

SAAB

SERVICE MANUAL



M 1969—1974

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SERVICE MANUAL

SAAB 99

Ordering No. 103556

SAAB-SCANIA AKTIEBOLAG
Saab Car Division

NYKÖPING SWEDEN
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Enbart för spridning utomlands

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SERVICE MANUAL

SAAB 900

Model No. 90002

SAAB-SCania AB
Box 1000
S-402 22 Gäddede
Sweden

TOOL SERVICE

ENGINE

ELECTRICAL SYSTEM
INSTRUMENTS

TRANSMISSION

BRAKES

STEERING DEVICE
FRONT AXLE ONLY

SUSPENSION WHEELS

BODY

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FOREWORD

This Service Manual has been compiled for the use of service shops as an aid to service and repair work which, we hope, will enable all concerned to do a thorough and successful job. The recommendations and directions contained in this Manual are based on experience gained up to date. As fresh experience becomes available, the relevant information will be passed on to Saab general agents and authorized service shops in the form of "Service Informations" (SI). Service Informations should be filed in a special binder labeled "Service Information Saab 99".

Altered and new pages for the loose leaf edition of the Service Manual will also be sent to General Agents, authorized service shops, and others on our mailing list.

Note! At reprints of the manual only altered pages become new dates. This means that different dates occur in the manual, but all pages are up-to-date.

Like the Spare Parts Catalogue, the Service Manual is arranged in sections according to the same system as used in the Repair Catalogue issued by the Swedish Automobile Servicing and Retailing Employers' Association.

Each section begins with a brief design description followed by detailed descriptions of the service work relevant to that section.

Technical data such as dimensions, tolerances, tightening torques, etc. are listed in Group 0.

SAAB-SCANIA AKTIEBOLAG

Saab Car Division

NYKÖPING

SWEDEN

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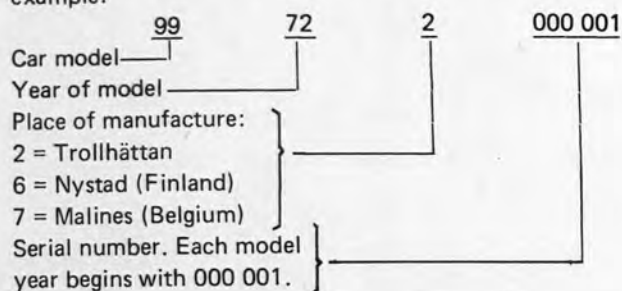
EXTERIOR, SAAB 99

CHASSIS AND ENGINE NUMBERS

The illustrations below show the location of the chassis and engine numbers. For positive identification of a car or engine, these numbers and the odometer reading of the car must always be quoted in connection with complaints and other correspondence. When a car is fitted with a replacement engine, the number of the old engine must always be die-stamped in the place provided for the purpose. This is most important in order to avoid any complications if the car in question is later taken abroad.

Chassis numbers, as from model 1972

As from model 1972 the chassis number consists of eleven digits. The meaning of the digits is shown in the following example:



Chassis number limits for the different year models

Cars made in Sweden

Model 1969: Chassis No. 99.001.001–99.014.259
Model 1970: Chassis No. 99.020.001–99.043.053
Model 1971: Chassis No. 99.050.001–99.075.331
Model 1972: Chassis No. 99722000001–99722031968
Model 1973: Chassis No. 99732000001–99732041390
Model 1974: Chassis No. 99742000001–99742038672

Cars made in Finland

Model 1970: Chassis No. 90600001–90601640
Model 1971: Chassis No. 91600001–90606152
Model 1972: Chassis No. 99726000001–99726008665
Model 1973: Chassis No. 99736000001–99736010841
Model 1974: Chassis No. 99746000001–99746015285

Cars made in Belgium

Model 1973: Chassis No. 99737000001–~99737000201
Model 1974: Chassis No. 99747000001–99747004096

Engine numbers 1,7 and 1,85 l engines

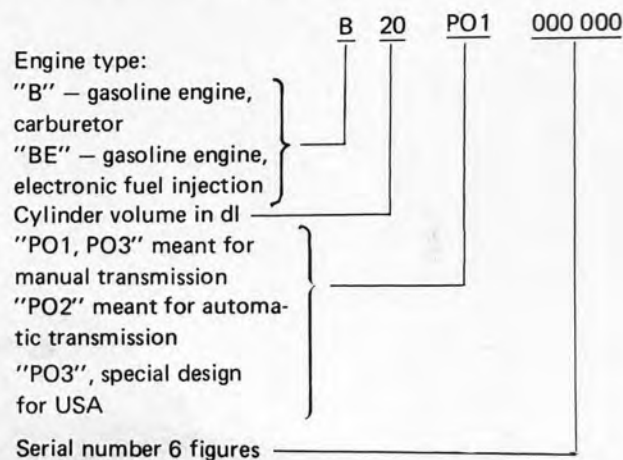
In front of the engine number, there are two letters punched. The first letter is J in all engines. The second letter varies as follows:

- B = 1,7 l carbureted engine, Europe
- C = 1,7 l carbureted engine, USA
- D = 1,7 l fuel injection engine
- E = 1,85 l carbureted engine, Europe
- F = 1,85 l carbureted engine, USA
- G = 1,85 l fuel injection engine

After the engine numbers, the following letters are punched:

- HE = Indicate High Compression Engine and are punched on all engine types.
- A = Engines, intended for installing on automatic transmission.

Engine number 2,0 l engine





Location of chassis number and paint color code signs, USA cars

1. Chassis number sign
2. Paint color code signs

CAR MANUFACTURED BY
SAAB-SCANIA
Trollhättan - Sweden
CAR COLOUR W:5

0073C001323
SAAB 90

Color code and chassis number signs



S 3709



Gear box number, manual transmission



Engine number 1,7 and 1,85 l motor



Chassis number punched in car body, 2-door model as from model 1972 (Placed under back seat cushion)



Chassis number punched in car body, 4-door model as from model 1972 (under back seat cushion)



Manufacturing number automatic transmission model 269



Engine number 2,0 l engine



Chassis number punched in car body, 2-door model up to and incl. model 1971



Chassis number punched in car body, 4-door model up to and incl. model 1971 (under back seat cushion)



Manufacturing number, automatic transmission model 35 TB



Manufacturing number, automatic transmission model 393 and 399

Guaranty questions concerning the automatic transmission will be dealt with by SAAB-SCANIA and the company representatives. Do not contact the manufacturer. By all correspondence about guaranty-, service- and spare parts questions the gearbox manufacturing number must be quoted.

GENERAL DATA

	Model 1969-1970	Model 1971	
Overall length incl. bumpers	14' 3.3" (4346 mm)	14' 3.3" (4346 mm)	
Overall width	5' 6.0" (1676 mm)	5' 6.0" (1676 mm)	
Overall height (empty)	4' 8.5" (1440 mm)	4' 8.5" (1440 mm)	
Road clearance (curb weight)	6.75" (175 mm)	6.75" (175 mm)	
Track, front wheels	4' 6.75" (1390 mm)	4' 6.75" (1390 mm)	
Track, back wheels	4' 7.25" (1400 mm)	4' 7.25" (1400 mm)	
Wheelbase	8' 1.5" (2473 mm)	8' 1.5" (2473 mm)	
Turning radius	16' 11" (5.1 m)	16' 11" (5.1 m)	
Curb weight	2360 lb. (1070 kg)	2420-2530 lb. (1090-1140 kg)	
Total weight (fully loaded)	3400 lb. (1530 kg)	3440 lb. (1560 kg)	
Vehicle capacity weight	970 lb. (440 kg)	900 lb. (410 kg)	
Weight distribution by total weight	front 51 %	front 51 %	
No. of seats (incl. driver)	5	5	
Available luggage space (SAE)	11.8 cu.ft. (0.347 m ³)	11.8 cu.ft. (0.347 m ³)	
Max. roof load	220 lb. (100 kg)	220 lb. (100 kg)	
Max. trailer weight	2400 lb. (1100 kg)	2400 lb. (1100 kg)	
	Model 1972	Model 1973	Model 1974
Overall length incl. bumpers	14' 4" (4370 mm)	14' 4" (4370 mm) USA: 14' 5" (4400 mm)	14' 6" (4420 mm) Saab 99 Combi Coupé: 14' 10" (4530 mm) Saab 99 X7: 14' 4" (4370 mm)
Overall width	5' 6.5" (1690 mm)	5' 6.5" (1690 mm)	5' 6.5" (1690 mm)
Overall height (empty)	4' 8.5" (1440 mm)	4' 8.5" (1440 mm)	4' 8.5" (1440 mm)
Road clearance (curb weight)	6.75" (175 mm)	6.75" (175 mm)	6.75" (175 mm)
Track, front wheels	4' 6.75" (1390 mm)	4' 6.75" (1390 mm)	4' 6.75" (1390 mm)
Track, back wheels	4' 7.25" (1400 mm)	4' 7.25" (1400 mm)	4' 7.25" (1400 mm)
Wheelbase	8' 1.5" (2473 mm)	8' 1.5" (2473 mm)	8' 1.5" (2473 mm)
Turning radius	17' 1" (5.2 m)	17' 5" (5.3 m)	17' 5" (5.3 m)
Curb weight	2440-2575 lb. (1110-1170 kg)	2470-2600 lb. (1120-1180 kg)	2380-2600 lb. (1080-1180 kg)
Curb weight, USA	2460-2650 lb. (1115-1200 kg)	2470-2650 lb. (1120-1200 kg)	2490-2710 lb. (1130-1230 kg)
Total weight (fully loaded)	3430-3500 lb. (1560-1590 kg)	3450-3500 lb. (1560-1590 kg)	3330-3550 lb. (1510-1610 kg)
Gross vehicle weight rating USA:			
2 door model	3440 lb. (1560 kg)	3440 lb. (1560 kg)	Heaviest model: 3640 lb. (1650 kg)
4 door model	3510 lb. (1590 kg)	3510 lb. (1590 kg)	
Gross axle weight rating USA:			
Front axle	1940 lb. (880 kg)	1940 lb. (880 kg)	1970 lb. (890 kg)
Rear axle	1770 lb. (800 kg)	1770 lb. (800 kg)	1770 lb. (800 kg)
Vehicle capacity weight USA:			
Without air conditioning	900 lb. (410 kg)	900 lb. (410 kg)	930 lb. (420 kg)
With air conditioning	860 lb. (390 kg)	850 lb. (385 kg)	930 lb. (420 kg)
Weight distribution by total weight	front 52-55 %	front 52-55 %	front 49-53 %
No. of seats (incl. driver)	5	5	5
Available luggage space (SAE)	11.8 cu.ft. (0.347 m ³)	11.8 cu.ft. (0.347 m ³)	11.8 cu.ft. (0.347 m ³) Saab 99 Combi Coupé: 13 cu.ft. (0.381 m ³)
Max. roof load	220 lb. (100 kg)	220 lb. (100 kg)	220 lb. (100 kg)
Max. trailer weight	2400 lb. (1100 kg)	2400 lb. (1100 kg)	2650 lb. (1200 kg)

ENGINE

General data

1.7 l Carburetor engine

1.7 l Injection engine

Type	4-cyl., 4-stroke with overhead camshaft	4-cyl., 4-stroke with overhead camshaft
Power rating, DIN	59 kW (80 hp)/5200 rev/min	64 kW (87 hp)/5200 rev/min
Max. torque, DIN	127 Nm (94 ft.lb., 13.0 kpm)/3000 rev/min	129 Nm (95 ft.lb., 13.2 kpm)/3000 rev/min
Compression ratio	9.0:1	9.0:1
No. of cylinders	4	4
Cylinder bore	3.288" (83.5 mm)	3.288" (83.5 mm)
Stroke	3.071" (78.0 mm)	3.071" (78.0 mm)
Cylinder volume	104.2 cu.in. (1709 cm ³)	104.2 cu.in. (1709 cm ³)
Order of firing (NO. 1 at rear)	1-3-4-2	1-3-4-2
Engine idling speed (warm)	800-850 rev/min	800-850 rev/min
Weight incl. clutch, carburetor, exhaust manifold, starter and oil filter but not incl. air cleaner appr.	285 lb. (130 kg)	285 lb. (130 kg)

1.85 l Carburetor engine

1.85 l Injection engine

Type	4-cyl., 4-stroke with overhead camshaft	4-cyl., 4-stroke with overhead camshaft
Power rating, DIN	65 kW (88 hp)/5000 rev/min	71 kW (95 hp)/5200 rev/min
Max. torque, DIN	147 Nm (108 ft.lb., 15.0 kpm)/3000 rev/min	143 Nm (105 ft.lb., 14.6 kpm)/3200 rev/min
Compression ratio	9.0:1	9.0:1
No. of cylinders	4	4
Cylinder bore	3.425" (87.0 mm)	3.425" (87.0 mm)
Stroke	3.071" (78.0 mm)	3.071" (78.0 mm)
Cylinder volume	113.1 cu.in. (1854 cm ³)	113.1 cu.in. (1854 cm ³)
Order of firing (No. 1 at rear)	1-3-4-2	1-3-4-2
Engine idling speed (warm)	800-850 rev/min	800-850 rev/min
Weight incl. clutch, carburetor, exhaust manifold, starter and oil filter but not incl. air cleaner appr.	290 lb. (132 kg)	290 lb. (132 kg)

2.0 l Carburetor engine

2.0 l Injection engine

Type	4-cyl., 4-stroke with overhead camshaft	4-cyl., 4-stroke with overhead camshaft
Power rating, DIN (SAE net)	70 kW (95 hp)/5200 rev/min	81 kW (110 hp)/5500 rev/min
Max. torque, DIN	157 Nm (115 ft.lb., 16.0 kpm)/3500 rev/min	167 Nm (123 ft.lb., 17.0 kpm)/3700 rev/min
Compression ratio	8.7:1	8.7:1
No. of cylinders	4	4
Cylinder bore	3.543" (90.0 mm)	3.543" (90.0 mm)
Stroke	3.071" (78.0 mm)	3.071" (78.0 mm)
Cylinder volume	121.0 cu.in. (1985 cm ³)	121.0 cu.in. (1985 cm ³)
Order of firing (No. 1 at rear)	1-3-4-2	1-3-4-2
Engine idling speed	800-850 rev/min	800-850 rev/min
Engine idling speed USA:		
Cars with manual transmission	850 rev/min	850 rev/min
Cars with automatic transmission	800 rev/min	800 rev/min
Weight incl. clutch, throttle housing, exhaust manifold, starter and oil filter but not incl. air cleaner	appr. 308 lb. (140 kg)	appr. 308 lb. (140 kg)

Cylinder block1.7 l1.85 l

Material	Specially alloyed cast iron	
No. of main bearings	5	
Cylinder bore:		
Standard (F)	83.487–83.497 mm	86.987–86.997 mm
— " — (G)	83.500–83.513 mm	87.000–87.013 mm
— " — (H)	83.530–83.543 mm	87.030–87.043 mm
1st oversize	84.005–84.021 mm	87.495–87.508 mm
2nd oversize	84.513–84.529 mm	88.003–88.016 mm

2.0 l

Material	Specially alloyed cast iron
No. of main bearings	5
Cylinder bore:	
Standard (A)	90.000–90.010 mm
— " — (B)	90.010–90.020 mm
1st oversize	90.500 mm
2nd oversize	91.000 mm

Cylinder head, 2.0 l engine

Max. grinding or facing of cylinder head surface	0.4 mm
Distance from cylinderhead gasket surface to valve cover gasket surface, new cylinder head	92.75 ± 0.05 mm

Pistons, 1.7 and 1.85 l engines1.85 l

Material	Light metal alloy	
No. of rings per piston	2 compression rings 1 oil scraper (3-piece)	
Width of ring grooves:		
Top	2.038–2.064 mm	1.790–1.810 mm (Mahle)
Middle	3.038–3.064 mm	2.030–2.050 mm (Mahle)
Bottom	3.988–4.013 mm	4.000–4.020 mm (Mahle)
Piston diameter (measured at lower edge perpendicular to piston pin):		
Standard (F)	83.464–83.475 mm	86.962–86.976 mm
— " — (G)	83.475–83.487 mm	86.977–86.991 mm
— " — (H)	83.490–83.503 mm	87.007–87.021 mm
1st oversize	83.983–83.992 mm	87.470–87.482 mm
2nd oversize	84.491–84.500 mm	87.978–87.990 mm
Piston clearance	0.013–0.038 mm	
Withdrawal of piston	from top of block	
Piston orientation	marking FRONT alt. → facing the engine transmission end	
Pin diameter	20.635–20.640 mm	22.225 mm
Fit of pin	sliding fit under gentle pressure with thumb 0.008 ± 0.007 mm	
Piston speed	13 m/sec. at 5000 rev/min	
Maximum allowed weight difference between pistons in same engine	6.0 g	

Pistons, 2.0 l engine

Material	Light metal alloy
No. of rings per piston	2 compression rings 1 oil scraper (3-piece)
Width of ring grooves:	
Top	1.79–1.81 mm
Middle	2.00–2.05 mm
Bottom	4.01–4.03 mm
Piston diameter (measured 16.5 mm from lower edge perpendicular to piston pin):	
Standard (AB)	89.980–89.986 mm
— (C)	89.999–90.010 mm
1st oversize	90.472–90.487 mm
2nd oversize	90.972–90.987 mm
Piston clearance	0.014–0.040 mm
Withdrawal of piston	from top of block
Piston orientation	groove on top should be fac- ing the engine transmission end
Pin diameter	23.996–24.000 mm
Fit of pin	0.005–0.014 mm sliding fit under gentle pressure with thumb
Piston speed	13 m/sec. at 5000 rev/min

Piston rings	1.7 and 1.85 l Fabr. Hepworth	1.7 and 1.85 l Fabr. Mahle	2.0 l Fabr. Mahle
Upper compression ring:			
Thickness	1.975–2.000 mm	1.728–1.740 mm	1.73–1.74 mm
Gap, fitted in new cylinder	0.30–0.45 mm		0.35–0.55 mm
Piston ring play in groove	0.050–0.082 mm		0.050–0.082 mm
Lower compression ring:			
Thickness	2.975–3.000 mm	1.987–1.990 mm	1.98–1.99 mm
Gap, fitted in new cylinder	0.30–0.45 mm		0.30–0.45 mm
Piston ring play in groove	0.040–0.063 mm		0.040–0.072 mm
Oil scraper:			
Thickness (segment)	0.584–0.635 mm		0.58–0.64 mm
Gap fitted in new cylinder (segment)	0.40–1.40 mm		0.38–1.40 mm
Thickness, middle ring	3.59–3.84 mm		2.63–2.73 mm

Connecting rods	1.7 l	1.85 l	2.0 l
Material			Forged steel
Big-end bore	48.146–48.158 mm		56.000–56.019 mm
Small-end bushing, installed	20.640–20.647 mm	22.232 mm	24.005–24.010 mm
Maximum allowed weight difference between con- necting rods in same engine			6 g

Crankshaft, 1.7 and 1.85 l engines

Crank pin diameter	44.450—44.463 mm
No. of main bearings	5
Main bearing diameter:	
Standard	53.987—54.000 mm
Max. out-of-round	0.05 mm
Crankshaft axial play	0.08—0.25 mm
Main bearing play	0.025—0.064 mm
Crank bearing play	0.020—0.058 mm
Max. out-of-round	0.05 mm

Crankshaft, 2.0 l engine

Material	Forged steel				
Surface treatment	Tennifer-coated				
Pin hardness	HV appr. 800				
No. of main bearings	5				
Crank pin diameter:					
Standard	51.981—52.000 mm				
1st undersize	51.731—51.750 mm				
2nd undersize	51.481—51.500 mm				
3rd undersize	51.237—51.250 mm				
4th undersize	50.987—51.000 mm				
Main bearing pin diameter:					
Standard	57.981—58.000 mm				
1st undersize	57.731—57.750 mm				
2nd undersize	57.481—57.500 mm				
3rd undersize	57.237—57.250 mm				
4th undersize	56.987—57.000 mm				
Radius at pin end	2.2—2.5 mm				
Max. out-of-round of pins	0.05 mm				
Max. conicity of pins	0.05 mm				
Bearing material	Lead-bronze				
Crankshaft axial play	0.08—0.28 mm				
Main bearing play	0.020—0.062 mm				
Crank bearing play	0.026—0.062 mm				
Colour marks, main and crank bearing halves:					
Standard	<table><tr><td>Thin</td><td>Thick</td></tr><tr><td>Red</td><td>Blue</td></tr></table>	Thin	Thick	Red	Blue
Thin	Thick				
Red	Blue				
1st undersize	<table><tr><td>Yellow</td><td>Green</td></tr></table>	Yellow	Green		
Yellow	Green				
2nd undersize	<table><tr><td>White</td><td>Brown</td></tr></table>	White	Brown		
White	Brown				

Camshaft	1.7 l Carb.	1.7 l Injection	1.85 l Carb.	1.85 l Injection
No. of bearings	5	5	5	5
Bearing diameter	31.75 mm	31.75 mm	31.75 mm	31.75 mm
Camshaft axial play	0.10—0.20 mm	0.10—0.20 mm	0.10—0.20 mm	0.10—0.20 mm
Valve timing:				
Inlet (nominal valve clearance 0.23 mm)	starts 12° BTDC ends 52° ABDC	starts 12° BTDC ends 52° ABDC	starts 12° BTDC ends 52° ABDC	starts 16° BTDC ends 56° ABDC
Exhaust (nominal valve clearance 0.43 mm)	starts 52° BBDC ends 12° ATDC	starts 52° BBDC ends 12° ATDC	starts 52° BBDC ends 12° ATDC	starts 56° BBDC ends 16° ATDC

2.0 l

No. of bearings	5
Bearing diameter	25.94 mm
Camshaft axial play	0.08—0.25 mm
Cam lifting height at valve clearance 0:	
Inlet valve	10.37 mm
Outlet valve	10.57 mm

Idler shaft

Axial play 0.05–0.13 mm

Valve timing:

Inlet (nominal valve clearance 0.25 mm)	starts 26° BTDC
	ends 70° ABDC
Outlet (nominal valve clearance 0.45 mm)	starts 70° BBDC
	ends 26° ATDC

Valve mechanism

	<u>1.7 and 1.85 l</u>	<u>2.0 l</u>
Valve grinding angle, inlet and outlet	45°	44.5°
Valve seat angle in cylinder head, inlet and outlet	45°	45.0°
Valve seat width, inlet and outlet	2.2–2.5 mm	1–2 mm
Valve spindle diameter:		
Inlet	7.89–7.90 mm	7.960–7.975 mm
Outlet	7.87–7.88 mm	7.955–7.980 mm
Max. play valve spindle – valve guide	0.5 mm	0.5 mm
	Measured on valve disc pulled 3 mm from seat	Measured on valve disc pulled 3 mm from seat
Valve disc diameter:		
Inlet	36.6 mm	42.0 mm
Outlet	32.5 mm	35.5 mm
Valve guides:		
Length	49 mm	46.65 mm
Outer diameter	13 mm	13.040–13.051 mm
Bore for valve guides in cylinder head, diameter	12.69–12.71 mm	13.000–13.018 mm
Valve springs:		
Installed length	36.3 mm	39.5 mm
Free length	Up to and incl. chassis number 99008253: 42.4 mm As from chassis number 99008254: 41 mm	44.3 mm
Length at full elevation	27.9 mm	29.5 mm
Load at full elevation	Up to and incl. chassis number 99008253: 490 ± 50 N (50 ± 5 kp) As from chassis number 99008254: 630 ± 50 N (64 ± 5 kp)	795 – 880 N (178–198 lb., 81–90 kp)
Valve depressors:		
Diameter	33.34–33.35 mm	37.87–37.98 mm
Height	27 mm	33 mm
Bore in cylinder head for valve depressors (camshaft bearing assy.) diameter	33.37–33.38 mm	38.000–38.016 mm
Pallets for valve adjustment:		
Diameter	15.5 mm	15.5 mm
Thickness	1.77–2.89 mm There are 23 pallets of different thicknesses at intervals of 0.050 mm	1.77–2.89 mm There are 23 pallets of different thicknesses at intervals of 0.050 mm

1.7, 1.85 and 2.0 l

Material:

Exhaust valve
Inlet valve

Stellite-steel
Steel
Valve spindles are chromium plated
Cast iron
Sintered metal

Valve guides
Valve seats

Valve clearances, cold engine (30 minutes after driving the engine warm):

Inspection tolerance zone:

Inlet	0.006—0.012" (0.15—0.30 mm)
Exhaust	0.014—0.020" (0.35—0.50 mm)

Adjustment tolerance zone:

Inlet	0.008—0.010" (0.20—0.25 mm)
Exhaust	0.016—0.018" (0.40—0.45 mm)

Lubrication system

1.7, 1.85 and 2.0 l

Differences 2.0 l engine

Type	Forced-flow circulating oil system
Pressure-lubricated points	Rotary-type or dual-rotor type oil pump Camshaft, crankshaft, idler shaft, connecting rods, transmission chain
Splash-lubricated points	Piston pins, cylinder walls, valve depressors and valve spindles
Oil filter	Full-flow type
Crankcase ventilation, fully enclosed	From air cleaner — oil filler neck — crankcase — valve cover — valve to inlet manifold

From air cleaner — connecting housing — crankcase — valve cover — pressure regulating valve to inlet manifold

2.0 l injection engines, model 1974:
From crankcase through valve cover — T-nipple to inlet manifold. The T-nipple is connected to atmospheric pressure via the air cleaner.

Lubricating oil, grade:		Service SE
Summer	Motor oil SAE 10 W 40 or SAE 10 W 30	in API-system or Ford spec. ESE—M2C—101C
Winter with temp. constantly -4°F (-20°C)	SAE 5 W 20	
NOTE: SAE 5 W 20 must not be used at temperatures above $+32^{\circ}\text{F}$ (0°C)		

Oil volume incl. filter	4.5 US qt, 6 Imp. pints (3.5 lit.)
Oil pump pressure-reducing valve opens at	Rotary-type 3.8—4.2 bar (kp/cm^2 , 54—60 psi) Dual-rotor type 3.3—4.0 bar (kp/cm^2 , 47—57 psi)
Oil pressure warning light comes on at	Appr. 0.3 bar (kp/cm^2 , 4.2 psi)
Oil pressure at 2000 rev/min (oil SAE 10 W 40 at 80°C)	

4.0—5.0 bar (kp/cm^2 , 57—71 psi.)

0.3—0.5 bar (kp/cm^2 , 4.2—7.1 psi.)

min. 3.0 bar (kp/cm^2 , 43 psi.)

Oil pump.	
Axial clearance between rotor and housing	Rotary-type 0.001—0.005" (0.03—0.13 mm) Dual-rotor type 0.002—0.003" (0.05—0.09 mm)
Radial clearance between rotor blades and housing (sum of both sides)	max. 0.026" (0.65 mm)
Rotor shaft diameter	0.498—0.499" (12.66—12.67 mm)
Bore for rotor shaft in pump housing	0.500—0.501" (12.70—12.72 mm)
Reducing valve spring:	
Free length	2.06" (52.3 mm)
Compressed length	1.32" (33.5 mm)
Spring force at compressed length	67—72 N (15—16 lb., 6.8—7.3 kp)

Fuel system

Carburetor

	<u>1.7 and 1.85 l</u>	<u>2.0 l</u>
Type	Zenith-Stromberg 175 CD-2S	Zenith-Stromberg 175 CD-2S
Diameter	1.75"	1.75"
Fuel needle	B 1 W, "swing needle" type	B 1 BR, "swing needle type"
Float level	0.630-0.709 in. (16-18 mm) between the highest point of the float and the mating sur- face of the carburetor housing	0.630-0.669 in. (16-17 mm) between the highest point of the float and the mating surface of the carburetor housing
Float valve	2.0	2.0
Oil in carburetor damper:		
Outside temp. above -4°F (-20°C)	SAE 10 W 30 or 10 W 40	SAE 10 W 30 or 10 W 40
Outside temp. below -4°F (-20°C)	SAE 5 W 20	SAE 5 W 20
Starting position for adjustment of carburetor jet	2 3/4 turns of adjusting screw back from position of contact between jet and bottom of closed vacuum piston	
Clearance between choke fast idling cam and adjusting screw	0.02-0.04" (0.5-1.0 mm) at idling speed without choke	0.02-0.04" (0.5-1.0 mm) at idling speed without choke
Normal idling speed (warm engine)	800-850 rev/min	800-850 rev/min. USA: Cars with manual transmission 850 rev/min. Cars with auto- matic transmission 800 rev/min.
Fuel jet setting		0.099 ± 0.008" (2.5 ± 0.2 mm) between fuel jet upper surface and the jet bridge surface in the carburetor housing
Fuel needle fitting in the piston		Lower part of groove for plastic washer level with the underside of vacuum piston

Carburetor USA-version

	<u>1.7 and 1.85 l</u>
Type	Zenith-Stromberg 175 CD-2SE
Diameter	1.75"
Fuel needle	B 1 AG, "swing needle" type
	0.65" (17 mm) between the highest point of the float and the mating surface of the carburetor housing
Float valve	2.0
Oil in carburetor damper:	
Outside temp. above -4°F (-20°C)	SAE 10 W 30 or 10 W 40
Outside temp. below -4°F (-20°C)	SAE 5 W 20
Air screw setting	Adjust to the best idling speed
Clearance between choke fast idling cam and adjusting screw	0.02-0.08" (0.5-2.0 mm) at idling speed without choke
Normal idling speed (warm engine)	800-850 rev/min

Fuel system, others, 1.7 and 1.85 l engines

Fuel pump (mechanical) type	AC Delco type Y No. 7971245
Static fuel pressure at starter speed	0.15-0.20 bar (kp/cm ² , 2.15-2.9 psi)
Fuel tank capacity:	
Up to chassis No. 99.024.297	12.7 US gal., 10.5 Imp. gal. (48 liters)
As from chassis No. 99.024.298	11.8 US gal., 10 Imp. gal. (45 liters)

Fuel system, others, 2.0 l engine

Fuel pump (mechanical) type	AC Delco No. 7990045
Static fuel pressure at starter speed	0.17-0.25 bar (kp/cm ² , 2.4-3.6 psi)
Fuel tank capacity:	
Saab 99 L and 99 EMS	11.8 US gal., 10 Imp. gal. (45 liters)
Saab 99 Combi Coupé	14.5 US gal., 12.1 Imp. gal. (55 liters)

Fuel system, fuel injection, 1.7 and 1.85 l engines

1.85 l Injection up to and
incl. chassi No. 99 074 342
+ cars for USA market

1.85 l Injection as from chassis
Nos. 99 074 343

Injection valve Bosch	0 280 150 001 alt. 0 280 150 013	0 280 150 004 alt. 0 280 150 013 the valve is marked with green paint to avoid being mixed up	0 280 150 001 alt. 0 280 150 013
Max. voltage at testing	3 V	3 V	3 V
Max. stroke	0.15 mm	0.15 mm	0.15 mm
Opening time at normal driving	2.5–9.0 milliseconds	2.5–9.0 milliseconds	2.5–9.0 milliseconds
Cold start valve Bosch	0.280 170 010	0 280 170 010	0 280 170 010
Voltage	12 V	12 V	12 V
Spraying angle	100°	100°	100°
Pressure sensor Bosch	0 280 100 009	0 280 100 018	0 280 100 009
Electronic control unit Bosch	0 280 000 010	0 280 000 018	0 280 000 010
Fuel pump Bosch	0 580 960 004	0 580 960 004	0 580 960 004
Voltage	12 V	12 V	12 V
Consumption	2.5 amp. at 14 V	2.5 amp. at 14 V	2.5 amp. at 14 V
Capacity	65 liters/hour, free outlet	65 liters/hour, free outlet	65 liters/hour, free o
Over-flow pressure	4.0 bar (kp/cm ²)	4.0 bar (kp/cm ²)	4.0 bar (kp/cm ²)
Working pressure in the system	2.0 bar (kp/cm ²)	2.0 bar (kp/cm ²)	2.3 bar (kp/cm ²)
Normal idling speed, warm engine	800–850 rev/min	800–850 rev/min	800–850 rev/min

Fuel system, fuel injection, 2.0 l engine

Injection valve Bosch	0 280 150 004 alt. 0 280 150 014 the valve is marked with green paint to avoid being mixed up
Max. voltage at testing	3 V
Max. stroke	0.15 mm
Opening time at normal driving	2.5–9.0 milliseconds
Start valve Bosch	0 280 550 201
Voltage	12 V
Spraying angle	100°
Pressure sensor Bosch	0 280 100 115 (USA cars with automatic trans- mission model 1974, have pres- sure sensor 0 280 100 118 with green color marks.)
Electronic control unit Bosch	0 280 000 039
Fuel pump Bosch	0 580 960 004
Voltage	12 V
Consumption	2.5 A at 14 V
Capacity	50 liters/hour, free outlet at 12 V
Over-flow pressure	3.0–4.5 bar (kp/cm ² , 43–64 psi)
Working pressure in the system	
Up to and incl. chassis No. 99732000357	2.2 bar (kp/cm ² , 31 psi)
As from chassis No. 99732000358	2.0 bar (kp/cm ² , 28 psi) (USA cars with automatic trans- mission, model 1974: 1.9 bar (kp/cm ² , 27 psi)

Normal idling speed, warm engine 800–850 rev/min

USA: Cars with manual transmission 850 rev/min

Cars with automatic transmission 800 rev/min

Exhaust system	<u>1.7 and 1.85 l</u>	<u>2.0 l</u>
Exhaust pipe inner diameter	1.5" (38 mm)	1.73" (44 mm)
Cooling system	<u>1.7 and 1.85 l</u>	<u>2.0 l</u>
Type	Pressurized	Pressurized
Liquid capacity of cooling system incl. heating system	9 US quarts 7.5 Imp quarts (8.5 liters)	10 US quarts 8.4 Imp quarts (9.5 liters)
Thermostat opens at	179.5–188°F (82–86.5°C)	185°F (85°C)
Thermostat fully open at	206–220°F (96.5–100.5°C)	
Radiator pressure cap opens at	Up to and incl. model 1970: 0.55–0.60 bar (kp/cm ² , 7.5–8.5 psi) As from model 1971: 0.55–0.75 bar (kp/cm ² , 7.5–10.3 psi)	Up to and incl. chassis No. 99742006947, 99746006714: 0.60 bar (kp/cm ² , 8.5 psi) As from chassis No. 99742006948, 99746006715: 1.0 bar (kp/cm ² , 14.2 psi)
Water pump	<u>1.7 and 1.85 l</u>	<u>2.0 l</u>
Clearance between impeller screw and pump	0.010–0.0197" (0.25–0.50 mm) Adjust by fitting gaskets of different thickness. Three thicknesses are available: 0.25, 0.50 and 0.75 mm	No adjustment needed. Original gasket gives correct clearance.

Tightening torques, 1.7 and 1.85 l engines

			Nm	ft.lb.	kpm
Main bearings	7/16"	UNF	78	58	8.0
Crank bearing screws	3/8"	—"	54	40	5.5
Camshaft bearing caps	5/16"	—"	23	17	2.3
Camshaft cover	1/4"	UNC	2	1.5	0.2
Crankshaft belt pulley	5/8"	UNF	83	62	8.5
Rear crankshaft seal	1/4"	—"	10	7	1.0
Cylinder head screws	7/16"	—"	74	54	7.5
Cylinder head nuts	7/16"	—"	74	54	7.5
Flywheel	3/8"	—"	59	44	6.0
Water pump impeller	5/16"	—"	25	18	2.5 (left-hand thread)
Carburetor	5/16"	—"	20	15	2.0
Oil pump	5/16"	—"	25	18	2.5
Spark plugs	14 mm		20	15	2.0
Oil filter center screw	3/8"	UNF	25	18	2.5
Idler shaft keeper plate	5/16"	—"	25	18	2.5
Chainwheel, idler shaft	5/16"	—"	25	18	2.5
Chainwheel, camshaft	5/16"	—"	14	10	1.4
Transmission case	5/16"	—"	25	18	2.5
Inlet manifold	5/16"	—"	25	18	2.5
Thermostat housing	5/16"	—"	25	18	2.5
Exhaust manifold	3/8"	—"	37	27	3.8

Tightening torques, 2.0 l engine

	Dimension	Nm	ft.lb.	kpm
Main bearings	M 12	108	79	11
Crank bearing screws	M 10	54	40	5.5
Camshaft bearing caps	M 8	18	13	1.8
Camshaft cover	M 8	2.0	1.4	0.2
Crankshaft belt pulley	M 16	190	137	19
Sealing end (flywheel side)	M 8	20	14	2.0
Cylinder head screw	M 12	93	69	9.5
Flywheel	M 10	59	43	6.0
Water pump impeller	M 8 (left-hand thread)	25	18	2.5
Oil pump	M 8	18	13	1.8
Spark plugs	M 14 x 1.25	28	20	2.8
Idler shaft keeper plate	M 8	20	14	2.0
Chainwheel, idler shaft	M 10	25	18	2.5
Chainwheel, camshaft	M 8	20	14	2.0
Inlet manifold	M 8	18	13	1.8
Thermostat housing	M 8	18	13	1.8
Throttle housing	M 8	18	13	1.8
Exhaust manifold	M 10	25	18	2.5

For other screws, use general tightening torques:

Dimension	Tightening torque		
	Nm	kpm	ft.lb.
M 5	4.9	0.5	3.6
M 6	9.8	1.0	7.2
M 8	19.6	2.0	14.4
M 10	39.2	4.0	28.9

ELECTRICAL SYSTEM

Battery

Voltage	12V
Capacity	60 Ah

Alternator, Bosch

Type designation	Bosch	K1 → 14V 35A 20
Rated voltage		14V
Rated speed		2000 rev/min
Max. permissible continuous load at 14V		35 A
Brush spring pressure	2.9–3.9 N (10.5–14 oz, 300–400 p)	
Rotation		Clockwise
Ratio engine belt pulley – alternator:		
Up to engine No. 33.980		1:1.9
As from engine No. 33 981		1:2.1
Electric test results, see Section 3		

Fuel injection engines and certain USA carburetor engines.
Model 1971 and 1972 in 1.7 and 1.85 l engines.

K1 → 14 V 55 A 20

55 A/14 V

Voltage regulator, Bosch

Type designation	Bosch AD 1 14V
	not radio interference suppressed
Alternator, SEV	<u>2.0 l Injection engine</u>

Type designation	SEV 71212002 (1972: SEV 21271012)
Type	Three phase
Voltage/current at 5000 rev/min	14 V/55A
Direction of rotation	Clockwise
Ratio engine alternator	1:2,1

Voltage regulator, SEV

Type designation	SEV 72717012
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Starter

		Up to chassis No. <u>99.033.650</u>	As from chassis No. <u>99.033.651</u>
Type designation	Bosch GF (R) 12V	0 001 311 026	0 001 311 039
No. of cogs on pinion	9		
No. of cogs on ring gear	142		
Gear ratio	15.8:1		
Output rating	0.7 kW (1 hp)		

Test results

Mechanical test results:

Brush spring pressure	11.3–12.8 N (1150–1300 p)
Backlash	0.35–0.60 mm
Distance from pinion to ring gear	2.5–3.0 mm
Contact reserve	1 mm
Axial play of rotor	0.05–0.30 mm
Rotor brake friction torque	0.25–0.40 Nm (2.5–4.0 kpcm)

Pinion free wheel torque 0.13–0.18 Nm (1.3–1.8 kpcm)
 Electrical test values:
No load
 11.5 V and 35–55 A 6500–8500 rev/min
Loaded
 9 V and 205–235 A 1000–1300 rev/min
Locked starter 6 V 325–375 A
Lowest engagement voltage for solenoid 8 V

Distributor

Carbureted engine

USA cars

Up to and incl. model 1969

Type designation:

Model 1969

AC Delco 7953500

AC Delco 7953820

Model 1970

AC Delco 7953870

Model 1971–1973:

1.7 l engine

AC Delco 7953870 alt.

Model 1970–1974

AC Delco 7953871

1.85 l engine

AC Delco 7953977

AC Delco 7953871

2.0 l engine

AC Delco 7992142

AC Delco 7992196

Model 1974:

1.85 l engine

AC Delco 7953977

2.0 l engine

AC Delco 7992142 alt.

Bosch 0 231 170 115

Capacitor

AC Delco STMC 516237

Bosch 1 237 330 280

Capacitance

0.18–0.22 μ F

Ignition setting:

Basic ignition advance 1.7 and

1.85 l engines

10° BTDC at max. 800 rev/min
and vacuum hose disconnected

9° BTDC at max. 800 rev/min
and vacuum hose disconnected

2.0 l engine

17° BTDC at max. 800 rev/min
and vacuum hose disconnected

14° BTDC at max. 800 rev/min
and vacuum hose disconnected

Order of firing (cyl. No. 1 at rear)

1–3–4–2

Breaker gap

AC Delco 0.35–0.40 mm

Bosch min. 0.40 mm

Dwell angle

AC Delco 40 $\pm$ 2°

Bosch 50 $\pm$ 3°

Contact pressure

AC Delco 4.2–5.9 N (425–600 p)

Bosch 4.9–6.2 N (500–630 p)

Direction of rotation

Counter-clockwise

Axial play, distributor shaft

AC Delco 0.12–0.28 mm

Bosch 0.10–0.30 mm

Ignition advance curves, see section
342.

Fuel injection engine

1.7 and 1.85 l

2.0 l

Type designation

Bosch 0 231 163 007

Bosch 0 231 163 025 up to and incl. model 1973

Capacitor

Bosch 1 237 330 154

Bosch 0 031 179 001 model 1974

Capacitance

0.2 μ F $\pm$ 10 %

Bosch 1 237 330 280

Trigger contacts

Bosch 1 230 090 005

Dwell angle

50° $\pm$ 2°

Breaker gap

Min. 0.014" (0.35 mm)

Contact pressure

4.9–6.2 N (18–23 oz, 500–630 p)

Resistance in rotor arm

5000 ohm $\pm$ 20 %

Direction of rotation

Counter-clockwise

Order of firing (cyl. No. 1 at rear)

1–3–4–2

Axial play, distributor shaft

0.10–0.30 mm

POINTS 1 237 013 044 740
 CAP 1 235 522 056
 ROTOR 1 234 332 074
 CAPACITOR 1 237 330 198

Ignition setting:
Basic ignition advance

1.7 and 1.85 l
5° BTDC at max. 800 rev/min
and vacuum hose disconnected

2.0 l
12° BTDC at max. 800 rev/min
and vacuum hose disconnected
USA cars up to model 1973

8° BTDC at max. 800 rev/min
and vacuum hose disconnected
USA cars model 1974
12° BTDC (cars for California:
4° BTDC) at max. 800 rev/min
and vacuum hose disconnected

Regulating
Ignition advance curves, see section
342.

Centrifugal vacuum

Ignition coil

Type designation
Resistance of primary winding
at 68°F (+20°C) (between con-
nections 1 and 15)
Length of starting spark at 6 V
600 sparks/minute (150 distri-
butor revolutions)
Medium current through primary
winding at 4000 sparks/minute
(1000 distributor revolutions)
Serial resistance
Resistance at 68°F (+20°C)

Bosch KW 12 V

1.7–2.1 ohm

0.4" (10 mm)

1.4–1.6 amps.
Bosch ZSW J 3Z 12
0.9 ± 0.05 ohm

Spark plugs

Type

1.7 and 1.85 l engines
NGK BP-5ES
Bosch W 175 T30
Champion N-11Y
AC 44.X.L.S.
Motorcraft AG 22

2.0 l engine
NGK BP-6ES
Bosch W 175 T30
Champion N-8Y

Thread
Thread length
Electrode gap
Tightening torque

M 14 x 1.25
0.7" (19 mm)
0.024–0.028" (0.6–0.7 mm)
25–29 Nm (18.1–21.8 ft.lb., 2.5–3.0 kpm)

Ignition cables

Resistance:
Cables to cylinders 1 and 2
Cables to cylinders 3 and 4
Cable between ignition coil
and distributor incl. connections

15000 ohm ± 20 %
10000 ohm ± 20 %
1000 ohm ± 20 %

Light bulbs

Model 1969–1970
Headlight
Front direction indicator
Front parking light
Rear direction indicator, braking
and back-up lights
Tail light and number plate light
Dome light
Trunk light
Heater control
Ignition switch
Instrument and indicator lights
Hazard warning signal switch
Rear-view mirror light (model 1970)

Watts	Socket	Qty.
40/45	P 45 t	2
21	BA 15 S	2
5	BA 15 S	2
21	BA 15 S	6
5	BA 15 S	4
10	S 8.5	1
5	S 8.5	1
3 (24V)	BA 7 S	1
2	BA 9 S	1
1.2	Glass	12
2	BA 7 S	1
5	S 8.5	1

Light bulbs**Model 1971-1974**

	Watts	Cap	Qty.
Headlights, normal	40/45W	P 45 t	2
Headlights, halogen H4	60/65W	P 43 t/38	2
Front direction indicators	21W	BA 15S	2
Front parking lights	5W	BA 15S	2
Rear direction indicator, stop and back-up lights	21W	BA 15S	6
Tail and number plate lights	5W	BA 15S	4
Dome light	10W	S 8.5	1
Trunk light	5W	S 8.5	1
Heater control illumination	1.2W	Glass fitting	1
Ignition switch illumination	2W	BA 9S	1
Rear view mirror light	5W	S 8.5	1
Instrument and indicator lights	1.2W	Glass fitting	8-11
Hazard warning signal switch	1.2W	Glass fitting	1
Switch illumination	1.2W	Glass fitting	1
Deviation Saab 99			
Combi Coupé:			
Number plate lights	5W	S 8.5	2

Light bulbs, USA

As from model 1971	Watts	SAE Trade No.	Qty.
Headlight, Sealed Beam, high beam	37.5W	4001	2
Headlight, Sealed Beam, high and low beam	37.5/50W	4002	2
Front direction indicator	21W	1073	2
Front parking light	5W	67	2
Side position light, front, up to and incl. model 1971	4W	57	2
Rear direction indicator, stop and back-up lights	21W	1073	6
Tail light and number plate light	5W	67	4
Side position light, rear	4W	S7	2
Dome light	10W	Cartridge bulb	1
Trunk light	5W	Cartridge bulb	1
Heater control illumination	1.2W	Glass fitting	1
Ignition switch illumination	2W	Miniature bulb	1
Rear view mirror light	5W	Miniature bulb	1
Instrument and indicator lights	1.2W	Glass fitting	8-11
Hazard warning signal switch	1.2W	Glass fitting	1
Switch illumination	1.2W	Glass fitting	1
Deviation Saab 99			
Combi Coupé:			
Number plate lights	5W	S 8.5	2

Fuses

Number of fuses	12
Length x diameter	1 x 0.25" (25 x 6 mm)
Rated current	8 Amps.
Electrically heated rear window	
Saab 99 Combi Coupé	16 Amps.
As from model 1971: Glass tube fuse (for headlight wipers)	3 Amps.

Direction indicator flasher

Type	Tungsol 550—12 V
Flashing frequency	Hella 91/1 P3 V 2 x 21 W—12 V 60—120 impulses/minute

Light relay

Type	SWR R 601030 12 V, 150 W
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Fuel level transmitter

Type designation	VDO K 221.821/4/1
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Horn

	<u>Up to and incl. model 1971</u>	<u>As from model 1972</u>
Type designation	Hella B 31 12 V H and B 31 12 V T	Hella B 34 alt. R Cajavec JAS 12/42

Heater fan motor up to model 1973

	<u>Up to and incl. chassis No. 99.061.235</u>		<u>As from chassis No. 99.061.236</u>	
Type designation	Elektrolux KS 4030/100		Elektrolux 4030/100	
Output and speed at free blowing and a voltage of 13 V:	rev/min $\pm 5\%$	W $\pm 5\%$	rev/min ± 200	W $\pm 5\%$
1/2-speed	2400	60	2400	56
1/1-speed	3000	80	3700	96
High speed	3950	125	—	—

Heater fan motor, model 1974

Type designation	Elektrolux KP 5035/140	
Output and speed at free blowing and a voltage of 13 V:	rev/min	W
1/2-speed	2150	80
1/1-speed	3150	120

Radiator fan motor

	<u>Up to and incl. model 1971</u>	<u>As from model 1972</u>	<u>Model 1974</u>
Type designation	Elektrolux KS 4034/100	Elektrolux KP 50351 or SWF 4E 4263	
Output	124 W	143 W	
Speed	2300 rev/min	2400 rev/min	
Thermostat cut-in temperature	181—200°F (88 $\pm$ 5°C)	181—200°F (88 $\pm$ 5°C)	194—212°F (95 $\pm$ 5°C)

Windshield wiper motor, up to and incl. model 1973

Type designation Elektrolux KSV 5035/110

Output rev/min and current consumption. Warm motor, loaded with 1 Nm (10 kpcm, 8.7 in.lb.) and tension 13 V

	rev/min	A
1/2-speed	38 ± 4	1.0 ± 0.6
1/1-speed	61 ± 6	1.9 ± 0.7

Blocked motor (e.g. frozen wiper blades)

— about 15

Windshield wiper motor, model 1974

Type designation Lucas 54 104 297

Output rev/min and current consumption. Warm motor loaded with 1 Nm (10 kpcm, 8.7 in.lb.) and tension 13.5 V

	rev/min	A
1/2-speed	43	1.8
1/1-speed	64	2.6

Blocked motor (e.g. frozen wiper blades)

— about 15

Headlight wiper motor

Type designation SWF 4E 3876/1

Output rev/min (double strokes/min) and current consumption.

Loaded with 0.25 Nm (2.5 kpcm, 2.2 in.lb.) and tension 13 V

	rev/min	A
	46 ± 5	1.5–2

Blocked motor (e.g. frozen wiper blades)

— 5–6

Windshield washer/headlight washer

Type designation MEAB (SCHÜRER)

Two jets, ϕ 0.7 mm:Pressure 1 bar (kp/cm², 14 psi)Capacity 260 cm³/min

Cars with headlight washers, as from chassis No. 99.069.710, up to model 1972:

At cross flow of four jets, ϕ 0.7 mm:Pressure 1.2 bar (kp/cm², 17 psi)Capacity 1000 cm³/min

As from model 1973 and EMS model 1972

Type designation VDO

At cross flow of four jets, ϕ 0.7 mm:Pressure about 1.3 bar (kp/cm², 18 psi)Capacity about 1,100 cm³/min**Electric heating of the driver's seat as from model 1972**Thermostat cut-in temperature +10°C ± 3.9°C
(+50°F ± 7°F)Thermostat cut-off temperature +27°C ± 2.8°C
(+80.5°F ± 5°F)

Heating elements, output:

Cold about 65 W

Warm about 50 W

TRANSMISSION

Clutch

Make	Borg & Beck
Type	Hydraulically operated single dry plate with spring-loaded hub

Transmission, manual

	Up to and incl. chassis No. 99722003498	As from chassis No. 99722003499
Oil volume	3 US qt, 5 Imp. pints (3 liters)	3 US qt, 5 Imp. pints (3 liters)
Grade of oil	EP oil SAE 75 or SAE 80	EP oil SAE 75 or SAE 80
NOTE! In cold climate SAE 75 must be used.		
Total reduction ratios (engine/driving wheel axle):		
1st gear	13.6:1	13.0:1
2nd gear	8.6:1	8.3:1
3rd gear	5.8:1	5.6:1
4th gear	4.0:1	4.0:1
Reverse gear	13.6:1	14.7:1
Primary gear ratio	0.95:1	0.95:1
Final drive ratio	4.22:1	4.22:1
No. of cogs, pinion/crown wheel	9:38	9:38
Road speeds at 1000 rev/min, 11.9" (302 mm) wheel radius:		
1st gear	5.2 mph (8.4 km/h)	5.5 mph (8.8 km/h)
2nd gear	8.3 mph (13.3 km/h)	8.6 mph (13.8 km/h)
3rd gear	12.2 mph (19.6 km/h)	12.7 mph (20.4 km/h)
4th gear	17.7 mph (28.5 km/h)	17.7 mph (28.5 km/h)
Reverse gear	5.2 mph (8.4 km/h)	4.8 mph (7.8 km/h)
Speedometer revolutions	1003 per mile (623 per km)	1003 per mile (623 per km)
Weight incl. oil	52 kg	55 kg

	As from gear box No. 500 001 Chassis No. ~99732007243	
Oil quantity	3 US quarts, 5 Imp. pints (3 liters)	
Grade of oil	EP oil SAE 75	
Total reduction ratios (engine/driving wheel axle):		
1st gear	13.4:1	
2nd gear	8.1:1	
3rd gear	5.4:1	
4th gear	3.9:1	
Reverse gear	14.7:1	
Primary gear ratio	1:1	
Final drive ratio	3.9:1	
No. of cogs, pinion/crown wheel	9:35	
Road speed at 1000 rev/min:	155 SR 15, 11.9" (302 mm) wheel radius	165 SR 15, 12.3" (310 mm) wheel radius
1st gear	5.4 mph (8.6 km/h)	5.4 mph (8.7 km/h)
2nd gear	8.9 mph (14.2 km/h)	9.0 mph (14.5 km/h)
3rd gear	13.3 mph (21.2 km/h)	13.5 mph (21.6 km/h)
4th gear	18.4 mph (29.5 km/h)	18.7 mph (30.0 km/h)
Reverse gear	4.9 mph (7.8 km/h)	5.0 mph (7.9 km/h)
Speedometer revolutions/km	623	
Speedometer revolutions/mile	1003	
Weight incl. oil	55 kg	

Tightening torques, transmission

All 5/16" screws	20–29 Nm (15–21 ft.lb., 2–3 kpm)
All 8 mm screws	20–25 Nm (15–18 ft.lb., 2–2.5 kpm)
Engine and transmission drain plugs	39–59 Nm (29–44 ft.lb., 4–6 kpm)
Speedometer drive	29–49 Nm (21–36 ft.lb., 3–5 kpm)
Hexagon screw, release bearing sleeve	6–14 Nm (4–10 ft.lb., 0.6–1.4 kpm)
Plastic screw, clutch plate shaft	1–2 Nm (0.75–1.5 ft.lb., 0.1–0.2 kpm)
Pinion shaft nut nearest the needle bearing (As from gearbox No. 400001)	29–49 Nm (21–36 ft.lb., 3–5 kpm)

Transmission, automatic

Up to model 1972

As from model 1973

Type	Borg-Warner 35 TB or 04 35 000 269 U	Borg-Warner 393 or Borg-Warner 399
Oil volume automatic transmission, 8.5 US quarts, 7 Imp. quarts (8.0 liters)	Automatic transmission fluid according to Ford specification M2 C 33F at ev. change. For topping up Automatic transmission oil type A, Suffix A or Dexron can be used.	
Oil volume final drive, 0.8 US quarts, 0.7 Imp. quarts (0.8 liter)	EP oil SAE 75 or SAE 80, API-GL-4 or GL-5	As from gear box No. 4465: 1.3 US quarts, 1.1 Imp. quarts (1.25 liters)

Gear ratio

Up to and incl. model 1972

As from model 1973

Torque converter ratio varies between	1.91:1–1:1	0.97:1
Primary gear ratio	1.09:1	
1st gear	2.39:1	
2nd gear	1.45:1	
3rd gear	1:1	
Reverse	2.09:1	
Final drive ratio	3.82:1	3.89:1
No. of teeth pinion/crownwheel	11:42	9:35
Torque ratio range engine to wheel for each selector position	D: 18.92–4.15 2: 18.92–6.1 1: 18.92–9.90 R: 16.55–8.66	17.29–3.79 17.29–5.49 17.29–9.04 15.13–7.92
Normal "stall" rev/min	1800–2200 rev/min	1900–2300 rev/min
Idling speed, injection engines	800–850 rev/min with selector in position P or N	
Weight incl. oil	ca 84 kg	

Shift speeds

	Upshifts		Downshifts	
	1–2	2–3	3–2	2–1
Full throttle	24–32 mph	45–52 mph	—	—
With "kick-down"	32–40 mph	60–68 mph	52–60 mph	22–28 mph

Springs for control system

Spring	Approx. free length		Number of turns	Wire diameter		Major diameter	
	in.	mm		in.	mm	in.	mm
1-2 Shift valve	1,094	27,8	13 1/2	0,024	0,61	0,240	6,10
2-3 Shift valve	1,590	40,4	22 1/2	0,036	0,91	0,285	7,24
Primary regulator valve	2,850	72,4	14 1/4	0,054	1,37	0,497	12,60
Secondary regulator valve	2,593	65,9	21 1/2	0,065	1,65	0,490	12,44
Servo orifice control valve	1,005	25,53	17	0,024	0,61	0,203	5,16
Modulator valve	1,005	25,53	17	0,024	0,61	0,203	5,16
Throttle valve, inner spring	0,807	20,5	28	0,018	0,46	0,146	3,72
Throttle valve, outer spring	1,185	30,1	19 1/2	0,032	0,81	0,240	6,10

Tightening torques

Brake bands

		Qty.	Nm	in.lb.	kpm
Front brake band			1,2	10	0,12
Rear brake band				ft.lb.	
(Back off adjusting screw 3/4 of a turn.)			14	10	1,40
Rear band adjusting screw locknut	9/16" - 12	1	39-53	30-40	4-5,4

Transmission

Converter to driveplate (flywheel)	3/8 - 24 UNF	4	33-39	25-30	3,4-4,0
Chain cover to converter housing	5/16" - 18 x 1"	12	14-21	10-15	1,4-2,1
Transmission case to converter housing	5/16" - 18 x 1"	6	14-21	10-15	1,4-2,1
	5/16" - 18 x 1 1/4"	3	14-21	10-15	1,4-2,1
	5/16" - 18 x 1 1/2"	1	14-21	10-15	1,4-2,1
Sprocket wheel to turbine shaft	3/8" - 24 x 3/4"	1	26-33	20-25	2,7-3,4
Sprocket wheel to input shaft in gearbox	1/2" - 20	1	33-40	25-30	3,4-4,1
Centre support to case	3/8" - 16 NC	3	14-25	10-18	1,4-2,5
Cover for selector rod to casing	1/4" - 20 x 1/2"	5	8-12	6-9	0,8-1,2
Oil pan to case	1/4" - 20 x 1/2"	12	8-12	6-9	0,8-1,2
Valve body cover to converter housing	1/4" - 20 x 1/2"	10	8-12	6-9	0,8-1,2
Oil pan drain plug	3/8" - 24 x 3/8"	1	5-8	4-6	0,5-0,8

Final drive

Pinion nut	1 3/8" - 18	1	245-265	180-200	25-27
Pinion housing			Nm	in.lb.	kpm
(Preload with spring balance 27-46 N			1,8-3,0	15-25	0,18-0,30
(2,8-4,7 kp)					
Seal housing pinion bearing	1/4" - 20 x 3/4"	2	Nm	ft.lb.	kpm
			8-12	6-9	0,8-1,2
Pinion bearing to case	3/8" - 16 x 1 1/8"	4	26-33	20-25	2,7-3,4

Oil pump

		Qty.	Nm	ft.lb.	kpm
Pump cover to pump housing	10 - 24 x 11/16"	1	2,5-3,9	2-3	0,25-0,40
	5/16" - 18 x 3/4"	5	23-29	17-22	2,3-3,0
Pump to converter housing	5/16" - 18 x 1 1/8"	3	18-25	13-18	1,8-2,5

Governor valve

Governor valve inspection cover to case	1/4" - 20 x 1/2"	2	7-11	5-8	0,7-1,1
Governor valve to counter weight	1/4" - 20 x 1 5/16"	2	5-8	4-6	0,5-0,8
Governor cover plate to governor valve body	10 - 24 x 3/8"	2	2-5	1,7-4,0	0,2-0,5

Valve body

				in.lb.	
Upper part to valve body	10 - 24 x 5/8"	2	2-3	20-30	0,2-0,3
	10 - 24 x 15/16"	5	2-3	20-30	0,2-0,3
	10 - 24 x 1 3/8"	1	2-3	20-30	0,2-0,3
Manual valve lever bracket to valve body	10 - 24 x 15/16"	2	2-3	20-30	0,2-0,3
	10 - 24 x 1 1/16"	2	2-3	20-30	0,2-0,3
Oil tube plate to valve body	10 - 24 x 5/8"	6	2-3	20-30	0,2-0,3
	10 - 24 x 15/16"	1	2-3	20-30	0,2-0,3
	10 - 24 x 1 1/16"	1	2-3	20-30	0,2-0,3
End plate, primary and secondary regulating valves to valve body	10 - 24 x 5/8"	3	2-3	20-30	0,2-0,3
Rear upper end plate to shift valve body	10 - 24 x 3/8"	3	2-3	20-30	0,2-0,3
Front upper end plate to shift valve body	10 - 24 x 3/8"	3	2-3	20-30	0,2-0,3
Down shift cam bracket to valve body	10 - 32 x 1 7/16"	2	2-4	20-40	0,2-0,4
Valve body to case	1/4" - 20 x 1 1/4"	3	6-12	4,5-9,0	0,6-1,2
Down shift, throttle cable to case	1/2" - 13 (cable)	1	11-14	8-10	1,1-1,4

Miscellaneous

Connector oil cooler	1/4" - 18 Dryseal	2	7-10	5-7	0,7-1,0
Nut connection oil cooler	1/2" - 24	2	13-16	10-12	1,3-1,6
Oil pressure gauge plug	1/8" - 27 Dryseal	1	5-7	4-5	0,5-0,7
Starter contact locknut	7/16" - 14	1	5-8	4-6	0,5-0,8

Make
Type, front and rear
Footbrake

Disc brakes with power assist
Hydraulic, two-circuit system
serving diagonally opposed pair
of wheels

**Mechanical drum brakes
acting on front wheels**

!SAE J 1703
USA: DOT 3 or DOT 4

Brake discs, front, diameter	10.614" (269.5 mm)
"—" rear "—"	10.614" (269.5 mm)
Thickness, brake disc	0.413" (10.5 mm)
Min. thickness of brake disc after grinding	0.374" (9.5 mm)
Note! Max. grinding 0.020" (0.5 mm) on each side.	

As from model 1971

0.75" (19.05 mm)

1.063" (27.0 mm)

Brake pads (ATE), rear, area 4 x 3.10 sq.in (4 x 20.0 cm²)

Front	186 sq.in (1200 cm ²)
Rear	165 sq.in (1065 cm ²)
Total	351 sq.in (2265 cm ²)

As from model 1971

ATE

T 51/727

7"

As from model 1973

 $1 \pm 0.5^{\circ}$ $0.5 \pm 0.5^{\circ}$

0.0 = 0.0

4" (0 ± 1 mm)

 $0 \pm 0.04''$ (0 ± 1 mm) $20.5 \pm 1^{\circ}$ $21.5 \pm 1^{\circ}$

0.35" (9 mm)

"Slip radius"

0.35" (9 mm)

Steering mechanism

Steering gear adjustment up to chassis No. 99.022.278

Adjustment of plunger Screw plunger tight, then
back off 1/4 turn

Adjustment of ball joint The tie rod should be movable
to its full limit in all directions
with a load of 30 N (7 lb., 3.2 kp)
applied to the outer ball joint

Steering gear adjustment as from chassis No. 99.022.279

resp. 90600001

Adjustment of plunger Clearance between cover
and plunger 0.002–0.006"
(0.05–0.15 mm)

Steering gear torque (= Pinion torque) 1.1–2.0 Nm (0.83–1.5
ft.lb., 11.5–20.7 kpcm)

Adjustment of ball joint The rod should be moveable to
its full limit in all directions with
a load of 12 N (2.7 lb., 1.25 kp)
applied to the outer joint

Adjustment of power steering gear

Adjustment of plunger Screw plunger tight, then back
off 1/6 turn. Check that the
cog rod does not stick in any
position.

Ball joints Must not be adjusted. Shall be
replaced if play arise.

Steering wheel turns, lock to lock
Up to chassis No. 99.022.278
3 1/3

As from chassis No. 99.022.279	As from model 1973	Power steer- ing gear
3 1/2	3 3/4	3.6

Tie rod ends:

Max. distance from end of thread to lock nut 1" (25 mm)

Max. permissible difference between
above measurements on both sides 0.08" (2 mm)

Tightening torque, tie rod end nut

49–69 Nm (36–50 ft.lb., 5–7 kpm)

Castle nut, outer drive shaft

196 Nm (145 ft.lb., 20 kpm)

Back wheel alignment

Camber $0 \pm 1^\circ$

Toe-in, sum of both wheels:

Measured at rims $0 \pm 0.2''$ (0 ± 5 mm)

Measured in degrees $0 \pm 0.7^\circ$

Max. toe-in for one wheel in degrees $0 \pm 0.6^\circ$

Max. difference between left hand

right wheelbase (front wheels

aligned straight ahead) 0.6" (15 mm)

SUSPENSION SYSTEM, WHEELS

Spring elements, front and rear

Coil springs

Type of suspension:

Front

Individually transverse control arms

Rear

Rigid rear axle with four longitudinal links and one lateral load cross bar

	Model 1969	Model 1970-1971 standard	Model 1970-1971 Automatic trans- mission	Model 1970-1971 Certain export markets
Front coil springs:				
Total number of turns	11 3/4 ± 1/8	11 3/4 ± 1/8	11 3/4 ± 1/8	10 1/4 ± 1/8
Number of free turns	10	10	10	8 1/2
Wire diameter	0.52" (13.2 mm)	0.52" (13.2 mm)	0.52" (13.2 mm)	0.55" (14 mm)
Free length	17.5" (445 mm)	17.9" (454 mm)	18.3" (464 mm)	15.4" (392 mm)
Marking color	green	yellow	blue	brown
	Model 1972, standard and auto- matic gear box	Model 1972, certain export markets	As from model 1973, standard and automatic gear box	
Front coil springs:				
Total number of turns	11 ± 1/8	10 1/2 ± 1/8	8 1/2 ± 1/8	
Number of free turns	9	8 1/2	6 1/2	
Wire diameter	0.54" (13.8 mm)	0.55" (14 mm)	0.55" (13.9 mm)	
Free length	16.4" (417 mm)	15.8" (401 mm)	15.4" (395 mm)	
Marking color	white	light blue/light grey	yellow	
	Model 1969-1971 standard	Model 1972-1973, standard	Model 1970-1973, certain export markets	
Rear coil springs:				
Total number of turns	9 1/4 ± 1/8	10 ± 1/8	8 1/4 ± 1/8	
Number of free turns	7 1/2	8	6 1/2	
Wire diameter	0.54" (13.6 mm)	0.55" (14 mm)	0.56" (14.6 mm)	
Free length	11.9" (302 mm)	11.8" (300 mm)	11.1" (277 mm)	
Marking color	green	white	brown	
	Model 1974, standard	Model 1974, Saab 99 Combi Coupé		
Rear coil springs:				
Total number of turns	10 1/8 ± 1/8	9 ± 1/8		
Number of free turns	8	7		
Wire diameter	0.55" (14 mm)	0.55" (14.2 mm)		
Free length	11.7" (297 mm)	11.7" (297 mm)		
Marking color	yellow	blue		
	Model 1969	As from model 1970		
Vertical wheel movement from normal-weight com- pression to full compres- sion:				
Front	3.9" (90 mm)	4" (100 mm)		
Rear	4.4" (110 mm)	4.4" (110 mm)		
Max. spring expansion:				
Front	6.3" (160 mm)	6.3" (160 mm)		
Rear	7.1" (180 mm)	7.1" (180 mm)		

Shock absorbers, front:

Type	Telescopic, hydraulic
Length between attachment lug centers:	
Max. fully compressed	10.2" (258 mm)
Min. fully extended	14.9" (379 mm)
Max. stroke installed in car	3.6" (91 mm)

Shock absorbers, rear:

Type	Telescopic, hydraulic
Length between attachment point surfaces:	
Max. fully compressed	11.1" (282 mm)
Min. fully extended	18.5" (470 mm)
Max. stroke installed in car	6.2" (158 mm)

Wheels

Type	Disc wheels
Rim dimensions	4.5" J FHA x 15"
Max. permissible out-of-round at rim	0.047" (1.2 mm)
Max. permissible rim throw	0.047" (1.2 mm)
Wheel nuts:	
Width across flats	3/4" (19.05 mm)
Thread	1/2" 20 UNF-2B
Tightening torque	88-108 Nm (65-80 ft.lb., 9-11 kpm)

Saab 99 EMS

5" JFHA x 15"

Tires

Type	Radial, tubeless
Dimensions	155 SR 15, 165 SR 15
USA-cars made after 1972.01.01	165-SR 15"
Alternative tires	165 S 15
Inflation pressures: (cold tires)	
Light load, front and rear	1.7 bar (kp/cm ² , 24 psi)
Full load, front and rear	1.9 bar (kp/cm ² , 27 psi)
Cars with air condition:	
Light load, front and rear	
Full load, front and rear	

Saab 99 EMS and certain markets

165 SR 15 (steel cord)

As from model 1972

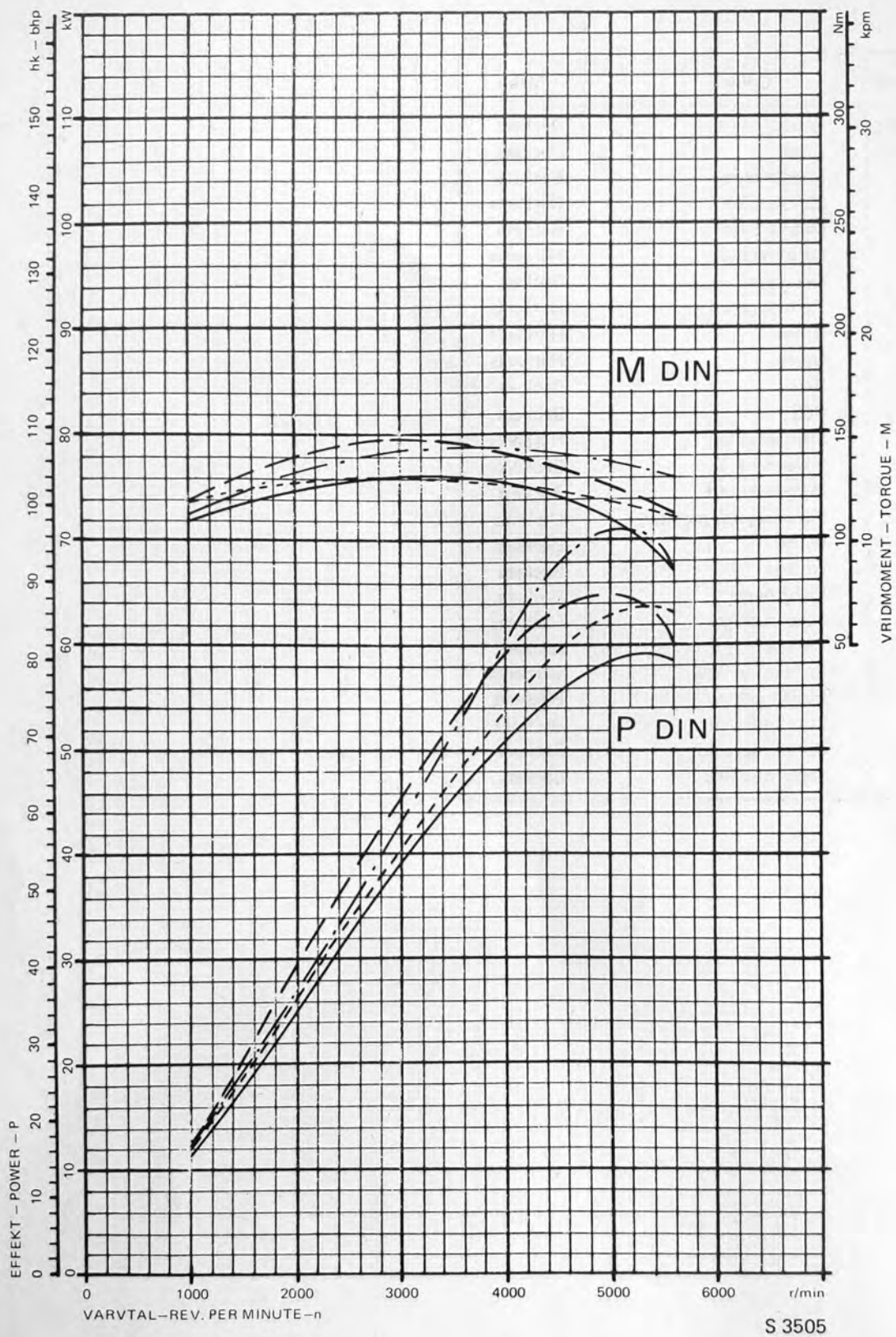
1.9 bar (kp/cm ² , 27 psi)
2.1 bar (kp/cm ² , 30 psi)
2.0 bar (kp/cm ² , 28.5 psi)
2.1 bar (kp/cm ² , 30 psi)

BODY

Approx. dimensions:	
Overall length	13' 10" (4214 mm)
Overall width	5' 6" (1676 mm)
Overall height	4' 0.5" (1233 mm)
Total weight model 1969 incl. hood, doors and trunk lid	approx. 630 lb. (285 kg)
Total weight model 1970 incl. hood, doors and trunk lid	approx. 650 lb. (295 kg)
Total weight as from model 1971:	
2-doors	approx. 670 lb. (304 kg)
4-doors	approx. 715 lb. (325 kg)

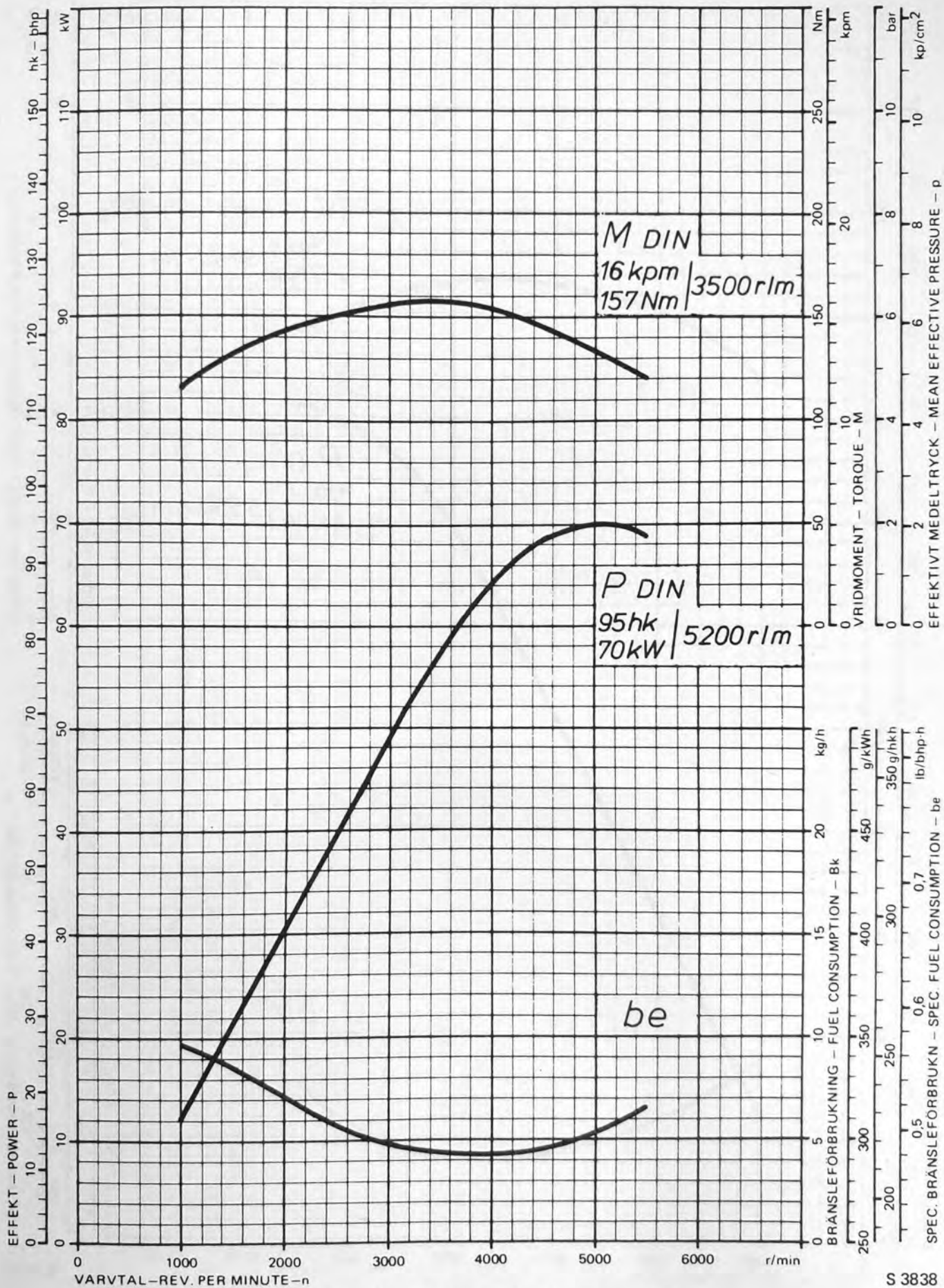
Enamel

Color code	Color	Make
BK 1 B	Black	Beckers
BK 1 L	Black	Beckers
B 6 L	Middle blue	Beckers
B 7 H	Middle blue	Herberts
B 7 L	Middle blue	Beckers
B 8	Caroline blue	Herberts
Gn 6 L	Sea green	Beckers
Gn 7 H	Tyroler green	Herberts
Gn 8	Green	Herberts
Gn 9	Green	Herberts
R 2 B	Red	Beckers
R 2 L	Red	Beckers
R 3	Sienna brown	Herberts
RB 1 B	Silvermink	Beckers
RB 2	Burgundy red	Beckers
SK 1	Silver crystal metallic	Du Pont
W 1 L	White	Beckers
W 1 B	White	Beckers
Y 5 L	Light beige	Beckers
Y 6 H	Savann beige	Herberts
Y 8	Yellow	Beckers
Y 9	Brilliant yellow	Herberts
Y 11	Indian yellow	Herberts
YR 4	Corall metallic	Du Pont
YR 1	Corall metallic	Beckers
YR 2	Sepia metallic	Beckers

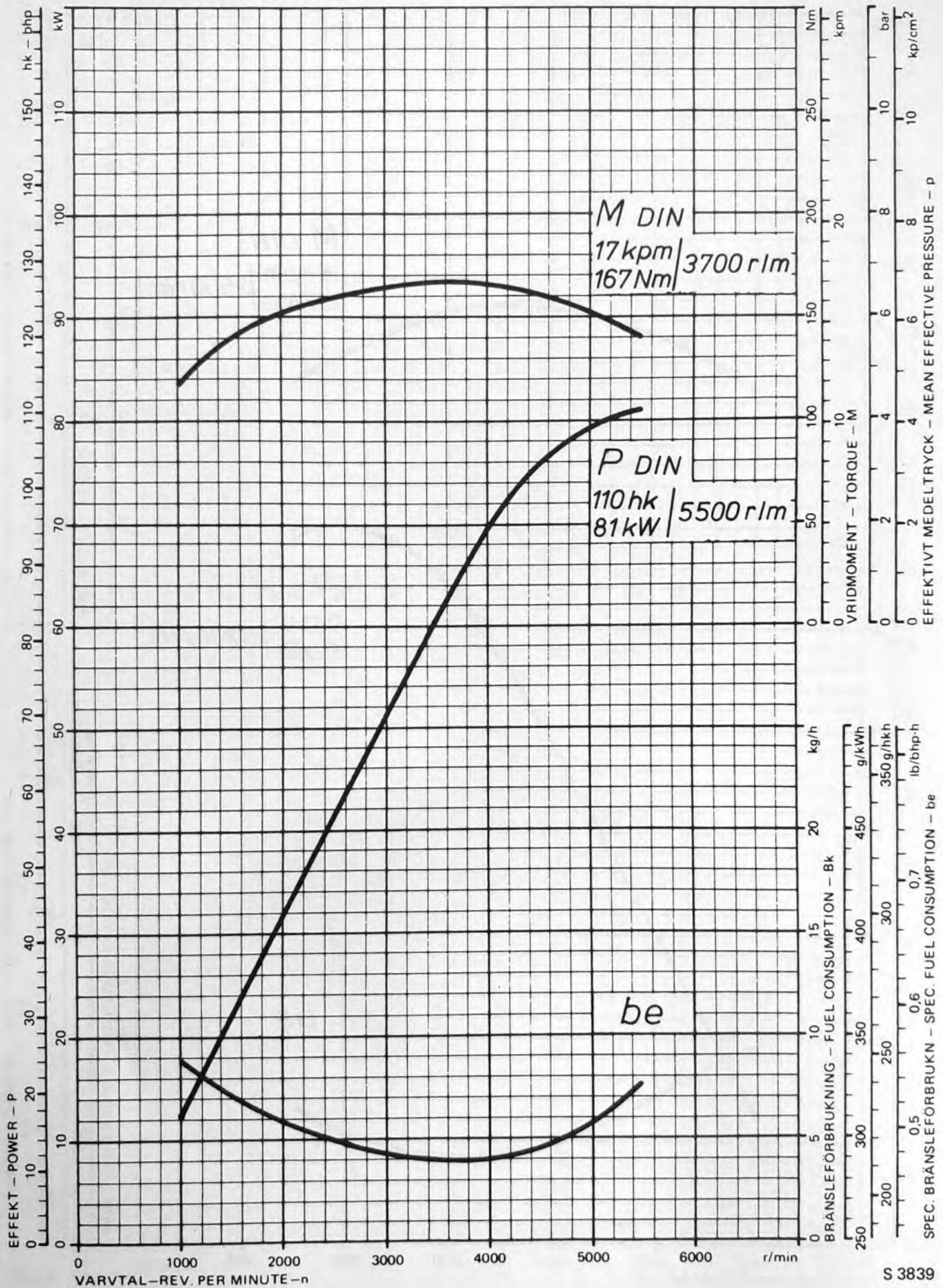


ENGINE PERFORMANCE GRAPHS

- 1.7 l carb.
- 1.7 l injection
- - - 1.85 l carb.
- . - . 1.85 l injection



S 3838



S 3839

CONTENTS

100	General hints
101	Special tools
110	Service inspections
120	Lubrication
141	Underbody and rustpreventing treatment

CONTENTS

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GENERAL HINTS

Neatness and cleanliness

A neat and tidy workshop is essential for the proper servicing of vehicles. Some parts of the car need to be treated with special care and effectively protected against dirt and contamination while work is in progress. For the mechanic who may be new to the job should the following points may be of help:

1. Protect fenders and other paintwork with suitable coverings.
2. Lay protective coverings over the seats and upholstery to save them from spots of oil and dirt.
3. Clean the insides of fenders and the space round the rear axle thoroughly before starting to work on wheel hubs and axles. This makes the job easier and prevents grit and dirt from getting into bearings and other susceptible parts.
4. Before unscrewing spark plugs, clean the recess round the plug thoroughly.
5. Every job must have its proper place. It is bad practice, for example, to disassemble an engine or transmission on a bench which is also used for filing, etc. or where filing is done in the immediate neighbourhood.

Jacking and blocking up

The car has a rigid self-supporting body and this lacks the natural application points for a jack that a girder chassis provides. There are however two special engagement recesses on each side designed to fit the jack supplied with the car's tool kit; these are intended for use during wheel changing, etc. The engine compartment floor is also reinforced immediately under the cross member that supports the engine to provide an application point for the workshop jack. A similar reinforced lifting point is provided underneath the floor at the back behind the fuel tank. As most workshop jacks have a forked lifting head, it is advisable to lay a wooden block of suitable size across the fork to avoid damaging the floor of the car. For some jobs it is necessary to raise the front or rear end of the car. In such cases the jack engagement recesses under the sills should be utilized.

Thread system and wrench sizes

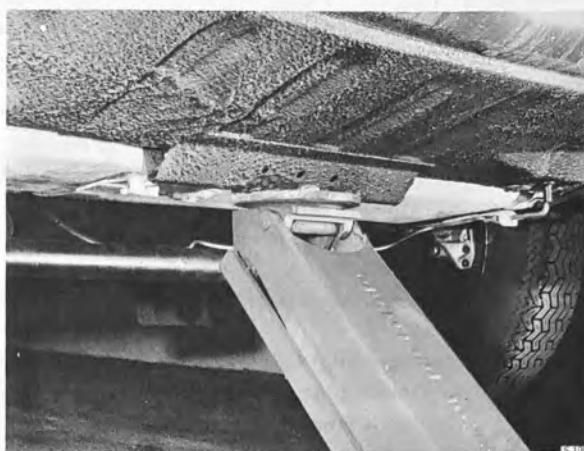
The standard thread system used in Saab cars is mainly UNIFIED COARSE (UNC), with the inch as the unit of measurement.

The width of UNC screw heads and nuts, measured across the flats in inches, corresponds to the designation of the wrench that fits in each case. In a few cases the UNIFIED FINE (UNF) system is used.

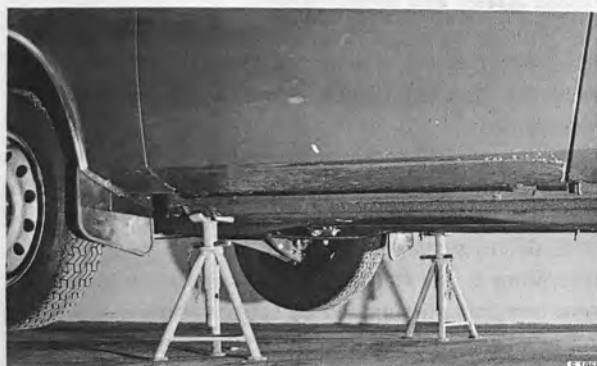
Exceptions to the standard thread system are found in some components supplied by subcontractors, e.g. Bosch and new constructions introduced as from model 1972, where the metrical thread system is used.



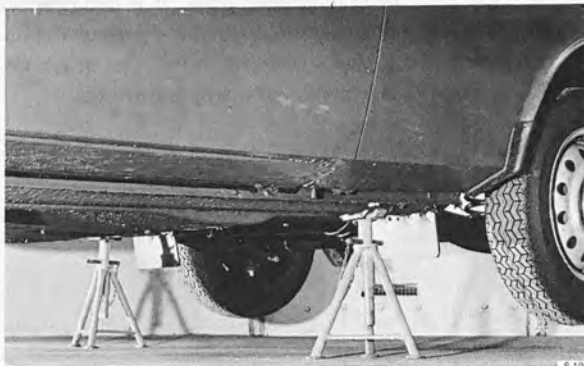
FRONT END RAISED



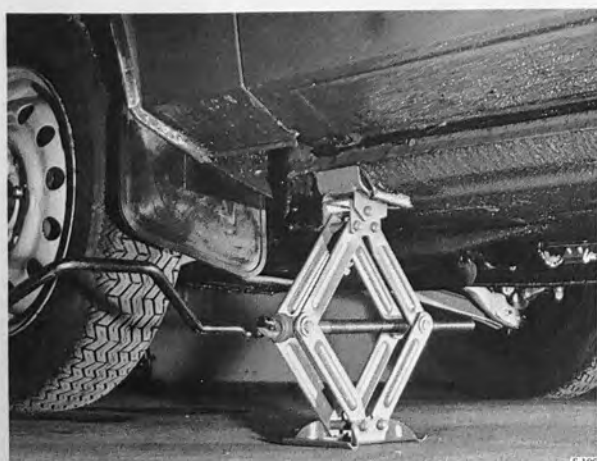
REAR END RAISED



FRONT END BLOCKED UP ON TRESTLES



REAR END BLOCKED UP ON TRESTLES



ONE SIDE JACKED UP

SPECIAL TOOLS

General

The 7-figure number quoted in the following list of special tools is the part number. The number which is also marked on the tools only includes the first six figures.

The special tools in the list are classified as follows:

Tools for engine, transmission and chassis work

- Class AO-1 = Tools used very frequently in service work (e.g. adjustment of timing)
- AO-2 = Tools used frequently in maintenance work (e.g. replacement of brake pads)
- A1 = Tools necessary for simple repairs (e.g. replacing the clutch or valves)
- A2 = Tools necessary for qualified repairs (e.g. reconditioning the gear box)
- A3 = Tools which are mainly recommended for reasons of operational efficiency

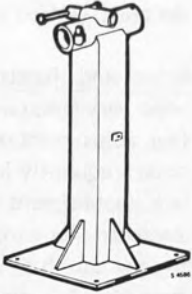
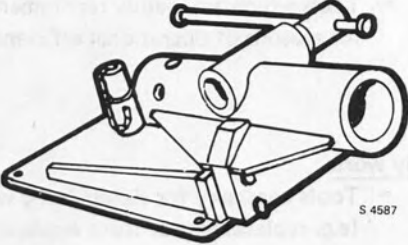
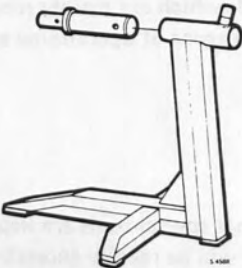
Tools for body work

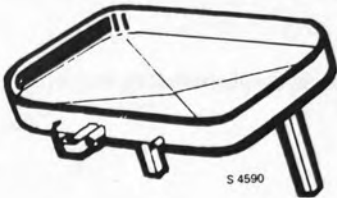
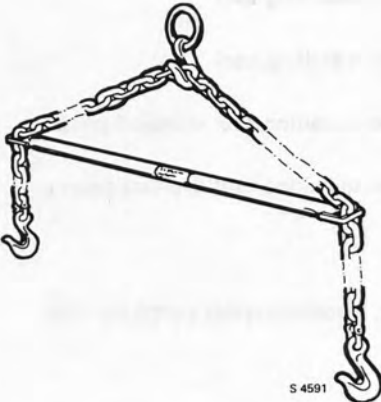
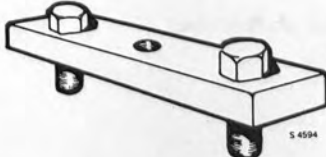
- Class B1 = Tools necessary for simple body work (e.g. replacement of front fenders)
- B2 = Tools necessary for qualified body work (e.g. alignment work)
- B3 = Tools which are mainly recommended for reasons of operational efficiency

Tool racks

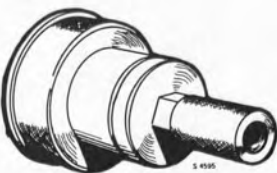
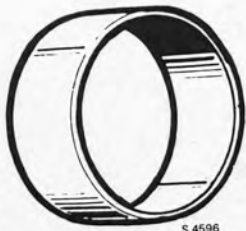
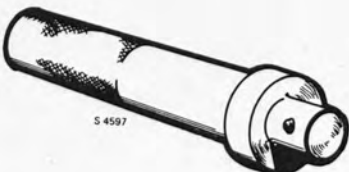
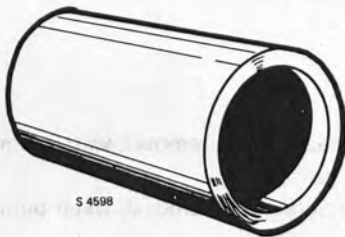
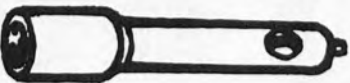
It is most important that special tools are kept in a suitable place, where they will be readily accessible and easily found.

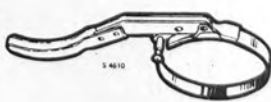
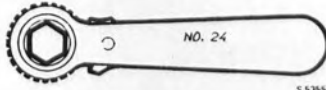
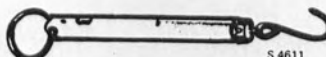
Special tools, engine

Part No.	Description	Class	Illustration	Remarks
	210 Engine body			
7860794	Floor stand	A 2		
7860877	Bench stand	A 2		
7860885	Vise stand	A 2		
7861479	Stand	A 2		
8390478	Axle for stand	A 2		
8392169	Holder, engine	A 2		Engine 2.0 l
8390452	Holder, engine	A 2		Engine 1.7 and 1.85 l

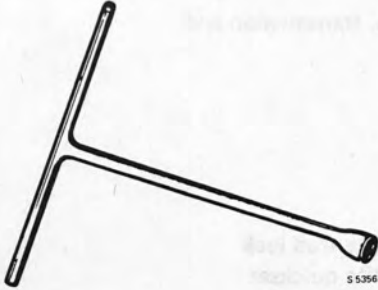
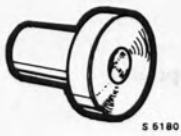
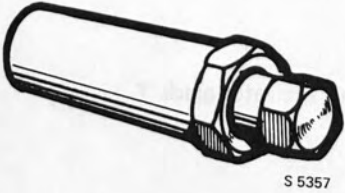
Special tools, engine				
Part No.	Description	Class	Illustration	Remarks
7860802	Oil pan	A 2		
8392409	Lifting hook	A 1		
8390270	Tapping-out hammer	A 1		Also trans- mission
8392136	Intermediate piece, removal, water pump	A 1		Engine 2.0 l
8390577	Intermediate piece, removal, water pump	A 1		Engine 1.7 and 1.85 l
8390668	Sleeve cpl., screw pulley	A 2		Engine 2.0 l
8390676	Sleeve 1 1/2"	A 2		
8390684	Intermediate piece 3/4" x 1/2"	A 2		
8392151	Puller, pulley	A 3		Engine 2.0 l
8391146	Puller, pulley	A 3		Engine 1.7 and 1.85 l

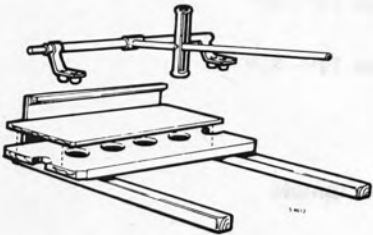
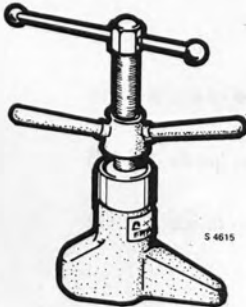
Special tools, engine

Part No.	Description	Class	Illustration	Remarks
8392540	Installing tool, crank shaft seal, flywheel end	A 1		Engine 2.0 l
8390411	Guide sleeve, crankshaft seal, transmission end	A 1		Engine 1.7 and 1.85 l
7862287	Piston installing tool	A 3		Engine 2.0 l
8392086	Piston installing tool			Engine 1.85 l
8390361	Piston installing tool standard piston	A 3		Engine 1.7 l
8391153	Piston installing tool oversize piston	A 3		Engine 1.7 l
8390445	Drift, installing water pump housing	A 2		See also 262 water pump
8390536	Sleeve, installation, water pump	A 2		See also 262 water pump
8392045	Adapter cpl. ignition setting	A 0-1		
8392052	Adapter, dwell angle setting	A 0-1		
8392185	Key, crank shaft screw	A 0-1		Engine 2.0 l
8390817	Key, crank shaft screw	A 0-1		Engine 1.7 and 1.85 l
8392128	Guide pin, cylinder head	A 1		

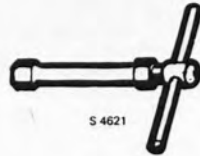
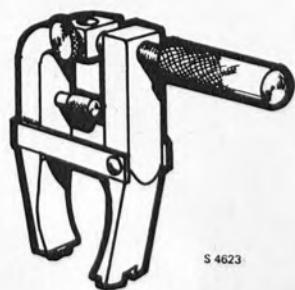
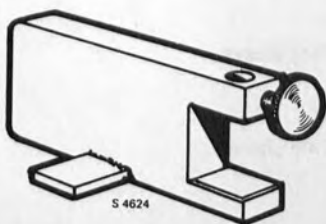
Special tools, engine				
Part No.	Description	Class	Illustration	Remarks
8392326	Air nipple, spark plug hole	A 3		
8391260	Crank, transmission end	A 3		
7860513 8343808	Locktite stud lock Locktite quickset			
8809097	Tikatät, can 1 pound			
8308454	Locquic activator grade T			
7862014	Key, oil filter cartridge	A 0-1		Engine 2.0 l
8391914	Key, oil filter	A 0-1		Engine 1.7 and 1.85 l
8390130	Dynamometer	A 2		See also transmission

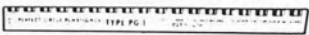
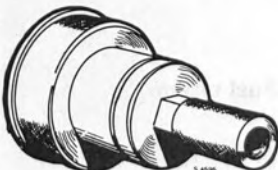
Special tools, engine

Part No.	Description	Class	Illustration	Remarks
8391989	Key, distributor	A 0-1		Engine 2.0 l
8390395	Key, distributor	A 0-1		Engine 1.7 and 1.85 l
8391799	Key, inlet manifold	A 2		Engine 1.7 and 1.85 l
8391849	Dolly, crankshaft	A 3		
8392367	Key, stud	A 1		Engine 1.7 and 1.85 l
8392383	Key, inner part			
8392375	Key, outer part			

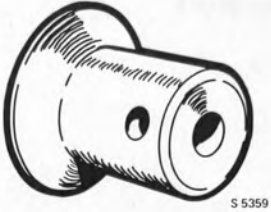
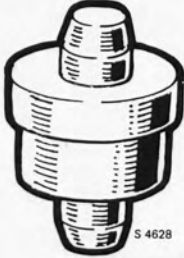
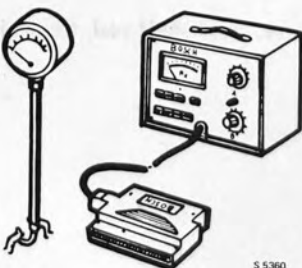
Special tools, engine				
Part No.	Description	Class	Illustration	Remarks
	214 Valve mechanism			
8391419	Feeler gauge, valve clearance	A 0-1	 S 5358	Engine 1.7 and 1.85 l
8392276	Removing—installing tool, valves	A 2		
8392300	Spring depressor	A 2		
8392284	Table	A 2		
8391401	Magnet tool	A 3	 S 4614	
8390437	Valve guide tool cpl.	A 2	 S 4615	
8390502	Pull rod	A 2	 S 4616	
8391377	Nut	A 2	 S 4617	
8390379	Installing sleeve	A 2	 S 4618	
8392144	Installing sleeve	A 2		Engine 2.0 l

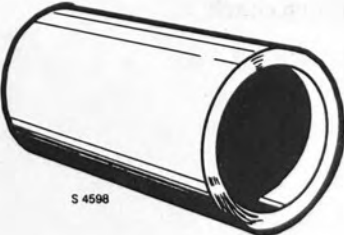
Special tools, engine

Part No.	Description	Class	Illustration	Remarks
8392193	Valve seat cutter cpl.	A 2		
8392201	Cutter 75°	A 2	 S 4619	Engine 2.0 l
7861032	Cutter 75°	A 2		Engine 1.7 and 1.85 l
8392219	Cutter 11°—45°	A 2		Engine 2.0 l
7861040	Cutter 11°—45°	A 2		Engine 1.7 and 1.85 l
7861057	Guide spindle	A 2	 S 4620	
7861065	T-key	A 2	 S 4621	
8392268	Reamer, valve guide $\varnothing$ 8 H8	A 2	 S 4622	Engine 2.0 l
8390601	Reamer, valve guide $\varnothing$ 8 H8	A 2		Engine 1.85 l
8390503	Reamer, valve guide $\varnothing$ 8 H8	A 2		Engine 1.7 l
8391450	Measuring tool, valve clearance	A 0—2	 S 4623	
8392250	Measuring point	A 0—2		
8391633	Measuring plate, checking of adjusting pallets	A 0—2	 S 4624	

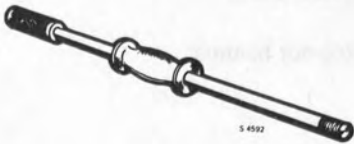
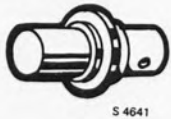
Special tools, engine				
Part No.	Description	Class	Illustration	Remarks
7840622	Dial indicator (0.01)	A 0-2		Also trans- mission
	216 Crank mechanism			
7860505	Plastigage, measuring bearing clearance	A 2		
8392540	Installing tool sealing ring flywheel end	A 1		Engine 2.0 l
8390411	Guide sleeve, crankshaft seal, transmission	A 1		Engine 1.7 and 1.85 l
8391898	Installing tool, crankshaft seal flywheel end	A 2		Engine 1.7 and 1.85 l
8391922	Handle to 8391898	A 2		Engine 1.7 and 1.85 l

Special tools, engine

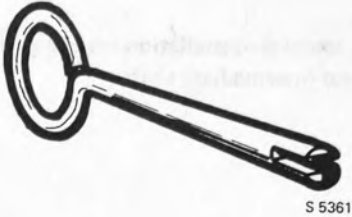
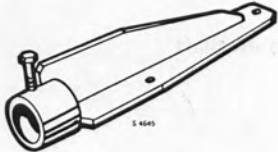
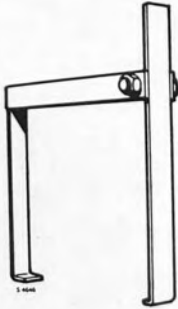
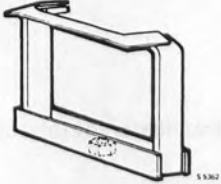
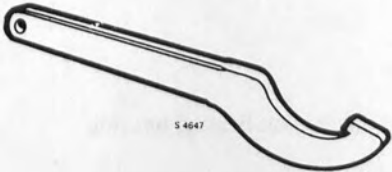
Part No.	Description	Class	Illustration	Remarks
8391880	Installing tool sealing ring, transmission end	A 1		
8390445	Drift to 8391880	A 1		
8391997	Drift, flywheel bearing	A 3		Engine 2.0 l
	230/240 Fuel system			
8391864	Testing instrument cpl fuel injection	A 3		
8392433	Key, fuel pump bracket	A 0-2		

Special tools, engine				
Part No.	Description	Class	Illustration	Remarks
8390270	262 Water pump Tapping-out hammer	A 1	 S 4592	Also trans- mission
8392136 8390577	Spacing piece removal, water pump Spacing piece removal, water pump	A 1	 S 4593	Engine 2.0 l Engine 1.7 and 1.85 l
8390544	Dolly	A 2	 S 4635	
8390585	Handle	A 2	 S 4636	
8390536	Sleeve, removal ball bearing	A 2	 S 4598	
8390551	Sleeve, installation ball bearing	A 2	 S 4637	
8390569	Installing sleeve, thrower	A 2	 S 4638	

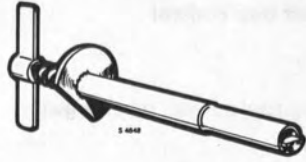
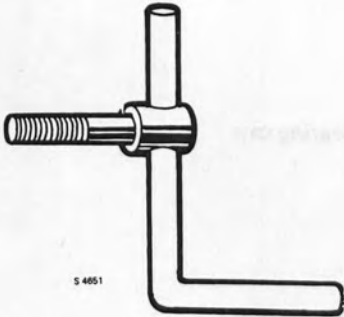
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8390270	411 Clutch Tapping-out hammer	A 1		Also engine
8790529 8390015	Joint, removal of clutch shaft Joint, removal of clutch shaft	A 1 A 1		M 8 5/16 UNC
8790586	Clutch tool	A 1		
8790594 8790602	Screw Wing nut	A 2 A 2		
8790412	Guide pin	A 2		
8390023	Spacer ring, clutch	A 1		
8392060	Centering tool, clutch disc	A 3		
8390370	Key, special nut, gear lever housing	A 1		

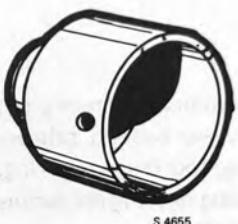
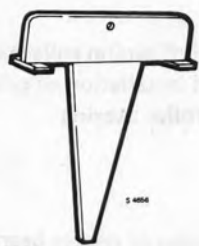
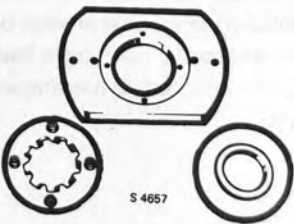
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8391229	432 Gear box control Installing tool spring, reverse gear	A 3		Ch. -99009988
8390460	471 Gear box Holder, gear box	A 2		
8790776	Puller, bearing cap	A 1		
8790354	Puller, inner drive shaft	A 1		
8790197	Hook wrench, intermediate shaft	A 2		

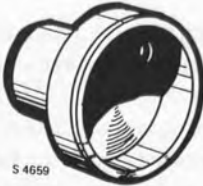
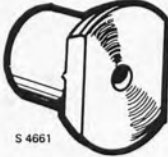
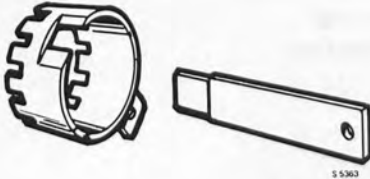
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8390049	Puller, removal—installation reverse gear shaft and intermediate shaft	A 2		
8790503	Catch, reverse wheel	A 2		
8790511	Puller, pinion shaft	A 2		
7840853	Screw	A 2		
8390262	Guide drift, installation of intermediate shaft	A 2		
8790438	Guide pin, pinion bearing housing	A 2		

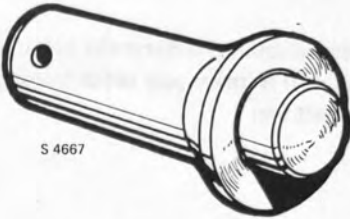
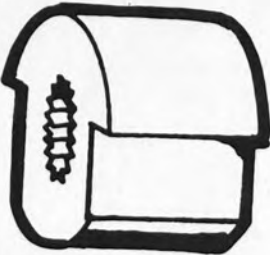
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8390148	Sleeve, installation of pinion shaft unit, inner roller bearing, primary gear housing pinion roller bearing and intermediate shaft inner ring and outer bearing. Removal of primary gear roller bearing, bearing housing outer rings, intermediate shaft inner ring and clutch shaft seal.	A 2		
8390114	Sleeve, installation of 4th gear, bearing housing outer ring, pinion and pinion shaft unit	A 2		
8790552	Measuring device, pinion shaft housing position	A 2		
8790636	Fixture, removal and installation of bearing from pinion	A 2		
8790651	Holder ring	A 2		
8790644	Installing ring	A 2		
8390080	Tool, removal of pinion from bearing housing	A 2		
8790072	Key, pinion shaft nut	A 2		-99722003498
8790453	Key, pinion shaft nut	A 2		-99726001716 99722003499- 99726001717-

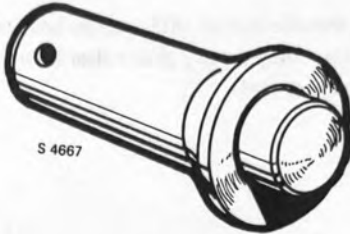
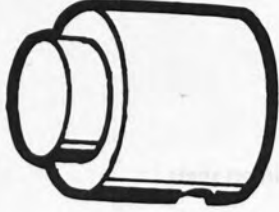
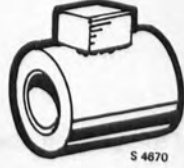
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8390122	Drift, installation of bearing housing outer ring (pinion) and ball bearing on 4th gear, and removal of primary gear with bearing from bearing housing.	A 2	 S 4659	
8390098	Dolly, installation and removal of primary gear, primary gear bearing, primary gear wheel bearing, fourth gear bearing, pinion bearing housing outer roller bearing rings, and pinion shaft	A 2	 S 4660	
8390106	Drift, removal of pinion roller bearing outer ring and installation of primary gear housing roller bearing	A 2	 S 4661	
8390189	Drift, installation of needle bearings in free wheel shaft and removal of free wheel shaft, free wheel shaft seal, free wheel shaft roller bearing input gear with ball bearing, outer bearing rings from bearing seats and steering knuckle housing outer ring and seal	A 2	 S 4662	
8790305	Tool, free wheel hub	A 2	 S 5363	
8390296	Removing tool, outer ring bearing seat	A 2	 S 5364	
8390221	Removing tool, roller bearing free wheel shaft	A 2	 S 4666	

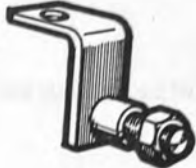
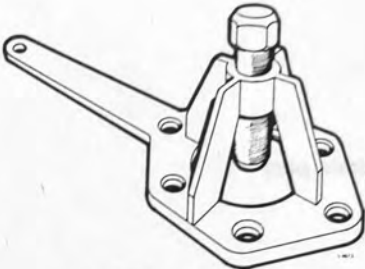
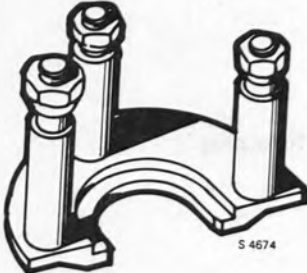
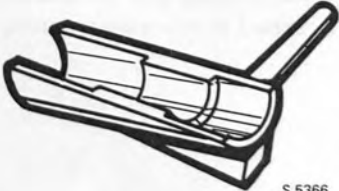
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8390320	Drift, installation of differential bearing seat seal, and primary gear roller bearing, clutch shaft seal	A 2	 S 4667	
8790461	Sleeve, bearing ring pinion bearing housing	A 2	 S 4663	
8390064	Holder, pinion shaft	A 2	 S 4664	
8390247	Dolly, installation of primary gear and input gear and removal of primary gear wheel and gear bearings and input gear bearing	A 2	 S 4665	
8390213	Ring, removal of 4th gear with bearing	A 2	 S 4666	

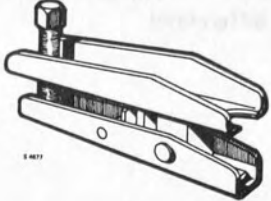
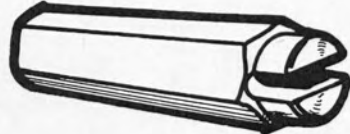
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8390320	Drift, installation of differential bearing seat seal, and primary gear roller bearing, clutch shaft seal	A 2	 S 4667	
8390312	Drift, removal of outer ring differential housing bearing	A 2	 S 5365	Also chassis
8790487	Sleeve, bearing differential housing	A 2	 S 4668	
8390130	Dynamometer	A 2	 S 4611	Also engine
8790677	Puller, sealing ring gear shift shaft	A 2	 S 4669	
8790685	Installing tool, sealing ring gear shift shaft	A 1	 S 4670	
8390155	Measuring tool cpl. pinion	A 2	 S 4671	

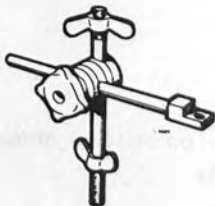
Special tools, manual transmission

Part No.	Description	Class	Illustration	Remarks
8390288	Dial indicator retaining tool, measuring back lash, differential	A 2	 S 4672	
8996084	Puller, bearing ring differential housing	A 1	 S 4673	Also engine and chassis
8790768	Puller, removal of bearing ring, differential housing	A 2	 S 4674	Also engine and chassis
7842024	Drift, outer drive shaft joint	A 1	 S 5366	
7841612	Lock ring pliers, outer drive shaft joint	A 1	 S 5367	
8344582	Cover, inner driver	A 1	 S 4675	
8916967	Cover, drive shaft joint	A 1		
7844699	Pliers bellows clamp	A 2	 S 4676	Also 95/96

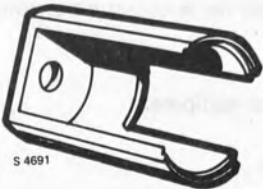
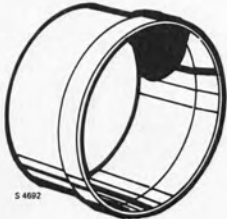
Special tools, manual transmission

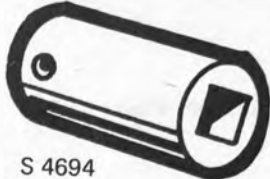
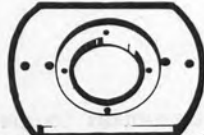
Part No.	Description	Class	Illustration	Remarks
8995409	Puller, removal of tie rod ends and ball joints	A 1		
8790420	Key, drain plug	A 1		
8790743	Key, oil filler plug	A 1		
8790479	Washer, wheel primary gear. Installation of needle bearing, primary gear housing	A 2		
8390560	Sleeve cpl. end nut pinion shaft	A 2		—99722003499
8390684	Intermediate piece, pinion shaft	A 2		—99726001717
8790578	Sleeve 42 mm	A 2		

Special tools, automatic transmission

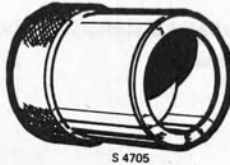
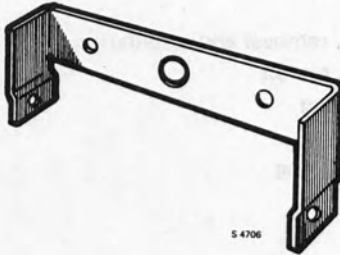
Part No.	Description	Class	Illustration	Remarks
8790016	Cpl. set tools for automatic transmission	A 2		
8790032	Pressure test equipment	A 1		
8790347	Manometer	A 2		
8790040	Hose	A 2		
8790057	Adapter	A 2		
8790727	Bracket cpl. measuring play in planet gear and gear back lash	A 2		
8790073	Spacer, adjustment of front band	A 1		

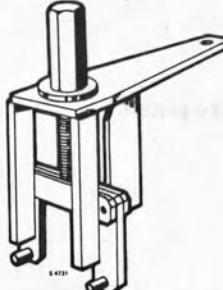
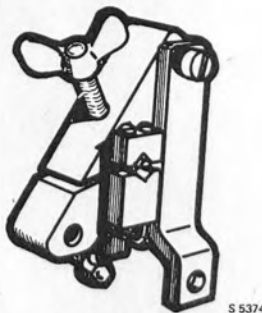
Special tools, automatic transmission

Part No.	Description	Class	Illustration	Remarks
8790081	Sleeve, removal and installation of spring, rear clutch	A 2	 S 4691	
8790693	Sleeve, installation of piston, rear clutch	A 2	 S 4692	
8790107	Sleeve, installation of piston, front clutch	A 2	 S 4693	
8790115	Sleeve, adjustment of rear band	A 1	 S 4694	
8790123	Key, lock nut on switch, ignition and back-up lights	A 2	 S 4695	
8790131	Torque key	A 1	 S 4696	
8790149	Screwdriver, adapter	A 2	 S 4697	

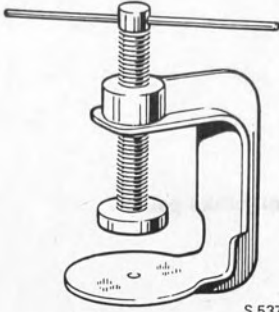
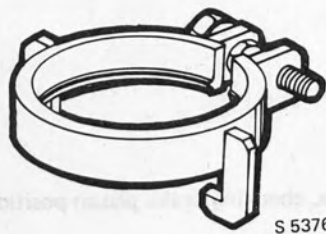
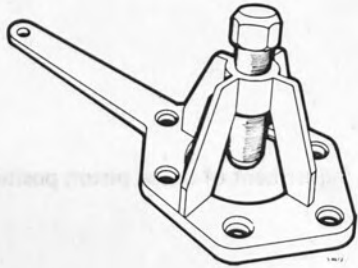
Special tools, automatic transmission				
Part No.	Description	Class	Illustration	Remarks
8790156	Sleeve, adjustment of front band	A 1	 S 4694	
8790164	Sleeve, removal and installation of oil seal, pinion housing	A 2	 S 4698	
8790636	Fixture, removal and installation of bearing, pinion	A 2	  S 5371	
8790651	Holder ring	A 2		
8790669	Holder ring	A 2		
8790644	Installing ring	A 2		
8790180	Pliers	A 2	 S 4699	
8790297	Yaw	A 2	 S 4700	
8790388	Removing tool, gear selector wire	A 2	 S 4701	
8790537	Ring, removal and installation of outer ring, rear pinion bearing	A 2	 S 4702	
8790214	Ring, removal and installation of front pinion bearing	A 2		
8790222	Guide pins, pinion bearing housing	A 2	 S 4703	

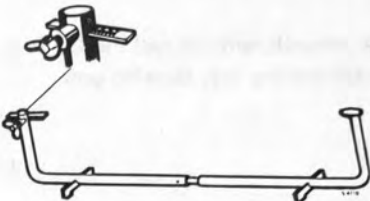
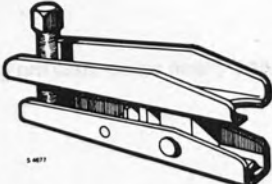
Special tools, automatic transmission

Part No.	Description	Class	Illustration	Remarks
8790230	Dolly, gear, primary shaft	A 2	 S 4704	
8790248	Centering sleeve, oil pump	A 2	 S 4705	
8790255	Transportation support, torque converter	A 2	 S 4706	
8790263	Sleeve (Bacho 2'') nut, pinion bearing	A 2	 S 4707	
8790610	Drift removal of ring gear	A 2	 S 4708	
8790487	Sleeve, bearing differential housing	A 2	 S 4709	

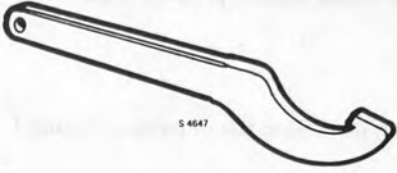
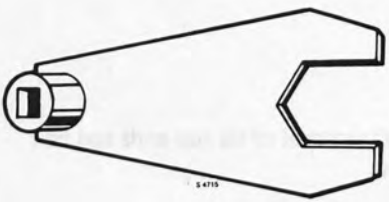
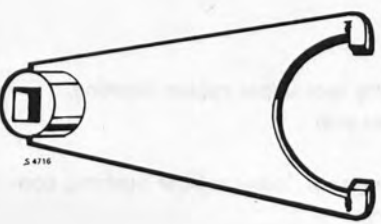
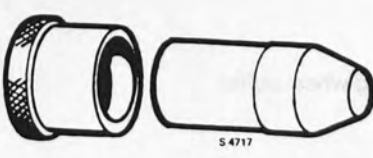
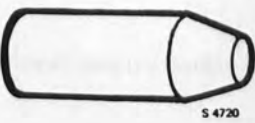
Special tools, chassis				
Part No.	Description	Class	Illustration	Remarks
	500 Brakes			
8995771	Removing tool, brake pads	A 3		
8995342	Template, checking brake piston position	A 0-2		
8995367	Pliers, adjustment of brake piston position	A 0-2		
8995359	Measuring device, checking brake disc throw	A 3		
8995607	Brake spring tool, removal and installation of brake spring	A 0-2		

Special tools, chassis

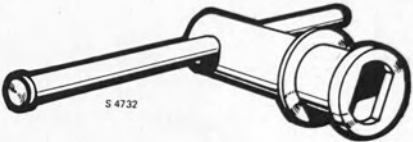
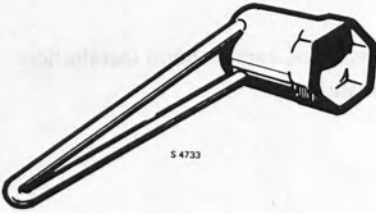
Part No.	Description	Class	Illustration	Remarks
7841323	Clamp, brake piston	A 1	 S 5375	
8995797	Puller, brake disc	A 3	 S 5376	
8996084	Puller	A 1		

Special tools, chassis				
Part No.	Description	Class	Illustration	Remarks
	600 Front assembly, steering device			
7840010	Tool, measuring toe-in (with extension)	A 2		
8995698	Measuring rule	A 2		
8995763	Ratchet key, front wheel assembly	A 0-2		
8995409	Puller, removal of tie rod ends and ball joints	A 1		
7841331	Pressing tool upper rubber bushing, control arm	A 3		
7841349	Pressing tool, lower rubber bushing, control arm	A 3		
8996019	Steering wheel puller	A 0-2		
8995813	Installing tool, bellows, steering wheel shaft	A 3		
8995375	Drift removal of steering gear bushing	A 3		

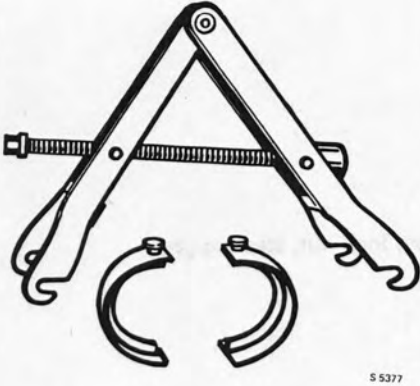
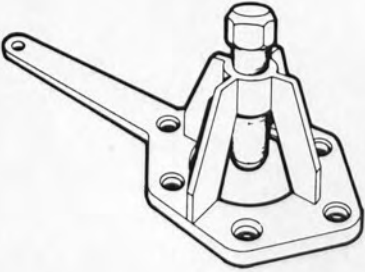
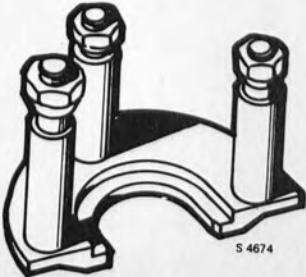
Special tools, chassis

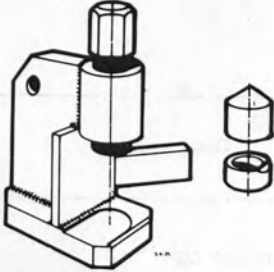
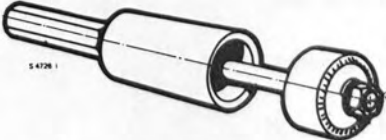
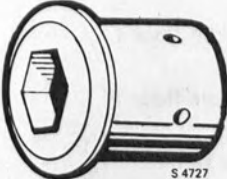
Part No.	Description	Class	Illustration	Remarks
8390197	Hook wrench, removal and installation of outer bearing cap, steering gear	A 2		
8995284	Puller, gear, steering gear. Used together with tapping hammer 8390270. See special tools, transmission.	A 2		
8995995	Key grip end piece servo steering gear	A 2		
8995961	Key grip, round nut servo steering gear	A 2		
8995938 8995946	Installing tool, sealing, servo steering gear Sealing guard	A 2 A 2		
8995953	Lock screw, servo steering gear	A 2		
8995987	Thread guard, rack servo steering gear	A 2		
8995979	Splines guard, servo steering gear	A 2		

Special tools, chassis

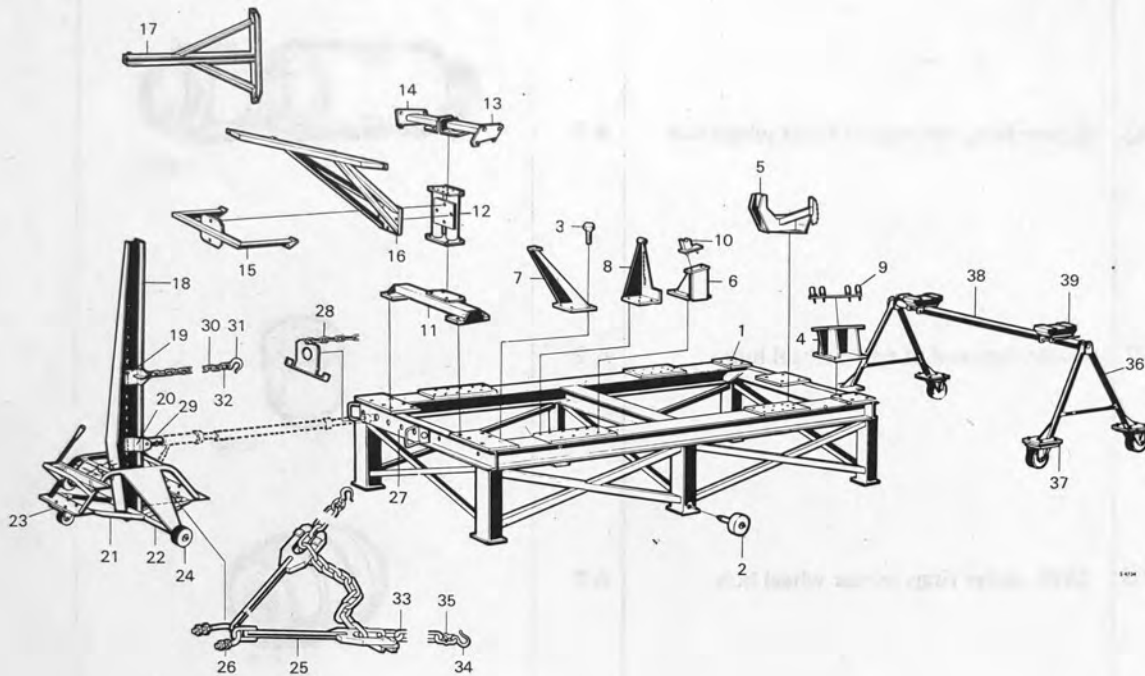
Part No.	Description	Class	Illustration	Remarks
7844699	Pliers, bellows clamps	A 2		
8995300	Key cpl. tightening plunge, steering gear	A 2		
8995318	Handle	A 3		
8995326	Sleeve	A 3		
8995565	Key, lock nut, steering gear	A 2		

Special tools, chassis

Part No.	Description	Class	Illustration	Remarks
	700 Spiral spring — hub			
8995839	Spring tool cpl. removal and installation of front spring	A 2		As from model 1973
8995011	Spring tool cpl. removal and installation of front spring	A 2		Up to and incl. model 1972
8996076	Safety chain, spring scissors	A 3		
8996084	Puller, hub	A 1		
8995250	Puller, bearing, front wheel hub	A 2		

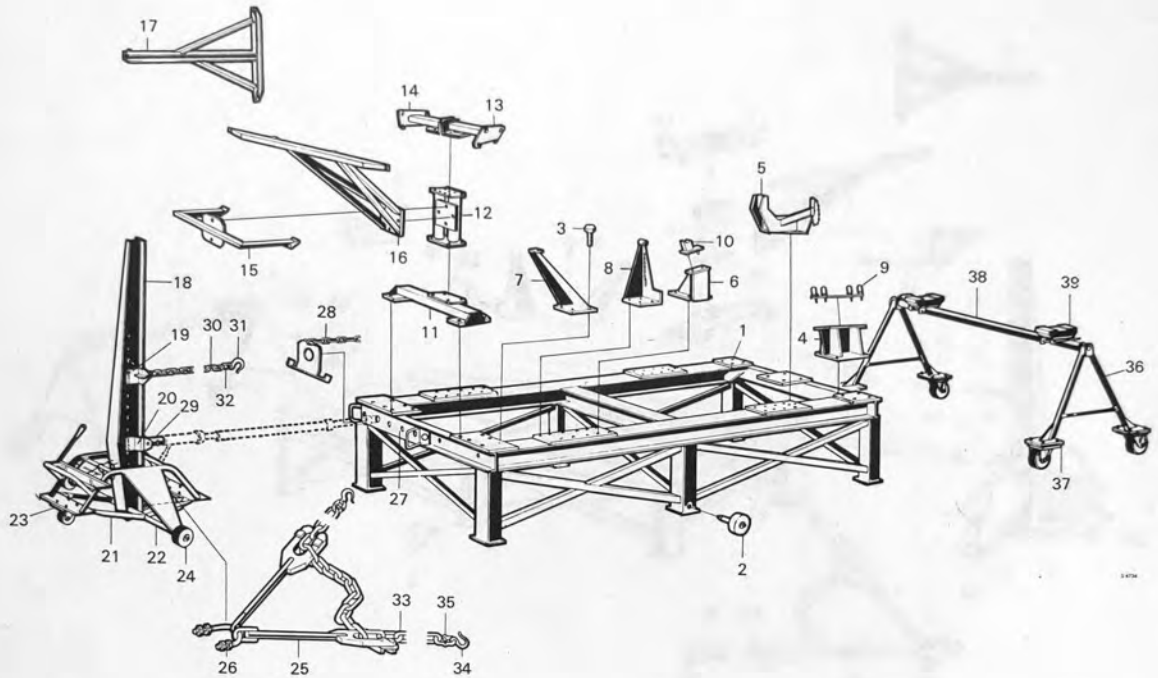
Special tools, chassis				
Part No.	Description	Class	Illustration	Remarks
8995243	Spacer bolt, removal of front wheel hub	A 2	 S 5378	
8995177	Dolly, removal of front wheel hub	A 2	 S 5258	
8995169	Drift, outer rings in rear wheel hub	A 2	 S 4724	
8995920	Tool, removal and installation of wheel screw	A 1	 S 4726	
8995789	Tool, rubber bushing rear axle	A 3	 S 4728	
8995805	Sleeve, wheel nut	A 0-1	 S 4727	

Special tools, body



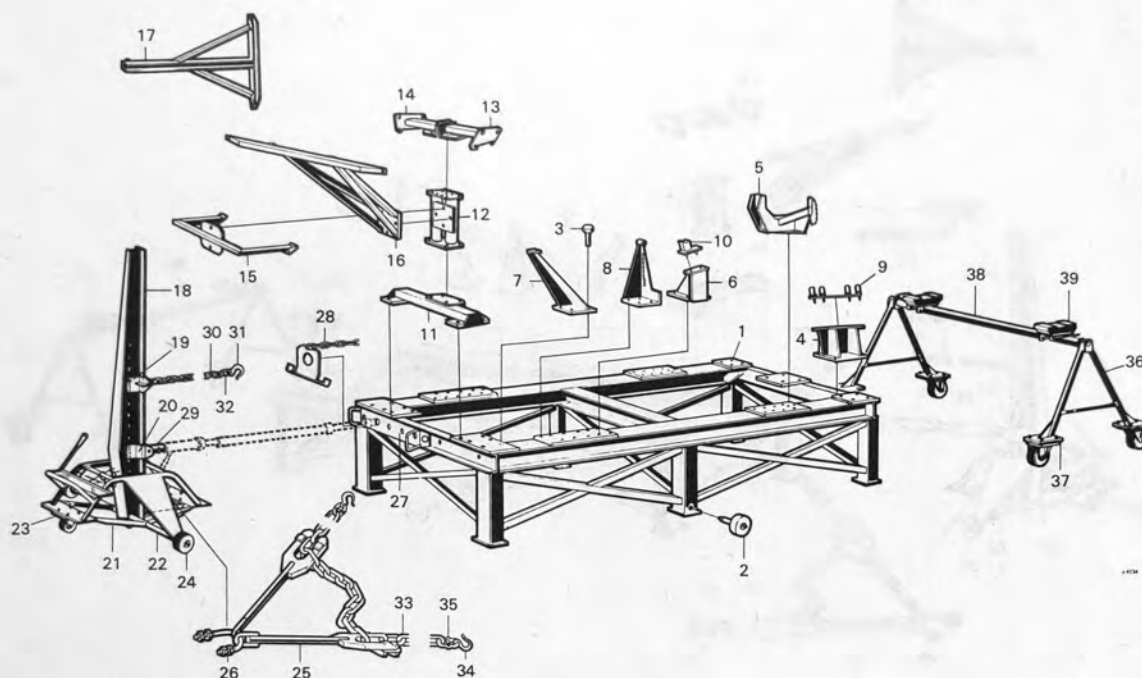
Part No.	Description	Class	Illustration	Remarks
8290140	Aligning bench cpl.	B 2	Pos. 1. Positions, see fig. above.	Also 95/96
8290157	Wheel	B 2	Pos. 2.	Also 95/96
7061559	Support screw	B 2	Pos. 3.	
8290363	Support set cpl.	B 2	Pos. 4 up to and incl. pos. 17.	
8290124	Front support L	B 2	Pos. 4.	
8290132	Front support R	B 2	Pos. 4.	
8290298	Scuff support L	B 2	Pos. 5.	
8290306	Scuff support R	B 2	Pos. 5.	
8290223	Support, middle floor L	B 2	Pos. 6.	
8290231	Support, middle floor R	B 2	Pos. 6.	
8290421	Support, rear floor	B 2	Pos. 7.	

Special tools, body



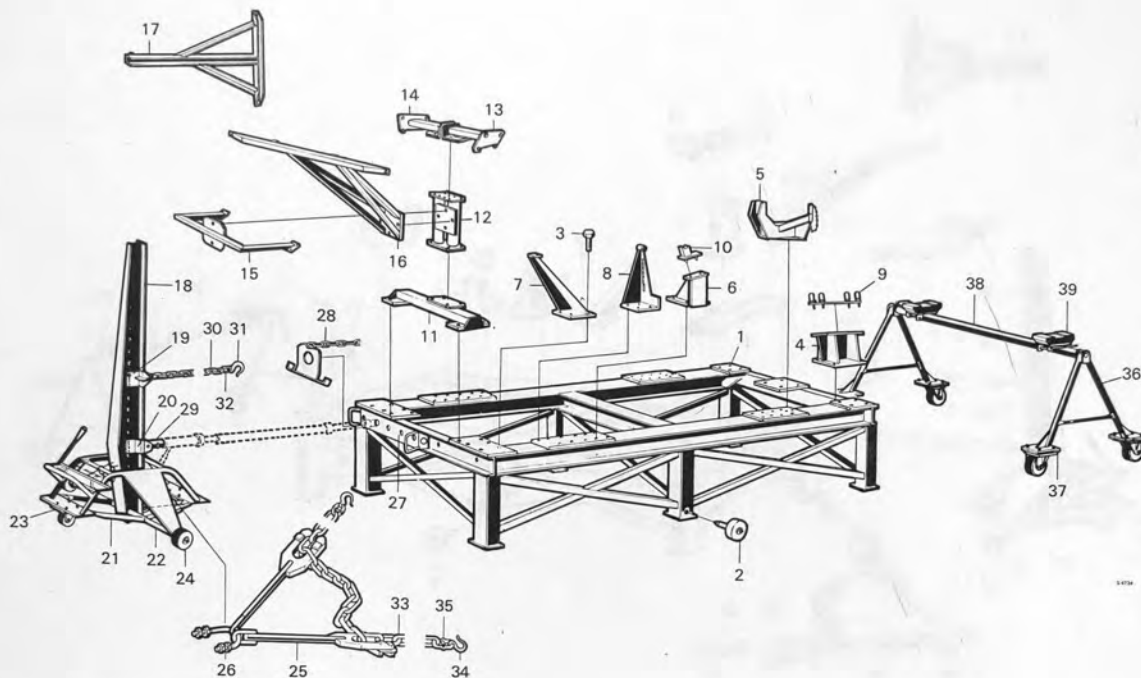
Part No.	Description	Class	Illustration	Remarks
8290470	Support, rear wheel housing L	B 2	Pos. 8. Positions, see fig. above.	
8290488	Support, rear wheel housing R	B 2	Pos. 8.	
8290439	Check support, front L	B 2	Pos. 9.	
8290447	Check support, front R	B 2	Pos. 9.	
8290165	Check support, rear	B 2	Pos. 10.	
8290652	Intermediate piece	B 2	Pos. 11.	
8290660	Pillar	B 2	Pos. 12.	
8290678	Support, front bearing bracket L	B 2	Pos. 13.	
8290686	Support, front bearing bracket R	B 2	Pos. 14.	
8291718	Fixture, steering gear bracket	B 2	Pos. 15.	
8291742	Fixture, front floor	B 2	Pos. 16.	

Special tools, body



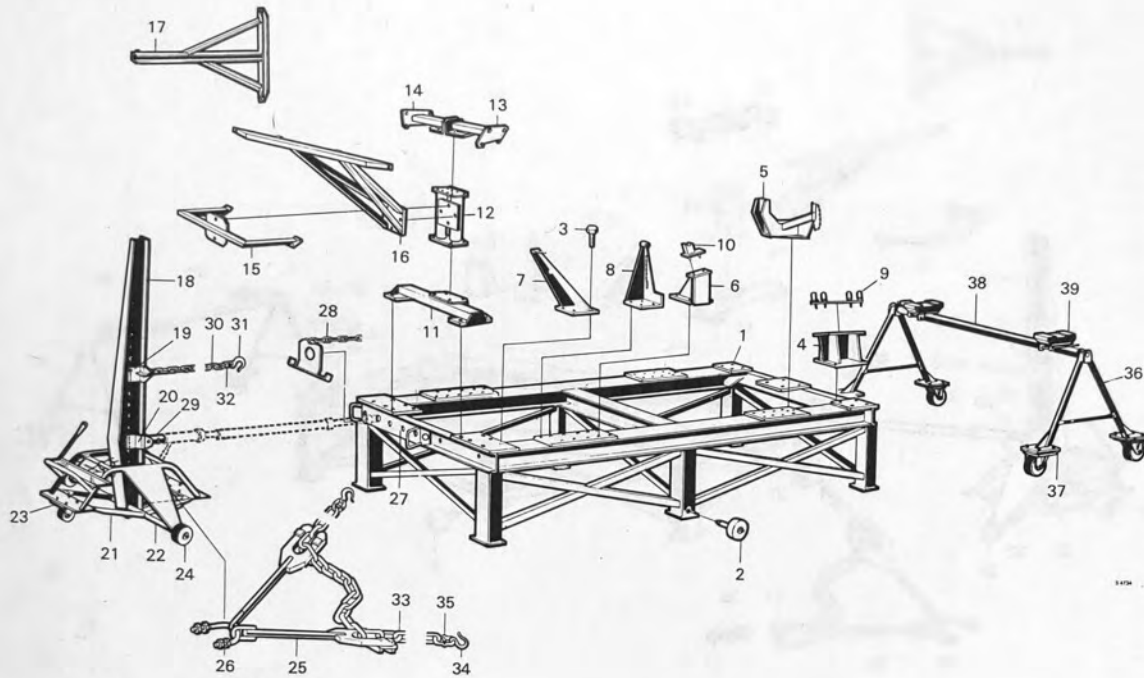
Part No.	Description	Class	Illustration	Remarks
8290728	Fixture, engine brackets	B 2	Pos. 17. Positions, see fig. above	
8290322	Driving aligner cpl.	B 2	Pos. 18 up to and incl. pos. 35	Also 95/96
8290801	Lever	B 2	Pos. 18.	Also 95/96
8290256	Driver head	B 2	Pos. 19.	Also 95/96
8290330	Pressure head	B 2	Pos. 20.	Also 95/96
8290264	Trolley	B 2	Pos. 21.	Also 95/96
8290371	Shaft	B 2	Pos. 22.	
8290520	Link roller	B 2	Pos. 23.	Also 95/96
8290538	Iron wheel	B 2	Pos. 24.	Also 95/96
8290405	Ancorage head	B 2	Pos. 25.	Also 95/96
8291288	Fastening yoke	B 2	Pos. 26.	

Special tools, body

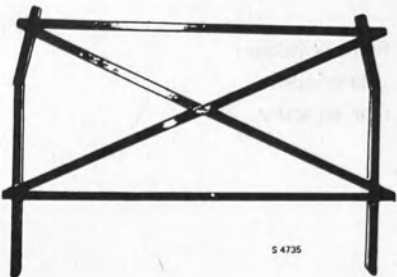
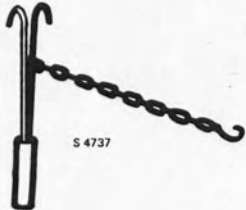
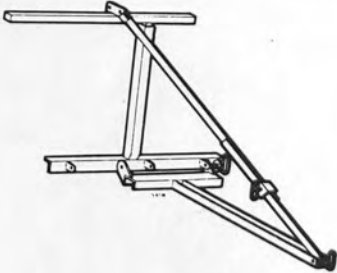
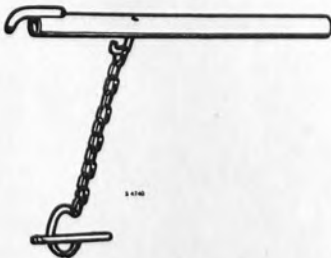


Part No.	Description	Class	Illustration	Remarks
8290173	Pressure piece	B 2	Pos. 27. Positions, see fig. above	Also 95/96
8291270	Safety chain	B 2	Pos. 28.	
8290389	Sleeve, Bacho and Nike, hydraulic equipment	B 2	Pos. 29.	Also 95/96
8291320	Pulling chain	B 2	Pos. 30.	
8291338	Hook	B 2	Pos. 31.	
8291346	Hammerlok link	B 2	Pos. 32.	
8291361	Ancorage chain	B 2	Pos. 33.	
8291379	Hook	B 2	Pos. 34.	
8291387	Hammerlok chain	B 2	Pos. 35.	
8290272	Threstle cpl. set	B 2	Pos. 36 up to and incl. pos. 39.	Also 95/96
8290694	Threstle	B 2	Pos. 36.	Also 95/96

Special tools, body

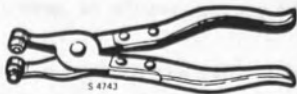
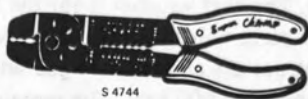
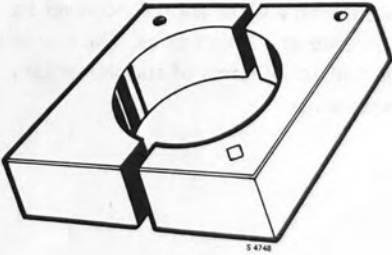


Part No.	Description	Class	Illustration	Remarks
8290546	Link roller	B 2	Pos. 37.	Also 95/96
8290702	Yoke	B 2	Pos. 38.	Also 95/96
8290280	Wooden plate	B 2	Pos. 39.	Also 95/96

Special tools, body				
Part No.	Description	Class	Illustration	Remarks
8290637	Fixture, front fender	B 1	 S 4735	
8291023	Installing tool, decorating strip	A 2	 S 4736	
8290579	Tensioning hook, headlining	A 2	 S 4737	
8290587	Hook, headlining	A 2	 S 4738	
7884166	Holder, door	B 3		
8290561	Holder, door	B 3		
7884182	Stay, holder, door	B 3		
8291577	Tool, spring, luggage compartment lid	A 2	 S 4740	

Special tools, body

Part No.	Description	Class	Illustration	Remarks
8291767 8291775 8291551	Pad, front window Pad, side window Pad, rear window	A 2 A 2 A 2	 S 4741	
8471039	Installing tool, door lock	A 2	 S 4742	

Special tools, others				
Part No.	Description	Class	Illustration	Remarks
7843303	Pliers, hose clamp	A 1		
7840937	Pliers, splice crimping	A 1		
7860695	Pliers, insulated cable terminals	A 1		
7860703	Pliers,uninsulated douglas plug	A 1		
8291395	Sleeve wrench	A 3		
8580029	Holder, rotor	A 2		

SERVICE INSPECTIONS

General

To assure the car owner of trouble-free motoring at lowest cost it is essential that the car receives the necessary care and attention.

The Service Book supplied with every new car up to and incl. model 1971 contains a number of vouchers listing the jobs which are necessary in the first instance for proper maintenance of the car. The first voucher is for the Delivery Inspection, which takes place before the car is delivered. The second voucher entitles the customer to guarantee inspection after 1,200 miles (2,000 km). The remaining vouchers are for regular servicing at intervals of 6,000 miles (10,000 km); these are billed according to a fixed price list.

With effect from the 1972 model the former Service Book is replaced by a Service Card (for the USA-market, included in the Guide as from model 1973), while details of the maintenance program are given in the Guide instead. The maintenance program has also been revised and is now divided into:

Routine service inspections

Supplementary work

Order work

Routine service inspections take place according to a basic schedule and are to be carried out in connection with regular checkups at intervals of 6,000 miles (10,000 km).

Supplementary work can be either entrusted to the service shop or done by the owner himself if he is able and willing to do so. The supplementary work should however be treated as one job offered at a fixed price. The owner cannot therefore order individual items of supplementary work from the service shop.

Order work covers a number of jobs that can be ordered individually as and when needed. If some item has recently been attended to, e.g. a change of spark plugs, an engine oil change or perhaps a wheel alignment checkup in connection with a change of tyres, this item need not of course be reordered.

It should however be pointed out to customers that the division of jobs into different groups is not intended to represent any kind of grading in order of importance. The idea is to make sure that the car is properly maintained while giving the enthusiastic and capable motorist the opportunity to save on overhaul expenses by doing the simpler jobs himself.

NOTE

The new maintenance program is also applicable to older cars, which means that the service shop can operate to a standard program. Service cards may therefore be issued to owners of older cars if they are agreeable to this.

After each routine inspection the service shop should put its rubber stamp on the service card.

In addition to routine inspection, the service card lists various jobs in a system of boxes. The idea is to draw a heavy line over boxes representing jobs that are not carried out by the service shop.

The maintenance program is valid for markets except the USA. For the USA market as from model 1973, a maintenance program according to the USA Guide is valid.

Delivery inspection

1. Check the engine oil level and if necessary replenish oil.
2. Check the gearbox oil level and if necessary replenish oil. Check the differential oil level (cars with automatic transmission).
3. Check the level of the fluid in the power steering gear reservoir, and top up as necessary.
4. Check level of coolant and its freezing point.
5. Check function of all locks, headlights, stop lights, direction indicators, warning flashers, back-up lights, indicator lights, windshield wipers/washer, headlight wipers/washer, heater fan and signal horns.
6. Check, if necessary, adjust the headlight alignment.
7. Check the battery electrolyte level and charging condition.
8. Tighten cable terminals at battery, starter motor, voltage regulator and alternator.
9. Check, if necessary, adjust fan belt tension.
10. Check, if necessary, adjust the ignition setting.
11. Check the fluid level and if necessary replenish brake fluid in the master cylinders for brakes and clutch.
12. Check, if necessary, adjust the parking brake.
13. Check brake hoses and lines for leakage.
14. Tighten the wheel bolts.
15. Adjust the tire pressure incl. the spare wheel.
16. Check, if necessary, adjust toe-in.
17. Check, if necessary, adjust the seat rails.
18. Check that tool kit, Owner's Manual and Service Card are in place.
19. Test run car on road and check its condition, especially the function of brakes and clutch.
20. Check and adjust idling and fast idling setting. (Carburetor engine).
21. Check and adjust idling setting. (Cars with fuel injection)

Guarantee service at 1,200 miles (2,000 km) covers the following points:

1. Check cylinder head nuts and bolts to prescribed torque.
2. Check and tighten flange screws of inlet manifold and carburetor valve housing.
3. Check and tighten exhaust manifold retaining screws and exhaust pipe flange nuts.
4. Check exhaust system for leaks; check and tighten exhaust pipe clamp and suspension screws.
5. Check and tighten screws on all engine mounts.
6. Change engine oil. Owner pays for oil.
7. Cars with manual transmission only: Change transmission oil and clean magnetic drain plug. Owner pays for oil.
8. Cars with automatic transmission only: Check and, if necessary adjust gear selector cable. Check and tighten screws retaining covers under transmission. Check oil level in transmission and final drive.
9. Check the level of the fluid in the power steering gear reservoir, and top up as necessary.
10. Check radiator coolant level and test cooling system for leaks (pressure test).
11. Check fluid level in clutch master cylinder and top up if necessary. Check and if necessary adjust clutch release bearing play (cars with manual transmission only).
12. Check function of all locks, headlights, stop lights, direction indicators, warning flashers, back-up lights, indicator lights, windshield wipers/washer, headlight wipers/washer, heater fan and signal horns.
13. Check and if necessary adjust headlight alignment.
14. Check battery electrolyte level and top up if necessary; grease cable clamps.
15. Check and if necessary adjust alternator drive belt tension.
16. Check and if necessary adjust closing angle of breaker points. Grease distributor breaker cam and lubricating felt. Check and if necessary adjust ignition timing.
17. Check fluid level in brake master cylinder; top up if necessary.
18. Check and if necessary adjust parking brake.
19. Check brake fluid lines and hoses for leaks and condition.
20. Check condition of rubber dust excluders on steering gear and inner and outer universal joints, and of rubber seals for ball joints and tierod ends.
21. Check and tighten screws securing rear axle to body.
22. Check and tighten screws securing control arms to body (front suspension).
23. Check and if necessary adjust wheel alignment (camber, caster and toe-in).
24. Test-drive car on road and check operation of all systems, especially brakes and clutch.
25. Check and if necessary adjust engine idling speed and the carburetor overflow valve.

Routine Service Inspection

To be carried out by authorised Saab dealer every 6,000 miles (10,000 km).

Engine

Cleaning of air cleaner insert.

Inspect vacuum piston diaphragm in carburetor. Check and if necessary top up oil level in damping cylinder (carbureted engines only).

Adjust engine idling speed and measure carbon monoxide emission in exhaust at idling speed (if prescribed by the authorities).

Clean fuel pump filter (carbureted engine).

Pressure test of the cooling system. Check condition of hoses.

Electrical system

Inspect alternator drive belt and adjust belt tension if necessary.

Inspect condition of headlights by eye.

Check headlight alignment and adjust if necessary.

Clean and adjust spark plugs.

Check condition of contact breaker points.

Check ignition timing and closing angle of points and adjust if necessary. Grease distributor breaker cam and lubricate felt.

Transmission

Check clutch release bearing play and fluid level in clutch master cylinder and adjust if necessary (manual transmission only). Check transmission oil level and top up if necessary (also final drive in automatic transmissions).

Brake system

Check fluid level in master cylinder and top up if necessary.

Remove wheels and check thickness of brake pads.

Adjust handbrake.

Check brake lines and hoses for leaks and general condition.

Front suspension and steering

Check toe-in.

Check condition of rubber dust excluder on steering gear and inner and outer universal joints and of rubber seals for ball joints and tie-rod ends.

Servo steering gear

Check servo steering gear for exterior leakage.

Check condition and tension of drive belt.

Check oil level in servo oil reservoir.

Final check

Test drive.

Supplementary work

To be performed at 6,000 miles (10,000 km) or shorter intervals.

The owner can do this work himself or order it as part of the 6,000 miles (10,000 km) inspection.

Check engine oil level.

Check coolant freezing point.

Check battery electrolyte level and top up if necessary.

Tighten and grease cable clamps.

Check fuel lines in engine compartment for leaks.

Check exhaust system for condition and leaks.

Lubricate door stops, door hinges, throttle control and hood lock mechanism.

Check depth of tire tread patterns.

Check operation of parking, stop and tail lights, license plate illumination, direction indicators, horns, back-up lights, hazard warning signal, interior lighting, ignition switch illumination, warning and indicator lights, brake warning light, instrument panel illumination, windshield and headlight wipers and washers, trunk illumination and ventilator fan.

Check washer jets and rubber wiper blades.

Order Work

To be carried out by an authorised Saab dealer

This can be arranged in conjunction with regular 6,000 miles (10,000 km) servicing and is carried out as needed (consult your local Saab dealer).

- B1. Change oil every 6,000 miles (10,000 km) or at least twice a year. If the car often is driven in highway conditions, i.e. long distances with high speed, it is recommended to change oil every 3,000 miles (5,000 km).
- B2. Change oil filter (every 6,000 miles/10,000 km).
- B3a. Change oil in manual transmission. Clean magnetic drain plug (every 12,000 miles/20,000 km or at least once a year).
- B3b. Change oil in final drive of automatic transmission (every 12,000 miles/20,000 km).
- B4. Change spark plugs (every 9,000–12,000 miles/15,000–20,000 km).
- B5. Change breaker points (after inspection).
- B6a. Change fuel filter in cars with injection engines (every 12,000 miles/20,000 km).
- B6b. Change of air cleaner insert every 18,000 miles (30,000 km).
- B7. Check and if necessary adjust wheel angles, i.e. camber, caster, toe-in (every 12,000 miles/20,000 km).
- B8. Adjustment of toe-in.
- B9. Change brake fluid (after 24,000 miles/40,000 km or two years).
- B10. Tighten cylinder head nuts and bolts to prescribed torque (at first 6,000 miles/10,000 km inspection only).
- B11. Check and if necessary adjust valve clearance at 6,000 miles (10,000 km) inspection. On 2.0 l engines also at 24,000—, 48,000— and 72,000 miles/40,000—, 80,000— and 120,000 km inspection.
- B12. Check and if necessary top up oil in steering gear. (After 30,000 miles/50,000 km).

LUBRICATION

NOTE

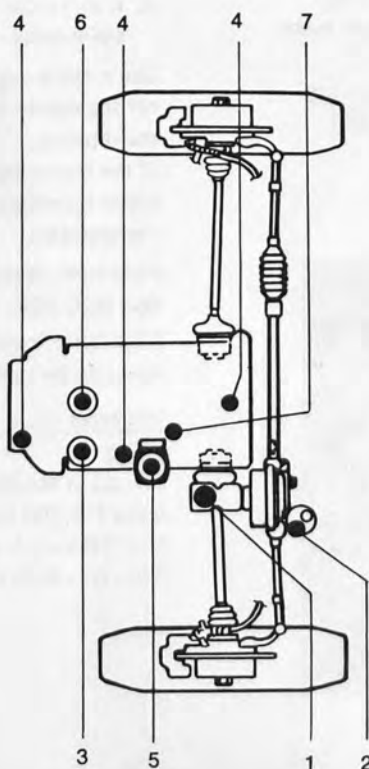
Saab Special chassis grease must be used with care, as it is apt to discolor the paintwork of the car.

NOTE

Use only Saab Special chassis grease for greasing and packing bearings.

Lubrication every 6,000 miles (10,000 km) or at least twice a year

Ref.	Lubrication point	Qty.	Lubricant	Direction
1	Brake system	1	Brake fluid, grade SAE J 1703 or SAE 70 R3 USA: DOT 3 or DOT 4	Brake fluid to be changed every 24,000 miles (40,000 km) or at least every 2 years.
2	Hydraulic clutch	1	Brake fluid grade as above	
3	Engine	1	Follow recommendations on page 120-2	Change oil and oil filter cartridge NOTE! Use only Saab original filter cartridge.
4	Manual transmission		Follow recommendations on page 120-2	Check every 6,000 miles (10,000 km), change every 12,000 miles (20,000 km)
	Automatic transmission			Check every 6,000 miles (10,000 km)
	Final drive, automatic transmission		Follow recommendations on page 120-2	Check every 6,000 miles (10,000 km), change every 12,000 miles (20,000 km)
5	Carburetor (oil damper)		As for engine	Check every 6,000 miles (10,000 km) at time of service inspection
6	Distributor, breaker cam	1	Bosch Ft 1 v 4 SAE 40 oil	Grease cam
	Distributor, lubr. felt under breaker plate			Oil can through hole in breaker plate
7	Throttle control, wire bearing	1	SAE 40 oil	Oil can
	Hood lock mechanism	1	SAE 40 oil	Oil can
	Door hinges and door stops	4+4 (8+8)	SAE 40 oil	Oil can



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Points to be lubricated every 6,000 miles (10,000 km) or at least twice a year

1. Brake system

The brake fluid container must always be kept well filled. The level in the container should be checked every three months, when the filler cap should also be inspected to make sure that the holes are not blocked. Follow the brake fluid recommendations given in the lubrication table.

2. Hydraulic clutch operation

Check that the container is full.

3. Engine

Oil volume 4 US quarts, 6 Imp. pints (3.5 liters)

Oil according to API Service SE or Fords specification ESE-M2C-101C should be used.

Oil grade SAE 10 W 30 or SAE 10 W 40

In extremely cold conditions with temperatures constantly below -4°F (-20°C) oil with a viscosity of SAE 5 W 20 should be used.

NOTE! This last-named oil must not be used at temperatures above $+32^{\circ}\text{F}$ (0°C).

The engine oil level should be checked regularly.

This should be done when the engine has been at a standstill for about one minute. The oil level must not be allowed to fall below the lower mark on the dipstick, nor must it be topped up beyond the upper mark, as this may result in abnormal oil consumption. The distance between the upper and lower marks corresponds to a volume of one liter (roughly 1 US quart or 1 3/4 Imp. pints). Top up as needed with oil of the recommended grade. Engine oil should be changed for the first time after 1,200 miles (2,000 km), for the second time at 6,000 miles (10,000 km) and thereafter every 6,000 miles (10,000 km) or at least twice a year. Change the oil filter insert (oil filter cartridge) every 6,000 miles (10,000 km).

The engine drain plug has a recess for a square pin spanner up to and incl. gearbox No. 6.779, and thereafter hexagon head.



DRAIN PLUGS

1. Engine

2. Transmission

4. Manual transmission

Up to gearbox No. 36472 there are two drain plugs with specially shaped recesses requiring use of special tool 839153, see illustration below. Both plugs must be removed to drain the transmission of oil. The plug with the square recess is for draining engine oil.

Check the oil level every 6,000 miles (10,000 km) by unscrewing the level plug. If the oil level is below the plug opening, add oil until it runs out of the opening.

When changing oil, drive the car for 15–20 minutes before draining off the old oil. Clean the magnetic drain plug, then add fresh transmission oil through the transmission filler plug opening until it runs out of the level plug opening. Remember that it takes some time for the oil to run from the primary gear housing into the transmission case. The transmission holds 3 US quarts of oil (5 Imp. pints, 3 liters). Oil should be changed for the first time after 1,200 miles (2,000 km) and thereafter every 12,000 miles (20,000 km) or at least once a year. SAE 75 EP oil or SAE 80 to specification API-GL-4 or API-GL-5 should be used. In cold climate SAE 75 must be used.

Automatic transmission

The oil in the automatic transmission does not need changing, but the level must be checked every 6,000 miles (10,000 km). The filler tube with graduated dipstick is located immediately behind the radiator. The dipstick has different level graduations for hot and cold oil. When the oil level is measured, the following points should be observed:

- Check that the car is level.
- Idle the engine for a few minutes with the gear selector lever at P.
- Shut off the engine and check that the oil level is between the min. and max. markings on the dipstick.
- If oil needs to be added, the engine should be idled again before the level is re-checked.

Use a nylon rag, lint-free paper or chamois leather to wipe off the dipstick — do not use rags that may leave fluff on the dipstick.

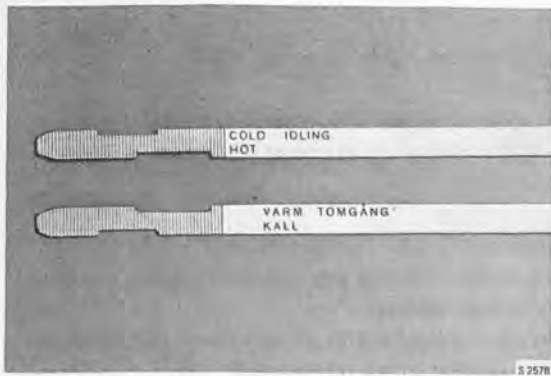
If the transmission needs topping up, use only special automatic transmission oil according to the following recommendations:

Automatic transmission oil according to Ford specification M2C.33F.

Automatic transmission oil Type A, Suffix A and Dexron may also be used for topping up.

The most scrupulous cleanliness must be observed during filling.

The oil in the final drive must be checked every 6,000 miles (10,000 km) and changed every 12,000 miles (20,000 km). Use SAE 75 or 80 EP oil to specification API-GL-4 or API GL-5.



DIPSTICK, AUTOMATIC TRANSMISSION



DRAIN PLUGS, AUTOMATIC TRANSMISSION

1. Engine
2. Final drive

5. Carburetor oil damper:
Use the same grade of oil as for the engine. The oil level should be so high that the damping piston dips into the oil before the thread of the plastic screw cap engages.
6. Distributor breaker cam:
Grease the cam sparingly.
Distributor lubricating felt under breaker plate:
Impregnate the felt with a moderate quantity of grease.
7. Throttle control:
All throttle control bearings are accessible from the engine compartment. As from model 1972 only the wire bearing should be oiled.
Hood lock mechanism:
Door hinges and door stops
Oil the hinges by dropping oil into the groove in the head of the hinge pin. The hinges are accessible from the front when the hood is open.

Every 30,000 miles (50,000 km)

Steering gear as from model 1973

Check the lubricant oil level on the left and right sides.

Checking the lubricant oil level on the left side:

1. Clean the tie rod and the clamp around the protective bellows on the left side and loosen and pull off the clamp.
2. Insert a screwdriver between the bellows and the tie rod along the underside of the tie rod.
3. Set the front wheels straight ahead.
4. Jack up the right side of the car so that the wheels are suspended 2 in. (5 cm) above the floor.
5. If the steering gear contains the proper amount of oil, the oil will begin to drip out next to the screwdriver.
6. Use an oil can to top-up the oil to the right level.
7. Re-fit the clamp. Make sure that the threaded end of the clamp screw is fitted with a rubber cap. Follow the same procedure on the right side.
8. Do the same check on the right side.

Servo steering gear, special version as from model 1974

Checking the lubricant oil level on the left and right sides.

1. Set the car on its wheels on a level floor. The distance from the floor to the lower edges of the front bumper brackets should be 1 ft. 5.7 in. (450 mm) in order for the tie rod to be at the proper angle. Jack up or load down the front end of the car to obtain the proper distance.
2. Unfasten and remove the bellows clamps on the tie rod.
3. Set the front wheels straight ahead.
4. Insert a screwdriver into the bellows along the underside of the bellows. (Same procedure on both right and left sides.)
If the steering gear contains the proper amount of oil, the oil will begin to drip out.
5. Use an oil can to top-up the oil to the right level.
6. Re-fit the clamps.

Reconditioning

For reconditioning, the following lubrication points are to be repacked with chassis grease:

Tie-rod end assemblies plus upper and lower ball joints:

Pack bellows 3/4 full.

Front wheel and rear wheel bearings:

Repack.

Inner universal joints up to and incl. the 1969 model:

Fill with 4 oz (100 g) of grease. The quantity will be correct if the needle bearing grooves are filled first and an equal quantity is then applied to the bottom of the driver.

Inner universal joints as from the 1970 model:

Fill with grease. The quantity will be correct if the driver is completely filled. Wipe off excessive grease when the drive shaft is installed.

Outer universal joints:

The correct quantity of grease is obtained if the cup with the balls inside is completely filled with grease.

Clutch controls:

Coat the joint with grease.

Release bearing:

Fill the groove 3/4 full.

Handbrake bellows:

Pack the bellows 1/3 full.

Steering gear up to and incl. model 1972

Rack, pinion and all bearings should be greased. The inner joints of the tie-rods are to be filled with grease.

All parts must be thoroughly cleaned before being repacked and dirt must be carefully excluded to prevent unnecessary wear on the parts.

Steering gear as from model 1973

In connection with overhaul of the steering gear fill approx. 1 cu.in. 0.15 dm³ (1.5 dl) oil type EP 90.

Servo steering gear as from model 1974

Lubricant oil:

When the steering gear is overhauled, add 0.33 pints (0.19 dm³/litres) of oil at one of the rubber bellows.

Oil grade: EP 90.

Hydraulic oil:

When making repairs on the hydraulic system, hydraulic oil is added as follows:

1. Add oil to a level 0.4 in. (1 cm) above the lower part of the strainer in the oil reservoir.
2. Start the engine and re-fill to the above-mentioned level.

Oil grade: Automatic transmission oil with the same specifications as that used for the automatic transmission.

The whole servo hydraulic system contains 2.0 l pints (1.2 dm³/litres).

Fuel

1.7 and 1.85 l engines:

Recommended grade of fuel: carburetor engines 97 octane gasoline; injection engines 91 octane gasoline.

2.0 l engine:

Carburetor engine 94 octane gasoline; injection engine 94 octane gasoline.

UNDERBODY COATING AND RUST-PREVENTIVE TREATMENT

Touching-up of underbody coating

To retain the advantages afforded by underbody composition, the underbody, too, should be regularly inspected and the coating touched up as necessary. Apart from protecting against corrosion, the coating improves sound insulation. This protection is particularly important with regard to the fenders, which are continuously exposed to wear from a constant barrage of flying stones and gravel. Before covering worn or bare parts with fresh underbody composition, clean the metal thoroughly with a scraper and a steel-wire brush and then wash with gasoline or suchlike. Before applying fresh composition, coat the metal with a reputable make of rust inhibitive, and then apply about 1.5 mm (0.06 in.) thick coating of composition before the rust inhibitive has dried. Excessive application will result in the composition running and it may even pull right away from the metal which it is intended to protect.

Naturally, new metal panels, such as fenders, must always be treated in a similar manner after fitting. If underbody coating is applied prior to spraying it is essential that all composition be washed off the surfaces which are to be enameled.

Rust-preventing treatment

The cars are treated with a rust preventive agent before leaving the factory. As from model 1974, spraying with rust-preventive oil has been greatly increased. The underside of the floor is sprayed after the underbody compound is applied. The rust preventing treatment which the car receives at the factory should be repeated within 12 months after delivery. The reason for this is that some settlement of the electrophoretic paint may occur in the welded body joints after the car has been driven for some time. Provided that this treatment is performed in accordance with the instructions issued by Saab-Scania, further spraying with rust-preventive oil will only be necessary every second or third year.

Holes and rubber plugs in the body

The parts of the body which must be sprayed with rust-preventive oil are listed under the heading Points of Treatment. On cars as from model 1974, no new holes need be made for this treatment. On older cars, some new holes must be drilled. The hole dimensions are 0.8 in. (20 mm) dia. and 0.4 in. (11 mm) dia. The holes are sealed with slitted rubber plugs (20 mm dia. 845948 and 11 mm dia. 845951).

Preliminary work

1. Clean the underbody, wheel housings and engine compartment, panel welds in the front floor, wheel housings and front fenders.
2. Remove the scuff plates, turn up the floor mats at the sills and seal the four drain holes in the sills (two in each sill), see fig.

Work site: Grease pit or lift.



DRAIN HOLES IN THE SILLS

3. Remove the wheels.
4. Mask the brake discs.
5. The reel belts on 2-door models should be completely pulled out and remain out until the treatment is finished.

Oil, pressure and temperature

About 3 1/2 pints (3 dm³/litres) of oil are used in the treatment. Information on pressure for spraying should be obtained from the oil manufacturer. Use heavy oil for the underbody and wheel housings and light oil for the members, cavities and welds. Heavy oil should be used for application with a brush or oil can. In order to assure sufficient penetration, the temperature of the car should not be less than 50°F (+10°C).

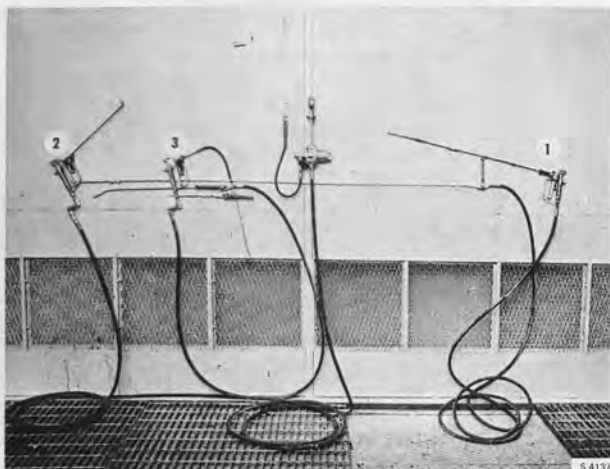
Equipment

2 high-pressure compressors for airless spraying with a 40:1 pressure increase for heavy oil and 48:1 for light oil.

2 spray guns.

Nozzles which permit access to cavities, members, doors and through slitted rubber plugs.

Oil can and brush for treatment of welds between wheel housings and fenders.



EQUIPMENT FOR RUST-PREVENTIVE TREATMENT

1. Nozzle for spraying doors
2. Nozzle for spraying members and cavities
3. Nozzle with reduced pressure for treatment of welds between wheel housings and fenders. Can be substituted by brush or oil can.

Oil spraying

The treatment is divided up into four groups. In group 1, the treatment is done from below, in group 2 from the sides and in groups 3 and 4 (horizontal reference line) from inside the engine compartment. The underbody and wheel housings are sprayed externally.

Cavities and members are sprayed internally. The welds between the front floor and the wheel housings are sprayed in the engine compartment.

Treated areas shall have a coat at least $30\mu\text{m}$ thick. The points of attachment between Z-beams and the floor shall be oiled liberally. All doors are oiled through holes in the end, about 4 in. (100 mm) from the bottom edge. A thin coat of oil shall be applied to the inside of the doors.

Treatment with brush or oil can

A brush or an oil can is used to treat the weld between the wheel housing and the front fender in the engine compartment and the weld between the wheel housing and the outer side panel in the luggage compartment. The oil is applied liberally to the uppermost point of the weld so it runs down along the weld.

Points of treatment

NOTE

Points of treatment with slitted plugs can be treated through the plug if the right nozzle is used.

Group 1 (from below)

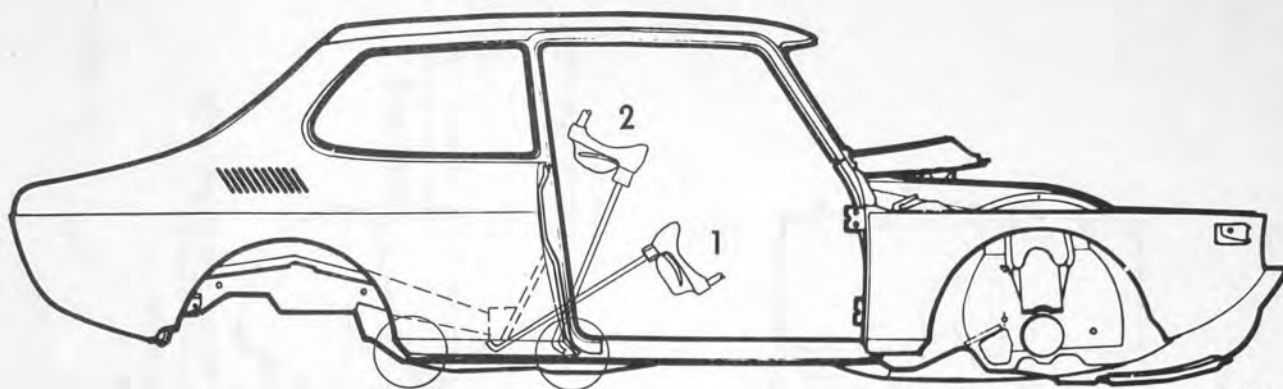
- 1.1. The cavity formed by the front engine member up against the front floor panel.
A hole 35 mm in dia. is provided in the front floor panel.
- 1.2. The front floor, the wheel housings and the entire underbody are sprayed with oil. Special care must be taken in treating Z-beams, the cross member in the engine compartment, jack attachment points (including the rear attachment point) and the linkage arm attachment point in the middle of the floor.
The front wheel housing rib against the front floor is treated through the recess in the wheel housing for the drive shafts and tie rods.
- 1.3. Cross bar member as from model 1974.
The cavity in the cross bar member is treated through the 11 mm dia. hole in the middle of the member.

Group 2 (from the sides)

- 2.1. The inside of the scuff plates is treated through the 20 mm holes in both ends on 2-door models.
- 2.2. The cavity formed by the outer side panel against the outer scuff plate is treated through the 20 mm dia. hole in the front edge.
Insert the nozzle through the hole in the end of the side panel. Hold the gun as in fig. 1 and spray, then twist the gun a half turn and spray again (fig. 2). The oil stream should hit the outlined areas. Any other spray direction will cause oiling of the seat belts, side boards and adjoining trim. Only airless spraying may be practised.

CAUTION

Point 2.2, 2-door models: Because of the location of the reel belt next to the side panel, only the lower part of the side panel may be sprayed.



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TREATMENT OF SIDE PANEL

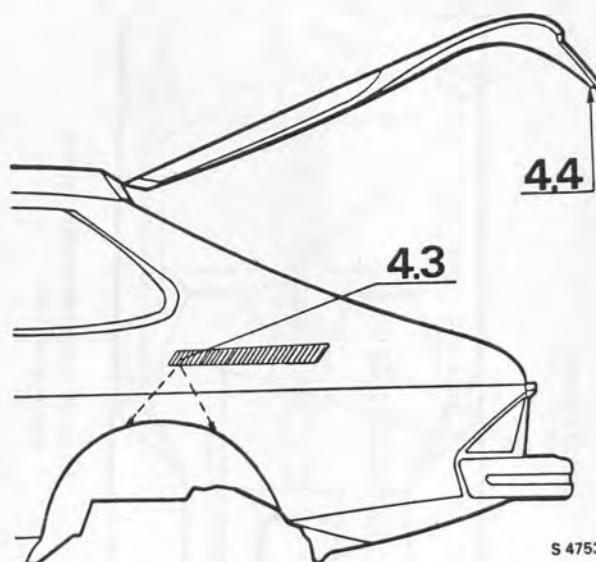
- 2.3. Rear wheel housing bracket.
Two 20 mm holes are provided.
- 2.4. Doors.
2 and 4-door models are treated through the 20 mm holes in the rear ends.
- 2.5. 4-door models only: The cavity in the lower rear pillar is treated through the 11 mm hole.
- 2.6. 4-door models only: The cavity up near the door frame between the side panel, outer wheel housing and end panel is treated through the 20 mm dia. hole in the end panel.

Groups 3 and 4 (horizontal reference line)

- 3.1. Hood.
The front part of the front hood frame is treated through the holes provided.
- 3.2. Treat the joint between the outer wheel housing and the front fender and between the front fender and the fender end and the reinforcing piece in the wheel housing panel beneath the bracket for the lower door hinge.
- 3.3. Treat the joint between the front floor and the inner wheel housing back towards the bearing bracket.
Treat the cross member connected to the bearing brackets through the existing holes.
- 4.1. Treat the joint between the outer wheel housing and the outer side panel from the trunk.
- 4.2. Trunk lid.
Treat the lower rib, as well as the other corners, through the holes provided.

Deviations, Saab 99 Combi Coupé

- 4.3. Treat the joint between the outer wheel housing and the outer side panel through the hole for the evacuation box after the latter has been removed.
- 4.4. Treat the trunk lid through the lower hole in the inner panel of the lid.

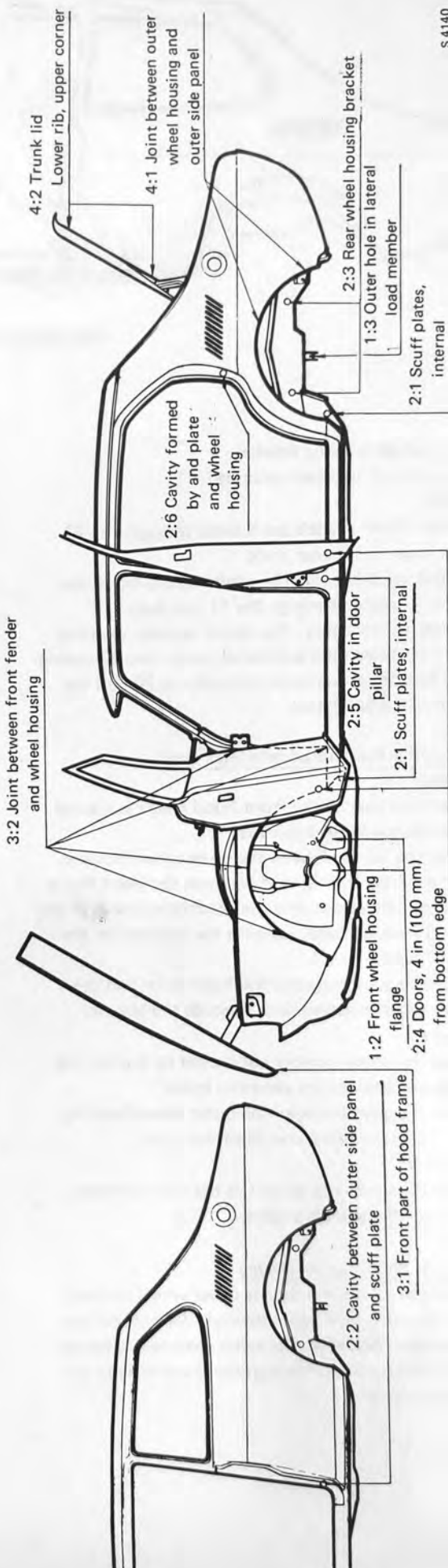
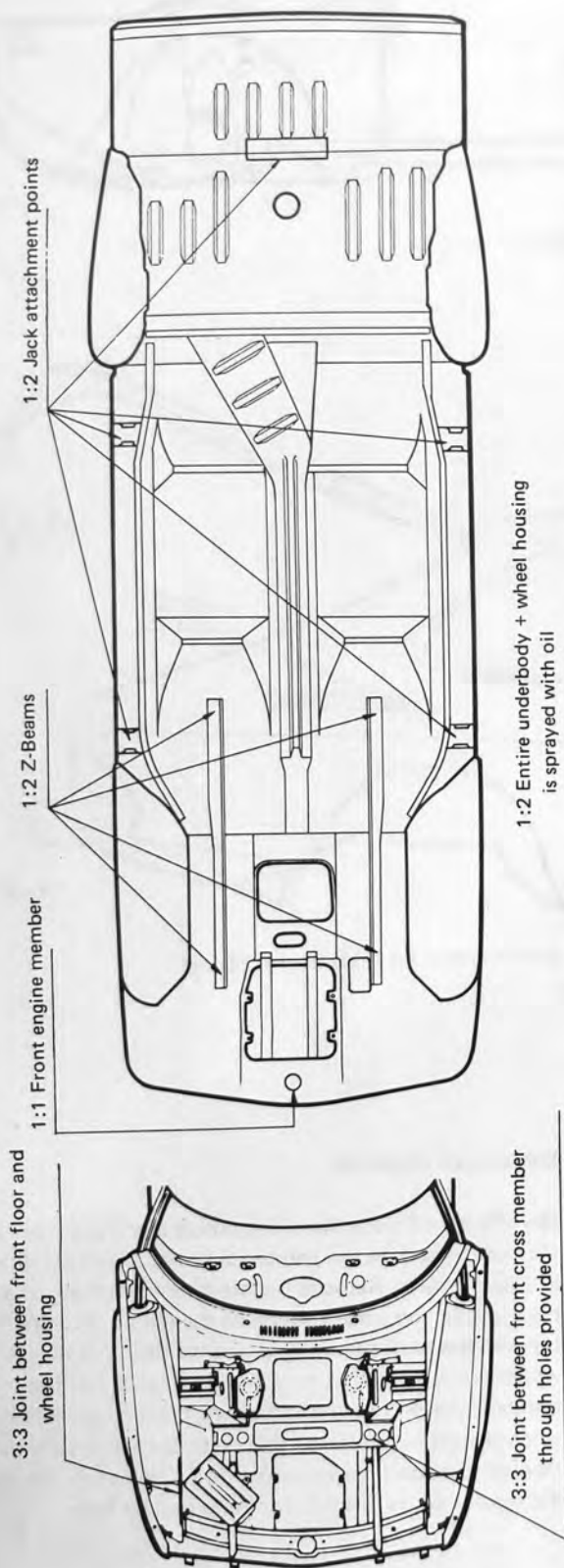


S 4753

DEVIATIONS, SAAB 99 COMBI COUPE

Subsequent treatment

Dry off the oil from the oiling points along the sides of the fenders and on the painted surfaces. Use a rag dipped in paint thinner. Remove the masking from the brake discs and fit the wheels. Remove the seals in the drain holes in the scuff plate members and clean off the oil which has run out. Put back the floor mats and fasten the scuff plates. Note! Oil draining must have ceased when the sealing plugs are removed. Oil which runs out through the scuff plate member drain holes will dissolve the insulation mat in the front and middle floor.



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GENERAL

The car has a liquid-cooled carbureted engine with overhead camshaft and four cylinders in line. Crankcase ventilation is fully enclosed. The carburetor is made by Zenith-Stromberg.

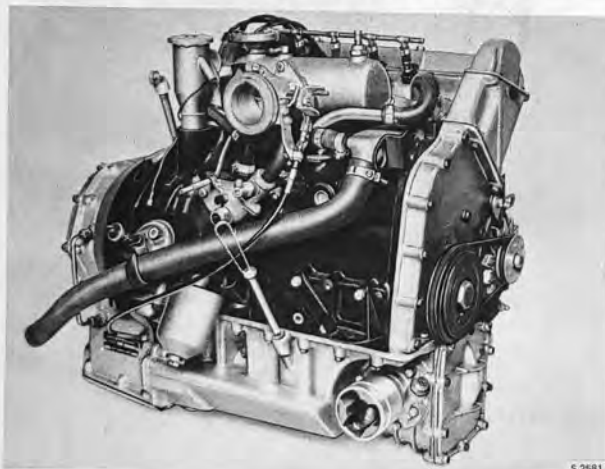
The Saab 99 E, introduced with the 1970 model, is a variant in which the engine is fitted with a Bosch electronic fuel injection system.

The cylinder block is inclined 45° to the right and the cylinder head is of cross-flow type, i.e. with intake ducts on one side and exhaust ducts on the other. The engine is oriented with the clutch to the front of the car.

In 1972 a new Swedish-built 2.0 l engine was introduced as an alternative to the existing 1.7 and 1.85 l engines manufactured in Britain.

Cylinder block

The cylinder block is made of special cast iron, cast in one piece. The cylinder bores, surrounded by cooling jackets, are drilled straight out of the block. The block also contains oil channels for the lubricating system.

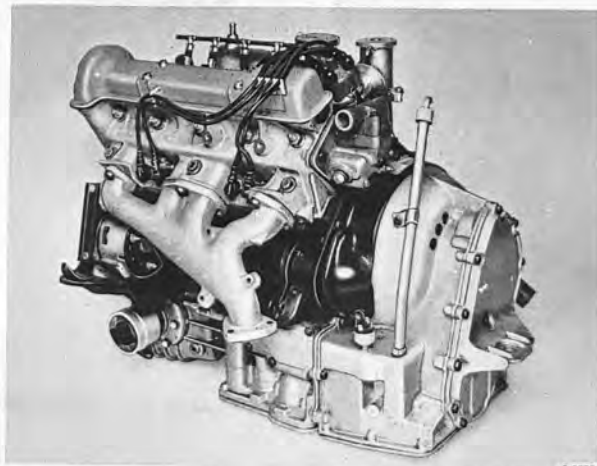


Cylinder head with valves

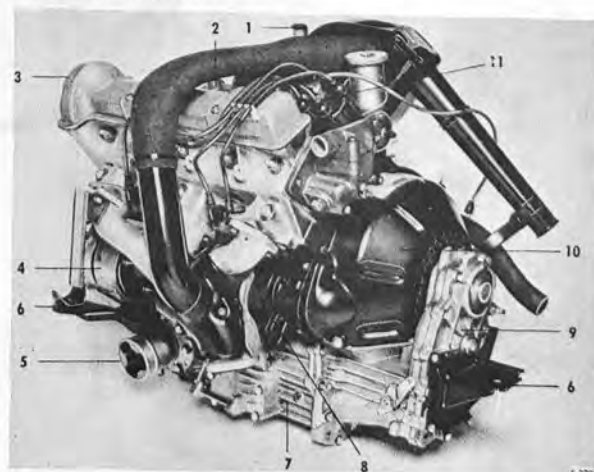
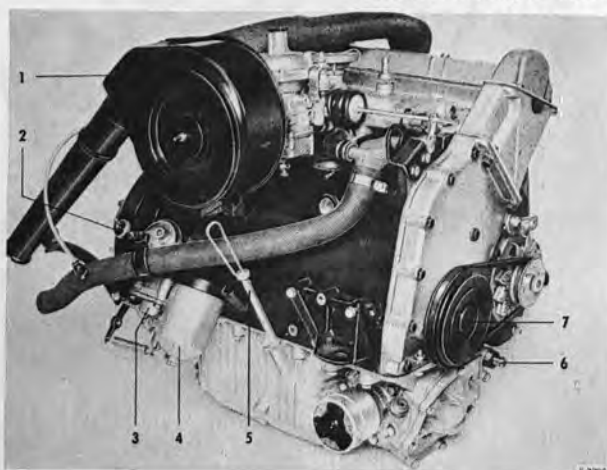
The cylinder head is made of aluminum alloy. On the 1.7 and 1.85 l engines the head is fastened to the block by studs and hexagonal screws. On the 2.0 l engine only hexagonal screws are used. Special quality castings are used for the camshaft. On the 1.7 and 1.85 l engines the camshaft bearings are integral with the cylinder head. On the 2.0 l engine a separate camshaft bridge is employed for camshaft bearings.

Crankshaft and bearings

The crankshaft is forged with ground journals. The 2.0 l engine crankshaft has been case hardened by tenifer treatment which provides a hard non-metallic surface giving good protection against wear. There are five main bearings. The center bearing also acts as an axial locating bearing. The shaft contains drilled passages for lubricating oil. All main bearing shells can be replaced. The crankshaft also drives a separate idler shaft which powers the oil pump, water pump and distributor through cog gears and the fuel pump by a cam.



POWER PLANT, 1.7 AND 1.85 L INJECTION ENGINES



POWER PLANT, 1.7 AND 1.85 L CARBURETED ENGINES

POWER PLANT SEEN FROM LEFT

- | | |
|------------------------|----------------------|
| 1. Air cleaner | 5. Oil dipstick |
| 2. Oil pressure switch | 6. Gear control |
| 3. Oil pump | 7. Crankshaft pulley |
| 4. Oil filter | |

POWER PLANT SEEN FROM RIGHT

- | | |
|--------------------------------|-------------------------|
| 1. Carburetor | 7. Transmission |
| 2. Crankcase ventilation valve | 8. Starter |
| 3. Camshaft cover | 9. Primary gear housing |
| 4. Alternator | 10. Clutch cover |
| 5. Front axle universal joint | 11. Distributor |
| 6. Engine bracket | |

Camshaft and valve depressors

The camshaft is cast and has hardened and phosphatized cams. It is driven by a chain from the crankshaft. The valves are directly actuated by the camshaft cams via valve depressors and adjusting pallets.

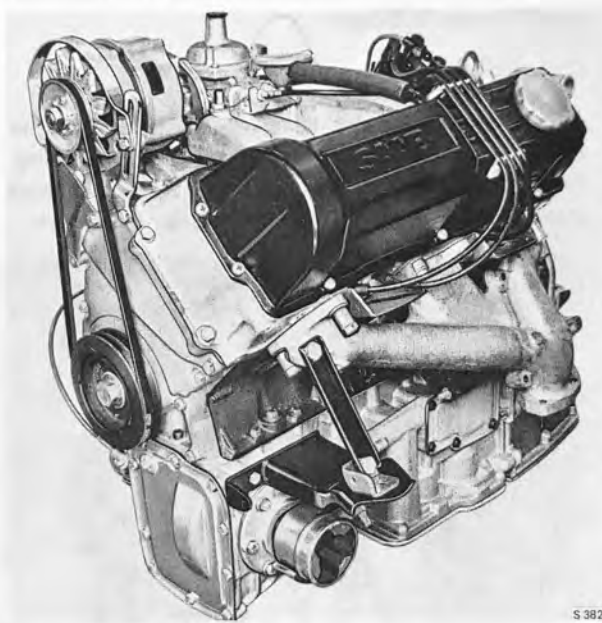
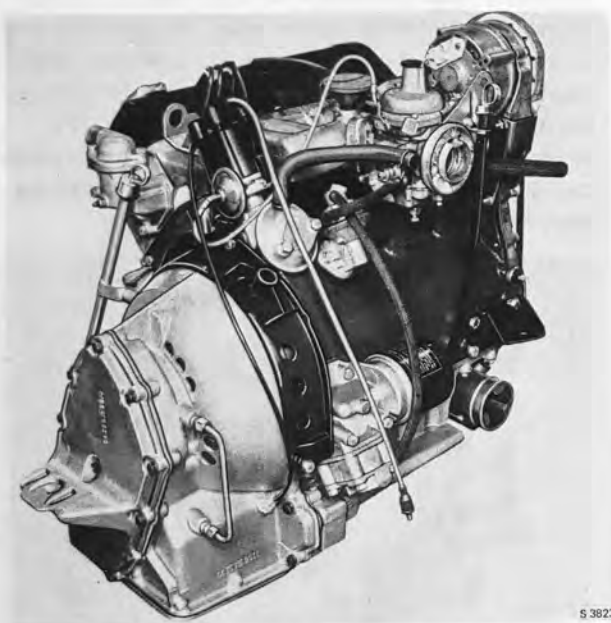
Pistons and piston rings

The pistons are made of light alloy and are provided with grooves for two compression rings and one oil scraper ring. The upper compression ring is flat with a chromed

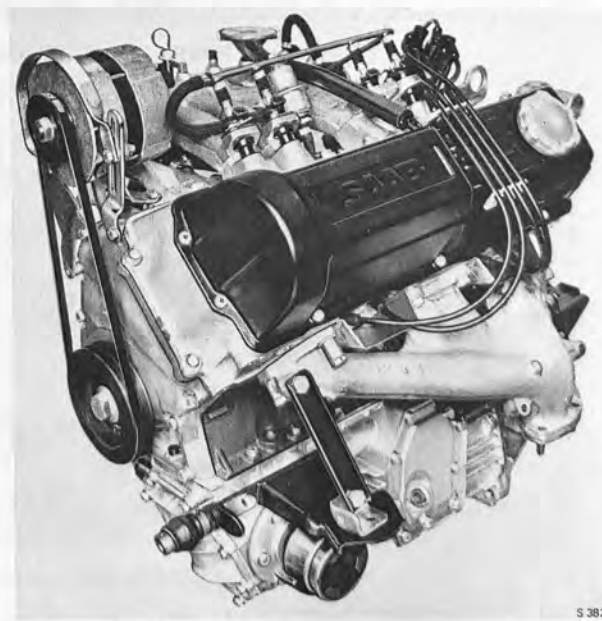
finish. The lower compression ring has oil-scraping characteristics and is somewhat wider than the upper one. The actual oil scraper is a three-piece ring.

Connecting rods and piston pins

The connecting rods are forged and fitted with bushings for journaling the piston pins. The piston pin bushing and big-end bearing halves are exchangeable. The piston pin makes a floating fit in the piston and connecting rod. Its axial movement is restricted by lock rings in the piston pin holes.



POWER PLANT, 2.0 L CARBURETED ENGINE WITH AUTOMATIC TRANSMISSION

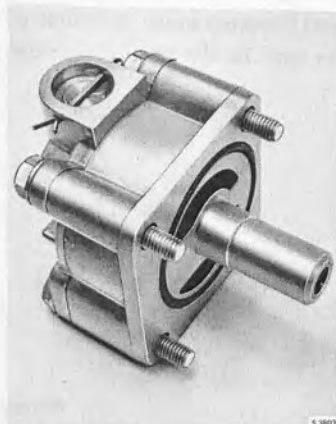


POWER PLANT, 2.0 L INJECTION ENGINE WITH MANUAL TRANSMISSION

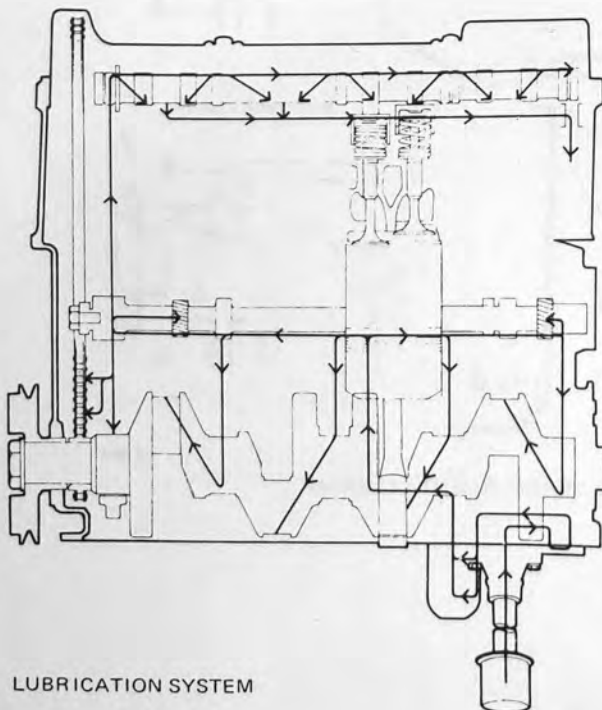
Lubricating system, oil filter

The engine has a forced lubrication system (see fig. below). Oil pressure is generated by a rotary pump driven from the idler shaft. The pump is located on the outside of the cylinder block. Its rotor vanes force the oil through a reducing valve in the pump itself and on through the oil filter and oil channels to the various lubrication points. Each connecting rod bearing has a separate oil channel from the main bearings. The oil filter is of full-flow type, i.e. all oil force-fed to the lubrication points goes through the filter.

The 2.0 l engine is fitted with a birotor pump. This pump has an inner rotor which drives an eccentrically located



OIL PUMP, ROTOR TYPE OIL PUMP, BIROTOR TYPE



Nov. 1972

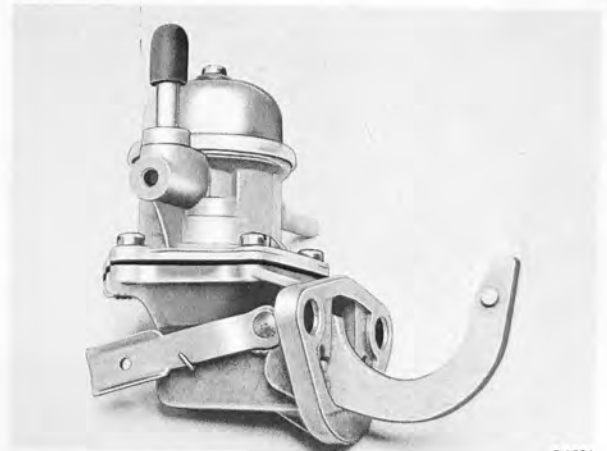
ring wheel. The birotor pump is also used as alternative equipment for 1.7 and 1.85 l engines.

Ignition system

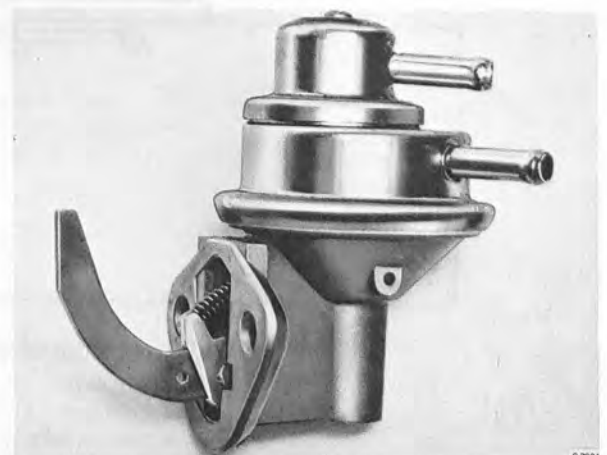
The distributor is driven by a gear transmission from the idler shaft. The rotor arm rotates counterclockwise. The order of firing is 1-3-4-2, cylinder No. 1 being farthest to the rear. Ignition advance in relation to engine speed is regulated by a centrifugal governor and in relation to load by a vacuum regulator.

Fuel system, carbureted engine

The fuel tank is located between the back wheels. The fuel pump, which is of diaphragm type, is driven by a special cam on the idler shaft. The pump is located on the left-hand side of the engine. The fuel passes through a nylon filter in the pump. The earlier pump is provided with an external lever for manual fuel feed.



FUEL PUMP, EARLIER DESIGN



FUEL PUMP, LATER DESIGN

Fuel tank as from ch.No. 99.024.298

As from the above chassis No., the fuel tank is designed so as to allow internal expansion of the fuel. The expansion space is opened by a valve which is actuated by the filler cap.

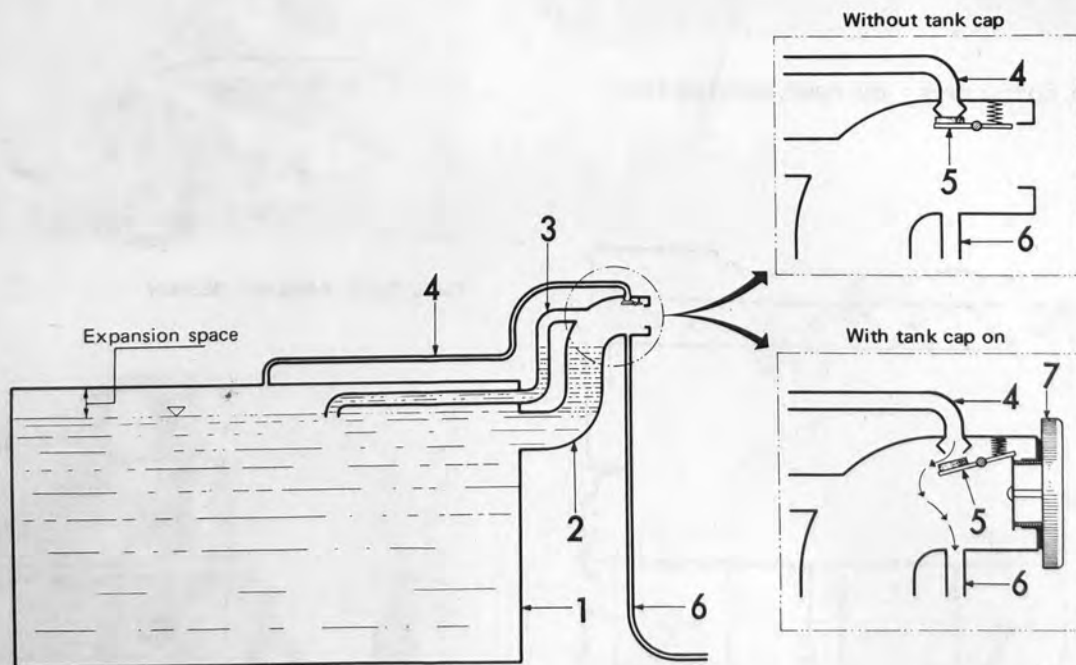
Fuel tank ventilation

When fuel is poured in, the tank (1) will not be completely filled, and instead the level rises only slightly above the lower opening on the venting tube (3). The reason for this is that an air cushion is formed above this level and prevents further filling of the tank.

The formation of this air cushion is due in its turn to the fact that a spring-loaded valve (5) located in the filler pipe (2) blocks the upper opening on the venting tube (4) from the upper side of the tank.

When the tank cap (7) is screwed on, a lever is actuated which opens the valve, thus providing a communication from the upper part of the tank to the surrounding air via the ventilation hose (6).

On cars up to and incl. chassis No. 99732028846, the ventilation hose runs out under the rear bumper. Beginning with chassis No. 99732028847, the hose runs inside the roof channel, through the left windshield pillar and out into the engine compartment behind the left wheel housing. The fuel, which increases in volume when the temperature rises, is now able to expand inside the tank instead of being pressed up through the filler pipe (2). As the fuel level becomes lower in course of driving, air is drawn into the tank via the ventilation hose (6).



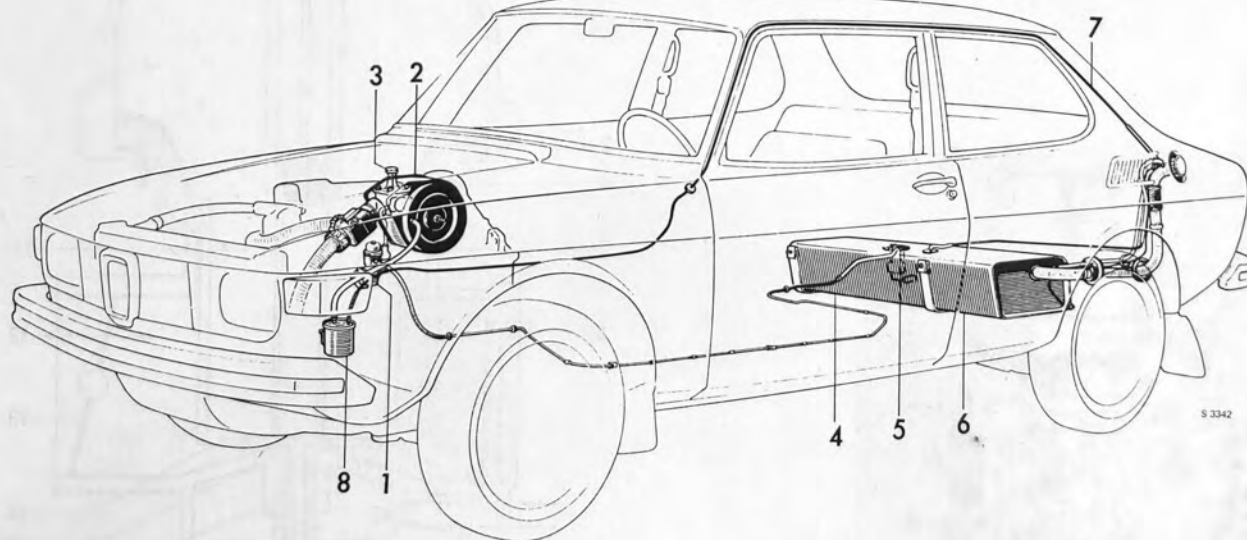
FUEL TANK VENTILATION, ARRANGEMENT DIAGRAM

1. Fuel tank
2. Filler pipe
3. Venting tube
4. Venting tube
5. Spring-loaded valve
6. Ventilation hose
7. Tank cap

S 2951

Evaporative loss control unit USA cars as from model 1971

As from model 1971, cars for USA-market are fitted with a charcoal filter, which absorbs the vapor from the fuel tank. The charcoal canister is placed in the engine compartment. It is connected to the vent hose of the fuel tank and with a hose to the air cleaner. When the engine is running, fresh air is sucked through the charcoal filter and further to the carburetor. The filter will then be cleaned from petrol.

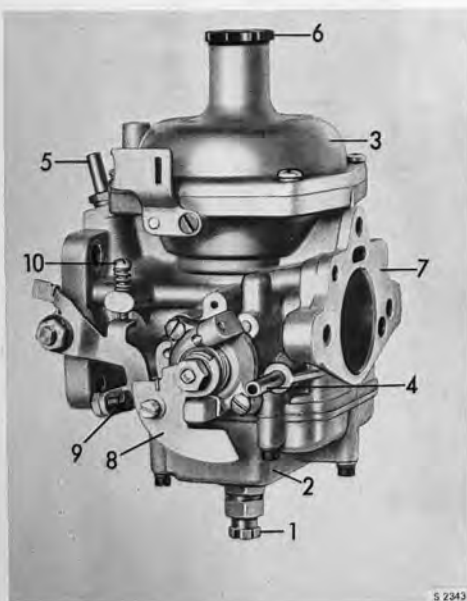


FUEL SYSTEM, CARBURETED ENGINE

1. Fuel pump
2. Air cleaner
3. Carburetor
4. Fuel tank
5. Fuel level transmitter
6. Drain plug
7. Vapor hose
8. Charcoal canister

Carburetor

The engine is fitted with a Zenith-Stromberg cross-flow carburetor with the type designation 175 CD-2S. It has only one jet, the cross-section area of fuel flow being regulated by a moving tapered needle. The position of the needle is determined by the negative pressurization of the carburetor housing, which acts upon a piston in which the needle is mounted. The needle is of self-centering type, i.e. it is suspended in springs; this makes it unnecessary to adjust the alignment of the carburetor jet. The carburetor is made of light metal. It consists of three main sections, the central one being the carburetor housing. The bottom section is the float chamber, which surrounds the jet. The jet is vertically adjustable. The top section is the vacuum chamber, the lower boundary of which is a diaphragm in which the piston is suspended. The vacuum chamber communicates with the carburetor inlet duct via two channels in the piston. The vacuum in the carburetor housing determines the rate of fuel flow, which is controlled by the needle, as well as the rate of air flow, which is regulated by the position of the piston in the air duct. In this way the engine always receives correctly adjusted quantities of fuel and air under all load conditions.



CARBURETOR

1. Jet adjusting screw
2. Float chamber
3. Cover for vacuum chamber
4. Fuel inlet
5. Vacuum nipple
6. Cap for oil damper
7. Carburetor body
8. Fast idle cam
9. Fast idle screw
10. Throttle screw

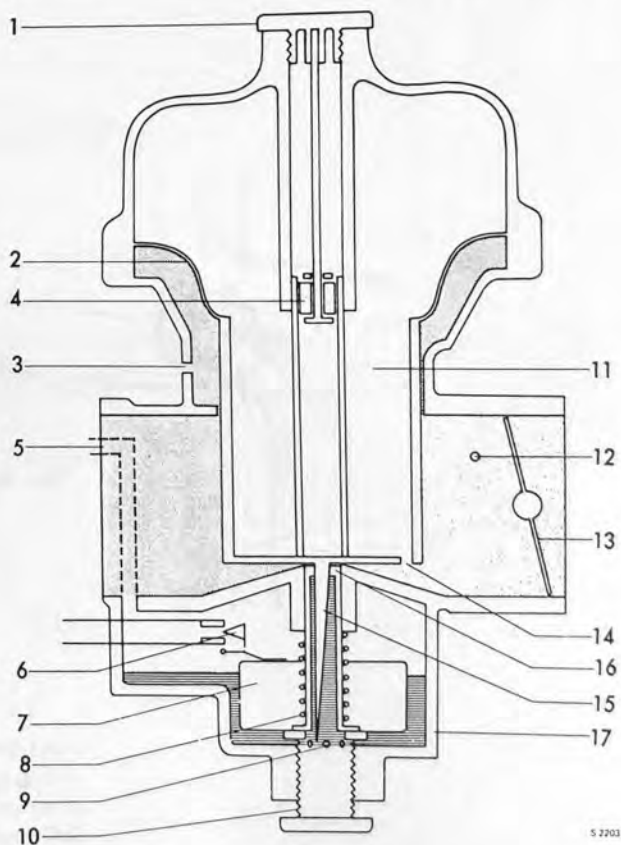
Float system

Fuel enters the float chamber through the float valve. The float, which is double, is located by a bridge on the underside of the carburetor housing. As the fuel level rises, the float rises with it, and when the correct level is reached, the float valve is closed by a tongue on the float arm. The fuel passes through four holes in the jet retainer and four holes in the top of the adjusting screw to the interior of the jet where it assumes the same level as in the float chamber. The seals between adjusting screw and jet retainer, between jet retainer and float chamber and between jet and guide are provided by O-rings.

Choke and fast idling

The carburetor is equipped with a choke device for easier starting of cold engine.

The choke consists of a valve disc which, when the choke spindle is rotated, opens four fuel holes of different sizes in succession as well as opening an emulsion air duct and freeing the choke fuel mixture duct to the carburetor head. When the choke button is pulled right out, all four fuel holes are in operation and the emulsion air duct is wide



CARBURETOR WITH THROTTLE CLOSED

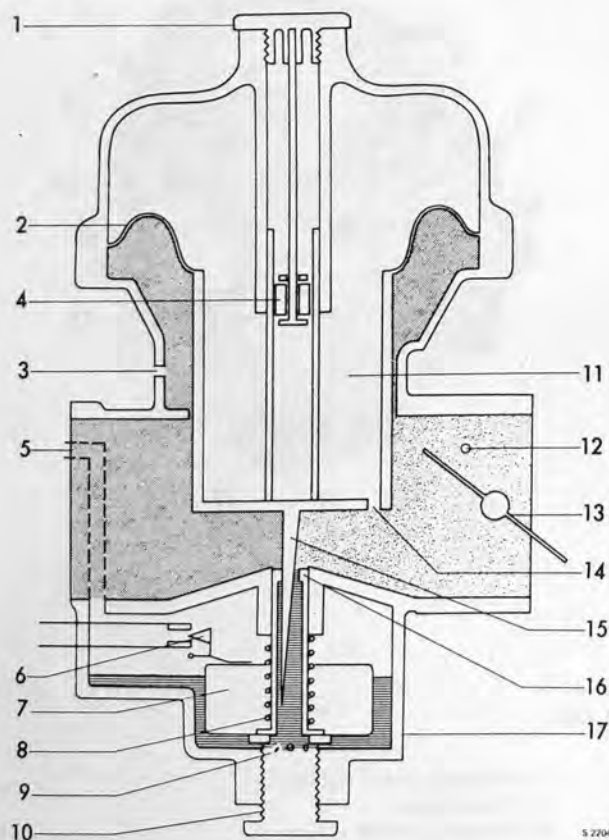
- | | |
|------------------------------|------------------------|
| 1. Damper cap | 10. Adjusting screw |
| 2. Diaphragm | 11. Vacuum piston |
| 3. Compensating hole | 12. Starting fuel hole |
| 4. Oil damper | 13. Throttle |
| 5. Float chamber ventilation | 14. Vacuum hole |
| 6. Float valve | 15. Fuel needle |
| 7. Float | 16. Jet |
| 8. Spring | 17. Float chamber |
| 9. Fuel holes | |

open. At intermediate choke positions one or more of the fuel holes are closed, but the emulsion air duct remains open as long as any of the fuel holes is open. When the choke button is pushed right home, this closes both fuel and emulsion air ducts as well as the starting fuel hole in the carburetor housing.

Emulsion air is drawn in through a jet from the carburetor housing. Its function is to improve the distribution of the choke fuel mixture among the cylinders. The choke spindle carries a cam to which the pull wire of the choke control is attached. When the car is driven on the choke, this cam acts upon the throttle control to raise the engine idling speed during starting and warmup.

Idling

The carburetor has no special idling system. When the engine is idling, the negative pressurization in the vacuum chamber of the carburetor is low, with the result that the gap between the vacuum piston and bridge is small. Most of the jet is therefore blocked by the thick end of the fuel needle and only a small quantity of fuel, corresponding to the idling demand, is drawn into the engine. The ratio of fuel to air is regulated at idling speed with the adjusting screw, and this setting remains correct for the full range of engine speeds.



CARBURETOR WITH THROTTLE OPEN

- | | |
|------------------------------|------------------------|
| 1. Damper cap | 10. Adjusting screw |
| 2. Diaphragm | 11. Vacuum piston |
| 3. Compensating hole | 12. Starting fuel hole |
| 4. Oil damper | 13. Throttle |
| 5. Float chamber ventilation | 14. Vacuum hole |
| 6. Float valve | 15. Fuel needle |
| 7. Float | 16. Jet |
| 8. Spring | 17. Float chamber |
| 9. Fuel holes | |

Normal driving

When the throttle is opened, a vacuum is generated in the vacuum chamber which is equal to that in the inlet manifold due to equalization via the holes in the piston. As atmospheric pressure prevails on the underside of the diaphragm, the piston is pulled up and the airflow through the carburetor is increased. At the same time the fuel flow also increases as the tapered needle, which is attached to the piston, is withdrawn from the jet.

Acceleration

In order to produce a temporarily richer fuel mixture on rapid opening of the throttle (acceleration), a damping device is provided in the spindle of the vacuum piston. This consists of a small piston called the oil damper mounted on a rod. The damper runs in oil. When the throttle is opened quickly, the negative pressurization in the vacuum chamber is abruptly increased. When the vacuum piston is raised, the oil damper is pressed against its seating and prevents oil from flowing past from below the damper to above it; this brakes the movement of the vacuum piston, temporarily generating a harder vacuum above the jet and momentarily enriching the fuel-air mixture.

The downward movement of the vacuum piston is assisted by a spring. The oil level in the hollow spindle of the vacuum piston, should be so high that the oil damper dips into oil before the thread of the screw cap engages the vacuum chamber cover. When filling, top up the hollow spindle with oil to its rim. **NOTE!** Do not fill the space above the spindle. Use the same oil as in the engine, i.e. SAE 10 W 40 or 10 W 30, or if the outdoor temperature is constantly below -4°F (-20°C), SAE 5 W 20.

Overrun braking, 2.0 l engine

The 2.0 l engine has been fitted with an overflow valve to achieve satisfactory combustion on the overrun. This type of overflow valve has previously been fitted to USA export models.

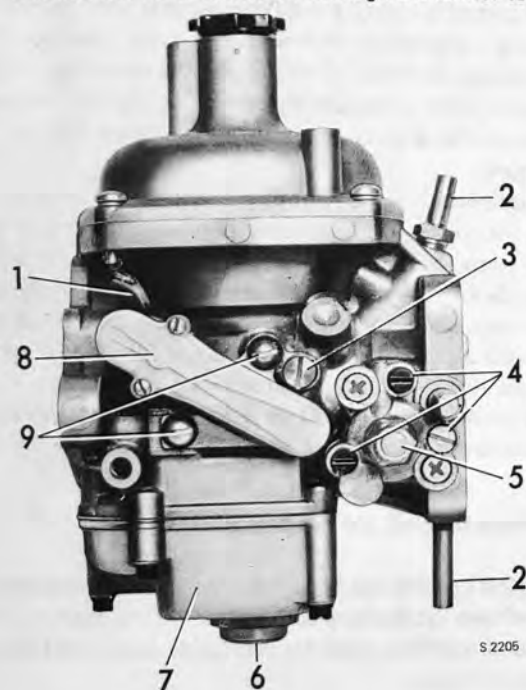
Fuel system, injection engine

The engine is equipped with a Bosch electronic fuel injection system. An electric fuel pump and a pressure regulator deliver fuel at constant pressure. The injection valves supply the four cylinders with an adjusted quantity of fuel. The fuel is injected into the inlet manifold just in front of the inlet valves and the fuel feed is depending of how long time the injection valves are open. This is controlled by an electronic unit and varies according to the load, speed and temperature of the engine. See also Section 234.

Carburetor, USA export model, 1.7 and 1.85 l engines

The engine is equipped with a Zenith-Stromberg cross-flow carburetor with the type designation 175 CD-2SE. This carburetor differs from the 175 CD-2S type in the following respects:

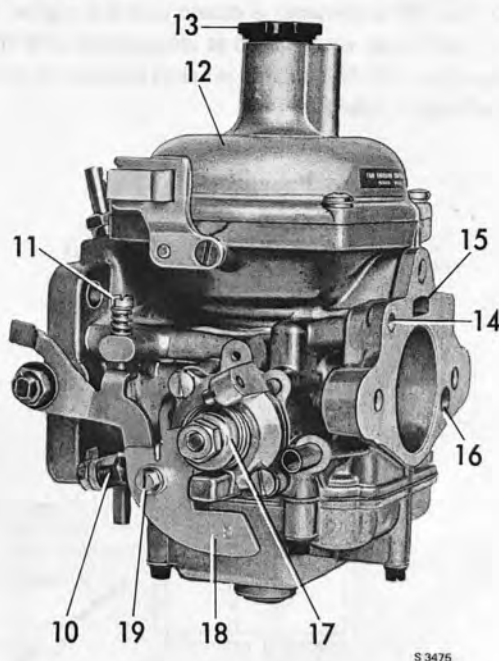
- a. It is fitted with a jet pressed into the housing, which means that the jet is not adjustable. The carburetor has a temperature compensator (8) consisting of an air valve regulated by a bimetal spring which keeps the fuel-air mixture constant regardless of the temperature in the engine compartment. The valve begins to open when the temperature of the carburetor reaches about +50°F (+10°C), admitting supplementary air through a channel that issues ahead of the piston.
- b. The carburetor is also equipped with an overflow valve (5) consisting of a spring-loaded diaphragm valve mounted in a housing with a cap and adjusting screw. The negative pressure inside the accelerator throttle can be transmitted through a channel to the



- c. There is also an air screw (3) for fine tuning of the idling speed.
- d. Finally, this carburetor has two vacuum nipples (2) communicating with the distributor. The upper one regulates the ignition rise during driving at low engine load with the engine running above idling speed, while the lower one cuts in and lowers the ignition when the throttle is in the idling position.

Carburetor, USA export model, 2.0 l engine

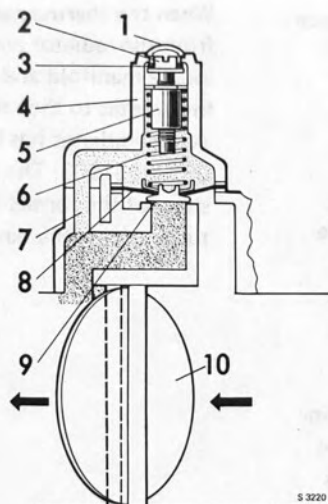
The engine is equipped with the same carburetor as the 2.0 l engine standard design. However, there is no temperature compensator.



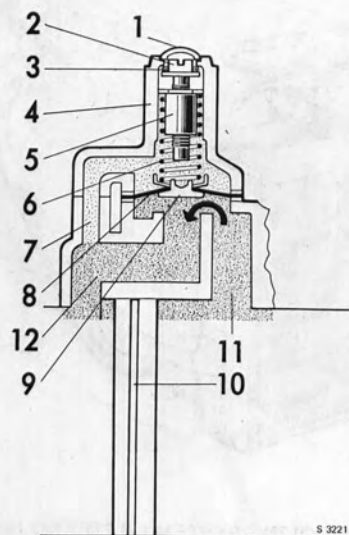
CARBURETOR, USA

1. Sealing
2. Vacuum nipple
3. Air screw
4. Screws for removal, overflow valve
5. Overflow valve
6. Float chamber plug
7. Float chamber
8. Temperature compensator (only on 1.7 and 1.85 l engines)
9. Screws for removal, temperature compensator

10. Adjusting screw, fast idling
11. Idling screw
12. Vacuum chamber cover
13. Damper cap
14. Air channel, float chamber ventilation
15. Channel, air to space under diaphragm
16. Channel, air to temperature compensator
17. Choke
18. Fast idling cam
19. Connection, choke control wire



OVERFLOW VALVE, NORMAL DRIVING



OVERFLOW VALVE, OVERRUN BRAKING

- | | |
|--------------------------------|---|
| 1. Cap washer | 8. Diaphragm |
| 2. Adjusting screw | 9. Valve |
| 3. Rubber ring | 10. Throttle |
| 4. Cover | 11. Inlet channel for fuel-air mixture |
| 5. Nut | 12. Outlet channel for fuel-air mixture |
| 6. Spring | |
| 7. Channel to top of diaphragm | |

Air cleaner

The air cleaner is mounted on the carburetor on the left-hand side of the engine. It serves both to clean the intake air and to muffle the intake noise. The filter insert, which is made of a special grade of paper, must not be washed or wetted. The only permitted form of servicing is cleaning the air filter by tapping it lightly.

The air cleaner is equipped with a valve with two settings. In the "Summer" setting the air is drawn in direct from outside, while in the "Winter" setting the air passes between the covers surrounding the exhaust pipe and thence through a hose to the air cleaner.

Exhaust system

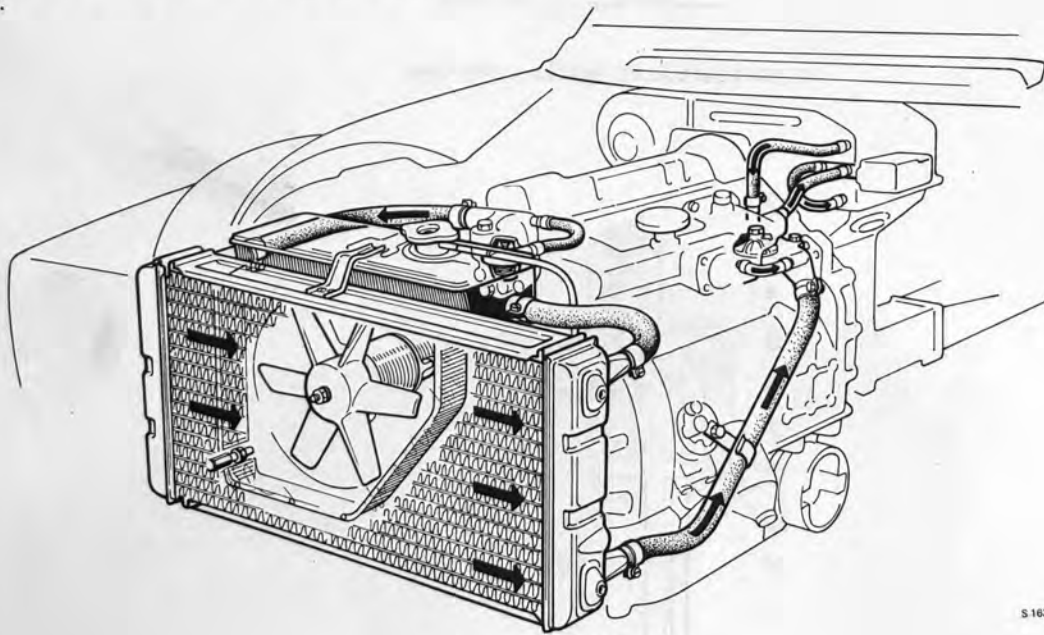
The exhaust system consists of front and rear mufflers, middle pipe and rear pipe. The middle pipe connects the two mufflers and is covered on its upper side by a heat guard bolted to the body floor. The front muffler is attached to the engine exhaust manifold. The rest of the system is suspended from the body floor by rubber mountings.

A new exhaust system was introduced in 1972. This consists of two major components: a front pipe attached to the exhaust manifold and a rear section which includes two mufflers.

Cooling system

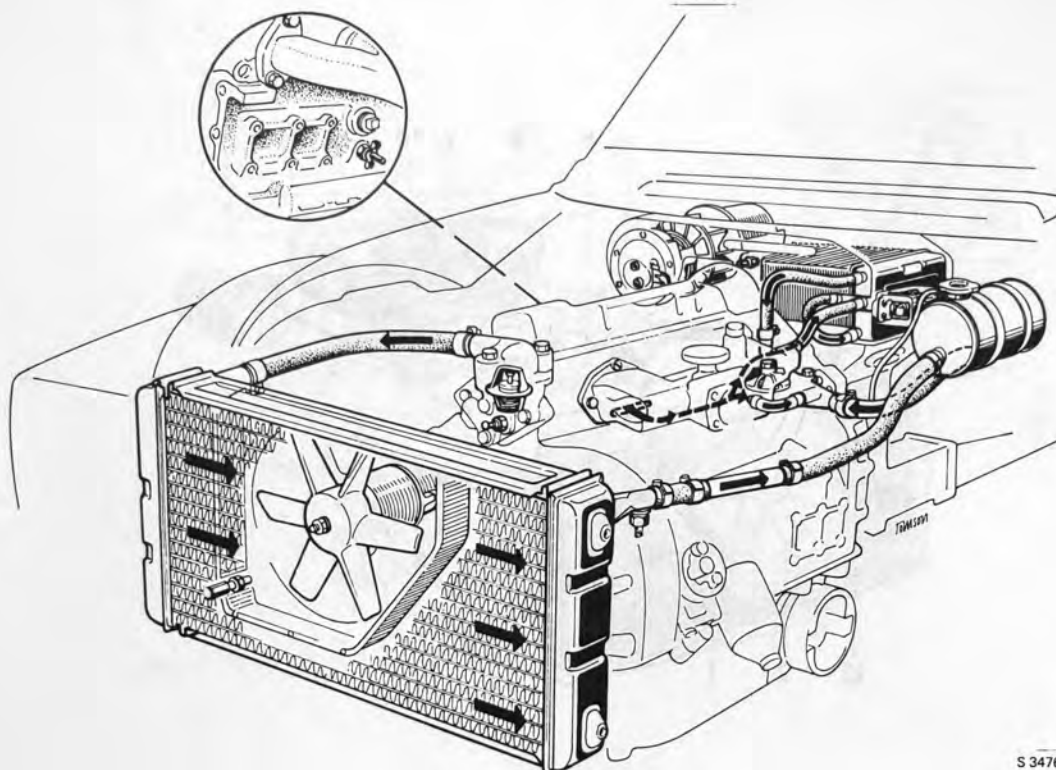
The cooling system is of pressurized type with a cross-flow radiator and expansion tank. The water pump is located in the engine block and is powered by a bevel gear from the idler shaft. The thermostat is located in a housing bolted to the front end of the cylinder head. The radiator fan is electrically driven and controlled by a thermostat. When the pump is working and the thermostat is closed, coolant circulates through the cylinder block, cylinder head, inlet manifold and heater core. When the thermostat is open, the pump draws coolant from the radiator and forces it through the cylinder block, intake manifold and heater core back through the open thermostat to the radiator inlet.

A new radiator has been installed on cars from chassis No. 99732031903. The cell package has two rows of cells instead of the former three. But each row contains more tubes, giving the new radiator greater cooling capacity.



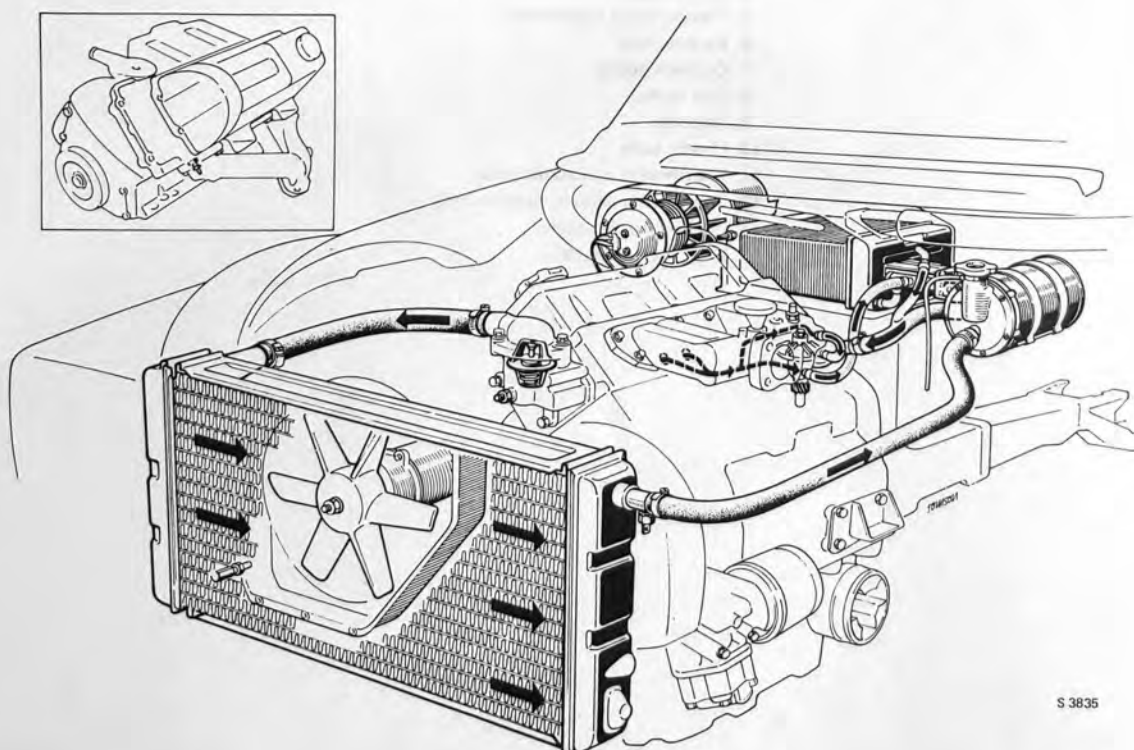
S 1638

CIRCULATION IN THE COOLING SYSTEM UP TO AND INCL. MODEL 1970



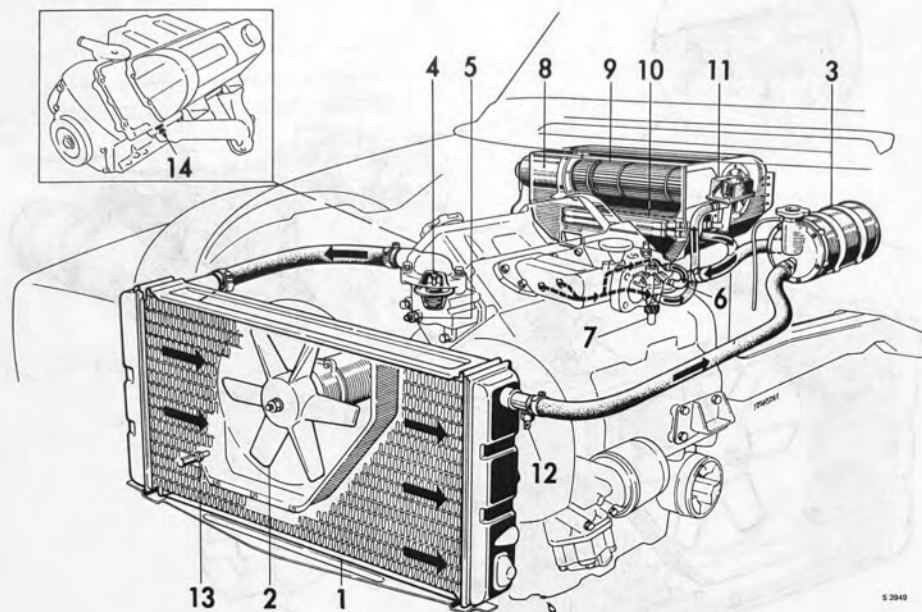
S 3476

CIRCULATION IN THE COOLING SYSTEM, 1.7 AND 1.85 L ENGINES, MODEL 1971-1972



S 3835

CIRCULATION IN THE COOLING SYSTEM, 2.0 L ENGINE, MODEL 1973



CIRCULATION IN THE COOLING SYSTEM, 2.0 L ENGINE, MODEL 1974

1. Radiator
2. Radiator fan
3. Expansion tank with pressure cap
4. Thermostat
5. Temperature transmitter
6. By-pass line
7. Coolant pump
8. Fan motor
9. Impeller
10. Heater core
11. Thermostat controlled valve
12. Thermostat switch, radiator fan
13. Radiator drain cock
14. Engine drain cock

Crankcase ventilation

1.7 and 1.85 l engines

2.0 l carburetor engines

2.0 l fuel injection engines up to and incl. model 1973

The engine has a fully enclosed crankcase ventilation system. The air is drawn in through the air cleaner and its filter insert and (on the 1.7 and 1.85 l engines) enters the oil filler tube via a flame guard and a hose. 2.0 l engines have a special connection housing with built-in flame guard through which air passes into the engine block. The air flows from the crankcase up into the valve cover, through oil traps and out through a hose to the Smith valve, which regulates the vacuum in the crankcase. The air then flows from the Smith valve to the inlet manifold.

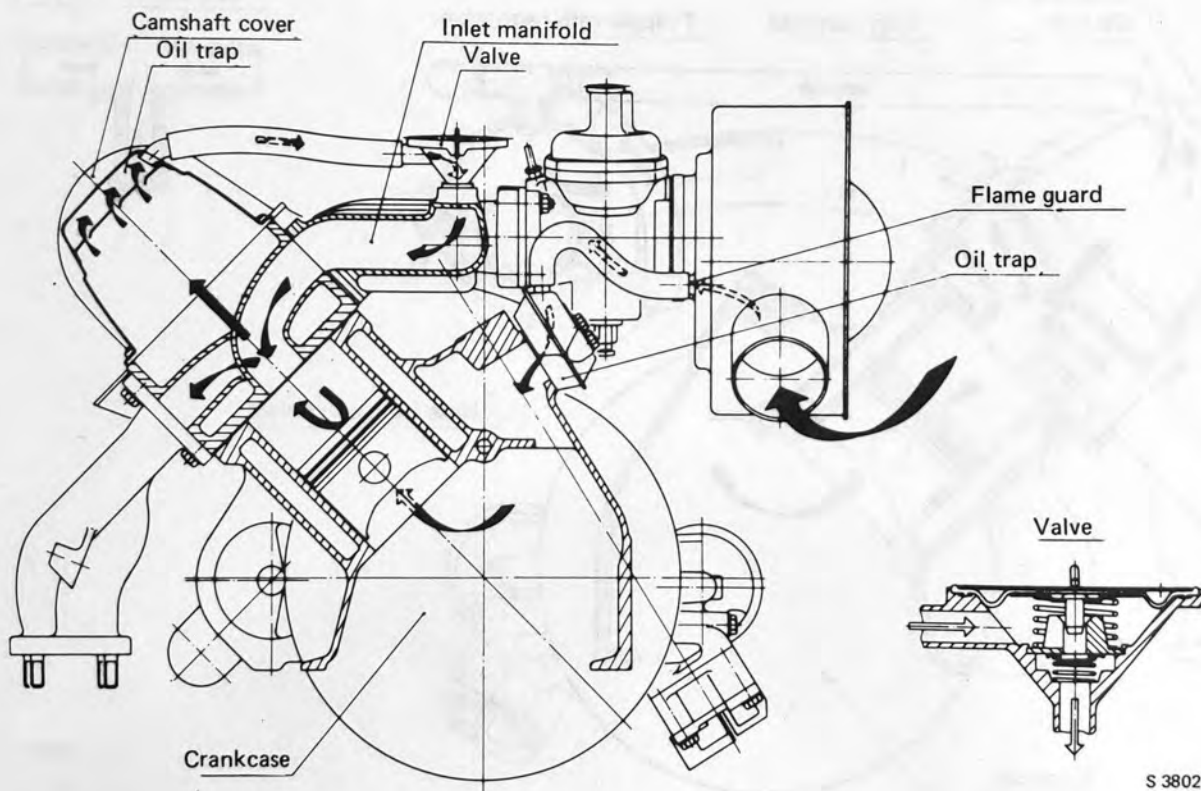


DIAGRAM OF CRANKCASE VENTILATION, 2.0 L ENGINE
CARBURETOR ENGINES AND INJECTION ENGINES UP TO AND INCL. MODEL 1973

2.0 l fuel injection engines, model 1974

The pressure in the crankcase is regulated via a T nipple connected to the inlet manifold. A hose from the valve cover and a hose from the air cleaner lead to this nipple. The T nipple contains an orifice plate with a 3.2 mm bore to give the crankcase the proper vacuum. When the crankcase pressure is too high, the air flow goes from the valve cover via a T nipple to the inlet manifold. When the crankcase pressure is too low, air is drawn from the air cleaner via the T nipple and into the inlet manifold.

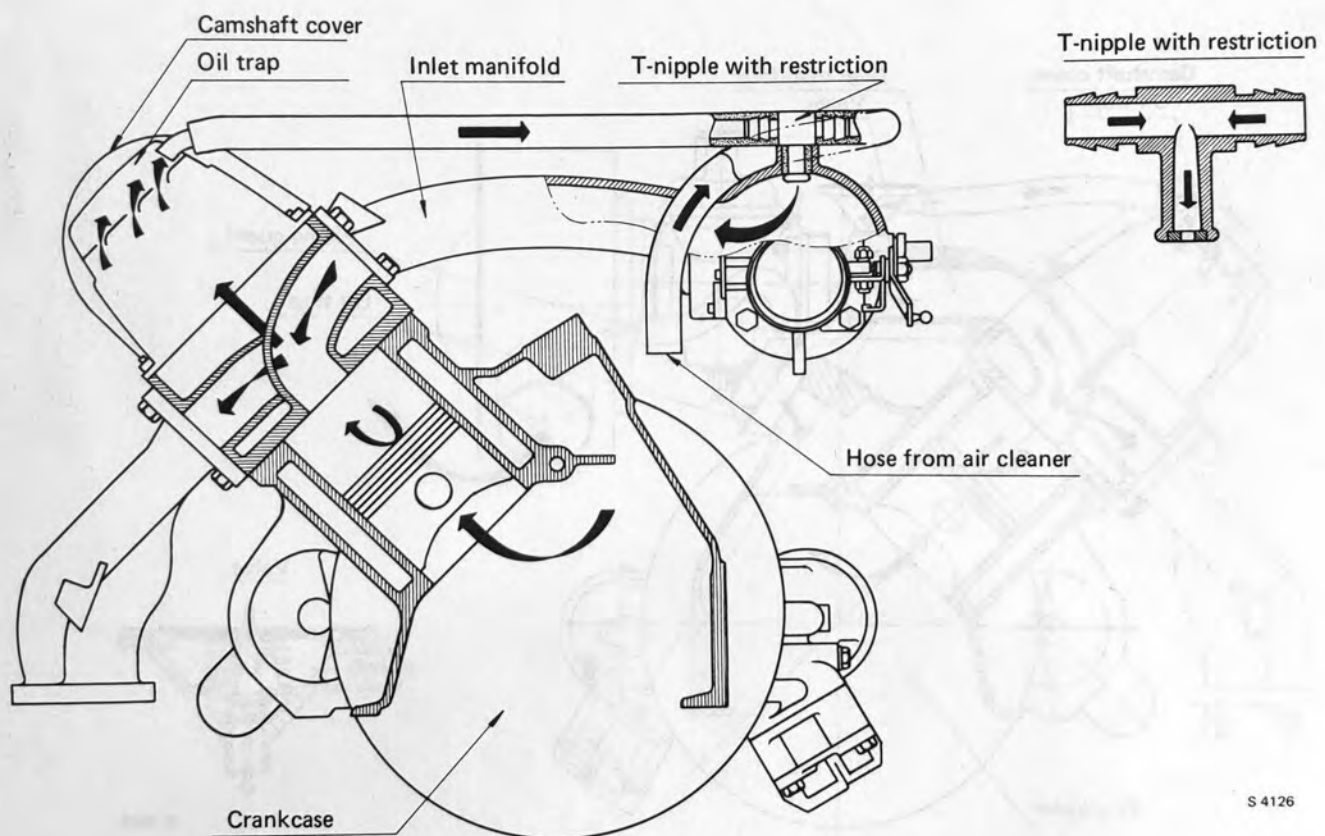


DIAGRAM OF CRANKCASE VENTILATION, 2.0 L INJECTION ENGINES MODEL 1974

REMOVAL AND INSTALLATION

1,7 and 1,85 l engines

Removing the power plant

For major work on the engine and transmission, the entire power plant should be lifted out. Removal of the engine by itself is not possible.

1. Remove the hood as follows:
Back off both the hood fastening screws. Lift off the hood. For this you need a helper to hold one side of the hood and help to lift it clear (see illustration).



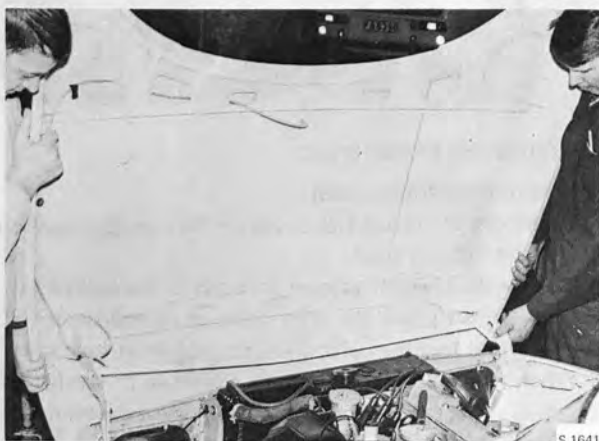
RADIATOR DRAIN COCK K RAN



UNDOING HOOD FASTENING SCREWS



ENGINE BLOCK DRAIN COCK



LIFTING OFF THE HOOD



HEATER CORE BLEEDER COCK, UP TO AND INCL. MODEL 1973

2. Detach the battery cables. Unclamp and lift out the battery.
3. Drain off coolant through the radiator and engine block drain cocks; open the bleeder cock on the heater core (up to and incl. model 1973).
4. Carbureted engine:
Detach the vacuum hose of the power assist cylinder from the inlet manifold and pull the fuel hose off the suction side of the fuel pump.
4. Injection engine:
 - a. Detach the vacuum hoses of the power assist cylinder and the pressure sensor from the inlet manifold.
 - b. Detach the fuel hoses from the tubes at inlet resp. outlet of the injection valves.

5. Carbureted engine:
Undo the cable connections to the ignition coil, serial resistance, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, headlights and headlight wipers.
5. Injection engine:
 - a. Undo the cable connections to the ignition coil, serial resistance, temperature transmitter, radiator fan, thermostat contact, headlights, contact on automatic transmission and headlight wiper motor.
 - b. Undo the connections for the fuel injection of distributor, injection valves, air cleaner, throttle valve switch and at the temperature sensor and temperature switch below the inlet manifold.

CAUTION

Do not detach the connections by pulling the cables. Grip the connecting pieces.

6. Carbureted engine:
 - a. Remove the air cleaner and preheater complete with hose and the ignition cable. As from model 1972: Remove the preheater hose, air cleaner with valve housing and cold air hose. NOTE! Save the spacer sleeves under the outer preheater casing.
 - b. Detach the throttle control linkage from the throttle shaft and remove the return spring. As from model 1972: Detach the throttle control wire from driver and bracket.
 - c. Detach the choke control wire and sheath from the carburetor.
6. Injection engine:
 - a. Remove air cleaner complete with hoses.
 - b. Undo the throttle control shaft from the driver on the throttle house. As from model 1972: Detach the throttle control wire from driver and bracket.



AIR CLEANER WITH HOSES, CARBURETED ENGINE
MODEL 1972

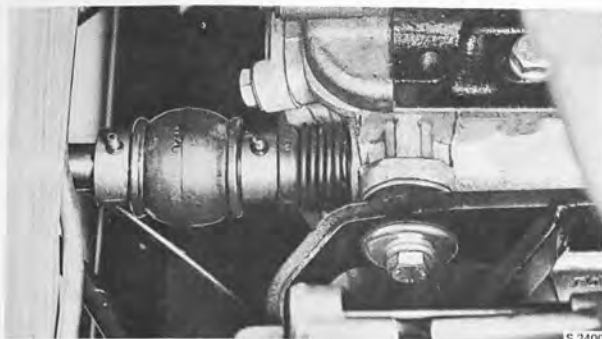
1. Air cleaner
2. Valve housing
3. Cold air hose
4. Preheater hose

7. Carbureted engine:
Undo the hose clamps at the connections to the thermostat housing, radiator, inlet manifold and water pump.
7. Injection engine:
Detach the hoses at the connections to the thermostat housing and to the radiator and both the hoses to the heater.
8.
 - a. Remove the four fastening screws from the front sheet.
 - b. Remove the self-tapping screws holding the headlight trim frames.
 - c. Remove the four lower self-tapping screws securing the headlights to the edge of the bodywork. As from model 1972: Remove the headlights from body and front sheet.
 - d. Remove the hood lock operating cable from its fastenings at the dash panel and wheel housing.
 - e. Remove the front sheet, lifting forward and upward.
9. Manual transmission:
Remove the slave cylinder and hang it up in some convenient place.



REMOVING THE FRONT SHEET

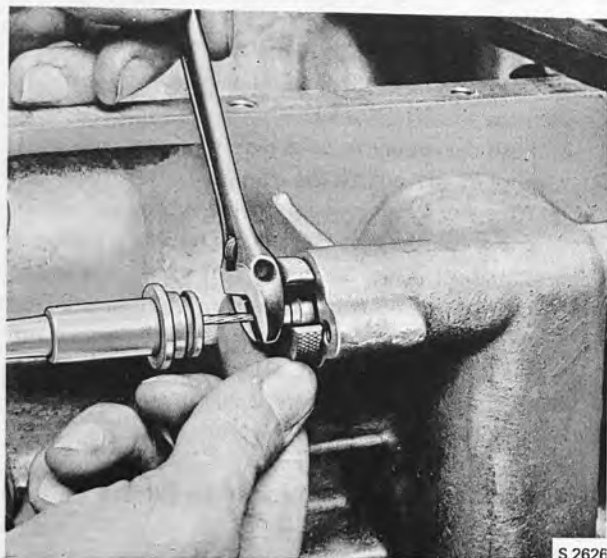
9. Automatic transmission:
Remove the protective cover on the exhaust manifold at the exhaust pipe.
10. Move the free wheel lever forward to the locked position. Release the wire clamp at the transmission and free the cable from the holder at the right-hand differential bearing seat. (Manual transmission)
11. Disconnect the exhaust pipe from the exhaust manifold.
12. Detach the ground cable from the transmission.
13. Jack up the front end of the car and place blocks under the body.
14. Manual transmission:
 - a. Put the gear lever in neutral.
 - b. Knock out the front taper pin from the gear shift rod joint. (In 1970 and later models, the rubber bellows must also be pulled free of the groove on the gear selector rod.) Separate the gear selector rod joint from the gear selector rod.



GEAR SHIFT ROD JOINT TAPER PIN

14. Automatic transmission:

Remove the screw for the gear selector wire at the transmission. Move the gear selector lever to position "1" and pull out the sheath from the transmission. Fit tool 879038 on the wire, turn the tool a little and pull out the wire.



REMOVING THE GEAR SELECTOR WIRE

15. Detach the speedometer cable from the transmission.
16. Undo the engine brackets.
17. Undo the larger clips round the rubber bellows on the inner universal joints. (In 1968-69 models the T-pieces of the drive shafts must be rotated to the horizontal position.)
18. Engage the lifting yoke (tool 839097) in the two engine lifting lugs.



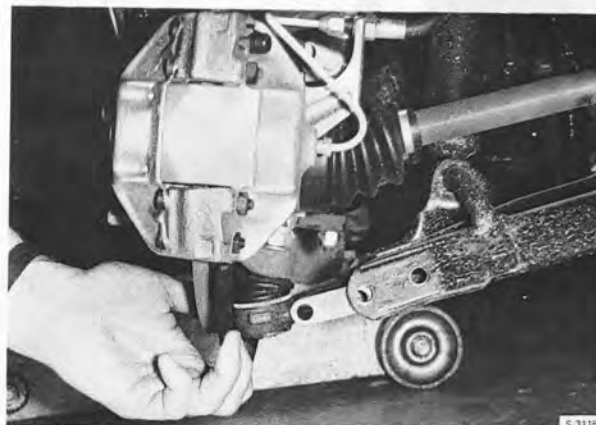
LIFTING YOKE
Tool No. 839097

19. 1968-1969 models:

Raise the power plant about 2" (50 mm) and separate the inner universal joints, first the left and then the right, with the power plant displaced as far as possible towards the opposite side. Make sure that the needle bearings do not come apart.

1970 and later models:

Undo the lower end piece from the control arm on the right-hand side. Turn the steering wheel to the left and withdraw the universal joint. Raise the power plant slightly and withdraw the left universal joint.



UNDOING LOWER END PIECE FROM CONTROL ARM

20. Raise the power plant to a suitable height for access to the cable connections to the starter and alternator, and disconnect the cables.
21. Hoist out the power plant. Fit protective caps over the inner drivers and rubber bellows.



REMOVING THE INNER UNIVERSAL JOINT

Installing the power plant

1. a. Check that the inner universal joints are packed with grease.
b. As from ch.No. 99.033.917:
Check the front engine cushion. Make sure that the washer is properly tightened.
bild.



FRONT ENGINE CUSHION

2. Hoist the power plant with the lifting yoke (tool No. 839097) and lower it into the engine compartment.

CAUTION

Take care when installing the power plant to avoid damaging the fuel line hose joint at the dash panel. After installing, check that there is at least 0.4" (10 mm) clearance between the alternator belt pulley and the hose.

3. Lower the power plant to a convenient working height and connect the cables to the starter and alternator.
4. Assemble the inner universal joints as follows:
Hang the clips on the inner drivers.
For 1968–69 models the procedure is as follows:
Lower the power plant to about 2" (50 mm) from the engine cushions. Assemble the inner universal joints with the T-piece horizontal. Assemble the right-hand joint first.
With 1970 and later models, the front end must be blocked up during installation of the power plant. Lower the power plant to about 1" (20–30 mm) from the engine cushions. First assemble the left-hand universal joint, then lower the power plant on to the cushions and assemble the right-hand joint. Connect the end piece to the lower control arm.



ASSEMBLING THE RIGHT INNER UNIVERSAL JOINT

5. a. Align the engine brackets. At the same time guide the throttle control shaft into its bearing (up to and including model 1971).
b. Bolt the power plant to the engine cushions.
6. Remove the lifting yoke.
7. a. Push the rubber bellows over the inner universal joint drivers and fit the clamps.
b. Wipe any surplus grease off the rubber bellows and check that the bellows are not deformed.
8. a. Connect the gear shift rod joint to the gear selector rod and insert the taper pin. In 1970 and later models, refit the rubber bellows in the groove on the gear shift rod joint. (Manual transmission)
b. Connect the speedometer cable to the transmission.
9. Manual transmission:
Fit the slave cylinder and adjust the clutch.
9. Automatic transmission:
Connect the gear selector wire to the transmission.
10. Bolt the exhaust pipe to the exhaust manifold.
11. Lower the front end of the car.
12. Manual transmission:
a. Connect the free wheel cable and secure it in the holder under the right-hand differential bearing seat.
b. Check the operation of the free wheel control.
13. Connect the ground cable.
14. Mount the front sheet complete with radiator and connect the hood lock operating cable to the attachment at the dash panel. As from model 1972: Mount the headlights.
15. Reconnect the cables to the radiator fan, thermostat contact, headlights, headlight wiper motor and clip the bundle of wiring to the front sheet.
16. Connect the coolant hoses to the radiator, thermostat housing, water pump and inlet manifold.
17. Connect the vacuum hose and fuel hose and connect cables to the temperature transmitter, ignition coil and oil pressure transmitter.

