

1997-98 ENGINES**3.0L SOHC V6 - VIN 1****ENGINE IDENTIFICATION**

This engine is of free wheeling design with a camshaft in each head, hydraulic valve lifters and two valves per cylinder. Combustion chamber is cross-flow with pent-roof combustion chamber and squish area. Main bearing cap is of one piece construction to increase rigidity and reduce vibration.

ENGINE IDENTIFICATION CODES

Engine	Code
3.0L SOHC V6	1

ADJUSTMENTS**VALVE CLEARANCE ADJUSTMENT**

Hydraulic lifters are used, and no valve adjustments are required.

TROUBLE SHOOTING

NOTE: For trouble shooting mechanical engine components, see appropriate table in TROUBLE SHOOTING in GENERAL INFORMATION.

REMOVAL & INSTALLATION

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems have completed a relearn cycle. See COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

NOTE: For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Also place mating marks on engine hood and other major assemblies before removal.

FUEL PRESSURE RELEASE

1. Remove fuel pump relay from left engine compartment relay block. Start engine.
2. After engine stalls, crank engine 2 or more revolutions to ensure pressure has been released.
3. Turn ignition OFF and install fuel pump relay. Using a rag to contain spray, disconnect fuel hoses. Plug hoses.

COOLING SYSTEM DRAINING, FILLING & BLEEDING

WARNING: Electric cooling fan may come on at any time when ignition switch is in ON position.

Draining

1. Turn ignition on, and move front blower switch to 4. Set front temperature control to full WARM position, and rear control switch to 4.

NOTE: For vehicles with rear heater, set rear heater blower switch to 4 and rear temperature control knob to full WARM position.

2. Set mode selection switches to any mode except OFF. Turn ignition off. Remove right hand splash shield.
3. Remove radiator pressure cap slowly, ensuring release of pressure before fully open. Position drain pan under radiator. Open draincock at bottom of radiator.

CAUTION: DO NOT use a galvanized drain pan if coolant is to be reused. DO NOT allow coolant to contact drive belts, or they will be damaged.

4. Remove coolant reservoir and drain. Clean reservoir and reinstall. Position drain pan under engine prior to removing engine block drain plugs. Remove engine block drain plugs.

Filling & Bleeding

1. Ensure block drain plugs and radiator draincock are installed and tightened. Remove engine air relief plug. Loosen radiator air relief plug 4 turns. DO NOT remove radiator air relief plug. Remove coolant reservoir and support it above engine. Ensure coolant recovery hose is attached to reservoir and radiator filler neck.
2. Place drain pan under radiator air relief plug opening. Slowly pour 50/50 mix of coolant and water into radiator filler neck. Allow several minutes for air to escape. Fill radiator filler neck with coolant only until coolant starts to drip from radiator air relief plug opening. When coolant starts to drip from radiator air relief plug opening, close plug. Tighten plug to 15-19 ft. lbs. (20-26 N.m).

NOTE: When adding more coolant, fill to bottom of overflow tube. Allow several minutes for air to escape.

3. Pour coolant into radiator while gently squeezing upper radiator hose. Install a wire under radiator pressure cap negative pressure valve to allow flow of air and coolant regardless of pressure. See **Fig. 1**. Install cap on radiator at this time. Add 50/50 mix of coolant and water to MAX mark on coolant reservoir.

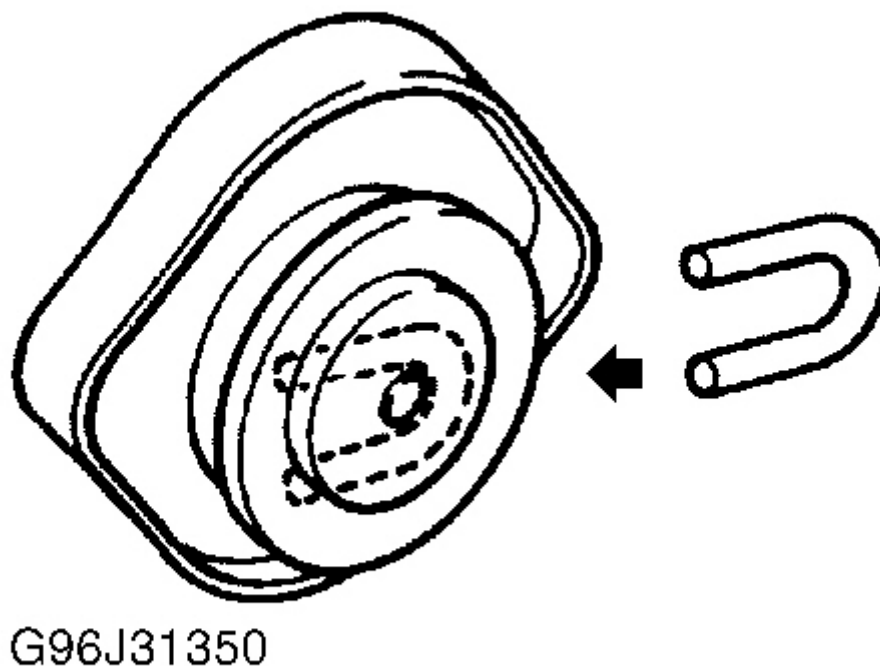


Fig. 1: Installing Wire Under Radiator Pressure Cap
Courtesy of FORD MOTOR CO.

4. With gear selector in Park, start and run engine at 2000 RPM for 15-30 minutes, allowing cooling system to reach full operating temperature. Cooling fan will turn on and off indicating cooling system has reached full operating temperature. Squeeze upper radiator hose to help burp air from cooling system.
5. Stop engine and allow to cool completely. Ensure recovery reservoir fluid level does not drop below MIN level. Lower recovery reservoir and reinstall. Remove radiator cap and remove wire. Reinstall radiator cap. Fill radiator and coolant reservoir as necessary.

ENGINE

NOTE: Engine and transaxle are removed as a unit through bottom of engine compartment.

Removal & Installation

1. Relieve fuel pressure. See **FUEL PRESSURE RELEASE**. Drain cooling system. See **COOLING SYSTEM DRAINING, FILLING & BLEEDING**. Disconnect battery. Remove battery and fresh air duct bracket bolt. Separate fresh air duct from air cleaner assembly. Remove and separate fresh air duct and resonance chamber No. 1.
2. Drain engine oil. Disconnect overflow tube from radiator filler neck. Remove coolant reservoir.
3. Mark and disconnect following electrical connectors:

- Vehicle speed sensor.
 - Valve body wiring harness.
 - Starter (wiring harness and positive battery cable).
 - Transmission Range (TR) switch.
 - Exhaust Gas Recirculation Control (EGRC) solenoid.
 - Throttle position sensor.
 - Idle switch.
 - Mass airflow sensor.
4. Disconnect and plug fuel lines. Disconnect carbon canister vacuum lines. Remove ignition coil dust cover. Disconnect ignition coil connector, 2 mounting bolts and ignition coil.

CAUTION: DO NOT pull on high-tension lead when removing from ignition coil.

5. Remove distributor cap dust cover. Disconnect distributor electrical connector. Unscrew 3 distributor cap screws and distributor cap. Position cap and wire aside to gain access to main engine wiring harness.
6. Disconnect main engine wiring harness clips from breather tube brackets. Disconnect fuel injector electrical connectors. Remove 2 ground wire bolts from intake plenum, and position ground wires aside.
7. Disconnect power transistor electrical connector, engine coolant temperature sensor connector, temperature gauge sender electrical connector, magnetic clutch electrical connector, A/C high pressure switch electrical connector and the 2 main harness connectors from right side of plenum intake.
8. Disconnect cruise control cable (if equipped) from throttle lever. Disconnect accelerator cable from throttle lever. Remove cruise control cable from hanging support (if equipped). Remove accelerator cable from bracket at top of intake plenum. Remove 2 bolts holding accelerator cable/cruise control cable bracket to intake plenum, and position aside.
9. Disconnect upper radiator hose from radiator. Disconnect lower radiator hose from radiator pipe. Remove 2 upper A/C compressor-to-accessory bracket bolts. Disconnect heater hoses. Remove ground from dipstick bracket. Disconnect brake booster vacuum hose from left side of intake plenum. Loosen A/C compressor drive belt tensioner and remove A/C belt.
10. Raise and support vehicle. Remove splash shields. Remove shift cable nut from transmission range switch, and slide shift cable off switch. Using a screwdriver, release locking pin from shift cable bracket. Remove shift cable from shift cable bracket.
11. Disconnect oil level sensor electrical connector. Disconnect low oil level sensor electrical connector. Disconnect generator electrical connector. Remove "B" terminal nut and generator ground wire nut from generator, and position wires aside. Remove generator wiring bracket nut from back of generator. Loosen generator lock bolt. Loosen generator adjustment bolt. Loosen front and rear generator-to-accessory bracket bolts, and remove generator belt.

NOTE: Access front power steering-to-bracket bolts by inserting socket through power steering pump pulley holes.

12. Loosen power steering pump tensioner center bolt. Loosen power steering pump adjustment bolt and remove power steering pump belt. Remove 3 front power steering pump-to-bracket bolts from front of

power steering pump. Remove rear power steering pump-to-bracket bolt, and position power steering pump aside.

13. Remove 2 lower A/C compressor-to-accessory bracket bolts, and position A/C compressor aside (if equipped).
14. Remove 2 converter inlet pipe-to-three way catalytic converter nuts. (Discard nuts and gasket.) Remove heated O2 sensor wire clips. Disconnect heated O2 sensor electrical connector.
15. Remove 4 front exhaust manifold flange cover bolts and front exhaust manifold flange cover. Remove converter inlet pipe-to-exhaust bracket bolt. Remove 3 front exhaust manifold-to-catalytic converter inlet pipe nuts. (Discard nuts and gasket.)
16. Remove 3 rear exhaust manifold-to-catalytic converter inlet pipe nuts. (Discard nuts and gasket.) Remove catalytic converter inlet pipe from vehicle. Remove drive axles. See appropriate FWD AXLE SHAFTS article in DRIVE AXLES.
17. Identify transaxle oil cooler hose-to-transaxle oil cooler line connections for reassembly. Disconnect and plug transaxle cooler lines and hoses. Disconnect transaxle ground.
18. Position lift and wood blocks under engine/transaxle assembly. Remove 3 front transaxle mount bolts. Remove 3 rear transaxle mount nuts. Remove 2 rear A/C and/or heater pipe brackets. Remove transverse member bolts. Remove transverse member.
19. Lower engine/transaxle from engine compartment. Remove upper transaxle-to-engine bolts. Remove 2 exhaust bracket-to-transaxle nuts and the exhaust bracket. Remove 4 rear transaxle-to-engine brace bolts. Remove 5 front transaxle-to-engine brace bolts.
20. Remove lower transaxle-to-engine bolt. Prevent crankshaft from spinning with a wrench, and remove 4 torque converter-to-flexplate bolts. Separate transaxle from engine assembly. To install, reverse removal procedure using NEW gaskets and nuts as required.

INTAKE PLENUM

Removal & Installation

1. Drain cooling system. See **COOLING SYSTEM DRAINING, FILLING & BLEEDING**. Disconnect negative battery cable. Remove air duct and resonance chamber. Disconnect TP sensor electrical connector. Remove TP sensor electrical connector from EGR Control (EGRC) bracket.
2. Disconnect idle switch electrical connector. Disconnect and plug front throttle body coolant hose. Disconnect and plug hose connected to top heater pipe. Disconnect EGRC solenoid-to-throttle body vacuum hose. Disconnect EGR valve-to-EGRC solenoid vacuum hose. Remove 2 EGRC bracket bolts, then lower EGRC bracket from intake plenum. Disconnect carbon canister-to-intake plenum vacuum hose.
3. Disconnect No. 1, 3 and 5 spark plug wires from spark plugs, then remove spark plug wire boots from between intake plenum runners. Remove the 2 spark plug wire bracket bolts and brackets from intake plenum. Remove distributor dust cover.
4. Unscrew the 3 distributor cap screws. Remove distributor cap, and position cap and wires aside to gain access to main engine wiring harness. Disconnect rear heater valve vacuum hose from right side of plenum (if equipped). Remove wiring harness bracket from right side of plenum and set aside.
5. Disconnect cruise control cable (if equipped) from throttle lever. Disconnect accelerator cable from throttle lever. Remove cruise control cable from hanging support (if equipped). Remove accelerator cable from bracket attached to top of intake plenum. Remove cruise control cable (if equipped), then accelerator cable from bracket on top of intake plenum and position aside.
6. Disconnect brake booster vacuum hose from left side of intake plenum. Remove EGR pipe from EGR valve. Disconnect EGR temperature sensor electrical connector (if equipped). Disconnect bypass air

