

Gregory's

No 259

LASER

MAZDA 323 1989-1992

SERVICE AND REPAIR MANUAL

MODELS

LASER

KF, KH SERIES

SEDAN

HATCHBACK

L, GL, S, GHIA

March 1990-1992

323

SEDAN, ASTINA

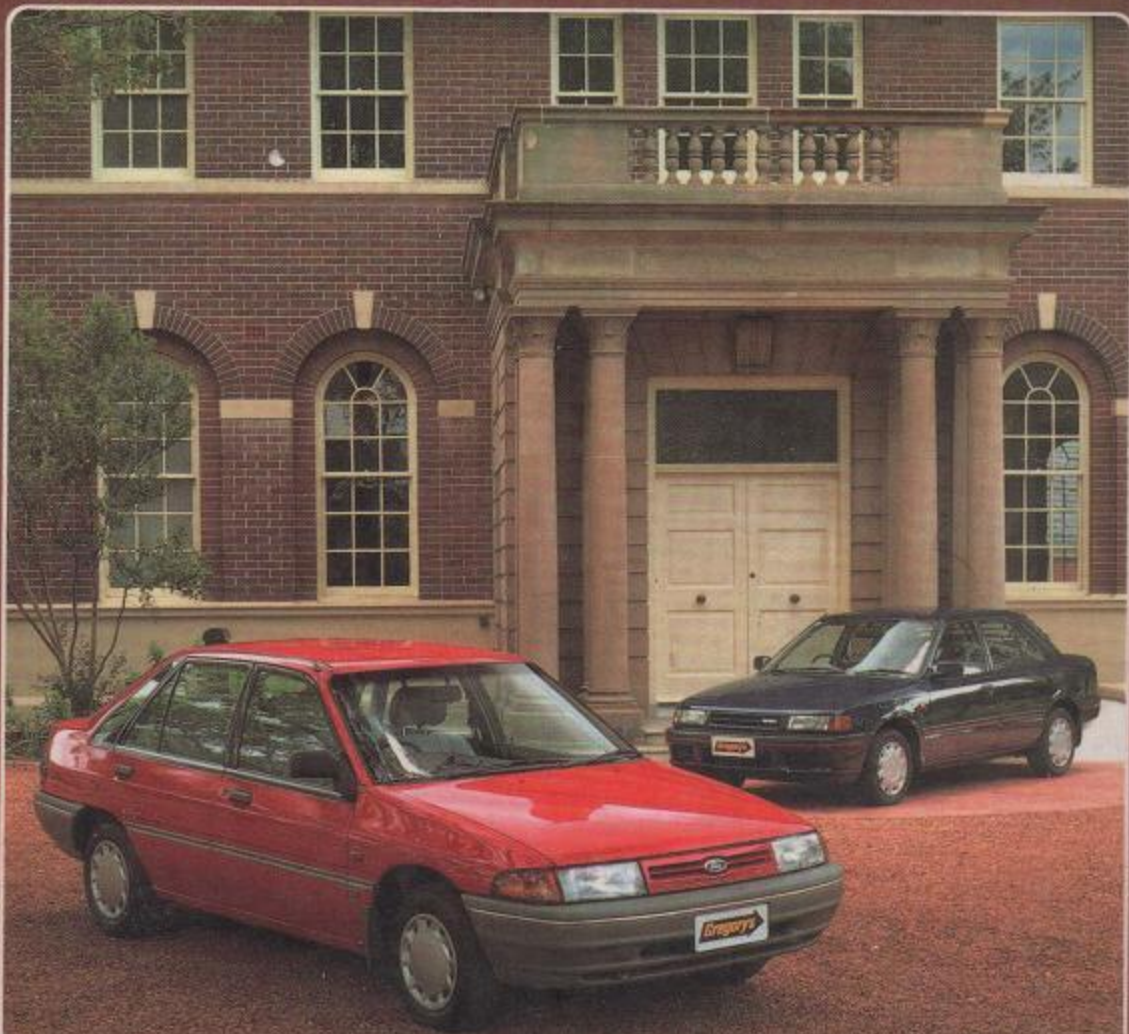
Oct 1989-1992

1.6 Litre

1.8 Litre EFI

Except Turbo

—
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ENGINE TUNE-UP

CAUTION: To prevent severe electrical shock, extreme care must be taken when working on or near the electronic ignition system as dangerous high tension voltages are produced in both the primary and secondary circuits. See the text for precautionary notes.

1. TUNE-UP SPECIFICATIONS

Firing order	1-3-4-2
Spark plug:	
Types —	
NGK	BKR5E11, BKR6E11
Nippon Denso	K16 PR-U11, K20 PR-U11
Motorcraft	AGPR-32CK-U11, AGPR-42CK-U11
Gap	1.0-1.1 mm
Tightening torque	15-23 Nm
High tension lead resistance	16 kΩ per metre
Ignition timing:	
1.6 litre at idle speed with vacuum hose disconnected and plugged	4° ± 1° BTDC
1.8 litre at idle speed with terminals TEN and GND of the diagnostic test connector bridged	5° ± 1° BTDC
Location of ignition timing marks	Crankshaft pulley and timing cover
Engine idle speed:	
1.6 litre —	
Manual transaxle	850 ± 50 rpm
Automatic transaxle in park	1 000 ± 50 rpm
1.8 litre with terminals TEN and GND of the diagnostic test connector bridged —	
Manual transaxle	750 ± 50 rpm
Automatic transaxle in park	750 ± 50 rpm
Compression pressure at 300 rpm:	
1.6 litre —	
Nominal	1 109 kPa
Minimum	775 kPa
1.8 litre —	
Nominal	1 197 kPa
Minimum	834 kPa
Maximum difference between cylinders	196 kPa

Valve clearances	No adjustment required, hydraulic tappets installed
CO concentration at idle speed:	
1.6 litre (at secondary air hose)	1.0-2.0%
1.8 litre	Not applicable
Drive belt deflection (all belts):	
New	8-9 mm
Used	9-10 mm

NOTE: If this information differs from that provided on the vehicle emission control label under the bonnet, use the information on the label.

2. TUNE-UP OPERATIONS

Special Equipment Required:

- To Test Compression — Compression gauge
- To Adjust Idle Mixture — Exhaust gas analyser
- To Adjust Ignition Timing and Idle Speed — Timing light, tachometer

TO ADJUST DRIVE BELTS

It is essential that the drive belts are adjusted to prevent slip but without imposing excessively upon the component bearings, particularly the alternator and water pump bearings.

The drive belt deflection should be checked as follows:

- (1) Using finger or thumb pressure, push firmly on the belt concerned in the middle of the longest run to assess the deflection.
- (2) If the deflection is not as specified, adjust the drive belt as follows.

Alternator Drive Belt

- (1) Loosen the alternator mounting bolt sufficiently to allow the alternator to pivot on the mounting bracket.
- (2) Loosen the adjusting bolt and carefully prise the alternator away from the engine to obtain the correct deflection.

ENGINE

SPECIFICATIONS

ENGINE ASSEMBLY

Type	4 cyl single OHC 16 valve
Capacity:	
1.6 litre	1 597 cc
1.8 litre	1 840 cc
Bore:	
1.6 litre	78.0 mm
1.8 litre	83.0 mm
Stroke:	
1.6 litre	83.6 mm
1.8 litre	85.0 mm
Compression ratio:	
1.6 litre	9.2:1
1.8 litre	8.9:1
Firing order	1-3-4-2
Lubricant:	
Type	SAE 15W/40 SG engine oil
Capacity 1.6 litre —	
With filter	3.3 litres
Without filter	3.0 litres
Capacity 1.8 litre —	
With filter	3.9 litres
Without filter	3.6 litres

NOTE: Engine performance specifications are listed in the Engine Tune-up section.

