

**SCIENTIFIC PUBLICATIONS'**

**WORKSHOP MANUAL SERIES No 87**

# DATSUN 1000 1200

**WITH SPECIFICATIONS  
REPAIR AND  
MAINTENANCE  
DATA**

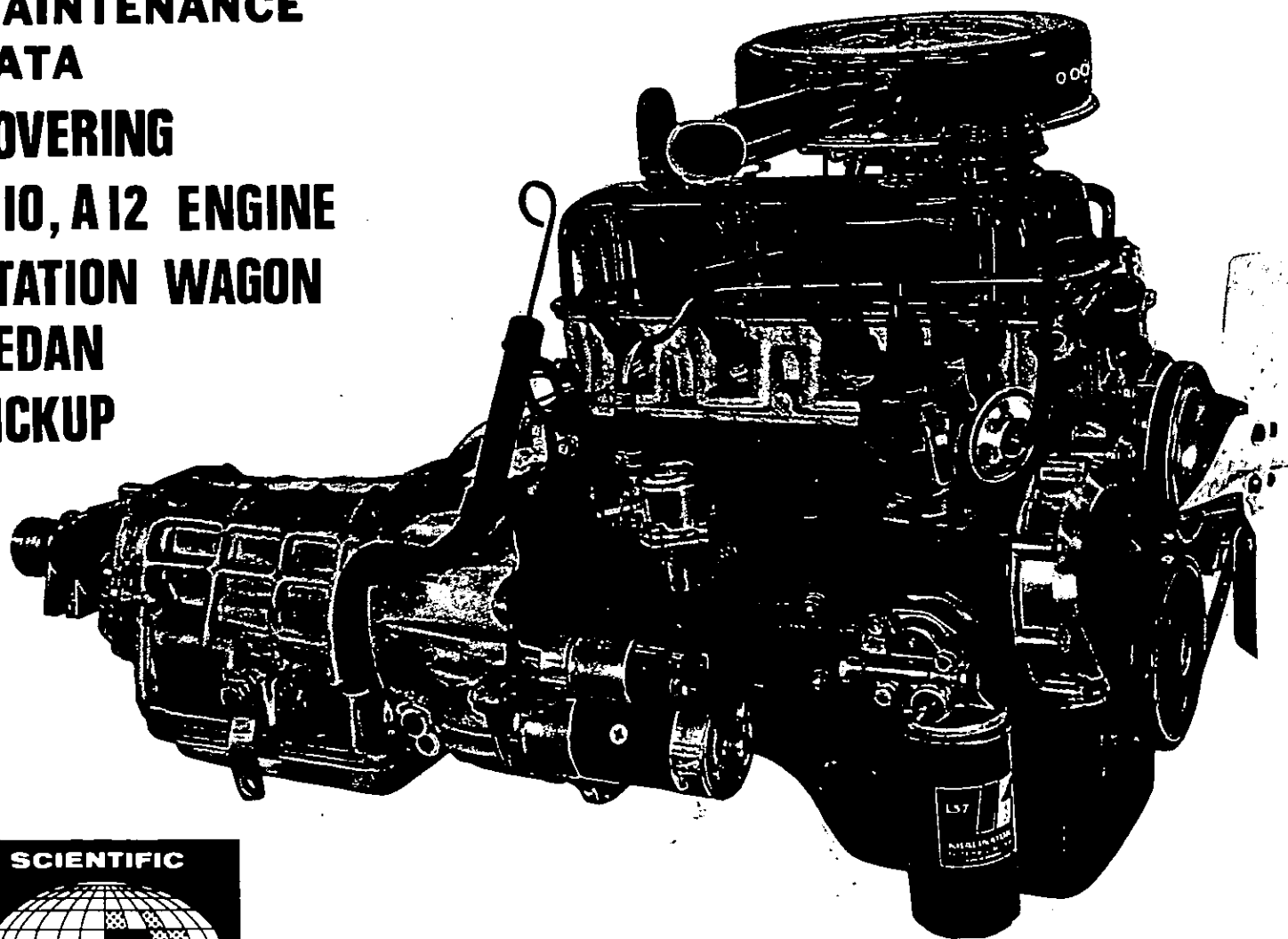
**COVERING**

**A10, A12 ENGINE**

**STATION WAGON**

**SEDAN**

**PICKUP**



**SCIENTIFIC PUBLICATIONS'**  
**WORKSHOP MANUAL SERIES No. 87**

**DATSUN 1000, 1200**

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**WORKSHOP MANUAL SERIES No. 87**