17. Injection engine:
Also connect the vacuum hose to the pressure sensor and the cables to the starting contact.
18. Connect the throttle control to the throttle control shaft and connect the choke control to the carburetor. As from model 1972: Connect the throttle control wire to driver and bracket.
19. Carbureted engine:
Mount the air cleaner and preheater casing complete with hose. As from model 1972: Connect the preheater hose, air cleaner with valve housing and cold air hoses. Connect the ventilation hose to the oil filler pipe. Connect the ignition cable to the distributor and coil.
19. Injection engine:
Mount the air cleaner complete with hoses. Connect the cables for the electronic fuel injection to the distributor, injection valves, air cleaner, throttle valve switch and to the temperature sensor and thermostat switch below the inlet manifold. Make sure that the rubber caps on the contact pieces are in place.

CAUTION

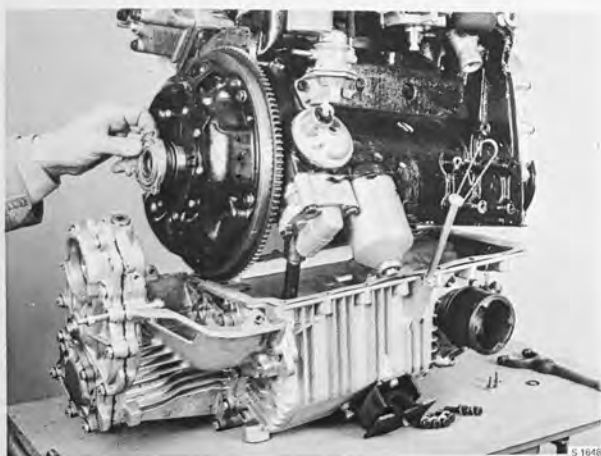
The connecting pieces only fit in one way and must thus not be forced in place.

20. Install the battery and connect the cables.
21. Close the radiator and engine block drain cocks, fill with coolant and oil. Bleed the heater core (up to and incl. model 1973).
22. Start the engine, checking oil pressure and coolant temperature. Check the operation of the transmission.
Check the operation of the radiator fan by grounding the thermostat contact cable to the radiator.
23.
 - a. Mount the hood and connect the windshield washer and headlight washer hoses.
 - b. Check the fit of the hood. Close the hood, open the doors, and check that the door jambs clear the rear edge of the hood.
 - c. Check the headlight alignment.
 - d. Refit the headlight trim frames.
24. Take the car out for a test run. Check the coolant level after driving.

Separating engine from manual transmission

1. Clean the power plant.
2. Drain the engine oil.
3. Take off the clutch cover.
4. Remove the starter.
5. Unscrew the alternator from the alternator support. Remove the drive belt.
6. Withdraw the clutch shaft (see instructions for disassembling the clutch).
7. Undo the three screws of the release bearing guide sleeve.
8. Back off the adjusting screw and disconnect the clutch lever.
9. Undo all screws in the mating flanges of engine and transmission and two screws accessible from under the transmission.
10. Lift the engine carefully off the transmission (see illustration). At the same time remove the release bearing guide sleeve.

Reassemble in the reverse order.



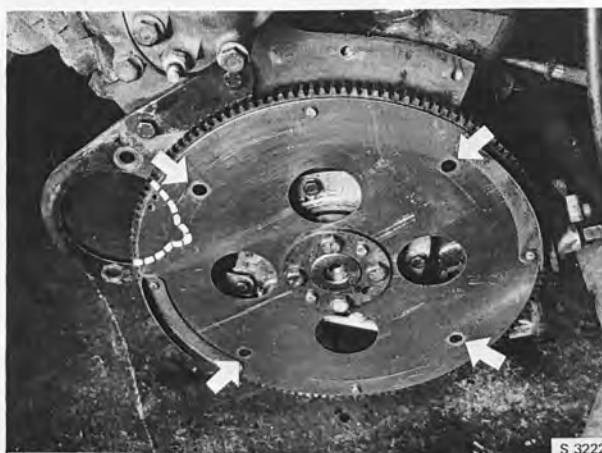
SEPARATING ENGINE FROM TRANSMISSION

CAUTION

Do not mix up the screws. The screws inserted from the block and threaded into the light alloy transmission case have UNC threads, while the ones inserted from the transmission and threaded into the cast iron cylinder block have UNF threads.

Separating engine from automatic transmission

1. Clean the outside of the power plant.
2. Drain the engine oil.
3. Undo the screw located inside the crankcase using a 1/2" socket and extension shank. This screw can be reached at an inward angle through the engine oil drain plug opening. Use a tool with a 3/8" square grip (this applies to the 1970 model only).
4. Remove the cover over the flywheel ring gear.
5. Remove the starter.
6. Unscrew the alternator from the alternator support. Take off the drive belt.
7. Disconnect the throttle wire from the throttle housing.
8. Remove the crankcase ventilation device and all screws (14 in number) in the mating flanges of engine and transmission.
9. Undo the four screws fastening the flywheel ring gear to the torque converter. These screws can be reached through a recess in the starter mount.



SCREW HOLES FOR FLYWHEEL RING GEAR — TORQUE CONVERTER

10. Lift the engine carefully off the transmission.
11. Fit the torque converter support (special tool 879025).

Reassemble in the reverse order.

CAUTION

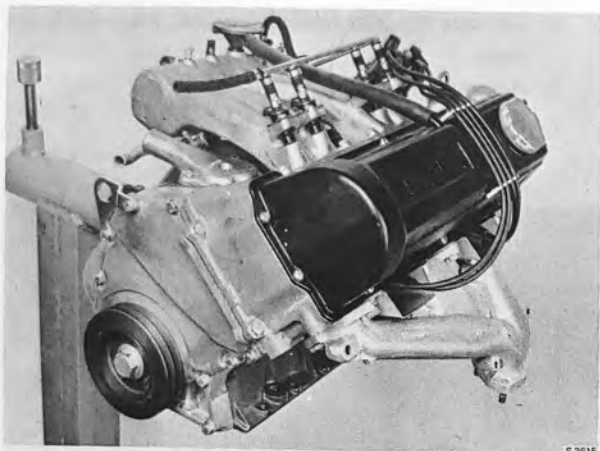
If the engine and transmission fail to separate, do not attempt to force them apart without first checking that all the screws have been taken out. Do not forget the screw inside the crankcase (1970 model only) or the transmission ventilation attachment on the right-hand side over the mating flanges.

REMOVAL AND INSTALLATION

2.0 l engine

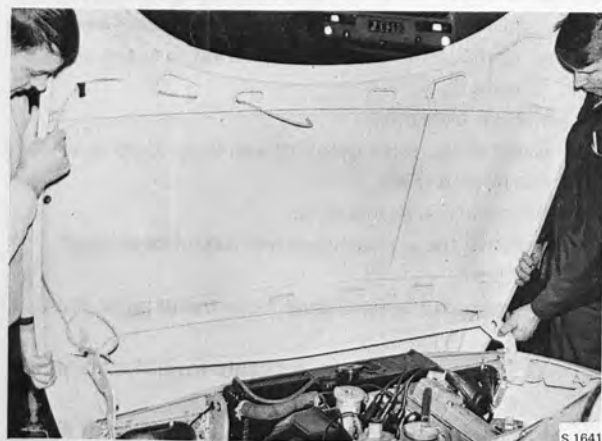
Removing the power plant

For major work on the engine and transmission, the entire power plant should be lifted out. Removal of the engine by itself is not recommended.



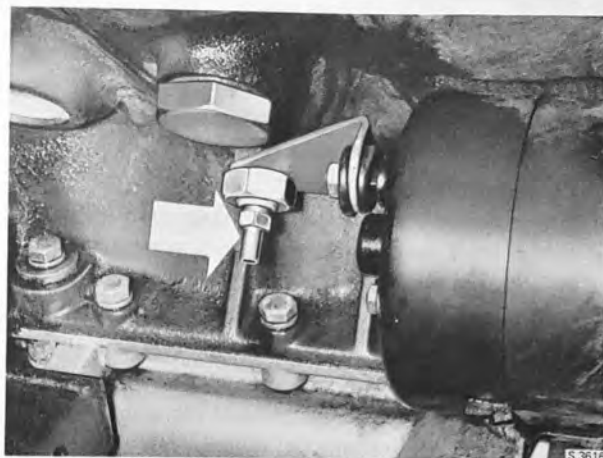
INJECTION ENGINE, SEEN FROM RIGHT

1. Remove the hood as follows:
Back off both the hood fastening screws. Lift off the hood. For this you need a helper to hold one side of the hood and help to lift it clear (see illustration).

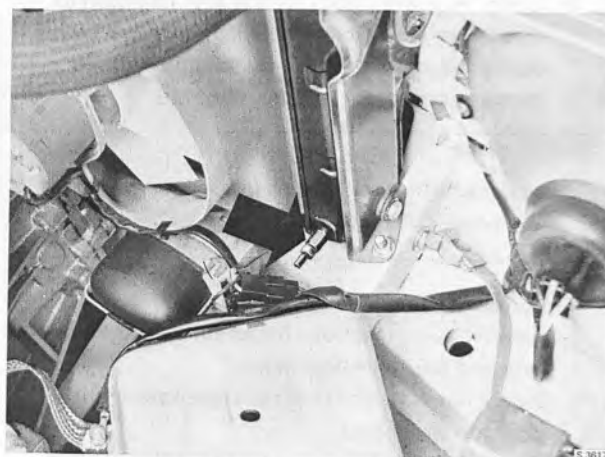


LIFTING OFF THE HOOD

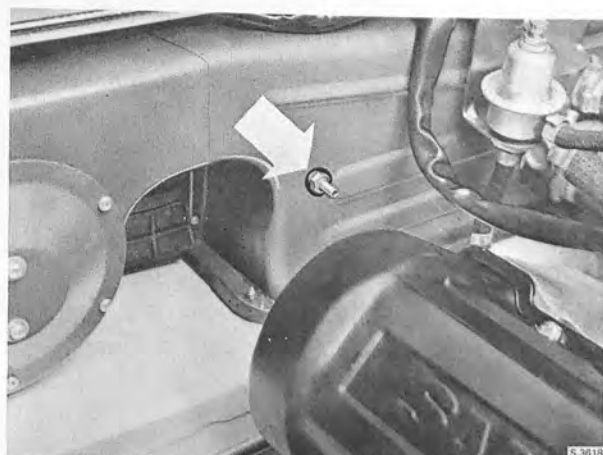
2. Detach the battery cables. Unclamp and lift out the battery.
3. Drain off coolant through the radiator and engine block drain cocks; open the bleeder cock on the heater core (up to and incl. model 1973).



ENGINE BLOCK DRAIN COCK



RADIATOR DRAIN COCK



HEATER CORE BLEEDER COCK, UP TO AND INCL. MODEL 1973

4. Carbureted engine:
Detach the vacuum hose of the power assist cylinder from the inlet manifold and pull the fuel hose off the suction side of the fuel pump.

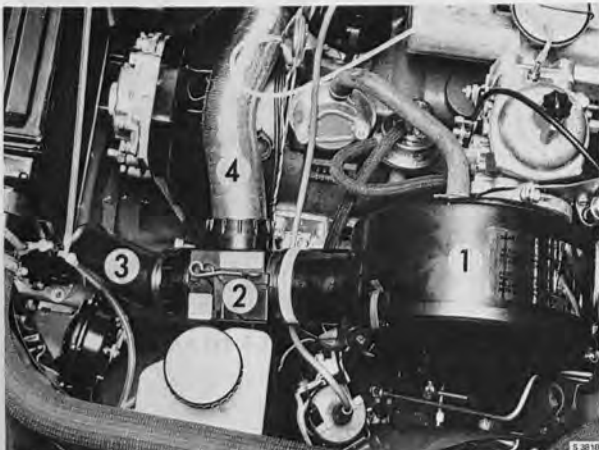
4. Injection engine:
 - a. Detach the vacuum hoses of the power assist cylinder and the pressure sensor from the inlet manifold.
 - b. Detach the fuel hoses from the tubes at inlet resp. outlet of the injection valves.
5. Carbureted engine:

Undo the cable connections to the ignition coil, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, headlights, headlight wipers and the switch on the gear box on cars with automatic transmission.
5. Injection engine:
 - a. Undo the cable connections to the ignition coil, temperature transmitter, radiator fan, thermostat contact, headlights, headlight wiper motor and the switch on the gear box on cars with automatic transmission.
 - b. Undo the connections for the fuel injection of distributor, thermostat housing, injection valves, start valve, throttle valve switch and at the temperature sensor at the inlet manifold.

CAUTION

Do not detach the connections by pulling the cables. Grip the connecting pieces.

6. Carbureted engine:
 - a. Detach the connections between the preheater hose and the valve housing.
 - b. Detach the hose for the crankcase ventilation from the air cleaner.
 - c. Remove the air cleaner, together with the valve housing and the cold air hose.
 - d. Remove the preheater casing with hose and the asbestos protection at the exhaust manifold.
 - e. Detach the throttle control wire from driver and bracket.
 - f. Detach the choke control wire and sheath from the carburetor.



AIR CLEANER WITH HOSES, AS FROM MODEL 1973

1. Air cleaner
2. Valve housing
3. Cold air inlet
4. Preheater hose

6. Injection engine:
 - a. Remove air cleaner complete with hoses.
 - b. Detach the throttle control wire from driver and bracket on the throttle valve housing.
7. Carbureted engine:

Detach the hoses at the connections to the thermostat housing, radiator, inlet manifold and water pump.
7. Injection engine:

Detach the hoses at the connections to the thermostat housing, radiator, water pump and valve at the heater core.
8.
 - a. Remove the four fastening screws from the front sheet.
 - b. Remove the headlight trim frames.
 - c. Remove the headlights.

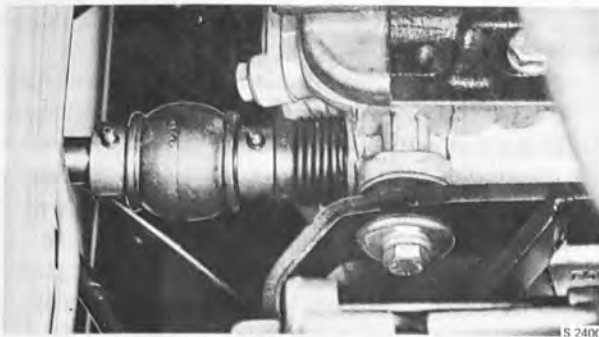


REMOVING THE FRONT SHEET

- d. Remove the hood lock operating cable from its fastenings at the dash panel and wheel housing.
- e. Remove the front sheet, lifting forward and upward.
9. Manual transmission:

Remove the slave cylinder and hang it up in some convenient place.
9. Automatic transmission:

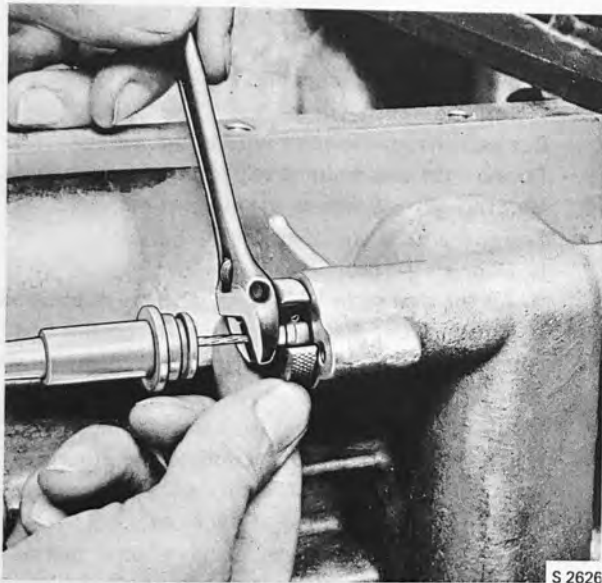
Remove the protective cover from the exhaust manifold.
10. Disconnect the hose pipe from the exhaust manifold.
11.
 - a. Disconnect the ground cable from the transmission.
 - b. Remove the alternator if it is mounted in the high position.
12. Jack up the front end of the car and place blocks under the body.
13. Manual transmission:
 - a. Put the gear lever in neutral.
 - b. Knock out the front taper pin from the gear shift rod joint and pull the rubber bellow free of the groove on the gear selector rod. Separate the gear selector rod joint from the gear selector rod.



GEAR SHIFT ROD JOINT TAPER PIN

13. Automatic transmission:

Remove the screw for the gear selector wire at the transmission. Move the gear selector lever to position "1" and pull out the sheath from the transmission. Fit tool 879038 on the wire, turn the tool a little and pull out the wire.



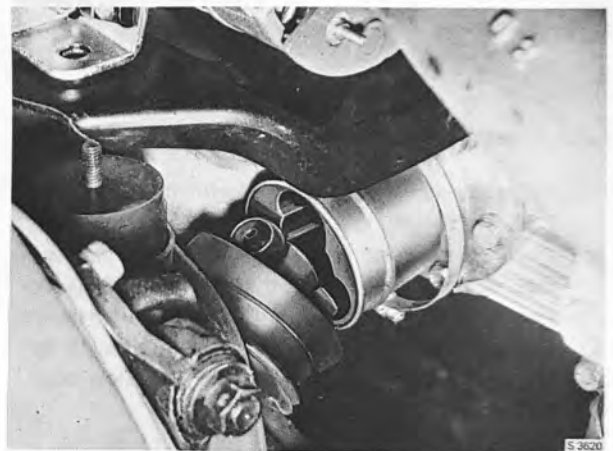
REMOVING THE GEAR SELECTOR WIRE

Tool 879038

14. Detach the speedometer cable from the transmission.
15. Undo the engine brackets.
16. Undo the larger clips round the rubber bellows on the inner universal joints.
17. Fit the lifting yoke to the two engine lifting lugs. (On power units with the alternator located in the high position, attach the rear hook of the yoke to the alternator bracket after removing the alternator.)
18. Undo the lower end piece from the control arm on the right-hand side and turn the steering wheel to the left. Raise the power plant from the rear engine cushions (the front bracket may rest on the cushion) and withdraw the left universal joint, by moving the power plant to the right. Move the power plant to the left and withdraw the right universal joint.



UNDOING LOWER END PIECE FROM CONTROL ARM



SEPARATING THE INNER UNIVERSAL JOINT

19. Lift the power plant to a convenient height for access to the cable connections on the starter and, on cars with alternators fitted in the low position, to the alternator cable terminals. Remove the cables.
20. Hoist out the power plant. Fit protective caps over the inner drivers and rubber bellows.

Installing the power plant

1. a. Check that the inner universal joints are packed with grease.
- b. Check the front engine cushion. Make sure that the washer is properly tightened.



FRONT ENGINE CUSHION

2. Raise the power plant with the lifting yoke (tool 829217) balancing the engine in such a way that the engine mounting at the flywheel end comes into position before the other two mountings. Position the power plant in the engine compartment.
3. Lower the power plant to a convenient height for fitting the starter and alternator cables (low position alternator). Connect the cables.
4. Assemble the inner universal joints as follows: Hang the clips on the inner drivers. Lower the power plant until it is about 2–2 1/2" (50–60 mm) from the engine cushions. Assemble the right-hand universal joint, then lower the power plant until it is about 1" (20–30 mm) above the engine cushions and push the power plant to the right. Lower the power plant and position it over the engine cushions while guiding the left-hand universal joint into place. Connect the end piece to the lower control arm.



ASSEMBLING THE RIGHT INNER UNIVERSAL JOINT

5. a. Align the engine brackets.

Model 1974:

Cars built to U.S. specifications and other cars with servo-assisted steering are equipped with special rear engine cushions. The cushions are designed to prevent the power plant from hitting the steering gear and damaging it in the event of a collision. A wire runs between the rear edge of the upper retaining plate and the front edge of the lower retaining plate in the cushions. The position of the cushions is determined by guides in the engine bracket and the cushion.

- b. Bolt the power plant to the engine cushions.
6. Remove the lifting yoke.
7. a. Push the rubber bellows over the inner universal joint drivers and fit the clamps.
- b. Wipe any surplus grease off the rubber bellows and check that the bellows are not deformed.
8. Manual transmission:
 - a. Connect the gear shift rod joint to the gear selector rod and insert the taper pin. Refit the rubber bellows in the groove on the gear shift rod joint.
 - b. Fit the slave cylinder and adjust the clutch.
8. Automatic transmission:
 - Connect the gear selector wire to the transmission.
9. Connect the speedometer cable to the transmission.
10. Bolt the exhaust pipe to the exhaust manifold.
11. Lower the front end of the car.
12. a. Connect the ground cable.
- b. Fit the alternator (if located in the high position).
13. Mount the front sheet complete with radiator and connect the hood lock operating cable to the attachment at the dash panel.
14. Mount the headlights and their trim frames.
15. Reconnect the cables to the radiator fan, thermostat contact, headlights, headlight wiper motor and clip the bundle of wiring to the front sheet.
16. Connect the coolant hoses to the radiator, thermostat housing, water pump, inlet manifold and heater.
17. Connect the vacuum hose and fuel hose and connect cables to the temperature transmitter, ignition coil and oil pressure transmitter. On injection engine also connect the vacuum hose to the pressure sensor and the cables to the start inhibitor switch.
18. a. Connect the throttle control wire to driver and bracket.
- b. Carbureted engine:
 - Connect the choke control wire to the carburetor.
19. Carbureted engine:
 - a. Mount the air cleaner with valve housing and cold air hose.
 - b. Fit the preheater casing, complete with hose. Fit the asbestos casing on the exhaust manifold and connect the hose to the throttle valve housing.
 - c. Connect the hose to the crankcase ventilation between air cleaner and vent housing.

19. Injection engine:
Mount the air cleaner complete with hoses. Connect the cables for the electronic fuel injection to the distributor, thermostat housing, injection valves, start valve, throttle valve switch and to the temperature sensor at the inlet manifold. Make sure that the rubber caps on the contact pieces are in place.

CAUTION

The connecting pieces only fit in one way and must thus not be forced in place.

20. Install the battery and connect the cables.
21. Close the radiator and engine block drain cocks, fill with coolant and oil. Bleed the heater core (up to and incl. model 1973).
22. Start the engine, checking oil pressure and coolant temperature. Check the operation of the transmission. Check the operation of the radiator fan by grounding the thermostat contact cable to the radiator.
23. a. Mount the hood and connect the windshield washer hose.
b. Check the fit of the hood. Close the hood, open the doors, and check that the door jambs clear the rear edge of the hood.
c. Check the headlight alignment.
24. Take the car out for a test run. Check the coolant level after driving.

Separating engine from manual transmission

1. Clean the power plant.
2. Drain the engine oil.
3. Take off the clutch cover.
4. Remove the starter.
5. Withdraw the clutch shaft (see instructions for disassembling the clutch).
6. Undo the three screws of the release bearing guide sleeve.
7. Back off the adjusting screw and disconnect the clutch lever.
8. Undo all screws in the mating flanges of engine and transmission and two screws accessible from under the transmission.
9. Lift the engine carefully off the transmission (see illustration). At the same time remove the release bearing guide sleeve.

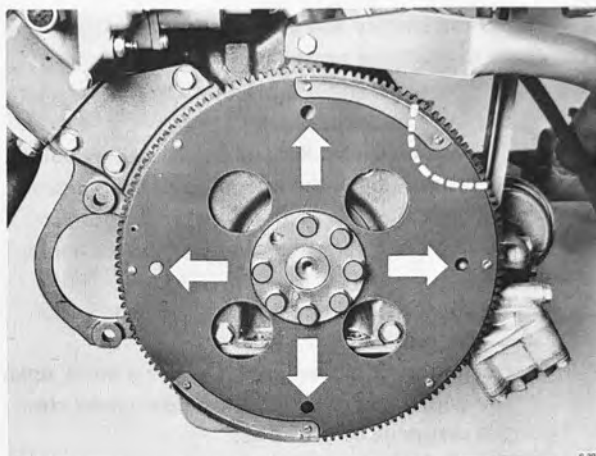
Reassemble in the reverse order.

CAUTION

If the engine and transmission fail to separate, do not attempt to force them apart without first checking that all the screws have been taken out.

Separating engine from automatic transmission

1. Clean the outside of the power plant.
2. Drain the engine oil.
3. Remove the cover over the flywheel ring gear.
4. Remove the starter.
5. Disconnect the throttle wire from the throttle housing (carburetor).
6. Remove the crankcase ventilation device and all screws (17 in number) in the mating flanges of engine and transmission.
7. Undo the four screws fastening the flywheel ring gear



SCREW HOLES FOR FLYWHEEL RING GEAR – TORQUE CONVERTER

to the torque converter. These screws can be reached at the crankcase ventilation connecting housing.

8. Lift the engine carefully off the transmission.
9. Fit the torque converter support (special tool No. 879025).

Reassemble in the reserve order.

ENGINE BODY

1,7 and 1,85 l engines

Disassembling the engine

1. Mount the engine in a work stand with engine holder 839045.



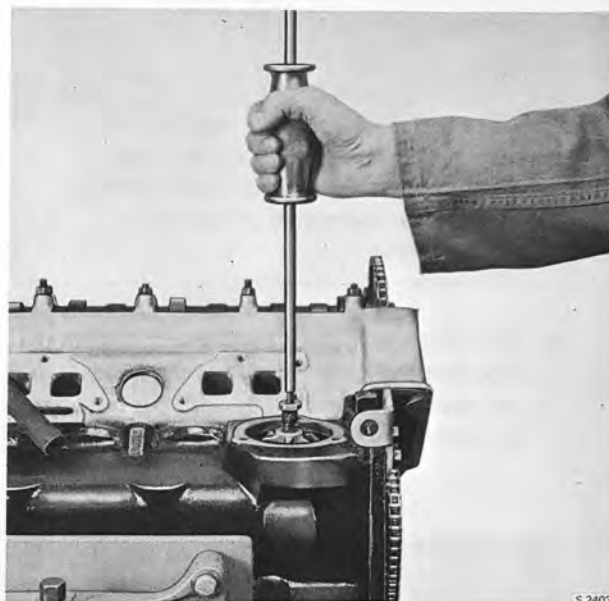
ENGINE MOUNTED IN WORK STAND
Tool 839045

2. Remove the distributor cap and disconnect the ignition cables.
3. Remove the carburetor. In the case of injection engines, remove the throttle housing.
4. Remove the inlet manifold and distributor (and the upper engine bracket on 1969 models).
5. Undo the hose connections from the water pump, bypass system and crankcase ventilation circuit.
6. Remove the fuel pump (remove the thermostat housing on injection engines).
7. Remove the cover over the oil channels complete with oil pressure transmitter.
8. Remove the oil filter.
9. Remove the oil pump and pump shaft and disconnect the suction line.
10. Remove the water pump as follows:
 - a. Take off the cover.
 - b. Undo the center screw from the impeller. Hold the impeller with polygrip pliers and unscrew clockwise (left-hand thread). Save the washer.



UNDOING THE CENTER SCREW OF THE WATER PUMP

- c. Fit tapping-out hammer 839027 with adapter 839057 to the water pump shaft and take out the pump unit.



REMOVING THE WATER PUMP
Tools 839027 and 839057

The bearing housing may be left behind in the cylinder block. If so, expel the bearing housing with an impact puller fitted with a nut and a flat washer, OD 1" (25 mm).



REMOVING THE BEARING HOUSING
Tool 839027

CAUTION

If the impeller is not immobilized while the center screw is unscrewed, the gear teeth on the pump shaft and idler shaft are liable to be damaged.

11. Remove the thermostat housing.
12. Unbolt the exhaust manifold.
13. Remove the camshaft cover and gaskets.

14. Remove the camshaft chainwheel as follows:
 - a. Screw a nut on to the threaded center stud of the camshaft chainwheel and tighten the center stud against the mounting plate provided for the purpose.

CAUTION

Tighten the nut securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the chainwheel cannot be replaced in position.

- b. Undo the two locked retaining screws from the camshaft chainwheel. Separate the wheel from the camshaft plate until it hangs free on the center stud in the mounting plate.

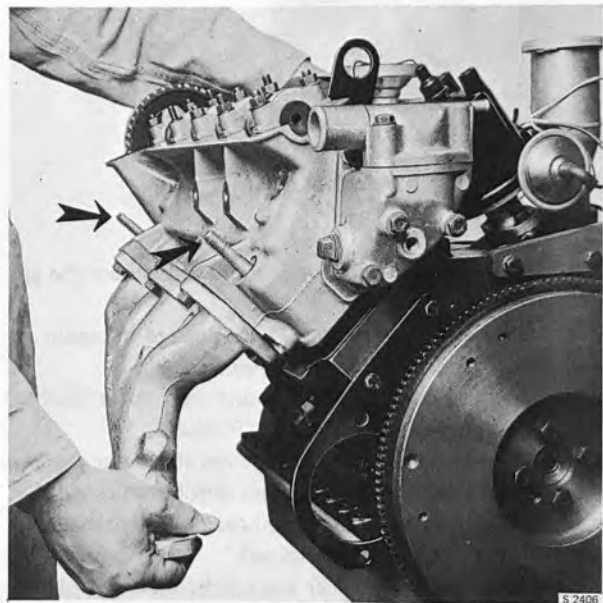


SEPARATING THE CAMSHAFT CHAINWHEEL FROM THE CAMSHAFT PLATE

15.
 - a. Unscrew all cylinder head screws and nuts.
 - b. Remove the cylinder head screws.
 - c. Remove two studs, using tools 839051 and 839052, and insert these studs in two of the cylinder head screw holes to act as locating pins (see illustration).
NOTE! Do not forget the screws in the chain transmission case.
 - d. Unscrew the other studs and lift off the cylinder head.

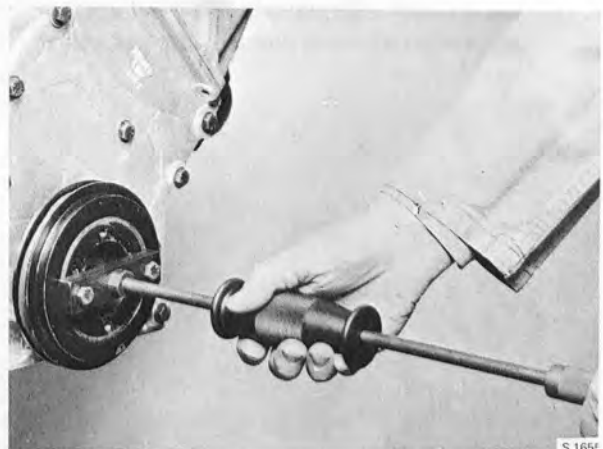


REMOVING STUDS
Tools 839051 and 839052



STUDS AS LOCATING PINS FOR REMOVAL AND MOUNTING OF CYLINDER HEAD

16. Undo the belt pulley screw ev. with aid of sleeve 839066. Pull out the belt pulley using tapping-out hammer 839027 and puller 839114.



REMOVING THE BELT PULLEY
Tools 839027 and 839114

17. Remove the chain transmission cover.
18. Remove the chain tensioner.
19. Undo the chain guide screws. Remove the mounting plate with the camshaft chainwheel and transmission chain.
20. Remove the chain guides.



DISASSEMBLING THE CRANKSHAFT SPROCKET
PULLER No. 839185

21. Remove the oil thrower ring and pull the sprocket off the crankshaft using puller 839185. Pullers 839118 and 899525 may also be used.
22. Unscrew the idler shaft keeper plate and carefully withdraw the idler shaft.

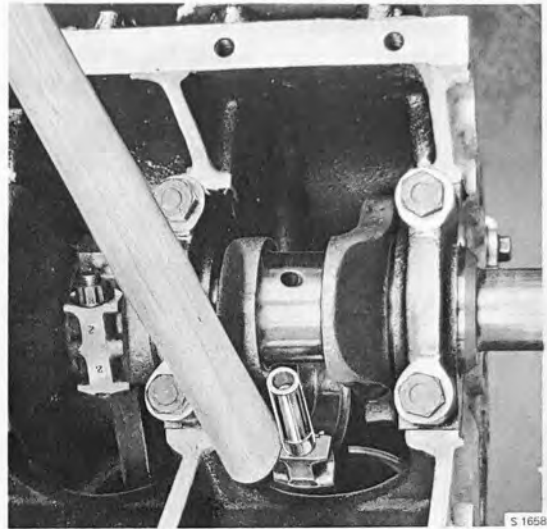


IDLER SHAFT KEEPER PLATE

23. Carefully remove any crusts and deposits of soot from the top ends of the cylinders.
24. Note the markings on the connecting rods and big-end bearing caps so that they can be reassembled later in their original positions. Remove the nuts

and bearing caps and push the pistons complete with connecting rods out of the cylinders (see illustration). Protect the stud threads with pieces of plastic hose when dismantling pistons and connecting rods.

For instructions with regard to exchanging pistons see p. 210-9.



DISASSEMBLING PISTON AND CONNECTING ROD

25. Replace the big-end bearings and caps loosely on the connecting rods from which they came.
26. Dismantle the clutch and flywheel (see illustration). Engine, automatic transmission: Remove the driver disc.

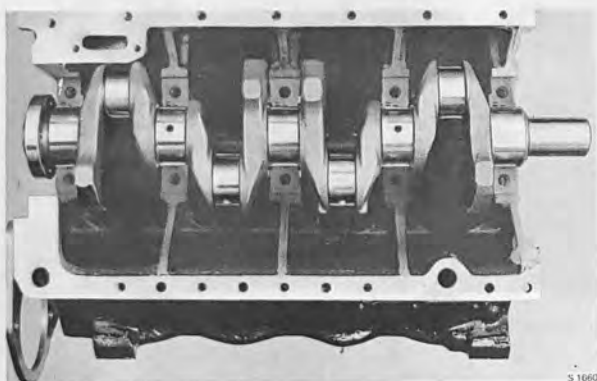


REMOVING THE FLYWHEEL

27. Remove the seal cap and shaft seal.
28. Undo the main bearing screws and remove the bearing caps and bearings.
29. Lift out the crankshaft.
30. Remove the bearing halves and thrust bearing washers and put them carefully aside so that they can be reassembled in their original positions.

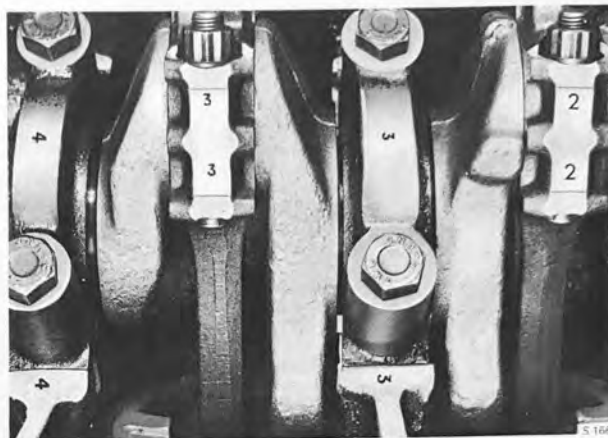
Assembling the engine

1. Place the bearing halves in the main bearing journals and lubricate the bearings with engine oil.
2. Locate the crankshaft carefully in the bearing journals.



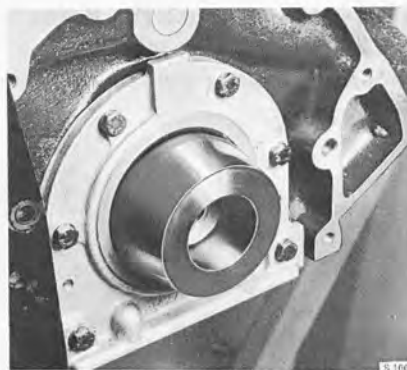
CRANKSHAFT LOCATED IN BEARING JOURNALS

4. Mount the main bearing caps with bearing halves already in position and oiled. (NOTE! Make sure the markings match up!) The main bearing caps are numbered; No. 1 goes at the transmission chain end and the others run consecutively to the fly-wheel end with the bearing locks facing each other.



MAIN BEARING CAP MARKINGS

5. Tighten the screws to the specified torque.
6. Fit the seal cap with the crankshaft seal, using guide sleeve 839041. Lubricate the inner surface of the seal ring.



FITTING THE CRANKSHAFT SEAL
Tool 839041

3. Locate the thrust bearing washers, making sure that the oil grooves face outward (see illustration).



POSITION OF THRUST BEARING WASHERS

7. Fit the flywheel. Use new screws.
Engine, automatic transmission: Fit the driver disc, using new screws.

NOTE!

The retaining screws have not the same length. Short screws for the flywheel. Long screws for the driver disc. Do not mix them up. When refitting the flywheel (driver disc), always use new screws. When fitting a crankshaft with six holes together with a flywheel (driver disc) with four holes, a thin layer of Tikatät or the equivalent must be applied to the contact surfaces.

8. Install the pistons and connecting rods using tool No. 839036 for 1.7 liter engines and tool No. 839208 for 1.85 liter engines. Make sure that the studs are still protected by their plastic sleeves. The connecting rods and big-end bearing caps are numbered to match the corresponding cylinders. Instructions for fitting piston rings are given on p. 210-10.

NOTE

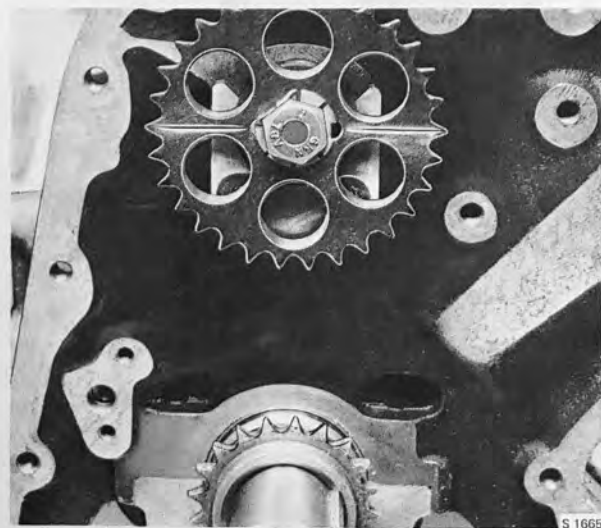
Pistons marked "FRONT" (pistons with offset piston pin) are to be installed with the marking nearest the transmission chain end of the engine.



INSTALLING A PISTON

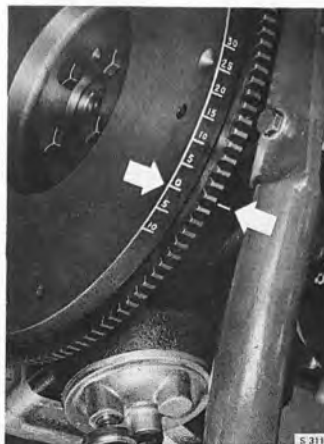
Tool 839036 (1.7 l) or 839208 (1.85 l)

9. Fit the big-end bearing caps so that the figures face the same way as those on the connecting rod, i.e. away from the idler shaft.
10. Assemble the idler shaft and fit the keeper plate. Turn the shaft until the marked line on the chainwheel is horizontal.



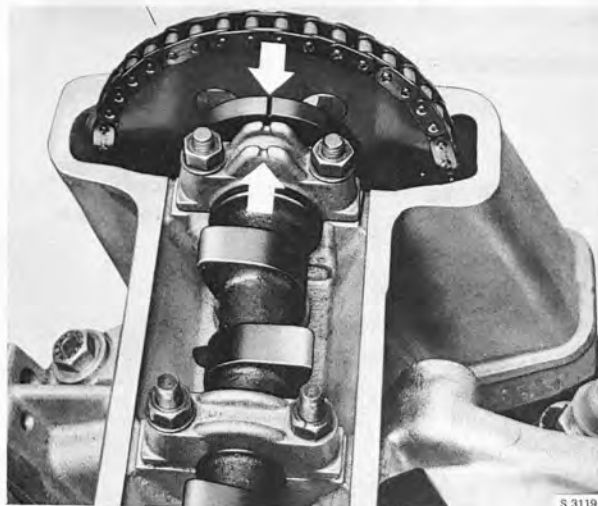
IDLER SHAFT CHAINWHEEL MARKING

11.
 - a. Mount the chainwheel on the crankshaft.
 - b. Align the 0 degree mark on the flywheel with the mark on the cylinder block.



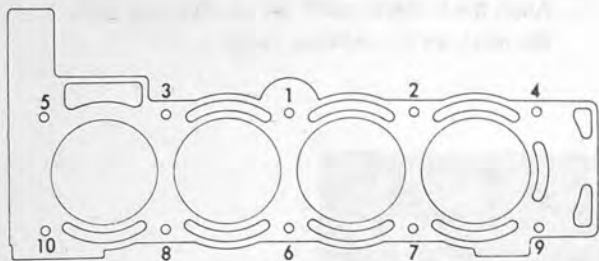
FLYWHEEL AND ENGINE BLOCK MARKINGS

12. Fit the cylinder head gasket.
13. Line up the camshaft setting mark with the notch on the bearing cap. If the camshaft is in any other position, the valves will be damaged when the cylinder head is mounted on the cylinder block.



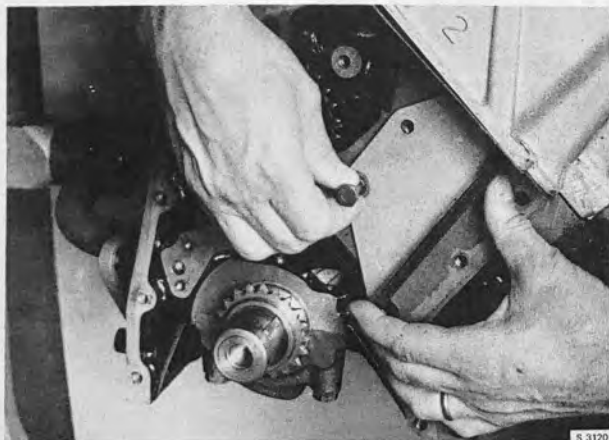
CAMSHAFT MARKING

14.
 - a. Mount the cylinder head.
 - b. Tighten the nuts and screws to the prescribed torque in the order shown in the drawing below see p. 211-2.
 - c. Do the final tightening after the engine has been allowed to cool for about 30 minutes.



ORDER OF TIGHTENING CYLINDER HEAD SCREWS

15. a. Mount the straight chain guide plate with the long screw in the bottom hole.



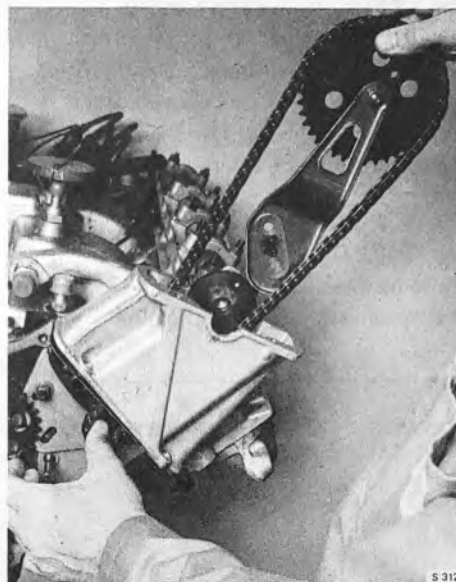
MOUNTING THE STRAIGHT CHAIN GUIDE PLATE

- b. Mount the curved chain guide plate loosely with a short screw in the hole nearest the idler shaft.



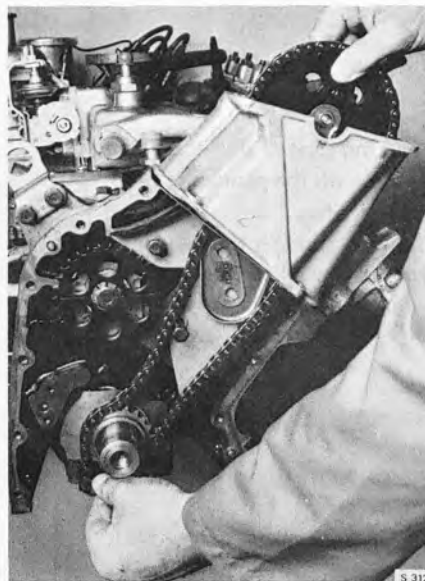
MOUNTING THE CURVED CHAIN GUIDE PLATE

16. Assemble the camshaft chainwheel and mounting plate, fit the transmission chain over the camshaft chainwheel, and lower the transmission chain and mounting plate past the camshaft flange until the center stud of the chainwheel is lined up with the camshaft.



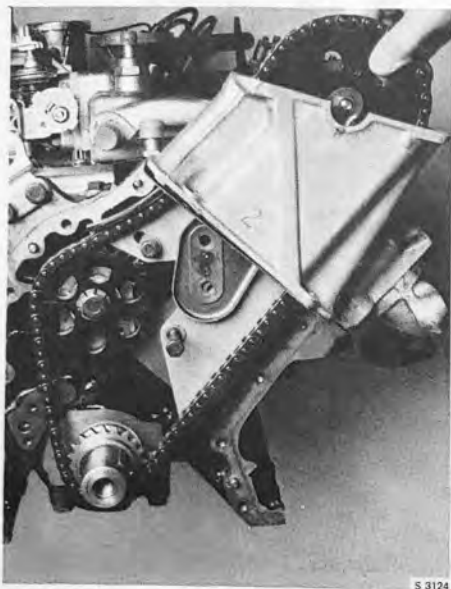
MOUNTING THE TRANSMISSION CHAIN

17. Rotate the camshaft chainwheel until the screw holes match the threaded holes in the camshaft flange.
18. Fit the transmission chain over the other sprockets so that it hangs straight from the camshaft to the crankshaft.
- NOTE! The shaft settings must not be altered.



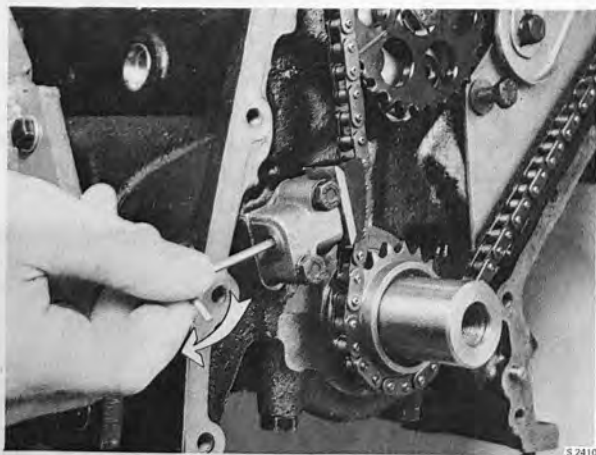
PLACEMENT OF TRANSMISSION CHAIN ON SPROCKETS

19. Guide the center stud of the camshaft chainwheel into the camshaft. Fit the locking plate and insert one screw.



GUIDING THE CENTER STUD

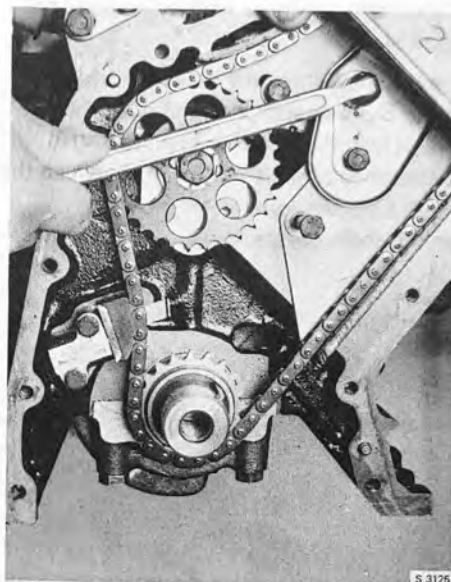
20. Fit the screws for the chain guides and the mounting plate.
21. a. Rotate the crankshaft one full turn in the direction of rotation of the engine, insert and tighten the camshaft chainwheel screws, and lock the screws with the locking plate.
b. Check the setting, "Camshaft - Crankshaft".
22. Mount the chain tensioner according to the following description.



APPLYING SCREW PRESSURE TO THE CHAIN TENSIONER

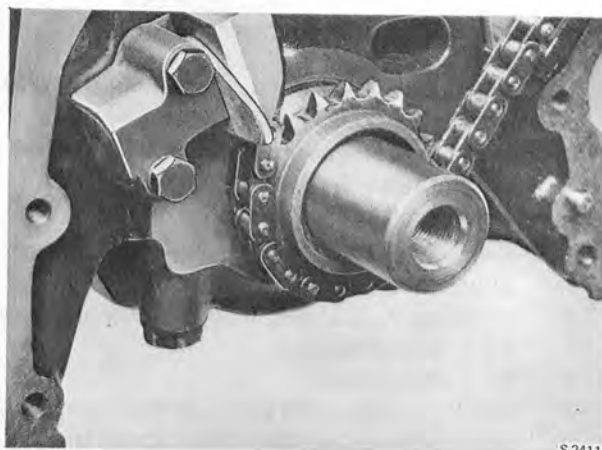
23. On engines with serial numbers up to and including 2954, fit the chain tensioner as follows:
 - a. Undo the screw on the back of the chain tensioner. Relieve the spring pressure on the tension plate by turning the clamping sleeve clockwise with a hexagon pin spanner to the "mounting position".

- b. Slacken the chain by loosening the screws of the curved chain guide.
- c. Mount the chain tensioner with guide plate on the engine block.
- d. Press on the curved chain guide to stretch the chain over the tensioner neck. Tighten the chain guide screws.



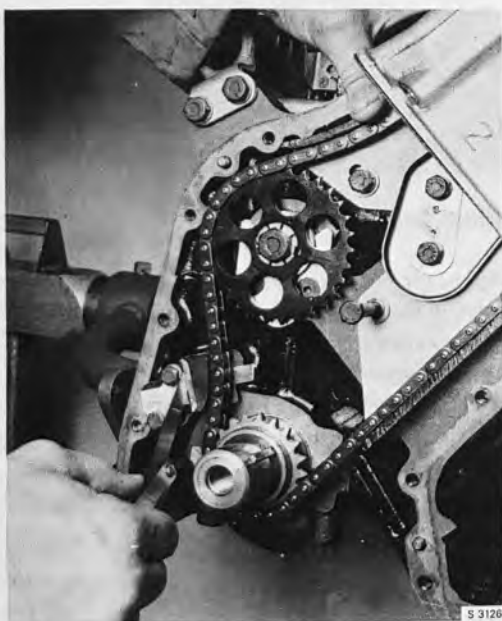
TIGHTENING THE CHAIN GUIDE

- e. Apply spring pressure to the chain tensioner by turning the clamping sleeve clockwise with a hexagon pin spanner. A distinct click will be heard as spring pressure is applied. Fit and lock the screw on the back of the chain tensioner.
- f. Rotate the crankshaft one full turn in its normal sense and check the chain tension. The movement of the tensioner neck from its butted position must be at least 0.02" (0.5 mm) and not more than 0.06" (1.5 mm).



SELF-TRIGGERING CHAIN TENSIONER

24. On engines with serial numbers of 2955 or higher, fit the chain tensioner as follows:
 - a. Relieve the spring pressure on the tensioner neck by turning the clamping sleeve clockwise to the "mounting position".
 - b. Fit a shim 0.118" (3 mm) thick on the tensioner neck. (The chain tensioner is supplied with this shim as a spare part.) Push the neck into the chain tensioner.
 - c. Mount the chain tensioner with guide plate on the engine block.
 - d. Remove the shim. Press the curved chain guide against the chain to stretch it and push the tensioner neck into the housing. Then adjust to leave a clearance of 0.02" (0.5 mm) between the housing and the tensioner neck. Tighten the chain guides.



ADJUSTING THE CHAIN TENSIONER CLEARANCE

- e. Rotate the crankshaft one full turn in its normal sense and check the chain tension. The movement of the tensioner neck from its butted position must be at least 0.02" (0.5 mm) and not more than 0.06" (1.5 mm).
25. Remove the nut from the camshaft chain wheel center stud.
26. Fit the oil thrower ring, transmission chain cover and alternator support.
27. Fit the belt pulley.
28. Install the pump shaft with bearing housing without impeller in the engine block. Check that the cogs of the pump shaft engages with the idler shaft sprocket. Position the bearing housing with aid of

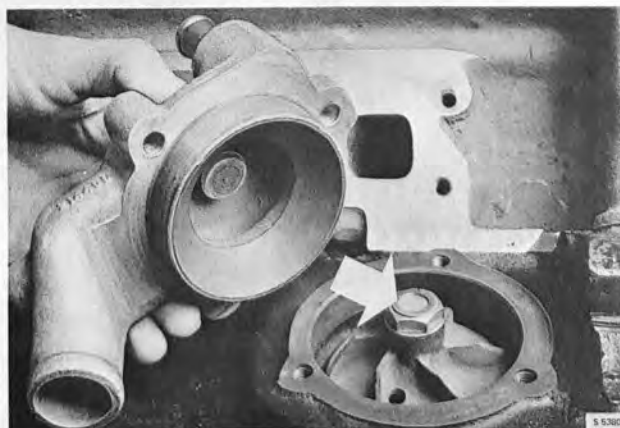


INSTALLING THE WATER PUMP

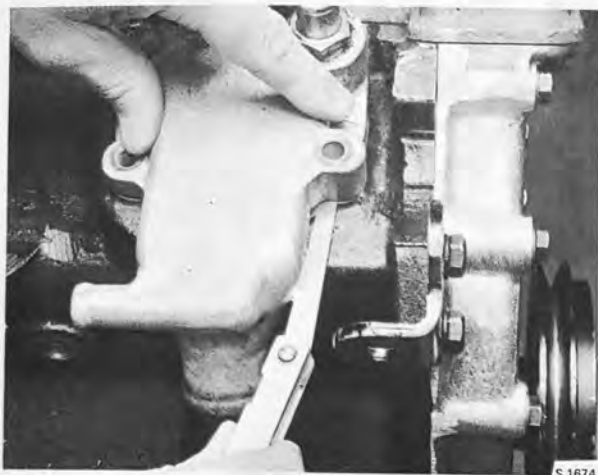
Tools 839044 and 839053

drift 839044, sleeve 839053 and hammer, so that the flange of the bearing housing is flush with the engine block. See illustration. Fit the impeller.

29. The clearance between the center screw of the impeller and the cover must be 0.01 — 0.02" (0.25 — 0.50 mm). Adjust the clearance as follows:
 - a. Place a washer 0.02" (0.5 mm) thick between the center screw of the impeller and the pump cover, see illustration. Use a feeler gauge to measure the gap between the cover and the engine block.
 - b. Remove the washer and fit one or two new gaskets corresponding in thickness to the measured gap between cover and block. There are three different gasket thicknesses to choose from, viz. 0.01", 0.02", and 0.03" (0.25, 0.50 and 0.75 mm). Tighten the cover.



MEASURING PUMP COVER CLEARANCE



MEASURING PUMP COVER CLEARANCE

30. Fit the fuel pump.
31. Fit the cover over the oil channels so that the locating pin engages the corresponding hole in the cover.
32. Fit the distributor (see group 3).
33. Fit the oil pump and its drive shaft.
34. Fit the oil pump suction line. Make sure that the suction tube gasket is the right way round.
35. Fit the oil filter.
36. Fit the inlet manifold. Connect water hoses and crankcase ventilation hoses. Screw in the engine lifting eye.
37. Mount the carburetor.
38. Mount the thermostat housing.
39. Fit the exhaust manifold.
40. Fit the two semicircular rubber seals and the camshaft cover.
41. Mount the clutch.

Changing pistons, piston rings and big-end bearings

(Engine mounted in work stand)

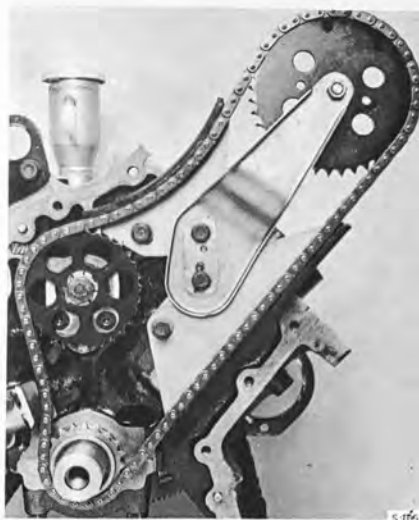
Disassembly

1. Remove the oil filter.
2. Remove the camshaft cover.
3. Remove the camshaft chainwheel as follows:
 - a. Screw a nut on to the threaded center stud of the camshaft chainwheel and clamp the chainwheel against the mounting plate provided for the purpose.

CAUTION

Tighten the nut securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the chainwheel cannot be refitted.

- b. Undo the two locked retaining screws from the camshaft chainwheel. Separate the wheel from the camshaft plate until it hangs freely by its center stud in the mounting plate.
4. a. Unscrew all cylinder head screws and nuts.

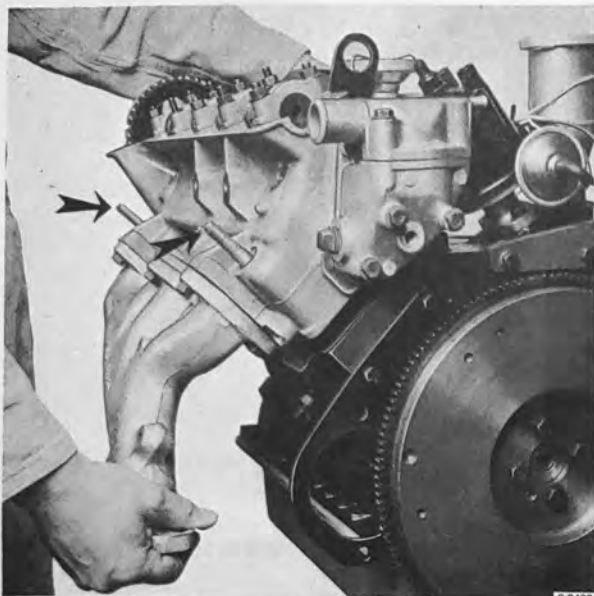


CAMSHAFT CHAINWHEEL CLAMPED TO MOUNTING PLATE



CAMSHAFT CHAINWHEEL RETAINING SCREWS

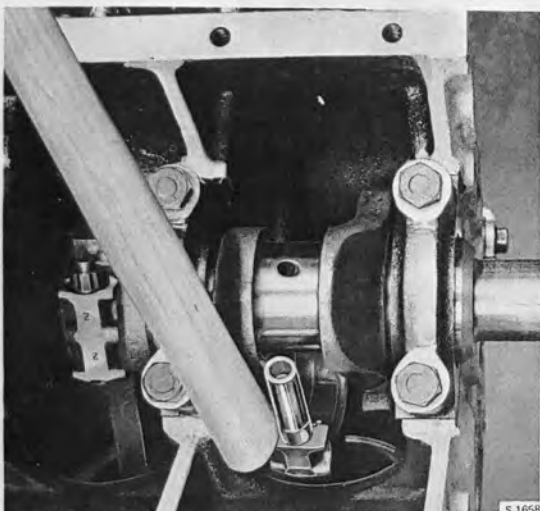
- b. Remove the cylinder head screws.
- c. Remove the screws from the transmission chain cover.
- d. Remove two studs, using tools 839051 and 839052, and insert these studs in two of the cylinder head screw holes to act as locating pins (see illustration).
- e. Remove the other studs.
5. Disconnect hoses and cables from the inlet manifold and carburetor. Unscrew the spark plugs.
6. Lift off cylinder head with carburetor, inlet manifold and exhaust manifold.
7. Remove the big-end bearing caps and push the pistons complete with connecting rods out of the cylinders (see illustration). Protect the studs with pieces of plastic hose.



STUDS AS LOCATING PINS FOR REMOVAL AND MOUNTING OF CYLINDER HEAD



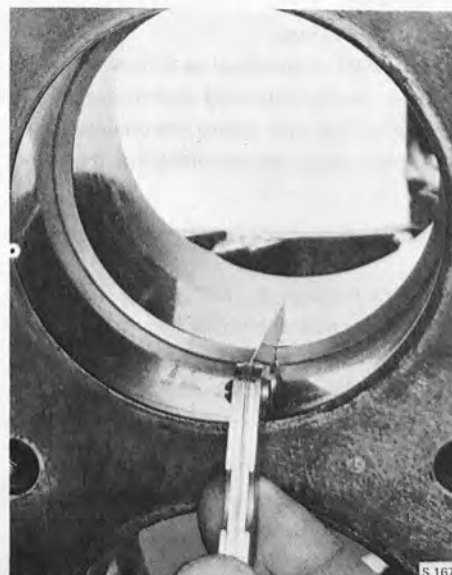
MEASURING PISTON CLEARANCE



REMOVAL PISTONS AND CONNECTING RODS

Fitting pistons

To fit pistons to the cylinder bores, use a feeler gauge $1/2''$ wide and 0.013–0.038 mm thick. To measure, first oil the cylinder lining lightly and insert the piston without rings in the cylinder in the position in which it will ultimately be working. Attach the feeler gauge to a spring balance and place it between the piston and cylinder bore at right angles to the axis of the piston pin (see illustration). At a tractive force of 8–12 N (1.8–2.6 lb., 0.8–1.2 kp), the mean value of the clearance equals the thickness of the feeler gauge. Repeat the test with the piston at several different depths on the piston. Spare pistons are stocked in both standard and oversize diameters. Where the latter are used, the cylinder bore must be honed or rebored to obtain the correct piston clearance.



MEASURING PISTON RING GAP

Fitting piston rings in a new or rebored cylinder

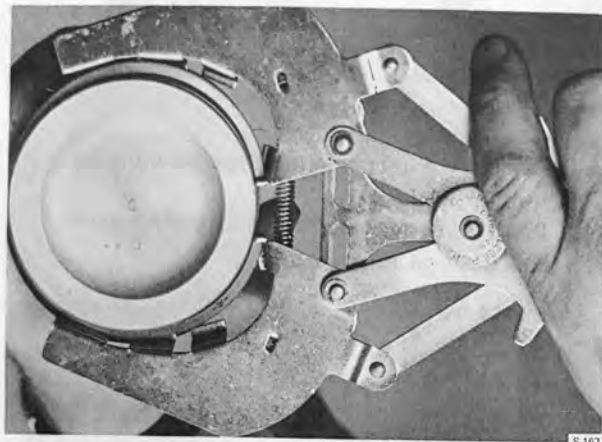
1. Push the piston rings down into the cylinder one at a time, using an inverted piston head to position them correctly.
2. Measure the ring gap with a feeler gauge (see illustration). Correct gap sizes are given in the specifications (group 0). If necessary, widen the gap with a special file.
3. Try the piston rings in their respective grooves by rolling. Measure the clearance at a few points too.

Fitting piston rings in worn cylinders

Rings to be fitted in a worn cylinder must be tried at the lower limit of travel of the piston, as the bore will be narrowest at this point.

Assembly of piston rings

Use a piston ring tool to position the rings as illustrated. Place the lower compression ring with the side marked "top" uppermost. Oil the piston and rings before assembling.



PISTON RING TOOL

bling. Rotate the compression rings so that the gaps are staggered 180°, one in line with each end of the piston pin. Make sure, too, that the spring gaps of the top and bottom rings in the three-piece scraper ring are staggered.



PISTON AND CONNECTING ROD

Installation

1. Install pistons and connecting rods using the piston installing tool 839036 for 1.7 liter engines and tool 839208 for 1.85 liter engines.

NOTE

Piston marked "FRONT" (piston with offset piston pin) are to be installed with the marking nearest the transmission chain end of the engine.

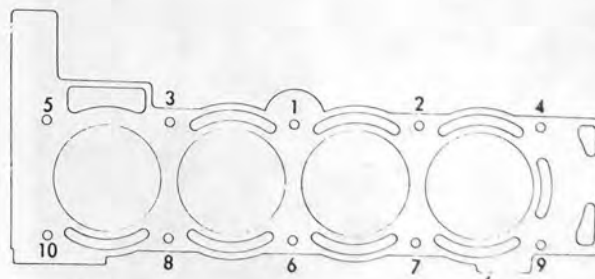


INSTALLING A PISTON

Tool 839036 (1.7l) or 839208 (1.85 l)

2. Mount big-end bearing caps with bearing halves.
3. Fit the cylinder head gasket.
4. Check that the mark on the camshaft is in line with the marks on the first camshaft bearing cap.
5. Mount the cylinder head. Screw in the studs using tools 839051 and 839052. Tighten the cylinder head screws to the specified torque. The order of tightening is illustrated below. See p. 211-2 for correct distribution of torque between screws and nuts. Tighten finally after the engine has cooled off for about 30 minutes.

Insert and tighten the transmission chain cover screws.



ORDER OF TIGHTENING CYLINDER HEAD SCREWS

6. Fit the camshaft chainwheel to the camshaft, making sure that the notches on the camshaft and bearing cap are in line. Tighten and lock both retaining screws. Remove the nut from the center stud of the camshaft chainwheel. Check at the same time that the mark on the flywheel is in line with the mark on the cylinder block.
7. Mount the camshaft cover.
8. Connect hoses and cables to the camshaft cover, inlet manifold and carburetor. Screw in the spark plugs and connect the ignition cables.
9. Install the oil filter.

ENGINE

2.0 l engine

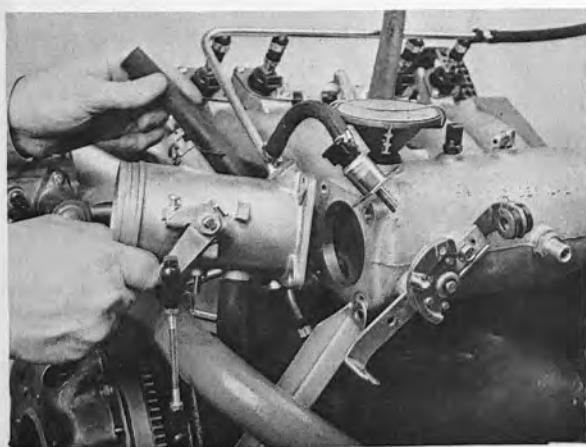
Disassembling the engine

1. Mount the engine in a work stand with engine holder 839216.



ENGINE MOUNTED IN WORK STAND
Tool 839216

2. Remove the distributor cap and disconnect the ignition cables.
3. Carbureted engine:
Remove the carburetor.



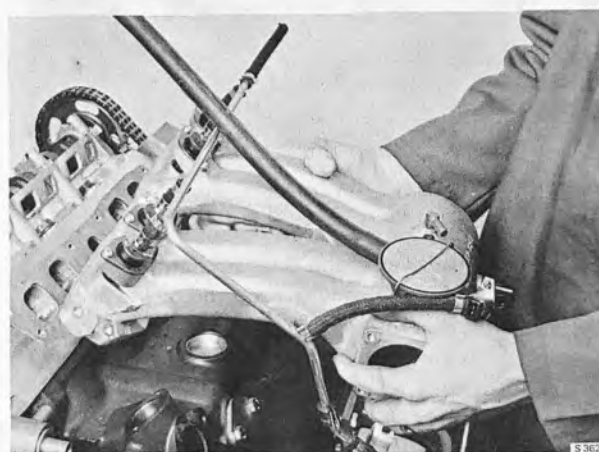
REMOVING THE THROTTLE VALVE HOUSING

3. Injection engine:
Undo the start valve from the throttle valve housing and let it be hanging in its hose. Remove the throttle valve housing.
4. Undo the hose connections from the water pump, bypass system and crankcase ventilation circuit.
5. Remove the valve cover.
6. Remove the distributor.



REMOVING THE DISTRIBUTOR

7. a. Remove the inlet manifold together with the front lifting lug.
b. Remove the alternator bracket (engines with high position alternator).



REMOVING THE INLET MANIFOLD

8. Remove the vent housing for the crankcase ventilation.
9. a. Remove the oil filter.
b. Remove the oil pump.
c. Remove the oil pump spacing piece.
d. Remove the suction line to the pump.
10. Remove the water pump as follows:
a. Take off the cover.
b. Undo the center screw from the impeller. Hold the impeller with polygrip pliers and unscrew clockwise (left-hand thread). Save the washer.

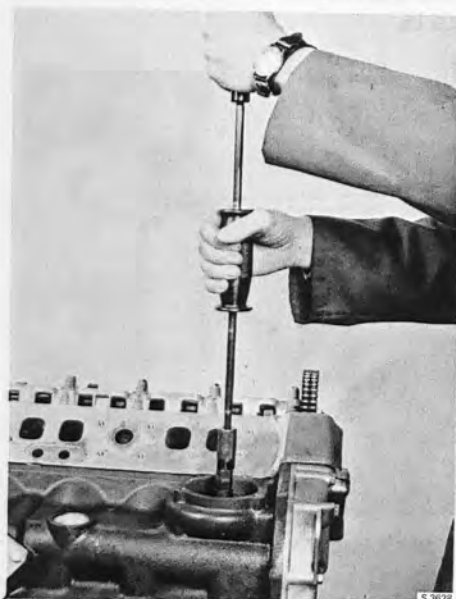
CAUTION

If the impeller is not immobilized while the center screw is unscrewed, the gear teeth on the pump shaft and idler shaft are liable to be damaged.



UNDOING THE CENTER SCREW OF THE WATER PUMP

- c. Fit tapping-out hammer 839027 with adapter 839213 to the water pump shaft and take out the pump unit.



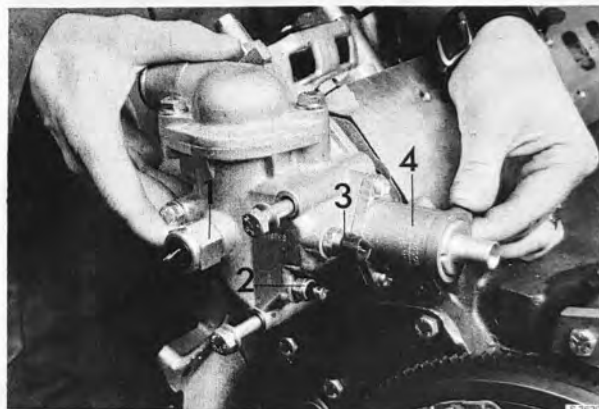
REMOVING THE WATER PUMP
Tools 839027 and 839213

- d. The bearing housing may be left behind in the cylinder block. If so, expel the bearing housing with tapping-out hammer 839027 fitted with a nut and a flat washer, OD 1" (25 mm) — see illustration.



REMOVING THE BEARING HOUSING
Tool 839027

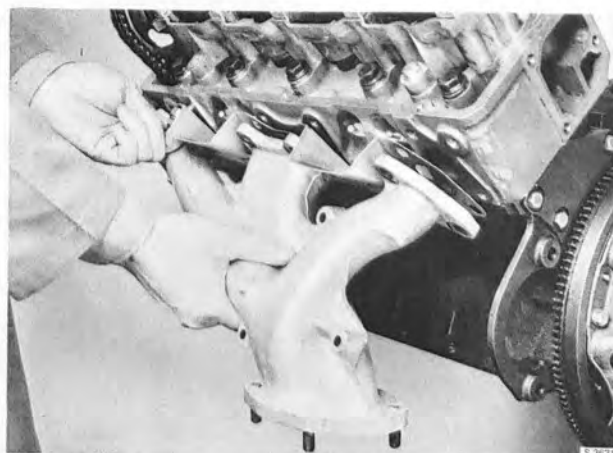
11. Remove the thermostat housing.



THERMOSTAT HOUSING (INJECTION ENGINE)

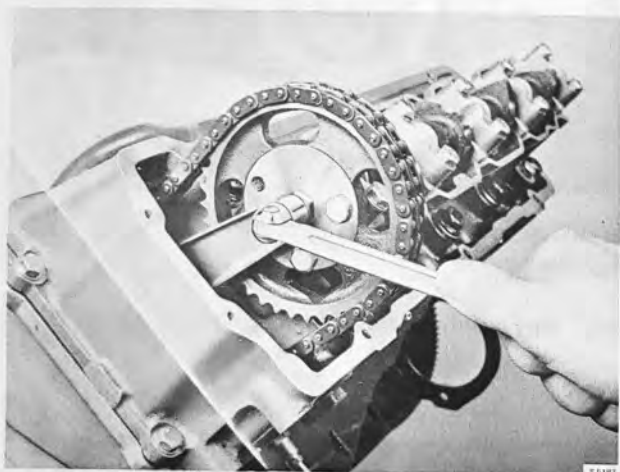
1. Thermoswitch for the injection system
2. Temperature transmitter for the temperature gauge
3. Temperature transmitter for the injection system
4. Auxiliary air regulator

12. Unbolt the exhaust manifold with gasket.



REMOVING THE EXHAUST MANIFOLD

13. Remove the camshaft sprocket as follows:
 - a. Turn the crankshaft to ignition position for No. 1 cylinder.
 - b. Screw a M8 nut on to the threaded center stud of the camshaft sprocket and tighten the center stud against the mounting plate provided for the purpose.



NUT MOUNTED ON THE CENTER STUD

CAUTION

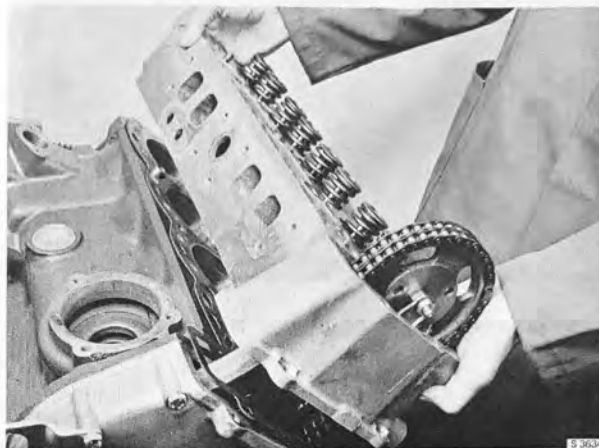
Tighten the nut securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be replaced in position.

- c. Undo the three locked retaining screws from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs free on the center stud in the mounting plate.
14. Remove the camshaft bearing caps and lift out the camshaft.
15. Remove the valve depressors and adjusting pallets from the camshaft bearing assembly using magnetic tool 839140.



REMOVING THE VALVE DEPRESSORS
Tool 839140

16. Remove the camshaft bearing assembly.
17. Unscrew all cylinder head screws and insert two locating pins (839212).
18. Lift off the cylinder head and remove the gasket.



REMOVING THE CYLINDER HEAD

19. Loosen the belt pulley screw and remove the belt pulley, using tapping-out hammer 839027 and puller 839215.

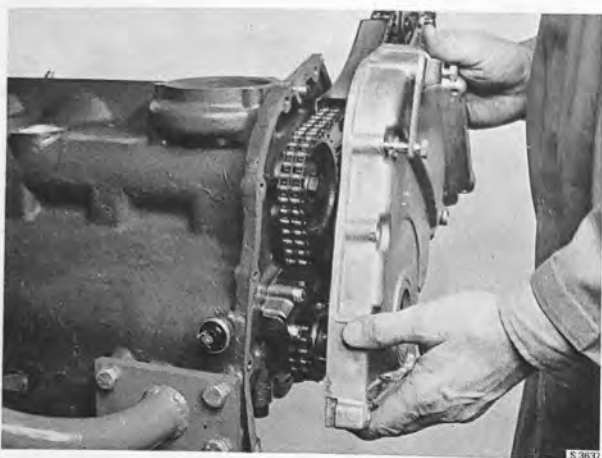


REMOVING THE BELT PULLEY SCREW



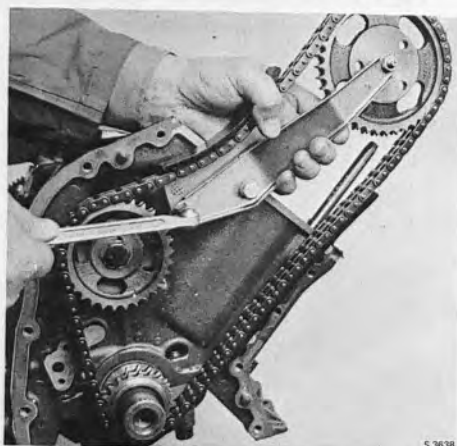
REMOVING THE BELT PULLEY
Tools 839027 and 839215

20. Remove the chain transmission cover.



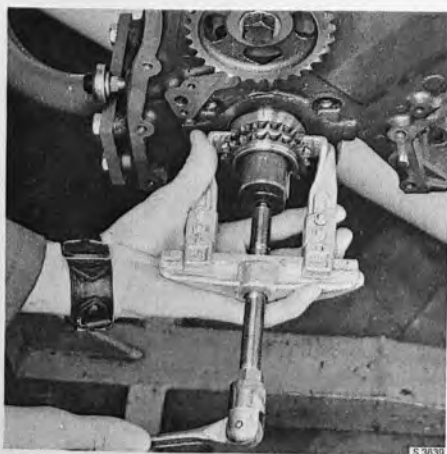
REMOVING THE CHAIN TRANSMISSION COVER

21. Remove the chain tensioner.
22. Undo the chain guides, the mounting plate with the camshaft sprocket and transmission chain.



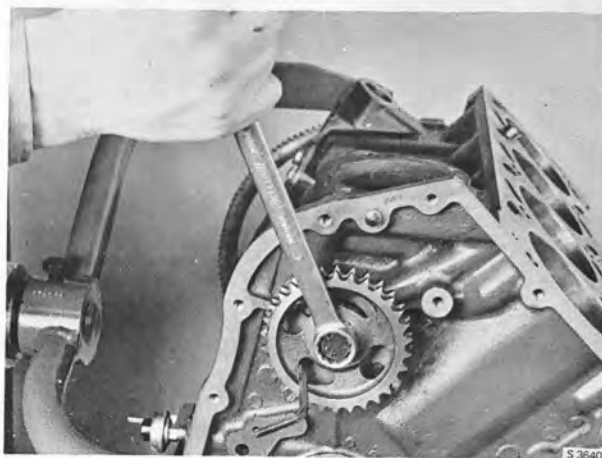
REMOVING THE TRANSMISSION PLANT

23. Remove the crankshaft sprocket using universal puller and dolly 839184.



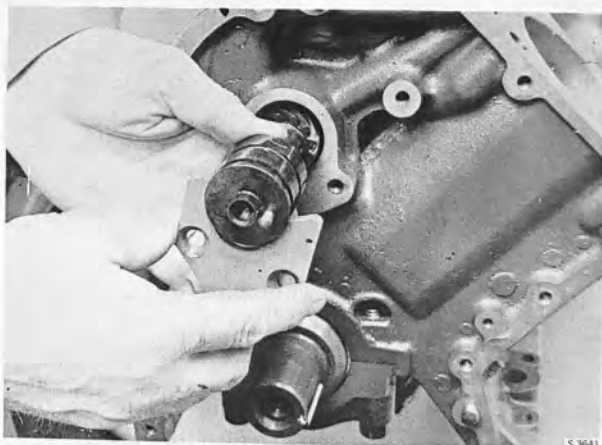
REMOVING THE CRANKSHAFT SPROCKET
Tool 839184 and universal puller

24. Remove the idler shaft sprocket. See illustration.



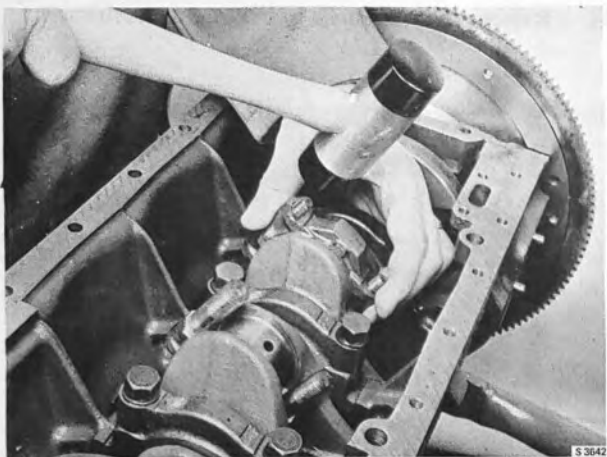
REMOVING THE IDLER SHAFT SPROCKET

25. Unscrew the idler shaft keeper plate and carefully withdraw the idler shaft.



REMOVING THE KEEPER PLATE

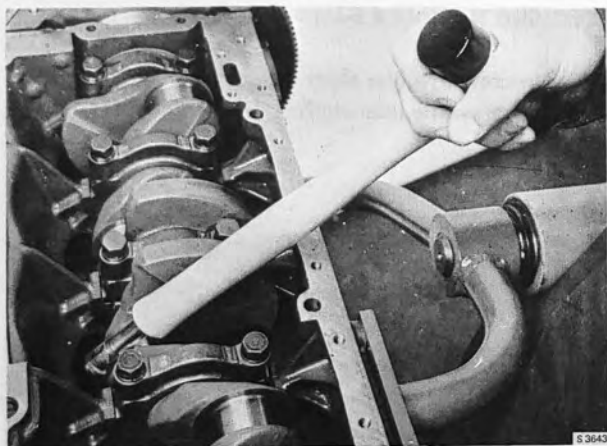
26. Carefully remove any crusts and deposits of soot from the top ends of the cylinders.
27. Note the markings on the connecting rods and big-end bearing caps so that they can be reassembled later in their original positions. Remove the nuts and bearing caps and push the pistons complete with connecting rods out of the cylinders (see illustration). Protect the stud threads with pieces of plastic hose when dismantling pistons and connecting rods.
For instructions with regard to exchanging pistons see page 210—21.



REMOVING THE BEARING CAPS



REMOVING THE GABLE PLATE



REMOVING PISTON AND CONNECTING ROD

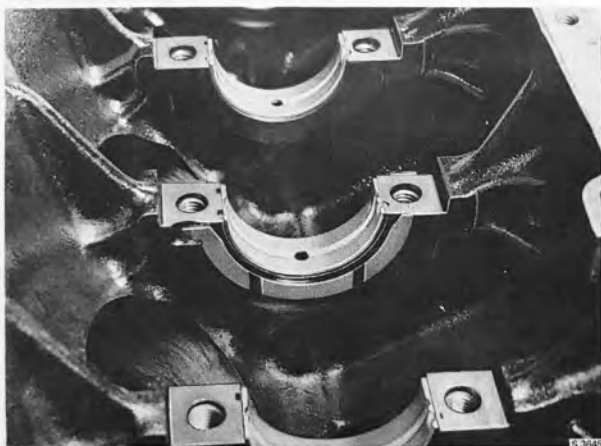
31. Undo the main bearing screws and remove the bearing caps.
32. Lift out the crankshaft.
33. Remove the bearing halves and thrust bearing washers and put them carefully aside so that they can be reassembled in their original positions.

28. Replace the big-end bearings and caps loosely on the connecting rods from which they came.
29. Manual transmission:
Dismantle the clutch and flywheel.
29. Automatic transmission:
Remove the driver disc.
30. Remove the gable plate and shaft seal.

Assembling the engine

Instructions for measuring the main bearing and big-end bearing clearance and choice of bearing halves, see section 216.

1. Place the bearing halves in the main bearing journals and lubricate the bearings with engine oil.
2. Locate the crankshaft carefully in the bearing journals.



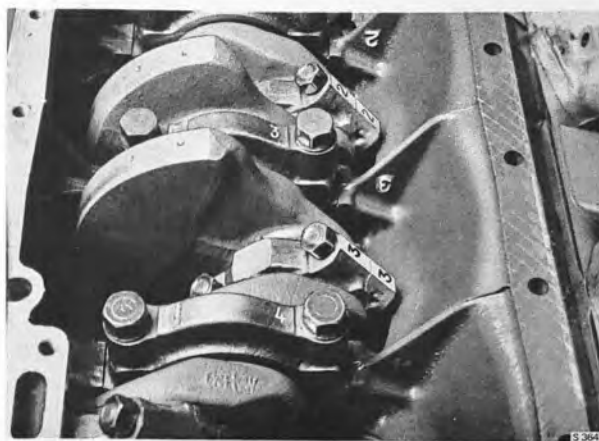
LOCATION OF THRUST BEARING WASHERS

3. Locate the thrust bearing washers, making sure that the oil grooves face the crankshaft bearing surfaces. Check the axial play with a feeler gauge.



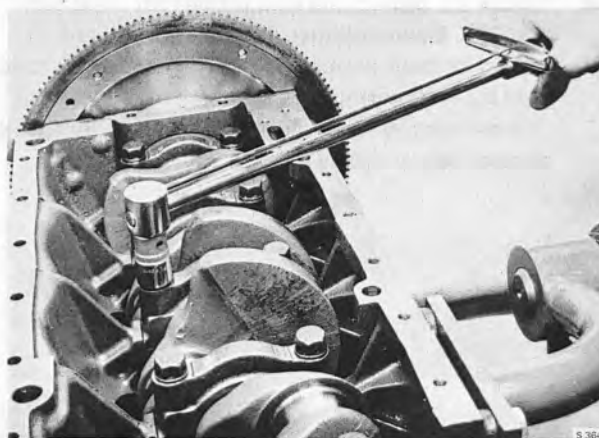
INSTALLING THE THRUST BEARING

4. Mount the main bearing caps with bearing halves already in position and oiled. (NOTE! Make sure the markings match up!) The main bearing caps are numbered; No. 1 goes at the transmission chain end and the others run consecutively to the fly-wheel end with the bearing locks facing each other. To each number on the bearing caps, corresponds a cast number on the crankcase.



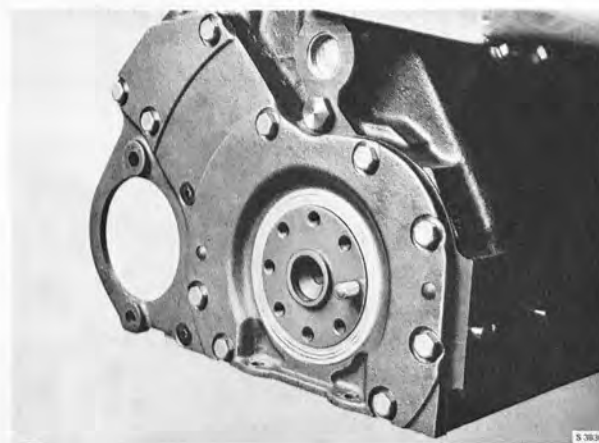
MARKS ON CONNECTING RODS, MAIN BEARINGS AND CYLINDER BLOCK

5. Tighten the screws to the specified torque.



TIGHTEN THE MAIN BEARING SCREWS

6. Fit the gable plate with the crankshaft seal, using guide sleeve 839197. Lubricate the inner surface of the seal ring.



GABLE PLATE FITTED

7. Fit the flywheel (driver disc). Apply Loctite Pipe Sealant 68 or the equivalent to the screw threads.



TIGHTEN THE FLYWHEEL SCREWS TO SPECIFIED TORQUE

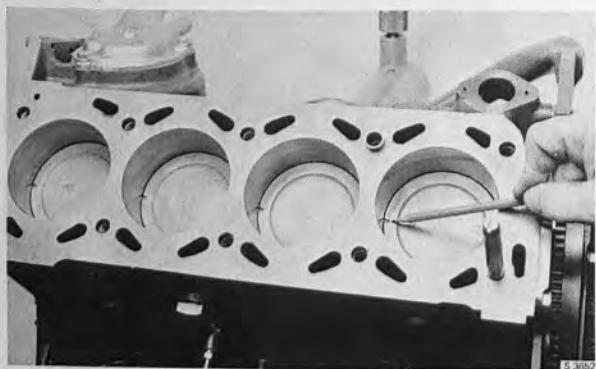
8. Install the pistons and connecting rods using tool 786228. Make sure that the studs are still protected by their plastic sleeves. The connecting rods and big-end bearing caps are numbered to match the corresponding cylinders. Instructions for fitting piston rings are given on page 210–22.



INSTALLING PISTON AND CONNECTING ROD
Tool 786228

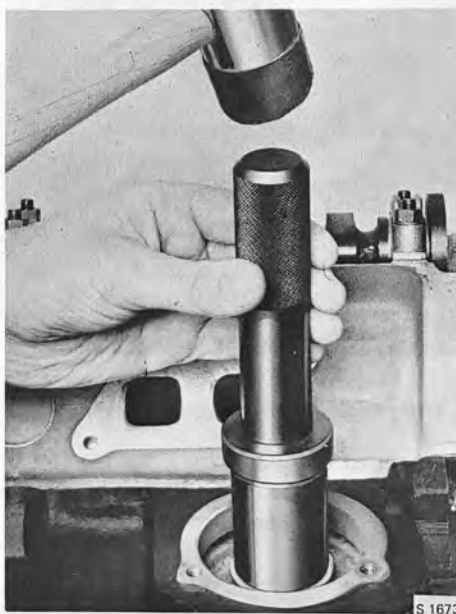
NOTE

The groove on top of the piston should be facing the transmission end.



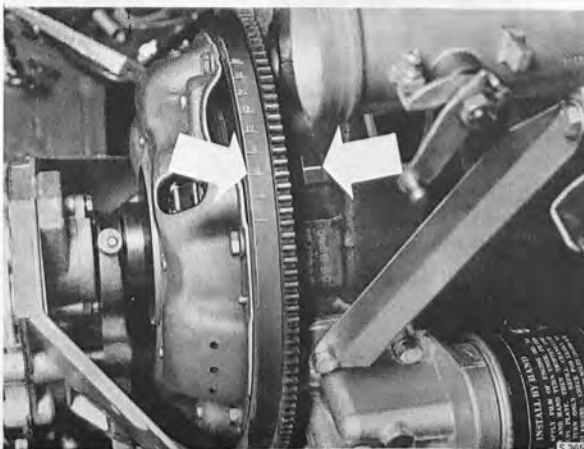
PISTON MARKINGS

9.
 - a. Fit the big-end bearing caps so that the figures face the same way as those on the connecting rod, i.e. away from the idler shaft.
 - b. Tighten to specified torque.
10.
 - a. Assemble the idler shaft and fit the keeper plate.
 - b. Mount the sprocket on the idler shaft.
11. Install the pump shaft with bearing housing without impeller in the engine block. Check that the cogs of the pump shaft engages with the idler shaft sprocket. Position the bearing housing with aid of drift 839044, sleeve 839053 and hammer, so that the flange of the bearing housing is flush with the engine block. Fit the impeller, the gasket and the water pump cover.



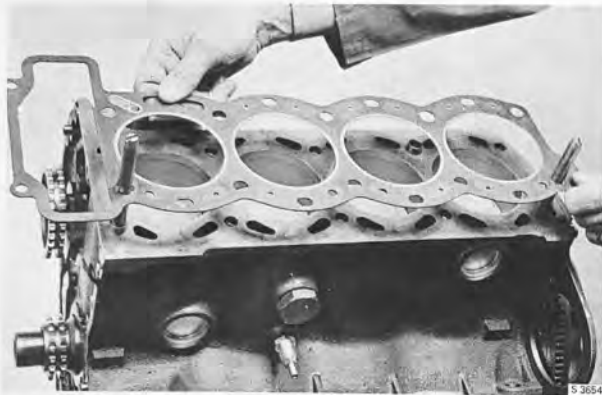
INSTALLING THE WATER PUMP
Tools 839044 and 839053

12.
 - a. Mount the sprocket on the crankshaft.
 - b. Align the 0 degree mark on the flywheel with the mark on the cylinder block.



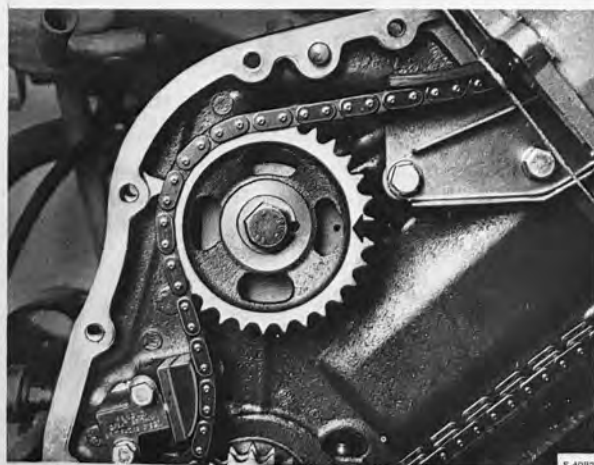
FLYWHEEL AND CYLINDER BLOCK MARKINGS

13. Fit the cylinder head gasket. Two locating pins 839212 for the cylinder head shall be fitted.

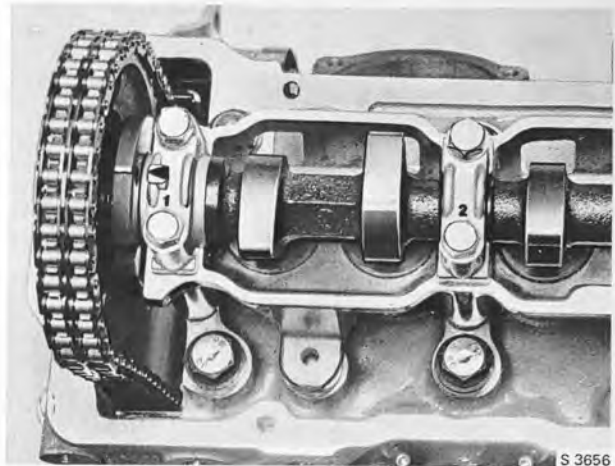


FITTING THE CYLINDER HEAD GASKET
Tool 839212

14.
 - a. Mount the cylinder head.
 - b. Tighten the screws in two steps, first to 59 Nm (6 kpm, 43 ft.lb.) then to 93 Nm (9.5 kpm, 69 ft.lb.). The order is shown in the drawing below, see page 210–23.
 - c. Do the final tightening after the engine has been allowed to cool for about 30 minutes.
15. Mount the camshaft bearing assembly.
16. Mount the adjusting pallets and valve depressors.
17. Fit the camshaft.
18. Fit the camshaft bearing caps. Note the marks and guide sleeves.
19. Mount the straight chain guide plate.
20. Check that the setting marks on the crankshaft, camshaft and idler shaft are in the right position, i.e. the ignition position for the first cylinder.

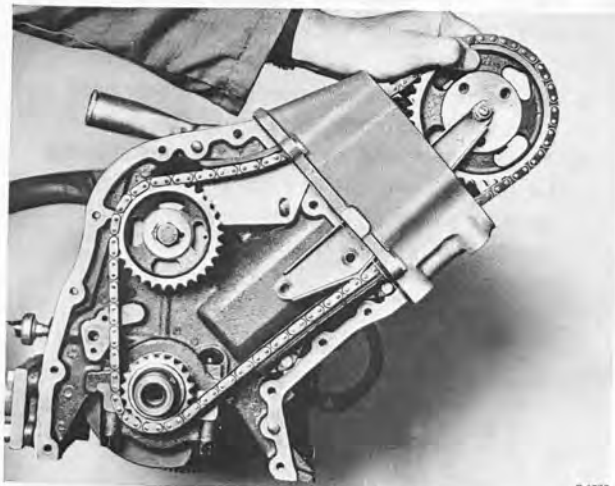


IDLER SHAFT MARKING. THE BULGE IN THE HOLE ON THE IDLER SHAFT CHAINWHEEL SHOULD LINE UP WITH THE SMALL HOLE IN THE KEEPER PLATE.



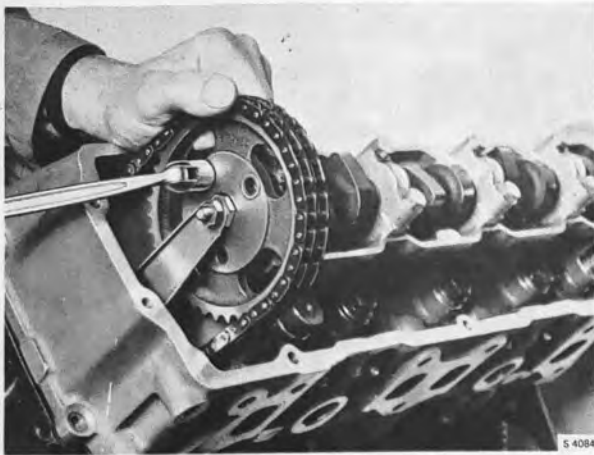
CAMSHAFT MARKINGS

21. Assemble the camshaft sprocket and mounting plate if they have been disassembled, fit the transmission chain over the camshaft sprocket, and lower the transmission chain and mounting plate

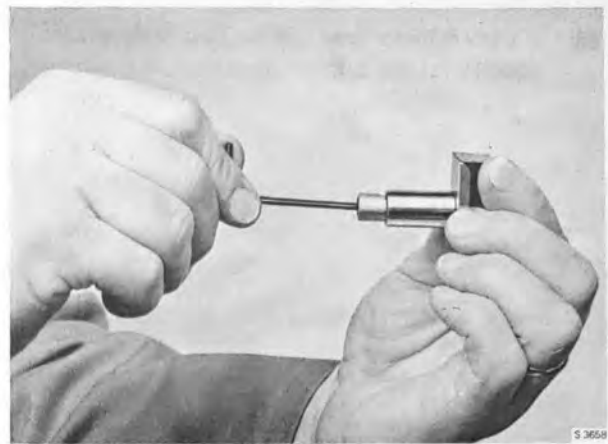


INSTALLING THE TRANSMISSION CHAIN

22. Rotate the camshaft sprocket until the screw holes match the threaded holes in the camshaft flange.
23. Fit the transmission chain over the other sprockets so that it hangs straight from the camshaft to the crankshaft.
- NOTE! The shaft settings must not be altered.
24. Guide the center stud of the camshaft sprocket into the camshaft. Fit a new locking plate and screws.



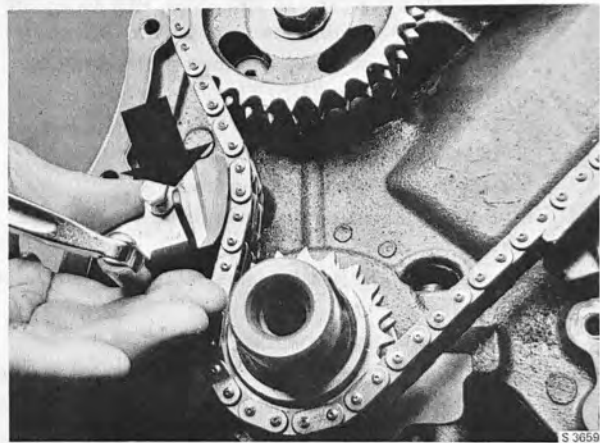
FITTING THE CAMSHAFT SPROCKET



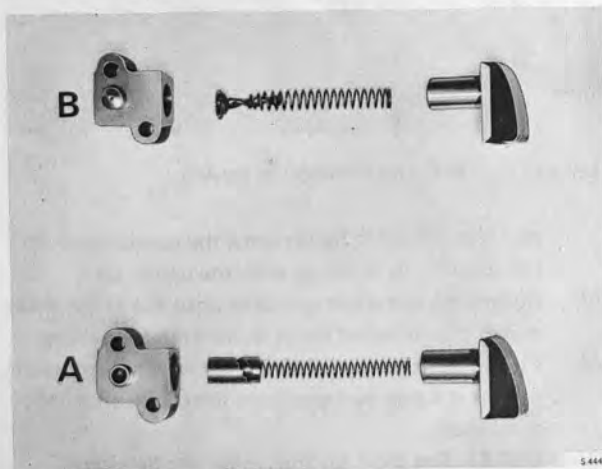
LOCKING THE RATCHET SLEEVE

25. Mount the curved chain guide plate together with the mounting plate (the chain guide plate nearest the block) with two screws and stretch the chain somewhat.
26. Check the setting "camshaft-crankshaft-idler shaft".
27. Fit the chain tensioner. There are two different versions, see illustration. Fit as follows:
Earlier version:
 - a. Before installation, remove the tensioner neck from the chain tensioner housing.
 - b. Tension the spring, by turning the ratchet sleeve (actuated by the spring) clockwise and at the same time pushing it until it locks in its innermost position.

- c. Fit the tensioner neck and a spacer piece, so that the tensioner neck will not bottom in the chain tensioner housing and release the self-adjuster.



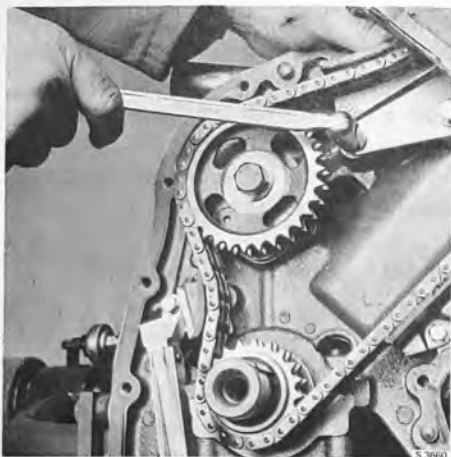
CHAIN TENSIONER WITH SPACER PIECE



CHAIN TENSIONER

- A. Earlier version
- B. Later version

- d. Mount the chain tensioner with guide plate on the engine block.
- e. Press the curved chain guide against the chain to stretch it and push the tensioner neck against the spacer piece. Remove the spacer piece while the chain is kept tensioned. Then adjust to leave a clearance of 0.02" (0.5 mm) between the housing and the tensioner neck. Tighten the chain guides.



ADJUSTING THE PLAY

- f. Rotate the crankshaft one full turn in its normal sense and check the chain tension. The movement of the tensioner neck from its butted position must be at least 0.02" (0.5 mm) and not more than 0.06" (1.5 mm).
- Later version:
- a. Place the lock washer in the chain tensioner housing.
 - b. Fit the spring, with the smaller end against the lock washer.
 - c. Fit the tensioner neck in the housing by simultaneously pressing and turning it.
 - d. Keep the tensioner neck depressed and tighten the chain tensioner with guide plate on the engine block. The tensioner neck must be kept depressed until the chain has been tightened.
 - e. Adjust the curved chain guide plate so that the clearance between the tensioner neck and the chain tensioner housing will be 0.02–0.06" (0.5–1.5 mm).
 - f. Tighten the chain guides. Rotate the crankshaft one full turn, checking the clearance of the tensioner neck.
28. Remove the nut from the camshaft sprocket center stud.
 29. Fit the transmission chain cover and alternator support.
 30. Fit the belt pulley.
 31. Mount the oil pump spacing piece with gasket. Note the guide pins!
 32. Fit the oil pump suction line. Make sure that the suction tube gasket is the right way round.
 33. Fit the oil filter.
 34. Fit the inlet manifold. Connect water hoses and crankcase ventilation hoses. Screw in the engine lifting eye.
 35. Carbureted engine:
Mount the carburetor.
 35. Injection engine:
Mount the throttle valve housing and the start valve.



FITTING THE START VALVE

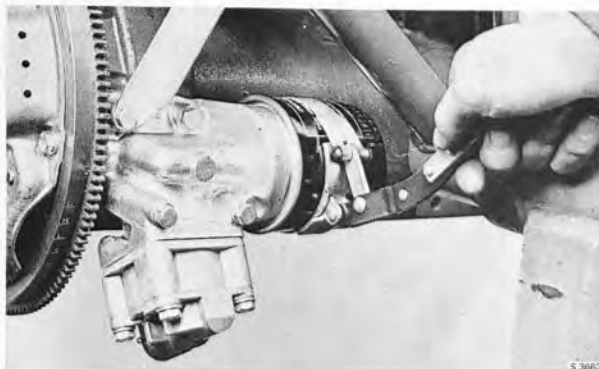
36. Mount the thermostat housing.
37. Fit the exhaust manifold with a new gasket.
38. Mount the distributor with drive shaft for the oil pump and make basic ignition setting. See group 3.
39. Fit the oil pump.
40. Mount the vent housing for the crankcase ventilation.
41. Fit the valve cover.
42. Mount the clutch. (Manual transmission)

Changing pistons, piston rings and big-end bearings

(Engine mounted in work stand)

Disassembly

1. Remove the oil filter using tool 786201.



REMOVING THE OIL FILTER

Tool 786201

2. Remove the valve cover.
3. Remove the camshaft sprocket as follows:
 - a. Turn the crankshaft to ignition position for No. 1 cylinder.
 - b. Screw a M8 nut on to the threaded center stud of the camshaft sprocket and clamp the sprocket against the mounting plate provided for the purpose.

CAUTION

Tighten the nut securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be refitted.

- c. Undo the two locked retaining screws from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs freely by its center stud in the mounting plate.
 - 4 a. Unscrew all cylinder head screws.
b. Remove the cylinder head screws and mount two guide pins.
c. Remove the screws from the transmission chain cover.
 5. Disconnect hoses and cables from the inlet manifold and carburetor. Unscrew the spark plugs.
 6. Lift off cylinder head with throttle valve housing, inlet manifold, exhaust manifold and valve mechanism.
 7. Remove the big-end bearing caps and push the pistons complete with connecting rods out of the cylinders. Protect the studs with pieces of plastic hose.
- NOTE! Remove any crusts and deposits of soot from the top ends of the cylinders.

Fitting pistons

To fit pistons to the cylinder bores, use a feeler gauge $1/2''$ wide and 0.013–0.038 mm thick. To measure, first oil the cylinder lining lightly and insert the piston without rings in the cylinder in the position in which it will ultimately be working. Attach the feeler gauge to a spring balance and place it between the piston and cylinder bore at right angles to the axis of the piston pin (see illustration). At a tractive force of 8–12 N (1.8–2.6 lb., 0.8–

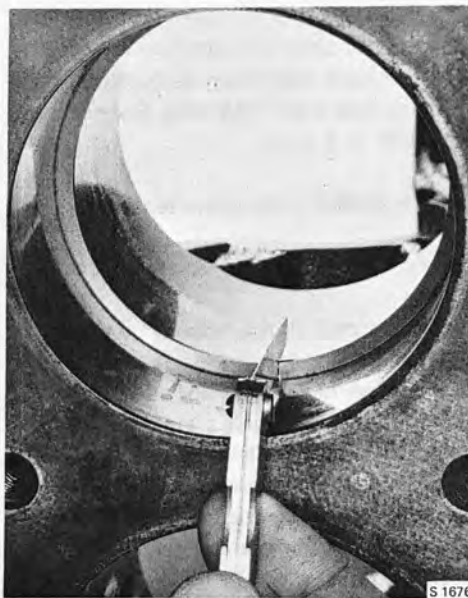


MEASURING PISTON CLEARANCE

1.2 kp), the mean value of the clearance equals the thickness of the feeler gauge. Repeat the test with the piston at several different depths on the piston. Spare pistons are stocked in both standard- and oversize diameters. Where the latter are used, the cylinder bore must be honed or rebored to obtain the correct piston clearance. Concerning piston clearance, see Group O.

Fitting piston rings in a new or rebored cylinder

1. Push the piston rings down into the cylinder one at a time, using an inverted piston head to position them correctly.
2. Measure the ring gap with a feeler gauge (see illustration). Correct gap sizes are given in the specifications. If necessary, widen the gap with a special file.



MEASURING PISTON RING GAP

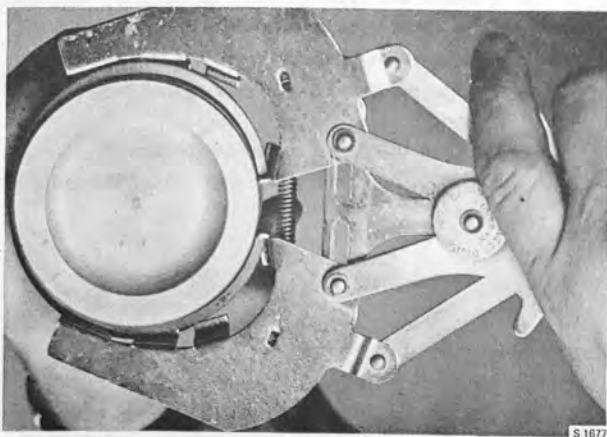
3. Try the piston rings in their respective grooves by rolling. Measure the clearance at a few points too.

Fitting piston rings in worn cylinders

Rings to be fitted in a worn cylinder must be tried at the lower limit of travel of the piston, as the bore will be narrowest at this point.

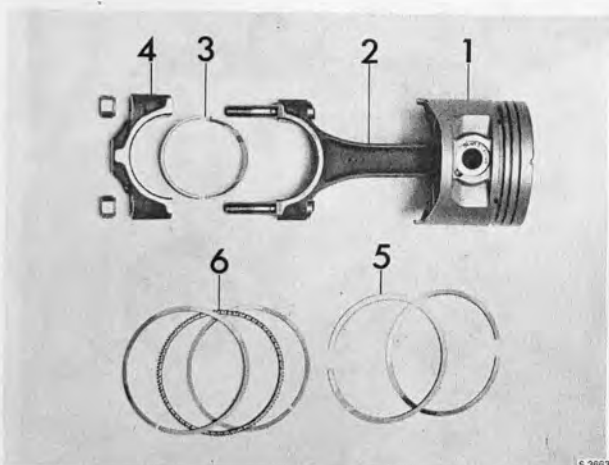
Assembly of piston rings

Use a piston ring tool to position the rings as illustrated. Place the lower compression ring with the side marked



PISTON RING TOOL

"top" uppermost. Oil the piston and rings before assembling. Rotate the compression rings so that the gaps are staggered 180°, one in line with each end of the piston pin. Make sure, too, that the spring gaps of the top and bottom rings in the three-piece scraper ring are staggered.



PISTON AND CONNECTING ROD WITH BEARINGS AND PISTON RINGS

1. Piston
2. Connecting rod
3. Bearing
4. Bearing cap
5. Compression rings
6. Three-piece oil scraper ring

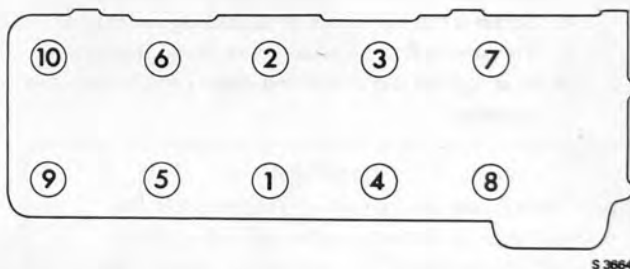
Installation

1. Install pistons and connecting rods using the piston installing tool No. 786228.

NOTE

The groove on top of the piston should be facing the transmission end.

2. Mount big-end bearing caps with bearing halves.
3. Fit the cylinder head gasket.
4. Check that the mark on the camshaft is in line with the marks on the first camshaft bearing cap.
5. Mount the cylinder head. Remove the guide pins and refit the screws. Tighten the cylinder head screws to the specified torque in two steps; first to 59 Nm (6 kpm, 43 ft.lb.) and then 93 Nm (9.5 kpm, 69 ft.lb.). The order of tightening is illustrated below. Tighten finally after the engine has been warmed up and then cooled off for about 30 minutes. Insert and tighten the transmission chain cover screws. Screws are re-tightened after 2.000 and 10.000 km (1.200 and 6.000 miles).



ORDER OF TIGHTENING, CYLINDER HEAD SCREWS

6. Fit the camshaft sprocket to the camshaft, making sure that the notches on the camshaft and bearing cap are in line. Tighten and lock the retaining screws. Remove the nut from the center stud of the camshaft sprocket. Check at the same time that the mark on the flywheel is in line with the mark on the cylinder block.
7. Mount the valve cover.
8. Connect hoses and cables to the valve cover, inlet manifold and throttle valve housing. Screw in the spark plugs and connect the ignition cables.
9. Install the oil filter.

CYLINDER HEAD

1,7 and 1,85 l engines

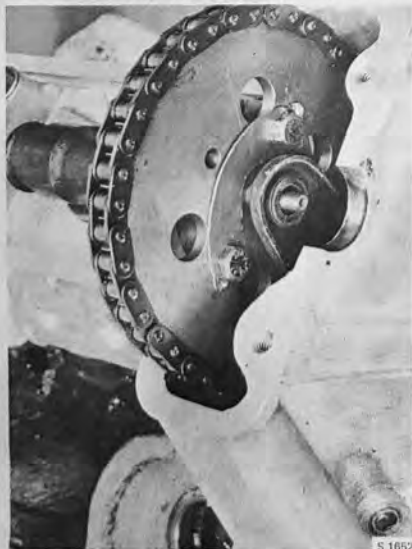
Disassembly (Engine in car)

1. Disconnect the battery cables.
2. Drain off coolant through the radiator and engine block drain cocks, and open the heater core bleeder cock.
3. Disconnect the power assist cylinder vacuum hose from the inlet manifold and pull the fuel hose off the fuel pump. In the case of injection engines, disconnect the fuel hoses from the nipples at the inlets and outlets of the injection valves.
4. Disconnect the cable from the temperature transmitter.
5. Remove the preheater cover and hose, take off the air cleaner and disconnect the throttle control.
6. Undo the hose clamps at the connections to the thermostat housing, water pump and inlet manifold.
7. Disconnect the choke control cable from the carburetor on carburetor engines.
8. Unbolt the exhaust pipe from the exhaust manifold.
9. Remove the distributor cap and ignition cables. In 1968-69 models, remove the side and torsion stays as well.
10. Remove the camshaft cover and gaskets.
11. Remove the camshaft chainwheel as follows:
 - a. Screw a nut on to the threaded center stud of the camshaft chainwheel and clamp the center stud against the mounting plate provided for the purpose.

CAUTION

Tighten the nut securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the chain wheel cannot be refitted. The chain tensioner cannot be reset without lifting the engine out of the car.

- b. Undo the two locked retaining screws from the camshaft chainwheel. Separate the wheel from the camshaft plate until it hangs free in the mounting plate by the center stud.



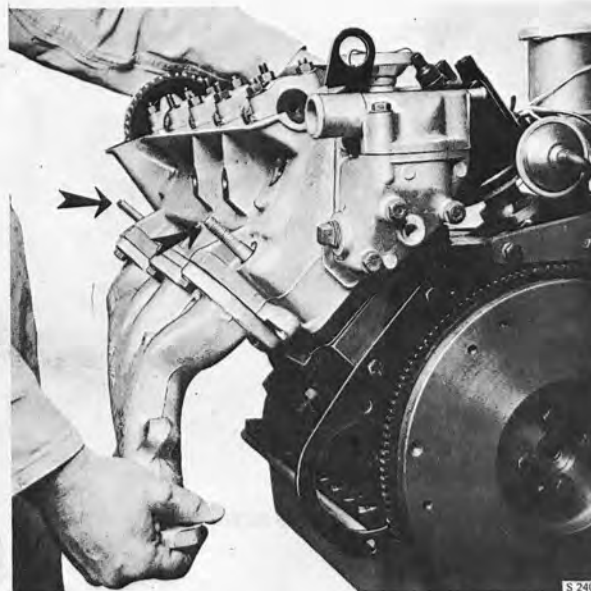
CAMSHAFT CHAINWHEEL RETAINING SCREWS

12.
 - a. Unscrew all cylinder head screws and nuts.
 - b. Remove the cylinder head screws.
 - c. Using tools 839051 and 839052, remove two studs and insert these in two of the cylinder head screw holes to act as locating pins (see illustration).
 - d. Remove the transmission cover screws.
 - e. Remove the other studs and lift off the cylinder head.



REMOVING STUDS

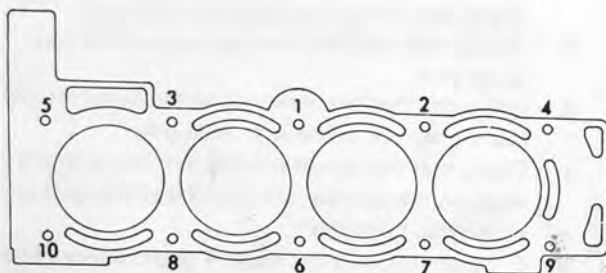
Tools 839051 and 839052



STUDS AS LOCATING PINS FOR REMOVAL AND MOUNTING OF CYLINDER HEAD

Assembling

1. Carefully scrape off old gasket material from the contact surfaces (emery cloth must not be used). Check that the contact surfaces are plane.
2. Fit the new cylinder head gasket over the two studs acting as locating pins.
3. Make sure that the markings on the camshaft and bearing cap are in line with each other.
4. Check that the flywheel mark is in line with the mark on the cylinder block and that the ignition is set on No. 1 cylinder.
5. Mount the cylinder head. Screw in the studs using tools 839051 and 839052. Tighten the cylinder head screws and nuts to the specified torque. The order of tightening is shown in the illustration. Insert and tighten the transmission chain cover screws.



ORDER OF TIGHTENING FOR CYLINDER HEAD SCREWS

- a. Tighten the cylinder head nuts and screws in two stages in the order indicated below.
The following torques apply:

1st stage	Nuts (top row)	30 Nm	22 ft.lb. (3 kpm)
	Screws	5 Nm	3 1/2 ft.lb. (0.5 kpm)
2nd stage	Nuts	74 Nm	54 ft.lb. (7.5 kpm)
	Screws	74 Nm	54 ft.lb. (7.5 kpm)
- b. Warm up the engine, then let it cool off for about 30 minutes. Tighten to 74 Nm (54 ft.lb., 7.5 kpm) in the prescribed order. Loosen each screw and nut before tightening to the prescribed torque.
- c. Cylinder head screws and nuts should be retightened as in b. above after 1,200 miles (2,000 km) and 6,000 miles (10,000 km) driving.
6. Mount the camshaft chainwheel on the camshaft. Unscrew the nut from the center stud of the chainwheel and lock both the retaining screws.

CAUTION

The nut on the camshaft chainwheel center stud must not on any account be unscrewed before the chainwheel is tightly screwed to the camshaft.

7. Fit the gaskets and camshaft cover.
8. Fit the distributor cap complete with ignition cables.
9. Bolt the exhaust pipe to the exhaust manifold.
10. Connect the throttle and choke control cables. (Carburetor engines)
11. Connect the hoses to the thermostat housing, water pump and inlet manifold and tighten the hose clamps.
12. Mount the preheater cover, hose and air cleaner.
13. Mount the air cleaner and connect the throttle control.
14. Connect the cables to the ignition coil and temperature transmitter.
15. Connect the vacuum hose from the intake manifold to the power assist cylinder. Connect the fuel hoses.
16. Close the drain cocks and fill with coolant. Bleed the heater core.
17. Connect the battery cables.

TORQUES
p. 020-410

Exh Manifold-Head 27 ft-lb

Exh Pipe-Exh Manifold 15 ft-lb

Intake Manifold-Head 18 ft-lb

CAMSHAFT BEARING CAPS 17 ft-lb

CAMSHAFT COVER 1.5

SPARK PLUGS 15 ft-lb

CAMSHAFT CHAINWHEEL 10

THERMOSTAT HOUSING 18

CYLINDER HEAD

2.0 l engine

Disassembly

(Engine in car)

1. Disconnect the battery cables.
2. Drain off coolant through the radiator and engine block drain cocks, and open the heater core bleeder cock.
3. Remove the aircleaner and the throttle control wire. (Also the choke control wire on carbureted engines.)
4. Disconnect the cable from the temperature transmitter.
5.
 - a. Detach the vacuum hose of the power assist cylinder from the inlet manifold.
 - b. Carbureted engine:
Detach the fuel hose and the vacuum hose from the carburetor.
 - b. Injection engine:
Detach the fuel hoses from the nipples at the inlets and outlets of the injection valves.
6. Undo the hose clamps at the connections to the thermostat housing, water pump and inlet manifold.
7. Unbolt the exhaust pipe from the exhaust manifold.
8. Remove the distributor cap and ignition cables.
9. Remove the valve cover.
10. Remove the camshaft sprocket as follows:
 - a. Screw a M8 nut on to the threaded center stud of the camshaft sprocket and clamp the center stud against the mounting plate provided for the purpose.

CAUTION

Tighten the nut securely to immobilize the center stud. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be refitted. The chain tensioner cannot be reset without lifting the engine out of the car.

- b. Undo the retaining screws from the camshaft sprocket. Separate the wheel from the camshaft plate until it hangs free in the mounting plate by the center stud.
11.
 - a. Unscrew and remove all cylinder head screws.
 - b. Mount two guide pins (tool 839212), in two of the cylinder head screw holes.
 - c. Remove the screws at the transmission cover.
 - d. Lift off the cylinder head.



LIFTING OFF THE CYLINDER HEAD

Assembling

1. Carefully scrape off old gasket material from the Check that the contact surfaces are plane.
2. Fit the new cylinder head gasket over the two guide pins.
3. Make sure that the markings on the camshaft and bearing cap are in line with each other.
4. Check that the flywheel mark is in line with the mark on the cylinder block and that the ignition is set on No. 1 cylinder.
5.
 - a. Mount the cylinder head. Tighten the cylinder head screws to the specified torque in two stages. The order of tightening is shown in the illustration on page 210-23. Insert and tighten the transmission chain cover screws. Retighten after the engine has been warmed up and then cooled off for about 30 minutes.
 - b. Screws are retightened after 2.000 and 10.000 km (1.200-6.000 miles).
6. Mount the camshaft sprocket on the camshaft. Unscrew the nut from the center stud of the sprocket.

CAUTION

The nut on the camshaft sprocket center stud must not on any account be unscrewed before the sprocket is tightly screwed to the camshaft.

7. Fit the valve cover. Undamaged gasket can be re-mounted.
8. Fit the distributor cap complete with ignition cables.
9. Bolt the exhaust pipe to the exhaust manifold.
10. Connect the throttle control cable.
11. Connect the hoses to the thermostat housing, water pump and inlet manifold and tighten the hose clamps.
12. Connect the vacuum hose from the inlet manifold to the power assist cylinder. Connect the fuel hoses.
13. Connect the cables to the ignition coil and temperature transmitter.
14. Mount the air cleaner.
15. Close the drain cocks and fill with coolant. Bleed the heater core.
16. Connect the battery cables.

VALVE MECHANISM

1,7 and 1,85 l engines

Removing the camshaft cover

1. Remove the preheater hose.
2. Disconnect the crankcase ventilation hose.
3. Detach the ignition cables from the cover and spark plugs.
4. Back off the six slotted screws and lift off the cover.

Replacing the camshaft cover

1. Fit the gasket. The original gasket may be reused if undamaged.
2. Fit the cover, insert and tighten the slotted screws.
3. Connect the ignition cables.
4. Connect the crankcase ventilation hose.
5. Install the preheater hose.

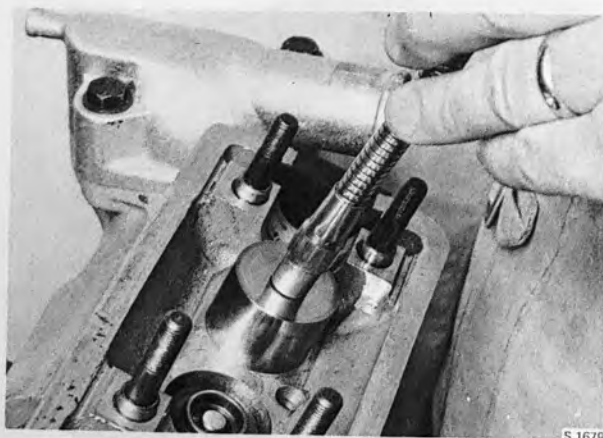
NOTE

Do not tighten the screws so hard that the cover is deformed – see tightening torques, group 0.

Disassembling the valves

(Cylinder head removed from cylinder block)

1. Remove the camshaft bearing caps.
2. Lift out the camshaft.
3. Withdraw the valve depressors, using the magnetic tool 839140, and lay them aside in the correct order.

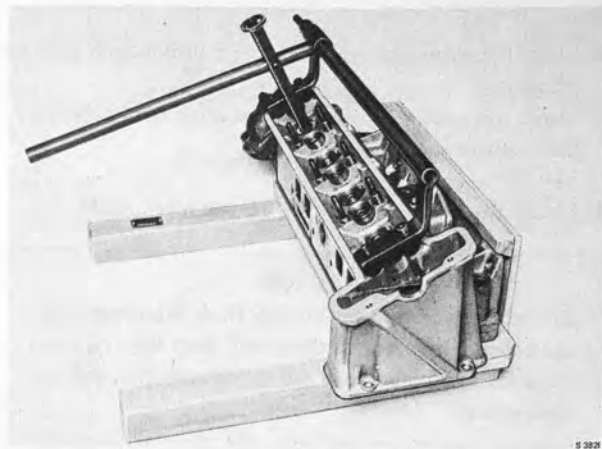


S 1678

WITHDRAWING VALVE DEPRESSOR

Tool 839140

4. Remove the adjusting pallets. Be careful not to mix them up.
5. Depress the valve spring using tool 839227 (see illustration).



S 3828

REMOVING VALVE SPRING

Tool 839227

6. Remove the valve locks (clips) and withdraw the tool.
7. Remove the top valve retainer, valve spring and spring seat.
8. Withdraw the valve spindle.

17 ft

Assembling the valves

1. Insert and oil the valve spindles.
2. Insert the spring seats.
3. Insert the springs with top retainers.
4. Depress the spring, using tool No. 839230 (see illustration), and fit the valve locks (clips). Then release the pressure on the spring and check that the clips are correctly positioned on the spindle. Remove the tool.

5. Insert adjusting pallets, replacing them in their original positions.
6. Insert the valve depressors, lubricating the bearing surfaces with engine oil.
7. Install the camshaft.
8. Install the bearing caps. (NOTE the markings!)

CAUTION

Do not turn or tip the cylinder head after inserting the valve depressors, as these will then slide out and the adjusting pallets will fall out of position and be randomized.

NOTE!

Machining the valve seat will only give the desired result if the valve guide is in good condition. So always check the play of the valve in its guide before starting work on the seat.

NOTE!

Correction milling must always be restricted to an absolute minimum. Material must never be milled off unnecessarily.

Changing valve seats

Changing the valve seats is only made by workshops, specialized on engine renovations. Valve seats are available as spare parts.

Changing valve guides

Removing

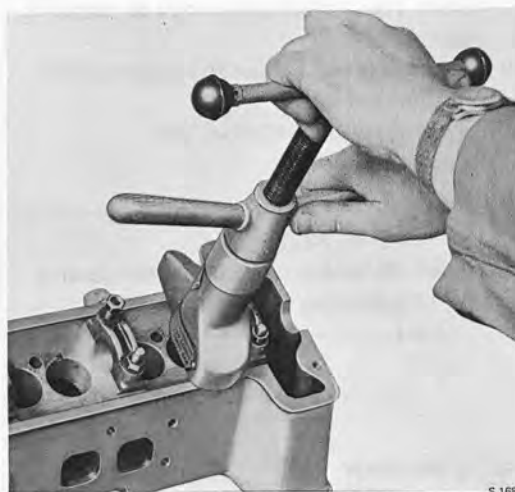
Before removing a valve guide, flush the cylinder head through with hot water. Withdraw the valve guide from the camshaft end using special tool 839043 with pull rod and nut (see illustration).

Installing

Install the new valve guide in the corresponding manner. First flush the cylinder head with hot water. Insert the guide from the cylinder end using special tool 839043 with pull rod, sleeve and nut (see illustration). Then ream the guide using special reamer 839038 to standard size.

Milling valve seats

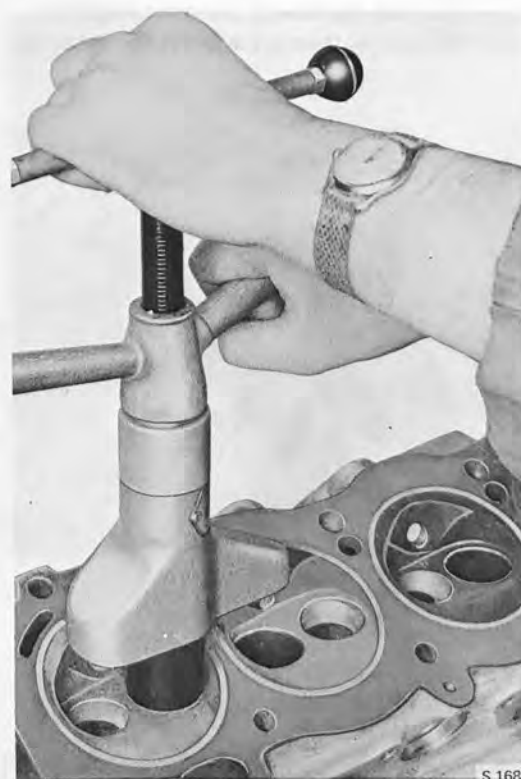
Clean all parts and remove all traces of soot and dirt from the valve and cylinder head duct. Insert the guide spindle, part of the set of cutters 839219, into the valve guide from the valve seat end and tighten the clamping screw until the guide spindle is securely clamped in the valve guide. The valve seats in the cylinder head are to be milled clean with a 45° cutter. It may be necessary to break up the hard surface of the exhaust valve seat first with an abrasive cloth. After being ground clean, the valve seat will usually be found to be too wide and must therefore be reduced. Reduce from inside with a 75° correcting cutter and from outside with an 1° correcting cutter. Adjust the reduction so that the contact surface of the valve seat touches the valve plate as close as possible to the center of the seat. This can conveniently be checked by the use of a marking dye. After adjustment, the seat width of both inlet and exhaust valves should be 0.087–0.098" (2.2–2.5 mm).



S.1682

REMOVING VALVE GUIDE

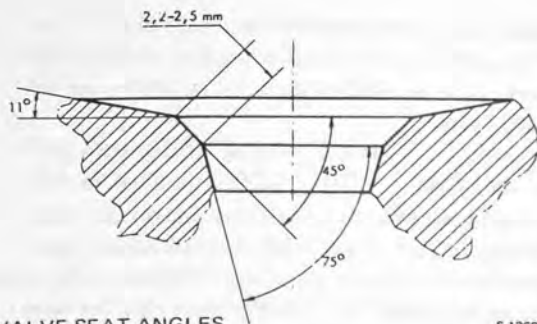
Tool 839043



S.1683

INSERTING VALVE GUIDE

Tool 839043



VALVE SEAT ANGLES

S 1269

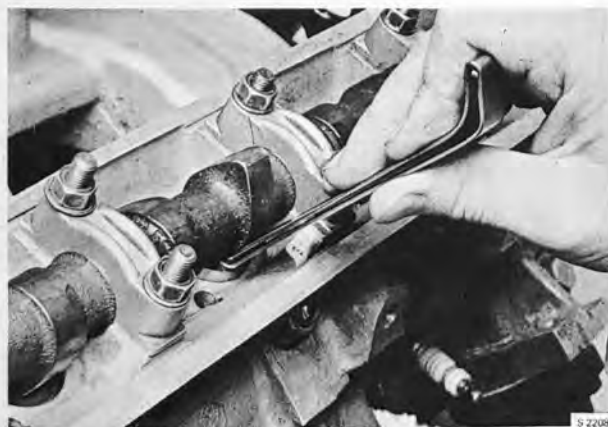
The condition of the valve will decide whether it can be machine ground or must be exchanged. The valve plate angle must be 45° .

Grinding valves

Smear a thin coat of grinding paste on the valve seat and insert the valve in the cylinder head. Make a few grinding movements with the grinding tool, clean all traces of paste off the seat, and check the fit with marking dye. Grind once more if required and finish by milling if necessary.

Checking valve clearance

Check the valve clearance with a feeler gauge (special tool 839141), comparing with the maximum and minimum tolerances. The tolerance limits for purposes of valve clearance checking are 0.006"–0.012" (0.15–0.30 mm) for inlet valves and 0.014"–0.020" (0.35–0.50 mm) for exhaust valves.



CHECKING VALVE CLEARANCE

Tool 839141

The procedure is as follows:

1. Remove the camshaft cover.
2. Lock the free wheel drive and engage 3rd gear. Push the car forward or backward to bring the camshaft cams into the correct measuring positions, i.e. with the cam of the valve to be measured pointing 180° away from the valve stem. Two cams will be in the measuring position at the same time.
3. Try the maximum and minimum clearances with feeler gauge 839141. The minimum feeler should slip in, but the maximum feeler should not. If this result is not obtained, the clearance must be measured for adjustment.
4. Refit the camshaft cover.

NOTE

To check and measure the valve clearance when the valves are in place in a car equipped with manual transmission, turn the camshaft by pushing the car forward or backward on the fourth gear to bring each cam in turn into position for measurement, i.e. pointing 180° away from the valve stem.

In cars with automatic transmission it is not possible to move the camshaft into position for measurement by pushing the car forward or backward. The following alternative methods are therefore recommended for checking the valve clearance in this case:

Alternative I:

Rotate the crankshaft using special wrench No. 839081 to bring the camshaft into position for measurement. This special wrench fits the center screw of the crankshaft belt pulley at the dash panel and can be used on all Saab 99 cars of 1970 or later model.

If the wrench is used on cars with manual transmission, the gear lever must be in the neutral position, as the screw is otherwise liable to come loose.

Alternative II:

1. Take out the spark plugs.
2. Disconnect the yellow cable (No. 84) from the starter and make a connection with a switch, e.g. a bell wire contact, between terminal 84 on the starter and the positive pole of the battery.
3. Turn the engine over by running the starter with the switch, switching off when a measurable cam position is obtained.

To turn the camshaft when the cylinder head has been removed from the engine, a grip for a hexagon wrench has been provided on the shaft between the fourth and fifth bearings (see illustration). This method of rotating the camshaft must not be used when the cylinder head is mounted on the engine.



ROTATING THE CAMSHAFT WITH CYLINDER BLOCK REMOVED FROM ENGINE

Measuring and adjusting valve clearance

If the clearance of any valve is found on checking to be outside the permissible limits, the clearance of all valves must be measured.

Adjustment of valve clearance is to be based on actual measurement. Measurements are made with tool 839145 and dial indicator 784062.

Adjust the deviation of the valve clearance from the correct value by changing the adjusting pallet.

The procedure for measurement and adjustment is as follows:

1. Turn the cam to the measuring position (180° from the valve stem).



MEASURING VALVE CLEARANCE

Tools 784062 and 839150

2. Mount tool 839145 and screw it on so that its triple claw grips the valve depressor (see illustration).
3. Mount the indicator dial 784062 in the tool so that the measuring point rests on the tip of the cam; zero the dial (see illustration).
4. Lift the valve depressor with the measuring tool and read off the deflection of the instrument pointer, which indicates the valve clearance. Note the reading.



MEASURING ADJUSTING PALLETS

Tools 784062 and 839163

5. Measure and note down the clearances of all valves in the same manner. Proceed to adjust the clearance of any valves in which it does not lie within the following limits:
Inlet valves 0.008"—0.010" (0.20—0.25 mm)
Exhaust valves 0.016"—0.018" (0.40—0.45 mm)
6. Remove the camshaft and the valve depressors and adjusting pallets of any valves needing adjustment.
7. Measure and make a note of the thickness of the pallet. (Special tool 839163.) This thickness plus the valve clearance adds up to the total distance between the valve and the cam.

Example:

Measured valve clearance	0.004" (0.12 mm)
Measured pallet thickness	0.099" (2.54 mm)
Total distance	0.103" (2.66 mm)

The choice of adjusting pallet is determined by the measured total distance between the valve depressor and the cam less the specified valve clearance for an intake or exhaust valve as the case may be.

Example:

Total distance	0.103" (2.66 mm)
Less specified inlet valve clearance	0.009" (0.23 mm)
Required pallet thickness	0.094" (2.43 mm)

8. Insert the new adjusting pallet and the valve depressor and install the camshaft.
9. Repeat the measurement procedure to check that the clearances are now correct.

CAUTION

Do not turn or tilt the cylinder head after inserting the valve depressors, as these will then slide out and the adjusting pallets will fall out of position and be randomized.

Measuring and adjusting valve clearance after valve reconditioning

1. Install adjusting pallets with a minimum thickness of 0.070" (1.77 mm).
2. Insert depressors and install the camshaft.
3. Measure the valve clearances, note the reading for each valve and calculate the total distance.
4. Select new pallets to give the correct clearances.
5. Remove the camshaft and depressors, take out the 0.070" (1.77 mm) pallets and insert new pallets to give the correct clearances.
6. Replace the depressors and reinstall the camshaft.
7. Check clearance measurements once more with the dial indicator. To make your choice of adjusting pallets easier, use the table on page 214—9.

VALVE MECHANISM

2.0 l engine

Removing the valve cover

1. Disconnect the crankcase ventilation hose.
2. Detach the ignition cables from the valve cover and spark plugs.
3. Back off the screws and lift off the cover.

Replacing the valve cover

1. Fit the gasket. The original gasket may be reused if undamaged.
2. Fit the cover.
3. Connect the ignition cables.
4. Connect the crankcase ventilation hose.

NOTE

Do not tighten the screws so hard that the cover is deformed — see tightening torques, group 0.

Disassembling the valves

(Cylinder head removed from cylinder block)

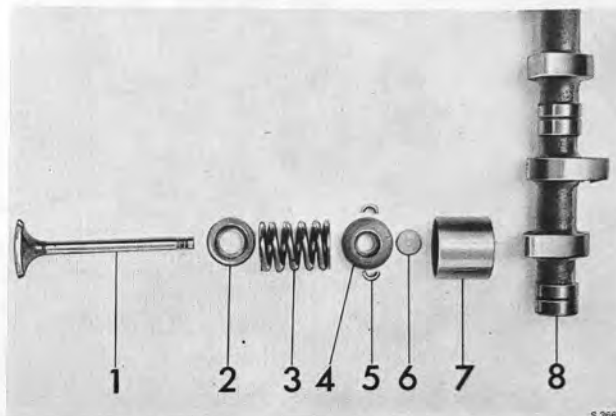
1. Remove the camshaft bearing caps.
2. Lift out the camshaft.
3. Withdraw the valve depressors, using the magnetic tool, and lay them aside in the correct order.
4. Remove the adjusting pallets. Be careful not to mix them up.
5. Remove the camshaft bearing assembly.
6. a. Depress the valve spring using a valve spring tool, 839227.



REMOVING THE VALVES

Tool 839227

- b. Remove the valve locks (clips), loosen the spring tension and withdraw the tool.
7. Remove the top valve retainer, valve spring and guide sleeve.
8. Withdraw the valve.



VALVE MECHANISM

1. Valve
2. Valve spring seat
3. Valve spring
4. Retainer
5. Lock
6. Adjusting pallet
7. Valve depressor
8. Camshaft

Assembling the valves

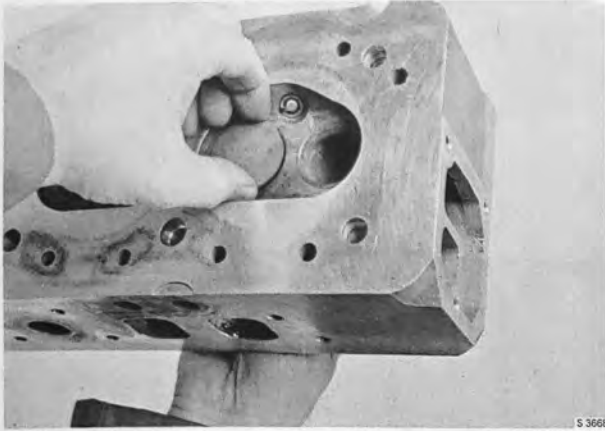
1. Insert and oil the valve spindles.
2. Insert the guide sleeve before the spring.
3. Insert the springs and top retainers.
4. Depress the spring, using a valve spring tool, and fit the valve locks (clips). Then release the pressure on the spring and check that the clips are correctly positioned on the spindle. Remove the tool.
5. Mount the camshaft bearing assembly.
6. Insert adjusting pallets, replacing them in their original positions.
7. Insert the valve depressors, lubricating the bearing surfaces with engine oil.
8. Install the camshaft.
9. Install the bearing caps. (NOTE the markings!)

CAUTION

Do not turn or tip the cylinder head after inserting the valve depressors, as these will then slide out and the adjusting pallets will fall out of position and be randomized.

Checking the valve guide wear

Pull out the valve about 0.12" (3 mm) from its seat and check the radial play of the valve, by rocking the valve disc. If the play exceeds 0.02" (0.5 mm), the valve guide is to be exchanged.



CHECKING THE VALVE GUIDE WEAR

Changing valve guides

Removing

Before removing a valve guide, flush the cylinder head through with hot water. Withdraw the valve guide from the camshaft end using special tool 839043 with pull rod and nut (see illustration).



REMOVING THE VALVE GUIDE
Tool 839043

Installing

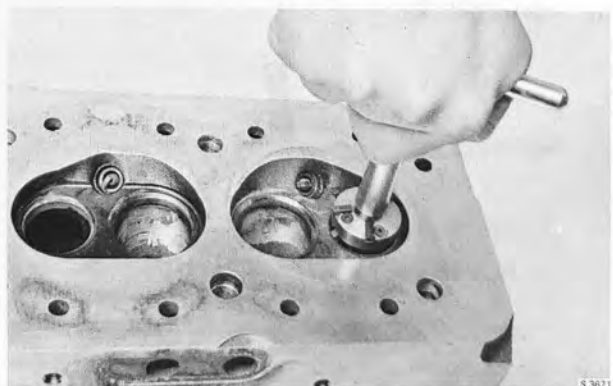
First flush the cylinder head with hot water. Insert the guide from the camshaft end using special tool 839043 attached on the combustion chamber end. For outlet valves, use sleeve 839037 and for inlet valves, use sleeve 839214. See illustration.



INSTALLING THE VALVE GUIDE
Tool 839043

Milling valve seats

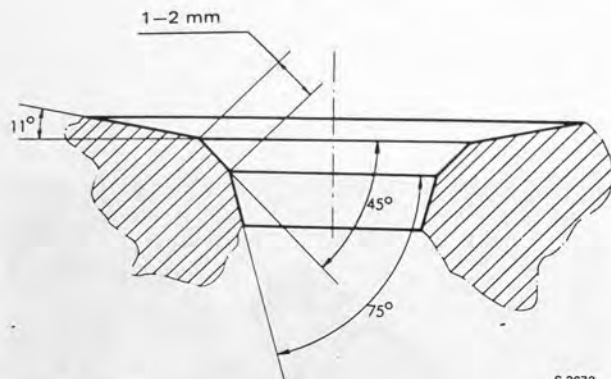
Clean all parts and remove all traces of soot and dirt from the valve and cylinder head duct. Insert the guide spindle, part of the set of cutters 839219, into the valve guide from the valve seat end and tighten the clamping screw until the guide spindle is securely



MILLING VALVE SEATS
Tool 839219

clamped in the valve guide. The valve seats in the cylinder head are to be milled clean with a 45° cutter. It may be necessary to break up the hard surface of the exhaust valve seat first with an emery cloth. After being ground clean, the valve seat will usually be found to be too wide

and must therefore be reduced. Reduce from inside with a 75° correcting cutter and from outside with an $11-12^{\circ}$ correcting cutter. Adjust the reduction so that the contact surface of the valve seat touches the valve plate as close as possible to the center of the seat. This can conveniently be checked by the use of a marking dye. After adjustment, the seat width of both inlet and exhaust valves should be $0.04-0.08''$ ($1-2$ mm).



VALVE SEAT ANGLES

The condition of the valve will decide whether it can be machine ground or must be exchanged. The valve plate angle must be 44.5° .

Grinding valves

Smear a thin coat of grinding paste on the valve seat and insert the valve in the cylinder head. Make a few grinding movements with the grinding tool, clean all traces of paste off the seat, and check the fit with marking dye. Grind once more if required and finish by milling if necessary.

Valve clearance

General

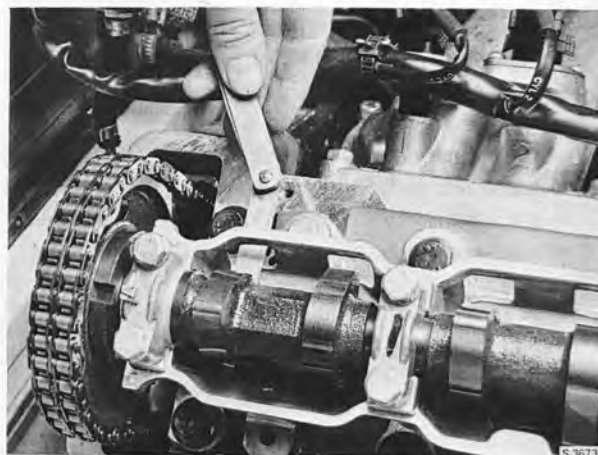
The valve clearance is stable and adjustment is needed only after a long time or when the valves are renovated. However, the valve clearance is to be checked at 6,000, 25,000 and 50,000 miles (10,000, 40,000 and 80,000 km).

Checking valve clearance

Check the valve clearance with a feeler gauge, comparing with the maximum and minimum tolerances. The tolerance limits for purposes of valve clearance checking are $0.006''-0.012''$ ($0.15-0.30$ mm) for inlet valves and $0.014''-0.020''$ ($0.035-0.050$ mm) for exhaust valves.

The procedure is as follows:

1. Remove the valve cover.
2. Engage 3rd gear. Push the car forward or backward to bring the camshaft cams into the correct measuring positions, i.e. with the cam of the valve to be measured pointing 180° away from the valve stem. Two cams will be in the measuring position at the same time.
3. Try the maximum and minimum clearances with feeler gauge. The minimum feeler should slip in, but the



CHECKING VALVE CLEARANCE

maximum feeler should not. If this result is not obtained, the clearance must be measured for adjustment.

4. Fit the valve cover.

Measuring and adjusting valve clearance

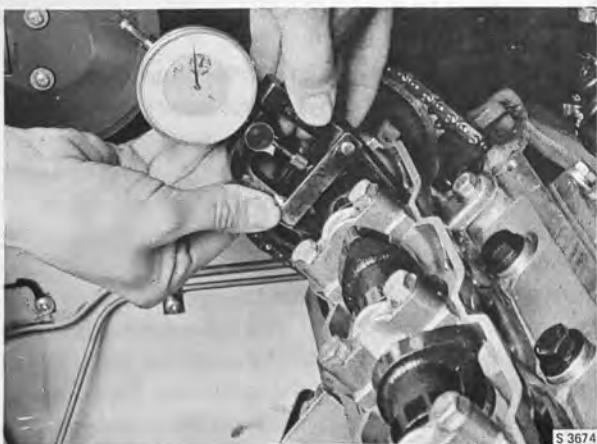
If the clearance of any valve is found on checking to be outside the permissible limits, the clearance of all valves must be measured.

Adjustment of valve clearance is to be based on actual measurement. Measurements are made with tool 839145 and dial indicator 784062.

Adjust the deviation of the valve clearance from the correct value by changing the adjusting pallet.

The procedure for measurement and adjustment is as follows:

1. Turn the cam to the measuring position (180° from the valve stem).
2. Mount tool 839145 and screw it on so that its triple claw grips the valve depressor.



MEASURING THE VALVE CLEARANCE

Tools 784062 and 839145

3. Mount the indicator dial in the tool so that the measuring point rests on the tip of the cam; zero the dial.
4. Lift the valve depressor with the measuring tool and read off the deflection of the instrument pointer, which indicates the valve clearance. Note the reading.
5. Measure and note down the clearances of all valves in the same manner. Proceed to adjust the clearance of any valves in which it does not lie within the following limits:
Inlet valves 0.008"—0.010" (0.20—0.25 mm)
Exhaust valves 0.016"—0.018" (0.40—0.45 mm)
6. Remove the camshaft and the valve depressors and adjusting pallets of any valves needing adjustment.
7. Measure and make a note of the thickness of the pallet. (Special tool No. 839163.) This thickness plus the valve clearance adds up to the total distance between the valve and the cam.

Example:

Measured valve clearance	0.004" (0.12 mm)
Measured pallet thickness	0.099" (2.54 mm)
Total distance	0.103" (2.66 mm)



MEASURING ADJUSTING PALLETS

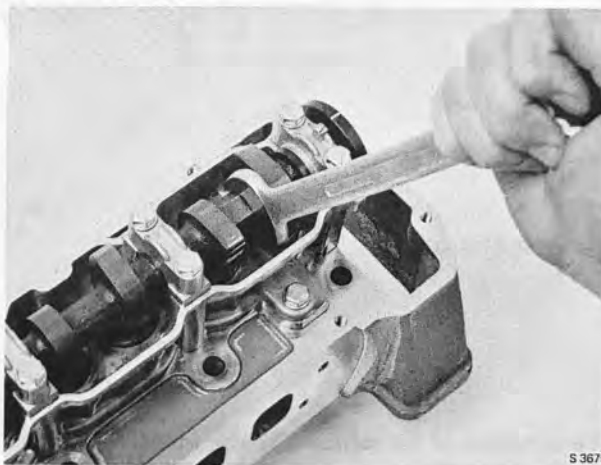
Tools 784062 and 839163

The choice of adjusting pallet is determined by the measured total distance between the valve depressor and the cam less the specified valve clearance for an intake or exhaust valve as the case may be.

Example:

Total distance	0.103" (2.66 mm)
Less specified inlet valve clearance	0.009" (0.23 mm)
Required pallet thickness	0.094" (2.43 mm)

8. Insert the new adjusting pallet and the valve depressor and install the camshaft.
9. Repeat the measurement procedure to check that the clearances are now correct.



TURNING THE CAMSHAFT

Measuring and adjusting valve clearance after valve reconditioning

1. Install adjusting pallets with a minimum thickness of 0.070" (1.77 mm).
2. Insert depressors and install the camshaft.
3. Measure the valve clearances, note the reading for each valve and calculate the total distance.
4. Select new pallets to give the correct clearances.
5. Remove the camshaft and depressors, take out the 0.070" (1.77 mm) pallets and insert new pallets to give the correct clearances.
6. Replace the depressors and reinstall the camshaft.
7. Check clearance measurements once more with the dial indicator. To make your choice of adjusting pallets easier, use the table on the next page.

Starting from 0.12 mm, which is the closest figure in the table to the measured clearance, go horizontally across the table to the column above the inlet pallet thickness of 2.54 mm. The correct pallet thickness, 2.43 mm, can be read from the table at the intersection of the horizontal line from 0.12 mm and the vertical column from inlet 2.54 mm.

The following example illustrates how the table is used:

The inlet valve clearance is 0.13 mm and therefore needs adjustment. The measured thickness of the adjusting pallet for this valve is 2.54 mm.

Replacement of valve springs without removing cylinder head, 1.7, 1.85 and 2.0 l engines

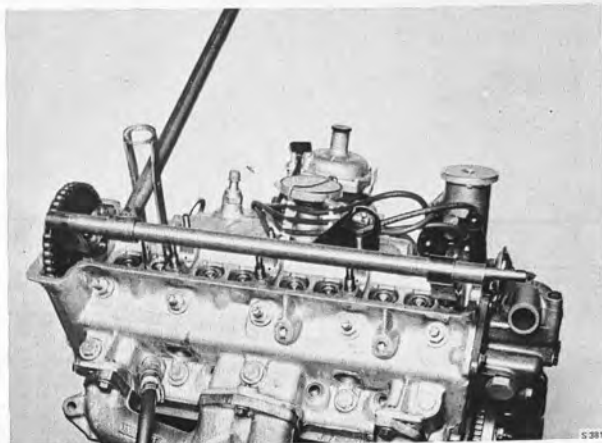
1. Remove the valve cover (camshaft cover).
2. Rotate the crankshaft until the No. 1 cylinder is in the ignition position.
3. Fit a nut to the camshaft sprocket center stud and tighten the camshaft sprocket against the retaining plate.

WARNING

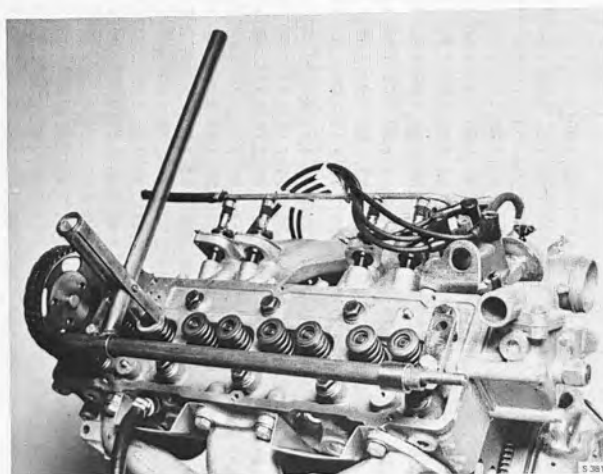
Tighten the nut fully, so that the center stud is held securely immobilized. Otherwise the chain tensioner will tighten the chain and lock in a new position so that the sprocket cannot be refitted.

4. Remove the screws holding the camshaft sprocket to the camshaft.
5. Unscrew the camshaft caps and remove the camshaft.
6. Remove the valve depressors and adjusting pallets.
7. 2.0 l engine: Remove the camshaft bridge.
8. Take out the spark plug for the cylinder requiring a new valve spring and fit an air hose connector (tool 839232) in the spark plug hole. Connect the cylinder to a compressed air supply to prevent the valve dropping into the cylinder.
9. Apply the valve spring tool (tool 839230) as shown in the illustration. Compress the valve spring and pick up the valve spring retainers using a magnetic tool. Remove the valve spring and the valve spring seat.

Reassemble in the reverse order.



REMOVING VALVES, 1.7 AND 1.85 L ENGINES
Tools 839230 and 839232



REMOVING VALVES, 2.0 L ENGINE
Tools 839230 and 839232

TRANSMISSION

Instructions for transmission chain, camshaft and idler shaft settings will be found in section 210.

Checking the chain tensioner

In order to prevent transmission damage caused by the chain tensioner running out to far, the position of the chain tensioner can be checked with the engine mounted in the car.

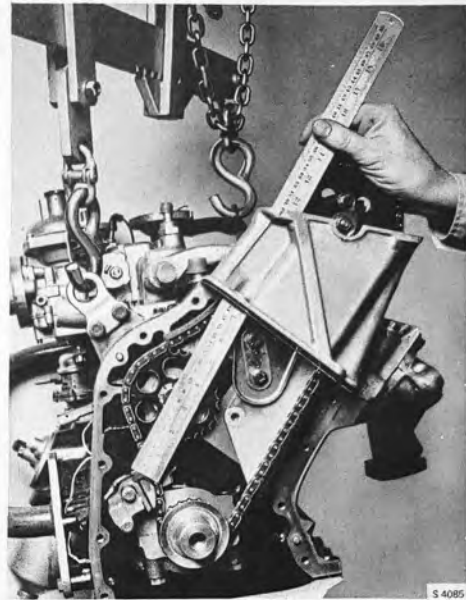
1. Remove the valve cover.
2. Insert a steel rule down against the rubber neck on the chain tensioner and measure the distance to the level of the cylinder head cover.

1.7 and 1.85 l engines:

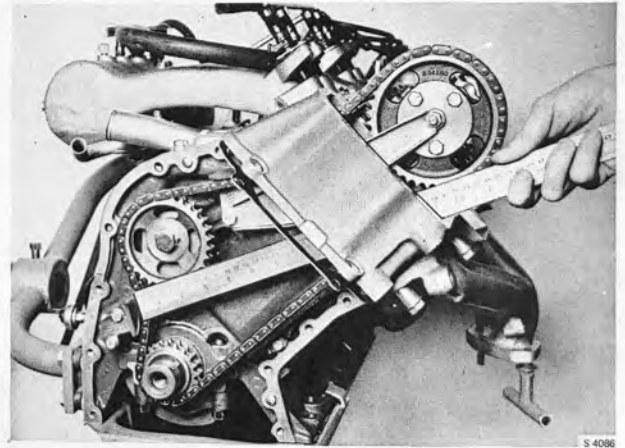
The distance should be more than 10.8 in (275 mm). If the distance is less than 10.8 in (275 mm), the engine should be removed as soon as possible for correction. For completely tight chain tensioners (newly adjusted transmissions), the distance should be about 11.3 in (287 mm).

2.0 l engines:

The distance should be more than 11.8 in (300 mm). If the distance is less than 11.8 in (300 mm), the engine should be removed as soon as possible for correction. For completely tight chain tensioners (newly adjusted transmissions) the distance should be about 12.3 in (313 mm).



CHECKING THE CHAIN TENSIONER ON 1.7 AND 1.85 L ENGINES



CHECKING THE CHAIN TENSIONER ON 2.0 L ENGINES

Indicates the condition of the chain and sprocket. If the chain is loose, it will be necessary to adjust the tension.

Checking the chain tension

1. To check the chain tension, the engine should be run at idle speed for about 10 minutes. This will allow the chain to settle into its normal position.

2. The chain tension should be checked at the top and bottom of the chain. The distance between the chain and the sprocket should be about 1/2 inch.

3. If the chain is too loose, it should be tightened. This can be done by adjusting the tensioner. If the chain is too tight, it should be loosened. This can be done by adjusting the tensioner.

4. The chain should be checked for wear. If the chain is worn, it should be replaced. The sprocket should also be checked for wear. If the sprocket is worn, it should be replaced.

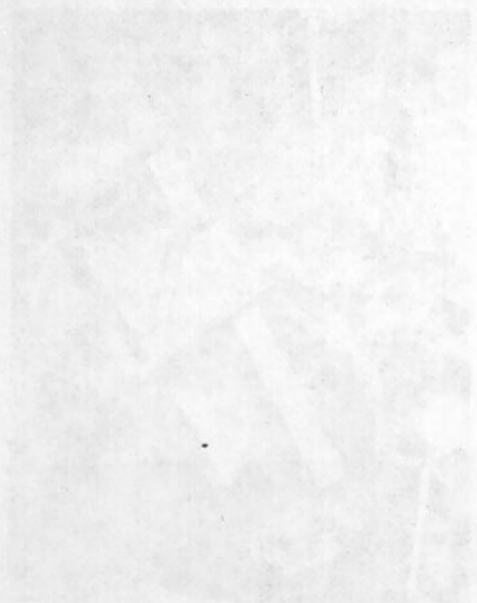


FIGURE 1-10 CHECKING THE CHAIN TENSION

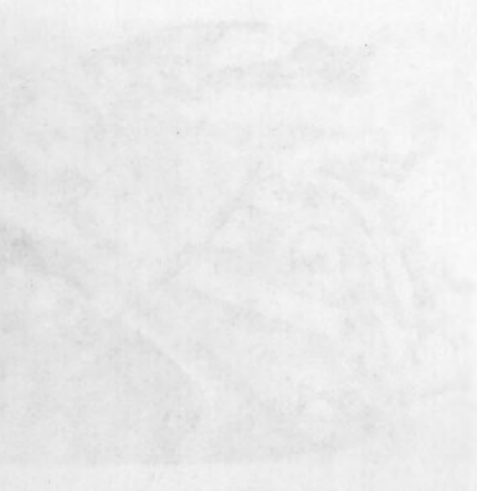


FIGURE 1-11 CHECKING THE CHAIN TENSION

CRANKSHAFT (CRANK MECHANISM)

1,7 and 1,85 l engines

Measuring the crankshaft

Clean the crankshaft and measure its journals with a micrometer. Measurements should be made at several points round the surface. Out-of-round at the main bearing journals and big-end bearing journals should not exceed 0.002" (0.05 mm).

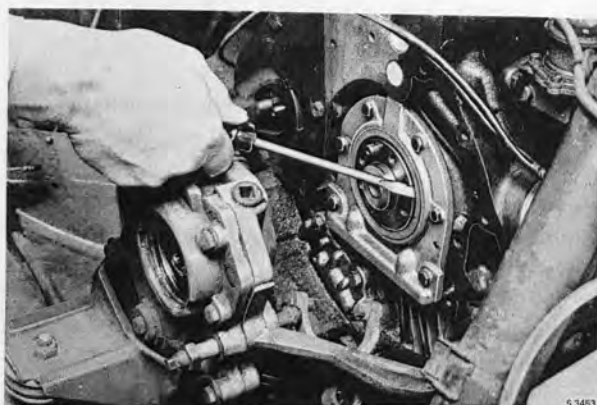
If the measurements are close to or over the stated limit of wear, the crankshaft should be ground down to under-sizes according to specification.

Check that the crankshaft is straight to within 0.002" (0.05 mm) by indicating it; mount the shaft in two V-blocks, place an indicator against the center journal, and rotate the shaft. If necessary, true up the shaft in a press.

Changing the crankshaft seal (seal ring) at the flywheel end

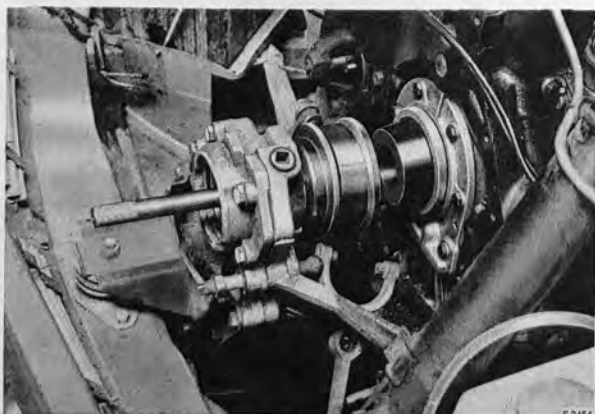
The seal can be changed with the engine in place in the car. The clutch and flywheel must first be removed.

1. Remove the old seal ring, using a screwdriver.



REMOVING THE SEAL RING AT THE FLYWHEEL END

2. Fit a new seal ring, using guide sleeve 839041, installing tool 839189 and drift 839192. Oil the sealing surface of the ring before fitting.



NECESSARY TOOLS FOR FITTING THE SEAL RING AT THE FLYWHEEL END

Tools 839041, 839189 and 839192

Press the seal ring into the seal cap by knocking the drift with a shank or mallet.

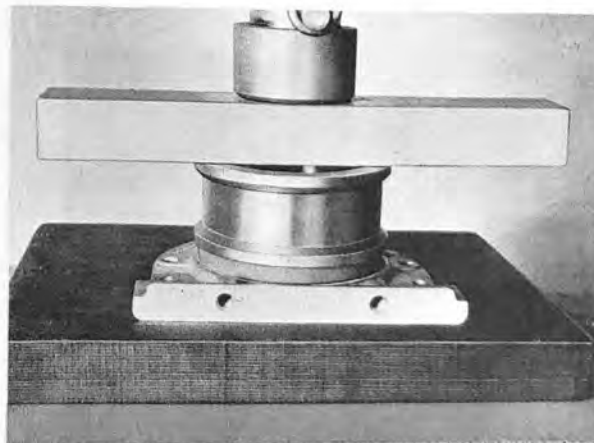


FITTING THE SEAL RING

Tools 839041, 839189 and 839192

Changing the seal ring on a removed seal cap

1. Remove the old seal ring.
2. Put the seal cap on a level surface to avoid damaging the sealing surface.
3. Mount the seal ring on to the spacing pin of installing tool 839189.
4. Press the seal ring into the cap so that the spacing pin on the installing tool goes right down to the surface on which the cap rests.



FITTING THE SEAL RING INTO THE REMOVED SEAL CAP

Tool 839189

5. Oil the seal ring and mount the seal cap into the engine, using guide sleeve 839041.

NOTE

If the seal cap is removed or fitted when the engine is fitted to the gearbox, the seal between the cap and the gearbox will be damaged.

Changing the crankshaft seal (seal ring) at the transmission end

Engine and pulley removed

1. Remove the seal ring.



REMOVING THE SEAL RING AT THE TRANSMISSION END

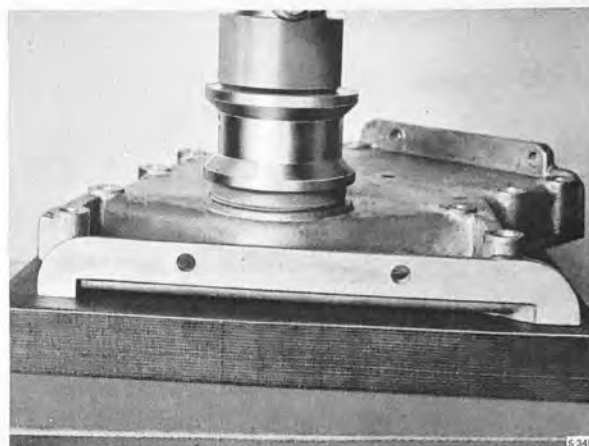
2. Fit a new seal ring and grease the sashing flanges with silicone grease.
3. Use installing tool 839188 and drift 839044. Make sure that the keyway on the installing tool is in line with the key on the end of the crankshaft. Press the seal ring into the transmission cover.



FITTING THE SEAL RING, TRANSMISSION END
Tools 839044 and 839188

Changing the seal ring on removed transmission cover

1. Remove the old seal ring.
2. Put the cover on a level surface to avoid damaging the sealing surface. Press the seal ring into the cover, using installing tool 839044.



FITTING THE SEAL RING INTO REMOVED TRANSMISSION COVER
Tool 839188

NOTE

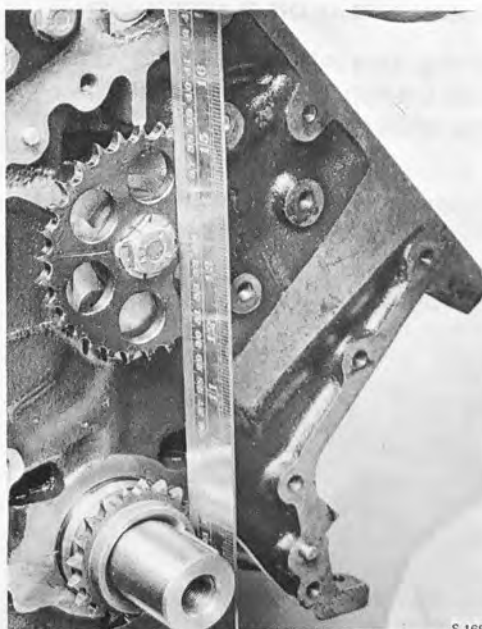
If the transmission cover is removed or fitted when the engine is fitted to the gearbox, the seal between the cover and the gearbox will be damaged.

Measuring and shimming the crankshaft chainwheel on crankshaft after installation of new parts

When a new crankshaft, idler shaft or chainwheel has been installed, the crankshaft chainwheel must be shimmed to align it with the idler shaft chainwheel, as there will otherwise be excessive wear on the chain transmission.

Measure the chainwheel alignment as follows:

1. Lay the edge of a rule against the idler shaft chainwheel as close as possible to the center of the chainwheel and lying across the crankshaft chainwheel.



CHECKING AXIAL ALIGNMENT OF CRANKSHAFT CHAINWHEEL

Make sure that the edge of the rule butts flat against the idler shaft chainwheel across its full width and press it hard against the chainwheel.

2. Adjust the axial position of the crankshaft chainwheel if necessary, using shims to align the idler shaft chainwheel and the camshaft chainwheel in the same plane.

Replacement of disc-shaft bushing

1. Fill the bushing with grease.
2. Introduce centering tool 839206 into bushing and tap gently with a plastic mallet in order to drive out the bushing. If necessary, gradually add more grease as the bushing is being driven out.
3. Remove all grease from the crankshaft and from the tool. Take care so that no grease adheres to the friction surface of the flywheel.
4. Fit a new bushing, using centering tool 839003.



REPLACEMENT OF DISC-SHAFT BUSHING
Tool 839206

Changing the idler shaft (Engine mounted in work stand)

Disassembling

1. Remove the inlet manifold complete with carburetor and air cleaner.
NOTE! This is not necessary on engines with electronic fuel injection.
2. Take off the alternator drive belt and the crankshaft belt pulley.
3. Undo the transmission cover screws and tap the cover gently forward to unseat it from the locating studs without damaging the gaskets.
4. Turn the crankshaft to TDC for No. 1 cylinder. The distributor rotor arm should then also be in the ignition position for No. 1 cylinder.

5. Remove the water pump, fuel pump and distributor.
6. Remove the chainwheel from the idler shaft. Do not turn the crankshaft, as the setting must not be disturbed.
7. Undo the two screws from the chain tensioner and twist the tensioner up out of the way.
8. Remove the idler shaft.

If the transmission casing gasket is damaged in the course of assembly or disassembly, a new gasket piece must be cut to shape and glued in place with Tikität 2. Apply the adhesive to the transmission casing flange at the gasket joints. Allow the adhesive to harden for a while, then position the gasket piece and let it dry on thoroughly before mounting the transmission cover.

Assembling

1. Fit a new locating pin in the new idler shaft. Then press on the chainwheel and having done this check that the locating pin does not project beyond the chainwheel. Insert the screws and tighten to a torque of 25 Nm (18 ft.lb., 2.5 kpm).
2. Mount the idler shaft, setting the chainwheel with the mark in the horizontal position and put on the chain.
3. Mount the chain tensioner, making the basic adjustment to chain tension if necessary.
4. Fit the transmission cover. NOTE! Before fitting the cover, knock the guide studs a fraction of an inch (a few mm) deeper into the cylinder block.
5. Fit the belt pulley and alternator drive belt.
6. Mount the water pump.
7. Mount the distributor and adjust the ignition timing.
8. Mount the fuel pump and inlet manifold complete with carburetor and air cleaner.

CRANKSHAFT (CRANK MECHANISM)

2.0 l engine

Measuring the crankshaft

Clean the crankshaft and measure its journals with a micrometer. Measurements should be made at several points round the surface. Out-of-round at the main bearing journals and big-end bearing journals should not exceed 0.002" (0.05 mm).

If the measurements are close to or over the started limit of wear, the crankshaft should be ground down to under-sizes according to specification.

The journals can be ground down one step below nominal size without re-hardening. If they are ground more than one step, the shaft must be "tenifer-hardened" again. Check that the crankshaft is straight to within 0.002" (0.05 mm) by indicating it; mount the shaft in two V-blocks, place an indicator against the center journal, and rotate the shaft.

Measuring the clearance

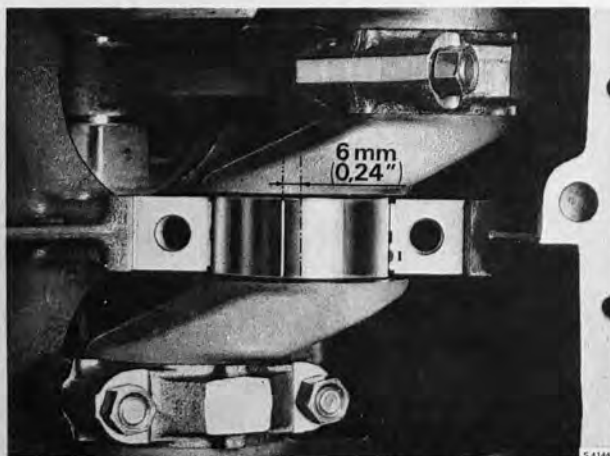
Before the bearing clearance is measured in connection with the fitting of new bearings, the out-of-round and taper of the big-end bearing journals should be checked. This clearance can be measured with a "Plastigage" which can be obtained as spare parts number 786050. The Plastigage is available in three thicknesses. Type PG-1 (green) should be used.

Instructions for use of Plastigage

Main bearings

The Plastigage can be used to measure both out-of-round and clearance.

1. Place the engine with the cylinder head plane downwards to prevent the weight of the crankshaft from affecting the measurement.
2. Ensure that the parts which are to be measured are free from oil and dirt. Put a strip of Plastigage about 6 mm long to the side of the centreline.



PLASTIGAGE STRIP PLACED ON THE MAIN BEARING JOURNAL

3. Fit the cap and tighten to a torque of 108 Nm (79 ft. lb., 11 kpm). The crankshaft must not be turned during the measurement.
4. Remove the cap. The strip should by now have been firmly pressed into the bearing cap or onto the big-end bearing journal.
5. Measure the width of the flattened Plastigage strip using the scale printed on the Plastigage package and read off the clearance. One side of the package gives the dimension in mm, the other side in thousandths of inches. Measure the strip at its widest point, but do not touch it with your fingers.



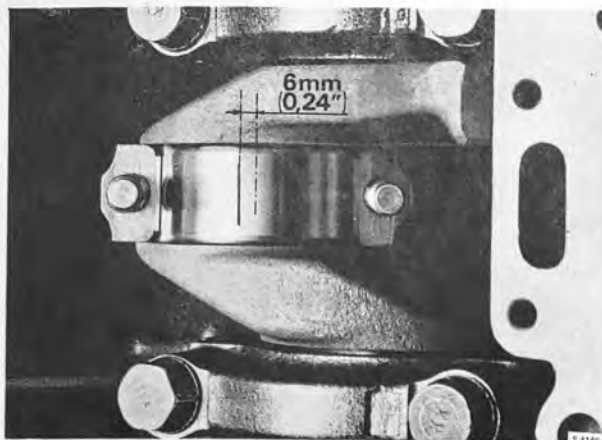
READING THE CLEARANCE

Big-end bearings

Plastigage strips cannot be used to measure out-of-round with the pistons fitted in the block. A micrometer should be used instead.

Big-end bearing clearance can be measured in connection with the fitting of new bearings as follows.

1. Turn the crank which is to be measured to a position about 60° before the top dead centre.
2. Ensure that those parts which are to be measured are dry and free from oil and dirt. Place a strip of Plastigage 6 mm to the side of the centreline.



THE PLASTIGAGE STRIP PLACED ON THE BIG-END BEARING JOURNAL

3. Fit the cap and tighten to a torque of 54 Nm (39 ft. lb., 5.5 kpm). The crankshaft must not be turned during the measurement.
- See further in points 4 and 5, main bearings.

Choice of bearing halves for main and big-end bearings

Bearing halves are available in two different classes for standard size, 1st undersize and 2nd undersize. The two classes are of different thickness and can be combined to obtain the proper clearance.

For the 3rd and 4th undersizes, bearing halves are only available in one thickness.

The classified bearing halves are colour-coded as follows:

Standard size:

Red — thin bearing half, gives **INCREASED** clearance

Blue — thicker bearing half, gives **REDUCED** clearance

1st undersize:

Yellow — thin bearing half, gives **INCREASED** clearance

Green — thicker bearing half, gives **REDUCED** clearance

2nd undersize:

White — thin bearing half, gives **INCREASED** clearance

Brown — thicker bearing half, gives **REDUCED** clearance

Example:

First try to obtain the proper clearance by fitting two thin bearing halves. If the clearance is too large between two thin bearing halves, fit a thin and a thick or two thick halves to reduce the clearance.

If the clearance is too large even after two thick bearing halves have been fitted, the crankshaft must be ground down to the next possible undersize and bearing halves of corresponding size fitted. See group 0.

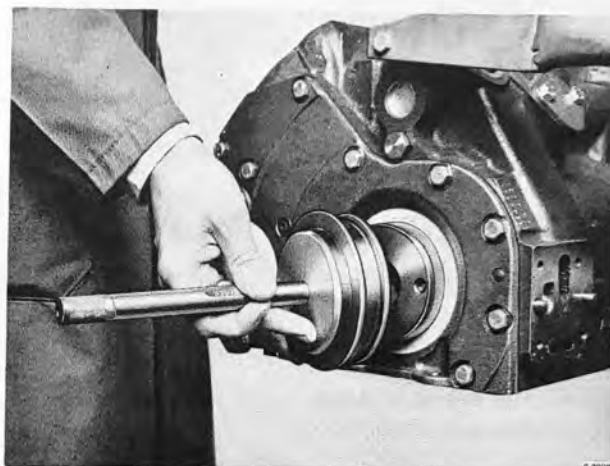
NOTE

The crankshaft journals may be ground down one undersize (0.25 mm) without necessitating hardening of the shaft. If the crankshaft is ground down more than one undersize, the shaft must be tenifer-hardened again.

Changing the crankshaft seal (seal ring) at the flywheel end

The seal can be changed with the engine in place in the car. The clutch and flywheel must first be removed.

1. Remove the old seal ring, using a screwdriver.
2. Fit a new seal ring with the spring ring facing the crankshaft. Use guide sleeve 839197, installing tool 839196 and drift 839192. Oil the sealing surface of the ring before fitting.



FITTING THE SEAL RING

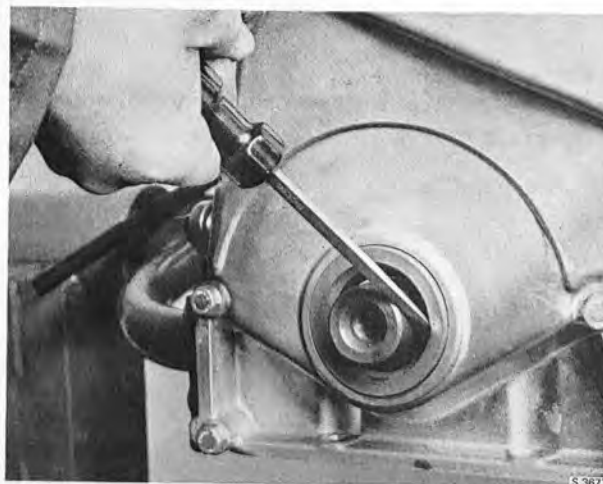
Tools 839197, 839196 and 839192

3. Press the seal ring into the seal cap by knocking the drift with a heavy hammer.

Changing the crankshaft seal (seal ring) at the transmission end

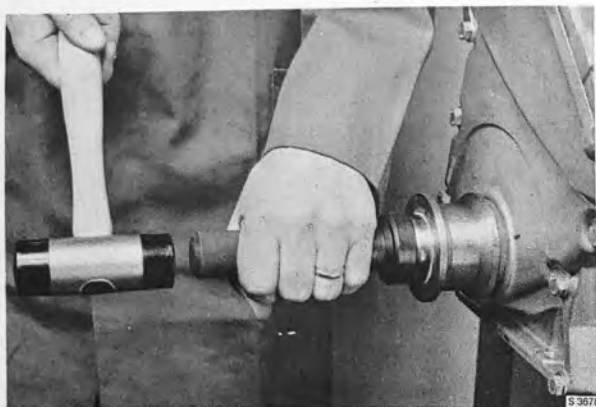
Engine and pulley removed

1. Remove the seal ring.



REMOVING THE SEAL RING

2. Fit a new seal ring and grease the sashing flanges with silicone grease.
3. Use installing tool 839188 and drift 839044. Make sure that the keyway on the installing tool is in line with the key on the end of the crankshaft. Press the seal ring into the transmission cover.



INSTALLING THE SEAL RING
Tools 839044 and 839188

Changing the seal ring on removed transmission cover

1. Remove the old seal ring.
2. Put the cover on a level surface to avoid damaging the sealing surface. Press the seal ring into the cover, using installing tool 839044.

NOTE

If the transmission cover is removed or fitted when the engine is fitted to the gearbox, the seal between the cover and the gearbox will be damaged.

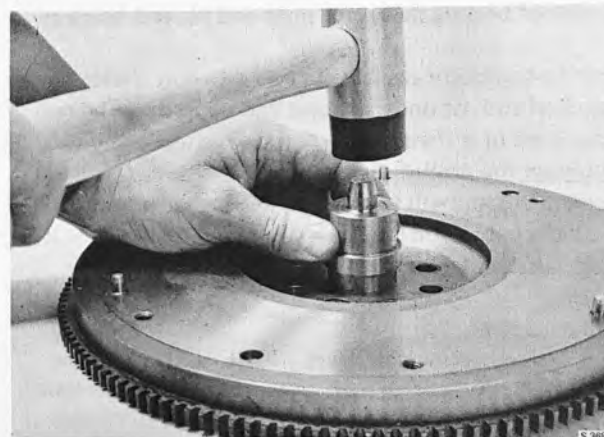
Changing the clutch shaft bearing

1. Remove the flywheel.
2. Remove the clutch shaft bearing from the flywheel, using drift 839199.



REMOVING THE CLUTCH SHAFT BEARING
Tool 839199

3. Fit a new clutch shaft bearing in the flywheel, using drift 839199.



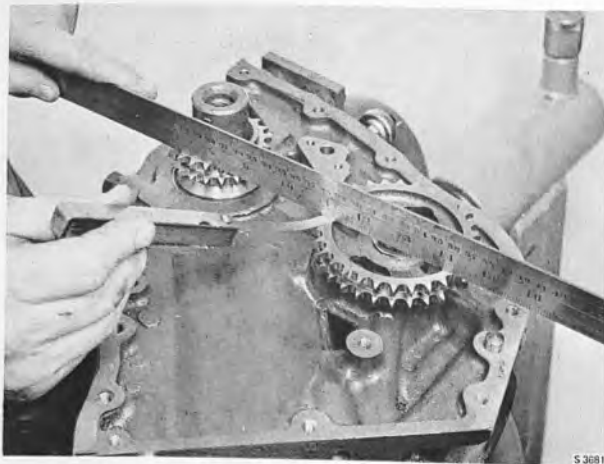
FITTING THE CLUTCH SHAFT BEARING
Tool 839199

Measuring and shimming the crankshaft sprocket on crankshaft after installation of new parts

When a new crankshaft, idler shaft or sprocket has been installed, the crankshaft sprocket must be shimmed to align it with the idler shaft sprocket, as there will otherwise be excessive wear on the chain transmission.

Measure the sprocket alignment as follows:

1. Lay the edge of a rule against the idler shaft sprocket as close as possible to the center of the sprocket and lying across the crankshaft sprocket. Make sure that the edge of the rule butts flat against the idler shaft sprocket across its full width and press it hard against the sprocket.



CHECKING ALIGNMENT OF CRANKSHAFT SPROCKET

2. Adjust the axial position of the crankshaft sprocket if necessary, using shims or grinding to align the idler shaft sprocket and the camshaft sprocket in the same plane.

If the crankshaft sprocket is grinded, great care must be taken, so that no axial throw will occur.

Changing the idler shaft

Disassembling

1. Take off the alternator drive belt and the crankshaft belt pulley.
2. Undo the transmission cover screws and tap the cover gently forward to unseat it from the locating studs without damaging the gaskets.
3. Turn the crankshaft to TDC for No. 1 cylinder. The distributor rotor arm should then also be in the ignition position for No. 1 cylinder.
4. Remove the water pump and distributor.
5. Remove the sprocket from the idler shaft. Do not turn the crankshaft, as the setting must not be disturbed.
6. Undo the two screws from the chain tensioner and twist the tensioner up out of the way.
7. Remove the idler shaft.

If the transmission casing gasket is damaged in the course of assembly or disassembly, a new gasket piece must be cut to shape and glued in place with Tikität 2. Apply the adhesive to the transmission casing flange at the gasket joints. Allow the adhesive to harden for a while, then position the gasket piece and let it dry on thoroughly before mounting the transmission cover.

Assembling

1. Fit the idler shaft and fixing plate. Tighten the two countersunk screws to prescribed torque.
2. Fit a new locating pin in the new idler shaft.
3. Put the chain on the sprocket and turn the idler shaft until the locating pin and hole corresponds and the sprocket can be mounted. Then check that the guide sleeve is flush with the sprocket.
4. Mount the locking plate with the retaining screw. Place a suitable dolly through one of the holes in the sprocket and tighten the screw. Lock the screw with the locking plate.
5. Turn the chain tensioner self-adjuster into its innermost position. Mount the chain tensioner and stretch the chain somewhat.
6. Fit the transmission cover. NOTE! Before fitting the cover, knock the guide studs a fraction of an inch (a few mm) deeper into the cylinder block.
7. Fit the belt pulley and alternator drive belt.
8. Mount the water pump.
9. Mount the distributor and adjust the ignition timing. See section "Installing of engine".

OIL PUMP

Rotary-type

Disconnecting

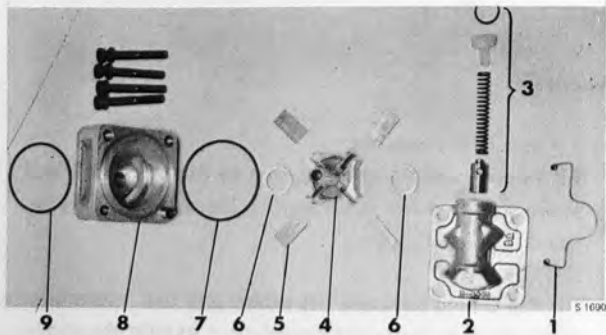
1. Undo the four retaining screws that pass through the corners of the pump.
2. Withdraw the pump complete with drive shaft. Remove the seal ring between the pump and cylinder block.



OIL PUMP WITH DRIVE SHAFT

Disassembly

1. Hold the pump in the hand with the guide sleeve of the housing downward.
2. Remove the retaining spring from the pump cover and twist the cover to one side. A guide sleeve in one of the screw holes in the housing locates the cover. Check that this sleeve is still in place when the cover is taken off.



OIL PUMP, DISMANTLED

- | | |
|----------------------------|-----------------|
| 1. Spring | 5. Rotor vanes |
| 2. Cover | 6. Spacer rings |
| 3. Pressure reducing valve | 7. O-ring |
| 4. Rotor | 8. Pump housing |
| | 9. O-ring |

3. Remove the rotor vanes and spacer rings.
4. Remove the pressure reducing valve in the cover by freeing the lock ring in front of the aluminium spring seat and taking out the spring and valve.

Assembling

1. Insert one spacer ring and the rotor, lubricating them with engine oil.
2. Insert the vanes with the rounded edges outward nearest the wall of the pump housing.
3. Fit the other spacer ring and turn the rotor by rotating the drive shaft until the vanes fall into their correct positions. Lubricate with engine oil.
4. Install the pressure reducing valve in the cover.
 - a. Insert the valve, spring and spring seat.
 - b. Fit the lock ring, checking that it enters its groove.
5. Locate the cover on the housing and fit the spring.

Birotor type

This type of dual rotor pump is fitted to all 2.0 l engines and to certain 1.7 and 1.85 l engines, commencing with chassis No. 99.050.001.

Removal

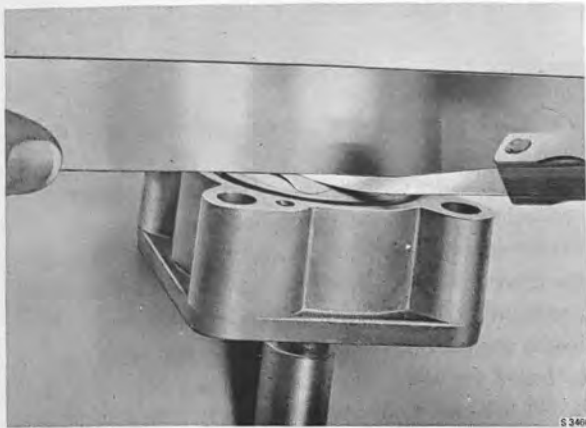
1. Undo the four retaining screws that pass thru the corners of the pump.
2. Remove the pump and the sealing ring between the pump and the intermediate plate.

Dismantling

1. Remove the two screws holding the cover and the pump housing together.
2. Separate the cover and the pump housing.
3. Remove the rotors and the O-ring from the housing.
4. Remove the pressure reducing valve located in the cover by pulling out the locking pin first and then removing the plug, the O-ring, the spring and the valve piston.

Checking clearance and wear

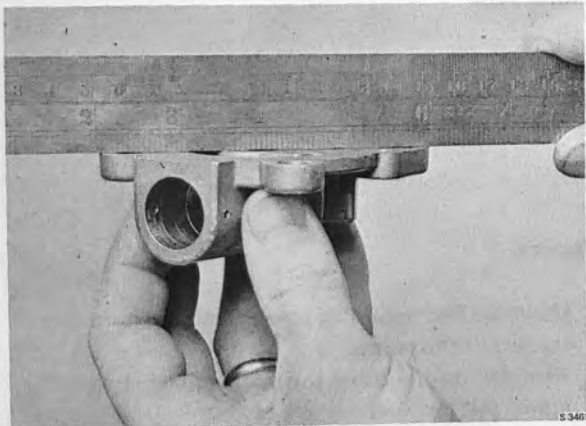
Check the axial clearance of the inner and outer rotors to the rotor housing with a rule and feeler gauge. The clearance should be 0.00197"—0.00354" (0.05—0.09 mm).



CHECKING THE AXIAL CLEARANCE

If the clearance must be adjusted, grind the sealing surface of the housing or the sides of the rotor with fine emery cloth on a flat wheel.

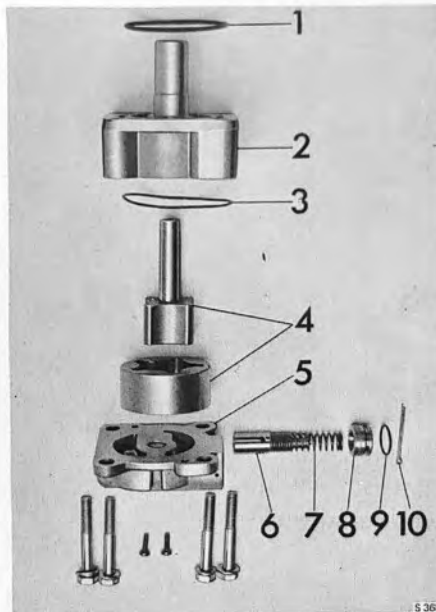
Check the evenness of the cover with a rule, see illustration. All deformities, scratches and pits are to be removed by grinding.



CHECKING EVENNESS OF COVER

Reassembly

1. Lubricate the rotors with engine oil and refit. **NOTE!** The chamfered edge of the outer rotor faces inwards in the pump housing (towards the drive shaft).
2. Fit the pressure reducing valve in the pump cover:
 - a. Fit the valve piston, the spring and the plug with the O-ring.
 - b. Fit the locking pin.
3. Fit the pump housing O-ring and the cover.



OIL PUMP

- | | |
|-----------------|-----------------|
| 1. O-ring | 6. Valve piston |
| 2. Pump housing | 7. Spring |
| 3. O-ring | 8. Plug |
| 4. Rotors | 9. O-ring |
| 5. Cover | 10. Locking pin |

Assembly

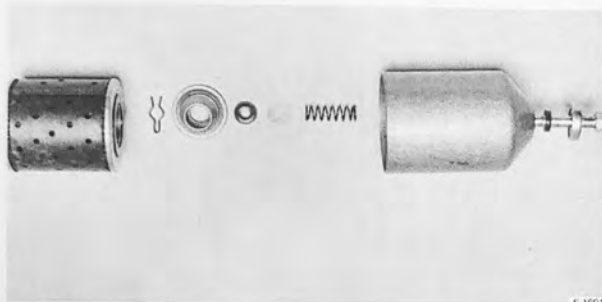
1. 1.7 and 1.85 l engines:
Fit the oil pump and the O-ring to the cylinder block. Make sure that the drive shaft is located correctly in the distributor shaft.
- 2.0 l engine:
Fit the O-ring between the pump and the intermediate plate, push in the pump and turn it so that the pump drive engages in the rotor.
2. Fit and tighten the four retaining screws.

OIL FILTER

1.7 and 1.85 l engines

Changing filter insert

1. Undo the screw on the filter housing using key 839191 and remove the filter housing from the engine block.
2. Withdraw the filter insert.
3. Clean the component parts, checking at the same time that none of them is damaged.
4. Remove the rubber seal from the engine block and fit a new one.
5. Place a new filter insert in the housing and assemble the filter in position on the engine block.
6. Tighten the screw to a torque of 20–25 Nm (14–18 ft.lb., 2–2.5 kpm).



OIL FILTER AND FILTER HOUSING

OIL FILTER

2.0 l engine

Replacement of filter cartridge

1. Free the filter cartridge with special wrench 786201.



REMOVAL OF OIL FILTER CARTRIDGE

Tool 786201

2. Lubricate the rubber seal of the new filter cartridge and screw in the cartridge until the seal is in place up against the intermediate piece. Then tighten an additional half turn.

NOTE

If the filter cartridge is tightened too hard there is a risk that oil will leak out, as the rubber seal may be twisted in its rack.

1. Park the vehicle on a level surface. Engage the parking brake.
2. Turn the engine off. Wait 5 minutes for the oil to settle.
3. Place the drain pan under the oil drain plug.
4. Remove the oil drain plug. Allow the oil to drain into the pan.
5. Tighten the oil drain plug.
6. Add the new oil to the oil filler neck.
7. Check the oil level with the dipstick.
8. Dispose of the old oil properly.



REMOVAL OF OIL DRAIN PLUG

2. Turn the engine off. Wait 5 minutes for the oil to settle.
3. Add the new oil to the oil filler neck.
4. Check the oil level with the dipstick.

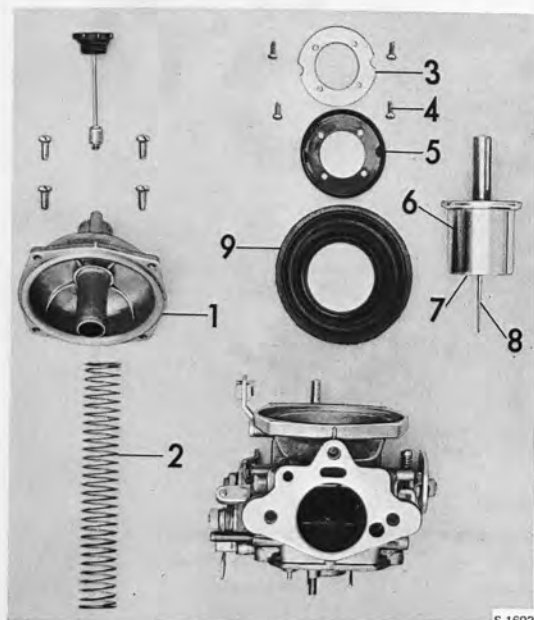
NOTE
If the filter cap is not tightened properly, the filter cap may leak oil. Always tighten the filter cap properly.

CARBURETOR

1.7 and 1.85 l engines

Removing

1. Remove the air cleaner and preheater hose.
2. Disconnect the fuel hose, the throttle and choke controls and the vacuum hose to the distributor.
3. Back off the four retaining nuts and lift off the carburetor.

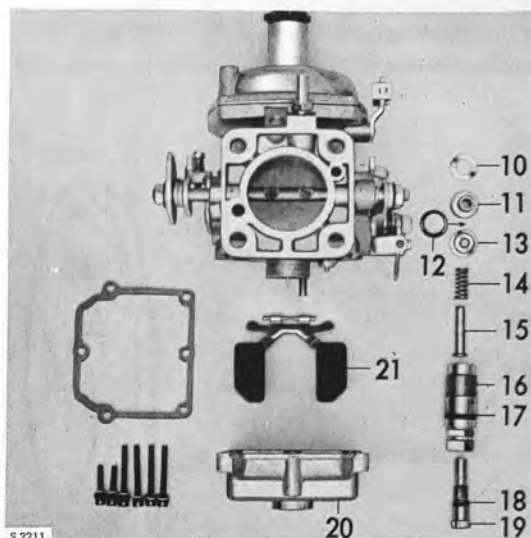


CARBURETOR

1. Vacuum chamber cover
2. Spring
3. Metal washer
4. Screw
5. Plastic washer
6. Vacuum piston
7. Locking screw
8. Fuel needle
9. Diaphragm

Disassembly

1. Take off the vacuum chamber cover (1, see illustration) and take out the spring (2).
2. Remove the piston (6) with the diaphragm (9).
3. Undo the locking screw (7) and take out the fuel needle (8).
4. Remove the screws (4), the plastic and metal washers (5, 3) and the diaphragm (9).
5. Remove the float chamber (20).
6. Carefully disengage the float spindle from the bridge and remove the float (21).



CARBURETOR

10. Washer
11. Bushing
12. O-ring
13. Guide bushing
14. Spring
15. Jet
16. Jet retainer
17. O-ring
18. O-ring
19. Adjusting screw
20. Float chamber
21. Float

7. Unscrew and remove the jet retainer (16) with adjusting screw (19), jet (15), spring (14), bushings (11 and 13), washer (10). Save O-ring (12).
8. Remove the float valve and washer.
9. Remove the choke mechanism.

Wash carburetor parts with paraffin oil or gasoline.

NOTE

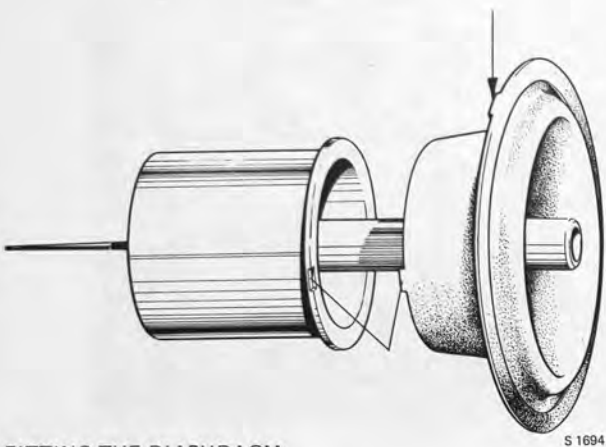
Use only paraffin oil for washing the diaphragm. Avoid the use of volatile cleaning fluids such as trichloroethylene.

Cleaning

Use compressed air to clean the holes in the valve plate of the choke mechanism. Check that the diaphragm is undamaged. If the diaphragm is distended or burst it must be exchanged for a new one. Check the fuel needle for wear; if it is bent or worn, fit a new one. Check that all contact and sealing surfaces are undamaged. Check that the choke plate of the choke mechanism and the matching surface of the carburetor housing are free from scratches.

Assembling

1. Mount the diaphragm on the vacuum piston so that the locating lip (see illustration) engages the corresponding recess in the piston and the inner edge fits easily into the matching groove in the piston.



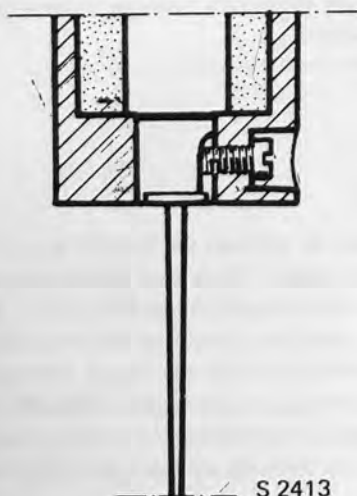
FITTING THE DIAPHRAGM

ding recess in the piston and the inner edge fits easily into the matching groove in the piston.

NOTE

If the diaphragm is so distended that it will not fit into the piston, exchange it for a new one.

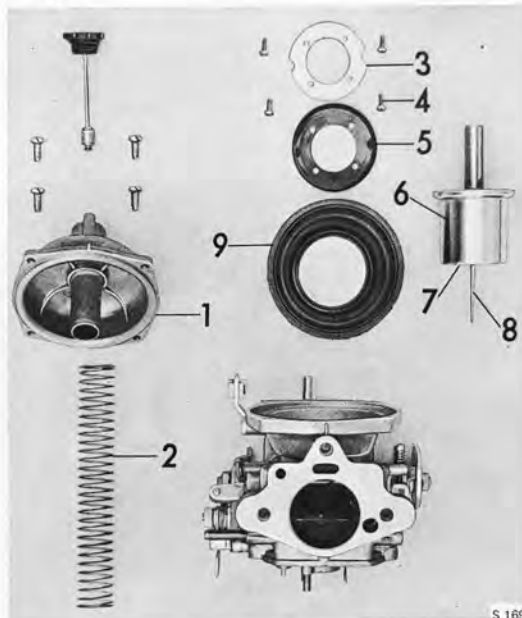
Place the plastic washer (5, see illustration) and the metal washer (3) carefully in position, lining up the screw holes with those in the piston and diaphragm without twisting the washer and matching the groove in the washer to the locating edge of the diaphragm. Secure the washers with the screws (4). Install the self-centering fuel needle so that its plastic washer lies flush with the lower surface of the vacuum piston.



FITTING THE FUEL NEEDLE

The flat milled jacket surface of the spring housing must face the locking screw, i.e. the needle should be pushed by spring action towards the air cleaner side when the piston is in place in the carburetor. No centering adjustment of the carburetor jet is necessary.

2. Install the piston complete with diaphragm and spring in the carburetor housing. Make sure that the outer lip of the diaphragm engages the matching recess in the housing (see illustration). Place the vacuum chamber cover carefully in position according to the markings. The groove and locating rim should be a good fit; if not exchange the diaphragm. Tighten the screws.
3. Insert the adjusting screw (19) with a new O-ring (18) in the jet retainer (16). Fit a new O-ring (17) on the jet retainer. Figures refer to illustration on previous page.



CARBURETOR

- | | |
|-------------------------|------------------|
| 1. Vacuum chamber cover | 6. Vacuum piston |
| 2. Spring | 7. Locking screw |
| 3. Metal washer | 8. Fuel needle |
| 4. Screw | 9. Diaphragm |
| 5. Plastic washer | |

4. Place the spring (14), guide bushing (13), bushing (11), O-ring (12) and aluminium washer (10) on the jet (15) and install the complete assembly together with the jet retainer (16) and adjusting screw (19) in the carburetor housing. (Figures refer to illustration on previous page.) Screw in and tighten the jet retainer. Screw in the adjusting screw until the top of the jet touches the piston when the latter is in its lowest position, then back off the adjusting screw 2 3/4 turns. This is the basic setting.
5. Mount the float (21) with spindle. The flat side of the float faces away from the carburetor housing.

Float level

6. Check the float level as follows:
 - a. To check the float level the carburetor must be removed from the engine, and inverted with the float chamber off.
 - b. For the level to be correct the highest point of the float should be 0.63–0.71" (16–18 mm) above the edge of the carburetor housing (see illustration).



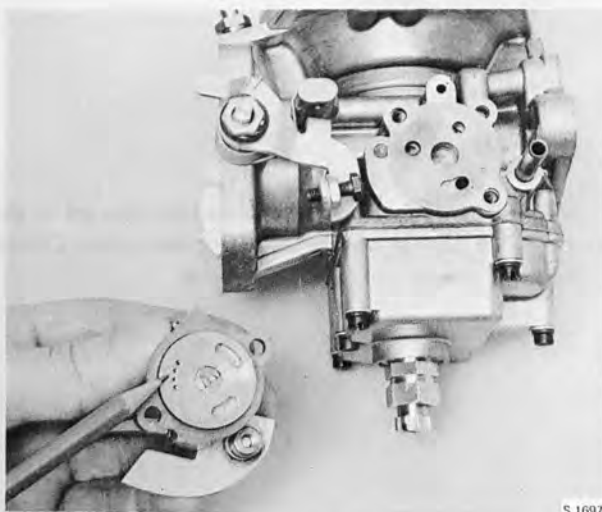
MEASURING FLOAT LEVEL

tion) when the float valve is closed. If the level is not correct, adjust by bending the tongue at the float valve.

NOTE

Do not bend the arm between the float and the spindle.

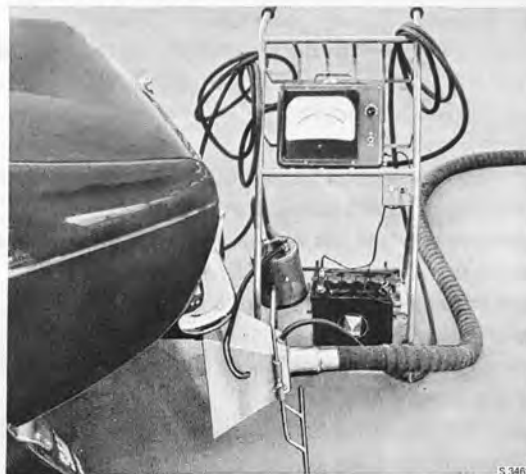
7. Fit a new gasket and slide the float chamber on until it cushions against the O-ring. First insert all screws and give them a few turns, then push down the float chamber until it butts firmly and tighten the screws.
8. Mount the choke mechanism. (If the mechanism has been removed, fit the choke plate, choke shaft and cam plate as illustrated.) The calibrated holes face the cam plate.



FUEL HOLES IN CHOKE MECHANISM

Adjusting the carburetor with carbon monoxide indicator

In order to reduce the emission of carbon monoxide and hydrocarbon gases through the exhaust system while idling, it is always necessary to check the carburetor setting with a carbon monoxide indicator in connection with every service, adjustment or engine overhaul. The highest permitted carbon monoxide content while idling is 4.5 per cent by volume.



CO TEST

Test procedure

1. Check and if necessary adjust the dwell angle.
2. Check and if necessary adjust the ignition setting.
3. Warm up the engine. The correct temperature for measuring the CO value is from the time when the thermostat opens and up to five minutes thereafter.
4. Make the necessary test preparations and idle the engine. Follow the recommendations for the indicator in question.
5. Take a reading. The CO content should be 3–4.5 %. If the value does not lie within these limits, the idling mixture adjusting screw (19) of the carburetor must be reset until the desired CO value is obtained. If the value is too high, the adjusting screw must be screwed in and vice versa if it is too low.
6. If the engine idling speed changes while adjusting the carburetor it must be reset.
7. The procedure mentioned in 5 and 6 above must be repeated until the engine idling speed is stable after the adjustment in point 5.

NOTE

If the idling speed mixture is adjusted when the engine temperature is too high (long idling; fan starts repeatedly), there is a risk that the fuel-air mixture will be incorrect at normal temperatures. Wait until the engine has cooled before continuing with the adjustment.

Idling and fast idling settings in the absence of carbon monoxide indicator

The idling adjustment is made in two stages: first the basic fuel flow setting, then the engine speed adjustment.

Basic setting:

Remove the air cleaner and push the vacuum piston (6, see illustration on opposite page) down towards the bridge. Screw up the adjusting screw (19, see illustration on p. 231-1) until the jet touches the piston. Then back off the adjusting screw 2 3/4 turns.

Engine speed adjustment:

1. Run the engine warm.
2. Set the idling speed to about 600-700 rev/min with the idling adjusting screw. Make sure that there is clearance between the fast idling cam of the choke and the adjusting screw on the throttle lever.
3. Turn the adjusting screw (19) clockwise to give a leaner mixture until the engine starts to run roughly as a result of fuel starvation. From this position, back off the screw a quarter turn.
4. Make fine adjustments to the engine idling speed (800-900 rev/min).
5. Make a clearance of 0.02-0.04" (0.5-1 mm) between the fast idling cam and the throttle adjusting screw when the choke is fully pushed in. In cold weather, a small clearance is an advantage.
6. After adjusting the idling speed, screw the throttle adjusting screw out or in so that movement of the accelerator pedal is transmitted to the throttle spindle without any noticeable play.
7. Check that the carburetor is set for the correct fuel mixture as follows:
Race the engine and note whether it momentarily drops below normal idling speed when it returns to idling. If so, the setting is too lean; turn the adjusting screw (19) 1/8 turn counterclockwise. Repeat the checking until accurate return to idling is achieved. If the engine can be started cold without using the choke system, the carburetor setting is too rich; turn the adjusting screw a quarter turn clockwise.

Choke control

Removing

1. Undo the control cable and its sheath from the carburetor. Note how the cable is fitted, as it is different in the case of each model. Free the cable in the engine compartment.
2. Remove the control button. In the case of the 1969-1970 model, it is threaded onto the pull rod. As from the 1971 model, it is screwed onto the pull rod.
3. Unscrew the eye nut which holds the control onto the instrument panel.
4. As from the 1970 model, remove the left section (in R.H.D.-cars, the right section) of the protective paneling. Up to and including the 1970 model, the headlight switch must also be removed.

5. Undo the control cable from the instrument panel. As from the 1970 model, undo the warning-light cable from the control contact.
6. Pull the control cable out of the grommet on the dash panel.

Installing

1. Check that the grommet is correctly positioned in the dash panel. Feed in the control cable, so that it can be fitted to the instrument panel. Up to the 1970 model, this is easier if the cool air hose is removed or pushed to one side.
2. As from the 1970 model, connect the warning-light cable to the control contact.
3. a. Mount the control onto the instrument panel.
b. Screw on the button.
4. Up to the 1970 model, replace the headlight circuit switch onto the instrument panel.
5. As from the 1970 model, replace the protective paneling under the instrument panel.
6. Refit the cable as far as the carburetor.
7. Fit the cable to the carburetor and trim in as explained under "Choke control setting".

Changing the choke control locking spring

Up to the 1970 model, the choke control locking spring can be changed separately.

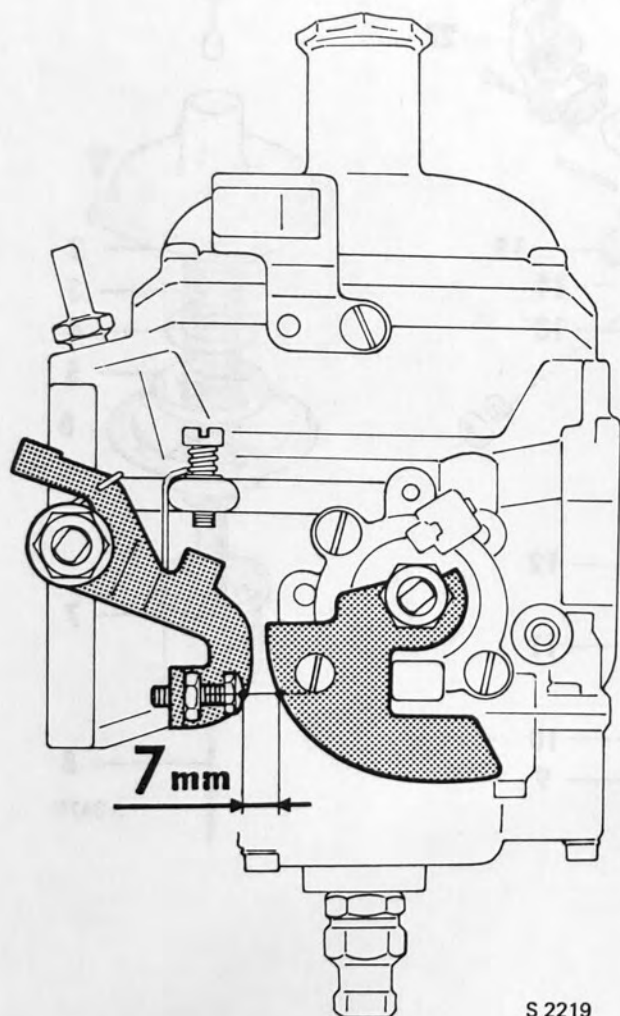
1. Remove the control as explained under "Removing", points 2, 3, 4 and 5.
2. Fit the locking spring in the groove on the pull rod guide bushing. Check its locking function.
3. Install the control.

Choke control setting

Make sure that the choke button is fully pushed in. Secure the choke control wire in fast idling cam screw. Connect the control with the clip.

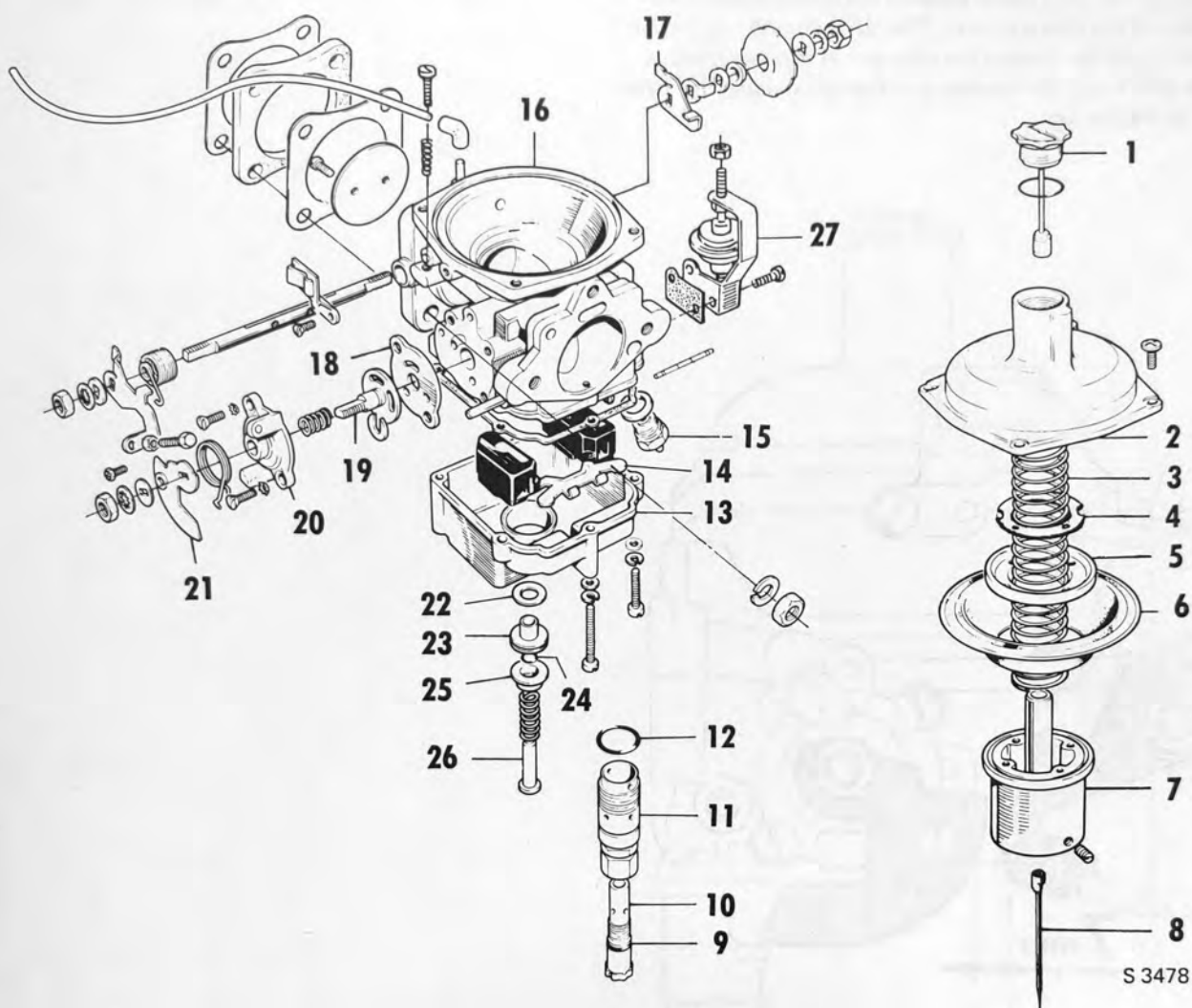
Setting the damper

Check that the damper is properly installed by introducing a 0.275" (7 mm) spacer between the choke throttle cam disc and the stop arm screw. The damper push rod should then touch the stop on the stop arm. If necessary, adjust the position of the damper with the nuts holding the damper to the bracket.



S 2219

SETTING THE DAMPER



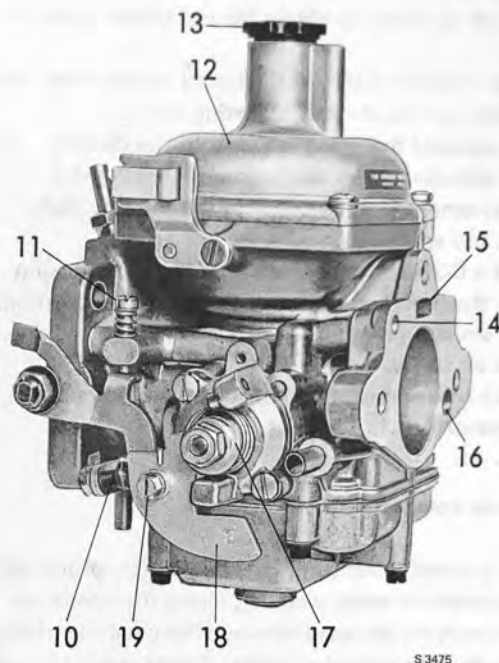
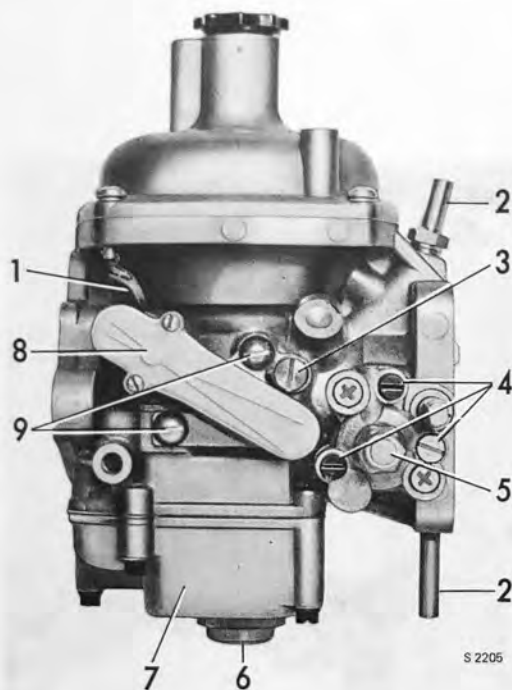
S 3478

CARBURETOR, 1.7 AND 1.85 L ENGINES, EXPLODED VIEW

- | | |
|-------------------------|-----------------------------|
| 1. Damper screw cap | 14. Float |
| 2. Vacuum chamber cover | 15. Float valve |
| 3. Spring | 16. Carburetor housing |
| 4. Metal washer | 17. Carrier |
| 5. Plastic washer | 18. Valve plate |
| 6. Diaphragm | 19. Choke plate |
| 7. Vacuum piston | 20. Choke mechanism housing |
| 8. Fuel needle | 21. Fast idling cam plate |
| 9. O-ring | 22. Aluminum washer |
| 10. Jet adjusting screw | 23. Bushing |
| 11. Jet retainer | 24. O-ring |
| 12. O-ring | 25. Guide bushing |
| 13. Float chamber | 26. Jet |
| | 27. Damper |

Carburetor, USA export model, 1.7 and 1.85 l engines

The carburetor is specially adjusted by the manufacturer and fine tuned with a carbon monoxide meter by Saab.



CARBURETOR, USA, 1.7 AND 1.85 L ENGINES

1. Clip, choke control wire
2. Vacuum chamber cover
3. Damper cap
4. Air channel, float chamber ventilation
5. Channel, air to space under diaphragm
6. Channel, air to temperature compensator
7. Choke
8. Fast idling cam
9. Connection, choke control wire
10. Adjusting screw, fast idling
11. Idling screw

10. Adjusting screw, fast idling
11. Idling screw
12. Vacuum chamber cover
13. Damper cap
14. Air channel, float chamber ventilation
15. Channel, air to space under diaphragm
16. Channel, air to temperature compensator
17. Choke
18. Fast idling cam
19. Connection, choke control wire

Adjusting the carburetor

Before adjusting the carburetor, check the following parts of the system and adjust if necessary:

Spark plugs, breaker contacts (cam angle),
ignition setting and compression.

Check also that there is no leakage on the induction side or in the vacuum control unit of the distributor. The operation of the accelerator control and throttle should also be checked.

Always use a carbon monoxide meter when adjusting the carburetor. The setting must be made at an ambient temperature of 59–77°F (15–25°C) within eight minutes

after the opening of the coolant thermostat, the engine being warmed up from stone cold.

For CO measurement it is important that the carburetor is at the right temperature. You can check that it is not too warm by feeling the float chamber with the hand. It should be cold to the touch, i.e. not above room temperature.

The air cleaner valve must be at the "Summer" setting, i.e. direct air intake without preheating. To be certain of getting accurate CO readings, the measurement must be made within the time limit stated above.

Measure the CO emission according to the instructions that come with the CO meter. It is important that the

exhaust pipes and mufflers are in perfect condition when measurements are made.

1. Check that there is oil in the damper.
2. Connect a tachometer and warm up the engine until the thermostat opens. (You can feel when the radiator inlet from the thermostat housing starts to grow warm.)
3. Adjust engine idling speed to 800–850 rev/min with the throttle screw.
4. Adjust the air screw to obtain the smoothest possible idling.
5. Set a gap of 0.02–0.08" (0.5–2 mm) between the fast idling cam and the throttle adjusting screw.
6. Having adjusted the idling speed, turn the throttle control adjusting screw out or in until accelerator pedal movement is transmitted to the throttle shaft without any appreciable backlash.
7. Connect a CO meter and check that the CO emission is below the limit laid down for the model in question. The CO emission can be adjusted within narrow limits with the air screw.
If the CO emission is too high, check the temperature compensator first.

Temperature compensator

If the idling speed tends to fall off badly after prolonged idling, especially in warm weather, check the operation of the temperature compensator by taking off the plastic cap and pushing in the valve, which should result in rougher idling. If the valve has a tendency to move sluggishly or to stick, it can be adjusted provided that it is not scored or covered with scale, in which case it must be exchanged as a unit.

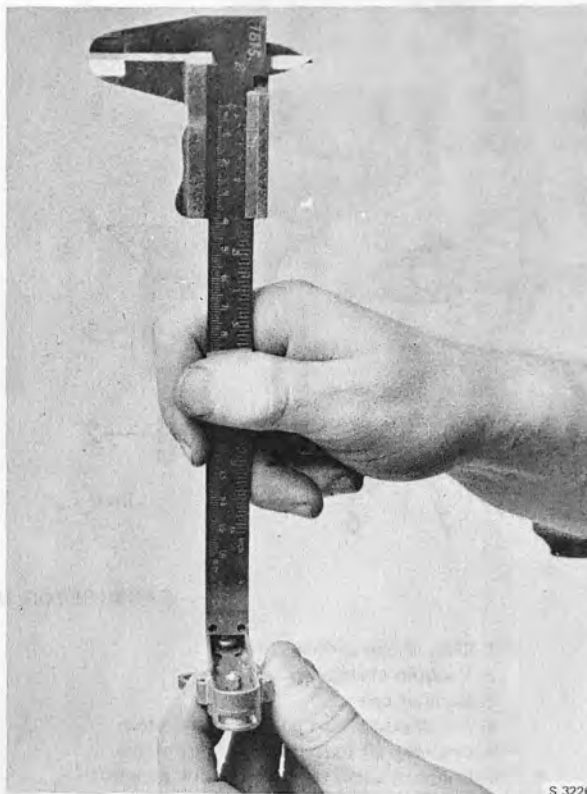
Adjusting the valve

Slacken the cross-recessed screw of the bimetal spring and center the valve so that it works smoothly.



CENTERING THE VALVE

At 68°F (20°C) the valve should have opened 0.004–0.012" (0.1–0.3 mm). To check the setting, remove the temperature compensator from the carburetor and store it at 68°F (20°C) until it has assumed this temperature. Adjust with the bimetal spring nut.



S 3226

CHECKING THE SETTING OF THE TEMPERATURE COMPENSATOR

Changing the temperature compensator

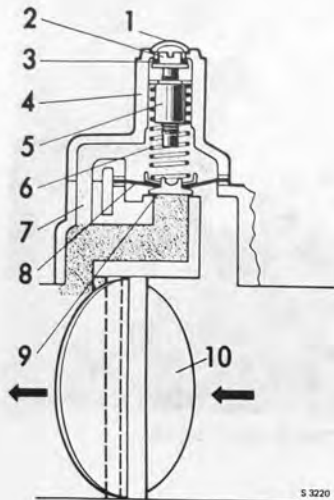
Change the temperature compensator as a complete unit. To remove it, undo the two slotted screws.

NOTE

Both the outer and inner rubber gaskets must be exchanged.

Overflow valve

If the engine tends to idle too fast, the cause may be a faulty or badly adjusted overflow valve.

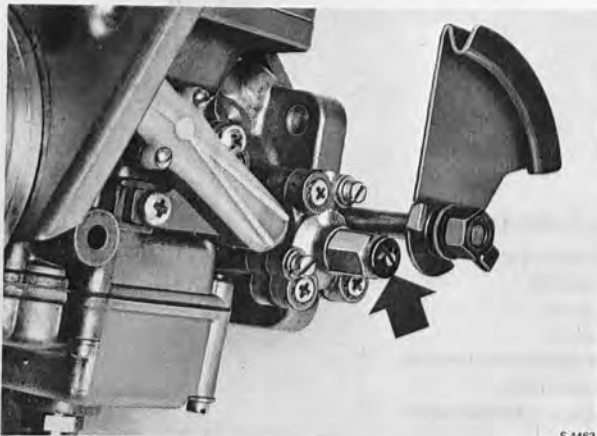


OVERFLOW VALVE

- | | |
|--------------------------------|--------------|
| 1. Cap washer | 8. Diaphragm |
| 2. Adjusting screw | 9. Valve |
| 3. Rubber ring | 10. Throttle |
| 4. Cover | |
| 5. Nut | |
| 6. Spring | |
| 7. Channel to top of diaphragm | |

Adjusting the valve

1. Take the rubber bellows off the driver disc of the throttle shaft.
2. a. If there is no hole in the driver disc opposite the cap washer (brass washer) on the overflow valve, remove the disc and drill a hole in it approx. 1/4" (6–8 mm) in diameter.



OVERFLOW ADJUSTMENT SCREW

- b. Remove the cap washer, e.g. by drilling a hole in it and then prying it off with a suitable tool. The washer need not be replaced.
Refit the driver disc.

3. Turn the overflow valve adjusting screw counterclockwise to the limit position, i.e. until it will not turn any farther. The valve is now held shut.

CAUTION

Do not push the screw down, as this may break the seal so that the idling adjustment cannot be made.

4. Check and if necessary adjust the cam angle and ignition setting.
5. Connect a tachometer and adjust the idling speed with the throttle adjustment screw (800–850 rev/min, warm engine). Stop the engine.
(If you have difficulty in getting the idling speed down to normal, check the induction side and the vacuum control unit of the distributor for leaks.)
6. Turn the overflow valve adjusting screw 6 full turns clockwise.
7. Start the engine and raise the speed to 3000 rev/min by turning the driver disc. Then release the driver disc. If the speed then drops to the present value, the valve is properly adjusted.
If the engine does not drop back to idling speed, turn the adjusting screw one full turn counterclockwise and repeat the check.
If necessary, repeat this procedure by adjusting one full turn at a time counterclockwise until the desired result is obtained.

If the above adjustment fails to get results, the valve must be dismantled and checked (cleaned), and possibly exchanged.

Removing the overflow valve

To remove the valve unit, undo the three slotted screws. When reassembling, scrape any remaining fragments of gasket off the mating surfaces and always fit a new gasket.

Float level

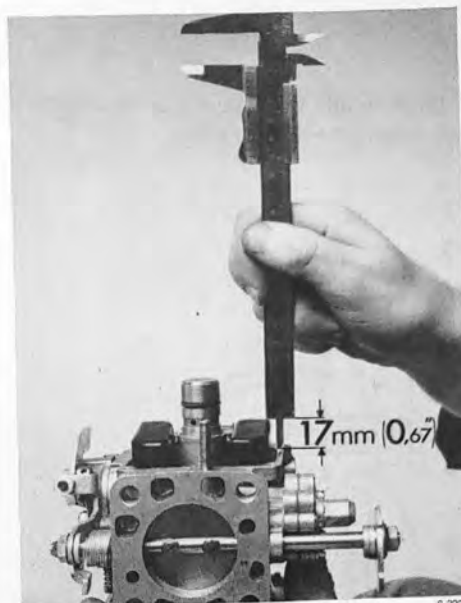
Check the float level as follows:

- a. To check the level the carburetor must be removed from the car and inverted with the float housing removed.
- b. If the level is correct, the highest point of the float should project 0.67" (17 mm) and the rear edge 0.43" (11 mm) beyond the mating surface of the carburetor

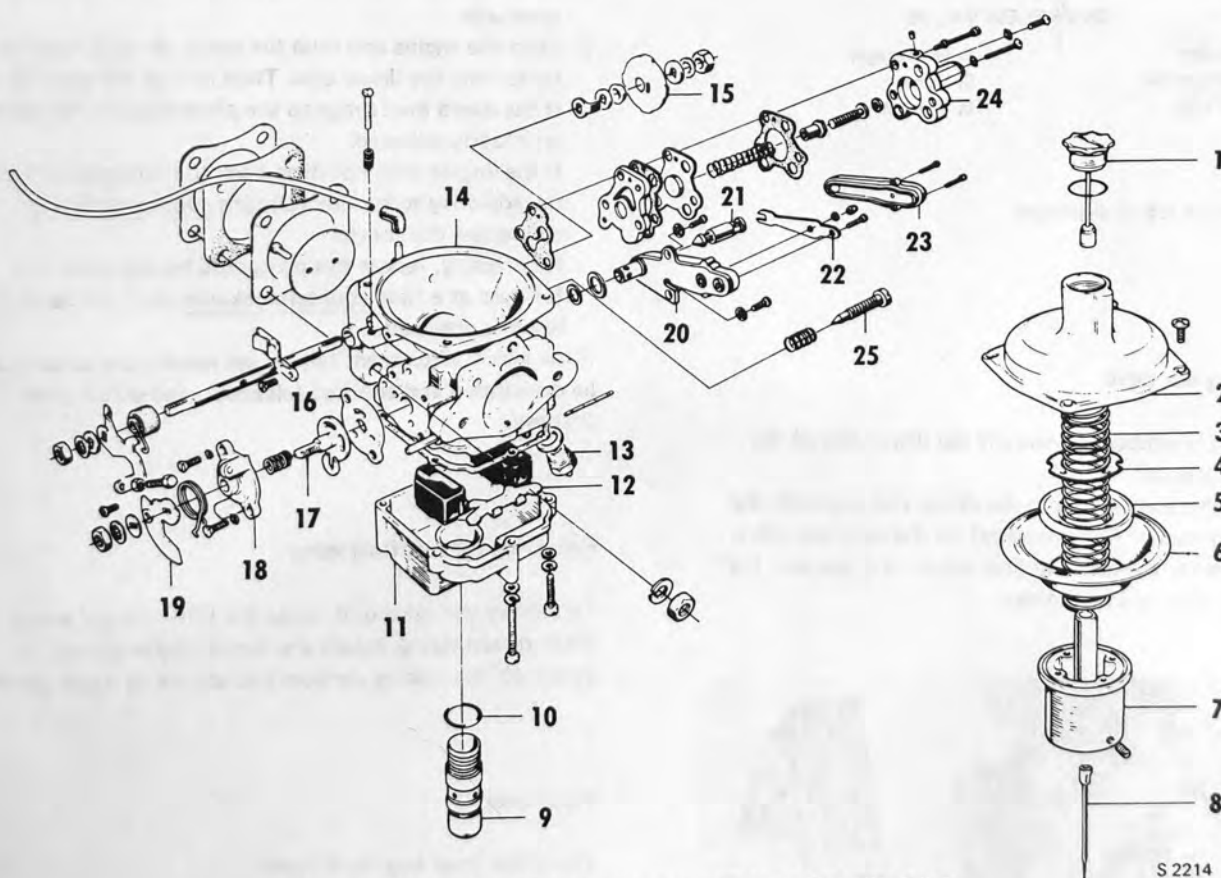
housing with the float valve closed. If the level is not correct, adjust by bending the tongue of the float valve.

NOTE

Do not bend the arm between the float and the spindle.



CHECKING THE FLOAT LEVEL

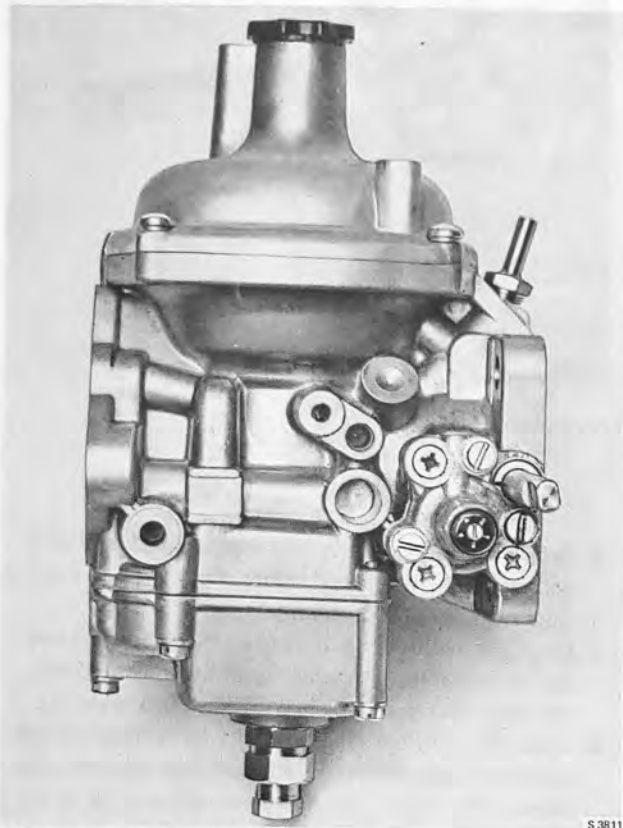


CARBURETOR, USA, EXPLODED VIEW, 1.7 AND 1.85 L ENGINES

- | | |
|-------------------------|-----------------------------|
| 1. Damper screw cap | 14. Carburetor housing |
| 2. Vacuum chamber cover | 15. Throttle lever |
| 3. Spring | 16. Valve plate |
| 4. Metal washer | 17. Valve plate |
| 5. Plastic washer | 18. Choke mechanism housing |
| 6. Diaphragm | 19. Idling cam plate |
| 7. Vacuum piston | 20. Temperature compensator |
| 8. Fuel needle | 21. Valve |
| 9. Float chamber plug | 22. Bimetal spring |
| 10. O-ring | 23. Cover |
| 11. Float chamber | 24. Overflow valve |
| 12. Float | 25. Air screw |
| 13. Float valve | |

CARBURETOR

2.0 l engine



CARBURETOR, 2.0 L ENGINE

Removal, dismantling, cleaning and reassembly

See carburetor 1.7 and 1.85 l engines.

Removal of overflow valve

The valve unit can be removed by undoing the three slotted screws. When reassembling, always fit a new gasket and scrape off all remaining traces of the old gasket.

Float level

Follow the instructions given on pages 231–2 but note that the tolerances here are closer: 0.630"–0.669" (16–17 mm).

Basic setting

The vertical location of the fuel jet in relation to the level of the jet bridge has been carefully tested in view of the load conditions likely to be experienced. No further adjustment of the jet screw – apart from the adjustments described below – should be attempted. If additional adjustment should be required, the vertical position of the fuel needle in the piston should be modified.

1. Remove the vacuum chamber cover together with the spring, and the vacuum piston and diaphragm.
2. Measure the distance between the jet bridge and the jet, using a slide gauge, and adjust to 0.089 ± 0.008 " (2.5 ± 0.2 mm). (If the jet is set exactly at 2.5 mm, a quarter turn's adjustment of the screw either way is permissible in connection with the subsequent CO check ($1/4$ turn = 0.2 mm height variation)).

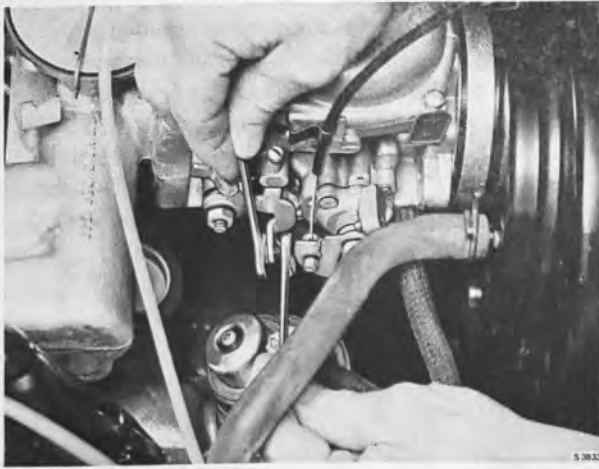


ADJUSTMENT OF MAIN JET

3. Check that the lower part of the track for the plastic washer on the fuel needle is level with the underside of the vacuum piston.
Adjust by slackening the retaining screw and moving the needle up or down.
4. Refit the vacuum piston and diaphragm, the spring and the vacuum chamber cover.

Adjustment of choke

Check that the distance between the adjustment screw on the throttle shaft carrier and the choke cam disc is 0.020–0.039" (0.5–1.0 mm). Make sure that the choke control is pushed in and that the throttle disc is completely closed.



ADJUSTMENT OF CHOKE CONTROL

Adjustment of idling speed

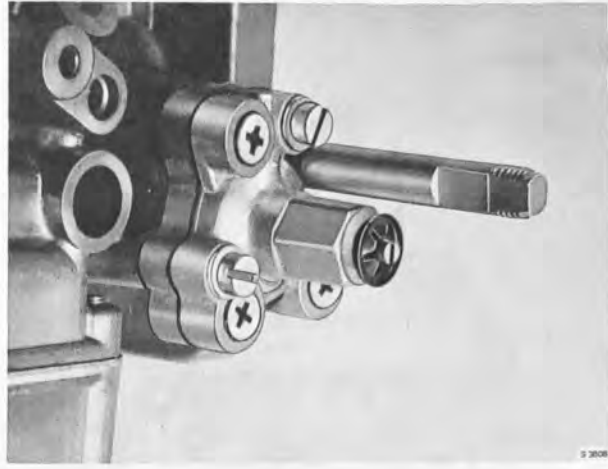
Run the engine up to normal working temperature. Adjust the throttle shaft screw to obtain an idling speed of 850 rev/min.



ADJUSTMENT OF IDLING SPEED

Adjustment of overflow valve

1. Run the engine and the carburetor up to working temperature. Note that the air preheater must be in the appropriate position for the time of year.
2. Run the engine at idling speed and check that the overflow valve is closed. If there is any uncertainty as to this point, turn the overflow valve adjustment screw a few turns counter-clockwise.

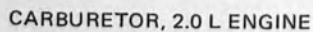


OVERFLOW VALVE

3. Adjust the fuel quantity and engine speed to the recommended idling speed values. (If there is any uncertainty, check ignition timing.)
4. Open the overflow valve completely by turning the adjustment screw clockwise until the engine speed no longer increases (approx. 1500–1800 rev/min).
5. Close the overflow valve carefully by turning the adjustment screw counter-clockwise until the valve just closes. (The engine will now have returned to its normal idling speed.) Then turn the overflow adjustment screw an additional one-half to three-quarters of a turn counter-clockwise.
6. Check the above adjustments by racing the engine up to approx. 3000 rev/min and then releasing the throttle control to idling position again. The engine should return to a normal idling speed although there will be some slight delay. If this is not the case, the overflow valve adjustment screw should be turned slightly more counter-clockwise.

Adjustment of CO emission

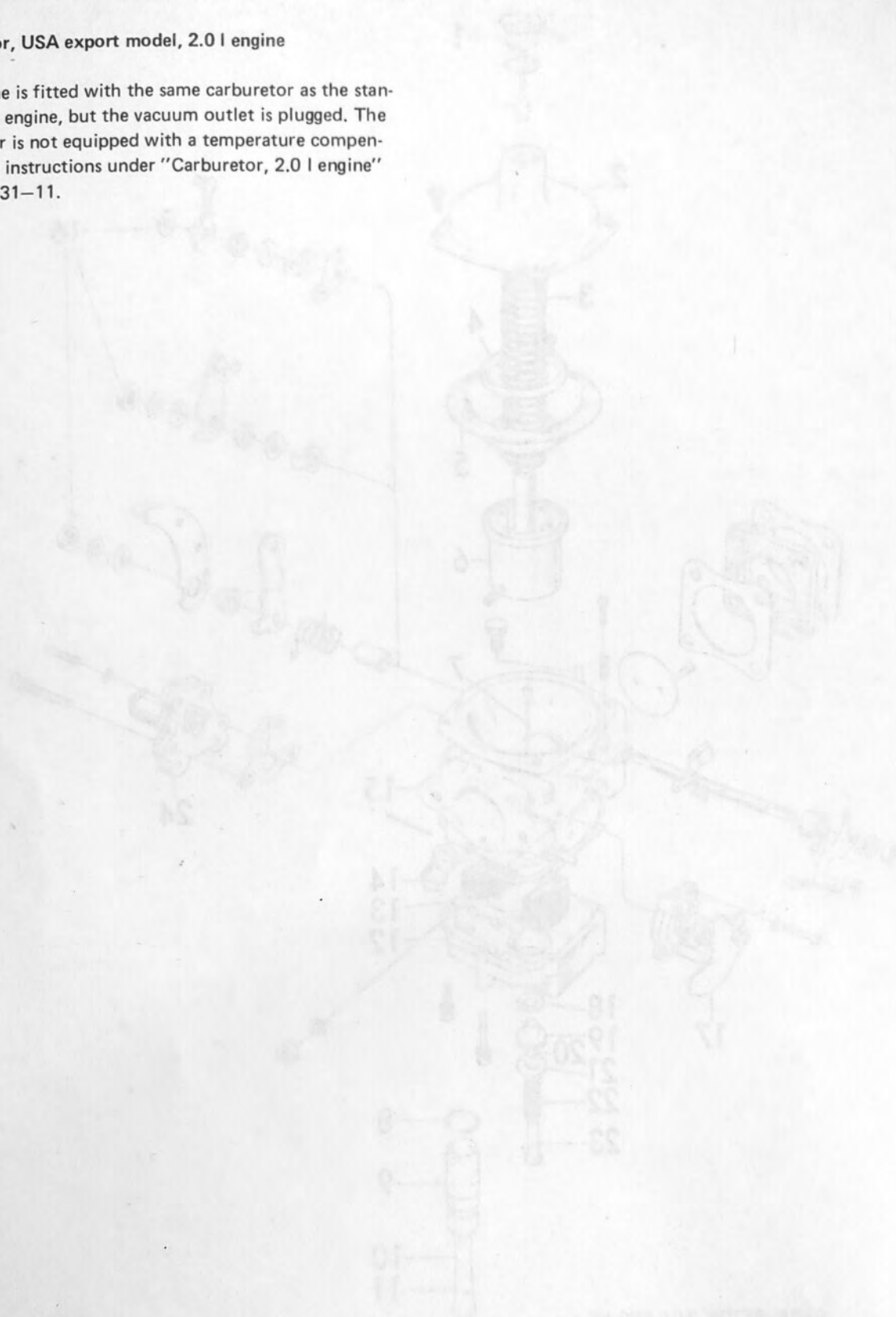
CO adjustment is carried out at an idling speed of 850 rev/min. A CO meter is required. If the carbon monoxide value is in excess of 4.5 per cent by volume, adjust the jet screw for a leaner mixture but not more than 1/4 of a turn. If the adjustment is not sufficient, the vertical position of the fuel needle in the piston must be adjusted.



17. Choke mechanism with cam plate
18. Aluminum washer
19. Bushing
20. O-ring
21. Bushing
22. Spring
23. Jet
24. Overflow valve

Carburetor, USA export model, 2.0 l engine

The engine is fitted with the same carburetor as the standard 2.0 l engine, but the vacuum outlet is plugged. The carburetor is not equipped with a temperature compensator. See instructions under "Carburetor, 2.0 l engine" on page 231-11.



FUEL PUMP, EARLIER MODEL

Removing

Pull the fuel line hose off the pump. Remove the retaining screws and washers, unship the pump and remove the old gasket. Always use a new gasket when reassembling.

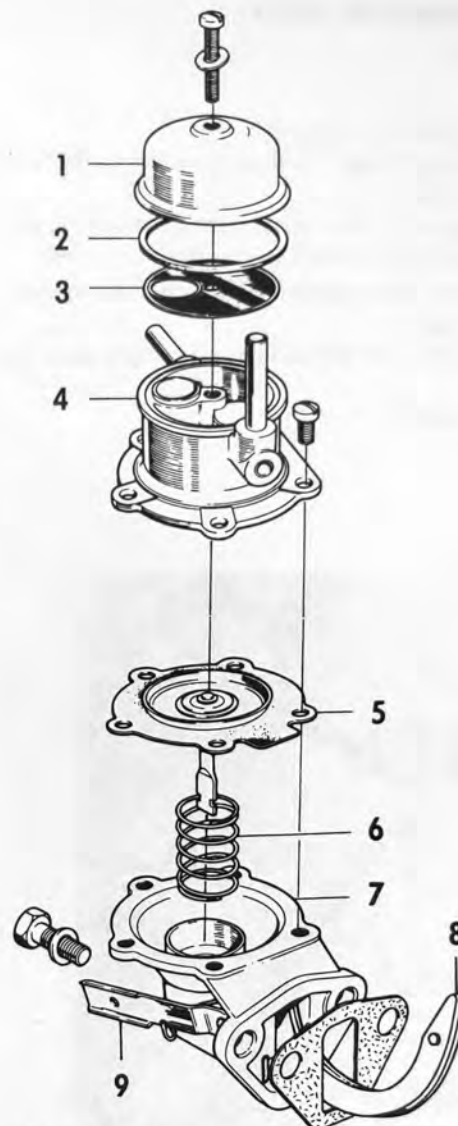
Disassembly

1. Unscrew the cover and take out the gasket and filter.
2. Mark the flanges of the top and bottom halves of the pump housing so that they can be reassembled later in the same position.
3. Remove the flange screws and separate the two halves of the housing.
4. Hold the bottom half of the housing in the hand. Push down the diaphragm and twist it a quarter turn to the right to disengage the diaphragm rod from the pump lever. Remove the diaphragm rod and spring.

The top half of the pump containing the valves and the bottom half containing the lever and manual priming lever cannot be further disassembled.

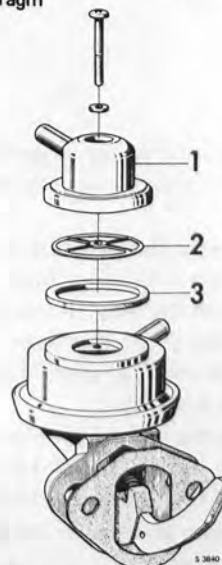
Assembling

1. Hold the bottom half of the pump in the hand, and insert the diaphragm with spring and rod so that the rod slips into the slot in the lever.
2. Give the diaphragm a quarter turn to the left and check that the rod has hooked on to the lever.
3. Push in the lever to relieve the tension on the diaphragm. Align the top half of the pump by the flange markings. Insert the screws in this position and screw the two halves together.
4. Fit a new gasket and filter. Screw on the cover.



FUEL PUMP, EARLIER MODEL

- | | |
|---------------------|------------------------|
| 1. Cover | 6. Diaphragm spring |
| 2. Gasket | 7. Bottom half of pump |
| 3. Filter | 8. Lever |
| 4. Top half of pump | 9. Manual lever |
| 5. Diaphragm | |



FUEL PUMP, LATER MODEL

1. Cover
2. Filter
3. Gasket



S 1700

INSTALLING THE FUEL PUMP

FUEL TANK AND FUEL LINES

Removal

1. Jack up the rear end of the car.
2. Drain the tank through the drain plug (accessible from beneath the car).
3. Take out the trunk floor covering and remove the access panel for the fuel level transmitter. Disconnect the wires from the transmitter. Undo all hose connections at the tank.
4. Back off the nuts on the two securing straps under the tank.
5. Remove the tank.



REMOVING THE FUEL TANK

Installation

1. Make sure that the straps are properly mounted and cover the filler and vent hose openings with masking tape.
2. Clamp the wires to the top of the tank. Lift the tank into position and suspend it in the two straps.
3. Center the tank and tighten the nuts. Remove the masking tape from the filler pipe and vent hose.
4. Connect the fuel line hose and filler pipe. Make sure that the rubber grommet is in place.
5. Connect the vent hose to the upper filler pipe. (As from model 1970 also on top of the tank.) Connect the wires to the fuel level transmitter and replace the access panel. Relay the floor covering in the trunk.
6. Lower the rear end of the car.

Removal, Saab 99 Combi Coupé

1. Disconnect one of the battery terminals.
2. Jack up the rear of the car.
3. Drain the tank by means of the drain plug accessible from beneath the car.
4. Remove the rear floor cover and floor panel in the luggage compartment.
5. Disconnect the vent hoses and the filler pipe from the tank. Plug or blank off the ends of the pipes.
6. Disconnect the fuel hose (hoses) from the pipe (pipes) in front of the frame side member and remove the clip from the side member. Plug the ends of the hose (hoses) and pipe (pipes).
7. Remove the two securing strap nuts under the tank. Lower the tank slightly and disconnect the electrical connections from the fuel level transmitter (and the fuel pump).
8. Remove the tank.

Installation, Saab 99 Combi Coupé

1. Check that the rubber seals on the fuel level transmitter (and fuel pump) are in good condition and correctly fitted.
2. Move the fuel tank roughly into position and connect the electric cables for the fuel level transmitter (and fuel pump).
3. Lift the tank and suspend it in the two securing straps.
4. Adjust the lateral position of the tank and then secure it in position. Remove the plugs and masking tape.
5. Connect the fuel line (lines), filler pipe and vent hoses. Check that the rubber grommet is in position.
6. Replace the floor panel and rear floor cover in the luggage compartment.
7. Lower the car.

Exchanging fuel lines in the passenger compartment, model 1969

Removal

1. Remove the right front seat and scuff plate protector. Turn back the floor carpets and right wheel housing carpet and fold up the seat cushion to expose the fuel line.
2. Unscrew the joints in the engine compartment and in front of the fuel tank. Unscrew the fuel line clamps inside the car.
3. Pull back the forward end of the fuel line into the passenger compartment and bend it over to the left of the car. Pull out the line a foot or so from under the back seat. Straighten out the two bends under the seat and remove the fuel line.

Installation

1. Blow down the new fuel line with compressed air. Close the ends with masking tape.
2. Straighten the two bends at the rear end slightly and insert the fuel line through the left-hand door under the back seat.
3. Bend the new line to the same shape as the old one that has been removed. Connect it to the hose from the fuel tank and the hose in the engine compartment, after removing the masking tape.
4. Make sure that the plastic clips are evenly spaced along the line at the scuff plate, and tighten the screw clamps.

Exchanging fuel lines in the passenger compartment, as from model 1970

Removal

1. Remove the left front seat and seat back cushion. Turn back the floor carpets and left wheel housing carpet.
2. Undo the fuel line from clamps and hose connections.
3. Pull the rear part of the fuel line into the passenger compartment and remove the line through the trunk lid opening.