CYLINDER HEAD

Type	One piece
Material	Aluminium alloy
Valve seat angle	45°
Valve seat contact width	0.8-1.4 mm
Valve guide type	Replaceable
*Cylinder head height	107.4-107.6 mm
Distortion limit:	
1.6 litre	0.15 mm
1.8 litre	0.10 mm
Machining limit:	
1.6 litre	0.20 mm
1.8 litre	0.10 mm
*Measurement from cylinder head face to rocker cover gasket face.	

VALVES AND SPRINGS

Valve head diameter:

1.6 litre —	
Inlet	29.4-29.6 mm
Exhaust	23.4-23.6 mm
1.8 litre —	
Inlet	29.9-30.1 mm
Exhaust	24.85-25.15 mm

Valve stem diameter:

Inlet	5.970-5.985 mm
Exhaust	5.965-5.980 mm

Valve head margin:

1.6 litre —	
Inlet	0.90 mm
Exhaust	1.0 mm
1.8 litre —	
Inlet	0.65 mm
Exhaust	1.20 mm

Valve length:

1.6 litre inlet —	
Standard	103.84 mm
Minimum	103.34 mm
1.6 litre exhaust —	
Standard	104.94 mm
Minimum	104.44 mm
1.8 litre inlet —	
Standard	101.77 mm
Minimum	101.27 mm
1.8 litre exhaust —	
Standard	102.97 mm
Minimum	102.47 mm

Valve stem to guide clearance:

Inlet	0.025-0.060 mm
Exhaust	0.030-0.065 mm
Maximum	0.20 mm

Valve face angle

	45°
--	-----

Valve stem installed height:

1.6 litre inlet —	
Allowable	42.5-43.0 mm
Maximum	44.0 mm
1.6 litre exhaust —	
Allowable	41.5-42.0 mm
Maximum	43.0 mm
1.8 litre inlet —	
Allowable	42.05-42.95 mm

Engine

Maximum	44.0 mm
1.8 litre exhaust —	
Allowable	40.55–41.45 mm
Maximum	42.5 mm
Valve spring free length:	
1.6 litre inlet —	
Standard	46.12 mm
Minimum	39.0 mm at 205–232 N
1.6 litre exhaust —	
Standard	42.86 mm
Minimum	38.0 mm at 133–151 N
1.8 litre inlet —	
Standard	46.1 mm
Minimum	39.0 mm at 205–232 N
1.8 litre exhaust —	
Standard	43.6 mm
Minimum	37.5 mm at 129–147 N
Valve spring distortion limit:	
1.6 litre —	
Inlet	1.61 mm
Exhaust	1.50 mm
1.8 litre —	
Inlet	1.61 mm
Exhaust	1.52 mm

CAMSHAFT AND BEARINGS

Number of bearings	5
Maximum runout	0.03 mm
End float:	
1.6 litre —	
Standard	0.04–0.13 mm
Maximum	0.15 mm
1.8 litre —	
Standard	0.06–0.20 mm
Maximum	0.20 mm
Journal diameter:	
No 1 and No 5	43.440–43.460 mm
No 2 and No 4	43.425–43.450 mm
No 3	43.410–43.435 mm
Maximum journal ovality	0.05 mm
Maximum bearing oil clearance	0.15 mm
Minimum camshaft lobe height:	
1.6 litre —	
Inlet	35.629 mm
Exhaust	35.459 mm
1.8 litre —	
Inlet	35.793 mm
Exhaust	36.073 mm
Timing belt:	
Deflection	11.0–13.0 mm
Tensioner spring free length	64.0 mm

ROCKER ARMS AND SHAFTS

Rocker arm bore diameter:	
1.6 litre —	
Inlet and exhaust	19.000–19.033 mm
1.8 litre —	
Inlet	19.000–19.027 mm
Exhaust	19.000–19.033 mm

Rocker shaft diameter	18.959–18.980 mm
Maximum rocker arm to shaft clearance	0.10 mm

CYLINDER BLOCK

Standard bore diameter:	
1.6 litre	78.006–78.063 mm
1.8 litre	83.006–83.013 mm
Maximum ovality and taper	0.019 mm
Standard oversizes	0.25 and 0.50 mm
Face distortion limit	0.15 mm
Face machining limit	0.20 mm
Cylinder block height	221.5 mm

PISTONS AND RINGS

Standard piston diameter:	
1.6 litre	77.954–77.974 mm
1.8 litre	82.954–82.974 mm
Piston measuring point:	
Below oil ring groove —	
1.6 litre	18.1 mm
1.8 litre	16.5 mm
Piston to cylinder bore clearance:	
Standard	0.039–0.052 mm
Maximum	0.15 mm
Standard oversizes	0.25 and 0.50 mm
Number of piston rings:	
Compression	2
Oil control	1

Compression ring side clearance:	
1.6 litre —	
Top	0.030–0.065 mm
Second	0.030–0.070 mm
1.8 litre —	
Top	0.030–0.070 mm
Second	0.030–0.070 mm
Maximum 1.6 and 1.8 litre	0.15 mm

Ring end gap:	
Top compression	0.15–0.30 mm
Second compression —	
Early models	0.15–0.30 mm
Late models	0.30–0.45 mm
Oil ring segments	0.20–0.70 mm
Maximum	1.0 mm

CRANKSHAFT AND BEARINGS

Number of main bearings	5
End float taken at	No 4 main bearing
End float:	
Standard	0.08–0.282 mm
Maximum	0.30 mm
Thrust bearing standard thickness oversizes	0.25, 0.50 and 0.75 mm
Main bearing journal diameter:	
Standard	49.938–49.956 mm
Minimum	49.904 mm
Main bearing oil clearance:	
Standard	0.018–0.036 mm
Maximum	0.10 mm
Crankpin diameter:	

Engine

Standard	44.940-44.908 mm
Minimum	44.908 mm
Maximum taper and ovality, journals and crankpins	0.05 mm
Crankshaft runout limit	0.04 mm
Standard undersizes	0.25, 0.50 mm

CONNECTING RODS AND BEARINGS

Connecting rod side clearance:	
Standard	0.110-0.262 mm
Maximum	0.30 mm
Connecting rod maximum bend	
	0.075 mm per 50.0 mm
Connecting rod bearing oil clearance:	
Standard	0.028-0.068 mm
Maximum	0.10 mm
Standard undersizes	0.25, 0.50 and 0.75 mm

LUBRICATION

Oil pump type	Trochoid rotor
Oil filter type	Full flow, disposable
Oil pressure:	
At 1 000 rpm	196-294 kPa
At 3 000 rpm	294-392 kPa
Maximum inner and outer rotor end clearance	
	0.14 mm
Maximum outer rotor to pump body clearance	
	0.22 mm
Maximum rotor tip clearance	
	0.20 mm
Relief valve spring free length	
	45.5 mm

TORQUE WRENCH SETTINGS

Cylinder head bolts	76-81 Nm
Main bearing cap bolts	54-59 Nm
Connecting rod nuts:	
1.6 litre	50-54 Nm
1.8 litre	49-51 Nm
Rocker cover bolts	4.9-8.8 Nm
Manifold retaining nuts and bolts:	
Inlet	19-25 Nm
Exhaust	16-23 Nm
Plenum chamber nuts and bolts	19-25 Nm
Camshaft sprocket bolt	49-61 Nm
Crankshaft sprocket bolt	108-118 Nm
Crankshaft pulley bolts	12-17 Nm
Timing cover bolts	7.8-11 Nm
Rocker shaft bolts	22-28 Nm
Timing belt tensioner pulley bolt	19-25 Nm
Oil pump bolts	19-25 Nm
Oil pump pickup pipe bolts	7.8-11 Nm
Oil pressure switch	12-18 Nm
Stiffener plate bolts	16-21 Nm
Engine sump bolts	7.8-11 Nm
Rear crankshaft oil seal carrier bolts	7.8-11 Nm
*Flywheel/driveplate bolts	96-103 Nm
Exhaust manifold flange nuts	31-46 Nm
Right hand side engine mounting:	
Through bolt and nut	67-93 Nm

Mounting to bracket nuts	74-103 Nm
Damper to mounting bolt and nut	55-80 Nm
Left hand side engine mounting:	
Nuts	67-93 Nm
Mounting to body bolts	43-61 Nm
Mounting member bolts and nuts	64-89 Nm
Mounting member to mounting nuts	37-52 Nm
Transaxle brace bolts	37-52 Nm

*Refer to text.

