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WORKSHOP MANUAL SERIES No 87

DATSUN 1000 1200

WITH SPECIFICATIONS
REPAIR AND
MAINTENANCE
DATA

COVERING
A10, A12 ENGINE
STATION WAGON
SEDAN
PICKUP

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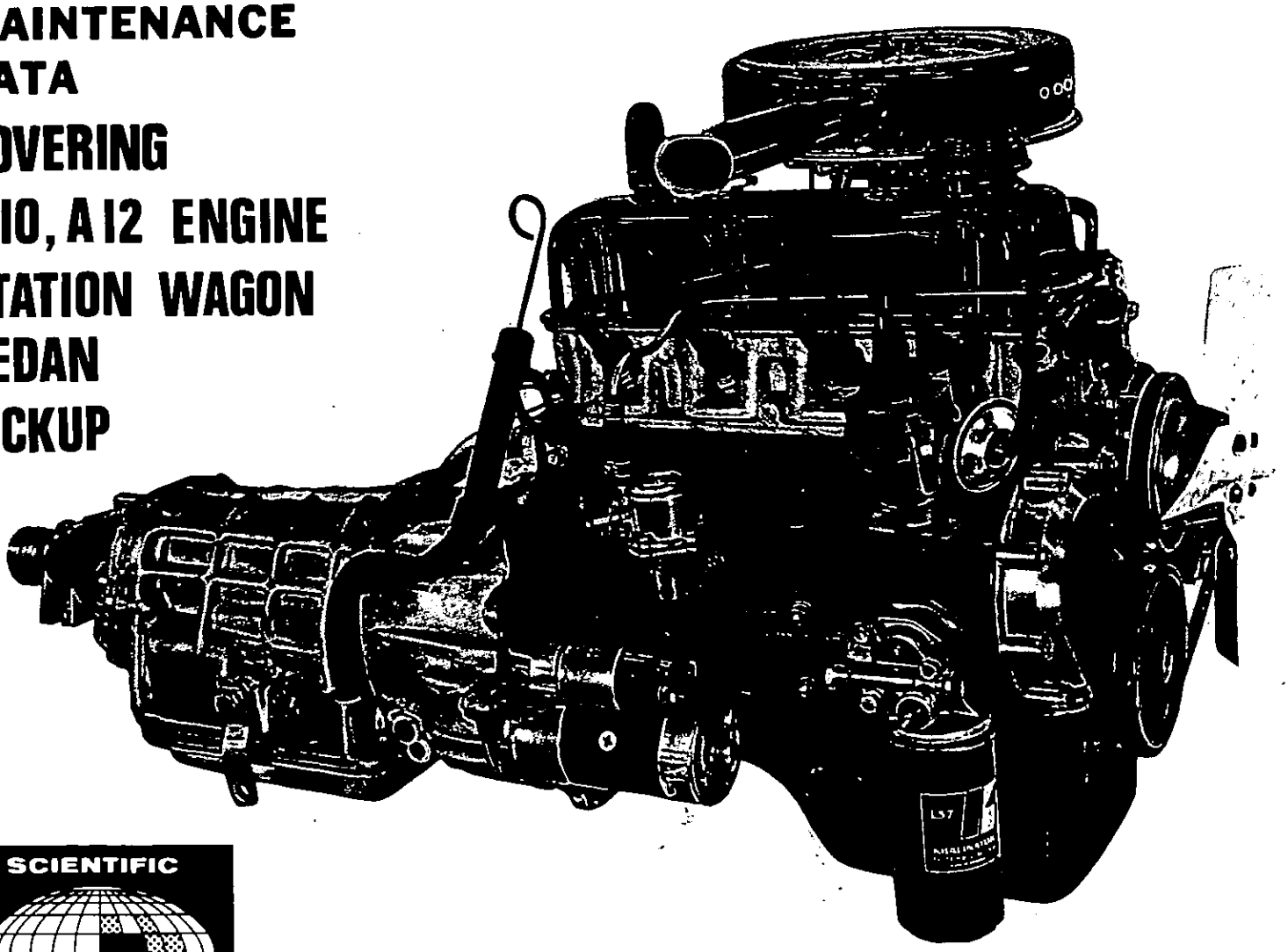

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DATSUN 1000, 1200

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DATSUN 1000, 1200 SERIES B10, B110

SEDAN, WAGON, PICK-UP

AUTOMATIC and MANUAL TRANSMISSIONS

With Specifications,
Repair and Maintenance Data

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ENGINE

SPECIFICATIONS

Type	4 cylinder-in line-OHV
Bore	73 mm (2.874 in)
Stroke:	
A10 engine	59 mm (2.323 in)
A12 engine	70 mm (2.756 in)
Capacity:	
A10 engine	988 cm^3 (60.3 in^3)
A12 engine	1171 cm^3 (71.5 in^3)
Compression ratio:	
A10 engine	8.5:1
A12 engine	9.0:1
Bhp (Maximum):	
A10 engine	56 at 6000 rpm
A12 engine	68 at 6000 rpm
Maximum torque:	
A10 engine	8.50 kg/m @ 4000 rpm (61.5 ft/lb @ 4000 rpm)
A12 engine	9.70 kg/m @ 3600 rpm (70.1 ft/lb @ 3600 rpm)
Firing order	1–3–4–2
Idling speed	600 rpm

CYLINDER HEAD

Type	Aluminium alloy
Gasket face distortion limit	0.10 mm (0.004 in)
Valve seat material:	
Inlet	Aluminium bronze
Exhaust	Cast iron
Valve seat insert recess diameter in head:	
Inlet – standard insert	37.016–37.00 mm (1.4573–1.4567 in)
Inlet – replacement insert	37.516–37.50 mm (1.4770–1.4763 in)
Exhaust – standard insert	33.016–33.00 mm (1.2998–1.2992 in)
Exhaust – replacement insert	33.516–33.50 mm (1.3195–1.3190 in)
Cylinder head bore diameter for valve guide:	
Standard guide	12.011–12.00 mm (0.4728–0.4724 in)
Replacement guide	12.211–12.200 mm (0.4807–0.4800 in)
Valve seat angle	45°
Valve seat width:	
Inlet	1.30 mm (0.0512 in)
Exhaust	1.80 mm (0.0709 in)
Valve seat insert outer diameter – standard:	
Inlet	37.080–37.096 mm (1.459–1.460 in)
Exhaust	33.080–33.096 mm (1.302–1.303 in)
Valve seat insert inner diameter:	
Inlet	30 ± 0.10 mm (1.181 ± 0.004 in)
Exhaust	26 mm (1.023 in)
Valve seat insert depth:	
Inlet and exhaust	6.0–5.90 mm (0.2362 – 0.2323 in)
Insert interference fit in head	0.064–0.096 mm (0.0025–0.0038 in)

VALVES, GUIDES AND SPRINGS

Valves:	
Head diameter – inlet	35 mm (1.378 in)
– exhaust	29 mm (1.142 in)
Stem diameter	8.70–8.69 mm (0.3426–0.3430 in)
Overall length	103.5–104.1 mm (4.0750–4.0984 in)
Stem to guide clearance:	
Inlet	0.015–0.045 mm (0.0006–0.0018 in)
Exhaust	0.040–0.070 mm (0.0016–0.0028 in)
Valve lift:	
A10 engine	7.80 mm (0.3071 in)
A12 engine	7.50 mm (0.2953 in)
Valve guide:	
Inner diameter	8.015–8.000 mm (0.3155–0.3150 in)
Outside diameter	12.044–12.033 mm (0.4740–0.4737 in)
Interference fit in head	0.022–0.044 mm (0.0009–0.0017 in)
Length	53 mm (2.087 in)

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Fitted height above spring seat	18 mm (0.709 in)
Valve spring:	
Free length	45.7 mm (1.7992 in)
Fitted length and load	38.5 mm @ 30.0 kg (1.516 in @66.1 lb)
Number of effective coils	4.5
Wire diameter	4.276 mm (0.1693 in)
Coil diameter	26.224 mm (0.0324 in)
Rocker arm to valve stem clearance:	
Hot	0.35 mm (0.0138 in)
Cold	0.25 mm (0.0098 in)

PISTONS, PISTON RINGS AND GUDGEON PINS

Pistons:	
Type	Slipper skirt, cast aluminium alloy
Piston fit	Selective
Skirt diameter – standard	72.967–73.017 mm (2.8727–2.8747 in)
1st oversize – 25 mm	73.217–73.267 mm (2.8826–2.8845 in)
2nd oversize – 50 mm	73.467–73.517 mm (2.8924–2.8944 in)
3rd oversize – 75 mm	73.717-73.767 mm (2.9022–2.9042 in)
4th oversize – 100 mm	73.967–74.017 mm (2.9121–2.9140 in)
5th oversize – 125 mm	74.217–74.267 mm (2.9219–2.9239 in)
6th oversize – 150 mm	74.467–74.517 mm (2.9318–2.9337 in)
Piston to cylinder bore clearance	0.023–0.043 mm (0.0009–0.0017 in)
Piston rings:	
Width – compression	2.00 mm (0.0787 in)
– oil control	4.00 mm (0.1575 in)
Side clearance in groove	0.04–0.07 mm (0.0016–0.0027 in)
Ring gap	0.20–0.30 mm (0.0079–0.0118 in)

GUDGEON PIN

Gudgeon pin:	
Diameter	17.447–17.452 mm (0.6869–0.6871 in)
*Clearance in piston	0.006–0.008 mm (0.0002–0.0003 in)
Interference fit in connecting rod	0.017–0.034 mm (0.0007–0.0013 in)
Length	65.23–65.48 mm (2.5681–2.5779 in)

*With piston at a temperature of 20°C (68°F).

CRANKSHAFT AND MAIN BEARINGS

Crankshaft:	
Main journal diameter	49.964–49.957 mm (1.9671–1.9668 in)
Journal, taper or ovality wear limit	0.03 mm (0.0012 in)
Main bearing clearance	0.020–0.062 mm (0.0008–0.0024 in)
Clearance wear limit	0.15 mm (0.0059 in)
Crankshaft run-out	0.015–0.050 mm (0.0006–0.0020 in)
End float	0.05–0.15 mm (0.0020–0.0059 in)
End float wear limit	0.30 mm (0.0118 in)
Main bearing thickness	1.835–1.827 mm (0.0722–0.0719 in)
Crankpin diameter	44.974–44.961 mm (1.7706–1.7701 in)
Crankpin taper or ovality wear limit	0.03 mm (0.0012 in)

CONNECTING ROD AND BIG END BEARING

Connecting rod:	
Length – A10 engine	116.97–117.3 mm (4.6051–4.6188 in)
– A12 engine	121.47–121.53 mm (4.7822–4.7846 in)
Big end bearing thickness	1.500–1.508 mm (0.0591–0.0594 in)
Big end end-float	0.20–0.30 mm (0.0079–0.0012 in)
End float wear limit	0.40 mm (0.016 in)
Big end bearing clearance on crankpin	0.020–0.050 mm (0.0008–0.0020 in)
Connecting rod bent or misalignment	0.05–0.10 mm (0.0020–0.0039 in)

CAMSHAFT AND BEARINGS

Camshaft bearing journal diameter:	
No. 1	43.793–43.806 mm (1.7241–1.7246 in)
No. 2	43.283–43.296 mm (1.7040–1.7046 in)

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No. 3	42.783–42.796 mm (1.6844–1.6849 in)
No. 4	42.283–42.296 mm (1.6647–1.6652 in)
No. 5	41.218–41.231 mm (1.6228–1.6233 in)
Camshaft run out	0.01–0.10 mm (0.0004–0.0039 in)
Journal to bearing clearance	0.024–0.065 mm (0.0009–0.0026 in)
Bearing inner diameter:	
No. 1	43.843–43.833 mm (1.7261–1.7257 in)
No. 2	43.333–43.323 mm (1.7060–1.7050 in)
No. 3	42.846–42.836 mm (1.6868–1.6865 in)
No. 4	42.333–42.323 mm (1.6667–1.6663 in)
No. 5	41.268–41.258 mm (1.6247–1.6243 in)

LUBRICATION

Type	Full pressure
Oil pump type	Eccentric motor (trochoid)
Filter type	Full flow
Oil pump:	
Side clearance, inner and outer rotors	0.05–0.12 mm (0.0020–0.0047 in)
Clearance, outer rotor and body	0.15–0.21 mm (0.0059–0.0083 in)
Clearance, rotor to end cover	0.12 mm (0.0492 in)
Relief valve spring:	
Free length	43.49 mm (1.71 in)
Fitted length	30.30 mm (1.19 in)
Relief pressure	3.80–4.20 kg/cm^2 (54.0–59.70 psi)
Capacity:	
With new filter	3.20 litre (2.75 Imp qts) (3.37 US qts)
Less filter	2.70 litre (2.37 Imp qts) (2.87 US qts)

TORQUE WRENCH SETTING – MAXIMUM

Connecting rod nuts	3.6 kg/m (26 ft/lb)
Cylinder head bolts	4.80 kg/m (34.70 ft/lb)
Flywheel bolts:	
A10 engine	3.00 kg/m (7.50 ft/lb)
A12 engine	7.50 kg/m (54.20 ft/lb)
Main bearing cap bolts	5.30 kg/m (38.30 ft/lb)
Camshaft sprocket bolt	4.50 kg/m (32.50 ft/lb)
Camshaft locating plate bolts	0.50 kg/m (3.60 ft/lb)
Sump bolts	0.60 kg/m (4.30 ft/lb)
Oil pump attachment bolts	1.50 kg/m (10.80 ft/lb)
Oil strainer bolts	1.40 kg/m (10.10 ft/lb)
Crankshaft pulley bolt	16 kg/m (116 ft/lb)
Timing chain tensioner bolts	0.80 kg/m (5.80 ft/lb)
Rocker pedestal bolts	2.50 kg/m (18.10 ft/lb)
Mainfold bolts	1.40 kg/m (10.10 ft/lb)
Pump release valve plug	5.00 kg/m (36.20 ft/lb)

1. DESCRIPTION

The four cylinder overhead valve engine has a cast iron alloy cylinder block and crankcase. The cylinder head is of cast aluminium alloy, with replaceable valve guides. Each valve has its individual port and is operated by a tappet, push rod and rocker arm from the camshaft.

Pistons are slipper skirt aluminium alloy type with two compression rings and one oil ring. The lower compression ring is taper faced and the oil ring comprises an upper and lower chrome faced steel segment with a spacer in between.

The gudgeon pin is an interference fit in the small end of the connecting rod and this is the only means of retaining the gudgeon pin in the assembly.

The crankshaft is counter balanced and runs in three (A10) or five (A12) steel backed copper lead split shell main bearings. Crankshaft end-float is taken at the centre main bearing.

Connecting rod big end bearings are split steel backed copper lead replaceable shells.

Pistons are marked on the crown with a code number of the cylinder bore size, which must be to the front of the engine.

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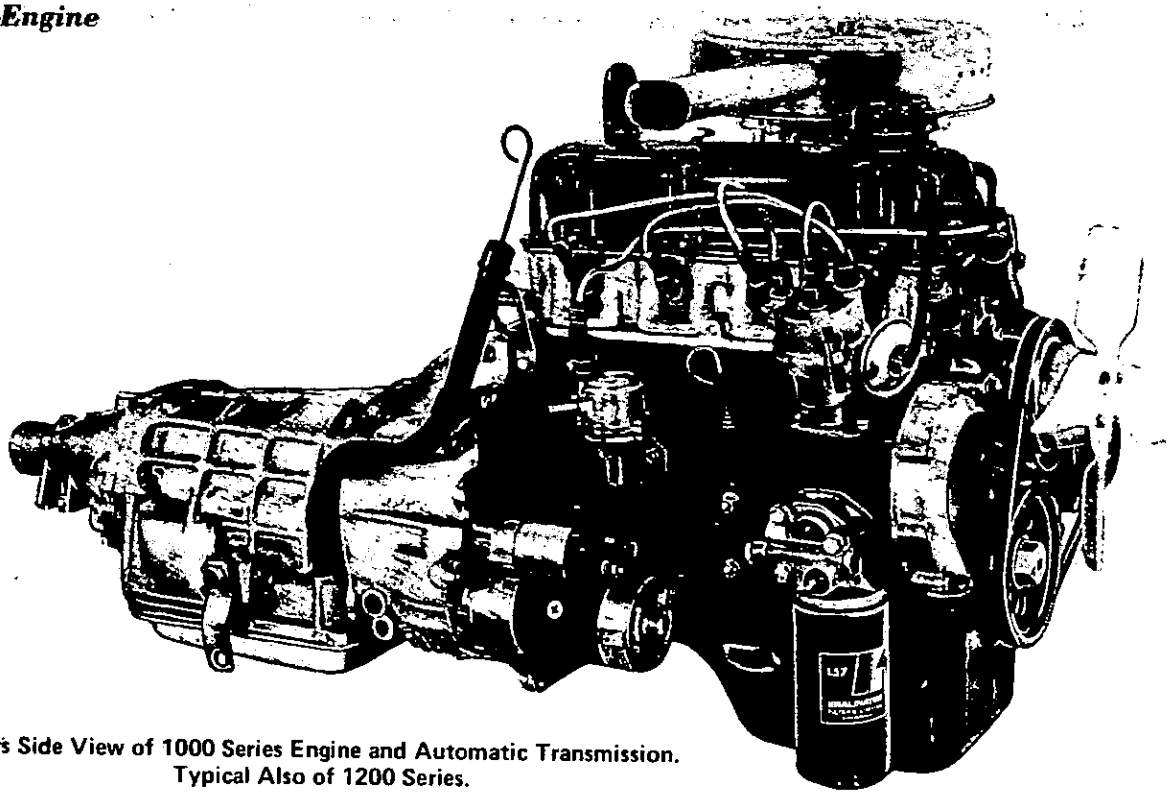

Drivers Side View of 1000 Series Engine and Automatic Transmission. Typical Also of 1200 Series.

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Connecting rods and big end bearing caps are numbered. The big ends of the connecting rods are bored with an oil squirt hole on the thrust side.

The oil pump is the trocoid gear or internal rotor type and is driven by the camshaft to provide full pressure to the engine.

Oil passes through a drilling to the centre rocker pedestal to provide lubrication to the rocker arms and shaft.

Oil pressure is maintained at a pre-determined maximum by a spring loaded relief valve, situated within the pump body.

The lubricating oil passes through a full flow oil filter mounted externally on the oil pump.

2. ENGINE AND TRANSMISSION

TO REMOVE AND INSTAL

(1) Drain the cooling system and the gearbox.

(2) Disconnect the battery leads at the battery and remove the battery and battery tray.

(3) Release the retaining clips and remove the upper and lower radiator hoses. Remove the air cleaner.

(4) Where fitted, release the retaining clips and disconnect the heater hoses at the engine.

(5) Disconnect the high and low tension leads at the coil and distributor.

(6) Disconnect the alternator leads at the alternator and the starter leads at the starter solenoid.

(7) Disconnect the oil gauge and temperature gauge wires at the engine.

(8) Disconnect the choke and throttle control linkage at the carburettor.

(9) Disconnect the fuel inlet pipe at the fuel pump.

(10) Remove the flange nuts and disconnect the exhaust outlet pipe at the manifold.

(11) Raise the car sufficiently, take out the split pins and disconnect the gear change links at the levers on the side of the gearbox.

(12) Unscrew the ferrule and disconnect the speedometer drive cable assembly at the gearbox rear extension.

(13) Disconnect the earth strap at the starter motor mounting bolt.

(14) Disconnect the handbrake rod support on the gearbox.

(15) Take out the four bolts, disconnect the rear universal joint flange from the pinion flange at the rear and withdraw the propeller shaft from the rear of the gearbox.

(16) 1000 model: Slacken the lock nut at the adjuster end of the clutch control cable and unscrew the cable adjuster bolt from the end of the cable. 1200 model: Slacken the adjustment at the upper end of the cable case and unhook the lower end of the cable off the clutch release (throwout) lever.

(17) Remove clutch cable casing bracket attaching bolt and withdraw the cable and bracket clear of the engine and gearbox assembly.

(18) On models with hydraulic clutch operation,

disconnect the flexible hose at the slave cylinder and plug both the hose and the cylinder connection to prevent entry of dirt.

(19) Take out the four securing bolts and remove the radiator.

(20) Using suitable lifting tackle attached to the lifting brackets on the engine, tighten the lifting gear to take the weight of the engine assembly.

(21) Remove the nuts securing the front engine mountings, take out the two bolts attaching the rear engine mounting to the rear extension housing, take out the two bolts attaching the mounting bracket to the underframe and remove the rear mounting assemble.

(22) Raise the engine, tilting it upwards sharply at the front and lift it from the car through the bonnet opening.

Installation is a reversal of the removal procedure with attention to the following points:

Allow the weight of the engine to settle on the front engine mounting before tightening the mounting nuts.

Fill the gearbox with the correct grade and quantity of oil.

Ensure that there are no water leaks.

3. ROCKER ARMS AND SHAFT

TO REMOVE AND DISMANTLE

(1) Remove the air cleaner and the pipe from the air cleaner to the rocker cover.

(2) Take out the screws and lift off the rocker cover and remove the cork gasket.

(3) Unscrew the five rocker pedestal bolts, progressively loosening each bolt a few turns at a time until they are all free and lift off the rocker assembly.

(4) Remove the bolts from the rocker pedestals, starting at the rear and withdraw the rear pedestal, rocker arm spring, rocker arm, pedestal, in that order noting any spacer washers interposed between the rocker arms and the adjacent pedestal.

NOTE: Keep each component in the order of dismantling so that it can be assembled in the original position. This is important as the rocker arms are off-set with the adjusting screw end towards the adjacent pedestal.

TO ASSEMBLE AND INSTAL

(1) Check each rocker arm and the rocker shaft for wear. Check that the oil holes and passages in the rocker arms are clean and free of any sludge or scale.

(2) Position the front rocker pedestal on the front end of the shaft and insert the pedestal bolt to hold it in position.

(3) Instal a spacer washer, if fitted, followed by the front rocker arm, spring, rocker arm, washer and the second pedestal, push the pedestal along the shaft, compressing the spring until the pedestal bolt can be inserted to hold the assembly in position.

(4) Continue to reassemble the remaining components until the rear pedestal has been installed and retained in position by inserting the securing bolt.

NOTE: If the rocker shaft is correctly assembled, each rocker arm will be off-set with the adjuster screw end of the rocker towards the adjacent pedestal.

(5) Place the rocker assembly on the cylinder head and screw the securing bolts into the head until they are finger tight. Ensure that the ball end of each rocker adjusting screw is seated correctly in the socket end of its push rod.

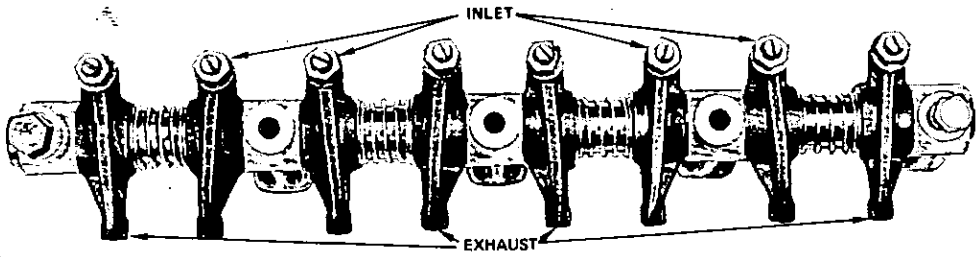
(6) Using a suitable spanner, tighten each pedestal securing bolt progressively a few turns each until the five pedestals are seating securely on the cylinder head. Use care to ensure that the centre pedestal is located correctly on the oil passage in the cylinder head.

(7) Tighten the rocker pedestal securing bolts to the specified torque.

(8) Check the rocker arm to valve stem clearance and adjust if necessary as described in TO ADJUST VALVE CLEARANCE.

(9) Using a new gasket, place the rocker cover on the cylinder head with the oil filler cap to the front, instal the six securing screws firmly, but do not over tighten or the cover flange will become distorted.

(10) Position the air cleaner on the carburettor and secure with clamp and wing nut. Using suitable pliers to expand the clips connect the pipe between the air cleaner and the rocker cover.



Rocker and Shaft Assembly. Note Offset of Rocker Screws.

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4. CYLINDER HEAD

TO REMOVE

(1) Remove the air cleaner and the pipe from the air cleaner to the rocker cover.

(2) Drain the cooling system at the two drain cocks, one on the rear of the lower radiator tank and the other on the left hand side of the engine towards the rear.

NOTE: If anti-freeze mixture is being used, drain into a clean container to be used again.

(3) Disconnect the earth cable at the battery terminal.

(4) Slacken both hose clips and remove the upper radiator hose between the radiator and the thermostat housing.

(5) Disconnect the fuel feed pipe at the carburettor and the fuel pump, release the fuel pipe from the steady clip on the front of the cylinder head and remove the pipe from the engine.

(6) Disconnect the vacuum advance pipe from the carburettor and distributor and remove from the engine.

(7) Disconnect the high tension leads at the spark plugs and coil and remove the distributor cap and leads. Remove the spark plugs from the cylinder head.

(8) Disconnect the temperature gauge wire at the connection on the front of the cylinder head.

(9) Take out the six securing screws and remove the rocker cover and gasket from the cylinder head.

(10) Progressively loosen the rocker pedestal securing bolts a few turns at a time until they can be fully unscrewed with the fingers. Do not remove the bolts from the pedestals and shaft as they will serve to retain the rocker components on the shaft. Remove the rocker and shaft assembly from the cylinder head.

(11) Withdraw the push rods, keeping them in order of removal to ensure installation in the original positions.

(12) Remove the nuts and washers and remove the inlet and exhaust manifold assembly. Remove and discard the manifold gasket.

(13) Unscrew and remove the cylinder head bolts in the reverse order of tightening (see illustration). Note that the cylinder head bolt removed from the centre hole on the right hand side is marked with a 'T' on the bolt head.

(14) Lift off the cylinder head and gasket. Discard the gasket.

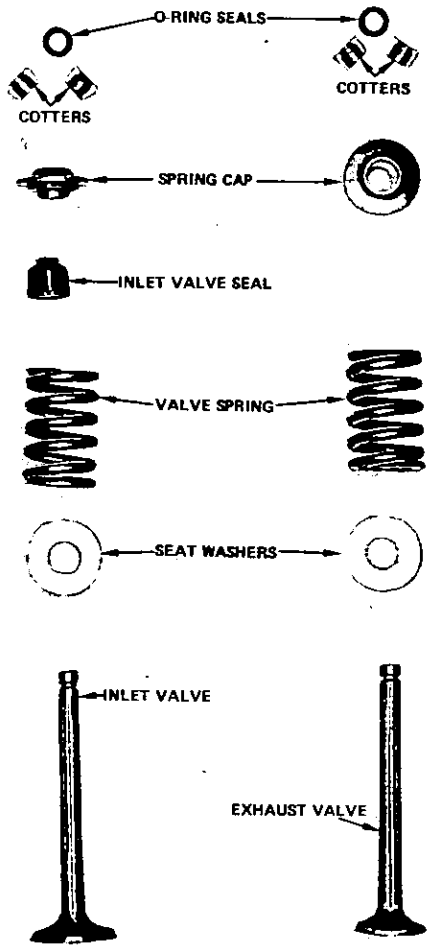
TO DISMANTLE

(1) Place the cylinder head on its edge on a bench and, using a suitable valve spring compressor, compress each valve spring in turn, remove the O-ring seal and split retaining collets.

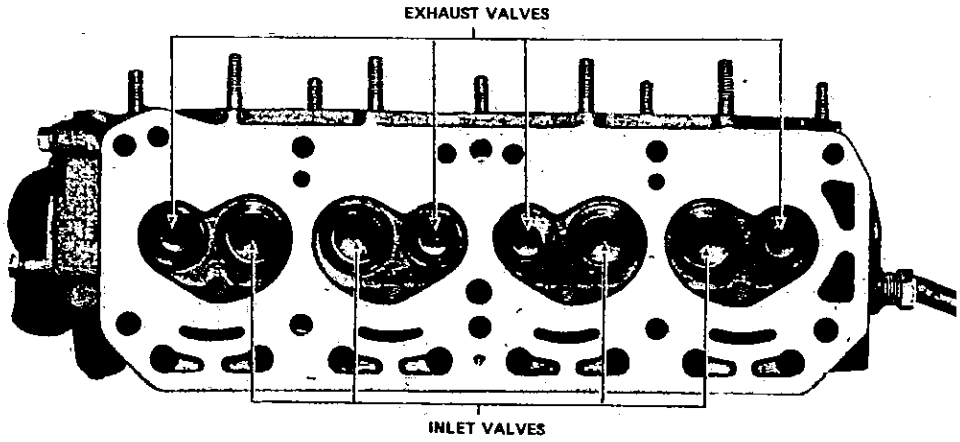
(2) Release the spring compressor and remove the valve spring retaining cap, spring and spring seat washer, if fitted.

(3) Check the end of the valves for burrs and upsetting caused by slack adjustment, and if necessary, clean up with a smooth file.

(4) Withdraw the valves, keeping them in order so that



Valve and Valve Spring Components.



Combustion Chamber Side of Cylinder Head.

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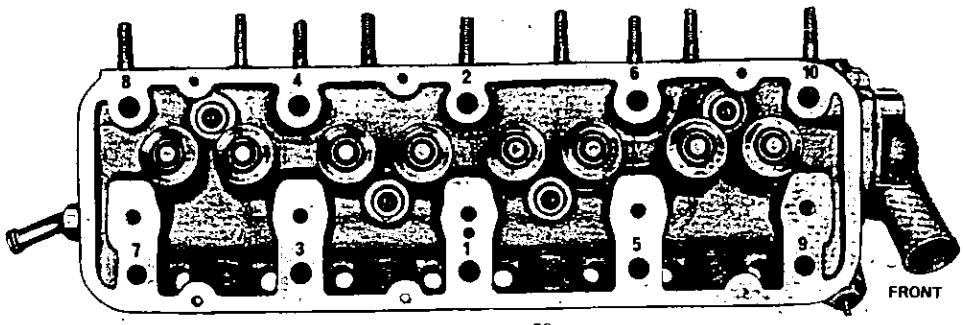

Sequence for Tightening Cylinder Head Bolts, Loosen in Reverse Order.

they can be reassembled in the original positions.

(5) Pull the shroud type neoprene seal off the end of the inlet valve guide and discard if they have been in service for a considerable time. Note that the shroud type seal is retained on the end of the guide by a spring ring.

TO CHECK AND INSPECT

(1) Clean the valves thoroughly of carbon deposit and discard any valve that is cracked or burnt.

(2) Reface each valve face to the recommended angle as shown in the specifications and each valve stem flat and true on a suitable valve refacing machine. Discard any valve that proves to be excessively bent.

If a valve head has been reduced to 0.50 mm (0.020 in) or less, after the grinding operation, then the valve concerned should be renewed.

Valve stem ends may only be reduced up to 0.50 mm (0.020 in).

(3) Measure the valve stem outer diameter and the valve guide inner diameter to calculate the actual valve stem to guide clearance. If clearance is in excess of the limit of 0.1 mm (0.004 in) then the valve guides and/or valves should be renewed.

(4) Remove the carbon deposits from the cylinder head face and the valve throats and check the conditions of the valve seats.

If necessary, recut the seats with a valve seat cutter to the recommended angle and width.

NOTE: If the seats in the head are worn or recessed excessively then new inserts will have to be installed. It is recommended that the installation of new valve inserts and/or valve guides, if necessary, be entrusted to an automotive engine reconditioner who has the necessary specialised equipment to carry out these operations.

(5) Lap the valves to the valve seats with a lapping compound. Apply a smear of Prussion blue to the valves after lapping and check the valves on their respective seats to ensure that a true and concentric seating has been gained.

(6) With a steel straight edge and feeler gauge, check the cylinder head face for warping. If the cylinder head is found to be warped in excess of the limit specified (see Specifications), then it will be necessary to have the head surface ground to bring the head back to a serviceable condition.

(7) With a valve spring tester check the valve spring tensions and lengths (see Specifications). If a valve spring tester is unavailable then the test can be made by comparing the used springs with a new spring.

Also check the valve springs for squareness.

TO RENEW VALVE GUIDES

(1) Using a suitable pilot drift, drive the worn valve guides out of the cylinder head towards the combustion chamber.

(2) Clean the area in and around the guide position in the cylinder head and wipe clean.

(3) Warm the cylinder head up to a temperature of 200°C (392°F), lightly oil the lower end of the new guide and using the shouldered drift, drive the new guide into position so that it stands proud of the valve spring seat by the specified amount. (See Specifications.)

NOTE: The internal bore of the exhaust valve guide is counter-bored at its combustion chamber end. Ensure that this end of the guide enters the cylinder head first.

(4) Check the fit of the valve in the new valve guide and, if necessary, ream the guide to the specified diameter.

(5) After the new guide has been fitted and if necessary reamed to size, reface the valve seat using a vibro-centric or suitable tool to ensure that the valve seat is true and concentric with bore axis of the valve guide. This is most important to ensure that the valve seats correctly.

TO CHECK VALVE SPRING

(1) Check the valve spring free length and length under load.

(2) Check that the springs are not bent or distorted from heat.

If a spring tester is not available, check the springs by comparison with new springs. This can be done by using a surface plate and straight edge for checking free length and by using a new spring and a used spring loaded in a vice end on end, with a plate in between. Measure from the plate to the vice jaw adjacent to both the new and used springs.

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A used spring is serviceable if it does not show collapse in excess of five percent when subjected to this comparison test.

TO ASSEMBLE

(1) Before assembling the cylinder head, ensure that all traces of emery dust or grinding paste are removed from the valve seats and ports and apply a light coating of oil to the seats and the valve guides.

(2) Oil the valve items and instal all eight valves, ensuring that each valve is installed in the position from which it was removed.

(3) On inlet valves, instal a new shroud type seal on each valve stem and secure on the valve guide upper end by fitting the spring ring.

(4) Instal a valve spring seat washer, valve spring and spring retaining cap.

(5) Using a suitable spring compressor, compress the spring and fit the split retaining collets in the recess in the end of the valve stem. Hold the collets in position and carefully release and remove the spring compressor. Ensure that the collets are correctly seated in the spring retaining cap by tapping on the end of the valve stem with the end of a hammer handle.

(6) Oil a new O-ring seal and instal it in the recess in the spring retaining cap above the split collets. Assemble the remaining valves in a similar manner.

TO INSTAL

(1) Ensure that the gasket faces of the cylinder block and the cylinder head are perfectly clean and free of any burrs or pieces of the old gasket.

(2) Place the new gasket in position on the cylinder block face and ensure that all bolt and water circulation holes register. If available, screw a guide pin into one of the hold down bolts holes at each end of the cylinder block face.

NOTE: The cylinder head gasket is marked TOP to facilitate correct assembly.

(3) Lower the cylinder head into position and instal several of the cylinder head bolts finger tight.

(4) Remove the two guide pins, if used, and instal the remainder of the cylinder head bolts finger tight.

NOTE: One of the cylinder head bolts is marked with a "T" on the bolt head. This bolt must be installed at the centre hole position on the right hand side of the engine.

(5) Using a suitable torque wrench, tighten the cylinder head bolts evenly and progressively to the specified tightening figure, (See Specifications), in the order shown in the illustration.

(6) Instal the push rods, ensuring that each is replaced in the location from which it was removed and that each rod seats correctly in its tappet.

(7) Position the rocker shaft and rocker arm assembly on the cylinder head and instal the rocker pedestal securing bolts finger tight.

(8) Tighten the rocker pedestal bolts a few turns at a time evenly and progressively to the specified torque (see Specifications).

(9) Turn the engine crankshaft in the direction of normal rotation until each valve tappet is exactly on the heel of its cam and adjust the clearance between the rocker arm and the valve stem. (See Specifications.) This is a starting point for valve adjustment and the clearance should be checked when the engine is at normal operating temperature.

(10) Refit the inlet and exhaust manifolds using a new manifold gasket and temporarily fit the rocker cover and gasket.

(11) Connect the fuel delivery pipe between the carburettor and the fuel pump and the vacuum advance pipe between the distributor and the carburettor.

(12) Clean, adjust and instal the spark plugs, fit the distributor cap and connect the high tension leads to the spark plugs and the ignition coil.

(13) Connect the wire to the temperature gauge sender unit on the front of the cylinder head.

(14) Instal the upper radiator hose and secure with the two hose clips.

(15) Fill the cooling system with clean water, if necessary, using the water and anti-freeze mixture drained from the engine previously.

(16) Connect the earth lead to the battery terminal, start the engine and bring it to normal operating temperature, switch off the engine, remove the rocker cover and check and if necessary, adjust the rocker to valve stem clearance (see Specifications).

(17) Re-instal the rocker cover and tighten the six screws securely.

(18) Instal the air cleaner and pipe from the cleaner to the rocker cover, start the engine and run to check for oil leaks.

TO ADJUST VALVE CLEARANCE

(1) Run the engine at a fast idle speed until it has attained the normal operating temperature.

(2) Remove the air cleaner and rocker cover.

(3) Turn the crankshaft in the normal direction of rotation until No. 1 cylinder is at tdc on the compression stroke and adjust both rocker arms to give the specified rocker to valve stem clearance.

(4) Using the same procedure for the remaining three cylinders, adjust the other six rockers.

(5) To check the adjustment, turn the crankshaft until one valve is fully open, then turn a further one complete turn and check the clearance for this valve. Check the remaining valves in the same manner.

(6) Refit the rocker cover and air cleaner.

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5. ENGINE SUMP

TO REMOVE AND INSTAL

(1) With the engine removed from the vehicle, remove the drain plug and drain the oil into a suitable container. Replace and tighten the plug.

(2) Progressively loosen and remove all the bolts and spring washers securing the sump to the crankcase.

(3) Remove the sump, lifting it clear of the oil intake strainer. Remove the side gasket and the end seals around the rear bearing cap and the lower edge of the timing cover and discard.

(4) Clean the sump thoroughly, ensuring that all traces of the old gasket are removed.

(5) Clean the gasket face of the crankcase and the end seals, ensuring that all traces of the old gasket are removed.

(6) Using a small quantity of suitable sealing compound, position a new gasket on the crankcase face of the cylinder block.

NOTE: With new cork gaskets that appear to be too small or have shrunk, a few minutes immersed in water will restore them to their normal length.

(7) Place the end seals in position and ensure that the ends of the seals mate with the ends of the side gasket to form an oil tight joint.

(8) Carefully place the sump in position on the gaskets and instal two or three sump retaining bolts to hold it in position.

(9) Instal the remainder of the bolts and tighten finger tight.

(10) Using a suitable socket wrench, tighten the bolts, evenly and progressively a few turns each, to pull the sump up firmly against the gasket. Do not over-tighten the bolts or the flange on the sump will be distorted. Ensure that the drain plug is tight before filling with oil.

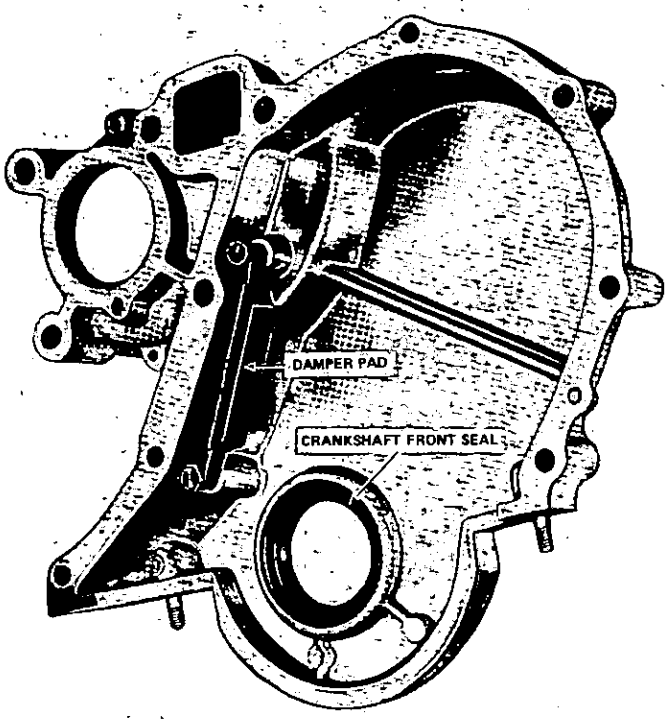
6. TIMING CHAIN AND COVER

TO REMOVE

(1) With the engine removed from the vehicle, remove the water pump and fan assembly.

(2) Take out the retaining bolt and washer and withdraw the crankshaft pulley.

(3) Remove the sump drain plug, drain the oil into a suitable container and remove the sump.



Timing Cover showing Timing Chain Damper Pad.

(4) Remove the remaining bolts and washers and withdraw the timing chain cover from the front of the engine: Remove the oil slinger, if fitted, from the front end of the crankshaft.

(5) Unscrew the two bolts securing the chain tensioner to the front of the cylinder block and remove the chain tensioner.

NOTE: Use care when removing the tensioner as the pad and stem will be forced out of the tensioner body by the spring, when the bolts are moved.

(6) Rotate the crankshaft until the sprocket key is at 4 o'clock and the timing mark on the crankshaft sprocket is adjacent to the marked link plate on the chain. The other marked link plate on the chain will be at approximately 12.15 o'clock and adjacent to the timing mark (dimple) on the camshaft sprocket.

(7) Remove the camshaft sprocket retaining bolt and washers, and using a suitable lever, prise the sprocket off the camshaft from the top and remove the sprocket and chain, disengaging the chain from around the crankshaft sprocket.

TO INSTAL

(1) Clean all components and remove all traces of the old gasket from the timing cover, water pump body and sump.

(2) Check and if necessary, rotate the camshaft until the sprocket locating dowel is at the 4 o'clock position in relation to the centre of the camshaft.

(3) Check and if necessary, rotate the crankshaft until the sprocket drive key in the shaft is at 4 o'clock position

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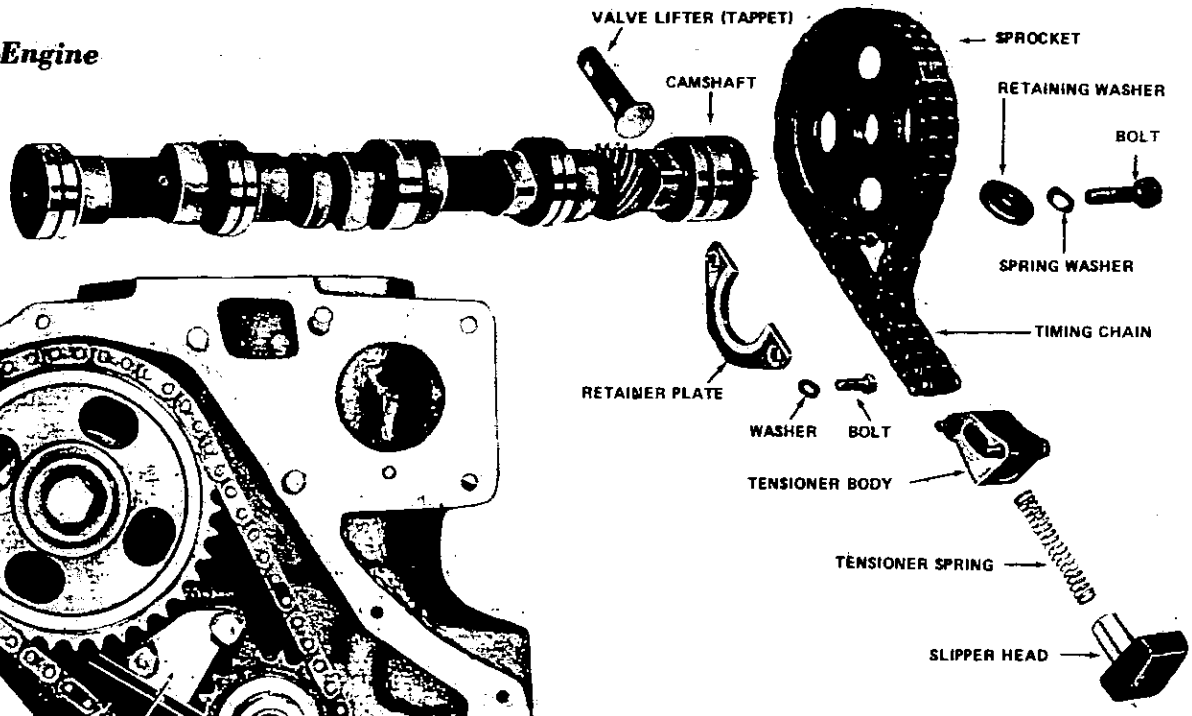
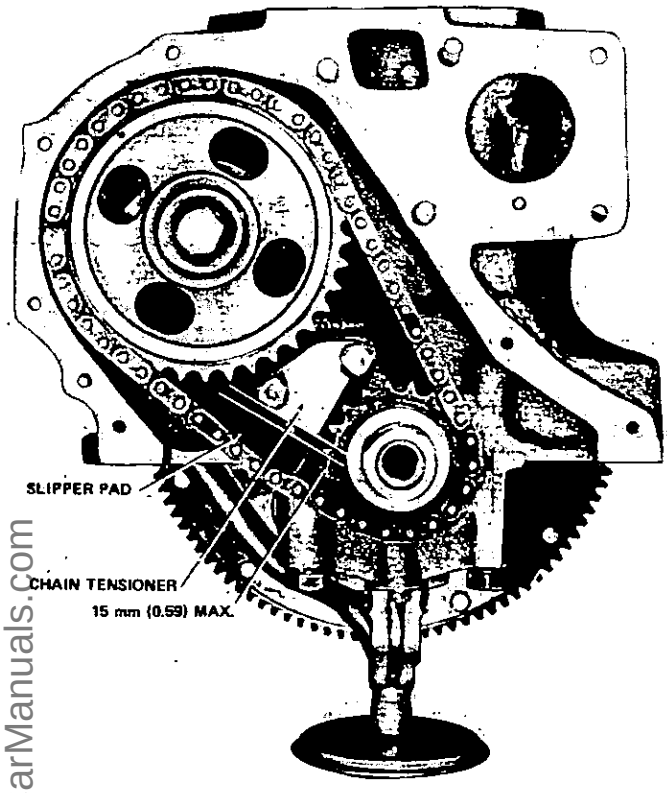


Camshaft and Timing Chain Components.



Showing Wear Limit for Timing Chain Stretch and Tensioner Pad Wear.

in relation to the centre of the crankshaft.

(4) With the camshaft and crankshaft positioned as in (2) and (3) above, a line drawn through the centre of each shaft will also pass through the centre of the camshaft dowel and the crankshaft key.

(5) Lay the camshaft sprocket flat on a bench with the timing mark (dimple) to the top and facing up. The locating dowel hole will be at 4 o'clock.

(6) Loop the timing chain on the camshaft sprocket so that one of the two marked link plates of the chain engages the sprocket adjacent to the sprocket timing mark (dimple). The second marked chain link plate must be to the right on the short chain run.

NOTE: The timing chain, link plate marks (circles) are ten plates apart on the shortest chain run. This includes the marked plates.

(7) Grasp the camshaft sprocket, engaged in the chain and position it on the camshaft, looping the chain around the crankshaft sprocket so that the second mark (circle) on the chain link is adjacent to the timing mark (dimple) on the crankshaft sprocket (see illustration).

(8) Push the camshaft sprocket on to fully engage the locating dowel, instal the securing bolt and washers and tighten to the specified torque (see Specifications).

(9) Check that both sprocket and chain timing marks register for correct valve timing.

(10) Instal the chain tensioner on the front face of the cylinder block, ensuring that the long end of the slipper pad is to the camshaft sprocket.

(11) Check that the side tensioner pad in the timing cover is serviceable and renew if excessively worn.

(12) Instal a new oil seal in the timing cover with the lipped face of the seal towards the timing sprocket. Instal the oil slinger, if fitted, with the concave face towards the crankshaft pulley.

(13) Further installation is a reversal of the removal procedure with attention to the following.

Fit new gaskets where necessary.

Do not over-tighten the sump retaining bolts.

7. CAMSHAFT AND TAPPETS

TO REMOVE

(1) With the engine removed from the vehicle, remove the water pump and fan assembly and take off the rocker cover.

(2) Evenly and progressively loosen the rocker pedestal securing bolts and remove the rocker arm and shaft assembly.

(3) Take out the retaining bolt and withdraw the crankshaft pulley.

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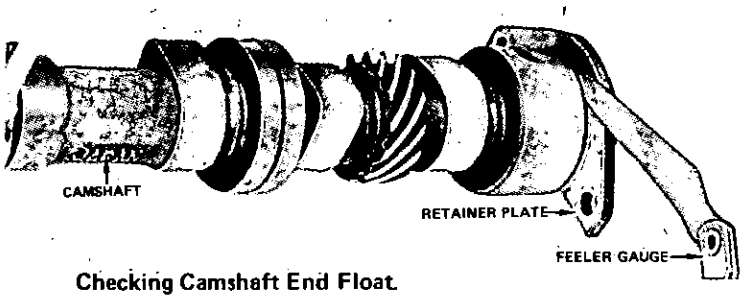


Checking Camshaft End Float.

(4) Drain the engine oil and remove the sump.

(5) Take out the remaining bolts and withdraw the timing chain cover from the front of the engine. Remove the oil slinger from the front end of the crankshaft.

(6) Unscrew the two bolts securing the chain tensioner to the front of the cylinder block and remove the chain tensioner.

NOTE: Use care when removing the tensioner as the pad and stem will be forced out of the tensioner body by the spring when the bolts are removed.

(7) Remove the camshaft sprocket retaining bolt and washers, and using a suitable lever, prise the sprocket off the camshaft from the top and remove the sprocket and chain, disengaging the chain from around the crankshaft sprocket.

(8) Turn the engine so that the crankshaft is uppermost and press each tappet down well clear of the camshaft.

(9) Disconnect the fuel delivery pipe at the fuel pump, take out the two bolts and remove the fuel pump from the right hand side of the engine.

(10) Remove the distributor cap and high tension leads, disconnect the vacuum pipe at the vacuum advance unit.

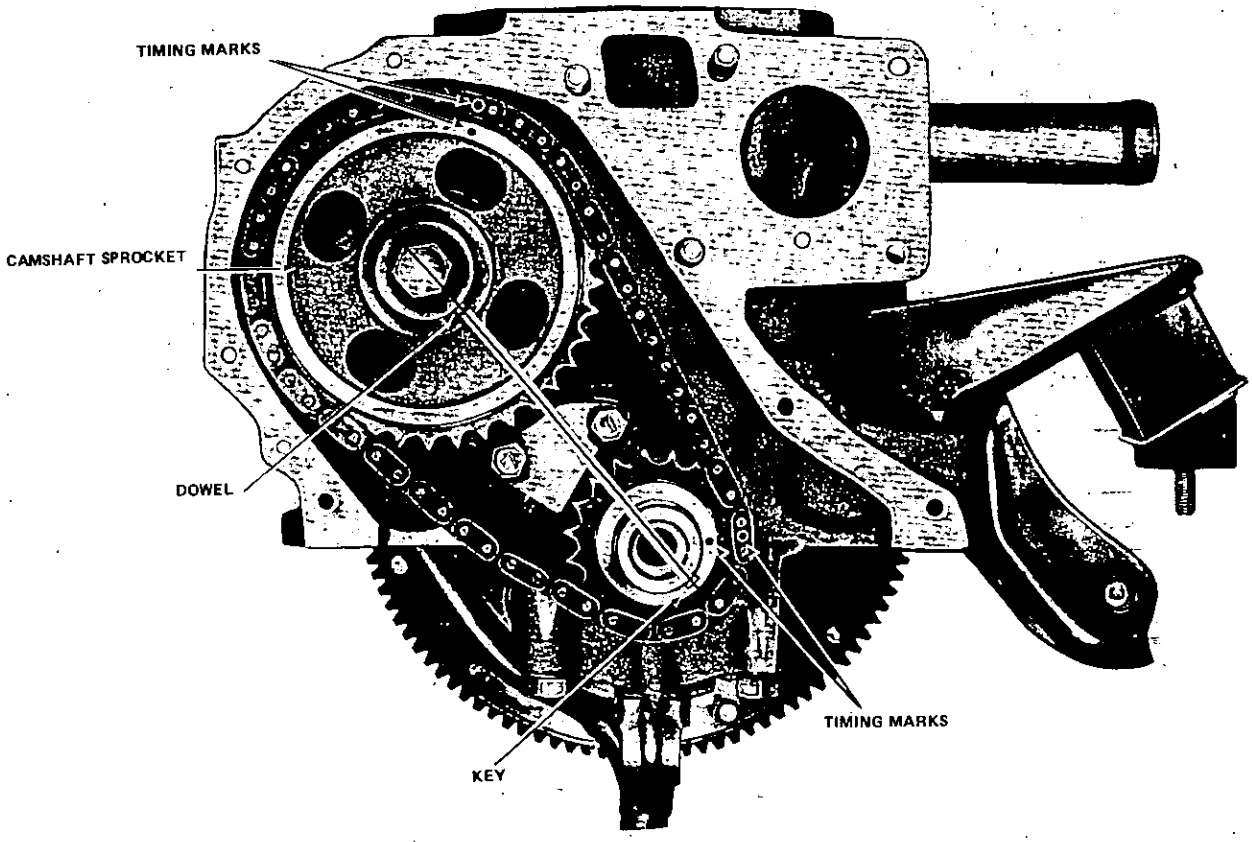
(11) Unscrew and remove the two bolts from the distributor retaining plate and withdraw the distributor from the cylinder block.

(12) Remove the oil pump and filter as an assembly by unscrewing the three bolts and withdrawing the assembly from the crankcase.

(13) Remove the two retaining bolts and washers and slide the camshaft retaining plate clear of the groove in the camshaft and remove the plate.

(14) Withdraw the camshaft from the cylinder block, using care not to damage the camshaft bearings with the sharp sides of the cams. Remove the tappets keeping them in their correct order for reassembly.

(15) Check the camshaft bearings and if worn to excess, using a special screw press, remove the worn bearings and press new bearings into position. Line bore the new bearing to the correct size and fit a new expansion plug, using a small quantity of sealing compound, in the end of the rear camshaft bearing bore.



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TO INSTAL

(1) Check that the bearings are clean and if new bearings have been installed, check that the oil holes register with the oil passages in the block casing.

(2) Blow out all oil ways to remove any dirt or metal cuttings. Apply engine oil to the tappets and fit them in their correct positions.

(3) Apply engine oil to the bearing bores and the camshaft journals and insert the camshaft into position, taking care not to damage the bearings with the edges of the cams.

(4) Check the camshaft retaining plate for wear and if serviceable, apply a coating of oil and position it in the groove in the camshaft, line up the holes and instal the two securing bolts and tighten firmly. If a small lubrication hole is present in the camshaft retaining plate, it should be to the right of the engine when the plate is correctly installed.

(5) Rotate the camshaft until the sprocket locating dowel is at the 4 o'clock position in relation to the centre of the camshaft.

(6) Rotate the crankshaft until the sprocket drive key in the shaft is at 4 o'clock position in relation to the centre of the crankshaft.

(7) With the camshaft and crankshaft positioned as in (5) and (6) above, a line drawn through the centre of each shaft will also pass through the centres of the camshaft dowel and the crankshaft key.

(8) Lay the camshaft sprocket flat on a bench; with the timing mark (dimple) to the top and facing up. The locating dowel hole will be at 4 o'clock.

(9) Loop the timing chain on the camshaft sprocket so that one of the two marked link plates engages the sprocket adjacent to the sprocket timing mark (dimple). The second marked link plate must be to the right on the short chain run.

NOTE: The timing chain link plate marks (circles) are ten plates apart on the shortest chain run. This includes the marked plates.

(10) Grasp the camshaft sprocket, engaged in the chain and position it on the camshaft, looping the chain around the crankshaft sprocket so that the second mark on the chain link (circle) is adjacent to the timing mark (dimple) on the crankshaft sprocket. (See illustration.)

(11) Push the camshaft sprocket on to fully engage the locating dowel, instal the securing bolt and washers and tighten to the specified torque (see Specifications).

(12) Check that both sprocket and chain timing marks register for correct valve timing.

(13) Instal the chain tensioner, ensuring that the long end of the slipper pad is to the camshaft sprocket.

(14) Check the side tensioner in the timing cover is serviceable and renew if excessively worn.

(15) Instal a new oil seal in the timing cover with the lipped face of the seal towards the timing sprocket. Instal the oil slinger, if fitted, with the concave face towards the crankshaft pulley.

(16) Further installation is a reversal of the removal procedure with attention to the following.

Fit new gaskets where necessary.

Instal the distributor and time the ignition as described in DISTRIBUTOR – ELECTRICAL SYSTEM.

Ensure that the push rods are installed in the positions from which they were removed and adjust the valve clearance after the engine has been brought to operating temperature.

8. PISTONS AND CONNECTING RODS

TO REMOVE AND DISMANTLE

(1) With the engine removed from the vehicle, drain the engine oil and remove the sump.

(2) Remove the cylinder head as previously described.

(3) Turn the crankshaft until two of the pistons are at the top of the cylinder bores. The two other connecting rods will be at the lowest points in the engine.

(4) Check that the big end bearing caps and connecting rods are numbered with the number of the corresponding cylinder bore and note the side of the engine adjacent to the numbers.

(5) Release and remove the big end bearing nuts on one of the connecting rods and withdraw the big end bearing cap and lower half shell bearing.

NOTE: If the piston rings are to be renewed, it is good policy to remove any ridge around the upper end of the cylinder bore, using a suitable ridge removing tool before removing the piston and connecting rod assemblies from the cylinder bores. This will prevent the metal shavings from getting into the crankcase area of the engine.

(6) Push the connecting rod and piston up the bore of the cylinder and remove from the top of the engine. Remove the other piston and connecting rod assemblies in a like manner.

(7) Replace the big end bearing shells and cap in each assembly as it is removed and instal the retaining nuts.

(8) If new piston rings are being installed, remove the old piston rings from the pistons, using care not to damage the piston skirt or ring lands.

(9) Clean all carbon deposits from the bottoms of the ring grooves, taking care not to damage the sides of the lands or base of the grooves. A broken piston ring of the correct section width, used carefully, makes a satisfactory scraper.

(10) Remove the carbon deposits from the piston crown using care not to score the top of the piston.

(11) Do not press the gudgeon pin out of the piston

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and small end of the connecting rod, unless one or other of the components are to be renewed.

NOTE: The gudgeon pin is an interference fit in the small end of the connecting rod and this is the sole means of retaining the assembly together. The gudgeon pin is a thumb push fit in the piston at normal room temperature.

TO FIT NEW PISTON RINGS

(1) Wipe the cylinder bores clean and ensure that there are no traces of carbon or other foreign matter present.

(2) Place a new piston ring in the bore of the cylinder, and using the piston inverted, push the piston ring down to a relatively unworn part of the cylinder bore.

(3) Using a feeler gauge of the correct thickness, check the gap. If necessary, adjust the gap by filing to increase the gap width. If the gap is too wide select another ring from the set. If the rings are a matched set, adjustment will not be necessary.

(4) Treat all piston rings in the same manner and ensure that the ring side clearance in the piston groove is within the specified limits and that the rings are installed on the piston for the cylinder to which the rings have been fitted.

NOTE: Use a ring expanding tool to fit the rings on the pistons. Fit the rings from the top of the piston, never over the skirt.

(5) Lubricate the piston and ring assemblies with engine oil before fitting in the cylinder bores.

(6) If the compression rings are taper faced, they will be marked Top and this mark must be uppermost when the rings are installed on the pistons.

TO REASSEMBLE AND INSTAL

(1) With the rings fitted to the pistons and the piston and connecting rod assembly adequately lubricated with clean engine oil, arrange the piston rings so that the top ring gap will be to the side of the piston directly away from the exhaust valve position.

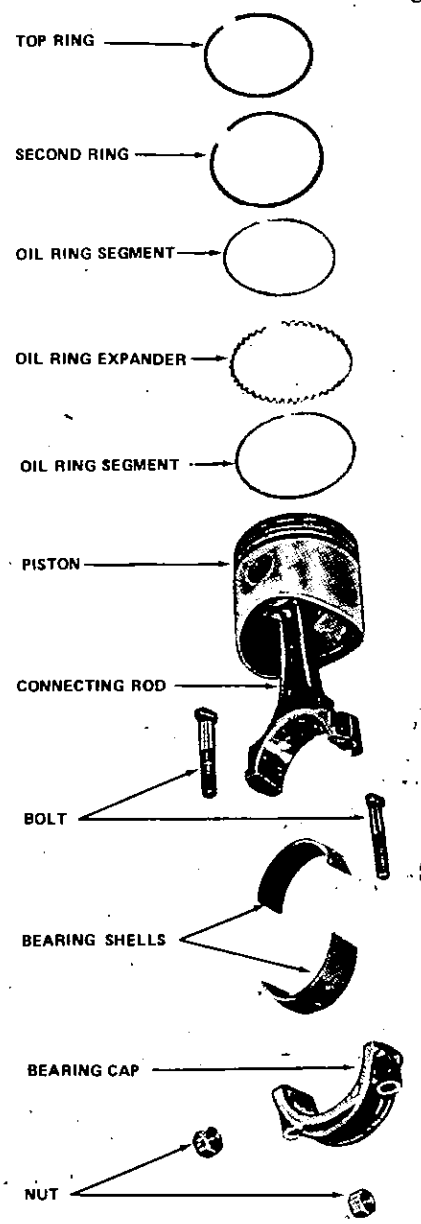
(2) Fit the second compression ring with the gap at 180° to the top ring gap.

(3) Fit the oil ring spacer with the gap to the right side of the engine, and the upper and lower oil ring segments with their gaps 120° either side of the spacer gap.

(4) Insert the connecting rod into the cylinder bore from which the assembly was originally removed, and, using a suitable ring compressor to compress the rings, tap the assembly into the bore using a clean hammer handle, until the ring compressor is free. The size code number and the letter F if shown, should be to the front.

(5) Oil the upper half of the big end bearing shell and ensure that it is correctly seated in the connecting rod, with tang of the bearing shell locating with the recess in the rod.

(6) Pull the connecting rod and piston assembly down



Piston and Connecting Rod Components.

the bore until the big end of the connecting rod engages squarely with the crankpin.

(7) Oil the lower half bearing shell and bearing cap and fit it to the connecting rod. Instal the big end nuts finger tight.

NOTE: Ensure that the number of the bearing cap is adjacent to the number on the connecting rod and that the squirt hole in the big end of the connecting rod is to the right hand side of the engine.

(8) Instal the other piston and connecting rod assemblies using the same procedure.

(9) Tighten the big end bearing nuts to the specified torque. (See Specifications.)

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9. CYLINDER BORES AND PISTONS

TO CHECK CYLINDER BORES

NOTE: To accurately check cylinder bore condition and wear it is essential that all pistons and connecting rod assemblies be removed from the cylinder block, also that accurate measuring equipment be available to determine the actual cylinder bore overall wear, including taper and ovality. The cylinder bores should be wiped thoroughly clean with a clean rag before checking.

(1) Visually check the bores for cracks, flaws, scuffing or scoring.

(2) Check each cylinder bore for wear, including taper and ovality.

(3) Cylinder bores that, upon checking, prove to be unserviceable should be rebored and honed to the smallest immediate oversize and new oversize pistons and rings fitted.

NOTE: If it is found that the cylinders need boring, select the cylinder with the most wear to determine what oversize pistons are to be used. Bore all cylinders to that oversize. (See Specifications for available oversize pistons.)

Engines that have been bored to their extreme limit can be fitted with cylinder sleeves which are available in three sizes on outer diameters. New pistons and rings should still be fitted with sleeves.

DEGLAZING CYLINDER BORES

NOTE: Cylinder bores that are fit for further service with original pistons but require re-ringing should be deglazed with a hone.

(1) Position plenty of clean rag over the crankshaft and under each cylinder bore to keep abrasive materials from entering the crankcase area.

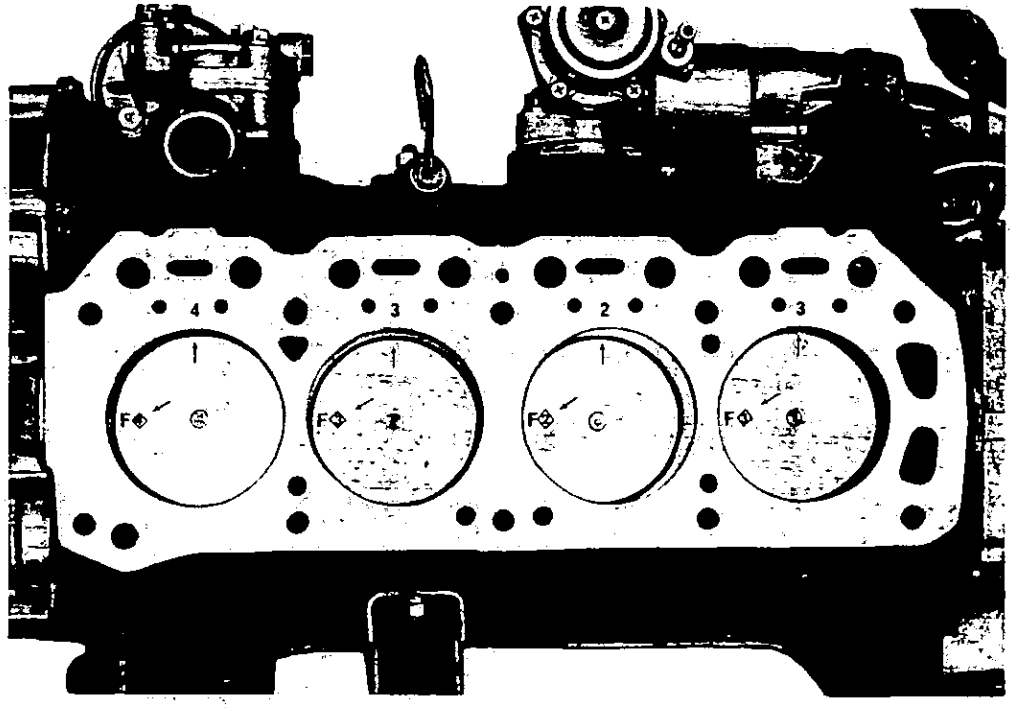
(2) De-glazing of the cylinder walls may be done by using a cylinder surfacing hone equipped with 280 grit stones.

(3) Honing should be carried out by moving the hone up and down the cylinder walls fast enough to achieve a cross hatch pattern. When hone marks intersect at 60 deg. the cross hatch angle is most satisfactory for the correct seating of piston rings.

NOTE: When deglazing, it is important that only enough strokes of the hone are made to eliminate the glazing condition of the cylinder. Excessive honing will increase bore size and thus increase piston skirt clearance.

(4) Use honing oil which is available from all major distributors. Do not use engine or transmission oil, mineral spirits or kerosene.

(5) After honing it is necessary that the cylinder block be thoroughly cleaned to remove all traces of abrasive.



Piston and Cylinder Grade Numbers Stamped on Pistons and Top of Cylinder Block.

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CAUTION: Be sure that all abrasives are removed from the engine after honing. It is recommended that a solution of soap and water be used with a brush and the affected components thoroughly dried.

The cylinder bores can be considered clean when they can be wiped clean with a white cloth and the cloth remains clean. Smear the bores with engine oil after cleaning to prevent rusting.

CHECKING PISTON SKIRT CLEARANCE

NOTE: Cylinders that have been rebored and honed to take the appropriate oversize pistons should have each piston measured and then tried in its respective bore with a feeler strip and spring scale to ensure that correct skirt clearance is obtained.

(1) Measure the outside diameter of the piston skirt at right angles to the gudgeon pin axis and 18.6 mm (0.732 in) down from the gudgeon pin centres.

The piston temperature when measuring should be approximately 20°C (68°F).

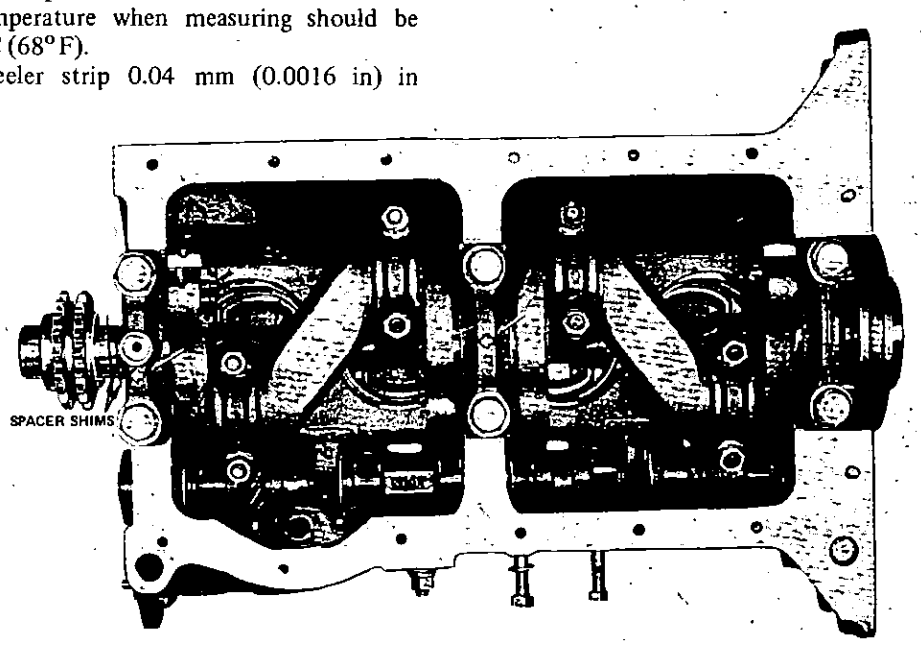
(2) Select a feeler strip 0.04 mm (0.0016 in) in thickness and approximately 12 mm (0.50 in) in width. The strip should be long enough to extend the full length of the piston.

(3) Insert the feeler strip into the cylinder bore. Invert the piston and position it into the cylinder bore so that the feeler strip is located lengthwise between the cylinder wall and the full length of the piston at 90 degrees to the gudgeon pin axis.

(4) Attach a spring scale to the top end of the feeler strip and withdraw the feeler strip in a plane parallel to the centre line of the cylinder bore, noting the reading on the spring scale.

(5) The correct spring scale reading should be within 0.2 and 1.5 kg (0.44 and 3.30 lbs). If the reading is not within these specifications then check the original measurements, of the piston and bore and also check the piston skirt for high spots. If necessary select, measure and check another piston to obtain the required fit.

(6) Follow the same procedure to fit the remaining pistons as required.



Underside of Engine with Sump Removed Showing Arrow on Front and Intermediate Main Bearings and Shims behind Crankshaft Sprocket. 1000 Series shown – 1200 has five Main Bearings.

10. CRANKSHAFT AND MAIN BEARINGS

TO REMOVE AND INSTAL

(1) With the engine removed from the vehicle remove the rocker mechanism, manifold and cylinder head as previously described.

(2) Remove the sump, timing cover, timing chain and sprockets as previously described.

(3) Remove the oil pick up tube and strainer.

(4) Release the lock plates, take out the six securing bolts and remove the flywheel, marking the flywheel position in relation to the crankshaft flange.

(5) With the engine inverted and resting on a clean bench on the cylinder block top gasket surface, release the big end bearing cap nuts and remove the caps and lower half of the bearing shells. Keep each cap and shell together for correct installation and note the number on the side of each cap.

(6) Push the connecting rod and piston assemblies

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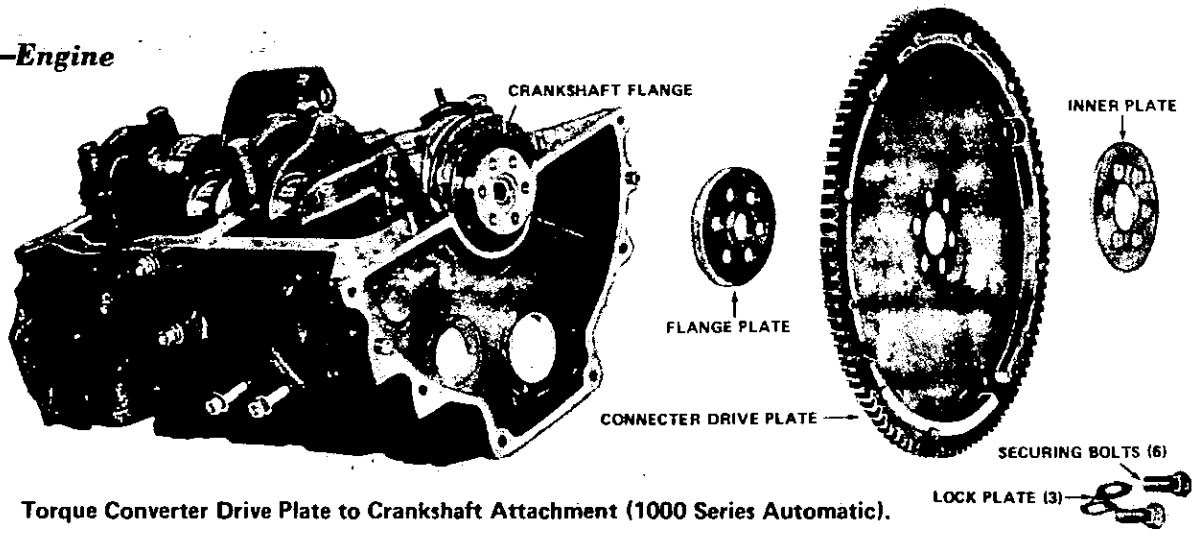

Torque Converter Drive Plate to Crankshaft Attachment (1000 Series Automatic).

down the bores towards the top of the block, well clear of the crankshaft, but do not push the pistons out through the top of the bores. Ensure that the upper half of each big end bearing shell has remained in the connecting rod and is not sticking to the crankpin.

(7) On the A10 engine, release the main bearing cap bolts and lift off the three main bearing caps and lower half bearing shells. Keep each cap and shell together for reassembly. On the A12 engine, release the main bearing cap bolts and remove the five main bearing caps and lower half bearing shells. Keep each cap and shell together for reassembly.

NOTE: Number the main bearing caps if they are not already numbered. With the exception of the rear main

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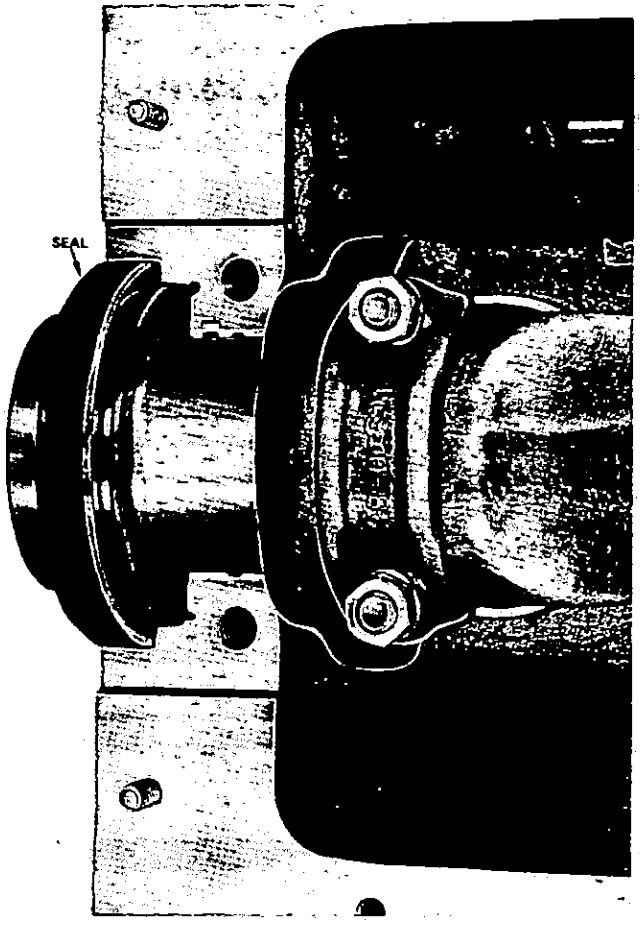
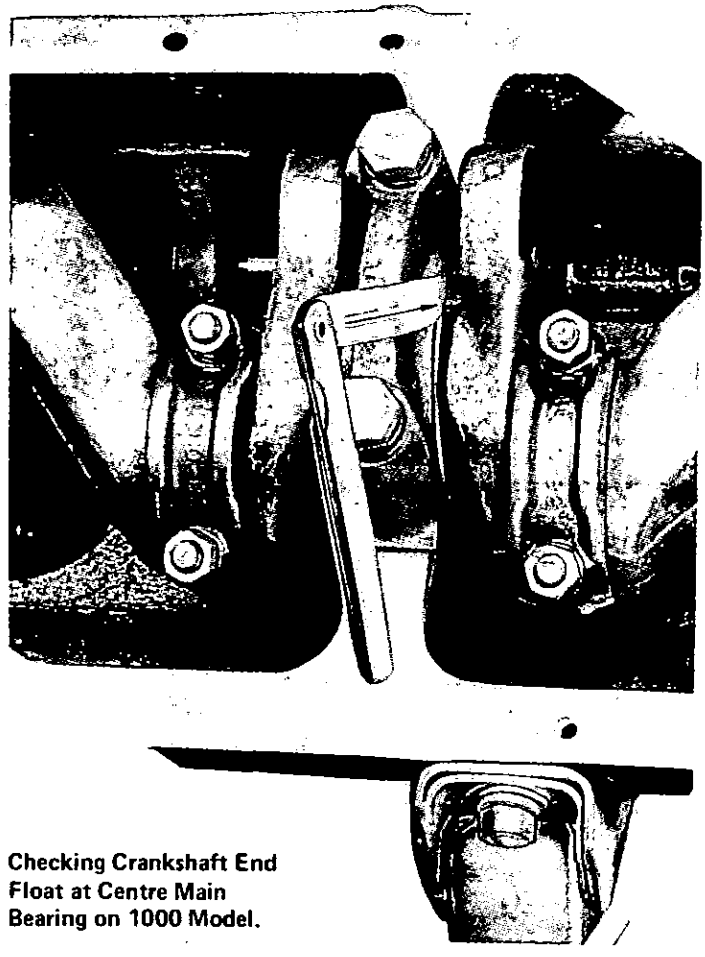


Rear Main Bearing Oil Seal with Bearing Cap Removed.



Checking Crankshaft End Float at Centre Main Bearing on 1000 Model.

bearing, there is an arrow cast in the cap of all other bearings, which must point to the front of the engine.

(8) Lift the crankshaft directly upwards and remove from the crankcase.

(9) Remove the upper half of the main bearings and keep them together in pairs with each cap for correct reassembly.

NOTE: The centre main bearing shells have a flange on each side to take crankshaft end thrust.

Installation is a reversal of the removal procedure with attention to the following points.

Journals and bearing shells should be checked for excessive wear, taper or scoring. Bearings that are unserviceable should be replaced with the appropriate undersize shells and the journal ground to fit.

One damaged journal will necessitate the grinding of all journals and fitting new undersize bearing shells; or fitting a new crankshaft and standard bearings. Ensure that the arrow on the bearing cap points to the front of the engine and the number on the cap coincides with the number on the crankcase.

Connect up the connecting rod big ends to the crankpins before tightening the main bearing bolts and then tighten one main bearing to the specified torque, followed by rotating the crankshaft one or two revolutions to check for binding.

It will be good policy to renew the rear main bearing oil seal and the seal in the timing cover. Instal new gaskets throughout.

It will be necessary to reset the valve timing on the timing chain and sprockets, check the ignition timing and adjust rocker to valve stem clearance with the engine installed and at working temperature.

11. OIL PUMP AND FILTER

TO REMOVE AND INSTAL

(1) Grasp the oil filter body firmly, turn it anti-clockwise and unscrew it off the oil pump body. If the filter is too tight to rotate by hand, a special tool is available to fit the lower end of the filter body.

(2) Take out the three securing screws and withdraw the oil pump from the right hand side of the crankcase.

Installation is a reversal of the removal procedure with attention to the following points.

Use a new gasket between the pump cover and the pump body and the body and crankcase.

Tighten the three pump securing bolts to the specified torque (see Specifications).

Instal a new filter if the original unit is not comparatively new.

Tighten the filter to the pump by hand only. Do not over-tighten or leaking may result.

Ensure that gasket faces are clean and free of any burrs.

TO DISMANTLE AND ASSEMBLE

(1) Remove the oil filter, take out the three securing bolts and withdraw the pump assembly from the crankcase. Discard the gasket.

(2) Unscrew and remove the single bolt attaching the body cover to the main body of the pump, separate the two assemblies and discard the gasket.

(3) Mark the outer end face of the pump outer trochoid rotor, and remove it by tapping the end of the main body on the bench.

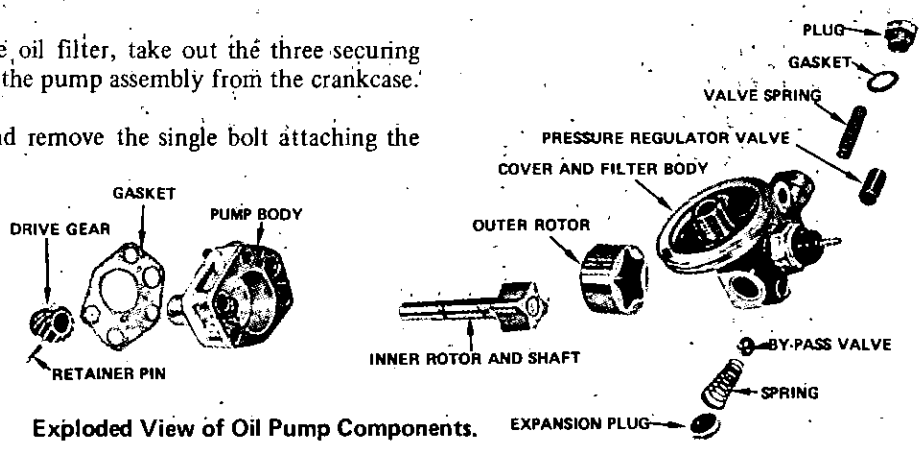
(4) Using a suitable pin punch, drive out the pin securing the pump drive gear to the shaft and tap the shaft and inner rotor out of the gear and the pump body.

NOTE: Do not remove the inner rotor from the shaft. Renew the shaft and inner rotor as an assembly if either are worn.

(5) Unscrew and remove the screwed plug and gasket and withdraw the pressure relief valve and spring. Do not lose the adjusting shim between the outer end of the spring and the screwed plug.

(6) Unscrew and remove the pressure gauge sending unit, being careful to avoid damage to the sender element.

(7) Using a sharp centre punch driven through the



Exploded View of Oil Pump Components.

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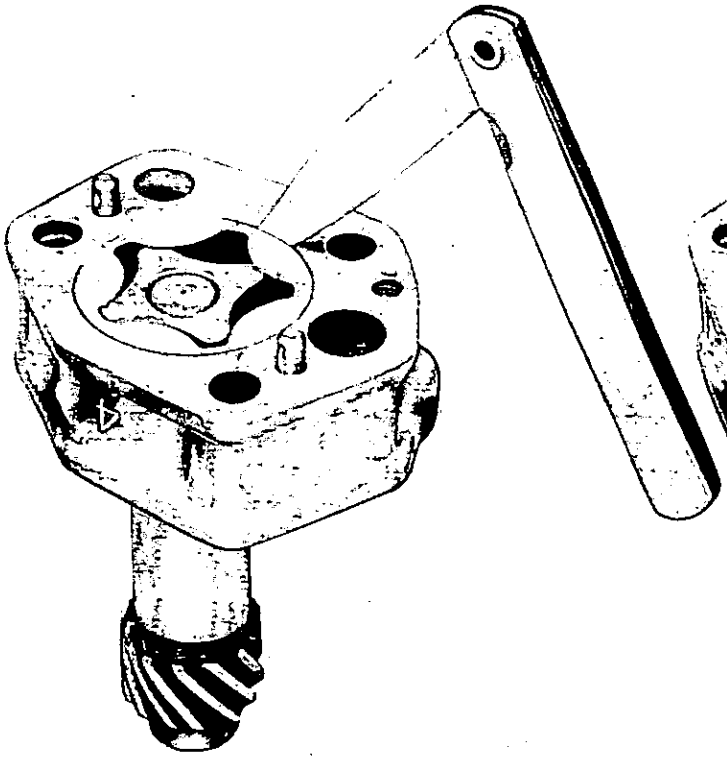
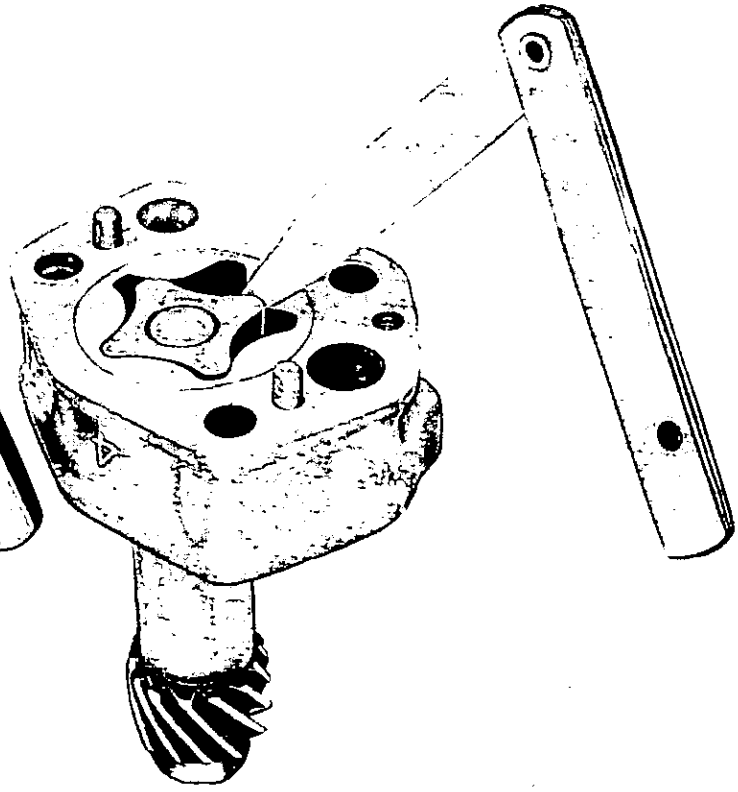


Checking Clearance Between Outer Rotor and Body.



Checking Clearance Between Inner and Outer Rotor Lobes.

expansion plug, remove the plug and withdraw the filter by-pass valve spring and ball. Discard the expansion plug.

(8) Thoroughly clean all components of the pump and remove all traces of the old gaskets from the gasket faces of the pump and crankcase.

(9) Insert the inner rotor and shaft in the pump body, fit the drive gear and temporarily fit the retaining pin.

(10) Check the end-float of the shaft and rotor in the body. This should be a minimum free fit.

(11) Apply engine oil to the outer (trochoid) rotor with the mark made on dismantling to the top and slide it into the pump body to mesh with the inner rotor.

(12) Check the clearance between the outer rotor and the pump body and also between the highest point of the inner rotor lobe to the highest point on the outer rotor lobe, using feeler gauges of the specified thickness (see Specifications). If clearance at these points is in excess of wear limits, renew the pump assembly.

(13) Using a straight edge placed across the ends of the rotors and the pump body, use a feeler gauge to measure rotor to cover end clearance (see Specifications).

(14) If end-float of the rotor shaft is excessive, remove the drive gear and instal a suitable spacer shim.

(15) Instal the drive gear and peen the retaining pin.

(16) Apply engine oil to the inner and outer rotor and instal the outer rotor.

(17) Position a new gasket on the cover face of the pump body and locate it on the cover dowels.

(18) Place the body cover in position on the main body, to locate on the dowels and instal and tighten the small securing bolt.

(19) Place the filter by-pass valve ball in position, followed by the spring, small end first, and instal a new expansion plug. Use a small amount of sealing compound on the plug to prevent oil leaks.

(20) Insert the relief valve, plain end first, in the bore in the pump body, followed by the spring and any shims that are fitted. Place the shims in the hollow bore of the retaining plug.

(21) Instal the plug and gasket and tighten securely.

(22) Screw the pressure light sender unit into position in the cover and tighten just sufficiently to prevent any oil leaks.

(23) Using a new gasket instal the pump assembly on the crankcase and tighten the three securing bolts to the specified torque.

(24) Instal the oil filter unit on the pump cover and tighten by hand only.

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12. ENGINE MOUNTINGS

TO REMOVE AND INSTAL – FRONT

(1) Raise the front of the vehicle and support on chassis stands.

(2) Remove the bolt nuts fixing the engine mounting brackets to the front crossmember.

(3) Interpose a wooden block between the engine sump and a jack and jack up the front of the engine assembly.

(4) Remove the nuts securing each engine mounting to the engine mounting brackets and the bolts from the bracket to the crossmember.

(5) Remove both front mountings from the brackets.

Installation is a reversal of the removal procedure. Allow the full weight of the engine assembly to bear on the mountings before tightening the securing bolts and nuts.

TO REMOVE AND INSTAL – REAR

(1) Raise the front of the vehicle and support on chassis stands.

(2) Place a jack under the transmission to take the weight of the engine and transmission assembly.

(3) Remove the two transmission rear crossmember to mounting securing bolts.

(4) Remove the bolts which attach the rear transmission crossmember to the underbody and remove the crossmember.

(5) Undo the bolts connecting the rear engine mounting to the transmission extension housing and remove the mounting.

Installation is a reversal of the removal procedure.

Ensure that the mounting is centralized and that engine and transmission weight is taken on the mounting before finally tightening the mounting securing bolts.

NOTE: Engine mountings that are oil soaked should be renewed and the cause of the oil leak rectified to ensure a normal working life for the mounting concerned.

13. ENGINE FAULT DIAGNOSIS

1. **Engine will not start by normal cranking.**

Possible cause	*Remedy*
(a) Dirty or corroded distributor points.	– Clean or renew and adjust points.
(b) Carburettor flooding.	– Check needle valve and float, clean out fuel system.
(c) Moisture on high tension wires and/or inside distributor cap.	– Dry out high tension wires and cap.
(d) Dirt or water in carburettor and fuel system.	– Clean out carburettor and fuel system.
(e) Incorrectly set spark plug gaps.	– Reset spark plug gaps to specification.
(f) Faulty coil or capacitor.	– Test and renew faulty components.
(g) Faulty low or high tension wires.	– Test and renew faulty wires.
(h) Fuel vapor lock.	– Check source of vapor lock and insulate against heat.
(i) Faulty fuel pump.	– Test and overhaul fuel pump.
(j) Incorrectly set ignition timing.	– Check and retime ignition.
(k) Broken or short-circuited low tension lead to distributor points.	– Test and renew lead.

2. **Engine will not start – weak or erratic cranking.**

Possible cause	*Remedy*
(a) Weak or faulty battery.	– Recharge or renew battery.
(b) Fault in starter lead or solenoid.	– Test and renew faulty components.
(c) Faulty starter.	– Test and overhaul starter.

3. **Engine stalls.**

Possible cause	*Remedy*
(a) Idling speed set too slow.	– Readjust idling speed stop screw.
(b) Idling mixture too lean or rich.	– Readjust idling mixture screw and idling speed screw.
(c) Carburettor flooding or float-level incorrectly set.	– Check needle valve or reset float level.

(Continued next page)

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(d) Fault in coil or capacitor.	– Test and renew faulty component.
(e) Valve clearance out of adjustment.	– Adjust valve clearance.
(f) Air leak at inlet manifold or carburettor flange.	– Tighten securing bolts or renew gaskets.
(g) Carbon tracking or cracked distributor cap.	– Clean or renew cap.
(h) Weak or faulty battery and/or corroded terminals.	– Recharge or renew battery and/or clean or renew terminals.
(i) Carburettor flooding or incorrect float level setting.	– Check needle valve or reset float level.
(j) Faulty coil or capacitor.	– Test and renew faulty component.
(k) Excessive wear in distributor shaft and bushes or contact breaker cam.	– Renew worn components.
(l) Burned, warped or pitted valves.	– Carry out top overhaul on engine.

4. Engine missing at idling speed.

Possible cause	*Remedy*
(a) Dirty, defective or incorrectly set spark plugs.	– Clean or renew and set spark plugs.
(b) Burned or pitted distributor contact points.	– Clean or renew and adjust contacts.
(c) Loose or broken low or high tension wires in ignition system.	– Tighten or renew defective components.
(d) Carburettor idling mixture out of adjustment.	– Adjust idling mixture screw.
(e) Burned or cracked distributor rotor.	– Renew faulty component.
(f) Moisture on high tension wires, spark plug or distributor cap.	– Dry out high tension system and cap.

5. Engine misses on acceleration.

Possible cause	*Remedy*
(a) Distributor points dirty or incorrectly adjusted.	– Clean and readjust points.
(b) Spark plug/s dirty, faulty or gap set too wide.	– Clean or renew and reset faulty plug/s.
(c) Dirt or water in carburettor.	– Clean and blow out carburettor and fuel pump filter.
(d) Carburettor accelerator pump discharge jet blocked or pump defective.	– Clean out carburettor.
(e) Coil or capacitor faulty.	– Renew defective component.
(f) Incorrect ignition timing.	– Check and reset ignition timing.
(g) Burned, warped or pitted valves.	– Carry out top overhaul on engine.

6. Engine misses at high speed.

Possible cause	*Remedy*
(a) Distributor points dirty or incorrectly adjusted.	– Clean and readjust points.
(b) Spark plug/s dirty, faulty or gap set too wide.	– Clean or renew and reset faulty plug/s.
(c) Dirt or water in carburettor.	– Clean out carburettor and fuel pump filter.
(d) Burned or cracked distributor rotor.	– Renew faulty component.
(e) Faulty coil or capacitor.	– Renew faulty component.
(f) Dirt in carburettor power jet.	– Clean and blow out carburettor.
(g) Incorrect ignition timing.	– Check and reset ignition timing.
(h) Excessive wear in distributor, shaft or cam.	– Renew faulty components.

7. Engine lacks power.

Possible cause	*Remedy*
(a) Dirty or incorrectly set spark plugs.	– Clean and reset gap to specifications.
(b) Dirt or water in carburettor and fuel system.	– Drain and clean out fuel system and carburettor.
(c) Incorrect ignition timing.	– Check and reset ignition timing.
(d) Incorrect carburettor float level.	– Check and reset float level.
(e) Faulty fuel pump.	– Check and overhaul fuel pump.
(f) Incorrect valve clearance.	– Check and readjust valve clearance.
(g) Faulty distributor automatic advance.	– Check and rectify or renew.
(h) Restricted muffler or tail pipe.	– Check and clean as necessary.

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(i) Faulty coil or capacitor.	– Renew faulty component.
(j) Burned or cracked distributor rotor.	– Renew faulty component.
(k) Excessive wear in distributor shaft or cam.	– Renew faulty components.
(l) Incorrect valve timing.	– Check and reset as necessary.
(m) Burned, warped or pitted valves.	– Carry out top overhaul on engine.
(n) Blown cylinder head gasket.	– Renew gasket.
(o) Loss of compression.	– Carry out compression test and rectify.

8. **Noisy valve operation.**

Possible cause	*Remedy*
(a) Incorrectly adjusted clearance.	– Check and adjust to specifications.
(b) Weak or broken valve springs.	– Check and renew faulty components.
(c) Worn valve guides.	– Renew or ream and fit oversize valve.

9. **Big end bearing noise.**

Possible cause	*Remedy*
(a) Lack of adequate oil supply.	– Check oil level in sump, condition of oil pump and relief valve. Renew oil filter element.
(b) Excessive bearing clearance.	– Renew bearing shells, check and regrind journals if oval.
(c) Thin oil or crankcase dilution.	– Change to correct oil grade. Check operating conditions and cooling system thermostat.
(d) Low oil pressure.	– Check pressure relief valve and spring, oil filter by-pass valve.
(e) Misaligned big end bearings.	– Align connecting rods and renew bearings if necessary.

10. **Apparent main bearing noise.**

Possible cause	*Remedy*
(a) Loose flywheel.	– Tighten securing bolts to specified torque.
(b) Loose crankshaft pulley.	– Renew or tighten pulley.
(c) Low oil pressure.	– Check bearing to journal clearance, check condition of oil pump and pressure relief valve. Recondition as necessary.
(d) Excessive crankshaft end play.	– Renew centre main bearing thrust washers.
(e) Crankshaft journals out of round and excessive bearing to journal clearance.	– Regrind journals and fit undersize bearings.
(f) Insufficient oil supply.	– Replenish oil in sump to correct level.

11. **Excessive oil consumption.**

Possible cause	*Remedy*
(a) Oil leaks.	– Check and renew gaskets as necessary.
(b) Damaged or worn valve stem oil seals.	– Renew damaged or worn components.
(c) Excessive clearance, valve stem to valve guide.	– Renew valve guides, bushes and valves, or ream and fit oversize valves.
(d) Worn or broken rings.	– Renew rings.
(e) Rings too tight or stuck in groves.	– Renew rings and clean out ring grooves.
(f) Excessive wear in cylinders, pistons and rings.	– Recondition cylinders and renew pistons and rings.
(g) Compression rings incorrectly installed, oil rings clogged or broken.	– Renew rings.

12. **Drop in oil pressure.**

Possible cause	*Remedy*
(a) Oil level low in sump.	– Check and replenish to full mark.
(b) Thin or diluted oil.	– Change to correct oil grade and rectify source of dilution.
(c) Oil pump relief valve stuck or spring broken.	– Free valve or renew broken spring.
(d) Excessive bearing clearance.	– Renew bearing shells or recondition journals as necessary.
(e) Excessive wear of oil pump components.	– Renew or recondition oil pump.
(f) Air leak in oiling system.	– Rectify as necessary.

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COOLING SYSTEM

SPECIFICATIONS

Water pump:	
Type	Centrifugal impeller
Bearing type	Double row ball bearing and shaft assembly
Impeller to body clearance	0.5 mm (0.019 in)
Thermostat:	
Type	Wax pellet
Opening temperature	82 deg. C (180 deg. F)
Maximum valve lift	8 mm @ 95 deg. C (0.315 in @ 203 deg. F)
Radiator cap:	
Type	Pressure
Working pressure	0.9 kg/cm^2 (12.8 psi)
Radiator type	Corrugated fin
Cooling system capacity:	
With heater	4.9 litre (9 Imp pt) (10.5 US pt)
Without heater	4.2 litre (7 Imp pt) (9 US pt)
Fan belt deflection	10–15 mm (0.394 – 0.590 in)

1. DESCRIPTION

The cooling system is the thermo-syphon type with fan and water pump assistance. Two draining points are incorporated in the system, one at the lower radiator tank and the other at the left hand side of the engine assembly.

The system is also pressurised in order to raise the boiling point of the coolant within the system and so increase the efficiency of the engine.

NOTE: To avoid accidental scalding, use caution when releasing the radiator cap of an engine that is at normal operating temperature.

The fan belt and water pump are driven by a V-belt from the crankshaft pulley. This belt also drives the alternator.

The water pump is fitted with a shaft and ball bearing assembly which is pre-lubricated and requires no further lubrication in service.

The water pump seal is a spring loaded carbon thrust washer and rubber bellows assembly.

Temperature within the cooling system is controlled by a thermostat located in the cylinder head water outlet pipe housing.

A by-pass is incorporated in the system to allow limited circulation of the coolant when the thermostat is closed.

2. RADIATOR

TO REMOVE

(1) Remove the radiator cap and drain the cooling system via the tap on the lower radiator tank.

(2) Disconnect and remove the upper and lower radiator hoses.

(3) On vehicles with automatic transmission, disconnect the torque converter cooling pipes, if fitted, at the lower radiator tank, plug the pipes and unions to prevent entry of dirt.

(4) Unscrew the fixing bolts and remove the radiator grille.

(5) Remove the four radiator retaining bolts and lift out the radiator.

NOTE: When a radiator that has been in use for some time is removed from the vehicle to enable repairs to be carried out to the engine, it should not be allowed to stand empty for any length of time. The radiator should be immersed in a tank of water or otherwise kept full. Failure to observe this precaution may result in overheating when the engine is put back into service. This is caused by internal deposits in the radiator drying and flaking and so obstructing the circulation of the coolant in the system.

(6) Securely plug the water outlets in the upper and lower radiator tanks and fill the radiator assembly with clean water.

TO CHECK

(1) With the radiator removed from the vehicle, turn it upside down, and apply a hose to the lower tank outlet and reverse flush the unit.

(2) Stand the radiator upright and using a jet of water or air pressure to the rear side of the core remove any dirt

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or foreign matter that may have accumulated on the front side of the core.

(3) With the aid of a flash light make a visual check down through the radiator fill point onto the radiator tubes. If it is apparent that the tubes are severely impregnated with flakes of rust it will be necessary to have the upper and lower tanks un-sweated from the core and the tubes thoroughly cleaned. It is recommended that this operation be carried out by a radiator specialist who has the necessary specialised equipment to carry out this type of work.

TO INSTAL

(1) Position the radiator assembly in the front panel opening and instal and tighten the four securing bolts.

(2) Connect the upper and lower radiator hoses between the radiator and the engine. Use a light smear of grease between the hoses and pipes.

NOTE: Inspect all hoses before installing for cracking or perishing and renew any hose that, upon inspection, proves to be unserviceable.

(3) On vehicles fitted with automatic transmission, and where applicable, connect up the torque converter cooling pipes at the lower radiator tank.

(4) Close the radiator drain tap and instal the drain plug at the cylinder block. Fill the system with clean water and instal the pressure cap.

(5) Start the engine and check that the water level in the radiator is approximately within 12.7 mm (0.50 in) of the bottom of the filler neck.

NOTE: Use care to avoid the risk of scalding. If the engine is at operating temperature remove the radiator cap slowly to allow pressure to escape before removing the cap.

(6) With the engine running and at operating temperature, check thoroughly for water and/or transmission fluid leaks.

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3. THERMOSTAT

TO REMOVE AND INSTAL

(1) Remove the radiator pressure cap and drain the water from the cooling system via the tap on the lower radiator tank.

(2) Disconnect and remove the top radiator hose.

(3) Remove the two bolts securing the water outlet elbow to the front portion of the cylinder head.

(4) Detach the water outlet elbow and gasket and withdraw the thermostat from the recess in the cylinder head.

NOTE: A visual examination of the thermostat will often determine its serviceability and obviate the necessity for further testing. For instance, a thermostat with its valve open when removed from a cold engine is obviously faulty and should be discarded and a new unit fitted.

Installation is a reversal of the removal procedure.

Ensure that a new gasket is fitted when assembling.

Fill the cooling system with clean water to approximately 12.7 mm (0.50 in) below the radiator filler neck and check for water leaks.

TO CHECK

(1) Check that the thermostat is closed when it is cold.

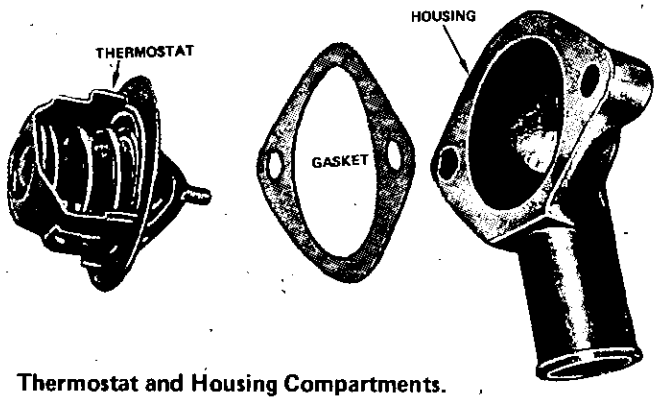
(2) Suspend and immerse the thermostat together with a reliable thermometer in a vessel of cold water, ensuring that neither the thermostat or thermometer is touching the sides or bottom of the vessel.

(3) Progressively heat the water noting the temperature reading on the thermometer as the thermostat valve commences to open.

(4) Continue heating until the valve is completely open and then measure the maximum lift of the thermostat valve.

See Specification section for maximum valve lift and valve opening temperature.

A thermostat with opening temperature and maximum valve lift not within specifications should be discarded and a new unit fitted.



Thermostat and Housing Compartments.

4. WATER PUMP

TO REMOVE

(1) Remove the radiator cap and drain the cooling system via the tap on the lower radiator tank and at the plug on the left hand side of the cylinder block.

(2) Disconnect and remove the upper and lower radiator hoses.

(3) On vehicles fitted with automatic transmission and where applicable, disconnect the torque converter cooling pipes at the lower radiator tank, plug the pipes and unions to prevent entry of dirt.

(4) Unscrew the fixing bolts and remove the radiator grille.

(5) Remove the four radiator retaining bolts and lift out the radiator.

(6) Slacken the fan belt adjusting bracket bolt and the two bolts attaching the alternator to the mounting bracket on the cylinder block.

(7) Push the alternator towards the cylinder block and remove the fan belt.

(8) Bend back the lock tabs (where applicable) and remove the four bolts securing the fan and fan pulley to the water pump and withdraw the fan and pulley.

(9) Unscrew the water pump to timing case securing bolts and detach the water pump and gasket. Discard the gasket.

Installation is a reversal of the removal procedure with attention given to the following:

Use a new gasket between the water pump and timing cover when installing the pump.

Apply a smear of jointing compound to both sides of the new gasket.

Adjust the fan belt as described under FAN BELT — TO ADJUST.

Ensure that the cooling system drain points are closed and that the system is replenished with clean water.

TO DISMANTLE

(1) Drain the cooling system and remove the water pump as previously described.

(2) Using a suitable puller, withdraw the pump pulley flange from the forward end of the shaft and bearing assembly.

(3) Remove the bearing retaining clip and press the bearing and shaft assembly, together with the seal and impeller, out of the pump body.

(4) Press the impeller off the end of the shaft and bearing assembly and withdraw the seal assembly.

(5) Remove the seal rubbing block and shaft seal from the recess in the impeller.

TO CHECK

NOTE: It is generally unnecessary to dismantle the water pump assembly unless it is leaking water past the seal, or if the ball bearing has become noisy. Once dismantled it is a good policy to instal a complete water pump kit which consists of seal assembly, bearing and shaft assembly and impeller.

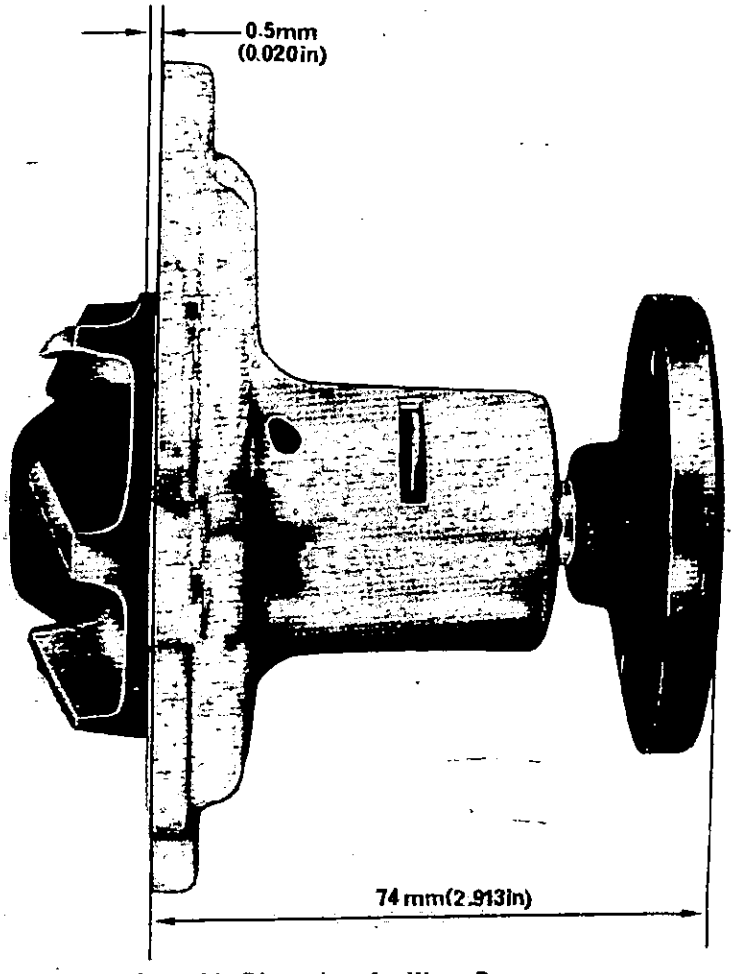
When the pump is removed from the vehicle make a visual check of the pump body. If it is apparent that the pump body is corroded or cracked then it can be assumed that the pump body is unserviceable, in which case the complete water pump assembly should be discarded and a new unit fitted.

(1) Check the pump body for corrosion, cracks or damage.

(2) Check the bearing for looseness in the pump body bore and for roughness when rotated.

(3) Check that the water by-pass hole in the pump body and timing cover are free of obstruction.

NOTE: When cleaning the pump components, do not immerse the shaft and bearing assembly in cleaning solvent, if the assembly is to be used again.



Assembly Dimensions for Water Pump.

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TO ASSEMBLE

(1) With a small amount of waterproof sealing compound applied to the large end of the new seal assembly, press the new seal assembly into position in the pump body so that the carbon face of the seal will be facing towards the pump impeller.

(2) Applying pressure to the outer portion of the bearing, press the bearing and shaft assembly into the pump body from the front side of the pump.

NOTE: Only press the bearing far enough into the pump body to align the bearing retaining clip grooves.

(3) Instal the bearing retaining clip.

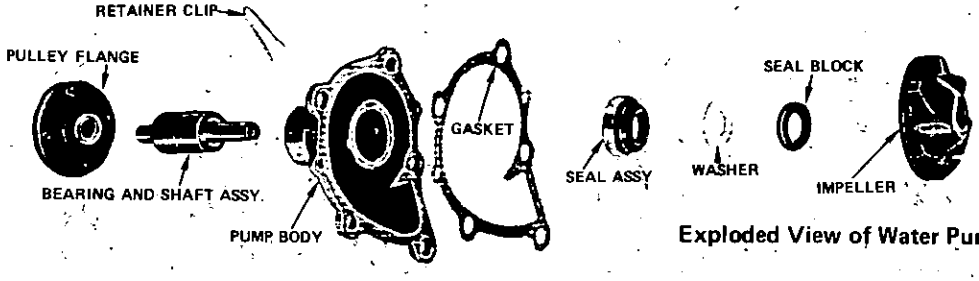
(4) Position the shaft seal and rubbing block into the recess in the impeller.

(5) Support the pump on the front end of the shaft assembly and press the impeller onto the shaft until a clearance of 0.5 mm (0.019 in) is obtained between the impeller and the pump body.

(6) Invert the pump and support it on the impeller end of the shaft.

(7) With the bossed side of the pulley flange facing towards the pump, press the flange onto the front end of the pump bearing shaft until a measurement of 74 mm (2.913 in) is obtained between the gasket face of the pump body and the outer face of the flange.

NOTE: When pressing the pulley flange onto the shaft as detailed in operation (7), ensure that the assembly is supported directly on the end of the shaft and not on the impeller, otherwise the clearance between the impeller and the rear face of the pump, as given in operation (5) may be decreased, with possible damage to the impeller and seal assembly.



Exploded View of Water Pump Components.

5. FAN BELT

TO RENEW

(1) Loosen the two alternator to mounting bracket bolts.

(2) Loosen the alternator adjusting bracket bolts.

(3) Push the alternator as far as possible towards the cylinder block assembly.

(4) Slip the old belt off the alternator pulley and then manoeuvre it off the fan and crankshaft pulleys and remove it from the engine.

(5) Manoeuvre the new belt over the crankshaft and fan pulleys and position it on the alternator.

(6) Adjust the tension on the fan belt and retighten the adjusting bracket bolts.

(7) Securely tighten the two alternator to engine bracket securing bolts.

TO ADJUST

(1) Loosen the two alternator mounting bracket bolts.

(2) Loosen the alternator adjusting bracket bolts and pull the alternator away from the cylinder block sufficiently to give the belt enough tension to prevent it slipping on the pulleys.

(3) Hold the alternator in this position and tighten the adjusting bracket and mounting bracket bolts securely.

NOTE: Do not over-tighten the fan belt. An over-tensioned fan belt will cause rapid wear in the water pump and alternator bearings.

The belt will be deemed to have sufficient tension when it can be flexed between 10 and 15 mm (0.394 and 0.590 in) with finger and thumb between the alternator and water pump pulleys.

6. HEATER UNIT

TO REMOVE AND INSTAL (1000)

(1) Raise the engine bonnet.

(2) Remove the radiator cap and drain the cooling system at the lower radiator tank and at the plug situated at the left hand side of the engine assembly.

(3) Disconnect both heater hoses from within the engine compartment and remove the hose clips.

