Chapter 2 Part A Engines

Contents

Specifications

General – all engines

Firing order	1-3-4-2
Cylinder numbers (front-to-rear)	1-2-3-4

B1600, B1800 and B2000 engines (with timing chain)

Camshaft

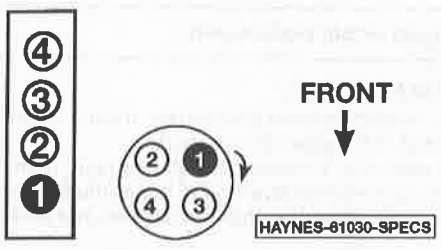
End play	
New	0.001 to 0.007 in (0.02 to 0.18 mm)
Wear limit	0.008 in (0.20 mm)

Oil pump

Outer rotor-to-pump body clearance	
New	0.006 to 0.010 in (0.14 to 0.25 mm)
Wear limit	0.012 in (0.30 mm)
Rotor end play	
New	0.002 to 0.004 in (0.04 to 0.10 mm)
Wear limit	0.006 in (0.15 mm)
Clearance between rotor lobes	
New	0.002 to 0.006 in (0.04 to 0.15 mm)
Wear limit	0.010 in (0.25 mm)
Clearance between pump shaft and body	
New	0.0002 to 0.0020 in (0.006 to 0.051 mm)
Wear limit	0.004 in (0.10 mm)
Oil pump chain slack	0.157 in (4.0 mm) maximum

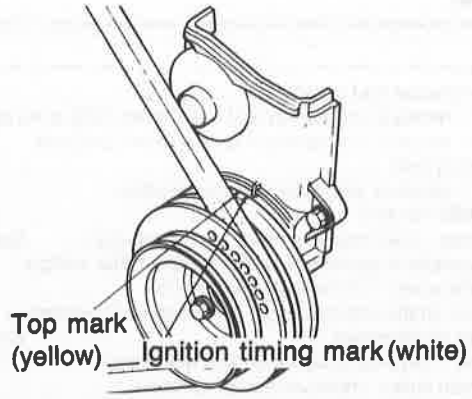
Torque specifications

	Ft-lbs
Rocker arm cover nuts	1.1 to 1.4
Intake manifold nuts/bolts	14 to 19
Exhaust manifold nuts/bolts	
B1600 and B1800	12 to 17
B2000	16 to 21
Camshaft sprocket nut	51 to 58
Cylinder head bolts	
B1600 and B1800	
Cold engine (initial)	56 to 60
Warm engine (final)	69 to 72
B2000	
Cold engine (initial)	65 to 69
Warm engine (final)	69 to 72
Crankshaft pulley-to-crankshaft bolt	101 to 108
Distributor drive gear nut	51 to 58
Oil pump sprocket nut	22 to 25
Oil pan bolts	5 to 7
Flywheel bolts	112 to 118
Miscellaneous	
6 mm bolt	5.8
8 mm bolt	13.7
10 mm bolt	27.5

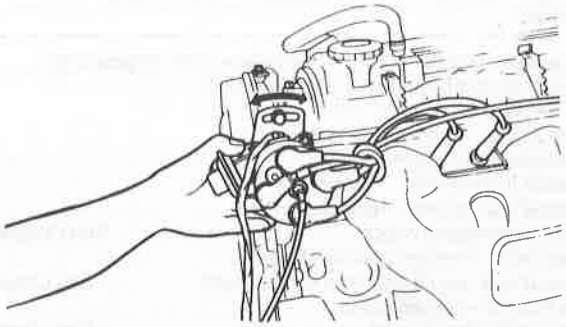


B1600, B1800 and B2000 ENGINES (WITH TIMING CHAIN)

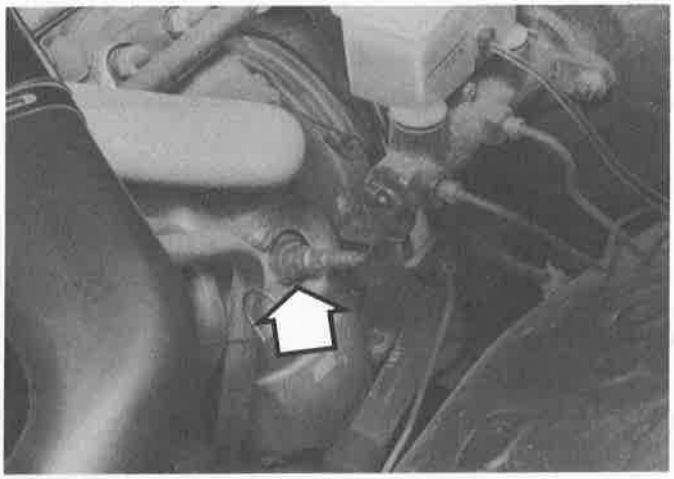
Cylinder location and distributor rotation



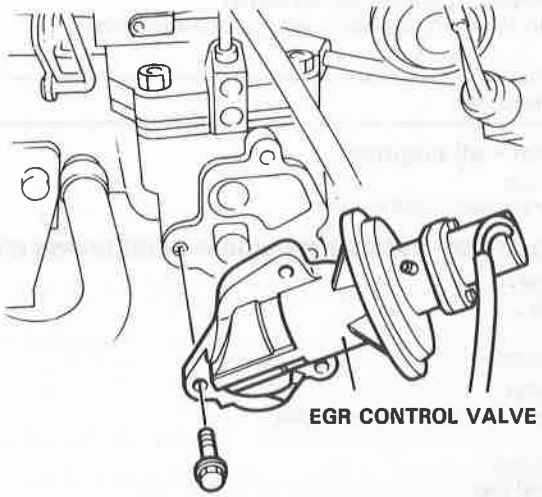
47.4 The timing marks are located on the pulley and the pointer is attached to the engine on 1600/1800/2000/2200 engines



47.11 Ignition timing is adjusted by swiveling the distributor slightly either clockwise or counterclockwise



48.2 The oxygen sensor (arrow) threads into the exhaust manifold and is accessible in the engine compartment



49.2 EGR valve details

11 Start the engine and slowly rotate the distributor either left or right until the timing marks are aligned **(see illustration)**.
12 Shut off the engine and tighten the distributor mounting/adjusting bolts, being careful not to move the distributor.
13 Restart the engine and recheck the timing to make sure the marks are still in alignment.

48 Oxygen sensor replacement

Refer to illustration 48.2

1 The oxygen (exhaust gas) sensor, used on later models, should be replaced at the specified intervals.
2 The sensor is threaded into the exhaust manifold and can be identified by the wires attached to it **(see illustration)**. Replacement consists of disconnecting the wire harness and unthreading the sensor from the manifold. Tighten the new sensor securely, then reconnect the wire harness.

49 EGR valve replacement (1985 and later 2000/2200 engine)

Refer to illustration 49.2

1 With the engine cold, disconnect the vacuum tube from the EGR valve.
2 Remove the retaining bolts and lift the EGR valve from the exhaust manifold **(see illustration)**.
3 To install, place the new EGR valve in position and install the retaining bolts. Tighten the bolts securely.
4 Connect the vacuum hose.
5 Start the engine, run it at idle and check for exhaust leaks.

12 mm bolt	47
14 mm bolt	66

B2000 and B2200 engines (with timing belt)

Camshaft

End play	
New	0.003 to 0.006 in (0.08 to 0.16 mm)
Wear limit	0.008 in (0.20 mm)
Timing belt deflection	0.43 to 0.51 in (11 to 13 mm)

Oil pump (gear type)

Inner gear-to-crescent clearance	
New	0.0010 to 0.0015 in (0.26 to 0.38 mm)
Wear limit	0.016 in (0.40 mm)
Outer gear-to-crescent clearance	
New	0.0078 to 0.0126 in (0.02 to 0.32 mm)
Wear limit	0.016 in (0.40 mm)
Gear-to-cover clearance	
New	0.0012 to 0.0025 in (0.03 to 0.063 mm)
Wear limit	0.040 in (0.10 mm)

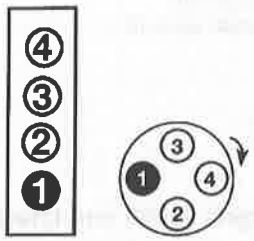
Oil pump (rotor type)

Inner rotor-to-outer rotor clearance limit	0.007 in (0.018 mm)
Rotor-to-pump cover clearance limit	0.004 in (0.10 mm)
Outer rotor-to-pump body clearance limit	0.008 in (0.20 mm)

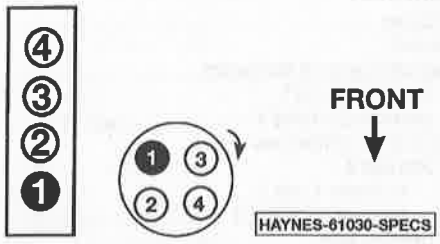
Torque specifications

	Ft-lbs
Rocker arm cover nuts	2 to 3
Intake manifold nuts/bolts	14 to 19
Exhaust manifold nuts/bolts	16 to 21
Camshaft sprocket bolt	35 to 48
Cylinder head bolts	59 to 64
Crankshaft pulley bolt	9 to 12.3
Oil cooler/filter adapter bolts	10.8 to 14.5
Oil pump **(see illustration 15.14)**	
Bolt A*	14 to 19
Bolt B**	27 to 38
Oil strainer bolts	5.8 to 8.7
Oil pan bolts	5 to 9.0
Flywheel/driveplate bolts	71 to 76
Block end plate bolts	14 to 22
Timing belt cover nuts/bolts	5 to 7.2
Rear oil seal housing bolts	5.8 to 8.7
Rocker arm shaft assembly bolts	13 to 20
Front housing-to-cylinder head bolts	14 to 19
Timing belt tensioner lock bolt	27 to 38
Idler pulley bolt	27 to 38
Miscellaneous	
6 mm bolt	5.8
8 mm bolt	13.7
10 mm bolt	27.5
12 mm bolt	47
14 mm bolt	66

**All bolts on 1986 and 1987 models* ***1988 and later models only*



B2000 and B2200 ENGINES (WITH TIMING BELT)



B2600 (2.6L) ENGINE

Cylinder location and distributor rotation

B2600 (2.6L) engine (through 1988)

Timing chain tensioner spring free length	2.587 in (65.7 mm)

Balance shaft

Left bearing journal diameter	0.906 in (23 mm)
Left bearing oil clearance	0.0008 to 0.0024 in (0.02 to 0.06 mm)
Right bearing journal diameter	1.693 in (43 mm)
Right bearing oil clearance	0.0020 to 0.0035 in (0.05 to 0.09 mm)
Chain-to-guide clearance (slack)	0.008 to 0.031 in (0.2 to 0.8 mm)

Oil pump

Relief spring free length	1.850 in (47 mm)
Gear-to-housing clearance	0.0043 to 0.0059 in (0.11 to 0.15 mm)
Gear-to-pump body clearance	0.0008 to 0.0020 in (0.02 to 0.05 mm)
Gear-to-pump cover bearing clearance	0.0016 to 0.0028 in (0.04 to 0.07 mm)
Gear end play	
Drive	0.0020 to 0.0043 in (0.05 to 0.11 mm)
Driven	0.0016 to 0.0039 in (0.04 to 0.10 mm)

Camshaft

End play	
Standard	0.0008 to 0.007 in (0.02 to 0.18 mm)
Wear limit	0.008 (0.20 mm)

Torque specifications	Ft-lbs
Intake manifold nuts	11 to 14
Exhaust manifold nuts	11 to 14
Cylinder head-to-block bolts (HOT)	72 to 79
Cylinder head-to-block bolts (COLD)	65 to 72
Cylinder head-to-timing chain case bolts	11 to 16
Crankshaft sprocket/pulley bolt	80 to 94
Camshaft bearing cap bolts	
All except bolt number 5	14 to 15
Bolt number 5	15 to 20
Flywheel/driveplate-to-crankshaft bolts	
1972 through 1988	94 to 101
1989 and later	67 to 72
Rocker arm cover bolts	3.6 to 5.1
Jet valves	13 to 15
Engine mount bracket	36 to 43
Distributor drive gear/camshaft sprocket bolt	
Timing chain cover bolts	8.7 to 10.2
Oil pan bolts	4.3 to 5.1
Timing chain guide bolts	7.2 to 8.7
Balance shaft drive gear/oil pump sprocket bolt	22 to 29
Balance shaft sprocket bolt	43 to 50
Balance shaft thrust plate bolts	7.3 to 7.9
Balance shaft chain guide bolts	
Left guide (A) and upper guide (B)	3.6 to 5.8
Lower guide (C)	
Upper bolt	5.8 to 6.5
Lower bolt	11 to 15
Oil pump sprocket bolt	22 to 29
Oil pump mounting bolt	5.7 to 6.5
Oil strainer bolts	11 to 16

B2600I (2.6L) engine (1989 and later)

General

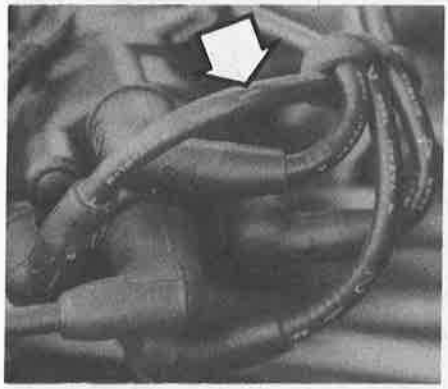
Displacement	158.97 cubic inches (2.6 liters)
Intake/exhaust manifold warpage limit	0.006 inch
Balance shaft chain slack	1/8-inch

Camshaft

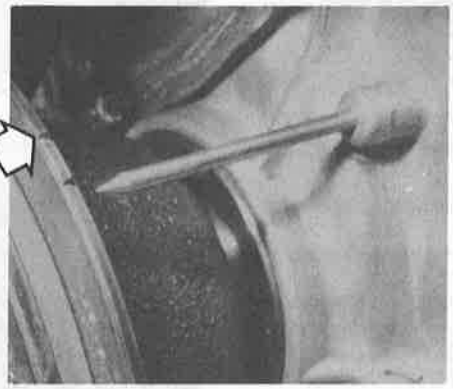
Endplay	0.0008 to 0.0059 inch
Runout	0.0012 inch
Camshaft journal diameters	
Journals 1 and 5	1.1788 to 1.1797 inches
Journals 2, 3 and 4	1.1776 to 1.1785 inches
Journal oil clearances	
Standard	
Journals 1 and 5	0.0014 to 0.0033 inch
Journals 2, 3 and 4	0.0026 to 0.0045 inch
Service limit	0.006 inch
Lobe height	
Intake	1.6423 inches
Exhaust	1.6531 inches
Balance shaft oil clearance	
Front	0.0020 to 0.0045 in
Center and rear	0.0031 to 0.0057 in
Oil pump	
Side clearance	0.0039 maximum
Tooth tip clearance	0.0071 maximum
Outer rotor-to-pump body clearance	0.0078 maximum
Pressure relief valve spring – free length	1.827 inches

Torque specifications	**Ft-lbs** (unless otherwise indicated)
Camshaft bearing cap bolts	14 to 19
Valve cover bolts	52 to 78 in-lbs
Balance shaft chain guide bolts	156 in-lbs
Timing chain guide bolts	70 to 95 in-lbs
Camshaft sprocket bolt	37 to 40
Crankshaft pulley bolt	131 to 144
Cylinder head bolts (except bolts "A" in illustration 19.27d)	
First step	21
Second step	42
Third step	59 to 64
Cylinder head-to-timing chain cover bolts (bolt A)	12 to 16
Flywheel/driveplate-to-crankshaft bolts	68 to 72
Intake manifold bolts	14 to 18
Exhaust manifold bolts	16 to 20

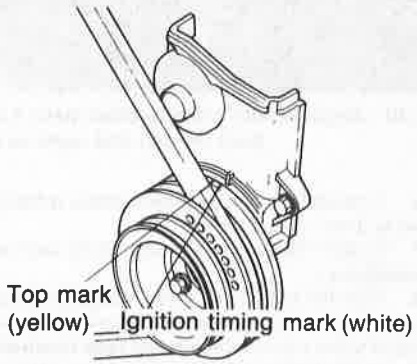
Balance shaft sprocket bolt	27 to 39
Oil pan-to-engine bolts	70 to 95 in-lbs
Oil pump pick-up tube bolts	70 to 95 in-lbs
Oil pump body bolts	14 to 18
Oil pump pressure relief valve	28 to 44
Rear main oil seal housing bolts	70 to 95 in-lbs
Timing chain/balance shaft chain access cover	
Bolts	70 to 95 in-lbs
Nuts	61 to 86 in-lbs
Timing chain cover bolts	14 to 18
Water pump bolts	See Chapter 3



3.5 Mark the distributor directly under the number one plug wire terminal in the cap – the wires may be marked (arrow)



3.8a Align the second notch in the drivebelt pulley (arrow) with the pointer on the front of the engine (early models)



3.8b Align the yellow (TDC) mark with the pointer on the timing cover (2.2L engine shown, others similar)

1 General information

This Part of Chapter 2 is devoted to in-vehicle repair procedures for the engine. All information concerning engine removal and installation and engine block and cylinder head overhaul can be found in Part B of this Chapter.

The following repair procedures are based on the assumption that the engine is installed in the vehicle. If the engine has been removed from the vehicle and mounted on a stand, many of the steps outlined in this Part of Chapter 2 will not apply.

The Specifications included in this Part of Chapter 2 apply only to the procedures contained in this Part. Part B of Chapter 2 contains the Specifications necessary for cylinder head and engine block rebuilding.

2 Repair operations possible with the engine in the vehicle

Many major repair operations can be accomplished without removing the engine from the vehicle.

Clean the engine compartment and the exterior of the engine with some type of degreaser before any work is done. It will make the job easier and help keep dirt out of the internal areas of the engine.

Depending on the components involved, it may be helpful to remove the hood to improve access to the engine as repairs are performed (refer to Chapter 11 if necessary). Cover the fenders to prevent damage to the paint. Special pads are available, but an old bedspread or blanket will also work.

If vacuum, exhaust, oil or coolant leaks develop, indicating a need for gasket or seal replacement, the repairs can generally be made with the engine in the vehicle. The intake and exhaust manifold gaskets, timing chain cover gasket, oil pan gasket, crankshaft oil seals and cylinder head gasket are all accessible with the engine in place.

Exterior engine components, such as the intake and exhaust manifolds, the oil pan (and the oil pump), the water pump, the starter motor, the alternator, the distributor and the fuel system components can be removed for repair with the engine in place.

Since the cylinder head can be removed without pulling the engine, valve component and camshaft servicing can also be accomplished with the engine in the vehicle. Replacement of the timing chain or belt and sprockets is also possible with the engine in the vehicle.

In extreme cases caused by a lack of necessary equipment, repair or replacement of piston rings, pistons, connecting rods and rod bearings is possible with the engine in the vehicle. However, this practice is not recommended because of the cleaning and preparation work that must be done to the components involved.

3 Top Dead Center (TDC) for number one piston – locating

Refer to illustrations 3.5, 3.8a and 3.8b

Note: *The following procedure is based on the assumption that the distributor is correctly installed. If you are trying to locate TDC to install the distributor correctly, piston position must be determined by feeling for compression at the number one spark plug hole, then aligning the ignition timing marks as described in Step 8.*

1 Top Dead Center (TDC) is the highest point in the cylinder that each piston reaches as it travels up-and-down when the crankshaft turns. Each piston reaches TDC on the compression stroke and again on the exhaust stroke, but TDC generally refers to piston position on the compression stroke.

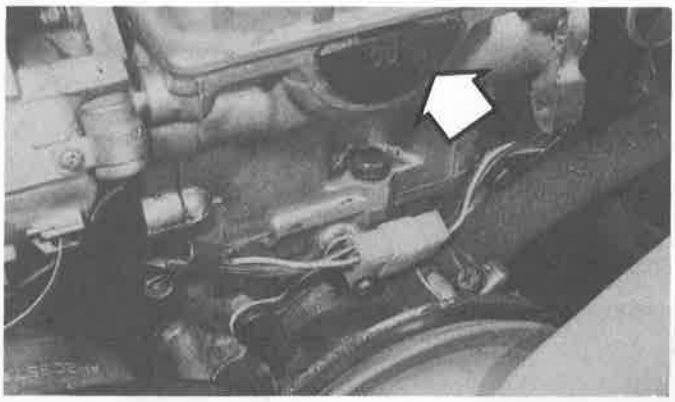
2 Positioning the piston(s) at TDC is an essential part of many procedures such as rocker arm removal, camshaft and timing chain/belt/sprocket removal and distributor removal.

3 Before beginning this procedure, be sure to place the transmission in Neutral and apply the parking brake or block the rear wheels. Also, disable the ignition system by detaching the coil wire from the center terminal of the distributor cap and grounding it on the block with a jumper wire. Remove the spark plugs (see Chapter 1).

4 In order to bring any piston to TDC, the crankshaft must be turned using one of the methods outlined below. When looking at the front of the engine, normal crankshaft rotation is *clockwise*.

a) The preferred method is to turn the crankshaft with a socket and ratchet attached to the bolt threaded into the front of the crankshaft.
b) A remote starter switch, which may save some time, can also be used. Follow the instructions included with the switch. Once the piston is close to TDC, use a socket and ratchet as described in the previous paragraph.
c) If an assistant is available to turn the ignition switch to the Start position in short bursts, you can get the piston close to TDC without a remote starter switch. Make sure your assistant is out of the vehicle, away from the ignition switch, then use a socket and ratchet as described in Paragraph a) to complete the procedure.