1. ENGINE MECHANICAL TROUBLE SHOOTING

ENGINE MISSES AT IDLE SPEED

NOTE: Most causes of engine misfire can be traced to faults in the Ignition system or Fuel and Engine Management system. If reference to the above sections does not locate the fault, check the following faults and rectifications.

- (1) Air leak at the inlet manifold gasket: Check for air leaks by running oil or dewatering fluid around the manifold joints while the engine is running and listen for hissing sounds. Renew the gasket if an air leak is evident.
- (2) Weak or broken valve springs: Remove the rocker cover and check the condition of the valve springs



Running oil around the inlet manifold joints to check for air leaks.

- (3) Burnt valves or valve seats in the cylinder head: Check the cylinder compression and overhaul the cylinder head as necessary.
- (4) Blown head gasket: Check the cylinder compression and renew the head gasket as necessary.
- (5) Broken or worn piston rings: Check the cylinder compression and renew the piston rings as necessary.

NOTE: Isolate the ignition system and check the compression pressure in each cylinder as described in the Engine Tune-up section.



Testing cylinder compression using a compression gauge.

NOISY VALVE OPERATION

- (1) Faulty hydraulic lifters: Renew the faulty lifter assemblies.
- (2) Weak or broken valve springs: Remove the rocker cover and check the valve springs.
- (3) Worn valve guides: Overhaul the cylinder head as described in this section.
- (4) Worn rocker gear: Remove the rocker gear and check the components for wear.
- (5) Worn camshaft lobe: Renew the camshaft.
- (6) Low oil pressure: Refer to the Low Oil Pressure heading.



Inspect the valve springs with the rocker cover removed.

BIG END BEARING NOISE

- (1) Low oil pressure: Refer to the Low Oil Pressure heading.
- (2) Excessive bearing clearance: Renew the bearing shells. Check and regrind the big end journals if oval or tapered.
- (3) Misaligned big end bearings: Align the connecting rods and renew the big end bearing shells.

NOTE: Big end bearing noise is indicated by a metallic knock which is usually loudest at approximately 60 km/h with the throttle closed. Before dismantling the engine to inspect the big ends, check the engine oil for correct level and dilution on the dipstick. Also remove the oil pressure switch and connect an oil pressure gauge into the oil gallery to check the oil pressure readings.

MAIN BEARING NOISE (APPARENT)

- (1) Loose flywheel: Tighten the flywheel securing bolts to the specified torque.
- (2) Low oil pressure: Refer to the Low Oil Pressure heading.
- (3) Excessive crankshaft end float: Renew the main bearings.
- (4) Excessive bearing clearance: Renew the bearing shells. Check and regrind the main journals if oval, tapered or scored.

NOTE: Main bearing noise is indicated by a heavy but dull knock when the engine is under load. A loose flywheel is indicated by a thud or dull click when the ignition is turned off. It is usually accompanied by vibration.

Crankshaft end float noise is indicated by a sharp rap at idle speed. The crankshaft can be checked for excessive end float by levering the crankshaft backwards and forwards.

Remove the main bearing caps and assess the bearing clearance using the Plastigage method as described in this section. Ovality and wear on the main bearing journals can only be checked with a micrometer after the crankshaft has been removed.

EXCESSIVE OIL CONSUMPTION

- (1) Oil leaks: Check and renew the engine gaskets or seals as necessary.
- (2) Damaged or worn valve stem oil seals: Dismantle the cylinder head and renew the damaged or worn oil seals.



Run the engine over white paper to check for oil leaks.

Engine

Check the head, piston and cylinder bore for damage and repair or renew as necessary.

NOTE: Frequent jamming of the starter motor drive with the flywheel ring gear can be due to a bent starter armature shaft or damaged teeth on the drive or ring gear. With the starter motor removed the flywheel ring gear teeth can be examined through the starter motor mounting aperture. Renewal of the ring gear requires removal of the transaxle and on manual transaxle models, removal of the clutch and flywheel.

When a cylinder head gasket blows allowing water into the cylinders, or compression loss occurs between cylinders, it is essential to check the gasket faces on the cylinder block and head for distortion. Sufficient water can enter a cylinder due to a blown gasket, cracked cylinder or head to prevent an engine rotating. Normally this is preceded by difficult starting, misfiring, excessive steam from the exhaust and loss of water from the radiator.

2. DESCRIPTION

The range of vehicles covered by this manual are powered by either a 1.6 litre carburettor engine or a 1.8 litre fuel injected engine.

The engines are similar in design, however, the 1.8 litre engine has a larger bore and longer stroke while the 1.6 litre engine has a higher compression ratio.

The four cylinder single overhead camshaft engines have an aluminium alloy crossflow cylinder head and a cast-iron cylinder block.

The crankshaft is supported by five main bearings and the main bearing is controlled by thrust faces on No 4 main bearing.

The control at the front and rear of the crankshaft is provided by oil seals installed in the oil pump housing and sump cover which is mounted behind the rear main bearing. Lubrication at the front of the camshaft is by an oil seal located at the cylinder head.

The cylinder heads have two inlet valves and two exhaust valves in each combustion chamber. The rocker arms incorporate hydraulic lifters, providing automatic adjustment of the valves by maintaining zero valve clearance.

The camshaft is driven from the crankshaft by a reinforced rubber timing belt and a camshaft drive sprocket. Belt and timing belt tension is controlled by a tensioner roller which is adjusted by spring tension and is then sealed for lubrication.

The pistons are aluminium, with two compression rings and a three piece oil control ring. The gudgeon pins are aluminium as are the connecting rods and fully floating in the bearings.

The oil pump is mounted directly to the front of the crankshaft ahead of the front main bearing cap and is

driven by the crankshaft, which engages the inner rotor of the oil pump.

The engines have a stiffener plate mounted between the engine sump and the cylinder block to provide extra rigidity and strength to the cylinder block.

The 1.8 litre engine uses oil jets in the crankcase to lubricate the cylinder walls and pistons during engine operation.

NOTE: When a silicone sealant is required on 1.8 litre engines, ensure that it does not contain acetic acid, which may damage the oxygen sensor.

3. ENGINE AND TRANSAXLE ASSEMBLY

Special Equipment Required:

To Remove and Install — Suitable overhead lifting equipment

TO REMOVE AND INSTALL

(1) Disconnect the negative and positive battery terminals.

NOTE: On 1.8 litre models, depressurise the fuel system as described in the Fuel and Engine Management section before disconnecting the battery.

(2) Raise the front of the vehicle and support it on chassis stands. Remove the engine bonnet as described in the Body section.

(3) Drain the coolant from the cooling system. Refer to the Cooling and Heating Systems section if necessary.

(4) Drain the engine and transaxle oils. Refer to the Lubrication and Maintenance section if necessary.

(5) Remove the retaining bolts and remove the engine compartment lower cover from below the right hand end of the engine.

