconds. Note the highest rev/min obtained	a.	A reading outside the range 1,700 to 1,800 rev/min	12a.	Refer to 'Stall Test Diagnosis'

PRESSURE TEST DIAGNOSIS

The figures given in test 6 of the 'Test Procedure' are the minimum acceptable figures for a satisfactory transmission line pressure. Pressure variations due to temperature changes may be ignored as long as the pressure does not drop below the figure given.

Check the figures obtained in the pressure test (test 6) against the following table:

Note: *When repairs are being carried out to rectifify a low pressure fault, take the opportunity to examine other components which are accessible and which may have been affected by low pressure.*

Fault	Possible cause
1. Low pressure in all selector positions	a. Blocked oil strainer b. Damaged valve block c. Worn or leaking pump d. Wrongly positioned filter gasket
2. Low pressure in positions **'1', '2', '3'** and **'D'**	a. Leakage from forward clutch or forward clutch supply line
3. Low pressure in position **'2'**	a. Leakage from second gear servo or second gear servo supply line
4. Low pressure in position **'3'**	a. Leakage from third gear servo or third gear servo supply line
5. Low pressure in position **'R'**	a. Leakage from reverse servo or reverse servo supply line b. Leakage from top/reverse clutch or top/reverse clutch supply line

STALL TEST DIAGNOSIS

The maximum engine speed obtained in the stall test (see test 12) is an indication of the condition of the engine converter, and transmission.

Check the engine speed obtained in the stall test against the following table:

Rev/min	Indication
Below 1,000	Stator slip (defective converter)
Below 1,600	Engine power down
1,700 to 1,800	Satisfactory
Over 1,900	Transmission slip

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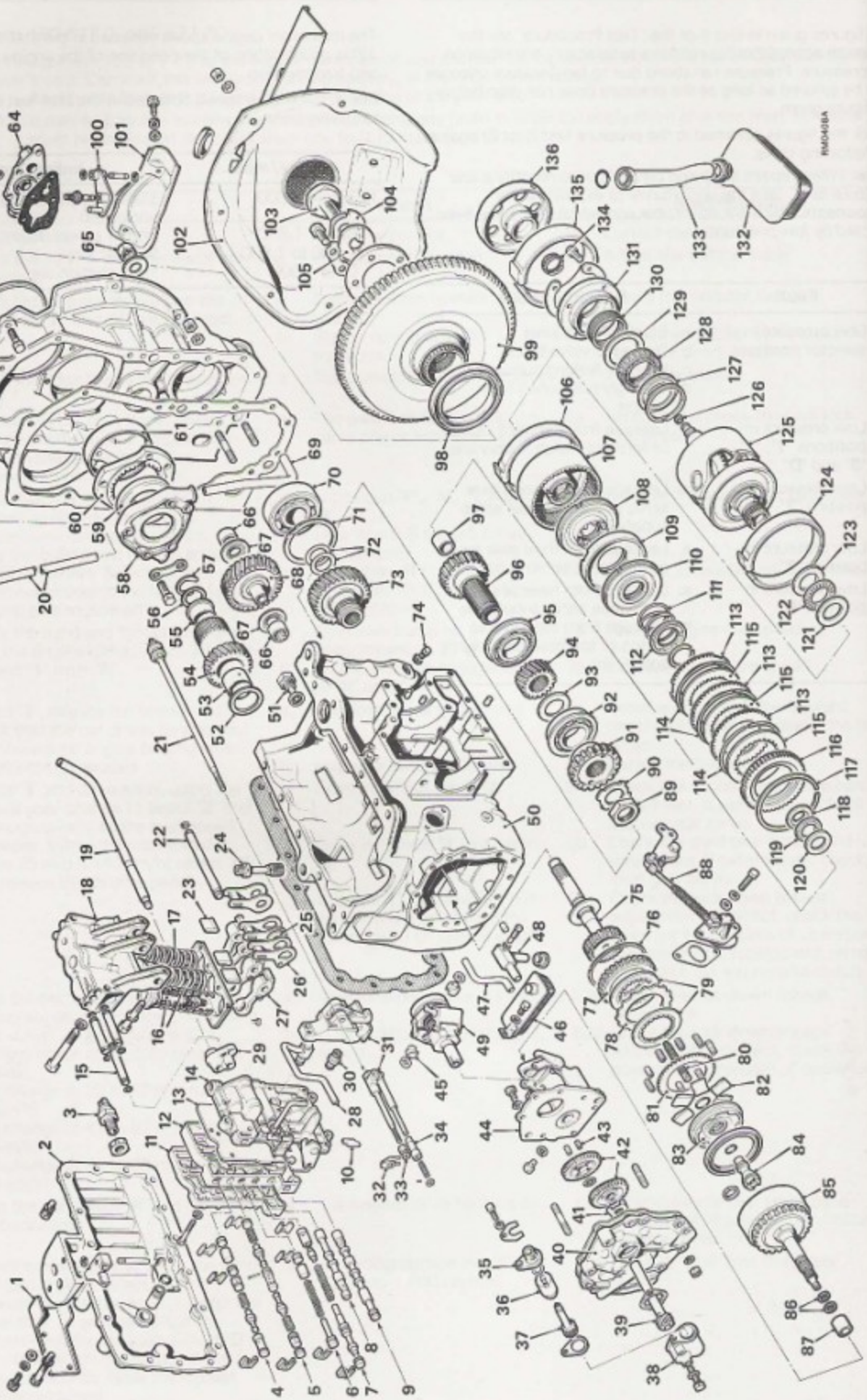

AUTOMATIC GEARBOX COMPONENTS

1 Inhibitor switch guard plate
2 Front cover
3 Inhibitor switch
4 Reverse dump valve and third gear valve
5 Top and second gear valves
6 Engagement control pressure valve
7 Regulator valve
8 Governor valve
9 Selector valve
10 Flap valve
11 Lid
12 Valve chest
13 Separator plate
14 Pipe chest
15 Pipes — valve block to servos
16 Second and reverse gear servos
17 Third gear servo
18 Servo body
19 Pipe — converter to valve block
20 Dipstick tube
21 Transverse selector rod
22 Pivot shaft
23 Strut
24 Adaptor
25 Pivot shaft washer
26 Reaction levers
27 Servo levers
28 Valve block connector and pipe
29 Guide — pipe assembly
30 Valve block connector
31 Park lock assembly
32 Locking clip
33 Adjuster
34 Cam
35 Bush assembly
36 Plain bush
37 Speedometer pinion
38 Speedometer drive housing
39 Speedometer gear
40 End housing
41 Thrust washer
42 Governor drive gears
43 Roll pin
44 Governor mounting plate
45 Yoke
46 Oil strainer
47 Pipe — forward clutch
48 Oil suction pipe
49 Governor
50 Gearbox case
51 Drain plug
52 Front thrust washer
53 Front bush
54 Converter output gear
55 Rear bush
56 Backing ring
57 'C' shaped thrust washer
58 Rear case
59 Oil seal
60 Stator carrier
61 Bush
62 Converter housing
63 Oil pump cover
64 Low pressure valve
65 Input gear nut
66 Idler gear bearing
67 Thrust washer
68 Idler gear
69 Pipe — converter to low pressure valve
70 Bearing
71 Retainer
72 Shims
73 Input gear
74 Dowel bolt
75 Forward shaft
76 Circlip
77 End plate
78 Intermediate plate
79 Clutch plates
80 Reverse shut-off valve
81 Pressure plate
82 Toggle
83 Piston
84 Reverse shut-off valve piston
85 Forward clutch
86 Forward clutch shaft rings
87 Assembly sleeve
88 Kick-down linkage
89 Nut
90 Lock washer
91 Forward clutch hub
92 Bearing
93 Spacing washer
94 Final drive pinion
95 Bearing
96 Top and reverse clutch hub
97 Bush
98 Oil seal
99 Converter
100 Bellcrank lever
101 Bellcrank lever cover
102 Converter cover
103 Converter retaining bolt
104 Lock washer
105 Key plate
106 Second gear brake band
107 Top and reverse clutch
108 Reverse gear booster piston
109 Cylinder
110 Top gear piston
111 Piston return spring
112 Spring retainer
113 Intermediate plates
114 Separation springs
115 Clutch plates
116 End plate
117 Circlip
118 Thrust washer
119 Needle-roller thrust bearing
120 Thrust race washer
121 Thrust washer (thin)
122 Needle-roller thrust bearing
123 Thrust washer (thick)
124 Third gear brake band
125 Bevel gear train
126 Sealing ring
127 End plate spacer
128 Freewheel
129 Intermediate spacer
130 Needle-roller bearing
131 Freewheel housing
132 Main oil strainer
133 Oil pick-up pipe
134 Needle-roller bearing
135 Reverse gear brake band
136 Freewheel reaction member

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SELECTOR CABLE ADJUSTMENT

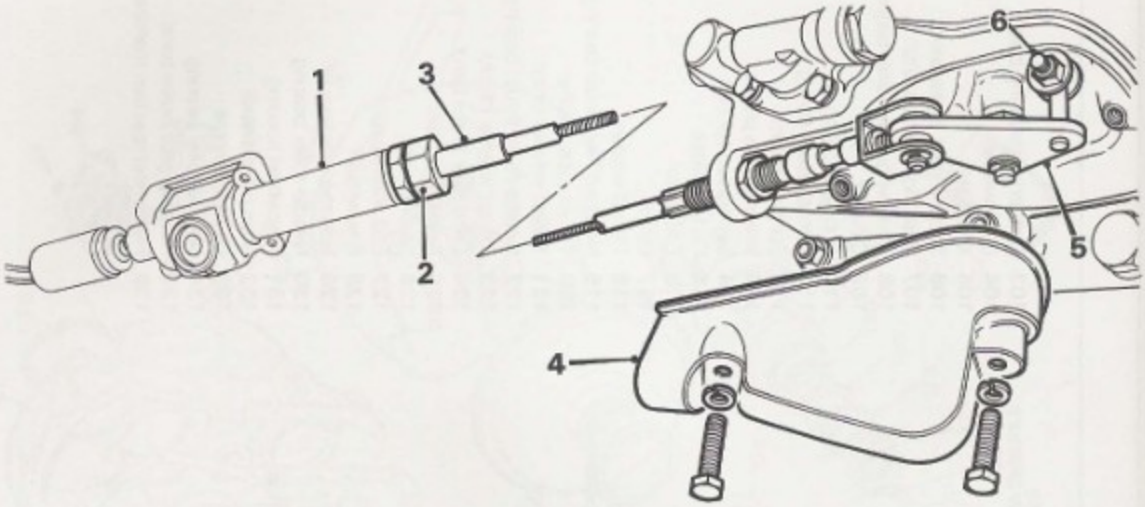

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Fig. 4

Selector cable adjustment

1 Selector housing
2 Cable securing nut
3 Outer cable
4 Bellcrank cover
5 Bellcrank lever
6 Transverse selector rod

Checking

1. Firmly apply the handbrake, select **'N'** and start the engine.

2. Move the selector lever to the **'R'** position and check that reverse is engaged. Slowly move the lever back towards the **'N'** position, checking that the gear is disengaged just before or exactly when the lever locates the **'N'** position.

3. Repeat the above procedure, moving the selector lever from **'1'** to **'N'.**

Adjusting

1. Raise the front of the car and support it on stands.

2. Slacken the large nut securing the cable into the selector housing.

3. Remove the bellcrank cover from the gearbox and, using the bellcrank lever, pull the transverse selector rod to its fully out (park) position.

4. Select **'P',** locate the lever (by feel) in the notch at the right-hand side of the gate and hold it there, if a notch cannot be felt, remove the selector lever nacelle and locate the lever 0.035 in (0.9 mm) from the end of the gate slot. While the lever is held in this position, a second operator should adjust the cable as follows:

5. Pull the outer cable away from the selector housing, holding the bellcrank lever in the fully out (park) position. Tighten the cable securing nut.

6. Repeat the checking procedure.

7. Check that the engine will start only when **'P'** or **'N'** is selected and, if necessary, adjust the starter inhibitor switch.