(4) To gain access to the heater unit the radio, glove box and parcel tray (where fitted) should be removed.

(5) Disconnect the heater fan electrical wires at the harness connector which is located at the rear of the heater unit.

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(6) Detach the two demisting tubes by hand at each side of the unit.

(7) Remove the four heater assembly mounting bolts and carefully remove the heater assembly from the vehicle.

NOTE: The heater assembly is mounted to the vehicle by two bolts at the engine bulkhead and by two bolts at the dash panel.

Installation is a reversal of the removal procedure.

Ensure that the cooling system is refilled after heater unit installation.

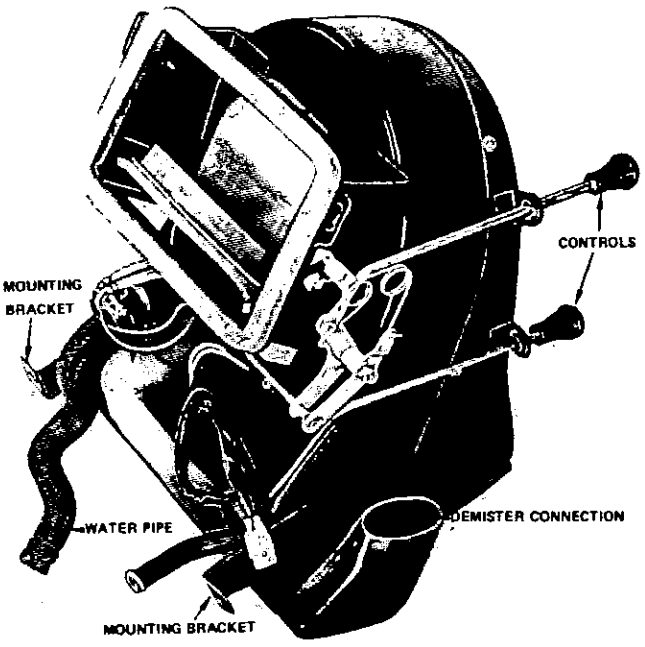
Start and run the engine until it reaches normal operating temperature and check that the heater unit is functioning correctly.

Allow the engine to cool off and check the coolant level.

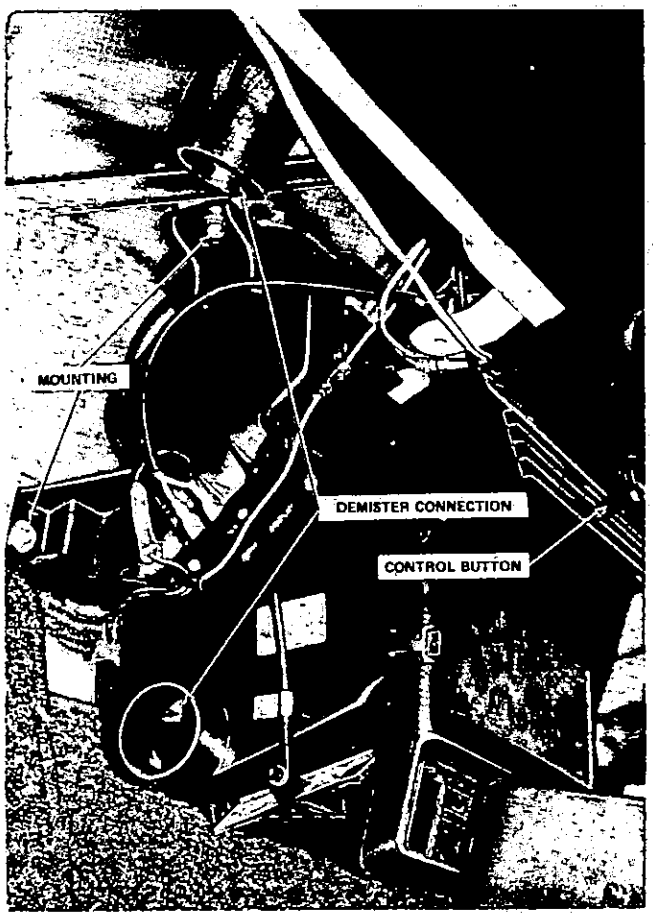
TO REMOVE AND INSTAL (1200)

(1) Raise the engine bonnet.

(2) Remove the radiator cap and drain the cooling system at the lower radiator tank and at the plug which is situated on the left hand side of the engine assembly.



Heater, Demister Assembly. 1000 Series.



Heater, Demister Assembly. 1200 Series.

(3) Disconnect both heater hoses from within the engine compartment and remove the hose clips.

(4) To gain access to the heater unit remove the parcel tray and the ash tray.

(5) Disconnect the heater control wires and rod at the heater unit.

NOTE: Before carrying out operation (5) set the upper control lever to the demisting position and the lower lever to the off position.

(6) Disconnect the heater fan electrical wires at the harness connection which is located at the rear of the heater unit.

(7) Detach the two demisting tubes by hand which are located at each side of the heater room valve.

(8) Remove the four heater assembly mounting bolts and carefully remove the heater assembly from the vehicle.

NOTE: The heater assembly is mounted to the vehicle by two bolts at the engine bulkhead and by two bolts at the dash panel stays.

Installation is a reversal of the removal procedure.

Ensure that the cooling system is refilled after heater unit installation.

Start and run the engine until it reaches normal operating temperature and check that the heater is functioning correctly. Allow the engine to cool off and check the coolant level.

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7. COOLING SYSTEM FAULT DIAGNOSIS

1. **Coolant leakage–external.**

Possible cause	*Remedy*
(a) Loose hose clips or faulty hoses.	– Tighten hose clips or renew faulty components.
(b) Leaking radiator core or tanks.	– Repair or renew radiator.
(c) Worn or damaged water pump seal assembly.	– Renew seal assembly.
(d) Worn or damaged water pump bearing assembly.	– Renew water pump bearing and shaft assembly.
(e) Loose or rusted expansion plugs.	– Renew faulty components.
(f) External crack in cylinder block or head.	– Renew faulty components.
(g) Faulty cylinder head gasket or loose holding down bolts.	– Renew gasket and correctly tighten cylinder head bolts.
(h) Leaks at thermostat cover and/or water pump joint gaskets.	– Rectify leaks.

2. **Coolant leakage–internal.**

Possible cause	*Remedy*
(a) Crack in cylinder bore wall.	– Renew cylinder block.
(b) Crack in cylinder head, combustion chambers or valve ports.	– Renew cylinder head.
(c) Cylinder head cracked and leaking into valve rocker compartment.	– Renew cylinder head.
(d) Cracked cylinder block water jacket, leaking into engine tappet compartment.	– Renew cylinder block.
(e) Cylinder head gasket leak due to warped head.	– Reface cylinder head and renew gasket.

3. **Coolant loss by overflow.**

Possible cause	*Remedy*
(a) Over-full system.	– Drain and refill to ½" below filler neck.
(b) Faulty pressurised radiator cap.	– Renew faulty cap.
(c) Blocked radiator core tubes.	– Clean or renew radiator core.
(d) Coolant foaming due to poor quality anti-freeze or corrosion inhibitor.	– Drain system and renew coolant and additive.

4. **Engine overheating.**

Possible cause	*Remedy*
(a) Obstructed air passage through radiator core from front to rear.	– Blow out obstruction from rear to front of radiator core with compressed air or water pressure.
(b) Incorrect ignition timing.	– Check and reset ignition timing.
(c) Incorrect valve timing.	– Check and reset valve timing.
(d) Low engine oil level.	– Stop engine immediately and replenish oil in sump.
(e) Engine tight after overhaul.	– Check and if satisfactory, stop engine and allow to cool out.
(f) Poor circulation.	– Check and rectify as under item (5).
(g) Loss of coolant due to overflow.	– Check and rectify as under item (3).
(h) Faulty thermostat.	– Renew thermostat.
(i) Restricted muffler or tail pipe, accompanied by loss of power.	– Remove restrictions or renew component/s.
(j) Incorrectly adjusted or dragging brakes.	– Check and rectify by adjustment or renewal of components.

5. **Coolant circulation faulty.**

Possible cause	*Remedy*
(a) Partial blockage of radiator core tubes.	– Clean out or renew radiator core.
(b) Water sludge deposits in engine water jacket.	– Clean and flush engine water jacket and add rust inhibitor to coolant.
(c) Fan belt broken or slipping.	– Renew or adjust fan belt.
(d) Faulty water pump or thermostat.	– Overhaul or renew water pump, renew thermostat.
(e) Collapsing lower radiator hose.	– Check and renew lower radiator hose and check radiator core tubes.
(f) Insufficient coolant in system.	– Replenish coolant.

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FUEL SYSTEM

SPECIFICATIONS

CARBURETTOR

Make and model:	
1000	Hitachi DCG286 – Dual barrel
1200	Hitachi DCG306 –Dual barrel
Primary throttle barrel diameter:	
1000–1200	26 mm
Secondary throttle barrel diameter:	
1000	28 mm
1200	30 mm
Primary venturi diameter:	
1000–1200	20 mm
Secondary venturi diameter:	
1000	24 mm
1200	26 mm
Primary main jet:	**Metric – 100ths mm**
1000	95
1200	98
Secondary main jet:	
1000	140
1200	135
Primary slow jet:	
1000	40
1200	43
Secondary slow jet:	
1200	50
Primary main air bleed:	
1000–1200	80
Secondary main air bleed:	
1000	120
1200	80
Primary slow air bleed:	
1000	210
1200	220
Secondary slow air bleed:	
1200	100
Power jet:	
1000–1200	60
Primary main jet with altitude compensation jetting (1000–1200):	
98–96	1000 m (3300 ft)
92	2000 m (6600 ft)
90	3000 m (10000 ft)
86	4000 m (13300 ft)
Secondary main jet with altitude compensation jetting (1000):	
140–135	1000 m (3300 ft)
135	2000 m (6600 ft)
130	3000 m (10000 ft)
125	4000 m (13300 ft)
Secondary main jet with altitude compensation jetting (1200):	
135–130	1000 m (3300 ft)
130	2000 m (6600 ft)
125	3000 m (10000 ft)
120	4000 m (13300 ft)
*Float level:	
1000	10.5 mm (0.413 in)
1200	12.0 mm (0.472 in)
†Float seat clearance:	
1000–1200	1.3–1.7 mm (0.051–0.066 in)

* Distance between carburettor top cover gasket surface and upper edge of float with float in the raised position.
† Distance between float seat and needle valve stem with float in the lowered position.

FUEL PUMP

Type	Mechanical diaphragm
Delivery pressure:	
1000	0.16 kg/cm^2 (2.28 psi)
1200	0.18 kg/cm^2 (2.56 psi)
Delivery rate:	
1000-1200	450 cc per min (0.7 Imp pt per min) (0.8 US pt per min)

AIR CLEANER

Type	Paper element

FUEL TANK

Capacity:	
Sedan	40 litre (8.81 Imp gal) (10.57 US gal)
Wagon and coupe	38 litre (8.37 Imp gal) (10.04 US gal)

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1. CARBURETTOR

The Hitachi DCG286 and DCG306 carburettors are fitted to the Datsun 1000 and 1200 engines respectively, and are almost identical in construction.

The major difference between the two carburettors is the power valve mechanism which was introduced to the 1200 version to improve high speed driving.

As both carburettors are quite similar, overhaul procedure etc. as outlined in the carburettor section will be applicable to both models, unless otherwise stated.

The carburettor is of the twin barrel type with each barrel incorporating a multiple venturi system.

The barrels provide a primary and secondary system and each barrel shares a common air horn and separate main nozzle and throttle valve.

The primary system provides suitable mixtures for low speed, moderate speed and acceleration. It also provides adequate mixtures for starting when the choke plate is closed.

The secondary bore provides mixtures for high speed and also for full throttle openings at low speed.

A high speed valve which is incorporated in the secondary system opens against a counterweighted lever to enable the secondary system to maintain full mixture for high power operation.

TO REMOVE AND INSTAL

(1) Raise the engine bonnet and fit fender covers to both front fenders.

(2) Remove the air cleaner assembly.

(3) Disconnect the fuel feed pipe.

(4) Disconnect the distributor vacuum advance pipe.

(5) Disconnect the choke control cable.

(6) Detach the throttle cable from the carburettor throttle lever.

(7) Remove the four nuts and washer securing the carburettor to the inlet manifold and withdraw the carburettor and gasket from the engine. Discard the gasket.

Installation is a reversal of the removal procedure with attention given to the following:

Use a new gasket between the carburettor and inlet manifold. If necessary, scrape the gasket surfaces clean, making sure that no foreign matter is dropped into the inlet manifold orifice.

NOTE: It is good practice to cover the inlet manifold with rag when the carburettor is removed for overhaul. Extensive engine damage may result if objects are accidentally dropped into the induction orifice.

Ensure that the choke valve is fully open when the choke control knob is in the full off position at the dash panel.

Check the carburettor for fuel and vacuum leaks and adjust the idling speed to the specified rpm after warm-up.

TO SERVICE

When overhauling the carburettor several items of importance should be observed to ensure a thorough job.

(1) All parts should be carefully cleaned in a suitable solvent and then inspected for damage or wear.

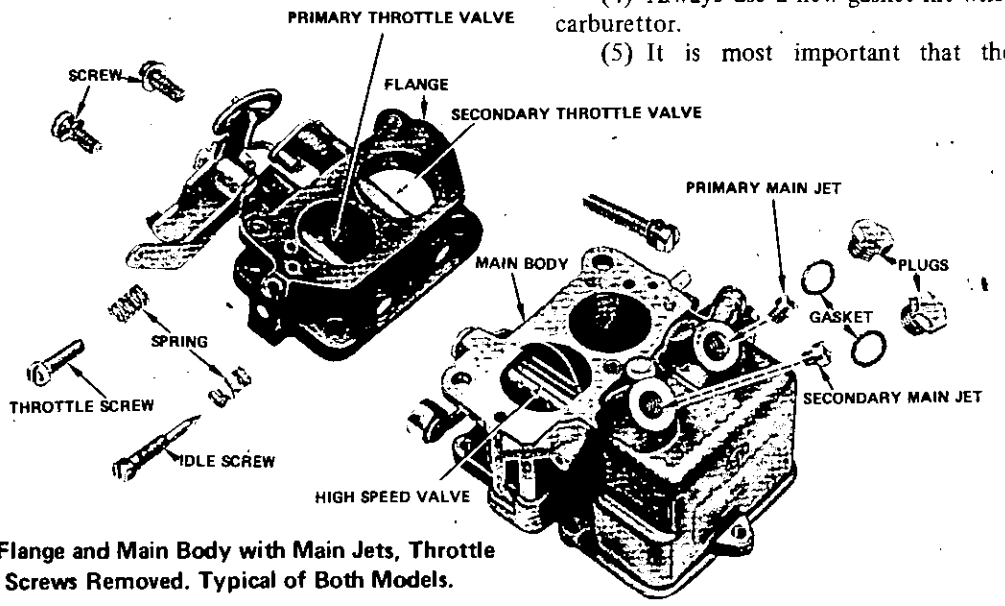
(2) Use air pressure only to clear the various orifices and channels.

(3) Replace faulty parts with new ones. When checking parts removed from the carburettor it is at times very difficult to be sure whether they are satisfactory for further service.

It is therefore recommended that in such cases new parts be installed.

(4) Always use a new gasket kit when overhauling the carburettor.

(5) It is most important that the correct fitting



Carburettor Flange and Main Body with Main Jets, Throttle and Idle Screws Removed. Typical of Both Models.

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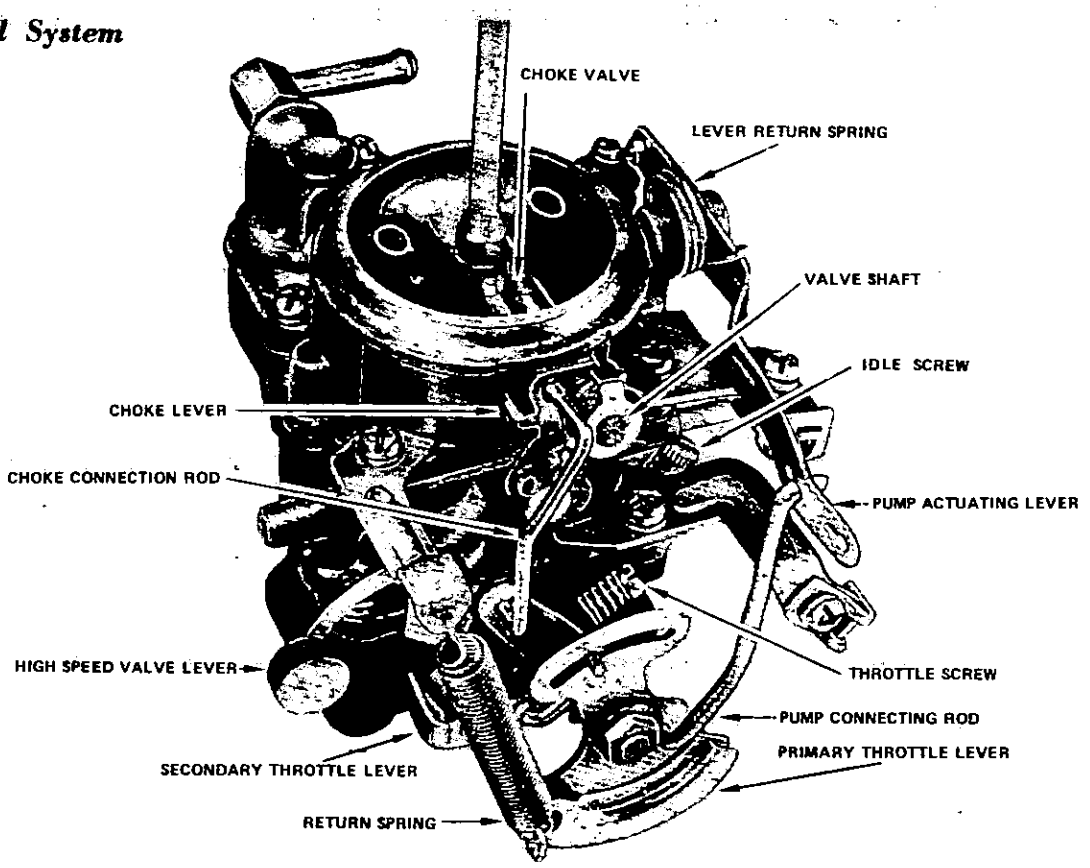


Rear View of 1200 Series Carburettor, Also Typical of 1000 Series.

screwdrivers and spanners be used when servicing the carburettor.

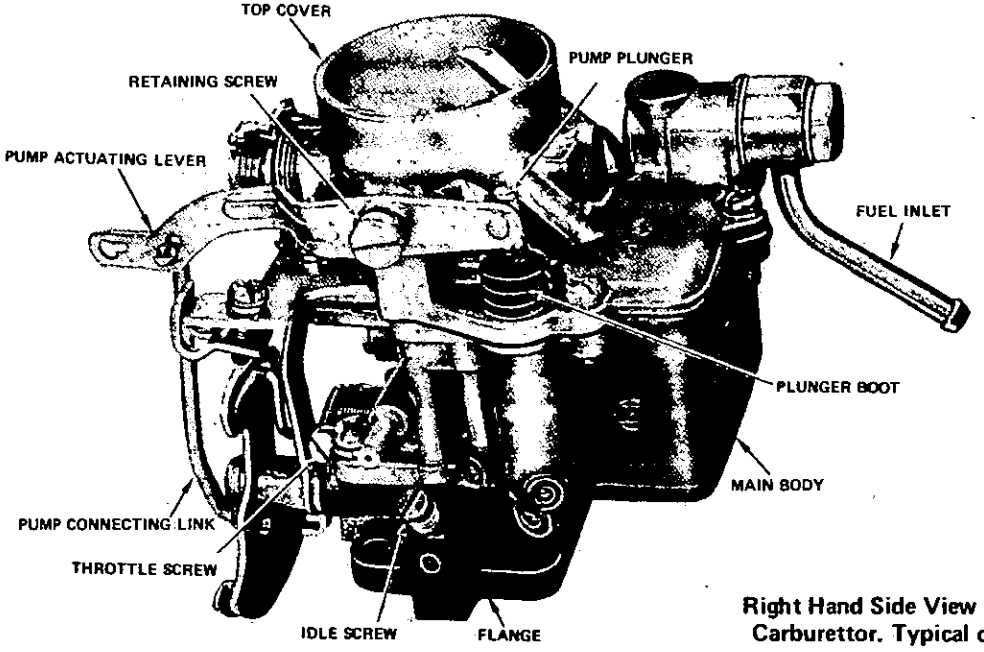
TO DISMANTLE

(1) Remove the carburettor from the engine as previously described.

(2) Disengage and remove the primary throttle return spring.

(3) Unscrew the retaining screw and detach the accelerator pump actuating lever from the top cover. On 1200 models remove the actuating lever return spring with the lever.

(4) Take out the five screws and washers and detach



Right Hand Side View of 1000 Series Carburettor. Typical of 1200 Series.

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the carburettor top cover assembly. Disconnect the choke link during this operation.

(5) Remove the three retaining screws and separate the carburettor flange from the main body.

(6) The carburettor has now been dismantled into its three major components namely main body, flange and top cover.

TO CLEAN PARTS

(1) Clean all carburettor components in petrol or cleaning solvent and place in a suitable container.

(2) If compressed air is available, blow each component clean when assembling.

NOTE: Do not clean jets with wire, drills or other mechanical means, as orifices may become enlarged causing too rich a mixture for proper performance.

(3) Clean away any carbon deposits that may have accumulated around the throttle valves.

(4) Discard all used gaskets and packings.

(5) Before assembling check all fuel passages by blowing through with compressed air.

TO SERVICE MAIN BODY

(1) Remove the primary and secondary main air bleeds.

(2) Remove the primary and secondary emulsion tubes.

(3) Remove the primary slow jet.

(4) On 1200 models only remove the secondary slow jet.

(5) Unscrew the two plugs to gain access to the main jets and then remove the primary and secondary main jets.

(6) On 1200 models, remove the power valve.

(7) Withdraw the accelerator pump plunger, invert the carburettor body and remove the plunger spring and check ball.

(8) With the carburettor body still inverted allow the accelerator pump outlet weight to become dislodged from its bore.

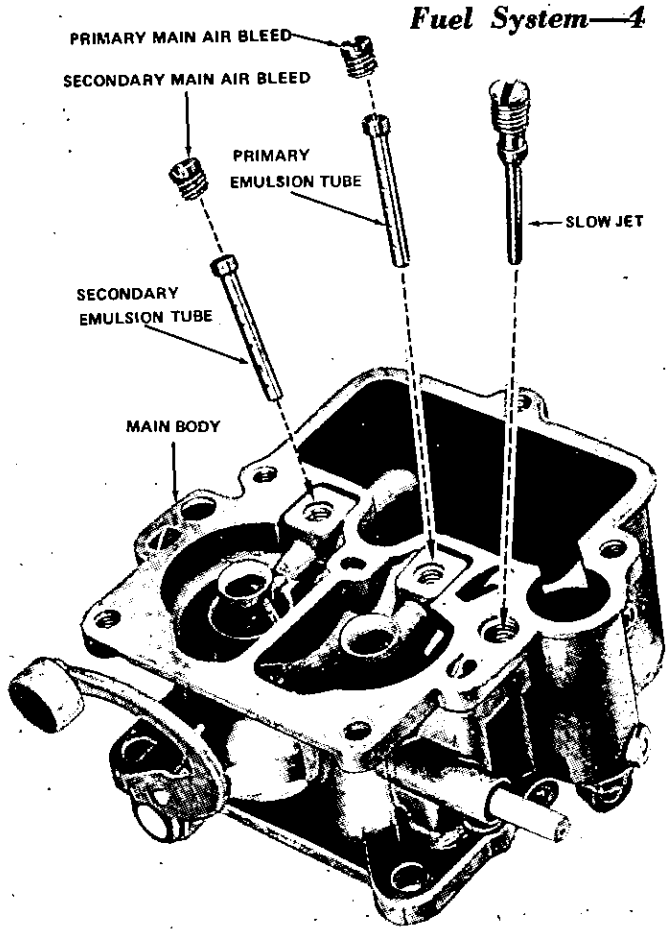
(9) Using a small file, remove the peening from the ends of the high speed valve retaining screws and mark the valve in relation to the carburettor body to facilitate correct assembly.

(10) With a suitable screwdriver remove the two high speed valve retaining screws and withdraw the high speed valve.

(11) Remove the high speed valve shaft from the body.

NOTE: Only remove the high speed valve and shaft from the carburettor body if it is unserviceable.

(12) Now that the carburettor main body is dismantled, check all components for serviceability and make replacements as found necessary.



Slow Jets and Main Air Bleeds Dismantled from Carburettor Main Body, 1000 Series.

(13) Inspect the body for cracks and all gasket surfaces for nicks or burrs.

(14) Check the power valve for smooth operation and proper seating. If necessary blow against the power valve to ensure that it does not leak.

(15) Check the accelerator pump plunger for wear and for smooth operation in the plunger bore. Check the spring for rust or weakness.

(16) Check the high speed valve shaft for excessive play in the body and also for bend.

(17) Reassembly is a reversal of the dismantling procedure with attention given to the following:

Instal all new gaskets when reassembling.

Peen the ends of the throttle and choke valve retaining screws to ensure that they will not become dislodged in service.

TO SERVICE TOP COVER

The carburettor top cover assembly which houses the choke valve and shaft normally requires very little service. Do not remove the choke valve and shaft unless it is absolutely necessary.

(1) Remove the primary and secondary slow air bleeds. (On 1000 models the primary side only.)

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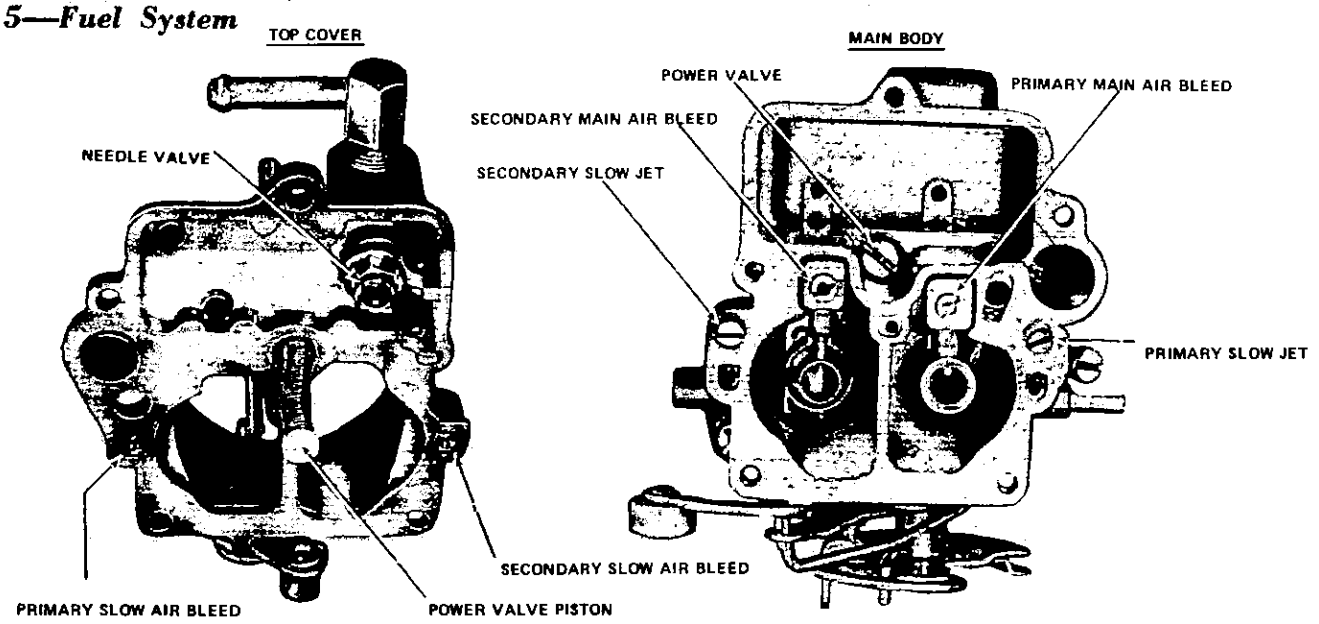

Internal View of Carburettor Top Cover and Main Body Assemblies. 1200 Series.

(2) Mark the choke valve in relation to the cover to facilitate correct assembly.

(3) Using a small file, remove the peening from the ends of the choke valve retaining screws.

(4) With a suitable screwdriver remove the two choke valve retaining screws and withdraw the choke valve.

(5) Remove the choke valve shaft from the cover.

(6) Lay a straight edge across the gasket face of the cover to check for warpage. File the cover gasket face back to a true condition if excessive warpage is evident.

(7) Reassemble by carrying out the dismantling procedure in reverse with attention given to the following points.

Check the choke valve for proper operation. Instal the two new choke valve retaining screws and peen the ends of the screws to ensure that they will not work loose and fall into the inlet manifold.

TO SERVICE FLANGE

(1) Screw out the idle adjusting screw and spring.

(2) Remove the throttle adjusting screw and spring.

(3) Check the primary and secondary throttle valve shafts for wear in the flange body. If wear is not evident then do not dismantle the shaft assemblies.

(4) Mark the primary and secondary throttle valves in conjunction with their respective bores. File the peening away from the ends of the throttle plate retaining screws and remove the screws.

(5) Withdraw both throttle valves, disconnect the primary to secondary connecting link and then remove both throttle shafts from the flange.

(6) If necessary unscrew the retaining nut and remove the throttle lever etc. from the end of the primary throttle shaft. Note how components are situated before dismantling to ensure correct assembly.

(7) Inspect the flange for cracks and the gasket surfaces for nicks or burrs.

(8) Lay a straight edge across the gasket surfaces and check for warping.

(9) Check the seating surface and the thread of the idle adjusting screw for damage.

(10) Place both primary and secondary throttle shafts into their respective bores in the flange and check for excessive clearance. Renew the shafts or flange as found necessary.

(11) Assemble the flange in the reverse order of dismantling with attention given to the following:

Adjust the primary and secondary throttle valves to close fully.

Check both primary and secondary throttle valve and shafts for smooth operation and peen over the ends of the valve retaining screws.

Turn the idle adjusting screw and spring in gently with the fingers until it just seats and then back it off approximately 3 turns.

Screw the throttle adjusting screw in two or three turns.

NOTE: The abovementioned adjustments on the throttle and idle screw are only preliminary adjustments. Engine idle mixture and speed must be adjusted correctly with the engine at operating temperature. See adjustment section for procedure.

TO ASSEMBLE

(1) Assemble the flange with a new gasket onto the carburettor main body and instal and tighten the three retaining screws.

(2) Assemble the top cover to the main body with a new gasket, and instal and tighten the five retaining screws.

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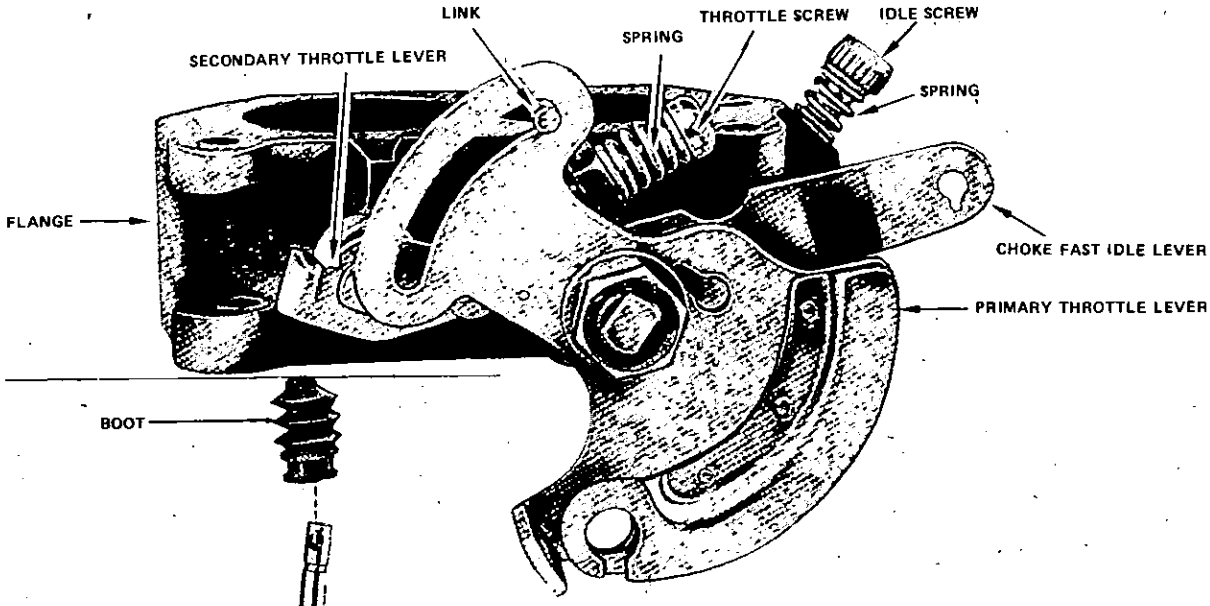
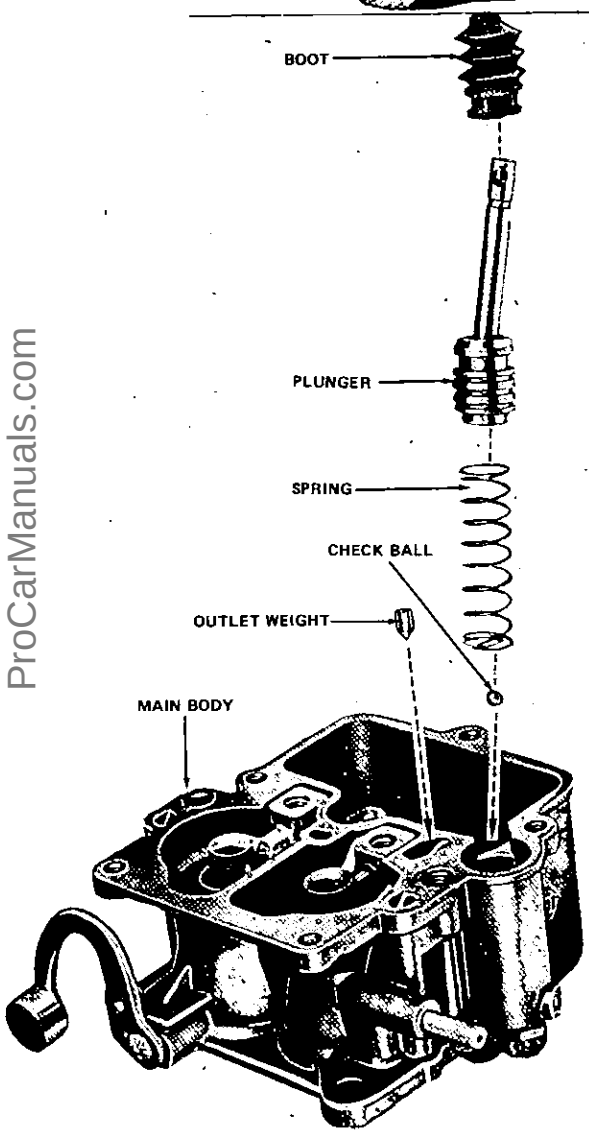


Throttle and Idle Screws Installed. 1200 Series Carburettor Flange, Typical of 1000 Series.



Pump Components Dismantled From Carburettor Main Body. Typical Both Models.

(3) Connect up the choke link during the above operation.

(4) Fit the accelerator pump actuating lever and spring (where fitted) to the top cover and instal and tighten the securing screw to retain the lever. During this operation connect the primary throttle lever to accelerator pump actuating lever link into the inner hole on the actuating lever.

(5) Attach the primary throttle lever return spring.

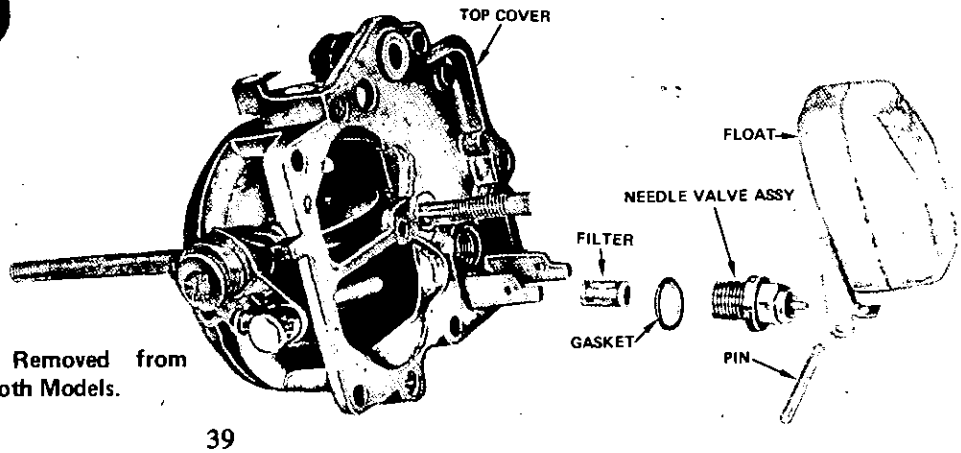
(6) Actuate all throttle and choke linkage by hand to ensure that all mechanism is operating smoothly.

TO CHECK AND ADJUST FLOAT LEVEL

(1) Remove the air cleaner and carburettor top cover assembly as previously described.

(2) Invert the carburettor top cover and allow the float seat to rest against the needle valve.

(3) Measure the distance from the upper edge of the



Float and Needle Valve Assembly Removed from Carburettor Top Cover, Typical of Both Models.

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float to the carburettor top cover gasket surface. This measurement should be 10.5 mm (0.413 in) for 1000 models and 12.0 mm (0.472 in) for 1200 models.

(4) If adjustment is required bend the float seat tab gently with a pair of long nosed pliers until the desired measurement is obtained.

(5) With the carburettor top cover still inverted raise the float with the fingers until the float stopper tab contacts its stop.

(6) Now measure the distance between the needle valve stem and the float seat tab.

This measurement should be within the limits as set out in the Specification section under Float Seat Clearance.

(7) If found necessary, bend the float stopper tab with a pair of long nosed pliers until the correct float seat clearance is obtained.

CHOKE INTERLOCK ADJUSTMENT

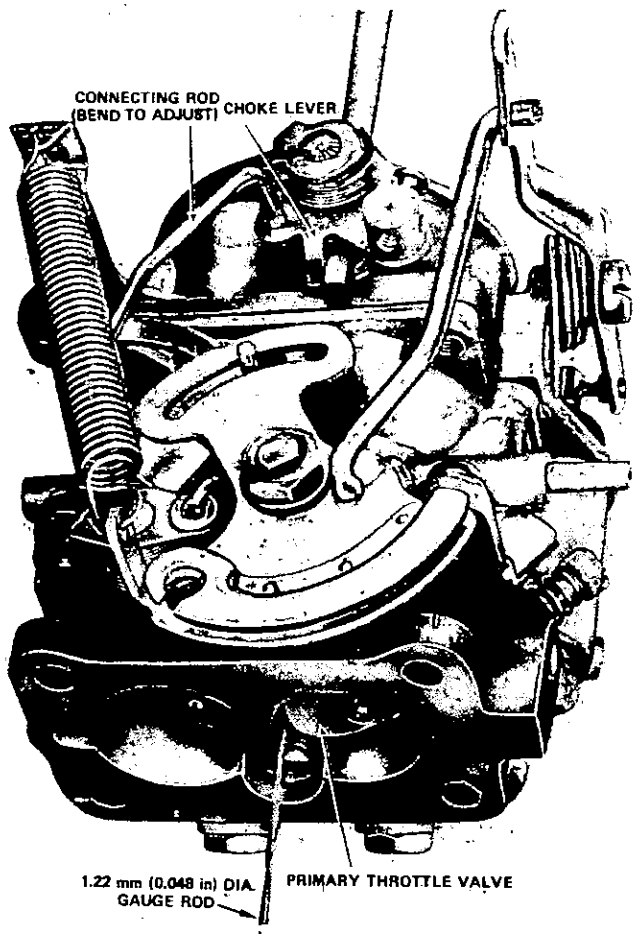
NOTE: When the choke valve is in the fully closed position the primary throttle valve should be opened 1.22 mm (0.048 in). This will obtain a throttle valve opening angle of 14 degrees from the fully closed position.

(1) Remove the carburettor from the vehicle as previously described.

(2) Actuate the choke operating lever by hand until the choke valve is in the fully closed position.

(3) Using a 1.22 mm (0.048 in) diameter rod as a gauge, check the clearance between the primary throttle valve and the valve bore.

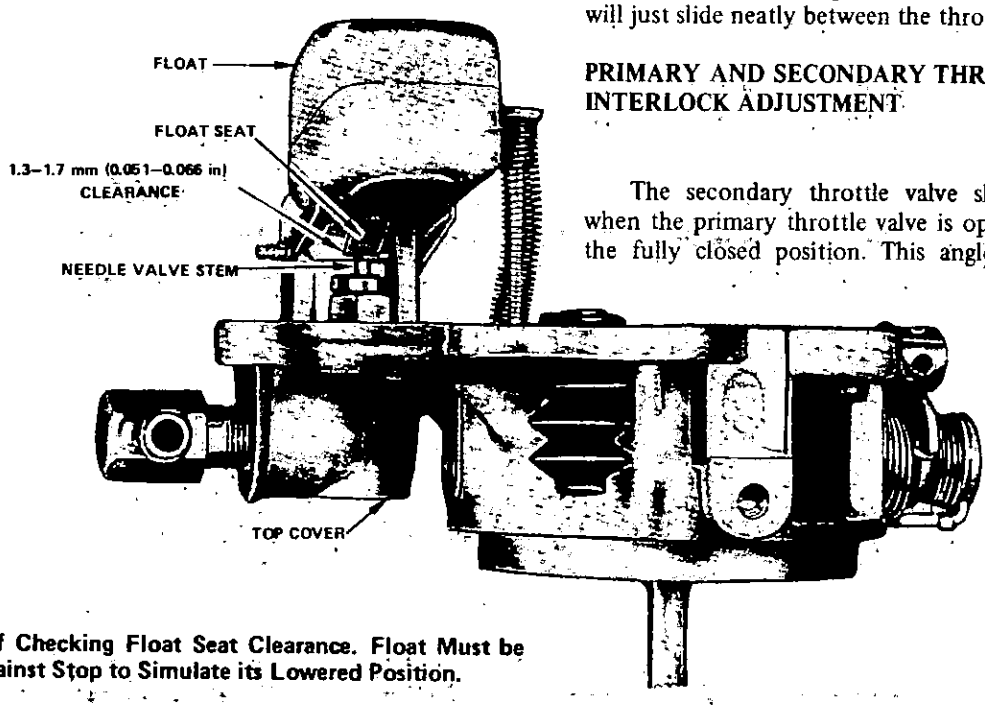
(4) If the throttle valve clearance is larger or smaller than the gauge rod, then carefully bend the choke connecting rod with a pair of suitable pliers until the gauge will just slide neatly between the throttle valve and bore.



Method of Checking Choke Interlock Adjustment, Both Models.

PRIMARY AND SECONDARY THROTTLE INTERLOCK ADJUSTMENT

The secondary throttle valve should begin to open when the primary throttle valve is opened 48 degrees from the fully closed position. This angle can be assessed by



Method of Checking Float Seat Clearance. Float Must be Raised Against Stop to Simulate its Lowered Position.

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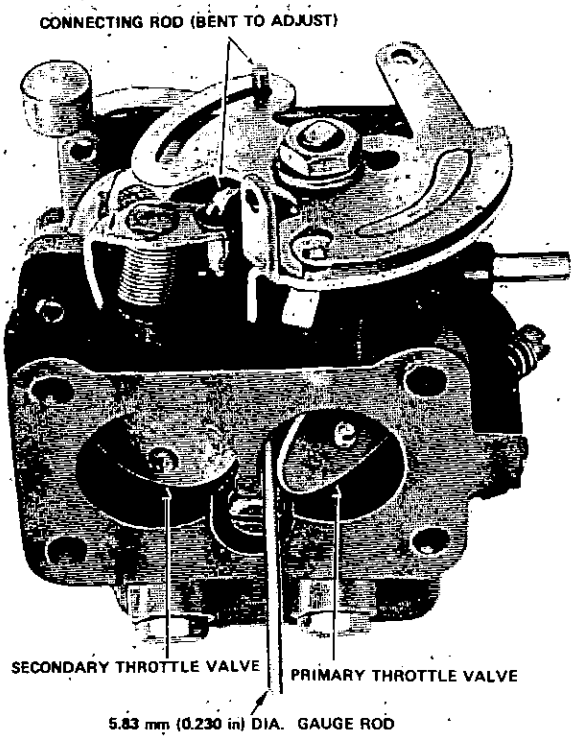


Method of Checking Primary and Secondary Throttle Interlock Opening, Typical of Both Models.

positioning a 5.83 mm (0.230 in) diameter rod between the primary throttle valve and valve bore.

(1) Remove the carburettor from the vehicle as previously described.

(2) Position a 5.83 mm (0.230 in) diameter rod, as shown in the illustration, between the primary throttle valve and the throttle bore.

(3) Ensure that the secondary throttle valve is fully closed.

(4) Bend the connecting rod with a pair of pliers until it just comes into contact with the primary throttle lever.

(5) Check the adjustment by withdrawing the gauge rod, closing both throttle valves and then gradually open the primary throttle valve, via the throttle lever until the secondary throttle valve just commences to open. In this position the gauge rod should just slide neatly between the primary throttle valve and the primary throttle bore.

TO ADJUST IDLING SPEED AND MIXTURE

(1) Remove the vacuum access plug from the inlet manifold.

(2) Connect a vacuum gauge with suitable adaptors into the inlet manifold.

(3) Connect a tachometer to the ignition coil.

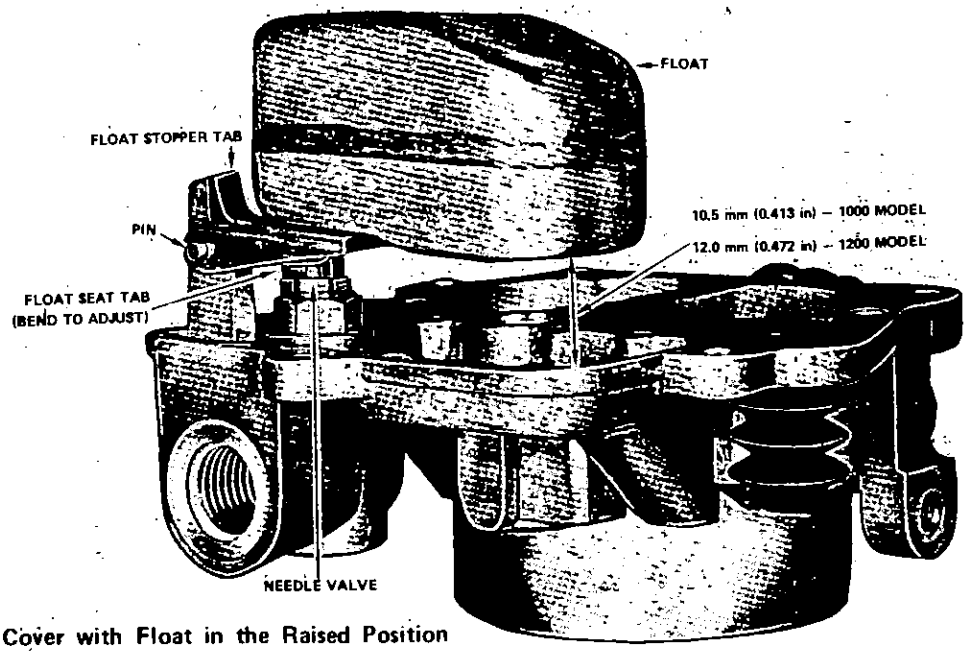
(4) Start and run the engine until it reaches normal operating temperature.

(5) Adjust the throttle idling screw until an idle speed of 600 rpm is obtained on the tachometer.

(6) Adjust the idling mixture screw until the highest vacuum reading on the vacuum gauge is obtained. It may be necessary to re-adjust the idle speed during this operation.

(7) Stop the engine and disconnect the vacuum gauge and tachometer.

NOTE: An exhaust gas analyser, if available, can be used to adjust the mixture, or to check as a comparison with the vacuum gauge readings. An optimum mixture strength reading is desired on the gas analyser at engine idle. Turning the idling mixture screw in a clockwise direction gives a leaner mixture and anti-clockwise a richer mixture.



Carburettor Top Cover with Float in the Raised Position Showing Correct Float Level.

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2. FUEL PUMP

DESCRIPTION

The fuel pump is a mechanically operated diaphragm type, actuated by a rocker arm assembly which in turn is operated by an eccentric on the engine camshaft.

When the carburettor float chamber is full and the carburettor needle valve is closed, pressure in the pump outlet pipe will hold the pump diaphragm downwards, against the pressure of the diaphragm spring.

At this time the rocker arm assembly will run freely on the diaphragm stem until the pressure in the outlet pipe is relieved.

When the outlet pipe pressure is relieved the pump diaphragm again rises under pressure from the diaphragm spring and into operation by the rocker arm assembly.

A small compression spring holds the rocker arm in constant contact with the eccentric on the camshaft to minimise operating noise.

A seal which runs on the diaphragm stem and which is retained in the fuel pump lower body by the diaphragm spring, prevents engine oil from entering the upper section of the pump lower body.

The rubber fuel pump diaphragm is held together by two metal discs and is specially treated so that it is not affected by gasoline.

TO REMOVE AND INSTAL

(1) Raise the engine bonnet and fit fender covers to both front fenders.

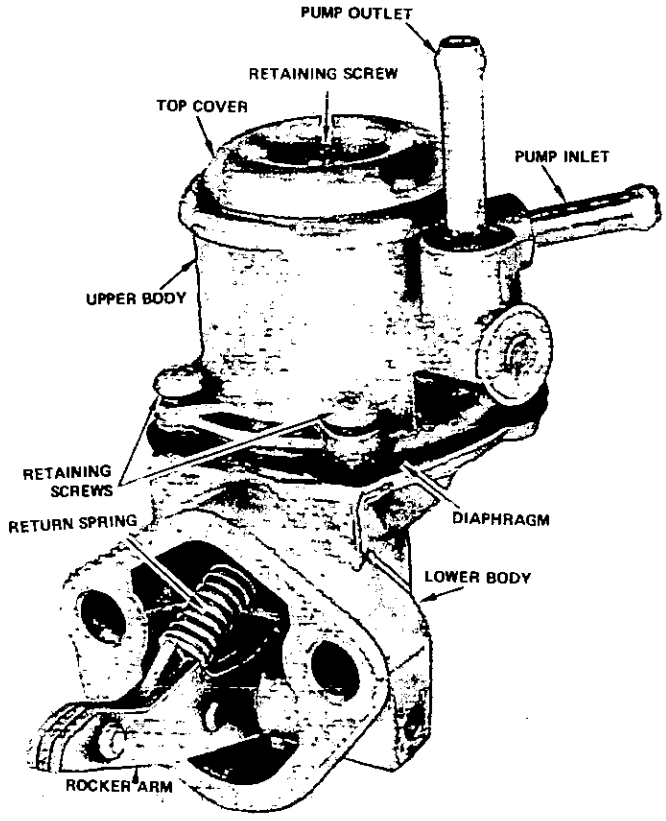
(2) Disconnect the fuel inlet and outlet pipes at the fuel pump connections.

(3) Remove the two nuts and spring washers which secure the fuel pump to the cylinder block and withdraw the fuel pump with spacer and gaskets.

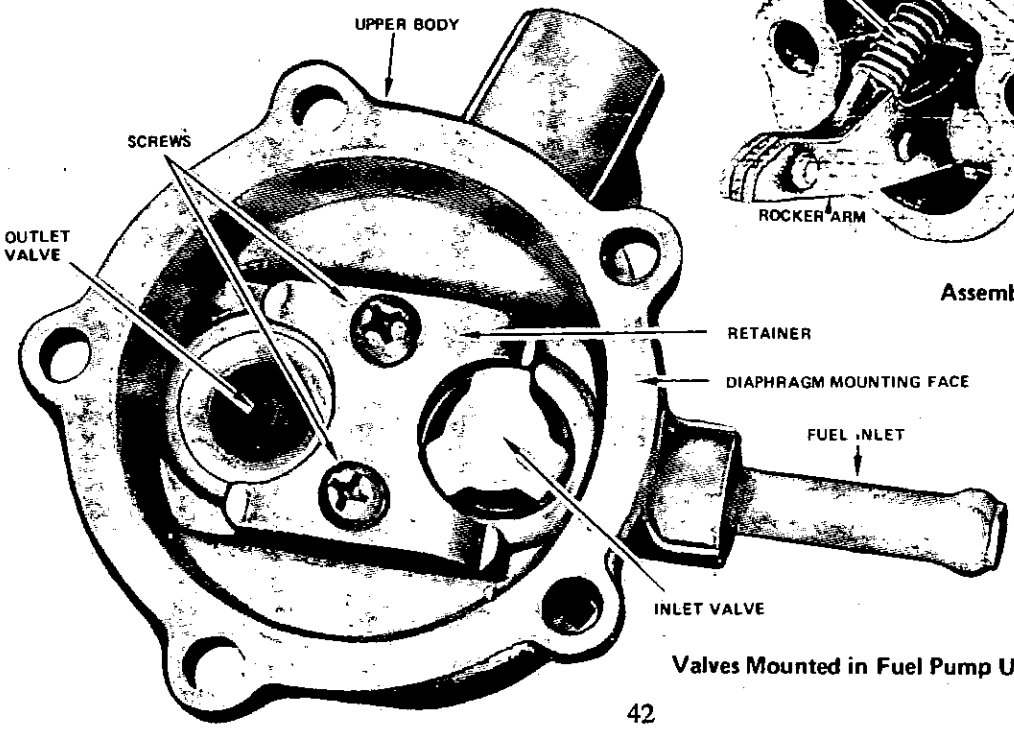
NOTE: During operation (3) loosen the nuts progressively until pressure of the diaphragm and rocker arm spring is relieved.

Installation is a reversal of the removal procedure with attention given to the following:

Instal new gaskets to both sides of the fuel pump spacer.



Assembled View of Fuel Pump.



Valves Mounted in Fuel Pump Upper Body.

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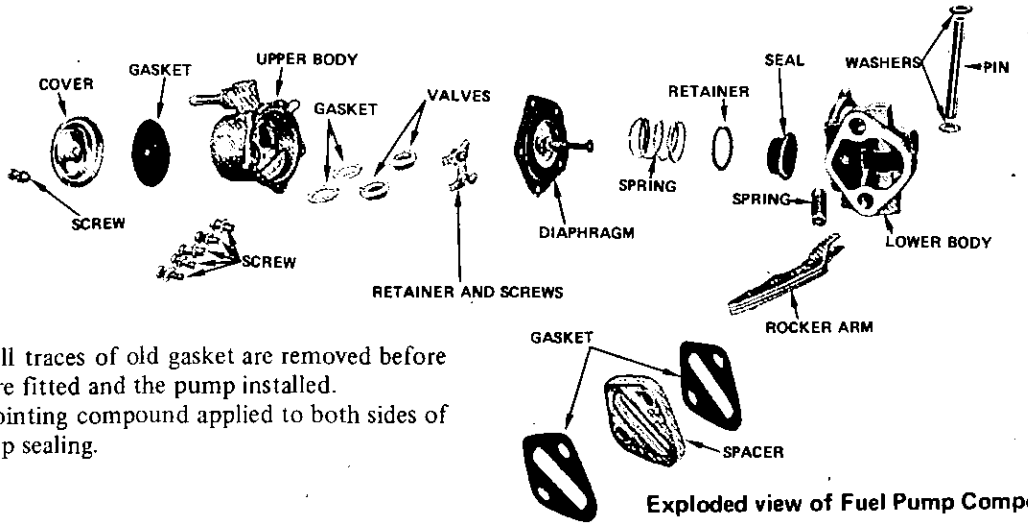


Exploded view of Fuel Pump Components.

Ensure that all traces of old gasket are removed before the new gaskets are fitted and the pump installed.

A smear of jointing compound applied to both sides of the gasket will help sealing.

TO DISMANTLE

(1) Remove the fuel pump from the engine as previously described.

(2) Actuate the rocker arm by hand and expel residual fuel out of the pump into a suitable container.

(3) Remove the pump top cover retaining screws and detach the top cover and gasket.

(4) With the corner of a file mark the assembled position of the upper and lower body section of the pump to facilitate correct assembly.

(5) Remove the screws from the pump upper body and separate the two pump body section.

(6) Mark or note the position of the inlet and outlet valves in relation to the pump upper body section.

(7) Remove the two screws from the valve retainer and take out the retainer, valves and gaskets. Discard the gaskets.

(8) Press down on the diaphragm and by using a probe, working through the rocker arm aperture in the pump lower body, unhook the diaphragm stem from the end of the rocker arm.

(9) Withdraw the diaphragm and lift off the diaphragm spring, take out the seal retainer and withdraw the diaphragm stem oil seal from the pump lower body.

(10) Relieve the staking on one end of the rocker arm pivot pin and with the pump suitably supported on the pivot pin boss, tap in one end of the rocker arm pivot pin with a pin punch to remove it from the opposite end of the pump body.

(11) Withdraw the pin punch and lift out the rocker arm and rocker arm spring.

TO CLEAN AND CHECK

(1) Wash all components thoroughly in cleaning solvent.

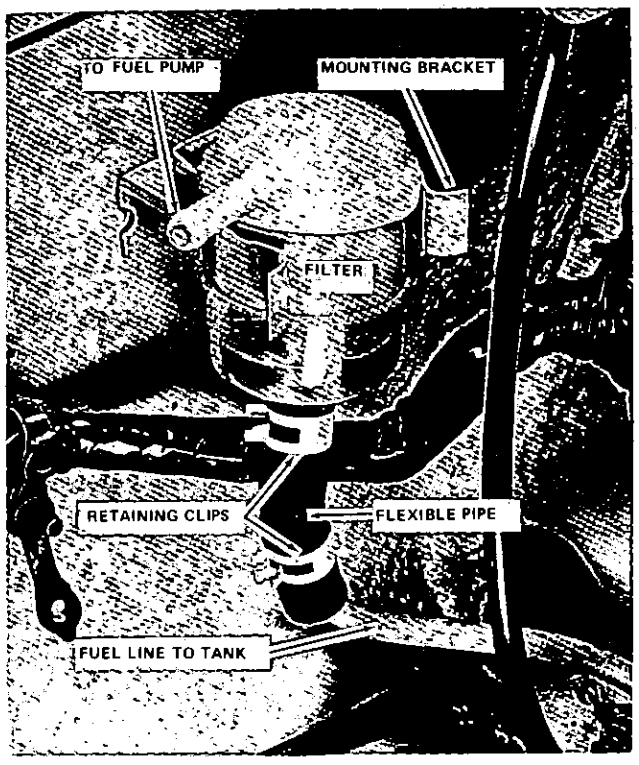
(2) Check the pump diaphragm and stem oil seal for perforation and/or deterioration.

(3) Check the valve assemblies and mechanical linkage for undue wear.

(4) Using a suitable flat surface or surface plate, check the diaphragm surface of the two main sections of the pump for distortion. Rectify by filing if necessary.

(5) Renew faulty components as found necessary.

NOTE: If a fuel pump has seen considerable service and is dismantled for repair or inspection it is advisable to fit a repair kit which includes diaphragm seal, valves and gasket. This will ensure a thorough job and further trouble free service from the unit.



Mounting Position of Disposable Type. Fuel Filter Assembly.

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TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention given to the following.

Ensure that valve assemblies are installed correctly in their respective seats and that each valve is fitted with a new gasket.

Lubricate the mechanical linkage and the diaphragm stem with engine oil when assembling.

FUEL PUMP PRESSURE TEST

(1) Disconnect the fuel feed pipe at the carburettor.

(2) Fit a 'T' fitting to the fuel feed pipe and from one junction connect a pipe back to the carburettor.

(3) Connect a suitable pressure gauge to the remaining junction of the 'T' piece.

(4) Start and run the engine at varying speeds observing the pressure readings on the pressure gauge. Check the specifications in the front of the section to compare recommended pressures with pressure readings.

A fuel pump that has a delivery pressure above or below that recommended is unserviceable and should be removed and dismantled for inspection.

NOTE: Excessively high pressures usually indicate that an incorrect diaphragm spring has been fitted to the pump or that the diaphragm is pulled too tight.

Low pressures could be caused by worn linkage, perforated diaphragm, gummed valves or a weak or broken diaphragm spring.

FUEL PUMP CAPACITY TEST

NOTE: This test should be carried out if the pump pressure was checked and found to be within specifications.

(1) Run the engine for a few minutes to ensure that the carburettor float chamber is full of fuel.

(2) Stop the engine and disconnect the fuel pump delivery pipe at the carburettor.

(3) Position a measuring beaker under the pipe and start and run the engine at 1000 rpm for one minute.

(4) If the capacity of fuel delivered in the beaker is below that specified (see Specifications) then either a partial blockage in the system may be evident or the pump is unserviceable. Check the condition of the fuel filter and blow out the fuel lines before removing the pump for inspection.

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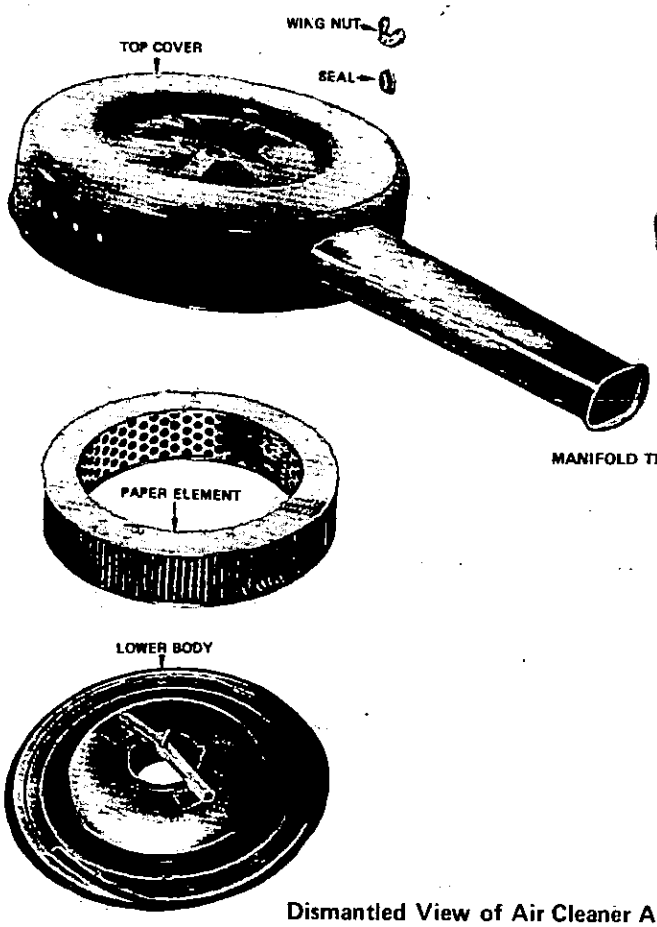
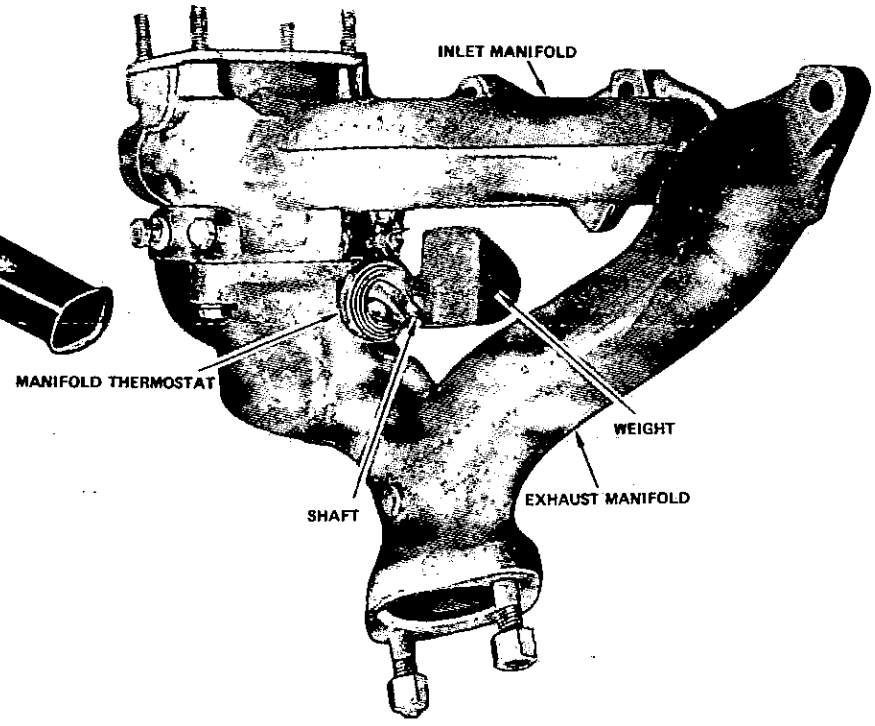


Dismantled View of Air Cleaner Assembly. Typical of Both Models.



View of 1000 Inlet and Exhaust Manifold Assembly. Also Typical of 1200.

3. AIR CLEANER

DESCRIPTION

The air cleaner assemblies on the two models covered in this manual are fitted with viscous paper type elements.

The elements should not be cleaned in service but should be renewed at the recommended mileage of 40,000 kilometres (24,000 miles).

This mileage is only a guide for normal operating conditions and should be reduced accordingly if the vehicle is operating under extremely dusty conditions.

NOTE: Paper air cleaner elements should not be washed in petrol or any other type of solvent. Elements that have been washed in solvent or that have become oil soaked should be discarded and a new element fitted.

TO REMOVE

(1) Detach the rocker cover to air cleaner ventilation hose.

(2) Remove the two bolts which secure the air cleaner assembly to the inlet manifold bracket.

(3) On 1200 models, disconnect the additional bracket which is secured on the inlet manifold to cylinder head retaining stud.

(4) Remove the air cleaner assembly from the carburettor.

(5) Unscrew the wing nut and remove the top cover from the air cleaner main body and withdraw the paper element.

TO INSTAL

(1) With a piece of clean fluffless cloth thoroughly wipe accumulated dust away from both portions of the air cleaner assembly.

(2) Place the paper element into the air cleaner body and centre it on its seat.

(3) Position the air cleaner top cover onto the main body and instal and tighten the wing nut.

(4) Instal the air cleaner assembly to the carburettor.

(5) Fit and tighten the two inlet manifold to air cleaner assembly bracket bolts.

(6) On 1200 models, connect the additional bracket which is secured to the inlet manifold to cylinder head retaining stud.

(7) Reconnect the rocker cover to air cleaner ventilation hose.

4. FUEL SYSTEM FAULT DIAGNOSIS

1. Engine will not start.

	Possible cause	*Remedy*
(a)	Lack of fuel in bowl.	– Check fuel pump delivery, sticking or clogged needle valve.
(b)	Engine flooded with fuel when cold, by excessive use of choke or accelerator.	– Hold accelerator flat until engine starts and revise starting procedure.
(c)	Engine flooded when hot, as in (b) above.	– Hold accelerator pedal flat until engine starts.

2. Engine stalls at idle speed.

	Possible cause	*Remedy*
(a)	Incorrect adjustment of idling speed and/or mixture control screws.	– Check and adjust control screws.
(b)	Carburettor float bowl flooding.	– Check float level and for sticking needle valve or punctured float. Clean and blow out carburettor.
(c)	Carburettor starving for fuel.	– Check fuel delivery at needle valve. Clean and blow out carburettor. Check fuel pump.
(d)	Blocked idling jet or idle air bleed.	– Clean and blow out carburettor.
(e)	Carburettor to manifold attachment bolts loose.	– Check and tighten bolts.
(f)	Leaking carburettor flange or intake manifold gaskets.	– Check and renew faulty gaskets.
(g)	Faulty gasket or loose attachment screws, carburettor main body to air horn assembly.	– Renew faulty gaskets and tighten securing screws.

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3. Flat spot on acceleration.

Possible cause	*Remedy*
(a) Blocked accelerator pump discharge jet or sticking check valve.	– Clean and blow out carburettor.
(b) Faulty accelerator pump plunger.	– Renew pump plunger assembly.
(c) Faulty accelerator pump linkage.	– Check and rectify pump linkage. Check that pump connecting link is in correct position in the pump lever.

4. Engine misfires or cuts out at high speed.

Possible cause	*Remedy*
(a) Obstruction in main or power jets.	– Dismantle and blow out jets.
(b) Low fuel level in float chamber or float chamber starving for fuel.	– Check float level setting, check fuel pump filter and supply lines.
(c) Failure of fuel pump to deliver sufficient fuel.	– Overhaul fuel pump.
(d) Blockage in fuel tank pipe.	– Remove blockage and clean pipe.
(e) Restriction in fuel filter.	– Clean or renew filter.
(f) Air leak between fuel pump and filter or between filter and tank.	– Rectify air leak.
(g) Air leak between carburettor air horn and main body assemblies or main body flange.	– Check and renew gasket and tighten securing screws.
(h) Water in carburettor.	– Drain and clean fuel system.

5. Excessive fuel consumption.

Possible cause	*Remedy*
(a) Float level too high.	– Check and re-adjust float level.
(b) Choke butterfly partially closed.	– Check and rectify.
(c) Air cleaner element dirty or requires renewal.	– Clean element or renew.
(d) Accelerator pump requires an adjustment or in wrong hole in pump connecting link.	– Re-adjust accelerator pump stroke with link in other hole of lever.
(e) Fuel pump delivery pressure too high.	– Check and fit correct diaphragm spring, adjust fuel pressure, with pump base gasket.
(f) Faulty fuel pump diaphragm.	– Overhaul fuel pump and renew as necessary.
(g) Leaks between fuel pump and fuel tank or fuel pump and carburettor.	– Check and rectify leaks.
(h) Power jet vacuum plunger stuck in release (lower) position.	– Free plunger or renew.
(i) Faulty power jet.	– Check and renew faulty jet.
(j) Worn or damaged main or power jets.	– Check and renew faulty components.
(k) Excessive use of choke or accelerator pump.	– Revise driving habits.

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CLUTCH

SPECIFICATIONS

1000 SERIES

Type	Single dry plate
Operation	Hydraulic or mechanical
Type of driven plate hub	Spring cushion
Driven plate:	
Outside diameter	160 mm (6.30 in)
Facing thickness	3.2 mm (0.126 in)
Inside diameter	110 mm (4.330 in)
Total friction area	212 cm^2 (32.860 in^2)
Master cylinder diameter	15.87 mm (0.625 in)
Piston stroke	31.5 mm (1.240 in)
Clutch throw-out bearing free travel	1.5 – 2.0 mm (0.059 – 0.078 in)
Slave cylinder diameter	19.05 mm (0.750 in)
Piston stroke	23.5 mm (0.925 in)
Pedal height	144.5 mm (5.689 in)
Clutch pedal free travel	15 – 20 mm (0.590 – 0.787 in)

1200 SERIES

Type	Single dry plate
Operation	Hydraulic or mechanical
Type of driven plate hub	Spring cushion
Driven plate:	
Outside diameter	180 mm (7.09 in)
Facing thickness	7.8 mm (0.307 in)
Inside diameter	125 mm (4.92 in)
Total friction area	264 cm^2 (40.92 in^2)
Master cylinder diameter	15.87 mm (0.625 in)
Clutch throw-out bearing free travel:	
Mechanical	0.9 – 1.2 mm (0.0354 – 0.0472 in)
Hydraulic	0.7 mm (0.027 in)
Clutch pedal free travel:	
Mechanical	11.0 – 15.0 mm (0.433 – 0.591 in)
Hydraulic	30 mm (1.181 in)
Pedal height:	
Mechanical	139.5 – 143.5 mm (5.492 – 5.65 in)
Hydraulic	141.5 mm (5.57 in)

TORQUE WRENCH SETTINGS

Pressure plate to flywheel bolts	2.2 kg/m (15.9 ft/lb)

1. DESCRIPTION

1000 SERIES

The clutch driven plate and pressure plate assembly is of the same design as that fitted to the 1200 Series with the following exceptions.

The throw-out bearing release mechanism differs in that the release fork is mounted on a shaft which extends through the clutch housing.

The release fork is mounted on the centre of the shaft by means of two tapered pins with the fork extending down to contact the throw-out bearing sleeve, thus engaging and disengaging the bearing.

A return spring is fitted to the shaft to assist in the return of the fork and release of the bearing when the clutch pedal is returned from the depressed position.

Operation of the release fork on the mechanical clutch is by means of a cable, which is connected to the arm of the release shaft at one end and to the clutch pedal at the opposite end.

Removal of the throw-out bearing and release shaft differs in that with the gearbox removed, the bearing and sleeve are removed first, tap out the tapered dowels and withdraw the shaft sufficiently to remove the return spring and fork then withdraw the shaft.

Throw-out bearing adjustment is achieved by adjusting

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the bolt connecting the cable to the release shaft arm. Measure the distance between the lower faces of the cable support bracket and the release shaft arm. The correct measurement between the two faces is to read 124 mm (4.881 in).

Pedal height adjustment is obtained by adjusting the pedal stop and cable.

First, adjust the pedal stop and measure the distance between the top of the pedal through a centre line to the floor.

Secondly, to obtain correct pedal free travel, adjust the cable at the cable lower end.

Where a hydraulic clutch is fitted (LH drive vehicles) the same type of master cylinder and slave cylinder as fitted to the 1200 Series is utilised.

Adjustment of the throw-out bearing and clutch pedal and bleeding procedure for the hydraulic system is the same as that of the 1200 Series.

1200 SERIES

The single dry plate clutch comprises a pressure plate and cover assembly and a driven plate assembly. The pressure plate and cover assembly incorporates a diaphragm type spring.

The assembly has eighteen tapered levers which are integral with the diaphragm and maintain constant pressure on its pressure plate, thus holding the driven plate to the flywheel.

The driven plate has a spring cushioned hub, splined to slide on the clutch shaft (gearbox input shaft).

The spigot bearing for the clutch shaft (gearbox input shaft) located in he end of the engine crankshaft, is a porous bronze bush.

The clutch throw-out bearing is a single row ball thrust type, mounted on the bearing sleeve, which slides on the clutch shaft bearing retainer.

Where a hydraulically operated clutch release mechanism is fitted, the push rod on the slave cylinder is adjustable to provide clearance between the throw-out bearing and diaphragm fingers with the throw-out bearing in the released position.

Where a mechanically operated release mechanism is fitted, the cable is adjustable to provide clearance between the throw-out bearing and the diaphragm fingers with the throw-out bearing in the released position.

2. CLUTCH UNIT

TO REMOVE AND INSTAL

(1) Raise the vehicle and remove the propeller shaft and gearbox as described in the MANUAL TRANSMISSION section.

(2) Mark the pressure plate cover in relation to the flywheel so that they may be assembled in their original positions.

(3) Take out the six bolts and spring washers securing the pressure plate assembly to the flywheel, releasing them evenly and progressively and remove the clutch pressure plate and cover assembly and the clutch driven plate.

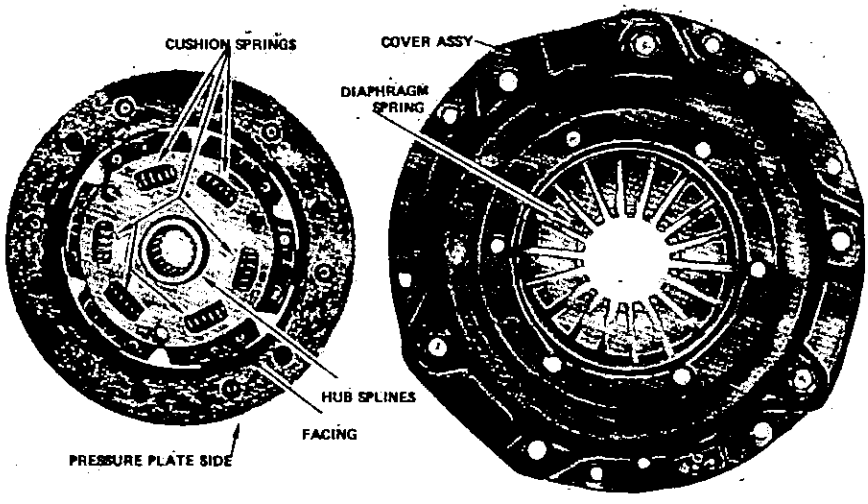
Installation is a reversal of the removal procedure with particular attention to the following points.

Use the special aligning tool or used gearbox input shaft to align the centre of the driven plate hub with the spigot bearing in the rear end of the crankshaft.

NOTE: The raised section of the driven plate hub must face the pressure plate.

Align the marks on the pressure plate cover and flywheel made on dismantling.

Tighten the six securing bolts evenly and progressively



Diaphragm Spring Type Pressure Plate and Driven Plate Assemblies. Release Bearing Side of Pressure Plate.

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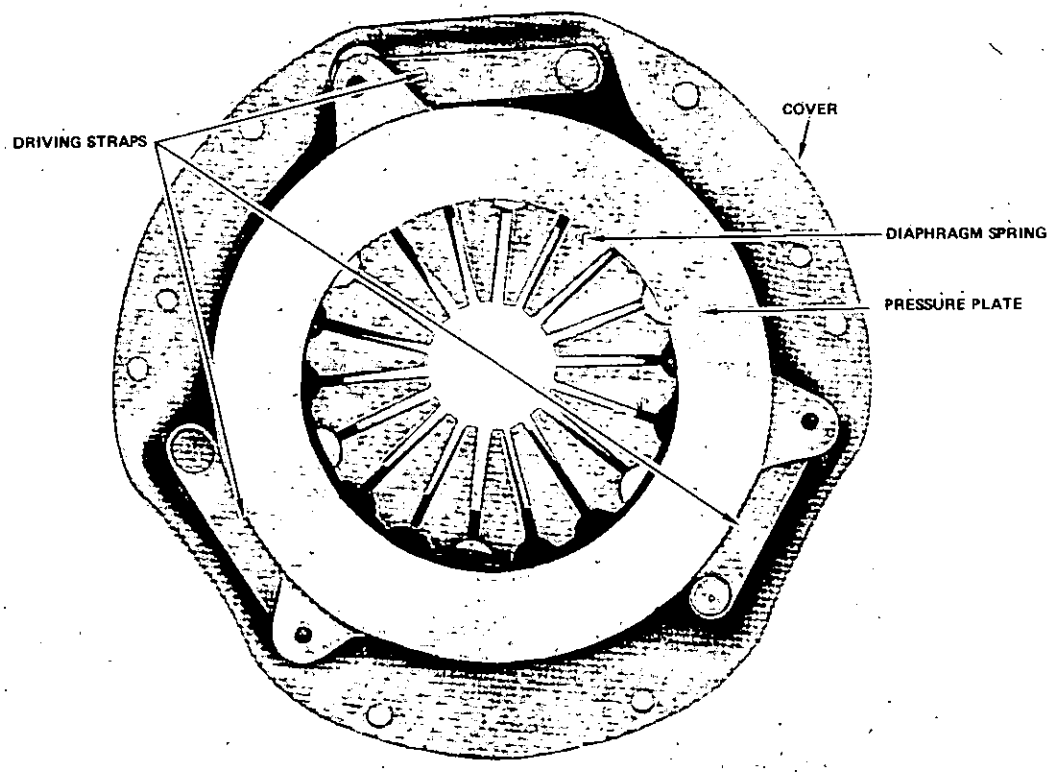

Diaphragm Spring Type Pressure Plate Assembly Flywheel Side.

to the specified torque. Fit new spring washers prior to fitting the securing bolts.

If the flexible hydraulic pipe has been disconnected from the slave cylinder, it will be necessary to bleed the hydraulic system.

Fill the gearbox with the recommended oil and ensure that the propeller shaft rear universal joint flange and pinion flange are connected to the marks made on dismantling, in order to maintain the original balance of the shaft.

TO CHECK AND INSPECT

(1) Check that the driven plate facings are not highly glazed or gummed with burned oil.

(2) If the driven plate facings are worn down to the rivets, check the flywheel and pressure plate faces for wear and scoring.

(3) Check the hub of the driven plate for looseness or wear in the hub splines. Check effective action of the driven plate hub cushion springs.

(4) Check that the run out of the flywheel face does not exceed 0.050 mm (0.002 in).

(5) Check that the clutch shaft (gearbox input shaft) spigot bearing in the flywheel flange is in serviceable condition.

This bearing is a sintered bronze bush and requires no lubrication in service.

(6) Check the throw-out bearing for noise or roughness.

NOTE: When cleaning the clutch parts do not immerse the throw-out bearing in the cleaning fluid. This bearing is lubricated when assembled and requires no further lubrication in service.

(7) If the driven plate is still serviceable do not allow any cleaning fluid, oil or grease to contaminate the plate facings.

(8) Do not ream the input shaft spigot bearing. Apply a light coating of high melting point grease to the bore of the bush before assembling the clutch.

(9) Check the flywheel and pressure plate for high spots, glazing and cracking.

If glazing and high spots are in evidence, remove the flywheel from the crankshaft. Machine the surface removing only sufficient material to restore the flywheel face. Renew both the driven plate and pressure plate assembly.

3. MASTER CYLINDER

TO REMOVE AND INSTAL

(1) Remove the split pin and clevis pin to release the master cylinder push rod from the clutch pedal.

(2) Disconnect the pressure pipe at the master cylinder.

(3) Remove the two attaching bolts and withdraw the master cylinder assembly and spacer shims.

(4) Installation is a reversal of the removal procedure.

Refill the reservoir with clean hydraulic brake fluid and bleed the system. Ensure that hydraulic fluid is not spilt on any painted surface.

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TO DISMANTLE

(1) Remove the filler cap from the reservoir and drain the fluid from the master cylinder and reservoir.

(2) Pull back the rubber boot and remove the circlip.

(3) Withdraw the push rod and stop washer.

(4) Remove the inlet valve stop bolt from the master cylinder and withdraw the piston assembly and return spring.

(5) Remove the spring from the spring retainer, lift the spring retainer from the spigot end of the piston and take out the spring and inlet valve.

Take care not to lose the inlet valve spring.

(6) Remove the inlet valve seal from he inlet valve and remove the primary and secondary cup from the piston assembly.

TO CLEAN AND INSPECT

(1) Thoroughly clean the master cylinder components and the inside of the master cylinder in methylated spirits.

(2) Check the inside of the bore for wear and/or pitting. If necessary, hone the bore.

(3) Check the piston groove and piston body for wear and renew the piston cups.

(4) Check the tension of the piston return spring.

(5) Renew the rubber boot if it shows signs of deterioration.

(6) Check the breather hole in the reservoir cap to ensure that it is clear.

(7) Remove any sediments that may have accumulated in the bottom of the reservoir.

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TO ASSEMBLE

(1) Dip the master cylinder components in a container of clean hydraulic fluid and instal the new primary and secondary cup on the piston, ensuring that the cups are seated correctly and that the lip is facing the spigot end of the piston.

(2) Place the inlet valve seal on the inlet valve with the lip facing the piston assembly.

(3) Place the inlet valve spring, with the tapered end on the face of the inlet valve flange and press the spring retainer down over the splined end of the piston assembly and secure.

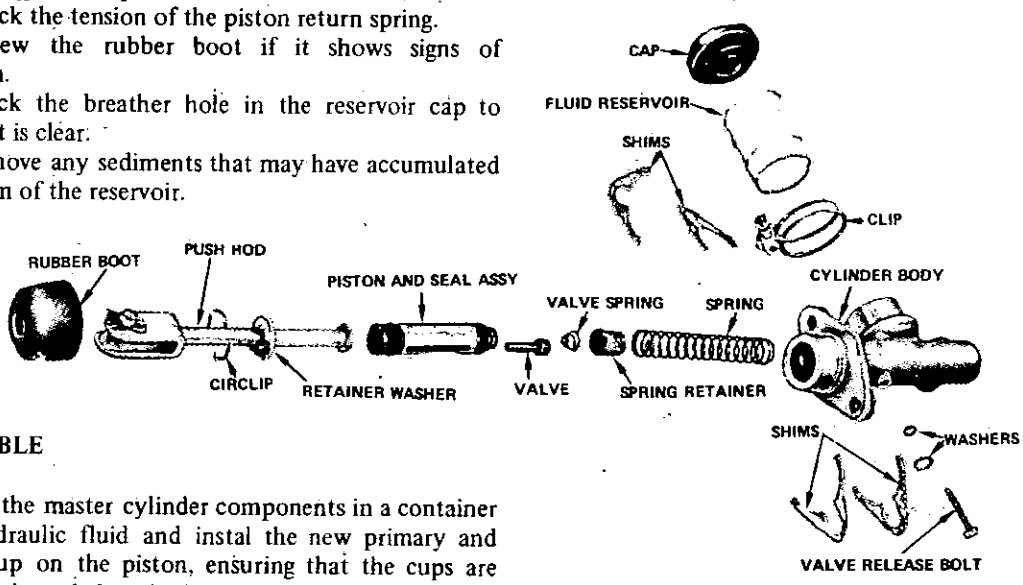
(4) Place the piston return spring over the spring retainer, dip the piston in hydraulic fluid and instal the spring and piston assembly. Screw in the inlet valve stop bolt.

(5) Insert the push rod, push in and instal the retaining washer, circlip and rubber boot.

(6) Partially fill the reservoir with clean hydraulic fluid and pump the push rod until fluid emits from the cylinder outlet.

(7) Fit the master cylinder to the vehicle and ensure that the correct number of spacer shims are fitted between the master cylinder retaining flange and the fire wall to achieve correct pedal clearance.

(8) Connect the hydraulic pipe to the master cylinder, top up the master cylinder, replace the filler cap and bleed the air from the system as described in TO BLEED in the HYDRAULIC SYSTEM. Top up the master cylinder on completion.



Clutch Master Cylinder, Exploded View. Left Hand Drive Models.

4. SLAVE CYLINDER

TO REMOVE AND DISMANTLE

(1) Unhook and remove the clutch withdrawal lever return spring connected to the lever and the lug on the slave cylinder.

(2) Disconnect the flexible hydraulic pipe at the slave cylinder and plug the pipe to prevent loss of fluid and ingress of dirt.

(3) Unscrew the two lock nuts and withdraw the push rod from the withdrawal lever.

(4) Remove the two bolts attaching the slave cylinder to the clutch housing and remove the slave cylinder from the vehicle.

(5) Draw back the slave cylinder rubber boot, remove the retaining clip and withdraw the piston and push rod from the slave cylinder. Remove the seal from the piston.

TO CLEAN AND INSPECT

(1) Clean all parts and wash in methylated spirits, do not use petrol or mineral solvents for this purpose.

(2) Check the bore of the cylinder for wear or pitting. Hone if necessary and fit new cups on reassembly.

(3) Check the piston for wear, scoring and pitting, and renew as necessary.

(4) Check the piston cup and rubber boot for wear and deterioration and renew as necessary.

(5) Check the cylinder retaining clip and renew if weak or worn in the cylinder groove.

TO ASSEMBLE AND INSTAL

(1) Dip the piston and piston cup in clean hydraulic fluid and instal the cup on the piston, easing it into the groove so that the lip of the seal faces the spigot end of the piston.

Ensure that the cup is correctly seated in the groove. Screw in the bleeder valve but do not tighten past finger tight.

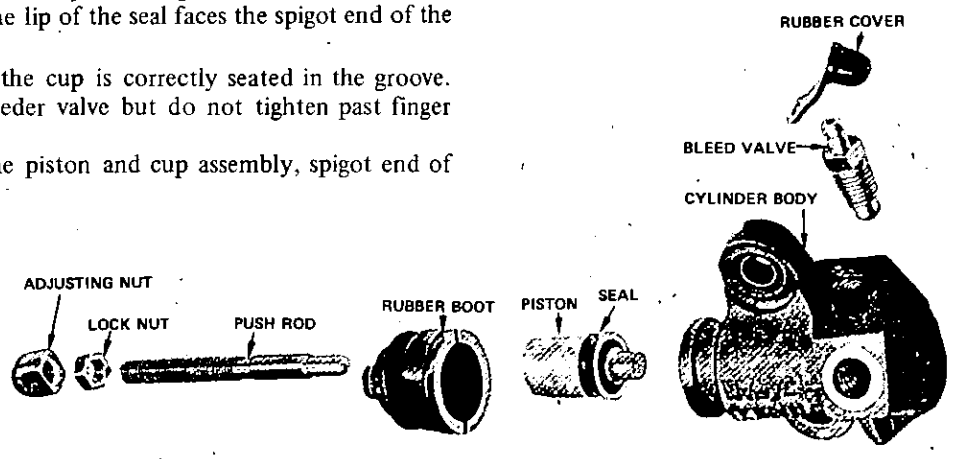
(2) Insert the piston and cup assembly, spigot end of the piston first, in the bore of the cylinder taking care not to bend back or damage the lip of the seal.

(3) If the slave cylinder is not to be fitted to the vehicle immediately, fit the rubber boot to open end of the cylinder as a guard against the piston falling out of position or the ingress of dirt.

Installation is a reversal of the removal procedure with particular attention to the following points:

Ensure that the slave cylinder retaining clip is seated correctly in the groove on the cylinder body, and that the rubber boot is correctly fitted over the open end of the cylinder body.

Bleed the clutch hydraulic system and adjust the withdrawal lever free travel as detailed under the appropriate headings in this section.



Exploded View of Clutch Slave Cylinder Components. Left Hand Drive 1200 Model Shown.

5. HYDRAULIC SYSTEM

TO BLEED

(1) Remove the cap and fill the fluid reservoir with clean hydraulic fluid to within approximately half an inch of the reservoir top.

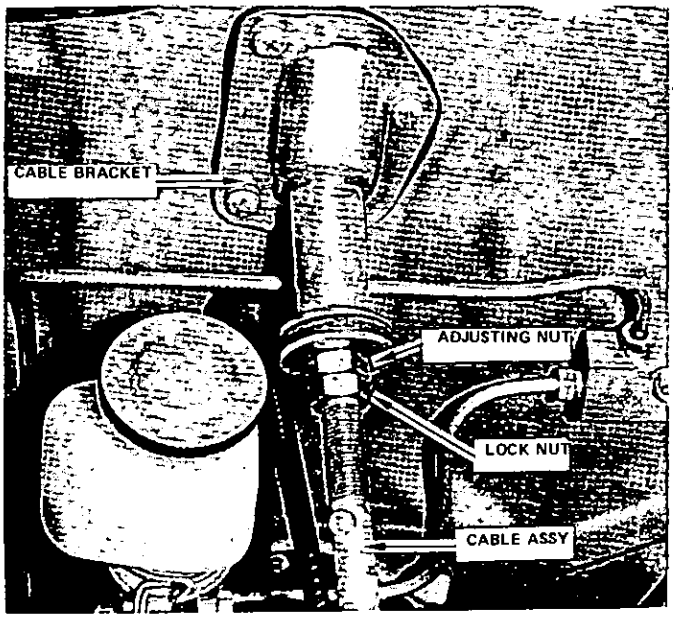
(2) Attach a bleeder tube to the bleeder valve on the slave cylinder and immerse the free end of the tube in a small amount of fluid in a clean glass container.

(3) Open the bleed screw approximately three-quarters of a turn and apply pressure to the clutch pedal. Close the bleed screw at the end of the pedal down stroke before the pedal is allowed to return to the off position.

(4) Repeat the above operation until clean fluid, free from air bubbles is being pumped into the container.

It is important that the pedal be allowed to return slowly to avoid drawing air into the system and to maintain the fluid level at least half way in the fluid reservoir.

(5) Close the bleeder valve, remove the bleeder tube and top up the master cylinder reservoir to within approximately 12.70 mm (0.500 in) of the filler orifice.



Clutch Operating Cable Adjusting Point. 1200 Models.

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6. CLUTCH THROW-OUT BEARING

MECHANICALLY OPERATED CLUTCH TO RENEW (1000 SERIES)

(1) Remove the gearbox and clutch bell-housing assembly as described in the TRANSMISSION SECTION of this manual.

(2) Unhook and remove the bearing return spring from the release shaft fork.

(3) Slide the throw-out bearing and hub assembly forward along the gearbox input shaft bearing retainer sleeve and withdraw from the bellhousing.

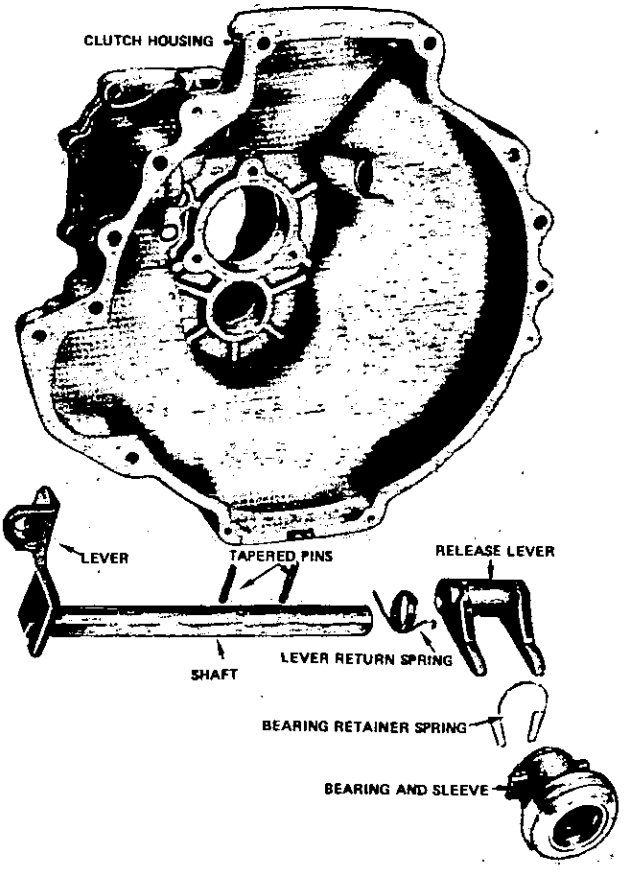
(4) Tap out the two tapered pins securing the release shaft fork to the shaft and withdraw the shaft sufficiently to remove the fork and return spring from the shaft and withdraw the shaft from the bellhousing.

(5) Inspect the release shaft and fork for wear and distortion.

(6) Check the release shaft bushes in the bellhousing for wear.

(7) Using a suitable puller or press, remove the throw-out bearing from the bearing hub and check the bearing hub for wear.

Replace all worn or damaged components where necessary.



Exploded View of Clutch Release Components. 1000 Models.

(8) Instal the new throw-out bearing on the bearing hub so that the thrust face of the bearing is facing away from the end of the hub.

NOTE: Apply pressure to the inner race of the bearing when installing on the bearing hub.

(9) Insert the bearing release shaft sufficiently into the housing to instal the return spring and release shaft fork.

(10) Push the release shaft fully home and check the movement and alignment in the bellhousing.

(11) Centre the fork on the shaft and tap in the two tapered pins and check that they are secure.

(12) Lightly lubricate the input shaft and sleeve with high melting point grease.

(13) Instal the bearing and hub assembly on the input shaft bearing retaining sleeve and position the fork on the bearing hub.

(14) Instal the bearing return spring on the bearing hub and locate the end of the spring on the fork.

(15) Check the operation of the clutch release mechanism and instal the gearbox and bellhousing assembly in the vehicle as described in the TRANSMISSION section of this manual.

(16) Adjust the clutch release shaft free travel to specifications as detailed in under ADJUSTMENTS in this section.

MECHANICALLY OPERATED CLUTCH TO RENEW (1200 SERIES)

(1) Remove the gearbox and clutch bellhousing assembly as described in the TRANSMISSION section of this manual.

(2) Remove the rubber dust excluder from the end of the withdrawal lever and the aperture in the bellhousing.

(3) Separate the withdrawal lever return spring from the lever and throw-out bearing and withdraw the throw-out bearing and bearing hub out over the input shaft bearing retaining sleeve.

(4) Disengage the withdrawal lever from the lever pivot pin and withdraw the lever from the bellhousing.

(5) Using a suitable puller or press, remove the throw-out bearing from the bearing hub.

(6) Clean the components, excluding the bearing, in a suitable solvent and allow to dry.

(7) Inspect the bearing hub, withdrawal lever pivot pin, return spring and dust excluder for wear, damage and fatique. Renew worn or damaged components where necessary.

(8) Instal the new throw-out bearing on the bearing hub so that the thrust face of the bearing is facing away from the lever end of the hub.

NOTE: When installing the bearing on the bearing hub, the pressure must be applied to the inner race of the bearing.

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Unless this procedure is adhered to the bearing will be damaged.

(9) Position the end of the withdrawal lever in the aperture of the bellhousing and locate the opposite end of the lever on the lever pivot pin.

(10) Lubricate the gearbox input shaft bearing retainer sleeve sparingly with a high melting point grease and instal the throw-out bearing and bearing hub on the sleeve.

(11) Locate the ends of the withdrawal lever return spring in the holes in the lever and the throw-out bearing hub.

NOTE: Ensure that the spring ends are correctly located prior to installation of the gearbox and bellhousing assembly.

(12) Instal the rubber dust excluder over the end of the withdrawal lever and ensure that it is correctly seated in the clutch bellhousing aperture.

(13) Instal the gearbox and bellhousing assembly in the vehicle as described in the TRANSMISSION section of this manual.

(14) Adjust the clutch withdrawal lever free travel to specifications as detailed under ADJUSTMENTS in this section.

HYDRAULIC CLUTCH TO RENEW (1200 SERIES)

(1) Remove the gearbox and clutch bellhousing assembly as described in the TRANSMISSION section of this manual.

(2) Remove the rubber dust excluder from the end of the withdrawal lever and the aperture in the bellhousing.

(3) Remove the return spring from the throw-out bearing hub and withdraw the bearing and hub assembly.

(4) Remove the withdrawal lever from the lever pivot pin and withdraw the lever from the clutch bellhousing.

(5) Using a suitable puller or press remove the throw-out bearing from the bearing hub.

(6) Clean the components excluding the bearing in a suitable solvent and allow to dry.

(7) Inspect the bearing hub, withdrawal lever, pivot pin, bearing return spring and dust excluder for wear, damage and fatigue. Renew worn parts and damaged components where necessary.

(8) Instal the new throw-out bearing on the bearing hub so that the thrust face of the bearing is facing away from the lever end of the hub.

NOTE: When installing the bearing on the bearing hub, the pressure must be applied to the inner section of the bearing. Unless this procedure is adhered to the bearing will be damaged.

(9) Position the end of the withdrawal lever in the bellhousing aperture and locate the lever on the lever pivot pin.

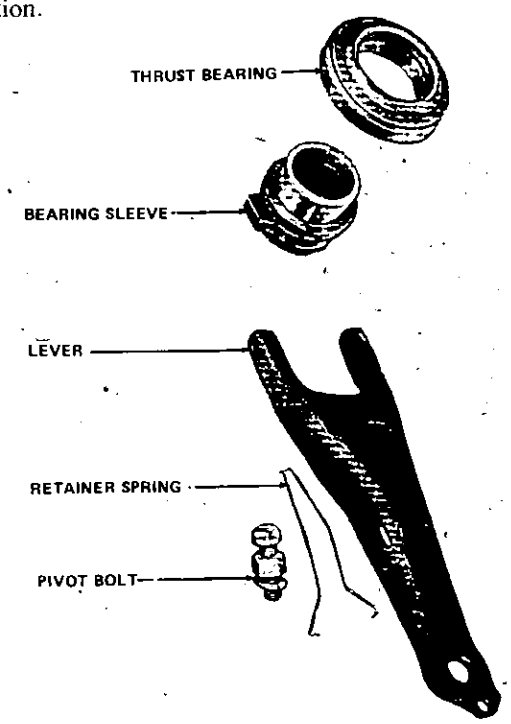
(10) Lubricate the gearbox input shaft bearing retainer sleeve sparingly with high melting point grease and instal the throw-out bearing and hub assembly on the gearbox input shaft sleeve.

(11) Position the throw-out bearing return spring on the throw-out bearing, ensuring that it is correctly seated on the bearing and in the bellhousing.

(12) Instal the rubber dust excluder over the end of the withdrawal lever and ensure that it is correctly seated in the clutch bellhousing aperture.

(13) Instal the gearbox and bellhousing assembly in the vehicle as described in the TRANSMISSION section of this manual.

(14) Adjust the clutch withdrawal lever free travel to specifications as detailed under ADJUSTMENTS in this section.



Clutch Withdrawal Lever and Bearing. Typical Left Hand Drive Models.

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7. CLUTCH PEDAL

HYDRAULIC CLUTCH

To Remove and Instal

(1) Disconnect and remove the clutch pedal return spring.

(2) Withdraw the split pin and washer, take out the clevis pin and disconnect the clutch pedal from the master cylinder push rod.

(3) Unscrew the self locking nut, remove the flat washer, waved washer and withdraw the clutch pedal pivot bolt, and lift out the clutch pedal. Remove the two nylon flanged bushes from the metal spacer.

(4) Check the pedal bushes and pivot bolt for wear.

(5) Check the clevis and clevis pin for wear.

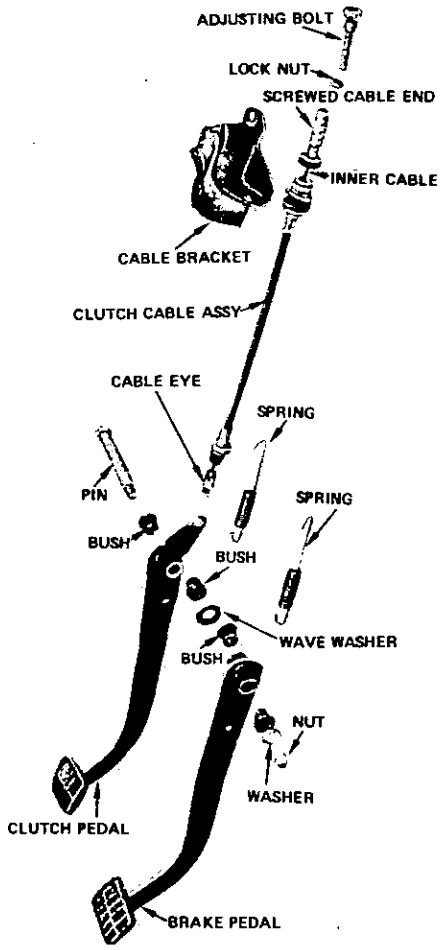
(6) Replace all components where necessary.

(7) Lightly apply high melting point grease to the pedal bush and pivot bolt and instal the nylon bushes in the metal spacer.

(8) Place the clutch pedal in position and insert the pivot bolt, fit the waved washer and flat washer and secure with the self locking nut.

(9) Align the holes in the clevis with the hole in the clutch pedal, instal the clevis pin and secure with the flat washer and new split pin.

(10) Instal the clutch pedal return spring and check the operation of the pedal.



Exploded View of Clutch and Brake Pedal Fulcrum Bushes, Pin and Clutch Cable. (1000 Models).

PEDAL AND CONTROL CABLE

To Remove and Instal (1000 Series)

Removal and installation, including components, of the clutch pedal on the 1000 Series is the same as for the hydraulic system with the exception that the clutch control clevis coupling is connected to the top of the clutch pedal.

(1) To remove the control cable from the clutch pedal, remove the split pin and flat washer, withdraw the clevis pin from the clevis thus disconnecting the clutch control cable from the slot at the top of the clutch pedal.

(2) Withdraw the clevis and the outer cable from the firewall at the upper end.

(3) Working at the clutch release shaft end, disconnect the lower end of the control cable from the release shaft.

(4) Loosen the two lock nuts connecting the inner and outer cable to the cable support bracket attached to the engine and separate the cables from the support bracket.

(5) Withdraw the control cable from the vehicle and check the outer cable for damage or fatigue.

(6) Check lock nuts for thread damage and the rubber insulators for fatigue.

(7) Replace all worn or damaged components where necessary.

Installation is the reverse procedure to that of removal with attention to the following:

Lubricate the cable with molybdenum disulphide grease.

Adjust the pedal height and release shaft free travel to specifications as detailed under ADJUSTMENTS in this section.

To Remove and Instal (1200 Series)

Removal and installation, including components, of the clutch pedal on the 1200 series is the same as for the hydraulic system with the exception that the clutch control clevis coupling is connected to the top of the clutch pedal.

(1) To remove the control cable from the clutch pedal, unhook the clutch cable from the slot at the top of the clutch pedal.

(2) Remove the three screws attaching the control cable flange to the fire wall.

(3) Working at the lower end of the control cable, disconnect the cable from the withdrawal lever.

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(4) Release the lock nuts at the upper end of the outer cable and withdraw the cable assembly.

(5) Inspect the inner and outer cable for fraying and external damage.

(6) Replace worn or damaged components where necessary.

Installation is the reverse procedure to that of removal with attention to the following:

Instal the control cable with the grease nipple uppermost to facilitate lubrication and lubricate the cable.

Adjust the clutch release lever free travel and pedal height to specifications as detailed in this section.

8. ADJUSTMENTS

HYDRAULIC CLUTCH

To Adjust Pedal Height

Pedal height adjustment is carried out in two stages.

(1) Check the pedal height by measuring in a straight line, with a steel rule, the distance from the floor to the top of the pedal pad. The correct measurement should be 143.5 mm (5.65 in).

If adjustment is necessary, back off the pedal stop, loosen the two bolts attaching the master cylinder to the fire wall and add or remove adjusting shims as required to obtain the correct pedal height.

Ensure that the upper and lower adjusting shims are of equal thickness and that the two bolts attaching the master cylinder to the fire wall have been secured on completion of this adjustment.

(2) Measure the distance between the floor and the top of the pedal pad and adjust the pedal stop so that the pedal pad height is 141.5 mm (5.57 in).

Tighten the pedal stop lock nut and recheck the measurements.

To Adjust Withdrawal Lever Free Travel

(1) Raise the front of the vehicle and support on stands or support the complete vehicle on a hoist.

(2) Apply clutch pedal and allow to return to the off position.

(3) Check the adjustment by measuring the free travel of the lever from the full off position and the position when the thrust bearing contacts the clutch diaphragm fingers.

(4) If adjustment is required, slacken the lock nut on the slave cylinder push rod and turn the adjustment nut to achieve the specified free travel of the withdrawal lever. See Specification section.

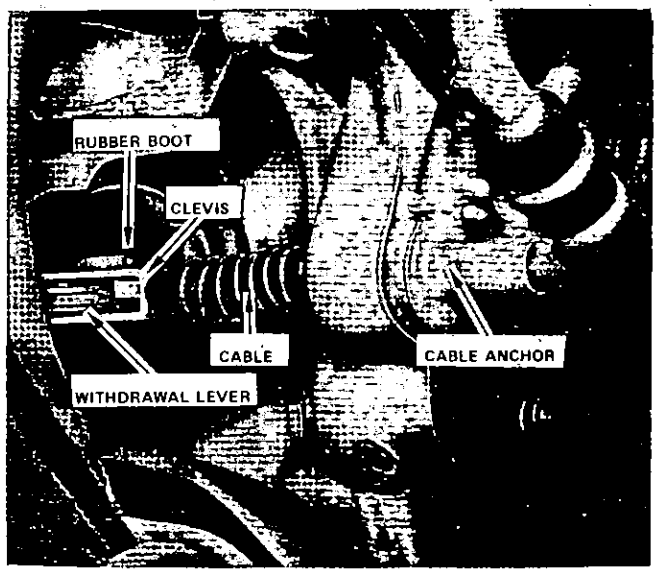
(5) Hold the adjusting nut and push rod and tighten the lock nut. Recheck the free travel.

PEDAL AND CONTROL CABLE

To Adjust (1000 Series)

Pedal height adjustment is obtained by adjusting the pedal stop.

(1) Check the pedal height by measuring in a straight line with a steel rule, the distance from the floor to the top of the pedal pad. The correct measurement should be 144.5 mm (5.728 in).



Clutch Release Mechanism — Cable Operated. 1200 Models.

If adjustment is necessary, back off the pedal stop lock nut and adjust the stop to obtain the correct pedal height. Tighten the lock nut and recheck the pedal pad height.

(2) Working at the lower end of the cable, release the lock nut on the adjusting bolt and measuring the distance between the lower face of the release shaft lever and the under side of the cable lower support bracket. The correct measurement between the two faces is 124 mm (4.881 in) with the release shaft free travel reading 1.5 – 2.0 mm (0.059 – 0.078 in).

Tighten the lock nut and recheck both measurements.

To Adjust (1200 Series)

Pedal height adjustment is carried out in two stages.

(1) Check the pedal pad height by measuring in a straight line, with a steel rule, the distance from the floor to the top of the pedal pad.

The correct measurement should be from 139.5 to 143.5 mm (5.49 – 5.65 in).

Should pedal height adjustment be necessary, back off the pedal stop lock nut and adjust the pedal stop to obtain the correct pedal height.

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Secure the lock nut and recheck the pedal pad height.

(2) Release the lock nut at the upper end of the outer cable and adjust the pedal free travel.

Adjust the cable until a free travel of between 11-15 mm (0.433-0.591 in) from the original pedal height setting has been obtained.

Check the bearing release lever free travel and this reading should be 3.0 – 4.0 mm (0.1181 – 0.1575 in).

Should the bearing release lever free travel not be within this tolerance, readjust the pedal free travel.

Tighten the cable adjusting lock nut and recheck the free travel.

9. CLUTCH FAULT DIAGNOSIS

1. Clutch slipping.

	Possible cause	*Remedy*
(a)	Clutch cable adjustment.	– Check and adjust to specifications.
(b)	Weak or broken diaphragm spring.	– Check and renew assembly.
(c)	Worn driven plate facings.	– Check and renew driven plate.
(d)	Worn or scored flywheel face.	– Renew flywheel and ring gear.

2. Clutch shudder.

	Possible cause	*Remedy*
(a)	Oil or gummy driven plate facings.	– Check and renew driven plate.
(b)	Scored pressure plate or flywheel.	– Renew pressure plate and cover assembly or flywheel and ring gear.
(c)	Loose or damaged engine mounting.	– Check and renew mountings as necessary.
(d)	Loose or damaged driven plate hub.	– Check and renew driven plate.
(e)	Loose driven plate facings.	– Renew or check driven plate.
(f)	Cracked pressure plate face.	– Renew pressure plate and cover assembly.

3. Clutch grab.

	Possible cause	*Remedy*
(a)	Gummy driven plate facings.	– Renew driven plate.
(b)	Cracked pressure plate face.	– Renew pressure plate and cover assembly.
(c)	Loose or broken engine mountings.	– Check and renew engine mountings as necessary.

4. Throw-out bearing noise.

	Possible cause	*Remedy*
(a)	Dry or seized bearing.	– Check and renew bearing.
(b)	Incorrect clutch cable adjustment.	– Check and readjust to specification.
(c)	Faulty or broken diaphragm spring.	– Check and renew pressure plate assembly.

5. Insufficient clutch release.

	Possible cause	*Remedy*
(a)	Excessive free travel of clutch pedal.	– Adjust correctly.
(b)	Excessive play of release lever.	– Adjust correctly.
(c)	Pilot bushing sticking.	– Replace pilot bearing.
(d)	Clutch disc warped.	– Replace clutch disc.
(e)	Leaking master cylinder cup.	– Replace cup.
(f)	Leaking slave cylinder cup.	– Replace cup.
(g)	Air in hydraulic system.	– Bleed system.
(h)	Low fluid level in reservoir.	– Top up with brake fluid.