(6) On 1.6 litre models, remove the air cleaner assembly, complete with the resonance chamber, from the engine.

(7) On 1.8 litre models, remove the air cleaner assembly, complete with the air flow meter and all associated hoses and air ducts, from the vehicle. Refer to the Fuel and Engine Management section if necessary.

(8) Remove the battery mounting clamp, the battery cover as applicable and the battery from the vehicle.

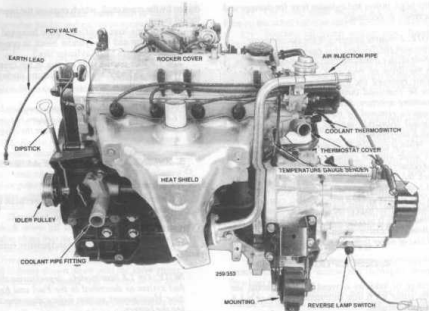
(9) Remove the retaining bolts and remove the battery tray from the vehicle.

(10) If applicable, remove the battery cooling air duct retaining bolts and remove the duct from the vehicle.

(11) Disconnect the throttle cable from the engine. Refer to the Fuel and Engine Management section if necessary.

(12) On 1.8 litre models, remove the resonance chamber from behind the top radiator tank.

Engine



Front view of the 1.6 litre engine and manual transaxle assembly.

(13) Disconnect the top and bottom radiator hoses from the radiator.

(14) Disconnect the overflow hose from the radiator filler neck.

(15) Disconnect the electric cooling fan and on 1.8 litre automatic transaxle models, the thermosensor wiring connectors at the left hand end of the radiator.

(16) On automatic transaxle models, disconnect the fluid hoses from the bottom radiator tank. Plug the radiator fittings and the ends of the hoses to prevent the loss of fluid and the entry of dirt.

(17) Remove the radiator top mounting bracket retaining bolts and lift the radiator and electric cooling fan assembly out of the engine compartment.

NOTE: When a radiator that has been in use for sometime 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 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, flaking and subsequently obstructing the circulation of the coolant in the system.

(18) If the vehicle is equipped with power steering and/or air conditioning, loosen the applicable mounting and adjusting bolts and remove the drive belt from the power steering pump and/or the air conditioner compressor.

Remove the applicable mounting bolts and separate the power steering pump and/or the air conditioner compressor from the engine ensuring that the fluid or refrigerant lines are not disturbed.

Secure the power steering pump and/or the air conditioner compressor to one side clear of the engine.

NOTE: Do not loosen the compressor high pressure lines as escaping refrigerant can cause eye injury and frostbite. Also, the loss of refrigerant will necessitate regassing of the system.

(19) On 1.8 litre models, suitably mark and disconnect the wiring from the following engine and transaxle components: the alternator, oil pressure switch, throttle sensor, idle speed control valve, starter motor, oxygen sensor, injectors, temperature gauge sender, coolant thermoswitch, distributor, manual transaxle neutral and reverse lamps switches, automatic transaxle inhibitor switch, engine and transaxle earths and the high tension lead from the ignition coil.

Engine

(20) On 1.6 litre models, suitably mark and disconnect the wiring from the following engine and transaxle components: the alternator, starter motor, temperature gauge sender, carburettor including the PTC heater, oil pressure switch, coolant thermostat, manual transaxle reverse lamp switch, automatic transaxle inhibitor switch, engine and transaxle earths and the high and low tension leads from the ignition coil.

(21) On 1.8 litre models, suitably mark and disconnect the following hoses in the engine compartment: the brake servo unit vacuum hose from the inlet manifold, cruise control vacuum hose from the inlet manifold if applicable, purge control vacuum hose from the throttle body, heater hoses from the bulkhead fittings ensuring that the spacers and O rings are not lost during disconnection, and the fuel supply and return hoses from the fuel rail and pressure regulator ensuring that the joints are covered with absorbent cloth to restrict fuel spray on disconnection.

NOTE: To disconnect the heater hoses from the bulkhead fitting, compress the lock tabs on each side of the fitting and carefully pull on the heater hose.

(22) On 1.6 litre models, suitably mark and disconnect the following hoses in the engine compartment: the

brake servo unit vacuum hose from the inlet manifold, air injection hose from the air injection pipe, fuel supply and return hoses from the fuel pump, vacuum hoses from the solenoid valve mounted on the bulkhead, charcoal canister hoses, automatic transaxle vacuum hose if applicable and the heater hoses from the bulkhead fittings ensuring that the spacers and O rings are not lost during disconnection.

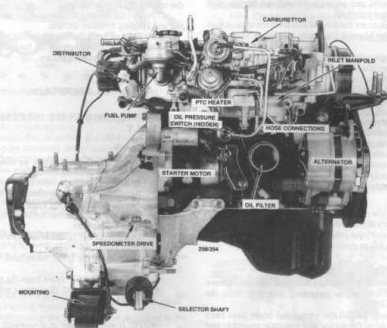
NOTE: To disconnect the heater hoses from the bulkhead fitting, compress the lock tabs on each side of the fitting and carefully pull on the heater hose.

(23) Disconnect the speedometer cable from the transaxle.

(24) On manual transaxle models, remove the clutch slave cylinder retaining bolts and the hydraulic pipe mounting bracket retaining bolts and position the clutch slave cylinder to one side, clear of the transaxle. Ensure that the hydraulic pipe and hose are not damaged.

(25) On manual transaxle models, remove the nut and washers retaining the gear lever assembly stay bar to the transaxle and slide the stay bar off the stud.

Remove the nut and bolt securing the gear lever control rod to the transaxle selector shaft and separate the control rod from the selector shaft.



Rear view of the 1.6 litre engine and manual transaxle assembly.

Engine



Removing the engine and transaxle assembly from the vehicle.

(26) On automatic transaxle models, remove the inner cable retaining clip and washer and the outer cable mounting bracket retaining bolt and separate the selector cable from the transaxle.

(27) Remove the flange nuts and the mounting bracket retaining bolts and separate the exhaust engine pipe from the exhaust manifold.

(28) Disconnect the drive shafts from the transaxle as described in the Manual Transaxle and Drive Shafts section.

(29) Attach overhead lifting equipment to the engine and take the weight of the engine and transaxle assembly.

(30) Remove the nuts retaining the front and rear transaxle mountings to the mounting member.

(31) Remove the mounting member retaining bolts and nuts and if applicable, separate the refrigerant pipe bracket from the member and remove the mounting member from the vehicle.

(32) Remove the retaining bolt and nut and remove the damper from the right hand side engine mounting.

(33) Remove the through bolt and the retaining nuts and washers and remove the right hand side engine mounting from the vehicle.

NOTE: On air conditioned models, it will be necessary to remove the retaining bolt from the refrigerant pipe mounting bracket and move the bracket to gain clearance for the through bolt.

(34) Remove the retaining bolts and nuts and remove the left hand side engine mounting assembly from the vehicle.

(35) Ensure that all the wiring and hoses have been disconnected from the engine and transaxle assembly and carefully lift the assembly out of the engine compartment ensuring that nothing is damaged during the removal.

NOTE: On models equipped with air conditioning, place a piece of timber behind the condenser to prevent possible damage as the engine is being manoeuvred from the vehicle.

(36) Place the engine and transaxle assembly on a work bench and if necessary, dismantle the engine by referring to the relevant headings for the correct procedure.

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

(1) Install the engine and transaxle assembly side mounting bolts before the full weight of the engine is taken by the mountings. Tighten the mounting bolts to the specified torque.

(2) Install the front and rear transaxle mountings and tighten the bolts and nuts securely.

(3) Install the drive shafts as described in the Manual Transaxle and Drive Shafts section.

(4) Using new gaskets, install the exhaust engine pipe and tighten the nuts securely.