Installation

1. Clean the fuel line by blowing with compressed air. Close the ends with masking tape.
2. Insert the fuel line through the trunk lid opening and under the seat beams into the tube passage at dash panel and left bearing bracket. Insert the line as far as possible and place the line in rear passage at the cross member.
3. Remove the masking tape at the fuel line ends. Clamp the line and connect the fuel hose in the engine compartment and the hose from the fuel tank.
4. Refit seat back cushion, the left front seat and the carpets.

Removing/Installing fuel line in passenger compartment Cars with injection engines

See the same description as from model 1970.

Removing/Installing return fuel line Cars with injection engines

See the same description for model 1969.

ELECTRONICALLY CONTROLLED FUEL INJECTION

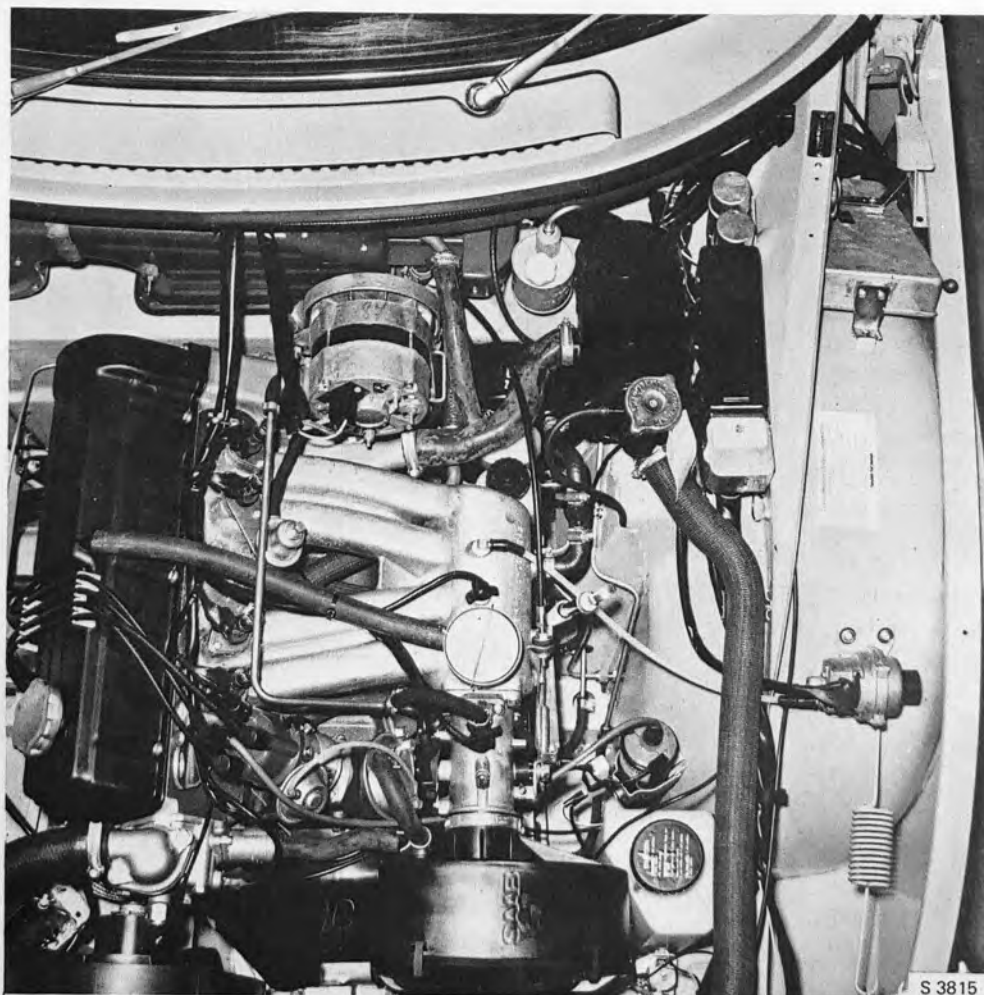
Contents

Page 234-6 up to and including 10	1. Description of System
Page 234-11	2. Testing Instruments and Tools Required
Page 234-11 up to and including 20	3. Testing the Fuel Injection System with Test Instrument EFAW 228 S 10
Page 234-22 up to and including 23	4. Fault Chart, Cause-Remedy
Page 234-24 up to and including 29	5. Removal, Installation and Adjustment of the Individual Components in the System

Special testing devices and tools are required for repairing the electronically controlled fuel injection system (page 234-11).

In case of trouble the complete component (except ignition distributor) is to be replaced instead of repairing.

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ENGINE COMPARTMENT

SELECTING APPROPRIATE FUEL INJECTION

Special testing devices and tools are required for testing the electrical - controlled fuel injection system (pages 234-235).
 1. Care of the engine the complete - adjustment - excess gas
 2. The adjustment - to be correct - excess of fueling

Parts of pages 234-235 to 244-250 include the technical
 by kind - system on the engine - fuel - fuel - fuel - fuel
 244-250

Contents	
Page 234-235 up to end	1. Description of System
Page 234-235	2. Testing Instruments and Tools Required
Page 234-235 up to end	3. Testing the Fuel Injection System with Test Instrument
Page 234-235 up to end	4. Fuel Control - Control - Control - Control
Page 234-235 up to end	5. Removal, Installation and Adjustment of the Individual Components in the System

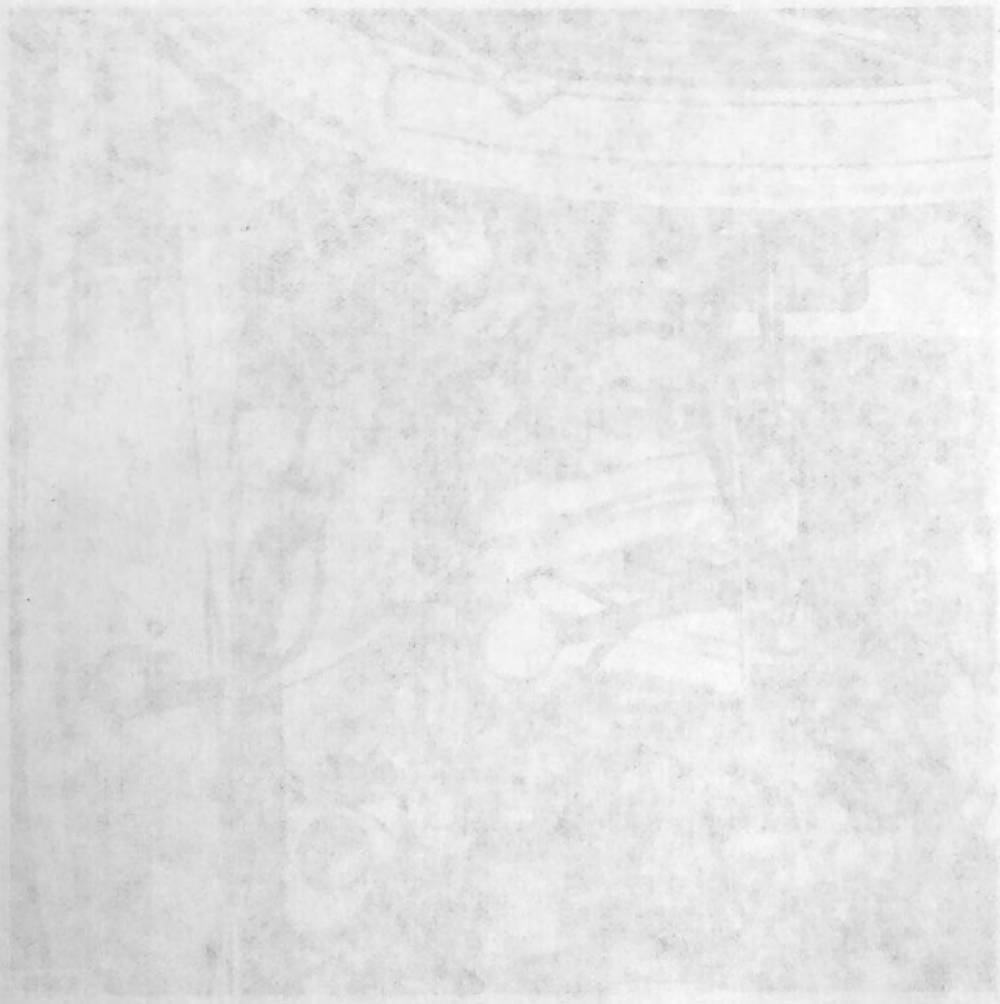


FIGURE 1 - FUEL INJECTION SYSTEM

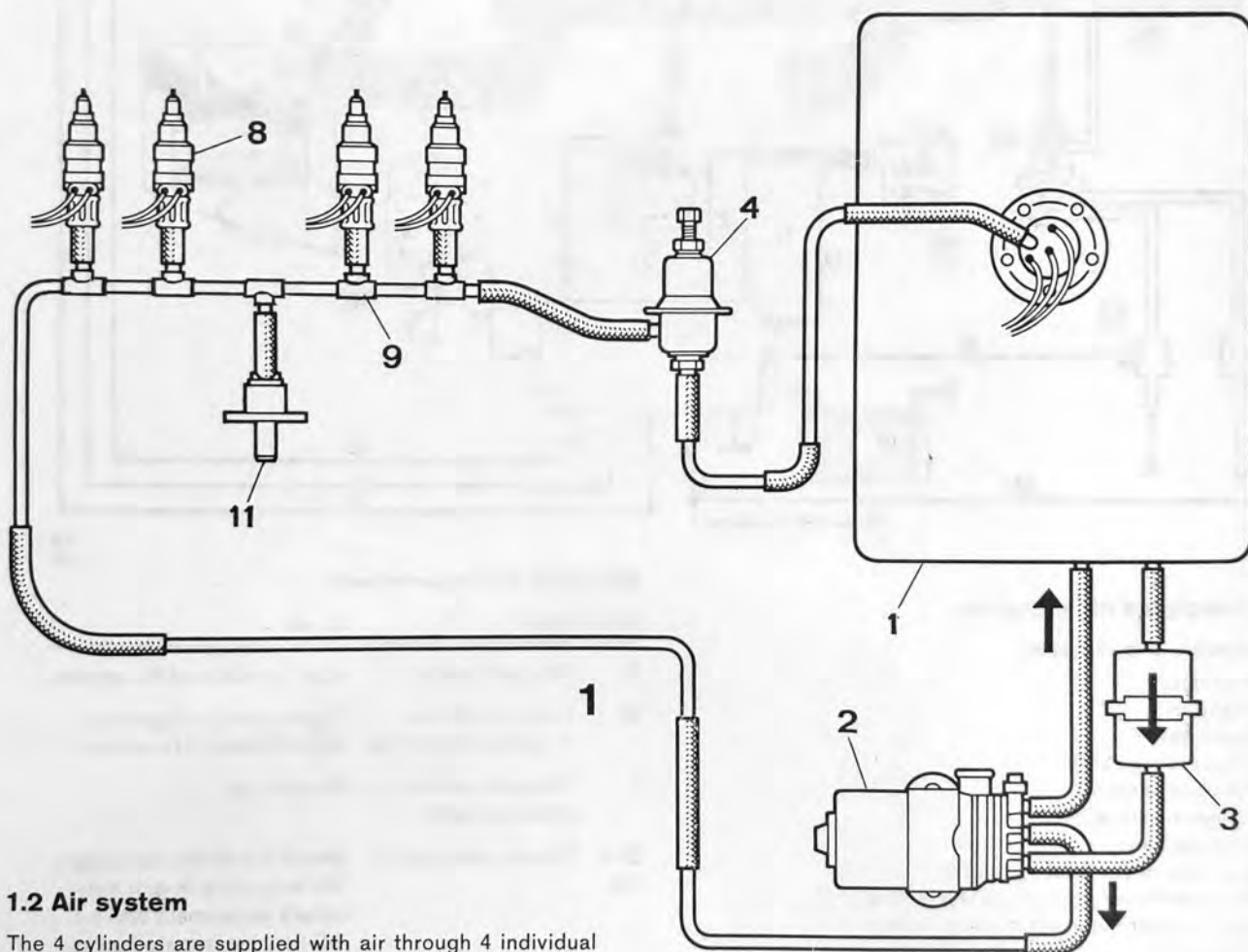
1. Description of System

1.1 Fuel system

Fuel is drawn by the electric fuel pump ② from the tank ① via the filter ③ and forced into the fuel pressure line.

The pressure regulator ④ connected to the end of the pressure line limits the fuel pressure. The electro-magnetic fuel injectors ⑧ as well as the start valve ⑩ are connected to the pressure line by means of the fuel distributor pipes ⑨. From the pressure regulator the excess

fuel can flow back to the tank through the return line. The return line coming from the pump also leads into the tank. A relief valve is fitted in the fuel pump which opens if, due to a fault in the pressure system, the pressure reaches a value much above that requires. A check valve in the pressure connection of the fuel pump prevents a complete loss of pressure in the fuel line when the pump is switched off.



1.2 Air system

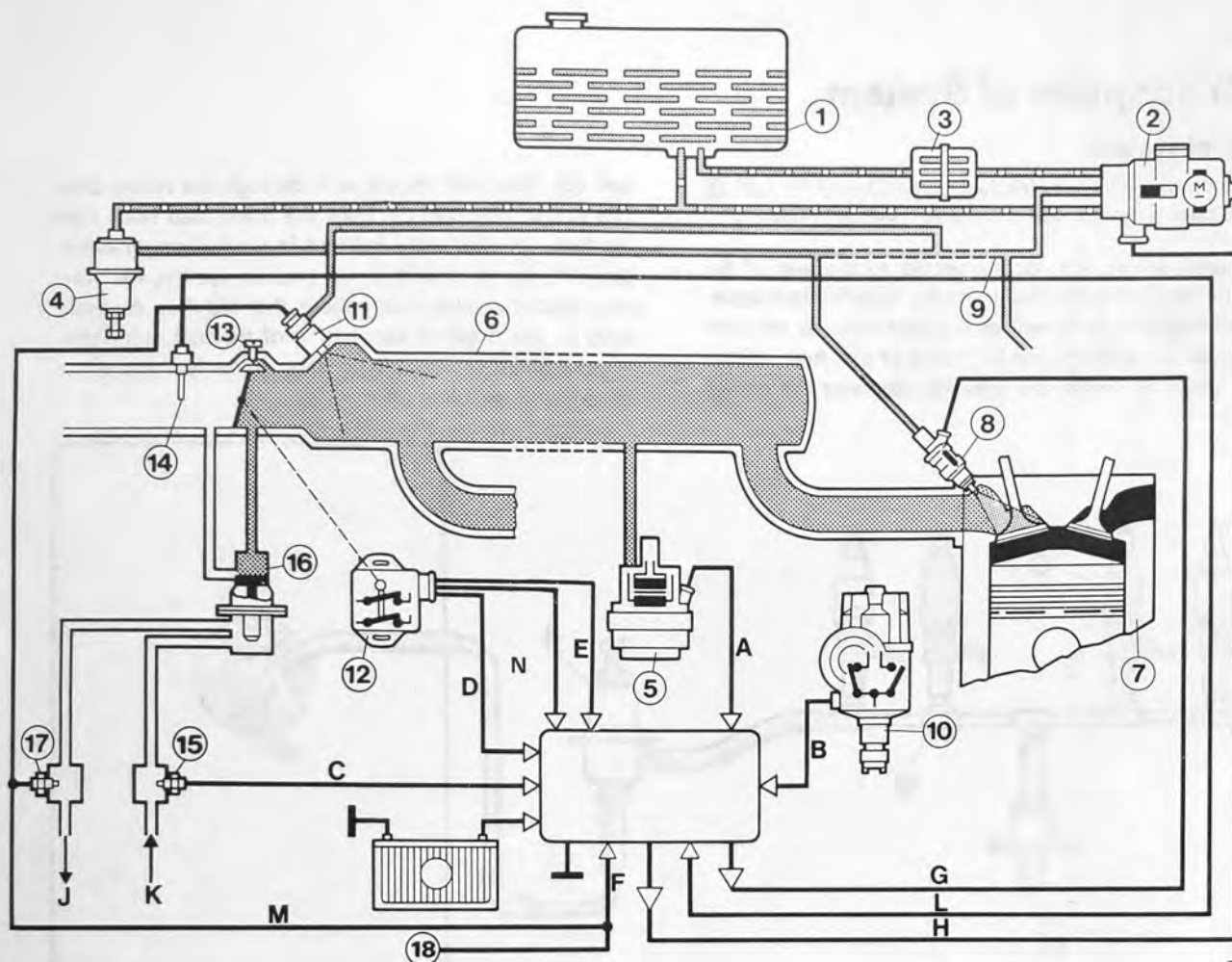
The 4 cylinders are supplied with air through 4 individual induction pipes which are connected to one common inlet duct. The pressure sensor and the vacuum advance for the ignition distributor are also connected to the common inlet duct.

There is a throttle valve, which is operated by a linkage from the accelerator pedal, at the mouth of the common inlet duct. Air is drawn into the common inlet duct through an air filter.

When driving, the air flow into the common inlet duct is controlled by the throttle valve. When idling, the throttle valve is completely closed. The idling air enters the common inlet duct only via a by-pass port behind the throttle valve. The idling speed is set by altering the cross-section of the by-pass pipe.

Adjustment of the idling speed should only take place when the engine is warm, approx. 80° C (175° F) cooling liquid temperature. This will ensure that the auxiliary air regulator is closed. The engine not fully warmed up requires an additional air flow for smooth running. This is controlled by the auxiliary air regulator ⑬. It alters the effective cross-sectional area of the auxiliary air pipe depending on the cooling liquid temperature.

The position of the regulator is dependent on an element made of expanding material which projects into the cooling liquid. At about -30° C (-22° F) the regulator is fully open, and at about +60° C (140° F) it is completely closed.



2

1.3 Principles of operation

Key to schematic of system

- ① Fuel tank
- ② Fuel pump
- ③ Fuel filter
- ④ Pressure regulator
- ⑤ Pressure sensor
- ⑥ Common inlet duct
- ⑦ Cylinder head
- ⑧ Injection valves (fuel injectors)
- ⑨ Fuel distributor pipes to the 4 injectors
- ⑩ Ignition distributor with trigger contacts
- ⑪ Start valve
- ⑫ Throttle valve switch
- ⑬ Idling adjustment screw
- ⑭ Temperature sensor I (intake air)
- ⑮ Temperature sensor II (cooling liquid)
- ⑯ Auxiliary air regulator
- ⑰ Temperature switch
- ⑱ From starter terminal 50

Information for the control unit

Information	Signal
A Pressure sensor	Load condition of the engine
B Trigger contacts of ignition distributor	Engine speed, triggering signal for start of injection
C Temperature sensor II (cooling liquid)	Warming up
D+E Throttle valve switch +N	Switching off the fuel supply while coasting in gear, temporary enrichment and for 2.0 I engine, supply fuel at full throttle
F From starter terminal 50 (if at the same time temperature switch is closed)	Start enrichment
L Temperature sensor I (intake air)	Correction of injected quantity, dependent on air temperature in the intake manifold
G	To injection valves
H	To fuel pump
M	To start valve
J+K	Cooling liquid circuit to the auxiliary air regulator.

Due to the fuel pressure, fuel is injected during the time for which the injector is open. The nozzle duct of the fuel injector is accurately calibrated. Since the fuel pressure is kept constant, the injected quantity of fuel is dependent only upon the length of time for which the injector is open.

The duration of injection is "computed" by the control unit. The information processed by the electronic control unit comes from the individual sensors on the engine. This is done in the following manner:

The moment when the fuel is injected is controlled by the distributor contacts (trigger contacts I and II) according to the position of the cam shaft (B). These contacts are installed under the centrifugal advance mechanism in the distributor and are maintenance-free.

The duration of injection (fuel quantity) is governed basically by two factors: by the engine speed and the load condition of the engine. The engine speed is relayed to the control unit by the distributor contacts I and II. The load condition is determined by measuring the absolute pressure in the inlet manifold. This pressure is converted to an electrical impulse and relayed to the control unit by the pressure sensor (5), which is connected to the common inlet duct (6) by a hose (A).

The control unit processes this information and gives a signal for the injectors to be open for a longer or shorter period of time (G). The control unit thus allows a varying amount of fuel to be passed through the electrically operated injectors depending on engine load and speed. This is how the "basic quantity" of fuel is governed.

In addition to the "basic quantity" of fuel, an accurately metered amount of fuel is injected **additionally** when starting at low ambient temperatures, when warming up, during acceleration and at full load.

The start valve (11) injects fuel into the common inlet duct for as long as the starter is operated and at a cooling liquid temperature of up to approximately $0 \pm 5^\circ\text{C}$ ($+32 \pm 9^\circ\text{F}$) for 1.7 and 1.85 l engines and $+5 \pm 5^\circ\text{C}$ ($+41 \pm 9^\circ\text{F}$) for 2.0 l engines (closed temperature switch). The additional quantity of fuel gives an considerably better cold start performance of the engine.

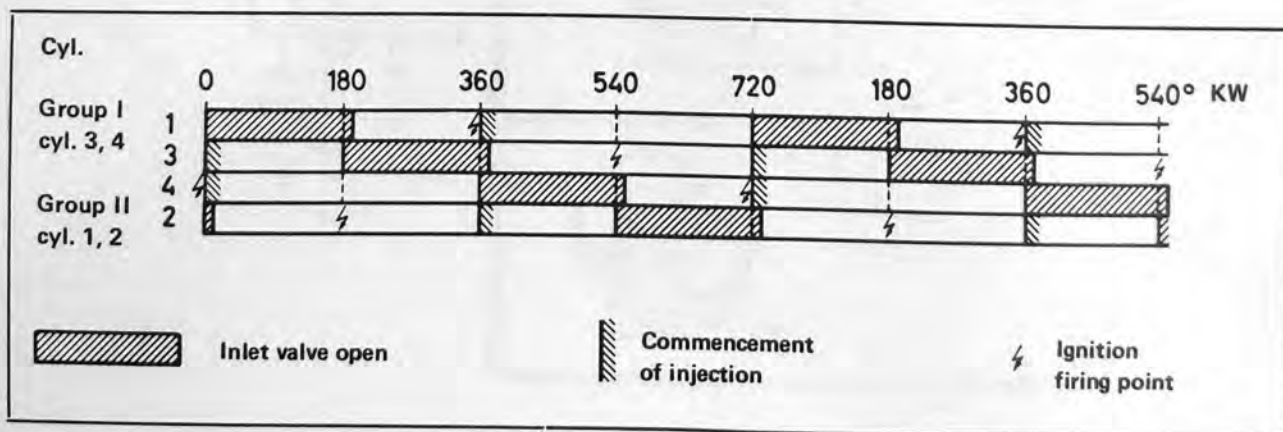
The control unit receives the signal "warming up" (C) from the temperature sensor I in the cooling liquid circuit II (5).

The temperature sensor I (14) (intake air) in the air filter corrects the injected quantity dependent on air temperature.

The throttle valve switch (10) on 1.7 and 1.85 l engines has two functions. Firstly, it signals "coasting in gear" (D) (braking with the engine); in this condition no fuel should be injected. This operating condition is characterised by a closed throttle valve and increased engine speed. The throttle valve switches off the fuel supply when coasting in gear, at a speed over 1600 rev/min (for 2.0 l engine 1850 rev/min). If, when coasting in gear, the speed drops to 1000 rev/min (for 2.0 l engine 1050 rev/min), the fuel supply is switched on again so that a smooth change-over to idling operation is guaranteed. When the engine is cold, the speed limits are raised by approx. 300 rev/min to equalize the higher frictional resistance.

The second function of the throttle valve switch is to give the control unit the information "more fuel" (E) when the accelerator is depressed. This means that for temporary enrichment, a certain accurately metered quantity of fuel is injected in addition to the normal amount of fuel.

On 2.0 l engine, the throttle valve switch has another function (N). Its task is to give the engine a somewhat richer fuel/air mixture at full throttle. This gives the engine an improved inner cooling at extended periods of high speed driving.

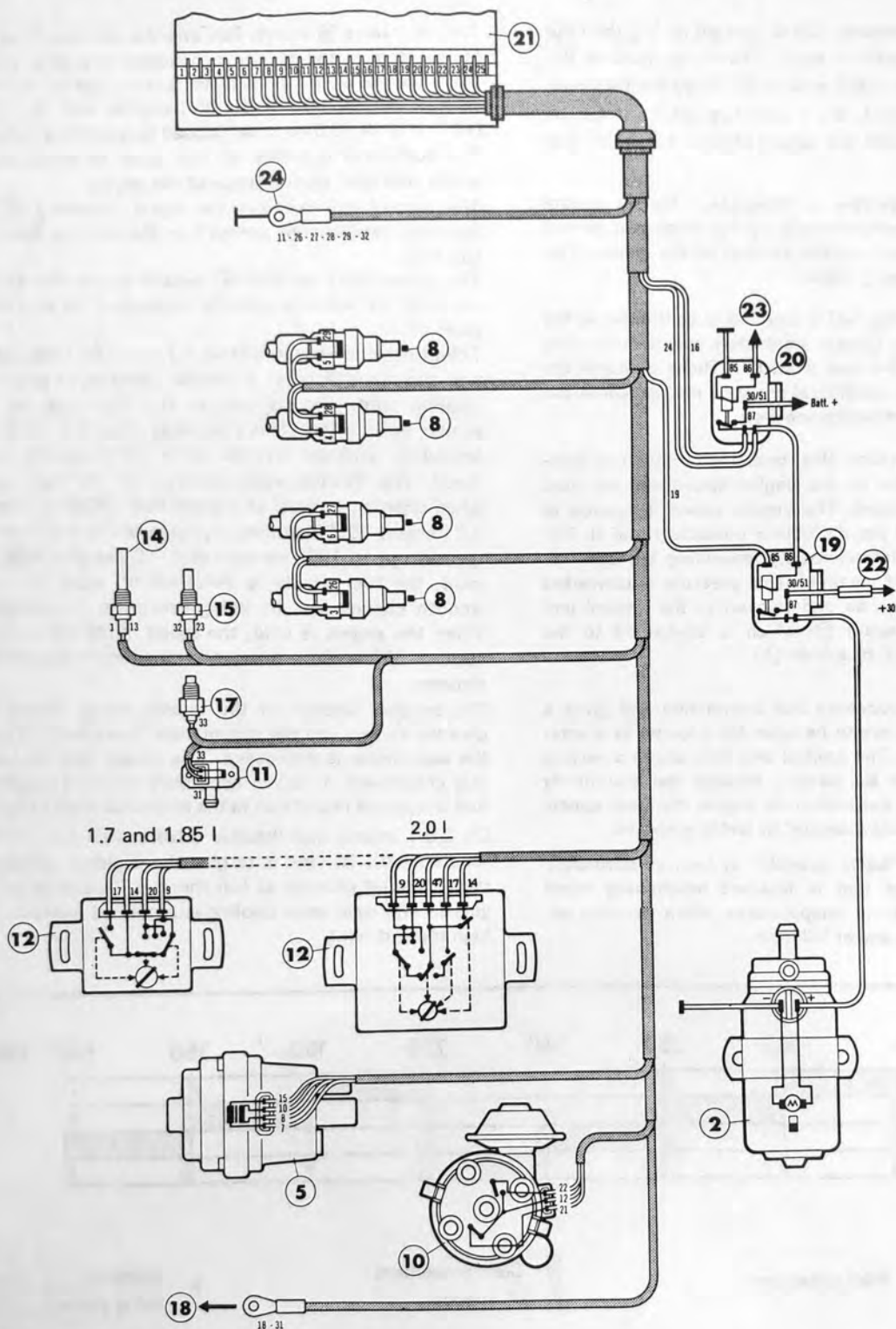


3

By signals from the control unit, the fuel injectors (8) are opened electrically in two groups (group 1: cyl. 3 and 4; group 2: cyl. 1 and 2).

The two fuel injectors of one group inject at the same time. The injectors of cylinders 1 and 4 inject fuel during the expansion stroke and the injectors of cylinders

3 and 4 during the exhaust stroke. The injectors always inject onto the still closed inlet valves and store the fuel there. This fuel is transferred later, when the inlet valve opens, together with the air stream into the combustion chamber.



4

1.4 Electronic controls

Description

- | | |
|--|--|
| ② Electrically operated fuel pump | ①⑦ Temperature switch (cold start) |
| ⑤ Pressure sensor | ①⑧ From starter terminal 50 |
| ⑧ Electro-magnetic injection valves | ①⑨ Pump relay |
| ⑩ Ignition distributor with trigger contacts | ②⑩ Main relay |
| ⑪ Start valve | ②① Electronic control unit |
| ⑫ Throttle valve switch | ②② Fuse no. 8 in main fuse box |
| ⑬ Temperature sensor I (intake air) | ②③ Terminal 15 (of series resistor of ignition coil) |
| ⑭ Temperature sensor II (cooling liquid) | ②④ Ground |

Description of the cable runs

Remark:

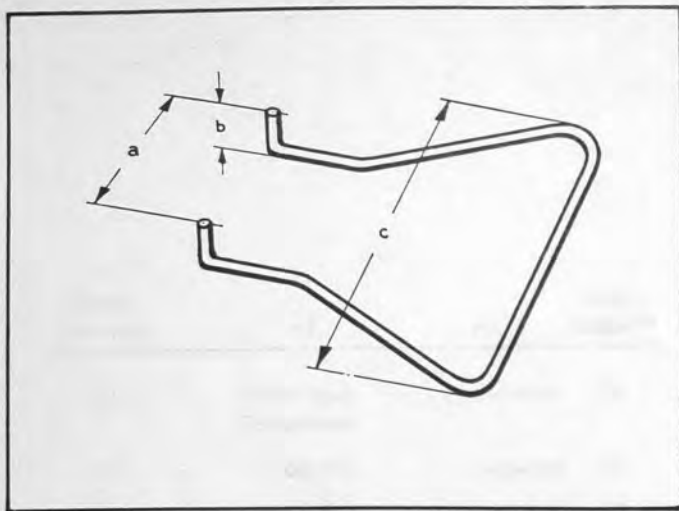
The individual cables are marked with the corresponding cable number. These numbers are printed at a distance of about $\frac{3}{4}$ in from the plug.

Cable Number	From	To	Cable Number
1	control unit	temperature sensor I (intake air)	1
2	not used		
3	control unit	injection valve cyl. 4	3
4	control unit	injection valve cyl. 3	4
5	control unit	injection valve cyl. 1	5
6	control unit	injection valve cyl. 2	6
7	control unit	pressure sensor	7
8	control unit	pressure sensor	8
9	control unit	throttle valve switch	9
10	control unit	pressure sensor	10
11	control unit	ground	11
12	control unit	ignition distributor	12
13	control unit	temperature sensor I (intake air)	13
14	control unit	throttle valve switch	14
15	control unit	pressure sensor	15
16	control unit	main relay terminal 87	16
17	control unit	throttle valve switch	17
18	control unit	starter terminal 50	18
19	control unit	pump relay terminal 85	19
20	control unit	throttle valve switch	20
21	control unit	ignition distributor (trigger contact)	21
22	control unit	ignition distributor (trigger contact)	22
23	control unit	temperature sensor II (cooling liquid)	23

Cable Number	From	To	Cable Number
24	control unit	main relay terminal 87	24
25	not used	ground	25
26	fuel injector cyl. 1	ground	26
27	fuel injector cyl. 2	ground	27
28	fuel injector cyl. 3	ground	28
29	fuel injector cyl. 4	ground	29
30	pump relay terminal 86	main relay terminal 87	30
31	start valve	starter terminal 50	31
32	temperature sensor	ground	32
33	start valve	temperature switch	33
34	main relay terminal 30/51	battery +	34

When the ignition is switched on, the control unit ② receives its operating voltage directly from the battery via the main relay ②. The fuel pump is controlled by the pump relay ③. The pump relay only works either when the starter is operated (terminal 50) or when the speed of the engine is higher than 200 rev/min. This feature ensures that the combustion chamber cannot become filled with fuel should a fuel injector become defective.

A time switch installed in the electronic control unit allows the fuel pump to run for approximately one second after the ignition is switched on in order to build up the fuel pressure at once.



2. Testing Instruments and Tools Required

Tester EFAW 228 S 10 (839194) for testing the system in the vehicle 0 681 500 001

Dwell-tach tester
Stroboscopic timing light
Vacuum tester

Tester trolley for carrying the testers, e.g. EFAW 172 A

0 681 169 084

Extractor hook for cable harness plug, to be made. Fig. 5

3 clampers for closing off the fuel hoses; to be obtained from Matra-Werke, D 6 Frankfurt/Main, Dieselstr. 30, Part No. W 157.

a = 45 mm ($1\frac{3}{4}$ in)
b = 12 mm ($\frac{1}{2}$ in)
c = ca. 100 mm (approx. $3\frac{15}{16}$ in)
material: welding wire 2 mm ϕ ($\frac{1}{16}$ in ϕ)

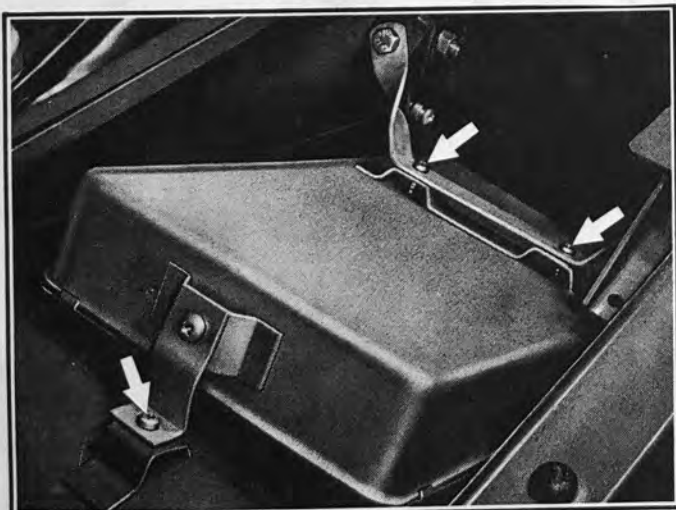
3. Testing the Fuel Injection System with Test Instrument EFAW 228 S 10

With the test instrument EFAW 228 S 10 all the sensors as well as the fuel pump and the injectors are tested according to the set program. It is important that **all points** be checked.

All the steps described in the following must be carried out with the ignition switched off!



TESTING INSTRUMENT EFAW 228 S 12 WITH PRESSURE GAUGE S 3230



6 Removing the control unit:

Remove the control unit (above the left wheelhouse) by unscrewing the 3 fastening screws (arrows). Pull out the control unit.

Fig. 6



7

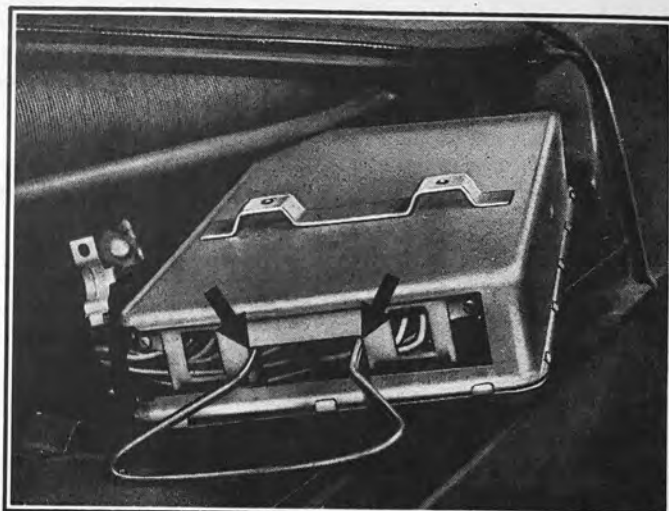
Open the cable clamp (arrow) with a Phillips screw driver and push off the cover in the direction indicated by the arrow.

Fig. 7

Carefully pull the cable harness plug out of the control unit with the extractor hook (to be made according to fig. 5).

Fig. 8

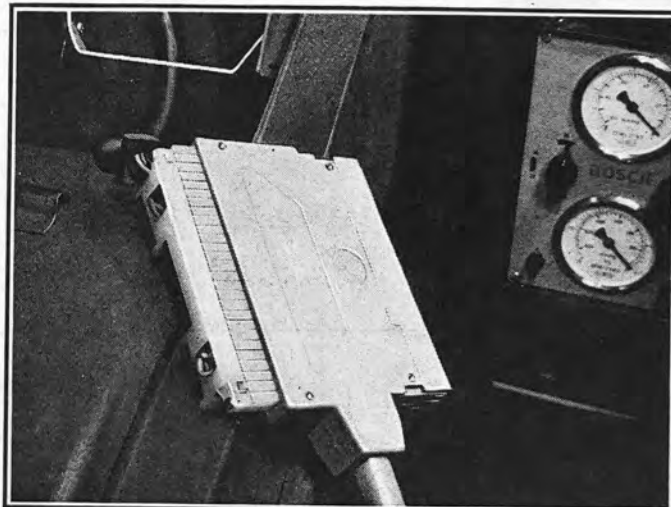
8



Connect the cable harness plug to the multiple plug on the test instrument EFAW 228 S 10.

Fig. 9

9

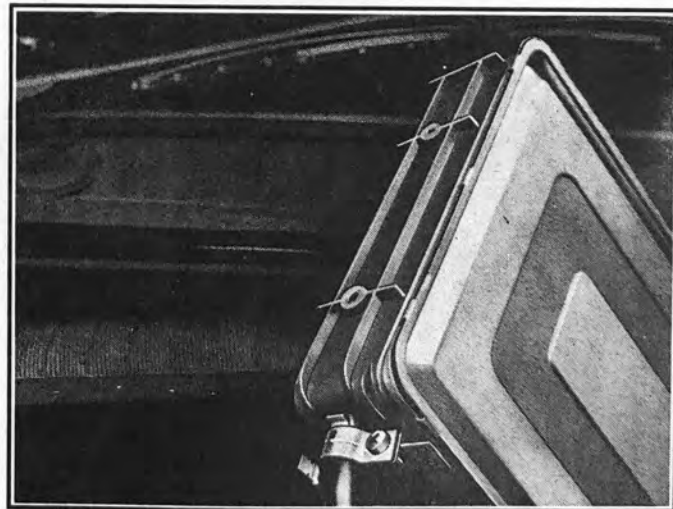


When refitting the control unit, observe the following:

Push the cable harness plug carefully into the control unit (the plug can only be connected in one direction). Carefully push the rubber grommet on the cable harness into the recess on the control unit.

Put the cover and the cable clamp back in place. Refit the control unit in its mounting above the wheelhouse and fasten (see fig. 6).

10



Preparatory work for the test (without electronic control unit connected):

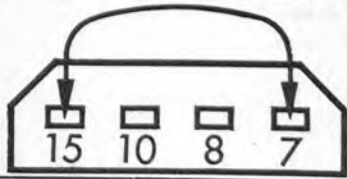
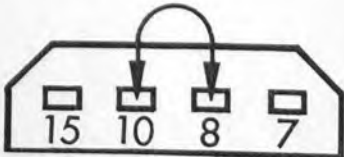
Switch on ignition, turn switch "A" to position "Measuring".

The test stages are listed in the following chart.

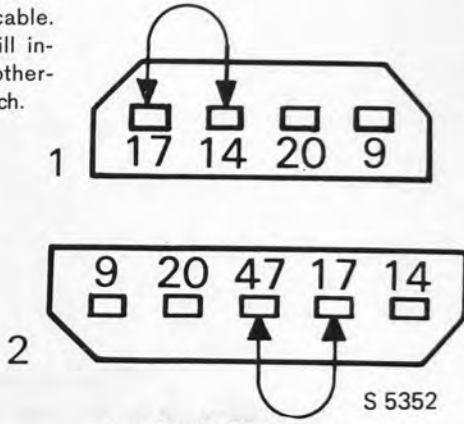
When checking the fuel injection system the entire test program must always be carried out.

Any defects which are found should be eliminated before testing is continued.

Position of switch B	Operate	to measure
Voltage I	Switch on ignition and leave on throughout the following test procedure	Voltage supply for the control unit
Voltage II		
Voltage Starter	Operate starter for a short time	Voltage at terminal 50 of starter
Adjustment "∞", pressure sensor	Set test instrument to "∞" by turning the adjustment knob	
	Push "ground" button	Resistance between pressure sensor windings and ground (short circuit to ground)
	Push "primary" button	Resistance of primary windings of pressure sensor
	Push "secondary" button	Resistance of secondary windings of pressure sensor

Indication (nominal value)	Deviation from nominal value. Possible faults and their elimination.
11 ... 12.5 (11 ... 12.5 V)	No reading: Open circuit: plug connection of cable 16 from main relay terminal 87 to control unit. Main relay does not energize: check for voltage at terminal 86 of main relay; if no voltage, check cable connecting terminal 86 of main relay and terminal 15 of ignition coil series resistor. Measure voltage at terminal 87 of main relay: if voltage "0", check cable connecting main relay terminal 30/51 and battery+. Check central ground cable. Voltage below 11 volt: Battery flat, contact resistance in cable 16, 11 or at relay contacts. (Check cables, exchange main relay.) As for voltage I but check cable 24.
9.0 ... 12 (9.0 ... 12 V)	No voltage, starter operates: Open circuit from starter terminal 50 to control unit (check cable 18 to the control unit terminal 18). No voltage as above, starter does not operate: Ignition/starter switch defective, open circuit in cable. Voltage below 9.0 volt: Battery flat, voltage drop in the cable from ignition/starter switch to terminal 50 of the starter too high (check cable with voltmeter).
	When full deflection on the instrument is not obtained, the voltage of the vehicle battery is too low. See also test stage "voltage I".
Resistance " ∞ " ($\infty\Omega$)	Resistance "0": Short circuit to ground in cable or at pressure sensor (pull plug out of pressure sensor and if test instrument shows "∞", replace pressure sensor. If test instrument remains at "0", the cables 7, 8, 10 or 15 may be short circuited; replace cable harness.) Resistance below "∞", but not "0": Damage to insulation (proceed as described above).
0.8 ... 1.2 on the Ω scale (approx. 90 Ω)	Resistance considerably smaller than nominal value: Damage to insulation (pull plug out of pressure sensor and if test instrument shows "∞", replace pressure sensor). Resistance "0": Short circuit to ground, short circuit in secondary windings (pull plug out of pressure sensor and if test instrument shows "∞", replace pressure sensor). Resistance considerably larger than nominal value: High contact resistance (test plugs and cables for corrosion or open circuits). Resistance "∞": Open circuit. Bridge plug as shown in illustration. If test instrument shows "0", replace pressure sensor. If "∞" indicated, check cables. 
3 ... 4 on the Ω scale (approx. 350 Ω)	As under "primary". With resistance "∞", bridge the two inner terminals. 

Position of switch B	Operate	To measure
Distributor contact I Distributor contact II	Rotate distributor by operating starter for a short time	Functioning of the trigger contacts in the distributor
Throttle valve switch I, then Throttle valve switch II	Depress accelerator pedal slowly	Functioning of the temporary enrichment device
Throttle valve switch III	a) Throttle valve in idling position (closed) b) Throttle valve slightly open (approx. 1°)	Functioning of the contacts in the throttle valve switch
Temperature sensor I (intake air)		Resistance of the temperature sensor
Temperature sensor II (cooling liquid)		Resistance of the temperature sensor
Valves	Adjust instrument again to "∞", if necessary (switch in position "Valves"). Pushbuttons: 1 = injector for cyl. 4 2 = injector for cyl. 1* 3 = injector for cyl. 2 4 = injector for cyl. 3 *cyl. 1 is at the rear end of the engine	Resistance of the windings in the injector with cable

Indication (nominal value)	Deviation from nominal value. Possible faults and their elimination.
Alternating between "0" and " ∞ " (0/ ∞ Ω)	If the needle of the test instrument does not swing when starting, i.e. remains at " ∞ " or "0", check terminals 12, 21 and 22 at the trigger contact holder. If the terminals and the cable harness are not defective, replace the trigger contacts.
Instrument needle swings approx. 10 times between "0" and " ∞ ". (Alternately 0/ ∞ Ω)	As the fully depressed accelerator pedal is released, the needle of the instrument must remain in the " ∞ " position. If "0" is shown then the throttle valve switch is defective, replace.
a) 0 (0 Ω) b) ∞ (∞ Ω)	a) Resistance "∞": Throttle valve switch incorrectly adjusted or open circuit in cable (check adjustment, pull out plug and bridge as shown in illustration). If still at "∞", replace cable harness, otherwise replace throttle valve switch. b) Resistance "0": Throttle valve switch incorrectly adjusted or short circuit in the cable. Pull out plug; if the test instrument still indicates "0", replace the cable harness, otherwise adjust or replace throttle valve switch.  1. 1.7 and 1.85 l engines 2. 2.0 l engine
2...5 (300 Ω) 20° C (68° F), strongly affected by temperature: higher temperatures give lower values	Nominal value is at 20° C (68° F). At higher temperatures, the resistance is smaller. Reading "∞" : Open circuit (pull out plug and bridge; if instrument shows "0", replace temperature sensor, otherwise replace cable harness). Reading "0" : Short circuit (pull out plug, if reading is the same, cable is defective. If the test instrument then shows " ∞ ", replace temperature sensor.)
0.5...2.5 (approx. 2.5 k Ω) 20° C (68° F), strongly affected by temperature: higher temperatures give lower values	See temperature sensor I.
2...3 (2.4 Ω at 20° C = 68° F)	Resistance "0": Short circuit in the cable or in the injector (pull plug out of injector concerned and if test instrument shows "∞", exchange injector; otherwise replace cable harness). Resistance "∞": Open circuit in the cable or in the injector windings. Bridge contacts in injector plug; if test instrument then shows "∞", cable harness is defective. If "0", then injector is defective. Resistance over "3": Ground cable from the injectors has a bad connection on the engine.

Position of switch "A"
Switch "B" has no effect

Operate

To measure

Valve check

Press "pump" button

Pressure in fuel line (connect pressure gauge: disconnect fuel line between cyl. 1 and pressure regulator and connect pressure gauge in between)

Press "pump" button briefly.

Leaks in the fuel system (pressure side)

Note: Carry out the following test only if injectors are thought to be defective.
Injectors are removed.

Pressure build-up:
Press "pump" button.
Press buttons 1, 2, 3 and 4, one after the other.

Visual check of the injector spray.
Collect fuel.

Checking start valve and temperature switch:

a) Cooling liquid over
 $0^{\circ} \pm 5^{\circ} \text{ C } (+32^{\circ} \pm 9^{\circ} \text{ F})$

1. Press "pump" button, operate starter briefly.
2. Connect temperature switch to ground.

Function of the temperature switch and start valve.

b) Cooling liquid below
 $0^{\circ} \pm 5^{\circ} \text{ C } (+32^{\circ} \pm 9^{\circ} \text{ F})$

Press "pump" button and operate starter briefly (temperature switch again normally connected).

Switch off ignition and remove pressure gauge.

Indication (nominal value)	Deviation from nominal value. Possible faults and their elimination.
Conc. the nominal value of the fuel pressure see table on page 234-21. A deviation of ± 0.2 bar from the nominal value can be allowed.	No pressure build-up (pump does not start up): Pull out 2-pole plug from pump, press "pump" button and measure the voltage with the voltmeter at the plug contacts. Reading 12 V: Pump defective, exchange. Reading "0": Check by listening whether relay energizes or not. If yes: Break in cable from pump relay terminal 87 to pump plug or from plug to ground. Fuse no. 8 in main fuse box blown. If cables are good, pump relay is defective. If not: Break in cable from main relay terminal 87 to pump relay terminal 86 or from pump relay terminal 85 to cable 19 to the control unit. If the cables are in order, exchange the pump relay. Pressure above or below nominal value: Pressure regulator incorrectly adjusted (readjust); if adjustment is not possible, pressure regulator defect (replace).
Pressure may drop back to 1.2 bar (kp/cm ² , 17 psi); after this, any pressure drop should be very slow .	Pressure drops quickly below 1.2 bar (kp/cm², 17 psi) as soon as the "pump" button is released: Leak in pressure system (from fuel pump to pressure regulator). Close off fuel pressure hose coming from the pump just before the pressure pipe. If no pressure drop occurs, the leak is at the pump or in the pressure line. If the pressure continues to drop, the leak should be sought at the connections to the injectors, in the injectors themselves or at the pressure regulator. Close off the fuel line with a clammer before the pressure regulator. If the pressure continues to drop, check injectors and start valve for leaks (see the following test step). If the pressure remains constant, the pressure regulator is defective and must be replaced. Build up the pressure several times during the test as required. Make visual check to see if leaks occur at hose connections (also pressure gauge connection).
	Press "pump" button and check visually for leaks. The injector orifice may become wet, but not more than two drops should form per minute on the injector. If no leaks have been determined, exchange the pressure regulator.
1. Pressure should not drop visibly. 2. Start valve injects, gauge pressure drops.	1. Pressure drops steadily as the starter is operated: temperature switch defective, exchange. 2. Pressure does not drop when the starter is operated: check cable 31 from start valve to starter terminal 50 for breaks. If broken, renew cable harness; otherwise check start valve. Winding resistance 4.2 Ω at 20° C (68° F).
Pressure must drop slowly.	If the pressure does not drop, renew temperature switch or check start valve as described under 2. above.

Important! The following points must be observed before starting up the engine:

1. Never let the engine run without the battery connected.
2. Never use a high speed battery charger as a starting aid.
3. When using a high speed charger to charge the battery in the vehicle, the battery should be disconnected from the rest of the electrical system.
4. Check the polarity of the battery before installing.

Starting the engine:

Cold engine: without depressing the accelerator pedal. If the engine is warm and the outdoor temperature is high, a slight depression of the accelerator pedal will assist starting.

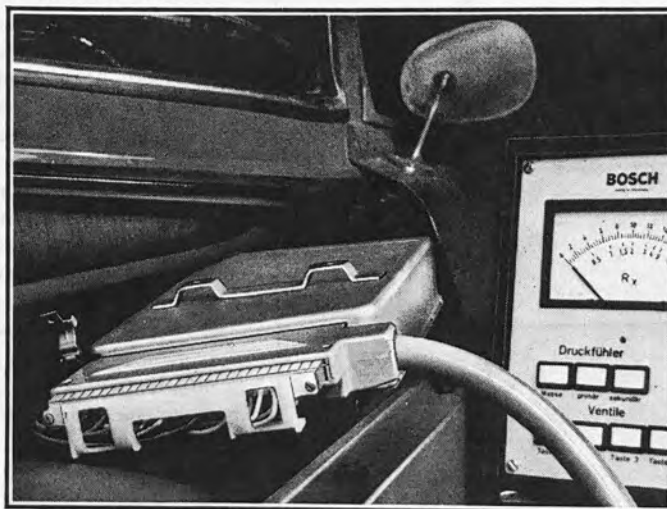
Important!

Please observe the test procedure exactly.

Connect the control unit only after the ignition has been switched off.

Before starting the engine, do not fail to turn switch "A" to the end position "Distributor contact 1".

In position "Valve check" all injectors are open. The engine does not start.



Test with control unit connected:

Connect the control unit to the multiple plug of the test instrument.

The position of the switch "B" has no influence on the test procedure.

Position of switch "A"	Operate	To measure
Distributor contact I, then Distributor contact II	Let engine run at about 2000 rev/min Switch over test instrument from distributor contact I to distributor contact II	Displacement of the trigger contacts in the ignition distributor.

Indication	Deviation from nominal value. Possible faults and their elimination.
Needle moves toward full deflection and then oscillates about an average value. When switching over from distributor contact I to II, max. deviation may be 2 graduations from the average value on the voltage scale.	If deviation is greater, the trigger contact holder in the ignition distributor should be renewed.

Fuel pressure

CAUTION

The various components of the injection system are carefully matched to each other and must only be assembled in the combinations shown in the table below.

Engine	Electronic control unit Part number	Pressure sensor Part number	Injection valve Part number	Fuel pressure bar (kp/cm ²)	Remarks
1.7 l	Saab No. 837601 Bosch No. 0 280 000 010	Saab No. 837602 Bosch No. 0 280 100 009	Saab No. 837605 Bosch No. 0 280 150 001 0 280 150 013 ^{x)}	2.0	
1.85 l	Saab No. 838069 Bosch No. 0 280 000 018	Saab No. 838070 Bosch No. 0 280 100 018	Saab No. 838071 835466 ^{x)} Bosch No. 0 280 150 004 0 280 150 014 ^{x)}	2.0	Up to and incl. ch.No. 99.074.342 and all cars with 1.85 l en- gines destined for USA
1.85 l	Saab No. 837601 Bosch No. 0 280 000 010	Saab No. 837602 Bosch No. 0 280 100 009	Saab No. 837605 Bosch No. 0 280 150 001 0 280 150 013 ^{x)}	2.3	As from ch.No. 99.074.343
2.0 l	Saab No. 835070 Bosch No. 0 280 000 039	Saab No. 835071 Bosch No. 0 280 100 115	Saab No. 835071 835466 ^{x)} Bosch No. 0 280 150 004 0 280 150 014 ^{x)}	2.2	Up to and incl. ch.No. 99732000357
2.0 l	Saab No. 835070 Bosch No. 0 280 000 039	Saab No. 835071 Bosch No. 0 280 100 115	Saab No. 838071 835466 ^{x)} Bosch No. 0 280 150 004 0 280 150 014 ^{x)}	2.0	As from ch.No. 99732000358
2.0 l	Saab No. 835070 Bosch No. 0 280 000 039	Saab No. 835493 Bosch No. 0 280 100 118 Colour-coded with green	Saab No. 838071 835466 ^{x)} Bosch No. 0 280 150 004 0 280 150 014 ^{x)}	1.9	Cars with automatic transmission destined for USA, as from ch.No. 99742000001

^{x)} Alternative to earlier design.

4. Trouble-shooting chart for defects in fuel injection system only. Prerequisite is that the ignition system and the engine be in satisfactory condition.

Trouble	Cause	Remedy
Engine will not start. Fuel pump not running.	1. Fuse to pump relay terminal 30/51 blown. Cables to pump or pump relay or cables on fuel pump relay defective. 2. Check plug on fuel pump for good connection.	Renew 8 amp fuse. Check whether pump relay energizes (switch ignition on and off and listen for audible action of relay), if necessary test with voltmeter.
	No voltage at terminal 86 of pump relay (12 V), because main relay not operating or cable defective.	Eliminate any existing open circuit.
	Voltage present at terminal 86 of pump relay but no ground connection at terminal 85.	Fuel pump operates for approx. 1—2 sec. after switching on ignition. Check with voltmeter; ground for terminal 85 is made by control unit. Replace control unit.
	Open circuit in cable from pump relay to pump plug.	Eliminate open circuit. (Check plug connection.)
Engine will not start. Fuel pump runs.	Connection from cable harness (cable 18) to starter terminal 50 defective.	Check with EFAW 228 S 10.
	Pressure sensor cable not connected or open circuit.	Push on pressure sensor cable or repair.
	Open circuit in cable connection at temperature sensor II (cooling liquid).	Check cables, if necessary exchange temperature sensor.
	No pressure building up in fuel ring main (pipe compressed or pressure regulator defective).	Check pressure with gauge; if necessary exchange pressure regulator.
Engine will start cold, but stalls.	Cable connector for triggering contacts not pushed on at ignition distributor or open circuit in cable.	If necessary, connect test instrument EFAW 228 S 10 and localize the fault; exchange trigger contacts or cable harness.
	Trigger contacts defective.	Replace.
	See also "Engine will not start".	
	Pressure sensor defective.	Replace.
Engine cuts out when driving (usually preceded by misfiring)	1. Trigger contacts have excessive contact resistance or are dirty. 2. Plug loose. 3. No fuel pressure.	1. Replace trigger contacts. 2. Check. 3. Measure pressure. Determine cause.

Trouble	Cause	Remedy
Engine runs irregularly, one cylinder not firing, exhaust white.	One injector sticking.	Exchange.
	Connection to injector or injector coil not in order.	Check connections, exchange injector. Test with instrument EFAW 228 S 10.
Engine misfiring but not caused by ignition system.	Loose connections, main ground cable has poor connection to car body.	Check connections, tighten up ground connection.
Engine not reaching full power.	Fuel pressure too low.	Check pressure regulator.
	Pressure sensor defective.	Exchange.
	Throttle valve does not open sufficiently.	Check throttle valve.
Fuel consumption too high.	"Information" sensors or the control unit not functioning correctly or the electrical connections have too high contact resistances.	Test the system according to section 3.
	Throttle valve switch incorrectly adjusted.	Adjust with test instrument EFAW 228 S 10.
	Fuel pressure incorrect.	Check pressure regulator, if necessary exchange.
Engine hunts excessively at idle (between 1,000 and 1800 rev/min)	Hose between auxiliary air regulator and induction manifold detached or defective.	Push hose into position or replace.
	Throttle valve stop incorrectly adjusted (too wide open).	Readjust throttle valve stop.
	Idling speed set too high.	Adjust idling speed.
Engine misfires when accelerating.	Temporary enrichment device in throttle valve switch not functioning or plug incorrectly connected.	Check throttle valve switch (test instrument EFAW 228 S 10).
Too high idling speed. Idling speed cannot be adjusted.	1. Idling air system leaks.	1. Check idling air system.
	2. Small rubber sealing ring (spare part No. 837614) under the injector leaks.	2. Replace rubber sealing ring.
	3. Throttle valve adjustment incorrect.	3. Readjust throttle valve.

5. Removal, Installation and Adjustment of the Individual Components

Grip the sides of the plugs when pulling them out, never pull on the cable. When reconnecting the plugs to the individual components, take care that the rubber caps are correctly pushed over the plug.

Disconnect the battery.

5.1 Pressure sensor

Fig. 12

The pressure sensor is screwed to the left wheelhouse (fender).

Open hose clamp of the pressure line and remove hose.

Pull out 4-pole plug.

Loosen the 3 fastening screws (arrow) with a Philips screw driver. Remove pressure sensor with bracket.

Note for installation!

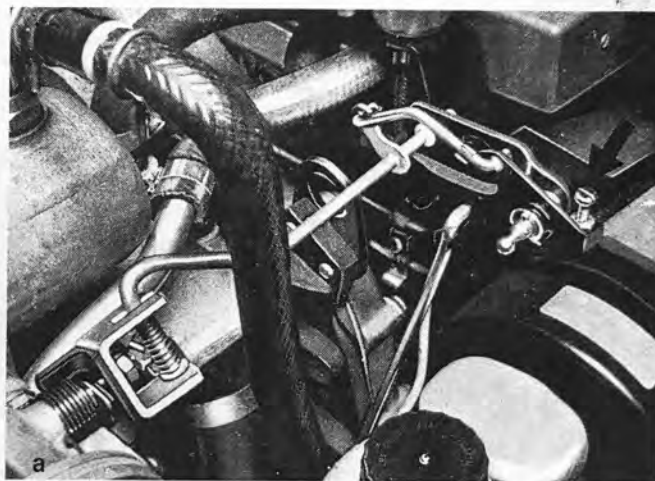
The protection sleeve on the hose connection of a new pressure sensor must be removed only immediately before pushing on the connecting hose.

Danger of dirt.

12



13



5.2 Adjustment of throttle valve

Fig. 13 a

Important note!

The throttle valve stop screw is set in the factory so that the valve is completely closed. The stop screw bracket is locked and must not be readjusted. It prevents the valve from closing too hard and resulting in possible seizure of the throttle valve.

If readjustment becomes necessary, one should proceed as follows:

Adjust linkage play; up to and including model 1971:

Remove the air cleaner.

Set the linkage play by means of the adjustment screw (arrow) to a minimum but taking care that it is still easy to move.

Finally tighten the top nut.

13



Fig. 13 b

Adjust throttle wire, as from model 1972:

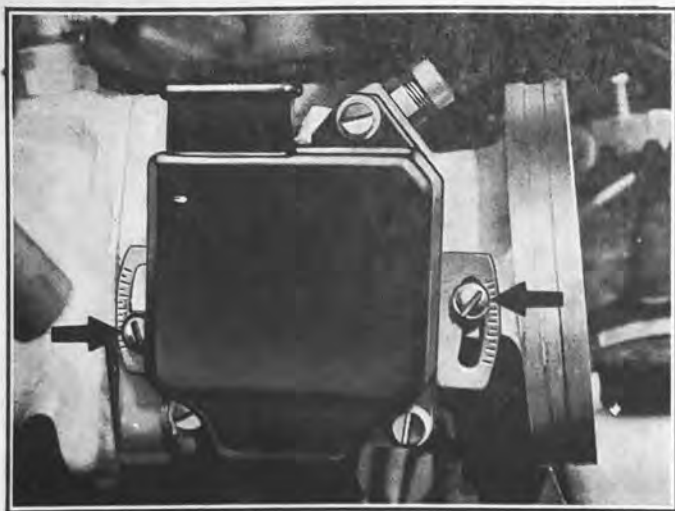
The play of the throttle wire can be adjusted with the nuts at the bracket.

Fig. 14

Adjust the stop screw (arrow) so that the throttle valve is approx. 0.05 mm open. Measure the throttle valve opening with a feeler gauge, after the air cleaner is removed.

14





5.3 Throttle valve switch

To remove, first take off the air filter. Pull out four-pole plug, loosen both fastening screws and draw the switch off the throttle valve shaft.

Fig. 15

15

Adjusting the throttle valve switch

The throttle valve switch should operate when the throttle valve has opened 1° from its neutral position. To facilitate adjustment, graduations have been stamped into the base plate of the throttle valve switch on both sides (1 graduation mark = 2°).

These graduations face an orientation marking on the induction manifold (throttle valve housing). If there is no mark, make one yourself.

Adjustment can be carried out in accordance with instruction 1 or 2.

1. Make adjustments using test instrument EFAW 228 S 12 as described on page 234-15. Switch "A" should be in the "Measure" position and switch "B" in the "Throttle valve switch III" position. Fit the throttle switch onto the throttle valve shaft and slightly tighten the two fastening screws.

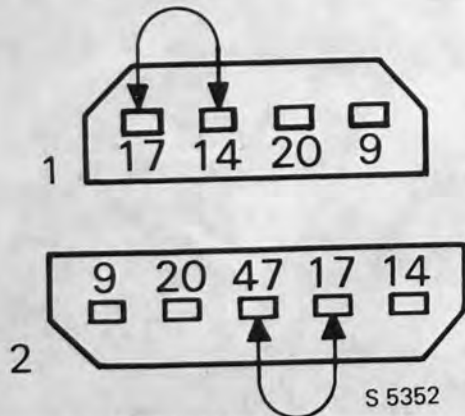
Insert the plug and turn on the ignition. Rotate the throttle switch until the needle on the test instrument moves from " ∞ " position to "0". Now turn the throttle switch $1/2$ graduation ($=1^\circ$) clockwise and tighten the fastening screws. Finally, check the adjustment by opening the throttle valve.

2. Check adjustment using a resistance meter or a buzzer.
 - a. Remove the plug from the throttle switch.
 - b. 1.7 and 1.85 l engines: Connect a resistance meter or a buzzer to terminals "14" and "17" on the throttle switch.
 - c. 2.0 l engine: Connect the resistance meter or a buzzer to terminals "47" and "17" on the throttle switch.
 - d. When the throttle valve is closed, the electrical circuit is closed. An ohm-meter will then register "0" or the buzzer will sound.
 - e. If the throttle valve is then opened approx. 1° , the circuit will be broken. An ohm-meter will then register " ∞ " or the buzzer will stop operating.

Adjustment: Unscrew the throttle switch somewhat. Try to establish the exact position at which the circuit is closed after having been broken. (This is achieved by turning the throttle switch.) Then turn the throttle switch an additional 1° ($= 1/2$ a graduation) in the direction in which the circuit is completed. Tighten up the throttle switch. Check in accordance with procedures 2 a, b, c, d and e.



S 3805



1. 1.7 and 1.85 l engines
2. 2.0 l engine

Check the full load stage, 2.0 l engine

This check is only called for in countries where vehicles are driven for long distances at maximum speeds, e.g. on turnpikes.

1. Connect the resistance meter or a buzzer to terminals "14" and "47" on the throttle switch.
2. Open the throttle valve and check that the circuit closes at an opening angle of about 68° (approx. 12° from full throttle valve opening). This angle is completely dependent on the adjustment of the throttle switch and cannot be adjusted.

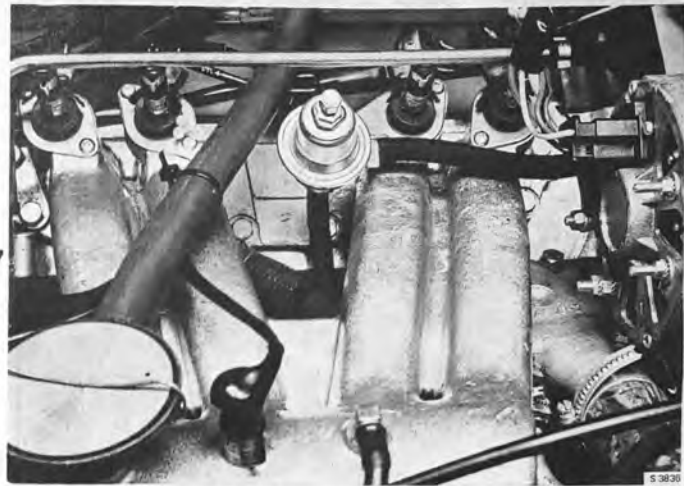
5.4 Pressure regulator

Removing the pressure regulator:

Open the hose clamps of pressure and return lines and remove the hoses. The hoses should be plugged immediately to prevent loss of fuel. Use either a 27 mm ($1\frac{1}{16}$ in) open end or box wrench to loosen the fastening nut and remove pressure regulator.

Fig. 17

17



Adjusting the pressure regulator:

Fig. 18

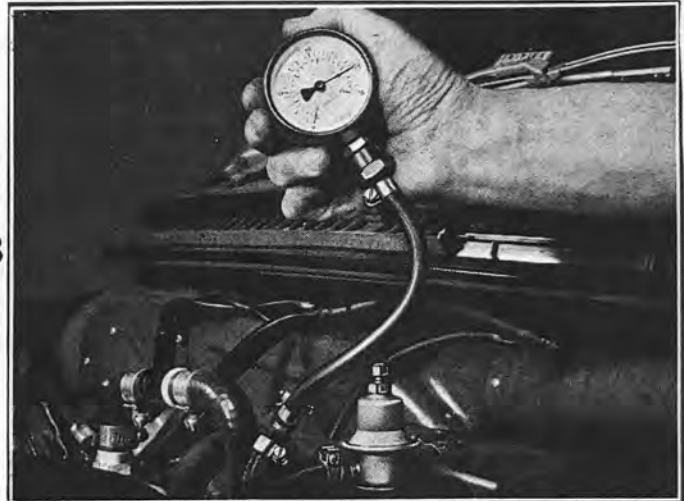
The setting of the pressure regulator (and hence the fuel pressure) has a considerable influence on fuel consumption and composition of the exhaust gases.

For this reason the setting should be altered only if the pressure measured varies from the nominal value.

Connect the pressure gauge in the fuel line leading to the pressure regulator. Crank the engine and run at idling speed or control the fuel pump from the test instrument EFAW 228 S 10.

Loosen the lock nut on the pressure regulator and set the pressure using the hexagon screw. Then tighten the lock nut again.

18



5.5 Temperature sensor I (inlet air)

Fig. 19

Unscrew the temperature sensor with a 13 mm ($\frac{1}{2}$ in) box or open end wrench.

5.6 Temperature sensor II (cooling liquid)

Fig. 20

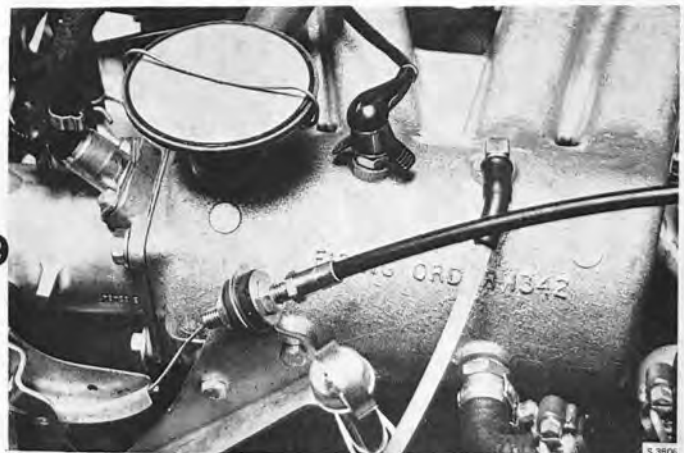
Before the temperature sensor can be removed, part of the cooling liquid must be drained off (collect the cooling liquid).

On 1.7 and 1.85 l engines the air cleaner should also be removed.

Loosen electrical plug connection and screw out the sensor with a 13 mm ($\frac{1}{2}$ in) open end wrench.

When refitting the temperature sensor, the sealing ring (arrow) must always be renewed.

19



5.7 Temperature switch

Fig. 20

Drain off part of the cooling liquid as described under 5.6; also remove the air cleaner (1.7 and 1.85 l engines).

Unscrew the temperature switch with a 24 mm ($\frac{15}{16}$ in) box or open end wrench.

When refitting, the sealing ring must always be renewed.

5.8 Auxiliary air regulator

Fig. 20

Drain off some cooling liquid.

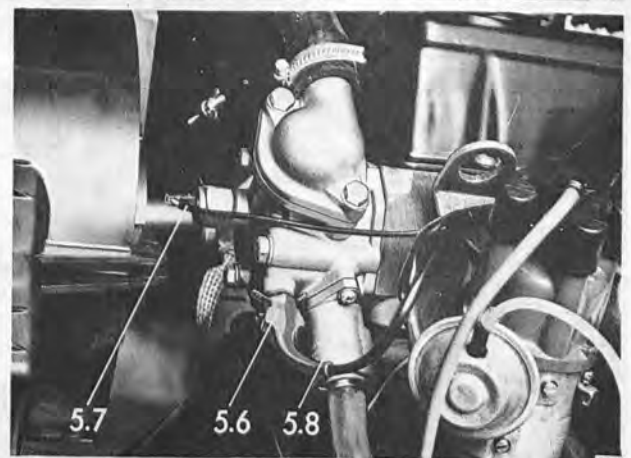
Remove air cleaner.

Pull off both air hoses from the auxiliary air regulator.

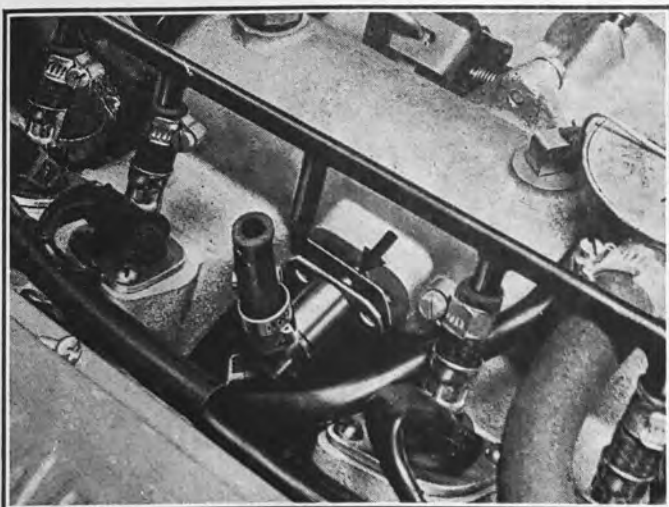
Loosen the fixing screws and draw out the regulator.

When refitting, the sealing ring between auxiliary air regulator and the engine block should be renewed.

20



- 5.6 Temperature sensor
- 5.7 Temperature switch
- 5.8 Auxiliary air regulator



5.9 Start valve

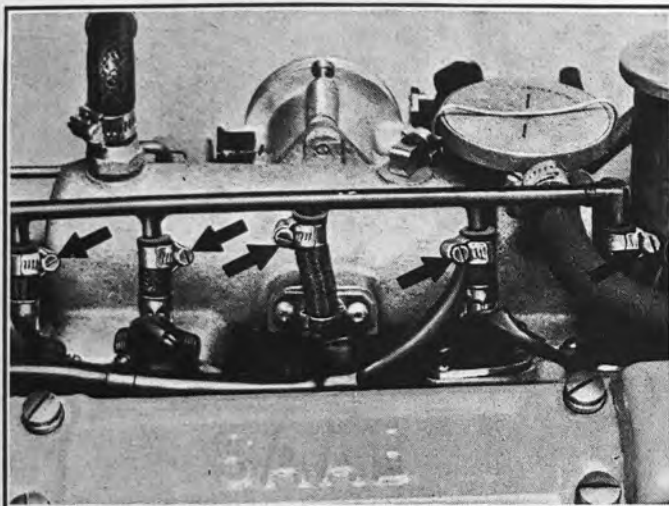
Fig. 23

Disconnect the fuel hose from the fuel ring main. Loosen the fastening screws for the start valve and pull the valve out of the inlet manifold.

Carefully take off the fuel hose from the removed start valve.

23

Before refitting the valve, push the fuel hose on to the start valve and fix it. Do not forget the seal (arrow) between the start valve and the inlet manifold.



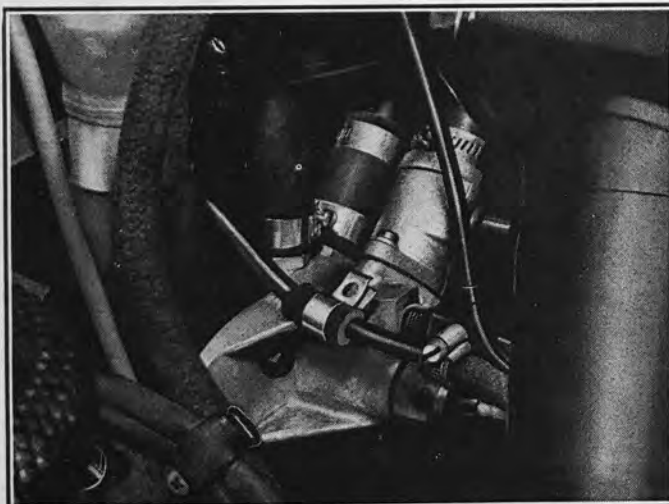
5.10 Fuel injectors

Fig. 24

Before removing an injector, the fuel pipe should be taken off from **all** injectors and from the start valve (arrow).

Pull the two-pole plug out of the injector.

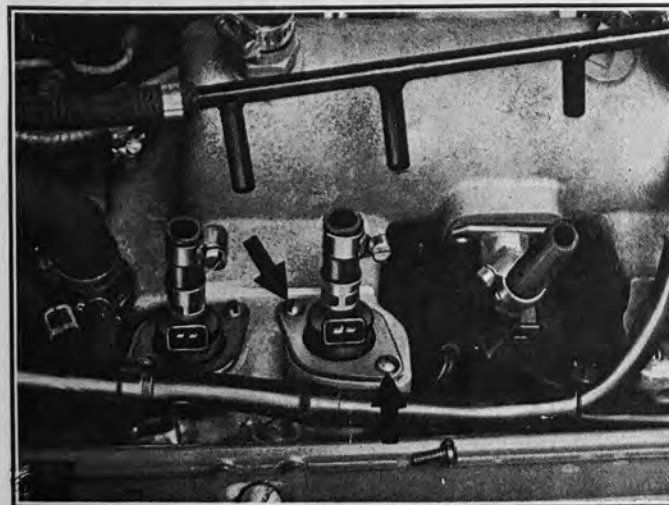
24



Unscrew the fastening clip for the fuel line beside the auxiliary air regulator.

Fig. 25

25



Pull the fuel pipe out of the injectors.

Screw out the fastening screws (arrow) from the injector to be removed.

Pull out the injector together with its holder.

Caution: Cover the opening for the injector immediately to prevent any foreign matter from falling into the inlet manifold.

Fig. 26

26

Refitting the injectors:

Fig. 27

Push large rubber ring onto the injector, and the small rubber sealing ring onto the injector body. Place the injector in its holder. Do not damage the injector needle. Align the injector (electrical connection on the injector in the direction of the engine block). Push the holder over the injector and equally tighten the two fastening screws. Place the fuel ring main in position and tighten the hose clamps carefully and correctly.

27

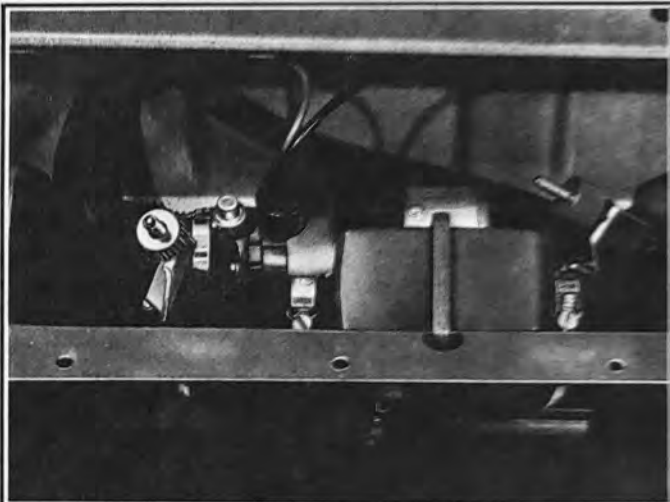


5.11 Fuel filter

Fig. 28

Remove the panelling in the trunk on the left side of the reserve wheel. Loosen the three fastening screws and pull the flap forward. Pinch off the fuel lines, downstream and upstream from the fuel filter with two clampers. Open the hose clamps. Pull out the filter with hoses upwards through the guide slot. Pull the hoses off the filter. The filter must be renewed every 12,000 miles. When refitting, check the direction of flow (embossed arrow on filter bowl — from tank via filter to pump).

28



Saab 99 Combi Coupé

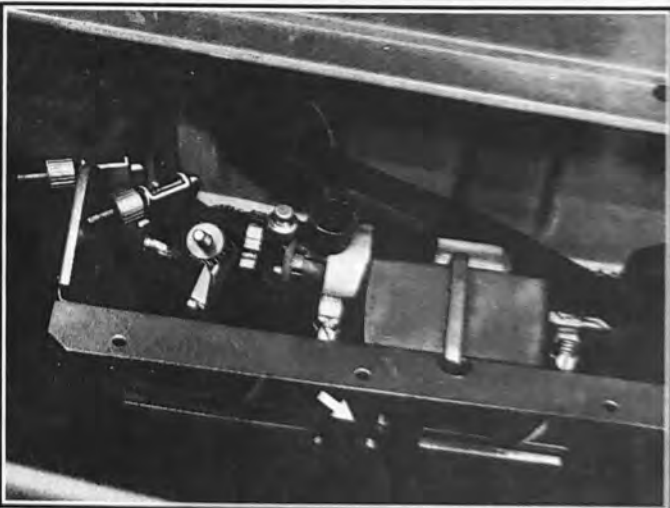
The fuel filter is fitted to the circuit between the fuel pump and the fuel injectors. The filter is fitted in the engine compartment close to the ignition coil.

5.12 Fuel pump

Fig. 29

Pinch off the three fuel hoses on the pump with clampers. Pull out the electrical plug. Unscrew the two fastening nuts (arrows) with a 10 mm ($13/32$ in) socket wrench and remove the fuel pump together with the rubber pads and fuel hoses in an upward direction. Open the hose clamps and pull the fuel hoses off the pump.

29

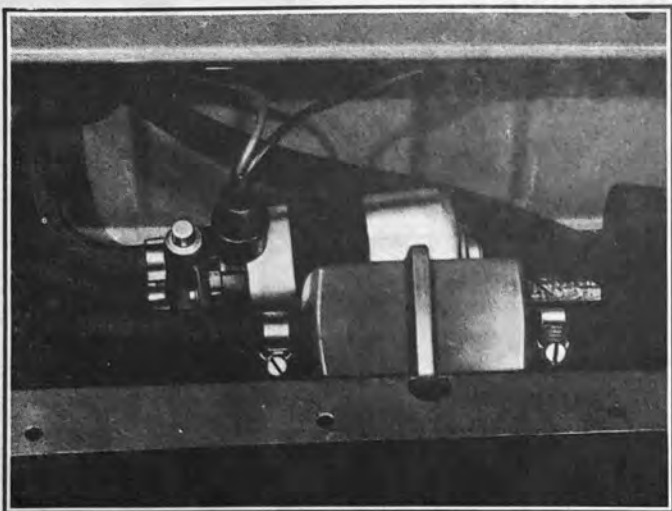


Saab 99 Combi Coupé

The fuel pump is located inside the fuel tank. The pump unit, which consists of a pump mounting, pump, splash cover and fuel filter, is mounted in an opening in the top of the tank by means of a bayonet socket. An O-ring is located between the pump mounting and the tank.

To remove the fuel pump, the tank must first be removed (see page 234-1). Special spanner 839243 is used to remove the pump unit from the tank.

One of the tongues in the pump mounting is wider than the others and it is therefore only possible to remove or install the pump in a given position. The wider tongue has a locking piece which locates in a corresponding recess in one of the tongues in the tank opening.



Refitting

Fig. 30

Fit the hoses and tighten the hose clamps in the following sequence:

- 30** suction side (9 mm [$\frac{23}{64}$ in] dia connection), pressure side (center connection) and return side.

Caution. Do not interchange the fuel hoses.

Fit the pump together with the rubber pads.

Refit electrical plug.



Adjustment knob, control unit

The control unit has been provided with a device to permit adjustment of CO (carbon monoxide) value. This device is regulated by a knob on the control unit.

Note! This adjustment can just be done, if the throttle valve is correctly adjusted.

Fine adjustment of the CO value is carried out at an idling speed of 800–850 rev/min with a CO meter connected. Adjust for max. 3.5% CO (cars for USA max. 2.5% CO).

5.15 Idling speed adjustment

Fig. 34

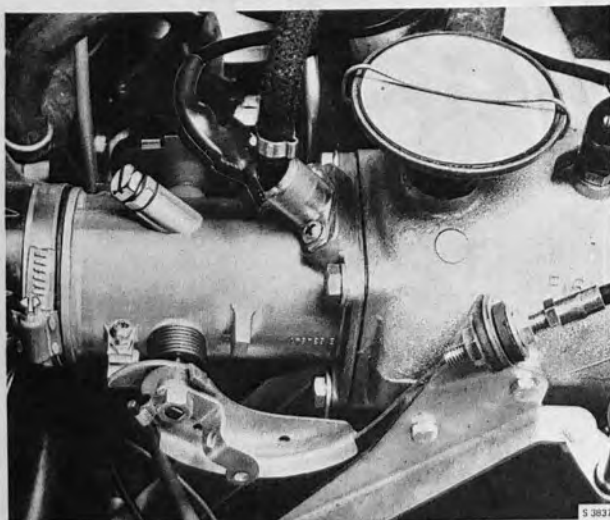
The idling speed is altered by variations in a by-pass. The idling adjustment screw is found on the venturi control unit.

- 34** Adjustment of the idling speed may only be carried out with the engine at running temperature ($80^{\circ}\text{C} = 175^{\circ}\text{F}$ cooling liquid temperature).

The speed should be:

800–850 rev/min for vehicles with manual gear change.

800–850 rev/min for vehicles with automatic transmission with selector lever in position "P" or "N".



EXHAUST SYSTEM

Removing the front muffler

1. Jack up the front end of the car.
2. Remove the preheater casing and unscrew the screws securing the front exhaust pipe to the exhaust manifold.
3. Undo the clamps holding the connecting ring at the joint with the middle exhaust pipe. Unhook the rubber suspension from the front exhaust pipe and separate the pipes.

To remove the rear muffler and the other sections of pipe, detach the rubber suspensions and clamps from the part to be removed.

NOTE!

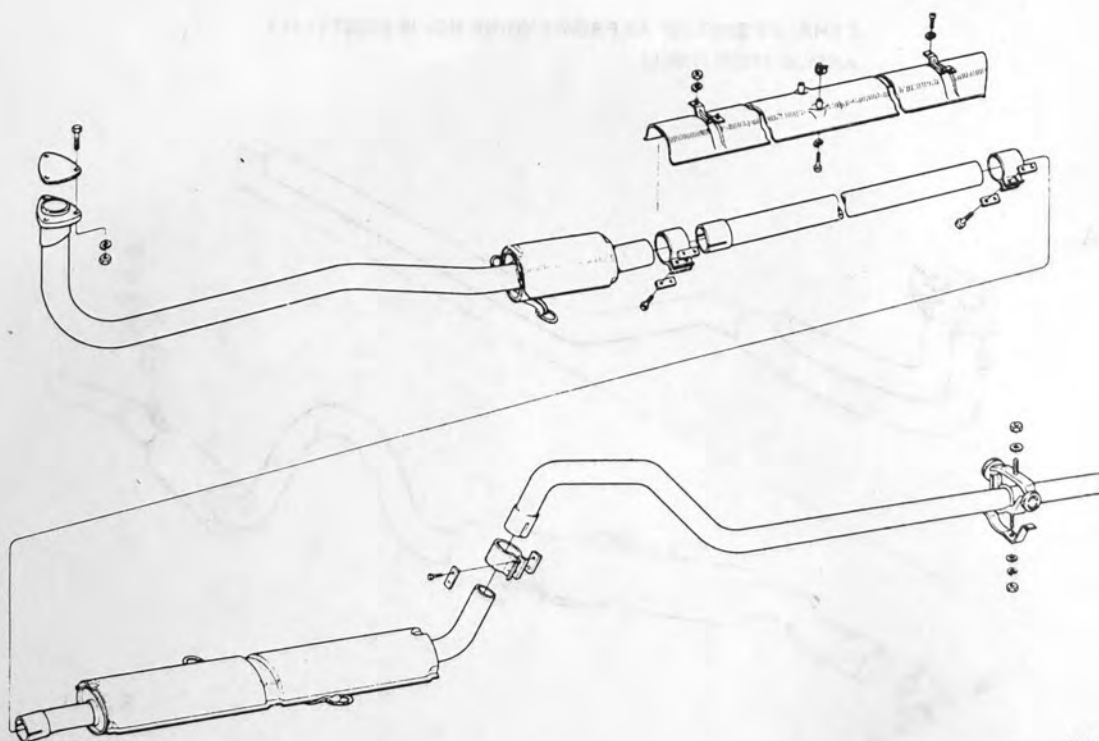
After assembling, check the exhaust system for leaks and make sure that the pipe is not in contact with the body, heat shield or fuel filler extension hose. Pipe clamps are to be fitted with the plate washer pointing 45° downward.

Removing the middle exhaust pipe and/or rear muffler

To remove the middle exhaust pipe or the rear muffler it is best to begin by unclamping the joint between these two units.

To remove the entire system, first undo the front pipe from the exhaust manifold and then unclamp the rear pipe joint. Withdraw the rear pipe from the rear.

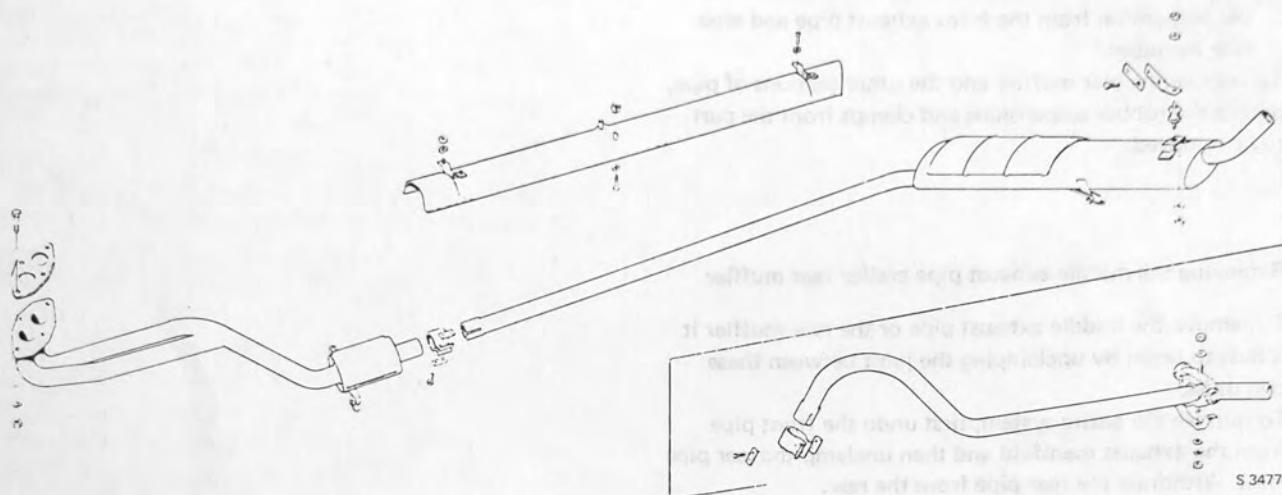
Reassemble in the reverse order.



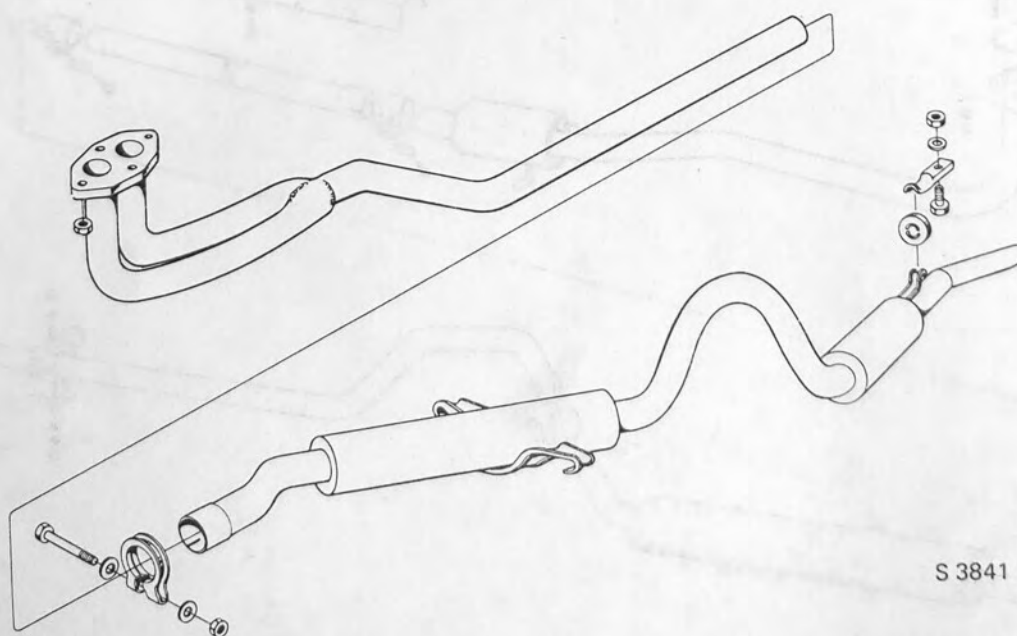
S 1703

EXHAUST SYSTEM

As from engine No. JB 85583 (1.7 l) JE 77359 (1.85 l)
model 1971, the exhaust manifold is fitted with two
outlets and the front muffler with two pipes.



EXHAUST SYSTEM' AS FROM ENGINE NO: JB 85583 (1.7L)
AND JE 77359 (1.85L)



EXHAUST SYSTEM, AS FROM CHASSIS NO. 99722012428

RADIATOR AND COOLING SYSTEM

Removing and installing

1. Drain off coolant.
2. Undo the water hose clips at the radiator and disconnect the hoses.
3. Undo the wiring terminals for the radiator fan and thermoswitch.
4. Remove the front sheet complete with radiator (see p. 201-2).

Reassemble in the reverse order.

Test pressurization of the radiator

Leakage in the cooling system can often be difficult to detect because the system only develops full pressure when the car is actually being driven. A good method is to pressurize the system with a pressure tester, whereupon the radiator, hoses and seals can be checked out. The maximum permitted gauge pressure is 1.0 bar (kp/cm², 14 psi). A pressure tester can also be used to check the opening pressure of the radiator filler. Opening pressure, see Group 0.

Inspecting the radiator

If the radiator has been removed from the car, it can be tested for leakage by being immersed in water with the tube opening plugged and supplied with compressed air. The maximum test pressure is 1.0 bar (kp/cm², 14 psi). Leaks, if any, can be repaired by soldering. The use of proprietary sealing agents added to the coolant should only be resorted to in emergencies, as these agents are apt to clog the jacket and tubes and interfere with free circulation. The cells of the radiator battery may sometimes become blocked with dust, insects, etc. with reduced air flow as a result. If so, wash the radiator and blow it clear with compressed air.

Filling or changing coolant

1. Unscrew the pressure cap from the expansion tank. (As from model 1971 the expansion tank is located at the left wheel housing.)
2. Open the heater core bleeder nipple and set the heater control to maximum heat.
3. Fill the system with fresh coolant. Start the engine and let it run at moderate speed until coolant overflows from the heater core bleeder nipple with no air bubbles.
4. Close the bleeder nipple, stop the engine, and top up with more coolant if necessary. Use only clean liquid for filling.

CAUTION

Be very careful if for any reason the coolant should be boiling when you are about to remove the radiator cap. Loosen the cap gently and allow steam to escape before taking the cap off. Never add large quantities of coolant when the engine is warm, as this may crack the cylinder block.

Non-freezing coolant mixtures

During the cold season the coolant must be mixed with anti-freeze, as pure water is liable to freeze and burst the cylinder block. Ethylene glycol is recommended as an anti-freeze fluid. For maximum protection against freezing and rusting the glycol dosage should be 40-50 per cent, i.e. for 1.7 and 1.85 l engines: 3-4 Imp. quarts or 4-5 US quarts (3.6-4.5 liters) and for 2.0 l engine: 3-4 Imp. quarts or 4-5 US quarts (3.8-4.7 liters) of glycol. Use only the glycol grade recommended (see group 0 for details). Saab glycol 838362 can be used with good result all the year round for two years at a time. Other recommended glycol grades should be changed every year. If ordinary water is used in the summer season, an anti-rust agent should be added. NOTE! When anti-freeze is added, it must be premixed with a suitable quantity of water as the liquid in the expansion tank is not affected by the general circulation of coolant.

Cleaning the cooling system

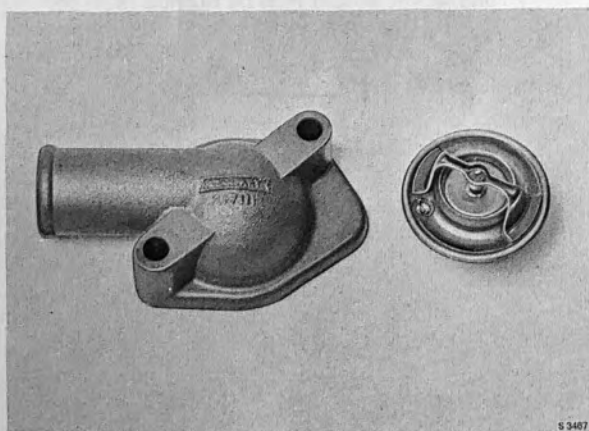
1. Drain off coolant.
2. Flush the system with clean water.
3. Fill the system with clean water containing a commercial solvent, following the manufacturer's directions for use.
4. Run the engine warm to start all the coolant circulating.
5. Stop the engine and wait a few minutes before draining off the coolant.
6. Flush the system again with clean water; this time, flush the engine and radiator separately and in the reverse direction to the normal coolant circulation. The engine jacket should thus be flushed from the

See p. 200-10

- cylinder head down, and the radiator from the left connecting pipe. Remove the thermostat first.
7. Flush out the heater core, likewise in the reverse direction to the normal flow.
 8. Check the operation of the cock in the line to the heater core.
 9. Fit the thermostat, water outlet pipe and hoses and check the system for leakage. When cleaning the cooling system, check also that the radiator overflow pipe system, check also that the radiator overflow pipe is not blocked by dirt. If the method of cleaning described here fails to clear the radiator of deposits, it should be removed and sent to a radiator specialist.



**THERMOSTAT HOUSING WITH THERMOSTAT, WATER
OUTLET PIPE AND VALVE BODY**
(Valve body only up to and incl. model 1970.)



**THERMOSTAT AND WATER OUTLET PIPE AS FROM
MODEL 1971**

WATER PUMP

Removing the pump

(Engine in the car)

1. Drain off coolant through the engine and radiator drain cocks.
2. Remove the battery ground cable.
3. Disconnect the power assist cylinder vacuum hose from the inlet manifold, pull the fuel hose off the carburetor and pull off the hose between the camshaft cover and the crankcase ventilation valve.
4. Remove the preheater hose and air cleaner and disconnect the throttle control.
5. Undo the hose clamps at the connections to the pump and inlet manifold, and the distributor vacuum hose.
6. Undo the six retaining screws from the inlet manifold, unscrew the lifting lug, and lift out the manifold complete with carburetor. If necessary, disconnect the choke control cable from the carburetor. In 1968-69 models, remove the distributor cap and torsion stay.
7. Cover the openings.
8. 2.0 l engine with alternator in high position:
 - a. Remove the alternator.
 - b. Remove the screw holding the alternator bracket to the pump cover.
 - c. Unbolt both rear engine mountings.
 - d. Place a jack fitted with a wooden block under the rear end of the power plant and raise the engine slightly until the upper screw fastening the alter-

nator bracket to the transmission cover can be removed.

- e. Slacken the lower retaining screw slightly and turn the bracket so that it is as far from the engine as possible.
9. Undo the three retaining screws from the cover of the water pump and knock the lower hose intake gently from below with a plastic mallet to unseat the cover.
10. a. Take off the cover.
 - b. Undo the center screw from the impeller. Hold the impeller with polygrip pliers and unscrew clockwise (left-hand thread). Save the washer.
 - c. Fit a tapping-out hammer with adapter (on 1.7 and 1.85 l engines tool 839057 and on 2.0 l engine tool 839213) to the water pump shaft and take out the pump unit.

The bearing housing may be left behind in the cylinder block. If so, expel the bearing housing with an impact puller fitted with a nut and a flat washer, OD 1" (25 mm) — see illustration page 210-1.

CAUTION

If the impeller is not immobilized while the center screw is unscrewed, the gear teeth on the pump shaft and idler shaft are liable to be damaged.

Disassembling

(Pump removed from engine)

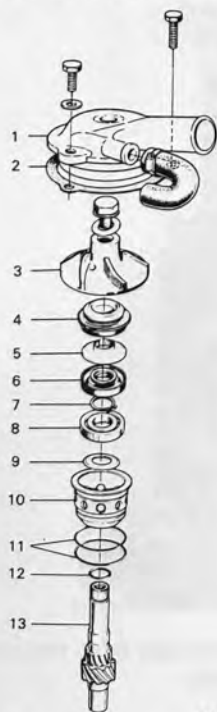
1. Mount the pump in tool 839054 and push off the impeller using tool 839058.



FORCING OFF THE IMPELLER

Tools 839054 and 839058

2. Press the pump shaft with seals and ball bearing from the bearing housing, using tool 839054. Place the pump with the driving worm uppermost.



WATER PUMP, EXPLODED VIEW

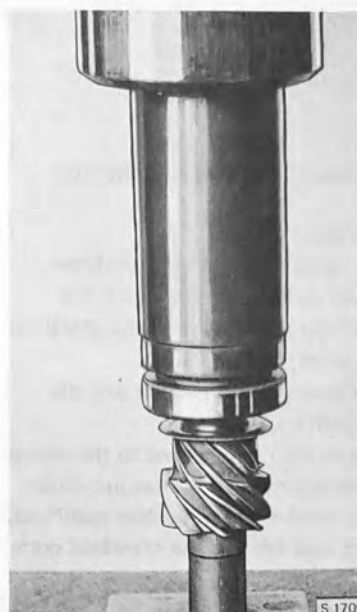
- | | |
|---------------------------|---------------------|
| 1. Pump cover | 8. Ball bearing |
| 2. Gasket | 9. Oil thrower ring |
| 3. Impeller | 10. Bearing housing |
| 4. Water pump seal | 11. O-rings |
| 5. Thrower | 12. Seal ring |
| 6. Seal ring | 13. Pump shaft |
| 7. Ball bearing lock ring | |



EXPELLING THE PUMP SHAFT

Tool 839054

3. Remove the pump seal, O-ring, thrower and seal ring.
4. Free the ball bearing lock ring.
5. Place the pump shaft and bearing in tool 839053 with the drive end downward and press the shaft from the bearing.



PRESSING THE BALL BEARING ON TO THE SHAFT

Tools 839055 and 839056

3. Fit the bearing lock ring.
4. Press the pump shaft complete with bearing into the bearing housing (see illustration) with the housing supported in tools 839054 and 839055.



EXPELLING THE SHAFT FROM THE BEARING

Tool 839053

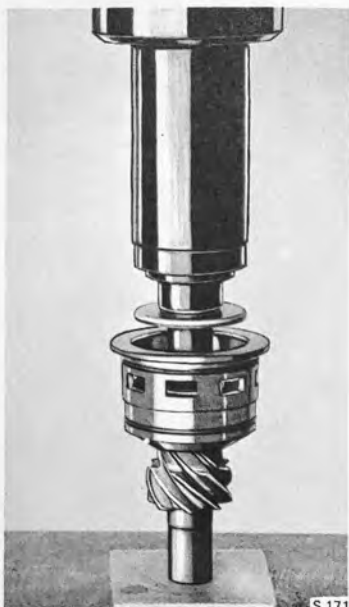


PRESSING THE PUMP SHAFT INTO THE BEARING HOUSING

Tools 839054 and 839055

Assembling

1. Fit the oil thrower ring.
2. Press the ball bearing on to the pump shaft using tools 839055 and 839056.
5. Fit the seal ring with tool 839055.
6. Fit the thrower using tools 839055 and 839056.



FITTING THE THROWER
Tools 839055 and 839056

7. Fit the O-ring.
8. Fit the water pump seal using tools 839053 and 839054.

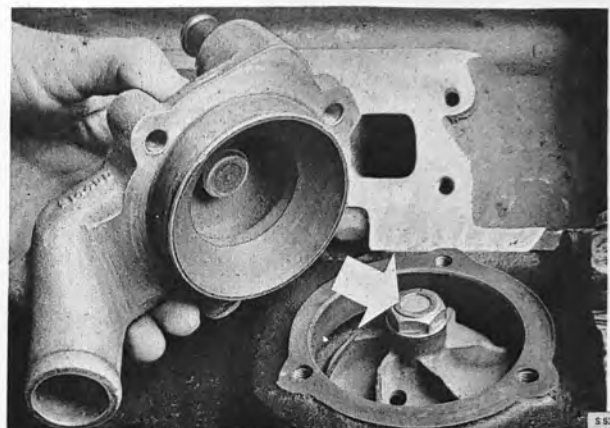


FITTING THE WATER PUMP SEAL
Tools 839053 and 839054

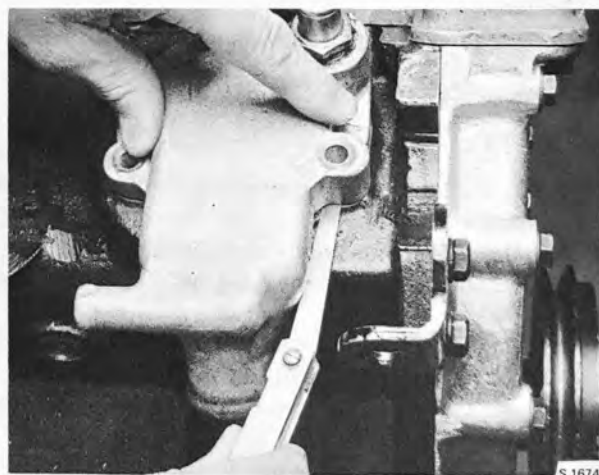
9. Mount the pump in the engine block, checking that the pump gear engages the gear on the idler shaft. Seat the bearing housing using sleeve 839053 and a drift. Make sure that the flange of the bearing housing butts against the plane of the engine block.
10. Fit the impeller with washer and screw. Tighten the screw counterclockwise (left-hand thread).
11. 1.7 and 1.85 l engines:
There should be a clearance of 0.01–0.02" (0.25–0.50 mm) between the center screw of the impeller

and the cover. Adjust the clearance if necessary as follows:

- a. Place an 0.02" (0.5 mm) shim between the impeller center screw and the cover; then use a feeler gauge to measure the gap between the cover and the engine block.
- b. Remove the shim and fit one or two new gaskets with a total thickness equal to the measured distance between cover and block. Gaskets of three different thicknesses are available for the purpose, viz. 0.01, 0.02 and 0.03" (0.25, 0.50 and 0.75 mm). Screw the cover on tight.



MEASURING PUMP COVER CLEARANCE, 1.7 AND 1.85 L ENGINES



MEASURING PUMP COVER CLEARANCE, 1.7 AND 1.85 L ENGINES

11. 2.0 l engine:
Fit the gasket and the pump cover. Tighten the cover.

FAN MOTOR

Removing the fan motor

1. Remove the battery.
2. Unscrew the expansion tank and lay it to one side (see illustration. (Up to and incl. model 1970.)



REMOVING THE FAN MOTOR

3. Disconnect the wire connector from the fan motor.
4. Remove the headlight wiper motor. (As from model 1971.)
5. Unscrew the fan housing with the fan and lift it out.
6. Unscrew the nut on the fan motor shaft and remove the fan.
7. Undo the two retaining screws and remove the fan motor.

Assembling

1. Locate the fan motor in the fan housing and tighten the screws.
2. Mount the fan on the motor shaft, making sure that the locating stud on the shaft engages the recess in the fan hub.
3. Install the fan housing. On cars up to and incl. model 1970, mount the expansion tank on the radiator.
4. Connect the wires to the fan motor and thermost switch by their connector.
5. Mount the headlight wiper motor. (As from model 1971.)
6. Connect the battery cable.
7. Check the operation of the radiator fan by grounding the connecting wire to the thermost switch.

THROTTLE CONTROLS

Up to and including model 1971

Disassembling

1. Free the panel plate from the pedal lever by driving out the rivet.
2. Unhook the return spring.
3. Remove the throttle control damper assembly.
4. Release the locking clip from the lower control link.
5. Release the locking clip from the upper control link and remove the rubber joint complete with control shaft.
6. Undo the screws of both lever bearings.
7. Remove the rubber seal from the dash panel and withdraw the pedal and seal forward into the engine compartment.

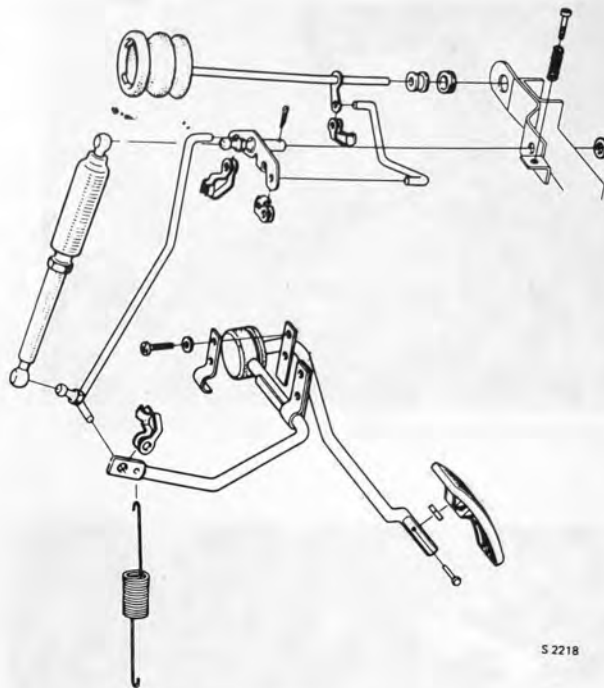
Assembling

Worn or otherwise damaged parts must be exchanged for new ones.

1. Mount the shaft in its journal in the bracket on the dash panel and connect the other end with the rubber joint to the carburetor.
2. Work the rubber seal on to the pedal lever and mount the lever in the dash panel, inserting it from the engine compartment side.
3. Connect the lower control link between the lever and the shaft.
4. Fit the throttle control damper assembly.
5. Hook on the return spring.
6. Rivet the pedal plate to the pedal lever.
7. Check that the throttle shaft makes a full stroke when the pedal is depressed.
8. After adjusting the engine idling speed, turn the throttle adjusting screw out or in so that the movements of the accelerator pedal are transmitted to the throttle shaft without any noticeable play.

Inspection

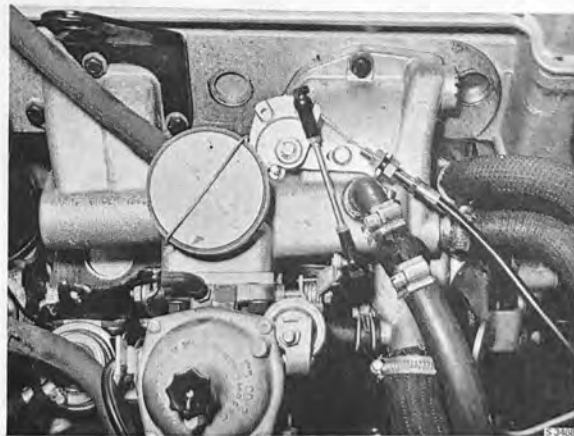
There should be a clearance of about 4.9" (124 mm) between the accelerator pedal and the bottom of the dash panel. Check that the throttle in the carburetor is wide open when the pedal is fully depressed. If the lever has been deformed, it must be bent back to the correct shape, but take care to avoid overstraining its bearings. Lubricate throttle control joints and bearings with oil.



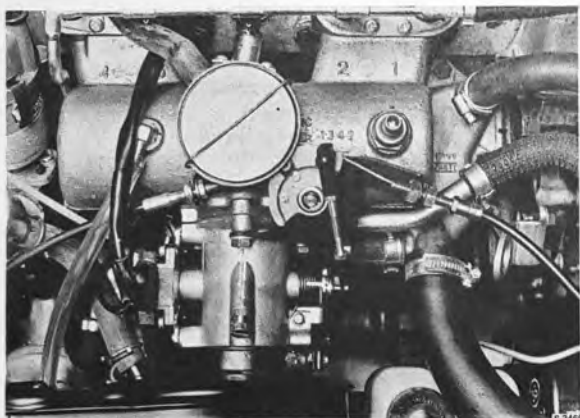
THROTTLE CONTROL

As from model 1972

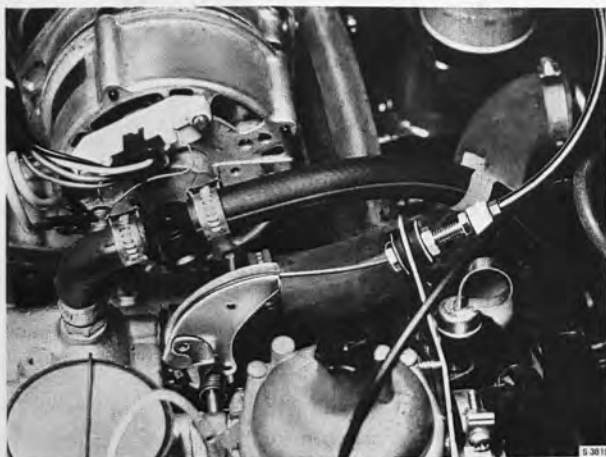
Double return springs for the throttle have been introduced on model 1974 on both the carburetor and injection engines. The springs are fitted to the throttle shaft on either side of the carburetor housing (throttle housing).



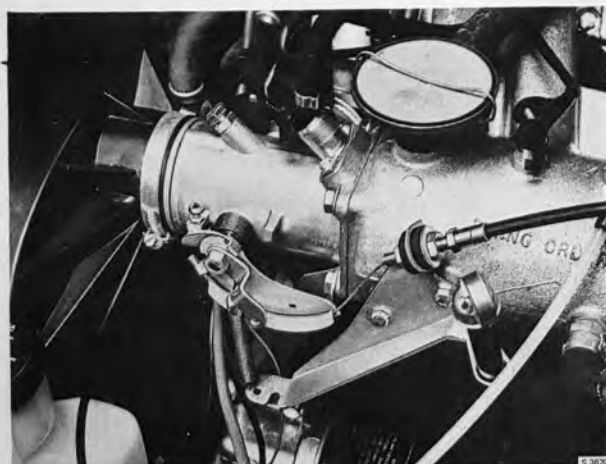
CABLE CONTROL, MODEL 1972, CARBURETED ENGINE



CABLE CONTROL, MODEL 1972, INJECTION ENGINE



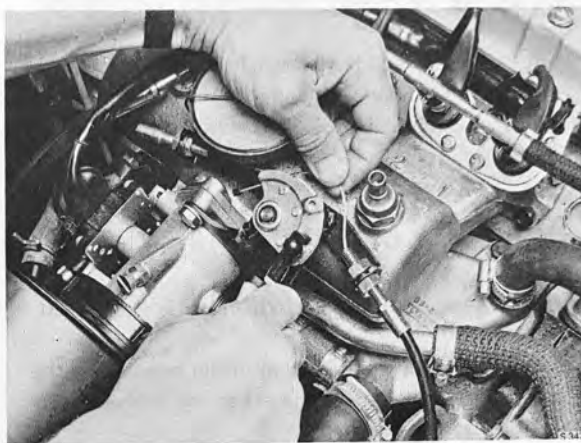
CABLE CONTROL, MODEL 1973, CARBURETED ENGINE



CABLE CONTROL, MODEL 1973, INJECTION ENGINE

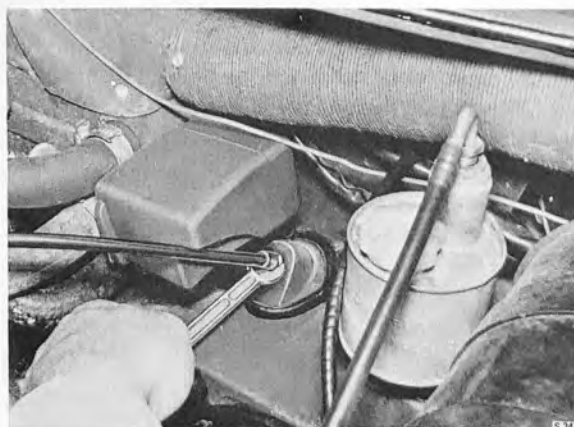
Removing

1. Undo the control link from the driver.
2. Turn the driver clockwise and detach the wire from its anchorage by opening the clip behind the wire stop.



CHANGING THE THROTTLE CONTROL WIRE, MODEL 1972

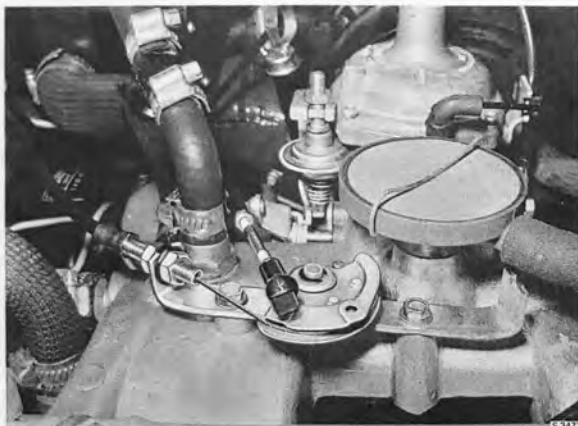
3. Undo the wire from the bracket.
4. Take off the locking washer and remove the driver and tension spring.
5. Remove the bracket.
6. Undo the wire from the pedal by first removing the locking pin. See under "Removing of accelerator pedal".
7. Unscrew the wire from the grommet on the dash panel.



REMOVING THE WIRE FROM THE GROMMET ON THE DASH PANEL

Installing

1. Screw the wire to the grommet on the dash panel.
2. Mount the bracket.
3. Fit the tension spring, the driver and the locking washer, so that the driver is pressed against the stop on the bracket.
4. a. Fit the wire to the groove on the driver, and bend the clip behind the wire stop so that the wire can run in its groove.



FIT THE CONTROL WIRE INTO THE LOWER GROOVE OF THE DRIVER, MODEL 1972

- b. Fit the wire sheath onto the bracket.
5. Fit the wire to the pedal and replace the locking pin in the anchoring point on the pedal.
6. Connect the control link to the driver. Check that the driver and the throttle shaft lever press against their respective stop positions. If this is not the case, adjust the control link (valid for the 1972 model).
7. Adjust the tension of the wire with the adjustment nuts on the wire anchorage in the bracket so that there is no play on the pedal.
8. a. After adjusting the wire, check that the driver and the throttle shaft lever press against their respective stop positions.
b. Press the accelerator pedal right down to the floor and check that the throttle is fully open.

Changing the control wire

1. Remove the wire as explained under "Removing", points 2, 3, 6 and 7.
2. Fit a new wire as explained under "Installing", points 1, 4, 5, 7 and 8.

NOTE

Avoid hand manipulating the throttle control at the carburetor end (throttle housing), as there is a risk that the wire will come out of its slot and disengage itself from the driver.

Accelerator pedal as from the 1972 model



ACCELERATOR PEDAL

Removing

1. Remove the left (in R.H.D.-cars, the right) protective panelling from under the instrument panel.
2. Remove the throttle control damper assembly (does not apply to cars with automatic transmission).
3. Hook off the return spring.
4. Remove the locking pin at the anchorage point of the wire on the accelerator pedal.



CONTROL WIRE LOOSENED FROM ACCELERATOR PEDAL

5. Pull the wire loose from the accelerator pedal.
6. Undo the upper covering of the dash panel and fold it out of the way.
7. Remove the accelerator pedal from the dash panel.

Installing

1. Mount the accelerator pedal onto the dash panel.
2. Fold back the dash panel covering.
3. Fit the wire to the accelerator pedal and insert the locking pin at the anchorage point of the wire on the accelerator pedal.
4. Hook on the return spring.
5. Fit the throttle control damper assembly (does not apply to cars with automatic transmission).
6. Replace the protective panelling under the instrument panel.
7. Make any necessary adjustments to the throttle control.



1. The first step is to mount the accelerator pedal onto the dash panel. This is done by fitting the pedal to the dash panel and securing it with the mounting screws. The dash panel covering is then folded back to reveal the accelerator pedal.

2. The next step is to fit the wire to the accelerator pedal. The wire is inserted into the anchorage point of the wire on the accelerator pedal. The locking pin is then inserted into the anchorage point of the wire on the accelerator pedal.

3. The return spring is then hooked on to the accelerator pedal. This is done by fitting the spring to the pedal and securing it with the mounting screws.

4. The throttle control damper assembly is then fitted to the accelerator pedal. This is done by fitting the damper assembly to the pedal and securing it with the mounting screws.

5. The protective panelling under the instrument panel is then replaced. This is done by fitting the panelling to the instrument panel and securing it with the mounting screws.

6. Finally, any necessary adjustments to the throttle control are made. This is done by adjusting the throttle control cable and the throttle control damper assembly.

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GENERAL

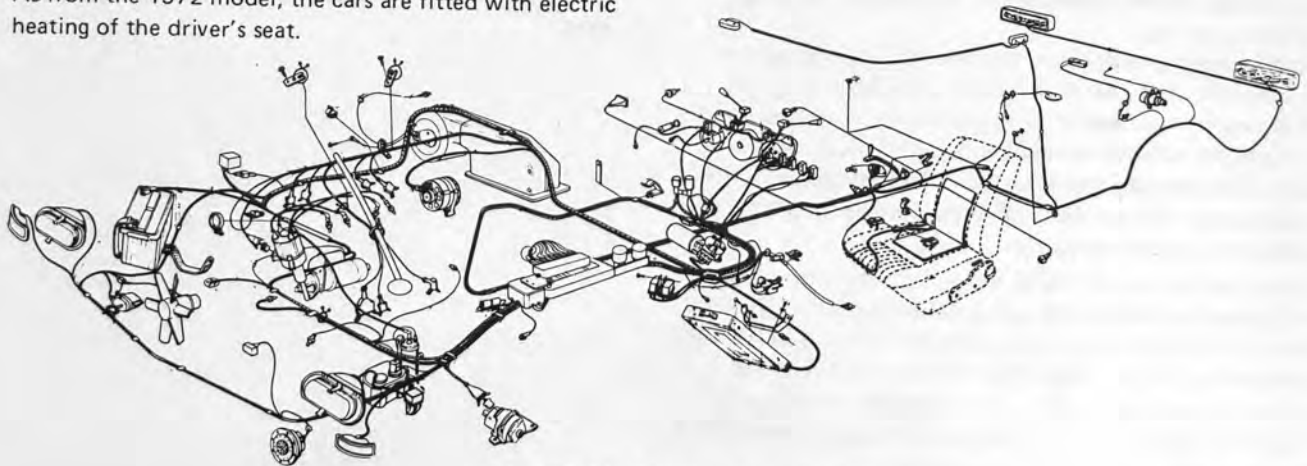
The electrical system operates on 12 volts and the electrical equipment comprises the following units:

Battery, starter, alternator, voltage regulator, distributor, ignition coil with series resistance, spark plugs, outside and inside lights, direction indicators, windshield wipers, windshield washer, horns, heater and ventilator fan motor, radiator fan motor, brake light contact, brake warning contact, handbrake contact, temperature transmitter, fuel level transmitter, radiator fan relay, hazard warning flasher switch, back-up lights, wiring harness and loose wires as well as switches and fuses.

Additional electrical equipment as from the 1970 model comprises clock, extra light for interior illumination, choke control contact and a contact on the gear lever housing for manual operation of the interior lights.

As from the 1971 model, cars intended for certain markets are fitted with headlight wipers and washers. These cars have additional relays for operation of the headlight wipers. Illumination of switches has also been introduced with the 1971 model.

As from the 1972 model, the cars are fitted with electric heating of the driver's seat.



ELECTRICAL SYSTEM, GENERAL VIEW

S 3868

On model 1974, cars intended for certain markets are fitted with a warning system for unfastened seat belts.

Battery

The 12 volts battery is of lead-acid type with six cells. Its capacity is 60 ampere-hours (Ah). It is located on a shelf in the front right-hand corner of the engine compartment with the negative pole grounded to the bodywork of the car.

Alternator

The generator is of the AC-type. A signal light on the instrument panel shows whether or not the alternator is charging.

Starter

The starter is rated at 0,7 kW (1.0 hp). Its drive pinion is moved into engagement by a control magnet operated by the ignition key.

Ignition system

The engine has a battery ignition system consisting of an ignition coil with serial resistance and a distributor with a combined centrifugal and vacuum system for ignition advance. The system is energized by the ignition key.

Lights

The outside lighting consists of headlights, front parking, direction indicators and side position lights, number plate light, and tail lights with rear direction indicators and side position lights, brake lights, and back-up lights which are automatically switched on when the gear shift lever is placed in reverse.

The headlight mountings are arranged for vertical and lateral adjustment of the beam.

Headlights are controlled by the same lever that operates the direction indicators. To dim the lights, the lever is pulled towards the steering wheel. A blue light on the instrument panel indicates when the headlights are at

high beam. When the headlights are on, the parking and tail lights are also lit.

A special rheostat on the instrument panel regulates the intensity of the instrument panel illumination in 1970 and earlier models.

In the 1971 and 1972 models the instrument illumination is combined with the illumination of the switches and is controlled by a switch with three positions: off, subdued and bright.

As from model 1973, the instrument illumination is regulated with a rheostat switch, placed on the instrument panel.

Other electrical equipment

Interior lighting consists of the dome light and ignition switch illumination, both controlled by the dome light switch and a contact at each door. As from the 1970 model there is an extra dome light located by the rear view mirror and a switch on the gear lever cover for manual operation of the interior lights. The trunk is illuminated by a light controlled by a contact at the hinge of the trunk lid.

A self-canceling lever under the steering wheel controls the current supply to the direction indicators. This lever also controls the headlights. A green light on the instrument panel indicates when direction indicators are operating. The warning flasher switch is located on the instrument panel. All four direction indicators flash together when this switch is actuated.

Up to and incl. model 1973, the windshield wiper motor drives both wipers by link and wire transmission. On model 1974, the windshield wipers are operated by a reciprocating flexible cable. The switch also actuates the windshield washer as well as the headlight wipers and washers fitted on cars on some markets as from model 1971.

The windshield wipers have two speeds.

The horns are operated by a contact in the steering wheel safety padding. (In the 1969 model, the horns are controlled by the same lever as the windshield wipers.)

The radiator fan is driven by an electric motor and is located behind the radiator. It is thermostat-controlled and operates only when the coolant temperature in the radiator exceeds the set cut-in temperature of the thermo-contact.

As from the 1972 model, the backrest and cushion of the drivers seat have thermostat-controlled electric heating elements (see group 8).

Wiring and fuses

The wires leading from the battery or alternator to the various current-consuming units are arranged in a wiring network divided into groups. The individual wires are color-coded for ease of identification. The terminals consist of solderless AMP connectors. Fuses are provided to protect the wiring, etc. against abnormally high current loads (e.g. short circuits) and to reduce the risk of fire in such an event. The fuses are grouped in a fuse box mounted on the left wheel housing in the engine compartment.

The fuse box contains one spare fuse for any extra equipment that may be installed.

Brake warning system

Defects in the brake system, e.g. leakage from either of the two brake line circuits, are signaled by a brake warning light in the indicator light display instrument. The light is operated by a contact located above the brake pedal.

BATTERY

General

The battery is a 12 volt lead accumulator with six cells and a working voltage of about 2 volts per cell. The electrolyte used in the battery is dilute sulphuric acid with a spec. gravity of 1.28 at +68°F (+20°C) when the battery is fully charged. The capacity of the battery is 60 ampere-hours (Ah), i.e. it is rated to deliver a current of 3 amperes for 20 hours at +68°F (+20°C). The positive pole of the battery is connected to the starter and other current-consuming units and the negative pole is grounded to the bodywork of the car.

Removing and installing the battery

To remove the battery from the car, first disconnect the negative (ground) cable to prevent shorting, then disconnect the positive cable. Note that the engine must be stopped before the terminals are disconnected, as the alternator may otherwise be damaged.

Next unscrew the two wing nuts from the hooks, after which the battery can be lifted out of the car.

Before replacing the battery, make sure that the outside is clean and that the pole terminals and cable clamps are also clean so that they make proper contact. After connecting the cables, coat the pole terminals and clamps with acidfree vaseline.

Battery maintenance

As the ability of the battery to start the engine depends on its state of charge, regular checking and maintenance of the battery are important — especially in wintertime, when the load on the starter is heavier and the capacity of the battery is reduced by low temperature. Moreover, an undercharged battery is apt to freeze.

Electrolyte level

The level of electrolyte in the battery tends to fall due to evaporation and electrolytic decomposition of water. Use only distilled water to top up. The surface of the electrolyte should be about 0.4" (10 mm) above the top edge of the plates.

Sulphuric acid of the correct concentration should only be added if the spec. gravity of the electrolyte needs to be corrected as a result of drainage or leakage from the battery.

Electrolyte specific gravity

The spec. gravity of the electrolyte is measured with a hydrometer; the reading indicates the state of charge of the battery (see table).

State of charge	Spec. gravity
Full charge	approx. 1.28
Half charge	" 1.21
Discharged	" 1.12



TESTING THE BATTERY

Charging

Charging must be adjusted to the capacity of the battery. The battery is fully charged when the voltage per cell has reached 2.5–2.7 V, without load, and has remained constant during the last three hours of charging.

Decomposition of water causes the electrolyte to boil. The filler caps must therefore be removed from the cells while charging is in progress.

CAUTION

Do not misconnect the battery. Reversing the pole connections, even momentarily, will damage the alternator rectifier. Connect the positive cable to the positive pole of the battery (both marked +) and the negative cable (ground lead) to the negative pole (both marked -). If an external battery is temporarily connected to the car battery, connect the poles positive-to-positive and negative-to-negative. The battery must not be connected to or disconnected from the electrical system of the car while the engine is running. When quick-charging the battery, first disconnect the positive cable.

ALTERNATOR

General

While the car is running, the alternator supplies the current needed by the various items of electrical equipment and at the same time charges the battery.

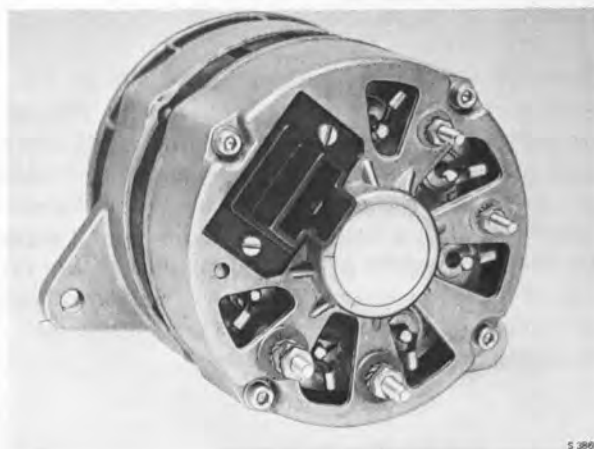
To remove the heat generated in the alternator, its drive pulley is provided with fan vanes that draw air through the alternator as long as it is running.

The alternator is driven by a belt from a pulley on the crank shaft. On engines with electronic fuel injection, the alternator is fitted with a cooling device on the 1971 and 1972 models. This consists of a hose attached to the bottom of the radiator which conducts cool air to a hood mounted on the rear of the alternator.

On model 1974, the alternator shaft is shortened and the belt pulley nut is recessed into the belt pulley. This change applies to both Bosch and SEV alternators.

Existing alternator types

- Bosch 35 A: All carbureted engines.
- Bosch 55 A: Injection engines, models 1971 and 1972.
- SEV 55 A: Injection engines, as from model 1973, and Saab 99 EMS as from model 1972.



ALTERNATOR, MAKE SEV

Location of alternator

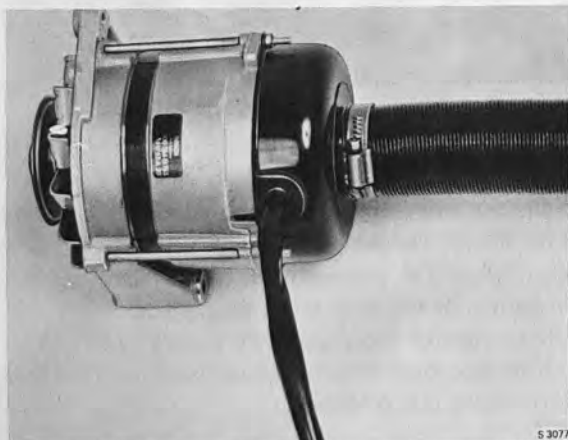
Up to and incl. model 1972, on the right-hand side of the engine.

As from model 1973, on the top of the engine, 2.0 l engine.

Internal wiring

The alternator is internally ventilated. It has a 12-pole rotor and six silicon diode rectifiers. An exciter diode is connected to each of the three stator windings, with a common junction point at terminal D+. (Alternators for the 1972 model 2.0 l injection engines do not have exciter diodes. Instead, they are equipped with two protective diodes. See the wiring diagram.) The stator windings comprise three phases and are star-connected. The six rectifier diodes are arranged and wired in an AC bridge, e.e. three diodes are wired for normal polarity (anode to the terminal) and the other three for reverse polarity (anode to the casing).

According to polarity, the diode holder is insulated from the body or directly grounded by a body contact. The annular exciter winding is mounted on the rotor, which has pole claws, one half of the claw acting as a north pole and the other as a south pole. The ends of the exciter winding are connected to slip rings which transmit the exciting current.



ALTERNATOR, MAKE BOSCH WITH COOLING DEVICE, 1971 AND 1972 MODELS

Functional description

When the ignition key is turned to the drive position (K), the circuit is energized.

The circuit runs from the ignition switch via the charge indicator light to terminal D+ on the voltage regulator and thence over the breaker contact to terminal DF on the alternator, and finally through the brushes to the exciter winding, after which the circuit is grounded.

The rotor is thus magnetized and a force field is generated in the rotor.

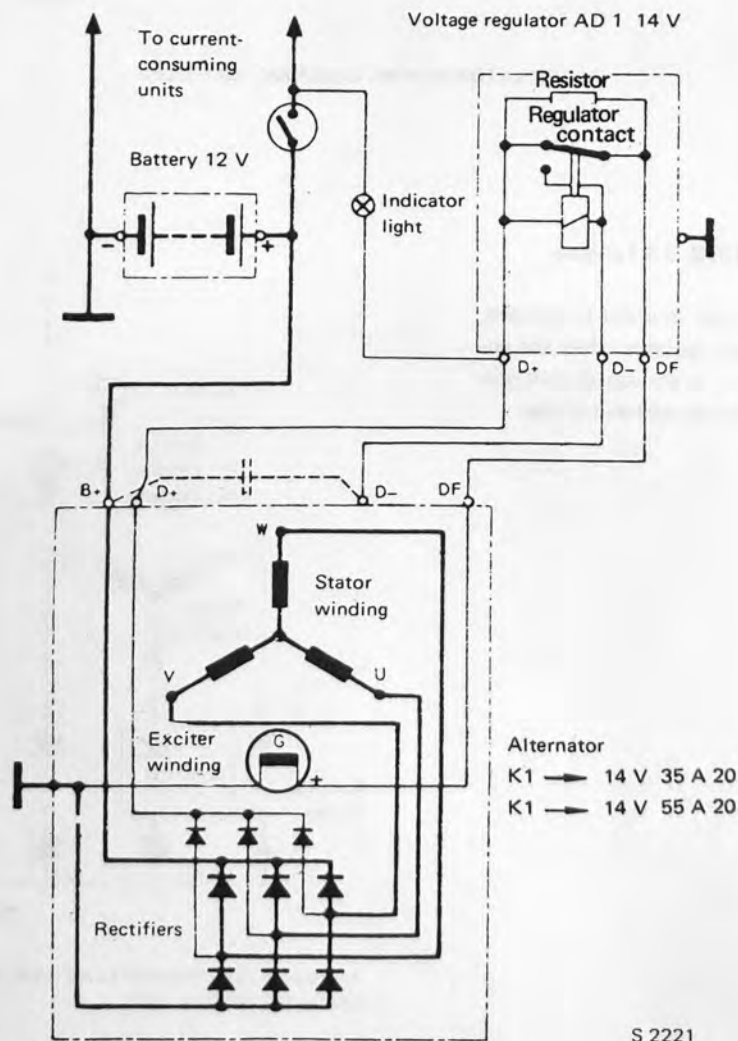
When the engine starts and the rotor begins to spin, an alternating current is generated in the stator winding; this current is rectified as it passes the diodes and is fed into the battery from terminal B+.

The voltage obtained from the stator winding also passes via the exciter diodes to the voltage regulator and acts upon the coil that controls the breaker. When the voltage rises to 14 V or above, the magnetic field of the coil becomes so powerful as to overcome the spring resistance of the regulating contact and break the circuit.

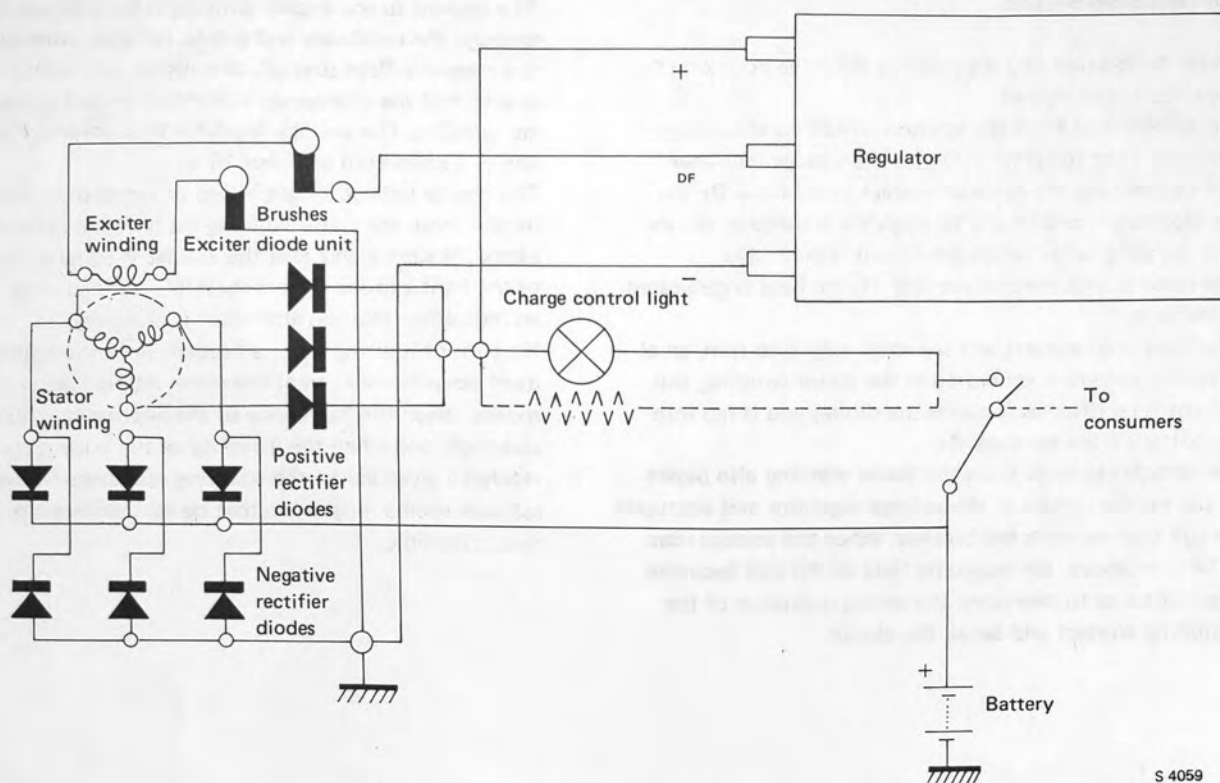
The current to the exciter winding is then forced to go through the resistance and is thus reduced, whereupon the magnetic field strength diminishes, and with it the strength of the alternating current generated in the stator winding. The voltage regulator thus governs the voltage to a maximum of about 14 V.

The charge indicator light is also influenced by the voltage output from the stator winding via terminal D+ on the regulator, in such a way that the voltage is equal on both sides of the light and the light is therefore extinguished. This is an indication that the alternator is charging.

No current-limiting relay is needed, since the alternator itself governs the current intensity. At high alternator speeds, when the frequency of the alternating current is also high, and when the intensity of the output current reaches a given value, the resulting resistance (impedance) assumes such a magnitude that no further increase of current is possible.



ALTERNATOR WIRING DIAGRAM, MAKE BOSCH

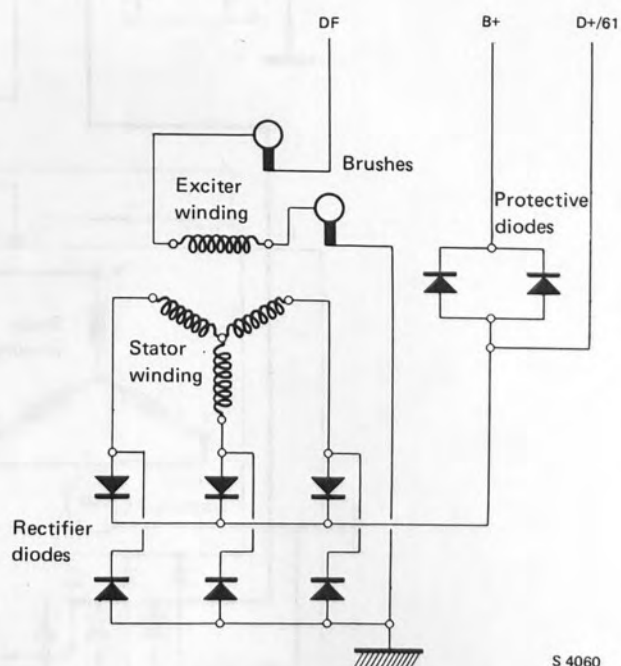


S 4059

ALTERNATOR WIRING DIAGRAM, MAKE SEV

Deviation, SEV alternator for 1972, 2.0 l engine

The alternator lacks exciter diodes. In order to prevent a short circuit across the voltage regulator when the engine is not running, the alternator is equipped with protective diodes which protect against reverse current.



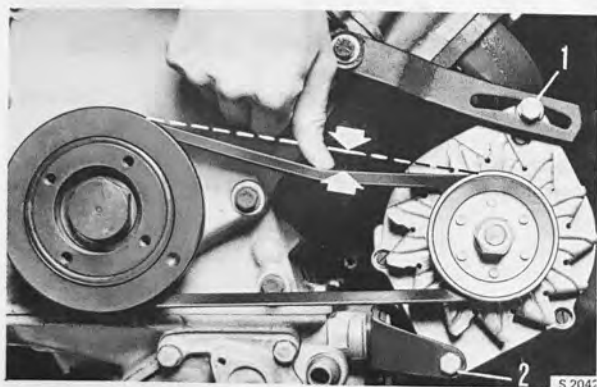
S 4060

ALTERNATOR WIRING DIAGRAM, MAKE SEV, 2.0 L ENGINES, MODEL 1972

Maintenance

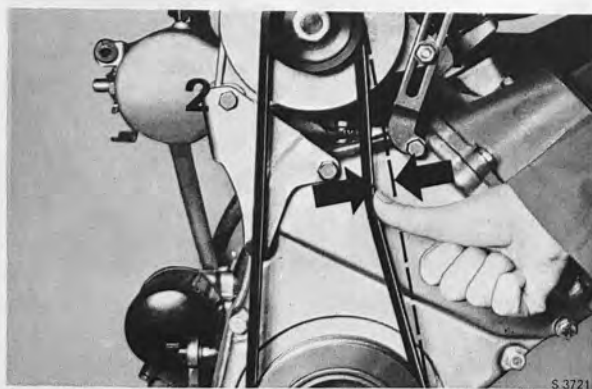
A Alternator

No lubrication is necessary. The bearings are lifetime lubricated. Belt tension must be checked at regular intervals. The alternator drive belt should be so taut that it can be pressed in about 0.4" (1 cm) by a load of 3.3 lb. (15 N, 1.5 kp).



CHECKING BELT TENSION, UP TO AND INCL. MODEL 1972

1. Adjusting screw
2. Retaining screw



CHECKING BELT TENSION, AS FROM MODEL 1973, 2.0 L ENGINE

1. Adjusting screw
2. Retaining screw

B Regulator

The regulator needs neither adjustment nor maintenance.

IMPORTANT DON'T'S

- NEVER ground the exciter terminals of the alternator or regulator or the connecting cable.
- NEVER reverse the regulator wiring connections.
- NEVER disconnect the regulator or the battery while the alternator is running.
- NEVER dismantle the alternator while the battery is connected.
- NEVER start the alternator unless the cable between "—" on the alternator and "—" on the regulator is connected.
- NEVER test the alternator-regulator assembly in the car or on the test bench without the battery connected.
- NEVER reverse the battery connections, since this will result in serious damage to the alternator. Any necessary repairs should be done by a specialist electrical workshop; it is essential that disassembly and testing are properly carried out, as even small errors may result in extensive damage.

CAUTION

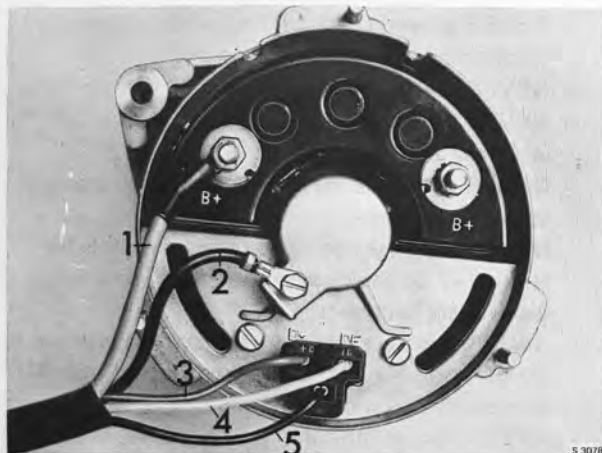
Before any electric welding is done on a car equipped with an AC generator (alternator), the battery ground cable and all wiring to the alternator must be disconnected, as the rectifier diodes may otherwise be damaged.

Terminal clamps

Alternator

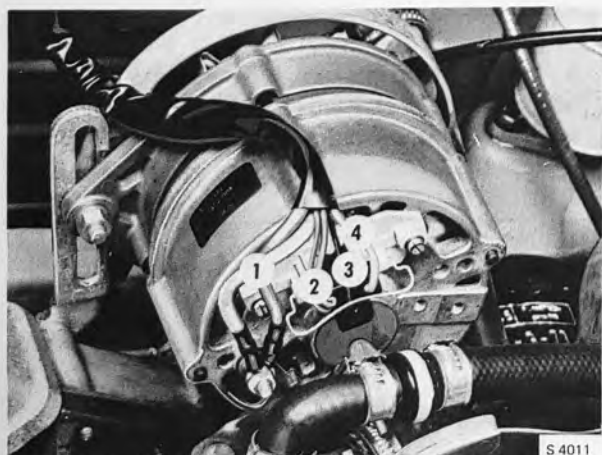
- D+ Exciter diode output, terminal for regulator D+
- DF Terminal to exciter winding and for regulator DF
- B+ Battery connection

The indicator light is wired to D+ on the voltage regulator. Connection to D- on the regulator is by a wire in the tripole joint housing.



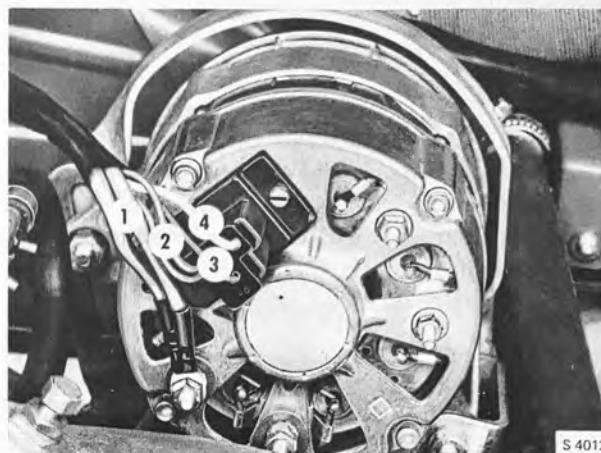
ALTERNATOR WIRING CONNECTIONS AND COLOR CODE, MAKE BOSCH (EARLIER DESIGN)

- 1. 85 gray to B+
- 2. 47 black to earth (1970 and earlier models only)
- 3. 72 red to D+
- 4. 73 yellow to DF
- 5. 49 black to D-



ALTERNATOR WIRING CONNECTIONS AND COLOR CODE, MAKE BOSCH (LATER DESIGN)

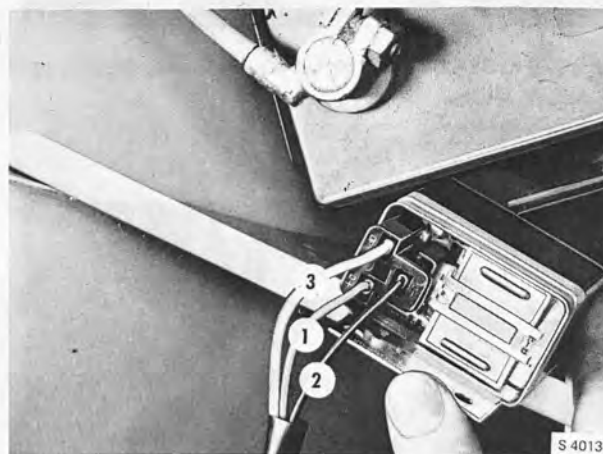
- 1. 74 gray to B+
- 2. 72 red to D+
- 3. 49 black to D-
- 4. 73 yellow to DF



ALTERNATOR WIRING CONNECTIONS AND COLOR CODE, MAKE SEV

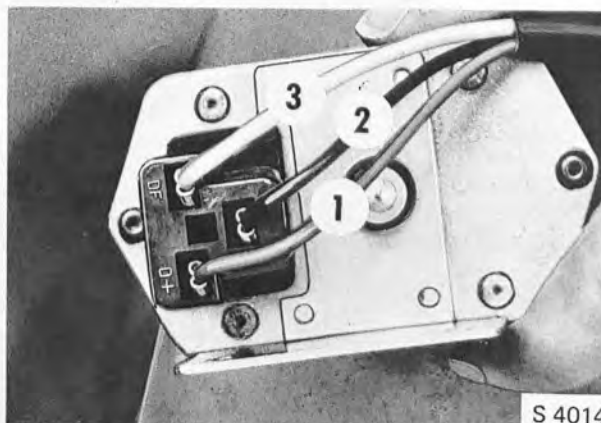
- 1. 74 gray to B+
- 2. 72 red to D+
- 3. 49 black to D-
- 4. 73 yellow to DF

Regulator



REGULATOR, MAKE BOSCH

- 1. 72 red to D+
- 2. 49 black to D-
- 3. 73 yellow to DF

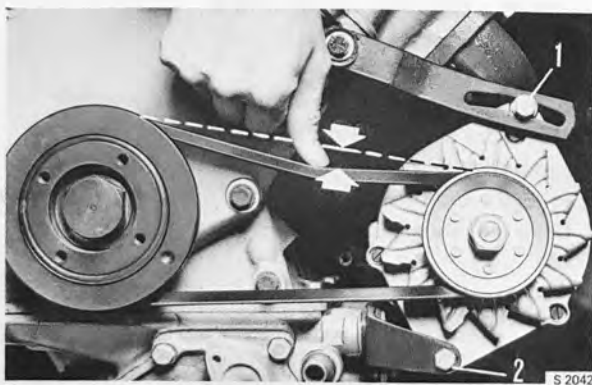


REGULATOR, MAKE SEV

- 1. 72 red to D+
- 2. 49 black to D-
- 3. 73 yellow to DF

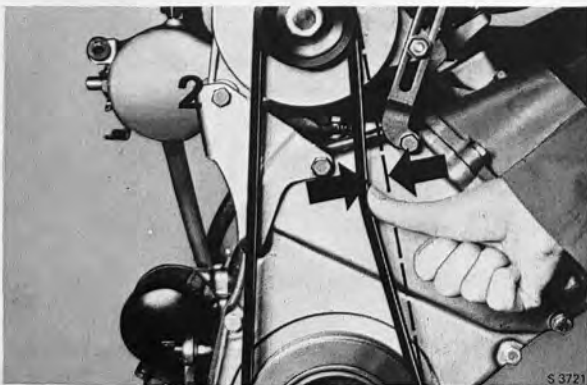
Removing and mounting the alternator

1. Disconnect the negative battery lead. Remember that the engine must be stopped before this is done.
2. Undo the alternator wiring connections, retaining screw and adjusting screw and take off the drive belt. In earlier cars with 55 A Bosch alternator: Undo the cooling hose.
3. Lift out the alternator.
4. Remount the alternator, proceeding in the reverse order.
5. Adjust the tension of the drive belt.
The tension should be such that the belt can be depressed about 0.4" (10 mm) under a load of 15 N (3.5 lb, 1.5 kp).



CHECKING BELT TENSION, UP TO AND INCL. MODEL 1972

1. Adjusting screw
2. Retaining screw



CHECKING BELT TENSION, AS FROM MODEL 1973, 2.0 L ENGINE

1. Adjusting screw
2. Retaining screw

Disassembling and assembling the alternator

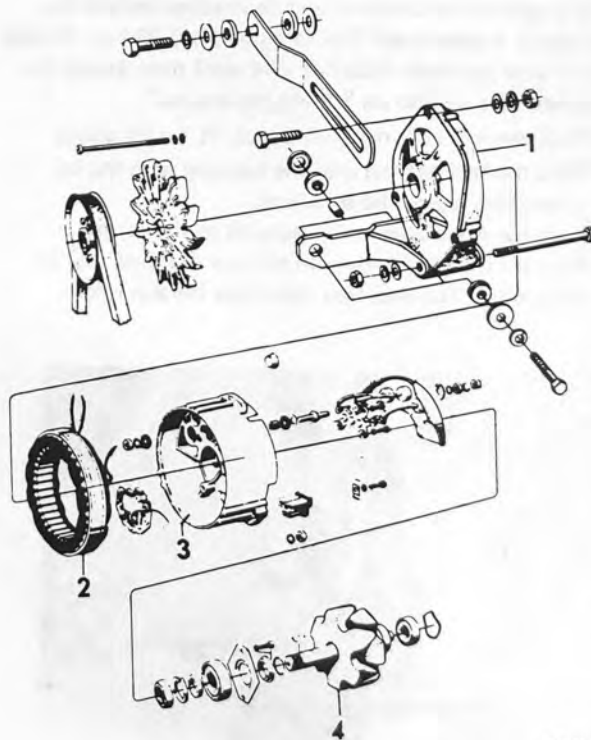
NOTE

To protect the diodes from overheating during soldering, proceed as follows:

- a. Use a well heated soldering iron with a fine tip to do the job quickly.
- b. Hold the wire between the body of the diode and the soldering point, with pliers to conduct away as much heat as possible.

Make Bosch

Alternator, 1.7 and 1.85 l engines



S 2356

ALTERNATOR, 1.7 AND 1.85 L ENGINES

1. Drive bearing assembly
2. Stator
3. Slip ring end bracket
4. Rotor

Disassembling the alternator to exchange the bearing

1. Hold the belt pulley securely in a suitable tool and unscrew the nut with a 7/8" (22 mm) wrench. Remove the pulley and fan disc.
55 A alternator: Remove the cooling cover and the cables.
2. Mark the position of the tension lug on the drive bearing housing. Undo the bearing housing retaining screws and withdraw the rotor together with the bearing housing from the stator.
3. Place the drive bearing housing on a suitable backing surface and carefully press out the rotor. The bearing can then be removed. Take care that the rotor does not fall to the floor and suffer damage when it comes free of the bearing housing.
4. Use a suitable puller to remove the ball bearing from the slip ring side.

Assembling the alternator

The length of the brushes must be checked before the alternator is assembled. The minimum is 0.354 in. (9 mm), but if they are under 0.551 in. (14 mm) they should be replaced. See section on "Changing brushes".

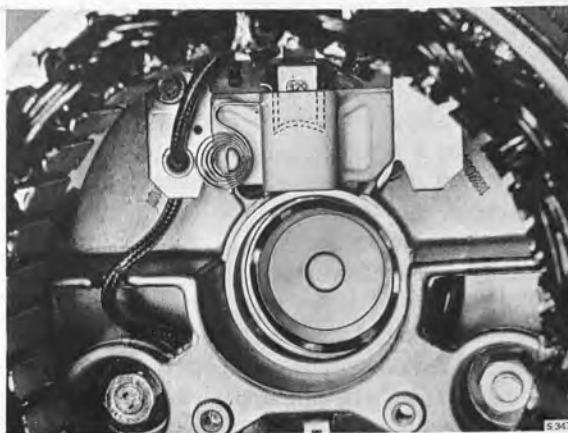
1. Pack the ball bearings with Bosch Ft 1 v 34 grease. Press the ball bearing into the housing with the enclosed side facing the drive end.
2. Press the drive bearing housing on to the rotor.
3. Press on the ball bearing on the slip ring side (see illustration). The enclosed side faces the slip rings.



S 998

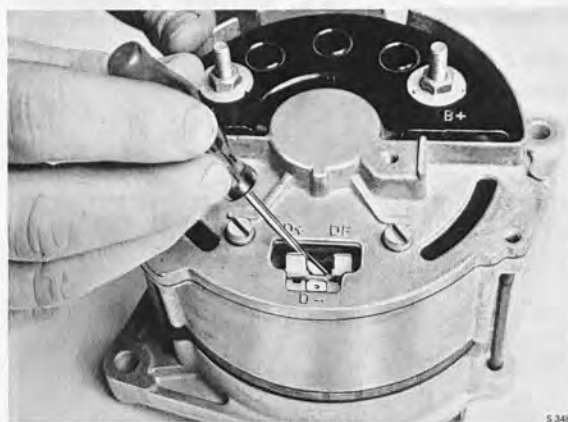
PRESSING THE SLIP RING BALL BEARING INTO POSITION

4. Put the spring washer into the bearing seat. Push up the brushes and secure them with the brush springs (this is easier if the brush unit assembly is removed).



BRUSHES PUSHED UP AND SECURED

5. Insert the rotor and screw the assembly together. Make sure that the drive bearing housing is correctly positioned relative to the slip ring bearing housing. Press the brushes down from the outside with a screwdriver or similar.



S 3490

PRESSING DOWN THE BRUSHES

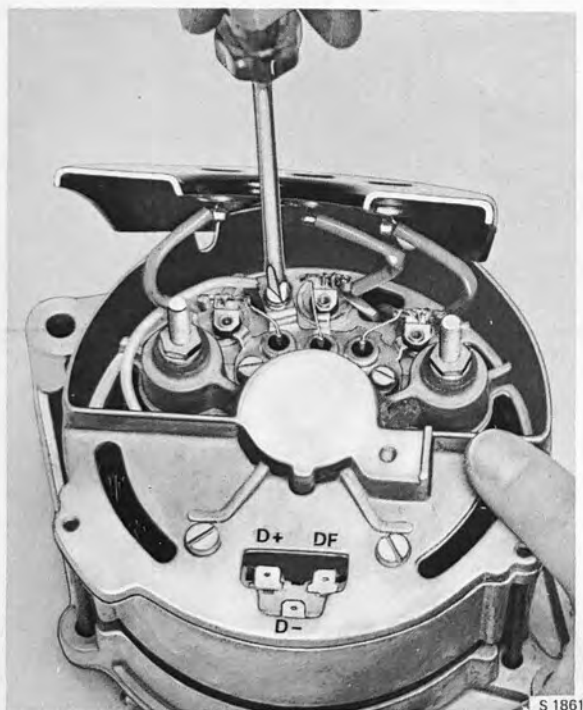
6. Fit the fan and belt pulley. The large spacer is to be placed between the fan and the belt pulley. The small spacer is to be placed between the belt pulley and the spring washer. Tighten the nut to a torque of 23–29 ft.lb. (34–39 Nm, 3.5–4 kpm).

55 A alternator: Fit cables and cooling cover.

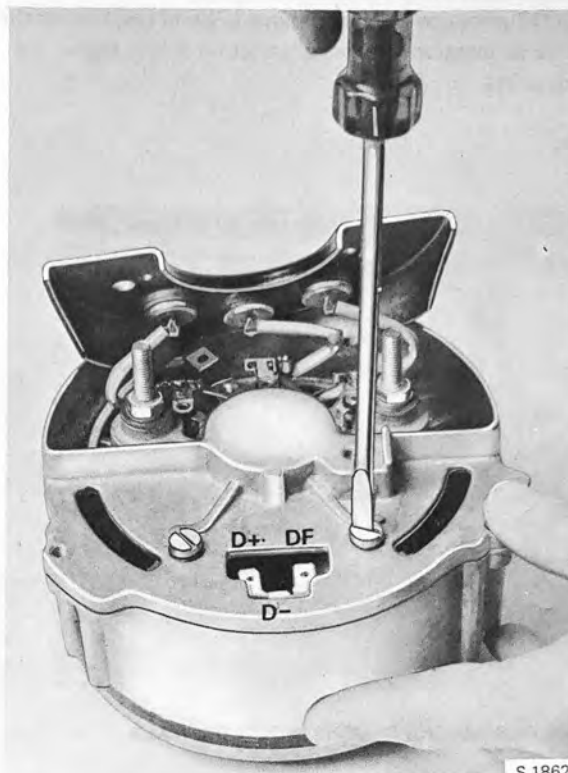
Changing brushes

Min. length of the brushes is 0.354 in. (9 mm). If the alternator is renovated the brushes shall be replaced if they are under 0.551 in. (14 mm).

1. Mark the position of the tension lug on the drive bearing housing. Undo the bearing housing retaining screws and remove the rotor with the bearing housing from the stator.
2. Undo both nuts holding the rectifier bridge in place.
3. Undo the terminal screw of the connecting wire to the brush unit assembly (see illustration).
(Later alternator models are fitted with AMP-connections.)



DISCONNECTING THE BRUSH UNIT ASSEMBLY WIRE



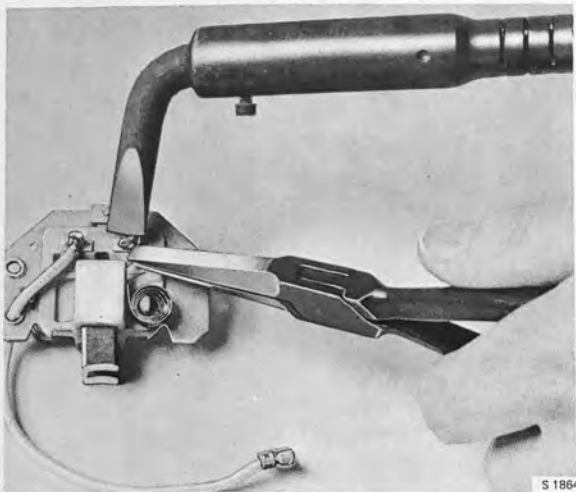
UNSCREWING THE BRUSH UNIT ASSEMBLY



REMOVING THE BRUSH UNIT ASSEMBLY

4. Undo the brush unit assembly retaining screws and remove the assembly (see illustration).

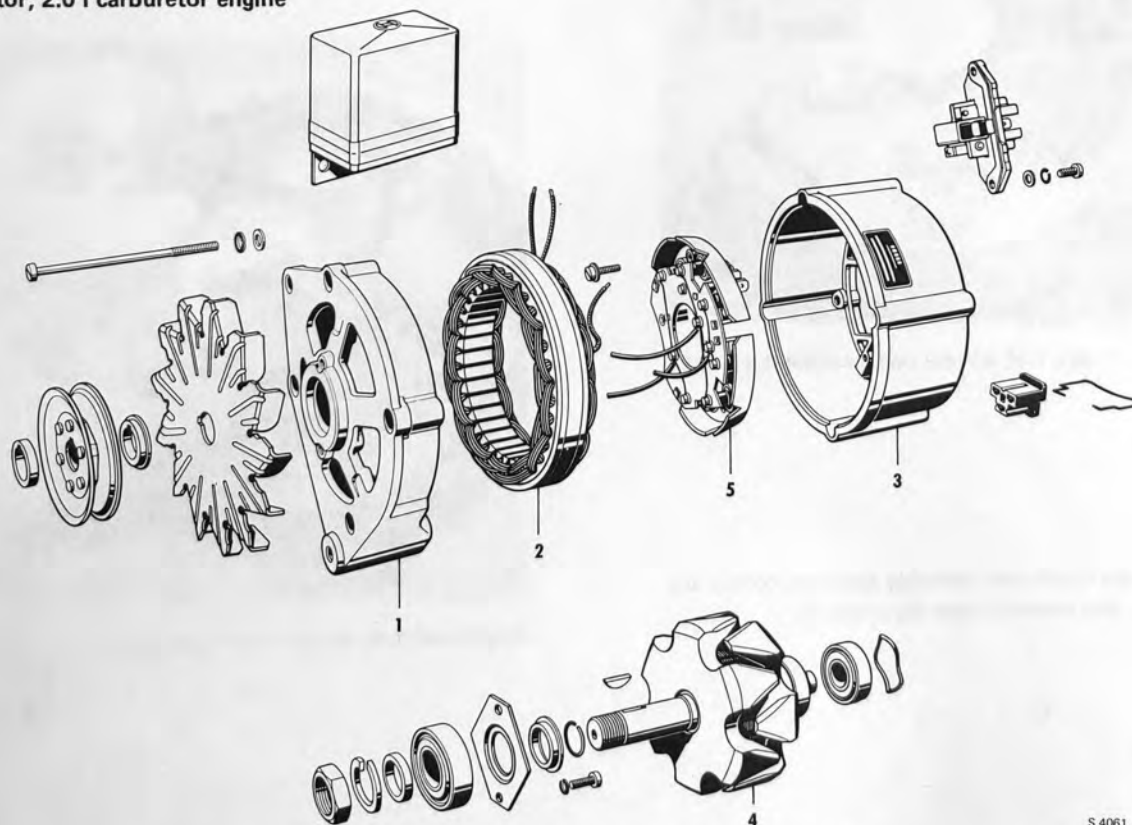
5. Disconnect the wires with the help of a soldering iron; the brushes can then be removed. When resoldering the wire connections, make sure that no solder flows into the wires.



UNSOLDERING THE BRUSH UNIT TERMINALS

6. Push up the brushes and secure them with the brush springs. Fit the brush unit assembly and make sure that the spring washer is in its correct place in the bearing seat.
7. Insert the rotor and screw the assembly together. Make sure that the drive bearing housing is correctly positioned relative to the slip ring bearing housing. Press the brushes down from the outside with a screwdriver or similar.

Alternator, 2.0 l carburetor engine

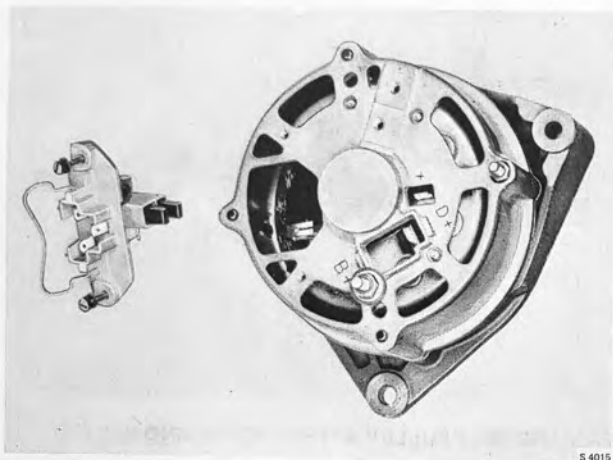


ALTERNATOR, 2.0 L CARBURETOR ENGINE

1. Drive bearing assembly
2. Stator
3. Slip ring end bracket
4. Rotor
5. Rectifier unit

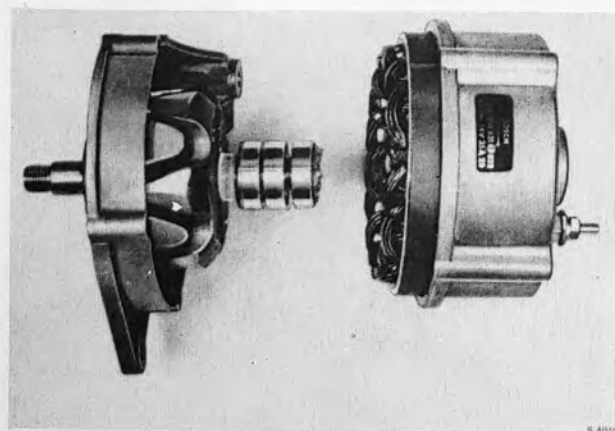
Disassembling

1. Hold the belt pulley with a suitable tool and unscrew the nut with a 7/8" (22 mm) wrench. Remove the pulley and fan.
2. Remove the brush unit assembly from the alternator.



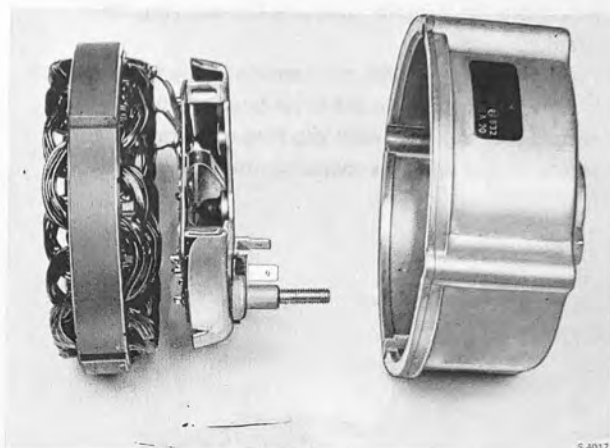
BRUSH UNIT ASSEMBLY REMOVED FROM ALTERNATOR

3. Separate the stator and slip ring end bracket from the drive bearing housing and rotor. Mark the position of the drive bearing housing relative to the stator and slip ring end bracket.



STATOR AND SLIP RING END BRACKET SEPARATED FROM ROTOR AND DRIVE BEARING HOUSING

4. Unscrew the retaining screws and nut for the rectifier unit and separate the stator and the rectifier unit from the slip ring end bracket.



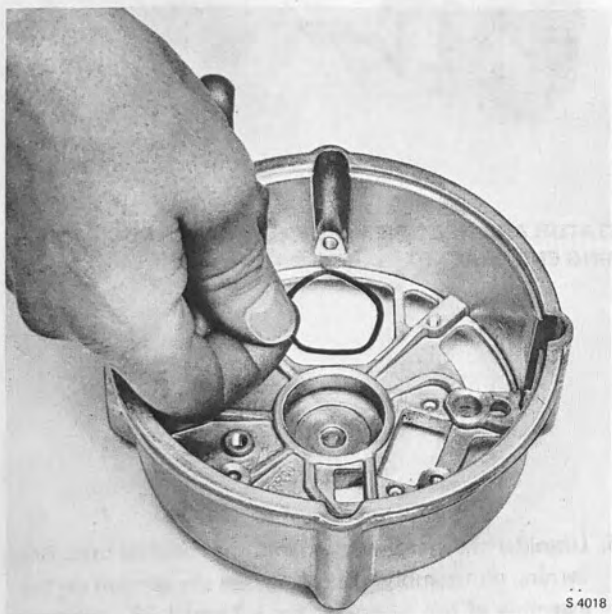
STATOR AND RECTIFIER UNIT SEPARATED FROM SLIP RING END BRACKET

5. Unsolder the stator cables from the rectifier unit. Concerning disassembly of bearing, see the section on disassembly of the alternator for 1.7 and 1.85 l engines.

Assembling

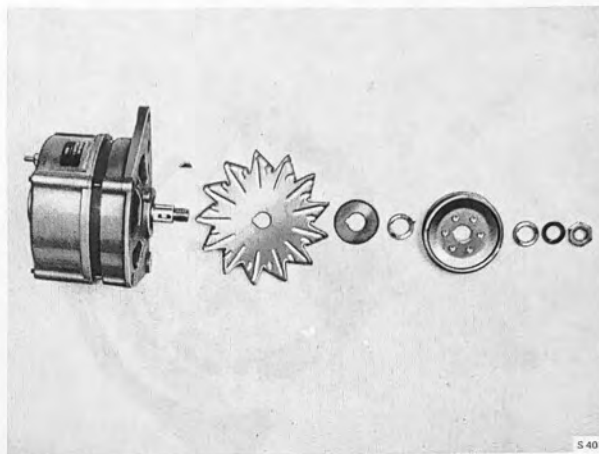
Concerning assembly of bearing, see the section on assembly of the alternator for 1.7 and 1.85 l engines.

1. Solder the stator cables to the rectifier unit.
2. Assemble the rectifier unit and the slip ring end bracket.
3. Place the snap ring for the bearing in the slip ring end bracket and assemble the drive bearing housing and rotor units together with slip ring end bracket and stator in line with the markings made previously.



FITTING THE SNAP RING IN THE SLIP RING END BRACKET

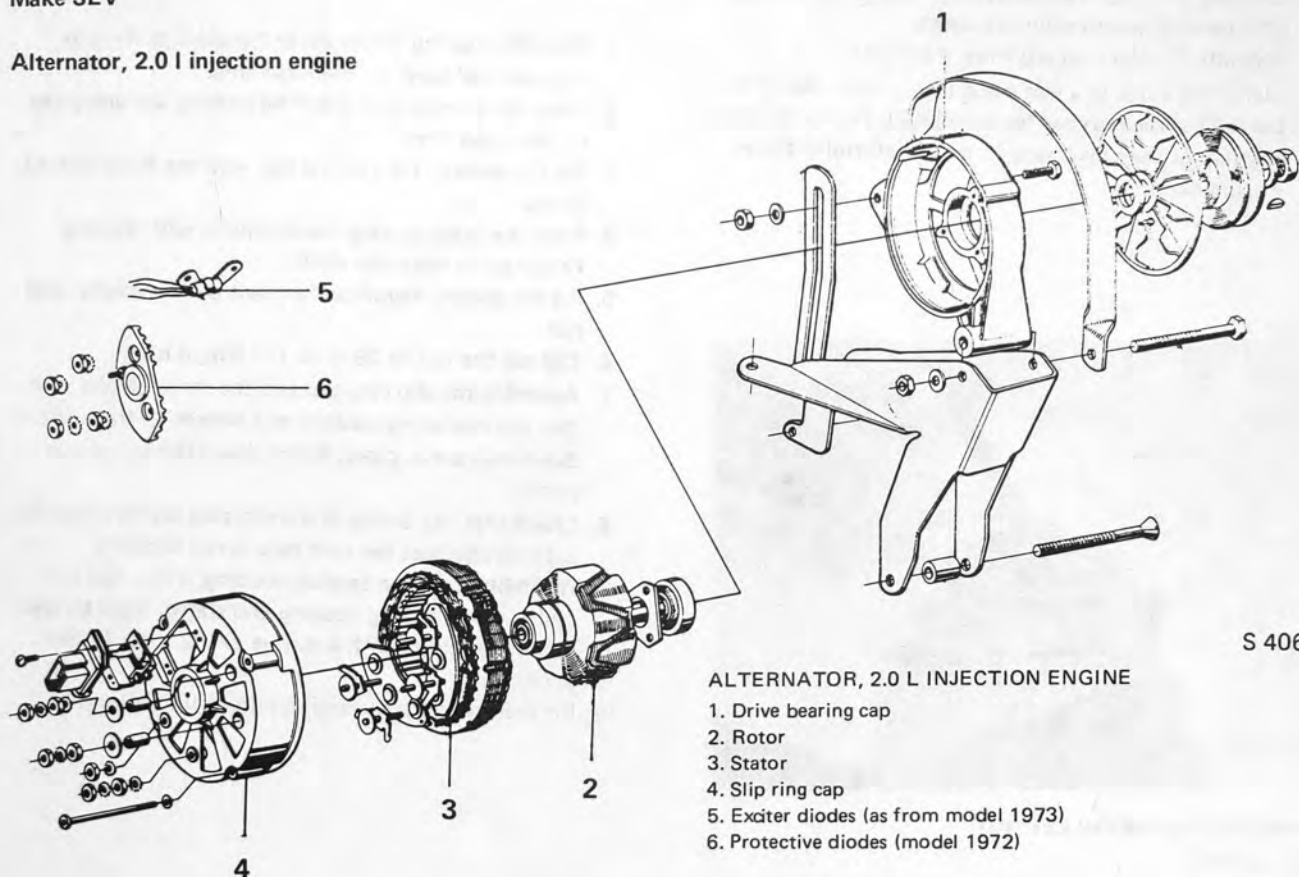
4. Check the length of the brushes (see page 321-18) and fit the brush unit assembly.
5. Fit the fan and belt pulley. Make sure the washers are in the right order (see the picture). Tighten the nut with a torque of 23-29 ft.lb. (34-39 Nm, 3.5-4 kpm).



FAN AND BELT PULLEY WITH SPACERS AND BELT

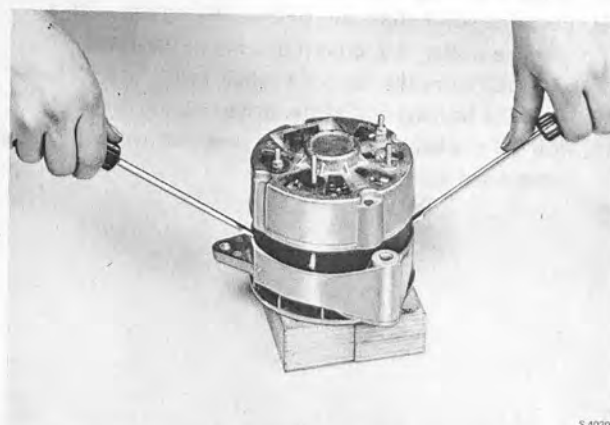
Make SEV

Alternator, 2.0 l injection engine



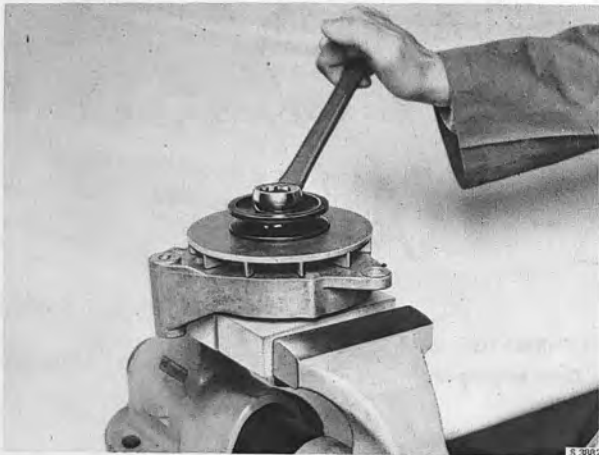
Disassembly

1. Remove the contact point and brush holder.
2. Remove the four socket head screws with square nuts which hold the alternator together. Mark the position of the drive bearing housing in relation to the stator and slip ring cap.
3. Separate the slip ring cap and stator assembly from the drive bearing cap, rotor, fan and pulley assembly, using two screwdrivers inserted in the slots on both sides of the alternator between the stator and the drive bearing cap. Never insert the screwdrivers deeper than 0.08" (2 mm) as this may damage the stator windings.



SEPARATING THE STATOR AND SLIP RING CAP FROM THE DRIVE BEARING CAP AND ROTOR

4. Unscrew the nuts and remove the washers from the positive and negative diode holders.
5. Separate the slip ring cap from the stator.
6. Clamp the rotor in a vise using the wooden blocks intended for the purpose (tool 858002). Do not tighten any harder than necessary to avoid deforming the armature cores.



UNSCREWING THE PULLEY NUT
Tool 858002

7. Unscrew the nut and remove the washer, belt pulley, fan, keypiece and spacer. Note which way the spacer faces.
8. Undo the three screws in the bearing cap.
9. Push the rotor shaft out of the bearing cap with a suitable puller, e.g. pinion bearing puller (tool 784115) from the Saab V4 repair kit.
10. Push the bearing out of the drive bearing cap.
11. Pull off the bearing at the slip ring end using the puller mentioned above.

Reassembly

1. Press the bearing firmly on to the shaft at the slip ring end and press on the inner ring.
2. Press the bearing into the drive bearing cap and press on the outer ring.
3. Fit the plate in the bearing cap with the three slotted screws.
4. Press the drive bearing cap complete with bearing firmly on to the rotor shaft.
5. Fit the spacer, keypiece, fan, belt pulley, washer and nut.
6. Tighten the nut to 29 ft.lb. (40 Nm, 4 kpm).
7. Assemble the slip ring cap and the stator. Make sure that the insulating washers and sleeves on the positive diode unit are in place. Screw down the two diode plates.
8. Check that the O-ring in the slip ring cap bearing seat is fitted and that the vent hole is not blocked.
9. Assemble the drive bearing housing, rotor, fan belt pulley with slip ring housing and stator. Tighten the mounting screws with a torque of 2.2 ft.lb. (3 Nm, 0.3 kpm).
10. Fit the contact piece and the brush unit assembly.

Testing — general comments

Note the following before testing the alternator or its component parts:

Only direct current with a maximum voltage of 40 V may be used to test the rectifiers.

A 40V/40W AC glow lamp should be used for insulation and short circuit tests on stator windings and rotor windings. (Do not use a mains voltage of 110 or 220 V, since this might damage the rectifiers.)

The battery cable must not be disconnected while the engine is running for the purpose of measuring the charging current.

If it is necessary to solder or unsolder diode connections, the diode connecting wire must be held in a pair of flat pliers to conduct away excess heat, on account of the heat sensitivity of the semiconductors. (Solder and unsolder the connections quickly with a hot soldering iron.) Avoid mechanical strain at the point where the connecting wires issue from the heat sink assembly; the wire must not be bent or subjected to load at the point of attachment.

During repairs to the alternator, whether in the car or on a test bench, the battery must be disconnected.

Start the engine and let it run at max. 2000 rev/min while watching the charge indicator light.

WARNING

Do not run the engine at a higher speed than 2000 rev/min, as there is a risk of damage to the power consumers being caused by overvoltage.

If the indicator light goes out immediately, the charging regulator is defective and must be renewed.

If the indicator light flashes or lights continuously, the alternator must be overhauled.

Measuring the charging capacity

The charging voltage and charging current can be measured in the car or on the test bench.

Measure the voltage using a voltmeter connected between terminal B+ and the alternator ground.

Measure the current using an ammeter connected in series with the wire from terminal B+ on the alternator. See the test values on page 321—18.

Quick checking of alternator and charging regulator

If the charge indicator light does not go out, the first thing to do is to check that the alternator belt is not slipping and/or that the cable connections have not loosened. If the lamp still glows after checking in this way, the cause can be determined in the following manner:

Remove the connector from the charging regulator. Connect a cable between the red cable's terminal D + and the yellow cable's terminal DF.



TERMINALS DF AND D+ CONNECTED

Testing the alternator on a test bench

When on the test bench, the alternator must be driven by its belt pulley only.

Connecting wires must be fitted with cable shoes or pin connectors. Improvised connectors must not be used on the battery either.

During testing a 12 volt battery must be coupled in parallel with the alternator. The battery serves as a buffer to damp out the peak voltages that occur when the load is switched on and off. If these peaks exceed the permitted maximum voltage, the rectifier effect of the diodes will be lost. The voltage limit for silicon diodes is about 100 V.

Mounting the alternator

The alternator can be tested in most types of generator test bench. In some cases it may be necessary to provide suitable extra mounting and drive arrangements.

CAUTION

When mounted for testing the alternator must be secured by screws in the normal manner and not clamped in place or secured by other means.

Testing with the voltage regulator

Mount the alternator in the test bench and connect it to the voltage regulator. **Do not misconnect the terminals!** Connect the excitation ammeter to terminal DF on the alternator. Connect the battery and indicator lamp. Connect the voltmeter to terminal B+. For bias, increase the speed from zero until an alternator voltage of about 14 V is obtained, then reduce speed again.

Magnetization

Unlike a DC generator, the alternator does not demagnetize spontaneously after a long period of disuse. A 12 V indicator lamp with a power of at least 1.2–2 W must therefore be connected between terminals D+ and B+ (see wiring diagram). Bias current is then supplied to the exciter winding through the indicator light, alternator terminal D+, regulator terminal D+, the closed regulator contacts and terminal DF. It is important in this connection that the lamp wattage is at least as high as that stated above. Self-excitation begins as soon as the alternator voltage opens the exciter diodes, which occurs at 1–2 V. The voltage then rises rapidly and the potential difference across the indicator lamp gradually diminishes. The lamp remains lit until battery voltage has been attained.

Testing the components

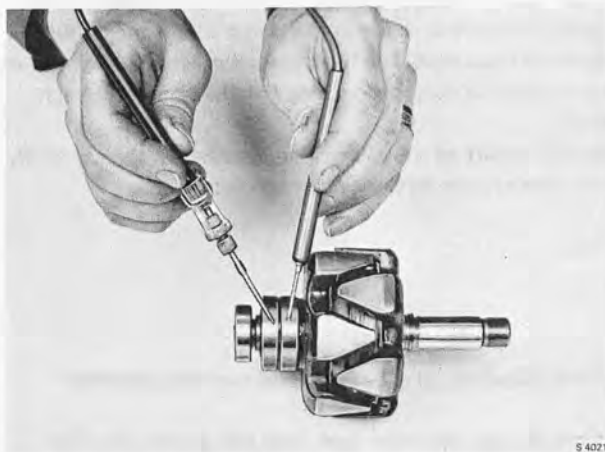
A. Rotor

Short circuit in the winding

Measure the resistance in the winding from slip ring to slip ring using an ohmmeter.

The resistance should be:

Bosch alternator	4.0–4.4 ohm
SEV alternator	3.8–4.2 ohm



MEASURING THE RESISTANCE OF THE ROTOR WINDING

Short circuit to ground

Test the insulation of the exciter winding and the slip rings for a short circuit to ground.

Test equipment: 40V/40W AC glow lamp.



CHECKING THE INSULATION OF THE EXCITER WINDING AND THE SLIP RINGS

Slip rings

Check that the surface of the slip rings is not greasy, dirty or scratched. Clean using trichloroethylene. Avoid polishing the surface of the slip rings. A ring which is too highly polished may impair the electrical contact of the brushes.

B. Stator

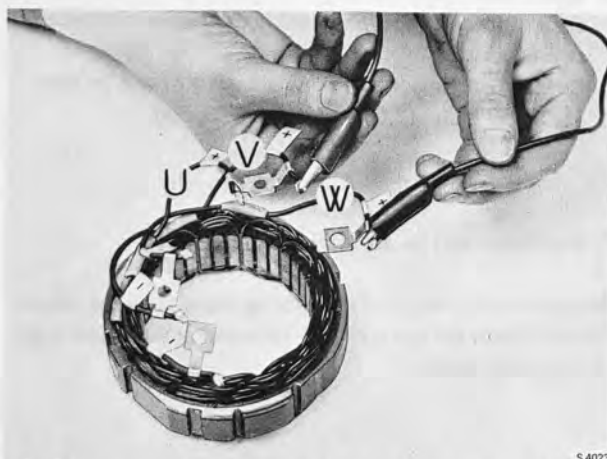
Short circuit in the windings (rectifiers unsoldered)

The test for a short circuit in the stator windings can be made by probing with a winding tester. This test can only be made when the alternator is disassembled. A further possibility is to measure the joint resistance in two phases. Three measurements will reveal any deviation in the resistance of the stator winding. If the phases are marked U, V and W, measure U-V, U-W and V-W. In each case the reading should be (at 68°F/20°C):

Bosch 35 A alternator: 0.26 ohm + 10 %

Bosch 55 A alternator: 0.14 ohm + 10 %

SEV 55 A alternator: 0.15 ohm + 10 %



MEASUREMENT OF RESISTANCE ACROSS TWO PHASES (V-W)

Short circuit to ground (rectifiers unsoldered)

The test should be made with a 40V/40W AC glow lamp. Connect the glow lamp between the iron core of the stator and each of the disconnected stator cables.

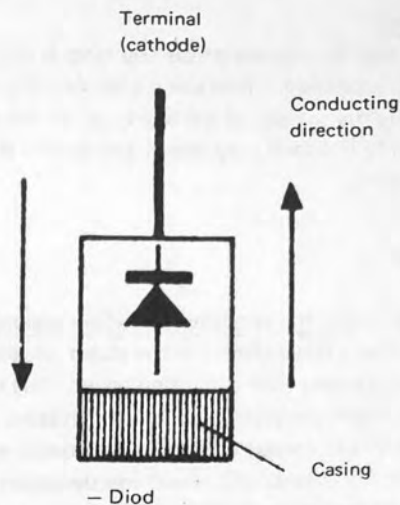
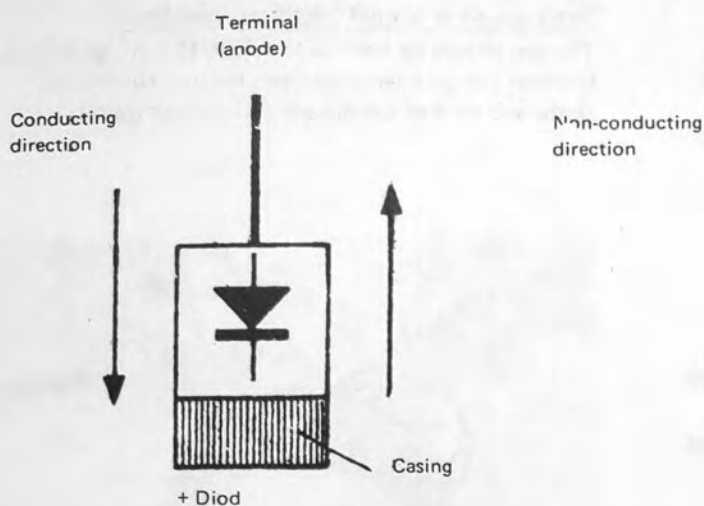


TEST OF STATOR WINDING

C. Rectifiers

Testing the rectifiers

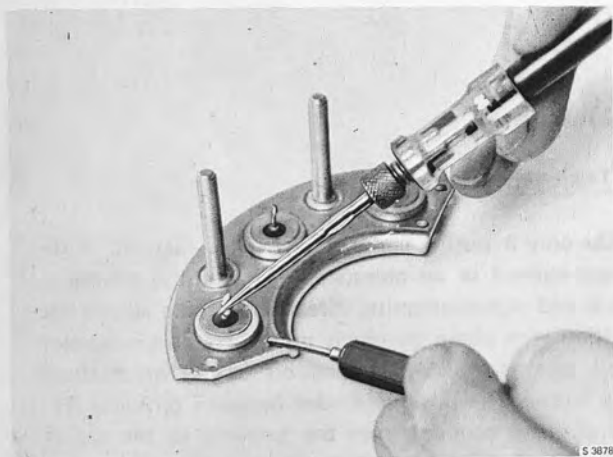
Use only a testing lamp of not more than 40 V direct current or an ohmmeter. To test the conducting and non-conducting directions of the silicon rectifiers, the phase terminals must first be disconnected, as it is otherwise impossible to tell which diode is faulty. The positive diodes between terminal B+ and phase conduct from the terminal to the casing but not from the casing to the terminal. The negative diodes connected between phase and B- (inverse polarity) conduct from the casing to the terminal but not from the terminal to the casing (see illustration). To test this, connect the testing lamp in series with the diode under test. The lamp should light up when B+ is connected to the anode of a diode with normal polarity. The lamp should not light up when B+ is applied to the casing. If the diode has inverse polarity, the lamp will light up when B+ is connected to the terminal (cathode) but not when the direction of current flow is reversed. A faulty diode that fails to pass current in the conducting direction has been overheated by excessive current intensity. A diode that passes current in both directions has probably been subjected to excessive voltage.



S 2227

Testing rectifiers with an ohmmeter

The rectifiers can also be tested with an ohmmeter. In a properly working diode, resistance is low in the conducting direction (e.g. a few ohms) but much greater in the non-conducting direction (e.g. several kilohms).



S 3878

CHECKING THE DIODES

D. Checking the brush unit assembly and connections (brush unit assembly detached or rotor removed)

1. Check the movement of the brushes in the assembly.
2. Check the wear of the brushes. Compare with wear limits on page 321-18.
3. Check that the brushes are completely insulated from each other. Connect the testing instrument between two brushes.
4. Check that the contact between each of the brushes and the "-" and "DF" terminals is good.

E. Insulation test on assembled alternator

After disassembling and assembling the alternator, check the insulation between the B+ terminal and ground with an insulation tester.

Test values and wear limits

Ratio engine belt pulley—alternator, see chapter 0.

Bosch alternator

Testing at 2/3 maximum current

Connect the battery and load the alternator. Adjust the alternator speed to exactly 2.000 rev/min. The alternator must then deliver two-thirds of the maximum current:

For the 35 A alternator = 23 A

For the 55 A alternator = 36 A

Checking speed for maximum output

Connect the battery. Load the alternator and run it warm. Increase speed. The maximum output of 35 resp. 55 A at 14 V should be obtained within the speed range 2700–3.700 rev/min. (alternator speed).

Maximum permissible wear of the brushes 1.7 and 1.85 l engines: The brushes should have a minimum length of 9 mm. When overhauling the alternator, the brushes should be replaced if they are less than 14 mm in length.
2.0 l carburetor engine: The brushes should project more than 5 mm from the brush unit assembly when the latter is removed.

SEV alternator

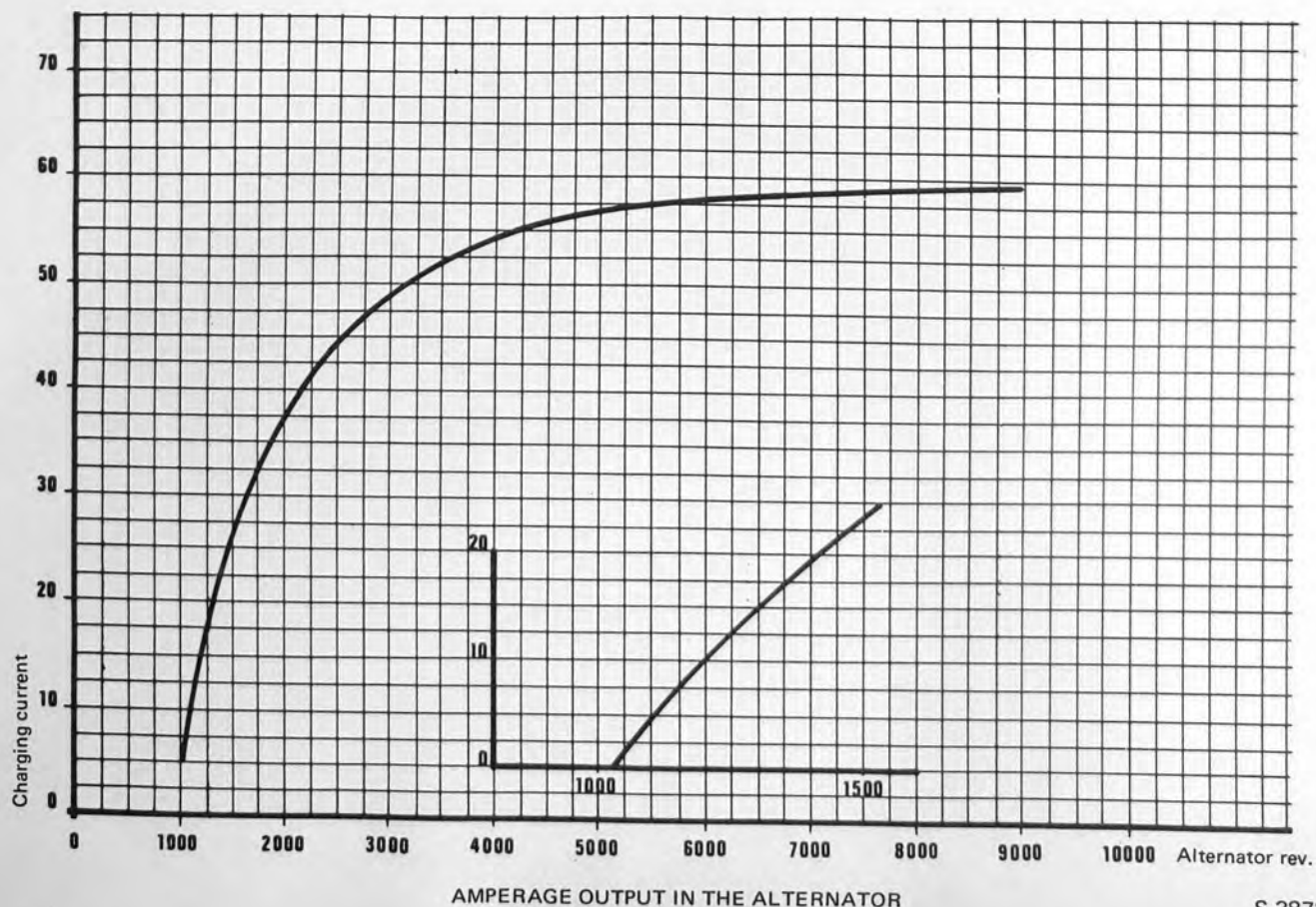
At 3.000 rev/min., the alternator should generate 14V/48A.

At 5.000 rev/min., the alternator should generate 14V/55A.

Maximum permissible wear of the brushes:

2.0 l injection engine:

The brushes should project more than 4 mm from the brush unit assembly when the latter is removed.



Trouble shooting

Alternator not charging

The cause may be

- a. slack drive belt
- b. break in charging circuit and return circuit to ground
- c. defective electric brushes
- d. shorted diodes
- e. break in exciter circuit
- f. faulty regulator
- g. broken rotor winding
- h. grounded stator
- i. exciter diode unit ground connection broken or shorted

Low or irregular amperage

The cause may be

- a. slack drive belt
- b. irregular breaking in the charging circuit
- c. worn electric brushes
- d. faulty regulator
- e. broken or shorted rectifier diode
- f. partly shorted rotor
- g. stator ground connection broken or partly shorted

Abnormally high amperage

The cause may be

- a. faulty regulator
- b. bad contact between regulator and alternator

Noise in alternator

The cause may be

- a. badly worn drive belt
- b. pulley loose or out of true
- c. crankshaft and alternator pulleys out of alignment
- d. worn or defective bearings
- e. a shorted rectifier diode
- f. loose alternator retaining screws

STARTER

General

The starter spins the engine flywheel by a starter pinion and a gear ring. The pinion slides on the rotor shaft of the starter and is brought into engagement with the gear ring by a solenoid which thereupon trips the switch that supplies current to the starter. As soon as the engine fires, the gear ring on the flywheel starts to drive the pinion. When this happens, the pinion is released from the driver shaft by a freewheel arrangement but remains in engagement with the ring gear as long as the solenoid is energized by the ignition key. It is disengaged by a return spring when current to the solenoid is cut off.

Removing the starter

1. Disconnect the negative battery lead.
Cars with 55 A Bosch alternator: Undo the cooling hose.
2. Disconnect the wiring to the starter.
3. Undo the flywheel cover retaining screws and remove the cover.
4. Unscrew the nuts on the screws securing the starter to engine block.
5. Withdraw the starter until it comes free and can be lifted out of the engine compartment.

Installing the starter

1. Slide the starter into place and tighten the screws.
2. Connect the wiring to the starter.
3. Fit the flywheel cover.
4. Connect the negative battery lead.
Cars with 55 A Bosch alternator: Fit the cooling hose.

Disassembling the starter

See exploded view on the next page.

1. Disconnect the solenoid feeder cable.
2. Remove the solenoid retaining screws.
3. Unhook and remove the solenoid.
4. Undo the two retaining screws from the capsule bracket.
5. Remove the capsule bracket, U-washer, spacers and rubber gasket (pos. 5-8).
6. Undo the screws from the commutator bearing housing (1).
7. Remove the commutator bearing housing (10).
8. Lift the brush springs off their retainers with a wire hook and remove the brushes.
9. Remove the brush plate, fiber washer and steel washer (11-13).

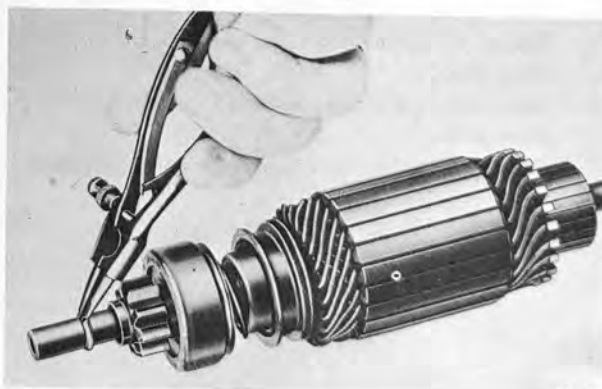
10. Pull the starter assembly off the drive and bracket assembly.
11. Undo the engaging lever arm locating screw.
12. Remove the rubber and steel washers from the drive and bracket housing (17-18).
13. Remove the rotor and engaging lever arm.
14. Press the stop ring towards the cog with a piece of tubing (see illustration).



S 1338

PUSHING DOWN THE STOP RING

15. Remove the lock ring with lock ring pliers (see illustration).
Remove the pinion and the gasket ring.



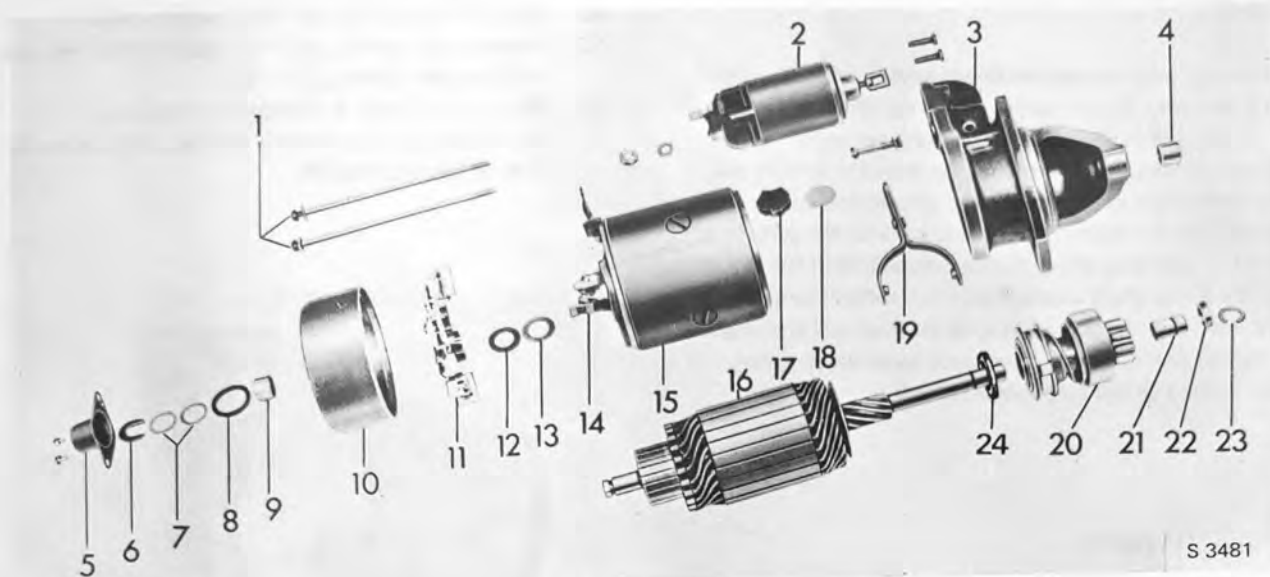
S 1340

REMOVING THE LOCK RING

16. Inspect the spiral splines on the rotor shaft for burrs. If there are any, file them off.
17. Check the gear ring, starter drive cog and the bushings.

NOTE

Check all components and exchange or repair any that are damaged. Soak the bearing bushings in hot oil before reassembling.

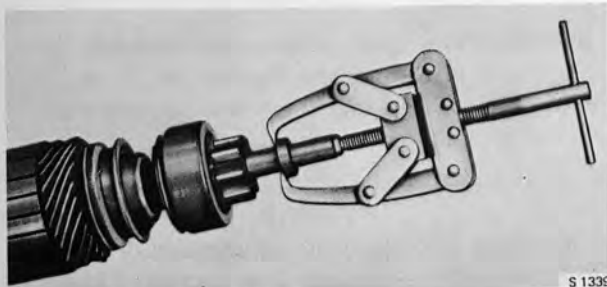


STARTER, DISASSEMBLED

- | | | | |
|----------------------------|--------------------------------|---------------------|------------------------|
| 1. Screws, bearing housing | 7. Shim | 13. Steel washer | 19. Engaging lever arm |
| 2. Solenoid | 8. Rubber gasket | 14. Field winding | 20. Pinion |
| 3. Drive housing | 9. Bushing, commutator side | 15. Starter housing | 21. Bushing, pinion |
| 4. Bushing, drive side | 10. Commutator bearing housing | 16. Rotor | 22. Stop ring |
| 5. Capsule bracket | 11. Brush plate | 17. Rubber washer | 23. Lock ring |
| 6. U-washer | 12. Fiber washer | 18. Steel washer | 24. Gasket ring |

Assembling

- Place the gasket ring on the rotor shaft. Lubricate the spiral splines and the drive cog engaging ring with silicone grease.
- Mount the pinion, stop ring and lock ring on the rotor shaft.
- Use pliers to seat the lock ring in its groove in the rotor shaft.
- Push up the stop ring using a press or claw puller.
- Fit the engaging lever arm to the cog engaging ring and insert the assembly, together with the rotor, into the drive housing.
- Secure the engaging lever arm with its locating screw.
- Place the washers in the drive housing, first the steel washer and then the rubber washer. The lips must be turned towards the rotor.
- Fit the starter housing with the notches above the guide pin and the lip of the rubber washer.
- Slip the steel washer and fiber washer over the rotor shaft.
- Fit the brush plate. Lift the brush springs with a wire hook and insert the brushes.
- Mount the commutator bearing housing with the notches above the feed cable's rubber insulation.
- Fit the rubber gasket, shims and U-washer.
- Locate the capsule bracket and secure it with the two screws.
- Insert and tighten the bearing housing screws.
- Check the axial play of the shaft 0.002–0.012 in. (0.05–0.30 mm) and correct with shims if necessary.
- Hook the solenoid to the engaging lever arm and secure with the two screws.
- Connect the feeder cable.
- Test the starter (see group 0 for specifications and test values).



S 1339

PUSHING UP THE STOP RING

Removing and refitting the solenoid (starter removed from car)

Removing

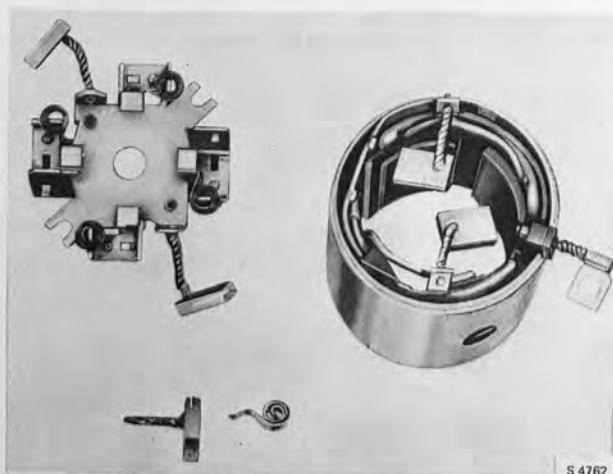
1. Disconnect the feeder cable.
2. Remove both retaining screws and remove the solenoid.

Refitting

1. Hook the solenoid to the engaging lever arm and secure it with the two screws.
2. Connect the feeder cable.
3. Test the starter (see group 0).

Changing brushes (starter removed from car) Removing old brushes

1. Remove the two screws from the capsule bracket.
2. Remove the capsule bracket, U-washer, shims and rubber gasket (pos. 5–8).
3. Remove the screws from the commutator bearing housing (1).
4. Remove the commutator bearing housing (10).
5. Lift the brush springs from the holders with a wire hook and take out the brushes.
6. Remove the brush plate.
7. Unsolder the brush wiring connections from the brush plate and field winding.



BRUSH PLATE AND FIELD WINDING

Fitting new brushes

1. Wire the new brushes to the brush plate and field winding by soldering.
2. Fit the brush plate in position. Lift the springs with a wire hook and insert the brushes.
3. Mount the commutator bearing housing with the notches above the feed cables rubber insulation.
4. Fit the rubber gasket, shims and U-washer.
5. Locate the capsule bracket and secure it with the two screws.
6. Insert and tighten the bearing housing screws.
7. Check the operation of the starter (see group 0).

Changing the starter pinion (starter removed from car)

Dismantling

1. Disconnect the feeder cable from the solenoid.
2. Undo the solenoid retaining screws.
3. Unhook the solenoid and remove it.
4. Undo the engaging lever arm locating screw.
5. Remove the commutator bearing housing screws (1).
6. Pull off the drive housing. Save the rubber and steel washer (17–18).
7. Push down the stop ring towards the pinion.
8. Remove the lock ring with lock ring pliers.
9. Remove the stop ring and the pinion.
10. Check the spiral splines on the rotor shaft for burrs. If there are any, file them off.

Assembling

1. Lubricate the spiral splines on the rotor shaft and the pinion engaging ring with silicone grease.
2. Mount the pinion, stop ring and lock ring on the rotor shaft.
3. Use pliers to seat the lock ring in its groove in the rotor shaft.
4. Push up the stop ring using a claw puller.
5. Fit the engaging lever arm to the pinion engaging ring and put on the drive housing.
6. Secure the engaging lever arm with its locating screw.
7. Place the washers in the drive housing, first the steel washer and then the rubber washer. The lips must be turned towards the rotor.
8. Mount the drive housing so that the notches on the starter housing are above the guide pin and the lip of the rubber washer.
9. Insert and tighten the bearing housing screws.
10. Hook the solenoid to the engaging lever arm and secure it with the two screws.
11. Connect the feeder cable.
12. Check the operation of the starter.

IGNITION COIL

General

The ignition coil is made by Bosch. It is of high-output type and requires a series resistance. When the starter is switched on, the series resistance is disconnected and battery voltage is fed direct to the ignition coil, but when the starter is switched off again, the series resistance comes into function and reduces the current to the coil. The ignition coil with series resistance is located on the left front wheel housing.

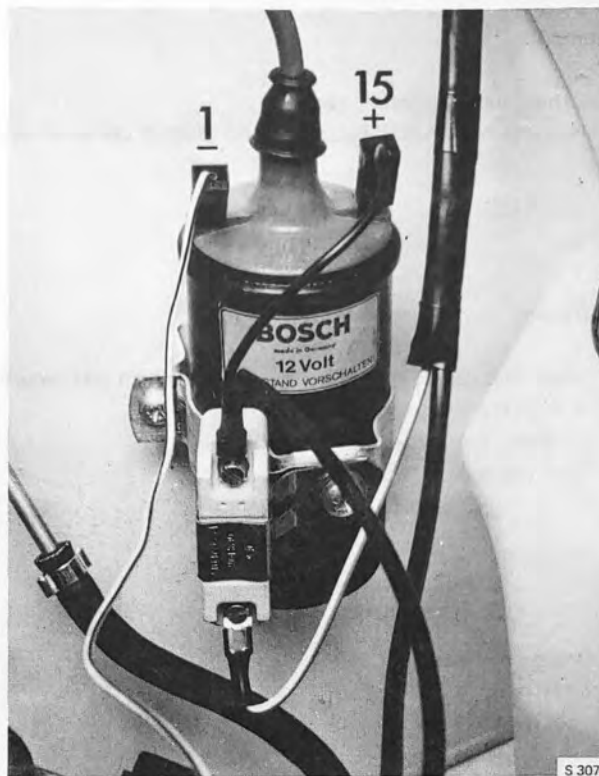
Removing and installing the ignition coil

Removing

1. Disconnect the wiring from the coil.
2. Undo the clamping screws and withdraw the coil.

Installing

1. Tighten the two screws to clamp the coil in position.
2. Connect the wiring. See fig.



S.3079

Inspecting the ignition coil

1. Disconnect the wiring.
2. Connect test equipment and check the coil as follows:
 - a. Measure the primary winding resistance between terminals 1 and 15. Test value, see group 0.
 - b. Measure coil performance in volts or spark length.
Note: Check that the breaker gap and closing angle of the distributor are correct.

NOTE

Faults, if present, can often only be detected when the coil has warmed up. In case of doubt, leave the coil connected under load on the test bench for half an hour; it should still function perfectly at the end of this time.

Removing and refitting the solenoid (starter removed from car)

Removing

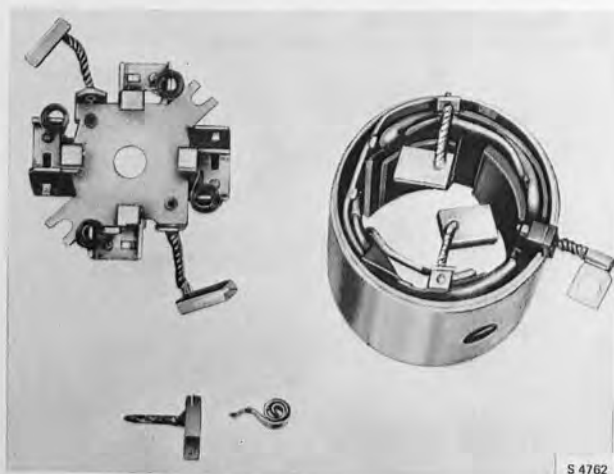
1. Disconnect the feeder cable.
2. Remove both retaining screws and remove the solenoid.

Refitting

1. Hook the solenoid to the engaging lever arm and secure it with the two screws.
2. Connect the feeder cable.
3. Test the starter (see group 0).

Changing brushes (starter removed from car) Removing old brushes

1. Remove the two screws from the capsule bracket.
2. Remove the capsule bracket, U-washer, shims and rubber gasket (pos. 5–8).
3. Remove the screws from the commutator bearing housing (1).
4. Remove the commutator bearing housing (10).
5. Lift the brush springs from the holders with a wire hook and take out the brushes.
6. Remove the brush plate.
7. Unsolder the brush wiring connections from the brush plate and field winding.



BRUSH PLATE AND FIELD WINDING

Fitting new brushes

1. Wire the new brushes to the brush plate and field winding by soldering.
2. Fit the brush plate in position. Lift the springs with a wire hook and insert the brushes.
3. Mount the commutator bearing housing with the notches above the feed cables rubber insulation.
4. Fit the rubber gasket, shims and U-washer.
5. Locate the capsule bracket and secure it with the two screws.
6. Insert and tighten the bearing housing screws.
7. Check the operation of the starter (see group 0).

Changing the starter pinion (starter removed from car)

Dismantling

1. Disconnect the feeder cable from the solenoid.
2. Undo the solenoid retaining screws.
3. Unhook the solenoid and remove it.
4. Undo the engaging lever arm locating screw.
5. Remove the commutator bearing housing screws (1).
6. Pull off the drive housing. Save the rubber and steel washer (17–18).
7. Push down the stop ring towards the pinion.
8. Remove the lock ring with lock ring pliers.
9. Remove the stop ring and the pinion.
10. Check the spiral splines on the rotor shaft for burrs. If there are any, file them off.

Assembling

1. Lubricate the spiral splines on the rotor shaft and the pinion engaging ring with silicone grease.
2. Mount the pinion, stop ring and lock ring on the rotor shaft.
3. Use pliers to seat the lock ring in its groove in the rotor shaft.
4. Push up the stop ring using a claw puller.
5. Fit the engaging lever arm to the pinion engaging ring and put on the drive housing.
6. Secure the engaging lever arm with its locating screw.
7. Place the washers in the drive housing, first the steel washer and then the rubber washer. The lips must be turned towards the rotor.
8. Mount the drive housing so that the notches on the starter housing are above the guide pin and the lip of the rubber washer.
9. Insert and tighten the bearing housing screws.
10. Hook the solenoid to the engaging lever arm and secure it with the two screws.
11. Connect the feeder cable.
12. Check the operation of the starter.

IGNITION COIL

General

The ignition coil is made by Bosch. It is of high-output type and requires a series resistance. When the starter is switched on, the series resistance is disconnected and battery voltage is fed direct to the ignition coil, but when the starter is switched off again, the series resistance comes into function and reduces the current to the coil. The ignition coil with series resistance is located on the left front wheel housing.

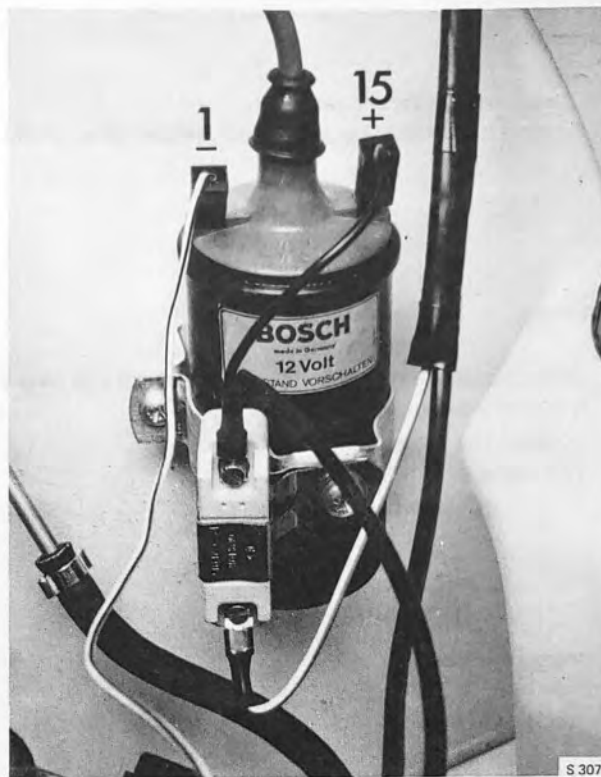
Removing and installing the ignition coil

Removing

1. Disconnect the wiring from the coil.
2. Undo the clamping screws and withdraw the coil.

Installing

1. Tighten the two screws to clamp the coil in position.
2. Connect the wiring. See fig.



Inspecting the ignition coil

1. Disconnect the wiring.
2. Connect test equipment and check the coil as follows:
 - a. Measure the primary winding resistance between terminals 1 and 15. Test value, see group 0.
 - b. Measure coil performance in volts or spark length.
Note: Check that the breaker gap and closing angle of the distributor are correct.

NOTE

Faults, if present, can often only be detected when the coil has warmed up. In case of doubt, leave the coil connected under load on the test bench for half an hour; it should still function perfectly at the end of this time.

DISTRIBUTOR, CARBURETOR ENGINE

General

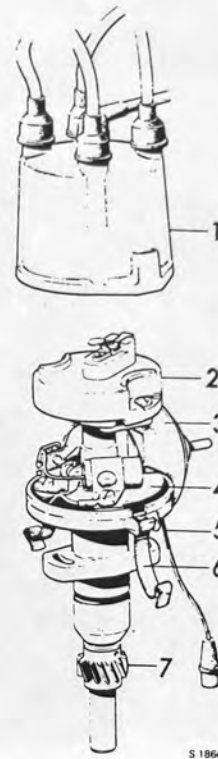
The distributor is made by AC Delco and is mounted on the front of the engine block, i.e. at the clutch end of the engine. It rotates counterclockwise and is driven by a worm gear from the idler shaft. The distributor is designed for centrifugal- and vacuum regulation; the centrifugal regulator controls the ignition setting relative to the engine speed, while the vacuum regulating system controls the ignition setting in relation to the load. The order of firing is 1-3-4-2 (cylinders numbered from rear to front).

Directions for lubricating the distributor are given in group 1.

Removing and installing the distributor

Removing

1. Disconnect the ignition cables.
2. Release the spring clips and take off the distributor cap.
3. Disconnect the low-voltage wire from the ignition coil.
4. Pull off the vacuum hose.
5. Crank the engine until the flywheel marking is at the ignition position on cylinder No. 1. (See group 0, basic ignition advance.)
6. Undo the screws that secure the distributor to the engine block, using wrench 839039.
7. Pull the distributor away from the engine.



DISTRIBUTOR

1. Distributor cap
2. Rotor
3. Vacuum control unit
4. Breaker plate
5. Low-voltage wire
6. Spring clip
7. Drive gear

Installing

1. Check the flywheel position, (see group 0, basic ignition advance), which shall correspond with the ignition position on cylinder No. 1.
2. Turn the distributor shaft until the rotor arm points away from the flywheel along the fore-and-aft line of the engine.
3. Locate the distributor in the engine block with the vacuum control unit facing the flywheel.
4. Engage the drive gears. Rotate the crankshaft back

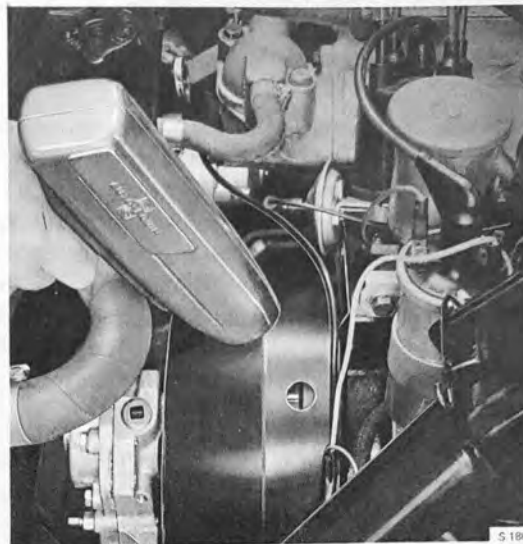


POSITION FOR INSTALLING THE ROTOR, DISTRIBUTOR FULLY ENGAGED

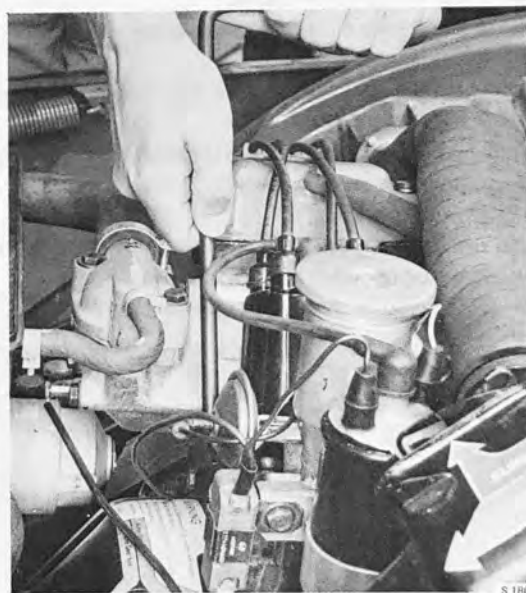
and forth slightly until the distributor shaft engages the oil pump drive.

On account of the cog bevelling the rotor must be turned 25–30° counterclockwise.

5. Check that the basic ignition advance mark on the flywheel matches the mark on the flywheel cover (ignition point for No. 1 cylinder).
6. Tighten the screws slightly (but not so hard that the distributor cannot be turned).
7. Connect the low-voltage wire to the ignition coil.
8. Connect the cam angle meter, switch on, and check and adjust the cam angle at starter speed.
9. Put on the distributor cap, secure it with the spring clips, and connect the ignition cables.
10. Connect a stroboscope lamp; adjust the ignition point at starter speed or at 800 rev/min and with the vacuum hose disconnected. A higher engine speed will give a wrong ignition setting, as the centrifugal governor of the distributor then begins to act.
11. Tighten the distributor retaining screws using wrench 839039 for 1.7 and 1.85 l engines or 839198 for 2.0 l engine. Connect the vacuum hose.
12. Adjust the idling speed setting.



STROBOSCOPE SETTING

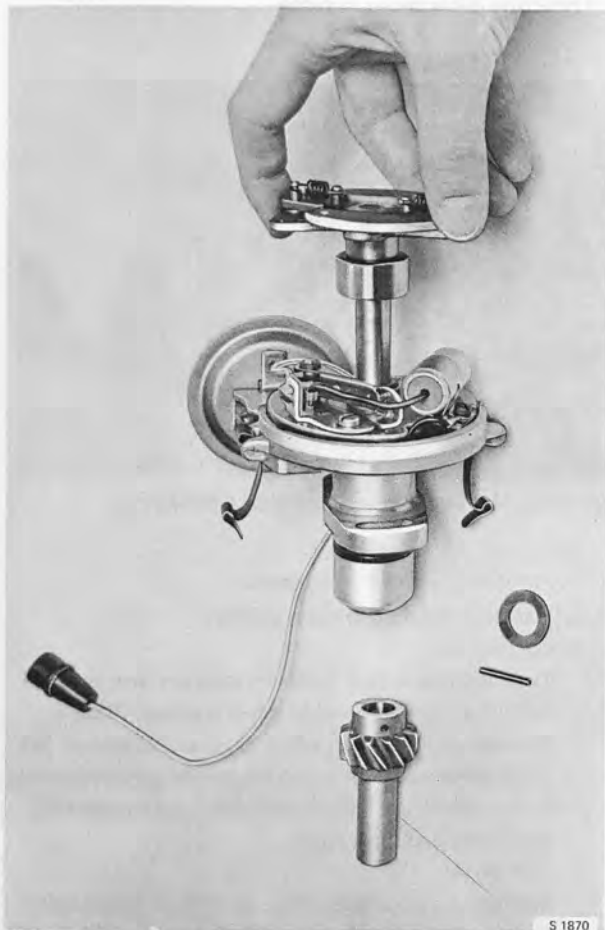


TIGHTENING DISTRIBUTOR RETAINING SCREWS
Tool 839039 (1.7 and 1.85 l engines)

Reconditioning the distributor (removed from car)

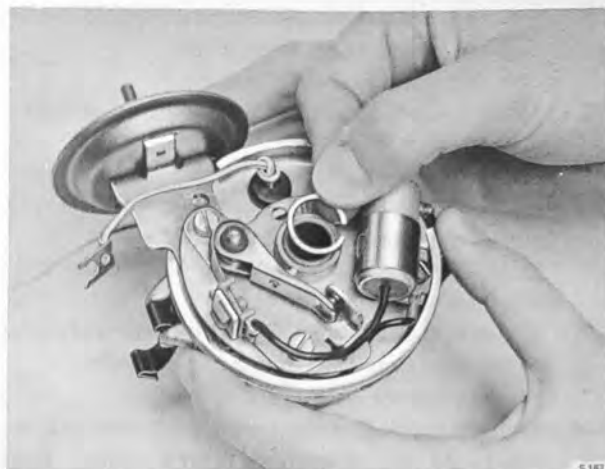
Disassembling

1. Undo the two retaining screws of the distributor arm (rotor) and remove the distributor arm.
2. Drive out the cotter pin from the distributor drive gear.
3. Tap the shaft gently with a drift inserted through the hexagonal hole in the distributor drive gear.
4. Pull the distributor shaft up and out.



LIFTING OUT THE DISTRIBUTOR SHAFT

5. Detach both coil springs from the advance mechanism and remove the weights.
6. The breaker cam can then be separated from the distributor shaft.
7. Disconnect the breaker arm wiring.
8. Disconnect the ground lead to the condenser.
9. Remove the lock ring that holds the breaker plate and lift out the plate.



REMOVING THE LOCK RING

10. Take out the lubricating felt pad.
11. Remove the vacuum regulator after undoing both retaining screws.
12. Remove the condenser from the breaker plate.
13. Undo the retaining screws of the fixed breaker contact and lift out the contact together with the breaker arm mounted on it.
14. Remove the rubber seal from the distributor housing.
15. Inspect all parts, clean them and exchange any that are defective.

Assembling

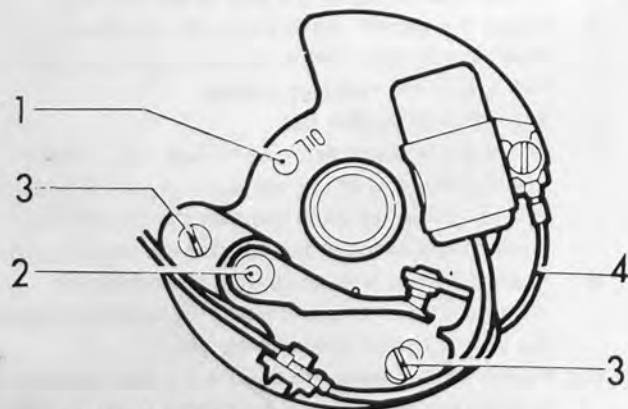
1. Fit the rubber ring on the distributor housing.
2. Mount the vacuum regulator on the distributor housing, not forgetting to secure the ground lead with one of the retaining screws.
3. Insert and oil the felt pad.
4. Mount the breaker plate and its lock ring, making sure that the arm of the vacuum regulator is hooked into its hole in the plate and that the ground lead is not caught between the housing and breaker plate.
5. Insert the fixed breaker contact complete with attached breaker arm and insert the retaining screws, but do not tighten them finally yet.
6. Mount the condenser on the breaker plate and connect the ground lead to the retaining screw. Make sure that the fixed breaker contact does not touch the condenser — some clearance must be left for adjustment.
7. Connect the condenser lead and the lead from the breaker arm to the insulated contact plate. The pressure of the breaker arm leaf spring will hold the cable shoes in place.

8. Fill the groove of the distributor shaft generously with grease and fit the breaker cam.
9. Coat the breaker cam with grease.
10. After lubricating, insert the distributor shaft into the housing.
11. Fit the spacer washer and push the gear on to the shaft until the cotter pin hole is lined up. The axial play of the distributor must be 0.005–0.011 in. (0.12–0.28 mm). Measure with a feeler gauge and adjust by shimming if necessary.
12. Knock in the cotter pin. The distributor shaft must be properly supported during this operation.
13. Fit the governor weights and springs.
14. Turn the distributor shaft until the breaker arm is lifted right clear of the fixed breaker contact. Place a screwdriver in the adjusting groove and slot on the fixed breaker contact and turn the screwdriver to adjust the contact gap. Tighten the retaining screws and check the gap again.
15. Fit the rotor arm, making sure that its square locating stud engages the distributor shaft properly.

Changing breaker contacts (distributor in place in the car)

Disassembling

1. Push the retaining springs aside and take off the distributor cap.
2. Undo the two rotor arm retaining screws and remove the arm.
3. Pull the breaker arm leads away from the contact plate.
4. Undo the retaining screws from the fixed breaker contact and remove it complete with attached breaker arm.



BREAKER CONTACTS

S 1872

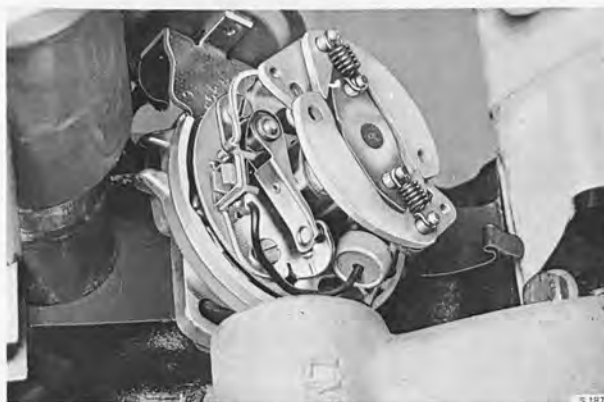
1. Oil hole for lubricating pad
2. Breaker arm
3. Breaker contact retaining screws
4. Ground lead

Assembling

NOTE

The contact surfaces must not come in contact with oil or grease (risk of oxidation).

1. Insert the fixed breaker contact with attached breaker arm and insert the retaining screws, but do not tighten them finally yet.
2. Connect the wiring to the contact plate on the breaker arm. The pressure of the breaker arm leaf spring will hold the cable shoes in place.



DISTRIBUTOR WITH ROTOR AND CAP REMOVED

3. Coat the breaker cam with grease.
4. Adjust the contact gap (cam angle):
 - a) Contact gap

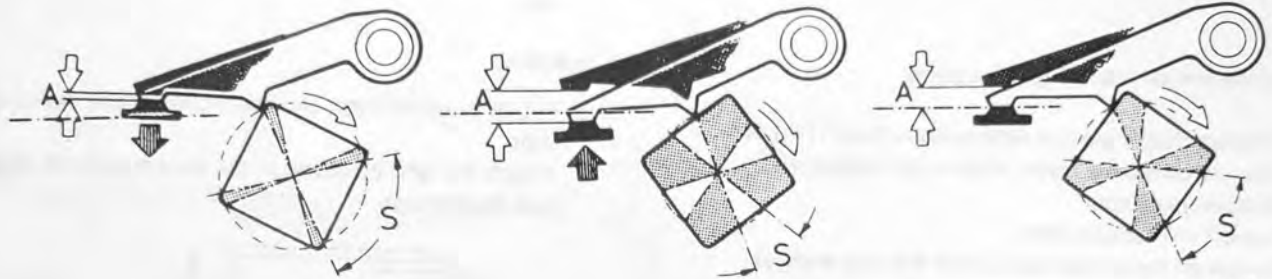
Turn the crankshaft until the breaker arm is lifted right clear of the fixed breaker contact. Place a screwdriver in the adjusting groove and slot on the fixed breaker contact and adjust the gap by turning the screwdriver. Tighten the retaining screws and check the gap once again.
 - b) Cam angle

Connect a cam angle meter, switch on the ignition and turn the engine over with the starter. Compare the indicated reading with the specification figure (see group 0) and correct if necessary by adjusting the fixed breaker contact. Tighten the retaining screws and recheck the setting.

NOTE

The lower setting should be used for new contacts, as the angle grows greater with wear.

»A» = contact gap
»S» = closing angle



S 1343

»A» = too small
»S» = too large

»A» = too large
»S» = too small

»A» = correct
»S» = correct

The relationship between the contact gap "A" and the closing angle "S" is shown by the three diagrams on this page. The shaded contact shows the contact gap at the highest position of the cam.

5. Fit the rotor arm, making sure that its square locating stud engages the distributor shaft properly.
6. Put on the distributor cap and secure it with the two spring clips.
7. Connect a stroboscope lamp and check the ignition point at starter speed or with the engine idling at not more than 800 rev/min. The vacuum hose must be disconnected during this operation. Adjust as necessary.

Changing the condenser (distributor in place in the car)

Removing

1. Push the spring clips aside and take off the distributor cap.
2. Disconnect the condenser lead from the contact plate on the breaker arm.
3. Undo the condenser retaining screw and take out the condenser.

Installing

1. Screw on the new condenser, attaching the ground lead to the condenser retaining screw.
2. Push the end of the condenser lead into the contact plate on the breaker arm. The pressure of the leaf spring will hold the cable shoe in place.
3. Put on the distributor cap and secure it with the two spring clips.

Changing the vacuum regulator (distributor removed from car)

Removing

1. Knock the cotter pin out of the distributor drive gear with a drift and pull the gear off the shaft.
2. Lift out the entire shaft assembly with the rotor arm.
3. Undo the condenser retaining screw and disconnect the ground lead.
4. Disconnect the lead to the breaker arm by pulling the cable shoe out of the insulated contact plate on the breaker arm.
5. Remove the breaker plate lock ring and lift out the plate.
6. Undo both retaining screws of the vacuum regulator and remove the unit.

Installing

1. Screw the vacuum regulator to the distributor housing, not forgetting to attach the ground lead to one of the screws.
2. Mount the breaker plate and its lock ring, making sure that the arm of the vacuum control unit hooks into its hole in the breaker plate and that the ground lead is not caught between the housing and the plate.
3. Attach the ground lead to the condenser retaining screw.
4. Attach the breaker arm lead by pushing the cable shoe into the insulated contact plate on the breaker arm. The pressure of the leaf spring on the breaker arm will hold the cable shoes in place.

5. Oil the distributor shaft and insert the shaft assembly complete with rotor into the housing.
6. Fit the spacer washer and push the drive gear on to the shaft until the cotter pin hole is lined up.
7. Knock in the cotter pin. The distributor shaft must be properly supported during this operation.

Checking and setting the ignition point

1. Connect Saab's ignition service instrument (TSI) or separate cam angle meter, revolution counter and stroboscope lamp.
2. Pull off the vacuum hose.
3. Switch on the ignition and check the cam angle at starter speed and idling speed. Adjust as necessary.
4. Check the ignition point setting at starter speed or an engine speed of not more than 800 rev/min.
5. If necessary, slacken the distributor retaining screws using a special wrench 839039 (1.7 and 1.85 l engines) or 839198 (2.0 l engine) and rotate the distributor housing (clockwise for earlier ignition, counterclockwise for later ignition). See Group 0 for correct settings. Reconnect the vacuum hose. Adjust the engine idling speed.



IGNITION SERVICE INSTRUMENT

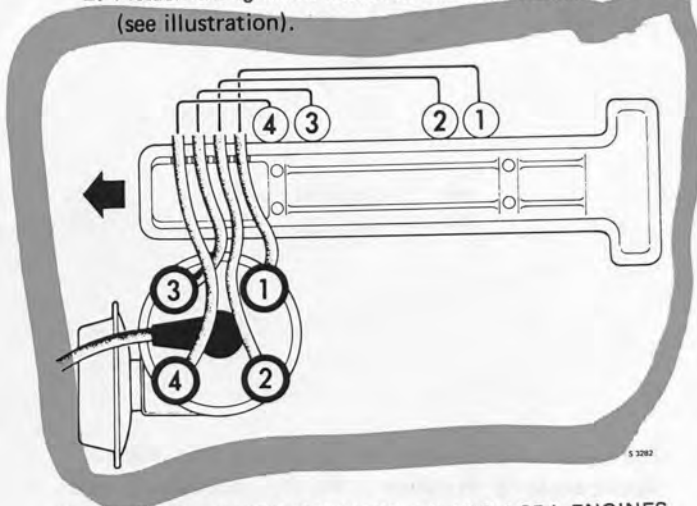
Changing the distributor cap

Removing

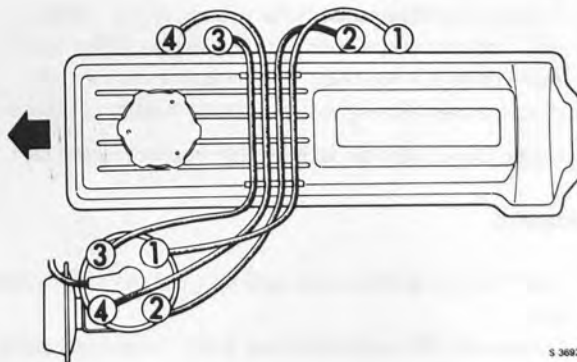
1. Remove all ignition cables with rubber cups from the distributor cap.
2. Push the spring clips aside and take off the distributor cap.

Installing

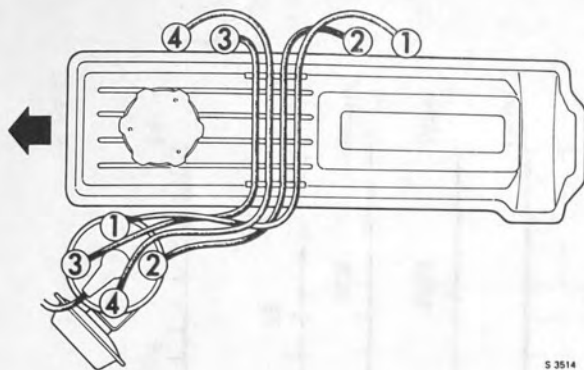
1. Put on the distributor cap and secure it with the spring clips.
2. Attach the ignition cables in the correct order of firing (see illustration).



POSITIONS OF IGNITION CABLES, 1.7 AND 1.85 L ENGINES



POSITIONS OF IGNITION CABLES, 2.0 L CARBURETED ENGINE



S 3514

POSITIONS OF IGNITION CABLES, 2.0 L INJECTION ENGINE

Checking out the distributor on a test bench

Test according to the directions supplied with the test equipment. See ignition advance graph for correct settings.

NOTE

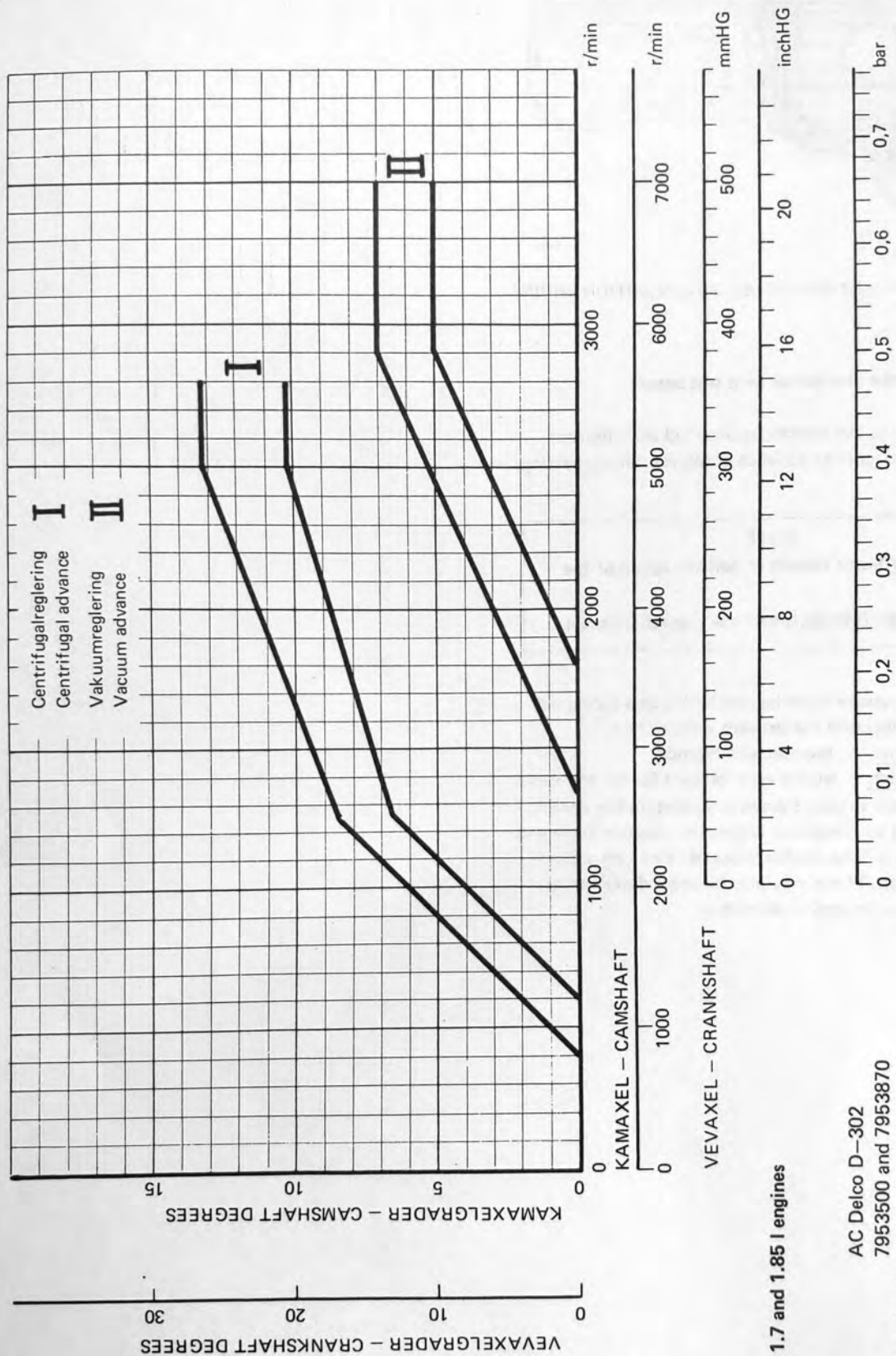
1. The distributor rotates at half the speed of the engine.
2. The camshaft angle is half the crankshaft angle.

The contact pressure must be checked with a spring balance secured opposite the breaker arm contact.

Pressure too low — the contacts bounce

Pressure too high — undue wear on cam fender and cams.

If the distributor is tested when mounted on the engine, the main point to remember is that the advance angle and speed readings will be double those obtained on a distributor test bench. There may also be some deviation in the readings due to engine vibration.



VAKUUM - VACUUM

Ignition advance graphs, 1.7 and 1.85 l engines

Applicable for:
DistributorsAC Delco D-302
7953500 and 7953870

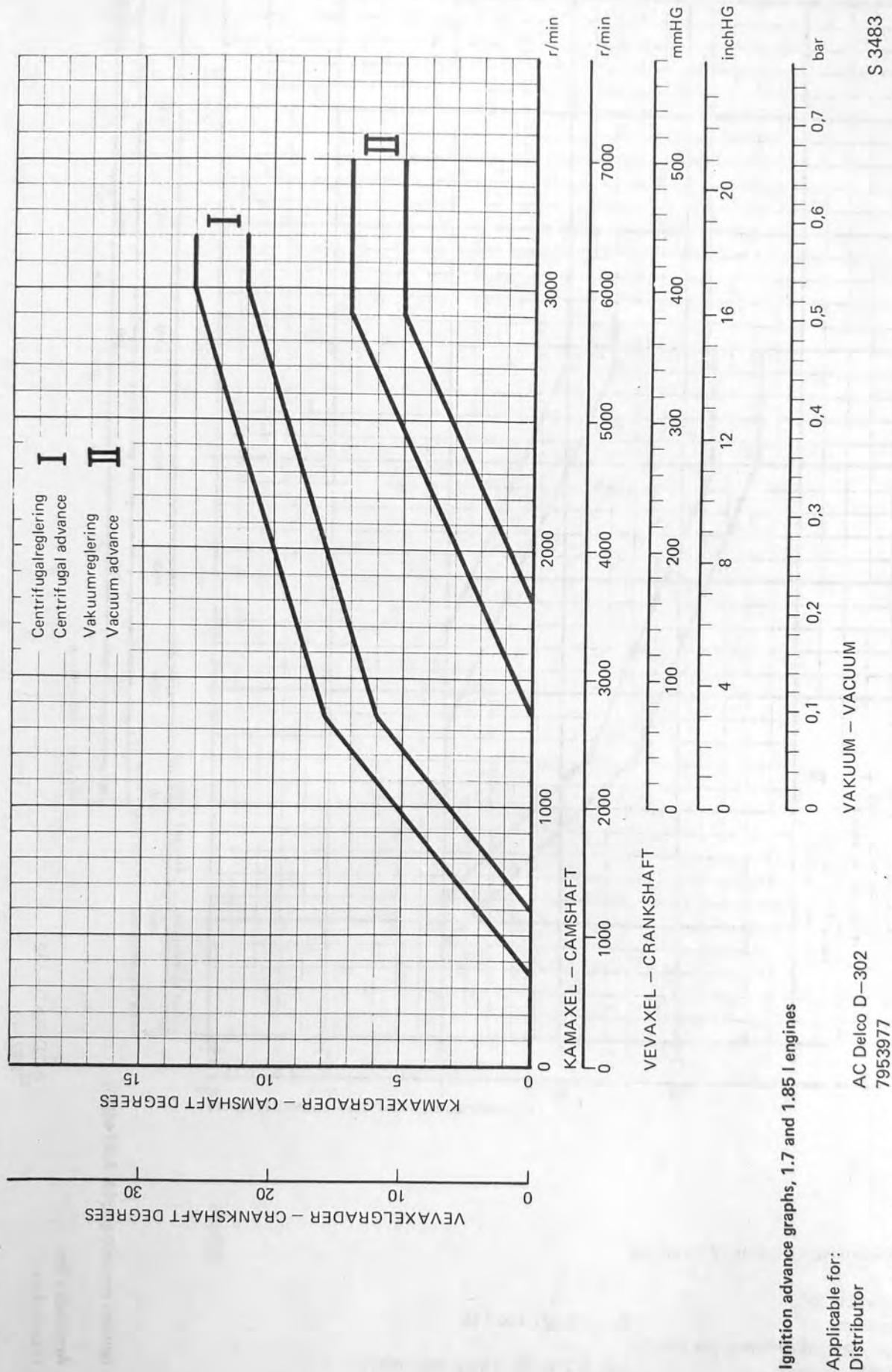
Checking on distributor test bench.

Contact pressure 4.2-5.9 N (15-21 oz, 425-600 p)

Breaker gap 0.012-0.016" (0.3-0.4 mm)

Dwell angle $40 \pm 2^\circ$

S 3482



Ignition advance graphs, 2.0 l engine

Applicable for:

Distributor

Checking on distributor test bench.

Contact pressure

Breaker gap

Dwell angle

Bosch 0 231 170 115

4.9–6.2 N (18–23 oz, 500–630 p)

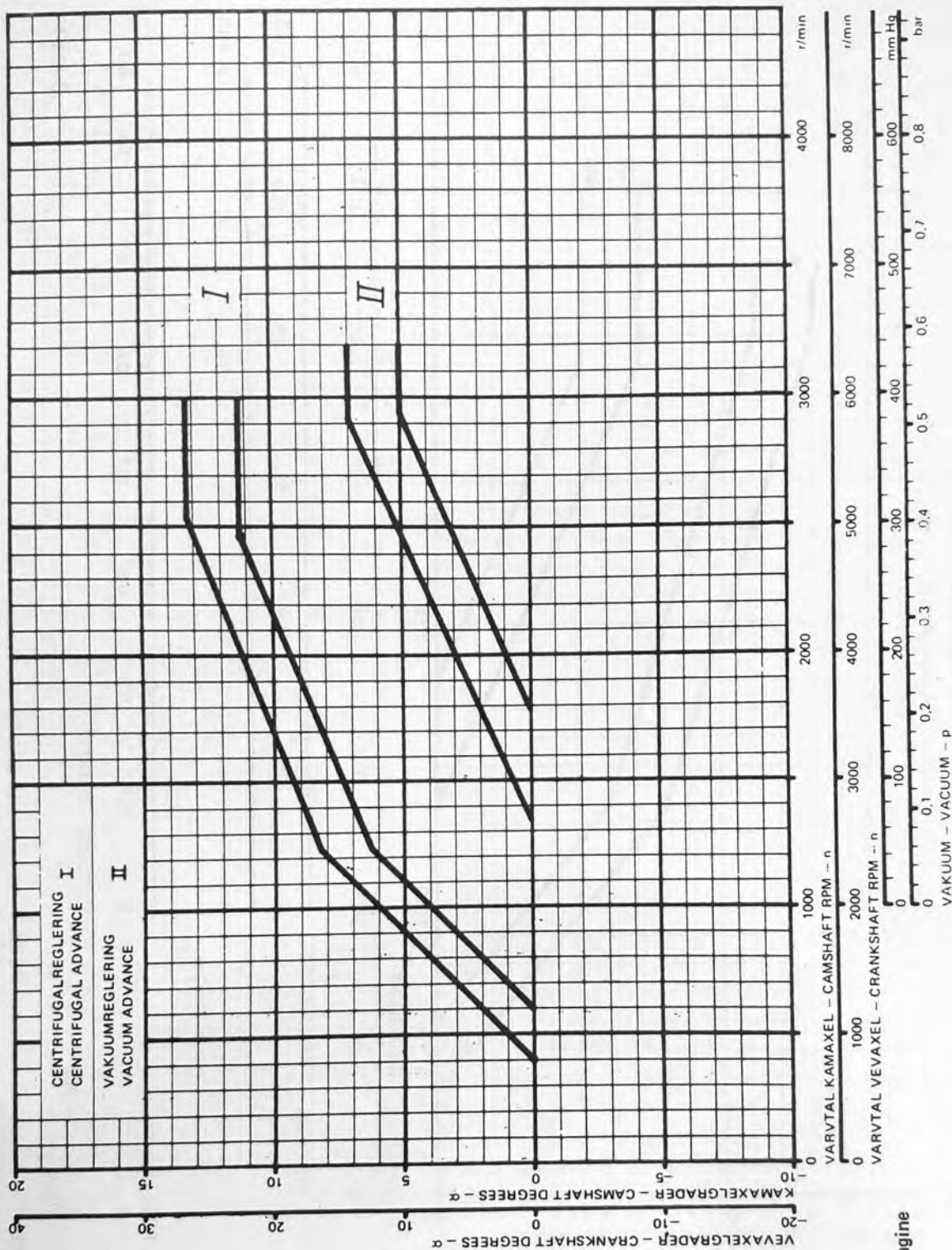
Min. 0.016" (0.40 mm)

50 ± 3°

342–10

SAAB

S 3884



Ignition advance graphs, 2.0 l engine

Applicable for:

Distributors

AC Delco D-302

7992142

Checking on distributor test bench.