KICK-DOWN LINKAGE ADJUSTMENT

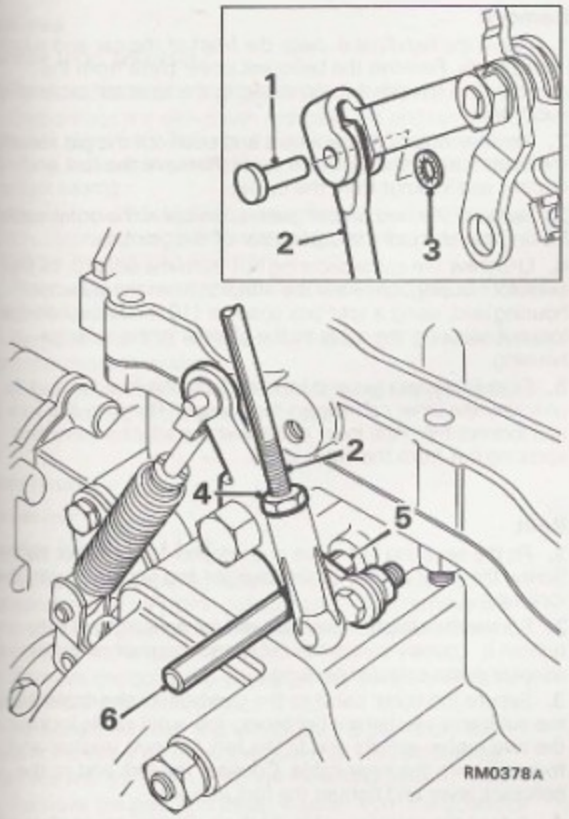


Fig. 5

Kick-down adjustment

1 Clevis pin
2 Control rod
3 Starlock washer
4 Locknut
5 Hole in gearbox casing
6 6 mm (¼ in) diameter rod)

Service tool: 18G 677 ZC

Checking

1. Connect the tachometer connections of tool 18G 677 ZC, see 'Test Equipment'.
2. Run the engine to its normal running temperature.
3. Check the engine idling speed against the figure given in Data, and adjust if necessary.
4. Disconnect the kick-down control rod at the carburetter.
5. Insert a 6 mm (¼ in) diameter rod through the hole in the intermediate bellcrank lever and locate it in the hole in the gearbox casing.
6. The clevis pin should now be an easy sliding fit through the kick-down control rod end and the carburetter throttle lever.

Adjusting

1. Slacken the kick-down rod ball-joint locking nut and turn the rod until the correct length is obtained.
2. Connect the rod at the carburetter lever using a new Starlock washer, tighten the ball-joint locking nut and remove the checking rod.
3. Test drive the car to ensure that the 'kick-down' changes occur within the speed range given in Test 10 of the 'Test Procedure'.

a. If the gear changes occur at a lower speed, slacken the ball-joint locking nut, disconnect the rod and screw it in a further two complete turns. Connect and tighten the ball-joint and check the kick-down changes.

b. If the gear changes occur at a higher speed, follow the procedure in 'a' except that the ball-joint must be unscrewed two complete turns to lengthen the rod.

STARTER INHIBITOR SWITCH ADJUSTMENT

1. Apply the handbrake, raise the front of the car and support it on stands. Ensure that the selector cable is correctly adjusted and position the selector lever at **'D'.**
2. Remove the starter inhibitor switch guard plate from the gearbox front cover, disconnect the leads from the switch and fully slacken the inhibitor switch locknut.
3. Connect a test lamp and battery to the switch terminals and screw the switch into the front cover until the test lamp just goes out. Screw the switch in a further 3 to 4 flats and lock it in this position.
4. Check with the selector lever that the lamp lights up when **'P'** or **'N'** is selected.
5. Remove the test lamp, connect the inhibitor switch leads, fit the guard plate and lower the car to the ground.
6. Check that the engine will start only when **'P'** or **'N'** are selected.

REVERSE LIGHT SWITCH ADJUSTMENT

1. Raise the front of the car and support it on stands. Apply the handbrake and position the selector lever at **'R'**.
2. Disconnect the leads from the reverse light switch and fully slacken the switch locknut.
3. Connect a test lamp and battery to the switch terminals and screw the switch into the selector housing until the test lamp just lights. Screw the switch in a further 1½ to 3 flats and lock it in this position.
4. Remove the test lamp, connect the reverse light switch leads and lower the car to the ground.
5. Check that the reverse lights operate only when **'R'** is selected.

Automatic Gearbox

BRAKE BAND ADJUSTMENT

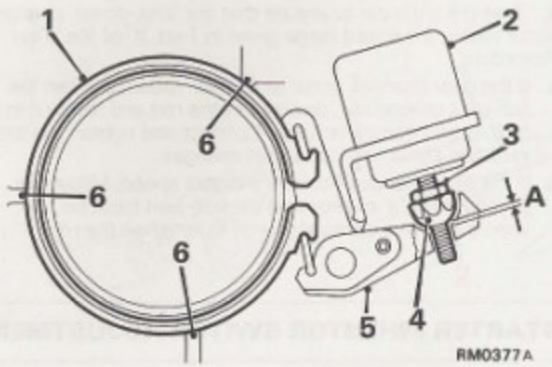


Fig. 6

Brake band adjustment

1 Brake band
2 Servo
3 Locknut
4 Adjusting nut
5 Servo lever
6 Brake band stops
A Clearance between adjusting nut and lever

Checking

1. Drain the oil from the engine/automatic gearbox.

2. Apply the handbrake, raise the front of the car and support it on stands.

3. Support the engine/gearbox and remove the L.H. front engine mounting bracket.

4. Remove the starter inhibitor switch guard plate and disconnect the leads from the switch.

5. Remove the front cover securing bolts and lift off the cover complete with the oil filter assembly.

6. Check the brake band adjustment; the free movement ('A' in Fig. 6) between the servo lever and the spherical nut should be approximately 1.02 mm (0.040 in).

Adjusting

1. Slacken the locknut and turn the spherical adjusting nut upwards until the pressure on the servo lever is released, this will allow the brake band to expand to its stops.

2. Turn the spherical adjusting nut downwards into the lever just until no free play exists, then turn the adjusting nut upwards 5 to 7 flats.

3. Check that the clearance is as given in 6 above, hold the spherical nut and tighten the locknut.

4. Repeat the procedure above to adjust the other two brake bands.

5. Fit a new joint washer coated with Hylomar jointing compound (or equivalent). Fit the front cover and tighten the retaining bolts.

6. Connect the starter inhibitor switch leads, fit the guard plate and engine mounting bracket, and lower the car to the ground.

7. Fill the engine/automatic gearbox with the correct quantity and grade of oil.

8. Check the inhibitor switch adjustment and adjust if necessary.

SELECTOR CABLE ASSEMBLY

Remove

1. Apply the handbrake, raise the front of the car and support it on stands. Remove the bellcrank cover plate from the gearbox and release the clip securing the selector cable to the sub-frame.

2. Remove one of the retainers and push out the pin securing the cable fork to the bellcrank lever. Remove the fork end, washer and locknut from the cable.

3. Remove the two rubber gaiters, unscrew the outer cable locking nut and pull the cable clear of the gearbox.

4. Unscrew the cable securing nut from the adaptor in the selector housing, unscrew the adaptor from the selector housing and, using a split box spanner (10 mm), slacken the locknut securing the cable to the plunger in the selector housing.

5. Fit the fork locknut and fork, and use the fork locknut to unscrew the inner cable from the plunger. Remove the fork and locknut from the inner cable and the adaptor olive and securing nut from the outer cable.

Refit

1. Fit the securing nut, olive and adaptor to the outer cable. Screw the inner cable into the plunger and secure it with the locknut.

2. Screw the adaptor into the selector housing and fully tighten it. Loosely screw the cable securing nut onto the adaptor in the selector housing.

3. Secure the outer cable to the gearbox, fit the cable into the subframe clip before tightening the outer cable locknut. Fit the two rubber gaiters and fit the fork locknut, washer and fork end onto the inner cable. Connect the fork end to the bellcrank lever and tighten the fork locknut.

4. Adjust the selector cable, fit the bellcrank cover plate and lower the car to the ground.

SPEEDOMETER PINION AND DRIVE GEAR

Remove

1. Disconnect the speedometer cable from the pinion housing, remove the securing screw and withdraw the speedometer drive pinion assembly from the drive housing.

2. If the drive gear is to be renewed, remove the speedometer drive housing and joint washer and withdraw the speedometer drive gear.

Refit

1. Fit the drive gear and housing. Fit the drive pinion assembly and connect the speedometer cable.

GOVERNOR AND FORWARD CLUTCH

Remove

Service tool: 18G 1097

1. Remove the engine and gearbox assembly.
2. Disconnect the kick-down rod ball-joint and remove the bellcrank pivot bolt. Release the kick-down operating lever retaining bolts and withdraw the kick-down linkage from the gearbox casing.
3. Using tool 18G 1097 to retain the position of the forward clutch, remove the governor housing securing nuts and withdraw the housing assembly.
4. Remove the forward clutch feed pipe, and the oil strainer and pick-up pipe.
5. Remove tool 18G 1097 and withdraw the forward clutch from the gearbox casing.
6. Remove the forward output shaft; note the reverse shut-off valve located in the end of the shaft.

Overhaul

Governor

Service tool: 18G 1106

1. Remove the securing screw and withdraw the speedometer drive pinion components, then remove the screws, detach the pinion housing and withdraw the speedometer drive gear.
2. Remove the bolts and withdraw the governor mounting plate from the end housing.
3. Remove the circlip and withdraw the gear from the governor shaft. Withdraw the governor with its bearing retainers and trunnions from the mounting plate.
4. Remove the gear and thrust washer from the governor housing end cover.
5. Examine all components for wear or damage; renew the governor assembly if the bearing requires replacement. Renew the gear and casing assemblies as necessary.
6. Fit the gear and thrust washer into the governor housing end cover.
7. Locate the governor with its bearing retainers and trunnions on the mounting plate, and fit the gear and circlip to the governor shaft.
8. Using tool 18G 1106, fit and align the governor mounting plate to the end housing. Tighten the bolts to the torque figure given in Data.
9. Insert the speedometer drive gear through the end housing and governor, ensuring that the lugs on the drive gear shaft locate in the slots in the governor shaft, then fit the pinion housing with a new joint washer and fit the speedometer drive pinion components.

Forward clutch

Service tool: 18G 1102

1. Remove the circlip, end-plate and clutch plates (two paper-faced interposed with one steel intermediate plate).
2. Lift out the piston return springs, the pressure plate and the six toggles. Using an air pressure line, blow out the piston.
3. Remove the circlip and the reverse shut-off valve piston from the forward output shaft.
4. Check all parts for wear, and renew as required. Fit new 'O' rings and seals to the piston and the reverse shut off valve.
5. Check the cast-iron sealing rings for wear; the rings should not have any sideways movement in their locating grooves; replace as required.

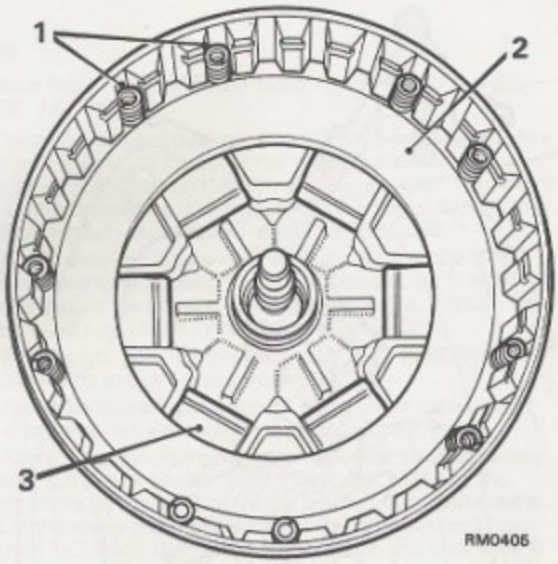


Fig. 7

Forward clutch — location of springs and toggles

1 Piston return springs
2 Pressure plate
3 Toggles

6. Examine all clutch plates and replace those showing signs of wear or damage.
7. Fit the reverse shut-off valve to the forward output shaft and secure it with a new circlip.
8. Lubricate the piston seal and using tool 18G 1102, press the piston fully into its bore, ensuring that the lips of the seal are facing inwards.
9. Fit the toggles, pressure plate and piston return springs, positioning the springs as shown in Fig. 7.
10. Assemble the remaining components in the following order to check the end-float. Fit the two paper-faced plates together, fit the intermediate plate, end plate and circlip.
11. Using a feeler gauge, check the clearance between the intermediate plate and the end plate and, if necessary, fit an alternative end plate and/or intermediate plate to obtain the end-float given in Data.
12. Assemble the clutch plates in the correct order (see Fig. 3) and fit the circlip. Check that the paper-faced plates rotate freely, and align their splines to assist when fitting the unit to the gearbox.