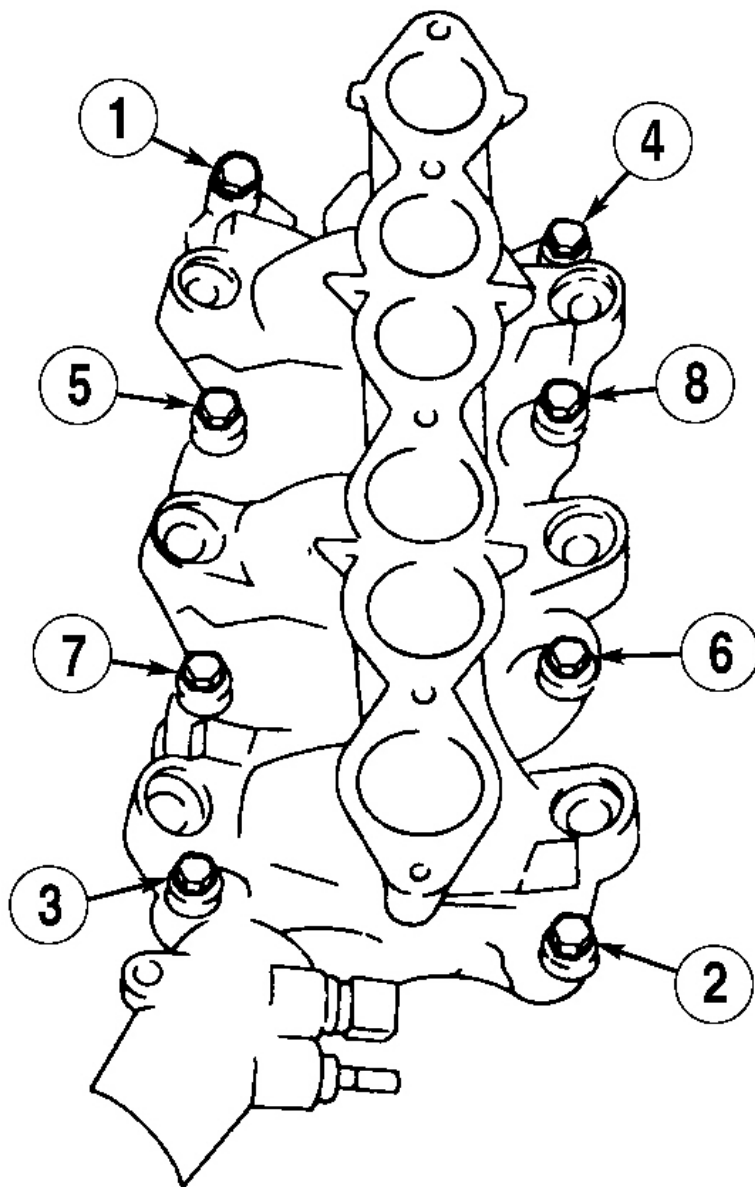
valve electrical connector. Disconnect Idle Air Control/Fast Idle Control assembly connectors.

7. Disconnect fuel pressure regulator-to-intake manifold vacuum line from fuel pressure regulator. Disconnect main engine wiring harness clips from breather tube brackets. Remove 2 ground wire bolts from intake plenum, and position ground wires and main wiring harness aside.
8. Remove the 2 front breather bracket-to-intake plenum bolts. Disconnect front breather hose from front rocker arm cover. Remove 5 Allen-head intake plenum bolts. Remove intake plenum and discard gasket.
9. To install, reverse removal procedure. Ensure gasket surfaces are clean before using a NEW intake plenum gasket.

INTAKE MANIFOLD

Removal & Installation

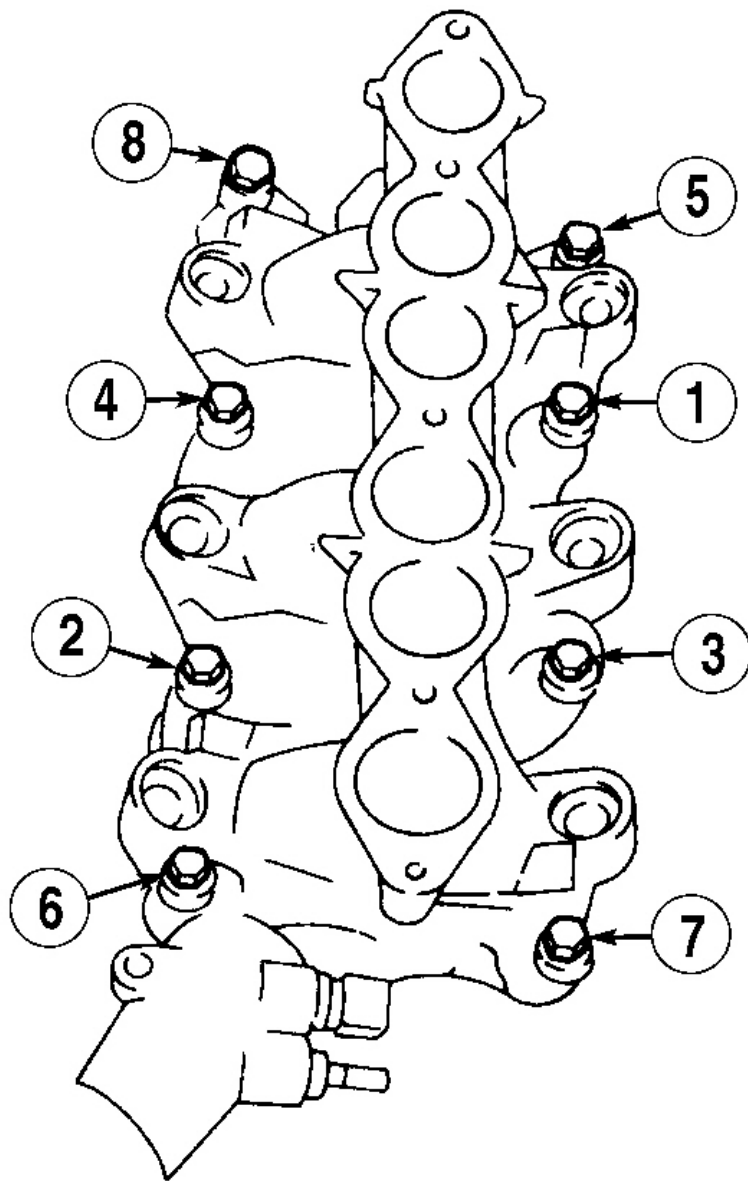
1. Remove intake plenum. See **INTAKE PLENUM**. Disconnect 6 fuel injector electrical connectors. Remove rear breather hose from rear rocker arm cover. Remove crossover breather tube from engine front cover. Remove fuel rail and position fuel rail and insulators aside.
2. Disconnect engine coolant temperature sensor connector. Disconnect water temperature sender connector. Remove upper radiator hose from intake manifold. Remove upper radiator hose bracket bolt. Remove water bypass hose from intake manifold. Remove bolt attaching water hose connection to engine front cover. Remove heater hose from top heater core pipe.
3. Remove 4 Allen-head intake manifold bolts and 4 intake manifold nuts in 2 steps in correct sequence. See **Fig. 2**. Remove intake manifold washers. Remove intake manifold and discard gaskets. To install, reverse removal procedure using NEW gaskets. Tighten 4 Allen-head bolts and 4 nuts in 3 steps and in correct sequence. See **Fig. 3**. Step 1: 27-44 INCH lbs. (3-5 N.m). Step 2: 12-14 ft. lbs. (16-20 N.m). Step 3: repeat step 2.



LOOSENING SEQUENCE

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Fig. 2: Intake Manifold Loosening Sequence
Courtesy of FORD MOTOR CO.



TIGHTENING SEQUENCE

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Fig. 3: Intake Manifold Tightening Sequence
Courtesy of FORD MOTOR CO.

EXHAUST MANIFOLD

Removal & Installation (Left)

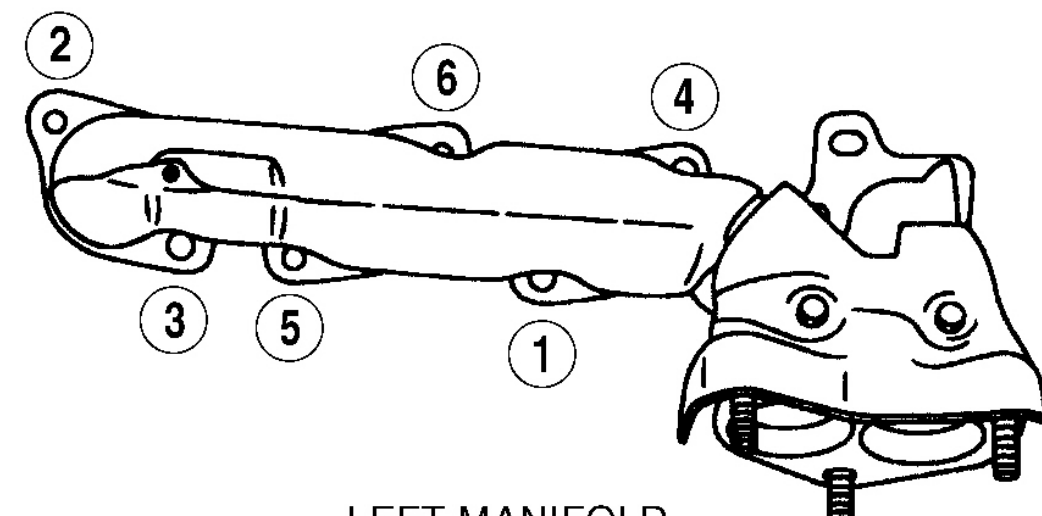
1. Disconnect negative battery cable. Remove 2 nuts and 1 bolt attaching crossover tube-to-front exhaust manifold, and discard gasket. Remove transmission fluid dipstick heat shield. Raise and support

vehicle. Loosen front exhaust manifold nuts in 2 steps in sequence. See **Fig. 4**. Remove top 3 nuts, but DO NOT remove 3 lower nuts.

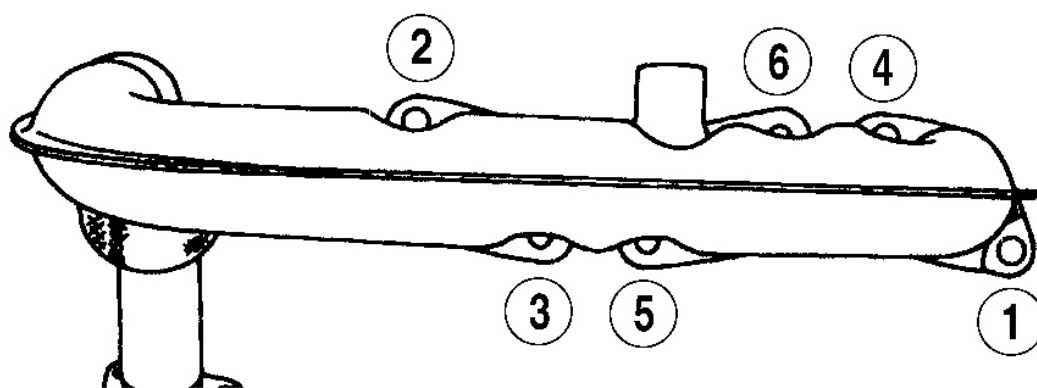
2. Remove front exhaust manifold mounting bracket bolt. Disconnect heated oxygen sensor electrical connector. Remove 3 front exhaust manifold-to-converter inlet pipe nuts. Remove exhaust flex tube bracket bolt. Remove left inner engine and transmission splash shield. Remove 3 lower front exhaust manifold nuts. Remove front exhaust manifold and gasket from cylinder head. Discard gasket. To install, reverse removal procedure using NEW gaskets. Tighten in sequence to 13-16 ft. lbs. (18-22 N.m). See **Fig. 5**.

Removal & Installation (Right)

1. Disconnect negative battery cable. Disconnect radiator overflow hose from radiator. Remove coolant recovery reservoir. Remove air duct and resonance chamber. Remove 6 rear exhaust manifold crossover tube heat shield bolts. Remove heat shields from crossover tube. Remove 2 nuts and one bolt attaching rear exhaust manifold crossover tube-to-front exhaust manifold, and discard gasket.
2. Remove transmission fluid dipstick heat shield. Disconnect idle switch connector. Disconnect throttle position sensor connector. Disconnect EGR control solenoid connector. Raise and support vehicle. Remove EGR valve-to-backpressure transducer valve tube nut and position aside.
3. Remove EGR pipe from between EGR valve and rear exhaust manifold. Remove 6 rear exhaust manifold nuts in sequence. See **Fig. 4**. Remove rear exhaust manifold and discard gasket. To install, reverse removal procedure using NEW gasket. Tighten in sequence to 13-16 ft. lbs. (18-22 N.m). See **Fig. 5**.