Contact pressure

Breaker gap

Dwell angle

4.2–5.9 N (15–21 oz, 425–600 p)

0.014–0.016" (0.35–0.4 mm)

40 ± 2°

DISTRIBUTOR, USA EXPORT MODEL

This distributor is largely identical to the standard distributor. 1.7 and 1.85 l engines are equipped with a double-acting vacuum regulator.

On the 2.0 l engine, there is no vacuum regulator.

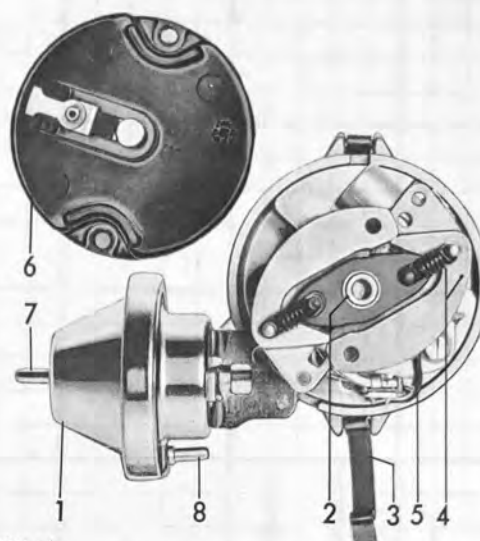
Ignition advance graphs, 1.7 and 1.85 l engines

Applicable for:
Distributors

AC Delco D-302
7953820 and 7953871

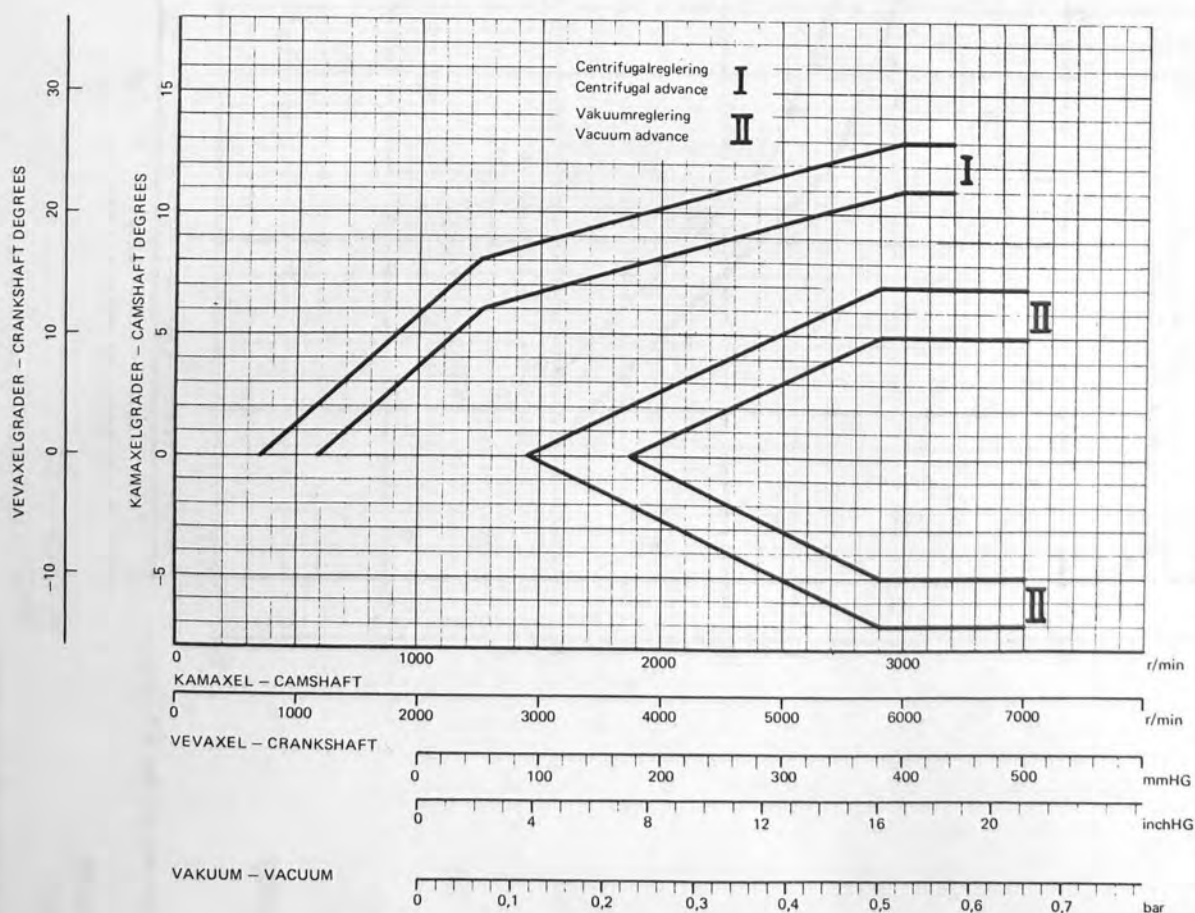
Checking on distributor test bench.

Contact pressure 4.2–5.9 N (15–21 oz, 425–600 p)
Breaker gap 0.012–0.016" (0.3–0.4 mm)
Dwell angle $40 \pm 2^\circ$

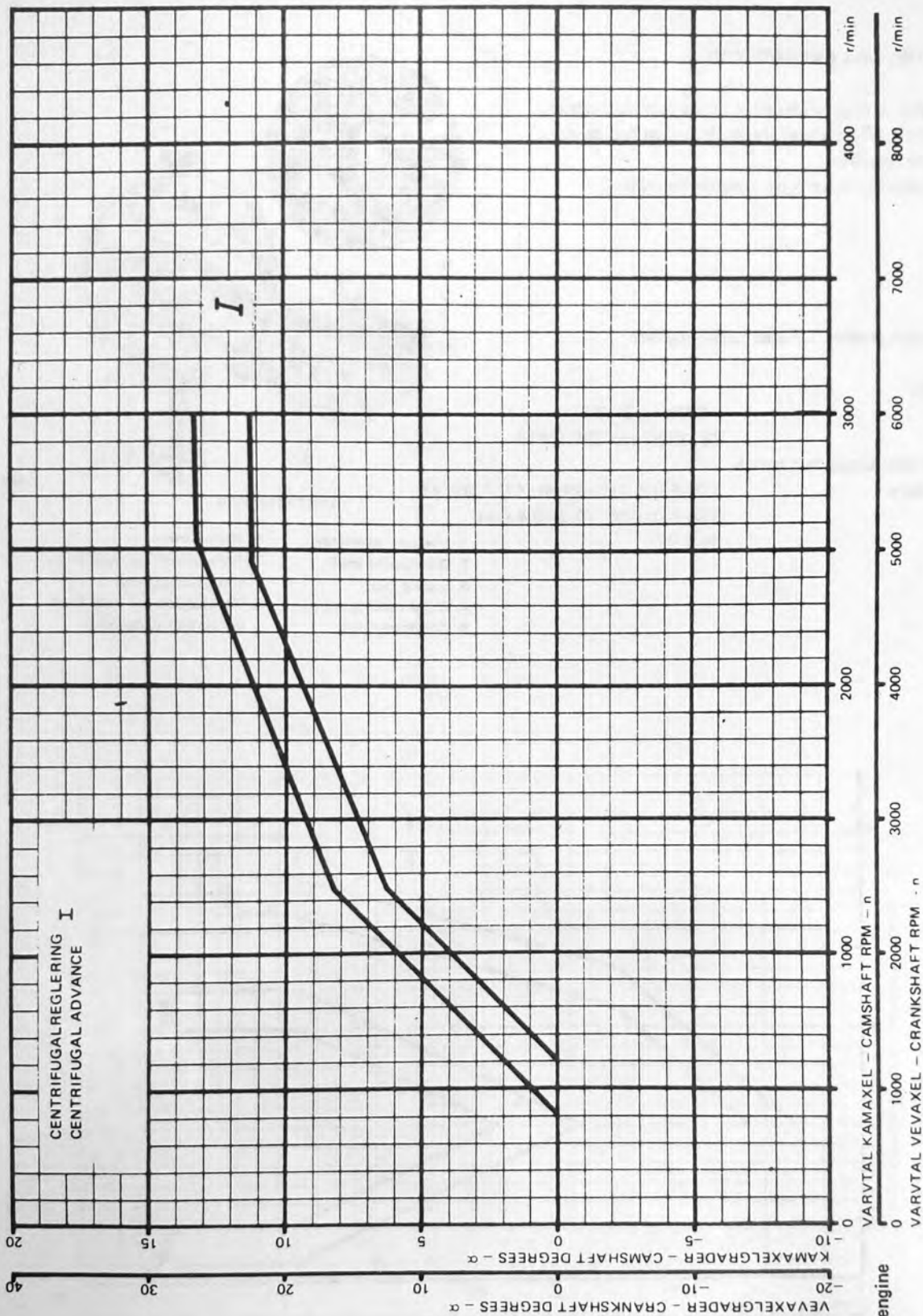


DISTRIBUTOR

- | | |
|----------------------|--|
| 1. Vacuum regulator | 6. Rotor arm |
| 2. Distributor shaft | 7. Connection for hose from top of carburetor |
| 3. Spring clip | 8. Connection for hose from bottom of carburetor |
| 4. Weight spring set | |
| 5. Condenser lead | |



S 3484



Ignition advance graphs, 2.0 l engine

Applicable for:
Distributors

AC Delco D-302
7992196

Checking on distributor test bench.

Contact pressure

Breaker gap

Dwell angle

4.2-5.9 N (15-21 oz, 425-600 p)
0.012-0.016" (0.3-0.4 mm)
40 ± 2°

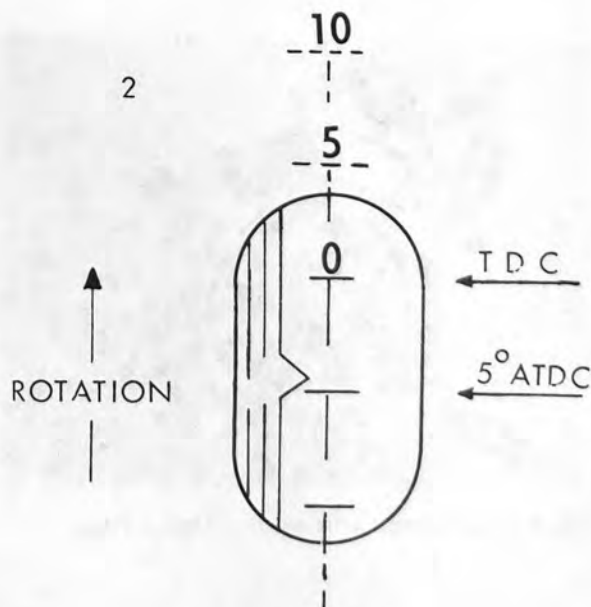
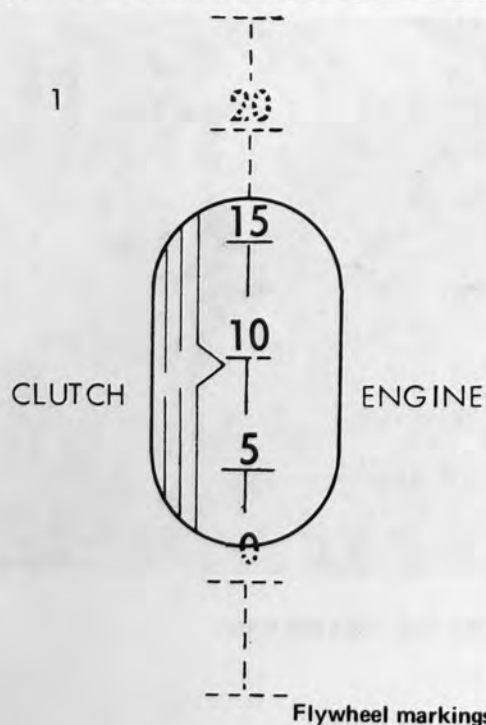
USA export distributor

Ignition timing, 1.7 and 1.85 l engines

1. Connect Saab's ignition service instrument (TSI) or separate cam angle meter, revolution counter and stroboscope lamp.
2. Switch on the ignition and check the cam angle at starter speed and with the engine idling. Adjust the cam angle if necessary.
3. ~~Disconnect both vacuum hoses.~~
4. Adjust the idling speed to not more than 800 rev/min. It is easier to reduce the idling speed to below this figure if the engine is cold. On a warm engine it may be necessary to close off the vacuum hoses to get the idling speed low enough. It may also be necessary to adjust the overflow valve on the carburetor (see group 2).
5. Adjust the ignition setting (9° BTDC), and tighten the retaining screws with wrench 839039.
6. Reconnect both vacuum hoses; the hose from the bottom of the carburetor connects to the negative side of the diaphragm (retarded ignition). Adjust the ignition setting once again. The timing pointer should now be at 4° ATDC (see fig. 2).

NOTE

It is most important that the ignition timing is correct with both vacuum hoses disconnected (9° BTDC, Fig. 1). The second check with the hoses connected is made to ensure that the vacuum regulation is working properly.



The flywheel is marked with numbered lines at 0° , 5° BTDC, 10° BTDC, etc. There are two more unnumbered lines below the zero mark, the first of which represents 5° ATDC. The flywheel rotates counterclockwise when viewed from the front of the car.

7. Adjust the idling speed to 800–850 rev/min. If the engine tends to idle too fast when the vacuum hoses are connected, check the vacuum regulator for leakage.

Ignition timing, 2.0 l engine

Ignition timing for the distributor on the 2.0 l engine to the USA market, see the corresponding part for the standard distributor.

*NO
Timing for
Fuel Injection*

DISTRIBUTOR, FUEL INJECTION ENGINE

General

The distributor is of Bosch type. In addition to centrifugal and vacuum regulating devices it has two pairs of impulse contacts mounted on the bottom of the distributor housing. The function of these contacts, which need no maintenance, is to supply the electronic control system with information on engine speed and when injection begins.

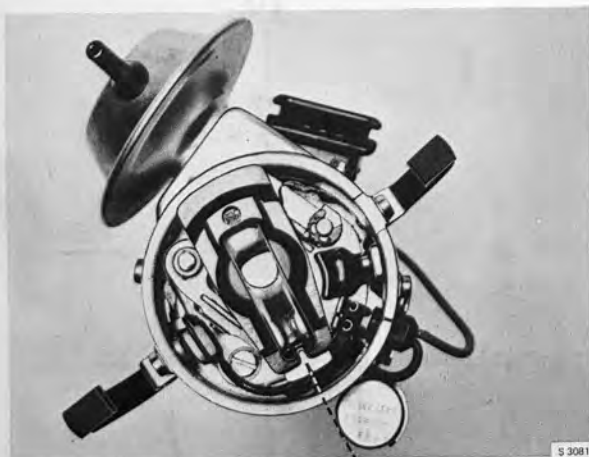
Removing and installing the distributor

Removing

The procedure is the same as already described for carburetor engines.

Installing

1. Turn the crankshaft to ignition point for cylinder No. 1. (See group 0, basic ignition advance.)
2. Turn the rotor arm to the position for mounting (see illustration) and mount the distributor. As the distributor is inserted into the engine the rotor arm turns counterclockwise; when the distributor is fully inserted, the marks on the distributor housing and rotor arm should be in line with each other.



POSITION OF ROTOR ARM PRIOR TO MOUNTING

For the rest of the installing procedure, see under "Distributor, carburetor engine".

NOTE

Cam angle and ignition timing settings are not the same for injection engines as for carburetor engines — see group 0.

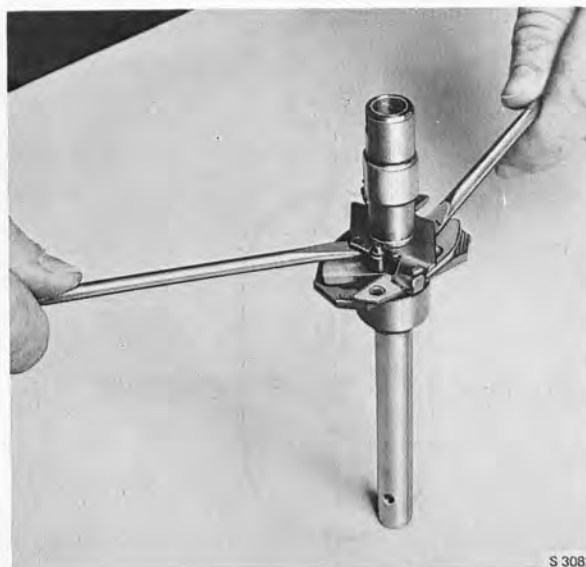
Reconditioning the distributor (distributor removed from car)

NOTE

The breaker plate, the distributor shaft and the mechanical ignition advance mechanism can not be removed on model 1974. Renovation of these distributors can only be done partly.

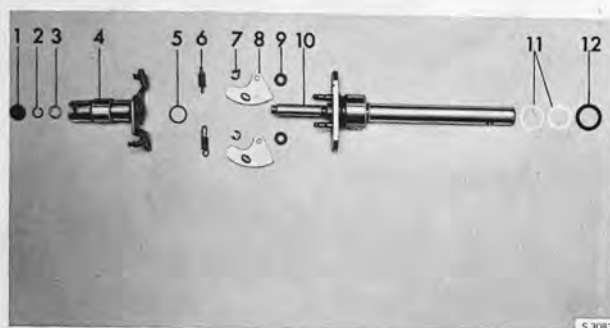
Dismantling the distributor

1. Remove the rotor arm.
2. Disconnect the breaker arm lead.
3. Undo the condenser retaining screw and remove the condenser together with the lead.
4. Take the lock ring off the bearing pin of the regulator.
5. Undo both retaining screws of the vacuum regulator and remove the regulator.
6. Unscrew both the spring clips holding the distributor cap.
7. Lift the breaker plate.
8. Undo the retaining screws of the impulse contact holder and take out the contact unit.
9. Knock the cotter pin out of the drive gear using an 0.12" (3 mm) drift.
10. Pull off the gear. Save the shims.
11. Lift the complete shaft assembly up and out. Remember the shims above the top bushing.
12. Undo both the spiral springs from the advance mechanism.
13. Push the cam off the centrifugal advance weights using two screwdrivers.



REMOVING THE BREAKER CAM

14. Remove the felt lubricating pad, lock ring and wearing washer from the breaker cam.
15. Push the leaf spring out of the hole in the contact holder and remove the breaker arm.
16. Remove the retaining screw from the fixed breaker contact.
17. If necessary, push out the bushings as follows:
Remove the lubricating pad between the bushings with a chisel or similar. Turn the housing upside down and press the bottom bushing through the housing, using a suitable drift, so that the bottom bushing displaces the top bushing.
18. Inspect and clean all parts, renewing as necessary.



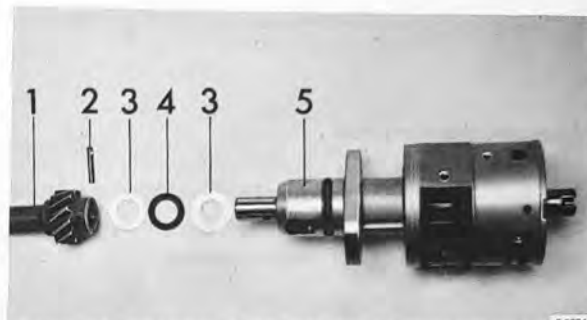
IGNITION ADVANCE MECHANISM

- | | |
|--------------------|-----------------------|
| 1. Lubricating pad | 7. Lock ring |
| 2. Lock ring | 8. Governor weight |
| 3. Wearing washer | 9. Spacer washers |
| 4. Breaker cam | 10. Distributor shaft |
| 5. Spacer ring | 11. Shims |
| 6. Spiral spring | 12. Fiber washer |

Assembling

1. Soak the bearing bushings in warm oil before fitting, then press in the top bushing against the stop in the distributor housing.
2. Oil the lubricating pad and place it in the distributor housing. Press in the bottom bushing until it is flush with the distributor housing.
3. Oil the distributor shaft, put on the breaker cam, and hook in both spiral springs.
4. Fit the wearing washer and lock ring to the breaker cam, pushing on the lock ring with a tube (ID 0.24"/6 mm, OD 0.315"/8 mm, length about 2"/50 mm).
5. Put in the lubricating pad and oil it.

6. Oil the distributor shaft. Put on the shims and fiber washer (the same ones previously removed) and insert the shaft in the housing.
7. Mount the shims, fiber washer and drive gear, using enough shims to give an axial play, measured with a feeler gauge, of 0.004"—0.012" (0.1—0.3 mm) in the shaft. Knock in the cotter pin. The distributor shaft must be properly supported during this operation.



DISTRIBUTOR DRIVE GEAR WITH SHIMS AND FIBER WASHER

1. Gear
2. Cotter pin
3. Shims
4. Fiber washer
5. Distributor housing

8. Insert the breaker plate in the distributor housing (the spring with the ball must face the primary connection).
9. Screw on the spring clips.
10. Put in the fixed breaker contact or breaker unit and insert the retaining screw but do not tighten it hard.
11. Lubricate the bearing pin and bushing on the breaker arm with Bosch Ft 1 v 22 grease.
12. Engage the breaker arm leaf spring in the hole in the contact holder. The contact surfaces should be parallel to each other. Correct any misalignment by using spacers or adjusting the fixed breaker contact.
13. Coat the breaker cam and fiber block with Bosch Ft 1 v 4 grease.
14. Rotate the distributor shaft until the breaker arm is lifted right clear of the fixed breaker contact. Insert the screwdriver between the two adjusting studs and the slot and turn it to adjust the contact gap. Tighten the retaining screw and then recheck the gap.
15. Fit the impulse contacts.
16. Hook the regulating arm of the vacuum regulator on to the bearing pin and secure with the lock ring.
17. Secure the vacuum regulator with both retaining screws.
18. Insert the condenser connecting piece in the distributor housing and screw on the condenser.
19. Connect the breaker arm lead.
20. Mount the rotor arm.

Changing breaker contacts (distributor in place in car)

The procedure is much the same as for carburetor engines — see the relevant section.

NOTE

Cam angle and ignition timing settings are not the same for injection engines as for carburetor engines — see group 0.

Changing the condenser

This is easier to do if the distributor is removed. Undo the condenser retaining screw and disconnect the condenser lead, then fit the new condenser.

Changing the vacuum regulator (distributor in place in car)

1. Take off the distributor cap and rotor arm.
2. Remove the lock ring from the bearing pin of the regulating arm.
3. Undo the retaining screws. The regulator can then be lifted off.

Assemble in the reverse order.

Checking and setting the ignition point

See under "Distributor, carburetor engine".

NOTE

Cam angle and ignition timing settings are not the same for injection engines as for carburetor engines — see group 0.

Changing the distributor cap

See under "Distributor, carburetor engine".

Changing impulse contacts

1. Remove the distributor.
2. Undo the vacuum regulator retaining screws.
3. Remove the retaining screws from the contact set.
4. Lift the vacuum regulator slightly and take out the contact set.

Assemble in the reverse order.

NOTE! Before fitting the new contact set, lubricate the cam followers on both contact arms with Bosch Ft 1 v 4 grease. Do not adjust the contacts in any way.



REMOVING THE IMPULSE CONTACTS

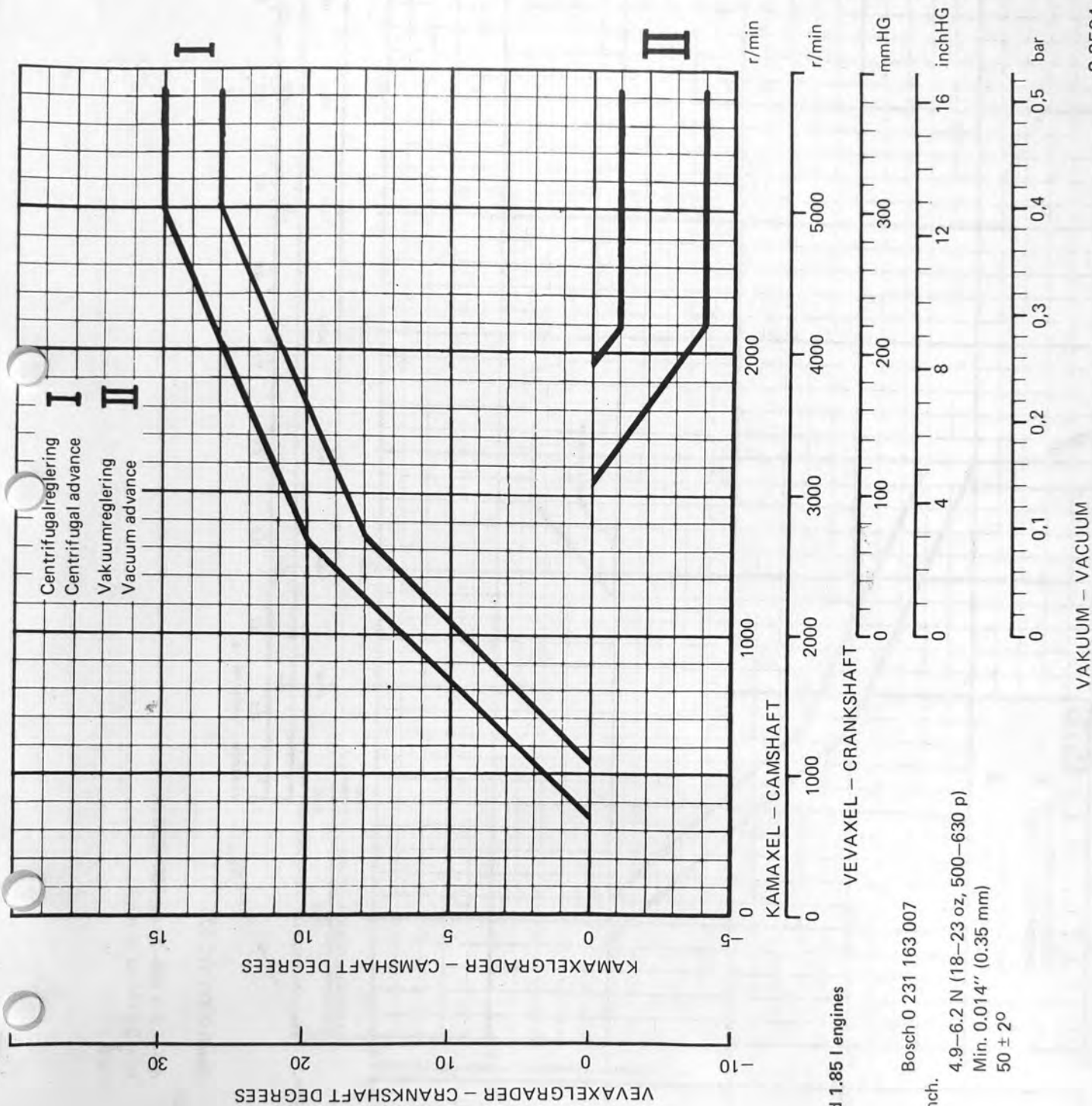
Checking out the distributor on a test bench

Test according to the directions supplied with the test equipment. See ignition advance graph for correct settings. The contact pressure must be checked with a spring balance secured opposite the breaker arm contact.
Pressure too low — the contacts bounce
Pressure too high — undue wear on cam fender and cams

NOTE

1. The distributor rotates at half the speed of the engine.
2. The camshaft angle is half the crankshaft angle.

If the distributor is tested when mounted on the engine, the main point to remember is that the advance angle and speed readings will be double those obtained on a distributor test bench. There may also be some deviation in the readings due to engine vibration.



Ignition advance graphs, 1.7 and 1.85 l engines

Applicable for:

Distributor

Checking on distributor test bench.

Contact pressure

Breaker gap

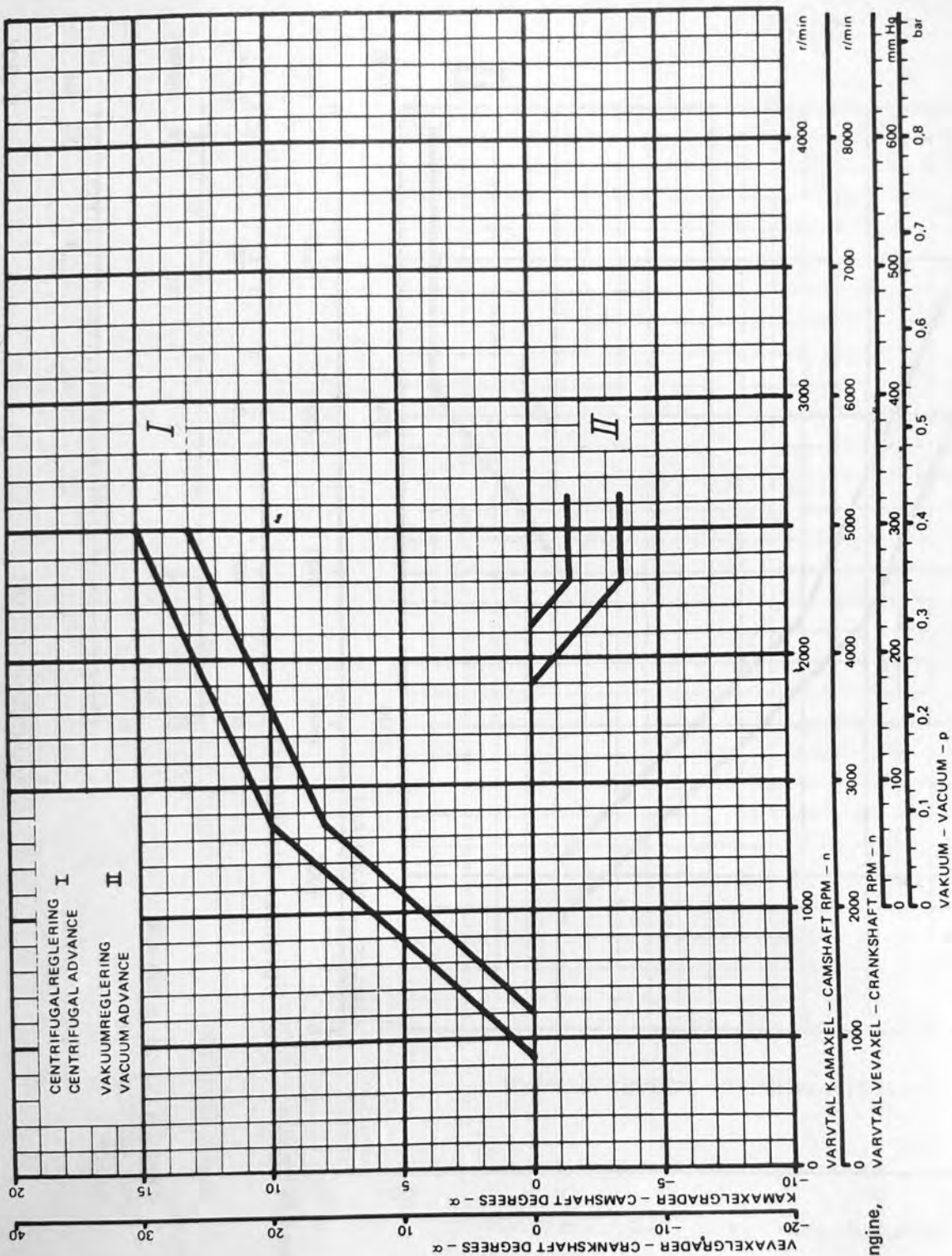
Dwell angle

Bosch 0 231 163 007

4.9-6.2 N (18-23 oz, 500-630 p)

Min. 0.014" (0.35 mm)

50 ± 2°



Ignition advance graphs, 2.0 l engine,
model 1972-1973

Applicable for:

Distributor

Checking on distributor test bench.

Contact pressure

Breaker gap

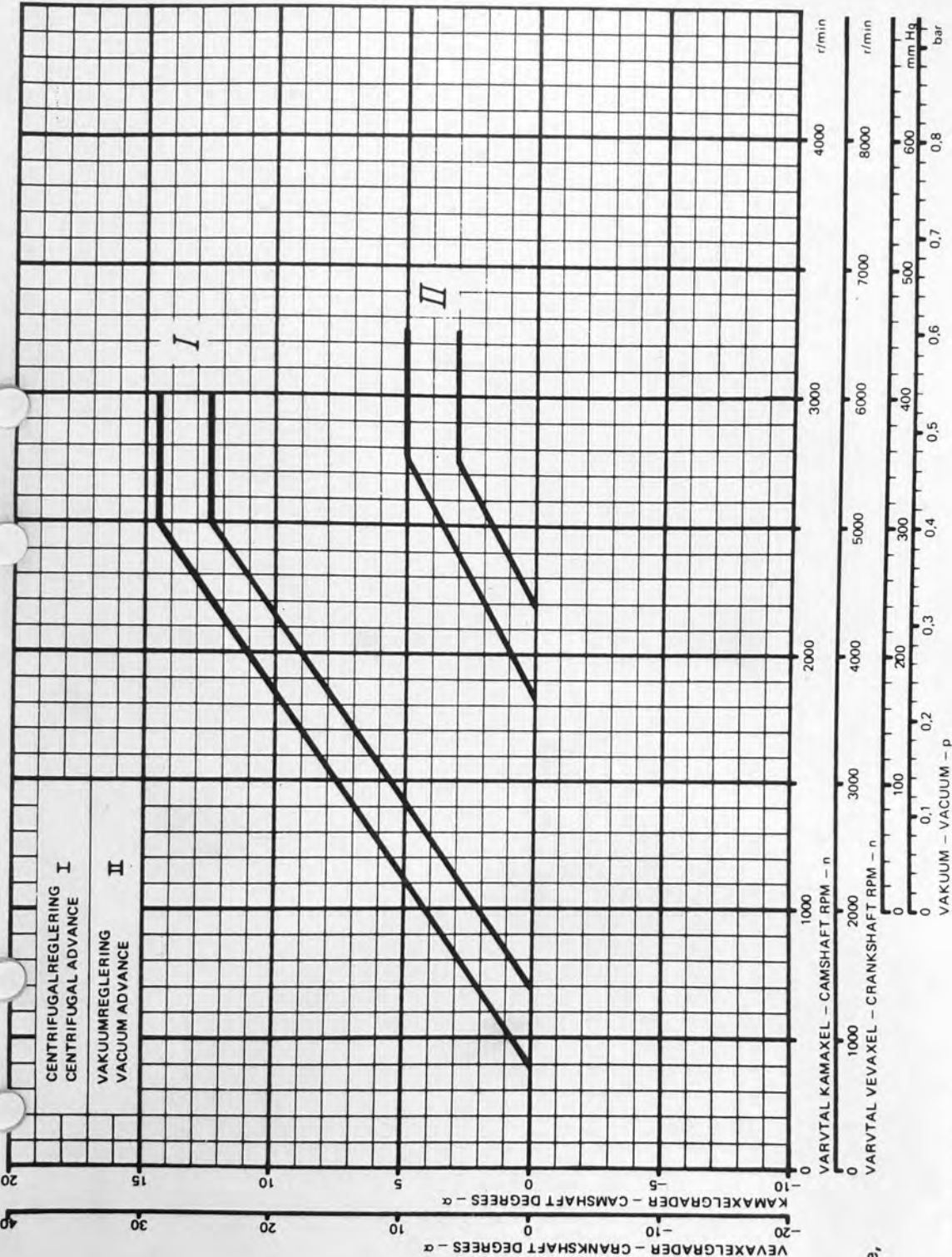
Dwell angle

Bosch 0 231 163 025

4.9-6.2 N (18-23 oz, 500-630 p)

Min. 0.014" (0.35 mm)

50 $\pm$ 2°



Ignition advance graphs, 2.0 l engine,
model 1974

Applicable for:

Distributor

Checking on distributor test bench.

Contact pressure

Breaker gap

Dwell angle

Bosch 0 031 179 001

4.9-6.2 N (18-23 oz, 500-630 p)

Min. 0.014" (0.35 mm)

50 ± 3°

Q1000 9000

Q1000 9000

Q1000 9000

Q1000 9000

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SPARK PLUGS

Changing spark plugs

Removing

1. Pull off the ignition cable.
2. Clean the cylinder head round the plug by blowing.
3. Unscrew the spark plug.

Installing

1. Screw in the plug by hand.
2. Tighten with a spark plug wrench to 25–29 Nm (18–21 ft.lb., 2.5–3.0 kpm) torque.
3. Attach the ignition cable.

Inspecting spark plugs (removed from cylinder head)

1. Clean the spark plug by sandblasting.
2. Check the electrode gap and adjust if necessary by bending the side electrode.
3. Test the plugs under pressure in a test apparatus.

INTERFERENCE SUPPRESSORS

Installation kits for Blaupunkt and Philips car radios are available. These kits include all components for fitting the radio set as well as the necessary interference suppressing components.

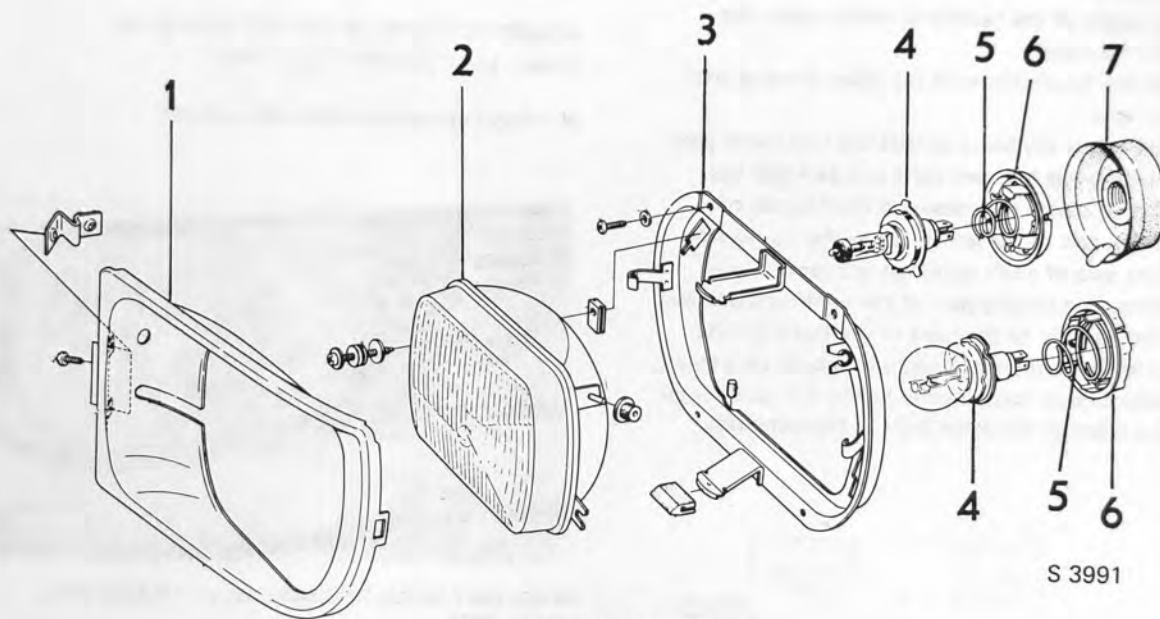
Carburetor engines are delivered with suppressed ignition cables while injection engines have both ignition cables and rotor suppressed. Concerning resistance values, see group 0.

LIGHTING

General

The headlights are built into the front sheet. The left and right headlight inserts are identical and freely interchangeable. The headlight bulbs have two filaments for high and low beam respectively; the beam elevation is controlled by the combined headlight dimmer/flasher and direction

indicator control lever on the steering column. A light on the instrument panel glows blue when the headlights are on at high beam. The standard version is fitted with asymmetric headlights with the beam canted to the right; export models destined for certain markets have asymmetric lights canted to the left or sealed beam headlights.



HEADLIGHT, EXPLODED VIEW

- | | |
|-------------------------|------------------|
| 1. Headlight trim frame | 5. Spring |
| 2. Headlight insert | 6. Bulb retainer |
| 3. Retainer plate | 7. Sealing cap |
| 4. Bulb | |

Changing headlight inserts

1. Open the hood and pull off the bulb connector.
2. Close the hood. Undo the trim frame retaining screw (as from model 1971 two screws) and remove the frame.
3. Undo the four headlight retaining screws and lift out the headlight complete with retainer plate.
4. Slacken the adjusting screws until they can be freed from the retainer lugs on the insert, and then separate the insert from the retainer plate.

Install in the reverse order.

NOTE

The headlight beam alignment must always be checked after a headlight insert or bulb has been exchanged.

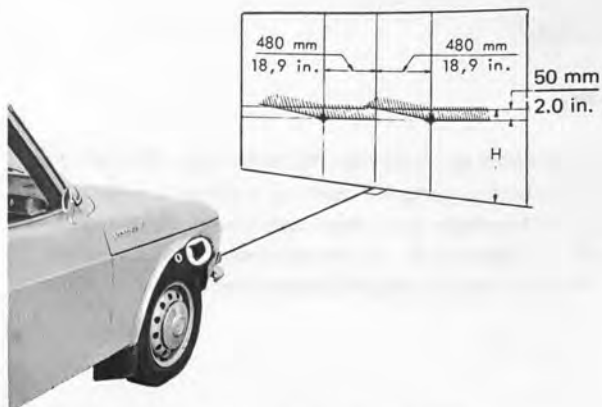


REMOVING THE TRIM FRAME

Aligning right and left asymmetric beams

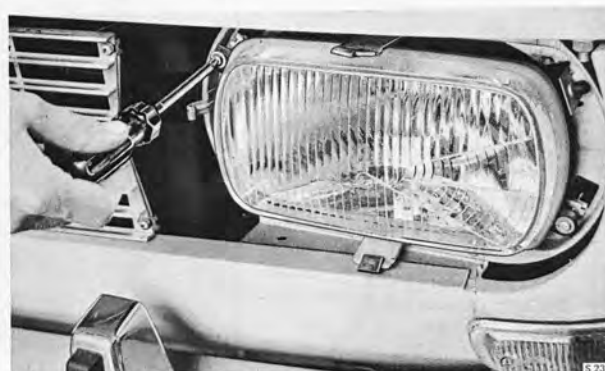
Headlight beams are normally adjusted with the help of special apparatus. If such apparatus is not available, a marked panel or a wall can be used for the purpose. The procedure is as follows:

1. Remove the trim frame to expose the adjusting screws (see illustration). As from model 1973, the trim frame is provided with holes for the adjusting screws. It is not necessary to remove the trim frames.
2. Check the tire pressures and place the car, which should be empty, on a flat surface at a distance of 16' 6" (5 m) from the panel.
3. Mark the height of the headlamp center above the ground on the panel.
4. Switch on the headlights with the beam dimmed and mask one light.
5. Check and adjust the beam so that the horizontal part of the dividing line between light and darkness lies 2.0" (50 mm) below the measured dead center of the headlight and to the left of the center (or to the right in the case of a left asymmetric beam) — see illustrations. The sloping part of the light-dark dividing line should lie fully to the right of the mark (to the left for a left asymmetric beam) and should thus meet the horizontal part immediately below the dead center.
6. Check the beam of the other light in the same way.

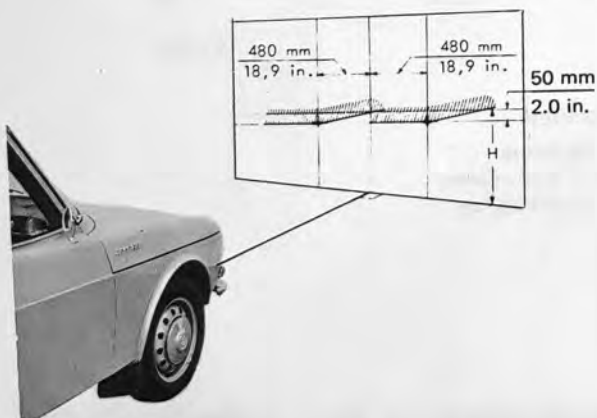


ADJUSTING THE BEAM AGAINST A MARKED PANEL, LEFT ASYMMETRIC LIGHTS

H = Height of headlamp center above ground



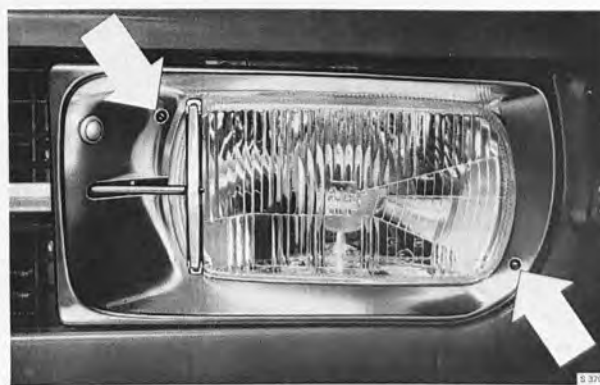
HEADLIGHT ADJUSTING SCREWS, UP TO AND INCL. MODEL 1972



ADJUSTING THE BEAM AGAINST A MARKED PANEL, RIGHT ASYMMETRIC LIGHTS

H = Height of headlamp center above ground

7. Check that the high beam has an even spread. If the light pattern is irregular or if any difficulty is experienced in setting the dimmed beam correctly, check that the bulb is properly mounted or, if necessary, fit a new bulb.



HEADLIGHT ADJUSTING SCREWS, AS FROM MODEL 1973

Changing headlight bulbs

Headlight bulbs normally deliver maximum light output during the first hundred hours of burning. Although they can last longer, their efficiency deteriorates considerably after this time. To insure the best possible visibility at all times, therefore, the headlight bulbs should be changed about once a year with normal mileage. The halogen bulbs have almost unchanged light output during the whole time of burning.

It is also essential that the reflectors are undamaged and that the wiring terminals make proper contact.

1. Open the hood and remove the contact housing and rubber sealing cap from the headlight.
2. Push in the bulb retainer and twist it counterclockwise; the bulb can then be withdrawn.
3. Fit the new bulb. Do not touch the glass with your fingers. Make sure that the locating lug is correctly positioned.



CHANGING A HEADLIGHT BULB



CHANGING A HEADLIGHT BULB, HALOGEN TYPE

4. Fit the bulb retainer. Make sure that the spring locates the bulb securely in its correct position.
5. Push on the connector. Install the sealing cap, making sure that it fits snugly round the bulb retainer and that the drain hole is at the bottom.

IMPORTANT

If the bulb is wrongly oriented in the reflector, the throw of the beam will be wrong.

Parking, braking, back-up and direction indicator lights

General

The front parking lights are recessed into the front fenders and are combined with the direction indicator lights. At the rear, the tail lights are mounted in a frame together with the braking, back-up and direction indicator lights. The braking light is operated by a mechanical contact on a bracket above the brake pedal.

Changing bulbs — direction indicator, back-up, parking, braking and number plate lights.

1. Undo the retaining screws and lift off the glass.



CHANGING BULBS, FRONT, UP TO AND INCL. MODEL 1971

Interior lighting

General

The dome light and its switch are mounted on the left side roof member. It can be switched on by either of the two door contacts or by the built-in switch. As from the 1970 model the interior lighting comprises both a rear light (dome light) complete with switch mounted on the left doorpost and a forward light mounted on the rear view mirror. These lights are operated by the switch on the doorpost light or by a switch on the gear lever hood.

Changing the bulb, rear light

1. Up to and including model 1971: Insert a screwdriver under the forward edge of the light fitting and carefully prize out the fitting; the bulb can then be removed.
As from model 1972: Undo the two screws; then the bulb can be removed.
2. Snap in the new bulb, making sure that it is properly seated in both grips and securely held.
3. Up to and including model 1971: Mount the fitting by hooking the rear edge into the roof recess and then pushing home the forward edge.
As from model 1972: Mount the bulb and the two screws.

To repair or exchange faulty wiring, remove the light fitting as above.

Changing the bulb, forward light

1. Lift off the transparent plastic glass to expose the bulb.
2. Change the bulb and press the glass back into place.

Ignition switch and gear indicator illumination on cars with automatic transmission

General

The light at the ignition switch is switched on by the two door contacts. As from the 1970 model, it can also be operated by the switch on the gear lever cover. Cars with automatic transmission have illuminated gear selector scales. On the 1970 model, this light is connected in parallel with the tail light. As from the 1971 model it is connected to the ignition terminal "15".



CHANGING BULBS, FRONT, AS FROM MODEL 1972



CHANGING BULBS, REAR, SAAB 99, 99 L AND 99 EMS



CHANGING BULBS, REAR, SAAB 99 COMBI COUPE

2. Release the bulb from its bayonet fitting.
3. Clean any dirt off the bulb holder and glass.
4. Fit the bulb. Check that the bulb makes good contact, especially the ground contact.
5. Mount the glass.

Changing the bulb

1. Undo the three retaining screws of the gear lever cover.
2. Raise the cover as far as it will go, insert a hand under the cover from the left and remove the bulb with holder from its fitting in the cover.
3. Pull out the bulb with holder and change the bulb.
4. Replace the bulb with holder in the fitting in the cover.
5. Insert and tighten the three cover retaining screws.

Trunk illumination

The trunk light, mounted on the front beam in the center of the trunk compartment, is switched on and off by a contact located on the left-hand side above the wheel housing. The contact is actuated by the left hinge of the trunk lid.

Saab 99 Combi Coupé:

The trunk light, mounted on the right hand side in the trunk, is switched on and off by a contact at the rear door striker. The contact is actuated by the door lock.

Changing the bulb

1. Remove the fitting by prying the left edge up carefully with a screwdriver, after which the bulb can be removed.
2. Snap in the new bulb, making sure that it is properly seated in both grips and securely held.
3. Mount the fitting by locating the right edge in the recess and pushing home the left edge.

Saab 99 Combi Coupé:

1. Remove the two bulb holder retaining screws and pull out the holder somewhat.
2. Remove the bulb and fit a new one.
3. Remount the bulb holder.

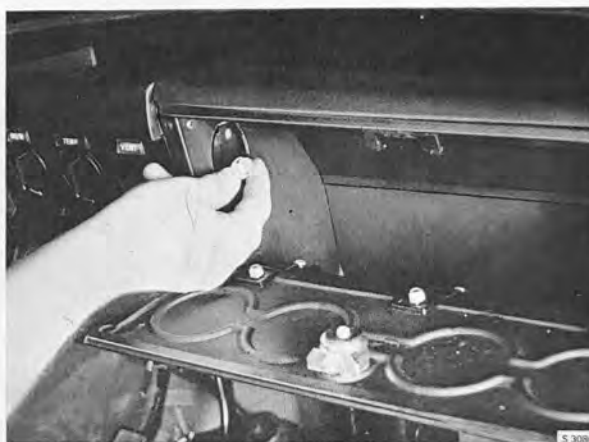
Illumination of control switches and heater controls, as from 1971 model

General

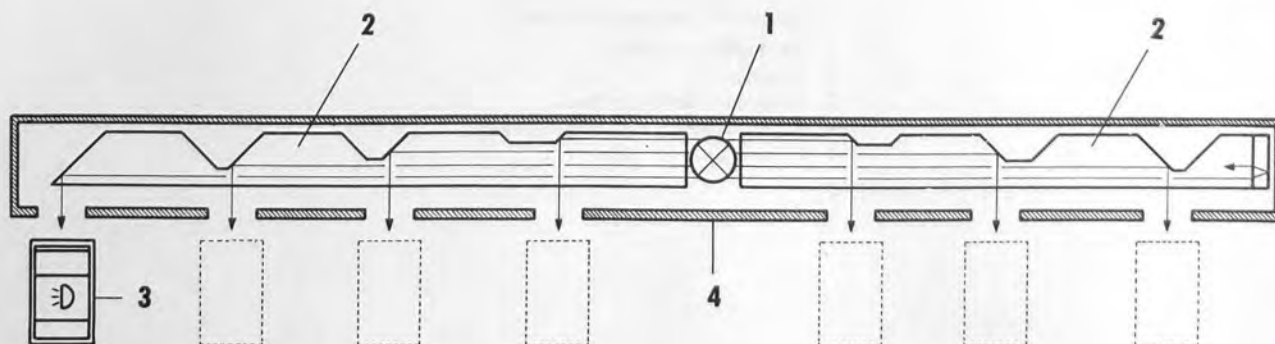
The control switches are illuminated by a light bulb located between two refractors in the instrument panel above the switches. The refractors, which are made of acrylic plastic, have recesses in line with each switch, the depth of the recess increasing with distance from the bulb. Light rays striking such a recess are refracted 90° to illuminate the switch through a hole in the panel. The heater controls are illuminated in the same way.

Changing bulbs

The control switch light bulb is located below the speedometer and can be reached after removal of the screen on the instrument side under the instrument panel. The heater control light bulb can be reached by removing the plastic cover inside the glove compartment.



CHANGING THE HEATER CONTROL LIGHT BULB



S 3140

CONTROL SWITCH ILLUMINATION (SCHEMATIC)

1. Bulb
2. Refractor
3. Control switch
4. Instrument panel

HEADLIGHTS, USA EXPORT MODEL

General

Cars for the USA market are equipped with four Sealed Beam headlights.

The headlights are built into the front sheet.

All four headlights have high beam function but only the outer ones have low beam.

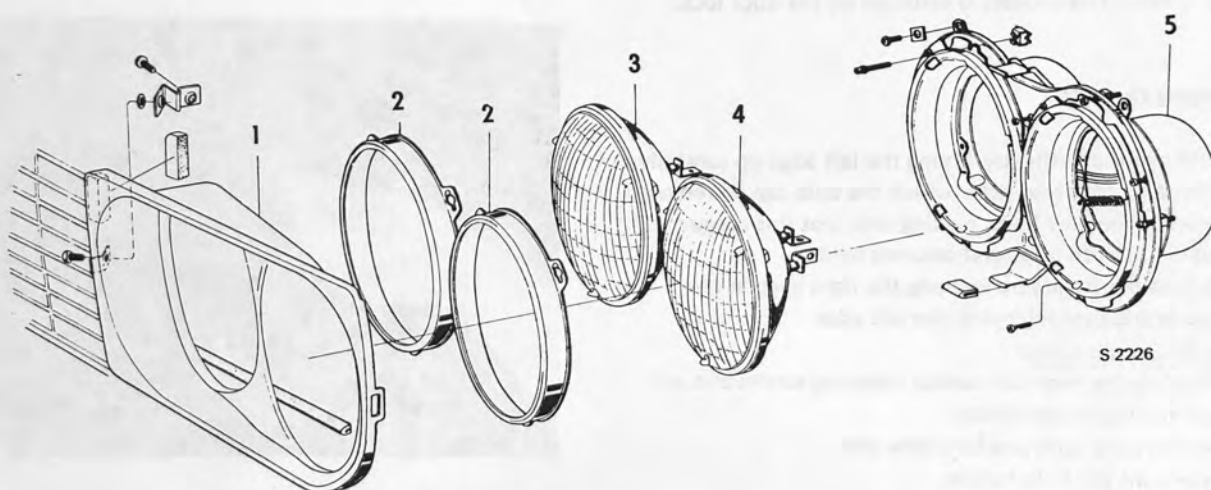
Changing Sealed Beam units

1. Undo the trim frame retaining screw and remove the frame.

2. Undo the three screws for retainer ring and remove the ring.
3. Lift out the insert and pull off the connector.
4. When installing make sure the headlight lugs fit the recesses of the cradle.

NOTE

The headlight beam alignment must always be checked after a headlight insert has been exchanged.



HEADLIGHT EXPLODED VIEW

1. Headlight trim frame
2. Retainer ring
3. Headlight insert, high beam
4. Headlight insert, high and low beam
5. Lamp cradle

DIRECTION INDICATORS

General

The direction indicators consist of flashing lights at front and rear. The front ones are combined with the parking lights and flash with an orange light. The rear direction indicators have separate bulbs which also flash with an orange light.

The flasher unit is mounted under the instrument panel and is combined with a control relay which flashes a green light on the instrument to indicate that the direction indicators are on and that both front and rear lights are flashing.

If either light is not working, this can be detected by failure of the indicator lamp to flash and by a faster rate of flashing in the light that is still intact. The rate of flashing is 60–120 per minute when the flasher unit is in normal condition and bulbs of the right power are installed. The flasher unit cannot be adjusted. If other components (switch, wiring and bulbs) are normal, the cause of an abnormal flashing rate lies in the flasher unit, which should then be exchanged.

NOTE

The flasher will work at abnormal speed if bulbs of the wrong power are fitted.

Self-canceling mechanism of direction indicator control lever

The play between the actuator and the "tooth" of the lever should be 0.008–0.024" (0.2–0.6 mm) when the lever is in neutral. Adjust the clearance by placing spacer washers between the lever and its mounting bracket.

NOTE

The actuator must be so placed that its centerline coincides with the centerline of the control lever housing when the front wheels are lined up fore-and-aft.

HORNS AND HORN CONTROLS

General

Up to and including model 1971:

The horns are mounted under the front bumper. They are of loud-tone type, tuned with a high and low note respectively.

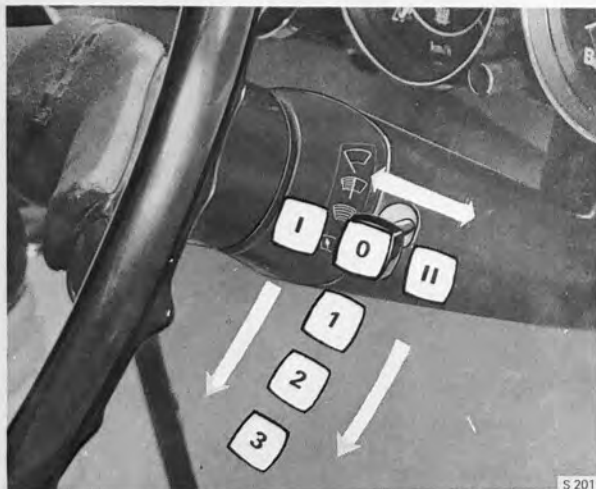
If the horns give a discordant note, locate the one that is defective and adjust by turning the contact screw marked with red paint on the back of the horn until a pure chord is obtained.

As from model 1972, there is only one horn mounted. The horn is located on the left reinforcement in the engine compartment.

As from model 1973, the horn is located on the outside of the left inner bumper bar.

Horn control, model 1969

In the 1969 model the horns are operated by the windshield wiper control lever. To sound the horns, the lever is pulled towards the steering wheel.



CONTROL LEVER FOR WINDSHIELD WIPERS AND WASHER AND HORNS, MODEL 1969

- I. Horn
- II. Windshield washer
- 0. Neutral
- 1. Windshield wipers, low speed
- 2. Windshield wipers, high speed
- 3. Windshield wipers, high speed + washer

Horn control, as from model 1970

In 1970 and later models the horns are operated by buttons in the steering wheel safety padding.

Removing the horn control

Remove the safety pad with horn contact from the steering wheel by undoing the four screws, which are accessible from the underside of the wheel.

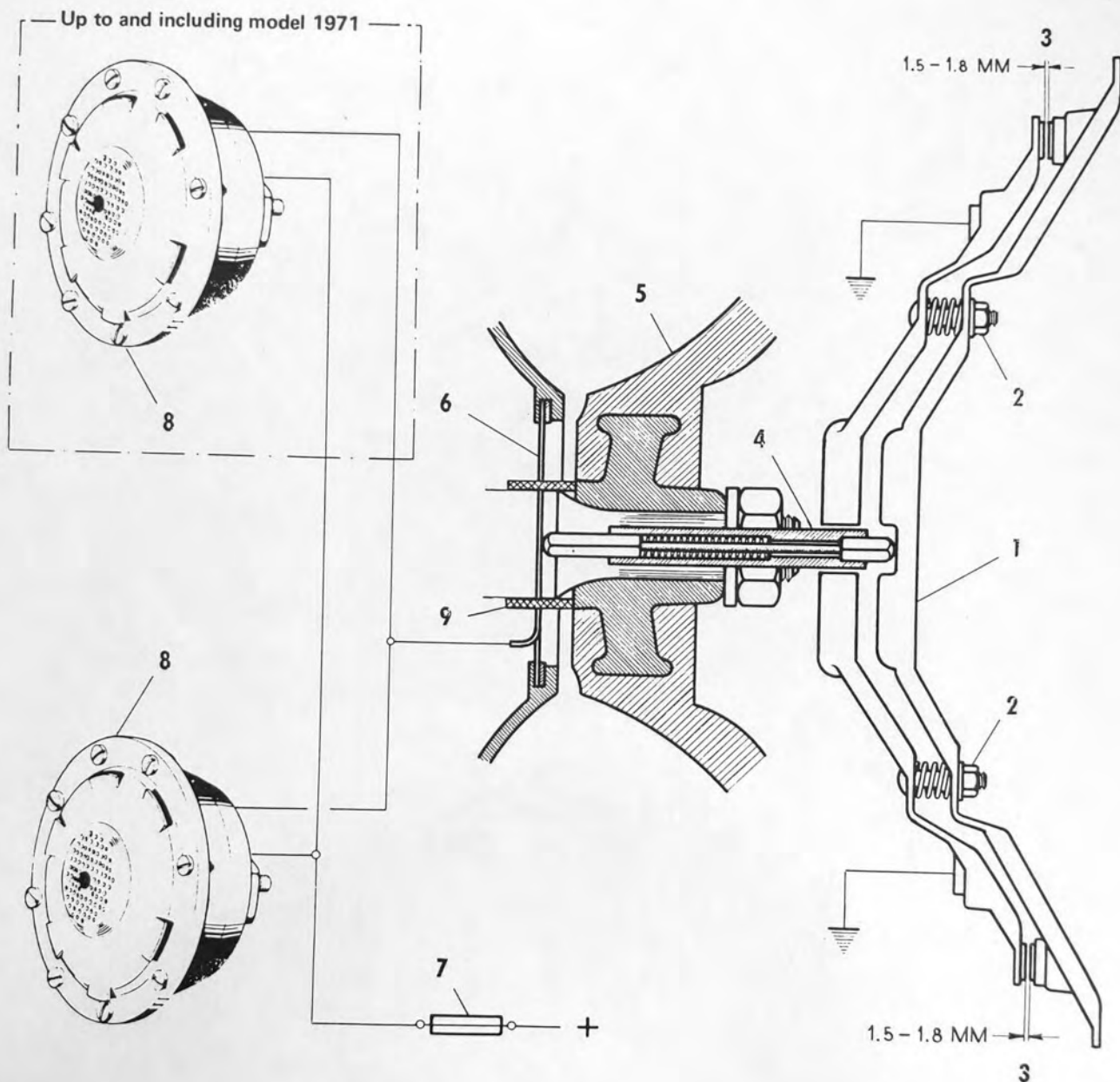
1970–1973 models: Then undo the two nuts which hold the horn contact to the safety pad.

Model 1974: Disconnect the two cable ends to the horn contact from the back side of the safety pad and remove the contact from the safety pad.

When removing the slip ring, the steering wheel must first be removed (see group 6).



HORN CONTACT DISCONNECTED FROM SAFETY PAD (MODEL 1974)



S 3485

HORN CONTROL, 1970-1973 MODELS

1. Horn contact
2. Adjusting nuts
3. Contact gap
4. Contact finger
5. Steering wheel
6. Slip ring
7. Fuse, 8 amp
9. Spacer (as from ch.no. 99.063.198)

WINDSHIELD WIPERS

General

Up to and incl. model 1973:

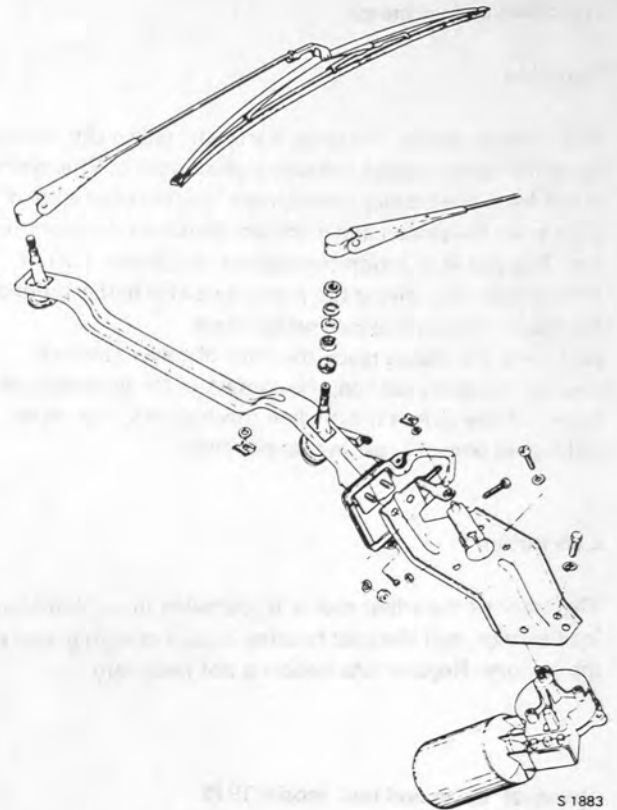
The windshield wipers are powered by an electric motor that imparts motion to the wiper blades through a gear housing and linkage system. The motor is mounted on a bracket on the dash panel and attached to a bracket and the car body.

The spindles are driven by a crank rod and wires. They are located in the mounting arm, which in turn is screwed to the body.

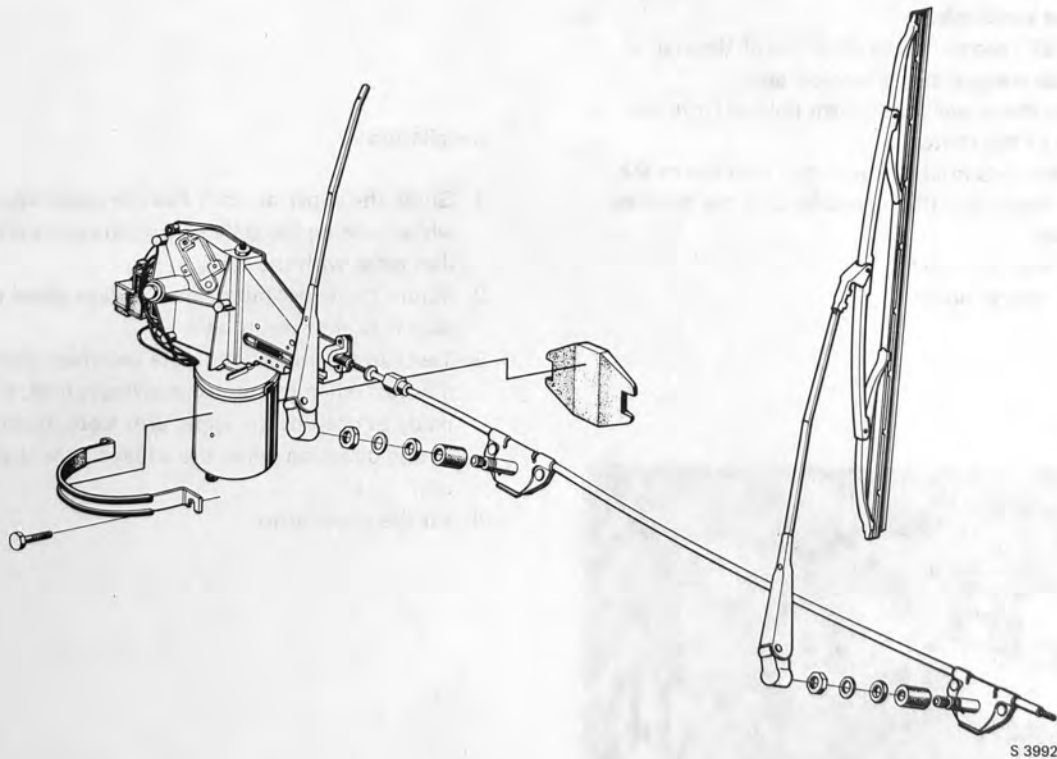
Model 1974:

The windshield wiper motor is located on the right side of the dash panel. The movement is transmitted from the motor gear housing via a reciprocating flexible cable to gears attached to the wiper spindles. The cable runs in a steel tube between the wiper motor and the two spindles.

The motor is equipped with a self-parking device so that the wiper blades always come to rest at the bottom of the windshield no matter what position they are in when the motor is switched off.



WINDSHIELD WIPERS, UP TO AND INCL. MODEL 1973



WINDSHIELD WIPERS, MODEL 1974

Windshield wiper motor

Function

In the wiper motor, the drive is transmitted to the linkage system (flexible cable) through a gear housing. The motor is fed from the battery through the ignition contact and via a fuse, the switch and a contact device in the gear housing. This last is in action throughout the greater part of the blade stroke, giving the motor two alternative grounding routes while the wiper switch is on.

Each time the blades reach the limit of travel at which they are normally parked, the contact in the gear housing breaks. If the switch is off when this happens, the motor and blades come to rest in that position.

Lubrication

The rotor of the wiper motor is journaled in self-lubricating bearings, and the gear housing is packed with grease at the factory. Regular lubrication is not necessary.

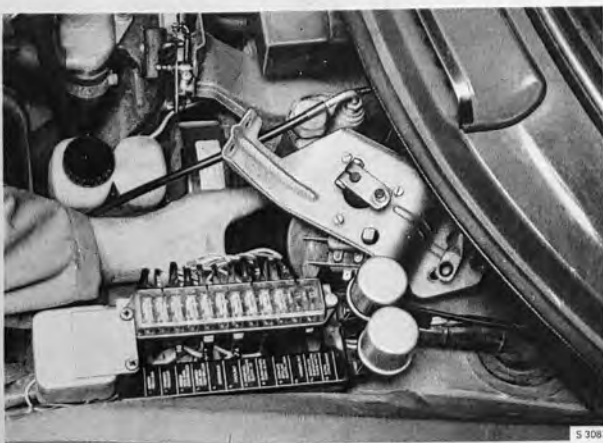
Removal up to and incl. model 1973

1. Disconnect the power leads, noting how they are connected. The plate above the gear housing on the underside of the wiper motor carries instructions for connecting the terminals.

As from 1971 model: drain off some of the engine coolant and remove the expansion tank.

2. Disconnect the wiper mechanism linkage from the crank arm of the motor.
3. Unscrew the nuts holding the motor bracket to the mounting frame and the screws holding the bracket to the body.
4. Lift out the wiper motor.

Install in the reverse order.



REMOVAL OF WINDSHIELD WIPER MOTOR, UP TO AND INCL. MODEL 1973

Removal of windshield wiper motor, model 1974

1. Remove the wiper arms from the wiper spindles.
2. Remove the nut that holds the steel tube to the wiper motor.
3. Release the wiper motor and remove the motor and the flexible cable. (Pull the cable out of the tube.)



REMOVAL OF WIPER MOTOR AND FLEXIBLE CABLE

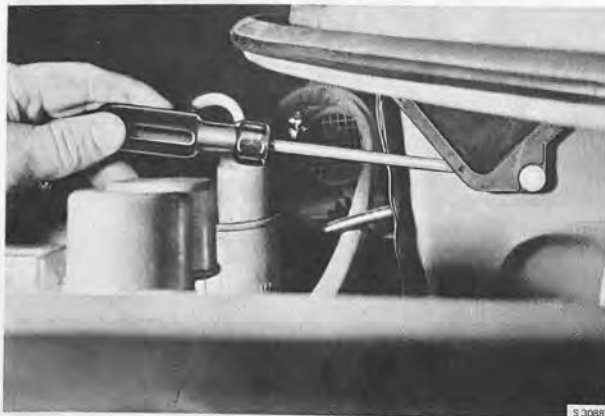
Installation

1. Guide the wiper motor's flexible cable into the tube while twisting the tube so that the gears on the spindles mesh with the cable.
2. Mount the wiper motor on the dash panel and connect it to the steel tube.
3. Test run the wipers and note on which side the spindles rest when the motor is switched off. (This test is made to prevent the wiper arm from moving in the wrong direction when the wiper motor is switched on.)
4. Fit the wiper arms.

Wiper mechanism, 1970 and earlier models

Removing

1. Remove the wiper motor (see above).
2. Remove the rubber seal by prying it loose with a screwdriver.



REMOVING THE RUBBER SEAL

3. Remove the wiper blades and arms.
4. Take out the fresh-air hoses on the left-hand and right-hand sides of the engine compartment.
5. Remove the fan housing complete with fan motor and cover plate (see group 8). On right-hand-drive cars this operation is easier if the clutch master cylinder is unbolted and lifted away.
6. Undo the spindle nuts. Take off the washers and rubber rings and push out the spindles through the holes in the body.



TYING A STRING TO THE WIPER LINKAGE

7. Tie a string or wire to the linkage (see illustration). The string will be pulled through the "tunnel" and used later to assist reassembly of the mechanism.
8. Pull out the wiper mechanism to the right and then untie the string from the linkage.



REMOVING THE WIPER MECHANISM

Installing

1. Tie the string previously pulled through the tunnel to the wiper linkage. Insert the wiper mechanism from the right while an assistant pulls on the string from the left to guide the linkage through the opening in the bodywork.
2. Fit the rubber seal.
3. Mount the wiper motor.
4. Fit the wiper arms and blades and check the operation of the wipers.
5. Mount the fan housing and cover plate. Remount the clutch master cylinder if previously unbolted (RHD cars only).
6. Connect the fresh-air hoses.

Wiper mechanism, 1971–1973 models

To remove or install the wiper mechanism it is necessary to unbolt the heater core unit and move it forward. (The reason for this is that an extra fresh-air intake to the passenger compartment has been introduced, leaving less space behind the heater core.)

Otherwise the procedure is as described above. For removal of the heater core see group 8.

Wiper mechanism, model 1974

Removal

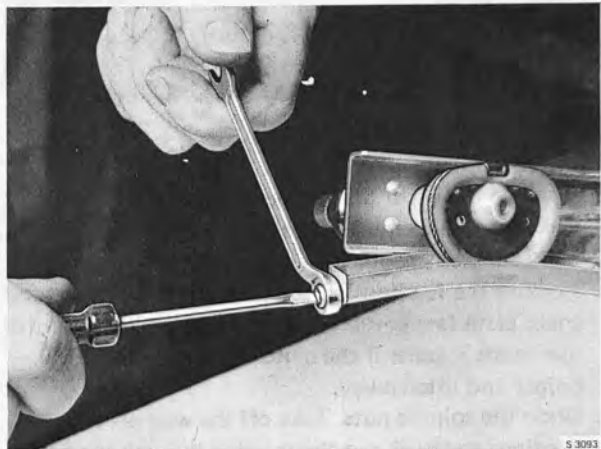
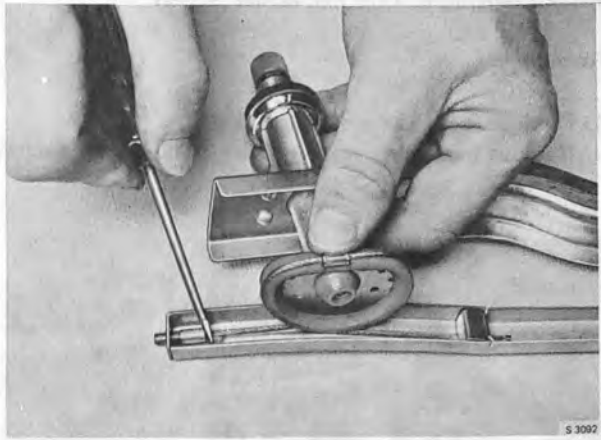
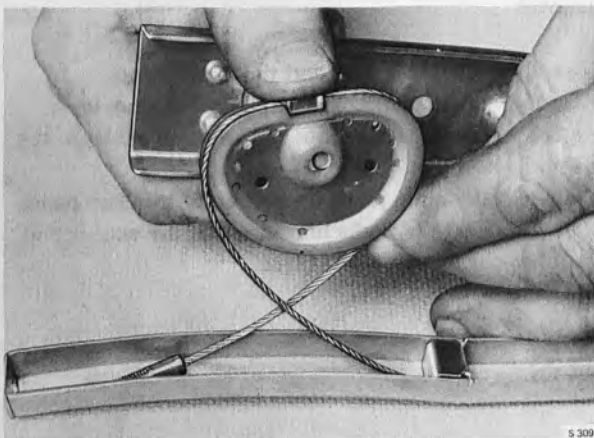
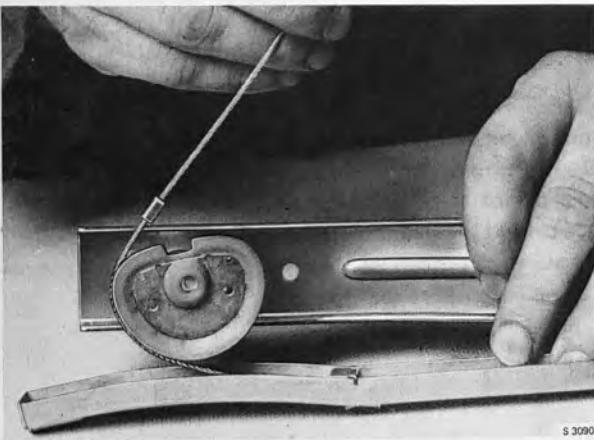
1. Remove the wiper arms and the wiper motor.
2. Undo the base plates on the spindle housings with a 3/8" wrench so the tubes can be detached from the spindle housings.
3. Undo the retaining nuts on the top of the dash panel and remove the spindle housings. Put the washer and rubber bushings in a safe place.

Installation

1. Mount the spindle housings on the dash panel plate with the rubber bushings, washers and nuts. Do not tighten the nuts.
2. Guide the tubes into their positions between the spindle housings and their base plates.
3. Insert the flexible cable while twisting to facilitate meshing and check that it runs smoothly.
4. Tighten the spindle nuts.
5. Mount the wiper motor on the dash panel and connect it to the steel tube.
6. Test run the wipers and note on which side the spindles rest when the motor is switched off. (This test is made to prevent the wiper arm from moving in the wrong direction when the wiper motor is switched on.)
7. Fit the wiper arms.

Wiper mechanism wires, up to and incl. model 1973

If a wire is derailed from its pulley, refit it by first unscrewing the nut from the wire grip and then replacing the wire on the pulley as shown in the following series of illustrations.



REFITTING DERAILED WIPER MECHANISM WIRE

Wiper blade parking position

Adjust the parking position of the wipers by altering the position of the crank arm on the motor shaft.

Windshield washer

The windshield washer consists of an electrically driven centrifugal pump. Up to and incl. model 1972: The motor is mounted on the filler cap of the water container with a shaft transmission to the pump inside the container. In models from 1973 and Saab 99 EMS models from 1972, the motor is located on the outlet side of the water container and connected to the container by a hose. If the motor is disassembled for any reason, its bushings should be oiled before reassembly.

HEADLIGHT WIPER AND WASHER

General

As from the 1971 model, Saab 99 cars destined for certain markets are equipped with a headlight cleaning system. This consists of a wiper and washer unit powered by separate electric motors which are operated by the same control lever as the windshield wipers and washer.

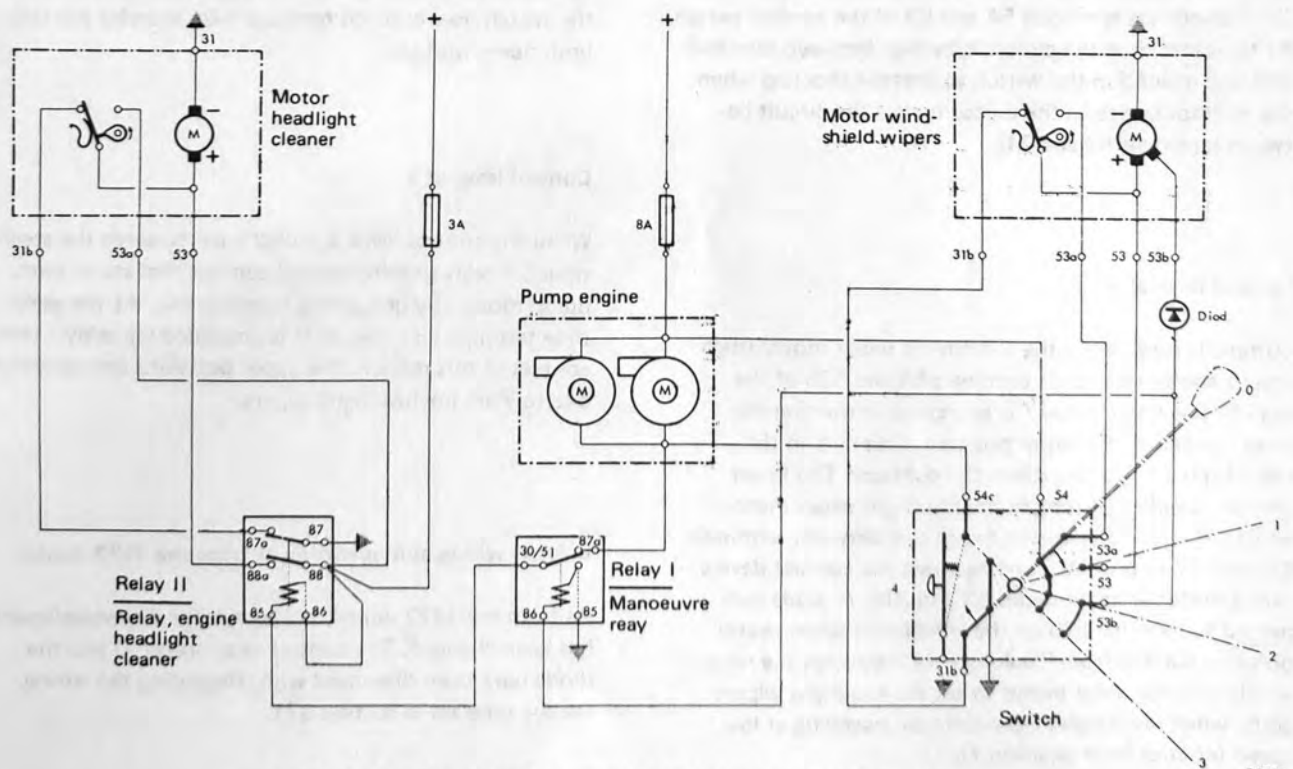


HEADLIGHT WIPER MECHANISM

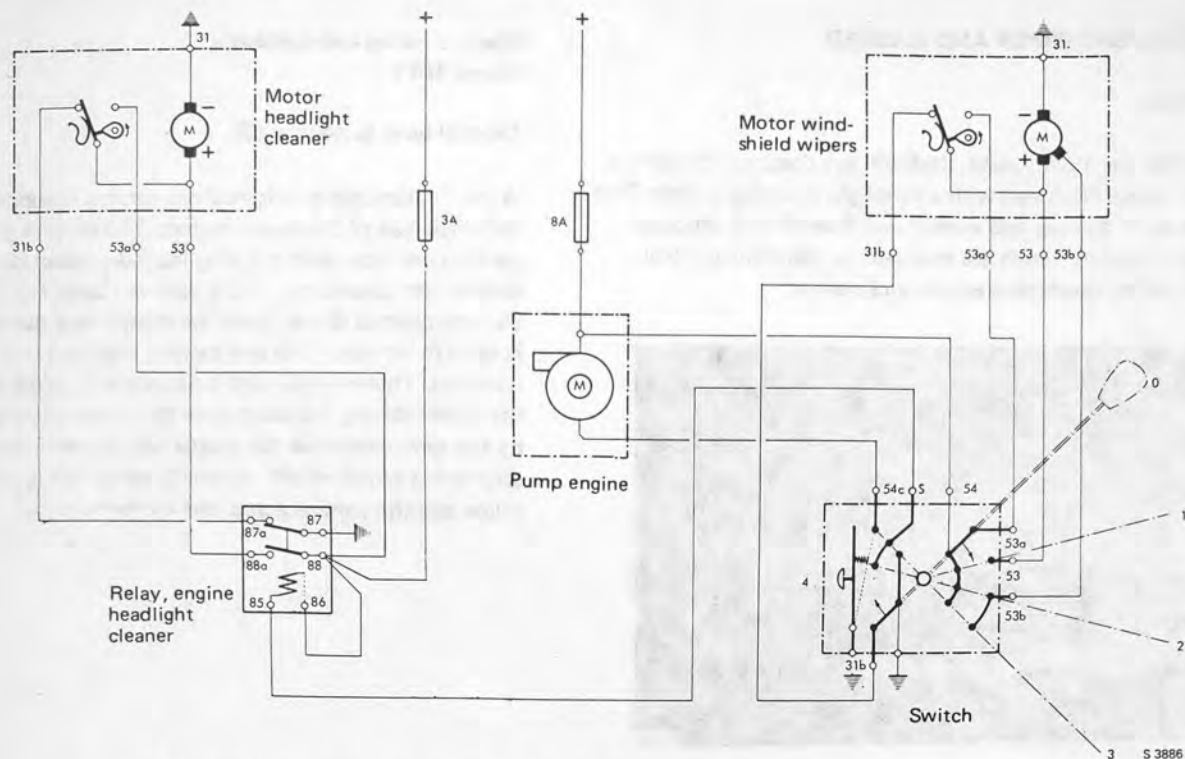
Electric wiring and operation Model 1971

Control lever in neutral (0)

When the ignition is switched on, current is supplied to terminals 53a of the wiper motors. The motors go to the parking position when a spring-loaded contact device in each motor breaks the circuit between terminals 53a and 53. The contact device stops the motor very quickly by cutting in terminal 31b and thereby shorting out the rotor windings. This arrangement is necessary in order to stop the motor during the short time the contact is actuated by the cam; otherwise the motor would continue to run after being switched off, especially when blade resistance is low and the voltage across the motor is high.



WIRING DIAGRAM, HEADLIGHT WIPER AND WASHER MODEL 1971



WIRING DIAGRAM, HEADLIGHT WIPER AND WASHER AS FROM MODEL 1972

Control lever at 1

Current is supplied to the windshield wiper motor only (low speed) via terminals 54 and 53 of the control switch. At the same time the circuit is broken between terminal 31b and ground in the switch to prevent shorting when the contact device in the motor makes the circuit between terminals 53 and 31b.

Control lever at 2

Current is supplied to the windshield wiper motor (high speed) and to relay I via terminals 54 and 53b of the switch. The coil in relay I is energized, attracting the relay contact to the lower position. This cuts in the coil of relay II, pulling down the contacts. The lower contact supplies current to the headlight wiper motor, while the upper one breaks the circuit between terminals 87a and 87 to prevent shorting when the contact device in the motor links terminals 53 and 31b. A diode connected to terminal 53b on the windshield wiper motor prevents current from "leaking back" through the rotor winding in the wiper motor to set the headlight wipers going when the windshield wipers are sweeping at low speed (control lever position 1).

Control lever at 3

The same functions operate here as in position 2, but the switch now grounds terminal 54c, thereby starting both pump motors.

Control lever at 4

When the control lever is pulled back towards the steering wheel, it trips a spring-loaded contact that starts both pump motors by grounding terminal 54c. At the same time terminal 85 on relay II is grounded via relay I (the contact in this relay in the upper position) and terminal 54c to start the headlight wipers.

Electric wiring and operation as from the 1972 model

As from the 1972 model, the switch for the wiper/washer has been changed. The control relay (relay 1) and the diode have been dispensed with. Regarding the wiring, see the diagram in section 371.

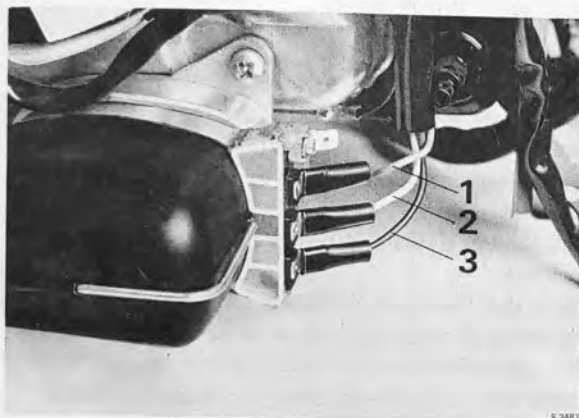
Wiper motor

Removal and installation

1. Remove the headlight trim frames and grilles.
2. Remove the crank arm from the wiper motor and the nut from the shaft.
3. Remove the battery.
4. Disconnect the wires from the wiper motor.
5. Remove the screw which holds the wiper motor to the fan cover. The motor can then be removed. Take care of the spacers on the shaft.

Install in the reverse order.

NOTE! The screw in the wiper motor crank arm must be tightened to a torque of 7.2 ft.lb. (10 Nm, 1.0 kpm) and locked with Loctite.



WIRE CONNECTIONS AND COLORS, HEADLIGHT WIPER MOTOR

1. Red to "53a"
2. Yellow to "31b"
3. Brown to "53"

NOTE

For normal use of the wipers, a fuse for a maximum current of 3 amp. is to be fitted in order to avoid damage to the wiper motor if the wipers freeze onto the glass.

While testing the assembly (dry headlight glass), an 8 amp. fuse may be temporarily fitted.

Wiper mechanism

Removal and installation

1. Remove the headlight trim frames and grilles.
2. Prize apart the ball joint between the push rod and the crank arm of the motor.



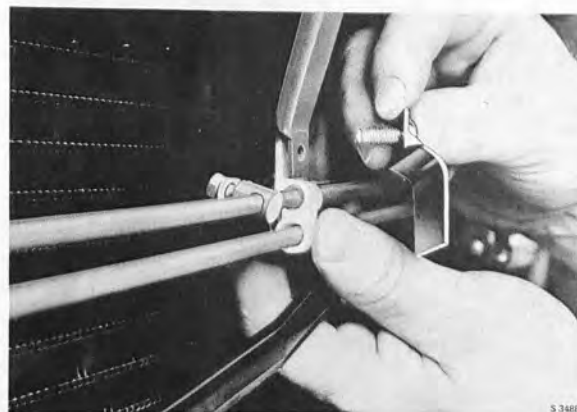
LOOSE THE CRANK ARM FROM THE PUSH ROD

3. Unhook the springs which hold the wiper shaft bushings to the front sheet.
4. Up to and incl. model 1972:
Remove the screw which holds the central bushing to the anchorage bracket. The wiper mechanism can then be removed.

Install in the reverse order.

Before the springs and bushings are fitted, the recesses in the front sheet must be greased on both sides.

The central bushing must be placed on the back of the bracket and the locking washer must be placed between the central bushing and the bracket. Tighten the locking screw so that the bushing does not follow the movement of the wiper and thus lock the mechanism.



FITTING THE CENTRAL BUSHING

4. As from model 1973:

Remove the four screws, holding the protecting cover and remove the cover together with the wiper mechanism.

Install in the reverse order.

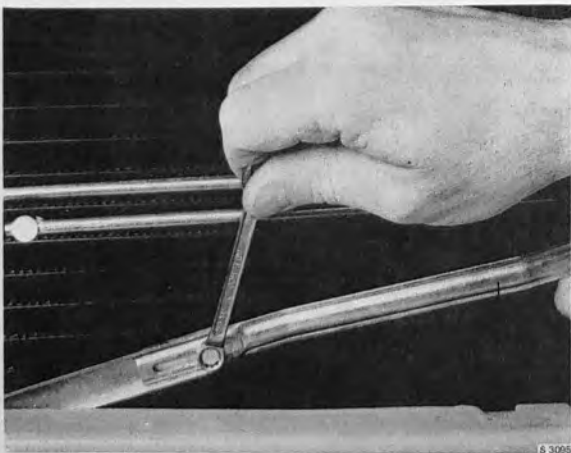
Before the springs and bushings are fitted, the recesses in the front sheet must be greased on both sides.



PROTECTING COVER WITH WIPER MECHANISM, AS FROM MODEL 1973

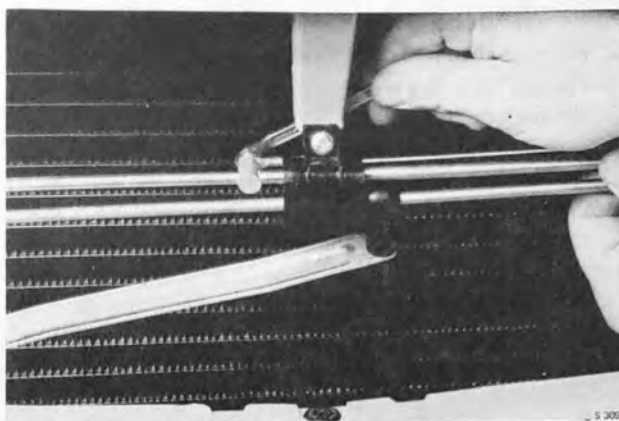
Adjustments

1. Adjust the parking position of the wipers by altering the length of the push rod.



ADJUSTING THE PARKING POSITION OF THE HEADLIGHT WIPERS

2. Adjust cord tension by slackening the set screw in the cord attachment bushings and then moving the bushings to stretch the cords.



ADJUSTING CORD TENSION

3. Check the pressure of the wiper blades on the headlight glasses and make sure that the bushing does not stick in the recesses in the front sheet. The pressure of the wiper blades, measured in the parked position, must not exceed 11 oz (3 N, 300 p). CRC 5.56 or similar is a suitable lubricant for the bushings.
4. Check that the wiper shafts are parallel (as seen from the front). If necessary, adjust by bending the bracket forwards or backwards, (up to and incl. model 1972).
5. Check that the central bushing is not loose and that it does not follow the movement of the wipers. Lubricate the central bushing with CRC 5.56 or similar.

Changing wiper blades

1. Release the catch on the wiper shaft and pull off the wiper blade.
2. Fit a new wiper blade on the shaft and secure the catch.

ELECTRICAL CONTROLS AND SWITCHES

General

The ignition switch is located on the gear lever console and is combined with the starter switch and gear lever security lock.

To protect the ignition switch contacts against excessively high currents, an extra relay is fitted. The windshield

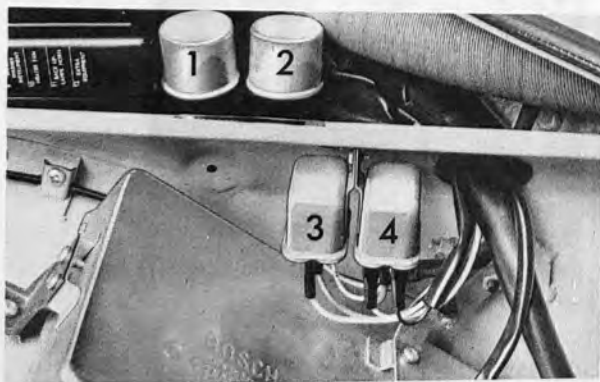


RADIATOR FAN RELAY AND IGNITION SWITCH RELAY

1. Ignition switch relay
2. Radiator fan relay

wipers and washer, the radiator fan relay, the ventilator fan and the backup lights are supplied with current via this relay, which is located by the fuse box.

Engines with electronic fuel injection are provided with a master relay for the injection system and a relay for the fuel pump.

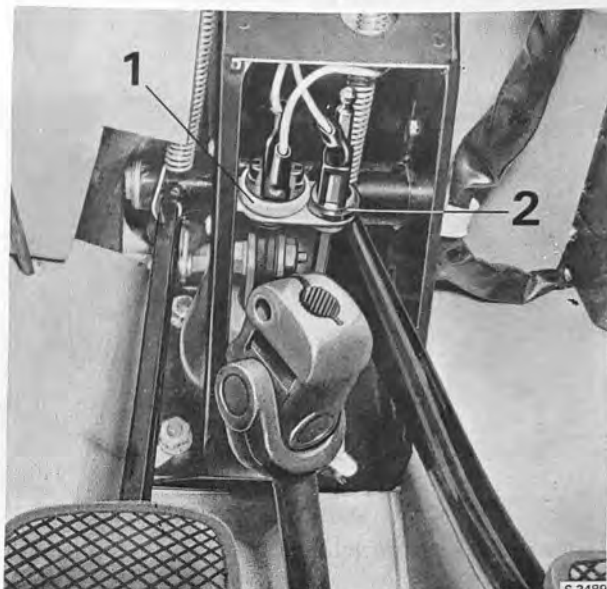


REALYS, INJECTION ENGINE

1. Ignition relay
2. Radiator fan relay
3. Master relay
4. Fuel pump relay

The stop light contact is mechanical with direct actuation by the brake pedal. When actuated it supplies current to the stop lights.

In cars with manual transmission the backup light switch is located to the left of the gear lever under the console and is tripped by the gear lever when reverse gear is engaged, whereupon the back-up lights light up.



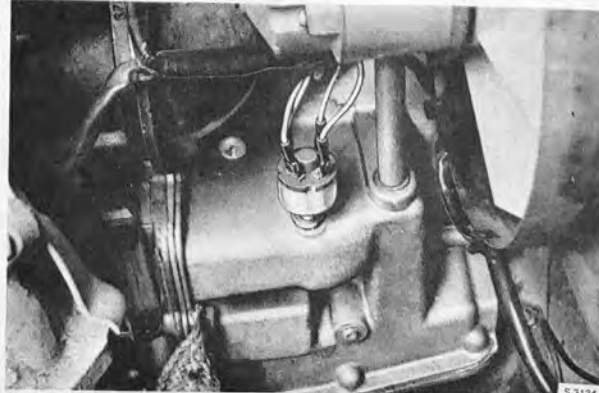
STOP LIGHTS CONTACT AND BRAKE WARNING CONTACT

1. Stop lights contact
2. Brake warning contact



BACK-UP LIGHT SWITCH, MANUAL TRANSMISSION

In cars with automatic transmission the contact is mounted on the front of the transmission casing and is combined with the starter interlock. With reference to the setting of the contact, see under "Automatic transmission" in group 4.



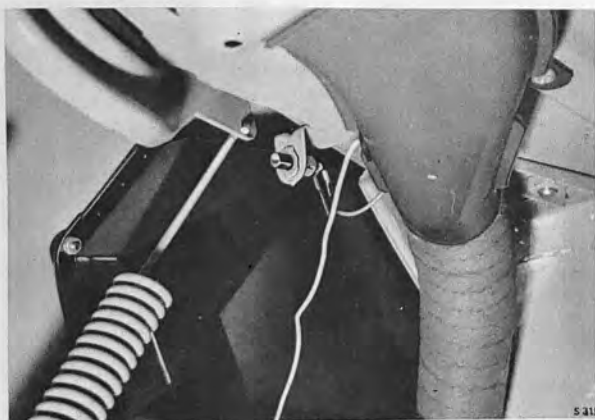
BACK-UP LIGHT SWITCH, AUTOMATIC TRANSMISSION

The switch that operates the handbrake warning light is located on the right of the handbrake lever under the console and is actuated by the movement of the handbrake lever.



HANDBRAKE WARNING LIGHT SWITCH

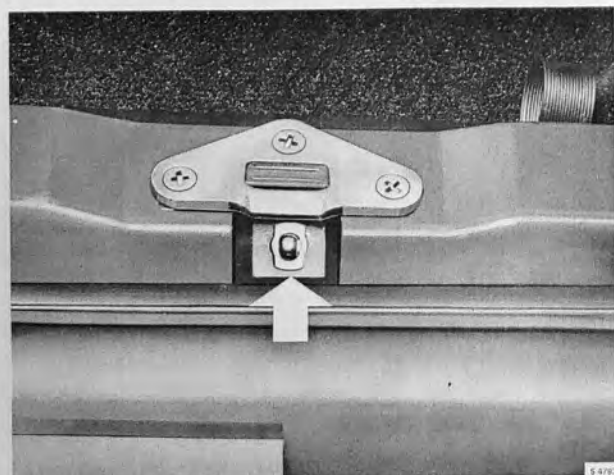
The switch that operates the trunk light is located at the left hinge of the trunk lid.



TRUNK LIGHT SWITCH

Saab 99 Combi Coupé:

The switch that operates the trunk light is located at the rear door striker.



TRUNK LIGHT SWITCH SAAB 99 COMBI COUPÉ

Ignition and starter switch

As from chassis No. 99.005.444 a new ignition and starter switch has been introduced with five terminals instead of six as previously. The two types of switch are fully interchangeable if the wires are connected as shown in the diagrams below.

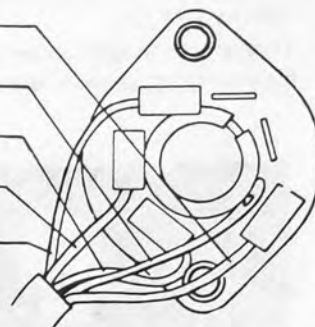
Green/white to "15"

Red to "15"

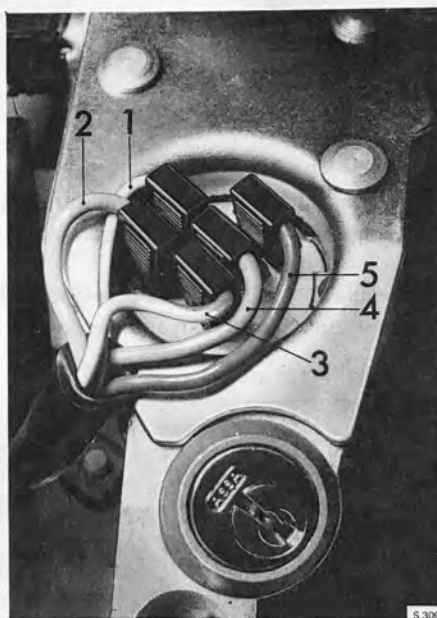
Yellow to "50"

Brown/white to "75"

Gray to "30"



STARTER SWITCH TYPE 837443 UP TO CHASSIS NO. S 2361
99.005.443



STARTER SWITCH TYPE 837456 FROM CHASSIS NO.
99.005.444

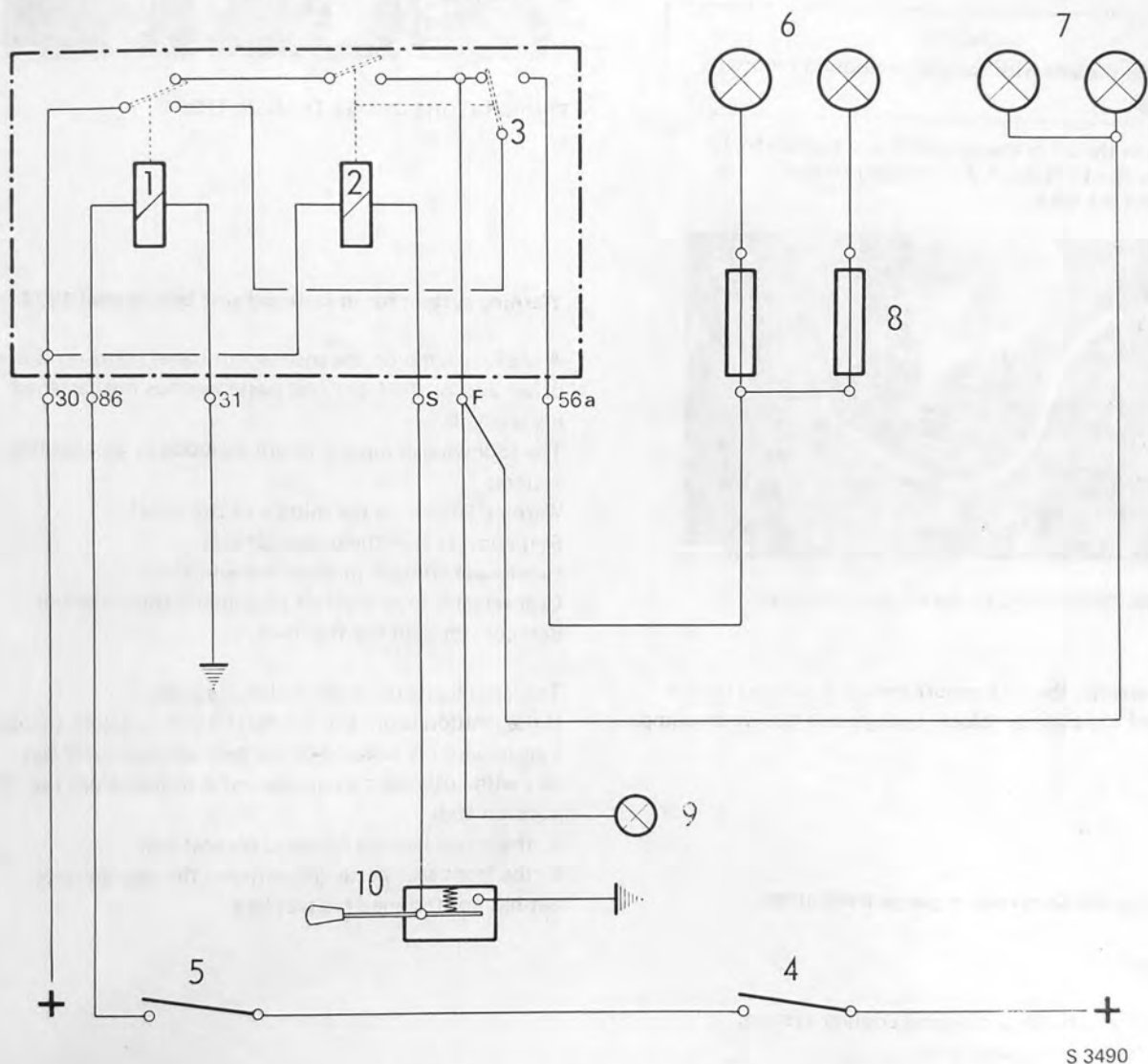
1. Brown/white to "54"
2. Yellow to "50"
3. Green/white to "15"
4. Gray to "30"
5. Red to "X"

Lighting relay

The lighting relay contains devices for flashing the high beam and switching between high beam and low beam. Function (see wiring diagram):

If the ignition switch (4) and the light switch (5) are on, current will pass through relay coil (1). The coil contact is pulled down and connects either high or low beam via contact (3). Contact (3) can change position as it is me-

chanically influenced by the contact at relay coil (2). This coil is connected with the headlight dimmer and flasher switch (10) (i.e. the same lever as the direction indicator switch). If either the ignition switch or the light switch — or both — are switched off, the high beam signal can be used. The contact at coil (1) is then in the upper position and the high beam is connected through the contact at coil (2), which is grounded through the light switch.



WIRING DIAGRAM, LIGHTING RELAY

1. 2. Relay coils
3. Contact
4. Ignition switch
5. Light switch
6. Low beam
7. High beam
8. Fuses
9. High beam indicator light
10. Headlight dimmer and flasher switch

Exchanging the oil pressure switch

Removing

1. Pull off the connecting wire.
2. Unscrew the oil pressure switch (width across flats 7/16").

Installing

NOTE

Coat the threads with sealant compound before installing.

1. Screw in the oil pressure switch and tighten to 12–15 Nm (9–11 ft.lb., 1.2–1.5 kpm) torque.
2. Connect the wire



OIL PRESSURE SWITCH, 1.7 AND 1.85 L ENGINES

On 2.0 l engine, the oil pressure switch is located on the left side of the cylinder block, underneath the water pump.

Exchanging the temperature gauge transmitter

Removing

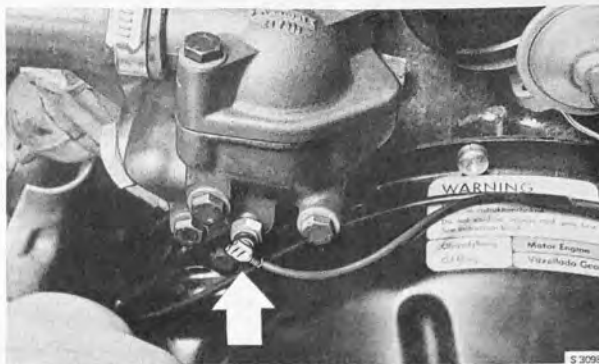
1. Drain the radiator and engine coolant system.
2. Pull off the connecting wire.
3. Unscrew the transmitter (width across flats 1/2").

Installing

NOTE

Coat the threads with sealant compound before installing

1. Screw in the transmitter.
2. Connect the wire.
3. Fill the system with coolant.
4. Warm up the engine and check the temperature transmitter deflection.
5. Check the coolant level and top off if necessary.



TEMPERATURE GAUGE TRANSMITTER

Warning system for unfastened seat belt, model 1974

A warning lamp on the instrument panel lights up if the driver and/or the front seat passenger has not fastened his seat belt.

The following components are included in the warning system:

Warning lamp — in the middle of the panel

Seat contact — in the passenger seat

Handbrake contact (manual transmission)

Gear selector lever contact (automatic transmission)

Belt contact — in the flap lock

The lamp lights up in the following cases:

If the ignition is on, the handbrake (on cars with manual transmission) is released or the gear selector lever (on cars with automatic transmission) is moved from the "P" position and:

- a. the driver has not fastened his seat belt
- b. the front seat passenger actuates the seat contact but has not fastened his seat belt.

Warning system for unfastened seat belt on 1972–1973 models (USA versions)

A buzzer and a warning lamp go on if the driver and/or the front seat passenger has not fastened his seat belt. The following components are included in the warning system:

Buzzer — under the instrument panel
Warning lamp — on the instrument panel
Seat contact — in the passenger seat
Handbrake contact — (manual transmission)
Gear selector lever contact — (automatic transmission)
Retractor contacts — in the front seat retractor reels

The buzzer sounds and the warning lamp lights up in the following cases:

If the ignition is on, the handbrake (on cars with manual transmission) is released or the gear selector lever (on cars with automatic transmission) is moved from the "P" position and:

- the driver has not fastened his seat belt
- the front seat passenger actuates the seat contact but has not fastened his seat belt.

Model 1974

A device which prevents the engine from starting and a buzzer and a warning lamp are actuated if the driver and/or

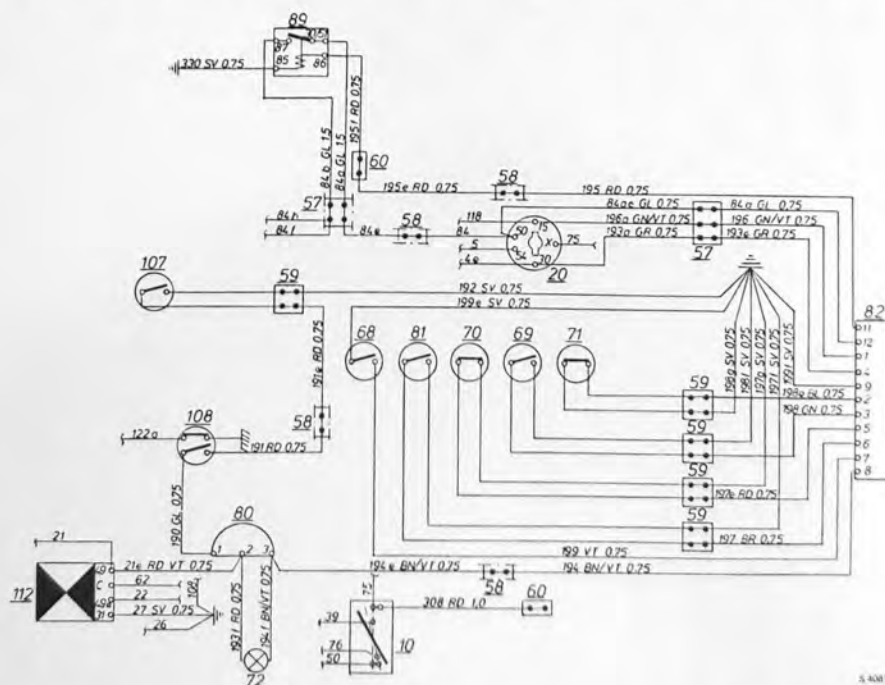
the front seat passenger has not fastened his safety belt. The following components are included in the warning system:

Buzzer — under the instrument panel
Warning lamp — on the instrument panel
Start inhibitor relay — next to the fuse box in the engine compartment
Seat contact — in the driver's seat
Seat contact — in the passenger's seat
Belt contact — in the flap lock
Handbrake contact — (manual transmission)
Logic unit — under the rear seat cushion

The warning system is controlled through a logic unit to which all the components in the system are connected. The control circuit to the starter motor is broken when the driver or front seat passenger actuates his seat contact but has not fastened his seat belt. As soon as the belt is fastened, the starter motor is reconnected. The signals to the logic unit from the seat contact and the belt contact must be received in the right order. This prevents tampering with the system.

The buzzer sounds and the warning lamp lights up if the ignition is on and:

- (manual transmission) the handbrake is released
 - (automatic transmission) the gear selector lever is moved from the "P" position
- and the driver or the front seat passenger actuates his seat contact without having fastened his seat belt.



WIRING DIAGRAM, WARNING SYSTEM FOR UNFASTENED SEAT BELT MODEL 1974

- | | |
|------------------------|--|
| 10. Light switch | 71. Belt contact. R.H. |
| 20. Ignition switch | 72. Warning light, belt warning system |
| 57. 3-pin connector | 80. Buzzer, key and belt warning |
| 58. 8-pin connector | 81. Seat contact |
| 59. 2-pin connector | 82. Logic unit |
| 60. 1-pin connector | 89. Start inhibitor relay |
| 68. Handbrake contact | 107. Key contact |
| 69. Seat contact | 108. 2-pin door contact |
| 70. Belt contact, L.H. | 112. Electronic flasher unit |

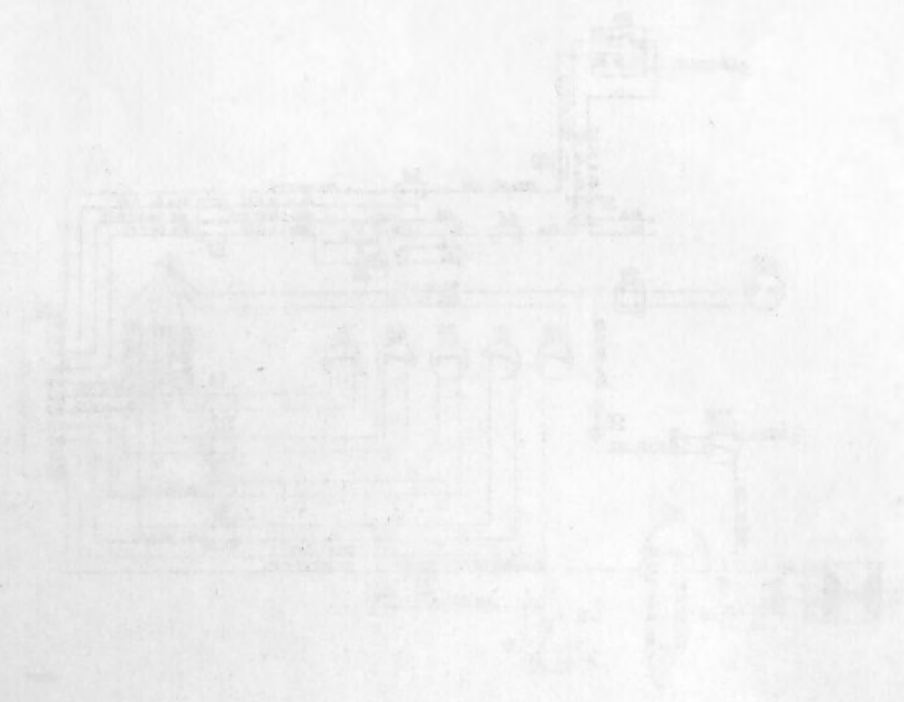
The first of these is the fact that the system is not a simple one. It is a complex system, and the complexity is not only in the hardware but also in the software. The system is designed to be flexible and adaptable, and this is achieved by the use of a modular architecture. The hardware is designed to be scalable, and the software is designed to be extensible. This allows the system to be adapted to a wide range of applications, and it also allows the system to be upgraded as new requirements arise.

The second of these is the fact that the system is not a simple one. It is a complex system, and the complexity is not only in the hardware but also in the software. The system is designed to be flexible and adaptable, and this is achieved by the use of a modular architecture. The hardware is designed to be scalable, and the software is designed to be extensible. This allows the system to be adapted to a wide range of applications, and it also allows the system to be upgraded as new requirements arise.

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The fifth of these is the fact that the system is not a simple one. It is a complex system, and the complexity is not only in the hardware but also in the software. The system is designed to be flexible and adaptable, and this is achieved by the use of a modular architecture. The hardware is designed to be scalable, and the software is designed to be extensible. This allows the system to be adapted to a wide range of applications, and it also allows the system to be upgraded as new requirements arise.



The diagram illustrates the internal structure of the system, showing the interconnection of various functional blocks. The central bus provides a common communication path for all components. The logic gates perform the necessary Boolean operations, while the registers store data and control signals. The input/output ports allow the system to interface with the external world. The overall design is modular and scalable, allowing for easy expansion and adaptation to different system requirements.

WIRING AND FUSES

Wiring

The wiring conducts current from the battery or alternator to the various items of electrical equipment. To protect the wiring and reduce the risk of short circuits, the wires have been grouped wherever possible in cable networks, i.e. a number of independently insulated wires surrounded by an outer plastic sheath.

The wiring networks are divided into two groups, one at the dash panel and in the engine compartment, and the other leading to the rear end of the car. The connections of the wiring are illustrated in the wiring diagram; it should not be too difficult to remove or install wires if this diagram is used as a guide. The wires in a cable network are color coded.

The wires terminate in solderless AMP connectors. Check that wiring is properly connected to avoid undue potential drop. The insulation of the cable network should be tested if fuses blow frequently and damage to the insulation is suspected. Note that a fuse will not blow if a short occurs between it and the source of current. When installing new wiring, always take special care to make sure that the size of wire chosen can handle the current load for which it is intended, and that the wiring is well protected from wear and damage at points where it passes through steel partitions or is held by clamps.

Fuses

To protect wiring, etc. against abnormally heavy current loads, e.g. in the event of a short circuit, and to reduce the fire hazard if this should occur, the electrical system is provided with twelve 8-amp fuses grouped in a fuse box on the left wheel housing in the engine compartment. One of the fuses is intended for extra equipment. All parts of the system are fused except the headlights and the ignition system. A label by the fuse box shows which fuses protect which circuits.

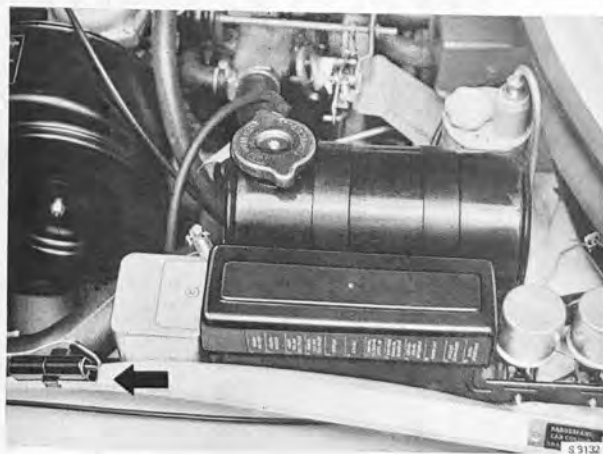
In addition to these fuses as from model 1971 there is a 3-amp fuse for the headlight wiper system, placed in a separate holder (see illustration).

IMPORTANT

As 3-amp and 8-amp fuses are the same length, there is a risk that they may be confused. The wiper motor is liable to be damaged if an 8-amp fuse is fitted by mistake.

NOTE

Always check when putting in a new fuse that it makes proper contact. If a break in any circuit is suspected, check the fuse contacts first. If the test is made with a voltmeter, the maximum permitted potential drop is 0.1 V.



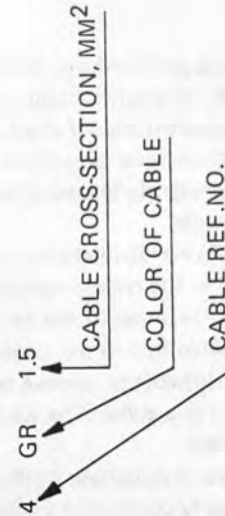
FUSE BOX AND FUSE HOLDER FOR HEADLIGHT WIPER SYSTEM AS FROM MODEL 1971

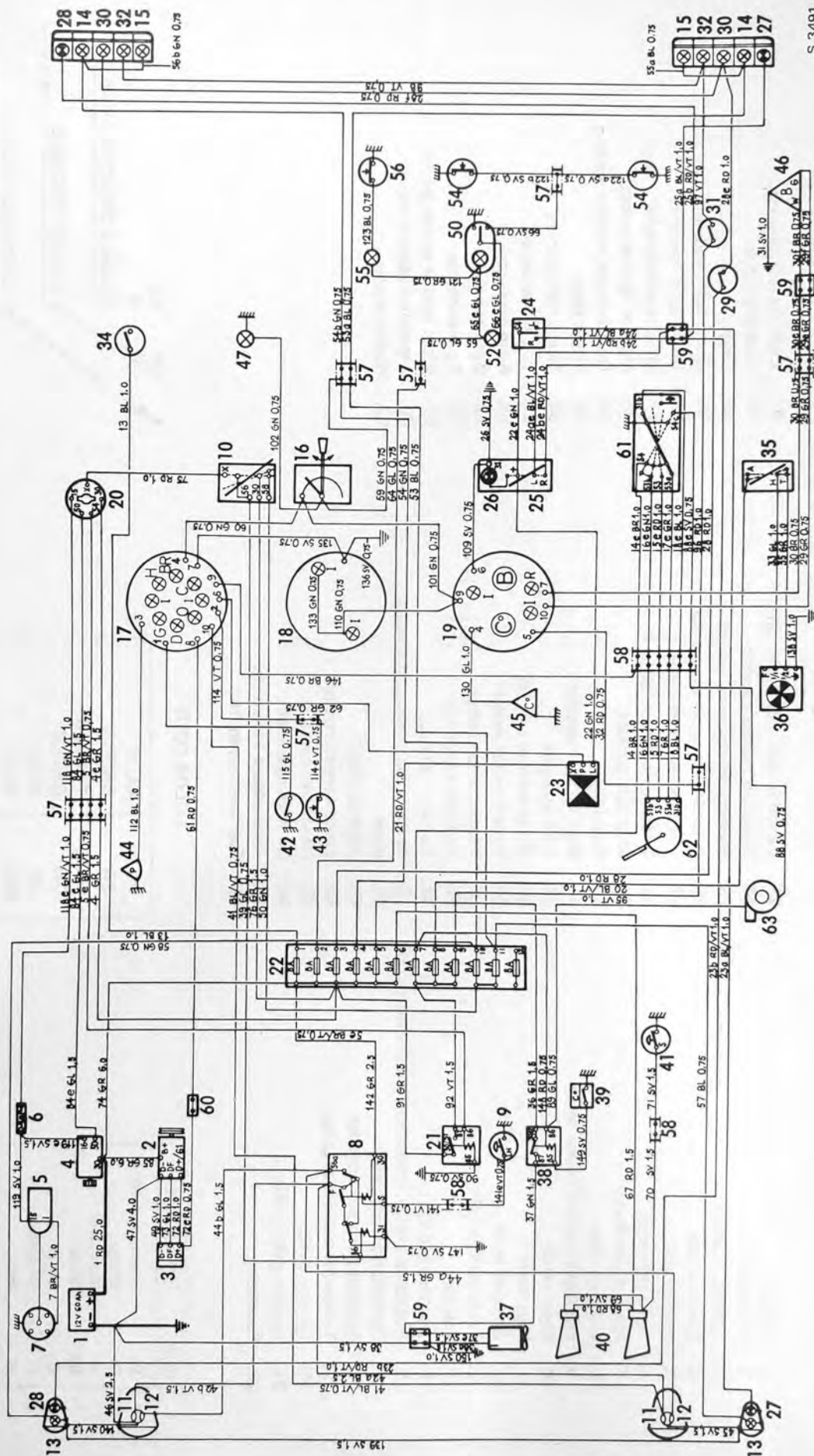
- | | | |
|--|--------------------------------------|-------------------------------------|
| 1. Battery | 23. Direction indicator flasher unit | 47. Light, heating controls |
| 2. Alternator | 24. Direction indicator switch | 50. Dome light |
| 3. Voltage regulator | 25. Hazard warning signal switch | 52. Ignition switch light |
| 4. Starter motor | 26. Hazard warning signal repeater | 54. Door contact, interior lighting |
| 5. Ignition coil | 27. Direction indicator lights, L | 55. Trunk light |
| 6. Serial resistance | 28. Direction indicator lights, R | 56. Trunk light contact |
| 7. Ignition distributor | 29. Stop light contact | 57. 12-pin connector |
| 8. Lighting relay | 30. Stop lights | 58. 8-pin connector |
| 9. Headlight dimmer/flasher switch | 31. Back-up light contact | 59. 2-pin connector |
| 10. Light switch | 32. Back-up lights | 60. 1-pin connector |
| 11. High beam | 34. Switch, extra equipment | 61. Wiper and washer system switch |
| 12. Dimmed beam | 35. Ventilator fan switch | 52. 2-speed windshield wiper |
| 13. Front parking light | 36. Ventilator fan motor | 63. Washer motor |
| 14. Tail light | 37. Radiator fan motor | |
| 15. License plate light | 38. Radiator fan relay | |
| 16. Resistance switch, instrument panel illumination | 39. Radiator fan thermostat contact | |
| 17. Combination instrument | 40. Horn | |
| 18. Speedometer and odometer | 41. Horn contact | |
| 19. Temperature and fuel gauge | 42. Brake warning contact | |
| 20. Ignition switch | 43. Handbrake contact | |
| 21. Ignition switch relay | 44. Oil warning contact | |
| 22. Fuse box | 45. Temperature transmitter | |
| | 46. Fuel level transmitter. | |

COLOR CODE

Code	Indicator light
D	Direction indicator
G	Charge
H	High beam
FB	Footbrake
B	Handbrake
O	Oil pressure
R	Fuel
I	Instrument lighting

	COLOR CODE
BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





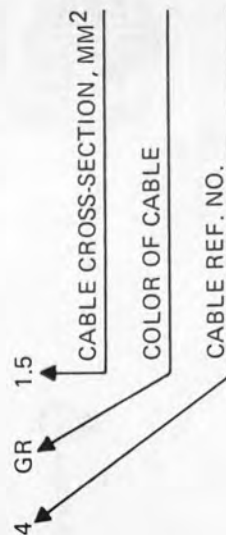
S 3491

- | | | |
|--|--------------------------------------|-------------------------------------|
| 1. Battery | 23. Direction indicator flasher unit | 47. Light, heating controls |
| 2. Alternator | 24. Direction indicator switch | 48. Cigarette lighter |
| 3. Voltage regulator | 25. Hazard warning signal switch | 49. Clock |
| 4. Starter motor | 26. Hazard warning signal repeater | 50. Dome light, middle |
| 5. Ignition coil | 27. Direction indicator lights, L | 51. Dome light, forward |
| 6. Serial resistance | 28. Direction indicator lights, R | 52. Ignition switch light |
| 7. Ignition distributor | 29. Stop light contact | 53. Interior lighting switch |
| 8. Lighting relay | 30. Stop lights | 54. Door contact, interior lighting |
| 9. Headlight dimmer/flasher switch | 31. Back-up light contact | 55. Trunk light |
| 10. Light switch | 32. Back-up lights | 56. Trunk light contact |
| 11. High beam | 34. Choke control contact | 57. 12-pin connector |
| 12. Dimmed beam | 35. Ventilator fan switch | 58. 8-pin connector |
| 13. Front parking light | 36. Ventilator fan motor | 59. 2-pin connector |
| 14. Tail light | 37. Radiator fan motor | 60. 1-pin connector |
| 15. License plate light | 38. Radiator fan relay | 61. Wiper washer system switch |
| 16. Resistance switch, instrument panel illumination | 39. Radiator fan thermostat contact | 62. 2-speed windshield wiper |
| 17. Combination instrument | 40. Horn | 63. Washer motor |
| 18. Speedometer and odometer | 41. Horn contact | |
| 19. Temperature and fuel gauge | 42. Brake warning contact | |
| 20. Ignition switch | 43. Handbrake contact | |
| 21. Ignition switch relay | 44. Oil warning contact | |
| 22. Fuse box | 45. Temperature transmitter | |
| | 46. Fuel level transmitter | |

Code	Indicator light
D	Direction indicator
G	Charge
H	High beam
BR	Brake
C	Choke
O	Oil pressure
R	Fuel
I	Instrument lighting

COLOR CODE

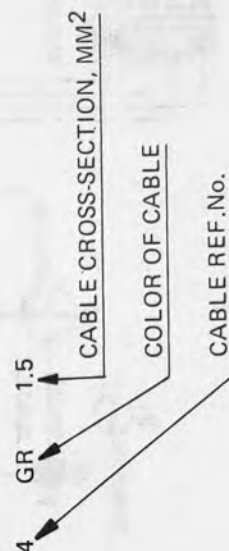
BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE



- | | | |
|--|-------------------------------------|--|
| 1. Battery | 24. Direction indicator switch | 47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater |
| 2. Alternator | 25. Hazard warning signal switch | 48. Cigarette lighter |
| 3. Voltage regulator | 26. Hazard warning signal repeater | 49. Clock |
| 4. Starter motor | 27. Direction indicator lights, L | 50. Dome light, middle |
| 5. Ignition coil | 28. Direction indicator lights, R | 51. Dome light, forward |
| 6. Serial resistance | 29. Stop light contact | 52. Ignition switch light |
| 7. Ignition distributor | 30. Stop lights | 53. Interior lighting switch |
| 8. Lighting relay | 31. Back-up light contact | 54. Door contact, interior lighting |
| 9. Headlight dimmer/flasher switch | 32. Back-up lights | 55. Trunk light |
| 10. Light switch | 33. Choke warning light | 56. Trunk light contact |
| 11. High beam | 34. Choke control contact | 57. 12-pin connector |
| 12. Dimmed beam | 35. Ventilator fan switch | 58. 8-pin connector |
| 13. Front parking light | 36. Ventilator fan motor | 59. 2-pin connector |
| 14. Tail light | 37. Radiator fan motor | 60. 1-pin connector |
| 15. License plate light | 38. Radiator fan relay | 61. Wiper system switch |
| 16. Resistance switch, instrument panel illumination | 39. Radiator fan thermostat contact | 62. 2-speed windshield wiper |
| 17. Switch light | 40. Horn | 63. Washer motor |
| 18. Instrument panel light | 41. Horn contact | 64. Diode, headlight wiper |
| 19. Glove compartment and heater control light | 42. Brake warning contact | 65. Fuse holder, headlight cleaning device |
| 20. Ignition | 43. Handbrake contact | 66. Headlight wiper motor |
| 21. Ignition relay | 44. Oil warning contact | 67. Headlight wiper motor relay |
| 22. Fuse box | 45. Temperature transmitter | 68. Control relay |
| 23. Direction indicator flasher unit | 46. Fuel level transmitter | |

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





371-7

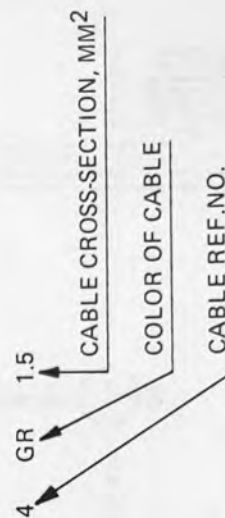
1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Resistance switch, instrument panel illumination
17. Switch light
18. Instrument panel light
19. Glove compartment and heater control light
20. Ignition
21. Ignition relay
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch
25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact

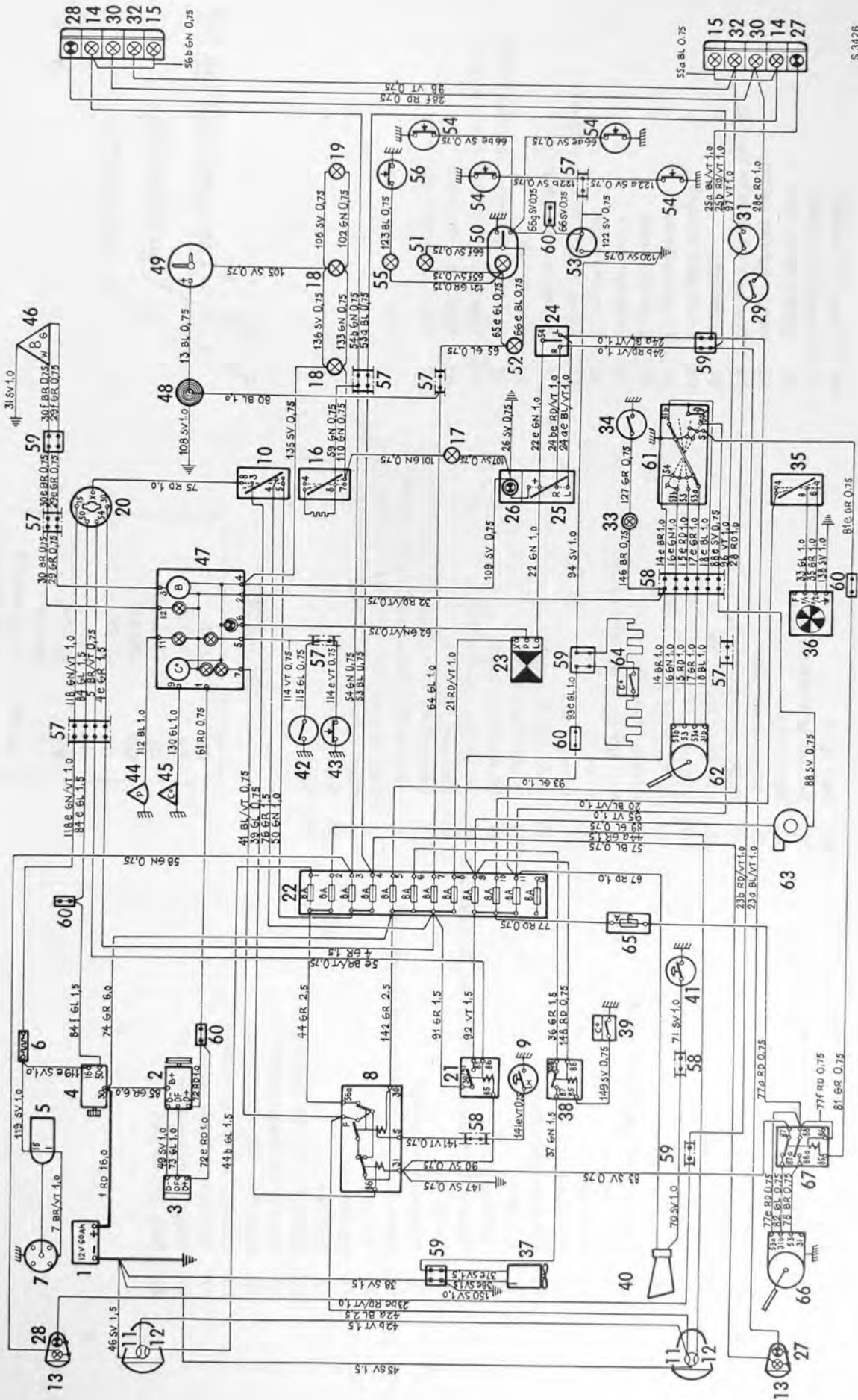
30. Stop lights
31. Backup light contact
32. Backup lights
33. Choke warning light
34. Choke control contact
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel level transmitter
47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater.
48. Cigarette lighter
49. Clock

50. Dome light, middle
51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper and washer system switch
62. 2-speed windshield wiper
63. Washer motor
64. Seat heating element with thermostat
65. Fuse holder, headlight cleaning device
66. Headlight wiper motor
67. Headlight wiper motor relay

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





WIRING DIAGRAM L.H.D. CAR MODEL 1972

Details of wiring diagram for injection engine and automatic transmission see pages 371-40 to -41.

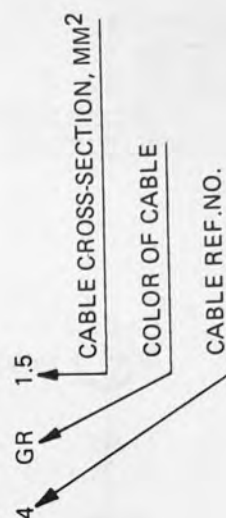
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2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Resistance switch, instrument panel illumination
17. Switch light
18. Instrument panel light
19. Glove compartment and heater control light
20. Ignition
21. Ignition relay
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch
25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact

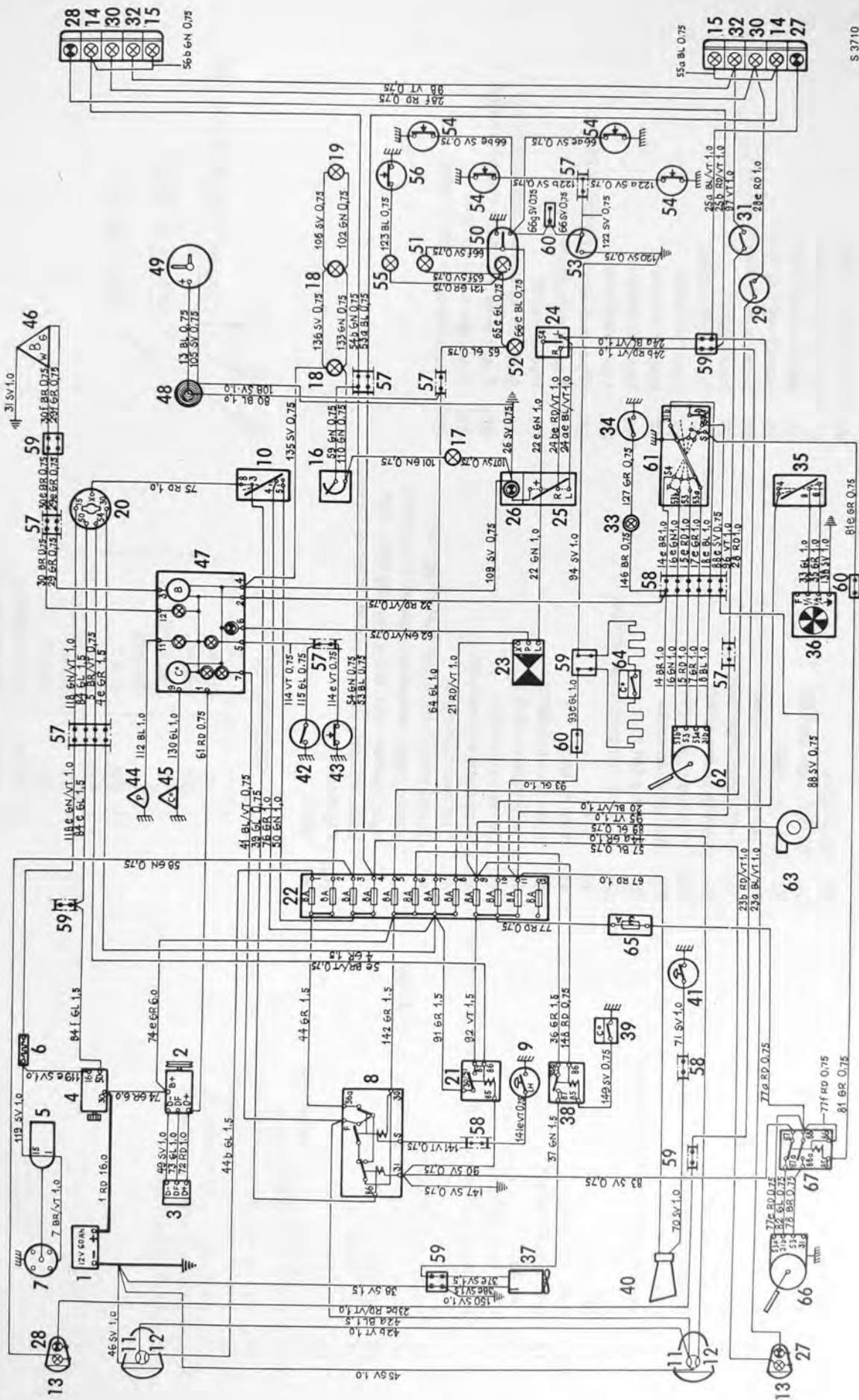
30. Stop lights
31. Backup light contact
32. Backup lights
33. Choke warning light
34. Choke control contact
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel level transmitter
47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater.
48. Cigarette lighter
49. Clock

50. Dome light, middle
51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper and washer system switch
62. 2-speed windshield wiper
63. Washer motor
64. Seat heating element with thermostat
65. Fuse holder, headlight cleaning device
66. Headlight wiper motor
67. Headlight wiper motor relay

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





S 3710

WIRING DIAGRAM L.H.D. CAR MODEL 1973
Details of wiring diagram for injection engine and automatic transmission see pages 371-42 to -43.

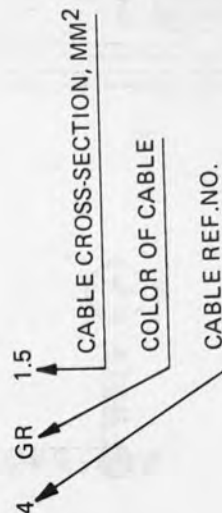
1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Resistance switch, instrument panel illumination
17. Switch light
18. Instrument panel light
19. Glove compartment and heater control light
20. Ignition
21. Ignition relay
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch
25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact

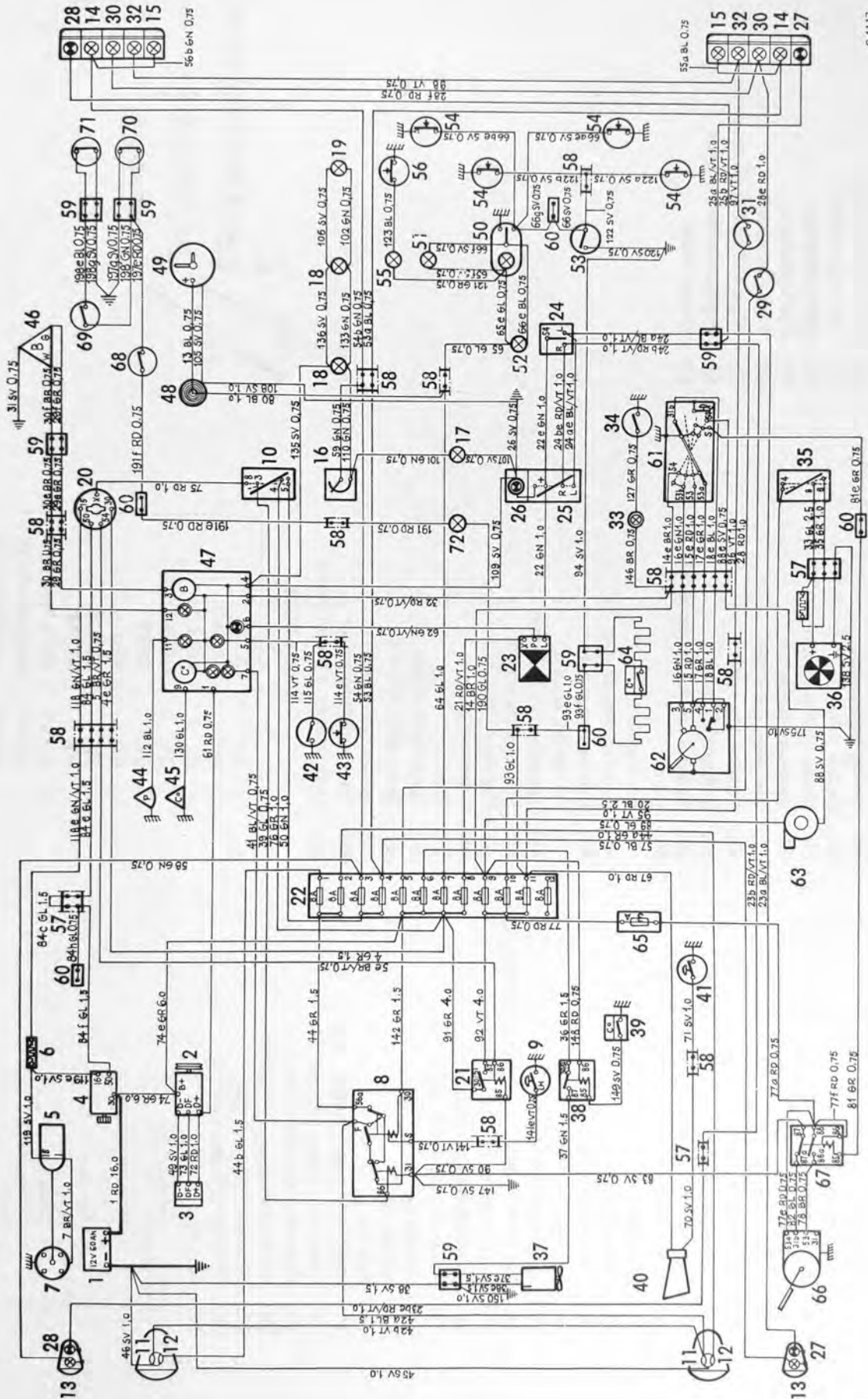
30. Stop lights
31. Back-up light contact
32. Back-up lights
33. Choke warning light
34. Choke control contact
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel level transmitter
47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater.
48. Cigarette lighter
49. Clock

50. Dome light, middle
51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 3-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper and washer system switch
62. 2-speed windshield wiper
63. Washer motor
64. Seat heating element with thermostat
65. Fuse holder, headlight cleaning device
66. Headlight wiper motor
67. Headlight wiper motor relay

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





S 4117

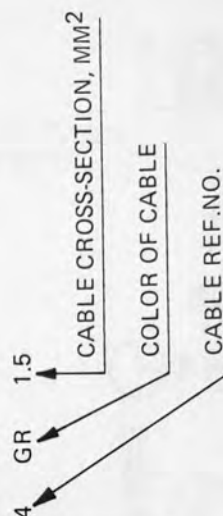
WIRING DIAGRAM L.H.D. CAR MODEL 1974
Details of wiring diagram for injection engine and automatic transmission see pages 371-42 to -43.

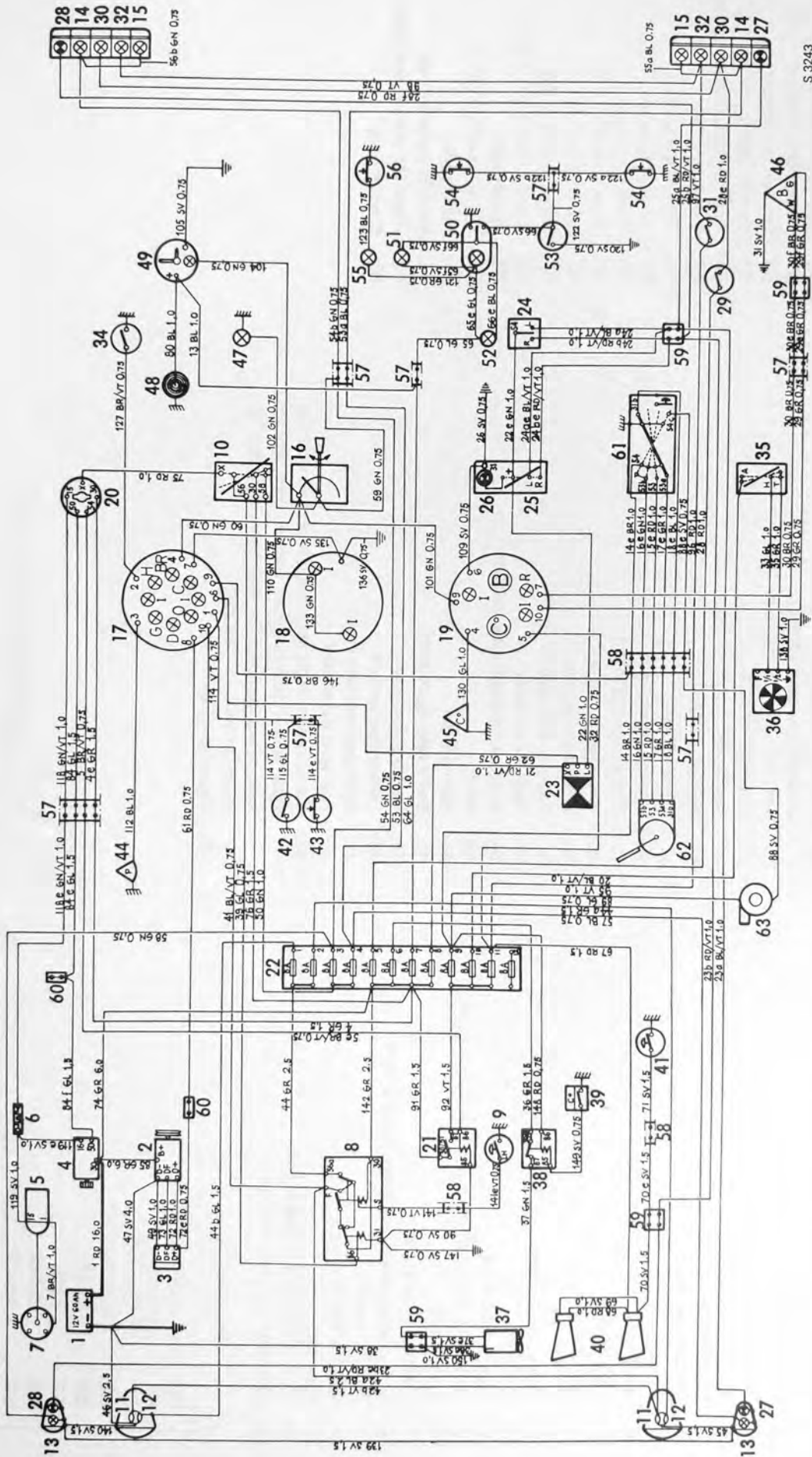
- | | | |
|--|-------------------------------------|------------------------------------|
| 1. Battery | 30. Stop lights | 55. Trunk light |
| 2. Alternator | 31. Backup light contact | 56. Trunk light contact |
| 3. Voltage regulator | 32. Backup lights | 57. 12-pin connector |
| 4. Starter motor | 34. Choke control contact | 58. 8-pin connector |
| 5. Ignition coil | 35. Ventilator fan switch | 59. 2-pin connector |
| 6. Serial resistance | 36. Ventilator fan motor | 60. 1-pin connector |
| 7. Ignition distributor | 37. Radiator fan motor | 61. Wiper and washer system switch |
| 8. Lighting relay | 38. Radiator fan relay | 62. 2-speed windshield wiper |
| 9. Headlight dimmer/flasher switch | 39. Radiator fan thermostat contact | 63. Washer motor |
| 10. Light switch | 40. Horn | |
| 11. High beam | 41. Horn contact | |
| 12. Dimmed beam | 42. Brake warning contact | |
| 13. Front parking light | 43. Handbrake contact | |
| 14. Tail light | 44. Oil warning contact | |
| 15. License plate light | 45. Temperature transmitter | |
| 16. Resistance switch, instrument panel illumination | 46. Fuel level transmitter | |
| 17. Switch light control instrument | 47. Heating control light | |
| 18. Speedometer and odometer | 48. Cigarette lighter | |
| 19. Temperature and fuel gauge | 49. Clock | |
| 20. Ignition switch | 50. Dome light, middle | |
| 21. Ignition relay | 51. Dome light, forward | |
| 22. Fuse box | 52. Ignition switch light | |
| 23. Direction indicator flasher unit | 53. Interior lighting switch | |
| 24. Direction indicator switch | 54. Door contact, interior lighting | |
| 25. Hazard warning signal switch | | |
| 26. Hazard warning signal repeater | | |
| 27. Direction indicator lights, L | | |
| 28. Direction indicator lights, R | | |
| 29. Stop light contact | | |

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE

Code	Indicator light
D	Direction indicator
G	Charge
H	High beam
BR	Brake
C	Choke
O	Oil pressure
R	Fuel
I	Instrument lighting





WIRING DIAGRAM R.H.D. CAR MODEL 1970

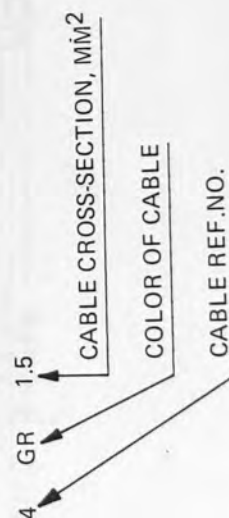
1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Resistance switch, instrument panel illumination
17. Switch light
18. Instrument panel light
19. Glove compartment and heater control light
20. Ignition switch
21. Ignition switch relay
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch

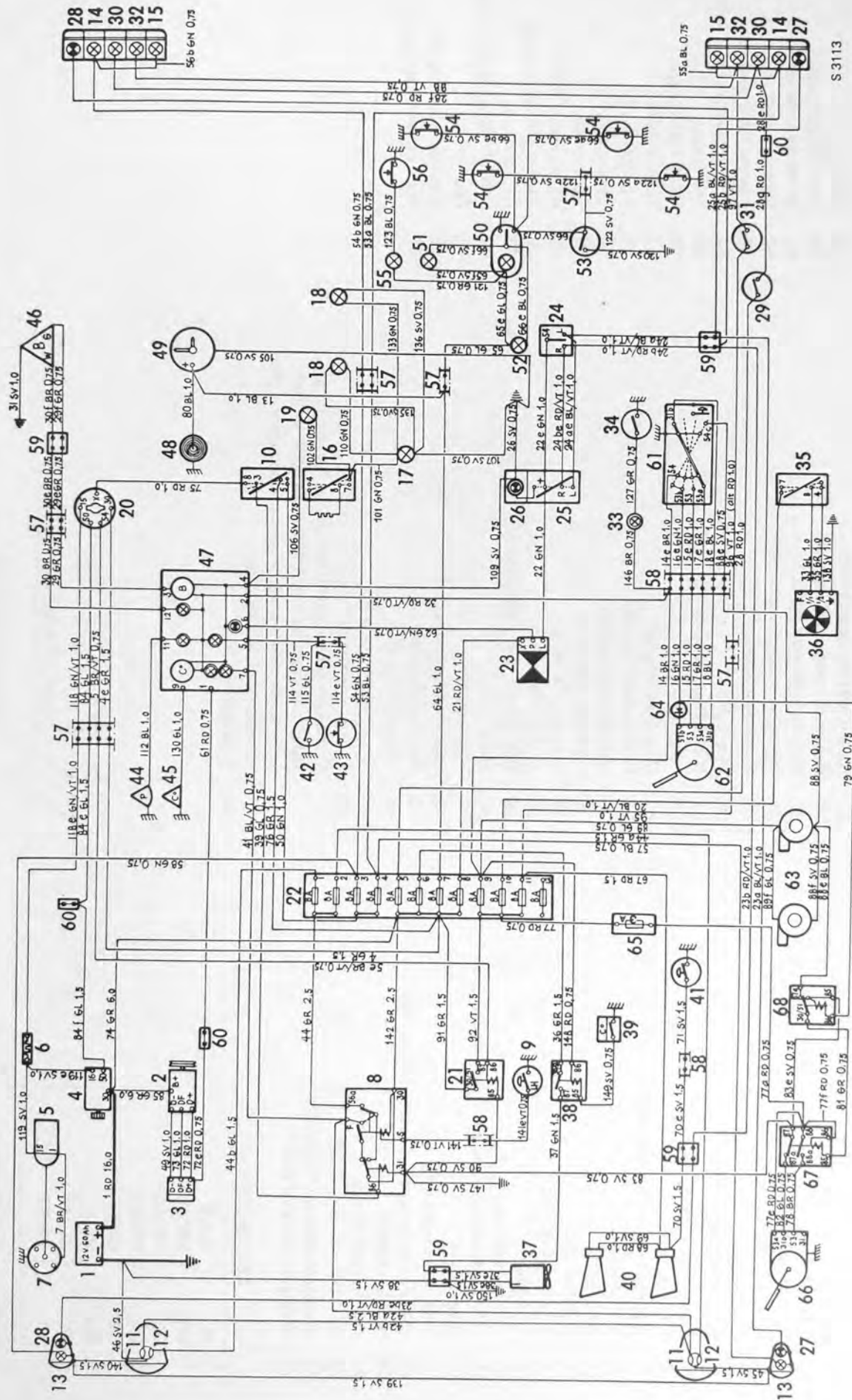
COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE

25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact
30. Stop lights
31. Backup light contact
32. Backup lights
33. Choke warning light
34. Choke control contact
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel level transmitter
47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater
48. Cigarette lighter

49. Clock
50. Dome light, middle
51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper system switch
62. 2-speed windshield wiper
63. Washer motor
64. Diode, headlight wiper
65. Fuse holder
66. Headlight wiper motor
67. Headlight wiper motor relay
68. Control relay





WIRING DIAGRAM R.H.D. CAR MODEL 1971
Details of wiring diagram for injection engine and automatic transmission see pages 371-36 to -39.

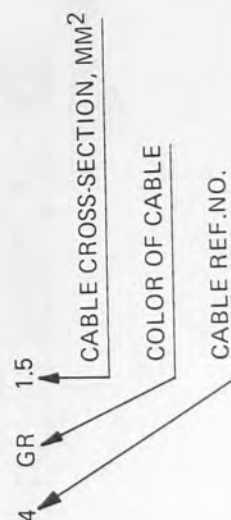
1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Resistance switch, instrument panel illumination
17. Switch light
18. Instrument panel light
19. Glove compartment and heater control light
20. Ignition switch
21. Ignition switch relay
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch

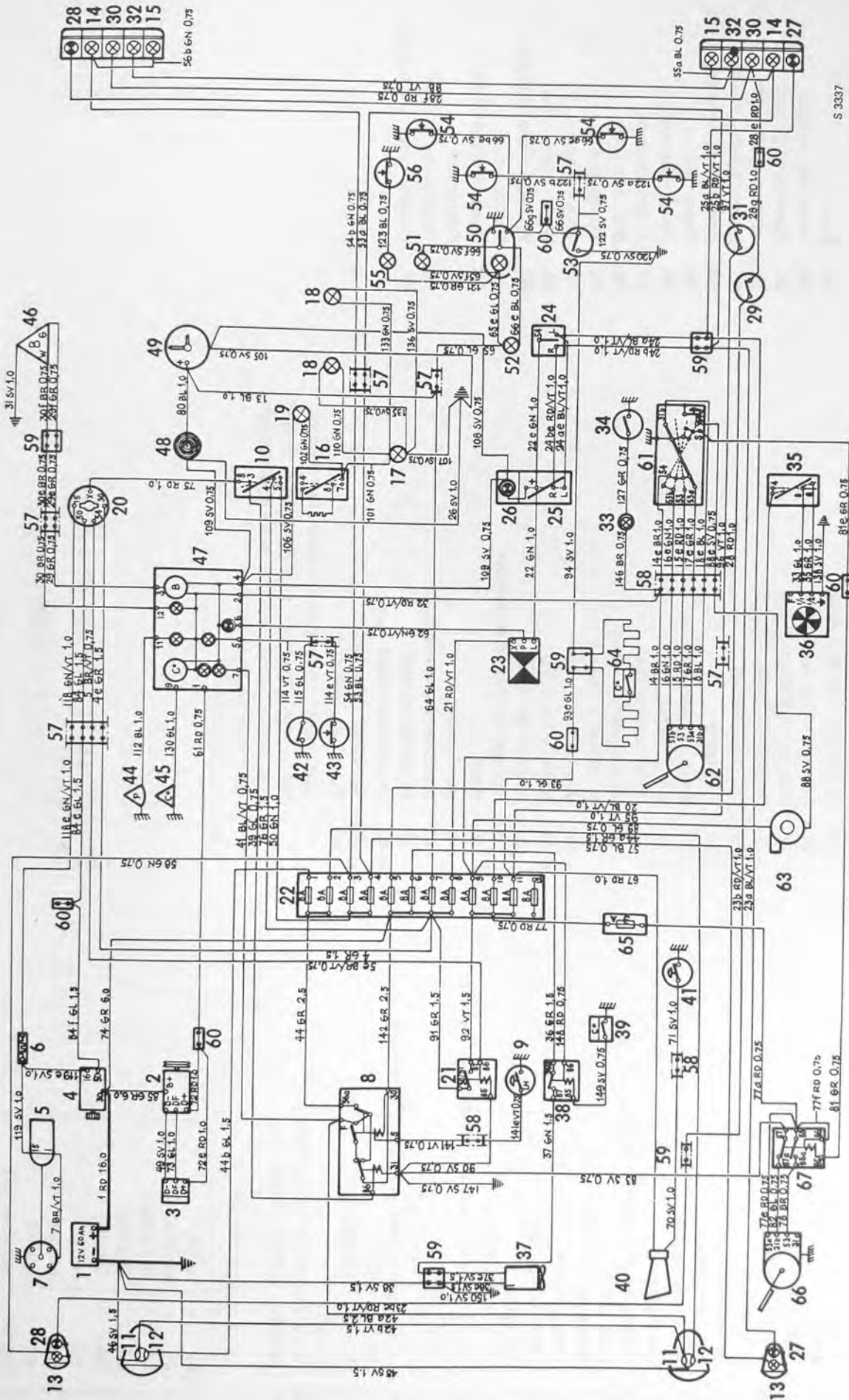
COLOR CODE

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BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE

25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact
30. Stop lights
31. Backup light contact
32. Backup lights
33. Choke warning light
34. Choke control contact
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel level transmitter
47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater
48. Cigarette lighter

49. Clock
50. Dome light, middle
51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper system switch
62. 2-speed windshield wiper
63. Washer motor
64. Seat heating element with thermostat
65. Fuse holder
66. Headlight wiper motor
67. Headlight wiper motor relay





S 3337

WIRING DIAGRAM R.H.D. CAR MODEL 1972
Details of wiring diagram for injection engine and automatic transmission see pages 371-40 to -41.

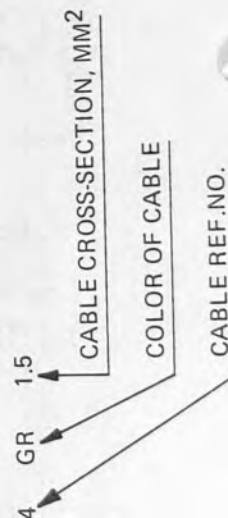
1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Resistance switch, instrument panel illumination
17. Switch light
18. Instrument panel light
19. Glove compartment and heater control light
20. Ignition switch
21. Ignition switch relay
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch

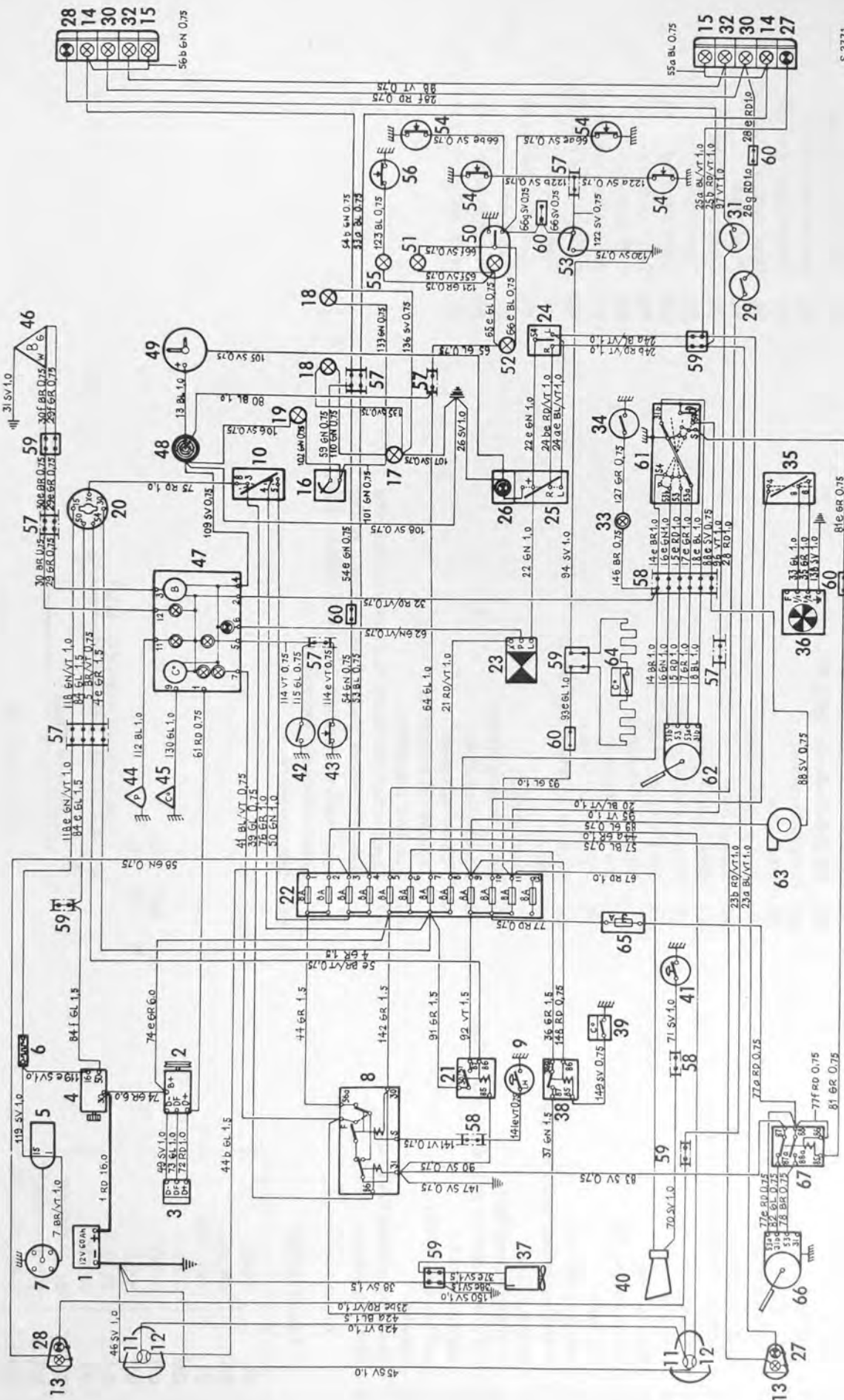
COLOR CODE

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GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE

25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact
30. Stop lights
31. Backup light contact
32. Backup lights
33. Choke warning light
34. Choke control contact
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan relay
38. Radiator fan thermostat contact
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel level transmitter
47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater
48. Cigarette lighter

49. Clock
50. Dome light, middle
51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper system switch
62. 2-speed windshield wiper
63. Washer motor
64. Diode, headlight wiper
65. Fuse holder
66. Headlight wiper motor
67. Headlight wiper motor relay





WIRING DIAGRAM R.H.D. CAR MODEL 1973
Details of wiring diagram for injection engine and automatic transmission see pages 371-42 to -43.

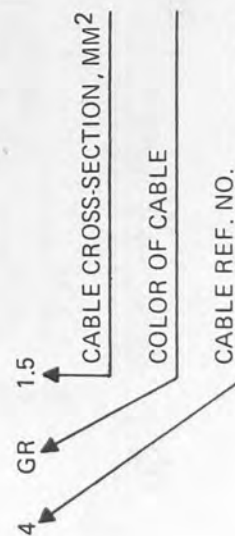
1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Resistance switch, instrument panel illumination
17. Switch light
18. Instrument panel light
19. Glove compartment and heater control light
20. Ignition switch
21. Ignition switch relay
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch

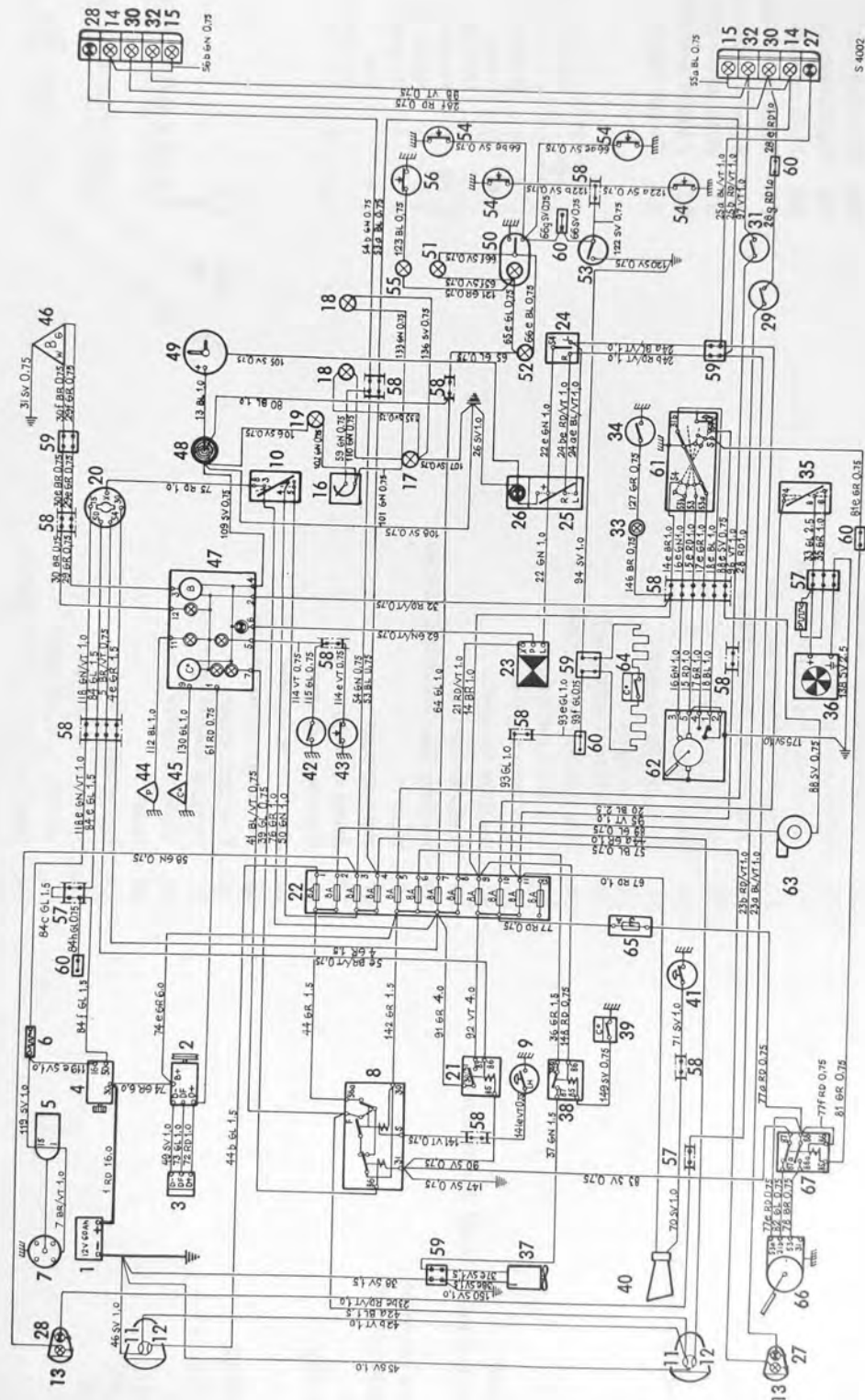
25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact
30. Stop lights
31. Backup light contact
32. Backup lights
33. Choke warning light
34. Choke control contact
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel level transmitter
47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater
48. Cigarette lighter

49. Clock
50. Dome light, middle
51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 3-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper system switch
62. 2-speed windshield wiper
63. Washer motor
64. Diode, headlight wiper
65. Fuse holder
66. Headlight wiper motor
67. Headlight wiper motor relay

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





S 4002

WIRING DIAGRAM R.H.D. CAR MODEL 1974

Details of wiring diagram for injection engine and automatic transmission see pages 371-42 to -43.

56. Trunk light contact
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper system switch
62. 2-speed windshield wiper
61. Wiper and washer system switch
62. 2-speed windshield wiper
63. Washer motor

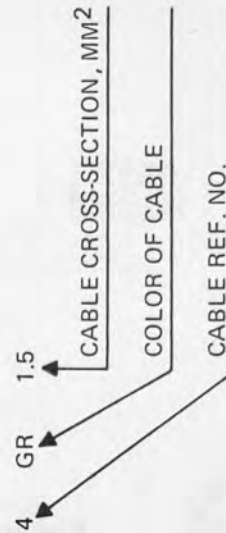
Code	Indicator light
D	Direction indicator
G	Charge
H	High beam
FB	Footbrake
B	Handbrake
O	Oil pressure
R	Fuel
I	Instrument lighting

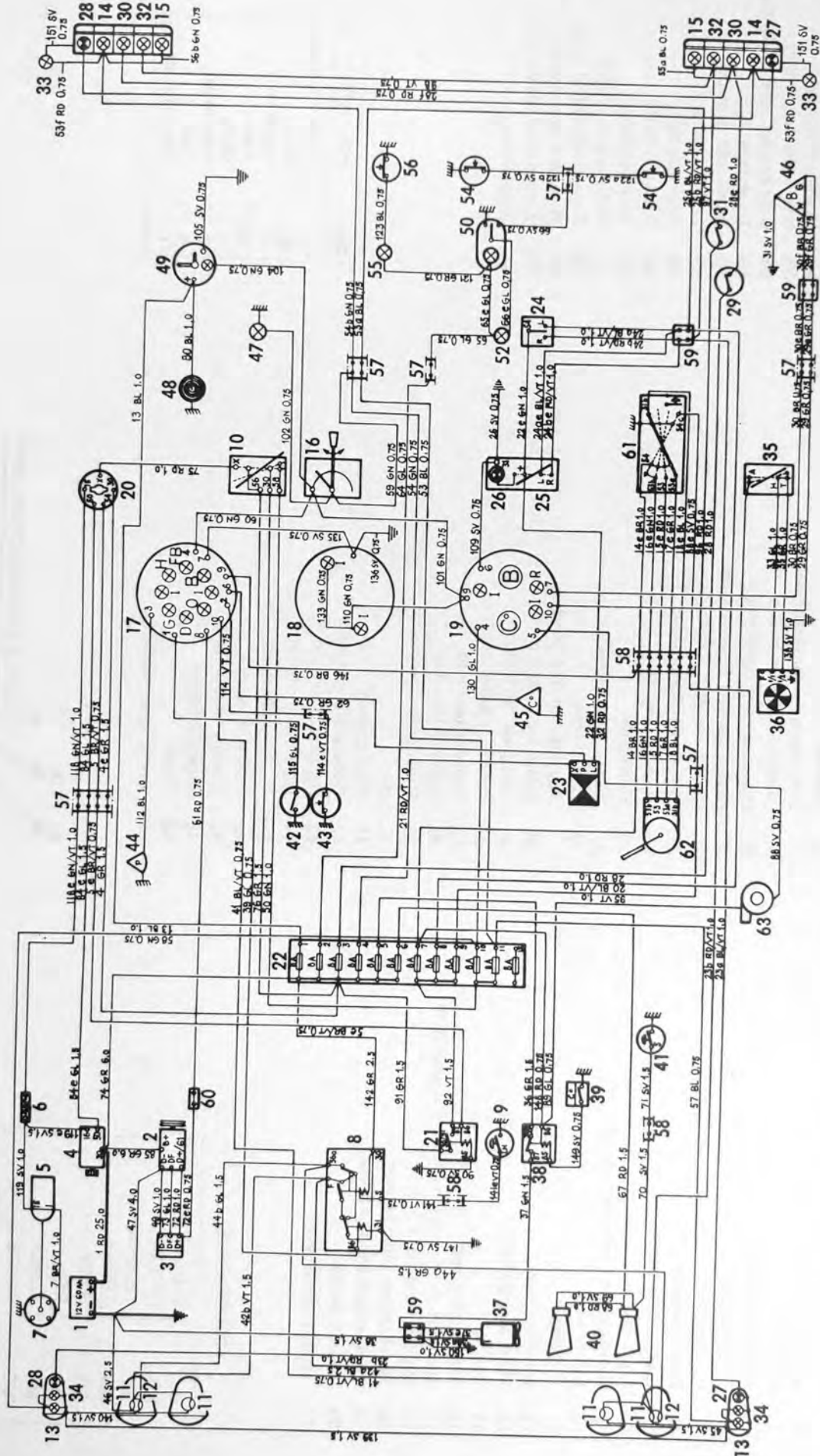
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch
25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact
30. Stop lights
31. Backup light contact
32. Backup lights
33. Side position light (rear)
34. Side position light (front)
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel tank gauge
47. Heating control light
48. Cigarette lighter
49. Clock
50. Dome light, middle
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light

1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Rheostat switch, instrument panel illumination
17. Switch light
18. Speedometer and odometer
19. Temperature and fuel gauge
20. Ignition switch
21. Ignition switch relay

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





S 3244

WIRING DIAGRAM, CARS FOR USA EXPORT MODEL 1969

1. Battery
2. Alternator
3. Voltage regulator
4. Starter motor
5. Ignition coil
6. Serial resistance
7. Ignition distributor
8. Lighting relay
9. Headlight dimmer/flasher switch
10. Light switch
11. High beam
12. Dimmed beam
13. Front parking light
14. Tail light
15. License plate light
16. Rheostat switch, instrument panel illumination
17. Control instrument
18. Speedometer and odometer
19. Temperature and fuel gauge
20. Ignition switch
21. Ignition switch relay

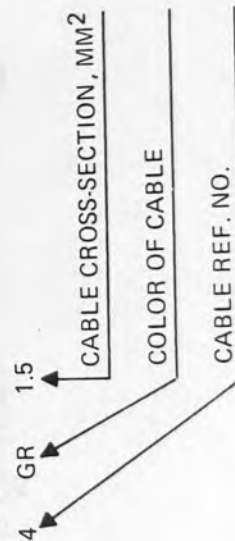
22. Fuse box
23. Direction indicator flasher unit
24. Direction indicator switch
25. Hazard warning signal switch
26. Hazard warning signal repeater
27. Direction indicator lights, L
28. Direction indicator lights, R
29. Stop light contact
30. Stop lights
31. Backup light contact
32. Backup lights
33. Side position light (rear)
34. Side position light (front)
35. Ventilator fan switch
36. Ventilator fan motor
37. Radiator fan motor
38. Radiator fan relay
39. Radiator fan thermostat contact
40. Horn
41. Horn contact
42. Brake warning contact
43. Handbrake contact
44. Oil warning contact
45. Temperature transmitter
46. Fuel tank gauge
47. Heating control light
48. Cigarette lighter
49. Clock
50. Dome light, middle

51. Dome light, forward
52. Ignition switch light
53. Interior lighting switch
54. Door contact, interior lighting
55. Trunk light
56. Trunk light contact
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
61. Wiper system switch
62. 2-speed windshield wiper
61. Wiper and washer system switch
62. 2-speed windshield wiper
63. Washer motor

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE

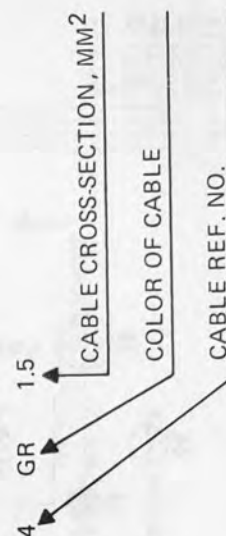
Code	Indicator light
D	Direction indicator
G	Charge
H	High beam
BR	Brake
C	Choke
O	Oil pressure
R	Fuel
I	Instrument lighting

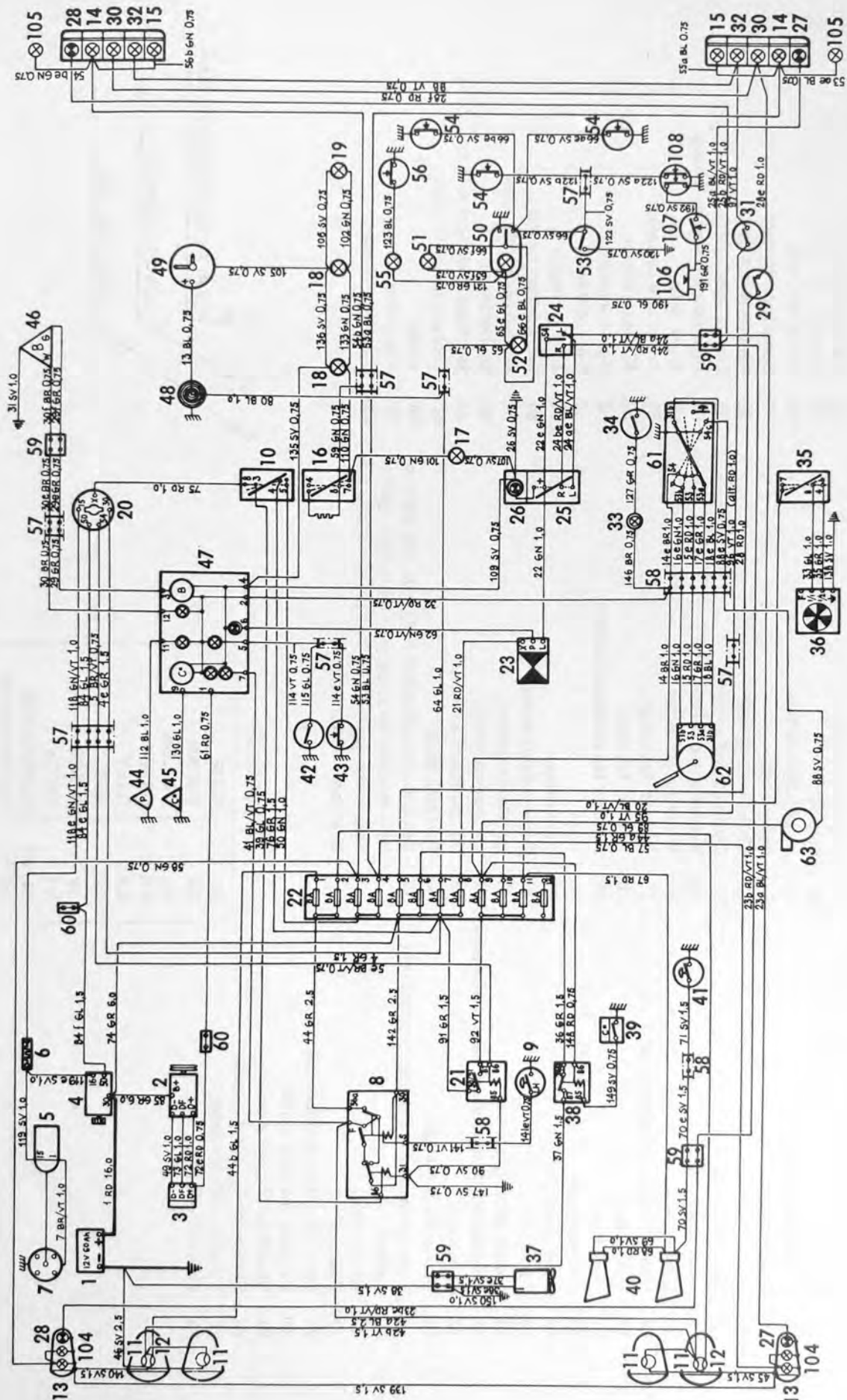


- | | | |
|---|--|-------------------------------------|
| 1. Battery | 29. Stop light contact | 48. Cigarette lighter |
| 2. Alternator | 30. Stop lights | 49. Clock |
| 3. Voltage regulator | 31. Backup light contact | 50. Dome light, side |
| 4. Starter motor | 32. Backup lights | 51. Dome light, forward |
| 5. Ignition coil | 33. Choke warning light | 52. Ignition switch light |
| 6. Serial resistance | 34. Choke control contact | 53. Interior lighting switch |
| 7. Ignition distributor | 35. Ventilator fan switch | 54. Door contact, interior lighting |
| 8. Lighting relay | 36. Ventilator fan motor | 55. Trunk light |
| 9. Headlight dimmer/flasher switch | 37. Radiator fan motor | 56. Trunk light contact |
| 10. Light switch | 38. Radiator fan relay | 57. 12-pin connector |
| 11. High beam | 39. Radiator fan thermostat contact | 58. 8-pin connector |
| 12. Dimmed beam | 40. Horn | 59. 2-pin connector |
| 13. Front parking light | 41. Horn contact | 60. 1-pin connector |
| 14. Tail light | 42. Brake warning contact | 61. Wiper system switch |
| 15. License plate light | 43. Handbrake contact | 62. 2-speed windshield wiper |
| 16. Rheostat switch, instrument panel illuminator | 44. Oil warning contact | 63. Washer motor |
| 17. Switch light | 45. Temperature transmitter | 104. Side position light (front) |
| 18. Instrument panel light | 46. Fuel tank gauge | 105. Side position light (rear) |
| 19. Glove compartment and heater control light | 47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater | 106. Buzzer |
| 20. Ignition | | 107. Key contact (buzzer) |
| 21. Ignition relay | | 108. 2-pin door contact |
| 22. Fuse box | | |
| 23. Direction indicator flasher unit | | |
| 24. Direction indicator switch | | |
| 25. Hazard warning signal switch | | |
| 26. Hazard warning signal repeater | | |
| 27. Direction indicator lights, L | | |
| 28. Direction indicator lights, R | | |

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





S 2912

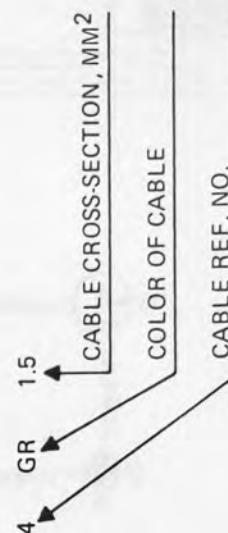
WIRING DIAGRAM, CARS FOR USA EXPORT MODEL 1971, CARBURETOR ENGINE

Details for wiring diagram for injection engine and automatic
transmission see pages 371—36 to —39.

- | | | |
|--|--|--|
| 1. Battery | 29. Stop light contact | 48. Cigarette lighter |
| 2. Alternator | 30. Stop lights | 49. Clock |
| 3. Voltage regulator | 31. Backup light contact | 50. Dome light, side |
| 4. Starter motor | 32. Backup lights | 51. Dome light, forward |
| 5. Ignition coil | 33. Choke warning light | 52. Ignition switch light |
| 6. Serial resistance | 34. Choke control contact | 53. Interior lighting switch |
| 7. Ignition distributor | 35. Ventilator fan switch | 54. Door contact, interior lighting |
| 8. Lighting relay | 36. Ventilator fan motor | 55. Trunk light |
| 9. Headlight dimmer/flasher switch | 37. Radiator fan relay | 56. Trunk light contact |
| 10. Light switch | 38. Radiator fan motor | 57. 12-pin connector |
| 11. High beam | 39. Radiator fan thermostat contact | 58. 8-pin connector |
| 12. Dimmed beam | 40. Horn | 59. 2-pin connector |
| 13. Front parking light | 41. Horn contact | 60. 1-pin connector |
| 14. Tail light | 42. Brake warning contact | 61. Wiper system switch |
| 15. License plate light | 43. Handbrake contact | 62. 2-speed windshield wiper |
| 16. Rheostat switch, instrument panel illumination | 44. Oil warning contact | 63. Washer motor |
| 17. Switch light | 45. Temperature transmitter | 64. Seat heating element with thermostat |
| 18. Instrument panel light | 46. Fuel tank gauge | 105. Side position light (rear) |
| 19. Glove compartment and heater control light | 47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater | 106. Buzzer |
| 20. Ignition | | 107. Key contact (buzzer) |
| 21. Ignition relay | | 108. 2-pin door contact |
| 22. Fuse box | | |
| 23. Direction indicator flasher unit | | |
| 24. Direction indicator switch | | |
| 25. Hazard warning signal switch | | |
| 26. Hazard warning signal repeater | | |
| 27. Direction indicator lights, L | | |
| 28. Direction indicator lights, R | | |

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





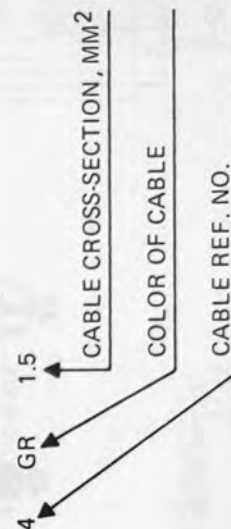
transmission see pages 371–40 to –41.

Wiring diagram, cars for USA export model 1973, carburetor engine

1. Battery	29. Stop light contact	48. Cigarette lighter
2. Alternator	30. Stop lights	49. Clock
3. Voltage regulator	31. Backup light contact	50. Dome light, side
4. Starter motor	32. Backup lights	51. Dome light, forward
5. Ignition coil	33. Choke warning light	52. Ignition switch light
6. Serial resistance	34. Choke control contact	53. Interior lighting switch
7. Ignition distributor	35. Ventilator fan switch	54. Door contact, interior lighting
8. Lighting relay	36. Ventilator fan motor	55. Trunk light
9. Headlight dimmer/flasher switch	37. Radiator fan motor	56. Trunk light contact
10. Light switch	38. Radiator fan relay	57. 12-pin connector
11. High beam	39. Radiator fan thermostat contact	58. 8-pin connector
12. Dimmed beam	40. Horn	59. 2-pin connector
13. Front parking light	41. Horn contact	60. 1-pin connector
14. Tail light	42. Brake warning contact	61. Wiper system switch
15. License plate light	43. Handbrake contact	62. 2-speed windshield wiper
16. Rheostat switch, instrument panel illumination	44. Oil warning contact	63. Washer motor
17. Switch light	45. Temperature transmitter	64. Seat heating element with thermostat
18. Instrument panel light	46. Fuel tank gauge	105. Side position light (rear)
19. Glove compartment and heater control light	47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater	106. Buzzer
20. Ignition		107. Key contact (buzzer)
21. Ignition relay		108. 2-pin door contact
22. Fuse box		
23. Direction indicator flasher unit		
24. Direction indicator switch		
25. Hazard warning signal switch		
26. Hazard warning signal repeater		
27. Direction indicator lights, L		
28. Direction indicator lights, R		

COLOR CODE

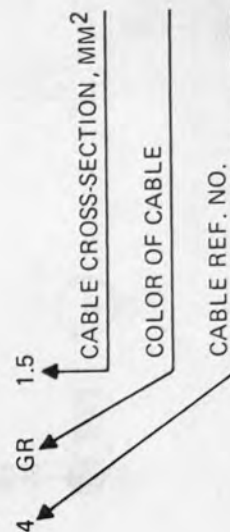
BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE

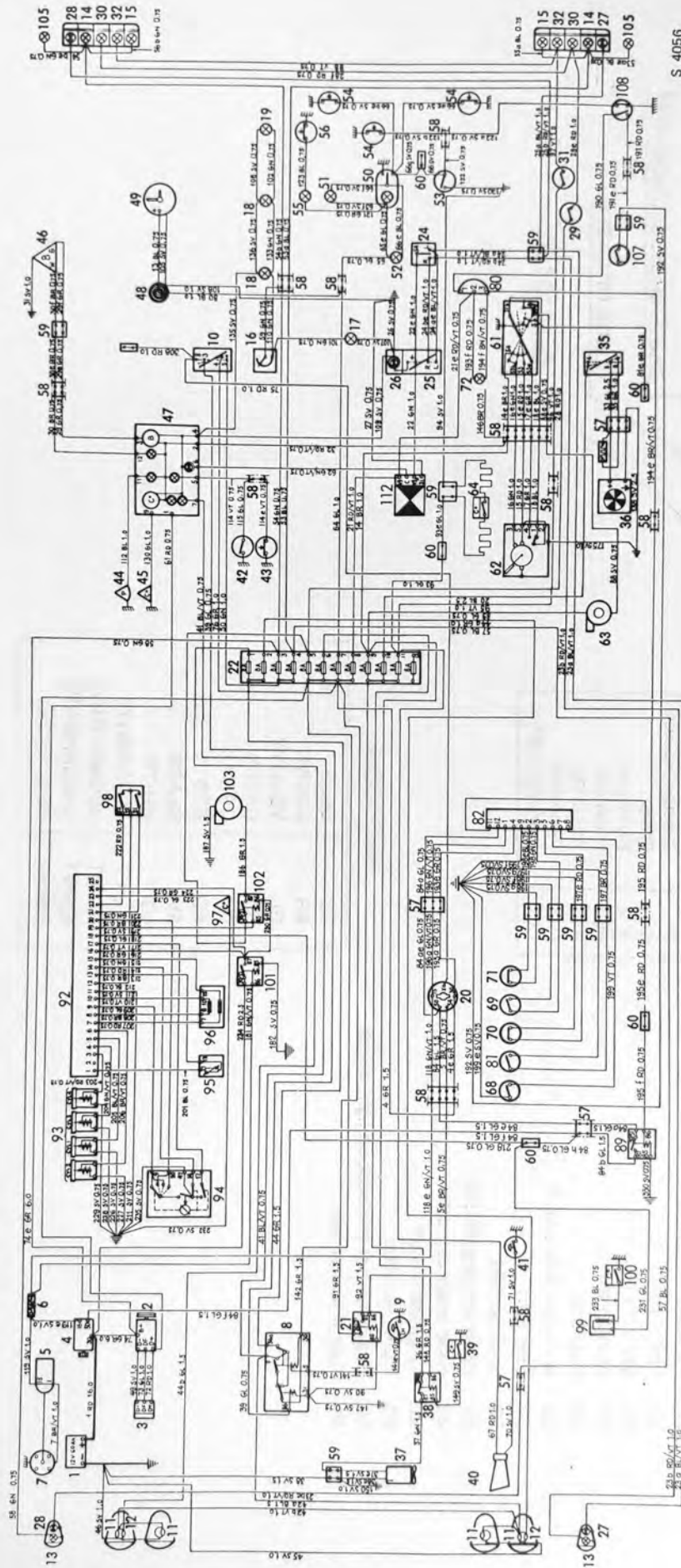


1. Battery	29. Stop light contact	48. Cigarette lighter
2. Alternator	30. Stop lights	49. Clock
3. Voltage regulator	31. Backup light contact	50. Dome light, side
4. Starter motor	32. Backup lights	51. Dome light, forward
5. Ignition coil	33. Choke warning light	52. Ignition switch light
6. Serial resistance	34. Choke control contact	53. Interior lighting switch
7. Ignition distributor	35. Ventilator fan switch	54. Door contact, interior lighting
8. Lighting relay	36. Ventilator fan motor	55. Trunk light
9. Headlight dimmer/flasher switch	37. Radiator fan motor	56. Trunk light contact
10. Light switch	38. Radiator fan relay	57. 12-pin connector
11. High beam	39. Radiator fan thermostat contact	58. 8-pin connector
12. Dimmed beam	40. Horn	59. 2-pin connector
13. Front parking light	41. Horn contact	60. 1-pin connector
14. Tail light	42. Brake warning contact	61. Wiper system switch
15. License plate light	43. Handbrake contact	62. 2-speed windshield wiper
16. Rheostat switch, instrument panel illuminator	44. Oil warning contact	63. Washer motor
17. Switch light	45. Temperature transmitter	64. Seat heating element with thermostat
18. Instrument panel light	46. Fuel tank gauge	105. Side position light (rear)
19. Glove compartment and heater control light	47. Combination instrument: fuel gauge, fuel warning light, temperature gauge, oil warning light, ignition light, brake warning light, high beam indicator light, direction indicator repeater	106. Buzzer
20. Ignition		107. Key contact (buzzer)
21. Ignition relay		108. 2-pin door contact
22. Fuse box		
23. Direction indicator flasher unit		
24. Direction indicator switch		
25. Hazard warning signal switch		
26. Hazard warning signal repeater		
27. Direction indicator lights, L		
28. Direction indicator lights, R		

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





S 4056

WIRING DIAGRAM, CARS FOR USA EXPORT MODEL 1974 CARBURETOR ENGINE

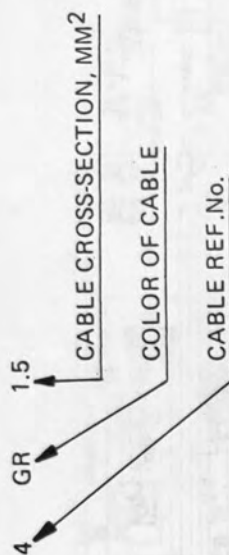
Details of wiring diagram for injection engine and
automatic transmission see pages 371-42 to -43.

Details of wiring diagram for cars with injection engine and automatic gear box as from model 1970

Other electrical connections, see wiring diagram for the respective year model.

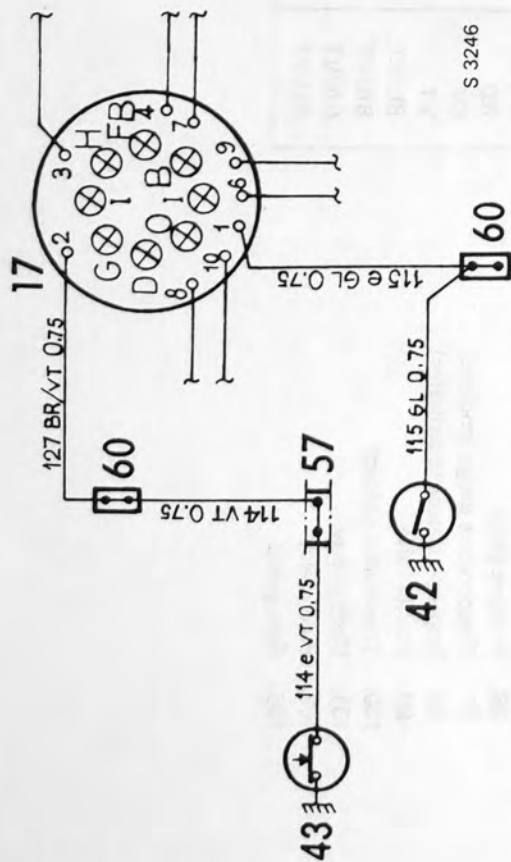
- 4. Starter motor
- 14. Tail light
- 15. Licence plate light
- 17. Control instrument
- 20. Ignition switch
- 22. Fuse box
- 28. Direction indicator, R
- 30. Stop light
- 32. Back-up light
- 42. Brake warning contact
- 43. Hand brake contact
- 57. 12-pin connector
- 60. 1-pin connector
- 90. Start inhibitor and back-up light switch
- 91. Gear indicator light

Code	Indicator light
D	Direction indicator
G	Charge
H	High beam
FB	Footbrake
B	Handbrake
O	Oil pressure
I	Instrument lighting



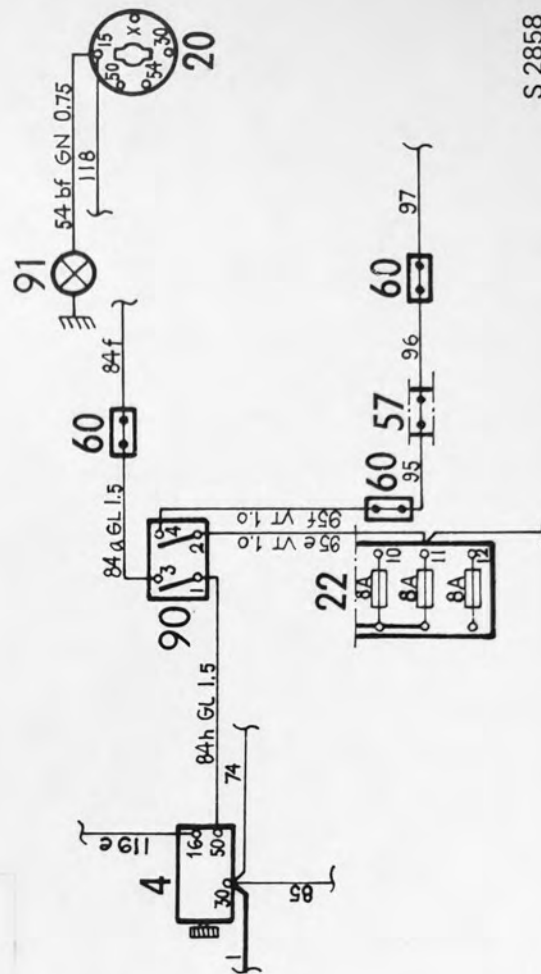
COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE



DETAIL OF WIRING DIAGRAM, FUEL INJECTION ENGINE,
ONLY MODEL 1970

S 3246



DETAIL OF WIRING DIAGRAM, AUTOMATIC GEAR BOX,
ONLY MODEL 1970

S 3247

S 2858

DETAIL OF WIRING DIAGRAM, CARBURETOR ENGINE
AND AUTOMATIC GEAR BOX AS FROM MODEL 1971

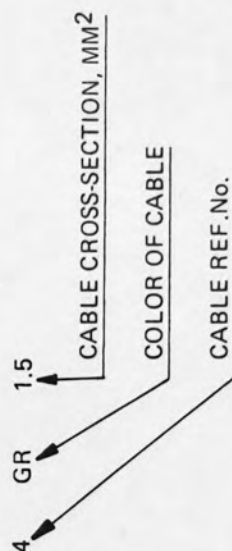
Details of wiring diagram for cars with injection engine and automatic gear box models 1970 and 1971

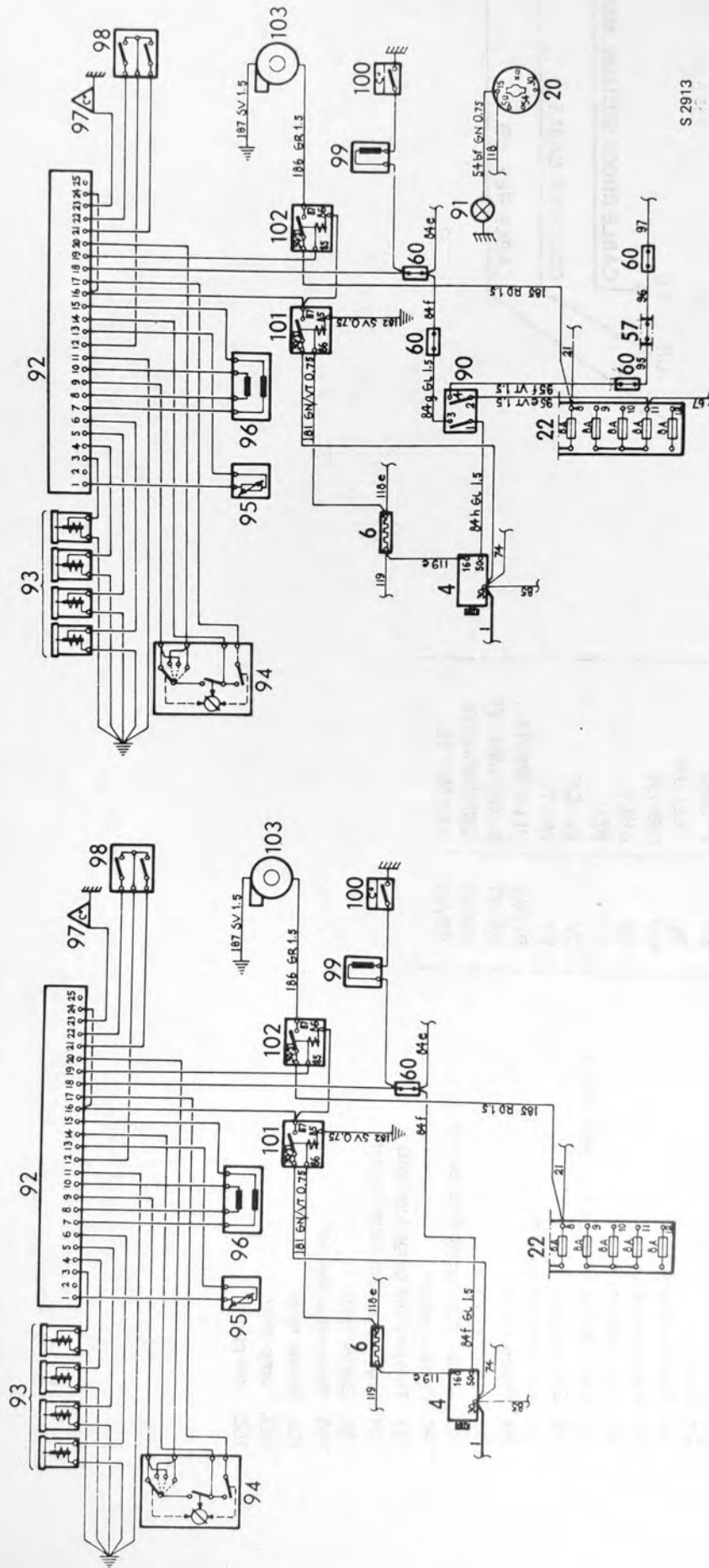
Other electrical connections, see wiring diagram for the respective year model.

- 4. Starter motor
- 6. Serial resistance
- 22. Fuse box
- 57. 12-pin connector
- 60. 1-pin connector
- 90. Start inhibitor and back-up light switch
- 91. Gear indicator light
- 92. Injection system control
- 93. Injection valve
- 94. Throttle contact
- 95. Temperature gauge (induction)
- 96. Pressure gauge
- 97. Temperature gauge (coolant)
- 98. Impulse contact (distributor)
- 99. Starter valve
- 100. Thermostat contact
- 101. Master relay
- 102. Pump relay
- 103. Fuel pump

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





S 2913

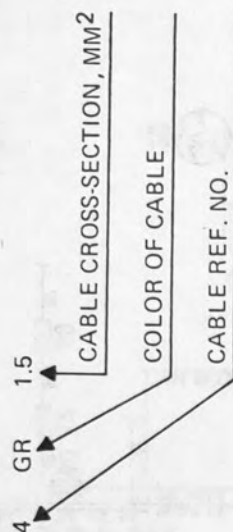
DETAIL OF WIRING DIAGRAM, INJECTION ENGINE WITH
AUTOMATIC TRANSMISSION, MODEL 1970-1971

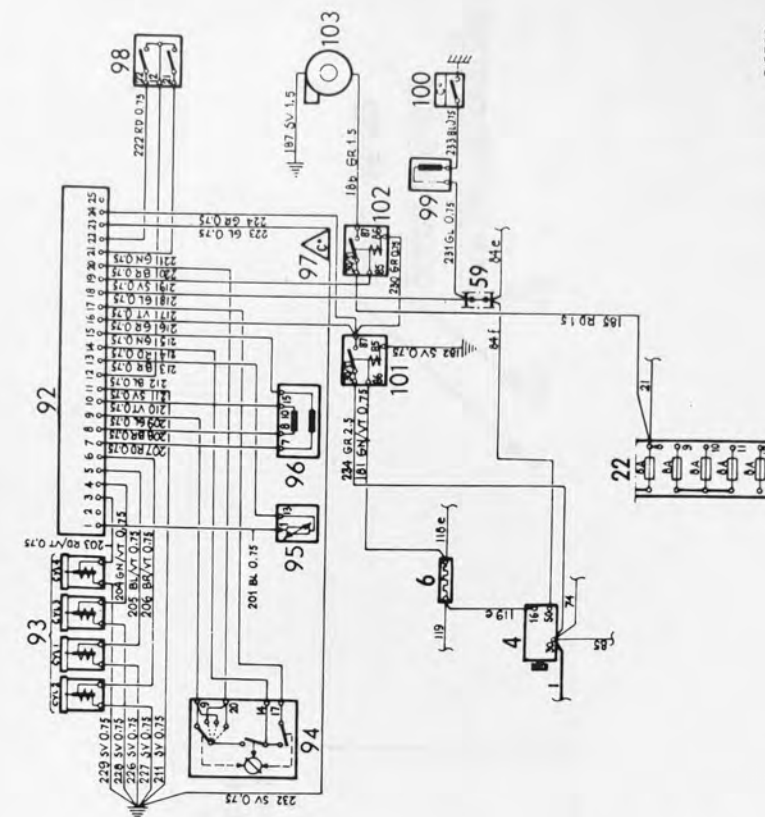
DETAIL OF WIRING DIAGRAM, INJECTION ENGINE WITH
MANUAL TRANSMISSION, MODEL 1970-1971

COLOR CODE

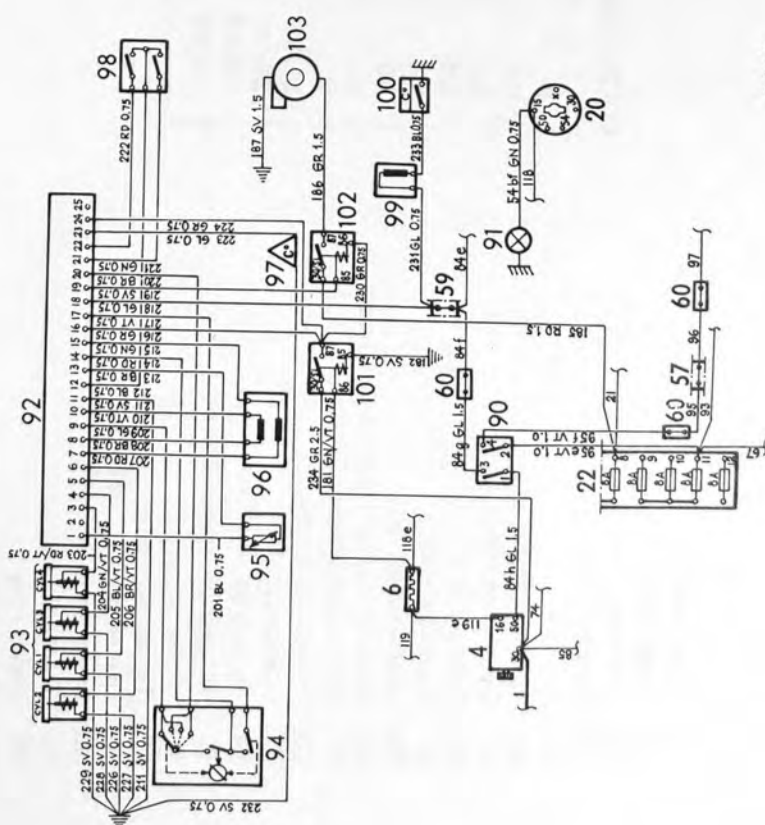
BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE

4. Starter motor
6. Serial resistance
20. Ignition switch
22. Fuse box
57. 12-pin connector
59. 2-pin connector
60. 1-pin connector
90. Start inhibitor and back-up light switch
91. Gear indicator light
92. Injector system control
93. Injector valve
94. Throttle contact
95. Temperature gauge (induction)
96. Pressure gauge
97. Temperature gauge (coolant)
98. Impulse contact (distributor)
99. Starter valve
100. Thermostat contact
101. Master relay
102. Pump relay
103. Fuel pump





S 3506

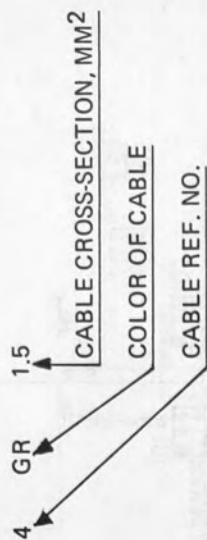


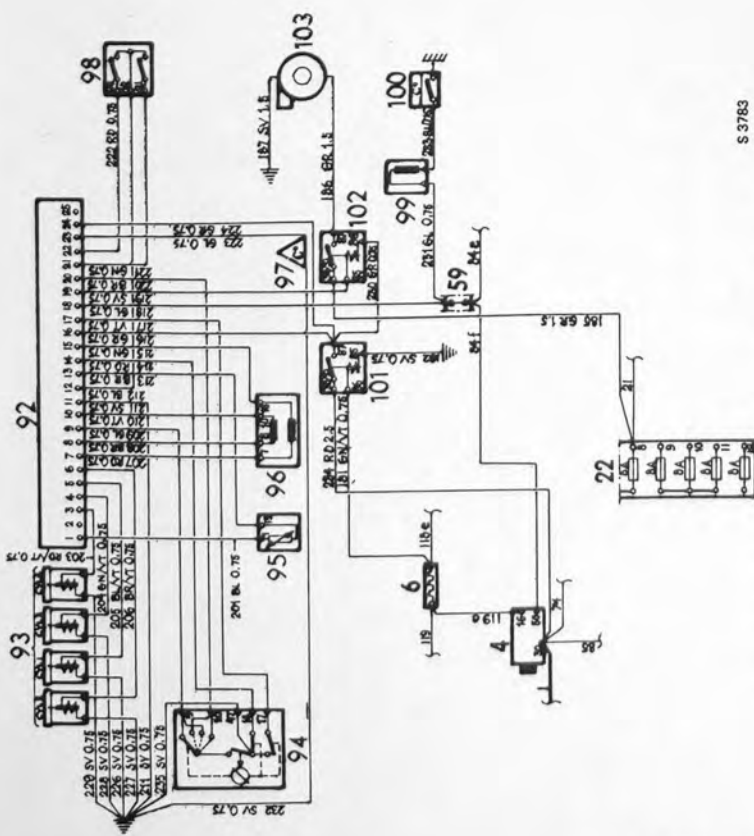
S 3493

4. Starter motor
5. Ignition coil
6. Serial resistance
20. Ignition switch
22. Fuse box
57. 12-pin connector
58. 8-pin connector
59. 2-pin connector
60. 1-pin connector
89. Start inhibitor relay
90. Start inhibitor and back-up light switch
91. Gear indicator light
92. Injector system control
93. Injector valve
94. Throttle contact
95. Temperature gauge (induction)
96. Pressure gauge
97. Temperature gauge (coolant)
98. Impulse contact (distributor)
99. Starter valve
100. Thermostat contact
101. Master relay
102. Pump relay
103. Fuel pump
110. Tachometer

COLOR CODE

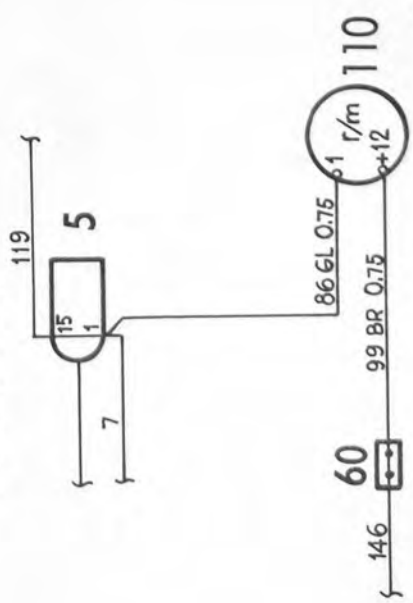
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BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE





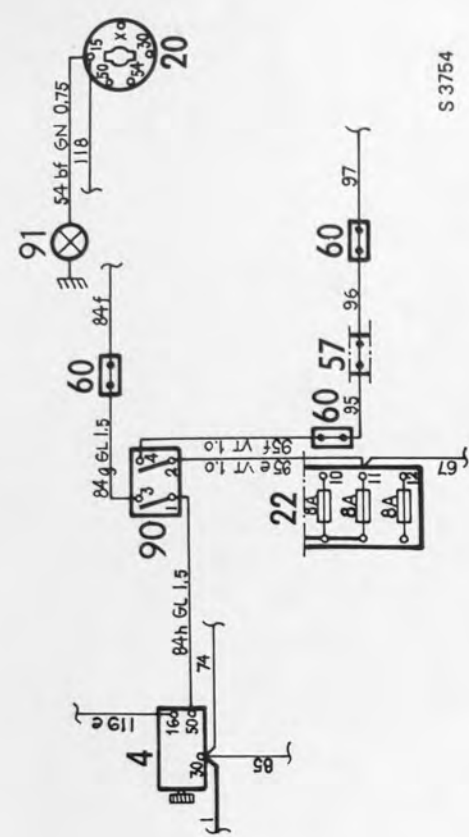
DETAILS OF WIRING DIAGRAM, CARS WITH INJECTION ENGINE, MODELS 1973-1974

S 3763



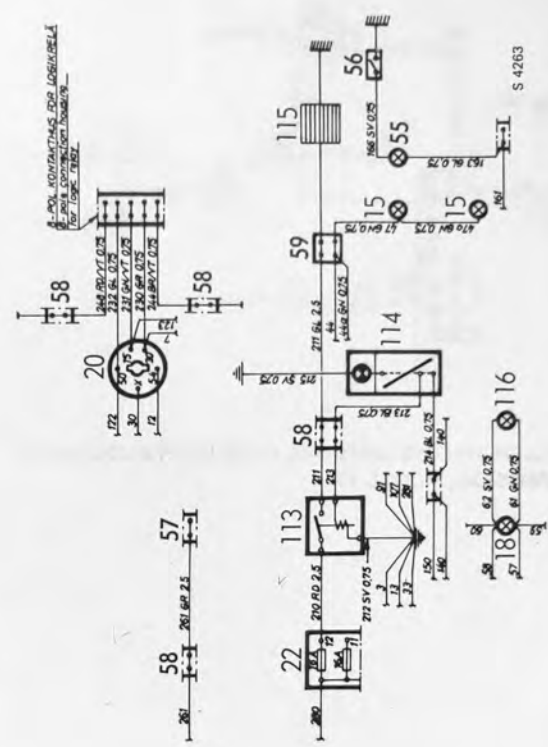
S 3755

DETAILS OF WIRING DIAGRAM, SAAB 99 COMBI COUPE



S 3754

DETAILS OF WIRING DIAGRAM, CARS WITH AUTOMATIC TRANSMISSION, MODEL 1973



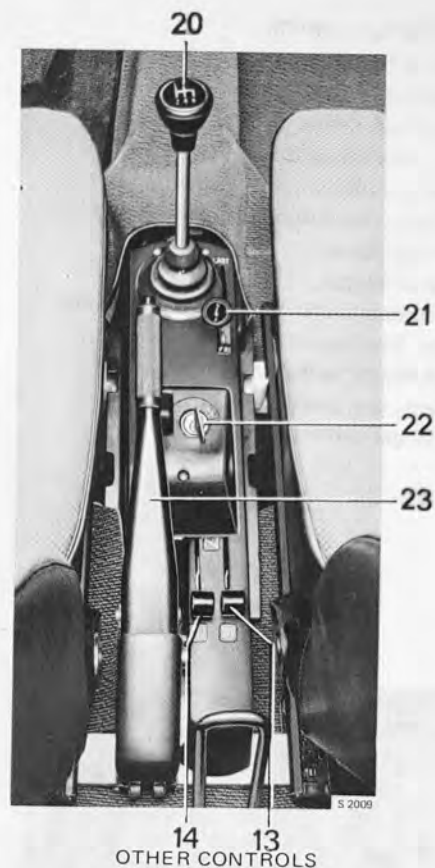
S 4263

DETAILS OF WIRING DIAGRAM, SAAB 99 COMBI COUPE



INSTRUMENTS AND CONTROLS MODEL 1969

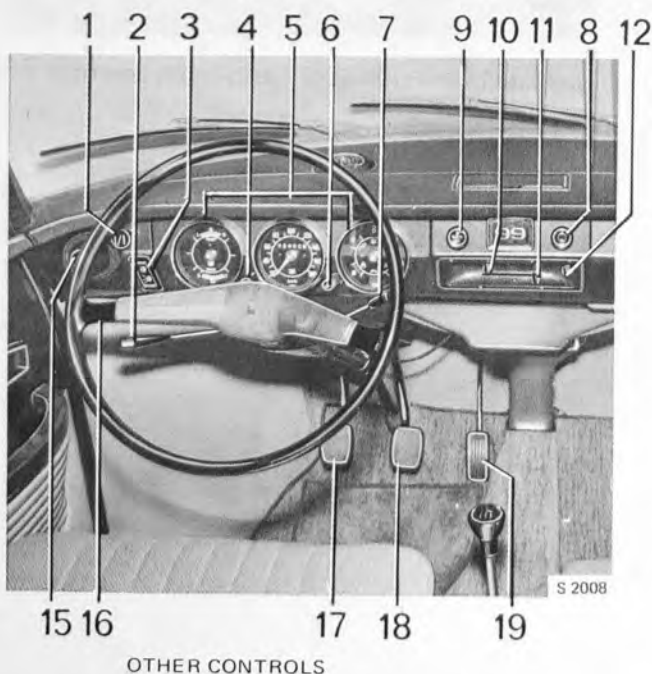
1. Choke.
2. Direction indicator lever, headlight dimmer and flasher switch.
3. Headlight and parking light switch.
4. Hazard warning signal switch.
5. Instruments.
6. Instrument lighting rheostat.
7. Windshield wiper and washer and horn control lever.
8. Spare switch for extra equipment.
9. Heater fan switch.
10. Defroster control for windshield and front side windows.
11. Temperature control.
12. Ventilation control for front seat floor.
13. Defroster control for rear window.
14. Ventilation control for back seat floor.
15. Fresh air blowers, adjustable.
16. Hood lock release handle.
17. Clutch pedal.
18. Brake pedal.
19. Accelerator pedal.
20. Gear lever.
21. Free wheel control.
22. Ignition switch and gear lever lock.
23. Handbrake lever.



The various controls and instruments are described in the following section except where reference is made to other parts of the manual. Numbers refer to the table above and the illustrations.

2. Direction indicator lever, headlight dimmer and flasher switch.

The left direction indicators flash when the lever is moved down and the right direction indicators when



COMBINED DIRECTION INDICATOR LEVER AND HEADLIGHT DIMMER AND FLASHER SWITCH

1. Left direction indicator
2. Right direction indicator
3. Headlight dimmer and flasher switch

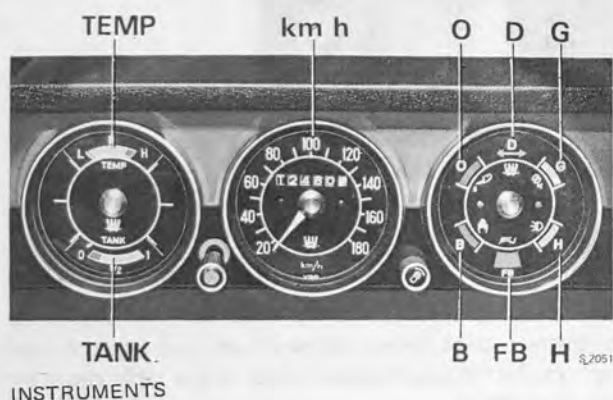
it is moved up. Pulling the lever towards the steering wheel shifts the headlights from low to high beam or vice versa, this action also flashes the high beam when the main headlight switch is off.

3. Headlight and parking light switch.

Flicking the switch to first position turns on side and tail lights independently of the ignition. Flicking to second position turns on the headlights as well, but only if the ignition is switched to G, K or S. The switch plate lies flush with the instrument panel when in the headlights on position; this reduces the risk of accidentally switching off the lights

4. Hazard warning signal switch.

All four direction indicators flash together when this switch is pulled out. The hazard warning signal must only be used when the car is stalled in the roadway, e.g. after an accident, in a position where it is liable to obstruct or endanger other vehicles.



5. Instruments

TEMP Temperature gauge for engine coolant. The green indicates normal running temperature.

TANK Fuel gauge. The fuel warning light comes on when there are less than 2 US gallons (1.75 Imp. gal, 8 liters) left in the tank.

MPH Speedometer and odometer. The speedometer is graduated in mph and the odometer shows the total mileage of the vehicle.

O. Oil pressure warning light. Glows red to indicate dangerously low oil pressure or oil level. If it lights up when the car is on the move, the engine must be switched off at once and the cause investigated.

D. Direction indicator repeater light. Flashes green in time with the direction indicators.

G. Charge indicator light. If this light glows yellow, the alternator is not charging.

B. Handbrake warning light. Glows red when handbrake is on.

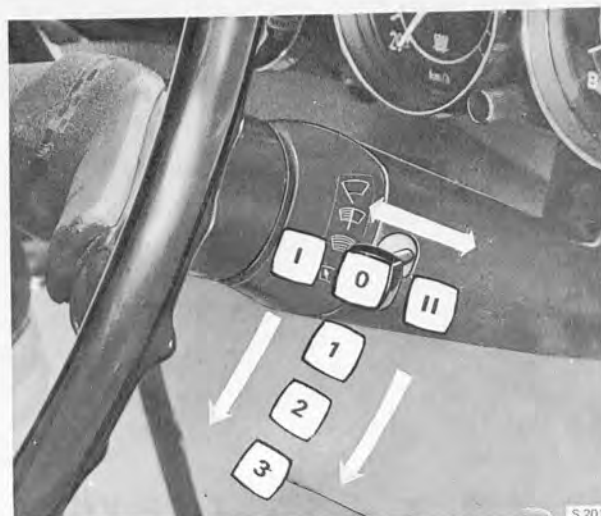
FB. Footbrake warning light. Glows red to indicate excessive pedal stroke. The cause may be leakage from one of the two brake line circuits. (Wear on brake blocks is indicated by increased pedal pressure.) If this light lights up, investigate the cause of the trouble and repair the break if any.

H. High beam indicator light. Glows blue when the headlights are on high beam.

An electric clock is available as an optional accessory. It fits in place of the »99« emblem.

6. Instrument lighting rheostat. Turning the button regulates the intensity of illumination. This switch operates when the outside lights are on.

7. Windshield wiper/washer and horn control lever (see illustration)



WINDSHIELD WIPER/WASHER AND HORN CONTROL LEVER

I. Horn

II. Windshield washer

0. Neutral

1. Windshield wipers, half speed

2. Windshield wipers, full speed

3. Windshield wipers, full speed + washer

9. Heater fan switch. The fan has two speeds, half speed at the first switch position and full speed with the switch pulled right out. The fan motor also has summer and winter settings.

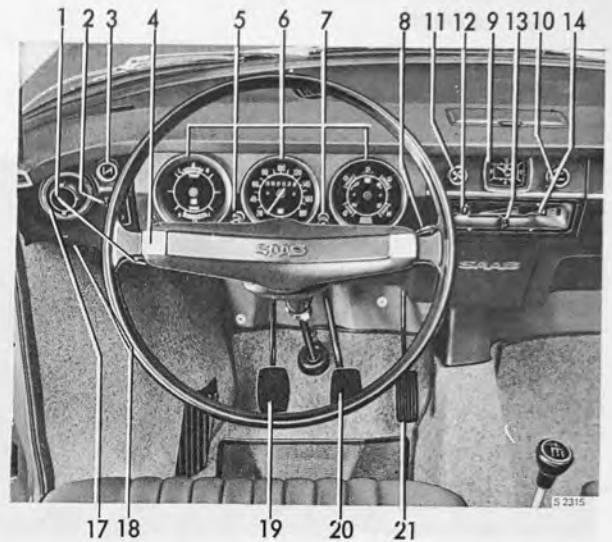


FRONT SEAT HEATING AND VENTILATION CONTROLS

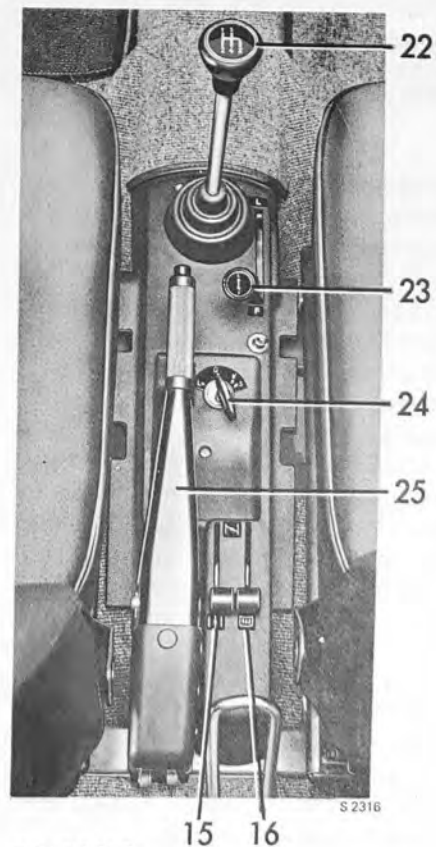
- ⊕ Heater fan switch
- ↑ Windshield defroster control
- ↓ Ventilation control, front seat floor
- T Temperature control
- Red Open or hot position
- Blue Closed or cold position

INSTRUMENTS AND CONTROLS MODEL 1970

1. Direction indicator lever, headlight dimmer and flasher switch
2. Headlight and parking light switch
3. Choke
4. Horn button
5. Hazard signal switch
6. Instruments and warning lights
7. Instrument lighting rheostat
8. Windshield wiper and washer switch
9. Clock
10. Cigarette lighter
11. Ventilator fan switch
12. Defroster control for windshield and front side windows
13. Temperature control
14. Ventilation control for front seat floor
15. Ventilation control for back seat floor
16. Defroster control for rear window
17. Fresh air vent, adjustable
18. Hood lock release handle
19. Clutch pedal
20. Brake pedal
21. Accelerator pedal
22. Gear lever
23. Free wheel control
24. Ignition switch and gear lever lock
25. Handbrake lever



CONTROLS AND INSTRUMENTS



CONTROLS

1. Combined direction indicator lever and headlight dimmer and flasher switch.

To signal a turn, move the lever down for left, up for right.

When the headlights are switched off, you can flash the high beam by pulling the lever towards the steering wheel.

When the headlights are switched off, you can flash the high beam by pulling the lever towards the steering wheel.

When the headlights are on, pulling the lever towards the wheel shifts the beam from high to dimmed or vice versa.



S 2317

TURN INDICATOR CONTROL LEVER, HEADLIGHT DIPPER AND FLASHER

1. Left direction indicator
2. Right direction indicator
3. Dim or flash headlights

2. Headlight and parking light switch.

Flicking the switch to first position turns on the parking lights, irrespective of the ignition switch position. Flicking to second position turns on the headlights as well, but only if the ignition key is at "G" or "K". In this second position the switch plate is flush with the instrument panel, which minimizes the risk of accidentally switching off the headlights in the dark.

NOTE! If the headlights are already on, i.e. if the light switch is in second position, when the ignition key is turned to "L", all lights will be extinguished. If for any reason you want to have the parking lights on while the ignition switch is in position "L", the light switch must be returned to first position.

5. Hazard warning signal switch. All direction indicator lights flash together when the button is pulled out. The hazard warning signal must only be used when the vehicle is stalled in the roadway, e.g. after an accident or breakdown, in a position where it is liable to endanger or obstruct traffic.



S 2318

INSTRUMENTS AND INDICATOR LIGHTS

6. Instruments and indicator lights.

TEMP Temperature gauge for engine coolant. The green zone indicates normal running temperature.

TANK Fuel gauge. The fuel warning light comes on when there are less than 1 3/4 Imp. gal. (8 liters) left in the tank.

MPH Speedometer and odometer.

The speedometer is graduated in mph and the odometer shows the total mileage of the vehicle.

O. Oil pressure warning light. Glows red to indicate dangerously low oil pressure or oil level. If it lights up while you are driving, switch off the engine at once and investigate the cause.

D. Direction indicator repeater light. Flashes green in time with the direction indicators.

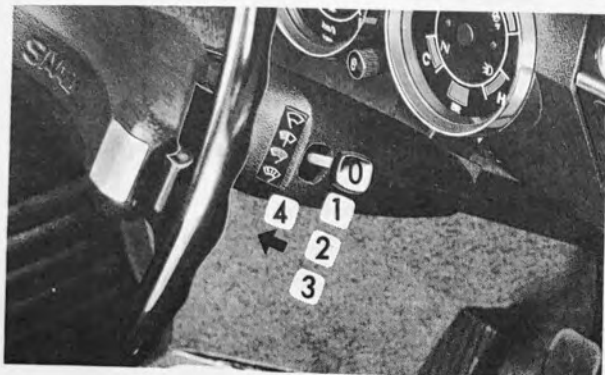
G. Charge indicator light. If this light glows yellow, the alternator is not charging.

H. High beam warning light. Shows a blue light when the headlights are on high beam.

C. Choke indicator light. Glows red when the choke knob is pulled out.

BR. Brake indicator light. Glows red when the hand-brake is on or to indicate excessive pedal travel. This may be caused by leakage from one of the two brake line circuits. (Wear on brake pads is indicated by increased pedal pressure.) If this light lights up, investigate the cause of the trouble as soon as possible and have the fault repaired by an authorized Saab dealer.

7. Instrument lighting rheostat. Turn the switch to control the intensity of illumination. This switch operates only when the parking lights or headlights are on.
8. Windshield wiper and washer control.

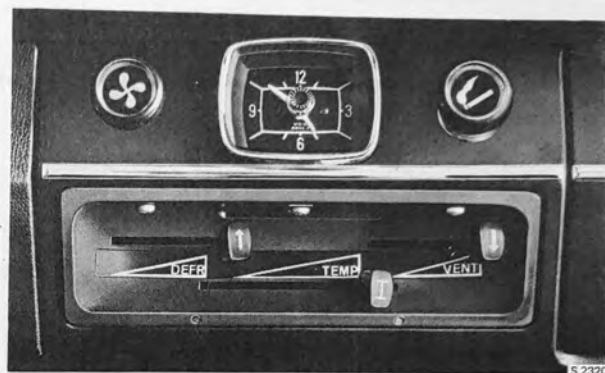


WINDSHIELD WIPER AND WASHER CONTROL LEVER

0. Neutral position
1. Windshield wipers, half speed
2. Windshield wipers, full speed
3. Windshield wipers, full speed + washer
4. Washer only (works in positions 0-3)

11. Heater fan switch.

The fan has two speeds, half speed at the first switch position and full speed with the switch pulled fully out. The fan motor also has summer and winter settings. The summer setting delivers about 30 % more fresh air.



FRONT SEAT HEATING AND VENTILATION CONTROLS

- ⊕ Heater fan switch
- ↑ Windshield defroster control
- ↓ Ventilation control, front seat floor
- T. Temperature control
- Red Open or hot position
- Blue Closed or cold position

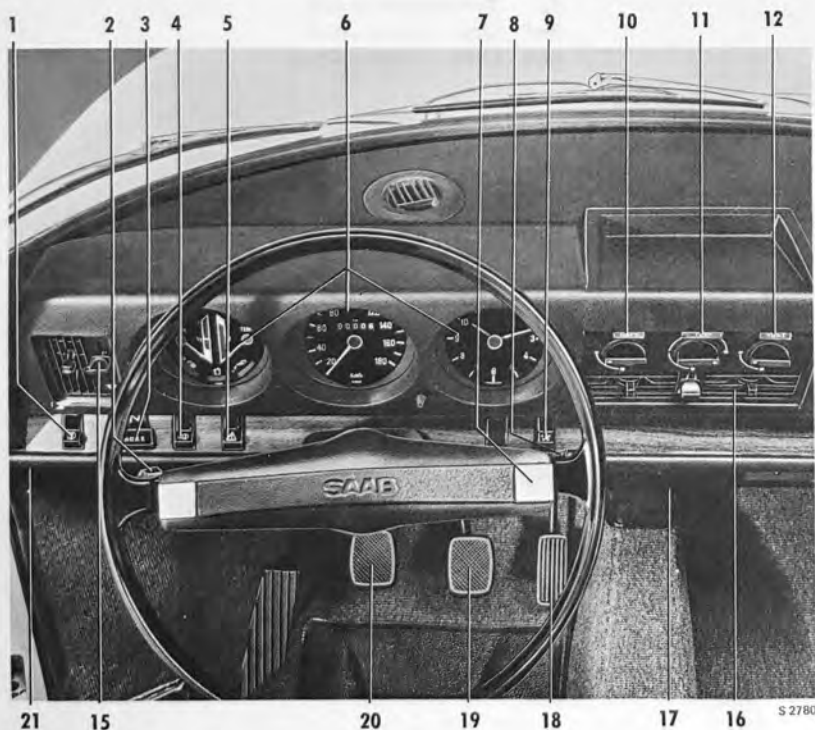
CONTROLS AND INSTRUMENTS AS FROM MODEL 1971

1. Headlight and parking light switch
2. Direction indicator, headlight dimmer and headlight flasher switch
3. For cars with carbureted engines:
Choke with warning light
For cars with injection engines:
Spare switch
4. Instrument lighting switch. As from model 1973, the instrument lighting is regulated with a rheostat switch.
5. Hazard warning signal switch
6. Instruments and indicator lights.
7. Horn control
8. Windshield wiper, headlight wiper* and washer switch
9. Ventilator fan switch
10. Defroster control for windshield and front side windows
11. Temperature control
12. Ventilation control for front seat floor
13. Ventilation control for back seat floor

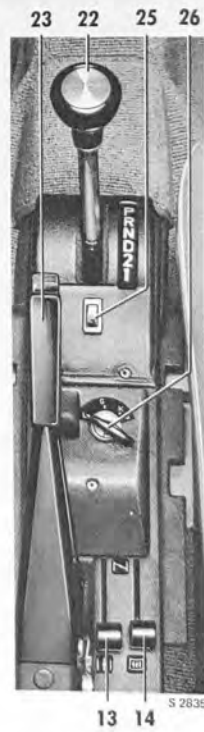
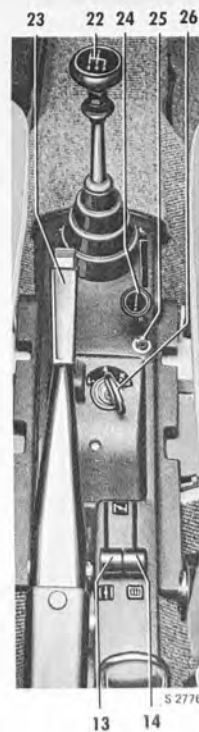
*Extra equipment for certain markets.

14. Defroster control for rear window
15. Fresh air vents, side
16. Fresh air vent, center
17. Ashtray with lighter. As from the middle of model 1972, the cigarette lighter is located on the instrument panel.
18. Accelerator pedal
19. Brake pedal
20. Clutch pedal (cars with manual transmission)
21. Hood lock release handle
22. Gear (selector) lever
23. Handbrake
24. Free wheel drive control (cars with manual transmission and 1.7 l engine)
25. Interior lighting switch
26. Ignition switch and gear (selector) lever lock

The functions of the instruments and the operation of those controls that need further explanation are described in the next few pages. Figures in the margin refer to the above list.



CONTROLS AND INSTRUMENTS



MANUAL GEAR BOX AUTOMATIC GEAR BOX

1. Headlight and parking light switch.
The switch has three positions: off, parking lights on and headlights on.

When the switch is pushed in to the first stop the parking lights are turned on regardless of the position of the ignition switch.

Pushing in to the second stop turns on the headlights as well if the ignition key is at G or K.

NOTE! If the headlights are already on, i.e. if the switch is pushed in to the second stop, and the ignition key is turned back to L, all outside lights will be extinguished. If for any reason you want to have the parking lights on while the ignition switch is in position L, the light switch must be pulled back to the first stop.

2. Combined direction indicator lever and headlight dimmer and flasher switch.

To signal a turn, move the lever down for left, up for right.

When the headlights are switched off, you can flash the high beam by pulling the lever towards the steering wheel.

When the headlights are on, pulling the lever to-



SWITCH WINDSHIELD WIPERS, HEADLIGHT WIPERS AND WASHER

1. Left direction indicator
2. Right direction indicator
3. Headlight dimmer and flasher switch

wards the wheel shifts the beam from high to dimmed or vice versa.

4. Instrument lighting switch.

Up to and incl. model 1972:

The switch has three positions: off, subdued and bright.

The instrument lighting cannot be turned on unless the parking lights or headlights are lit.

As from model 1973:

The instrument lighting can be regulated variably with a rheostat switch.

5.  Hazard warning signal switch.

All direction indicator lights flash together when the button is pushed in. The hazard warning signal must only be used when the car is immobilized by accident, breakdown, etc. in a position where it is liable to endanger or obstruct traffic.



INSTRUMENT AND INDICATOR LIGHTS

6. Instruments and indicator lights.

- A. Combination instrument comprising:

TEMP Temperature gauge for engine coolant. The green zone indicates normal running temperature.

TANK Fuel gauge.



Brake warning light. This light glows red when the handbrake is on or to indicate excessive brake pedal stroke. If it lights up because the brake pedal goes too far down, this may be due to leakage from one of the two brake line circuits. (Wear on brake pads is indicated by increased pedal resistance.) If the brake warning light comes on while you are driving, investigate the cause at once and have the fault repaired by an authorized Saab dealer.



Direction indicator repeater light. Flashes green in time with the direction indicators.



High beam warning light. Shows a blue light when the headlights are on high beam.



Charge indicator light. If this light glows yellow, the alternator is not charging.



Fuel reserve warning light. Shows a steady red glow when there are less than 2 US gallons (8 liters) left in the tank. Saab 99 Combi Coupé: 2.5 US gallons (10 liters).



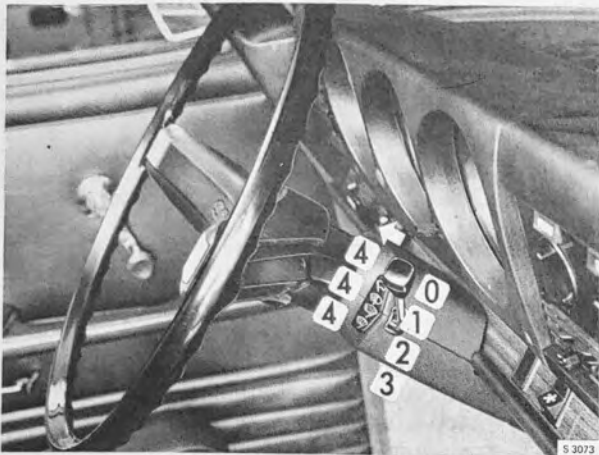
Oil pressure warning light. Glows red to indicate dangerously low oil pressure or oil level. If it lights up while you are driving, switch off the engine at once and investigate the cause.

- B. Speedometer, odometer and trip meter.

The zeroing button for the trip meter is located to the left of the speedometer.

- C. Clock. The setting button is located to the left of the clock dial.

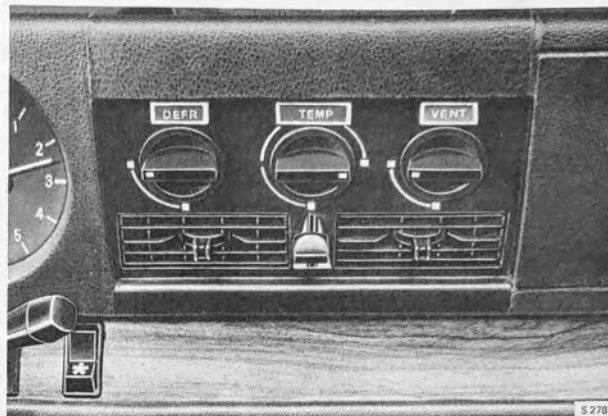
8. Windshield wiper and washer control — see illustration



DIRECTION INDICATOR, HEADLIGHT FLASHER AND DIMMER SWITCH

- 0. Neutral
- 1. Windshield wipers, half speed
- 2. Windshield wipers, full speed + headlight wipers
- 3. Windshield wipers, full speed + headlight wipers + washing of windshield and headlights
- 4. Washing of windshield and headlights. If you begin from position 0, 1 or 2 you will achieve washing during the time the lever is held in the spring-loaded position toward the steering wheel. If this is done in position 0 it will be possible to wash the windshield before you start the wipers. (The headlight wipers are always working when you operate the washer, thus also in position 4.)

9. Ventilator fan switch. The switch has two positions, first for half speed and second for full speed.



FRONT CONTROLS, HEATING AND VENTILATION

Instruments up to and incl. model 1970

Removing the instrument panel

1. Disconnect the speedometer cable.
2. Undo the two retaining screws at the bottom edge of the panel.
3. Lift out the panel and disconnect the wiring.

Install in the reverse order.

On model 1970 there is a screen below the instrument panel which is divided at the steering column. The left and right sections of the screen can be removed separately, which is necessary if instrument light bulbs or the speedometer cable have to be exchanged.

Speedometer and odometer

Removal and installation

As this instrument forms an independent unit, it can be removed and replaced without interference with the other instruments.

1. Disconnect the ground lead, pull out the light bulb holders together with connecting wiring, and disconnect the speedometer cable.
2. Squeeze the two retaining springs together and pull the instrument out of the panel.



REMOVING THE INSTRUMENT UNIT

3. To refit the instrument, push in with the two springs lined up with the recesses in the panel.
4. Reconnect all wiring, insert bulb holders and connect the speedometer cable.

NOTE! As from model 1970 the speedometer cable has a bayonet fitting.

Fuel and temperature gauge and indicator light display instrument

These instruments form separate units and can be independently removed from the instrument panel: disconnect wiring, compress the retaining springs and pull the instrument out of the panel.

Any repair or adjustment of these instruments should be done by a specialist workshop.

Changing instrument light bulbs

1. Push in the flat part of the bulb holder and give it a quarter turn, after which the entire bulb holder can be removed.
2. Pull the bulb out of the contact springs in the holder.
3. Push in the new bulb and mount the holder, locking it by giving it a quarter turn.

Changing the clock or cigarette lighter (1970 and later models)

Remove the ashtray. Unship the glove compartment and bend its left wall carefully inward to reach the clock and lighter.

To remove the lighter, disconnect the cable and unscrew the nut that secures the mounting bracket.

To remove the clock, disconnect the cable and then unscrew the two nuts that hold the mounting bracket.

NOTE! When installing the clock, remember that the black cable must be clamped under one of the nuts.

Instruments as from model 1971

Removing the instrument panel

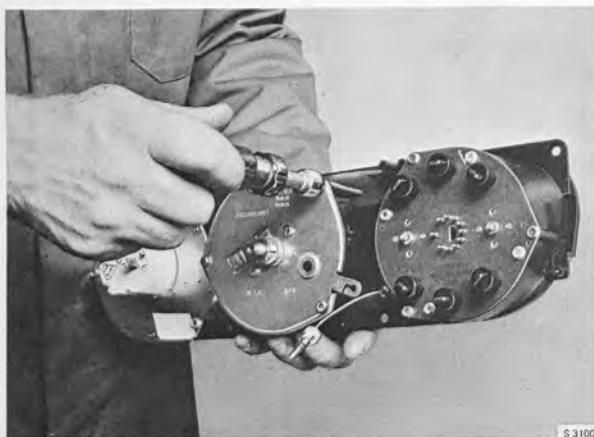
p. 853-4

- 1-4. Remove the safety padding (see description in group 8).
5. Undo the four self-tapping screws that secure the panel.
6. Disconnect the speedometer wire and the electric wiring to the clock and combination instrument. Pull out the instrument illumination bulb holder. The instrument set can then be lifted out.



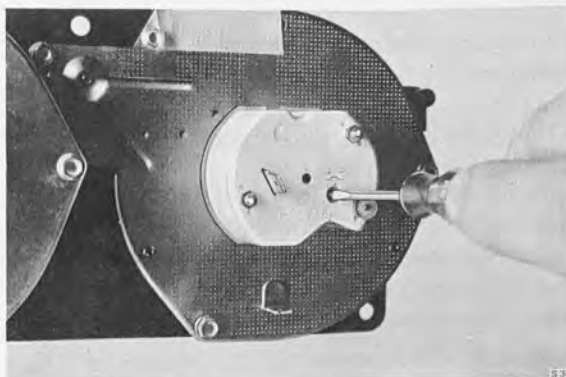
REMOVING THE INSTRUMENT UNIT, 1971 MODEL

The instruments or the clock can then be separated from the panel by removal of the retaining screws. To remove the speedometer with built-in trip meter it is also necessary to disconnect the trip meter control wire from the instrument. Any repairs or adjustments to the instruments should be carried out by a specialist workshop.