Refit

Service tools: 18G 1094, 18G 1097

1. Fit the forward output shaft and forward clutch to the gearbox, ensuring that the clutch plates are fully engaged on the hub splines.

CAUTION: *If the clutch is not fully engaged on the hub splines, the flange of the governor housing will not contact the gearbox casing. Any excessive force used in fitting the clutch may damage the clutch plates.*

2. Using tool 18G 1097 to retain the forward clutch, fit and secure the oil stainer assembly. Fit the forward clutch feed pipe with its long end into the gearbox casing and pull the nylon sleeve over the sealing rings on the forward clutch shaft.

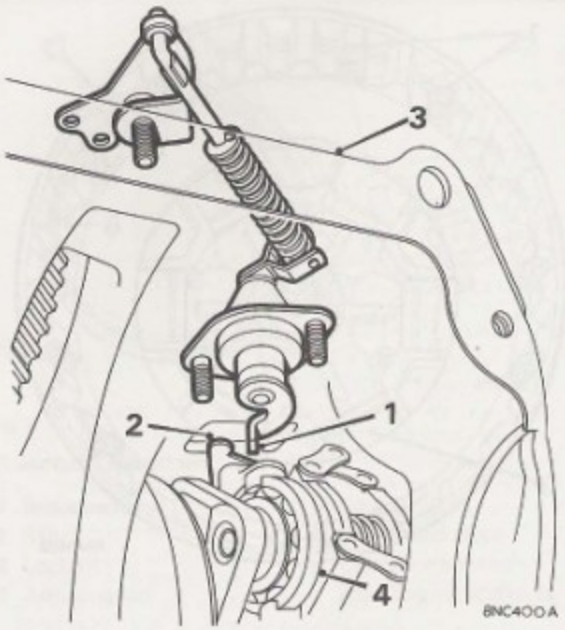


Fig. 8

Kick-down lever position

1 Kick-down operating lever
2 Governor lever
3 Gearbox case
4 Governor

3. Using tool 18G 1094, align the oil pipes and the forward clutch shaft; remove the tool.

4. Apply jointing compound to a new joint washer, and fit it to the gearbox casing.

5. Fit the governor housing giving particular attention to the following points:

a. Ensure that the forward clutch feed pipe is engaged in its location in the housing.

b. Ensure that the governor valve linkage engages correctly with the spring clip of the governor. The link engages between the spring clip and the two forks; it MUST NOT enter the boxed portion of the clip.

6. Tighten the governor housing securing nuts and screw. Remove tool 18G 1097 and fit the kick-down control assembly with the operating lever positioned as shown in Fig. 8. Fit the bellcrank pivot bolt and connect the kick-down rod ball-joint to the control lever.

7. Fit the engine and gearbox assembly.

PRIMARY DRIVE GEARS

Remove

1. Remove the converter and converter housing.

2. Remove the 'C' shaped thrust washer, backing ring, output gear and front thrust washer from the crankshaft.

3. Remove the idler gear and thrust washers and the input gear and adjustment shims.

Overhaul

1. If any of the gears are worn or damaged, replace them as a set.

Refit

Service tools: 18G 191, 18G 191 A, 18G 1089-1, 18G 1089 A, 18G 1089/1, 18G 1098

1. Fit the output gear front thrust washer, with it's chamfered bore side towards the crankshaft.

2. Fit the output gear, backing ring and 'C' shaped thrust washer to the crankshaft.

3. Check the output gear end-float against the figure given in Data and, if necessary, fit an alternative front thrust washer to correct the end-float. Remove the output gear after adjustment.

4. Fit the idler gear to the transmission case with a nominal sized thrust washer from the range available (see Data) on the transmission side of the idler gear.

5. Assemble the thin washers of tool 18G 1089-1, interposed with a dental wax washer, onto the converter housing side of the idler gear.

6. Cut a dental wax washer and interpose it between tools 18G 1089 A and 18G 1089/1, this assembly replaces the input gear for checking the pre-load adjustment.

7. Fit tool 18G 1089 A and 18G 1089/1 with the wax washer onto the input gear shaft.

8. Fit the converter housing using a new joint washer and tighten the housing nuts and bolts to the torque figure given in Data. Do not fit the input shaft nut.

9. Remove the converter housing, and the washers with dental wax interposed, and measure the thickness of the washer assembly with a micrometer. Subtract 0.102 to 0.178 mm (0.004 to 0.007 in) from the measurement figure taken and fit a thrust washer of that thickness to the converter side of the idler gear.

10. Place the input gear onto tool 18G 191 A, and set tool 18G 191 to zero when it registers the total length of the input gear.

11. Remove the input gear from tool 18G 191 A, and replace it with 18G 1089 A and 18G 1089-1 with the wax washer still in position. The increased measurement shown on tool 18G 191 indicates the thickness of shims required to eliminate end-float. Add 0.025 to 0.07 mm (0.001 to 0.003 in) to give the required input bearing pre-load adjustment. Select the required thickness of shims.

12. Fit the input gear and shims.

13. Remove the converter housing joint washer used for the adjusting procedure and fit a new one.

14. Fit the front thrust washer, output gear, backing ring and 'C' shaped thrust washer to the crankshaft.

15. Fit tool 18G 1098 over the output gear and fit the converter housing and converter.

CONVERTER, OIL SEAL AND HOUSING

Remove

Service tools: 18G 587, 18G 1086, 18G 1087, 18G 1088, 18G 1098

1. Drain the oil from the engine/automatic gearbox.
2. Remove the battery and support tray. Raise the front of the vehicle and support it on stands.
3. Attach suitable lifting equipment to the engine, support the engine and remove the nut and washer from the right-hand rear engine mounting and the through bolt from the R.H. front engine mounting.
4. Remove the bonnet lock platform, and move the radiator to one side.
5. Remove the oil filter assembly and the starter motor.
6. Remove the converter cover retaining bolts and move the earth cable and carburetter overflow pipe aside.

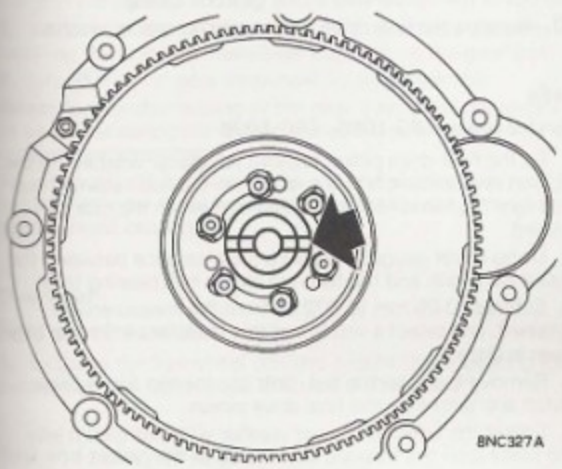


Fig. 9

Converter and crankshaft slots in horizontal position

7. Remove the converter cover, ensure that the slot in the crankshaft is in the horizontal position shown in Fig. 9 and remove the converter retaining bolt using tool 18G 587.
8. Remove the key plate and insert the plug of tool 18G 1086 into the end of the crankshaft.
9. Remove three equally spaced bolts from the converter centre to accept tool 18G 1086 and remove the converter; note that it will still retain a quantity of oil.
10. Locate tool 18G 1087 in the groove in the converter housing oil seal and tap outwards on the tool. Continue the tapping action whilst moving the tool round the edge of the seal until the oil seal is removed.
11. Remove the securing screws, and detach the low pressure valve from the converter housing.
12. Using tool 18G 1088 to hold the converter output gear, remove the input gear nut. Disconnect the selector cable, unscrew the bellcrank pivot post and remove the bellcrank lever from the converter housing.
13. Remove the R.H. front engine mounting and fit tool 18G 1098 over the converter output gear. Remove the nuts and screws securing the converter housing to the power unit and partially withdraw the converter housing. Disconnect the oil feed pipe and withdraw the converter housing.

Refit

Service tools: 18G 587 18G 1068 A, 18G 1068 B, 18G 1088, 18G 1098

1. Insert the oil feed pipe into its location in the gearbox, fit a new joint washer to the converter housing and, ensuring that tool 18G 1098 is still on the converter output gear, partially fit the converter housing. Connect the oil feed pipe, then push the housing fully home and remove tool 18G 1098.
2. Fit the securing nuts and screws, ensure that the U.N.C. screws secure the housing to the gearbox and the U.N.F. screws secure the housing to the cylinder block. Tighten the screws and nuts to the torque figure given in Data.
3. Fit the input gear nut and, using tool 18G 1088, tighten the nut to the torque figure given in Data.
4. Fit the bellcrank lever, connect the selector cable and fit the low pressure valve using a new joint washer.
5. There is a drain hole behind the converter housing oil seal which must not be sealed off by the oil seal. Measure the depth of the oil seal bore (from the housing face to the outer end of the stator bush) and subtract the measurement from 9,5 mm (0.375 in). Using tools 18G 1068 A and 18G 1068 B fit the oil seal, allowing it to protrude (at the position where the measurement was taken) by the difference between the above figures. If the measurement taken is equal to or greater than 9,5 mm (0.375 in) fit the oil seal flush with the housing face.
6. Remove each pair of bolts in turn from the converter centre and fit new locking plates. Tighten the bolts to the torque figure given in Data.

Note: *Do not remove all six screws from the converter centre at one time.*

7. Fit the converter onto the crankshaft, align the slots in the crankshaft and converter, fit the key plate and a new locking washer and using tool 18G 587 tighten the converter retaining bolt to the torque figure given in Data. Fit the R.H. front engine mounting to the sub-frame. Fit the converter cover.
8. Fit the carburetter overflow pipe, earth cable, starter motor and oil filter assembly.
9. Secure the R.H. front and rear engine mounting points and remove the engine lifting equipment.
10. Position the radiator assembly on its mountings and fit the bonnet lock platform. Lower the car and fit the battery support tray and battery.
11. Refill the engine/automatic gearbox with the correct quantity and grade of oil.

Automatic Gearbox

GEARBOX ASSEMBLY

Note: *It is necessary to separate the gearbox from the engine to:*
Renew the gearbox case.
Renew the gearbox assembly.
Remove the main oil pick-up pipe and strainer.

Remove

1. Remove the engine/gearbox assembly.

2. Remove the converter cover, converter, and converter housing.

3. Disconnect the external engine oil feed pipe from the adaptor on the gearbox casing and lever the main oil feed pipe from the oil pump and gearbox casing.

4. Remove the gearbox securing bolts, separate the engine from the gearbox and remove the front main bearing cap oil seal.

Refit

1. Renew the oil feed 'O' ring and fit a new joint washer to the transmission casing, lubricate and fit a new front main bearing cap oil seal and fit the engine to the gearbox.

2. Connect the external oil feed pipe to the adaptor on the gearbox casing.

3. Fit the internal oil feed pipe into its locations in the oil pump and cylinder block.

4. Fit the converter housing, converter and converter cover, then fit the engine/gearbox assembly.

BRAKE BANDS

Remove

1. Move the selector lever to the **'D'** position.

2. Remove the engine/gearbox assembly.

3. Remove the converter, the converter housing, and the gear train assembly.

4. Remove the valve block and the servo assembly.

5. Push the two inner brake bands into the gearbox until they contact the centre web.

6. Tilt the top of the outer brake band forward over the end of the forward shaft, and withdraw the brake band from the gearbox casing.

7. Repeat the procedure in 6 to remove the remaining two brake bands.

Refit

1. Fit the three bands into the gearbox, commencing with the second gear band, third gear band and finally the 'wider' reverse band.

2. Fit the valve block and servo assembly, and the gear train assembly.

3. Adjust the brake bands.

4. Fit the converter housing and converter, then fit the engine and gearbox assembly.

FINAL DRIVE PINION

Remove

Service tools: 18G 1095, 18G 1096

1. Move the selector lever to the **'D'** position.

2. Remove the engine/gearbox assembly.

3. Remove the differential end covers, noting the adjustment shims fitted beneath the cover on the final drive gear side.