**DATSUN 1000, 1200**  
**SERIES B10, B110**

**SEDAN, WAGON, PICK-UP**

**AUTOMATIC and MANUAL TRANSMISSIONS**

**With Specifications,**  
**Repair and Maintenance Data**

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Holden FE, FC, FB	16	80	82	1.85	Standard Space-master Series II	42	125	105	3.00
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Holden HK, HT, HG V8 Engine	85	272	215	7.00	Toyota Corolla 1100	73	176	107	5.75
Holden HK, HT, HG 6 cyl Engine	86	224	188	6.25	Toyota Corolla 1200	93*			
Holden Torana S, SL, 1969 Brabham	72	191	120	6.25	Toyota Corona	83	224	175	6.00
IHC Trucks AR-AL	17	437	657	3.50	Triumph TR2, 3, 4	44	167	130	5.25
IHC Trucks AS line	18	173	245	1.40	Valiant AP 6, VC, VE, VF-V8 Engine	69	174	95	6.25
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\* In Production

† Recommended retail price in Australia.

**OVERSEAS REPRESENTATIVES**

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# ENGINE

## SPECIFICATIONS

Type .....	4 cylinder-in line-OHV	Replacement guide .....	12.211–12.200 mm (0.4807–0.4800 in)
Bore .....	73 mm (2.874 in)	Valve seat angle .....	45°
Stroke:		Valve seat width:	
A10 engine .....	59 mm (2.323 in)	Inlet .....	1.30 mm (0.0512 in)
A12 engine .....	70 mm (2.756 in)	Exhaust .....	1.80 mm (0.0709 in)
Capacity:		Valve seat insert outer diameter – standard:	
A10 engine .....	988 cm <sup>3</sup> (60.3 in <sup>3</sup> )	Inlet .....	37.080–37.096 mm (1.459–1.460 in)
A12 engine .....	1171 cm <sup>3</sup> (71.5 in <sup>3</sup> )	Exhaust .....	33.080–33.096 mm (1.302–1.303 in)
Compression ratio:		Valve seat insert inner diameter:	
A10 engine .....	8.5:1	Inlet .....	30 ± 0.10 mm (1.181 ± 0.004 in)
A12 engine .....	9.0:1	Exhaust .....	26 mm (1.023 in)
Bhp (Maximum):		Valve seat insert depth:	
A10 engine .....	56 at 6000 rpm	Inlet and exhaust .....	6.0–5.90 mm (0.2362 – 0.2323 in)
A12 engine .....	68 at 6000 rpm	Insert interference fit in head .....	0.064–0.096 mm (0.0025–0.0038 in)
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)

## 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)

## 2—Engine

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)



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)
<b>Bearing inner diameter:</b>	
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 <sup>2</sup> (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.