5 Note the position of the terminal for the number one spark plug wire on the distributor cap **(see illustration)**. If the wire/terminal isn't marked, follow the plug wire from the number one cylinder spark plug to the cap.



4.10 Engines with a timing chain have a semi-circular plug at the front (arrow) that must be in place

6 Use a felt-tip pen or chalk to make a mark on the distributor body directly under the terminal.
7 Detach the cap from the distributor and set it aside (see Chapter 1 if necessary).
8 Turn the crankshaft (see Paragraph 3 above) until the notch in the crankshaft pulley is aligned with the 0, T or pointer on the timing plate (located at the front of the engine) **(see illustrations)**.
9 Look at the distributor rotor – it should be pointing directly at the mark you made on the distributor body.
10 If the rotor is 180 degrees off, the number one piston is at TDC on the exhaust stroke.
11 To get the piston to TDC on the compression stroke, turn the crankshaft one complete turn (360-degrees) clockwise. The rotor should now be pointing at the mark on the distributor. When the rotor is pointing at the number one spark plug wire terminal in the distributor cap and the ignition timing marks are aligned, the number one piston is at TDC on the compression stroke.
12 After the number one piston has been positioned at TDC on the compression stroke, TDC for any of the remaining pistons can be located by turning the crankshaft and following the firing order. Mark the remaining spark plug wire terminal locations on the distributor body just like you did for the number one terminal, then number the marks to correspond with the cylinder numbers. As you turn the crankshaft, the rotor will also turn. When it's pointing directly at one of the marks on the distributor, the piston for that particular cylinder is at TDC on the compression stroke.

4 Rocker arm cover – removal and installation

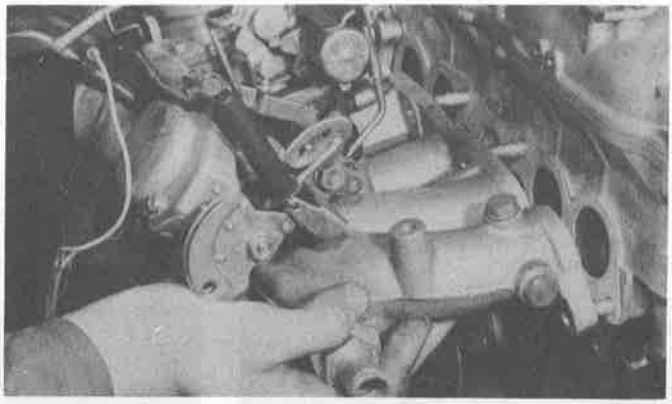
Refer to illustration 4.10

1 Disconnect the negative cable from the battery.
2 Remove the air cleaner assembly (see Chapter 4).
3 Disconnect the hoses and wires from the rocker arm cover.
4 Detach the wire holders from the rocker arm cover.
5 Clearly label and then disconnect any emission hoses which cross over the rocker arm cover.
6 Disconnect the throttle cable from the rocker arm cover and carburetor (see Chapter 4).
7 If so equipped, detach the cruise control and automatic transmission cables from the rocker arm cover.
8 Unbolt the rocker arm cover and lift it off. If the cover sticks to the cylinder head, gently pry all around it. Take your time to avoid damaging the cover.
9 Thoroughly clean the rocker arm cover and remove all traces of old gasket material.
10 Install the cover with a new gasket and, on timing chain equipped models, the end seal **(see illustration)**. Tighten the fasteners to the specified torque.
11 The remaining steps are the reverse of removal.

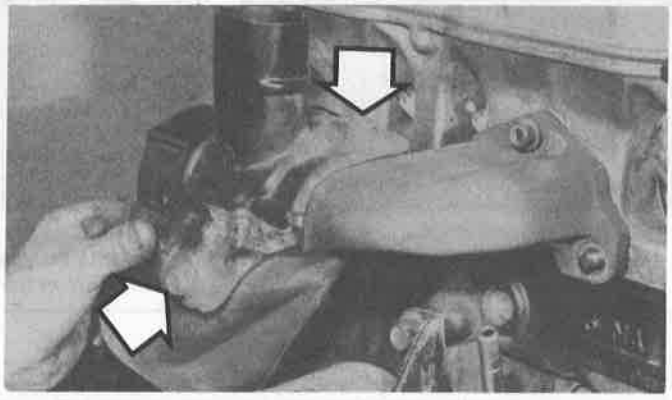
5 Intake manifold – removal and installation

Refer to illustration 5.8

Warning: *Gasoline is extremely flammable, so extra precautions must be taken when working on any part of the fuel system. Make sure the engine is cool. Don't smoke or allow open flames or bare light bulbs near the work area. Also, do not work in a garage if a natural gas-type appliance with a pilot light is present. Have a fire extinguisher handy.*



5.8 Slip the intake manifold off the cylinder head studs and lift it out of the engine compartment



6.6 The exhaust manifold heat shield may have to be removed to gain access to the manifold nuts/bolts

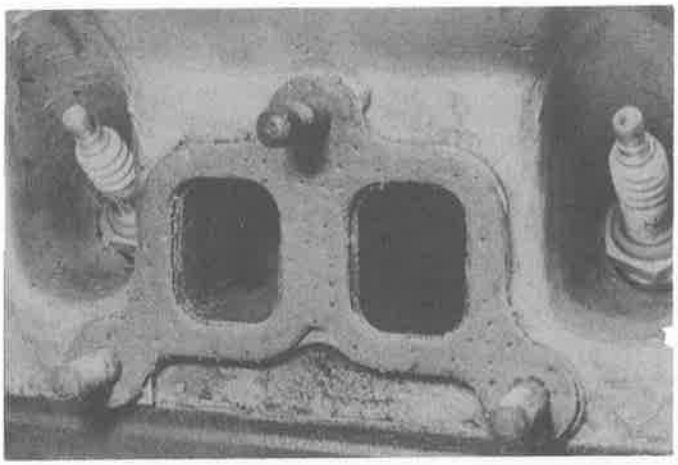
1 Disconnect the negative cable from the battery.
2 Drain the cooling system (see Chapter 1).
3 Remove the air cleaner (carbureted models) or disconnect the intake duct from the throttle body (fuel injected models) (see Chapter 4).
4 Clearly label and then disconnect all hoses, brackets and emission lines which run to the carburetor or throttle body/intake manifold assembly.
5 Disconnect the fuel lines from the carburetor or fuel rail (relieve the fuel pressure first) and cap the fittings to prevent leakage (see Chapter 4).
6 Disconnect the throttle cable from the carburetor or throttle body (see Chapter 4).
7 Detach the cable which runs from the carburetor or throttle body to the transmission (automatic transmission only) and the cruise control cable, on vehicles so equipped.
8 Unbolt the intake manifold and remove it from the engine **(see illustration)**. If it sticks, tap the manifold with a soft-face hammer. **Caution:** *Do not pry between the gasket sealing surfaces.*
9 Thoroughly clean the manifold and cylinder head mating surfaces, removing all traces of gasket material.
10 Install the manifold, using a new gasket and tighten the nuts in several stages, working from the center out, until the specified torque is reached.
11 The remaining steps are the reverse of removal.
12 Add coolant, run the engine and check for leaks and proper operation.

6 Exhaust manifold – removal and installation

Refer to illustrations 6.6 and 6.11

Warning: *Allow the engine to cool completely before beginning this procedure.*

1 Disconnect the negative cable from the battery.
2 Raise the vehicle and support it securely on jackstands.



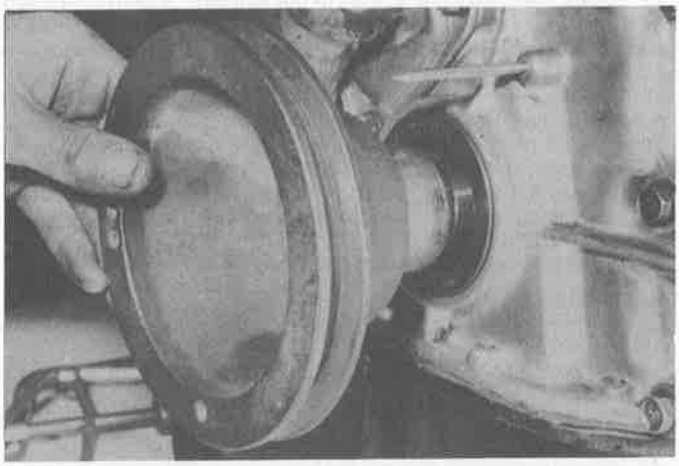
6.11 Be sure to position new gaskets over the studs before installing the exhaust manifold – do not use sealant!

3 Disconnect the exhaust pipe from the bottom of the exhaust manifold (see Chapter 4).
4 On carbureted models, remove the air cleaner assembly (see Chapter 4).
5 Unplug the oxygen sensor wire, on models so equipped.
6 Remove the heat shield **(see illustration)** from the exhaust manifold (except models with permanent "spot welded in place" shields).
7 Remove the brackets and emission components from the exhaust manifold (see Chapter 6).
8 Unbolt the manifold and remove it from the engine compartment.
9 Clean and inspect all the threaded fasteners and repair as necessary.
10 Remove any traces of gasket material from the mating surfaces and inspect them for wear and cracks.
11 Using new gasket(s) **(see illustration)**, install the manifold and tighten the nuts in several steps, working from the center out, to the specified torque.
12 The remaining steps are the reverse of removal.
13 Run the engine and check for exhaust leaks.

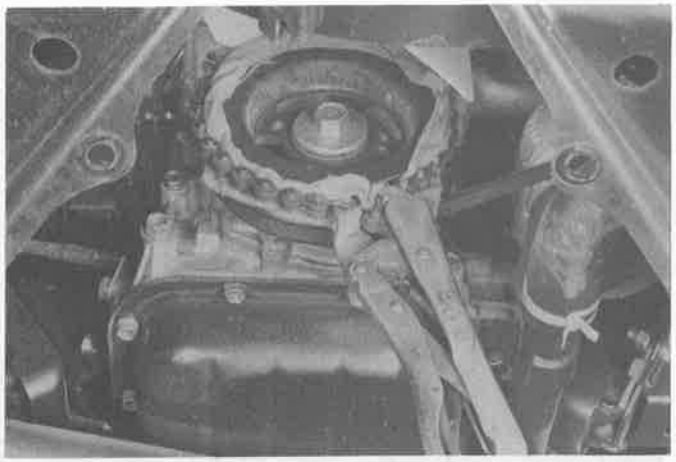
7 Crankshaft front oil seal – replacement

Refer to illustrations 7.4, 7.5 and 7.9

1 Remove the drivebelts (see Chapter 1) and unbolt the belly pan.
2 Remove the radiator and shroud (see Chapter 3). On B2600i models (1989 and later), remove the cooling fan and water pump pulley.



7.5 The crankshaft pulley may slip off by hand, but it may require a puller if it's stuck

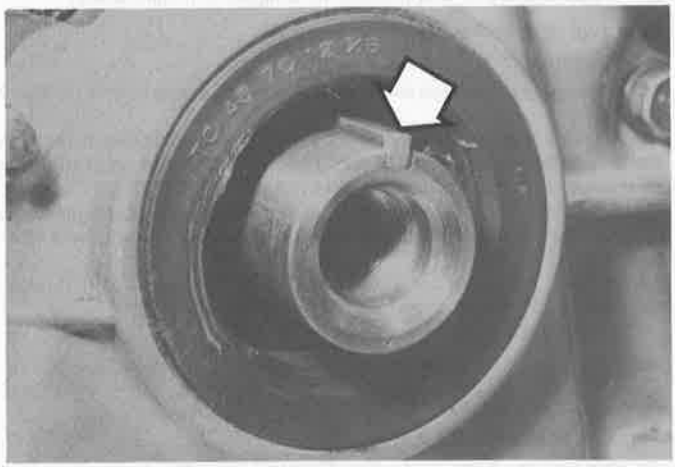


7.4 When using a chain wrench to keep the crankshaft from turning, protect the pulley with a rag – if the pulley is nicked or otherwise damaged, it will destroy the drivebelt

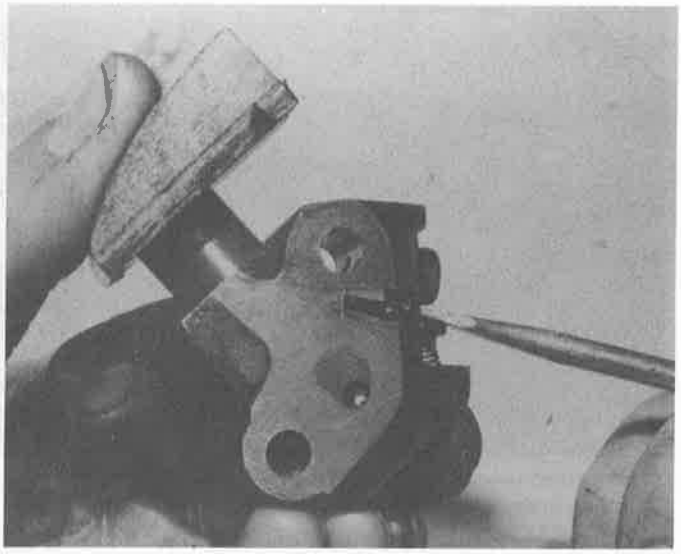
3 Remove the timing belt and crankshaft sprocket, if equipped (see Section 11).
4 On timing chain equipped models, remove the crankshaft bolt. To keep the crankshaft from turning, set the parking brake, block the wheels and put the transmission in high gear (manual transmission only) or wrap a chain wrench around the pulley **(see illustration)**. **Caution:** *Don't overtighten the chain wrench, as it may damage the pulley, which could result in rapid belt failure.*
5 Unbolt and remove the lower crankshaft pulley **(see illustration)**.
6 Using a screwdriver or a seal puller, pry the seal out of the housing. Be careful not to damage the crankshaft or seal bore.
7 Thoroughly clean and inspect the seal bore and sealing surface.
8 Lubricate the outer edge of the new seal with engine oil and drive it into place with a large socket or piece of pipe and a hammer.
9 Reinstall the timing belt, (if removed) and crankshaft pulley and bolt. Be sure to align the pulley keyway with the key **(see illustration)**. Tighten the bolt to the specified torque.
10 Reinstall the drivebelts, radiator and shroud. Run the engine and check for leaks.
11 Reinstall the belly pan.

8 Timing chain tensioner – adjustment, removal and installation

Note: *This procedure applies to pre-1985 models only. For 2.6L engine timing chain tensioner information, see Section 10.*



7.9 After the seal is installed flush with the housing, align the key (arrow) with the slot in the pulley



8.4 Wedge a screwdriver in the tensioner while compressing the snubber spring

1 Timing chain adjustment is normally taken care of automatically. However, after removal and installation of the timing chain, it is recommended that the adjustment procedure in this Section be followed (Steps 2 through 9, or 15 through 22, as appropriate).

Hydraulic type

Adjustment

Refer to illustration 8.4

2 Remove the water pump (refer to Chapter 3 if necessary).
3 Remove the cover from the timing chain tensioner (three nuts and washers). Be careful not to damage the sealing surfaces if the cover is stuck to the engine.
4 Rotate the crankshaft slightly in the direction of normal rotation (clockwise), then lift the release on the tensioner and compress the snubber spring as far as possible. Wedge a screwdriver in the tensioner to prevent it from releasing **(see illustration)**.
5 Remove the two plugs and aluminum washers from the holes in the timing chain cover. Loosen the chain guide screws through the holes in the cover.
6 Push on the top of the guide through the adjusting hole in the cylinder head, then tighten the guide screws.
7 Remove the screwdriver from the tensioner to allow the snubber to take up the spring slack.
8 Install the chain tensioner cover and gasket, using a new gasket and RTV sealant.
9 Install the water pump (refer to Chapter 3 if necessary).

Removal and installation

Refer to illustration 8.11

10 To remove the tensioner, initially proceed as described in Steps 2 and 3.
11 Remove the bolts from the tensioner, then withdraw it through the hole in the timing chain cover. Hold the body and shoe together as there is a spring inside **(see illustration)**.
12 When installing the tensioner, wedge a screwdriver in the tensioner release mechanism while compressing the snubber spring **(see illustration 8.4)**.
13 Without removing the screwdriver, insert the tensioner through the hole in the cover, then install and tighten the bolts.
14 Adjust the tensioner as described above.

Spring type

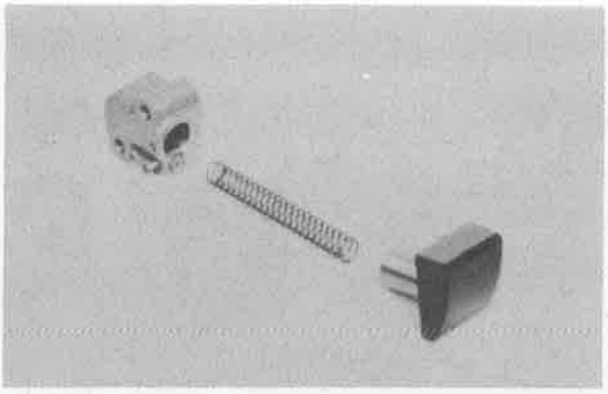
Adjustment

Refer to illustration 8.17

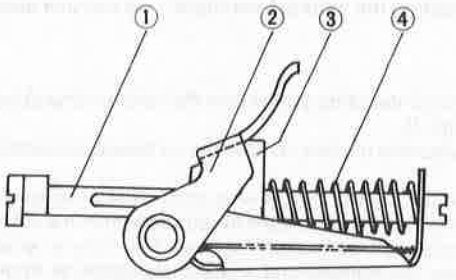
15 Remove the water pump (see Chapter 3) and the rocker arm cover (see Section 4).
16 Remove the cover from the timing chain tensioner (three nuts and washers). Be careful not to damage the sealing surfaces if the cover is stuck to the engine.
17 Rotate the crankshaft slightly in the direction of normal rotation, then pass a screwdriver down the opening at the side of the camshaft sprocket. Depress the slide pin as far as possible and turn it clockwise 90 degrees **(see illustration)**.
18 Remove the two plugs and aluminum washers from the holes in the timing chain cover. Loosen the chain guide through the holes.
19 Push on the top of the guide through the adjusting hole in the cylinder head, then tighten the guide screws.
20 Release the tensioner slide pin by turning it counterclockwise.
21 Install the chain tensioner cover and gasket using a new gasket and RTV sealant.
22 Install the water pump (refer to Chapter 3 if necessary).

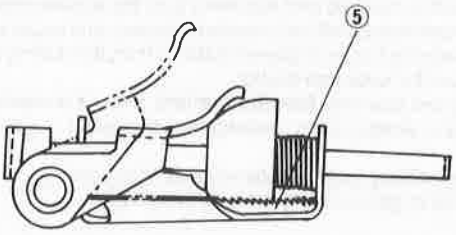
Removal and installation

23 To remove the tensioner, initially proceed as described in Steps 15 and 16.
24 Remove the bolt and withdraw the tensioner through the hole in the timing chain cover.
25 When installing the tensioner, depress the slide pin all the way and turn it clockwise 90 degrees to lock the wedge.
26 Insert the tensioner through the hole in the timing chain cover, then install and tighten the bolt.
27 Adjust the tensioner as described above.