REMOVING INSTRUMENTS FROM THE UNIT

There is a screw on the back of the clock for adjusting the movement. An arrow with plus and minus signs shows in which direction the screw must be turned to obtain the required result.



ADJUSTING THE CLOCK

Reassemble and reinstall the instrument unit in the reverse order.

Changing instrument light bulbs

A. Instrument illumination.

The bulbs (2 in number) can be reached after removal of the safety padding (see group 8).



CHANGING INSTRUMENT ILLUMINATION LIGHT BULB

B. Warning and indicator lamps.

If the instrument panel unit is unscrewed and pulled forward, the indicator and warning lamps can be reached conveniently. The bulb holders have bayonet fittings.

Changing the speedometer cable

1. Disconnect the speedometer cable from the transmission.
2. Disconnect the hose on the left-hand side of the fresh-air hood and remove the cable grommet from the lower dash panel.
3. Remove the instrument panel unit. Take out the cable grommet from the upper dash panel.
4. Insert the new cable through the holes in the dash panel. Fit the cable grommet in the upper dash panel and mount the instrument unit.
5. Fit the cable grommet in the lower dash panel and reconnect the fresh-air hose. Connect the cable to the transmission. Make sure that the cable is evenly tensioned with smooth curves.

Tachometer, Saab 99 EMS

The Saab 99 EMS is equipped with a tachometer, combined with a clock. The connecting cables to the tachometer are these:

86 yellow to "1" on the tachometer
99 brown to "+12" on the tachometer

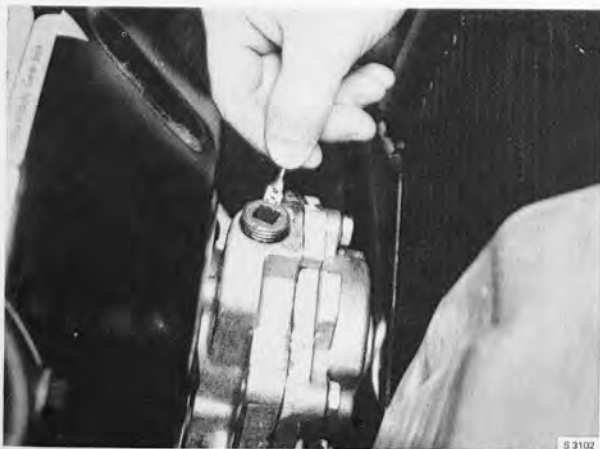
Radiator fan

General

The radiator fan is driven by an electric motor and is located behind the radiator. The fan is thermostat-controlled. The thermoswitch is located on the left of the radiator. Instructions for removing and installing the radiator fan will be found in group 2.

Checking operation of radiator fan

To check the operation of the radiator fan, switch on the ignition and then disconnect the cable from the radiator fan thermoswitch and ground the cable shoe. The fan should then start. Exchange the thermoswitch if defective.



CHECKING RADIATOR FAN OPERATION

NOTE

If the radiator fan fails to start, the reason may be faulty ground contact between the radiator and bodywork. The easiest way to check this is to touch the cable shoe first to the metal casing of the thermoswitch and then to some part of the body or engine.

Fuel level transmitter

The fuel level transmitter consists of a float which deflects the fuel gauge via a lever and a contact. When the volume of fuel in the tank falls below about 2 US gallons (1.75 Imp. gal, 8 liters), a warning light in the fuel gauge lights up. Saab 99 Combi Coupé: 2.5 US gallons (2.2 Imp. gal., 10 liters).

The transmitter is located on top of the fuel tank and is accessible for adjustment or repair when the trunk floor covering and floor are removed.

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411 Clutch

412 Clutch control

Manual transmission

430 General

431 Removal and installation

432 Transmission control

471 Disassembly, assembly

473 Differential and pinion/crown wheel gear

475 Universal joints

Automatic transmission

440 General, road test and fault diagnosis

442 Removal and installation

444 Transmission control

472 Disassembly, assembly, adjustment

473 Differential and pinion/crown wheel gear

475 Universal joints

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413	Shift control
	Manual transmission
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432	Transmission control
433	Operation, assembly
434	Differential and axle assembly, wheel gear
435	Universal joints
	Automatic transmission
436	General, type and basic features
437	General and installation
438	Transmission control
439	Operation, assembly, adjustment
440	Differential and axle assembly, wheel gear
441	Universal joints

CLUTCH

General

The car is fitted with a single dry plate clutch of diaphragm spring type. The principal clutch components are the disc, pressure plate assembly and release bearing. The clutch disc consists of a resilient steel plate attached to a hub which slides on splines on the clutch shaft. The clutch linings are riveted to both sides of the disc.

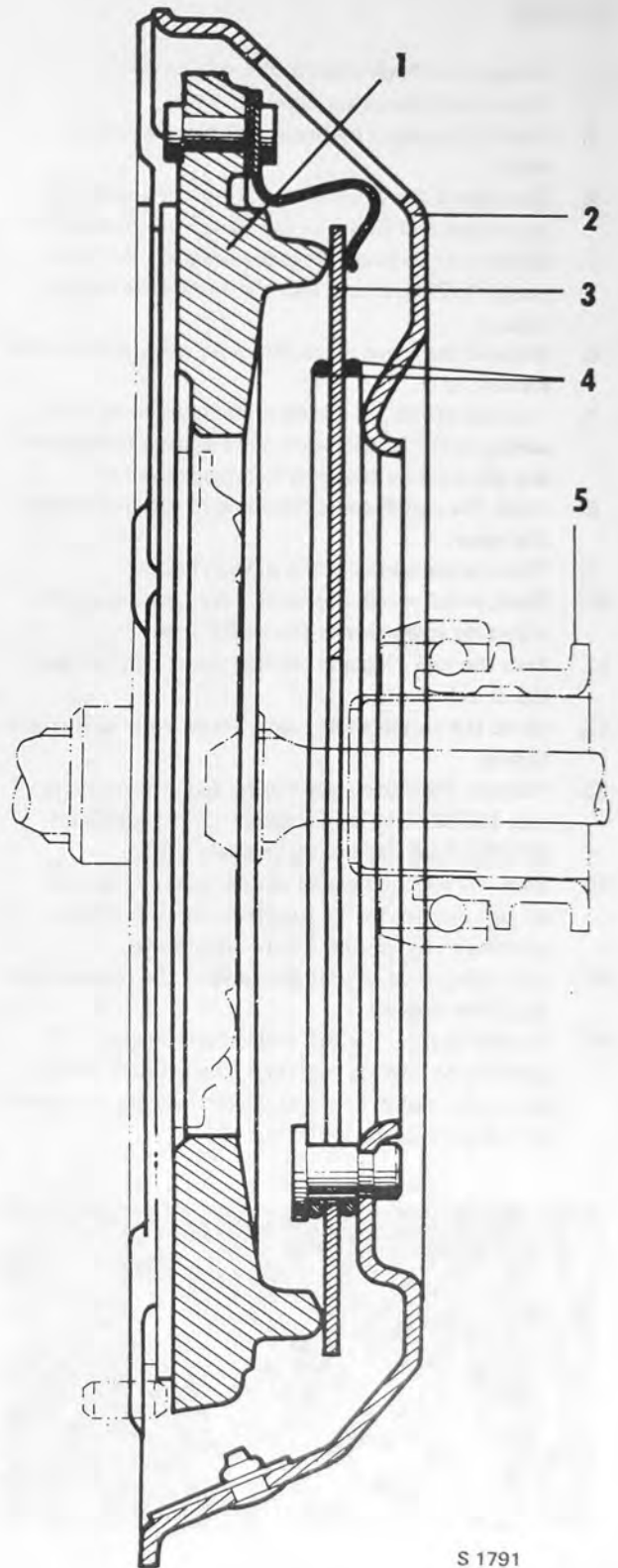
The pressure plate assembly consists chiefly of the pressure plate, pressure spring (diaphragm spring) and housing. The spring acts as a lever and as pressure spring. The pressure plate assembly is an integral unit and must not be disassembled.

The release bearing is a ball bearing of special construction with an elongated outer ring that presses direct against the diaphragm spring when the clutch is let out. It is mounted on a guide sleeve screwed to the transmission case. As from transmission No. 45459 a new release bearing has been introduced. The new bearing has an O-ring bearing on the guide sleeve. The operation of the clutch is hydraulic; the clutch pedal actuates a master cylinder connected by a hose to a slave cylinder, which is mounted on the transmission case. The action of the slave cylinder is transmitted to the release bearing by a clutch lever journaled in the transmission case.



S 179C

PRESSURE PLATE



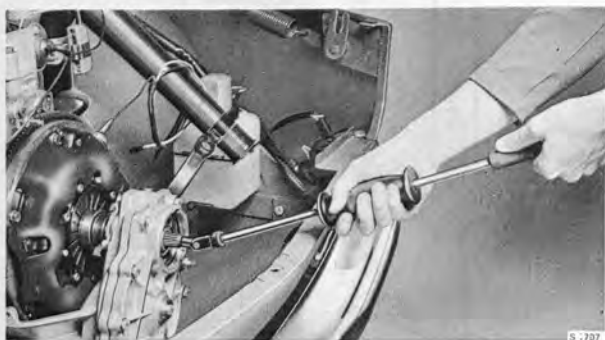
S 1791

PRESSURE PLATE ASSEMBLY, SECTIONAL VIEW

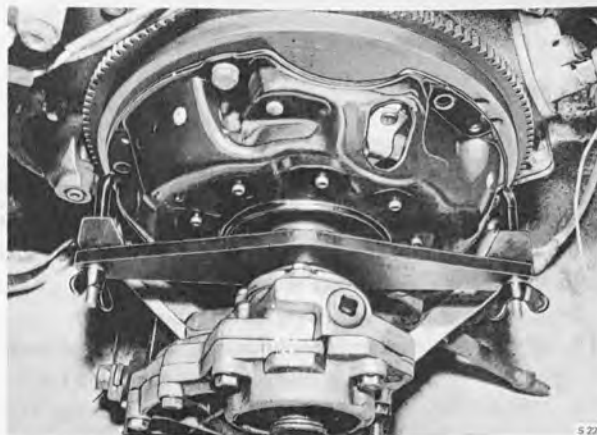
1. Pressure plate
2. Housing
3. Diaphragm spring
4. Pressure bearing rings
5. Release bearing

Removing

1. Remove the engine hood (see section 201).
2. Disconnect the battery ground cable.
3. Drain off coolant by opening the radiator drain cock.
4. Disconnect the electric wiring from the radiator fan motor and from the fan switch on the radiator.
5. Disconnect all hoses from the radiator. As from model 1972: Remove also the air cleaner cold air hose.
6. Remove the front sheet complete with radiator (see section 201).
7. The rest of the job can be done more easily if the wiring to the ignition coil, temperature transmitter and oil pressure switch is first disconnected.
8. Undo the clutch cover retaining screws and remove the cover.
9. Remove the spring at the slave cylinder.
10. Slacken the clutch adjustment by backing off the adjusting screw; lower the clutch lever.
11. Free the lock ring and remove the sealing cap over the clutch shaft.
12. Undo the clutch shaft center screw with washer and O-ring.
13. Remove the clutch shaft using tapping-out hammer 839027 and joint 839001 (5/16" UNC) alt. 879052 (M8) depending on shaft design.
14. Back off and remove all clutch retaining screws except the two at the top; these are left in place to prevent the clutch from falling down.
15. Undo the three retaining screws of the release bearing guide sleeve.
16. Fit clutch tool 839207 and clamp the clutch and release bearing together. The pressure plate assembly, clutch disc and release bearing with guide sleeve can then be taken out.



PULLING THE CLUTCH SHAFT
Tools 839001 and 839027



REMOVING THE CLUTCH

Tool 839207

Assembling

1. Place the clutch disc in the flywheel. Press together clutch and release bearing with tool 839207. If necessary use guide spindle 879041 for centering of release bearing, see fig. Place the guide sleeve in the release bearing and place the clutch assembly in position.



CENTERING OF RELEASE BEARING

Tool 879041

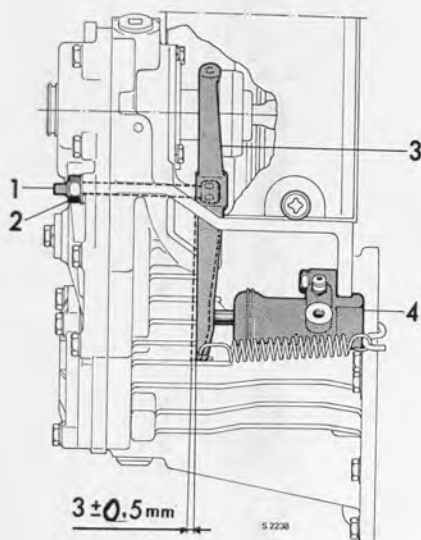
2. True up the center of the clutch disc using the clutch shaft. Then check that the clutch slips on to the locating pins and tighten the top screws lightly.
3. Tighten the three retaining screws of the guide sleeve.

CAUTION

The gasket is not symmetric.

4. Remove the clutch tool and tighten the clutch retaining screws.
5. Insert and tighten the clutch shaft center screw with washer and O-ring.
6. Fit the sealing cover and lock ring over the clutch shaft.
7. Line up the clutch lever and fit the spring at the slave cylinder.

8. Tighten the adjusting screw so that the clutch is released when the clutch pedal is depressed. Adjust the clearance between the diaphragm spring and the release bearing by turning the adjusting screw and tighten the lock nut. The clearance between the diaphragm spring and the release bearing should be 0.06" (1.5 mm), corresponding to a measured 0.12 ± 0.02 " (3 ± 0.5 mm) at the outer end of the clutch lever.



MEASURING CLUTCH CLEARANCE

- | | |
|--------------------|-------------------|
| 1. Adjusting screw | 3. Clutch lever |
| 2. Lock nut | 4. Slave cylinder |
9. Mount the clutch cover.
 10. Mount the front sheet complete with radiator. Connect the coolant hoses.
 11. Connect electric wiring.
 12. Fill the radiator with coolant.
 13. Fit the engine hood.
 14. Check the headlight alignment.

Changing clutch linings

1. Drill out the old rivets and remove the old linings.
2. Check that the set of the tongues is regular and that the disc is not out of true. Check also that the rivets in the hub are secure and that there are no cracks. The disc must slide freely on the clutch shaft without any radial play.
3. Rivet on the new linings. The thickness of the disc is to be checked under a compressive force of 4230 N (948 lb., 430 kg), the correct thickness being 0.270–0.290" (6.85–7.37 mm).



CORRECT POSITION OF CLUTCH LINING RIVETS

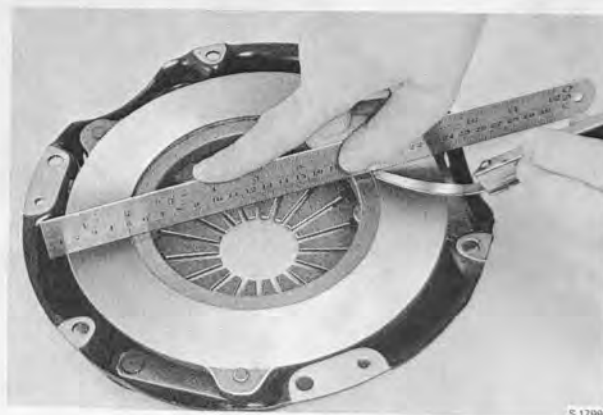
Clutch disc

Inspecting the clutch and exchanging clutch linings

1. Inspect the surface of the flywheel where the clutch disc makes contact. Blueing or small cracks on the surface are of no particular importance, but if there are any deep scratches the flywheel ought to be machined down or exchanged.
2. Check the pressure plate in the pressure plate assembly for scratches and distortion. If there are any irregularities the plate should be exchanged.
3. Check the release bearing for noise, wear, etc.
4. Check the disc for wear and fit new linings if necessary.
5. Before riveting on the new linings, check and if necessary adjust the set of the disc.

Inspecting the pressure plate assembly

Check the pressure plate for cracks and scratches. Check that the surface of the plate is not cambered, using a rule and feeler gauge as illustrated. A gap of not more than



CHECKING THE PRESSURE PLATE

0.0012" (0.03 mm) is allowable at the inner edge of the friction surface, but there must be no gap at all between the rule and the outer edge of the friction surface. Make this check at several points. Check that the pressure spring is not cracked or otherwise damaged. Check that the release bearing turns freely when rotated under slight axial pressure.

CLUTCH CONTROL

Removing and installing the clutch pedal

1. Remove the split pin and washer and pull out the shaft bolt for the master cylinder push rod.
2. Unhook the clutch pedal return spring.
3. Remove the split pin and washer from the pedal shaft. Take out the pedal.
4. Remove the spring if necessary.
5. Lubricate the pedal bearing with chassis grease before reassembling.

Reassemble in the reverse order.

Adjusting clutch play

The clutch play, i.e. the clearance between the release bearing and the diaphragm spring, is regulated by an adjusting screw that threads into the transmission case and acts as the fulcrum of the clutch lever. The gap is increased when the screw is backed off. The gap should be checked at the outer end of the clutch lever (see illustration on p. 411-2), where it should be $0.12 \pm 0.02''$ (3 ± 0.5 mm).



ADJUSTING CLUTCH PLAY

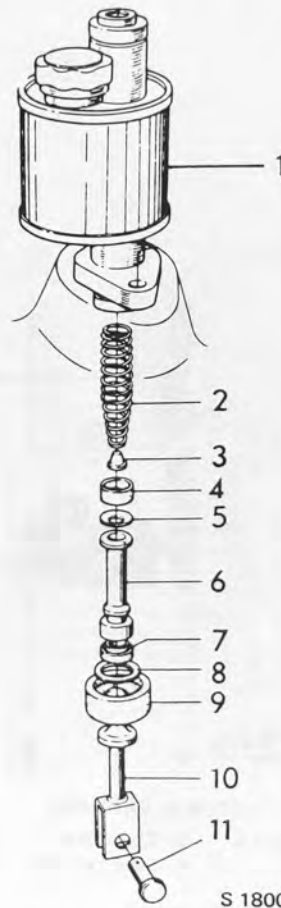
Removing the release bearing and clutch lever

To remove the release bearing or clutch lever, proceed in the same manner as when removing the clutch.

Master Cylinder

General

The master cylinder consists of a cast housing surrounded by a sheet metal fluid container. The operating elements consist of a push rod, piston, piston seal and return spring (see illustration). The end of the push rod is sealed by a rubber bellows.



CLUTCH MASTER CYLINDER

- | | |
|--------------------|--------------------|
| 1. Housing | 7. Seal |
| 2. Spring | 8. Lock ring |
| 3. Spring retainer | 9. Sealing bellows |
| 4. Seal | 10. Push rod |
| 5. Washer | 11. Shaft bolt |
| 6. Piston | |

Removing

1. Disconnect the hose from the slave cylinder and pump out the fluid into a clean container.
2. Disconnect the push rod from the clutch pedal by removing the split pin and shaft bolt.
3. Undo the retaining screws and remove the master cylinder.

Installing

1. Mount the master cylinder.
2. Connect the push rod to the clutch pedal by inserting the shaft bolt through the holes in the fork of the push rod and the hole in the clutch pedal. Locate the push rod and secure with the split pin.
3. Connect the hose.
4. Bleed the system.

Disassembling

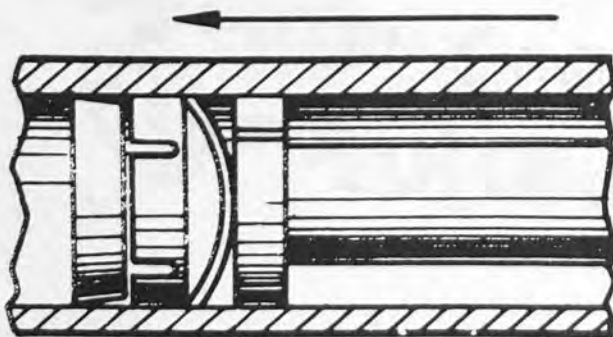
Pull back the sealing bellows and remove the lock ring with a pair of pliers. Take out the push rod with the washer. The piston and its seal is now visible. Remove the piston, washer, piston seal and spring. Take the seal carefully off the piston. Examine the cylinder walls; if they are smooth and unscratched, new seals can be fitted, but if the surface of the cylinder bore is rough, a complete new cylinder should be installed. If the old seals on the piston are enlarged or swollen, they are probably contaminated with mineral oil; this is the most common cause of cylinder malfunction. Seals made of natural rubber are very sensitive to mineral oil, and even small quantities of oil can cause them to swell with time. If this is suspected, change all the seals and flush the system with clean hydraulic brake fluid.

Assembling

Fit the return spring with its retainer. Lubricate the piston and seals thoroughly with Girling Rubber Grease 3 and fit the packing, washer and piston with seals.

NOTE

The washer must be fitted with the convex side facing the piston (see illustration).



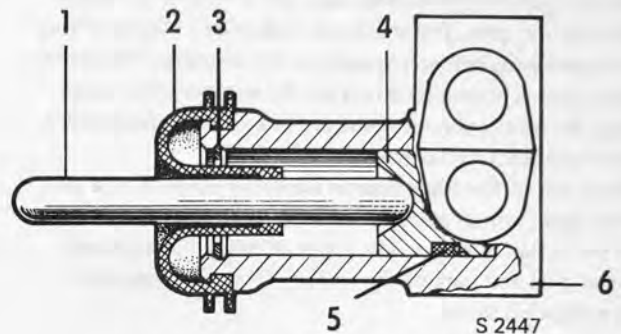
CORRECT POSITION OF WASHER

Fit the push rod into the cylinder, followed by the washer and lock ring, which are located in the cylinder housing groove. Replace the sealing bellows or fit a new bellows if the old one is damaged.

Slave cylinder

General

The slave cylinder consists of a cast-iron housing with an operating unit consisting of a push rod, lock ring and piston. A rubber cap seals the end of the push rod. The cylinder housing is provided with a bleeding nipple.



SLAVE CYLINDER

- | | |
|----------------|----------------|
| 1. Push rod | 4. Piston |
| 2. Sealing cap | 5. Piston seal |
| 3. Lock ring | 6. Housing |

Bleeding the master and slave cylinders

1. Connect a hose (about 1/4" or 6 mm ID) to the slave cylinder bleeder nipple, and place the free end in a collecting vessel part-filled with hydraulic brake fluid.
2. Fill the master cylinder header tank with brake fluid.
3. Open the bleeder nipple on the slave cylinder a half turn.
4. Place the coolant system tester over the filler opening of the master cylinder (see illustration).



BLEEDING THE CLUTCH SYSTEM

5. Pump one or more times until all air has been expelled from the system.
6. Close the slave cylinder bleeder nipple.
7. Check that all air has been expelled by pushing down the clutch pedal.

GENERAL

Manual transmission, up to and incl. chassis No. 99722003498

The transmission is designed for front-wheel drive and is so constructed that all shafts with gears, free wheel, differential and inner universal joints form an integral unit.

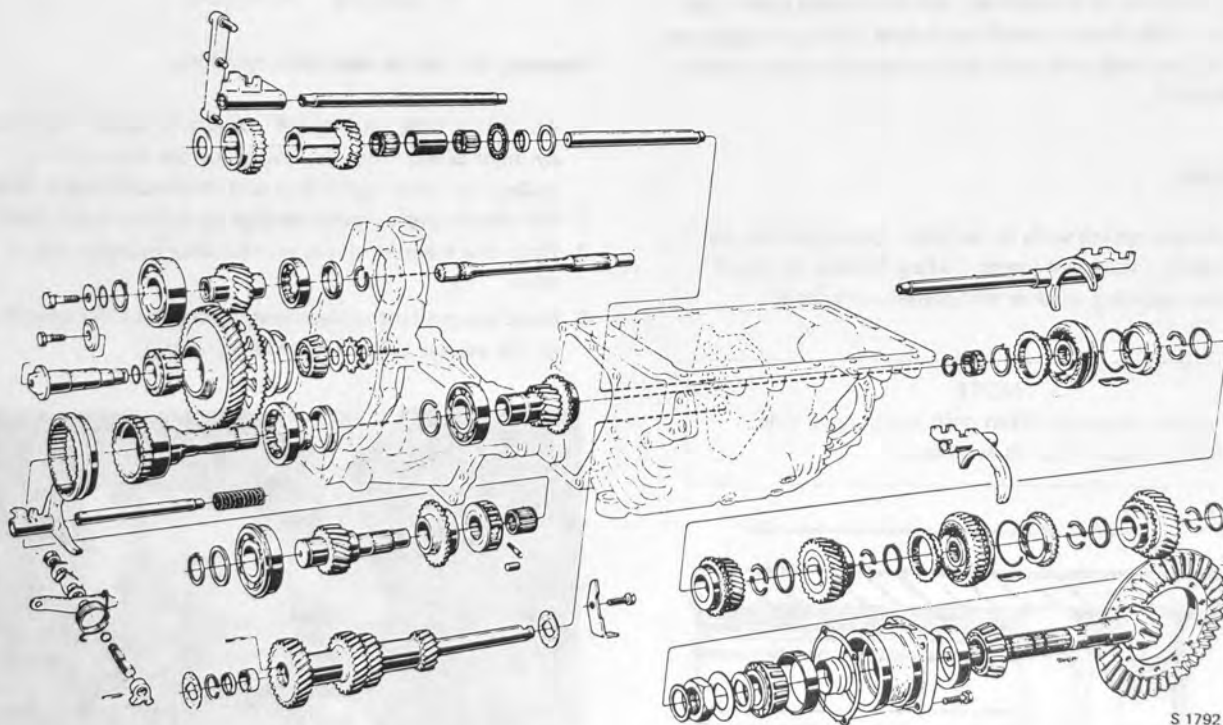
The transmission incorporates a four-speed gearbox. All forward gears are synchronized, while reverse is engaged by a sliding gear. The shafts are journaled in the transmission case with ball and tapered roller bearings. The pinion shaft gear is journaled direct on the shaft without bushings. All gears except reverse are in constant engagement and have spiral-cut teeth.

The front of the transmission assembly consists of a primary gear, which transmits shaft power from the clutch to the actual gearbox. The latter is located underneath the engine and part of the transmission case serves as an engine oil sump.



S 2030

TRANSMISSION UP TO AND INCL. CHASSIS NO. 99722003498



S 1792

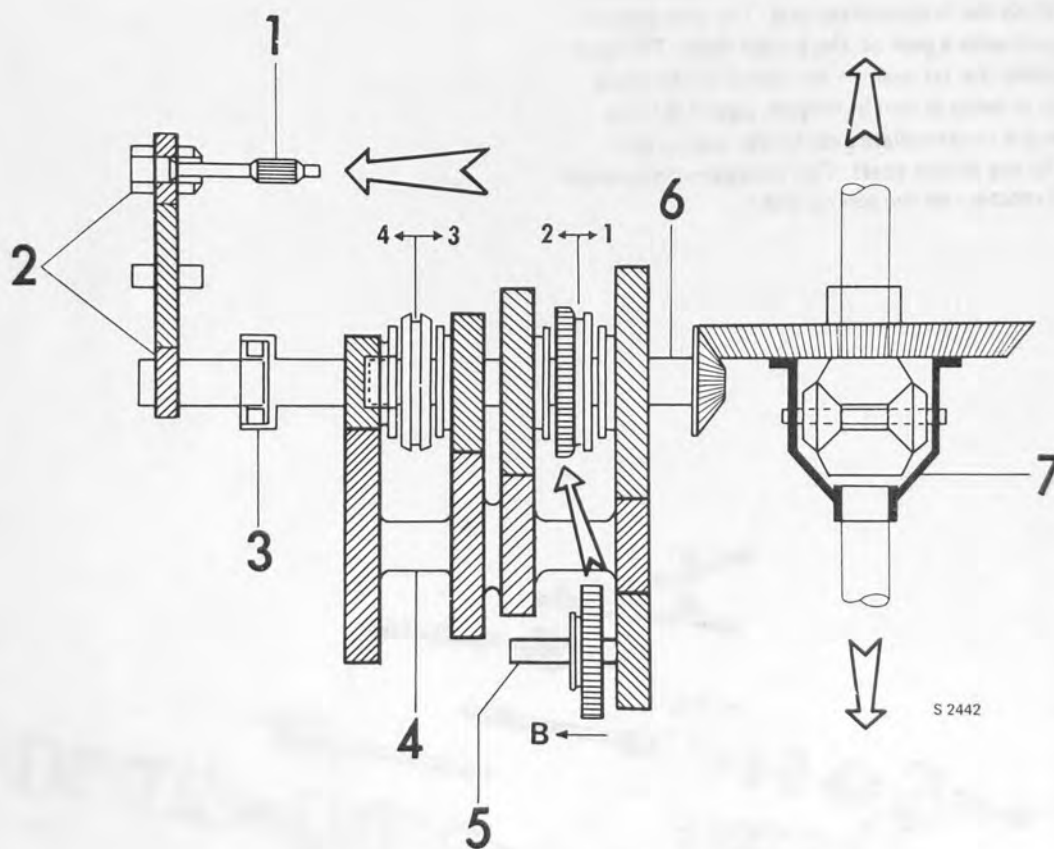
TRANSMISSION UP TO AND INCL. CHASSIS NO. 99722003498,
EXPLODED VIEW

The operation of the transmission is illustrated in the diagram below. Shaft power is transmitted through the clutch, primary gear and free wheel to the input gear in the gearbox. When the car is being driven in first gear, power is transmitted by the intermediate gear to the pinion shaft, the No. 1 gear, which is journaled on the pinion shaft, being locked to it by a sliding muff.

For driving in second or third, power is transmitted to the pinion shaft in the same way but with No. 2 or No. 3 gear locked to the pinion shaft by a coupling muff.

For driving in top gear, the input shaft in the gearbox is locked to the pinion shaft direct by a coupling muff, i.e. in this case power is not transmitted through the intermediate gear.

Reverse drive is provided by an extra shaft, the reverse gear shaft. A gear journaled on this shaft is in constant engagement with first gear on the intermediate gear. The reverse gear shaft also carries a sliding gear wheel connected to the reverse gear by splines. The sliding wheel can be moved into engagement with a gear on the pinion shaft; this last-named gear forms part of the coupling muff for first and second gear synchronization. Thus when the car is being driven in reverse, power is transmitted from the intermediate gear to the reverse gear and sliding wheel, which in turn drives the pinion shaft through the gear on the coupling muff. This arrangement reverses the sense of rotation of the pinion shaft.



TRANSMISSION UP TO AND INCL. CHASSIS NO. 9972003498,
SCHEMATIC DIAGRAM

- 1. Clutch shaft
- 2. Primary gear
- 3. Free wheel
- 4. Intermediate gear
- 5. Reverse gear shaft
- 6. Pinion shaft
- 7. Differential housing
- B=Reverse gear

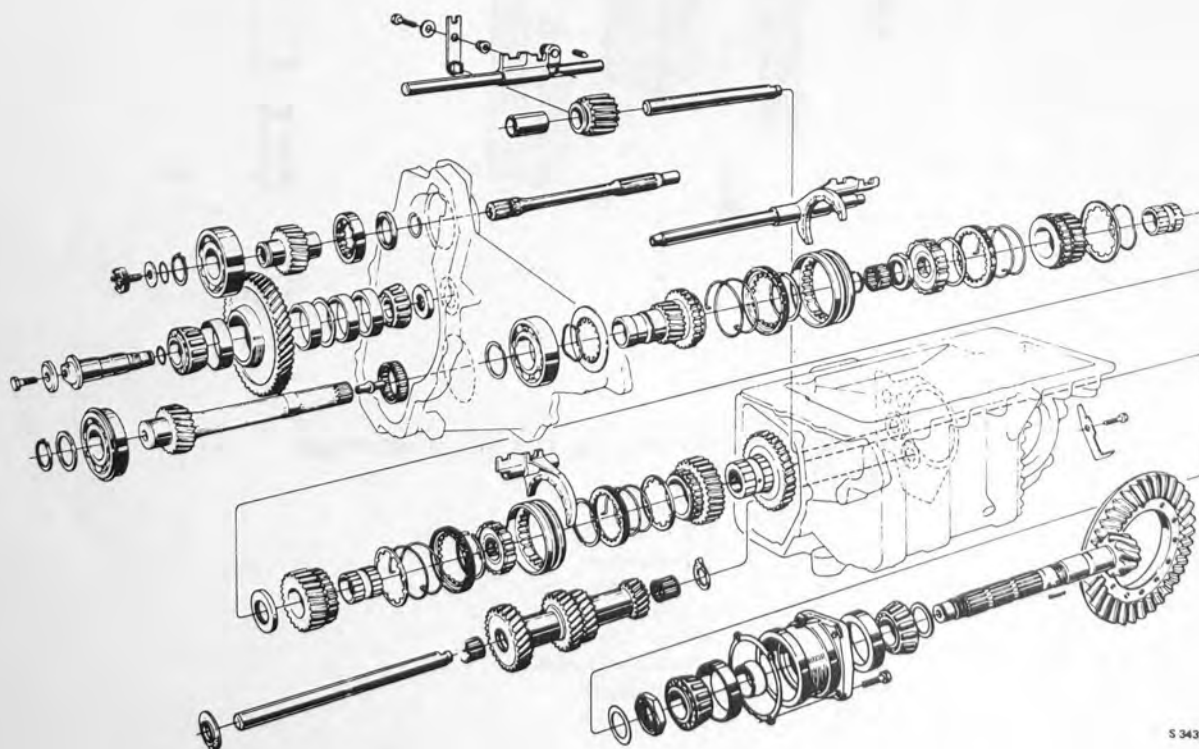
Manual transmission as from chassis No. 99722003499

The operation of the transmission is illustrated in the diagram. Shaft power is transmitted through the clutch and primary gear to the input gear in the gearbox. When the car is being driven in 1st gear, power is transmitted by the intermediate gear to the pinion shaft through the No. 1 gear, which is journaled on the pinion shaft and locked to it by a sliding muff.

For driving in 2nd or 3rd, power is transmitted to the pinion in the same way but with No. 2 or No. 3 locked to the pinion shaft by a coupling muff. For driving in top gear, the input shaft in the gearbox is locked to the pinion shaft direct by a coupling muff, i.e. in this case power is not transmitted through the intermediate gear. Reverse drive is provided by an extra reverse gear shaft. A gear journaled on this shaft is in constant engagement with 1st gear on the intermediate gear. The gear pinion can be engaged with a gear on the pinion shaft. This gear is placed behind the 1st gear on the pinion shaft. Thus when the car is being driven in reverse, power is transmitted from the intermediate gear to the reverse gear, and thence to the pinion shaft. This arrangement reverses the sense of rotation of the pinion shaft.

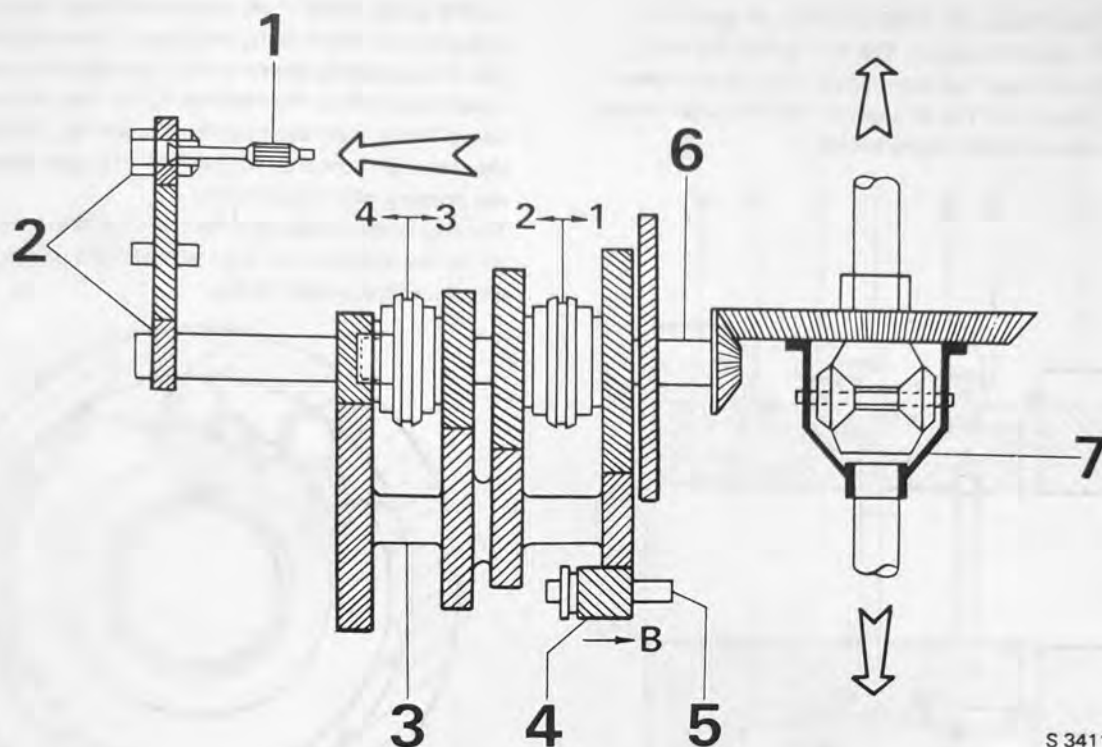


TRANSMISSION AS FROM CHASSIS NO. 99722003499



S 3432

TRANSMISSION AS FROM CHASSIS NO. 99722003499, EXPLODED VIEW



S 3411

TRANSMISSION AS FROM CHASSIS NO. 99722003499
SCHEMATIC DIAGRAM

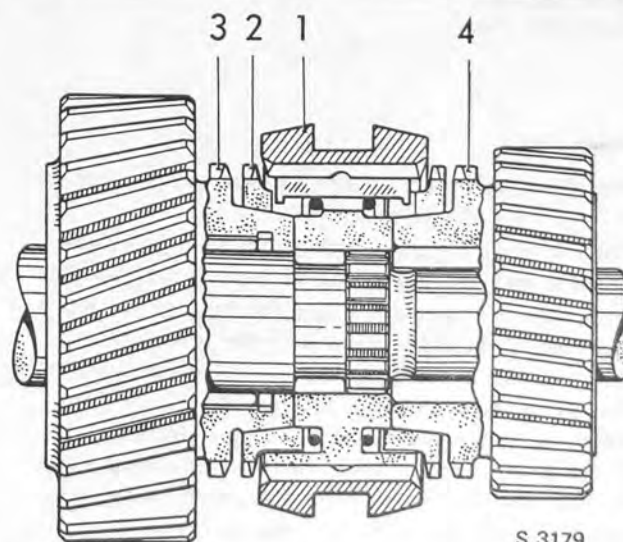
1. Clutch shaft
2. Primary gear
3. Intermediate gear
4. Reverse gear
5. Reverse gear shaft
6. Pinion shaft
7. Differential housing

Synchronization up to and incl. gearbox No. 38.686

The synchronization of the gears (see illustration) works as follows:

When the coupling muff is about to be brought into engagement with the coupling teeth of, say, third gear, it pushes a synchronizing ring ahead of it; this ring is tapered on the inside, while the outside carries teeth that match the coupling teeth of the gear. The synchronizing ring rotates at the same speed as the pinion shaft and is free to twist half the pitch of one tooth in relation to the muff. If No. 3 gear happens to be running at a different speed to the pinion shaft at the moment when third gear is about to be engaged and the muff approaches the No. 3 gear position, the muff is obstructed by the coupling teeth on the synchronizing ring, which get in the way of the female teeth in the muff. The synchronizing ring is therefore displaced until its tapered inner surface mates with the male cone of the No. 3 gear, whereupon friction equalizes the speeds of the gear and the coupling muff; the way is then clear for the muff to slide into engagement with the coupling teeth of No. 3 gear.

The synchronizing ring for first gear is of special design. It can be distinguished from the others by the fact that it lacks three teeth.



S 3179

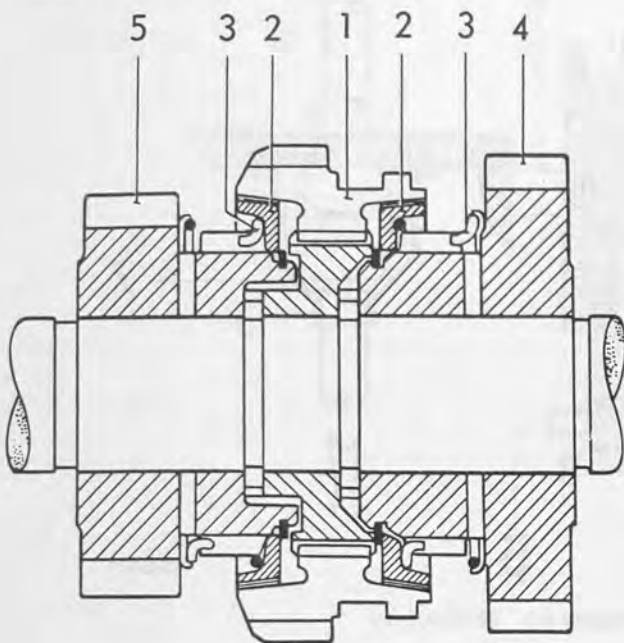
SYNCHRONIZER UNIT

1. Synchronizer sleeve
2. Bronze blocking ring
3. Dog ring, 3rd speed gear
4. Dog ring, 4th speed gear

Synchronization as from gearbox No. 38.687

With effect from gearbox No. 38.687 a new type of synchronization has been introduced from the 1st and 2nd

gears. As from chassis No. 99722003499, all gears have this type of synchronization. The new design features larger synchronizing rings working against a female cone in the coupling muff. The arrangement of the new synchronization is shown in the figure below.



S 3180

SYNCHRONIZER UNIT

1. Synchronizer sleeve
2. Synchronizing ring
3. Spring
4. 1st gear wheel
5. 2nd gear wheel

Free wheel

The free wheel is only provided in gearboxes to engines with 1,7 l cylinder volume.

The free wheel transmits power from the primary gear wheel to the input gear of the gearbox via the free wheel shaft. The free wheel hub is splined on to the primary gear shaft and contains ten roller seats with an equal number of rollers. Each roller is individually spring loaded by two coil springs, which constantly strive to force the roller upward on its curved bearing seat.

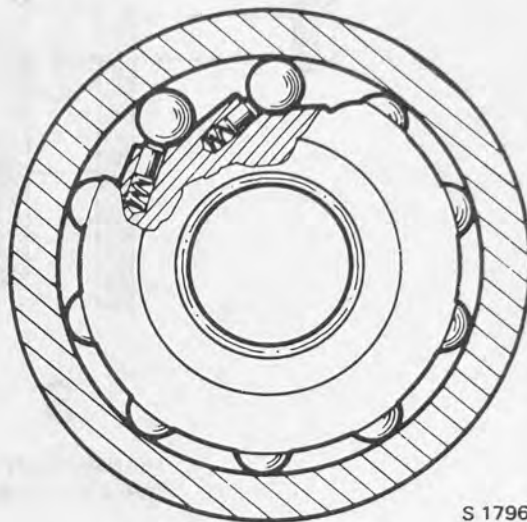
The free wheel hub is surrounded by a cylindrical sleeve forming part of the free wheel shaft, which is the an integral part of input shaft to the gearbox.

The primary gear wheel is driven by the engine crankshaft through the clutch shaft and primary gear. When the engine is driving the car, the free wheel is locked because the hub tends to rotate faster than the free wheel shaft, so that the rollers are forced upward on the curved bearing seats of the hub:

The rollers bind between the free wheel hub and the surrounding sleeve, forcing the free wheel shaft to rotate at the same speed as the primary gear wheel shaft and thus locking the former to the latter. If on the other

hand the free wheel shaft is rotating faster than the primary gear wheel shaft, as happens for example when the car is coasting downhill with the engine idling, the rollers are freed as the rotation of the free wheel shaft sleeve forces them back against the springs. This allows the sleeve and the free wheel shaft to rotate faster than the primary gear wheel shaft.

The free wheel is also provided with a locking device which immobilizes the joint between the primary gear wheel and free wheel shafts.



S 1796

FREE WHEEL

Differential, etc.

The differential assembly consists of two differential gears and two front axle gears, one for each front axle. All these gears have straight beveled teeth. The axle gears are splined to the ends of the inner drivers. The crown wheel, which is driven from the transmission by the pinion shaft, is screwed to the differential case.

The speedometer drive gear is secured to the differential case by a lock ring. Its rotation is transmitted by a worm gear to the speedometer cable attachment.

REMOVAL AND INSTALLATION

Manual transmission

Removal

For major work on the engine and transmission, the entire power plant should be lifted out. Removal of the engine by itself is not recommended.

1. Remove the hood as follows:
Back off both the hood fastening screws. Lift off the hood. For this you need a helper to hold one side of the hood and help to lift it clear.
 2. Detach the battery cables. Unclamp and lift out the battery.
 3. Drain off coolant through the radiator and engine block drain cocks; open the bleeder cock on the heat exchanger. (Up to and incl. model 1973.)
 4. Carbureted engine:
Detach the vacuum hose of the power assist cylinder from the inlet manifold and pull the fuel hose off the suction side of the fuel pump.
 4. Injection engine:
 - a. Detach the vacuum hoses of the power assist cylinder and the pressure sensor from the inlet manifold.
 - b. Detach the fuel hoses from the tubes at inlet resp. outlet of the injection valves.
 5. Carbureted engine:
Undo the cable connections to the ignition coil, serial resistance, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, headlights and headlight wiper motor.
 5. Injection engine:
 - a. Undo the cable connections to the ignition coil, serial resistance, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, headlight, headlight wiper motor.
 - b. Undo the connections for the fuel injection of distributor, injection valves, air cleaner alt. inlet manifold, throttle valve switch and at the temperature sensor and temperature switch below the inlet manifold.
- CAUTION**

Do not detach the connections by pulling the cables. Grip the connecting pieces.
6. Carbureted engine:
 - a. Remove the air cleaner and preheater complete with hose and the ignition cable. As from model 1972: Remove the preheater hose, air cleaner with valve housing and cold air hose.

NOTE: Save the spacer sleeves under the outer preheater casing.
 - b. Detach the throttle control linkage from the throttle shaft and remove the return spring.
As from model 1972: Detach the throttle control wire from driver and bracket.
 - c. Detach the choke control wire and sheath from the carburetor.
 6. Injection engine:
 - a. Remove air cleaner complete with hoses.
 - b. Undo the throttle control shaft (wire) from the driver on the throttle house.
 7. Undo the hoses at the connections to the thermostat housing, radiator, inlet manifold and water pump.
 8.
 - a. Remove the four fastening screws from the front sheet.
 - b. Remove the self-tapping screws holding the headlight trim frames.
 - c. Remove the four lower self-tapping screws securing the headlights to the edge of the bodywork. As from model 1972: Remove the headlights from body and front sheet.
 - d. Remove the hood lock operating cable from its fastenings at the dash panel and wheel housing.
 - e. Remove the front sheet, lifting forward and upward.
 9. Remove the slave cylinder and hang it up in some convenient place.
 10. Move the free wheel lever forward to the locked position. Release the wire clamp at the transmission and free the cable from the holder at the right-hand differential bearing seat. (Only cars with free wheel.)
 11. Disconnect the exhaust pipe from the exhaust manifold.
 12. Detach the ground cable from the transmission. As from model 1973: Remove the alternator.
 13. Jack up the front end of the car and place blocks under the body.
 14.
 - a. Put the gear lever in neutral.
 - b. Knock out the front taper pin from the gear shift rod joint. (In 1970 and later models, the rubber bellows must also be pulled free of the groove on the gear selector rod.) Separate the gear selector rod joint from the gear selector rod.
 15. Detach the speedometer cable from the transmission.
 16. Undo the engine brackets.
 17. Undo the larger clips round the rubber bellows on the inner universal joints. (In 1968–1969 models the T-pieces of the drive shafts must be rotated to the horizontal position.)
 18. Engage the lifting yoke 839240 in the two engine lifting lugs.
 19. 1968–1969 models:
Raise the power plant about 2" (50 mm) and separate the inner universal joints, first the left and then the right, with the power plant displaced as far as possible towards the opposite side. Make sure that the needle bearings do not come apart.

1970 and later models:

Undo the lower end piece from the control arm on the right-hand side. Turn the steering wheel to the left and withdraw the universal joint. Raise the power plant slightly and withdraw the left universal joint.

20. Raise the power plant to a suitable height for access to the cable connections to the starter and up to and incl. model 1972 the alternator, and disconnect the cables.
21. Hoist out the power plant. Fit protective caps over the inner drivers and rubber bellows.

Installing the power plant

1. a. Check that the inner universal joints are packed with grease.
b. As from ch.No. 99.033.917:
Check the front engine cushion. Make sure that the washer is properly tightened.
2. Hoist the power plant with the lifting yoke 839240 and lower it into the engine compartment.

CAUTION

Take care when installing the power plant up to and incl. model 1972 to avoid damaging the fuel line hose joint at the dash panel. After installing, check that there is at least 0.3" (10 mm) clearance between the alternator belt pulley and the hose.

3. Lower the power plant to a convenient working height and connect the cables to the starter and up to and incl. model 1972, alternator.
4. Assemble the inner universal joints as follows:
Hang the clips on the inner drivers.
Lower the power plant to about 2" (50 mm) from the engine cushions. Assemble the inner universal joints with the T-piece horizontal. Assemble the right-hand joint first.
With 1970 and later models, the front end must be blocked up during installation of the power plant. Lower the power plant to about 1" (20-30 mm) from the engine cushions. First assemble the left-hand universal joint, then lower the power plant on to the cushions and assemble the right-hand joint. Connect the end piece to the lower control arm.
5. a. Align the engine brackets. At the same time guide the throttle control shaft into its bearing (up to and incl. model 1971).
b. Bolt the power plant to the engine cushions.
6. Remove the lifting yoke.
7. a. Push the rubber bellows over the inner universal joint drivers and fit the clamps.

- b. Wipe any surplus grease off the rubber bellows and check that the bellows are not deformed.
8. a. Connect the gear shift rod joint to the gear selector rod and insert the taper pin. In 1970 and later models, refit the rubber bellows in the groove on the gear shift rod joint.
b. Connect the speedometer cable to the transmission.
9. Fit the slave cylinder and adjust the clutch.
10. Bolt the exhaust pipe to the exhaust manifold.
11. Lower the front end of the car.
12. a. Connect the free wheel cable and secure it in the holder under the right-hand differential bearing seat.
b. Check the operation of the free wheel control.
13. Connect the ground cable. Mount the alternator, as from model 1973.
14. Mount the front sheet complete with radiator and connect the hood lock operating cable to the attachment at the dash panel.
15. Reconnect the cables to the radiator fan, thermostat contact, headlights, headlight wiper motor and clip the bundle of wiring to the front sheet.
16. Connect the coolant hoses to the radiator, thermostat housing, water pump and inlet manifold.
17. Connect the vacuum hose and fuel hose and connect cables to the temperature transmitter, ignition coil and oil pressure transmitter. On injection engines, also so connect the vacuum hose to the pressure sensor and the cables to the starting contact.
18. Connect the throttle control to the throttle control shaft and connect the choke control to the carburetor. As from model 1972: Connect the throttle control wire to driver and bracket.
19. Carbureted engine:
Mount the air cleaner and preheater casing complete with hose. Connect the ventilation hose to the oil filler pipe. Connect the ignition cable to the distributor and coil.
19. Injection engine:
Mount the air cleaner complete with hoses. Connect the cables for the electronically fuel injection to the distributor, injection valves, air cleaner, inlet manifold, throttle valve switch and to the temperature sensor and thermostat switch at the inlet manifold. Make sure that the rubber caps on the contact pieces are in place.

CAUTION

The connecting pieces only fit in one way and must thus not be forced in place.

20. Install the battery and connect the cables.
21. Close the radiator and engine block drain cocks, fill with coolant and oil. Bleed the heater core. (Up to and incl. model 1973.)
22. Start the engine, checking oil pressure and coolant temperature. Check the operation of the transmission.
Check the operation of the radiator fan by grounding the thermostat contact cable to the radiator.

23.
 - a. Mount the hood and connect the windshield washer and headlight washer hoses.
 - b. Check the fit of the hood. Close the hood, open the doors, and check that the door jambs clear the rear edge of the hood.
 - c. Check the headlight alignment.
 - d. Refit the headlight trim frames.
24. Take the car out for a test run. Check the coolant level after driving.

Separating engine from manual transmission

Some works can be done without separating the engine and gear box.

1. Clean the power plant.
2. Drain the engine oil.
3. Take off the clutch cover.
4. Remove the starter.
5. Unscrew the alternator from the alternator support. Remove the drive belt.
6. Withdraw the clutch shaft (see instructions for disassembling the clutch).
7. Undo the three screws of the release bearing guide sleeve.
8. Back off the adjusting screw and disconnect the clutch lever.
9. Undo all screws in the mating flanges of engine and transmission and two screws accessible from under the transmission.
10. Lift the engine carefully off the transmission (see illustration). At the same time remove the release bearing guide sleeve.

Reassemble in the reverse order.

Do not mix up the screws:

Screws, inserted from the block and threaded into the gear box, have up to and incl. model 1971 UNC threads and as from model 1972 M threads.

Screws, inserted from the transmission and threaded into the cast iron cylinder block have on 1.7 and 1.85 l engines UNF threads and on 2.0 l engines M threads.

TRANSMISSION CONTROL

Manual transmission

General

Gear shifting is controlled by a floor-mounted lever located between the front seats.

As from chassis No. 99.039.548 a new design of gear lever has been introduced. To release the reverse gear catch on levers of the new design, pull the ring-shaped handle, located under the lever knob, upwards. The lever is made in two parts, insulated from each other by rubber bearings. The rest of the transmission control system consists of a gear lever housing recessed into the floor between the front seats and a rod that transmits gear lever movements to the gearbox.

Adjusting gear positions

1. Engage reverse gear and turn the ignition key to L (Locked).
2. Move the gear lever back and forth. The gear shift rod should then have an axial movement of 0.06–0.1" (1.5–2.5 mm). Adjust by moving the gear lever housing forward or backward.

Gear lever lock

General

The car is equipped with a combined ignition switch and gear lever lock. When the gear lever is placed in reverse and the ignition key withdrawn, the gear lever is locked. The ignition switch has the following positions:

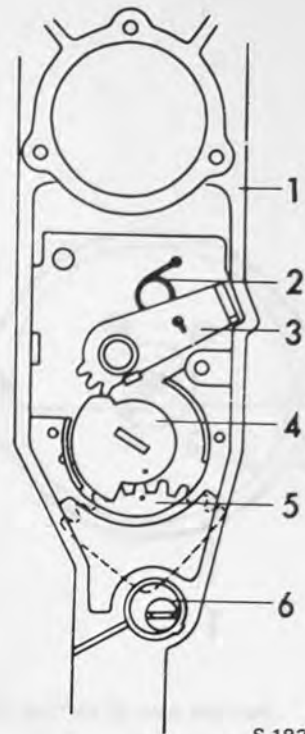
L. Locked. Reverse gear must be engaged before the key can be turned to L, and the key can only be withdrawn in this position.

Parking lights and hazard warning lights can be switched on.

G. Garage. All lights can be switched on.

K. Drive. All electrical systems including the ignition circuit are live.

S. Start. This position has a spring-loaded return to K. The gear lever lock consists of a tongue (3) and cogwheel (4) actuated by a toothed segment (5) mounted under the lock cylinder (6). The segment turns with the lock cylinder.



S 1835

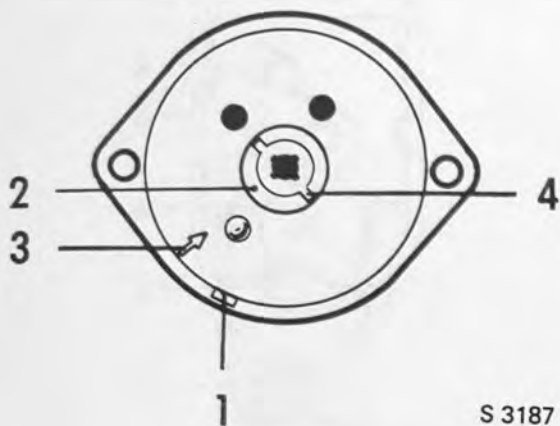
GEAR LEVER LOCK

1. Housing
2. Spring
3. Locking tongue
4. Cogwheel
5. Toothed segment
6. Lock cylinder

Ignition and starter contact

Removing

1. Engage reverse gear and take out the ignition key.
2. Take out the left front seat and slide the right one forward.
3. Disconnect the battery cables.
4. Pull up the rubber boot of the gear lever.
5. Undo the three screws in the gear lever cap.
6. Pull out the gear lever complete with carrier.
7. Take out the lever bearing and spring ring.
8. Remove or turn back the floor carpet.
9. Take the plate off the heater cover.
10. Remove the knobs from the free wheel and heater control levers.
11. Undo the three retaining screws from the gear lever cover and lift off the cover.
12. Disconnect the wiring from the ignition switch and back-up light contact.
13. Undo the retaining screws from the gear lever housing, using special wrench 839123.
14. Raise the gear lever housing slightly and twist it so that the cover plate screws can be undone from underneath.
15. After the cover plate has been taken off, the cogwheel, tongue and spring can be removed from the lock.

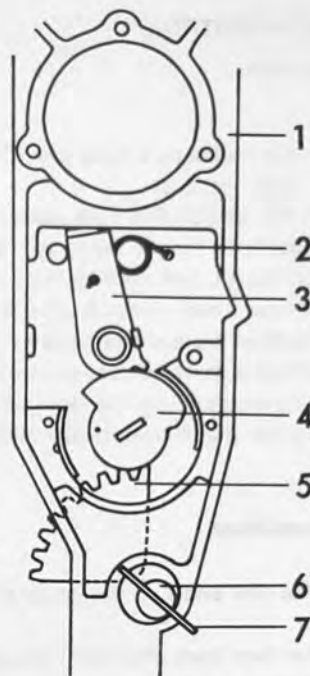


S 3187

IGNITION AND STARTER CONTACT

1. Locating stud
2. Setting mark
3. Marking arrow
4. Gear wheel fitting groove

1. Insert a screwdriver in the slot (4) and turn the contact to bring the mark (2) opposite the arrow (3), (see illustration).
2. Check that the ignition key is in position L (locked).
3. Mount the contact with the locating stud (1) in the matching groove in the gear lever housing.
4. Turn the ignition key back and forth to make sure that the gear lever lock does not stick or jam.
5. Fit the cover plate.
6. Mount the gear lever housing, making sure that the plastic bushing on the gear shift rod is correctly positioned in the bracket.
7. Move the rod to the neutral position and mount the gear lever with bearing and spring ring, tightening the three retaining screws.
8. Adjust the gear positions (see page 432-1).
9. Connect the cables to the ignition switch and back-up light contact. Engage reverse gear and withdraw the ignition key.
10. Mount the gear lever cowl and other removed components.



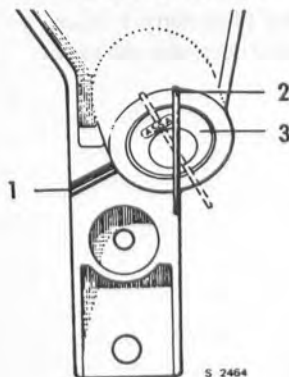
GEAR LEVER LOCK

1. Housing
2. Spring
3. Locking tongue
4. Cogwheel
5. Toothed segment
6. Lock cylinder
7. Ignition key

Lock cylinder

Removing the cylinder

1. Take off the gear lever housing (see section on removing the gear lever housing).
2. Up to and incl. the 1973 model: Turn the key so that the key lines up with the right edge of the "ASSA" trademark.
As from model 1974: Turn the key to a position between the locking- and garage position.
3. With the key in this position, the lock cylinder cotter pin can be pushed in to free the cylinder with the help of a wire lockpick or similar inserted through a hole under the gear lever housing (see illustration).
4. Pull out the lock cylinder.



LOCK CYLINDER AND KEY,
UP TO AND INCL. MODEL 1973

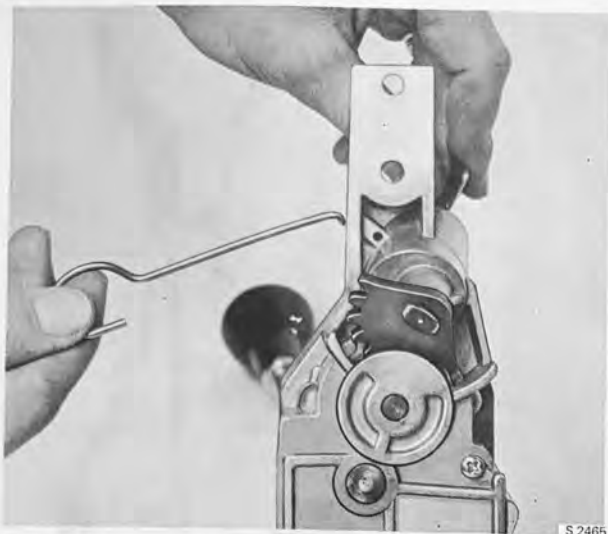
1. Hole for catch pin
2. Key
3. Lock cylinder



S 4116

LOCK CYLINDER AND KEY,
AS FROM MODEL 1974

1. Key
2. Lock cylinder



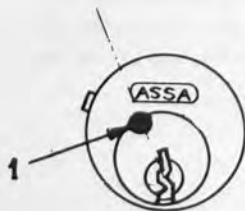
PUSHING IN THE CATCH PIN

Assembling

1. Up to and incl. model 1973: Turn the key in the lock cylinder so that it lines up with the right edge of the "ASSA" trademark.
As from model 1974: Turn the key in the lock cylinder to a position between the locking- and garage positions.
2. Push in the lock cylinder catch pin. Check that the toothed segment driver pins are correctly positioned to fit in the lock cylinder. Push in the lock cylinder and check that it is engaged in the toothed segment.
3. Mount the gear lever housing according to the instructions given below.

Disassembly when key is missing

If the key has been lost or if it is necessary to remove the lock or the lock cylinder, the cylinder must be drilled before the catch pin can be pressed in. Drill an 0.12 in. (3 mm) hole in the cylinder to a depth of about 1.0 in. (25 mm) as illustrated.



DRILLING LOCK CYLINDER FOR REMOVAL WHEN KEY IS MISSING, UP TO AND INCL. MODEL 1973

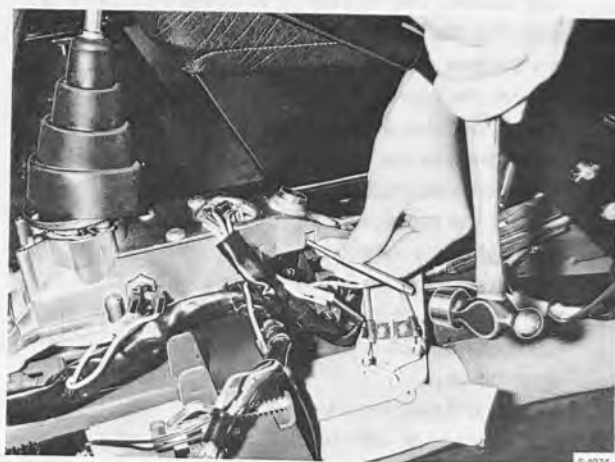
1. Hole, diameter 0.12 in. (3 mm), depth 1.0 in. (25 mm)

Disassembly when key is missing

As from model 1974: If the key is missing, the lock cylinder is removed from the gear lever housing as follows:

1. Lift out the left front seat and the gear lever housing protection casing.
2. Loosen the gear lever housing retaining nuts with the aid of special tool 839123.
3. Drill out the plug covering the hole for the lock cylinder catch pin in the gear lever housing.
4. Drive in the catch pin approx. 0.08 in. (approx. 2 mm) with the aid of a drift and remove the lock cylinder.

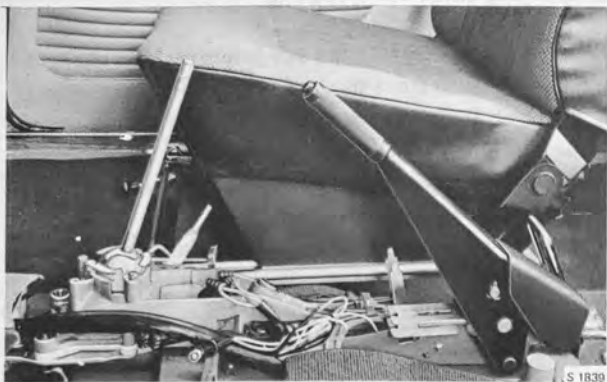
Before installation, plug the hole in the gear lever housing again. The plug is made of a suitable screw or rivet that is cut to a length of approx. 0.19 in. (approx. 5 mm).



THE LOCK CYLINDER CATCH PIN IS DRIVEN IN WITH THE AID OF A DRIFT

Removing the gear lever housing

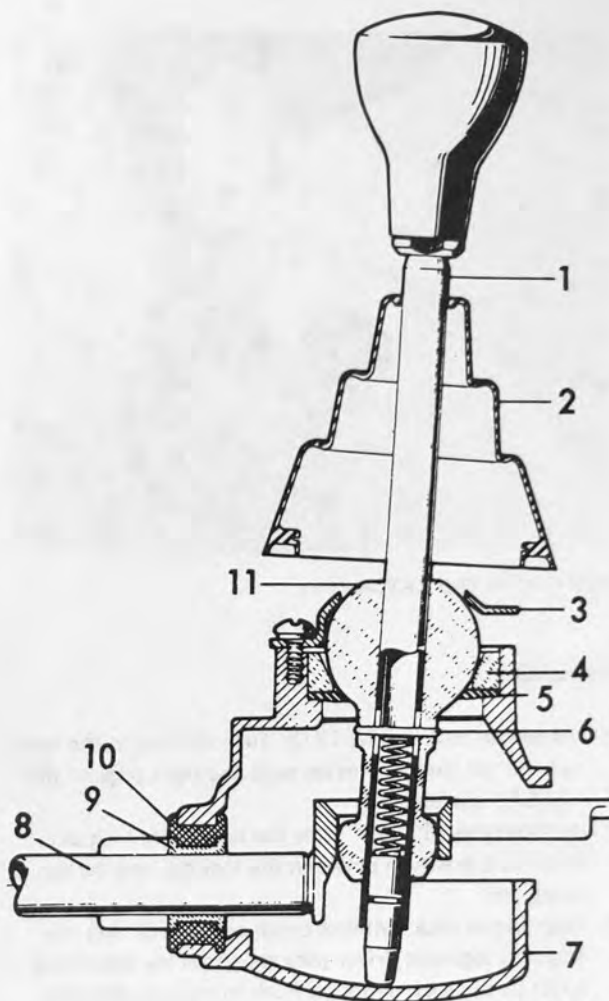
1. Put the gear lever in reverse and take out the ignition key.
2. Take out the left front seat and slide the right one forward.
3. Disconnect the battery cables.
4. Pull up the rubber boot on the gear lever.
5. Unscrew the three retaining screws from the cover.
6. Remove the gear lever and the carrier.
7. Remove the gear lever bearing and if any spring ring.
8. Turn back the floor carpet.
9. Remove the plate on the heater cover.
10. Remove the buttons to the free wheel control and heater control.
11. Unscrew the three retaining screws from the gear lever cover and lift off the cover.
12. Disconnect the wiring from the ignition switch and back-up light contact.
13. Back off the retaining nuts from the gear lever housing, using special tool 839123.
14. Raise the gear lever housing slightly and twist it to reach the bottom cover screws. Take off the bottom cover and disconnect the free wheel control wire.



GEAR LEVER HOUSING, COVER REMOVED

Assembling

1. Turn the ignition key to K (Drive).
2. Assemble the gear lever housing and bottom cover and connect the free wheel control cable, making sure that the rubber bushing is properly positioned on the gear shift rod.
3. Mount the gear lever housing, making sure that the plastic bushing on the gear shift rod is correctly positioned in the bracket.
4. Move the rod into neutral.
5. Mount the gear lever with bearing and spring ring and tighten the three retaining screws.
6. Adjust the gear positions (see page 432-1).
7. Connect the cables to the ignition switch and back-up light contact. Engage reverse gear and withdraw the ignition key.
8. Mount the gear lever cover.
9. Fit the control lever buttons.
10. Fit the rubber boot.
11. Fit the plate on the heater cover.
12. Lay the carpets, install the front seats and connect the battery cables.



S 1841

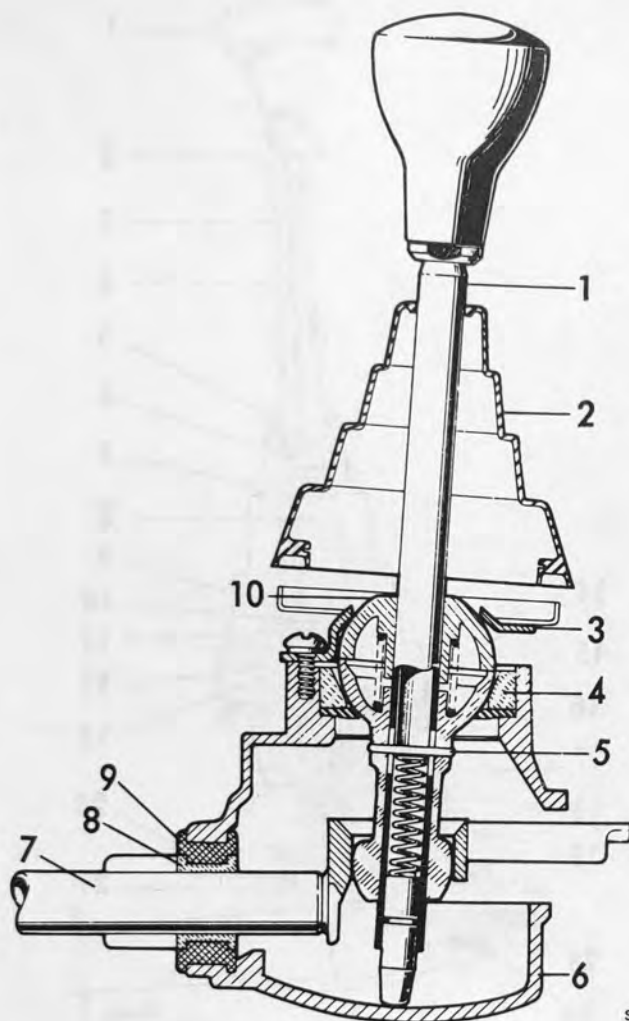
SECTION THROUGH GEAR LEVER HOUSING,
up to chassis No. 99.009.988

1. Gear lever
2. Rubber boot
3. Cap
4. Bearing
5. Spring ring
6. Tension pin
7. Bottom part
8. Gear shift rod
9. Bearing
10. Rubber bushing
11. Carrier

Removing the gear lever from the car

1. Put the gear lever in neutral.
2. Pull up the rubber boot (2).
3. Undo the three screws from the cap (3).
4. Pull out the lever (1) with the carrier (11).
5. Remove the gear lever bearing (4) and spring ring (5).

Reassemble in the reverse order.



SECTION THROUGH GEAR LEVER HOUSING,
as from chassis Nos. 99.009.989

1. Gear lever
2. Rubber boot
3. Cap
4. Bearing
5. Tension pin
6. Bottom part
7. Gear shift rod
8. Bearing
9. Rubber bushing
10. Carrier

Removing the gear lever as from chassis No. 99.039.548

1. Undo the three screws under the rubber boot and remove the gear lever from the gear lever housing.
2. Pull out the tension pin from the carrier, screw out the catch stud and remove the spring.
3. Remove the carrier, the bearing and the cover.
4. Knock carefully with a plastic hammer on the knob, so that it will loosen from the gear lever and remove the carrier, the catch rod and the rubber boot.
5. Remove the lock ring, which holds the hollow lever and the gear lever together and pull out the hollow lever with its rubber bushing.

Replace damaged or worn parts.

Assembly

1. Fit slot ring, washers and rubber bushings on the hollow lever.
2. Fit the hollow lever in the gear lever and fit the lock ring.
3. Fit rubber boot, carrier and catch rod. Put the spring

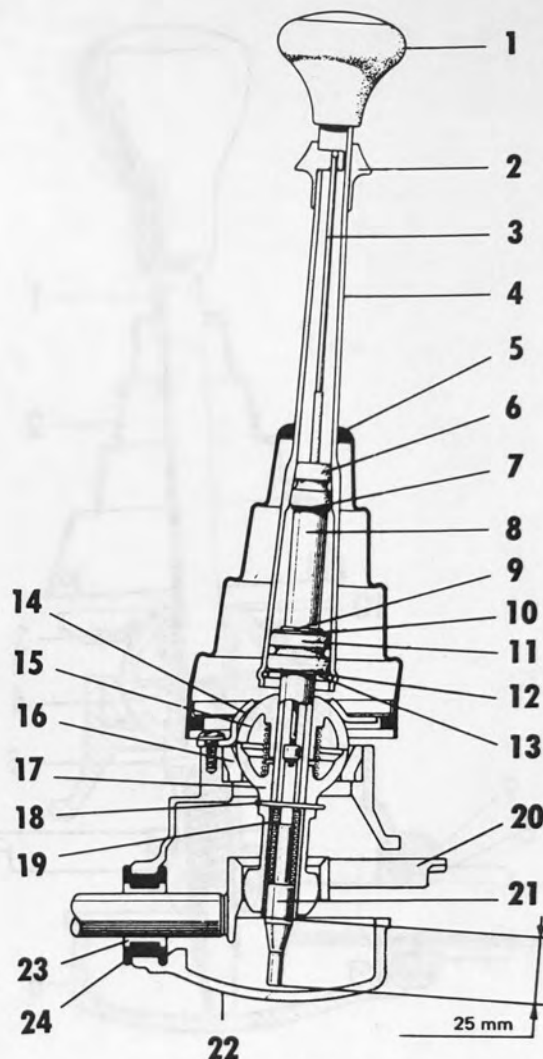
Removing the carrier, spring up to chassis No. 99.039.547

1. Take out the gear lever as above.
2. Undo the lock nut and take off the gear lever knob.
3. Insert tool 839122 into the hollow lever and push down the spring pressing against the carrier tension pin. Press just enough to relieve the pressure on the pin. Pull out the pin with pliers and withdraw the tool. Remove the spring and carrier.

Reassemble in the reverse order.

into the hollow lever and screw in the catch stud 1" (25 mm) see illustration.

4. Fit cover, bearing, carrier and tension pin.
5. Press the knob on the gear lever.
6. Fit the gear lever on the gear lever housing.



S 3190

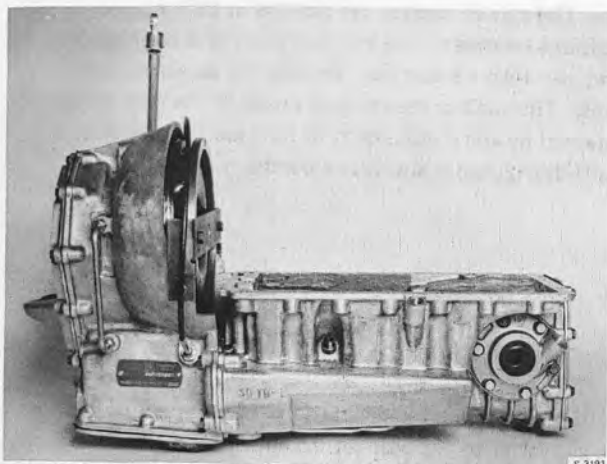
SECTION THROUGH GEAR LEVER HOUSING, AS FROM CHASSIS NOS. 99.039.548

1. Knob
2. Carrier
3. Catch rod
4. Gear lever
5. Rubber boot
6. Rubber bushing
7. Washer
8. Hollow lever
9. Slot ring
10. Washer
11. Rubber bushing
12. Washer
13. Lock ring
14. Cover
15. Bearing
16. Gear lever bearing
17. Carrier
18. Tension pin
19. Spring
20. Gear shift rod
21. Catch stud
22. Bottom part
23. Bearing
24. Rubber bushing

GENERAL, ROAD TEST AND FAULT DIAGNOSIS

Automatic transmission

The Automatic Transmission consists of a three-element hydrokinetic torque converter, and a hydraulically operated gearbox comprising a planetary gear set providing three forward ratios and reverse.



Operation

'D' Range

This is provided for use when full performance of the car is required and when selected gives a first speed start with automatic up- and down change.

'2' Range

This is provided for use when only the first two ratios are required.

Automatic change from '1'-'2' is also provided.

Driving on 3rd is eliminated. Position 2 may not be selected at speeds above 55 mph (90 km/h).

'1' Range

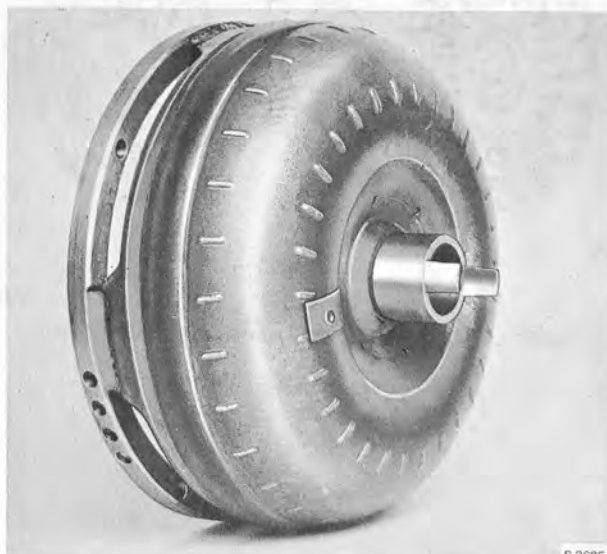
This gives manual selection of 1st gear only. When this gear has been engaged it will remain in engagement until '2' or 'D' has been selected.

When selected at higher speeds, the transmission immediately changes to 2nd and when the speed has slowed down to a certain speed the 1st gear will engage. Position 1 may not be selected at speeds above 90 km/h.

The torque converter

The feature of using a hydraulic converter in conjunction with a three speed automatic gearbox provides a means of obtaining a smooth application of engine power to the driving wheels and additional engine torque multiplication.

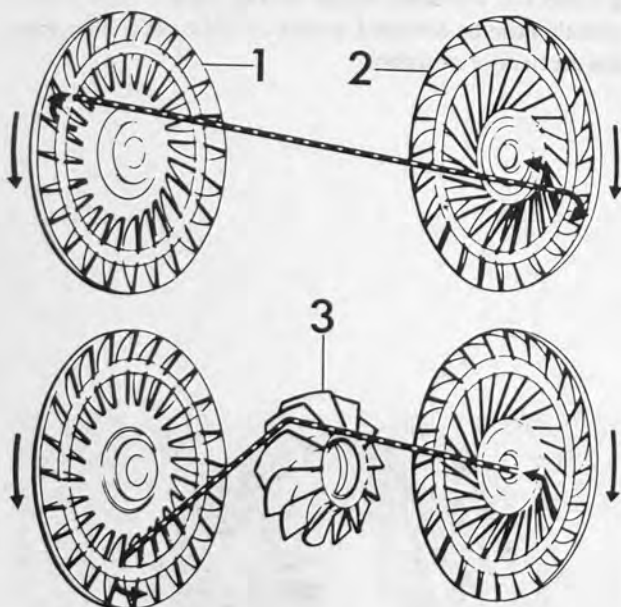
The converter also provides extreme low speed flexibility when the gearbox is in 3rd gear and, due to the ability of multiplying engine torque, it provides good acceleration from very low road speed without having to resort to a downshift in the gearbox. Torque multiplication from the converter is infinitely variable between the ratios of 2:1 and 1:1. The speed range, during which torque multiplication can be achieved, is also variable, depending upon the accelerator position.



TORQUE CONVERTER

The torque converter for use in conjunction with the gearbox, comprises an impeller connected to the engine crankshaft, a turbine connected to the input shaft of the gearbox, and a stator mounted on a sprag type oneway clutch supported on a fixed hub projecting from the converter housing.

The impeller is rotated by the engine and converts the engine power into hydrokinetic energy. The fluid flows from the impeller vanes to the turbine vanes and returns to the impeller through the stator vanes. The curvature of the various vanes is so designed that when a speed differential exists between the impeller and the turbine, the angle of the fluid flow from the turbine is changed by the stator vanes in such a way that the discharge of fluid from the stator assists in driving the impeller. Under such conditions, torque multiplication occurs and varies from 2:1 when the turbine is stalled to 1:1. The torque 2:1 is received when the vehicle is held stationary with the engine operating at maximum throttle opening and any one of the driving ranges selected. The torque 1:1 is received when the turbine reaches a speed approximately 90 % of the impeller. When this speed differential between the impeller and turbine is achieved, the fluid flow angle from the turbine is such that the stator is driven in the same direction as the turbine and the impeller. Under these circumstances, the converter becomes a fluid flywheel or coupling and there is no torque multiplication.



S 3192

PRINCIPLES OF OPERATION, TORQUE CONVERTER

1. Impeller
2. Turbine
3. Stator

The gear set

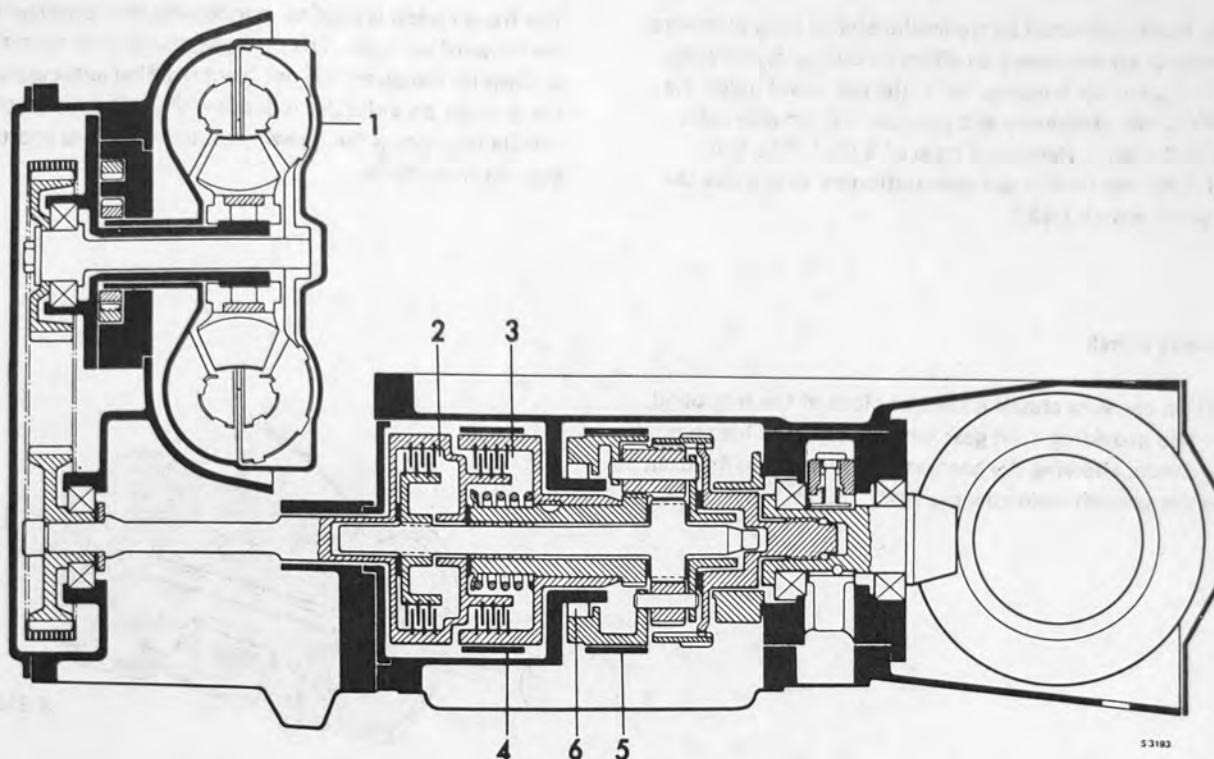
The planetary gear set consists of two sun gears, two sets of pinions, a pinion carrier and a ring gear. Helical involute tooth forms are used throughout. Power enters the gear set via the sun gear. In all forward gears, power enters through the forward sun gear; in Reverse, power enters through the reverse sun gear. Power leaves the gear set 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 correct positions relative to the two 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.

Clutches

Multi-disc clutches operated by hydraulic pistons connect the converter to the gear set. In all forward gears the front clutch connects the converter to the forward sun gear; for Reverse, the rear clutch connects the converter to the reverse sun gear.

Chain transmission

From the turbin shaft of the torque converter is the power transmitted via a chain to the input shaft of the transmission.



PRINCIPLES OF OPERATION, AUTOMATIC TRANSMISSION

1. Torque converter
2. Front clutch
3. Rear clutch
4. Front band
5. Rear band
6. One-way clutch

Selector Position	Ratio	Applied	Driving	Held
1	1st	Front Clutch Rear Band	Rear sun gear	Planet Carrier
D and 2	1st	Front Clutch One-way Clutch	Rear sun gear	Planet Carrier
D and 2	2nd	Front Clutch Front Band	Rear sun gear	Reverse Sun
D	3rd	Front Clutch Rear Clutch	Rear sun gear	
R	Reverse	Rear Clutch Rear Band	Front sun gear	Planet Carrier

APPLICATION OF BANDS AND CLUTCHES FOR THE
VARIOUS SELECTED POSITIONS

Brake bands

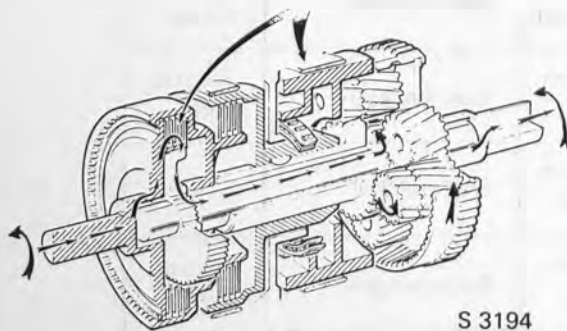
Brake bands, operated by hydraulic servos, hold elements of the gear set stationary to effect an output speed reduction and a torque increase. In '1' the rear band holds the pinion carrier stationary and provides the 1st gear ratio of 2.39:1 and, in Reverse, a ratio of 2.09:1. The front band holds the reverse sun gear stationary to provide the 2nd gear ratio of 1.45:1.

One-way clutch

In 'D', a one-way clutch is used in place of the rear band, thus also providing a 1st gear ratio of 2.39:1. This one-way clutch, allowing the gear set to freewheel in 1st gear, provides smooth ratio changes from 2nd to 1st.

The mechanical power flow First Gear ('1' selected)

The front clutch is applied, connecting the converter to the forward sun gear. The rear band is applied, holding the planet carrier stationary; the gear set provides the reduction of 2.39:1. The reverse sun gear rotates freely in the opposite direction to the forward sun gear.

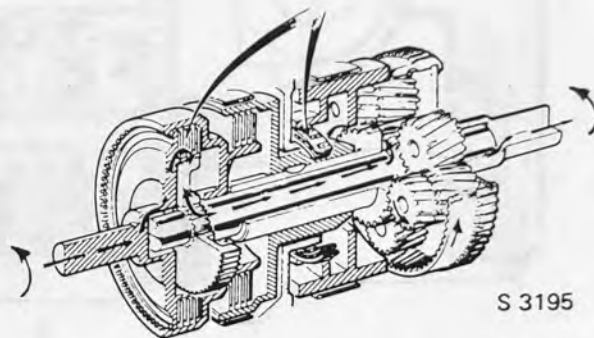


S 3194

MECHANICAL POWER FLOW – FIRST GEAR '1' SELECTED

First Gear ('D' or '2' selected)

The front clutch is applied, connecting the converter to the forward sun gear. The one-way clutch is in operation, preventing the planet carrier from rotating anti-clockwise; the gear set provides the reduction of 2.39:1. When the vehicle is coasting the one-way clutch over-runs and the gear set freewheels.

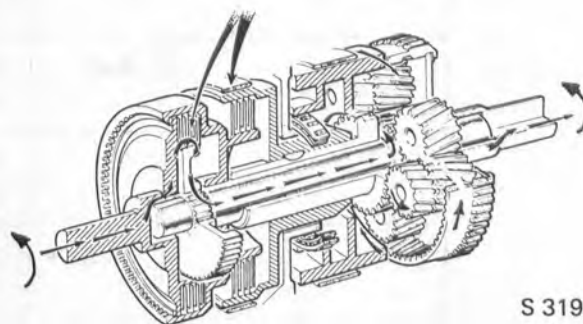


S 3195

MECHANICAL POWER FLOW – FIRST GEAR 'D' OR '2' SELECTED

Second Gear ('D' or '2' selected)

Again the front clutch is applied, connecting the converter to the forward sun gear. The front band is applied holding the reverse sun gear stationary; the gear set provides the reduction of 1.45:1.

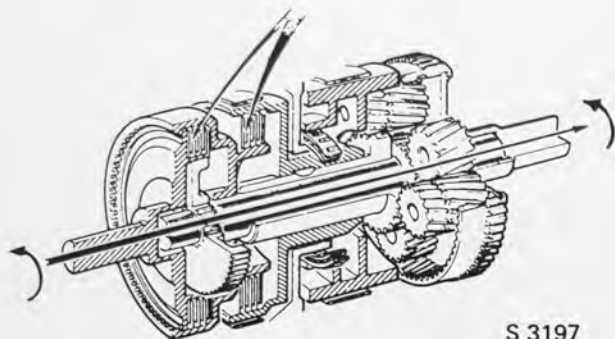


S 3196

MECHANICAL POWER FLOW – SECOND GEAR 'D' OR '2' SELECTED

Third Gear ('D' selected)

Again the front clutch is applied connecting the converter to the forward sun gear. The rear clutch is applied, connecting the converter also to the reverse sun gear; thus both sun gears are locked together and the gear set rotates as a unit providing a ratio of 1:1.



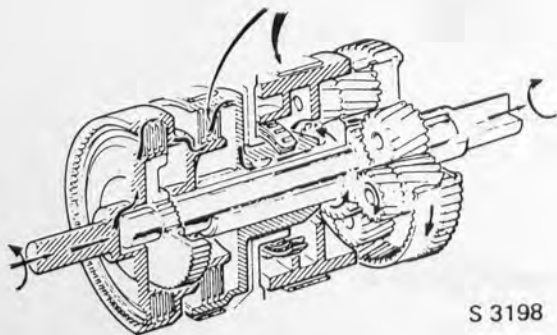
MECHANICAL POWER FLOW — THIRD GEAR 'D' SELECTED

Neutral and Park

In neutral the front and rear clutches are off, and no power is transmitted from the converter to the gear set. The front and rear bands are also released.

Reverse (R selected)

The rear clutch is applied, connecting the converter to the reverse sun gear. The rear band is applied, holding the planet carrier stationary; the gear set provides the reduction of 2.09:1 in the reverse direction.



MECHANICAL POWER FLOW — REVERSE GEAR 'R' SELECTED

The hydraulic system

The hydraulic system contains a pump of the internal/external gear pattern, picking up fluid from the oil pan through a strainer. Automatic control is provided by a centrifugally operated hydraulic governor on the transmission pinion shaft. This governor works in conjunction with valves in the valve bodies assembly located in the transmission. These valves regulate the fluid pressure and direct the pressure to the appropriate transmission components.

The Pump

The pump, driven by the converter impeller, is in operation whenever the engine is running. This pump, through the primary and secondary regulator valves, supplies the hydraulic requirements of the transmission both with the engine idling and whilst the car is in motion.

The Governor

The governor, revolving with the output shaft is basically a pressure regulating valve which reduces line pressure to a value that varies with output shaft (i.e. vehicle) speed. This variable pressure, known as governor 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 be affected by centrifugal force. This outward force is opposed by an opposite and equal hydraulic force produced by pressure acting on the regulating area of the governor valve. The governor valve is a regulating valve and will attempt to maintain equilibrium. Governor pressure will rise in proportion to the increase in centrifugal force caused by higher output shaft speed.

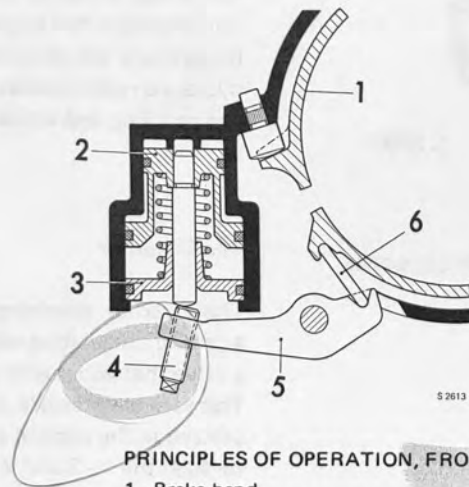
As speed increases, the governor weight moves outwards centrifugally to a stop in the governor body, when it can move no further. When this occurs, a spring located between the weight and the governor valve becomes effective. The constant force of this spring then combines with the centrifugal force of the governor valve, the total then being opposed by governor pressure, thus rendering this 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.

The 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 downshift and throttle valve pressure acting upon the spring end and modulated throttle pressure acting on the opposite end. Shift control is provided by the 1-2 and 2-3 shift valves

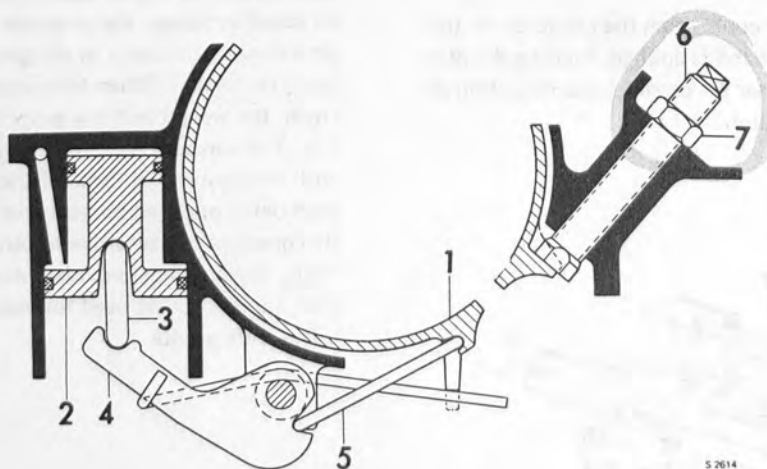
operated by governor pressure acting upon one end and throttle pressure acting upon the spring end, line pressure acting, upon differential areas providing "shift speed hysteresis".

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 hydraulic circuits are identified by numbers. See table on page 440-19.



PRINCIPLES OF OPERATION, FRONT SERVO

1. Brake band
2. Piston, inner
3. Piston, external
4. Adjusting screw
5. Lever
6. Push rod



PRINCIPLES OF OPERATION, REAR SERVO

1. Brake band
2. Piston
3. Push rod
4. Lever
5. Push rod
6. Adjusting screw
7. Locking nut

Operation in 'N'

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 of the front end of the gear train (21). Identical pressure (23) is directed to the rear end of the gear train. The valve returns excess flow (24) to the oil pan.

Operation in 'P'

An internal linkage from the manual valve detent lever engages the parking pawl with teeth formed on the driven 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 upon the design of the hydraulic system without the rear servo or band performing any function in this selector position.

Operation in 'R'

Pressure control of the front 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 absence of governor pressure the shift valves and servo orifice control valve perform no function in this selector position. The fluid passages (13), and (15) of other manual valve positions are utilised in 'R' to simplify the hydraulic circuit.

Operation in 'D' or '2' — First gear

Pressure control of the front pump will be 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 upon the primary regulator valve opposing throttle pressure (9), thus modulating line pressure in the interest 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) reaches the 2-3 shift valve for the subsequent 2-3 shift.

The front clutch applied in conjunction with the one-way clutch, permits the car to move off from rest, in first gear. The hydraulic circuit for 2 (1st gear) is the same as for position D (1st gear) except that the system pressure (3) is prevented from reaching the 2nd-3rd shift valve by a flange on the shift valve.

Operation in 'D' or '2' — Second gear

Pressure control by the primary regulator valve will be of the front pump output. Throttle pressure (8-9) acts upon the primary regulator valve as in 'D' — first gear.

Shift control is provided by the 1-2 shift valve moving under influence of governor pressure (2), opposed by spring force and throttle pressure (10). 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 2nd gear. With the downshift valve in the forced throttle position as illustrated, forced throttle pressure (11) acts upon the 1-2 shift valve and the 2-3 shift valve thus further delaying the upshift (or providing a 3-2 downshift or a 2-1 downshift at speeds when there is little governor pressure (2). The hydraulic circuit for 2 (2nd gear) is the same as position D (2nd gear) except that the line pressure is prevented from reaching the 2nd-3rd shift valve from a flange or edge on the shift valve.

The figure D-2 shows the "kick-down" valve actuated.

Operation in 'D' — 3rd gear

Pressure control is as in 'D' except that in the throttle valve position shown (minimum throttle) no throttle pressure or modulated throttle pressure acts upon the two ends of the primary regulator valve.

Shift control is provided by the 2-3 shift valve moving against spring force under influence of governor pressure (2). This permits line pressure (3) to reach the rear clutch (15) and the release side of the front servo through the servo orifice control valve. When governor pressure (2) is apparent, the servo orifice control valve closes, forcing line pressure through a .059 in. (1.49 mm) orifice which thus 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 3rd gear.

The absence of throttle pressure as mentioned above will

cause the 2-3 shift valve to move early under influence of governor pressure, thus providing a low-speed 2-3 shift.

Operation in 1

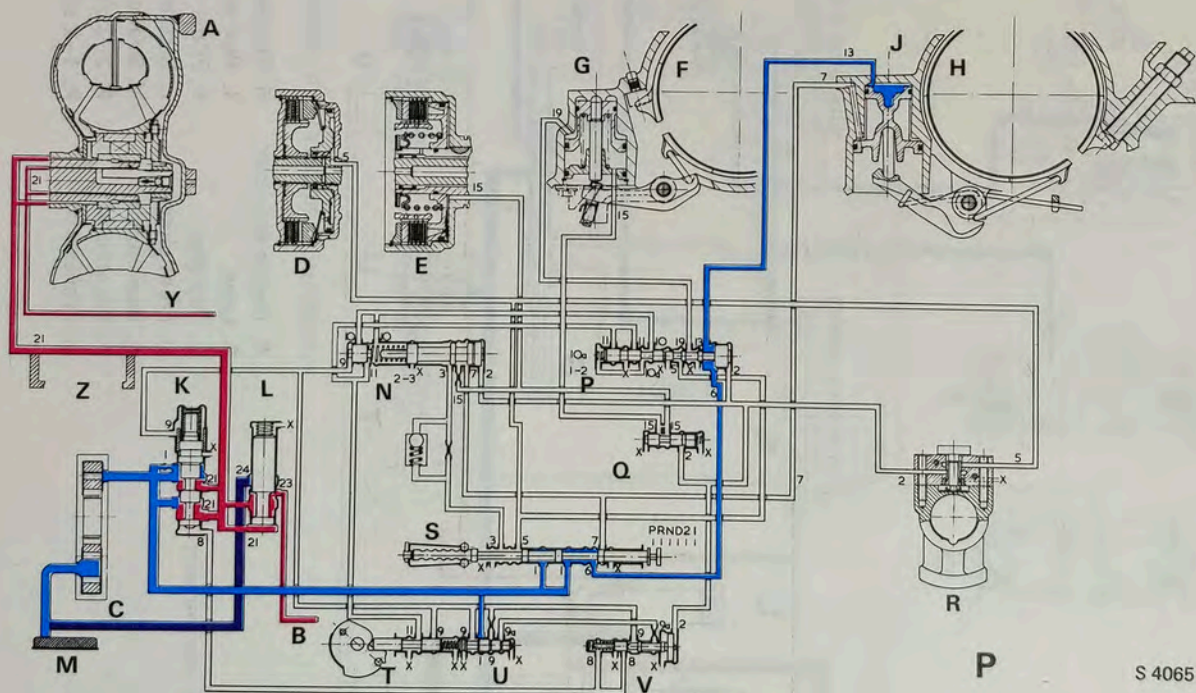
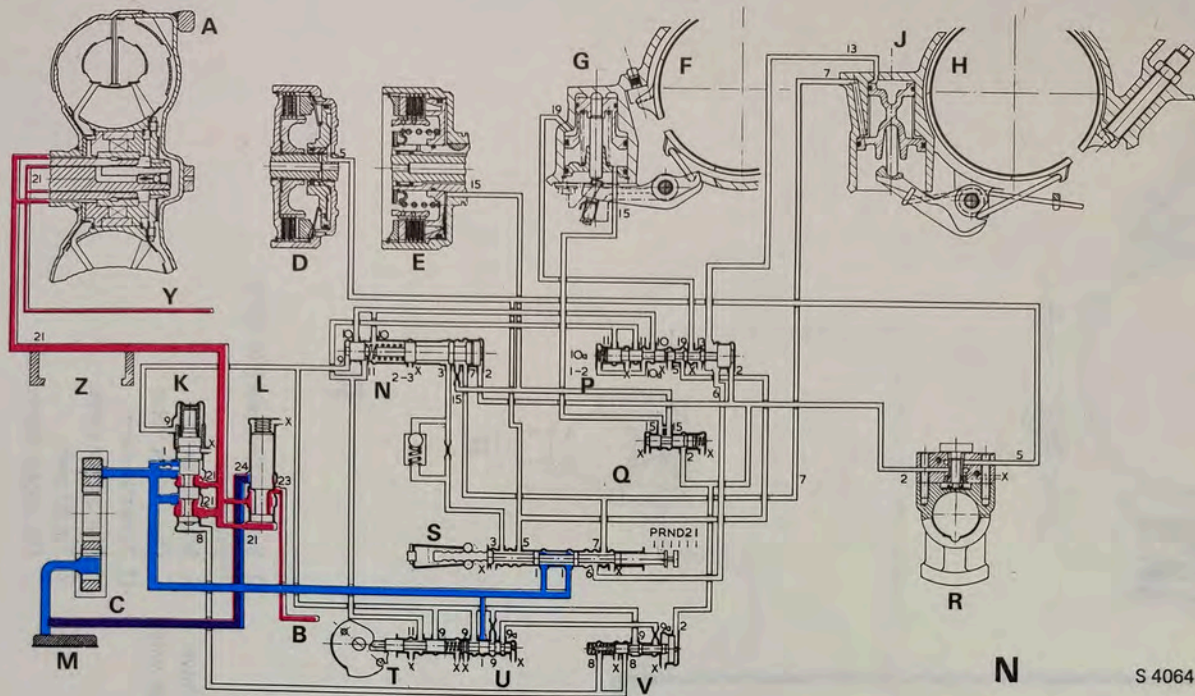
Pressure control of the front pump will be as in 'D' or '2'. The manual valve directs line pressure (5) to the front clutch, governor feed and 1-2 shift valve. In the position illustrated, the 1-2 shift valve is subjected to insufficient governor pressure (2) to overcome spring pressure. The result is that the valve prevents line pressure (5) from reaching the apply side of the front servo but line pressure (6) is open to the rear servo.

With the manual valve in the 1-2 position, 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 line pressure (6) is open to the rear servo.

With the manual valve in the 1-2 position, 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 line pressure (6) is open to the rear servo.

With the manual valve in the 1-2 position, 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 line pressure (6) is open to the rear servo.

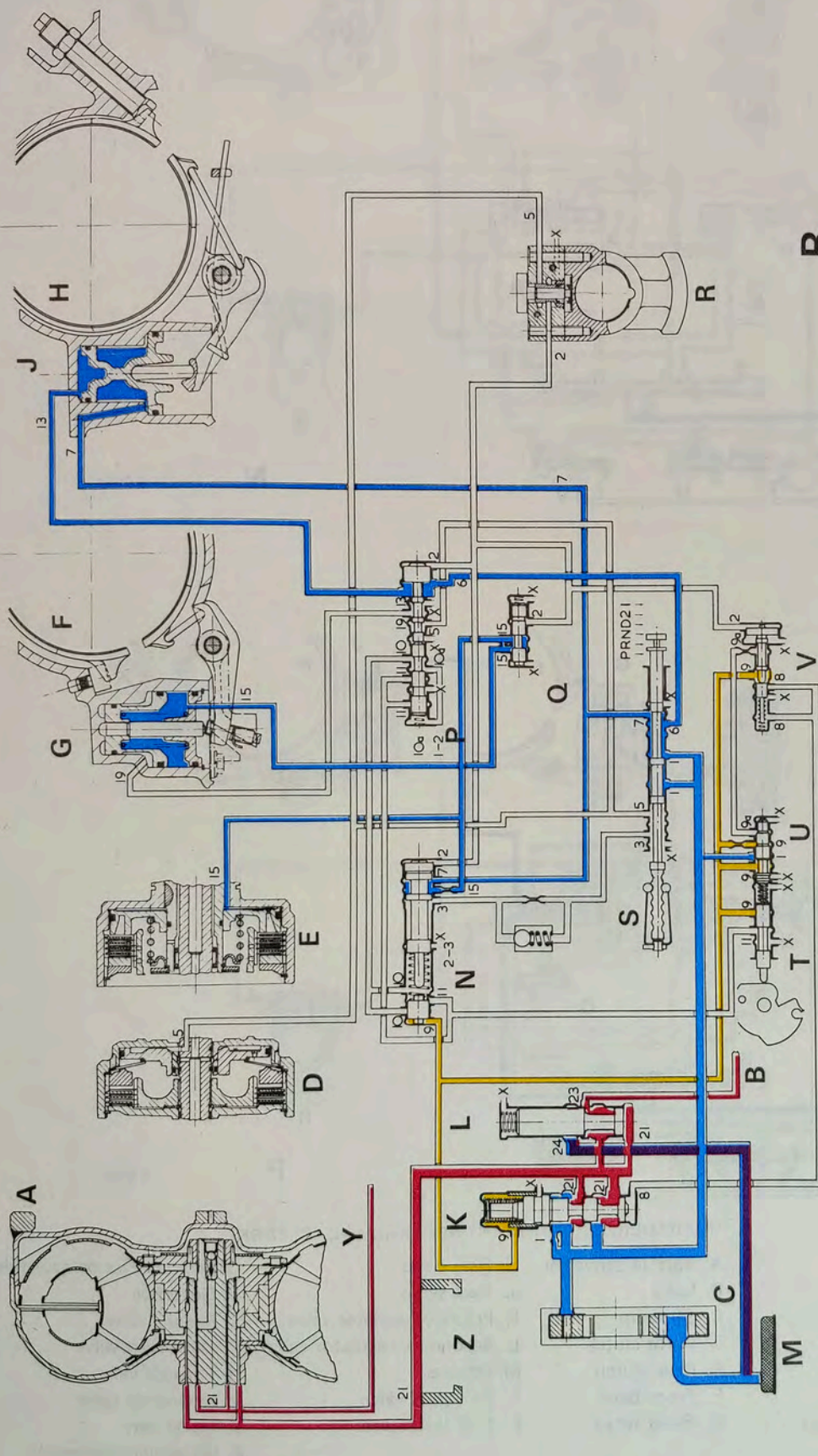
With the manual valve in the 1-2 position, the 1-2 shift valve is subjected to insufficient governor pressure (2) to overcome spring pressure. The result is that the valve prevents line pressure (5) from reaching the apply side of the front servo but line pressure (6) is open to the rear servo.



HYDRAULIC CIRCUIT IN "N" NEUTRAL AND "P" PARK

 Line pressure
 Converter pressure
 Return from secondary regulator valve

- | | | |
|---------------------|------------------------------|--------------------------------|
| A. Torque converter | H. Rear band | Q. Servo orifice control valve |
| B. Lube | J. Rear servo | R. Governor |
| C. Oil pump | K. Primary regulator valve | S. Manual valve |
| D. Front clutch | L. Secondary regulator valve | T. Downshift valve |
| E. Rear clutch | M. Strainer | U. Throttle valve |
| F. Front band | N. 2-3 shift valve | V. Modulator valve |
| G. Front servo | P. 1-2 shift valve | Y. To oil pan |
| | | Z. Oil cooler (optional) |

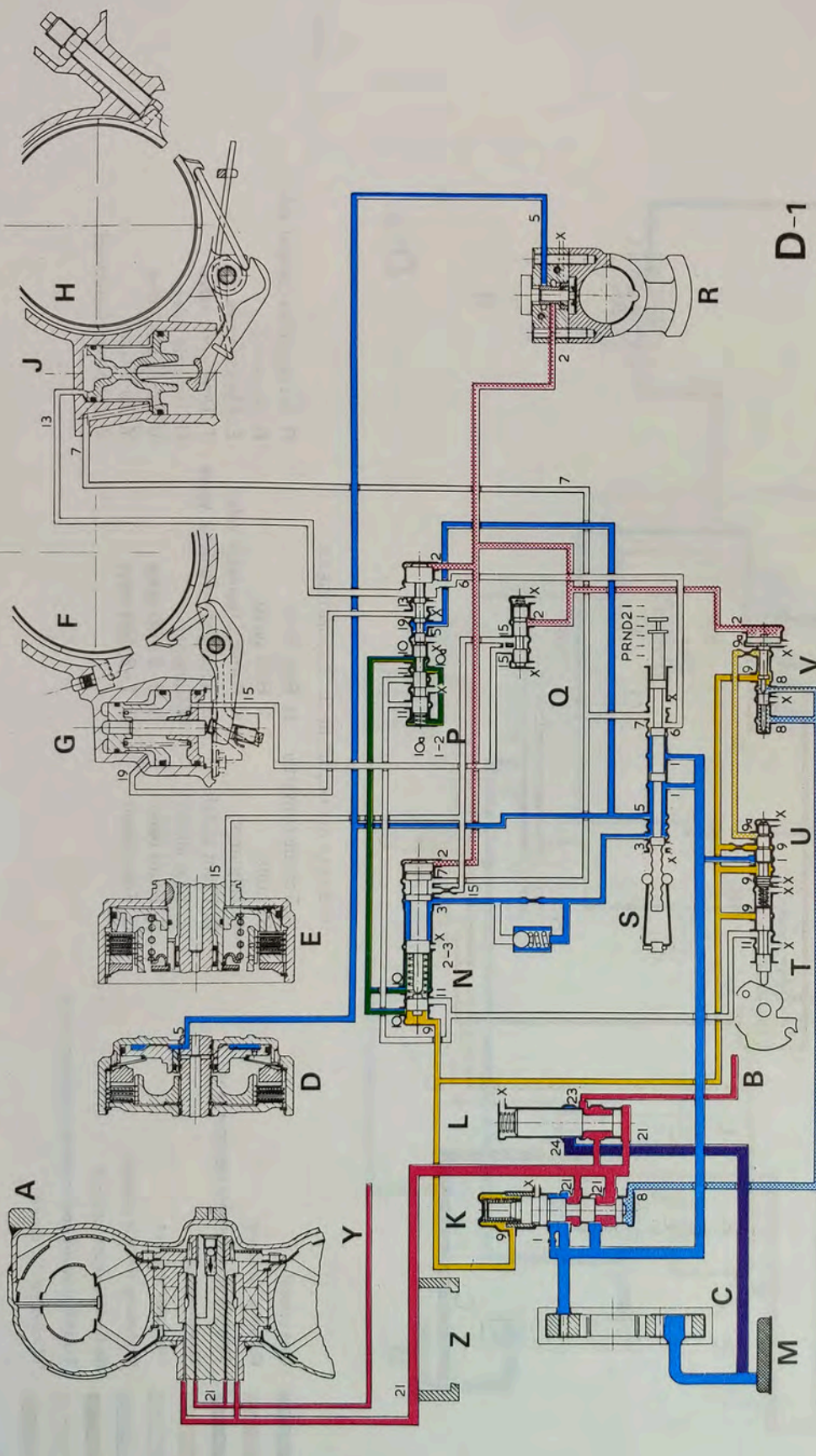


HYDRAULIC CIRCUIT IN "R" REVERSE

Line pressure
 Converter pressure
 Return from secondary regulator valve
 Throttle pressure

- | | | |
|---------------------|------------------------------|--------------------------------|
| A. Torque converter | H. Rear band | Q. Servo orifice control valve |
| B. Lube | J. Rear servo | R. Governor |
| C. Oilpump | K. Primary regulator valve | S. Manual valve |
| D. Front clutch | L. Secondary regulator valve | T. Downshift valve |
| E. Rear clutch | M. Strainer | U. Throttle valve |
| F. Front band | N. 2-3 shift valve | V. Modulator valve |
| G. Front servo | P. 1-2 shift valve | Y. To oil pan |
| | | Z. Oil cooler (optional) |

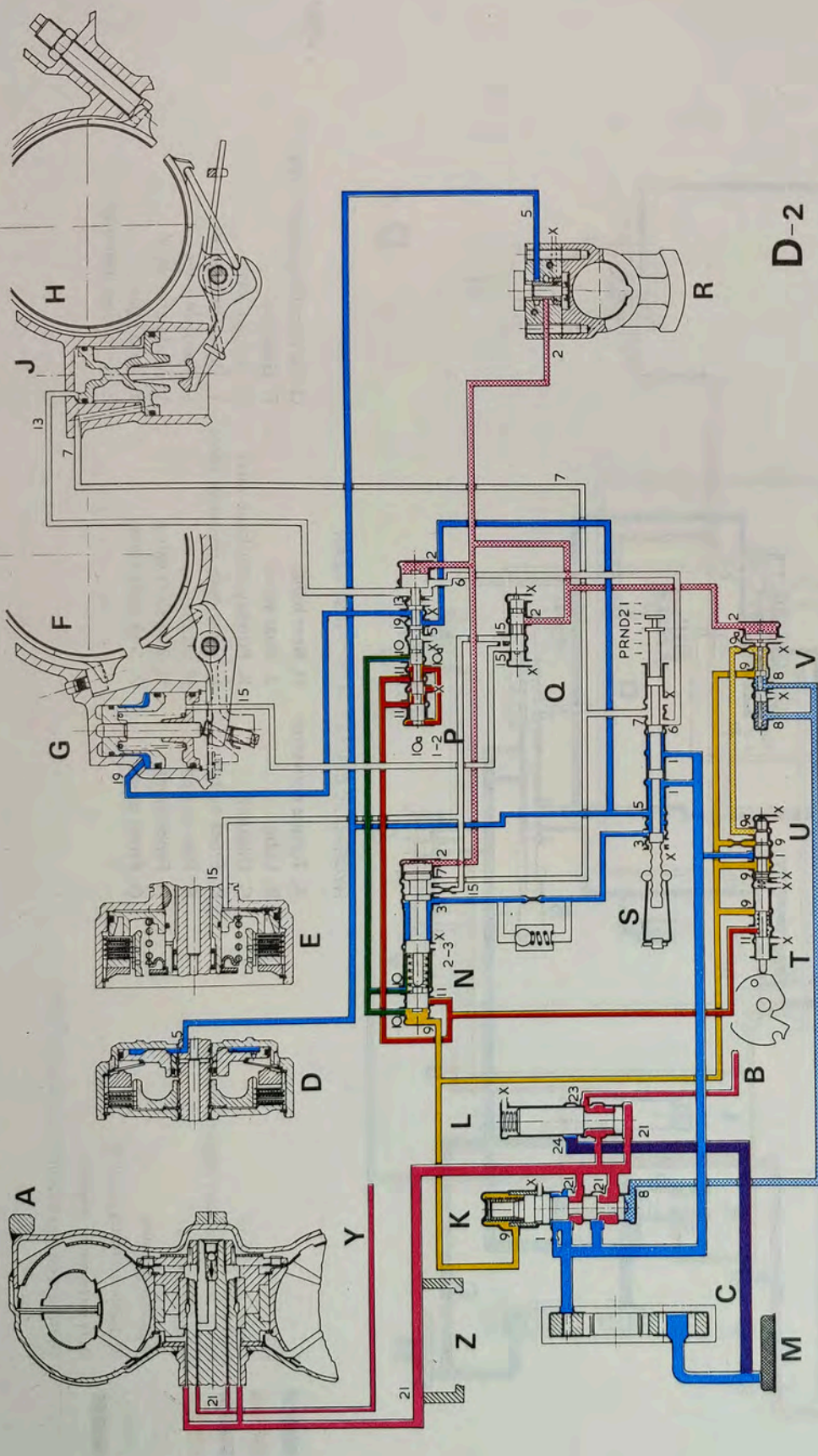
S 4066



HYDRAULIC CIRCUIT IN "D" FIRST GEAR

- | | | | |
|---|---------------------|------------------------------|--------------------------------|
| Line pressure | A. Torque converter | H. Rear band | Q. Servo orifice control valve |
| Converter pressure | B. Lube | J. Rear servo | R. Governor |
| Return from secondary regulator valve | C. Oil pump | K. Primary regulator valve | S. Manual valve |
| Throttle pressure | D. Front clutch | L. Secondary regulator valve | T. Downshift valve |
| Regulator pressure | E. Rear clutch | M. Strainer | U. Throttle valve |
| Modulated throttle pressure | F. Front band | N. 2-3 shift valve | V. Modulator valve |
| Shift valve piston pressure | G. Front servo | P. 1-2 shift valve | Y. To oil pan |
| Throttle pressure controlled by modulator valve | | | Z. Oil cooler (optional) |

S 4067

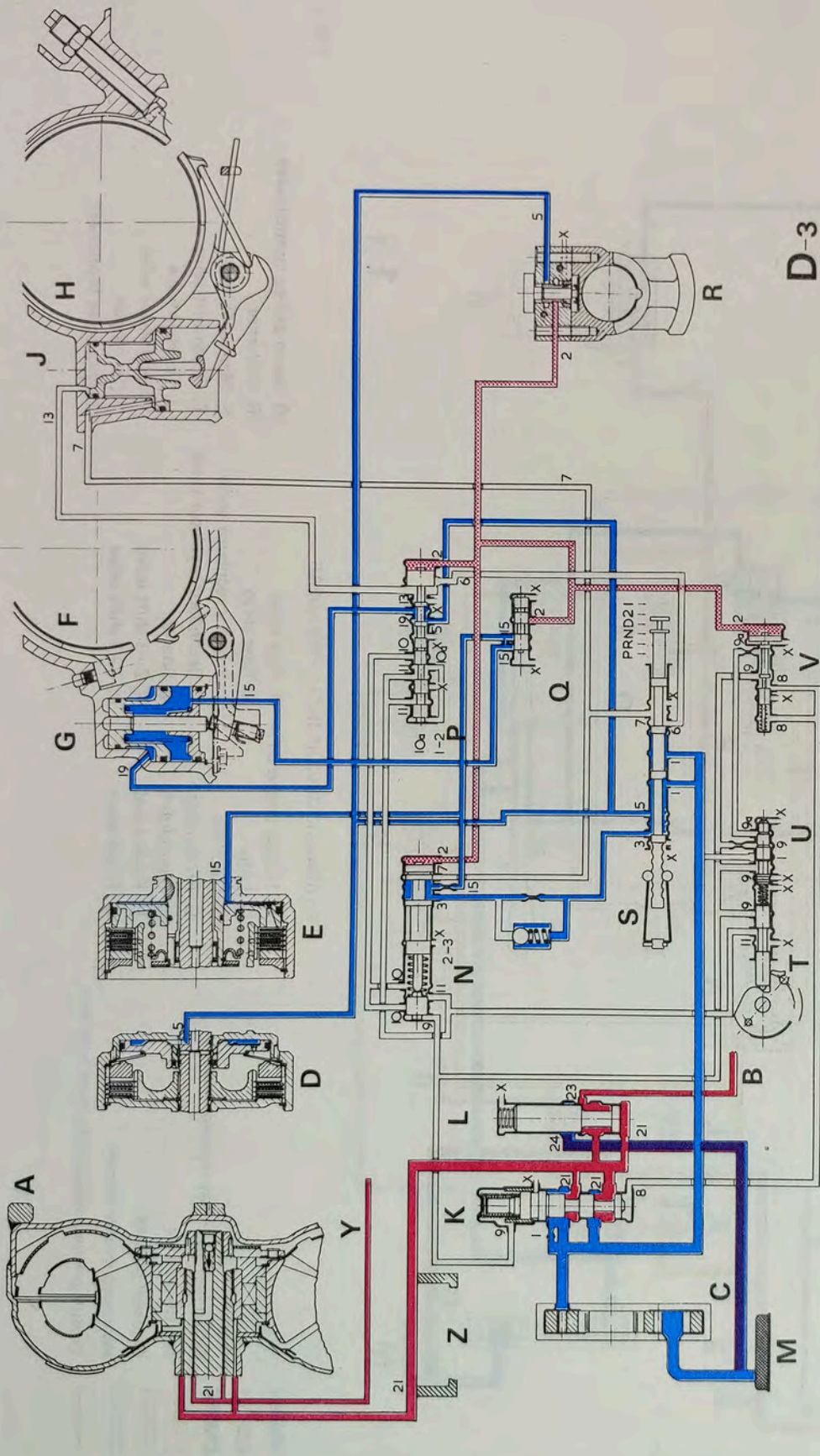


HYDRAULIC CIRCUIT IN "D" SECOND GEAR

- A. Torque converter
- B. Lube
- C. Oil pump
- D. Front clutch
- E. Rear clutch
- F. Front band
- G. Front servo
- H. Rear band
- J. Rear servo
- K. Primary regulator valve
- L. Secondary regulator valve
- M. Strainer
- N. 2-3 shift valve
- P. 1-2 shift valve
- Q. Servo orifice control valve
- R. Governor
- S. Manual valve
- T. Downshift valve
- U. Throttle valve
- V. Modulator valve
- Y. To oil pan
- Z. Oil cooler (optional)

- Line pressure
- Converter pressure
- Return from secondary regulator valve
- Throttle pressure
- Regulator pressure
- Modulated throttle pressure
- Shift valve piston pressure
- Throttle pressure controlled by modulator valve
- "Kick-down" pressure

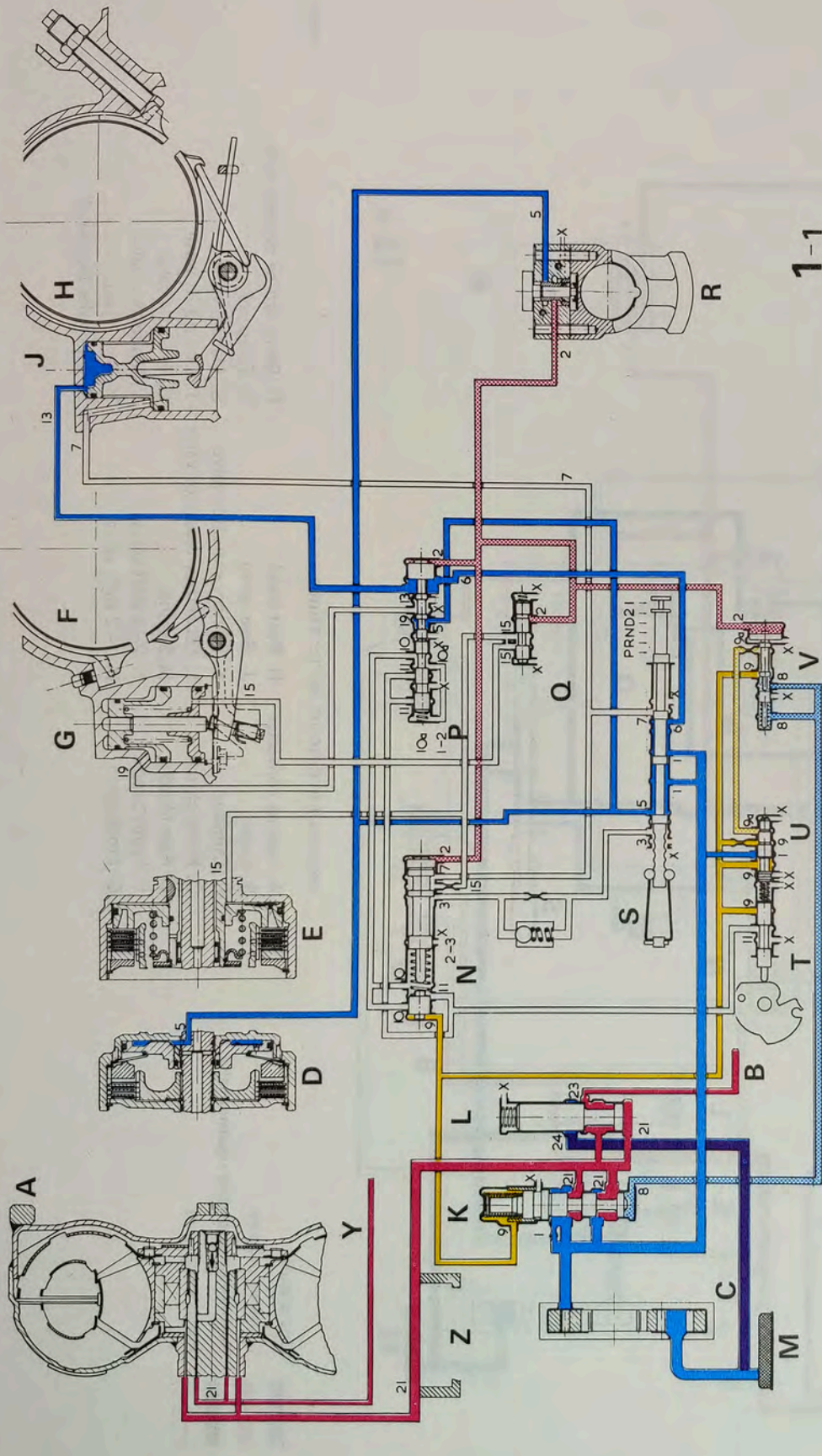
S 4069



HYDRAULIC CIRCUIT IN "D" THIRD GEAR

- | | | | |
|---------------------------------------|---------------------|------------------------------|--------------------------------|
| Line pressure | A. Torque converter | H. Rear band | Q. Servo orifice control valve |
| Converter pressure | B. Lube | J. Rear servo | R. Governor |
| Return from secondary regulator valve | C. Oil pump | K. Primary regulator valve | S. Manual valve |
| Regulator pressure | D. Front clutch | L. Secondary regulator valve | T. Downshift valve |
| | E. Rear clutch | M. Strainer | U. Throttle valve |
| | F. Front band | N. 2-3 shift valve | V. Modulator valve |
| | G. Front servo | P. 1-2 shift valve | Y. To oil pan |
| | | | Z. Oil cooler (optional) |

S 4071

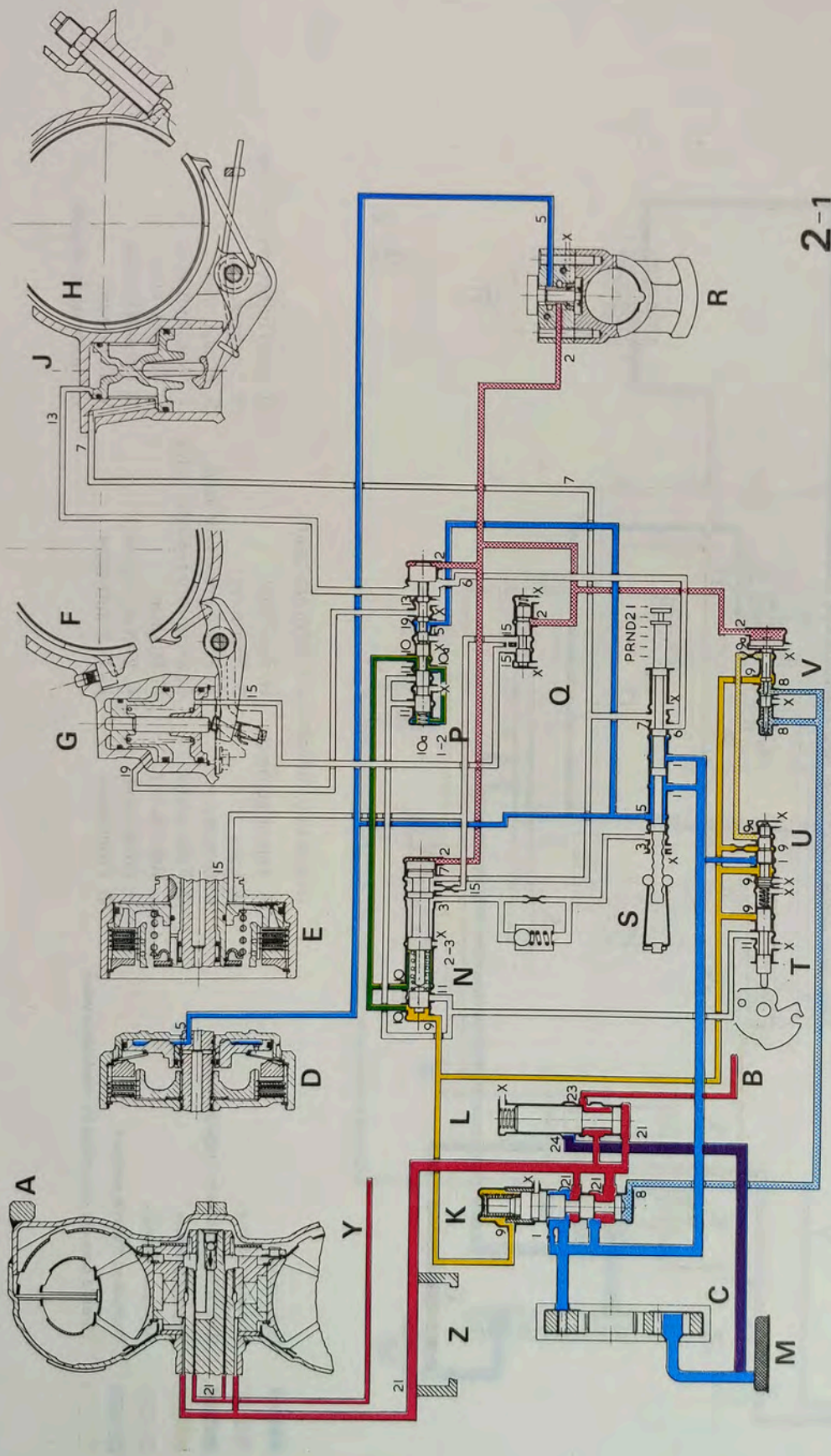


HYDRAULIC CIRCUIT IN "1" FIRST GEAR

- Line pressure
- Converter pressure
- Return from secondary regulator valve
- Throttle pressure
- Regulator pressure
- Modulated throttle pressure
- Throttle pressure controlled by modulator valve

- A. Torque converter
- B. Lube
- C. Oil pump
- D. Front clutch
- E. Rear clutch
- F. Front band
- G. Front servo
- H. Rear band
- J. Rear servo
- K. Primary regulator valve
- L. Secondary regulator valve
- M. Strainer
- N. 2-3 shift valve
- P. 1-2 shift valve
- Q. Servo orifice control valve
- R. Governor
- S. Manual valve
- T. Downshift valve
- U. Throttle valve
- V. Modulator valve
- Y. To oil pan
- Z. Oil cooler (optional)

S 4072



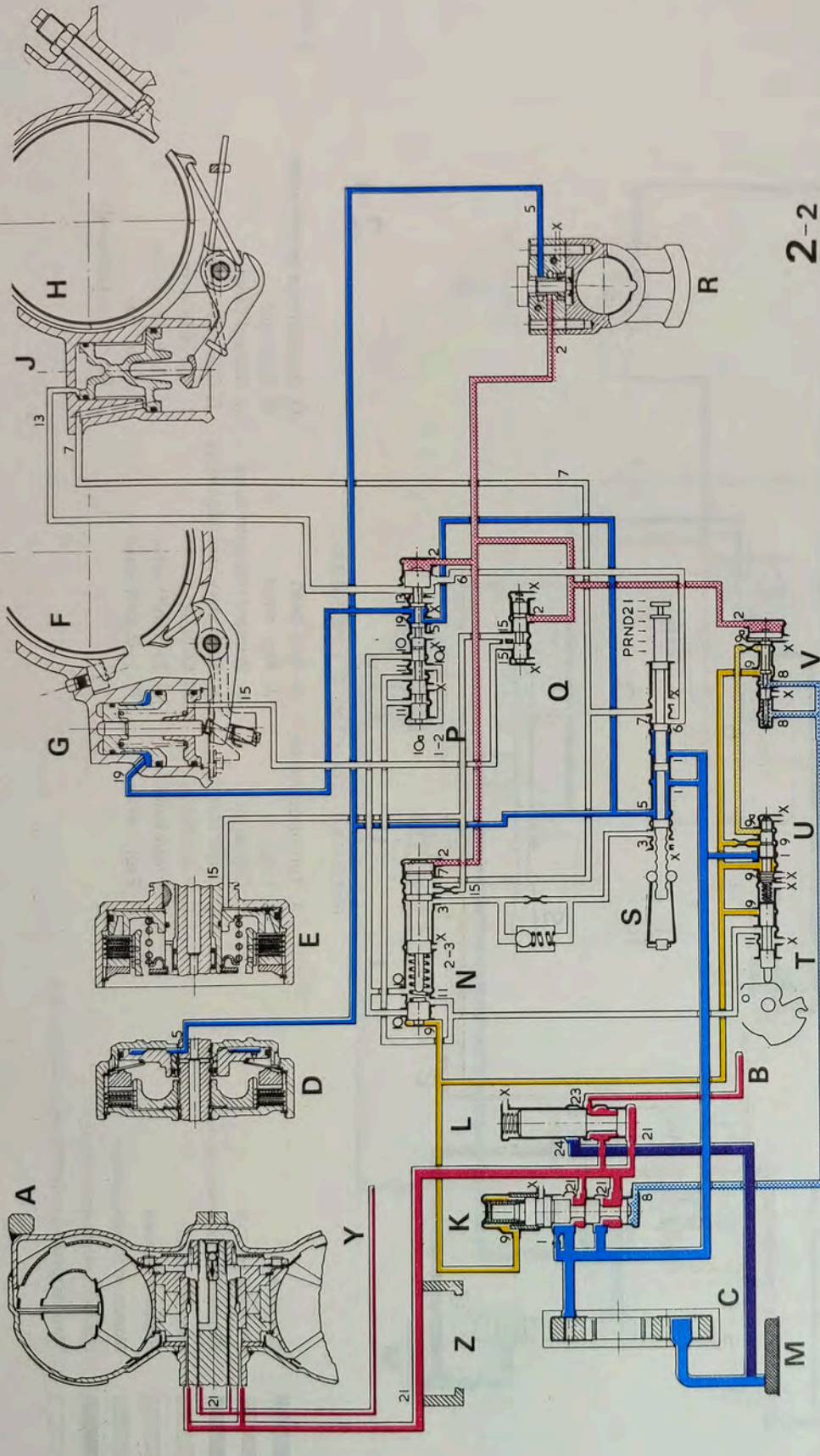
S 4068

- Q. Servo orifice control valve
- R. Governor
- S. Manual valve
- T. Downshift valve
- U. Throttle valve
- V. Modulator valve
- Y. To oil pan
- Z. Oil cooler (optional)

- A. Torque converter
- B. Lube
- C. Oil pump
- D. Front clutch
- E. Rear clutch
- F. Front band
- G. Front servo
- H. Rear band
- J. Rear servo
- K. Primary regulator valve
- L. Secondary regulator valve
- M. Strainer
- N. 2-3 shift valve
- P. 1-2 shift valve

HYDRAULIC CIRCUIT IN "2" FIRST GEAR

- Line pressure
- Converter pressure
- Return from secondary regulator valve
- Throttle pressure
- Regulator pressure
- Modulated throttle pressure
- Gear shift valve piston pressure
- Throttle pressure controlled by modulator valve



S 4070

HYDRAULIC CIRCUIT IN "2" SECOND GEAR

- | | | |
|---------------------|------------------------------|--------------------------------|
| A. Torque converter | H. Rear band | Q. Servo orifice control valve |
| B. Lube | J. Rear servo | R. Governor |
| C. Oil pump | K. Primary regulator valve | S. Manual valve |
| D. Front clutch | L. Secondary regulator valve | T. Downshift valve |
| E. Rear clutch | M. Strainer | U. Throttle valve |
| F. Front band | N. 2-3 shift valve | V. Modulator valve |
| G. Front servo | P. 1-2 shift valve | Y. To oil pan |
| | | Z. Oil cooler (optional) |

- Line pressure
- Converter pressure
- Return from secondary regulator valve
- Throttle pressure
- Regulator pressure
- Modulated throttle pressure
- Throttle pressure controlled by modulator valve

Operation of the valves

Primary regulator valve

This valve regulates pump pressure during vehicle operation.

Line pressure (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. The line pressure (1) is directed to the manual valve and throttle valve.

Secondary regulator valve

This is a regulating valve which controls the values of converter pressure (21) and lubrication (23) for the components in the rear of the transmission case. 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 suction side of the pump. Thus, at high speed, excess pump output is directed back to minimize pumping losses.

Downshift valve and throttle valve

The downshift valve is connected to the carburettor linkage via a cable-actuated cam. Movement of the downshift valve compresses the throttle valve spring located between the downshift 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 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 capacities and appropriate shift quality under all operating conditions.

Full movement of the downshift valve, which is a shuttle valve, directs throttle pressure (11-9) to the 2-3 shift valve and the 1-2 shift valve to further delay upshifts or effect a 3-2 downshift or a 2-1 downshift at a preset maximum vehicle speed.

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. Throttle pressure (11-9) is also directed to the 1-2 shift valve enabling a 3-1 downshift to be made at a preset speed.

Modulator plug and valve

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). Moreover 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 part-throttle) conditions with a reduction in these pressures after "cut-back".

Servo orifice control valve

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 shift.

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 upshifts, 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 downshifts, 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

Both are shuttle valves and operate in unison in 'D' and '2' selector positions. In 1st gear governor pressure (2), operating on the large end of the valve, is opposed by line pressure (5) operating on an area of this valve, the 1-2 shift valve spring and reduced throttle pressure (10-10a) operating on the opposite end of the plunger. When governor pressure exceeds these opposing forces, the valve moves to the 2nd gear position and line pressure (5) is directed to the apply side of the front servo piston (19). The movement also results in an area of the valve being no longer subjected to line pressure (5). This allows the 2-1 downshift to occur at a lower speed than the 1-2 shift. The difference between the upshift and downshift speed is known as "shift point hysteresis". When governor pressure is less than the spring force combined with the reduced throttle pressure force, the valve moves to the 1st gear position and the apply side of the front servo (19) is opened to exhaust (x).

In '1'-Lock-up, with low governor pressure (2) the valve also moves to the 1st gear position; line pressure (6) thus directed to the rear servo (13) latches the valve hydraulically in the 1st gear position, preventing an upshift. Forced throttle pressure can cause the 1-2 shift valve to give a 3-1 downshift below 30 m.p.h. (50 km/h) in the 'D' range or a 2-1 downshift in the 'D' or '2' range.

2-3 shift valve and plunger

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 "Downshift and throttle valve".

The 2-3 shift valve is a shuttle valve. In the 2nd 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 a 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, is opposed by line pressure (3) operating on an area 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 3rd 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. Moreover, 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 movement 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 upshift.

When the manual valve is moved to the '2' 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 (7) through a port (x) at the opposite end of the manual valve collar. This inevitably results in an immediate downshift to 2nd gear regardless of the position of the 2-3 shift valve and no third gear is possible. In Reverse, line pressure (7) is directed to the rear clutch and front servo release (15).

Manual control valve

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. P: Movement of the valve mechanically engages the parking pawl with the externally toothed ring gear on the driven shaft, effectively immobilising 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 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).

R: 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.

N: The clutches and servos are not pressurised and exhausted, because circuits 3 and 5 are open to a port (x) nearest to the manual control valve collar. Therefore the gear set is disconnected from the converter and no engine power is transmitted to the wheels.

D: Line pressure (5) is directed to the front clutch, governor and 1-2 shift valve. It is also directed to the 2-3 shift valve. When there is sufficient governor pressure, it passes without obstruction to the 1-2 shift valve.

2: Line pressure (5) is again directed to the front clutch, governor and 1-2 shift valve. Governor pressure is directed to the 1-2 shift valve.

1: Line pressure (5) is directed to the front clutch, governor and 1-2 shift valve. Line pressure (6) is directed to a differential area of the 1-2 shift valve to lock it in position, and hence to the rear servo (13).

Table of hydraulic circuits

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 1-2 shift valve 2-3 shift valve Servo orifice control valve
3.	Directed line pressure	Manual control valve	2-3 shift valve
5.	Direct line pressure	Manual control valve	Front clutch & governor feed 1-2 shift valve
6.	Directed line pressure	Manual control valve	1-2 shift valve
7.	Directed line pressure	Manual control valve	2-3 shift valve
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 Shift valve plunger
9a.	Throttle pressure controlled by modulator valve	Modulator valve	Throttle valve
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
11.	Forced throttle pressure	Downshift 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
21.	Converter pressure	Primary regulator valve	Secondary regulator valve and converter
23.	Lubrication pressure	Secondary regulator valve	The mechanical part of the transmission

Driving instructions

Gear selector lever

A scale beside the gear selector lever is marked with symbols indicating the different positions:

- P = Park
 - R = Reverse
 - N = Neutral
 - D = Drive
 - 2 = 2nd gear
 - 1 = 1st gear
- } Forward gears

Always press lightly on the footbrake or have the handbrake on when shifting the selector lever if the car is at a standstill with the engine idling. Otherwise the car will start to creep forward when a driving gear is selected.



GEAR SELECTOR LEVER

Driving

The selector lever must be in position N or P when you start the engine as the starter contact does not work if the lever is in any other position.

1. Apply the handbrake or tread lightly on the footbrake.
2. Turn the ignition key to S (Start) and let it spring back to K (Drive) when the engine fires.

Selecting gears

- P. Position P (Park) is selected when the car has been parked, and the lever must be in this position before the ignition key can be turned to L (Locked) and withdrawn. The selector lever is then locked and the transmission is immobilized. The starter contact is operative in position P. Do not select position P when the car is in motion.
- R. Position R (Reverse) must not be selected unless the car is stationary.

- N. In position N (Neutral) no gear is engaged. The starter contact is operative in this position. The handbrake should be applied when the selector lever is in position N to avoid the car from moving if it is placed on a slope.
- D. The D (Drive) position is for normal forward driving. Whichever of the three forward gears best matches the speed and load on the engine is automatically engaged. In the 'D' range downshifts will not occur automatically at speeds over 10 mph (16 km/h) (approximately) unless the accelerator pedal is depressed past the detent to the 'Full kickdown' position. This may result in a 3-1 change instead of the required 3-2 change.

"Kick-down"

To obtain maximum acceleration, e.g. for overtaking, it is possible to effect an instant downshift at speeds below 50-55 mph (80-85 km/h) by pushing the accelerator pedal hard down to the "kick-down" position. Upshift to the next higher gear is automatic as soon as the engine reaches maximum revs for the gear engaged or when the pedal is eased up.

2. Position 2 gives automatic shift between first and second gears but top gear cannot be engaged. If the lever is moved from D to 2, this gives an immediate manual downshift for more engine braking power. Position 2 must not be selected at road speeds above 55 miles per hour (90 km/h).
1. Position 1 is used to obtain maximum engine braking power on steep downgrades. Road speed must be reduced to below about 12 mph (20 km/h) before 1st gear is engaged. This position should also be used for uphill driving on very steep hills to avoid overheating the transmission oil. Second and top gears cannot be engaged when the lever is at 1. Position 1 must not be selected at road speeds above 55 mph (90 km/h).

Towing

The following rules must be observed if for any reason the car has to be towed:

1. The selector lever must be at N.
2. The transmission must have the correct oil level.
3. National speed limits for towing must of course be complied with, but in any event towing speed must not exceed 25 mph (40 km/h).
4. The car must not be towed more than about 25-30 miles (40-50 km). For longer distances, the front wheels must be raised off the ground.
5. The engine cannot be started by towing or pushing. Towing lugs are provided at the front and rear bumper attachments.

Maintenance

It is most important that the following maintenance instructions are closely followed and absolute cleanliness is maintained when topping up or filling the transmission.

It is vitally important when checking the fluid level that no dirt or foreign matter enters the transmission otherwise trouble will almost certainly arise. Before removing the transmission dipstick, the surrounding area must be cleaned off to prevent dirt from entering the dipstick aperture. When filling the transmission with fluid ensure that the fluid container and funnel are perfectly clean. In countries where temperatures are unusually high, dust and/or mud must not be allowed to decrease the effective areas of the transmission case. Also any foreign matter on the oil pan must be removed as it would act as a temperature insulator.

ROAD TEST AND FAULT DIAGNOSIS

It is important to gain as much information as possible on the precise nature of any fault. In all cases the following road-test procedure should be completely carried out, as there may be more than one fault.

It is essential when making a diagnosis, to be thoroughly familiar with the Operation section and Driving Instructions section.

Testing the car

Any condition of improper operation shown by the checks can be found, with its possible causes, in the "Fault diagnosis through road test" section.

IMPORTANT

When testing or making a diagnosis, it is important that the transmission fluid is at operating temperature and at the correct level as previously detailed in the "Maintenance" section.

1. Check that the starter will operate only with the selector in 'P' and 'N' and that the reverse light operates only in 'R'.
2. Apply the brakes and, with the engine at normal idling speed, select 'N-D', 'N-2', 'N-1', 'N-R'. Transmission engagement should be felt in each position selected.
3. Check the stall speed (see Stall Speed Tests), with the transmission in '1' and 'R'. Check for slip or clutch break-away.

IMPORTANT

To prevent damage to transmission through overheating do not stall for longer than 10 seconds.

4. With the transmission at normal running temperature select 'D'. Release the brakes and accelerate with a minimum throttle opening. Check for 1-2 and 2-3 shifts.
Note: At minimum throttle opening the shifts may be difficult to detect. Confirmation that the transmission is in third gear may be obtained by selecting '2' when a 3-2 downshift should be felt.
5. a. From a standing start using full throttle acceleration, i.e. accelerator at the resistance point, check that 1-2 and 2-3 shifts are as shown on the chart. See page 020-18.

- b. At 25 m.p.h. (40 km/h) in 3rd gear, depress the accelerator to the resistance point. The car should accelerate in top gear but not downshift to second.
- c. At 30 m.p.h. (50 km/h) in 3rd gear depress the accelerator to the "kick-down" position (through the resistance point). The transmission should downshift to second gear.
6. a. Restart using "kick-down" (accelerator through the resistance point) and check for 1-2 and 2-3 shifts according to the table on page 020-18.
b. At 40 m.p.h. (64 km/h) in top gear release the accelerator and select '2'. Check for 3-2 downshift and engine braking.
7. Stop in '1', release the brakes and using full throttle accelerate to 20 m.p.h. (32 km/h). Check for slip or clutch break-away noise.
8. Stop and select 'R'. Release the brakes and reverse, using full throttle if possible. Check for slip and/or clutch break-away noise.
9. Stop the car on a gradient facing downhill and select 'P'. Release the brakes and check that the parking pawl will hold the car. Re-apply the brakes before disengaging the parking pawl. Repeat with the car facing uphill. Make sure that the selector is trapped by the gate in 'P'.

Converter trouble shooting

Inability to start on steep gradients combined with poor acceleration from rest indicates that the converter stator one-way clutch is slipping or that the stator support is damaged. This condition permits the stator to rotate in an opposite direction to the turbine and torque multiplication cannot occur.

Substandard acceleration in 3rd gear above about 30 mph (50 km/h), combined with a substantially reduced maximum speed, indicates that the stator one-way clutch has locked in the engaged position. The stator will then not rotate with the turbine and impeller, therefore the fluid flywheel phase of the converter performance cannot occur. This condition will also be indicated by severe overheating of the transmission, although the stalling speed will remain normal. The converter assembly must be replaced.

The torque converter is sealed by welding and cannot be dismantled; therefore it must be replaced as a unit. The ventilation holes in the converter housing must be kept free from dirt.

Checking the stalling speed

The stalling speed is the maximum speed at which the engine can drive the torque converter impeller while the turbine is held stationary. As the stalling speed is dependent both on engine and torque converter characteristics, it will vary with the condition of the engine. This must be borne in mind when investigating the cause of the low stalling speed.

To check the stalling speed, apply the handbrake, press down hard on the brake pedal, set the selector to "D", "1" or "R", and push the accelerator right to the floor.

Normal stalling speed should be: for 1.7 and 1.85 l engines 1.800–2.200 rev/min, for 2.0 l engines 1.900–2.300 rev/min. Use a revolution counter. If the engine stalling speed is down to 300 rev/min below normal, the engine is not developing its full power. If it is more than 800 rev/min below normal, the converter assembly must be renewed. A stalling speed substantially higher than normal indicates that the converter is not receiving its required supply or that slip is occurring in one of the gearbox clutches.

NOTE

When checking stalling speed ensure that the transmission is at normal operating temperature. Do not stall for longer than ten seconds, or the transmission will overheat.

Engine rev/min stalling speed 1.7 and 1.85 l engines	Engine rev/min stalling speed 2.0 l engines	Condition
1.800–2.200	1.900–2.300	Normal
1.500	1.600	Engine not developing full power
Below 1.000	Below 1.100	Converter stator free-wheel slipping or stator support damaged
Over 2.400 Position D Position 1 Position R	Over 2.500 Position D Position 1 Position R	Slip in gearbox Front clutch or one-way clutch slipping Front clutch or rear band slipping Rear clutch or rear band slipping

Fault diagnosis through road test

Use in conjunction with the "Key to Actions" at the end of the table.

No.	Fault	Action
1.	Starter will not operate in P or N	19
	Starter operates in all selector positions	20
2.	Excessive bump on engagement of D, 1, 2 or R	4,3
3.	If "stall" speed higher than specified:	
a.	With slip and break-away noise in 1	1, 2, 3, 13, 11
b.	With slip and break-away noise in R	1, 2, 3, 13, 12
	If "stall" speed lower than specified	Check engine performance
	If "stall" speed 600 r.p.m. lower than specified	21
4.	No drive in D or 2	1, 2, 3, 13, 11, 16
	No drive in D or 2 but normal in 1	1, 2, 3, 16
	No drive in D, 2, 1 or R	1, 2, 3, 13, 11, 17, 16
	Delayed or no 1-2 shift	3, 14, 13, 5, 6
	Slip on 1-2 shift	2, 3, 5, 6, 7, 13
	Delayed or no 2-3 shift	3, 14, 13, 5, 6, 12
	Delayed or no 2-3 shift but normal in R	3, 14, 13, 5, 6
	Slip or engine run-up on 2-3 shift	2, 3, 5, 13, 12
	Bumpy gear shifts	3
	Drag or binding on 2-3 shift	5, 6
5. a.	Slip, break-away noise or judder on full throttle take-off in D or 2	1, 2, 3, 13, 11
	Loss of performance and overheating in D-3rd (seized stator) . . .	21
	Continue as for 4 above.	
b.	Transmission downshifts too easily	3
c, d.	Transmission will not downshift	3, 13, 14
6. a.	As for test 5a above	1, 2, 3, 13, 11
b.	No 3-2 downshift or engine braking	1, 5, 6, 7, 12
	No 2-1 downshift or engine braking	8, 9, 10
7.	Slip, break-away noise or judder on take-off in 1	1, 2, 3, 13, 11
	Transmission up-shifts	1
8.	Slip, break-away noise or judder on take-off in R	1, 2, 3, 13, 12
	Slip but no judder on take-off in R	1, 2, 3, 8, 9, 10
	As above, with engine braking available in 1	1, 2, 3
	Drag in R	5
	No drive in R	1, 2, 3, 8, 13, 9, 10, 12
	As above with engine braking available in 1st gear of 1	1, 2, 3, 13, 12
9.	No P	1, 15
Miscellaneous		
	Screech or whine increasing with engine speed	17
	Grinding and grating noise from the gearbox	18
	Knocking noise from torque converter area	22

Key to actions

- 1. Check manual linkage adjustment.
2. Check fluid level.
- 3. Check adjustment of downshift valve cable.
4. Reduce engine idling speed.
- 5. Check adjustment of front band.
6. Check front servo seals and fit of tubes.
7. Check front band for wear.
8. Check adjustment of rear band.
9. Check rear servo seal and fit of tubes.
10. Check rear band for wear.
11. Examine the front clutch and seals, also the forward sun gear shaft sealing rings. Verify that the cup plug in the driven shaft is not leaking or dislodged.
12. Examine rear clutch valve and seals. Check fit of tubes.
13. Strip valve bodies and clean.
14. Strip governor valve and clean.
15. Examine parking pawl, gear and internal linkage.
16. Examine one-way clutch.
17. Strip and examine front pump and drive tangs.
18. Strip and examine gear train.
19. Adjust starter inhibitor switch inwards.
20. Adjust starter inhibitor switch outwards.
21. Replace torque converter
22. Examine torque converter drive plate for cracks or fracture.

Quick-reference fault diagnosis chart

(Numbers indicate the recommended sequence of Fault Investigation. Letters apply to the remedies on next page.)

Engagement of R, D, 2 or 1:	A	B	C	D	E	F	a	b	c	d	e	f	g	h	i	m	n	p	q	N	O	P	Q	R	S	T	U	V	W	X	Z	
Bumpy	.	2	.	1	.	.	.	.	5	3	.	4	.	.	.	.	.	.	.	.	.	6	.	7	.	.	.	.	.	.	.	.
Delayed	1	.	2	3	.	.	4	7	6	5	.	.	.	.	.	.	.	.	13	9	.	10	.	.	11	.	.	.	.	12	.	
None	1	.	2	.	.	.	3	4	5	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7	8	9	10	
Starting from rest:																																
No forward	.	.	1	.	.	.	.	3	2	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	5	.	.	.	.	.	
No reverse	.	.	1	.	.	2	7	6	5	.	.	.	.	.	.	3	4	.	.	.	9	.	.	8	.	.	.	.	.	.	.	
Seizure reverse	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	
No neutral	.	.	1	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	
Upshifts:																																
No 1-2	.	.	1	.	2	.	8	9	10	.	.	6	7	3	.	4	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	
No 2-3	.	.	1	.	.	.	8	9	10	.	.	6	7	2	.	3	4	.	.	.	5	.	.	.	.	.	.	.	.	.	.	
Above normal shift speeds	.	1	.	.	.	.	.	8	9	10	.	2	7	3	.	4	5	6	.	.	.	.	.	.	.	.	.	.	.	.	.	
Below normal shift speeds	.	1	.	.	.	.	.	5	6	.	.	2	.	3	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	
Upshift quality:																																
Slip 1-2	1	2	3	.	4	.	8	9	10	6	.	7	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	
Slip 2-3	1	2	3	.	4	.	9	10	11	7	.	8	.	.	.	.	.	.	.	.	5	.	6	.	.	.	.	.	.	.	.	
Rough 1-2	.	1	.	.	2	.	.	10	3	.	4	5	6	.	.	.	.	.	.	9	.	.	.	.	7	8	.	.	.	.	.	
Rough 2-3	.	1	.	.	2	.	.	6	3	.	4	.	.	.	.	.	.	.	.	.	5	.	.	.	.	.	.	.	.	.	.	
Seizure 1-2	.	.	.	.	1	.	.	5	6	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	3	4	.	.	.	.	.	
Seizure 2-3	.	.	.	.	1	.	2	3	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Downshifts:																																
No 2-1	.	1	.	.	.	.	.	.	.	.	.	.	.	3	.	2	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	
No 3-2	.	1	.	.	.	.	.	.	.	.	.	.	.	3	.	2	.	.	.	.	.	4	5	.	.	.	.	.	.	.	.	
Involuntary high speed 3-2	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	
Above normal shift speeds	.	1	.	.	.	.	.	5	6	.	.	4	.	2	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Below normal shift speeds	.	1	.	.	.	.	.	5	6	.	.	4	.	2	.	7	8	3	.	.	.	.	.	.	.	.	.	.	.	.	.	
Downshift quality:																																
Slip 2-1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	
Slip 3-2	.	.	.	.	1	.	6	7	8	4	.	5	.	.	3	.	.	.	.	.	9	.	2	.	.	.	.	.	.	.	.	
Rough 2-1	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	
Rough 3-2	.	.	.	.	1	.	.	5	3	.	4	.	.	2	.	.	.	.	.	.	6	7	8	.	.	.	.	.	.	.	.	
Line pressure:																																
Low, idling	1	.	2	3	.	.	6	8	5	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	9	.	.	
High, idling	.	1	.	2	.	.	.	.	3	5	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Low at stall	1	2	.	.	.	.	6	8	7	3	.	5	4	9	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	
High at stall	.	.	.	.	.	.	.	4	1	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
Stall speed:																																
Below 1.000 rev/min	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	
Over 2.400 rev/min	1	.	2	.	.	3	4	5	6	7	.	.	.	.	.	.	.	.	.	8	.	9	.	.	10	11	.	12	.	.	13	
Overheating																																
	1	.	.	.	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	

Fault investigation key

Preliminary Adjustment Faults

- A. Fluid level incorrect.
- B. Downshift valve cable incorrectly assembled or adjusted.
- C. Manual linkage incorrectly assembled or adjusted.
- D. Incorrect engine idling speed.
- E. Incorrect front band adjustment.
- F. Incorrect rear band adjustment.

Hydraulic Control Faults

- a. Oil tubes missing or not installed correctly.
- b. Sealing rings missing or broken.
- c. Valve body assembly screws missing or not correctly tightened.
- d. Primary regulator valve sticking.
- e. Secondary regulator valve sticking.
- f. Throttle valve sticking.
- g. Modulator valve sticking.
- h. Governor valve sticking, leaking or incorrectly installed.
- i. Orifice control valve sticking.
- m. 1-2 shift valve sticking.
- n. 2-3 shift valve sticking.
- p. 2-3 shift valve plunger sticking.
- q. Converter "out" check valve missing or sticking.

Mechanical Faults

- N. Front clutch slipping due to worn plates, faulty parts or leaking cup plug in driven shaft.
- O. Front clutch seized or plates distorted.
- P. Rear clutch slipping due to worn plates or faulty check valve in piston.
- Q. Rear clutch seized or plates distorted.
- R. Front band slipping due to faulty servo, broken or worn band.
- S. Rear band slipping due to faulty servo, broken or worn band.
- T. One-way clutch slipping or incorrectly installed.
- U. One-way clutch seized.
- V. Input shaft broken.
- W. Pump drive tangs on converter hub broken.
- X. Pump worn.
- Z. Converter blading and/or one-way clutch failed, stator support fractured.

Refinery Instrument Faults

- A. Final level indicator
- B. Downward valve action indicator stopped or adjusted
- C. Upward valve action indicator stopped or adjusted
- D. Indicator stopped when open
- E. Indicator from level adjustment
- F. Indicator from level adjustment

Hydraulic Control Faults

- a. Or signal missing or not installed correctly
- b. Design change or signal or control
- c. Valve body assembly screws missing or not correctly tightened
- d. Primary regulator valve sticking
- e. Secondary regulator valve sticking
- f. Control valve sticking
- g. Control valve sticking
- h. Control valve sticking, leaking or incorrectly installed
- i. Control valve sticking
- j. 1-2 shift valve sticking
- k. 2-3 shift valve sticking
- l. 3-4 shift valve sticking
- m. 4-5 shift valve sticking or sticking

Mechanical Faults

- a. Front clutch slipping due to worn plates, faulty pins or backing cup pin in wrong place
- b. Front clutch seized or plates distorted
- c. Front clutch slipping due to worn plates or faulty backing cup pin
- d. Rear clutch seized or plates distorted
- e. Front clutch slipping due to faulty spring broken or weak
- f. Front clutch slipping due to faulty spring broken or weak
- g. Clutch pedal sticking or not fully installed
- h. Clutch pedal seized
- i. Clutch pedal broken
- j. Clutch pedal seized and not fully installed
- k. Clutch pedal seized and not fully installed
- l. Clutch pedal seized and not fully installed
- m. Clutch pedal seized and not fully installed

REMOVAL AND INSTALLATION

Automatic transmission

Removal

For major work on the engine and transmission, the entire power plant should be lifted out. Removal of the engine by itself is not recommended.

1. Remove the hood as follows:
Back off both the hood fastening screws. Lift off the hood. For this you need a helper to hold one side of the hood and help to lift it clear.
2. Detach the battery cables. Unclamp and lift out the battery.
3. Drain off coolant through the radiator and engine block drain cocks; open the bleeder cock on the heater core. (Up to and incl. model 1973.)
4. Carbureted engine:
Detach the vacuum hose of the power assist cylinder from the inlet manifold and pull the fuel hose off the suction side of the fuel pump.
4. Injection engine:
 - a. Detach the vacuum hoses of the power assist cylinder and the pressure transmitter from the inlet manifold.
 - b. Detach the fuel hoses from the tubes at the inlet and outlet of the injection valves.
5. Carbureted engine:
Undo the cable connections to the ignition coil, serial resistance, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, contact on automatic transmission, headlights and headlight wiper motor.
5. Injection engine:
 - a. Undo the cable connections to the ignition coil, serial resistance, temperature transmitter, oil pressure transmitter, radiator fan, thermostat contact, headlights, contact on automatic transmission, and headlight wiper motor.
 - b. Undo the cable connections to the fuel injection system from the distributor, injection valves, air cleaner or inlet manifold and throttle valve switch and thermostat housing and from the temperature transmitter and thermostat contact at the inlet manifold.

CAUTION

Do not detach the connections by pulling the cables. Grip the contact pieces.

6. Carbureted engine:
 - a. Remove the air cleaner and preheater complete with hose and ignition cable.
NOTE! Save the spacer sleeves under the outer preheater casing (up to and incl. model 1972).
 - b. Detach the throttle control linkage from the throttle shaft and remove the return spring. As from the 1972 model, detach the throttle wire from driver and bracket.
 - c. Detach the choke control wire and sheath from the carburetor.

6. Injection engine:
 - a. Remove air cleaner complete with hoses.
 - b. Undo the throttle control wire from the driver on the throttle housing.
7. Undo the hose clamps at the connections to the thermostat housing, radiator, inlet manifold and water pump.
8. a. Remove the four fastening screws from the front sheet.
b. Remove the self-tapping screws holding the headlight trim frames.
c. Remove the four lower self-tapping screws securing the headlights to the edge of the bodywork. As from model 1972: Remove the headlights from front sheet and body.
d. Remove the hood lock operating cable from its fastenings at the dash panel and wheel housing.
e. Remove the front sheet, lifting forward and upwards.
9. Remove the protective cover on the exhaust manifold at the exhaust pipe.
10. Disconnect the exhaust pipe from the exhaust manifold.
11. Detach the ground cable from the transmission. As from model 1973: Remove the alternator.
12. Jack up the front end of the car and place blocks under the body.
13. Remove the screw for the gear selector wire from the transmission. Move the gear selector lever to position "1" and pull out the sheath from the transmission. Fit tool 879038 on the wire, turn the tool a little and pull out the wire.
14. Detach the speedometer cable from the transmission.
15. Undo the engine brackets.
16. Engage the lifting yoke 839240 in the two engine lifting lugs.
17. Undo the larger clips round the rubber bellows on the inner universal joints. Undo the lower end piece from the control arm on the right-hand side. Turn the steering wheel to the left and withdraw the universal joint. Raise the power plant slightly and withdraw the left universal joint.
18. Raise the power plant to a suitable height for access to the cable connections to the starter and up to and incl. model 1972 alternator, and disconnect the cables.
19. Hoist out the power plant. Fit protective caps over the inner drivers and rubber bellows.

Installing the power plant

The front end of the car should be on trestles when fitting the power unit.

1. a. Check that the inner universal joints are packed with grease.
b. As from chassis No. 99.033.917: Check the front engine cushion. Check that the washer is properly tightened on the screw.
2. Hoist the power plant with the lifting yoke 839240 and lower it into the engine compartment.

CAUTION

Take care when installing the power plant up to and incl. model 1972, to avoid damaging the fuel line hose joint at the dash panel. After installing, check that there is at least 0.4" (10 mm) clearance between the alternator belt pulley and the hose.

3. Lower the power plant to a convenient working height and connect the cables to the starter and up to and incl. model 1972, alternator.
4. Assemble the inner universal joints as follows: Hang the clips on the inner drivers. Lower the power plant to about 2" (50 mm) from the engine cushions. Assemble the inner universal joint on the right-hand side, lower the power plant to 1" (20–30 mm) from the engine cushions and move the power plant to the right. Lower the power plant on to the cushions and at the same time assemble the left-hand universal joint. Connect the end piece to the lower control arm.
5. a. Align the engine brackets. At the same time guide the throttle control shaft into its bearing (up to and incl. model 1971).
b. Bolt the power plant to the engine cushions.
6. Remove the lifting yoke.
7. a. Push the rubber bellows over the inner universal joint drivers and fit the clamps.
b. Wipe any surplus grease off the rubber bellows and check that the bellows are not deformed.
8. Connect the speedometer to the transmission.
9. Connect the gear selector wire to the transmission.
10. Bolt the exhaust pipe to the exhaust manifold.
11. Lower the front end of the car.
12. Connect the ground cable. As from model 1973: Refit the alternator.
13. Mount the front sheet complete with radiator and connect the hood lock operating cable to the attachment at the dash panel.
14. Reconnect the cables to the radiator fan, thermostat contact, headlights and headlight wiper motor and clip the bundle of wiring to the front sheet.
15. Connect the coolant hoses to the radiator, thermostat housing, water pump and inlet manifold.
16. Connect the brake vacuum hose and fuel hose and connect cables to the temperature transmitter, ignition coil, contact on automatic transmission and oil pressure transmitter. In the case of injection engines, connect the vacuum hose to the pressure transmitter and the cables to the starting contact.
17. Connect the throttle control to the throttle control shaft and connect the choke control to the carburetor. As from model 1972: Refit the throttle control wire to driver and bracket.
18. Carbureted engine:
Mount the air cleaner and preheater casing complete with hose. Connect the ventilation hose. Connect the ignition cable to the distributor and coil.
18. Injection engine:
Mount the air cleaner complete with hoses. Connect the cables for the electrical fuel injection system to the distributor, injection valves, air cleaner up to and incl. model 1972, or inlet manifold, thermostat hous-

ing and throttle valve switch and to the temperature transmitter and thermostat contact below the inlet manifold. Make sure that the rubber caps on the contact pieces are in place.

CAUTION

The contact pieces only fit in one way and must thus not be forced into place.

19. Install the battery and connect the cables.
20. Close the radiator and engine block drain cocks, fill with coolant and oil. Bleed the heater core (up to and incl. model 1973).
21. Start the engine, checking oil pressure and coolant temperature. Check the operation of the transmission. Check the operation of the radiator fan by grounding the thermostat contact cable to the radiator.
22. a. Mount the hood and connect the windshield washer and headlight washer hoses.
b. Check the fit of the hood. Close the hood, open the doors, and check that the door jambs clear the rear edge of the hood.
c. Check the headlight alignment.
d. Refit the headlight trim frames.
23. Take the car out for a test run. Check the coolant level after driving.

Separating engine from automatic transmission

1. Clean the outside of the power plant.
2. Drain the engine oil.
3. Undo the screw located inside the crankcase using a 1/2" socket and extension shank. This screw can be reached at an inward angle through the engine oil drain plug opening. Use a tool with a 3/8" square grip (this applies to the 1970 model only).
4. Remove the cover over the flywheel ring gear.
5. Remove the starter, alternator and V-belt (up to and incl. model 1972).
6. Remove the right-hand engine bracket.
7. Disconnect the throttle wire from the throttle housing (carburetor).
8. Remove the crankcase ventilation device and all screws in the mating flanges of engine and transmission.
9. Undo the four screws fastening the flywheel ring gear to the torque converter. On 1.7 and 1.85 l engines the screws can be reached through a recess in the starter mount. On 2.0 l engine the screws are accessible near the crankcase ventilation connection housing.
10. Lift the engine carefully off the transmission.
11. Fit the torque converter support (special tool 879025).

Reassemble in the reverse order.

CAUTION

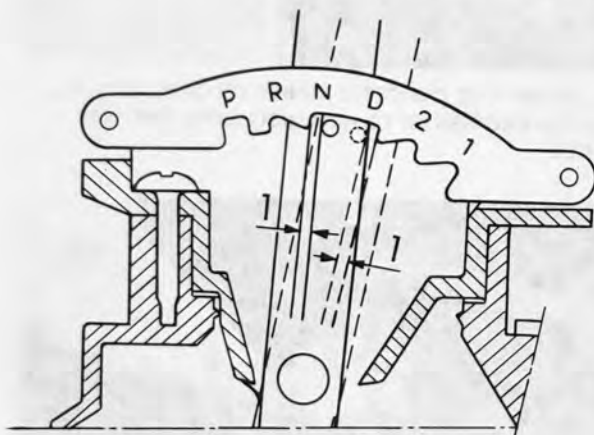
If the engine and transmission fail to separate, do not attempt to force them apart without first checking that all the screws have been taken out. Do not forget the screw inside the crankcase (1970 model only) or the transmission ventilation attachment on the right-hand side over the mating flanges.

TRANSMISSION CONTROL

Automatic transmission

Checking the gear selector lever cable

1. Move the selector lever to N. Check the clearance against the segment.
2. Move the selector lever to D. Check the clearance against the segment. The clearance in N and the clearance in D should be the same. See illustration.
3. Check that P, R, 2 and 1 are in correct position.

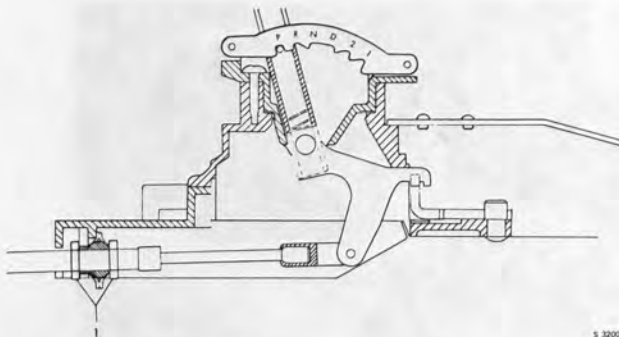


S 3199

ADJUSTING THE GEAR SELECTOR LEVER HOUSING

1. The clearance in N and in D are the same.

Adjusting the gear selector lever cable

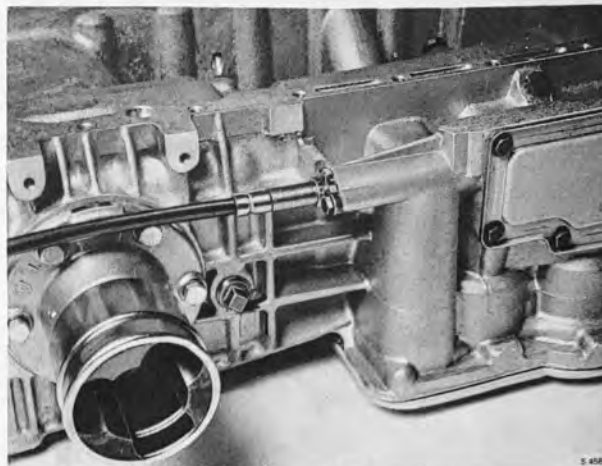


S 3200

SECTION THROUGH GEAR SELECTOR LEVER HOUSING

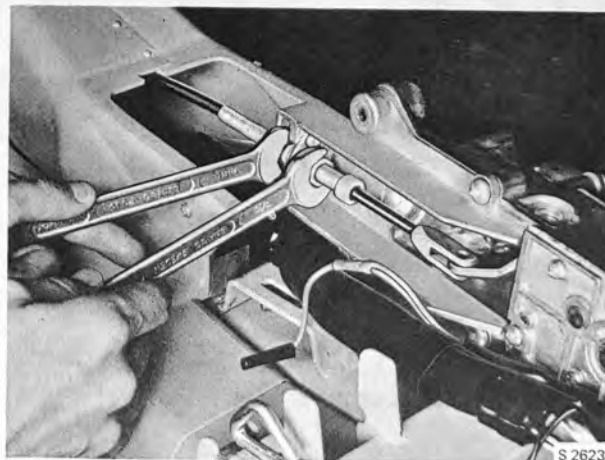
- P = Park
R = Reverse
N = Neutral
D = Drive 1, 2, 3rd
2 = Drive 1, 2nd
1 = Drive 1st

1. Adjusting the wire with nut



FINE SETTING OF THE GEAR SELECTOR LEVER CABLE, LATER DESIGN

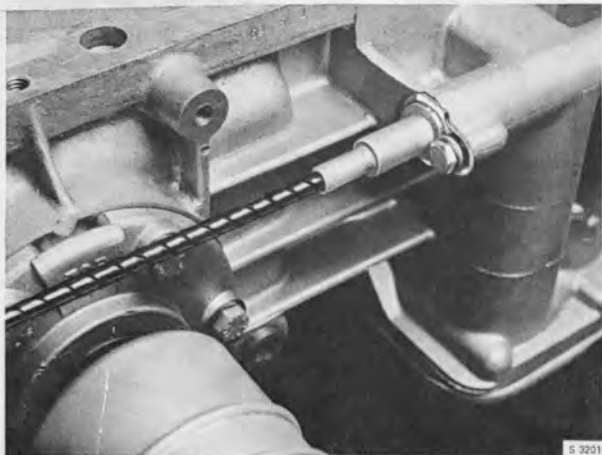
1. Remove the gear selector lever cover.
2. Slack off the gear selector lever housing nuts with tool 839123.
3. Lift the gear selector lever housing and turn it so that the adjustment nuts of the wire will be accessible.
4. Adjust by screw the nuts on the outer cover so that this will be displaced inwards or outwards.
5. After adjusting, the gear selector lever housing will be reassembled, and the clearance in N and D will be checked once again.



S 2623

ADJUSTING THE GEAR SELECTOR LEVER CABLE

In the connection between the gear selector lever cable and the automatic transmission case a fine setting can be done. Earlier design: The fine setting is done with shims, see illustration. Max. three shims can be fitted. Later design: The fine setting is done with a special adjusting nut. Cable of later design fits to all types of transmissions.

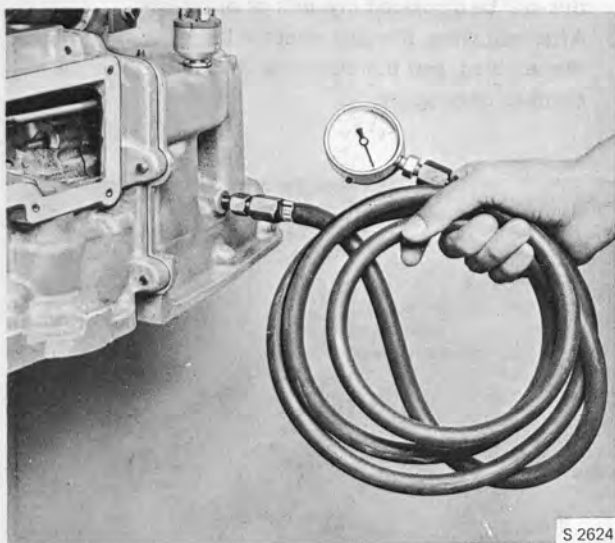


S 3201

FINE SETTING OF THE GEAR SELECTOR LEVER CABLE, EARLIER DESIGN

Adjusting the downshift valve

1. Connect a revolution counter to the engine and a pressure gauge 879003 to the transmission.
2. Immobilize the wheels by applying the brakes.



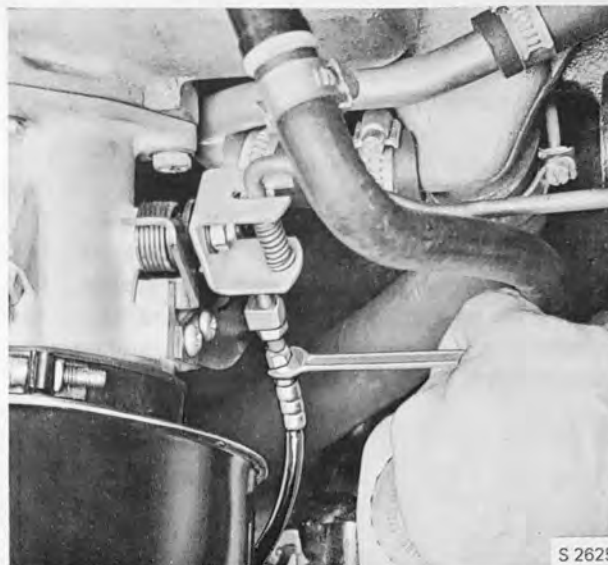
S 2624

CONNECTING THE PRESSURE GAUGE
Tool 879003

3. Start the engine and check that the idling speed is properly adjusted.
4. Move the selector lever to D.
5. Read off the pressure on the pressure gauge.
6. Rev up from idling by 500 rev/min.
7. Read off the pressure again. It should be up by 20–30 psi (1.4–2.1 bar, kp/cm^2). If the pressure rise is too little, the control cable must be adjusted outward, if the pressure rise is too high, the control cable must be adjusted inward.

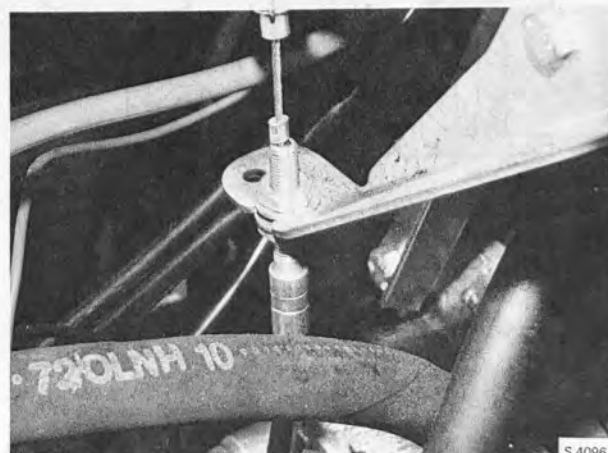
NOTE

The pressure should be 50–70 psi (3.5–4.9 bar, kp/cm^2) in idling with gear selector lever in D.



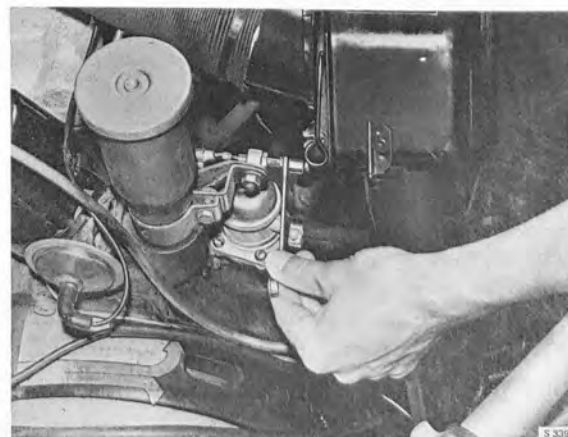
S 2625

ADJUSTING THE THROTTLE CABLE ON CARS WITH INJECTION ENGINES UP TO AND INCLUDING THE 1971 MODEL



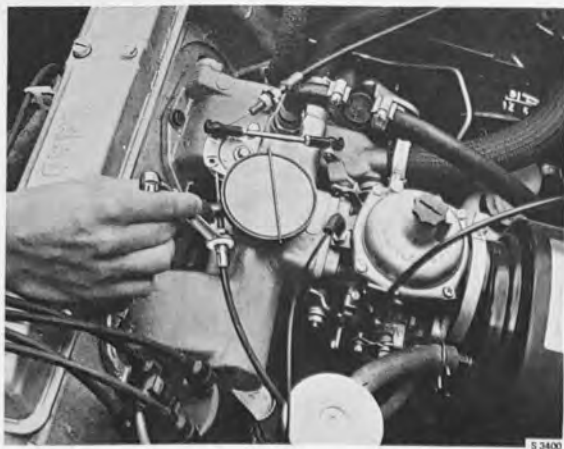
S 4096

ADJUSTING THE THROTTLE CABLE, INJECTION ENGINE, AS FROM THE 1973 MODEL

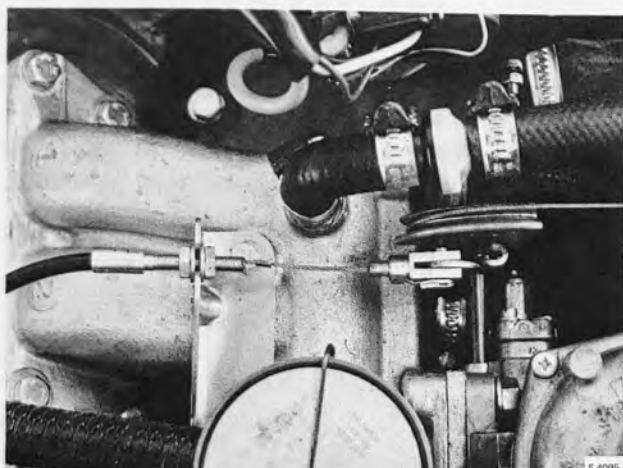


S 3396

ADJUSTING THE THROTTLE CABLE ON CARS WITH 1.85 LITER CARBURATED ENGINES UP TO AND INCLUDING THE 1971 MODEL



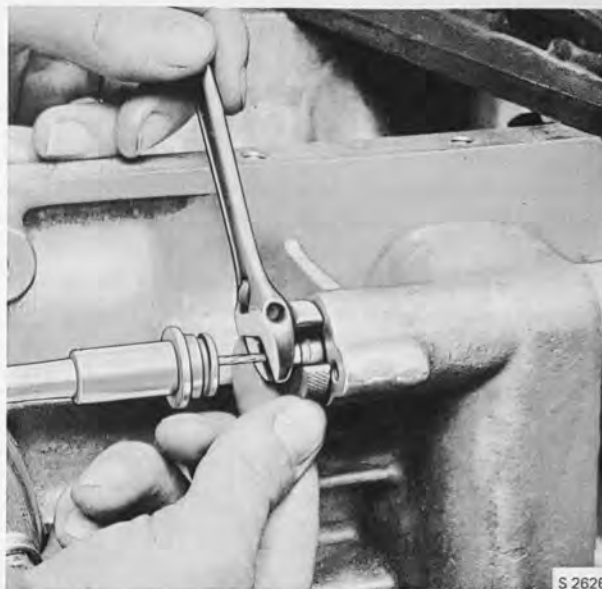
ADJUSTING THE THROTTLE CABLE, CARBURETOR ENGINE, MODEL 1972



ADJUSTING THE THROTTLE CABLE, CARBURETOR ENGINE, AS FROM THE 1973 MODEL

Changing the gear selector cable

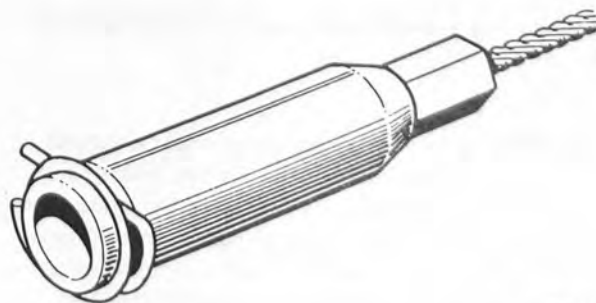
1. Remove the gear selector housing so that the cotter pin securing the wire to the gear selector rod can be driven out. Then disconnect the cable from the housing by undoing the two screws holding the wire clamp.
2. Disconnect the cable from the transmission casing using the special tool 879038.



REMOVING THE GEAR SELECTOR LEVER CABLE
Tool 879038

3. Take off the heater duct and remove the old cable.
4. Fit a new cable, being sure to obtain a perfect seal where it passes through the toeplate, and replace the heater duct.
5. Connect the cable to the transmission and then pull out the wire to engage position P in the transmission.
6. Connect the wire to the gear selector rod and the housing.
Then adjust the cable to roughly the correct position with P engaged in the transmission.
7. Screw on the selector lever housing and check the selector lever in the various positions, readjusting if necessary (see directions for adjusting the gear selector cable).

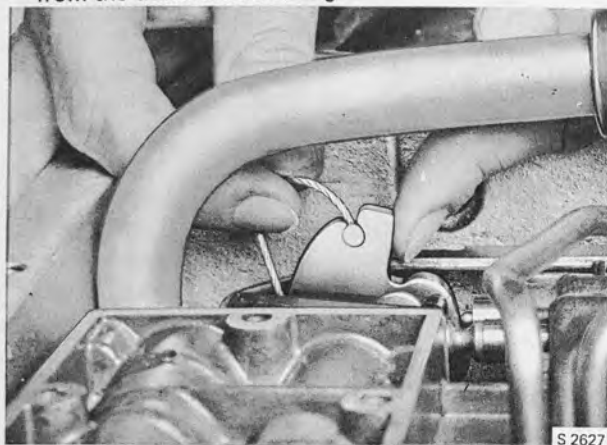
Note! As from transmission serial No. TB 1074 a new clips on the gear selector lever cable has been introduced. The new clips must be fitted as shown below.



GEAR SELECTOR LEVER CABLE WITH CLIPS

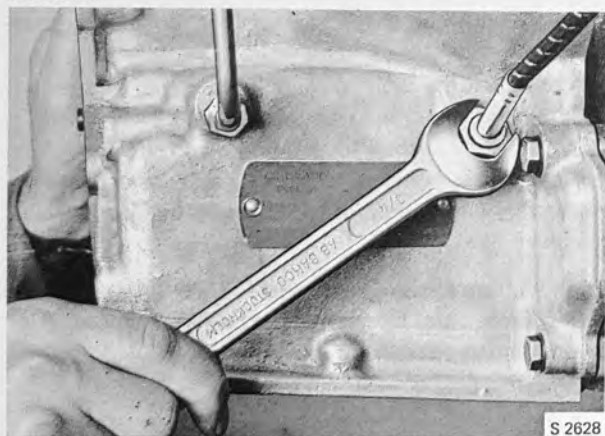
Changing the downshift valve cable

1. Disconnect the wire from the throttle damper at the intake manifold and from its attachment to the retaining plate.
2. Drain oil from the automatic transmission and take off the forward bottom cover.
3. Disconnect the throttle wire from the cam at the control valve on the valve housing and unscrew the cable from the transmission casing.



S 2627

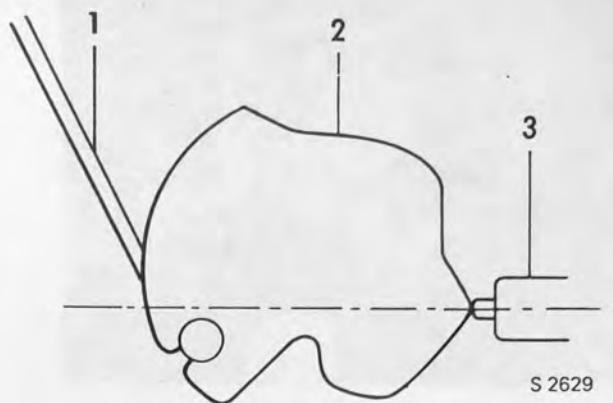
REMOVING THE THROTTLE CABLE FROM VALVE HOUSING



S 2628

REMOVING THE THROTTLE CABLE FROM TRANSMISSION CASE

4. Connect a new cable to the transmission casing and hook it to the cam on the control valve, making sure that the wire is properly positioned on the guide pulley.
5. Connect the wire to the throttle damper at the intake manifold and adjust the wire roughly by noting the position of the cam relative to the position of the throttle damper. When the accelerator pedal is fully depressed, i.e. in the kickdown position, the highest point of the cam should be in contact with the kick-down valve (see illustration).
6. Refit the bottom cover to the oil sump and fill the transmission with oil. For adjustment of the throttle wire, see the relevant directions.



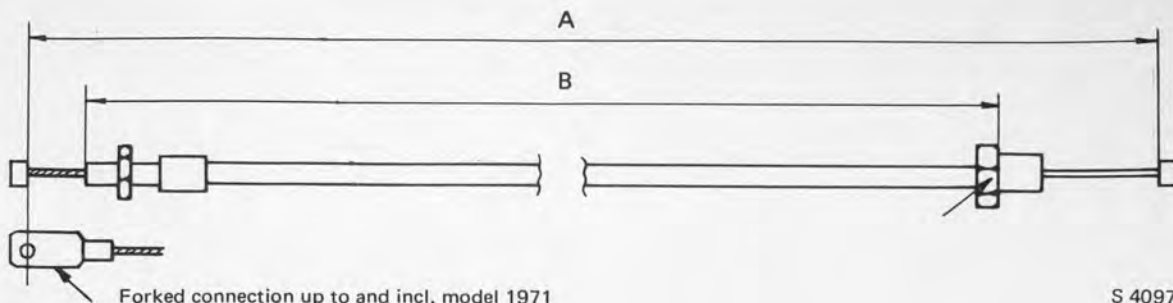
THE CAM IN "KICK-DOWN" POSITION

1. Throttle wire 2. Cam 3. Valve

Identification table, throttle cables

The table below of dimensions and identification numbers has been compiled to help you tell the cables apart.

An identification number is stamped into the hexagon nut at the end of the cable which is connected to the transmission.



S 4097

Transmission type	Year model	Cable No.	Identification No.	Lengths			
				A		B	
				mm	in.	mm	in.
TB	1971 and earlier	870819	76	939.0	36.97	742.2	29.12
TB	1972	870902	143	1009.1	39.73	769.9	30.31
269	1971 and earlier	870903	146	951.7	37.47	742.2	29.12
269	1972	870904	144	996.4	39.23	769.9	30.31
393 (carb.)	1973 and later	870910	210	1242.3	48.94	1029.9	40.55
399 (injection)	1973 and later	870909	211	627.1	24.64	430.0	16.93

Removing the gear selector lever housing

1. Disconnect the battery earth cable.
2. Move the selector lever to P and take off the ignition key.
3. Loosen the lock nut under the button of the gear selector lever and unscrew the button and nut.
4. Remove the scale cover. Before the cover can be removed, the switch cable connections must be loosened.
5. Remove the scale light reflector and the lamp socket for the scale light.
6. Remove the heater control lever button. The right one is accessible when the control lever is in its rear position and the right seat is in its front position.
7. Turn back the lever console carpet and remove the heater cover.
8. Remove the three gear cover retaining screws. Raise the cover and take off the ignition switch lamp. Remove the cover.
9. Remove the ignition switch cable and note its position.
10. Remove the retaining nuts for the gear selector lever with tool 839123.
11. Raise the gear selector lever housing and twist it. Loosen the two bottom cover screws and take off the wire bracket tension pin.

Assembling the gear selector lever housing

1. Move the ignition switch to Drive.
2. Assemble the gear selector housing with the bottom cover and connect the wire bracket.
3. Attach the house with one or two screws. Check and if necessary adjust the gear positions. See "Adjusting the gear selector cable". Assemble the house.
4. Assemble the ignition switch cable. Move the gear selector to P and take off the key.
5. Assemble the ignition switch light in the gear cover and attach the cover.
6. Assemble the lamp socket and the scale light reflector.
7. Assemble the cable in the scale cover and attach the cover.
8. Assemble the gear selector lever buttons and heater control.
9. Assemble the heater cover lid, carpet and battery cable.

Removing and installing the gear selector lever

1. Remove the gear selector lever housing. See this section.
2. Turn the ignition key to Drive.
3. Take off the tension pin from the ratch sector.
4. Remove the screws and take off the lever. Reassemble in reverse order.

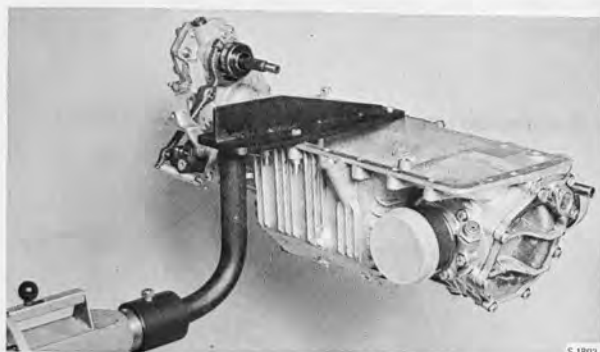
DISASSEMBLY, REASSEMBLY

Manual transmission up to and incl. chassis No. 99722003498

Disassembling and assembling of the gear box can be done without separating the engine and the gear box.

IMPORTANT

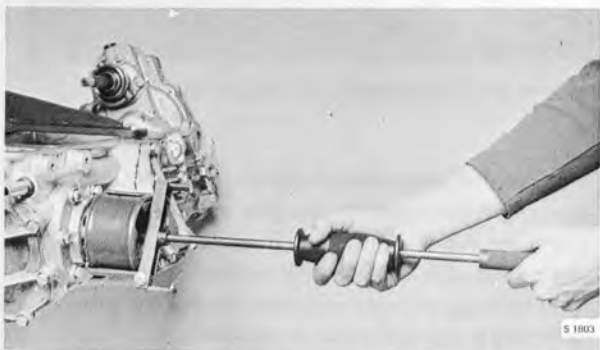
Before disassembling the transmission, always measure up the positions of the pinion gear and crown wheel. This is to check whether there is any error in their locations. If the pinion and crown wheel assembly is relatively new, i.e. if it has done less than 6,000 miles (10,000 km), it can be adjusted, but if the mileage is any greater the gears will have worn themselves into a given position. In the latter case, they should be reassembled in the same measured positions which they occupied before disassembly.



TRANSMISSION MOUNTED IN WORK FRAME
Tool 839046

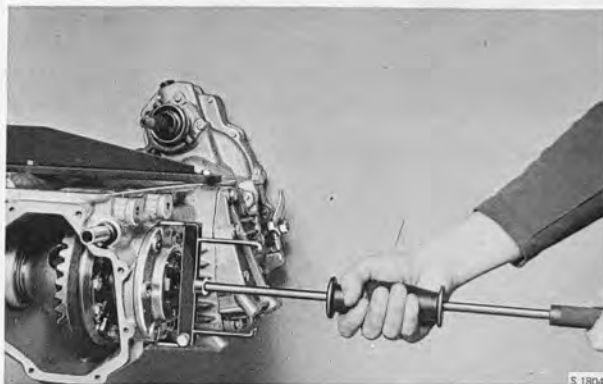
Proceed in the following order as far as necessary in order to remove whichever component needs attention.

1. Clean off the transmission case and drain the oil.
2. Remove inner drive shaft joints with shafts. Up to and incl. the 1969 model with the aid of puller 839147 and tapping hammer 839027. As from the 1970 model, puller 879035 and tapping hammer 839027. Then remove the cover from the differential housing.

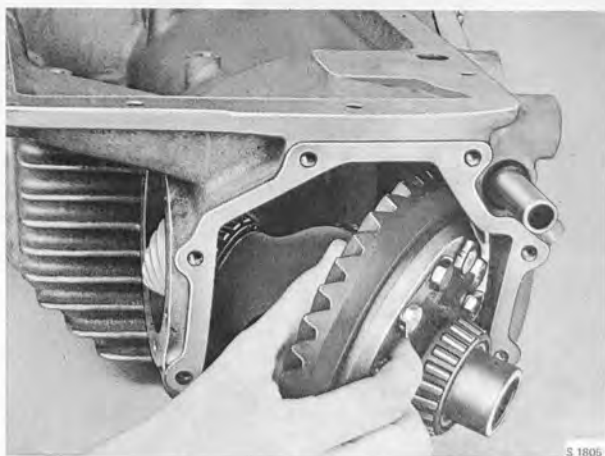


REMOVING THE INNER UNIVERSAL JOINTS
Tools 839027 and 879035

3. Remove the differential assembly by unscrewing the differential bearing seats on both sides and removing them with the help of puller 839147 and tapping hammer 839027. Take out the differential assembly with shims (if any). Safe the spacer washers and shims; the latter must be replaced in their original positions on reassembly unless the differential gear backlash has been altered by the exchange of some component. Before disassembling the differential, read section 473.

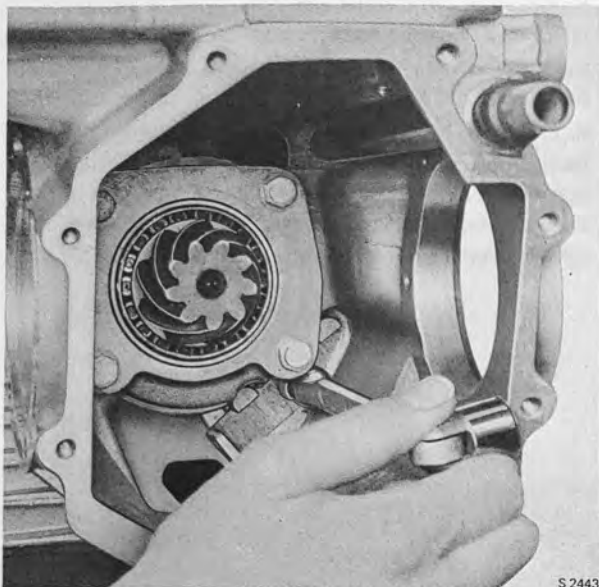


REMOVING THE DIFFERENTIAL BEARING SEATS
Tools 839027 and 839077



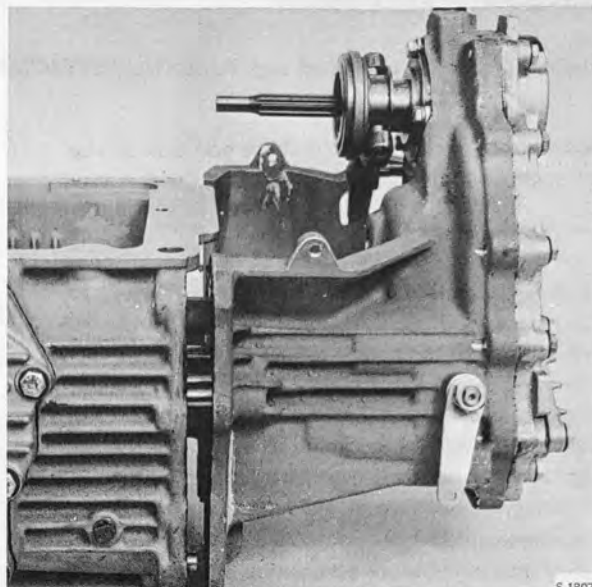
REMOVING THE DIFFERENTIAL ASSEMBLY

4. Remove the lock plate for the intermediate and reverse gear shafts (see illustration). Using tool 839004, pull the intermediate gear shaft until the intermediate gear set drops free (see illustration).



S 2443

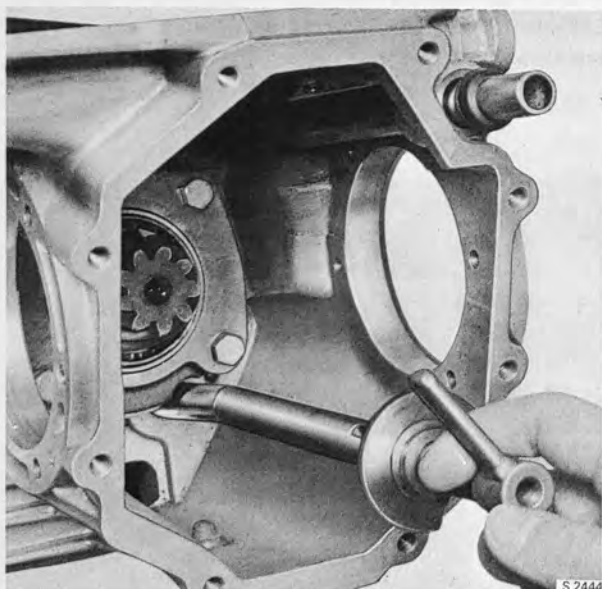
REMOVING THE LOCKING PLATE



S 1807

SEPARATING THE PRIMARY GEAR HOUSING FROM THE GEARBOX

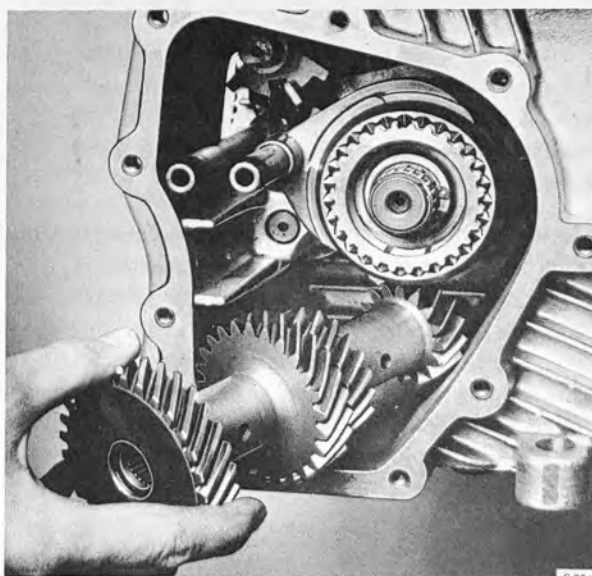
6. Remove the intermediate gear set (see illustration).



S 2444

PULLING THE INTERMEDIATE GEAR SHAFT
Tool 839004

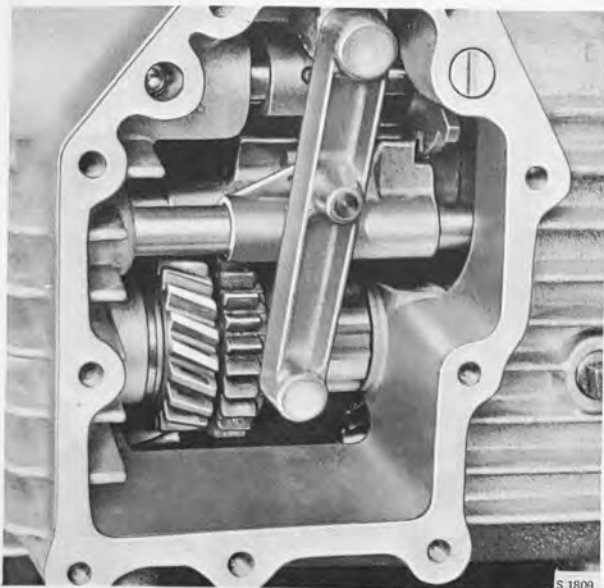
5. Separate the transmission at the joint between the gearbox and primary gear housing and lift away the primary gear housing (see illustration).



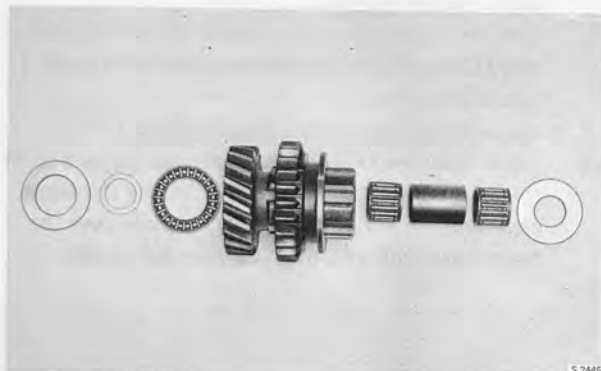
S 2241

REMOVING THE INTERMEDIATE GEAR SET

7. Unscrew the transmission side cover, take out the spring and ball catch for the gear selector rod, and put them in a safe place (see illustration). Pull out the reverse gear shaft and lift out the reverse gear with bearings and washers; then remove the gear shift shafts and forks (see illustration).

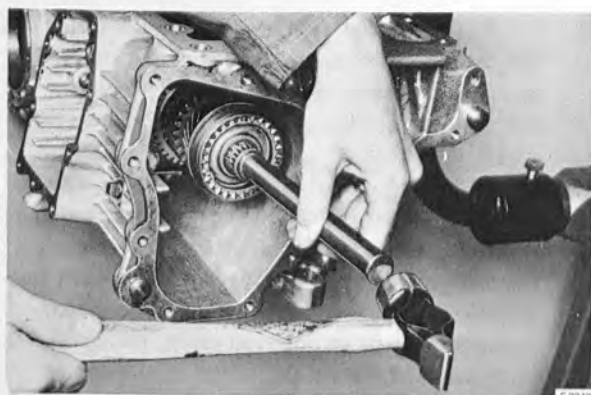


GEAR SHIFT SHAFTS AND FORKS



REVERSE GEAR WITH BEARINGS AND WASHERS

8. Undo the four pinion shaft retaining screws and tap the pinion shaft gently out of the transmission case with a drift (see illustration).

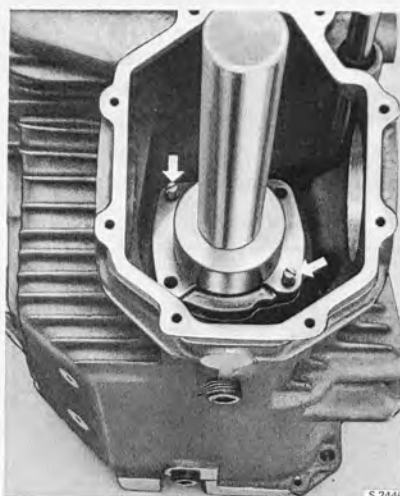


TAPPING OUT THE PINION SHAFT

Assembling the transmission

Having removed the component that needs attention, clean all fragments of old gaskets and all traces of old sealant compound off the covers. Inspect the transmission case and all disassembled parts and wash them in kerosene or similar. Then reassemble the transmission, following the procedure described below.

1. Adjust the differential bearings to the correct compression (see section 473 — this applies to manual transmissions with serial numbers of 4007 and higher).
2. Screw the two stud bolts (tool 839016) into the transmission case. Then shim and locate the pinion shaft assembly. Tap the assembly gently into position, using a plastic mallet, drift 839011 and sleeve 839014. Then insert and tighten the four bearing housing screws and secure them with Loc-tite.



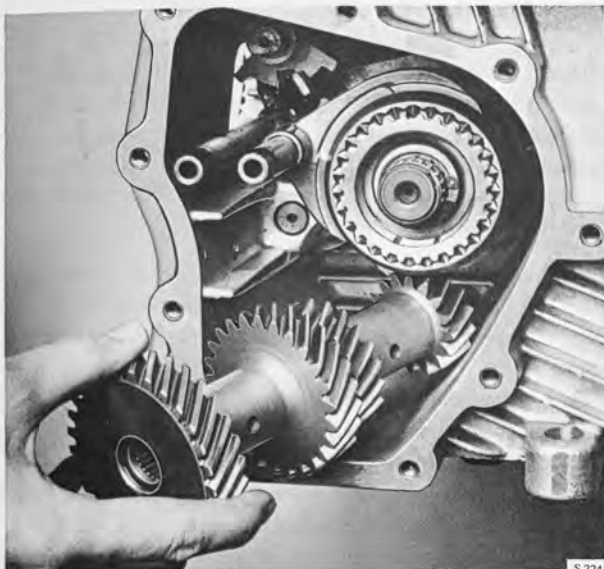
MOUNTING THE PINION SHAFT

Stud bolts 839016, drift 839011 and sleeve 839014

NOTE

If the position of the pinion shaft has been altered by the fitting of new components, the gear setting must be readjusted. See section 473.

3. Slide the coupling muffs on the pinion shaft to their neutral positions and fit the gear shift forks and gear assembly that the thrust washer is correctly positioned. It will be easier to install the intermediate gear if this washer is first glued in place.
4. Locate the loose needles (25 in number) in the intermediate gear, using grease to hold them in place until the intermediate gear shaft is inserted. Then lay the intermediate gear set loose in the bottom of the transmission case (see illustration).



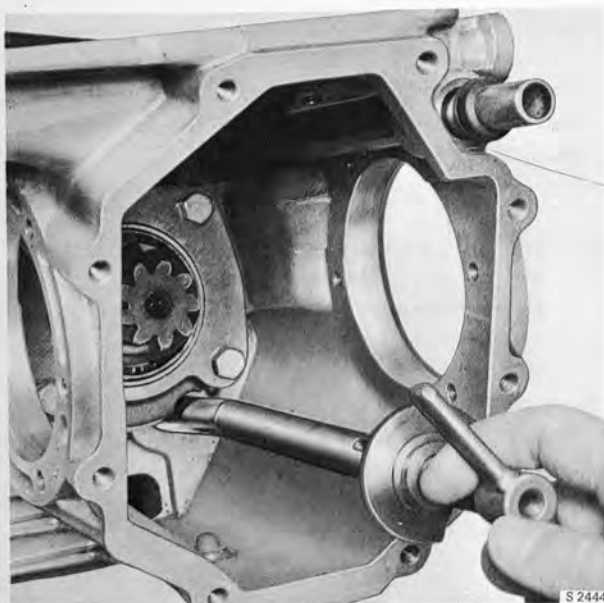
INSERTING THE INTERMEDIATE GEAR SET

5. Coat the mating flange of the primary gear housing with sealant compound, e.g. Tikatät 2, and screw the primary gear housing to the transmission case. This operation will be easier if polygrip pliers are used to clamp the mating flanges together on both sides alternately.

NOTE

Leave the screws slightly slack to avoid jamming the loose intermediate gear set in the wrong position before the intermediate shaft is inserted.

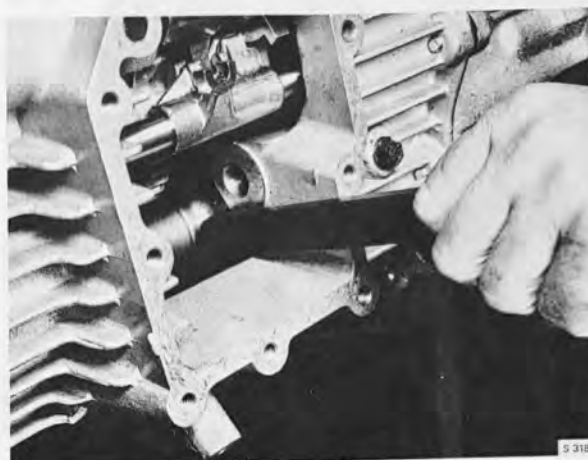
6. Alternative I:
Rock the transmission case gently until the intermediate gear set comes into the right position, and then insert the intermediate gear shaft using arbor 839026 and tool 839004, (see illustration).



INSERTING THE INTERMEDIATE SHAFT

Tool 839004

471-4



INSERTING THE INTERMEDIATE GEAR SHAFT

Tool 839019

Alternative II:

With installed engine.

Lift the intermediate gear with the hook wrench 839019 and insert the intermediate shaft as alt. I (see illustration).

7. Tighten the primary gear housing screws.
8. Install the reverse gear and shaft, making sure to fit the axial bearing at the same end as the spiral-cut gear (see illustration). Fit the lock plate over the reverse gear and intermediate gear shaft ends.



REVERSE GEAR WITH BEARINGS AND WASHERS

9. Fit the reverse gear shift lever. Insert the spring and ball catch for the gear selector rod. Coat the flange of the transmission case side cover with sealant compound, e.g. Tikatät 2, and then screw on the cover.
10. Install the differential assembly (see section 473).
11. Inspect the shaft seals in the differential bearing seats and fit new ones if necessary. Then mount the seats and adjust the crown wheel backlash (see section 473). Mount the two inner drive shafts complete with inner universal joints, taking care not to damage the shaft seals.
12. Coat the flange of the differential end cover with sealant compound, e.g. Tikatät 2, and screw the cover to the transmission case.
13. Fill the transmission case with oil (3 US qt, 5 Imp. pints, 3 liters).

Disassembling the pinion shaft

To disassemble the pinion shaft, follow the instructions already given for disassembling the transmission up to the point where the pinion shaft is unscrewed. Then continue as follows:



PINION SHAFT WITHDRAWN

1. Release lock rings and remove spacers. Dismantle bearings, gears and coupling muffs.

NOTE

The locking for the No. 2 gear is larger than others.

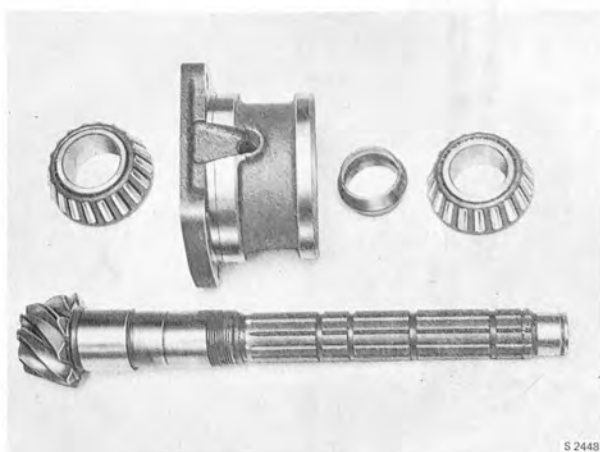
2. Put the pinion shaft in tool 839006 and loosen the nut with aid of key 839007.
3. Set up the unit in a press. Press the pinion shaft from the bearing housing using tools 839008 and 839009. As alternative, fixture 879063 and holder ring 879065 can be used to press the unit apart.



TOOLS 839008 AND 839009



PRESSING THE SHAFT OUT OF THE BEARING HOUSING
Tools 839008 and 839009



PINION SHAFT WITH BEARING HOUSING AND INNER BEARING RINGS

4. Press the outer rings of the conical roller bearings out of the bearing housing using tools 839009, 839010 and 839014.



TOOLS 839009, 839010 AND 839014

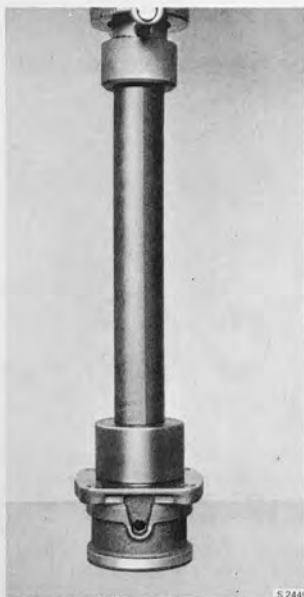
Installing the pinion shaft

Having removed the part that needs attention, inspect all disassembled parts and wash them in kerosene or similar. Then reassemble and install, proceeding as follows:

NOTE

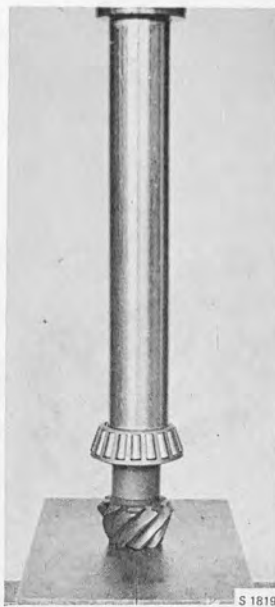
The bearings must be lubricated before being assembled.

1. Press the outer rings of the conical roller bearings into the bearing housing, using tools 839011, 839012 and 839014 (see illustration).



INSTALLING THE BEARING RACE INTO BEARING HOUSING
Tools 839011 and 839014

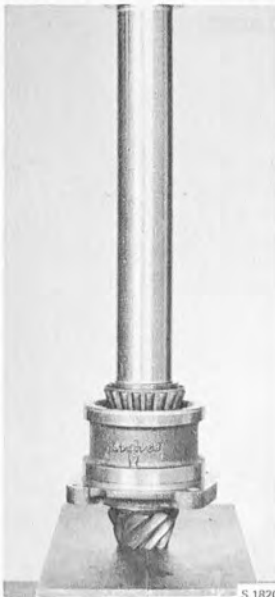
2. Press on the roller bearing nearest the pinion gear until it butts against its stop, using tool 839014 (see illustration).



PRESSING ON THE ROLLER BEARING NEAREST THE
PINION GEAR

Tool 839014

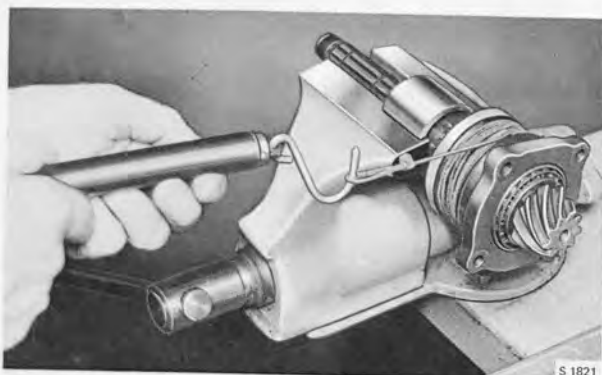
3. Mount a new spacer sleeve on the shaft.
4. Fit the bearing housing.
5. Fit the front roller bearing.
6. Set up the shaft in a press (see illustration). Using tool 839014, press the bearing housing slowly on and twist it at the same time until resistance to twisting is felt.



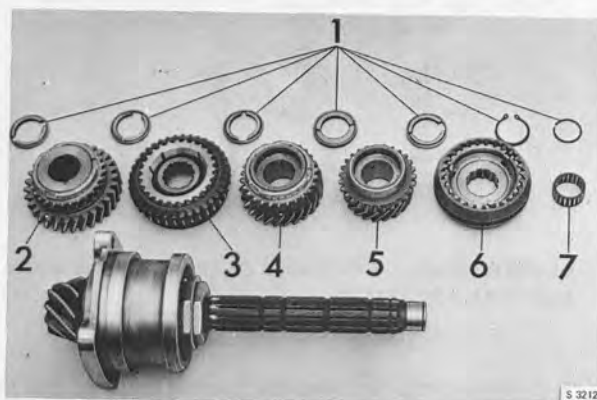
PRESSING ON THE FRONT ROLLER BEARING

Tool 839014

7. Set up the pinion shaft in a vice, using tool 839006. Wind the dynamometer wire round the bearing housing and pull the dynamometer handle. Tighten the nut until the torque reaches the correct value as indicated below. Lock with the securing plate.
Lightly oiled bearings:
New bearings 31.4–56.0 N (7–12.5 lb., 3.2–5.7 kp) dynamometer reading, which corresponds to a torque of 1.8 ± 0.5 Nm (7.3 ± 0.5 lb.in, 18 ± 0.5 kpcm).
Old bearings that have done more than 1,200 miles (2,000 km): 10.0–34.0 N (2.2–7.7 lb., 1.0–3.5 kp) dynamometer reading, which corresponds to a torque of 0.9 ± 0.5 Nm (8 ± 4.0 lb.in, 9 ± 5 kpcm).



TIGHTENING THE PINION SHAFT BEARING
Tools 839006 and 839013



PINION SHAFT DISASSEMBLED

- | | |
|----------------------------|----------------------------|
| 1. Spacers with rings | 5. 3rd gear wheel |
| 2. 1st gear wheel | 6. 3rd–4th synchronization |
| 3. 1st–2nd synchronization | 7. Needle bearing |
| 4. 2nd gear wheel | |

8. Fit the spacers and ring close to the nut.
9. Fit the 1st gear wheel with spacers and ring.
10. Fit the 1st–2nd synchronization with spacers and ring.

NOTE

In gearboxes up to and incl. chassis No. 99722003498, the synchronizing ring for 1st gear is of special design and can be distinguished from the others by the fact that it lacks three teeth.

11. Fit the 2nd gear wheel with spacers and ring.
Note that the spacers and ring for the 2nd gear are thicker.
12. Fit the 3rd gear wheel with spacers and ring.
13. Fit the 3rd–4th synchronization and lock ring.
14. Fit the needle bearing and the lock ring.
15. Fit the pinion shaft in the transmission case and tighten it.

NOTE

Use tools 839011 and 839014 and stud bolt 839016 to mount the pinion shaft complete with bearing housing in the transmission case.

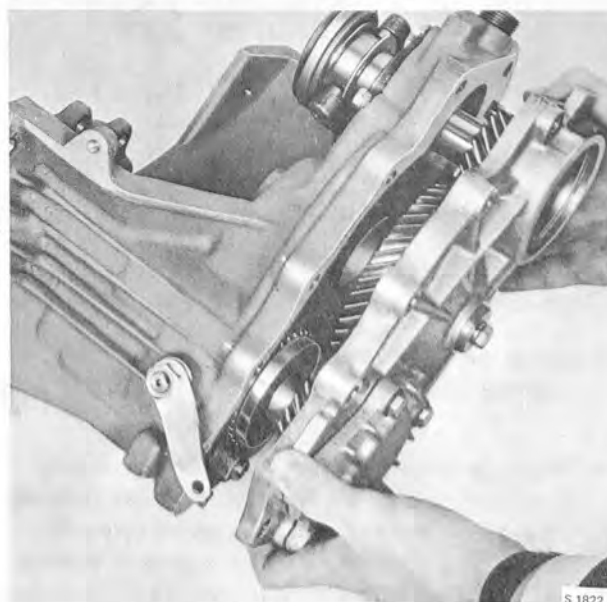
16. Now measure and if necessary adjust the pinion shaft (see section 473).

Removing the primary gear housing

To remove the primary gear housing, follow the instructions already given for disassembling the transmission. According to these, the differential assembly must be removed and the intermediate shaft gear freed before the primary gear housing can be separated from the transmission case.

Disassembling

1. Separate the bearing housing from the primary gear case (see illustration).

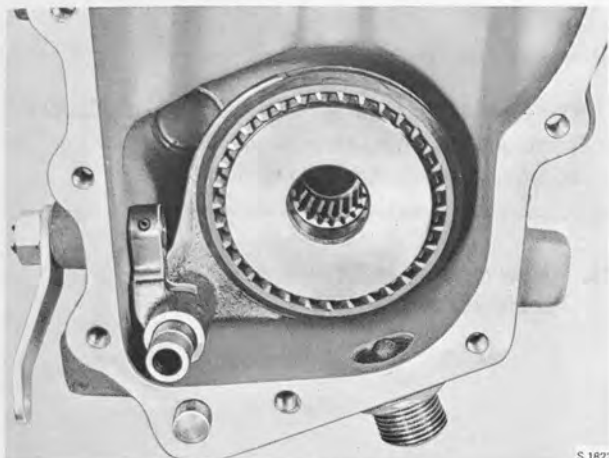


OPENING THE PRIMARY GEAR HOUSING

NOTE

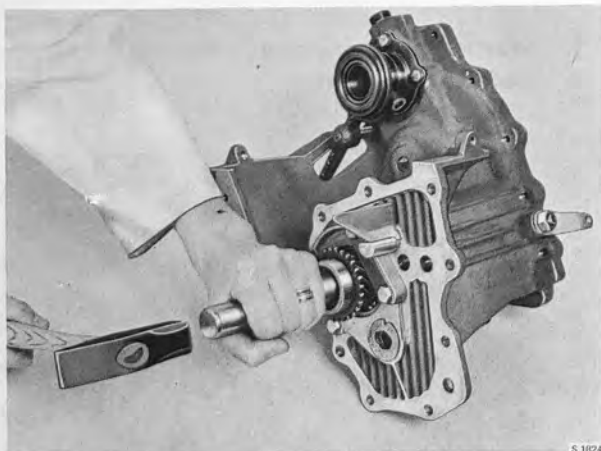
Remember to undo the clutch adjustment nut.

2. Remove the free wheel control (see illustration).



FREE WHEEL CONTROL

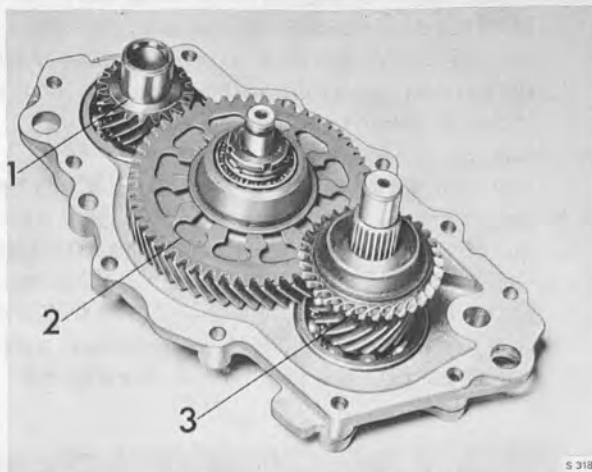
3. Pull the free wheel shaft. If it sticks, use drift 839018 to free it (see illustration). Remove the free wheel hub from the free wheel shaft using tool 879030. If the needle bearing in the free wheel shaft needs exchanging, it will have to be broken out, as it is force fitted to the shaft.



FREEING THE FREE WHEEL SHAFT

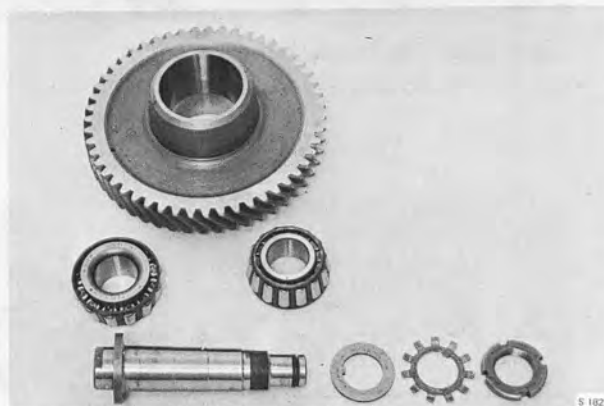
Tool 839018

4. Remove the center wheel shaft from the bearing housing and back off the center shaft nut using tool 839019 so that the center gear can be taken off. Then press the inner ring off the center shaft using tool 839014. If necessary, remove the friction wheel from the center gear wheel.



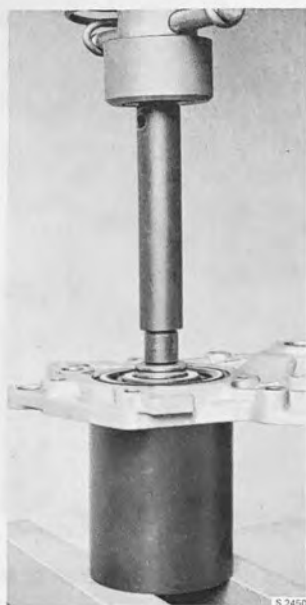
PRIMARY GEAR TRAIN

1. Input gear
2. Center wheel
3. Output gear



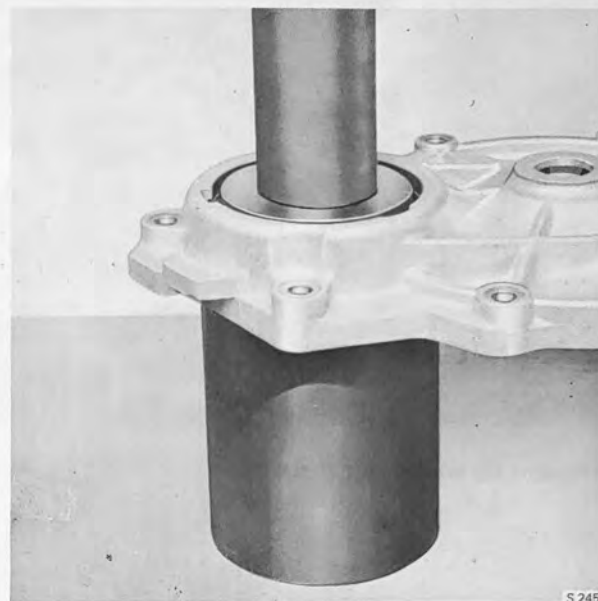
CENTER WHEEL OF PRIMARY GEAR ASSEMBLY WITH SHAFT AND BEARINGS

5. Remove the cap from the bearing housing, free the lock ring from the shaft and press the output gear out of the bearing, using tool 839009 as a support and pressing with drift 839018 (see illustration). Then press the bearing out of the bearing housing using tool 839012 and sleeve 839014.



PRESSING OUT THE OUTPUT GEAR FROM THE BEARING
Drift 839018, support 839009

6. If necessary, press the driver gear off the output gear shaft using drift 839018 and tools 839009 and 839024 as supports (see illustration).



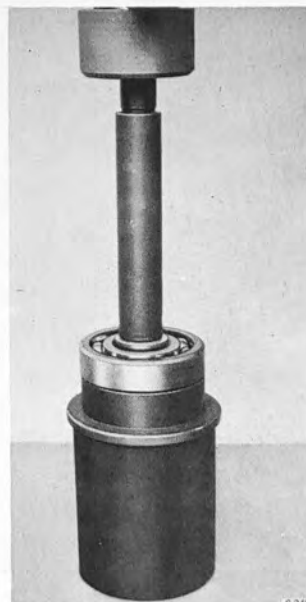
PRESSING OUT THE INPUT GEAR WITH BEARING FROM
THE BEARING HOUSING
Drift 839012 and support 839009

8. Undo the lock ring from the input gear and press the ball bearing off the gear, using supports 839009 and 839024 and drift 839018 (see illustration).



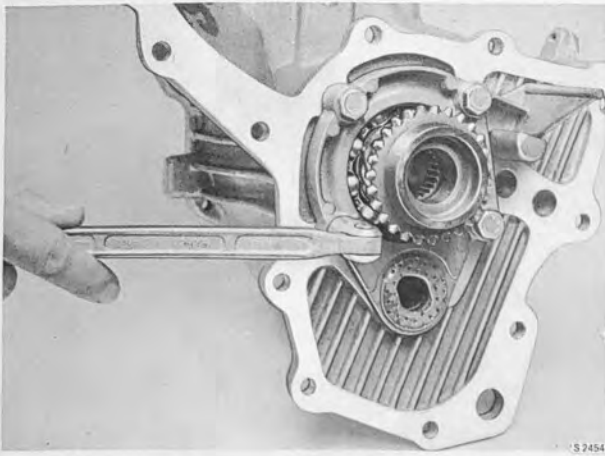
PRESSING OFF THE DRIVER GEAR
Drift 839018, supports 839009 and 839024

7. Press the input gear complete with ball bearing out of the bearing housing, using drift 839012, sleeve 839014 and support 839009 (see illustration).

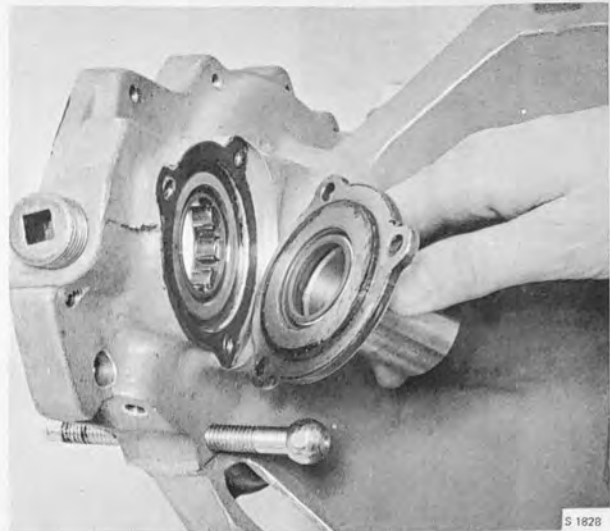


PRESSING THE INPUT GEAR OUT OF THE BEARING
Drift 839018, supports 839009 and 839024

9. Remove the bearing support that retains the gearbox input gear (4th) with bearing (see illustration).



REMOVING THE BEARING SUPPORT



THE CLUTCH SHAFT SEAL LOCATION IN THE GUIDE SLEEVE

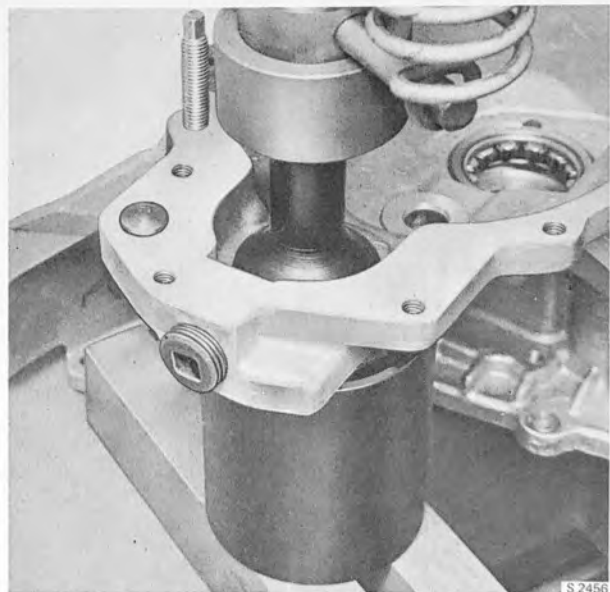
10. Press the gearbox input gear (4th) out of the primary gear housing, using ring 839021, drift 839018 and support 839009. Release the lock ring and press the bearing off the shaft, using ring 839021, drift 839018 and supports 839009 and 839024 (see illustration).

13. If necessary, change the clutch shaft seal in the guide sleeve of the release bearing and press out the roller bearing (using tool 839032) for the input gear (clutch shaft, see illustration).



PRESSING OFF THE BEARING

Ring 839021, drift 839018, supports 839009 and 839024



PRESSING OUT THE ROLLER BEARING

Drift 839032, support 839009

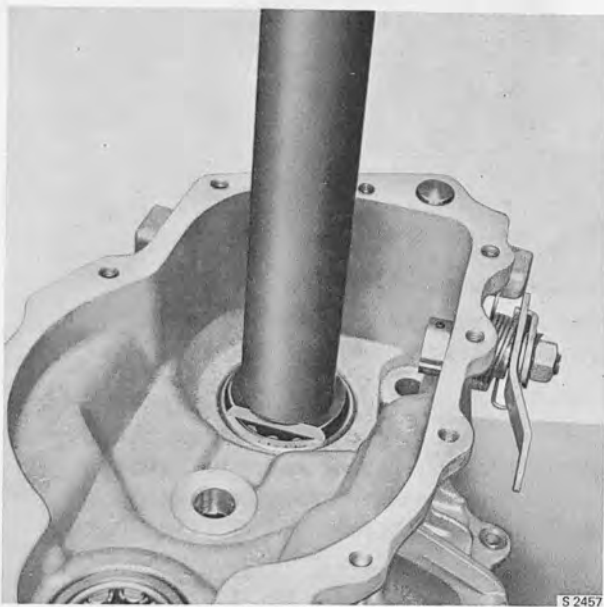
11. Press the free wheel shaft roller bearing out of the primary gear housing, using tool 839022 and drift 839018.
12. If necessary, remove the oil seal ring from the primary gear housing.

Assembling the primary gear unit

Having removed whichever part needs attention, clean the mating flange surfaces of the bearing housing and primary gear housing to remove gasket fragments and traces of sealant compound. Inspect all disassembled parts and wash them in kerosene or similar.

Then reassemble as follows:

1. Fit the labyrinth seal, noting the marking, and the oil seal ring if they have been removed. Then press the free wheel shaft roller bearing into the primary gear housing using drift 839010 and sleeve 839014 (see illustration).



PRESSING IN THE ROLLER BEARING

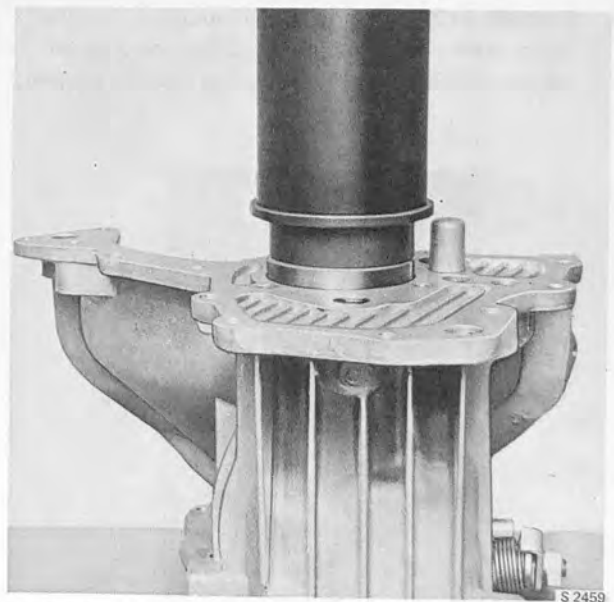
Tools 839010 and 839014

2. Press the ball bearing on to the gearbox input gear (4th), using drift 839018, washer 839029 and supports 839009 and 839024 (see illustration). Fit the bearing lock ring and press the gear-box input gear (4th) complete with bearing into the primary gear housing, using tools 839009 and 839024 (see illustration).



PRESSING ON THE BALL BEARING

Tools 839009, 839018, 839024 and 839029



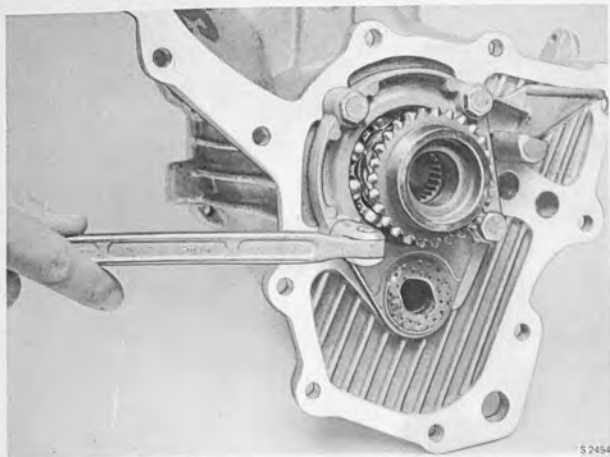
PRESSING IN THE GEAR WITH BEARING

Tools 839009 and 839024

3. Mount the bearing support for the ball bearing of the gearbox input gear (4th) to the primary gear housing, securing the screws with Loctite.

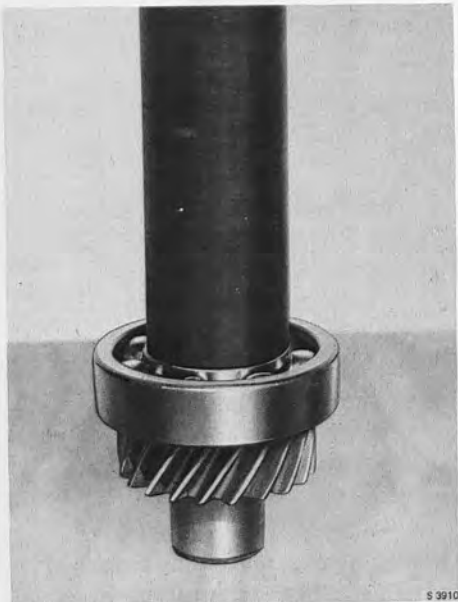
NOTE

Use the intermediate gear shaft as a guide to locate the bearing support correctly. The intermediate gear thrust washer should be glued to the bearing support to ease the job of mounting the intermediate gear shaft. Make sure that the oil catcher is properly located and held in position by the bearing support (see illustration).



FITTING THE BEARING SUPPORT

4. Fit the needle bearing in the free wheel shaft if previously removed, using drift 839018.
5. Fit the free wheel drive hub in the free wheel shaft, using tool 879030, and mount the free wheel shaft in the primary gear housing. Fit the free wheel drive control.
6. Press the ball bearing on to the input gear (for the clutch shaft), using supports 839009 and 839024 and drift 839018. Fit the lock ring (see illustration).



PRESSING ON THE BALL BEARING
Tool 839014

7. Press the primary input gear complete with ball bearing into the bearing housing, using tools 839009 and 839024 (see illustration). The bearing must be pressed in until it lies flush with the mating surface of the bearing housing.



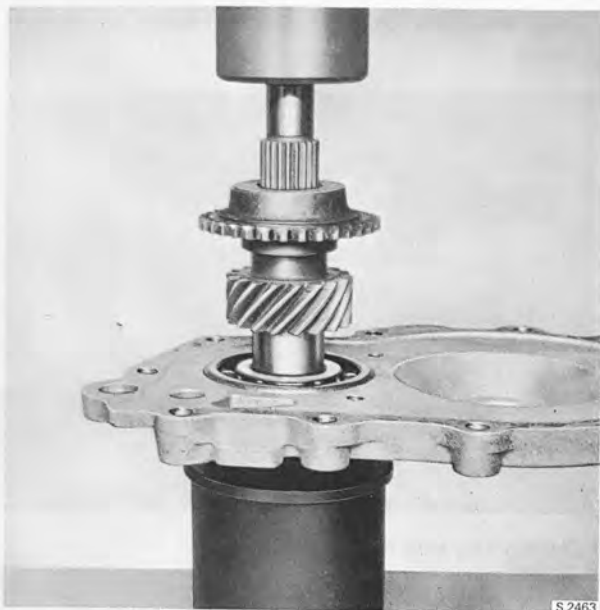
PRESSING ON THE GEAR AND BALL BEARING
Tools 839009 and 839024

8. Press the free wheel driver gear on to the output gear shaft if previously removed, using supports 839009 and 839024 and drift 839018 (see illustration).



PRESSING ON THE FREE WHEEL DRIVER GEAR
Tools 839009, 839018 and 839024

9. Press the output gear ball bearing into the bearing housing, using supports 839011 and 839024. Then press the output gear into the ball bearing, using supports 839009 and 839024 (see illustration). Then fit the washer and lock ring.



PRESSING THE OUTPUT GEAR INTO THE BALL BEARING
Tools 839009 and 839024

10. Fit the inner roller bearing to the center gear shaft, using sleeve 839014 if necessary. Then mount the center gear and outer roller bearing plus the friction wheel if this has previously been removed.
11. Set up the center wheel, shaft and bearing in a vise. Wind a cord round the gear wheel and rotate the wheel with a dynamometer 839013 (see illustration). Tighten and lock the nut when the dynamometer reading reaches 6.0–8.0 N (1.32–1.76 lb., 0.6–0.8 kp), which corresponds to a torque of 0.4–0.5 Nm (3.5–4.3 in.lb., 4.0–5.0 kpcm). Use wrench 839019 to tighten the lock nut. Then mount the center wheel in the bearing housing.



COMPRESSING THE CENTER SHAFT BEARINGS
Tool 839013

12. Press the input gear roller bearing into the primary gear housing if previously removed, using tool 839032.
13. Coat the bearing housing sealing surface and cap with sealant compound, e.g. Tikatät 2, and fit the bearing housing to the primary gear housing. Secure the bearing housing to the primary gear housing and the cap to the bearing housing.
14. Fit a new seal ring in the release bearing guide sleeve if necessary.
15. Mount the primary gear housing on the transmission case.

Clutch shaft sealing ring

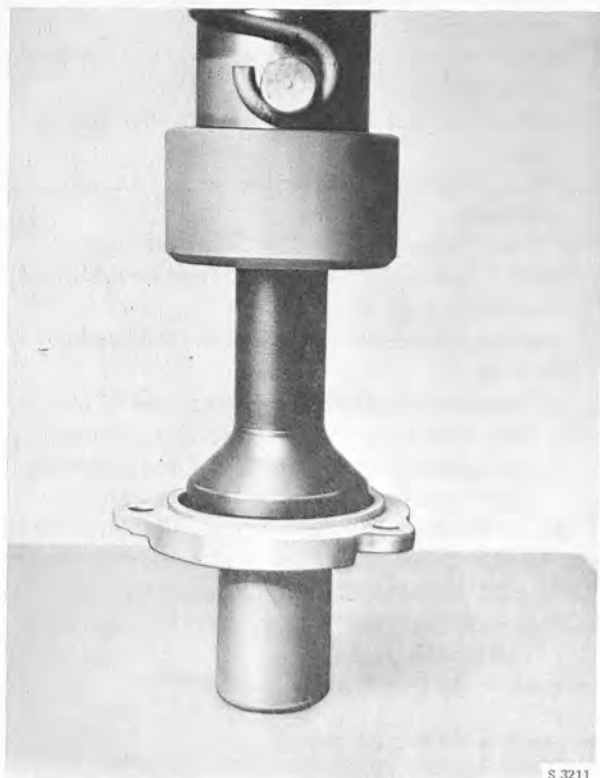
Changing the clutch shaft sealing ring

Removal

Remove clutch, clutch disc, release bearing and guide sleeve. See description on page 411–2. Remove the sealing ring from the guide sleeve with for example a screw driver.

Assembly

Fit the sealing ring in the guide sleeve with aid of tool 839032 (see illustration). Fit clutch, clutch disc, release bearing and guide sleeve. See description on page 411–2.



FITTING THE CLUTCH SHAFT SEALING RING
Tool 839032

Free wheel

Free wheel hub

If the free wheel hub has to be disassembled for repair, it is usually sufficient to renew the hub and rollers. If the free wheel shaft sleeve is damaged, however, the free wheel shaft must be exchanged as a unit.

Removal and installation

The power plant doesn't need to be lifted out when removing the free wheel.

1. Remove the hood (see page 201-1).
2. Loosen the battery cables and lift out the battery.
3. Drain off the coolant.
4. Undo the cable connections to radiator fan, thermostat contact, headlamps and headlamps cleaner motor.
5. Detach the radiator hoses.
6. Undo the four fastening screws from the front sheet.
7. Remove the headlamp decor frames.
8. Remove the four lower screws securing the headlamps (two screws for each headlamp).
9. Detach the hood lock operating cable.
10. Remove the front sheet.
11. Remove the front engine bracket. (As from model 1970.)
12. Undo the three exhaust pipe screws.
13. Detach the throttle control linkage and the throttle control damper.
14. Raise the power plant about 4" (100 mm) in the front end.
15. Remove the lock ring and the clutch shaft sealing cover.
16. Remove the clutch shaft center screw with washer and O-ring.
17. Fit the tapping hammer 839027 and the joint 839001 in the clutch shaft end. Then carefully pull out the clutch shaft.
18. Separate the primary gear case from the bearing housing.
19. a. Insert wrench 879032 into the splines of the free wheel drive hub and twist the hub to the right, pulling the hub outward at the same time until the rollers project for half their length.
b. Fit the sleeve 879031 over the rollers on the hub and keep the tool pressed against the free wheel shaft. Continue to twist the hub to the right with the wrench and at the same time pull the hub into the tool sleeve.

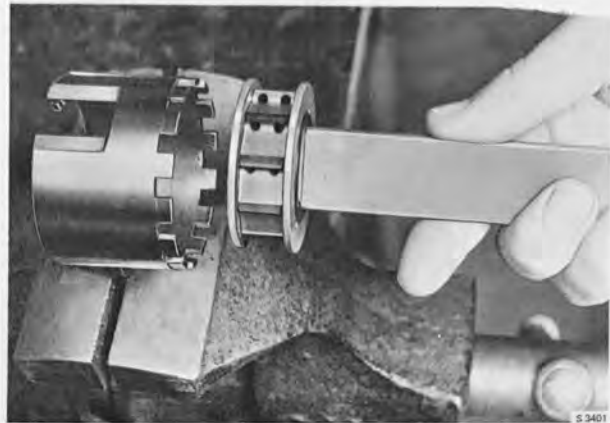
Reassemble in the reverse order.

Disassembling the free wheel hub

1. Place a clean rag over the free wheel hub and tool sleeve to prevent the rollers and springs from being thrown out on to the floor.
2. Push the hub out of the sleeve.
3. Clean the hub and rollers with paraffin oil.

Assembling

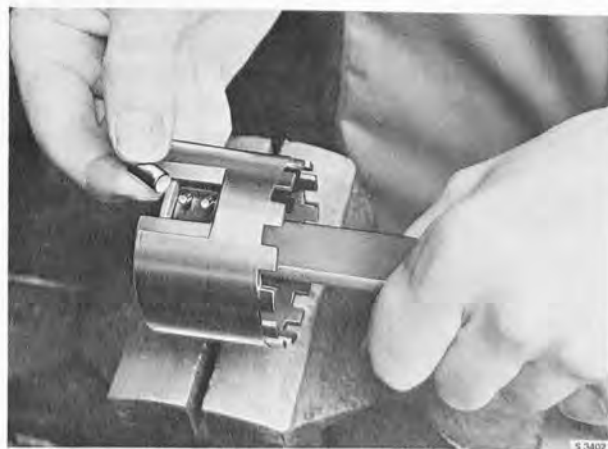
1. Set up the sleeve of tool 879030 in a vise (see illustration).
2. Orient the hub so that the figures will face inward when the hub is mounted in the free wheel sleeve.
3. Insert the key to tool 879030 into the splines of the hub, and place the hub in the tool sleeve (see illustration).



PLACING THE HUB IN THE TOOL

Tool 879030

4. Insert the springs, plungers and rollers. Turn the hub to the left with the key, and at the same time, using the thumb, push down the roller against the springs, until the roller slips under the edge of the tool sleeve. The installation is made easier if two rollers, facing each other, are put in. Then place the hub in the sleeve for centering.
5. When all the rollers have been inserted, turn the hub just enough to hold the last one in place in the sleeve — otherwise the first one will jump out again.