4. Remove the differential assembly.

5. Remove the converter and converter housing.

6. Remove the gear train complete with the freewheel reaction member and the top and reverse clutch.

7. Remove the governor assembly, and the forward clutch.

8. Remove the valve block and the servo assembly and remove the brake bands.

9. Using tools 18G 1095 and 18G 1096, remove the forward clutch hub retaining nut, then drift the top and reverse clutch hub out of the centre web of the gearbox casing.

10. Remove the final drive pinion with its spacer washer.

Refit

Service tools: 18G 1095, 18G 1096

1. Fit the final drive pinion without its spacer washer. Fit the top and reverse clutch hub and tighten the hub retaining nut until light friction is felt on the bearings when the hub is rotated.

2. Using feeler gauges, measure the clearance between the final drive pinion and the forward clutch hub bearing face.

3. Subtract 0.05 mm (0.002 in) from the measurement obtained, and select a washer of this thickness from the chart given in Data.

4. Remove the retaining nut, drift out the top and reverse clutch and withdraw the final drive pinion.

5. Smear the selected spacer washer with petroleum jelly and place it on the forward clutch side of the pinion.

6. Refit the final drive pinion with its spacer washer. Refit the top and reverse clutch hub and, using tools 18G 1095 and 18G 1096, tighten the hub nut to the torque figure given in Data.

7. Check that there is only light friction on the bearings when the hub is rotated.

8. Fit the brake bands and the valve block and servo assembly.

9. Fit the gear train complete with the freewheel reaction member and the top and reverse clutch.

10. Fit the forward clutch and the governor assembly and adjust the brake bands.

11. Fit the converter housing, the converter and converter cover.

12. Fit the differential assembly to the gearbox, and adjust the bearing pre-load.

13. Fit the engine/gearbox assembly.

FREEWHEEL, GEAR TRAIN AND TOP AND REVERSE CLUTCH

Remove

1. Remove the engine/automatic gearbox assembly.
2. Remove the converter, the converter housing and the idler gear.
3. Remove the dowel bolt securing the gear train assembly.
4. Pull out the gear train assembly complete with the free-wheel reaction member and the top and reverse clutch.
5. Remove the thrust washer, needle thrust bearing and the stepped thrust washer from the end of the top and reverse clutch.
6. Remove the top and reverse clutch from the gear train, noting the order in which the thrust washer (thin), needle thrust bearing, and selective thrust washer (thick), locate on the reverse output gear shaft.
7. Pull off the input gear and remove the first gear freewheel reaction member.
8. Knock back the locking plate tabs and remove the bolts retaining the first gear freewheel assembly to the gear train.
9. Lift off the first gear freewheel housing assembly.

Note: *Further dismantling of the gear train is not necessary, as all the remaining components are incorporated in a replacement gear train.*

10. Remove the Spirolox circlip and end plate spacer, and lift out the first gear freewheel, intermediate spacer plate and needle thrust bearing.

Overhaul

First gear freewheel

1. Examine the freewheel unit and needle thrust bearing for excessive wear or damage, and renew if necessary.

Top and reverse clutch

Service tool: 18G 1120

1. Remove the Spirolox circlip and retainer plate, and lift out the clutch plates and spring rings.
2. Remove the Spirolox circlip, spring retainer and piston return spring and lightly shock the clutch drum against a flat surface to remove the top gear piston and cylinder.

Note: *If the reverse booster piston is shocked out of its bore, the piston ring will prevent it being removed from the clutch drum. It must therefore be refitted by easing the piston ring in with a screwdriver.*

3. Fit tool 18G 1120 into the clutch unit, hold both together upside-down and shock the assembly against a flat surface to remove the reverse booster piston from the clutch drum into the tool. Lift out tool 18G 1120 complete with the piston and remove the piston from the tool.
4. Remove the seals from the top gear piston, cylinder and reverse booster piston.
5. Examine all parts for wear and renew those showing signs of wear or damage. Renew all oil seals in the pistons and cylinder.
6. Check the piston rings, and replace if necessary. The piston ring gap for both rings when fitted in their respective bores should be as given in Data.
7. Lubricate the new seals with oil and fit them to their respective components.
8. Using tool 18G 1120, fit the reverse booster piston into its bore, ensuring that the boss faces outwards.
9. Fit the top gear piston into its cylinder with the boss facing outwards, then fit the assembly into the clutch drum, with the cut-aways on the rear outer edge of the cylinder opposite the holes in the clutch drum.
10. Fit the top gear piston return spring, spring retainer and Spirolox circlip. Fit the clutch plates and spring rings, with the cut-away portion of the steel plates in alignment.
11. Fit the retainer plate and Spirolox circlip. Check that the bronze plates rotate freely, and align their splines to assist when fitting the unit to the gearbox.

Refit

1. Fit the needle thrust bearing, spacer plate and freewheel, then secure them with the Spirolox circlip. Ensure that the lip of the freewheel is positioned uppermost otherwise the unit will be inoperative in use.
2. Fit the first gear freewheel assembly to the gear train, use new locking plates, tighten the retaining bolts and lock up the locking plate tabs.
3. Fit the freewheel reaction member and input gear.
4. Fit the selective thrust washer (thick), needle thrust bearing, and thrust washer (thin) to the reverse output gear shaft.
5. Check the condition of the 'O' ring seals on the reverse output gear shaft; replace as necessary.
6. Fit the top and reverse clutch to the gear train assembly, and place a straight edge across the splined end of the reverse output shaft and the face of the top and reverse clutch, the faces must be level with each other to eliminate third speed reaction gear end-float and maintain the correct backlash. If the faces are not level, measure the difference in height, lift off the top and reverse clutch, and remove the thrust washers and needle thrust bearing.
7. Measure the thickness of the selective thrust washer (thick) and select the required thickness washer from the size chart given in Data.
8. Fit the selected thrust washer, needle thrust bearing and the thin thrust washer to the reverse output gear shaft, refit the top and reverse clutch and check that the two faces are now level.
9. Smear petroleum jelly onto the stepped thrust washer and locate it on the end of the top and reverse clutch.
10. Smear petroleum jelly onto the thrust washer and needle-roller bearing and fit them to their locations on the top and reverse clutch hub.
11. Fit the gear train complete with the freewheel and the top and reverse clutch into the gearbox and, ensuring that the clutch plates are fully engaged on the clutch splines, fit the dowel bolt.

Note: *When the clutch is correctly located on the splines, the dowel bolt will engage easily in the freewheel reaction member.*

12. Fit the idler gear, the converter housing and the converter.
13. Fit the engine/automatic gearbox assembly.

Automatic Gearbox

VALVE BLOCK, PARK LOCK AND SERVOS

Remove

1. Move the selector lever to the **'D'** position.

2. Remove the engine/automatic gearbox assembly.

3. Remove the converter, the converter housing and the gear train assembly.

4. Remove the transverse selector rod and unhook the three brake bands from the servo reaction levers and struts.

5. Remove the front cover securing bolts, remove the engine mounting and lift off the cover complete with the oil filter assembly.

6. Disconnect the oil cooler pipe from the adaptor.

7. Unscrew and remove the adaptor, and withdraw the shaped copper pipe through the adaptor hole.

8. Remove the servo assembly securing bolts, and the three bolts securing the valve block.

9. Withdraw the servo unit and valve block as an assembly from the gearbox casing.

10. Detach the servo unit from the valve block, and remove the locking clip securing the park lock adjuster to the selector detent rod.

11. Remove the three bolts and detach the park lock assembly from the valve block.

Overhaul

Servos

1. Remove the centre shaft and lift out the servo levers, reaction levers, washer, and struts.

2. Hold the servo cover, remove the securing screws, and allowing the spring pressure to be gradually released, remove the cover.

3. Lift out the piston springs and servo pistons.

4. Examine all parts for wear and check the bores of the servo unit for scoring; fit a new assembly if the bores are damaged. Renew the piston seals and any other parts as required.

5. Lubricate the new piston seals with oil and fit them onto their respective pistons, ensuring that the lips of the seals face inwards towards the bores.

6. Fit the pistons and springs into their bores and secure the servo cover.

7. Fit the reaction levers and struts to the servo unit, ensuring that the washer is correctly positioned, see Fig. 3.

Valve block

CAUTION: *Before dismantling the valve block, remember to store the valves in their fitted order so that each one can be fitted to its original bore.*

Note: *Absolute cleanliness is essential, therefore it is advisable to dismantle the unit on a clean sheet of paper.*

1. Remove the six bolts and detach the valve block lid.

2. Remove the valve chest and separator plate from the pipe chest, noting the flap valve fitted between the valve chest and separator plate.

3. Remove the selector valve and the governor valve.

4. Remove the 'C' clips and plugs and withdraw the regulator valve components, the engagement control valve components, and the second and fourth gear valves and components.

5. Remove the end 'C' clip and withdraw the plug and one-way dump valve, remove the centre 'C' clip, end plug and spring retainer and withdraw the third gear valve components.

6. Depress the abutment plug, remove the retaining washer, and withdraw the third gear shuttle valve from the rear of the pipe chest.

7. Repeat the procedure in 6 to remove the reverse gear shuttle valve, noting that an engagement piston is fitted in the same bore.

8. Depress the spring, release the spring retainer, spring and stabilisation valve.

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

10. Check for burrs on the valves and bores, check that all valves move freely in their respective bores. Immerse all components in clean engine oil before assembling.

11. Assemble the valves in the valve block and pipe chest as shown in Figs. 10 and 11.

12. Check that all 'C' clips have been correctly located and fitted.

13. Position the valve chest with its front face downwards and insert the flap valve into its location.

14. Fit the separator plate and pipe chest to the valve chest, locate the governor operating lever in the groove in the governor valve, and the selector rod link in the grooved end of the selector valve.

15. Hold the complete assembly together, turn it over, fit the lid and tighten the six lid retaining bolts to the torque figure given in Data.

Park lock

1. Compress the spring, extract the roll pin and remove the retaining washer, spring and cam.

2. Unscrew the adjuster.

3. Examine all parts for damage or wear. Renew the cam, spring, roll pin, locking clip and adjuster if necessary.

Note: *If a new cam (see Data) is fitted it must be dimensionally the same as the one it replaces and the final position of the pawl should be adjusted as described under* ***'Refit'*** *(para. 2 a to d).*
If any other parts are damaged or worn, fit a new park lock assembly.

4. Fit the cam and spring retaining washer and secure with the roll pin.

5. Screw on the adjuster.

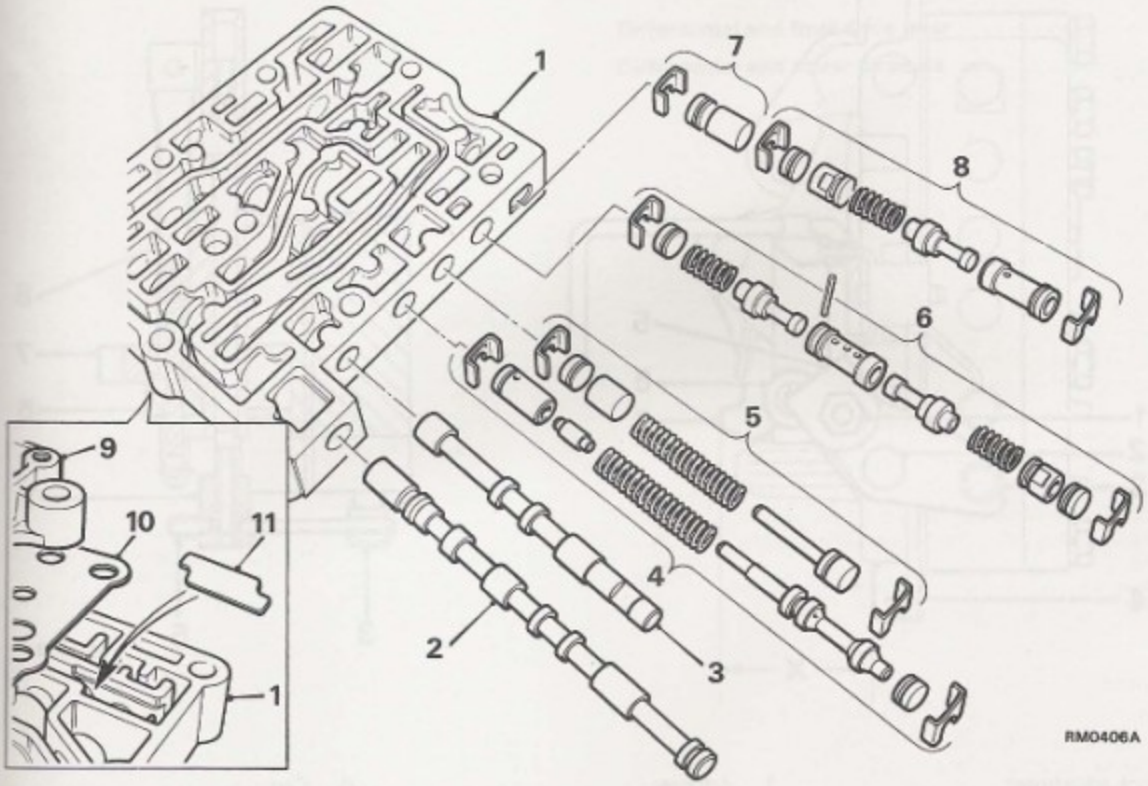


Fig. 10

Valve chest components

1 Valve chest
2 Selector valve
3 Governor valve
4 Regulator valve components
5 Engagement valve components
6 Second and fourth gear valve components
7 Dump valve components
8 Third gear valve components
9 Pipe chest
10 Separator plate
11 Flap valve