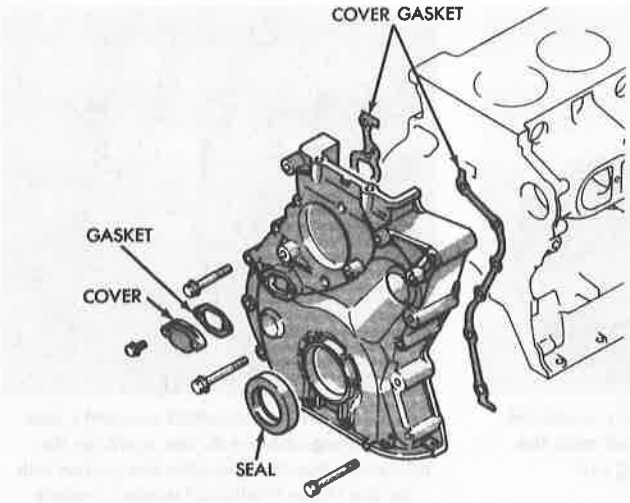
8.11 Hydraulic chain tensioner components – exploded view



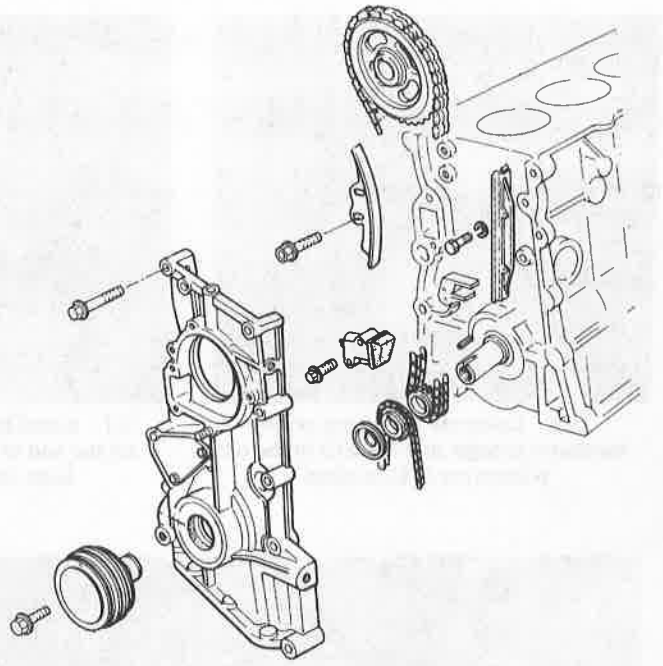


8.17 Spring type chain tensioner components

1 Slide pin
2 Arm
3 Wedge
4 Spring
5 Wedge plate



9.9a 2.6L engine timing chain cover and related components – exploded view (models through 1988 shown, later models similar)



9.9b Mazda engine timing chain cover and related components – exploded view

9 Timing chain cover – removal and installation

Refer to illustrations 9.9a and 9.9b

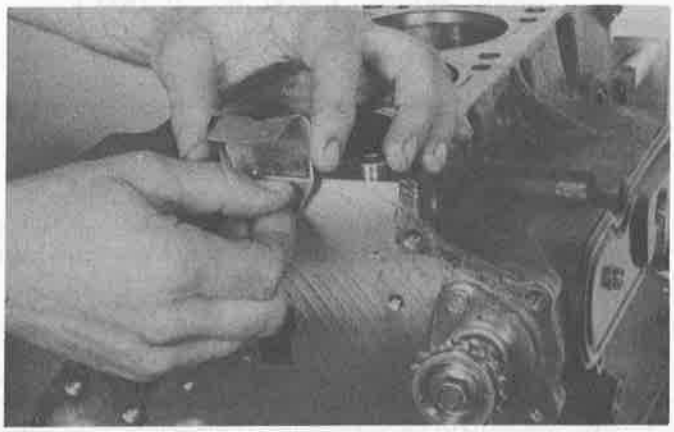
1 Remove the radiator and water pump (see Chapter 3).
2 Remove the oil pan (see Section 20).
3 Remove the cylinder head (see Section 19). **Note:** *Although it is possible to remove the timing chain cover without removing the cylinder head, it is not recommended. The head gasket seals the gap between the timing chain cover and head. During disassembly the gasket will probably tear, leading to oil leaks later.*
4 Remove the crankshaft pulley (see Section 7). On 1989 and later B2600i models, remove the power steering pump and bracket (see Chapter 10).
5 Remove the air pump (if equipped) and brackets (see Chapter 6). On 1989 and later B2600i models, remove coolant bypass pipe.
6 On A/C equipped models, unbolt the compressor and set it aside without disconnecting the refrigerant hoses. **Warning:** *Do not disconnect any refrigerant lines unless the system pressure has been discharged by an A/C technician.*
7 On 1989 and later B2600i models, remove the alternator and bracket. On all other models, remove the bolt holding the alternator adjusting bracket to the timing chain cover, then move the bracket toward the alternator.
8 Remove all wires, lines and brackets from the timing chain cover.
9 Remove the timing chain cover bolts, noting the locations of the various size bolts **(see illustrations)**. Tap on the cover with a soft-face hammer to separate it from the engine block. If the cover doesn't come loose easily, recheck for any remaining bolts.
10 Thoroughly clean away all traces of gasket material. Take extra care when scraping aluminum parts since they gouge easily.
11 Affix a new gasket with RTV sealer on both sides and position the cover on the engine.
12 Install the bolts and tighten them to the specified torque in three or four steps.
13 Perform the remaining steps in the reverse order of removal.
14 Be sure to add oil and coolant. Run the engine and check for leaks.

10 Timing chain/sprockets – removal, inspection and installation

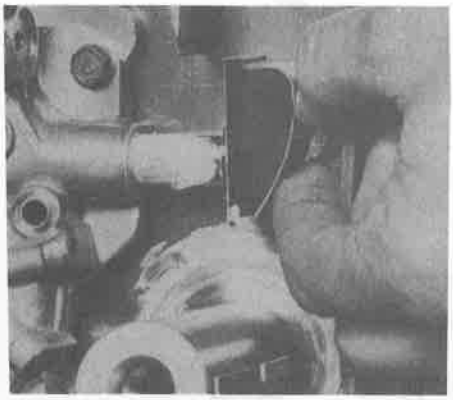
2.6L engine

Refer to illustrations 10.5, 10.6, 10.7, 10.8, 10.9a, 10.9b, 10.9c and 10.10

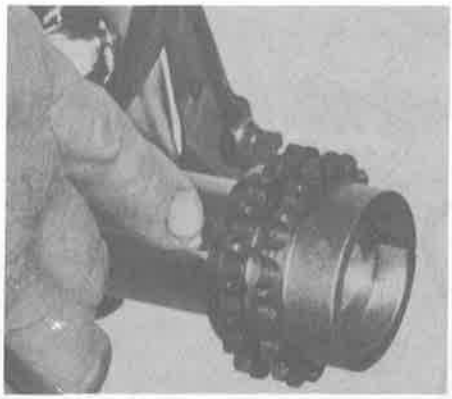
1 The balance shaft chain and sprockets must be removed to gain access to the timing chain assembly (Section 12) and the number one piston must be at TDC (see Section 3).
2 Depress the timing chain tensioner plunger on the oil pump (models through 1988) or unbolt and remove the tensioner (1989 and later models) and slide the camshaft sprocket, the crankshaft sprocket and the timing chain off the engine as an assembly. Do not lose the key that indexes the crankshaft sprocket in the proper place. On 1988 and earlier models, remove the timing chain tensioner plunger and spring from the oil pump.
3 Remove the camshaft sprocket holder (if equipped) and the right and left timing chain guides from the front of the engine block.
4 Inspect the sprocket teeth for wear and damage. Check the chain for cracked plates and pitted or worn rollers. Check the chain tensioner rubber shoe (if equipped) for wear and the tensioner spring for cracks and deterioration. Measure the tensioner spring free length and compare it to the Specifications (if the spring is a separate part). Check the chain guides for wear and damage. Replace any defective parts with new ones.
5 Install the sprocket holder **(see illustration)** and the right and left timing chain guides on the engine block. Tighten the bolts securely. The upper bolt in the left timing chain guide should be installed fingertight only. Then coat the entire length of the chain contact surfaces of the guides with clean, high-quality moly-base grease.



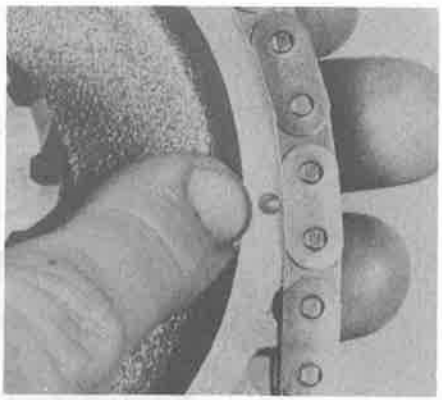
10.5 Installing the camshaft sprocket holder on the engine block (2.6L engine)



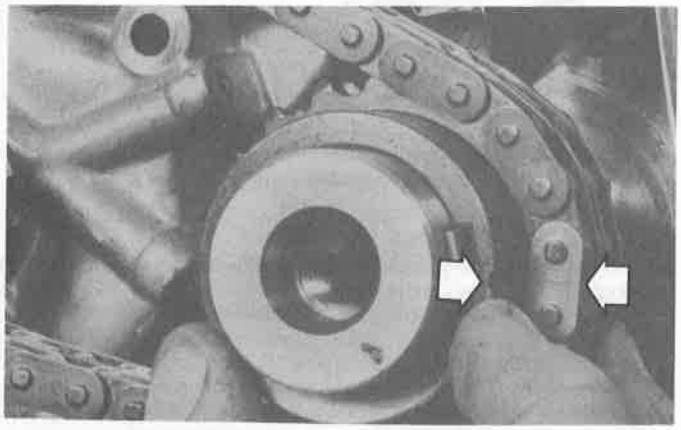
10.6 Lubricate the timing chain tensioner plunger and install it in the oil pump bore (2.6L engine)



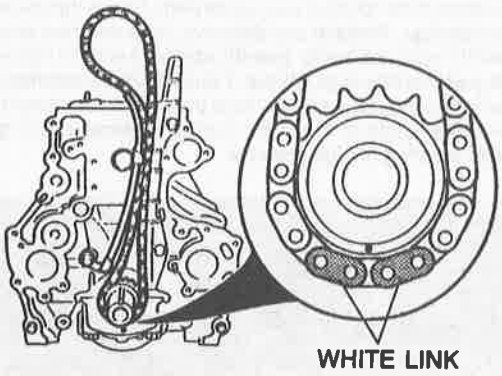
10.7 Install the timing chain sprocket on the end of the crankshaft with the wide shoulder facing out



10.8 Mesh the camshaft sprocket and the timing chain with the mark on the sprocket directly opposite the plated link on the chain (1988 and earlier models shown)



10.9a Installing the timing chain on the crankshaft sprocket (note that the sprocket mark and the plated link are opposite each other) (1988 and earlier models)



10.9b On 1989 and later models, install the timing chain on the crankshaft sprocket with the plated chain links flanking the mark on the crank gear

6 Turn the crankshaft bolt with a large wrench until the number one piston is at top dead center. The piston is at TDC when it's flush with the top of the engine block. On 1988 and earlier models, apply a layer of clean moly-base grease or engine assembly lube to the timing chain tensioner plunger and install the tensioner spring and plunger loosely into the oil pump body **(see illustration).**

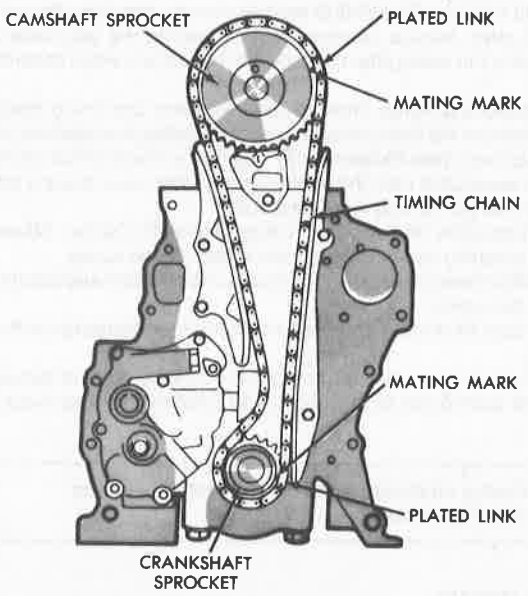
7 Position the timing chain sprocket on the end of the crankshaft with the wide shoulder facing out **(see illustration).** Line up the keyway in the sprocket with the key on the crankshaft.

8 Mesh the camshaft sprocket with the chain, lining up the plated link on the chain with the marked tooth on the sprocket **(see illustration).** On 1988 and later models, the mark on the sprocket is a line.

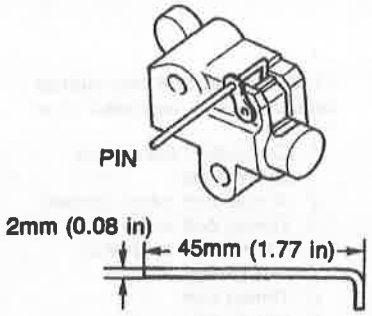
9 Slip the chain over the crankshaft sprocket, lining up the plated links on the chain with the marked tooth on the sprocket **(see illustration).** Slide the crankshaft sprocket all the way onto the crankshaft while, on 1988 and earlier models, depressing the chain tensioner so the chain fits into place between the guides. Rest the camshaft sprocket on the sprocket holder **(see illustration)** and make sure the plated links and mating marks are aligned properly. **Caution:** *Do not rotate the crankshaft for any reason until the cylinder head and camshaft have been properly installed.*

10 On 1989 and later push the timing chain tensioner plunger into the tensioner, lift the lever on the tensioner to lock it in place, then insert a fabricated pin through the hole in the lever to hold the lever in place **(see illustration). Note:** *Leave the pin in this position until the cylinder head is installed and the camshaft sprocket is bolted to the camshaft.*

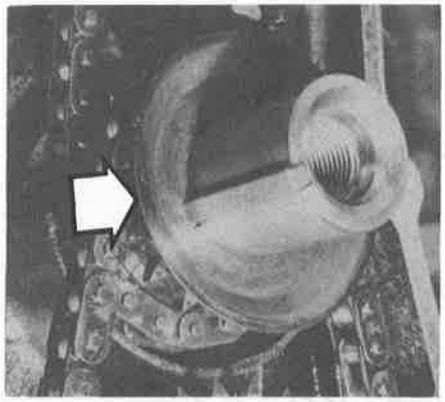
11 On 1989 and later models, after installation of the timing chain cover and the cylinder head (and the camshaft sprocket has been bolted to the camshaft), remove the tensioner access cover from the timing chain cover and remove the retaining pin from the chain tensioner. Reinstall the service cover with a new gasket and tighten the bolts to the torque listed in this Chapter's Specifications.



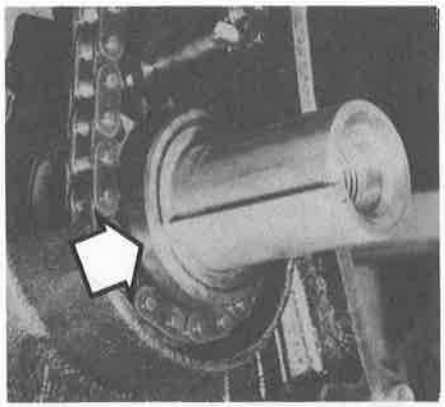
10.9c Correct timing chain and sprocket relationship – 2.6L engines through 1988



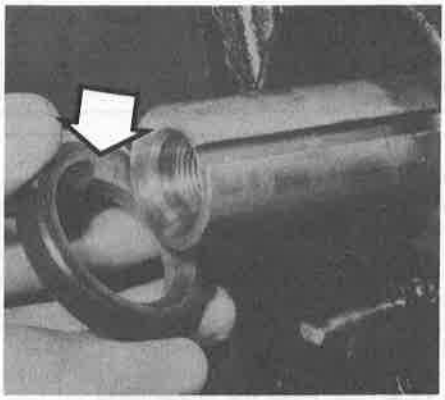
10.10 On 1989 and later models, insert a pin fabricated from a piece of coat hanger or welding rod through the tensioner lock lever to keep the tensioner plunger in the retracted position



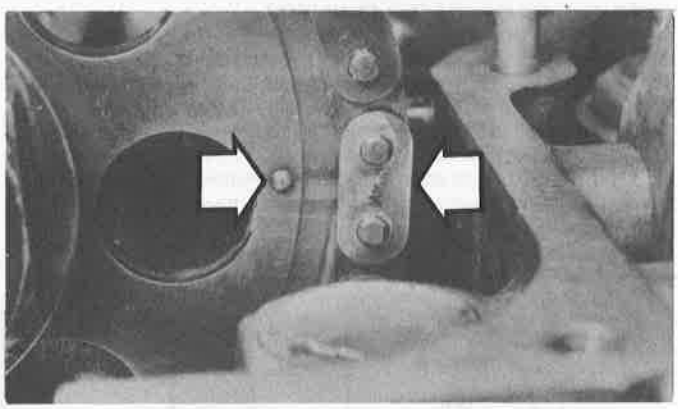
10.13 The oil slinger (arrow) fits over the crankshaft outside of the oil pump drive chain (Mazda engine)



10.15 A spacer (arrow) fits between the oil pump sprocket and timing chain sprocket (Mazda engine)



10.17 Be sure the inner spacer is in place – the chamfered side (arrow) must face in (Mazda engine)



10.21a The single bright link must align with the dot on the camshaft sprocket (arrows) – Mazda engine with timing chain

Pre-1985 models

Refer to illustrations 10.13, 10.15, 10.17, 10.21a and 10.21b

12 Position the number one piston at TDC (see Section 3) and remove the timing chain cover (see Section 9) and loosen the screws which retain the timing chain guide.

13 Remove the oil slinger from the crankshaft **(see illustration)**.

14 Remove the oil pump as described in Section 16, then take off the oil pump drive chain.

15 Remove the oil pump sprocket from the crankshaft. Where applicable, remove the spacer from the crankshaft **(see illustration)**.

16 Pull the chain and sprocket off the crankshaft. If the chain and sprocket must be removed from the camshaft, the camshaft will have to be removed first (see Section 18).

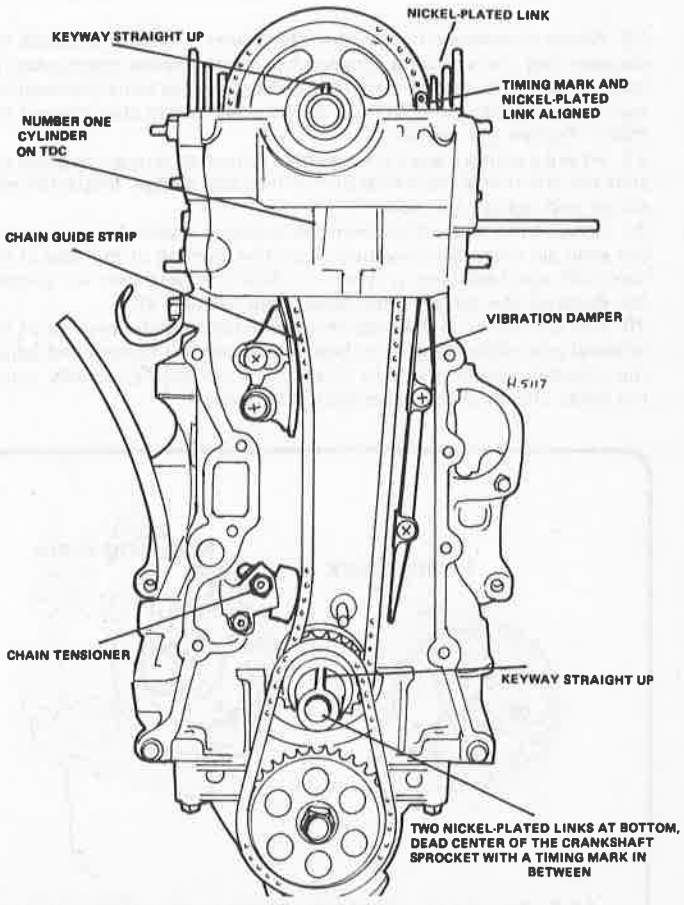
17 Mesh the crankshaft sprocket in the timing chain with the mark on the sprocket between the two bright chain links, then position them both on the crankshaft. Where applicable, install the spacer and key first **(see illustration)**.

18 Slide the spacer on first, then position the oil pump drive chain and sprocket on the crankshaft.

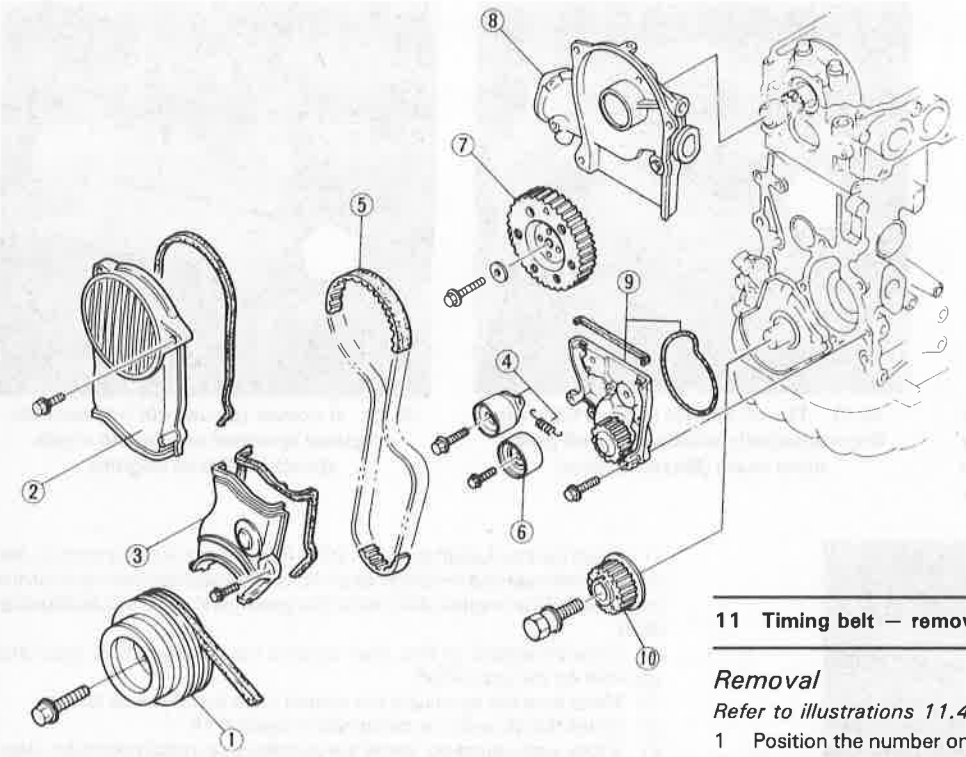
19 Make sure the sprockets are seated, then install the oil slinger.

20 Install the oil pump as described in Section 16.

21 If they were removed, install the camshaft, sprocket and chain. Align the nickel plated links on the chain with the marks on the camshaft and crankshaft sprockets as they are reinstalled **(see illustrations)**.