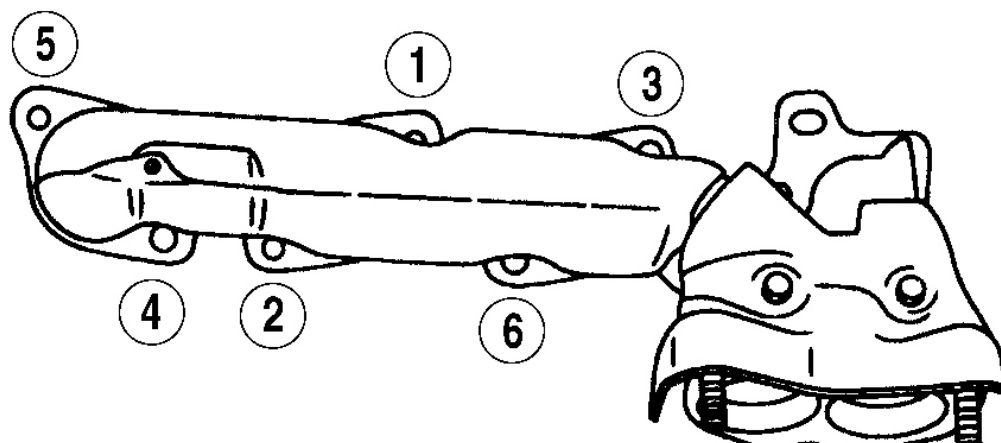
LEFT MANIFOLD



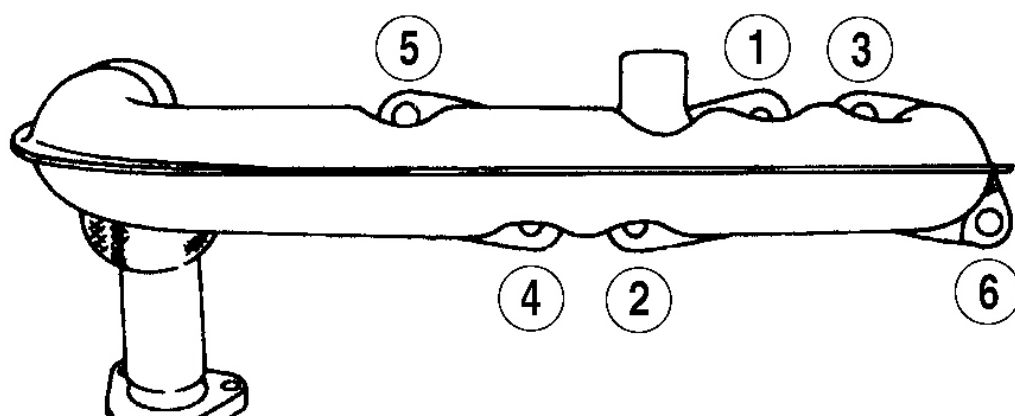
RIGHT MANIFOLD

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Fig. 4: Exhaust Manifold Loosening Sequence
Courtesy of FORD MOTOR CO.



RIGHT MANIFOLD



LEFT MANIFOLD

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Fig. 5: Exhaust Manifold Tightening Sequence

Courtesy of FORD MOTOR CO.

CYLINDER HEAD**Removal**

1. Drain cooling system. See **COOLING SYSTEM DRAINING, FILLING & BLEEDING**. Disconnect negative battery cable. Remove fresh air duct. Remove timing belt. See **TIMING BELT**. Remove intake plenum. See **INTAKE PLENUM**.

NOTE: Mark spark plug wire locations for installation.

2. Disconnect spark plug wires and high-tension lead. Remove distributor. Mark and disconnect

following electrical connectors:

- EGR control solenoid.
 - Mass airflow sensor.
 - Pulse signal generator.
 - Valve body wiring harness.
 - Park/Neutral position switch.
 - Magnetic clutch.
 - Power transistor.
 - A/C high-pressure switch.
 - Fuel injectors.
 - Ignition coil.
 - Temperature gauge sender.
 - Engine coolant temperature sensor.
3. Remove main wiring harness bracket from intake manifold coolant outlet. Remove fuel line bracket bolt from EGRC solenoid bracket. Disconnect coolant bypass hose from intake manifold coolant outlet. Remove 4 Allen-head fuel rail bolts, and position fuel rail and injectors aside. Disconnect upper heater hose. Remove intake manifold. See **INTAKE MANIFOLD**.
 4. Remove 9 rocker arm cover screws, rocker arm cover and gasket. Discard gasket. Using Camshaft Pulley Holder (T92P-6312-AH), remove camshaft sprocket bolt. Using a small 3-leg gear puller, remove camshaft sprocket. Remove 4 rear timing belt cover bolts and the rear timing cover. If removing the front cylinder head, remove 2 dipstick bolts and dipstick bracket.
 5. Raise and support vehicle. If removing front cylinder head, remove 4 front exhaust manifold flange cover bolts and front exhaust manifold flange cover. Remove 3 front exhaust manifold-to-converter inlet pipe nuts. Remove and discard gasket. Remove 2 nuts and one bolt attaching rear exhaust manifold crossover tube-to-front exhaust manifold, and discard gasket. Remove front exhaust manifold mounting bracket bolt. If removing front cylinder head, remove the 2 lower A/C compressor-to-accessory bracket bolts. Lower vehicle.

NOTE: The upper A/C compressor-to-accessory bracket bolts are too long to remove from A/C compressor. Remove them after compressor has been moved aside.

6. If removing front cylinder head, loosen 2 upper A/C compressor-to-accessory bracket bolts, and wire A/C compressor aside. If removing front cylinder head, remove the 2 upper accessory bracket bolts and the 2 radiator/heater pipe bracket bolts.

CAUTION: Ensure that the first bolt in removal sequence is located in the No. 1 position outside of the cylinder head. This bolt is easily forgotten and the tab can be broken off if cylinder head is moved prior to bolt being removed. See **Fig. 6**. Be aware that the head bolts stretch to yield on installation and may not be reused. Discard head bolts on removal and replace with **NEW** bolts during reassembly.

7. When removing cylinder head, remove head bolts in 2 steps in correct sequence. See **Fig. 6**. Remove cylinder head bolt washers, noting which side of washer faces head. Remove cylinder head and gasket. Discard bolts and gasket. If necessary, remove exhaust manifold from cylinder head. Remove

6 exhaust manifold nuts in sequence and discard gasket. See **Fig. 4**.

Inspection

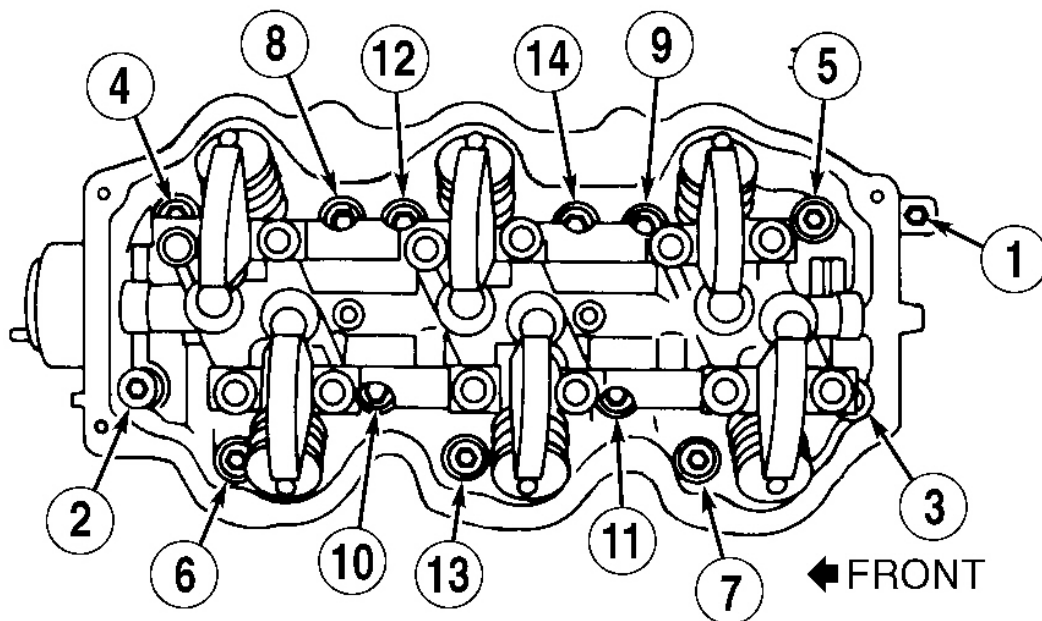
Inspect cylinder head for damage, cracks and leakage of water and oil. Measure cylinder head for distortion. Maximum distortion for cylinder head is 0.004" (0.10 mm). If distortion exceeds specification, grind cylinder head surface. Cylinder head must be replaced if head height is not within 4.205-4.220" (106.8-107.2 mm).

Installation

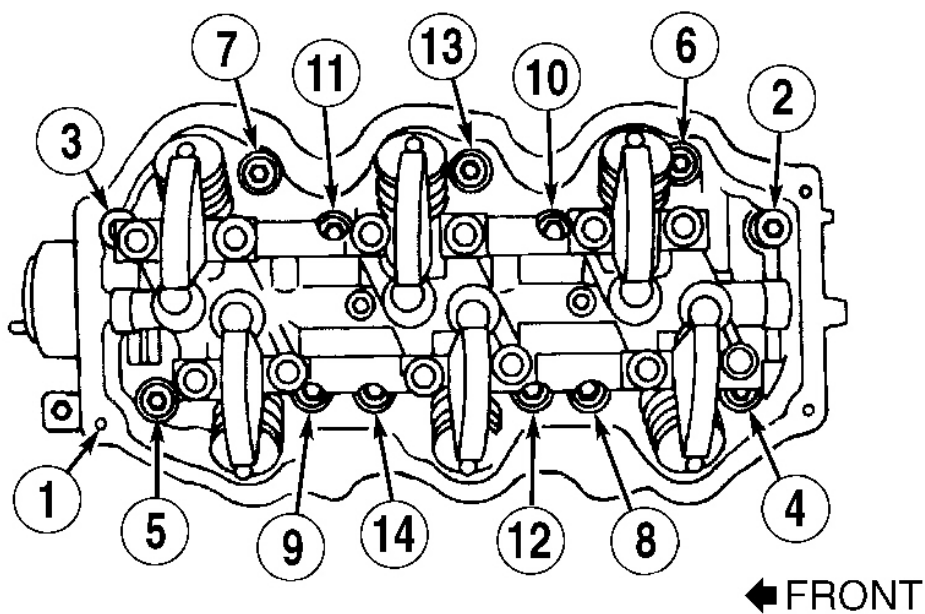
To install, reverse removal procedure using NEW gaskets and NEW cylinder head bolts. Tighten NEW cylinder head bolts in sequence in 6 steps:

- Step 1: Tighten bolts to 22 ft. lbs. (29 N.m).
- Step 2: Tighten bolts to 43 ft. lbs. (59 N.m).
- Step 3: Loosen all bolts completely using loosening sequence. See **Fig. 6**.
- Step 4: Tighten bolts to 22 ft. lbs. (29 N.m).
- Step 5: Tighten bolts to 40-47 ft. lbs. (54-64 N.m).
- Step 6: Install bolt located at "A". See **Fig. 7**. Tighten bolt "A" to 80-104 INCH lbs. (9-12 N.m).