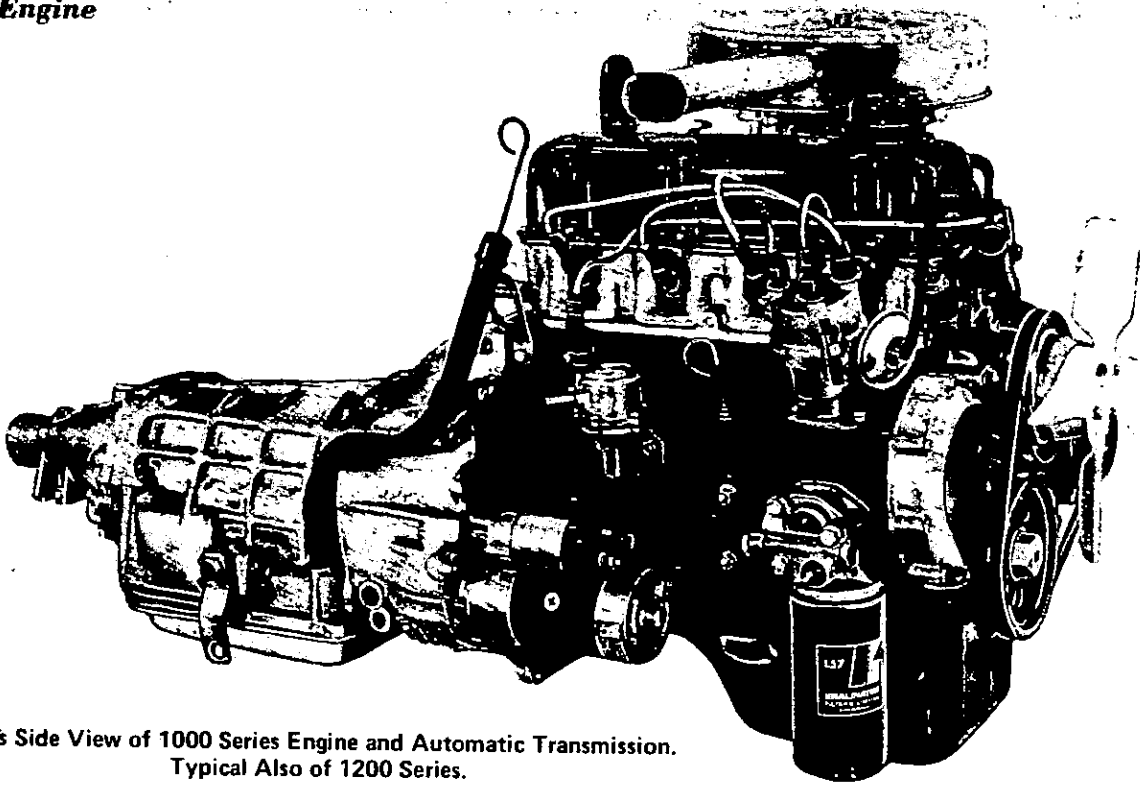
The gudgeon pin is an interference fit in the small end of

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.



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

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 trochoid 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.

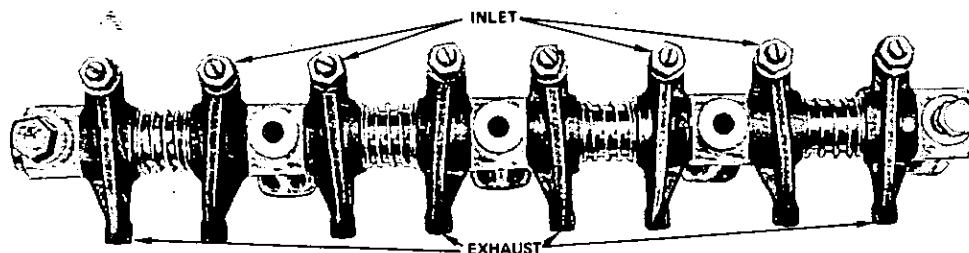
(6) Using a suitable spanner, tighten each pedestal securing bolt progressively a few turns each until the five pedestals are seating securely on the cylinder head. Use care to ensure that the centre pedestal is located correctly on the oil passage in the cylinder head.

(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.

### 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.

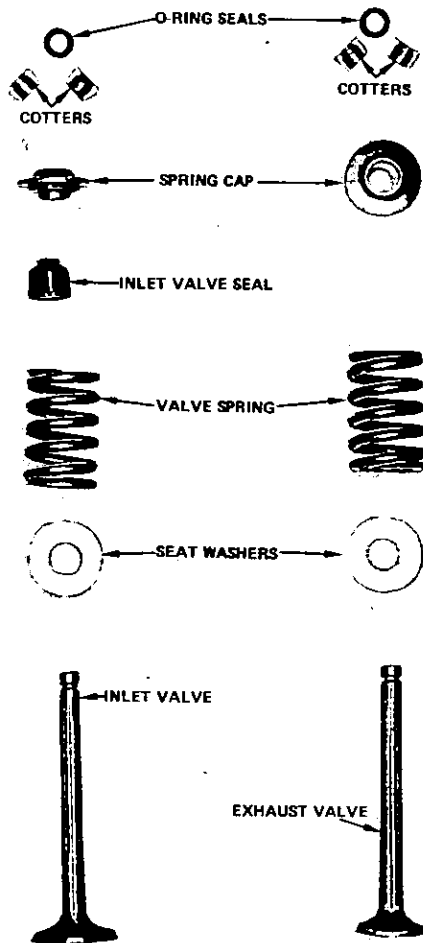
- (7) Disconnect the high tension leads at the spark plugs and coil and remove the distributor cap and leads. Remove the spark plugs from the cylinder head.
- (8) Disconnect the temperature gauge wire at the connection on the front of the cylinder head.
- (9) Take out the six securing screws and remove 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.