10.21b Make sure the timing chain and sprockets are installed with the marks aligned as shown here – Mazda engine with timing chain



11.4 Timing belt and related components — exploded view

1 Crankshaft pulley and baffle plate
2 Timing belt cover (upper)
3 Timing belt cover (lower)
4 Timing belt tensioner and spring
5 Timing belt
6 Idler pulley
7 Camshaft sprocket
8 Front housing
9 Oil pump
10 Crankshaft sprocket

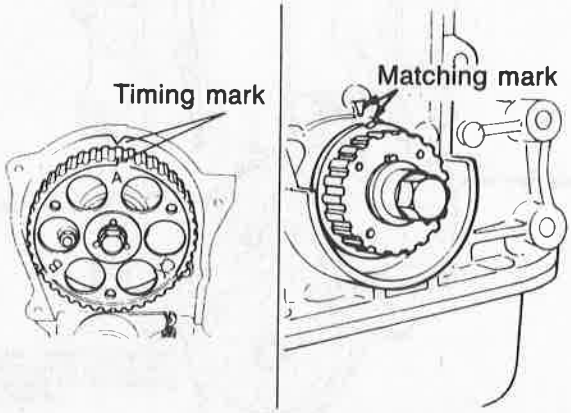
22 Where a hydraulic timing chain tensioner is used, compress the snubber ring and wedge a screwdriver in the release mechanism to hold it in place. Install the tensioner and tighten the bolts (screwdriver still in place), then push the top of the chain guide strip toward the chain. Tighten the screws.
23 Where a spring loaded timing chain tensioner is used, depress the slide pin and turn it clockwise 90° to lock the wedge. Install the tensioner and tighten the bolt.
24 Remove the screwdriver from the tensioner (hydraulic type) or turn the slide pin using a screwdriver from the opening at the side of the camshaft sprocket (spring type), to allow the tensioner to release.
25 Reinstall the timing chain cover (see Section 9).
26 The remainder of the installation procedure is the reverse of the removal procedure. When finished, fill the cooling system and adjust the drivebelt tension (refer to Chapter 1 if necessary). Finally adjust the valve clearances as described in Chapter 1.

11 Timing belt — removal, installation and adjustment

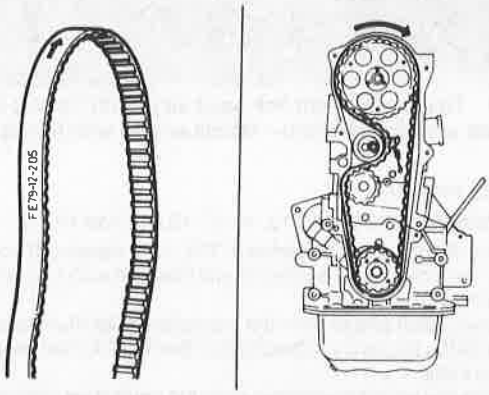
Removal

Refer to illustrations 11.4, 11.7 and 11.8

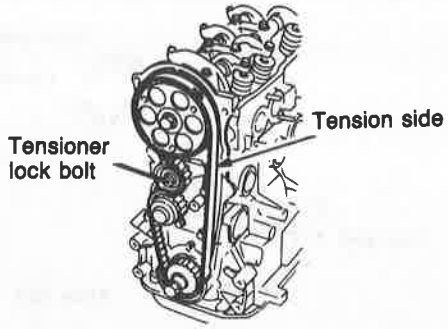
1 Position the number one piston at Top Dead Center (see Section 3).
2 Disconnect the negative cable from the battery.
3 Remove the drivebelts and spark plugs (see Chapter 1).
4 Remove the crankshaft pulley **(see illustration)**. Refer to Section 7 if necessary.
5 If so equipped, remove the three air injection tubes which run in front of the timing belt cover (see Chapter 6).
6 Unbolt and remove the upper and lower timing belt covers **(see illustration 11.4)**. Don't lose the rubber seals.
7 Be sure the camshaft mark (A) lines up with the mark on the front housing and the crankshaft sprocket notch lines up with the pointer on the oil pump housing **(see illustration)**.
8 If you plan on reinstalling the timing belt, paint an arrow on it to indicate the direction of rotation **(see illustration)**.
9 Loosen the timing belt tensioner lock bolt, move the tensioner toward the intake side of the engine and retighten the lock bolt.
10 Slip the belt off the sprockets and remove it from the engine.
11 Inspect the belt for damage, peeling, wear, cracks, hardening, crimping and signs of oil or other fluid contamination. The belt should be replaced if any of these conditions exist or if the specified mileage has elapsed (see Chapter 1).



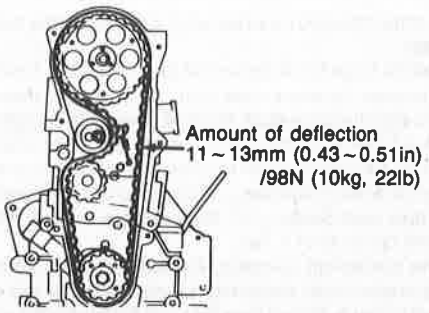
11.7 Be sure the marks are aligned as shown here before and after timing belt installation



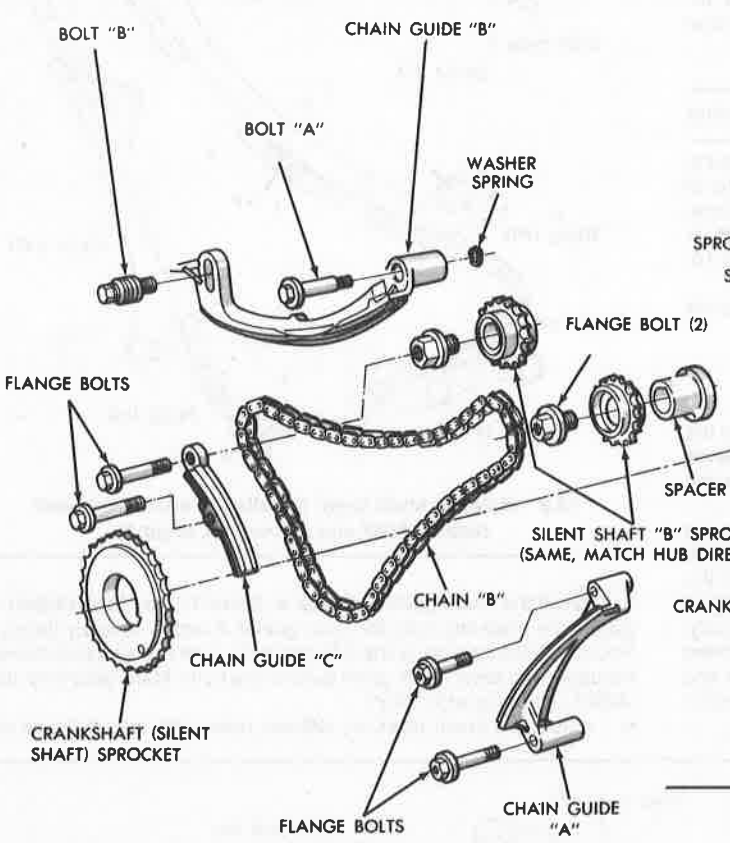
11.8 If you plan to reuse the belt, paint an arrow on it to indicate the direction of rotation

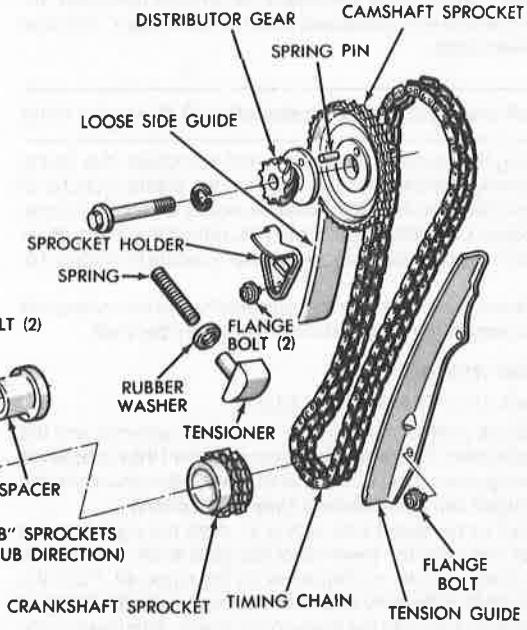


11.14 Slip the belt over the sprockets so that moderate tension is maintained

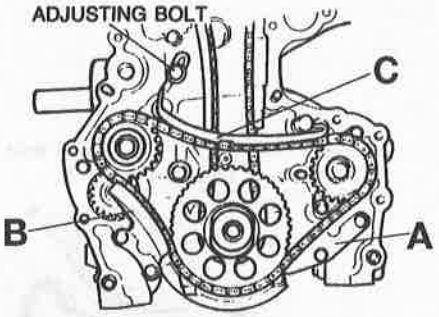


11.17 Check the belt deflection midway between the crankshaft and camshaft sprockets





12.2a Balance shaft, timing chain and related components – exploded view (1988 and earlier 2.6L engine)



12.2b Locations of balance shaft chain guide A, B and C (1989 and later models)

Installation

Refer to illustration 11.14

12 Make sure the crankshaft and camshaft sprocket timing marks are still aligned.

13 If the old belt is being reinstalled, make sure the arrow is pointed in the proper direction.

14 Slip the belt onto the camshaft and crankshaft sprockets from the tension (right) side so the tension is maintained **(see illustration)**.

Adjustment

Refer to illustration 11.17

15 Loosen the tensioner lock bolt so only the spring is applying pressure.

16 Install the crankshaft pulley bolt and use it to turn the crankshaft in the normal direction of rotation (clockwise) through two complete revolutions (720-degrees) so equal tension is applied to both sides of the timing belt. Tighten the lock bolt to the specified torque.

17 Recheck the timing mark alignment and check the deflection of the belt midway between the crankshaft and camshaft sprockets on the tension side **(see illustration)**. Compare it to the Specifications. If the deflection is incorrect, repeat the adjustment operation.

18 Reinstall the remaining parts in the reverse order of removal.

12 Balance shaft chain/sprockets – removal and inspection (2.6L engine only)

Refer to illustrations 12.2a and 12.2b

1 Remove the timing chain cover (Section 9).

2 Remove the chain guides labeled A, B and C **(see illustrations)**. Each guide is held in place by two bolts. Draw a simple diagram showing

the location of each bolt so it can be returned to the same hole from which it was removed.

3 Reinstall the large bolt in the end of the crankshaft. Hold it in place with a wrench to prevent the crankshaft from turning while loosening the bolt on the end of the right balance shaft, the bolt attaching the right balance shaft drive sprocket to the oil pump shaft and the bolt in the end of the left balance shaft. On 1988 and earlier models, if the bolt in the end of the right balance shaft is difficult to loosen, remove the oil pump and balance shaft as an assembly (see Section 17), then remove the bolt with the balance shaft securely clamped in a vise.

4 Slide the crankshaft sprocket, the balance shaft sprockets and the chain off the engine as an assembly. Leave the bolt in the end of the right balance shaft in place. Do not lose the keys that index the sprockets to the shafts.

5 Check the sprocket teeth for wear and damage. Check the sprocket cushion rings and ring guides (balance shaft sprockets only) for wear and damage. Rotate the cushion rings and check for smooth operation. Inspect the chain for cracked side plates and pitted or worn rollers. Replace any defective or worn parts.

13 Balance shaft chain/sprockets – installation (2.6L engine only)

1 Before installing the balance shaft chain and sprockets, the timing chain must be properly installed and the number one piston must be at TDC on the compression stroke. Both balance shafts and the oil pump should also be in place. On 1989 and later models, retract the timing chain tensioner and hold it in this position, following the procedure in Section 10, Step 10.

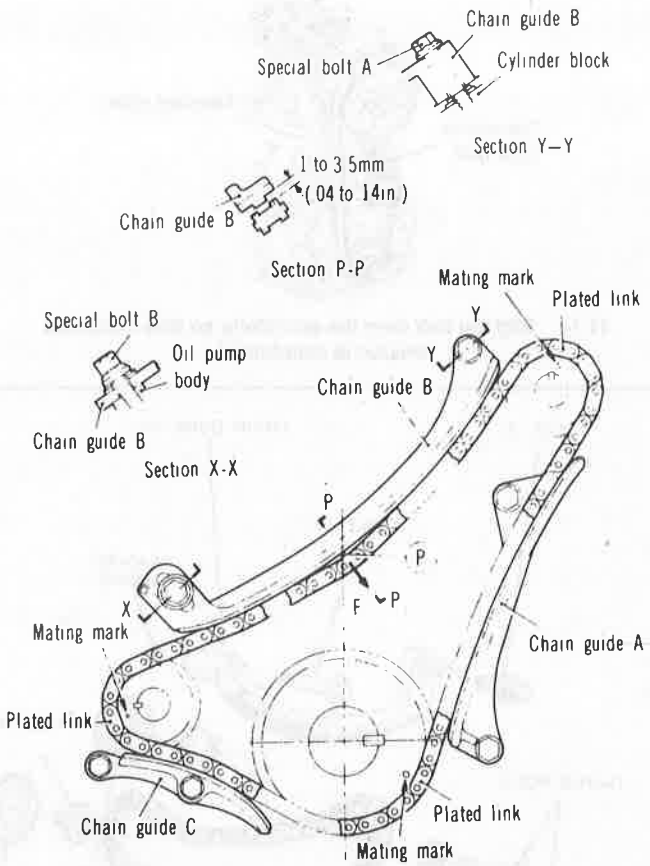
2 Slide the crankshaft sprocket part way onto the front of the crankshaft by lining up the keyway in the sprocket with the key on the shaft.

1988 and earlier models

Refer to illustrations 13.3, 13.5, 13.6 and 13.8

3 Install the balance shaft chain onto the crankshaft sprocket and the left balance shaft sprocket. The dished or recessed side of the left balance shaft sprocket must face out. Line up the plated links on the chain with the mating marks stamped into the sprockets **(see illustration)**.

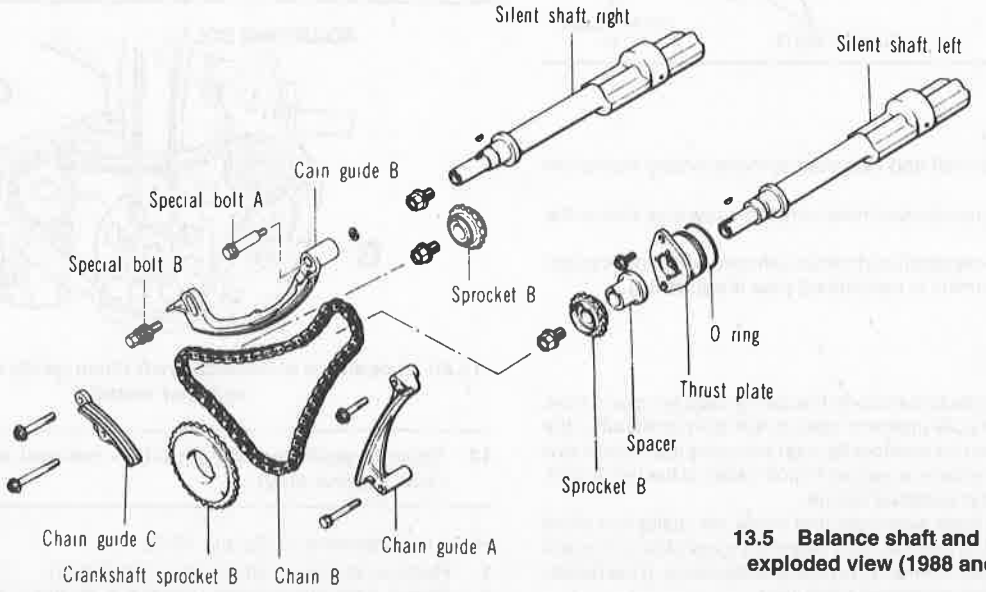
4 With the dished or recessed side facing in, slide the right balance shaft sprocket part way onto the lower oil pump gear shaft. Line up the plated link on the chain with the mating mark on the sprocket. Push the balance shaft sprockets all the way onto their respective shafts, lining up the keyways in the sprockets with the keys on the shafts. Simultaneously, push the crankshaft sprocket back until it bottoms on the crankshaft timing chain sprocket. Recheck the position of the mating marks on the chain and sprockets, then install the balance shaft sprocket bolts and tighten them to the specified torque.



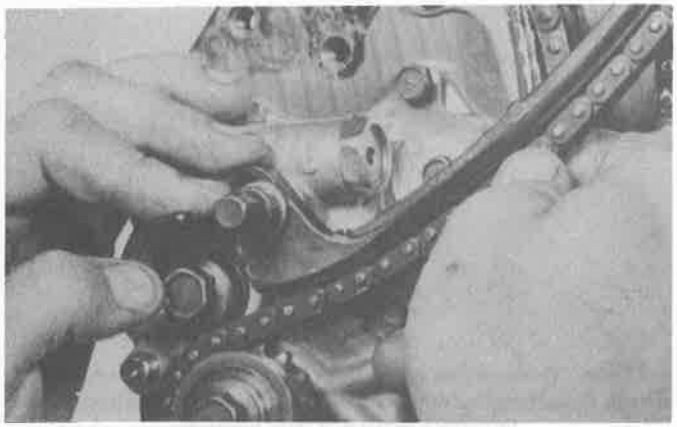
13.3 Balance shaft chain installation and adjustment details (1988 and earlier 2.6L engine)

5 Install the chain guides labeled A, B and C **(see illustration)** and tighten the mounting bolts for chain guides A and C securely (leave the mounting bolts for chain guide B finger-tight). Note the difference between the upper and lower chain guide B mounting bolts. Make sure they are installed in the proper location.

6 Adjust the chain slack as follows: rotate the right balance shaft

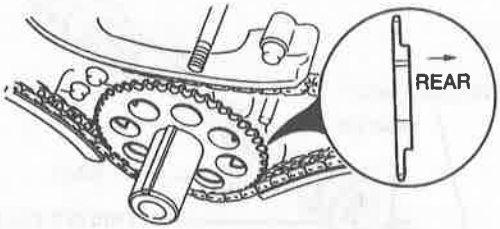


13.5 Balance shaft and related components – exploded view (1988 and earlier 2.6L engine)

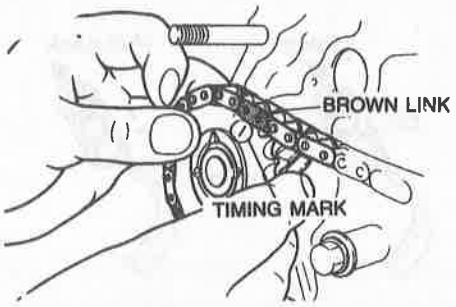


13.6 Adjusting the balance shaft chain slack (1988 and earlier 2.6L engine)

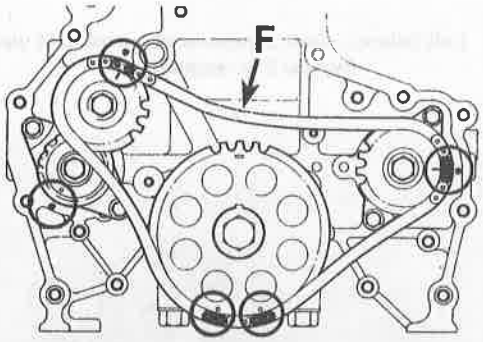
13.8 Drive the old oil seal out of the timing chain cover with a hammer and punch



13.12a Assembly direction of the balance shaft gear on the crankshaft (1989 and later models)



13.12b Line up the brown link of the balance shaft chain with the mark on the idler gear (1989 and later models)



13.12c Make sure all five marks are in alignment when the balance shaft chain is installed (F indicates the point where excess chain slack is taken up during adjustment) (1989 and later models)

clockwise and the left balance shaft counterclockwise so the chain slack is collected at point P. Pull the chain with your finger tips in the direction of arrow F, then move the lower end of the chain guide B up or down, as required **(see illustration)**, until the clearance between the chain and the guide (chain slack) is as specified. Tighten the chain guide B mounting bolts securely, then recheck the slack to make sure it has not changed. If the chain is not tensioned properly, engine noise and damage will result.

7 Apply a coat of clean moly-base grease to the chain and chain guides.

8 Using a hammer and punch, drive the oil seal out of the timing chain case **(see illustration)**.

9 Lay a new seal in place – make sure the spring faces in – and tap around it with a block of wood and a hammer until it's properly seated.

10 Reinstall the timing chain cover and related components (see Section 9).

11 Apply a thin layer of clean moly-base grease to the seal contact surface of the crankshaft pulley, then slide it onto the crankshaft. Install the bolt and tighten it finger-tight only. **Note:** *The bolt should be tightened to the specified torque only after the cylinder head and camshaft have been installed.*

1989 and later models

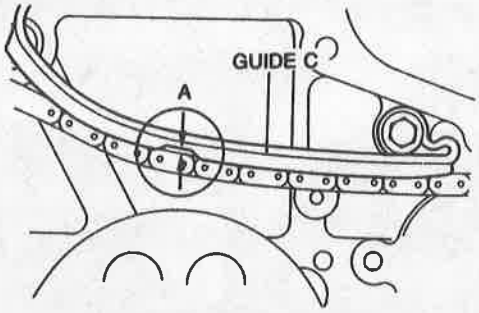
Refer to illustrations 13.12a, 13.12b 13.12c, 13.15a, 13.15b and 13.15c

12 Install the balance shaft sprocket part way onto the crankshaft. The raised side of the gear faces to the rear, towards the engine block **(see illustration)**. Install the sprockets part way onto the idler shaft and the left side balance shaft. Install the balance shaft chain onto the sprocket. Line up the brown link on the chain with the mark on the idler sprocket (which drives the right side balance shaft). Install the chain over the other balance shaft sprocket and make sure all of the marks are in alignment **(see illustrations)**.