NOTE: **Bolts in positions 4, 5, 12 and 13 are 5" (127 mm) in length. Remaining bolts are 4.17" (106 mm) in length.**



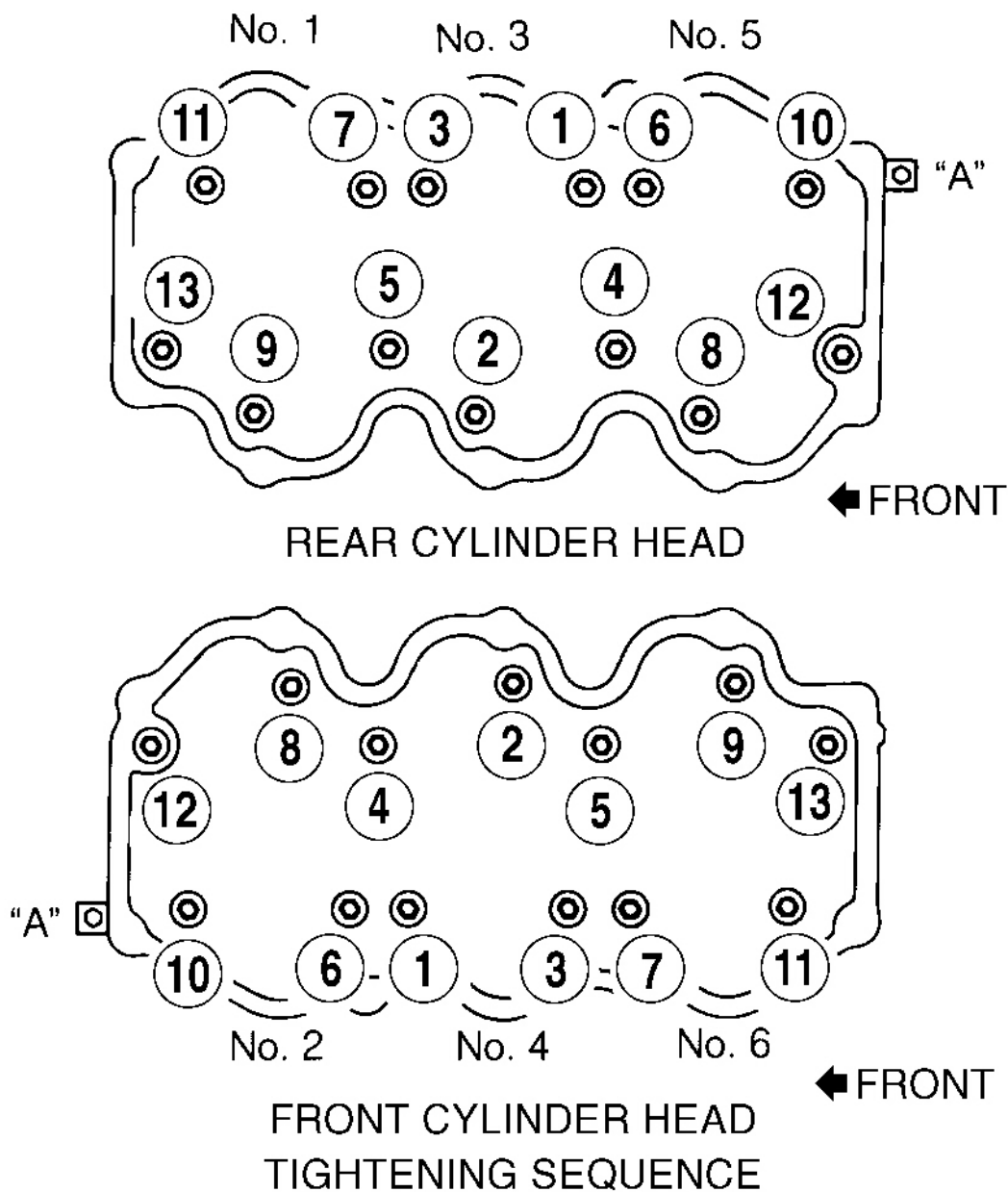
REAR CYLINDER HEAD



FRONT CYLINDER HEAD
LOOSENING SEQUENCE

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Fig. 6: Cylinder Head Bolt Loosening Sequence
Courtesy of FORD MOTOR CO.



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Fig. 7: Cylinder Head Bolt Tightening Sequence
 Courtesy of FORD MOTOR CO.

CRANKSHAFT FRONT SEAL

Removal

Disconnect negative battery cable. Remove timing belt. See **TIMING BELT**. Remove outer timing belt guide. Remove crankshaft sprocket and inner timing belt guide. Using Seal Remover (T92C-6700-CH), remove front seal.

Installation

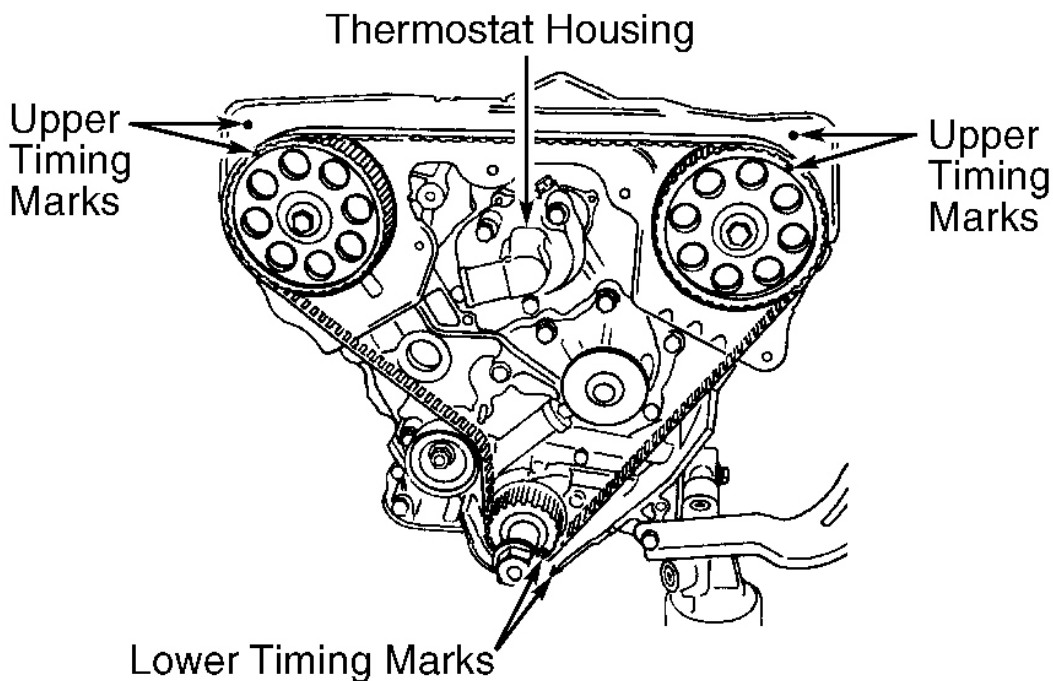
Using Seal Replacer (T92P-6701-BH) with Sleeve, Nut, Bolt and Plate (T88T-6701-A), oil lip of NEW seal and install until seal bottoms against oil pump body. To complete installation, reverse removal procedure.

TIMING BELT**Removal**

1. Drain cooling system. See **COOLING SYSTEM DRAINING, FILLING & BLEEDING**. Disconnect negative battery cable. Remove accessory drive belts. Remove 3 A/C compressor drive belt tensioner bolts and tensioner.
2. Remove upper radiator hose bracket bolt. Loosen 2 upper radiator hose clamps, and remove upper radiator hose and bracket from vehicle. Remove coolant bypass hose from between thermostat housing and intake manifold coolant outlet.
3. Remove main wiring harness from upper timing belt cover. Remove 8 upper timing belt cover bolts and upper timing belt cover.
4. Raise and support vehicle. Remove right front wheel. Remove right front outer splash shield. Remove water pump pulley. Remove crankshaft pulley. Remove 5 lower timing belt cover bolts and lower timing belt cover.

NOTE: If timing belt is to be reused, ensure direction of rotation is marked for reinstallation.

5. Align timing marks between camshaft sprockets and rear timing belt cover. Ensure timing marks between crankshaft timing belt sprocket and oil pump housing align. See **Fig. 8**. Loosen timing belt tensioner nut. Remove timing belt.



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Fig. 8: Identifying Timing Marks
Courtesy of FORD MOTOR CO.

Inspection

Inspect for damage, wear, peeling, cracks, hardening or contamination from oil or grease. Replace if necessary.

Installation

1. Ensure all timing marks are properly aligned. See **Fig. 8**. Use an Allen wrench to turn timing belt tensioner counterclockwise. Temporarily tighten tensioner nut. If installing NEW timing belt, ensure white lines on belt align with camshaft and crankshaft sprocket timing marks, and that arrow on belt is pointing away from engine block.
2. Install timing belt. Hold tensioner with Allen wrench and loosen tensioner nut. Allow tensioner to put pressure on timing belt. With Allen wrench, turn timing belt tensioner clockwise 70-80 degrees and tighten nut to 32-43 ft. lbs. (43-58 N.m).
3. Rotate crankshaft clockwise 2 revolutions and align No. 1 piston at TDC on compression stroke. Apply 22 lbs. (9.98 kg) force on timing belt between rear camshaft sprocket and timing belt tensioner.
4. With assistance from a helper, adjust timing belt as follows:
 - Step 1: While holding timing belt tensioner steady with an Allen wrench, start a 0.0138" (0.35 mm) feeler gauge between belt and tensioner. See **Fig. 9**.
 - Step 2: Turn crankshaft clockwise until feeler gauge is positioned between tensioner and belt. See **Fig. 10**. Tighten timing belt tensioner nut to 32-43 ft. lbs. (43-58 N.m).

- Step 3: Rotate crankshaft clockwise 2 revolutions and align No. 1 piston at TDC on compression stroke. Remove feeler gauge when beginning rotation.
5. Apply 22 lbs. (9.98 kg) force on timing belt between camshaft sprockets. Measure timing belt deflection. Deflection should be 0.51-0.59" (13-15 mm). If deflection is not within specification, repeat adjustment procedure. If timing belt cannot be adjusted to specification, replace belt. To complete installation, reverse removal procedure. There should be 40 timing belt teeth between timing marks on camshaft sprockets, and 43 timing belt teeth between left camshaft sprocket and crankshaft timing belt sprocket timing mark.

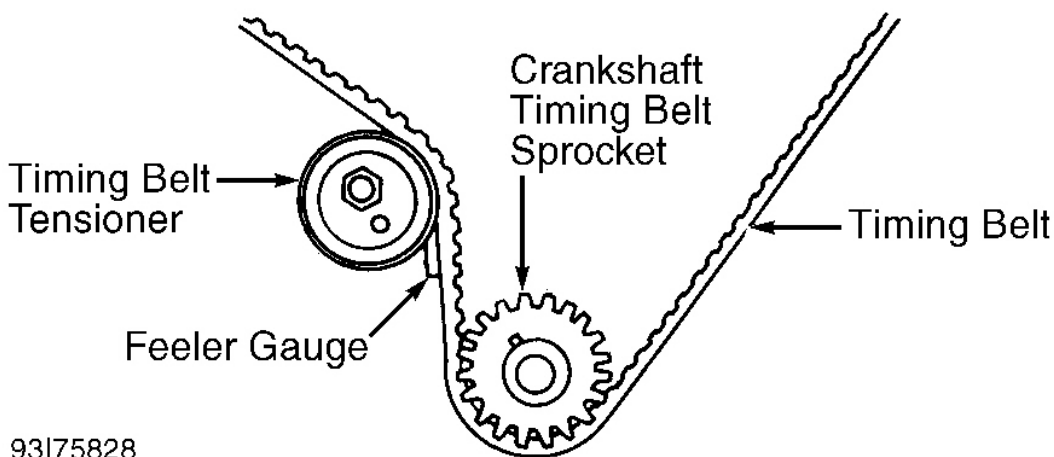


Fig. 9: Starting Feeler Gauge Under Timing Belt
Courtesy of FORD MOTOR CO.

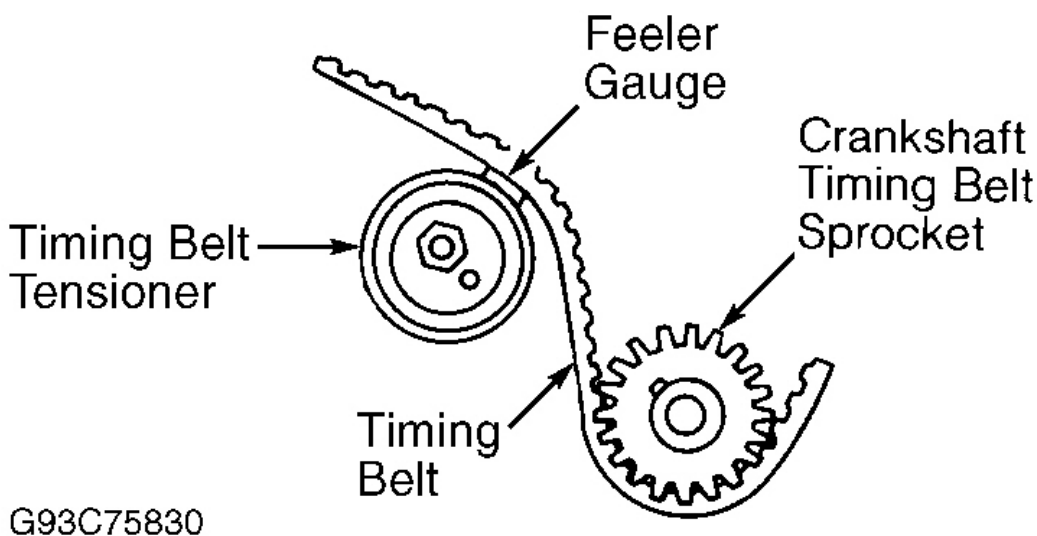


Fig. 10: Positioning Feeler Gauge Under Timing Belt
Courtesy of FORD MOTOR CO.

ROCKER ARM & HYDRAULIC VALVE LIFTER

1. Disconnect negative battery cable. If removing rear rocker arm shaft, rocker arms and valve lifters, remove intake plenum. See **INTAKE PLENUM**. If removing front rocker arm shaft, rocker arms and valve lifters, remove distributor. Remove rocker arm cover.

NOTE: Mark location of rocker arm shaft, rocker arms and valve lifters for installation.

CAUTION: Removing rocker arm shaft bolts in one step may bend the rocker arm shaft.