(5) Connect all wiring connectors and hoses securely to the positions marked prior to removal.

(6) Fill the engine and transaxle with the correct grade and quantity of lubricant.

On models equipped with power steering, check and if necessary, replenish the power steering reservoir with the correct grade of lubricant.

(7) Fill the cooling system as described in the Cooling and Heating Systems section.

(8) Start and run the engine until it reaches normal operating temperature and check for fuel, oil, coolant and exhaust leaks. Rectify as necessary.

4. MANIFOLDS

TO REMOVE AND INSTALL INLET MANIFOLD ASSEMBLY

1.6 Litre Models

(1) Drain the cooling system as described in the Cooling and Heating Systems section.

(2) Disconnect the negative battery terminal.

(3) Remove the air cleaner assembly, complete with the resonance chamber, from the engine.

(4) Disconnect the throttle cable from the mounting bracket and the carburettor.

(5) Disconnect the heater hose from the right hand end of the inlet manifold.

(6) Disconnect the brake servo unit vacuum hose from the inlet manifold.

(7) Separate the PCV valve from the rocker cover.

(8) Suitably mark and disconnect all the vacuum hoses from the inlet manifold.

NOTE: It will be easier to disconnect the distributor vacuum advance hoses from the distributor.

(9) Disconnect the wiring from the coolant thermostat at the left hand end of the inlet manifold.

(10) Disconnect the coolant hose from the left hand end of the inlet manifold and on 1.6 litre automatic transaxle models, remove the EGR pipe from the engine.

(11) Disconnect the carburettor and the PTC heater wiring at the connectors adjacent to the fuel pump, release the cable tie and lift the wiring harnesses over the fuel pump.

(12) Disconnect the fuel supply hose from the fuel pump and release the hose from the rocker cover bracket.

(13) Disconnect the choke heater wire from the alternator. Check and ensure that all the wiring and hoses have been disconnected from the inlet manifold.

(14) Remove the retaining nuts and remove the inlet manifold and carburettor as an assembly from the engine.

the air flow meter and all associated hoses and air ducts, from the vehicle. Refer to the Fuel and Engine Management section if necessary.

(5) Disconnect the throttle cable and if applicable, the automatic transaxle kickdown cable from the mounting bracket and the throttle body.

(6) Suitably mark and disconnect all the coolant, fuel and vacuum hoses and the electrical wiring from the inlet manifold and plenum chamber assembly.

(7) Remove the nuts retaining the inlet manifold to the lower support bracket.

(8) Remove the nuts retaining the lower support bracket to the engine crankcase and separate the bracket from the inlet manifold.

(9) Remove the nuts retaining the inlet manifold to the cylinder head and remove the inlet manifold and plenum chamber as an assembly from the engine.

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

(1) Ensure that all carbon and oil gasket material is cleaned from the manifold and cylinder head faces.

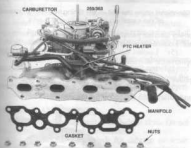
(2) Check the mating face of the manifold for excessive distortion with a straight edge and feeler gauge.

(3) Install a new gasket and tighten the inlet manifold retaining nuts to the specified torque in the following sequence: upper centre, lower inner, upper intermediate, lower outer, upper outer.

(4) Connect all the hoses and wiring to the marked positions.

(5) Fill the cooling system as described in the Cooling and Heating Systems section.

(6) Run the engine and check for leaks. Rectify as necessary.



Inlet manifold components. 1.6 litre model.

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

(1) Ensure that all carbon and old gasket material is cleaned from the manifold and cylinder head faces.

(2) Check the mating face of the manifold for excessive distortion with a straight edge and feeler gauge.

(3) Use a new gasket and ensure that all manifold nuts are tightened to the specified torque.

(4) Ensure that all the vacuum hoses are returned to the marked positions and that the wiring is securely connected.

(5) Fill the cooling system as described in the Cooling and Heating systems section.

(6) Run the engine and check for leaks. Rectify as necessary.

1.8 Litre Models

(1) Drain the cooling system as described in the Cooling and Heating Systems section.

(2) Depressurise the fuel system as described in the Fuel and Engine Management section.

(3) Disconnect the negative battery terminal.

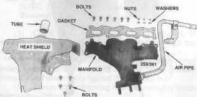
(4) Remove the air cleaner assembly, complete with

TO REMOVE AND INSTALL EXHAUST MANIFOLD

(1) Remove the flange nuts and the mounting bracket retaining bolts and separate the exhaust engine pipe from the exhaust manifold.

(2) Remove the retaining bolts and remove the heat shield from the exhaust manifold.

(3) On 1.6 litre models, remove the retaining nuts and separate the air injection pipe from the exhaust manifold and on automatic transaxle models, remove the EGR pipe from the engine.



Exhaust manifold components. 1.6 litre model.

(4) On 1.8 litre models, disconnect the oxygen sensor wiring connector.

(5) Remove the exhaust manifold retaining bolts and nuts and remove the exhaust manifold from the cylinder head.

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

(1) Ensure that all carbon and old gasket material is cleaned from the manifold and cylinder head faces.

(2) Check the mating face of the manifold for excessive distortion with a straight edge and feeler gauge.

(3) Use a new gasket and ensure that all mounting bolts and nuts are tightened to the specified torque.

(4) Run the engine and check for leaks. Rectify as necessary.

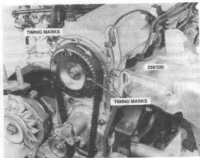
5. TIMING BELT AND SPROCKETS

TO REMOVE

(1) Disconnect the negative battery terminal.
 (2) Raise the front of the vehicle and support it on chassis stands.

(3) Remove the retaining bolts and remove the engine compartment lower cover from below the right hand end of the engine.

(4) If the vehicle is equipped with power steering and/or air conditioning, loosen the applicable mounting and adjusting bolts and remove the drive belt from the



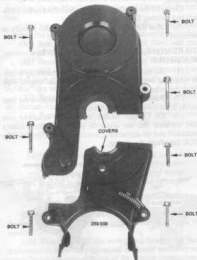
Directional arrow marked on the timing belt and alignment of the camshaft sprocket timing marks.

power steering pump and/or the air conditioning compressor. Loosen the water pump drive pulley retaining bolts.

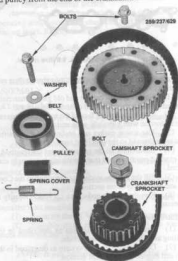
(5) Loosen the mounting and adjusting bolts and remove the alternator drive belt from the engine.

(6) Remove the retaining bolts and remove the drive pulley from the water pump.

(7) Remove the retaining bolts and remove the plate and pulley from the end of the crankshaft.



Timing belt upper and lower covers.



Timing belt, tensioner and components.

(8) Remove the retaining bolts and remove the timing belt upper cover and seal from the engine.

(9) Remove the retaining bolts and remove the timing belt lower cover and seal from the engine.

(10) Remove the crankshaft bolt and guide plate from the end of the crankshaft.

(11) Disconnect the high tension leads from the spark plugs and remove the spark plugs from the engine.

(12) Rotate the engine until the camshaft sprocket timing marks are aligned with the engine timing marks and mark the timing belt rotational direction with an arrow. Verify that the crankshaft sprocket key is aligned with the timing mark.

(13) Loosen the tensioner pulley securing bolt and move the pulley away from the timing belt. Tighten the securing bolt to hold the pulley in this position.

(14) Remove the timing belt from the camshaft and crankshaft sprockets.

(15) Remove the tensioner pulley securing bolt and remove the tensioner pulley and spring from the engine.

(16) Remove the crankshaft sprocket from the end of the crankshaft. If necessary, remove the crankshaft front oil seal from the oil pump housing.