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MANUAL TRANSMISSION

SPECIFICATIONS

GEARBOX

3–SPEED

Type	3-speed with remote control column change
Synchromesh	On all forward gears
Ratios:	
Top	1.00 : 1
Intermediate	1.73 : 1
Low	3.38 : 1
Reverse	3.64 : 1

4–SPEED

Type	4-speed with floor change
Synchromesh	On all forward gears
Ratios:	
Top	1.00 : 1
Third	1.40 : 1
Second	2.17 : 1
First	3.76 : 1
Reverse	3.64 : 1

3 and 4 SPEED

Gear end-float:	
1st and 2nd gears (all)	0.15 – 0.25 mm (0.006 – 0.010 in)
3rd gear (4 speed)	0.15 – 0.35 mm (0.006 – 0.014 in)
Reverse gear (3 speed)	0.10 – 0.25 mm (0.004 – 0.010 in)
Reverse idler (3 speed)	0.05 – 0.15 mm (0.002 – 0.006 in)
Baulk ring to gear clearance:	
Standard	1.05 – 1.40 mm (0.040 – 0.055 in)
Minimum	0.5 mm (0.020 in)
Gear backlash	0.08 – 0.15 mm (0.003 – 0.006 in)
Laygear:	
End-float	0 – 0.1 mm (0 – 0.004 in)
Thrust washer sizes for adjustment	0.8 – 1.3 mm increments of 0.1 mm (0.031 – 0.051 in increments of 0.004 in)
Front bearing cover:	
Adjusting shim sizes	0.1 – 0.2 – 0.5 mm (0.004 – 0.008 – 0.020 in)
Detent spring:	
Length at load	16.4 mm at 7 kg (0.6457 in at 15.4 lb)

PROPELLER SHAFT

Type	Open tubular
Number of universal joints	2
Type of universal joints	Needle roller bearing and trunnion

TORQUE WRENCH SETTINGS

Main drive bearing retainer	1.0 – 1.4 kg/m (7 – 10 ft/lb)
Extension housing	1.6 – 2.2 kg/m (12 – 16 ft/lb)

PART 1 THREE SPEED TRANSMISSION

1. GEARBOX

DESCRIPTION

The three speed gearbox has synchromesh on all forward gears. The gears are helical cut and run in constant mesh with the laygear. Reverse gear runs in mesh with a reverse idler gear which is constantly meshed with the laygear.

The laygear operates on two ball type bearings which locate in the carrier plate and gearbox casing. Laygear end-float is adjusted by a washer which can be obtained in different thicknesses for this purpose.

Mainshaft, laygear and reverse idler are attached to the carrier plate which is interposed between the gear case and rear extension. The mainshaft operates on two ball type

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bearings which also locate in the carrier plate and gearbox casing.

Front bearing end float is adjusted by shims which are available in different thicknesses for this purpose. All mainshaft gears run on needle roller bearings. A needle roller bearing is also used to mount the input shaft to the mainshaft.

The gear change is the remote control type mounted on the steering column. Rods transfer the gear change lever movement to operating levers located in the gearbox case and through selector forks to the synchro sleeves. Rod adjustment is carried out at the steering box end of the rods.

TO REMOVE AND INSTAL

(1) Jack up the front of the vehicle and support on axle stands.

(2) Remove the drain plug and drain the oil from the gearbox.

(3) Disconnect the exhaust pipe at the manifold and holding brackets.

(4) Disconnect the speedometer cable at the rear extension housing.

(5) Mark across the edges of the rear universal joint and axle pinion flanges to ensure reassembly in their original positions.

(6) Disconnect the universal joint flange from the pinion flange and withdraw the propeller shaft from the rear of the gearbox.

(7) Take out the spring clips and detach the gear change rods from the operating levers and relay shaft.

(8) Detach the relay shaft from between the gearbox and side plate.

(9) Disconnect the clutch cable from the clutch lever, or clutch slave cylinder (where fitted) from the bell housing.

(10) Loosen off and remove the starter motor.

(11) Take out the bolts and remove the dust shield from the lower half of the bell housing.

(12) Support the engine and transmission on a jack.

(13) Remove the bolts attaching the rear gearbox mounting cross member to the chassis and extension housing.

(14) Unscrew and remove the bolts securing the clutch bell housing to the rear of the engine.

(15) Carefully draw the gearbox rearward, lower it to the floor and remove from beneath the vehicle.

Installation is a reversal of the removal procedure.

TO DISMANTLE

(1) Disconnect the release bearing retaining spring from the release fork and withdraw the bearing and sleeve assembly.

(2) Knock out the taper pins securing the release fork to the release shaft and lever. Withdraw the shaft from the case and fork, (1000 model only).

(3) Take out the three bolts retaining the mainshaft front bearing cover to the case and withdraw the cover, 'O' ring and shims.

NOTE: Check the number of adjusting shims fitted to facilitate adjustment at reassembly.

(4) Remove the two bolts retaining the speedo driven gear assembly to the extension housing and withdraw the assembly.

(5) Remove the bolts securing the extension housing to the carrier plate and gearbox casing.

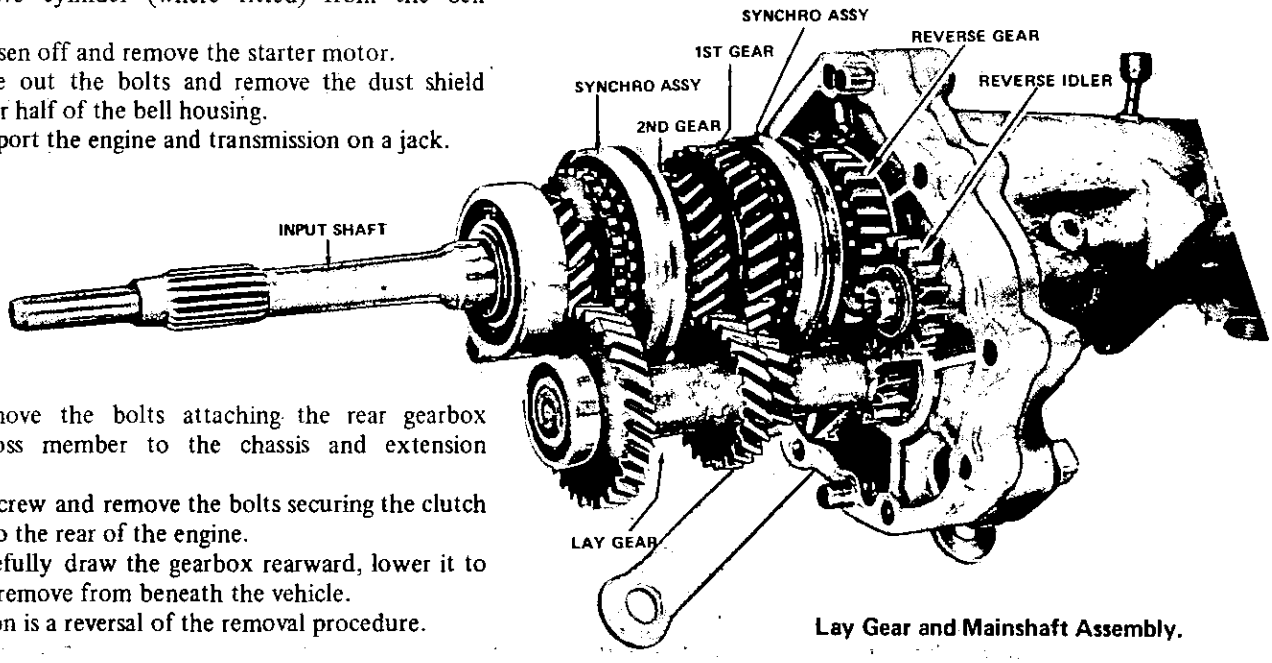
(6) Withdraw the extension housing from the rear face of the carrier plate. It may be necessary to ease the housing off the plate dowels, this can be best accomplished by exerting upward pressure on the housing while tapping the ends of the dowels with a punch and hammer.

(7) Hold the mainshaft and using a soft faced hammer gently tap the gearbox casing to separate the carrier plate and gear assembly from the casing.

NOTE: Check the number of adjusting shims at the front of the laygear to facilitate adjustment at reassembly.

(8) Mount the carrier plate and gear assembly in the jaws of a vice fitted with protective covers.

(9) Remove the circlip and thrust washer at the front



Lay Gear and Mainshaft Assembly.

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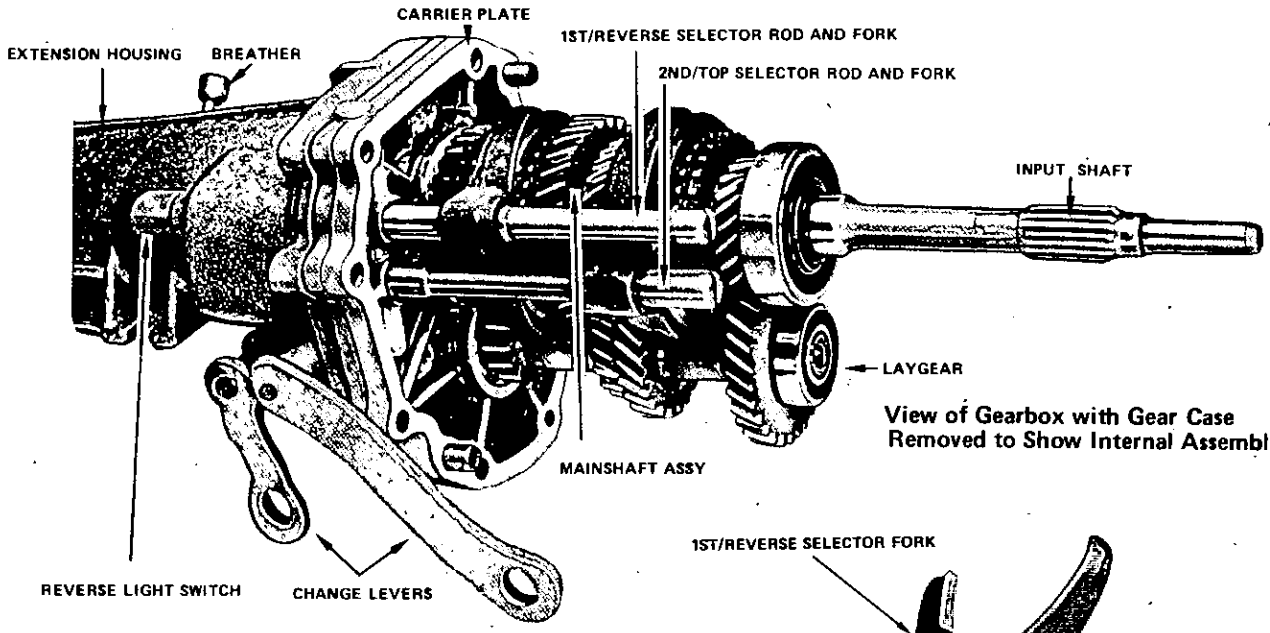


View of Gearbox with Gear Case Removed to Show Internal Assembly.

of reverse idler gear shaft and also at the rear carrier plate face end of the shaft.

(10) Knock out the idler shaft from the rear face of the carrier plate and detach the idler gear and rear thrust washer.

(11) Support the selector forks and knock out the spring pin attaching each fork to each selector rod.

(12) Unscrew the plug retaining the detent spring and ball in the end of the carrier plate.

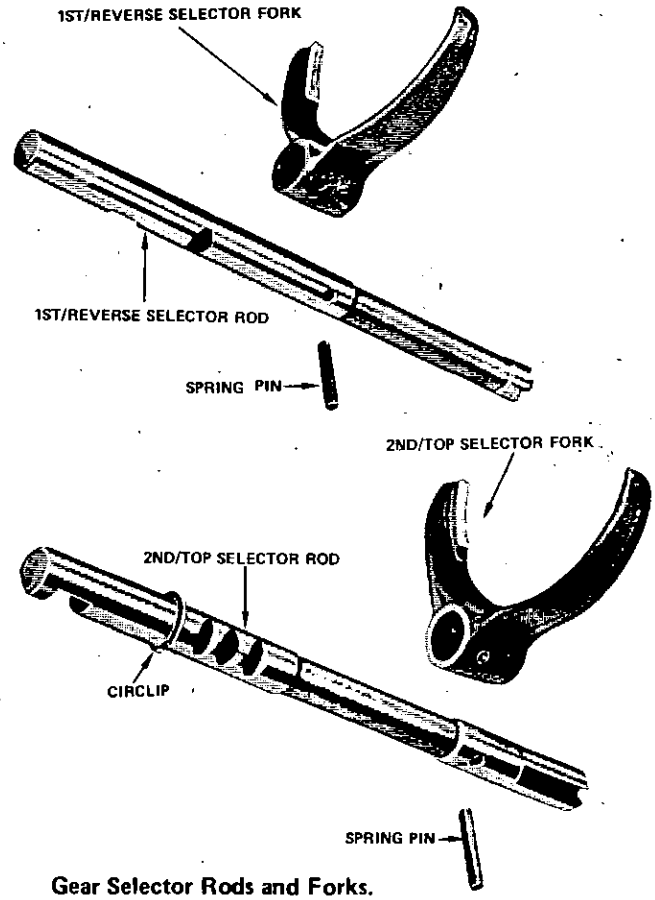
(13) Tap the 1st/reverse selector rod out of the carrier plate allowing the rod to move through the fork.

(14) Repeat the operation for the 2nd/top selector rod and remove the interlock plunger located in the carrier plate between the selector rod holes.

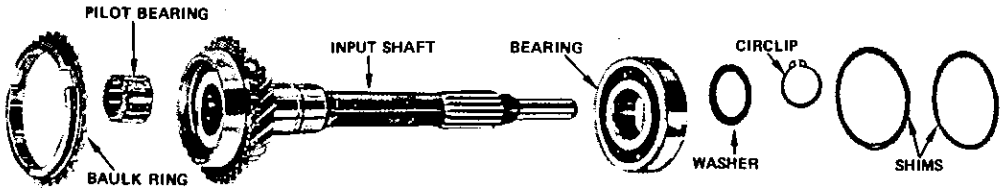
NOTE: An additional detent ball and spring are located in a blank ended hole in the carrier plate and should be removed when practicable.

(15) Using a soft faced hammer tap the rear end of the mainshaft to dislodge the bearing from the carrier plate. It may be also necessary to tap the laygear rear bearing to enable the laygear and mainshaft assembly to be withdrawn together from the carrier plate.

(16) Pull the input shaft from the end of the mainshaft assembly, remove the needle roller bearing if attached to the mainshaft spigot.



Gear Selector Rods and Forks.



Exploded View of Input Shaft Components.

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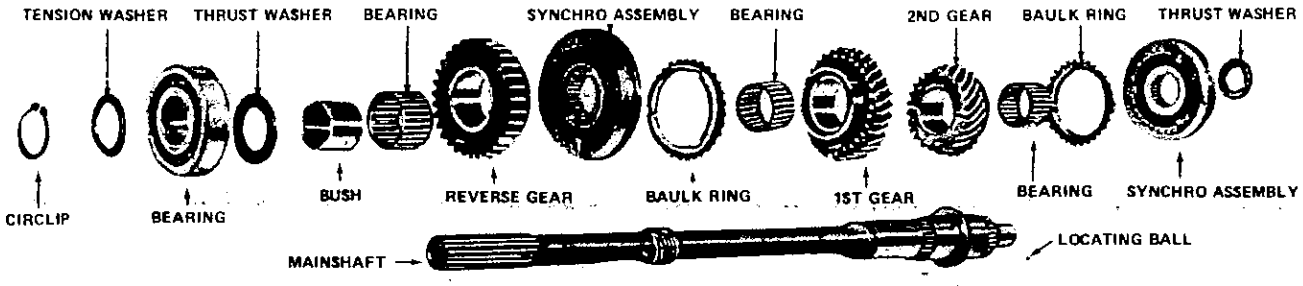

Exploded View of Mainshaft Components.

(17) Remove the thrust washer and ball bearing from the end of the mainshaft followed by the baulk ring, synchro hub assembly, second baulk ring and second gear complete with needle roller bearing.

(18) Remove the circlip and washer retaining the mainshaft rear bearing and remove the bearing.

(19) Withdraw the thrust washer, reverse gear with needle roller bearing and mainshaft bush.

(20) Remove the synchro hub assembly followed by the baulk ring and low gear with needle roller bearing.

NOTE: Some mainshaft assemblies may have the gears mounted on a narrow section roller bearing with the addition of a bearing spacer. Note the spacer position when dismantling to facilitate reassembly.

(21) Before dismantling the extension housing, mark the position of the levers in relation to the housing.

(22) Remove the nut and washer and knock out the cotter pin retaining the low/reverse selector lever to the cross-shaft.

(23) Withdraw the cross-shaft from the housing and selector lever.

(24) Repeat the operation to remove the second/top cross shaft and selector lever.

(25) If replacement of the oil seal and/or the main shaft bush is necessary, knock out the components from the rear of the extension housing.

(26) If replacement of the input shaft bearing is necessary, remove the circlip and washer and press or draw the bearing from the shaft.

TO CLEAN AND INSPECT

(1) Clean all components in cleaning solvent and blow dry with compressed air.

(2) Check ball bearings for roughness or excessive side play. Do not rotate the bearings at high speed with compressed air, particularly when the bearings are dry or damage will result.

(3) Check needle roller bearings for wear and/or pitting.

(4) Examine the teeth on all gears for wear and/or pitting, also burring on the teeth ends.

(5) Check the synchronising teeth on the gear for wear or chipping.

(6) Check the baulk rings on their corresponding gear cones for wear (see specifications).

(7) Check the selector forks for wear, the selector detent balls for wear and the detent springs for breakage or loss of tension (see specifications).

(8) Renew all worn or damaged components as necessary.

TO ASSEMBLE

(1) Instal the low gear and needle roller bearing on the mainshaft with the gear cone facing to the rear of the shaft.

NOTE: Instal the bearing spacer if originally fitted and oil components during assembly.

(2) Position the baulk ring on the gear cone.

(3) If the synchro hub has been dismantled, instal the synchro plates in the hub slots and slide the sleeve over the hub splines. Fit the synchro springs under the synchro plate lugs at each side to tension the plates.

NOTE: The synchro springs must be installed so that when viewed from one side they travel in opposite directions.

(4) Instal the synchro hub assembly on the mainshaft, engaging the ends of the synchro plates in the notches of the baulk ring and the hub splines on the mainshaft splines.

(5) Lubricate and instal the needle roller bearing and mainshaft bush for reverse gear.

(6) Position the reverse gear on the mainshaft with the gear cone facing the synchro hub assembly.

NOTE: Instal the bearing spacer if originally fitted.

(7) Instal the thrust washer and press the rear bearing onto the mainshaft.

(8) Position the tension washer on the mainshaft so that the concave face of the washer faces the bearing.

(9) Instal the circlip and check that it is correctly seated in the groove of the mainshaft.

(10) Check the end-float between the reverse gear and thrust washer and the first gear and mainshaft flange. (See specifications for end-float clearance.)

NOTE: If end-float exceeds the limit renew the thrust washer.

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(11) Instal the second gear needle roller bearing on the front of the mainshaft.

(12) Instal bearing spacer if originally fitted.

(13) Position the second gear on the needle roller bearing with the gear cone facing forward.

(14) If dismantled, assemble the synchro hub as previously described.

(15) Position the synchro hub assembly on the mainshaft so that the synchro plate ends engage the baulk ring notches and the hub splines engage the mainshaft splines.

(16) Instal the ball bearing in the mainshaft recess, grease both faces of the thrust washer and instal so that the oil groove side of the washer abuts the synchro hub. Locate the notch in the thrust washer over the ball bearing.

(17) Position the baulk ring so that the synchro plate ends engage the baulk ring notches.

(18) Lubricate and instal the needle roller bearing on the mainshaft spigot.

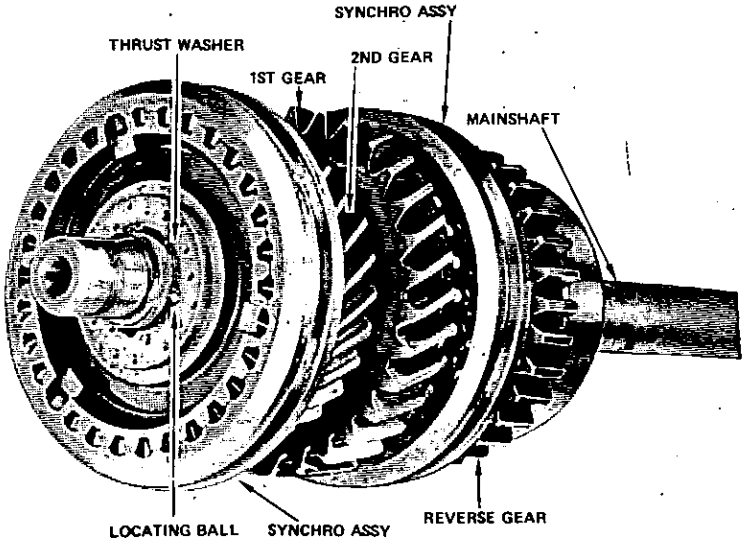
(19) If the input shaft has been dismantled press on the bearing and secure with the washer and circlip.

(20) Position the input shaft on the mainshaft needle roller bearing and engage the gear cone in the baulk ring. Mainshaft assembly is now completed ready for installation.

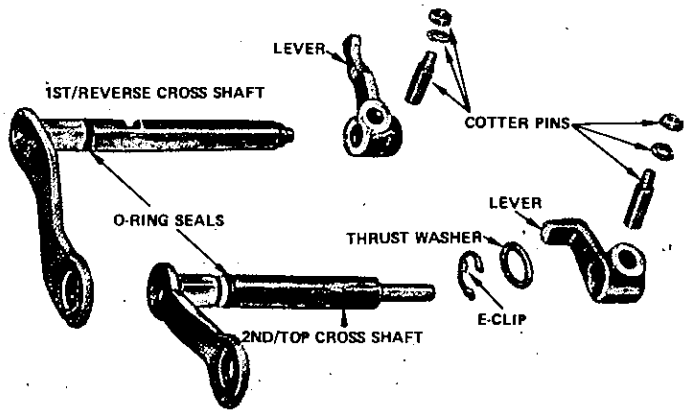
NOTE: Before the laygear assembly can be installed to the mainshaft assembly, it will be necessary to check the laygear end-float in the gear case. This is essential particularly if any parts of the assembly have been renewed.

(21) Ensure that the circlip is correctly located in the bearing aperture at the front of the gear case.

(22) Instal the laygear in the case so that the bearing abuts the circlip.



Thrust Washer Must be Fitted with Dumpled Face Forward.



Exploded View of Selector Cross Shaft Components.

(23) Using special tool No. ST4367, position the tool across the faces of the open end of the gear case with the laygear rear bearing located immediately below the cutaway in the tool.

(24) Insert the thrust washer, originally removed on dismantling, between the top face of the bearing and the lower edge of the gauge cutaway.

(25) Using feeler gauges check the remaining gap between the washer and gauge. Measure the thickness of the washer and add the thickness of the feeler gauges used. Deduct from the total measurement 0.03 mm (0.001 in) for end-float. The balance remaining is the thickness of the washer necessary for correct adjustment. (See specifications for washer thicknesses and end-float tolerance.)

(26) Alternatively, if the special tool is not available, the Plastigage method can be used as follows.

(27) Cut three pieces of Plastigage or soft lead wire to fit on the bearing aperture flange in the carrier plate, space them equidistant around the flange.

NOTE: To hold the three pieces of Plastigage or lead wire in position it may be necessary to use a smear of grease.

(28) With the laygear installed as described in operations (21) and (22) fit the carrier plate into position over the laygear rear bearing and onto the gear case.

(29) Instal the carrier plate retaining bolts and tighten them evenly and diagonally to a torque of 12–16 ft/lb.

(30) Remove the carrier plate and carefully detach the pieces of Plastigage or lead wire from the flange.

NOTE: Provided the Plastigage or lead wire was of adequate thickness it should now be in a flattened condition.

(31) Using a micrometer check the thickness of each piece of compressed Plastigage or soft lead wire and arrive at a mean figure. Deduct from this figure, the necessary end-float (operation 25) and the balance represents the thickness of the washer required.

(32) Remove the laygear assembly from the gear case.

(33) Mount the carrier plate in the jaws of a vice fitted with protective covers.

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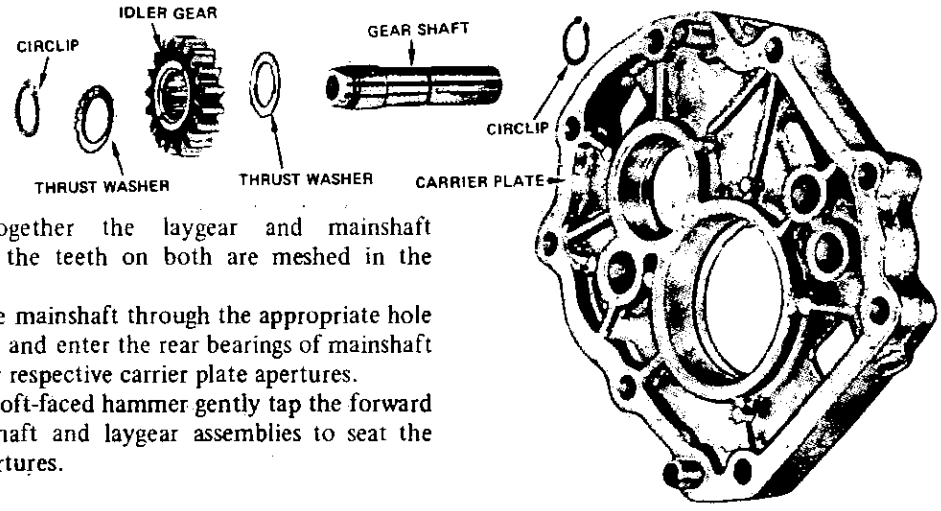


Exploded View of Reverse Idler Components.

(34) Bring together the laygear and mainshaft assembly so that the teeth on both are meshed in the running position.

(35) Insert the mainshaft through the appropriate hole in the carrier plate and enter the rear bearings of mainshaft and laygear in their respective carrier plate apertures.

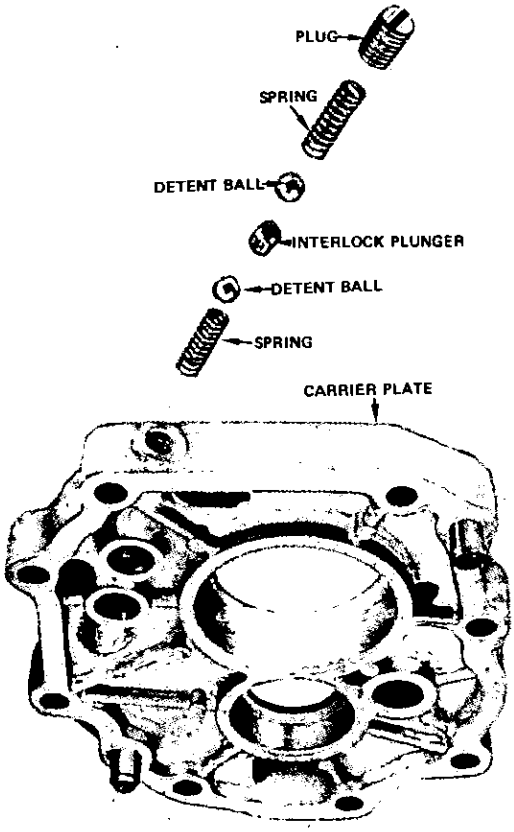
(36) Using a soft-faced hammer gently tap the forward end of the mainshaft and laygear assemblies to seat the bearings in the apertures.

NOTE: Ensure that both bearings enter the apertures squarely and do not allow the gear teeth to come out of mesh.

(37) Instal the selector forks to the synchro sleeves.

(38) Instal a detent spring and ball to the blank end hole in the carrier plate and using a piece of rod, depress the ball and spring and hold in this position.

(39) Insert the second/top selector rod through the selector fork and into the carrier plate, with the three detents on the selector rod facing the detent ball.



Order in which Selector Road Detent Components are Fitted to the Carrier Plate.

(40) When the selector rod engages over the depressed detent ball, remove the holding rod and push in the selector rod until the ball engages in the centre detent on the shaft. Instal the stop circlip at the rear end of the selector rod.

(41) Insert the interlock plunger into the hole located at right angles to and between the selector rod holes.

(42) Instal the first/reverse selector rod with the single detent on the rod facing the interlock plunger.

(43) Drop the remaining detent ball and spring into the hole on the edge of the carrier plate and screw in the plug until it is flush with the plate edge.

NOTE: The position of the detent plug regulates the amount of tension on the detent ball and spring. Normally it is correct when set as described in operation (43).

(44) Firmly support the selector rods and forks, align the hole in each rod and fork and tap in the retaining spring pins.

(45) With the gears in neutral position instal the reverse idler gear with front and rear thrust washers.

(46) Tap the idler shaft into position and secure with circlips at the front and rear of the shaft.

(47) Check the end-float on the reverse idler gear and renew the thrust washers if the clearance exceeds specifications.

(48) Instal the selected laygear end-float adjusting washer to abut the circlip in the front bearing aperture. Smear with a little grease to hold in position.

(49) Instal the carrier plate assembly into the gear case so that the front bearings of the mainshaft and laygear assemblies enter the bearing apertures squarely.

(50) Check that the dowel holes and dowels are aligned in the carrier plate and gear case. Use a soft-faced hammer and gently tap the carrier plate down into position.

(51) If the extension housing components have been dismantled, assemble as follows.

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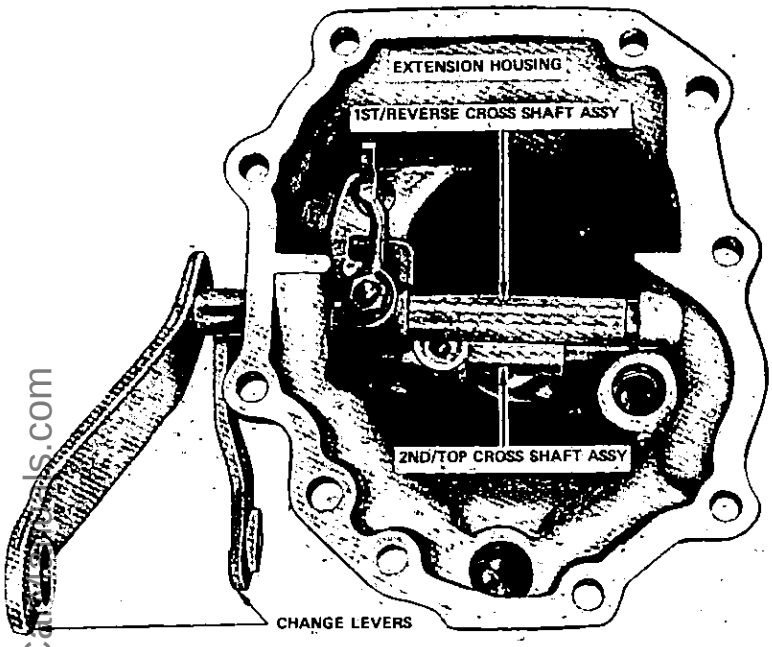
(52) Instal the E clip (if removed), thrust washer and a new 'O' ring to the second/top speed cross shaft.

(53) Hold the selector lever in position and insert the cross shaft through the housing and lever. Secure the lever to the cross shaft with the cotter pin, nut and washer.

NOTE: To facilitate assembly align the marks made on dismantling.

(54) Fit a new 'O' ring seal to the first/reverse speed cross shaft and instal as described for the second/top speed cross shaft and lever.



Selector Cross Shafts and Levers Correctly Assembled.

(55) Instal a new oil seal in the rear of the extension housing.

(56) Position the extension housing on the carrier plate and instal the retaining bolts. Tighten the bolts evenly and diagonally to a torque of 1.6 – 2.2 kg/m (12 – 16 ft/lb).

(57) Using a depth gauge check the dimension from the face of the front bearing outer race to the gear case front cover face. Deduct from the dimension 5.00 – 5.15 mm (0.20 – 0.206 in) to allow for the cover bearing retainer boss. The balance is the thickness of shim required for adjustment.

(58) Instal the selected shim on the bearing outer race, smear a new oil seal with grease and fit to the front cover.

(59) Position the front cover with gasket ring on the gear case, instal and tighten the retaining bolts to a torque of 1.0 – 1.4 kg/m (7 – 10 ft/lb).

(60) Insert the clutch release shaft through the case, return spring and release fork.

(61) Instal the taper pins to secure the shaft and fork. Position the return spring so that one leg engages over the front of the fork leg and the other spring leg against the case.

(62) Instal the release bearing and sleeve assembly and attach to the release fork by the spring legs.

(63) Lubricate the speedometer driven gear assembly and instal in the extension housing with the two retaining bolts.

(64) Check that all gears engage by operating the change speed levers at the side of the casing.

(65) Instal the transmission to the vehicle and fill with the correct grade and quantity of oil.

2. GEAR CHANGE ASSEMBLY

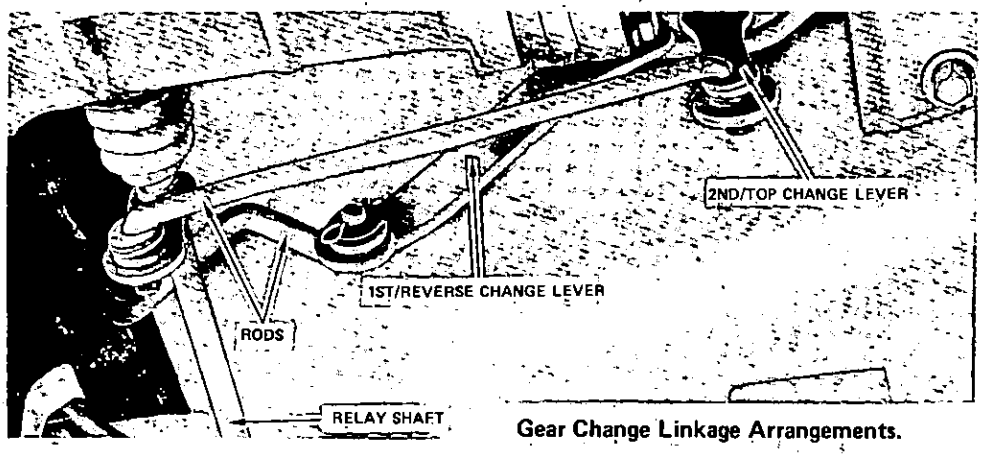
TO REMOVE AND INSTAL

(1) Take out the retaining screws from the column cover assembly and detach both halves of the cover.

(2) Remove the circlip at the control rod top support bracket.

(3) Remove the circlip and clevis pin retaining the gear change lever to the control rod and withdraw the lever and rubber bush.

(4) Loosen off and remove the steering column upper support bracket.



Gear Change Linkage Arrangements.

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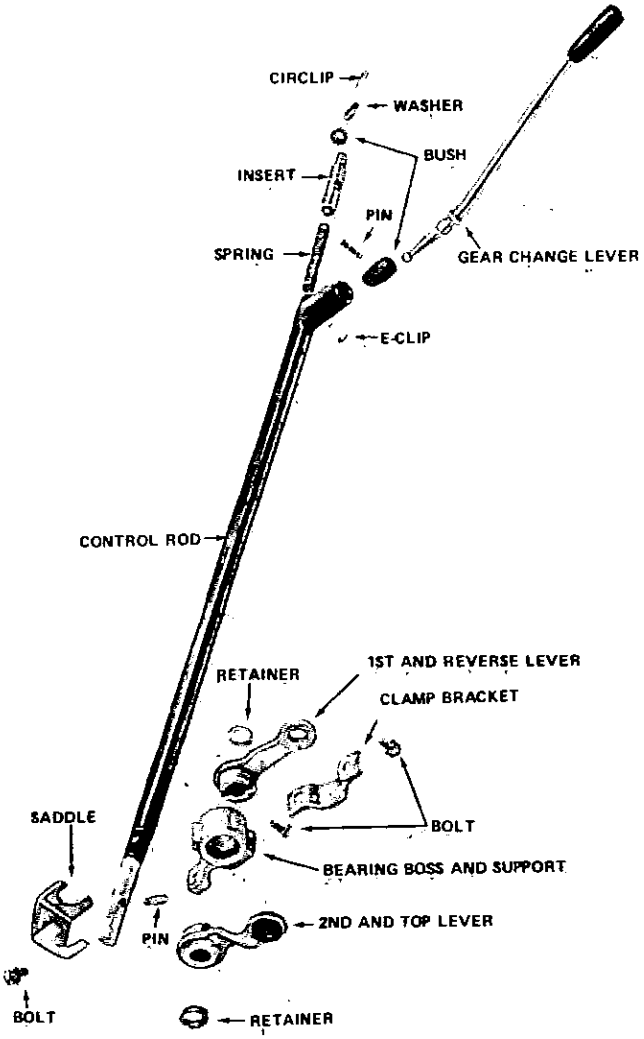

Column Control Gear Change Components.

(5) Remove the screws attaching the rubber dust seal to the floor boards and work the seal up the column.

(6) Working at the steering box disconnect both gear change rods from the control rod levers.

(7) Remove the two set bolts from the bracket retaining the lever assembly to the steering column.

(8) Move the control rod assembly down the column to facilitate removal of the spring, swivel pin and bush from the upper end of the control rod.

(9) Ease the control assembly down and out from the vehicle working the rod through the rubber dust seal.

Installation is a reversal of the removal procedure.

TO DISMANTLE AND ASSEMBLE

(1) Remove the set bolt retaining the saddle to the control rod lever bearing boss and remove the saddle.

(2) From the end of the control rod remove the grooved retainer, operating lever and bearing boss.

(3) Extract the pin from the hole in the control rod and remove the remaining operating lever and grooved retainer.

(4) Clean all components and examine the bearing bushes for wear. Renew any components which are worn or damaged. Lubricate components during assembly.

Assembly is a reversal of the dismantling procedure.

TO ADJUST GEAR CHANGE RODS

(1) Check that the transmission is in neutral.

(2) Note that the control rod operating levers are marked with a groove on their top edge and the bearing boss with a ridge. When correctly adjusted in the neutral position all three marks will be aligned.

(3) If adjustment is required, lengthen or shorten the gear change rods as necessary, at the adjusting nuts located above and below the trunnions.

PART 2 FOUR SPEED TRANSMISSION

1. GEARBOX

DESCRIPTION

The four speed gearbox has synchromesh on all forward speeds. The gears are helical cut and run in constant mesh with the laygear.

The laygear operates on two ball type bearings which locate in the carrier plate and gearbox casing. Laygear end-float is adjusted by a washer which can be obtained in different thicknesses for this purpose.

Mainshaft, laygear, reverse gear and reverse sliding and idler gears are attached to the carrier plate which is interposed between the gear case and rear extension.

All mainshaft forward gears run on needle roller bearings. A needle roller bearing is also used to mount the input shaft to the mainshaft.

Reverse gear is splined to the mainshaft and secured by a circlip. The reverse idler gear is splined to the laygear and secured by a circlip. A reverse sliding gear operated by the selector fork meshes with both reverse gear and idler when reverse is selected. All components of the reverse gear assembly are located at the rear face of the carrier plate.

The floor type gear change is spring loaded to prevent accidental selection of reverse gear.

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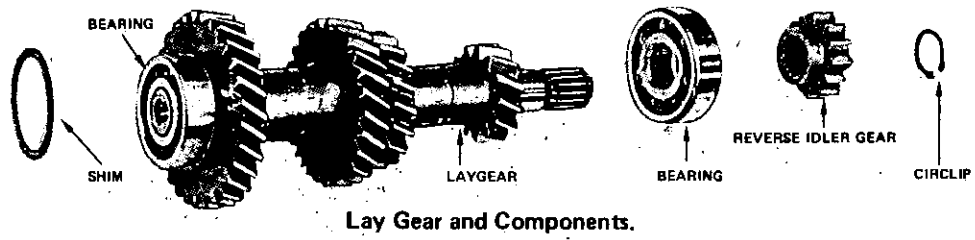


Lay Gear and Components.

TO REMOVE AND INSTAL

(1) Jack up the front of the vehicle and support on axle stands.

(2) Unscrew the gear lever knob and move the floor coverings to gain access to the rubber boot at the base of the gear lever.

(3) Remove the E clip and pin retaining the gear lever to the control assembly and detach the lever.

(4) Remove the drain plug and drain the oil from the gearbox.

(5) Disconnect the reverse switch wires at the side of the gearbox.

(6) Disconnect the exhaust pipe at the manifold and support brackets.

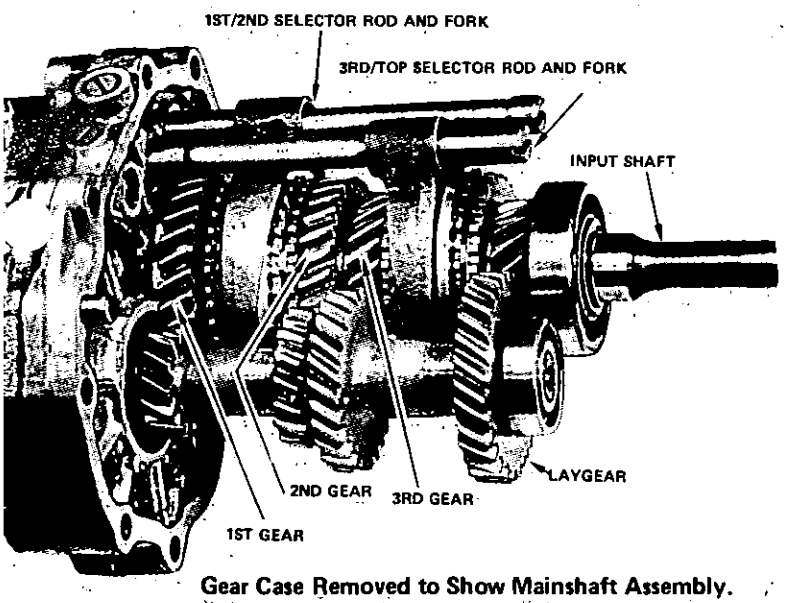
(7) Disconnect the speedometer cable at the rear extension housing.

(8) Mark across the edges of the rear universal joint and rear axle pinion flanges to ensure reassembly in their original positions.

(9) Disconnect the universal joint flange from the pinion flange and withdraw the propeller shaft from the rear of the gearbox.

(10) Disconnect the clutch cable from the clutch withdrawal lever, or clutch slave cylinder (where fitted) from the bell housing.

(11) Loosen off and remove the starter motor.



Gear Case Removed to Show Mainshaft Assembly.

(12) Take out the bolts and remove the dust shield from the lower half of the bell housing.

(13) Support the engine and transmission on a jack.

(14) Remove the bolts attaching the gearbox rear mounting crossmember to the chassis and extension housing.

(15) Unscrew and remove the bolts securing the clutch bell housing to the rear of the engine.

(16) Lower the assembly and draw it rearward until clear of the engine and remove from beneath the vehicle.

Installation is a reversal of the removal procedure.

TO DISMANTLE

(1) Disconnect the release bearing retaining spring from the release fork and withdraw the bearing and sleeve assembly.

(2) Knock out the taper pins securing the release fork to the release shaft and lever. Withdraw the shaft from the case and fork, (1000 model only).

(3) Take out the three bolts retaining the mainshaft front bearing cover to the case and withdraw the cover, seal and shims.

NOTE: Check the number of adjusting shims fitted to facilitate adjustment at reassembly.

(4) Remove the two bolts retaining the speedometer driven gear assembly to the extension housing and withdraw the assembly.

(5) Remove the bolts securing the extension housing to the carrier plate and gearbox casing.

(6) Remove the extension housing, carrier plate, mainshaft and laygear as a complete assembly from the gear case.

NOTE: Remove and check the adjusting shims at the front of the laygear to facilitate adjustment at reassembly.

(7) Support the selector forks and knock out the spring pin attaching each fork to each selector rod.

(8) Unscrew the plug retaining the detent spring and ball for the 1st/2nd selector rod and remove the spring and ball.

(9) Instal the gear lever to the control assembly and move it through neutral until it contacts the spring resistance for reverse selection. Do not engage reverse gear.

(10) Pull the 1st/2nd selector rod through the selector fork until it is clear of the carrier plate.

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NOTE: Ensure that the interlock plunger is recovered if it should be dislodged from the carrier plate.

(11) Move the gear lever across to what is normally the 1st/2nd position and retain in this position.

(12) Carefully tap the extension housing with a soft-faced hammer to disengage it from the carrier plate dowels and separate the housing from the carrier plate assembly.

(13) Unscrew the plug retaining the detent spring and ball for the 3rd/4th selector rod and remove the spring and ball.

(14) Unscrew the blanking plug for the reverse selector rod but note that the detent ball and spring cannot be removed until the rod is withdrawn.

(15) Tap the 3rd/4th selector rod through the selector fork and out of the carrier plate, detach the fork.

(16) Tap the reverse selector rod through the carrier plate and out of the selector fork, detach the fork.

(17) Remove reverse selector detent spring and ball from the blank ended hole in the carrier plate, also interlock plungers from their respective positions.

(18) Withdraw the reverse sliding gear from its shaft.

(19) Remove the circlips retaining reverse gear to the mainshaft and reverse idler gear to the layshaft.

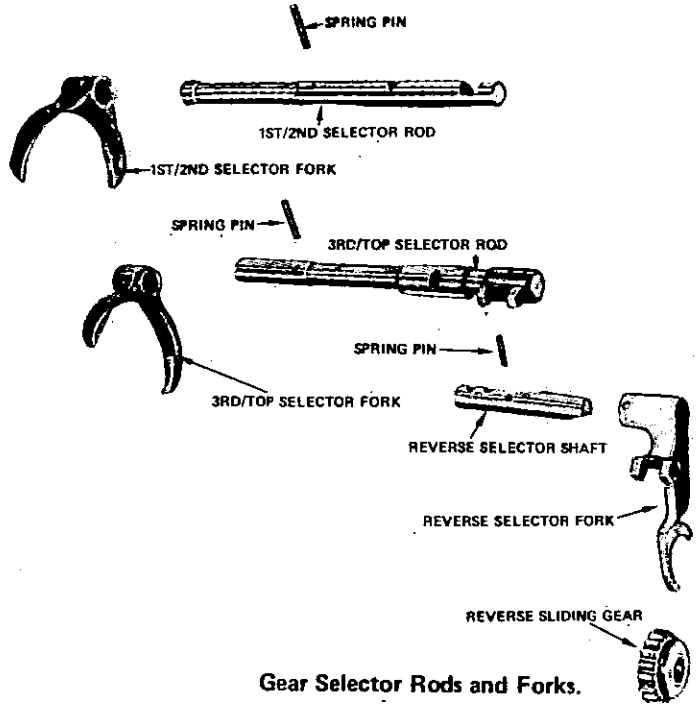
(20) Slide both gears from the splines of their respective shafts.

(21) Using a soft-faced hammer tap the rear end of the mainshaft to dislodge the bearing from the carrier plate. It may be necessary to tap the laygear shaft also to allow the laygear and mainshaft assemblies to be withdrawn together from the carrier plate.

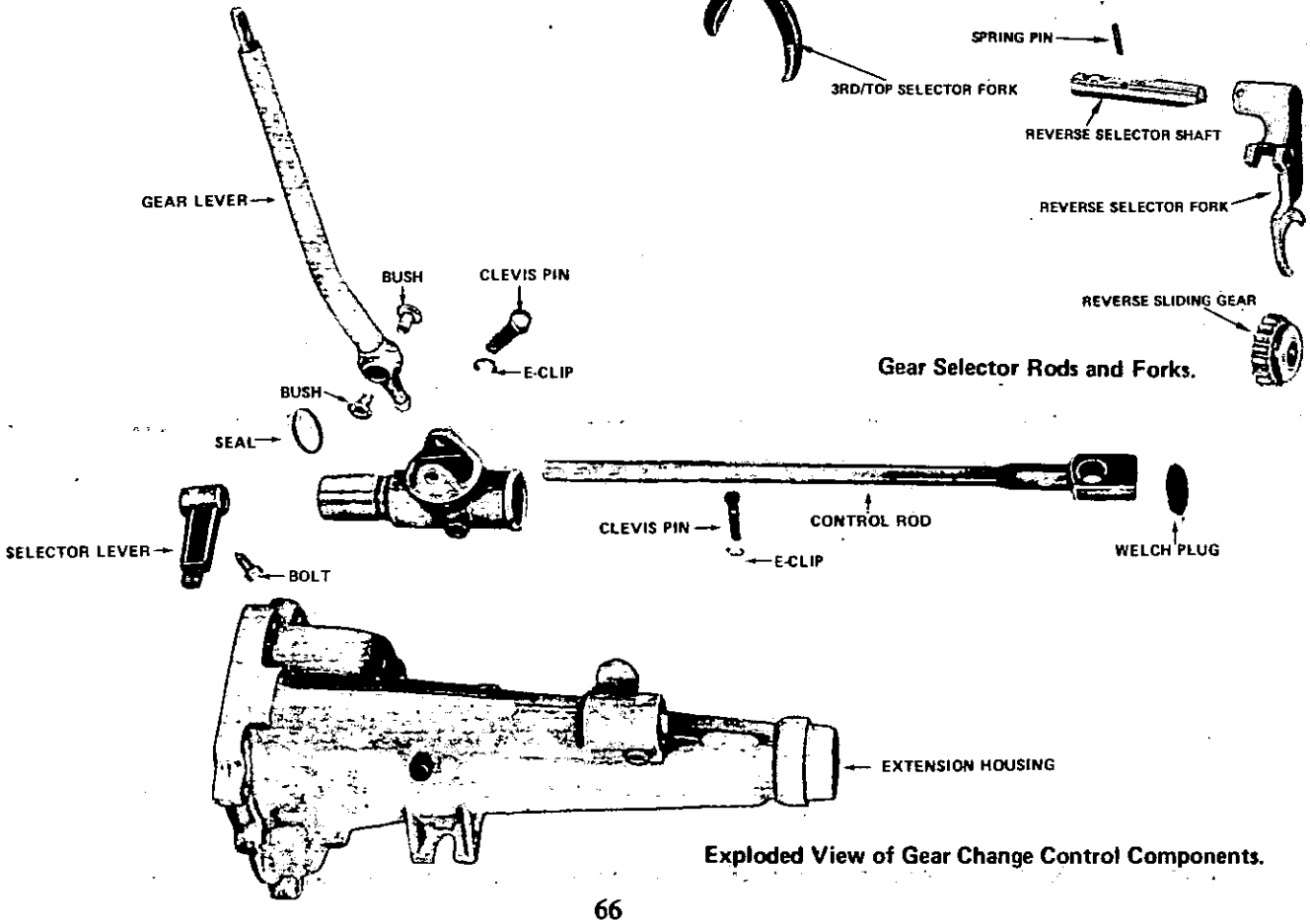
(22) Separate the laygear from the mainshaft and pull the input shaft from the top of the mainshaft assembly, remove the needle roller bearing if still attached to the mainshaft spigot.

(23) Remove the thrust washer and ball bearing from the end of the mainshaft followed by the baulk ring, synchro hub assembly, third gear baulk ring and third gear complete with needle roller bearing.

(24) Remove the mainshaft rear bearing and thrust



Gear Selector Rods and Forks.



Exploded View of Gear Change Control Components.

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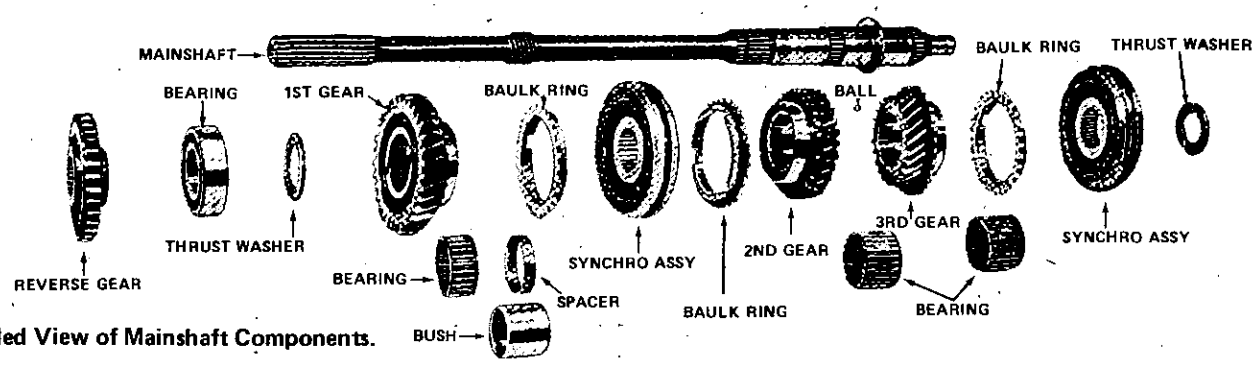


Exploded View of Mainshaft Components.

washer followed by first speed gear complete with needle roller bearing, spacer and mainshaft bush.

(25) Withdraw from the mainshaft the first gear baulk ring, synchro hub assembly; second gear baulk ring and second gear complete with needle roller bearing.

(26) If dismantling the synchro hub assemblies is necessary, mark one face of the hub and sleeve to ensure reassembly in the correct order.

(27) Remove the synchro springs from each end of the hubs and press out the hubs from the sleeves.

(28) If replacement of the input shaft bearing is necessary, remove the circlip and washer and press or draw the bearing from the shaft.

(29) To remove the gear change control rod assembly from the extension housing, remove the wire locking the control rod selector lever retaining bolt and remove the bolt and lever.

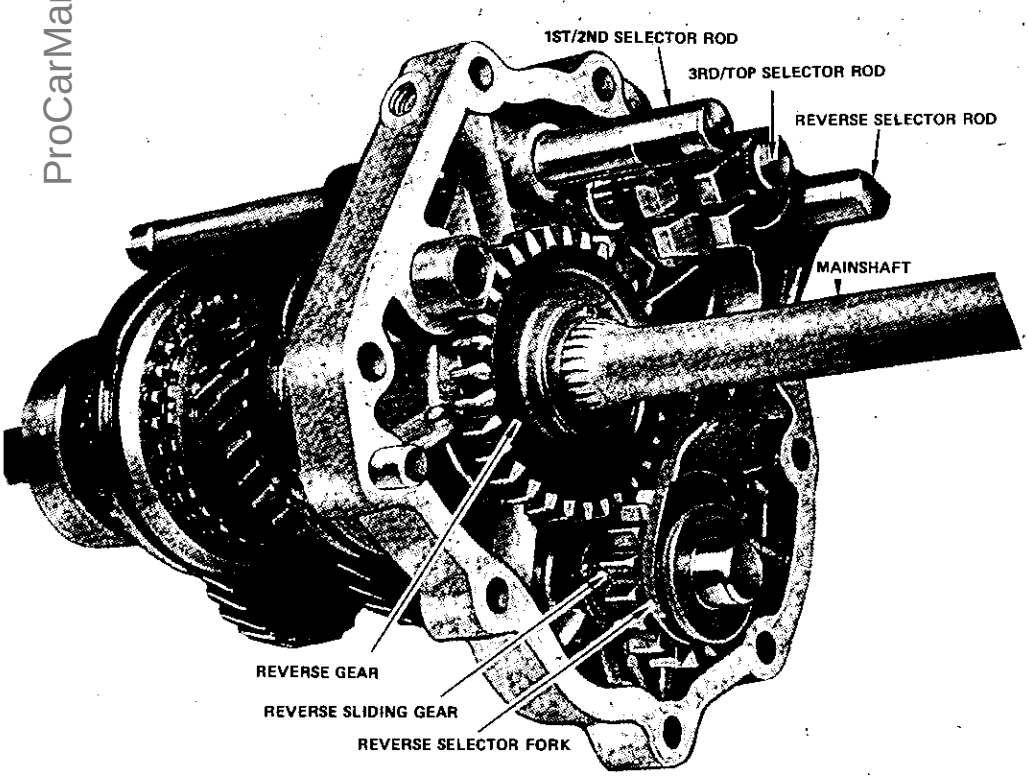
(30) Unscrew the retaining plug and withdraw the double spring and plunger for reverse selector loading.

(31) Remove the gear lever if not already removed.

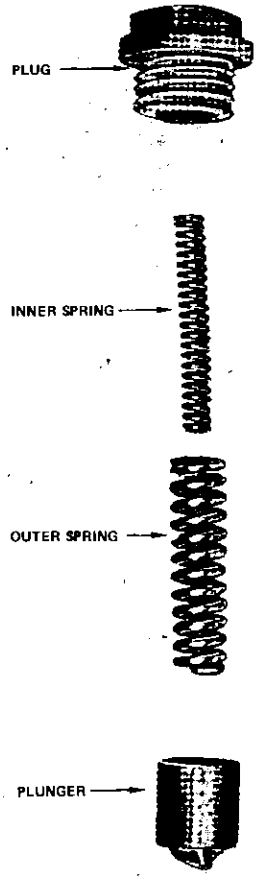
(32) Remove the circlip and clevis pin retaining the control rod assembly to the extension housing and withdraw the assembly from the housing sleeve.

(33) To separate the control rod from the pivot assembly it will be necessary to remove the expansion plug and push out the control rod.

(34) If replacement of the oil seal and/or the mainshaft bush is necessary, knock out the components from the rear of the extension housing.



Extension Housing Removed to Show Reverse Gear Assembly.



Components for Reverse Selector Loading.

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TO CLEAN AND INSPECT

(1) Clean all components in cleaning solvent and blow dry with compressed air.

(2) Check ball bearings for roughness or excessive side play. Do not rotate the bearings at high speed with compressed air, particularly when the bearings are dry or damage will result.

(3) Check needle roller bearings for wear and/or pitting.

(4) Examine the teeth on all gears for wear and/or pitting, also for burring on the teeth ends.

(5) Check the synchronising teeth on the gears for wear or chipping.

(6) Check the baulk rings on their corresponding gear cones for wear (see specifications).

(7) Check the selector forks for wear, the selector detent balls for wear and the detent springs for breakage or loss of tension (see specifications).

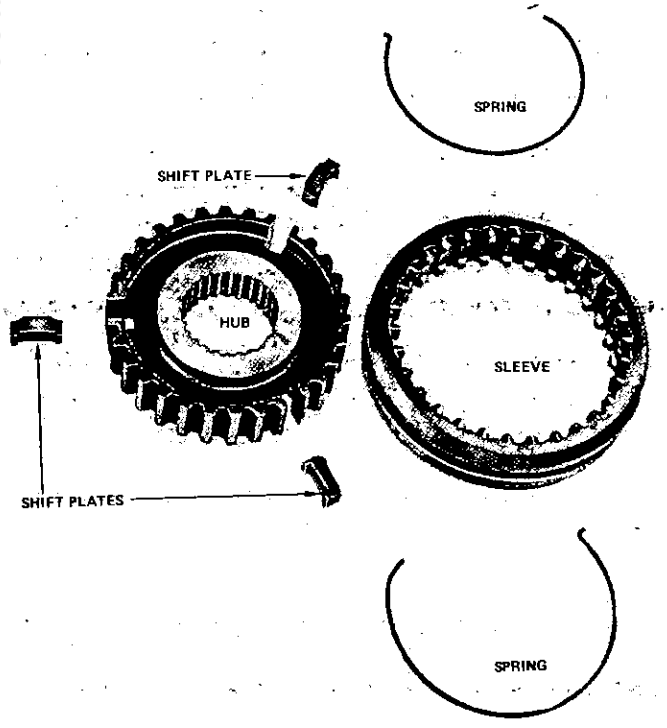
(8) Renew all worn or damaged components as necessary.

TO ASSEMBLE

(1) Instal second gear and needle roller bearing on the mainshaft with the gear cone facing to the rear of the shaft.

(2) Position the baulk ring on the gear cone.

(3) If the synchro hub has been dismantled instal the synchro plates in the hub slots and slide the sleeve over the hub splines so that the marks made on dismantling are at the same side.



Exploded View of Synchronizer Components.

(4) Fit the synchro springs under the synchro plate lugs at each side to tension the plates.

NOTE: The synchro springs must be installed so that when viewed from one side they travel in opposite directions.

(5) Instal the synchro hub assembly on the mainshaft engaging the ends of the synchro plates in the notches of the baulk ring and the hub splines on the mainshaft splines.

(6) Lubricate and instal the mainshaft bush, needle roller bearing and spacer for first gear.

(7) Engage the notches of a baulk ring on the synchro hub plate ends and instal the first gear entering the cone into the baulk ring.

(8) Instal the thrust washer and press the rear bearing onto the mainshaft.

(9) For the purpose of checking first gear to thrust washer end-float, instal the reverse gear and secure with the circlip. Check the end-float between first gear and thrust washer, also between second gear and the mainshaft flange. (See specifications for end-float clearance.)

NOTE: If end-float exceeds the limit, renew the thrust washer and re-check.

(10) Remove reverse gear and circlip on completion of (9).

(11) Lubricate and instal third gear complete with needle roller bearing to the front of the mainshaft with gear cone facing forward.

(12) Instal a baulk ring to the third gear cone.

(13) If dismantled, assemble the synchro hub as previously described.

(14) Position the synchro hub assembly on the mainshaft so that the synchro plate ends engage the baulk ring notches and the hub splines engage the mainshaft splines.

(15) Instal the ball bearing in the mainshaft recess, grease both faces of the thrust washer and instal so that the oil groove side of the washer abuts the synchro hub. Locate the notch in the thrust washer over the ball bearing.

(16) Position the remaining baulk ring so that the synchro plate ends engage the baulk ring notches.

(17) Lubricate and instal the needle roller bearing on the mainshaft spigot.

(18) If the input shaft has been dismantled, press on the bearing and secure with the washer and circlip.

(19) Position the input shaft on the mainshaft needle roller bearing and engage the gear cone in the baulk ring. Mainshaft assembly is now completed ready for installation.

NOTE: Before installation of the laygear and mainshaft assemblies to the carrier plate it will be necessary to check the laygear end-float. This is essential particularly if any parts of the assembly have been renewed.

As in the three speed gearbox the end-float figure is normally found by use of a special tool for this purpose,

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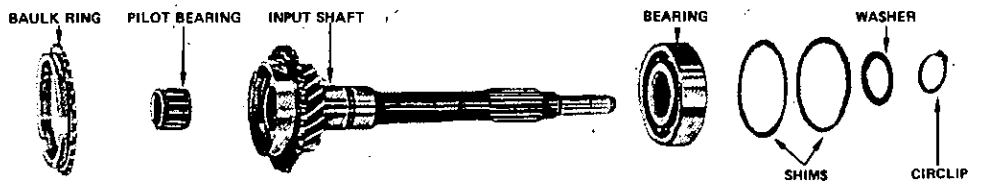

Exploded View of Input Shaft Components.

which should be used if available. Alternatively if the tool is not available the Plastigage method can be used as follows.

(20) Ensure that the circlip is correctly located in the bearing aperture at the front of the gear case.

(21) Instal the laygear in the case so that the bearing abuts the circlip.

(22) Cut three pieces of Plastigage or soft lead wire to fit on the bearing aperture flange in he carrier plate, space them equidistant around the flange.

NOTE: To hold the three pieces of Plastigage or lead wire in position it may be necessary to use a smear of grease.

(23) Fit the carrier plate into position over the laygear rear bearing and onto the gear case.

(24) Instal the carrier plate retaining bolts and tighten them diagonally and evenly to a torque of 12 – 16 ft/lb.

(25) Remove the carrier plate and carefully detach the pieces of Plastigage or lead wire from the flange.

NOTE: Provided the Plastigage or lead wire was of adequate thickness it should now be in a flattened condition.

(26) Using a micrometer, check the thickness of each piece of compressed Plastigage or soft lead wire and arrive at a mean figure. Deduct from this figure the necessary end-float of 0.03 mm (0.001 in) and the balance represents the thickness of the washer required.

(27) Remove the laygear assembly from the gear case.

(28) Mount the carrier plate in the jaws of a vice fitted with protective covers.

(29) Bring together the laygear and mainshaft assembly so that the teeth on both are meshed in the running position.

(30) Insert the mainshaft through the appropriate hole in the carrier plate and enter the rear bearings of the mainshaft and laygear in their respective carrier plate apertures.

(31) Using a soft-faced hammer or press, seat the bearings in their apertures.

NOTE: Ensure that both bearings enter the apertures squarely and do not allow the gear teeth to unmesh.

(32) Instal the reverse idler gear to the layshaft and secure with the circlip.

(33) Instal reverse gear on the mainshaft and secure with the circlip.

(34) Instal the reverse sliding gear on its shaft.

(35) Instal the selector forks on the synchro sleeves and the reverse selector fork on the sliding gear.

(36) Insert the detent spring and ball for the reverse selector rod in the blank ended hole in the carrier plate. Using a piece of metal rod depress the ball and spring and hold in this position.

(37) Insert the reverse selector rod through the fork and carrier plate with the two detents on the selector rod facing the detent ball.

(38) When the selector rod engages over the depressed detent ball, remove the holding rod and push in the selector rod until the ball engages the first detent on the rod. Instal the plug in the detent hole.

(39) Align the holes in the selector rod and fork and knock in the spring pin to secure.

(40) Instal the interlock plunger for reverse and third/top selector rods.

(41) Insert the third/top selector rod through the carrier plate and selector fork with the three detents on the rod facing the hole in the carrier plate for the detent ball and spring.

(42) Align the centre detent on the rod with the carrier plate hole and instal the detent ball and spring. Screw in the retaining plug until it is flush with the plate edge.

(43) Align the holes in the selector rod and fork and knock in the spring pin to secure.

NOTE: First/second selector rod should not be installed until the extension housing has been fitted.

(44) Assemble the control rod components to the extension housing in the reverse order of removal. Instal a new oil seal and expansion plug to the pivot assembly and locking wire to the control rod selector lever retaining bolt.

(45) Fit the gear lever to the control rod assembly and move the gear lever to what is normally the first/second position and retain in this position.

(46) Offer the extension housing up to the carrier plate and engage it on the dowels. Use a soft-faced hammer and gently tap the housing into position on the carrier plate.

(47) Move the gear lever across to the reverse position but do not attempt to engage the gear, hold in this position.

(48) Insert the interlock plunger for third/top and first/second selector rods.

(49) Push the selector rod through the first/second selector fork and into the carrier plate with the three

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detents on the shaft facing the hole in the carrier plate for the detent ball and spring.

(50) Align the holes in the selector rod and fork and knock in the spring pin to secure.

(51) Insert the detent ball and spring into the carrier plate and screw in the retaining plug until it is flush with the plate edge.

NOTE: The position of the detent retaining plugs regulates the amount of tension on the detent balls and springs (except reverse selector). Normally the tension is correct when the plugs are screwed in flush with the carrier plate edge.

(52) Instal the selected laygear end-float adjusting washer to abut the circlip in the front bearing aperture. Smear with a little grease to hold in position.

(53) Instal the carrier plate assembly into the gear case so that the front bearings of the mainshaft and laygear assemblies enter the bearing apertures squarely. Ensure that the selector rods enter the support holes in the gearcase.

(54) Check that the dowel holes and dowels are aligned in the carrier plate and gear case. Use a soft-faced hammer and gently tap the carrier plate down into position.

(55) Instal the retaining bolts and tighten evenly, working diagonally from one bolt to another, to a torque of 1.6 – 2.2 kg/m (12 – 16 ft/lb).

(56) Using a depth gauge, check the dimension from the front face of the front bearing outer race to the gear case front cover face. Deduct from the dimension 5.00 – 5.15 mm (0.20 – 0.206 in) to allow for the cover bearing retainer boss.

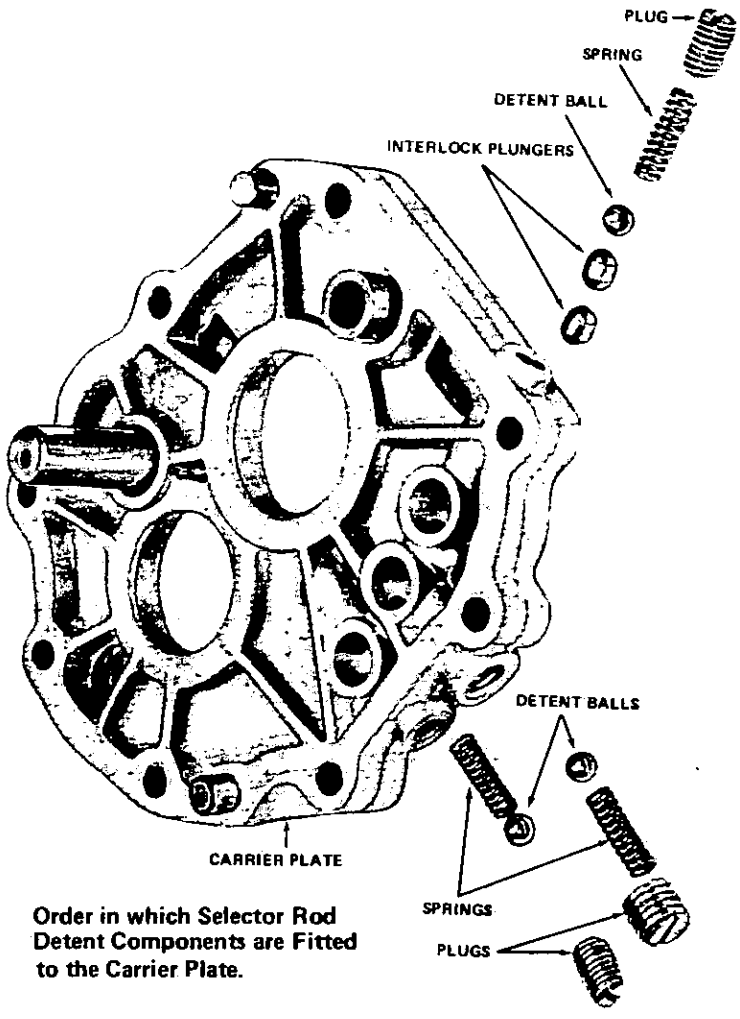
The balance is the thickness of shim required for adjustment.

(57) Instal the selected shim on the bearing outer race, smear a new oil seal with grease and fit to the front cover.

(58) Position the front cover with gasket ring on the gear case, instal and tighten the retaining bolts to a torque of 1.0 – 1.4 kg/m (7 – 10 ft/lb).

(59) Insert the clutch release shaft through the case, return spring and release fork.

(60) Instal the taper pins to secure the shaft and fork. Position the return spring so that one leg engages over the front of the fork leg and the other spring leg against the case.



Order in which Selector Rod Detent Components are Fitted to the Carrier Plate.

(61) Instal the release bearing and sleeve assembly and attach to the release fork by the spring legs.

(62) Lubricate the speedometer driven gear assembly and instal in the extension housing with the two retaining bolts.

(63) Instal the plunger, double spring and retaining plug for the reverse selector loading. Refit the reverse light switch if it has been removed.

(64) Check that all gears engage by operating the gear change lever.

(65) Instal the transmission to the vehicle and fill with the correct grade and quantity of oil.

PART 3. PROPELLER SHAFT

DESCRIPTION

The one piece tubular propeller shaft is fitted with two needle roller and trunnion type universal joints.

The rear yoke of the rear universal joint is flanged and bolted to the rear axle pinion shaft flange.

The sleeve on the front yoke of the front universal joint has internal splines which slide on mating splines on the rear end of the gearbox mainshaft – which is supported on its outer circumference by a bush with an oil seal in the gearbox rear extension.

Oversize circlips are available to compensate for any end-float in the bearing cups.

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TO REMOVE AND INSTAL

(1) Jack up the rear of the vehicle and support on axle stands.

(2) Mark across the edges of the rear universal joint and rear axle pinion flanges to ensure reassembly in their original positions.

(3) Remove the four universal joint flanges to rear axle pinion attaching bolts and nuts.

(4) Withdraw the propeller shaft to the rear and disengage the front yoke sleeve from the gearbox mainshaft.

Insert a spare sliding sleeve in the transmission rear cover to prevent loss of oil.

Installation is a reversal of the removal procedure.

TO DISMANTLE AND ASSEMBLE

(1) Knock out and remove the two securing circlips on opposed needle roller bearings of the front universal joint.

(2) Holding the joint in a vice, and using a soft metal drift, tap on the end of one of the bearing cups to drive the other bearing out of the yoke. Lift the bearing out with the fingers to avoid dislodging the needle rollers.

(3) Again using a soft drift, tap on the end of the trunnion of the bearing just removed to drive the other bearing out of the yoke and again carefully remove to avoid dislodging the needle rollers.

(4) Manoeuvre the yoke over the ends of the trunnion and withdraw from the shaft assembly.

(5) Treat the other two bearings of the front universal joint and the bearings of the rear universal joint in a similar manner to completely dismantle the propeller shaft.

(6) Check the needle roller bearings and trunnions for wear. If wear is apparent, renew the trunnions and bearings as a kit. Never renew individual needle roller bearing assemblies or fit old bearings to a new trunnion. Always use new bearing retaining circlips and bearing seal washers.

Reassembly is a reversal of the dismantling procedure.

NOTE: When dismantling or reassembling, do not hold the machined section of the front universal joint yoke in the unprotected jaws of a vice or the seal surface of the yoke will be damaged. Where necessary reduce any bearing cup end-float by installing oversize circlips.

PART 4. MANUAL TRANSMISSION FAULT DIAGNOSIS

GEARBOX

1. Difficult gear change.

Possible cause	*Remedy*
(a) Maladjustment of selector mechanism.	– Check and adjust selector mechanism.
(b) Faulty gear synchroniser mechanism.	– Overhaul gearbox.
(c) Faulty clutch or clutch release mechanism.	– Check and overhaul clutch and/or adjust release mechanism.
(d) Damaged gear teeth.	– Renew damaged components.
(e) Distorted transmission shaft splines.	– Renew damaged components.

2. Gear clash on changing down.

Possible cause	*Remedy*
(a) Faulty clutch or clutch release mechanism.	– Overhaul clutch and/or adjust release mechanism.
(b) Faulty synchro rings and cones.	– Check and overhaul gearbox, renew components as required.
(c) Broken or incorrect positioning of synchro bar retaining springs.	– Check and overhaul gearbox, renew components as required.
(d) Gearbox lubricating oil too heavy.	– Drain gear case and refill with correct quantity and grade of oil.

3. Slipping out of gear (1st and 2nd)

Possible cause	*Remedy*
(a) Weak or broken selector shaft detent spring.	– Renew faulty components.
(b) Worn mainshaft sliding gear or laygear.	– Check and renew faulty components.

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(c)	Excessive end-float of laygear.	– Check and renew faulty thrust washers.
(d)	Worn main drive gear, or mainshaft ball bearings.	– Check and renew worn components.
(e)	Incorrectly adjusted gear change mechanism.	– Check and re-adjust as necessary.

4. Slipping out of gear (3rd and Top).

	Possible cause	*Remedy*
(a)	Weak or broken selector shaft detent spring.	– Check and renew faulty components.
(b)	Worn synchro teeth on third or top speeds.	– Check and renew worn components.
(c)	Excessive end-float of laygear.	– Check and renew worn thrust washers.
(d)	Worn ball bearings on main drive gear or mainshaft.	– Check and renew worn bearings.
(e)	Incorrectly adjusted gear change mechanism.	– Check and re-adjust as necessary.

5. Gearbox noise (in neutral).

	Possible cause	*Remedy*
(a)	Worn main drive ball bearing.	– Overhaul and renew bearing.
(b)	Chipped or pitted constant mesh gears (laygear main drive gear or 2nd and 3rd speed mainshaft gears).	– Overhaul and renew components as necessary.
(c)	Excessive laygear end-float.	– Check and renew laygear thrust washers.
(d)	Lack of sufficient lubricant.	– Drain and refill gear case with correct quantity and grade of oil.

PROPELLER SHAFT

1. Shaft vibration.

	Possible cause	*Remedy*
(a)	Bent propeller shaft.	– Renew shaft.
(b)	Excessive wear in universal joint trunnion and bearings.	– Renew complete universal joint (trunnion and bearings).
(c)	Propeller shaft out of balance.	– Renew complete propeller shaft.
(d)	Excessive wear of front joint sleeve in rear extension bush bearing.	– Renew extension housing bush assembly.
(e)	Rear universal joint to pinion flange bolts loose.	– Renew and tighten loose bolts.

2. Excessive backlash.

	Possible cause	*Remedy*
(a)	Worn universal joint trunnion and bearings.	– Renew joint trunnion and bearings as assembly.
(b)	Worn mainshaft and universal joint sleeve splines.	– Renew worn components.

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AUTOMATIC TRANSMISSION

SPECIFICATIONS

Type	Three forward speeds and reverse, epicyclic gear train with torque converter.
Model	Nissan 3N71A
Operation	Automatic hydraulic
Gear control:	
1000 Series	Column change
1200 Series	Floor change, T-bar quadrant
Gear ratios:	
Low	2.458
Intermediate	1.458
High	1.000
Reverse	2.182
Lubricant:	
Type	3N71A Type 'F' or equivalent
Total capacity	5.5 litres (9.750 Imp pts) (11.750 US pts)

Shift Speeds – 4.111:1 Axle ratio

Upshift speeds – light throttle:	
Low to intermediate	12 – 17 kph (8 – 11 mph)
Intermediate to high	29 – 34 kph (18 – 21 mph)
Upshift speeds – full throttle:	
Low to intermediate	34 – 39 kph (21 – 24 mph)
Intermediate to high	55 – 60 (34 – 38 kph)
Upshift speeds – on kickdown:	
Low to intermediate	43 – 48 kph (27 – 30 mph)
Intermediate to high	77 – 82 kph (48 – 51 mph)
Downshift speeds – on kickdown:	
High to intermediate	71 – 76 kph (44 – 47 mph)
Intermediate to low	34 – 39 kph (21 – 24 mph)
Downshift speeds – nil throttle:	
Intermediate to low	8 – 13 kph (5 – 8 mph)

Shift Speeds – 3.900:1 Axle ratio

Upshift speeds – light throttle:	
Low to intermediate	10 – 18 kph (6 – 11 mph)
Intermediate to high	14 – 24 kph (9 – 15 mph)
Upshift speeds – kickdown:	
Low to intermediate	35 – 48 kph (22 – 30 mph)
Intermediate to high	80 – 96 kph (50 – 60 mph)
Downshift speeds – on kickdown:	
High to intermediate	78 – 88 kph (48 – 55 mph)
Intermediate to low	24 – 40 kph (15 – 25 mph)
Downshift speeds – nil throttle:	
Intermediate to low	8 – 13 kph (5 – 8 mph)

TORQUE WRENCH SETTINGS

Drive plate to crankshaft	6.0 kg/m (43 lb/ft)
Drive plate to torque converter	1.0 kg/m (7 lb/ft)
Oil pan drain plug	4.5 kg/m (32 lb/ft)
Inhibitor switch to transmission case	1.1 kg/m (8 lb/ft)
Manual shift lock nut	4.5 kg/m (32 lb/ft)
Oil cooling pipe flare nut	1.1 kg/m (8 lb/ft)
Oil cooling pipe connecting nut	3.0 kg/m (21 lb/ft)
Converter housing to engine	2.5 kg/m (18 lb/ft)

1. DESCRIPTION

The automatic transmission combines a fluid coupling or torque converter with a fully automatic three speed epicyclic gear system. The torque converter housing and the transmission case are separate casings.

The transmission provides three forward ratios and one reverse. The hydraulic system consists of a single pump and a valve arrangement.

Fluid level in the transmission is checked by a dipstick type indicator located in the oil filler tube. The 1200 Series gear selector is a floor mounted T-bar and quadrant.

The speed selector quadrant, adjacent to the base of the floor mounted selector lever is marked L (lock in first or low), 2 (drive in 1 and 2), D (drive or direct), N (neutral), R (reverse) and P (park).

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2—*Automatic Transmission*

The following gear selections cannot be made without depressing the spring loaded button on the side of the T-shaped gear selector lever: P to R, R to P, D to 2, 2 to 1 and N to R.

In addition a starter inhibitor switch ensures that it is not possible to start the engine unless the selector lever is in the P or N position.

The 1000 Series gear selector differs from the 1200 series in that the gear selection lever is mounted on the steering column.

ENGINE TUNING

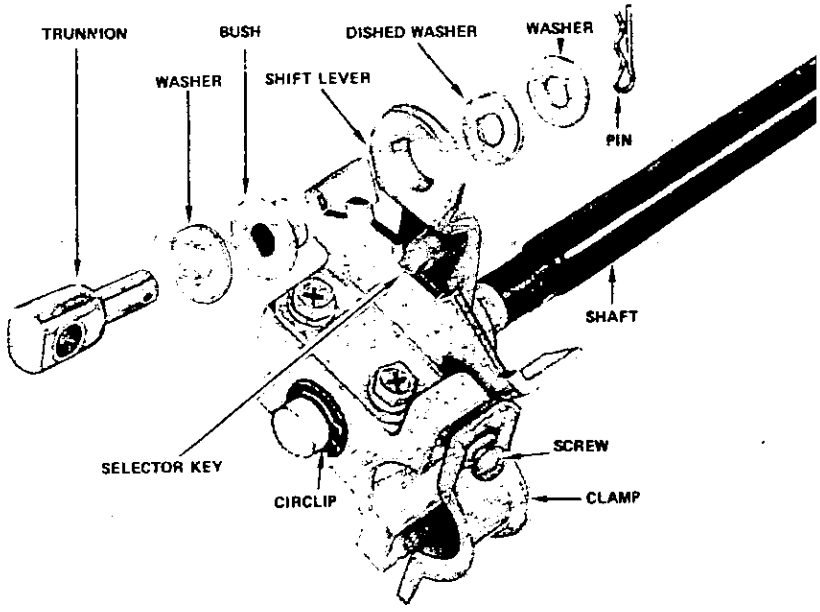
When tuning or testing the engine, the handbrake must be firmly applied and the selector lever must be in the P (park) or N (neutral) position, otherwise the vehicle will move forward or backward as the engine speed is increased.

When adjusting the idling speed, move the selector lever to the D position in order that the correct idling speed adjustment may be obtained.

If idling speed is too slow, the engine will not operate smoothly. If it is too high a shock or crunch develops when changing from N to D or R.

TOWING

For long distance towing, the propeller shaft should be disconnected at the rear universal flange and removed from the vehicle and a suitable plug applied to the rear of the transmission case to prevent loss of fluid or ingress of dirt.



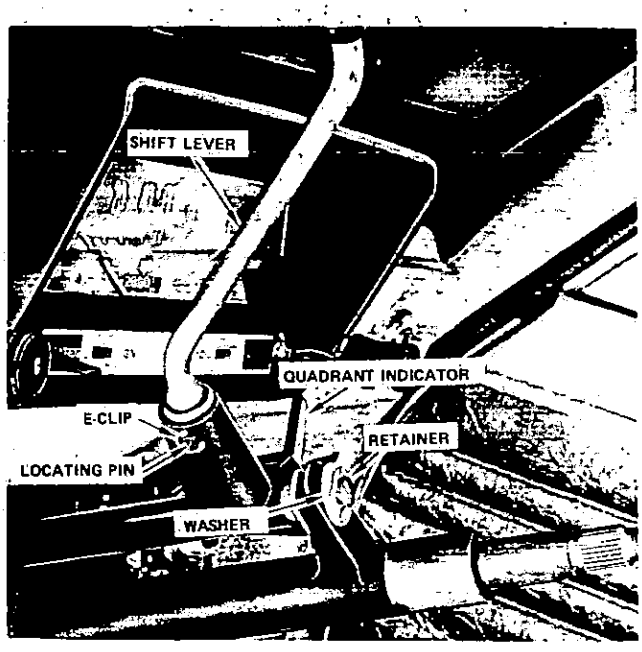
View of the Automatic Transmission Selector Components Lower End of Steering Column. 1000 Models.

An alternative method is to tow the vehicle suspended from the rear.

The vehicle may be towed for a short distance without disconnecting the propeller shaft provided the towing speed does not exceed 48 kmh (30 mph) and the cause for which the vehicle is being towed is not within the transmission or the rear axle.

It is not practicable to start the engine by either towing or pushing the vehicle.

2. HYDRAULIC FLUID



Gear Selector Level Pivot and Quadrant with Turn Signal Switch and Top Column Covers Removed. 1000 Models.

Only a recommended Automatic Transmission Fluid should be used in the transmission when topping up or changing the fluid in the system. See Specification section.

The fluid level in the transmission case should be checked at regular intervals of no greater than 6,500 km (4,000 miles) and it is good policy to check the fluid level at each lubrication service.

Every 48,000 km (30,000 miles) the fluid should be drained off while the transmission assembly is at operating temperature.

TO CHECK AND TOP UP

(1) Place the vehicle on a level floor and open the engine bonnet.

(2) Carefully clean around the top of the transmission case filler tube and dipstick, to ensure that no dirt or foreign matter can enter the filler tube as the dipstick is withdrawn.

(3) Check the transmission thoroughly for damp areas and determine the type of oil present. Transmission oil is readily identified by its reddish colour.

(4) It is difficult to determine the exact area from

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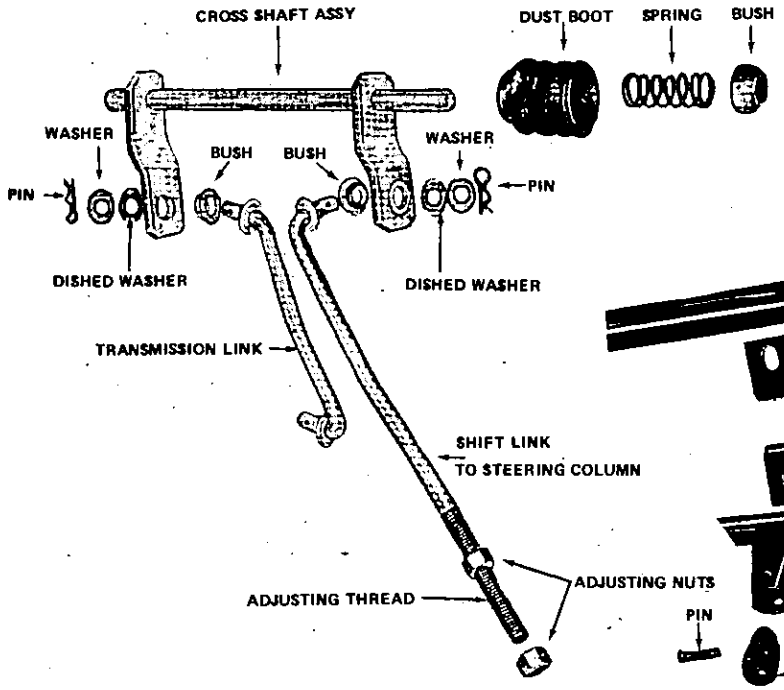
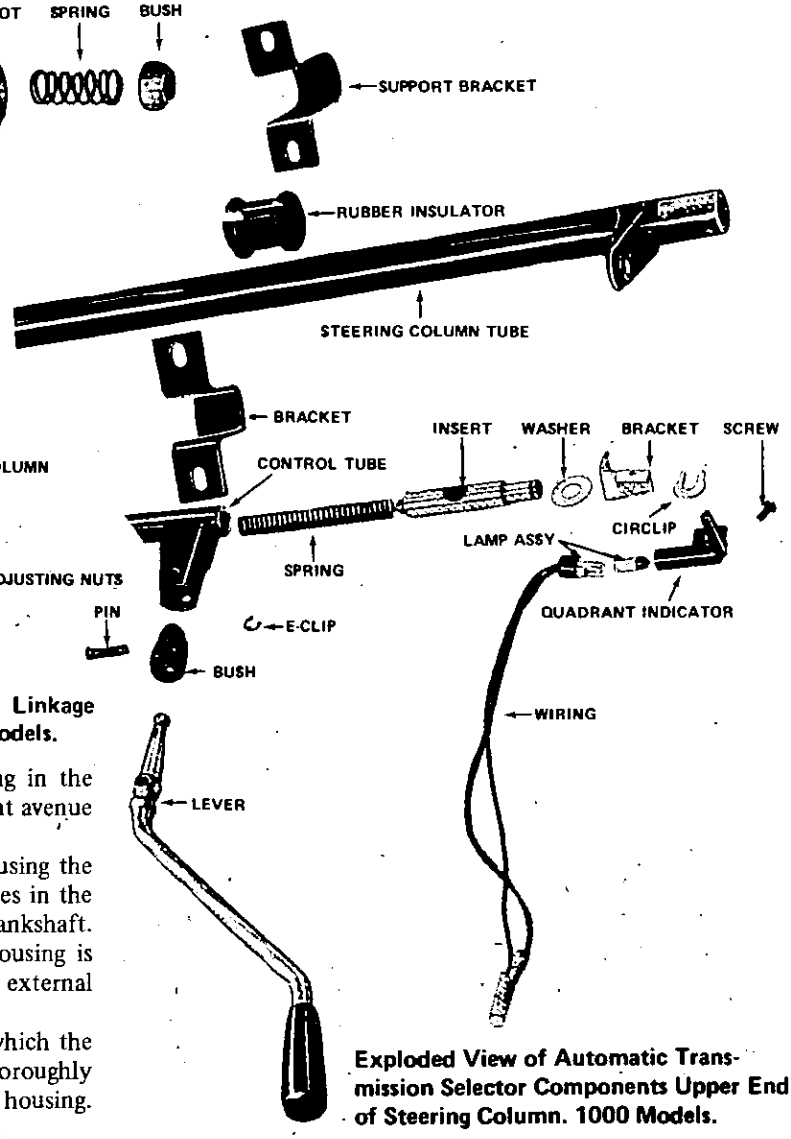


Exploded View of Cross Shaft Assembly and Linkage Components Automatic Transmission. 1000 Models.



Exploded View of Automatic Transmission Selector Components Upper End of Steering Column. 1000 Models.

which the fluid is escaping. However by checking in the following sequence it can be determined from what avenue the oil is escaping.

Should oil be leaking from the converter housing the oil could be emitting from the pump housing, holes in the pump external wall or the oil seal of the engine crankshaft.

If the rubber ring fitted to the oil pump housing is defective it will allow the oil to seep out onto the external walls of the converter housing.

(5) To determine accurately the areas from which the oil is escaping, wipe the transmission assembly thoroughly and remove the dust cover from the converter housing. Having removed the dust cover wash the area clean.

(6) Bring the oil to normal operating temperature, then select D or R to increase the oil pressure and examine the torque converter housing for leakage.

(7) Clean the area where the transmission body is coupled to the extension housing. Select the D or R position and with the transmission fluid under pressure, examine the elbow connector, oil pressure inspection hole and the gasket between the transmission body and extension housing for leakage.

(8) Should the vacuum diaphragm be damaged, this can be readily detached by checking the emission of smoke at the rear end of the exhaust pipe.

If white smoke is emitting from the exhaust pipe this indicates a damaged diaphragm, allowing the transmission fluid to be drawn up into the manifold and dispensed through the exhaust system.

A damaged diaphragm will result in excessive consumption of transmission fluid and premature engine wear.

Replace the defective vacuum diaphragm immediately.

(9) Check and top up the fluid in the following manner. Place the selector lever in the P position and firmly apply the handbrake.

(10) Start the engine and run at a fast idle to bring the engine and transmission to normal operating temperature.

NOTE: Alternatively run the vehicle on the road for approximately five miles.

(11) Return the engine to the correct idling speed, withdraw the dipstick and check the level of the hydraulic fluid. If necessary, add sufficient fluid to the transmission case via the filler tube to bring the level to the FULL mark on the dipstick.

NOTE: Use a recommended automatic transmission fluid only, do not overfill or foaming and unsatisfactory operation of the assembly will result.

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(12) Replace the dipstick in the filler tube, ensuring that no dirt or dust can enter the transmission case.

TO DRAIN AND FILL

(1) Bring the transmission to the normal operating temperature and raise the vehicle on a hoist or place it over a pit so that the transmission case is reasonably level.

(2) Unscrew and remove the transmission case oil pan drain plug and drain the hydraulic fluid into a suitable container.

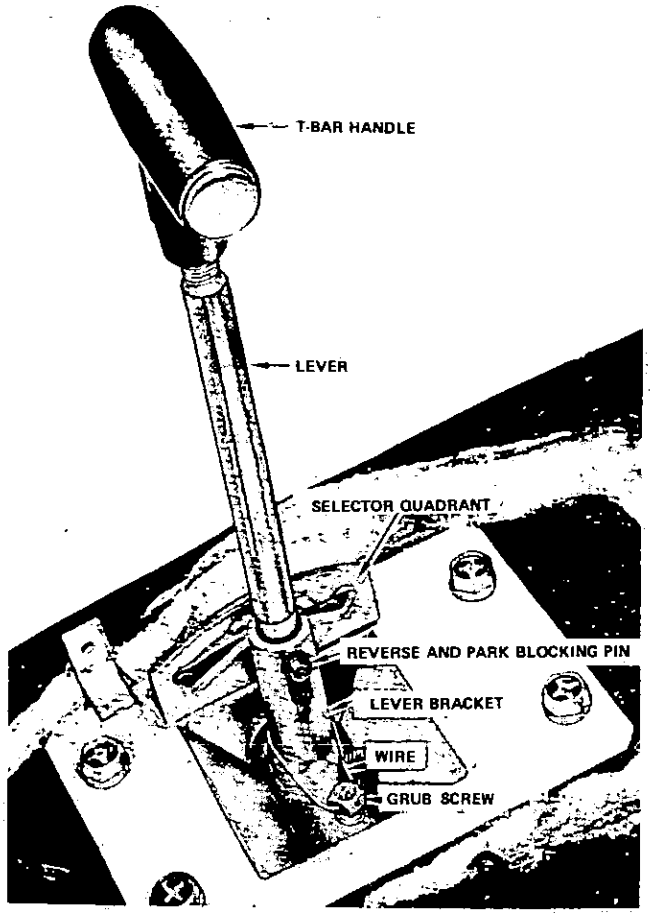
NOTE: Exercise extreme caution when draining the fluid after a long run as scalding could result.

(3) Replace and tighten the oil pan drain plug to the specified torque.

(4) Refill the transmission case with the correct grade and quantity of fluid as recommended, start the engine and bring it to the normal operating temperature.

(5) Check the fluid level on the dipstick and top up, if necessary, as detailed in TO CHECK AND TOP UP.

3. TRANSMISSION SELECTOR LINKAGE



View of Selector Lever Showing Reverse and Park Blocking Pin and Method of Locking the Lever Bracket Grub Screw. Floor Change System. 1200 Models.

TO ADJUST

(1) Raise the front of the vehicle and support on stands.

(2) Check the position of the gear indicator in relation to the actual selected or detent position on the transmission by selecting either P (park) or L (low).

(3) When either of the gears are selected a slight perceptible drag is experienced during the change pattern, this indicates that the manual valve is correctly positioned in the detent position in the valve body and that the lever is correctly aligned.

(4) Check position of the gear indicator when released, in relation to the relevant position on the plate.

(5) Should adjustment be necessary raise the bonnet and working from inside the engine compartment (1000 Models only) adjust the linkage. Prior to carrying out adjustment, select position D on the gear indicator mounted on the steering column.

NOTE: On 1200 Models with T-bar floor shift, the adjustment point on the link rod is accessible from below the vehicle.

Adjust the linkage so that the detent position D corresponds with position D on the indicator plate quadrant.

4. NEUTRAL SAFETY SWITCH

The neutral safety switch, incorporating the reverse light switch, is attached to the right hand side of the transmission case. The black/yellow wires of the switch are connected with the starter inhibitor switch to ensure that the engine can only be started with the transmission in either the N (neutral) or P (park) positions.

The two red/black wires of the switch are connected in series with the reverse light which should only operate when the R (reverse) position is selected on the selector quadrant.

Any adjustment to the transmission linkage should be followed by the neutral safety switch adjustment.

TO ADJUST

(1) With the engine stopped, disconnect the remote control lower rod and position the gear selecting lever at N (neutral) on the side of the transmission case.

It will be noted that the parallel flats on the switch

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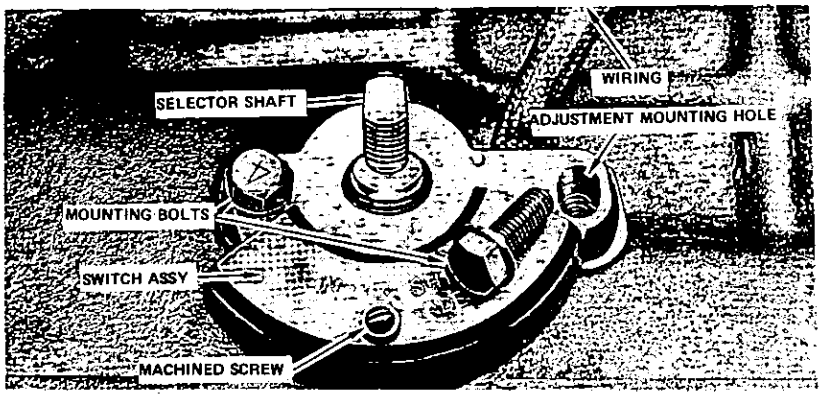
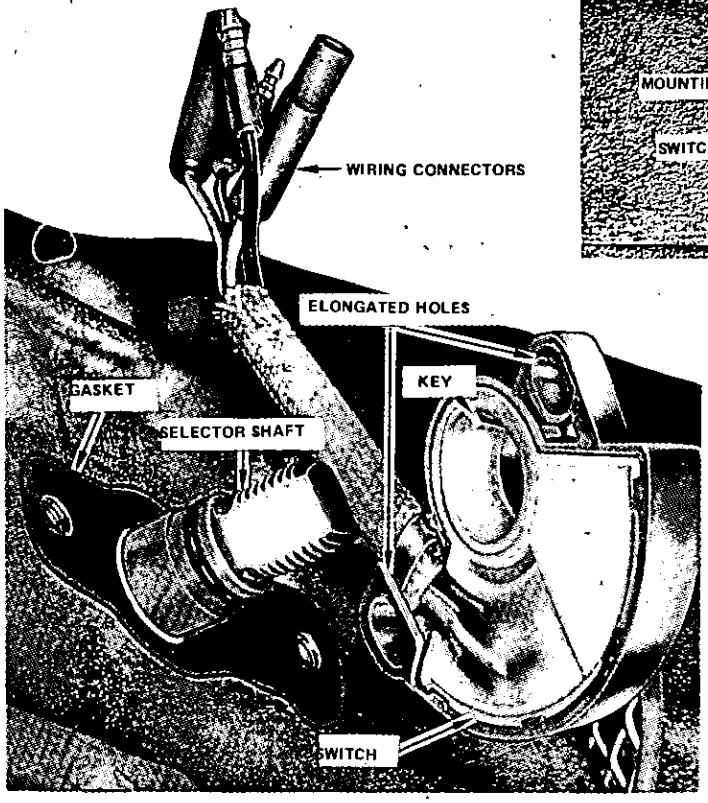


Neutral Safety Switch Showing Adjustment Points.



View of Neutral Safety Switch Removed from the Selector Shaft.

shaft will be in the vertical position with the gear selector lever in N (neutral) position.

(2) Disconnect the black/yellow wires to the neutral safety switch and connect a 12 volt test lamp in series with these wires and the battery and earth. Similarly connect a second test lamp across the red/black reverse light wires and the switch.

(3) Move the selector lever to the P (park) position. The lamp connected to the black/yellow wires should be extinguished as the indicator moves to the R (reverse) position. This lamp should light again as the P (park) position is selected.

The reverse light test lamp must light only when the R (reverse) position is selected.

(4) If adjustment is necessary unscrew the nut on the gear selector lever and loosen the two bolts securing the switch body, then remove the machined screw from the body of the switch.

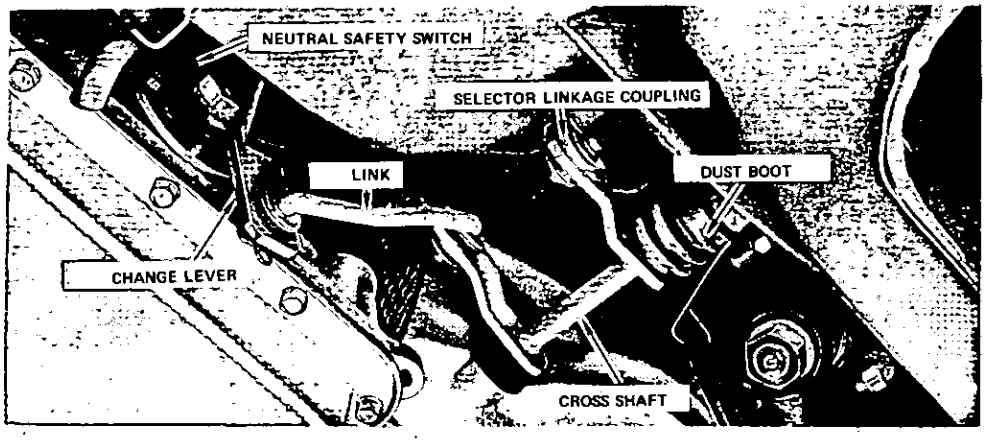
(5) Move the manual shaft to the N (neutral) position noting that the selection of the N (neutral) position can be determined by a pronounced click.

(6) Move the switch sufficiently to align the screw hole with the pin hole of the internal rotor and manual shaft. Check this alignment by inserting a 1.5 mm (0.0591 in) diameter pin to align the holes.

(7) Should the alignment check prove satisfactory, retighten the switch body bolts, remove the pin and replace the machined screw.

(8) Recheck the continuity with the test lamps. Should the switch prove inoperable, replace the complete safety switch.

(9) Remove the test lamps and restore the original connections.



View of Under Body Automatic Transmission Selector Linkage Column Change System. 1000 Models.

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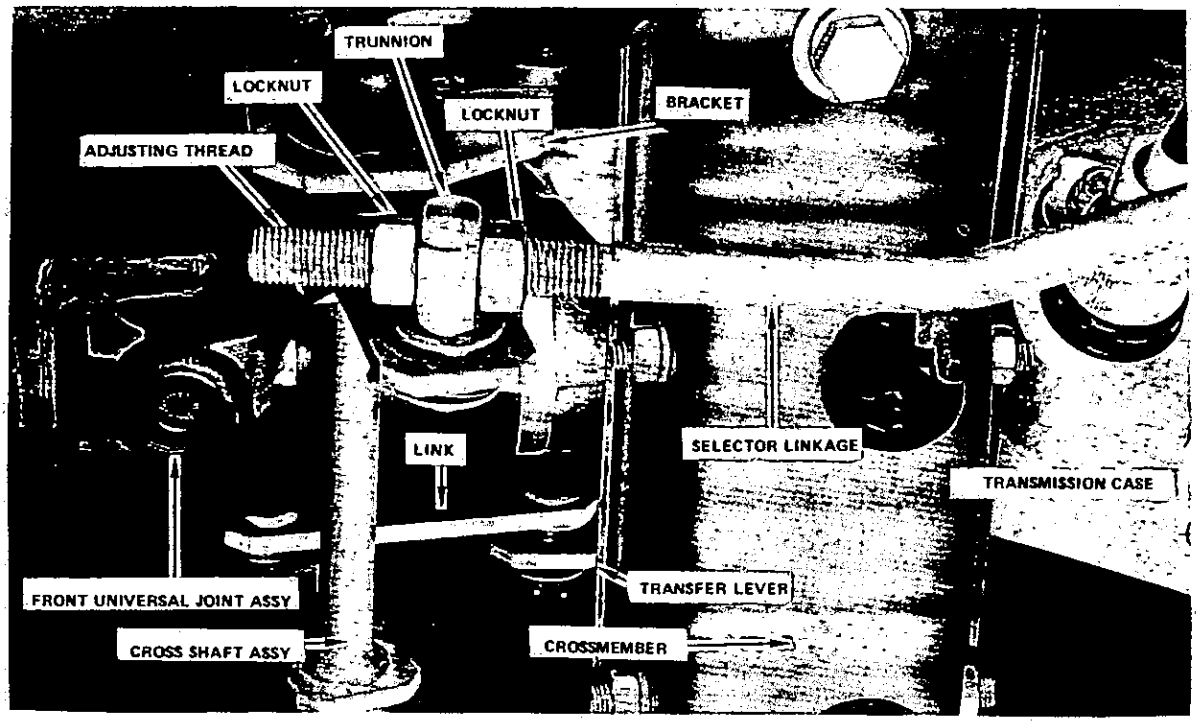
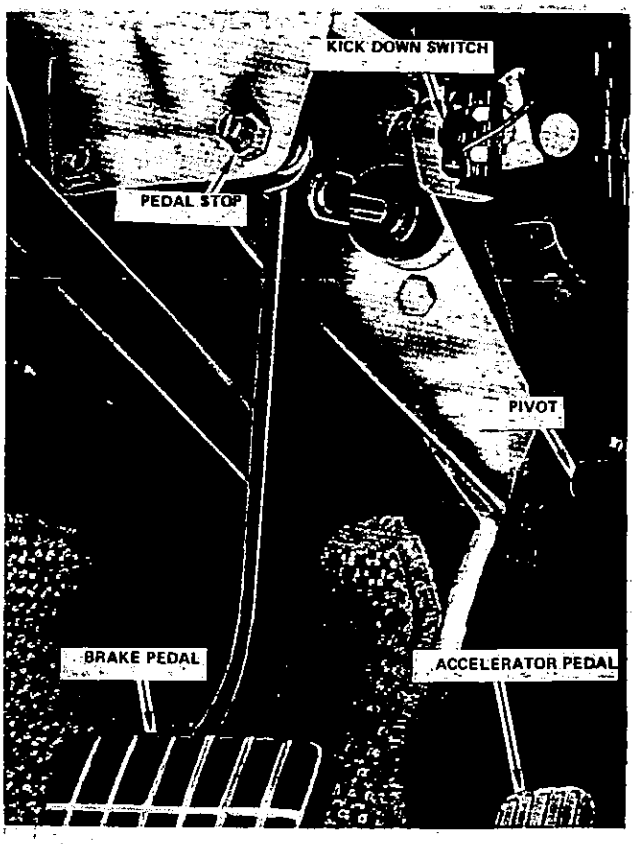


View of the Under Body Automatic Transmission Selector Linkage Floor Change System. 1200 Models.

5. KICKDOWN SWITCH AND DOWNSHIFT SOLENOID



View of Brake Pedal and Accelerator Pedal Showing Location of Automatic Transmission Kick Down Switch. 1000 Models.

TO CHECK AND TEST

(1) Turn the ignition key to the ON position and press the accelerator pedal fully.

(2) During the pressing of the pedal, the electrical circuit between the kickdown switch and the solenoid is completed. When the circuit is completed, a click is emitted from the solenoid.

(3) Should the solenoid fail to emit a click during this operation or the gear change speed be higher than specified, check the following components with suitable electrical test equipment.

(4) Test the kickdown switch for internal shorting out.

(5) Test the downshift solenoid for internal shorting out and faulty connections.

(6) Check the wiring connecting the kickdown switch to the downshift solenoid for continuity.

(7) Replace defective components where necessary. If the solenoid is to be replaced, the torque converter shall have to be partially drained.

(8) Drain off approximately 1 litre (1.750 Imp pts, 2.125 US pts) fit the new solenoid and replace the same amount of oil as drained from the torque converter.

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6. STALL TEST

The stall test is performed in 1 (low), 2 (intermediate), D (drive) and R (reverse) range at full throttle to check engine performance, converter clutch operation, or installation and the holding ability of the forward clutch, reverse clutch and low band.

NOTE: While performing this test, do not hold the throttle at full opening for more than ten seconds at a time.

Prior to carrying out the tests, bring the engine and transmission to normal operating temperature by placing the transmission in P (park) and running for several minutes.

(1) Check the transmission oil, engine oil and radiator. Top up where necessary.

(2) Chock all wheels and apply the parking brake firmly.

(3) Connect the tachometer to the engine and mount the tachometer where it is plainly visible from the driver's seat.

(4) Mark the tachometer at 1700 rpm ± 100 rpm on the dial.

(5) Apply the foot brake and shift the selector lever to 1, 2, D and R ranges successively and at each range press the accelerator pedal gradually and note the engine speed (rpm).

When the accelerator pedal is fully compressed, the engine speed will become constant and this speed is called the stall point at which the engine speed should be noted. The speed should be the same in all ranges and should be between 1950 and 2000 rpm.

NOTE: Having tested one range and prior to testing the next range, place the transmission in N and run at approximately 1200 rpm for one or two minutes to cool the torque converter oil.

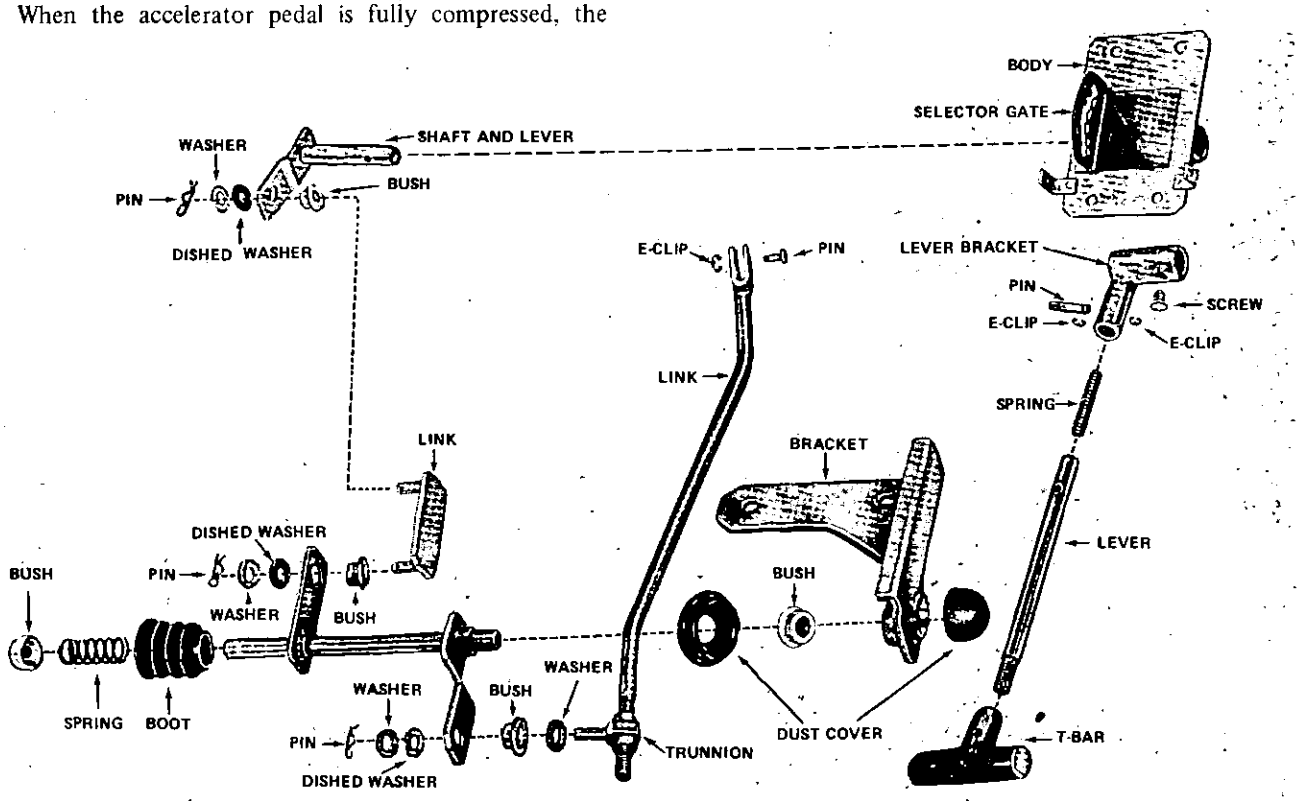
(6) If the stall point is the same in each range but below the specified rpm the following defects may be present. (a) The engine output is inadequate. Check the throttle valve in the carburettor for full throttle opening in relation to accelerator pedal movement. (b) The stator one way clutch may be slipping in the converter.

(7) When the stall point exceeds the specified figure, band or clutch slippage is apparent, depending on the range selected.

(8) Excessive engine speed in 1, 2 and D, indicate that the rear clutch is slipping.

(9) Excessive engine speed in 2 and D, and normal rpm in 1, the one way clutch is slipping.

(10) Excessive engine speed in R only indicates that the front clutch or low and reverse brake is slipping.



Exploded View of the Automatic Gear Change Linkage. 1200 Models.

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(11) When the stall test speeds are the same in every range, but above 2100 rpm and discharge pressure from the oil pump is normal and there is no slippage of clutch or band, the following defects may be present. (a) Low oil level in the torque converter. (b) Oil circulation to the converter has ceased, thus allowing the generation of steam and air inside the converter. (c) Air in the transmission fluid due to overheating of the oil.

7. LINE PRESSURE TEST

TO CHECK AND TEST

(1) Should the transmission performance indicate slipping of the clutch band and brake or incorrect speeds during gear change, check the line pressure.

(2) To check the line pressure, remove the plugs and connect the line pressure gauge to the measuring points in the rear flange.

(3) Commence the line pressure measurement at idle speed and check by stages through to throttle range.

(4) High throttle pressure results in excessive speeds and a sharp thump or shock during the changing up process.

(5) Leaking spool valve or gear trains result in slipping or faulty transmission performance.

(6) With the line pressure gauge fitted to the transmission, carry out a slow idling line pressure test for the full gear range.

Should low idling pressures exist in all ranges, namely, R, P, 1, 2 and D, this condition can be caused by a defective pressure supply system or insufficient power due to a worn oil pump, a sticking regulator valve or oil pressure leak in the valve body or case, or an oil pressure leakage in the oil pump.