2. Loosen rocker arm shaft bolts in 2 steps. Remove rocker arm shaft assemblies from cylinder head. Slide rockers off of the rocker arm shaft.
3. Secure valve lifters in valve lifter guide with mechanic's wire prior to removal. Remove valve lifter guide with valve lifters. Remove lifters from valve lifter guide.

Inspection

Inspect rocker arms, rocker arm shafts and lifters for scratches, seizure and wear. See **ROCKER ARM & HYDRAULIC VALVE LIFTER SPECIFICATIONS** table. Repair or replace as necessary.

ROCKER ARM & HYDRAULIC VALVE LIFTER SPECIFICATIONS

Component	In. (mm)
Rocker Arm Shaft Diameter	0.7078-0.7087 (17.979-18.000)
Rocker Arm Bore	0.7089-0.7098 (18.007-18.028)
Oil Clearance (Maximum)	0.0017-0.0026 (0.043-0.066)
Lifter Diameter	0.6278-0.6282 (15.947-15.957)
Valve Lifter Guide Bore	0.6299-0.6304 (16.00-16.013)
Valve Lifter Bore Oil Clearance	0.0017-0.0026 (0.043-0.066)

Installation

To install, reverse removal procedure. Tighten rocker arm shaft bolts in 2 stages to 13-16 ft. lbs. (18-22 N.m).

CAMSHAFT

Removal & Installation

1. Remove cylinder head. See **CYLINDER HEAD**. Remove rocker arm shaft, rocker arms and valve lifters. See **ROCKER ARM & HYDRAULIC VALVE LIFTER**. Install cylinder head on Head Holding Fixture (D83L-500-A).
2. Remove camshaft oil seal using Seal Remover (T92C-6700-CH). Discard seal. Remove 3 camshaft end-plate bolts, bracket and camshaft end plate.

3. Temporarily install camshaft sprocket on end of camshaft. Hold camshaft with Camshaft Pulley Holder (T92P-6312-AH), and remove camshaft thrust plate bolt. Remove camshaft thrust plate. Remove camshaft sprocket. Remove camshaft from front of cylinder head. To install, reverse removal procedure.

CRANKSHAFT REAR OIL SEAL

Removal & Installation

1. Rear main seal is a one-piece seal. Remove transaxle. See TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. Remove flywheel (M/T) or flexplate plate (A/T).
2. Using an awl, punch a hole in metal portion of seal. Using Jet Plug Remover (T77L-9533-B), remove seal. Coat seal lip with engine oil before installing. Use Seal Installer (T88L-6701-A) to install seal. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

WATER PUMP

Removal

Drain cooling system. See **COOLING SYSTEM DRAINING, FILLING & BLEEDING**. Disconnect negative battery cable. Remove accessory drive belts. Raise and support vehicle. Remove water pump pulley. Remove crankshaft pulley. Remove lower timing belt cover. Remove 6 water pump bolts. Remove water pump.

NOTE: For installation reference, mark location of bolt having threads in bolt head.

CAUTION: Ensure there is no gasket residue on pump or block before installation.

Installation

Using Gasket Maker E2AZ-19562-B (WSK-M2G348-A5), lay a continuous bead 0.079-0.118" (2-3 mm) wide on water pump gasket surface. Position pump on engine block and install 6 bolts, noting placement of bolt with threads in bolt head. To complete installation, reverse removal procedure.

OIL PAN

Removal

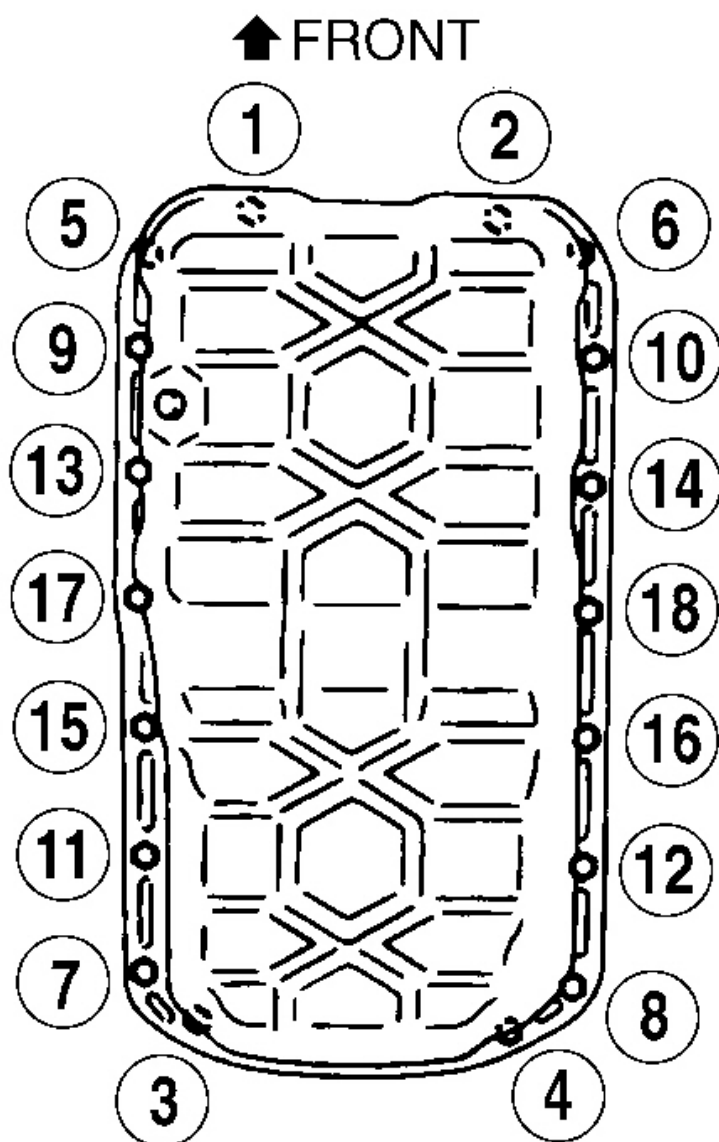
1. Raise and support vehicle. Drain engine oil. Install a support (screw-type jack) under crankshaft pulley. Remove both engine mount through-bolts.
2. Remove 2 rear refrigerant/heater pipe bracket bolts. Remove transverse member nuts and bolts. Remove transverse member from vehicle.
3. Remove 4 front exhaust manifold flange cover bolts and front manifold flange cover. Remove converter inlet pipe-to-exhaust bracket bolt. Remove 2 exhaust bracket-to-transaxle nuts and exhaust bracket.
4. Remove 3 front exhaust manifold-to-catalytic converter inlet pipe nuts. Discard nuts and gasket.

Remove 3 rear exhaust manifold-to-catalytic converter inlet pipe nuts. Discard nuts and gasket. Position catalytic converter inlet pipe aside.

5. Remove 4 rear transaxle-to-engine brace bolts. Remove 5 front transaxle-to-engine brace bolts. Disconnect oil level sensor electrical connector.
6. Remove 18 oil pan bolts in correct sequence. See **Fig. 11**. Remove oil pan and discard oil pan end gaskets.

Installation

Ensure gasket surfaces are clean. Apply Loctite Ultra Gray (599) Silicone Sealant (WSE-M4G320-A2) to oil pan end gaskets and a bead around oil pan. See **Fig. 12**. Install oil pan to engine block. Tighten 18 bolts in correct sequence to 62-71 INCH lbs. (7-8 N.m). See **Fig. 13**. To complete installation, reverse removal procedure.



LOOSENING SEQUENCE

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Fig. 11: Oil Pan Loosening Sequence
Courtesy of FORD MOTOR CO.

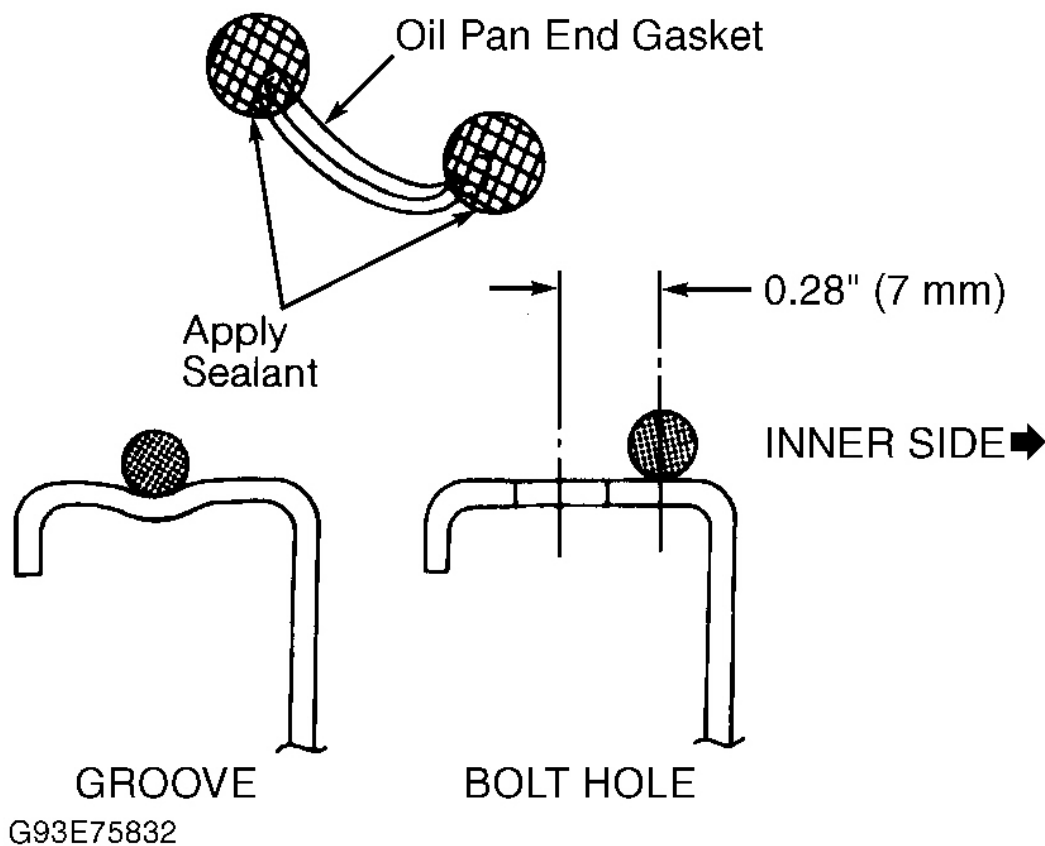
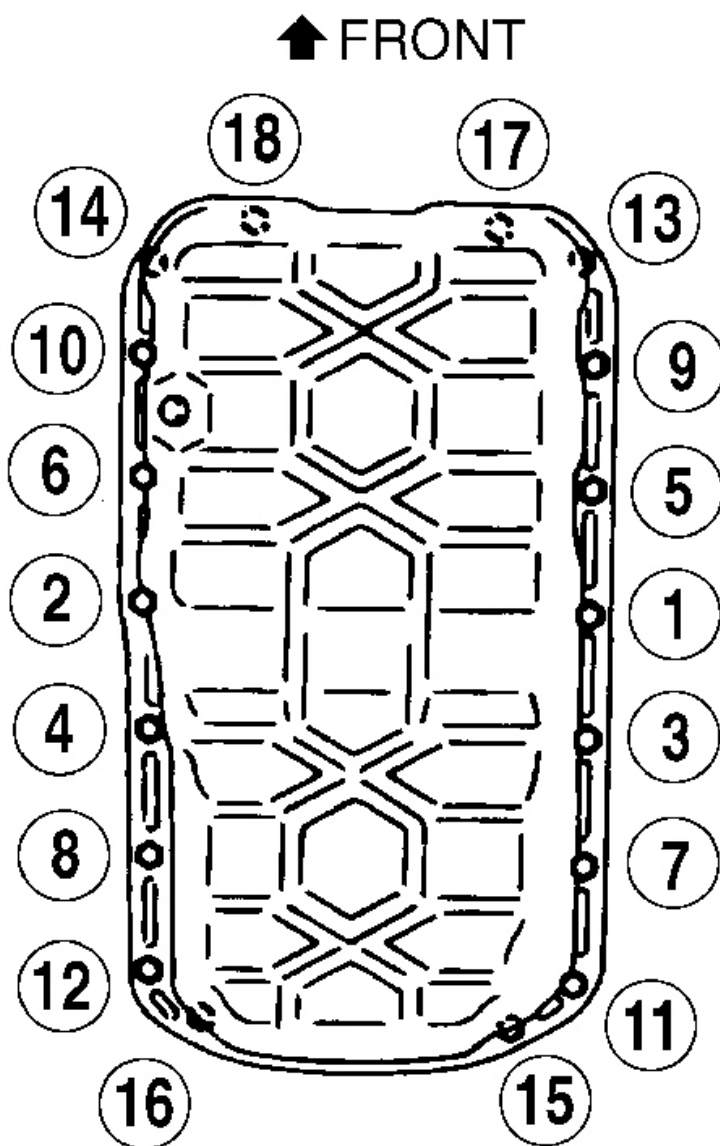


Fig. 12: Sealing Oil Pan End Gaskets & Oil Pan
Courtesy of FORD MOTOR CO.