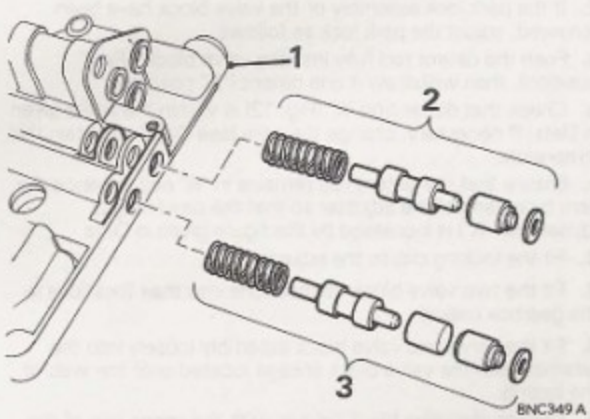


Fig. 11

Shuttle valves

1 Pipe chest
2 Third gear shuttle valve components
3 Reverse gear shuttle valve components

Automatic Gearbox

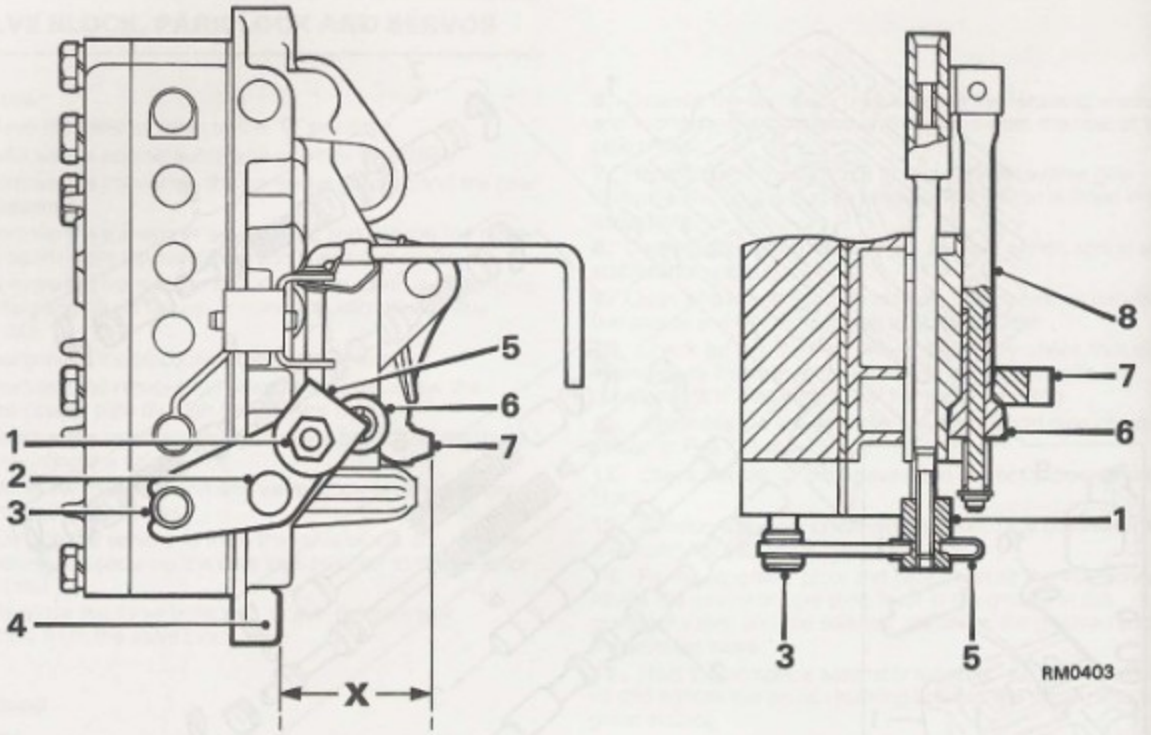


Fig. 12

Park lock adjustment

1 Adjuster
2 Detent rod
3 Selector valve
4 Mounting lug
5 Locking clip
6 Cam
7 Pawl
8 Cam rod
X Dimension 'X' — height of pawl above mounting lug

Refit

1. Fit the park lock assembly to the valve block and tighten the three retaining bolts to the torque figure given in Data.

2. If the park lock assembly or the valve block have been renewed, adjust the park lock as follows:

a. Push the detent rod fully into the valve block ('Park' position), then withdraw it one detent (**'R'** position).

b. Check that dimension 'X' (Fig. 12) is within the limits given in Data. If necessary, change the cam (see Data) to obtain this dimension.

c. Ensure that the detent rod remains in **'R'** and advance the cam by means of the adjuster so that the pawl height (dimension 'X') is increased by the figure given in Data.

d. Fit the locking clip to the adjuster.

3. Fit the two valve block connections into their locations in the gearbox casing.

4. Fit the servo and valve block assembly loosely into the gearbox with the valve block linkage located over the web of the casing.

5. Engage the valve block linkage with the spring clip of the governor unit.

6. Assemble the servo unit to the valve block and locate both assemblies in the gearbox case.

7. Fit the shaped copper pipe through the adaptor hole and locate in the pipe chest.

8. Fit the valve block and servo unit securing bolts, and tighten them to the torque figures given in Data.

9. Screw the transverse selector rod fully into the valve block selector valve linkage.

10. Locate the brake bands onto the servo unit reaction levers and struts and fit the gear train assembly to the gearbox.

11. Screw in the adaptor and connect the engine oil feed pipe.

12. Use a new joint washer coated with jointing compound and fit the front cover.

13. Fit the converter housing and the converter.

14. Fit the engine/automatic gearbox assembly.

Final Drive

Final Drive

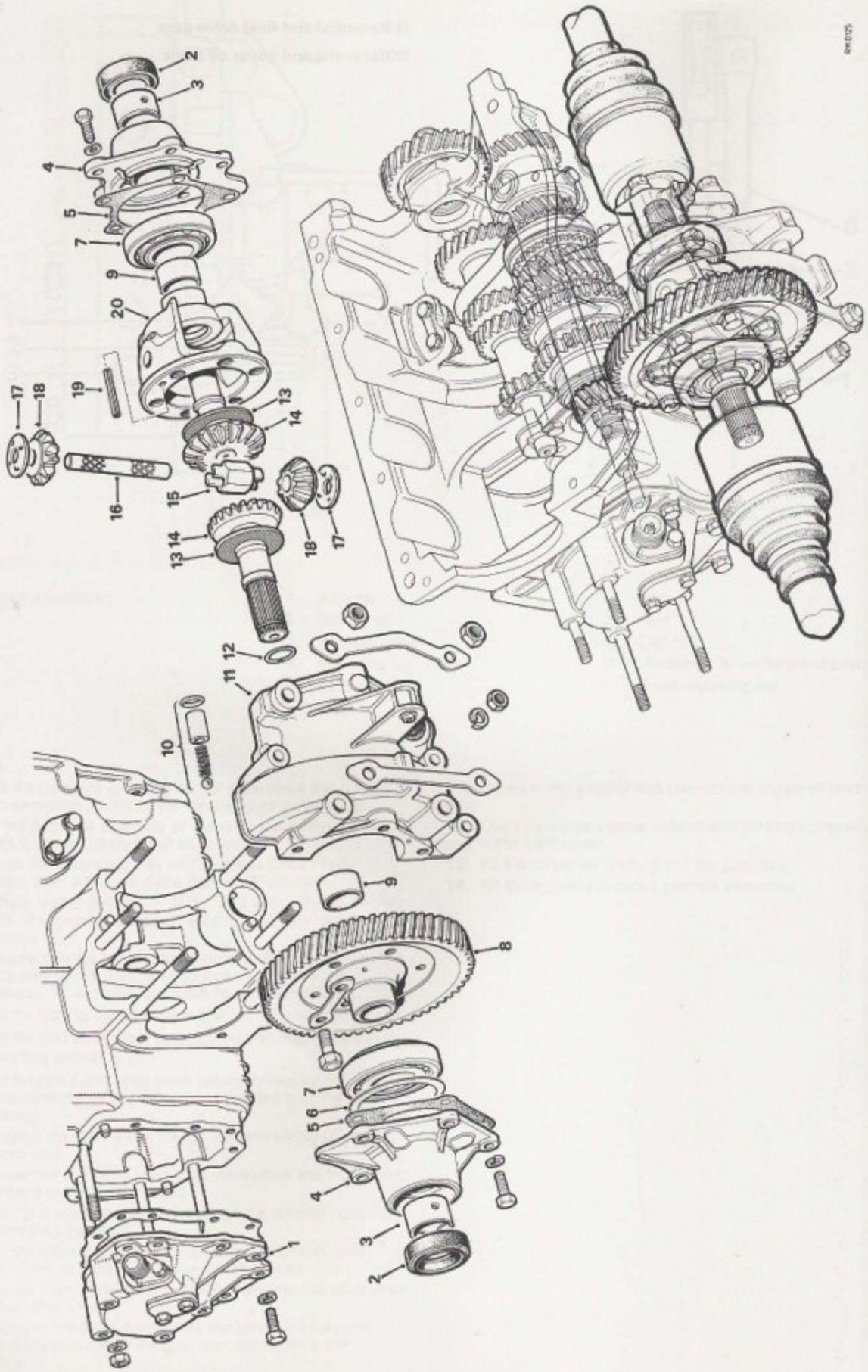


Fig. 1

DIFFERENTIAL AND FINAL DRIVE COMPONENTS

1 Speedometer drive housing
2 Oil seal
3 Bush
4 Differential end cover
5 Gasket
6 Shim
7 Bearing
8 Final drive gear
9 Bush
10 Detent ball, spring, sleeve and 'O' ring
11 Differential housing
12 Spring ring
13 Thrust washer
14 Differential gear
15 Differential thrust block
16 Differential pinion pin
17 Thrust washer
18 Differential pinion
19 Roll-pin
20 Differential cage

Final Drive

DIFFERENTIAL END COVER OIL SEALS

Remove

Service tool: 18G 1087

1. Remove the drive shaft and inboard joint.
2. Remove the differential end cover oil seal, using tool 18G 1087.

Refit

Service tool: 18G 1238

1. Fit the differential end cover oil seal, using tool 18G 1238.
2. Fit the inboard joint and drive shaft.

DIFFERENTIAL, FINAL DRIVE GEAR AND PINION

Remove

Service tools: 18G 587, 18G 1236

1. Remove the engine/gearbox assembly.
2. Remove the differential end covers, noting the adjustment shims fitted beneath the cover on the final drive gear side.
3. Extract the selector shaft detent spring, sleeve and ball from the gearbox casing.
4. Locate tool 18G 1236 over the selector shaft and remove the differential assembly.

Note: *If there are gaskets fitted between the gearbox and differential housing, new gaskets must be used during refitting. If no gaskets are fitted between the gearbox and differential housing, a sealant must be used as described under* **'Refit'.**

5. Remove the speedometer drive pinion, housing and gear. Rotate the selector shaft anti-clockwise to disengage the operating stub and the interlock spool from the bellcrank levers, then lever the first/second speed selector fork towards the centre web of the gearbox casing to engage first gear. Using a screwdriver, carefully drift the centre bellcrank lever inwards to select fourth gear; the gear train is now locked in two gears.
6. Using 18G 587, remove the securing nut and final drive pinion.