(7) Select ranges 1, 2 and D and check the line pressure at low idle.

Should the readings in the three respective ranges be below those readings specified, and pressure reading in R is within the specified range, the cause of the low pressure reading can be attributed to oil leakage in the governor and rear clutch.

(8) Select positions R and P and check the line pressure. If the pressure reading is below that specified and on selecting 1, 2 and D and finding that the pressures are as specified, it can be determined that the loss of pressure in R and P is due to oil leakage in the low and reverse brake circuit.

(9) High idling line pressures are caused by increased line pressures due to sticking regulator valve and increased throttle pressure due to vacuum tube or diaphragm leakage.

(10) To measure the vacuum leakage, remove the vacuum pipe and measure the negative pressure immediately the pipe is removed.

(11) A defective or punctured diaphragm can be determined by the emission of white smoke from the exhaust pipe. If the diaphragm is damaged, replace immediately as a damaged diaphragm will drain the oil from the transmission via the manifold.

(12) Checking of line pressure increase should be carried out in conjunction with the STALL TEST. Using a vacuum gauge with a range from 0 mm Hg – 300 mm Hg carry out the necessary tests.

(13) Should the line pressures fail to increase with the vacuum decreasing then check the vacuum rod connection.

(14) Faulty line pressures are due mainly to a defective pressure regulator valve plug, or pressure regulating valve.

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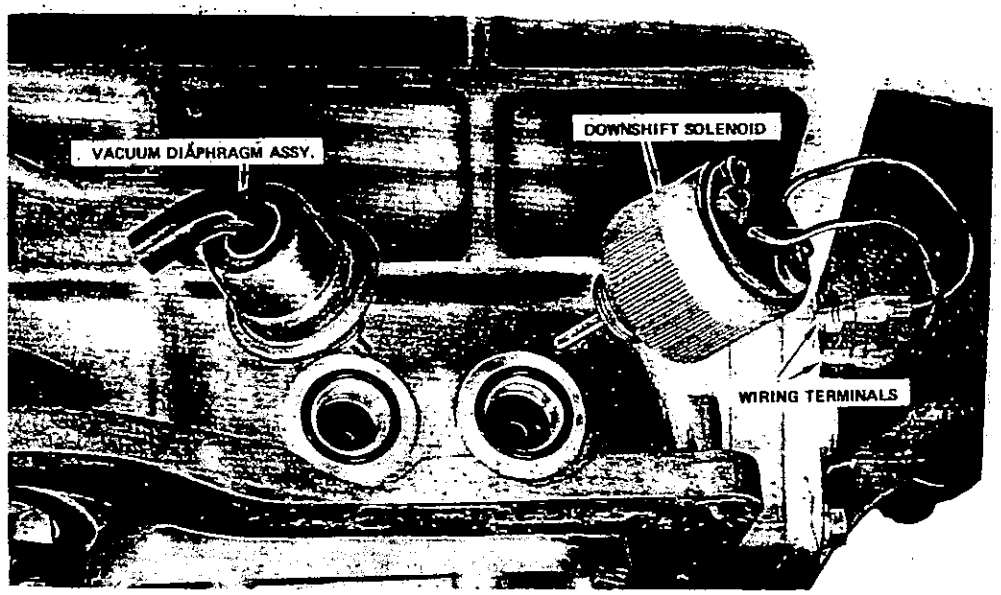

View of Automatic Transmission with Oil Pan, Vacuum Diaphragm Assembly and Down Shift Solenoid Removed.

LINE PRESSURE SPECIFICATIONS

Gear Range	Throttle Opening	Low Speed 15 kph (9.3 mph) and below		High speed 35 kph (21.7 mph) and above	
		Metric	**English**	**Metric**	**English**
1	Full throttle	10 kg/cm^2	142 lb/in^2	6 kg/cm^2	85 lb/in^2
	Half throttle	7 kg/cm^2	99 lb/in^2	4.8 kg/cm^2	68 lb/in^2
	Minimum throttle	3.5 kg/cm^2	49 lb/in^2	3.5 kg/cm^2	49 lb/in^2
2	Full throttle	10 kg/cm^2	142 lb/in^2	6 kg/cm^2	85 lb/in^2
	Half to minimum throttle	9.3 kg/cm^2	132 lb/in^2	5.7 kg/cm^2	81 lb/in^2
D	Full throttle	10 kg/cm^2	142 lb/in^2	6 kg/cm^2	85 lb/in^2
	Half throttle	7 kg/cm^2	99 lb/in^2	4.8 kg/cm^2	68 lb/in^2
	Minimum throttle	3.5 kg/cm^2	49 lb/in^2	3.5 kg/cm^2	49 lb/in^2
R	Full throttle	15 kg/cm^2	213 lb/in^2		
	Half throttle	10.7 kg/cm^2	152 lb/in^2		
	Minimum throttle	5.4 kg/cm^2	76 lb/in^2		

8. TRANSMISSION ASSEMBLY

TO REMOVE

(1) Raise the vehicle and support on stands, disconnect the earth lead at the battery terminal and the lead at the terminal on the starter solenoid switch.

(2) Disconnect the wiring connecting the kickdown switch to the downshift solenoid.

(3) Disconnect the accelerator linkage at the carburettor.

(4) Disconnect the lower shift rod from the manual control lever.

(5) Disconnect the cross shaft from the transmission assembly.

(6) Unscrew and withdraw the speedometer cable.

(7) Take out the drain plug and drain off the oil into a clean container for further use.

(8) Disconnect the vacuum tube and remove the inlet and outlet oil cooling pipes.

(9) Disconnect the exhaust outlet pipe at the manifold.

(10) Disconnect the propeller shaft at the rear universal flange, withdraw the propeller shaft from the rear of the transmission and remove the shaft assembly from the vehicle. Plug the rear end of the transmission to prevent ingress of dirt.

NOTE: To preserve the original balance of the propeller shaft, mark across the joint and pinion flange to ensure replacement in the original positions.

(11) With suitable protection on the jack head, support under the transmission case and remove the transmission supporting crossmember from the underbody and from the gearbox.

(12) Disconnect the wires to the starter safety switch on the side of the transmission, noting the correct position of the wires for reassembly.

(13) If installed, disconnect the reversing light earth wire from under the appropriate gearcase to extension housing bolt.

(14) Take out the securing bolts and remove the starter motor, then remove the torque converter dust cover.

(15) Working through the aperture for the starter motor, rotate the crankshaft as necessary and mark the drive plate in relation to the torque converter plate, then progressively slacken off and remove the drive plate to converter bolts.

(16) Support the engine with a suitable jack using care not to damage the sump.

(17) Progressively slacken off and remove the eight bolts connecting the torque converter housing to the engine.

NOTE: Ensure that the transmission is supported on, and secured to, a suitable jack so that it cannot become dislodged as it is withdrawn from the vehicle. Ensure that the jack does not damage the transmission oil pan.

(18) Lower the transmission assembly slightly and remove the dipstick assembly. Carefully withdraw the assembly rearwards to clear the converter from the plate.

NOTE: Exercise extreme caution when withdrawing the assembly to ensure that the torque converter does not become dislodged from the front of the transmission.

Attach a suitable retaining strap to the converter housing, bolting it to the housing cover bolts so that it retains the converter in position when the transmission is withdrawn from the rear of the engine.

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(19) Lower the jack supporting the transmission assembly and withdraw it from the vehicle.

TO INSTAL

Installation is a reversal of the removal procedure with particular attention to the following points:

(1) Ensure that the converter is fully engaged in the front of the transmission and in the spigot in the rear of the crankshaft.

(2) Ensure that the attachment faces of the torque converter housing and the rear of the engine crankcase are perfectly clean and free of any burrs.

(3) Instal the bolts securing the converter to the drive plate and tighten evenly to the specified torque.

(4) Tighten the bolts securing the converter housing to the rear of the engine to the specified torque.

(5) Fill the transmission with the specified grade and quantity of the recommended hydraulic fluid.

(6) Check and if necessary adjust the selector linkage.

(7) Check the neutral safety switch and kickdown switch. Replace if necessary.

(8) Road test the vehicle and recheck the hydraulic fluid level as described in HYDRAULIC FLUID – TO CHECK AND TOP UP.

9. AUTOMATIC TRANSMISSION FAULT DIAGNOSIS

1. Engine will not start in P or N:

Possible cause	*Remedy*
(a) Incorrect selector linkage adjustment.	– Check and adjust linkage.
(b) Defective inhibitor switch or wiring.	– Check switch and wires, adjust or renew switch as necessary.
(c) Faulty ignition switch or starter motor.	– Check and repair or renew switch or starter.

2. Engine starts in D or R range.

Possible cause	*Remedy*
(a) Incorrect selector linkage adjustment.	– Check and adjust linkage.
(b) Defective inhibitor switch or wiring.	– Check switch and wires, adjust or renew switch as necessary.

3. Harsh engagement, N to D.

Possible cause	*Remedy*
(a) Engine idling speed too high.	– Check and adjust idling speed.
(b) Faulty vacuum diaphragm or pipe.	– Check and renew faulty components.
(c) Throttle pressure too high.	– Check throttle pressure and regulator valve and plug.
(d) Control valve sticking or faulty.	– Free up or renew control valve.

4. No drive in D, operates in other ranges.

Possible cause	*Remedy*
(a) Incorrect selector linkage adjustment.	– Check and adjust linkage.
(b) Throttle pressure too high.	– Check throttle pressure, regulator valve and plug.
(c) Control valve sticking or faulty.	– Free up or renew control valve.

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5. No drive in R, operates in other ranges, poor acceleration.

Possible cause	*Remedy*
(a) Low fluid level in transmission	– Check and top up fluid level.
(b) Selector linkage requires adjustment.	– Check and adjust selector linkage.
(c) Low throttle pressure.	– Check pressure and regulator valve and plug.
(d) Control valve sticking or faulty.	– Free up or renew control valve.

6. Slipping in all ranges.

Possible cause	*Remedy*
(a) Low fluid level in transmission.	– Check fluid level and top up.
(b) Selector linkage requires adjustment.	– Check and adjust linkage.
(c) Low throttle pressure.	– Check pressure, regulator valve and plug.
(d) Transmission fluid foaming.	– Change to recommended brand of fluid.
(e) Control valve sticking or faulty.	– Free up or renew control valve.

7. No upshift in D range.

Possible cause	*Remedy*
(a) Incorrectly adjusted selector linkage.	– Check and adjust linkage.
(b) Faulty vacuum diaphragm or piping.	– Check and renew diaphragm or piping.
(c) Fault in shift solenoid and kickdown switch wiring.	– Check and renew or repair wiring.
(d) Faulty governor valve, servo or control valve.	– Renew governor valve, overhaul servo.
(e) Fluid level low or fluid foaming.	– Drain and refill with recommended grade and quantity of fluid.

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REAR AXLE

SPECIFICATIONS

1000 MODELS

Type	Hypoid
Ratio:	
Sedan	4.111 : 1
Station Sedan	4.375 : 1
Number of crownwheel and pinion teeth:	
4.111 : 1 ratio	37:9
4.375 : 1 ratio	35:8
Bearing type	Tapered roller
Drive pinion:	
Dimension, pinion head to crownwheel centre	45.0 mm (1.772 in)
Bearing pre-load	6 – 8 kg/cm (5.2 – 6.9 lb/in)
Thickness range of selective fit shims (pinion height adjustment)	0.05 – 0.50 mm increments (0.002 – 0.020 in increments)
Thickness range of selective fit washers (bearing preload adjustment)	2.30 – 2.60 mm increments of 0.02 mm (0.09 – 0.10 in increments of 0.0008 in)
Thickness range of selective fit spacers (bearing preload adjustment)	5.75 mm (0.226 in) 6.00 mm (0.236 in) 6.25 mm (0.246 in)
Crownwheel:	
Backlash between crownwheel and pinion	0.10 – 0.15 mm (0.004 – 0.006 in)
Maximum run-out at crownwheel face	0.08 mm (0.003 in)
Carrier bearings:	
Standard width	17.5 mm (0.69 in)
Thickness range of adjusting shims	0.05 – 0.50 mm increments (0.002 – 0.020 in increments)
Side gears:	
Thickness range of thrust washers	0.76 – 0.91 mm increments of 0.05 mm (0.030 – 0.036 in increments of 0.002 in)
Gear to thrust washer clearance	0.1 – 0.2 mm (0.004 – 0.008 in)

TORQUE WRENCH SETTINGS

Maximum Settings:	
Differential carrier to axle housing	2 kg/m (14.5 ft/lb)
Propeller shaft flange nuts	2.5 kg/m (18 ft/lb)
Pinion nut	14 – 17 kg/m (101 – 123 ft/lb)
Crownwheel bolts	3.5 kg/m (25.5 ft/lb)
Carrier bearings cap nuts	5 kg/m (36 ft/lb)

1200 MODELS

Type	Hypoid
Ratio:	
Sedan and coupe	3.900 : 1
Station sedan and van	4.111 : 1
Number of crownwheel and pinion teeth:	
3.900 : 1 ratio	39 : 10
4.111 : 1 ratio	37 : 9
Bearing type	Tapered roller
Drive pinion:	
Dimension, pinion head to crownwheel centre (approx)	45.0 mm (1.772 in)
Preload, with new bearings and oil seal (initial)	7 – 9 kg/cm (6.1 – 7.8 lb/in)
Preload, with used bearings and oil seal (initial)	4 – 5 kg/cm (3.5 – 4.3 lb/in)
Preload, with new bearings but without oil seal (initial)	6 – 8 kg/cm (5.2 – 6.9 lb/in)

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Preload, with used bearings but without oil seal (initial)	3 – 4 kg/cm (2.6 – 3.5 lb/in)
Thickness range of selective fit washers (pinion height adjustment)	2.74 – 3.25 mm increments of 0.03 mm (0.108 – 0.128 in increments of 0.0012 in)
Crownwheel:	
Backlash between crownwheel and pinion	0.10 – 0.15 mm (0.004 – 0.006 in)
Maximum run-out at crownwheel face	0.05 mm (0.002 in)
Carrier bearings:	
Standard width	17.5 mm (0.69 in)
Thickness range of adjusting shims	0.05 – 0.50 mm increments (0.002 – 0.020 increments)
Side gears:	
Thickness range of thrust washers	0.76 – 0.91 mm increments of 0.05 mm (0.030 – 0.036 increments of 0.002 in)
Gear to thrust washer clearance	0.1 – 0.2 mm (0.004 – 0.008 in)

TORQUE WRENCH SETTINGS

Maximum settings	
Differential carrier to axle housing nuts	2.5 kg/m (18 ft/lb)
Oil filler plug	10 kg/m (72 ft/lb)
Propeller shaft flange nuts	2.7 kg/m (19.5 ft/lb)
Pinion nut	12 – 17 kg/m (87 – 123 ft/lb)
Crownwheel bolts	7 kg/m (50 ft/lb)
Carrier bearing cap bolts	6 kg/m (43 ft/lb)

PART 1. REAR AXLE — 1000 MODELS

1. DESCRIPTION

The rear axle is a semi-floating type with hypoid final drive gears mounted in a detachable carrier.

The crownwheel and differential case assembly is supported in the carrier by two tapered roller bearings, the bearing preload and crownwheel backlash is adjusted by means of shims.

The drive pinion is supported in the carrier by two tapered roller bearings which are adjusted for pre-load by a washer and spacer installed between the pinion shoulder and the front bearing inner cone assembly.

Pinion height in relation to the crownwheel is controlled by shims located between the rear bearing outer cone and the carrier.

Axle shaft bearings are the pre-lubricated ball type which require no lubrication in service and are retained to the shafts by means of collars. End-float in the axle shaft assembly is adjusted by shims located at the brake backing plate.

With the removal of the axle shafts, the differential carrier assembly can be detached from the axle without removing the axle casing from the vehicle.

It is important to note that adjustment figures stamped on the final drive components are in units of 0.001 inch which must be taken into consideration when calculating the various differential and pinion adjustments.

2. DIFFERENTIAL CARRIER ASSEMBLY

TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle and support on axle stands.

(2) Loosen off and remove the rear wheels and brake drums.

(3) Disconnect the handbrake cables and hydraulic brake pipes at the rear of the brake backing plates. Plug the pipes to prevent the loss of fluid and entry of dirt.

(4) Remove the nuts retaining the brake backing plates to the axle casing through the holes provided in the axle shaft flange.

(5) Withdraw each axle shaft assembly from the axle casing using a slide hammer and adaptor if necessary.

(6) Take out the oil drain plug and drain the differential oil into a suitable container.

(7) Mark across the flanges of the pinion and rear universal joint, take out the four securing bolts and nuts to release the propeller shaft.

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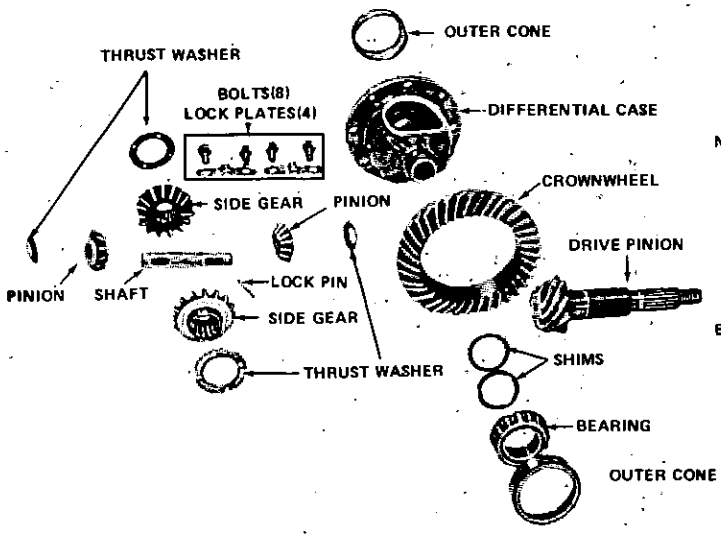

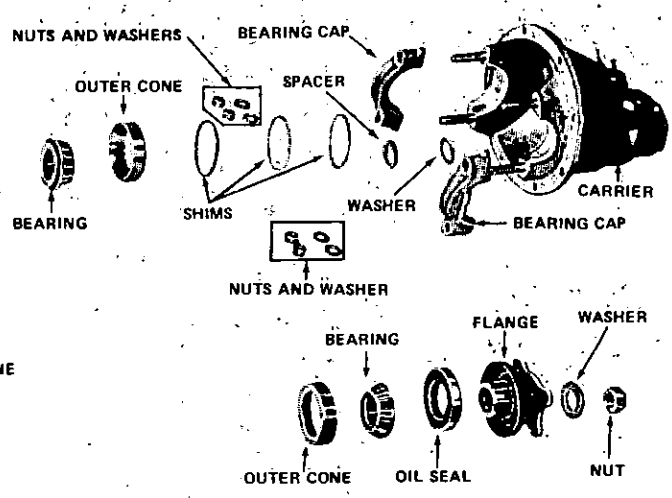

Exploded View of Differential Final Drive Components.

(8) Remove the nuts retaining the differential carrier assembly to the axle casing and withdraw the assembly.

Installation is a reversal of the removal procedure but it will be necessary to bleed the brake hydraulic system.

TO DISMANTLE

NOTE: Before dismantling the assembly, carry out the following checks. The information gained from the checks will prove helpful when assembling the unit.

(a) Check the tooth contact of the crownwheel and pinion by applying a thin coating of red lead and engine oil to both sides of six or eight of the crownwheel teeth.

(b) Rotate the pinion both ways, placing a bar between the differential case and the carrier to apply a load to the gear teeth and so obtain a good marking. If the pinion height, bearing pre-load and backlash are correct the area of contact should be as shown in the teeth marking illustration.

(c) The margin above and below the area of contact should be the same and the contact margin should run approximately three quarters of the tooth length, check the patterns on both sides of the tooth.

(d) Mount a dial indicator gauge on to the differential carrier housing so that the plunger is in contact with and at right angles to, the heel of a crownwheel tooth, then zero the dial gauge.

(e) Hold the pinion firmly and rock the crownwheel back and forth to check the backlash on the dial gauge. Check the backlash at approximately three positions around the crownwheel. Backlash is correct when within the limits of 0.10 – 0.15 mm (0.004 – 0.006 in).

NOTE: Having completed the foregoing checks dismantle the assembly as follows.

(1) Remove the carrier bearing cap nuts and detach the caps. Check that the caps are marked in relation to he carrier to ensure installation in their original positions.

(2) Lift out the differential assembly from the carrier but ensure that the bearing outer cones are kept with their respective bearings.

NOTE: To facilitate assembly carry out the following check.

(a) Using a pre-load measuring gauge or spring scale and cord, check the torque required to rotate the pinion, at the flange end. Torque required should be within the limits of 4 – 5 kg/cm (3.5 – 4.3 in/lb). Note the reading.

(3) With the pinion flange held to prevent it from turning, remove the flange retaining nut and washer.

(4) Using a suitable puller withdraw the pinion flange from the end of the pinion shaft.

(5) Using a soft metal drift, tap the pinion shaft with rear bearing inner cone assembly, washer and bearing spacer out of the differential carrier housing.

(6) Working through the rear bearing outer cup, drift out the front bearing inner cone and rollers and the pinion flange oil seal.

NOTE: Unless replacement of the pinion taper bearings is intended do not remove the taper bearing outer cones from the carrier.

Provided replacement of the pinion is not required do not remove the rear bearing inner cone assembly from the pinion.

If, however, replacement of one or both of the above is required continue dismantling as follows.

(7) Using a suitable puller or a press, remove the rear taper bearing inner cone assembly from the pinion.

(8) Draw or press the taper bearing outer cones from the carrier, taking particular note of the pinion height

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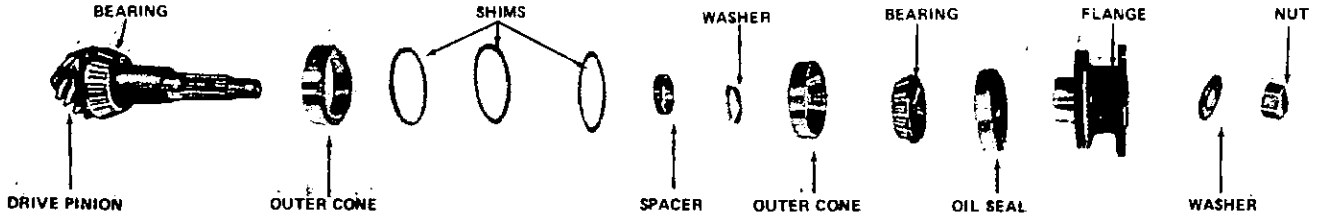

Exploded View of Drive Pinion Components.

adjusting shims located between the rear outer cone and carrier.

NOTE: Before dismantling the differential check the carrier bearings at each end of the differential case. Provided the bearings are fit for further service, do not remove from their position.

(9) Mark the position of the crownwheel in relation to the differential case.

(10) Release the locks from the crownwheel retaining bolts and remove the bolts and crownwheel.

(11) Knock out the differential shaft lock pin from the crownwheel side of the differential case.

(12) Knock out the differential shaft and remove the pinions and side gears together with the thrust washers.

NOTE: It is important that each pinion and side gear, together with its thrust washer, is marked in relation to the differential case to ensure original installation on assembly.

(13) If necessary for bearing replacement or bearing pre-load or backlash setting, use a suitable puller and draw the carrier bearings from each side of the differential case. Note the adjusting shims between the bearing and case.

TO CLEAN AND INSPECT

(1) Wash all components in a cleaning solvent and blow dry with compressed air.

(2) Check the crownwheel and pinion for wear, pitting or damage.

NOTE: Crownwheel and pinion are supplied as matched sets only, therefore damage to one item requires the replacement of both.

(3) Check the differential carrier bearings for wear, pitting or damage. If a bearing is faulty, renew the complete bearing, comprising inner cone, rollers and outer cup.

(4) Check the pinion taper bearings and renew as described in (3).

(5) Examine the differential pinion and side gear teeth and thrust faces for wear, pitting or damage. Check that the thrust washers are in a serviceable condition.

(6) Check the differential shaft for wear, pitting or damage. Replace parts listed in (5) and (6) if not in serviceable condition.

(7) Examine the differential case for damage and/or distortion and renew if necessary. Check also the pinion and side gear thrust faces in the case for wear and/or pitting.

(8) Ensure that all shims and spacers are free of damage.

TO ASSEMBLE AND ADJUST DRIVE PINION

Where the old pinion and bearings are serviceable and the tooth contact, turning torque and backlash checks made on dismantling are satisfactory, then assembly is a reversal of the dismantling procedure.

If any of the above factors proved incorrect on the check it will be necessary to carry out the appropriate adjustment as described in this section.

This is not the case however, when a new pinion (and crownwheel) is to be installed and/or the bearings renewed. Adjustment of the pinion position and bearing pre-load then becomes essential.

There are two methods of obtaining the correct pinion position, which is regulated by the shims located between the rear bearing outer cup and the carrier. One method requires the use of an arbor and gauge kit to calculate the thickness of shim required. The second method entails the alteration of the existing shims thickness to compensate for the new pinion head variation, using the old pinion head variation as a guide.

Note that the pinion head variation from standard figures is given in units of 0.001 in.

To Adjust Pinion Position
Method 1. (With special tools)

(1) Instal the front and rear bearing outer cones with original shims to the carrier.

(2) Instal the rear bearing inner cone assembly to the dummy pinion.

(3) Fit the dummy pinion to the carrier and instal the front taper bearing and the pinion flange.

NOTE: Do not instal the bearing pre-load spacer and washer at this point.

(4) Instal and tighten the flange retaining nut until the

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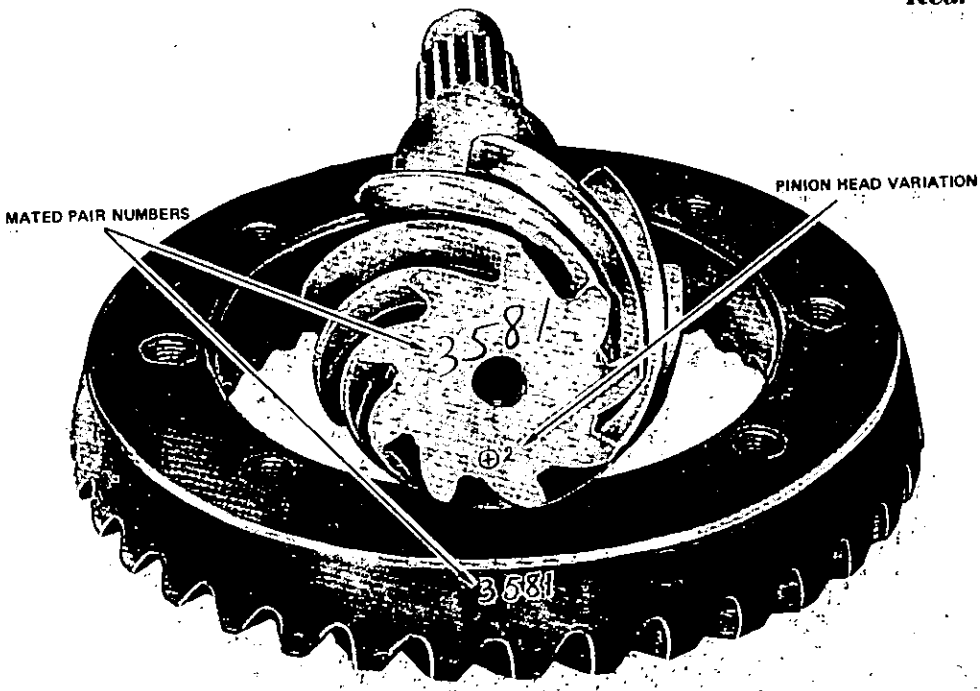

Crownwheel and Pinion Mating Numbers and Pinion Head Variation from Standard. (Units of 0.001 in).

correct initial turning torque of the pinion is obtained (see specifications). This should be checked with pre-load measuring gauge or spring scale and cord.

(5) Mount the arbor into the differential case carrier bearing bores so that the gauge rod is directly over the pinion head.

(6) Using feeler gauge, check the clearance between the pinion head and the tip of the gauge rod and note the measurement.

(7) Calculate the thickness of shims required, to obtain correct pinion position, from the following equation:

$$W + N - (H \times 0.001) - 0.008 = T \text{ (inches)}$$

Definition:

W = thickness of adjusting shims fitted.
N = clearance figures obtained in (6) with feeler gauges.
H = pinion head variation figure on the pinion head.
T = thickness of shims required to correctly position pinion.

Example:

W = 0.010 in
N = 0.004 in
H = –1

Therefore:

$$0.010 + 0.004 - (-1 \times 0.001) - 0.008 = 0.007 \text{ in}$$

Thickness of shims required to correctly position pinion is 0.007 in (0.178 mm).

(8) Remove the dummy pinion assembly from the carrier and withdraw the rear bearing outer cone and old adjusting shims from the carrier.

(9) Instal the shims as calculated to the carrier and refit the rear bearing outer cone.

To Adjust Pinion Position
Method 2. (Without special tools)

In the event of the arbor and gauge kit not being available it will be necessary to use the shims removed from behind the rear bearing outer cone plus or minus, as the case may be, the figure etched on the new pinion as a starting point for pinion position adjustment. This method of adjustment entails assembling the pinion and adjusting pinion bearing pre-load, fitting crownwheel and differential assembly; and adjusting the backlash and taking teeth markings with red lead or engineers' blue. This is a trial and error method until a satisfactory marking is obtained.

If a new crownwheel and pinion are to be fitted with the old pinion bearing it is a relatively simple matter to calculate the thickness of the pinion positioning shims, if the shims from the old pinion are kept intact and used again, taking into consideration the markings on the old and new pinions.

Example 1:

If both pinion markings are 0 or zero, the original shims will be correct.

If the old pinion marking is 0 or zero and the new pinion marking is +2, then 0.002 in must be SUBTRACTED from the original shim thickness.

Again, if the new pinion mark is –2, then 0.002 in must be ADDED to the original shim thickness to give the correct pinion position.

Example 2:

Where the old pinion marking is –2 and the new pinion marking is +2, the position is slightly more complicated.

As 0.002 in was added to the shim thickness for a zero marked pinion to compensate for the –2 mark on the old pinion head, then 0.002 in must now be subtracted from

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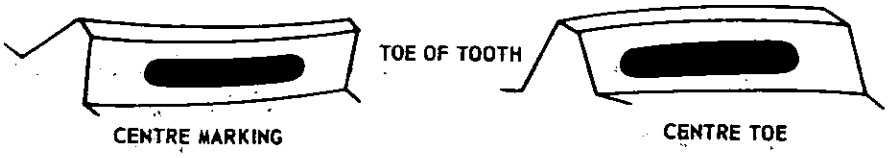
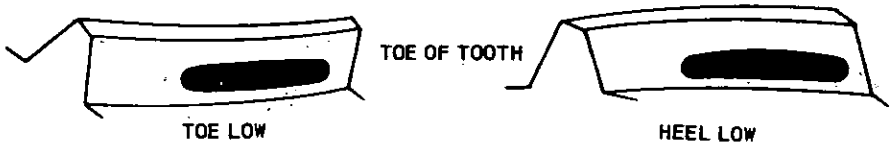
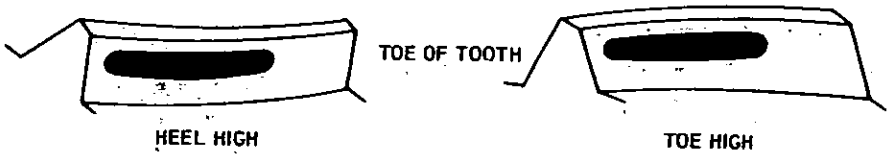
DRIVE **OVERDRIVE**



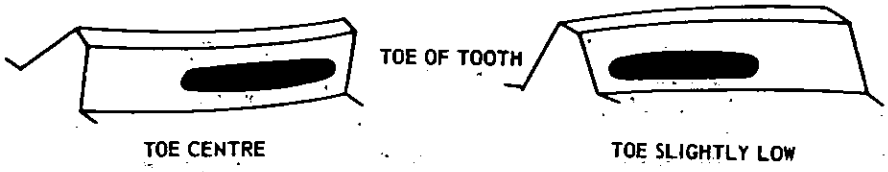
Crownwheel Tooth Marking for Correctly Adjusted Crownwheel and Pinion. Marking will be slightly Closer to Toe of Tooth on Overdrive or Concave Side. Changes in Thickness of Pinion Positioning Shims will Affect Tooth Marking on Overdrive to Greater Extent than on Drive or Convex Side of Tooth. Changes in Backlash have a more Pronounced Effect on Drive Side Markings (All models.)



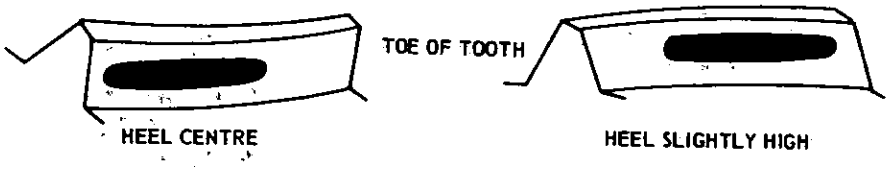
Low Profile Marking on Both Sides of Tooth. Rectify by Reducing Thickness of Pinion Positioning Shims and Reset Backlash (All models.)



High Profile Marking on Both Sides of Crownwheel Tooth. Rectify by Increasing of Pinion Positioning Shims and Reset Backlash (All models.)



Toe Marking on Drive Side and Low Profile Marking on Overdrive Side of Crownwheel Tooth. To Rectify, Increase Backlash. It may be Necessary to Increase Thickness of Pinion Positioning Shims to Maintain Backlash within Specified Limits (All models.)



Heel Marking on Drive Side and High Profile Marking on Overdrive Side of Crownwheel Tooth. To Rectify, Reduce Backlash. It may be Necessary to Decrease Thickness of Pinion Positioning Shims to Maintain Backlash within Specified Limits (All models.)

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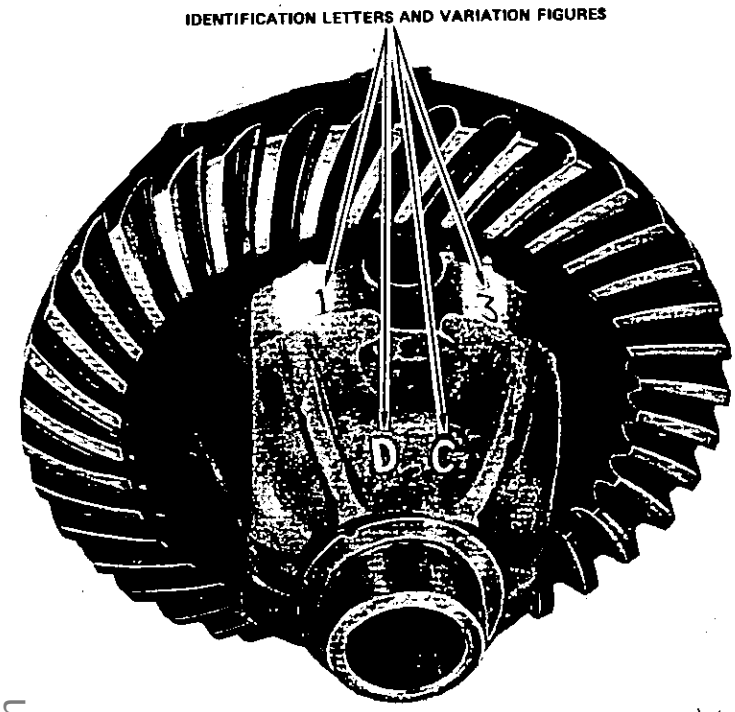

Differential Case Variation from Standard. (Units of 0.001 in).

the present shim thickness and a further 0.002 in subtracted for the +2 marking on the new pinion head. Thus, 0.004 in should be subtracted from the shim thickness when replacing an old pinion marked −2 with a new pinion marked +2.

The pinion head thickness as calculated in the previous paragraph is an accurate starting point for pinion position adjustment; but final assessment will be influenced by the crownwheel tooth contact markings taken after the crownwheel to pinion backlash adjustment has been made.

TO ADJUST PINION BEARING PRE–LOAD

(1) With the selected pinion positioning shims fitted between the rear bearing outer cone and the carrier, instal the bearing spacer and original adjusting washer to the pinion.

NOTE: Do not instal the oil seal at this point, but lubricate the bearings.

(2) Insert the pinion assembly into the carrier and through the front taper bearing.

(3) Fit the pinion flange, washer and retaining nut during the tightening of the retaining nut rotate the pinion to seat the bearings.

NOTE: Tighten the retaining nut a little at a time checking the bearing pre-load frequently to avoid exceeding the specified bearing pre-load and retaining nut torque. (See specifications for permissible limits on bearing pre-load and nut torque.)

If the pre-load becomes excessive before the nut maximum tightening torque is reached, substitute the washer and/or spacer for thicker ones to relieve the pre-load.

(4) With the retaining nut tightened to the correct torque, check the torque required to rotate the pinion assembly with a pre-load measuring gauge.

(5) If necessary, adjust the bearing pre-load to obtain a turning torque figure within the specified limits by replacing the washer and/or spacer from the available sizes.

NOTE: Reducing the overall length of the spacer and washer will increase the turning torque. Increasing the overall length will reduce the turning torque. When used bearings are taken back into service the pre-load should be adjusted to the lower limit.

(6) Recheck the pinion position to ensure that there has been no alteration in height.

(7) On final assembly, instal a new oil seal, tighten the retaining nut to the specified torque and secure with a new split pin.

TO ASSEMBLE AND ADJUST DIFFERENTIAL

(1) Instal the side gears and pinions together with mating thrust washers into their former positions in the differential case.

(2) Instal the differential shaft aligning the hole in the shaft with the hole in the case for the lock pin.

(3) Check the clearance by feeler gauge between the side gears and thrust washers. Clearance should be within the limits of 0.10 – 0.20 mm (0.004 – 0.008 in). If necessary, replace the thrust washers to obtain the correct clearance.

(4) Instal the differential shaft lock pin from the right side of the case and secure in position by peening the hole.

(5) Position the crownwheel on the differential case according to the marks made on dismantling.

(6) Instal the crownwheel retaining bolts with new lock plates. Tighten the bolts progressively a little at a time in a diagonal pattern to the specified torque. Secure the bolts by turning the lock plate tabs against the bolt heads.

NOTE: During the tightening procedure lightly tap each bolt head to assist seating of the crownwheel on the case.

(7) Provided the original differential case and carrier bearings assemblies are to be used, mount the differential case assembly, with the original pre-load shims between the carrier bearing inner cone and case, into the carrier.

NOTE: Operations (7) and (8) are only practical when the dismantling check on tooth contact pattern, backlash and pre-load proved satisfactory.

However, if the differential case, or carrier bearings

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have been replaced, or the differential checks proved unsatisfactory, it will be necessary to adjust the differential as follows.

(8) Instal the carrier bearing caps and nuts according to the mating marks on the cap and housing. Tighten the retaining nuts to the specified torque.

(9) Using a surface plate and dial indicator measure the variation from standard width (standard width 17.5 mm, 0.689 in) of each carrier bearing when subject to a 2.5 kg (5.5 lb) load. Variation should be in units of 0.001 in.

(10) Calculate the thickness of shims required for each carrier bearing by the following equations:

Left side (T1) = (A–C+D–N+E) x 0.001 + 0.008

Right side (T2) = (B–D–N+F) x 0.001 + 0.008

Definition – location of letters and variation from standard figures (in units of 0.001 in).

A = left side carrier bearing housing

B = right side carrier bearing housing

C + D = differential case

E + F = bearing width variation from standard for each carrier bearing (in units of 0.001 in).

N = crownwheel.

Thickness of shims required for each carrier bearing calculated by the equation will be in thousandths of an inch (0.001 in).

NOTE: If the old carrier bearings are to be taken back into service the pre-load required will be slightly less than that for new bearing. To compensate for the old bearings reduce the shim thickness already calculated by 0.03 – 0.07 mm (0.001 – 0.003 in).

(11) Instal the selected shims on their respective ends of the differential case and fit the carrier bearing inner cone assemblies.

(12) With the carrier bearing outer cones mated with the correct inner cone assembly instal the differential in the carrier using a soft-faced hammer, to tap the assembly in to the bearing seats.

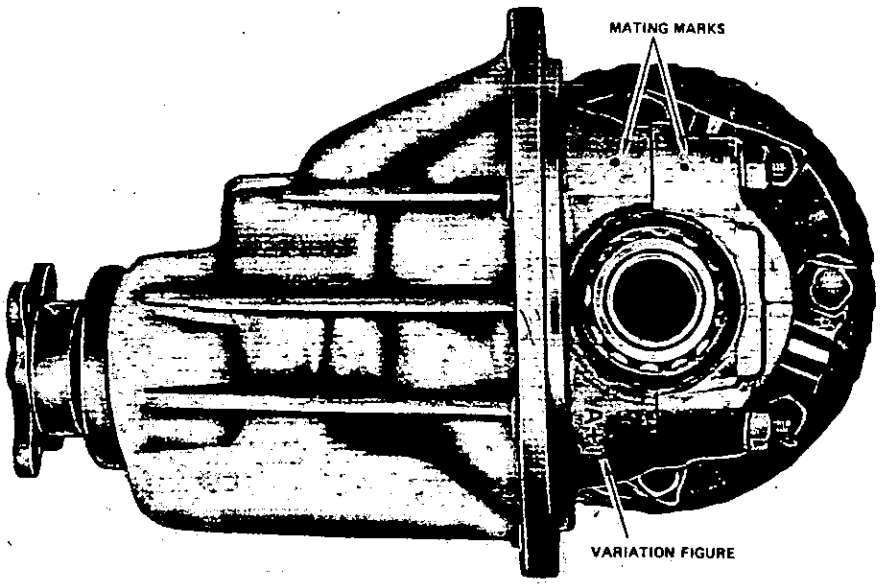
(13) Instal the carrier bearing caps and nuts according to the mating marks on the cap and housing. Tighten the retaining nuts to the specified torque.

(14) Check the crownwheel backlash as previously described in TO DISMANTLE. If necessary adjust the backlash by transferring the appropriate thickness of carrier bearing shims from one side to the other according to the requirement.

(15) Check the crownwheel run-out, if the run-out exceeds specifications, remove the differential assembly, detach the crownwheel from the case and check the contact faces of the case and crownwheel for dirt or burrs. During assembly ensure that the crownwheel is pulled down squarely on the case. If the run-out still exceeds specifications a new crownwheel and pinion set will have to be installed.

(16) Carry out the tooth contact pattern check as described previously in TO DISMANTLE. Provided pinion height, backlash and pre-loads are correct the desired tooth patterns will be obtained.

(17) Instal the assembly in the vehicle in the reverse order of removal, fill with correct quantity and grade of oil.



Carrier Bearing Housing Variation From Standard. (Units of 0.001 in).

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3. AXLE SHAFT AND BEARINGS

TO REMOVE

(1) Raise the rear of the vehicle and support on stands.
(2) Loosen off and remove the rear wheel and brake drum.

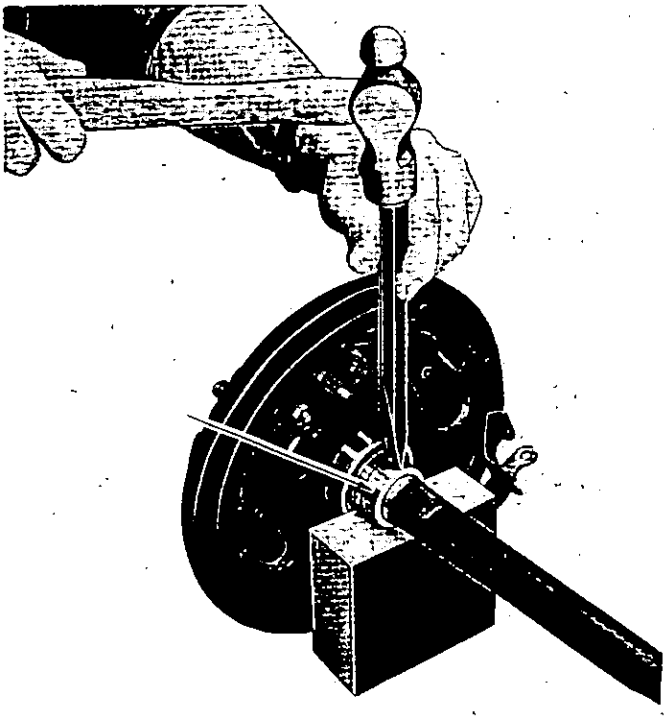
NOTE: It may be necessary to release the brake adjuster several notches if the brake drum proves difficult to remove.

(3) Disconnect the handbrake cable and hydraulic brake pipe at the rear of the brake backing plate. Plug the pipe to prevent the loss of fluid or entry of dirt.
(4) Remove the nuts retaining the brake backing plate to the axle casing through the holes provided in the axle shaft flange.
(5) Withdraw the axle shaft from the axle casing using a slide hammer and adaptor if necessary.

NOTE: Keep intact the end-float adjustment shims fitted between the backing plate and casing.

TO RENEW AXLE SHAFT BEARING

(1) Remove the axle shaft as described above.



Method of Removing Rear Axle Shaft Bearing Retainer.

(2) Place the axle shaft so that the bearing retaining collar is resting on an anvil and, using a hammer and cold chisel, make a cut in the top of the retaining collar.

NOTE: Use care not to damage the axle shaft with the chisel if it is necessary to cut completely through the collar. Usually it will be necessary to make shallow cuts only in order to expand the collar sufficiently for it to be removed.

(3) Using a press and press plates, support the bearing on the inner race and press the axle shaft out of the bearing, or use special tool No. ST37130000 to pull the bearing from the shaft.
(4) Detach the bearing spacer, brake backing plate and grease trap.
(5) Clean all parts and check the condition of the axle shaft for wear, damage or distortion.
(6) If necessary, remove the old oil seal from the axle casing, grease the seal lips of the new seal and instal into the casing.
(7) Position the grease trap, brake backing plate, bearing spacer and bearing on the axle shaft.
(8) Press a new bearing retaining collar onto the shaft to secure the bearing; a load of 4–5 tons will be necessary for collar installation.

TO INSTAL

(1) Pack the axle shaft bearing with suitable grease and smear the outer face of the retaining collar with grease.
(2) Position the shims originally removed on the brake backing plate.
(3) Insert the axle shaft assembly into the rear axle casing engaging the splines of the shaft and differential side gear.

NOTE: Ensure that the oil seal lip is not damaged as the shaft is passed through it.

(4) Instal and tighten the retaining nuts to secure the assembly to the axle casing flange.
(5) Mount a dial gauge to the brake backing plate with the gauge plunger bearing on the axle shaft flange and zero the gauge. Check the end-float on the axle shaft which should be within the limits of 0 – 0.1 mm (0 – 0.004 in).
(6) If adjustment to the shaft end-float is necessary, add to or subtract from, the shims located between the brake backing plate and axle casing until the correct end-float is obtained.
(7) Connect the brake cable and hydraulic brake pipe and refit the brake drum.
(8) Adjust the braking system and bleed as described in the BRAKES section.
(9) Ensure that the rear axle oil level is correct, refit the road wheel and lower the vehicle to the ground.

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4. REAR AXLE ASSEMBLY

TO REMOVE AND INSTAL

(1) Jack up the rear of the vehicle and support it on stands placed under the jacking points.

(2) Raise the axle housing and remove the road wheels.

(3) Disconnect the handbrake cable at the equaliser lever.

(4) Mark across the pinion and universal joint flanges to ensure assembly in the original position.

(5) Remove the four nuts and bolts connecting the universal joint flange to the pinion flange, tie the shaft to the underbody, out of the way.

(6) Disconnect the hydraulic brake hose from the three way connector on the axle casing and plug the flexible hose to prevent loss of fluid and/or entry of dirt.

(7) Remove the shock absorber lower mounting retaining nut on each rear shock absorber and detach them from the spring seats.

(8) Unscrew and remove the securing nuts from each of the spring U-bolts and detach the spring seats and pads.

(9) Lift the axle assembly and withdraw it from one side clear of the vehicle or alternatively disconnect the rear spring shackles and lower the assembly to the ground.

Installation is a reversal of the removal procedure but it will be necessary to bleed the hydraulic brake system and check the handbrake adjustment.

PART 2. REAR AXLE — 1200 cc MODELS

1. DESCRIPTION

The rear axle is a semi-floating type with hypoid final drive gears mounted in a detachable carrier.

The crownwheel and differential case assembly is supported in the carrier by two tapered roller bearings, the bearing pre-load and crownwheel backlash is adjusted by means of shims.

The drive pinion is supported in the carrier by two tapered roller bearings which are adjusted for pre-load by a compressible spacer installed between the front and rear bearing inner cone assemblies.

Pinion height in relation to the crownwheel is controlled by a washer located between the rear bearing inner cone and the pinion head.

Axle shaft bearings are the pre-lubricated ball type which require no lubrication in service and are retained to the shafts by means of collars. End-float in the axle shaft assembly is adjusted by shims located at the brake backing plate.

With the removal of the axle shafts, the differential carrier assembly can be detached from the axle without removing the axle casing from the vehicle.

It is important to note that adjustment figures stamped on the final drive components are in units of 0.01 mm which must be taken into consideration when calculating the various differential and pinion adjustments.

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2. DIFFERENTIAL CARRIER ASSEMBLY

TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle and support on axle stands.

(2) Loosen off and remove the rear wheels and brake drums.

(3) Disconnect the handbrake cables and hydraulic brake pipes at the rear of the brake backing plates. Plug the pipes to prevent the loss of fluid and entry of dirt.

(4) Remove the nuts retaining the brake backing plates to the axle casing through the holes provided in the axle shaft flange.

(5) Withdraw each axle shaft assembly from the axle casing using a slide hammer and adaptor if necessary.

(6) Take out the oil drain plug and drain the differential oil into a suitable container.

(7) Mark across the flanges of the pinion and rear universal joint, take out the four securing bolts and nuts to release the propeller shaft.

(8) Remove the nuts retaining the differential carrier assembly to the axle casing and withdraw the assembly.

Installation is a reversal of the removal procedure but it will be necessary to bleed the brake hydraulic system.

TO DISMANTLE

NOTE: Before dismantling the assembly, carry out the following checks. The information gained from the checks will prove helpful when assembling the unit.

(a) Check the tooth contact of the crownwheel and pinion by applying a thin coating of red lead and engine oil to both sides of six or eight of the crownwheel teeth.

(b) Rotate the pinion both ways, placing a bar between the differential case and the carrier to apply a load to the gear teeth and so obtain a good marking. If the pinion height, bearing pre-load and backlash are correct the area of contact should be as shown in the teeth marking illustration.

(c) The margin above and below the area of contact

should be the same and the contact margin should run approximately three quarters of the tooth length, check the patterns on both sides of the tooth.

(d) Mount a dial indicator gauge on to the differential carrier housing so that the plunger is in contact with and at right angles to, the heel of a crownwheel tooth, then zero the dial gauge.

(e) Hold the pinion firmly and rock the crownwheel back and forth to check the backlash on the dial gauge. Check the backlash at approximately three positions around the crownwheel. Backlash is correct when within the limits of 0.10 – 0.15 mm (0.004 – 0.006 in).

NOTE: Having completed the foregoing checks dismantle the assembly as follows.

(1) Take out the carrier bearing cap bolts and detach the caps. Check that the caps are marked in relation to the carrier to ensure installation in their original positions.

(2) Lift out the differential assembly from the carrier but ensure that the bearing outer cones are kept with their respective bearings.

NOTE: To facilitate assembly carry out the following check.

(a) Using a pre-load measuring gauge or spring scale and cord, check the torque required to rotate the pinion, at the flange end. Torque required should be within the limits of 4 – 5 kg/cm (3.5 – 4.3 in/lb). Note the reading.

(3) With the pinion flange held to prevent it from turning, remove the flange retaining nut and washer.

(4) Using a suitable puller withdraw the pinion flange from the end of the pinion shaft.

(5) Using a soft metal drift, tap the pinion shaft with rear bearing inner cone and rollers and bearing spacer out of the differential carrier housing.

(6) Working through the rear bearing outer cup, drift out the front bearing inner cone and rollers and the pinion flange oil seal.

NOTE: Unless replacement of the pinion taper bearings is intended do not remove the taper bearing outer cones from the carrier.

Provided replacement of the pinion is not required do not remove the rear bearing inner cone assembly from the pinion.

If, however, replacement of one or both of the above is required continue dismantling as follows.

(7) Using a suitable puller or a press, remove the rear taper bearing inner cone assembly and adjusting washer from the pinion.

(8) Draw or press the taper bearing outer cones from the carrier.

NOTE: Before dismantling the differential check the carrier bearings at each end of the differential case. Provided the bearings are fit for further service, do not remove them from position.

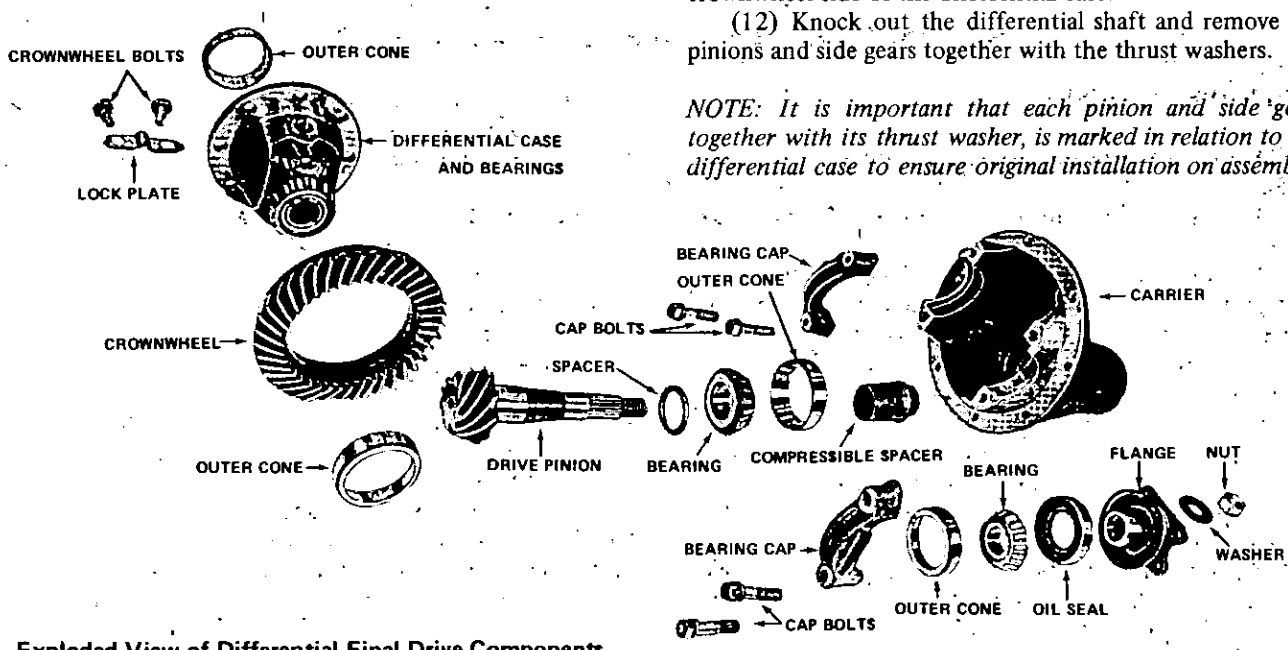
(9) Mark the position of the crownwheel in relation to the differential case.

(10) Release the locks from the crownwheel retaining bolts and remove the bolts and crownwheel.

(11) Knock out the differential shaft lock pin from the crownwheel side of the differential case.

(12) Knock out the differential shaft and remove the pinions and side gears together with the thrust washers.

NOTE: It is important that each pinion and side gear, together with its thrust washer, is marked in relation to the differential case to ensure original installation on assembly.



Exploded View of Differential Final Drive Components.

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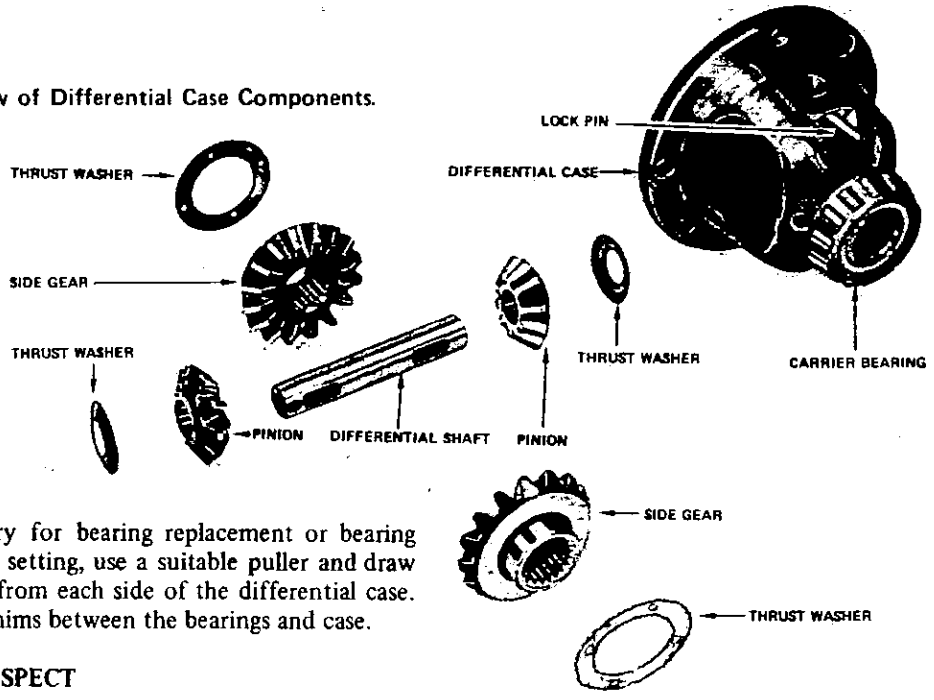
Exploded View of Differential Case Components.



(13) If necessary for bearing replacement or bearing pre-load or backlash setting, use a suitable puller and draw the carrier bearings from each side of the differential case. Note the adjusting shims between the bearings and case.

TO CLEAN AND INSPECT

(1) Wash all components in a cleaning solvent and blow dry with compressed air.

(2) Check the crownwheel and pinion for wear, pitting or damage.

NOTE: Crownwheel and pinion are supplied as matched sets only, therefore damage to one item requires the replacement of both.

(3) Check the differential carrier bearings for wear, pitting or damage. If a bearing is faulty, renew the complete bearing, comprising inner cone, rollers and outer cup.

(4) Check the pinion taper bearings and renew as described in (3).

(5) Examine the differential pinion and side gear teeth and thrust faces for wear, pitting or damage. Check that the thrust washers are in a serviceable condition.

(6) Check the differential shaft for wear, pitting or damage. Replace parts listed in (5) and (6) if not in serviceable condition.

(7) Examine the differential case for damage and/or distortion and renew if necessary. Check also the pinion and side gear thrust faces in the case for wear and/or pitting.

(8) Ensure that all shims and spacers are free of damage.

TO ASSEMBLE AND ADJUST DRIVE PINION

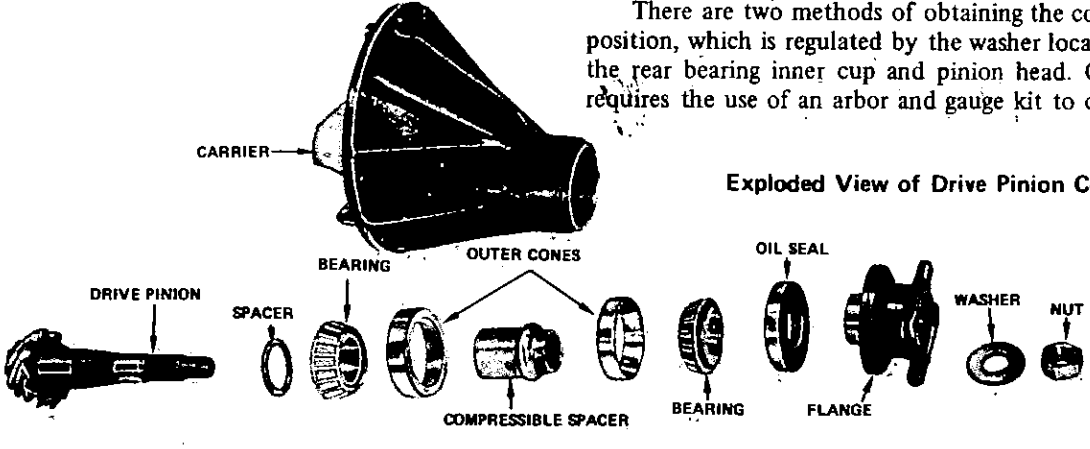
Where the old pinion and bearings are serviceable and the tooth contact, turning torque and backlash checks made on dismantling are satisfactory, then assembly is a reversal of the dismantling procedure.

If any of the above factors proved incorrect on the check it will be necessary to carry out the appropriate adjustment as described in this section.

This is not the case however, when a new pinion (and crownwheel) is to be installed and/or the bearings renewed. Adjustment of the pinion position and bearing pre-load then becomes essential.

There are two methods of obtaining the correct pinion position, which is regulated by the washer located between the rear bearing inner cup and pinion head. One method requires the use of an arbor and gauge kit to calculate the

Exploded View of Drive Pinion Components.



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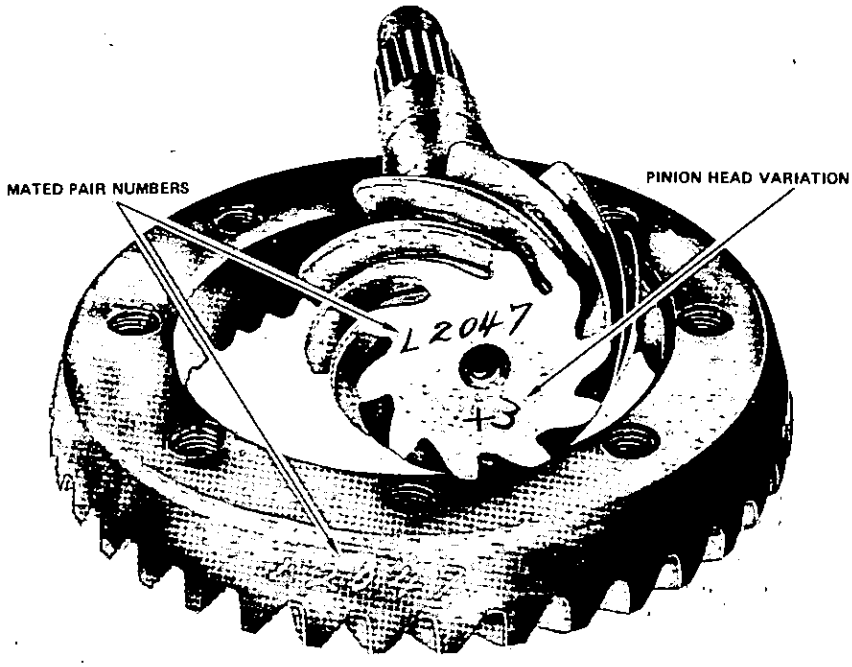

Crown wheel and Pinion Mating Numbers and Pinion Head Variation from Standard Figure (Units of 0.01 mm).

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thickness of washer required. The second method entails the alteration of the existing washer thickness to compensate for the new pinion head variation, using the old pinion head variation as a guide.

Note that the pinion head variation from standard figure is given in units of 0.01 mm.

To Adjust Pinion Position
Method 1. (With special tools)

(1) Instal the front and rear bearing outer cones to the carrier.

(2) Instal the rear bearing inner cone assembly and original adjusting washer to the dummy pinion.

(3) Fit the dummy pinion to the carrier and instal the front taper bearing and the pinion flange.

NOTE: Do not instal the bearing pre-load spacer at this point.

(4) Instal and tighten the flange retaining nut until the correct initial turning torque of the pinion is obtained (see specifications). This should be checked with a pre-load measuring gauge or spring scale and cord.

(5) Mount the arbor into the differential case carrier bearing bores so that the gauge rod is directly over the pinion head.

(6) Using feeler gauges, check the clearance between the pinion head and the tip of the gauge rod and note the measurement.

(7) Calculate the thickness of washer required, to obtain correct pinion position, from the following equation:

$$W + N - (H \times 0.01) - 0.2 = T \text{ (in mm)}$$

Definition:

W = thickness of adjusting washer fitted.
N = clearance figure obtained in (6) with feeler gauges.
H = pinion head variation figure on the pinion head.
T = thickness of washer required to correctly position pinion.

Example:

W = 2.95 mm
N = 0.4 mm
H = –1

Therefore:

$$2.95 + 0.4 - (-1 \times 0.01) - 0.2 = 3.16 \text{ mm}$$

Thickness of washer required to correctly position pinion is 3.16 mm (0.1244 in).

(8) Remove the dummy pinion assembly from the carrier and withdraw the rear bearing inner cone and old adjusting washer from the dummy pinion.

(9) Instal the washer as calculated to the pinion and refit the rear bearing inner cone.

NOTE: Ensure that the chamfer on the adjusting washer is towards the pinion head.

To Adjust Pinion Position
Method 2. (Without special tools)

In the event of the arbor and gauge kit not being available it will be necessary to use the washer removed from behind the rear bearing inner cone plus or minus, as the case may be, the figure etched on the new pinion as a starting point for pinion position adjustment. This method of adjustment entails assembling the pinion and adjusting pinion bearing pre-load, fitting crownwheel and differential assembly, and adjusting the backlash and taking teeth

markings with red lead or engineers' blue. This is a trial and error method until a satisfactory marking is obtained.

If a new crownwheel and pinion are to be fitted with the old pinion bearing it is a relatively simple matter to calculate the thickness of the pinion positioning washer, if the washer from the old pinion is kept intact and used again, taking into consideration the markings on the old and new pinions.

Example 1:

If both pinion markings are 0 or zero, the original washer will be correct.

If the old pinion marking is 0 or zero and the new pinion marking is +2, then 0.02 mm must be SUBTRACTED from the original washer thickness.

Again, if the new pinion mark is −2, then 0.02 mm must be ADDED to the original washer thickness to give the correct pinion position.

Example 2:

Where the old pinion marking is −2 and the new pinion marking is +2, the position is slightly more complicated.

As 0.02 mm was added to the washer thickness for a zero marked pinion to compensate for the −2 mark on the old pinion head, the 0.02 mm must now be subtracted from the present washer thickness and a further 0.02 mm subtracted for the +2 marking on the new pinion head. Thus, 0.04 mm should be subtracted from the washer thickness when replacing an old pinion marked −2 with a new pinion marked +2.

The pinion head thickness as calculated in the previous paragraph is an accurate starting point for pinion position adjustment, but final assessment will be influenced by the crownwheel tooth contact markings taken after the crownwheel to pinion backlash has been made.

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TO ADJUST PINION BEARING PRE–LOAD

(1) With the selected pinion positioning washer fitted between the rear bearing inner cone and pinion head, instal a new bearing spacer to the pinion.

NOTE: Ensure that the chamfer on the adjusting washer is towards the pinion head.

(2) Instal a new oil seal in the carrier and insert the pinion assembly into the carrier and through the front taper bearing and oil seal.

NOTE: Lubricate the oil seal lips and bearings but ensure that the pinion thread, nut and washer are free of oil or grease.

(3) Fit the pinion flange, washer and retaining nut, during the tightening of the retaining nut rotate the pinion to seat the bearings.

NOTE: Tighten the retaining nut a little at a time checking the bearing pre-load frequently to avoid exceeding the specified bearing pre-load and retaining nut torque (see specifications for permissable limits on bearing pre-load and nut torque).

Do not slacken back the flange retaining nut if the specified bearing pre-load is exceeded, it is essential in this case to renew the compressible bearing spacer.

(4) Recheck the pinion position to ensure that there has been no alteration in height.

TO ASSEMBLE AND ADJUST DIFFERENTIAL

(1) Instal the side gears and pinions together with mating thrust washers into their former positions in the differential case.

(2) Instal the differential shaft aligning the hole in he shaft with the hole in the case for the lock pin.

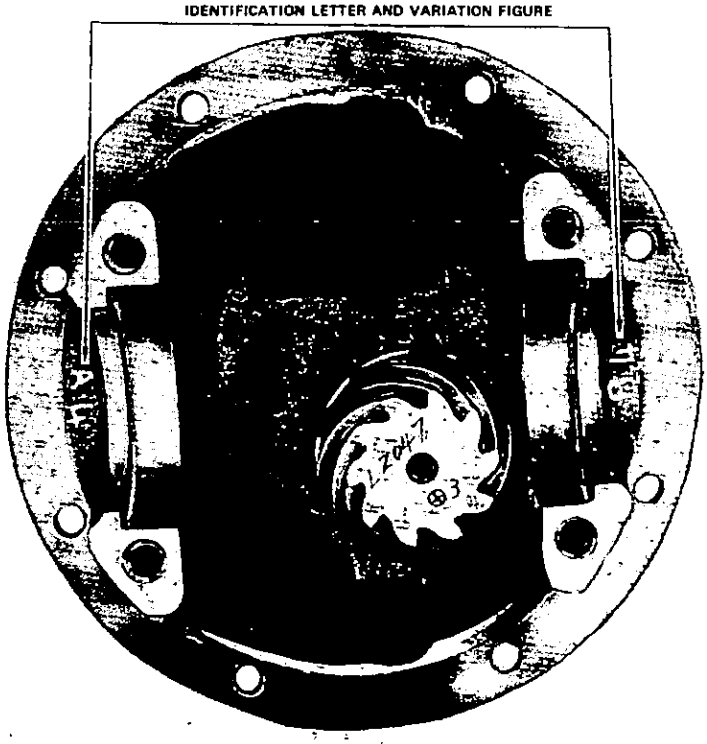
(3) Check the clearance by feeler gauge between the side gears and thrust washers. Clearance should be within the limits of 0.10 – 0.20 mm (0.004 – 0.008 in). If necessary, replace the thrust washers to obtain the correct clearance.

(4) Instal the differential shaft lock pin from the right side of the case and secure in position by peening the hole.

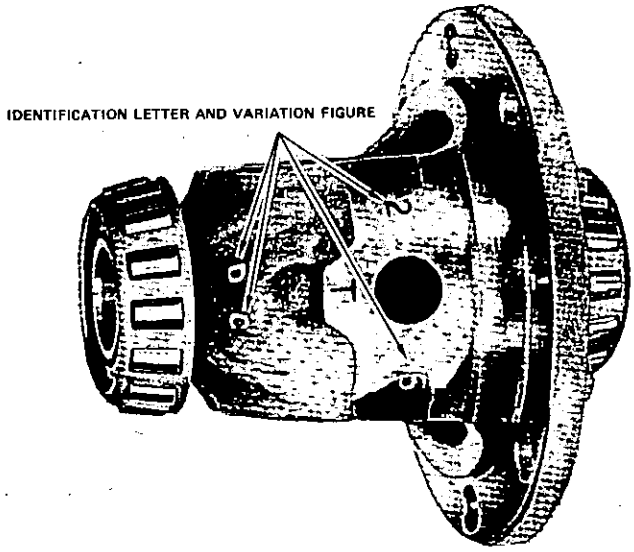
(5) Position the crownwheel on the differential case according to the marks made on dismantling.

(6) Instal the crownwheel retaining bolts with new lock plates. Tighten the bolts progressively a little at a time in a diagonal pattern to the specified torque. Secure the bolts by turning the lock plate tabs against the bolt heads.

IDENTIFICATION LETTER AND VARIATION FIGURE



Carrier Bearing Housing Variation from Standard Figures (Units of 0.01 mm).



Differential Case Variation from Standard Figures (Units of 0.01 mm).

NOTE: During the tightening procedure lightly tap each bolt head to assist seating of the crownwheel on the case.

(7) Provided the original differential case and carrier bearing assemblies are to be used, mount the differential case assembly, with the original pre-load shims between the carrier bearing inner cones and case, into the carrier.

(8) Instal the carrier bearing caps and bolts according to the mating marks on the cap and housing. Tighten the retaining bolts to the specified torque.

NOTE: Operations (7) and (8) are only practical when the dismantling check on tooth contact pattern, backlash and pre-load proved satisfactory.

However, if the differential case, or carrier bearings have been replaced, or the differential checks proved unsatisfactory, it will be necessary to adjust the differential as follows.

(9) Using a surface plate and dial indicator measure the variation from standard width (standard width 17.5 mm, (0.689 in) of each carrier bearing when subject to a 2.5 kg (5.5 lb) load. Variation should be in units of 0.01 mm.

(10) Calculate the thickness of shims required for each carrier bearing by the following equations:

Left side (T1) = (A – C + D + E) x 0.01 + 0.2

Right side (T2) = (B – D + F) x 0.01 + 0.2

Definition – location of letters and variation from standard figures (in units of 0.01 mm).

A = left side carrier bearing housing

B = right side carrier bearing housing

C + D = differential case

E + F = bearing width variation from standard for each carrier bearing (in units of 0.01 mm).

Thickness of shims required for each carrier bearing calculated by the equation will be in hundredths of a millimetre (0.01 mm).

NOTE: If the old carrier bearings are to be taken back into service the pre-load required will be slightly less than that for new bearing. To compensate for the old bearings reduce the overall shim thickness already calculated by 0.03 – 0.07 mm (0.001 – 0.003 in).

(11) Instal the selected shims on their respective ends of the differential case and fit the carrier bearing inner cone assemblies.

(12) With the carrier bearing outer cones mated with the correct inner cone assembly, instal the differential in the carrier using a soft faced hammer, to tap the assembly in to he bearing seats.

(13) Instal the carrier bearing caps and bolts according to the mating marks on the cap and housing. Tighten the retaining bolts to the specified torque.

(14) Check the crownwheel backlash as previously described in TO DISMANTLE. If necessary adjust the backlash by transferring the appropriate thickness of carrier bearing shims from one side to the other according to the requirement.

(15) Check the crownwheel run-out, if the run-out exceeds specifications, remove the differential assembly, detach the crownwheel from the case and check the contact faces of the case and crownwheel for dirt or burrs. During assembly ensure that the crownwheel is pulled down squarely to the case. If the run-out still exceeds specifications a new crownwheel and pinion set will have to be installed.

(16) Carry out the tooth contact pattern check as described previously in TO DISMANTLE. Provided pinion height, backlash and pre-loads are correct the desired tooth patterns will be obtained.

(17) Instal the assembly in the vehicle in the reverse order of removal, fill with correct quantity and grade of oil.

3. DRIVE PINION OIL SEAL

TO RENEW OIL SEAL AND/OR PINION FLANGE

(1) Raise the rear of the vehicle and support on stands under the axle housing, or raise the complete vehicle on a hoist.

(2) Remove both axle shaft and bearing assemblies from the axle housing, as described under AXLE SHAFT AND BEARING – TO REMOVE.

(3) Mark the relative position of the pinion flange and propeller shaft flange if not previously marked and remove the retaining bolts, support the propeller shaft to the underbody clear of the pinion flange.

NOTE: As the tension of the lip of a new pinion oil seal on the seal surface of the pinion flange will be greater than that of the original component, particularly if a new flange

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is also being installed, it will be necessary to calculate the overall pre-load to ensure that after reassembly the actual pinion bearing pre-load is the same as originally. This calculation is carried out during the following operations.

(4) Using a suitable pre-load measuring gauge, measure the overall torque required to rotate the drive pinion at the flange before loosening the flange securing nut, and make a record of the figure obtained.

(5) Undo the pinion flange retaining nut approximately three complete turns and, using a suitable puller, draw the flange along the pinion shaft to abut the retaining nut.

(6) Tighten the flange retaining nut until there is a slight end-float in the pinion shaft bearings.

NOTE: This will relieve the assembly of any pinion bearing pre-load, but will maintain the side bearing pre-load and the torque necessary to turn the pinion assembly against the retarding effect of the old oil seal.

(7) Again using a pre-load measuring gauge, measure the torque required to rotate the pinion at the flange end, with negative pinion bearing pre-load as in operation (4), and record the figure obtained.

(8) Undo and completely remove the pinion flange retaining nut and washer, and again using a suitable puller, withdraw the flange from the pinion shaft.

(9) Prise the defective seal assembly out of the differential carrier bore and discard.

(10) Clean the recess for the new seal in the end of the carrier bore and the splines on the end of the pinion shaft.

NOTE: Ensure that no foreign matter finds its way into the front pinion bearing or a false pre-load setting will be obtained.

(11) Apply a light coating of suitable sealing compound to the outer surface of a new pinion oil seal, position it in the bore of the differential carrier so that the lip of the seal faces the pinion bearing, and tap it fully into place.

NOTE: The new seal should be allowed to stand immersed in light engine oil for at least one hour before installing.

(12) Apply a coating of non-hardening sealing compound to the inner splines of the pinion flange, position the flange on the end of the pinion shaft, and fit the washer and a new nut on the threaded end of the pinion shaft.

NOTE: Renew the pinion flange if the splines are a loose fit on the shaft or if the seal surface of the flange is grooved or rough. A new flange should be a reasonably tight fit on the shaft splines.

(13) Hold the flange against rotation and carefully tighten the pinion retaining nut until there is just a slight end-float in the pinion shaft and bearings.

(14) Using a pre-load measuring gauge, measure the torque required at the flange end to rotate the pinion, with negative pinion bearing pre-load, but with the original pre-load on the carrier side bearings, plus the retarding effect of the new pinion seal and, if fitted, the new pinion flange. Record the figure obtained.

(15) Subtract the figure obtained in operation (7) from that obtained in operation (14) and add the result to the figure obtained in operation (4).

(16) The result, calculated in operation (15) will be the overall pre-load required at the pinion flange when the assembly is correctly adjusted.

(17) To apply the overall pre-load (see operations (15) and (16)), hold the pinion flange against rotation and very carefully tighten the flange retaining nut to just remove the bearing end float. Rotate the assembly to correctly seat the pinion bearings.

(18) Continue to tighten the flange retaining nut carefully, a fraction of a turn at a time, alternatively checking the overall pre-load at the pinion flange, until the pre-load gauge reading is as detailed in operation (16).

NOTE: It is most important to adhere strictly to the instructions given in operation (18) to avoid exceeding the calculated overall pre-load by tightening the retaining nut beyond this point and over-compressing the special spacer between the inner cones of the pinion bearings. In the event of the pinion bearing pre-load figure being exceeded by overtightening the flange nut, it will be necessary to remove the pinion flange and oil seal again, and withdraw the front pinion bearing inner cone, instal a new collapsible spacer and re-instal the bearing cone, oil seal, pinion flange with washer, and a new nut, and carry out operations (17) and (18) again.

(19) When the calculated pre-load has been correctly applied to the assembly, connect the rear universal joint flange to the pinion flange, then instal and tighten the bolts and self-locking nuts.

(20) Instal both rear axle shaft and bearing assemblies in the axle housing and fit the brake drums and road wheels. Adjust the brake shoes.

(21) Check the lubricant level in the rear axle and top up with the correct grade if necessary.

(22) Check the differential housing breather to make sure it is clear.

(23) Lower the vehicle to the floor.

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4. AXLE SHAFT AND BEARING

TO REMOVE

(1) Raise the rear of the vehicle and support on stands.
(2) Loosen off and remove the rear wheel and brake drum.

NOTE: It may be necessary to release the brake adjuster several notches if the brake drum proves difficult to remove.

(3) Disconnect the handbrake cable and hydraulic brake pipe at the rear of the brake backing plate. Plug the pipe to prevent the loss of fluid or entry of dirt.
(4) Remove the nuts retaining the brake backing plate to the axle casing through the holes provided in the axle shaft flange.
(5) Withdraw the axle shaft from the axle casing using a slide hammer and adaptor if necessary.

NOTE: Keep intact the end-float adjustment shims fitted between the backing plate and casing.

TO RENEW AXLE SHAFT BEARING

(1) Remove the axle shaft as described above.
(2) Place the axle shaft so that the bearing retaining collar is resting on an anvil and, using a hammer and cold chisel, make a cut in the top of the retaining collar.

NOTE: Use care not to damage the axle shaft with the chisel if it is necessary to cut completely through the collar. Usually it will be necessary to make shallow cuts only in order to expand the collar sufficiently for it to be removed.

(3) Using a press and press plates, support the bearing on the inner race and press the axle shaft out of the bearing, or use special tool No. ST37130000 to pull the bearing from the shaft.
(4) Detach the bearing spacer, brake backing plate and grease trap.
(5) Clean all parts and check the condition of the axle shaft for wear, damage or distortion.
(6) If necessary, remove the old oil seal from the axle casing, grease the seal lips of the new seal and instal into the casing.
(7) Position the grease trap, brake backing plate, bearing spacer and bearing on the axle shaft.
(8) Press a new bearing retaining collar onto the shaft to secure the bearing; a load of 4 – 5 tons will be necessary for collar installation.

TO INSTAL

(1) Pack the axle shaft bearing with suitable grease and smear the outer face of the retaining collar with grease.
(2) Position the shims originally removed on the brake backing plate.
(3) Insert the axle shaft assembly into the rear axle casing engaging the splines of the shaft and differential side gear.

NOTE: Ensure that the oil seal lip is not damaged as the shaft is passed through it.

(4) Instal and tighten the retaining nuts to secure the assembly to the axle casing flange.
(5) Mount a dial gauge to the brake backing plate with the gauge plunger bearing on the axle shaft flange and zero the gauge. Check the end-float on the axle shaft which should be within the limits of 0 – 0.1 mm (0 – 0.004 in).
(6) If adjustment to the shaft end-float is necessary, add to or subtract from the shims located between the brake backing plate and axle casing until the correct end-float is obtained.
(7) Connect the brake cable and hydraulic brake pipe and refit the brake drum.
(8) Adjust the braking system and bleed as described in the BRAKES section.
(9) Ensure that the rear axle oil level is correct, refit the road wheel and lower the vehicle to the ground.

5. REAR AXLE ASSEMBLY

TO REMOVE AND INSTAL

(1) Jack up the rear of the vehicle and support it on stands placed under the jacking points.
(2) Raise the axle housing and remove the road wheels.
(3) Disconnect the handbrake cable at the equaliser lever.
(4) Mark across the pinion and universal joint flanges to ensure assembly in the original position.
(5) Remove the four nuts and bolts connecting the universal joint flange to the pinion flange, tie the shaft to the underbody, out of the way.
(6) Disconnect the hydraulic brake hose from the three way connector on the axle casing and plug the flexible hose to prevent loss of fluid and/or entry of dirt.
(7) Remove the shock absorber lower mounting retaining nut on each rear shock absorber and detach them from the spring seats.
(8) Unscrew and remove the securing nuts from each of the spring U-bolts and detach the spring seats and pads.
(9) Lift the axle assembly and withdraw it from one side clear of the vehicle or alternatively disconnect the rear spring shackles and lower the assembly to the ground.

Installation is a reversal of the removal procedure but it will be necessary to bleed the hydraulic brake system and check the handbrake adjustment.

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6. REAR AXLE FAULT DIAGNOSIS

1. Rear wheel noise.

Possible cause	*Remedy*
(a) Wheel loose on axle flange.	– Check condition of axle and wheel and tighten or renew component.
(b) Defective brake components (shoes or wheel cylinder).	– Renew faulty components.
(c) Worn or defective axle shaft bearing, lack of lubrication.	– Renew faulty components.
(d) Bent axle tube or shaft.	– Renew axle housing and/or shaft.
(e) Wheel out of balance or bent.	– Check and rectify wheel balance or renew or true-up.

2. Final drive gear noise.

Possible cause	*Remedy*
(a) Faulty pinion bearings.	– Renew pinion bearings and readjust gears.
(b) Faulty differential carrier bearings.	– Renew carrier bearings and readjust gears.
(c) Lack of lubrication.	– Check condition of assembly, flush and renew lubricant.
(d) Incorrectly adjusted crownwheel and pinion.	– Check condition of gears and readjust or renew as mated pair.
(e) Incorrectly adjusted bearing pre-load (pinion or carrier bearings).	– Check condition of assembly, adjust bearing pre-load or renew faulty components.
(f) Excessive noise or grind under load.	– Overhaul assembly and renew faulty components.
(g) Excessive noise or grind on overdrive.	– Overhaul assembly and renew faulty components.
(h) Excessive noise on coast.	– Faulty final drive gears and adjustment. Renew and readjust.
(i) Bent axle housing.	– Renew housing and faulty components.

3. Excessive backlash in differential.

Possible cause	*Remedy*
(a) Looseness between axle shaft and differential side gear splines.	– Check and renew axle and/or side gears.
(b) Worn differential side gear thrust washers.	– Check and renew differential side gear thrust washers.
(c) Worn differential pinion thrust washers.	– Check and renew differential pinion thrust washers.
(d) Excessive backlash between differential side gears and pinions.	– Check condition of gear and pinion teeth and renew gear and/or pinion thrust washers.
(e) Excessive wear between differential shaft and pinions and/or shaft bore in carrier housing.	– Check and renew faulty components.

4. Repeated axle shaft breakage.

Possible cause	*Remedy*
(a) Bent axle housing.	– Check and renew housing.
(b) Repeated over loading.	– Revise load capacity.
(c) Abnormal clutch operation.	– Revise driving habits or check condition of clutch.
(d) Incorrectly torqued axle shaft bearing retaining plate nuts.	– Tighten axle shaft bearing retaining nuts to specified tightening torque.

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STEERING

SPECIFICATIONS

Type	Recirculating ball nut and worm
Ratio	15.0 : 1
Preload adjustment:	
Steering worm shaft	Steel shims
Sector shaft end thrust	Steel shim and screw
Shim thickness:	
Five sizes for worm shaft	0.05 – 0.20 mm (0.002 – 0.008 in)
Four sizes for sector shaft	1.515 –1.655 mm (0.059 – 0.065 in)
Collapsible steering column bush	0.05 – 0.10 mm (0.002 – 0.004 in)
Sector shaft end play	0.05 mm (0.002 in)
Steering wheel turning torque minus sector shaft	5.0 kg/cm (69 in/oz)
Ball nut balls:	
Number	38
Size – new	5.556 mm (0.218 in)
Oil capacity	0.23 litre (0.405 Imp pts) (0.486 US pts)
Oil grade	SAE 90 EP

TORQUE WRENCH SETTINGS

Column flange fixing bolts	2.8 kg/m (20 ft/lb)
Ball stud nut	5.0 kg/m (36 ft/lb)
Sector shaft to pitman arm nut	14.0 kg/m (101 ft/lb)
Idler arm nut	6.3 kg/m (45 ft/lb)
Gear housing fixing bolts	2.6 kg/m (19 ft/lb)
Idler arm fixing bolts	2.6 kg/m (19 ft/lb)
Steering wheel lock nut	3.5 kg/m (25 ft/lb)

1. DESCRIPTION

The steering gear is the worm and re-circulating ball type.

The steering shaft at the worm end operates in two ball thrust bearings and at the steering wheel end in a plastic bush.

The sector shaft operates in bronze bushes and has an oil seal at its lower end.

A three toothed sector on the upper end of the sector shaft engage a sector on the side of the ball nut.

There are 60 steel balls in the ball nut, 5.556 mm (0.218 in) in diameter.

The steering worm shaft bearing adjustment is controlled by shims between the steering box and the steering column flange.

Sector shaft end thrust is controlled by an adjusting screw and lock nut in the top cover and attached to a recessed slot in the upper end of the sector shaft.

The steering gear linkage comprises a steering connecting rod, connected by a ball joint at one end to the steering gear pitman arm and at the other end to the idler arm, which in turn pivots on a bracket attached to the underbody frame.

An adjustable tie-rod on either side of the steering linkage is attached by ball joints at its inner end to the connecting rod and at its outer end to the steering arm attached to the brake backing plate. These tie-rods are a means for setting the alignment for the front wheels (toe-in) and must both be the same length, to maintain the steering box on centre when the front wheels are in a straight ahead position.

2. STEERING GEAR ASSEMBLY

TO REMOVE (Column Gear Change)

(1) Disconnect the lead at the positive terminal of the battery.

(2) Unscrew the two horn ring emblem retaining screws and lift off the horn ring.

(3) Remove the steering wheel retaining nut and withdraw the steering wheel.

(4) Remove the column shell retaining bolts and shell. Loosen the trafficator clamp screws, disconnect the electrical plug and slide the trafficator switch off the steering column complete with the column shell cover.

(5) Remove the two bolts connecting the steering column to the facia.

(6) Remove the dust cover screws connecting the cover to the floor.

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(7) Release the gear shift control rod circlip at the support bracket at the top of the control rod.

(8) Remove the E-clip and pin retaining the gear change lever to the control rod and detach the lever and bush.

(9) Working at the steering box end of the linkage, disconnect the gear change rods from the control levers by removing the split pin and flat washer on each of the rod trunnions.

(10) Take out the lower support bracket retainer bolt and detach the control rod lever retainer.

(11) Place all linkages to one side and secure.

(12) Remove the lower change speed lever and bush by sliding off the lower end of the control rod.

(13) Pull down on the control rod and remove the control lever actuating pin.

(14) Press down on the control rod insert and disengage from the bracket on the upper end of the steering column. Withdraw the insert bush and spring from the end of the control rod.

(15) Withdraw the control rod from the drivers compartment of the vehicle.

(16) Disconnect the steering linkage connecting rod at the steering gear pitman arm ball joint.

(17) Remove the three retaining bolts securing the steering box to the body.

(18) Withdraw the steering box from the engine compartment.

TO DISMANTLE

(1) With the steering box removed from the vehicle as already described, remove the filler plug, turn the box upside down and drain off the oil.

(2) Remove the pitman arm retaining nut and spring washer. Using a suitable puller, remove the pitman arm.

NOTE: Prior to removal, ensure that the pitman arm is marked in relation to the sector shaft. This will facilitate assembly.

(3) Loosen the sector shaft adjusting bolt lock nut and back off the adjusting bolt.

(4) To remove the sector shaft from the housing, remove the four retaining bolts attaching the cover to the housing and remove the cover and sector shaft. Unscrew the adjusting bolt out of the cover and lock nut and slide the adjusting bolt and shim out of the upper end of the sector shaft.

(5) Take out the four retaining bolts securing the steering column tube flange to the housing. Withdraw the column assembly. Do not allow the ball nut to rotate on the worm as damage will be incurred to the ball guides.

NOTE: The cover plate shims are situated with a gasket on the cover plate. Ensure that the shims are not damaged during dismantling procedure. Store shims and gasket in a safe place for reassembly.

(6) Remove the worm shaft from the column tube.

(7) Remove the upper bearing outer cup from the column tube flange with a suitable puller.

(8) Remove the lower bearing outer cup from the steering box with a suitable puller.

(9) Remove the sector shaft oil seal from the steering box.

(10) Before dismantling ball-nut and worm shaft, check for correct alignment and excessive wear.

(11) Remove the clamp fitted to the ball guide tubes and withdraw the ball guide tube from the ball nut. Empty the balls into a suitable container.

(12) Invert the nut and rotate the column left to right until all 38 balls have been removed from the nut. Having removed the balls, the nut can be withdrawn from the column.

TO CLEAN AND INSPECT

(1) Wash all components in cleaning solvent and dry off.

(2) Check the steering worm shaft bearing inner cones for wear or pitting.

(3) Check the outer cups and balls of the steering worm shaft bearings for wear and pitting.

(4) Check the ball nut and track guides and balls for wear or pitting.

(5) Check the ball tracks on the steering worm for wear and pitting.

(6) Check the sector shaft bushes for wear and alignment.

(7) Check the ball nut sector teeth for wear and chipping.

(8) Check the adjusting bolt head and shim for wear or damage.

(9) Replace all worn or faulty components as found necessary.

TO ASSEMBLE

(1) Fit the ball nut to the worm with the ball guide holes uppermost.

(2) Place 19 balls in each of the two holes on the same side of the nut. As the balls are being fitted turn the worm shaft gradually away from the holes until the 38 balls are installed.

NOTE: If the balls are stopped by the end of the worm, use a clean punch or rod to hold down the balls previously fitted and turn the shaft in the opposite direction until the passage is clear.

Add remainder of the balls, filling the circuit fully.

(3) Instal the remaining 22 balls in the guide tubes – 11 to each tube. Hold the guides together and plug with petroleum jelly ready for installation.

(4) Fit the guide tubes to the guide holes of the ball nut.

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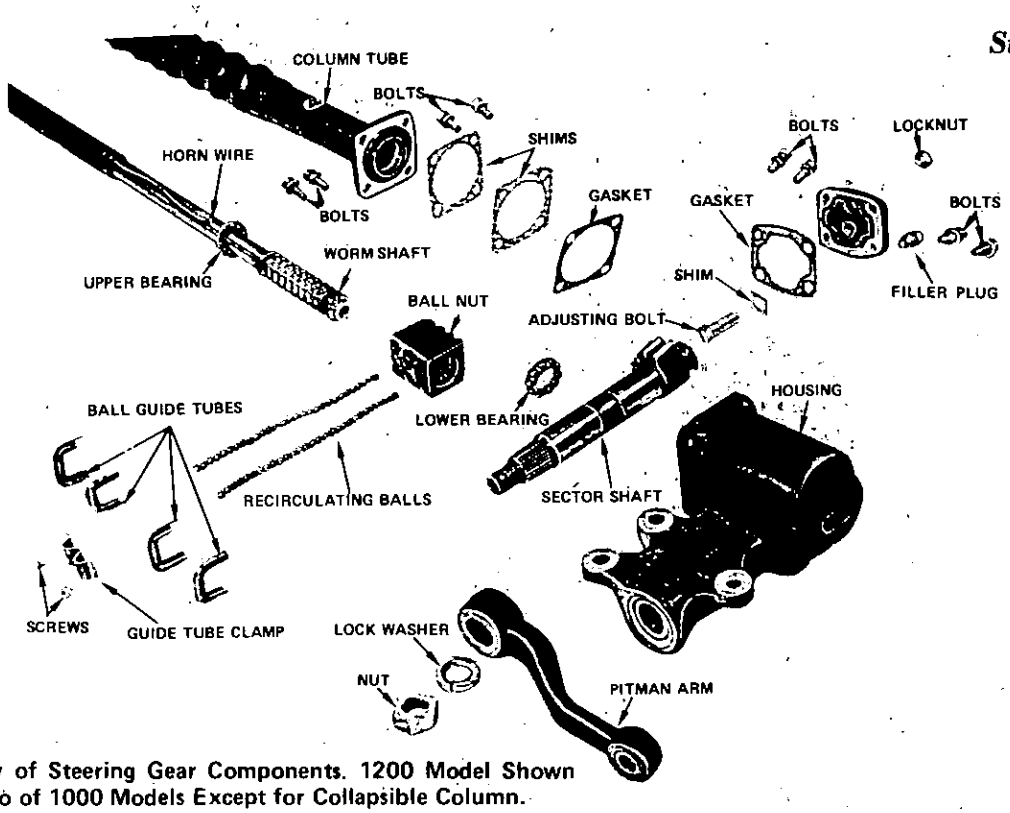


Exploded View of Steering Gear Components. 1200 Model Shown Typical also of 1000 Models Except for Collapsible Column.

(5) Fit the ball guide retaining clamp to the ball nut and secure with two screws.

(6) When replacing the sector shaft bushes in the steering box, press the new bushes into position so that the plain end of the bush is flush with the oil seal shoulder in the bore housing.

(7) Press the oil seal into the housing. Ensure that the oil seal is lightly lubricated with a suitable grease.

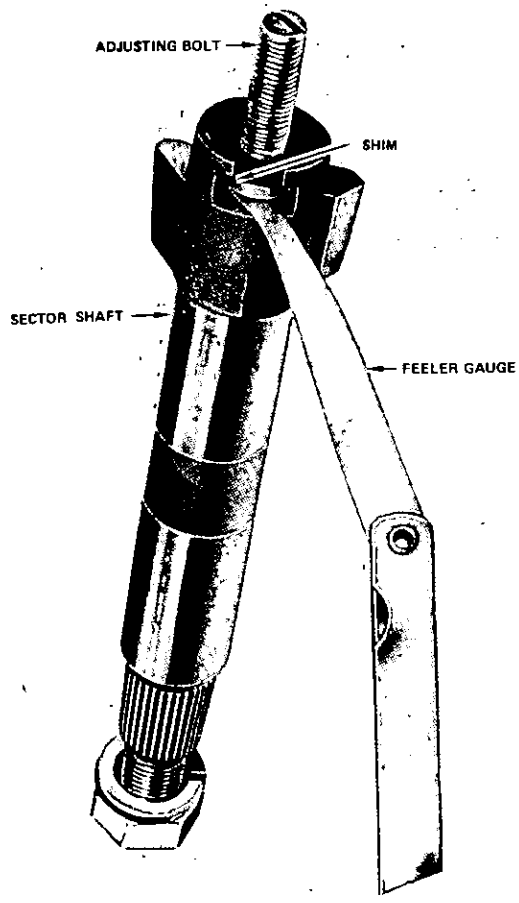
(8) Fit the bearing cups to the column tube and steering box. Fit the worm shaft and ball nut assembly into the steering box with the ball nut sector facing the sector shaft side of the box. Fit the column tube over the worm shaft and attach to the steering box, with new gasket and shims, as removed. Instal the four bolts and adjust the worm shaft bearing pre-load by adding or removing shims. See Specifications.

(9) To determine the correct end clearance and lash adjustment on the sector shaft, fit the lash adjuster bolt to the slot and check the clearance with a feeler gauge. Clearance should be 0.01 – 0.03 mm (0.0004 – 0.0012 in). Shim sizes are available in different thicknesses (see Specifications) for the purpose of obtaining the correct end float.

(10) Rotate the worm shaft by hand until the ball nut is located in the centre position to allow the centre tooth of the sector shaft to engage the centre tooth of the ball nut. Prior to installing the sector shaft, smear the shaft with oil.

Insert the sector shaft and cover into place and check that back lash exists between ball nut and sector shaft teeth, before tightening the side cover bolts.

(11) Temporarily secure the adjusting screw with the lock nut.



Check Sector Shaft End Float.

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(12) Rotate the sector shaft several times ensuring it turns smoothly.

(13) Fit the pitman arm to the sector shaft and ensure that the marking on the pitman arm is in line with the marking on the sector shaft.

(14) Select the central point in the steering box, release the adjusting screw lock nut and adjust the screw until the movement of the pitman arm is within 0.01 mm (0.0039 in).

(15) Refill the steering box with SAE 90 EP oil and instal the plug.

(16) Instal the steering box assembly to the vehicle. Installation is a reversal of the removal procedure.

(17) Finally check the steering wheel alignment, gear shift mechanism, and lubricate all applicable points.

3. COLLAPSIBLE STEERING

DESCRIPTION

The principle of the steering column is to compress on impact of a pre-determined force.

The operation of a collapsible steering column assembly is the same as that of the conventional type. The only variance is that caution must be exercised when working on the column when in situ. Severe bumping or downward pressure to or on the steering wheel could result in the shearing of the nylon pins connecting the upper and lower shafts causing the column to collapse.

The column assembly is comprised of an upper and lower shaft, lower column tube, jacket tube, column bush and collar, steering post clamp, snap link and washer.

The column is so designed so that on impact, the force applied to the steering wheel forces the upper shaft down, shearing the nylon pins connecting the upper and lower shaft, allowing the upper shaft to move down over the lower shaft.

The jacket is constructed of a fibre glass material and is of the convoluted design. This design allows the jacket to absorb initial shock then collapse when the upper shaft is forced down over the lower shaft.

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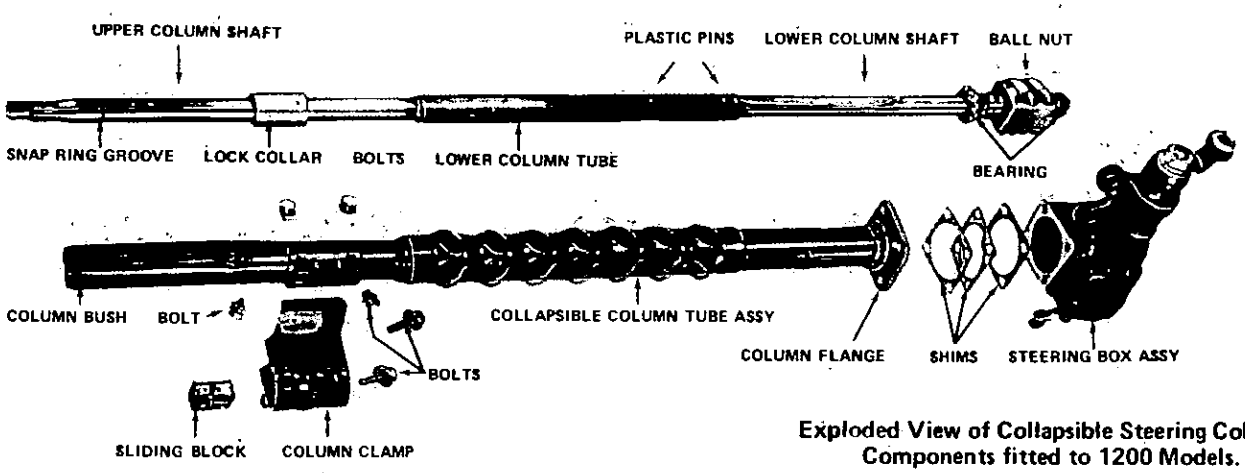


Exploded View of Collapsible Steering Column Components fitted to 1200 Models.

4. JACKET TUBE

TO REMOVE AND INSPECT

(1) Remove the steering gear assembly in the same manner as the conventional assembly, but firstly remove the snap ring from the upper face of the column bush. Do not bump the steering wheel or convoluted section of the assembly during removal.

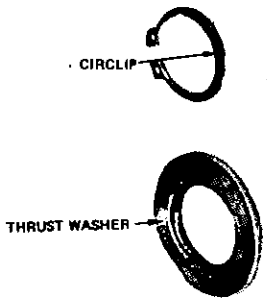
(2) Carry out an inspection of the steering box and components in the normal manner.

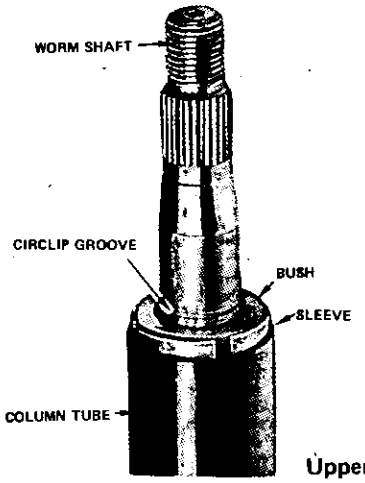
(3) With the steering jacket installed on the shaft, measure the end clearance between the jacket bush flange and the washer on the shaft. If the end clearance is not within 3 mm (0.118 in), the jacket can be put back into service by means of a thicker thrust washer at the top of the jacket.

(4) Inspect the plastic pins connecting the column shafts for fatigue.

(5) Inspect the steering column lock collar for fatigue and looseness.

(6) Support the column shaft on two 'V' blocks at the worm end and check the shaft for distortion. If distortion exceeds 1.0 mm (0.039 in) at the steering wheel end, correct or replace as necessary.





Upper End of Steering Worm Shaft and Column Tube.

TO ASSEMBLE AND INSTAL

(1) With the previous adjustments completed and the ball nut fitted to the worm shaft, lubricate where necessary and fit the worm shaft and column to the steering box. Tighten the four bolts connecting the column to the steering box and check the adjustment.

(2) Fit the upper bush to the column and apply the washer and snap ring. Check the snap ring for correct seating in the groove.

(3) Raise the bush until the top of the bush contacts the lower surface of the washer. Back off the bush until a clearance of less than 1.0 mm (0.039 in) is obtained.

Check for free turning of the column shaft and adjust the bush accordingly. Should the clearance between the washer and the bush be insufficient, binding will result.

(4) Align the upper end of the jacket tube with the groove in the column bush and chalk two symmetrical positions on the jacket.

Caulk the two positions to a depth not exceeding 4.0 mm (0.157 in) and ensure that the inner periphery of the tube measurement is less than 31.8 mm (1.252 in).

Re-check the clearance of the bush and should the clearance be incorrect, it will be necessary to re-caulk or adjust by adding shims.

(5) Fit and adjust the sector shaft and tighten the side cover bolts to the specified torque.

5. COLUMN CLAMP

TO INSPECT AND INSTAL

(1) Inspect the two aluminium spacer blocks for damage with particular attention to the nylon pins.

(2) Check the column clamp for damage and cracking.

(3) Check that the bolts connecting the clamp to the jacket lock collar are of the correct length. Fit the clamp to the jack lock collar ensuring that the bolts do not contact the steering shaft.

(4) Fit the steering assembly to the vehicle with the open end of the spacer blocks facing the steering wheel. It is imperative that the spacer blocks be fitted in this manner to ensure that on impact the nylon pins will shear off allowing the column to move forward away from the driver. Replace parts where necessary.

6. STEERING LINKAGE

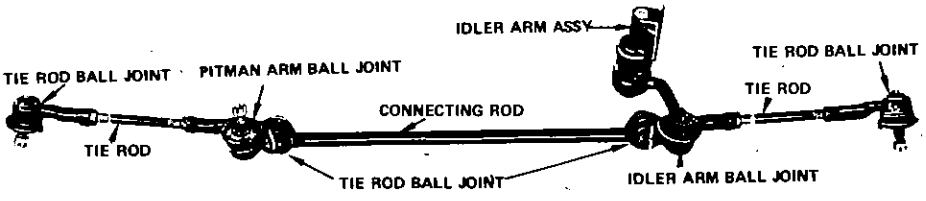
TO REMOVE AND DISMANTLE

(1) Jack up the front of the vehicle, block the rear wheels and lower the vehicle on to jack stands.

(2) Take out the split pin and remove the castellated nut securing the tie-rod outer ball joint to the steering arm on each suspension unit.

(3) Using a suitable extractor, press the tapered ball joint out of the tapered hole in each steering arm.

(4) Repeat operations (1) and (2) to detach the inner end of each tie-rod from the steering connecting rod and withdraw the tie-rods from the vehicle.



View of Steering Linkage Components Removed from Vehicle. 1000 Models.

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(5) Take out the split pin and remove the nut on the steering connecting rod joint bolt on the pitman arm.

(6) Using a suitable extractor, press the bolt out of the forward end of the pitman arm.

(7) Using similar procedure as in operations (4) and (5), disconnect the steering connecting rod from the forward end of the idler arm and withdraw the connecting rod from the vehicle.

(8) If tie-rods ends are unserviceable they must be replaced as a complete unit, not serviced separately.

TO ASSEMBLE AND INSTAL

(1) If the steering connecting rod ends are to be renewed, press the new bolt and bush into the rod until the end of the outer sleeve of bush is flush with the end of the eye in the connecting rod. Repeat on the other end of the rod.

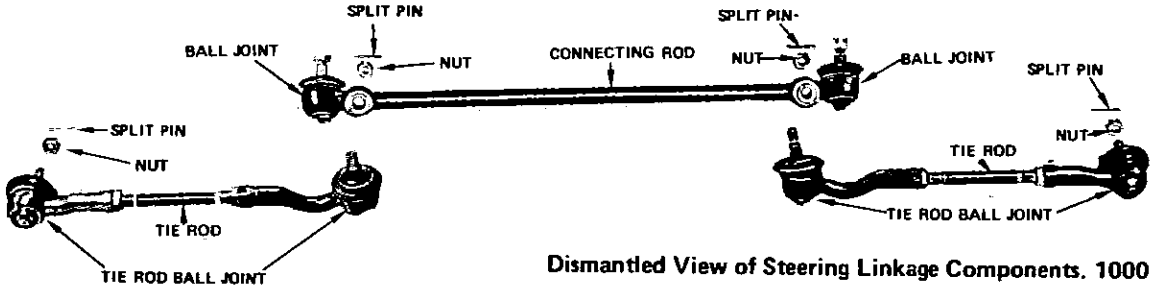
(2) Position the connecting rod on the pitman arm and idler arm. Fit castellated nuts and split pins.

(3) Attach the inner ball joint of each tie-rod to the connecting rod, tighten the castellated nut and secure with a new split pin.

(4) Attach the outer ball joint of each tie-rod to its respective steering arm, tighten the castellated nut and fit a new split pin.

(5) Measure the length of tie-rods between the ball stud centres. Distance between centres should be 296.8 mm (11.69 in).

(6) Centre the steering box with the wheels in the straight ahead position and check the wheel alignment (toe-in) as described under LINKAGE ADJUSTMENT.



Dismantled View of Steering Linkage Components. 1000 Models.

7. IDLER ARM

TO REMOVE AND DISMANTLE

(1) Remove the split pin and castellated nut securing the idler arm to the connecting rod and detach the connecting rod.

(2) Remove the two nuts and bolts securing the idler bracket assembly to the body side member and remove the assembly from the vehicle.

(3) Remove the split pin and castellated nut and press the idler arm pivot bolt out of the bracket body.

TO ASSEMBLE AND INSTAL

(1) With the idler assembly removed check the bushes for wear and fatigue.

If new bushes are required, wet the bushes with a soapy solution and instal them in the idler housing. Ensure that the lip of the bushes is protruding equally at either end.

The wetting procedure is unnecessary where a nylon bush is fitted.

(2) Instal the idler arm pivot bolt, fit the castellated nut and tighten to the specified torque. (See Specification section.) Fit a new split pin.

(3) Position the bracket assembly on the body side member and secure with the two retaining bolts and nuts.

(4) Connect the steering connecting rod to the idler arm and instal the castellated nut and new split pin.

(5) When the idler arm assembly is mounted on the body the centre line of the idler arm should be parallel to the chassis.

(6) Check and if necessary adjust the front wheel alignment (toe-in) as described in LINKAGE ADJUSTMENT.

8. LINKAGE ADJUSTMENTS

TO ADJUST STEERING LOCK STOPS

(1) Set the vehicle up with turn tables under the front wheels and slacken the lock nuts and stop adjusting bolts.

(2) Turn the front wheels to the left lock and check the degree angle of the wheel. Adjust the stop bolt, setting the angle to the specified degree reading and tighten the lock nut (See Specifications).

(3) Turn the front wheels to the right hand lock and check the degree angle of the wheel. Adjust the stop bolt setting the angle to the specified degree reading and tighten the lock nut. (See Specifications section).

(4) Recheck both locks and remove the turn tables.

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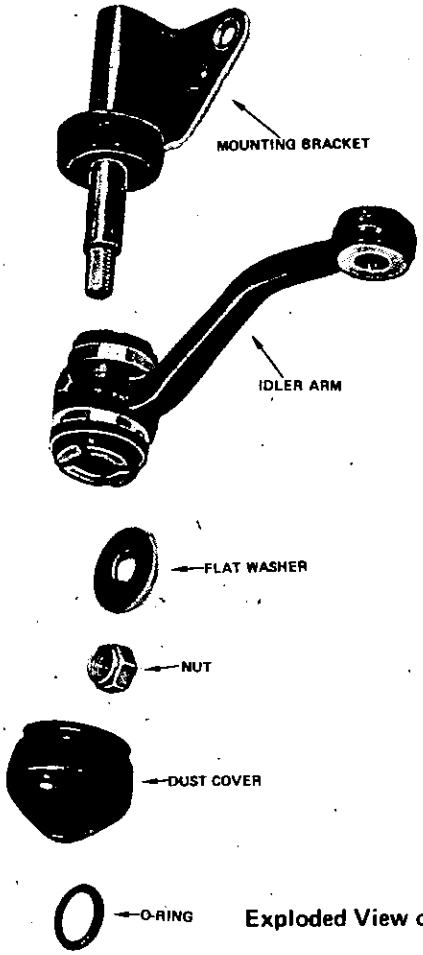
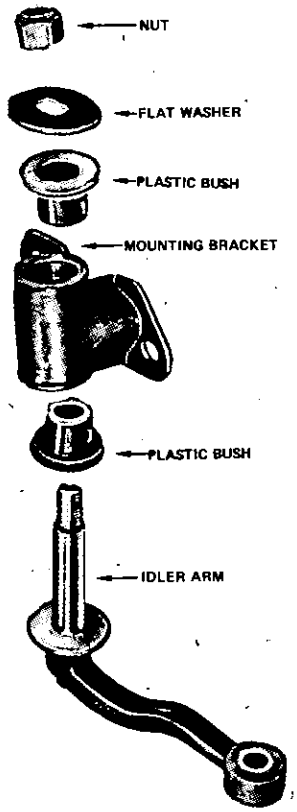


Exploded View of Idler Arm Components. 1000 Models.



Exploded View of Idler Arm Components. 1200 Models.

TO CHECK AND ADJUST TOE–IN

(1) With the vehicle on a level floor, jack up the front of the vehicle.