TIGHTENING SEQUENCE

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Fig. 13: Oil Pan Tightening Sequence
Courtesy of FORD MOTOR CO.

OVERHAUL

CYLINDER HEAD

CAUTION: Replace cylinder head if warpage exceeds specification.

Cylinder Head

Check cylinder head warpage at cylinder block and manifold mating surfaces. Replace head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Valve Springs

Inspect valve spring free length and pressure. Replace valve spring if not within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seals

Using Slide Hammer (T50T-100-A) and Seal Remover (T89P-6510-D), remove valve stem oil seal from cylinder head. Using Seal Installer (T92P-6510-AH), press seal in by hand until it is fully seated.

Valve Guides

To replace valve guide, drive valve guide from camshaft side of cylinder head using Valve Guide Remover/Installer (T89P-6510-A). Using valve guide remover/installer, install valve guide until its top is seated in cylinder head 0.520-0.528" (13.2-13.4 mm) from lower valve spring seat. See **Fig. 14**.

Valve Seat

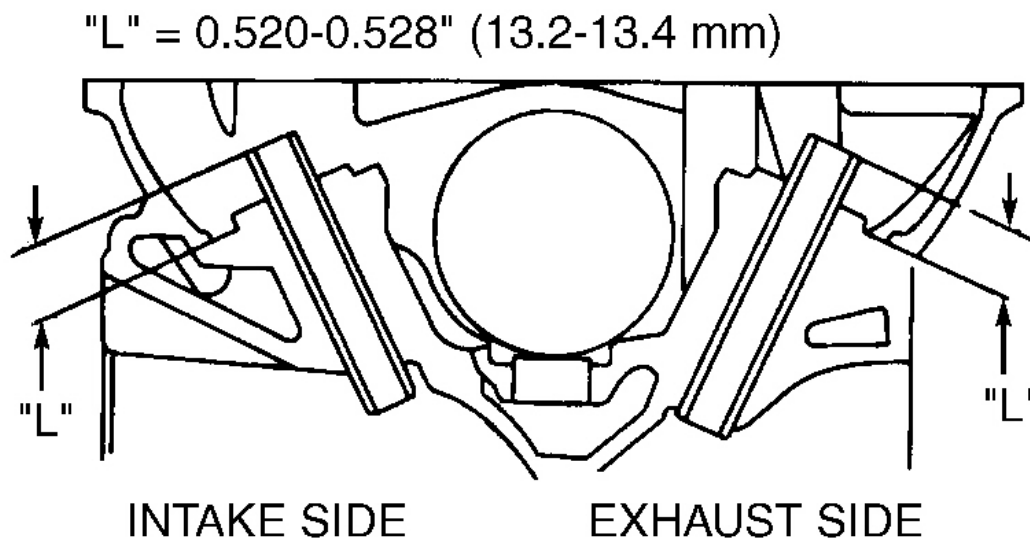
Valve seat angle and seat width must be within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Replacement information is not available from manufacturer.

Valves

Ensure head diameter, stem diameter, stem length and valve margin are within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Seat Correction Angles

Use a 30-degree wheel to lower seat or a 45-degree wheel to raise seat. Use a 60-degree wheel to narrow seat width.



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Fig. 14: Installing Valve Guide
Courtesy of FORD MOTOR CO.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

Ensure rod, piston and rod cap are marked with matching cylinder number before removing. Install piston with indent on top of piston toward front of engine. Ensure connecting rod is installed with front mark ("W") toward front of engine. See **Fig. 15**.

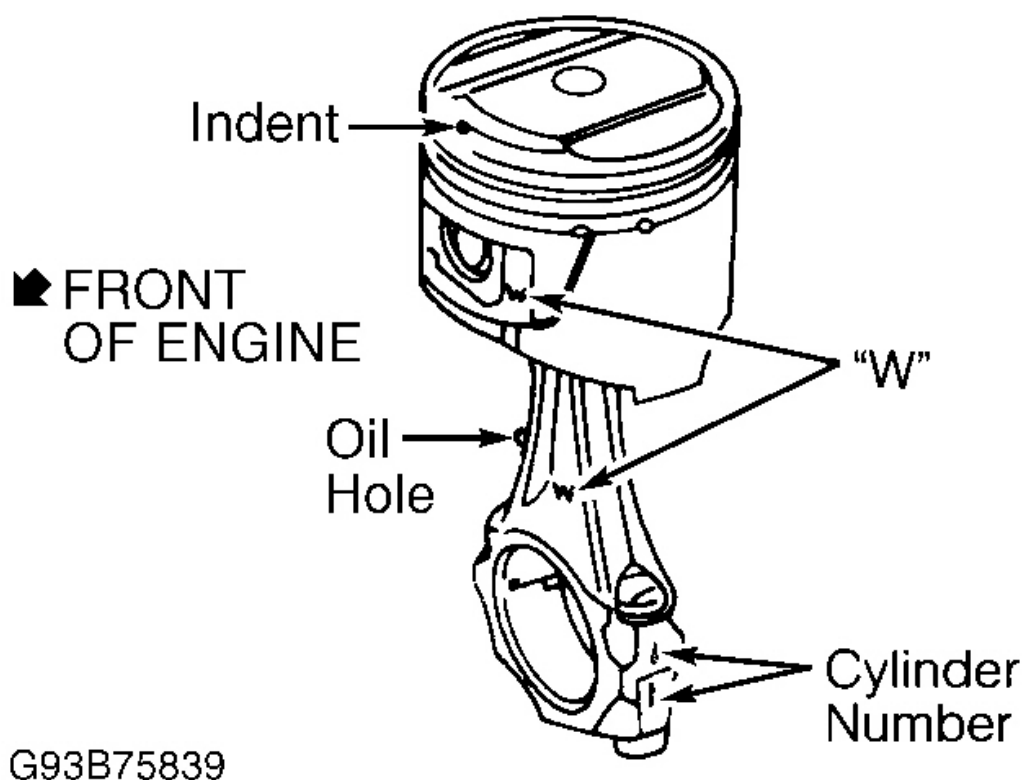


Fig. 15: Installing Piston & Connecting Rod
 Courtesy of FORD MOTOR CO.

Fitting Pistons

Ensure piston-to-bore clearance is as specified. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

Piston Rings

Ensure ring end gap and side clearance are within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Piston rings must be properly installed. Position piston rings so end gaps are placed 120 degrees apart, but DO NOT align with piston pin.

Rod Bearings

1. Ensure rod, piston and rod cap are marked with matching cylinder number before removing. Coat rod bearings with Assembly Lubricant (D9AZ-19579-D) before installing. Before installation, place rubber or plastic tube over rod bolt threads to protect crankshaft bearing surfaces. Coat rod bolts with oil before installing nuts.
2. Install piston with indent on top of piston toward front of engine. Ensure connecting rod is installed with front mark "W" toward front of engine. See **Fig. 15**.
3. Ensure bearing oil clearance and side clearance are within specification. See **CRANKSHAFT, MAIN**

& CONNECTING ROD BEARINGS and **CONNECTING RODS** tables under ENGINE SPECIFICATIONS.

4. When tightening connecting rod nuts, it must be done in 2 steps. Step 1: Tighten connecting rod nuts to 10-12 ft. lbs. (14-16 N.m). Step 2: Turn connecting rod nuts 60-65 degrees. If no degree wrench is available, tighten to 28-32 ft. lbs. (38-44 N.m).

Crankshaft & Main Bearings

1. Four main bearings are retained by a single bearing cap which also stiffens the crankcase. Loosen main bearing cap bolts in 2 steps following correct sequence. See **Fig. 16**.
2. Coat main bearings with Assembly Lubricant (D9AZ-19579-D) before installing. Apply oil to main bearing cap bolts.
3. Tighten main bearing cap in 2 or 3 steps in correct sequence to 66-74 ft. lbs. (90-100 N.m). See **Fig. 17**.

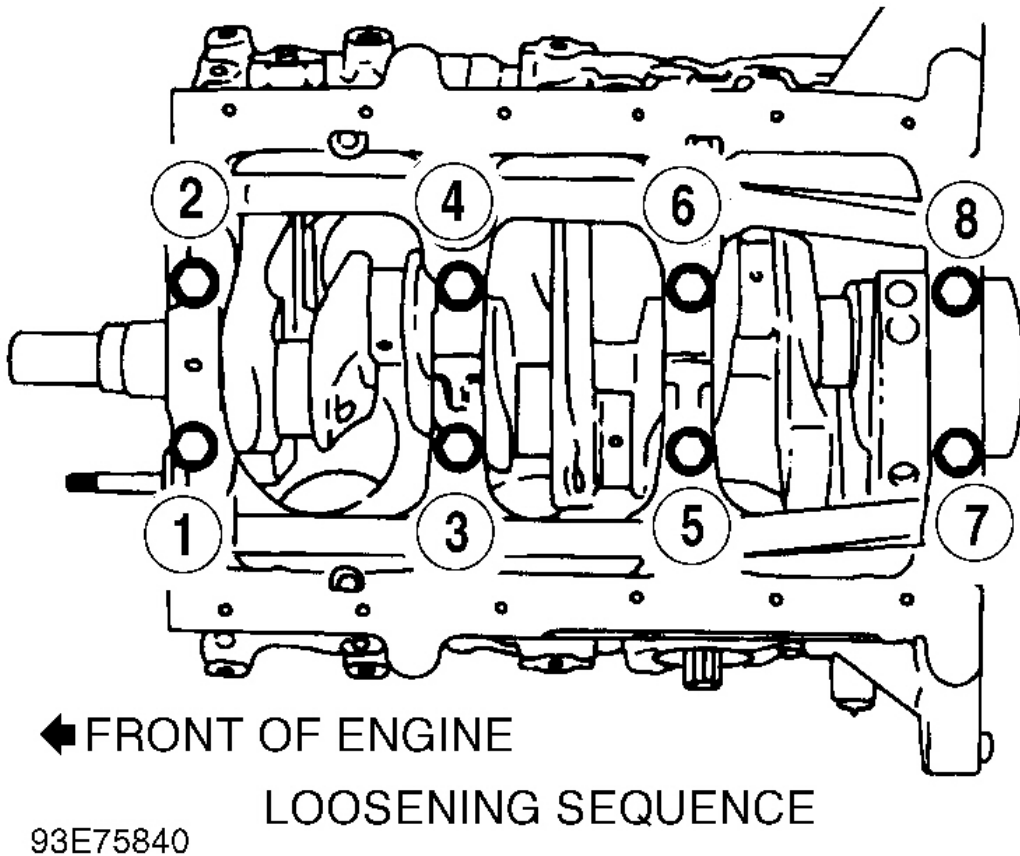
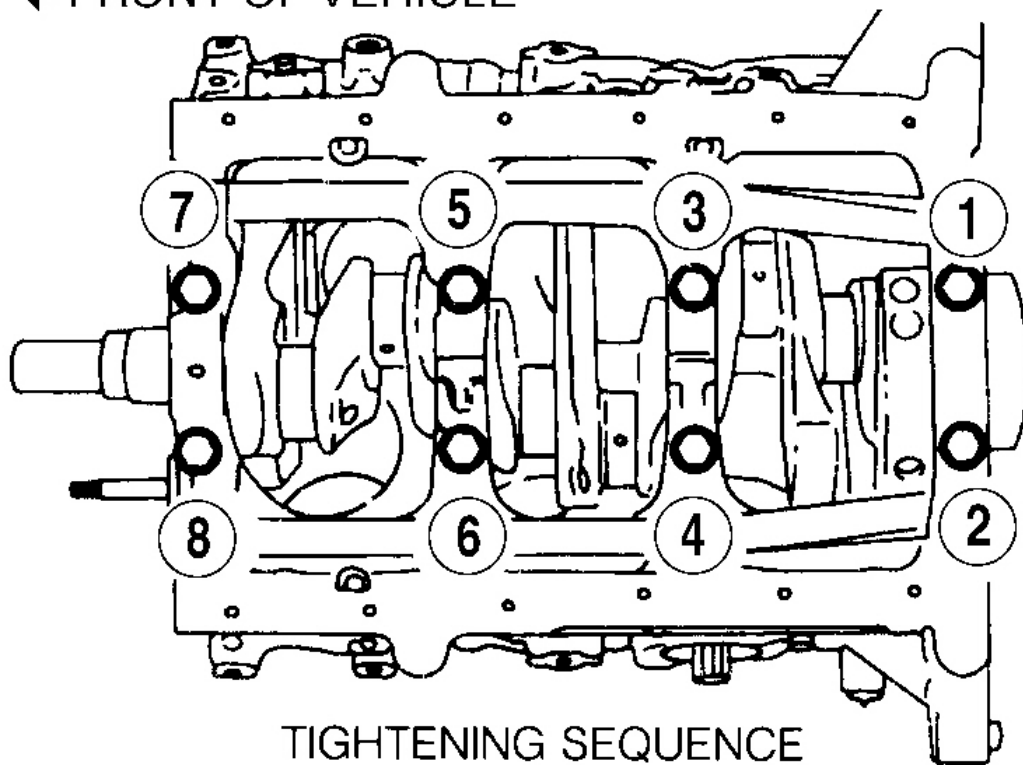


Fig. 16: Main Bearing Cap Bolt Loosening Sequence
Courtesy of FORD MOTOR CO.