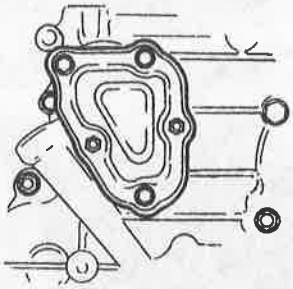
13 Push the sprockets all the way onto their respective shafts. Re-check the position of the mating marks, then install the balance shaft sprocket bolts and tighten them to the torque listed in this Chapter's Specifications.

14 Apply a coat of moly-based grease to the chain and chain guides. Install the chain guides labeled A, B and C **(see illustration 12.2b)** and tighten the mounting bolts for chain guides A and B securely (leave the mounting bolts for chain guide C finger-tight). Note the difference between the upper and lower chain guide C mounting bolts. Make sure they are installed in the proper location.

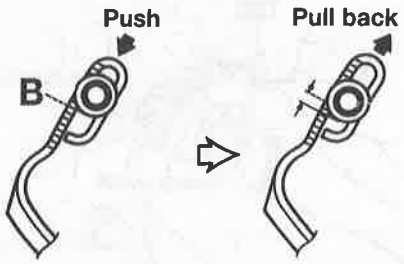
15 Adjust the chain slack as follows: rotate the right (passenger side) balance shaft clockwise and the left (driver's side) balance shaft counterclockwise so the chain slack is collected at point F **(see illustration 13.12)**. Pull the chain with your finger tips in the direction of arrow F, then move the lower end of chain guide C up or down, as required, until the clearance between the chain and the guide (chain slack) **(see illustration)** is as listed in this Chapter's Specifications. Tighten the mounting bolts for chain guide C securely, then re-check the slack to make sure it hasn't changed. If the chain is not tensioned properly, engine noise will result. **Note:** *To adjust the chain without removing the timing chain cover, remove the access cover mounted on the front of the timing chain cover* **(see illustration)**. Loosen bolt "B" **(see illustration)** and using your finger push chain guide "C" down until it bottoms out. Don't use a screwdriver or other implement. Now pull the chain guide up 1/8-inch (3 mm) and tighten bolt "B". Reinstall the access cover.



13.15a Adjust chain guide C until the clearance between the chain and the guide is correct (1989 and later models)



13.15b Remove this cover from the timing chain cover for access to the balance shaft chain tensioner and the timing chain tensioner (1989 and later models)



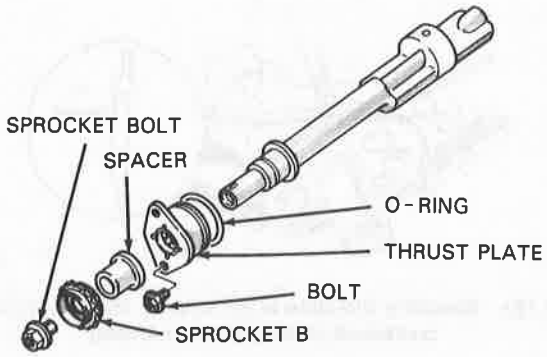
13.15c Loosen bolt B, push down on the chain guide, then pull it up 1/4-inch and tighten the bolt (1989 and later models)

16 Install a new crankshaft front oil seal in the timing chain cover (see Section 11).
17 Using a new gasket and RTV sealant, install the timing chain cover onto the engine. Tighten the bolts to the torque listed in this Chapter's Specifications. If the gasket protrudes beyond the top or bottom of the case and engine block, trim off the excess with a razor blade.
18 Apply a thin layer of multi-purpose grease to the seal contact surface of the crankshaft pulley, then slide it onto the crankshaft. Install the bolt and tighten it finger-tight only. **Note:** *The bolt should be tightened to the specified torque only after the cylinder head and camshaft have been installed.*
19 The remainder of installation is the reverse of removal. Once the camshaft sprocket has been bolted to the camshaft, remove the pin from the timing chain tensioner, push the chain guide in (towards the driver's side), then install the access cover. Be sure to use a new gasket.

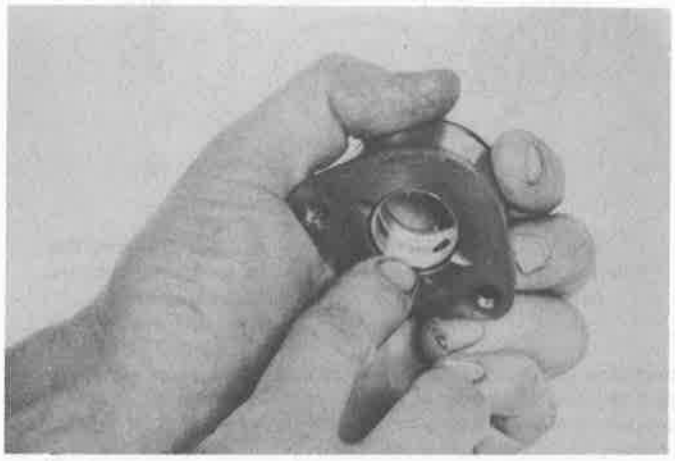
14 Balance shafts – removal, inspection and installation (2.6L engine only)

Refer to illustrations 14.5, 14.7, 14.8 and 14.11

1 The balance shaft chain and sprockets, the timing chain and sprockets and the oil pump should be removed before the balance shafts.
2 Remove the left balance shaft chamber cover plate from the engine block. It is held in place with two bolts. You may have to tap the cover with a soft-faced hammer to break the gasket seal.
3 Remove the two bolts attaching the left balance shaft thrust plate to the engine block, then carefully pull out the thrust plate and the balance shaft as an assembly. Support the rear of the shaft (by reaching through the access hole) to prevent damage to the rear bearing as the shaft is withdrawn from the engine. If the thrust plate proves to be difficult to pull out, screw an appropriate size bolt into each of the threaded holes in the thrust plate flange until they bottom on the engine block. Continue turning them with a wrench, one turn at a time, alternating between the two, until the thrust plate is backed out of the engine block. Remove the bolts from the thrust plate flange.

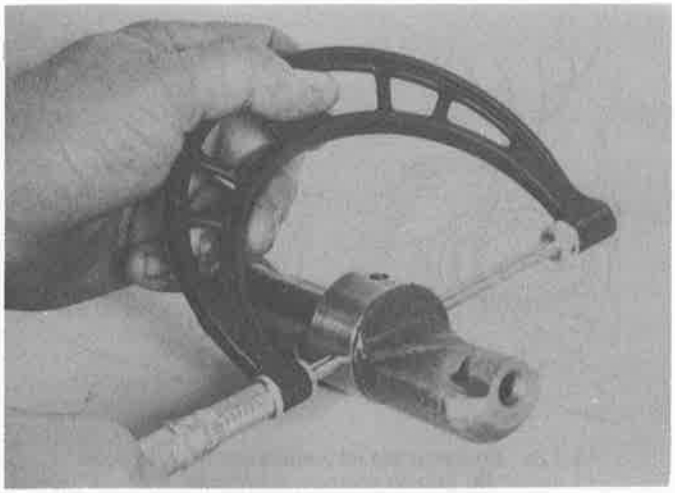


14.5 Left balance shaft components – exploded view (typical 2.6L engine)



14.7 Checking the bearing in the thrust plate for wear and damage

4 On 1988 and earlier models, the right balance shaft is removed with the oil pump (see Section 17).
5 To disassemble the left balance shaft, slip off the spacer and the thrust plate/bearing assembly. Do not lose the key in the end of the shaft. Remove the O-ring from the thrust plate – if equipped **(see illustration)**.
6 Clean the components with solvent and dry them thoroughly. Make sure that the oil holes in the shafts and thrust plate are clean and clear.
7 Check both balance shafts and the thrust plate for cracks and other damage. Check the bearings in the engine block and the thrust plate **(see**



14.8 Measuring the balance shaft bearing journal outside diameter with a micrometer

illustration) for scratches, scoring and excessive wear. Check the bearing journals on the balance shafts for excessive wear and scoring.

8 Measure the outside diameter of each bearing journal **(see illustration)** and the inside diameter of each bearing. Subtract the journal diameter from the bearing diameter to obtain the bearing oil clearance. Compare the measured clearance to the Specifications. If it is excessive, have an automotive machine shop or dealer service department replace the bearings with new ones. If new bearings do not restore the oil clearance, or if the bearing journals on the shafts are damaged or worn, replace the shafts too. If the bearing in the left balance shaft thrust plate is bad, replace the bearing and thrust plate as an assembly.

9 Apply a thin layer of clean moly-based grease (or engine assembly lube) to the bearing journals on the left balance shaft, then carefully insert it into the engine block. Support the rear of the shaft so the rear bearing is not scratched or gouged as the shaft is inserted into its chamber.

10 On 1988 and earlier models, install a new O-ring on the outside of the thrust plate and lubricate it with clean multi-purpose grease. Also, apply a layer of grease to the thrust plate balance shaft bearing.

11 On 1988 and earlier models, cut the heads off two 6 x 50 mm bolts and install the bolts in the thrust plate mounting bolt holes. Using the bolts as a guide, carefully slide the thrust plate into position in the engine block **(see illustration)**. The guides are necessary to keep the bolt holes in the thrust plate aligned with the holes in the engine block. If the thrust plate is turned to align the holes, the O-ring could be twisted or damaged.

12 On 1988 and earlier models, remove the guide bolts, install the mounting bolts and tighten them securely.

13 Slip the spacer onto the end of the balance shaft (make sure that the key is in place).

14 Turn the shaft by hand and check for smooth operation.

15 Using a new rubber gasket and RTV-type gasket sealant, as well as new O-rings on the bolts, install the left balance shaft chamber cover plate and tighten the bolts securely.

16 On 1988 and earlier models, the right balance shaft is installed with the oil pump (see Section 17).

15 Oil pump – removal, inspection and installation (engines with timing belt)

Removal

Refer to illustration 15.4

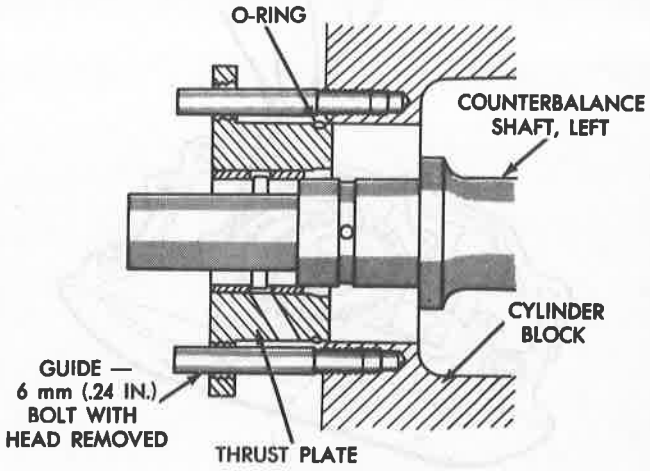
1 Remove the timing belt covers, timing belt and crankshaft sprocket (see Section 11).

2 Remove the oil pan (see Section 20).

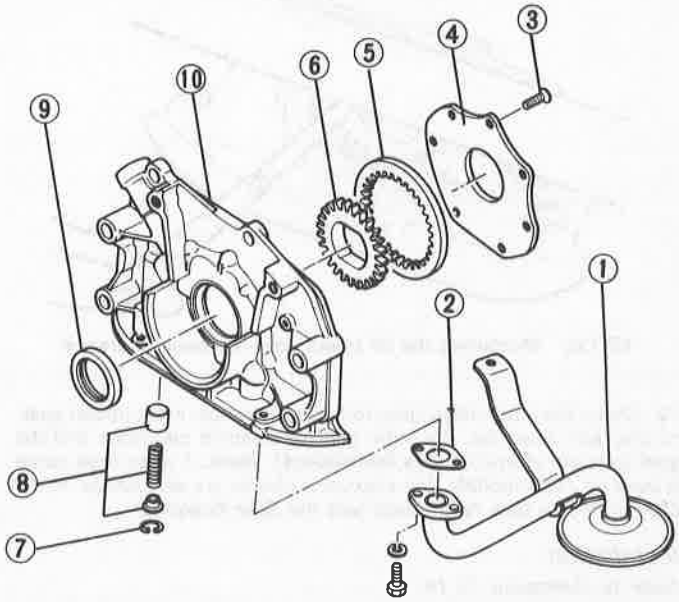
3 Remove the oil pump mounting bolts.

4 Unbolt and remove the oil strainer **(see illustration)**.

5 Insert a screwdriver at the corner of the pump body to break the gasket seal and remove the pump.



14.11 Install the left balance shaft thrust plate using bolts (with the heads removed) as guides (1988 and earlier 2.6L engine)



15.4 Oil pump components – exploded view (Mazda engine with timing belt) (gear type pump shown – rotor type similar)

1	*Oil strainer*	7	*Snap-ring*
2	*Gasket*	8	*Oil pressure relief valve plunger assembly*
3	*Screw*	9	*Crankshaft front oil seal*
4	*Pump cover*	10	*Pump body*
5	*Outer gear*		
6	*Inner gear*		

6 Clean the oil pump body mating surfaces to remove old gasket material.

Inspection

Refer to illustrations 15.12a, 15.12b and 15.12c

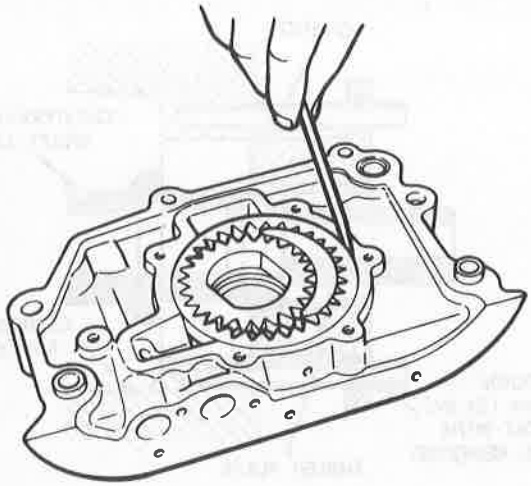
7 Remove the retaining screws and cover from the rear of the pump **(see illustration 15.4)**.

8 Remove the gears from the pump body. It may be necessary to turn the body over to remove the gears by allowing them to fall out.

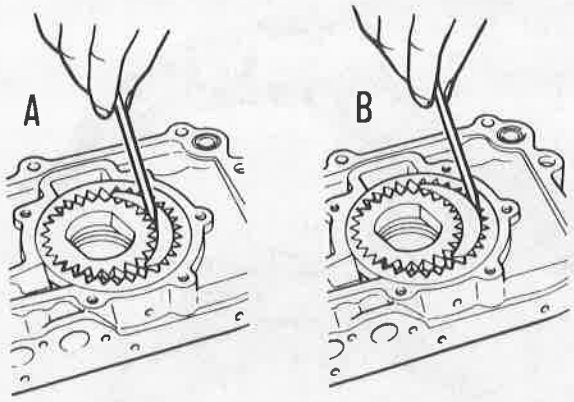
9 Mount the pump body in a vise and remove the oil pressure sending unit, the snap-ring and the relief valve plunger assembly.

10 Wash the oil pump parts in solvent.

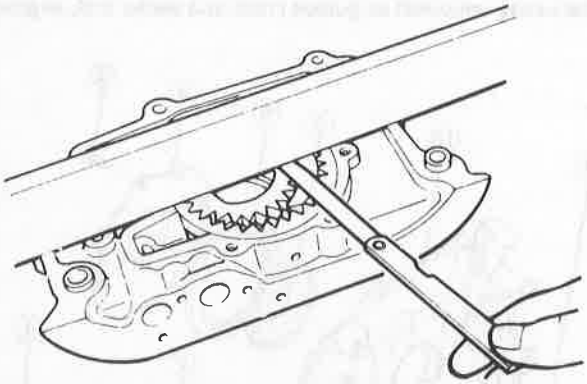
11 Inspect the components for wear, cracks and other damage.



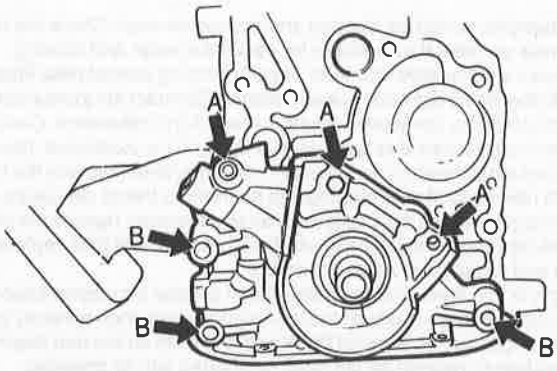
15.12a Checking the oil pump outer gear-to-body clearance



15.12b Checking the oil pump inner (A) and outer (B) gear-to-crescent clearances



15.12c Measuring the oil pump gear-to-cover clearance



15.14 On 1988 and later models, the oil pump mounting bolts labelled A must be tightened to 14 to 19 ft-lbs – bolts labelled B must be tightened to 27 to 38 ft-lbs (on 1986 and 1987 models, tighten all bolts to 14 to 19 ft-lbs)

12 Check the outer (idler) gear-to-body clearance, inner (drive) gear-to-crescent clearance, the outer gear-to-crescent clearance and the gear-to-cover clearance **(see illustrations). Note:** *A rotor type pump is used on 1988 models. The clearance checks are very similar to the checks for the gear type pump (see the Specifications).*

Installation

Refer to illustration 15.14

13 Coat the O-ring with petroleum jelly and insert it into the pump. Coat the pump housing with sealant. Apply clean engine oil to the lip of the oil seal.

14 Place the pump and new gasket in position and install the bolts. Tighten the bolts to the specified torque. Note that the bolts are different on 1988 models and require different torque specifications **(see illustration).**

15 Using a new O-ring, install the strainer. Tighten the bolts to the specified torque.

16 Install the oil pan.

17 Install a new oil filter and reconnect the oil pressure switch harness.

18 Install the crankshaft sprocket, timing belt and covers.

16 Oil pump — removal, inspection and installation (pre-1985 models)

Removal

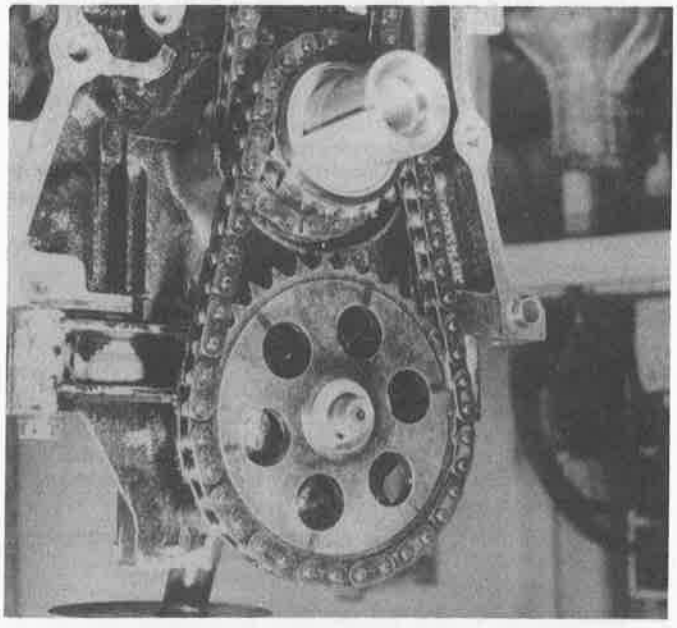
Refer to illustrations 16.4 and 16.5

1 Remove the oil pan (see Section 20).

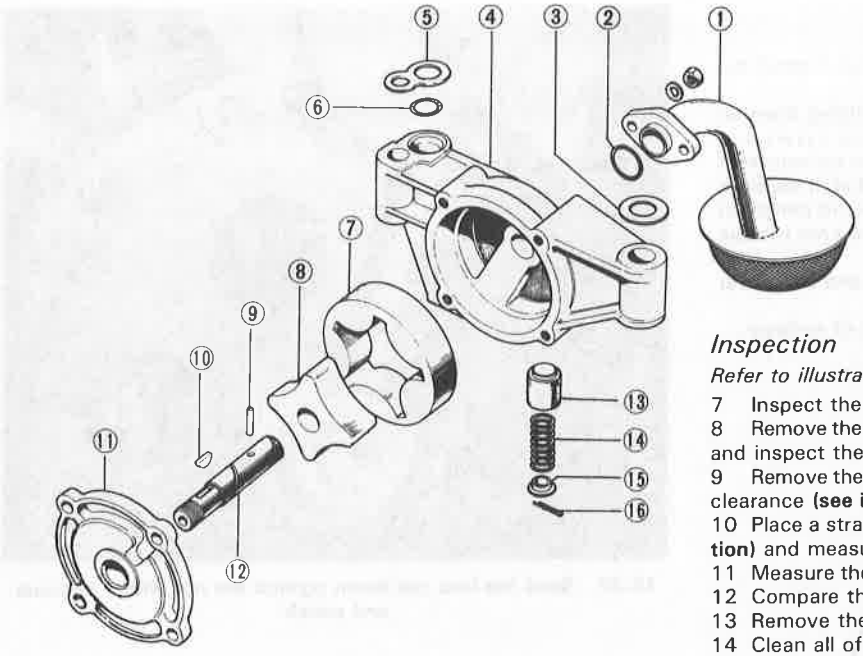
2 Remove the timing chain cover (see Section 9).