(2) Spin each wheel in turn, and using a piece of chalk, mark a line around the periphery of each tyre as near to the centre as possible.

(3) Lower the vehicle to the floor, bounce the front and rear of the vehicle up and down several times and let it find its own height. Set the front wheels in the straight ahead position.

(4) Mark the centre chalk line on both tyres at a position approximately 203 – 254 mm (8 – 10 in) above the floor and in front of the suspension.

(5) Using a suitable telescopic gauge, measure the distance between the two marks on the tyre centres and record the measurements.

(6) Maintain the wheels in the straight ahead position, roll the vehicle forward until the marks are the same distance above the floor at the rear of the front suspension.

(7) Again use the telescopic gauge to measure and record the distance between the marks on the tyres.

The distance measured at the front of the wheels must be approximately 5±1 mm (0.2±0.04 in) Sedan and 6±1 mm (0.24±0.04 in) Station Wagon less than the measurement taken at the rear of the wheels.

(8) If adjustment of the toe-in is required, loosen the lock nuts on each tie-rod and turn each rod by equal amounts until the toe-in is correct. Tighten the four lock nuts.

NOTE: It is important to make equal adjustments on each tie-rod to maintain the central position of the steering gear. If an optical or other type gauge is used, follow the manufacturer's instructions.

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9. STEERING FAULT DIAGNOSIS

1. Excessive play or looseness in steering gear.

Possible cause	*Remedy*
(a) Steering gear worn or out of adjustment.	– Overhaul steering gear, renew faulty components and adjust.
(b) Steering linkage ball joints worn or loose.	– Tighten or renew faulty components.
(c) Pitman arm loose on sector shaft.	– Tighten pitman arm retaining nut.
(d) Idler lever bush and bolt worn.	– Renew and adjust idler lever bush and bolt.
(e) Steering gear loose on sub-frame mounting bolts.	– Tighten mounting bolts and check alignment of steering gear mounting.

2. Heavy steering.

Possible cause	*Remedy*
(a) Low or uneven tyre pressures.	– Chech tyres and inflate to recommended pressures.
(b) Steering gear incorrectly adjusted.	– Check and readjust steering gear.
(c) Lack of lubricant in steering linkage joints.	– Ascertain cause of loss of lubricant and lubricate steering linkage where applicable.
(d) Front suspension worn or out of alignment.	– Check front end for wear, renew worn components, and re-align front end.
(e) Mis-alignment between steering gear and column mountings.	– Check and align steering gear and column mountings.
(f) Soft or sagging front springs.	– Renew springs and check front end alignment.

3. Steering pulls to one side.

Possible cause	*Remedy*
(a) Uneven tyre wear or pressure.	– Check conditions of tyres and inflate to recommended pressures.
(b) Incorrect front end adjustment.	– Check front end alignment.
(c) Dragging brakes.	– Check and adjust brake shoes.
(d) Broken or sagging rear spring/s.	– Renew faulty springs.
(e) Broken rear spring mounting bolts.	– Renew faulty components.
(f) Damaged front suspension or front sub-frame members.	– Check and renew damaged components.
(g) Faulty or damaged front crossmember.	– Check and renew front crossmember.

4. Front wheel wobble or shimmy.

Possible causes	*Remedy*
(a) Looseness in steering gear.	– Rectify and adjust.
(b) Uneven tyre wear or incorrect tyre pressures.	– Check condition of tyres and inflate to recommended pressures.
(c) Tyre and/or wheel unbalance.	– Check and balance as necessary.
(d) Front end damaged or out of alignment.	– Check and rectify front end damage and alignment.
(e) Worn or badly adjusted front wheel bearing.	– Check condition and adjust wheel bearings.
(f) Wheel alignment incorrectly adjusted.	– Check and adjust front wheel toe-in (alignment).
(g) Loose or worn tie-rod ends.	– Check and renew faulty components.
(h) Faulty shock absorbers.	– Check and renew as a pair.

5. Steering erratic or wandering.

Possible cause	*Remedy*
(a) Incorrect or uneven camber and/or castor setting.	– Check and renew components to rectify.
(b) Smooth front tyres.	– Check and renew tyres as necessary.
(c) Excessive play in steering gear and/or linkage.	– Check and renew faulty components, readjust.
(d) Excessively high or low tyre pressures.	– Check and inflate to recommended pressures.
(e) Loose or incorrectly adjusted front wheel bearings.	– Check and adjust front wheel bearings.

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FRONT SUSPENSION

PART 1. 1000 SERIES

SPECIFICATIONS

Type	Transverse leaf spring, with upper and lower control arms, tubular shock absorbers and radius rods.
Spring dimensions:	
Length	976 mm (36.925 in)
Width	50 mm (1.968 in)
Thickness	4 mm (0.157 in)
Number of leaves	6
Free camber	120 mm (4.724 in)
Wheel alignment:	
Toe-in	2 – 3 mm (0.0787 – 0.118 in)
Caster angle	2° 15 min
Camber angle	1° 15 min
King pin inclination	6° 30 min
Toe-out on turn – inner wheel	45°
Toe-out on turn – outer wheel	36° 36 min

TORQUE WRENCH SETTINGS

Lower ball nut	7.6 kg/m (55 lb/ft)
Lower control arm connecting bolt	5.3 kg/m (38 lb/ft)
Radius rod – front	4.5 kg/m (32 lb/ft)
Radius rod – rear	5.3 kg/m (38 lb/ft)
Upper ball joint	4.9 kg/m (35 lb/ft)
Retaining nut, fulcrum	5.3 kg/m (38 lb/ft)
Stub axle nut	2.5 kg/m (18 lb/ft)
Shock absorber, bolt – front	2.8 kg/m (20 lb/ft)
Upper ball to control arm bolts	2.2 kg/m (16 lb/ft)
Lower ball to control arm bolts	2.8 kg/m (20 lb/ft)

1. SPRING AND LOWER CONTROL ARM

TO REMOVE AND INSPECT

(1) Jack up the front of the vehicle, block the rear wheels and support the vehicle on jack stands.

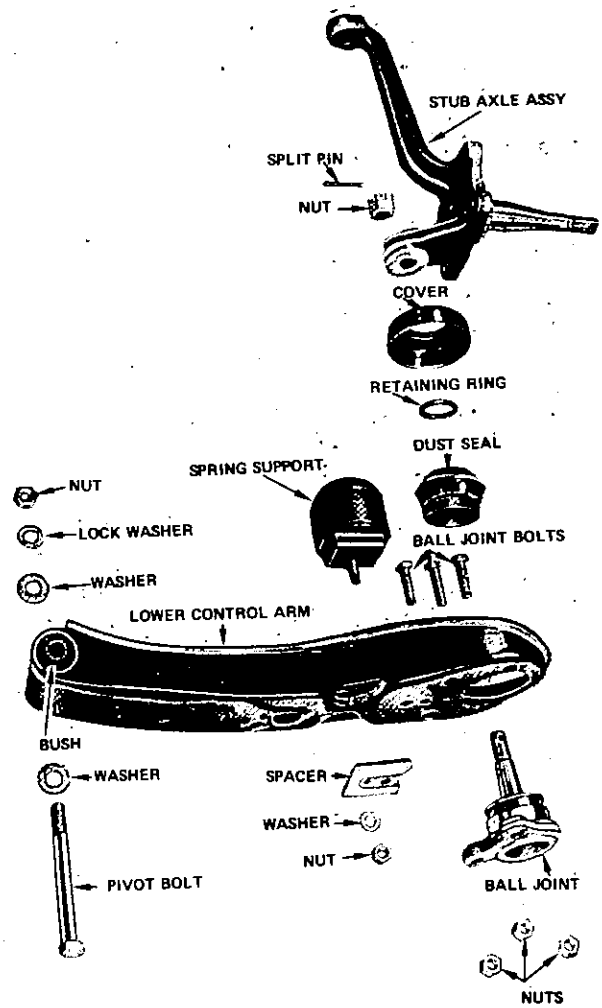
(2) Remove the road wheels.

(3) Remove the two bolts attaching the shock absorber to the radius rod and lower control arm.

(4) Remove the bolts attaching the radius rod to the lower control arm.

(5) Support the lower control arm with a floor jack and remove the split pin and castellated nut and lowering the floor jack to withdraw the lower ball joint from the stub axle swivel.

(6) Working at the opposite end of the control arm, unscrew the nut, remove the washers and withdraw the



Exploded View of Lower Control Arm with Stub Axle and Swivel Arm Components: 1000 Models.

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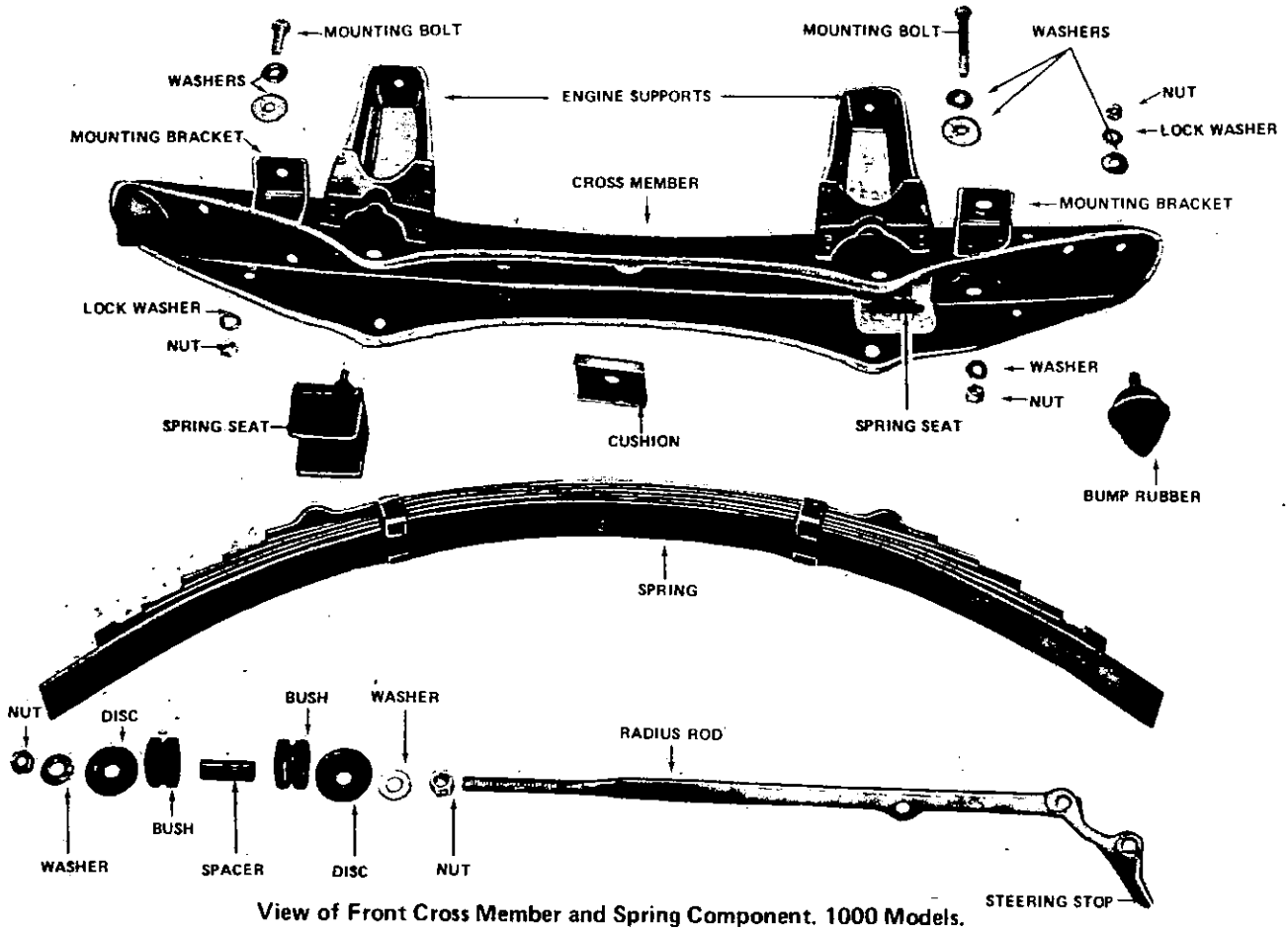

View of Front Cross Member and Spring Component. 1000 Models.

control arm to crossmember pivot bolt and lift out the control arm.

(7) Support the transverse spring with a jack and carry out the same procedure to dismantle the opposing side.

NOTE: If spring only is to be removed, disconnect one lower control arm only to withdraw the spring.

(8) With the left and right hand lower control arms removed, the spring can now be lowered and removed from the vehicle.

(9) Remove the two swivel rubber insulators from the crossmember and the two spring support rubbers from the control arms.

(10) Inspect the rubbers for fatigue and elasticity.

(11) Inspect the spring for sag, distorted and broken leaves.

(12) Check the lower control arm for fatigue and distortion and check the rubber bushes for wear.

(13) Check the lower ball joint for wear.

(14) Disconnect the shock absorber from its upper mounting and remove it from the vehicle. Check for oil leaks, damage and recoil action.

TO INSTAL

Installation procedure is the reversal to that of removal with attention to the following points:

(1) With the two swivel insulator rubbers fitted to the crossmember offer the spring to the crossmember and support the spring.

(2) Jack up one end of the spring and retain it with the front spring clamp tool ST – 4369 then lower the jack.

(3) Fit the support rubber to the lower control arm and attach the arm to the crossmember by inserting the pivot bolt from the rear.

(4) Connect the lower ball joint to the stub axle swivel and tighten to the specified torque. Remove the clamp.

Carry out the same procedure when assembling the suspension on the opposite side of the vehicle.

(5) Fit the shock absorbers and radius rods. Ensure that the radius rods are of equal length.

(6) Fit the road wheels and lower the vehicle to the floor.

(7) Finally, tighten the control arm inner pivot bolts.

(8) Replace all worn or damaged components, lubricate where necessary and tighten all nuts and bolts to the specified torque as described in the Specification section.

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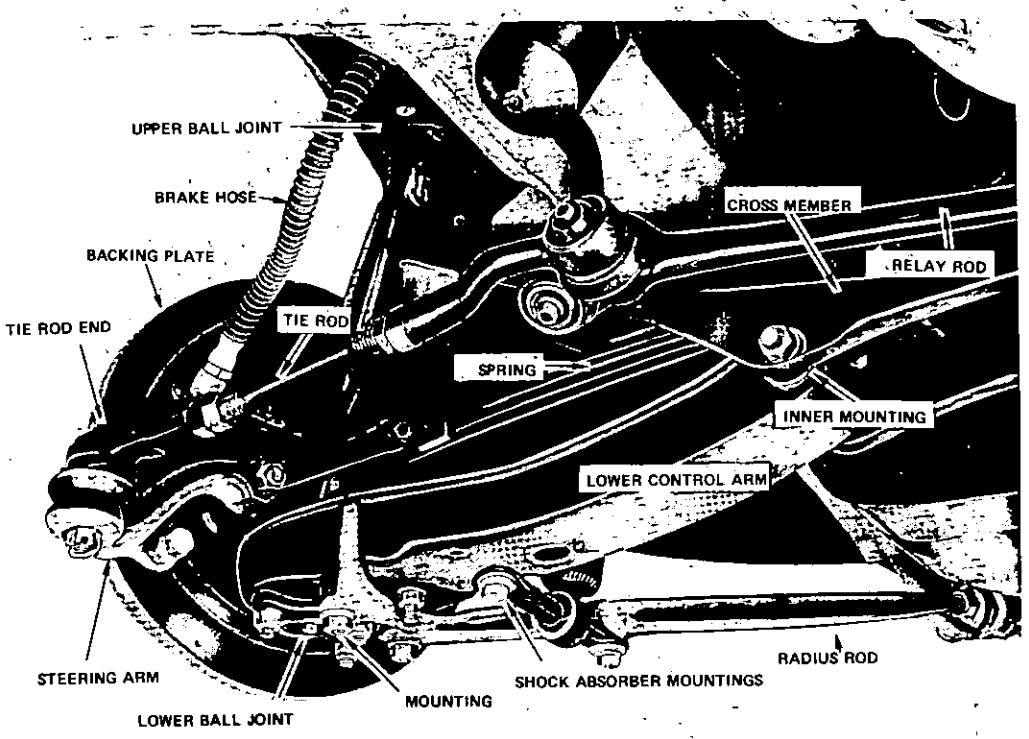


Rear View of the Left Hand Side Suspension and Steering Components. 1000 Models.

2. UPPER CONTROL ARM

TO REMOVE AND INSPECT

(1) Raise the front of the vehicle, block the rear wheels and support the vehicle on jack stands.

(2) Remove the road wheels.

(3) Withdraw the split pin, unscrew the castellated nut and disconnect the arm from the stub axle swivel at the upper ball joint.

(4) Working at the opposite end of the control arm, remove the two retaining nuts and bolts and lift off the control arm assembly, noting the position and number of shims between the pivot shaft and the body frame.

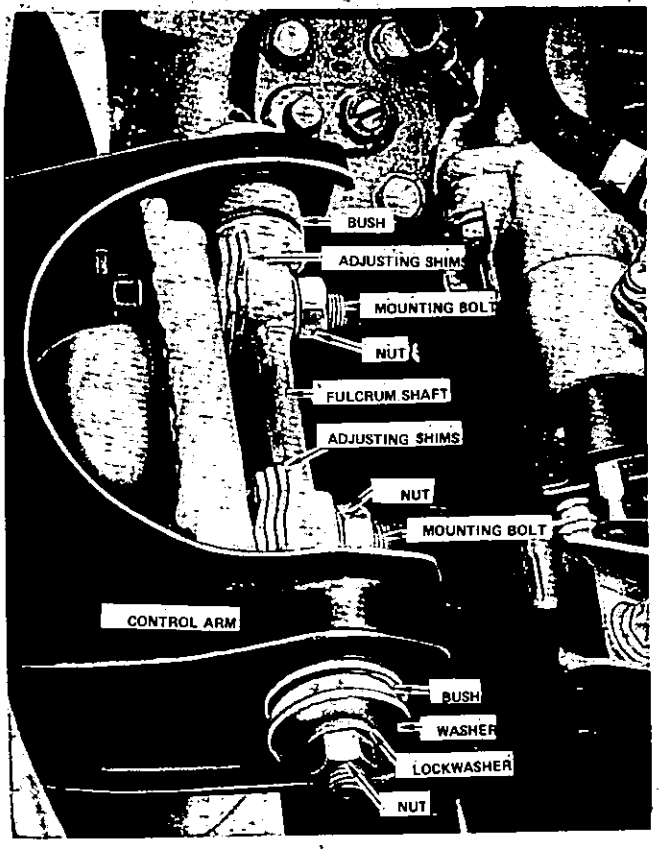
(5) Clean the arm assembly and inspect for fatigue or distortion.

(6) Inspect the bushes for wear. If replacement is necessary, press the bushes out from the opposite ends and remove the pivot shaft. To fit new bushes, place the pivot shaft in the upper control arm and press the bushes home ensuring that the splines on the bush are correctly aligned with the splines in the control arm.

(7) Inspect rebound rubbers for fatigue and cracking.

(8) Check the upper ball joint for wear.

(9) Replace all worn or damaged components where necessary.



View of Upper Inner Control Arm in Mounted Position. 1000 Models.

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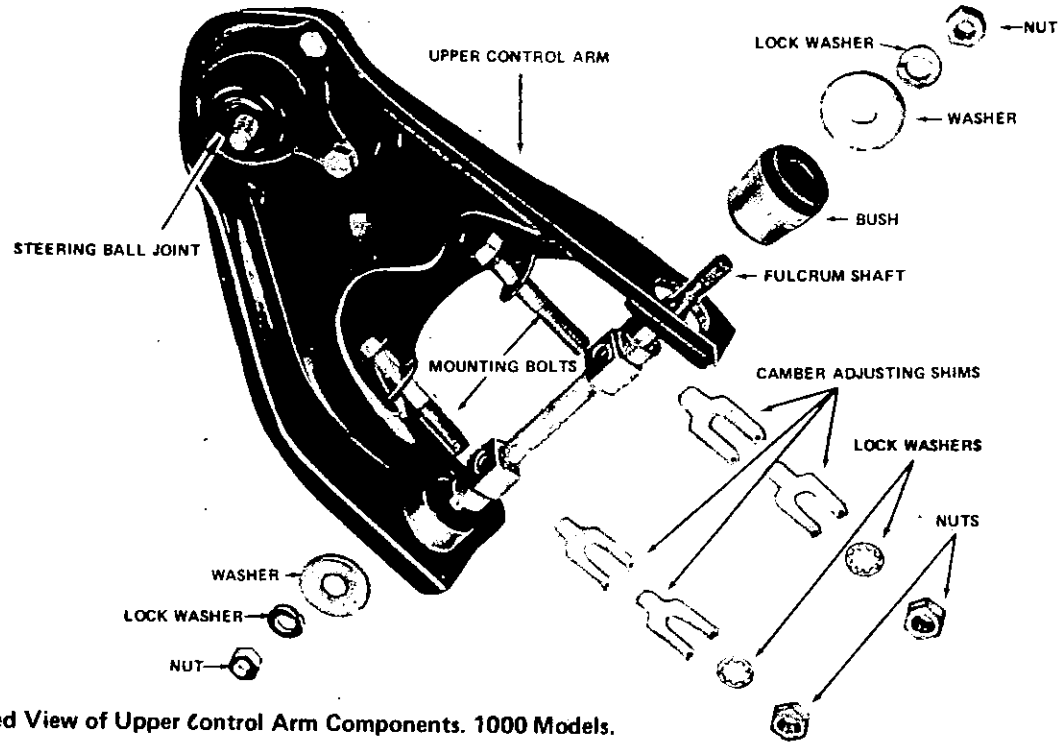

Dismantled View of Upper Control Arm Components. 1000 Models.

TO INSTAL

Installation procedure is the reverse to that of removal with attention to the following points:

(1) As a starting point fit the camber adjusting shims in the positions from which they were removed.

(2) Check and adjust front end alignment.

(3) Carry out tightening torque to required specifications. See Specification section.

(4) Lubricate all points where necessary.

3. STUB AXLE SWIVEL

TO REMOVE AND INSPECT

(1) Raise the vehicle, block the rear wheels and support the vehicle on jack stands.

(2) Remove the road wheels.

(3) Remove the hydraulic brake line retaining clamp, disconnect the brake line and plug the line to avoid loss of fluid and ingress of dirt.

(4) Remove the brake drum and hub assembly as described, in the 1200 Series FRONT SUSPENSION section in this manual.

(5) Disconnect the stub axle swivel from the upper and lower control arms and withdraw the assembly from the vehicle.

(6) Check the swivel and stub axle for distortion.

(7) Remove and inspect the wheel bearings, cups and seals and assembly as described in the 1200 Series.

TO INSTAL

Installation is the reversal of the removal procedure with attention to the following points.

(1) Bleed the hydraulic system and top up the master cylinder.

(2) Carry out tightening procedure as specified in the Specification section.

4. TO CHECK AND ADJUST CASTOR AND CAMBER ANGLES

(1) Check and adjust tyre pressures and set the vehicle up with the alignment equipment being used according to the manufacturer's instructions. Bounce the vehicle up and down and let it find its own level.

(2) Check the castor angle, and, if necessary adjust by transferring shims from one upper suspension pivot shaft mounting bolt to the other. Transferring shims from the rear bolt to the front bolt will decrease castor and transferring shims from the front bolt to the rear bolt will increase castor.

(3) Check the camber angle and adjust by removing or installing an equal number of shims at each of the two upper suspension pivot shaft mounting bolts.

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5. SHOCK ABSORBERS

TO REMOVE AND INSTAL

(1) Raise the front of the vehicle and support on stands.

(2) Remove the two bolts connecting the shock absorber to the lower control arm and radius rod.

(3) Remove the nut and washer connecting the upper end of the shock absorber to the sub-frame and withdraw the shock absorber from the vehicle.

Installation is a reversal of the removal procedure.

Check, test and bleed the shock absorber as described under TO TEST AND BLEED.

TO TEST AND BLEED

The extent to which a shock absorber can be tested without special testing equipment, is limited to the following:

(1) Mount the shock absorber upright in a vice by the lower eye or stem.

(2) Grasp the upper half of the shock absorber, pull up to the fully extended position and then slowly push down until the shock absorber is fully compressed.

(3) Repeat operation (2) six or eight times to remove any slack spots caused by air in the system. If slack spots exist and cannot be removed by this method, the shock absorber is evidently defective and should be renewed.

NOTE: The resistance will be greater on upward stroke of the shock absorber than on the downward stroke.

(4) Check the body of the shock absorber for dents or damage and for fluid leakage. The shock absorbers cannot be repaired in service and should be renewed if defective.

6. BALL JOINTS

TO REMOVE AND INSTAL

(1) Raise the front of the vehicle, support on stands and remove the road wheel.

NOTE: It will also be necessary to support the lower control arm on a jack to relieve the spring pressure on the upper rebound rubber.

(2) To remove the upper and lower ball joints separately, remove the split pin and nut from the upper ball joint and using a suitable spreader press the ball joint tapered spindle out of the stub axle swivel.

NOTE: Use care not to damage the hydraulic brake pipe by stretching.

(3) Remove the bolts connecting the ball joint to the upper control arm and withdraw the ball joint.

(4) Support the lower control arm with a jack and remove the split pin and nut from the lower ball joint.

Using a suitable spreader, press the lower ball joint tapered spindle out of the stub axle swivel.

(5) Remove the bolts connecting the lower ball joint to the lower control arm and withdraw the ball joint.

(6) Place the ball joint in the vice, and check the dust cover, metal circlip or 'O' ring – whichever is fitted to the dust cap – for damage or fatigue.

Installation is a reversal of the removal procedure.

7. FRONT SUSPENSION FAULT DIAGNOSIS (1000 SERIES)

1. Front end noise

	Possible cause	*Remedy*
(a)	Loose upper suspension mounting.	– Tighten mounting.
(b)	Loose or worn suspension unit lower ball joint.	– Tighten or renew lower ball joint.
(c)	Noise in shock absorber unit.	– Renew shock absorber unit.
(d)	Worn steering linkage or idler arm components.	– Renew defective components.
(e)	Mal-adjusted front hub bearings.	– Readjust or renew hub bearings.

(Continued next page)

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2. Poor or erratic road holding ability.

Possible cause	*Remedy*
(a) Low or uneven tyre pressure.	– Inflate tyres to recommended pressures.
(b) Defective shock absorber operation.	– Check and renew faulty unit.
(c) Incorrect front end alignment.	– Check and adjust alignment as necessary.
(d) Loose or defective front crossmember.	– Check and tighten or renew member.
(e) Weak or broken front spring leaf or leaves.	– Check and renew spring.
(f) Broken leaf in, or weak rear spring.	– Check and renew leaf or complete rear spring.
(g) Loose or defective front hub bearings.	– Adjust or renew hub bearings.
(h) Mal-adjusted or defective steering gear or idler.	– Adjust or renew faulty components.
(i) Defective tyres or front wheel balance.	– Renew defective tyres and balance front wheels.
(j) Worn or sagging spring pivot rubber.	– Renew spring pivot rubbers.

3. Heavy steering.

Possible cause	*Remedy*
(a) Low or uneven tyre pressure.	– Check and inflate tyres to recommended pressures.
(b) Incorrect front end alignment.	– Check and adjust alignment.
(c) Lack of lubricant in steering gear and components.	– Check oil level in steering gear and apply grease gun to any grease nipples.
(d) Worn or damaged front suspension.	– Check and renew worn or damaged components and adjust front end alignment.
(e) Sagging or broken transverse spring.	– Renew spring.
(f) Incorrect adjustment of steering gear.	– Check and adjust steering gear.

4. Front wheel wobble or shimmy.

Possible cause	*Remedy*
(a) Tyre and/or wheel unbalance.	– Check and balance tyre and wheel as a unit.
(b) Rapid and uneven tyre wear.	– Check front end alignment (see Wheels and Tyres).
(c) Worn or loose hub bearings.	– Check and renew or adjust hub bearings.
(d) Worn or damaged steering linkage.	– Check, renew faulty components, and adjust.
(e) Incorrect front end alignment.	– Adjust and/or renew suspension components to restore alignment.
(f) Mal-adjusted or worn steering gear.	– Renew and/or adjust steering gear components.
(g) Steering gear loose on frame mounting or off centre.	– Check and tighten mounting and/or centre steering gear.

5. Vehicle pulls to one side.

Possible cause	*Remedy*
(a) Low or uneven tyre pressure.	– Check and inflate tyres to recommended pressures.
(b) Incorrect or unequal front end alignment – side to side.	– Check and adjust to restore correct alignment.
(c) High road camber.	– Avoid as far as possible.
(d) Weak or broken rear spring.	– Renew faulty spring.
(e) Front brake dragging.	– Adjust or rectify cause.
(f) Steering gear off centre.	– Check and re-centre steering.

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PART II 1200 SERIES

SPECIFICATIONS

Type	Suspension and shock absorber unit with coil spring and lower control arm.
Coil spring:	
Free length	338 ± 10 mm (13.3 ± 0.4 in)
Loaded length	203 ± 5 mm (7.99 ± 0.2 in)
Load at loaded length	200 kg (441 lb)
Total number of coils	7.7
Wire diameter	10 mm (0.394 in)
Wheel alignment:	
Caster angle—Sedan models	1°10' ± 30'
Caster angle—Station wagon	1°40' ± 30'
Camber angle	1°05' ± 30'
King pin inclination:	
Sedan models	7°55'
Station wagon	7°45' ± 30'
Toe-out on turns:	
Inner wheel	43° ± 1°
Outer wheel	36° ± 1°
Toe in:	
Sedan models	5 ± 1 mm (.2 ± .04 in)
Station wagon	6 ± 1mm (.24 ± .04 in)

TORQUE WRENCH SETTINGS

Gland packing	11.0 kg/m (79 lb/ft)
Piston rod nut	6.5 kg/m (47 lb/ft
Upper mounting bolts	2.1 kg/m (15 lb/ft)
Stabiliser bar link retaining nuts	1.2 kg/m (8 lb/ft)
Stabiliser bar bracket bolts	1.2 kg/m (8 lb/ft)
*Stub axle nut	2.4 kg/m (17 lb/ft)
Radius rod to frame	6.5 kg/m (47 lb/ft)
Radius rod to control arm	3.0 kg/m (21 lb/ft)
Lower ball joint to strut	6.1 kg/m (44 lb/ft)
Lower ball joint retaining nut	7.4 kg/m (53 lb/ft)
Engine mounting bracket nut	1.2 kg/m (8 lb/ft)
Disc brake caliper bolts	6.1 kg/m (44 lb/ft)
Disc to hub assembly	6.0 kg/m (43 lb/ft)
Backing plate installation bolts	3.7 kg/m (26 lb/ft)
Lower ball joint to control arm	3.0 kg/m (21 lb/ft)

* Back off to nearest castellation.

1. DESCRIPTION

Each McPherson strut type front suspension unit comprises a vertical tubular shock absorber, surrounded at the upper end by a coil on top of which is the upper spring mounting attached to the underside of the front wheel housing.

The piston rod of the shock absorber is in turn attached to the upper centre of the spring upper mounting by a rubber mounted thrust bearing assembly.

The suspension unit foot, integral with the wheel stub axle, is attached to the lower end of the shock absorber tube.

A ball joint incorporating the steering arm is attached to the suspension unit foot by two bolts and spring washers.

The ball bolt of the ball joint attaches the suspension unit to the suspension control arm, which pivots at its inner end on a bolt and rubber bush attaching it to the suspension crossmember.

A radius rod is attached at its rear end by two bolts to the outer end of the lower control arm and at its forward end to a bracket on the under frame, by a rubber bush mounting arrangement.

A stabiliser bar attached to the body sub-frame, forward of the suspension and connected between the outer

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end of each suspension unit control arm by a rubber bushed link.

Caster, camber and swivel inclination are set in production and cannot be adjusted. Any variations in these angles will be caused by worn or damaged components.

If the coil spring is to be removed from the unit, special clips must be used to hold the spring in a compressed condition to assist in the removal and installation of the unit.

2. WHEEL HUB AND BEARING

TO REMOVE AND DISMANTLE (Drum Type Brakes)

(1) Place blocks at rear and front of rear wheels, raise the front of the vehicle and support on jack stands.

(2) Remove the wheel nuts then take off wheel and drum.

(3) Remove the dust cover, withdraw the split pin and remove hub retaining nut and washer.

(4) Remove the outer bearing cone and withdraw hub assembly from the stub axle.

(5) Place the assembly in a vice and using a drift or suitable hand tool, tap out the grease seal.

(6) Lift out the inner bearing cone, re-mount hub assembly in a vice and using a suitable drift, tap out both inner and outer bearing cups from the hub assembly.

TO CLEAN AND INSPECT

(1) Wash the bearings, cups and hub assembly in a suitable cleaning solvent and carry out a thorough inspection of component parts.

(2) Inspect bearing cups and cones for scoring and chipping. Should it be necessary to renew either a bearing or cup, they must be renewed as a complete unit. Do not mix new and used parts.

(3) Once having removed the grease seals, they should be replaced with new seals.

(4) Check the stub axle for mis-alignment and the inner bearing seating area for scoring.

(5) Check the castellated nut and the thread on the stub axle for damage or wear. If the thread on the stub axle is badly damaged, the suspension unit must be replaced.

TO ASSEMBLE AND INSTAL

(1) Drift the two hub bearing cups into position in the hub ensuring that their tapers are opposed to each other.

(2) Pack the space in the hub between the cups with wheel bearing grease, apply grease to the rollers of the inner cone and place it in position in the hub.

(3) Place a new grease retaining seal on the inner end of the hub and tap into position.

(4) Apply wheel bearing grease to the inner cone and rollers of the outer hub bearing, place the hub assembly on the stub axle and fit the roller bearing to the hub.

(5) Fit the 'D' washer and castellated nut on the stub axle and while rotating the hub, tighten the nut until a slight preload is placed on the hub bearings.

(6) Slacken off the nut until there is a slight end-float in the hub bearings and then tighten with the fingers until the end-float is just removed.

(7) Fit a new split pin and replace the grease retaining cap.

NOTE: If the split pin hole does not line up with a slot in the nut, release the nut until pin can be installed.

(8) Instal the road wheels and re-adjust the brake shoes. Lower the vehicle to the floor.

TO REMOVE (Disc Type Brakes)

(1) Place blocks at front and rear of rear wheels.

(2) Raise the front of the vehicle and support with jack stands.

(3) Screw off the wheel retaining nuts and lift off the road wheel.

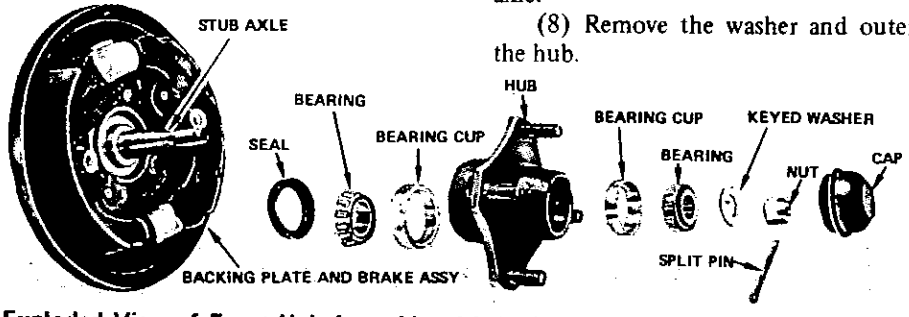
(4) Disconnect the hydraulic brake hose – adjacent to the chassis – from the brake pipe and plug the pipe to avoid leakage of hydraulic fluid.

(5) Remove the retaining bolts securing the caliper to the stub axle flange and withdraw the caliper assembly.

(6) Remove the dust cover and split pin, unscrew the nut from the stub axle.

(7) Withdraw the hub and disc assembly from the stub axle.

(8) Remove the washer and outer bearing cone from the hub.



Exploded View of Front Hub Assembly with Backing Plate Assembly. (Drum Brakes).

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(9) Place the assembly in a vice and using a drift or suitable hand tool, tap out the grease seal.

(10) Lift out the inner bearing cone, re-mount the assembly in the vice and using a suitable drift, tap out both inner and outer bearing cups from the hub assembly.

(11) Remove the bolts connecting the disc to the hub assembly and separate the disc from the assembly.

TO CLEAN AND INSPECT

(1) Wash the bearings, cups, hub assembly in cleaning solvents. Inspect bearings and cups for scoring, chips and pitting. If damaged, replace as complete assembly.

Inspect the disc for distortion, chipping or cracking. Replace where necessary. When replacing the disc, also renew the bolts.

(2) Renew the grease seal.

(3) Check the stub axle for misalignment and the inner bearing seating area for scoring.

(4) Check the castellated nut and the thread on the stub axle for damage or wear. If the thread is badly damaged, the suspension unit must be replaced.

TO ASSEMBLE AND INSTAL

(1) Assembly and installation procedure is the reversal to that of removal. (See also Drum Type Brakes.)

(2) When reassembling the bearings to the hub, pack the bearings and hub with heavy duty wheel bearing grease to manufacturer's instructions.

(3) Tighten and adjust to specified torque (see Specification section).

(4) Bleed the hydraulic system and test the brakes.

3. STABILISER BAR

TO REMOVE

(1) Chock the rear wheels, raise the front of the vehicle, fit the special spring clips and support on jack stands. Remove the road wheels.

(2) Remove the engine splash cover.

(3) Remove the retaining nuts, rubber bushes and washers attaching the stabiliser bar link to the lower suspension arms.

(4) Take out the retaining bolts attaching the stabiliser supporting brackets to the chassis and withdraw the stabiliser bar from the vehicle.

(5) Inspect the bar for distortion and fatigue. Renew all rubber bushes if necessary.

TO INSTAL

NOTE: Instal the stabiliser bar with the painted identification mark to the left hand side of the vehicle.

(1) Place a flat washer and rubber half bush on each of the stabiliser bar links so that the flange of the half bush is adjacent to the washer.

(2) With the sweep of the stabilising bar facing upwards, position the bar with its link ends in the suspension arm holes. Instal each half bush and washer on the ends of the bar link and fit the self locking nuts.

(3) Instal the mounting brackets on the stabiliser bar mounting bushes and secure with bolts and lock washers.

(4) Tighten the nuts on the ends of the stabiliser bar link to the specified torque, (see Specification section).

NOTE: Ensure the vehicle is in the lowered position when final tightening procedure is carried out.

(5) Instal the engine splash cover.

(6) Lower the front of the vehicle and remove the spring clips.

4. RADIUS ROD

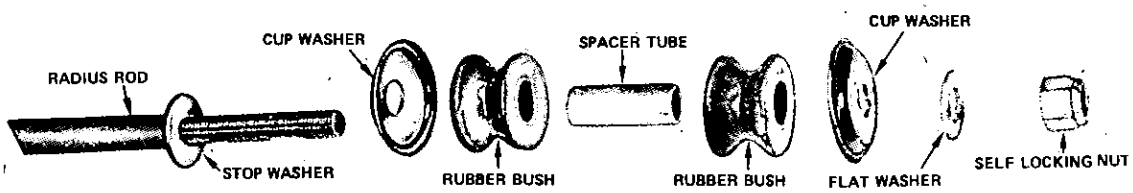
TO REMOVE

(1) Remove the retaining bolts attaching the radius rod to the lower support arm.

(2) Remove the retaining nut, washer and rubber bushes from the forward end of the radius rod and withdraw the rod from the bracket on the under-frame.

Check the radius rod for distortion and fatigue. Renew all rubber bushes and washers if necessary.

Replace the radius rod where necessary.



Radius Rod Forward Mounting. 1200 Model.

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TO INSTAL

Installation procedure is the reversal of removal with attention to the following points.

(1) Tighten the nuts and bolts to the specified torque (see Specification section) and ensure that the rods are fitted correctly.

(2) The rods are marked L.H. and R.H. and must be fitted accordingly.

(3) Ensure that the metal bush and rubber bushings are seated correctly.

5. SUSPENSION UNIT

TO REMOVE

(1) Block the rear wheels. Raise the vehicle with a jack under the suspension control arm on the side that is to be removed and remove the road wheel.

(2) With the full weight of the vehicle still on the coil spring, fit the special spring clips to maintain the coil spring in the compressed position.

(3) Raise the front of the vehicle and support with jack stands.

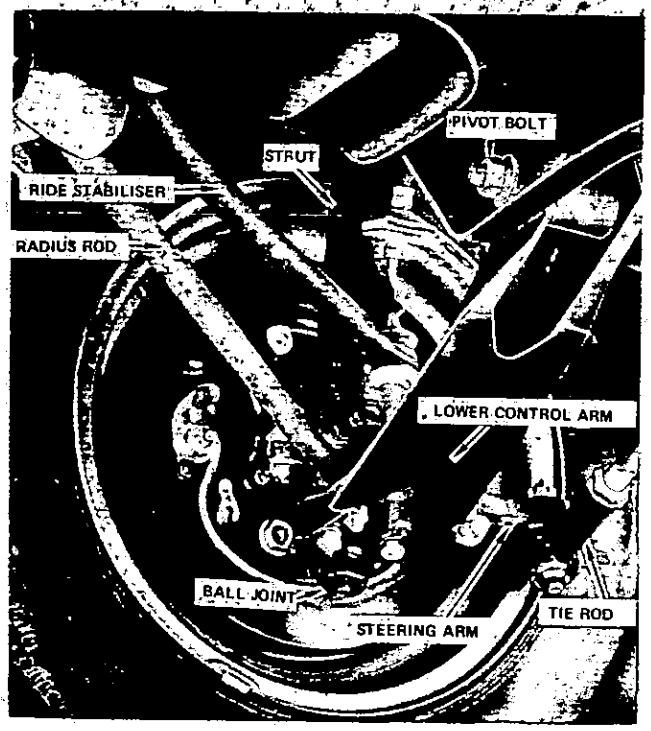
(4) Remove the hub grease retaining cap, withdraw the split pin and remove the stub axle nut and washer.

(5) Withdraw the brake drum and hub assembly from the stub axle. Remove the outer wheel bearing.

NOTE: Where disc brakes are fitted, use the procedure for removal of hub, disc and caliper. Disconnect the brake hose and plug the hydraulic line.

(6) Unscrew the four retaining nuts and bolts securing the backing plate to the stub axle flange.

(7) Now remove the hydraulic brake line retaining clip from the suspension unit. Withdraw the backing plate assembly from the stub axle and support the backing plate to avoid damage to the hydraulic line and hose.



Drivers Side Suspension Unit. 1200 Models.

(8) Withdraw the split pin and unscrew the castellated nut securing the tie-rod end ball bolt to the steering arm. Remove the ball bolt from the steering arm.

(9) Disconnect the radius rod and stabiliser bar from the lower suspension control arm.

(10) Place a jack under the lower suspension control arm.

(11) Remove the two bolts securing the suspension control arm to the suspension unit and ball joint.

(12) Raise the bonnet and working from the engine compartment, remove the retaining nuts securing the suspension unit to the upper support member.

(13) Lower the jack and remove the suspension unit from the vehicle.

TO CLEAN AND DISMANTLE

(1) Prior to dismantling of the suspension unit clean thoroughly and ensure that a clean working area is available prior to dismantling.

(2) Fit the strut attachment (tool ST35650000) to the strut outer casing and mount in a vice. Fit coil spring compressor to the suspension unit and compress the spring until the insulator can be turned by hand.

NOTE: To remove the lock nut from the piston rod, instal a nut on one of the bolts connecting the suspension to the body and using as a lever base apply a screw driver to the lock nut and using a levering action release the lock nut.

(3) Remove the suspension mounting insulator, thrust bearing, spring seat, bumper rubber and dust cover.

(4) Back off the spring compressor and remove the coil spring.

(5) Using special gland packing wrench remove the gland packing.

NOTE: Prior to removal, push the piston rod down to the lowest point, clean the gland nut and surrounding area.

If the gland packing nut has been caulked, break the seal and remove gland nut.

(6) Pull the piston rod slowly upwards, remove the 'O' ring from the top of the piston guide and withdraw the piston rod and cylinder assembly.

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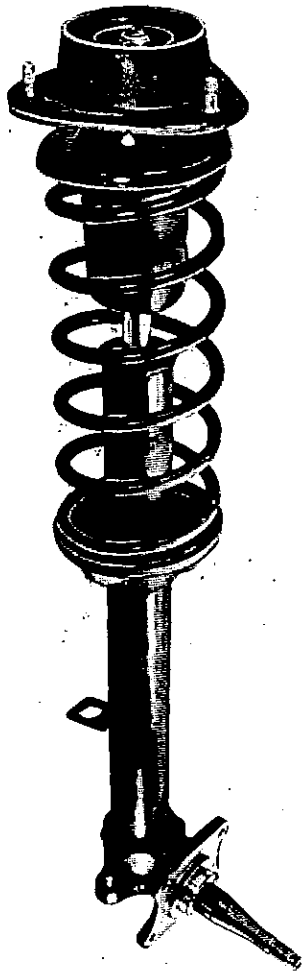
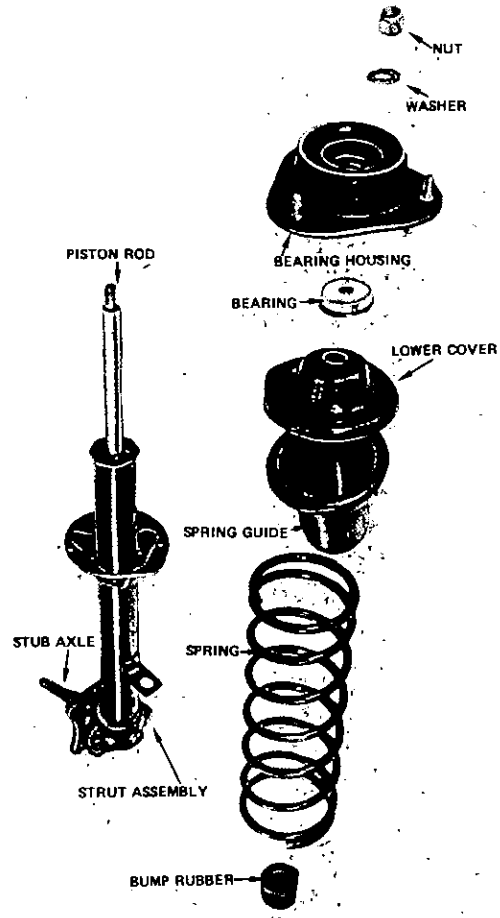


Strut and Coil Spring Assembly. 1200 Models.



Strut and Coil Spring Components. 1200 Model.

NOTE: Do not remove the piston rod and guide from the cylinder as they are serviced as an assembly.

TO CLEAN AND INSPECT

(1) Drain oil from the casing and cylinder, wash components and dry off with compressed air.

Non metalic parts to be cleaned by air only.

(2) New gland packing, 'O' ring and hydraulic fluid is to be used every time the assembly is dismantled.

(3) Check the strut outer casing for distortion and cracks.

(4) Inspect the spindle for distortion. Check the base and threaded section for fatigue.

(5) Test the coil spring for sag and fatigue and check rubber components.

(6) Check thrust bearing for pitting, scoring and general wear.

TO ASSEMBLE

(1) Prior to assembly, ensure that all parts are clean. Avoid damage to working parts as they are precision made.

Do not use cotton waste for wiping down. Particles could lodge in the cylinder and result in faulty operation.

(2) To reassemble, fit the outer casing to the suspension unit body.

(3) Place the piston rod and cylinder assembly in the outer casing and fill the casing with the specified quantity and type of oil.

The operating efficiency of the suspension unit is greatly influenced by the specified quantity and quality of hydraulic fluid.

(4) Fit the 'O' ring to the top of the piston rod guide and assemble the gland packing. Take care not to damage the oil seal during assembly.

Use special tool No. ST35550000 gland packing guide to instal gland packing.

NOTE: Prior to tightening the gland packing nut, withdraw the piston rod approximately 90 mm (3.54 in) to facilitate bleeding of the shock absorber.

(5) Using special tool ST35500000 tighten the gland packing nut to the specified torque (see Specification section).

(6) Bleed the air from the shock absorber by

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pumping the piston up and down until all air is expelled.

This is carried out in the following manner: Have the spindle in the down position when the piston is drawn upwards and the spindle in the upper position when the piston is pushed down.

Expulsion of all air from the system can be determined by even pressure in either direction of the piston.

(7) Fully extend the piston rod and fit the coil spring, bump rubber, spring seat and dust cover. Compress the coil spring and fit the bearing assembly and mounting insulator.

NOTE: Ensure that the thrust bearing, gland packing nut and oil seal are lubricated prior to assembly.

Fit a new washer and self locking nut and tighten to the specified torque (see Specification section).

(8) Remove the coil spring compressor and fit the suspension unit to the vehicle. Renew all parts where necessary.

TO INSTAL

Using the reverse procedure to that of removal, observing torque settings set out in the specification section, fit the suspension unit to the vehicle.

6. SUSPENSION CONTROL ARM

TO REMOVE

(1) Block the rear wheels, raise the front of the vehicle and support with jack stands. Remove the road wheel.

(2) Remove the retaining bolts and nuts connecting the radius rod and stabiliser bar to the control arm.

(3) Remove the lower ball joint retaining bolts.

(4) Unscrew the retaining nuts connecting the control arm to the body member and withdraw the control arm from the member.

TO INSPECT

(1) Clean the control arm and inspect the metalic section for distortion and fatigue. Replace if damaged.

(2) Check the rubber bushings for damage and/or fatigue. Should the rubber bushing require replacing, mount the control arm in the press and remove the bush from the control arm.

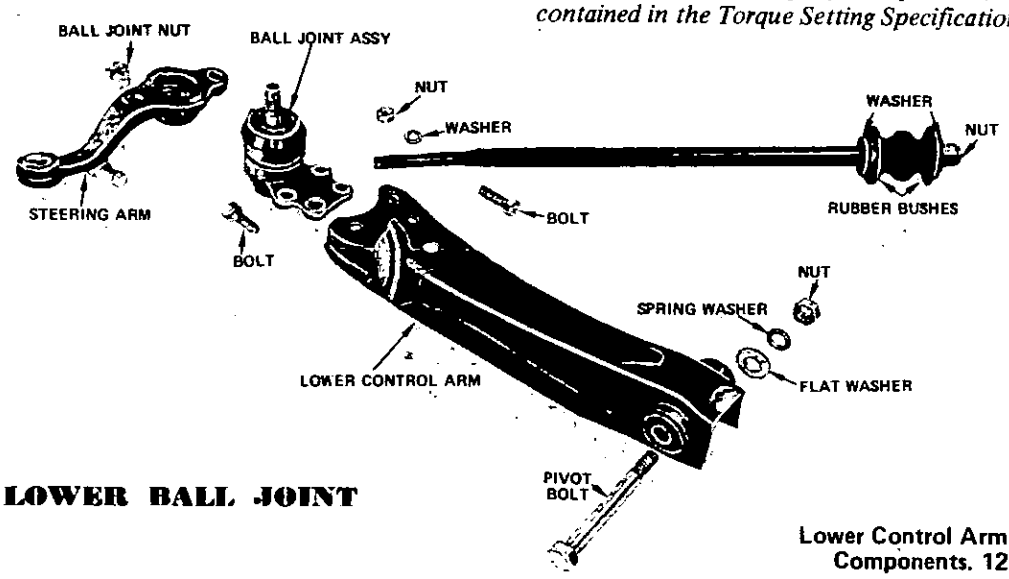
To replace the bushing, lubricate the bushing with soapy solution mount the arm in the press and fit the bushing to the arm.

Ensure that the bushing protrudes equally from either end of the arm collar when fitted.

TO INSTAL

Installation procedure is the reverse to that of removal.

NOTE: Tightening torque for respective nuts and bolts are contained in the Torque Setting Specification section.



Lower Control Arm and Ball Joint Components. 1200 Models.

7. LOWER BALL JOINT

TO REMOVE

(1) Block the rear wheels, raise the vehicle and support on jack stands. Remove the road wheel.

(2) Remove the bolts and nuts attaching the stabiliser bar and radius rod to the lower control arm.

(3) Take out the retaining bolts attaching the stub axle assembly and suspension unit to the steering arm.

(4) Withdraw the split pin, remove the tie-rod ball joint retaining nut and disconnect the ball joint from the steering arm.

(5) Remove the two bolts connecting the steering arm to the suspension unit and remove the steering arm.

(6) Mount the steering arm in a vice, remove the split pin and castellated nut and withdraw the ball bolt from the arm.

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TO CLEAN AND INSPECT

(1) Clean the ball joint in suitable cleaning fluid and carry out inspection.

(2) Inspect the ball joint for excessive end play and metal fatigue.

When the end play between the upper spring seat and top of the spring exceeds 1.0 mm (0.039 in) the ball joint should be replaced.

(3) Check the shaking torque by mounting the ball joint in a vice and attaching a spring gauge to the top of the ball joint bolt beneath the castellated nut and measure the amount of torque required to move the ball.

The torque reading should be between 35-60 kg/cm (30–52 lb/in). If the readings are not within these tolerances the ball joint should be replaced.

The ball joint is not repairable and must be renewed when found to be defective.

(4) Renew the dust cover at all times.

NOTE: To lubricate the ball joint, remove the plug at the base of the ball joint, fit a grease nipple and fill with grease until old grease is expelled. When lubricating with high pressure gun, ensure dust cover is not damaged.

TO INSTAL

Installation is the reverse procedure to that of removing.

Tightening torque is set out in the Specification section.

8. SUSPENSION ASSEMBLY

TO REMOVE

(1) Block the rear wheels, raise the vehicle and support on jack stands. Remove the road wheels.

(2) Disconnect and plug the left and right hand brake hose, then remove the hose retaining spring clips.

(3) Remove the radius rod from the vehicle.

(4) Disconnect the stabiliser bar from the chassis.

(5) Using a suitable engine lifting device, support the engine and remove the engine mounting bolts from the member.

(6) Place a floor jack under the centre of the crossmember and supporting the member, remove the bolts connecting the member to the chassis.

(7) Remove the self locking nuts connecting the suspension units to the upper support members.

(8) Lower the floor jack slightly and withdraw the suspension assembly from the vehicle.

TO CLEAN AND INSPECT

(1) Inspect all insulator rubbers and rubber bushes for fatigue and wear.

(2) Check the stabiliser bar and radius rod for distortion and thread damage.

(3) Check the suspension crossmember for cracking with particular attention to the mounting bolt holes.

(4) Inspect the lower control arm for distortion or damage.

(5) Remove the brake drum and hub assembly and inspect the bearings and stub axle. Where disc brakes are fitted inspect the disc distortion and fatigue.

(6) Check the coil springs for sag and cracking.

(7) Inspect the strut for distortion and upper support mounting for cracking.

(8) Check the ball joint operation.

(9) Replace component parts where necessary.

TO INSTAL

Installation procedure is the reversal to that of removal with attention to the following points.

(1) Instal the stabiliser bar with the paint identification mark fitted to the left hand side of the vehicle.

(2) Instal the radius rods to their respective sides on the vehicle. The rods are marked LH and RH and must be fitted in this manner.

(3) Lubricate all applicable points.

(4) Carry out adjustments and torque settings as annotated in the Specification section.

9. SUSPENSION AND STEERING ANGLES

ADJUSTMENT

(1) Prior to carrying out a wheel alignment, select a clean and level area to carry out the necessary adjustments.

(2) Carry out a thorough inspection of the steering linkage, front wheel bearing adjustment, suspension joints and rods, springs and suspension unit, recoil action. Replace or repair where necessary.

(3) Inspect the tyres for even tread. If found defective replace with serviceable tyres.

(4) Inflate tyres to correct pressure.

TO CHECK AND ADJUST TOE-IN

(1) With the vehicle on a level floor, jack up the front of the vehicle.

(2) Spin each front wheel in turn and using a piece of chalk, mark a line around the periphery of each tyre as near to the centre as possible.

(3) Lower the front of the vehicle to the floor and bounce the vehicle up and down several times and let it find its own level. Set the front wheels in the straight ahead position.

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(4) Mark the centre line on both tyres at approximately 208-254 mm (8 - 10 in) above the floor and in front of the suspension.

(5) Using a suitable telescopic gauge, place it between the two front tyres on the chalk marks and record the distance between the centres of the tyres.

(6) Maintaining the wheels in the straight ahead position roll the vehicle forward until the marks are the same distance above the floor, but to the rear of the suspension.

(7) Again use the telescopic gauge to measure and record the distance between the marks on the tyres. The distance measured at the front of the tyres should be less than the measurement at the rear of the tyres.

(8) If adjustment is required, loosen the lock nut on each end of each tie-rod and turn each rod by equal amounts until the toe-in is correct.

Tighten the four tie-rod lock nuts.

NOTE: It is important to make equal adjustments on each tie-rod to maintain the central position of the steering gear.

If an optical or other type of toe-in guage is used, follow the manufacturer's instructions.

TO CHECK CAMBER AND CASTER

(1) Before any attempt is made to check the camber or caster angles or to check and adjust front wheel toe-in, the suspension unit should be thoroughly checked to ascertain that it is in a serviceable condition.

The tread of the tyres should be examined for excessive or uneven wear, as certain conditions of tyre wear are indicative of damaged or worn components in the suspension, steering linkage and/or wheels and bearings.

The vehicle should be unladen except for the normal amount of petrol, oil and water, with the tyres inflated to the normal pressure.

(2) Check and adjust the tyre pressures and set the vehicle up with the alignment equipment being used, according to the manufacturers instructions. Bounce the vehicle up and down several times and let it find its own level.

(3) Check the front wheel alignment (toe-in) and if necessary, adjust as previously described.

(4) Check the caster, camber and swivel inclination according to the instructions set down for alignment equipment being used and compare with the manufacturers specifications.

(5) If the caster angle is incorrect, check the radius rod brackets and rubber bushes. Also check the suspension control arm rubber pivot bushes for wear.

(6) If the camber and swivel inclination angles are both incorrect, check the suspension unit upper mounting and lower ball joint for wear or looseness. Check the suspension control arm for distortion and its rubber pivot bushes for wear.

(7) If the swivel inclination angle is correct and the camber angle is incorrect, the stub axle is bent. A new suspension unit should be installed.

(8) Measure the toe-out on turns of the front wheels using the equipment according to instructions.

If the toe-in is correctly adjusted and the toe-out on either or both left or right hand turn is incorrect, then the tie-rods are of unequal length, or one or both steering arms may be bent.

In the latter case, the steering arm/s must be renewed and the steering linkage re-adjusted.

Note: The maximum/minimum steering angle – toe-in, toe-out on turns – is also determined by the distance between the face of the adjustable stop fitted to the steering arm and the bracket on the rear of the lower control arm when the wheels are turned from lock to lock.

When adjusting the steering angle by stop adjuster, ensure the distance between the radius rod and the tyre is not less than 30 mm (1.181 in). Should the clearance be less than specified, adjust the angle stop outwards until a length reading not exceeding 27.5 mm (1.083 in) on the stop adjuster bolt is obtained.

(9) For angle and adjustment settings, see Specification section.

10. FRONT SUSPENSION FAULT DIAGNOSIS (1200 SERIES)

1. Front end noise

	Possible cause	*Remedy*
(a)	Loose upper suspension mounting or piston rod bearing.	– Tighten mounting and/or adjust piston rod bearing.
(b)	Loose or worn suspension unit lower ball joint.	– Adjust, tighten or renew lower ball joint.
(c)	Noise in shock absorber unit.	– Renew shock absorber unit.
(d)	Worn steering linkage or idler arm components.	– Renew defective components.
(e)	Mal-adjusted front hub bearings.	– Readjust or renew hub bearings.

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2. Heavy steering

Possible cause	*Remedy*
(a) Low or uneven tyre pressure.	– Check tyres and inflate to recommended pressures.
(b) Steering gear incorrectly adjusted.	– Check and readjust steering gear.
(c) Lack of lubricant in steering linkage joints.	– Ascertain cause of loss of lubricant and lubricate steering linkage where applicable.
(d) Front suspension worn or out of alignment.	– Check front end for wear, renew worn components and re-align front end.
(e) Mis-alignment between steering gear and column mountings.	– Check and align steering gear and column mountings.
(f) Soft or sagging front springs.	– Renew springs and check front end alignment.

3. Steering pulls to one side.

Possible cause	*Remedy*
(a) Uneven tyre wear or pressure.	– Check condition of tyres and inflate to recommended pressures.
(b) Incorrect front end alignment.	– Check front end alignment.
(c) Dragging brakes.	– Check and adjust brake shoes.
(d) Broken or sagging rear spring/s.	– Renew faulty springs.
(e) Broken rear spring mounting bolts.	– Renew faulty components.
(f) Damaged front suspension or front sub-frame members.	– Check and renew damaged components.
(g) Faulty or damaged front crossmember.	– Check and renew front crossmember.

4. Front wheel wobble or shimmy.

Possible cause	*Remedy*
(a) Looseness in steering gear.	– Rectify and adjust.
(b) Uneven tyre wear or incorrect tyre pressures.	– Check condition of tyres and inflate to recommended pressures.
(c) Tyre and/or wheel unbalance.	– Check and balance as necessary.
(d) Front end damaged or out of alignment.	– Check and rectify front end damage and alignment.
(e) Worn or badly adjusted front wheel bearing.	– Check condition and adjust wheel bearings.
(f) Front wheel alignment incorrectly adjusted.	– Check and adjust front wheel toe-in (alignment).
(g) Loose or worn tie-rod ends.	– Check and renew faulty components.
(h) Faulty shock absorbers.	– Check and renew as a pair.

5. Steering erratic or wandering.

Possible cause	*Remedy*
(a) Incorrect or uneven camber and/or castor setting.	– Check and renew components to rectify.
(b) Smooth front tyres.	– Check and renew tyres as necessary.
(c) Excessive play in steering gear and/or linkage.	– Check and renew faulty components, readjust.
(d) Excessively high or low tyre pressures.	– Check and inflate to recommended pressures.
(e) Loose or incorrectly adjusted front wheel bearings.	– Check and adjust front wheel bearings.

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REAR SUSPENSION

SPECIFICATIONS

Type	Semi-elliptic leaf spring and double acting shock absorbers.

1000 SERIES

Spring width	50 mm (1.968 in)
Leaf thickness:	
Sedan	7 mm (0.275 in)
Station wagon	5, 7 and 11 mm (0.197, 0.275 and 0.433 in)
Spring length	1150 mm (45.275 in)
Spring free camber:	
Sedan	156 mm (6.142 in)
Station wagon	161.5 mm (6.358 in)
Number of spring leaves	3
Shock absorber stroke	160 mm (6.299 in)

1200 SERIES

Spring width	50 mm (1.968 in)
Leaf thickness:	
Sedan and coupe	6 and 7 mm (0.236 and 0.275 in)
Station wagon	6, 7 and 11 mm (0.236, 0.275 and 0.433 in)
Spring length	1110 mm (43.70 in)
Spring free camber:	
Sedan and coupe	109 mm (4.291 in)
Station wagon	131 mm (5.157 in)
Spring laden camber	11 mm (0.433 in)
Spring eye diameter:	
Front	35 mm (1.377 in)
Rear	23 mm (0.905 in)
Shock absorber stroke:	
Sedan	167 mm (6.574 in)
Coupe and station wagon	180 mm (7.086 in)

TORQUE WRENCH SETTINGS

Shock absorber mounting nuts	2.5 kg/m (18 lb/ft)
Spring U-bolts	4 kg/m (29 lb/ft)
Shackle bolt nuts:	
Front	4 kg/m (29 lb/ft)
Rear	2.5 kg/m (18 lb/ft).

1. DESCRIPTION

The rear suspension comprises semi-elliptic leaf springs with double acting type tubular shock absorbers.

The shock absorbers are mounted just to the rear of the axle housing and connect to the spring mounting plate at the lower end and to the body at the upper end.

Shock absorber mountings are in the form of rubber bushes.

The bump rubbers on the 1200 Series differ to the conventional type, in that they are mounted on the shock absorber spindle.

The front end of the spring on 1200 Series is connected to the vehicle by two plates, three shackle pins and nuts complete with rubber bushes. Two shackle pins passing through the upper section of the plate insulated by rubber bushes connect the upper section of the spring hanger to the body. The third pin and rubber bush are fitted to the lower section of the spring hanger through the spring eye.

The rear end of the spring is connected to the body by two plates, upper and lower shackle pins and bushes.

The spring centre bolt is located in a hole in the axle housing bracket and the spring is attached to the assembly by two U-bolts with self locking nuts and mounting plate.

Plastic inserts are fitted to the ends of the lower spring leaves to reduce metal friction.

NOTE: The only mounting variation between the 1000 and 1200 series is that the front end of the rear spring of the 1000 series is connected directly to the chassis by a single shackle pin and insulating rubber bushes through the spring eye.

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2. SHOCK ABSORBERS

TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle, block the front wheels and support on jack stands placed under the rear axle.

(2) Disconnect the shock absorber at the body attachment at its upper end.

(3) Disconnect the lower end of the shock absorber at the spring plate attachment and remove the shock absorber from the vehicle.

Installation procedure is the reversal to that of removal.

Check, test and bleed the shock absorber as described under TO TEST AND BLEED.

TO TEST AND BLEED

The extent to which a shock absorber can be tested without special testing equipment is limited to the following:

(1) Mount the shock absorber upright in the vice by the lower mounting eye or stem.

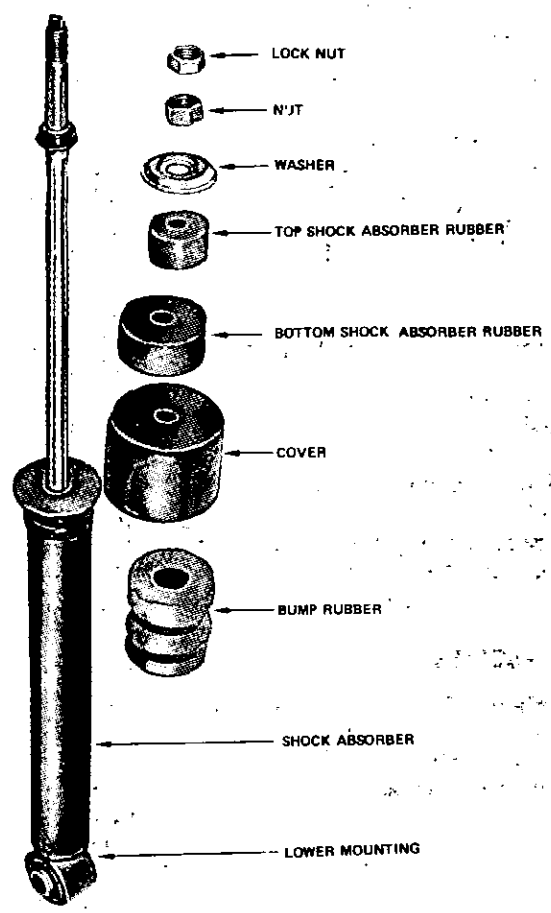
(2) Grasp the upper half of the shock absorber, pull up to the fully extended position and then slowly push down until the shock absorber is fully compressed.

(3) Repeat operation (2) several times to remove any slack spots caused by air in the system. If slack spots exist and cannot be removed by this method, the shock absorber is obviously defective and should be renewed.

NOTE: The resistance will be greater on the upward stroke of the shock absorber than on the downward stroke.

(4) Check the body of the shock absorber for denting or damage and for fluid leakage. The shock absorbers cannot be repaired in service and should be renewed if found defective.

(5) Inspect the retaining nuts, washers and rubber bushes. Renew the rubber bushes as required.



Shock Absorber Assembly with Bump Rubber Components. 1200 Models.

3. SPRINGS

TO REMOVE AND DISMANTLE

(1) Jack up the vehicle and support on stands placed just forward of the rear spring front hanger.

(2) With a jack under the centre of the rear axle case raise the axle assembly sufficiently to take strain off the shock absorbers.

(3) Disconnect the shock absorber lower mounting at the spring mounting plate and push the shock absorber up clear of the axle housing.

(4) Lower the housing to take the weight off the springs, remove the nuts from the U-bolts and take off the mounting plate.

(5) Remove the rear shackle nuts and washers.

(6) Remove the shackle plates, noting the position of the shackle pins; the retaining nut is installed towards the centre of the vehicle.

(7) Support the axle housing on stands and lower the rear of the spring to the floor. Remove the rubber bushes from the body and spring.

(8) Remove the nut/s from the spring front mounting pin/s and withdraw the pin/s. Lower the spring to the floor and remove the bushes from the spring eye and body.

(9) Inspect the spring for sag and cracking.

(10) Check rubber bushes for fatigue.

(11) Check shackle pins for wear and cracking.

(12) Replace all worn or damaged parts where necessary.

TO ASSEMBLE AND INSTAL

(1) Install the front spring eye bushes and the bushes (1200 only) in the chassis with the special tool used to remove the old bushes. Ensure that the bushes are fitted correctly.

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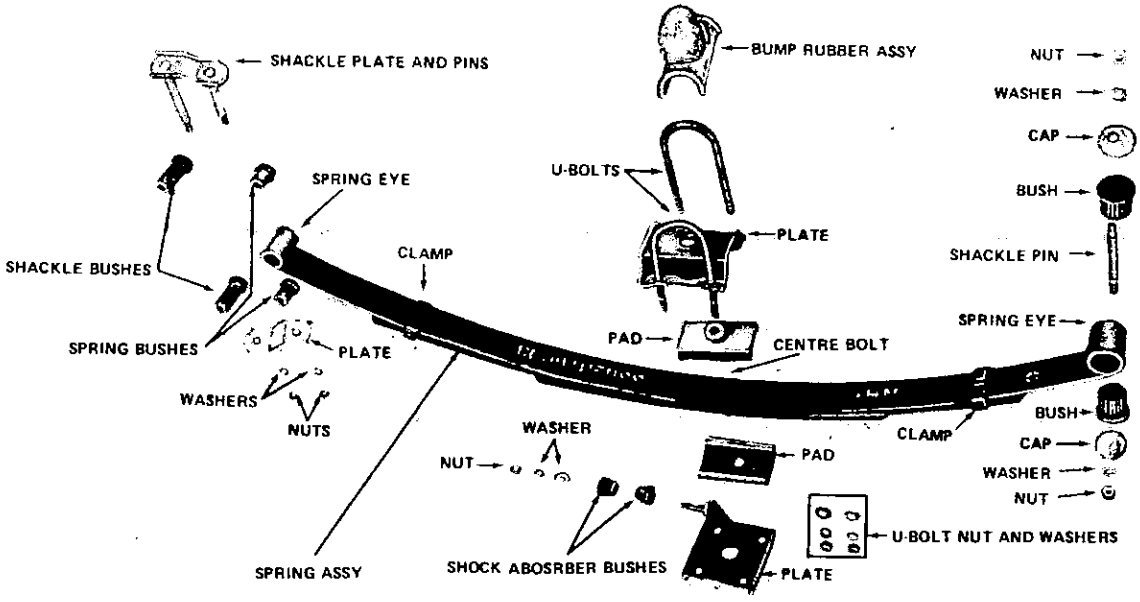
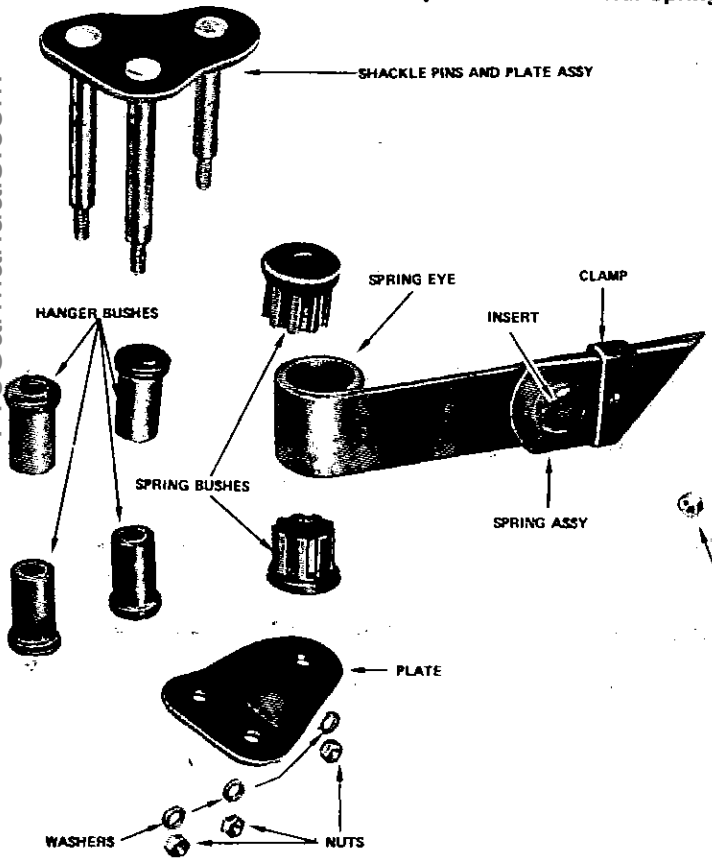


Exploded View of Rear Spring Components. 1000 Models.



Exploded View of the Front Hanger of the Rear Spring. 1200 Models.

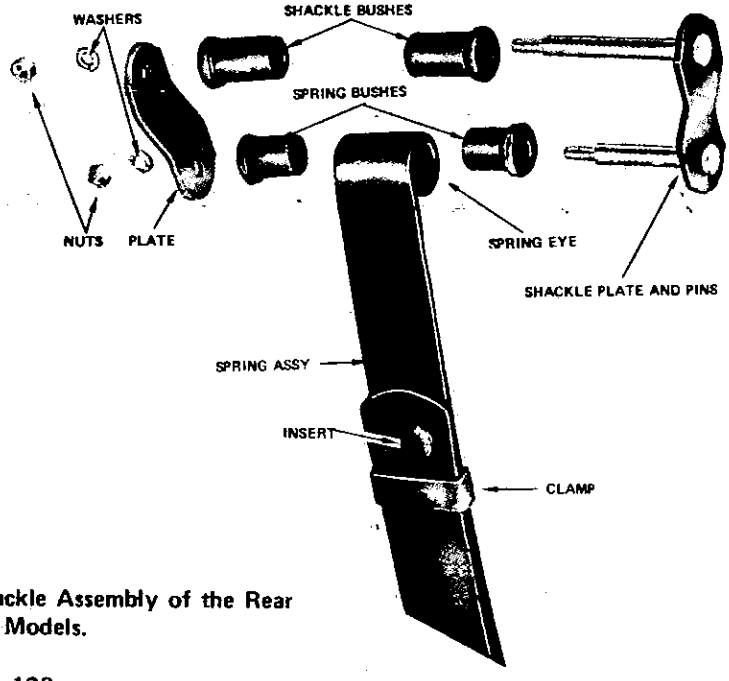
Lubricate the bushes with a liquid soap prior to fitting.

(2) Instal the rear bushes in the spring eye and spring hanger.

(3) Refit the spring to the vehicle using the reverse procedure to removal with attention to the following points.

(a) Do not tighten the U-bolts nuts in excess of the specified torque or the spring and rear axle casing may be affected.

(b) Do not fully tighten the shackle bolts until the full weight of the vehicle is on the rear wheels. This will prevent the rubber bushes from being overstressed when in the normal working position.



Exploded View of the Rear Shackle Assembly of the Rear Spring. 1200 Models.

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4. SUSPENSION FAULT DIAGNOSIS

1. Noise in suspension.

	Possible cause	*Remedy*
(a)	Defective shock absorber and/or mounting.	– Renew faulty components.
(b)	Loose or worn rear shackle bolts and bushes.	– Tighten or renew loose or worn components.
(c)	Loose or worn spring anchor bolt and/or bushes.	– Tighten or renew loose or worn components.
(d)	Broken rear spring leaf or leaves.	– Renew broken leaves or complete spring.
(e)	Sprung or bent axle tube.	– Renew axle casing.
(f)	Worn or deteriorated spring leaf inserts.	– Check and renew inserts.
(g)	Faulty or overtight spring seat.	– Check and adjust.
(h)	Loose or broken spring leaf clamps.	– Tighten or renew faulty clamps.

2. Rear wheels not in alignment with front wheels.

	Possible cause	*Remedy*
(a)	Broken main leaf of spring, forward of spring seat.	– Renew main leaf or complete spring.
(b)	Broken main leaf of spring at rear of spring seat.	– Renew main leaf or complete spring.
(c)	Broken spring mounting bolts or rear shackle.	– Renew faulty components.
(d)	Spring badly sagging on one side.	– Renew defective spring.
(e)	Sprung or bent axle casing.	– Renew axle casing.

3. Rear brake locked on one side.

	Possible cause	*Remedy*
(a)	Broken spring main leaf forward of spring seat.	– Renew main leaf or complete spring.
(b)	Broken spring centre bolts.	– Renew spring centre bolt.
(c)	Broken spring anchor bolt.	– Renew spring anchor bolt.

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BRAKES

SPECIFICATIONS

Type front:	
1000	Drum
1200	Disc or drum
Type rear:	Drum
Operation:	
Foot brake	Hydraulic
Handbrake	Cable (rear wheels only)
Front and rear drums:	
Diameter	203.2 mm (8.00 in)
Out of round limit (in diameter)	0.05 mm (0.002 in)
Machining limit (in diameter)	204.2 mm (8.039 in)
Front disc (1200):	
Diameter	212.5 mm (8.370 in)
Thickness	9.5 mm (0.374 in)
Machining limit	8.4 mm (0.331 in)
Run out limit	0.03 mm (0.0012 in)
Front pads (1200):	
Width	42.5 mm (1.673 in)
Thickness	10.3 mm (0.406 in)
Length	53.1 mm (2.091 in)
Front and rear linings:	
Width	35.0 mm (1.378 in)
Thickness	4.8 mm (0.189 in)
Length	195.0 mm (7.680 in)
Braking area:	
Front drums	273 cm^2 (42.3 in^2)
Rear drums	273 cm^2 (42.3 in^2)
Front discs	90.3 cm^2 (14.0 in^2)
Wheel cylinder:	
Front and rear diameter	20.64 mm (0.812 in)
Rear diameter (1200 with disc only)	17.46 mm (0.687 in)
Piston clearance limit	0.15 mm (0.006 in)
Caliper cylinder:	
Diameter	48.1 mm (1.894 in)
Piston clearance limit	0.15 mm (0.006 in)
Master cylinder:	
Diameter	17.46 mm (0.687 in)
Piston clearance limit	0.13 mm (0.005 in)
Brake pedal height:	
1000	144.5 mm (5.688 in)
1200	141.5 mm (5.570 in)
Available brake pedal height adjusting shim thickness:	
First size	0.50 mm (0.0197 in)
Second size	0.80 mm (0.0315 in)
Third size	1.60 mm (0.0630 in)

TORQUE WRENCH SETTINGS

Calliper securing bolts	6.1 kg/m (44 ft/lb)
Backing plate retaining bolts	3.7 kg/m (27 ft/lb)
Wheel cylinder securing bolts	2.2 kg/m (16 ft/lb)
Brake disc retaining bolts	5.9 kg/m (43 ft/lb)
Rear brake adjuster securing bolts	2.2 kg/m (16 ft/lb)
Master cylinder securing bolts	2.9 kg/m (21 ft/lb)
Brake pedal fulcrum pin	2.9 kg/m (21 ft/lb)
Brake pipe connection	1.8 kg/m (13 ft/lb)
Brake hose	2.0 kg/m (14 ft/lb)
Master cylinder cap bolt	3.5 kg/m (25 ft/lb)

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1. DESCRIPTION

DRUM BRAKES

The four wheel hydraulically operated drum brakes are fitted as standard equipment to all 1000 and 1200 models.

Two leading shoe type brakes are fitted on each of the front brake assemblies and trailing shoe type on each rear assembly.

The front brakes use a separate wheel cylinder to operate each shoe, whereas the rear wheel shoes are operated by a single ended type wheel cylinder only.

The rear wheel cylinders also incorporate the handbrake operating levers which protrude from the rear backing plates. Handbrake cable pull applied at the outer ends of the levers allows the inner ends of the levers to operate directly on the rear wheel cylinder pistons.

The rear wheel cylinders are not rigidly attached to their respective backing plates and are capable of sliding on the plates, within limits, to provide a self centring action for the rear brake shoes.

Each front brake shoe is adjusted by a hexagonal headed cam which is located on the outer section of the brake backing plate.

Rear wheel shoe adjustment is made available by a single tapered adjuster unit bolted rigidly on the brake backing plate positioned diametrically opposite the wheel cylinder. The adjuster operates on both shoes at the same time and also acts as a shoe anchor when the brakes are applied. A square end on the outer portion of the adjuster, and which protrudes through the brake backing plate, enables rear brake shoe adjustment to be carried out.

The single and the dual circuit type master cylinders are operated directly by a push rod from the pendant type brake pedal.

The hydraulic system incorporates bleeder valves at the dual type master cylinder and a bleeder valve at each of the wheel cylinder assemblies.

DISC BRAKES

As a safety item for high speed driving, later model 1200 vehicles are available with front wheel disc type brakes.

The caliper assemblies are of the floating type and are allowed to float in a lateral direction.

As found with most disc type brakes the assemblies are self-adjusting and require no adjustment in service. As pad wear takes place the caliper piston is allowed to slide outwards through its seal to take up a new position in the caliper cylinder bore.

When the brakes are in the off position a minimum of clearance is maintained between the pads and disc.

Elastic deformation of the piston seal on the piston takes place when the brakes are applied and returns the piston to its normal 'off' position when the brakes are released.

2. SINGLE CIRCUIT MASTER CYLINDER

TO REMOVE AND INSTAL

(1) Raise the engine bonnet and fit fender covers to both front fenders.

(2) Disconnect the brake fluid pipe at the front end of the master cylinder and plug the pipe to prevent entry of dirt.

(3) Remove the spring pin and withdraw the clevis pin from the master cylinder push rod clevis and pedal.

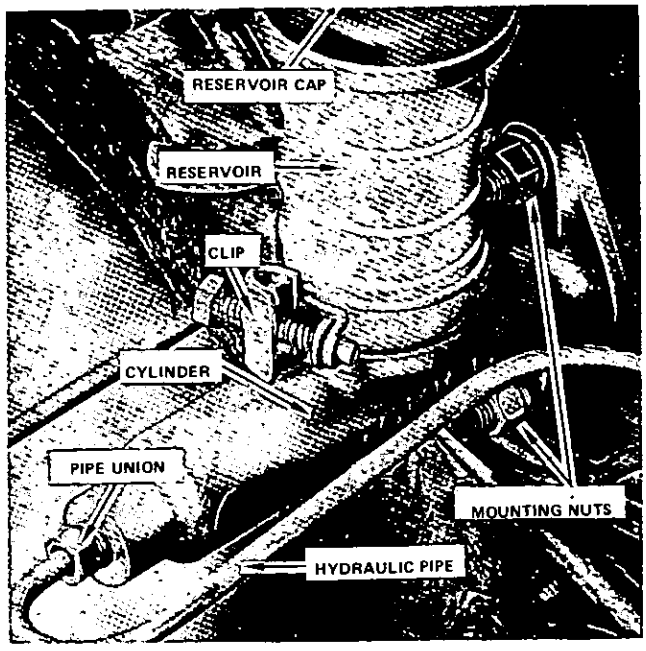
(4) Unscrew the two nuts securing the brake master cylinder to the engine bulkhead and remove the cylinder.

NOTE: Care should be exercised when removing or installing the master cylinder assembly to ensure that brake fluid is not permitted to drop onto the surrounding paintwork of the vehicle. Brake fluid if accidentally spilt should be immediately washed away with water and then allowed to dry naturally, and not wiped with cloth.

Installation is a reversal of the removal procedure with attention to he following:

Fill the master cylinder reservoir with clean brake fluid.

Bleed all air from the system as described in the HYDRAULIC SYSTEM section.



Single Circuit Type Master Cylinder Mounted on Engine Bulkhead Typical.

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Adjust the brake pedal height. See relevant section for adjusting procedure.

Check the master cylinder for fluid leaks.

TO DISMANTLE

(1) Remove the reservoir cap and seal and drain the fluid from the cylinder reservoir.

(2) Pull back the dust boot from the rear end of the cylinder and with a suitable pair of snap ring pliers remove the snap ring.

(3) From the rear end of the cylinder withdraw the push rod assembly with dust boot, piston, primary cup, return spring, check valve and check valve seat in that order.

(4) Remove the secondary cup from the piston being careful not to score the piston.

(5) Loosen the reservoir to cylinder retaining clip and detach the reservoir.

TO CLEAN AND INSPECT

(1) Wash all component parts thoroughly in clean brake fluid or alcohol.

(2) Check the master cylinder bore for excessive wear, scoring or pitting.

(3) Inspect the piston for pitting, excessive wear or scoring.

(4) Check the piston to cylinder clearance and renew the piston and/or cylinder if the clearance is in excess of that specified (see SPECIFICATION section for piston clearance limit).

(5) Check the lips on the primary and secondary cups for wear and the check valve rubber for swelling, perforation or distortion.

(6) Check the piston compression spring for weakness or rusting.

(7) Renew all components of the cylinder assembly, that upon checking, prove to be unserviceable.

NOTE: It is always advisable to instal new cups, check valve and dust boot to a master cylinder that has been dismantled. This will ensure a thorough overhaul and long service from the unit.

TO ASSEMBLE

(1) Soak all internal components of the cylinder in clean hydraulic brake fluid before assembling.

(2) Carefully instal the secondary cup to its recess in the piston.

Ensure that the leading lip of the cup is facing to the front of the piston.

(3) Instal the check valve seat, check valve, spring, primary cup and piston in that order into the rear end of the cylinder. Ensure that the leading lip of the primary cup is facing towards the front of the cylinder.

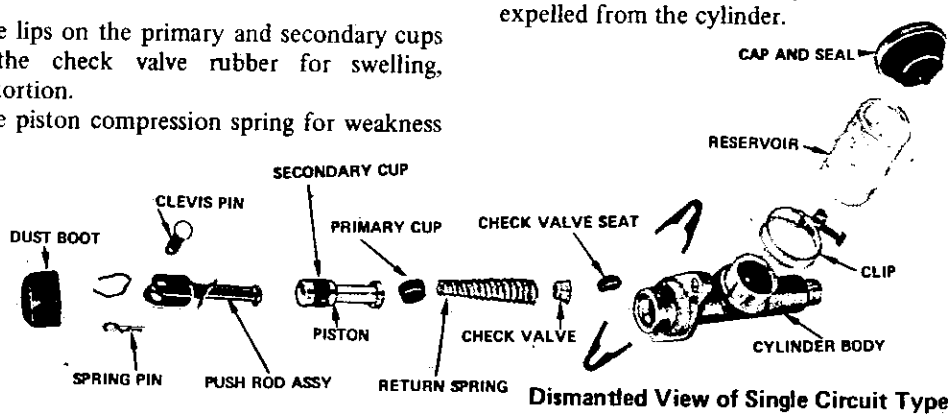
(4) Fit the push rod assembly to the rear of the cylinder and instal the snap ring.

(5) Instal the dust boot to the rear of the cylinder making sure that the dust boot is positioned correctly over its retaining lip on the cylinder body.

(6) Attach the reservoir to the cylinder and fit and securely tighten the reservoir retaining clip.

(7) Fill the reservoir with clean hydraulic brake fluid.

(8) Fit the reservoir cap and seal and bleed the cylinder by hand by slowly pumping the piston via the push rod at the rear of the cylinder until all trapped air is expelled from the cylinder.



Dismantled View of Single Circuit Type Master Cylinder.

3. DUAL CIRCUIT MASTER CYLINDER

The dual circuit type master cylinder assembly was introduced as a safety factor on later type vehicles and can be of either Nabco or Tokico manufacture.

The front and rear brakes are applied by independant circuits. If a malfunction occurs in one circuit the remaining circuit is capable of stopping the vehicle safely.

A brake line pressure differential warning light switch incorporated within the system allows a bulb to glow on the dash panel when a malfunction occurs within the system.

The switch is actuated by a shuttle valve when a pressure difference of between 13 and 17 kg (185 and 242 psi) is encountered between the two hydraulic circuits.

NOTE: The complete switch assembly should be renewed if it is found to be unserviceable. Under no circumstances should an attempt be made to repair the switch.

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TO REMOVE AND INSTAL

(1) Raise the engine bonnet and fit fender covers to both front fenders.

(2) Disconnect the two brake fluid pipes from the outlets on the cylinder, plug the pipes to prevent entry of dirt.

(3) Remove the split pin and withdraw the clevis pin from the master cylinder push rod clevis and brake pedal.

(4) Unscrew the two nuts securing the brake master cylinder to the engine bulkhead and remove the cylinder.

NOTE: Care should be exercised when removing or installing the master cylinder assembly to ensure that brake fluid is not permitted to drop onto the surrounding paintwork of the vehicle.

Brake fluid, if accidentally spilt, should be immediately washed away with water and then allowed to dry naturally, and not wiped with cloth.

Installation is a reversal of the removal procedure with attention given to the following.

Fill the master cylinder reservoirs with clean brake fluid.

Bleed all air from the system as described in the HYDRAULIC SYSTEM section.

Check the brake pedal height and adjust if necessary. See relevant section.

TO DISMANTLE (NABCO)

(1) Remove the reservoir caps and seals and drain the hydraulic fluid from the cylinder and fluid reservoirs into a suitable container.

(2) Unscrew and remove the secondary piston stop screw with sealing washer from the side of the master cylinder body.

(3) Pull back the dust boot from the rear end of the cylinder.

(4) Using a suitable pair of snap ring pliers remove the snap ring from the groove at the rear of the cylinder and detach the push rod assembly.

(5) Tap the open end of the cylinder on a block of wood and allow the primary piston assembly to become dislodged from the cylinder bore.

(6) Using the same procedure remove the secondary piston assembly from the cylinder bore.

(7) Using the correct fitting ring spanner and with the master cylinder body assembly securely clamped in a vice, remove the two cap bolts and washers from the front underside portion of the cylinder body.

(8) Lift out the front and rear check valve and spring assemblies from the cap bolt apertures.

(9) Unscrew and remove the bleeder valve(s) from the side of the cylinder body.

(10) If found necessary loosen the reservoir retaining clips and detach the reservoirs.

(11) Withdraw the spring, spring retainer and then the primary cup from the spigot on the front end of the secondary piston.

(12) Using a suitable blunt instrument, remove the two opposing secondary rubbers from the rear end of the secondary piston. Be careful not to score the piston during this operation.

(13) Remove the bolt from the aperture of the primary piston spring retainer and dismantle the two spring retainers, primary cup and shim from the spigot end of the primary piston.

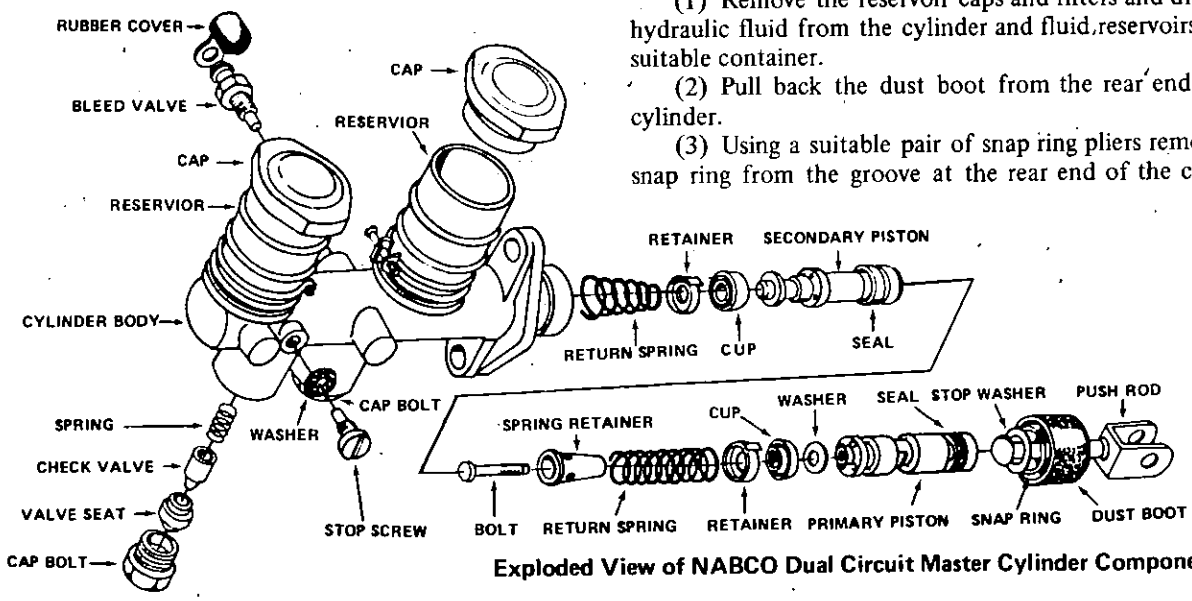
(14) Again using a blunt probe, remove the secondary cup from the recess in he primary piston being careful not to score the piston.

TO DISMANTLE (TOKICO)

(1) Remove the reservoir caps and filters and drain the hydraulic fluid from the cylinder and fluid reservoirs into a suitable container.

(2) Pull back the dust boot from the rear end of the cylinder.

(3) Using a suitable pair of snap ring pliers remove the snap ring from the groove at the rear end of the cylinder



Exploded View of NABCO Dual Circuit Master Cylinder Components.

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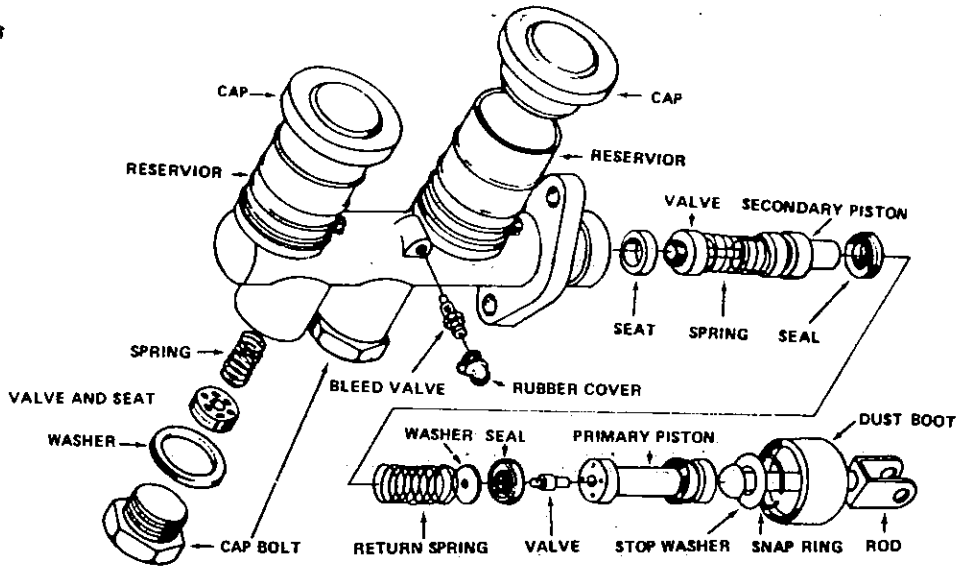

Exploded View of TOKICO Dual Circuit Master Cylinder Components.

and detach the push rod assembly.

(4) Tap the cylinder gently on a block of wood and allow the primary and then the secondary piston assemblies to become dislodged from the cylinder bore.

(5) Using the correct fitting ring spanner, and with the master cylinder securely clamped in a vice, remove the two cap bolts and washers from the front underside portion of the cylinder body.

(6) Lift out the front and rear check valve assemblies from the cap bolt apertures.

(7) Dismantle the spring, spring retainer and primary cup from the spigot which is situated at the front end of the primary piston assembly.

(8) Remove the secondary cup from the primary piston rear groove being careful not to score the piston if a blunt probe has to be used.

NOTE: The secondary piston assembly is preset at manufacture and should not be dismantled. If components of the assembly are unserviceable then renew the complete piston assembly.

(9) Unscrew the bleeder valve from the side of the cylinder body.

(10) If deemed necessary loosen the reservoir retaining clips and detach the reservoirs.

TO CLEAN AND INSPECT (NABCO AND TOKICO)

(1) Wash all components thoroughly in clean hydraulic brake fluid or alcohol.

(2) Check the master cylinder bore for excessive wear, scoring or pitting.

(3) Check both pistons for pitting, excessive wear or scoring.

(4) Check the piston to cylinder clearance and renew the pistons and/or cylinder if the clearance is in excess of that specified (see SPECIFICATION section for piston clearance limit).

(5) Check the lips on all cups for wear and the check valve rubbers for swelling or distortion.

(6) Check the piston compression springs, and the check valve springs for weakness or rusting.

(7) Renew all components of the cylinder assembly that, upon inspection, proves to be unserviceable.

NOTE: Once a cylinder is dismantled it is always advisable to instal all new rubber components. This will ensure a thorough overhaul and long service from the unit.

TO ASSEMBLE (NABCO)

(1) Soak all internal components of the cylinder in clean hydraulic brake fluid before assembling.

(2) Carefully instal the new cups to the primary and secondary piston assemblies. Ensure that the shim is fitted behind the primary cup of the primary piston and that all piston cups, except the rear cup on the secondary piston have their leading lips facing towards the front end of their respective pistons.

NOTE: Instal the secondary cup of the secondary piston with its leading lip facing towards the rear portion of the cylinder.

(3) Instal the spring retainers and compression spring to the primary piston and fit and tighten the special bolt through the front spring retainer aperture.

(4) Instal the spring retainer and spring to the spigot end of the secondary piston.

(5) Now that the primary and secondary piston assemblies are assembled, lubricate the bore of the cylinder and carefully enter the secondary and primary piston assemblies, in that order, into the cylinder.

(6) Fit the push rod assembly to the rear of the cylinder and instal the snap ring.

(7) Instal the dust boot to the rear of the cylinder

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making sure that it is seated correctly over its retaining lip on the cylinder body.

(8) Compress the cylinder pistons via the push rod and instal the secondary piston stop bolt and sealing washer.

(9) Instal a check valve assembly into each of the cap bolt apertures in the cylinder body.

(10) Secure the master cylinder in a vice and fit and tighten both cap bolts and washers. (See specification section for torque setting.)

(11) Attach the reservoirs to the cylinders, if they were removed, and securely tighten the two retaining clips.

(12) Fit and tighten the cylinder bleeder valve(s).

(13) Fill both reservoirs with clean hydraulic brake fluid and fit the reservoir caps and seals. Bleed the cylinder by hand, by slowly pumping the pistons via the push rod assembly at the rear, until all air is expelled from the cylinder.

TO ASSEMBLE (TOKICO)

(1) Soak all internal components of the cylinder in clean hydraulic brake fluid.

(2) Carefully instal the new cups to the primary piston assembly with their leading lips facing frontwards.

NOTE: The secondary piston should not be dismantled and should be renewed as an assembly if cups etc. appear to be unserviceable.

(3) Assemble the spring seat and compression spring to the spigot end of the primary piston.

(4) Lubricate the bore of the cylinder with clean hydraulic brake fluid and carefully enter the secondary and primary piston assemblies in that order into the cylinder.

(5) Fit the push rod assembly to the rear of the cylinder and instal the snap ring.

(6) Instal the dust boot to the rear of the cylinder making sure that it is seated correctly over its retaining lip on the cylinder body.

(7) Attach the reservoirs to the cylinder, if they were removed, and securely tighten the two retaining clips.

(8) Instal a check valve spring, seat and valve into each cap bolt aperture in the cylinder body.

(9) Secure the master cylinder in a vice and fit and tighten both cap bolts and washers.

(10) Screw the bleeder valve(s) into position in the cylinder body.

(11) Position the reservoir filters into the reservoir chambers, and fill the reservoirs with clean hydraulic brake fluid. Fit the reservoir caps and seals.

(12) Bleed the cylinder by hand by slowly pumping the pistons via the push rod at the rear of the cylinder until all air is expelled from the cylinder.

4. REAR BRAKE ASSEMBLY

TO REMOVE AND DISMANTLE

(1) Raise the rear of the vehicle and support on chassis stands.

(2) Remove the road wheel, release the handbrake and withdraw the brake drum.

NOTE: It may be necessary to back off the brake shoe adjuster in order to remove the brake drum.

(3) Detach the return spring, remove the clevis pin and disconnect the handbrake cable or rod, whichever is applicable from the handbrake operating lever protruding from the rear wheel cylinder.

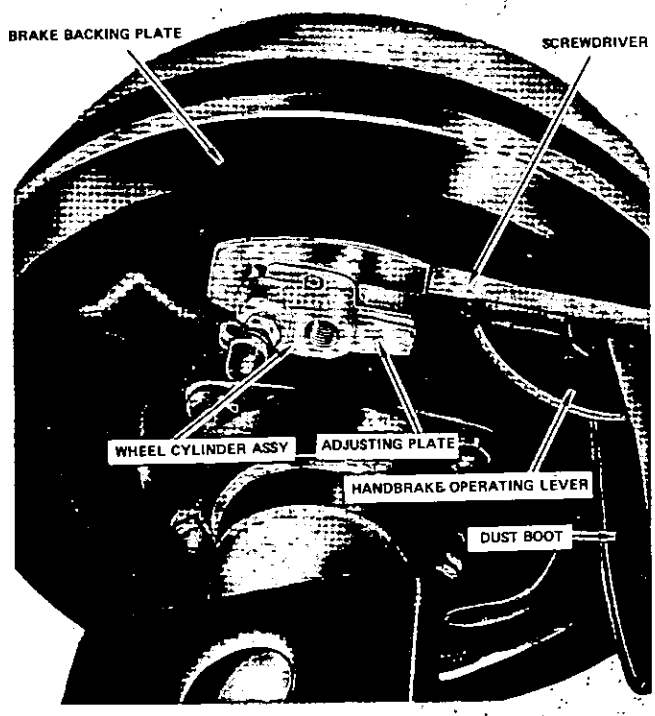
(4) Mark each brake shoe for correct assembly, compress the shoe retaining spring on one shoe, turn the top washer through 90 deg. and remove the spring, washer and retainer pin. Use the same procedure to remove the retainer spring, washers and pin from the remaining shoe.

(5) Back off the brake shoe adjuster in an anti-clockwise direction until it is in the full off position.

(6) Using a suitable pair of brake spring pliers disconnect the upper return springs from each brake shoe.

(7) Ease the end of the brake shoes from the adjuster tappets and wheel cylinders and detach the brake shoes.

(8) Position a rubber band lengthwise around the



Method of Disloding Adjusting Plates from Rear Wheel Cylinder Assembly.

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wheel cylinder to prevent the piston and cup from becoming dislodged.

(9) Disconnect the lower brake shoe return spring from the brake shoes.

(10) Disconnect the brake fluid pipe from the wheel cylinder at the rear of the backing plate and plug the pipe to prevent entry of dirt.

(11) Remove the rubber dust cover from behind the brake backing plate and unscrew the bleeder valve from the back of the wheel cylinder assembly.

(12) Withdraw the retainer plates and adjusting shims and remove the wheel cylinder assembly from the brake backing plate.

(13) Detach the retaining clip and rubber boot from the open end of the wheel cylinder and withdraw the piston and seal. Detach the seal from the spigot end of the piston.

(14) If it is necessary to remove and dismantle the brake shoe adjuster, unscrew and remove the two nuts and lock washers and withdraw the assembly from the brake backing plate.

(15) Mark the adjuster tappets and withdraw them from the adjuster housing. Unscrew the adjuster wedge bolt from the housing.

TO CLEAN AND INSPECT

(1) Check the shoe linings for wear. Renew the linings if thickness is found to be less than 1.5 mm (0.059 in).

(2) If the linings are still serviceable, check for oil saturation and gumminess and renew as required.

(3) Check the brake drum for cracks, ovality or scoring and renew or machine as found necessary. See SPECIFICATION section for drum ovality and machining limits.

(4) Wash the wheel cylinder components in methylated spirits and blow dry with compressed air.

(5) Check the rubber boot and piston seal for deterioration or damage and renew as necessary.

(6) Check the wheel cylinder piston and cylinder bore for wear and/or pitting and renew the assembly if necessary.

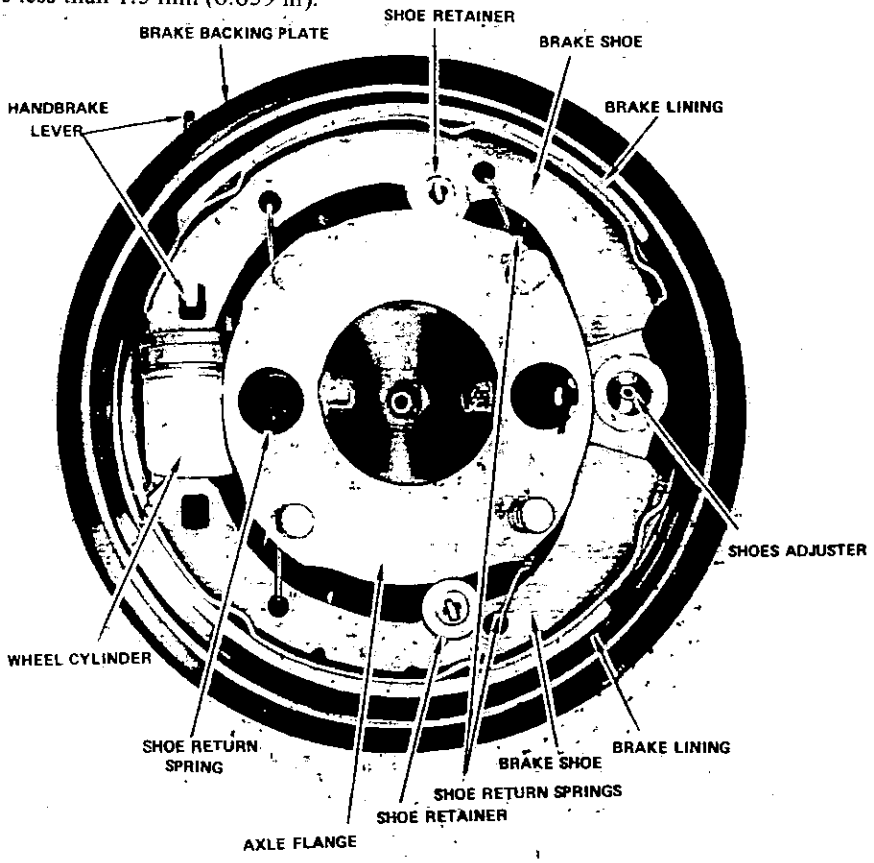
(7) Clean the adjuster components in solvent and check for wear or damage and renew if required.

(8) Check the tension of the brake shoe return springs by comparison with new springs and make replacements as found necessary.

TO ASSEMBLE AND INSTAL

(1) Lubricate the components of the adjuster assembly with zinc oxide grease, screw the wedge bolt into the adjuster housing and instal the adjuster tappets according to the marks made on dismantling.

(2) Position the adjuster assembly on the brake



View of Right Hand Rear Brake Shoe Assembly with Drum Removed.

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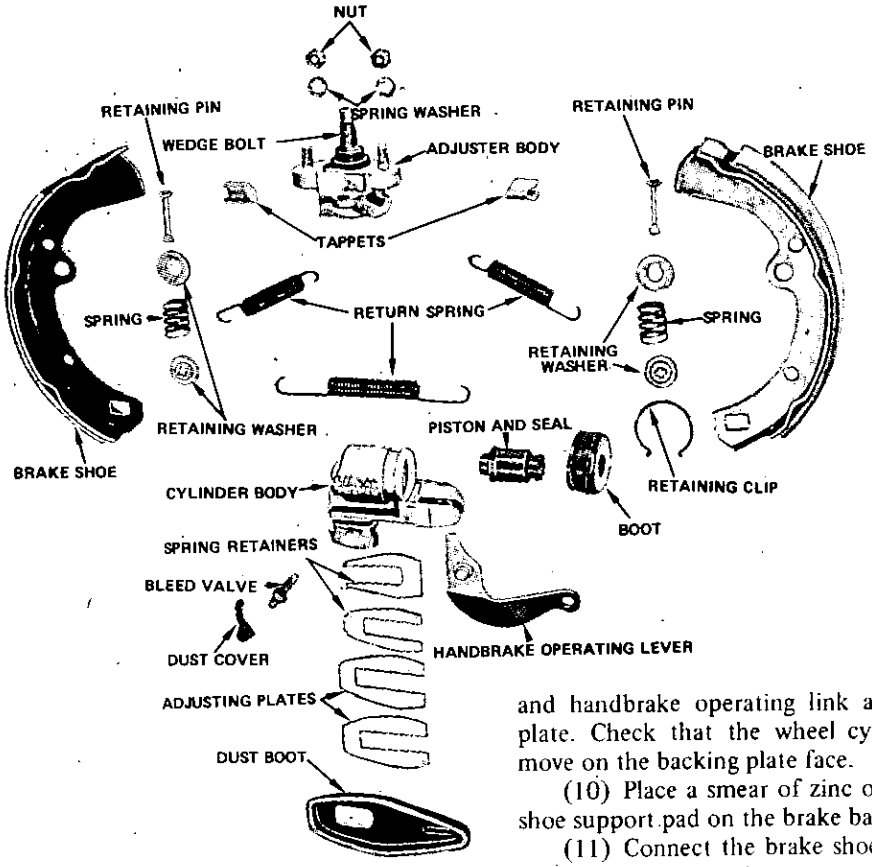

Exploded View of Rear Brake Components.

backing plate and secure with the two retaining nuts and lock washers. Position an elastic band around the assembly to prevent the tappets from becoming dislodged.

(3) Lubricate the wheel cylinder bore with clean brake fluid, also dip the piston and seal in the fluid and instal the seal on the piston so that the lip of the seal will be facing towards the spigot end of the piston.

NOTE: Ensure that the seal is seating correctly in the groove in the piston.

(4) Dip the piston and seal assembly into clean hydraulic brake fluid and insert it into the cylinder bore. Take care not to turn back the lip of the seal on entry.

NOTE: The seal lip must face the blind end of the cylinder bore.

(5) Position the rubber boot on the open end of the wheel cylinder and secure it with the boot retaining clip.

(6) Position the handbrake operating lever in he slot end of the wheel cylinder body, locating the lever pivot in the recess in the wheel cylinder body.

(7) Insert the handbrake operating lever in the backing plate and position the wheel cylinder on the plate from inside.

(8) Instal the adjusting plates and spring retainers on to the wheel cylinder from the rear of the brake backing plate.

(9) Instal the rubber dust boot over the wheel cylinder and handbrake operating link at the rear of the backing plate. Check that the wheel cylinder assembly is free to move on the backing plate face.

(10) Place a smear of zinc oxide grease on each brake shoe support pad on the brake backing plate inner face.

(11) Connect the brake shoes together with the lower brake shoe return spring.

(12) Position the brake shoes on the backing plates according to the marks made on dismantling, locating the rear shoe on the adjuster tappet and with the handbrake operating lever entered in the aperture provided in the brake shoe.

(13) Pull the other shoe into position on the adjuster tappet and wheel cylinder.

(14) Insert the shoe retaining pin through the hole in the backing plate and shoe from behind, and instal the retaining washers and spring, turn the top washer through 90 deg. to lock into position. Instal the other shoe retaining pin, washers and spring in a similar manner.

(15) Using a suitable pair of brake spring pliers instal the two upper return springs to the adjuster ends of the brake shoes.

(16) Fit the brake fluid pipe and the bleeder valve to the wheel cylinder.

(17) Instal the brake drum on the axle flange and fit and tighten the road wheel.

NOTE: It will be necessary to fully tighten the road wheel when the vehicle is lowered to the ground.

(18) Adjust the brake shoes and bleed the hydraulic system as described in the appropriate sections.

(19) Reconnect the handbrake cable or rod, whichever is applicable, to the handbrake operating lever and instal the return spring. It may be necessary to back off the handbrake cable adjuster to connect the cable.

(20) Lower the vehicle to the ground, fully tighten the road wheel retaining nuts and road test the vehicle.

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5. FRONT WHEEL DRUM BRAKES

TO REMOVE AND DISMANTLE

(1) Raise the front of the vehicle and support on chassis stands.

(2) Remove the hub and grease retaining caps, withdraw the split pin, undo the stub axle nut and remove the road wheel and brake drum.

NOTE: It may be necessary to back off each shoe adjusting cam in order to remove the wheel and drum assembly.

(3) Mark each brake shoe for correct assembly, compress the shoe retaining spring on one shoe, turn the top washer through 90 deg. and remove the spring, washers and retainer pin. Use the same procedure to remove the retainer spring, washers and pin from the remaining shoe.