Valve and Valve Spring Components.

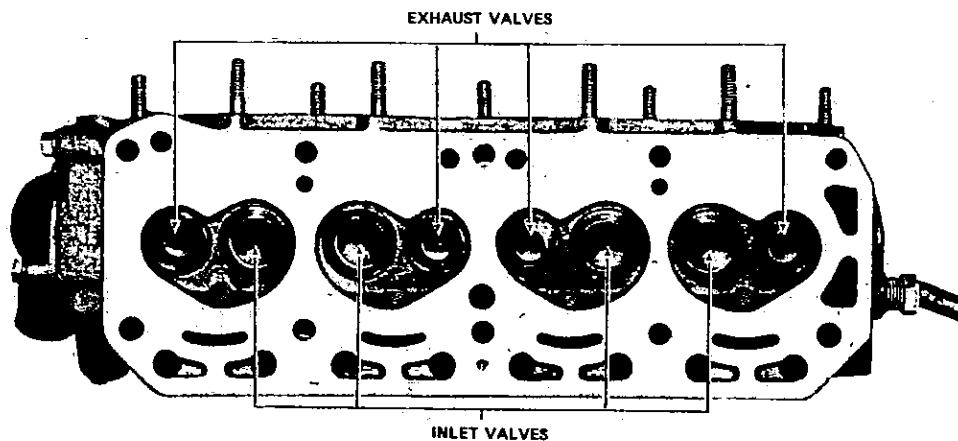
#### TO DISMANTLE

(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.

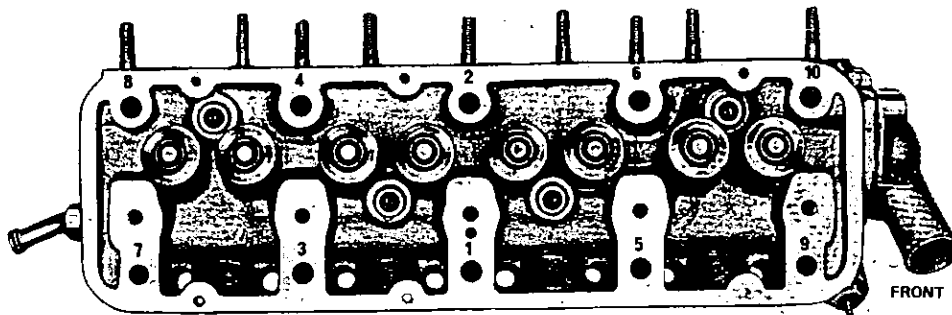
(2) Release the spring compressor and remove the valve spring retaining cap, spring and spring seat washer, if fitted.

(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



Combustion Chamber Side of Cylinder Head.



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 Prussian-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.

## 8—Engine

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.

## 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.

(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.

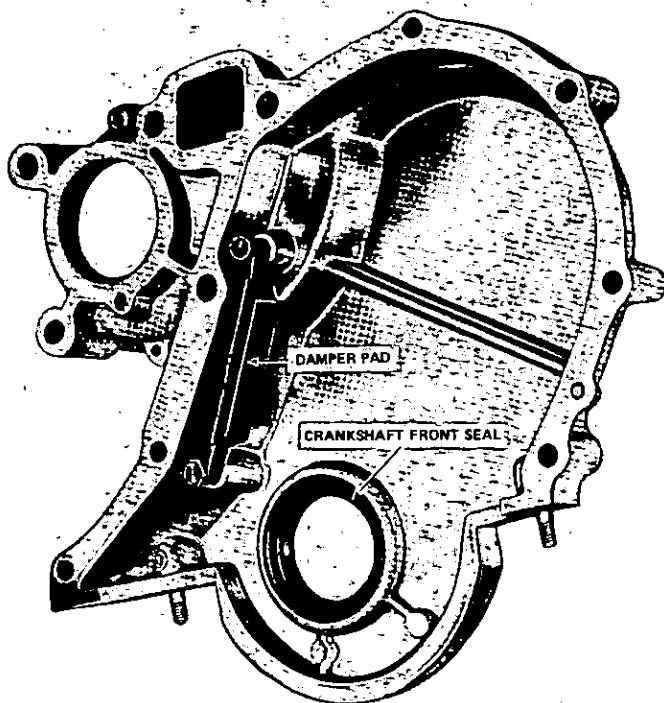
(7) Remove the camshaft sprocket retaining bolt and washers, and using a suitable lever, prise the sprocket off the camshaft from the top and remove the sprocket and chain, disengaging the chain from around the crankshaft sprocket.