(17) Lock the camshaft using an open ended spanner on the hexagon area adjacent to the camshaft sprocket and remove the camshaft sprocket retaining bolt. Remove the sprocket from the end of the camshaft. If necessary, carefully remove the oil seal from the cylinder head.

TO CHECK AND INSPECT

(1) Clean all components with a clean cloth. Do not use cleaning solvent on any components.

(2) Inspect the timing belt for damage or wear. Check the belt thoroughly for peeling, cracking or hardening of the rubber. Check to ensure that the belt is not contaminated with oil or grease. Renew the belt if any of

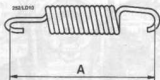
the above conditions are evident. If necessary, rectify any oil leaks prior to renewing the belt.

NOTE: The manufacturer recommends renewal of the timing belt at intervals of 100 000 km (Ford) or 105 000 km (Mazda).

During inspection, do not turn the belt inside out, forcibly twist the belt or bend in excess of a 12.5 mm radius.

(3) Check the crankshaft and camshaft sprockets for wear and damage. Renew the worn components as necessary.

(4) Inspect the tensioner pulley for smooth and silent operation. Renew as necessary.



Measure the tensioner spring free length and compare measurement A to Specifications.

(5) Measure the tensioner spring free length. Renew the spring as necessary.

(6) Check the water pump for leakage. If necessary renew the water pump as described in the Cooling and Heating Systems section.

TO INSTALL

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

(1) If removed, install a new crankshaft and/or camshaft oil seal ensuring that the oil seal and the seal recess are coated in clean engine oil. Ensure that the lip of the seal is facing towards the inside of the engine.

(2) Install the camshaft and crankshaft sprockets. Lock the camshaft and tighten the camshaft sprocket retaining bolt to the specified torque.

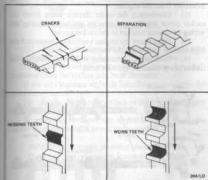
NOTE: The taper on the crankshaft sprocket Woodruff key must be towards the oil pump.

(3) Check that the timing marks are aligned. If necessary rotate the camshaft or crankshaft to align the timing marks.

(4) Install the tensioner pulley. Lever the tensioner pulley away from the drive belt until the spring is fully extended and temporarily tighten the securing bolt.

(5) Ensure that the timing belt is thoroughly clean prior to installation.

(6) Install the timing belt to the engine, with the slack of the belt being kept on the tensioner side.



Check the timing belt for the illustrated faults.

Engine

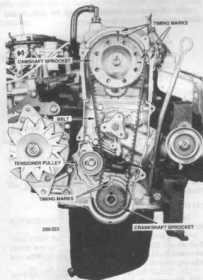
If the original belt is being installed, ensure that the directional arrow made on removal is facing the direction of rotation.

(7) Loosen the tensioner pulley securing bolt.

Carefully rotate the crankshaft clockwise two complete revolutions and check that the timing marks are aligned.

If the marks do not align, remove the timing belt and repeat operations (3) to (7).

(8) Tighten the tensioner pulley securing bolt to the specified torque.



Timing mark alignment.

(9) Apply a 10 kg force against the timing belt midway between the camshaft sprocket and the crankshaft sprocket and measure the deflection.

If the deflection is not 11–13 mm, repeat operations (7) and (8).

(10) Install the crankshaft sprocket guide plate ensuring that the taper on the guide plate is facing away from the sprocket.

(11) Prevent the crankshaft turning and tighten the crankshaft sprocket retaining bolt to the specified torque.

(12) Install the timing belt covers.

Tighten the retaining bolts to the specified torque.

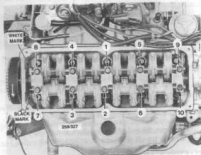
(13) Install the crankshaft pulley and tighten the retaining bolts to the specified torque.

(14) Install and adjust the engine drive belt(s) as described in the Engine Tune-up section.

6. ROCKER ARMS AND SHAFTS

TO REMOVE AND DISMANTLE

- (1) Disconnect the negative battery terminal.
- (2) On 1.6 litre models, proceed as follows:



Rocker shaft bolt tightening sequence. Loosen in the reverse order. Mark the shafts with paint for identification.

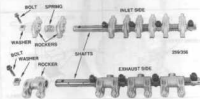
(a) Disconnect the outer throttle cable from the air cleaner bracket.

(b) Remove the retaining bolts and the wingnut, disconnect the vacuum hoses and remove the air cleaner assembly from the engine.

(c) Disconnect the outer throttle cable from the rocker cover bracket and remove the bolt retaining the wiring connector bracket to the rocker cover.

(3) Disconnect the engine ventilation hoses and the high tension leads from the rocker cover.

(4) Remove the retaining bolts and remove the rocker cover from the cylinder head.



Rocker shaft components.

(5) Progressively loosen the rocker shaft retaining bolts in a spiral sequence beginning with the outer bolts and ending with the centre bolts. Refer to the illustration. Leave the bolts through the shafts to hold the components in position. Suitably mark the installed position of each shaft.

(6) Remove the rocker shafts as assemblies from the cylinder head.

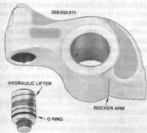
(7) Using electrical tape or an equivalent method, secure each hydraulic lifter into its respective rocker arm to avoid disturbing the lifter O ring.

(8) Suitably mark the installed position of each component on the rocker shafts and carefully dismantle the rocker shafts, keeping the components in the order of their removal.

TO CLEAN AND INSPECT

(1) Wash all components in cleaning solvent and dry with compressed air.

(2) Inspect the rocker arms and shafts for wear, scoring and damage. Light scoring of the rocker arm heel can be corrected with an oil stone. Renew worn components as necessary.



Hydraulic lifter and rocker arm.

(3) Measure the diameter of the rocker shaft and the corresponding rocker arm bore with a micrometer.

To obtain the oil clearance, subtract the rocker shaft diameter from the rocker arm bore diameter.

If the oil clearance exceeds Specifications, renew the worn components.

(4) Examine the contact face of the hydraulic lifters for wear or damage.

If necessary, remove the hydraulic lifter from the rocker arm and install a new lifter assembly.

NOTE: To prevent possible damage to the O ring, do not remove the hydraulic lifter from the rocker arm unless necessary.

(5) Prior to assembly, ensure that all components are thoroughly clean and free of dust and lint.

TO ASSEMBLE AND INSTALL

Assembly is a reversal of the dismantling procedure with attention to the following points:

(1) If a hydraulic lifter was removed from a rocker arm, fill the rocker arm cavity with clean engine oil and also apply oil to the lifter assembly.

Carefully insert the lifter assembly into the rocker arm cavity, ensuring that the O ring is not damaged during this procedure.

(2) Lubricate all components with clean engine oil prior to assembly.

(3) Assemble the rocker shafts in the reverse order to which they were dismantled with attention to the following points:

(a) Install the components to the positions marked prior to removal.

(b) As the assembly progresses, install the rocker shaft retaining bolts and special washers to hold the components in position.

(4) Install the rocker shaft assemblies to the positions marked prior to removal.

(5) Progressively tighten the rocker shaft retaining bolts to the specified torque in a spiral sequence beginning with the centre bolts and ending with the outer bolts.

(6) If the rocker cover gasket is serviceable and being installed for further service, apply a bead of sealant to the bottom of the groove in the rocker cover and install the gasket to the groove.

NOTE: When a silicone sealant is required on 1.8 litre engines, ensure that it does not contain acetic acid which may damage the oxygen sensor.

(7) Install the rocker cover to the cylinder head and tighten the retaining bolts to the specified torque.

(8) Install the timing belt cover to the rocker cover and tighten the retaining bolts to the specified torque.

(9) Connect the engine ventilation hoses and the high tension leads to the rocker cover.