INSERTING THE ROLLERS

Tool 879030

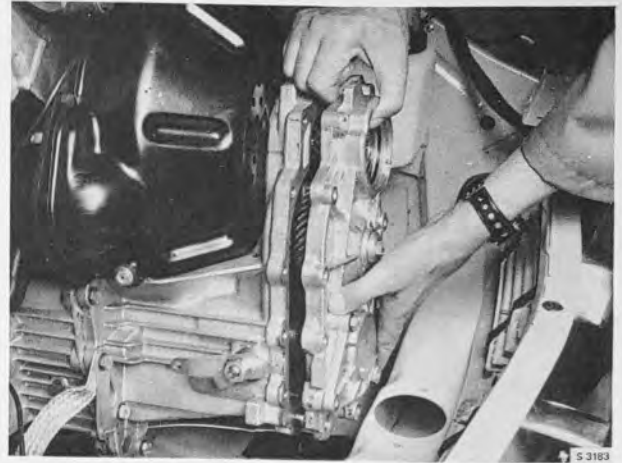
6. In this position, slide the hub into the unrecessed end of the tool sleeve, letting the rollers project for half their length so that they will slip easily into the free wheel drive sleeve. This locates the hub in relation to the sleeve. Push and at the same time twist the hub to the right with aid of the wrench, to seat the hub in the free wheel drive sleeve.

Primary gear

The power plant doesn't need to be lifted out when removing the primary gear.

Removal

1. Remove the hood (see page 201-1).
2. Loosen the battery cables and lift out the battery.
3. Drain off the coolant.
4. Undo the cable connections to radiator fan, thermostat contact, headlights and headlight wiper motor.
5. Detach the radiator hoses.
6. Undo the four fastening screws from the front sheet.
7. Remove the headlight trim frames.
8. Remove the four lower screws securing the headlights (two screws for each headlight). As from the 1972 model the headlights are disconnected from the front sheet and the body.
9. Detach the hood lock operating cable.
10. Remove the front sheet.
11. Remove the front engine bracket. (As from model 1970.)
12. Undo the three exhaust pipe screws.
13. Detach the throttle control linkage and the throttle control damper.
14. Raise the power plant about 4" (100 mm) in the front end.
15. Remove the lock ring and the clutch shaft sealing cover.
16. Remove the clutch shaft center screw with washer and O-ring.
17. Fit the tapping hammer 839027 and the joint 839001 in the clutch shaft end. Then carefully pull out the clutch shaft.
18. Detach the free wheel cable and separate the primary gear case from the bearing housing, see illustration.

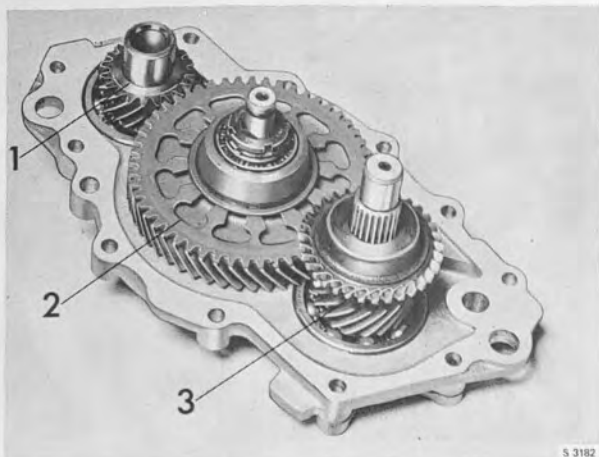


OPENING THE PRIMARY GEAR HOUSING WITH THE POWER PLANT INSTALLED IN THE CAR

NOTE

Remember to undo the clutch adjustment nut.

19. If necessary remove the free wheel control.
20. Remove the center wheel shaft from the bearing housing and back off the nut using tool 839019 so that the center wheel can be taken off. Then press the inner ring off the shaft using tool 839014. If necessary, remove the friction wheel from the center wheel.



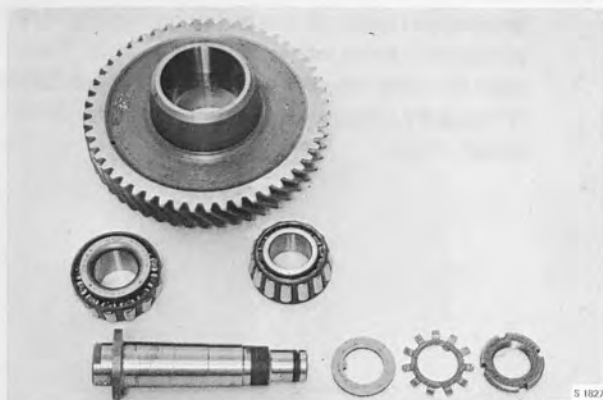
PRIMARY GEAR TRAIN

1. Input gear
2. Center wheel
3. Output gear



PRESSING OUT THE OUTPUT GEAR FROM THE BEARING
Drift 839018, support 839009

22. If necessary, press the driver gear off the output gear shaft using drift 839018 and tools 839009 and 839024 as supports (see illustration).



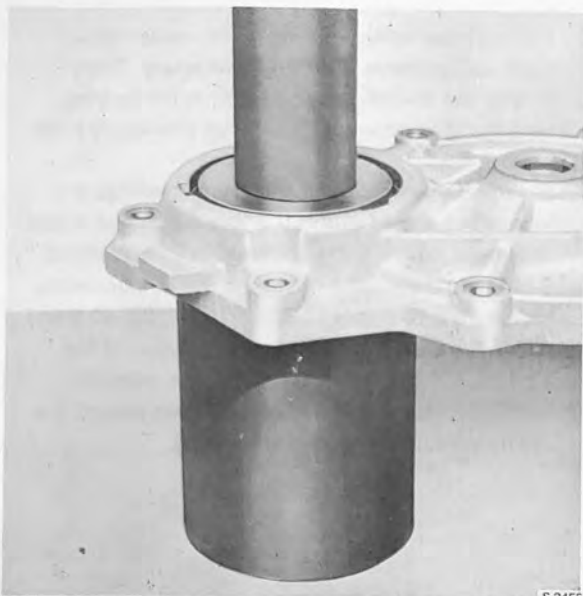
CENTER WHEEL OF PRIMARY GEAR ASSEMBLY WITH
SHAFT AND BEARINGS

21. Remove the cap from the bearing housing, free the lock ring from the shaft and press the output gear out of the bearing, using tool 839009 as a support and pressing with drift 839018 (see illustration). Then press the bearing out of the bearing housing using tool 839012 and sleeve 839014.



PRESSING OFF THE DRIVER GEAR
Drift 839018, supports 839009 and 839024

23. Press the input gear complete with ball bearing out of the bearing housing, using drift 839012, sleeve 839014 and support 839009 (see illustration).



PRESSING OUT THE INPUT GEAR WITH BEARING FROM THE BEARING HOUSING

Drift 839012, sleeve 839024, support 839009

24. Undo the lock ring from the input gear and press the ball bearing off the gear, using supports 839009 and 839024 and drift 839018 (see illustration).

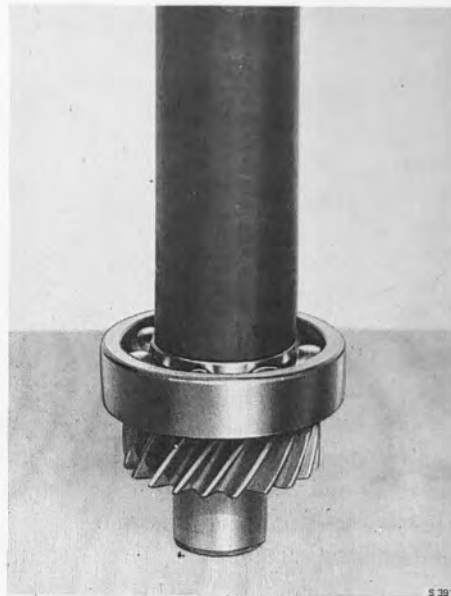


PRESSING THE INPUT GEAR OUT OF THE BEARING

Drift 839018, supports 839009 and 839014

Assembly

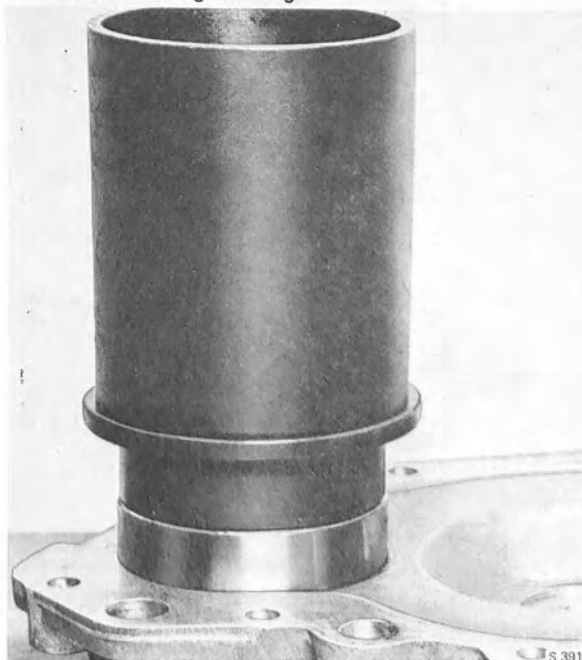
1. Fit the free wheel drive control if this previously has been removed.
2. Press the ball bearing on to the primary gear train input gear, using sleeve 839014.



PRESSING ON THE BALL BEARING

Sleeve 839014

3. Press the input gear complete with ball bearing into the bearing housing, using tools 839009 and 839024 (see illustration). The bearing must be pressed in until it lies flush with the mating surface of the bearing housing.



PRESSING ON THE GEAR WITH BALL BEARING

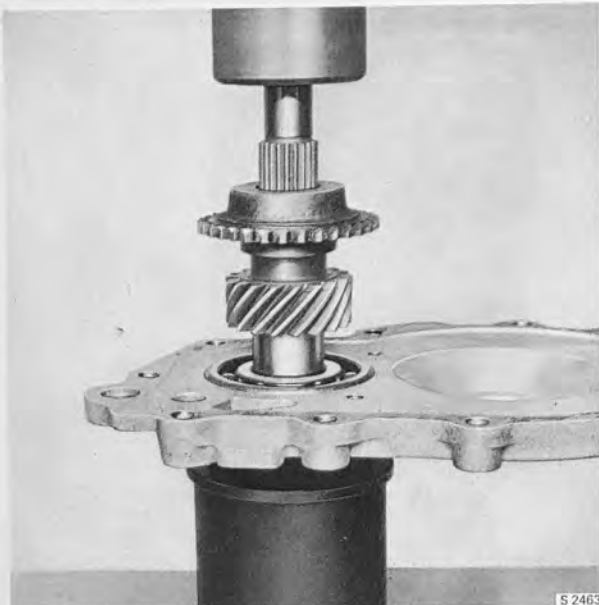
Sleeve 839004, ring 839024

4. Press the free wheel driver gear on to the shaft if previously removed, using supports 839009 and 839024 and drift 839018.



PRESSING ON THE FREE WHEEL DRIVER GEAR
Drift 839018, supports 839009 and 839024

5. Press the output gear ball bearing into the bearing housing, using supports 839009 and 839024. Then press the output gear with shaft into the ball bearing, using supports 839009 and 839024 (see illustration). Then fit the washer and lock ring.



PRESSING THE OUTPUT GEAR INTO THE BALL BEARING
Supports 839009 and 839024

6. Fit the inner roller bearing to the center wheel shaft, using sleeve 839014 if necessary. Then mount the center gear and outer roller bearing plus the friction wheel if this has previously been removed.
7. Set up the center wheel, shaft and bearings in a vice. Wind a cord round the gear wheel and rotate the wheel with a dynamometer (see illustration). Tighten and lock the nut when the dynamometer reading is 6.0–8.0 N (1.32–1.76 lb., 0.6–0.8 kp) which corresponds to a torque of 0.4–0.5 Nm (3.5–4.3 in.lb., 4.0–5.0 kpcm). Use wrench 839019 to tighten the lock nut. Then mount the center wheel in the bearing housing.



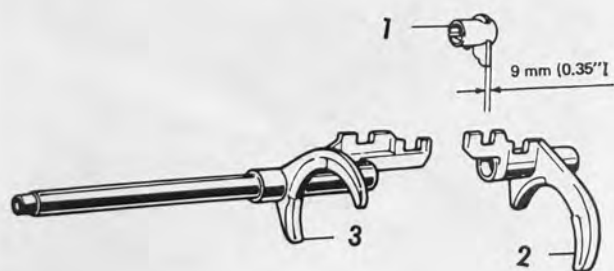
COMPRESSING THE CENTER SHAFT BEARINGS
Dynamometer 839013

8. Press the input gear roller bearing into the primary gear housing if previously removed, using tool No. 839032.
9. Coat the bearing housing sealing surface and cap with sealant compound, e.g. Tikatät 2, and fit the bearing housing to the primary gear housing. Secure the bearing housing to the primary gear housing and the cap to the bearing housing.
10. Fit the clutch shaft.
11. Fit the clutch shaft center screw with washer and O-ring.
12. Fit the clutch shaft sealing cover and its lock ring.
13. Fit the front engine bracket and low the power plant. Tighten the engine bracket nut.
14. Adjust the clearance between diaphragm spring and release bearing with the adjusting screw and then tighten the lock nut.
15. Fit the throttle control linkage.
16. Fit the exhaust pipe.
17. Fit the free wheel cable.
18. Fit the front sheet and the radiator. Connect the radiator hoses.
19. Connect the electrical cables and fit the battery.
20. Fill the radiator with coolant.
21. Fit the engine hood.
22. Check the headlight alignment.

Gear shift mechanism

The gear shift mechanism consists of gear shift forks, shafts and a selector rod with spring-loaded ball catch. A stronger detent with a flange 0.35" (9 mm) thick has been introduced with effect from transmission No. 15792. Gear shift forks for 1st–2nd and 3rd–4th gears adapted to the new detent have also been introduced at the same time.

If the detent or a gear shift fork needs to be exchanged, both the detent and the mentioned gear shift forks must be changed together. Components of the earlier design are no longer stocked as spares. The new components are listed in the Spare Parts Catalogue.



S 3184

DETENT, GEAR SHIFT FORKS

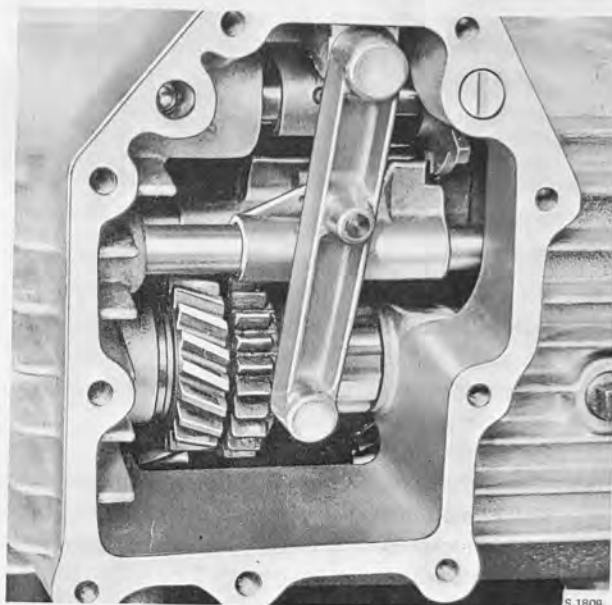
1. Detent
2. Gear shift fork 1st and 2nd
3. Gear shift fork 3rd and 4th

Disassembling

Clean off the transmission case and drain the oil.

1. Take off the rear cover from the differential housing and remove the inner universal joints with drive shafts.
2. Remove the differential assembly by unscrewing the right and left differential bearing seats. Take out the differential assembly. Put aside the shims, if any, for reassembly later.
3. Remove the lock plate that holds the intermediate and reverse gear shafts and pull the intermediate gear shaft using tool 839004, leaving the intermediate gear set loose in the transmission case.
4. Separate the primary gear housing from the transmission case and lift it off.

5. Unscrew the side cover from the transmission case. Take out the ball catch and spring for the gear selector rod and put them in a safe place. Pull both the gear shift shafts and lift out the gear shift forks. If the selector rod assembly or any part of it is to be exchanged, use a drift or similar tool to knock out the tension pin.



GEAR SHIFT SHAFTS AND FORKS

Assembling

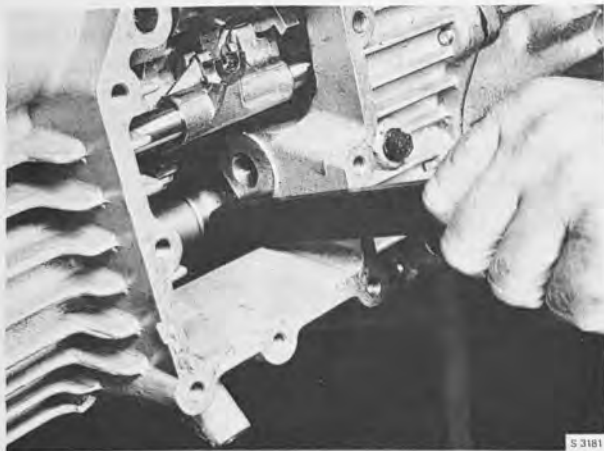
Before beginning to reassemble the gear shift mechanism, clean the mating flange surfaces of the transmission case and covers to remove fragments of old gaskets and traces of sealant compound.

1. Place the coupling muffs in neutral, engage the gear shift forks and fit the two gear shift shafts.
2. Coat the mating flange of the primary gear housing with sealant compound, e.g. Tikatät 2, and mount the primary gear housing on the transmission case.

NOTE

Draw the screws hand tight only, to avoid jamming the intermediate gear set in the wrong position before the intermediate gear shaft is inserted.

3. Lift the intermediate shaft gear with the hook wrench 839019 and fit the intermediate shaft. Use tool 839004 and sleeve 839026.
4. Tighten the primary gear housing screws.



INSERTING THE INTERMEDIATE SHAFT GEAR UNIT
Tool 839019

5. Fit the reverse gear, the ball, the spring and the lever. Coat the cover with sealant compound, e.g. Tikität 2 and then fit the cover.
6. Fit the lock plate for the intermediate and reverse gear shafts.
7. Fit the differential assembly.
8. Check the shaft seals in the differential bearing seats before mounting them. Use arbor 839032 to fit new seals if required. Then insert both inner drive shafts complete with inner universal joints, taking care not to damage the shaft seals.
9. Coat the rear cover of the differential housing with sealant compound, e.g. Tikität 2, and screw the cover to the transmission case.
10. Fill the transmission with oil (3 US qt, 5.5 Imp.pints, 3.0 liters).

Speedometer drive

Removal and installation

1. Disconnect the speedometer cable from the transmission.
2. Unscrew and remove the bearing sleeve with shaft and gear. Save the gasket.
3. Knock out the tension pin that retains the gear on the shaft, after which the gear, shaft and bearing sleeve can be taken apart. Exchange any damaged or worn parts.

Reassemble in the reverse order.

Friction brake

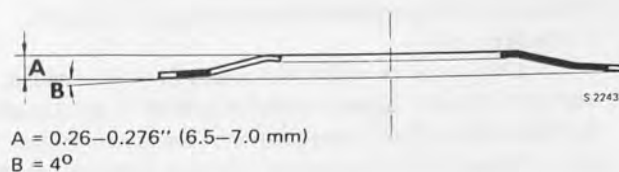
General

The center gear wheel in the primary gear assembly of some gearboxes has a friction brake, the function of which is to eliminate gear backlash and thereby reduce noise.

The device consists of a friction wheel with two more teeth than the center gear wheel; it therefore rotates slowly with respect to the latter. As the friction wheel is spring loaded, it exerts enough retarding force to prevent backlash between the primary input gear and the output gear.

Directions for fitting

When fitting the friction brake, check that the teeth make contact with the center gear wheel at an angle of 4° and that the tops of the spring spokes are at the correct distance from the plane of contact (see illustration).



FRICION WHEEL



MOUNTING THE FRICTION WHEEL

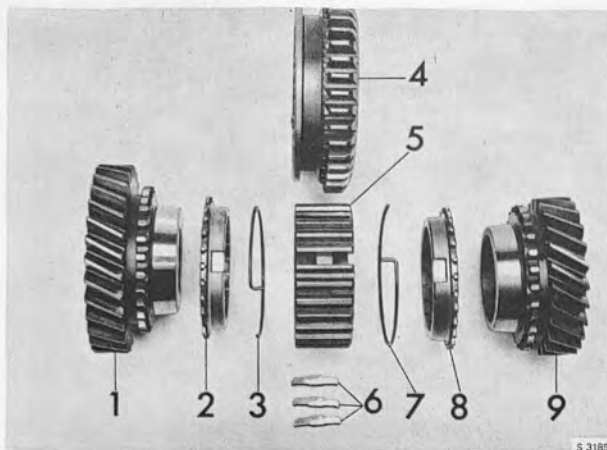
Synchronization

Synchronizing rings

If the synchronization is to work properly, the synchronizing rings must mate properly with the cones. When a synchronizing ring is mounted, there must be a gap of at least 0.04" (1 mm) between it and the coupling teeth. If not, the ring should be exchanged for a new one.

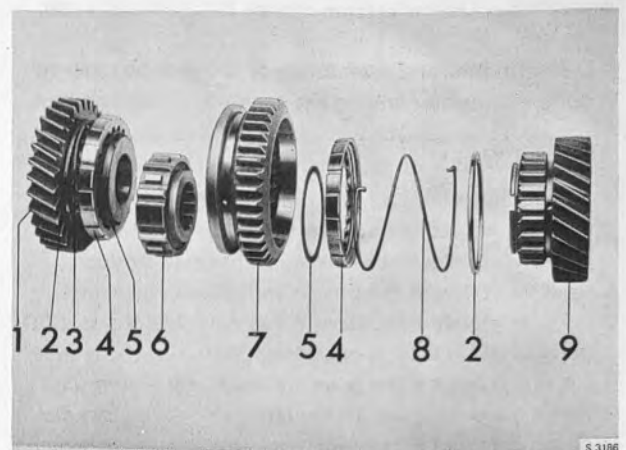
NOTE

Up to gearbox No. 38.686 the synchronizing ring for first gear is of special design. It can be told apart from the others by the fact that it lacks three teeth.



SYNCHRONIZATION, 1ST AND 2ND GEARS UP TO GEARBOX NO. 38.686

- | | |
|-----------------------|-----------------------|
| 1. 1st gear | 6. Driver |
| 2. Guide ring | 7. Spring |
| 3. Spring ring | 8. Synchronizing ring |
| 4. Synchronizing muff | 9. 2nd gear |
| 5. Synchronizing hub | |



SYNCHRONIZATION, 1ST AND 2ND GEARS AS FROM GEARBOX NO. 38.687

- | | |
|-------------------------------|-------------------------------|
| 1. 1st gear | 6. Synchronizing hub |
| 2. Guide ring | 7. Synchronizing muff |
| 3. Retaining spring, 1st gear | 8. Retaining spring, 2nd gear |
| 4. Synchronizing ring | 9. 2nd gear |
| 5. Lock ring | |

With effect from gearbox No. 38.687 a new type of synchronization has been introduced for the 1st and 2nd gears. The new design features larger synchronizing rings working against a female cone in the synchronizing muff. The arrangement of the new synchronization is shown in the figure.

Note that the 1st gear spring gives a lower pressure than the 2nd gear spring. The 1st gear spring is copper-colored so that the two can easily be distinguished from each other. The springs are to be placed on the gears in such a way that there are five teeth between the ends of the springs.

The procedure for removing the gears from the pinion shaft and reassembling them remains the same as before.

Disassembling and assembling of the gear box can be done without separating the engine and the gear box.

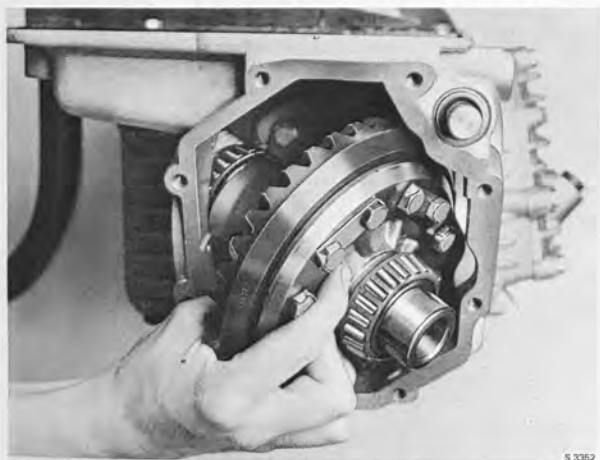
IMPORTANT

Before disassembling the transmission, always measure up the positions of the pinion gear and crown wheel. This is to check whether there is any error in their locations. If the pinion and crown wheel assembly is relatively new, i.e. if it has done less than 6,000 miles (10,000 km), it can be adjusted, but if the mileage is any greater the gears will have worn themselves into a given position. In the latter case, they should be reassembled in the same measured positions which they occupied before disassembly.

Disassembling the transmission

Proceed in the following order as far as necessary in order to remove whichever component needs attention.

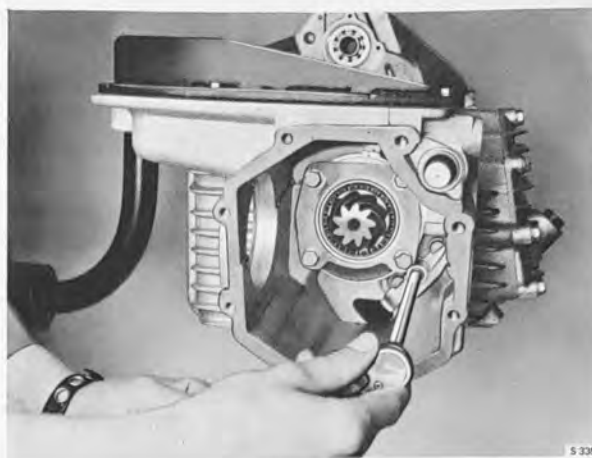
1. Clean off the transmission case and drain the oil.
2. Remove the inner universal joints using puller 879035 and tapping hammer 839027. Remove the cover from the differential housing.
3. Remove the differential assembly by unscrewing the differential bearing seats on both sides and removing them with the help of puller 839147 and tapping hammer 839027. Take out the differential assembly with shims (if any). Save the spacer washers and shims; the latter must be replaced in their original



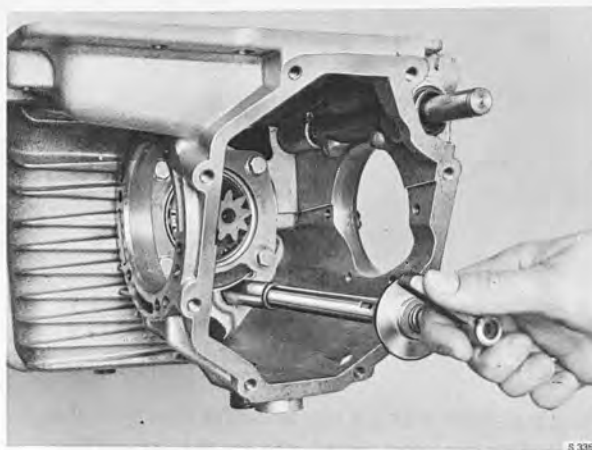
REMOVING THE DIFFERENTIAL ASSEMBLY

positions on reassembly unless the differential gear backlash has been altered by the exchange of some component. Before disassembling the differential, read section 473.

4. Remove the locking plate that holds the intermediate and reverse gear shafts in place (see illustration). Use tool 839004 to withdraw the intermediate gear shaft so that the intermediate gear set drops down.

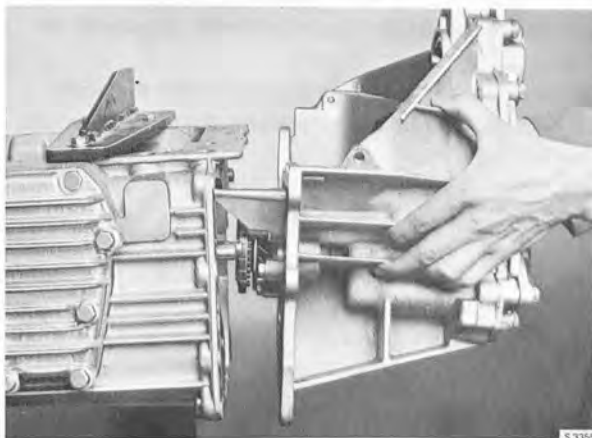


REMOVING THE LOCKING PLATE



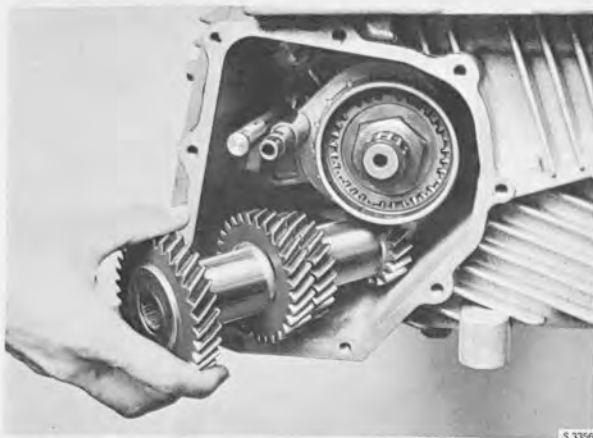
REMOVING THE INTERMEDIATE GEAR SHAFT
Tool 839004

5. Separate the transmission at the joints between the gearbox and primary gear housing and lift away the primary gear housing (see illustration).



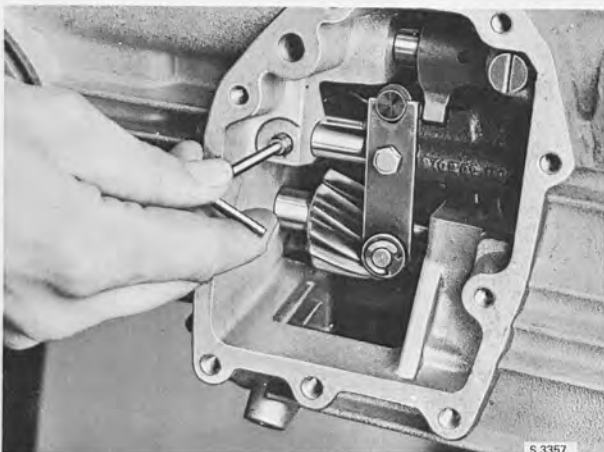
SEPARATING THE PRIMARY GEAR HOUSING FROM THE GEARBOX

6. Remove the intermediate gear set (see illustration).



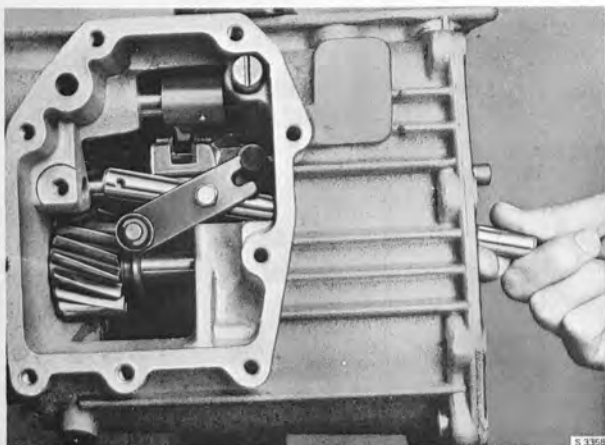
REMOVING THE INTERMEDIATE GEAR SET

7. Unscrew the transmission side cover, take out the spring and ball catch for the gear selector rod, and put them in a safe place.
8. Undo the reverse gear shift shaft retaining screw.



REMOVING THE REVERSE GEAR SHIFT SHAFT RETAINING SCREW

Turn the gear selector rod so that the driver is detached from the reverse gear shift and pull out the shaft.

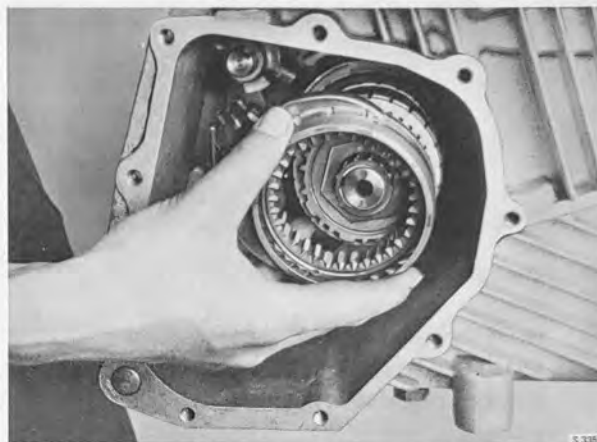


REMOVING THE REVERSE GEAR SHIFT SHAFT

Remove the shift shaft for the 1st—2nd gear 3rd—top gear and shift forks and remove the shift fork and sliding muff for 3rd—top gear.

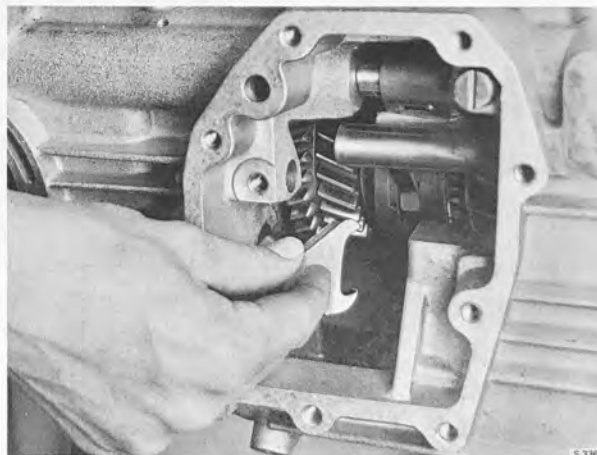
NOTE

The reverse lever need not be undone from the gear shift shaft when the shaft is removed.



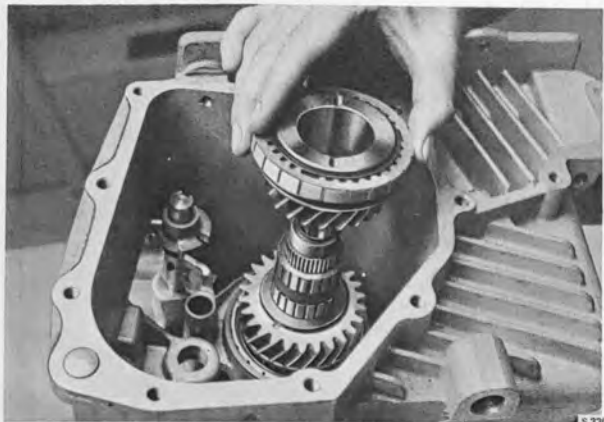
REMOVING THE SLIDING MUFF FOR 3RD — TOP GEARS

9. Pull out the reverse gear shaft. Use tool 839004 to lift out the reverse gear.
10. Remove the needle bearing from the pinion shaft and install tool 879050 as a lock for the reverse gear (see illustration), and undo the pinion shaft nut.



INSTALLING TOOL 879050

11. Remove tool 879050 and remove the 3rd-top gear synchronization hub and 3rd gear.



REMOVING 3RD GEAR

12. Undo the four pinion shaft bearing housing screws. Install tool 879051 and press out the pinion shaft. Put the gears, sleeves, washers and shims in a safe place.



PRESSING OUT THE PINION SHAFT
Tool 879051

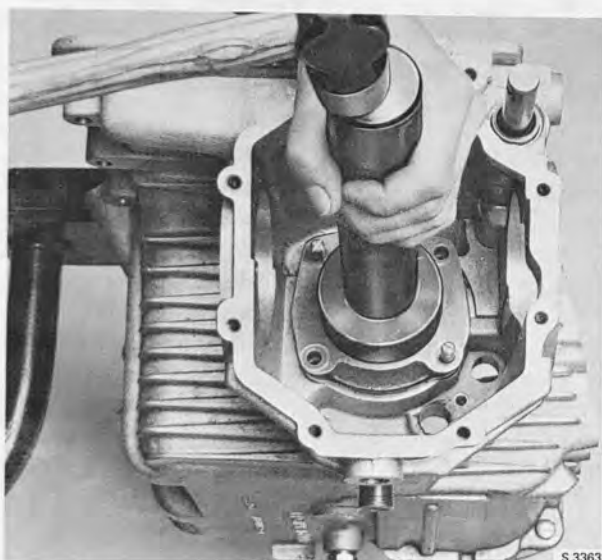
Differences in number of cogs and outer diameter (measured on the cogs) between transmissions up to and incl. model 1972 and transmissions as from model 1973.

Primary gear	Transmission model 1972 Serial No. up to and incl. 437751		Transmission as from model 1973 Serial No. as from 500.000	
	No. of teeth	Outer diam.	No. of teeth	Outer diam.
Input gear	20	2.276" (57.8 mm)	20	2.318" (58.9 mm)
Intermediate gear	48	5.151" (130.8 mm)	48	5.118" (130.0 mm)
Output shaft	19	2.276" (57.8 mm)	20	2.318" (58.9 mm)
Intermediate gear (tooth surface engaged in first gear)	17	2.224" (56.3 mm)	16	2.181" (55.4 mm)
First gear	30	3.626" (92.1 mm)	30	3.665" (93.1 mm)
Sliding wheel, reverse	14	1.890" (48.0 mm)	14	1.906" (48.4 mm)
Reverse gear	34	4.166" (105.8 mm)	33	4.154" (105.5 mm)
Pinion	9	2.077" (52.75 mm)	9	2.205" (56.0 mm)
Crown wheel	38	6.914" (175.6 mm)	35	7.047" (179.0 mm)

Assembling the transmission

Having removed the component that needs attention, clean all fragments of old gaskets and all traces of old sealing compound off the covers and mating surfaces. Inspect the transmission case and all disassembled parts and wash them in kerosene or similar. Then reassemble the transmission, following the procedure described below:

1. Adjust the differential bearings to the correct compression. See section 473.
2. Screw the two locating studs (tool 879043) into the transmission case. Then shim and locate the pinion shaft assembly. Tap the assembly gently into position, using a plastic mallet, drift 839011 and sleeve 839014. Then insert and tighten the four bearing housing screws.



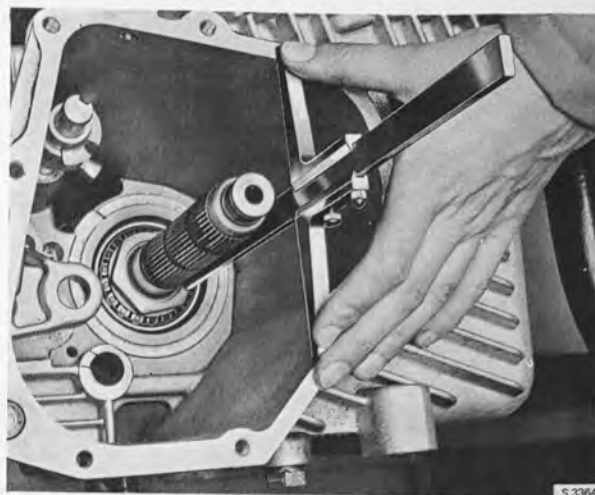
MOUNTING THE PINION SHAFT

Locating studs 879043, drift 839011, sleeve 839014

NOTE

Any measuring or adjusting of the pinion shaft must be done before the screws are secured with Loctite. See section 473.

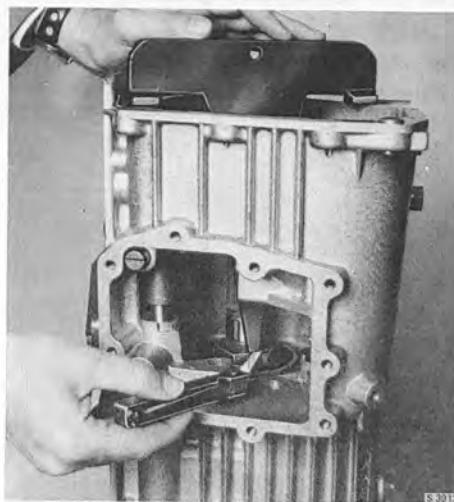
3. a. Before mounting the reverse gear on the pinion shaft, the distance between the connecting surface for the primary gear housing and the pinion shaft nut must be checked. The distance must be 7.677"–7.681" (195.0–195.1 mm). If it is not this distance, shims must be placed between



MEASURING THE POSITION OF THE PINION SHAFT IN THE GEARBOX HOUSING

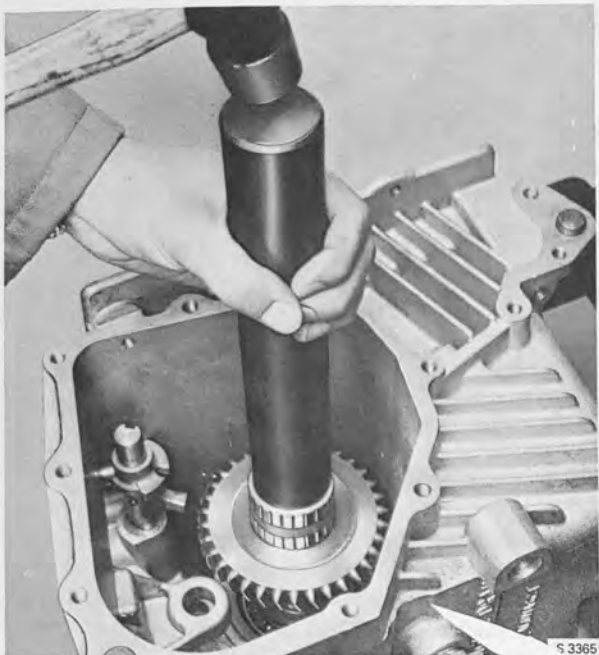
the nut and the reverse gear. Shims are available in thicknesses of 0.0118" (0.30 mm), 0.0157" (0.40 mm) and 0.0197" (0.50 mm). If the position of the pinion shaft is unchanged, the shims used earlier can be replaced.

- b. When using measuring tool 879055, the procedure of shimming is the following: Install the measuring tool in the gearbox housing according to fig. and measure the distance between tool and nut with the aid of a feeler gauge. Fit shims with a thickness equivalent to that of the used feeler gauge.



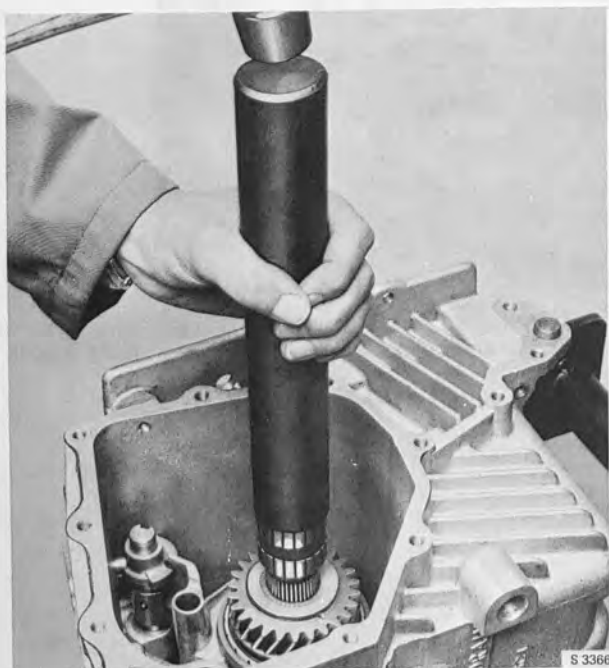
MEASURING THE POSITION OF THE PINION SHAFT IN THE GEARBOX HOUSING WITH THE AID OF TOOL 879055

4. Install the reverse gear using sleeve 839014.



INSTALLING THE REVERSE GEAR
Sleeve 839014

5. Fit the 1st gear on the bearing sleeve of the reverse gear.
6. Fit 1st—2nd synchronization hub. Fit 1st—2nd gear shift fork into 1st—2nd coupling muff and mount these on the synchronization hub. Fit 1st—2nd gear shift fork into 1st—2nd coupling muff and mount these on the synchronization hub.
7. Install the 2nd gear sleeve with tool 839014 and mount the 2nd gear on the sleeve.
8. Fit the spacer, mount the sleeve for 3rd gear with tool 839014 and mount the 3rd gear on this sleeve.



INSTALLING SLEEVE FOR THE THIRD GEAR
Sleeve 839014

9. Fit 3rd—4th gear synchronization hub. (As from gearbox No. 500.001, the synchronization hub is fitted with the three locking holes against the pinion nut.) Fit 3rd—4th gear shift fork into 3rd—4th gear coupling muff and mount these on the synchronization hub.
10. Install tool 879050 at a lock for the reverse gear and tighten the pinion shaft nut to the prescribed torque of 29—49 Nm (22—36 ft.lb., 3—5 kpm) and secure the nut. Install the pinion shaft needle bearing and its locking ring. Remove tool 879050.



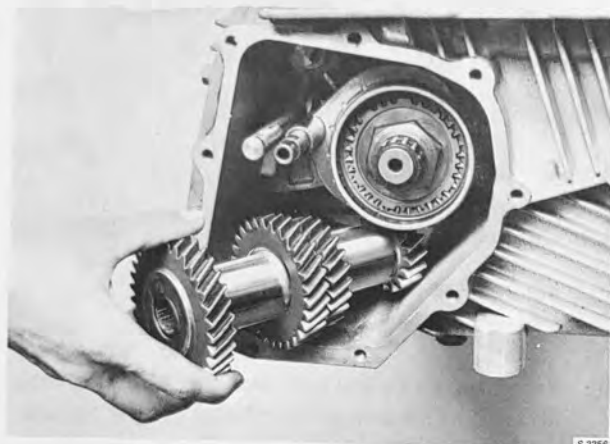
TIGHTENING THE PINION SHAFT NUT

11. Ease the coupling muffs on the pinion shaft in the neutral position and fit the gear shift shaft for 1st—2nd and 3rd—4th gear shift forks.
12. Turn the gear selector rod clockwise so that there is room to mount the reverse gear shift shaft. Mount the latter. Tighten the axle with the stop screw.

NOTE

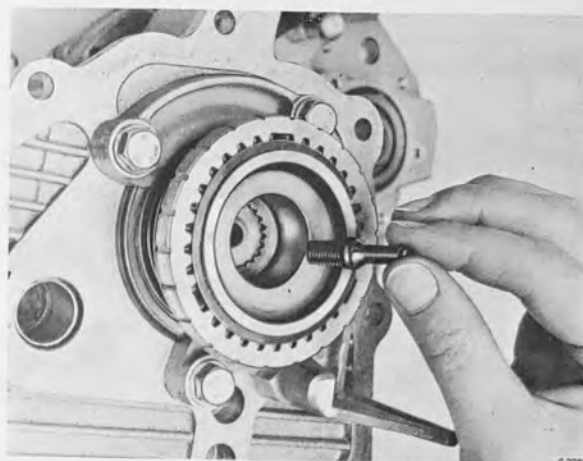
The reverse lever can be fitted to the reverse gear shaft before the shaft is mounted in the gearbox.

13. Mount the needle bearings in the intermediate gear set with the help of grease so that they are held in place until the intermediate gear set is fitted. Place the intermediate gear set in the bottom of the gear-box.



INSTALLING THE INTERMEDIATE GEAR SET

14. Check that the thrust washer for the intermediate gear set is in the right place on the primary gear housing. The washer can be glued on to facilitate the fitting of the intermediate gear set. Check that the connecting tube is fitted in the output shaft of the primary gear.



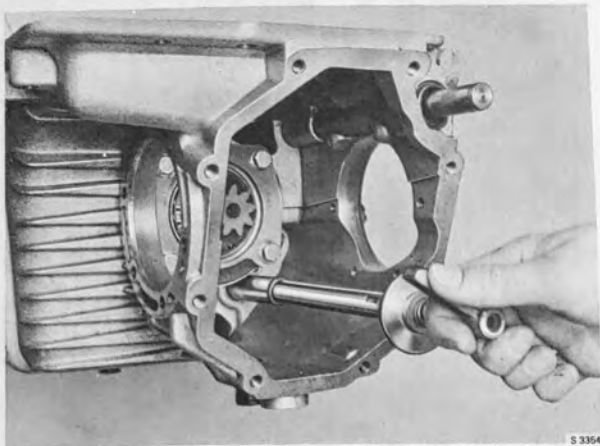
FITTING THE CONNECTING TUBE IN THE OUTPUT GEAR OF THE PRIMARY GEAR SET

15. Coat the mating flange of the primary gear housing with sealant compound, e.g. Tikität No. 2, and screw the primary gear housing to the transmission case.

NOTE

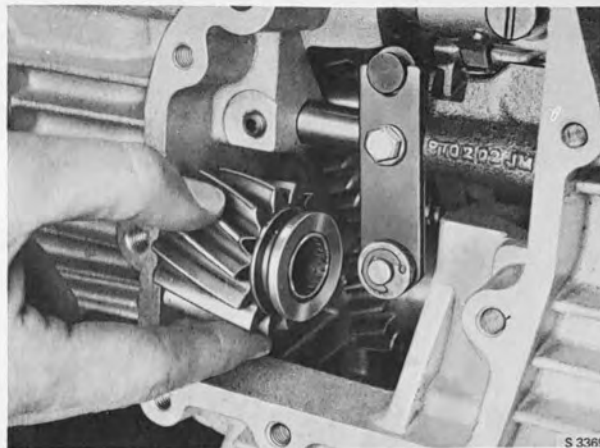
Leave the screws slightly slack to avoid jamming the loose intermediate gear set in the wrong position before the intermediate gear shaft is inserted.

16. Ease the intermediate gear into its correct position either by turning the transmission housing or by lifting the intermediate gear. Fit the rear thrust washer and push in the intermediate gear shaft, using tool 839004.



INSERTING THE INTERMEDIATE GEAR SHAFT
Tool 839004

17. Tighten the primary gear housing screws.
18. Install the reverse gear and shaft, making sure that the reverse lever is fitted into the groove on the reverse gear. Fit the lock plate over the reverse gear and intermediate gear shaft ends. Secure the screw with Loctite.



INSTALLING THE REVERSE GEAR

19. Insert the spring and ball catch for the gear selector rod and fit the transmission housing cover together with its gasket.
20. Install the differential assembly (see section 473).
21. Inspect the shaft seals in the differential bearing seats and fit new ones if necessary. Adjust the crown wheel backlash if necessary (see section 473). Mount the two inner drive shafts complete with inner universal joints, taking care not to damage the shaft seals.
22. Fit the cover complete with gasket on to the transmission case.
23. Fill the transmission case with oil (3 US qt, 5 Imp. pints, 3 liters).

Disassembling the pinion shaft

To disassemble the pinion shaft, follow the instructions already given for disassembling the transmission up to the point where the pinion shaft is unscrewed. Then continue as follows:

1. Fasten fixture 879063 and holder ring 879065 in a vice. Put the pinion shaft in the tool and loosen the nut with the aid of tool 879045.



REMOVING THE PINION BEARING NUT

Tools 879063, 879065 and 879045

2. Put the unit in a press and press off the front roller bearing with the help of sleeve 839009, see illustration.



PRESSING THE SHAFT OUT OF THE BEARING HOUSING

Tool 839009

3. Press off the rear roller bearing with the aid of tools 879063 and 879065.



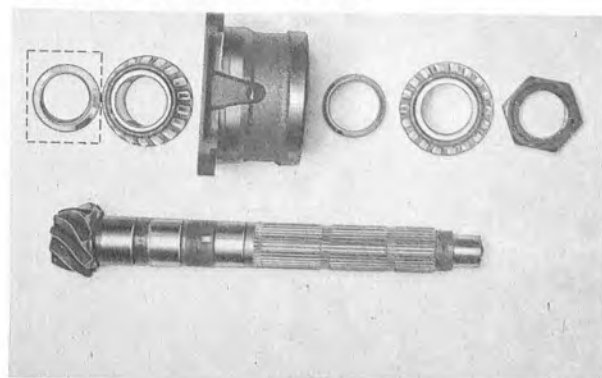
PRESSING THE REAR BEARING OFF THE SHAFT

Tools 879063 and 879065

4. Press the outer rings of the conical roller bearings out of the bearing housing using tools 839009, 839010 and 839014 (see illustration).



TOOLS 839010, 839014 AND 839009



PINION SHAFT WITH BEARING, BEARING HOUSING AND SPACER SLEEVE

The washer between the pinion gear and the rear bearing occurs only on gearboxes with serial numbers lower than 500.000.

Installing the pinion shaft

Having removed the part that needs attention, inspect all disassembled parts and wash them in kerosene or similar. Then reassemble and install, proceeding as follows:

NOTE

The bearings must be oiled before being assembled.

1. Press the outer races of the tapered roller bearings into the bearing housing, using tools 839018 and 879046.



INSTALLING THE BEARING RACE IN BEARING HOUSING
Tools 839018 and 879046

2. Fit the spacer washer (only valid for gear boxes with serial numbers lower than 500.000), and press on the roller bearing nearest the pinion gear until it butts against its stop, using tool 839014 (see illustration).



PRESSING ON THE ROLLER BEARING NEAREST THE
PINION GEAR
Tool 839014

As from gear box No. 401651 a collapsible spacer has been incorporated on the pinion shaft. This collapsible spacer is to be used when overhauling pinion shafts of the earlier type.

3. Fit the spacer on the shaft.
4. Fit the bearing housing.
5. Fit the front roller bearing.



PRESSING IN THE FRONT ROLLER BEARING
Tool 839014

6. Set up the shaft in a press (see illustration). Press the bearing housing slowly on, using tool 839014, and twist it at the same time until resistance to twisting is felt.
7. Smear Loctite "stud lock" on the threads and put on the nut. Install the pinion shaft in a vice with fixture 879063 and holder ring 879065. As alternative, tool 839006 (see illustration), or tool 879044 can be used, depending on shaft design. Pull the nut with key 879045 until the correct torque is obtained. Measure the torque by pulling the bearing housing with the aid of a dynamometer 839013. The bearings should be lightly oiled and tightened as follows:
New bearings 47–70 N (10–15 lb., 4.7–7.0 kp) on



CHECKING THE BEARING HOUSING TORQUE
Tools 839006 and 839013

the dynamometer which corresponds to a torque of 2.5 ± 0.5 Nm (2 ± 0.5 ft.lb., 25 ± 5 kpcm). Old bearings that have done more than 1.200 miles (2.000 km) 19–43 N (4.2–9.5 lb., 1.9–4.3 kp) dynamometer reading which corresponds to a torque of 1.3 ± 0.5 Nm (1 ± 0.5 ft.lb., 13 ± 5 kpcm). When the correct value is obtained, upset the flange of the nut with a drift.



LOCKING THE PINION BEARING NUT

8. Fit two locating pins, tool 879043, in the gearbox housing. Then fit on the shims and mount the pinion shaft with bearing housing. Knock the bearing housing carefully into place using a plastic mallet or hammer together with drift 839011 and sleeve 839014. Then tighten the four screws.

NOTE

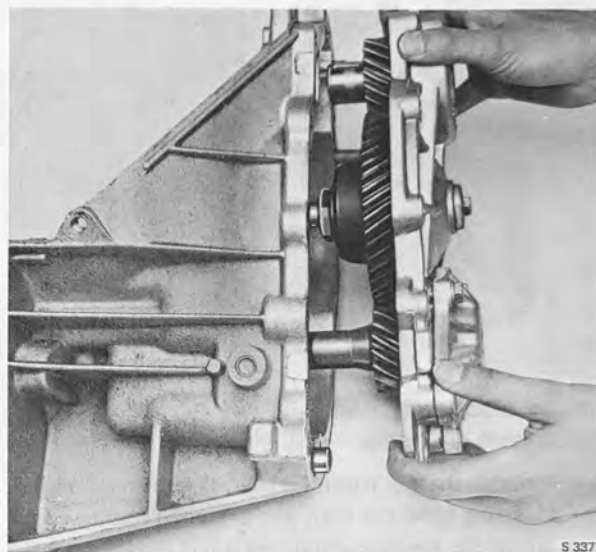
Any measuring or adjusting of the pinion shaft must be done before the screws are secured with Loctite. See section 473.

Removing the primary gear housing

To remove the primary gear housing, follow the instructions already given for disassembling the transmission. According to these, the differential assembly must be removed and the intermediate gear set freed before the primary gear housing can be separated from the transmission case.

Disassembling

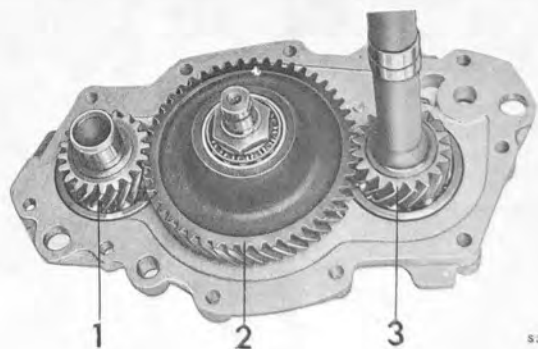
1. Separate the bearing housing from the primary gear case (see illustration).



OPENING THE PRIMARY GEAR HOUSING

NOTE

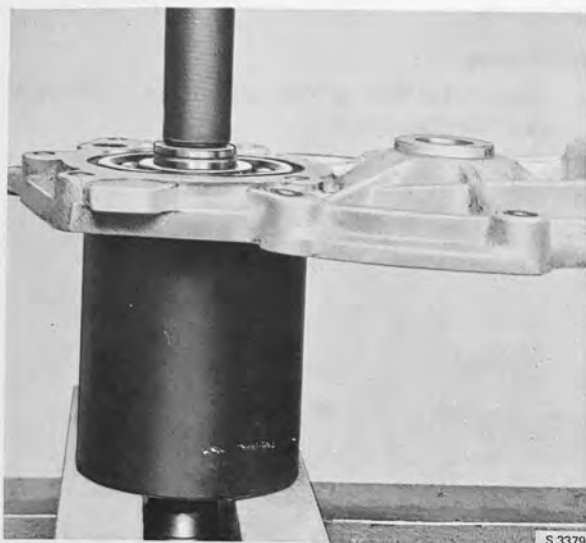
Remember to undo the clutch adjustment nut.



PRIMARY GEAR TRAIN

1. Input gear
2. Center wheel
3. Output gear

2. Remove the center wheel shaft from the bearing housing and back off the center shaft nut so that the center wheel can be taken off.
3. Press the outer races of the tapered roller bearings out of the center wheel with drift 839018 and sleeve 879047, using tool 839009 as a support.



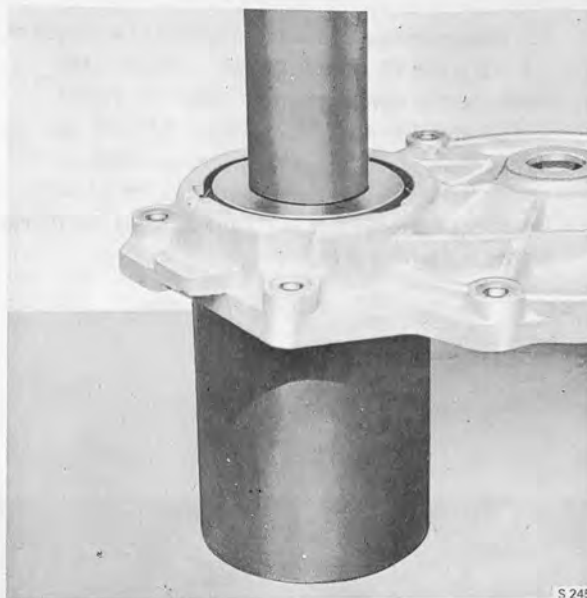
PRESSING OUT THE GEAR
Tools 839018 and 839009

4. Remove the cap from the bearing housing, free the lock ring from the shaft and press the output gear out of the bearing, using tool 839009 as a support and pressing with drift 839018 (see illustration). Then press the bearing out of the bearing housing. Use tools 839018 and 879046 (see illustration).



PRESSING OUT THE BEARING FROM THE BEARING HOUSING
Tools 839018 and 839046

5. Press the input gear complete with ball bearing out of the bearing housing, using drift 839012, sleeve 839014 and support 839009 (see illustration).



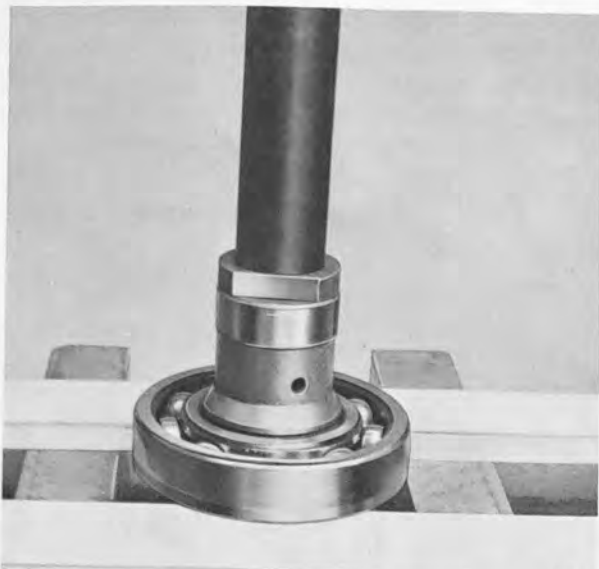
PRESSING OUT THE INPUT GEAR
Tools 839012, 839014 and 839009

6. Undo the lock ring from the input gear and press the ball bearing off the gear, using supports 839009 and 839024 and drift 839018 (see illustration).



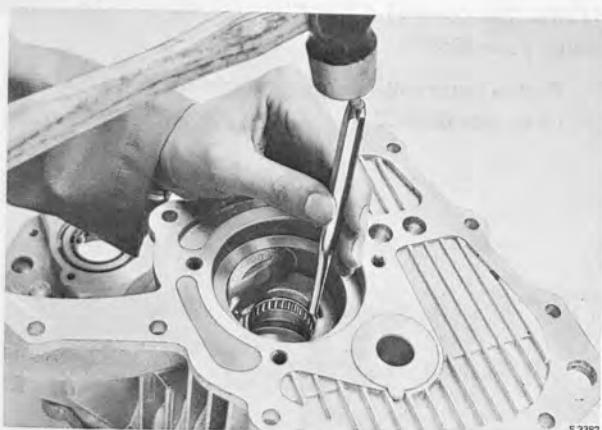
PRESSING THE BEARING OFF THE INPUT GEAR
Tools 839018, 839009 and 839024

7. Remove the bearing support that retains the gearbox input gear (4th) with bearing.
8. Press the gearbox input gear (4th) out of the primary gear housing, using ring 839021 and drift 839018. Release the lock ring and press the bearing off the shaft, using ring 839021 and drift 839018.



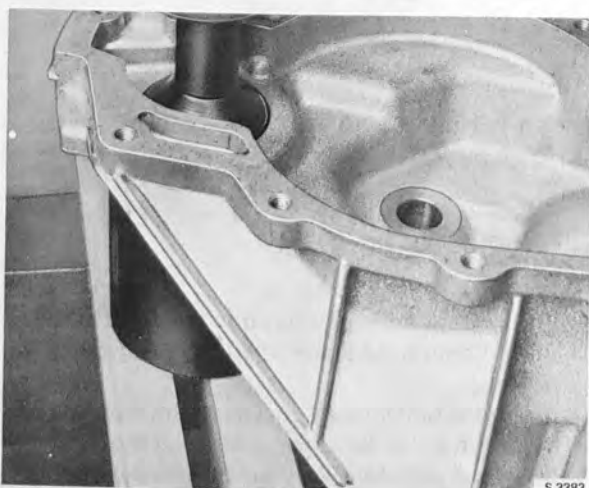
REMOVING THE BEARING FROM THE INPUT GEAR
Drift 839018, ring 839021

9. If necessary, remove the oil collector and needle bearing from the primary gear housing.



REMOVING THE NEEDLE BEARING

10. Press out the input gear roller bearing from the primary gear housing, using tool 839032 and support 839009 (see illustration).



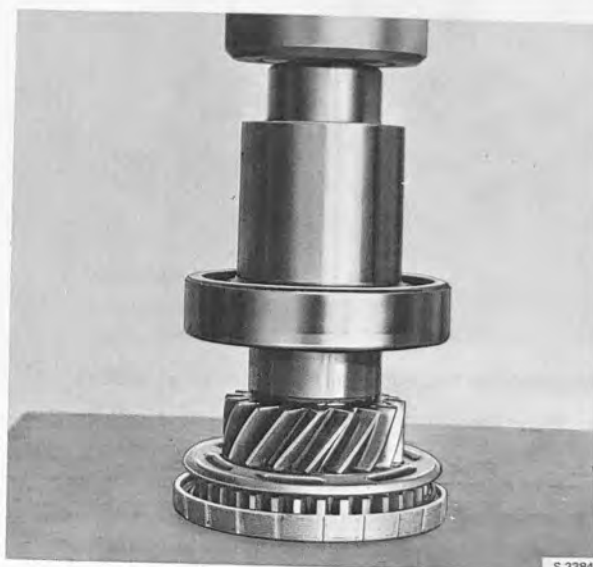
REMOVING THE ROLLER BEARING
Drift 839032, support 839009

Jan. 1973

Assembly

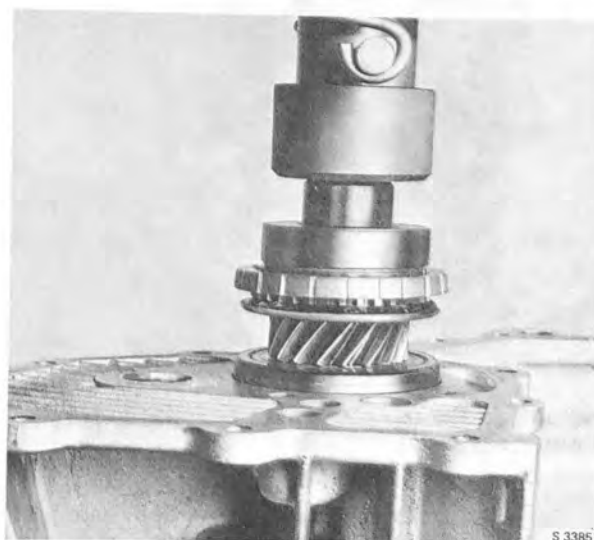
Having removed whichever part needs attention, clean the mating flange surfaces of the cover to remove gasket fragments and traces of sealant compound. Inspect all disassembled parts and wash them in kerosene or similar. Then reassemble as follows:

1. Fit the needle bearing with tool 879047 and drift 839018, and the oil collector into the primary gear housing if they have been removed.
2. Press the ball bearing on to the input gear of the gearbox (4th), using sleeve 879048. Fit the bear-



MOUNTING THE BEARING ON THE INPUT GEAR
Sleeve 879048

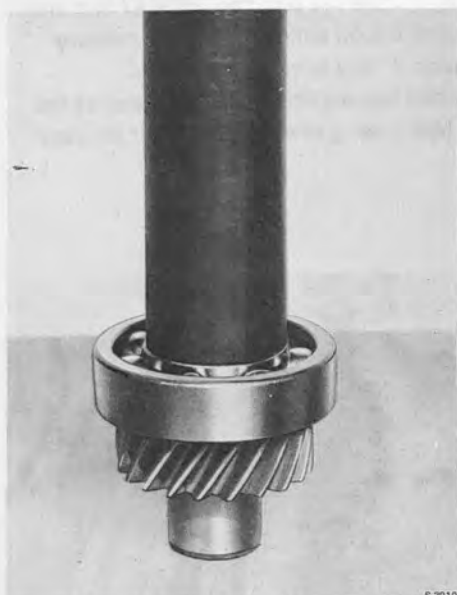
ing lock ring and press the gearbox input gear (4th) complete with bearing into the primary gear housing, using tool 839012.



MOUNTING THE INPUT GEAR AND ITS BEARING INTO THE PRIMARY GEAR HOUSING
Sleeve 839012

SAAB

3. Mount the bearing support for the ball bearing of the gearbox input gear to the primary gear housing, securing the screws with Loctite.
4. Press the ball bearing on to the input gear of the primary gear unit, using sleeve 839014, see illustration. Fit the lock ring.



PRESSING ON THE BALL BEARING, SLEEVE 839014

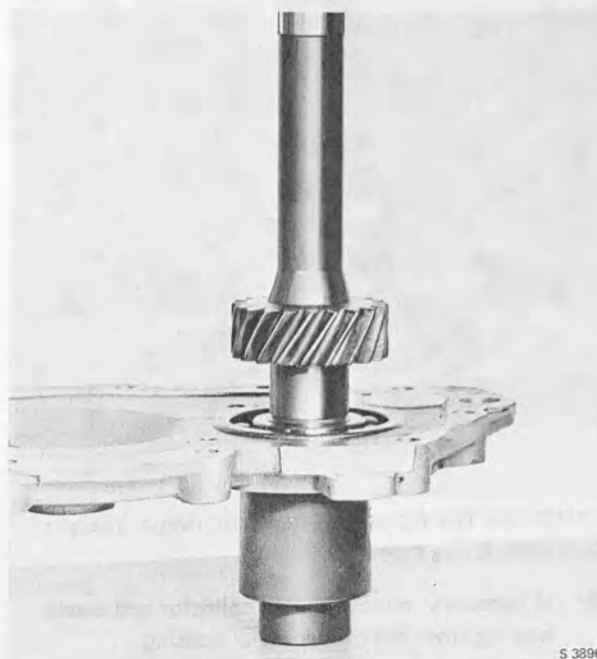
5. Press the primary input gear complete with ball bearing into the bearing housing, using sleeve 839009 and ring 839024 and a suitable support between the sleeve and the press head. The bearing must be pressed in until it lies flush with the mating surface of the bearing housing.



PRESSING IN THE GEAR AND BALL BEARING IN THE BEARING HOUSING

Sleeve 839009 and ring 839024

6. Press the output gear ball bearing into the bearing housing, using tools 839014 and 839011. Then press the output gear into the ball bearing, using sleeve 879048 as support (see illustration). Then fit the washer and lock ring.



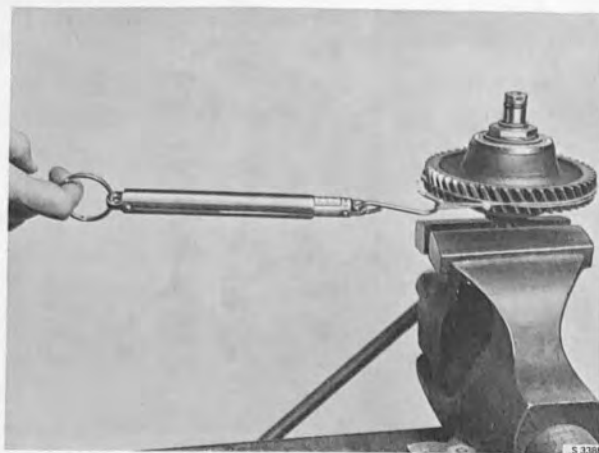
FITTING THE OUTPUT GEAR INTO THE BEARING HOUSING
Support sleeve 879048

7. Fit the outer roller bearing race in the center wheel, using tool 839032.



FITTING THE BEARING RACE IN THE CENTER WHEEL
Drift 839032

8. Fit the front roller bearing on to the center wheel shaft. Then fit the center wheel and the outer roller bearing.
9. Set up the center wheel complete with shaft and bearing in a vice. Wind the cord round the cog-wheel and pull the wheel round with a dynamometer (see illustration).



MEASURING THE TORQUE OF THE CENTER WHEEL
Dynamometer 839013

- Tighten and secure the nut with Loctite and upset the flange of the nut with a drift when the dynamometer reading is 6–8 N (1.3–1.8 lb., 0.6–0.8 kp) which corresponds to a torque of 0.4–0.5 Nm (3–4 in.lb., 4–5 kpcm).
10. Fit the center wheel into the bearing housing and tighten the screw and secure it with Loctite.
 11. Press in the primary input gear roller bearing into the primary gear housing if it has been removed, using tool No. 839032.
 12. Coat the flange of the bearing housing with a sealing compound, for example Tikatät No. 2, and fit the bearing housing into the primary gear housing. Tighten the bearing housing cover.
 13. Mount the primary gear housing on to the gearbox and follow the instructions for assembly of the gearbox.

Clutch shaft sealing ring

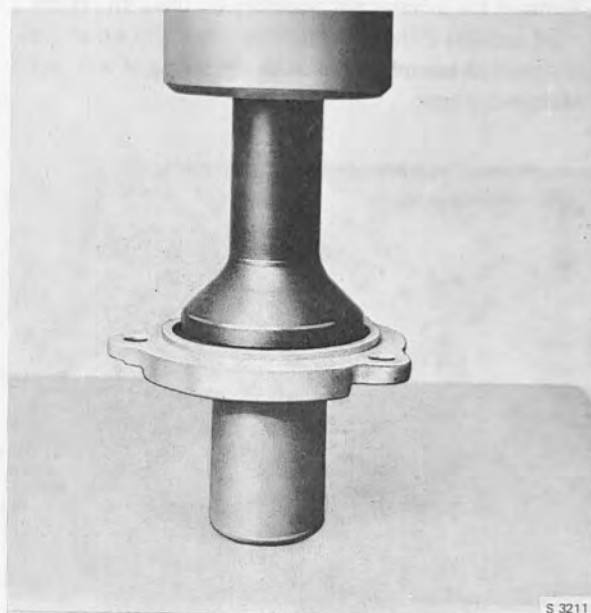
Changing the clutch shaft sealing ring

Removal

Remove clutch, clutch plate, release bearing and guide sleeve. See description on page 411–2.
Remove the sealing ring from the guide sleeve with, for example, a screwdriver.

Assembly

Fit the sealing ring in the guide sleeve using tool 839032 (see illustration). Fit clutch, clutch plate, release bearing and guide sleeve. See description on page 411–2.



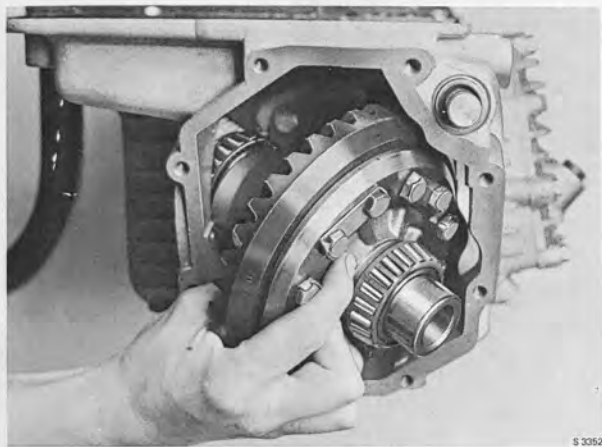
FITTING THE CLUTCH SHAFT SEALING RING
Drift 839032

Gear shift mechanism

The gear shift mechanism consists of gear shift forks, shafts and a selector rod with a spring-loaded ball catch.

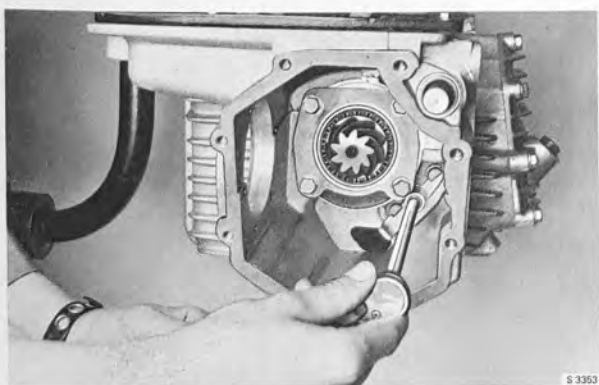
Disassembling

1. Clean off the transmission case and drain the oil.
2. Take off the cover from the differential housing and remove the inner universal joints with guide shafts.
3. Remove the differential assembly by unscrewing the right and left differential bearing seats. Take out the differential assembly. Put aside the shims, if any, for reassembly later.

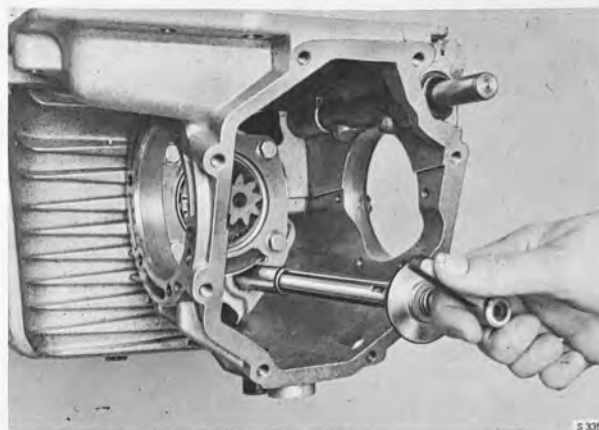


DISASSEMBLING THE DIFFERENTIAL

4. Remove the lock plate that holds the intermediate and reverse gear shafts and pull out the intermediate gear shaft, using tool 839004, so that the intermediate gear drops out.

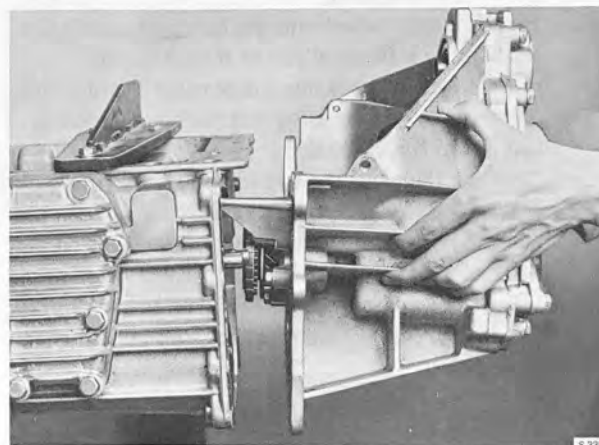


REMOVING THE LOCK PLATE



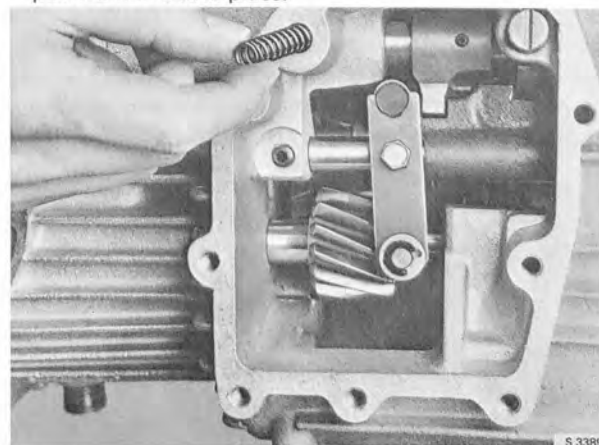
REMOVING THE INTERMEDIATE GEAR SHAFT Tool 839004

5. Separate the primary gear housing from the transmission case and lift it off. Remove the intermediate gear.



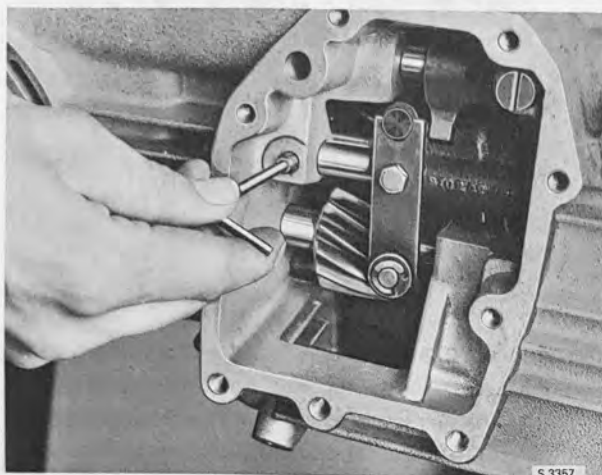
SEPARATING THE PRIMARY GEAR HOUSING FROM THE TRANSMISSION CASE

6. Unscrew the transmission side cover, take out the spring and ball catch for the gear selector rod, and put them in a safe place.

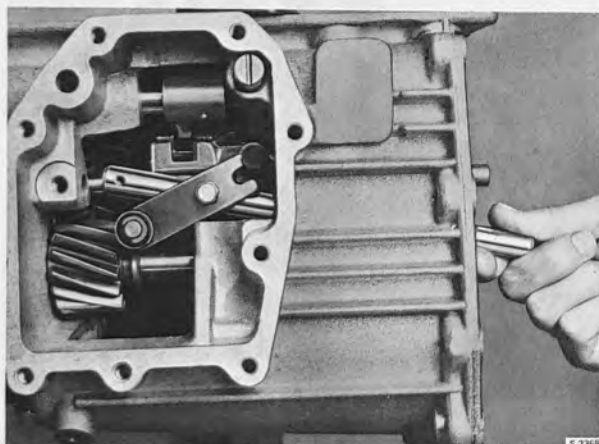


REMOVING THE GEAR SELECTOR ROD SPRING

7. Undo the reverse gear shift shaft retaining screw. Turn the gear selector rod to free the driver from the reverse gear shift and pull out the shaft.



REMOVING THE REVERSE GEAR SHIFT SHAFT RETAINING SCREW

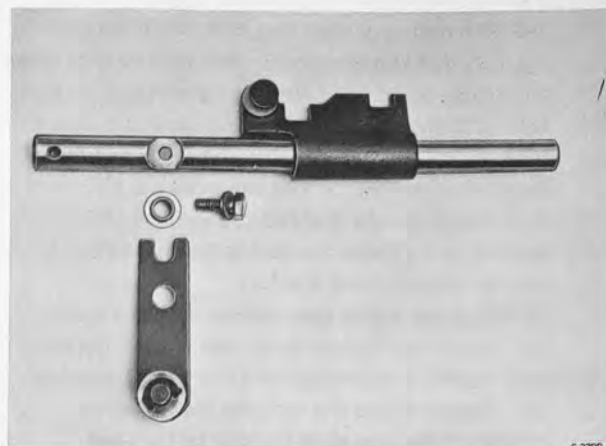


REMOVING THE REVERSE GEAR SHIFT SHAFT

Remove the shift shaft for the 1st—2nd gear and 3rd—top gear shift forks together with the shift fork for 3rd—top gear.

NOTE

The reverse lever need not be undone from the gear shift shaft when the shaft is removed, but can be removed afterwards by undoing the screw which holds the reverse lever to the shaft.



GEAR SHIFT MECHANISM FOR REVERSE GEAR

8. Remove the locating stud for the pawl shaft and remove the latter by withdrawing it from the gear selector rod. The gear selector rod can be removed from the transmission case without the driver being taken away. The cotter pin in the driver can then be removed by using a drift or similar tool.



REMOVING THE COTTER PIN FROM THE DRIVER

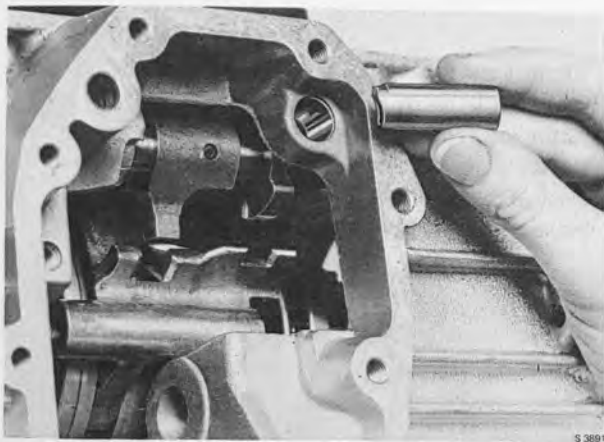
9. If the gear shift fork for 1st—2nd gear has to be removed, the pinion shaft must be removed (see section on disassembling the transmission).

Assembling

1. Install the pinion shaft, shims and reverse gear, 1st gear and synchronizing hub. Fit 1st—2nd gear shift fork into 1st—2nd gear coupling muff and mount these on to the synchronizing hub. Install sleeve and 2nd gear, spacer and sleeve and 3rd gear and

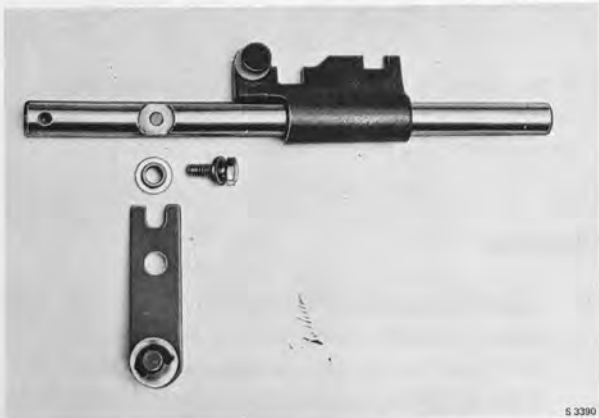
3rd–4th gear synchronizing hub. (As from gearbox No. 500.001 the synchronization hub locking holes are turned against the nut.) Put 3rd–top gear shift fork into 3rd–top gear coupling muff and mount these on to the synchronizing hub. Smear Loctite on the threads and tighten the pinion shaft nut to a torque of 29–49 Nm (22–36 lb.ft., 3–5 kpm) and secure it. Install the needle bearing and lock ring on to the pinion shaft.

2. Fit the driver to the gear selector rod and mount the latter in the transmission case. Install the pawl shaft on the gear selector rod and fit the locating stud. See to it that the locating stud is correctly located or the gear shift rod can be jammed.



FITTING THE LOCATING STUD

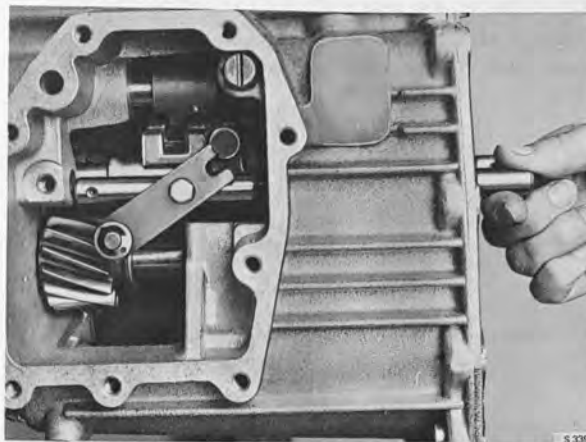
3. Slide the coupling muffs on the pinion shaft to their neutral position and fit the gear shift shaft for 1st–2nd gear and 3rd–top gear shift forks.
4. Fit the bearing sleeve and reverse lever to the reverse gear shift shaft and tighten the screw.



GEAR SHIFT MECHANISM FOR REVERSE GEAR

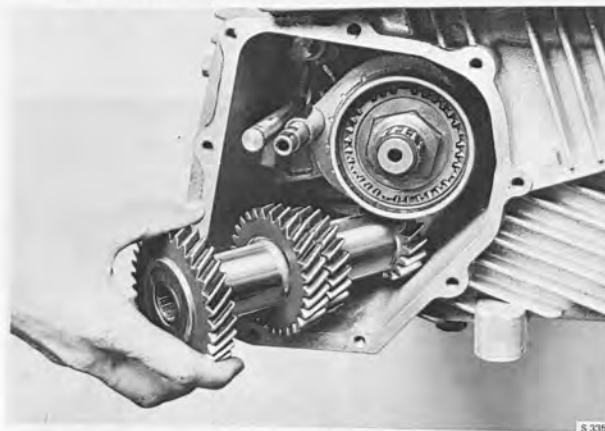
Fit the reverse gear shift to the shaft. Turn the selector rod clockwise so that there is room to mount the reverse gear shift shaft. Mount the latter. Make sure that the reverse lever engages the groove on the reverse gear.

Tighten the shaft with the stop screw.



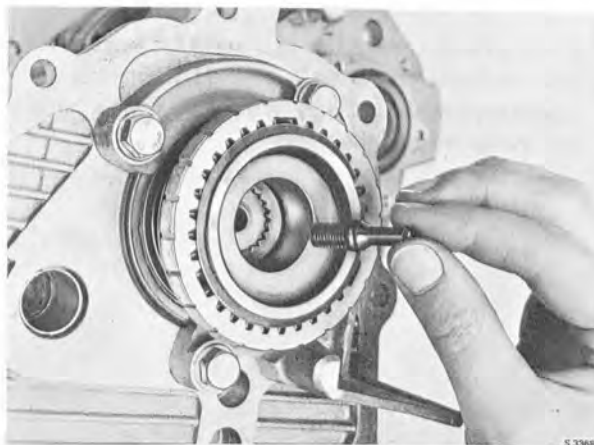
INSTALLING THE REVERSE GEAR SHIFT SHAFT

5. Fit the needle bearing into the intermediate gear with the help of grease so that it will be held in place until the intermediate gear shaft is installed. Then place the intermediate gear set in the bottom of the transmission case.



INSTALLING THE INTERMEDIATE GEAR SET

6. Make sure that the thrust washer for the intermediate gear is in the correct place in the primary gear housing. The washer can be glued in place to facilitate the installing of the intermediate gear. Check also that the connecting tube is fitted into the output shaft of the primary gear.



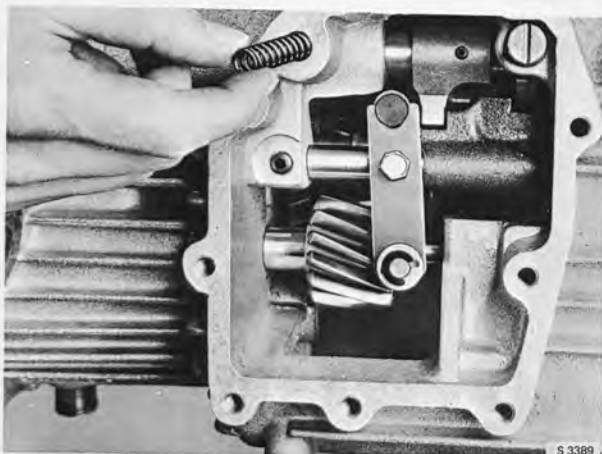
INSTALLING THE CONNECTING TUBE

7. Coat the flange of the primary gear housing with a sealant compound, e.g. Tikität No. 2, and fit the primary gear housing on to the transmission case.

NOTE

Leave the screw slightly slack to avoid jamming the loose intermediate gear set in the wrong position before the intermediate shaft is inserted.

8. Ease the intermediate gear into its correct position either by turning the transmission housing or by lifting the intermediate gear. Fit the rear thrust washer and push in the intermediate gear shaft, using tool 839004.
9. Fit the lock plate over the reverse gear and intermediate gear shaft ends. Secure the screw with Loctite.
10. Tighten the primary gear housing screws.
11. Insert the spring and the ball catch for the gear selector rod and mount the transmission case side cover together with its gasket.



FITTING THE SPRING FOR THE GEAR SELECTOR ROD

12. Install the differential assembly (see section 473).
13. Inspect the shaft seals in the differential bearing seats and fit new ones if necessary. Adjust the crown wheel backlash if necessary (see section 473). Mount the two inner drive shafts complete with inner universal joints taking care not to damage the shaft seals.
14. Fit the cover complete with gasket to the transmission case.
15. Fill the transmission case with oil (3 US qt, 5 Imp.pints, 3 liters).

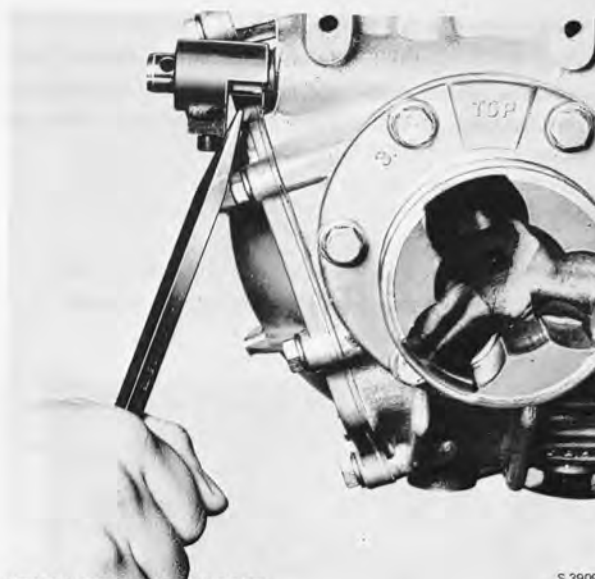
Changing the sealing ring, gear shift rod

Can be done in car or on a removed gearbox.

Removal

1. Knock off the front taper pin from the gear shift joint and separate the joint from the rod.
2. Pull off the rubber bellows from the collar on the sealing ring.
3. Put the removing tool 879067 over the collar on the sealing ring and screw in the screw of the tool against the shaft.

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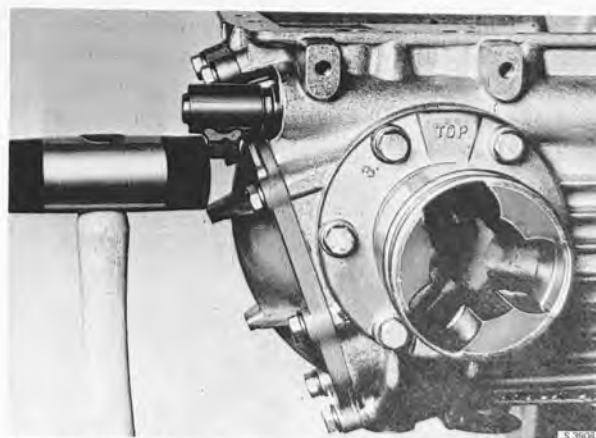


REMOVING TOOL 879067

4. Pry off the sealing ring with the aid of a screwdriver held between the tool and one of the screw heads on the rear cover.

Installation

1. Fit the new sealing ring with the aid of installing tool 879068 and a suitable hammer.



INSTALLING TOOL 879068

2. Fit the rubber bellows on the sealing ring.
3. Put together the gear shift rod joint and the gear shift rod and fit the taper pin.

Synchronization

Synchronizing rings

When changing the synchronizing rings, follow the instructions for the dismantling of the gear box. The differential unit must be removed and the intermediate gear disconnected so that the primary gear housing can be removed. When changing the synchronizing ring for top gear, no

further dismantling is necessary.

When changing the synchronizing ring for 1st and 2nd gear, the pinion shaft must be taken out of the transmission housing, so that the gears can be removed from the shaft.

Disassembling

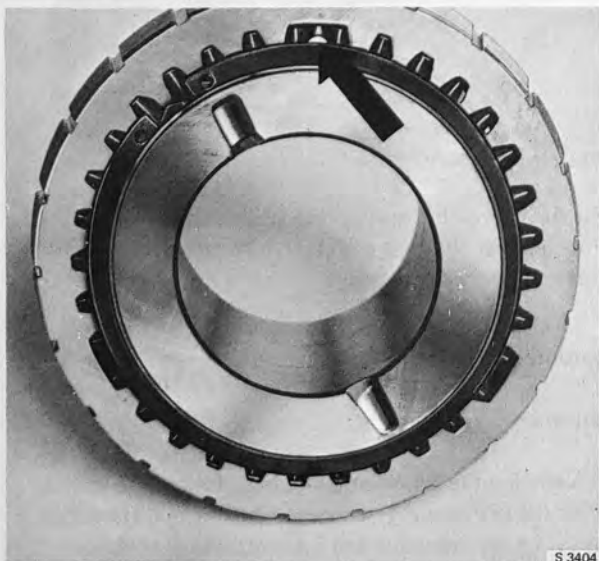
The synchronizing ring is removed by undoing the lock ring which attaches the synchronizing ring to the gear.



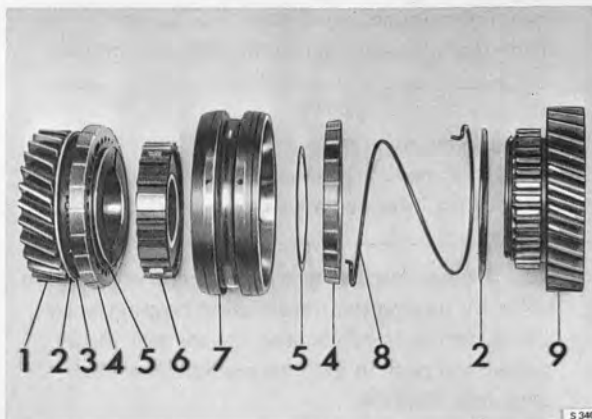
REMOVING THE SYNCHRONIZING RING FOR 3RD GEAR

Assembling

First fit the guide rings for the retaining springs, and the lock rings for the guide rings on 3rd and 4th gear. First and second gear have no lock rings for the guide rings. The retaining spring is fitted with a long wire end nearest the guide ring, and the spring is placed so that there are eleven teeth between the ends of the spring. The synchronizing ring is placed so that the ends of the retaining spring fit into the spaces between the teeth, after which the lock ring is fitted.

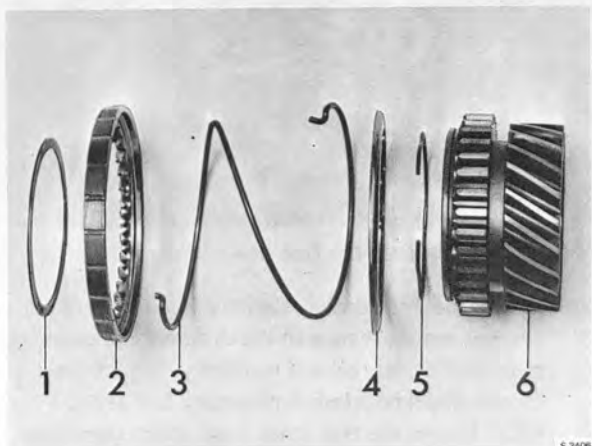


POSITIONING OF A SPRING END IN THE SPACE BETWEEN THE TEETH OF THE RING



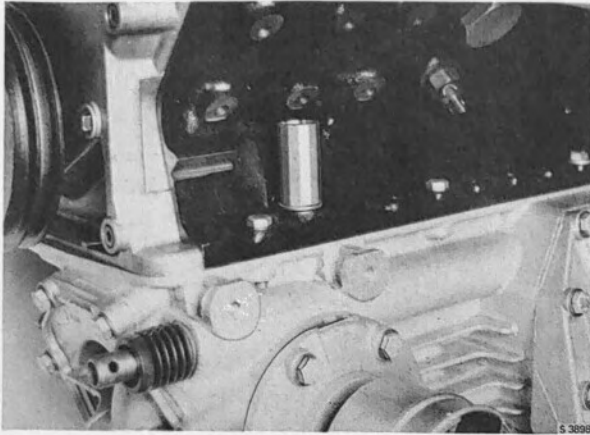
SYNCHRONIZATION, 1ST AND 2ND GEARS

1. 2nd gear
2. Guide ring
3. Retaining spring, 2nd gear
4. Synchronizing ring
5. Lock ring
6. Synchronizing hub
7. Coupling muff
8. Retaining spring, 1st gear
9. 1st gear

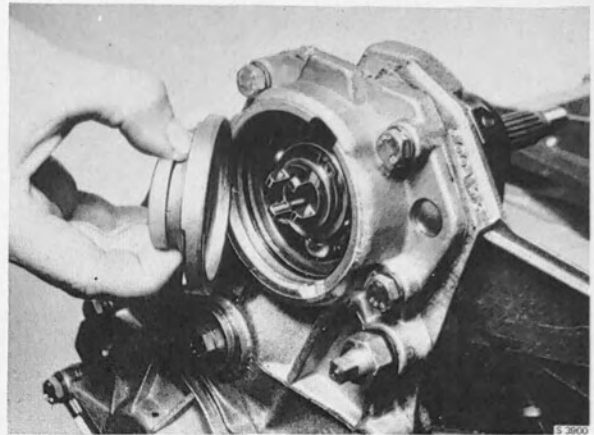


SYNCHRONIZATION, 3RD GEAR

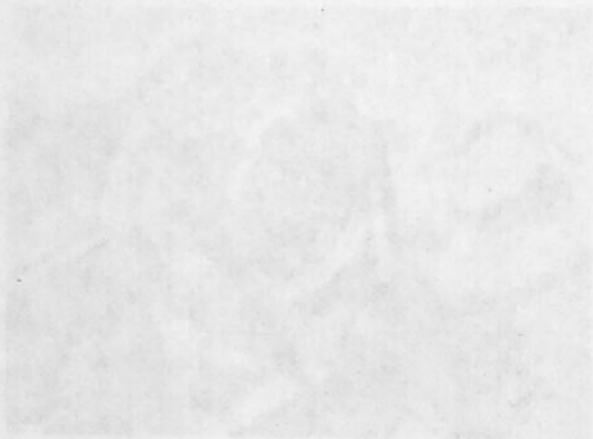
1. Lock ring
2. Synchronizing ring
3. Retaining spring, 3rd gear
4. Guide ring
5. Lock ring for guide ring
6. 3rd gear



BLEEDER, EARLIER DESIGN



BLEEDER, LATER DESIGN



BLEEDER, LATER DESIGN



BLEEDER, LATER DESIGN

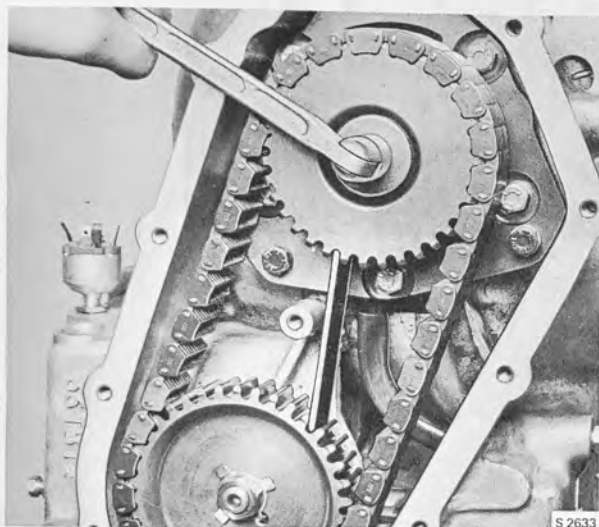
DISASSEMBLY, ASSEMBLY, ADJUSTMENT

Automatic transmission

Concerning removal and installation of power plant, see page 442-1.

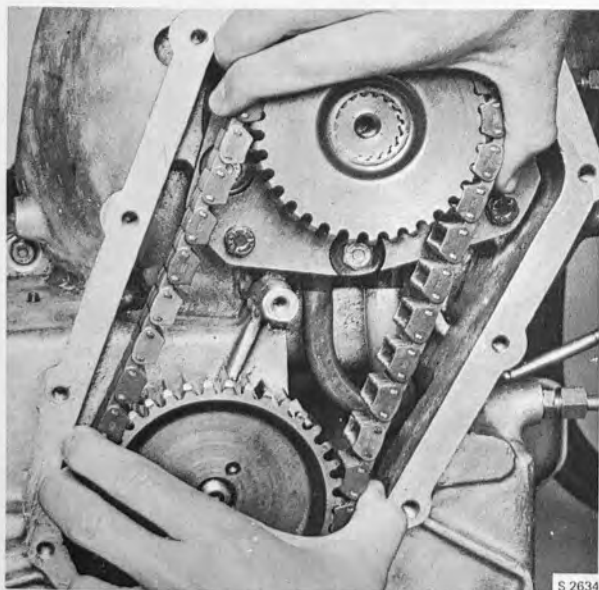
Disassembling the transmission

1. Drain oil.
2. Invert gearbox and remove front and rear bottom covers.
3. Remove front cover.
4. Undo retaining screw and nut for sprocket wheels, using tool 879023 to lock.



UNDOING THE SCREW FOR PRIMARY GEAR
Support 879023

5. Remove the wheels.

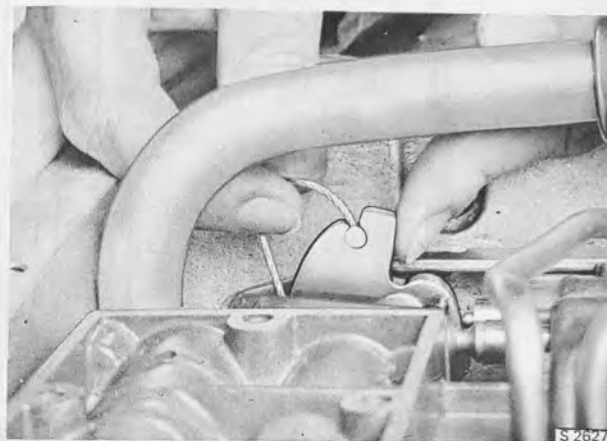


REMOVING THE PRIMARY GEAR

NOTE

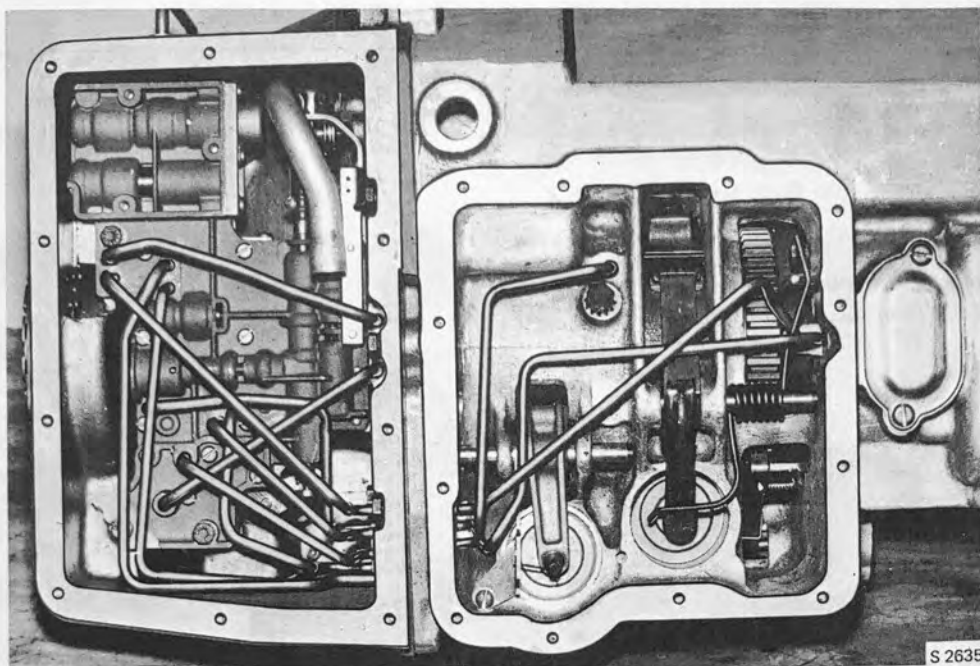
Gear unit axial clearance must be checked before each disassembly.

6. Remove cover on right-hand side.
7. Disconnect throttle valve control cable.

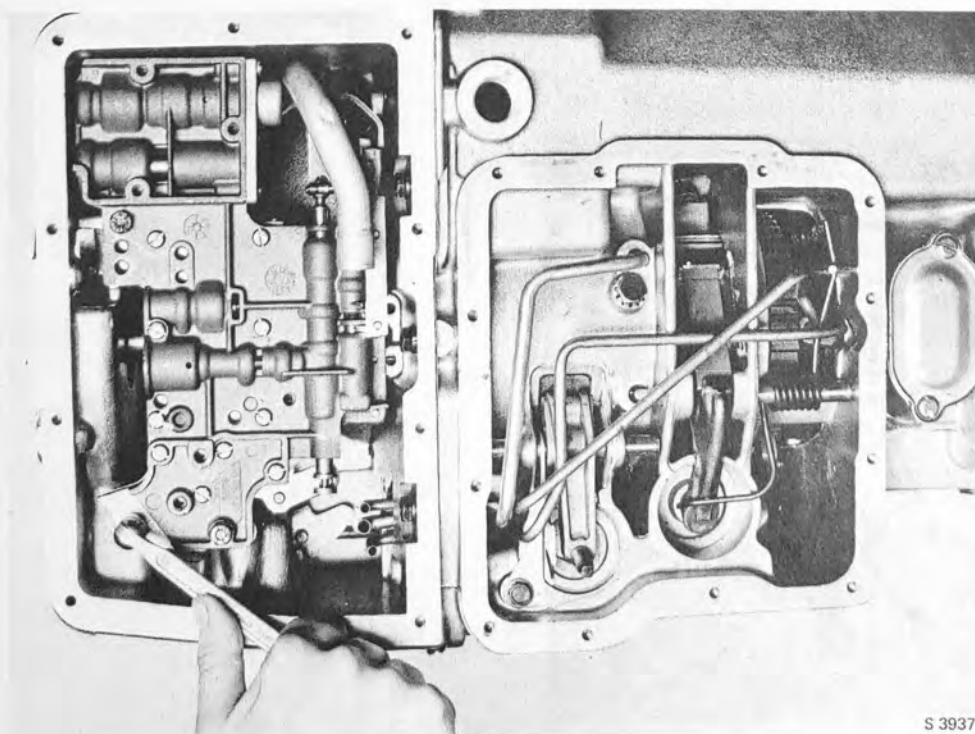


REMOVING THE THROTTLE CABLE FROM VALVE HOUSING

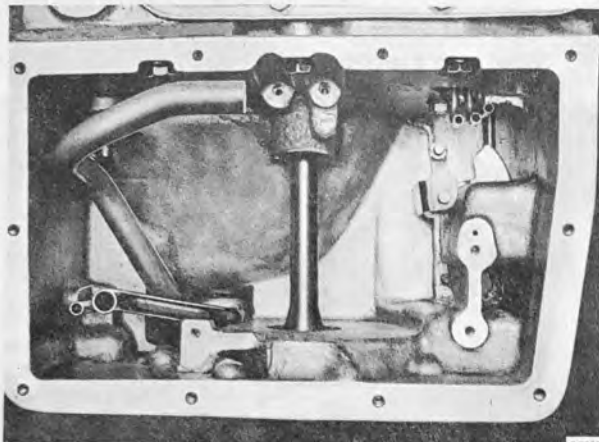
8. Remove all oil pipes inside the front bottom cover. The three pipes inside the rear bottom cover is to be removed later.
9. Undo the three retaining screws from the valve housing, lift the housing straight up and remove the two large oil pipes from the pump.



LOCATION OF OIL PIPES

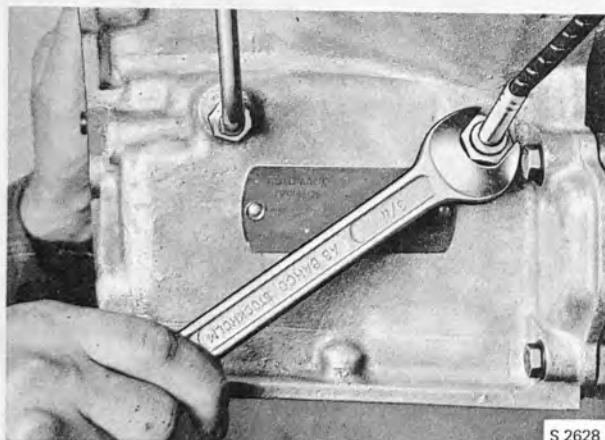


REMOVING THE RETAINING SCREWS OF THE VALVE HOUSING



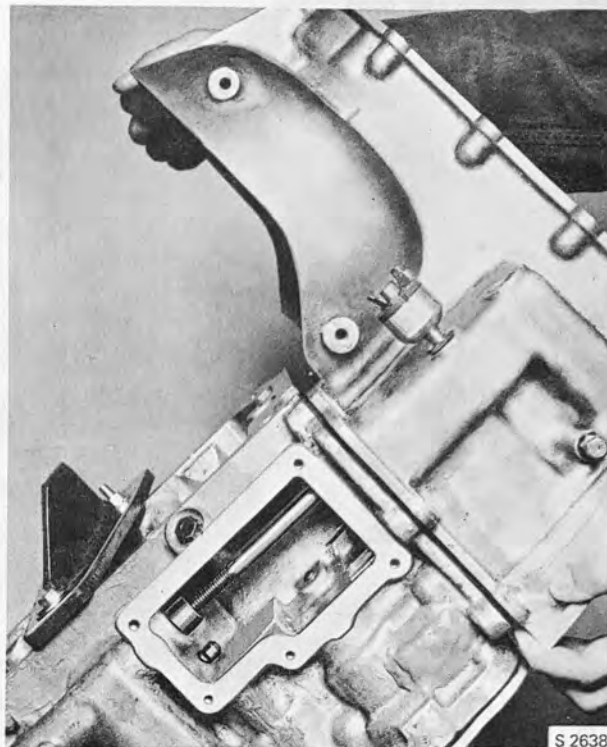
OIL PIPE BETWEEN VALVE HOUSING AND OIL PUMP

10. Turn gearbox right way up, undo the three oil pump retaining screws, and remove the pump. Lift the torque converter at the same time to make the work easier.
11. Lift out the torque converter.
12. If necessary, disconnect throttle cable.



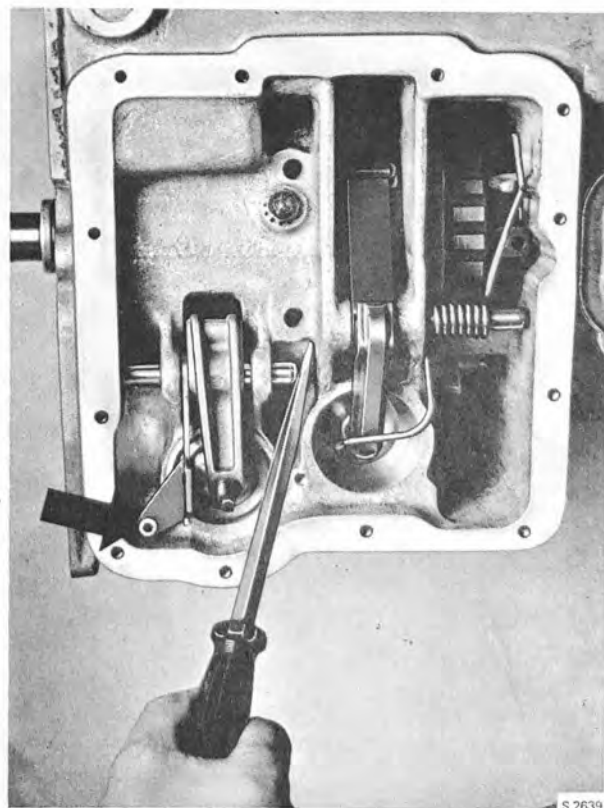
REMOVING THROTTLE CABLE FROM TRANSMISSION CASING

13. Remove retaining screws from torque converter housing (five outside and five inside).
14. Before lifting out the housing, pull the gear selector rod as far forward as possible. Remove the three remaining oil pipes and at the same time remove the converter housing.



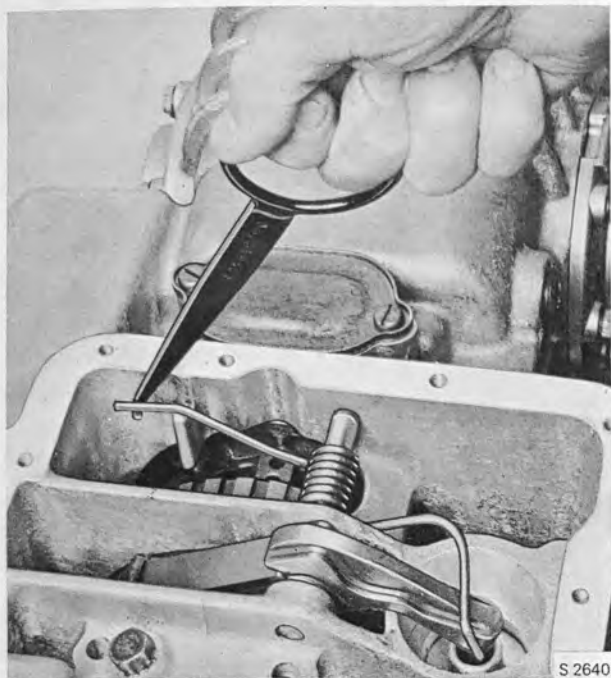
REMOVING TORQUE CONVERTER HOUSING

15. Remove gasket.
16. Undo automatic adjustment screw, see illustration.
17. Remove front band lever shaft.



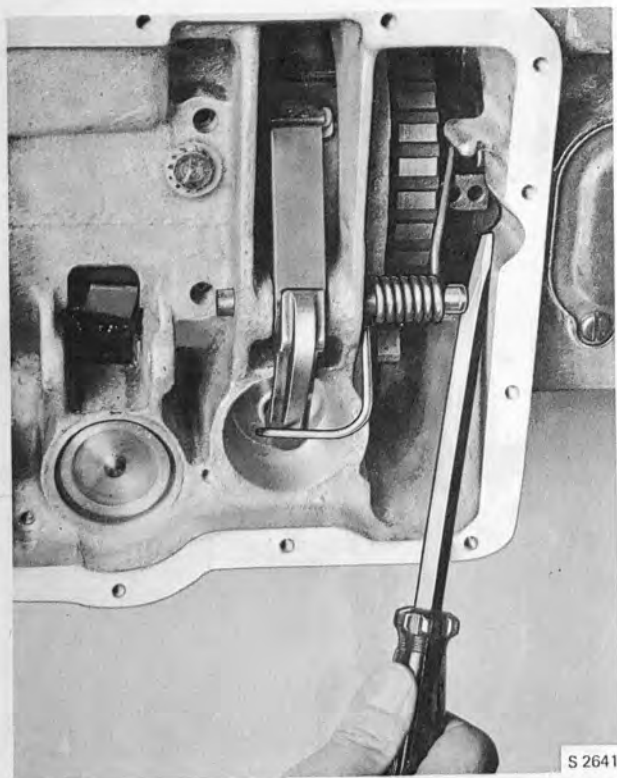
REMOVING FRONT BAND LEVER SHAFT

18. Unhook rear band spring.



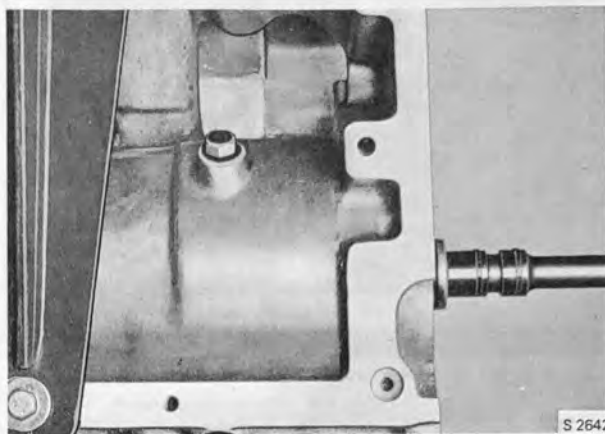
REMOVING THE SPRING

19. Remove rear band lever shaft, removing the spring at the same time.



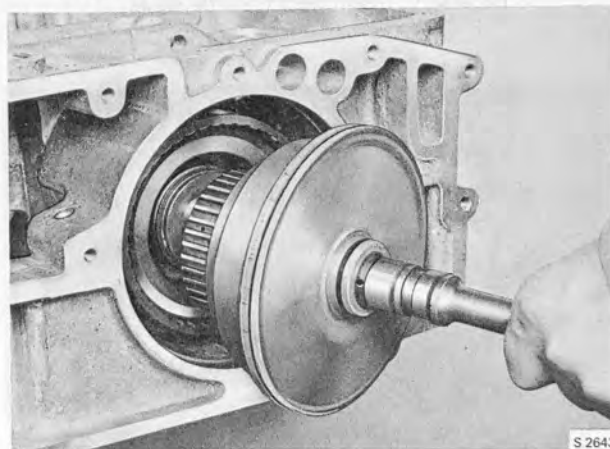
REMOVING REAR BAND LEVER SHAFT

20. Undo the three screws securing the centre support. Note that the screw in the engine oil sump is provided with a rubber gasket.



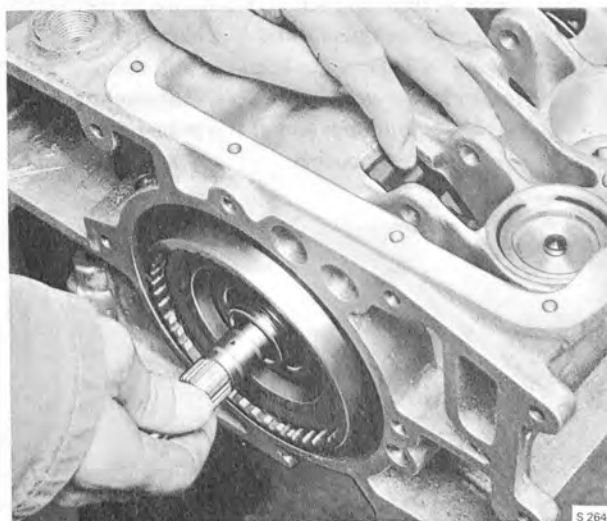
SCREW FOR CENTRE SUPPORT

21. Remove the front clutch. Take care of the axial washer (washers). There are two different designs, the one washer of the later design is thicker and supersedes the two washers on the earlier design as spare part.



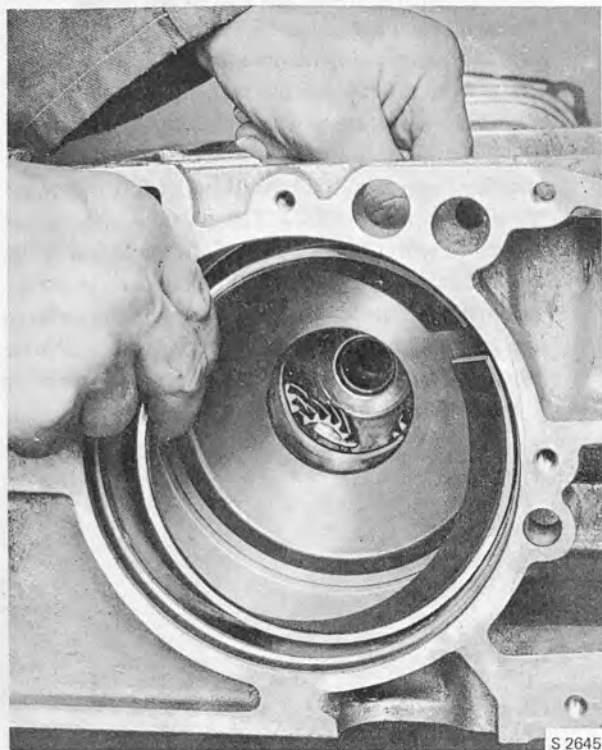
REMOVING THE FRONT CLUTCH

22. Remove the rear clutch with the shaft for the forward sun gear, holding the front band securely to prevent it from falling over.



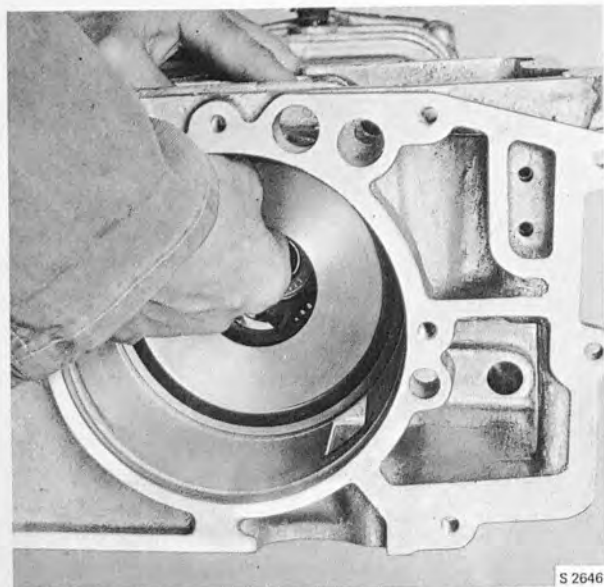
REMOVING THE REAR CLUTCH

23. Remove front band.



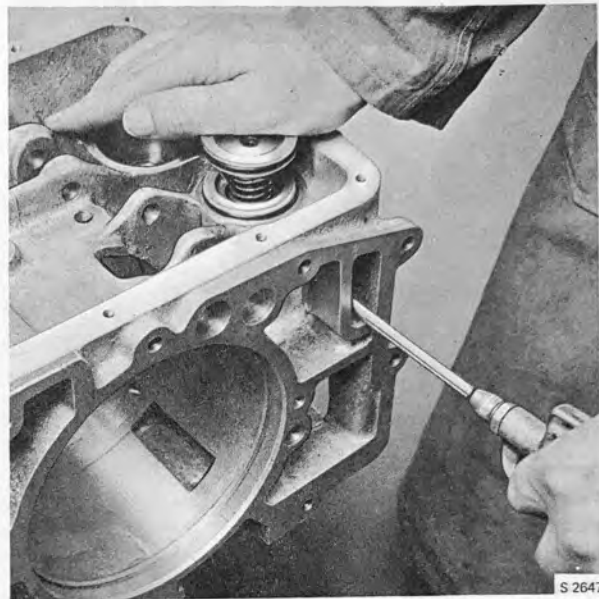
REMOVING THE FRONT BAND

24. Remove centre support, holding the planet carrier in place by compressing the rear band.



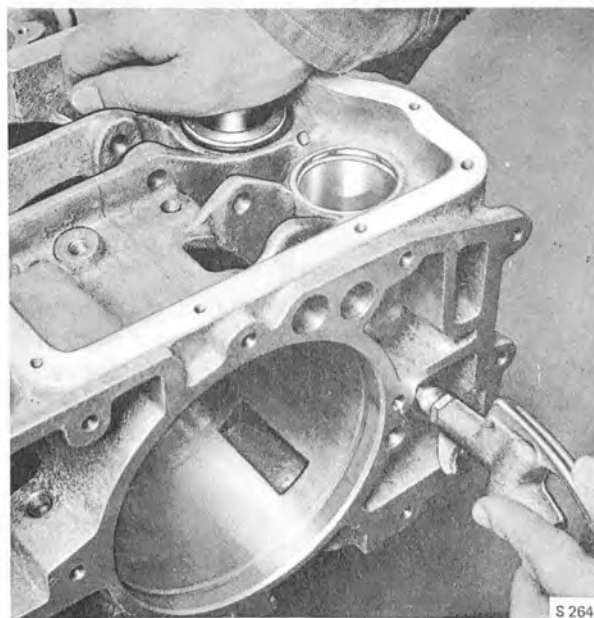
REMOVING THE CENTRE SUPPORT

25. Remove the planet carrier, save the thrust washer and bearing.
26. Remove rear band.
27. Remove the ring gear (valid only for earlier design). On automatic transmissions of later design the ring gear is removed together with the pinion bearing housing.



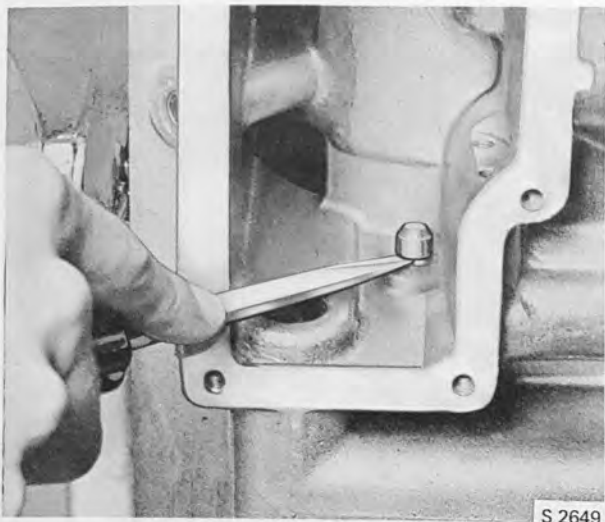
REMOVING THE FRONT PISTON

28. Dismantle lock ring from front piston and remove the piston with aid of compressed air.
29. Remove the rear piston with aid of compressed air.

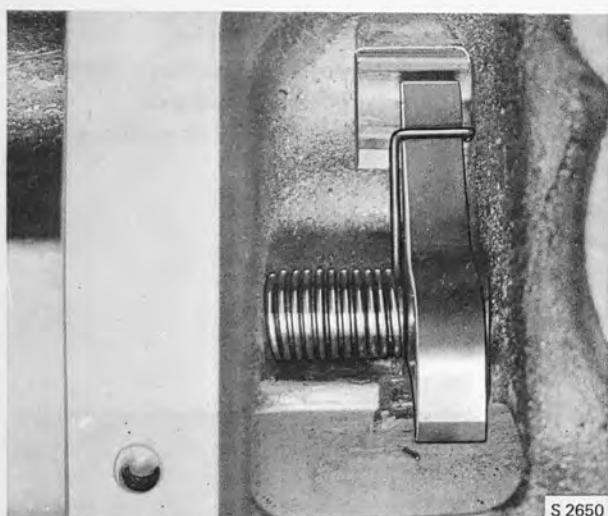


REMOVING THE REAR PISTON

30. If necessary dismantle the parking pawl shaft and remove the parking pawl and spring.



REMOVING PARKING PAWL SHAFT

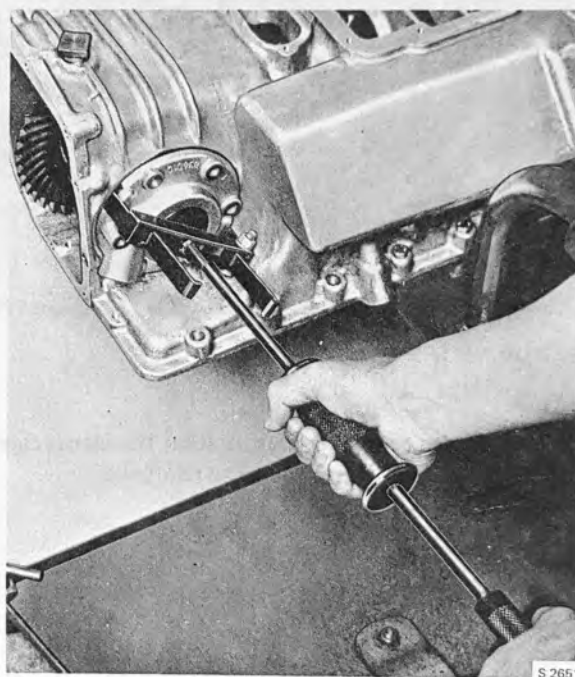


PARKING PAWL

NOTE

If overheating or the like has occurred, the differential and pinion must be disassembled for inspection of the front pinion bearing, which is lubricated by oil from the automatic transmission.

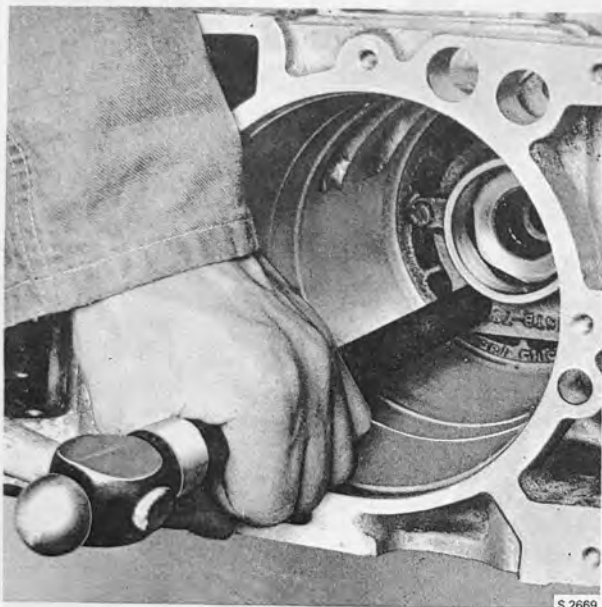
31. If necessary, take off bearing houses and remove differential and pinion shaft as stated below. Remove the inner universal joints using puller 839147 and tapping hammer 839027. Remove the cover from the differential housing. Remove the differential assembly by unscrewing the differential bearing seats on both sides and removing them with the help of puller 839147 and tapping hammer 839027. Take out the differential assembly with shims (if any). Save the spacer washers and shims; the latter must be replaced in their original positions on reassembly unless the differential gear backlash has been altered by the exchange of some component. Instructions for disassembling the differential are given in section 473.



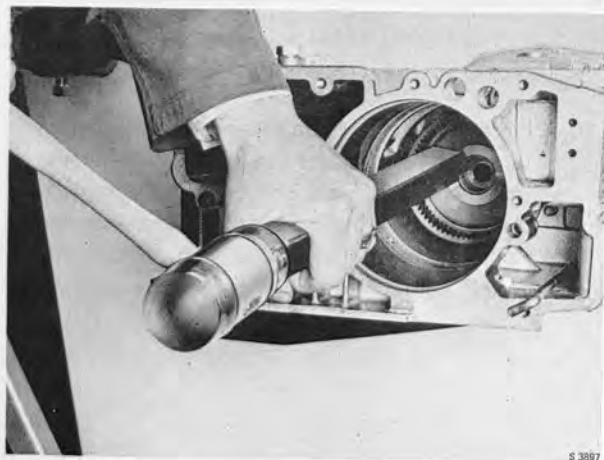
REMOVING DIFFERENTIAL BEARING SEATS
Puller 839147, tapping hammer 839027

32. The pinion and its bearing housing are removed as follows:

Undo the four screws securing the pinion bearing housing and free the housing by tapping gently, using a wooden drift to avoid damaging the surfaces.

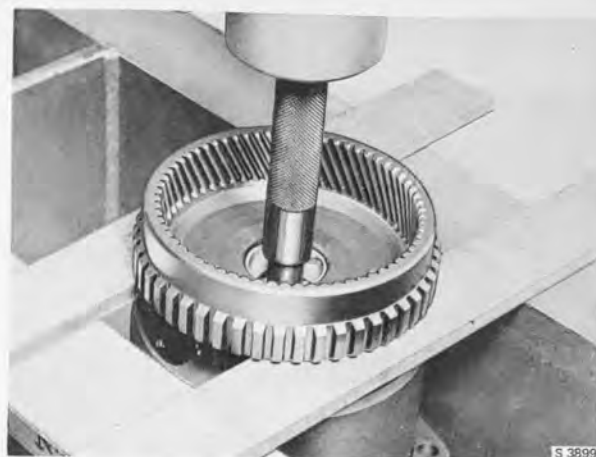


REMOVING THE PINION BEARING, EARLIER DESIGN



REMOVAL OF PINION BEARING , LATER DESIGN

33. Place the ring gear and the pinion bearing housing in a press and use the press to separate the splines of the ring gear hub and the pinion. The press drift and its retainer 879061 are introduced through the hole in the ring gear hub so as to make contact with the pinion. See illustration.



SEPARATION OF RING GEAR AND PINION UNDER PRESSURE

Drift 879061

Assembly of transmission

- Automatic transmission of later design:
The following procedure should be used when pressing the ring gear hub and the pinion together. Lubricate the seal rings with automatic transmission oil and ensure that they move freely in their grooves. Slacken the two screws holding the seal housing and hold the housing away from the seal rings, while pressing the ring gear and the pinion together to avoid damaging the seal rings.
- Screw the seal housing to the pinion bearing housing using the two screws.
- Fit the O-ring on the pinion housing.
- Screw in the locating studs 879022 and put on the necessary number of shims. Locate the pinion housing and tighten the screws to the correct torque.
- If the parking pawl previously has been removed, fit parking pawl and spring and put in the shaft so that the spring will be locked in the shaft groove.
- Invert the transmission casing so that the underside is uppermost.
Automatic transmission of earlier design: Check that the seal rings on the ring gear turn freely in their grooves. Lubricate the ring gear with automatic transmission oil and refit it. Fit the rear brake band.
- Place the shims, thrust bearing and thrust needle bearing on the planet gear carrier. Grease the small thrust bearing washer and the sun wheel rear thrust needle bearing with vaseline and attach them to the inside of the planet gear carrier. NOTE! The flange on the small thrust bearing washer must point inwards towards the planet gear carrier.

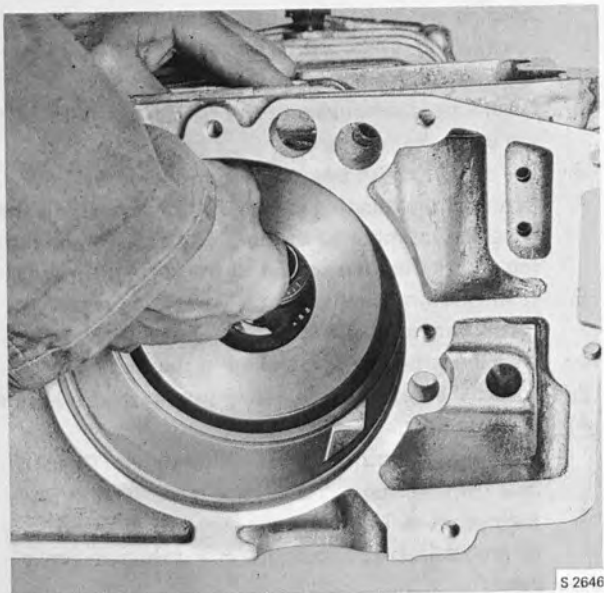


S 2652

PLANET GEAR CARRIER WITH SHIMS AND THRUST NEEDLE BEARING

1. Planet gear
2. Shims
3. Thrust bearing washer
4. Thrust bearing

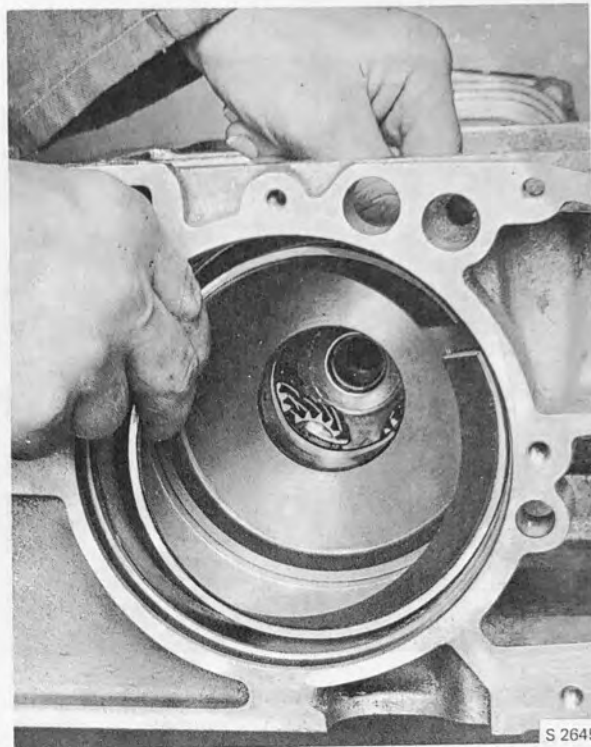
8. Fit the planet gear carrier and centre support.



S 2646

FITTING THE CENTRE SUPPORT

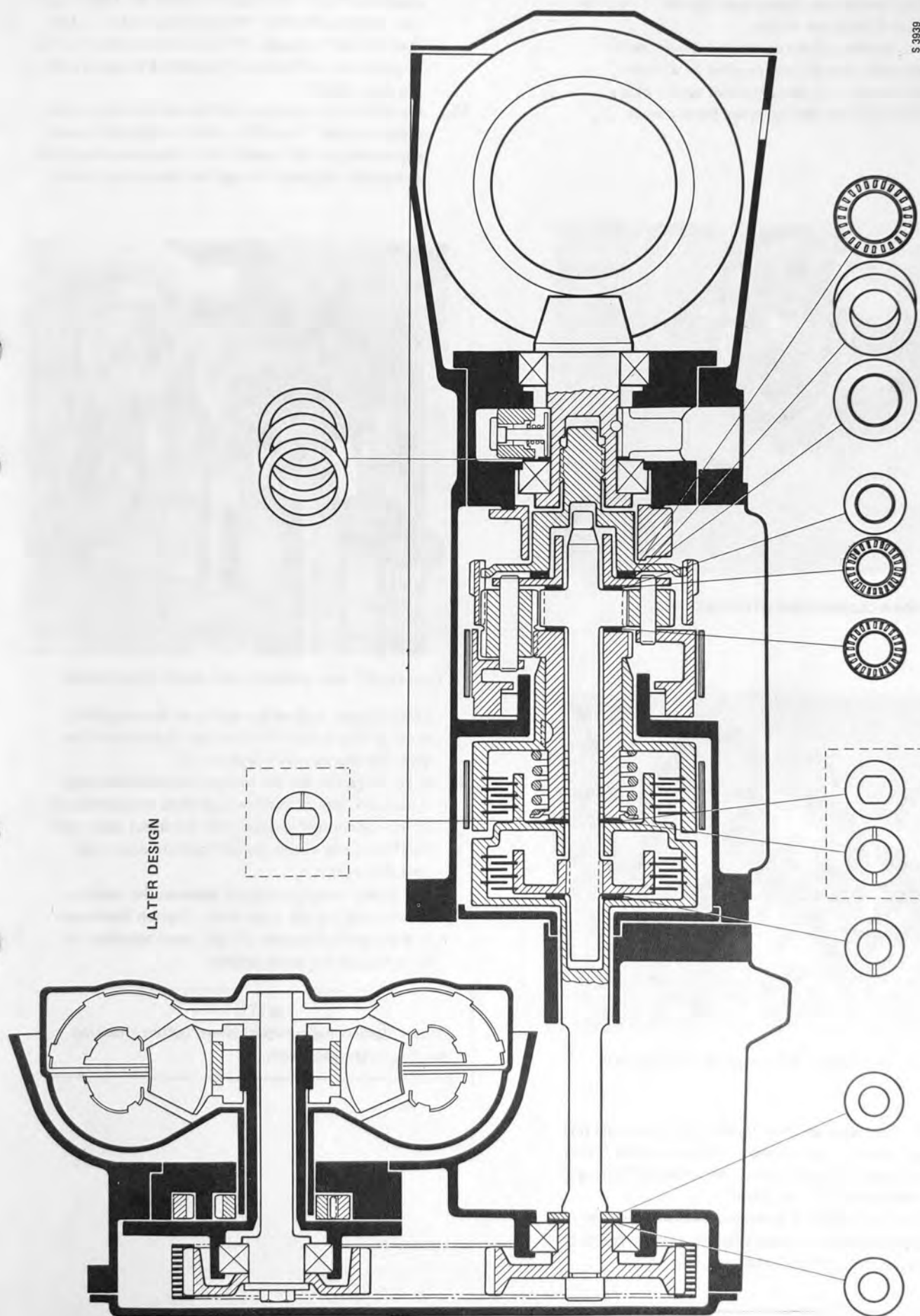
9. Fit the front brake band.



S 2645

FITTING THE FRONT BAND

10. Place the thrust needle bearing between the two sun wheels on the rear sun wheel shaft. Check that the seal rings are intact and move freely in their grooves. Lubricate with automatic transmission oil. Carefully insert the shaft through the rear clutch, taking care not to damage the seal rings.

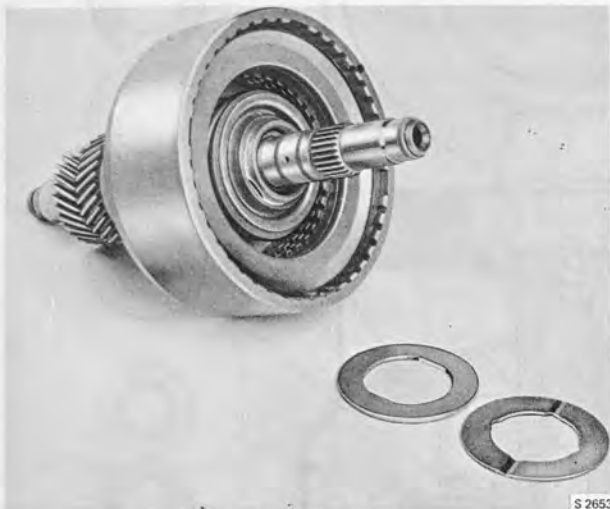


LATER DESIGN

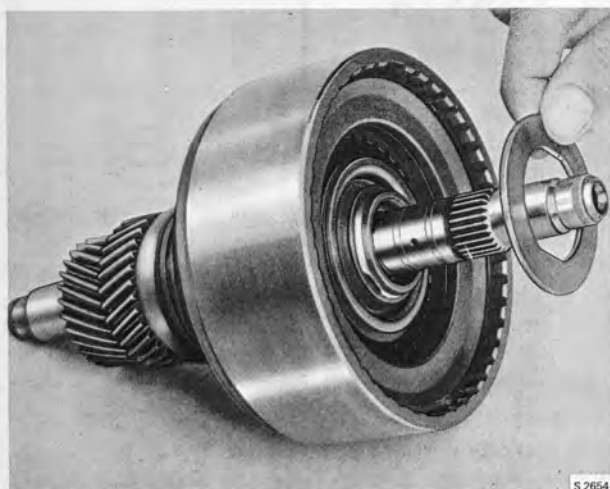
EARLIER DESIGN
SHIMS, THRUST BEARING AND THRUST BEARING WASHER

11. Locate the steel washer (with the two flat sides in the hole) on the rear clutch hub. Mount the bronze washer and the front clutch.

On later versions of the automatic transmission, the two axial washers are replaced by a single thicker washer with bearing metal on one side. The bearing metal side faces the front clutch.



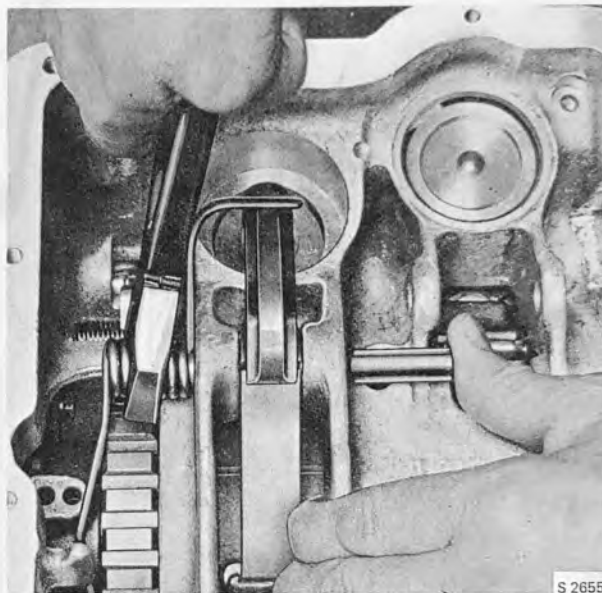
REAR CLUTCH HUB WITH WASHERS



LOCATION OF THE WASHER ON REAR CLUTCH HUB

12. Insert the complete clutch assembly (front and rear clutch) and fit the end plate. Check that the O-ring is in place and intact. Check also the small O-ring on the hub of the end plate.
13. Clean, inspect and if necessary exchange pistons and piston seals. Lubricate the servo pistons and insert in the servo cylinders.

14. Place the long pressure rod against the rear band, place the lever in position and insert the shaft from side, at the same time holding the spring in place so that the shaft engages. NOTE: One end of the spring must lie against the lever throughout to avoid scratching the cylinder.
15. Place the short pressure rod against the front band, place the lever in position, and place the automatic adjustment carrier against the front band. Insert the shaft from the side through the carrier and lever si-



FITTING SHAFT AND SPRING FOR LEVER REAR BAND

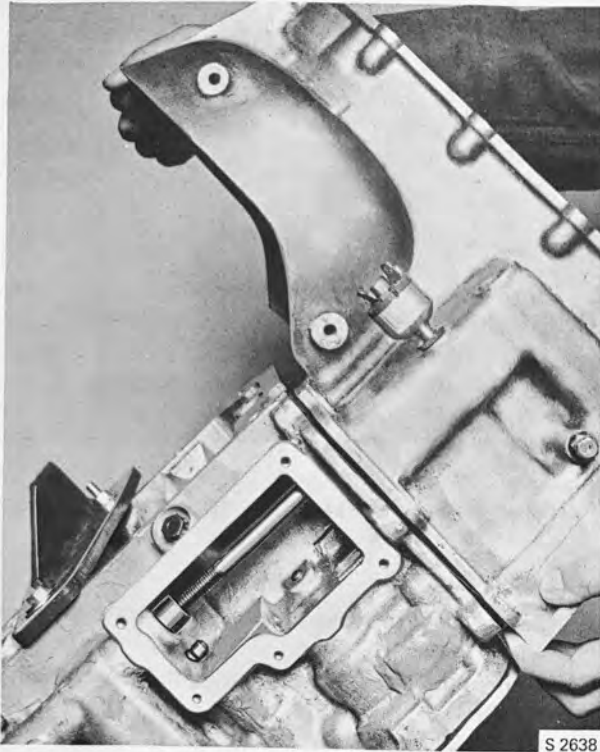
multaneously. Adjust the spring on the adjusting screw so that it lies 1.5–2 thread flights from the lever (see chapter on Adjustment).

16. Place the gasket for the torque converter housing in position. Mount the housing while simultaneously fitting the contact washer onto the input shaft and the three pipes inside the rear bottom cover. See page 472–13.

The washer must be located between the bearing and the step on the input shaft. Tighten the screws to the specified torque. Fit the lower sprocket so as to true up the shaft radially.

NOTE

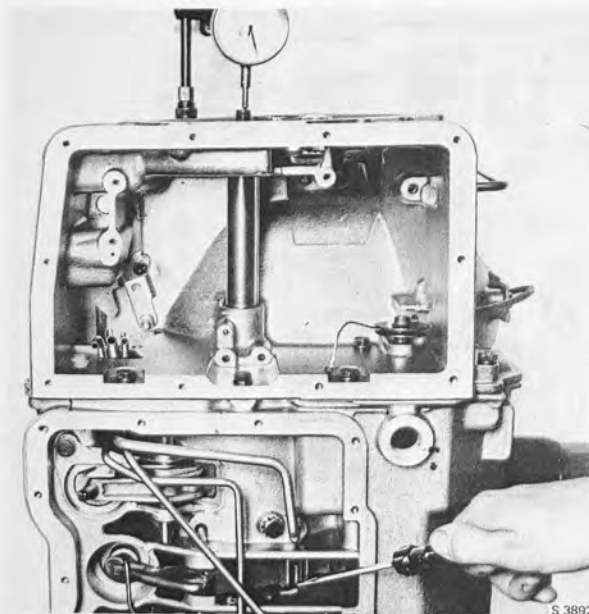
Do not tighten the sprocket wheel before checking the play in the gear train.



S 2638

FITTING TORQUE CONVERTER HOUSING

17. Mount the indicator dial 784062 in holder 879006 and prize up under the planet carrier with a screwdriver. The play should be 0.01–0.03" (0.25–0.75 mm); if it is not within these limits, adjust by shimming between the ring gear and the forward sun gear, or between the washer and bearing on the input shaft.



S 3892

MEASURING THE PLAY
Tools 784062 and 879006

18. Mount the torque converter and oil pump. This must be done with great care to avoid damaging the seal ring. Tap the pump housing with a plastic mallet and tighten the screws.

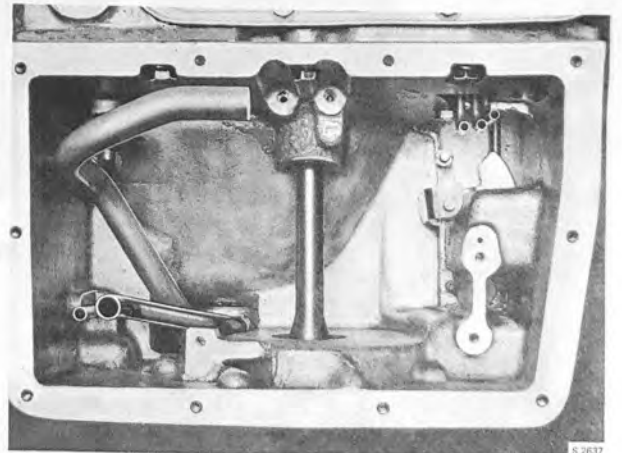
Check that the pressure pipe from the pump to the valve housing not have become deformed. Compare the removed pipe with a new one.



S 4098

CHECKING THE OIL PIPE

19. Fit the two wide-bore oil pipes to the pump. Check that the O-ring to the suction line is in place. Fit the short pipe between the valve housing and torque converter housing.



S 2637

OIL PIPE BETWEEN VALVE HOUSING AND OIL PUMP

20. Locate the valve housing and check that the pipes engage the housing. Check that the manual gear selector is connected.

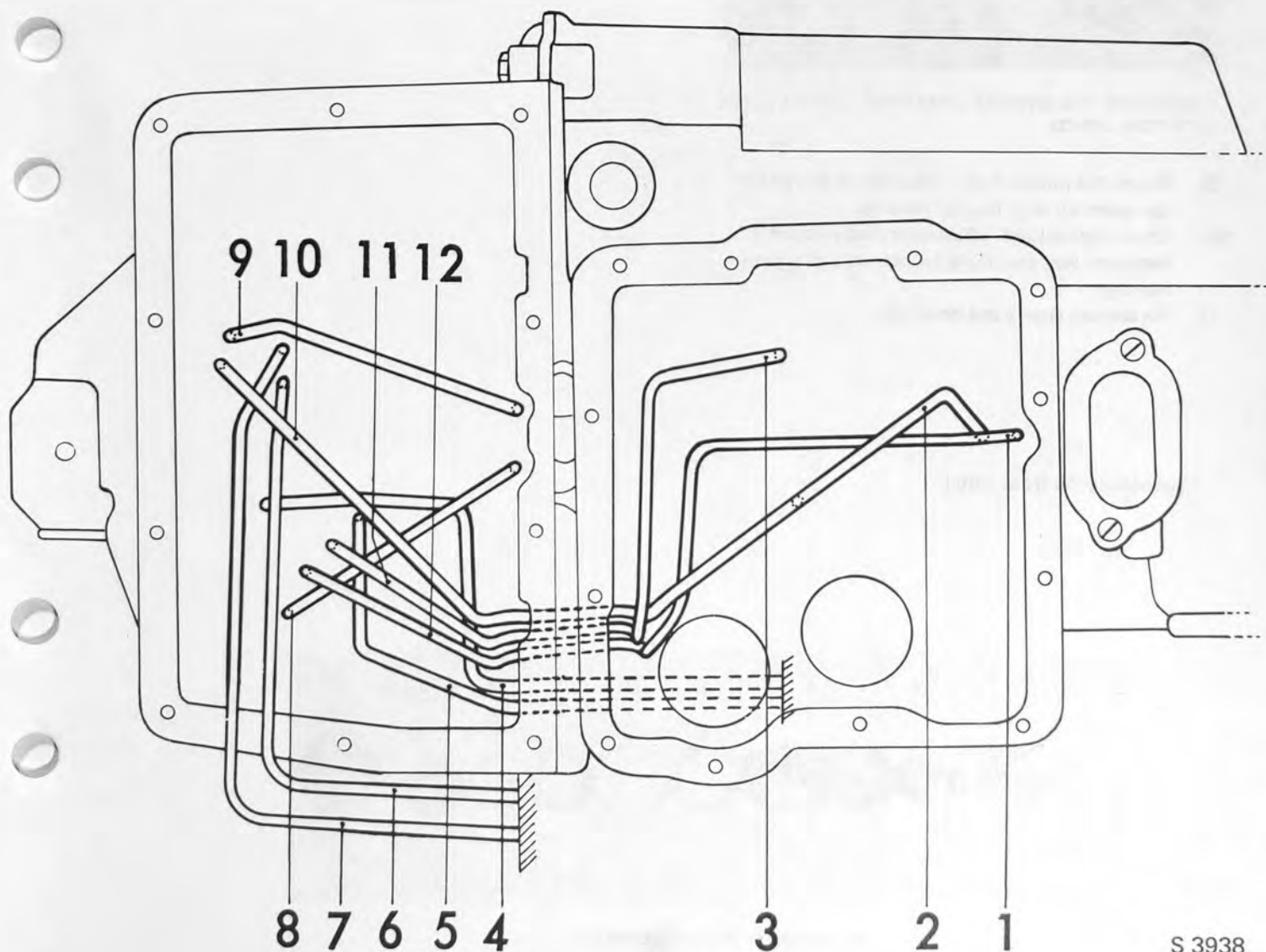
The following pipes are fitted on conjunction with step 16 (in the following order):

Return from the governor	No. 1
Main lubrication	No. 2
Rear clutch	No. 3

These are located under the rear bottom cover.

23. Fit the remaining oil pipes in the following order:

Rear brake band (inner hole)	No. 4
Rear brake band (outer hole)	" 5
Front brake band (application lower hole)	" 6
Front brake band (release upper hole)	" 7
Front clutch and governor	" 8
Front lubrication	" 9
Connect main lubrication from No. 2 to	No. 10
Connect rear clutch from No. 3 to	" 11
" governor return line from No. 1 to	No. 12

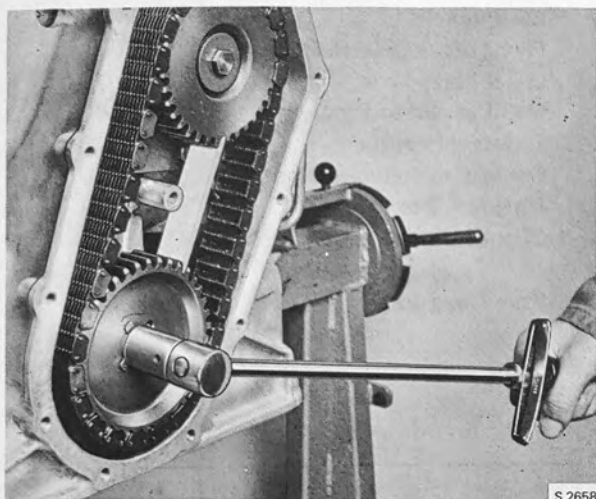


FITTING OIL PIPES

- | | |
|---|--|
| 1. Return line from governor | 7. Front brake band, releasing, upper hole |
| 2. Main lubrication | 8. Front clutch and governor |
| 3. Rear clutch | 9. Front lubrication |
| 4. Rear brake band, inner hole | 10. Main lubrication from 2 |
| 5. Rear brake band, outer hole | 11. Rear clutch from 3 |
| 6. Front brake band, application lower hole | 12. Return line governor from 1 |

S 3938

24. Fit the chain and sprockets and tighten.

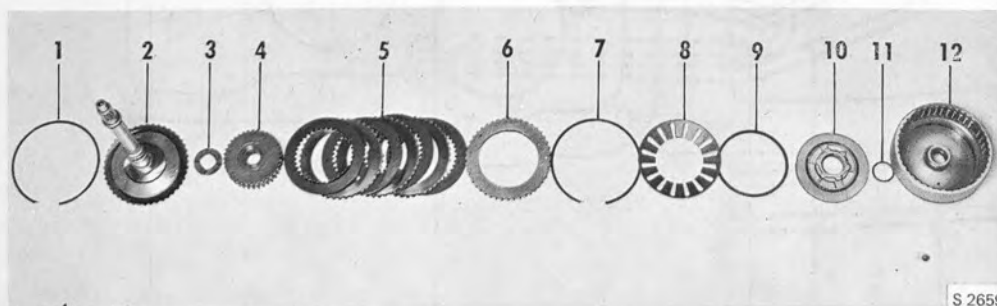


S 2658

TIGHTENING THE SPROCKET, THE WHEELS ARE LOCKED WITH TOOL 879023

25. Mount the pinion shaft, crown wheel and differential assembly with bearing housing.
26. Check the backlash adjustment, and readjust if necessary (see directions for assembly of pinion bearing).
27. Fit bottom covers and cowlings.

Dismantling the front clutch

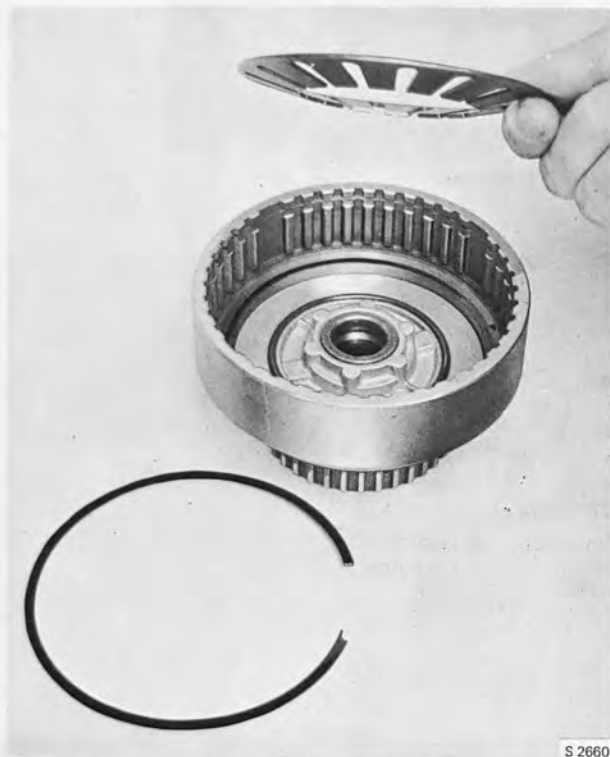


S 2659

FRONT CLUTCH DISASSEMBLED

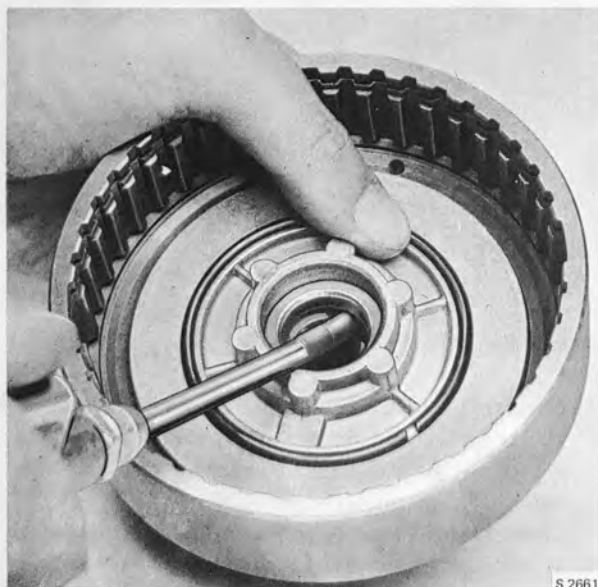
- | | |
|------------------|--------------------------|
| 1. Lock ring | 7. Lock ring |
| 2. Input shaft | 8. Return spring |
| 3. Thrust washer | 9. Piston sealing |
| 4. Hub | 10. Piston |
| 5. Discs | 11. Sealing ring |
| 6. Spacer | 12. Front clutch housing |

1. Remove plate.
2. Remove lock ring from input shaft, saving the thrust washer.
3. Lift out the forward clutch hub.
4. Remove clutch discs.
5. Remove lock ring for return spring and remove spring.



REMOVING RETURN SPRING

6. Remove the piston with aid of compressed air.



REMOVING FRONT CLUTCH PISTON WITH THE AID OF COMPRESSED AIR

7. Check all seals and clutch discs for damage and wear, replacing damaged parts. Do not forget the small O-ring on the cylinder hub. Check the small leaf valve on the back of the piston; spring movement should be 0.020–0.039" (0.5–1.0 mm).

Assembling the front clutch

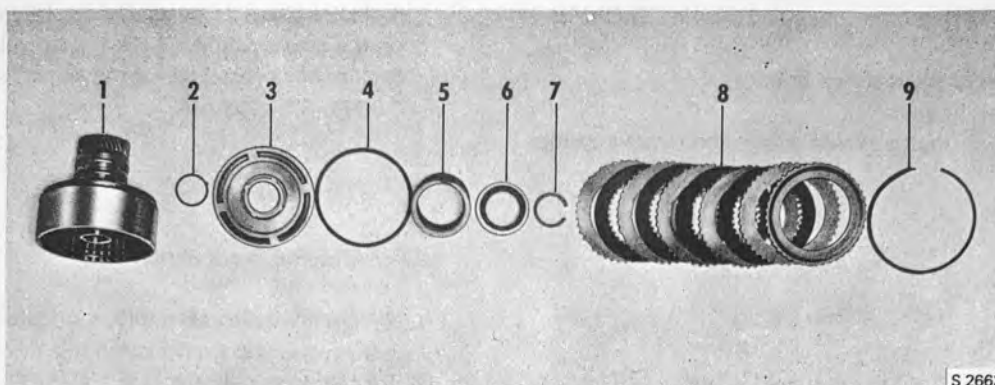
1. Before beginning assembly, lubricate all components with automatic transmission oil.
2. Fit O-ring to cylinder hub.
3. Insert piston using sleeve 879010.



INSERTING PISTON IN FRONT CLUTCH
Tool 879010

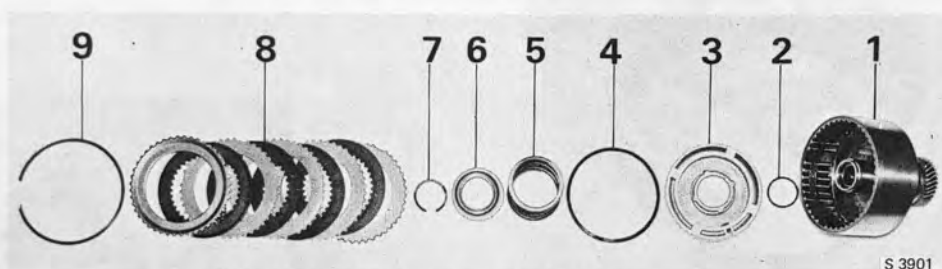
4. Check that steel ring on piston is properly seated.
5. Fit return spring with convex part downward on piston.
6. Fit pressure plate with flat side upward, checking that outer plates are flat; if not, they must be exchanged for new ones.
7. Place hub, clutch discs and thrust washer in position.
8. Check that the bushing on the input shaft is intact. At the same time, check that the seal rings on the shaft rotate freely in their grooves. If the rings stick, check that the housing is not damaged.
9. Lay the input shaft in the clutch disc housing and fit the lock ring.

Dismantling the rear clutch



S 2663

REAR CLUTCH DISMANTLED, EARLIER MODEL



S 3901

REAR CLUTCH DISMANTLED, LATER MODEL

- | | |
|--|--------------|
| 1. Rear clutch housing with forward sun gear | 6. Washer |
| 2. Sealing ring | 7. Lock ring |
| 3. Piston | 8. Discs |
| 4. Piston sealing | 9. Lock ring |
| 5. Spring | |

In the course of production of the 1972 model a new rear clutch was introduced, fitted with three lock ring grooves. The center groove is used for the standard disc assembly. The new disc assembly has a thicker pressure plate and one of the steel discs has been removed.

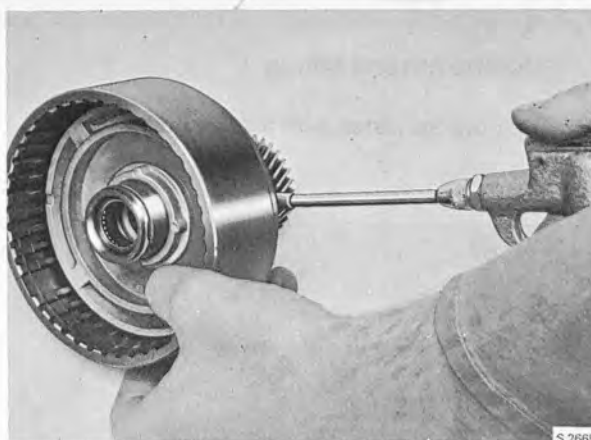
1. Pull out forward sun gear shaft.
NOTE: Thrust bearings on both sides of gear.
2. Remove lock ring securing clutch discs.
3. Compress return spring using tool 879008 in a press, and remove the lock ring with aid of special pliers 879018.



S 2664

REMOVING LOCK RING IN REAR CLUTCH,
Tools 879008 and 879018

4. Remove the piston with aid of compressed air.



S 2665

REMOVING REAR CLUTCH PISTON

Assembling the rear clutch

1. Check the needle bearing and bushing in the hub. Make sure there are no scratches on the drum. If scratches are found, the drum must be exchanged. Small blue-annealed areas can be accepted.
Check that the cylinder is free from scratches. Check all seals and clutch discs; if in doubt, fit new parts. If the piston has a leaf spring, check that the latter has a movement of 0.020–0.039 in. (0.5–1.0 mm). Small scratches on the piston can be smoothed off with a fine cleaning cloth. Check the small O-ring on the clutch housing hub.

2. Install the piston with sleeve 879009 or 879069 depending on piston design. The flat side shall be turned downwards.



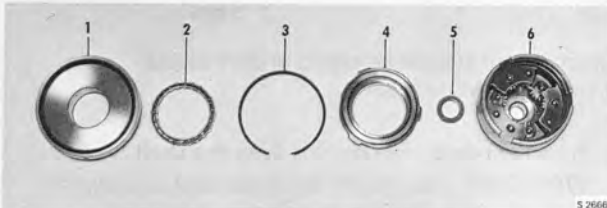
S 3906

INSTALLING PISTON IN REAR CLUTCH

Tool 879009 alt. 879069

3. Place the return spring on the piston.
4. Place the spring seat on the spring.
5. Compress the spring in a press with tool 879008 and fit the lock ring. See page 472-16.
6. NOTE: The outer clutch discs are cambered, and the cambers must face the same way. Begin assembly of clutch discs with an outer disc, finishing with a spacer disc and pressure plate.
7. Fit lock ring.

Dismantling the planet gear



S 2666

PLANET GEAR WITH CENTRE SUPPORT AND FREE WHEEL

1. Centre support
2. Free wheel
3. Lock ring
4. Free wheel carrier
5. Thrust washer
6. Planet carrier

1. Pull out centre support from planet carrier and take out free wheel.
2. Remove lock ring from planet carrier with a screwdriver and pull out free wheel carrier.

Assembling the planet gear

1. Insert free wheel carrier and secure with lock ring.
2. Fit free wheel. NOTE: Flange on inner roller retainer faces outwards.
3. Insert centre support in the planet carrier and check that it can be rotated clockwise.

NOTE

There are two versions of the rear sun wheel and the planet gear carrier and planet gear. The sun wheel of one version and the planet gear carrier/planet gear of the other version cannot be used together.

Identification grooves are used on the later version to enable the two designs to be distinguished.

The rear sun wheel has a groove cut into the tops of the cogs while the planet gear carrier has a groove round its perimeter.

Exchanging the ring gear

It may be necessary to exchange the ring gear if its male teeth have been damaged, e.g. by misuse of the parking pawl.

NOTE: If the ring gear has jammed on the pinion splines, the latter can be removed together with the pinion bearing housing.

Remove lock ring and pull out shaft.

Reassemble in reverse order.

NOTE: Check that the seal rings rotate freely in their grooves.



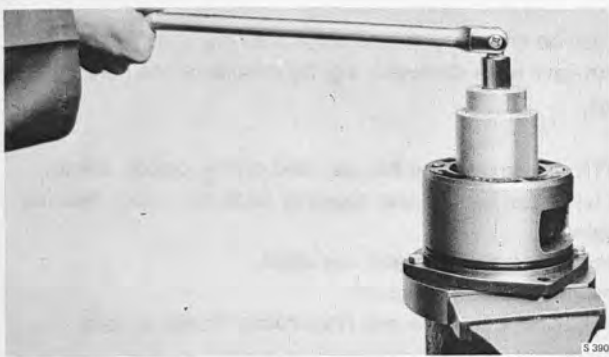
S 2667

CHANGING RING GEAR

Dismantling the pinion bearings

When dismantling the pinion bearing the description "dismantling the transmission" will be followed until the pinion with its bearing housing has been removed. Then the dismantling continued as follow below.

1. Undo the two screws securing the seal housing over the pinion nut.
2. Fit the pinion housing to fixture 879063 and its associated retainer ring. Retainer ring 879066 should be used for automatic transmissions of 1972 and earlier models, while retainer ring 879065 should be used for 1973 and later models.
3. Remove O-ring.
4. Clamp tool in a vice and unscrew pinion nut.



UNSCREWING THE PINION NUT

Tools 879026, 879063 and 879065 alt. 879066

5. Withdraw pinion from bearing housing.
6. Press off the rear pinion bearing. Use the fixture and the retainer ring as a support (see point 2).

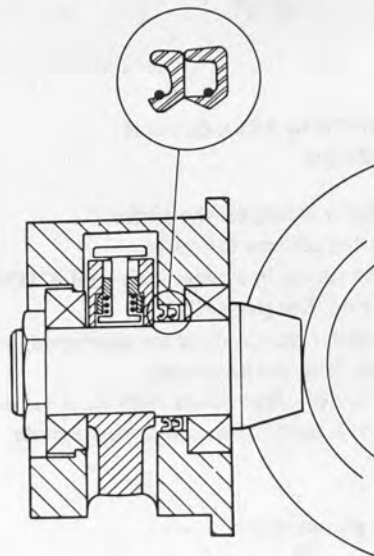


PRESSING OFF THE REAR PINION BEARING
Tools 879063 and 879065 alt. 879066

7. Remove shaft seals with a screwdriver.
8. Tap the front race out gently with tool 879021.
9. Tap out the rear race with tool 879020 together with drift 839044 up to and incl. gearbox No. 35 TB 2848. As from gearbox No. 35 TB 2849, tool 879053 should be used, together with drift 839044.

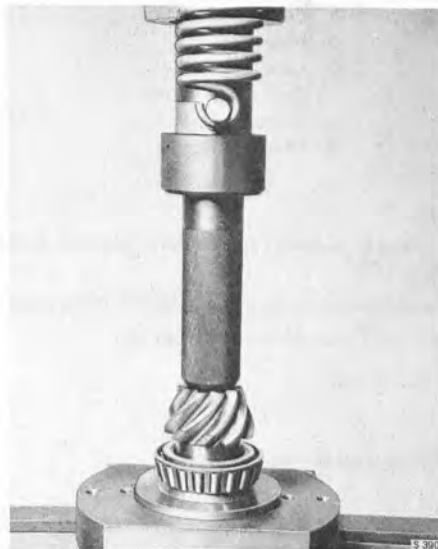
Assembling the pinion bearing

1. Fit the two shaft seals back-to-back in the housing using tool 879016. Fit outer bearing rings.
2. Press rear pinion bearing on to shaft.



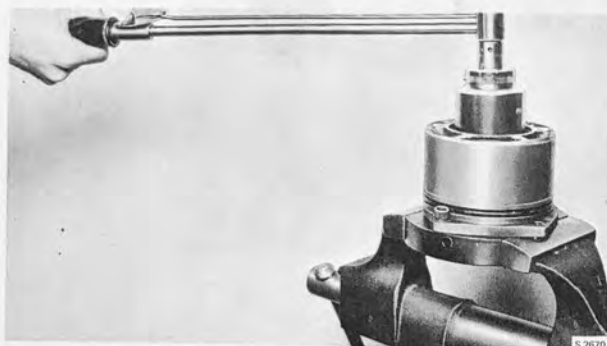
LOCATION OF PINION BEARING SHAFT SEALS
IN THE BEARING HOUSING

2. Press the rear pinion bearing onto the shaft. Fixture 879063 and press ring 879064 are used as a support.



PRESSING ON THE REAR PINION BEARING
Tools 879063 and 879064

3. Fit governor in housing with cover plate facing forward.
4. Hold the shaft horizontal with the driver ball in position and insert the shaft in the bearing housing so that the ball engages the track in the governor.
5. Shim between governor and front bearing.
6. Screw on nut and tighten to prescribed torque of 245–265 Nm (165–200 ft.lb., 25–27 kpm).



TIGHTENING THE PINION NUT

Tools 879026, 879063 and 879065 alt. 879066

7. Check the pre-load with a dynamometer 839013. Adjustment of the pre-load is carried out by placing shims between the front bearing and the governor housing.

Lubricate the bearing sparingly.

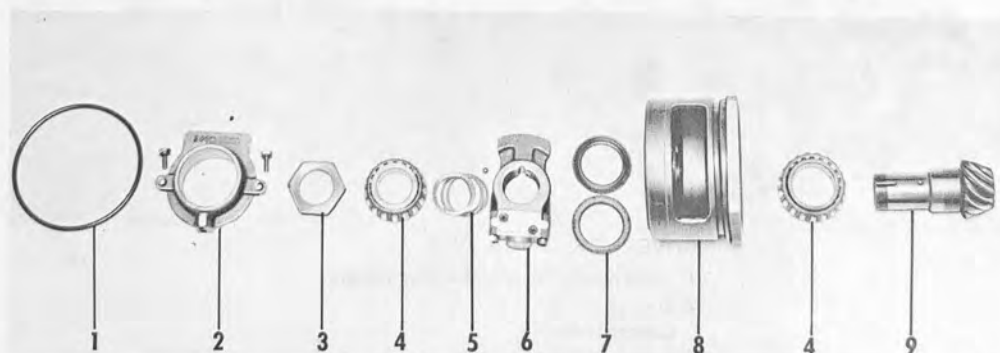
New bearings 27–46 N (6.1–10.3 lb., 2.8–4.7 kp) dynamometer reading which corresponds to a torque of 1.8–3.0 Nm (15–25 in.lb., 0.18–0.30 kpm).
Old bearings that have done more than 1,200 miles (2,000 km): 15–24 N (3.3–5.3 lb., 1.5–2.4 kp) dynamometer reading which corresponds to a torque of 0.9–1.5 Nm (7.5–12.5 in.lb., 0.09–0.15 kpm).



CHECKING PRE-LOAD WITH SPRING BALANCE

Tools 839013, 879063 and 879065 alt. 879066

8. Fit seal housing and O-ring to bearing housing.

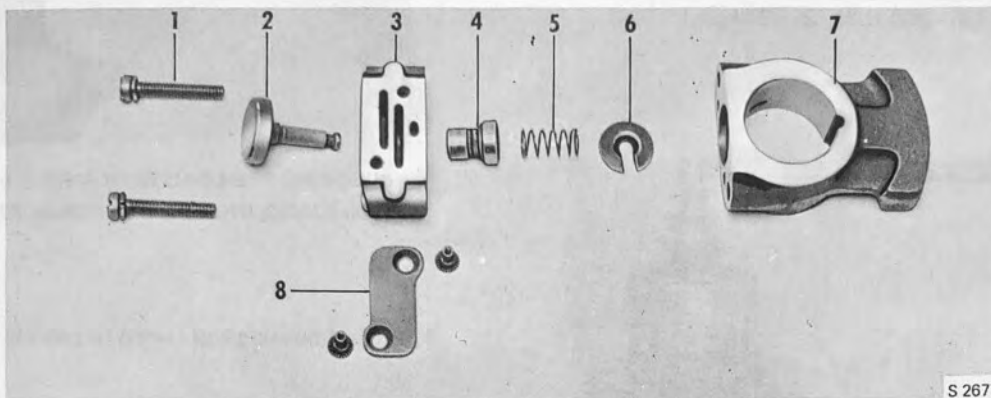


PINION BEARING DISASSEMBLED

1. O-ring
2. Seal housing
3. Nut
4. Bearing
5. Shims
6. Governor
7. Shaft seals
8. Bearing housing
9. Pinion shaft

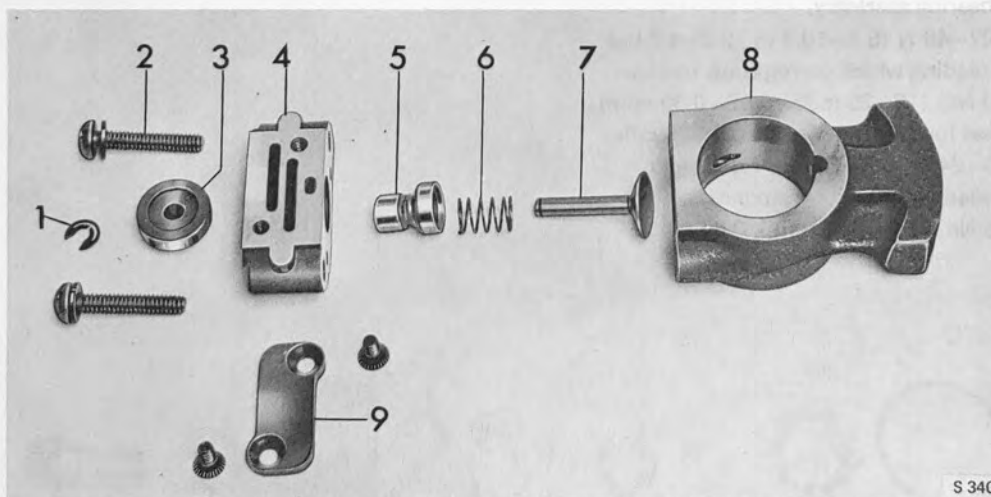
Governor

At the moment there are two different types of governor. Complete governors of both types are completely interchangeable.



GOVERNOR DISASSEMBLED, EARLIER TYPE

1. Screws
2. Governor weight
3. Governor housing
4. Governor valve
5. Spring
6. Lock washer
7. Governor carrier
8. Washer



GOVERNOR, LATER TYPE

1. Lock washer for the governor weight
2. Screws
3. Governor weight
4. Governor housing
5. Governor valve
6. Spring
7. Shaft
8. Governor carrier
9. Washer

Dismantling the governor

1. Take the governor off the carrier.
2. Undo the screws securing the cover washer on the governor housing.
3. Removing the lock washer and take out the governor weight and valve.

Assembling the governor

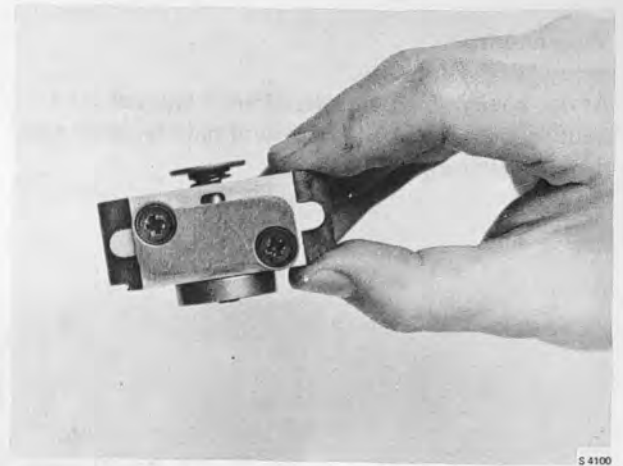
Before reassembling, lubricate all parts with transmission oil.
Reassemble in reverse order of dismantling.

Disassembling and checking the governor
(Transmission in car)

1. Jack up the car. Remove the small cover (two slotted screws) and let the oil run out (about 1 pint = 1/2 liter).
2. Revolve the wheels so that the governor's two retaining screws are accessible.
3. Undo the retaining screws so that the governor can be removed.



THE GOVERNOR SCREWS ARE REMOVED



CHECKING THAT THE VALVE IS NOT STUCK

5. Replace the governor and cover.

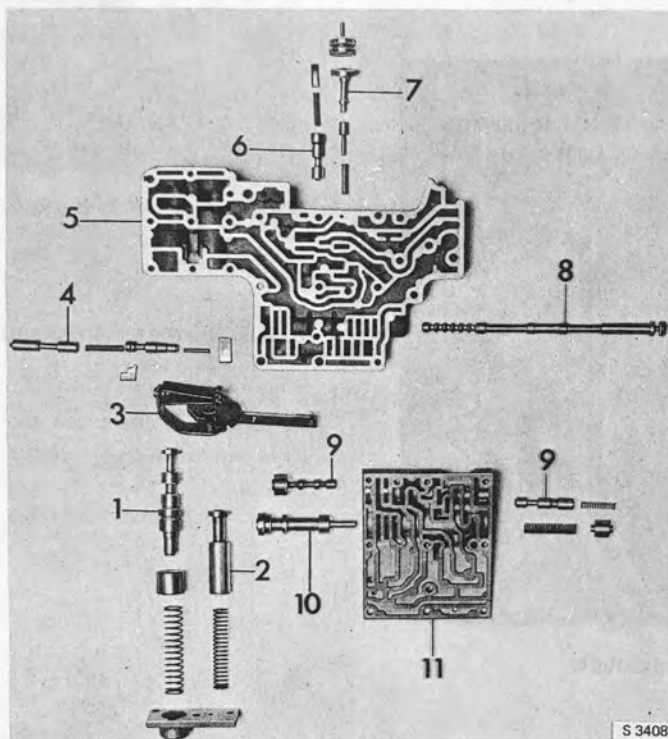
4. Check that the governor valve moves freely; i.e. that the valve moves when the governor is shaken.

If the valve is stuck it must be disassembled and the parts thoroughly cleaned. Check afterwards that the valve does not stick when it is turned and moved to-and-fro in its seating. Scratches on the valve can be smoothed with a whetstone or fine emery cloth. Before the parts are reassembled they should be lubricated with automatic transmission oil.

If any parts of the governor need replacing note that there are two different types. The new type is fitted as from transmission No. TB 2849.

Valve housing

At the moment there are two different types of valve housing. Complete valve housings of both types are completely interchangeable.



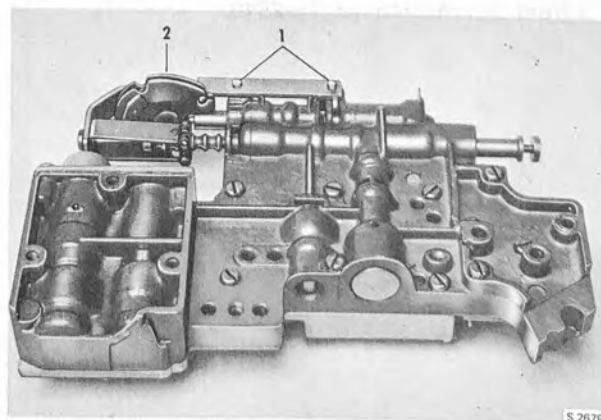
VALVE HOUSING DISASSEMBLED

- | | |
|---------------------------------------|----------------------------------|
| 1. Primary regulator valve | 7. Modulator valve |
| 2. Secondary regulator valve | 8. Manual valve |
| 3. Carrier and cam for kickdown valve | 9. Shift valve for 1st-2nd gear |
| 4. Kickdown and throttle valve | 10. Shift valve for 2nd-3rd gear |
| 5. Lower part of valve housing | 11. Upper part of valve housing |
| 6. Servo orifice control valve | |

Dismantling

NOTE: All work on the valve housing should preferably be done in a diesel test room or clean room of equivalent standard.

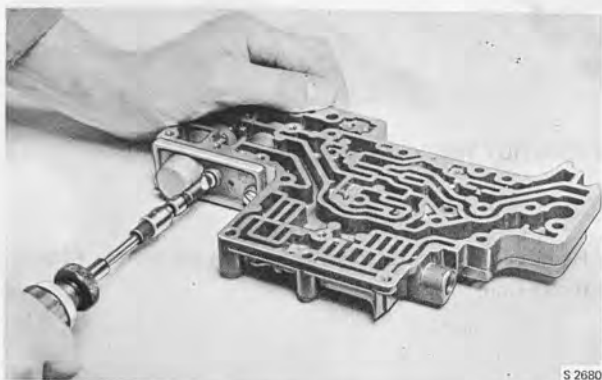
1. Undo both carrier screws and the cam for the downshift valve.



VALVE HOUSING

1. Screws, carrier for downshift valve cam
2. Downshift valve cam

2. Pull out the manual valve.
3. Separate the upper and lower sections of the valve housing by removing six screws from the top and two screws from the bottom and the four screws for the manual valve lever bracket.
4. Undo the eight screws securing the oil tube plate.
5. Remove the throttle valve stop. Then pull out the downshift valve, spring and throttle valve.
6. Remove the servo orifice control valve stop and pull out the valve.
7. Remove the pin retaining the modulator valve plug and take out the plug, valve, piston and spring.
8. Undo the three screws from the end plate and take out the primary regulator valve spring, sleeve and valve and the secondary regulator valve.



REMOVING END COVER

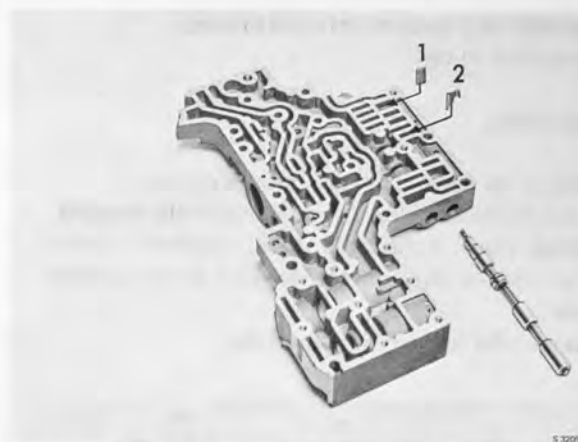
9. Remove the screws from the cover on the top section of the valve housing and take out the 1-2 and 2-3 shift valves.

Assembling the valve body

NOTE: Before assembling, make sure that all components are thoroughly clean and free from scratches. If the valves are scratched they can be smoothed with a fine emery cloth. Small lengthwise scratches in the housing can be tolerated, but if the scratches are big enough to be felt distinctly with the fingernails, the housing must be exchanged. Small scratches running right round the cylinder can be tolerated. Check that the valves move freely in their cylinders.

When the valve spring are removed, the valves should move due to their own weight when the valve housing is tilted. Rotate the valves and check that they do not stick in any position.

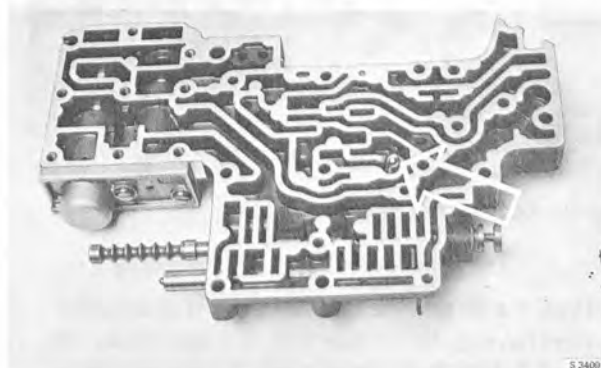
1. Dip the valves in automatic transmission oil before inserting them.
2. Mount the secondary regulator valve and spring.
3. Fit the primary regulator valve with sleeve and spring.
4. Fit the modulator valve, spring, valve and plug and secure with the pin.
5. Fit the servo orifice control valve with spring and stop.
6. Fit the throttle valve with spring and stop and the downshift valve with spring. See illustration.



LOCATION OF STOP WASHER AND DETENT WASHER

1. Stop washer
2. Detent washer

7. Screw the top and bottom housing sections together.
8. Fit the manual valve.
9. Fit the detent spring carrier and the downshift valve cam.

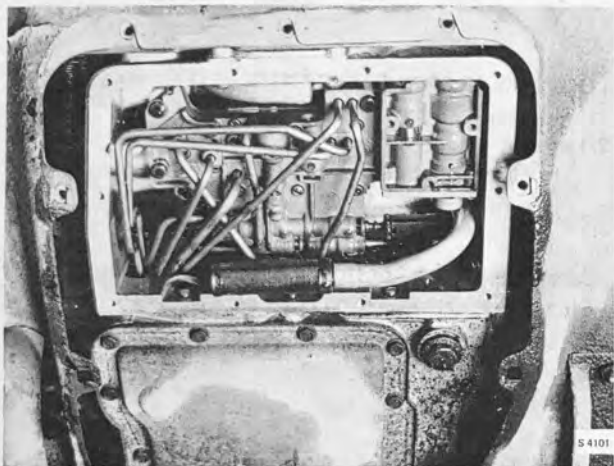


LOCATION OF BALL VALVE IN VALVE HOUSING OF LATER DESIGN

Disassembly and assembly of valve housing (Transmission in car)

Disassembling

1. Jack up the car and remove the guard plate.
2. Drain the oil and clean carefully round the forward bottom cover. If the car is rocked a further quantity of oil will run out from the rear part of the transmission.
3. Remove the forward bottom cover.



FORWARD BOTTOM COVER REMOVED

4. Disconnect all the oil pipes.
5. Disconnect the throttle wire.



DISCONNECTING THE THROTTLE WIRE

6. Undo the three valve housing retaining screws. The valve housing should now only be supported by the pressure pipe from the oil pump. Lift out the valve housing.



LIFTING OUT THE VALVE HOUSING

7. Remove the large suction pipe from the pump. Check the O-ring

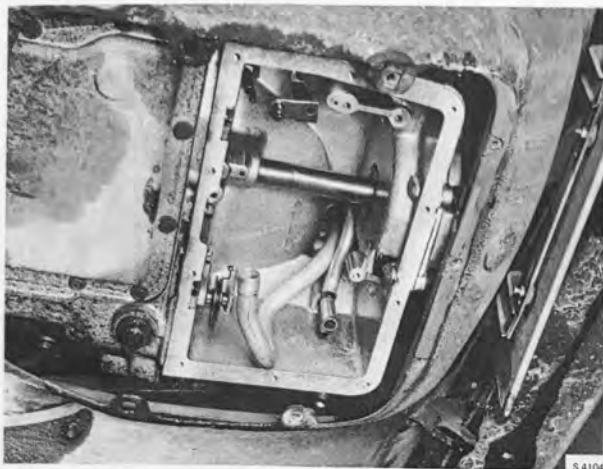
Check that the pressure pipe from the oil pump to the valve housing has not been deformed. Compare the pipe in question with a new one.



CHECKING THE OIL PIPE

Assembling

1. Fit the large suction pipe (with a fault-free O-ring) together with the pressure pipe into the oil pump. Both pipes are secured with a clip.



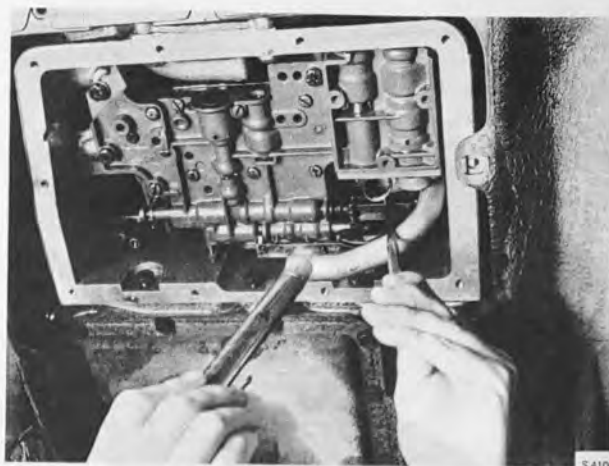
SUCTION PIPE AND PRESSURE PIPE CONNECTED TO THE OIL PUMP

2. The small pipe which provides the torque converter with oil pressure and the pressure pipe are also attached with a clip. These pipes must be in line with each other.
3. Lift up the valve housing. Guide both the pipes into their respective holes in the valve housing. The pipes must go freely into the valve housing. If force is used during assembly, the pressure pipe will be deformed.
4. Tighten the three retaining screws.



SCREWING ON THE VALVE HOUSING

5. Check with the help of a small mirror that the pipes are in place.



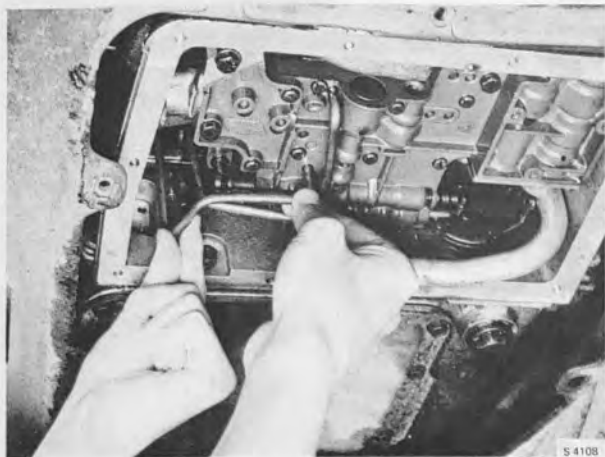
THE PIPE CONNECTIONS ARE CHECKED WITH THE AID OF A MIRROR

6. Fit the throttle cable and make sure that it is correctly placed on the blade wheel.
7. Then continue with the fitting of the pipes. Various problems can arise, and we therefore suggest that you refer to the diagram in the Service Manual (page 472-13), which can be of great help.
8. Start with pipe No. 4. It is necessary to feel around for the hole in the transmission housing, as it is difficult to remove the side cover with the transmission in the car.



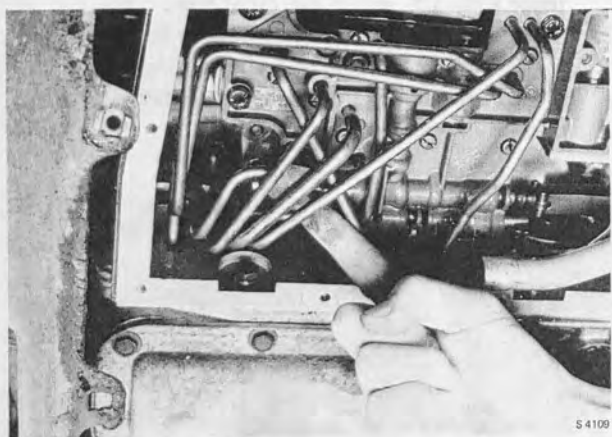
PIPE NO. 4 IS INSTALLED

9. Then fit pipe No. 5, which must not be confused with pipe No. 11, in the valve housing. In the case of later transmissions the hole in the valve housing has been moved to facilitate fitting.



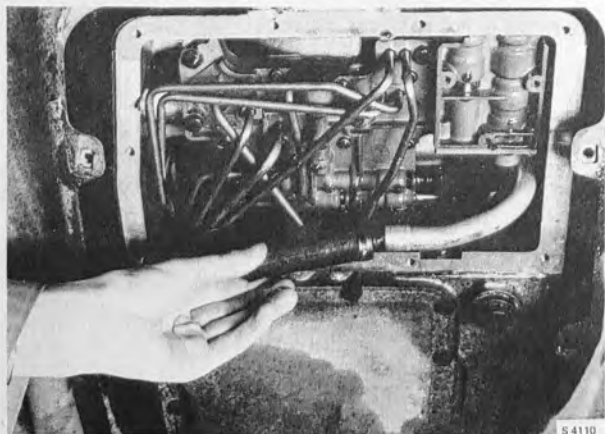
PIPE NO. 5 IS INSTALLED

10. If the diagram is followed the remaining pipes should not present any difficulty in fitting.
11. Do not forget to place the little magnet above pipes No. 11 and 12.



THE MAGNET IS PUT IN PLACE

12. Secure the filter to the suction pipe.



THE FILTER IS SECURED TO THE SUCTION PIPE

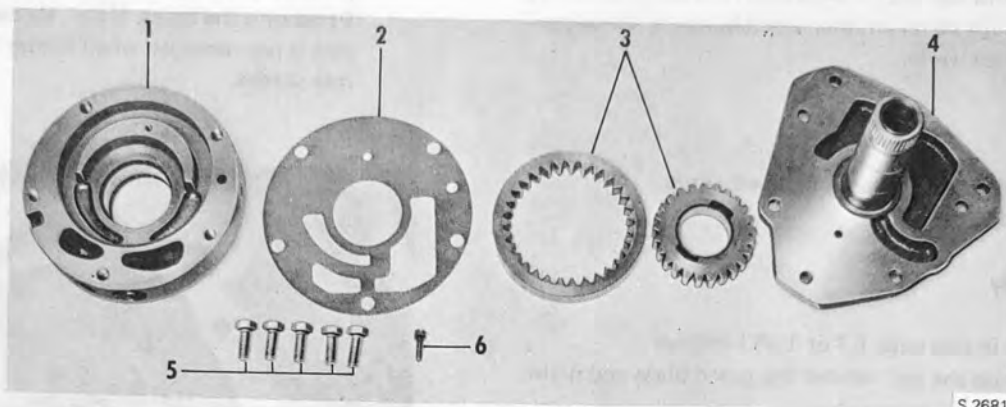
13. Check that the bottom cover is not deformed at the screw holes. If such is the case it must be straightened.
14. Fit the bottom cover with a new gasket without adhesive.



THE BOTTOM COVER IS INSTALLED

15. Screw on the guard plate.
16. Fill with oil to correct level.
17. Adjust the oil pressure with the throttle cable.

Dismantling the oil pump



S 2681

OIL PUMP DISASSEMBLED

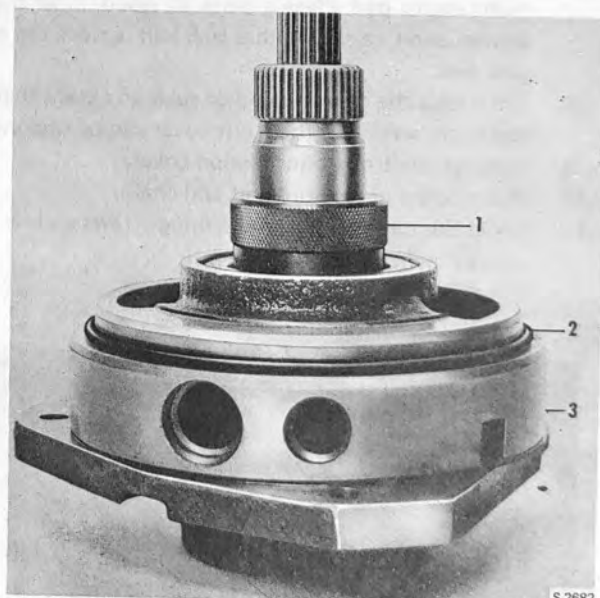
1. Pump housing
2. Back plate
3. Pump gears
4. Pump housing, front
5. Screw
6. Slotted head screw

1. Undo the five screws and the slotted head screw holding the pump housing together and separate the housing.
2. Check that the back plate is free from scratches and otherwise undamaged.
3. Mark the pump gears with a pencil or similar and remove them.
4. Check that the pump gears are free from scratches and other damage.
5. Check the bearing in the pump housing and the seal.

Assembling the oil pump

Reassemble in the reverse order. Use tool 879024 to center the pump.

Check the O-ring on the outside of the housing.



S 2682

OIL PUMP

1. Tool for centering the pump at assembling, 879024
2. O-ring
3. Housing

Changing the oil pump ball bearing

1. Remove the lock ring.
2. Tap the narrow end of the shaft gently with a plastic mallet to free the shaft with the bearing.
3. Knock off the bearing with a piece of tubing of 1.46" (37 mm) inner diameter and 5.9" (150 mm) long.
4. Reassemble in the reverse order.

Changing the oil pump seal ring

Remove the seal with a screwdriver. Fit the new seal using tool 879016.

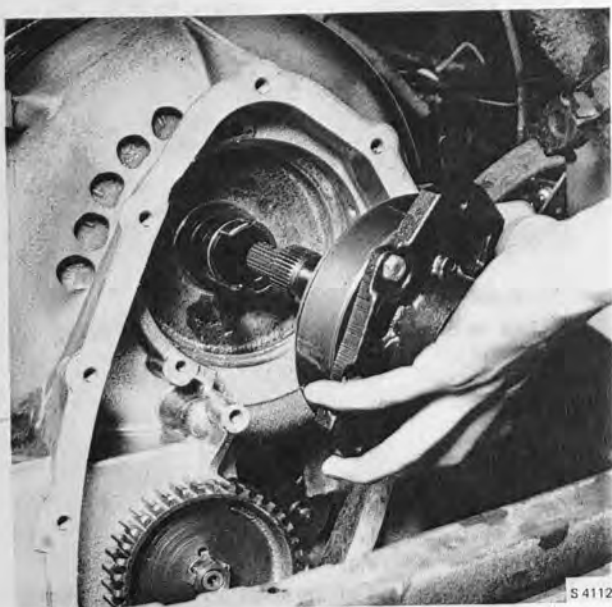
Note that this seal has to withstand the system pressure; thus care must be taken when assembling the oil pump and torque converter.

Disassembling and assembling the oil pump (Transmission in car)

Disassembly

Valid only in cars with 1,7 or 1,85 l engines

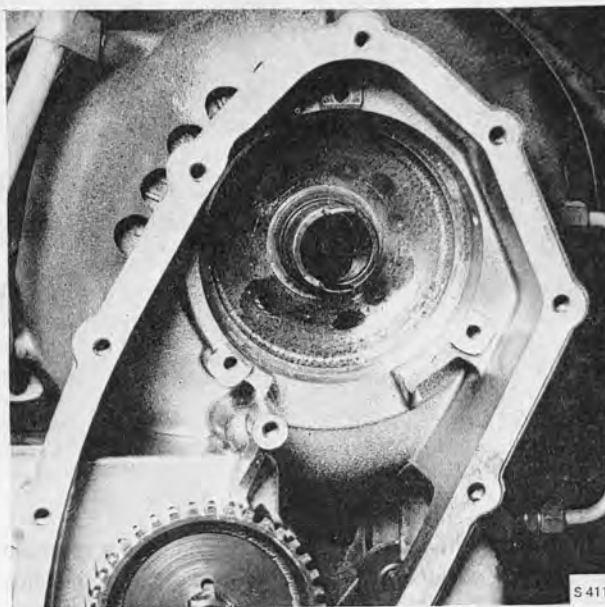
1. Jack up the car, remove the guard plate and drain the oil.
2. Remove the front bottom cover and disassemble all the oil pipes. Undo the throttle wire.
3. Undo the three valve housing retaining screws and remove the valve housing. Disconnect the suction and pressure pipes from the oil pump.
4. Remove the hood.
5. Remove front plate and radiator.
6. Disconnect the exhaust pipe from the manifold.
7. Undo the transmission from its anchorage on the front engine pad. Place a block of wood under the transmission, raise it with a jack and remove the engine pad.
8. Then raise the transmission to such an extent that the lower screws of the front cover can be undone.
9. Remove the front transmission cover.
10. Remove the upper sprocket and chain.
11. Undo the three oil pump retaining screws and remove the oil pump.



REMOVING THE OIL PUMP

Assembly

1. Fit the oil pump. This is made easier if the torque converter forks are in a vertical position. The oil pump cog should be turned so that it can be easily fitted into the forks. Note! Be careful that the seal ring is not damaged when fitting the oil pump into skadas.

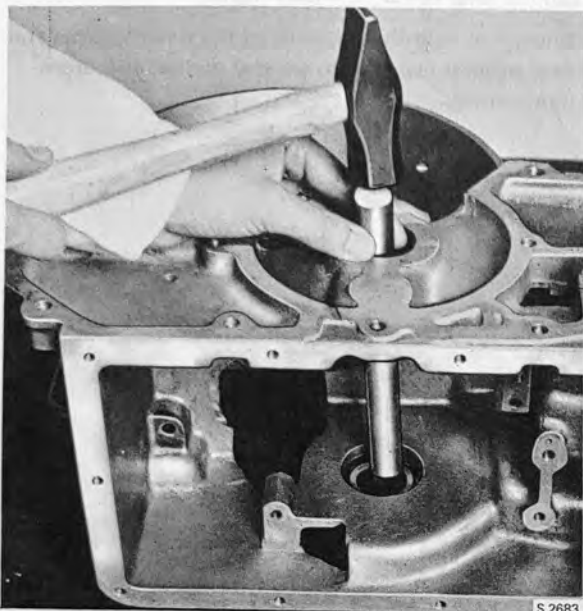


THE TORQUE CONVERTER FORKS IN VERTICAL POSITION

2. Replace the chain and sprocket and tighten the sprocket to the correct torque of 26–33 Nm (19–24 ft.lb., 2.6–3.3 kpm).
3. Fit the front cover. Use a new gasket.
4. Fit the front engine pad.
5. Lower the transmission and screw the front cover anchorage to the engine pad.
6. Connect the exhaust pipe to the manifold.
7. Replace the front plate and radiator. Fit the hood.
8. Connect the suction and pressure pipes to the oil pump.
9. Mount the valve housing. Guide both pipes into their respective holes in the valve housing. The pipes must go freely into the valve housing.
10. Screw on the valve housing. Make sure that the gear-selector valve operating link is correctly fitted.
11. Connect the throttle cable. Make sure that the cable is seated on its pulley.
12. Connect the pipes to the valve housing.
13. Connect the filter to the suction pipes No. 11 and 12.
14. Fit the bottom cover and check that it is not deformed. If such is the case it must be straightened.
15. Screw on the guard plate.
16. Fill oil and coolant.

Changing the bearing in the torque converter housing

1. Remove the lock ring.



REMOVING THE BEARING IN THE TORQUE CONVERTER HOUSING

2. Pull out the bearing using a drift.
3. Reassemble in the reverse order using tool 879016.



INSTALLING THE BEARING IN THE TORQUE CONVERTER HOUSING

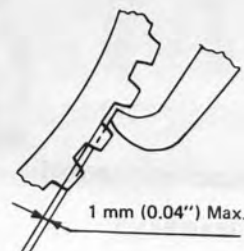
Sleeve 879016

Parking pawl

In order to ensure the functioning of the parking pawl it has been necessary to provide two gear selector rods, one of which is 0.1" (2.5 mm) longer than the other. Variations in length due to assembly tolerances can thus be eliminated. Both rods can be identified as the longer one is grooved, see illustration. When fitting, make the following checks:

A. Short rod (without groove)

Fit the rod and move it to gear selector position P. Press the rod forward towards the torque converter so that the play on the rod is eliminated. Measure the distance between the tooth of the parking pawl and the bottom of the clearing between the teeth of the ring gear where the pawl engages. If this measurement is greater than 0.04" (1 mm), the longer rod must be fitted.

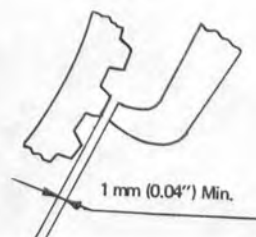
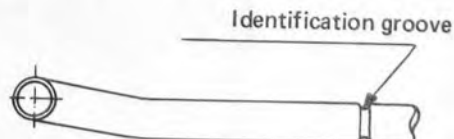


S 4114

SHORT ROD (WITHOUT GROOVE)

B. Long rod (with groove)

Fit the rod and move it to gear selector position R. Press the rod backward (towards the final drive) so that the play on the rod is eliminated. Measure the distance between the tooth of the parking pawl and the nearest tooth crown on the ring gear. If this measurement is less than 0.04" (1 mm), the shorter rod must be fitted.



S 4115

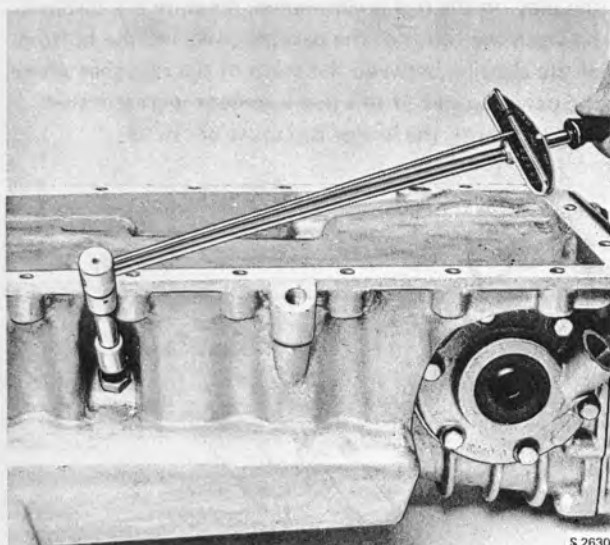
LONG ROD (WITH GROOVE)

ADJUSTMENT

Adjusting the rear band

The rear band adjusting screw is located outside the transmission casing on the left-hand side.

1. Slacken the lock nut a few turns.
2. Tighten the adjusting screw to the prescribed torque 13–14 Nm (10 ft.lb., 1.3–1.4 kpm), using tool No. 879011 (square socket). Then back off 3/4 turn.
3. Hold the adjusting screw in that position and tighten the lock nut.

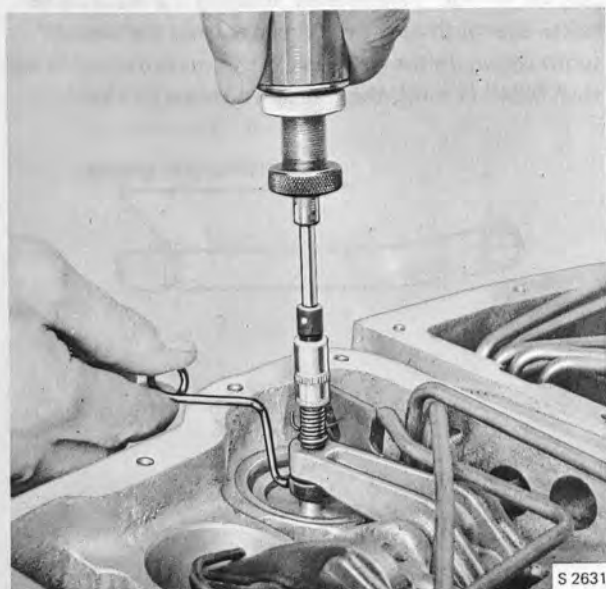


ADJUSTING THE REAR BAND

Tool 879011

Adjusting the front band

1. Place the spacer 879007 1/4" (6.35 mm) between the adjusting screw and the boss on the piston.

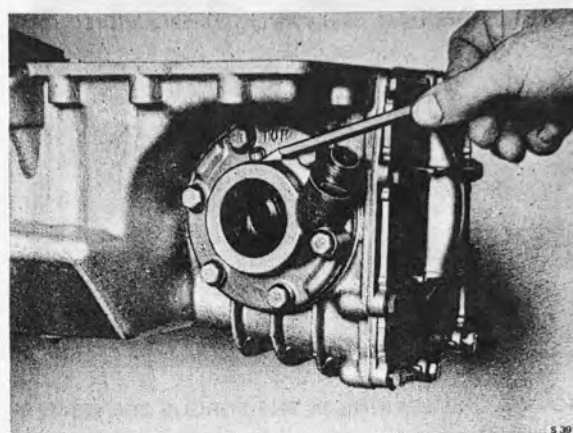


ADJUSTING THE FRONT BAND

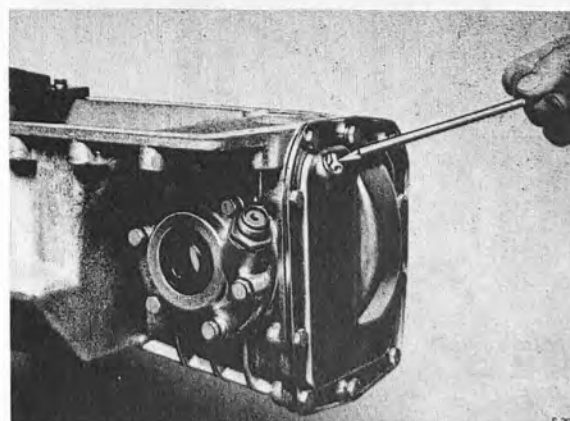
Tools 879007, 879006 and 879013

2. Tighten the adjusting screw to a torque 1.3 Nm (10 in.lb., 12 kpcm) and tighten the lock nut.
3. Transmissions with self-adjusting mechanism:
Check that the gap between the self-adjusting spring and the lever is 1.5–2 thread flights.

In connection with the adjusting of the throttle cable and the gear selector lever cable, see also section 444, transmission control.



DIFFERENTIAL BLEEDER, EARLIER DESIGN

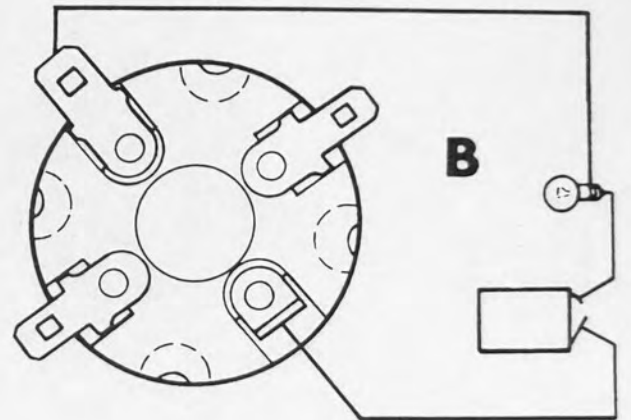
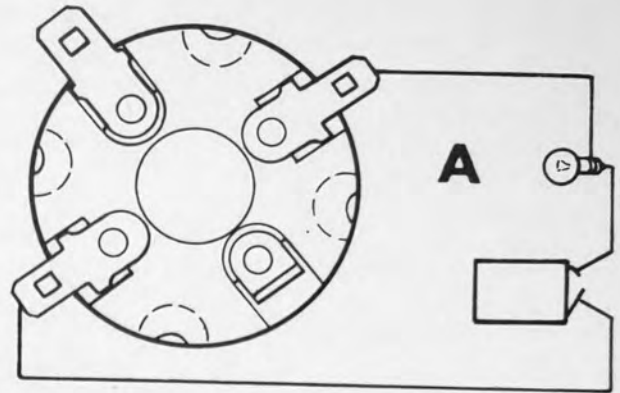


DIFFERENTIAL BLEEDER, LATER DESIGN

Adjusting the contact for back-up lights and starter

Disconnect the cable. The wide terminals are for reversing lights and the narrow ones for starter motor.

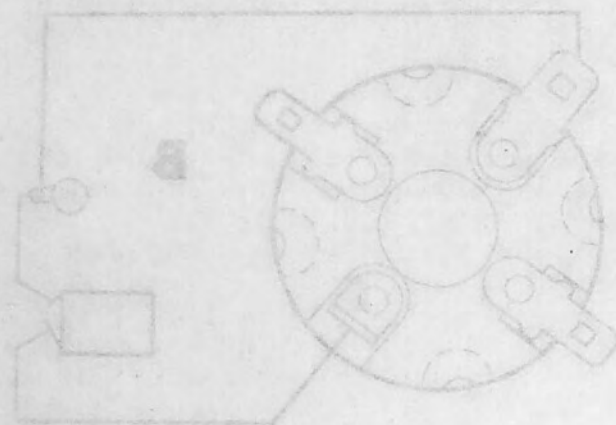
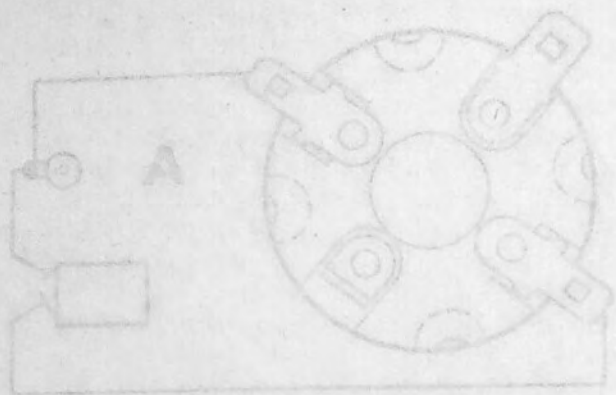
1. With the selector lever at D and the inhibitor switch screwed out, connect a test lamp between the narrow terminals (starter motor) via a battery. The lamp should light up.
2. Screw in the inhibitor switch until the lamp goes out. Mark the position on both the inhibitor switch and the transmission. Move the test lamp to the wide (reversing light) terminals and screw in the inhibitor switch until the lamp lights up again. Count the number of turns between these two positions, and back off to a point half-way between them.
3. Secure the lock nut with tool 879012 tightening to the correct torque. NOTE: If the inhibitor switch is locked too hard, it may be damaged.



S 2632

ADJUSTING THE CONTACT FOR BACK-UP LIGHTS AND STARTER MOTOR

- A. Lamp connected to the starter motor switch
B. Lamp connected to the back-up light switch



ADJUSTING THE CONTACT FOR BACK-UP LIGHTS AND STARTER MOTOR

A. Lamp connected to the starter motor switch
B. Lamp connected to the back-up light switch

1. Disconnect the cable. The wide terminal is for running lights and the narrow one for starter motor.
2. With the indicator lever at 0 and the inhibitor switch screwed out, connect a test lamp between the narrow terminal (starter motor) via a battery. The lamp should light up.
3. Screw in the inhibitor switch until the lamp goes out. Mark the position on both the inhibitor switch and the transmission. Move the test lamp to the wide terminal (running lights) and screw in the inhibitor switch until the lamp lights up again. Count the number of turns between these two positions, and back off to a point half-way between them.
4. Secure the lock nut with tool 878012 tightening to the correct torque. NOTE: If the inhibitor switch is locked too hard, it may be damaged.

DIFFERENTIAL AND PINION/CROWN WHEEL GEAR

General

The crown wheel and pinion are a matched pair, so if one is exchanged the other must be exchanged too. The parts are tested together for noise and the optimum setting for minimum noise output is measured. The key measurements as far as the pinion and crown wheel are concerned are firstly the distance from the end face of the pinion to the center of the crown wheel, and secondly the backlash between the teeth. These measurements and the mating number are stamped into both parts at the time of noise testing. When the pinion and crown wheel are installed, these measurements must be accurately adjusted with shims and a special measuring instrument. The pinion gear shims are placed next to the bearing housing of the pinion shaft bearings, and the crown wheel (differential) shims are distributed between the two differential bearing seats.

Adjusting the position of the pinion gear

General

Data for adjustment of the distance from the pinion gear to the center of the crown wheel are stamped into the end face of the pinion (an example is illustrated below).



END FACE OF PINION

- +3 = measurement for pinion setting
- R 913 = mating number, also stamped on crown wheel
- 0 = pinion not offset — shaft centerline intersects crown wheel centerline (all pinions are marked 0 and this datum has no relevance to the adjustment)

IMPORTANT

Before disassembling the transmission, always measure the positions of the pinion and crown wheel. This provides a check on whether the setting may have been wrong. If the pinion shaft and crown wheel assembly has done less than 6,000 miles (10,000 km), the setting can be adjusted, but after longer mileage, when the gears will have worn themselves into a certain position, the parts should be reassembled with the same settings as were measured prior to disassembly.

Before measuring

The following preparations must be made prior to measuring the pinion gear setting:
With reference to manual transmissions up to and includ-

ing chassis No. 99722003498 and transmissions with collapsible spacers starting from chassis No. 99722003499, the following is applicable:

The pinion shaft bearings must be compressed until the torque required to rotate the pinion shaft in the housing is 1.8 ± 0.5 Nm (16 ± 4 in.lb., 18 ± 5 kpcm), corresponding to a dynamometer reading of 31.4–56.0 N (7–12.5 lb., 3.2–5.7 kp). These figures apply to new, lightly oiled bearings that have done more than 1,200 miles (2,000 km) the torque should be 0.9 ± 0.5 Nm (8 ± 4 in.lb., 9 ± 5 kpcm), corresponding to a dynamometer reading of 10–34 N (2.2–7.7 lb., 1.0–3.5 kp).

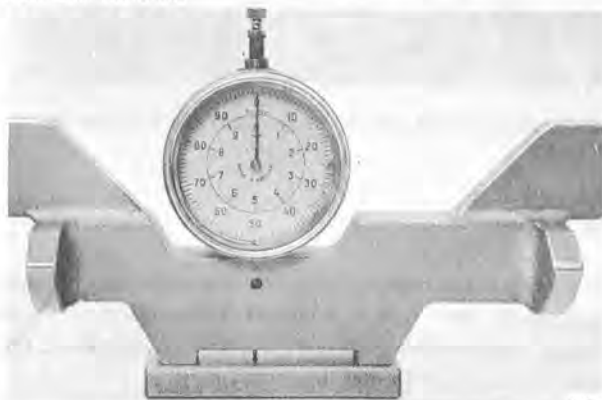
In the case of manual transmissions as from chassis No. 99722003499 with solid spacers the following is applicable:

The pinion shaft nut must be tightened to 150–200 Nm (110–150 ft.lb., 15–20 kpm). The torque required to rotate the pinion shaft in the housing must be 2.5 ± 0.5 Nm (22 ± 4 in.lb., 25 ± 5 kpcm), corresponding to a dynamometer reading of 48–71 N (10.4–15.4 lb., 4.7–7.0 kp). These figures apply to new, lightly oiled bearings. For bearings that have done more than 1,200 miles (2,000 km) the torque should be 1.3 ± 0.5 Nm (11.6 ± 4.4 in.lb., 13 ± 5 kpcm), corresponding to a dynamometer reading of 19–43 N (4.2–9.5 lb., 1.9–4.3 kp).

In the case of automatic transmissions the following is applicable:

The pinion shaft nut must be tightened to 245–265 Nm (180–200 ft.lb., 25–27 kpm). The torque required to rotate the pinion shaft in the housing must be 1.8–3.0 Nm (16–26 in.lb., 18–30 kpcm), corresponding to a dynamometer reading of 27–46 N (5.9–10.1 lb., 2.7–4.6 kp). These figures refer to new, lightly oiled bearings. For bearings that have done more than 1,200 miles (2,000 km) the torque should be 0.9–1.5 Nm (8–13 in.lb., 9–15 kpcm), corresponding to a dynamometer reading of 15–24 N (3.3–5.3 lb., 1.5–2.4 kp).

The differential unit must be removed to permit installation of the measuring instrument (tool 839015), which consists of a measuring jig with attached indicator dial 784062. A ground gauge block is provided for calibration of the dial; the block is laid against the calibration stops of the instrument, and the distance between these stops and the centerline of the tool is exactly 2.362" (60.000 mm), equal to the distance from the end face of the pinion shaft to the center of the crown wheel (see illustration). The procedure for measuring the pinion gear position is as follows:

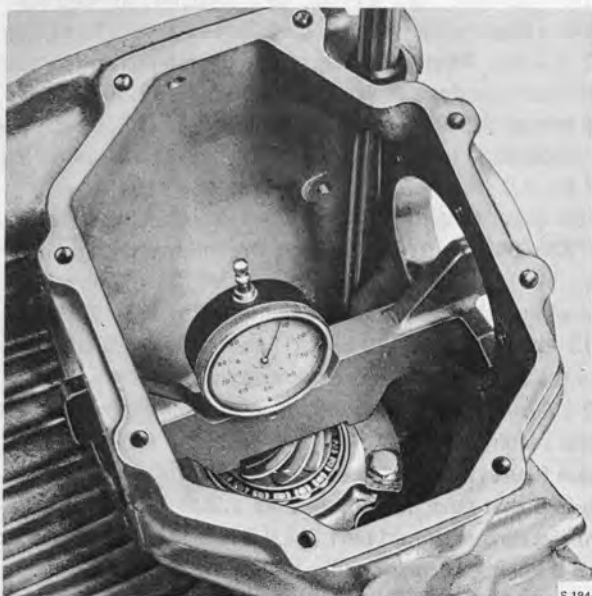


CALIBRATING THE INSTRUMENT DIAL

Measuring instrument 839015 and instrument dial 784062

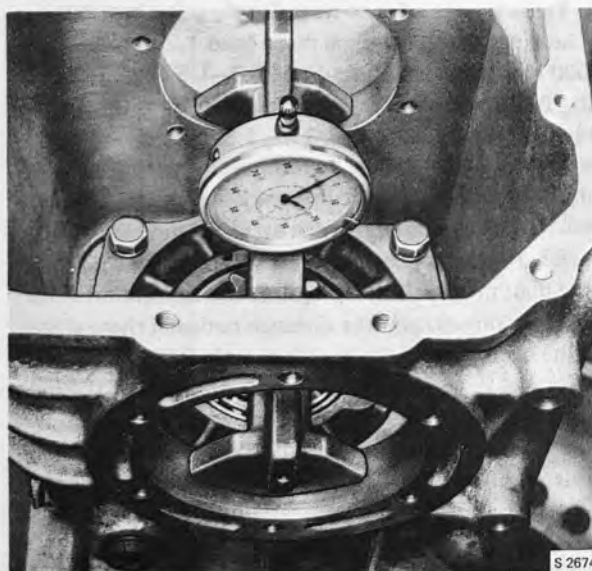
Measuring

1. Check that the pointers of the instrument are zeroed when the measuring point touches the gauge block (see illustration).
2. Place the instrument in the differential housing with the point applied to the flat end of the pinion gear and take a reading (see illustration).



MEASURING TOOL LOCATED IN DIFFERENTIAL BEARING OPENINGS, MANUAL TRANSMISSION

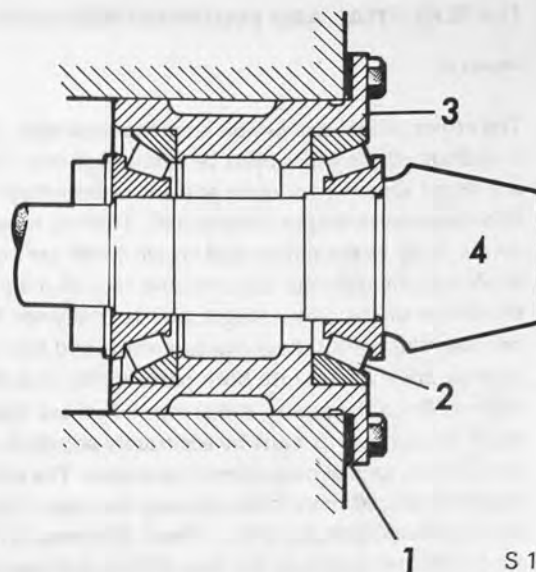
3. When the pinion gear is correctly positioned, the dial should show the number of hundredths of a millimeter (+ or -) stamped into the pinion with a permitted tolerance of ± 0.05 mm.



MEASURING TOOL LOCATED IN AUTOMATIC TRANSMISSION

Shimming

If the measured reading is outside the permitted tolerance, the pinion shaft must be adjusted. This is done with shims placed between the pinion shaft bearing housing and the transmission case (see illustration).



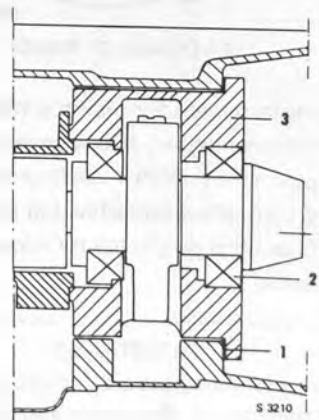
S 1845

ADJUSTING THE PINION GEAR, MANUAL TRANSMISSION

1. Shim
2. Roller bearing
3. Bearing housing
4. Pinion

SHIM TABLE, MANUAL TRANSMISSION

Location	Shims	
	Thickness mm	Spare part No.
Pinion shaft between bearing housing and transmission case	0.10	834175
	0.15	834176
	0.30	834177
	0.50	834472



S 3210

ADJUSTING THE PINION GEAR, AUTOMATIC TRANSMISSION

1. Shims
2. Roller bearing
3. Bearing housing
4. Pinion gear

SHIM TABLE, AUTOMATIC TRANSMISSION

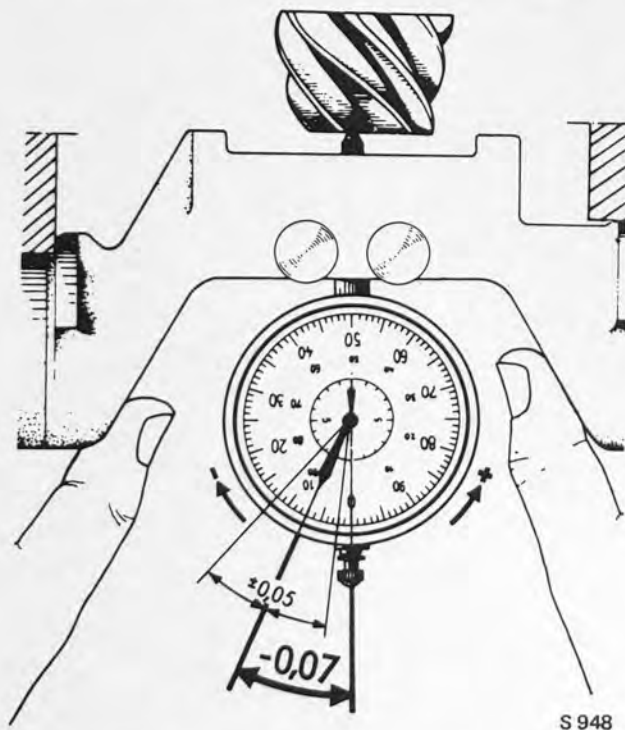
Location	Shims	
	Thickness mm	Spare part No.
Pinion shaft between bearing housing and transmission case	0.10	870748
	0.15	870749
	0.30	870750

Procedure for shimming is as follows:

1. Undo the four screws from the pinion shaft bearing housing and tap the pinion shaft gently out of the transmission case.
2. Change the shimming according to the following rules:
 - a) If the dial reading is higher than the correct value, increase the shim combination.
 - b) If the dial reading is lower than the correct value, reduce the shim combination.

NOTE! + reads clockwise and - reads counter-clockwise on the dial.

Reduce or increase the shim combination by the difference between the measured and correct values.



If the pinion is stamped -7, the pointers should indicate -0.07 mm. A deviation of ± 0.05 mm from this reading is permitted.

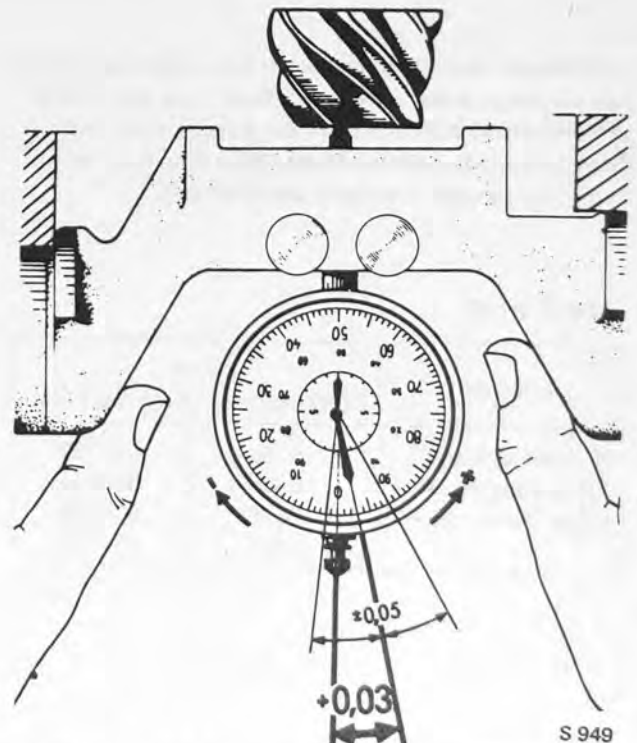
Checking the measuring jig

The measuring jig is a precision-made tool. It should be handled with care to avoid knocks and deformation. If there is reason to suspect that the jig may have been damaged in such a way that it gives wrong readings, it can be measured as a check. The dimension indicated in the illustration on the right should be measured for this purpose.

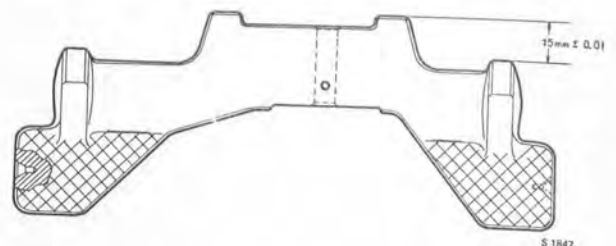
3. Having selected the correct combination of shims, place them in the transmission case with aid of the locating pins 839016. Mount the pinion shaft to the transmission case using sleeve 839014 and arbor 839011. Remove the locating pins and tighten the screws to the prescribed torque and lock them with Loc-tite.

Rechecking

After shimming, replace the measuring jig in the differential housing and check that the dial now gives the correct reading to within ± 0.05 mm. If it does not, the shimming procedure must be gone through again.



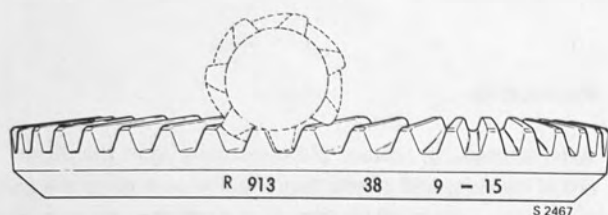
If the pinion is stamped +3, the pointers should indicate +0.03 mm. A deviation of ± 0.05 mm from this reading is permitted.



CHECKING THE JIG

Adjusting crown wheel backlash, manual and automatic transmission

Certain data for adjustment of crown wheel backlash are stamped into the crown wheel as illustrated below.



CROWN WHEEL MARKINGS

- 38 = No. of teeth on crown wheel
- 9 = No. of teeth on pinion
- 15 = backlash 0.15 mm
- R 913 = mating number, also stamped on pinion

The backlash should be checked at four points round the circumference of the crown wheel and must not deviate by more than ± 0.05 mm from the stated measurement. Crown wheel backlash is adjusted with shims. Up to four shims may be used in suitable combinations.

TABLE SHIMS

Location	Shims	
	Thickness mm	Spare part No.
Between differential bearing seat and transmission case	0.10	834160
	0.15	834161
	0.30	834162
	0.50	834163

Measuring and shimming automatic transmission, and manual transmission as from transmission serial No. 4007

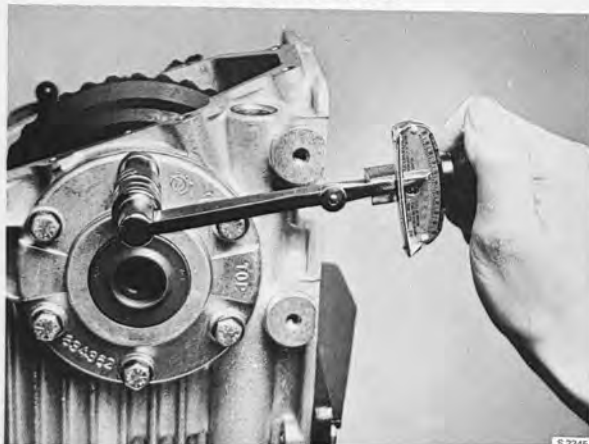
A new bearing seat has been introduced for the differential in manual transmissions with serial numbers 4007 and higher. This means that the journal bearings must be adjusted with shims.

Adjustment of differential bearings

NOTE

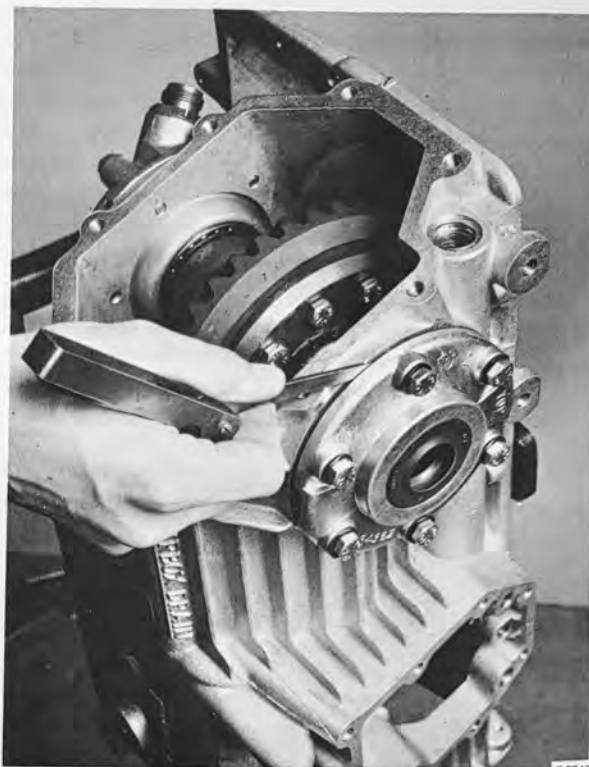
Adjustment must be done before the pinion shaft is mounted.

1. Place the differential assembly complete with crown wheel in the transmission case.
2. Mount the left bearing seat (the one with the speedometer drive) without shims and tighten the screws to the prescribed torque of 20–25 Nm (14–18 ft.lb., 2.0–2.5 kpm).
3. Oil the differential bearings and mount the right bearing seat, tightening the screws in two or three stages to 2.2 Nm (20 in.lb., about 22 kpcm). Rotate the differential while tightening the screws.



TIGHTENING THE RIGHT BEARING SEAT

4. Measure the gap between the transmission case and bearing seat with a feeler gauge at two points opposite each other and take an average of the two measurements. Then select shims corresponding to this result plus an increment of 0.20 mm to obtain the correct bearing compression.



MEASURING BEARING SEAT GAP

NOTE

The method described above applies to both new and old bearings.

The compression obtained in this way corresponds to a friction torque of 1.8 ± 0.5 Nm (16 ± 4.5 in.lb., 18 ± 5 kpcm) on the differential. If a line is wound round the widest part of the differential and a dynamometer attached, the following readings should be obtained:

New, lightly oiled bearings 31–56 N (7–12.5 lb., 3.2–5.7 kp)
Bearings that have done more than 1,200 miles (2,000 km) 10–34 N (2.5–7.7 lb., 1.0–3.5 kp).

Shims of four different thicknesses can be suitably combined. The available thicknesses are shown in the table below

TABLE SHIMS, MANUAL AND AUTOMATIC TRANSMISSION

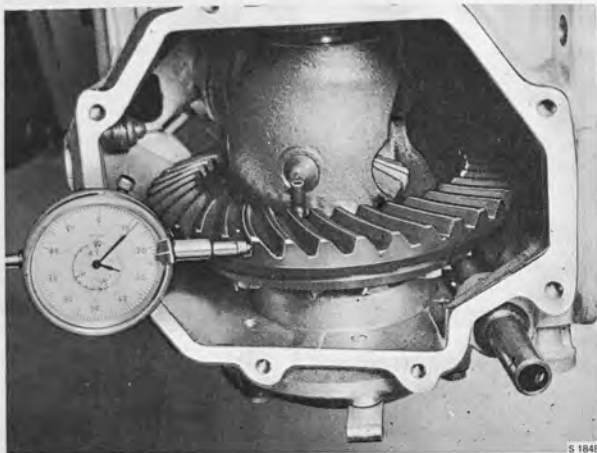
Location	Shims	
	Thickness mm	Spare part No.
Between differential bearing seat and transmission case	0.10	834160
	0.15	834161
	0.30	834162
	0.50	834163

NOTE

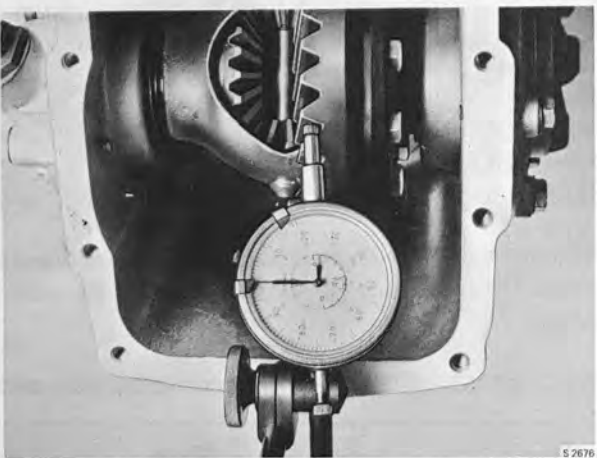
The resulting set of shims should then be distributed between the right and left sides to give the correct gear backlash.

Adjusting crown wheel gear backlash

1. Place the differential assembly complete with crown wheel in the transmission case.
2. Mount the left bearing seat (the one with the speedometer drive) without shims and the right bearing seat with the selected set of shims, tightening the screws to the prescribed torque of 20–25 Nm (14–18 ft.lb., 2.0–2.5 kpm).
3. Fit a special fixture in one of the holes for the differential housing cover and install instrument dial 784062. Use fixture 839028 for manual transmission and fixture 879006 for automatic transmission.



MEASURING GEAR BACKLASH, MANUAL TRANSMISSION
Tools 784062 and 839028



MEASURING GEAR BACKLASH, AUTOMATIC TRANSMISSION

Tools 784062 and 879006

4. Calculate the difference between the measured backlash and the desired gear backlash, and then move shims of suitable thickness over to the left bearing seat. Measure again afterwards as a check.

NOTE

The preselected set of shims must be used for adjusting the backlash. The total thickness of the set must not be altered.

Differential, manual and automatic transmission

Removing

To exchange parts inside the differential assembly it is only necessary to unscrew the two long crown wheel screws that locate the differential gear shaft, see illustration. The shaft and gears can then be taken out without removing the differential assembly.



DIFFERENTIAL ASSEMBLY

1. Remove the universal joints and the rear cover of the differential housing.
2. Take off the two differential bearing seats and lift out the differential assembly, saving the spacers and shims.
3. If necessary, press the outer bearing rings out of the bearing seats using washer 839029 and drift 839018. Remove the speedometer drive and press both journal bearings off the differential housing using tools 899518, 899525 and 899517.



S 1851

REMOVING DIFFERENTIAL JOURNAL BEARINGS
Puller 899518, 899525, wheel nuts 890914

4. Remove the crown wheel screws and take off the crown wheel.
5. Push out the differential gear shaft.
6. Remove the gears from the differential casing and take the springs out of the gears. As from gear box No. 500.001 also the wear washers are to be removed.

Assembling

IMPORTANT

If the crown wheel is exchanged, the pinion gear must be exchanged with it, as these two parts are individually matched.

1. Exchange worn or damaged parts.
2. Mount the springs in the two bigger gears.
3. Locate the gears and wear washers if any in the differential casing and slide in the differential shaft. As from gear box No. 500.001: Fit the lock rings on the shaft.



S 38904

WEAR WASHERS

4. Mount the crown wheel and tighten the screws to 25 Nm (18 ft.lb., 2.5 kpm) torque. Note that the two longer screws also serve to locate the differential shaft axially. (Valid for gear boxes with serial numbers below 500.000.)
5. Transmissions with serial numbers below 500.000: lock the crown wheel screws with lock washers. Transmission with serial numbers over 500.000: use Loctite stud lock" to lock the crown wheel screws. Press on the journal bearings and the speedometer drive, if these have been previously removed, using tool 879048.



S 3410

PRESSING ON THE DIFFERENTIAL JOURNAL BEARINGS

6. Locate the differential assembly in the transmission case. If any part affecting the overall width of the differential assembly — e.g. the bearings — has been exchanged, the crown wheel backlash must be adjusted. This is done by alteration of the combination of shims. See section "Adjusting crown wheel gear backlash".
7. Press the outer bearing rings into the bearing seats using tool 839031 and change the shaft seals if necessary. Use tool 839032. Mount the bearing seats on the transmission case and tighten the screws to the prescribed torque.



S 2468

SEATING THE OUTER BEARING RINGS

Tools 839031 and 839032

8. Mount the rear cover of the differential housing and both universal joints.

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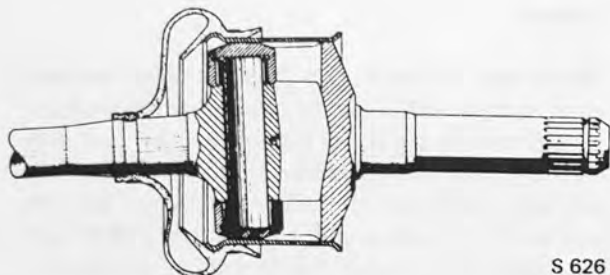
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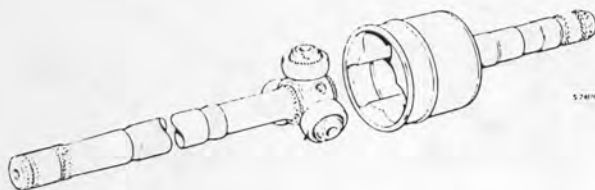
UNIVERSAL JOINTS

Inner universal joint

The inner universal joint consists of a driver journaled in the differential housing and splined into the differential side gear. It is locked to the differential side gear by a resilient lock ring fitting into a groove inside the side gear. When the driver is inserted or withdrawn, the ring expands into its groove.



INNER UNIVERSAL JOINT, UP TO MODEL 1969



INNER UNIVERSAL JOINT, AS FROM MODEL 1970

The outer end of the driver takes the form of a fork in which the drive shaft is journaled in needle bearings (see illustrations). When the car is in motion, the drive shaft can slide axially as well as being jointed. The joint is packed with grease and shielded by a rubber bellows. Lubrication is needed only when the joint is reconditioned or removed for some other reason. Saab Special chassis grease must be used.

Removing

1. Jack up the front of the car and take off the wheel.
2. Remove the brake housing and hang it up by the wheel housing to avoid strain and damage to the brake hose; then remove the brake disc and parking brake assembly with cable.

3. Undo the large clamp from the rubber bellows on the inner universal joint.

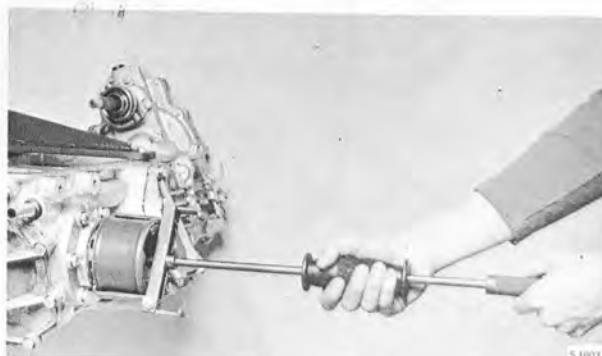
To separate the inner universal joint, fit protection covers in the rubber bellows and on the inner driver. Universal joints, earlier design: Use cover 732373 in the rubber bellows and 783846 on the driver.

Universal joints, later design: Use cover 834458 in the rubber bellows and 891696 on the driver.