3 Flatten the locking tab and remove the oil pump sprocket nut.

4 Pull the chain and sprockets off as an assembly **(see illustration).**



16.4 Once the nut has been removed grasp the sides of the pump sprocket and pull it off the shaft (Mazda engine)



16.5 Oil pump components – exploded view (pre-1985 models)

1 Oil strainer	*9 Pin*
2 O-ring	*10 Key*
3 Adjusting shim	*11 Cover*
4 Body	*12 Shaft*
5 Adjusting shim	*13 Plunger*
6 O-ring	*14 Spring*
7 Outer rotor	*15 Spring seat*
8 Inner rotor	*16 Cotter pin*

5 Remove the nuts and detach the oil strainer **(see illustration)**. Discard the O-ring.

6 Unbolt the oil pump from the engine. Carefully separate the pump and save the adjusting shims, which are located between the pump and block.

Inspection

Refer to illustrations 16.9, 16.10, 16.11 and 16.16

7 Inspect the chain and sprockets for wear and damage.

8 Remove the cotter pin and oil pressure relief valve plunger assembly and inspect the parts for wear and damage.

9 Remove the pump cover bolts and measure the outer rotor-to-body clearance **(see illustration)**.

10 Place a straightedge across the pump body opening **(see illustration)** and measure the rotor end play.

11 Measure the clearance between the rotor lobes **(see illustration)**.

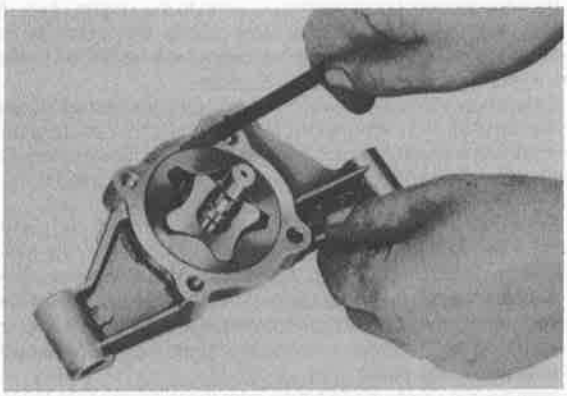
12 Compare the results to the Specifications.

13 Remove the inner rotor, the shaft and the outer rotor.

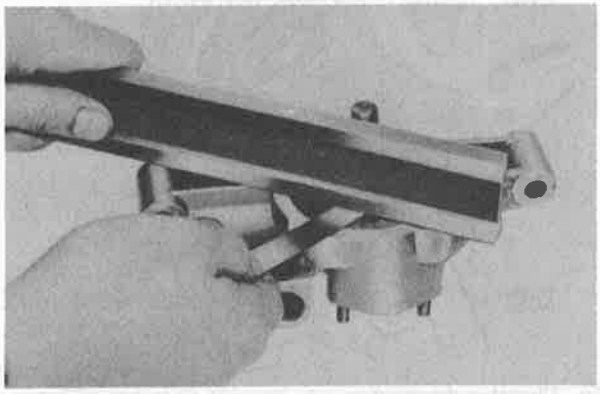
14 Clean all of the parts in solvent. Be sure the small openings are unobstructed. Check the body for wear and score marks.

15 Following the inspection, replace any components that are worn or damaged. If the pump is worn, replace it.

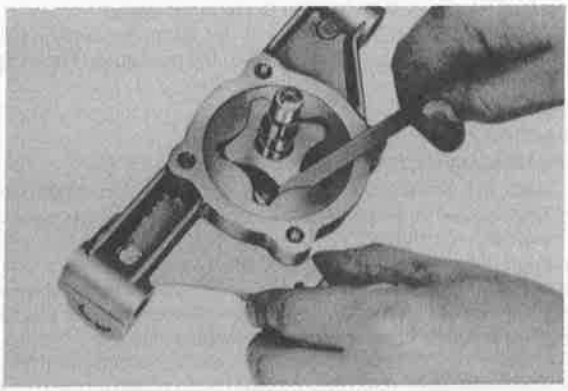
16 Be sure to lubricate all moving parts with engine oil. If the pump is being reused, reassemble it in the reverse order of dissassembly. Use new O-rings between the pump and strainer and between the pump and block **(see illustration)**.



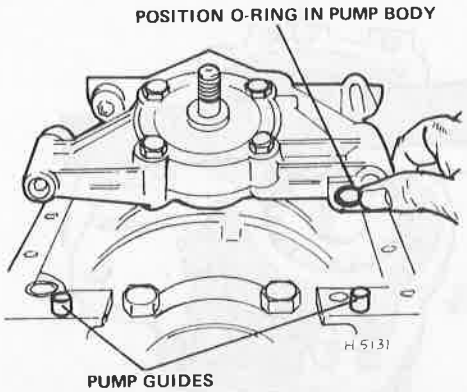
16.9 Checking the outer rotor-to-body clearance



16.10 Checking rotor end play



16.11 Checking clearance between rotor lobes



16.16 Position the O-ring in the pump body when installing the oil pump

Installation

Refer to illustration 16.20

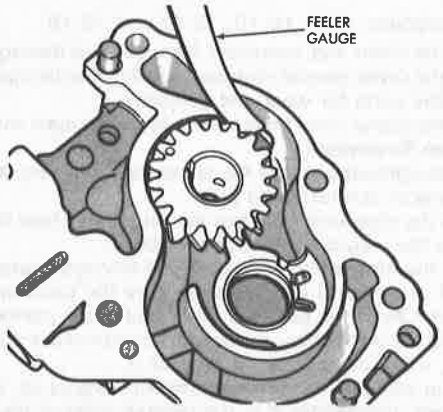
17 Mount the pump, using the same shims you took out. Tighten the bolts securely.

18 Install the oil pump drive chain and sprockets, slipping them on together as an assembly. Be sure to align the keys and keyways.

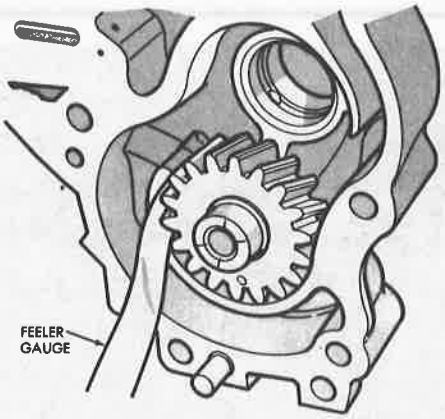
19 Measure the chain slack (deflection) midway between the sprockets before installing the lock tab and nut on the pump sprocket. If the slack is excessive, add adjusting shims (which are 0.006-inch/0.15 mm thick) between the pump and engine **(see illustration 16.5)**. Do not remove all slack.

20 Tighten the sprocket nut to the specified torque and bend over the lock tab **(see illustration)**.

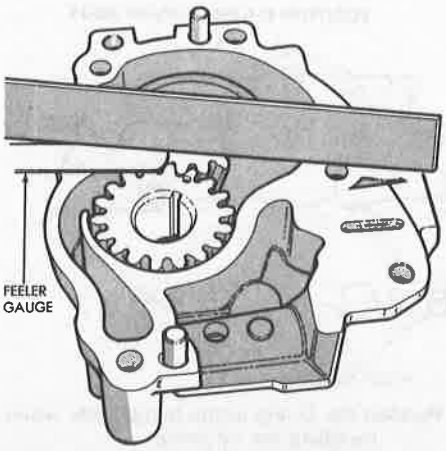
21 Reinstall the remaining parts in the reverse order of removal.



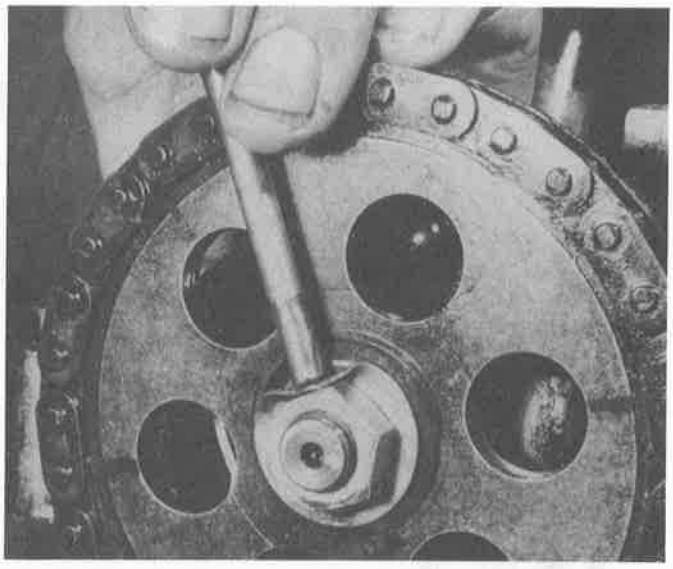
17.11a Checking the driven gear-to-housing clearance with a feeler gauge



17.11b Checking the drive gear-to-housing clearance with a feeler gauge



17.11c Checking gear end play with a feeler gauge and straightedge



16.20 Bend the lock tab down against the nut with a hammer and punch

17 Oil pump – removal, inspection and installation (2.6L engine)

1988 and earlier models

Removal

1 The oil pump and right balance shaft are removed from the engine as an assembly.

2 Remove the timing chain (see Section 10).

3 Remove the bolt attaching the oil pump to the engine block. Some of the balance shaft chain guide mounting bolts also serve as oil pump mounting bolts; they have already been removed. Leave the Phillips head screw in the front side of the pump in place.

4 Carefully pull straight ahead on the oil pump and remove it, along with the balance shaft, from the engine block. You may have to tap gently on the oil pump body with a soft-face hammer to break the gasket seal. **Caution:** *Prying between the oil pump and engine block could result in damage to the engine.*

5 Remove the bolt from the nose of the balance shaft and pull the shaft out of the oil pump from the rear (do not lose the key in the nose of the shaft). Refer to Section 12 for balance shaft inspection procedures.

6 Remove the plug from the upper side of the pump body and withdraw the relief spring and plunger. You may have to mount the pump body in a vise equipped with soft jaws to loosen the plug. If so, do not apply excessive pressure to the pump body.

7 Remove the Philips head screw from the left side of the pump. Separate the oil pump cover from the body and lift out the two pump gears. Do not lose the key in the lower gear shaft. **Caution:** *Prying between the cover and body may result in damage to the pump body.*

8 Clean the parts with solvent and dry them thoroughly. Use compressed air to blow out all of the oil holes and passages. **Warning:** *Wear eye protection.*

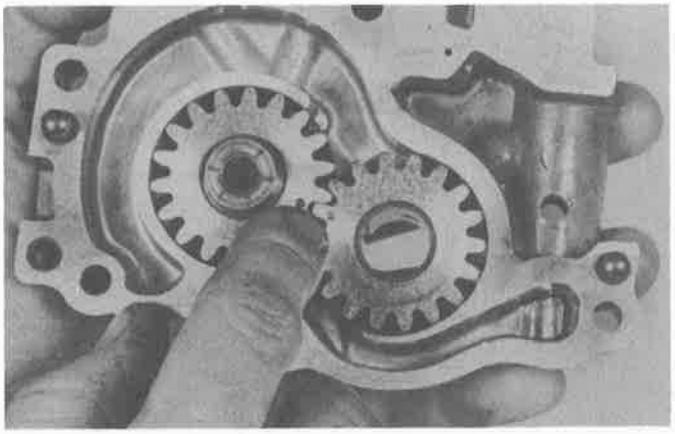
Inspection

Refer to illustrations 17.11a, 17.11b, 17.11c and 17.15

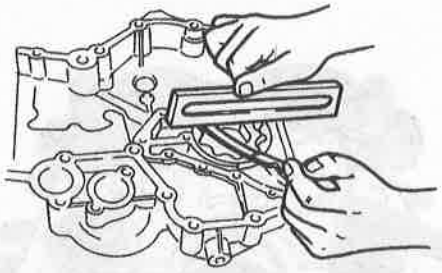
9 Check the entire pump body and cover for cracks and excessive wear. Look closely for a ridge where the gears contact the body and cover.

10 Insert the relief plunger into the pump body and check to see if it slides smoothly. Look for cracks in the relief spring and measure its free length. Inspect the timing chain tensioner plunger sleeve for noticeable wear and the rubber pad for cracks and excessive wear. Measure the tensioner spring free length and compare it to the Specifications.

11 Measure the inside diameter of the bearing surfaces and the outside diameter of each gear shaft. Subtract the two to obtain the gear-to-bearing clearance. Measure the gear-to-housing clearance with a feeler gauge and the gear end play with a feeler gauge and straightedge **(see illustrations)**. Compare the measured clearances to the Specifications.



17.15 Be sure to align the marks on the oil pump gears before installing the cover



17.28a Using a feeler gauge and straightedge to check the side clearance (1989 and later models)

12 If the oil pump clearances are excessive, or if excessive wear is evident, replace the oil pump as a unit.

Installation

Refer to illustration 17.15

13 The oil pump and right balance shaft are installed as a unit.

14 Coat the oil pump relief plunger with clean moly-based grease and insert the plunger and spring into the oil pump body. Install the cap and tighten it securely.

15 Apply a layer of moly-based grease to the gear teeth, the sides of the gears and the bearing surfaces in the pump body and cover. Lay the gears in place in the body with the mating marks aligned **(see illustration)**. If the mating marks are not properly aligned, the right balance shaft will be out of phase and engine vibration will result.

16 Lay the cover in place using the dowel pins to align it properly. Install the Phillips head screw in the left side of the pump, but do not tighten it completely at this time. Make sure the gears rotate smoothly without binding.

17 Lay a new gasket in place on the cover. It's not necessary to use sealant. The dowel pins will align the gasket properly and hold it in place.

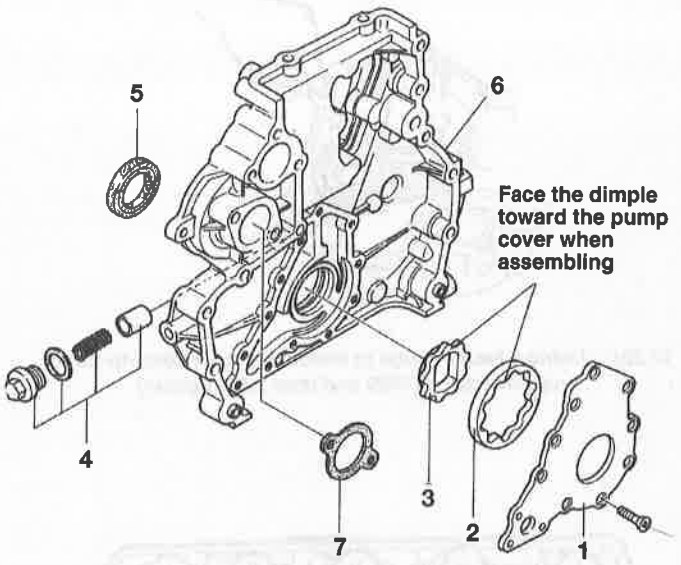
18 Make sure the key is in place in the nose of the shaft, then slip the right balance shaft through the oil pump driven gear as you line up the key in the shaft with the keyway in the gear. Once the shaft and gear are properly mated, clamp the counterweight end of the shaft in a vise equipped with soft jaws, install the bolt in the front end of the shaft and tighten it to the specified torque.

19 Apply a thin layer of clean moly-based grease (or engine assembly lube) to the rear bearing journal of the right balance shaft.

20 Hold the pump upright and fill it with a minimum of 10cc of engine oil. Insert the balance shaft into the engine block and through the rear bearing. Be careful not to scratch or gouge the bearing as the shaft is installed.

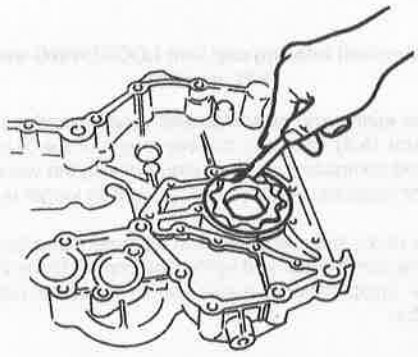
21 Make sure the pump is seated against the engine block, then install the mounting bolts and tighten them evenly and securely. Do not forget to tighten the Phillips head screw. The remaining pump mounting bolts will be installed with the chain guides.

22 Temporarily slip the balance shaft drive sprocket onto the lower pump gear shaft and use it to rotate the pump gears/balance shaft. Check for any obvious binding.



17.27 Exploded view of a typical 1989 and later 2.6L oil pump assembly

1 *Cover*
2 *Outer rotor*
3 *Inner rotor*
4 *Relief valve and spring assembly*
5 *Oil seal*
6 *Timing chain cover*
7 *Gasket*



17.28b Using a feeler gauge to check the tooth-tip clearance between the inner and outer rotors (1989 and later 2.6L models)

1989 and later models

Removal

Refer to illustration 17.27

23 Remove rocker arm cover (see Section 4) and unscrew the two bolts attaching the cylinder head to the timing chain cover.

24 Remove the oil pan (see Section 20).

25 Remove oil pickup tube and screen from pump housing.

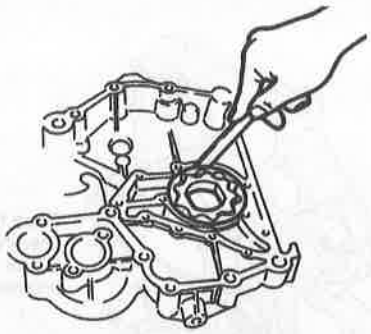
26 Remove timing chain cover (see Section 9).

27 Remove the screws and disassemble the oil pump **(see illustration)**. You may need to use an impact screwdriver to loosen the pump cover screws without stripping the heads out.

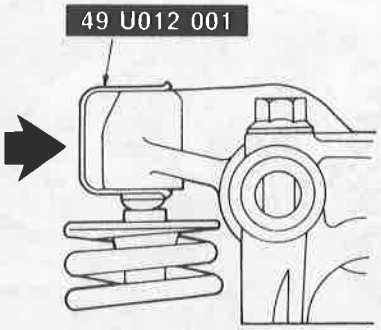
Inspection

Refer to illustrations 17.28a, 17.28b and 17.28c

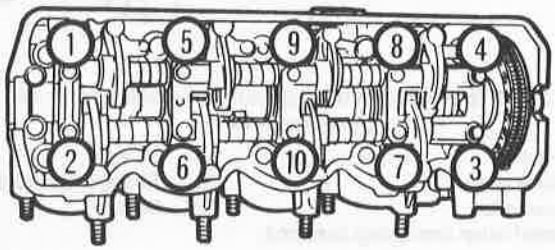
28 Check the oil pump clearances on both inner and outer rotors to each other and to the pump body **(see illustrations)**. Compare your measurements to the figures listed in this Chapter's Specifications. Replace the pump if any of the measurements are outside of the specified limits.



17.28c Using a feeler gauge to check the outer rotor-to-pump body clearance (1989 and later 2.6L models)



18.6 Install special holders to prevent the lash adjusters from falling out



18.7 Camshaft bearing cap bolt LOOSENING sequence (2.6L engine)

29 Extract the spring and oil pump relief valve from the pump housing **(see illustration 15.5)**. Measure the free length of the oil pressure relief valve spring and compare your measurement with the value listed in this Chapter's Specifications. Replace the spring if its length is not as specified.

30 Install the rotors with the dimples in alignment and facing the pump cover. Install the pump cover and tighten the screws to the torque listed in this Chapter's Specifications. Install the oil pressure relief valve and spring assembly.

Installation

31 Install the timing chain cover (see Section 9).

32 Install the oil pick-up tube and screen, using a new gasket. Tighten the bolts to the torque listed in this Chapter's Specifications.

33 Install the oil pan (see Section 20).

34 Remainder of installation is the reverse of removal. Add the specified type and quantity of oil and coolant (see Chapter 1), run the engine and check for leaks.

18 Rocker arm shafts and camshaft – removal and installation

2.6L engine

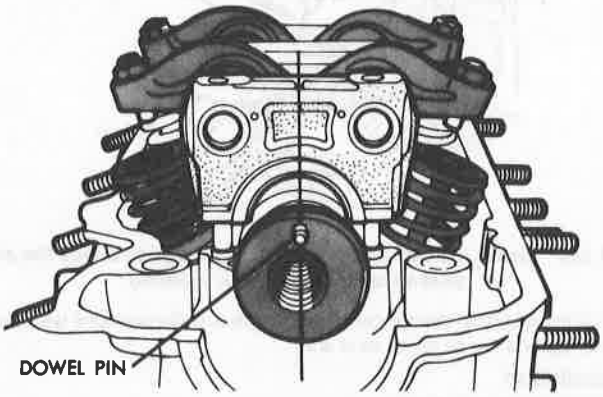
Refer to illustrations 18.6, 18.7, 18.9, 18.10a and 18.10b

1 Remove the rocker arm cover (see Section 4).

2 Rotate the crankshaft until the number one piston is at top dead center on the compression stroke (see Section 3).

3 Locate the timing mark on the camshaft sprocket and make sure the plated link of the cam chain is opposite the mark.

4 Remove the timing chain tensioner (see Section 8). **Note:** *Place a rag in the timing chain opening to prevent anything from falling into the opening.*



18.9 Position the camshaft with the dowel pin at the top before installing the rocker arm assembly (2.6L engine)

5 Remove the camshaft sprocket bolt from the front of the camshaft. To facilitate loosening the camshaft sprocket bolt, you can prevent the crankshaft from turning by holding the large bolt on the end of the crankshaft with a wrench. Remove the distributor drive gear from the front of the camshaft by tapping it with a soft-face hammer. Pull the camshaft sprocket – with the chain in place – off the camshaft, and allow it to rest on the sprocket holder.