Overhaul

Service tools: 18G 2, 18G 2 G

1. Remove the oil seals from the end covers.
2. Using tools 18G 2 and 18G 2 G, pull the bearings off the differential cage. The bearings are marked 'THRUST' on their outer face.
3. Mark the final drive gear and differential cage for assembly purposes, remove the final drive gear securing bolts and remove the final drive gear complete with the differential gear located in it, then remove the differential gear from the final drive gear.
4. Drift out (towards the final drive gear flange) the roll-pin retaining the differential pinion pin, then drift out the pinion pin. Remove the differential gear thrust block, pinions, and thrust washers.
5. Renew all components which are worn or damaged. Fit new differential pinions and gears as a complete set if they are worn and reassemble with new thrust washers. If it is necessary to renew the final drive gear and/or pinion, they must be renewed as a pair.
6. Assemble the differential gear thrust block, pinions and thrust washers.
7. Fit the differential pinion pin and the securing roll-pin, then bolt the final drive gear to the differential cage, tightening the bolts to the torque figure given in Data.
8. Use tool 18G 578 to drift the bearings onto the differential cage, with the flanged side of the outer races facing outwards.
9. Fit new oil seals into the differential end covers, using tool 18G 1238.

Refit

Service tools: 18G 578, 18G 587, 18G 1236, 18G 1238

1. Fit the final drive pinion, using 18G 587 to tighten the securing nut to the torque figure given in Data.
2. Fit the speedometer drive housing, gear and pinion.
3. Move the selector bellcrank levers into the neutral position and rotate the interlock spool and selector shaft stub into engagement with the bellcrank levers.
4. Fit the differential assembly into the gearbox casing with a slight bias towards the flywheel end of the engine.
5. Fit tool 18G 1236 over the selector shaft and fit the differential housing; use new gaskets if gaskets were fitted originally, if none were fitted assemble without sealant at this stage. Tighten the securing nuts sufficiently to hold the differential assembly firmly and yet allow the unit to be displaced by the fitting of the end cover on the flywheel end.
6. Fit the selector shaft detent ball, sleeve and spring to the gearbox casing.
7. Fit the (flywheel end) end cover, using a joint washer, and ensure that the oil holes in the end cover are aligned with those on the differential housing. Tighten the screws evenly in a diagonal sequence.

Note: *As the screws are tightened, the differential assembly will be displaced away from the flywheel end of the engine to allow the bearing pre-load adjustment to be carried out.*

8. Fit the second end cover without its joint washer or shims and tighten the securing screws in diagonal sequence just sufficiently for the cover register to nip the bearing outer race; over-tightening will distort the cover flange.
9. Take feeler gauge measurements in several positions between the cover flange and the gearbox/final drive housing; variations in measurement will indicate that the cover securing screws have not been tightened evenly; adjust the tension on the screws until the same reading is obtained in all positions. If no gap exists between the flange and the housing, remove the cover and add shims between the cover and bearing to produce a clearance; calculate the pre-load shim requirement as follows.

If the measured gap is greater than the pre-load figure (see Data); subtract the pre-load figure from the measured gap and remove that thickness of shims from those already fitted. Fit an additional 0.18 mm (0.007 in) shim to allow for the compressed thickness of the gasket.

If the pre-load figure is greater, subtract the measured gap from it and add that thickness of shims. Fit an additional 0.18 mm (0.007 in) shim to allow for the compressed thickness of the gasket.

10. If no differential housing gaskets are fitted, remove the differential housing and apply an unbroken line of R.T.V. sealant Unipart No. GCH 111 to the differential joint face. Fit the differential, differential housing, and (flywheel end) end cover.

Note: *The differential housing should be finally tightened within 20 minutes of applying the sealant.*

11. Grease the adjustment shims and fit them to the thrust face of the bearing. Fit the end cover, using a new joint washer, and tighten the end cover securing screws and the final drive housing securing nuts to the correct torque figure.
12. Fit the engine/gearbox assembly.

Drive Shafts

Drive Shafts

DRIVE SHAFT AND JOINTS

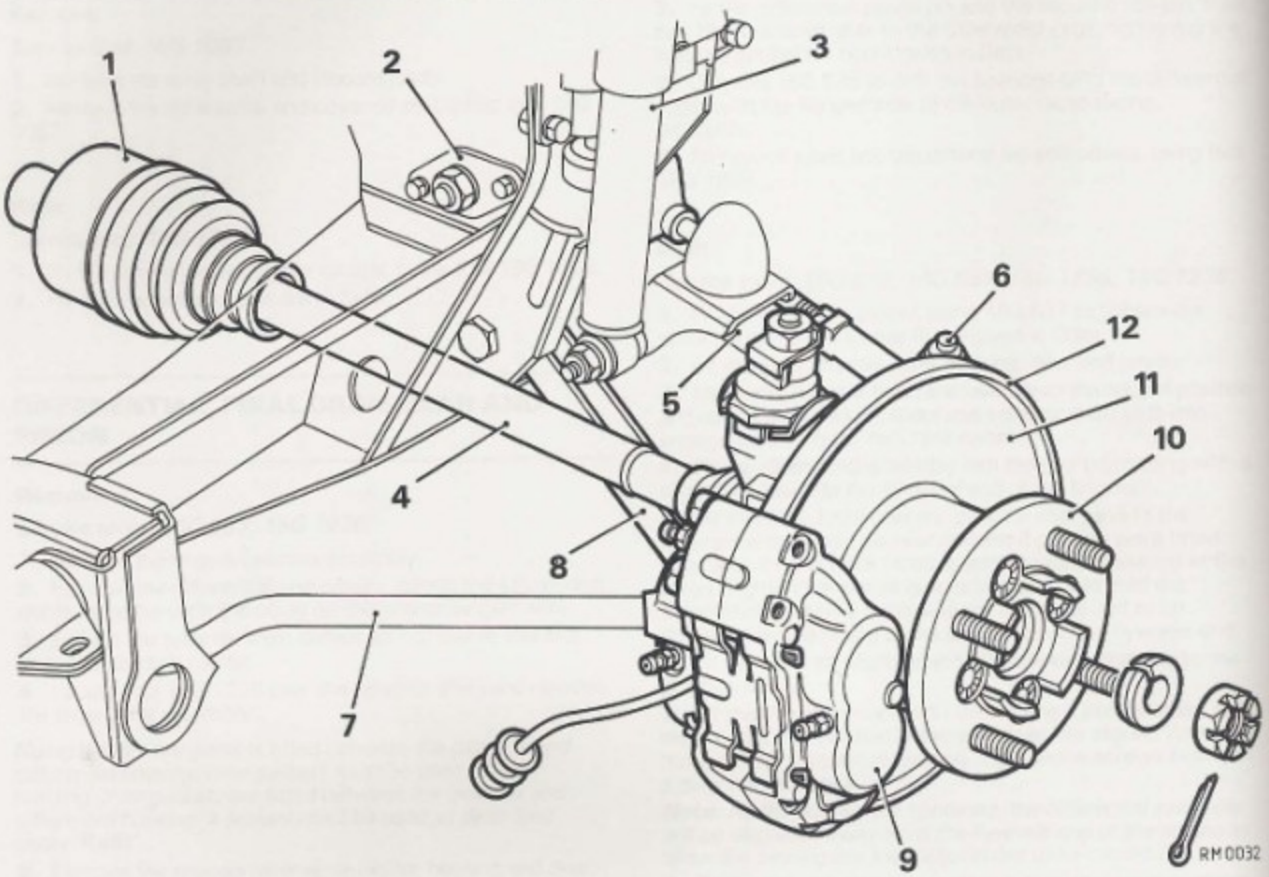


Fig. 1

Drive shaft and joints

1 Inboard joint
2 Upper arm pivot shaft retaining plate
3 Damper
4 Drive shaft
5 Upper suspension arm
6 Steering ball pin
7 Anti-roll tie-bar
8 Lower suspension arm
9 Brake caliper
10 Driving flange
11 Disc
12 Disc shield

Remove

Service tools: 18G 304, 18G 304 F, 18G 1063, 18G 1240, 18G 1342

1. Remove the rebound rubber from the sub-frame and insert a distance piece between the sub-frame and the upper arm to keep the suspension in the running position. Apply the handbrake and slacken the front road wheel nuts.

2. Raise the front of the car, support it on stands and remove the wheel.

3. To avoid damage to the inboard joint boot, ensure that there are no sharp corners or edges anywhere on the tapered end of tool 18G 1342. Lubricate the nose of the tool and slide it along the top of the drive shaft until its nose enters the neck of the rubber boot and contacts the inboard joint extension tube.

4. Clamp the flat portion of tool 18G 1342 beneath the drive shaft and contacting the side of the sub-frame; on the L.H. drive shaft, the outer end of the tool will rest on the tool 'U' bolt. Drive the top portion of the tool towards the centre of the vehicle to release the shaft from the inboard joint and remove the tool.

5. If the outer joint is to be separated from the drive shaft, apply the brakes, and remove the nut and split collar securing the driving flange.

6. Remove the caliper and support it to prevent straining the hoses.

7. If the outer joint is to be separated from the drive shaft, remove the driving flange and disc, using tools 18G 304 and 18G 304 F if necessary.

8. Disconnect the steering ball pin from the steering lever, using tool 18G 1063, and remove the disc brake shield. Remove the nuts and separate the upper and lower arms from the swivel hub ball joint, using tool 18G 1063. Remove the swivel hub and drive shaft assembly.

9. If the driving flange has been removed, pull the swivel hub assembly from the drive shaft and, if the inner bearing inner race remains on the stub shaft, use tool 18G 705-2 to pull it off. Withdraw the water shield from the drive shaft.

10. If the inboard joint is to be removed, insert tool 18G 1240 between the joint and final drive cover. Strike the flat face of the tool to release the joint and remove it.

Overhaul

Service tool: 18G 1099

1. Cut the rings securing the boot(s) and remove the boot(s) from the joint(s).

2. Outer joint: Hold the drive shaft vertical with its inboard end uppermost and, using a soft-faced mallet, strike the outer edge of the joint to release it from the shaft. Remove the spring ring from the shaft.

3. If the rubber boots are damaged, renew them.

4. Outer joint: Fit a new spring ring to the drive shaft, compress the ring on the shaft to assist entry of the shaft into the inner member and use a soft-faced mallet to drift the drive shaft into the inner member.

5. Pack the inner joint with 75 cm^3 and the outer joint with 66 cm^3 of Molycote VN 2461C grease and secure the boot retaining clips, using tool 18G 1099, as follows:

a. Fit the clip so that its fold will lead with forward rotation of the drive shaft.

b. Pull the free end of the clip tightly between the front locking tabs of the clip and close the front locking tabs onto the clip.

c. Fold the clip back over the front locking tabs and close the rear locking tabs to secure the clip end.

Refit

Service tools: 18G 1104, 18G 1104 B

1. If the inner joint has been removed, lubricate its oil seal bearing surface and push the joint smartly into the final drive to lock the joint into the final drive.

2. If the outer joint is separated from the drive shaft, position the water shield 6.4 mm (0.25 in) onto the drive shaft; fill its sealing face with grease and pull the drive shaft into the hub, using tools 18G 1104 and 18G 1104 B.

3. Lubricate the inner joint boot to ease fitting of the drive shaft and push the shaft smartly into the inboard joint to lock the shaft into the joint.

4. Fit the upper and lower arms to the swivel hub and lock each nut with its tab washer after tightening the nuts to the torque figure given in Data.