(10) On 1.6 litre models, proceed as follows:

(a) Install the wiring connector bracket to the rocker cover. Tighten the retaining bolts securely.

(b) Connect the outer throttle cable to the rocker cover bracket.

Check and if necessary, adjust the throttle cable as described in the Fuel and Engine Management section.

(c) Connect the vacuum hoses and install the air cleaner to the engine.

Tighten the retaining bolts and the wingnut securely.

(d) Connect the outer throttle cable to the air cleaner bracket.

(11) Start the engine and check for correct hydraulic lifter operation.

NOTE: It may be necessary to run the engine for up to 10 minutes before the hydraulic lifters operate correctly.

7. CYLINDER HEAD

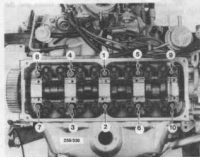
Special Equipment Required:

- To Dismantle and Assemble — Valve spring compressor
- To Inspect — Dial gauge, straight edge
- To Measure — Micrometer

TO REMOVE AND INSTALL

NOTE: It is possible to remove the cylinder head with the manifolds in position. The following procedure is described to reduce weight when lifting the cylinder head from the engine.

- (1) On 1.8 litre models, depressurise the fuel system as described in the Fuel and Engine Management section.
- (2) Disconnect the negative battery terminal.
- (3) Drain the cooling system as described in the Cooling and Heating Systems section.
- (4) Remove the inlet and exhaust manifolds as previously described under the Manifolds heading.
- (5) Remove the timing belt as previously described under the Timing Belt heading. While the timing marks are aligned, removed the distributor as described in the Electrical System section.
- (6) Remove the rocker arms and shafts as previously described under the Rocker Arms and Shafts heading.
- (7) Disconnect the earth leads from the cylinder head.
- (8) Disconnect the wiring from the oil pressure switch and the coolant thermostat.
- (9) Disconnect the top radiator hose from the thermostat cover.
- (10) If applicable, remove the refrigerant pipe mounting bracket retaining bolt from the cylinder head.
- (11) Remove the heater pipe mounting bracket retaining bolt from the cylinder head.



Cylinder head bolt tightening sequence. Loosen in the reverse order.

(12) Progressively loosen and remove the cylinder head bolts in a spiral sequence starting with the outer bolts and ending with the centre bolts. Refer to the illustration.

(13) Carefully separate the cylinder head from the cylinder block and remove the cylinder head from the vehicle.

NOTE: Do not place the cylinder head face down on a steel workbench as the head surface may be damaged. Cover the bench with cloth and rest the cylinder head on its side.

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

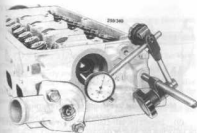
- (1) Ensure that the gasket surfaces of the cylinder head and the cylinder block are perfectly clean and free from any burrs or traces of old gasket.
- (2) Check the cylinder head for distortion diagonally and lengthwise using a straight edge and feeler gauges. Check Specifications for distortion limits. If the cylinder head is distorted it must be machined or renewed to restore it to Specifications.
- (3) Check the cylinder block for distortion diagonally and lengthwise using a straight edge and feeler gauges. If the block is distorted beyond Specifications, it will be necessary to remove the engine and have the block machined.
- (4) Place the cylinder head gasket in position ensuring that the gasket is correctly positioned on the locating dowels and that all holes are aligned.
- (5) Lubricate the cylinder head bolts sparingly with clean engine oil and tighten the bolts to the specified torque in two or three stages in a spiral sequence beginning with the centre bolts and working outwards. Refer to the illustration.
- (6) Install the associated components using the procedure described under the appropriate heading.
- (7) Fill the cooling system as described in the Cooling and Heating Systems section.
- (8) Run the engine and check for leaks. Rectify as necessary.

TO DISMANTLE

NOTE: Overhauling the cylinder head requires the use of specialised equipment. Buying or hiring this equipment is usually too expensive when overhauling a single cylinder head.

Overhauling the cylinder head is best left to a workshop which has the necessary equipment. Some workshops have a cylinder head exchange service which greatly reduces the amount of time that the vehicle is off the road.

- (1) Remove the retaining bolts and remove the thermostat cover, gasket and thermostat from the cylinder head.



Using a dial gauge to measure the camshaft end float.

(2) Remove the temperature gauge sender from the cylinder head to prevent accidental damage to the sender during the cylinder head overhaul.

(3) Measure the camshaft end float using a dial gauge. Inspect and renew the camshaft or the thrust plate if the end float exceeds the specified maximum.

(4) Using an open ended spanner, lock the camshaft by gripping the hexagon area of the shaft adjacent to the camshaft sprocket.

(5) Remove the camshaft sprocket retaining bolt and remove the sprocket from the end of the camshaft.

(6) Remove the thrust plate from the camshaft bearing housing at the distributor end of the cylinder head.



Camshaft and components.

(7) Carefully slide the camshaft out of the cylinder head ensuring that the cam lobes do not damage the bearing surfaces in the cylinder head.

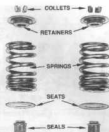
(8) Clean the deposits from the combustion chambers ensuring that the gasket face is not scratched or damaged.

(9) Compress the valve spring using a valve spring compressor and remove the retaining collets.

NOTE: If difficulty is experienced in separating the valve spring retainer from the collets, apply light pressure to the valve spring compressor and tap the edge of the retainer with a soft faced hammer.

(10) Release the spring compressor and remove the retainer, valve springs and the valve spring seat. Remove the valve stem oil seal from the valve guide.

(11) Using a small file, remove any burrs from the



Inlet and exhaust valve components.

end of the valve stem to prevent damage to the valve guide and withdraw the valve.

(12) Remove the remaining valves using the same procedure. Place the valves in a rack or tray in the order of removal to ensure assembly to the original locations.

(13) Remove and discard the oil seal from the camshaft sprocket end of the cylinder head.

TO CLEAN AND INSPECT

(1) Clean the valves thoroughly and discard any that are burnt or cracked.

(2) Using a sharp scraper, carefully remove all traces of gasket from the cylinder head. Remove all carbon deposits from the cylinder head using a rotary wire brush and electric drill. Do not use a wire brush on the cylinder head mounting face.

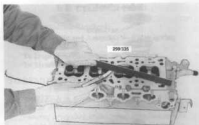
(3) Clean the valve guides using a piece of wadded cloth or a suitable brush and cleaning solvent.

(4) Thoroughly clean the cylinder head in cleaning solvent using a soft brush.

(5) Check the cylinder head for cracks and inspect the coolant passages for corrosion.

(6) Check the cylinder head mounting face and the inlet and exhaust manifold mating faces for distortion using a straight edge and feeler gauges.

If the distortion exceeds Specifications, machine the cylinder head. If it is necessary to machine more than the



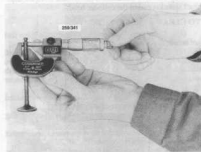
Checking for cylinder head distortion using a straight edge and feeler gauge.

specified maximum from the cylinder head mounting face or if the cylinder head height is not within Specifications, renew the cylinder head.

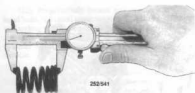
(7) Check the condition of the valve seats and if necessary, cut the seats using a valve seat cutter, to the correct angle and width as specified.

(8) Measure the valve stem to valve guide clearance using a dial gauge. Install the valve to its original valve guide and position the dial gauge plunger against the valve stem, slightly above the valve guide. Open the valve slightly and move the valve stem in a lateral direction, noting the dial gauge reading. If the reading exceeds Specifications, measure the valve stem with a micrometer. If the valve stem diameter is within Specifications, it will be necessary to renew the valve guide.