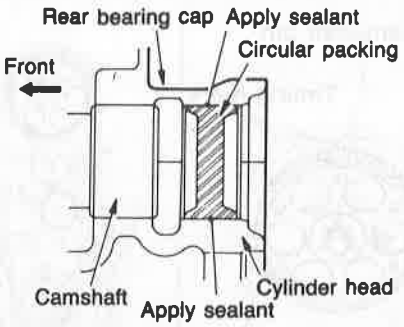
6 Install hydraulic lash adjuster holders (Mazda tool no. 49 U 012 001 or equivalent) to prevent the adjusters from falling out when the rocker arm assembly is lifted up **(see illustration)**.

7 Loosen the ten camshaft bearing cap bolts, 1/2-turn each, in sequence, until all pressure from the valve springs has been released **(see illustration)**. Next remove the six inner bolts and lift the rocker arm shaft assembly away from the cylinder head with the four end bolts in place. No further disassembly of these components is necessary unless new parts are required. Carefully lift the camshaft out of the cylinder head and store it someplace where it will not be damaged. See Chapter 2, Part B for inspection procedures.

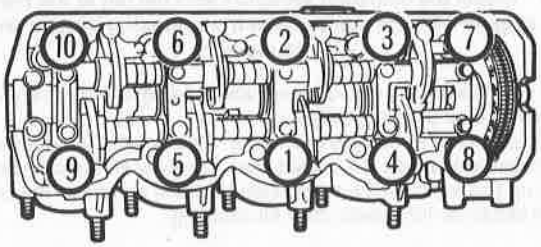
8 Wipe the camshaft bearing surfaces in the cylinder head clean and apply a coat of clean moly-base grease (or engine assembly lube) to each of them.

9 Make sure the camshaft bearing journals are clean, then carefully lay the camshaft in place in the head. Do not lubricate the cam lobes at this time. Rotate the camshaft until the dowel pin on the front is positioned at 12 o'clock **(see illustration)**.

10 Wipe the camshaft bearing cap bearing surfaces clean and apply a coat of clean moly-based grease (or engine assembly lube) to each of them. Also, apply a very small amount of grease to the end of each valve stem. Lay the rocker arm shaft assembly in place with the number one



18.10a Apply sealant to the shaded areas of the rear bearing cap (1988 and earlier 2.6L engines)



18.10b Camshaft bearing cap bolt TIGHTENING sequence (2.6L engine)

bearing cap toward the timing chain. On 1988 and earlier models apply sealant to the circular packing at the rear bearing cap **(see illustration)**. On 1989 and later models, apply anaerobic-type sealant to the cylinder head contact surfaces of bearing caps 1 and 5. Install the camshaft bearing cap bolts and tighten them to the specified torque in the recommended sequence **(see illustration)**. Note that on some models bolt number 5 requires a different torque.

11 Next, lift up on the camshaft sprocket (with the chain attached) and slip it into place on the end of the camshaft. The dowel pin on the cam should slip into the hole in the sprocket.

12 Install the distributor drive gear (again, line up the dowel pin and hole) and the bolt. Tighten the bolt to the specified torque. To keep the camshaft and crankshaft from turning, hold a large screwdriver against the head and sprocket teeth.

13 Camshaft end play can be checked with a dial indicator set or a feeler gauge (see Chapter 2, Part B).

14 Adjust the jet valves (see Chapter 1).

15 Reinstall the remaining components in the reverse order of removal.

Engines equipped with a timing belt

Refer to illustrations 18.21, 18.28, 18.29 and 18.32

16 Remove the rocker arm cover (see Section 4).

17 Position the number one piston at Top Dead Center (see Section 3).

18 Remove the distributor (see Chapter 5.)

19 Remove the fuel pump (see Chapter 4).

20 Remove the timing belt (see Section 11). Remove the bolt and washer, then detach the sprocket from the end of the camshaft.

21 Unbolt the front housing **(see illustration)**, carefully pry the housing away from the engine and remove it. Remove all traces of old gasket material from the sealing surfaces.

22 Loosen the rocker arm assembly retaining bolts, 1/4-turn at a time, working from the ends toward the center.

23 Once the bolts are loose, remove them and place them in a numbered piece of cardboard for reinstallation in the same positions.

24 Lift the rocker arm assembly off the engine. Remove the camshaft.

25 See Chapter 2, Part B for camshaft and rocker arm inspection procedures.

26 Carefully clean the mating surfaces of the rocker arm assembly and the cylinder head to remove all traces of sealant.

27 Lubricate the camshaft and rocker arm assembly with engine assembly lube.

28 Place the camshaft in position with the dowel pin at the top (12 O'clock position) **(see illustration)**.

29 Apply sealant to the cylinder head-to-rocker arm assembly mating surfaces of the end bearing caps **(see illustration)**.

30 Lower the rocker arm assembly into place and install the bolts finger tight, then tighten them in 1/4-turn increments, working from the center out toward the ends.

31 Install the front housing with a new gasket. Tighten the bolts a little at a time to the specified torque.

32 Install the camshaft sprocket with the dowel pin at the top, making sure the sprocket and front housing marks are aligned **(see illustration)**.

33 Tighten the sprocket bolt to the specified torque. Slip a bar through the cam sprocket to keep it from turning.

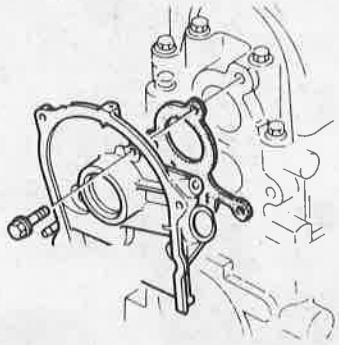
34 Install the timing belt as described in Section 11.

35 Check the valve clearances (see Chapter 1).

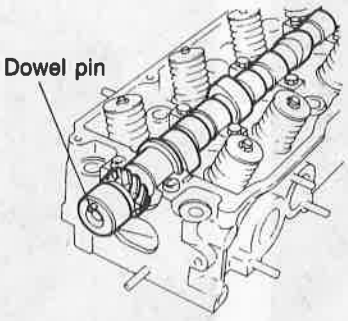
36 Install the remaining components in the reverse order of removal.

Engines equipped with a timing chain (except 2.6L)

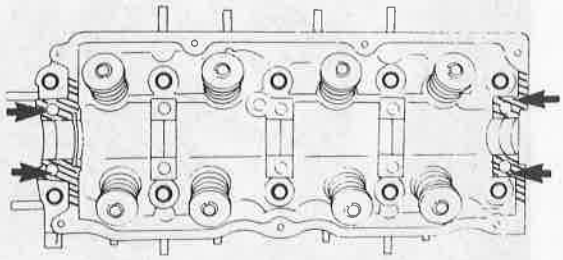
The rocker arm assembly and camshaft are retained by the cylinder head bolts. Whenever the bolts are removed, the cylinder head gasket must be replaced. Follow the procedure outlined in Section 19 *(Cylinder head – removal and installation)*.



18.21 The front housing is bolted to the cylinder head (Mazda engine with timing belt)



18.28 Install the camshaft with the dowel pin at the top (Mazda engine with timing belt)



18.29 Apply sealant to the shaded areas of the end bearing caps (arrows) (Mazda engine with timing belt)

19 Cylinder head – removal and installation

Caution: *The engine must be completely cool before beginning this procedure.*

Removal

Refer to illustrations 19.14, 19.15, 19.17a, 19.17b, 19.17c, 19.18 and 19.19

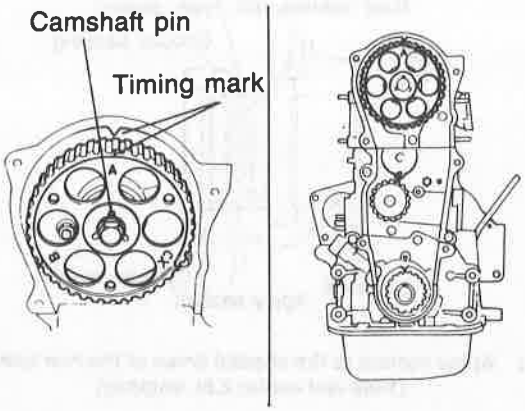
1 Position the number one piston at Top Dead Center (see Section 3).
2 Disconnect the negative cable from the battery.
3 Drain the cooling system and remove the spark plugs (see Chapter 1).
4 Remove the intake manifold (see Section 5).
5 Remove the exhaust manifold (see Section 6).
6 Remove the distributor (see Chapter 5), including the cap and wires.
7 Remove the fuel pump (see Chapter 4).
8 Remove the timing belt, if equipped (see Section 11). **Caution:** *Do not turn the crankshaft while the timing belt is removed.*
9 Remove the rocker arm cover (see Section 4).
10 On 2.6L and all timing belt equipped engines, remove the rocker arm shafts and camshaft as described in Section 18.

Pre-1985 models only

11 Place a rag in the opening of the timing chain cover to prevent anything from falling into it.
12 Secure the timing chain to the camshaft sprocket with a section of wire.
13 Remove the timing chain tensioner (see Section 8).
14 Flatten the lock tab, then remove the first nut, the lock plate and the distributor gear **(see illustration)**.
15 Flatten the lock tab on the front of the camshaft sprocket, then remove the large nut and lock plate **(see illustration)**. **Note:** *Slip a large screwdriver through the camshaft sprocket to prevent it from turning when the nuts are loosened.*
16 Support the sprocket and chain with a wire until the cylinder head is removed.

All models

17 Loosen the cylinder head bolts, 1/4-turn at a time, in the sequence shown **(see illustrations)**. Use the diagram applicable to your vehicle.
18 Be sure to remove the small end bolts **(see illustration)**.
19 On pre-1985 models, lift the rocker shaft assembly straight up with the head bolts still in it **(see illustration)**. This will hold the rocker components in place. Tilt the camshaft slightly and pull it out, leaving the sprocket and chain in place in the front cover.



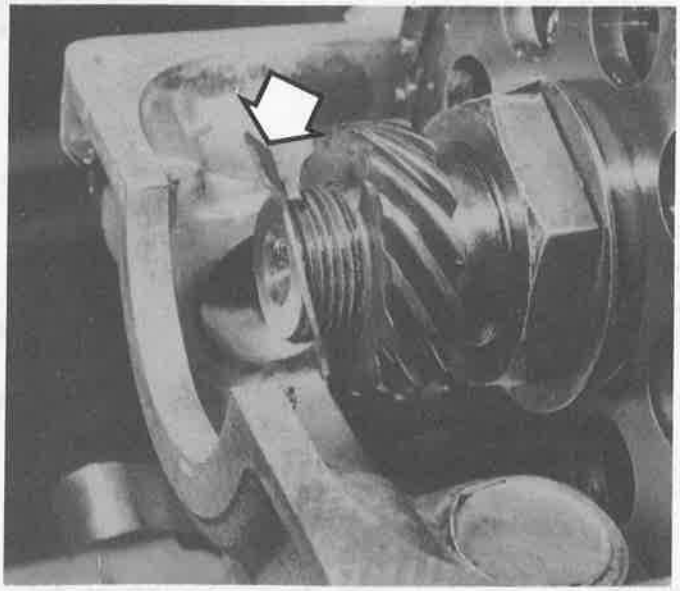
18.32 Install the camshaft sprocket with the pin at the top and the A aligned with the mark on the front housing (Mazda engine with timing belt)

20 Be sure to keep the cam bearing caps (and replaceable bearings – if equipped) in their original positions.
21 Hold a block of wood against the side of the cylinder head and strike it with a hammer to break the gasket seal. Carefully lift the cylinder head straight up (avoid hitting the timing chain guides) and place the head on wooden blocks so the valves don't hit anything.

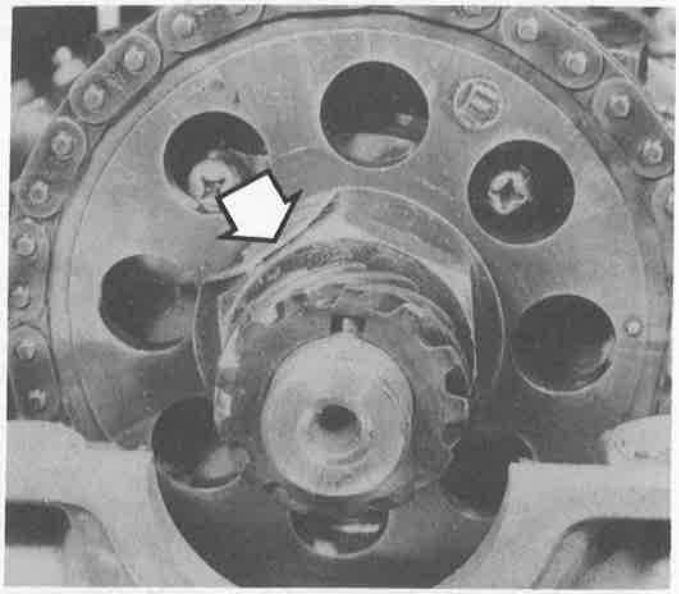
Installation

Refer to illustrations 19.24a, 19.24b, 19.25, 19.26, 19.27a, 19.27b, 19.27c and 19.27d

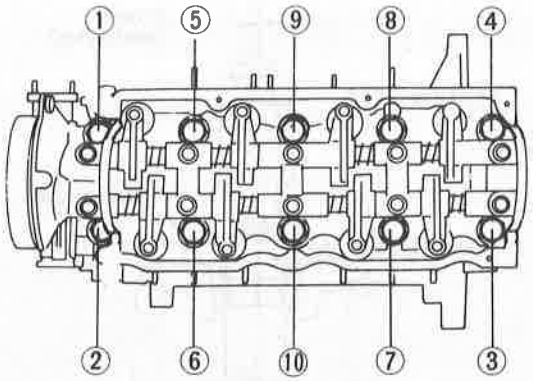
22 Remove all traces of old gasket material from the block and head. Don't allow anything to fall into the engine. Clean and inspect all threaded fasteners and be sure the threaded holes in the block are clean and dry.
23 See Chapter 2, Part B for cylinder head, camshaft and rocker arm service information.
24 If you are working on a 2.6L engine, apply sealant to the junction of the timing chain cover and engine block **(see illustration)**. Place a new gasket **(see illustration)** and the cylinder head in position, followed by the camshaft and rocker arm assembly (see Section 18). Be sure to lubricate all moving parts with moly-base grease or assembly lube.
25 On pre-1985 models, make sure the flat surfaces of the rocker arm swivels contact the ends of the valve stems **(see illustration)**.



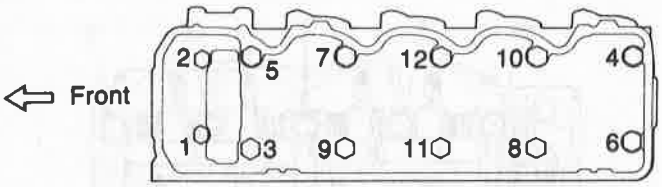
19.14 Flatten the lock tab, remove the first nut, then pull off the lock plate (arrow)



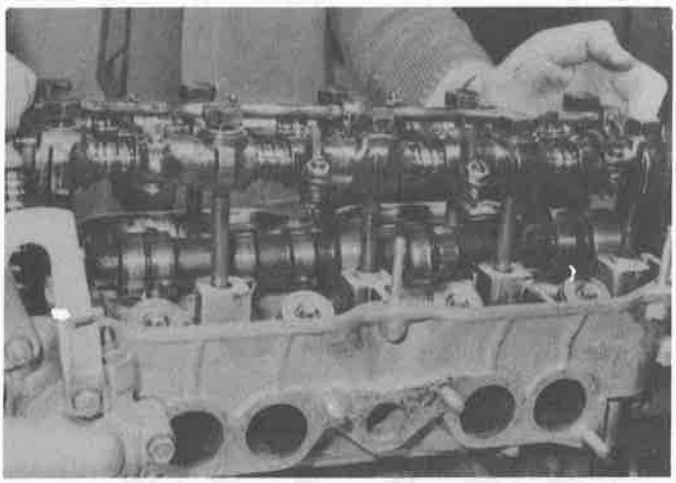
19.15 Pull off the distributor gear, then flatten the lock tab (arrow) and remove the large sprocket retaining nut



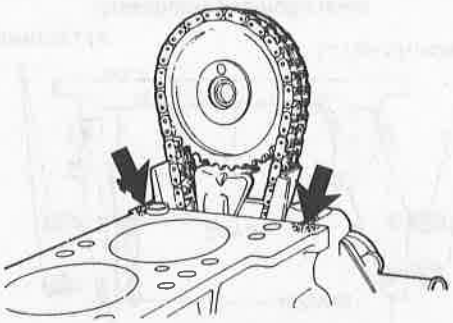
19.17a Cylinder head bolt LOOSENING sequence – Mazda engine with timing belt



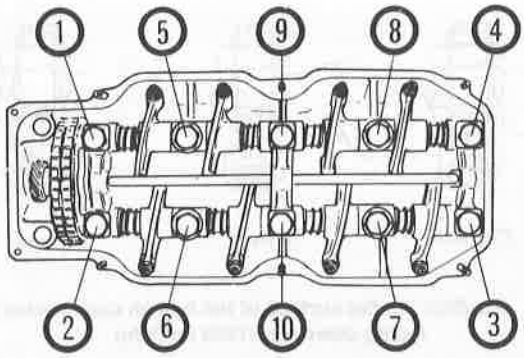
19.17c Cylinder head bolt LOOSENING sequence – 2.6L engine



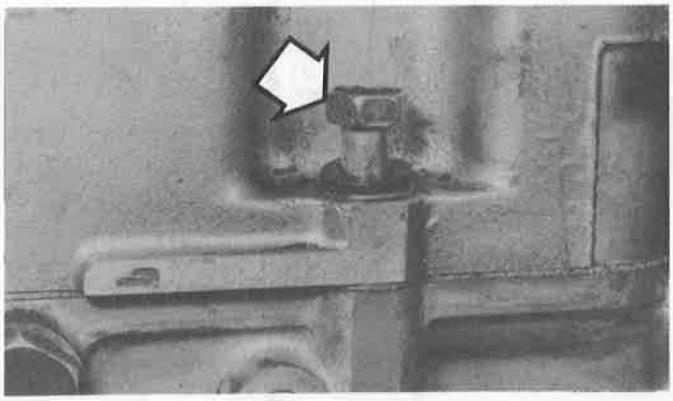
19.19 Remove the rocker arm shaft assembly (pre-1985 engines) with the head bolts in place to prevent the shaft components from coming apart



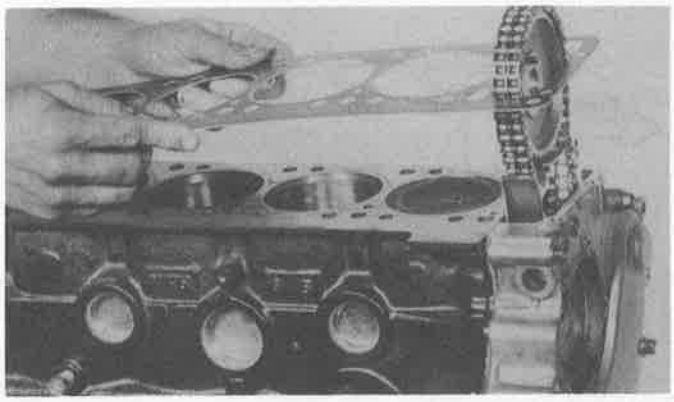
19.24a On 2.6L engines, apply sealant to the junction of the timing chain cover and block (arrows)



19.17b Cylinder head bolt LOOSENING sequence – Mazda engine with timing chain



19.18 Be sure to remove the small bolts as well (arrow)



19.24b DO NOT use sealant on the new head gasket

26 On pre-1985 models, prior to head bolt tightening, move each rocker arm shaft support on the exhaust side to offset the rocker arm 0.040-inch (1 mm) from the valve center **(see illustration)**.

27 The cylinder head bolts should be tightened in several steps, following the recommended sequence **(see illustrations)**, until the specified torque is reached.

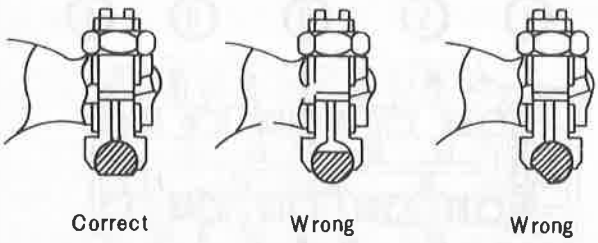
28 Reinstall the timing chain/belt. Be sure to follow the proper installation procedure. Align the timing marks, turning the camshaft, if necessary, to align the cam sprocket.

29 Reinstall the remaining parts in the reverse order of removal. Be sure all fasteners are tightened securely and the locking tabs have been secured, where applicable.

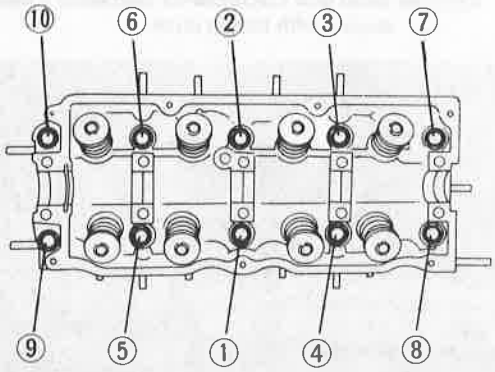
30 Be sure to refill and check all fluid levels. Turn the crankshaft slowly by hand through two complete revolutions. If anything hits, stop immediately and recheck the timing chain/belt installation.