### TO INSTAL

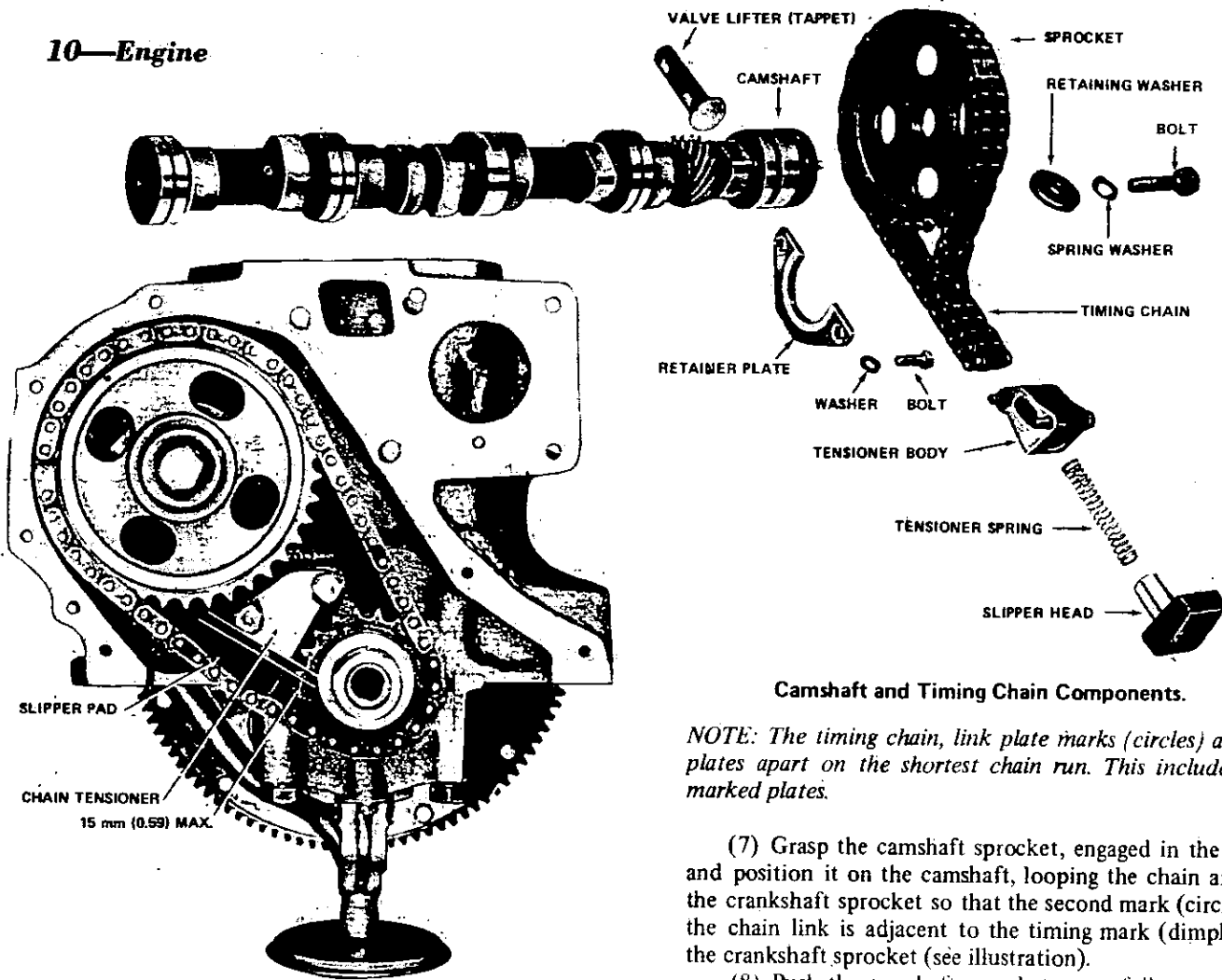
(1) Clean all components and remove all traces of the old gasket from the timing cover, water pump body and sump.

(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



Timing Cover showing Timing Chain Damper Pad.



Camshaft and Timing Chain Components.