← FRONT OF VEHICLE

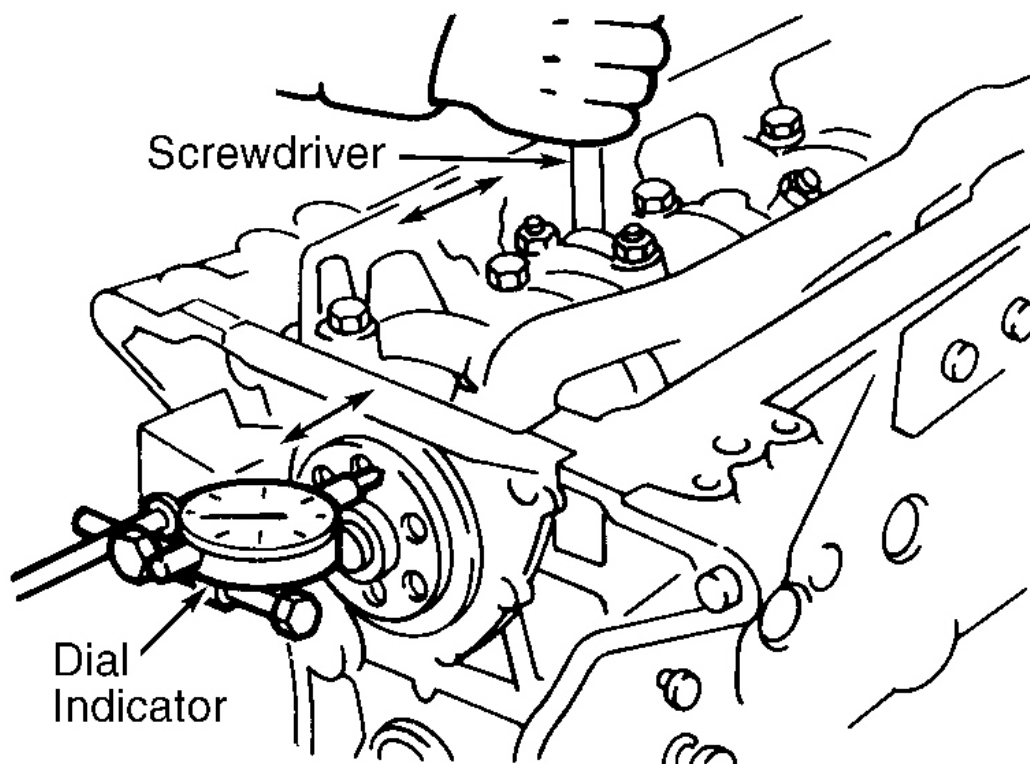


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Fig. 17: Main Bearing Cap Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Thrust Bearing

1. Thrust bearing is integral with main bearing No. 4. Apply a liberal amount of clean oil to main bearings, thrust bearings and main journals. Install crankshaft and main bearing cap.
2. Tighten main bearing cap in 2 or 3 steps in correct sequence. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS**. Using a dial indicator and a screwdriver, measure crankshaft end play. See **Fig. 18**. End play should be 0.0020-0.0067" (0.050-0.17 mm). If end play exceeds 0.0118" (0.30 mm), replace thrust bearing with one of oversize thickness.



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Fig. 18: Measuring Crankshaft End Play
Courtesy of FORD MOTOR CO.

Cylinder Block

Cylinder bore diameter is measured at top, middle and bottom of bore. Check cylinder bore diameter, taper, out-of-round and deck warpage. Repair or replace if not within specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

CAUTION: DO NOT remove more than .008" (.20 mm) from combined cylinder block deck and cylinder head thickness when resurfacing.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pump is positive displacement, crankshaft driven. Oil is drawn from oil pan through an oil pickup tube and strainer. Pump sends oil to oil filter, and from there it is directed to cylinder heads and engine block under pressure. The oil then drains back to oil pan. See **Fig. 19**.

Crankcase Capacity

Oil capacity is 4.2 qts. (4.0L) with filter and 3.7 qts. (3.5L) without filter.

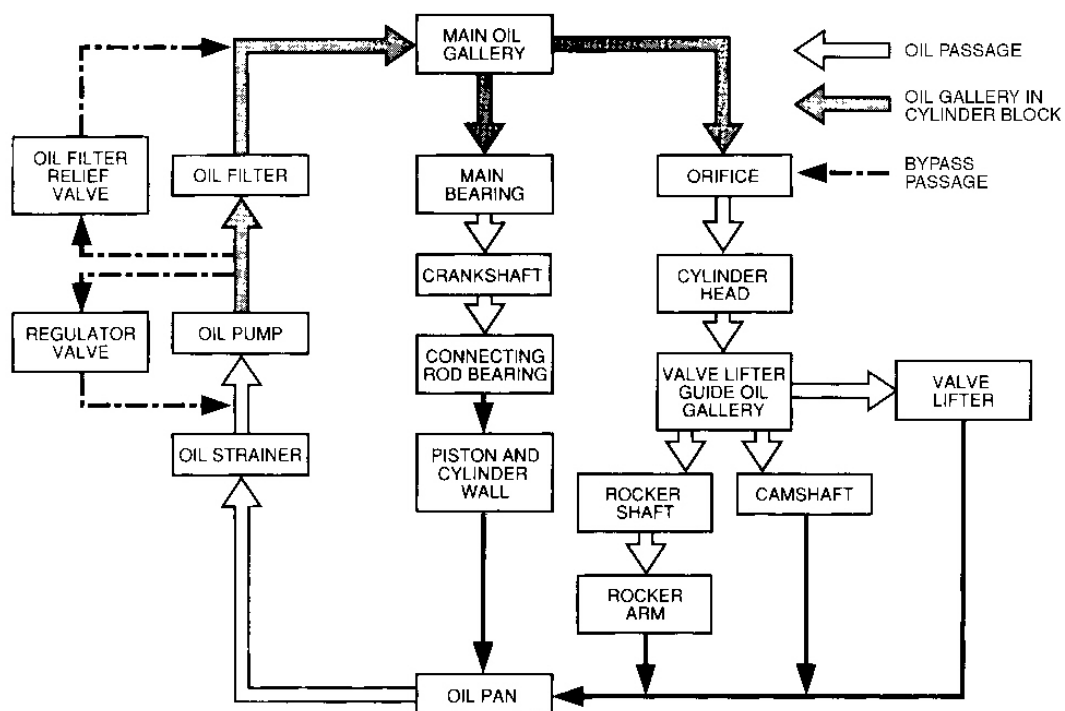


Fig. 19: View Of Engine Oil Circuit
Courtesy of FORD MOTOR CO.

OIL PUMP

Removal & Disassembly

1. Disconnect negative battery cable. Remove accessory drive belts. Remove timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION. Raise and support vehicle.
2. Drain engine oil. Remove generator bracket-to-oil pump bolt and position bracket aside. Remove power steering pump bracket bolts, and position power steering pump aside. Remove crankshaft pulley. Remove outer timing belt guide. Remove crankshaft sprocket and inner timing belt guide.
3. Disconnect low oil pressure switch electrical connector. Remove 3 oil filter adapter bolts and the oil filter adapter. Discard the 2 "O" rings. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION.
4. Remove 2 oil pickup tube bolts and oil pickup tube. Discard "O" ring. Remove 6 oil pump bolts. Remove oil pump from engine block. Discard gasket.
5. Carefully pry crankshaft front seal out of oil pump body. Discard seal. Remove 6 oil pump cover screws and the oil pump cover. See **Fig. 20**.
6. Remove inner rotor from outer rotor. Remove outer rotor from pump body. Unscrew pressure regulator cap from oil pump body.

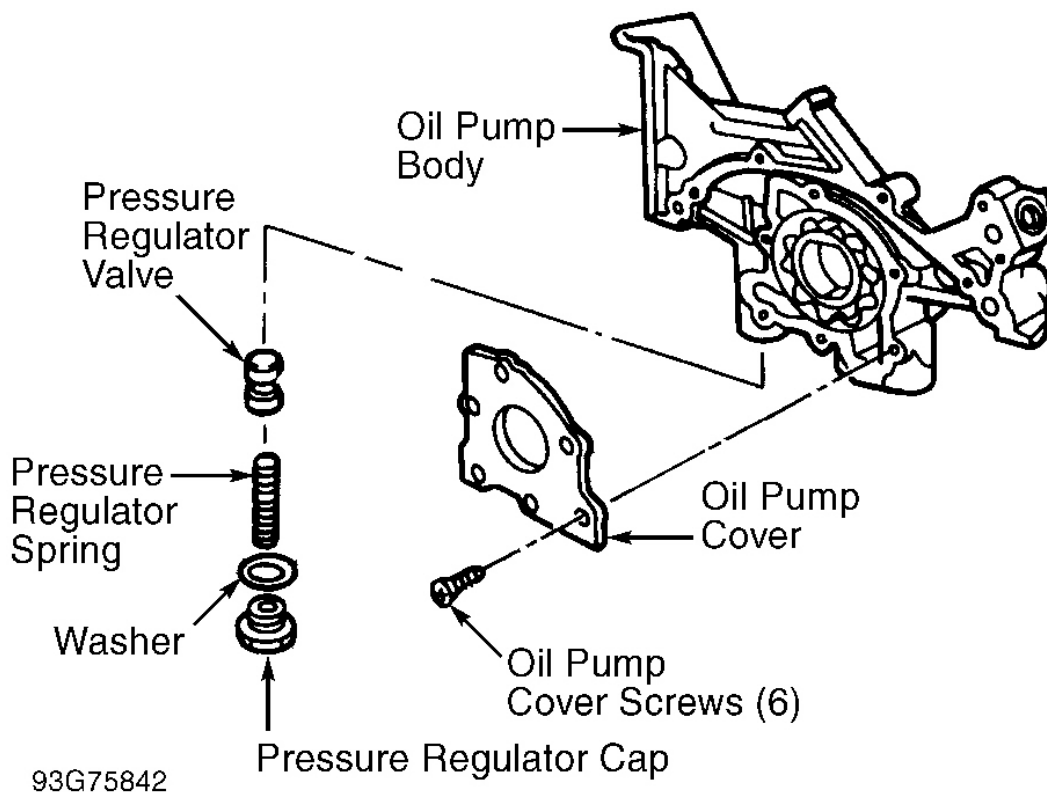


Fig. 20: Exploded View Of Oil Pump
Courtesy of FORD MOTOR CO.

Inspection

1. With a feeler gauge, measure inner rotor tooth tip clearance. Maximum clearance is 0.0071" (0.18 mm). If measurement is above specification, replace oil pump.
2. With a feeler gauge, measure outer rotor-to-pump body clearance. Maximum outer rotor-to-pump body clearance is 0.0045-0.0079" (0.114-0.200 mm). If measurement is above specification, replace oil pump.
3. Using a straightedge and feeler gauge, inspect oil pump inner rotor clearance. Maximum inner rotor clearance is 0.0020-0.0035" (0.05-0.09 mm). If measurement is above specification, replace oil pump.
4. Using a straightedge and feeler gauge, inspect oil pump outer rotor clearance. Maximum outer rotor clearance is 0.0020-0.0043" (0.05-0.11 mm). If measurement is above specification, replace oil pump.
5. Measure inner rotor ridge. Measure pump body. See **Fig. 21** and **Fig. 22** . Subtract inner ridge measurement from pump body measurement to obtain inner rotor ridge-to-oil pump body clearance. Maximum inner rotor ridge-to-oil pump body clearance is 0.0018-0.0036" (0.045-0.91 mm). If measurement is above specification, replace oil pump.