31 Start the engine and set the ignition timing (see Chapter 1). Run the engine until normal operating temperature is reached.

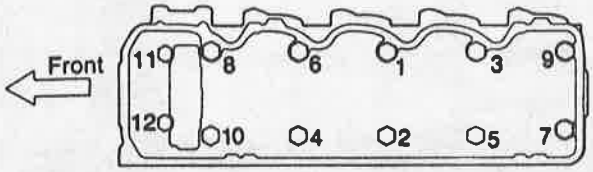
32 Check for leaks and proper operation.



19.25 Position the flat surface of the ball on each rocker arm facing down (pre-1985 models)



19.27a Cylinder head bolt TIGHTENING sequence – Mazda engine with timing belt



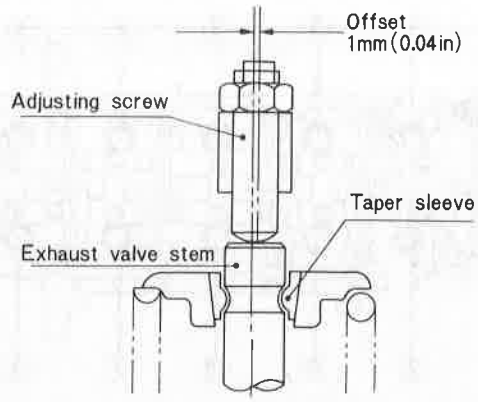
19.27c Cylinder head bolt TIGHTENING sequence – 1988 and earlier 2.6L engine

33 Shut off the engine and retorque the cylinder head bolts (unless the gasket manufactrer states otherwise).
34 Recheck the valve adjustment.

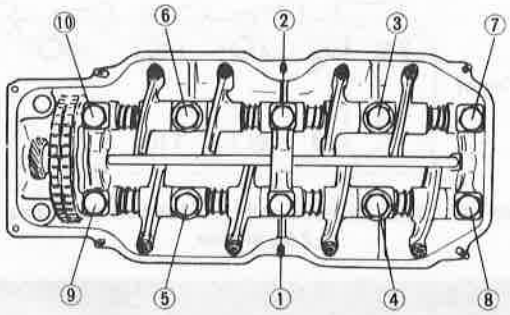
20 Oil pan - removal and installation

Refer to illustrations 20.5, 20.9 and 20.10

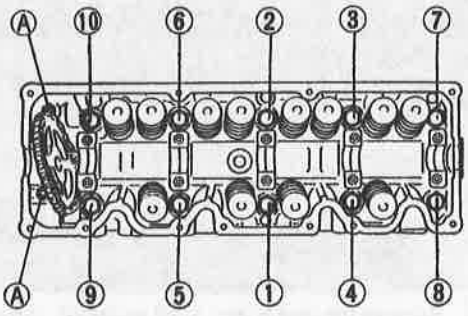
1 Disconnect the negative cable from the battery.
2 Raise the vehicle and support it securely on jackstands.
3 Remove the belly pan(s) and dipstick. Drain the engine oil (see Chapter 1).
4 Unbolt and remove the crossmember located below the engine. On 4WD models, detach the front differential from the crossmember (see Chapter 8).
5 Remove the gusset plates (braces) that connect the engine and bellhousing (if equipped). They are located on both sides of the engine at the rear of the oil pan **(see illustration)**.
6 Disconnect the center link from the pitman arm (see Chapter 10). On vehicles so equipped, disconnect the emission line from the oil pan.
7 Remove the bolts and detach the oil pan from the vehicle. If the



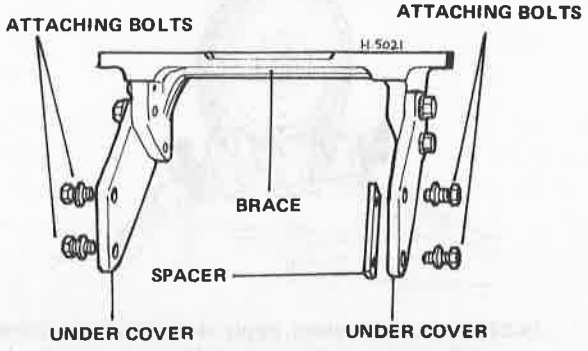
19.26 Move the rocker arm shaft supports on the exhaust side to offset each rocker arm (pre-1985 models)



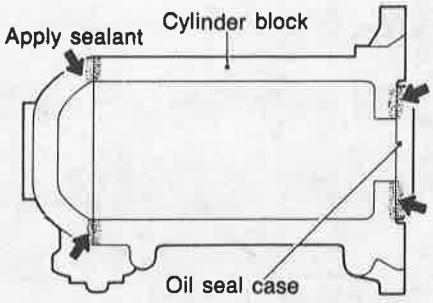
19.27b Cylinder head bolt TIGHTENING sequence – Mazda engine with timing chain



19.27d Cylinder bolt TIGHTENING sequence – 1989 and later 2.6L engines – (tighten the bolts marked A after the others have been tightened completely)



20.5 Typical rear engine gussets (braces)



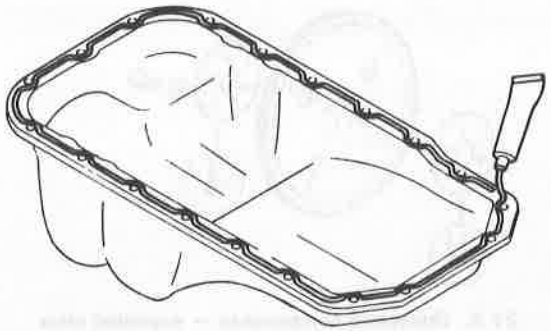
20.9 Apply sealant to the shaded areas (arrows) when installing an oil pan with a gasket

pan is stuck, tap it with a soft-face hammer or insert a thin knife blade between the sealing surfaces and work around the perimeter.

8 Thoroughly clean the oil pan and mating surfaces. Remove all traces of old gasket material. Check the oil pan gasket surface for distortion. Straighten or replace as necessary.

9 On engines with an oil pan gasket, apply sealant (Mazda no. 8527 77 739 or equivalent) to the four corners as shown **(see illustration)**. Use a new gasket.

10 On engines with RTV sealant in place of an oil pan gasket, apply a bead of sealant (Mazda no. 8527 77 739 or equivalent) to the oil



20.10 Apply the sealant to the INSIDE of the bolt holes in a continuous bead all the way around the oil pan flange

pan flange **(see illustration)**, position the pan and install the bolts finger tight.

11 Working in a spiral pattern from the center out, tighten the bolts to the specified torque in three or four steps.

12 Reinstall the remaining parts in the reverse order of removal.

13 Refill the crankcase with the proper quantity and grade of oil and run the engine. Check carefully for leaks.

21 Flywheel/driveplate — removal and installation

Refer to illustrations 21.7a, 21.7b, 21.7c, 21.7d and 21.8

1 Refer to Chapter 7 and remove the transmission. If the vehicle has a manual transmission, the pressure plate and clutch will also have to be removed (see Chapter 8).

2 To keep the crankshaft from turning, insert a large screwdriver into a driveplate hole or pry against the ring gear teeth on the flywheel to prevent it from turning.

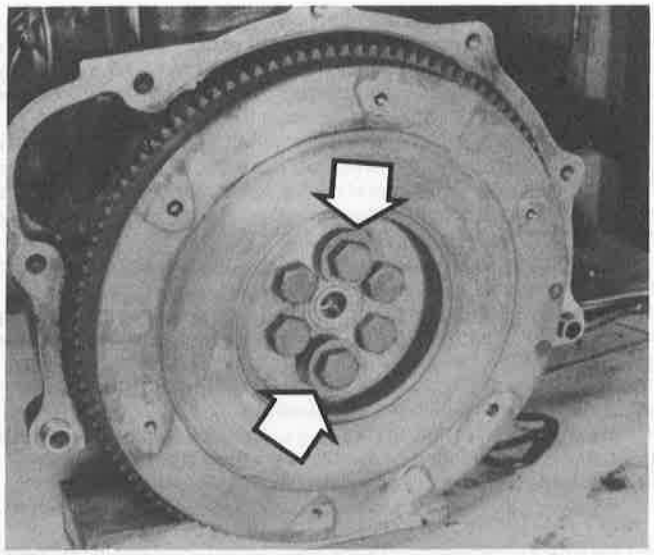
3 Remove the mounting bolts. Since it's fairly heavy, support the flywheel as the last bolt is removed. Pull straight back on the flywheel/driveplate to detach it from the crankshaft.

4 On manual transmission equipped vehicles, check the pilot bearing and replace it if necessary (see Chapter 8).

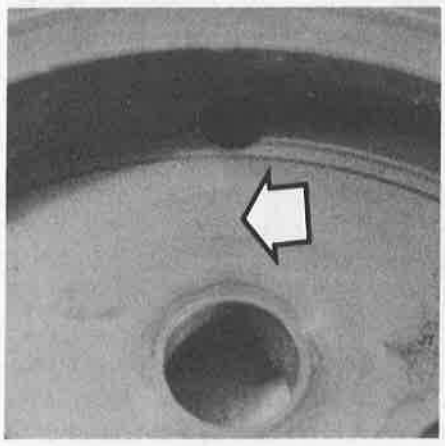
5 Inspect the flywheel/driveplate for cracks and check the ring gear teeth for damage.

6 Apply a light coat of sealant (Mazda no. 8530 77 743 or equivalent) to the bolt threads.

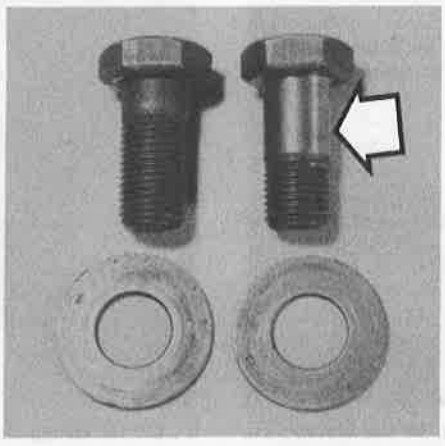
7 On manual transmission equipped models, position the flywheel on the crankshaft. If the flywheel had large washers under some of the flywheel bolts **(see illustration)**, look for a mark on the flywheel **(see illustration)**. The mark must be aligned with the stepped bolt hole in the crankshaft. Install the bolt with the long unthreaded shank **(see illustration)** in the stepped crankshaft hole **(see illustration)**.



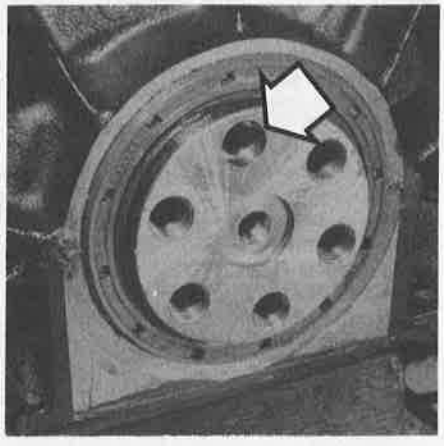
21.7a If the flywheel has large washers on some bolts (arrows), . . .



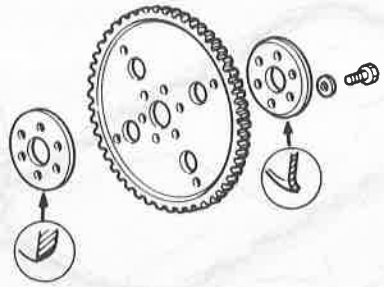
21.7b . . . look for a mark (arrow) adjacent to the bolt hole and . . .



21.7c . . . use the bolt with the long unthreaded shank (arrow) . . .



21.7d . . . in the stepped crankshaft hole (arrow)



21.8 Driveplate components — exploded view

8 On automatic transmission equipped models, place the adapter, driveplate and backing plate on the crankshaft **(see illustration)**.
9 Install and tighten the bolts to the specified torque in a criss-cross pattern.
10 On manual transmission equipped vehicles, install the clutch disc and pressure plate as described in Chapter 8.
11 The remainder of installation is the reverse of removal.

22 Crankshaft rear oil seal — replacement

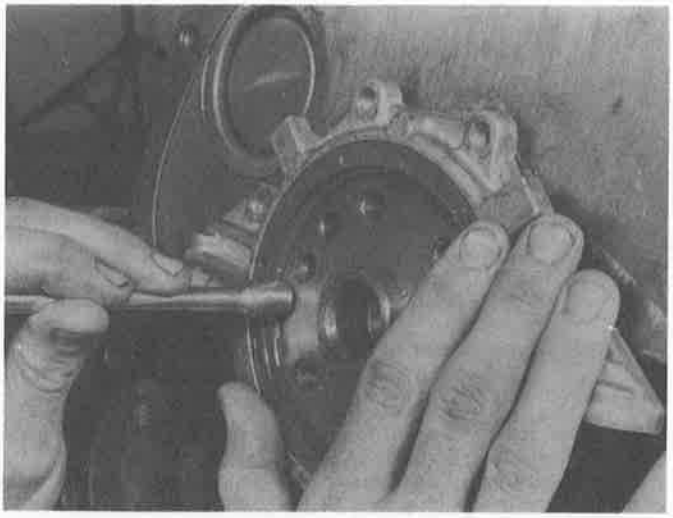
Engines with seal groove in block and rear main cap

1 This procedure applies to engines with the seal flush mounted in the block and main bearing cap.
2 Remove the flywheel/driveplate as described in Section 21.
3 Using an awl, carefully punch two holes in opposite sides of the seal and install self-tapping screws in the holes.
4 Carefully pry the seal out with a claw hammer or two screwdrivers pulling on the screws. **Caution:** *Don't scratch the crankshaft or seal bore.*
5 Clean the seal bore and inspect the crankshaft seal contact surface for nicks and a wear groove.
6 Lubricate the new seal with engine oil or moly-base grease. Position the seal in the bore with the spring side facing in and tap it into place with a soft-face hammer.
7 Reinstall the remaining components in the reverse order of removal.

Engines with seal housing

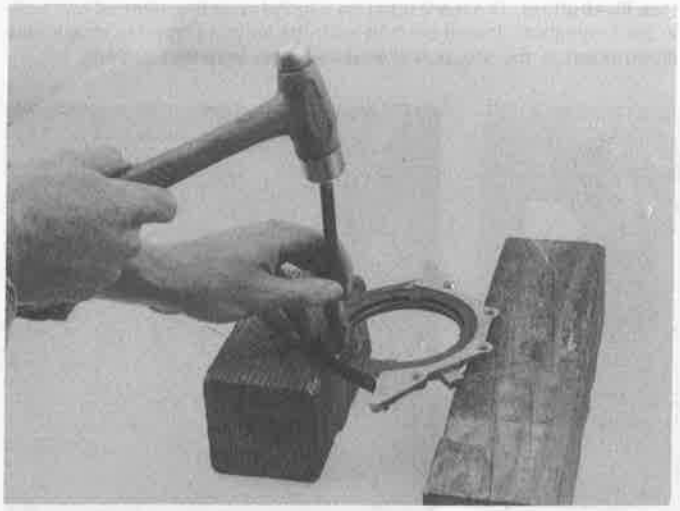
Refer to illustrations 22.11, 22.14, 22.15 and 22.17

8 This procedure applies to engines with the seal mounted in a removable housing.
9 Remove the flywheel/driveplate (see Section 21).

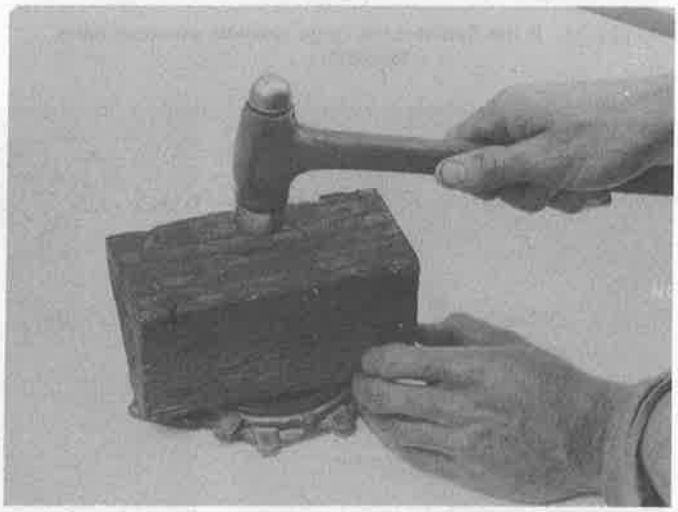


22.11 Since the seal lip is quite stiff, if won't slide over the end of the crankshaft very easily — if you lubricate the journal and the seal lip with moly-base grease and carefully work the seal over the journal with a smooth, blunt object, you'll get it on without damaging it

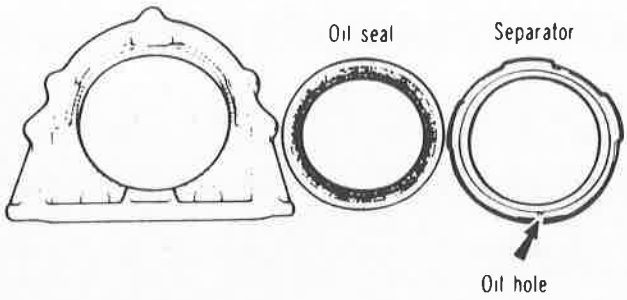
10 The seal can be replaced without removing the oil pan or the seal housing. However, this method is not recommended because the lip of the seal is quite stiff and it's possible to cock the seal in the housing or damage it during installation. If you want to take the chance, carefully pry out the old seal with a screwdriver. Clean and inspect the seal cavity.
11 Apply moly-base grease to the crankshaft seal journal and the lip of the new seal and carefully push the seal into place. The lip is stiff so carefully work it onto the seal journal of the crankshaft with a smooth object like the end of an extension **(see illustration)** as you tap the seal into place. Don't rush it or you will damage the seal.
12 The following method is recommended but requires removal of the oil pan (see Section 20) and the seal housing.
13 After the oil pan has been removed, unbolt and remove the seal housing. Thoroughly clean the seal mounting cavity and peel off any old gasket material. On 1988 and earlier 2.6L engines, remove the oil separator.
14 Position the seal housing on wooden blocks and drive the old seal out with a hammer and punch **(see illustration)**.
15 Drive the new seal into the housing with a block of wood **(see illustration)**. The open (spring) side must face the engine when installed.
16 Lubricate the lip of the new seal with moly-base grease.



22.14 After removing the seal housing from the block, support it on a couple of wood blocks and drive out the old seal with a punch and hammer



22.15 Drive the new seal into the housing with a block of wood — make sure you don't cock the seal



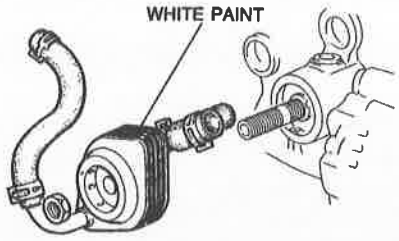
22.17 When installing the engine rear oil seal housing on 1988 and earlier 2.6L models, make sure the separator oil hole is at the bottom

17 Position a new housing gasket on the block. On 1988 and earlier 2.6L engines, place the oil separator into the back of the seal housing with the hole facing down **(see illustration)**.
18 Slowly and carefully push the new seal/housing assembly onto the crankshaft. The seal lip is stiff, so work it onto the crankshaft with a smooth object as you push the housing against the block.
19 Gently tap the seal housing into position. Install and tighten the bolts to the specified torque.
20 The remaining steps are the reverse of removal.

23 Engine mounts – replacement

Warning: *Don't position any part of your body under the engine when the engine mounts are unbolted!*

1 Engine mounts are non-adjustable and seldom require service. Periodically they should be inspected for hardness and cracks in the rubber and separation of the rubber from the metal backing.
2 To replace the engine mounts with the engine in the vehicle, disconnect the battery and use the following procedure.
3 Loosen the nuts and bolts that retain the front mounting insulator and heat shield (if equipped) to the engine mount bracket and frame. Do this on both sides.



24.3 When installing the oil cooler, make sure the white paint mark faces up

4 Next, the weight of the engine must be taken off the mounts. This can be done from beneath using a jack and wooden block positioned under the oil pan (after removing the belly pan, or from above by removing the air cleaner and using an engine hoist attached to the two engine lifting brackets. The engine should be raised slowly and carefully, while keeping a constant check on clearances around the engine to prevent anything from binding or breaking. Pay particular attention to areas such as the fan, ignition coil wires, vacuum lines leading to the engine and rubber hoses and ducts.
5 Raise the engine just enough to provide adequate room to remove the mounting insulator.
6 Remove the nuts and bolts retaining the insulator, then lift it out, noting how it's installed.
7 Installation is the reverse of removal, but be sure the insulator is installed in the same position it was in before removal.

24 Oil cooler (later 2.6L engines) – removal and installation

Refer to illustration 24.3

1 Drain the engine oil and remove the oil filter (see Chapter 1).
2 Drain the engine coolant (see Chapter 1).
3 Disconnect the two coolant hoses at the oil cooler **(see illustration).**
4 Remove the mounting nut and detach the oil cooler.
5 Attach the oil cooler to the engine, using a new gasket, and tighten its mounting nut to the torque listed in this Chapter's Specifications.
6 The remainder of installation is the reverse of removal. Use a new oil cooler gasket and refill the cooling system with the proper mixture of water and coolant (see Chapter 1).

NOTES