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

**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.

(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**

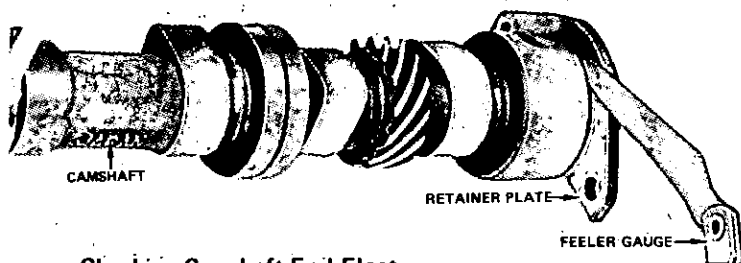
**TO REMOVE**

(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.





**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.

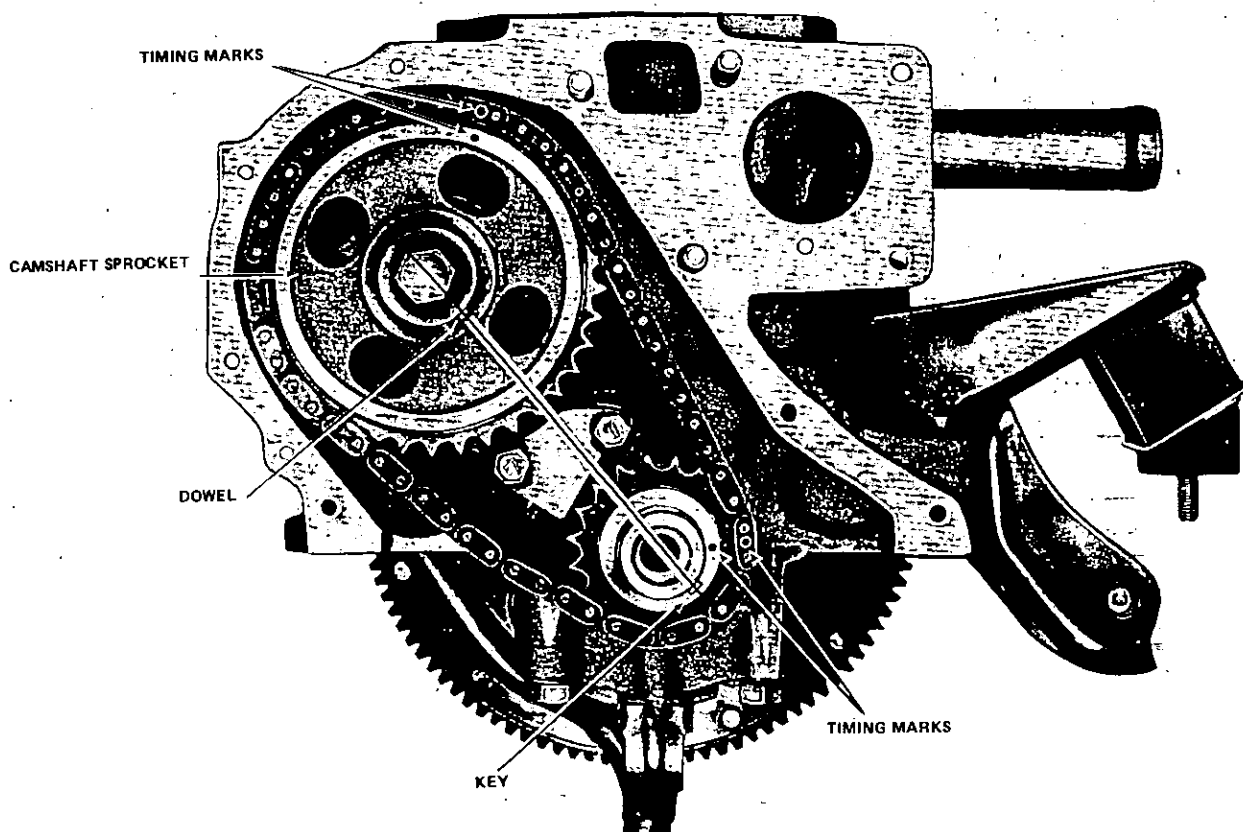
(11) Unscrew and remove the two bolts from the distributor retaining plate and withdraw the distributor from the cylinder block.

(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.