(4) Pull the shoe away from the wheel cylinder piston and disengage the other end of the shoe from the blind end of the other wheel cylinder. Unhook the return spring at the shoe web and at the brake backing plate and remove the shoe and spring. Remove the other shoe in the same manner.

(5) Disconnect and remove the short hydraulic bridge pipe which connects the two wheel cylinders at the rear of the backing plate and also the remaining steel brake pipe, which runs from one wheel cylinder to the strut bracket.

(6) Remove the bolts and nuts securing one wheel cylinder to the backing plate and withdraw the cylinder.

(7) Remove the rubber boot and withdraw the piston, cup, spring seat and spring in that order from the open end of the wheel cylinder.

(8) If necessary unscrew and remove the wheel cylinder bleeder valve.

(9) Repeat operations (6), (7) and (8) to remove and dismantle the other wheel cylinder. Any further dismantling will be unnecessary.

TO CLEAN AND INSPECT

(1) Check the shoe linings for wear. Renew the linings if thickness is found to be less than 1.5 mm (0.059 in).

(2) If the linings are still serviceable, check for oil saturation and gumminess and renew as required.

NOTE: Linings must be renewed as sets only, with the corresponding linings on the other front wheel.

(3) Check the brake drum for cracks, ovality or scoring and renew or machine as found necessary. See SPECIFICATION section for drum ovality and machining limits.

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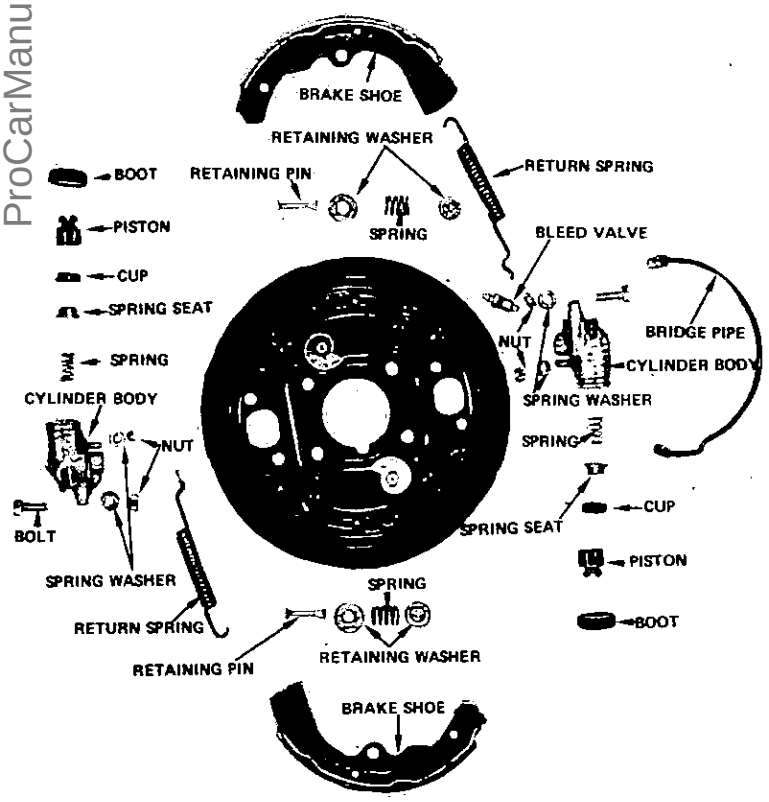
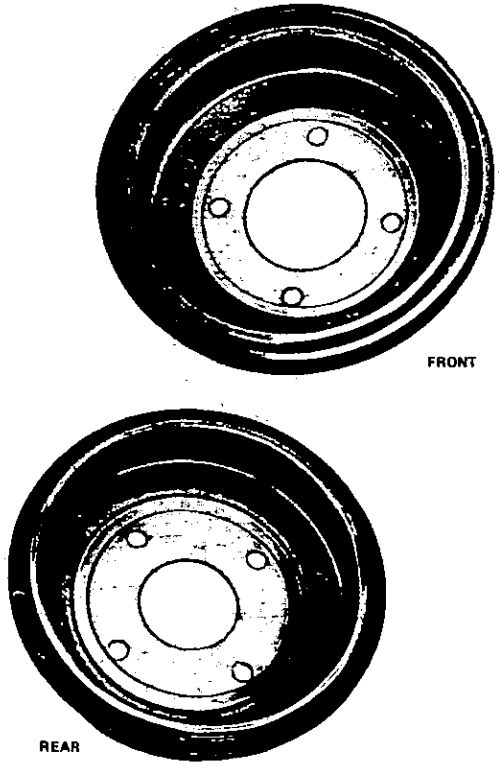
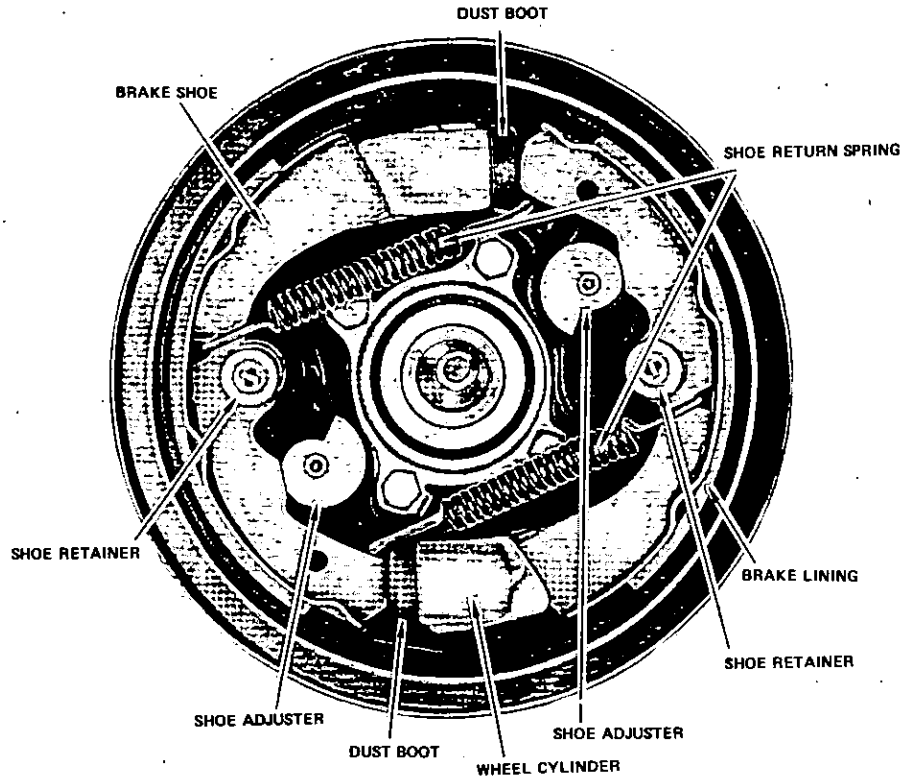


Exploded View of Right Hand Front Brake Shoe Components.



1000 Series Sedan Front and Rear Brake Drums. Note Additional Ribbing on Front Drum Periphery.



View of Right Hand Front Brake Shoe Assembly with Drum and Hub Removed.

(4) Wash the wheel cylinder components in methylated spirits and blow dry with compressed air.

(5) Check the rubber boot and cylinder cup for deterioration or damage and renew as necessary.

(6) Check the wheel cylinder piston and cylinder bore for wear and/or pitting and renew the assembly as necessary.

(7) Check the adjusters in the backing plate for wear or looseness and renew as required.

(8) Check the tension of the brake shoe return springs by comparison with new springs and renew as found necessary.

TO ASSEMBLE AND INSTAL

(1) Lubricate the internal components and the wheel cylinder bore with clean hydraulic brake fluid.

(2) Instal the spring, spring seat, cup and piston in the open end of the cylinder. Ensure that the cup is installed with its lip facing towards the blind end of the cylinder.

(3) Position the rubber dust boot over the 'spigot' portion of the piston and over the open end of the cylinder. Fit a rubber band lengthwise around the assembly to prevent the piston and cup from becoming dislodged from the cylinder bore.

(4) Position the wheel cylinder assembly in the locating hole in the brake backing plate and instal and tighten the retaining bolts and stud nuts.

(5) Fit the cylinder bleeder valve where necessary.

(6) Repeat operation (1) and (5) inclusive to assemble and instal the other wheel cylinder.

(7) Instal the short connecting pipe between the two cylinders and tighten the unions.

(8) Place a smear of high melting point grease on each of the brake shoe support pads on the brake backing plate and instal each brake shoe and return spring according to the marks made on dismantling.

(9) Insert the shoe retaining pin through the hole in the brake backing plate and shoe, from behind, and instal the retaining washer and spring, turn the top washer through 90 deg. to lock into position. Instal the other shoe retaining pin, washers and spring in a similar manner.

NOTE: Ensure that the brake shoe ends are properly located on the wheel cylinder pistons and also on the blind end of the cylinder. Ensure that the brake shoe adjusting cams are in the full off position.

(10) Instal and tighten the steel brake pipe which runs from one wheel cylinder to the strut bracket union.

(11) Instal the brake drum and road wheel assembly onto the stub axle and adjust the hub bearings as detailed in the FRONT SUSPENSION section. Refit the grease and hub caps.

(12) Bleed the hydraulic system and adjust the brake shoes, lower the front of the vehicle and road test.

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6. FRONT WHEEL DISC BRAKES

TO REMOVE AND INSTAL BRAKE CALIPER

(1) Raise the front of the vehicle and support on chassis stands.

(2) Remove the hub cap and road wheel.

(3) Remove the caliper pads as follows:

Withdraw the retaining spring clip from the pad retaining pins.

Remove the pad retaining pins and coil spring noting that the spring is installed on the lower pin.

Disengage and remove the two anti-rattle clips.

Mark the pads and anti-squeal shims with chalk or crayon to facilitate correct assembly and with a pair of long nosed pliers withdraw the pads with shims from the caliper assembly.

(4) Disconnect the steel brake tube at the caliper cylinder and strut bracket.

(5) Remove the two bolts securing the lower suspension unit to the steering arm and separate the suspension unit far enough away from the steering arm to gain access to the two caliper assembly mounting bolts.

(6) Unscrew the two caliper assembly to stub axle flange mounting bolts and detach the caliper assembly from the stub axle.

Installation is a reversal of the removal procedure with attention to the following points.

Tighten the caliper assembly to stub axle flange bolts to the correct specified torque. See BRAKE SPECIFICATION section for correct torque setting.

Instal and tighten the two steering arms to lower suspension unit bolts to the correct specified torque. See FRONT SUSPENSION section for correct torque setting.

Instal the brake pads and anti-squeal shims according to the marks made when dismantling. If new shims are being fitted then instal with shim arrows facing towards wheel rotation.

Renew the brake pads if lining thickness is worn down to less than 1.6 mm (0.063 in).

NOTE: Brake pads should only be renewed in sets of four.

It will be necessary to bleed the hydraulic system when installation is completed.

TO DISMANTLE AND ASSEMBLE

(1) Thoroughly clean accumulated dirt from the outside of the caliper cylinder.

(2) Unscrew the bleeder valve and drain the hydraulic fluid from the caliper cylinder.

(3) Securely position the flanged end of the caliper plate in a vice.

(4) With a soft faced hammer carefully tap the caliper plate head until the cylinder assembly is dislodged from the caliper plate. During this operation ensure that the pistons are not allowed to slide from the cylinder body.

(5) Note or mark which way the pistons are positioned in the cylinder to facilitate correct assembly. This is important as the two pistons are not interchangeable.

(6) Remove the retaining rings and detach the dust boots from the ends of the cylinder.

(7) Using finger pressure, press both pistons out of the cylinder body.

(8) Again using the fingers carefully lift and remove the two piston seals from their respective grooves in the caliper cylinder bore.

(9) Disengage the two caliper plate springs from the caliper plate.

(10) With a suitable pair of pliers withdraw the nylon bias spring from the bore of the inner piston. Only remove the bias spring if it is found to be unserviceable.

(11) Clean all caliper components, except the disc pads, in methylated spirits and examine for wear. Renew all components that, upon inspection, prove to be excessively scored, pitted or worn.

Discard the piston seals and also the dust boots.

NOTE: It is permissible to lightly hone the caliper cylinder bore with fine carborundum paper to remove accumulated rust or foreign matter. Do not attempt to use carborundum paper or similar abrasive materials on the plated surface of the caliper pistons.

(12) Lubricate the caliper cylinder bore and seals with a small amount of rubber grease and position the new seals in their respective grooves in the cylinder bore.

(13) If the nylon bias spring was removed from the inner piston, then instal the spring, rounded portion first, into the piston bore. Press the bias spring down far enough to allow it to seat on the bottom of the piston bore.

(14) Smear a small amount of rubber grease on the sliding surfaces of the caliper pistons and carefully enter the pistons into the cylinder. Slowly push the pistons into the cylinder by hand until the piston rims are approximately flush with the ends of the cylinder.

NOTE: Ensure that the pistons are not pushed too far into the cylinder bore otherwise the piston seals will be allowed to drop into the stepped portion of the pistons and may be damaged.

(15) Instal the two caliper cylinder dust boots and retaining rings.

(16) If removed, instal the caliper plate springs on the plate.

(17) Apply a small amount of rubber grease to the caliper cylinder and caliper plate sliding surfaces and assemble the cylinder to the caliper plate. It may be necessary to tap the caliper plate head with a soft faced hammer to seat the plate tongue fully into the nylon bias spring.

(18) Fit and tighten the cylinder bleeder valve.

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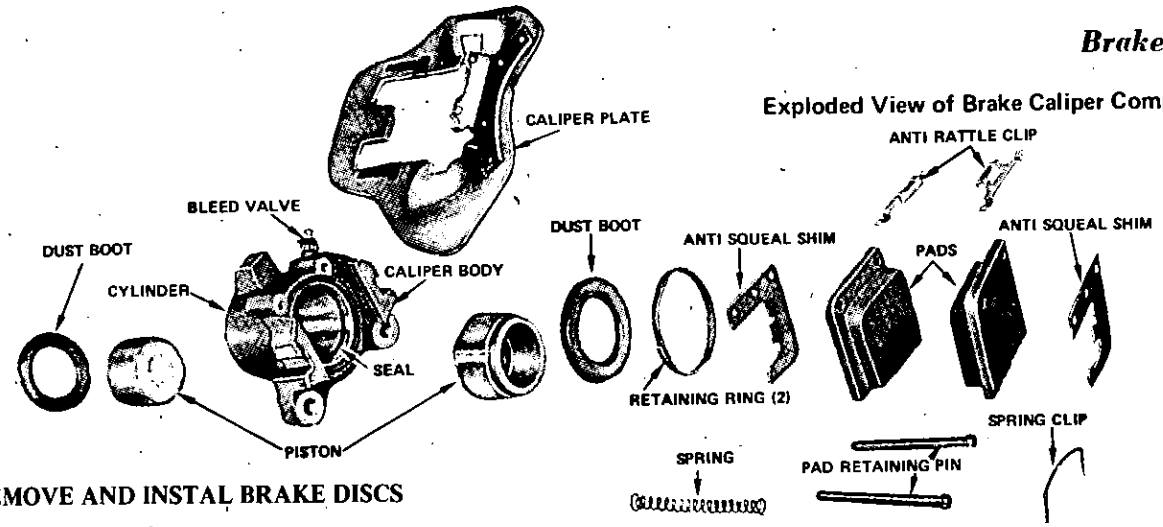

Exploded View of Brake Caliper Components.

TO REMOVE AND INSTAL BRAKE DISCS

(1) Raise the front of the vehicle and support on chassis stands.

(2) Remove the hub cap and road wheel.

(3) Remove the brake pads and caliper assembly as previously described.

(4) Detach the grease cup from the disc hub.

(5) Withdraw the split pin from the castellated nut on the stub axle and tighten the nut slightly to eliminate any end float that may be present on the hub and bearing assembly.

(6) Mount a dial indicator gauge on the suspension unit so that the dial plunger is bearing on the outer periphery of the disc.

(7) Zero the dial gauge and rotate the disc to assess the maximum run-out of the brake disc.

(8) If the disc run-out is in excess of the limits specified and/or if the disc is scored then machining of the disc will be necessary.

See SPECIFICATION section for brake disc run-out limit and reconditioning limit.

(9) Remove the stub axle nut, thrust washer and outer hub bearing and withdraw the hub and disc assembly.

(10) Mark the hub in relation to the disc and remove the four securing bolts. Separate the hub and brake disc.

(11) If necessary remove the hub bearings and seal as described in the FRONT SUSPENSION section of this manual.

(12) Clean the mating faces of the brake disc and the hub flange and instal and correctly torque the four securing bolts. See SPECIFICATIONS for torque setting.

(13) If the hub bearings and seal have been removed, assemble, instal and adjust the hub bearings as described in the FRONT SUSPENSION section of this manual.

(14) Mount a dial gauge to the brake disc as previously described and again check the disc run-out.

(15) If the run-out is in excess of the limit specified, recheck the hub flange and disc mating surfaces for dirt or burrs, and the hub bearings for correct adjustment.

NOTE: If a new brake disc was fitted and excessive run-out is still evident even although the abovementioned checks have been made and proved to be not the run-out cause, then check the run-out on the hub flange and brake disc separately. If the fault is in the hub flange, then renew the hub assembly.

If the hub flange is true and the fault is in the disc then fit a new disc and again check the run-out.

(16) Further installation is a reversal of the removal procedure.

7. REAR BRAKE BACKING PLATE

TO REMOVE AND INSTAL

(1) Raise the rear of the vehicle and support on chassis stands.

(2) Remove the wheel hub cap.

(3) Loosen off and remove the rear wheel and brake drum.

NOTE: It may be necessary to release the brake adjuster several notches if the brake drum proves difficult to remove.

(4) Disengage the return spring and disconnect the handbrake cable or rod, whichever is applicable, and the hydraulic brake pipe at the rear of the brake backing plate. Plug the pipe to prevent the loss of fluid or entry of dirt.

(5) Remove the nuts retaining the brake backing plate to the axle casing through the holes provided in the axle shaft flange.

(6) Withdraw the axle shaft assembly from the axle casing. If found necessary use a slide hammer and adaptor.

NOTE: Keep intact the end-float adjustment shims which are fitted between the backing plate and casing.

(7) Place the axle shaft assembly on an anvil so that the bearing retaining collar is supported by the anvil. Using

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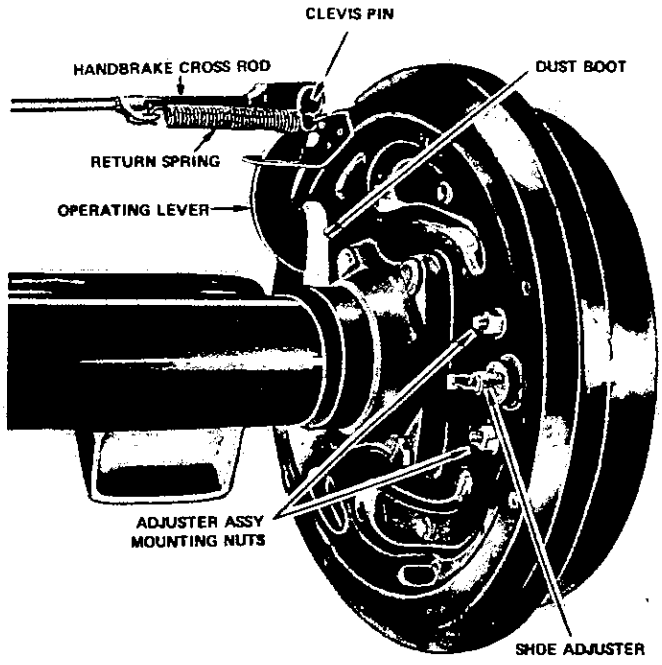


Left Hand Rear Brake Assembly Showing Shoe Adjuster and Handbrake Linkage. 1000 Models.

a hammer and cold chisel make a cut in the top of the retaining collar.

NOTE: Use care not to damage the axle shaft with the chisel if it is found necessary to cut completely through the collar.

Usually it will be necessary to make shallow cuts only in order to expand the collar sufficiently for it to be removed.

(8) Using a press and press plates, support the bearing on the inner race and press the axle shaft out of the bearing, or use special tool No. ST37130000 to pull the bearing from the shaft.

(9) Detach the brake backing plate with the bearing and grease trap.

Installation is a reversal of the removal procedure with attention to the following points:

Use a new bearing retaining collar when reassembling the axle shaft assembly.

Check the axle shaft end-float as described in the AXLE SHAFT AND BEARING of the REAR AXLE section. Adjust end-float if necessary by subtraction or addition of shims to the shim pack between the brake backing plate and axle casing.

Adjust and bleed the brake system. See relevant sections.

8. FRONT BRAKE BACKING PLATE

TO REMOVE AND INSTAL (DRUM BRAKES)

(1) Raise the front of the vehicle and support on chassis stands.

(2) Remove the road wheel with the brake drum and hub as previously described.

NOTE: It may be necessary to back off the brake shoe adjusting cams in order to withdraw the brake drum from the shoes.

(3) Disconnect the steel hydraulic brake pipe which runs from the wheel cylinder to the flexible hose at the strut bracket.

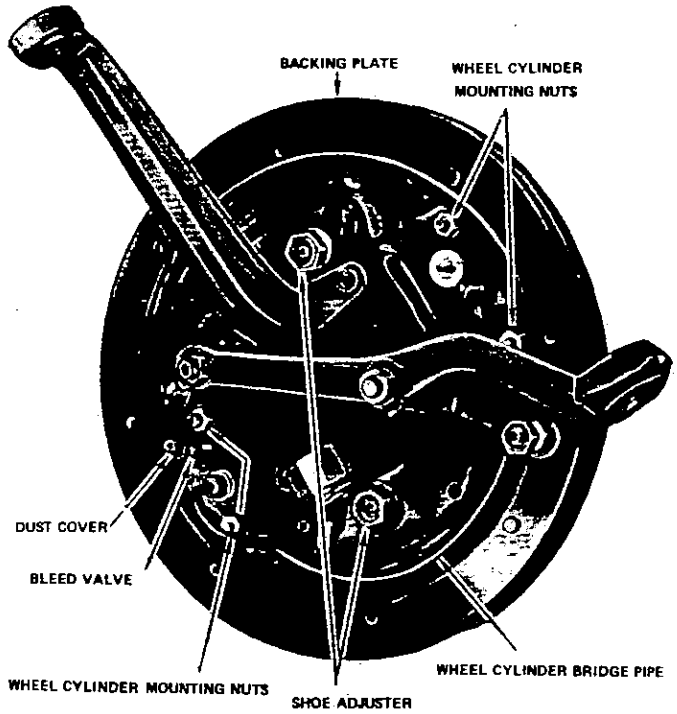
(4) Unscrew and remove the four bolts securing the brake backing plate and grease shield to the stub axle flange and withdraw the backing plate and grease shield from the stub axle. Separate the backing plate and grease shield.

Installation is a reversal of the removal procedure with attention to the following.

Tighten the brake backing plate securing bolts to the correct specified torque. See SPECIFICATIONS section for torque setting.

Ensure that the hub bearings are adequately lubricated with wheel bearing grease and instal and adjust the hub bearings as detailed in the FRONT SUSPENSION section of this manual.

On completion of installation, bleed the hydraulic system and adjust the brake shoes on both front wheels before road testing.



Rear View of 1000 Series Right Hand Front Backing Plate Assembly. Typical also of 1200 Models.

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9. HANDBRAKE ASSEMBLY

HANDBRAKE LEVER ASSEMBLY AND FRONT CABLE – TO REMOVE AND INSTAL (1000)

(1) Chock the two rear road wheels and release the handbrake to the full off position.

(2) Withdraw the spring retainer and clevis pin and disconnect the front cable from the handbrake lever.

(3) Remove the spring retainer and clevis pin and disconnect the handbrake pull lever yoke from the lower end of the handbrake lever.

(4) On the upper end of the pull lever, and at the pull guide, withdraw the spring retainer and clevis pin and disconnect the pull guide from the assembly bracket.

(5) The handbrake pull lever assembly can now be removed from the vehicle.

(6) With the vehicle raised to a suitable working height and supported on stands,, disconnect the clamp which secures the handbrake cable to the underbody.

(7) From underneath the vehicle unscrew the cable adjusting nut and detach the cable from the bottom lever.

(8) Still working from under the vehicle, withdraw the lock plate at the lower cable fixing point and pull the cable clear of the underbody.

(9) Pull the cable through the top assembly bracket and remove the cable from the vehicle.

(10) If found necessary, drive out the handbrake pull lever spring pin and dismantle the pull lever assembly. Observe the position of the pawl and spring and also the handbrake pull set spring to ensure correct assembly.

(11) Check the handbrake pull lever components and the front cable for serviceability and make replacements as found necessary.

NOTE: Renew cables that are excessively stretched or that have chaffed or broken braid.

Installation is a reversal of the removal procedure with attention to the following:

Lubricate all working points of the handbrake mechanism when assembling.

Adjust the handbrake as described in the BRAKE ADJUSTMENT section.

TO REMOVE AND INSTAL (1200)

(1) Raise the vehicle to a suitable working height and support on chassis stands.

(2) Release the handbrake to its full off position.

(3) Working from underneath the vehicle back off the turn-buckle adjusting nut and disengage the front cable from the rear cable.

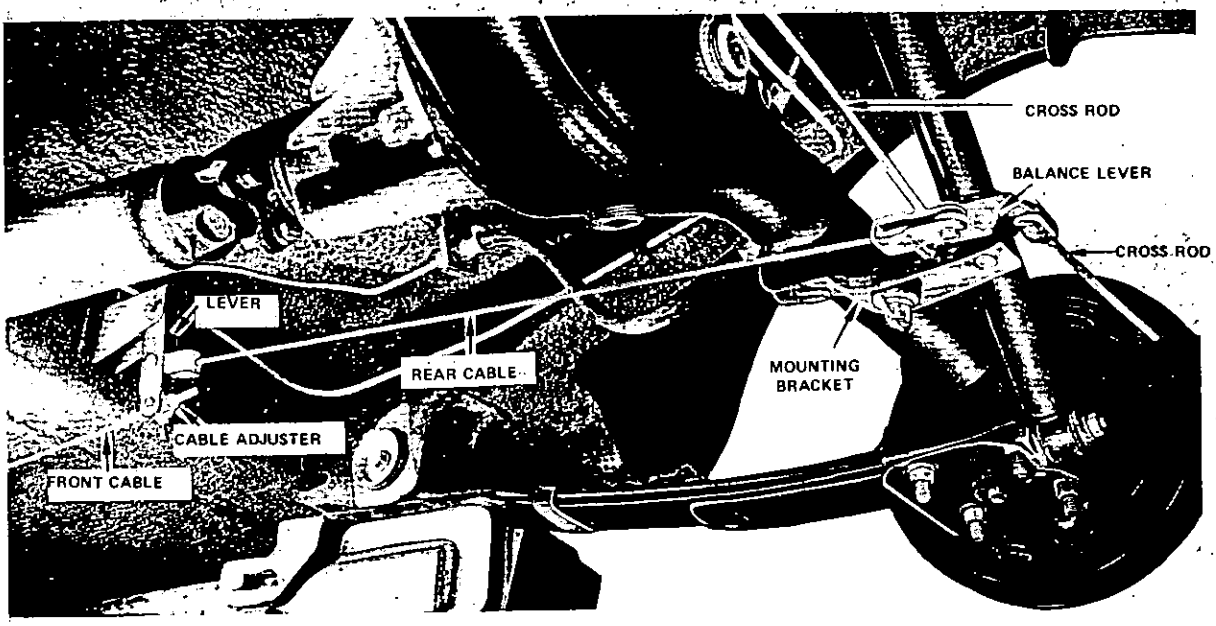
(4) Still working from under the vehicle, withdraw the lock plate at the front cable lower fixing point and pull the cable clear of the underbody.

(5) At the upper end of the front cable and working from within the vehicle withdraw the lock plate to disconnect the cable from its upper fixing point.

(6) Remove the handbrake lever cover from the handbrake lever assembly.

(7) Unscrew the nuts securing the handbrake lever assembly to the body and remove the lever assembly, with front cable attached, from the vehicle.

(8) Remove the spring pin and clevis pin and disconnect the front handbrake cable from the lever assembly.



Rear Underbody View of 1000 Series Showing Handbrake Cable and Rod Arrangement.

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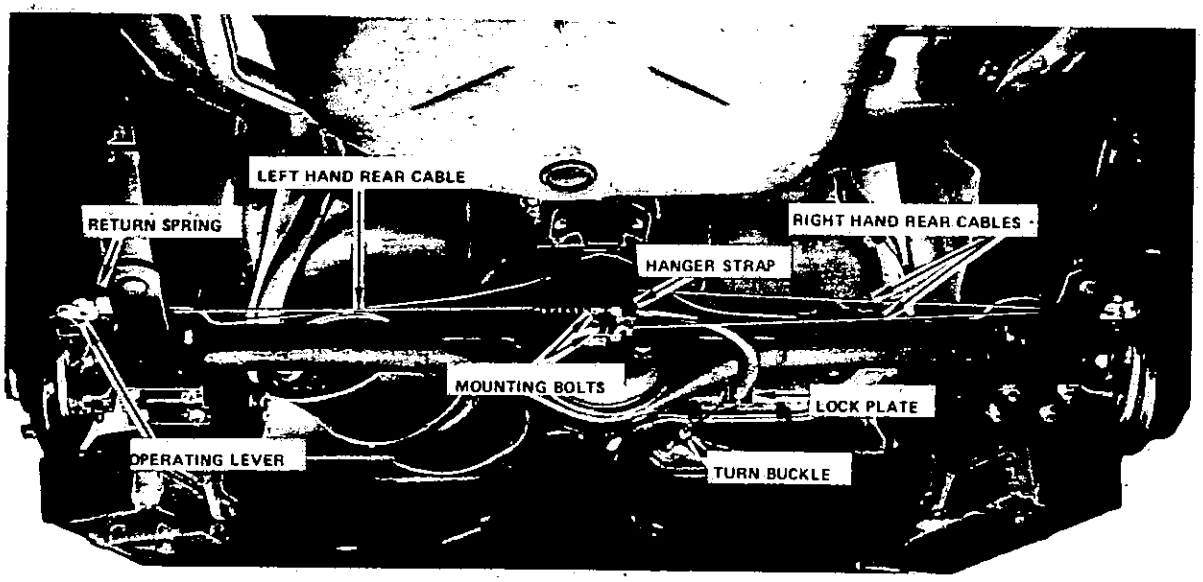

Rear Underbody View of 1200 Series Showing Rear Handbrake Cable Arrangement.

(9) Check the handbrake lever assembly components and the front cable for serviceability and make replacements as found necessary.

NOTE: Renew cables that are excessively stretched or that have chaffed or broken braid.

Installation is a reversal of the removal procedure with attention given to the following points:

Lubricate all working points of the handbrake mechanism when assembling.

Adjust the handbrake as described in the BRAKE ADJUSTMENT section.

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REAR HANDBRAKE CABLE
TO REMOVE (1000)

(1) Raise the vehicle to a suitable working height and support on chassis stands.

(2) Working from underneath the vehicle withdraw the split pin and clevis pin and detach the rear cable from the balance lever which is located on the differential housing assembly.

NOTE: It may be necessary to back off the adjusting nut at the rear of the front cable to allow the clevis pin to be withdrawn.

(3) Remove the split pin and clevis pin and disconnect the front portion of the rear cable at the lever protruding down from the centre of the underbody.

(4) The rear cable can now be removed from the vehicle.

(5) If found necessary, disengage the return springs and remove the cross rods which run from the balance lever assembly on the differential housing across to both rear wheel cylinder assemblies.

TO REMOVE (1200)

(1) Raise the vehicle to a suitable working height and support on chassis stands.

(2) Working from underneath the vehicle back off the turn-buckle adjusting nut and disengage the rear cable from the front cable.

(3) Withdraw the lock plate at the rear cable front fixing point on the differential housing.

(4) Detach the return springs and disconnect the cables at the wheel cylinder assemblies.

(5) Remove the hanger strap mounting bolts at the differential assembly and remove the complete rear handbrake cable assembly as a unit.

(6) If found necessary, undo the hanger strap unit nut and separate the two rear cable assemblies.

TO INSPECT (BOTH MODELS)

Check the cables for excessive stretching, chaffing or broken braid.

Check all clevis pins and eyes for wear.

Renew all components that, upon inspection, prove to be unserviceable.

TO INSTAL (BOTH MODELS)

Installation is a reversal of the removal procedure for the model applicable.

Apply lubricant to all working points when installing.

Adjust the rear brake shoes and then the handbrake as described in the following BRAKE ADJUSTMENT section.

10. BRAKE ADJUSTMENT

TO ADJUST FRONT BRAKE SHOES (Drum Type)

(1) Raise the front of the vehicle so that the wheels are clear of the floor and support on chassis stands.

(2) Check that the wheels rotate freely and that there is no end-float in the hub bearings.

(3) Working from under the vehicle and at the back of the brake backing plate, rotate one of the adjusting cams in a forward direction until the brake shoe locks the brake drum.

(4) Slowly back off the adjuster until the wheel will just rotate freely without any sign of brake drag.

(5) Carry out operations (3) and (4) on the other shoe adjuster for the same wheel and again check that the wheel will rotate freely.

(6) Using the same procedure adjust the shoes on the other front wheel and lower the front of the vehicle to the ground.

NOTE: Disc brakes where fitted to the front wheels are self-adjusting and no manual adjustment is provided or required.

TO ADJUST REAR BRAKE SHOES (ALL MODELS)

(1) Raise the rear of the vehicle and support on stands placed under the axle housing so that the wheels are clear of the ground.

(2) Release the handbrake pull lever to the full off position.

(3) Back the front handbrake cable adjusting nut off several turns at the adjusting point under the vehicle.

(4) Check that both rear wheels are capable of being rotated without any sign of brake drag.

(5) Working from beneath the vehicle and at the rear of the backing plate turn the square on the adjuster in a clockwise direction until the brake drum is locked by the rear shoes.

(6) Back off the adjuster, a little at a time, until the wheel is just free to rotate without dragging.

(7) Using the same procedure adjust the shoes on the other rear wheel.

(8) Adjust the handbrake cable as described in the following section, lower the vehicle to the floor and road test.

TO ADJUST HANDBRAKE CABLE (1000)

(1) Raise the rear of the vehicle, support on chassis stands and adjust the rear brake shoes as previously described.

(2) From underneath the vehicle adjust the front cable adjusting nut until an application stroke of between 110 and 120 mm (4.330 and 4.724 in) is obtained on the handbrake pull lever stem within the vehicle. This will be accomplished easier with two operators, one underneath the vehicle and the other sitting in the driving position assessing the pull lever stroke.

(3) Lower the vehicle to the ground and check the handbrake operation on an incline. Check that no brake binding is evident when the handbrake is in the fully released position.

TO ADJUST HANDBRAKE CABLE (1200)

(1) Raise the rear of the vehicle, support on chassis stands and adjust the rear brake shoes as previously described.

(2) Back off the locknut and adjust the turn-buckle between the front and rear cables until an application stroke of 78.5 mm (3.091 in) is obtained on the handbrake lever within the vehicle. This should be equivalent to approximately six notches on the ratchet.

The adjusting operation will be accomplished easier with two operators, one under the vehicle and the other sitting in the driving position assessing the lever stroke.

(3) When correct adjustment is obtained tighten the lock nut at the turn-buckle and lower the vehicle to the ground.

(4) Check handbrake operation on an incline and ensure that no brake binding is evident when the handbrake is in the fully released position.

BRAKE PEDAL HEIGHT ADJUSTMENT (1000)

(1) Loosen the brake pedal stop lock nut and back the stop well away from the brake pedal arm.

(2) Adjust the brake pedal to a height of 146.5 mm (5.767 in) by adding or subtracting shims between the master cylinder assembly and the engine bulkhead. See SPECIFICATION section for shim sizes available.

NOTE: If shim adjustment is necessary ensure that the shim thickness for upper and lower bolts are of an even thickness when installing shims.

Pedal height dimension should be measured from the top of the pedal pad down to the sloping section of the bulkhead.

(3) When satisfied that the abovementioned pedal height has been obtained, adjust the pedal stop down against the pedal arm until a height of 144.5 mm (5.689 in) is established between the top of the pedal pad and the sloping section of the engine bulkhead.

(4) Tighten the pedal stop lock nut.

BRAKE PEDAL HEIGHT ADJUSTMENT (1200)

(1) Loosen the lock nuts and back off the combined stop light switch and pedal stop well away from the brake pedal arm.

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(2) Adjust the brake pedal to a height of 143.5 mm (5.650 in) by adding or subtracting shims between the master cylinder assembly and the engine bulkhead. See SPECIFICATIONS section for shim sizes available.

NOTE: If shim adjustment is necessary ensure that the shim thickness for upper and lower bolts are of an even thickness when installing shims.

Pedal height dimension should be measured from the top of the pedal pad down to the sloping section of the bulkhead.

(3) When satisfied that the abovementioned pedal height has been obtained adjust the combined stop light switch and pedal stop down against the pedal arm until a height of 141.5 mm (5.57 in) is established between the top of the pedal pad and the sloping section of the bulkhead.

(4) Securely tighten the two lock nuts ensuring that the pedal height is not altered.

11. HYDRAULIC SYSTEM

TO BLEED

Bleeding the hydraulic system is not a routine maintenance operation and should only be necessary when some portion of the hydraulic equipment has been disconnected or fluid drained off, thereby allowing air to enter the system.

There are five parts in the system where bleeder valves may be found to be fitted: One on each front wheel cylinder (or caliper where fitted with disc brakes), one on each rear wheel cylinder and one on the master cylinder assembly.

(1) Fill the fluid reservoir on the master cylinder with clean hydraulic brake fluid and maintain it at least half full throughout the entire bleeding operation.

(2) Remove the dust cover from the bleeder valve on the master cylinder, attach a rubber bleeder tube to the valve and allow the other end of the tube to be immersed in a small amount of fluid contained in a clean glass jar.

(3) Unscrew the bleeder valve one complete turn.

(4) Depress the brake pedal slowly to the full extent of its travel and lock up the bleeder valve. Allow the pedal to return without assistance.

(5) Repeat operation (4) until a constant stream of clean fluid, without air bubbles, is being discharged into the glass jar.

(6) Carry out the bleeding operations, in the same manner, on the remaining bleeder valves in he system. Always work from the longest line in the system down to the shortest.

NOTE: Do not allow the fluid in the reservoir to fall below the half full level at any time during the bleeding operation or air may enter the system and a fresh start will have to be made. Always use new fluid for topping up the reservoir.

(7) Finally, remove the bleeder tube, refit the dust covers to the bleeder valves and top up the fluid in the reservoir.

NOTE: It is obvious that two operators will be needed to bleed the brakes when using the abovementioned system.

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12. BRAKE FAULT DIAGNOSIS

1. **Brake pedal hard.**

Possible cause	*Remedy*
(a) Incorrect shoe linings fitted.	– Check and replace linings with recommended type.
(b) Frozen pedal pivot.	– Rectify or renew pivot pin and bush if fitted.
(c) Restricted brake line from master cylinder.	– Check brake line and remove restriction or renew line.
(d) Frozen wheel cylinder or calliper piston/s.	– Check, free up or renew pistons.
(e) Vacuum-servo system inoperative.	– Check servo system and rectify.

2. **Brake drag due to pressure build-up.**

Possible cause	*Remedy*
(a) Clogged master cylinder ports.	– Check and clean master cylinder and fluid reservoir.
(b) Frozen wheel cylinder or calliper piston/s.	– Check, free up or renew pistons.
(c) Frozen handbrake linkage.	– Free up or renew linkage.
(d) Broken or stretched brake shoe return springs.	– Renew defective springs.
(e) Frozen handbrake cables.	– Free up or renew cables.
(f) Blocked vent in fluid reservoir cap.	– Check vent and remove obstruction.

3. **Lower spongy brake pedal.**

Possible cause	*Remedy*
(a) Incorrectly adjusted brake shoes.	– Check and adjust brake shoes.
(b) Lack of sufficient fluid in system.	– Check for leaks, replenish fluid to specified level and bleed brake system.
(c) Air in brake hydraulic system.	– Bleed hydraulic system.

4. **Brake locks on application.**

Possible cause	*Remedy*
(a) Gummy linings or disc pads due to oil or fluid contamination.	– Clean and renew linings or disc pads.
(b) Bent or eccentric brake drum/s.	– Check and renew faulty drum/s.
(c) Incorrect linings fitted.	– Check and renew linings in pairs with recommended type.
(d) Broken or stretched brake shoe return spring/s.	– Check and renew faulty spring/s.

5. **Brake pedal pulsates.**

Possible cause	*Remedy*
(a) Bent or eccentric brake drum or disc.	– Check and renew drums or disc as required.
(b) Loose or worn front hub bearings.	– Adjust or renew front hub bearings.
(c) Bent rear axle shaft.	– Check and renew faulty components.

6. **Brake fade at high speed.**

Possible cause	*Remedy*
(a) Incorrect shoe adjustment.	– Check and adjust shoe to drum clearance.
(b) Eccentric or bent brake drum.	– Check and renew faulty component.
(c) Lining/s saturated with hydraulic fluid.	– Renew contaminated lining/s.
(d) Incorrect linings fitted.	– Check and instal recommended linings in sets.

7. **Brakes overheat.**

Possible cause	*Remedy*
(a) Incorrect shoe adjustment.	– Check and adjust shoe to drum clearance.
(b) Broken shoe return spring/s.	– Renew faulty spring/s.
(c) Faulty handbrake cables and/or adjustment.	– Check cables, renew or adjust.
(d) Frozen wheel cylinder pistons.	– Free up or renew faulty components.
(e) Obstructed or damaged hydraulic-hose or line.	– Remove obstruction or renew hydraulic hose or line.
(f) Obstructed master cylinder compensating port.	– Clear compensating port.
(g) Blocked vent in master cylinder reservoir cap.	– Check and remove obstruction in vent.
(h) Broken rear spring main leaf or centre bolt.	– Check and renew faulty components.

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ELECTRICAL SYSTEM

SPECIFICATIONS

BATTERY

Type	12 volts
Capacity	40 amp/hrs at 20 hr rate
Polarity	Negative (–) earth
Specific gravity at 20 deg. C (68 deg. F)	1.260 fully charged 1.120 discharged

ALTERNATOR

Make and type:	
Hitachi	LT125.02 LT125.06 LT133.05
Mitsubishi	AS2025A – 1
Maximum output:	
Hitachi LT125.02	24 amps
LT125.06	25 amps
LT133.05	33 amps
Mitsubishi AS2025A–1	25 amps
Polarity	Negative earth
Stator windings	Star connected
Diode identification:	
Positive	Red markings on base
Negative	Black markings on base
Rectification:	
LT125.02 AS2025A–1	Diodes in heat sinks and/or end bracket
LT125.06 LT133.05	Diode rectifier pack assembly
Field resistance at 20 deg. C (68 deg. F)	
LT125.02	4.07 ohms
LT125.06	4.40 ohms
LT133.05	4.50 ohms
AS2025A–1	6–7 ohms
Brush length:	
LT125.02	19.0 mm (0.748 in)
LT125.06	14.5 mm (0.570 in)
LT133.05	14.5 mm (0.570 in)
AS2025A–1	13.0 mm (0.512 in)
Brush minimum length:	
Maximum wear all models	7.0 mm (0.275 in)
Brush spring tension:	
LT125.02	300 – 380 g (11 – 13 oz)
LT125.06	250 – 350 g (9 – 12 oz)
LT133.05	250 – 350 g (9 – 12 oz)
AS2025A–1	300 – 400 g (11 – 14 oz)
Drive belt deflection	13 mm (0.5 in)
Rotor shaft run out – all units	0.10 mm (0.004 in)

ALTERNATOR REGULATOR

Application and model:	
LT125.02 alternator	TLIZ 10A
LT125.06 alternator	TLIZ 37
AS2025A–1 alternator	RL2220B5
LT133.05 alternator	TLIZ 37
Type	Tirril – constant voltage relay
Mechanical Settings	
TLIZ10A Voltage regulator:	
Armature to frame air gap	0.9 – 1.0 mm (0.035 – 0.039 in)
Armature to core air gap	0.8 – 1.2 mm (0.031 – 0.047 in)
Point gap	0.4 – 0.5 mm (0.016 – 0.020 in)
Pilot lamp relay:	
Armature to frame air gap	0.2 mm (0.008 in)
Armature to core air gap	0.5 – 0.6 mm (0.020 – 0.024 in)
Point gap	0.4 – 0.5 mm (0.016 – 0.020 in)
TLIZ 37 Voltage regulator:	
Armature to frame air gap	Non adjustable
Armature to core air gap	0.6 – 1.0 mm (0.024 – 0.039 in)
Point gap	0.3 – 0.4 mm (0.012 – 0.016 in)
Charge relay:	
Armature to frame air gap	Non adjustable
Armature to core air gap	0.8 – 1.0 mm (0.031 – 0.039 in)
Point gap	0.4 – 0.6 mm (0.016 – 0.024 in)
RL2220 B5 Voltage regulator:	
Armature to frame air gap	0.8 – 1.1 mm (0.031 – 0.043 in)

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Armature to core air gap	0.8 – 1.2 mm (0.031 – 0.047 in)
Point gap	0.3 – 0.4 mm (0.012 – 0.016 in)
Pilot Lamp Relay:	
Armature to frame air gap	0.8 – 1.1 mm (0.031 – 0.043 in)
Armature to core air gap	0.9 – 1.2 mm (0.035 – 0.047 in)
Point gap	0.8 – 1.1 mm (0.031 – 0.043 in)

Electrical Settings

Voltage Relay	
Adjust engine speed to	2500 rpm
Primary and secondary side set voltage to 14.2 volts at ambient temperature of	20 deg C (68 deg F)
Reduce voltage setting by 0.1 volts for every ambient temperature rise of	10 deg C (20 deg F)
Increase voltage setting by 0.1 volts for every ambient temperature drop of	10 deg C (20 deg F)

Electrical Settings

Charge Relay	
Operating voltage	4.5 – 5.2 volts

STARTER MOTOR

Make and Model:	
Hitachi	S114 – 87, S114 – 87L
Mitsubishi	MW–V1 R
Drive – all	Over running clutch solenoid operated
Number of poles – all	4
Number of brushes	2 or 4
No Load Test – Hitachi:	
Volts	12 volts
Amperage draw	60 amps maximum
Revolutions	7000 rpm minimum
Mitsubishi:	
Volts	11 volts
Amperage draw	60 amps maximum
Revolutions	4800 rpm minimum
Lock test – Hitachi:	
Volts	6.3 volts
Amperage draw	420 amps maximum
Torque – minimum	0.9 kg/m (6.5 ft/lb)
Mitsubishi:	
Volts	6 volts
Amperage draw	470 amps maximum
Torque – minimum	0.68 kg/m (5 ft/lb)
Brush length new – Hitachi	16 mm (0.630 in)
– Mitsubishi	15 mm (0.590 in)
Brush length worn – Hitachi	9.5 mm (0.374 in)
– Mitsubishi	8 mm (0.315 in)
Brush spring tension – all	700 – 800 g (25 – 28 oz)
Armature shaft maximum bend – all	0.08 mm (0.003 in)
Commutator out of round maximum – all	0.20 mm (0.008 in)
Undercut of commutator segments – all	0.50 – 0.80 mm (0.020 – 0.031 in)
Commutator diameter – Hitachi	33 mm (1.299 in)
– Mitsubishi	32 mm (1.259 in)
Commutator minimum diameter – Hitachi	31 mm (1.220 in)
Commutator minimum diameter – Mitsubishi	30 mm (1.181 in)
Bush to shaft clearance – maximum – all	0.20 mm (0.008 in)
Centre bush maximum clearance – Hitachi	0.45 mm (0.018 in)
Armature end float – all	0.05 – 0.30 mm (0.002 – 0.012 in)
Pinion clearance – pinion to pinion stop solenoid energised – all	0.30 – 1.50 mm (0.012 – 0.059 in)

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Solenoid face to adjusting nut plunger depressed – all	31.70 – 32.30 mm (1.248 – 1.272 in)
Solenoid pull in voltage – Maximum:	
Hitachi	8 volts
Mitsubishi	9 volts

DISTRIBUTOR

Make	Hitachi Mitsubishi
Model:	
Hitachi	D412 – 53 D411 – 61 D412 – 63
Mitsubishi	TVA–4 FI L
Rotation	Anti-clockwise
Firing order	1–3–4–2
Dwell angle	49 – 55 deg
Capacitor capacity	0.20 – 0.24 mfd
Control	Vacuum advance and centrifugal advance.
Ignition timing:	
D412 – 53	8 deg at 600 rpm
TVA–4 FI L	8 deg at 600 rpm
D411 – 61 manual	7 deg at 600 rpm
automatic	7 deg at 600 rpm
D412 – 63 manual	5 deg at 700 rpm
Centrifugal advance:	
D412 – 53 commences	450 rpm
Maximum	12 deg at 1300 rpm
TVA–4 FI L	0 – 1.8 deg at 500 rpm 6.7 – 9.5 deg at 1000 rpm 11.0 – 13.0 deg at 1440 rpm
D411 – 61 commences	547 rpm
Maximum	11.5 deg at 2400 rpm
D412 – 63 commences	550 rpm
Maximum	12.5 deg at 2100 rpm
Vacuum advance:	
D412 – 53 commences	150 mm/hg (5.905 in/hg)
Maximum	9.5 deg at 305 mm/hg (9.5 deg at 12 in/hg)
TVA–4 FI L	1.7 deg at 160 mm/hg (1.7 deg at 6.299 in/hg) 5.5 – 8.7 deg at 250 mm/hg (5.5 – 8.7 deg at 9.842 in/hg) 8.5 – 10.5 deg at 350 mm/hg (8.5 – 10.5 deg at 13.779 in/hg)
D411 – 61 commences	150 mm/hg (5.905 in/hg)
Maximum	9.5 deg at 305 mm/hg (9.5 deg at 12 in/hg)
D412 – 63 commences	250 mm/hg (9.842 in/hg)
Maximum	6.5 deg at 350 mm/hg (6.5 deg at 13.779 in/hg)
Contact point gap – all	0.45 – 0.55 mm (0.018 – 0.022 in)
Contact spring tension – all	500 – 650 g (18 – 21 oz)
Shaft to housing clearance – Maximum	0.08 mm (0.003 in)
Shaft to cam clearance – Maximum	0.005 – 0.029 mm (0.0002 – 0.001 in)

SPARK PLUGS AND LEADS

Make	Hitachi or NGK
Hitachi:	
Early model vehicles	L45
Later model vehicles	L46 P
NGK:	
Early model vehicles	B–6E
Later model vehicles	BP–6E
High tension leads	Radio suppressed
Firing order	1–3–4–2
Reach	19 mm (0.750 in)

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Thread diameter	14 mm
Plug gap:	
L45 and B–6E	0.7 – 0.8 mm (0.028 – 0.031 in)
L46P and BP–6E	0.8 – 0.9 mm (0.031 – 0.035 in)
Tightening torque	1.5 – 2.0 kg/m (11 – 15 ft/lb)

IGNITION COIL

Make	Hitachi Mitsubishi Hanshin
Type:	
Hitachi	C14 – 51
– with series resistance	C6R – 200
Mitsubishi	HP5 – 10E
Hanshin with series resistance	HP5 – 13E

Resistance – measured at 20 deg C (68 deg F):	
C14 – 51 – primary resistance	3.2 – 4.1 ohms
– secondary resistance	20000 ohms maximum
– Spark gap	6 mm minimum
C6R200 – primary resistance	1.3 – 1.6 ohms
– secondary resistance	14000 ohms maximum
– series resistor	1.4 – 1.8 ohms
– Spark gap	7 mm minimum
HP5–10E – primary resistance	3.2 – 4.1 ohms
– secondary resistance	17,000 ohms maximum
– Spark gap	6 mm minimum

1. BATTERY

MAINTENANCE

Maintenance consists mainly of regular inspection and servicing.

(1) Keep the battery and its surroundings clean and dry. Give the top of the battery particular attention to prevent electrical leakage between the cell terminals.

(2) Remove the vent plugs and see that the vent holes are clean.

(3) Check the electrolite level and top up as necessary. The correct level is just over the top of the separators. Do not overfill or acid will escape through the vent holes with detrimental effect to the connections and adjacent parts of the car.

(4) Use only distilled water for topping up.

NOTE: Never use a naked light when examining the battery; as the gases given off by the battery can be dangerously explosive.

(5) If the battery required an excessive amount of topping up, the cause should be sought. If overcharging is suspected, check the regulator setting. If one cell in particular is at fault, check the case for cracks. Never transfer electrolite from one cell to another.

(6) Keep the positive and negative terminals clean and apply a small amount of petroleum jelly to the terminals to prevent corrosion.

TO REMOVE AND INSTAL

(1) Release the terminal screws and carefully remove the cables from the terminal posts.

(2) Release the battery holding clamp and lift the battery from the car.

Reverse the above operation to instal the battery and smear petroleum jelly on the terminals to prevent corrosion. Do not over tighten the terminal screws and make sure of the correct earth polarity.

2. ALTERNATOR

DESCRIPTION

The alternator charging unit uses a rotating field and pole shoe assembly and together form a rotor unit. Low amperage current is fed through the slip rings and brushes to the field windings so wear on brushes and slip rings is very slight and maintenance is reduced to a minimum.

The output current is generated in the fixed stator windings and is three phase alternating current (AC).

The stator windings are wound on a laminated soft iron former and are star-connected.

As it is not possible to recharge a storage battery with alternating current, it is necessary to rectify the output of the stator windings to direct current (DC). This is done by the bank of diodes mounted within the alternator end bracket.

The output of the alternator is governed by the control unit and built in characteristics of the alternator.

An electrical cut out unit is not necessary with the alternator charging system as the diodes stop a reverse current flow through the alternator.

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SERVICE PRECAUTIONS

(1) Make sure the battery is connected the correct way. Refer to Specifications.

(2) Do not short out or ground any terminals common to the charging circuit.

(3) Always disconnect the battery before connecting a battery charger.

(4) If a booster battery is used always connect it in a parallel circuit. i.e. positive to positive (+ to +) and negative to negative (– to –) to maintain a 12 volt supply pressure.

(5) Never disconnect the battery or terminals in the charging circuit while the engine is running.

(6) Regularly check fan belt tension, deflection should be 13 mm (0.5 in).

(7) Keep battery terminals clean and all electrical connections tight.

(8) Disconnect the battery and alternator when arc welding on the vehicle.

(9) Never connect a capacitor to the field (F) terminal.

TO REMOVE AND INSTAL

(1) Fit covers to both fenders and disconnect the battery terminal.

(2) Disconnect the terminal block at the alternator if used by pulling on the terminal block, not the wires, or remove the terminal nuts and lock washers to remove the wiring from the terminals.

(3) Loosen both mounting bolt nuts.

(4) Remove the fan belt from the pulley.

(5) Remove both mounting bolts while supporting the alternator with the hand, do not drop or bump the alternator.

Installation is a reverse of the removal procedure with particular attention to the following:

(1) Do not overtighten the mounting bolts as broken mounting lugs could result.

(2) Do not over tension the fan belt.

(3) Apply pressure to the mounting end bracket only, when adjusting the fan belt.

(4) Check the wiring where soldered to the slide-on terminals in the terminal block or where soldered to the eye terminals.

TO TEST THE ALTERNATOR

(1) Remove the alternator from the vehicle as described under the heading TO REMOVE AND INSTAL.

(2) Mount the alternator on an electrical test bench equipped for testing charging circuits.

(3) Using a fully charged battery connect a 0–50 amp test ammeter in series between the positive (+) battery terminal and the alternator A terminal with an on-off switch in series at the battery terminal.

(4) Bridge the F terminal and A terminal at the alternator.

(5) Connect a test voltmeter 0–20 volts between the A terminal of the alternator and the negative (–) terminal of the battery.

(6) Earth the alternator frame to the negative (–) battery terminal.

(7) Connect a variable load resistance of 35 amps 15 ohms with a switch in series across the battery.

(8) Open circuit the variable resistance with the switch.

(9) When testing Hitachi LT125–02 and Mitsubishi AS2025A–1 alternators, close the On-Off switch at the positive (+) battery terminals leaving the variable resistance switch open, slowly increase the speed of the alternator until the reverse current flow is eliminated and a 2 amp charge is indicated on the ammeter. The speed of the alternator should be approximately 1000 rpm at this point.

When testing the Hitachi LT125–06 and LT133–05 alternators, slowly increase the alternator speed to approximately 800 rpm and close the On-Off switch at the positive (+) battery terminal, gradually increase the alternator speed until the voltmeter reading reaches 14 volts, at this point the alternator speed should be less than 1000 rpm if the unit is serviceable.

(10) Close the switch of the variable resistance and slowly increase the alternator speed to approximately 2500 rpm, adjust the variable resistance until the voltmeter reads 14 volts. The alternator output should be at maximum reading, refer Specifications, no noticeable increase in alternator output should occur as the rpm is increased above this figure nor should there be any drop off in output.

NOTE: Do not leave the variable resistance in circuit longer than is necessary to do the test.

(11) Should the alternator not meet the above tests it will have to be dismantled and all components tested.

(12) If the alternator test proves that the alternator is serviceable but the battery is not receiving an electrical charge, carry out the regulator unit test procedure.

TO TEST ON THE VEHICLE

The regulator unit must not be in circuit when carrying out this test, disconnect the battery before connecting any of the test equipment and make sure that the battery is fully charged.

(1) Disconnect the wiring from the N and F terminals of the alternator.

(2) Connect a 0–20 volt test voltmeter between the A terminal of the alternator and a good earth, check that the voltmeter reads battery voltage when the battery is reconnected.

(3) Connect a jumper lead between the F and A terminals of the alternator.

(4) Connect a tachometer to the engine according to the manufacturers instructions.

(5) Reconnect the battery terminals and start the engine and allow to idle at its minimum speed.

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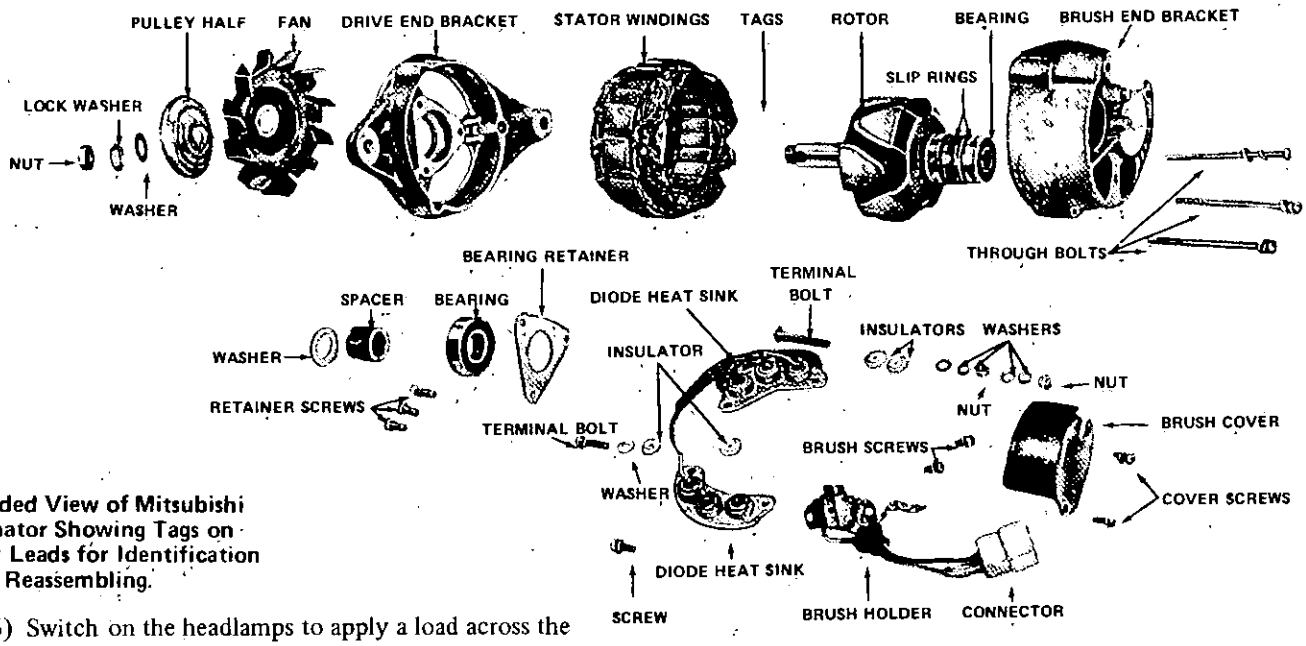


Exploded View of Mitsubishi Alternator Showing Tags on Stator Leads for Identification When Reassembling.

(6) Switch on the headlamps to apply a load across the battery.

(7) Slowly increase the engine speed to approximately 1000 rpm. The voltmeter should give a minimum reading of 12.5 volts if the alternator is serviceable, should the reading be below this figure the alternator will have to be removed for repairs.

NOTE: Do not switch off the headlamps until the engine has been stopped.

TO DISMANTLE

It is important that the diode wire be held with a pair of pointed pliers when soldering and unsoldering the leads, the pliers dissipate some of the heat and so protect the diode from being damaged.

All wiring connections should be marked and tagged before removal to avoid wrong connections during reassembling.

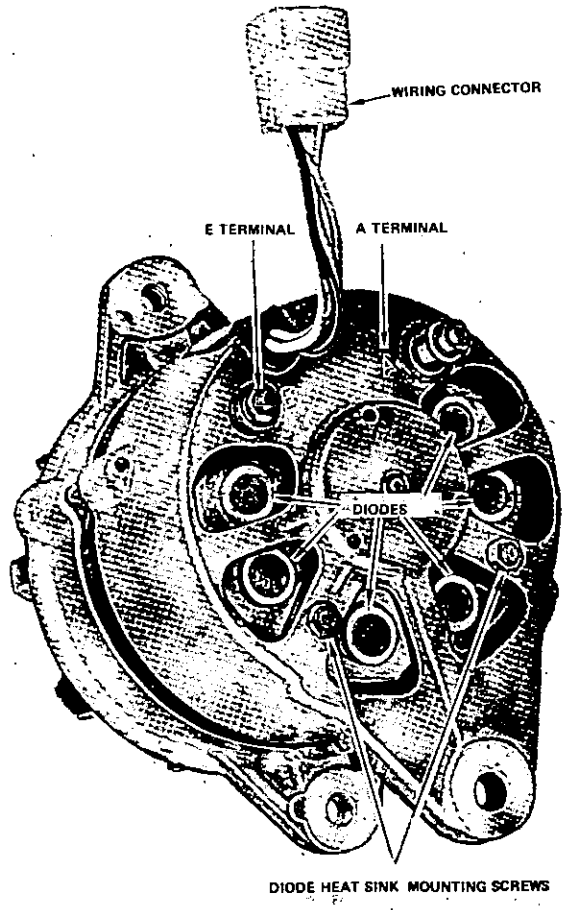
(1) Mark the assembled position of both end brackets and the stator winding lamination.

(2) Remove the brush cover screws and brush cover. On models LT125.06 and LT133.05 remove the brush holder mounting screws and remove the brush holder and brushes.

(3) Remove the through bolts and separate the drive end bracket and rotor from the stator windings and brush end bracket.

NOTE: It may be necessary to gently tap the drive end bracket with a soft-faced hammer to separate it from the stator laminations and brush end bracket.

(4) Carefully support the rotor in a vice fitted with soft jaws and remove the pulley nut, pulley, fan, woodruff key where fitted and spacer.



Hitachi Alternator LT125.02 showing Diode Locations Terminals and Wiring Connector.

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(5) Remove the bearing plate retaining screws from the drive end bracket.

(6) Support the drive end bracket on the bed of a press and carefully press the rotor and drive end bearing from the bracket.

(7) Using a bearing puller remove the bearing from the rotor shaft, remove the bearing retainer plate from the shaft and the bearing dust seal from the end bracket.

(8) Remove the slip ring end bearing using the bearing puller.

Models LT125.02 and AS2025A–1

Remove the heat sink, retaining bolt, nuts and washers from the end bracket.

On units fitted with one heat sink with the negative (–) diodes fitted directly into the end bracket, unsolder the stator leads using a very hot soldering iron while holding the diode wire with a pair of pointed pliers, remove the brush holder retaining screws.

Remove the end bracket from the stator winding and heat sinks at the same time easing the wiring terminal connector through the end bracket cover plate hole, note the position of all insulator washers and spacers for reassembly.

Remove the brush holder screws from the two heat sink type units and remove the brush terminal screws and wiring, remove the brush holder.

Unsolder the stator leads from the diodes using a very hot soldering iron while holding the diode wire with a pair of pointed pliers.

Unsolder the bridging wires from the diodes in preparation for testing.

Models LT125.06 and LT133.05

Unsolder the stator leads from the rectifier diode pack using a hot soldering iron while holding the diode leads with a pair of pointed pliers.

Remove the A terminal nut and the rectifier diode pack retaining nut and remove the rectifier diode pack assembly from the end bracket. Separate the stator windings from the end bracket.

TO CLEAN PARTS

(1) Do not immerse units of the alternator in cleaning solvents as damage to the windings will result.

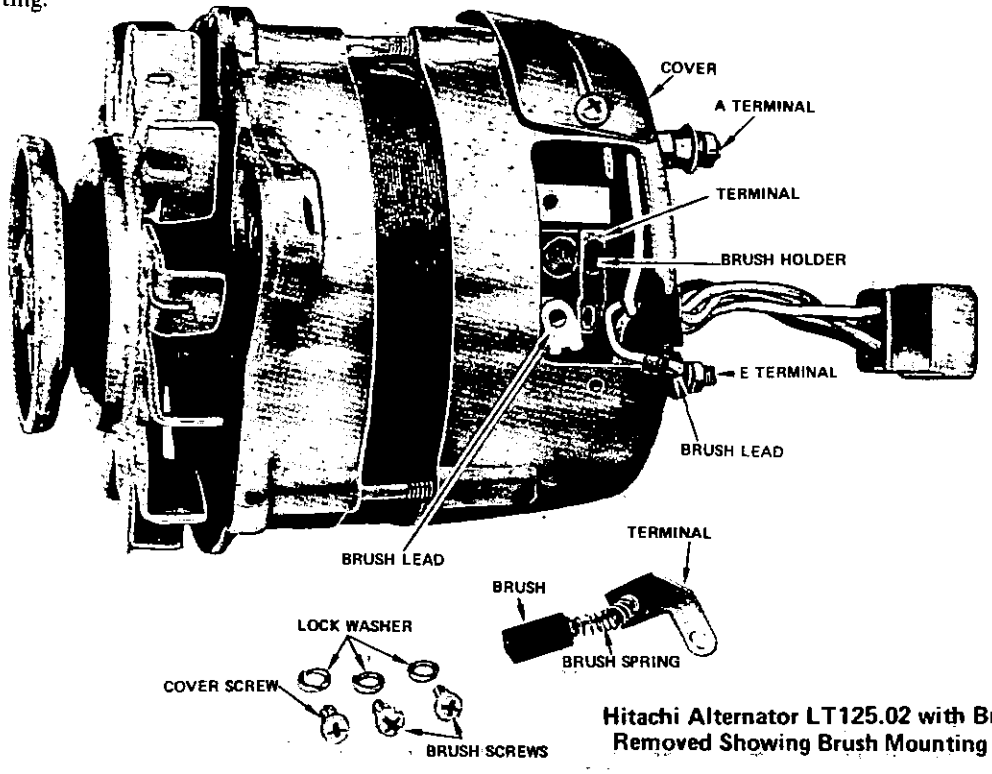
(2) The end brackets may be washed in kerosene or similar cleaning fluid after they have been completely dismantled from the unit. They should be thoroughly dried after cleaning.

(3) Compressed air can be used to carefully blow out the dust from the stator winding and the field winding on the rotor.

(4) Using a petrol damp rag carefully clean the slip ring assembly and check for any damage or wear. Never machine the slip rings. Any burrs or burn marks can be polished out with very fine sand paper (not emery paper).

(5) Clean the brushes and brush holders using a petrol damp rag and check and remove any burrs from the holders.

(6) The bearings are of the sealed ball type and are pre-packed shielded bearings and should be replaced when the alternator is overhauled if they show signs of being dry and rough.



Hitachi Alternator LT125.02 with Brush Cover Removed Showing Brush Mounting Positions.

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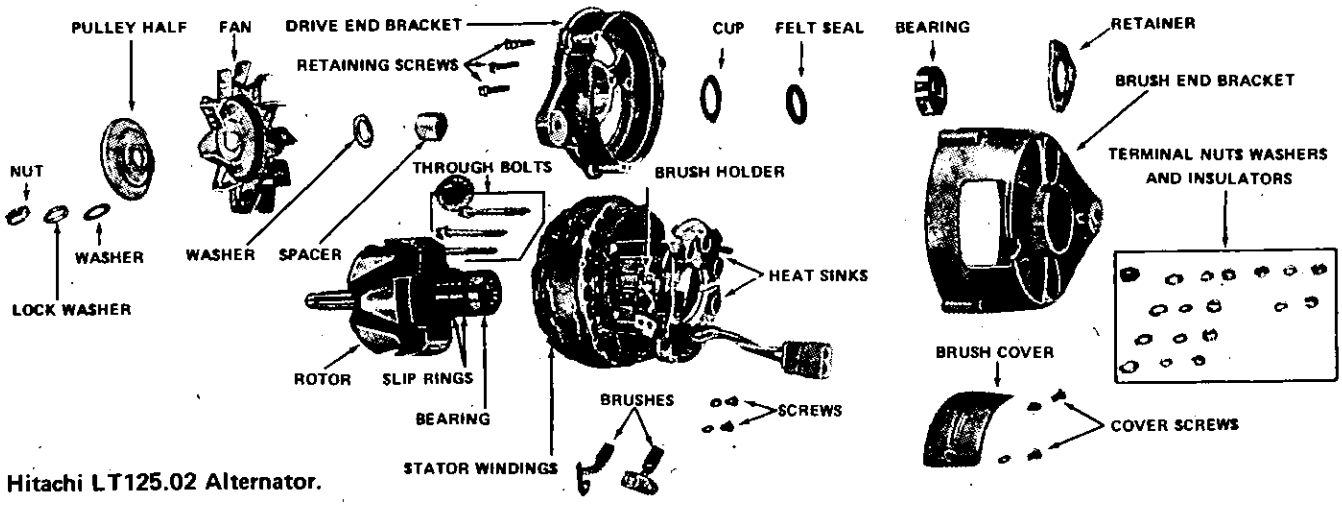

Hitachi LT125.02 Alternator.

TO CHECK AND TEST COMPONENT PARTS

All parts being electrically tested should be resting on a non-conductive pad.

Slip Rings

(1) Visually check the slip ring assembly for damage.

(2) Remove all burrs and burn marks with fine sand paper (not emery paper).

(3) With a 110 volt AC test lamp and prods, test the slip ring unit for an electrical bridge between the slip rings. The test lamp should not light.

NOTE: The above test is carried out with the field leads disconnected.

(4) If the test lamp lights up or burns dimly indicating an electrical bridge, a new slip ring assembly will have to be fitted.

(5) Using a 110 volt AC test lamp and prods check the slip ring to earth insulation by holding one prod on the rotor shaft and touching the other prod to each slip ring in turn.

(6) If the test lamp lights up or burns dimly indicating an electrical short, a new slip ring assembly will have to be fitted.

Field Windings and Rotor Assembly

(1) The insulation to earth test is done with the 110 volt test equipment, connect one of the test prods to one of the field wires and the other test prod to one pole piece of the rotor.

(2) If the test lamp lights or burns dimly and no visual earthing can be seen and rectified, a new rotor assembly will have to be fitted.

(3) To check for bridged or internal shorting of the field coil, connect a pair of test leads to a 12 volt battery with an ammeter connected in series with one lead, connect the test leads one to each field wire and note the ammeter reading, a high reading over 3.5 amps indicates a bridged circuit within the coil. No reading on the ammeter indicates an open circuit exists in the field coil. In both the above cases a new rotor assembly will have to be fitted.

Stator Windings

(1) The insulation to earth test is done with the 110 volt test equipment, connect one test prod to one stator wire and the other test prod to the laminated stator winding frame.

(2) If the lamp lights or burns dimly indicating a short circuit, a new stator winding assembly must be fitted.

(3) To test the continuity of the stator winding connect a pair of test leads to a 12 volt battery, connect in series with one of the leads a 36 watt globe.

(4) Connect the test leads across any two leads of the stator winding, the lamp should light. Repeat the operation to the remaining leads alternately.

(5) If the light fails to light on any one of the tests then the stator winding assembly will have to be renewed.

Diodes
Models LT125.02 and AS2025A–1.

CAUTION: Never use a hand driven generator type tester to test diodes.

Before the diodes can be tested the wiring has to be unsoldered from the diode leads, using a very hot soldering iron and holding the diode lead with a pair of pointed pliers to dissipate the heat and protect the diode, unsolder each wire in turn after marking and noting their connected positions.

Connect a pair of test leads to a 12 volt battery with a 1.5 watt globe in series with one lead, touch the diode wire with one lead and the heat sink of that diode with the other lead, then reverse the leads.

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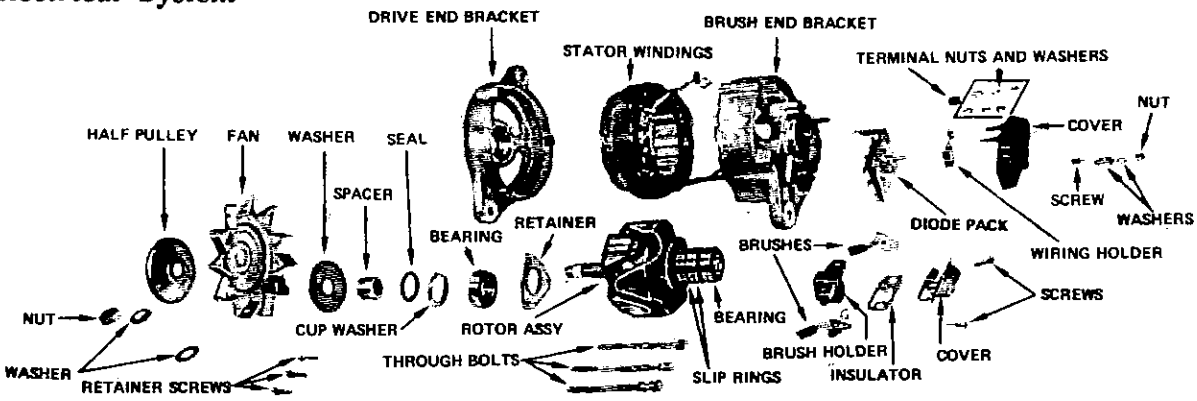

Exploded View of Hitachi LT125.06 and LT133.05 Alternator.

Repeat the tests to all diodes in turn. The globe should light when the leads are connected in one way only.

If any one or more of the diodes prove faulty, a new heat sink or the faulty diode(s) will have to be replaced.

Models LT126.06 and LT133.05

These units have the diodes mounted in a rectifier pack assembly and should any one diode prove unserviceable the rectifier pack will have to be replaced as an assembly.

Connect a pair of test leads to a 12 volt battery with a 1.5 watt globe in series with one lead.

Connect one test lead to the A terminal connecting link and the other lead to each heat sink in turn, the globe should light only when the lead is connected to one of the heat sinks, if the globe fails to light or light in both cases the rectifier diode pack is unserviceable which will necessitate a renewal of the assembly.

Brush Springs and Brushes

(1) Brush spring tension is tested with a push type spring tension gauge; push the spring and brush into the brush holder with the gauge until the face of the brushes and holder are flush. A serviceable spring should give a reading within specification limits. Replace unserviceable springs.

(2) The brushes should protrude from their holders, without tension on their springs when checking brush length. Fit new brushes when the measurement is less than specified.

Bearings

Check both tracks and balls or rollers for chips and roughness. Fit new bearings when in doubt of the serviceability of the old bearings.

TO ASSEMBLE

The assembly procedure is the reverse of the dismantling operations with attention to the following points.

(1) Carry out the cleaning operations and the testing and checking of component parts as laid down in the appropriate sections.

(2) Replace all worn, damaged, shorted or open circuited components.

(3) Take care not to damage the slip ring assembly when refitting.

(4) Resolder the field leads to the slip rings using a very hot soldering iron.

(5) Ensure that both ball races are serviceable. Fit new bearings when in doubt.

(6) Press the slip ring and bearing onto the rotor shaft.

(7) Instal the bearing dust seal into the drive end bracket with the bearing, bearing retainer and retainer screws.

(8) Press the bearing and drive end bracket onto the rotor shaft using a hollow arbor that will fit over the rotor shaft and contact the bearing centre.

NOTE: When fitting bearings always apply the fitting pressure on to the section of the bearing being fitted. Do not apply pressure through the balls or rollers.

(9) Instal the fan spacer and fit the woodruff key when used into its keyway.

(10) Fit the fan with the blades towards the alternator.

(11) Instal the pulley, lock washer and nut, tighten the nut to 3.8 kg/m (27 ft/lb).

(12) On LT125.02 and AS2025A–1 models resolder the stator leads to the diodes according to the tags and marks made before unsoldering the leads, take the necessary precautions to protect the diodes from being damaged by excessive heat.

(13) Resolder the terminal wiring back onto their original positions.

(14) Align the marks made on the brush end bracket and stator laminations before dismantling and assemble the two components while feeding the terminal wiring or stator leads through the end bracket cover plate hole.

(15) Instal the heat sink assembling bolts and insulation washers as noted when dismantling and tighten the retaining nuts evenly.

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(16) Instal the brush holder to the end bracke and or heat sink on LT125.02 and AS2025A–1 models.

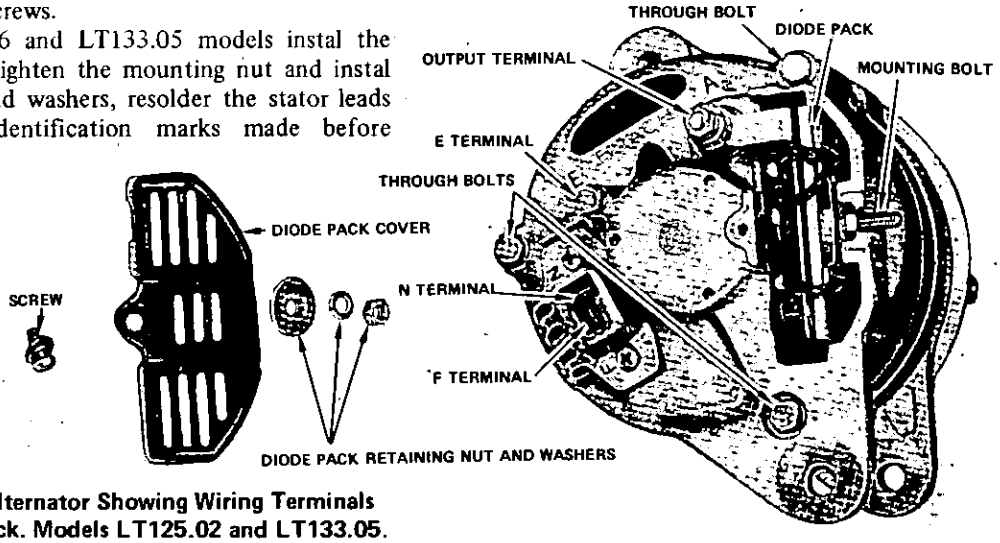
(17) Instal the rotor assembly aligning the marks made before dismantling.

(18) Instal the through bolts and tighten them evenly.

(19) On LT125.02 and AS2025A–1 models, instal the brushes and terminal screws.

(20) On LT125.06 and LT133.05 models instal the rectifier diode pack, tighten the mounting nut and instal the A terminal nut and washers, resolder the stator leads according to the identification marks made before dismantling taking the necessary precautions to protect the diodes from heat damage. Instal the brush holder and brushes, connect the wiring terminals to their respective screws and tighten all screws and terminals.

(21) Refit the end bracket brush cover and retaining screws.



End View of Hitachi Alternator Showing Wiring Terminals and Diode Rectifier Pack. Models LT125.02 and LT133.05.

3. ALTERNATOR REGULATOR

DESCRIPTION

The alternator regulator is a two unit type comprising a pilot lamp relay and a voltage regulator.

A cut-out relay is not required as a reverse current cannot flow from the battery to the alternator at any time, even with the engine stopped, due to the effect of the diode rectifiers.

The voltage relay directs the charging system voltage to the field circuit when the engine is running.

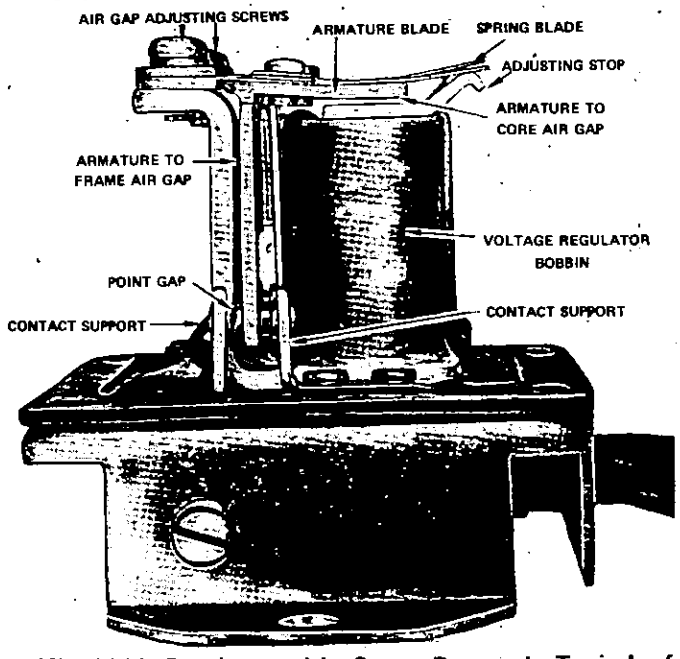
When the ignition is switched on, current from the battery flows through the charge indicator light, a parallel resistance and the voltage regulator contacts to the field coil of the rotor to supply a starting current for the alternator to commence charging. This is necessary, as the residual magnetism retained by the alternator is insufficient to start a voltage build-up within the alternator. The voltage regulator controls the alternator output according to the voltage of the battery and rpm of the engine.

REGULATOR ADJUSTMENTS

When testing or adjusting the alternator regulator on the vehicle, disconnect the earth lead at the battery negative terminal before attempting to connect the test instruments, removing or replacing the regulator cover, or making any adjustments. This is to obviate the possibility of short circuiting any of the regulator terminals or wires to earth, which would result in serious damage to the alternator or regulator.

Voltage relay and voltage regulator gap adjustment should be made with the regulator unit removed from the vehicle.

Electrical tests and adjustments should be made with the regulator unit on the vehicle, using reliable test equipment.



Mitsubishi Regulator with Cover Removed. Typical of Hitachi Early Model Voltage Control Unit.

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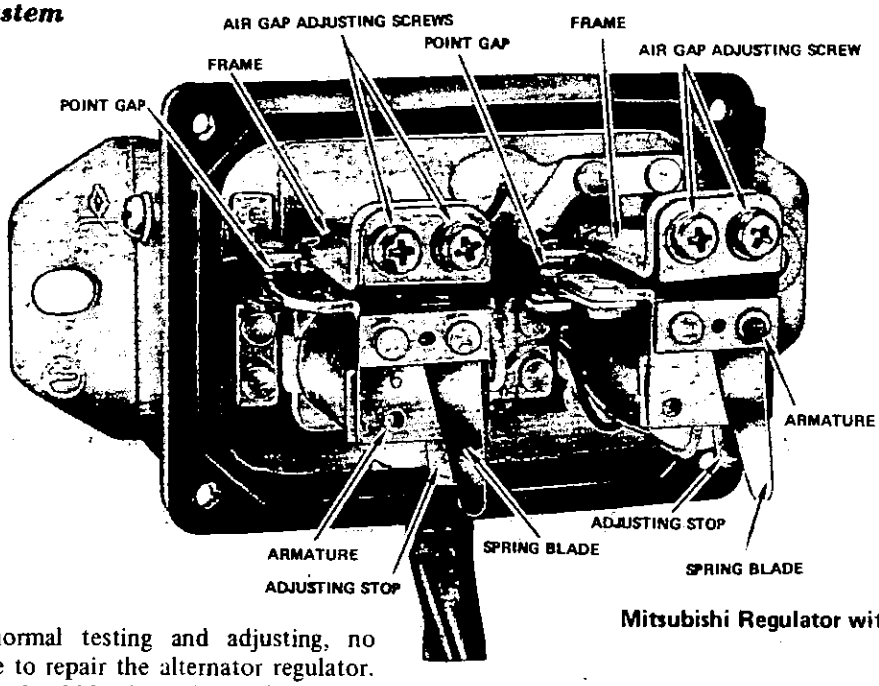
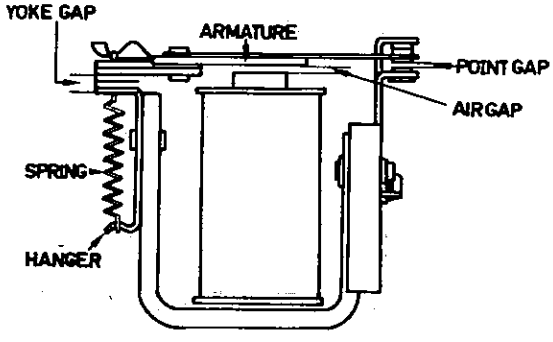


Mitsubishi Regulator with Cover Removed.

Apart from the normal testing and adjusting, no attempt should be made to repair the alternator regulator.

Dirty contact points should be dressed with fine emery cloth or carborundum stone and washed thoroughly after in a cleaning solvent. Burned or pitted points will necessitate the unit being replaced.

NOTE: Do not immerse the regulator unit in cleaning solvent as damage to the coil windings could result.



Early Model Hitachi Regulator Pilot Lamp Relay.

TO REMOVE AND INSTAL

(1) Disconnect the battery negative (–) terminal.

(2) Remove the regulator mounting screws.

(3) Disconnect the wiring terminal block and remove the unit from the vehicle.

Installation is the reverse to the removal procedure.

MECHANICAL ADJUSTMENTS

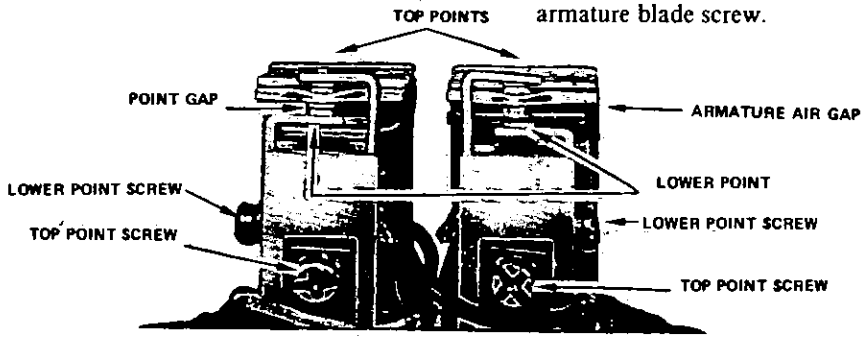
The mechanical adjustments should be carried out in the following order, starting with the voltage regulator unit.

Voltage Regulator – TLIZ10A and RL2220B5

(1) Remove the regulator from the vehicle with its harness and connector.

(2) Polish the regulator points using very fine emery cloth, clean thoroughly after polishing.

(3) Check the air gap between the armature blade and frame using a feeler gauge of the correct dimension, adjust the air gap by loosening the armature blade screw and moving the blade against the feeler gauge and retighten the armature blade screw.



Hitachi TLIZ-37 Regulator Showing Point Gaps and Air Gaps.

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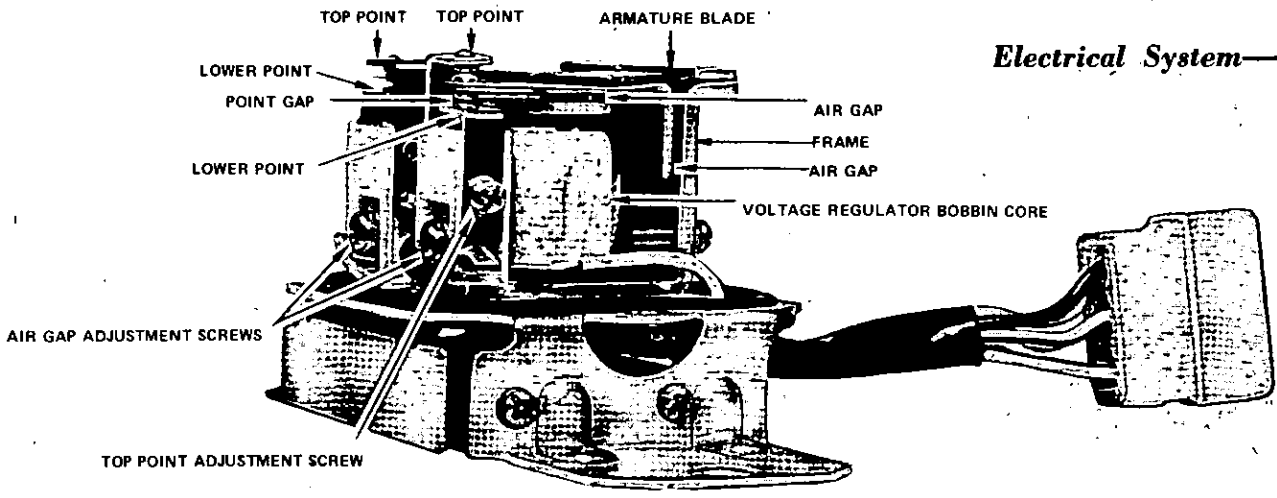


Hitachi TLIZ-37 Regulator with Cover Removed Showing Air Gap and Point Adjustments.

(4) Check the air gap between the bobbin core and armature blade using a feeler gauge of the correct dimension, adjust by bending the primary contact support bracket.

(5) Check the point gap with the armature at rest, using a feeler gauge of the correct dimension, adjust the point gap by bending the secondary contact support bracket.

Pilot Lamp Relay – TLIZ10A

(1) Check the yoke air gap between the armature blade and yoke (frame) using a feeler gauge of the correct dimension, adjust the gap at the armature set screw.

(2) Check the air gap between the bobbin core and armature blade using a feeler gauge of the correct dimension, adjust the air gap by loosening the retaining screw of the upper contact point blade and moving the blade in the direction required using a screw driver positioned in the adjusting slot.

(3) Check the point gap between the armature blade point and the lower fixed point with the armature blade at rest against the top point, use a feeler gauge of the correct dimension to check the gap, and adjust the gap by loosening the point support screw and moving the point support up or down to obtain the correct gap.

Voltage Regulator and Charge Relay – TLIZ37

(1) Remove the regulator from the vehicle with its harness and connector.

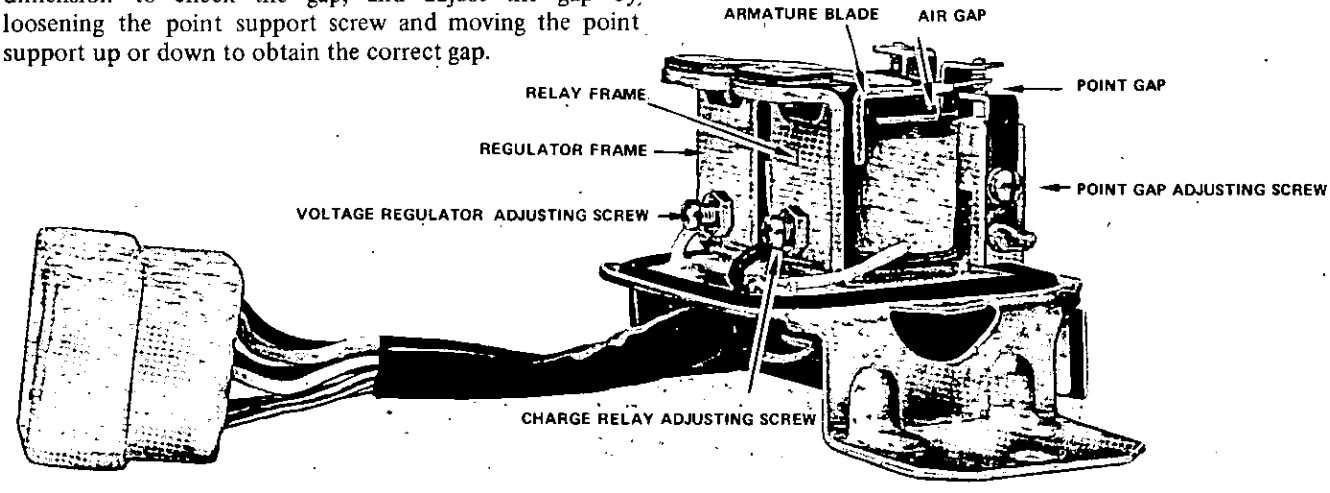
(2) Polish the regulator points with very fine emery cloth, clean thoroughly after polishing.

(3) Check the air gap between the bobbin core and armature blade using a feeler gauge of the correct dimension, adjust the air gap by loosening the top point support to frame retaining screw and move the point support to give the correct air gap, retighten the retaining screw.

(4) Check the point gap with the armature at rest using a feeler gauge of the correct dimension, adjust the point gap by loosening the lower point support retaining screw and moving the point support to obtain the correct gap, retighten the retaining screw.

ELECTRICAL ADJUSTMENTS
Charge Relay

The charge relay check and adjustment is done with the regulator removed from the vehicle.



Hitachi TLIZ-37 Regulator with Cover Removed Showing Regulator Adjusting Screws.

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(1) Disconnect the negative (–) battery terminal.

(2) Remove the regulator from the vehicle.

(3) Remove the cover from the regulator.

(4) Using a fully charged 12 volt battery connect a 0–3 ohm variable resistance with a switch in series between the positive (+) terminal and the N terminal (yellow wire) of the regulator wiring socket, leave the switch in the off position and the resistor at maximum.

(5) Connect a 12 volt 3 watt globe in series between the positive (+) battery terminal and the L terminal (red with white trace wire) of the regulator wiring socket.

(6) Connect the negative (–) battery terminal to the E terminal (black wire) of the regulator.

(7) Connect a 0–20 volt test voltmeter between the regulator side of the variable resistor and the E terminal or negative battery terminal.

(8) Turn on the switch and slowly reduce the resistance of the variable resistor until the test lamp goes out, note the voltage reading at this point which should be between 4.5 and 5.2 volts.

(9) To adjust, turn off the switch, turn the resistor to maximum, loosen the lock nut and screw the adjusting screw in to increase and out to decrease the boltage at which the lamp will go out, tighten the locknut after each adjustment and recheck as in item (8).

(10) After the charge relay adjustment is completed remove the test instruments and wiring and instal the regulator unit cover and instal the unit onto the vehicle.

Voltage Regulator – TLIZ10A and RL2220B5

(1) Check the state of charge of the vehicle battery, should it be under three quarters charged, recharge or replace it with a fully charged one before the electrical tests and adjustments are attempted.

(2) Disconnect the negative (–) battery terminal.

(3) Disconnect the wire from the battery terminal on the alternator.

(4) Connect a 0–50 amp test ammeter in series between the disconnected wire and the alternator battery terminal.

(5) Connect a 0–20 volt test voltmeter in parallel between the alternator battery terminal and a good earth such as the negative (–) battery lead.

(6) Make sure the regulator unit is firmly mounted to the vehicle and that the wiring terminal connection is firmly joined.

(7) Connect a tachometer to the engine according to the manufacturer's instructions.

(8) Reconnect the negative (–) battery terminal and start the engine and bring to operating temperature.

(9) Mount a thermometer on the cover of the regulator to register the ambient temperature, the thermometer can be held in place with a lump of putty or similar substance.

(10) When the engine reaches operating temperature and the ambient temperature reaches its maximum, allow the engine to idle then slowly increase the rpm and note the voltmeter reading which will rise with the engine speed until the regulator voltage is reached when the voltmeter needle will give a slight kickback, refer Specifications for correct setting.

(11) Increase the engine speed to approximately 2200 rpm and check that the voltage reading remains within Specifications.

(12) Should the voltage setting of the regulator not meet with Specifications stop the engine and remove the negative (–) battery terminal, remove the regulator cover and bend the voltage regulator armature spring blade stop up to increase the voltage setting and down to decrease the voltage setting.

NOTE: It is only necessary to bend the stop a minute amount to alter the voltage setting.

(13) After making the adjustment, replace the cover of the regulator, reconnect the negative (–) battery terminal and restart the engine.

(14) Repeat operations (9) to (13) until the correct voltage setting is obtained.

NOTE: If the voltage build up of the alternator cannot be controlled by the regulator it indicates that the regulator unit is at fault and should be replaced with a serviceable unit.

(15) After the voltage regulator adjustment has been corrected stop the engine and disconnect the negative (–) battery terminal, remove the test instruments and reconnect all wiring to the correct terminals, reconnect the negative (–) battery terminal.

Voltage Regulator – TLIZ37

To check and adjust the voltage setting the regulator unit should be installed in its mounted position on the vehicle.

(1) Check that the regulator points are clean and free from pits or burn marks.

(2) Check the state of charge of the vehicle battery, should it not be fully charged either charge it or replace it, with a fully charged one before the electrical tests and adjustments are attempted.

(3) Disconnect the negative (–) battery terminal.

(4) Disconnect the A terminal wiring from the alternator and connect a 0–50 amp test ammeter and a 0.25 ohm resistor in series with the terminal and disconnected lead, bridge the resistor and ammeter with a jumper lead to protect the ammeter until the alternator commences to charge.

(5) Connect a 0–20 volt test voltmeter between the A terminal of the alternator and the negative battery terminal.

(6) Connect a tachometer to the engine according to the manufacturer's instructions.

(7) Make sure all light switches and accessories are turned off.

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(8) Mount a thermometer on the cover of the regulator to register the ambient temperature, a cylindrical type thermometer may be held in place with a lump of putty or similar substance.

(9) Start the engine and allow it to reach operating temperature.

(10) Remove the jumper lead bridging the ammeter resistor and increase the engine speed to approximately 2500 rpm, the ammeter reading should be less than 5 amps after a few minutes operation.

(11) With the engine operating at 2500 rpm check the voltage reading on the voltmeter and note the ambient temperature reading on the thermometer, compare the readings with Specifications.

(12) If the voltage reading is not to specifications allow the engine to idle and reconnect the jumper lead bridge to protect the ammeter, then stop the engine.

(13) Remove the negative (–) battery terminal.

(14) Remove the regulator cover.

(15) Reconnect the negative battery terminal.

(16) Start the engine again and remove the jumper lead bridge.

(17) Loosen the adjusting screw lock nut and turn the adjusting screw in to increase the reading and out to decrease the reading. Tighten the locknut after each adjustment.

NOTE: The adjustment must be made within one minute after the removal of the regulator cover as the change in temperature occuring in the unit will alter the voltage setting and the procedure will have to be repeated after the unit has normalised with the cover installed.

(18) After the adjustment is completed stop the engine and remove the negative (–) battery terminal, disconnect the test instruments and reconnect the alternator A terminal and wiring.

(19) Reconnect the negative battery terminal.

4. STARTER MOTOR

DESCRIPTION

The starter motor is a 12 volt, series wound, four pole, four brush or two brush unit.

The starter motor is equipped with a solenoid actuated pre-engaging starter drive and over-running clutch assembly. The solenoid is attached to the starter frame; the solenoid plunger is connected to the over-running clutch and drive pinion assembly through a link, lever and pivot pin arrangement.

When the solenoid windings are energised, the plunger acting on the lever and pivot engages the drive pinion with the flywheel ring gear and at the same time closes the switch supplying power from the positive lead of the battery to the starter motor field coils to operate the motor.

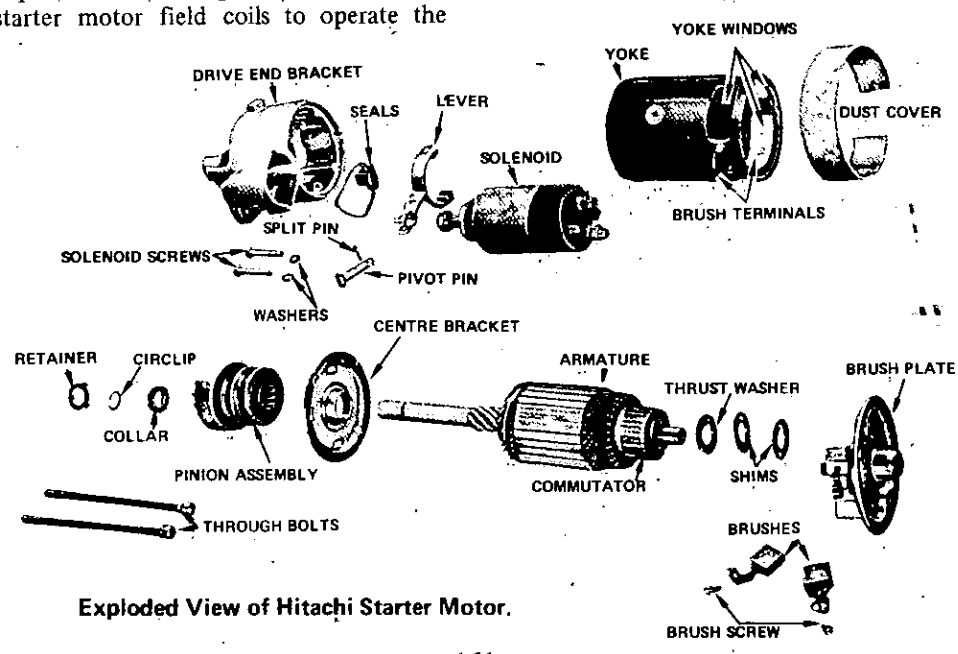
As the engine fires, the over-running clutch of the drive pinion assembly prevents high speed rotation of, and possible damage to, the starter armature if the solenoid windings are not immediately de-energised by releasing the switch key.

The starter solenoid switch windings are energised by the key operated combination ignition and starter switch.

TO TEST ON THE VEHICLE

Should the starter fail to operate when the switch is moved to the start position check the following points.

(1) Check the battery condition and state of charge, refer to battery section of this manual.



Exploded View of Hitachi Starter Motor.

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(2) Clean the battery terminals taking particular care to remove the scale from the positive (+) terminal post and terminal.

(3) Check the earth connections for tightness and cleanliness, do not overtighten the terminals.

(4) Switch on the headlamps and operate the starter control switch, if the lights go dim but the starter is not heard to operate it could indicate that a short circuit or high resistance has developed in the starting system which could be either external or internal.

(5) Check all the external wiring to make sure the fault is not external, if the external circuit proves satisfactory, indicating that the problem is in the starter assembly, the unit will have to be removed and bench checked.

TO REMOVE AND INSTAL

(1) Disconnect the battery terminal negative lead.

(2) Disconnect the battery lead from the starter solenoid.

(3) Disconnect the switch wire from the solenoid.

(4) Remove the two starter mounting nuts and lock washers.

(5) Remove the starter motor from the engine.

(6) The installation procedure is the reverse to the removal operations.

TO DISMANTLE

(1) Disconnect the field lead from the solenoid terminal.

(2) Remove the split pin from the pinion lever pivot pin and remove the pivot pin.

(3) Remove the solenoid mounting screws and unhook the solenoid plunger from the pinion lever and remove the solenoid and plunger assembly.

(4) Remove the dust seals from the solenoid mounting position.

(5) Remove the dust cover from the yoke windows.

(6) Remove the brush terminal screws and remove the brushes.

(7) Remove the two assembly through bolts and remove the commutator end bracket.

(8) Separate the drive end bracket and armature from the yoke.

(9) Remove the armature, pinion and clutch assembly with the pinion lever from the drive end bracket.

(10) Remove the circlip and collar from the armature shaft, tap the collar towards the pinion to gain access to the circlip.

(11) Remove the clutch and pinion assembly from the armature shaft.

(12) Remove the centre bracket from the armature shaft.

(13) If the field coils are to be removed mark the location of each individual pole shoe before removing the mounting screws. The pole shoes must be replaced in the same position from which they were removed.

TO CHECK AND INSPECT

(1) With the starter motor dismantled check the brush holder insulation, using a 110 volt test prod equipment with a globe in series with one lead.

Connect one test prod lead on the brush holder positive side and the other lead on the negative side. If there is any indication of leakage the globe will light or an arcing will occur at the point of shorting, either repair or replace the brush holder if a short circuit is evident.

(2) Check the brushes for adequate length. Brushes should be renewed when their length is below specifications: They should be a free sliding fit in the brush guides.

(3) Check the brush spring tension with a pull scale. Compare with Specifications.

(4) Check that the commutator is free from pitting and burning, clean with a petrol moistened cloth, and polish with a strip of fine glass paper.

A badly worn commutator may be cleaned up by mounting the armature in a lathe, spinning at high speed, and a light cut taken across the commutator with a very sharp tool. After turning, recut the insulation between segments to Specifications.

(5) Check the armature for short circuit, using a growler or by using the 110 volt test prods and globe.

(6) Place one of the test prods on the armature core or shaft and move the other prod around the circumference of the commutator. If the test lamp lights at any point, the armature is faulty and should be replaced.

(7) Test the field coils for continuity by connecting the test prods in series with the field windings. Failure of the lamp to light indicates an open circuit in the wiring of the field coils.

(8) Check the field coil for ground by placing one test prod on the field coil lead and the other lead on he starter yoke. If the globe lights or an arcing occurs between the field coils and earth, remove the field coils and repair or renew.

(9) Check the armature shaft bushes for wear. Check with specifications and replace as necessary. The old brushes must be removed and the new ones pressed into the end brackets and centre bracket using a polished mandrel of the exact diameter of the armature shaft.

NOTE: The new bushes must not be reamed to size, as reaming will impair the porosity of the bushes and cause early failure. New bushes should be allowed to stand immersed in clean light engine oil for 24 hours before fitting. This time period may be shortened to two hours in case of urgency, if the oil is heated to 100°C (212°F).

(10) Check the armature shaft for bend between centres using a dial gauge. Refer Specifications for

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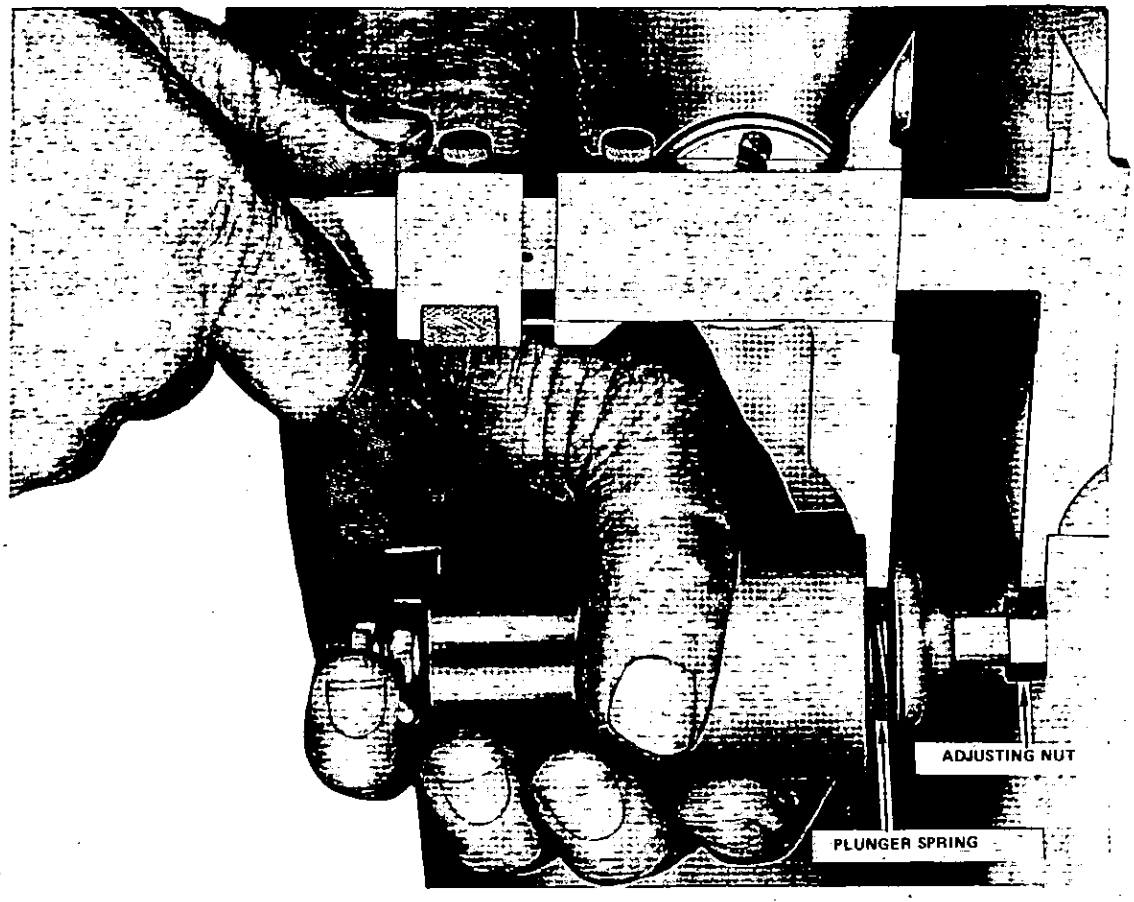

Showing Method of Measuring Protruding Length of Plunger from Solenoid Face to Adjusting Nut.

tolerances. Replace the armature if it is not within Specifications.

(11) Check the drive assembly clutch pinion teeth for wear, scoring or chipping. A clutch in good condition should take up the drive in one direction only. It should rotate easily and smoothly in the non-drive direction and the assembly should move smoothly along the armature helical splines.

NOTE: Do not wash the drive assembly or clutch in solvent as this will destroy the clutch lubricant and cause early failure of the unit.

(12) To replace the thrust plate and spring remove the circlip from the sleeve while compressing the spring with the thrust plate.

(13) Check the ring gear for chipped worn and/or bent teeth, replace as necessary.

TO ASSEMBLE

(1) Lubricate the drive assembly on the armature shaft splines, armature shaft bushes and solenoid switch moving stud with a light coating of multi-purpose grease.

(2) Instal the centre bracket to the armature shaft.

(3) Assemble the clutch and pinion to the shaft, fit the collar with the cup away from the pinion, fit the circlip and stake in position and fit the collar over the circlip.

(4) Check the protruding length of the plunger adjusting nut by pressing the solenoid plunger against a flat surface to completely depress the plunger, measure the distance from the face of the solenoid to the face of the flat surface, adjust the adjusting nut to give the correct measurement. Refer Specifications.

(5) Assemble the armature, starter clutch, pinion lever and centre bracket to the drive end bracket.

NOTE: Make sure the thrust washer assembly and the lever are correctly meshed.

(6) Instal the armature and drive end bracket assembly to the yoke.

(7) Instal the commutator end thrust washers to the armature shaft.

(8) Instal the brush plate bracket and through bolts.

(9) Tighten the through bolts and check the armature end-float. Refer Specifications, adjust with shims at commutator end.