REMOVING THE STEERING ARM
Tool No. 899540

4. Disconnect the tie rod from the steering arm using tool 899540 and undo the nut on the upper ball joint. Remove the screws from the lower control arm bracket.
5. Pull out the drive shaft through the wheel housing and remove the entire front axle assembly.
6. Disconnect the driver from the transmission with aid of tapping hammer 839027 and puller 839147 alt. 879035 depending on shaft design.



REMOVING THE INNER DRIVER
Tools 839027 and 839147

7. If the rubber bellows on the inner or outer universal joint needs renewing, detach the shaft from the outer joint (see "Outer universal joints"). The rubber bellows can then be slipped off the shaft.

Mounting

1. Make sure that the inner driver is washed clean, and then pack the needle bearing seats with Saab Special chassis grease. The right amount will be obtained if the driver is filled with grease.
2. Mount the inner driver by pushing it into the differential housing. Make sure that the lock ring in the differential side gear engages properly.
3. Slip the rubber bellows over the drive shaft and mount the shaft and rubber bellows to the outer universal joint (see "Outer universal joints").
4. Pack the needle bearings with Saab Special chassis grease and fit the bearings over the tee ends of the drive shaft. Mount protection cover in the rubber bellows to protect the bearings and prevent them from falling off. Then insert the shaft complete with rubber bellows through the wheel housing.
5. Take the cover out of the rubber bellows and slide the drive shaft complete with needle bearings into the inner driver. Locate the rubber bellows and put on the clamps.
6. Mount the steering knuckle housing and steering arm.
7. Mount the parking brake assembly with handbrake wire, the brake disc and the brake housing.
8. Mount the wheel and lower the front of the car.

IMPORTANT

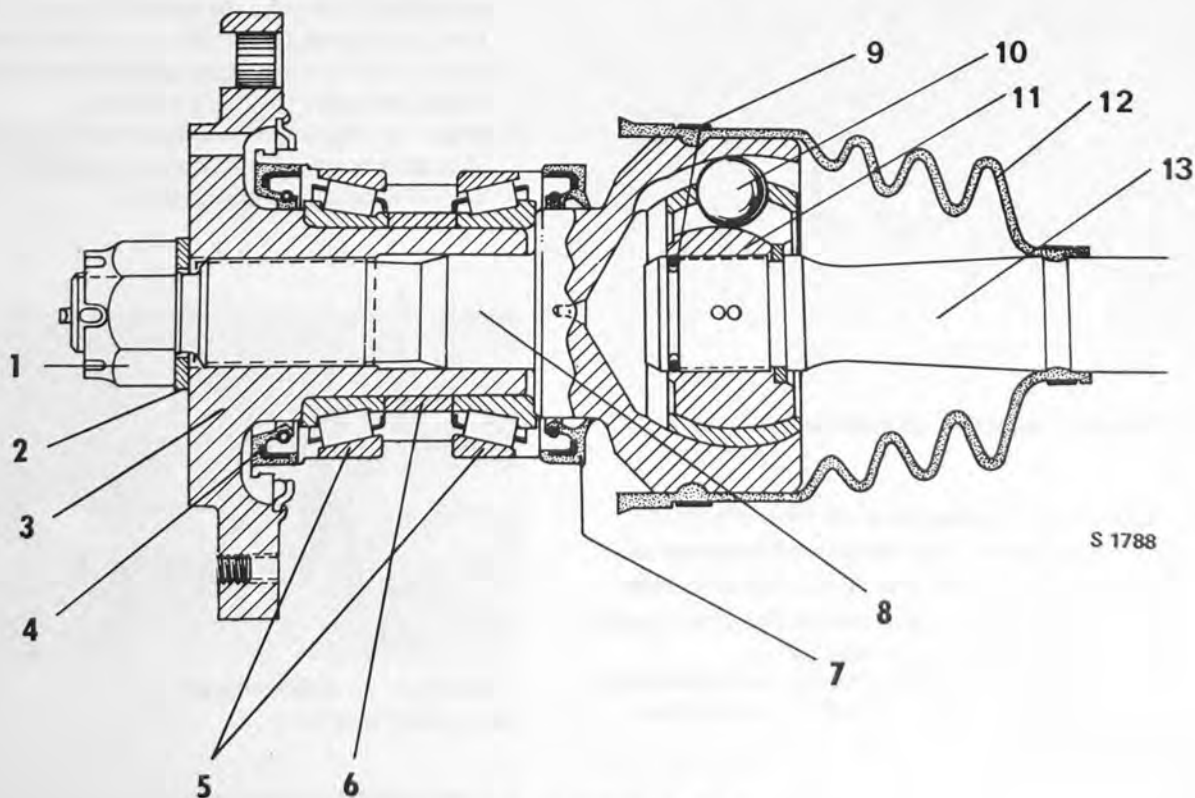
After the brake housing has been mounted the brake pads must be advanced to their correct positions close to the disc by repeated pumping of the foot-brake pedal. Otherwise the footbrake will not work.

Outer universal joints

General

On the outer universal joints the outer drive shaft terminates in a bell with a spherical track in which six balls transmit the driving power from a hub. The inner drive shaft is splined into the hub and located in it by a resilient lock ring. To mount the shaft in the hub, the lock ring is first compressed with a special tool 784161 and the shaft is then inserted. For removing, the shaft is knocked out of the hub with a special tool 784202. Only the complete outer drive shaft assembly, including hub, ball retainer and balls, is supplied as a replacement unit. Its component parts are individually matched and are not interchangeable.

The joint needs lubricating only in conjunction with re-conditioning or if disassembled for any other reason. Use Saab Special chassis grease.

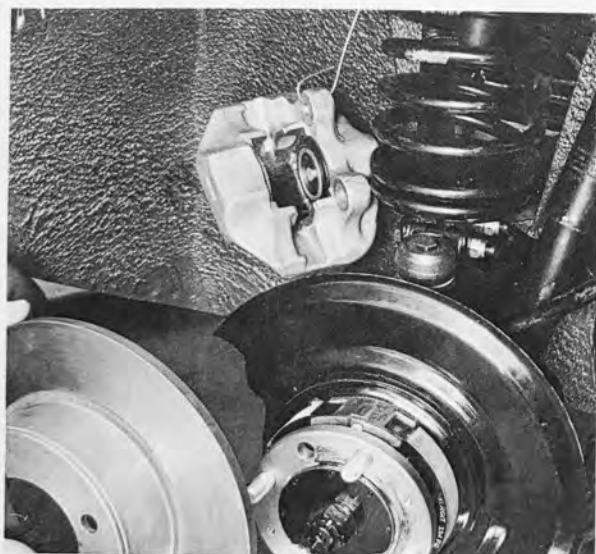


OUTER UNIVERSAL JOINT

- | | | |
|---------------------|----------------------|-----------------------|
| 1. Castle nut | 6. Spacer sleeve | 11. Hub |
| 2. Washer | 7. Inner shaft seal | 12. Rubber bellows |
| 3. Wheel hub | 8. Outer drive shaft | 13. Inner drive shaft |
| 4. Outer shaft seal | 9. Lock ring | |
| 5. Wheel bearing | 10. Ball | |

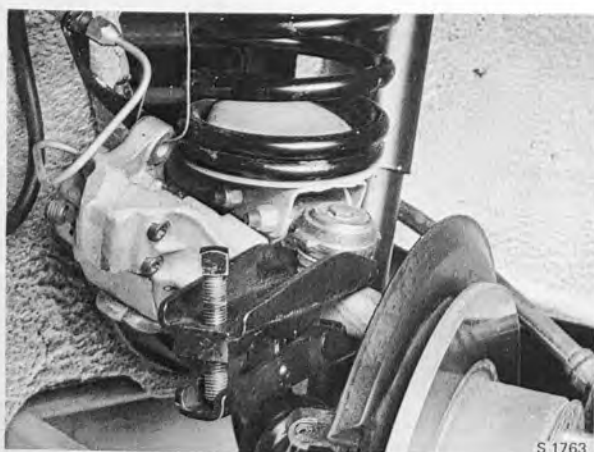
Disassembling

1. Take off the hub cap, remove the split pin and castle nut and back off the wheel nuts.
2. Block up the front end of the car and take off the wheel.
3. Take off the brake housing and hang it up to avoid damage to the brake hose. Remove the brake disc and disconnect the handbrake cable.



BRAKE HOUSING HUNG UP DURING WORK ON WHEEL

4. Undo the large clamp the rubber bellows of the inner universal joint.
5. Free the steering arm and the upper ball joint using tool 899540. Undo the screws on the lower control arm bracket.
To separate the inner universal joint, fit protection covers in the rubber bellows and on the inner driver. Universal joints, earlier design: Use cover 732373 in the rubber bellows and 783846 on the driver.



REMOVING THE UPPER BALL JOINT
Tool 899540



REMOVING THE STEERING ARM
Tool 899540

Universal joints, later design: Use cover 834458 in the rubber bellows and 891696 on the driver.

6. Pull out the drive shaft through the wheel housing and remove the entire front axle assembly, which should then be cleaned thoroughly. Take the large clamp off the outer universal joint.

IMPORTANT

Be careful not to damage the guard plate.

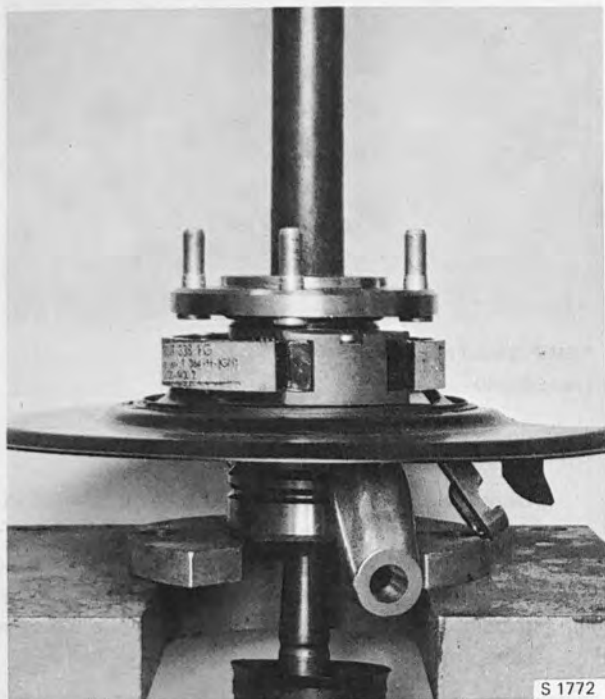
7. Pull off the wheel hub using tool 819518 and remove the outer drive shaft with the joint and inner drive shaft.



REMOVING THE WHEEL HUB
Tool 899518

Assembling

1. Mount the front axle assembly in a press. Press the outboard drive shaft into the steering knuckle housing (see illustration).



PRESSING IN THE OUTBOARD DRIVE SHAFT IN A PRESS

2. Put on the castle nut, tighten it to a torque of 196 Nm (145 ft.lb., 20 kpm) and lock it with the split pin. Pack the joint with grease, fit both clamps on the outer rubber bellows and the smaller shaft clamp on the inner rubber bellows. If the needle bearings have been removed, lubricate them with Saab Special chassis grease and mount them on the ends of the tee. Fit protection cover into the rubber bellows to protect the needle bearings and insert the drive shaft through the wheel housing. Make sure that the inner driver is clean and packed with fresh Saab Special chassis grease. Assemble the inner universal joint. Mount both ball bolts to the steering knuckle housing and tighten them to the prescribed torque. Fasten the clamp round the inner joint bellows.
3. Mount the brake disc, handbrake cable and brake housing.
4. Mount the steering arm and put on the wheel.
5. Lower the front of the car, tighten the wheel nuts securely and fit the hub cap.

CAUTION

The brake pads must be brought back to their proper position close to the disc, which is done by pumping the brake pedal repeatedly. Otherwise the brake will not work.

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520	Hydraulic footbrake system
521	Master cylinder
522	Brake lines
523	Wheel cylinders and brake housings
524	Brake control
551	Handbrake system

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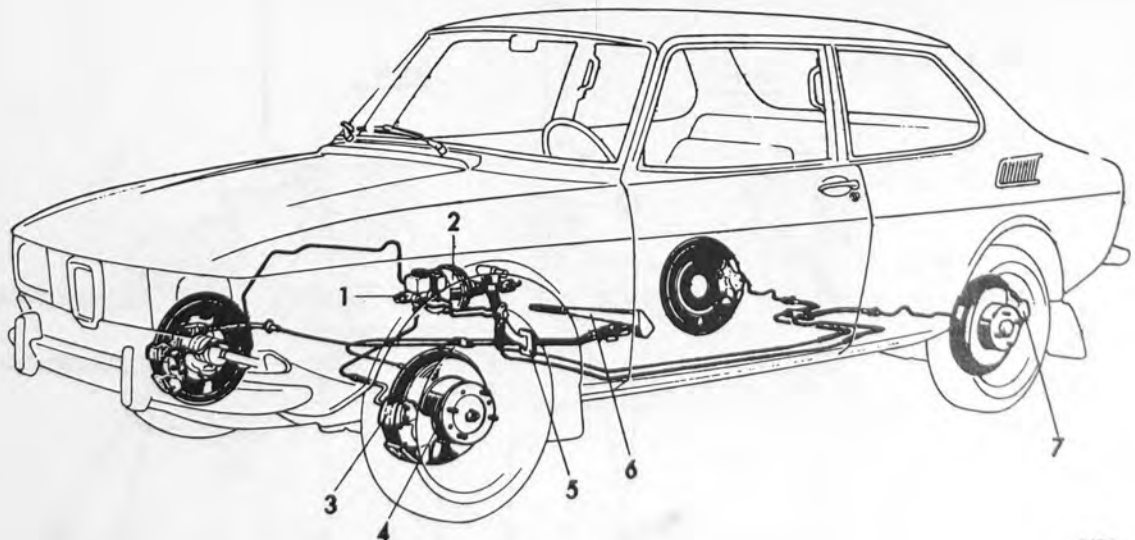
General	800
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GENERAL

The car has two mutually independent brake system: the footbrake or driving brake, which is hydraulic and acts on all four wheels, and the handbrake or parking brake, which is mechanical and acts on the front wheels through drums in the disc brake hubs.

The footbrake system has two separate circuits. The master cylinder acts simultaneously but independently on each diagonally opposed pair of wheels, i.e. right front + left back and left front + right back. Thus if the system is damaged and brake fluid leaks out, braking power will be lost on one diagonal pair of wheels only, the other pair being unaffected. A leak can be detected by abnormally long pedal travel and a tendency for the car to pull the side that still has braking power on the front wheel. The front wheel cylinders have a larger bore than the rear wheel cylinders, with the result that braking power is greater on the front wheels; this reduces the risk of the back wheels locking and skidding.

The footbrake system has a power assist from a cylinder connected to the engine inlet manifold. When the brake pedal is depressed it acts on the master cylinder via the power assist; the latter increases the pedal pressure and transmits the motion to the master cylinder. The handbrake is located between the front seats; operation of the lever is transmitted mechanically by cables. In the instrument panel there is a warning light that shows red if the handbrake is on or if the pedal goes too far down, because of brake fluid leakage.



S 1720

BRAKE SYSTEM, GENERAL LAYOUT

1. Master cylinder with brake fluid container
2. Power assist
3. Disc brake assembly, front wheel
4. Brake shoes, handbrake
5. Brake pedal
6. Handbrake lever
7. Disc brake assembly, rear wheel

Two-circuit brake system — functioning

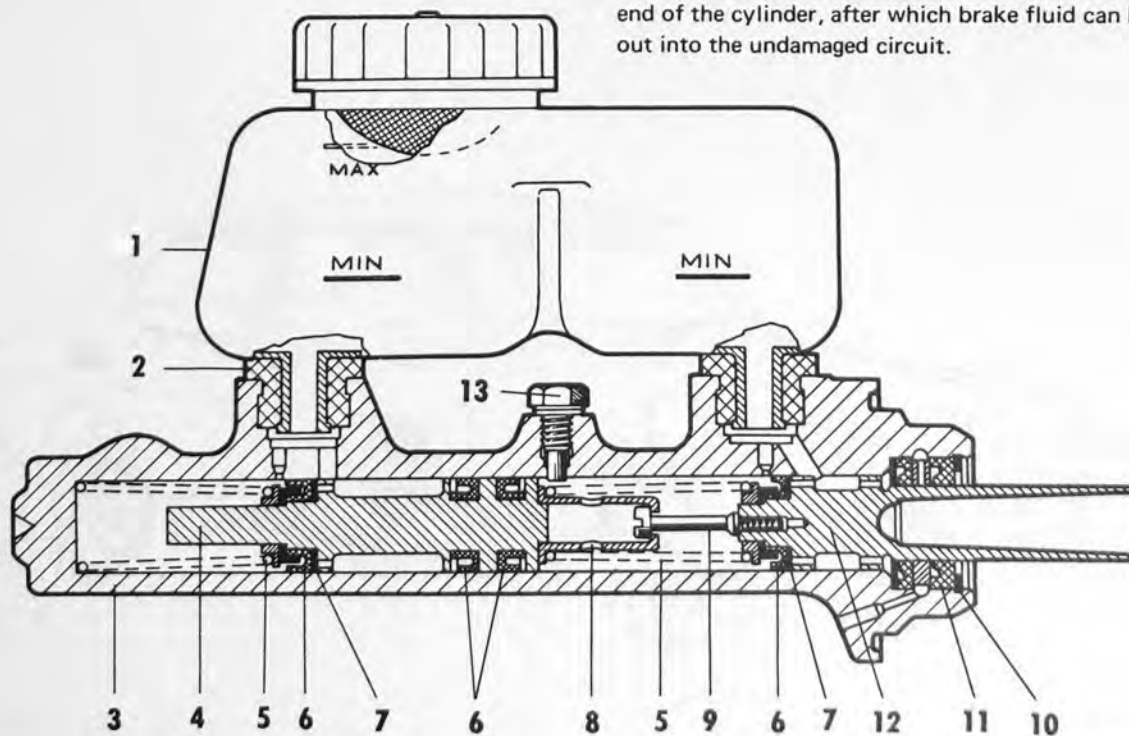
When the brake pedal is depressed, the pistons in the master cylinder generate pressure in the brake fluid. The pressure in the brake fluid is transmitted through the brake lines and hoses to the cylinders at the wheels, where the pistons force the brake pads against the discs. The master cylinder has two pistons each serving one circuit. If a leak occurs in either circuit, the piston in that circuit moves without affecting the brake pads; thus every time the brake pedal is pressed, a certain amount of fluid is pumped out of the system. However, as the fluid container is divided into two independent compartments, only one compartment can be emptied, and enough fluid remains in the other compartment to drive the car safely to the nearest workshop. As the two circuits are arranged diagonally, roughly half the normal braking power is always retained if one circuit develops a leak. This system also makes the car safer to steer because one front wheel and one rear wheel turn freely without locking.

Master cylinder

The master cylinder is of tandem type, consisting of a housing in which a primary piston and a secondary or intermediate piston are actuated by the push rod from the brake pedal. The distance between the pistons is controlled by a coil spring and a screw. The secondary piston has three seals, one at the front and two at the rear. Behind the front seal is a domed washer that prevents the seal from floating out into the filler holes in the flange of the piston. The primary piston likewise has a front seal with a domed washer and two rear seals.

The coil springs serve to return the pistons to their starting position. When at rest, the pistons are pushed backward by the spring and the channels between the fluid container and master cylinder are open. When the brake pedal is pushed down, the push rod moves the primary piston which closes the feed channel from the fluid container to the cylinder; the pressure ahead of the primary piston rises and acts to move the secondary piston, whereupon the same positive pressure is generated ahead of both pistons. The result is that brake fluid is forced out through the brake lines to the wheel cylinders and the brakes are applied.

If for example leakage occurs in the primary circuit, the primary piston spring is compressed until the primary piston works upon the secondary piston, whereupon the latter acts on the brakes in the secondary circuit. If there is a leak in the secondary circuit, the secondary piston is pushed forward by the primary piston until it strikes the end of the cylinder, after which brake fluid can be forced out into the undamaged circuit.



S 1721

SECTION THROUGH MASTER CYLINDER

- | | |
|---------------------|--------------------|
| 1. Container | 8. Sleeve |
| 2. Rubber seal | 9. Screw |
| 3. Housing | 10. Lock ring |
| 4. Secondary piston | 11. Seal ring |
| 5. Spring | 12. Primary piston |
| 6. Piston seals | 13. Screw |
| 7. Washer | |

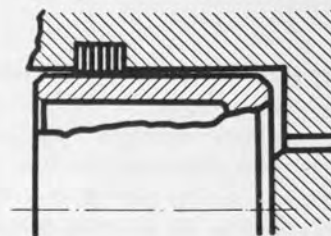
Wheel brakes

The disc brake assembly (see fig.) consists of a brake housing divided into two halves which are bolted together. Each half contains a brake cylinder, and the housing fits round the brake disc.

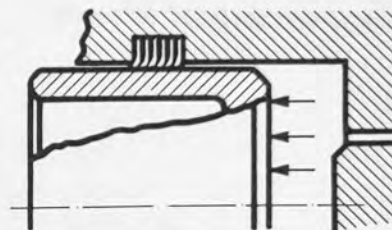
The brake assemblies on the front wheels are mounted on the steering knuckle housings, while the rear wheel brakes are attached to special fastening points on the rear axle. When the brakes are applied, the pistons push the pads against the disc. A bleeder nipple is provided at the highest point of the brake housing.

The cylinder has piston seals, which serve both to prevent brake fluid from leaking out and to return the pistons to their starting positions after braking. This return action is normally enough to prevent the pads from rubbing against the disc.

Up to and incl. model 1971, the front wheel brake pistons are provided with disc throw compensators, to prevent the pistons from going back to far after braking. However, it has shown that this device is not necessary, and it has therefore been taken away as from model 1972.



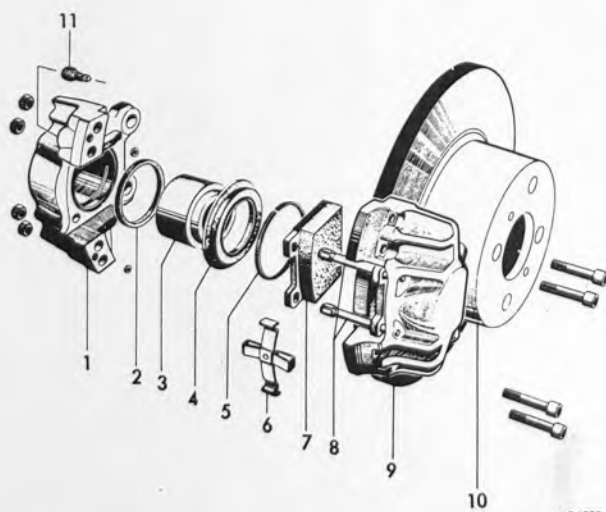
Rest position



Braking position

S 1723

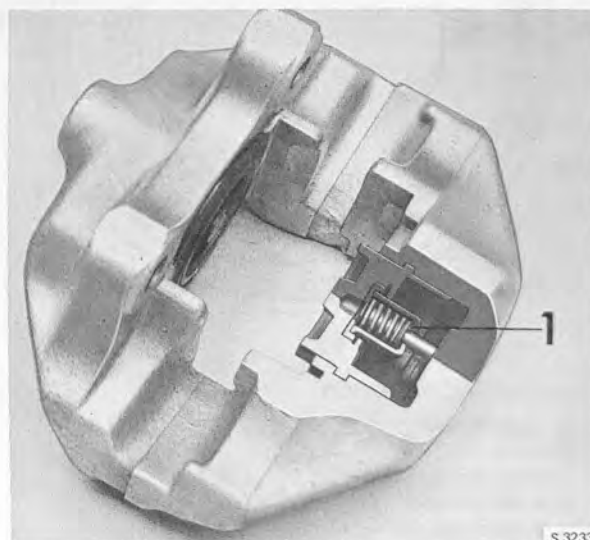
THE BRAKE PISTON IS RETURNED TO REST BY THE ACTION OF THE PISTON SEAL



S 1722

BRAKE ASSEMBLY, FRONT WHEEL

- | | |
|-----------------------|-------------------------|
| 1. Brake housing half | 7. Brake pad |
| 2. Piston seal | 8. Locking pins |
| 3. Piston | 9. Brake housing half |
| 4. Gasket | 10. Brake drum and disc |
| 5. Gasket retainer | 11. Bleeder screw |
| 6. Retaining spring | |



S 3233

BRAKE HOUSING

1. Disc throw compensator, up to and incl. model 1971

Handbrake

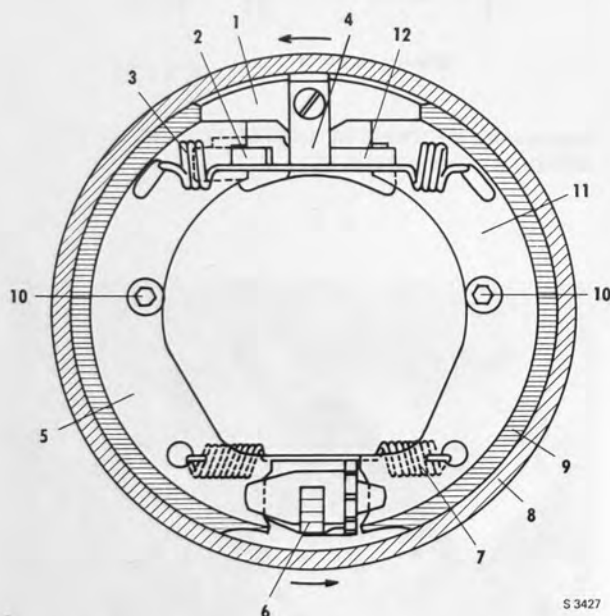
The handbrake acts on separate drums on the front wheels. The handbrake lever is located between the front seats and its action is transmitted mechanically by wires.

The upper ends of the brake shoes are held pressed against the support piece (1) by the upper tension spring (3). The lower ends are joined by the adjusting device (6) and are held against it by the lower spring (7). This form of suspension makes the brake shoes self-centering and both of them are partly self-applying. The brakes are thus of the Duo Servo type.

The brake shoes should be replaced when the thickness of the very lining is less than 0.02" (0.5 mm).

Brake cables

The brake cables are permanently lubricated and consist of steel wires in plastic coated spiral sheaths which run through grommets in the dash panel and wheel housings to the externally placed levers where the wires are connected by crosspieces and nuts. A return spring is located between the operating lever and the guard plate. The inner ends of the wires are fastened to the handbrake lever adjusting device.



HANDBRAKE, FUNCTION

1. Support piece
2. Lever
3. Upper tension spring
4. Holding spring
5. Primary brake shoe
6. Adjusting device
7. Lower tension spring
8. Brake drum
9. Brake lining
10. Compression spring and locking pin
11. Secondary brake shoe
12. Pressure rod

Vacuum power assist

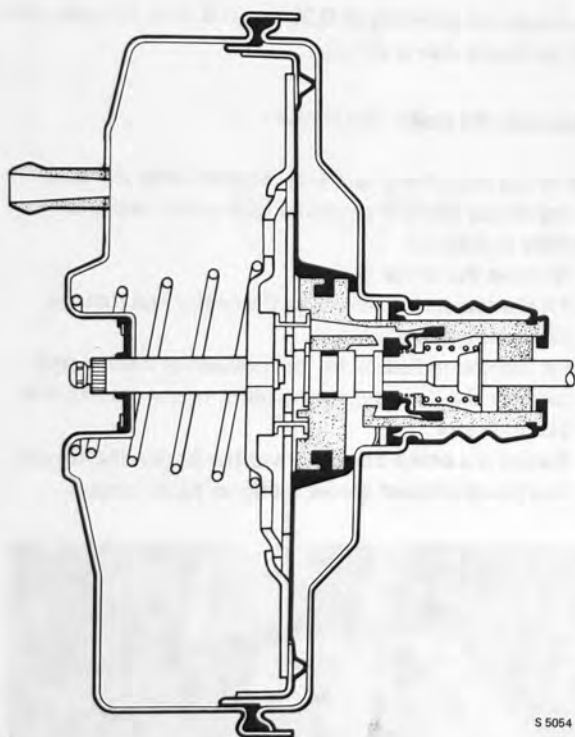
The vacuum power assist, made by Ate, consists of a vacuum cylinder worked by the brake pedal. This cylinder is connected by a hose to the engine inlet manifold. The function of the system is described below.

NOTE

The power assist cylinder cannot be disassembled.

Rest position

In the rest position the valve piston and push rod are held at the right-hand limit of travel in the guide housing by the return spring. In this position the atmospheric channel is closed and the vacuum channel is open. The same vacuum prevails on both sides of the diaphragm.



VACUUM POWER ASSIST, AT REST

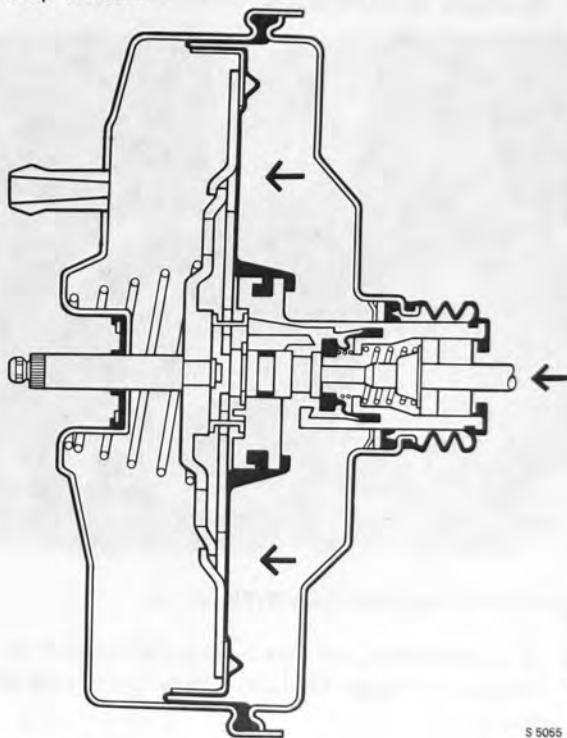
S 5054

Braking action

When pressing the brake pedal, the valve piston is moved to the left, the vacuum channel is closed and air of atmospheric pressure flows in on the right hand side of the diaphragm.

The power boost is derived from the difference between vacuum on the left-hand side of the diaphragm and atmospheric pressure on the right-hand side. The brakes can be applied harder by heavier pressure on the pedal. When the driver's foot is removed from the pedal, the spring returns the valve piston to the rest position, the vacuum channel opens and the atmospheric channel closes.

If the auxiliary vacuum system should fail, the driving brakes still work but without the power assist effect. The power cylinder is then simply an extension of push rod; the only difference is that heavier pedal pressure is needed to stop the car.



S 5055

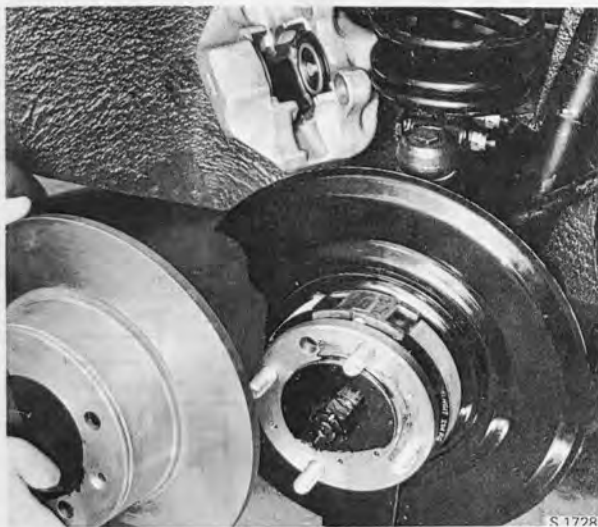
VACUUM POWER ASSIST, BRAKING

BRAKE DISCS

Changing brake discs

When a brake disc shows signs of heavy wear after long mileage it must be exchanged for a new one. Moderately deep scoring, on the other hand, does not mean that the disc need be discarded. To change a disc, proceed as follows:

1. Remove the hub cap and slacken the wheel nuts.
2. Jack up the front end of the car, and remove the wheel nuts and wheel.
3. Undo the two screws holding the brake housing to the steering knuckle housing. These screws are accessible from inside the steering knuckle housing.
4. Lift the brake housing away from the steering knuckle housing but do not disconnect the brake hose. Be careful not to scratch the brake pistons. Hang up the brake housing to avoid damage to the brake hose.



BRAKE HOUSING HUNG ON STEEL WIRE

5. On a front wheel, the parking brake shoes must be released by means of the adjusting screw to clear the drum.



RELEASING THE BRAKE SHOES

6. Back off the two disc retaining screws and remove the disc.

To fit the new disc, proceed in the reverse order. When installing the brake housing bolts a new locking plate should be used.

NOTE

Because of the "disc throw compensators" the brake pistons must be pushed well back before the brake housing is mounted on the disc and steering knuckle housing.

NOTE

After fitting the disc, remember to pump the brake pedal repeatedly to move the pistons close to the disc.

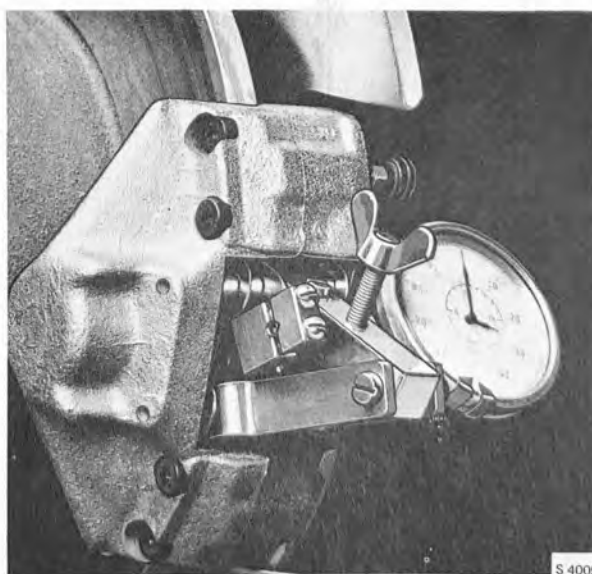
Grinding of brake disc

A maximum grinding of 0.02 in. (0.5 mm) on each side of the brake disc is allowed.

Measuring the brake disc throw

The brake disc throw can be measured with the measuring device 899535 provided with a dial indicator 784062 as follows:

1. Remove the brake pads.
2. Fit the measuring device to the brake pad locking pins in the brake housing.
3. Fit the dial indicator to the measuring device and connect the bent measuring point of the tool to the dial indicator.
4. Rotate the brake disc and read the brake disc throw. Maximum allowed throw 0.008 in (0.20 mm).



MEASURING THE BRAKE DISC THROW
Tools 784062 and 899535

BRAKE PADS

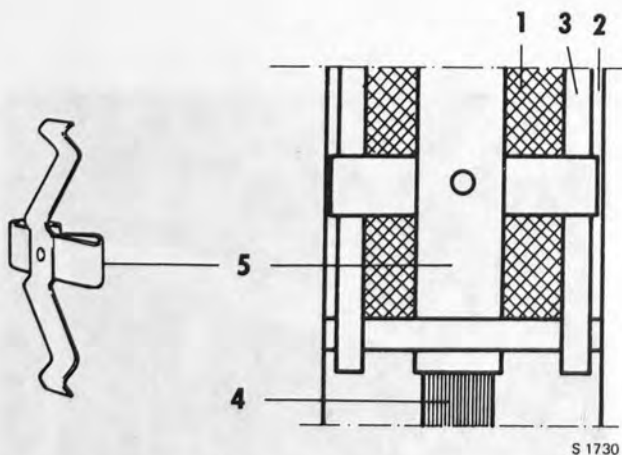
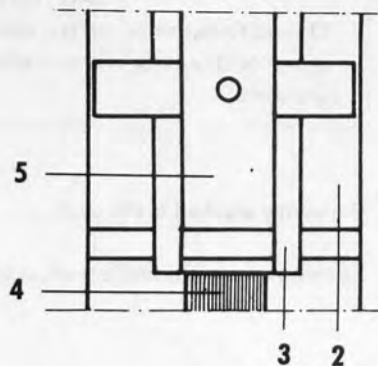
General

Because the disc brakes are self-adjusting, it is not possible to judge by the pedal stroke whether the brake linings are worn. It is therefore most important to take off the front wheels at the intervals stated in the service programme and check the thickness of the linings. The brake pads must be exchanged when the thickness of the lining is less than 0.08 in. (2 mm).

Changing brake pads

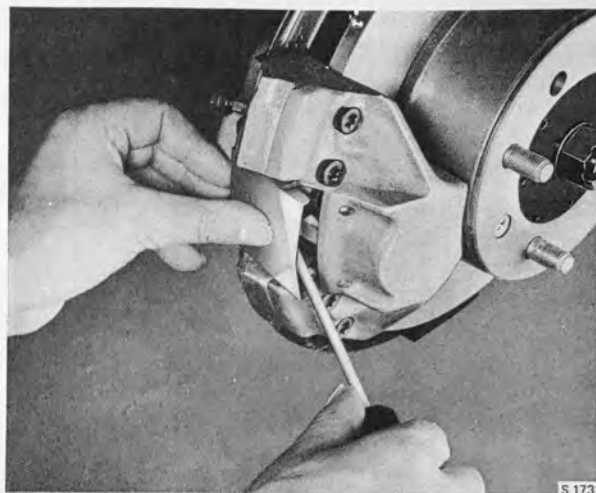
1. Jack up the front or rear end of the car and removed the wheels.

When the brake pads are worn to the limit and need changing, they give warning in the form of stiffer pedal resistance and reduced braking effect. This prior warning comes from the retaining spring, which is about 0.2" (5 mm) wider than the disc. When the pads are worn, the pressure plate of the pad (3) touches the edge of the spring (5) and the braking effect is reduced.

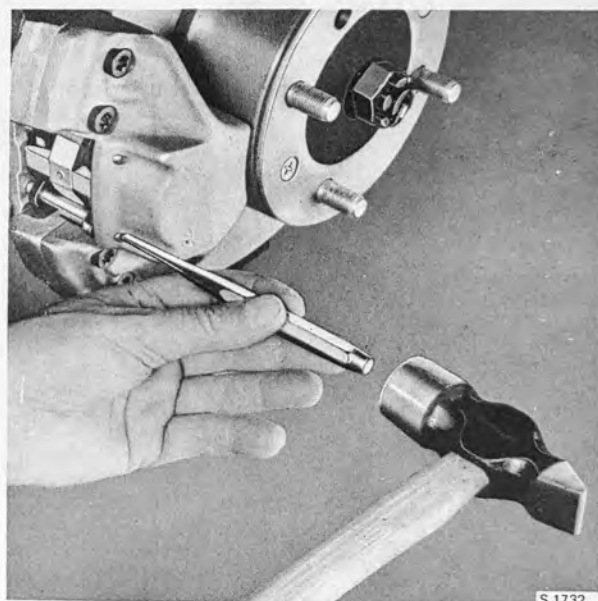


WARNING DEVICE FOR BRAKE PAD WEAR

1. Brake lining
2. Brake housing
3. Pressure plate
4. Brake disc
5. Retaining spring

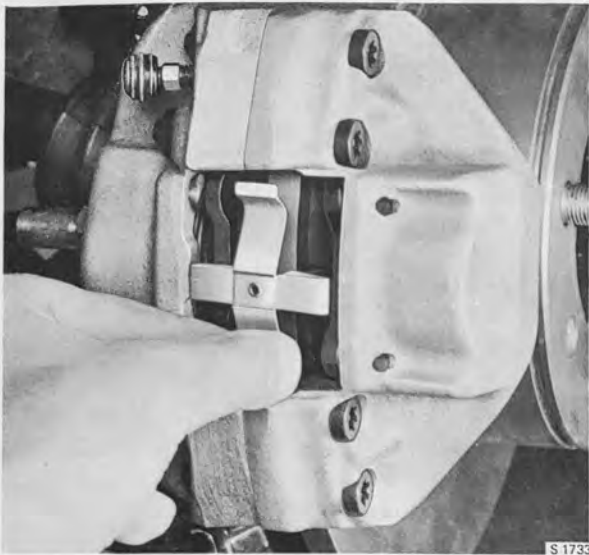


REMOVING THE GUARD PLATE



DRIVING OUT THE LOCKING PINS

2. Remove the guard plate and locking pins with a drift. Remove the pad retaining spring.
3. Pull out the pads.
4. Damaged dust seals must be exchanged. If dirt has penetrated the brake must be reconditioned.



REMOVING THE RETAINING SPRING

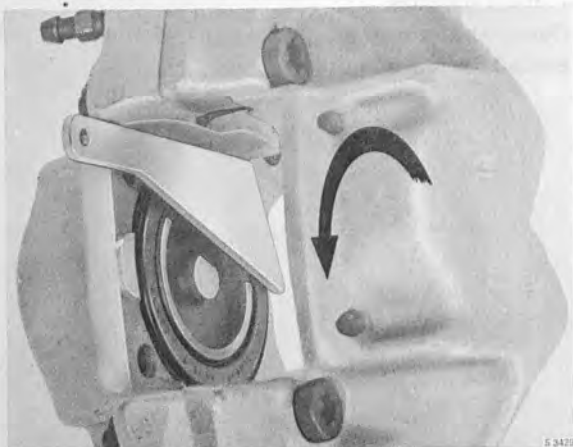
5. Push the pistons back into the cylinder using tool 786043.



PUSHING THE BRAKE PISTON INTO THE CYLINDER
Tool 786043

NOTE

When the brake pistons are pushed back into the cylinders, the level in the fluid container will rise. It may be necessary to drain off some of the fluid.



CHECKING BRAKE PISTON POSITIONS

Tool 899534

Wheel rotation when driving forward

6. Wash the brake disc thoroughly with trichlorethylene.
7. Check that the brake pistons are correct fitted. As gauge, use tool 899534. Move the tool into the brake housing with its back against the direction of rotation. The chamferings of the pistons shall then coincide with the tool. See fig. If the position of the pistons is not correct, turn them with pliers 899536.

NOTE

On the rear wheel brakes a washer is placed between the brake piston and the pad. The washer has a recess and prevents the piston from turning.

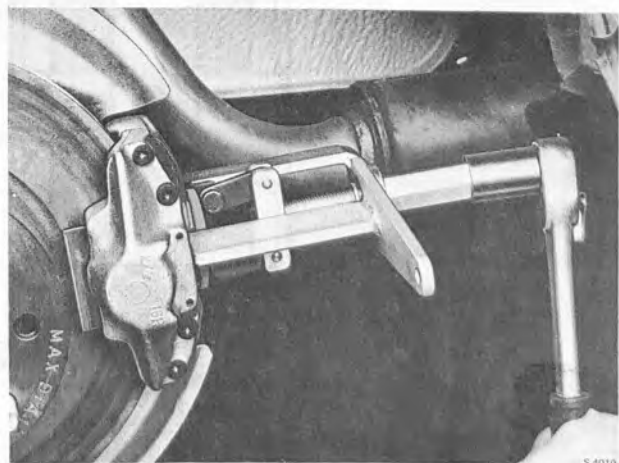
8. Fit the brake pads, and make sure that they fit easily into the recess in the brake housing.
9. Fit the spring, locking pins and guard plate.
10. Pump the brake pedal repeatedly to bring the pads forward to the brake disc.
11. Top up the container with brake fluid.

CAUTION

Do not forget to pump the brake pedal. Otherwise it will hit the floor without effect when the brakes are used.

Removing stucked brake pads

To remove stucked brake pads, use removing tool 899577.



REMOVING BRAKE PAD

Tool 899577

HYDRAULIC FOOTBRAKE SYSTEM

Instructions for overhaul

Scrupulous cleanliness is essential when the brake system or any part of it is disassembled. Wash off dirt and grease before disassembling. Do not wash any disassembled part in gasoline, kerosene, trichloroethylene or similar fluid, as these solvents attack rubber components. Disassemble units on a workbench covered with clean paper, and make sure that your hands are clean. After disassembling, soak all metal parts in a bowl containing clean brake fluid. Then wipe them with a clean lint-free rag and lay them out in order on a clean sheet of paper. To insure completely reliable brake functioning, all rubber parts should be exchanged; these are available in complete repair kits. Major components such as the brake housings should be cleaned in industrial methylated spirit or brake fluid. If spirit is used, all traces must be dried off before the brakes are re-assembled. All component parts are to be dipped in recommended brake fluid. See statements in section 020.

Brake fluid

The brake fluid container must be kept well filled at all times. The level should be checked every 6,000 miles (10,000 km) or every three months. It is most important to use the proper quality of brake fluid. Inferior fluids can totally ruin the hydraulic system. They may for example have a low boiling point so that they vaporize when the brakes are applied hard. This puts the brakes out of action, possible with disastrous results. Even the best brake fluids deteriorate with time through oxidation and water absorption, which lowers the boiling point. For this reason the brake fluid should be changed once a year if the car is used for competition or alpine driving.

Normally, brake fluid should be changed when the brake system is reconditioned, i.e. every other year or 24,000 miles (40,000 km). Brake fluid must always be stored in a sealed container. Use only recommended brake fluid. See statements in section 020.

Changing brake fluid

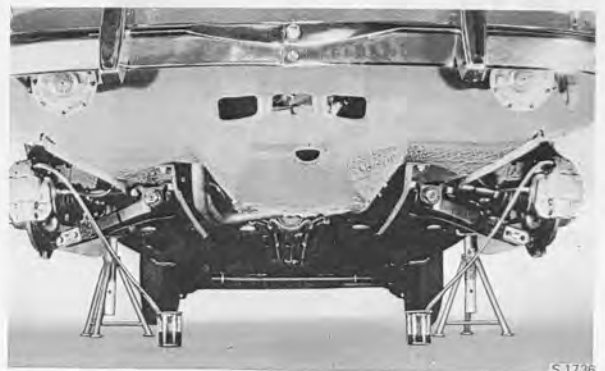
1. Open the bleeder screws on the primary circuit (right front and left rear wheel) and connect hoses as when bleeding. Pump the brake pedal until the fluid container is nearly empty. Then fill with fresh fluid and continue to pump until the system is completely filled with fresh fluid. Tighten the bleeder screws. Then repeat the operation for the secondary circuit, (left front and right rear wheel). Pump through at least half a quart (half a liter). Top off the container.
2. Bleed the brake system.

Bleeding the brake system

If air has entered the system, this can be detected by sponginess in the brake pedal or the need to press the pedal several times before the brakes take hold. Each wheel has a bleeder screw located in the inner part of the brake housing. It is easier to bleed the system if the car is first blocked up. The best result is achieved with a bleeding equipment, and the maker's instructions should be followed.

The following method can also be used:

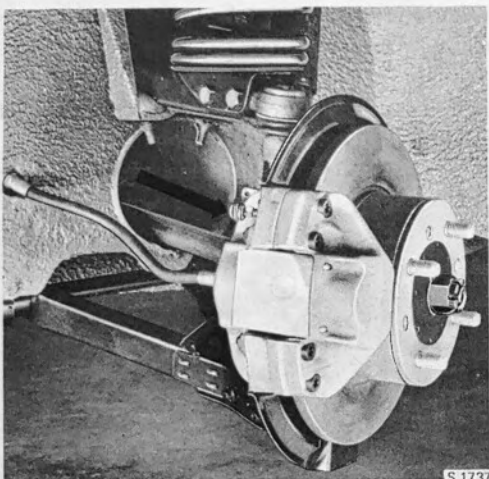
1. Make sure that the brake fluid container is well filled and the vent holes in the cap are not blocked.
2. Bleed either one wheel at the time or two wheels at the same time. Connect suitable hoses to the bleeder screws.
3. Place the free ends of the hoses in a container part-filled with clean brake fluid.
4. Open the screws 1/2–1 turn.



BLEEDING THE BRAKE SYSTEM

- Bleeder nipples 7mm
- Remove Wheels

5. Have a helper pump the brake pedal in easy time until the outflowing fluid is free from air bubbles. The ends of the hoses must be kept below the liquid surface in the glass container at all times.
6. Close the bleeder screws with the brake pedal held down.
7. Check that the brake fluid container does not run empty during bleeding.
8. Top off the container with fresh fluid after bleeding both circuits.



LOCATION OF BLEEDER NIPPLE

MASTER CYLINDER

General

All rubber gaskets and seals in the brake system should be changed at intervals of not more than three years or 35,000 miles (60,000 km). Scrupulous cleanliness is essential when the brake system or any part of it is disassembled (see also section 520).

Overhaul

The master cylinder should not be disassembled unless there is no replacement cylinder available.

Removing the master cylinder with vacuum power assist

1. Lay protective over the front fender and lay rags under the master cylinder to avoid damage to paintwork in case brake fluid should be spilt.
2. Remove the air cleaner.
3. Undo the brake line connections and put plastic stoppers in the holes.
4. Undo the clip that holds the speedometer cable to the power assist unit.
5. Undo the vacuum hose connection. *Remove Intake Panel*
6. Disconnect the push rod from the brake pedal.
7. Undo the four screws that hold the power assist unit to the dash panel and lift off the unit.

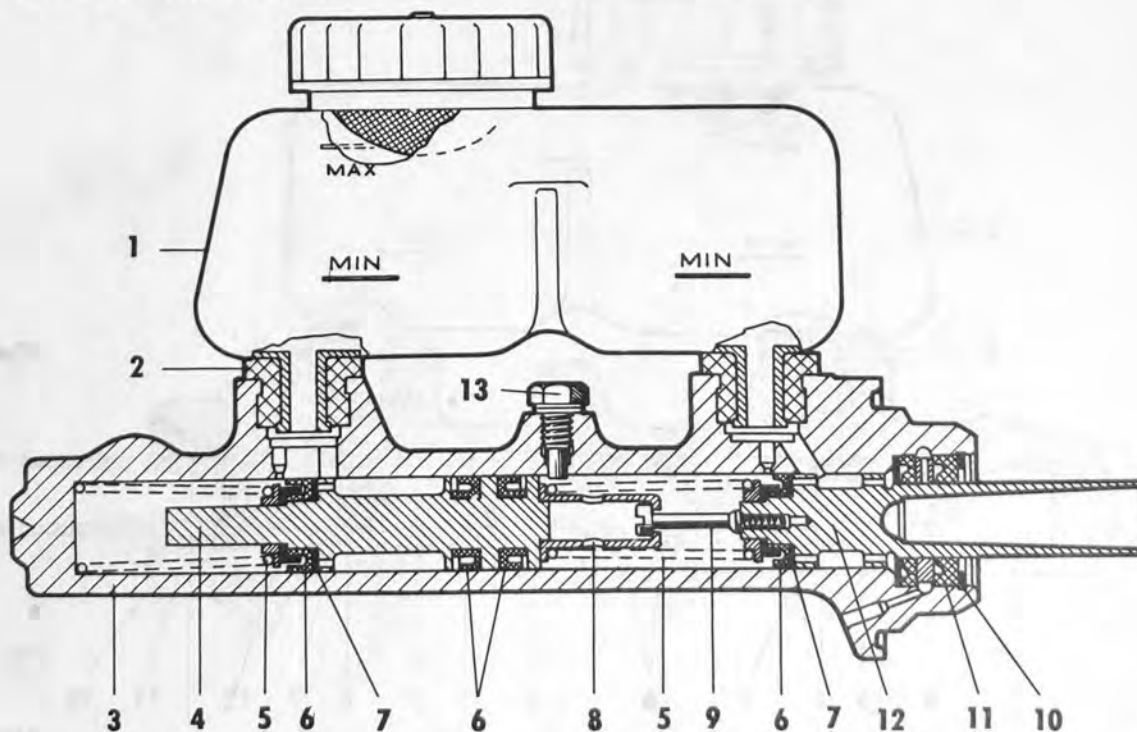
Disassembly

1. Separate the power assist unit from the master cylinder by backing off the nuts from the two retaining bolts.
2. Remove the lock ring (10) that holds the primary piston (12) in place.
3. Back off the stop screw (13).
4. Pull out the primary piston (12) with spring (5) and the secondary piston (4) with spring (5) and seals.
5. To change the seal ring (6) on the primary piston, the screw (9) with spring must be completely unscrewed and the spring retainer, support ring and support washer removed to gain access to the seal ring.

Inspection

1. Check that the cylinder bore is not scratched.
2. Check that the through-flow holes are clear by testing with a fine iron wire.
3. Check all parts and exchange any that are worn or defective.

Rubber gaskets and seals should be replaced by new ones. Repair kits containing complete replacement sets of rubber gaskets and seals are available.



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MASTER CYLINDER

- | | |
|---------------------|--------------------|
| 1. Container | 8. Sleeve |
| 2. Rubber seal | 9. Screw |
| 3. Housing | 10. Lock ring |
| 4. Secondary piston | 11. Seal ring |
| 5. Spring | 12. Primary piston |
| 6. Piston seals | 13. Screw |
| 7. Washer | |

Assembling -- fitting

(Dip all parts in brake fluid before assembling.)

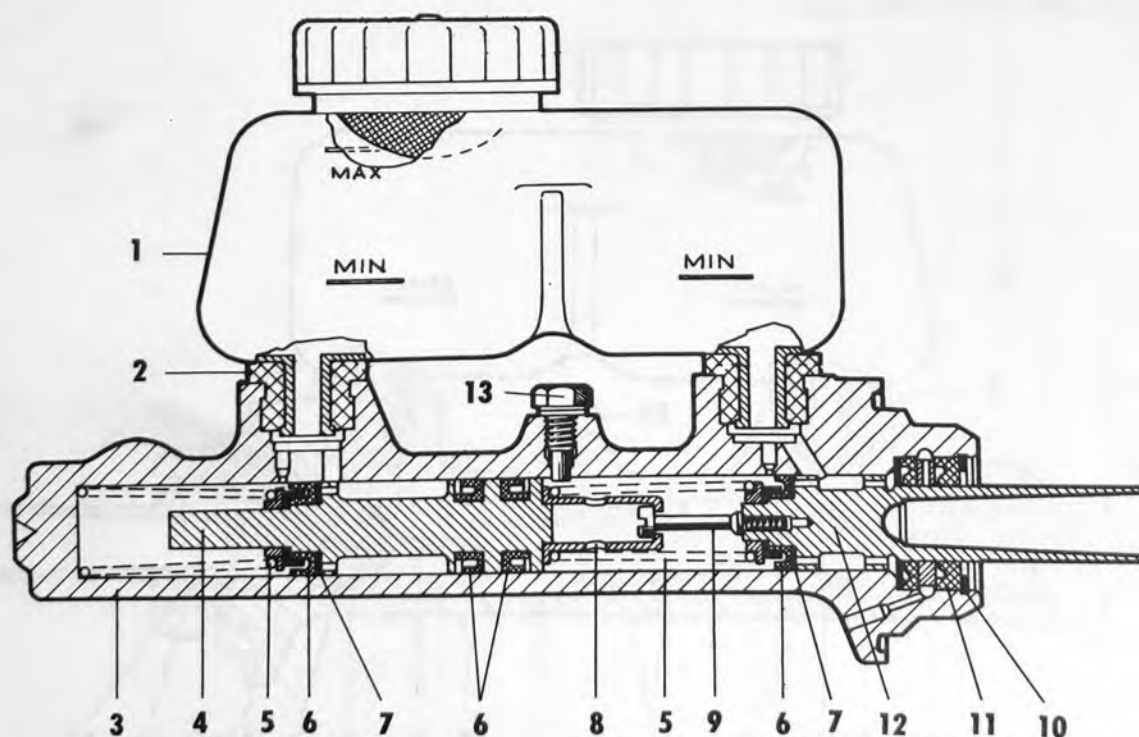
1. Insert the secondary piston (4) with spring and seals.
2. Insert the primary piston (12) with spring and seals.
3. Fit the lock ring (10).
4. Bolt the master cylinder to the power assist unit.
5. Cover all openings to keep dirt out of the cylinder during installation.
6. Fit the master cylinder complete with power assist unit to the dash panel and connect the push rod to the brake pedal.
7. Connect the brake lines.
8. Connect the vacuum hose and the clip that holds the speedometer cable to the power assist unit.
9. Mount the air cleaner.
10. Fill the container with brake fluid and bleed system.

Removing the master cylinder

1. Lay protective over the front fender and lay rags under the master cylinder to avoid damage to paintwork in case brake fluid should be spilt.
2. Unscrew the brake line unions from the master cylinder, plugging the cylinder openings with plastic stoppers as each line is disconnected.
3. Back off the two retaining nuts and lift the master cylinder off the power assist unit. Empty the cylinder of brake fluid.

Fitting

1. Cover all openings to keep dirt out of the cylinder during installation.
2. Mount the cylinder on the two bolts of the power assist unit and tighten the nuts.
3. Connect the brake lines and fill the cylinder with brake fluid.
4. Bleed the system (see section 520).



S 1721

MASTER CYLINDER

- | | |
|---------------------|--------------------|
| 1. Container | 8. Sleeve |
| 2. Rubber seal | 9. Screw |
| 3. Housing | 10. Lock ring |
| 4. Secondary piston | 11. Seal ring |
| 5. Spring | 12. Primary piston |
| 6. Piston seals | 13. Screw |
| 7. Washer | |

BRAKE LINES

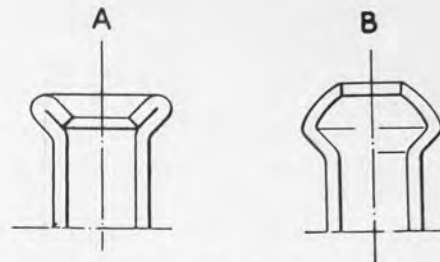
The brake pipers are of 3/16 in. Bundy tube. The ends of all the pipes are flanged and fitted with compression nuts, which must be passed onto the pipes before the ends are flanged. It is important to ensure that the pipes are properly flanged so that there will be no leakage at the joints. See fig. For reasons of safety, it is essential that all pipes, rubber hoses and connections in the brake system be kept in first-class condition at all times. Bearing this in mind, check regularly that the hoses have not been damaged by flying stones or by abraision. Pipes, too, must be installed so that they cannot rub or chafe against anything.

Make sure that the pipes and handbrake cables on the inclined panel under the rear seat are correctly fitted, so that they cannot rub against each other and so that the pipes cannot get damaged by the seat cushions.

All pipe and hose connections must be properly tightened to ensure leak-free joint. Make sure that the copper gaskets in the pipe connections are flawless, and change any defective ones. Copper gaskets which have become so hard that they no longer seal effectively may, however, be annealed and reused.

Pipes which are to be installed must fit well at both ends and at the clips. Never stretch a badly-fitting pipe by means of the compression nuts or bend an already fitted pipe. Both of these courses could give rise to stresses which may result in leakage, pipe fracture or stripped threads.

Pipes for connection to brake hoses are flanged as per "type A". Other pipes are flanged as per "type B".



FLANGING OF BUNDY TUBING

Brake hoses

The brake system incorporates two front and two rear brake hoses, affording the communication between the body and the wheel cylinders. These hoses are of different lengths and must not be confused. Install the hoses with the wheels freely suspended and aligned straight ahead. When tightening the brake pipe, hold the brake-hose nipple (not the locking nut) to prevent the hose from twisting and changing position.

WARNING

When fitting brake hoses it is highly important to position them correctly, thereby ensuring that steering or suspension movements do not bring them into contact with other parts of the car. The brake hoses must not be wrung or twisted but shall be mounted in a neutral position. In addition, see to it that the front hoses form a downward directed curve.



FIGURE 1. BRACE LINES

Brace Lines

The brace lines are the lines that connect the base of the component to the top of the component. They are the lines that support the component and prevent it from falling over. The brace lines are the lines that connect the base of the component to the top of the component. They are the lines that support the component and prevent it from falling over.

WARNING

When fitting brace lines it is highly recommended that the lines be fitted to the component in a way that allows the component to move freely. The lines should not be too tight, as this will restrict the movement of the component. The lines should also be fitted in a way that allows the component to move in a controlled manner. The lines should be fitted in a way that allows the component to move in a controlled manner.

The brace lines are the lines that connect the base of the component to the top of the component. They are the lines that support the component and prevent it from falling over. The brace lines are the lines that connect the base of the component to the top of the component. They are the lines that support the component and prevent it from falling over.

WHEEL CYLINDERS AND BRAKE HOUSINGS

Removing brake pistons and seals

IMPORTANT

The two halves of the brake housing are not to be separated. All normal servicing can be carried out with the two halves bolted together.

1. Jack up the front or rear end and take off the wheel.
2. Remove the guard plate with a screw driver. Knock out the locking pins with a drift and remove the retaining spring and brake pads.
3. Unscrew the brake housing from the steering knuckle housing and disconnect the brake line from the housing.
4. Lift the housing off the brake disc.
5. Clean the outside of the housing and wipe it thoroughly dry afterwards.
6. Apply screw clamp 786043 to one brake piston and force out the other piston by supplying compressed air to the brake line connection. Take care that the piston does not fall out and suffer damage.

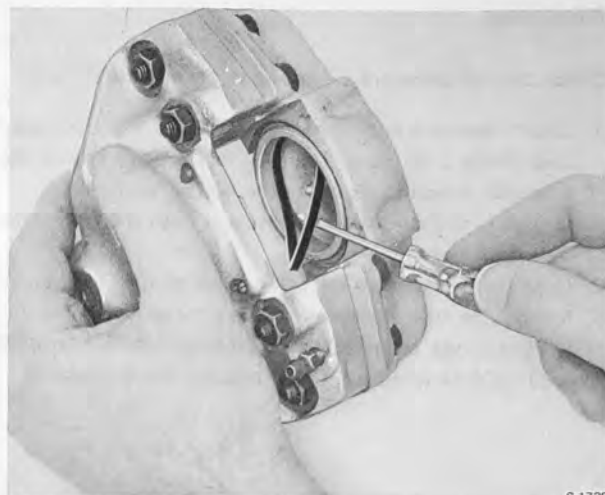
NOTE

When the piston has been removed, great care must be taken to insure that no dirt or oil gets into the brake system.

7. Use a blunt tool to prize the seal out of the cylinder. Be careful not to damage the seal groove or the cylinder itself (see fig.).

IMPORTANT

Use only brake fluid or denatured spirit for cleaning a brake cylinder, as the seal between the two halves of the housing may otherwise be destroyed.



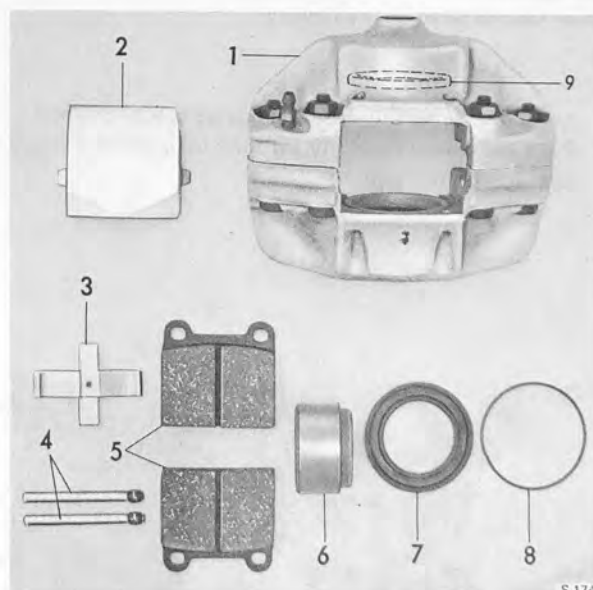
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REMOVING THE PISTON SEAL

8. After refitting the seals and piston (see Assembling), the other piston can be removed. The operation is the same for both.

NOTE

Honing or grinding the wheel cylinders is not recommended because the cylinder walls are treated against corrosion. If the surface is ground or in some other way damaged, there will be the risk that the pistons are jammed in the cylinders because of corrosion.



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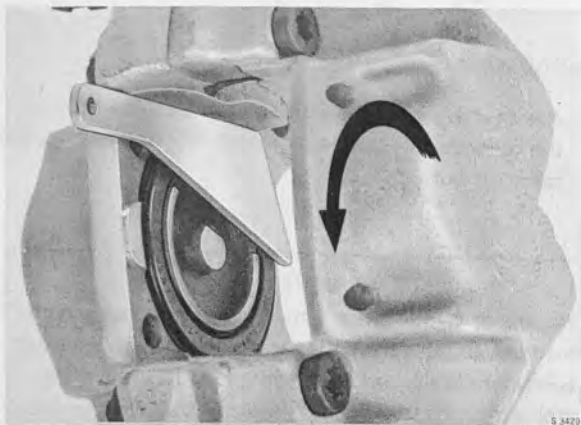
BRAKE HOUSING WITH COMPONENT PARTS

1. Brake housing
2. Guard plate
3. Retaining spring
4. Locking pins
5. Brake pads
6. Piston
7. Dust gasket
8. Seal retainer
9. Piston seal

Assembling

Check that all parts are clean and in perfect condition.

1. Coat a new seal with a special lubricant, e.g. Lockheed Disc Brake Lubricant. The seal must be dry before the lubricant is applied. Locate the seal carefully in its groove in the cylinder and rotate it with the fingers to seat it properly.
2. Coat the piston with the same grade of lubricant and locate it so that the recess in the contact surface with the brake pad is turned the right way. Use the template, tool 899534 (see fig.). If the piston must be rotated

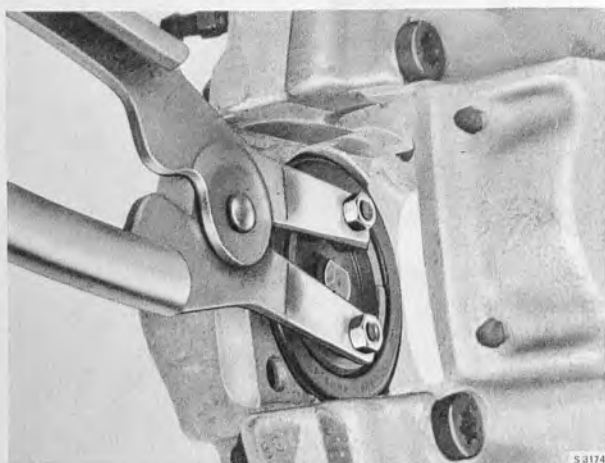


CHECKING BRAKE PISTON POSITIONS

Tool 899534

Wheel rotation when driving forward

tated after insertion, use the grippers, tool 899536. Push the piston carefully into the cylinder and check that it does not jam.



ROTATING THE PISTON

Tool 899536

3. Take a new dust gasket and coat it with the special lubricant. The gasket must be dry before the lubricant is applied. Press home the gasket retainer and brake piston using screw clamp 786043 (see fig.). Fit



PUSHING THE BRAKE PISTON INTO THE CYLINDER

Tool 786043

the piston and dust gasket in the other cylinder in the same manner.

4. Connect the brake line to the housing and screw the brake housing to the steering knuckle housing. Apply a new locking plate. Wash the brake disc with trichloroethylene.
5. Fit the brake pads.

NOTE

On the rear wheel brakes a washer is placed between the brake piston and the pad. The washer has a recess and prevents the piston from turning.

IMPORTANT

If you have to rotate the piston, make sure that the sealing surface is not damaged in the process.

6. Bleed the system. Pump the brake pedal to advance the pistons and top off the container with brake fluid.

BRAKE CONTROL

Brake pedal

The brake pedal is journaled in self-lubricated bushings on the same shaft as the clutch pedal and mounted in a bracket.

Removing and fitting

1. Disconnect the electric wiring and remove the brake light contact and brake warning contact holder. The holder is fixed to the pedal bracket by two screws.
2. Remove the eccentric shaft where the pedal is connected to the vacuum power assist push rod.
3. Pull the split pin from the right-hand end of the pedal shaft and push out the shaft.
4. Take out the pedal.
5. Reassemble in the reverse order.

Adjusting the position of the pedal

The position of the brake pedal in relation to the clutch pedal can be adjusted by means of an eccentric pin where the brake pedal is connected to the vacuum power assist push rod.



HANDBRAKE SYSTEM

Removing the handbrake cable for exchange

1. Remove the front seats and take up the carpet.
2. Remove the front branching duct of the heating system and the valve house assembly.
3. Remove the knob from the free wheel control lever.
4. Engage reverse gear and take out the ignition key. Unscrew the gear lever cover and lift it off.
(NOTE! Ignition switch light.)
5. Detach the handbrake lever cover and unscrew the wire adjusting screws completely. Pull the handbrake lever straight up so that the wires can be freed. Remove the rear duct with the heater control.
6. Remove the wire clamp from the floor tunnel.
7. Remove the front wheel. Unscrew the wire retainers from the wheel housings and undo the retainer straps on the steering gear.
8. Pull out the wire from the wheel end.

Installing brake cables

1. Proceed in the reverse order to the above. Make sure that the rubber grommet in the dash panel bulkhead is not damaged.
NOTE! The crossover of the wires. Make sure they are installed this way.
2. After installing, adjust the parking brake shoes first and then the wires.

Handbrake lever

Removing

1. Remove the left front seat.
2. Detach the handbrake lever cover.
3. Unscrew the wire adjusting screws completely and remove them.
4. Free the shaft lock ring and pull out the shaft until it clears the ratchet.
5. Remove the lock ring from the lower shaft bolt and pull the bolt right out. Lift off the lever.

Fitting the handbrake lever

Install in the reverse order.

Disassembling the handbrake lever up to and incl. model 1970

1. Remove the pawl pivot split pin and take out the pivot.
2. Push the pawl rod out towards the handle.
3. Undo the lock nut and remove the catch button, lock nut and return spring.
4. Remove the pawl rod with the pawl.

Assembling

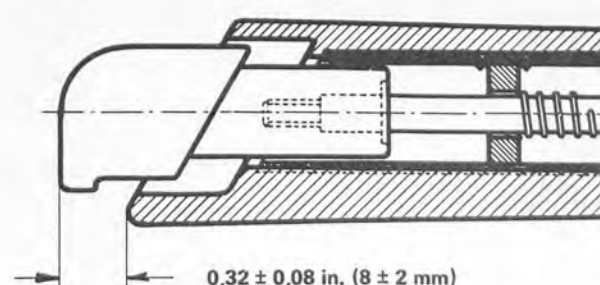
1. Check that all parts are in good condition before assembling.
2. Fit the pawl mechanism in the lever and screw the lock nut right home. Fix the correct position of the lever by mounting it in position. The pawl button should project 0.4" (10.5 mm) beyond the handle when the pawl is engaged in the ratchet. When this has been done, remove the lever again to lock the pawl button and fit in place once more.
3. Insert and pin the shaft and connect the wires to the lever.
4. Adjust the handbrake.

Disassembling the handbrake lever as from model 1971

1. Remove the pawl pivot split pin.
Undo inner pawl and both spring.
2. Push the pawl rod upwards so that the knob can be unscrewed.
3. Pull out the pawl rod with outer pawl, washer and return spring.

Assembling

1. Check that all parts are in good condition before assembling.
2. Fit washer, return spring and outer pawl on the pawl rod.



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CHECKING MEASURE ON THE HANDBRAKE KNOB WHEN THE OUTER PAWL IS ENGAGED

3. Place the pawl rod in the lever. Screw on the knob to the bottom of the thread and if necessary to obtain correct position for the knob, further not more than one turn.
When the lever has been fitted in the car, check that the measure from the outer end of the knob to the lever is 8 ± 2 mm (0.32 ± 0.08 in.). See fig.
4. Fit pawl springs, inner pawl and the shaft bolt. Check that the springs are correct placed. Lock with a split pin.

Disassembling the brake drum and shoes

1. Apply the handbrake, remove the front wheel hub caps and slacken the wheel nuts slightly.
2. Jack up the front end and take off the wheel. Release the handbrake.
3. Unscrew the brake housing from the steering knuckle housing and lift it off the brake disc.

NOTE

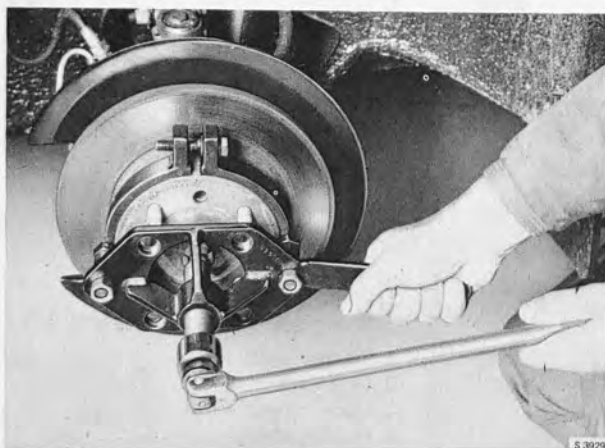
The brake housing must not be left hanging from the brake line but must be supported to relieve the brake hose.

4. Undo the brake drum retaining screws and pull off the drum.

If the brake drum is difficult to remove, use ring 899579 and puller 899518.

Place the ring so that the raised part fits in the recess on the brake drum and tighten the screws.

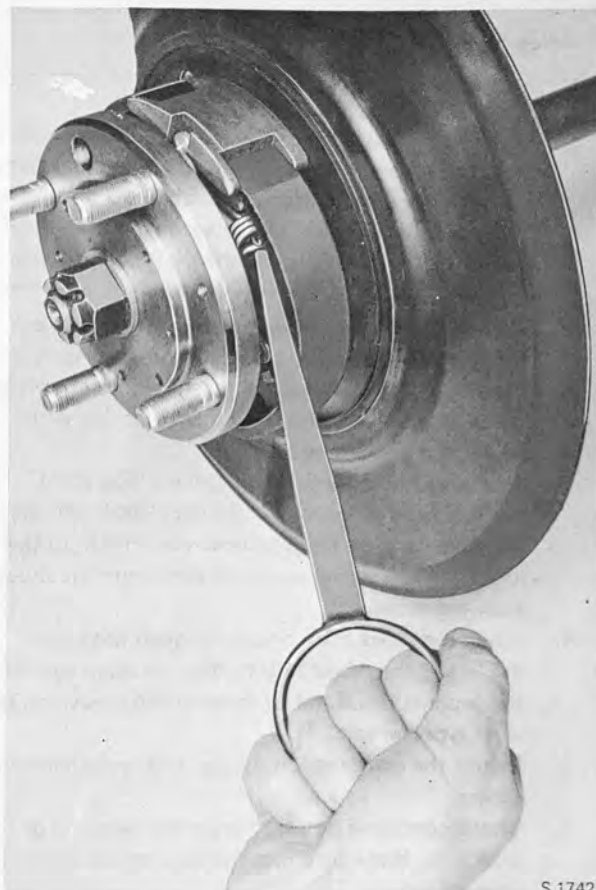
Fasten the puller at the ring with the aid of two spacer screws, tool number 899524, and pull off the brake drum. See fig.



REMOVING THE BRAKE DRUM

Tools 899518, 899524 and 899579

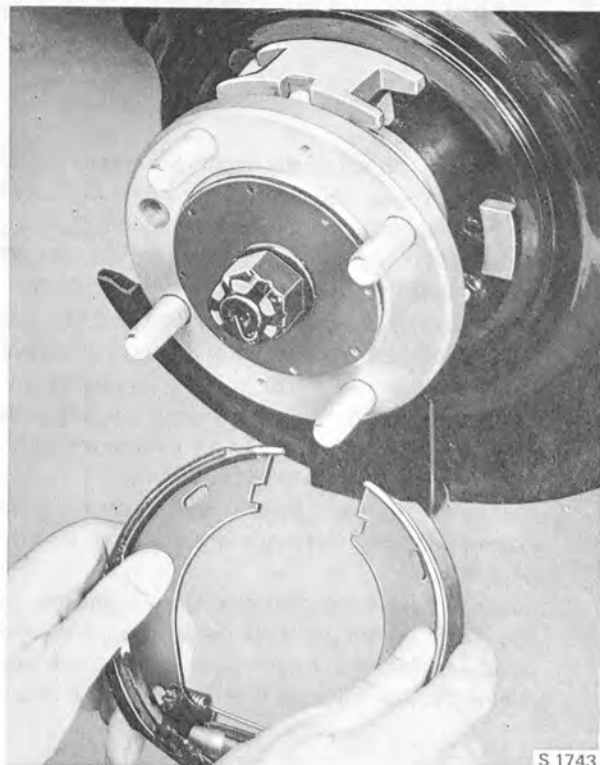
5. Unhook the upper return spring using tool 899560.



REMOVING THE RETURN SPRING

Tool 899560

6. Release the two retaining springs and remove the shoes by pulling them down.



REMOVING THE BRAKE SHOES

Assembling

NOTE

When fitting new linings, replace both brake shoes at the same time. They are ground in matching pairs and must not on any account be changed separately. The brake shoes should be replaced when the thickness of the very lining is less than 0.02" (0.5 mm).

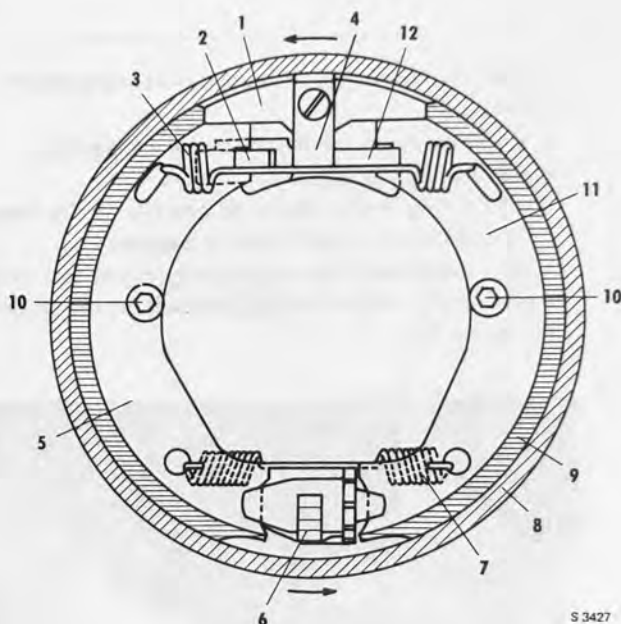
1. Before fitting new linings or a new drum, slacken the wire adjustment to avoid straining the wire.
2. Coat the three sliding studs on the shield as well as the lever arm joint and the adjusting screw with special grease. Grease sparingly.
3. Assemble the shoes and adjustment. The short sleeve should face forward on the right-hand side and backward on the left-hand side. Hook on the lower tension spring so that it lies inside the shoes after mounting.
4. Insert the shoes from below between the brake shield and the wheel hub to their location against the support piece and fit them in the groove on the lever arm and link.
5. Mount the compression springs and upper tension spring.
6. Check operation by pushing on the wire end of the lever arm. Make sure that the adjustment device is screwed in.
7. Mount the brake drum. If it will not slip straight over the shoes, this is probably because the shoes are not centered.
8. Fit the retaining screws and the brake housing. Make sure that the brake hose is not twisted.
9. Check that the brake pads clear the disc. Adjust the handbrake (see Adjustment of handbrake).
10. Mount the wheel and hub cap.

Adjusting the handbrake

Check the adjustment of the handbrake by jacking up the front end of the car and rotating the front wheels by hand. When correctly adjusted, the handbrake should, in model 1969 and 1970, begin to take hold at the second ratchet notch and lock the wheels at the third notch. As from model 1971 the brake should begin to take hold at the fourth notch and lock the wheels fully at the sixth or seventh notch. If not, the brake must be adjusted. To do this, adjust the brake shoes first and after that, if necessary, adjust the wire.

1. Apply the handbrake, remove the front wheel hub caps and slacken the wheel nuts slightly.
2. Jack up the front end, place trestles under the front suspension arms, release the handbrake and take the wheel off.
3. Check that the brake pads clear the disc and that the lever arm does not influence the position of the shoes on adjustment to give misleading results. It is best to release the wire adjustment at the handbrake lever end.

4. Line up the hole in the drum with the teeth of the adjusting screw. Insert a screwdriver into the hole, placing its point between the teeth of the screw. Apply the shoes to the drum by turning the screw until the drum can only just be turned. Then stop tightening and back off again 1–2 teeth. Apply and release the handbrake lever to center the shoes.

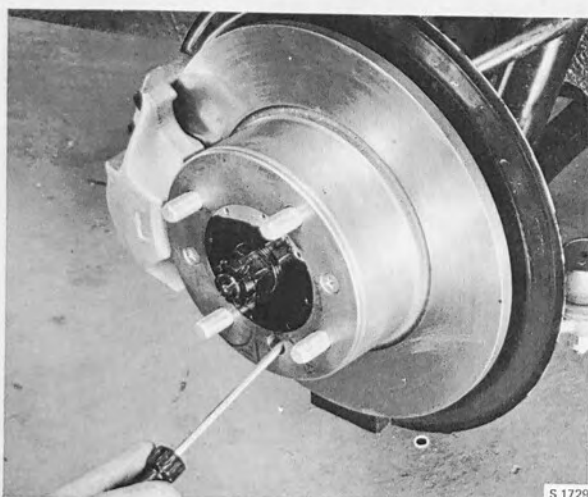


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PARKING BRAKE, COMPONENTS

1. Support piece
2. Lever arm
3. Upper tension screw
4. Holding spring
5. Primary brake shoe
6. Adjustment
7. Lower tension spring
8. Brake drum
9. Brake lining
10. Compression spring and locking pin
11. Secondary brake shoe
12. Pressure rod

5. Check that the shoes are not binding by rotating the drum in its normal direction. A very light contact can be accepted. If the drum does not turn easily, back off the screw another 1–2 teeth.
6. Repeat the adjustment on the other front wheel.
7. Pull up the handbrake lever, checking that the brake, in model 1969 and 1970, begins to take hold at the second notch and is fully applied at the third notch. As from model 1971 the brake should begin to take hold at the fourth notch and lock the wheels fully at the sixth or seventh notch. Check also that the brakes act with the same force on both front wheels.
8. Mount the wheels, after first cleaning all sand and dirt off the contact surfaces, and tighten the nuts until the wheel is immobilized on its hub. Then lower the front end of the car and tighten the wheel nuts to a torque of 65–80 ft.lb. (90–110 Nm, 9–11 kpm); tighten each nut in turn a little at a time, following a criss-cross pattern. Fit the hub caps.



ADJUSTING THE BRAKE SHOES

1. The first of the two is a...
 2. The second of the two is a...
 3. The third of the two is a...
 4. The fourth of the two is a...
 5. The fifth of the two is a...
 6. The sixth of the two is a...
 7. The seventh of the two is a...
 8. The eighth of the two is a...
 9. The ninth of the two is a...
 10. The tenth of the two is a...



Figure 1. A diagram of the...

CONTENTS

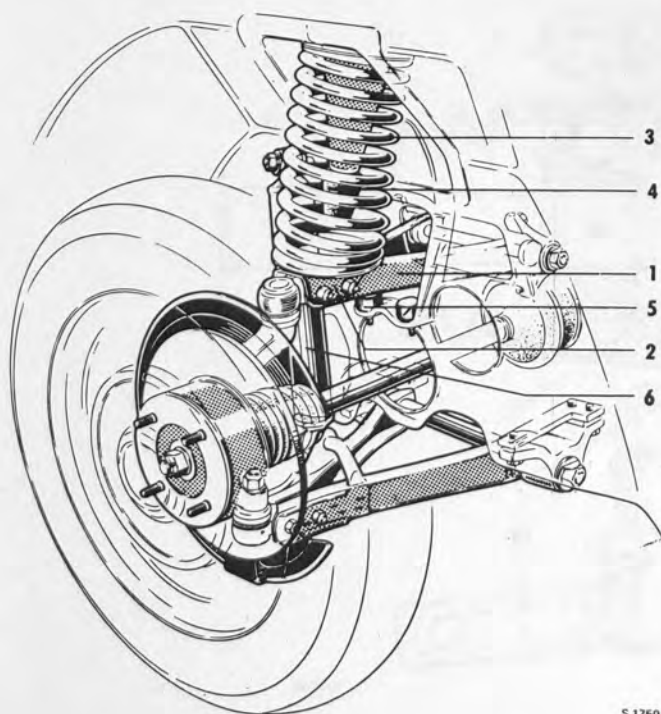
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632	Control arms
641	Steering wheel, steering column tube with support and steering column
642	Steering gear
643	Tie-rod assemblies
644	Power steering

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GENERAL

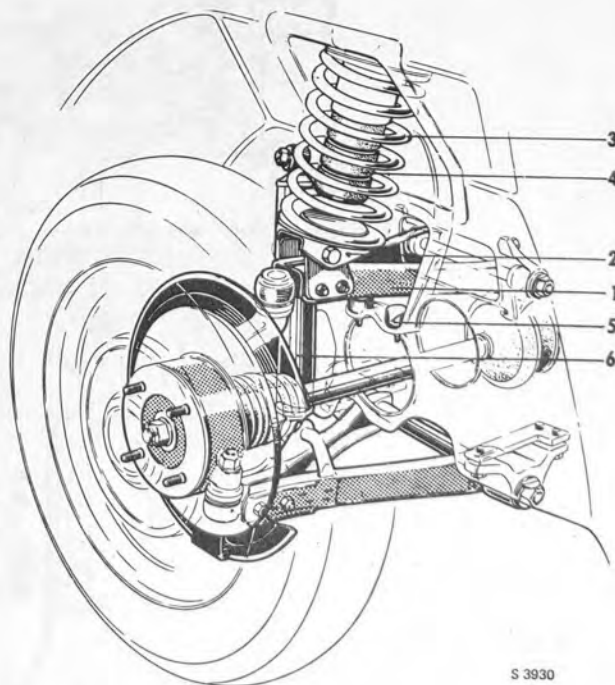
All wheels are equipped with coil springs. The front wheels are individually suspended and are mounted on the steering knuckle housings, which are connected to the control arms by permanently lubricated ball joints. The inner ends of the control arms are journaled to the body in rubber bearings. The spring movement of the wheels is limited by rubber buffers. As from model 1973 the lower spring supports are pivot suspended.



S 1750

FRONT SUSPENSION, UP TO AND INCL. MODEL 1972

1. Upper control arm
2. Lower spring support
3. Coil spring
4. Rubber buffer
5. Rubber buffers
6. Shock absorber



S 3930

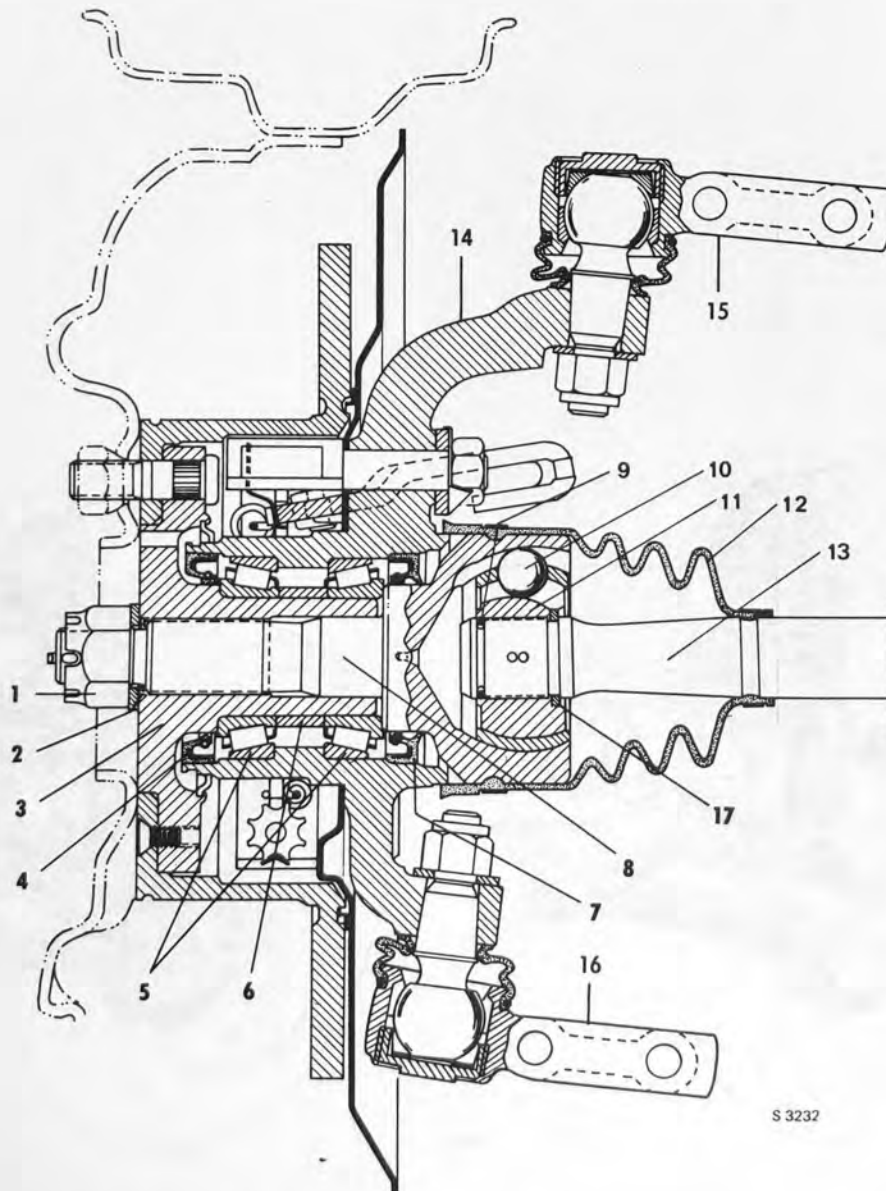
FRONT SUSPENSION, AS FROM MODEL 1973

1. Upper control arm
2. Lower spring support
3. Coil spring
4. Rubber buffer
5. Rubber buffers
6. Shock absorber

Steering knuckle housings

The front suspension consists of separate left-hand and right-hand units. The steering knuckle housing, on which the wheel is mounted, consists of a bearing housing with two inward-curving pivot arms. The wheel is journaled on two tapered roller bearings. The outer drive shaft is splined and force-fitted to the hub. The brake disc with integral parking brake drum is mounted on the hub, and the brake shield and parking brake mechanism are bolted to the steering knuckle housing. The steering arm is fastened to the steering knuckle housing by two screws.

In steering, the steering knuckle housing pivots about an imaginary axis, the "king-pin" or steering knuckle axis, which passes through the centers of both the ball joints and intersects the ground at a point close to the center line of the wheel. The outer and inner drive shafts are connected by the outer universal joint, which is protected from dirt by a rubber bellows.

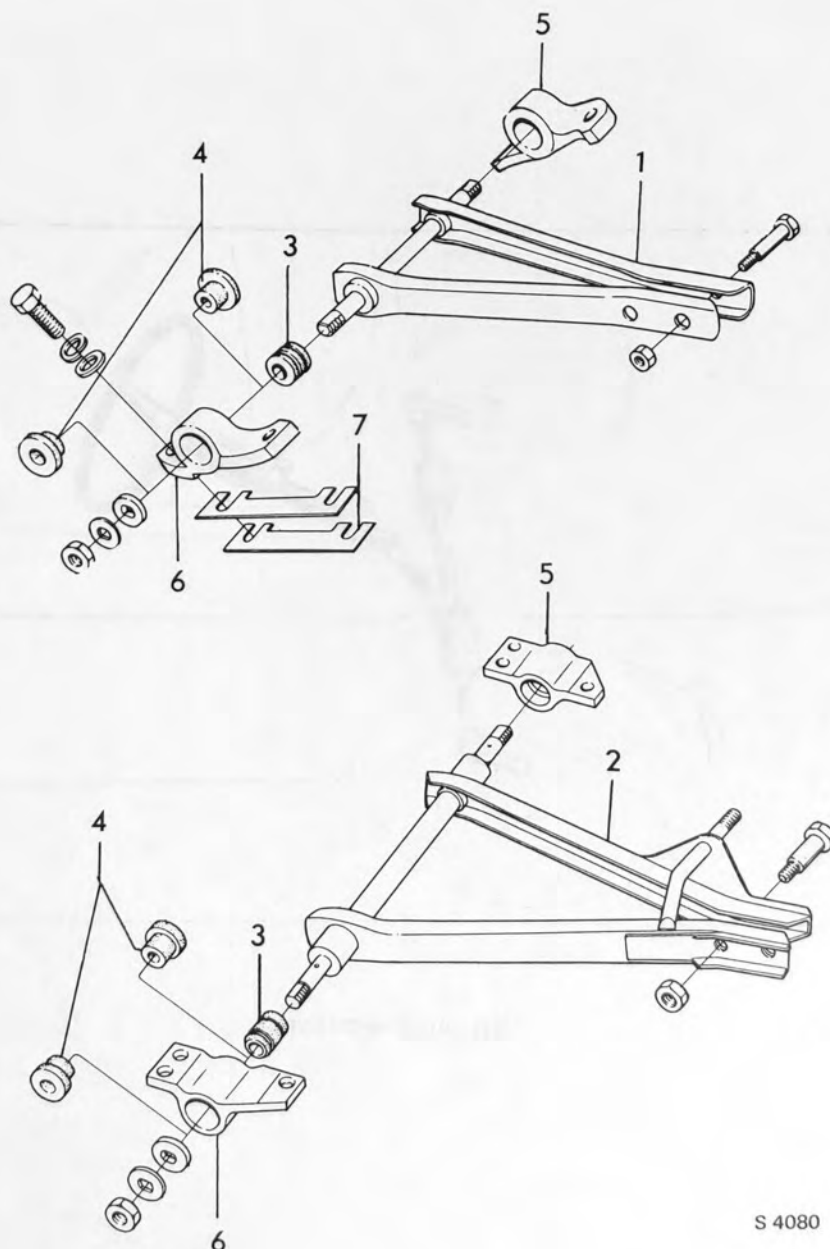


FRONT AXLE ASSEMBLY

- | | | |
|---------------------|----------------------|--|
| 1. Castle nut | 7. Inner shaft seal | 13. Inner drive shaft |
| 2. Washer | 8. Outer drive shaft | 14. Steering knuckle housing |
| 3. Wheel hub | 9. Lock ring | 15. Upper ball joint (upper end piece) |
| 4. Outer shaft seal | 10. Ball | 16. Lower ball joint (lower end piece) |
| 5. Wheel bearings | 11. Hub | 17. Stop ring |
| 6. Spacer ring | 12. Rubber bellows | |

Control arms

The front axle, forming a separate unit on each side, is bolted to ball joints forming the outer ends of the control arms. There are two control arms on each side, each journaled in rubber bushings in two bearing brackets. The upper control arms carry the coil spring supports, which also serve as compression stops for the rubber buffers.



S 4080

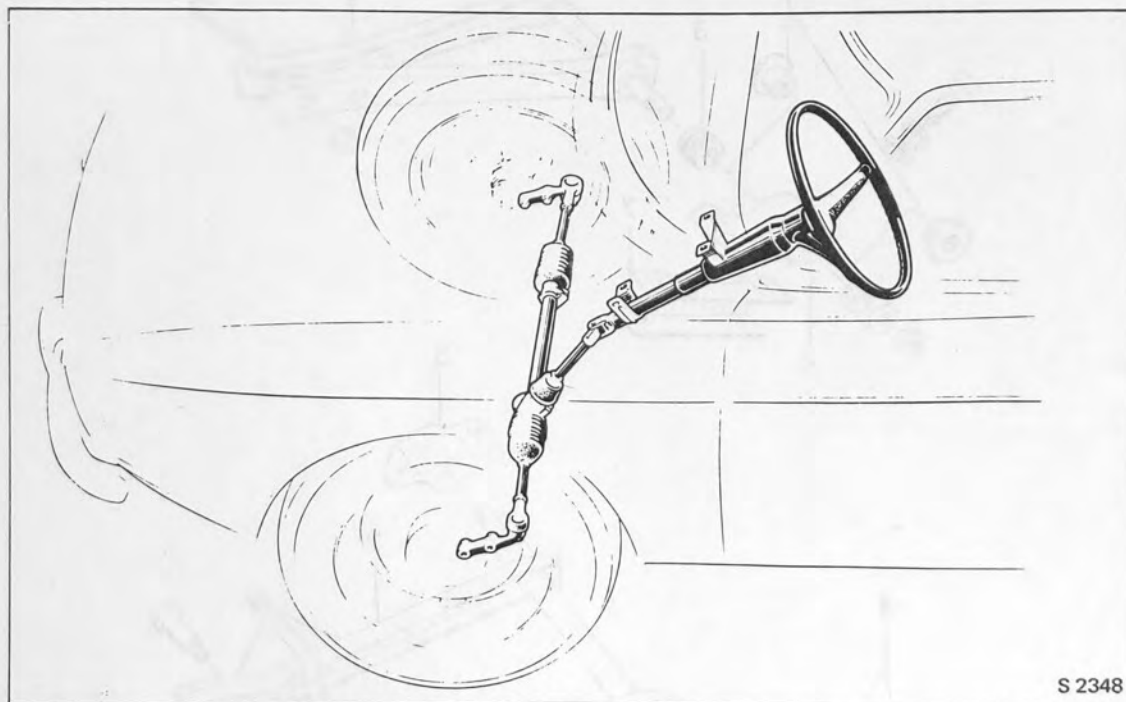
CONTROL ARMS, BEARINGS AND BUSHINGS

- | | |
|-----------------------------|-----------------------------|
| 1. Upper control arm | 4. Two-piece rubber bushing |
| 2. Lower control arm | 5, 6. Bearings |
| 3. One-piece rubber bushing | 7. Spacers |

Steering mechanism

The steering gear is of rack-and-pinion type. It consists of an angled spiralcut pinion gear engaging teeth on a rack. The rack is journaled in a housing consisting of a cast light-alloy unit with a steel tube pressed into it. The pinion bearing is provided with a spring-loaded plunger that presses the rack against the pinion. The other end of

the rack is journaled in a bushing. Steering-wheel movement is transmitted to the pinion by a two-piece steering column and two joints. This imparts an axial movement to the rack, which moves the two tie rods connected by ball joints to the ends of the rack. The tie rods in turn move the steering arms fastened to the steering knuckle housings and connected by ball joints to the tie rods.



STEERING MECHANISM

Power steering gear

On model 1974, some models are equipped with a hydraulic power steering gear.

The assembly consists of a rack-and-pinion steering gear with a servo valve which regulates the oil flow to a servo plunger on the rack. The hydraulic pressure is generated by an oil pump which is driven by a V-belt from the belt pulley on the crankshaft. A separate oil tank by the right wheel housing supplies the system with hydraulic oil.

The steering gear is permanently lubricated with oil. A tube running between the two ends of the steering gear housing leads the lubricating oil past the hydraulic portion of the rack.

WHEEL ALIGNMENT

Checking and adjustment

If there is reason to suspect that the front wheels are out of true, a condition which shows up in the form of abnormal tire wear, impaired steering and road-holding characteristics, etc., the front wheel alignment must be checked and adjusted. Before the wheel alignment is measured, the following preparations must be made:

1. Check that the tires are inflated to the correct pressure and that one front tire is not much more heavily worn than the other.
2. Check the front wheel bearings, control arm bearings, steering knuckle joints and tie-rod joints, and adjust or exchange parts as necessary to eliminate any faults of alignment that may be due to worn components.
3. Check the steering gear and make good any defects (see section 642).
4. Check the operation of the shock absorbers and exchange damaged shock absorbers and rubber bushings.
5. If the car has been involved in a collision, crash, etc., any resulting damage must be repaired before wheel alignment is measured. If the suspension control arms are bent, no attempt must be made to straighten them, they must be replaced by new ones.
6. Just before the measurements are made, the car should be driven without hard cornering and with normal suspension movement to work the wheels into their natural positions. For the same reason, the car should be rocked up and down a few times on its springs.

When the measurements are made, the car should be empty and should be standing on a flat horizontal surface; this is the only way to get reliable readings. Adjustment with the help of spacers must be kept within reasonable limits. If there are any deformations due to body damage, the body must be straightened up properly. If the suspension control arms are bent out of true, they must be replaced by new ones. For checking the wheel alignment there are various instruments, which are fitted either on the rim or directly on the axle. Each instrument has its own instruction manual explaining exactly how it is to be used.

NOTE

With front-wheel-drive cars it is important that the wheels are immobilized by the brakes while the measurements are being made in cases where the wheels are set up on turntables or the like, or when a measuring instrument is mounted on the end of the axle.

WARNING

When the car is on a hoist, do not seize a front wheel and twist it by main force to full steering-wheel lock. There is a very serious risk of damaging the steering mechanism if this is done, as the rack-and-pinion gear will cause the steering wheel to spin at high speed, imposing a severe torsional strain on the steering column when the rotation is arrested by the stop in the steering gear.

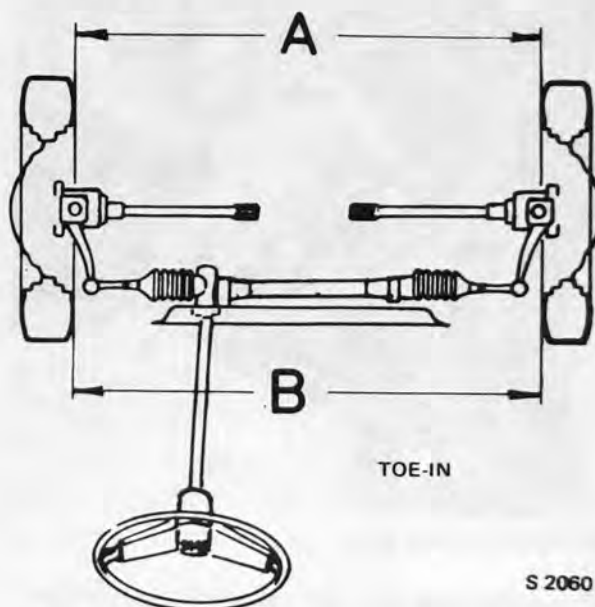
Toe-in

Seen from above, the wheels run at a certain angle to each other. Measurements A and B, made from rim to rim level with the axles, must bear a given relationship to each other (see illustration). If A is smaller than B, the wheels are said to converge or toe in, and if A is greater than B, the wheels diverge or toe out.

Wheel toe-in or toe-out is expressed in fractions of an inch or millimeters, being the difference between A and B.

Toe-in is zero if the wheels are parallel, in which case both measurements are exactly the same.

The correct toe-in is $0 \pm 0.04''$ (0 ± 1 mm), i.e. A is less than B by this much.



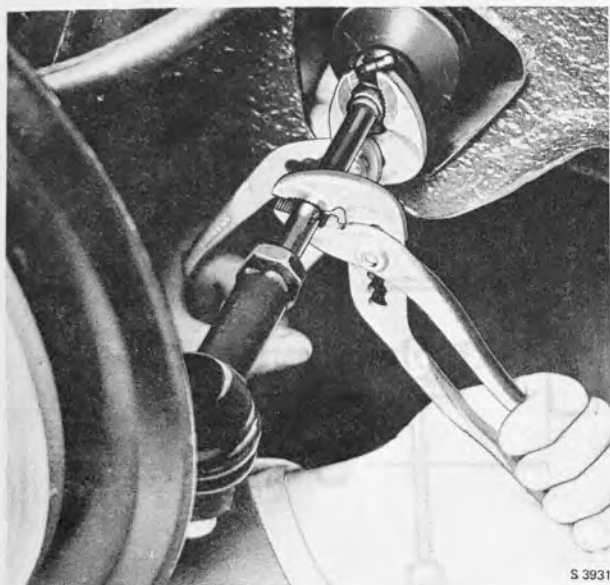
Checking and adjustment

1. Roll the car straight forward on a level floor and stop it without using the brakes. It must not be moved backward after this.
2. Take a reading of measurement A with the toe-in gauge between the front wheel rims level with the axles. Mark the measurement points with chalk. Roll the car forward until the chalk marks are level with but behind the axles, and take a reading of B. Any necessary adjustment is made by altering the length of the tie rod.

3. Undo the nut on the outer end of the tie rod and the outer clip on the steering gear rubber bellows.

WARNING

Oil lubricated steering gears (as from model 1973) are equipped with screw clamps that absolutely must be loosened so that the bellows are not twisted during adjustment. Hold the bellows during the turning.



ADJUSTING THE TIE ROD

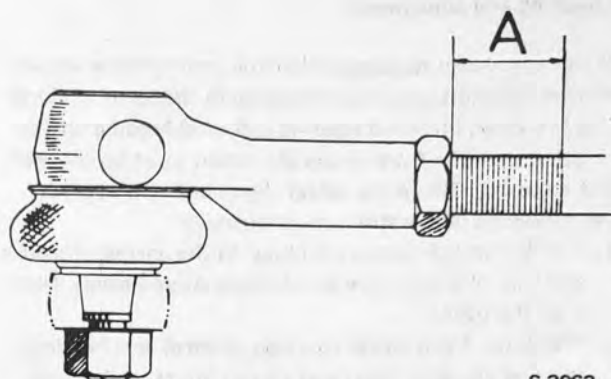
4. Use a suitable pair of grippers to twist the tie rod right or left; adjust until the toe-in is right.

NOTE

With the correct toe-in and the wheels lined up straight ahead, both tie rods should be the same length — or so adjusted that both wheels have the same clearance to the fenders and wheel housings at full right and left lock respectively. Check also that the steering wheel spokes are horizontal when the front wheels are pointing straight ahead. Do not forget to tighten the tie rod nut after adjusting.

NOTE

After adjustment of toe-in, the free length of thread on the tie rod (length A, see illustration) must not on any account be more than 1" (25 mm) (power steering gear 26 mm). The free thread lengths (A) on both tie rods must not differ from each other by more than 0.08" (2 mm).

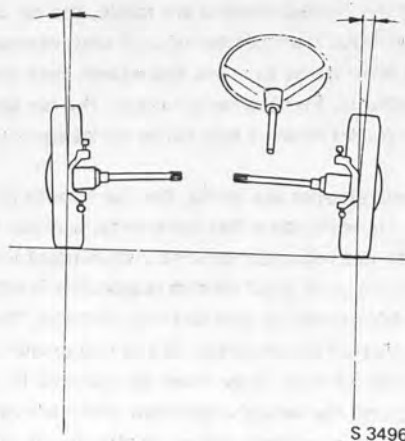


CHECKING THE LENGTH OF THE TIE ROD

A = 1 in. (25 mm), power steering gear max 26 mm

Camber

Camber is the angle by which the centerlines of the wheels lean from the vertical (see illustration). The camber is positive (+) if the wheels lean outward, and negative (−) if they lean inward. The correct front-wheel camber is $+3/4 \pm 1/4^\circ$.



CAMBER

Checking and adjustment

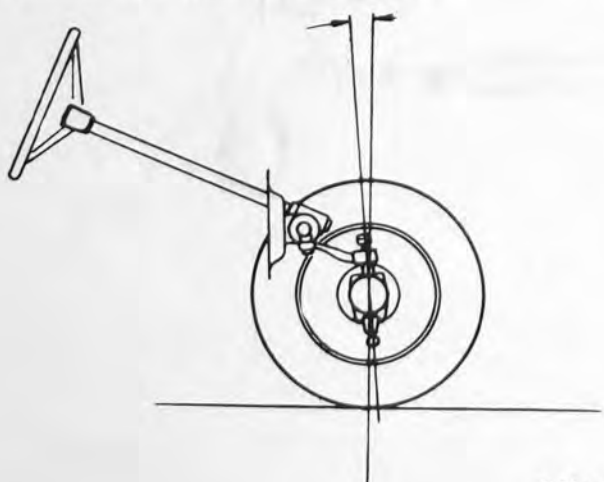
The camber, and with it the "king pin" angle, can be adjusted with spacers placed under the two bearing brackets of the upper control arms. The desired result can thus be obtained by increasing or reducing the number of spacers used. To increase or reduce camber, use the same number of spacers under both brackets. The rear bearing bracket is available in a lower design that gives bigger adjustment possibilities. See the spare parts catalogue.



LOCATION OF CAMBER ADJUSTMENT SPACERS

Caster

The caster is the angle by which the king pin axis (or, in the case of the Saab 99, the steering knuckle axis) departs from the vertical when viewed from the side and is generally expressed in degrees. Caster varies a great deal from one type of car to another, although in most cases the "king pin" leans backward as illustrated below; in such cases the caster is said to be positive (+), whereas if the "king pin" leans forward the caster is negative (-). If the "king pin" is vertical, the caster is zero. The correct caster angle up to and incl. model 1971 is $+1\frac{1}{4} \pm 1/4^\circ$. As from model 1972: $+3/4 \pm 1/4^\circ$.



CASTER

Checking and adjustment

If the caster angle needs adjusting, this is done with the help of spacers placed under the bearing brackets of the upper control arms.

To increase the caster, transfer spacers from the front bracket to the rear bracket.

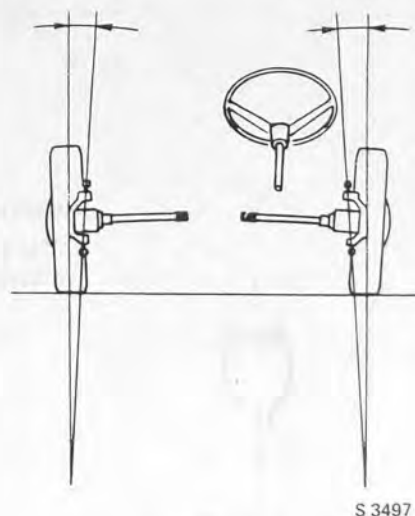
To reduce the caster, transfer spacers from the rear bracket to the front bracket.

In either case, the total spacer thickness removed from one bracket must be added to the other one.

Spacers for caster adjustment are supplied in thicknesses of 0.5, 1.0 and 2.0 mm (0.02", 0.04" and 0.08").

"King pin" angle

The car does not have king pins as such; the wheels pivot on two ball joints instead. It is thus more correct in this case to speak of the steering knuckle axis, i.e. the line passing through the centers of the ball joints and intersecting the ground near the wheel centerline. In the Saab 99, the steering knuckle axis should incline sideways from the vertical by $11\frac{1}{2} \pm 1^\circ$.



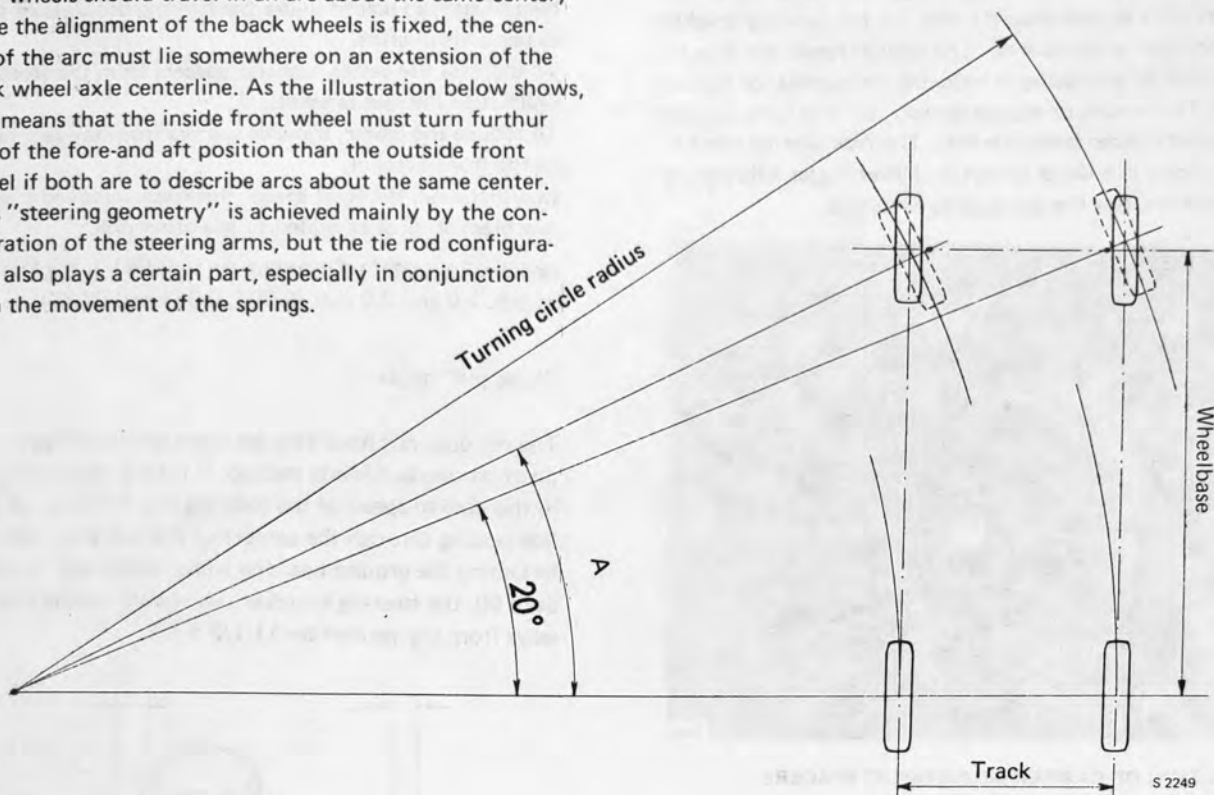
"KING PIN" ANGLE

Checking and adjustment

When the wheel camber is adjusted, the inclination of the steering knuckle axis is automatically altered by the same amount at the same time. The latter angle cannot be adjusted independently, as it is determined by the dimensions of the steering knuckle housing. If the steering knuckle axis is found to be out of true when the camber is correctly adjusted, this indicates that there is something wrong with the steering knuckle housing, which should therefore be exchanged.

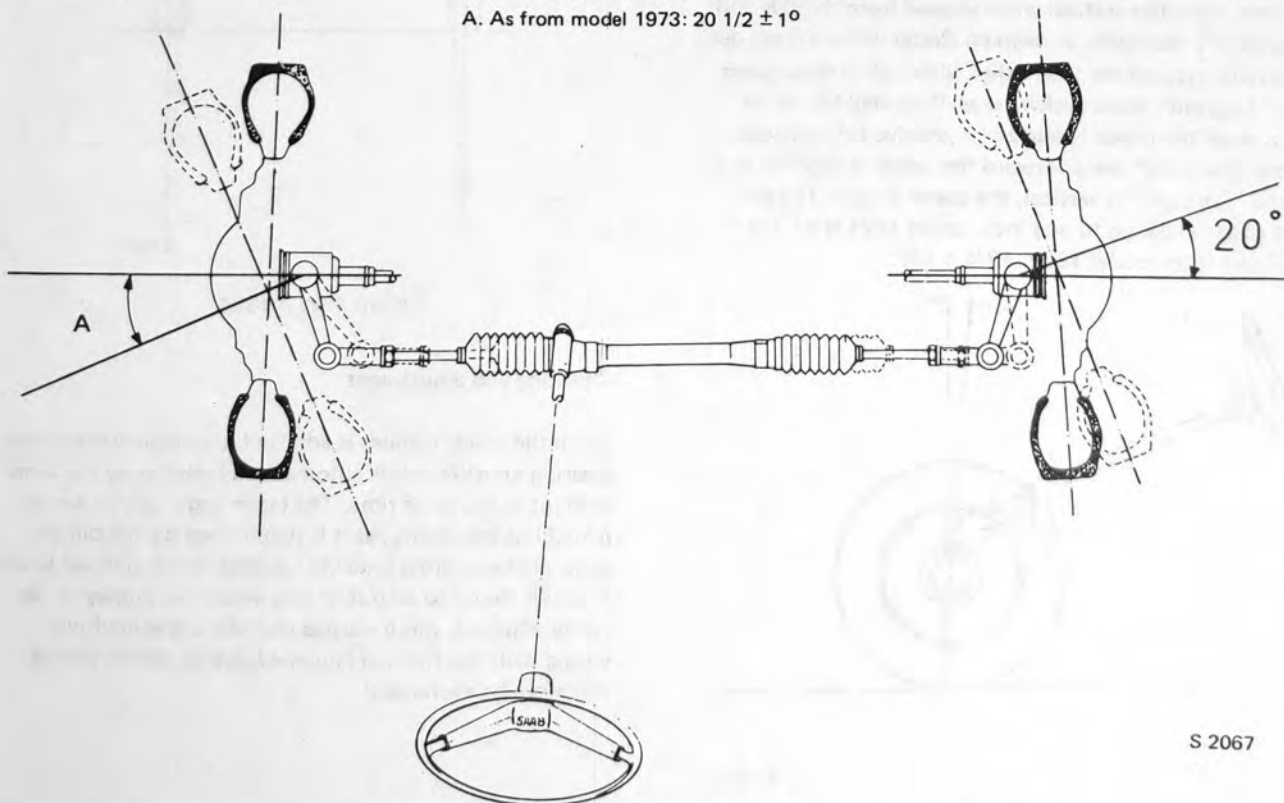
Wheel turning angles

When the car corners with properly aligned wheels, all four wheels should travel in an arc about the same center; since the alignment of the back wheels is fixed, the center of the arc must lie somewhere on an extension of the back wheel axle centerline. As the illustration below shows, this means that the inside front wheel must turn further out of the fore-and aft position than the outside front wheel if both are to describe arcs about the same center. This "steering geometry" is achieved mainly by the configuration of the steering arms, but the tie rod configuration also plays a certain part, especially in conjunction with the movement of the springs.



WHEEL ANGLES DURING CORNERING

- A. Up to and incl. model 1972: $21\ 1/2 \pm 1^\circ$
- A. As from model 1973: $20\ 1/2 \pm 1^\circ$



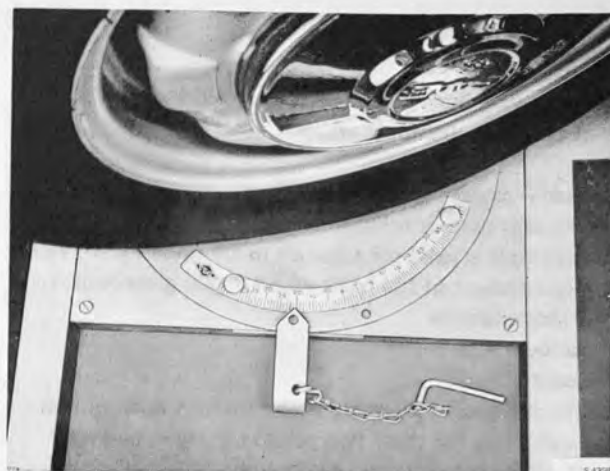
CORNERING POSITIONS OF FRONT WHEELS

- A. Up to and incl. model 1972: $21\ 1/2 \pm 1^\circ$
- A. As from model 1973: $20\ 1/2 \pm 1^\circ$

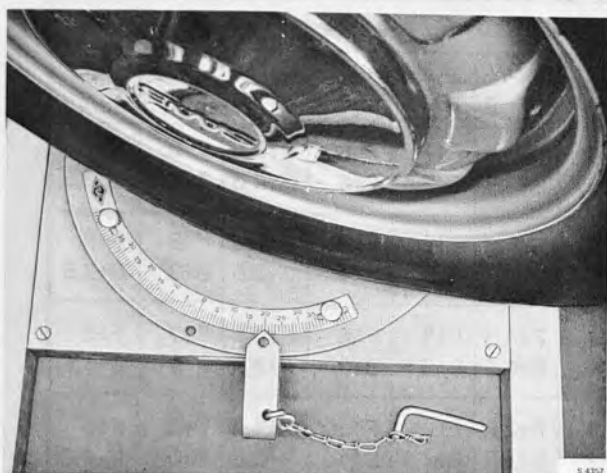
Checking and adjustment

Before the wheel turning angles are measured, the toe-in must be correctly adjusted. To measure the turning positions, use two turntables of standard type with scale graduations combined with optical measuring equipment (see illustration).

The centers of the turntables must be placed as close as possible under the pivoting centers of the wheels. Turn the steering wheel to the left until the right wheel, i.e. the outer wheel, shows a deflection of 20° . If the cornering adjustment is correct, the inner wheel should up to and incl. model 1972 show a deflection of $21\frac{1}{2} \pm 1^{\circ}$. As from model 1973, the deflection is $20\frac{1}{2} \pm 1^{\circ}$. Then make the same measurement with the wheels turned to

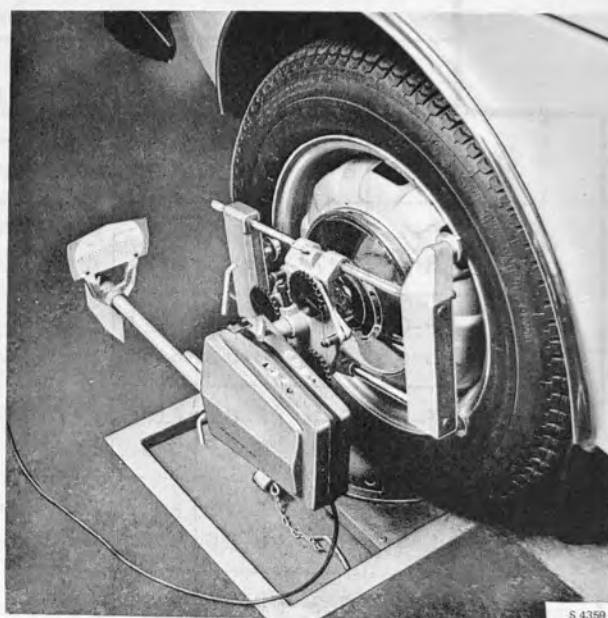


INNER WHEEL $21\frac{1}{2} \pm 1^{\circ}$ up to and incl. model 1972
 $20\frac{1}{2} \pm 1^{\circ}$ as from model 1973



OUTER WHEEL 20°

the opposite side. If the measurements reveal that the cornering adjustment is wrong, one or both steering arms be out of true. Defective steering arms must not be bent back to shape, they must be replaced.



OPTICAL MEASURING EQUIPMENT

Wheel alignment table

The following table can be used as an aid to the adjustment of wheel alignment angles.

Camber — caster

The table is used as follows:

The example is valid for table up to and incl. model 1971.

1. Measurement of the front wheel angles gives readings of, for example
 camber = $1\frac{1}{4}^{\circ}$
 caster = 2°
2. Find the box in the table where the row and column respectively for these two values intersect, and read off

F + 4

B + 1

which means:

(F) Front bearing bracket spacers to be increased (+) by 4 mm.

(B) Back bearing bracket spacers to be increased (+) by 1 mm.

3. Changing the spacers as indicated will correct both camber and caster angles simultaneously.

4. The figures enclosed by the broken lines in the table are within the permitted tolerances: no adjustment is needed in these cases.

Saab 99 up to and incl. model 1971

		Caster reading $^{\circ}$												
		$-1/2^{\circ}$	0	$1/4^{\circ}$	$1/2^{\circ}$	$3/4^{\circ}$	1°	$1\frac{1}{4}^{\circ}$	$1\frac{1}{2}^{\circ}$	$1\frac{3}{4}^{\circ}$	2°	$2\frac{1}{4}^{\circ}$	$2\frac{1}{2}^{\circ}$	$2\frac{3}{4}^{\circ}$
Camber reading $^{\circ}$	2°	F+2 B+9	F+3 B+8	F+3,5 B+7,5	F+4 B+7	F+5 B+6,5	F+5,5 B+6,5	F+6 B+6	F+6,5 B+5,5	F+7 B+5,5	F+8 B+5	F+8,5 B+4,5	F+9 B+4	F+10 B+3,5
	$1\frac{3}{4}^{\circ}$	F+1 B+8	F+2 B+7	F+2,5 B+6,5	F+3 B+6	F+4 B+5,5	F+4,5 B+5,5	F+5 B+5	F+5,5 B+4,5	F+6 B+5	F+7 B+4	F+7,5 B+3,5	F+8 B+3	F+9 B+2,5
	$1\frac{1}{2}^{\circ}$	F-0,5 B+6,5	F+0,5 B+6	F+1,5 B+5,5	F+2,5 B+5	F+3 B+4,5	F+3,5 B+3	F+4 B+4	F+4,5 B+3,5	F+5 B+3,5	F+6 B+3	F+6,5 B+2,5	F+7 B+2	F+8 B+1,5
	$1\frac{1}{4}^{\circ}$	F-2 B+5	F-1 B+4	F-0,5 B+3,5	F±0 B+3	F+1 B+2,5	F+1,5 B+2,5	F+2 B+2	F+2,5 B+1,5	F+3 B+1,5	F+4 B+1	F+4,5 B+0,5	F+5 B±0	F+6 B-0,5
	1°	F-3 B+4	F-2 B+3	F-1,5 B+2,5	F-1 B+2	F±0 B+1,5	F+0,5 B+1,5	F+1 B+1	F+1,5 B+0,5	F+2 B+0,5	F+3 B±0	F+3,5 B-0,5	F+4 B-1	F+5 B-1,5
	$3/4^{\circ}$	F-4 B+3	F-3 B+2	F-2,5 B+1,5	F-2 B+1	F-1 B+0,5	F-0,5 B+0,5	Correct setting	F+0,5 B-0,5	F+1 B-0,5	F+2 B-1	F+2,5 B-1,5	F+3 B-2	F+4 B-2,5
	$1/2^{\circ}$	F-5 B+2	F-4 B+1	F-3,5 B+0,5	F-3 B±0	F-2 B-0,5	F-1,5 B-0,5	F-1 B-1	F-0,5 B-1,5	F+0 B-1,5	F+1 B-2	F+1,5 B-2,5	F+2 B-3	F+3 B-3,5
	$1/4^{\circ}$	F-6 B+1	F-5 B±0	F-4,5 B-0,5	F-4 B-1	F-3 B-1,5	F-2,5 B-1,5	F-2 B-2	F-1,5 B-2,5	F-1 B-2,5	F±0 B-3	F+0,5 B-3,5	F+1 B-4	F+2 B-4,5
	0	F-8 B-1	F-7 B-2	F-6,5 B-2,5	F-6 B-3	F-5 B-3,5	F-4,5 B-3,5	F-4 B-4	F-3,5 B-4,5	F-3 B-4,5	F-2 B-5	F-1,5 B-5,5	F-1 B-6	F±0 B-6,5
	$-1/4^{\circ}$	F-9 B-2	F-8 B-3	F-7,5 B-3,5	F-7 B-4	F-6 B-4,5	F-5,5 B-4,5	F-5 B-5	F-4,5 B-5,5	F-4 B-5,5	F-3 B-6	F-2,5 B-6,5	F-2 B-7	F-1 B-7,5
	$-1/2^{\circ}$	F-10 B-3	F-9 B-4	F-8,5 B-4,5	F-8 B-5	F-7 B-5,5	F-6,5 B-5,5	F-6 B-6	F-5,5 B-6,5	F-5 B-6,5	F-4 B-7	F-3,5 B-7,5	F-3 B-8	F-2 B-8,5
	$-3/4^{\circ}$	F-11 B-4	F-10 B-5	F-9,5 B-5,5	F-9 B-6	F-8 B-6,5	F-7,5 B-6,5	F-7 B-7	F-6,5 B-7,5	F-6 B-7,5	F-5 B-8	F-4,5 B-8,5	F-4 B-9	F-3 B-9,5

If the adjustment range should prove too limited to permit the required adjustment, special bearing brackets with a wider adjustment range are available (see Spare Parts Catalogue).

Saab 99 as from model 1972

		Caster reading °												
		-3/4	-1/2	-1/4	0	1/4	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4
Camber reading °	2	F+3 B+7,5	F+3 B+7	F+3,5 B+6,5	F+4 B+6,5	F+4,5 B+6	F+5 B+6	F+6 B+6	F+6,5 B+5	F+7 B+5,5	F+7 B+5	F+7,5 B+5	F+8 B+4,5	F+8 B+4
	1 3/4	F+2 B+6,5	F+2 B+6	F+2,5 B+5,5	F+3 B+5,5	F+3,5 B+5	F+4 B+5	F+5 B+5	F+5,5 B+4,5	F+6 B+4	F+6 B+3,5	F+6,5 B+3,5	F+7 B+3	F+7 B+2,5
	1 1/2	F+1 B+5	F+1,5 B+5	F+1,5 B+4,5	F+2 B+4,5	F+2,5 B+4	F+3 B+4	F+4 B+4	F+4,5 B+3,5	F+5 B+3	F+5 B+2,5	F+5,5 B+2,5	F+6 B+2	F+6 B+1,5
	1 1/4	F-0,5 B+4	F±0 B+4	F+0,5 B+3	F+1 B+3	F+1 B+2,5	F+1,5 B+2,5	F+2 B+2	F+3 B+2	F+3,5 B+2	F+4 B+1,5	F+4,5 B+1,5	F+4,5 B+1	F+5 B+0,5
	1	F-1,5 B+3	F-1 B+2,5	F-1 B+2	F-0,5 B+2	F±0 B+1,5	F+0,5 B+1,5	F+1 B+1	F+1,5 B+1	F+2 B+0,5	F+2,5 B+0,5	F+3 B±0	F+3,5 B-0,5	F+4 B-1
	3/4	F-3 B+2,5	F-3 B+2	F-2,5 B+1,5	F-2 B+1	F-1 B+0,5	F-0,5 B+0,5	Correct setting	F+0,5 B-0,5	F+1 B-0,5	F+2 B-1	F+2,5 B-1,5	F+3 B-2	F+3 B-2,5
	1/2	F-4 B+1	F-3,5 B+0,5	F-3 B±0	F-2,5 B-0,5	F-2 B-0,5	F-1,5 B-1	F-1 B-1	F-0,5 B-1,5	F±0 B-1,5	F+0,5 B-2	F+1 B-2	F+1 B-2,5	F+1,5 B-3
	1/4	F-5 B-0,5	F-4,5 B-1	F-4,5 B-1,5	F-4 B-1,5	F-3,5 B-2	F-3 B-2	F-2 B-2	F-1,5 B-2,5	F-1 B-2,5	F-1 B-3	F-0,5 B-3	F±0 B-4	F+0,5 B-4
	0	F-6 B-1,5	F-6 B-2	F-5,5 B-2,5	F-5 B-2,5	F-5 B-3	F-4,5 B-3,5	F-4 B-4	F-3 B-4	F-2,5 B-4	F-2 B-4,5	F-1,5 B-4,5	F-1,5 B-5	F-1 B-5
	-1/4	F-7 B-2,5	F-7 B-3	F-6,5 B-3,5	F-6 B-3,5	F-6 B-4	F-5,5 B-4,5	F-5 B-5	F-4 B-5	F-3,5 B-5	F-3 B-5,5	F-2,5 B-5,5	F-2 B-6	F-2 B-6,5
	-1/2	F-8 B-4	F-8 B-4,5	F-7,5 B-5	F-7 B-5	F-7 B-5,5	F-6,5 B-5	F-6 B-6	F-5 B-6	F-4,5 B-6	F-4 B-6,5	F-3,5 B-6,5	F-3 B-7	F-3 B-7,5

The figures enclosed by the broken lines in the table are within the permitted tolerances; no adjustment is needed in these cases.

If the adjustment range should prove too limited to permit the required adjustment, special bearing brackets with a wider adjustment range are available (see Spare Parts Catalogue).

Toe-in (toe-out) measured on the rim

Reading value of toe-in		Screw tie rod in or out the following turns
Toe-out in mm	8	2 out
	7	1 3/4 out
	6	1 1/2 out
	5	1 1/4 out
	4	1 out
	3	3/4 out
	2	1/2 out
Toe-in in mm	1	1/4 ut
	0	Correct value
	1	1/4 in
	2	1/2 in
	3	3/4 in
	4	1 in
	5	1 1/4 in
	6	1 1/2 in
	7	1 3/4 in
	8	2 in

REAR WHEEL ALIGNMENT

Checking

If the rear axle has been subjected to abnormal strain in a collision or similar circumstances, it must be checked carefully for signs of failure and deformation.

Rear wheel alignment is not normally adjusted. However, if the rear axle has been subjected to such abnormal strain that the wheels may have been knocked out of true, the wheel angles should be measured. The angles must be within the tolerances listed below.

Camber $0 \pm 1^\circ$

Toe-in/toe-out

either wheel $0 \pm 0.6^\circ$

both wheels together $0 \pm 0.7^\circ$

both wheels together measured

rim-to-rim $0 \pm 0.2''$ (0 ± 5 mm)

Difference between left and right wheel-base (front wheels pointing straight ahead) $0.6''$ (15 mm)

NOTE

To be able to measure deviations in toe-in/toe-out, special equipment is needed for angle measurement.

NOTE

If the difference between the left and right wheel-bases is more than $0.2''$ (5 mm), the wheel angles must be checked.

The wheel angles can however be out of true without the wheelbase being affected.

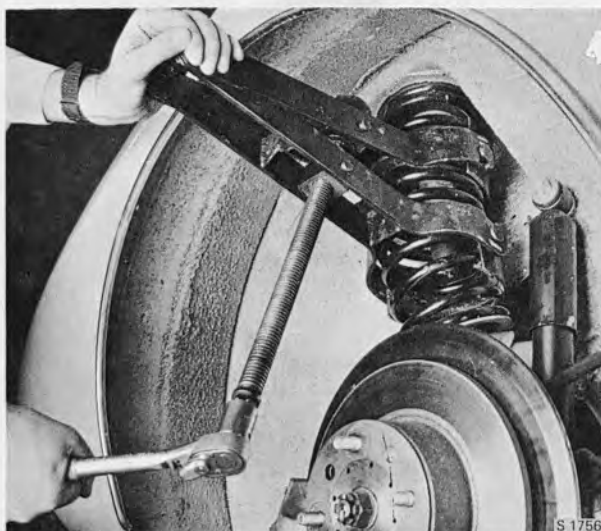
BALL JOINTS

Changing ball joints

1. Jack up the car and remove the wheel. Wash the ball joint and adjacent parts clean.
2. Only valid for the 1969 model:
If the upper ball joint is to be changed, remove the spring using spring tools 899506 and 899502.

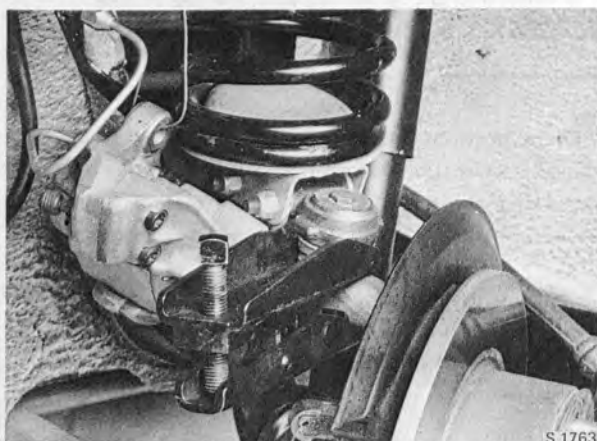
NOTE

Do not overload the tool. This can happen if the two cheeks of the tool are tightened hard against each other with the aid of a nut runner.



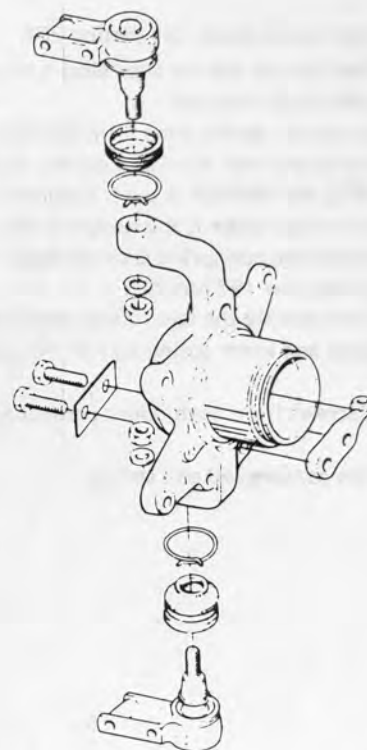
REMOVING THE FRONT COIL SPRING, MODEL 1969
Tools 899502 and 899506 or tool 899583

3. Unscrew the brake housing and hang it up in such a way that the brake hose or pipe not be damaged.
4. Undo the nut that holds the ball bolt in the steering knuckle housing, and remove the bolt using tool 899540.



REMOVING THE UPPER BALL JOINT
Tool 899540

5. Remove the ball joint from the control arm.
6. Mount a new ball joint, connect the bolt to the steering knuckle housing and tighten the nut.



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STEERING KNUCKLE HOUSING AND BALL JOINT FASTENINGS

7. Fasten the ball joint to the control arm (use new lock nuts). Model 1969: release the spring compression tool.
8. Mount the brake housing.
9. Put on the wheel and lower the car.

NOTE

Ball joints must not be disassembled but replaced as complete units.

Changing ball joint sealing bellows

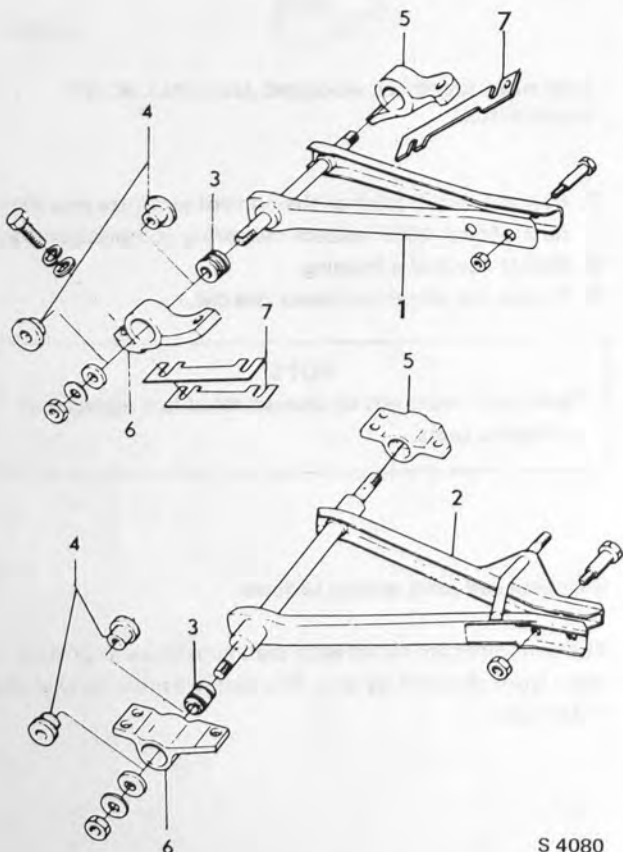
The ball joints are fitted with sealing bellows to protect them from abrasion by dirt. The bellows must be exchanged if damaged.

CONTROL ARMS

Changing the upper control arm

Removal

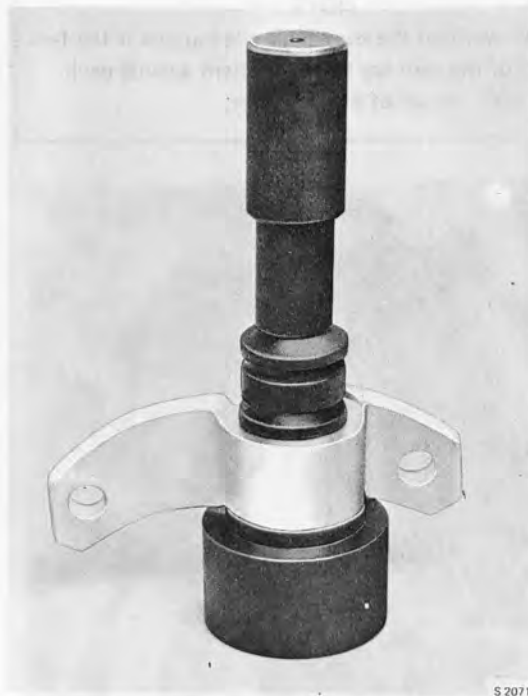
1. Remove the power plant. See section 201.
2. Jack up the front of the car and remove the wheel.
3. Remove the shock absorber.
4. Compress the coil spring using tools 899502 and 899506 up to and incl. the 1972 model. As from model 1973, tool 899584 is used. Removal and installation is made easier if the rubber buffer is removed before the coil spring is compressed (valid up to and incl. the 1972 model).
5. Back off and remove the two screws securing the upper ball joint and lower spring seat to the upper control arm.
6. Undo the screws from both upper control arm bearing brackets.
7. Remove the compressed coil spring.



UPPER AND LOWER CONTROL ARMS, FRONT SUSPENSION

- | | |
|-----------------------------|-----------------------------|
| 1. Upper control arm | 4. Two-piece rubber bushing |
| 2. Lower control arm | 5, 6. Bearings |
| 3. One-piece rubber bushing | 7. Spacers |

8. Remove the control arm and bearings. Save the spacers under the bearings and note the number of spacers under each bearing.
9. Undo both bearing nuts, after which the bearings and bushings can be removed from the control arm (see illustration).



INSERTING A ONE-PIECE RUBBER BUSHING

Installation

The parts must be well cleaned before they are assembled. Worn or damaged parts should be replaced by new ones.

1. Fit the rubber bushings. There are two types of these. If the one-piece type is fitted, it should be forced into the bearing with the aid of tool 784133. Soap the bushings before inserting.

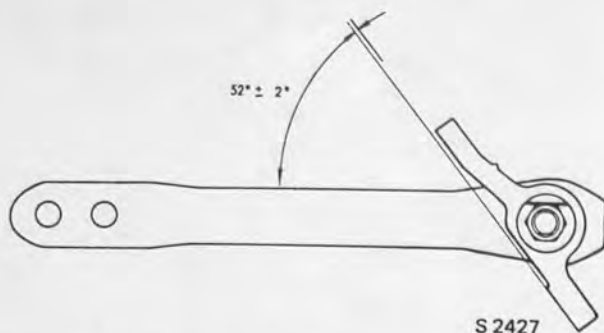
NOTE

On no account should oil or grease be used to assist insertion of rubber bushings. If lubrication is needed, use soapy water.

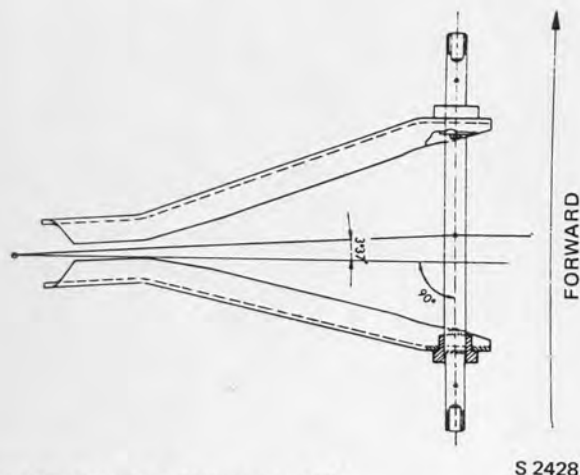
2. Mount the bearings to the control arm. When both nuts are tightened and locked, the angle between the arm and the bearing should be $52 \pm 2^\circ$.

NOTE

The control arm is asymmetrical (see illustration).



ANGLE BETWEEN UPPER CONTROL ARM AND BEARING



CONTROL ARM, ASYMMETRICAL

3. Locate the control arm but do not insert the bearing screws.
4. Check that the spacer and support ring of the top spring seat are in place and that the rubber buffers under the control arm are mounted.
5. Locate the compressed coil spring with rubber buffer and mount the ball joint and lower spring seat on the control arm.
6. Screw the control arm bearings to the body, not forgetting the spacers.
7. Gradually slacken the screw of the spring compression tool until the tool can be removed. Tighten the rubber buffer (valid up to and incl. the 1972 model).
8. Mount the shock absorber.
9. Mount the wheel and lower the front of the car.
10. Take the car out for a test run, then check and if necessary adjust the wheel alignment (see section 601).

Changing the lower control arm

Removal

1. Jack up the car and remove the wheel.
2. Disconnect the lower end of the shock absorber.
3. Back off and remove the two screws that secure the ball joint to the control arm.

4. Undo the lower control arm attachment screws under the engine compartment floor. The control arm and brackets can then be removed.
5. Undo both control arm bearing nuts and remove the bearings.

Installation

The parts must be well cleaned before they are assembled. Worn or damaged parts should be replaced by new ones.

1. Fit the rubber bushings. Two types exist, one-piece and two-piece. If the one-piece type is used, it should be force-fitted with the help of tool No. 784134. Soap the bushings before inserting. When both nuts are tightened and locked, the angle between the control arm and bearing should be $18^{\circ} \pm 2^{\circ}$.



ANGLE BETWEEN LOWER CONTROL ARM AND BEARING

2. Mount the control arm by screwing the bearings to the body.
3. Secure the ball joint to the control arm.
4. Mount the wheel and lower the car.
5. Take the car for a trial run.
6. Check and if necessary adjust the wheel alignment (see section 601).

NOTE

On no account should oil or grease be used to assist insertion of rubber bushings. If lubrication is needed, use soapy water.

Adjusting the control arms

If the control arms have been subjected to severe strain in a collision or similar circumstances, they must be checked carefully for failure and distortion. If the arms are out of true, they must be exchanged.

1. If the control arm is not in the correct position, the vehicle will not drive properly.
2. Check the control arm for any damage or wear.
3. If the control arm is damaged, it should be replaced.

When the control arm is in the correct position, the vehicle will drive properly. The control arm should be checked for any damage or wear. If the control arm is damaged, it should be replaced.

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4. If the control arm is damaged, it should be replaced.
5. Check the control arm for any damage or wear.
6. If the control arm is damaged, it should be replaced.

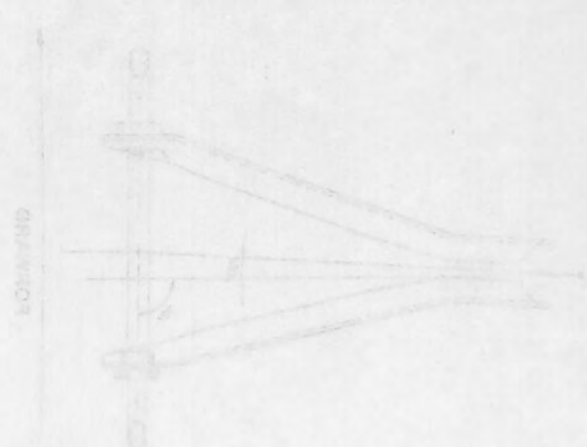


FIG. 1. A graph showing the relationship between distance and time.



1. If the control arm is not in the correct position, the vehicle will not drive properly.
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3. If the control arm is damaged, it should be replaced.

When the control arm is in the correct position, the vehicle will drive properly. The control arm should be checked for any damage or wear. If the control arm is damaged, it should be replaced.

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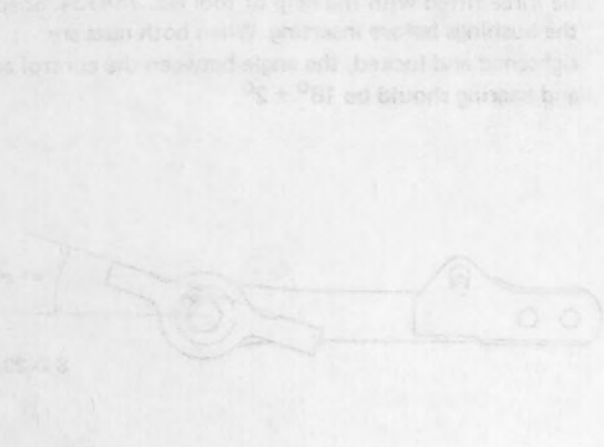
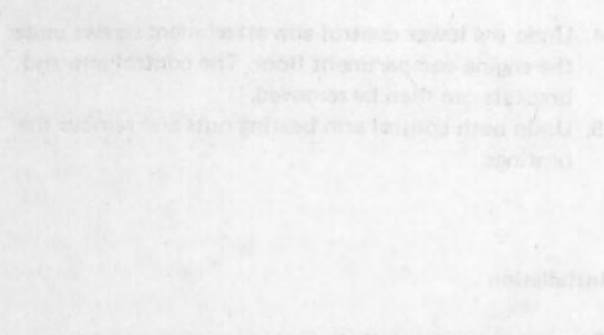


FIG. 2. A graph showing the relationship between distance and time.



STEERING WHEEL, STEERING COLUMN TUBE WITH SUPPORT AND STEERING COLUMN

General

The steering column is journaled in metal bushings surrounded by rubber bushings in a tube, the steering column tube or steering wheel bearing support, which is fixed to the pedal bracket and the body. An intermediate shaft jointed at both ends transmits the movement of the steering column to the steering gear.

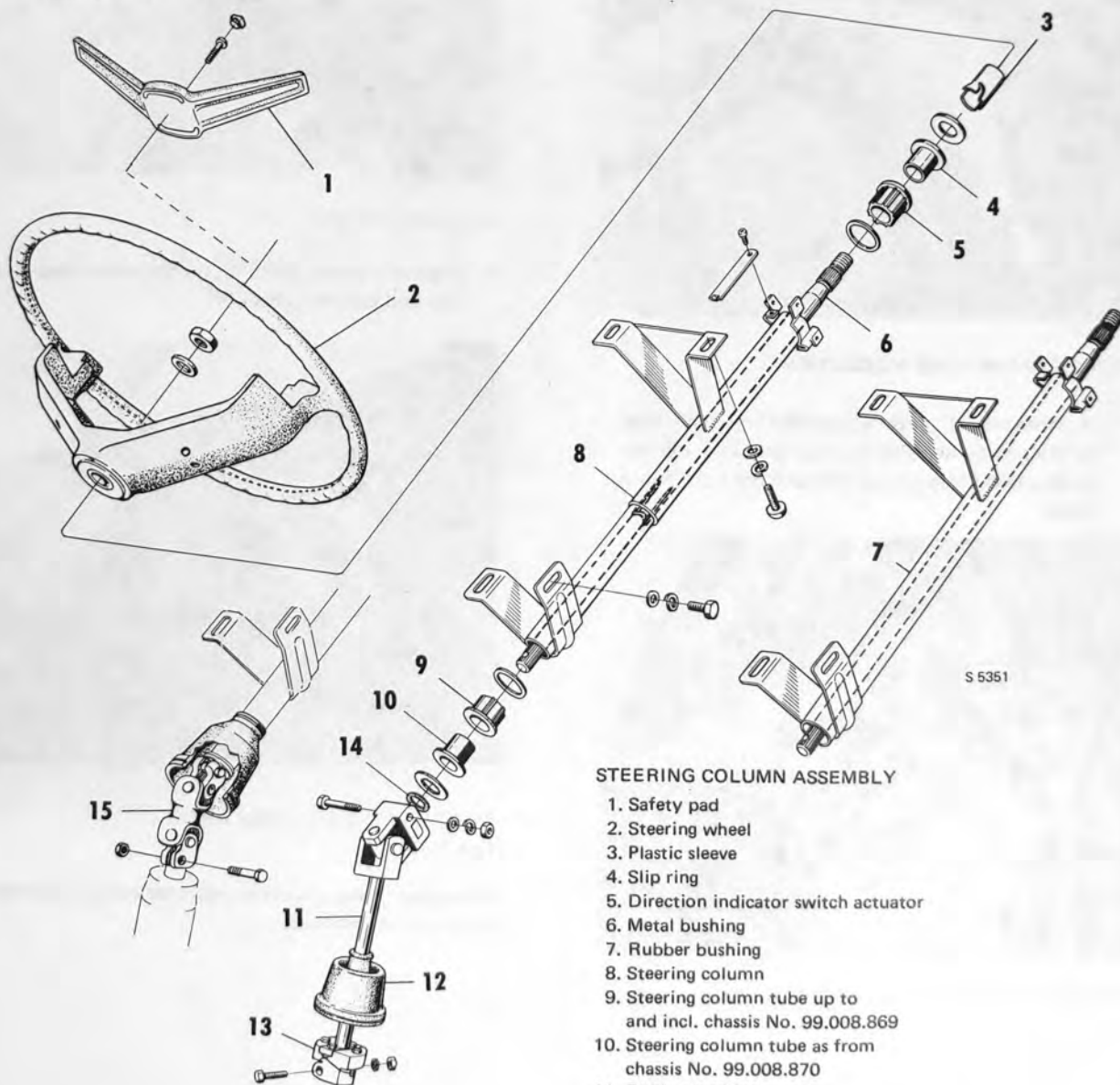
As from chassis No. 99.008.870 a new steering column and tube have been introduced. These are of telescopic type, i.e. the steering column and tube collapse when subjected to a certain critical axial force.

The 1974 model has been fitted with a new steering wheel and safety pad.

The steering column on cars with a power steering gear is equipped with a double joint.

WARNING

When the car is on a hoist, do not seize a front wheel and twist it by main force to full steering-wheel lock. There is a very serious risk of damaging the steering mechanism if this is done, as the rack-and-pinion gear will cause the steering wheel to spin at high speed, imposing a severe torsional strain on the steering column when the rotation is arrested by the stop in the steering gear.



S 5351

STEERING COLUMN ASSEMBLY

1. Safety pad
2. Steering wheel
3. Plastic sleeve
4. Slip ring
5. Direction indicator switch actuator
6. Metal bushing
7. Rubber bushing
8. Steering column
9. Steering column tube up to and incl. chassis No. 99.008.869
10. Steering column tube as from chassis No. 99.008.870
11. Rubber bushing
12. Metal bushing
13. Intermediate shaft
14. Sealing bellows
15. Joint half
16. Rubber washer
17. Spacer sleeve (as from chassis No. 99.063.198)
18. Double joint, power steering gear

Removing the steering wheel

1. a. Up to and incl. the 1969 model: remove the steering wheel safety pad by undoing the retaining screw. This can be reached after the plug has been pried off (see illustration).



PRYING OFF THE PLUG, MODEL 1969

- b. As from model 1970: remove the steering wheel safety pad by undoing the four screws under the spokes (see illustration). Remove the horn contact finger.



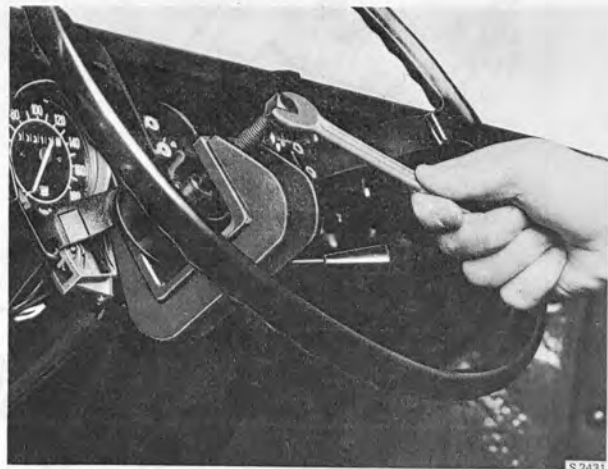
REMOVING THE SAFETY PAD, AS FROM MODEL 1970

2. Take the bottom cover off the steering wheel bearing by undoing the three screws holding it in place.
3. Back off the nut and remove the washer.



REMOVING THE NUT

4. Mount the puller, 899568, on the wheel (see illustration) and pull the wheel off.



REMOVING THE STEERING WHEEL

Tool 899568

If necessary, the direction indicator switch actuator can now also be removed.

Installation

1. Replace the direction indicator switch actuator if it has been taken out. Make sure that its center line coincides with the center line of the switch housing when the front wheels are straight ahead. Install the plastic sleeve on the driver.

CAUTION

The actuator is so designed that it is located on the steering column with a certain grip. On no account must it be welded to the column.

NOTE

As from chassis No. 99.063.198, the spacer sleeve should be mounted on the actuator.

2. Fit the steering wheel on to the steering column. The front wheels should be aligned straight ahead and the steering wheel mounted with the spokes forming a symmetrical inverted vee.
3. Mount the bottom cover of the steering wheel bearing, checking that the friction washer is properly seated. As from model 1970: replace the horn contact finger.
4. Fit the steering wheel safety pad.
Model 1969: replace the plug.

WARNING

The collapsible steering wheel shaft introduced as from chassis No. 99.008.870 must be handled with care. It must not be subjected to impacts, jolts or other rough treatment liable to alter the adjusted length of the telescope joint or impair its shock-absorbing effect.

When installing the steering wheel shaft, take special care to ensure that the splined lower end is pushed into the intermediate shaft until the clamping screw comes opposite the groove in the shaft. The intermediate shaft should normally slide freely on the shaft. If the splines stick, do not on any account knock on the top end of the steering wheel shaft. This also applies to removing and fitting the steering wheel. The wheel must not be knocked off or on. When the car is on a hoist, do not seize a front wheel and twist it by main force to full steering-wheel lock. There is a very serious risk of damaging the steering mechanism if this is done, as the rack-and-pinion gear will cause the steering wheel to spin at high speed, imposing a severe torsional strain on the steering column when the rotation is arrested by the stop in the steering gear.

Removing the steering column tube

1. Undo the locking screw at the joint.
2. Undo the two lower retaining screws at the pedal bracket and the two upper retaining screws. (Steering column tube- instrument panel.)
3. Detach the quick-release wiring connection and lift

out the steering column assembly.
Mount in the reverse order.

Disassembling the steering column

1. Undo the three retaining screws and remove the plastic cover under the steering wheel.
2. Pull the steering wheel shaft out of the tube.
3. Remove the two rubber bushings with associated steering wheel shaft bushings and washers.
Reassemble in the reverse order.

Replacement of sealing bellows on intermediate shaft

Removing

1. Remove the cover under the instrument panel. (Valid for cars as from model 1971.)
2. Undo the screw, which holds the steering column to the intermediate shaft.
3. Undo the four screws, which fasten the steering column tube to the body.
4. Withdraw the steering column from the intermediate shaft.
5. Cut off the old sealing bellows.



INSTALLATION OF SEALING BELLOWS, INTERMEDIATE SHAFT

Installation

1. Lubricate tool 899581 with vaseline or soapy water. Place the tool against the intermediate shaft. Ease the new sealing bellows over the tool and the joint. Check that the bellows are undamaged.
2. Refit the steering column into the intermediate shaft. Make sure that it is pushed in so that the screw is located directly opposite the groove. Tighten the screw.
3. Fasten the steering column to the body.
4. Check the position of the steering wheel and adjust if necessary.
5. Fit the bellows in the dash panel.
6. Refit the cover under the instrument panel. (Valid for cars as from model 1971.)

STEERING GEAR

General

The steering gear is precision adjusted before delivery and should not be disassembled unless absolutely necessary. As from chassis No. 99.022.279 up to and incl. model 1972 the steering gear is permanently grease lubricated. Earlier steering gears have lubrication nipple. As from the 1973 model the steering gear is oil lubricated but in other respects the same as the permanently lubricated type.

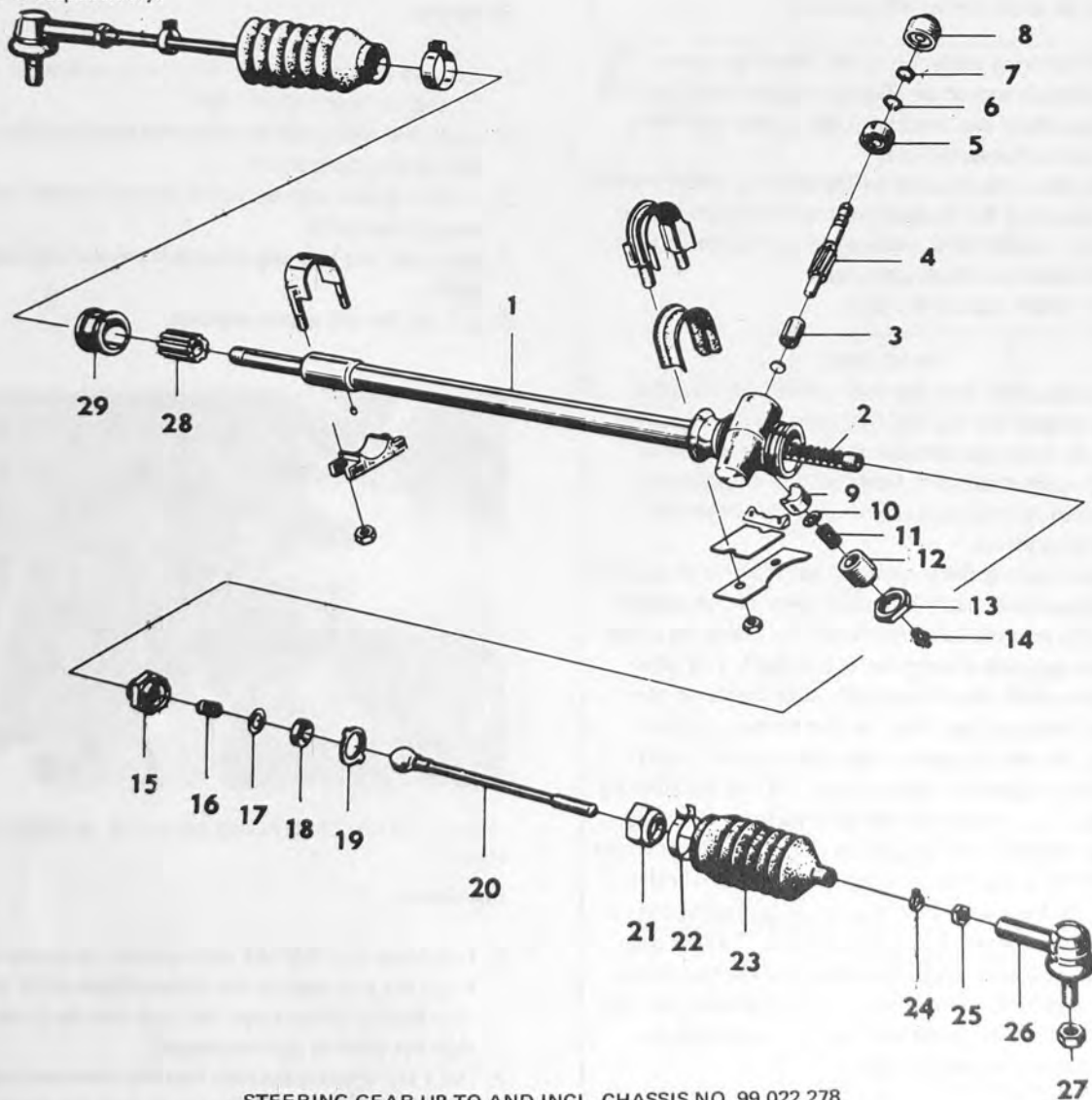
Disassembly and reassembly of the different steering gears are to be found in two separate sections 642-3 and 642-6 respectively.

Turn the steering wheel to full left lock before greasing. Use Saab Special chassis grease. Lubricate generously to ensure smooth action but not so much that the bellows are distended with grease.

Check occasionally to see that the oil-lubricated steering gear is not leaking. Check the oil level every 30,000 miles (50,000 km). See page 120-4.

Regarding the power steering gear, see section 644.

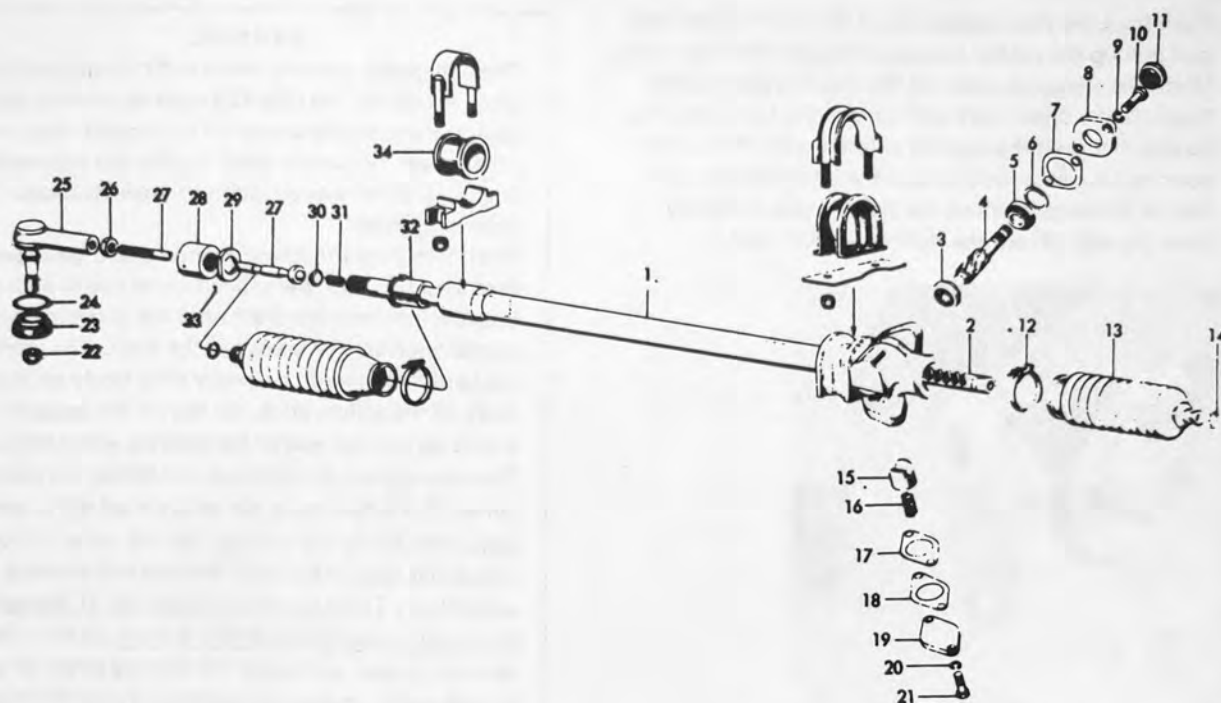
If the steering gear is noisy, it must be adjusted (see section "Adjustment of steering gear"). The illustration shows the steering gear of a left-hand-drive car. As the steering gear of the right-hand-drive model is essentially similar, the instructions given here apply to both types.



STEERING GEAR UP TO AND INCL. CHASSIS NO. 99.022.278

- | | | |
|-----------------------------------|-----------------------|--------------------------|
| 1. Steering gear housing assembly | 10. Spring | 21. Clamp |
| 2. Rack | 11. Fitting | 22. Rubber bellows |
| 3. Bushing | 12. Lock nut | 23. Washer |
| 4. Pinion | 13. Grease nipple | 24. Clamp |
| 5. Ball bearing | 14. End piece | 25. Nut |
| 6. Lock ring | 15. Spring | 26. Tie rod end assembly |
| 7. Sealing ring | 16. Shim | 27. Nut |
| 8. Fitting | 17. Inner bearing cup | 28. Rubber bushing |
| 9. Plunger | 18. Lock washer | 29. Bushing |
| | 19. Tie rod | |
| | 20. Outer bearing cup | |

S 2432



S 2433

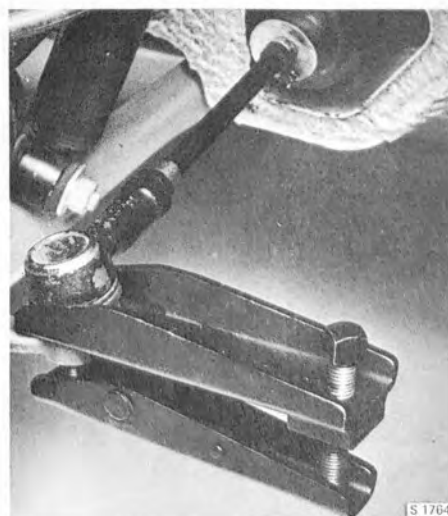
STEERING GEAR, AS FROM CHASSIS NO. 99.022.279

- | | | |
|-----------------------------------|--------------------|-----------------------|
| 1. Steering gear housing assembly | 12. Clip | 24. Ring |
| 2. Rack | 13. Rubber bellows | 25. Tie-rod end |
| 3. Ball bearing | 14. Clip | 26. Lock nut |
| 4. Pinion | 15. Plunger | 27. Tie rod |
| 5. Ball bearing | 16. Spring | 28. Outer bearing cup |
| 6. Shim | 17. Shim | 29. Lock nut |
| 7. Gasket | 18. Gasket | 30. Inner bearing cup |
| 8. Cap | 19. Cap | 31. Spring |
| 9. Washer | 20. Washer | 32. Bushing |
| 10. Screw | 21. Screw | 33. Cotter pin |
| 11. Seal ring | 22. Nut | 34. Rubber bushing |
| | 23. Rubber bellows | |

Some previously grease-lubricated steering gears have been modified for oil lubrication and fitted with a screw clamp at the attachment of the rubber bellows to the tie rod. These steering gears should also be checked to see that oil is not leaking out.

Removing the steering gear (left-hand-drive car)

1. Jack up the front of the car.
2. Remove the front wheels.
3. Disconnect the tie-rod ends from the steering arms using tool 899540. Undo both retaining caps.



DISCONNECTING THE STEERING ARM
Tool 899540

4. Turn back the floor carpet round the intermediate shaft and pull up the rubber bellows to expose the lower joint.
5. Undo the clamping screw on the steering gear pinion. Separate the upper joint and remove the four retaining screws that hold the steering column tube. Pull up the steering column a little so that the intermediate shaft can be removed. Pull out the steering gear assembly from the left. (From the right on R.H.D. cars.)



REMOVAL OF STEERING GEAR ASSEMBLY

Installing the steering gear assembly

1. Insert the steering gear assembly through the opening in the left wheel housing. (Right wheel housing on R.H.D. cars.) When a new steering gear is installed the paper cylinders on the bellows should be left until the gear is in place.
2. Mount the retaining caps and tighten the four nuts.
3. Connect the tie rods to the steering arms and tighten the self-locking nuts.
4. Mount the intermediate shaft and locate the steering column tube. Tighten the locking and retaining screws.
5. Locate the rubber bellows over the lower joint and lay the carpet.
6. Mount the wheels and lower the front of the car.

WARNING

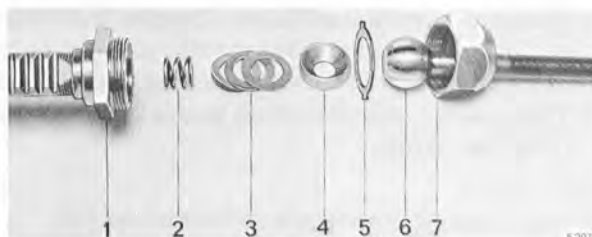
The collapsible steering wheel shaft introduced as from chassis No. 99.008.870 must be handled with care. It must not be subjected to impacts, jolts or other rough treatment liable to alter the adjusted length of the telescope joint or impair its shock-absorbing effect.

When installing the steering wheel shaft, take special care to ensure that the splined lower end is pushed into the intermediate shaft until the clamping screw comes opposite the groove in the shaft. The intermediate shaft should normally slide freely on the shaft. If the splines stick, do not on any account knock on the top end of the steering wheel shaft. This also applies to removing and fitting the steering wheel. The wheel must not be knocked off or on. When the car is on a hoist, do not seize a front wheel and twist it by main force to full steering-wheel lock. There is a very serious risk of damaging the steering mechanism if this is done, as the rack-and-pinion gear will cause the steering wheel to spin at high speed, imposing a severe torsional strain on the steering column when the rotation is arrested by the stop in the steering gear.

Steering gear up to and incl. chassis No. 99.022.278

Disassembling the steering gear

1. Undo the lock nuts and unscrew the tie-rod end assemblies.
2. Remove the clamps and the rubber bellows.
3. Prize up the lock washers.
4. Disassembly the two tie-rod ball joints by unscrewing the outer bearing cup with a ring spanner. Put the outer cups, lock washers, inner cups, shims and spring, carefully aside. Grip the rack in a vise between two wooden blocks and unscrew the end pieces.



BALL JOINT, DISASSEMBLED

1. End piece
2. Spring
3. Shim
4. Inner bearing cup
5. Lock washer
6. Tie rod
7. Outer bearing cup

5. Undo the lock nut of the rack adjustment and remove the fitting, spring and plunger.
6. Remove the pinion after unscrewing the fitting; extract the pinion using tapping hammer 839027 and puller 899528.



REMOVING THE PINION
Tools 839027 and 899528

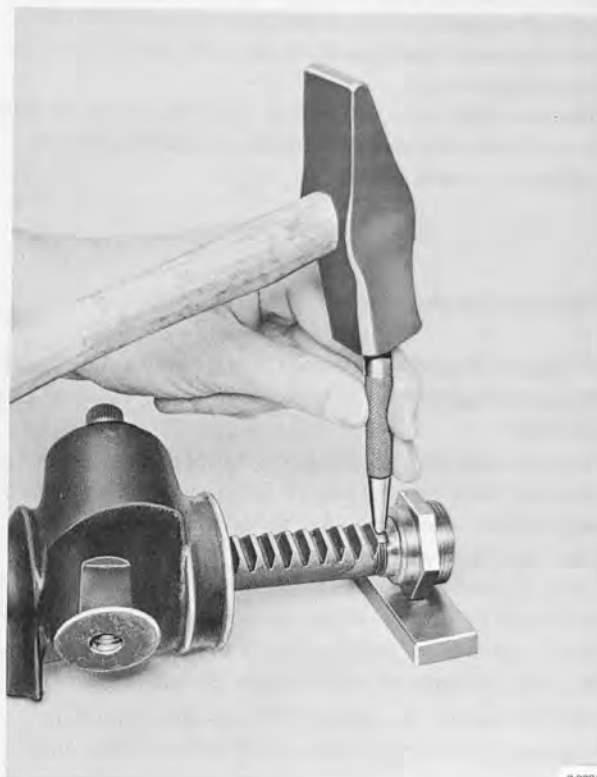
7. If the bearing is damaged, it can be freed with the help of a piece of pipe of matching diameter or a puller after the lock ring has been removed.
8. Pull the rack out of the steering gear housing, saving the plastic plug under the rubber bushing.
9. If the bushing at the right-hand end of the steering gear needs exchanging, use tool 899537 to expel it.

Assembling the steering gear

Scrupulous cleanliness is essential during the assembling operation. Lubricate gear teeth, bearing points and other sliding contact surfaces with Saab Special chassis grease.

1. Fit any bushings that have been removed into the steering gear housing. The hole in the large bushing must be in line with the hole in the housing.
2. Insert the rack into the housing, locate the pinion with bearing and lock ring, and tighten the fitting against the outer ring of the ball bearing. Insert the plastic plug and the rubber bushing.

3. Mount the plunger, spring, fitting and lock nut for the radial adjustment of the rack.
4. Fit the bellows clamp at the right-hand end of the steering gear. Screw the endpieces on to the rack and lock them (see illustration). Fit the lock washers, springs, shims and inner bearing cups.



LOCKING THE END PIECE WITH A PUNCH MARK

5. Mount the outer bearing cup on the tie rod and tighten it firmly against the nut.
6. Check that the ball joints are properly shimmed. If not, unscrew the outer cup and change the shim combination (see under Adjustment).
7. After adjusting the ball joint, bend the lock washer over the outer bearing cup and endpiece.
8. Adjust the radial play of the rack (see under Adjustment).
9. Fit the rubber bellows and screw the clamps to the steering gear and tie rod respectively, but not too tight — it must be possible to twist the tie rod in the bellows.

NOTE

Use band type clamps. Wire clamps may not be used.

10. Screw on the lock nuts and mount the tie-rod and assemblies on the tie rods.
11. Grease the steering gear; check by feeling the rubber bellows that the grease is distributed along the full length of the steering gear assembly.

Adjustment of steering gear

The adjustments that may be required are as follows:

1. Adjustment of rack radial play.
2. Adjustment of tie-rod inner ball joints.

The steering gear assembly must be removed from the car for adjustment of the inner ball joints, but the radial play of the rack can conveniently be adjusted with the steering gear in place, unless it has had to be removed for some other reason.

The inner ball joints will seldom need adjustment, as there is very little wear on them, besides which they are self-adjusting to some extent.

Adjusting the pinion play

If noise or knocking is noticed in the steering mechanism, the pinion ought to be checked for possible radial or axial backlash.

Backlash may occur if some part has been changed or as a result of wear. Normal wear is very low, so adjustment on this account is seldom called for provided that the parts have been kept well greased.

Axial and radial backlash in the pinion (steering column shaft) can only be corrected by a change of bushing and/or ball bearing, for which purpose the steering gear assembly must be removed from the car. On assembly, fitting 890303 must be tightened so that its lower end butts firmly against the outer ring of the ball bearing.

Adjusting radial backlash in the rack

The radial backlash of the rack is adjusted by a threaded fitting (adjusting screw) on the underside of the steering gear. This adjustment can be made with the steering gear in place in the car.

1. Unscrew the lock nut.
2. Screw the fitting right home.
3. Slacken the fitting about 1/8—1/4 turn and tighten the lock nut.
4. If necessary, readjust and then check that the rack does not stick in any position from lock to lock.

Adjusting the tie-rod inner ball joints

The tie rods (see illustration) are exactly the same on both sides. The inner end of each rod where it connects to the steering rack is spherical, while the outer end is threaded to engage the female thread of the outer ball joint assembly.

1. To adjust the inner ball joint, the steering gear assembly must first be removed from the car.
2. Undo the clamps and take off the rubber bellows.
3. Pull the rack as far as it will come to one side. Straighten out the lock washer and then separate the outer bearing cup from the nut (see illustration).



BALL JOINT, DISASSEMBLED

1. End piece
2. Spring
3. Shim
4. Inner bearing cup
5. Lock washer
6. Tie rod
7. Outer bearing cup

4. Fit a new lock washer on the inner nut. Place a suitable combination of shims between the inner bearing cup and the nut.
5. Slip the outer bearing cup over the tie rod and screw the cup tight to the rack endpiece.
6. Check that the shimming is correct. The ball joint should have no play whatsoever and should remain in any position to which it is moved without the tie rod sagging under its own weight; the joint must not however be so tight that it sticks in any position. It should be possible to move the tie rod to its full limit of travel in any direction by applying a force of 29 N (6,5 lb, 3 kp) to the end of the rod.

7. If the shimming is not correct, the outer bearing cup must be unscrewed again and the number of shims increased or reduced. Then lock the lock washer.
8. Repeat the adjustment in the same manner for the other tie rod.
9. Inspect the rubber bellows and fit new ones if necessary. Mount the steering gear assembly in the car.

NOTE

While the steering gear is out of the car, check the radial backlash of the rack and pinion.

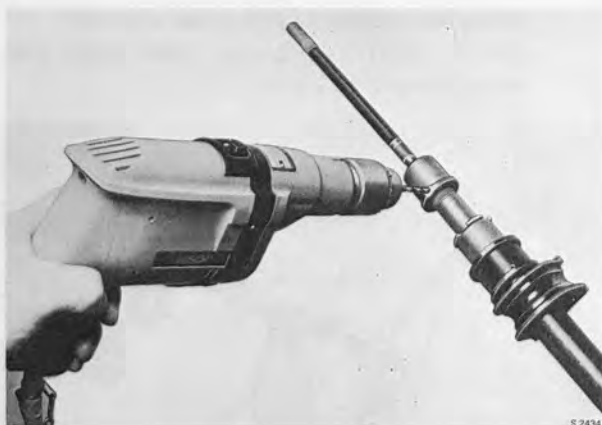
Steering gear, as from chassis No. 99.022.279

Disassembling the steering gear

1. Back off the lock nuts and unscrew the tie-rod ends.
2. Undo the clips and remove the rubber bellows.
3. Drill out the cotter pins from the inner ball joints using a 4 mm bit. The pins are 3/8" (9.4 mm) long (see illustration).

CAUTION

Do not drill too deep.



DRILLING OUT THE COTTER PIN

4. Remove the outer bearing cups and lock nuts using tool 839019 and polygrip pliers (see illustration).



REMOVING OUTER BEARING CUP AND LOCK NUT
Tool 839019 and polygrip pliers

5. Undo the rack adjustment screws and remove the cap with gasket, shims, spring and plunger.
6. Undo the pinion screws and remove the pinion with cap, gasket, shims and upper bearing.
7. Pull the rack out of the steering gear housing.
8. Remove the lower pinion bearing by tapping the housing on a porous surface. The bushing in the end of the steering gear housing should not normally be changed, as it must be precision reamed in order to function properly.

Assembling the steering gear

Scrupulous cleanliness is essential during the assembling operation. Make sure that the steering gear is well lubricated with Saab Special chassis grease, as it cannot be lubricated after it has been assembled (valid up to and incl. the 1972 model).

1. Seat the lower pinion bearing.

CAUTION

Make sure that both pinion bearings are the right way up. The extended parts of the inner bearing tracks should face each other.

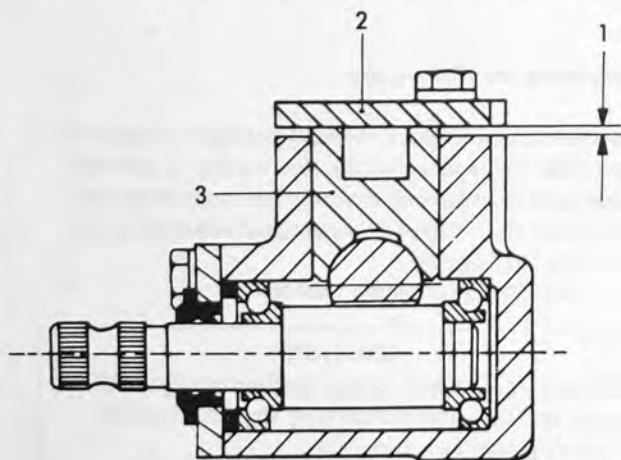
2. Assemble the inner ball joint on the pinion end of the rack as follows:
Thread the lock nut on to the rack. Fit the outer bearing cup on the rack and fill it with Saab Special chassis grease (valid up to and incl. the 1972 model). Insert the spring and inner bearing cup and tighten the bearing cup.

3. Tighten the bearing cup so that there is no looseness in the ball joint, but not so tight that the ball sticks in any position.
If the rack with tie rod mounted is held horizontal, the ball joint should be so tight that the tie rod with tie-rod end fitted can be placed in any position without bending down under its own weight.

CAUTION

The tie rod must not on any account stick in any position. It must be possible to move the rod to its full limit of travel in any direction by light hand pressure.

4. Tighten the lock nut against the bearing cup using tool 839019 and polygrip pliers, and check again that the ball joint is neither too tight nor too slack. Drill a new hole for the cotter pin 4 mm in diameter and 3/8" (9.4 mm) deep and insert a new cotter pin, securing it by four center punch blows at the edge of the hole. Be extremely careful that no drill shavings get into the steering gear.
5. Insert the rack in the housing. Then fit the pinion and upper bearing. Adjust the pinion with shims so that there is no axial play when the gasket and cap are mounted. Shims are available in thicknesses of 0.005", 0.0075", 0.010" and 0.090" (0.13, 0.19, 0.25 and 2.33 mm).
6. Adjust the radial play of the rack as follows:
 - a. Fit the plunger without the spring and screw on the cap without the gasket by hand until it butts against the plunger (see illustration). If a wrench is used, the cap will be deformed. It is also possible to adjust the radial play of the rack when the steering gear is in place in the car.

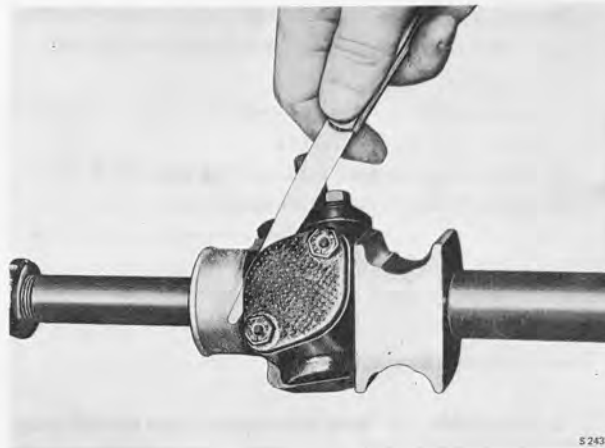


S 2436

CAP AND PLUNGER FITTED FOR MEASUREMENT OF PLAY

1. Clearance to be measured with feeler gauge
2. Cap
3. Plunger

- b. Measure the clearance between the cap and housing with a feeler gauge (see illustration).



S 2437

MEASURING CLEARANCE BETWEEN CAP AND HOUSING

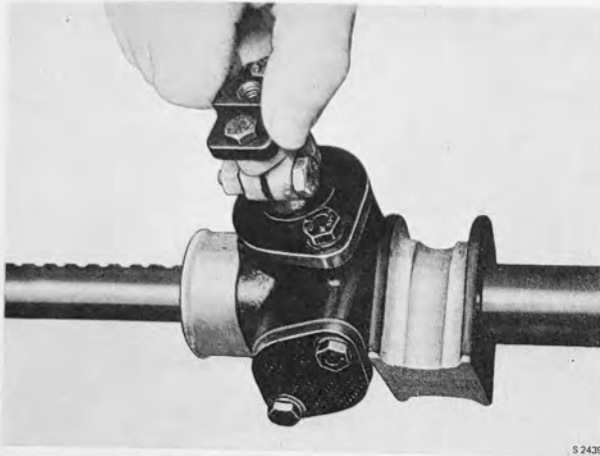
- c. Add 0.002" — 0.006" (0.05 — 0.15 mm) to the measured clearance to allow for the play to be left between the plunger and cap after assembly. If for example the feeler gauge measurement is 0.022" (0.55 mm), the total thickness of gasket and shims should be 0.024" — 0.028" (0.60—0.70 mm). Measure the thickness of the gasket and shims with a micrometer (see illustration). Shims are available in thicknesses of 0.005", 0.0075", 0.010", 0.015" and 0.020" (0.13, 0.19, 0.25, 0.38 and 0.51 mm).



S 2438

MEASURING GASKET AND SHIMS

7. Fit the plunger, spring, shims, gasket and cap.
8. Check that the rack does not stick in any position by rotating the pinion with tool 899528 (see illustration).



CHECKING THAT THE RACK DOES NOT STICK
Tool 899528

9. In a correct adjusted steering gear, the torque should be 1.1–2.1 Nm (0.83–1.5 ft.lb., 11.5–20.7 kpcm). This is checked with the aid of dynamometer 839013, brake spring tool 899560 and tool 899528. Connect the brake spring tool according to figure. A lever arm of about 6.03 (16 cm) is then obtained which corresponds 7–14 N (5.5–11 ft.lb., 0.7–1.4 kp) on the dynamometer.



CHECKING THE STEERING GEAR TORQUE
Tools 839013, 899528 and 899560

10. Assemble the other ball joint and adjust in the same manner as before.
11. Fit the rubber bellows and secure the clips round the steering gear. As from model 1973, the contact area between the rubber bellows and tie rod is lubricated with silicone grease. Fit all clamps except one of the outboard ones. Stand the steering gear assembly on end and pour in 5 fl.oz., 0.15 dm³ (1.5 dl) of EP 90 oil between the rubber bellows and tie rod, using an oil can. Fit the remaining clamp and make sure that the threads of the outboard clamping screws are protected by rubber caps.
12. Screw on the lock nuts and mount the tie rod end assemblies on the tie rods.

Steering gear, as from model 1973

The steering gear ratio has been modified commencing with the 1973 model. The number of turns of the steering wheel from lock to lock has been increased from 3.5 to 3.7. This has been achieved by lengthening the steering arms and the rack.

Two alternative versions are fitted to the earlier 1973 models. The first version is fitted to vehicles up to chassis number 99732005773 and also in a limited number of cars with higher chassis numbers. The later version used a 0.4" (10 mm) shorter rack, compensated for by a 0.2" (5 mm) increase in the length of both tie rods. In addition, the locking nut for the inner ball joint is 0.5" (13 mm) thick on the first version as compared with 0.3" (8 mm) on the later type.

WARNING

The short tie rods must not in any circumstances be used in conjunction with the new short rack. This is because the screw threads at the ends of the tie rods would then be too short. Only the longer type of tie rods is available as a spare part. (See the attached table.)

Exchanging	Fit	Note
Complete steering gear	Steering gear 892009 (RHD 892010)	Only the later version is available as a spare part.
Rack	Rack 892217 (RHD 892218)	Only 892217 (RHD 892218) is available as a spare part. <u>Rack 892217 (RHD 892218) must only be fitted in conjunction with the rods type 892216.</u>
Tie rod	Tie rod 892216	Only 892216 is available as a spare part. When tie rod type 892216 is fitted to the earlier type of steering gear, there is a possibility that the tie rod screw thread may butt against the tie rod end, thus restricting adjustment possibilities. If this happens, the threaded end should be ground off by max. 0.2" (5 mm). In order to make it possible to distinguish different types of tie rod, the new long version (892216) is provided with a machined track. See diagram. 892015 (short) 892216 (long) Track

Changing rubber bellows up to and incl. model 1969

If the steering gear rubber bellows are damaged they must be renewed immediately, as dirt may otherwise enter the steering gear mechanism and cause it to stick.

1. Jack up the front of the car and take off the wheel.
2. Disconnect the tie-rod end assemblies as described in section 643.
3. Undo the clamps securing the rubber bellows to the steering gear housing and tie rod respectively and pull off the bellows. It may be necessary to remove the air cleaner and alternator to get at the large clips on the steering gear.
4. Clean out the old grease and repack with fresh grease. Slip a new rubber bellows over the joint and secure with clips, but not so tightly that the tie rod cannot be rotated in the bellows.
5. Mount the tie-rod end assembly and connect it to the steering arm.
6. Adjust the toe-in as described in section 601, then tighten the lock nut.

Changing rubber bellows as from model 1970 up to and incl. the 1972 model

Changing the right hand side rubber bellows is done according to the above description. If the left hand side bellows is to be changed, the steering gear must be removed. See section "Removing the steering gear".

Changing rubber bellows, as from model 1973

If either of rubber bellows needs renewing, the steering gear must be removed and both rubber bellows renewed. At the same time the steering gear must be drained and refilled with fresh oil.

To drain:

Remove the steering gear and stand it on end until the oil has run out.

To refill:

Lubricate the contact area between the rubber bellows and tie rod with silicone grease when fitting the bellows. Fit all clamps except one of the outboard ones. Stand the steering gear assembly on end and pour in 5 fl.oz. 0.15 dm³ (1.5 dl) of EP 90 oil between the rubber bellows and tie rod, using an oil can. Fit the remaining clamp and make sure that the threads of the outboard clamping screws are protected by rubber caps.

TIE-ROD END ASSEMBLIES

General

The outer ball joints, the tie-rod end assemblies, are screwed on to the tie rods and secured by lock nuts. By backing off the lock nuts and twisting the tie rods clockwise or counterclockwise, it is possible to reduce or extend the length of the tie rod. This is how the toe-in of the front wheels is adjusted.

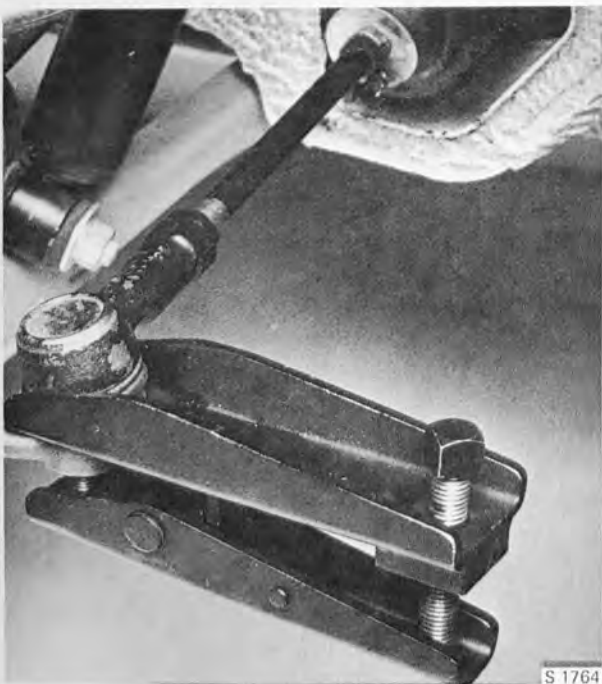
The tie rod is connected to the steering arm of the steering knuckle housing by a tapered ball bolt, which is secured by a self-locking nut. The tie-rod end assemblies cannot be disassembled; they adjust themselves to moderate wear and therefore seldom need exchanging.

However, damage caused by external force, as in a collision or crash, may make it necessary to renew both the tie rods and end assemblies. These components are vital to vehicle safety and must therefore be checked over with the utmost care if there is any reason to suspect that they are damaged or bent.

Changing tie-rod end assemblies

The tie-rod end assemblies cannot be disassembled and must therefore be exchanged complete if they have worn loose.

1. Jack up the front of the car and take off the wheel.
2. Remove the nut.
3. Disconnect the ball bolt from the steering arm using puller 899540 (see illustration). Do not knock the ball bolt out, as this is liable to damage the ball bolt and other parts.



DISCONNECTING THE STEERING ARM FROM THE TIE ROD
Tool 899540

4. Back off the nut that locks the end assembly to the tie rod.
5. Unscrew the end assembly from the tie rod.
6. Screw a new end assembly on to the tie rod, but do not lock it by tightening the nut yet.
7. Connect the ball bolt to the steering arm. Mount the nut and tighten it to a torque of 35–50 Nm (25–36 ft.lb., 3.5–5.0 kpm).
8. Mount the wheel and lower the car.
9. Check and adjust the toe-in (see section 601).

IMPORTANT

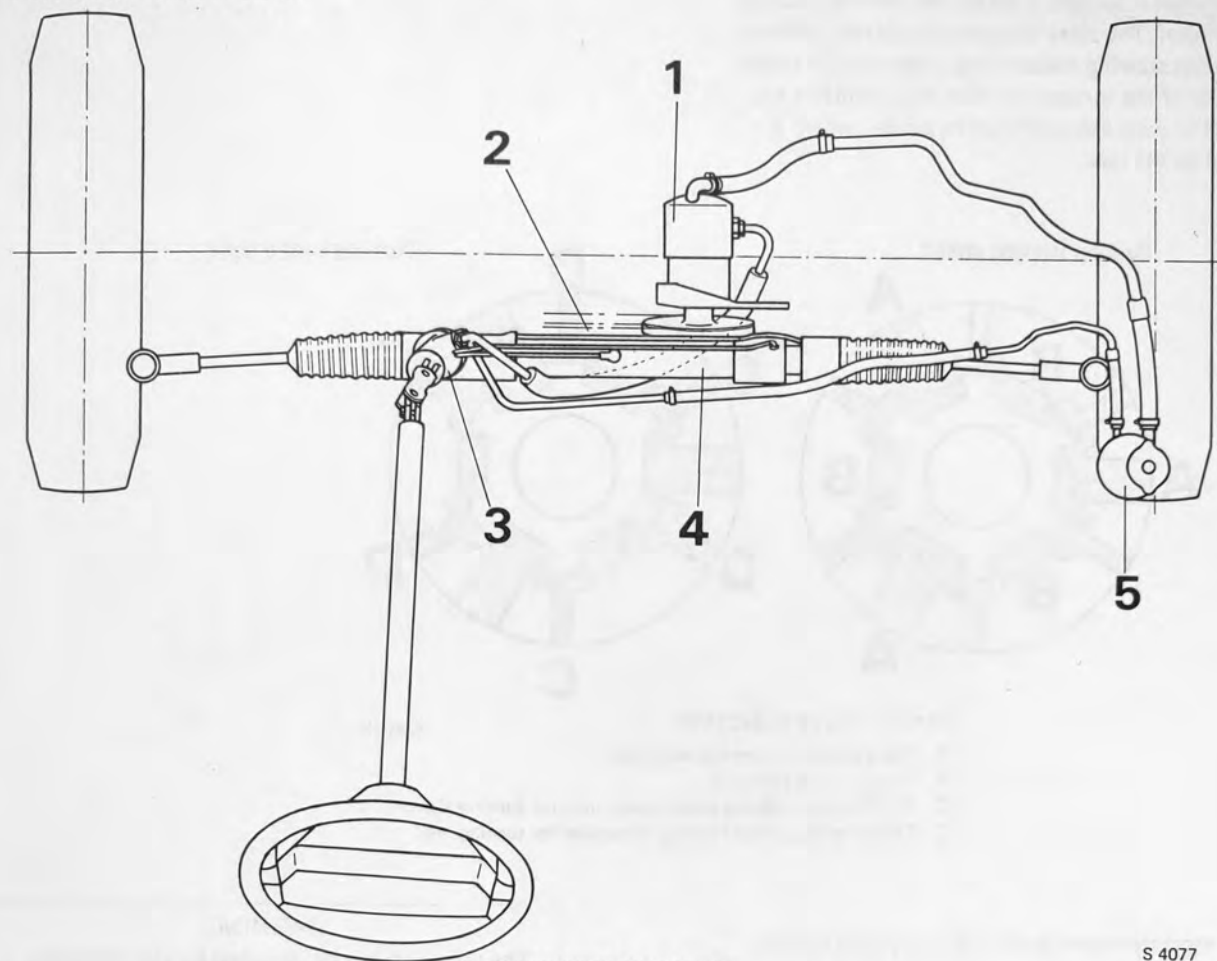
Do not forget to tighten the lock nut on the tie rod after adjusting.

Changing rubber bellows

Each ball joint is protected by a rubber bellows. If this is damaged and no longer makes a tight seal, it must be exchanged. The procedure is as follows:

1. Jack up the car and take off the wheel.
2. Remove the nut under the ball bolt of the tie-rod end assembly.
3. Free the ball bolt from the steering arm, using puller 899540 (see illustration). Do not attempt to knock the bolt out, as this is liable to damage both the bolt and other parts.
4. Remove the damaged bellows from the ball bolt and fit a new bellows.
5. Connect the ball bolt to the steering arm and put on the nut, tightening it with a torque wrench to 35–50 Nm (25–36 ft.lb., 3.5–5.0 kpm).
6. Put on the wheel and lower the car.

POWER STEERING GEAR



POWER STEERING GEAR

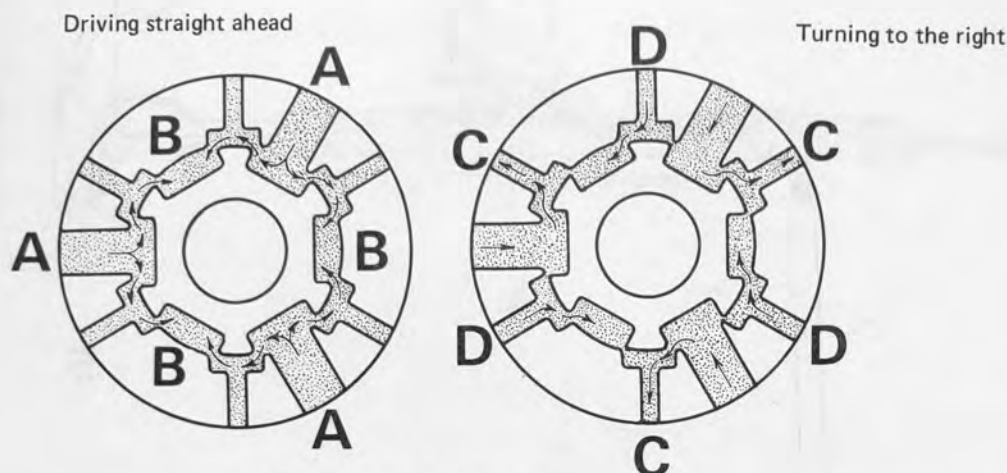
- | | |
|----------------|------------------|
| 1. Servo pump | 4. Steering gear |
| 2. V-belt | 5. Oil tank |
| 3. Servo valve | |

S 4077

Components

1. Oil tank, located on the right side of the engine compartment near the rear of the wheel housing. The capacity of the hydraulic system is 1.2 US quarts, 1.2 dm³ (litres).
2. Oil pump, located under the exhaust manifold, driven by a V-belt from the crankshaft. The pump has built-in flow control and an overflow regulator. This means that the flow increases as the pressure increases. Max. pressure: 56.25 bar (kp/cm²). Max. flow: 8.18 US quarts/min, dm³/min (l/min).
3. Delivery hose between pump and servo unit which is reinforced with textile fibre cord to resist the high pressures occurring in the hose.
4. Steering gear with power assistance unit, attached to the engine brackets with a yoke on the right and with bolts on the left.

The servo valve is located between the steering column and the pinion. The valve consists of a torsion rod connected to the steering column and a valve which reacts to the twist of the torsion bar. The valve controls the flow of oil to each side of the servo piston, which is connected to the rack.



SERVO VALVE FUNCTION

S 4078

- A Servo pressure from the oil pump
- B Return to oil reservoir
- C To the servo cylinder (power assistance for turning right)
- D To the servo cylinder (power assistance for turning left)

The seals separate the hydraulic servo system of the steering gear from the mechanical gearing and the inner ball joints.

The gear section and the inner ball joints are oiled separately. A bleeder line joins the two sides of the steering gear and enables lubricating oil to bypass the hydraulic section. The steering gear contains 6.5 fl.oz., 0.19 dm³ (1.9 dl) of oil.

WARNING

The oil pump can be damaged by the following causes:

1. If the steering wheel is kept against one of the end positions with a strong torque and the engine is running at the same time can the oil pump be overheated and damaged.
2. If the heat guard at the exhaust manifold is removed, the cooling of the pump can be insufficient.
3. If dirt is entering the hydraulic system, for example when checking or filling oil.
4. If the pump is allowed to run without oil in the hydraulic system.

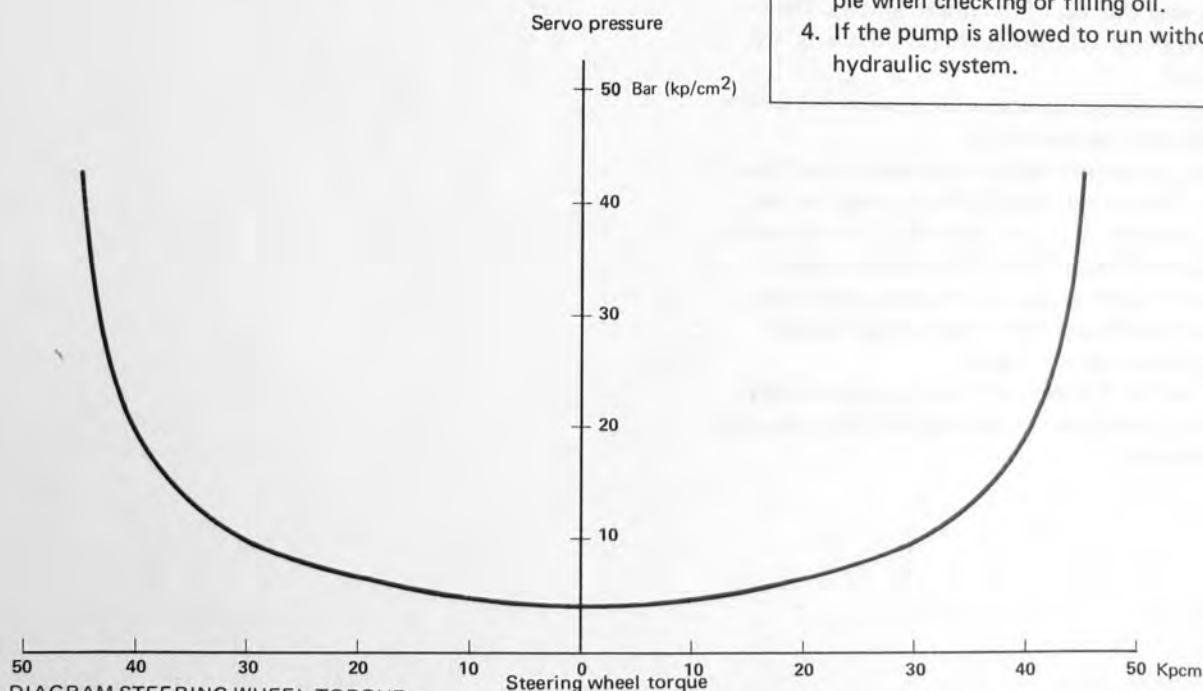
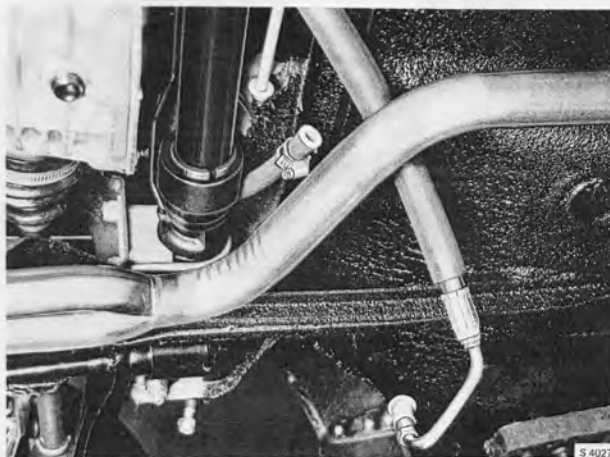


DIAGRAM STEERING WHEEL TORQUE –
SERVO PRESSURE

Removal and installation of the power steering gear

Removal

1. Jack up the front end of the car.
2. Remove the front wheels.
3. Detach the tie-rod end assemblies from the control arms using tool 899540. Unscrew the left tie-rod end assembly from the tie rod.
4. Turn the steering wheel a full turn to the left. Remove the left cover under the instrument panel and move up the rubber bellows to expose the double joint.
5. Undo the clamp screw on the steering column.
6. Undo the delivery hose on the pump, hold the hexagonal nipple at the pump steady. Plug the hose and the hole on the pump.
7. Remove the return hose from the tube. Plug the hose and the tube.



DELIVERY AND RETURN HOSES DETACHED AND PLUGGED

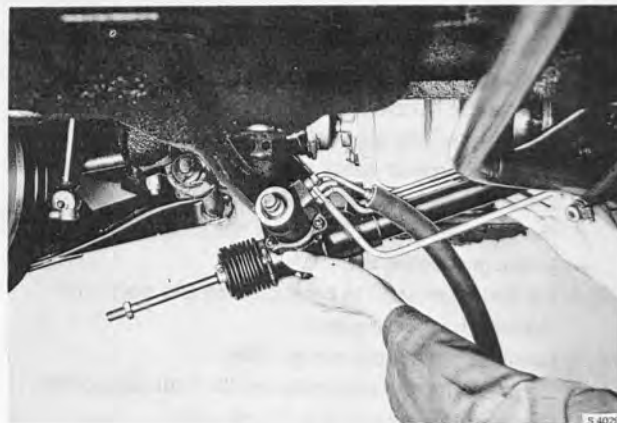
8. Disconnect the speedometer cable from the transmission.
9. Undo the steering gear body attachments:
Left side: Undo the two retaining screws and remove the intermediate piece.
Right side: Remove the yoke and intermediate piece. Move the steering gear down slightly so the clamp screw holding the double joint to the steering gear can be removed. Remove the double joint.
10. Move the steering gear over to the right far enough so that the left tie rod can be bent down through the opening in the body (see the figure) while twisting the valve housing backwards.



S 4028

BEND THE LEFT TIE ROD DOWN THROUGH THE OPENING IN THE BODY

11. Take the steering gear out down and to the right.



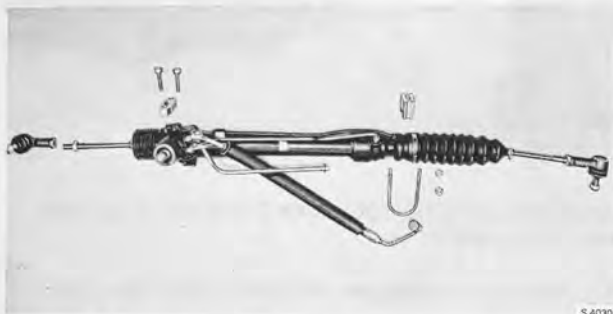
S 4029

REMOVE THE STEERING GEAR FROM THE CAR

Installation

During the installation of the power steering gear, the left tie-rod end assembly should be removed and the rack

should be moved all the way over to the right. The delivery hose and the return tube should be attached and plugged with protective plugs (see fig.).



STEERING GEAR READY FOR INSTALLATION

1. Move the steering gear up to the right through the bottom opening in the body with the valve housing pointing backwards. Turn the valve housing upwards through the body opening and lift the steering gear over to the right so that the left tie rod can be bent up.
2. Put the steering gear in place and make sure that the speedometer cable and the handbrake cables are in the right position. Fit the double joint to the steering shaft. Make sure the clamp screw fits in the groove on the shaft.
3. Fit the intermediate pieces, yoke and bolts and tighten the steering gear.
4. Connect the speedometer cable.
5. Connect the delivery hose to the hydraulic pump.
6. Connect the return hose to the tube.
7. Fit the rubber bellows and the cover under the instrument panel.
8. Attach the left tie-rod end assembly and attach the end assemblies to the control arms with new lock nuts.
9. Mount the wheels and jack down the car.
10. Adjust the toe-in, if necessary, the steering wheel.
11. Fill the servo unit with oil (see group 1).

Disassembling and assembling the power steering gear

Before disassembly, wash the steering gear thoroughly on the outside. When working on the servo-assisted steering gear, cleanliness is of the utmost importance. Be especially careful of the servo valve and the sealing surfaces on the rack.

Disassembly

1. Back off the lock nut and remove the tie-rod end assemblies.
2. Loosen the clamps and take off the rubber bellows.
3. Bend up the lock plate between the end piece and the rack.

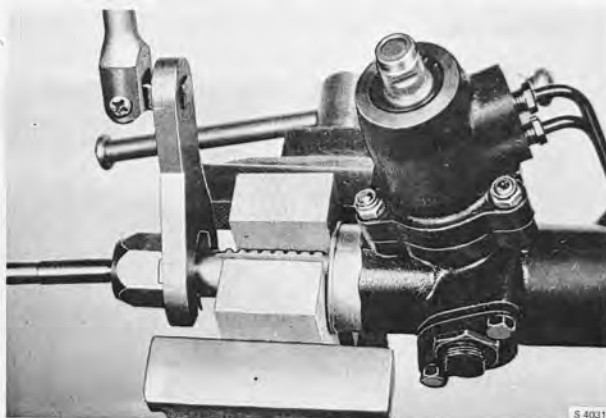
IMPORTANT

When the end piece is loosened and tightened, the torque in the rack must not be taken up by the pinion.

The rack must not be clamped in the servo end. Clamp the rack in the toothed end with suitable soft jaws (wooden blocks).

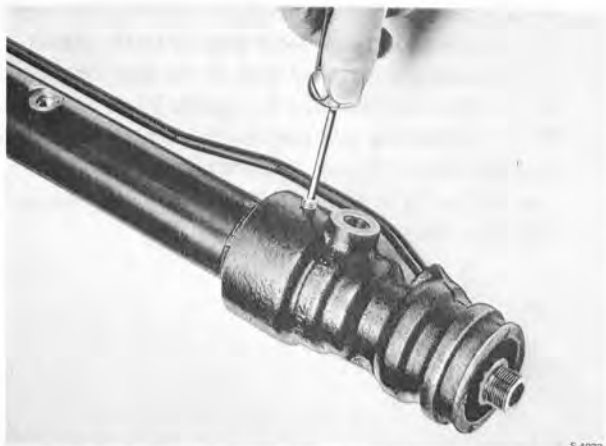
The end piece (tie rod with ball joint) should not be disassembled. If the tie rod or ball joint is damaged, the whole end piece must be replaced.

4. Clamp the toothed end of the rack in a vice between two wooden blocks and unscrew the end pieces with key 899599. Set the spring and washer aside.



THE END PIECES ARE REMOVED FROM THE RACK
Tool 899599

5. Undo the lock nut for the radial adjustment of the rack and undo the adjusting screw. Remove the adjusting screw retaining plate, the spring, the O-ring and the plunger.
6. Remove the tubes between the servo valve and the two sides of the servo cylinder.
7. Undo the three lock nuts and detach the valve housing and servo valve with pinion. Keep the servo valve in a clean plastic bag.
8. Remove the locking screw for the ring nut with a hexagon wrench.



REMOVING THE RING NUT LOCKING SCREW

9. Clamp the steering gear end in a vice and remove the ring nut with C spanner 899596.



REMOVING THE RING NUT

Tool 899596

10. Remove the steering gear end from the cylinder and the rack while removing the bleeder tube. Set aside the loose cone in the hole for the oil tube. Remove the sealing ring, washer and servo seal from the steering gear end.



REMOVING THE STEERING GEAR END FROM THE CYLINDER

11. Pull the rack out of the steering gear housing. Remove the knurled sleeve, the servo seal and the washer from the cylinder. Remove the plunger seal and snap ring.

NOTE

The plunger cannot be detached from the rack.

12. If the pinions needle bearing shows signs of wear, it should be removed into the steering gear housing. Inspect and replace damaged components. Replace all seals, lock plates and gaskets between the valve housing and the steering gear housing. The rubber bellows should also be replaced.

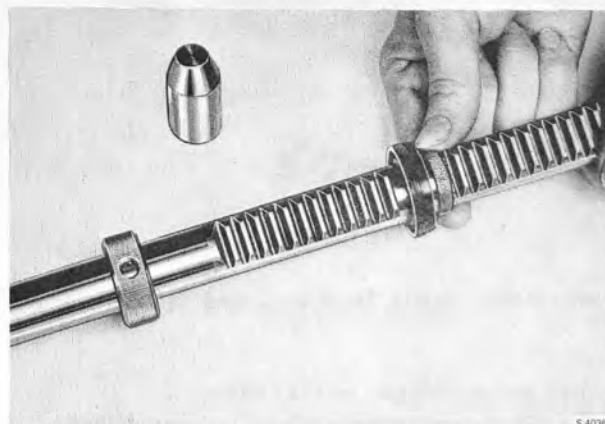
Assembly

1. Apply Loctite to the needle bearing seat and push in the needle bearing, if it has been removed.
2.
 - a. Fit the snap ring and new teflon ring on the rack plunger.
 - b. Slide the knurled sleeve onto the rack.
 - c. Fit the servo seal on the fitting sleeve using the cone. (Special tools 899593 and 899594). Slide the sleeve with seal past the teeth on the rack. Remove the tool. Turn the notch in the seal towards the servo plunger.



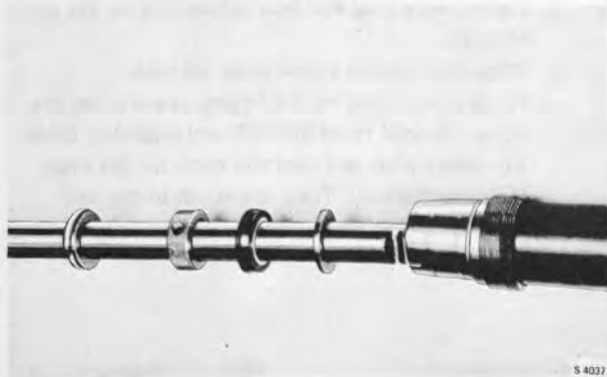
SLIDE THE SERVO SEAL ONTO THE FITTING SLEEVE USING THE FITTING CONE

Tools 899593 and 899594



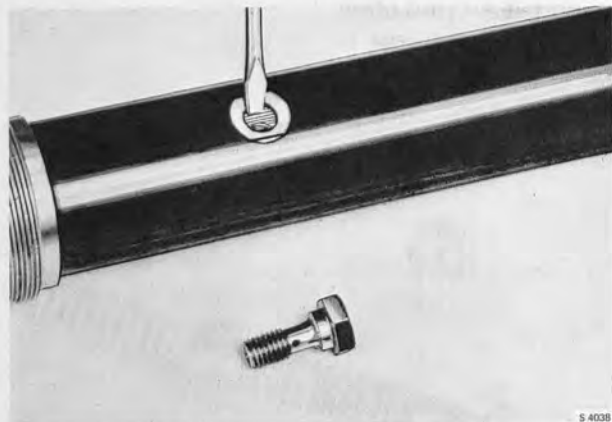
SLIDE THE FITTING SLEEVE WITH SEAL PAST THE TEETH ON THE RACK

d. Slide the washer onto the rack.



PUSH THE RACK WITH WASHER, SERVO SEAL, SLEEVE AND PLUNGER SEALS INTO THE SERVO CYLINDER

3. Push the rack into the servo cylinder until the knurled sleeve can be seen in the hole for the tube connection. Use a screwdriver to turn the sleeve to expose its threaded hole. Screw in the connecting screw temporarily to hold the washer in place. (Do not tighten the screw all the way or the rack may be damaged.)



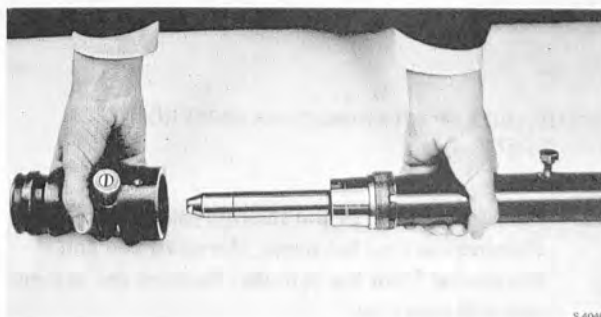
TURN UP THE HOLE IN THE KNURLED SLEEVE

4. Fit the steering gear end as follows:
 - a. Fit the servo seal in its seat. Turn notch in the seal towards the servo plunger.
 - b. Put on the washer. Turn the smaller diameter of the washer towards the servo seal.
 - c. Fit the seal with the square profile.
 - d. Put the cone into the tube connection and lock the cone using special tool 899595. The cylindrical part of the cone (inside the steering gear end) serves to fix the position of the steering gear end in relation to the servo cylinder.



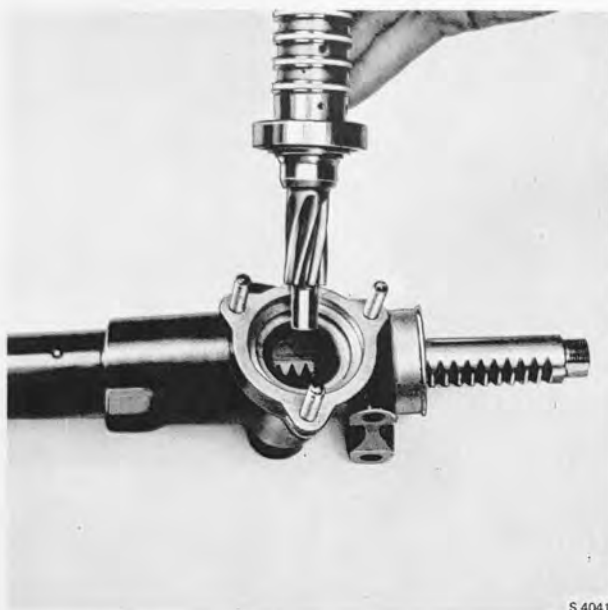
LOCKING THE CONE IN PLACE WITH A SPECIAL SCREW
Tool 899595

- e. Screw fitting cone 899598 onto the rack end and fit the steering gear end onto the rack and servo cylinder while inserting the vent tube. The cylindrical portion of the cone fits into the U-shaped recess in the end of the servo cylinder. Tighten the ring nut with a torque wrench connected to special tool 899596 with a torque of 120–125 ft.lb. (16.5–17.5 kpm, 165–175 Nm), corresponding to a torque of 130–135 ft.lb. (18–19 kpm, 180–190 Nm) at the nut. Lock the nut with the socket head screw.



FITTING THE STEERING GEAR END. THE RACK END IS
FITTED WITH FITTING CONE
Tool 899598

5. Fit the washer and the seal between the pinion and the servo valve in the steering gear housing.
6. Fit the servo valve in the gear housing.



FITTING THE SERVO VALVE

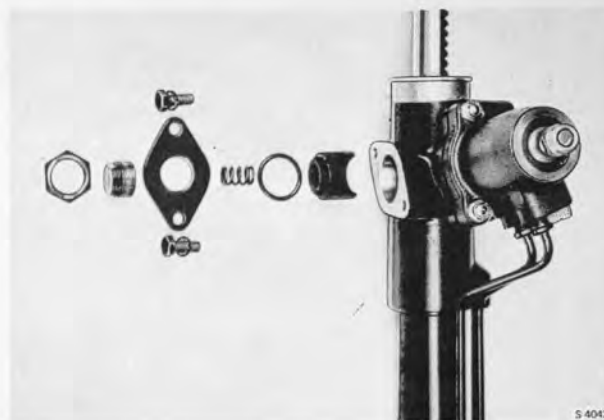
7. Fit the gasket between the valve housing and the steering gear housing. Fit the sealing ring, plastic washer and lock ring in the valve housing. Place the fitting tool 899597 over the shaft end of the valve. Fit the valve housing. Tighten the lock nuts with a torque of 16.6 ft.lb. (2.3 kpm, 23 Nm).



FITTING THE VALVE HOUSING. THE VALVE SHAFT IS FITTED WITH FITTING CONE

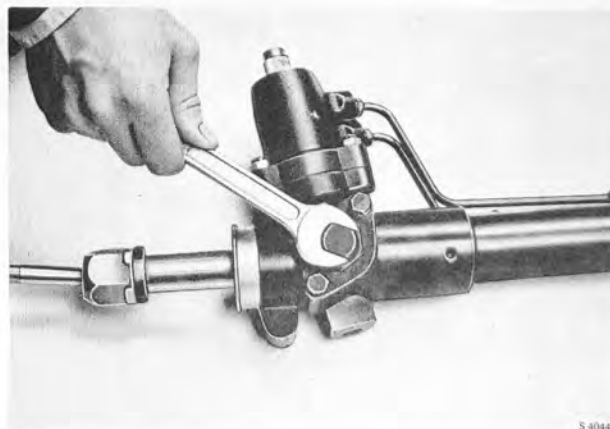
Tool 899597

8. Remove tool 899595 from the connection hole in the steering gear end. Fit the tubes between the servo valve and the two sides of the cylinder. Fit new gaskets on the banjo connection of the shorter tube to the cylinder.
9. Fit plunger, O-ring, spring, cover, adjusting screw and lock nut for the radial adjustment of the rack.



RADIAL ADJUSTMENT OF THE RACK

10. Clamp the toothed end of the rack in a vice between two wooden blocks and fit the complete end pieces with thrust washer, spring and lock washer. Tighten the end piece with a torque of 42.6–59.1 ft.lb. (5.9–6.8 kpm, 59–68 Nm), corresponding to a torque of 47.0–54.2 ft.lb. (6.5–7.5 kpm, 65–75 Nm) at the end piece. Lock the washer.
11. Adjust the radial play of the rack as follows:
 - a. Screw in the adjusting screw all the way until the resistance of the twisting steering gear is felt.
 - b. Back off the adjusting screw 1/6 turn.
 - c. Check that the steering gear can be turned from lock to lock in both directions without jamming.
 - d. Tighten the lock nut with a torque of 50–60 ft.lb. (7.0–8.3 kpm, 70–83 Nm).



ADJUSTING THE RADIAL PLAY OF THE RACK

12. Fit the rubber bellows. Fit all clamps except one at one of the tie rods. Hold the steering gear vertical and using an oil can, inject 6.5 fl.oz., 0.19 dm³ (1.9 dl) of EP 90 oil between the bellows and tie rod. Fit the clamp.
13. Fit lock nuts and tie-rod end assemblies.

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731	Coil spring suspension, front
732	Coil spring suspension, rear
761	Shock absorbers
771	Wheels
774	Hubs

CONTENTS

General	700
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Coil spring suspension, rear	732
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GENERAL

Front suspension

The front suspension has coil springs, transverse rubber-seated control arms and double-acting hydraulic shock absorbers.

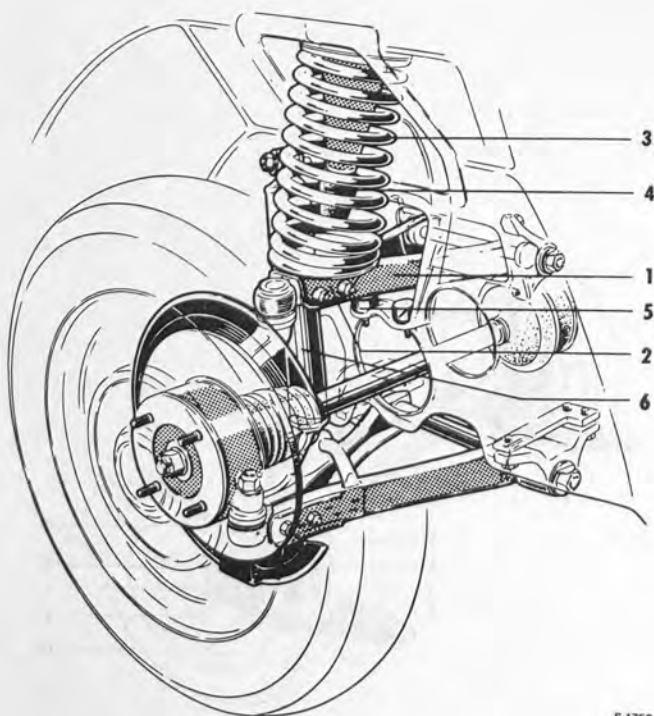
Up to and incl. model 1972 the coil springs are compressed between fixed seats. The lower seat is secured by two screws to the upper control arm in the 1969 model and welded to it in the 1970 and 1972 models. The top seat in the 1969–1972 models consists of a steel cone welded to the wheel housing with a rubber buffer screwed to the cone. The rubber buffer acts as a stop, limiting the upward stroke of the suspension.

As from model 1973 the lower spring seat is attached by a rubber bearing to the control arm. The seat is thus arti-

culated (pivoted). The top seat consists of a steel cone held in place in the wheel housing by the pressure of the spring itself and located in a pressed boss in the wheel housing that fits the inside rim of the cone. A rubber buffer is vulcanized to the cone. A rubber ring is placed between the steel cone and the spring. This rubber ring is supplied in different sizes which are fitted according to the equipment and weight of the vehicle.

The downward stroke is limited by two rubber buffers attached to the bodywork.

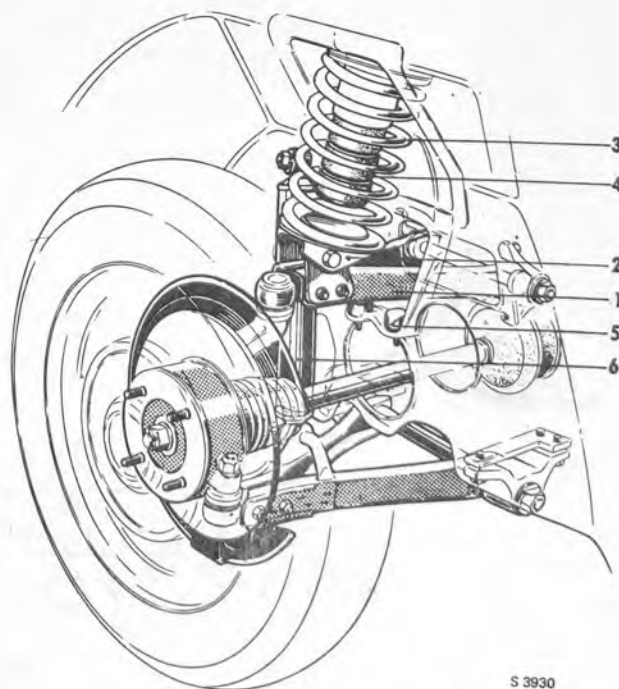
The shock absorbers are attached by rubber bearings at both ends, to the bodywork at the top and to the lower control arms at the bottom.



S 1750

FRONT SUSPENSION UP TO AND INCL. MODEL 1972

1. Upper control arm
2. Lower spring support
3. Coil spring
4. Rubber buffer
5. Rubber buffers
6. Shock absorber



S 3930

FRONT SUSPENSION AS FROM MODEL 1973

1. Upper control arm
2. Lower spring support
3. Coil spring
4. Rubber buffer
5. Rubber buffers
6. Shock absorber

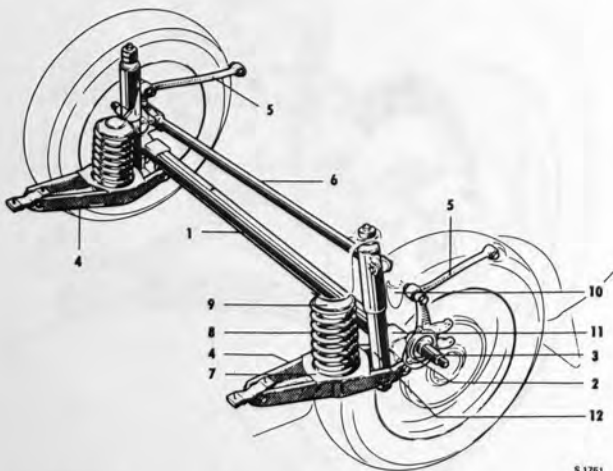
Rear suspension

The rear suspension comprises a rigid rear axle with coil springs and double-acting telescopic shock absorbers. The rear axle is a straight tube carrying end pieces into which the stub axles are force-fitted. The wheel hubs are journaled to the stub axles on conical roller bearings. The disc brake shields are bolted to the outside of the end pieces. The rear axle is movable with respect to the body, being attached to the latter by two spring links with their front ends journaled to the body and their rear ends connected by two rubber bushings to the rear axle tube. There are also two links connected between the end pieces of the rear axle and the body behind the rear axle. These links take up torsional stresses in the axle. Lateral forces are taken up by a cross bar with one end journaled in a rubber bearing in a bracket fixed to the underbody. The other end of the bar is attached to the right end piece of the rear axle.

On model 1974, a new cross bar has been introduced. Its attachment to the body has been moved somewhat forward and its attachment to the rear axle has been moved to a bracket on the axle tube.

The spring links carry seats for the lower ends of the coil springs, the upper seats being attached by spring insulators to the body. Upward movement of the rear wheels is limited by rubber buffers screwed into the body which at extreme spring compression strike a stop on the rear axle, while downward movement is limited by the shock absorbers.

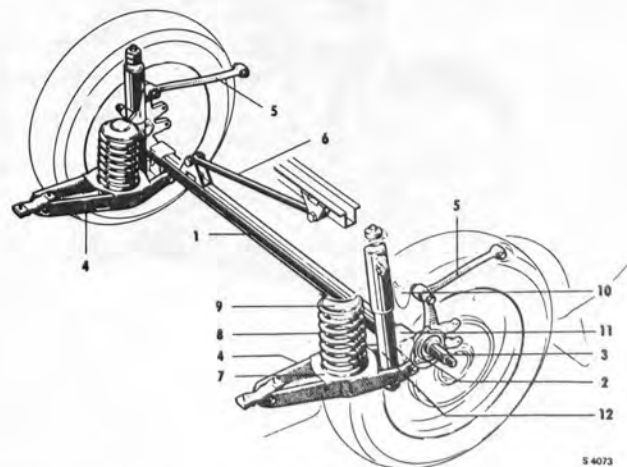
The rear shock absorbers are journaled in rubber bearings at both ends, the upper ends being attached to the body and the lower to the back axle spring links.



S 1751

REAR SUSPENSION, UP TO AND INCL. MODEL 1973

- | | |
|-----------------|---------------------|
| 1. Rear axle | 7. Spring seat |
| 2. End piece | 8. Coil spring |
| 3. Stub axle | 9. Spring insulator |
| 4. Spring links | 10. Rubber buffer |
| 5. Rear links | 11. Stop |
| 6. Cross bar | 12. Shock absorber |



S 4073

REAR SUSPENSION, MODEL 1974

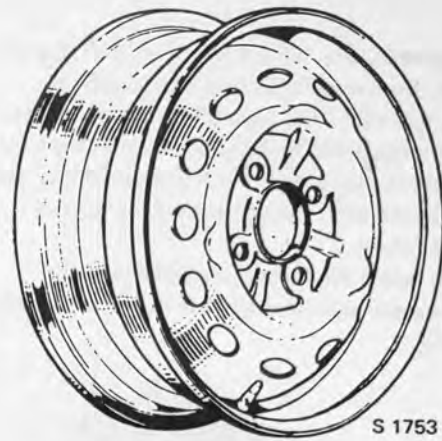
- | | |
|-----------------|---------------------|
| 1. Rear axle | 7. Spring seat |
| 2. End piece | 8. Coil spring |
| 3. Stub axle | 9. Spring insulator |
| 4. Spring links | 10. Rubber buffer |
| 5. Rear links | 11. Stop |
| 6. Cross bar | 12. Shock absorber |

Wheels

The wheels are of dished type with a wide rim base. They are for the standard models made in two parts, the disc and the rim, both of pressed steel sheet, which are then welded together. The rim designation is 4 1/2" JSL x 15", as from model 1972 4 1/2" JFHA x 15".

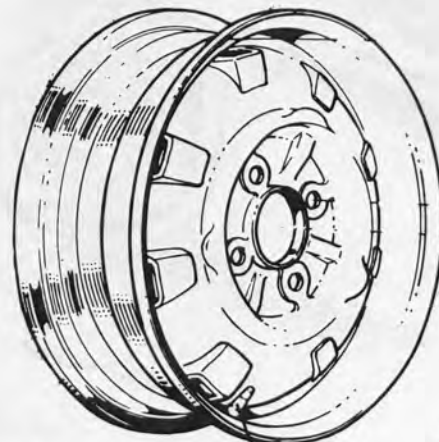
The rim has a hole to accommodate the air valve, and there are four pressing-reinforced holes for the wheel nuts in the disc, which also has three pressed retaining lips for the hub cap.

Saab 99 EMS is equipped with light metal alloy wheels 5" JFHA x 15.



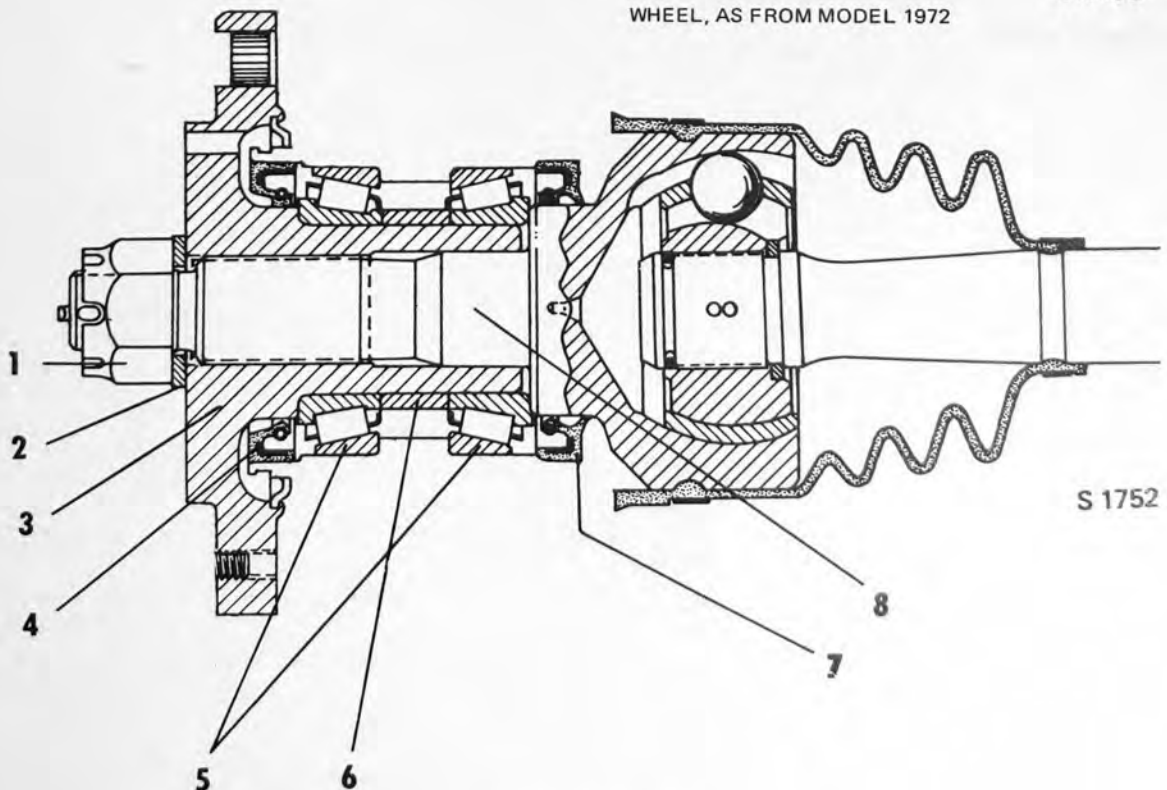
S 1753

WHEEL, UP TO AND INCL. MODEL 1971



S 3495

WHEEL, AS FROM MODEL 1972



S 1752

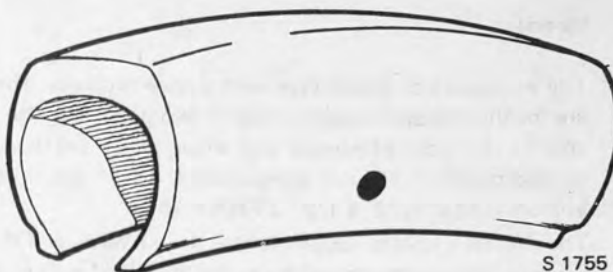
FRONT WHEEL HUB

- | | |
|---------------------|----------------------|
| 1. Castle nut | 5. Wheel bearings |
| 2. Washer | 6. Spacer sleeve |
| 3. Hub | 7. Inner shaft seal |
| 4. Outer shaft seal | 8. Outer drive shaft |

Tires

The tires are tubeless, size 155 x SR 15" up to and incl. model 1972. As from model 1973, most variants are equipped with 165 x SR 15". Saab 99 EMS is equipped with steel-cord tyres. They are provided with a balancing mark on one side in the form of a round colored spot (see illustration); this indicates the lightest side of the tire is mounted on the wheel.

The illustration below shows how the outside of the fluted tire bead seals against the inside of the wheel rim, the bead seating.

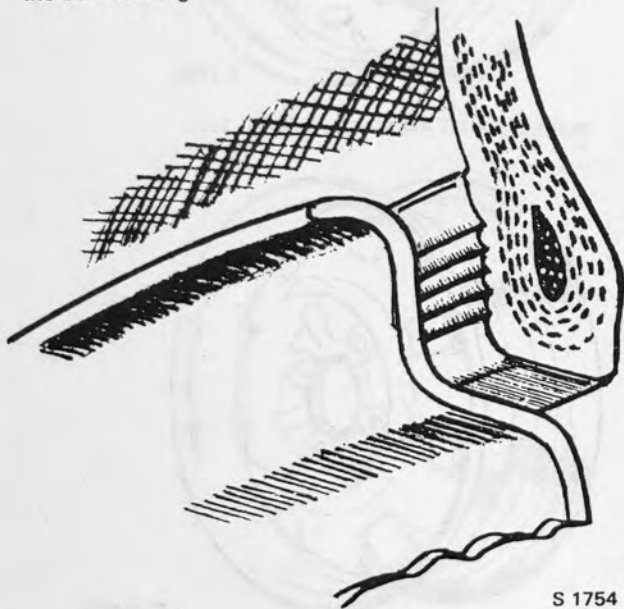


S 1755

BALANCE MARK ON TIRE

As from model 1971 the tires incorporate a profile depth indicator; when the tread pattern is worn down to 1/16" (1.6 mm), unpatterned cross bars appear. This is a signal that it is time to fit a new tire.

NOTE! Avoid fitting tires of different type or make on the same axle, the same is also valid for tires which are slightly different worn.



S 1754

TIRE BEAD AND RIM

COIL SPRING SUSPENSION, FRONT

Changing coil springs and rubber stops

As already stated, all wheels have coil spring suspension. Under no circumstances must the front and rear springs be interchanged, as the rear springs are shorter and much softer than the front ones. Concerning differences between the springs see group 0. The springs are delivered with a rustproof coating. If this coating has been rubbed off, it should be touched up before the spring is installed.

Removal up to and incl. model 1972

1. Jack up the front of the car put the car on trestles, and remove the wheel.
2. Compress the spring using compression tools 899502 and 899506 (see illustration).

It is easier to remove and install the spring if the rubber buffer is removed before the spring is compressed. Place the tool in such a way that most possible numbers of spring coils are surrounded by the tool.

NOTE

Do not overload the tool. This can happen if the two cheeks of the tool are tightened hard against each other with the aid of a nut runner.



REMOVING FRONT COIL SPRING

Tools 899502 and 899506

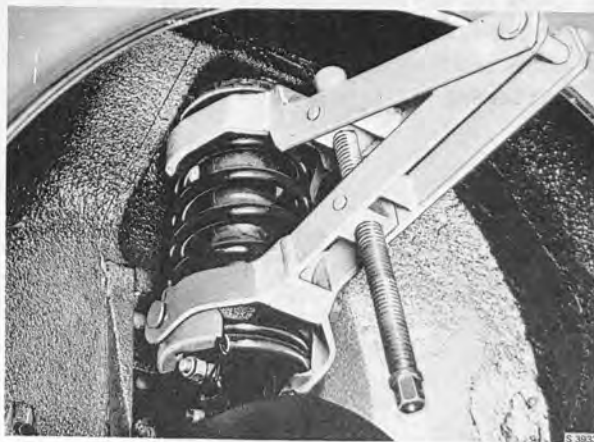
3. Remove the compressed spring.
4. Check and if necessary change the rubber spacer at the upper spring seat.
5. Inspect the two rubber buffers under the upper control arm and change them if necessary. These buffers limit the downward stroke of the suspension assembly.

Installation up to and incl. model 1972

1. Apply tool combination 899502 and 899506 to the spring so that the unmachined end of the spring is correctly located in the lower spring seat. Compress the spring.
2. Check that the rubber spacer and steel support ring at the upper spring seat and the rubber buffers under the upper control arm are in place.
3. Locate the spring between its seats, place the rubber buffer in the spring and gradually slacken the screw of the compression tool until the tool can be removed. Fit the rubber buffer.
4. Put on the wheel and lower the front of the car.

Removal, as from model 1973

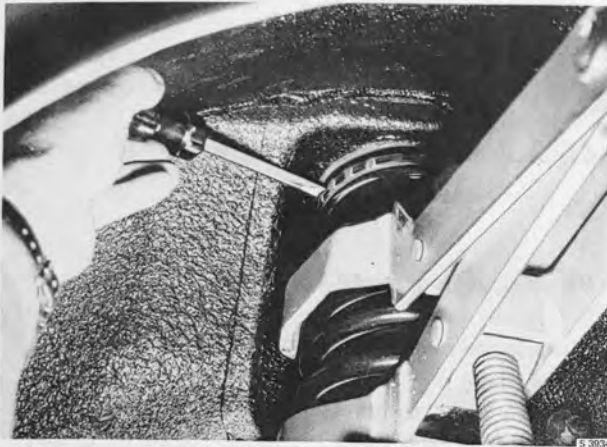
1. Raise and block up the front of the car and take off the wheel.
2. Apply spring compression tool 899584, engaging the upper shanks direct in the spring at the second free turn from the top and the lower shanks round the spring cups. These are located on the last turn of the spring with the color-coded cup right beside the end of the coil (see illustration).



REMOVING THE FRONT COIL SPRING

Tool 899584

3. Compress the spring to give 30–40 mm (roughly 1 1/2") clearance at the top end. If the upper spring attachment or the steel cone is left behind in the wheel housing, glued there by the underbody coating, chip it out of the housing with a chisel or similar tool (see illustration).

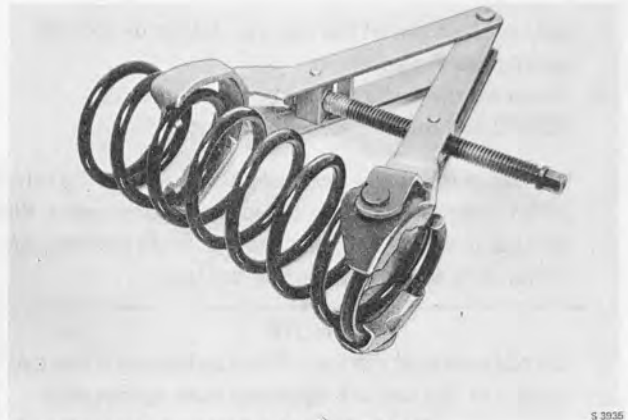


REMOVING THE UPPER SPRING ATTACHMENT

4. Remove the spring and steel cone.
5. Check, and if necessary, change rubber ring or steel cone with rubber buffer.
6. Check the two rubber buffers forming the bottom limit-of-stroke stop and change them if defective. Check and if necessary renew the bottom spring seat and bearing.

Installation, as from model 1973

1. If the spring has been taken out of the compression tool or when fitting a new spring, apply the compression tool with the spring cups in the correct position, i.e. locate the color-coded cup right beside the end of the coil, and hook the upper shanks of the tool over the second turn from the top (see illustration).



TOOL 899584 APPLIED ON COIL SPRING

2. Compress the spring. Place the steel cone and rubber ring in the top of the coil.
3. Locate the spring on its bottom seat. Slacken off gradually on the compression, guiding the steel cone into its seat in the wheel housing. Remove the compression tool. If the bottom seat has been removed, it is advisable when reassembling to mount the seat loosely and wait until after the spring is in place before securing the seat, which will automatically take up the correct position due to pressure from the spring.
4. Mount the wheel. Remove the blocks and lower the front wheels to the ground.

COIL SPRING SUSPENSION, REAR

Changing coil springs

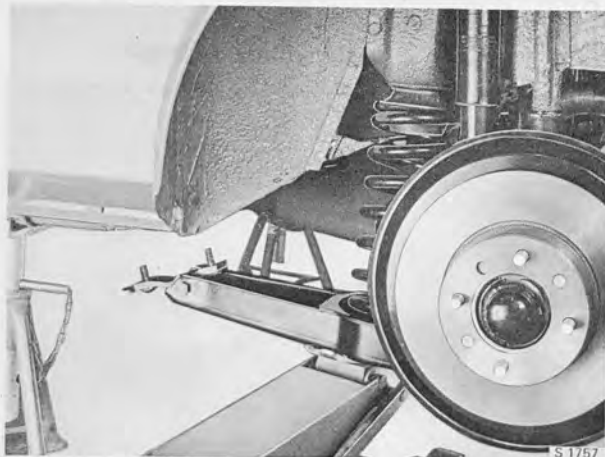
Removal

1. Apply the handbrake. Remove the rear hub cap and slacken the wheel nuts. Jack up the car and place a trestle under the side where the spring is to be removed.

CAUTION

The jack must not be placed under the rear axle, as this is liable to deform the axle.

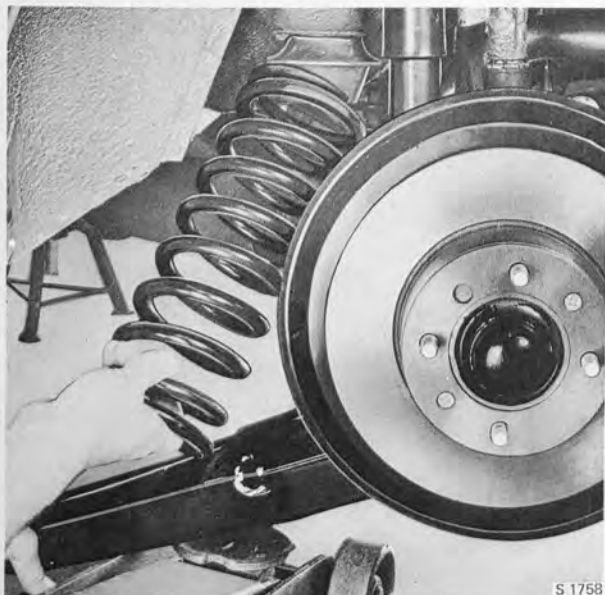
2. Take off the wheel. Apply a jack under the spring link and disconnect the lower end of the shock absorber.



LOCATION OF JACK UNDER SPRING LINK

Remove the two nuts under the rear seat that secure the front spring link bearing to the body. On model 1974, remove the lock nuts from underneath.

3. Lower the spring link so that the spring can be removed. On model 1974, the upper spring support is held in its place by the spring tension and is to be removed together with the spring.



REMOVING THE REAR WHEEL COIL SPRING

Installation

Proceed in the reverse order. Make sure that the unmachined end of the spring is at the bottom and is securely located in the lower spring seat (up to and incl. model 1973.)



LOCATION OF COIL SPRING

On model 1974, the upper end of the spring is unmachined and is instead provided with an upper rubber spring support.

The lock nuts at the front spring link bearing attachment in the body are to be exchanged (model 1974).

Rear axle

Removal

1. Apply the handbrake. Jack up the rear end of the car, place two trestles under the body and take off the rear wheels.

NOTE

It is absolutely forbidden to jack up the car with the jack applied direct to the rear axle.

2. Disconnect the brake hoses in front of the rear axle. Disconnect the lower shock absorber attachments and the cross bar
3. Place a jack under the rear axle. Lower the axle and lift out the rear springs.
4. Undo the screws of the spring link rear bushings and lift away the rear axle assembly.

Installation

Clean all parts thoroughly, inspect them, and exchange any that are worn or damaged. Install in the reverse order to the above. Note that the jack is not to be placed on the middle of the rear axle when this is put into position for installation. Use two jacks or a trestle at one side when the other is lifted to the correct position with the jack. Note that the rubber bearings must be mounted in such a way that no strain occurs when the weight of the car is supported by the wheels, i.e. the rubber bearings must be drawn tight only when the car is standing empty on its four wheels.