5. Fit the disc shield and connect the steering lever to the steering ball pin but do not fully tighten the nut.

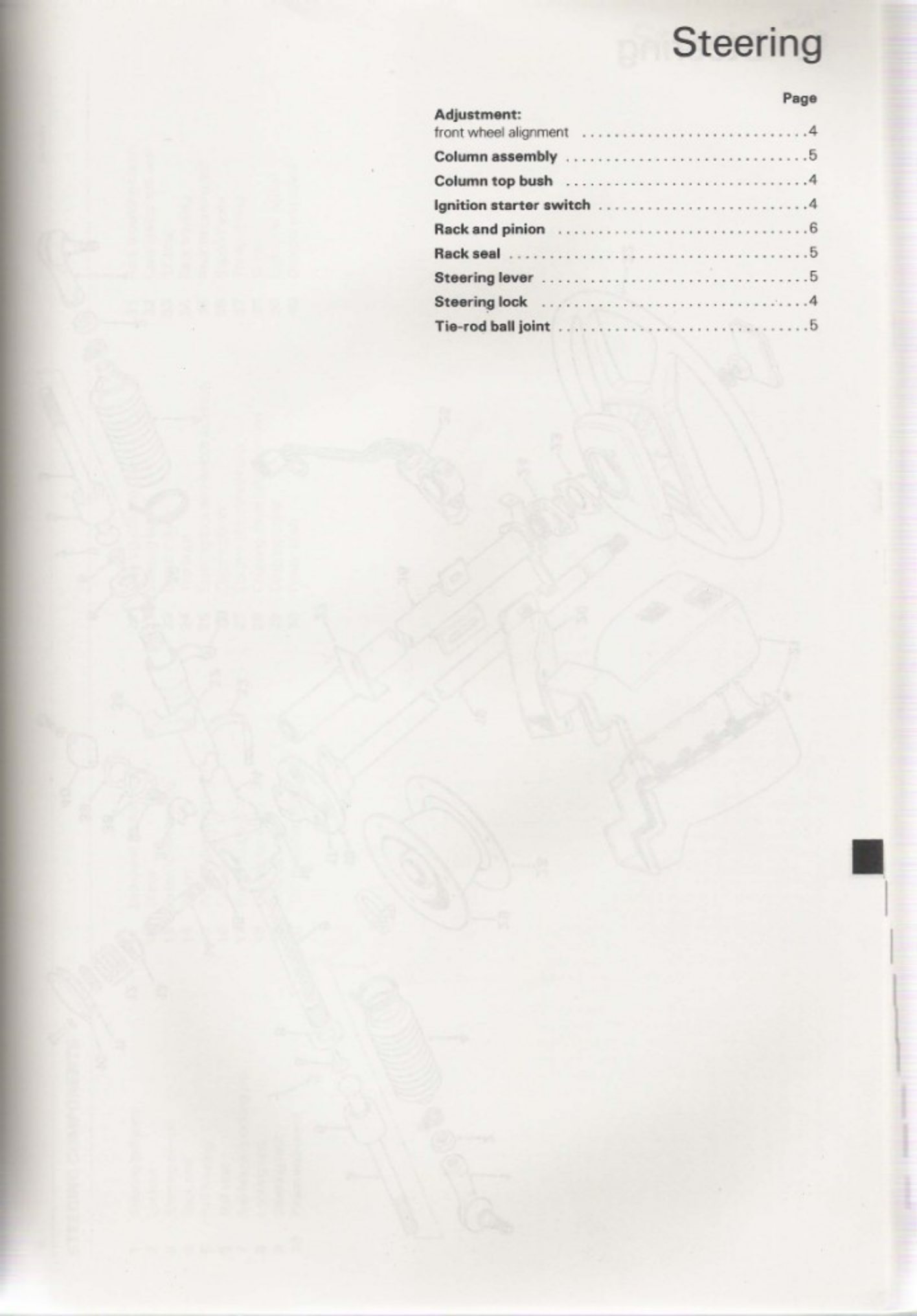
6. If it has been removed, fit the driving flange and disc assembly and the split collar and nut to the drive shaft.

7. Fit the brake caliper and tighten the caliper mounting bolts to the torque figure given in Data. Tighten the steering ball pin nut.

8. If it has been removed, tighten the drive shaft nut to the torque figure given in Data. Lock the nut with a new split pin.

9. Fit the road wheel and lower the car to the ground. Remove the distance piece from the suspension, fit the rebound rubber and tighten the road wheel nuts to the torque figure given in Data.

Steering



Steering

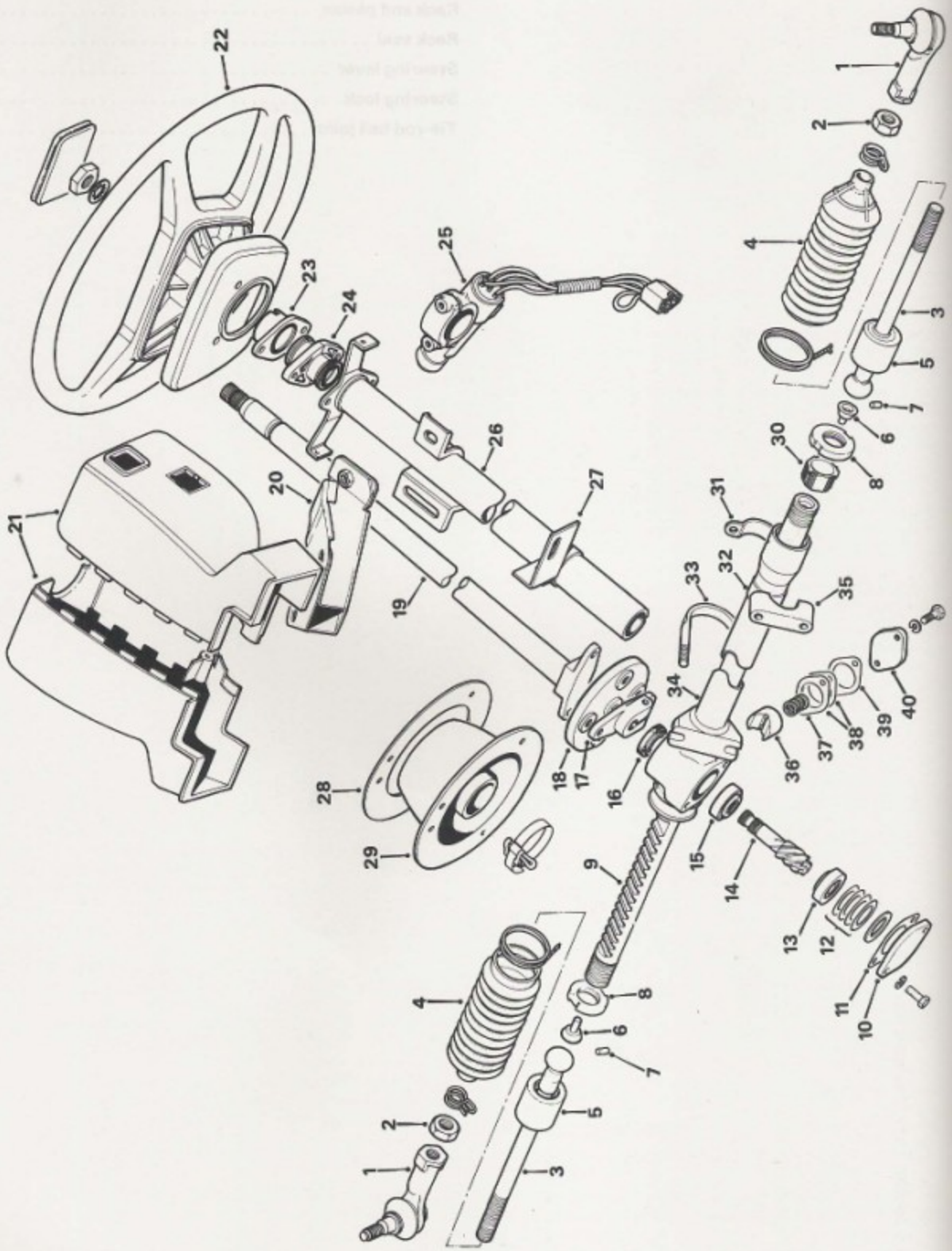

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Fig. 1

STEERING COMPONENTS

1 Steering ball joint
2 Locknut
3 Steering tie-rod
4 Rack seal
5 Ball housing
6 Ball seat
7 Ball housing locking pin
8 Locking ring
9 Steering rack
10 Pinion end-cover
11 End-cover gasket
12 Shims
13 Pinion lower bearing
14 Pinion
15 Pinion upper bearing
16 Oil seal
17 Pinion coupling
18 Flexible coupling
19 Inner column
20 Top mounting bracket
21 Steering-column cowl
22 Steering-wheel
23 Upper column
24 Top bush
25 Steering lock and switch assembly
26 Outer column
27 Column attachment clip
28 Coupling cover retention ring
29 Coupling cover
30 Plastic bush
31 Rack mounting clamp
32 Centralizing hole seal
33 'U' bolt
34 Rack housing
35 Rack mounting pad
36 Support yoke
37 Thrust spring
38 Shims
39 End cover gasket
40 Damper end cover

FRONT WHEEL ALIGNMENT

When checking the front wheel alignment the following points must always be observed:

a. The vehicle must be positioned on a level surface.

b. The vehicle must be loaded to kerbside unladen trim.

c. The tyres must be inflated to the recommended pressures.

d. The trim height must be correct.

Checking

1. Position the wheels in the straight-ahead position, rock the vehicle from side to side and roll it backwards and forwards at least a vehicle's length to relieve any stresses in the steering linkage.

2. Uncover the hole in the steering rack housing and centralize the rack by screwing a 6 mm bolt through the rack housing and into the threaded hole in the rack.

3. Using an optical gauge, take two readings on the front tyres at wheel centre height at the centre of the sidewall, then check the average of these two readings against the front wheel alignment figure given in Data.

Adjusting

1. Slacken the locknut on both tie-rods and the clips securing the seals to the tie-rods.

2. Rotate each tie-rod (both are right-hand thread) in the required direction by an equal amount to correct the alignment.

CAUTION: *It is important that the tie-rods are adjusted to exactly equal length.*

3. Tighten the tie-rod locknuts to the torque figure given in Data.

4. Tighten the rack seal clips and re-check the wheel alignment.

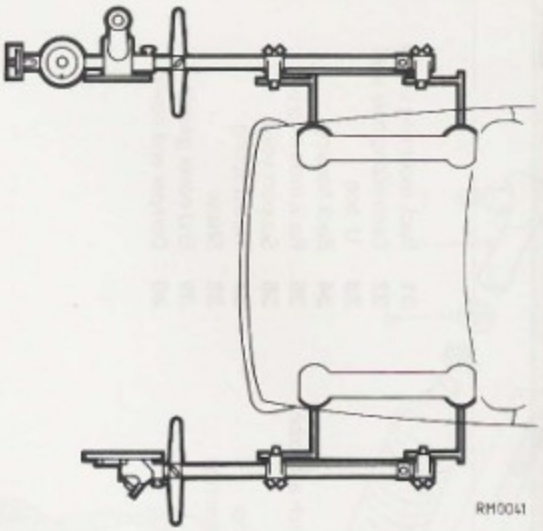

Fig. 2

Front wheel alignment gauge

STEERING-COLUMN TOP BUSH

Remove

1. Remove the cover from the centre of the steering-wheel, unscrew the retaining nut, mark the wheel hub and inner column for reassembly and withdraw the steering-wheel.

2. Remove the screws retaining the two halves of the steering-column cowl, remove the R.H. half of the cowl and disconnect the three wiring harness multi-connectors. Disconnect the plug from the lighting switch and remove the L.H. half of the cowl with the mixture (choke) control attached.

3. Slacken the screw securing the combined switch assembly to the steering-column and remove the switch assembly.

4. Slacken the steering-column to pedal bracket attachment clip and release the steering-column mounting bracket.

5. Remove the nuts and bolts securing the upper column to the outer column, slide the outer column down and remove the upper column and bush from the inner column.

Refit

1. Position the bush on the inner column, raise the outer column, fit the upper column and tighten the bolts to the torque figure given in Data.

2. Secure the steering-column mounting bracket and tighten the attachment clip.

3. Fit the switch assembly to the steering-column, tighten the clamp and position the switch striker bush with the arrow pointing to the direction indicator switch.

4. Fit the L.H. half of the steering-column cowl to the steering-column, connect the plug to the lighting switch, connect the three wiring harness multi-connectors and fit the R.H. half of the cowl. Secure both halves of the cowl.

5. Fit the steering-wheel, aligning the marks on the wheel hub and inner column; fit the retaining nut and cover.

STEERING-COLUMN LOCK AND IGNITION/STARTER SWITCH

Remove

1. Remove the steering-column, leaving the steering-wheel in position on the column.

2. Drill out the shear bolt heads from the clamp plate or, alternatively, use an extractor to remove the bolts.

3. Remove the steering lock and clamp plate from the steering-column.

Refit

1. Centralize the lock body over the slot in the outer column, fit the clamp plate, but do not shear the bolt heads.

2. Fit the steering-column but before fitting the steering-column cowls, check that the steering lock and switch operate correctly.