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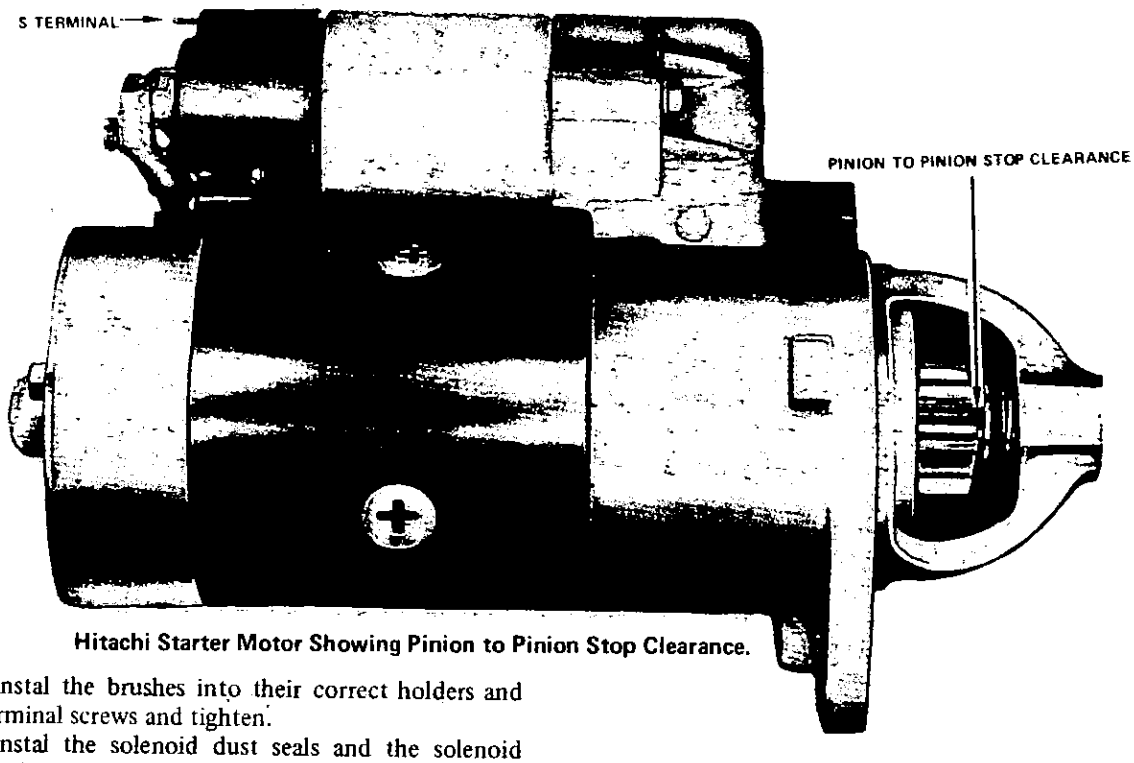

Hitachi Starter Motor Showing Pinion to Pinion Stop Clearance.

(10) Instal the brushes into their correct holders and fit their terminal screws and tighten.

(11) Instal the solenoid dust seals and the solenoid plunger to the pinion lever, invert the starter to allow the pinion lever to move into position to instal the pivot pin, move the solenoid to align the pivot pin holes and instal the pivot pin, fit the solenoid mounting screws and tighten, instal the split pin to the pivot pin.

(12) Instal the dust cover over the yoke windows.

TEST AND ADJUST

Starter Solenoid

The solenoid unit should be tested with the unit mounted on the starter motor and connected in its operating position but with the starter field lead disconnected.

(1) To test the series coil mount the starter motor securely in a vice, connect the negative terminal of a fully charged 12 volt battery to the M terminal of the solenoid using a suitable jumper lead.

(2) Make an 8 volt tapping on the battery and connect a jumper lead with a switch in series to the solenoid S terminal.

(3) Close the switch, the solenoid should be activated and the plunger pulled smartly into the solenoid moving the pinion assembly forward on the shaft.

(4) To test the hold-in coil connect the solenoid case to the negative battery terminal, energise the solenoid as for the series coil test then remove the M terminal connection. The solenoid plunger should remain held in the solenoid if the hold-in winding is serviceable.

(5) To check the pinion to pinion stop clearance, energise the solenoid as above to move the pinion into its mesh position.

(6) Measure the clearance between the pinion and the pinion stop. Refer Specifications for the correct clearance.

NOTE: Only hold the solenoid energised long enough to make the measurement as damage to the solenoid could occur from over-heating.

(7) If the pinion to pinion stop clearance is not within specifications remove the solenoid and adjust the plunger adjusting nut, instal the solenoid and recheck the clearance, repeat the operation until the clearance is within Specifications.

(8) When he pinion to pinion stop clearance is correctly adjusted remove the jumper leads and connect the field wire to the terminal of the solenoid.

Starter Motor

(1) Proceed with the no-load test after checking and adjusting the solenoid and pinion clearance.

(2) Connect an ammeter capable of reading 0–500 amps in series with the positive battery terminal and the solenoid B-terminal using heavy core cable.

(3) Earth the negative battery terminal to the starter body using heavy core cable.

(4) Bridge the B-terminal and the S-terminal of the solenoid using a jumper lead with a switch connected in series.

(5) Connect a revolution counter to the armature shaft.

(6) Close the switch in the jumper lead between the B and S terminals and note the rpm and current draw of the

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starter motor, compare the readings with specifications.

(7) After completing the starter test remove the test instruments and leads.

NOTE: High amperage reading with low revolutions check for shorted armature, shorted fields, worn bushes, bent armature shaft or poling armature; high amperage draw with no revolutions check for shorted field coils, shorted armature or shorted brushes.

To carry out the lock torque test, mount the starter motor on a starter test bench and make the connections according to the manufacturer's instructions, use a high amperage variable resistor in the battery circuit so that the voltage can be controlled accurately as small variations in voltage and amperage can considerably alter the torque of the starter motor. Refer Specifications for the correct test figures.

5. DISTRIBUTOR

DESCRIPTION

The distributor is driven by a skew gear from the camshaft. Mechanical advance and vacuum advance systems are incorporated in the distributor. Mechanical advance is by centrifugal weights mounted to the shaft and governed by one advance spring on all models except D411 – 61 which has two advance control springs.

The vacuum advance consists of a diapragm unit mounted externally onto the distributor body with linkage to the breaker plate from the diaphragm, advance is controlled by engine loadings.

TO CLEAN AND ADJUST BREAKER POINTS

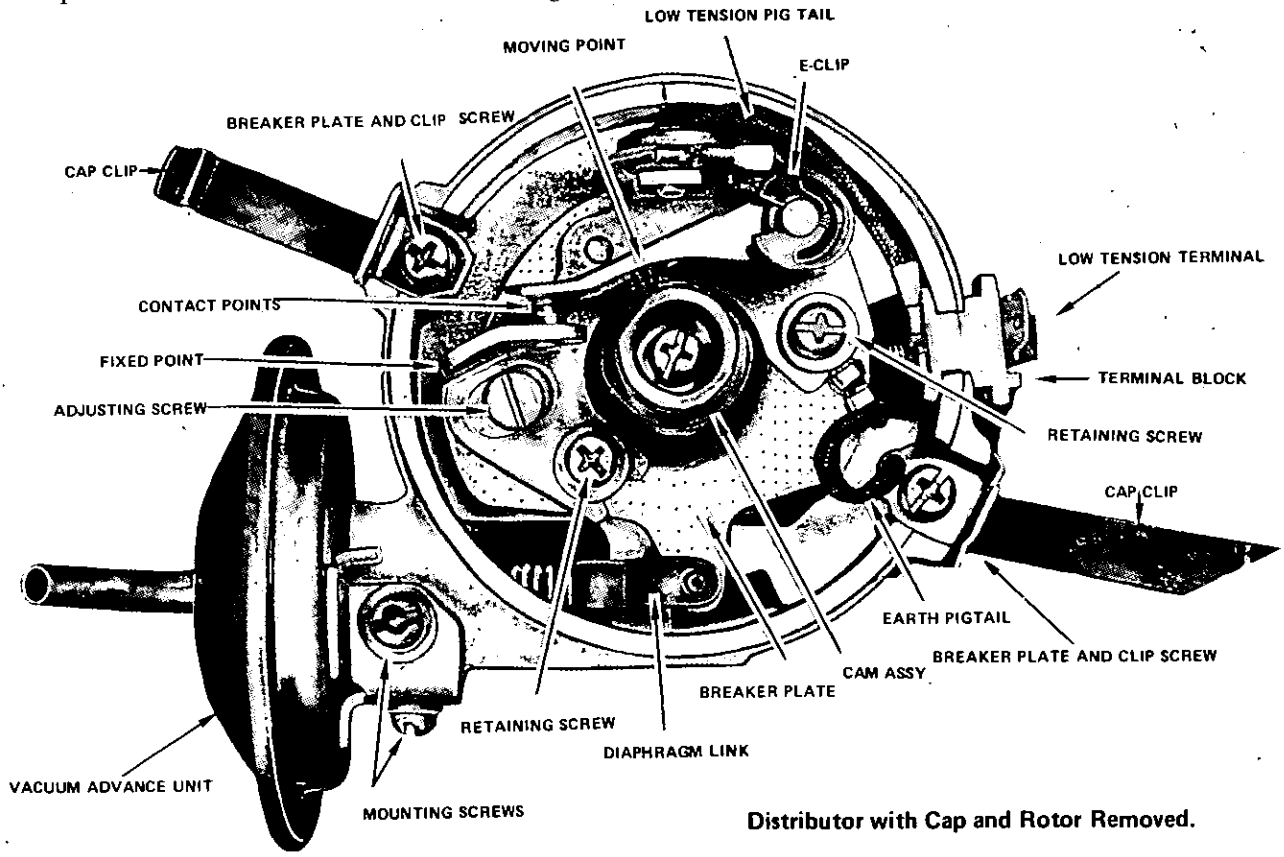
At intervals of 4000 km (3000 miles) the contact breaker points should be checked for excessive burning and pitting and the dwell angle should be checked and adjusted if necessary.

Points that are badly pitted and burned should be replaced. Points that are still serviceable should be cleaned to a smooth, square surface on a fine oil stone. Remove all traces of oil from the points by washing them in petrol as oil or grease on the points will cause pitting and burning.

(1) To remove the breaker points firstly remove the distributor cap and rotor button, then loosen the low tension lead screw on the fixed point and slide the wire terminal from behind the screw.

(2) Loosen the fixed plate retaining screws, do not remove the screws.

(3) Slide the breaker point assembly away from the retaining screws and adjusting screw, at the same time lift the breaker points clear of the distributor.



Distributor with Cap and Rotor Removed.

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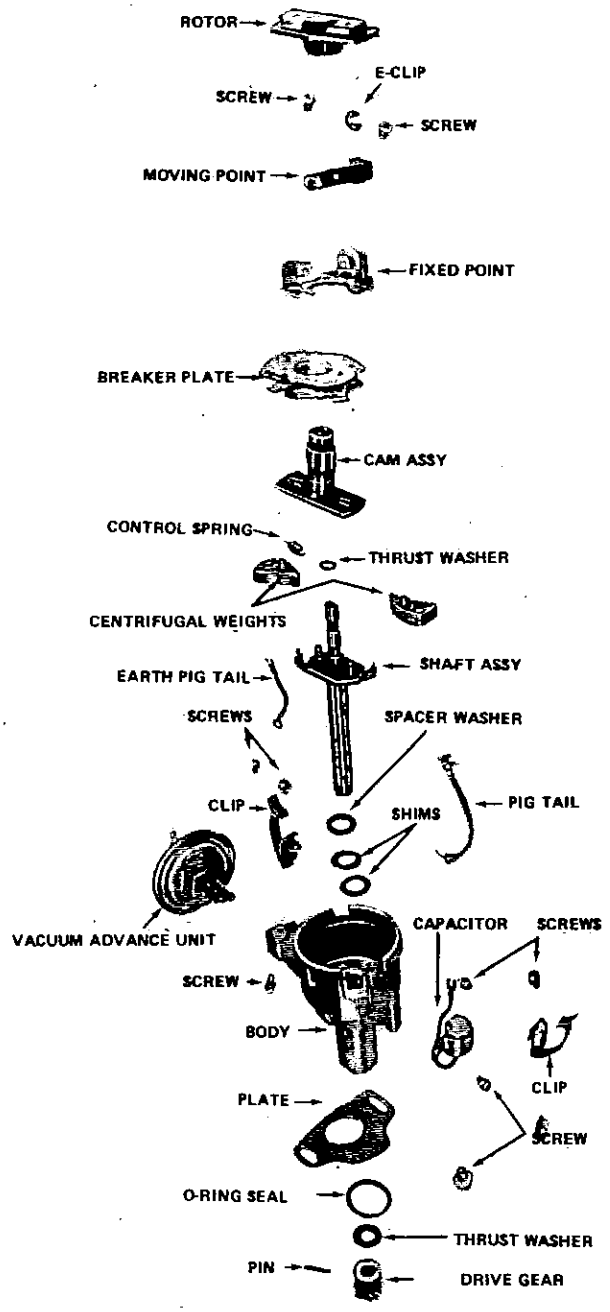
(4) To instal the breaker points reverse the removal procedure.

(5) Turn the engine until the rubbing block of the moving contacts is on the highest point of the cam lobe.

(6) Slightly loosen the fixed contact plate lock screw and using a suitable screwdriver, move the contact plate in the necessary direction until a clean feeler gauge blade of the specified thickness is a neat sliding fit in the point gap, then retighten the contact plate lock screw. Again check the fit of the feeler gauge blade between the contact points.



Exploded View of the Distributor Components. Model D411-61 Distributor uses two Control Springs.

NOTE: If new points are being fitted, set the gap at the upper limit of the specifications as the initial wear of a new breaker arm rubbing block will be rapid. If the points have been in use for some time, but are still serviceable, set the gap at approximately mid-way between the upper and lower limits of the specifications.

(7) Turn the engine and measure the contact point gap at each cam lobe, being sure that the heel of the breaker arm rubbing block is in the position of maximum lift on each cam.

(8) Measure the breaker arm pressure with a spring tension tester by pulling at right angles with the breaker points, see Specifications.

(9) Place a smear of high melting point grease on the lobes of the cam assembly and instal the rotor arm and the distributor cap.

(10) Connect the dwell meter and check the contact dwell, adjust if necessary to specifications.

(11) Connect the timing light and check the ignition timing.

TO REMOVE

(1) With the distributor cap removed turn the engine until the ignition timing mark indicates number one cylinder is on tdc that is, with the pointer in line with the extreme left hand mark on the pulley when looking at the engine from the front of the vehicle and the rotor button in line with number one high tension lead terminal position.

(2) Remove the vacuum advance line from the vacuum advance control unit.

(3) Remove the primary ignition lead from the terminal block.

(4) Remove the set bolt holding the mounting plate to the engine block and remove the distributor from the engine.

TO DISMANTLE

(1) Remove the rotor button.

(2) Remove the vacuum advance control unit mounting screws, disconnect the linkage from the diaphragm to breaker plate and remove the advance unit.

(3) Loosen the contact breaker point retaining screws and terminal screw, slide out the wire terminal and remove the contact breaker points.

(4) Remove the 'E' clip from the moving point pivot post and separate the breaker points.

(5) Remove the low tension terminal block and capacitor from the distributor body.

(6) Remove the two screws holding the fixed breaker plate to the distributor body and remove the breaker plate assembly.

(7) To dismantle the breaker plates compress the spring to gain access to the circlip and remove the circlip and spring, taking care not to lose the balls between the spring and plate and the two breaker plates.

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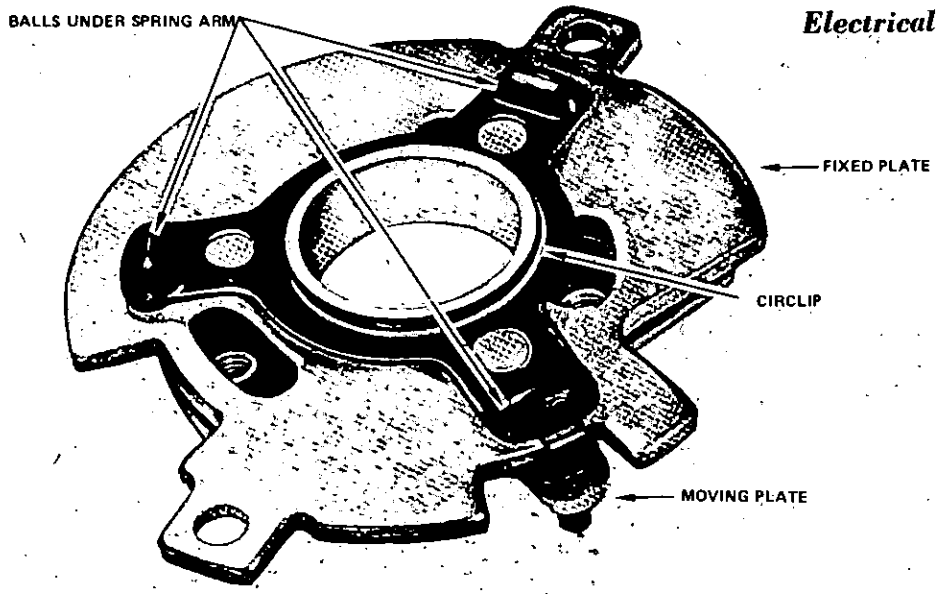

Under Side of Fixed Breaker Plate Showing Spring and Breaker Plate Assembly.

(8) Invert the distributor body and remove the screw holding the mounting plate to the distributor body.

(9) Support the distributor shaft near the drive end and using a hammer and suitable drift tap the drive pin from the shaft and drive gear.

NOTE: Mark the position of the drive gear in relation to the shaft for correct assembly.

(10) Remove the drive gear, spacer washer, 'O' ring seal and mounting plate from the distributor body.

(11) Remove the shaft assembly, spacer washers and shims from the distributor body.

(12) Mark the position of the rotor drive key of the cam assembly in relation to the shaft with a daub of quick drying paint on the centrifugal weight carrier of the shaft and an arm of the advance plate of the cam assembly.

(13) Remove the cam assembly retaining screw and the cam assembly.

(14) Mark the position of the centrifugal weights and the control spring(s) using quick drying paint.

(15) Remove both centrifugal weights, the advance control springs and cam assembly thrust washer from the shaft.

TO CLEAN AND INSPECT

(1) Thoroughly clean all parts with cleaning solvent, taking care not to immerse the capacitor or vacuum advance unit in solvent.

(2) Check and test the capacitor using a capacitor tester.

(3) Check the contacts for pitting and burning and, if necessary, renew as a set only.

NOTE: Points should be cleaned with a contact file or oil stone, never use emery cloth or sandpaper.

(4) Check the low tension and earth wires for possible fractures.

(5) Check the distributor shaft and body for wear and renew as necessary. Maximum clearance between shaft and body should not exceed 0.08 mm (0.003 in), if the clearance is in excess of this figure it will necessitate the renewal of the shaft and body.

(6) Check the cams for wear or roughness, variations in lift between any two cams in excess of 0.05 mm (0.002 in) will necessitate renewing the cam assembly.

(7) Check the clearance between the shaft and cam assembly, maximum clearance is 0.029 mm (0.0015 in). Clearance in excess of this figure will necessitate the renewal of the shaft and cam assembly.

(8) Inspect the governor weights for binding with the pivot pin.

(9) Check the distributor cap for cracks, carbon tracks, burned or corroded terminals.

(10) Check centre carbon for wear and protrusion.

(11) Check rotor for damage or deterioration.

(12) Check the vacuum advance unit for leaking diaphragm. To do this, push in on the diaphragm connecting link, place a finger over the suction pipe and release the connecting link. The vacuum on the finger should hold for at least 30 seconds.

(13) Check the rubber 'O' ring seal and renew as necessary.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points.

(1) Apply a small amount of high melting point grease to the centrifugal weight pivot posts and rubbing points of the weights before assembling.

(2) Instal the control springs as marked or noted on dismantling.

(3) Instal the cam assembly thrust washer and cam assembly as marked on dismantling.

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NOTE: On all single control spring models check that the long slot in the cam assembly advance plate is fitted to the weight with the control spring attached and the short slot is fitted to the weight without the control spring.

On dual control spring models the shortest spring is attached to the centrifugal weight which is installed into the long slot of the cam assembly advance plate and the longer spring is fitted to the weight which is installed into the short slot of the advance plate.

(4) Instal the cam assembly retaining screw and tighten.

(5) Place the washers on the distributor shaft and instal the shaft into the housing.

NOTE: Starting from the top the washers are in the following order – washer, bakelite washer and adjusting washer. Lubricate the shaft with engine oil before installing.

(6) Instal the mounting plate and the 'O' ring seal to the distributor body and instal the mounting plate to distributor body screw with the scale at the centre position, tighten the screw.

(7) Instal the drive gear and thrust washer on the shaft and align the marks made on dismantling, instal the drive pin.

(8) Measure the end thrust of the shaft with a feeler gauge or dial gauge, the end float should not exceed 0.40 mm (0.015 in). If the end float exceeds the maximum, restore to the correct clearance by installing a suitable adjusting washer.

(9) Assemble the breaker plates and lubricate the balls between the plates and between the spring and lower plate with high melting point grease.

(10) Instal the breaker plates and fit the retaining screws.

(11) Instal the vacuum advance unit and connect the link to the pin on the moveable plate and lightly lubricate with high melting point grease.

(12) Instal the capacitor, terminal connections, earth pigtail wire and cap retaining clips.

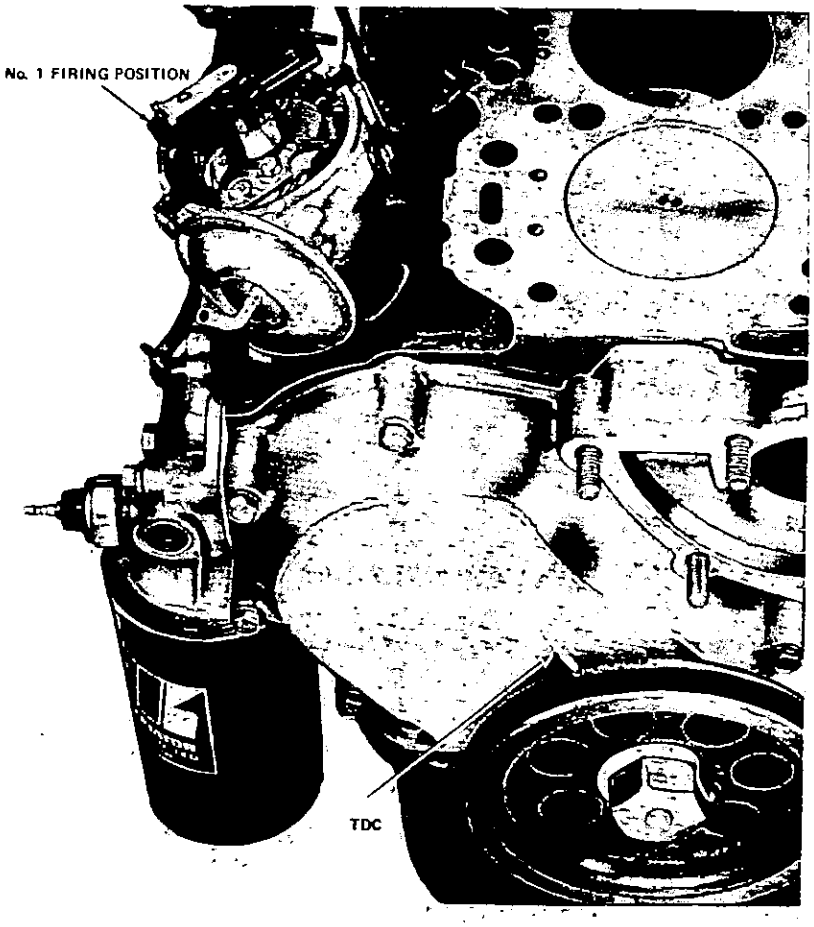
(13) Lightly lubricate the pivot post of the contact breaker set and assemble the breaker points.

(14) Instal the breaker points onto the breaker plate, lightly lubricate the cams and apply a small dab of high melting point grease to the rubbing block of the moving point.

(15) Adjust the contact breaker gap as described in the section TO CLEAN AND ADJUST BREAKER POINTS.

(16) Instal the rotor button and check that the centrifugal weights are free to operate by turning the rotor button against the centrifugal control spring while holding the drive assembly, when the rotor button is released it should return freely to the fully retarded position.

(17) If the rotor is inclined to stick or does not return to the retard position the cause should be located and rectified.



Tdc Timing Mark on Crankshaft Pulley in Line with Pointer on Timing Cover and Distributor Rotor at No 1 Cylinder Firing Point.

TO INSTAL

(1) Check that the engine has not been rotated after the distributor was removed by rechecking the timing position as described in item (1) of the TO REMOVE section.

(2) Turn the distributor shaft so that the rotor button points to the position of the high tension terminal for number one cylinder, then turn the rotor in a clockwise direction sufficiently to move the gear one tooth.

(3) Instal the distributor into its mounting hole making sure that the drive gear is fully engaged, and that the rotor button is pointing to the cap clip and the position of the high tension terminal for number one cylinder, instal the mounting plate to engine retaining bolt.

(4) Check that the contact breaker points are just starting to open when the cam assembly is turned in the direction of rotation and tighten the mounting plate to engine retaining bolt.

(5) Instal the distributor cap and connect the spark plug leads.

(6) Instal the low tension lead.

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(7) Check the ignition timing with a timing light and check and adjust the dwell angle if necessary.

(8) Instal the vacuum advance line.

TO TIME ENGINE AND SET IGNITION TIMING (Static method)

(1) Ensure that the contact breaker points are clean and adjusted to the specified clearance.

(2) Rotate the crankshaft until No. 1 piston is at tdc at the end of the compression stroke.

(3) Align the pointer on the timing cover with the extreme left hand mark on the crankshaft pulley when viewing the pulley from the front of the car.

(4) The position of the rotor should be in alignment with No. 1 high tension lead terminal of the cap and the contact breaker points should be just starting to open.

(5) To adjust, loosen the anchor plate to mounting bracket screw and move the distributor body in the direction required then retighten the screw.

(6) Road test the vehicle and make final adjustments to obtain best performance and smoothest operation.

TO ADJUST IGNITION TIMING AND DWELL ANGLE (Using instruments)

(1) Connect a tachometer, dwell meter and timing light to the engine according to the manufacturer's instructions.

(2) Start the engine and bring to normal operating temperature.

(3) Adjust the engine idle speed to specifications.

(4) Disconnect the vacuum line from the vacuum advance unit and check the advance position with the timing light, each division on the crankshaft pulley equals 5 degrees, refer specifications for the correct setting.

(5) Adjust the timing position by loosening the mounting plate retaining bolt and rotate the distributor body in the slot, if the adjustment is not possible at this point it will be necessary to loosen the screw holding the mounting plate to the distributor body, both these screw holes are elongated for this adjustment.

(6) After the correct timing position has been determined make sure the mounting plate to engine retaining bolt and the mounting plate to distributor body screws are firmly tightened.

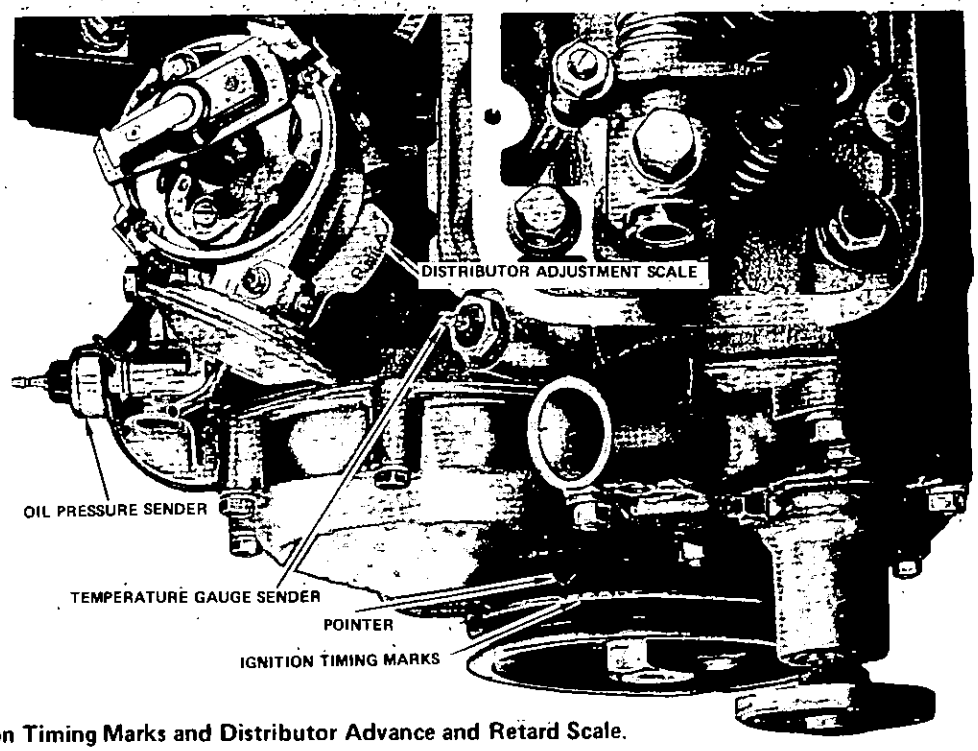
(7) Check the contact dwell, refer Specifications for the correct setting, adjust by opening or closing the contact breaker point gap, the engine will have to be stopped and the distributor cap and rotor button removed to carry out this operation.

(8) After setting the contact dwell at idle speed increase the engine speed to approximately 2500 rpm, checking the dwell angle as the rpm's increase. Any variation greater than specifications indicate worn parts within the distributor in which case the distributor will have to be removed for overhaul.

(9) After checking and adjusting the dwell angle recheck the ignition timing and adjust if necessary.

(10) Reconnect the vacuum advance line and adjust the engine idle to specifications.

(11) Remove the test instruments and reconnect any disconnected wiring etc.



Showing Ignition Timing Marks and Distributor Advance and Retard Scale.

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6. SPARKING PLUGS

TO SERVICE

The spark plugs should be removed for inspection, cleaning and resetting at intervals of 5,000 to 6,000 km (3,000 to 4,000 miles).

Spark plugs removed from an engine in good condition operating under normal conditions should have a light powdery deposit ranging in colour from light brown to greyish tan. After considerable service the electrodes will show signs of wear or normal burning. Spark plugs showing a thick black oily deposit indicate an engine in poor mechanical condition or possibly, that a plug with too low a heat range has been fitted.

Spark plugs showing a white or yellowish deposit indicate sustained high speed driving or possibly that plugs of too high heat range have been fitted, particularly when these deposits are accompanied by blistering of the porcelain and burning of the electrodes.

If the heat range is correct, clean the plugs on a sanding machine and blow clean with compressed air.

Set the electrode gap (see Specifications) by bending the earthing electrode(s) and test the plug on a reliable testing machine.

NOTE: Never attempt to set the electrode gap by bending the centre electrode or a cracked insulator will result.

Clean the spark plug threads and, using new gaskets, fit the plugs finger tight. Using a torque wrench tighten to the recommended torque. Refer Specifications.

7. HIGH TENSION LEADS

The high tension cables between the sparking plugs and the distributor cap and the centre high tension terminal on the distributor cap and the ignition coil are of special manufacture and have a carbon impregnated core instead of the normal wire core.

This is to eliminate radio interference, care must be exercised when removing the cables from the sparking plugs to ensure that the cables are not damaged by stretching, which will break the core and render the cable unserviceable.

Always remove the cable from a sparking plug by pulling on the cable terminal. Use the same care when connecting the cable to the plug.

If a cable has a broken core it will cause misfiring. Check the cables for perishing or cracking and renew as required. Never attempt to repair defective cables.

The cables may be carefully cleaned, using a cloth moistened with kerosene, then wiping completely dry.

Also check the distributor cap for cracks or tracking between the high tension terminals on both the inside and outside of the cap. Renew the cap if cracks or tracking is evident.

Check the carbon brush in the centre of the distributor cap for evidence of arcing and renew as necessary.

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8. IGNITION COIL

Two types of primary ignition circuits are used on these vehicles, the simple circuit and a series resistance circuit.

The primary circuit which does not include a resistance between the ignition switch and coil uses a normal 12 volt coil and a simple primary circuit.

When a series resistance is incorporated in the primary circuit a special 12 volt coil is used which is marked to be used with a series resistance.

The series resistance is mounted near the coil and when used cannot be overlooked or disregarded when the primary circuit is being checked, disconnected or connected.

When the series resistance is used in conjunction with the special coil a high secondary voltage is obtained throughout the speed range of the engine, resulting in better performance of the vehicle. The series resistance is by-passed when the ignition switch is moved to the start position by an internal bridge in the ignition switch which brings in a secondary primary circuit. This secondary circuit allows a full 12 volt pressure at the coil terminal resulting in a stronger spark for starting purposes as any voltage drop caused by the heavy starter draw is automatically compensated for by the circuitry.

9. TURN SIGNAL SWITCH, HEADLIGHT DIPPER AND HORN BUTTON

DESCRIPTION

The turn signal switch is a multi-purpose unit comprising switch mechanism for the turn signal lamps with automatic cancelling, the headlight dipper switch, a high beam flasher contact for overtaking, and the horn wiring contacts for the horn button circuit.

HORN BUTTON

To Remove and Instal – Early Model 1000

(1) Disconnect the battery negative terminal.
(2) Pull out and remove the horn button medallion.
(3) Remove the horn button retaining ring.

(4) Remove the steering wheel retaining nut, lock washer and flat washer.

(5) Remove the horn bar assembly from the steering wheel.

(6) Remove the three springs from under the insulator ring.

(7) To dismantle the horn bar remove the three assembling screws.

(8) Separate the insulator ring, horn contact seat, contact plate and the insulators between the horn bar and contact plate.

(9) Remove the steering wheel using a suitable puller.

(10) Remove the screws holding the turn signal trip insert and remove the horn contact slip ring and trip insert.

Assembly and installation is a reversal of the removal and dismantling procedures.

To Remove and Instal – Later Model 1000

(1) Disconnect the battery negative terminal.

(2) Press in on the horn button and turn in an anti-clockwise direction to release it from the retainer.

(3) Remove the horn button spring.

(4) Remove the three screws holding the retainer plate to the steering wheel hub and remove the retainer plate.

(5) To dismantle the horn button remove the three screws and the non-conductive retaining blocks from the horn button.

(6) Remove the contact plate and sponge rubber ring from the horn ring.

(7) The assembling and installation procedure is the reverse to removal and dismantling operations.

To Remove and Instal – 1200

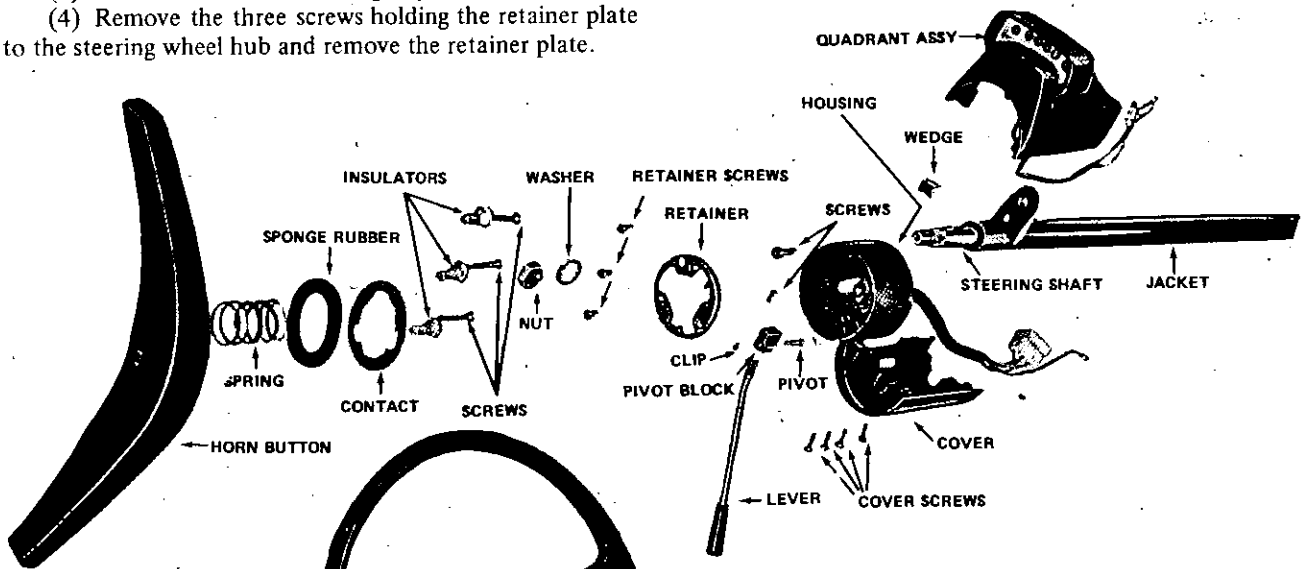
(1) Disconnect the battery negative terminal.

(2) Remove the two screws holding the horn button and medallion assembly to the steering wheel working from the underside of the wheel.

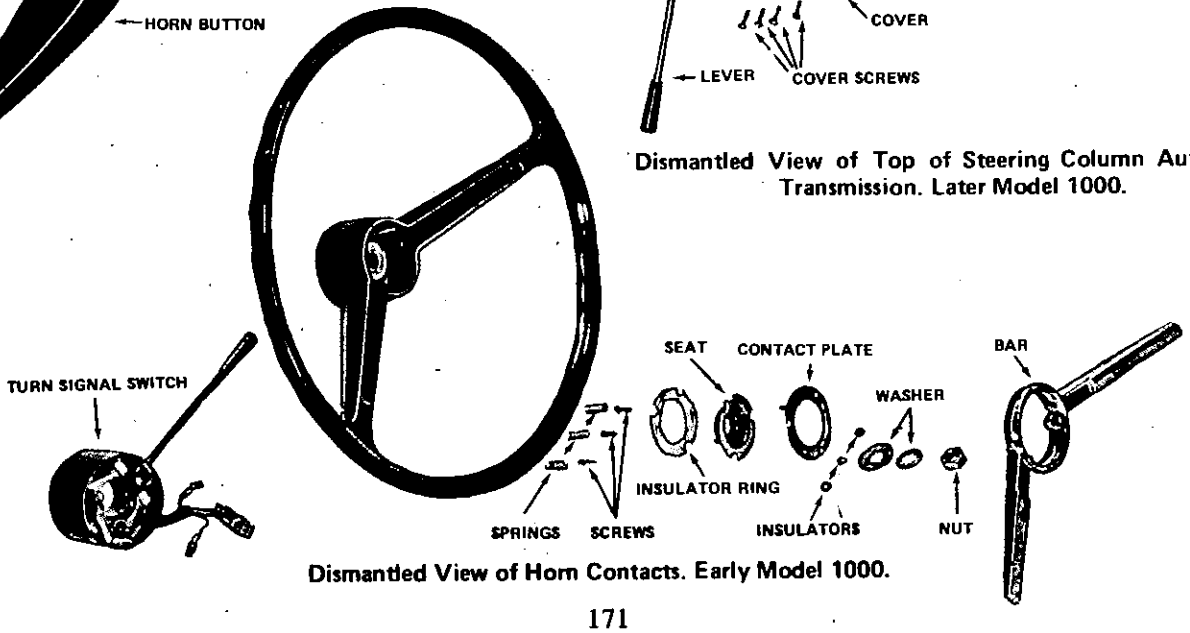
(3) Raise the button and medallion assembly from the steering wheel and disconnect the horn wire from the terminal in the steering wheel hub, remove the button and medallion.

(4) To remove the thumb press buttons from the medallion, remove the two 'E' clips retaining the thumb press button to the medallion and remove the button.

(5) Remove the nut, washers and wiring terminal from the centre terminal screw.



Dismantled View of Top of Steering Column Automatic Transmission. Later Model 1000.



Dismantled View of Horn Contacts. Early Model 1000.

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(6) Remove the insulation block, 'H' spring and contact assembly.

Installation is a reversal of the removal procedure.

TURN SIGNAL SWITCH

To Remove and Instal

(1) Disconnect the negative battery terminal.

(2) Remove the horn button assembly and retainer where used.

(3) Remove the steering wheel retaining nut and washer and remove the steering wheel.

(4) Remove the horn contact rubbing plate from the underside of the steering wheel and remove the contact spring and plunger.

(5) Remove the screws holding the two halves of the steering column cover together and remove the cover.

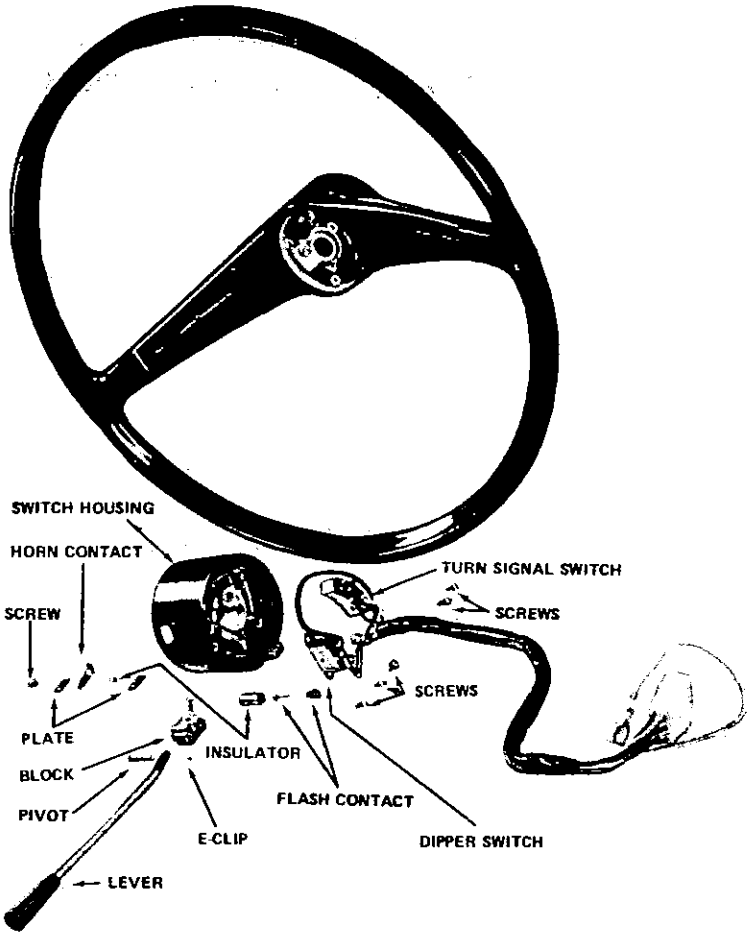
(6) On automatic transmission models, disconnect the quadrant light wires and remove the quadrant assembly.

(7) Disconnect the turn signal wiring at the terminal connecting block at the dash panel.

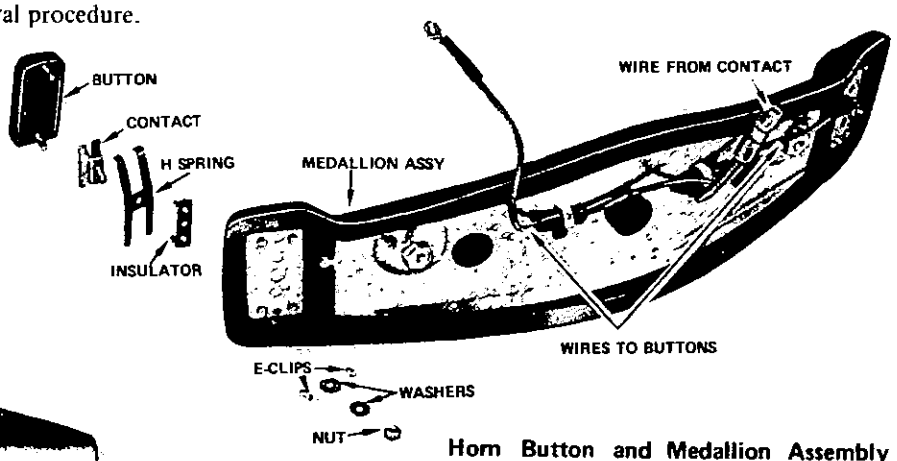
(8) On 1000 models loosen the mounting screw in the top of the switch and tap downwards to release the locating wedge, remove the switch from the steering jacket.

(9) On 1200 models remove the switch retaining screws from the clamp, loosen the switch from the steering jacket to free the locating peg and remove the switch from the steering jacket.

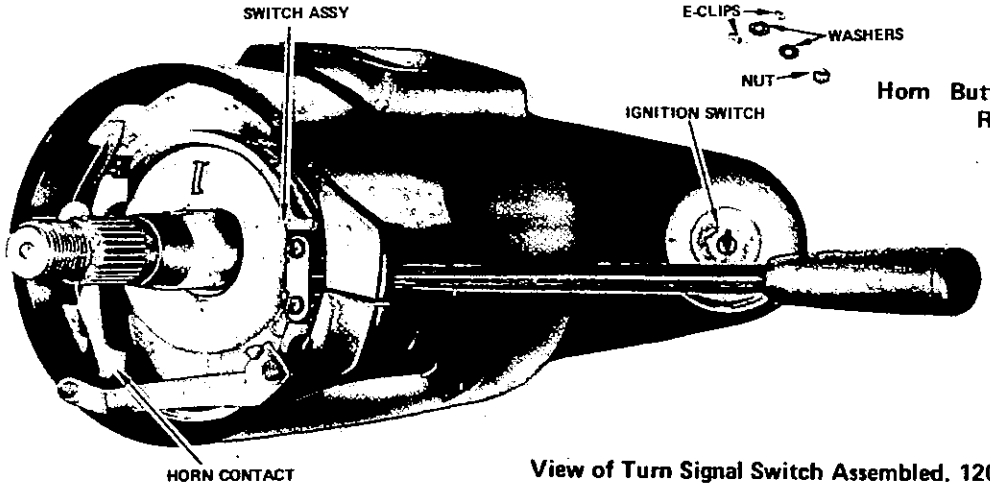
Installation is a reversal of the removal procedure.



Dismantled View of Turn Signal Switch. Later Model 1000.



Horn Button and Medallion Assembly Removed. 1200 Models.



View of Turn Signal Switch Assembled. 1200 Models.

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10. SWITCHES AND CONTROLS

HEADLAMP SWITCH

(1) Disconnect the negative (–) battery terminal.

(2) Press in on the switch knob and turn in an anti-clockwise direction to remove the knob from the rod.

(3) Remove the escutcheon nut using a special removing tool.

(4) Remove the switch from the rear of the panel.

(5) Disconnect the wiring terminal block from the switch and remove the switch.

Installation is a reversal of the removal procedure.

WINDSCREEN WIPER SWITCH

The removal and installation procedure is the same as for the headlamp switch.

IGNITION SWITCH – Standard Type

(1) Disconnect the negative (–) battery terminal.

(2) Remove the switch escutcheon nut using a special removing tool, on 1000 models remove the switch from the dash panel, on 1200 models remove the switch from the switch bracket.

(3) Disconnect the wiring terminal from the switch and remove the switch.

Installation is the reverse to the removal procedure.

Steering Lock Type

When the ignition switch is turned to the lock position and the key removed from the switch a plunger engages into a collar on the steering shaft locking the steering wheel and shaft.

The ignition switch is mounted onto the end of the locking barrel and is replaceable without removing the locking barrel and key assembly.

(1) To replace the steering lock assembly, use a suitable drill to drill out the old shear type assembly bolts.

(2) Remove the two ordinary assembling screws from the bracket and remove the lock assembly.

Installation is the reverse to the removal procedure but new shear type mounting bolts should be used.

Warning Buzzer

The buzzer switch is mounted to the steering lock assembly and operated when the vehicle door is opened while the switch is in the unlocked position.

The buzzer is mounted behind the dash panel on the left hand side and is held in place by two screws.

To remove the buzzer switch disconnect the wire terminals.

Remove the cover and remove the two mounting screws.

Installation is the reversal of the removal procedure.

INHIBITOR SWITCH

Refer to the AUTOMATIC TRANSMISSION section for adjustment and service procedure.

STOP LIGHT SWITCH

The 1000 model vehicles use a hydraulically operated switch which is mounted on the four way connection attached to the engine firewall.

The 1200 model vehicles use a mechanically operated switch which is mounted on a bracket under the dash panel and is operated by the brake pedal.

Hydraulic Type

To remove the hydraulic type switch disconnect the wires from the switch terminals and unscrew the switch from its mounting position.

Installation is the reverse to the removal procedure with the addition of bleeding the brake system as necessary. Refer to the BRAKES section for the bleeding procedure.

Mechanical Type

To remove the mechanical type switch disconnect the wires from the switch connections, loosen the lock nut and remove the mounting nut and the switch.

To instal the stop light switch refer to the BRAKES section of this manual under the sub heading BRAKE PEDAL HEIGHT ADJUSTMENT (1200).

NOTE: DO NOT attempt to adjust the stop light switch unless the pedal height is checked and adjusted, as faulty brake operation could result.

HANDBRAKE WARNING LIGHT

The warning light is operated by an earth switch controlled by the handbrake lever. when the handbrake is applied the switch is closed completing the warning light circuit, when the handbrake is released the switch is opened breaking the warning light circuit.

The handbrake dash warning light indicator also acts as the dual brake system warning light, as both systems are wired through the same dash warning light indicator.

DUAL BRAKE SYSTEM WARNING LIGHT SWITCH

Description

The switch is a differential type pressure switch. Should a failure occur in either the front or rear brake system the switch piston will be forced to the side with the lowest pressure earthing the contact of the electrical connection completing the circuit of the dash warning light.

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To Test

Using a suitable jumper lead earth the terminal on the switch, the dash warning light should come on if the circuit is serviceable, if the warning light fails to operate check the globe and live circuit using a test light.

After testing the electrical circuit check the switch in the following manner. Connect a bleeder tube and suitable container to a front brake bleeder nipple, have a second operater apply pressure to the brake pedal and release the bleeder nipple, the warning light should come on, repeat the operation to the rear brake system.

NOTE: After each test lock off the bleeder nipple and check the brake fluid level in the reservoir. Top up as necessary.

CIGARETTE LIGHTER

(1) Remove the negative (–) battery terminal.
(2) Remove the lighter element.
(3) Working from behind the dash panel remove the wiring terminal and unscrew the outer case from the cigarette lighter body.
(4) Remove the lighter body from the front of the dash panel.

CHOKE CONTROL

(1) Disconnect the negative (–) battery terminal.
(2) Press in on the knob and turn anti-clockwise to remove the knob.
(3) Remove the escutcheon nut.
(4) Disconnect the choke inner cable from the choke valve lever.
(5) Remove the outer cable from the bracket.
(6) Remove the choke cable complete towards the interior of the vehicle.

Installation is a reversal of the removal procedure.

NOTE: After installing adjust the choke cable according to instruction in the FUEL SYSTEM section.

HEATER CONTROLS – 1000

The heater controls on the 1000 model vehicles are attached to the heater unit with the booster fan control switch mounted in the dash panel.

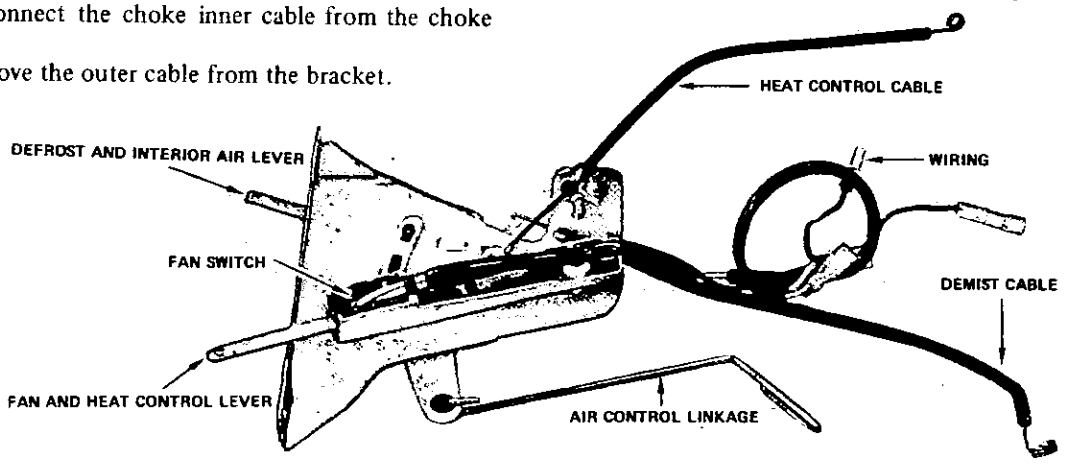
(1) To remove the booster fan control switch press in on the knob and turn anti-clockwise to release the knob from the switch stem.
(2) Remove the escutcheon nut using a special tool.
(3) Remove the switch from the dash panel and disconnect the wiring from the switch.

HEATER CONTROL – 1200

The heater control is mounted in the dash panel on 1200 model vehicles, the removal procedure is as follows.

(1) Disconnect the negative (–) battery terminal.
(2) Remove the grub screws holding the control knobs to the control levers and remove the knobs.
(3) Disconnect the control cables at the heater levers.
(4) Working from behind the dash panel remove the two control panel retaining screws.
(5) Remove the demister duct tubing and ash tray.
(6) Disconnect the booster fan switch wiring and remove the heater control unit from behind the dash panel.

Installation is a reversal of the removal procedure.



View of Heater Control Assembly Removed from Dash Panel. 1200 Models.

11. INSTRUMENT CLUSTER

TO REMOVE AND INSTAL – 1000

(1) Disconnect the negative (–) battery terminal.
(2) Remove the heater booster fan switch and the windscreen wiper switch refer SWITCHES AND CONTROLS section of this manual for removal and installation procedures.
(3) Remove the steering column upper cover, on automatic transmission models disconnect the quadrant wiring and remove the quadrant indicator, refer TURN

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SIGNAL SWITCH section of this manual for removal and installation procedures.

(4) Disconnect the speedo drive cable casing from the speedo head.

(5) Move the instrument cluster towards the steering wheel and disconnect the twelve point plug from the printed circuit terminals.

(6) Remove the instrument cluster from the dash panel.

Installation is a reversal of the removal procedure.

TO REMOVE AND INSTAL – 1200

(1) Disconnect the negative (–) battery terminal.

(2) Remove the radio control knobs and spindle retaining nuts.

(3) Remove the heater control knobs, cigarette lighter unit, head light switch, windscreen wiper switch and choke control cable from the dash panel, refer SWITCHES AND CONTROLS section of this manual for removal and installation procedures.

(4) Remove the steering column upper cover, refer TURN SIGNAL SWITCH section of this manual for removal and installation procedures.

(5) Remove the two screws holding the instrument cluster to the dash panel, models with round instruments only have one screw holding the instrument cluster to the dash panel.

(6) Disconnect the speedo drive casing from the speedo head.

(7) Move the instrument cluster towards the steering wheel and disconnect the twelve point plug from the printed circuit terminals.

(8) Remove the instrument cluster from the dash panel complete with cover panel.

Installation is a reversal of the removal procedure.

12. WINDSCREEN WIPER

TO REMOVE AND INSTAL

(1) Disconnect the negative (–) battery terminal.

(2) From under the dash panel on the left side remove the wiper spindle to linkage retaining nut and disconnect the linkage.

(3) Disconnect the wiring terminal connector at the wiper motor.

(4) Remove the wiper motor retaining bolts.

(5) Remove the wiper motor from the vehicle.

Installation is a reversal of the removal procedure with particular attention being paid to the sealing between the wiper spindle and vehicle body.

NOTE: The automatic parking position is not adjustable. The only adjustment is by the positioning of the wiper arms on the spindles.

TO REMOVE AND INSTAL THE PIVOT BOXES

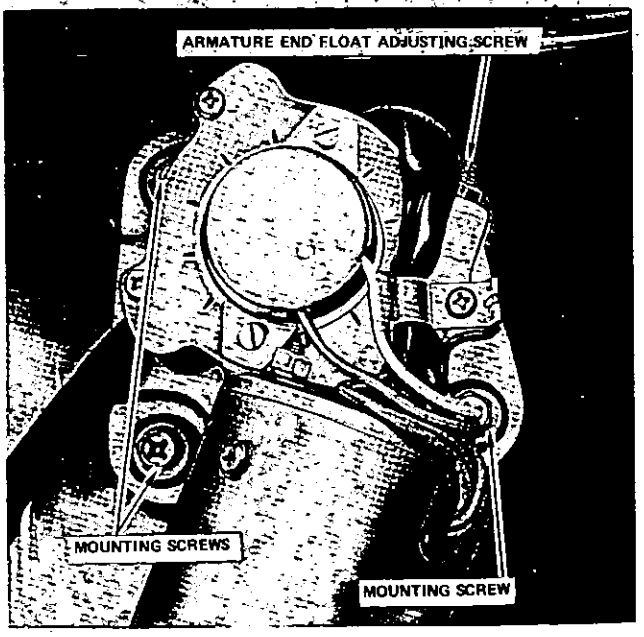
(1) Disconnect the negative (–) battery terminal.

(2) Remove the wiper arm to spindle retaining nuts and remove the wiper arms and blades.

(3) From under the dash panel remove the pivot box retaining bolts and the wiper motor spindle to linkage retaining nut.

(4) Remove the linkage and pivot boxes from the vehicle.

Installation is a reversal of the removal procedure paying particular care to the serviceability of the pivot box to body seals.



Wiper Motor. 1000 Models.

13. LAMP UNITS

TO REMOVE AND INSTAL HEADLAMP UNIT

(1) Disconnect the negative (–) battery terminal.

(2) Remove the headlamp rim on all models except coupes; on coupe models remove the radiator grille retaining screws and remove the grille.

(3) Remove the headlamp retaining bezel screws.

(4) Remove the lamp unit and disconnect the wiring plug.

Installation is a reversal of the removal procedure.

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TO ADJUST HEADLAMPS

(1) Make sure the tyres are inflated to their correct pressures.

(2) If a head light aiming machine is used follow the manufacturer's instructions for operating procedures.

(3) To raise or lower the head lamp beam the top adjusting screw is used.

(4) To move the beam to the left or right the side adjusting screws are used.

(5) When using head lamp aiming board cover the light not being adjusted with a suitable cloth so that only one beam is projected onto the board.

NOTE: Reference should be made to the local regulations governing head lamp focus and the lamps should be focused accordingly.

TO REMOVE AND INSTAL FRONT TURN SIGNAL AND PARK LAMP

(1) Remove the two lens retaining screws and remove the lens.

(2) Remove the bulb or bulbs as necessary according to the lamp type.

(3) Replace the bulb with one of the same wattage and voltage when renewing bulbs.

(4) To remove the lamp unit on 1000 models remove the lamp retaining nuts working from inside the engine bay, disconnect the wiring at the connector and remove the lamp unit.

(5) To remove the lamp unit on 1200 models remove the lamp retaining nuts working from under the fender, disconnect the wiring at the connector and remove the lamp unit.

Installation is a reversal of the removal procedure.

REAR COMBINATION LAMP

On sedan model vehicles it is not necessary to remove the lens or lamp unit to replace a faulty bulb as access to the bulb holder is from inside the luggage compartment, turn the bulb holder and remove the holder and bulb from the lamp body.

On coupe models remove the cover retaining screws and remove the cover from inside the luggage compartment and remove the bulb holders and bulbs as for the sedan models.

To remove the lamp units remove the retaining nuts and washers from inside the luggage compartment.

Installation is a reversal of the removal procedure, particular attention should be given to the sealing between the lamp and vehicle body to avoid water entry into the luggage compartment.

LICENCE PLATE LAMP

To Remove and Instal

(1) Remove the two screws holding the lens and shield to the lamp unit and remove the shield and lens.

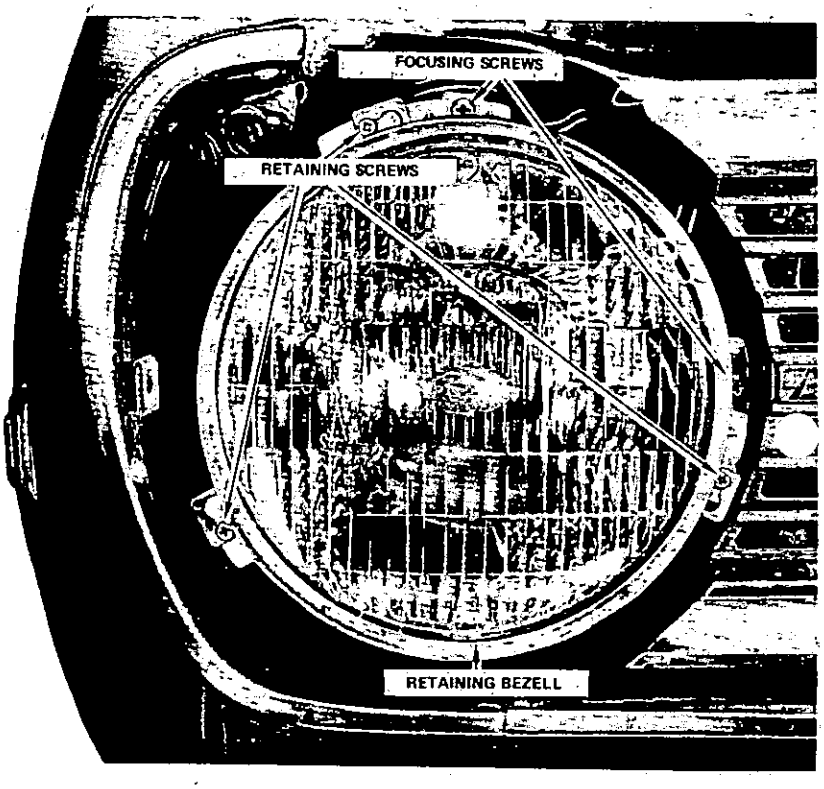
(2) Remove the bulb from the bulb holder.

(3) Remove the lamp body retaining screws and remove the lamp.

(4) Disconnect the wiring at the junction and remove the unit from the vehicle.

Installation is a reversal of the removal procedure.

NOTE: Always replace a damaged or burnt out bulb with a bulb of the same voltage and wattage as that which has been removed.



Headlamp with Rim Removed Showing Adjusting Points and Retaining Screws (Typical).

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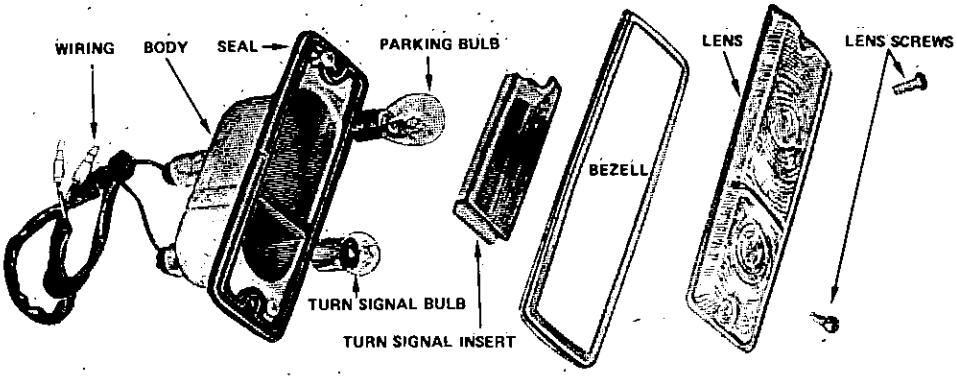
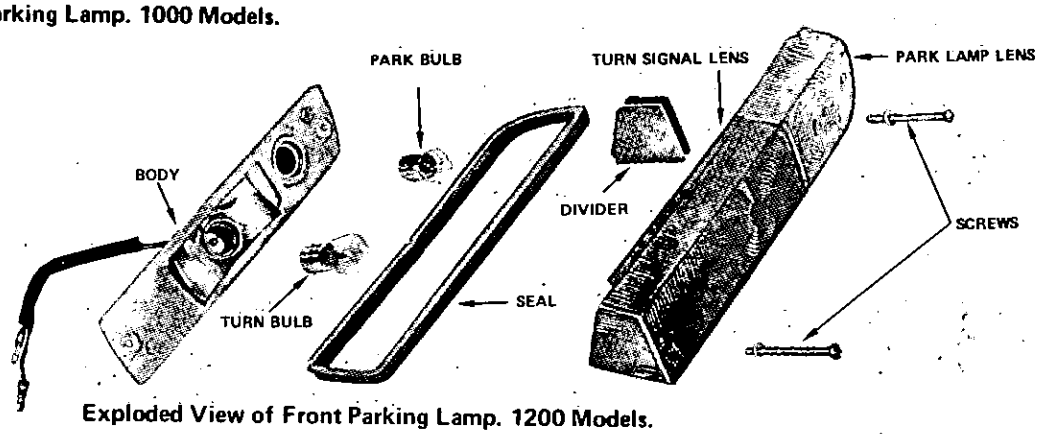
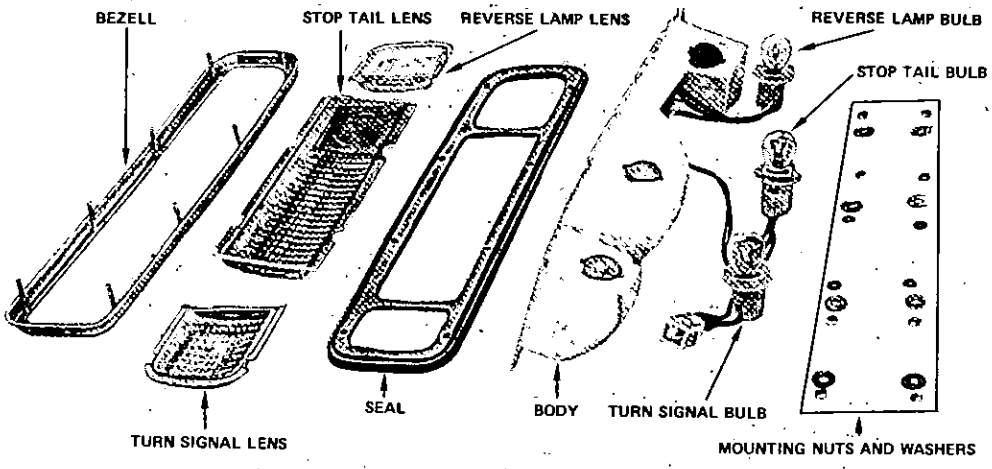


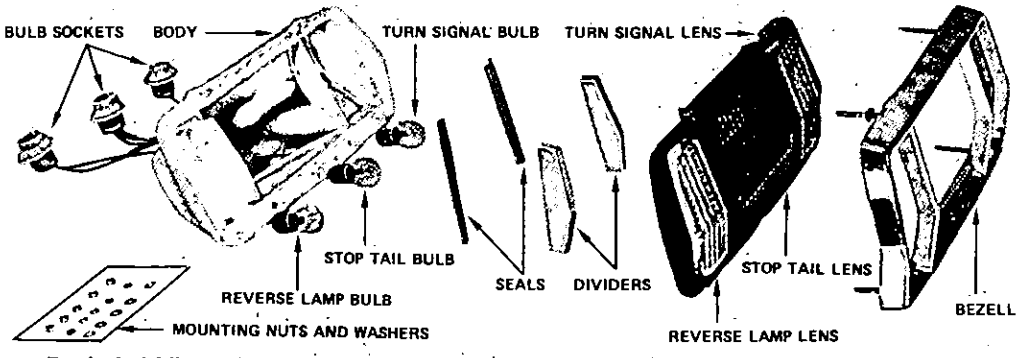
Exploded View of Front Parking Lamp. 1000 Models.



Exploded View of Front Parking Lamp. 1200 Models.



Exploded View of Rear Combination Lamp. 1000 Models.



Exploded View of Rear Combination Lamp. 1200 Models.

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14. ELECTRICAL FAULT DIAGNOSIS

BATTERY AND ALTERNATOR SYSTEM

1. Battery undercharged.

	Possible cause	*Remedy*
(a)	Loose or broken alternator drive belt	– Adjust or renew drive belt
(b)	Defective or incorrectly adjusted alternator regulator unit.	– Renew or adjust regulator unit.
(c)	Faulty battery	– Renew or repair battery.
(d)	Faulty alternator	– Overhaul or replace unit.
(e)	Defect in charging circuit wiring.	– Check and repair or replace wiring harness.
(f)	Faulty connection in charging unit.	– Check and renew or repair faulty components.

2. Battery over charged.

	Possible cause	*Remedy*
(a)	Defective or incorrectly adjusted alternator voltage regulator unit or charge relay.	– Renew or adjust voltage regulator and charge relay.
(b)	Faulty battery.	– Renew or repair
(c)	Faulty alternator.	– Overhaul or renew unit.
(d)	Faulty charging circuit wiring or connections.	– Check and repair or renew defective components.

3. Indicator light remains on.

	Possible cause	*Remedy*
(a)	Loose or broken drive belt.	– Adjust or renew drive belt.
(b)	Incorrectly adjusted regulator unit.	– Check and adjust regulator unit.
(c)	Faulty alternator/regulator.	– Check and overhaul faulty unit.
(d)	Low regulator voltage setting.	– Check and adjust voltage setting at regulator.

4. Indicator light does not operate.

	Possible cause	*Remedy*
(a)	Light globe blown.	– Check and renew faulty globe
(b)	Open circuit in wiring or globe socket.	– Check and rectify open circuit.

5. Noise in drive belt or alternator.

	Possible cause	*Remedy*
(a)	Drive belt frayed or out of alignment with pulleys.	– Renew drive belt and/or align pulleys.
(b)	Loose alternator mounting bolts or worn bearings.	– Tighten mounting bolts and/or renew bearings.
(c)	Loose alternator pulley	– Tighten pulley retaining nut.
(d)	Faulty alternator.	– Overhaul faulty unit.
(e)	Faulty diode(s).	– Overhaul alternator test diodes.

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BATTERY AND STARTING SYSTEM

1. Starter lacks power to crank engine.

Possible cause	*Remedy*
(a) Battery undercharged.	– Check charging system and rectify as necessary.
(b) Battery faulty, will not hold charge.	– Check and repair or renew battery.
(c) Battery terminals loose or corroded.	– Clean and tighten terminals.
(d) Faulty starter motor.	– Check and overhaul starter motor.
(e) Faulty starter solenoid switch or contacts.	– Check and renew solenoid as necessary.

2. Starter will not attempt to crank engine.

Possible cause	*Remedy*
(a) Open circuit in starting system.	– Check for: dirty or loose terminals, dirty commutator, faulty solenoid, faulty switch.
(b) Discharged battery.	– Check for fault or short circuit in system.
(c) Battery fully charged but will not crank engine.	– Check for: locked drive and ring gears, internal starter fault or seized engine.

IGNITION SYSTEM

1. Engine will not start.

Possible cause	*Remedy*
(a) Fault in ignition primary circuit wiring.	– Check circuit and repair as necessary.
(b) Fault in ignition switch.	– Renew ignition switch.
(c) Fault in coil primary winding.	– Renew coil
(d) Burnt or dirty contact breaker points.	– Clean and/or renew and adjust point/s.
(e) Faulty capacitor or capacitor lead.	– Check and renew capacitor.
(f) Fused or broken wire between breaker arm and low tension terminal.	– Renew low tension block and wires.
(g) Fault in coil high tension circuit.	– Test and renew coil as necessary.
(h) Cracks in distributor cap.	– Renew distributor cap.
(i) Crack in distributor rotor.	– Renew rotor.
(j) Faulty high tension leads.	– Check and renew leads.
(k) Faulty or incorrectly adjusted spark plugs.	– Renew and/or clean and adjust spark plugs.

2. Engine starts but misfires under load.

Possible cause	*Remedy*
(a) Faulty, dirty or incorrectly adjusted spark plugs.	– Renew and/or clean and adjust spark plugs.
(b) Dirty or incorrectly adjusted contact breaker.	– Clean and adjust points.
(c) Uneven wear on distributor cam.	– Check and overhaul distributor.
(d) Condensation moisture on inside or outside of distributor cap.	– Check and dry out and examine for minute cracks.
(e) Cracked spark plug insulator/s.	– Renew faulty plug/s.
(f) Faulty ignition coil.	– Renew or check coil.

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3. Engine runs but lacks power.

	Possible cause	*Remedy*
(a)	Ignition timing incorrectly set or contact points require adjusting.	– Check and readjust ignition timing and/or contact points.
(b)	Vacuum advance mechanism sticking or excessively worn.	– Overhaul distributor.
(c)	Vacuum advance unit inoperative.	– Check for faulty vacuum pipe or faulty advance unit.
(d)	Vacuum advance unit operates but ineffective.	– Advance unit link disconnected or requires adjustment.

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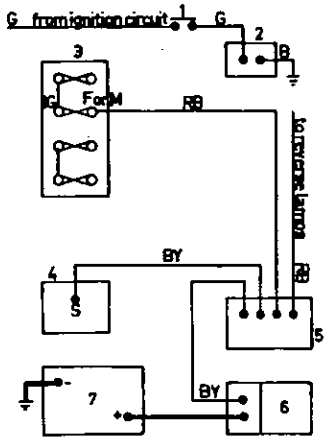
AUTOMATIC TRANSMISSION 1000 AND 1200 MODELS

1. Kickdown switch.
2. Kickdown solenoid.
3. Fuse panel.
4. Ignition switch.
5. Inhibitor switch.
6. Starter motor and solenoid.
7. Battery.



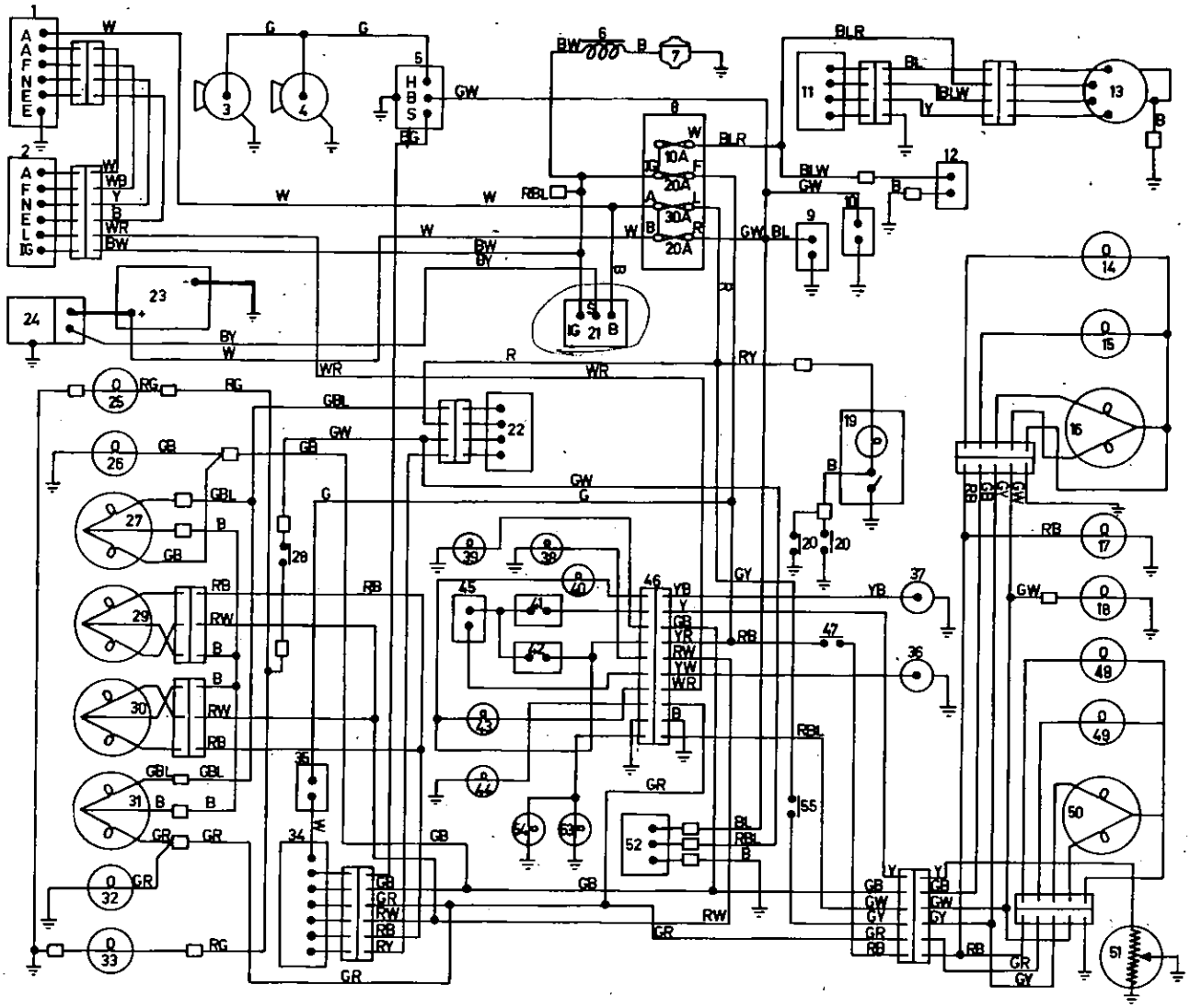
COLOR CODE:

G	– Green
B	– Black
RB	– Red with black tracer
BY	– Black with yellow tracer

DATSUN 1000 MANUAL TRANSMISSION

COLOR CODE:

Y	– Yellow
B	– Black
G	– Green
W	– White
R	– Red
BL	– Blue
WR	– White/red tracer
WB	– White/black tracer
RB	– Red/black tracer
BW	– Black/white tracer
YB	– Yellow/black tracer
GY	– Green/yellow tracer
BG	– Black/green tracer
GB	– Green/black tracer
GR	– Green/red tracer
YW	– Yellow/white tracer
RW	– Red/white tracer
GW	– Green/white tracer
BR	– Black/red tracer
BY	– Black/yellow tracer
WBL	– White/blue tracer
GBL	– Green/blue tracer
BBL	– Black/blue tracer
BLR	– Blue/red tracer
BLW	– Blue/white tracer
BW/W	– Black/white tracer/white sleeve
B/G	– Black/green sleeve



Wiring Diagram for 1000 Models with Manual Transmission.

1. Alternator.
2. Regulator.
3, 4. Horns.
5. Horn relay.
6. Ignition coil.
7. Distributor.
8. Fuse panel.
9. Radio.
10. Cigar lighter.
11. Windscreen wiper switch.
12. Heater.
13. Windscreen wiper.
14. R.H. reversing lamp.
15. R.H. turn signal lamp.
16. R.H. stop and tail lamps.
17. Reversing lamp (vans only).
18. Licence plate lamp.
19. Interior lamp and switch.
20. Courtesy lamp door switches.
21. Ignition switch.
22. Lighting switch.
23. Battery.
24. Starter motor and solenoid.
25. R.H. fog lamp.
26. R.H. front side turn signal lamp.
27. R.H. turn signal and parking lamp.
28. Fog lamp switch.
29. R.H. headlamp.
30. L.H. headlamp.
31. L.H. turn signal and parking lamp.
32. L.H. front side turn signal lamp.
33. L.H. fog lamp.
34. Turn signal and combination switch.
35. Turn signal relay unit.
36. Engine temperature sender unit.
37. Oil pressure warning lamp switch.
38. High beam indicator lamp.
39. R.H. turn signal indicator lamp.
40. Oil pressure warning lamp.
41. Fuel gauge.
42. Instrument voltage stabiliser.
43. Ignition warning lamp.
44. L.H. turn signal indicator lamp.
45. Engine temperature gauge.
46. Instrument panel harness connector.
47. Reversing lamp switch.
48. L.H. reversing lamp.
49. L.H. turn signal lamp.
50. L.H. tail and stop lamps.
51. Fuel gauge sender unit.
52. Clock.
53, 54. Instrument panel lamps.
55. Stop lamp switch.

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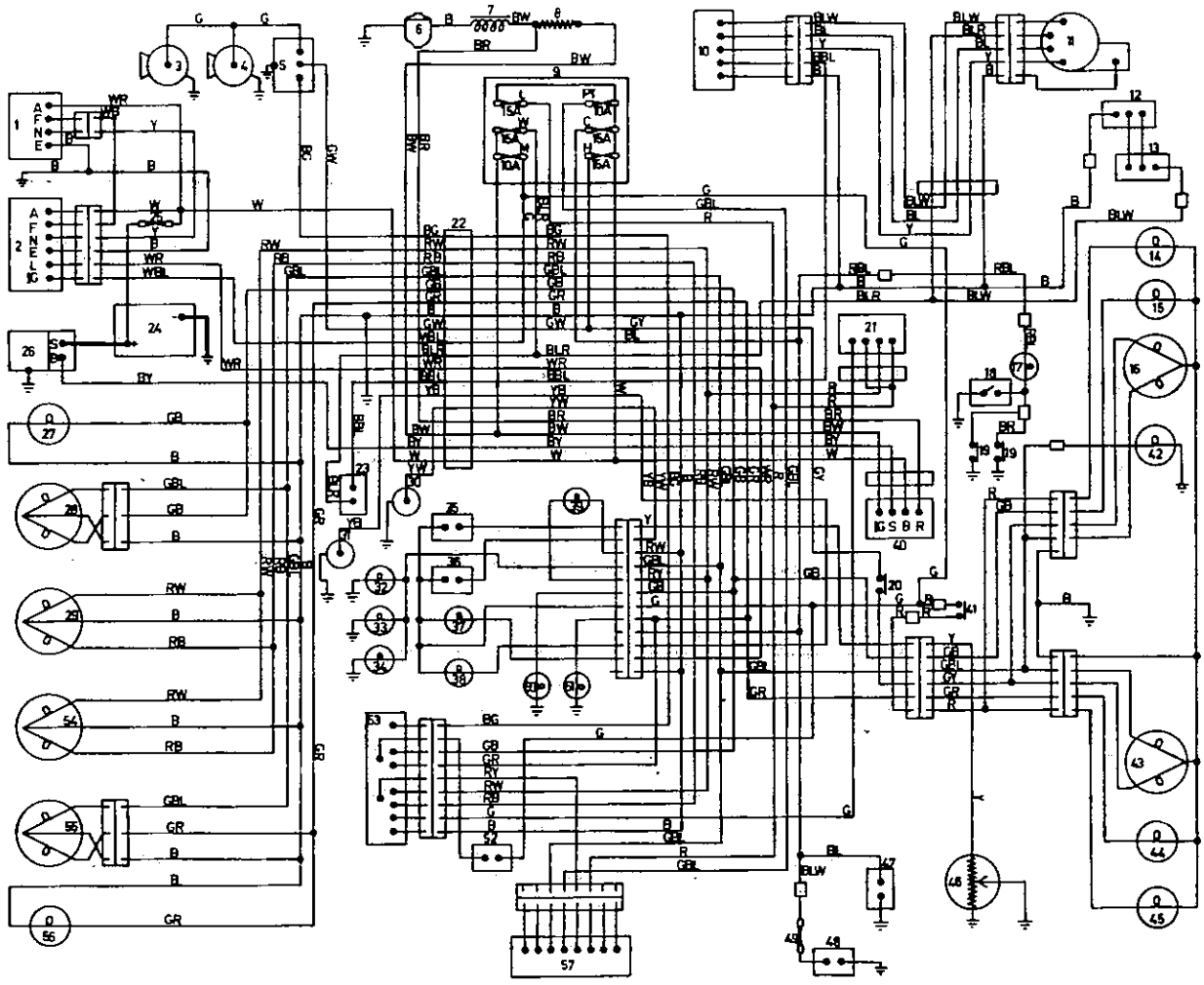

Wiring Diagram for 1200 (V) B110 Models with Manual Transmission.

1. Alternator.
2. Regulator.
3, 4. Horns.
5. Horn relay.
6. Distributor.
7. Ignition coil.
8. Resistor.
9. Fuse panel.
10. Windscreen wiper switch.
11. Windscreen wiper.
12. Heater.
13. Heater switch.
14. R.H. reversing lamp.
15. R.H. turn signal lamp.
16. R.H. tail and stop lamp.
17. Interior lamp.
18. Interior lamp switch.
19. Courtesy lamp door switches.
20. Stop lamp switch.
21. Passing lamp relay.
22. Wiring harness connectors.
23. Windscreen washer.
24. Battery.
25. Fuse.
26. Starter motor and solenoid.
27. R.H. front side turn signal lamp.
28. R.H. turn signal and parking lamp.
29. R.H. headlamp.
30. Engine temperature sender unit.
31. Oil pressure switch.
32, 33, 34. Instrument panel lamps.
35. Fuel gauge.
36. Engine temperature gauge.
37. Ignition warning lamp.
38. Oil pressure warning lamp.
39. High beam indicator lamp.
40. Ignition switch.
41. Reversing lamp switch.
42. Licence plate lamp.
43. L.H. tail and stop lamps.
44. L.H. turn signal lamp.
45. L.H. reversing lamp.
46. Fuel gauge sender unit.
47. Cigar lighter.
48. Radio.
49. Fuse.
50. R.H. turn signal indicator lamp.
51. L.H. turn signal indicator lamp.
52. Turn signal relay.
53. Turn signal and combination switch.
54. L.H. headlamp.
55. L.H. turn signal and parking lamp.
56. L.H. front side turn signal lamp.
57. Lighting switch.

COLOR CODE:

Y	–	Yellow
B	–	Black
G	–	Green
W	–	White
R	–	Red
BL	–	Blue
WR	–	White/red tracer
WB	–	White/black tracer
RB	–	Red/black tracer
BW	–	Black/white tracer
YB	–	Yellow/black tracer
GY	–	Green/yellow tracer
BG	–	Black/green tracer
GB	–	Green/black tracer
GR	–	Green/red tracer
YW	–	Yellow/white tracer
RW	–	Red/white tracer
GW	–	Green/white tracer
BR	–	Black/red tracer
BY	–	Black/yellow tracer
WBL	–	White/blue tracer
GBL	–	Green/blue tracer
BBL	–	Black/blue tracer
BLR	–	Blue/red tracer
BLW	–	Blue/white tracer
BW/W	–	Black/white tracer/ white sleeve
B/G	–	Black/green sleeve

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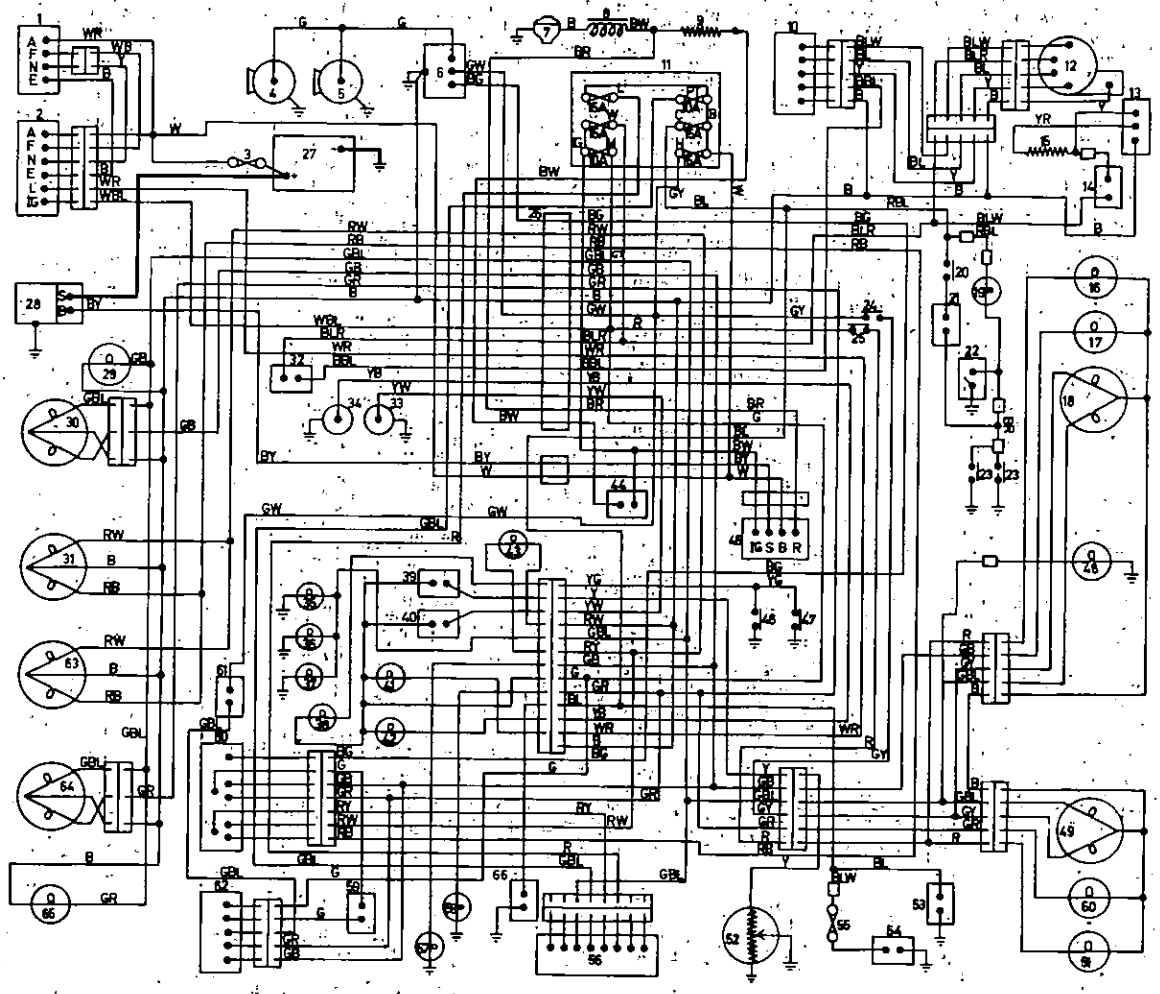

Wiring Diagram for 1200 Models with Manual Transmission for North America.

1. Alternator.
2. Regulator.
3. Fuse.
4, 5. Horns.
6. Horn relay.
7. Distributor.
8. Ignition coil.
9. Resistor.
10. Windscreen wiper switch.
11. Fuse panel.
12. Windscreen wiper.
13. Heater switch.
14. Heater.
15. Heater resistance.
16. R.H. reversing lamp.
17. R.H. rear turn signal lamp.
18. R.H. tail and stop lamps.
19. Interior lamp.
20. Warning buzzer switch.
21. Warning buzzer.
22. Interior lamp switch.
23. Courtesy lamp door switch.
24. Stop lamp switch.
25. Reverse lamp switch.
26. Harness connector.
27. Battery.
28. Starter motor and solenoid.
29. R.H. front side clearance lamp.
30. R.H. turn signal and parking lamp.
31. R.H. headlamp.
32. Windscreen washer.
33. Engine temperature sender unit.
34. Oil pressure warning switch.
35, 36, 37. Instrument lamps.
38. Handbrake warning lamp.
39. Fuel gauge.
40. Engine temperature gauge.
41. Ignition warning lamps.
42. Oil pressure warning lamp.
43. High beam indicator lamp.
44. Tachometer.
45. Ignition switch.
46. Handbrake warning lamp switch.
47. Dual brake warning lamp switch.
48. Licence plate lamp.
49. L.H. tail and stop lamps.
50. L.H. turn signal lamp.
51. L.H. reversing lamp.
52. Fuel gauge sender unit.
53. Cigar lighter.
54. Radio.
55. Fuse.
56. Lighting switch.
57. R.H. turn signal indicator lamp.
58. L.H. turn signal indicator lamp.
59. Turn signal relay.
60. Turn signal and combination switch.
61. Hazard signal relay.
62. Hazard signal switch.
63. L.H. headlamp.
64. L.H. turn signal and parking lamp.
65. L.H. front side clearance lamp.
66. Clock.

COLOR CODE:

Y	—	Yellow
B	—	Black
G	—	Green
W	—	White
R	—	Red
BL	—	Blue
WR	—	White/red tracer
WB	—	White/black tracer
RB	—	Red/black tracer
BW	—	Black/white tracer
YB	—	Yellow/black tracer
GY	—	Green/yellow tracer
BG	—	Black/green tracer
GB	—	Green/black tracer
GR	—	Green/red tracer
YW	—	Yellow/white tracer
RW	—	Red/white tracer
GW	—	Green/white tracer
BR	—	Black/red tracer
BY	—	Black/yellow tracer
WBL	—	White/blue tracer
GBL	—	Green/blue tracer
BBL	—	Black/blue tracer
BLR	—	Blue/red tracer
BLW	—	Blue/white tracer
BW/W	—	Black/white tracer/white sleeve
B/G	—	Black/green sleeve

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BODY

1. WINDSCREEN AND REAR WINDOW GLASS

WINDSCREEN

To Remove

(1) Cover the bonnet and scuttle panel with a suitable protective cloth to avoid damage to the paint work.

(2) Remove the windscreen wiper arms and blades from the front of the windscreen and remove the rear vision mirror.

(3) Push the weatherstrip lip under the top and sides of the windscreen aperture flange from inside the vehicle. Use a suitable lipping tool for this purpose.

(4) Applying firm pressure from inside the car, push the windscreen and weatherstrip assembly forward and out of the windscreen aperture.

(5) Prise out the joint cover clip and pull the finish strip out of the weatherstrip. Remove the weatherstrip from the glass.

To Instal

(1) Clean all old sealing compound from the glass and the body flange grooves in the weatherstrip and from the flange of the body aperture. Check the weatherstrip for deterioration.

(2) Place the weatherstrip correctly on the windscreen glass.

(3) Using a suitable pressure gun and sealing compound, apply the compound to the weatherstrip rubber to body groove.

(4) Insert a length of strong cord in the weatherstrip rubber to body groove, starting at the lower centre of the assembly and continuing around the periphery of the windscreen glass to meet and cross the start of the cord, and tape both ends to the glass on the inside.

(5) With the aid of a second operator, position the windscreen and weatherstrip assembly centrally in the windscreen aperture, applying firm pressure to the outside of the glass. Ensure that the ends of the cord are not trapped between the weatherstrip and the body flange.

(6) From inside the vehicle, carefully pull each end of the cord from the lower centre of the glass assembly, across the bottom of the lower corners of the body aperture to seat the lip of the rubber over the body aperture flange.

(7) Using a suitable pressure gun with swan-necked nozzle, and sealing compound, apply the compound to the rubber to glass groove.

(8) Replace the finish strip in its groove in the weatherstrip with the use of the lipping tool. Replace the joint cover clip.

(9) Clean off any excess sealing compound with a cloth soaked in petrol and wipe the assembly clean.

(10) Replace the windscreen wiper arms and blades.

REAR WINDOW GLASS

To Remove and Instal

The procedures for removing the rear glass are similar to the procedures described in the previous section for removal and installation of the windscreen.

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2. FRONT DOOR

INTERIOR HANDLES AND TRIM PANEL

To Remove

(1) Remove the window regulator handle retaining screw and remove the handle and thrust washer.

(2) Remove the inside door handle retaining screw on 1000 models, remove the escutcheon plate retaining screw on 1200 models, remove the handle and thrust washer or the escutcheon plate.

(3) Remove the arm rest retaining screws if an arm rest is fitted and remove the arm rest.

(4) On 1200 models remove the door pull mounting screws and door pull.

(5) Using a thin wide bladed lever inserted between the trim panel and the door near a retaining clip, lever the clip out of the retaining hole taking care not to damage the door paint work.

(6) Lever each clip free in turn and remove the door trim panel.

To Instal

(1) Check that the dust and splash shields are correctly fitted and not torn or damaged.

(2) Check the trim panel retaining clips and inserts, replace damaged parts.

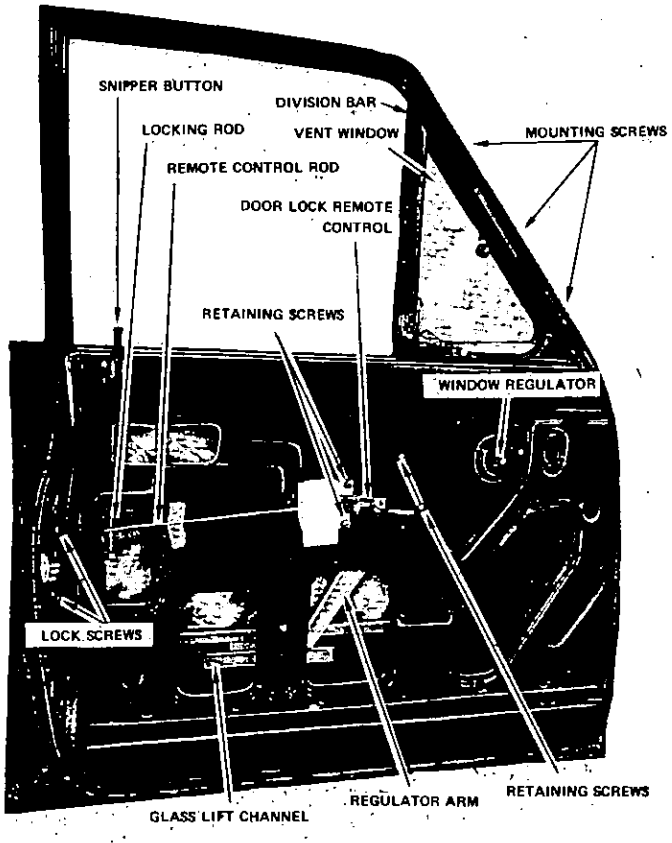
(3) Position the trim panel into its recess and align the clips with the mounting inserts.

(4) Check each clip individually before applying pressure to the panel and start at the top and work down.

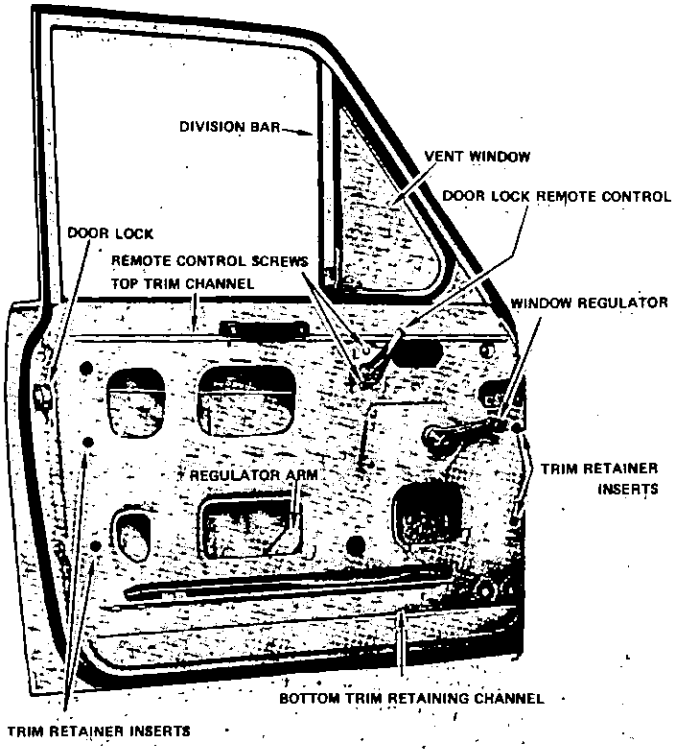
(5) Wind the window to the closed position, fit the thrust washer over the spindle, fit the handle to correspond with the opposite door and instal the retaining screw and tighten.

(6) On 1000 models fit the thrust washer over the door handle spindle, position the handle to correspond with the opposite door and instal the retaining screw, on 1200 models instal the escutcheon plate and retaining screw.

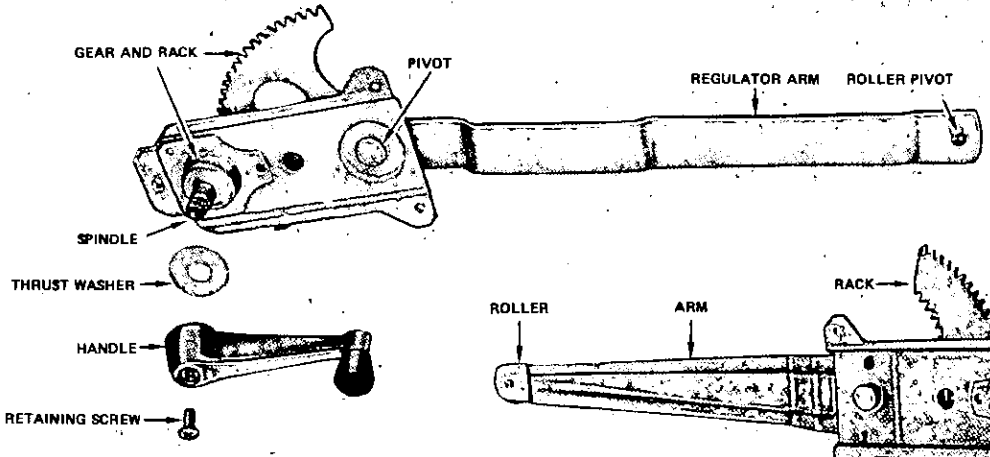
(7) Refit the door pull and arm rest where applicable.



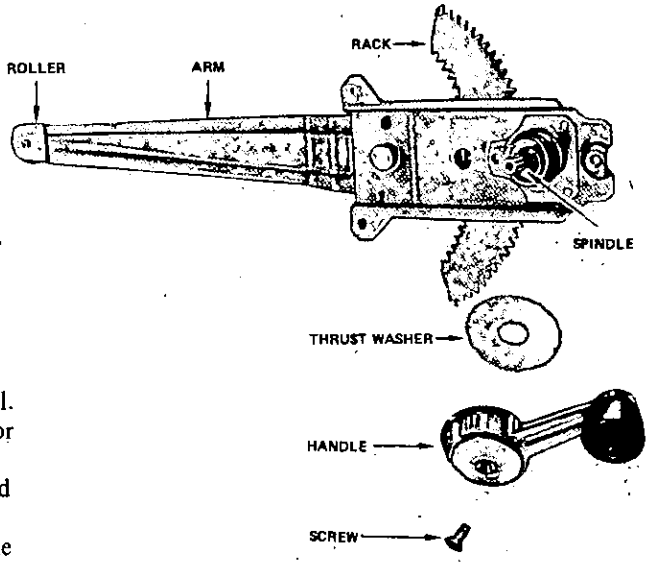
Front Door with Trim Panel and Splash Shields Removed. 1200 Models.



Front Door with Trim Panel and Splash Shields Removed. 4 Door 1000 Model.



Front Door Window Regulator Assembly. 1000 Models.



Front Door Window Regulator Assembly. 1200 Models.

WINDOW REGULATOR

To Remove and Instal

(1) Remove the interior handles and door trim panel.

(2) Remove the dust and splash shields from the door inner apertures.

(3) Raise the window to the closed position and hold in this position with rubber wedges.

(4) Remove the screws holding the regulator to the door panel and lower the regulator down inside the door.

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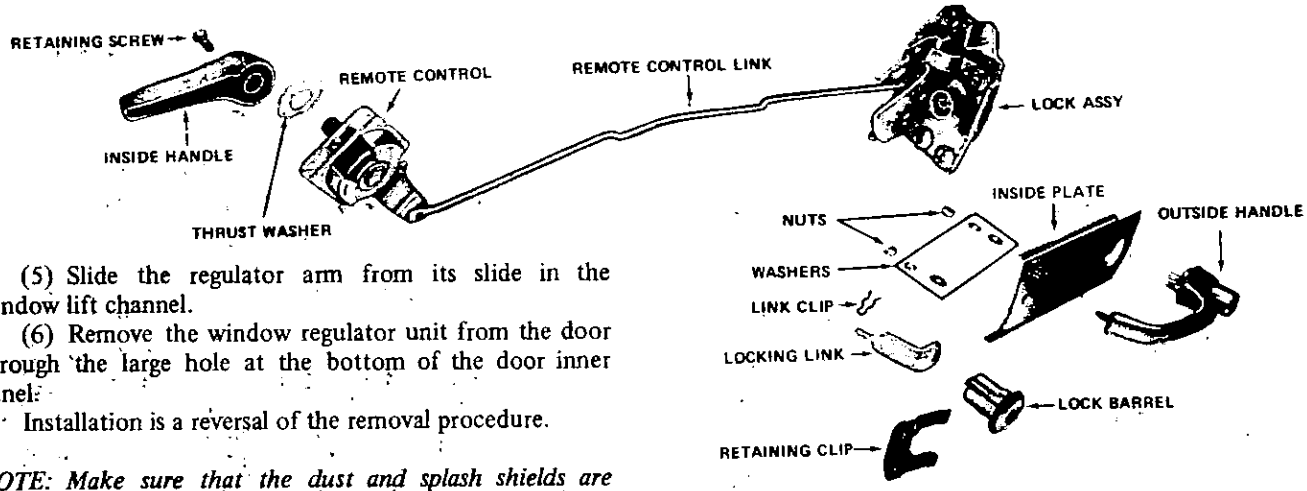


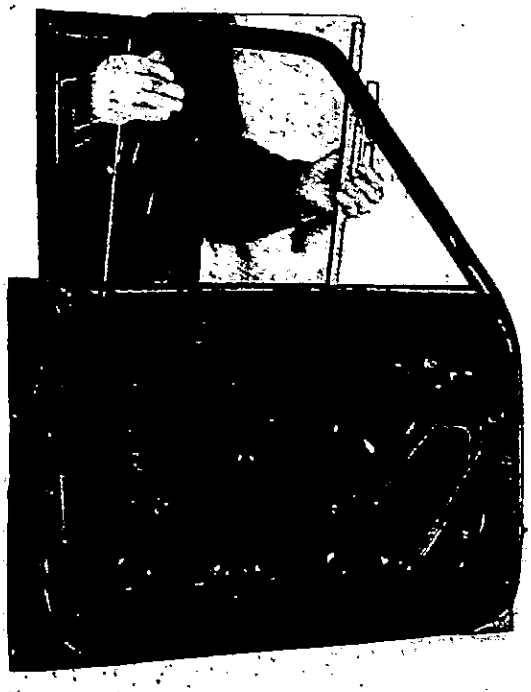
Front Door Lock Assembly Removed. Later Model 1000.

(5) Slide the regulator arm from its slide in the window lift channel.

(6) Remove the window regulator unit from the door through the large hole at the bottom of the door inner panel.

Installation is a reversal of the removal procedure.

NOTE: Make sure that the dust and splash shields are fitted correctly over the door panel apertures before fitting the trim panel.



Showing Method of Removing Front Door Glass.

WINDOW GLASS

To Remove and Instal

(1) Remove the interior handles and door trim panel.

(2) Remove the dust and splash shields from the door inner apertures.

(3) Remove the window regulator.

(4) Remove the window stop and lower the glass to the bottom of the door.

(5) Remove the quarter window mounting screws and the lower division bar mounting screw.

(6) Remove the quarter window assembly from the door.

(7) Rotate the door glass so that the glass lift channel is towards the front of the vehicle and remove the glass and lift channel assembly through the top of the door.

Installation is a reversal of the removal procedure.

DOOR LOCK AND REMOTE CONTROL

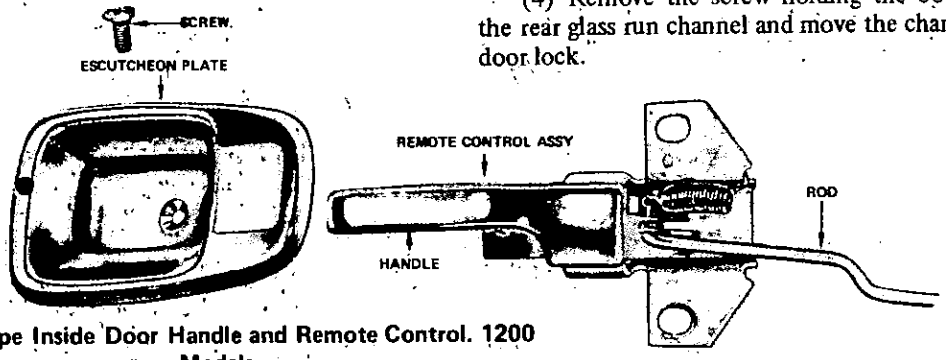
To Remove

(1) Remove the interior handles and door trim panel.

(2) Remove the dust and splash shields from the door inner apertures.

(3) Wind the window to the fully closed position.

(4) Remove the screw holding the bottom section of the rear glass run channel and move the channel to clear the door lock.



Flush Type Inside Door Handle and Remote Control. 1200 Models.

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(5) Disconnect the locking lever from the locking barrel.

(6) Remove the locking barrel spring retaining plate by sliding it out of the retaining grooves in the barrel.

(7) Remove the locking barrel and seal from the outer door skin.

(8) Remove the snipper button from the inside locking rod.

(9) Remove the door lock retaining screws.

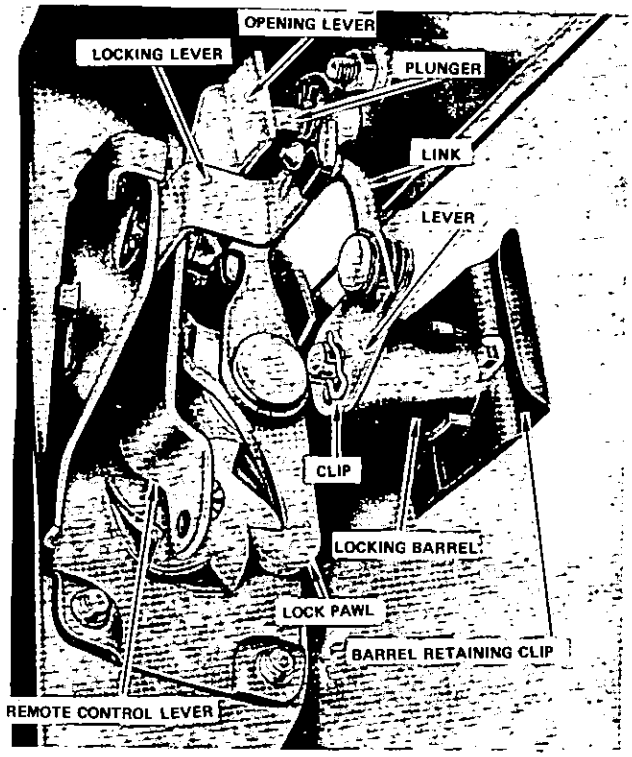
(10) Remove the door lock remote control retaining screws.

(11) Remove the door lock assembly from the door through the aperture.

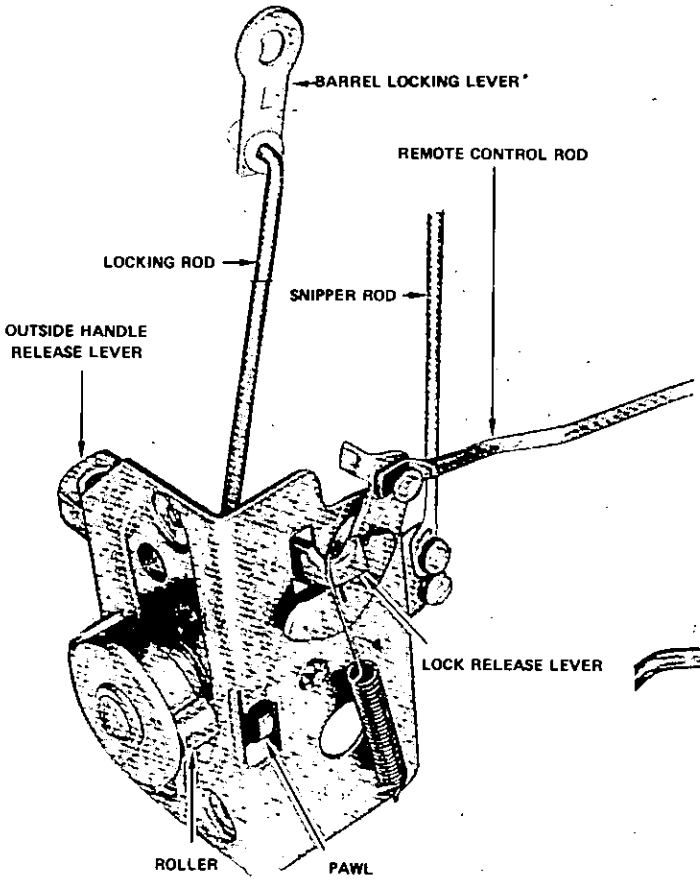
To Instal

Installation is a reversal of the removal procedure with attention to the following adjustment points.

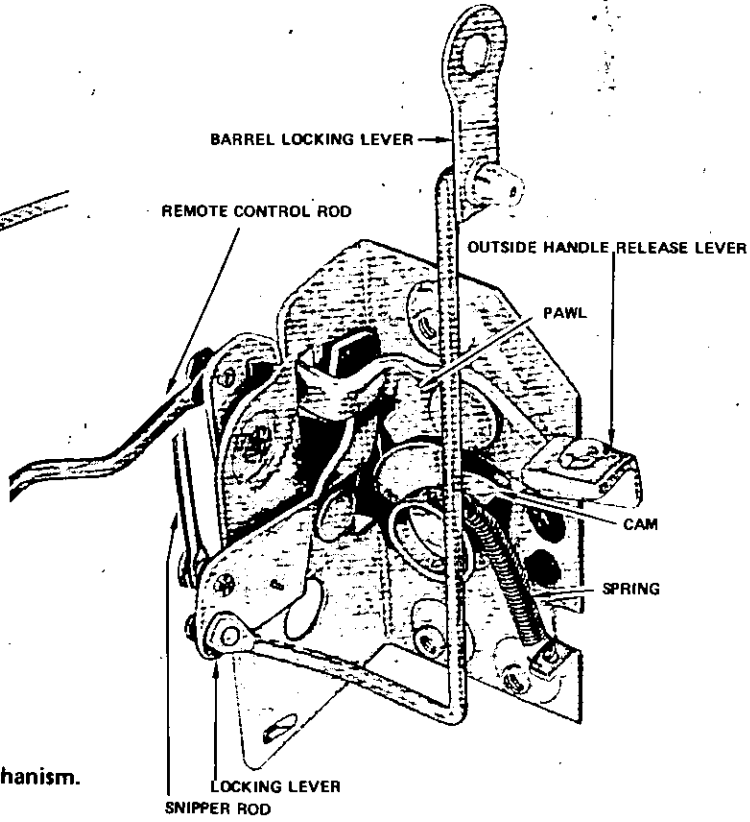
(1) With the door lock installed adjust the position of the remote control so that the remote control lever of the lock is just touching the lock body when the inside handle is at rest, then tighten the remote control mounting screws and check the lock operation.