## 12—Engine

### 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

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**

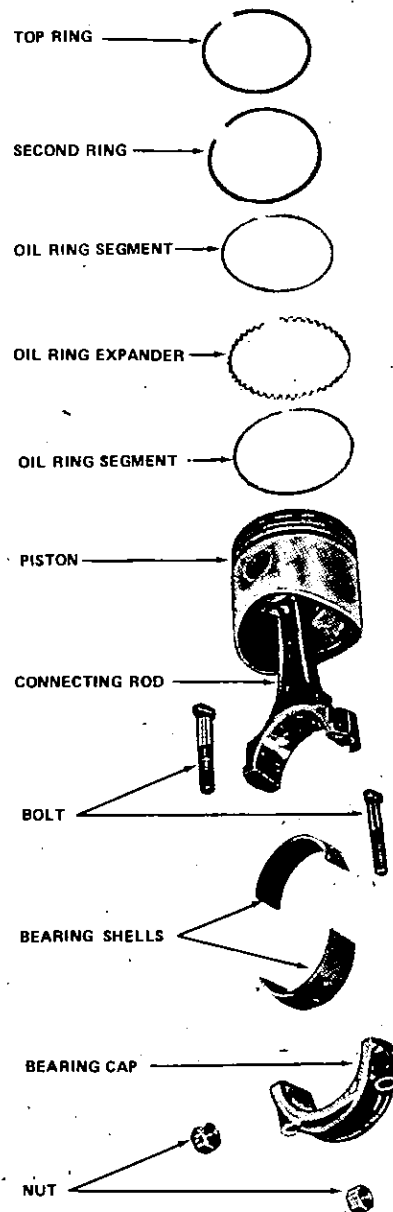
- (1) Wipe the cylinder bores clean and ensure that there are no traces of carbon or other foreign matter present.
- (2) Place a new piston ring in the bore of the cylinder, and using the piston inverted, push the piston ring down to a relatively unworn part of the cylinder bore.
- (3) Using a feeler 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.)

## 14—Engine

### 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.

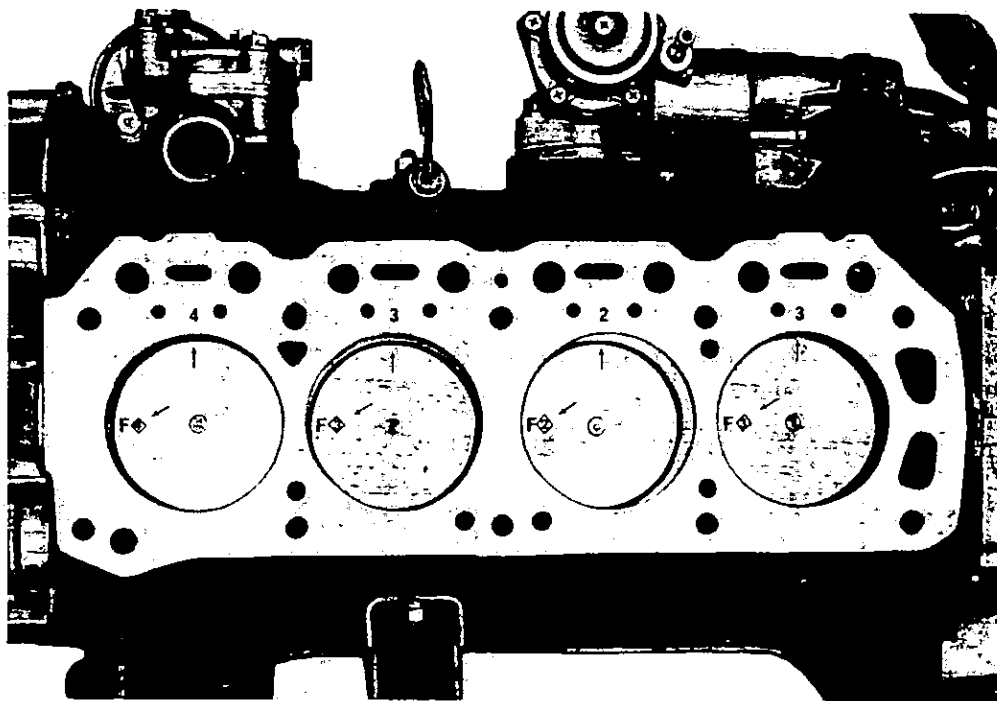
#### DEGLAZING CYLINDER BORES

*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.