NOTE: If it is necessary to renew the valve guides or machine the valves or seats, it is recommended that this work be performed by an engine reconditioning workshop.



Measuring the valve stem diameter. Note that the micrometer is measuring the unworn section of the valve stem. Deduct the measurement at the centre of the valve stem from this measurement to determine the wear.



Measuring the free length of a valve spring.

(9) Inspect the valve faces for grooves or pitting and the valve tips for wear or damage. If necessary, reface the valves to the specified angle and machine the valve stem tip flat on a valve refacing machine.

If the valve face margin is less than Specifications after machining, renew the valve.

(10) Install each valve to its original valve guide and with the valve closed, measure the distance between the valve tip and the valve spring seat.

If the height is between the allowable limit and the maximum figure, shim the valve spring seat.

If the valve stem installed height exceeds Specifications, renew the cylinder head.

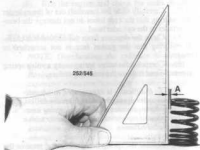
(11) Inspect the valve springs for cracks and measure the free length.

If a valve spring is cracked or its free length is not within Specifications, renew the valve spring.

(12) Check the valve springs for distortion using a set square. Renew valve springs that are distorted beyond Specifications.

(13) Lap the valves to the valve seats using lapping compound. Sparingly apply a smear of Prussian Blue to the valves after lapping and check the seat to ensure that a true and concentric seat has been obtained.

(14) Ensure that all valve lapping compound is removed from the valves and the combustion chambers.



Checking a valve spring for distortion. If distance A exceeds Specifications, renew the valve spring.

TO ASSEMBLE

Assembly is a reversal of the dismantling procedure with attention to the following points:

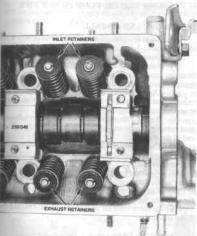
(1) Lubricate all component contact surfaces with clean engine oil.

(2) Using a tubular drift, carefully install the valve stem seals to the valve guides. Ensure that the seals are installed squarely and completely onto the valve guide.

(3) Install the valves to their guides. With the valve fully closed, measure the distance between the valve tip and the valve spring seat.

If the height is between the allowable limit and the maximum figure, shim the valve spring seat.

If the valve stem installed height exceeds Specifications, renew the cylinder head.



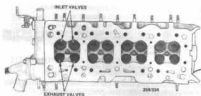
Valve spring retainers showing the different shapes for the inlet and exhaust valves.

(4) Install the valve spring seats. If necessary, install a spacer between the cylinder head and the valve spring seat.

(5) Install the valve springs, ensuring that the closer wound coils are installed towards the cylinder head.

(6) Install the retainer, compress the valve spring and install the retaining collets, ensuring that the collets are correctly seated before releasing the valve spring compressor.

NOTE: The retainers for the inlet and exhaust valves are different. Ensure that the smaller diameter retainers are installed to the exhaust valves only.



Cylinder head showing the valve arrangement.

(7) Lightly tap the top of the valve stem with a soft faced hammer to settle the collets in the retainer.

(8) Using compressed air, ensure that the cylinder head oil galleries are thoroughly clean.

(9) Ensure that the camshaft bearings are thoroughly clean and coat them in clean engine oil.

(10) Install a new oil seal to the camshaft sprocket end of the cylinder head. Lubricate the oil seal and the cylinder head recess with clean engine oil and install the seal until it is level with the end of the cylinder head.

(11) Carefully slide the camshaft into the cylinder head ensuring that the cam lobes do not damage the bearing surfaces. Install the thrust plate to retain the camshaft.

(12) Install the cylinder head to the engine as previously described.

8. CAMSHAFT

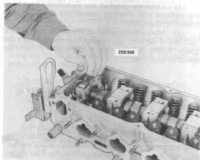
Special Equipment Required:

To Inspect — Vee blocks, dial gauge, micrometer

TO REMOVE AND INSTALL

(1) Remove the cylinder head as previously described.

(2) Measure the camshaft end float using a dial



Removing the camshaft thrust plate.



Camshaft and components.

gauge. Inspect and renew the camshaft or the thrust plate if the end float exceeds the specified maximum.

(3) Using an open ended spanner, lock the camshaft by gripping the hexagon area of the shaft adjacent to the camshaft sprocket.

(4) Remove the camshaft sprocket retaining bolt and remove the sprocket from the end of the camshaft.

(5) Remove the thrust plate from the camshaft bearing housing at the distributor end of the cylinder head.

(6) Carefully slide the camshaft out of the cylinder head ensuring that the cam lobes do not damage the bearing surfaces in the cylinder head.

(7) Remove and discard the oil seal from the camshaft sprocket end of the cylinder head.

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

(1) Renew the oil seal at the camshaft sprocket end of the cylinder head.

Lubricate the oil seal and the cylinder head recess with clean engine oil and install the oil seal until it is level with the end of the cylinder head.

(2) Lubricate the camshaft and the bearing surfaces with clean engine oil prior to installation.

(3) Carefully slide the camshaft into the cylinder head ensuring that the cam lobes do not damage the bearing surfaces in the cylinder head.

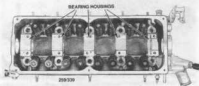
(4) Install the thrust plate to retain the camshaft.

(5) Install the cylinder head to the engine as previously described.

TO CLEAN AND INSPECT

(1) Clean the camshaft and the cylinder head bearing surfaces with cleaning solvent and dry with compressed air if available.

(2) Mount the camshaft on Vee blocks positioned at each end of the shaft and measure the runout using a dial gauge. Renew the camshaft if the runout exceeds the specified maximum.



Camshaft bearing locations.

(3) Using a micrometer, measure the camshaft journal diameters at a minimum of two places to assess size and ovality. Renew the camshaft if the ovality is excessive or the diameter is below the specified minimum.

(4) Measure the cylinder head bearing housing diameters and renew the cylinder head or the camshaft if the oil clearance is excessive.

(5) Inspect the camshaft lobes for wear, pitting or loss of hard facing. Using a micrometer, measure the cam lobe heights at two places across the cam lobe and renew the camshaft if the height is below the specified minimum.

NOTE: If pitting or excessive wear is apparent on the camshaft lobes, a thorough inspection of the rockers should be made.

9. SUMP AND OIL PUMP PICKUP PIPE

TO REMOVE AND INSTALL

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

(2) Disconnect the negative battery terminal.

(3) Remove the sump drain plug and drain the oil from the sump. Install and tighten the drain plug to the specified torque when the oil has drained.

(4) Disconnect the exhaust engine pipe from the exhaust manifold catalytic converter and mounting bracket and remove the engine pipe from the vehicle.

(5) Remove the retaining bolts and remove the engine compartment lower cover from below the right hand end of the engine.

(6) On 1.6 litre models, remove the retaining bolts and remove the brace from between the engine crankcase and the transaxle clutch or converter housing mating face.

(7) Remove the sump retaining bolts and nuts, where applicable.

(8) Carefully cut the sealant between the sump and the stiffener plate using a seal cutter or a sharp knife and separate the sump from the engine crankcase. Discard the sump end seals.

NOTE: On 1.6 litre models, prise between the sump and the main bearing stiffener plate. On 1.8 litre models, prise between the outer edge of the transaxle end of the sump and the edge of the engine crankcase.

(9) Remove the retaining bolts and remove the pickup pipe from the oil pump. Discard the gasket.

(10) Remove all traces of sealant from the sump and the engine.

(11) Wash the inside of the sump to remove carbon and sludge deposits. Check for any metal deposits which may indicate an imminent bearing failure.

(12) Inspect the sump for dents and cracks or damage to the mating face. Inspect the threads on the sump drain plug and the sump for damage or wear. Repair or renew as necessary.