Front Door Lock in Mounted Position with Method of Locking Barrel Connection Shown. Early Model 1000.



Front Door Lock Assembly. 1200 Models.



Front Door Lock Assembly Showing Operating Mechanism. 1200 Models.

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OUTSIDE HANDLE

To Remove and Instal

(1) Remove the interior handles and door trim panel.

(2) Remove the dust and splash shields from the door inner apertures.

(3) Wind the window glass to the fully closed position.

(4) On 1000 models remove the two mounting nuts, washers, lock washers and plate and remove the outside handle and seal.

(5) On 1200 models remove the mounting nuts and washers, ease the door handle from the door skin, disconnect the handle to lock linkage and remove the handle and seal when fitted, remove the linkage.

Installation is a reversal of the removal procedure with attention to the following adjustment procedure for 1200 models.

(1) Instal the handle to lock linkage with the nylon adjusting nut positioned correctly in the lever, adjust the nylon nut to give a free movement of from 2 to 3 mm (0.079 to 0.118 in) on the rod, lock the nylon nut in position with adhesive.

LOCK STRIKER

To Renew and Adjust

(1) Mark the position of the striker plate with a pencil.

(2) Remove the three Phillip head set bolts and remove the striker plate, inspect and replace parts where necessary.

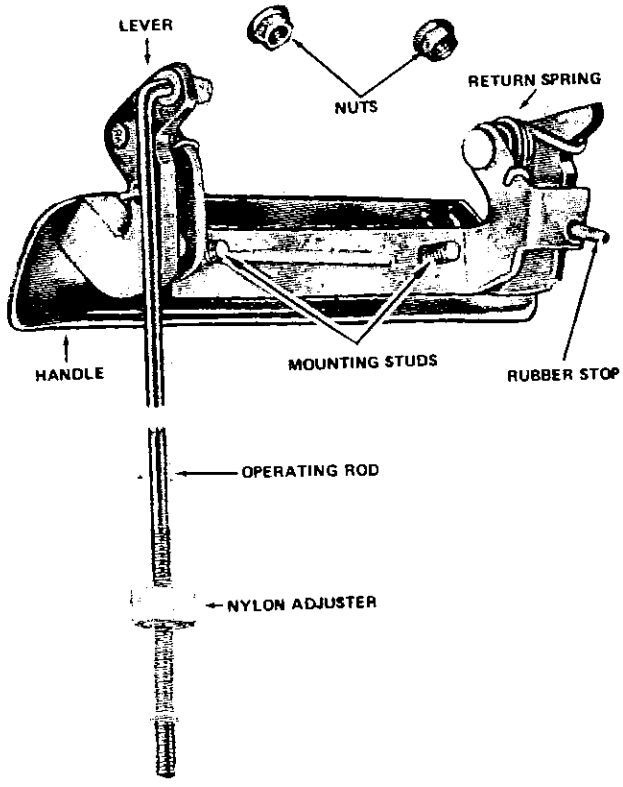
(3) To instal the striker plate the procedure is the reverse of the removing operations with attention to the following adjustment points.

(4) Refit the striker plate according to the pencil marks made on removing, refit the three set bolts but only tighten them sufficiently to hold the striker plate in position.

(5) Close the door and push it firmly shut.

(6) Press the outside release button and carefully open the door without moving the striker plate.

(7) Tighten the three mounting set bolts and again close the door checking the operation of the door lock and striker plate. If further adjustment is necessary open the door and slack off the three set bolts and move the striker plate a small amount in the direction required and retighten the three set bolts.



View of the Front Outside Door Handle Showing Adjusting Point of Lock Operating Rod. 1200 Models.

3. REAR DOOR

INTERIOR HANDLES AND TRIM PANEL

To Remove and Instal

The operating procedure is the same as for the front door except that the door pull does not have to be removed, but the following additional operations will be necessary when an ash tray is fitted to the door panel.

(1) Remove the ash container from the ash tray.

(2) Remove the ash tray body mounting screws and remove the ash tray body from the door panel.

WINDOW REGULATOR

To Remove and Instal

(1) Remove the interior handles and door trim panel.

(2) Remove the dust and splash shields from the door inner apertures.

(3) Wind the window glass to the closed position and hold with rubber wedges.

(4) Remove the two screws and washers holding the guide arm slide to the door panel, on 1000 models.

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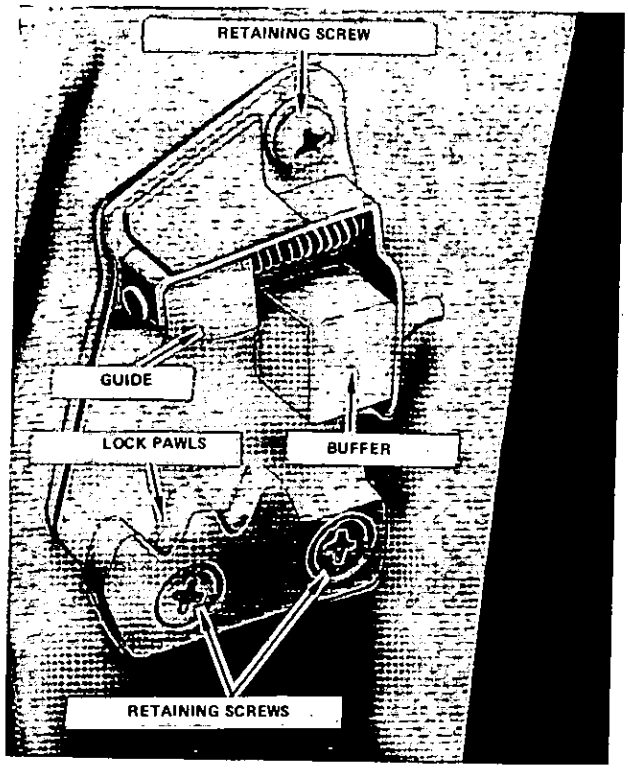
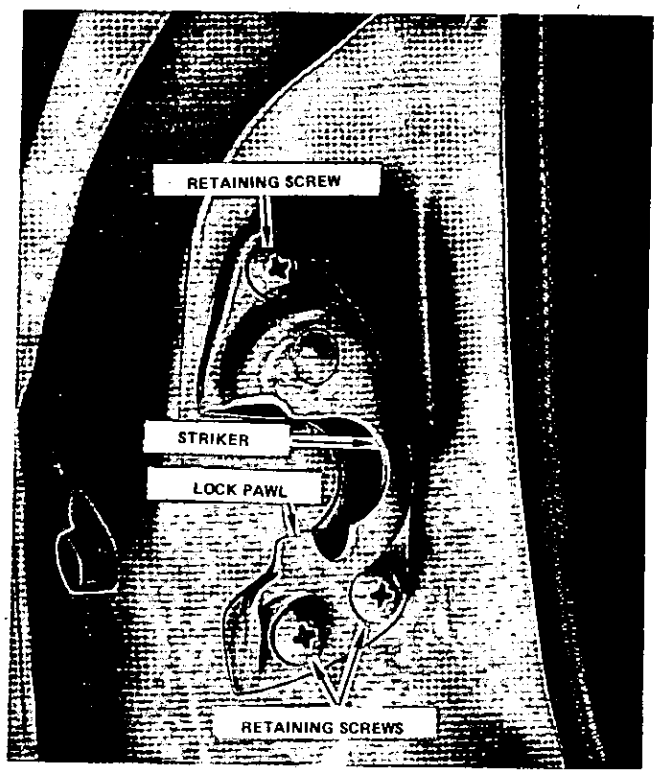


Door Lock Striker. Early 1000 Model.



Door Lock Striker Later Model 1000 and 1200 Models.

(5) Remove the screws holding the regulator to the door panel and lower the regulator.

(6) Slide the regulator arm, 1200 models, and the guide arm, 1000 models – from their slides in the window lift channel.

(7) Lower the regulator to the bottom of the door and wind the arm to the down position, align the guide arm with the regulator arm, 1000 models, and remove the regulator out through the large aperture of the door panel, both models.

Installation is a reversal of the removal procedure.

NOTE: Make sure the dust and splash shields are fitted correctly over the door panel apertures before fitting the trim panel.

WINDOW GLASS

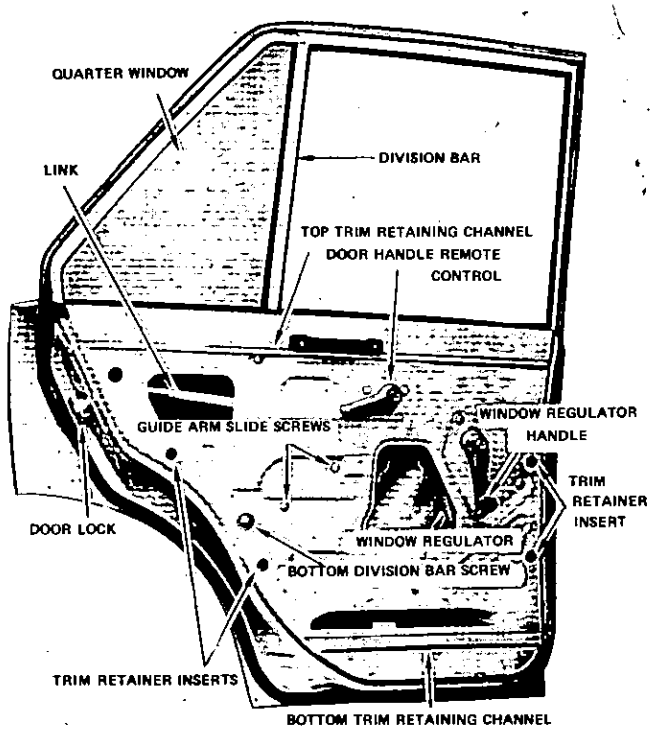
To Remove and Instal

(1) Remove the interior handles and door trim panel.

(2) Remove the dust and splash shields from the door inner apertures.

(3) Remove the window regulator and let the glass rest in the bottom of the door, it will be necessary to remove the window stop on 1200 models.

(4) Remove the screws at the top of the division bar and the screws holding the bottom of the division bar to the door inner panel.



Rear Door with Trim Panel and Splash Shields Removed. 4 Door 1000 Model.

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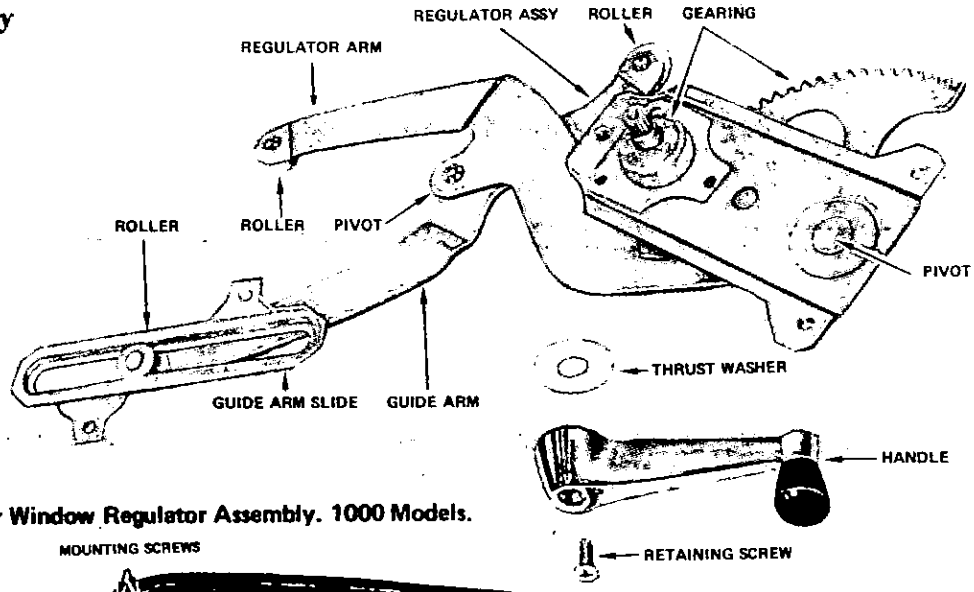
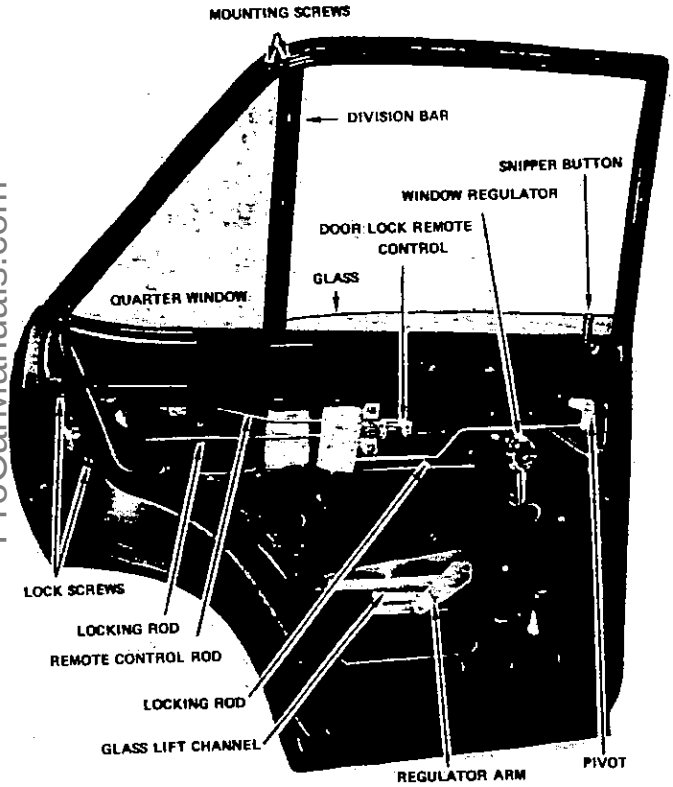
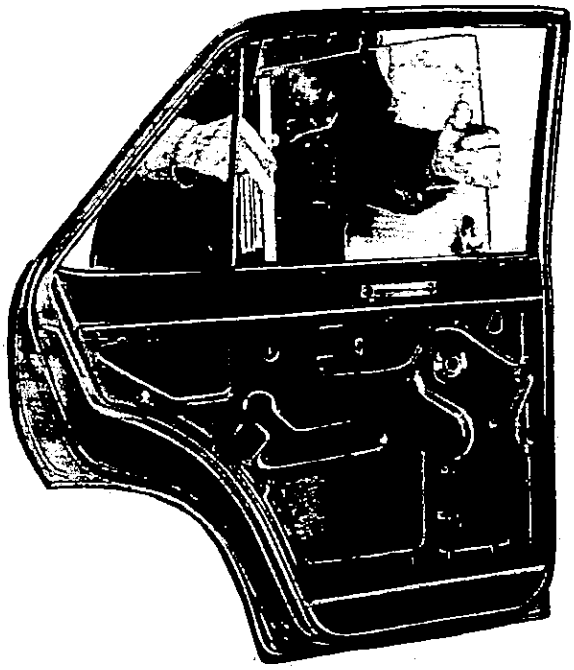


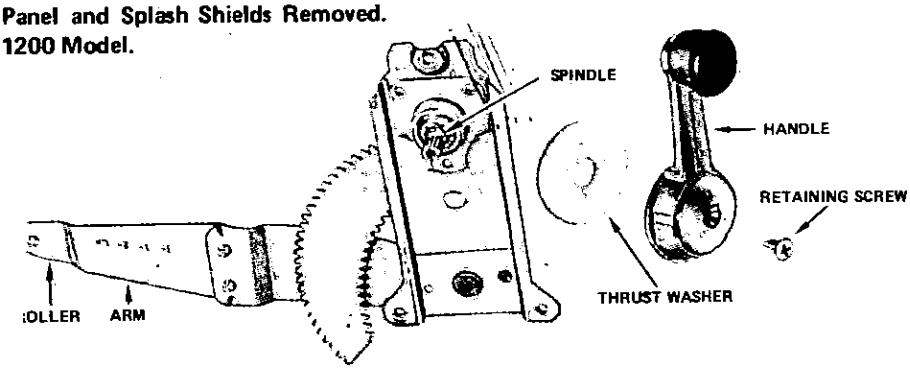
Rear Door Window Regulator Assembly. 1000 Models.



Rear Door with Trim Panel and Splash Shields Removed. 1200 Model.



Showing Method of Removing Rear Door Window Glass.



Rear Door Window Regulator Assembly. 1200 Models.

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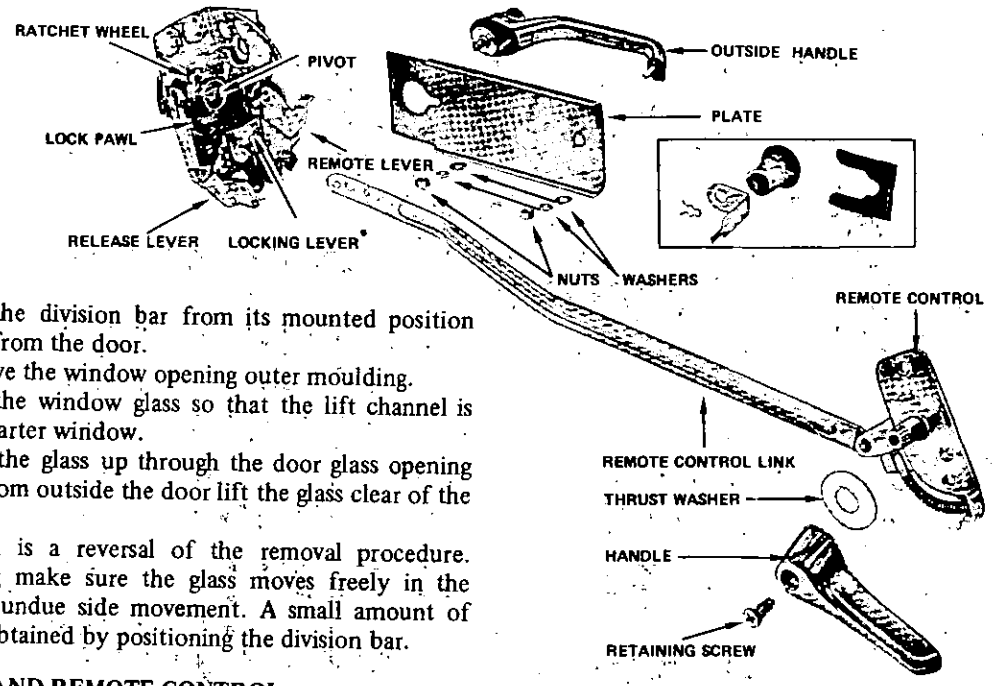


Rear Door Lock Assembly Removed with Door Lock Reversed to Show Detail; Lock Barrel and Lever Shown in Inset. 1000 Models.

(5) Ease the division bar from its mounted position and remove it from the door.

(6) Remove the window opening outer moulding.

(7) Turn the window glass so that the lift channel is towards the quarter window.

(8) Raise the glass up through the door glass opening and working from outside the door lift the glass clear of the opening.

Installation is a reversal of the removal procedure. After installing make sure the glass moves freely in the slides without undue side movement. A small amount of adjustment is obtained by positioning the division bar.

DOOR LOCK AND REMOTE CONTROL

To Remove and Instal – 1000

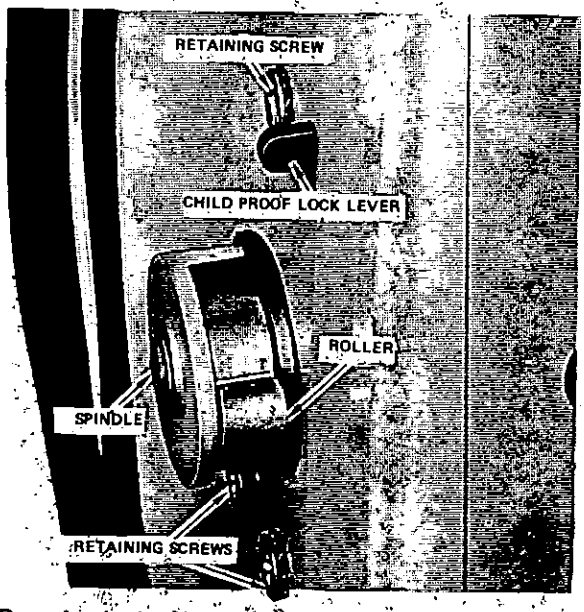
(1) Remove the interior handles and door trim panels.

(2) Remove the dust and splash shields from the door inner apertures.

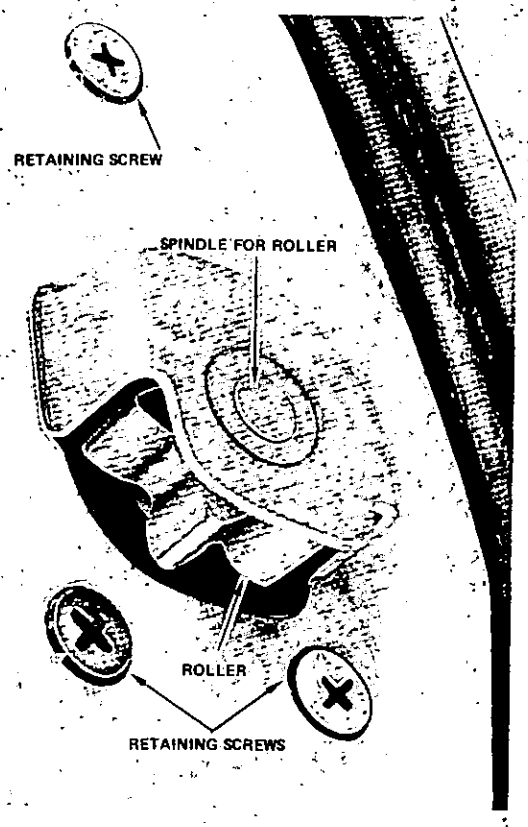
(3) Wind the window to the closed position.

(4) Remove the two screws holding the remote control to the door inner panel.

(5) Remove the door lock mounting screws.



Rear Door Lock showing Roller and Child Proof Locking Lever. Later 1000 Models.



Door Lock Roller. Early 1000 Model.

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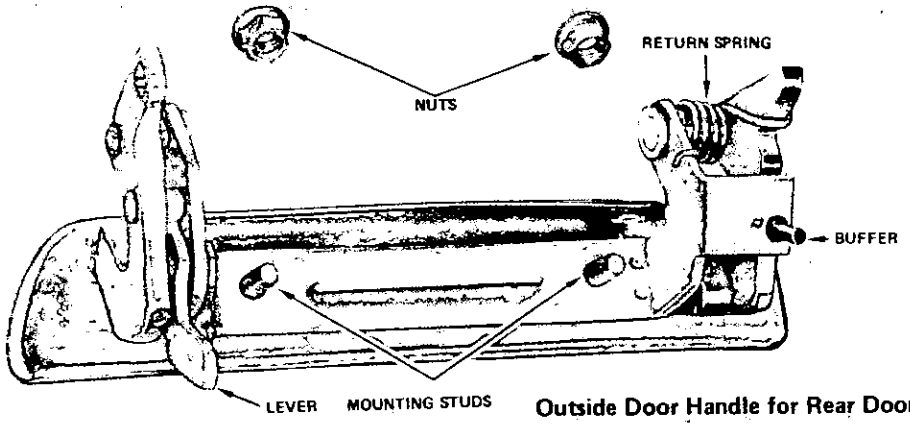


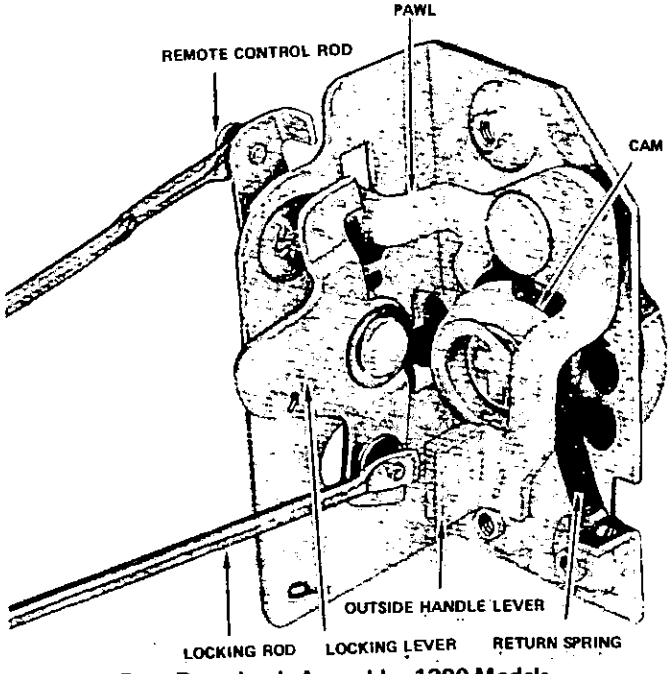
Outside Door Handle for Rear Door. 1200 Models.

(6) Remove the lower division bar screws.

(7) Remove the remote control and door lock from their mounted positions and slide them towards the front edge of the door.

(8) Working through the door aperture disconnect the lock from the remote control rod and remove the lock and remote control from the door.

Installation is a reversal of the removal procedure.



Rear Door Lock Assembly. 1200 Models.

To Remove and Instal – 1200

(1) Remove the interior handles and door trim panel.

(2) Remove the dust and splash shields from the door inner apertures.

(3) Wind the window to the closed position.

(4) Remove the outside door handle retaining nuts and washers and remove the door handle.

(5) Remove the two screws holding the remote control to the door inner panel.

(6) Remove the snipper button.

(7) Remove the snipper rod and locking rod pivot screw, washer and nylon bush.

(8) Remove the snipper rod from the door panel and the rod retaining tapes.

(9) Remove the door lock retaining screws and remove the door lock through the aperture.

Installation is a reversal of the removal procedure.

OUTSIDE HANDLE

To Remove and Instal

(1) Remove the interior handles and door trim.

(2) Remove the dust and splash shields from the top rear door panel aperture.

(3) Remove the outside handle retaining nuts and washers and remove the outside handle from the door panel.

Installation is a reversal of the removal procedure taking particular care that the outside handle weather seal is serviceable.

4. ENGINE BONNET

To Remove

(1) Release the bonnet catch and open the bonnet.

(2) Using a pencil, mark around the outside edge of each hinge plate.

(3) Cover both fenders with a protective cover to prevent damage to the paint work.

(4) With the help of a second operator support the bonnet and remove the bonnet stay from its guide.

(5) Remove the mounting bolts holding the hinges to the bonnet and remove the bonnet.

To Instal

(1) Holding the bonnet in the position previously marked, fit the bonnet hinge bolts and tighten to just over finger tight.

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(2) Close the bonnet and by pushing with the hand, position the bonnet evenly in its opening.

(3) Open the bonnet carefully and tighten the mounting bolts.

(4) Recheck for correct positioning, if necessary loosen one bolt at a time to adjust.

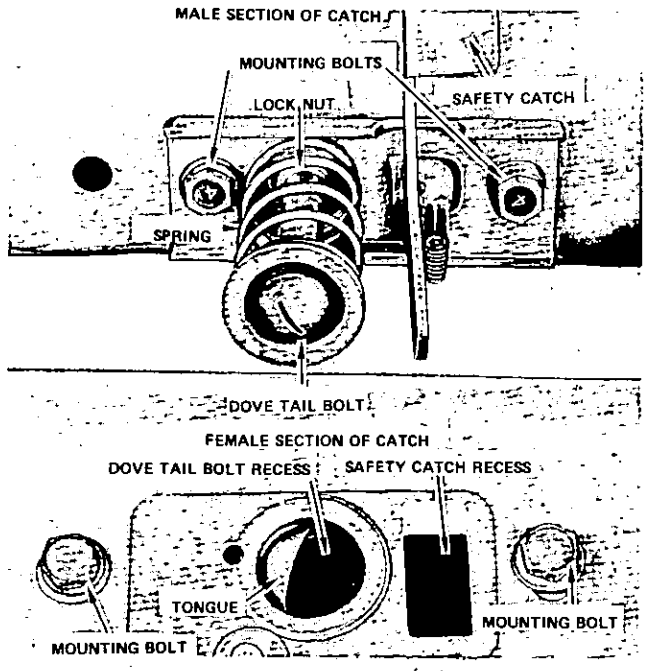
(5) Check the bonnet catch, when the catch is released the bonnet should pop up sufficiently to enable the fingers to release the safety catch and lift the bonnet.

(6) To adjust first mark the base position with a pencil, then loosen the mounting bolts and move the catch in the desired direction, tighten the bolts and recheck.

NOTE: The male section of the catch will move sideways for adjustment and the female section will move fore and aft for adjustment.

(7) Close the bonnet and check the locking position, if too loose shorten the dove-tail bolt, if too tight lengthen the dove-tail bolt.

(8) To adjust the dove-tail bolt, loosen the lock nut and screw the bolt in or out using a screw driver.



Engine Bonnet Lock Components.

5. LUGGAGE COMPARTMENT LID

To Remove

(1) Open the lid, with a pencil mark the edges of the mounting plate to lid position on both sides.

(2) Support the lid and remove the torsion bars.

(3) While supporting the lid remove the two bolts from each hinge plate and remove the lid.

To Instal and Adjust

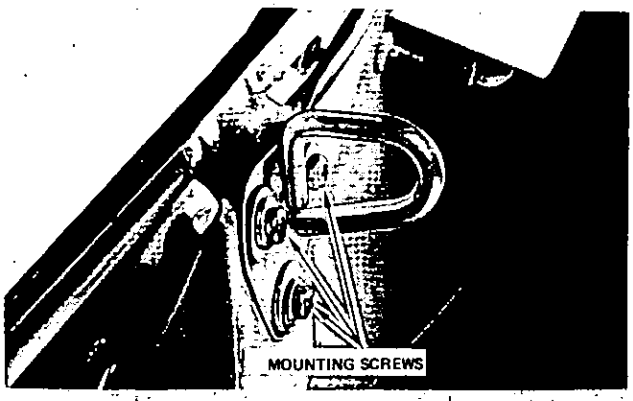
Installation is the reversal of the removal procedure with the addition of the following points.

(1) Tighten the mounting bolts to just over finger tight and close the lid, check for even clearance around the lid and push into position with the hands.

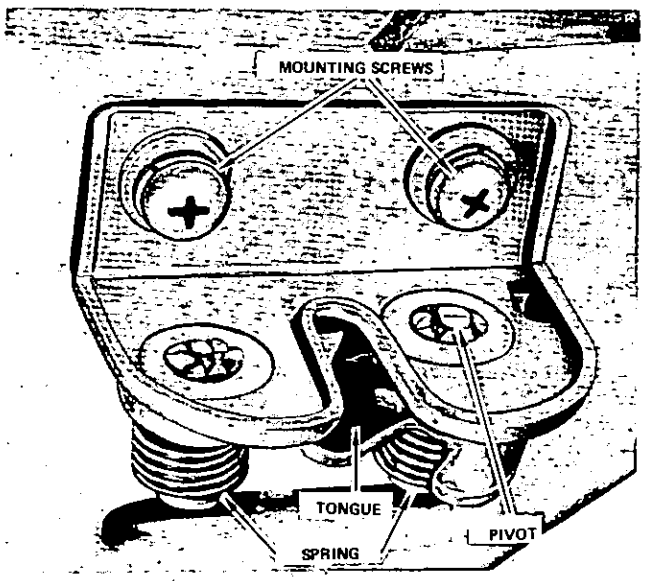
(2) When the lid is correctly positioned carefully open and tighten the hinge bolts and recheck.

(3) To adjust the closed position of the lid loosen the striker plate screws and move the striker plate in the required direction.

NOTE: The striker is adjustable sideways and up and down.



Boot Lid Striker Plate. 1000 Models.



Boot Lid Lock. 1000 Models.

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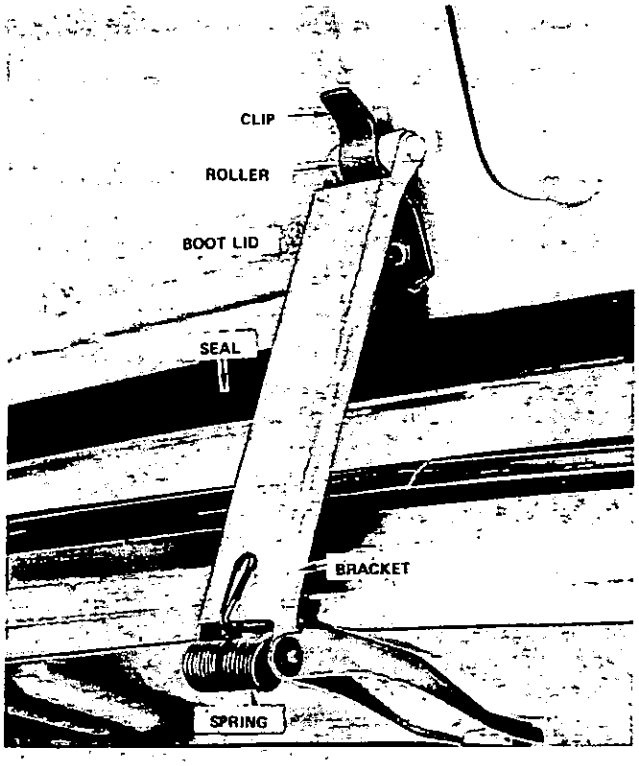
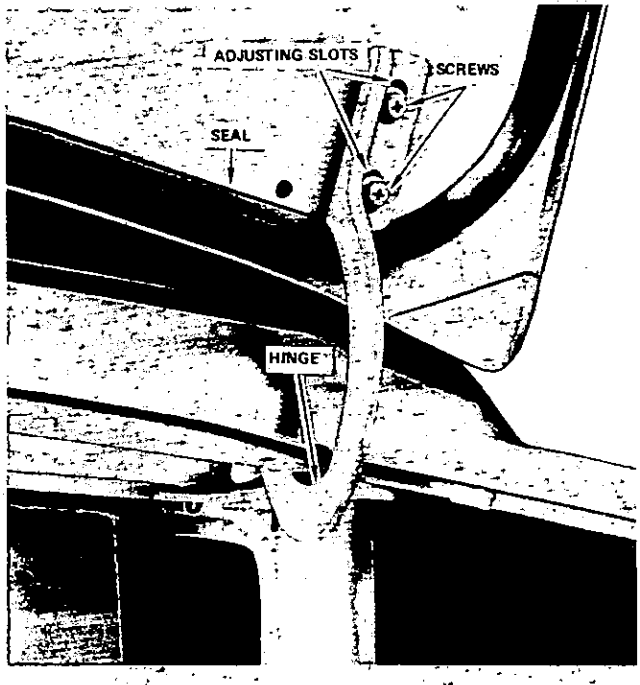


Boot Lid Support Bracket. 1000 Models.



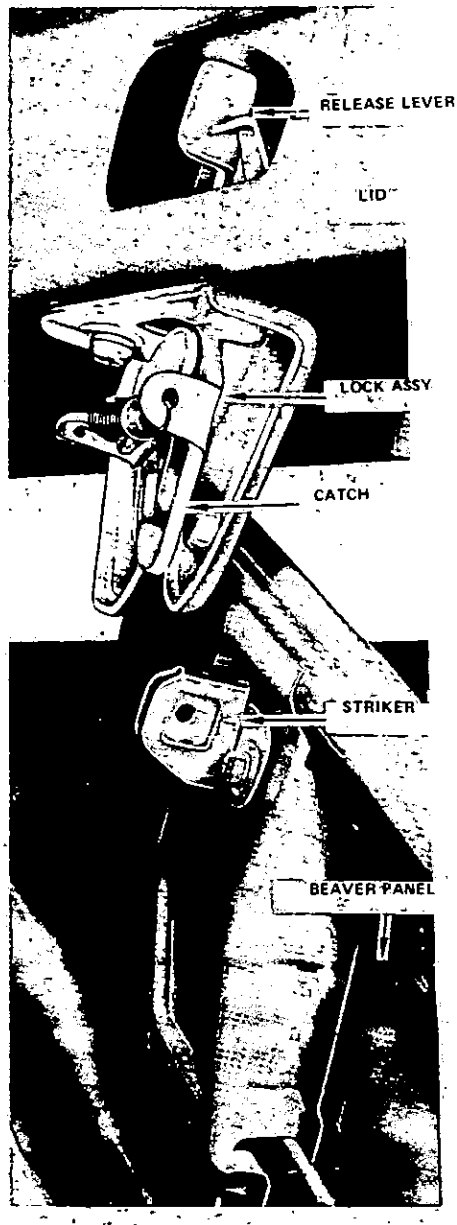
Boot Lid Hinge Showing Adjusting Screw Slots. 1000 Models.

LOCKING BARREL

To Remove and Instal

(1) Open the lid and lever the retaining clip from the lock and remove the locking barrel.

Installation is a reversal of the removal procedure.



View of Luggage Compartment Lid Lock and Striker. 1200 Models.

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WHEELS AND TYRES

SPECIFICATIONS

1000 MODELS

Wheel type	Pressed steel
Tyre size:	
Sedans	550 x 12 – 4 ply
Station sedan	500 x 12 – 4 ply (front) 6 ply (rear)
Inflation pressures (normal speed):	
Front – all models	1.2 kg/cm^2 (17 psi)
Rear – sedans	1.2 kg/cm^2 (17 psi)
Rear – station sedans	1.4 kg/cm^2 (20 psi)

1200 MODELS

Wheel type	Pressed steel
Tyre size:	
Sedans and station wagons	600 x 12 – 4 ply
Inflation pressures (normal speed):	
Front and rear	1.2 kg/cm^2 (17 psi)

NOTE: Increase the above pressures by 0.3 kg/cm^2 – 4 psi – for sustained high speed driving.

1. WHEEL AND TYRE ASSEMBLY

TO REMOVE

(1) Apply the handbrake.
(2) Detach the hub cap from the wheel to be removed.
(3) Unscrew the wheel nuts approximately three-quarters of a turn.
(4) Jack up the vehicle.
(5) Remove the wheel nuts and withdraw the wheel from the vehicle.

TO INSTAL

Installation is a reversal of the removal procedure with attention to the following points:

Tighten the wheel nuts in the order of 1, 3, 2 and 4 and do not over-tighten.

TO MAINTAIN

Proper tyre and wheel maintenance is essential for economical and safe operation.

(1) Check and adjust tyre pressures when the tyres are in a cold condition. Frequent loss of pressure should be investigated and the leakage rectified.

NOTE: Never adjust tyre pressures when the tyres are warm otherwise pressures will be incorrect when the tyres cool down.

(2) Inspect tyres regularly for damage and abnormal wear. Any abnormal wear may be due to one or more of the faults shown in the illustrations or listed in the Fault Diagnosis section. Attention should be given to penetrations or cuts in the tyre which will allow the entry of moisture into the carcass resulting in premature failure.
(3) Ensure that tyres are kept free of oil or grease.
(4) Inspect the wheel studs and nuts for thread damage and the stud holes in the wheels for elongation.
(5) Check the wheels for radial and lateral run-out and for damage to the flanges and bead seats.
(6) Tighten wheel retaining nuts to the correct torque.
(7) Periodically rotate wheels and tyres according to the illustration sequence.
(8) Maintain correct wheel balance.

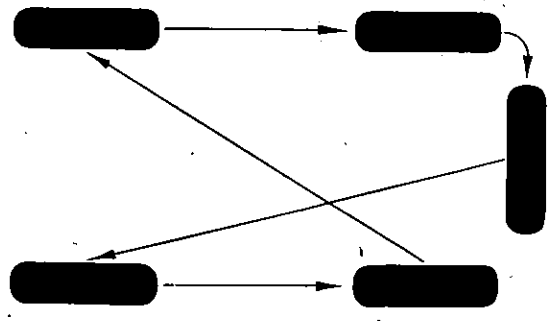

Diagram for Correct Wheel Rotation to Prolong Tyre Life and Minimise Tyre Wear.

2. TUBED TYRES

TO REMOVE

(1) Jack up the vehicle and remove the wheel.
(2) Remove the valve cap and valve core.
(3) Separate the inside bead from the inside wheel flange and using tyre levers, with rounded edges, lever the bead of the tyre over the inside edge of the flange.

NOTE: Exercise extreme care during operation (3) to ensure that the levers do not damage the tube by forcing it against the rim.

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(4) Push the valve of the inner tube into the tyre interior and withdraw the inner tube out between the inner bead of the tyre and the inner flange of the wheel.

(5) Separate the outside bead of the tyre from the outside flange at the wheel and using tyre levers with rounded edges, lever the bead of the tyre over the inside flange of the wheel separating the two components.

TO INSTAL

(1) Remove any loose or excessive scale or rust from the wheel flanges and finally clean with a wire brush or emery paper.

(2) Position the inside flange of the wheel partially inside one of the tyre beads and using tyre levers in good condition lever the remainder of the tyre bead over the flange onto the wheel.

NOTE: During operation (2) ensure that the position of the tyre bead opposite the side where the levers are applied is seating in the wellbase of the wheel rim.

(3) Place the inner tube inside the tyre and insert the valve through the hole in the wheel.

Screw a valve core removing tool on the end of the valve to prevent the valve slipping back into the interior of the tyre when the other tyre bead is being placed on the wheel.

(4) Fit the second bead of the tyre over the wheel inner flange, using the tyre levers or a rubber mallet, and ensuring that the side of the bead adjacent to the tube valve goes over the wheel flange last.

NOTE: In the event of a tyre being marked with a balance dot, place the dot adjacent to the valve stem to maintain correct tyre balance.

(5) Stand the wheel and tyre upright, fit the valve core and inflate the tube until the tyre beads commence to position themselves on the wheel bead seats.

(6) Bounce the tyre on the floor several times to position the tyre beads against the wheel flanges. Inflate the tyre and tube to the recommended pressure and finally check the valve core for leakage and instal the valve cap.

3. TUBELESS TYRES

TO TEST FOR LEAKS

(1) With the wheel removed from the vehicle, inflate the tyre to the recommended pressure, immerse the tyre and wheel in a water tank and check for leaks.

(2) Place the assembly in the tank so that the valve is uppermost, then submerge the valve and check for bubbles.

(3) Release and allow the assembly to float, ensuring the channel between the rim flange and the tyre is filled with water, carefully check for air bubbles emitting from this area.

(4) Turn the wheel assembly over and submerge the wheel rivets if not already submerged and check for leaks.

(5) Submerge the assembly and fill the channel between the flange and the tyre, allow to float and check for leaks. If leaking, wipe area dry and mark the position of the leak with chalk.

TO REPAIR LEAKS

(1) Repair of a small fracture not exceeding 2.38 mm (0.093 in) in the tyre may be repaired by applying sealing cement or dough with a suitable applicator.

(2) Minor repairs to the rim seat can be effected by deflating the tyre and holding the bead away from the seat and cleaning off the affected area.

(3) To repair fractures not exceeding 6.35 mm (0.250 in) in diameter remove the tyre from the wheel and repair the fracture by inserting a rubber plug coated in cement into the hole with the needle provided in the repair kit. Withdraw the needle, after ensuring it has fully penetrated the tyre, and cut the rubber leaving approximately 6.35 mm (0.250 in) protruding above the tread.

NOTE: Should the fracture be in excess of 6.35 mm (0.250 in) the repair should be carried out by an authorised tyre dealer.

(4) If the valve stem is leaking, deflate the tyre and remove from the wheel. Remove the valve from the wheel and inspect for splitting, crushing or dirt between the wheel and the valve. Clean area or replace if necessary.

When fitting a new valve, wet the valve stem and valve hole with soap and insert from the inside of the wheel. Using Schrader tool No. 553 pull the valve through until correctly seated on rim. Do not use pliers or similar hand tools to fit valve.

TO REMOVE

(1) Remove the wheel from the vehicle, remove the valve cap and core.

(2) Separate both inside and outside beads from the wheel flanges so that the beads are in the base of the rim.

(3) Using tyre levers with rounded edges, lever the beads of the tyre, one at a time, off the inner flange of the wheel.

Prior to removal use a soap solution on the beads and wheel flange, and see that the beads, diametrically opposite the point of leverage, are seating on the bottom of the wellbase.

TO INSTAL

(1) Remove loose or excessive scale or rust from the wheel, taking care not to damage paint. Repaint the wheel if necessary.

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(2) Remove any dents from the rim flanges and wipe clean with a moist rag.

(3) Clean off the tyre beads, moisten tyre beads, rim surfaces and tyre levers with clean water or soap solution.

(4) Fit the tyre in the normal way, use narrow levers and taking small bites to avoid strain and damage to the beads. Avoid damage at all times as the sealing quality of the tyre is determined by the condition of the bead.

(5) Fit the second bead so that the part of the bead nearest the valve goes over the rim flange last.

NOTE: Do not use hammer or mallet to fit tubeless tyres. Ensure that the balance mark on the tyre is adjacent to the valve.

TO INFLATE

(1) Holding the assembly upright, bounce the tread of the tyre on the ground at several points around its periphery. This will help to seat the beads on the tapered rim seats and provide a partial seal.

(2) With the valve core removed, connect the air hose and inflate the tyre until the beads have sealed correctly. It may be necessary to bounce the tyre while inflating.

(3) Remove the air hose, fit the valve core and inflate the tyre to 2.81 kg/cm^2 (40 psi). Test the tyre for leaks and deflate to the normal pressure.

TO INFLATE USING A TOURNIQUET

(1) Inflate the tyre with the assistance of a tourniquet use Dunlop tool No TT/1 or its equivalent, follow the fitting instructions included in the kit.

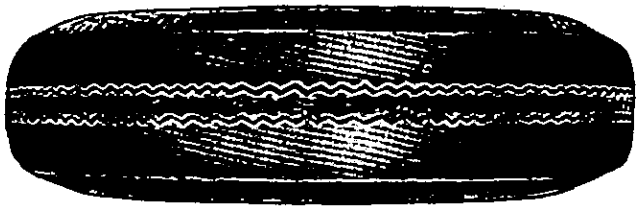
(2) With the valve core removed, inflate the tyre until the beads are sealed against the flanges. Remove the hose, fit the valve core and inflate the tyre to 2.81 kg/cm^2 (40 psi). Test the tyre for leaks and deflate to normal pressure.

NOTE: As an alternative method a tourniquet can be made by using a piece of rope and a suitable lever e.g. a bar, tyre lever or a piece of wood.

4. TYRE WEAR DIAGNOSIS

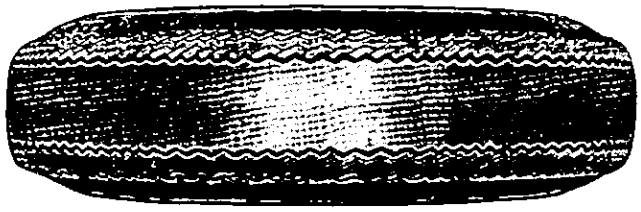
1. Abnormal wear on both sides of tread.

Possible cause	*Remedy*
(a) Under inflation of tyres.	– Check and inflate to recommended pressures.
(b) Over-loading.	– Reduce maximum loading.



2. Abnormal wear in centre of tread.

Possible cause	*Remedy*
(a) Over inflation of tyres.	– Check and reduce to recommended pressures.



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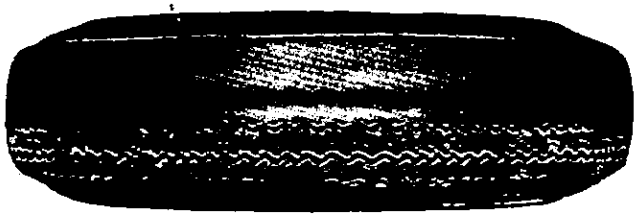
3. Abnormal wear on inside of tyres.

Possible cause	*Remedy*
(a) Insufficient camber angle.	– Check front end alignment and adjust as necessary.
(b) Sagging front coil spring(s).	– Check and renew faulty spring(s).
(c) Loose or worn front hub bearings.	– Check and adjust or renew hub bearings.
(d) Bent stub axle.	– Check and renew faulty components.
(e) Loose or worn suspension arm components.	– Check and renew faulty components. Align front end.



4. Abnormal wear on outside of tread.

Possible cause	*Remedy*
(a) Excessive camber angle.	– Check front end alignment and adjust as necessary.
(b) Incorrect coil spring(s) fitted.	– Check and instal recommended replacement spring(s).

5. Spotty or irregular wear.

Possible cause	*Remedy*
(a) Static or dynamic unbalance of wheel and tyre assembly.	– Check and balance wheel and tyre assembly.
(b) Lateral run-out of wheel.	– Check and true-up or renew wheel.
(c) Excessive play in wheel hub bearing.	– Check and adjust or renew hub bearing.
(d) Excessive play in steering knuckle ball joints.	– Check and renew ball joints.

6. Lightly worn spots at centre of tread.

Possible cause	*Remedy*
(a) Static unbalance of wheel and tyre assembly.	– Check and balance wheel and tyre assembly.
(b) Radial run-out (eccentricity) of wheel.	– Check and renew wheel.

7. Flat spots at centre of tread.

Possible cause	*Remedy*
(a) Eccentric brake drum.	– Check and renew brake drum.
(b) Repeatedly severe brake application.	– Revise driving habits.
(c) Lack of tyre rotation.	– Periodically change tyres by rotation of wheel/tyre assembly.

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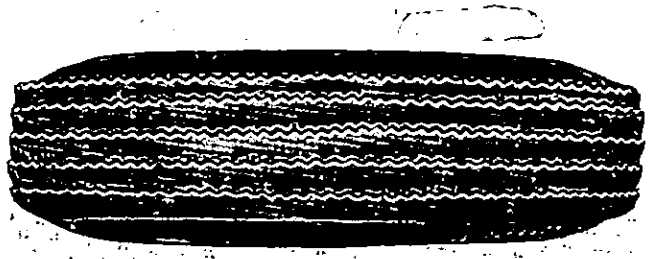
8. Heel and toe wear (sawtooth effect).

Possible cause	*Remedy*
(a) Over-loading.	– Revise maximum loading.
(b) High-speed driving.	– Avoid as far as possible.
(c) Excessive braking.	– Revise driving habits.

9. Feathered edge on one side of tread pattern.

Possible cause	*Remedy*
(a) Sharp inside edge – excessive toe-in.	– Check and adjust wheel alignment.
(b) One tyre sharp inside edge other tyre sharp outside edge.	– Check for bent steering arm and renew.



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LUBRICATION AND MAINTENANCE

1000 SERIES

ENGINE

Sump without filter	3.04 litre (5.352 Imp pt) (6.45 US pt)
Sump with filter	3.58 litre (6.125 Imp pt) (7.5 US pt)
Grade of lubricant	SAE 30

MANUAL TRANSMISSION

Capacity	0.8 litre (1.5 Imp pt) (1.8 US pt)
Lubricant grade	SAE 90 HD

AUTOMATIC TRANSMISSION

Capacity	5.250 litre (9.125 Imp pt) (11.1 US pt)
Lubricant grade	3N71A Type F or equivalent

REAR AXLE

Capacity	0.710 litre (1.250 Imp pt) (1.5 US pt)
Lubricant grade	SAE 90 HD

STEERING BOX:

Capacity	0.240 litre (0.5 Imp pt) (0.6 US pt)
Lubricant grade	SAE 90 HD

COOLING SYSTEM:

Without heater	3.8 litre (6.750 Imp pt) (7.8 US pt)
With heater	4.5 litre (8 Imp pt) (9.6 US pt)

FUEL TANK:

Capacity – Sedan	35 litre (7.875 Imp gal) (9.18 Us gal)
Capacity – Station Wagon, Van	30 litre (6.750 Imp gal) (8.8 US gal)

1200 SERIES

ENGINE

Sump without filter	2.7 litre (4.760 Imp pt) (5.750 US pt)
Sump with filter	3.24 litre (5.750 Imp pt) (6.875 US pt)
Grade of lubricant	SAE 30

MANUAL TRANSMISSION

Capacity	1.2 litre (2.125 Imp pt) (2.50 US pt)
Lubricant grade	SAE 90 HD

AUTOMATIC TRANSMISSION:

Capacity	5.5 litre (9.750 Imp pt) (11.750 US pt)
Lubricant grade	3N71A Type F or equivalent

REAR AXLE

Capacity	0.75 litre (1.375 Imp pt) (1.625 US pt)
Lubricant grade	SAE 90 HD

STEERING BOX

Capacity	0.23 litre (0.375 Imp pt) (0.500 US pt)
Lubricant grade	SAE 90 HD

COOLING SYSTEM

Without heater	4.2 litre (7.375 Imp pt) (8.875 US pt)
With heater	4.9 litre (9.625 Imp pt) (10.378 US pt)

FUEL TANK

Capacity – Sedan	40 litre (8.75 Imp gal) (10.5 US gal)
Capacity – Coupe, Station Wagon, Van	38 litre (8.375 Imp gal) (10.0 US gal)

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1. ENGINE

CRANKCASE AND OIL FILTER

(1) Check oil daily and top up with specified grade when necessary.

(2) Drain and fill the sump at the first 1000 km (600 miles), again at 3000 km (2000 miles). Continue to change oil at every 3000 km (2000 miles) until the mileage reading is 10,000 km (6000 miles). Subsequent changes every 5000 km (3000 miles). If vehicle is operating under dusty or severe conditions, change oil and filter more frequently.

(3) Change the oil filter at 5000 km (3000 miles) and every 10,000 km (6000 miles) during oil change, or every six months.

(4) Clean the oil filler cap every 10,000 km (6000 miles). Wash in petrol, dry out and re-oil.

(5) Clean crankcase ventilation control valve every 20,000 km (12,000 miles).

COOLING SYSTEM

(1) Check coolant level in radiator daily and top up with clean water when necessary.

(2) Drain, flush and refill the cooling system with clean water every 10,000 km – 16,000 km (6000 – 10,000 miles).

FUEL SYSTEM

(1) Clean the fuel pump filter every 10,000 km (6,000 miles) and check fuel pump operation every 20,000 km (12,000 miles).

Change the fuel pump filter every 20,000 km (12,000 miles).

(2) Remove air cleaner element every 5000 km (3,000 miles) and tap out dust. Using low pressure air, blow out the remainder of the dust. Clean the air cleaner body and re-instal element.

The air cleaner element should be changed every 40,000 km (24,000 miles) or more frequently when operating under dusty conditions. Do not washer the paper element in petrol or solvent of any kind.

(3) Lubricate accelerator linkage points with a few drops of engine oil every 10,000 km (6000 miles).

(4) Lubricate the carburettor linkage every 10,000 km (6000 miles) with a few drops of engine oil.

2. TRANSMISSION

GEARBOX

(1) Check the oil level and top up as necessary every 5,000 km (3,000 miles) with correct grade of lubricant.

(2) Drain and refill the gearbox when the vehicle has completed 1000 km (600 miles) and subsequently every 40,000 km (24,000 miles) with the correct grade of lubricant.

PROPELLER SHAFT

(1) Repack the universal joints every 50,000 km (30,000 miles) with lithium based grease.

(2) Replace the universal joints when found to be unserviceable.

REAR AXLE

(1) Check the oil level in the rear axle and top up as necessary every 5000 km (3000 miles) with the correct grade of lubricant.

(2) Drain and refill the rear axle when the vehicle has completed 1000 km (6000 miles) and subsequently every 50,000 km (30,000 miles) with the correct grade of lubricant.

3. SUSPENSION AND STEERING

FRONT SUSPENSION

(1) Remove, clean and repack the hub bearings with wheel bearing grease every 50,000 km (30,000 miles) or earlier if operating under severe conditions.

STEERING

(1) Steering box is filled on assembly and must not be over-filled.

(2) Check for leaks and if excessive, remove and rectify, refill with correct amount and grade of oil.

(3) Check oil level in the steering box every 10,000 km (6000 miles) and top up with correct grade of oil when necessary.

(4) Clean the area surrounding the suspension ball joint and grease every 20,000 km (12,000 miles).

(5) Renew the lubricant in the suspension ball joint every 50,000 km (30,000 miles).

(6) Lubricate the steering linkage every 20,000 km (12,000 miles).

(7) Renew the lubricant in the steering linkage every 50,000 km (30,000 miles).

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4. MISCELLANEOUS

BRAKE FLUID RESERVOIR

(1) When disc brakes are fitted, flush and change the hydraulic brake fluid every 20,000 km (12,000 miles) with clean heavy duty hydraulic brake fluid.

ALTERNATOR

The alternator bearings are packed with grease during assembly and no further lubricating is necessary during operation.

DISTRIBUTOR

(1) Remove the distributor cap and rotor and insert a few drops of oil in the top of the distributor shaft cam assembly, to lubricate the cam bearing, every 10,000 km (6000 miles).

(2) Smear the distributor cam lobes with a high melting point grease when the contact points have been removed for cleaning or renewal.

BATTERY

Check and top up electrolite with distilled water as required or at least fortnightly.

TYRES

(1) Test and inflate when cold to recommended pressures as required, or at least fortnightly.

(2) Rotate tyres every 10,000 km (6000 miles).

BODY

(1) Check and lubricate the following components every 10,000 km (6000 miles) with dry lubricant.

Door locks and strikers, bonnet catch, luggage lock and striker.

(2) Lubricate the following components with a few drops of engine oil: Door hinges, luggage compartment lock mechanism and hinges.

Lubricate the hand brake linkages, clutch and foot brake linkages and remote control lever.

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EMISSION CONTROL

SPECIFICATIONS

Ignition timing	5 deg btdc
Engine idle speed:	
Manual transmission	700 rpm
Automatic transmission	600 rpm in 'D' range
Distributor:	
Make	Hitachi
Model	D412–63
Capacitor capacity	0.22 mfd
Dwell angle	49–55 deg.
Point gap	0.508 mm (0.020 in)
Spark plug:	
Make	NGK
Model	BP–6E
Gap	0.80 – 0.90 mm (0.031 – 0.035 in)
Alternator:	
Make	Hitachi
Model	LT133–05
Capacity	12 volt 33 amp
Carburettor:	
Make	Hitachi
Model	DCG306
Type	Dual throat downdraft
Fast idle setting at full choke	17.5 deg
CO percentage setting	2 – 3
Flow guide valve:	
Make	Hitachi
Model	FGA–1
Opening pressure	10mm/hg (0.4in/hg)
Control valve:	
Make	Hitachi
Model	TPA28-1
Operating depression at sea level (manual transmission)	566 – 579 mm/hg (22.3 – 22.8 in/hg)
Servo diaphragm:	
Full stroke	5.0 mm (0.197 in)
Operating stroke (no loading)	1700 – 1800 engine rpm

To reduce Carbon Monoxide, Hydrocarbons and Oxides of Nitrogen which are the three primary automative emissions causing air pollution three distinct types of emission control systems are used in the B110 Series Datsun range of vehicles.

Depending on pollution standards involved the system may be found to be fitted collectively or separately to the vehicle.

1. CRANKCASE VENTILATION SYSTEM

DESCRIPTION

Two types of crankcase ventilation systems are used as standard equipment on the B110 series engines. One is known as the sealed system and the other as the closed system.

The sealed system was used on some earlier type vehicles but was replaced by the closed system which is now standard equipment on all models which are exported to the USA and Canada.

The Sealed System – consists of a hose connecting the rocker cover to the air cleaner assembly. Pressure drop created within the air cleaner assembly by air flow permits crankcase vapours to flow from the crankcase via the rocker cover into the air cleaner assembly where they are drawn into the inlet manifold and consumed in the cylinders.

The engine oil dipstick and also the oil filler cap are sealed to prevent crankcase fumes from escaping into the atmosphere.

To prevent air cleaner element oil contamination through crankcase vapour, the hose inlet connection into the air cleaner assembly is so situated that the vapour entering the assembly does not pass through the element.

The Closed System – draws clean induction air from within the air cleaner assembly through a meshed flame arrester and into a hose which is connected to the rocker cover.

The air is then passed through the engine and into the inlet manifold via an oil separator, hose and regulating valve. Crankcase vapours are thereby fed back into the cylinders and consumed.

As with the sealed system the oil dipstick and filler cap are sealed from the atmosphere.

This system is most effective at part throttle operation where a particularly high vacuum is present in the inlet manifold to allow the regulating valve to open and for all crankcase vapours to be scavenged from the crankcase. At full throttle operation the manifold vacuum is insufficient to draw all crankcase vapours through the regulating valve and into the inlet manifold. Under these conditions the crankcase ventilation flow is reversed, with the fumes drawing into the air cleaner instead of the inlet manifold.

If the engine is excessively worn and blow by is at a high level then irrespective of throttle operation a certain amount of crankcase vapour will re-cycle back through the rocker cover and into the air cleaner.

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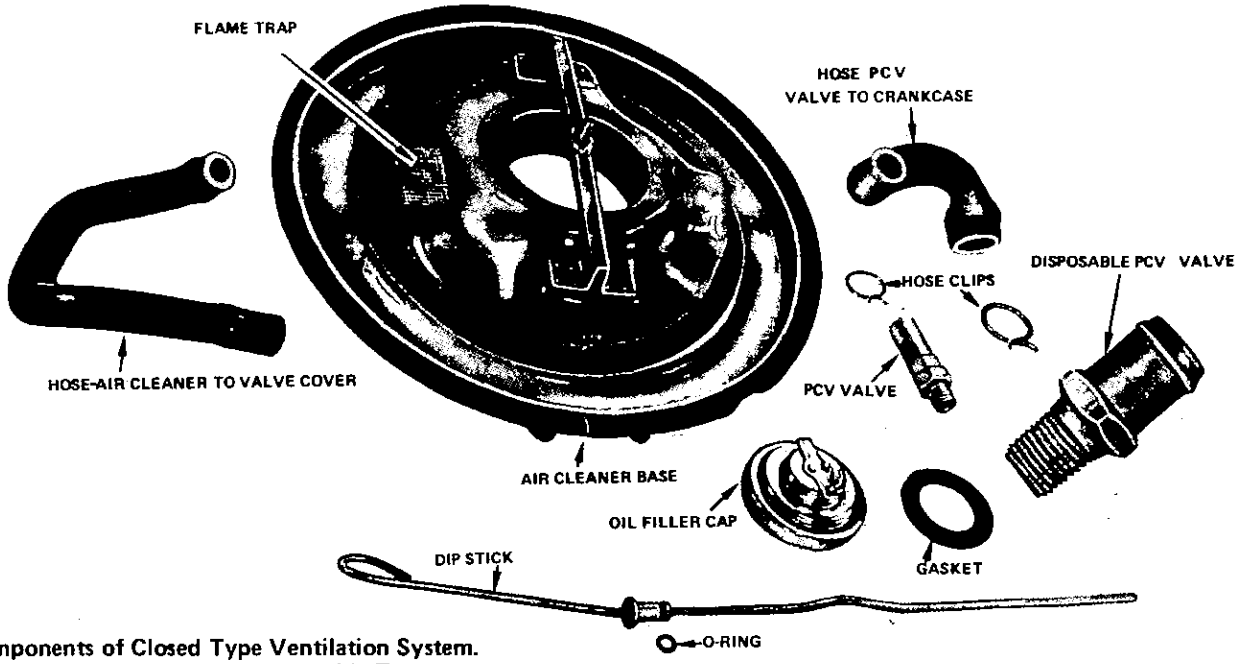

Components of Closed Type Ventilation System. Note inset PCV Valve Disposable Type.

A baffle plate and a meshed filter which is located within the crankcase prevents engine oil from being drawn upwards into the inlet manifold.

TO CHECK AND TEST OPERATION

Sealed System — As this system is relatively simple and does not incorporate a regulating valve it is only a matter of periodically checking the following components at the recommended intervals of 12 months or 18,000 kilometres (12,000 miles).

(1) Check the rocker cover to air cleaner assembly hose for collapsing, blocking or deterioration. Renew the hose, if after checking, it is found to be unserviceable.

(2) Check the seals on the engine oil filler cap and the dipstick. Renew the seals if they are damaged or if their sealing qualities are suspect.

Closed System — The system should also be serviced at the recommended intervals of 12 months or 18,000 kilometres (12,000 miles) with particular attention given to the regulating valve.

(1) Check the condition of the rocker cover to air cleaner assembly hose and also the crankcase to inlet manifold hose. Carefully check for blocking, collapsing or deterioration. Renew the hoses as found necessary.

(2) Check the seals on the engine oil filler cap and the dipstick. Renew the seals if they are damaged or if their sealing qualities are suspect.

(3) Check the operation of the ventilation regulating valve as follows:

With the engine running at a steady idle speed disconnect the hose from the regulating valve.

A sharp hissing noise will be heard at the valve when the hose is disconnected.

Now place a finger over the valve inlet. A strong vacuum should immediately be felt as the finger is placed over the valve.

If the regulating valve is found to be partially or fully inoperative, then renew the valve as a complete assembly. It is not practicable to dismantle and clean the valve.

(4) A faulty regulating valve may give rise to any one or more of the following conditions:

(a) Black smoke emerging from the exhaust.
(b) Engine hunting at idle.
(c) Engine idle fluctuates but engine does not stall.
(d) Loss of power and surging at speeds above idle.
(e) Engine stalls after stops and runs roughly after being restarted with indications of a lean mixture.

Note: To ensure efficient operation of the ventilation system it is advisable to renew the regulating valve every 50,000 kilometres (30,000 miles).

2. EXHAUST CONTROL SYSTEM

DESCRIPTION

The engine modifications system is utilized to reduce the percentage of pollutant gases being expelled from the engine exhaust.

Modifications to the distributor, carburettor and the introduction of a throttle opening device were used to achieve this result.

It is known that when a coasting condition exists and the throttle valve is fully closed an inadequate fuel air

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mixture is drawn into the engine where it is incompletely burnt, resulting in excessive carbon monoxide and hydrocarbon exhaust emission.

The throttle opening device is designed to open the carburettor throttle valve whenever these coasting conditions exist. This allows an adequate fuel air mixture to be drawn into the engine where proper combustion takes place, therefore reducing the level of hydrocarbon and carbon monoxide emission.

The basic components of the throttle opening device are:

Control Valve – Servo diaphragm – Interconnecting tubes.

When deceleration takes place and inlet manifold vacuum increases, the control valve opens, permitting manifold vacuum to be routed to the servo diaphragm vacuum chamber. As shown in the diagram the servo diaphragm assembly is mounted on the carburettor and is connected to the throttle lever through linkage. Applied vacuum actuates the servo diaphragm and linkage to the carburettor, thus slightly opening the throttle valve to the desired degree.

As manifold vacuum lowers to a predetermined level due to the vehicle speed decreasing, the control valve begins to close. The control valve closing allows the inlet manifold vacuum to be maintained at the constant predetermined level.

An altitude corrector is built into the control valve body and is adjusted to a slight preload to compensate for any variation in atmospheric pressure.

This system does not effect engine braking which is normally desired during deceleration.

CONTROL VALVE

To Remove

(1) Raise the engine bonnet.

(2) Disconnect the inlet manifold to control valve vacuum tube.

(3) Disconnect the control valve to servo diaphragm vacuum tube.

(4) Loosen and remove the two control valve assembly attaching bolts at the inlet manifold.

(5) The control valve assembly can now be removed from the engine compartment.

NOTE: It is not practicable to dismantle and repair the control valve. If the unit is malfunctioning then renew the valve as an assembly.

To Instal

(1) Position the control valve back in the engine compartment on the inlet manifold.

(2) Instal and tighten the control valve assembly attaching screws.

(3) Connect the inlet manifold to control valve vacuum tube.

(4) Connect the control valve to servo diaphragm vacuum tube.

(5) Check the operation of the valve and adjust if necessary as described in a following section.

SERVO DIAPHRAGM

To Remove

(1) Detach the vacuum hose from the servo diaphragm vacuum chamber connection.

(2) Remove the carburettor from the engine as previously described in the Fuel Section.

(3) With the carburettor removed from the vehicle and placed on a work bench, withdraw the split pin and disconnect the servo diaphragm link from the carburettor throttle lever.

(4) Loosen and remove the locknut and detach the servo diaphragm from the mounting bracket on the carburettor.

NOTE: It is not practical to dismantle and repair the servo assembly. If the unit is malfunctioning then renew the servo diaphragm assembly.

To Instal

(1) Position the servo diaphragm on the carburettor bracket and instal and tighten the locknut.

(2) Connect the servo diaphragm link to the carburettor throttle lever and retain with a new split pin.

(3) Instal the carburettor to the engine as described in the Fuel Section.

(4) Attach the vacuum hose to the servo diaphragm vacuum chamber connection.

(5) Check the servo diaphragm for correct operation and adjust if necessary. See following text for correct procedure.

TO ADJUST SERVO DIAPHRAGM AND CONTROL VALVE

NOTE: Make all checks and adjustments after first bringing the engine to operating temperature. Ensure that the choke valve is in the fully open position.

(1) Connect a tachometer to the engine distributor.

(2) Disconnect the servo vacuum pipe at the control valve.

(3) Disconnect the control valve vacuum pipe at the inlet manifold.

(4) Now connect the servo diaphragm vacuum pipe straight to the inlet manifold, by-passing the control valve.

(5) Start the engine and without working the throttle, note the engine rpm reading on the tachometer scale.

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NOTE: As soon as the engine is started, inlet manifold vacuum should actuate the servo diaphragm and pull the diaphragm link upwards until the link stop abuts the servo body.

(6) If the servo diaphragm adjustment is correct the engine speed should read between 1700 and 1800 rpm.

(7) If the engine speed is below the lowest figure quoted then back off the lock nut and turn the adjusting screw clockwise slightly until the engine speed falls within the figures quoted.

(8) When the engine speed is above the highest figure quoted back off the locknut and turn the adjusting screw in an anti-clockwise direction until the correct engine speed is obtained.

(9) Retighten the locknut after adjusting as described in operation (7) or (8) whichever was applicable, making sure that the adjusting screw is not disturbed.

NOTE: See diagram for situation of adjusting screw and locknut.

(10) Start the engine and disconnect the servo vacuum hose from the inlet manifold and reconnect back to the control valve. Reconnect the control valve vacuum pipe back to the inlet manifold. The control valve and servo diaphragm vacuum piping should now be back in its original position.

(11) Restart the engine and by actuating the carburettor throttle lever by hand bring the engine up to 3000 rpm.

(12) Release the throttle lever and let the engine speed decrease of its own accord.

(13) The engine speed should decrease from 3000 rpm to 1000 rpm in 3.5 to 4.5 seconds for manual transmission equipped vehicles and 2.5 to 3.5 seconds for automatic transmission equipped vehicles.

(14) If the engine speed decrease times are not within the limits specified (for respective applicable model) then loosen the control valve, lock screw and turn the vacuum adjusting screw slightly until the engine speed decrease time falls within the time figures as quoted in operation (13). (See diagram for control valve lock screw and adjusting screw situation.)

NOTE: Turn the adjusting screw in a clockwise direction to lengthen the engine speed decrease time and an anti-clockwise direction to shorten the engine speed decrease time.

(15) When satisfied the adjustment is correct tighten the control valve lock screw and recheck the engine speed adjustment to ensure that the vacuum adjusting screw has not altered position.

CARBURETTOR

To obtain effective exhaust emission control it is important that the carburettor idle speed and mixture settings are periodically checked and accurately adjusted. The choke setting should be checked and adjusted to affecting the final result regarding exhaust emission control.

To Adjust Idle Speed and Mixture

(1) Connect a tachometer to the engine distributor.

(2) Start and run the engine until it reaches normal operating temperature.

(3) Allow the engine to operate for one minute at idling speed.

(4) Adjust the throttle adjusting screw and the idle mixture screw, in conjunction with each other, until a smooth idle speed of 750 rpm is obtained (780 rpm for automatic transmission).

(5) Now turn the idle mixture screw clockwise to reduce the engine speed to 700 rpm (750 rpm for automatic transmission).

(6) For vehicles that are fitted with automatic transmission the idle speed should be 600 rpm when the shift lever is moved to the D position. This can be checked after operation (5) and any subsequent slight adjustment made.

IMPORTANT: Extreme care should be exercised when carrying out adjustment with the transmission in the drive position.

(7) Stop the engine and disconnect the tachometer.

ELECTRICAL EQUIPMENT

To ensure efficient burning of the fuel in the engine combustion chamber it is important that all electrical equipment be periodically checked for serviceability, as a fault in any one piece of electrical equipment usually has adverse effects on other related components as well as affecting the final result regarding exhaust emission control.

Spark plugs

Remove and sand blast the plugs at the recommended checking intervals. Check each plug thoroughly for cracking, chipping and for excessive wear at the electrodes. Renew the plugs as found necessary.

If the spark plugs are still serviceable, file the centre electrodes flat prior to setting gaps with the correct adjusting tool. See Specifications section for correct electrode gap.

High Tension Leads

Remove the distributor cap with high tension leads from the engine assembly.

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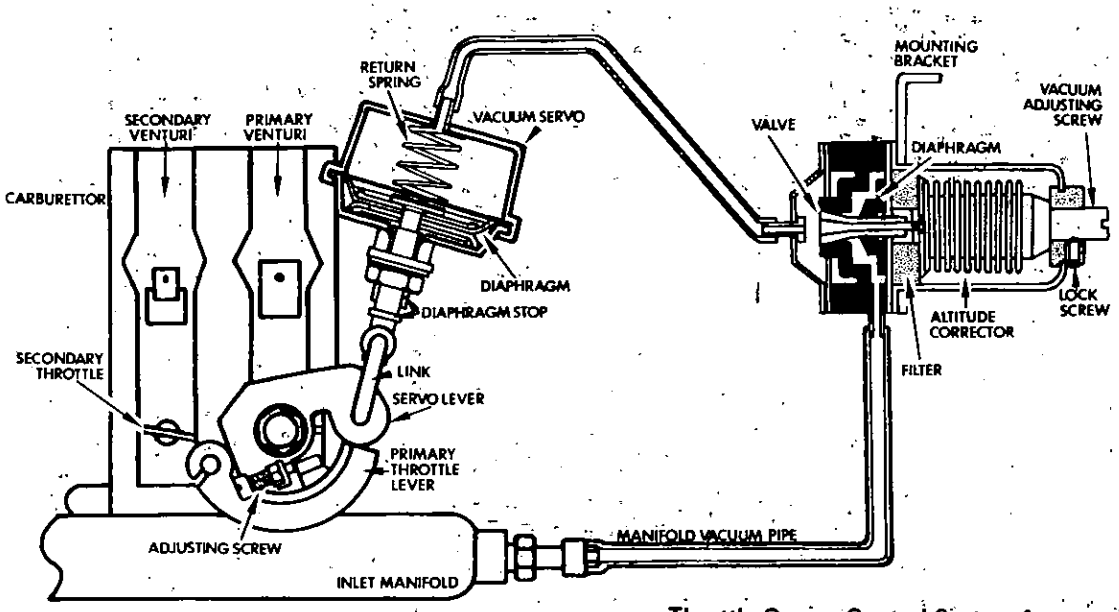

Throttle Opener Control System Arrangement.

Using an ohmmeter check the resistance in each high tension lead.

To make the test fit a plug adaptor into the spark plug end of the lead and connect the ohmmeter between the adaptor and the corresponding terminal in the distributor cap.

If the resistance in any lead is more than 30,000 ohms carefully remove the lead from the cap and check the lead resistance separately.

If resistance is still over 30,000 ohms then renew the leads at fault.

IMPORTANT: Carbon filled high tension leads must be handled carefully at all times. Mishandling of leads will cause a breakdown in lead continuity.

Distributor

The distributor breaker points should be checked at the recommended mileage intervals and renewed if abnormal pitting and wear is evident.

Ensure that the points are in correct alignment so that a full contact will be made when the points are in the closed position.

Set the gap and dwell angle to specifications in the normal manner and then check and adjust the ignition timing as follows:

(1) Check the spark plugs for serviceability and correct gap.

(2) Instal an ignition timing light and a tachometer to the engine.

(3) Wipe the crankshaft pulley so that the timing marks are clearly visible.

(4) Warm up the engine and set the idling speed to 700 rpm.

(5) Loosen the distributor retaining screw far enough to allow the distributor to be moved by hand.

(6) With the aid of the timing light adjust the ignition timing to 5 deg btdc.

NOTE: The 5 deg mark on the crank shaft pulley is the first graduation on the right side of the tdc mark.

(7) Tighten the distributor set screw when the ignition timing is correctly adjusted but make sure that the timing is not altered by moving the distributor.

(8) Set the idle speed and mixture as previously described.

3. EVAPORATIVE CONTROL SYSTEM

DESCRIPTION

The evaporative control system is another approach in reducing the amount of vehicle hydro-carbon emission. It has been estimated that approximately 20 percent of all automotive hydrocarbon emission results from evaporative loss from the fuel tank.

The basic components of the evaporative control system are:

Positive sealed fuel tank – Vapour liquid separator.

Vapour vent line – Flow guide valve.

When the engine is at rest – fuel vapour through evaporation gradually fills the air space in the fuel tank, vapour liquid separator and vapour vent lines and as the fuel tank is fitted with a positive type sealing cap vapour pressure builds up within the system.

The flow guide valve opens when the vapour pressure within the system exceeds 10 mm/hg (0.4 in/hg). Excess

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vapour is then by-passed into the crankcase via a connecting hose.

When the engine starts – Vacuum created within the inlet manifold opens the positive crankcase ventilation valve and also the crankcase side of the flow guide valve. Vapour which has been stored in the crankcase, vent line, separator and fuel tank is then drawn into the inlet manifold and consumed in the cylinders.

When vapour pressure within the system drops sufficiently, the air cleaner side of the flow guide valve opens. This permits atmospheric air pressure to be routed from the air cleaner assembly to the fuel tank. A flame arrester is situated in the line between the air cleaner and the flow guide valve in case of backfire through the carburettor.

Allowing air into the system prevents a high vacuum forming within the system which could cause technical difficulties including a crushed fuel tank.

FLOW GUIDE VALVE

The flow guide valve's most important function is to prevent crankcase blow-by from entering the vapour vent line and fuel tank. The valve should be removed and checked for serviceability at the recommended intervals. It is not practicable to repair the valve if it is found to be unserviceable.

For easy identification the valve apertures are clearly engraved with A, F and C denoting – Air Cleaner – Fuel Tank – Crankcase.

TO TEST

(1) Raise the engine bonnet.

(2) Disconnect all hoses and then remove the flow guide valve from the vehicle.

(3) Apply a low pressure of air to the fuel tank (F) side aperture of the valve. The air should flow through the valve and out the crankcase (C) side aperture.

(4) If no air pressure is felt at the crankcase (C) aperture then renew the valve.

(5) Now apply air pressure to the crankcase (C) side of the valve. Renew the valve if air flow is felt from the air cleaner (A) and fuel tank (F) apertures.

(6) When air pressure is applied to the air cleaner (A) aperture it is normal for air pressure to be felt at the crankcase (C) and fuel tank (F) sides of the valve.

FUEL TANK, VAPOUR LIQUID SEPARATOR AND VAPOUR VENT LINE

To Test

(1) Check the fuel tank filler cap and all hoses for serviceability.

(2) Disconnect the vapour vent line from the flow guide valve (F) aperture.

(3) Connect a tee-piece with manometer and a suitable cock into the vapour vent line.

(4) Slowly apply air pressure to the system via the cock until the manometer indicates 14.5 in/Aq, then close the cock.

(5) Leave the system undisturbed for 2.5 minutes and then measure the height of the liquid in the manometer.

(6) The variation of height in the test instrument should remain with 1.0 in/Aq.

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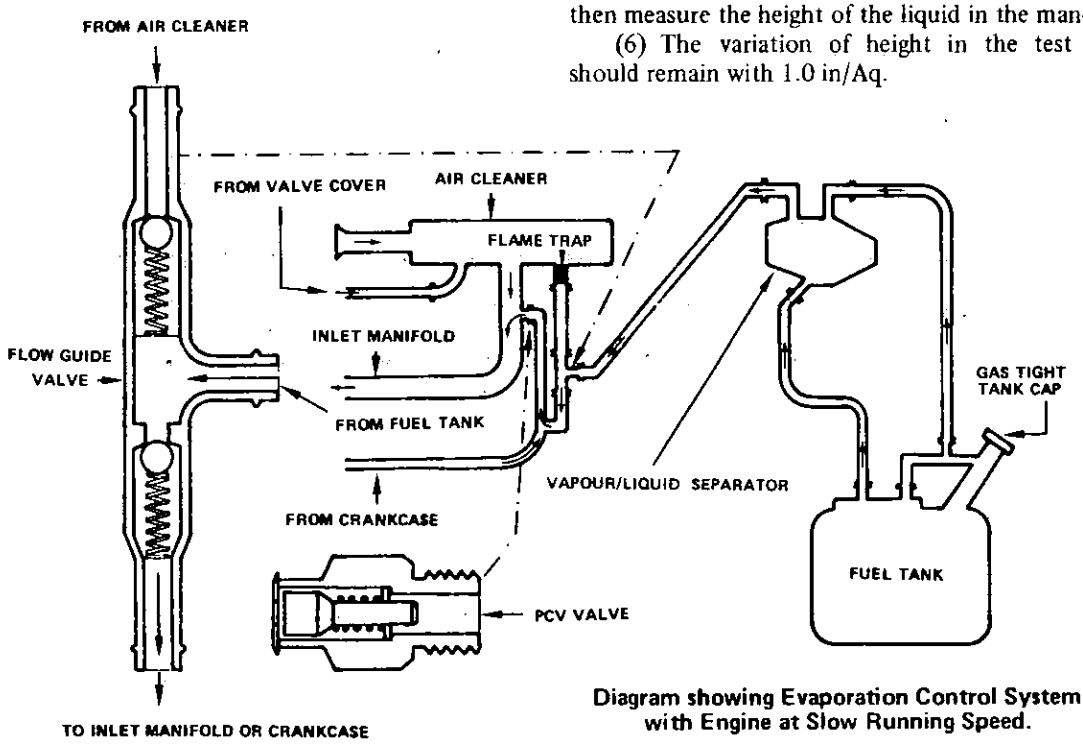

Diagram showing Evaporation Control System with Engine at Slow Running Speed.

(7) If the test is satisfactory remove the tank filler cap and check that the fluid in the manometer drops quickly to zero.

(8) If the fluid height in the manometer drops off slowly, a blocked vapour vent line is indicated. The blockage must be rectified to ensure sufficient vapour delivery to the crankcase.

(9) If the test instrument reading was unsatisfactory in operation (6) check the tank filler cap and hoses for leakage. Rectify as found necessary.

4. EXHAUST CONTROL SYSTEM FAULT DIAGNOSIS

1. Engine knock when coasting.

Possible cause	*Remedy*
(a) Incorrectly adjusted throttle opener.	– Adjust throttle opener.
(b) Malfunctioning control valve.	– Renew control valve.

2. Erratic engine idle.

Possible cause	*Remedy*
(a) Incorrect ignition timing.	– Reset ignition timing.
(b) Incorrect carburettor adjustment.	– Adjust carburettor.

3. Engine idling too fast.

Possible cause	*Remedy*
(a) Incorrectly adjusted throttle opener.	– Adjust throttle opener.
(b) Malfunctioning throttle cable or linkage.	– Check throttle cable or linkage and rectify.
(c) Malfunctioning control valve.	– Renew control valve.

4. Engine stops.

Possible cause	*Remedy*
(a) Incorrect carburettor adjustment.	– Adjust carburettor.
(b) Incorrect ignition timing.	– Reset ignition timing.

5. RECOMMENDED MAINTENANCE

To ensure efficient operation of the emission control system it is important that the following service procedure be carried out on the items mentioned at the recommended mileage intervals.

ENGINE

(1) Carry out the following service procedure every 5000 km (3000 miles):

Check distributor points for serviceability and adjust dwell angle.

Check and adjust ignition timing.

Check and adjust engine idle speed and mixture.

Remove clean and regap spark plugs.

(2) Carry out the following service procedure every 10,000 km (6000 miles):

Sparingly lubricate distributor cam and cam heel.

(3) Carry out the following service procedure every 20,000 km (12,000 miles):

Renew distributor contact points.

Renew spark plugs.

Check high tension leads for serviceability.

Tune and test engine.

(4) Carry out the following service procedure every 40,000 km (24,000 miles):

Renew carburettor air cleaner element.

CRANKCASE VENTILATION SYSTEM

(1) Carry out the following service procedure every 20,000 km (12,000 miles):

Check for correct operation of crankcase regulating valve.

Check all hoses and connection for leaks.

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EXHAUST CONTROL SYSTEM

(1) Carry out the following service procedure every 20,000 km (12,000 miles):

Check and adjust control valve and servo diaphragm.

EVAPORATIVE CONTROL SYSTEM

(1) Carry out the following service procedure every 20,000 km (12,000 miles):

Check hoses, pipes and connections for leakage.

Remove and test flow guide valve for correct operation.

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GLOSSARY OF NAMES AND TERMS

ENGINE

AIR CLEANER – Air filter.
BI-METAL SPRING – Thermostat spring.
CAMSHAFT SPROCKET OR GEAR – Timing gear, timing wheel.
CRANKSHAFT SPROCKET OR GEAR – Timing gear, timing wheel.
END PLAY – End float, end clearance.
ENGINE – Motor.
ENGINE:
  STEADY – Stabiliser, support.
  MOUNTING – Mounts, supports.
FLYWHEEL RING GEAR – Starter ring gear, starter drive gear.
FUEL PUMP – Petrol pump.
GUDGEON PIN – Piston pin, wrist pin.
INLET MANIFOLD – Intake manifold, induction manifold.
INLET VALVE – Intake valve, induction valve.
MUFFLER – Silencer.
NEOPRENE O-RING – Rubber O-ring, oil seal.
NEOPRENE SEAL – Rubber seal, oil seal.
OIL PUMP (Rotor type)
  INNER ROTOR
  OUTER ROTOR
OIL PUMP (Gear type)
  DRIVE GEAR
  DRIVEN GEAR
POWER UNIT – Engine and gearbox.
RELIEF VALVE – Release valve.
ROCKER ARM – Rocker, tappet.
SCREEN (Gauze type) – Filter.
SUMP – Oil pan.
TAPPET – (Hydraulic or solid) – Valve lifter, cam follower.
TIMING CHAIN TENSIONER – Chain tightener.
VALVE COTTER – Valve collet, valve keep, valve key.
WATER PUMP IMPELLER – Rotor.

CLUTCH

CLUTCH HOUSING – Clutch cover, clutch bell housing.
DRIVEN PLATE – Clutch plate, driven disc, clutch disc.
DRIVEN PLATE FACINGS – Driven plate linings, clutch linings.
PRESSURE PLATE – Clutch drive plate.
PRESSURE PLATE COVER – Clutch housing, clutch cover.
RELEASE BEARING – Throw-out bearing, thrust bearing, withdrawal bearing.
RELEASE BEARING PLATE – Throw-out bearing plate, thrust plate.
RELEASE LEVER – Clutch finger, release finger, throw-out lever.
SLAVE CYLINDER – Clutch cylinder, operating cylinder, actuating cylinder.
WITHDRAWAL LEVER – Throw-out lever, clutch fork, release fork.

TRANSMISSION

CIRCLIP – Snap ring, spring clip.
GEAR SHIFT LEVER – Change speed lever, gear selector lever, gear change lever.
INPUT SHAFT – Clutch shaft, first motion shaft, main drive shaft, primary shaft, main drive gear, spigot shaft.
LAYGEAR – Cluster gear, second motion gear, intermediate gear.
LAYSHAFT – Cluster gear shaft, second motion shaft, intermediate shaft.
LOW GEAR – First speed, first gear.
MAINSHAFT – Third motion shaft, output shaft, secondary shaft.
PROPELLER SHAFT – Drive shaft, tail shaft.
SELECTOR FORK – Shift fork, shifter fork.
SELECTOR SHAFT – Selector rod, selector rail, shift rail, shift rod, shifter shaft.
SPIGOT BEARING – Pilot bearing, support bearing.
SPRING RING – Synchro spring, energising spring.
SYNCHRO HUB – Clutch hub.
SYNCHRO RING – Baulk ring, synchro cone.
SYNCHRO SLEEVE – Clutch sleeve.
SYNCHRONISER PLATE – Synchro bar, synchro key, sliding key, shift plate.
TOP GEAR – High gear, high speed.
UNIVERSAL JOINT – Drive coupling.
UNIVERSAL JOINT CROSS – Joint trunnion.
UNIVERSAL JOINT YOKE – Universal joint fork.

REAR AXLE

AXLE SHAFT – Drive shaft, half shaft.
AXLE SHAFT BEARING – Rear wheel bearing, rear axle race.
CARRIER BEARING – Differential bearing, side bearing.
CROWNWHEEL – Ring gear.
DIFFERENTIAL PINION – Spider pinion, pinion gear.
DIFFERENTIAL SIDE GEAR – Axle shaft gear, spider gear.
DRIVE PINION – Differential pinion, bevel pinion.
PINION FLANGE – Drive coupling.

FRONT SUSPENSION/STEERING

BUMP RUBBER – Bumper.
CONTROL ARM – Wishbone, suspension arm, link.
CONTROL ARM SHAFT – Fulcrum pin, fulcrum shaft, pivot pin.
IDLER ARM – Intermediate lever or arm.

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KING PIN – Swivel pin.
PITMAN ARM – Steering arm, drop arm, sector shaft arm.
SECTOR SHAFT – Roller shaft, pitman arm shaft, drop arm shaft.
SHOCK ABSORBER – Damper.
STABILISER BAR – Ride stabiliser, sway bar.
STEERING ARM – Knuckle arm, steering lever.
STEERING CONNECTING ROD – Tie rod, relay rod.
STEERING LINKAGE – Track rods.
STEERING GEAR – Steering gearbox, steering box.
STEERING SHAFT – Worm shaft, steering column.
STUB AXLE – Swivel axle.
STUB AXLE SUPPORT – Steering knuckle support, swivel link, control arm link.
TIE ROD – Track rod, steering link rod.
TIE ROD BALL JOINT – Tie rod end.
WHEEL ALIGNMENT – Toe-in, track alignment.

BRAKES

BACK PLATE – Brake plate, backing plate.
FLEXIBLE BRAKE PIPE – Brake hose, flexible connector.
PISTON – Plunger.
PRIMARY CUP – Main cup, main rubber seal.
RETURN SPRING – Pull-off spring, retractor spring.
SECONDARY CUP – Piston seal.
WHEEL CYLINDER CUP – Wheel cylinder rubber, wheel cylinder seal.
WHEEL CYLINDER – Actuating cylinder.

ELECTRICAL

ADJUSTABLE CONTACT – Breaker point.
ALTERNATOR – AC Generator.
BREAKER ARM CONTACT – Breaker arm point.
CAPACITOR – Condensor.
COURTESY LIGHT – Interior light, roof light.
DIPPER SWITCH – Dimmer switch.
FUEL GAUGE – Petrol gauge.
GENERATOR – Dynamo.
GENERATOR REGULATOR – Voltage regulator, control box.
GLOBE – Bulb, lamp.
TURN SIGNAL LIGHT – Direction indicator light, flasher light, trafficator light.
TURN SIGNAL SWITCH – Direction indicator switch, flasher switch, trafficator switch.
HEADLAMP – Head light, main light.
HIGH TENSION LEADS – Plug wires.
HORN PUSH – Horn switch, horn button.
INSTRUMENT LIGHT – Panel light.
LENS – Glass, Crystal.
NUMBER PLATE LIGHT – Licence plate light.
MEDALLION – Name plate, cover.
PARKING LIGHT – Side light, side lamp.
REGULATOR – Alternator regulator, alternator control.
ROTOR ARM – Rotor button.
STOP LIGHT – Brake light.
STARTER – Starter motor.
STARTER DRIVE – Bendix gear, drive pinion.
TAIL LIGHT – Rear light.
TEMPERATURE GAUGE – Heat gauge.
WARNING LIGHT – Indicator light.
WINDSCREEN WIPER – Windshield wiper.

BODY

DOOR GLASS – Door window, window glass.
FENDER – Mudguard, wing.
GLASS LIFT CHANNEL – Window lift channel.
GLASS REGULATOR – Window lift regulator, window winder.
GLASS RUN CHANNEL – Glass channel, glass runner, bailey channel.
HEADLINING – Roof lining.
HOOD – Bonnet, engine compartment lid.
LUGGAGE COMPARTMENT – Boot.
REAR GLASS – Back light, back window.
VENTILATOR GLASS – No draught ventilator, vent glass, ventilator, flipper window, quarter-glass.
WEATHERSTRIP – Weathershield.
WINDSCREEN – Windshield.

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MAKE	Datsun	OPTIONS	nil
MODEL	1000	COLOR	white
BODY TYPE	4-door sedan	MILEAGE START	4790
PRICE	$1899	FINISH	4930

WEIGHT ..... 13 cwt

FUEL CONSUMPTION:
Overall ..... 35.2 mpg
Cruising ..... 36-39 mpg

TEST CONDITIONS:
Weather: fine. Surface: hot mix bitumen. Load: two persons. Fuel: premium grade.

SPEEDOMETER ERROR:

Indicated mph:	30	40	50	60	70
Actual mph:	30	37	45	53	62

PERFORMANCE

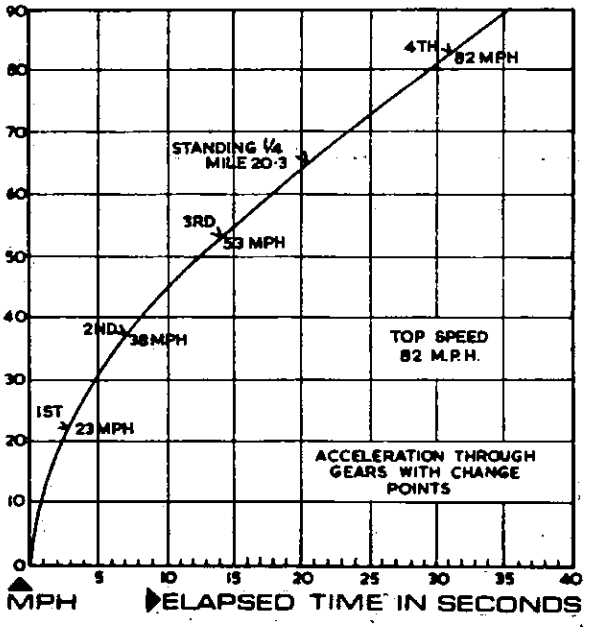
Piston speed at max bhp ..... 2320 ft/min
Top gear mph per 1000 rpm ..... 16.4 mph
Engine rpm at max speed ..... 4660 rpm
Engine rpm at cruising speed ..... 4250 rpm
Lbs (laden) per gross bhp (power to weight) 24

MAXIMUM SPEEDS:
Fastest run ..... 82 mph
Average of all runs ..... 82 mph
Speedometer indication fastest run ..... 89 mph
In gears: 1st 23 mph, 2nd 38 mph, 3rd 53 mph, 4th 82 mph.

ACCELERATION:
(through gears)
0-30 mph ..... 4.4 sec
0-40 mph ..... 8.1 sec
0-50 mph ..... 12.2 sec
0-60 mph ..... 18.2 sec
0-70 mph ..... 23.0 sec

	3rd gear	4th gear
20-40 mph	6.0 sec	8.2 sec
30-50 mph	7.5 sec	8.2 sec
40-60 mph	7.5 sec	11.5 sec
50-70 mph		12.5 sec

STANDING QUARTER MILE:
Fastest run ..... 20.2 sec
Average of all runs ..... 20.3 sec



Road test figures courtesy Wheels Magazine, from its October '68 Sydney report.

SPECIFICATIONS

ENGINE:
Cylinders ..... four in line
Bore and stroke ..... 73 mm by 59 mm
Cubic capacity ..... 988 cc
Compression ratio ..... 8.5 to 1
Valves ..... overhead pushrod
Carburettor ..... 2 bbl Haitachi d'draft
Fuel pump ..... mechanical
Oil filter ..... full flow
Power at rpm ..... 62.8 at 6000 rpm
Torque at rpm ..... 61.5 lb/ft at 4000 rpm

TRANSMISSION:
Type ..... 4-speed all syncro
Clutch ..... single dry plate
Gear lever location ..... floor
Direct ratio: 1st 3.76
2nd 2.17
3rd 1.40
4th 1.00
Final drive ..... 4.111 to 1

CHASSIS and RUNNING GEAR:
Construction ..... unitary
Suspension, front ..... wishbones, transverse spring
Suspension, rear ..... leaf springs
Shock absorbers ..... telescopic
Steering type ..... recirc 15:1 ratio
Turns 1 to 1 ..... 2.8
Turning circle ..... 26.2 ft
Steering wheel diameter ..... 15½ in.
Brakes, type ..... drum/drum
Dimensions ..... 8 in. diameter
Friction area ..... 89 sq in.

DIMENSIONS:
Wheelbase ..... 7 ft 5¾ in.
Track, front ..... 3 ft 10⅞ in.
Track, rear ..... 3 ft 10⅝ in.
Length ..... 12 ft 6½ in.
Height ..... 4 ft 5 in.
Width ..... 4 ft 8⅞ in.
Fuel tank capacity ..... 7½ gal

TYRES:
Size 5.50-12
Pressures ..... 17 psi
Make on test car ..... Dunlop Dunsafe

GROUND CLEARANCE:
Registered ..... 7½ in.

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3.38
2.17
1.40
1.00
4.375

MAKE	Datsun	PRICE	$2145 ($2119)
MODEL	1000 coupe (1000)	OPTIONS	nil
BODY TYPE	2-dr coupe (4-dr sedan)	COLOR	white (white)
		WEIGHT	13.25 cwt (13.1 cwt)

FUEL CONSUMPTION:

Overall	32 mpg (29 mpg)
Cruising	34-38 mpg (30-34 mpg)

TEST CONDITIONS:

Weather	fine
Surface	hot-mix bitumen
Load	2 persons
Fuel	premium grade

SPEEDOMETER ERROR:

Indicated mph:	30	40	50	60	70
Actual mph:	28	37	47	57	66
	(29.5)	(39.0)	(48.0)	(57.0)	(67.0)

PERFORMANCE

Piston speed at max bhp	2310 ft/min
Top gear mph per 1000 rpm	15.5 mph
Engine rpm at max speed	5350 rpm (4900 rpm)
Lbs (laden) per gross bhp power to weight	22.6 (23.6)

MAXIMUM SPEEDS:

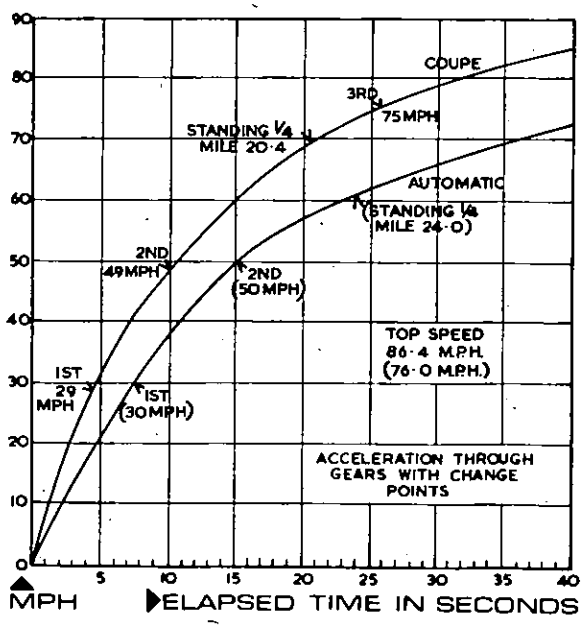
Fastest run	89.0 mph (78.2 mph)
Average of all runs	86.4 mph (76.0 mph)
Speedometer indication fastest run	92 mph (81 mph)

In gears:
1st 29 mph (30); 2nd 49 mph (50); 3rd 75 mph (76); 4th 86 mph.

Acceleration (through gears):

0-30 mph	4.8 secs (8.2 secs)
0-40 mph	7.2 secs (10.6 secs)
0-50 mph	10.5 secs (15.0 secs)
0-60 mph	15.2 secs (23.2 secs)
0-70 mph	21.0 secs (36.5 secs)
0-80 mph	32.6 secs

(Figures for Automatic Sedan in brackets)



Road test figures courtesy Wheels Magazine, from its August 1969 Sydney report.

	3rd gear	4th gear	(Drive)
20-40 mph	6.4 secs	9.9 secs	(5.5 secs)
30-50 mph	6.7 secs	10.1 secs	(7.0 secs)
40-60 mph	7.6 secs	11.2 secs	(10.7 secs)
50-70 mph	10.0 secs	13.7 secs	(21.8 secs)

STANDING QUARTER MILE:

Fastest run	20.3 secs (23.5 secs)
Average of all runs	20.4 secs (24.0 secs)

SPECIFICATIONS

ENGINE:

Cylinders	four in line
Bore and stroke	73 mm by 59 mm
Cubic capacity	988 cc
Compression ratio	9.0 to 1 (8.5 to 1)
Valves	ohv
Carburettor	2 bbl downdraught
Power at rpm	66 at 6000 rpm (62 at 6000 rpm)
Torque at rpm	65.7 lb/ft at 4000 rpm (61.5 lb/ft at 4000 rpm)

TRANSMISSION:

Type	4-speed (Nissan 3-speed fully automatic)
Clutch	sdp (torque converter)
Gear lever location	central floor (column quadrant)
Overall ratio:	1st 3.76 (2.458); 2nd 2.17 (1.458); 3rd 1.40 (1.000); 4th 1.00.
Final drive	4.111 to 1

CHASSIS and RUNNING GEAR:

Construction	unitary

SUSPENSION:

Front	wishbones, transverse leaf
Rear	leaf springs
Shock absorbers	telescopic

STEERING:

Type	recirc ball
Turns, 1 to 1	3.4
Turning circle	26 ft

BRAKES:

Type	drum front and rear

DIMENSIONS:

Wheelbase	89.8 in.
Track, front	46.9 in.
Track, rear	46.5 in.
Length	12 ft 4.4 in. (12 ft 5.6 in.)
Height	4 ft 3.6 in. (4 ft 5 in.)
Width	4 ft 8.9 in.
Fuel tank capacity	8 gals (7.7 gals)

TYRES:

Size	5.50-12
Make on test car	Dunlop Dunsafe

GROUND CLEARANCE:

Registered	6.7 in. (6.3 in.)

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MAKE:	Datsun	**MODEL:**	1200 Manual/ Automatic
BODY TYPE:	4-dr sedan	**WEIGHT:**	13.9 cwt (690 kg)
OPTIONS:	Nil	**PRICE:**	$2108/2334
MILEAGE START:	1609	**COLOR:**	Red
FINISH:	2023		

FUEL CONSUMPTION:
Overall: .... Manual 31 mpg (13.2 k-l); Auto 28 mpg (10.9 k-l).
Cruising: .... Manual 32-36 mpg (13.5-15.3 k-l); Auto 29-33 mpg (12.3-14 k-l).

TEST CONDITIONS:
Weather, fine; Surface, bitumen bonded gravel; Load, two persons; Fuel, premium grade.

SPEEDOMETER ERROR (mph):

Indicated	30	40	50	60	70
Actual	28	37	46	54.5	64

PERFORMANCE

Piston speed at max bhp (70,050 cm/min) 2760 ft/min
Top gear mph per 1000 rpm ..... 16.0 (25.8 kph)
Engine rpm at max speed 4200
Lbs (laden) per gross bhp (power-to-weight) .. 22.2 (10 kg-bhp)

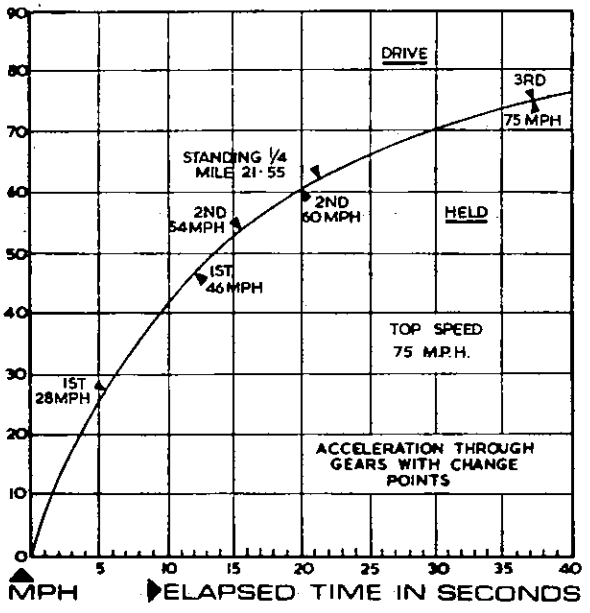
MAXIMUM SPEEDS:
Fastest run ..... (121 kph) 75.5 mph
Average of all runs ..... (120.5 kph) 75.0 mph
Speedometer indication, fastest run (146 kph) 91.0 mph

IN GEARS:

(Automatic)	Drive	Held
1st	28 mph (45 kph)	46 mph (74 kph)
2nd	54 mph (87 kph)	60 mph (97 kph)
3rd	75 mph (120 kph)	75 mph (120 kph)

ACCELERATION (Through gears):

0-30 mph	6.1 sec
0-40 mph	9.4 sec
0-50 mph	13.3 sec
0-60 mph	19.5 sec
0-70 mph	29.5 sec



Road test figures courtesy Wheels Magazine, from its September 1970 Sydney report.

	Automatic 2nd Gear	Drive
20-40 mph	6.3	4.1
30-50 mph	6.4	5.2
40-60 mph	7.3	7.1
50-70 mph	9.1	11.6

STANDING QUARTER MILE:
Fastest run ..... 21.5 sec
Average all runs ..... 21.55 sec

BRAKING:
From 30 mph to 0 ..... 1.0 sec
From 60 mph to 0 ..... 3.05 sec

SPECIFICATIONS

ENGINE:
Cylinders ..... 4 in-line
Bore and stroke .... 73 by 70 mm (2.87 by 2.76 in.)
Cubic capacity ..... 1171 cc (71.5 cu in.)
Compression ratio ..... 9.0 to 1
Valves ..... ohv
Carburettors ..... single downdraft Aisan SU
Power at rpm ..... 69 bhp at 6000 rpm
Torque at rpm .... 70 ft/lb (10.6 kg/m) at 3600 rpm

TRANSMISSION:
Type ... 4-speed all syncro (Borg Warner Type 35)
Clutch ..... Single dry plate (fluid)
Gear lever location ..... Central (central T-bar)
Overall ratio: 1st 3.76 (2.46), 2nd 2.17 (1.46), 3rd 1.40 (1.00), 4th 1.000, final drive 3.90.

CHASSIS AND RUNNING GEAR:
Construction ..... integral
Suspension front ..... coil/struts, anti-roll bar
Suspension rear ..... leaf springs
Shock absorbers ..... telescopic
Steering type ..... recirculating ball
Turns 1 to 1 ..... 4, 15 to 1 ratio
Turning circle ..... 27 ft (82 m)
Brakes type ..... drum, front and rear
Dimensions ..... 8 in. (20.2 cm) diameter

DIMENSIONS:
Wheelbase ..... 90.6 in. (243 cm)
Track front ..... 48.8 in. (124 cm)
Track rear ..... 49.0 in. (125 cm)
Length ..... 12 ft 6.9 in. (405 cm)
Height ..... 4 ft 6.7 in. (139 cm)
Width ..... 4 ft 10.9 in. (124 cm)
Fuel tank capacity ..... 8.8 galls (32.5 litres)
Tyres: Size ..... 6.00 x 12 (155 x 305)
Make on test car ..... Dunlop Dunsafe

GROUND CLEARANCE: ..... Registered 6.6 in. (16.8 cm)

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Road test figures courtesy Wheels Magazine, from its April 1971 report.

MAKE	Datsun
MODEL	1200 Coupe
BODY TYPE	2-door Coupe
PRICE	$2414
COLOR	Cream
MILEAGE START	21
MILEAGE FINISH	608
WEIGHT	1520 lb (695 kg)

FUEL CONSUMPTION:

Overall	31 mpg
Cruising	37-38 mpg

TEST CONDITIONS:

Weather	Hot, fine
Surface	Hot mix
Load	2 persons
Fuel	premium

SPEEDOMETER ERROR (mph):

Indicated	30	40	50	60	70
Actual	28.4	38.1	46.8	55.8	63.9

PERFORMANCE

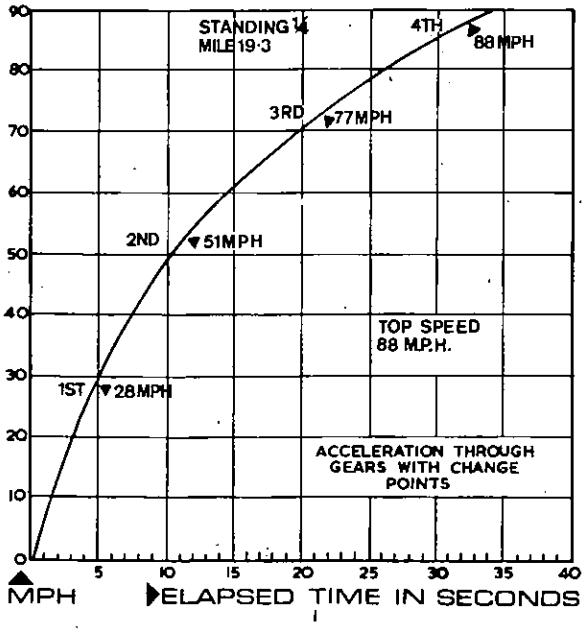
Piston speed at max bhp	(840 m/min) 2760 ft/min
Top gear mph per 1000 rpm	16
Engine rpm at max speed	5500
Lbs (laden) per gross bhp (power-to-weight)	22 lb (10 kg)

MAXIMUM SPEEDS:

Fastest run	(141 kph) 88 mph
Average of all runs	(136 kph) 85 mph
Speedometer indication, fastest run	(157 kph) 98 mph

IN GEARS:

1st	28.4 mph (45 kph) (6000 rpm)
2nd	51 mph (82 kph) (6000 rpm)
3rd	77.5 mph (124 kph) (6000 rpm)
4th	88 mph (141 kph) (5500 rpm)



ACCELERATION (through gears):

0-30 mph	5.4 sec
0-40 mph	7.7 sec
0-50 mph	10.9 sec
0-60 mph	15.5 sec
0-70 mph	22.1 sec
0-80 mph	32 sec

	2nd gear	3rd gear	4th gear
20-40 mph	4.0 sec	8.0 sec	11.6 sec
30-50 mph	4.2 sec	7.0 sec	9.6 sec
40-60 mph		8.2 sec	10.5 sec
50-70 mph		8.3 sec	12.4 sec

STANDING QUARTER MILE:

Fastest run	19.1 sec
Average all runs	19.3 sec

BRAKING:

From 30 mph to 0	1.7 sec
From 60 mph to 0	3.6 sec

SPECIFICATIONS

ENGINE:

Cylinders	Four in line
Bore and Stroke	2.87 in. x 2.76 in. (73 mm x 70 mm)
Cubic Capacity	71.5 cu in. (1171 cc)
Compression Ratio	9 to 1
Valves	Overhead pushrod
Carburettors	Two barrel downdraft
Fuel Pump	Mechanical
Oil Filter	Full flow
Power at rpm	69 bhp @ 6000
Torque at rpm	70 lb/ft (9.7 kg/m) @ 3600

TRANSMISSION:

Type	4 manual, all syncro
Clutch	SDP
Gear lever location	Floor console

RATIOS:

	Direct	Overall
1st	3.76	14.66
2nd	2.17	8.46
3rd	1.40	5.46
4th	1.0	3.9
Final Drive	3.9:1	

CHASSIS and RUNNING GEAR:

Construction	Unitary
Suspension Front	McPherson struts, anti-roll bar
Suspension Rear	Semi-elliptic leafs
Shock Absorbers	Telescopic
Steering Type	Recirculating ball
Turning Circle	26 ft 8 in. (8.2 m)
Steering Wheel Diameter	15 in. (38.1 cm)
Brakes Type	Disc/drum

DIMENSIONS:

Wheelbase	90.6 in. (230 cm)
Track Front	48.8 in. (124 cm)
Track Rear	49 in. (124.5 cm)
Length	12 ft 6 in. (382 cm)
Height	4 ft 5 in. (135 cm)
Width	4 ft 11.6 in. (151.5 cm)
Fuel Tank Capacity	8.5 gals (38 litres)

TYRES:

Size	155 SR 12
Pressures	24 lb all round
Make on Test Car	Dunlop SP 3

GROUND CLEARANCE:

Registered	6.7 in. (17 cm)

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