3. Tighten the new shear bolts until the heads shear off and then fit steering-column cowls.

TIE-ROD BALL JOINT AND RACK SEAL

Remove

Service tool: 18G 1063

1. Apply the handbrake and slacken the front road wheel nuts. Raise the front of the car, support it on stands and remove the wheel.
2. Slacken the ball joint locknut, remove the ball pin nut, and separate the ball joint from the steering lever using tool 18G 1063.
3. Unscrew the ball joint from the tie-rod and, if the rack seal is to be removed, slacken the clips and remove the seal.

Refit

1. Lubricate the contact area of the seal, position the large wire clip on the seal and push the seal onto its location on the housing and tighten the clip.
2. Fit the ball joint and locknut, ensuring that the tie-rods are equal in length, and tighten the locknut to the torque figure given in Data. Secure the steering ball joint to the steering lever.
3. Fit the road wheel, lower the car and tighten the wheel nuts to the torque figure given in Data.
4. Check, and if necessary adjust, the front wheel alignment.

STEERING LEVER

Remove

Service tool: 18G 1063

1. Apply the handbrake and slacken the front road wheel nuts. Raise the front of the car, support it on stands and remove the wheel.
2. Slacken the ball joint locknut, remove the ball pin nut, and separate the ball joint from the steering lever using tool 18G 1063.
3. Remove the bolts retaining the steering lever to the swivel hub, remove the steering lever and extract the hollow dowels from the steering lever.

Refit

1. Fit the steering lever to the swivel hub using a new lock washer and, if necessary, new hollow dowels. Tighten the steering lever bolts to the torque figure given in Data.
2. Secure the steering ball joint to the steering lever.
3. Fit the road wheel, lower the car and tighten the wheel nuts to the torque figure given in Data.
4. Check, and if necessary adjust, the front wheel alignment.

STEERING-COLUMN ASSEMBLY

Remove

1. Remove the cover from the centre of the steering-wheel, unscrew the retaining nut, mark the wheel hub and inner column for reassembly and withdraw the steering-wheel.
2. Pull back the carpet and release the steering-column coupling cover from the toeboard. Release the steering-column from the flexible coupling.
3. Remove the screws retaining the two halves of the steering-column cowl, remove the R.H. half of the cowl and disconnect the three wiring harness multi-connectors. Disconnect the plug from the lighting switch and remove the L.H. half of the cowl with the mixture (choke) control attached.
4. Release the steering-column attachment clip from the pedal bracket, release the steering-column top mounting bracket and remove steering-column assembly.

Overhaul

1. Slacken the screw securing the combined switch assembly to the steering-column and remove the switch assembly.
2. Remove the nuts and bolts securing the upper column to the outer column, withdraw the inner column from the outer column and remove the upper column and the bush halves from the inner column.
3. Renew the bush if worn or damaged.
4. Fit the inner column to the outer column, locate the bush in position, fit the upper column and tighten the bolts to the torque figure given in Data.
5. Fit the switch assembly to the upper part of the steering-column, tighten the clamp and position the switch striker bush with the arrow pointing to the direction indicator switch.
6. Fit the steering-wheel, aligning the marks on the wheel hub and inner column, fit the retaining nut and cover.

Refit

1. Position the steering-column and tighten the mounting bracket bolts finger tight. Slacken the steering-column clip and secure it to the pedal bracket and tighten the nut and bolt finger tight.
2. With the road wheels and steering-wheel in the straight-ahead position, secure the steering-column to the flexible coupling with the bolt heads uppermost. Ensure that the inner column is central in the outer column and tighten the steering-column mounting bolts, then tighten the attachment clip nuts and bolts.
3. Fit the L.H. half of the steering-column cowl to the steering-column, connect the plug to the lighting switch, connect the three wiring harness multi-connectors and fit the R.H. half of the cowl. Secure both halves of the cowl.
4. Secure the steering-column coupling cover to the toeboard.

STEERING RACK AND PINION

Remove

Service tool: 18G 1063

1. Disconnect the battery, apply the handbrake and slacken the front road wheel nuts. Raise the front of the car, support it on stands and remove the front wheels.

2. Pull back the carpet and release the steering-column coupling cover from the toeboard, then disconnect the steering rack pinion coupling from the flexible coupling.

3. Disconnect the ball pins from the steering levers, using tool 18G 1063. Remove the 'U' bolt, clamp and pad securing the steering rack, rotate the rack and withdraw it from the driver's side of the car.

Overhaul

Service tools: 18G 207, 18G 207 A, 18G 1278
Special lubricants: BP Energrease FGL, Esso Beacon 2 grease

1. Remove both ball joints and locknuts from the tie-rods and remove the seals and clips from the ends of the rack housing.

2. Using a $\frac{5}{32}$ in (4 mm) drill, drill out, to a depth of 6.3 mm (0.248 in), the pin securing each ball housing.

3. Using tool 18G 1278, remove both ball housings, noting that if they are to be refitted each ball housing and its associated parts must be refitted to the end from which it was removed. Withdraw the ball seat and locking ring from each end of the rack.

4. Remove the rack damper cover-plate, joint washer, shims, thrust spring and support yoke from the rack housing.

5. Remove the coupling from the pinion, then remove the pinion end cover, joint washer and shims. Push out the pinion and lower bearing.

6. Withdraw the rack from the pinion end of the rack housing.

7. Withdraw the pinion upper bearing and oil seal from the rack housing and extract the plastic bush from the plain end of the rack housing.

8. Renew any parts that are worn or damaged and, during assembly, lubricate the internal components with 100 cm^3 of fluid grease, BP Energrease FGL, putting 80 cm^3 in the pinion end and 20 cm^3 in the support end. Pack the ball joints with Esso Beacon 2 grease.

9. Fit the plastic bush in the plain end of the rack housing, engaging the bush projections in the slots in the housing.

10. Fit the upper bearing to the pinion, push the upper bearing fully into the rack housing and remove the pinion. Insert the rack from the pinion end, uncover the centralizing hole in the rack housing and centralize the rack by screwing a 6 mm bolt through the rack housing and into the threaded hole in the rack.

11. Fit the pinion and the lower bearing and pre-load the bearings as follows:

a. Add sufficient shims to stand proud of the pinion housing, fit the end cover (without the joint washer) and tighten the bolts lightly and evenly.

Note: *The bolts securing the support yoke cover plate are longer than those securing the pinion cover plate and can contact the steering rack if used in the wrong position.*

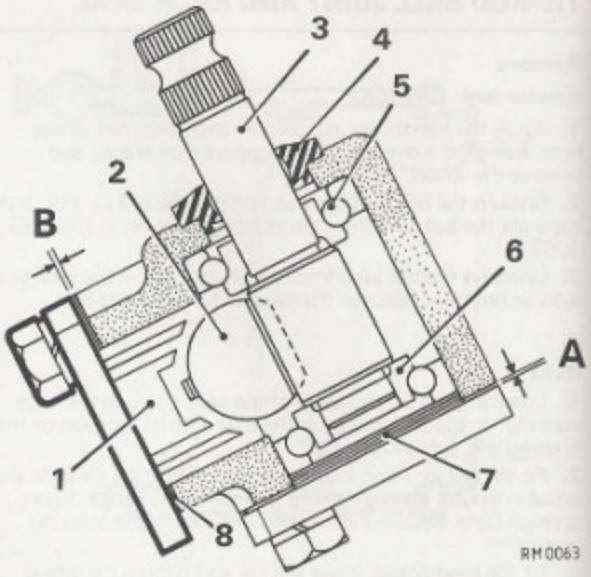

Fig. 3

Pinion bearing and support yoke

1 Rack support yoke
2 Steering rack
3 Pinion
4 Oil seal
5 Top bearing
6 Bottom bearing
7 Bearing pre-load shims
8 Support yoke shims

b. Measure the gap 'A' between the cover and the housing. Remove the cover and adjust the shim pack to obtain the gap given in Data; the gap quoted in Data makes allowance for the joint washer. Ensure that the standard (thick) shim is against the end cover, fit a new joint washer and tighten the bolts.

12. Fit a new pinion oil seal to the housing and fit the coupling to the pinion so that the coupling studs are parallel to the rack centre line.

13. Fit the rack support yoke (without the spring) and the cover-plate (without the joint washer) and adjust as follows:

a. Tighten the cover-plate bolts evenly until the rack is lightly clamped by the support yoke.

b. Remove the rack centralizing bolt, turn the pinion through 180 degrees in each direction and, if necessary, adjust the cover-plate bolts to obtain free movement without binding.

c. Measure the gap 'B' between the cover-plate and the housing and remove the cover-plate. Fit the thrust spring and add shims to the value of the gap measurement, plus the support yoke to cover-plate clearance (see Data), less 0.13 mm (0.005 in) for the joint washer thickness.

d. Refit the cover, using a new joint washer, and tighten the cover-plate bolts. Turn the pinion through 180 degrees in each direction from centre and ensure there is no tightness or binding.

e. Fit tools 18G 207 and 18G 207 A to the pinion, ensure that all parts are well lubricated, and check that the torque required to start movement of the pinion is 0.57 to 2.07 Nm (0.058 to 0.211 kgf m, 5 to 18 lbf in). If necessary, adjust the shim thickness to bring the torque within this limit.

14. Centralize the rack by screwing in the 6 mm bolt and fit and adjust each tie-rod as follows:

a. Lubricate the tie-rod ball with Esso Beacon 2 grease, then fit the locking ring, ball seat, tie-rod and ball housing to the rack. Tighten the ball housing until the tie-rod ball is just pinched and tighten the locking ring, using tool 18G 1278; ensure that the ball housing does not turn.

b. Attach a spring balance to the end of the tie-rod and check that the torque required to articulate the joint 25 degrees from the rack centre line is between 5.7 and 7.3 Nm (0.57 and 0.73 kgf m, 50 and 65 lbf in). Adjust the ball housing to obtain the correct pre-load on the ball joint.

c. Protect the rack housing from swarf and, using a 4 mm (5/32 in) drill, drill between the housing and locking ring to a depth of 10.3 mm (0.41 in).

CAUTION: *The rack end must not be drilled more than three times and the hole must be at least 90 degrees from a previous drilling. Do not drill in the arc subtended by the teeth.*

d. Drive in a new pin and retain it by peening over the edge of the hole in four places, using a chisel.

15. Fit the rack seals and tighten the retaining clips, noting that the seals and inner clips are handed; the seal with the larger diameter inner opening is fitted to the pinion end of the rack housing.

16. Screw the ball joint locknuts onto the tie-rods and screw on each ball joint an equal amount until the ball-pin centre dimension is as given in Data.

Refit

1. Fit the steering rack from the driver's side of the car and secure in position with the mounting pad, clamp and 'U' bolt, tightening the nuts to the torque figure given in Data.

2. Connect the steering ball pins to the steering levers and, with the steering-wheel in the straight-ahead position, connect the steering-column to the steering rack. Tighten the nuts to the torque figure given in Data.

3. Remove the rack centralizing bolt and cover the hole in the rack housing with the rubber band. Secure the steering-column gaiter to the toeboard and refit the carpet.

4. Fit the road wheels, lower the car, tighten the wheel nuts to the torque figure given in Data and connect the battery.

5. Check, and if necessary adjust, the front wheel alignment.

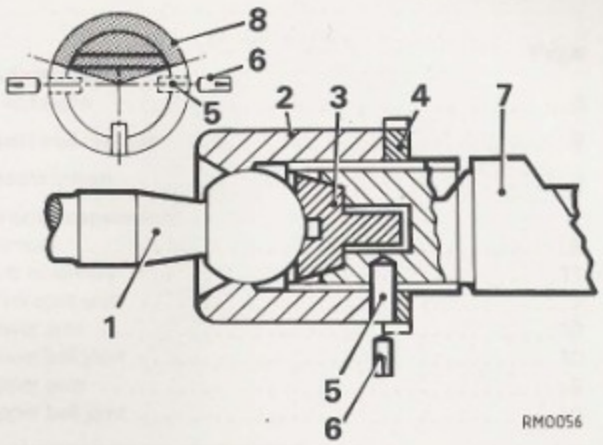

Fig. 4

Tie-rod pre-load adjustment

1 Tie-rod
2 Ball housing
3 Ball seat
4 Locking ring
5 4 mm (5/32 in) drilled hole
6 Locking pin
7 Steering rack
8 Permissible successive locking pin drillings