The screw at the cross bar attachment to the body shall be installed as follows:

Up to and incl. model 1973 with the nut facing backwards.
On model 1974 with the nut facing forwards.

NOTE

Do not forget to bleed the brakes.

SHOCK ABSORBERS

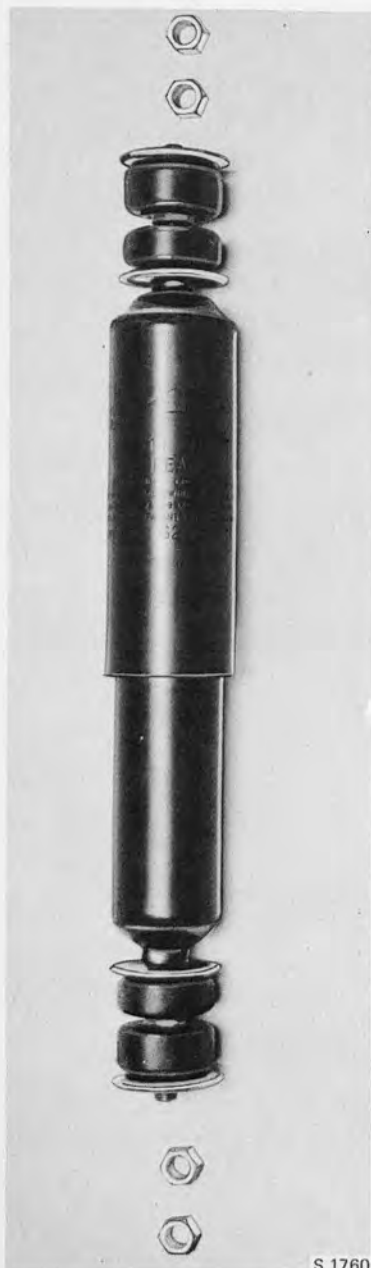
General

Defective shock absorbers should be exchanged. This is extremely important, as the shock absorbers contribute largely to the good roadholding and steering characteristics of the car.

Shock absorbers on the same axle should be exchanged in pairs.

Removal

1. Jack up the car and take off the wheel.
2. Unscrew the shock absorber, saving the washers and rubber parts.



S 1760

SHOCK ABSORBER

Installation

Inspect the rubber parts and exchange any that are defective. Use only original Saab rubber parts and washers at the upper and lower attachment points when installing shock absorbers; poorly fitting substitutes can cause body noise when the car is on the road. Before a shock absorber is installed, any air present in it must be expelled. To bleed the shock absorber, hold it upright in the same position as when installed, pump it up and down for a few full strokes, and then install it in the car. If the shock absorber is laid flat, more air can enter through the valve system.

Fit rubber bushings and washers. Note the positions of the washers as illustrated opposite. The nuts of the front shock absorbers should be tightened hard, while those on the back shock absorbers should be tightened enough to provide suitable tension against the rubber bushings.

Checking of shock absorbers installed in car

Check the condition of the shock absorbers as follows:

1. Check for leakage of oil from the shock absorbers.
2. Check for external damage, extensive corrosion or bends in the plungers.
3. Check that the nuts are tight.
4. Check the condition of the rubber bushings.
5. Test the functioning of the shock absorbers by rocking the car or in conjunction with test driving.

General

Defective work shall be corrected at the expense of the contractor. The contractor shall be responsible for the cost of any materials and labor required to correct the work. The contractor shall be responsible for the cost of any materials and labor required to correct the work.

Removal

When the work is completed, the contractor shall remove all materials and equipment from the site. The contractor shall be responsible for the cost of any materials and labor required to remove the work.

Installation

The contractor shall be responsible for the cost of any materials and labor required to install the work. The contractor shall be responsible for the cost of any materials and labor required to install the work. The contractor shall be responsible for the cost of any materials and labor required to install the work.

The contractor shall be responsible for the cost of any materials and labor required to install the work. The contractor shall be responsible for the cost of any materials and labor required to install the work. The contractor shall be responsible for the cost of any materials and labor required to install the work.

Checking of work submitted for review

1. Check the condition of the work submitted for review.
2. Check for leakage of oil from the work.
3. Check for external damage, structural damage or defects in the structure.
4. Check that the work is done.
5. Check the condition of the work submitted for review.
6. Test the functioning of the work submitted for review.

WHEELS

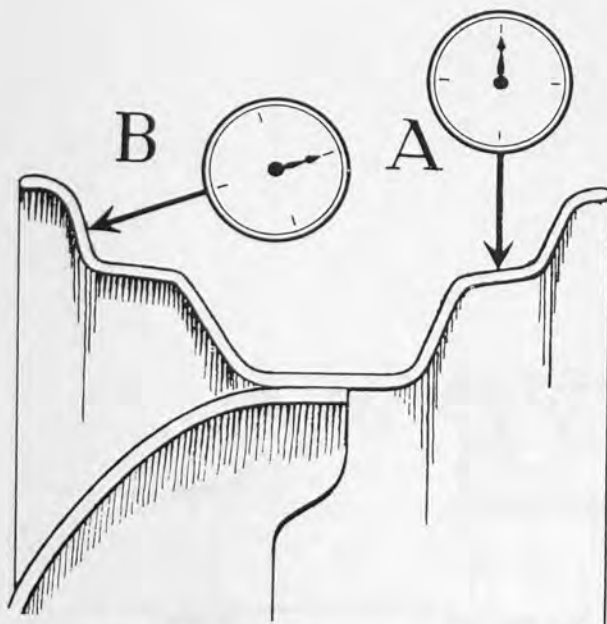
Adjusting and repairing wheels

Wheels may be damaged in collisions or if the car runs off the road or is driven on underinflated tires. As the tubeless tires seal direct against the wheel rims, air will leak out if the rim is deformed or otherwise damaged. If a leak occurs due to rim deformation, the tire should be taken off so that the wheel can be inspected and adjusted if necessary. If the rim is rusty at the bead seating, the rust must be removed; this can suitably be done with a steel brush or a pad of steel wool. If rust has pitted the rim, a file should be used. Any minor pits remaining after adjustment should be coated with thick rubber solution; the tire is then coated in the same way and mounted on the wheel before the solution dries.

NOTE

Check before mounting the tire that the rim is not out-of-round or out-of-true.

On a correctly journaled rotating rim, the difference between the highest and lowest point measured at A (see



MEASUREMENT POINTS ON THE WHEEL RIM

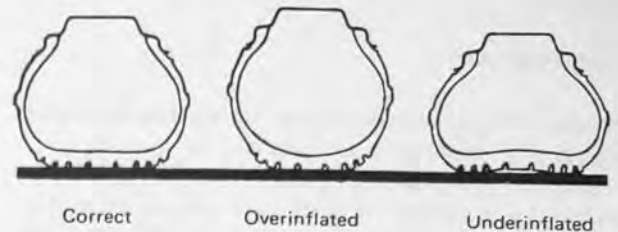
illustration) must not exceed 0.047" (1.2 mm). The side throw B (see illustration) should be measured in the same way and must not exceed 0.047" (1.2 mm).

When these measurements are made, the rim should be mounted in the usual way, either on a wheel hub or in a special apparatus, so that the rim can be rotated.

Tire maintenance

The working life of a tire depends very much on the care it receives and the conditions under which it has to work. Some of the factors affecting tire wear are listed below.

1. Inflation pressure. It is important to maintain the correct inflation pressure and to adjust the pressure according to load. For correct tire pressures, see under Specifications, group 0.



TREAD CONTACT WITH ROADWAY

2. Wheel balancing is necessary to avoid vibration and consequent wear. Wheels must be balanced both statically and dynamically.
3. Wheel alignment. Faulty alignment for the wheels can cause heavy wear on the tires.
4. Speed. Tire mileage diminishes sharply with rising speed, mainly due to the greater friction heat generated.
5. Engine power. Powerful engines give rapid acceleration and high speed, which in turn demand powerful brakes. This contributes to faster wear on the tires.
6. Road surface. Dry roads offering a good grip for the tires cause a great deal of wear.
7. Manner of driving. The temperament of the driver may weigh more heavily than any other factor. If the acceleration and braking resources of the car are regularly utilized to the limit, this will quickly wear down the tires.

A statically balanced wheel should be able to come to rest in any position when suspended and free to rotate.

A dynamically balanced wheel should rotate in a plane perpendicular to the axis of rotation, i.e. it should have no tendency to skew during rotation.

The balancing operation should not be performed on new wheels, but only after some 600–900 miles (1,000–1,500 km) motoring; this is to give the tire time to "shake down" on the rim.

Wheels need rebalancing after long mileage because tire wear alters the distribution of weight.

NOTE

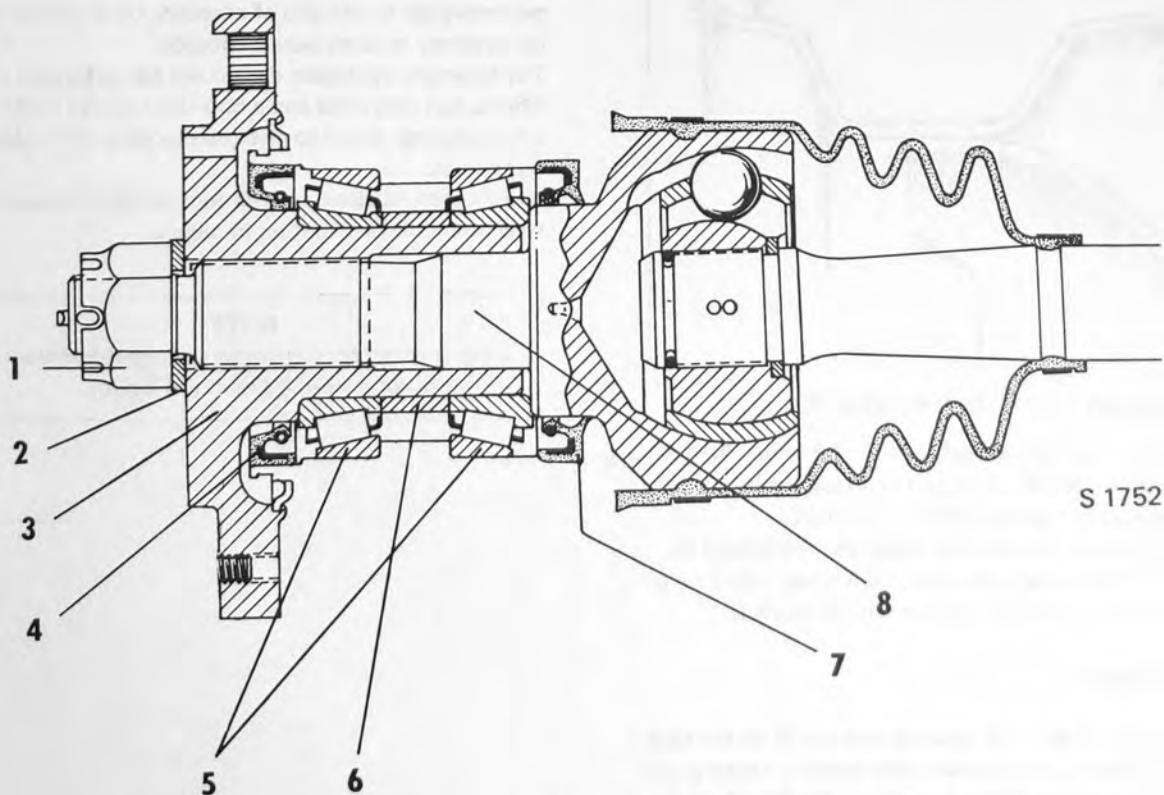
When a wheel spinner is used, the speedometer reading must not exceed 40 mph (70 km/h).

HUBS

Front wheel hubs

The hub and brake disc constitute two separate cast components. The front wheel hub is splined to the outer drive shaft and locked to it by a castle nut and split pin. The bearing surface for the shaft seal on the inside of the wheel hub must be protected against scratches and knocks when the hub is removed from the shaft. If the bearing surface is scratched or otherwise damaged, it must be smoothed and polished. This work should be done on a lathe, but the diameter of the bearing surface must not be appreciably reduced. These precautions are important, as the shaft seal will otherwise wear rapidly, permitting grease to leak out of the steering knuckle housing on to the brake disc and ruin the brake linings.

The inner rings of both front wheel bearings are seated on the wheel hub. The bearing contact surfaces must be protected against knocks and scratches, as it may otherwise prove difficult or even impossible to mount the front wheel bearings.



FRONT WHEEL HUB

- | | |
|---------------------|----------------------|
| 1. Castle nut | 5. Wheel bearings |
| 2. Washer | 6. Spacer sleeve |
| 3. Hub | 7. Inner shaft seal |
| 4. Outer shaft seal | 8. Outer drive shaft |

Wheel bearings

Changing front wheel bearings

Wheel bearings may, especially if not properly lubricated or badly fitted, become so worn that they develop play. If the play measured at the wheel rim exceeds 0.08" (2 mm), the wheel bearing must be renewed. Under no circumstances must wheel bearings be subjected to impact, as this may damage them.

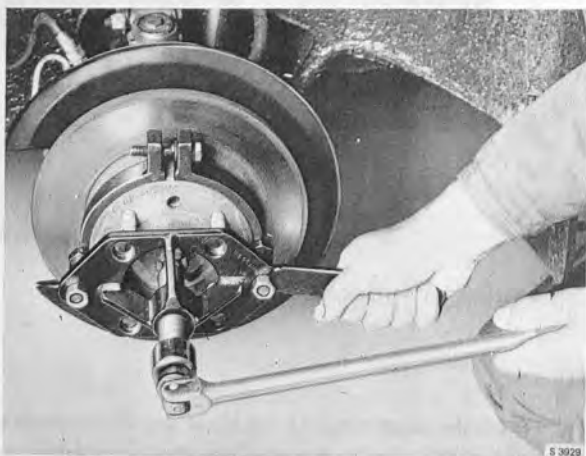
If abnormal play in the front-wheel bearings is found in new cars or after new bearings have been fitted, check first that the castellated axle nut is tightened to the correct torque of 196 Nm (20 kpm, 145 ft.lb.). If tightening the nut to the correct torque fails to eliminate the play, this indicates that the accumulated tolerances of the components involved is such that a shorter spacer sleeve must be fitted. The standard spacer sleeve should in such cases be replaced by sleeve 891796, which is 0.003" (0.08 mm) shorter and marked with yellow paint.

NOTE

Use only original special bearings as listed in the Spare Parts Catalogue.
Bearings should preferably be exchanged as complete sets, inner and outer bearings together.

Removing old bearings

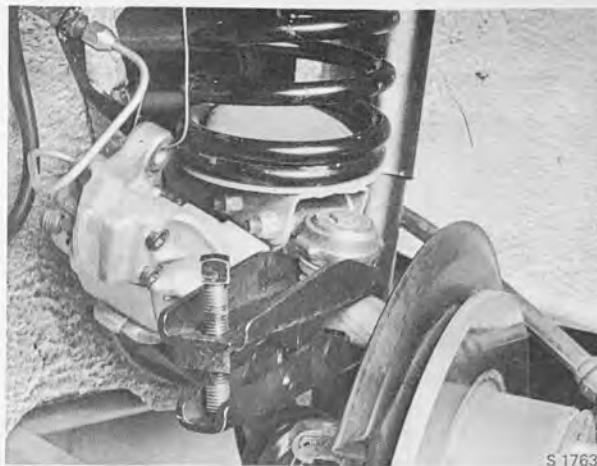
1. Take off the hub cap, remove the split pin and castle nut, and slacken the wheel nuts.
2. Block up the front of the car on trestles and remove the wheel.
3. Remove the brake housing and hang it up to avoid strain on the brake hose. Remove the brake disc. If the disc is difficult to remove, use ring 899579 and puller 899518.



REMOVING THE BRAKE DISC

Tools 899518, 899524 and 899579

Place the ring so that the raised part fits in the recess on the brake drum and tighten the screw. Fasten the puller at the ring with the aid of two spacer screws, tool 899524, and pull off the brake drum. See fig. Remove the handbrake cable.



REMOVING THE UPPER BALL JOINT

Tool 899540



REMOVING THE STEERING ARM

Tool 899540

4. Undo the large clamp round the rubber bellows of the inner universal joint.
5. Remove the steering arm and upper ball joint using tool 899540. Undo the screws on the lower control arm bracket.

When separating the inner universal joint, fit a cover in the rubber bellows to stop the needle bearings from falling out and to keep dirt out of the joint, and fit a cover over the inner driver.

6. Pull out the drive shaft through the wheel housing, remove the entire front axle assembly and clean it thoroughly. Loosen the outer universal joint bellows and move the bellows along the shaft.

7. Press out the drive shaft with tool 899518, see fig.

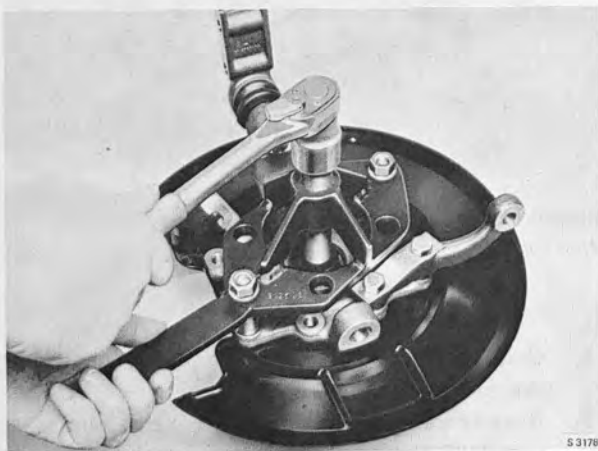


S 1765

REMOVING THE SHAFT

Tool 899518

8. If the hub is stuck in the bearings, turn the steering knuckle housing upside down and press out the hub with tool 899518, spacer bolts 899524 and dolly 899517.



S 3178

REMOVING THE HUB

Tools 899518, 899524 and 899517

9. If the outer bearing has stuck to the hub, use tools 899517, 899518 and 899525

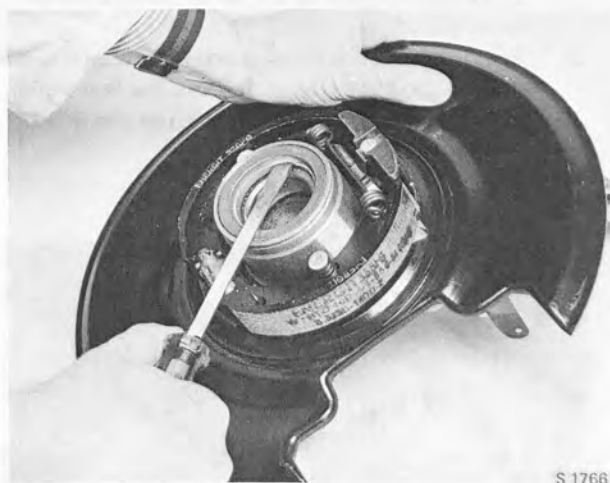


S 1768

REMOVING THE OUTER BEARING FROM THE HUB

Tools 899517, 899518 and 899525

10. Break out the inner and outer seal rings with a screwdriver or similar tool (the rings cannot be removed intact) and lift out the inner ring of the inner bearing.



S 1766

BREAKING OUT THE SEAL RING

11. Press the outer rings of the inner and outer bearings out of the steering knuckle housing using tool 839029.



REMOVING THE OUTER RINGS OF THE BEARINGS
Tool 839029

Installation

Before beginning assembly, clean and inspect all front axle components and exchange any worn or damaged parts for new ones. Check the rubber bellows with special care.

NOTE

New seal rings must be fitted every time the hub unit is reassembled, as the old rings are destroyed in the process of disassembling.

1. Press the outer rings of the bearings into the steering knuckle housing using tool 839031. Make sure that the rings are properly seated.



PRESSING IN THE OUTER RINGS OF THE BEARINGS
Tool 839031

IMPORTANT

The surfaces in contact with the outer rings of the bearings must be absolutely clean, as any dirt will interfere with the play of the bearings, etc. Use a wooden board as a support to avoid damage to the end face of the steering knuckle housing.

2. Fill about half the space between the two outer rings with Saab Special chassis grease. Grease and fit the bearing inner rings and spacer sleeve in the steering knuckle housing.



FITTING THE INNER RINGS OF THE BEARINGS

3. Grease the inner and outer sealing rings well and press them in flush with the outer edge of the steering knuckle housing, using tool 839031.

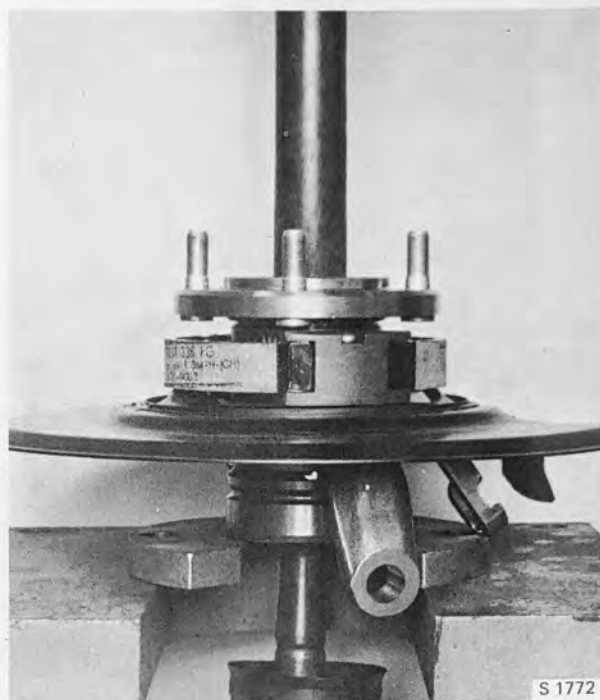


PRESSING IN THE SEAL RING
Tool 839031

NOTE

The sealing rings must not be pressed right home, as they will then foul the bearing and be destroyed by wear in a very short time.

4. Mount the front axle assembly in a press and press the outer drive shaft into the steering knuckle housing (see illustration).



ASSEMBLING DRIVE SHAFT AND HUB

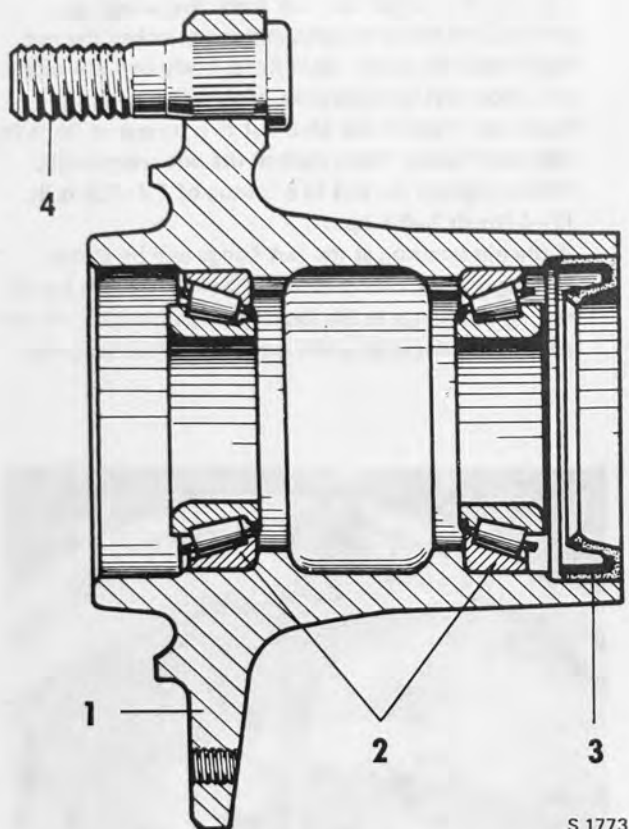
5. Put on the castle nut, tighten it to a torque of 196 Nm (145 ft.lb., 20 kpm). Check that there is no play. If so the accumulated tolerances in the parts involved can be such that a shorter spacer sleeve must be fitted. In that case, remove the parts and change the spacer sleeve to the shorter, yellow-marked one. Re-install in the same way. Lock the castle nut with a split pin. Pack the joint with grease, fit both clamps on the outer bellows and the shaft clamp on the inner bellows. If the needle bearings have been removed, grease them with Saab Special chassis grease and mount them on the ends of the tee piece. Fit protective cover in the bellows to protect the needle bearings and insert the drive shaft through the wheel housing. Make sure that the inner driver is clean and packed with Saab Special chassis grease. Assemble the inner universal joint. Fit both ball bolts to the steering knuckle housing and tighten them to the prescribed torque. Then secure the clamp round the drive joint bellows.
6. Mount the brake disc, connect the handbrake cable and fit the brake housing.
7. Mount the steering arm and the wheel.
8. Lower the car, tighten the wheel nuts securely and fit the hub cap.

CAUTION

The brake pads must be advanced to their proper position close to the disc, which is done by pumping the brake pedal repeatedly. Otherwise the brake will not work.

Back wheel hubs

Each rear wheel hub is journaled on two tapered roller bearings, both of the same type. On disassembling, the hub is removed complete with bearings and shaft seal.



BACK WHEEL HUB

- | | |
|-------------------|----------------|
| 1. Hub | 3. Seal ring |
| 2. Wheel bearings | 4. Wheel screw |

S 1773

Removal

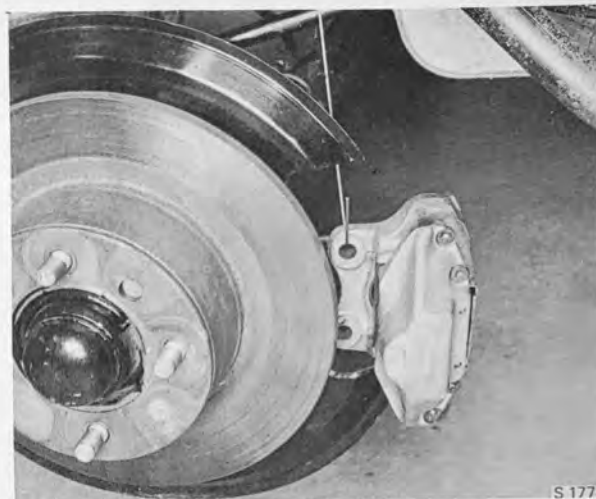
Wash thoroughly under the fenders before starting work and scrape off any dirt that could fall into the bearings.

1. Jack up the car and remove the wheel.

CAUTION

It is absolutely forbidden to apply the jack under the rear axle, as this is liable to deform the axle.

2. Remove the brake housing and brake disc.



BRAKE HOUSING HUNG UP DURING WORK ON THE WHEEL

NOTE

The brake housing must be supported to avoid damage to the brake pipe.

3. Prize out the cap with a screwdriver.
4. Remove the nut and washer. Earlier cars are provided with a castle nut, secured with a split pin. Later cars are provided with a lock nut, secured by upsetting.
5. Pull off the hub; if necessary, use puller 899518.
6. Break out the seal ring with a screwdriver (it cannot be removed intact) and remove the inner rings of both bearings.
7. Place a suitable drift in the three milled recesses in the hub and drive out the outer bearing rings. While doing this, it is advisable to place a wooden board under the hub to avoid deforming the end faces.

Installation

Clean and inspect all parts carefully, and renew any that are worn or damaged. A new seal ring must always be fitted.

IMPORTANT

Even though both tapered roller bearings are the same size, the inner and outer bearings must not be interchanged, as they wear themselves into a given fit after a time in use.

1. Press the outer rings of the bearings into the hub using drift 899516.



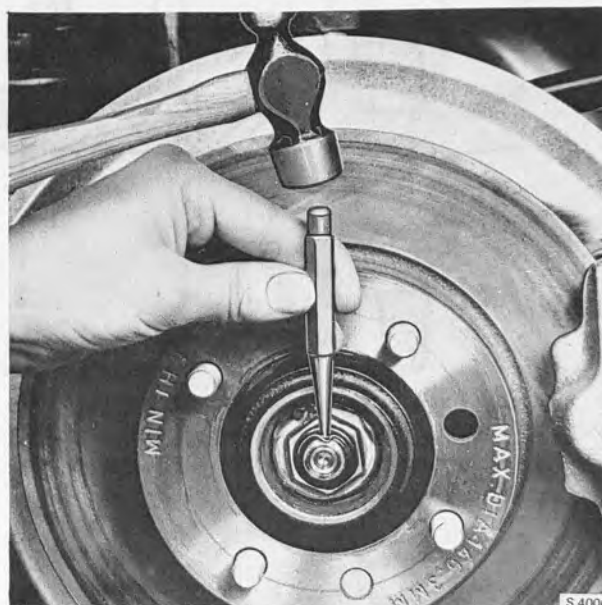
PRESSING IN THE BEARING OUTER RINGS
Tool 899516

2. Fill half the space between the outer rings with Saab Special chassis grease and grease the inner rings.
3. Locate the inner ring of the inner bearing and fit a new shaft seal, which should first be lubricated with grease or thick oil.



PRESSING IN THE SEAL RING
Tool 899516

4. Check that the bearing surface for the seal ring on the stub axle is perfectly smooth. If it is damaged, it must be smoothed and polished with a very fine emery cloth. Lubricate the bearing surface with consistent grease.
5. Fit the hub to the stub axle, insert the inner ring of the outer bearing and mount the washer and nut. Castle nut: Tighten the nut until the wheel begins to bind when rotated, and then slacken the nut again until the wheel again turns freely and the washer is loose but without play. Mount the split pin. Lock nut: Tighten the lock nut to a torque of 36 ft.lb. (49 Nm/5 kpm). Then slacken the nut completely. Finally tighten the nut to a torque of 1.4–2.9 ft.lb. (2–4 Nm/0.2–0.4 kpm).
If the old securing at the nut flange will be at the locking groove, change the nut. Secure the nut by up-setting the flange in the locking groove, using a round-end drift so that cracks will not occur when securing.



UPSETTING THE FLANGE OF THE LOCKING NUT

6. Fit the cap.
7. Mount the brake disc, brake housing, wheel and wheel nuts.

CAUTION

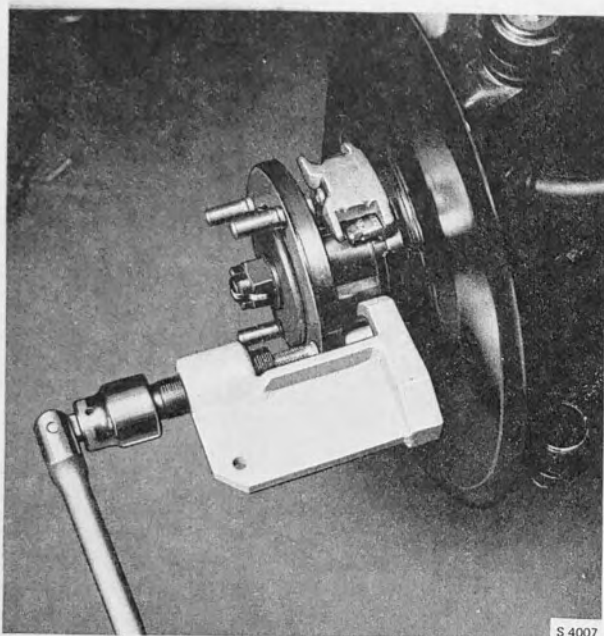
The brake pads must be advanced to their proper position close to the disc, which is done by pumping the brake pedal repeatedly. Otherwise the brake will not work.

8. Lower the rear of the car, tighten the wheel nuts securely and fit the hub cap.

Changing the wheel bolts

Removal

1. Remove the brake disc, see group 5. On the front wheels, also remove the handbrake shoes.
2. Press out the wheel bolts, using pressing tool 899592 with the removal sleeve on the inside of the hub.

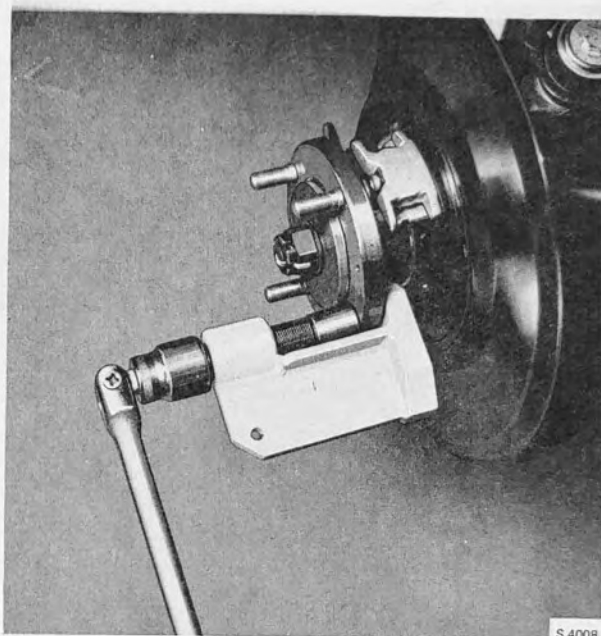


S 4007

REMOVING A WHEEL BOLT
Pressing tool 899592 with removal sleeve

Installing

1. Press in the new bolt, using pressing tool 899592.
2. Mount the handbrake shoes (front wheels) and the brake disc. Adjust the handbrake shoes (front wheels).



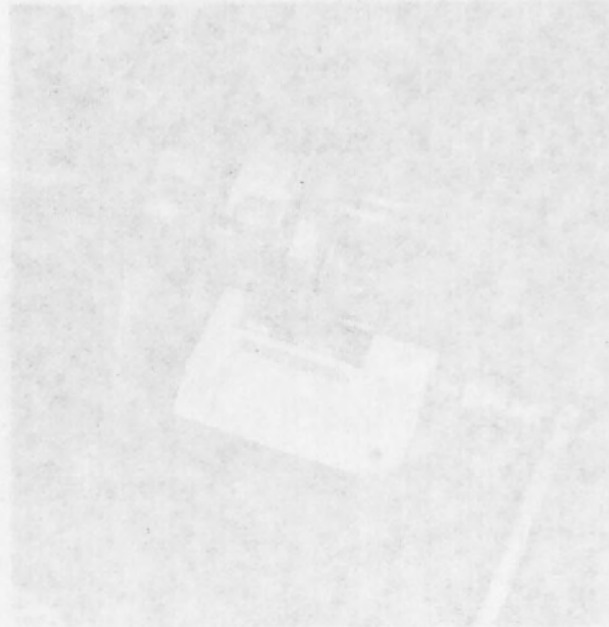
S 4008

INSTALLING A WHEEL BOLT
Pressing tool 899592

Changing the wheel bolts

Removal

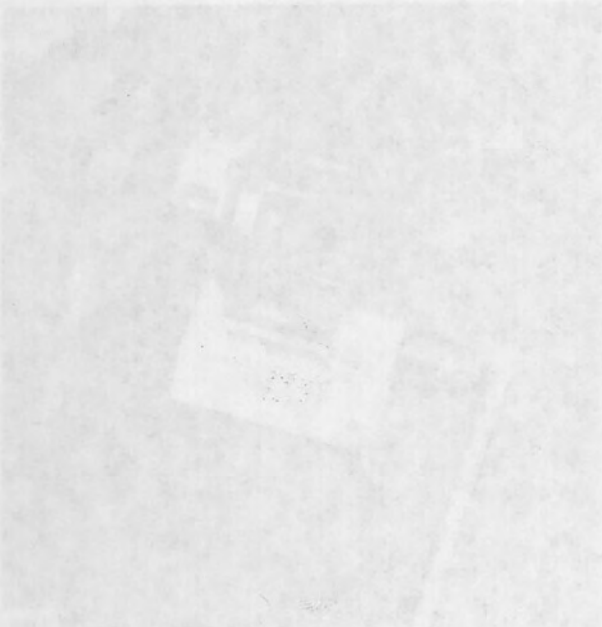
1. Remove the brake disc and group B. On the front wheels, also remove the fan/fan shroud.
2. Press out the wheel bolts using special tool 502222 with the impact sleeve on the inside of the rim.



REMOVING A WHEEL BOLT
Press out wheel bolts with impact sleeve

Installation

1. Press in the new bolt using pressing tool 502222.
2. Mount the fan/fan shroud, front wheels and the brake disc and group B when the front wheels are fitted.



INSTALLING A WHEEL BOLT
Pressing tool 502222

CONTENTS

800	General
810	Body assembly
820	Hood, front, fenders
830	Doors and trunk lid
843	Windows
851	Upholstery and interior fittings
852	Seats and carpeting
853	Interior equipment
854	Heating and ventilation system
860	Bumpers
890	Body finishing

CONTENTS

General	800
Body assembly	810
Hood, front fenders	820
Doors and trunk lid	830
Windows	843
Upholstery and interior fittings	851
Seats and carpeting	852
Interior equipment	853
Heating and ventilation system	854
Bumpers	860
Body finishing	860

GENERAL

The car has an all-welded cantilever steel unit body. The doors, engine hood and trunk lid are removable, while the front and rear fenders are welded on to form integral load-carrying parts of the body.

The body is constructed of a relatively small number of sections of pressed steel sheeting. These are joined together mainly by spot-welded overlapped joints. Body rigidity is achieved by longitudinal and transverse floor beams, heavy-gauge windshield pillars and profiled stiffeners round the roof. Moulded stiffening frames reinforce the windshield and back window. As from the 1973 model all doors are equipped with a reinforcement beam that gives improved protection if the car is involved in a side collision. Reinforcing pieces and brackets are welded to the engine and chassis unit mountings to take up prevailing forces.

The floor comprises front and center sections, cross members and rear section, together with a number of reinforcing plates and beams. The front floor section, also called the engine compartment floor, is welded at the dash panel to the center section, which forms the floor of the passenger compartment. The rear section forms the floor of the trunk compartment. The center and rear floor sections are joined by a cross member forming a tunnel for the rear axle.

Body insulation

The underbody, i.e. the floor, wheel housings and fenders, is sprayed with a sealing composition which serves to protect the metal from flying stones and rust and to insulate the body from road noise.

The upper surface of the floor in the passenger and trunk compartments is covered with an asphalt mat. This is laid before the body goes into the lacquering oven and therefore melts on to the steel, providing excellent rust protection and contributing to the sound insulation.

The rear wheel housings and fenders are covered with plastic coating asphalt matting. Thick asphalt matting faced with nylon fiber matting is bonded to the parts of the front wheel housing that lie inside the passenger compartment. The dash panel and engine compartment are insulated with glass wool, and the roof is insulated with foam plastic. As from the 1973 model the roof is insulated with pressed glass wool. Waffleboard is bonded to the insides of the doors and valances.

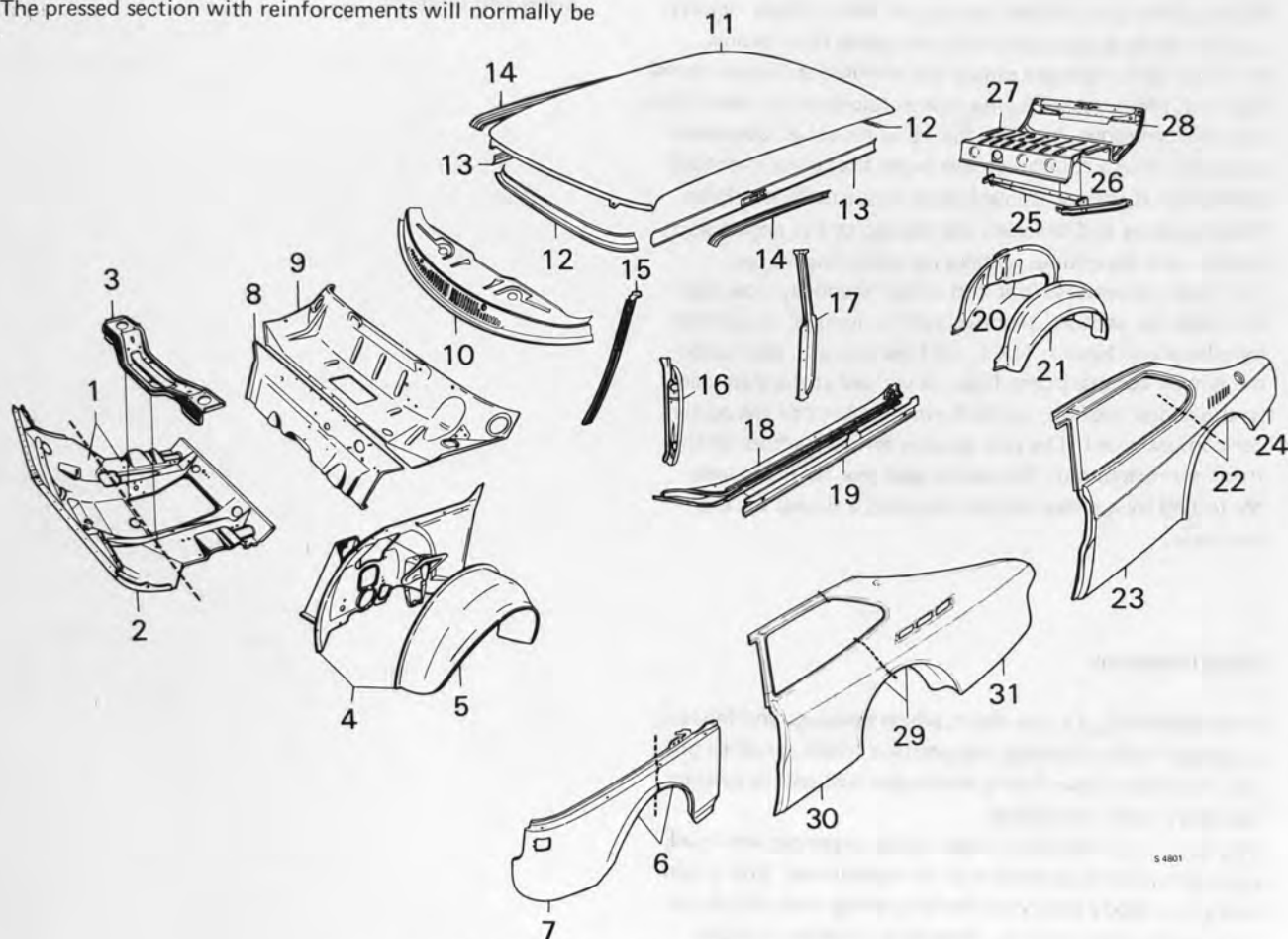
BODY ASSEMBLY

General

If any part of the body is deformed in a crash and the damage is so extensive that the part cannot be straightened out, it can be exchanged for a new part instead. Indeed, in many cases of minor damage it may actually prove quicker, cheaper and more satisfactory to renew all or part of the damaged section rather than straighten it.

The pressed section with reinforcements will normally be

available as a replacement part, but in addition, certain "economy spares" are stocked. Examples of these are the front ends of fenders, the front end of the engine compartment floor, and a divided rear valance. For details, see the Spare Parts Catalogue.



----- EXAMPLE OF INTEGRAL BODY DETAILS

EXAMPLE OF INTEGRAL BODY DETAILS AVAILABLE AS SPARE PARTS

- | | |
|---|---|
| 1. Front floor (engine compartment floor) | 18. Scuff plate, inner part |
| 2. Front floor front part (economy spare part) | 19. Scuff plate, outer part |
| 3. Floor member | 20. Rear wheel housing cpl. |
| 4. Front wheel housing cpl. | 21. Rear wheel housing, outer part |
| 5. Front wheel housing outer part | 22. Outer valance |
| 6. Front fender | 23. Outer valance front part (economy spare part) |
| 7. Front fender front part (economy spare part) | 24. Outer valance rear part (economy spare part) |
| 8. Dash panel, lower part | 25. Side member |
| 9. Dash panel, upper part | 26. Cross member |
| 10. Windshield member | 27. Rear floor |
| 11. Roof panel | 28. Rear plate |
| 12. Roof members | 29. Outer valance, Saab 99 Combi Coupé |
| 13. Side members | 30. Valance, front part, Saab 99 Combi Coupé (economy spare part) |
| 14. Water channels | 31. Valance, rear part, Saab 99 Combi Coupé (economy spare part) |
| 15. Front pillar | |
| 16. Plate front pillar | |
| 17. Rear pillar | |

Alignment jig for accident-damaged bodies

An alignment jig with trueing-up tools and accessories to fit both Saab 95/96 and Saab 99 cars has been designed to facilitate the repair of car bodies damaged in road accidents.

Alignment jig

The alignment jig consists of a rigidly constructed frame with plane surfaces containing a series of precision-drilled holes. Fixtures for accurate location of body parts can be screwed into these holes. Special checking fixtures are also provided; these are placed on top of the locating fixtures. When the car is set up on the alignment jig, it is possible with the help of the checking fixtures to measure any deformation of the chassis attachment points without having to remove parts of the chassis.

The alignment jig is provided with a pair of wheels to make it mobile. It need not be secured to the floor, but when in use it should be placed on a level surface with the wheels removed.



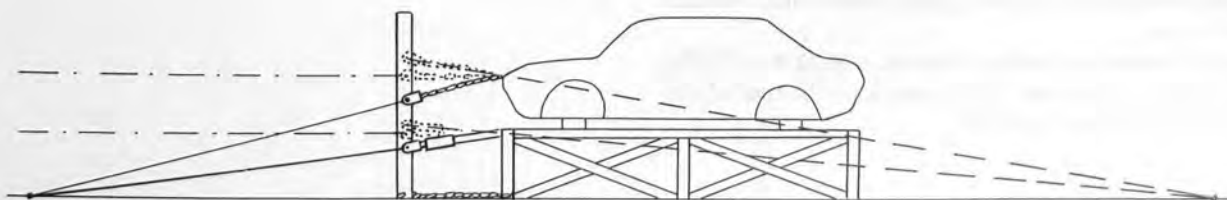
ALIGNMENT JIG

Trueing-up tool

The trueing-up tool is used to straighten out deformed portions of the car body. It consists of a lever which is secured at the bottom by a chain to two of the legs of the alignment jig. A hydraulic pressure cylinder is attached to the middle of the lever, and a draw chain is attached to the top. This arrangement makes the tool compact (and easily portable) and also allows the direction of pull to be varied within very wide limits. Neither the alignment jig nor the trueing-up tool need be anchored to the floor.

Before the trueing-up tool is used it is mounted on the alignment jig in the following manner:

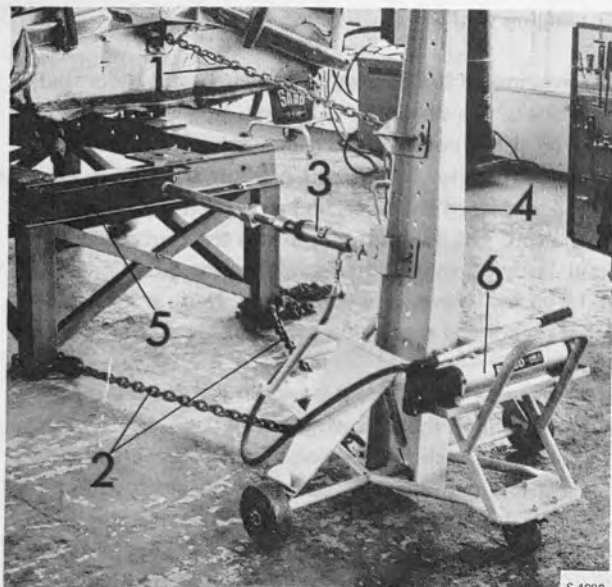
1. Select the desired direction of pull, first laterally by positioning the trueing-up tool accordingly, and then vertically by attaching the draw chain at a suitable height on the lever.
2. Secure the trueing-up tool to the alignment jig by fastening both ends of the anchor chain to two of the legs of the jig in such a way that tension will be applied to both halves of the chain.
3. Place the pressure cylinder against the pressure beam and alignment jig, first locating it laterally with respect to the jig so that the cylinder comes just about vertically below the draw chain. Then adjust the vertical position of the cylinder on the lever so that the lines of the draw chain and pressure cylinder, if extended, will intersect at the same point on the floor or will be almost parallel (see illustration).
4. Adjust chain lengths as necessary, prize apart the quick-release extension of the pressure cylinder, and wrap the safety chain one turn around the beam of the alignment jig.



APPLICATION OF TRUEING-UP TOOL

Application of trueing-up tool

The draw chain and hydraulic cylinder must be placed so that the extended lines drawn through them intersect at the same point on the floor or are nearly parallel. There are then no free forces tending to lift the tool or the alignment jig.



TRUEING-UP TOOL

- | | |
|----------------------|------------------|
| 1. Draw chain | 4. Lever |
| 2. Anchor chain | 5. Pressure beam |
| 3. Pressure cylinder | 6. Hand pump |

Hoisting gear, etc.

Before the alignment jig can be used, the car body or complete car must be lifted on to it. The best method is to use a fork-lift trolley or overhead traveling crane.

If these are not available, the job can be done with a high-lift garage jack and a mobile collapsible trestle set consisting of four legs on wheels and two cross-pieces.

The trestles can also be used for assembly and disassembly work on chassis, etc. and for blocking up and moving cars with the wheels off.

The procedure for mounting the car body on the jig is as follows:

Place the cross-piece on the jack and then push the latter under the car from the side at the rear edge of the threshold. Raise the rear of the car so that the legs can be fitted to the cross-piece. Then repeat the same procedure at the front. The car can then be maneuvered over the jig with the trestle legs straddling the jig and lowered into position with the jack.

A suitable bench or platform about 450–600 mm 1 1/2–2 ft.) high should be available for work on the roof of the car or upper parts of the body.

Description of alignment jig and trueing-up tool

A description of the alignment jig and accessories and trueing-up tool is available and can be ordered from Saab-Scania in Nyköping under the order number 101733.

Front fender fixture

Front fender fixture No. 829063 is intended for checking and location of the front fender in connection with collision damage repairs.

Figure 1 illustrates how it is used.

The fixture also has locating studs for the purpose of checking the position of the top hinge attachment in the windshield post. A ruler is first placed as shown in Fig. 2 to check the vertical position, and then is shown in Fig. 3 to check the horizontal position.

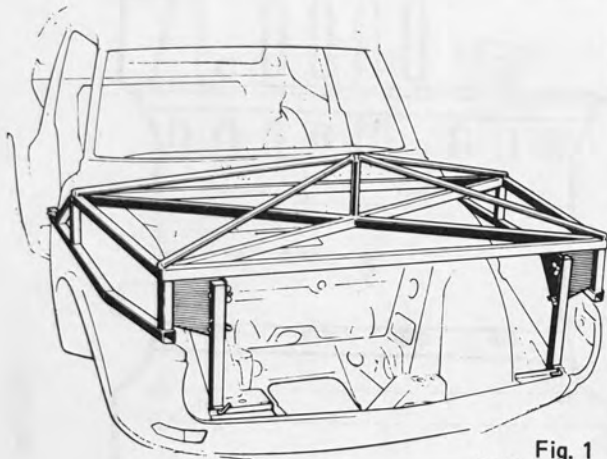


Fig. 1

S 4090

FRONT FENDER FIXTURE, FIG. 1

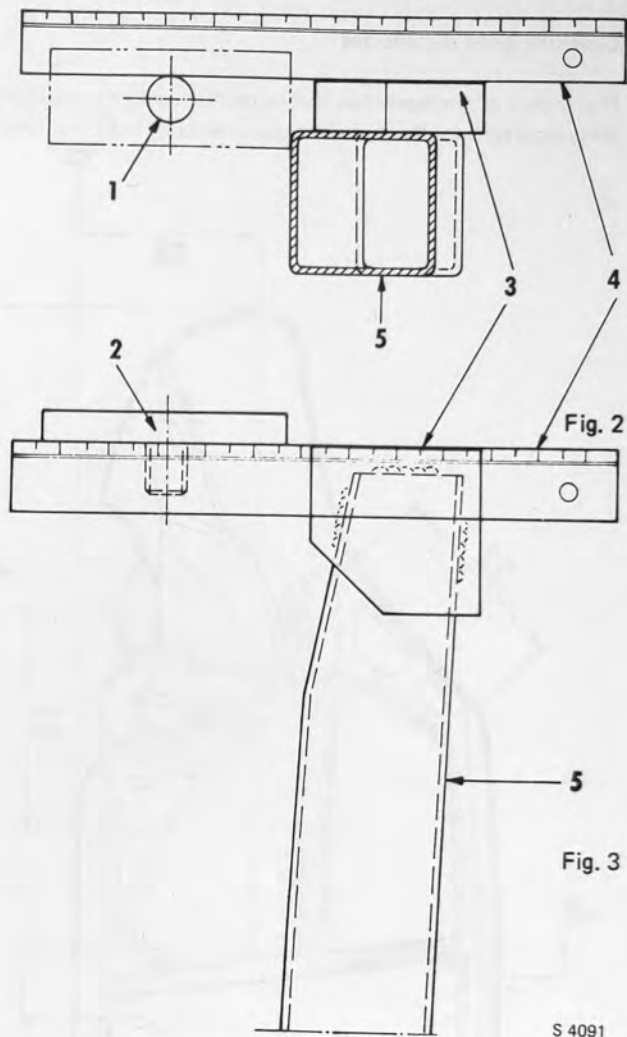


Fig. 2

Fig. 3

S 4091

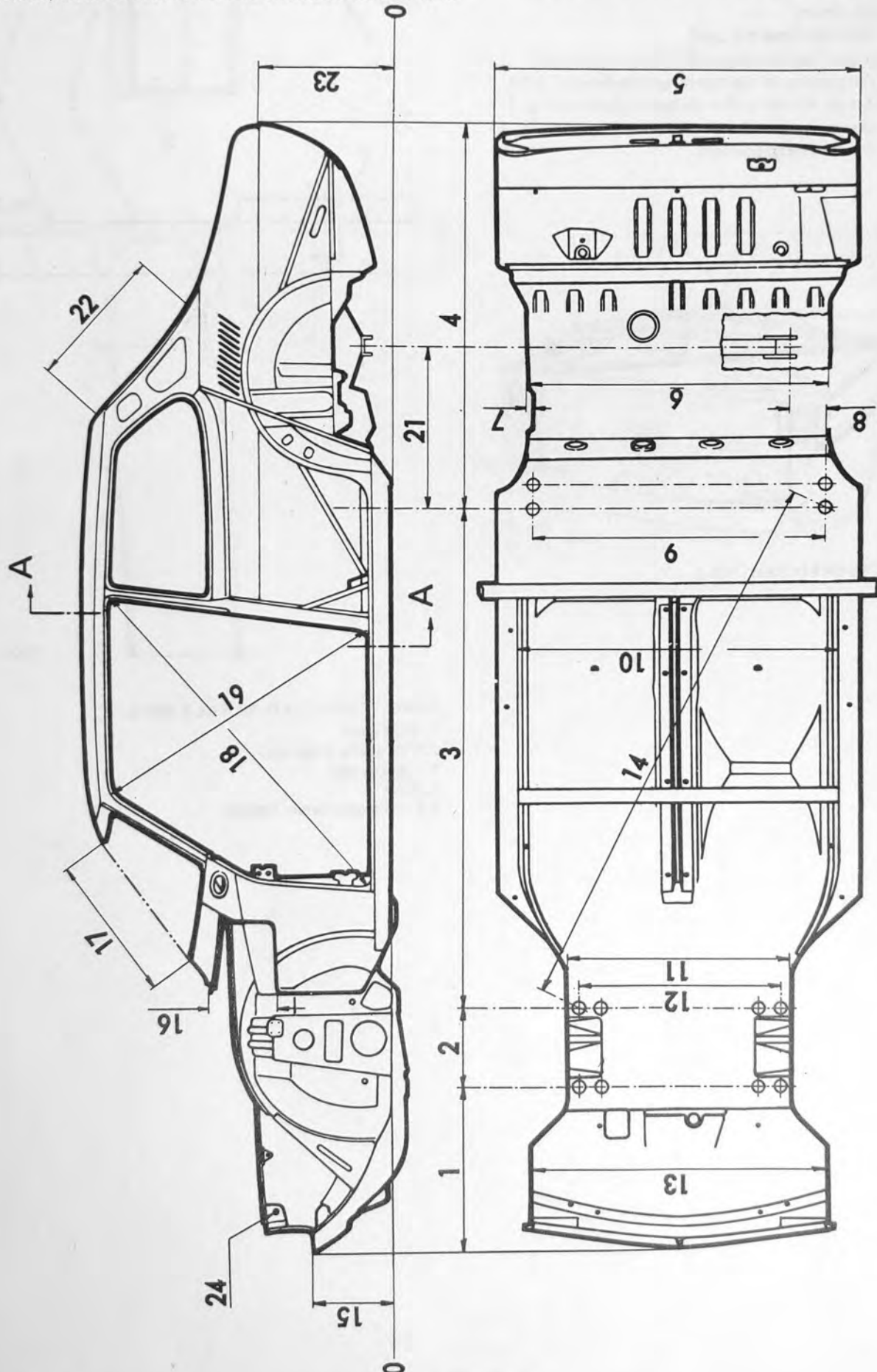
FRONT FENDER FIXTURE, FIG. 2 AND 3

1. Hinge screw
2. Plate nut for hinge screw
3. Locating stud
4. Ruler
5. Front fender fixture 829063

Checking body dimensions

If any part of the body has had to be renewed or straightened, it is important to check the measurements of the door open-

ings and the attachment points of the suspension and power unit. Diagonal measurements should also be made to check that there is no residual skew or asymmetry after repairs.



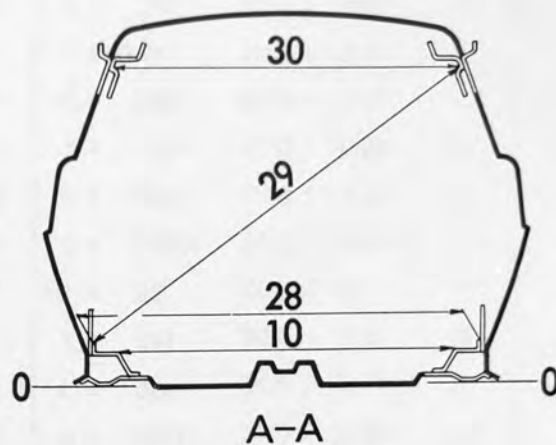
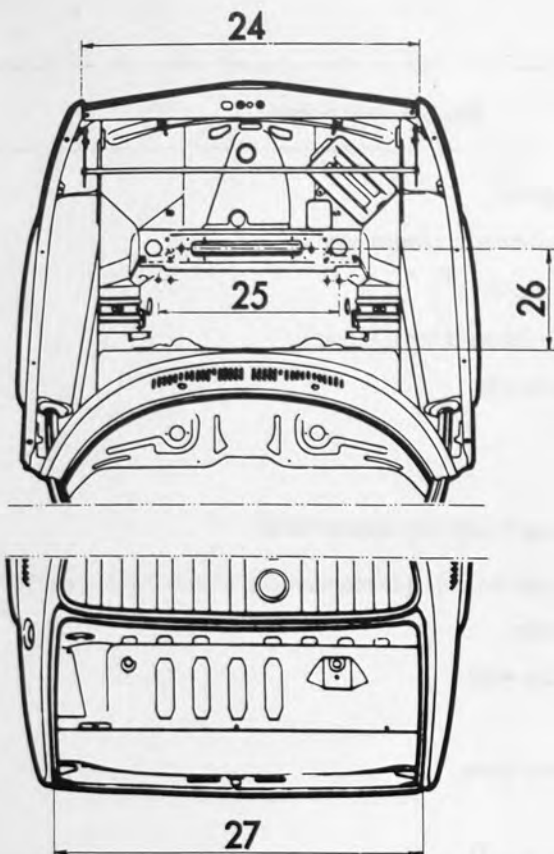
REFERENCE DATA FOR CHECKING BODY DIMENSIONS

Dimension data (see also drawings on next page)

Ref.	Measurements		Measurement points
	in.	mm	
0	Horizontal reference line		Underside of scuff plate
1	24.6 ± 0.12	625 ± 3	Centerline — forward hole ¹⁾ , control arm
2	10.61 ± 0.04	269.6 ± 1	Forward hole ¹⁾ — rear hole ¹⁾
3	74.1 ± 0.08	1883 ± 2	Rear hole ¹⁾ , front — forward hole ¹⁾ , rear
4	55.9 ± 0.16	1421 ± 4	Front hole ¹⁾ — centerline
5	52.8 ± 0.12	1340 ± 3	Rear floor
6	44.00 ± 0.12	1117.5 ± 3	Rear floor
7	1.2 ± 0.06	30 ± 1.5	Recess, rear floor (up to and incl. model 1973)
8	5.6 ± 0.08	142 ± 2	Hole ¹⁾ , spring linkage—hole ¹⁾ , side member (up to and incl. model 1973).
9	41.7 ± 0.12	1060 ± 3	Hole ¹⁾ , spring linkages
10	46.5 ± 0.16	1180 ± 4	Scuff plate, inside top edge
11	32.2 ± 0.08	817 ± 2	Front floor
12	30.7 ± 0.08	779 ± 2	Outer holes ¹⁾ , control arms
13	43.3 ± 0.12	1100 ± 3	Front floor
14	82.5 ± 0.12	2096 ± 3	Diagonal, rear outer hole ¹⁾ , control arm — forward hole, spring linkage
15	12.30 ± 0.12	312.5 ± 3	Horizontal reference line — front floor upper surface on centerline
16	9.70 ± 0.12	246.5 ± 3	Dash panel — windshield member, top front on centerline
17	21.48 ± 0.12	545.5 ± 3	Surface of glass down centerline
18	57.2 ²⁾	1453 ²⁾	Diagonal, door frame
19	45.8 ²⁾	1162 ²⁾	Diagonal, door frame
21	21.71 ± 0.12	551.5 ± 3	Forward hole ¹⁾ —side member on centerline (up to and incl. model 1973).
22	23.5 ± 0.12	596 ± 3	Surface of glass down centerline
23	20.1 ± 0.12	511 ± 3	Horizontal reference line — rear floor, upper surface on centerline
24	49.6 ± 0.12	1260 ± 3	Holes ¹⁾ for hood attachment
25	26.67 ± 0.12	677.5 ± 3	Top forward attachment points of upper control arm
26	14.1 ± 0.12	357 ± 3	Front engine cushion — dash panel (1969 model)
27	50.7 ± 0.12	1288 ± 3	Rear floor, upper surface
28	52.6 ± 0.16	1336 ± 4	Scuff plate, inside top edge
29	62.4 ± 0.12	1585 ± 3	Diagonal, bottom of roof side member — inside outer edge of scuff plate
30	46.6 ± 0.08 0.24	1184 ± 2 6	Side member, bottom edge

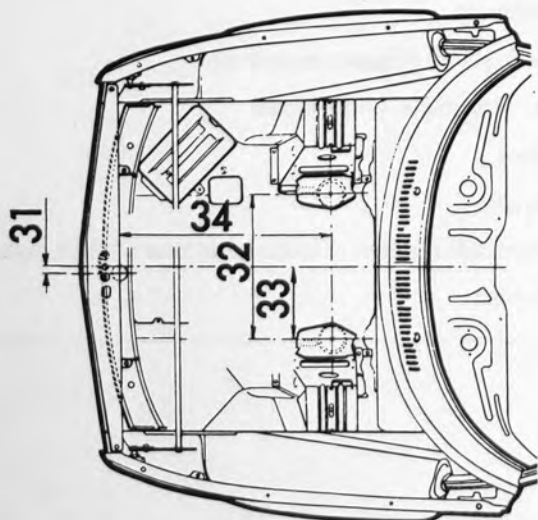
1) Center of hole.

2) Tolerance to give best door fit.

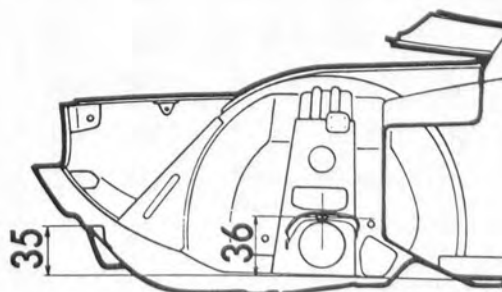


REFERENCE DATA FOR CHECKING BODY DIMENSIONS

S 3143



ENGINE SUSPENSION

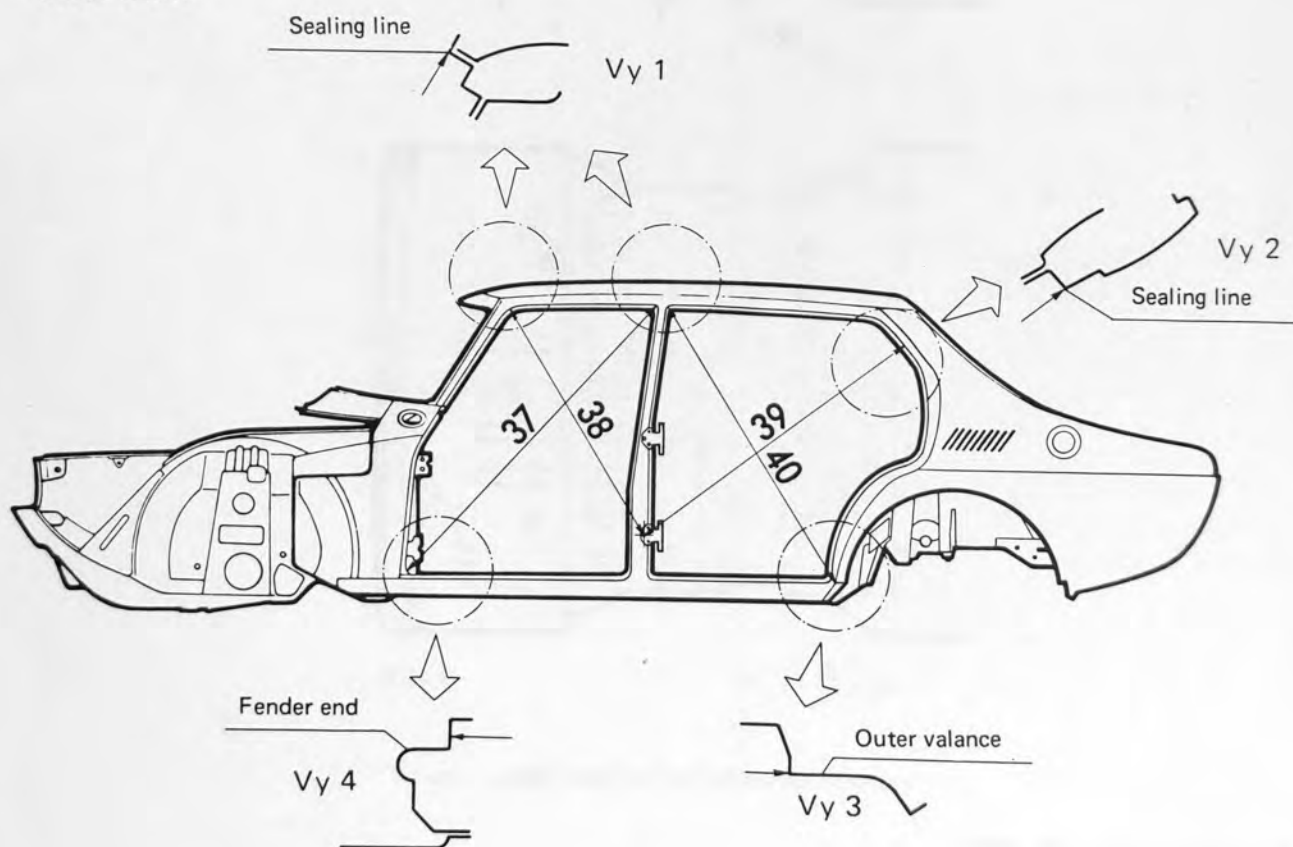


S 3144

Engine suspension as from 1970 models

Ref.	Measurements		Measurement points
	in.	mm	
31	1.2 ± 0.08	30 ± 2	Centerline — hole ¹⁾ , forward engine attachment point
32	20.3 ± 0.12	516 ± 3	Holes ¹⁾ , rear engine attachment points
33	10.2 ± 0.08	258 ± 2	Hole ¹⁾ , rear engine attachment point — centerline
34	27.1 ± 0.12	687 ± 3	Hole ¹⁾ , forward engine attachment point — centerline between holes, rear engine attachment points
35	5.6 ± 0.12	143 ± 3	Horizontal reference line — engine member, upper surface at attachment point
36	6.6 ± 0.12	167 ± 3	Horizontal reference line — floor member, upper surface at attachment point

1) Center of hole



VARIANT DIMENSIONS, 4-DOOR MODEL

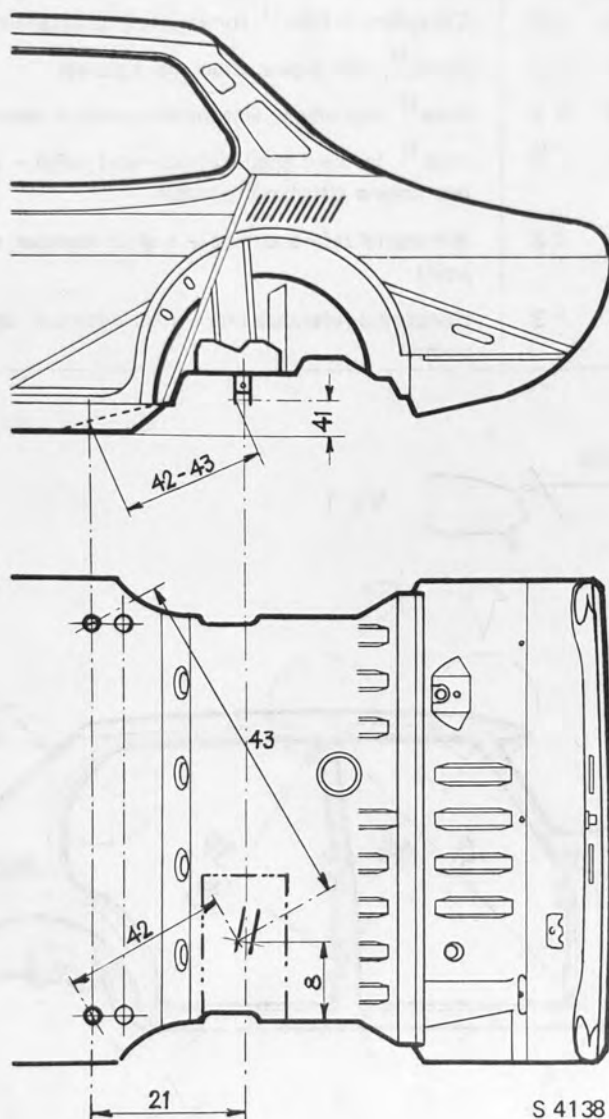
S 3145

Variant dimensions, 4-door model

Ref.	Measurements		Measurement points
	in.	mm	
37	51.5 ²⁾	1307	View 1 — View 4
38	38.2 ²⁾	970	View 1 — Forward hole ¹⁾ , hinge
39	43.3 ²⁾	1099	View 2 — Forward hole ¹⁾ , hinge
40	45.6 ²⁾	1157	View 1 — View 3

1) Center of hole.

2) Tolerance to give best door fit.



VARIANT DIMENSIONS, AS FROM MODEL 1974

Variant dimensions, model 1974

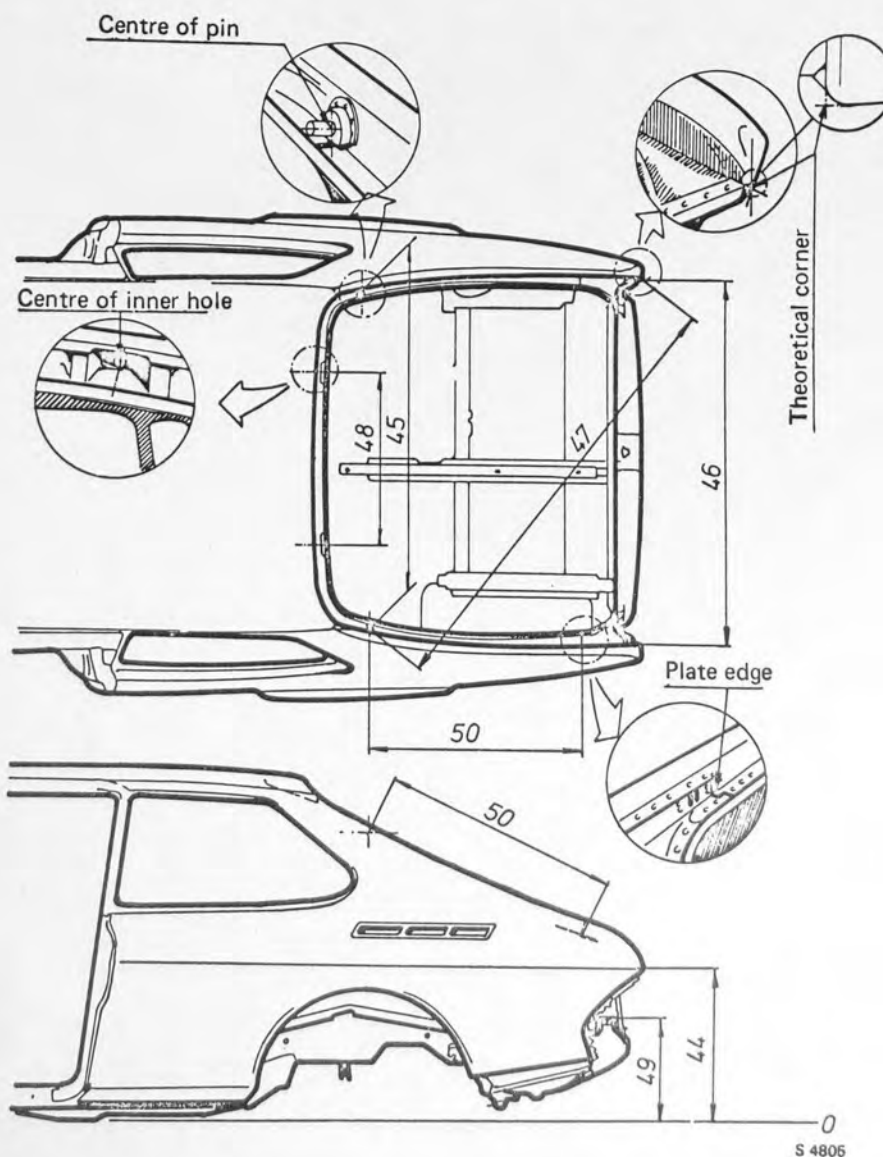
Ref.	Measurements		Measurement points
	in.	mm	
7	1.30 ± 0.06	33 ± 1.5	Recess, rear floor
8	6.45 ± 0.08	164 ± 2	Hole ¹⁾ , spring linkage — hole centreline in the middle between the holes
21	16.4 ± 0.12	416.5 ± 3	Forward hole ¹⁾ , spring linkage — side member on centreline
41	5.35 ± 0.08	136 ± 2	Horizontal reference line — hole ¹⁾ side member
42	17.7 ± 0.12	448 ± 3	Forward hole ¹⁾ , spring linkage V — forward hole ¹⁾ , side member attachment
43	38.8 ± 0.12	986 ± 3	Forward hole ¹⁾ , spring linkage H — forward hole ¹⁾ , side member attachment

¹⁾Center of hole.

Deviations from the nominal body dimensions of the Saab 99 Combi Coupé

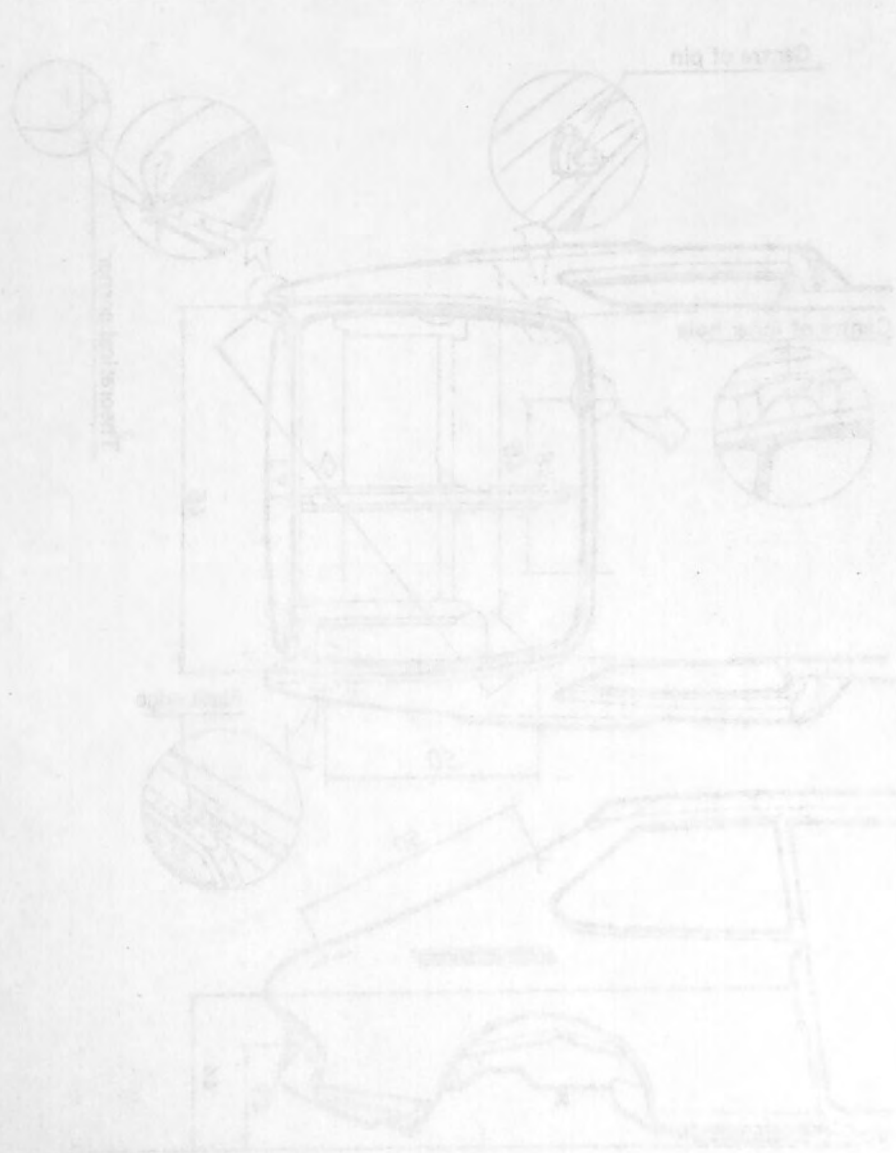
Ref.	Measurements		Measurement points
	in.	mm	
44	19.8	504	Horizontal reference line — rear floor, upper surface on centre line
45	45.8	1164	Mounting of the pneumatic springs
46	48.8	1240	Width of door opening at the height of the rear floor, upper surface on centre line
47	64.1	1628	Diagonal, pneumatic spring mounting — rear edge of door opening at height of the rear floor, upper surface on centre line
48	23.62	600	Centre of hinge pin ¹⁾
49	11.81	300	Reference line — top of rear sill plate
50	33.1	840	Pneumatic spring mounting — plate edge in the door gutter

1) Centre of hole



VARIANT DIMENSIONS, SAAB 99 COMBI COUPE

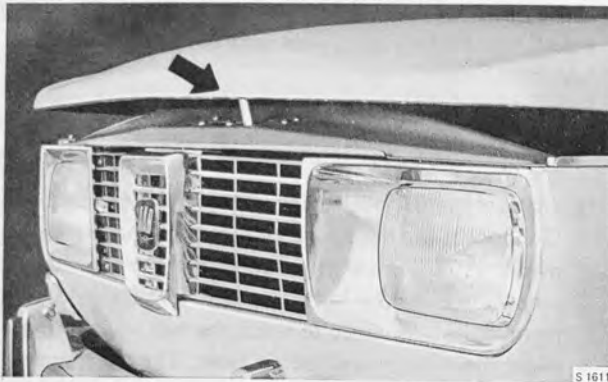
Part	Dimensions		Description
	mm	in	
1	200	7.87	Horizontal distance from the top of the hull to the top of the gun
2	1100	43.3	Length of the gun barrel
3	1200	47.2	Width of the gun barrel at the top of the hull
4	1050	41.3	Height of the gun barrel at the top of the hull
5	800	31.5	Width of the gun barrel at the top of the hull
6	300	11.8	Height of the gun barrel at the top of the hull
7	200	7.87	Horizontal distance from the top of the hull to the top of the gun



HOOD, FRONT, FENDERS

Taking off the hood

1. Pull the handle located under the instrument panel on the left-hand side. The hood will then spring open to the semi-locked position, retained by a safety catch under the front end (see illustration).



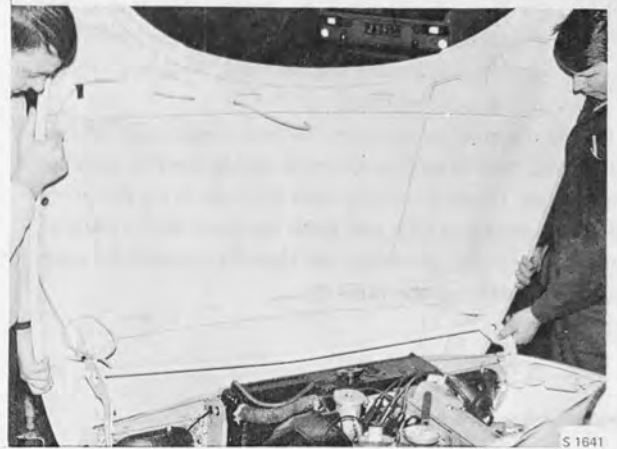
HOOD SAFETY CATCH

2. Push the catch backward and swing the hood forward and up.
3. Disconnect the hose from the windshield washer pump.
4. If only the hood is to be exchanged, remove the two through screws from the top end of the hinges. If the



HOOD RETAINING SCREWS

front sheet assembly is also to be removed, undo the two lower hinge screws, after which the hood can be lifted off.



LIFTING OFF THE HOOD

Mounting the hood

Locate the hood in the open position and tighten the through screws. If the lower hinge screws have been removed, locate the hood with the retaining screws in the hinge slots. In the latter case the position of the hood must be adjusted before the retaining screws are finally tightened.

Adjusting the hood

To adjust the position of the hood, slacken the two lower hinge screws and slide the hood in the slots until it fits properly on its seating.

Hood lock

The hood is fitted with a locking pin of adjustable length secured by a lock nut. This adjustment can be used to obtain the correct tension on the hood when it is locked. The lock assembly can be aligned with the pin mounted in the hood by slackening the two lock assembly retaining screws in the front member.

If anything goes wrong with the lock mechanism so that the hood cannot be opened from inside the car, proceed as follows: Insert a suitable tool through the grille immediately under the lock and push the mechanism control arm to the right; the hood can then be opened. Be careful not to damage the radiator.

Headlight trim frames

The trim frames are secured to the front sheet by a screw next to the grille.



GRILLE WITH HEADLIGHT TRIM FRAMES REMOVED

Grille

The grille is secured to the front member by five screws. One screw is located in the front member in front of the hood lock, and the other four are accessible when the headlight trim frames have been removed.

Front member

Removing and fitting

1. Remove the hood.
2. Remove the headlight trim frames.
3. Undo the self-tapping screws that secure the headlights to the front member and the screws at the top outer corners of the front member.
4. Undo the screw joint that secure the front member to the front floor on both sides of the radiator. (The 1969 model has through bolts with nuts accessible from beneath.)
5. Undo the radiator retaining screws.
6. a. Disconnect the hood lock release wire and lift off the front member.
b. As from model 1971 (cars with headlight wipers): Disconnect the hood lock release wire and disconnect the headlight washer hoses from their attachment points on the front member. Lift the front member away slightly to reach the ball joint of the wiper mechanism and take it apart. The front member can then be removed.

Installation is made in the reverse order.

DOORS AND TRUNK LID

Removing and fitting front door, 2-door and 4-door models

To remove the door, undo the six screws fastening the hinges to the body. The door can then be taken out complete with hinges.

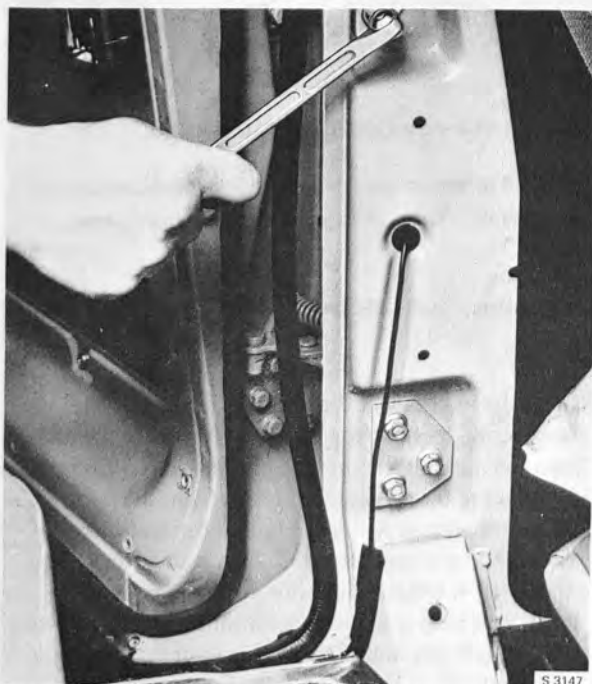
Hang the door in the reverse order.



UNSCREWING THE DOOR HINGES

Removing and fitting rear door, 4-door model

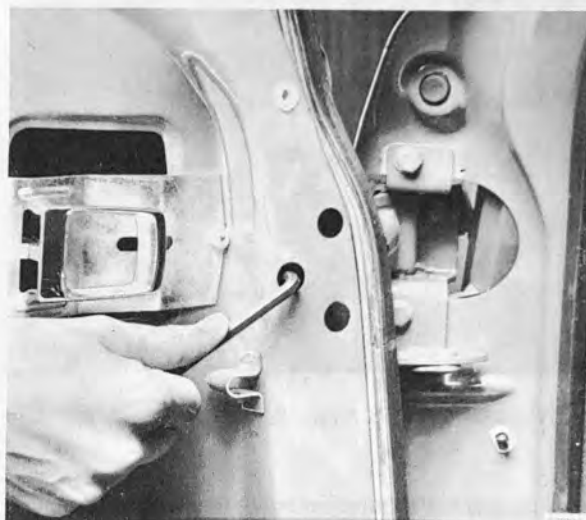
To remove the rear door, pull away the trim from the bottom of the door pillar and unscrew the nuts on the through bolts.



REMOVING REAR DOOR FROM 4-DOOR CAR

Adjusting front door, 2-door and 4-door models

To adjust the flush fit of a door, slacken the hinge screws on the body side. The door can then be moved outward or inward on the slotted holes in the hinges. To adjust the position of the door upward, downward, forward or backward, slacken the hinge screws in the door. These screws can be reached if the inside door trim is removed.



ADJUSTING VERTICAL AND FRONT-AND-REAR FIT OF FRONT DOOR

Adjusting rear door, 4-door model

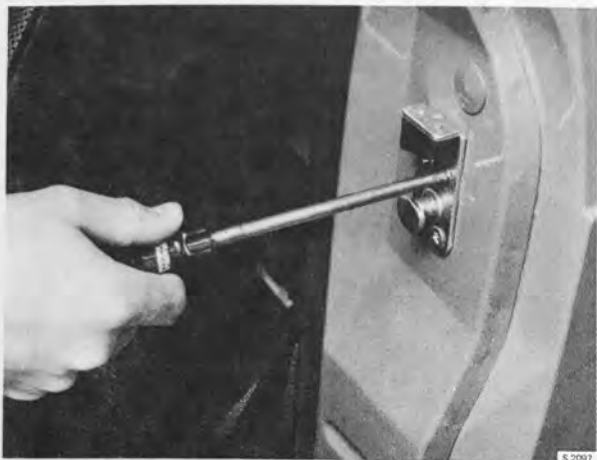
The flush fit and vertical position of the door can be adjusted after that the hinge screws on the door jamb side have been slackened. The door can also be adjusted slightly if the nuts on the hinge bolts through the door pillar are slackened. These nuts can be reached if the trim is removed from the bottom of the door pillar.



ADJUSTING VERTICAL AND FLUSH FIT OF REAR DOOR

Adjusting door striker plates, 2-door and 4-door models

The striker plate is adjustable and can be moved if the retaining screws are slackened. Adjust the plate so that it does not force the door either upward or downward. Check at the same time that the door opens and closes easily.



ADJUSTING THE STRIKER PLATE

Removing and fitting window regulators in front doors, 2-door and 4-door models

Remove the door trim and the window. Undo the four screws fastening the window regulator to the door and lift out the regulator. Fitting is made in the reverse order.



REMOVING THE WINDOW REGULATOR

Removing and fitting window regulators in rear doors, 4-door model

1. Crank the window right down and remove the inside door trim.
2. Undo the regulator retaining screws at the crank pivot and the bottom of the door frame.

3. Remove the screws from the window retainer.



REMOVING SCREWS FROM THE WINDOW RETAINER

4. Pull the window regulator down and out, taking care not to scratch the window pane.



REMOVING THE REAR-DOOR WINDOW REGULATOR

Reassemble in the reverse order. Check the operation of the window regulator before refitting the inside trim.

Changing door locks, 2-door model

Removal

1. Crank the window all the way up.
2. Remove the lock button and the inside door trim.
3. Turn the lock mechanisms to the closed position and unscrew the three retaining screws from the lock.
4. Door lock with drawing rod operation: Unhook the rear part of the operating link on the door lock. On model 1974, unfasten the link to the lock cylinder.
4. Door lock with angle rod operation: Unfasten the clip and unhook the link between the door lock and the angle rod.
5. Remove the lock. On model 1974, back off the pistol grip retaining screws slightly so that the grip can be wiggled when the mechanism is removed. One of the screws is inside the door and the other is on the rear edge of the door.

6. If necessary, the outer door handle can be removed by undoing its two retaining screws, one inside the door and one on the rear edge of the door.

Front door, 4-door model

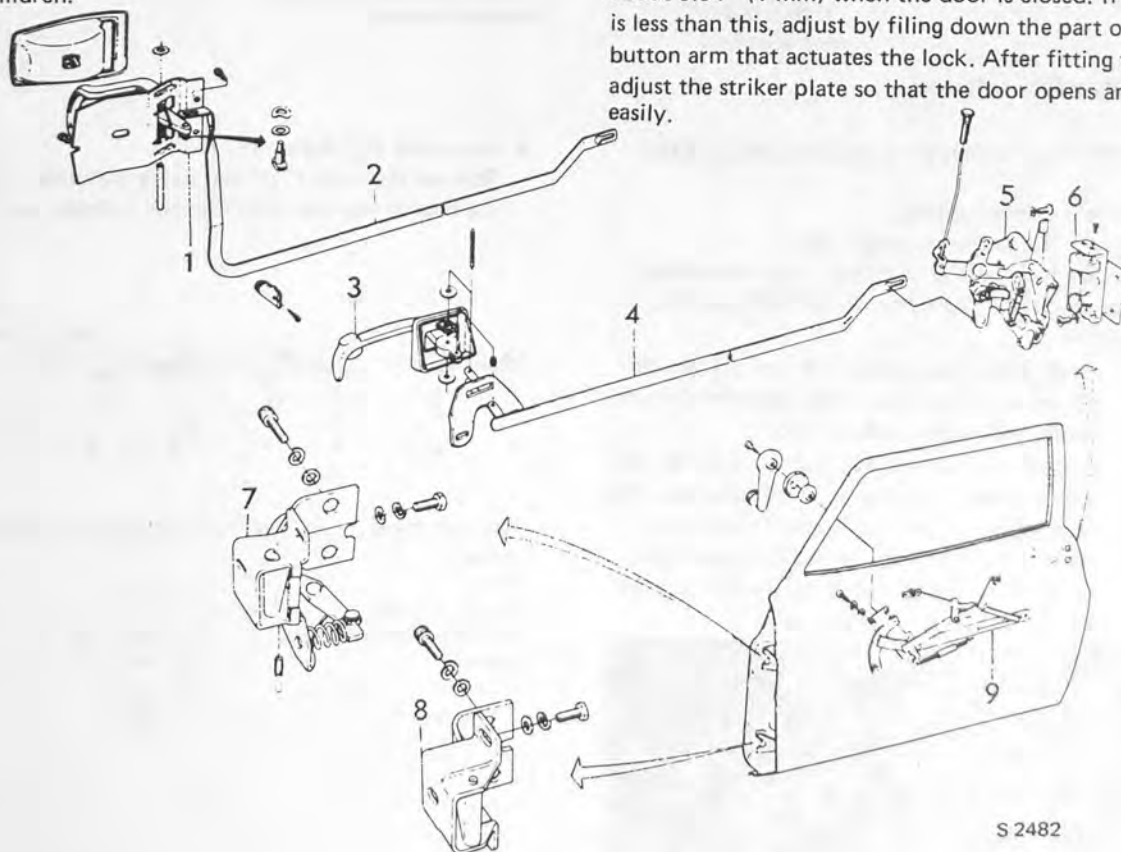
Removal

1. Crank the window all the way up.
2. Remove the inside door trim.
3. Turn the lock mechanism to the closed position and unscrew the three retaining screws from the lock.
4. Unscrew the bottom of the rear runner so that it can be bent forward when the door is removed.
5. Unhook the operating link to the inside handle at the lock and remove the link to the lock button. On model 1974, unfasten the link to the lock cylinder.
6. Remove the door lock.
7. If necessary, the outside door handle can be removed by undoing its two retaining screws, one inside the door and one in the rear edge of the door.

Rear door, 4-door model

Safety catches

The rear doors of the 4-door model are as from the 1973 model provided with safety catches to prevent that the doors unintended are opened from the inside by, for example children.



S 2482

FRONT DOOR WITH COMPONENT PARTS

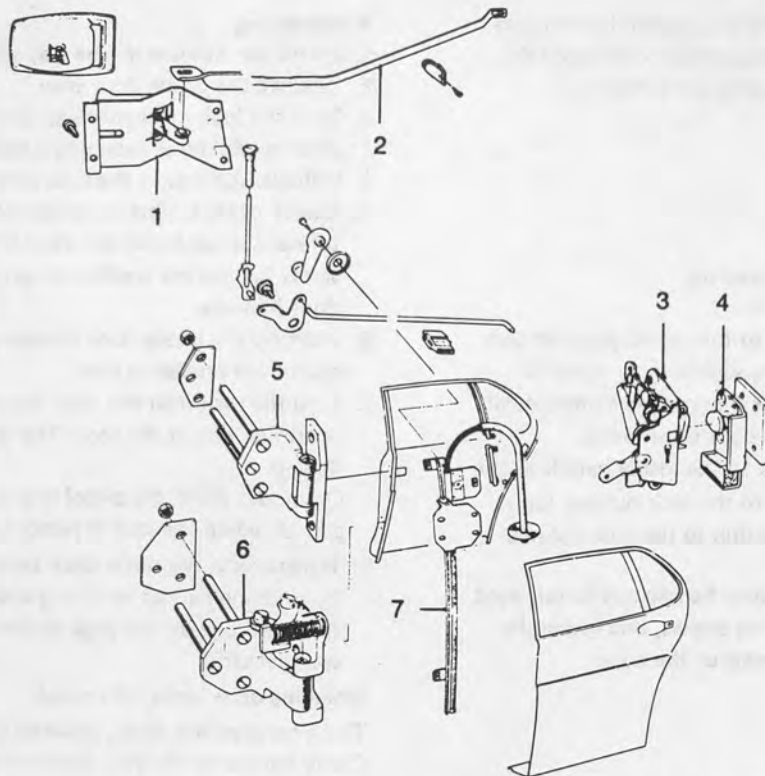
- | | |
|---|-----------------------------|
| 1. Inside door handle, up to model 1969 | 6. Striker plate |
| 2. Operating link, up to model 1969 | 7. Top hinge with door stop |
| 3. Inside door handle, as from model 1970 | 8. Bottom hinge |
| 4. Operating link, as from model 1970 | 9. Window regulator |
| 5. Door lock | |

Removing

1. Crank the window all the way up.
2. Remove the inside door trim.
3. Turn the lock mechanism to the closed position and unscrew the three retaining screws from the lock.
4. Unhook the link to the lock button on the door lock.
5. Model 1974: Unfasten the pistol grip by removing the forward screw inside the door and back off the rear screw behind the weather-strip on the edge of the door halfway.
6. Unscrew the inside door handle and unhook the front end of the operating link.
7. Push the lock into the door frame and unhook the operating link at the lock. The lock can now be removed.
On model 1974, the pistol grip must be wiggled slightly when the lock is removed.
8. If necessary, the outer door handle can be removed by undoing its two retaining screws, one inside the door and one on the edge of the door behind the weather-strip.

Installing door locks, all models

To fit handles and locks, proceed in the reverse order. Check before fitting that the moving parts and springs of the lock are well lubricated with Saab Special chassis grease. Up to and incl. model 1973: Check with the button of the outside handle pushed in that there is a play of about 0.04" (1 mm) when the door is closed. If the play is less than this, adjust by filing down the part of the push-button arm that actuates the lock. After fitting the lock, adjust the striker plate so that the door opens and closes easily.



REAR DOOR WITH COMPONENT PARTS

S 3216

- | | |
|-----------------------|--------------------------------|
| 1. Inside door handle | 5. Top hinge |
| 2. Operating link | 6. Bottom hinge with door stop |
| 3. Door lock | 7. Window regulator |
| 4. Striker plate | |

Changing door lock cylinders

Removal and disassembly, up to and incl. model 1973

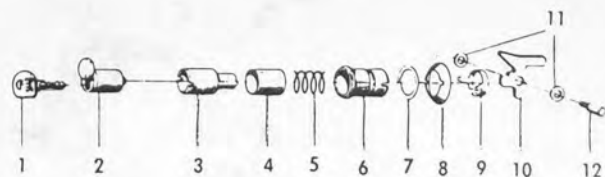
1. Crank the window right up.
2. Remove the inside trim from the door.
3. Remove the lock button as follows (two alternative methods described): As from model 1972 only alt. II is valid.

Alt. I Push in the two springs that lock the washer (8, see exploded view) with polygrip pliers or similar and take out the button.

Alt. II Pry off the snap ring (9) from its groove with a bent chisel or similar and push the snap ring towards the driver (10), where it can be unhooked if the lock cylinder (2) is pushed in. At the same time unhook the washer (8); the button can then be taken out.

4. Up to and incl. model 1971:

Remove the pivot (12), that holds the driver. Put aside the button together with the lock cylinder and spring.



S 2101

PUSH BUTTON UP TO AND INCL. MODEL 1971, EXPLODED VIEW

- | | |
|----------------------------|--------------|
| 1. Key | 7. Gasket |
| 2. Lock cylinder | 8. Washer |
| 3. Push button with sleeve | 9. Snap ring |
| 4. Sleeve | 10. Driver |
| 5. Spring | 11. Washers |
| 6. Sleeve | 12. Pivot |



S 3150

TAKING OFF THE SNAP RING

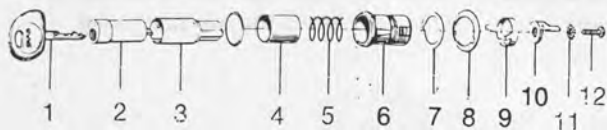
As from model 1972:

Remove the screw holding the push button driver (10) and remove the push button (3) and spring (5).

WARNING

Do not press out the pivot that holds driver. The pivot is guided by two spring loaded balls and can not be refitted unless a special tool is used.

5. Take off the nickel-plated sleeve (4) to expose the lock cylinder retaining pin.



S 3449

PUSH-BUTTON AS FROM MODEL 1972, EXPLODED VIEW

- | | |
|----------------------------|--------------|
| 1. Key | 7. Gasket |
| 2. Lock cylinder | 8. Washer |
| 3. Push button with sleeve | 9. Snap ring |
| 4. Sleeve | 10. Driver |
| 5. Spring | 11. Washer |
| 6. Sleeve | 12. Pivot |

6. Insert the key and turn it 35° clockwise; the retaining pin can then be pushed in and the lock cylinder taken apart. If the key is missing, the pin can be knocked into the lock cylinder by force with a center punch or with a pin not more than 0.12" (3 mm) in diameter, after which the cylinder can be pulled out of the button. This method however ruins the cylinder, and a new cylinder will have to be fitted.

Reassemble in the reverse order.

Fitting locks in door

1. Engage the snap ring (9) in the groove on the sleeve (6). Check that the washer (8) slips over the cylindrical part of the snap ring without sticking. If necessary, bend the snap ring.
2. Fit the push button in the door but not so far that the two springs are exposed inside the door. Place the washer (8) inside the driver (10).
3. Hold the button from the outside and push the washer (8) home with the aid of tool 847103, see fig.

NOTE

Check that both springs have engaged.



PUSHING HOME THE WASHER

Tool 847103

Removing the lock cylinder, model 1974

1. Crank the window all the way up.
2. Remove the inside door trim.
3. Unhook the link rod from the plastic arm of the lock cylinder.
4. Remove the lock clip using polygrip pliers and remove the entire lock cylinder.



THE LOCK CLIP IS REMOVED

S 4130

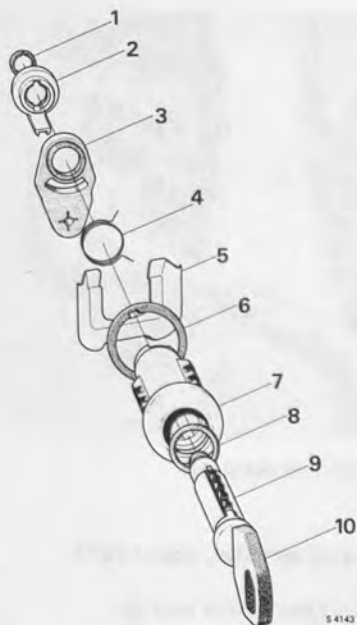
Disassembly and assembly of the lock cylinder, model 1974

1. Pry off the driver and remove its lock ring.
2. Remove the plastic arm and the spring.
3. Withdraw the lock cylinder from the lock sleeve. Leave the key in the lock cylinder as long as it is withdrawn from the lock sleeve or the lock cylinder may fall apart.
4. Remove the O-ring.

NOTE

The key in the new lock cylinder must not be withdrawn before the lock cylinder is fitted in the lock sleeve.

The lock ring should be changed after having been removed. Re-assemble in reverse order.



DOOR LOCK, MODEL 1974

- | | |
|----------------|-------------------|
| 1. Lock ring | 6. Gasket |
| 2. Driver | 7. Locking sleeve |
| 3. Plastic arm | 8. O-ring |
| 4. Spring | 9. Lock cylinder |
| 5. Lock clip | 10. Key |

Keys

Two keys are supplied with the car. Both fit the ignition switch and all locks.

Spare parts

If the lock cylinder in the ignition switch, the trunk lock or any door is damaged, a replacement cylinder can be ordered by quoting the serial number of the key and the spare part number (see Spare Parts Catalogue). The system of master keys fitting all locks can thus be maintained without the need to fit a complete new set of locks to the car.

Lubrication

If the lock cylinder is oiled or greased, the tumblers of the lock are liable to stick. This is because dirt sticks to the key and is deposited inside the cylinder. Lubrication of the cylinder itself should therefore be avoided, but if it is necessary to free a stuck lock, a little glycerine may be smeared on the heel of the key. Work the key back and forth a few times in the lock.

NOTE

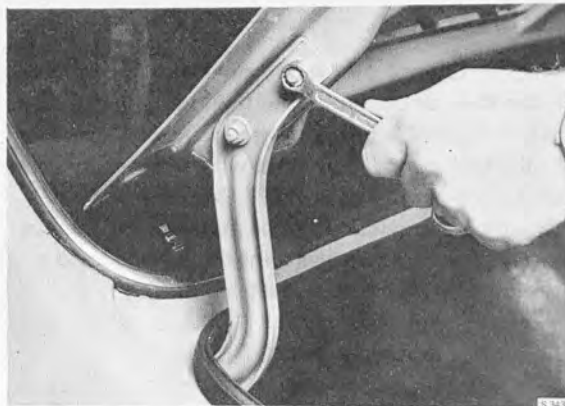
The serrated edge of the key must not be greased.

Removal and installation of trunk lid

Open the lid and undo the four screws by which the lid is fastened to its hinges. The lid can then be lifted up.

Adjustment of trunk lid

The position of the trunk lid can be adjusted upward and downward or forward and backward by loosening and retightening the hinge screws in the oversized holes.



ADJUSTING THE TRUNK LID

Adjusting the trunk lock striker plate

The striker plate is secured by screws in oversized holes and can be adjusted when the screws are loosened.

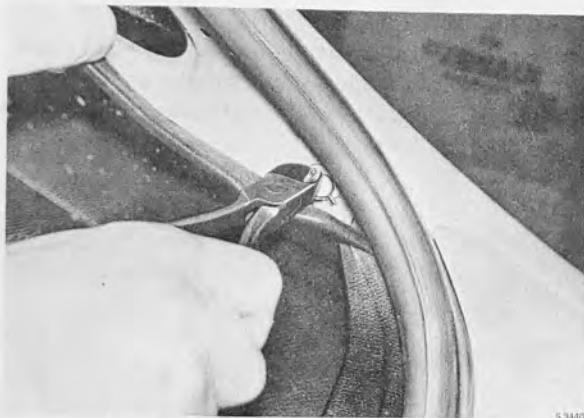
Changing the trunk hinges

1. Remove the trunk lid.
2. Remove the springs at the hinges with the aid of special tool 829157.



REMOVAL OF SPRING, TRUNK LID
Tool 829157

3. Bend away the side padding guards a little and remove cotter pins and washers from the hinge pins. The hinges can now be removed.



REMOVAL OF COTTER PINS

4. Fit the new hinges with new plastic bushings on the pins.
5. Install the springs at the hinges with the aid of tool 829157.
6. Install and adjust the trunk lid.

Changing the trunk lock cylinder

1. Open the trunk lid and remove the lock mechanism by undoing the two retaining screws.
2. Undo the two securing the handle to the lid.
3. Up to and incl. model 1973: Proceed in the same manner as for changing door lock cylinders as from model 1972.

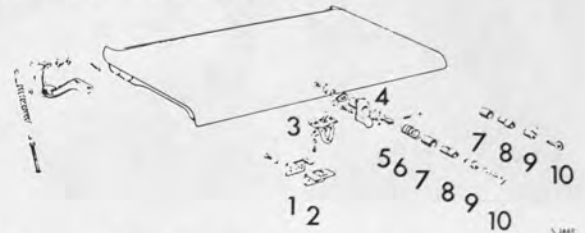
WARNING

Do not press out the pivot that holds driver. The pivot is guided by two spring loaded balls and can not be refitted unless a special tool is used.

3. Model 1974:

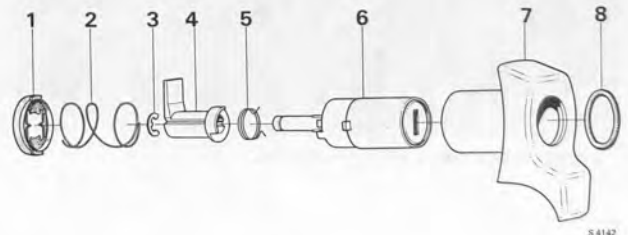
- a. Pry the plastic disc loose with a suitable tool and remove the compression spring and push button from the handle.
- b. The driver and the torsion spring can be removed after the lock ring has been taken off.
- c. If the lock cylinder is withdrawn from the push button sleeve, the key must first be inserted in the lock cylinder so the cylinder does not fall apart.

Reassemble in reverse order.



TRUNK LID WITH LOCK, STRIKER PLATE AND HINGES
(LOCK UP TO AND INCL. MODEL 1973)

- | | |
|----------------------|------------------|
| 1. Reinforcing plate | 6. Spring |
| 2. Striker plate | 7. Sleeve |
| 3. Lock | 8. Sleeve |
| 4. Handle | 9. Lock cylinder |
| 5. Pin | 10. Key |



TRUNK LOCK, MODEL 1974

1. Plastic disc
2. Compression spring
3. Lock ring
4. Driver
5. Torsion spring
6. Push button sleeve with lock cylinder
7. Handle
8. O-ring



REMOVING THE LOCK FROM THE TRUNK LID

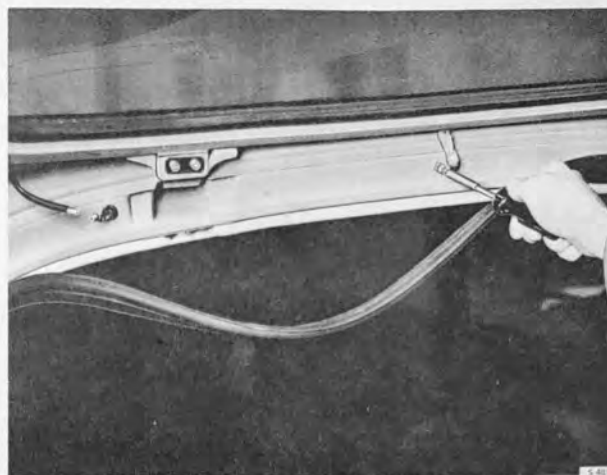


ADJUSTING THE STRIKER PLATE

TRUNK DOOR, SAAB 99 COMBI COUPE

Dismantling

1. Remove the cable clip and cut off the cable between the body and the door, and disconnect the main connection from the body.



DISCONNECTING THE MAIN CONNECTION

2. Mark the position of the door at the hinge mounting if the door is to be refitted, and back off the inset screws slightly.
3. Remove the two pneumatic springs and place a suitable support at the rear edge of the door.
4. Remove the inset screws and lift away the door with the aid of an assistant.



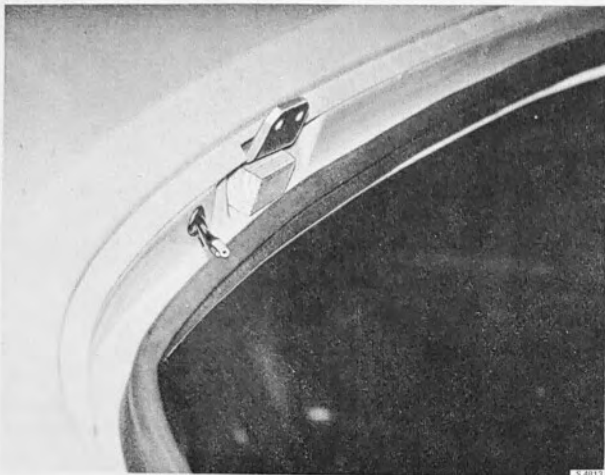
LIFTING AWAY THE TRUNK DOOR

NOTE

The pneumatic springs must not be dismantled. The pressure in the spring is more than 60 bar (kp/cm², 850 psi.), which means that in the event of the lock ring being removed, the internal components will be forced out at a force sufficient to cause injury.

Fitting

1. Place suitable spacers under the hinge plates.



SPACERS UNDER THE HINGE PLATES

2. With the help of an assistant, lift the door and secure it to the hinges. Simplify the lift by placing a suitable support at the rear edge of the door.
3. Remove the spacers under the hinges before lowering the door.

NOTE

The pneumatic springs can be damaged if they remain fitted to the body and if the door is closed without the springs being secured to the door.

4. Adjust the fit of the door at the hinges, and if necessary, adjust the lock mechanism.
5. Fit the pneumatic springs.
6. Connect the electric cable by means of joint sleeves and insulate the joint with black insulating tape. Clamp the cable to the body. Connect the main connection.

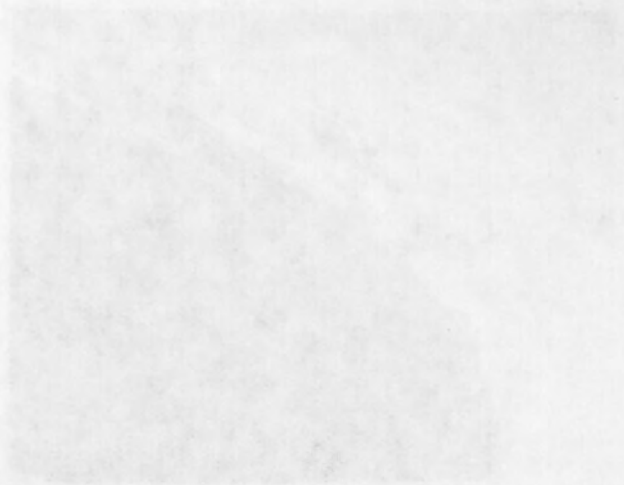


Figure 1. Aerial view of the study area.

1. The first step is to identify the study area and its boundaries.
2. The second step is to collect data on the study area.
3. The third step is to analyze the data and draw conclusions.

NOTE

The authors would like to thank the following people for their assistance in the collection of data:

1. John Doe, who provided the initial data set.
2. Jane Smith, who assisted in the data collection.
3. Bob Johnson, who provided the final data set.

WINDOWS

General

The windshield is made of laminated glass and all other windows of toughened glass. When fitting new windows, use only Saab original parts to ensure approved glass quality and a perfect fit.

Changing the windshield

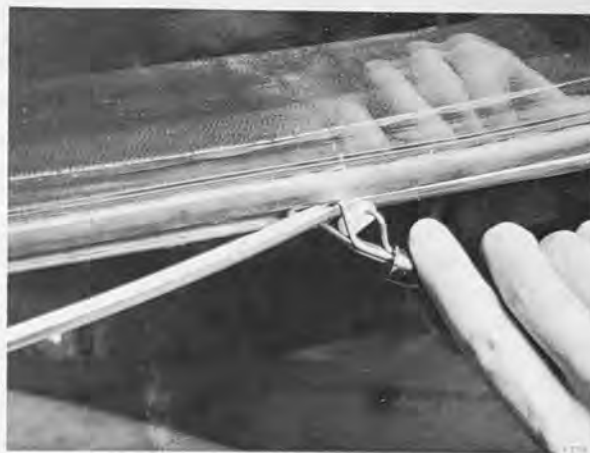
To change the windshield without removing the rubber strip from the body, proceed as follows.

Removal

1. Raise the windshield wiper arms. Crank the door windows down.
2. Remove the joint piece from one side of the windshield moulding and mark the end position of the moulding on the rubber strip with a pen. Remove the moulding.
3. Remove the rubber strip from the windshield by inserting a properly bent special tool under the strip and moving it around the strip.
4. Push out the upper left corner of the windshield by pressing carefully from the inside.
5. Free the upper edge and the sides of the windshield from the rubber strip.
6. Free the bottom edge of the windshield. Remove the windshield.

Installation

1. Adjust the rubber strip so it follows the windshield frame.
2. Apply paraffin oil to the rubber strip to facilitate the installation of the windshield.
3. Place the new windshield on the rubber strip and align the windshield in its proper position in the frame.
4. Fit the windshield into the bottom edge of the rubber strip and the lower part of the short side using the special tool.
5. Fit the windshield in the top edge of the rubber strip. Begin by pulling out a small bit of the rubber edging from the inside of the windshield about 6 in. (about 15 cm) from a corner. Complete the fitting of the rubber strip and make any necessary adjustments.
6. Apply paraffin oil to the slot for the windshield moulding to facilitate fitting.
7. Fit the moulding using tool 829102. Begin at the mark made previously on the rubber strip. Complete the fitting of the moulding.
8. Inject sealing compound between the rubber strip and the glass and between the rubber strip and the frame.
9. Clean off any excess sealing compound with a wooden putty knife.
10. Clean the glass and the strips with undiluted spirits.



APPLYING THE WINDSHIELD MOULDING
Tool 829102

11. Clean the inside and the outside of the glass with window cleaning liquid.

If the rubber strip has been removed from the frame, the procedure used for the rear window should be followed.

Changing the rear window

Removal

1. Remove the padding around the rear window. Protect the headlining from becoming soiled by applying masking tape to the edge above the window.
Saab 99 Combi Coupé: Disconnect the heating wire connections for the rear window.
2. Free the rubber strip from the frame and push out the rear window from the inside.
3. Clean the contact surface for the rubber strip round the frame and clean away the old sealing compound.

Installation

1. Fit a new rubber strip round the window and lay a piece of string in the slot in the rubber strip. Leave the ends of the string at the middle of the bottom of the window.
2. Apply paraffin oil to the window frame and the rubber strip and put the window in place.
3. Pull on the string from the inside of the car so that the edge of the rubber strip will be bent inwards and over the edge of the frame. Start from the middle and work towards the sides while pushing the glass down towards the edge of the frame. Continue around the whole rear window and ensure that the inside flange of the rubber strip overlaps the inside of the frame all the way around.
4. Fit the trim moulding using tool 829102. Apply paraffin oil to the slot to facilitate fitting.
Saab 99 Combi Coupé: Connect the heating wires for the rear window.
5. Inject sealing compound between the rubber strip and the glass and between the rubber strip and the frame.
6. Clean off any excess sealing compound with a wooden putty knife.
7. Clean the glass and the strip with undiluted spirits.

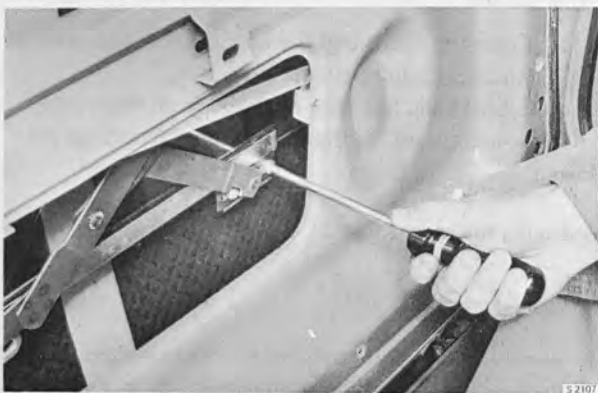
8. Fit the padding.
9. Clean the inside and the outside of the window with window cleaning liquid.

Changing front door window, 2-door and 4-door models

The door window is clamped at the bottom in a U-shaped retainer with a slot for the operating arms of the window regulator. The leading and trailing edges of the pane are located in U-shaped runners.

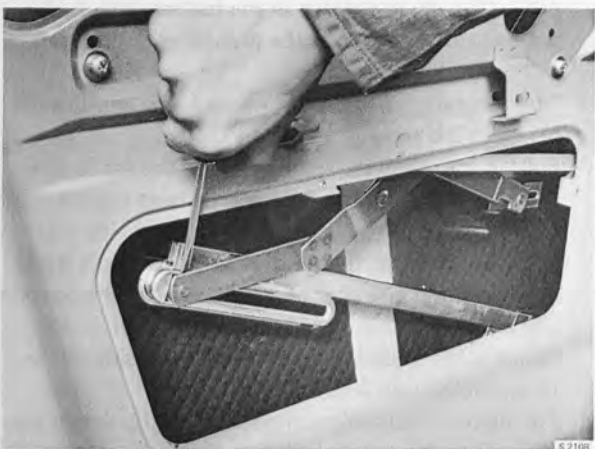
Removal

1. Take off the door inside trim.
2. Remove the inner longitudinal weatherstrip at the bottom of the window opening.
3. Undo the two screws fixing the front regulator arm to the window retainer.



REMOVING FORWARD OPERATING ARM OF WINDOW REGULATOR

4. Turn the pane so that its front part slopes down and move it forward so the plastic runner is facing the guide slot in the operating arm.
5. Pry carefully with a screwdriver between the operating arm and the guide rail so that the plastic runner comes out through the slot.



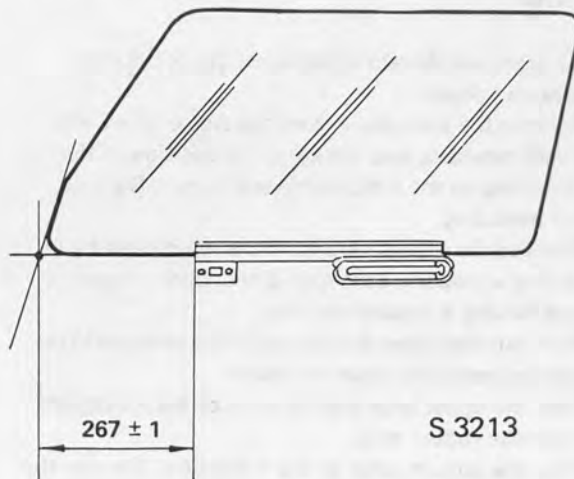
FREEING THE PLASTIC RUNNER FROM THE GUIDE SLOT

6. Turn the pane vertically and remove it.
7. If necessary, remove the pane from the retainer.

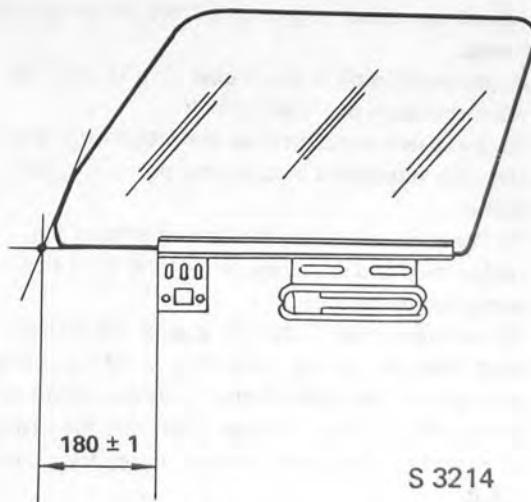
Installation

1. If the pane has been removed from its retainer, begin by placing the rubber pad in the U-shaped retainer and pressing in the pane. Make sure that the retainer grips the pane securely. The measurements stated on the sketch below must be followed carefully. If not, the function can be jeopardized.

When installing, check that the retainer is evenly pressed on. If for instance the middle part of the retainer is pressed harder on than the ends, the retainer can be curved. The glass can in that case slip out of the retainer.



MEASUREMENT FOR MOUNTING THE WINDOW PANE RETAINER, DOOR WINDOW OF 2-DOOR MODEL



MEASUREMENT FOR MOUNTING THE WINDOW PANE RETAINER, FRONT DOOR WINDOW OF 4-DOOR MODEL

2. Lower the pane vertically into the door with the retainer to the rear and work it into the horizontal position.



INSTALLING THE DOOR WINDOW

3. Push the plastic runner of the rear regulator arm into the slot and tighten the two retaining screws of the front regulator arm.
4. Fit the weatherstrip at the bottom edge of the window opening.
5. Check the operation of the window and refit the door trim.

Changing rear door window, 4-door model

Removing

1. Remove the inside trim from the door.
2. Remove the sealing strip along the bottom of the window opening.
3. Take out the fixed rear door window (see under "Changing side windows").
4. Undo the window regulator screws from the window pane retainer.
5. Remove the trim moulding from the window rear guide profile.



REMOVING THE SCREWS FROM THE WINDOW PANE RETAINER

6. Undo the retaining screws of the rear guide profile. The bottom screw can be reached by removing the rubber plug in the rear of the door. On cars up to and incl. chassis No. 99.053.410, the guide profile is fastened with two screws at the top. On cars of later design, the guide profile is fastened by a spring clamp.

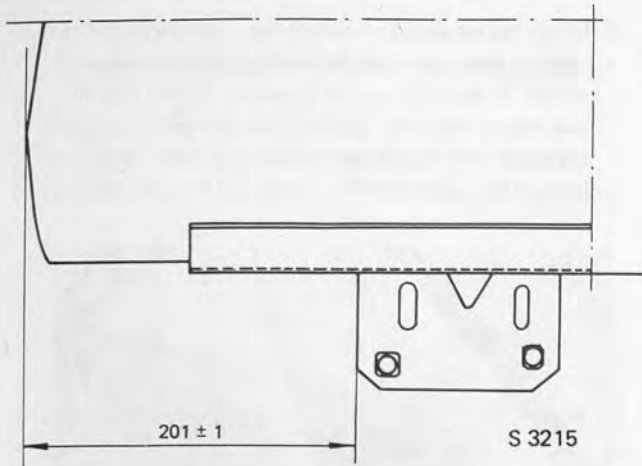


UNSCREWING THE RUNNER

7. Free the guide profile from the door frame and push it backward. The window pane can then be lifted out.
8. Separate the pane from its retainer if required.

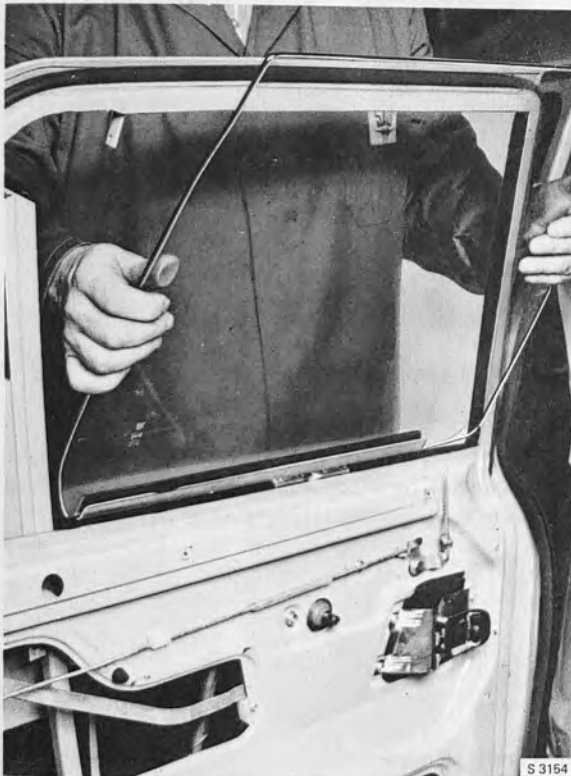
Installing the window

1. If the pane has been removed from its retainer, start by fitting the rubber pad to the pane and pressing on the U-shaped retainer. Make sure that the retainer grips the pane securely. The measurement quoted in the illustration must be exact, as the window will otherwise be difficult to operate. When assembling, take care to press the retainer on evenly. If for example the middle is pressed on harder than the ends, the retainer is liable to be bent, and the pane is then apt to work loose from the retainer.



MEASUREMENT FOR MOUNTING THE WINDOW PANE RETAINER, REAR DOOR WINDOW

2. Lower the pane horizontally from the inside of the door.



INSTALLING THE REAR DOOR WINDOW

3. Screw the window pane retainer to the mounting plate of the window regulator.
4. Fit the rear guide profile and insert the rubber plug in the rear jamb of the door.
5. Free the runner strip from the guide profile and mount the trim moulding. Then press the strip back into place.
6. Install the fixed window pane (see under "Changing side windows).

Changing fixed side windows in body (2-door model) and rear doors (4-door model)

1. Push the pane outward from the inside, starting from the trailing edge and folding back the inside flange of the rubber moulding at the same time.
2. Fit the moulding round a new window pane of the prescribed quality. Lay a cord in the slot round the rubber strip, with the ends of the cord coming together at the rear.
3. Fit the trim moulding with joint pieces to the rubber strip.
4. Install the pane and rubber strip using the cord as described in the directions for installing the windshield, beginning at the trailing edge of the window. Tap the pane home gently with a rubber mallet.

UPHOLSTERY AND INTERIOR FITTINGS

Door trim

Removing and installing

The door trim is stretched over a fiberboard backing and is secured to the door by screws and ordinary snap fasteners. To remove the door trim, proceed as follows:

1. Undo the window crank screw and remove the crank.
2. Remove the safety catch button.
3. Undo the screws from the door sill strip. (This does not apply to 2-door cars as from model 1971.)
4. a. Undo the door pocket screws (model 1969).
b. Unscrew the armrest (2-door models as from 1970 and front doors of 4-door models).
c. Unscrew the armrest and the screw at the bottom of the front edge of the door (rear doors of 4-door models).
5. Remove the cover plate under the inner door handle and all the snap fasteners that holds the door lining by prying outwards with the fingers, whereafter the lining can be removed (model 1969 and 4-door model).

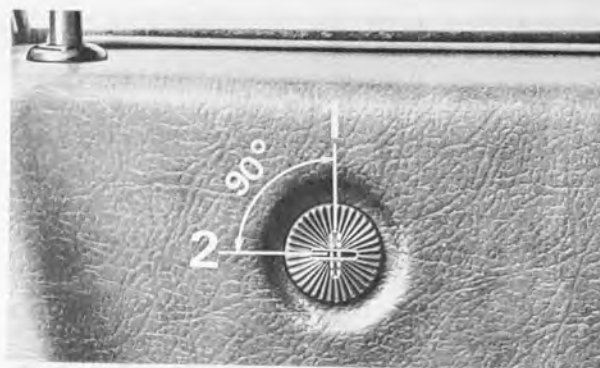
Refit the trim in the reverse order.



REMOVING THE DOOR TRIM

Make sure that the holes on the inside of the door are covered with protective paper with the bottom edge of the paper inside the door (to protect the inside trim from getting wet).

Saab 99 EMS model 1974 and Saab 99 Combi Coupé, have door and side trim of a new design which is held in place by speed screws. The speed screws can be loosened by turning them 90° from the tightened position.



SPEED SCREW, SAAB 99 EMS AND SAAB 99 COMBI COUPE

1. Installing position
2. Removing position

The back seat side trim is stretched over a frame consisting of a fiberboard sheet at the bottom and moulded cardboard at the top. To remove the trim, proceed as follows:

1. Undo the two self-tapping screws holding the window sill strip and remove the strip.
2. Undo all screws holding the scuff plate protector and loosen the plate to free the bottom of the side trim.
3. Unsnap the snap fasteners holding the side trim in place and ease the trim out carefully without damaging the back seat cushion and backrest.



REMOVING THE SIDE TRIM

Padding

The interior of the passenger compartment is provided with resilient padding strips. These are placed round the edges of the roof and windows and are secured by ordinary clips. The windshield pillar pads are secured by two plastic buttons each and are also glued in place. To remove these, pull them carefully off by hand after removing the sun visors, etc.

Headlining up to and incl. model 1972

The headlining is made of plastic-coated fabric and edged with a spiral wire. It is held in place by hooks mounted inside the roof members (one in each corner and in the middle of each side) that engage the spiral wire through cutouts in the headlining.

Installing

1. Hook the headlining on to the middle hook in the windshield frame.
2. Push in the rubber wedge between the roof and the top of the windshield frame immediately above the rear-view mirror mount. (The purpose of the wedge is to prevent any vibration in the roof from being transmitted to the mirror.)



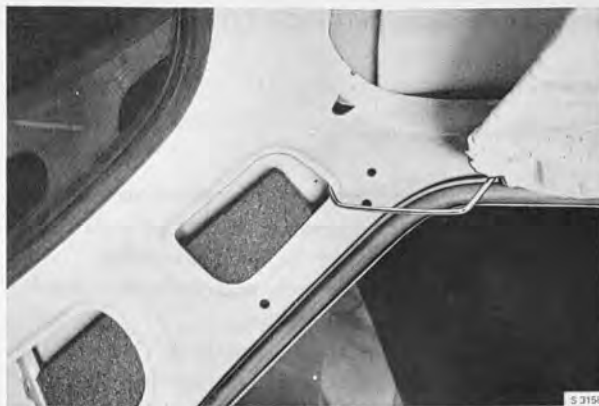
INSTALLING THE CROSS RIBS

3. Fit the cross ribs, starting with the forward one. Fold the rib up and stretch the headlining fabric between the ribs as each one is mounted.
4. Use the single hook (tool 829058) to engage the spiral wire in the hooks at the forward corners of the roof.



HOOKING THE HEADLINING TO THE FORWARD CORNERS
Tool 829058

5. Use the double hook (tool 829057) to hook the headlining to the rear corners of the roof. While the first corner is being hooked up, the headlining should be fastened in some suitable fashion at the opposite corner to keep the wire taut.



FASTENING THE HEADLINING TO STRETCH THE WIRE



HOOKING THE HEADLINING TO THE REAR CORNERS
Tool 829057

6. Tuck the headlining into the roof members, securing it to the hook in the middle of the rear roof member and the hooks in the middle of each side member.
 7. Refit the rear view mirror, the seat belts for the rear seats and locking devices for the rear side windows. Connect up the roof lights.
- If the headlining is not perfectly smooth after installation, it can be tautened by gentle heating with a lamp of the same type as used for paintwork repairs.

NOTE

If the headlining is overheated, the plastic will melt and go shiny.

Removal

1. Remove the locking devices for the rear side windows, and the seat belt attachments at the rear pillars.
2. Remove the rear view mirror and the roof lamps.
3. Remove the safety pads covering the roof members and the rear pillars.
4. With the aid of a screwdriver remove the spiral wire from the hooks at the rear pillars.
5. Hook off headlining spiral wire from the hook in the center of the roof member and in the center of each side member.
6. Hook off the spiral wire from the hooks at the front corner pillars.
7. Bend the cross ribs up so that they come loose from the side members, see fig.
8. Remove the rubber wedge, situated between the roof plate and the front roof member at the rear view mirror attachment and hook off the headlining from the hook in the center of the front roof member.

Headlining as from model 1973

The headlining is, as from the 1973 model, made of moulded glass fiber covered with velour. The lining is during the transportation covered with plastic which is to be removed after that the lining is mounted in the car. Because of its rigidity, the lining is sensitive to breaking especially around the edges of the recesses for the roof lamps and the sun visors. The installation of the lining must therefore be made with greatest care. The way of installation differ on 2-, 4-door versions and Saab 99 Combi Coupé.

Removal of headlining 2-door model

(Some of the instructions in the text apply to 4-door cars.)

1. Open the left door. Remove the left seat and drop the backrest of the right seat back.
2. Put the gear lever in reverse.
3. Remove the rear view mirror, the roof lamps, the sun visors and the coat hangers on the 4-door model.
4. Remove the seat belt attachments in the door pillars and remove the safety pads.
5. Remove the screws and the clips from the safety pads at the windshield pillars and move the pads inwards.



THE SAFETY PADS ARE REMOVED FROM THE WINDOW PILLARS

6. Remove the headlining from the pads at the rear window by moving the lining forwards. Then lift out the floor through the left door. On the 4-door model through the right door.



THE LINING IS LIFTED OUT THROUGH LEFT DOOR

Installing the headlining, 2-door model

If the front or rear window is already removed, move the lining through the window opening. Note! Leave the plastic cover on the lining during the installation.

1. Put the gear lever in reverse. Move the lining in through the left door if the front or rear window is not removed.



THE LINING IS LIFTED INTO THE CAR



THE LINING IS MOVED IN POSITION

2. Lift the lining up on the upper ends of the front pillar safety pads and pull it backwards to stop above the rear safety pads. Pull out the electric cables for the roof lights through the recesses in the lining.



THE REAR EDGE IS POSITIONED

3. Screw the pads on to the windshield pillars and the door pillars.



THE FRONT DOOR PILLAR PADS ARE INSTALLED



DOOR PILLAR PADS ARE MOVED INTO POSITION

4. Install and connect up the roof lamps, install the rear view mirror, sun visors, and coat hangers on the 4-door model.
5. Check that the lining is correctly fitted. Remove the plastic cover by removing the safety pins and tear off the cover from the sides and around the rear view mirror, sun visor attachment points and on the 4-door model around the coat hangers. Remaining plastic pieces can be folded in between the side edge of the lining and the roof plate. Suitable tool for this purpose is a putty spade.

Note! When mounting window panes and glueing in connection with this, the lining must be protected against stains. The edge of the lining must then be masked with plastic.

Removal of headlining, 4-door model

1. Remove the driver's seat, steering wheel and gear shift lever. Drop the back rest on the right seat rearwards.
2. See position 3, 4 and 5, "Removal 2-door model".

Installation of headlining, 4-door model

1. a. Move the lining in through the right front door, rear end first.



THE LINING IS MOVED IN, 4-DOOR MODEL

- b. With care, turn the lining by the door pillar on the left hand side and move it up rearwards to installation position.



THE LINING IS MOVED INTO POSITION IN THE CAR

2. See position 2, 3, 4 and 5 under "Installation 2-door model".
3. Fit the steering wheel, gear shift lever and driver's seat.

Removal and installation of head lining, Saab 99 Combi Coupé

1. Open the trunk door and tip forward the rear seat cushion and backrest.
2. Follow points 3, 4 and 5 under "Removal, 2-door model".
3. Separate the head lining from the rear door pillar trim by pulling the lining forward. The lining can then be lifted out through the trunk door.



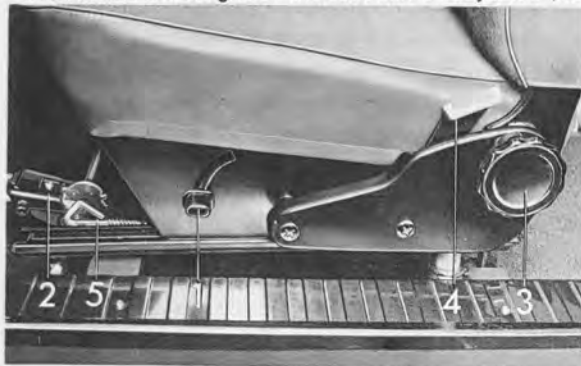
REMOVING THE HEAD LINING

Install in the reverse order.

SEATS AND CARPETING

General

The front seats are built up on a sheet steel frame to which the backrest is mounted. The upholstery consists of moulded rubber cushions laid on rubber sheets and covered with textile and plastic-coated fabric. Both front seats are mounted on rails to allow legroom adjustment. At the front of each pair of rails is an adjustment bolt with which the height of the seat can be adjusted (not



FRONT SEAT

1. Legroom adjustment catch
2. Vertical adjustment handle (driver's seat only)
3. Backrest angle adjusting knob
4. Backrest release, to drop backrest forward or back (backwards only up to and incl. model 1973)
5. Catch

provided on the front passenger seat as from model 1970). The rails are secured at the back ends by attachment hooks with two notches. The adjustment bolt can be manipulated to raise or lower the whole seat, raise the front and drop the back, or vice versa. A system of springs under the rails at the back helps to raise the seat.

Up to and incl. model 1970, the adjustment bolt is operated by a lever with a catch that is released by pulling out the lever. The new control device introduced as from model 1971 consists of a handle with a catch released by pushing in the handle.

The backrest is adjustable and can be set at various angles or in the fully reclining position by turning the knob or depressing the handle. On model 1974, the backrest can only be folded backwards by means of the knob. To enable passengers to enter or leave the back seat in the 2-door model, the front seat backrest can be folded forward by releasing the catch by means of the handle.

As from model 1972, the driver's seat is electrically heated. Heating elements consisting of resistance wiring and reflectors held by a plastic net is mounted in seat and backrest cushions and via a thermostat connected to the ignition lock.

The elements are switched on when the seat temperature is below 50°F (+14°C). The thermostat, mounted in the seat cushion, cuts out the current when the temperature is higher than 81°F (+27°C).

Installing and removing driver seat

The front seats are installed and taken out complete with rails.

1. Release the seat by moving the adjustment bolt lever or handle to the intermediate position. As from model 1972: Disconnect the electric wiring plug under the seat.
 2. Push the catches back to release the adjustment bolt. Raise the leading edge of the seat, tip it backward and disengage from the hooks at the rear.
- To install the seat, proceed in the reverse order.

Passenger seat

Model 1969: Same procedure as for driver's seat.

As from model 1970: Release the seat by removing the retaining screws (insex screws) from the rails.

Legroom adjustment

Move the catch 1 up, (see illustration) and slide the seat forward or backward to the desired position.

Modified adjustment system as from chassis No. 99.024.475

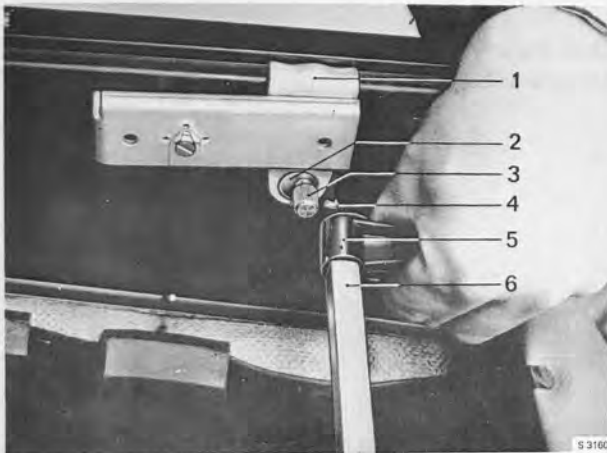
The front seats are continuously adjustable as from the chassis no. quoted above. It features a friction device that locks the seat frame to the rails.

The friction device must lock equally hard on both sides when the release catch is in its normal position (i.e. locked). This is best checked with the seat mounted in the car. The release catch must not touch the stop when in this position. If the friction device is not working properly, the seat must be taken out and the adjustment mechanism readjusted. It is normally sufficient to adjust the inner side only, as follows.

1. Separate the splined joint with a screwdriver.

NOTE

Make sure that the eccentric does not slip out of the hole in the locking arm. If this happens, the eccentric shaft tension spring will lose its grip.



SPLINED JOINT, DISASSEMBLED

- | | |
|----------------|----------------------|
| 1. Locking arm | 4. Spring |
| 2. Eccentric | 5. Twist ring |
| 3. Splines | 6. Intermediate tube |

2. Turn the twist ring and intermediate tube counter-clockwise until all play is eliminated and the release button is about 0.4" (10 mm) above the stop. Put the splined joint together in this position.

NOTE

The foregoing instructions apply to the left-hand seat. In the case of the right-hand seat, turn the twist ring and intermediate tube clockwise.

Dropping the backrest forward

To drop the backrest forward, press down catch 4 (see illustration, page 852-1).

Backrest adjustment

1. Turn knob 3 (see illustration, page 852-1) forward to raise and backward to lower the backrest.
NOTE! Do not press on the backrest while adjusting.
2. To drop the backrest to the reclining position or raise it again to the sitting position, catch 4 (see illustration, page 852-1) must be pushed down one step farther. This must also be done to return the backrest from either of these positions to the driving position. (Only valid for models up to and incl. model 1973.)

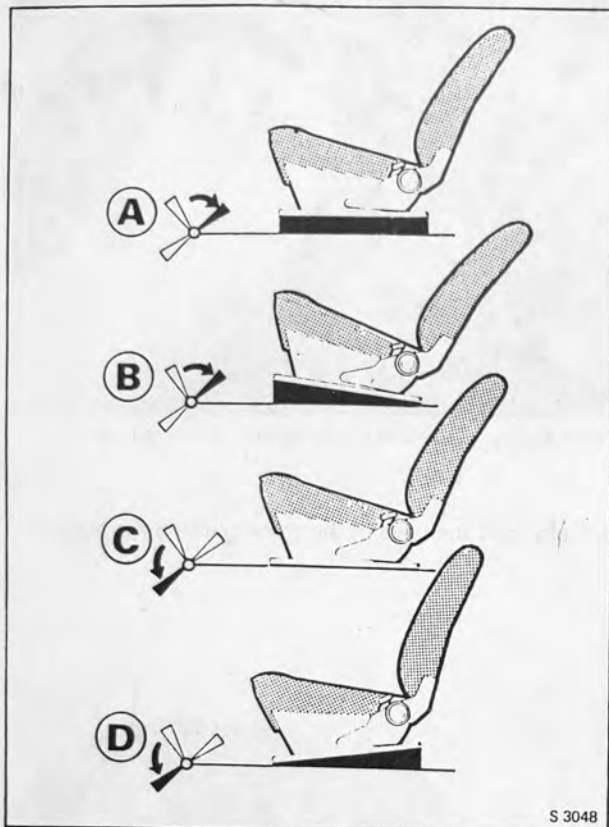
Adjusting the height of driver's seat

The lever under the front of the seat, which is provided with a catch, is used to adjust the front and rear of the seat to two alternative heights. As the front and rear adjustments are independent of each other, four different combinations are possible. The lever has three positions rear, front and middle.

Adjusting seat cushion height and angle

Release the lever/handle catch by pulling the lever/handle and moving it to the central position. The seat can now be adjusted to the desired position as follows:

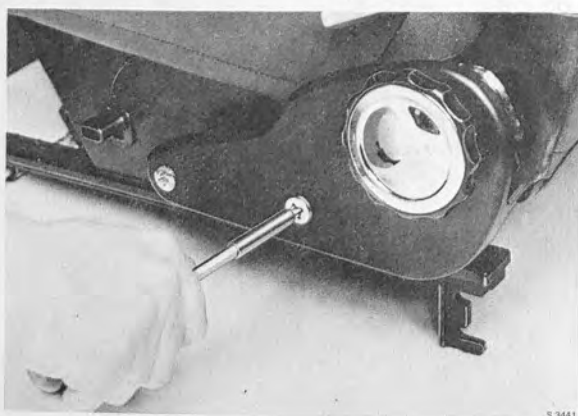
- A. Front and rear raised:
Move lever/handle back without weight on seat.
- B. Front raised, rear dropped:
Move lever/handle back, pressing down on seat.
- C. Front and rear dropped:
Move lever/handle forward, pressing down on seat.
- D. Front dropped, rear raised:
Move lever/handle forward without weight on seat.



VERTICAL ADJUSTMENT OF DRIVER'S SEAT

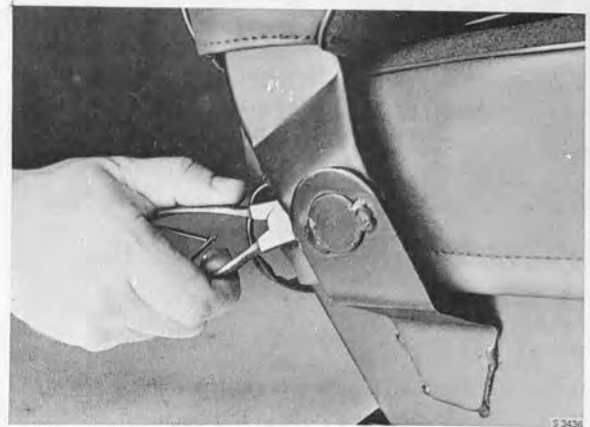
Separating backrest—seat cushion

1. Remove the two Philips head screws, according to fig.



REMOVAL OF SCREWS FOR THE RECLINING CONTROL

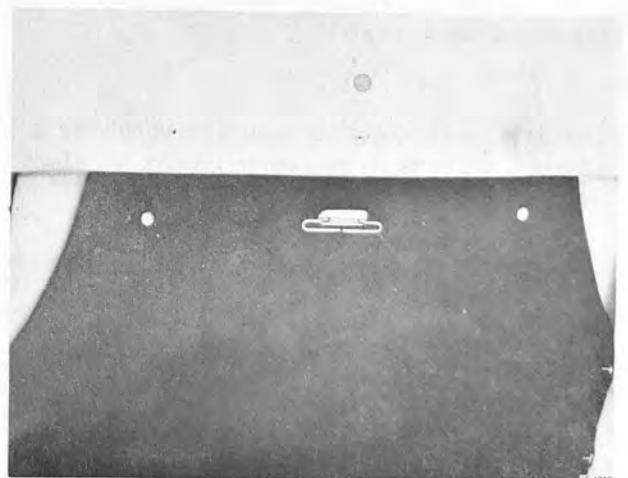
2. Remove the lock ring on the opposite side. (The ring is holding the back rest frame stud to the seat frame.) Then the back rest can be hooked off from the seat.



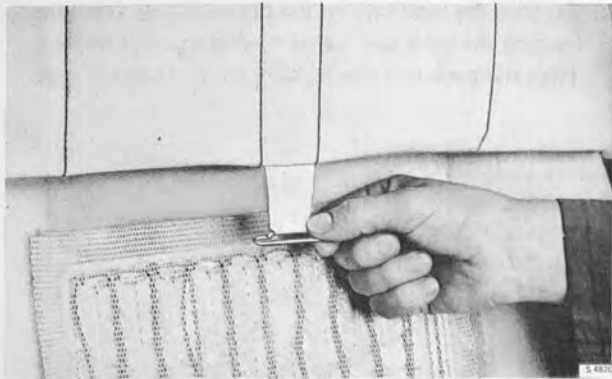
REMOVAL OF LOCK RING

Changing the backrest upholstery, model 1974

1. Remove the seat from the car.
2. Undo the zip in the lower edge and unhook the hooks at the bottom on each side.
3. Roll up the upholstery as far as the band in the middle of the backrest. Undo the clip at the rear of the backrest and pull the band and clip to the front of the seat.

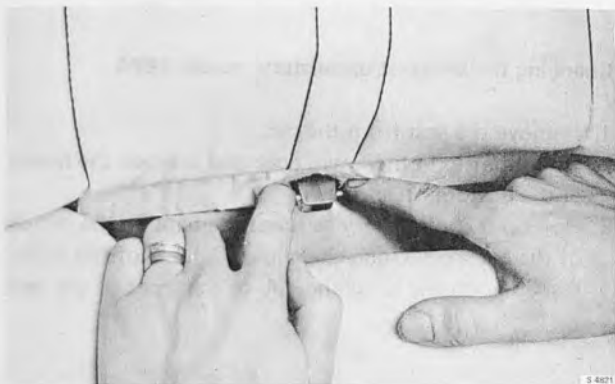


CLIP AT REAR OF BACKREST



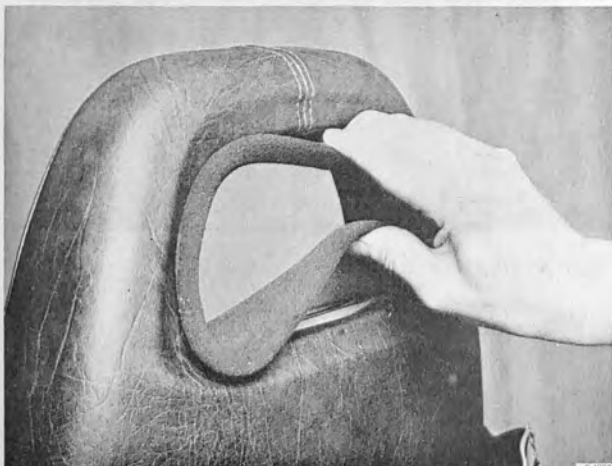
PULLING THE BAND TO THE FRONT

4. Unhook the thread which secures the upholstery at the front and below the hole in the backrest.



UNHOOKING THE THREAD

5. Bend the plastic ring which secures the upholstery at the hole and thread it through the hole from the back to the front.



COMPRESSING THE PLASTIC RING



THREADING THE PLASTIC RING OUT FORWARDS

6. Fold back the flaps in the grooves inside the hole.



FOLDING BACK THE FLAPS

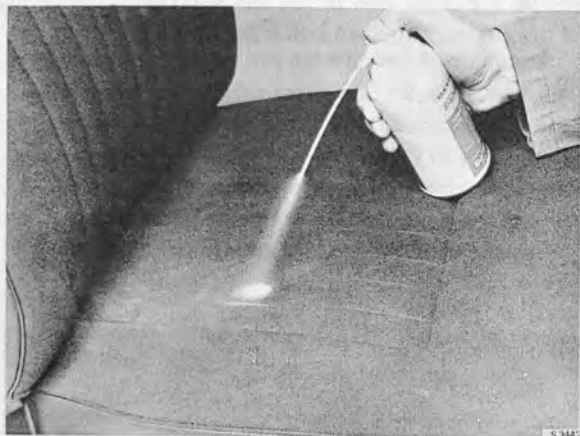
7. Remove the cover.

Fitting is carried out in the reverse order.

Driver's seat as from the 1972 model

Checking of heating pads

1. Undo the wire connection "67/93" (red and yellow wires) from fuse 11. Connect a test lamp between the wire connection and the fuse terminal.
2. Switch on the ignition.
3. Find the thermostat in the seat (feel with fingers) and cool the area in a suitable manner, for example with a cooling spray of the same type used for radio and TV service.



COOLING THE THERMOSTAT

After a while the thermostat will cut in and the lamp should light.

If the lamp does not light it may be due to:

Faulty fuse

Wire fracture in the wiring or the heating pads

Faulty thermostat

Faulty grounding

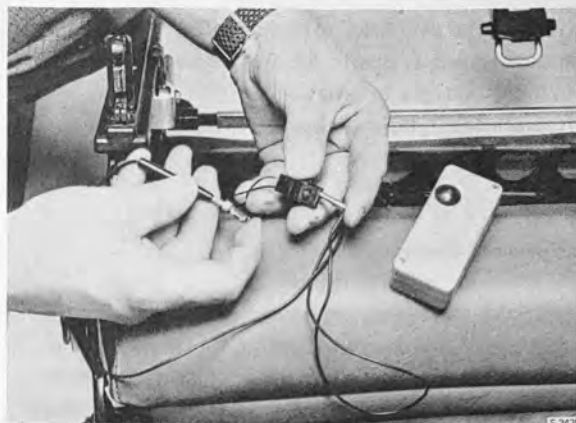
Defective test lamp

Possible wiring fracture in heating pads, check with the aid of a buzzer

(Disassembled, heated seat)

A. Backrest heating pad

Connect one of the leads of the buzzer to the pad leads (the splicing sleeve is pushed into the PVC tube). If there is no fault in the wiring, the buzzer will sound when its other lead is connected to one of the two pins in the dual-pole splice cover.



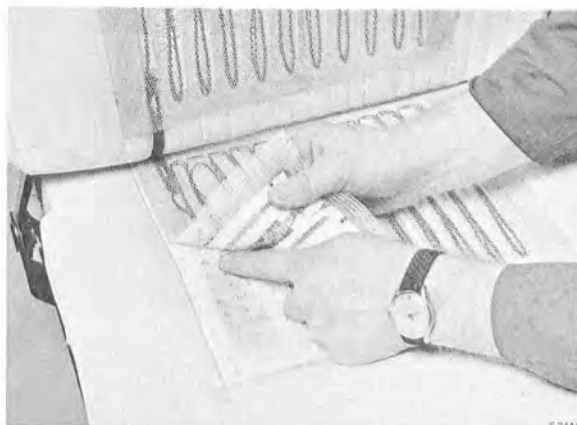
CHECKING WITH A BUZZER

B. Seat heating pad

Cool the thermostat until it is below the cut-in temperature and connect the buzzer as under A but to the other pin in the dual-pole splice cover. Note that even a thermostat fault can mean that the buzzer will not sound in this case.

Changing the heating pads

1. Take out the seat.
2. Remove the seat upholstery. The backrest cover can be removed when the zip at the bottom has been opened. The seat cover is removed by undoing all the lower clips, the rib on the right-hand side of the seat and the base rib. Pull up the cover from the right, and tuck it out of the way so that the heating pad is accessible.
3. Remove the heating pad(s). Dissolve the glue with pure gasoline (cleaning gasoline) so as not to tear off large pieces of the foam rubber cushioning.

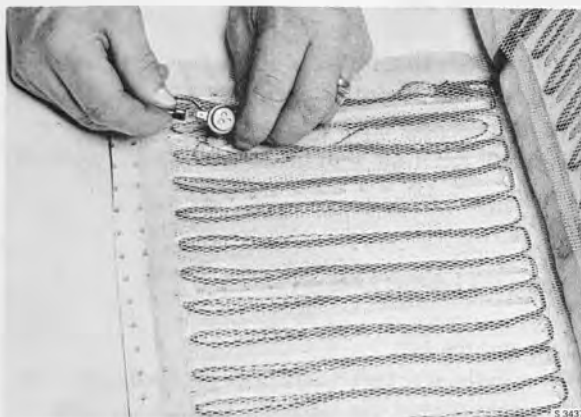


REMOVING THE HEATING PADS

4. Glue on the new heating pad(s) with suitable impact adhesive such as Bostik A3. Connect the wiring so that the pads are in series.
5. Replace the upholstery and mount the seat.

Changing the thermostat

Remove the seat cover, see points 1–2 "Changing the heating pads". Remove the binding threads from the thermostat connection wires, after which the thermostat can be pulled out and replaced. Fit binding threads to the new thermostat to eliminate the risk of the wires working loose after a time.



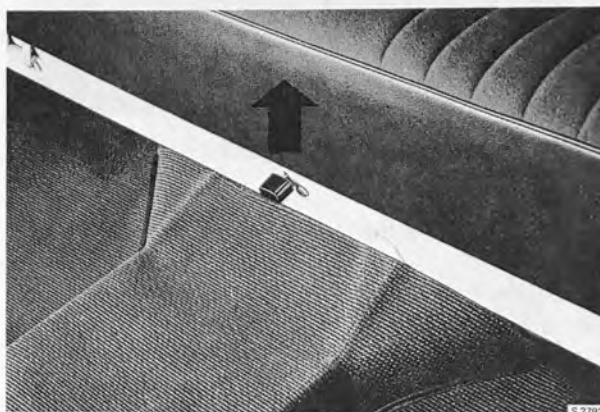
CHANGING THE THERMOSTAT

Back seat

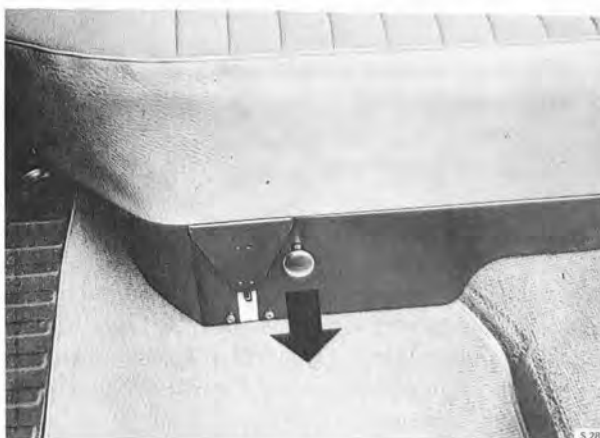
The back seat cushion and backrest are of spring interior construction with upholstery and covers. The cushion has a plywood base, while the backrest has a backing of pressed sheet steel. The cushion is attached to the body by two hinges at the front edge, while the backrest pivots on two hinges at the bottom. In the upright position, the backrest is secured by a catch so that it cannot be forced forward by loose objects in the trunk compartment if the brakes are applied hard.

The trunk can be extended into a larger cargo compartment at need by the following rearrangement of the back seat cushion and backrest:

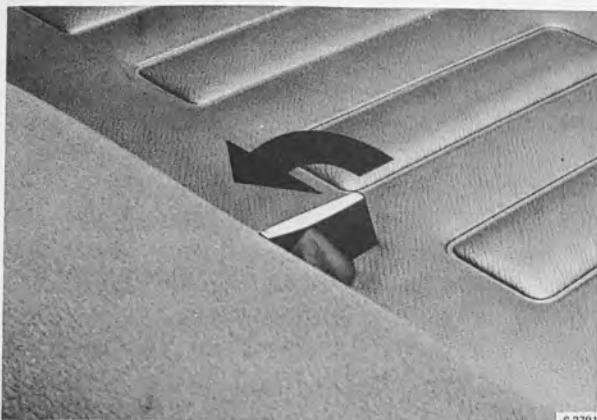
Press up the catch lever of the rear seat cushion and raise the front edge of it, then pull it forward and downward to stand the cushion on edge behind the front seats. As from chassis No. 99.008.118 a catch must be released before the seat cushion can be raised. The catch lever is placed below in the edge of the cushion. On the 4-door model the catch is released by pulling the control to the right under the cushion. Next release the backrest catch and fold the backrest forward and down.



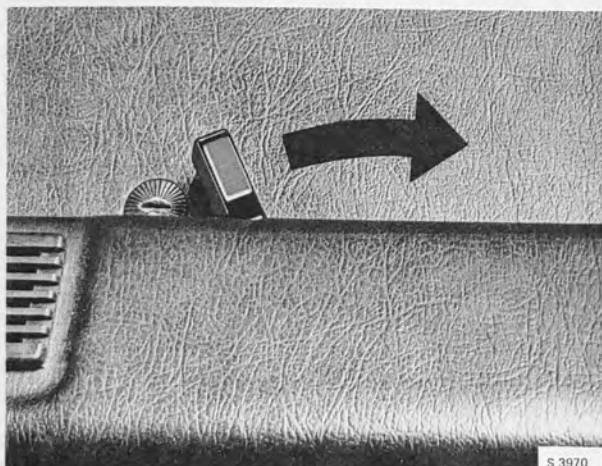
CATCH, SEAT CUSHION BACK SEAT, 2-DOOR MODEL



CATCH, SEAT CUSHION BACK SEAT, 4-DOOR MODEL



CATCH, BACK REST, UP TO AND INCL. MODEL 1973



CATCH, BACK REST, MODEL 1974



CATCH, BACK REST, SAAB 99 COMBI COUPE

Carpeting

The floor carpets are of nylon fiber on a jute backing. They are secured by snap buttons and velcro grips. The floor of the trunk compartment is covered with a plastic-coated mat.

The following are the names of the persons who have been identified as having been in contact with the subject of this investigation during the period of the investigation.



FIG. 1. (a) BACK VIEW OF THE SUBJECT'S HEAD.



FIG. 2. (b) FRONT VIEW OF THE SUBJECT'S HEAD.

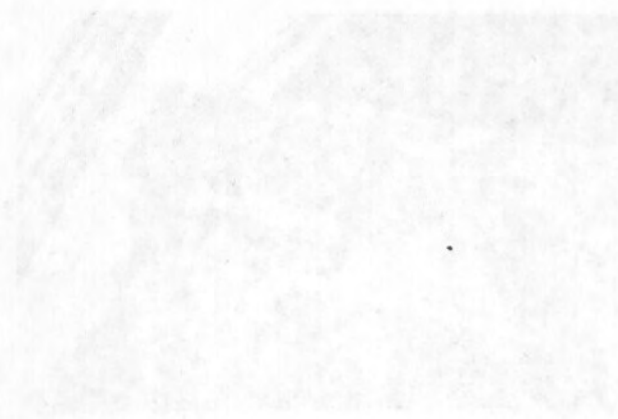


FIG. 3. (c) SIDE VIEW OF THE SUBJECT'S HEAD.

INTERIOR EQUIPMENT

Instrument panel, up to and incl. model 1970

Removing and installation

The instrument panel is secured to the body by three screws — one at each side, accessible from the wheel housings and from under the panel on the inside, and one in the center of the panel under the ashtray.

1. Take out the instrument unit.



REMOVING THE INSTRUMENT UNIT

2. a. Disconnect the choke control from the instrument panel.
b. Disconnect the heater and defroster control wires from the valve housing assembly.
c. Disconnect the temperature control lever from the wire.
d. Disconnect the hoses to the side defroster nozzles from the manifolds.
e. Pull the fresh air blower nozzles out of the panel.

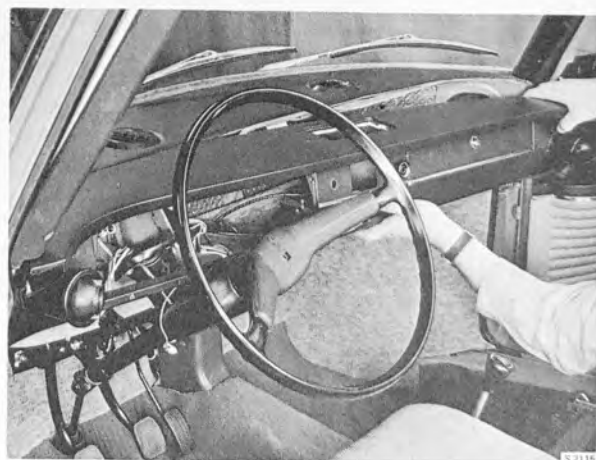


REMOVING THE FRESH AIR BLOWER NOZZLES

- f. Take out the ashtray.
3. Disconnect the electric wiring, undo the instrument panel retaining screws and pull the panel back.



REMOVING THE INSTRUMENT PANEL RETAINING SCREWS



PULLING BACK THE PANEL

Install in the reverse order.

NOTE

Make sure that the blower nozzle engages the hose when replaced.

Changing the instrument panel safety pad

The pad is secured to the panel by clips attached to the pad.

Demontering

1. Remove the instrument panel.
2. Relieve the clip pressure at the rear edge of the panel and pull or push the pad off the panel. The band clips will slip out of the holes on top of the panel at the same time.

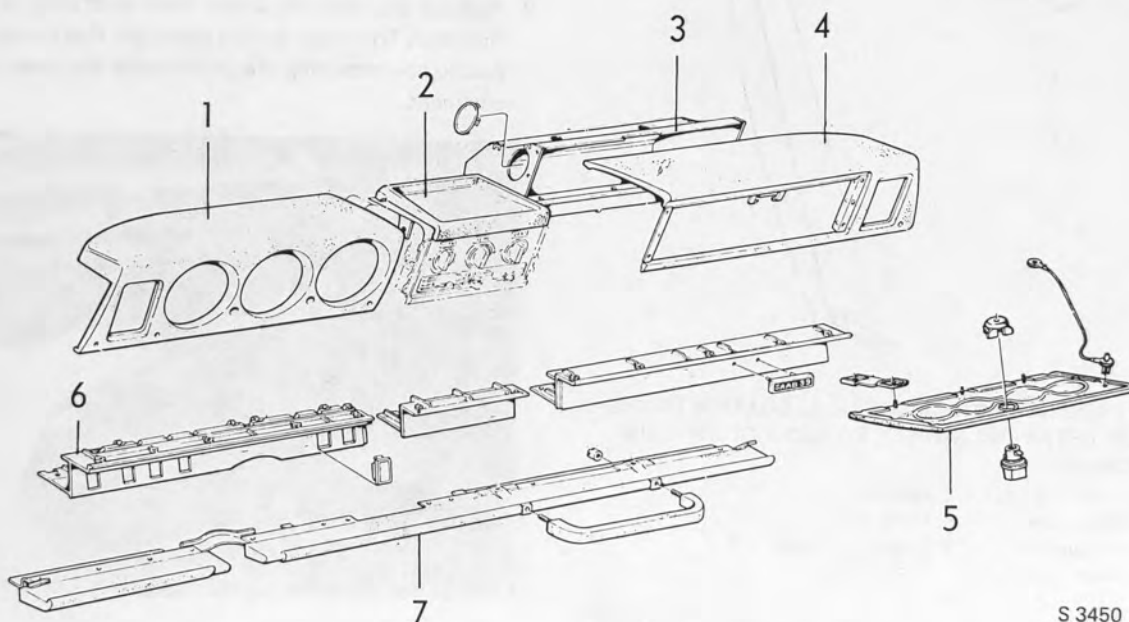
Reassemble in the reverse order.

Instrument panel as from 1971 model

As from the model 1971, the instrument panel is composed of several parts. The top consists of two safety pads with a tidy box mounted between them. The lower part is made up of a three-part switch panel and a knee guard mounted along the bottom edge of the switch panel. The knee guard also incorporates a courtesy handle located under the glove compartment.

The center section of the switch panel can be removed to make room for installation of a radio set (up to and incl. model 1973).

A three-part screen is mounted under the instrument panel.



S 3450

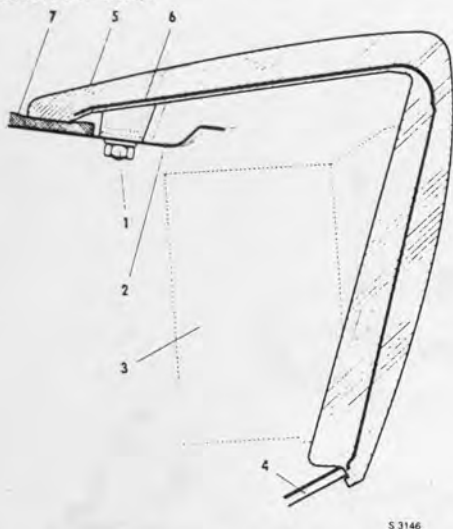
INSTRUMENT PANEL AS FROM MODEL 1971

1. Safety pad, instrument side
2. Tidy box
3. Glove compartment
4. Safety pad, glove compartment side
5. Glove compartment lid
6. Switch panel
7. Knee guard

Padding, instrument side

Removal and installation

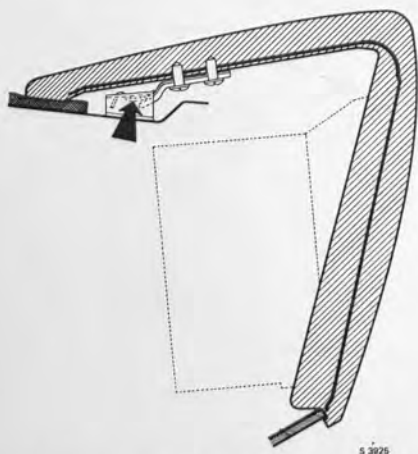
1. Up to and incl. chassis No. 99722011961:
Remove the section of the screen under the panel on the instrument side.
2. Up to and incl. chassis No. 99722011961:
Remove the two nuts holding the front screws of the pad. The nuts are placed on each side of the speedometer and are loosened with the aid of a 0.4" (10 mm) socket and a long extension. Pull out the setting button for the watch (cars with trip meter also the setting button for this).



SAFETY PADDING, INSTRUMENT SIDE, LOCATION OF THE FORWARD RETAINING NUTS UP TO AND INCL. CHASSIS NO. 99722011961

- | | |
|------------------|--------------------------|
| 1. Retaining nut | 5. Padding |
| 2. Bodywork | 6. Stiffener |
| 3. Instruments | 7. Windshield frame trim |
| 4. Switch panel | |

- 9972201873
3. Loosen the screws on the front lower edge of the pad.
 4. Remove the padding. As from chassis No. 99722011962, the padding is held to the windshield member by two spring yokes. When removing pull the padding rearwards so that the spring yokes come loose.



SAFETY PADDING, INSTRUMENT SIDE, SECURED WITH SPRING YOKE AS FROM CHASSIS NO. 99722011962

NOTE

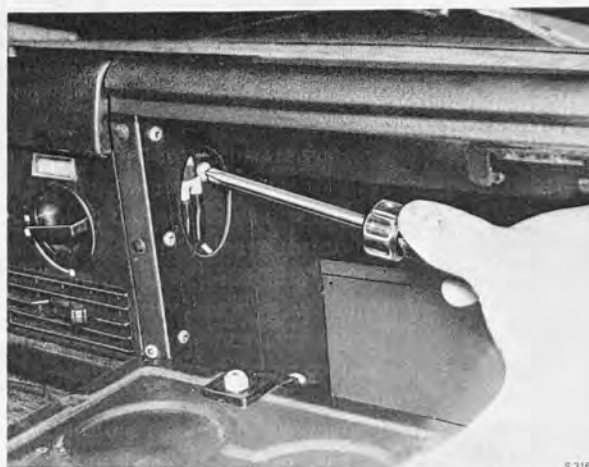
If the setting buttons mentioned in point 2 are stuck and will not come off without undue force, the pad can still be removed, but great care must be taken to avoid breaking the buttons off.

Reassemble in the reverse order.

Tidy box

Removal and installation

1. Remove the safety padding on the driver's side (see foregoing directions).
2. Remove the retaining screws from both sides of the tidy box. The screw on the passenger side can be reached by removing the cover inside the glove compartment.



REMOVING THE TIDY BOX

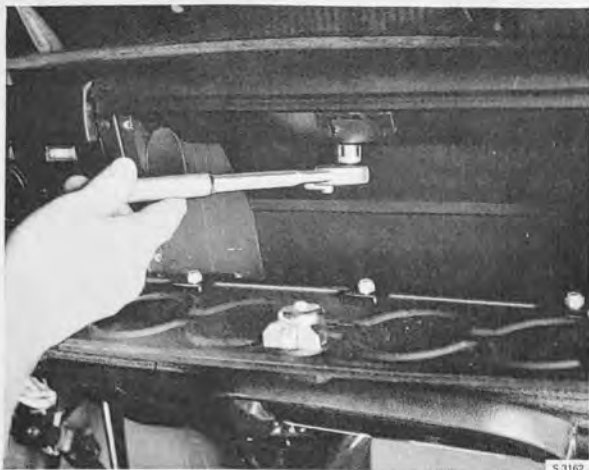
3. Lift out the tidy box.

Refit in the reverse order.

Padding, glove compartment side

Removal and installation

1. Remove the door of the glove compartment by removing the hinge screws inside the glove compartment.
2. Remove all screws from the glove compartment surround and the front of the safety pad. On later models, the glove compartment and safety pad are riveted together and should be removed as a unit.
3. Up to and incl. chassis No. 99722011961, the nuts from the top retaining bolts of the padding should be removed. These nuts are accessible through openings in the glove compartment. As from chassis No. 99722011962, the padding is attached to the windshield member by two spring yokes. When removing the glove compartment, the safety padding should



UNDOING THE PADDING RETAINING SCREWS, UP TO AND INCL. CHASSIS NO. 99722011961

be pulled backwards until the spring yokes are unhooked. See the picture "Safety padding, instrument side".

4. Up to and incl. chassis No. 99722011961, the clip holding the bottom edges of the glove compartment and padding together should be prised loose. The safety pad can then be lifted off.

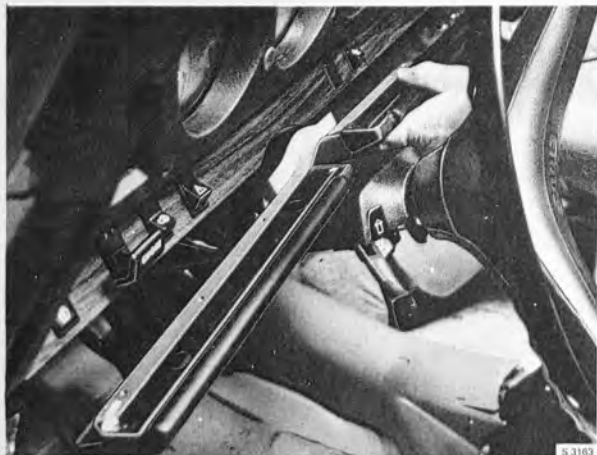
Reassemble in the reverse order.

Knee guard

Removal and installation

1. Take away the three-piece screen under the panel.
2. Remove the two screws securing the top end of the steering column tube. Slacken the two screws at the bottom end of the tube slightly so that the steering column can be lowered.
3. Remove all the screws along the bottom of the knee guard and lift the guard away.

Reassemble in the reverse order.



REMOVING THE KNEE GUARD

Switch panel

On cars up to and incl. model 1973, the centre section of the panel can be removed to make room for a radio.

Dec. 1975

Removal and installation

A. Center section

1. Take away the center screen section under the panel.
2. Undo the two top retaining screws of the panel section.
3. Remove the four retaining screws from the knee guard below the panel section.
4. Insert a hand from beneath and push out the panel section as illustrated. Replace the two outer knee guard screws.



PUSHING OUT THE CENTER SECTION OF THE PANEL

If the panel section is hard to push out, slacken more screws along the knee guard so that the knee guard can be pressed downward slightly.

B. Section on instrument side

1. Take away the screen section on the glove compartment side under the panel.
2. Remove the retaining screws from the knee guard under the section so that the knee guard can be lowered.
3. Undo the five retaining screws from the top of the section, after which the section can be removed.

C. Section on glove compartment side

1. Take away the screen section on the instrument side under the panel.
2. Remove the two retaining screws from the top of the

steering column tube and slacken the two screws at the bottom slightly so that the steering column can be lowered.

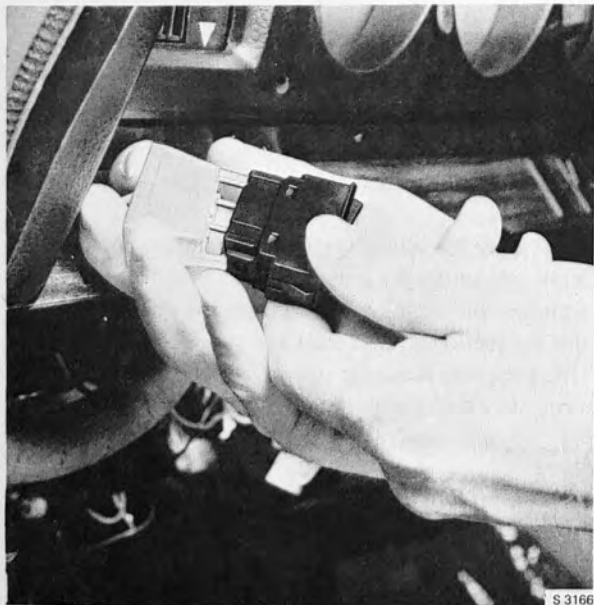
3. Remove the retaining screws from the knee guard under the section so that the knee guard can be lowered.
4. Cars with carburetor engines:
 - a. Take off the choke control button by removing the screw underneath.



S 3165

REMOVING THE CHOKE CONTROL BUTTON

- b. Remove the choke control by unscrewing the retaining nut with a suitable tool.
5. Push out the switches from behind and pull the switches and contact pieces apart.
Note the positions of the terminals on the hazard warning signal switch.



S 3166

REMOVING THE SWITCHES

6. Undo the five retaining screws from the top of the panel section, after which the section can be removed.

To reassemble panel sections, proceed in the reverse order.

Seat belts, USA cars, models 1972–1973

Seat belts are provided for all seats in the car. The front seat belts are of the three point type with an automatic adjustment device, so called retractor for the lap belts. The shoulder belts have to be adjusted manually. The rear seats are provided with three lap belts. The two outer ones of the retractor type and the center belt with manual adjustment device.

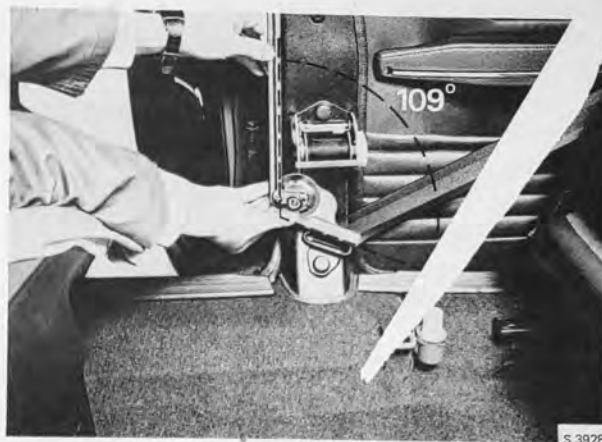
It is of greatest importance that the retractors and sliding knots are correctly installed, otherwise the function of the belts can be impaired.



LOCATION OF THE RETRACTOR, 2-DOOR MODEL



ANGLE BETWEEN RETRACTOR AND REAR EDGE OF DOOR PILLAR CHECKED WITH A GRADUATED ARC



ANGLE BETWEEN SLIDING KNOT AND REAR EDGE OF THE DOOR PILLAR IS CHECKED WITH A GRADUATED ARC

Seat belts, model 1974

Reel belts with buckle lock in the front seat

The belt consists of a strap with one end secured at the bottom. The free end runs through an eye up on the door pillar and into the reel which, on 2-door cars, is located inside of the rear side trim and on 4-door cars, on the door pillar.

The belt is fastened by pulling the strap out and inserting it directly into the buckle lock and dropping the yoke, which locks automatically. The strap can run freely through the buckle lock and the running eye and is thereby automatically adjusted. The belt is released by pressing the key marked "press".

The reels have two locking mechanisms. One mechanism is actuated by sudden acceleration of the reel (i.e. when the strap is pulled out at high speed). The other is actuated by a pendulum which senses the movements of the car. In the case of 4-door cars, there are two alternative mounting points on the door pillars for the front seat seat belts. For production reasons the belts are always mounted in the upper hole.

The seat belt can be mounted in the lower mounting point if so desired as a result of build, location of the seat or the like.

Note that if the mounting point for a seat belt is changed, the bolt should be tightened to a torque of 35–45 Nm (26–33 ft.lb., 3.5–4.5 kpm), and that a plastic plug should be fitted in the upper hole.

HEATING AND VENTILATION SYSTEM

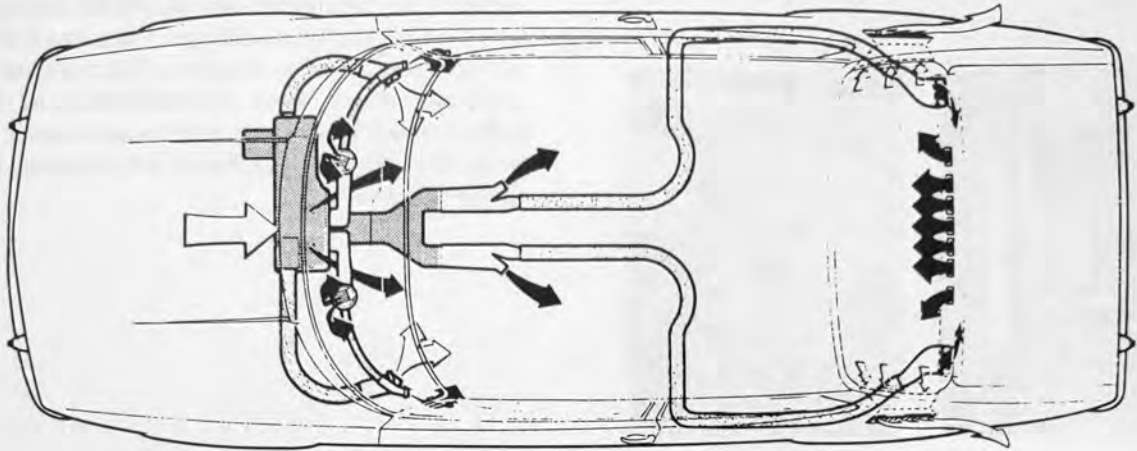
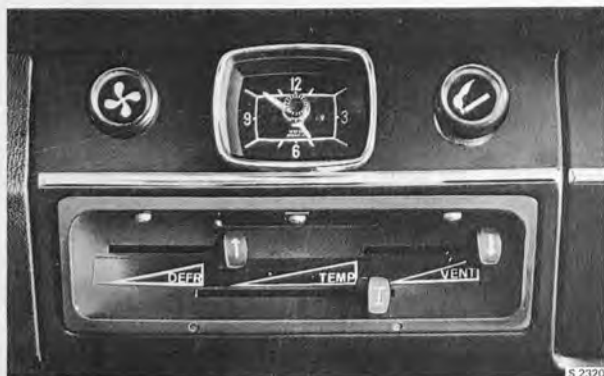


DIAGRAM OF HEATING AND VENTILATION SYSTEM, UP TO AND INCL. MODEL 1973

General, up to and incl. model 1973

Heating and ventilation are provided by a separate system connected to the engine cooling system. Air enters through the intake below the windshield to a collecting box formed by the body sheeting, passing through a splash guard to the fan heater core and on through the valve house into the passenger compartment. The fan and heater core are housed in connected casings. Air passing through the heater core is warmed by indirect heat exchange with circulating engine coolant. The temperature can be varied with the thermostat-controlled water valve; the sensitive element of the thermostat is placed in the air stream to the passenger compartment. Air from the heater core goes first to a valve house where it is distributed to the front floor of the passenger compartment by two flap valves. Branch pipes connected to the valve house conduct air to the windshield and side window defroster nozzles.



FRONT CONTROLS HEATING AND VENTILATION UP TO AND INCL. MODEL 1970

-  Heater fan switch
-  Windshield defroster control
-  Ventilation control, front seat floor
-  Temperature control
- Red Open or hot position
- Blue Closed or cold position

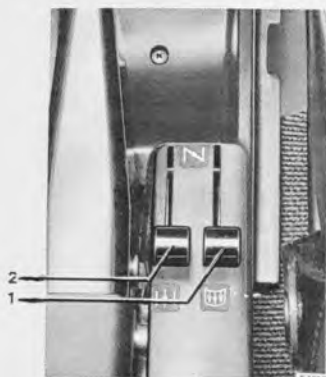


CONTROLS AS FROM MODEL 1971

At the bottom of the valve house is a branching section connected to the right and left rear channels, which contain flap valves and controls for distribution of the air supply to the back window defroster nozzles and the rear of the passenger compartment. On top of the heater unit are two separate fresh air takeoffs leading to swiveling blower nozzles at either end of the instrument panel.

As from model 1971 there are fresh air take offs on the instrument panel under the heating controls. The cold air, that is taken in via a separate collector box placed beyond the heat exchanger, is depending on the forced draught generated when the car is driven and is not influenced by the fan. The inlet is opened by means of a control and the air stream can be set in the wanted direction vertically and horizontally.

The fan switch has two positions. In addition the fan motor up to and incl. chassis No. 99.061.236 can be set to summer operation (high speed) or winter operation (low speed).



REAR SEAT HEATING AND VENTILATION CONTROLS

1. Rear window defroster control
2. Rear seat ventilation control



FAN MOTOR, SUMMER AND WINTER SETTINGS

Up to and incl. chassis No. 99.061.236

The heater core is equipped with a bleeder nipple intended for use during filling of the cooling system.



THE HEAT EXCHANGER BLEEDER NIPPLE, UP TO AND INCL. MODEL 1973

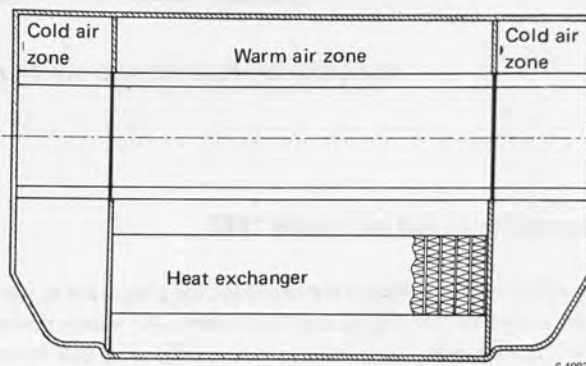
Fan motor

Removal

1. Remove the three cables from the fan motor. Note the respective cables location.
2. Undo the six screws holding the front fan housing cover plate.

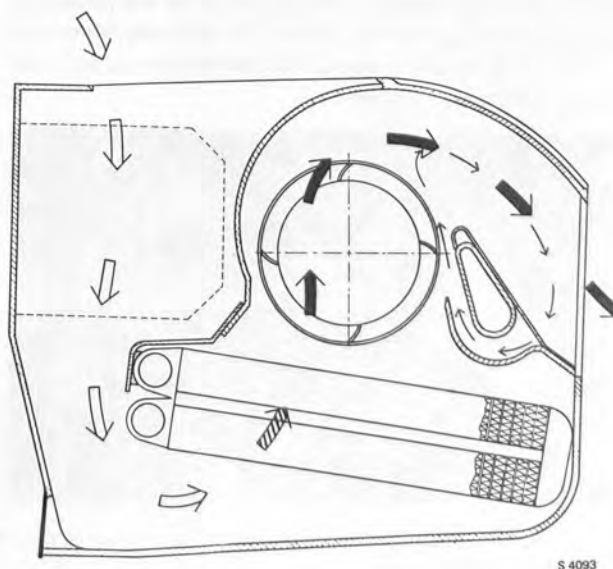
General, model 1974

The heating and ventilation system is different in many respects from the previous version. The fan casing contains both fan and heat exchanger. The casing is divided up into three zones with partitions. The two outer zones admit cold air and are connected to the fresh air channel and the three fresh air outlets. In the centre zone, the air passes through the heat exchanger which thereby supplies hot air to the coupé.



THREE ZONES OF THE FAN CASING AS SEEN FROM THE FRONT

The fan is a cross-flow fan with a common impeller for all three zones. The flow of the air is regulated by a pear-shaped guide vane around which the air circulates.



PATH OF AIR

The air passes into the fan casing through the air intake in the dash panel.

As in previous models, the air is distributed by a flap valve housing to the defroster nozzles and other outlets in the coupé. A continuous moulded plastic channel leads from the valve housing to the three fresh air outlets. The defroster nozzles to the rear window are located in a raised defroster channel in the front edge of the

parcel shelf. The nozzles are directed towards the middle of the rear window so that the part of the window in the line of sight from the rear-view mirror is the first to be defrosted.

The controls for the heating and ventilation system are essentially the same as on previous models. However, the two outer fresh air outlet controls are different.

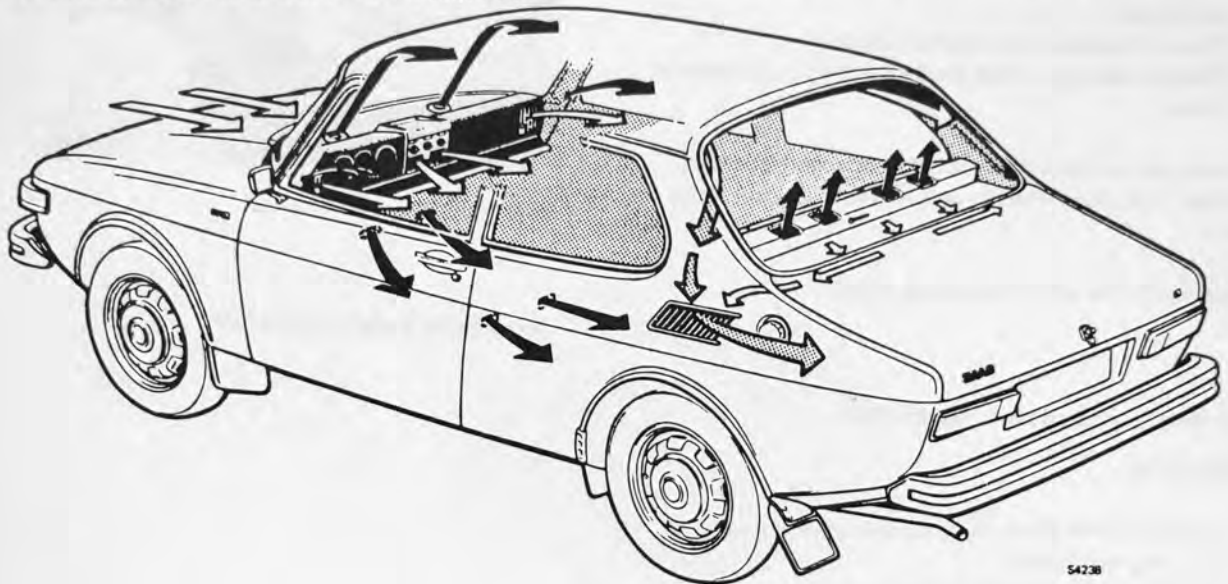
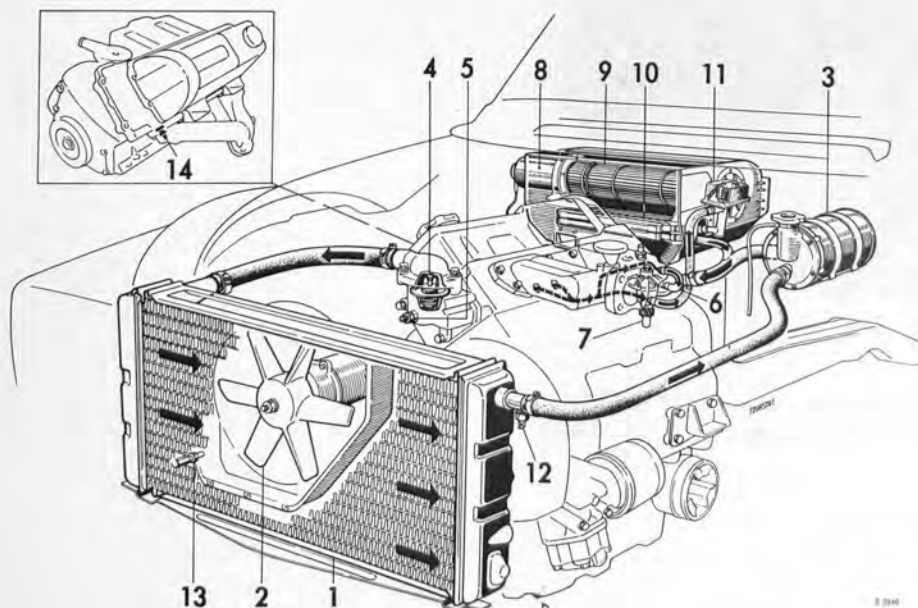


DIAGRAM OF HEATING AND VENTILATION SYSTEM, MODEL 1974



HEATING AND VENTILATION SYSTEM, MODEL 1974

- | | |
|-------------------------------------|-------------------------------------|
| 1. Radiator | 8. Fan motor |
| 2. Radiator fan | 9. Impeller |
| 3. Expansion tank with pressure cap | 10. Heater core |
| 4. Thermostat | 11. Thermostat controlled valve |
| 5. Temperature transmitter | 12. Thermostat switch, radiator fan |
| 6. By-pass line | 13. Radiator drain cock |
| 7. Coolant pump | 14. Engine drain cock |

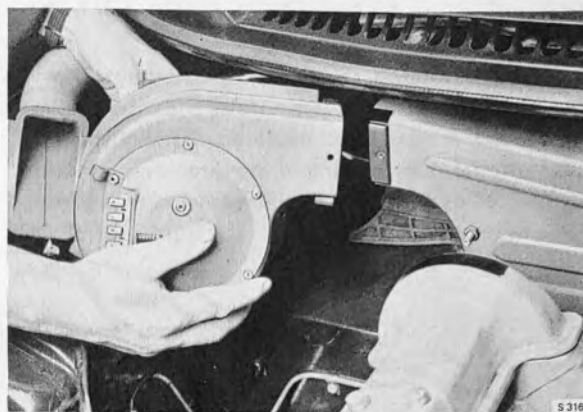
Fan casing, up to and incl. model 1973

Removal and installation

1. Remove the three cables from the fan motor. Note the respective cables location.
2. Undo the six screws holding the front fan housing cover plate.
3. Put out the cover plate and the motor.
4. Remove the screws that secure the motor to the cover plate.

Fan motor and fan wheel are balanced together, to eliminate vibrations. The fan unit is available as exchange unit.

Installation is made in the reverse order.



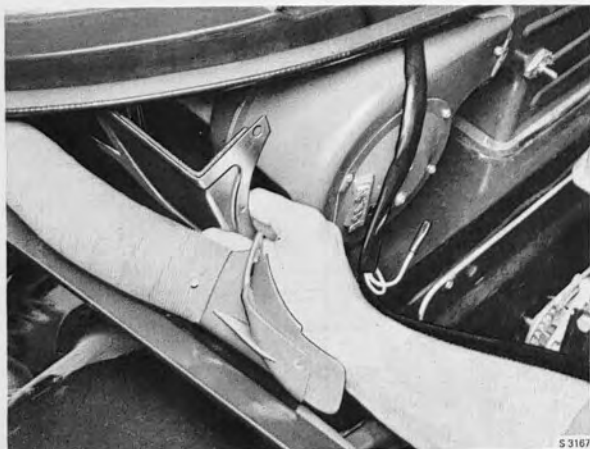
REMOVING THE FAN CASING

Reassemble in the reverse order.

Fan motor, up to and incl. model 1973

Dismantling

1. Disconnect the three wires from the fan motor; note how they are placed.
2. Disconnect the fresh air outlet from the fan casing.
3. Undo the retaining screws from the cover plate and take off the plate.



TAKING OFF THE COVER PLATE

4. Remove the fan casing retaining screws from the heat exchanger casing. The fan casing can then be lifted off.

Heat exchanger, up to and incl. model 1973

Removal and installation

1. Drain coolant from the system and disconnect the water hoses from the heat exchanger. Disconnect the hose leading to the fresh air outlet from the heat exchanger casing. Disconnect the control wire from the water valve.
2. Remove the fan casing (see foregoing directions).
3. 1969 model: Disconnect the throttle control at the rubber joint, withdraw the control shaft and undo the engine stay from the dash panel.
4. Undo the four screws in the front of the passenger compartment that unite the valve house to the top mating flange of the heat exchanger casing. With effect from the 1971 model, the three-piece screen under the instrument panel must be removed to get at these screws.



REMOVING THE RETAINING SCREWS FROM THE HEAT EXCHANGER CASING

5. Pull out the heat exchanger casing to the right NOTE! Remove the casing with care to avoid damaging the thermostat coil.
6. Release the clips holding the two halves of the casing together and undo the seal cover screws. Separate the casing and take out the heat exchanger. NOTE! Make sure that the seal rings are in place on the water pipes before the heat exchanger is reassembled.



SEPARATING THE HEAT EXCHANGER CASING

Reassemble in the reverse order.

After refilling the system with coolant, make sure that there are no leaky joints.

Fresh air heater water valve, up to and incl. model 1973

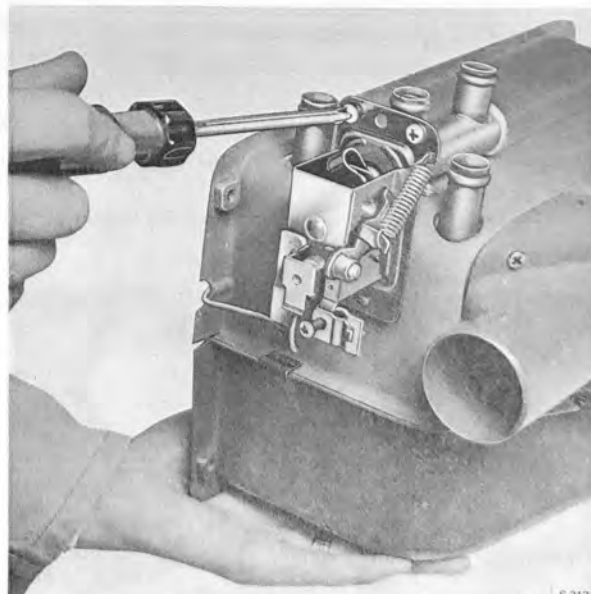
Removal and installation

- 1-5. Remove the fan casing and heat exchanger casing — see steps 1-5 of the instructions for dismantling the heat exchanger.
6. Take the plastic cap off the thermostat valve.
7. Free the thermostat coil, which is located in the bottom of the heat exchanger casing, by bending up the retaining clips.



FREEING THE THERMOSTAT COIL

Remove the protective cover and undo the two screws securing the water valve to the heat exchanger casing.



UNDOING THE WATER VALVE SCREWS



LIFTING OFF THE WATER VALVE

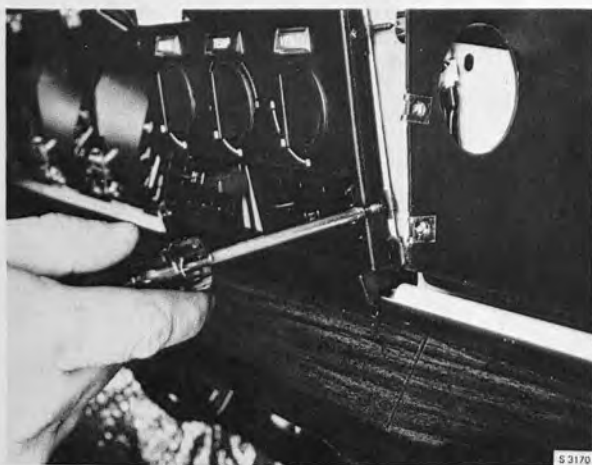
Refit the water valve in the reverse order.

After refilling the system with coolant, make sure that there are no leaky joints.

Heater controls as from model 1971

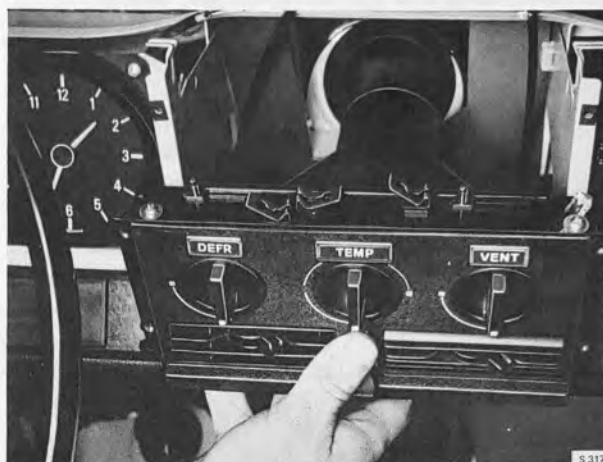
Removal and installation

1. Remove the safety padding on both sides and the tidy box from the instrument panel (see under "Interior equipment").
2. Disconnect the wires from the heater controls. Release the wire clamps by pulling them up and twisting them off at the same time.
3. Undo the four retaining screws from the heater control assembly.



UNDOING THE HEATER CONTROL RETAINING SCREWS

4. Up to and incl. model 1973: Withdraw the fresh air valve housing from the air intake on the dash panel. The control assembly can now be removed.



REMOVING THE HEATER CONTROLS, UP TO AND INCL. MODEL 1973

Model 1974: Lift the control assembly up until it has detached itself from the fresh air channel. The control assembly can now be removed.



REMOVING THE HEATER CONTROLS, MODEL 1974

Reassemble in reverse order.

Up to and incl. model 1973: Ensure the valve housing is properly seated in the fresh air intake.

Fan motor and fan, model 1974

Removal

1. Remove the windshield wiper motor (see group 3).
2. Disconnect the fan motor cables.
3. Undo the three fan motor retaining screws and pull out slightly the motor with the impeller. Separate the motor from the impeller at the rubber coupling, and first remove the motor and then the impeller.



REMOVING THE FAN MOTOR

4. Remove the plate with the fan bearing on the opposite side of the fan casing.

Installation

1. Push the impeller in slightly into the fan casing and connect the impeller and the motor to the rubber coupling.
2. Guide the fan into the casing and secure the motor to the casing.
3. Fit the plate with the fan bearing.
4. Connect the fan motor and check that the fan is rotating freely.
5. Fit the windshield wiper motor.

Heat exchanger and water valve, model 1974

The components can be removed and installed with the fan casing in position in the car.

Removal and installation

1. Drain about 4 litres (4 quarts) of coolant. Remove the generator and coolant fan relay.
2. Remove the front part of the fan casing. Then unscrew the heat exchanger retaining plate.



THE HEAT EXCHANGER RETAINING PLATE IS REMOVED

3. Remove the cap from the water valve, remove the control wire and remove the water valve retaining screws.
4. Loosen the hose clips on the heat exchanger and the water valve and disconnect the hoses.
5. Disconnect the thermostat coil from the heat exchanger and remove the water valve with coil.



THE THERMOSTAT IS REMOVED

6. Withdraw the heat exchanger from the thermostat casing.
- Reassemble in reverse order.

Removal and installation of fan casing, left-hand drive cars, model 1974

On right-hand drive cars, the power plant must first be lifted out.

Removal

1. Drain the coolant and disconnect one of the battery cable terminals.
2. Remove the safety padding with the glove compartment and the safety padding over the instrument insert.
3. Remove the instrument insert.



FAN CASING SCREWS



REMOVING THE FAN CASING

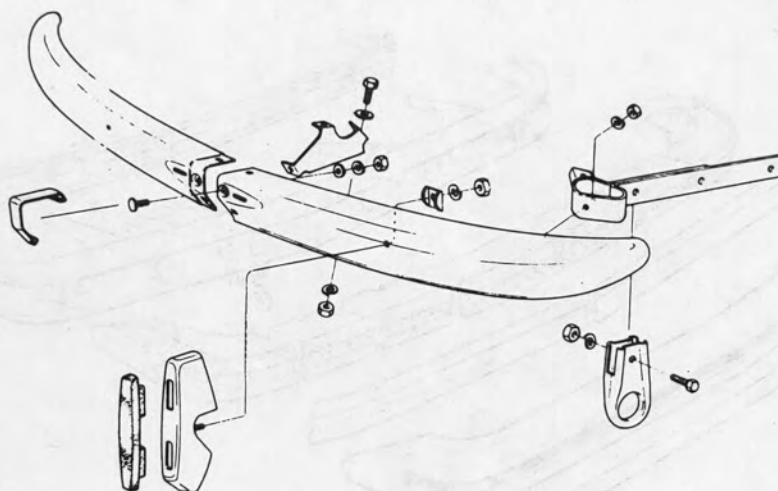
Installation

1. Fit the flap valve frame with the left-hand screw loosely tightened.
2. Put the fan casing in position, holding the right side of the valve frame out of the way.
3. Fit the valve frame right-hand screw and then tighten the left-hand screw.
4. Screw the fan casing to the dash panel plate. Ensure the gasket is in the right position.
5. Fit the impeller, fan bearing and fan motor.
6. Fit the right wiper spindle and wiper motor. (See group 3.)
7. Connect the water hoses, water valve wire and cap and the front part of the fan casing.
8. Fasten the cable harness in the brackets designed for this purpose.
9. Fit the alternator and connect the electrical cables to the wiper motor and fan motor.
10. Fit the instrument insert and its safety padding as well as the glove compartment with its safety padding.
11. Close the drain cock and fill with coolant. Connect the battery cable.

4. Remove the four screws which hold the fan casing to the dash panel plate.
5. Remove the windshield wiper motor and the right wiper spindle. (See group 3.)
6. Remove the fan motor, impeller and fan bearing.
7. Remove the cable harness from the brackets on and next to the fan housing.
8. Remove the alternator.
9. Remove the front part of the fan casing.
10. Remove the water valve cap and the control wire.
11. Disconnect the water hoses from the water valve and the heat exchanger.
12. Remove the air screen.
13. Undo the screws holding the valve frame above the fan casing.
14. Remove the fan casing to the right.

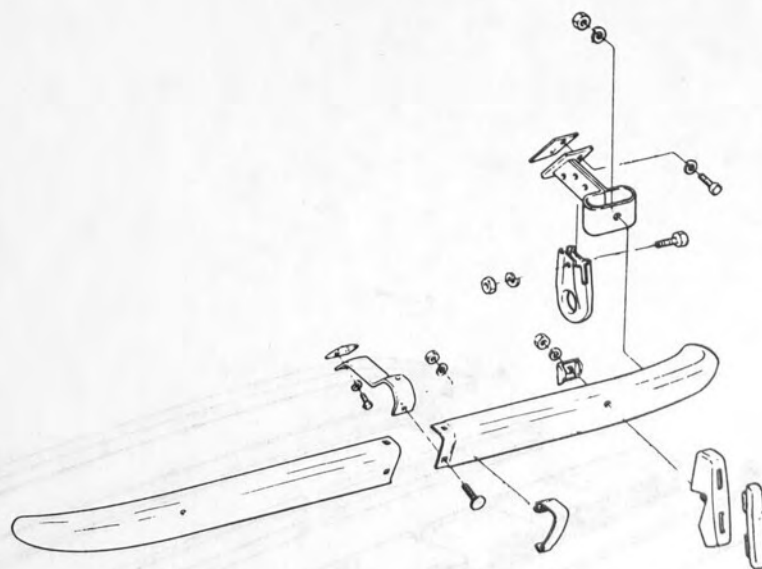
BUMPERS UP TO AND INCL. MODEL 1971

Each bumper is fitted with two overrides and consists of right and left sections joined together by screw fastenings. The bumpers are attached to the body by three brackets.



S 2484

FRONT BUMPER UP TO AND INCL. MODEL 1971, EXPLODED VIEW



S 2124

REAR BUMPER UP TO AND INCL. MODEL 1971, EXPLODED VIEW

BUMPERS AS FROM THE 1972 MODEL

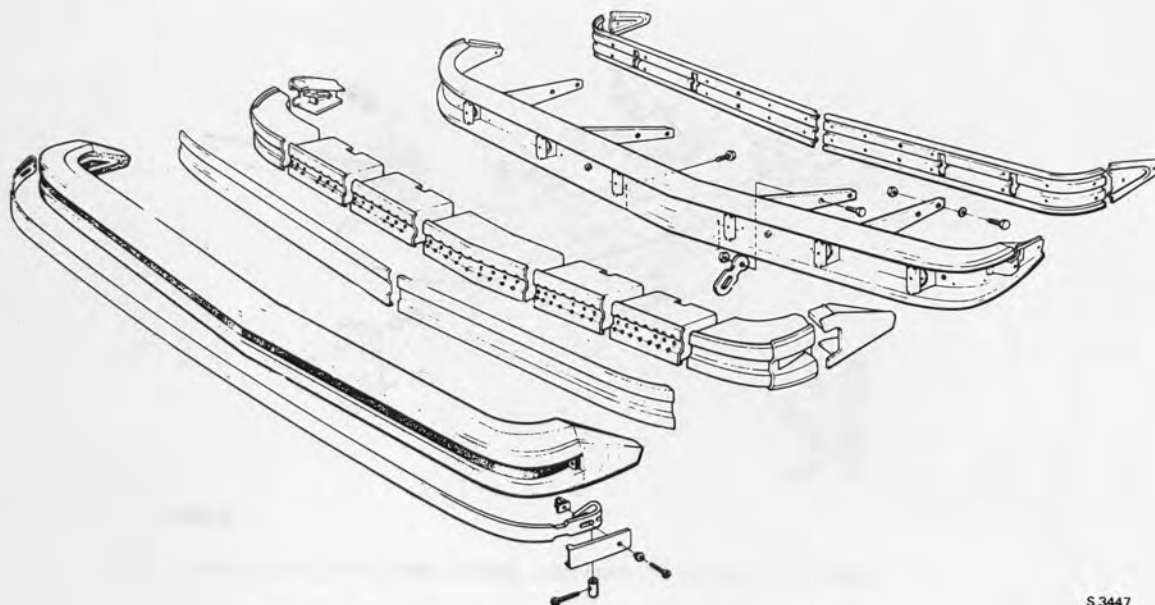
General

The shells of the bumpers consist of U-shaped steel bars to which the bumper brackets are welded. There are shock-absorbant cellular blocks of polyethylene in the bars (9 blocks in the front and 10 blocks in the rear bumper). Outside the blocks there are polyethylene braces and

the bumpers are coated with a layer of rubber. This layer is provided with anchorage bars on the inside and with a stainless steel bracing strip on the outside. Provision has been made on the front bumper for the attachment of license plates and additional lights.

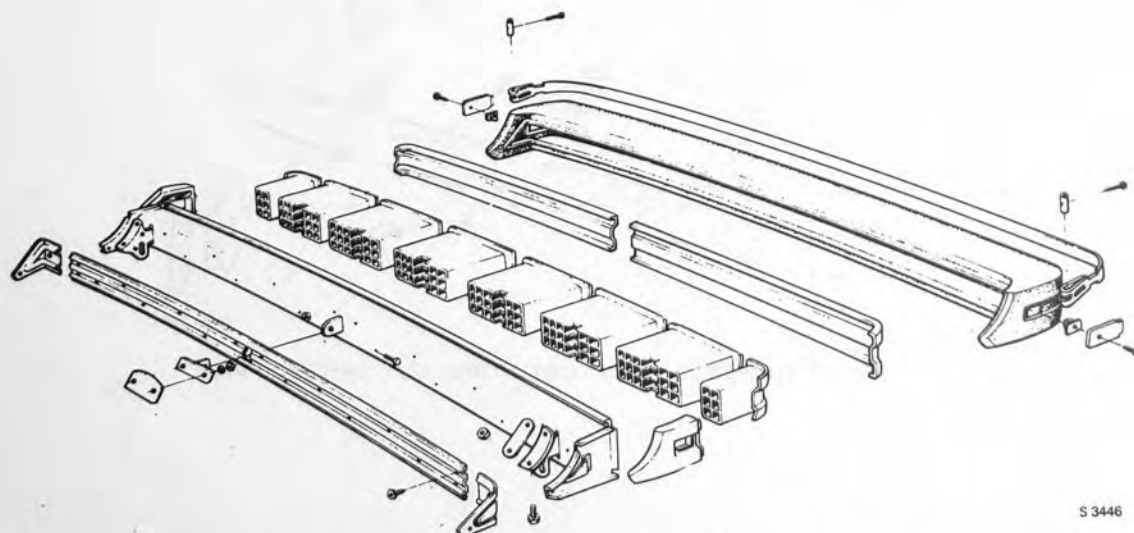
The front bumper is mounted with four brackets and the rear bumper with three.

On model 1974, new light metal bumper bars, cellular blocks of a new design and new bumper brackets have been installed.



S 3447

FRONT BUMPER AS FROM MODEL 1972, EXPLODED VIEW



S 3446

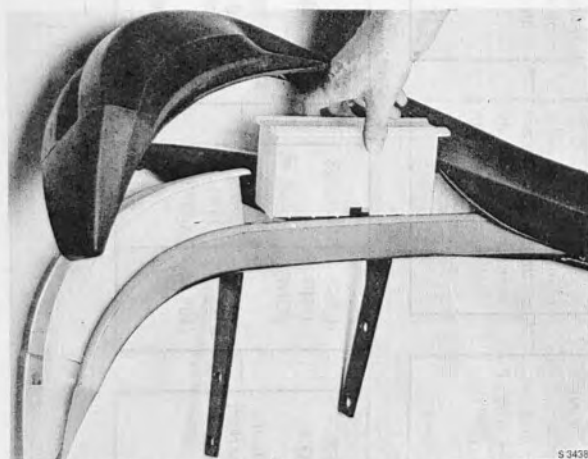
REAR BUMPER AS FROM MODEL 1972, EXPLODED VIEW

Removal and installation

The front bumper is removed by undoing the eight screws which hold the bumper brackets to the reinforcement bars and the support plates in the engine compartment. The rear bumper is removed by undoing the screws which hold the bumper brackets to the bodywork. Install in the reverse order.

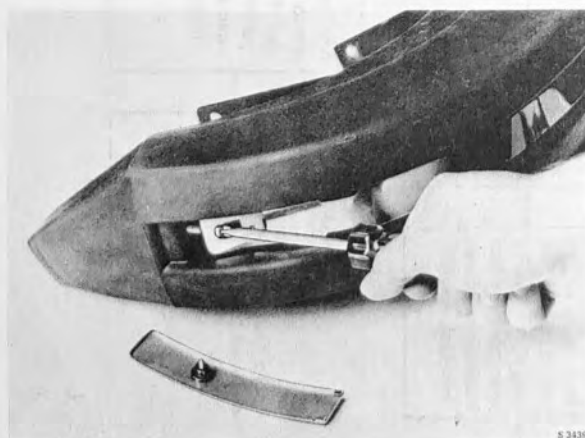
Changing the cellular blocks

1. Remove the bumper.
2. Remove the bracing strip. Note the spacing sleeves under the filling plates at each end of the bracing strip.
3. Remove the anchorage bars on the side of the bumper where the cellular block is to be changed. (If the center block on the front bumper has to be changed, both the longer anchorage bars must be removed.)
4. Pull off the rubber layer, after which the cellular blocks are accessible and can be removed.



CHANGING THE CELLULAR BLOCKS

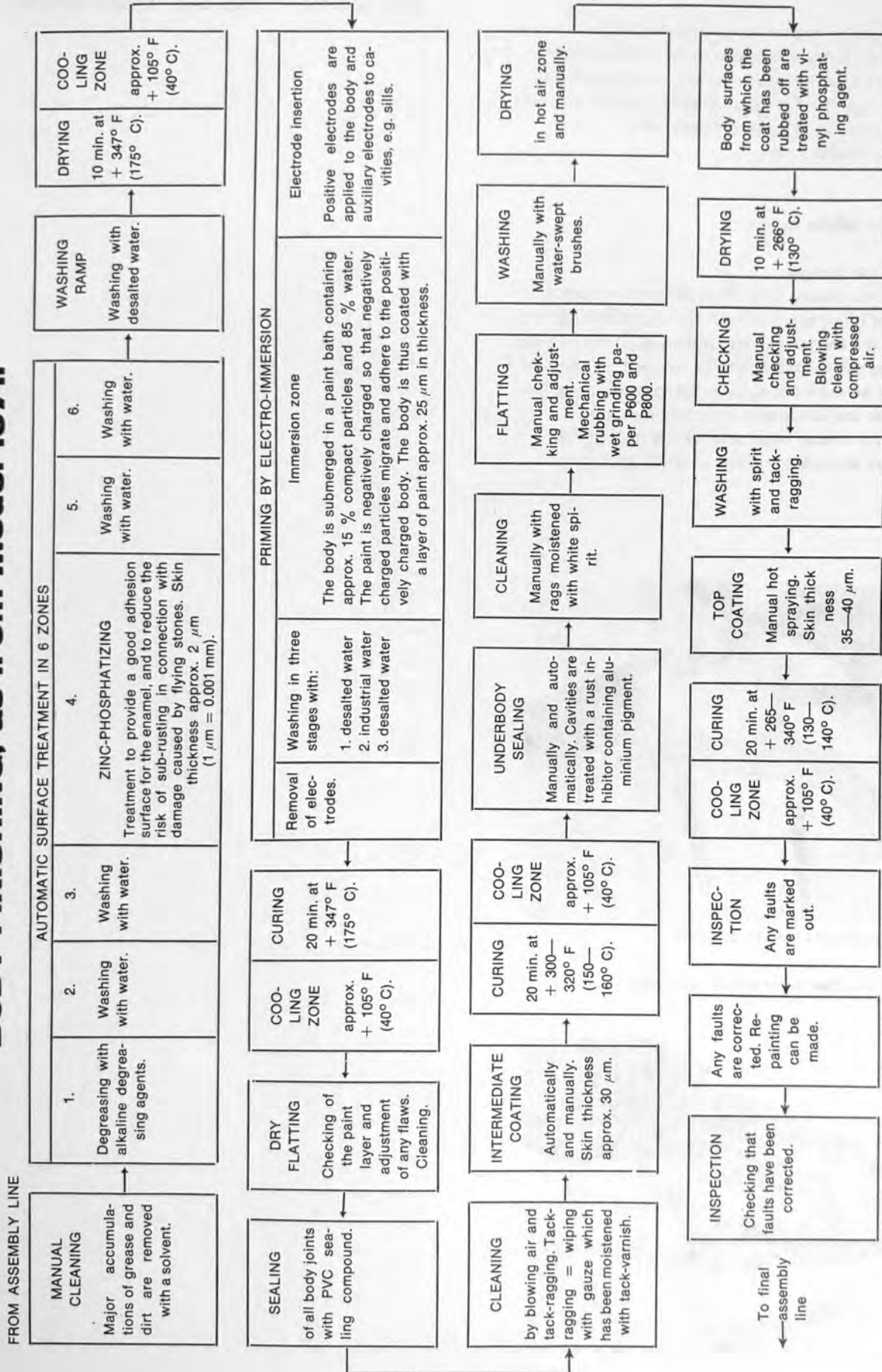
5. Refit the rubber layer and bracing strip.



FITTING THE BRACING STRIP

6. Mount the filling plates and their spacing sleeves together with the anchorage bars. Remount the bumper.

BODY FINISHING, as from model 1971.



Technical data, factory paints

Primer

Mode of application
Hardening
Manufacturer

Skin thickness after stoving

Electro-immersion
20 min. at +347°F (175°C)
AB Wilhelm Beckers
Dr Kurt Herberts
25 µm

Intermediate coat

Spraying viscosity
Mode of application

Curing
Supplier
Skin thickness

35–45 sec. (SIS beaker at 58°F or 20°C)
Hot spraying. Paint temperature approx.
122°F (50°C)
20 min. at +302°F (150°C)
AB Wilhelm Becker
25 µm

Top coat

Spraying viscosity
Mode of application
Curing
Supplier

Skin thickness after stoving
Primer + top coat

35–40 sec. (SIS beaker at 68°F or 20°C)
Hot spraying at approx. 122°F (50°C)
20 min. at 302°F (150°C)
AB Wilhelm Beckers
Dr Kurt Herberts

70–100 µm (0.07–0.1 mm)

Touch up enamel (factory paint with added hardener and enamel)

Spraying viscosity
Mode of application
Curing
Supplier

18–22 sec. (SIS beaker at 68°F or 20°C)
Cold spraying
60 min. at 320–338°F (160–170°C)
AB Wilhelm Beckers
Dr Kurt Herberts

Touch-up and refinish instructions

General

For all touch-up or refinish jobs, use synthetic stoving or airdrying enamel of the same quality type as that for the original paintwork.

For perfect results, it is essential that the premises in which the work is to be done, i.e. the paintshop, be kept absolutely free of dust. It should also be free of drafts and must naturally not be used as a means of access to other departments. The floor should be kept thoroughly damp while spraying. A paint job ruined by dust cannot be restored by polishing — flattening and respraying will be necessary.

Body finishing

Before undertaking any partial refinishing, always spray a test area to check that the shade used is identical with the color of the parts that are not to be refinished. Any deviations must be corrected by toning the paint. The painting job involves the following operations:

Removal of rust and old paint

Rubbing down

Cleaning with a solvent

Priming of bare metal surfaces, for instance with wash primer

Filling — if necessary

Flatting

Application of intermediate coat, for instance Surfacer or Non Sanding, if necessary

Flatting, if necessary

Finishing

Air-drying, stoving with infra-red radiant heat or in a drying oven, depending on the type of enamel used.

Cleaning

If the old paintwork shows defects such as cracking, pitting due to the impact of flying stones, etc., apply a paint remover or flatten down to the bare metal. After removal of the old paintwork by one or the other of these methods, degrease the metal with spirit, thinner or some other suitable solvent. In principle, the same procedure should be used even if the old paintwork has merely been rubbed down instead of being removed. Realign any distorted panels and grind, for instance with a disc grinder, if necessary, before flattening with wet abrasive paper P400. Finally, reclean the parts with spirit or cellulose thinner. Thoroughness in this respect is vital to good adhesion.

Priming

Coat all bare metal surfaces with primer. The drying time and temperature for oven-drying or air-drying should be as prescribed by the paint suppliers. In infra-red radiation lamp may also be used for drying, but care must be taken to keep it at a distance of not less than 16 in. (40 cm) from the metal. After drying, fill as necessary, applying the putty in thin layers and allowing the stipulated drying time for each layer before the next application.

Rubbing down

Rub down the primed and filled surface with wet abrasive paper P400 and then with grade P600. After removing all water, rewash the surfaces with spirit or cellulose and wipe with a piece of gauze drenched in slow-drying varnish (tack-ragging).

Equipment and procedure for refinishing

A. Stoving touch-up enamel

Oven: A convection oven with an air temperature of 194–212°F (90–100°C) is needed. A radiation oven can be used, and in this case the metal temperature should be about 176°F (80°C). It is important for the air temperature to be even throughout the oven and for the temperature to be continuously checked. For this purpose, it is appropriate to use, for example, a calibrated max. and min. thermometer or a thermo-element with a compensator. Only this latter measuring method can be used to check the plate temperature.

Enamel: Hardener must be added to the touch-up paint used in the amount stipulated by the paint supplier. The enamel can be sprayed either hot or cold, and the viscosity should be adjusted accordingly with the thinner recommended by the paint supplier to the following:

Hot spraying — viscosity approx. 35 sec.

Cold spraying — viscosity approx. 21 sec.

Measure the viscosity with a beaker according to the method described in the Swedish standard SIS 160011 at a temperature of approx. +68°F (20°C).



MEASURING VISCOSITY WITH AN SIS BEAKER



USE OF RADIATION LAMP TO DRY REFINISHED PART

Procedure: First of all, clean the body and chassis of the car thoroughly, thus ensuring that dust will not spread in the spraying booth or drying oven. Before drying in the oven in connection with touch-up, certain parts of the car must be masked or removed to prevent them from being damaged by the heat. Which parts should be removed is partly depending on the oven temperature and partly the time under which the car is exposed to heat. The measures mentioned below consider a temperature of 194–212°F (90–100°C) during one hour.

The following details should be removed to prevent them from being damaged by the heat:

- a) The control unit for the injection engine.
- b) The plastic grilles of the front plate (model 1971)
- c) The plastic strips of the fenders and the glasses of the rear clamps.
- d) Saab 99 Combi Coupé: The pneumatic springs for the rear door.

Cover the insides of all glass windows with sheets of board or the like to prevent the temperature from becoming too high.

If the trunk compartment lid, engine hood or a door must be left open during the drying, the opening must be masked to prevent the heat in the car to rise above +167°F (75°C).

The fuel tank should contain only a small amount of fuel. The filler cap should be removed.

When the car is being pretreated and painted it should be at normal room temperature. When the car is placed in the oven, the latter should have reached the prescribed temperature of 194–212°F (90–100°C). Leave the car there for one hour.

CAUTION

The pneumatic springs on the rear door on Saab 99 Combi Coupé model cars must be removed before the car is placed in the oven. The high temperature causes a pressure increase in the springs and this can result in damage or injury.

B. Air-drying touch-up enamel (68–176°F or 20–80°C)

When air-drying enamel is used, no special arrangements are necessary other than a well heated, dustless booth. The drying time can, however, be speeded up considerably by stoving the enamel with an infrared radiation lamp or in an oven with an air temperature of not more than +176°F (80°C).

The enamel can be sprayed either hot or cold, and the viscosity should be adjusted accordingly with the thinner recommended by the paint supplier to the following:

Hot spraying — viscosity approx. 35 sec.

Cold spraying — viscosity approx. 21 sec.

Measure the viscosity with a beaker according to the method described in the Swedish standard SIS 160011 at a temperature of approx. +68°F (20°C).

The metal must have adopted normal room temperature prior to pretreatment and painting.

NOTE

Under the chassis sign is a sign indicating by means of a code the original body color. Always quote this code when placing orders for touch-up enamel. This is particularly important as enamel conforming to the same color specification may be supplied by several different manufacturers.

General maintenance work

Proper care and maintenance of the care is necessary to retain the gloss and durability of the enamel finish and the protective properties of the underbody sealing. Recommendations in these respects are given in group 1.

METALLIC PAINTS

General remarks on metal-effect paints

Metal-effect paints, or metallic paints as they are more commonly called, consist of ordinary enamel paints doped with aluminum powder, which imparts a metallic lustre of the finish. Metal-effect paints can only be applied by spraying, and produce different color tones according to the spraying technique employed. Saturated wet spraying (with large quantities of paint) results in dark shades, while fog and dry spraying (with small quantities) give lighter shades. To make sure that spot repairs to paintwork match the original paint job, it is essential that the repair is made with recommended and tested qualities of paint.

Metallic paints can be divided into one-coat and two-coat types. Singlecoat metallic paint, as already mentioned, consists of enamel paint doped with aluminum powder. A two-coat application comprises an undercoat of enamel paint containing aluminum particles and a topcoat of transparent varnish giving a high-gloss finish.

Repairs to metallic paintwork call for a technique that differs in some respects from the conventional method of applying solid paints. The purpose of this Service Information is to give advice and instructions on correct procedure.

Now that we have acquired some experience of metallic painting in our production and obtained very good results with one-coat paints, we have discontinued production of two-coat painted cars. We have also found that repairs to two-coat paint jobs can be made with excellent results using the same technique as employed for cars with original one-coat paintwork.

Touch-up paints that match the original paint are essential to good repair results. Even so, slight differences in coloration are sometimes found between the original paint job and the repair. As a rule these differences can be ascribed to one of the following causes:

Vehicle paintwork changes color with age under the influence of external factors such as solar ultraviolet radiation, extreme fluctuations in temperature, the chemical effects of atmospheric pollution and road salt in winter-time, and many others.

Car owners sometimes use unsuitable and excessively harsh cleaning and polishing compounds which discolor and bleach the paintwork.

A special problem arises in the case of metallic paints, as the finish and shade vary according to the type of paint and the application technique. The method of spraying influences the way in which the fine aluminum particles distribute themselves in the paint layer; this effect can be controlled to some extent by the choice of spraying technique. Repainting should therefore be extended out to the natural boundaries of the area in need of repair, and the car owner should be told in advance that there may be some difference in the shade of the repainted part.

To avoid trouble with complaints, we would advise all bodywork painters to follow the instructions given below:

a) Stir the paint thoroughly.

- b) Check that all cans of paint used on the same car are marked with the same batch number.
- c) Always test-spray a specimen piece. Comparison with the color of the paint in liquid form is not reliable, as the color changes during drying and may also be influenced by the method of application.
- d) Always match up the colors in daylight (but not in direct sunlight) before you start painting.

General recommendations

1. The temperature in the paint shop should not be less than 64°F (18°C). Vehicles that have stood out of doors must have come to room temperature before painting starts. The same applies to the paint itself.
2. Take care over the preparations. The surface must be free from rust and grease and must be dry. Degreasing with a damp rag is not good enough; wash the surface using plenty of grease dissolver. Take special care with areas close to trim and panel edges.
3. Do not touch degreased and sanded surfaces with bare hands. Perspiration contains salt compounds that will cause the finished coat of paint to swell. Old, blistered paintwork must be completely removed.
4. The water used for grinding must not exceed 5 German degrees in hardness. It may be necessary to soften the water in a desalination unit. In any event, great care must be taken and the surface must be thoroughly cleaned. Do not let any drops of grinding water dry on the surface — wipe them off with a chamois leather. Remove all traces of grinding dust. Before proceeding further, dry off all moisture thoroughly in a drying oven or with a heat lamp.
5. Compressed air must be dry and clean. Spraying pressure should be 45–70 psig (3–5 atmospheres gauge pressure) unless otherwise specified.
6. Spray boxes and drying ovens must be provided with fresh-air intake, dust filter and air extractor.
7. The top coat must not be applied until all traces of solvent have evaporated from the surface, as pores may otherwise form in the paintwork.

Products and procedures for paintwork spot repairs

Priming materials

Du Pont Hi-Speed Primer-surfacer 30 S (233–1940) air drying (gray)

Du Pont Thinner 3608 S (145010)

Du Pont Universal Putty 2284 R (228–BS 146)

Top coat materials

Du Pont Lucite ^R Spot Repair 945-line metallic		
Coral Metallic YR1 & YR4	1/4 gal.	Part No. 845114
Coral Metallic YR1 & YR4	1/8 lit.	Part No. 847025
Sepia Metallic YR2	1/4 gal.	Part No. 843680
Sepia Metallic YR2	1/8 lit.	Part No. 847026
Du Pont Thinner 3632	1 lit.	Part No. 845115
Du Pont Thinner 3602	5 lit.	Part No. 847027

Other materials

Prep-Sol^R 3919 S

Emery paper No. 400 or finer

Metal conditioner 5717 S

Du Pont Rubbing Compound 202 (hand rubbing)

Du Pont Rubbing Compound 303 (machine rubbing)

Synthetic thinner 621 R (T-3810)

Adhesive rags

Preparakote^R primer-surfacer 3012 S

Uniforming finish 200 S

Uses

Lucite^R Spot Repair is intended for spot repairs, as well as partial and total respraying.

Surface preparation

Clean off old paint with Prep-Sol^R 3919 S. Smooth edges of paintwork with emery paper No. 400 or finer. Treat bare metal surfaces with Metal conditioner 5717 S. Polish round the damaged spot with Du Pont Rubbing Compound 202 to remove grinding scratches and to obtain good adhesion to original paintwork. Wash off the whole surface with Synthetic thinner and wipe off with adhesive rags.

Priming

Prime all bare metal surfaces with Hi-Speed primer-surfacer (for whole panel painting, primer with Preparakote^R primer-surfacer 3012 S). Fill as necessary with Universal Putty.

Cover painting

Topcoat with Lucite^R Spot Repair acrylic paint, diluting with 100% thinner 3602 S. Apply three wet coats with flash-off between the first three coats and a fourth half-wet coat straight on top of the third. Each coat of cover paint and primer should be 30–50 μ m thick.

One or two thicker coats cannot take the place of three or four thinner ones. Ground-through or almost ground-through spots must be reprimed with the recommended primer. Spray pressure should be 45–50 psi (approx. 3.5 atmospheres) gauge.

To further enhance the initial gloss and make an invisible transition to the original paintwork, two or three coats of Uniforming Finish 200 S should be sprayed on and around the resprayed area.

Drying

Large areas should be allowed to air-dry for four hours, preferably overnight, before being polished.

Alternatively, the paint can be force-dried for 15 minutes at 175°F (80°C) before polishing of small areas (spot repairs) or for about 45 minutes before polishing of complete resprays.

Polishing

Lucite^R Spot Repair has a high initial gloss and needs only light polishing to smooth off color edges and blend into the original paintwork. Polish small areas by hand with Rubbing Compound 202. Machine-polish larger areas with Rubbing Compound 303.

Please note

Lucite^R Spot Repair should not be applied by brushing as it contains metal particles. It can however be used to fill small pits by flying gravel.

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- 930 Radio installation
- 952 Towing attachment

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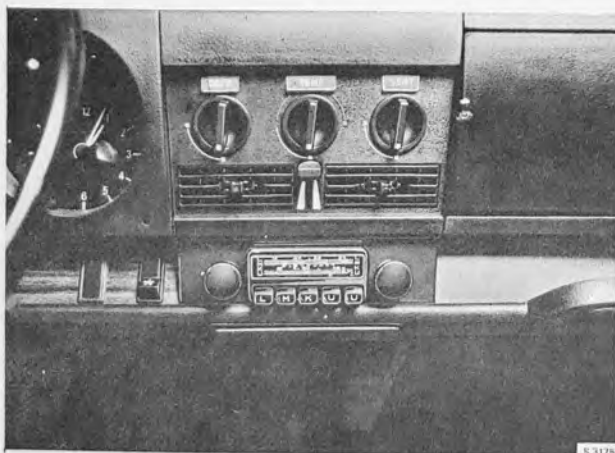
RADIO INSTALLATION

Mounting kits are available for Blaupunkt and Philips car radios. All necessary mounting details and suppression components are enclosed. The figure shows a radio mounted in the special holder that is part of the mounting kit.

As from model 1971 up to and incl. model 1973 there is space for installation of a radio if the middle part of the switch panel is removed. Concerning removal see group 8. Owing to redesign of the fresh air ducting on model 1974, it is no longer possible to install a car radio in the same position as in earlier models. A special mounting panel has been produced for installation on the floor below the instrument panel. It has recesses for radio and loudspeaker, and is also provided with a storage compartment.



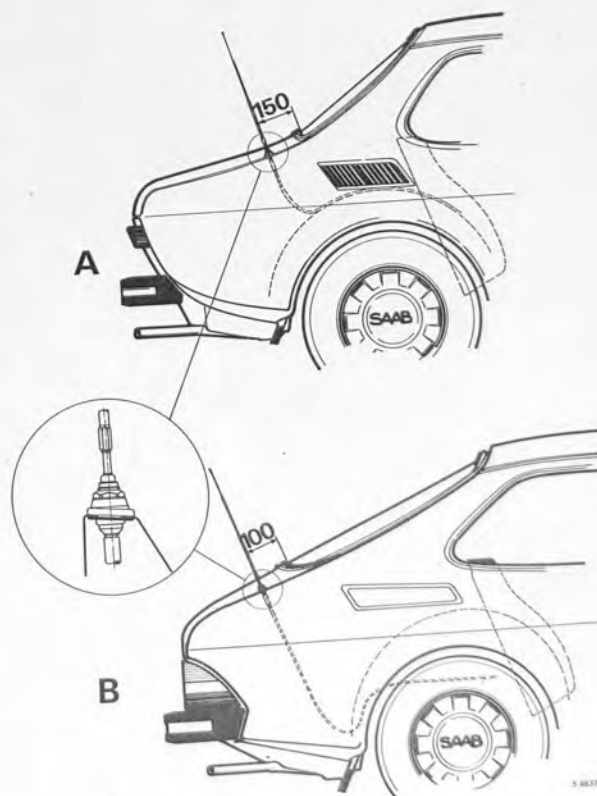
RADIO INSTALLATION UP TO AND INCL. MODEL 1970



RADIO INSTALLATION AS FROM MODEL 1971 UP TO AND INCL. MODEL 1973



RADIO INSTALLATION MODEL 1974



SUITABLE ANTENNA LOCATION

A. SAAB 99, 99 L AND 99 EMS

B. SAAB 99 COMBI COUPE

TOWING ATTACHMENT

Mounting

The towing attachment (1) for the Saab 99, ordering No. 117-12000, is rated for a maximum trailer weight of 2,425 lb (1,100 kg). The car body has holes for the mounting bolts, and the mounting kit contains all parts needed for fitting the attachment.

The towing attachment is mounted as follows:

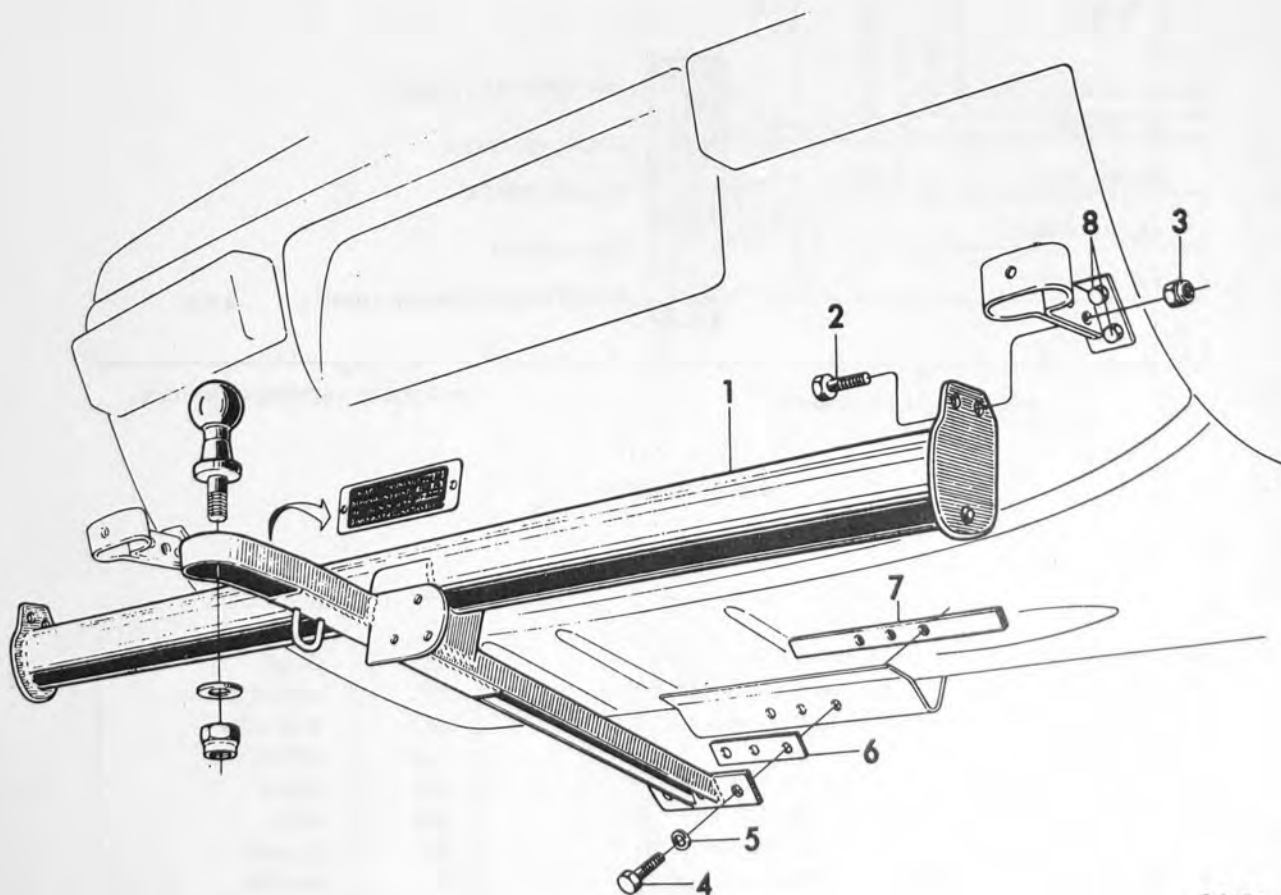
1. Undo the screws (8) holding the rear bumper brackets to the body and remove the rubber seals between brackets and body. Then replace and tighten the screws and seal the holes with body sealant on the inside to keep water out.
2. Lift the towing attachment into place and secure first by the bolts (2) and nuts (3) to the bumper brackets.
3. Place the strip nut (7) inside the rear jack support, insert the necessary number of spacers (6) and insert and tighten the bolts (4) with spring washers (5).
4. Make sure that all mounting bolts are well tightened.

The mounting kit for the wiring harness to the 7-pole trailer contact ordering No. 117-12001 is intended for use with the Saab 99 and its towing attachment ordering No. 117-12000.

The harness is installed according to the instructions for mounting and the wiring diagram on the next page; two holes must be drilled in the body for the purpose, 1" (25 mm) and 0.15" (3.8 mm) in diameter respectively.

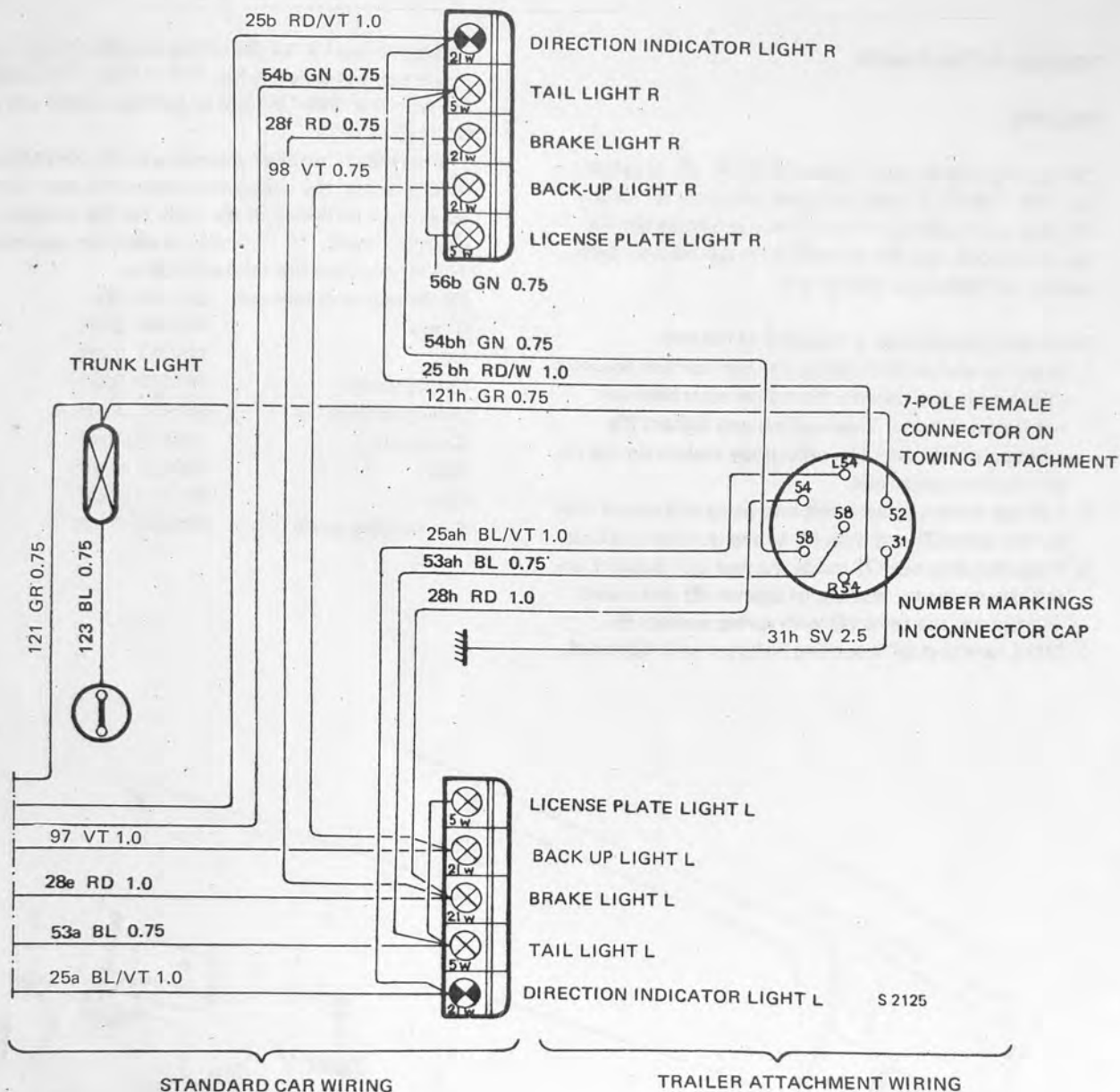
The kit contains the following parts:

7-pole female connector	255-20300
Screw	793449 3 off.
Nut	791047 3 off.
Spring washer	791053 3 off.
Wiring harness	850452 1 off.
Grommet	732609 1 off.
Clip	710849 4 off.
Clip	793344 2 off.
Self-tapping screw	792280 1 off.



S 2485

TOWING ATTACHMENT



WIRING DIAGRAM

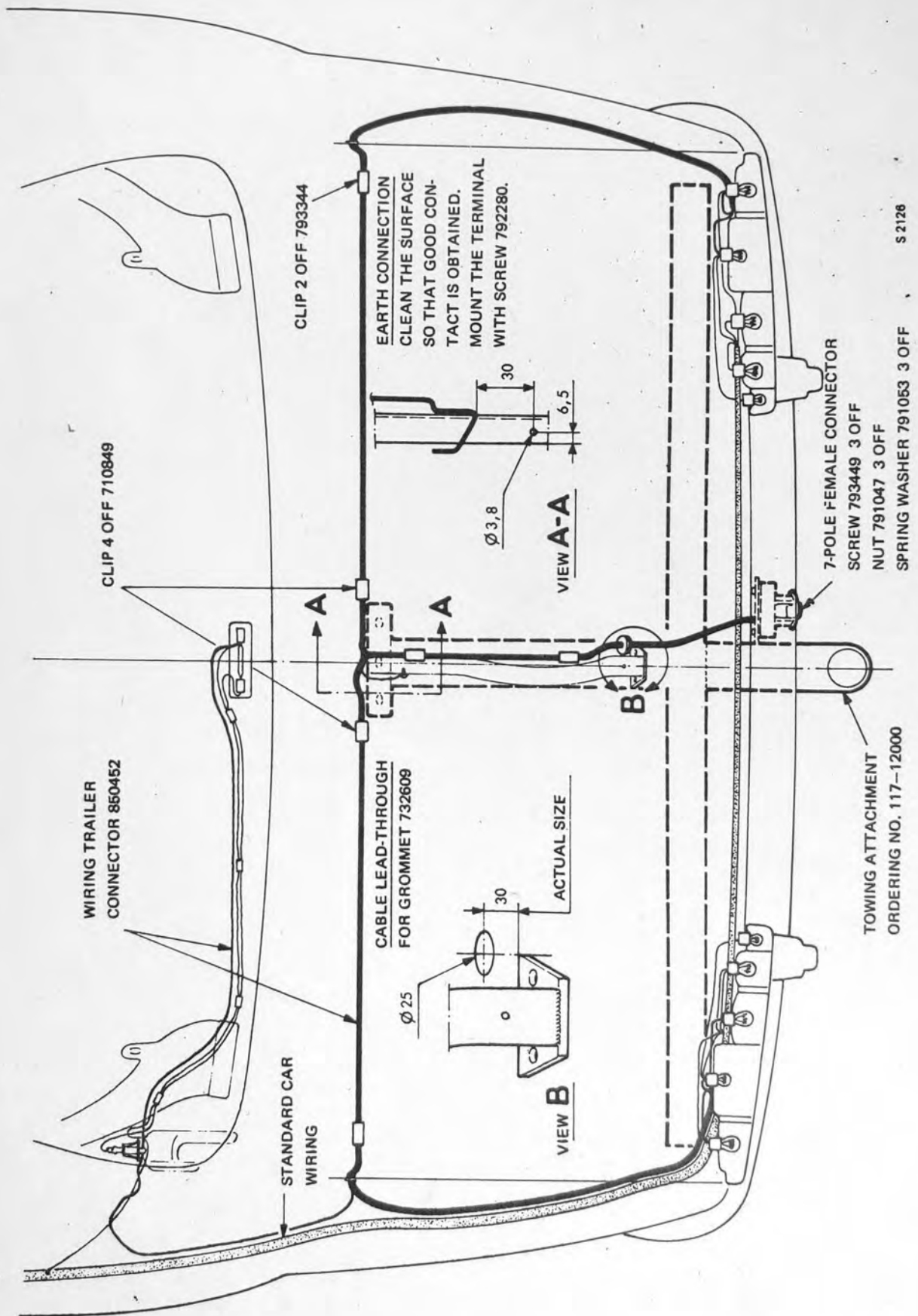
NOTE

According to the wiring diagram, cable 121h is to be connected to 121 GR 0.75 in the car. This arrangement is sufficient for normal interior lighting in a trailer (max. 50 W).

If additional electrical equipment on the trailer has to be supplied via cable 121h (extra lights etc.) a 2.5 mm² cable must instead be connected from 121h Gr 2.5 direct to the car's fuse No. 7. Note that in the case of older wiring systems for trailer contacts cable 121h Gr is only 0.75 mm², in which case the 2.5 mm² cable is connected to female connector 52.

COLOR CODE

BL	BLUE
BR	BROWN
GL	YELLOW
GN	GREEN
GR	GREY
RD	RED
SV	BLACK
VT	WHITE
BL/VT	BLUE/WHITE
BR/VT	BROWN/WHITE
GN/VT	GREEN/WHITE
RD/VT	RED/WHITE



MOUNTING INSTRUCTIONS

S 2128