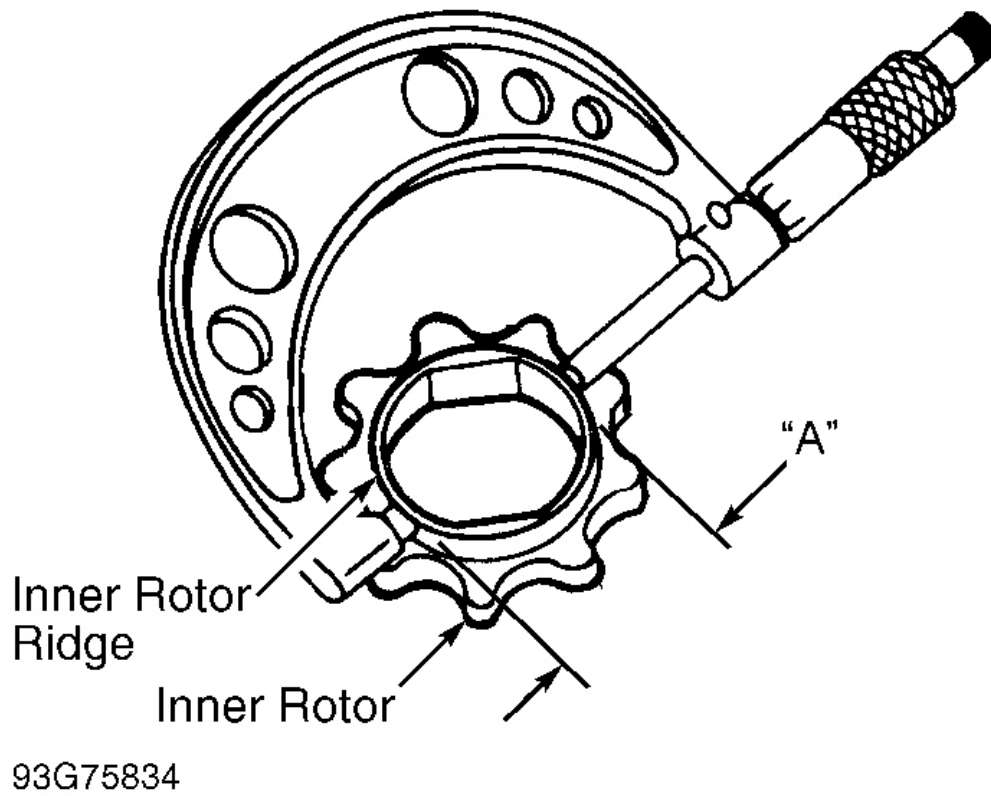


Fig. 21: Measuring Rotor Ridge
Courtesy of FORD MOTOR CO.

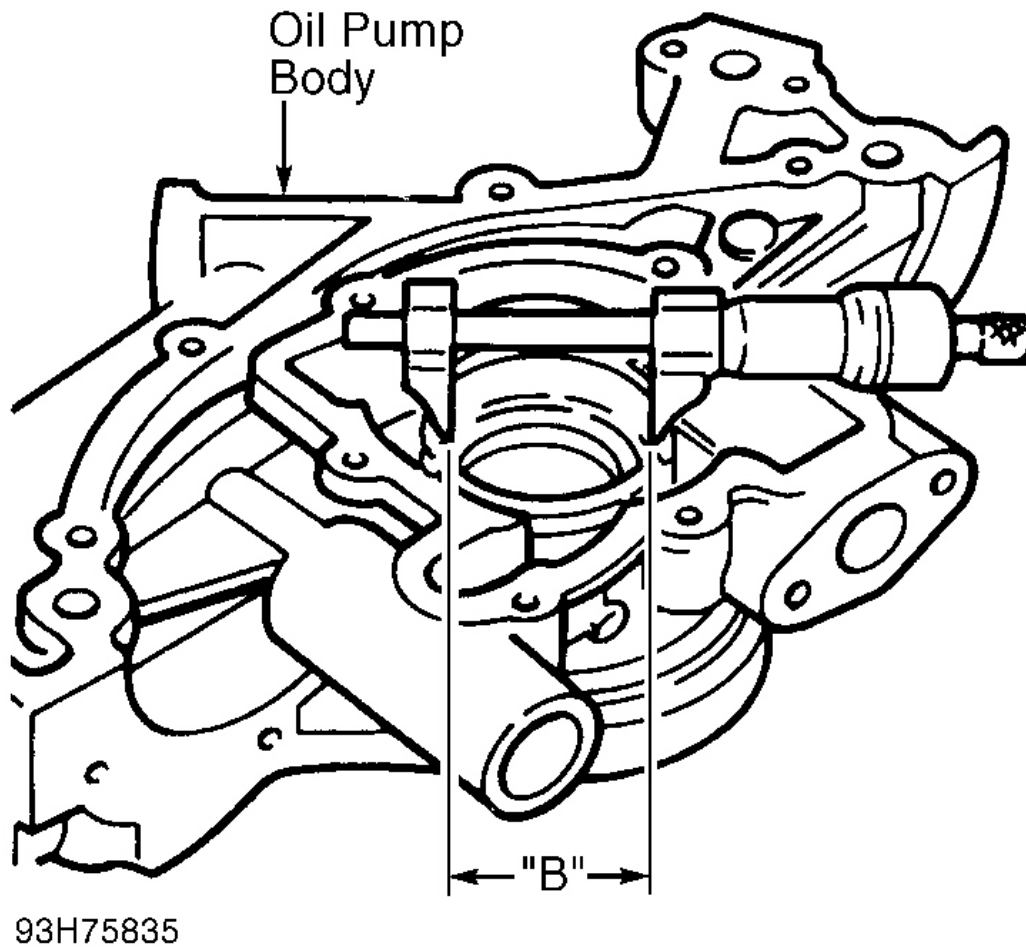


Fig. 22: Measuring Pump Body
Courtesy of FORD MOTOR CO.

6. Visually inspect pressure regulator valve and valve spring for wear or damage. Check pressure regulator housing for nicks or scratches. Coat pressure regulator valve with clean engine oil and ensure the valve slides smoothly in the housing. Replace as necessary.
7. Measure pressure regulator valve housing bore. Measure pressure regulator valve O.D. Subtract valve diameter from housing bore diameter to obtain pressure regulator valve-to-pressure regulator housing clearance. Maximum clearance is 0.0016-0.0038" (0.040-0.097 mm). If measurement is above specification, replace oil pump.

Reassembly & Installation

For reassembly and installation, reverse disassembly and removal procedures using NEW seal, gasket and "O" rings. Tighten nuts and bolts to proper specifications. See **TORQUE SPECIFICATIONS**.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

1997 Mercury Villager GS

1997-98 ENGINES 3.0L SOHC V6 - VIN 1

Application	Ft. Lbs. (N.m)
A/C Compressor Drive Belt Tensioner Bolts	15 (21)
A/C Compressor-To-Accessory Bracket Bolts	17-20 (23-27)
Camshaft Sprocket Bolt	58-65 (78-88)
Camshaft Thrust Plate Bolt	58-65 (78-88)
Catalytic Converter Inlet Pipe-To-Exhaust Bracket Bolt	32-40 (44-54)
Catalytic Converter Inlet Pipe-To-Three Way Catalytic Converter Nuts	32-40 (44-54)
Connecting Rod Nuts	(1)
Crankshaft Pulley Bolt	141-156 (191-211)
Cylinder Head Bolts	(2)
Distributor Hold-Down Bolt	10-13 (14-17)
Engine Mount Bracket Bolts (Rear)	30-38 (41-52)
Engine Mount Through-Bolts	58-65 (78-88)
Engine-To-Transaxle Bolts	22-30 (30-40)
Exhaust Bracket-To-Transaxle Nuts	22-30 (30-40)
Exhaust Manifold Nuts	13-16 (18-22)
Exhaust Manifold-To-Catalytic Converter Inlet Pipe Nuts	32-40 (44-54)
Flexplate Bolts	61-69 (83-93)
Fuel Rail Bolts	18-20 (24-27)
Generator Bracket-To-Oil Pump Bolt	15 (21)
Generator Lock Bolt	12-15 (16-20)
Generator-To-Accessory Bracket Bolts	17-19 (23-36)
Intake Manifold Bolts & Nuts	(3)
Intake Plenum Bolts	13-16 (18-22)
Main Bearing Bolts ⁽⁴⁾	66-74 (90-100)
Oil Drain Plug	21-29 (29-39)
Oil Filter	(5)
Oil Filter Adapter Bolts	12-15 (16-21)
Oil Pickup Tube Bolts	12-15 (16-21)
Oil Pump Bolts (Long)	9-12 (12-16)
Pressure Regulator Cap	29-51 (39-69)
Power Steering Pump-To-Bracket Bolts	11-15 (15-20)
Power Transistor Bracket-To-Cylinder Head Bolt	18 (25)
Radiator/Heater Pipes Bracket Bolts	15 (21)
Rocker Arm Shaft Bolts	13-16 (18-22)
Thermostat Housing Bolts	12-15 (16-21)
Timing Belt Tensioner Nut	32-43 (43-58)
Transaxle Mount Bolts (Front)	30-38 (41-52)
Transaxle Mount Nuts (Rear)	32-41 (43-55)
Transaxle-To-Engine Bolt (Lower)	22-30 (30-40)
Transaxle-To-Engine Bolt (Upper)	29-36 (39-49)
Transaxle-To-Engine Brace Bolts	22-30 (30-40)
Torque Converter-To-Flexplate Bolts	32-44 (44-59)

1997 Mercury Villager GS

1997-98 ENGINES 3.0L SOHC V6 - VIN 1

Transverse Member Bolts & Nuts	58-65 (78-88)
Upper Radiator Hose Bracket Bolt	38-48 (46-65)
Upper Radiator Hose Clamps	14-17 (19-23)
Water Pump Bolts	12-15 (16-21)
Water Pump Pulley Bolts	12-15 (16-21)
Wheel Lug Nuts	72-87 (98-118)
INCH Lbs. (N.m)	
Exhaust Manifold Flange Cover Bolts (Front)	48-59 (5.4-6.7)
Cylinder Head Bolt "A"	71 (8)
Dipstick Tube Bracket Bolts	71 (8)
Ignition Coil Bolts	71 (8)
Oil Pan Bolts	62-71 (7-8)
Oil Pump Bolts (Short)	53-62 (6-7)
Oil Pump Cover Screws	35-44 (4-5)
Rear Main Seal Housing Bolts	71 (8)
Rocker Arm Cover Screws	9-27 (1-3)
Timing Belt Cover Bolts (All)	27-44 (3-5)

(1) Tighten in 2 stages: first to 10-12 ft. lbs. (14-16 N.m), then to 28-32 ft. lbs. (38-44 N.m).

(2) See CYLINDER HEAD under REMOVAL & INSTALLATION.

(3) See INTAKE MANIFOLD under REMOVAL & INSTALLATION.

(4) See CRANKSHAFT & MAIN BEARINGS in CYLINDER BLOCK ASSEMBLY under OVERHAUL.

(5) Tighten 1 1/6 turns after gasket touches mounting surface.

ENGINE SPECIFICATIONS**GENERAL SPECIFICATIONS****GENERAL SPECIFICATIONS**

Application	Specification
Displacement	181 Cu. In. (3.0L)
Bore	3.43" (87 mm)
Stroke	3.27" (83 mm)
Compression Ratio	9.0:1
Fuel System	SFI

CRANKSHAFT, MAIN BEARINGS & CONNECTING ROD BEARINGS SPECIFICATIONS**CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS**

Application	In. (mm)
Crankshaft	
End Play	0.002-0.007 (0.005-0.18)
Runout	
Standard	.0010 (.025)

1997 Mercury Villager GS

1997-98 ENGINES 3.0L SOHC V6 - VIN 1

Limit	0.00339 (0.086)
Main Bearings	
Journal Diameter	
Grade No. 0	2.4790-2.4793 (62.984-62.975)
Grade No. 1	2.4787-2.4790 (62.959-62.967)
Grade No. 2	2.4784-2.4787 (62.951-62.959)
Journal Out-Of-Round	0.0002 (0.005)
Journal Taper	0.0002 (0.005)
Oil Clearance	
Standard	0.0011-0.0022 (0.028-0.055)
Limit	.0035 (.089)
Connecting Rod Bearings	
Journal Diameter	
	1.9667-1.9675 (49.955-49.974)
Journal Out-Of-Round	0.0002 (0.005)
Journal Taper	0.0002 (0.005)
Oil Clearance	0.0006-0.0021 (0.015-0.053)

CONNECTING RODS SPECIFICATIONS**CONNECTING RODS**

Application	Specification
Bore Diameter	
Pin Bore	0.8261-0.8265" (20.982-20.994 mm)
Crankpin Bore	1.9669-1.9682" (49.960-49.991 mm)
Maximum Bend	0.0039" Per 3.94" (0.10 mm Per 100 mm)
Side Clearance	0.0079-0.0138 (0.20-0.35 mm)

ENGINE PISTONS, PISTON PINS & PISTON RINGS SPECIFICATIONS**PISTONS, PINS & RINGS**

Application	In. (mm)
Pistons	
Clearance	0.0010-0.0018 (0.025-0.046)
Standard Diameter	
Grade No. 1	3.4238-3.4242 (86.965-86.975)
Grade No. 2	3.4242-3.4246 (86.975-86.985)
Grade No. 3	3.4246-3.4250 (86.985-86.995)

1997 Mercury Villager GS

1997-98 ENGINES 3.0L SOHC V6 - VIN 1

Oversize Diameter	
First Oversize 0.0098 (0.25)	3.4337-3.4356 (87.215-87.265)
Second Oversize 0.0197 (0.50)	3.4435-3.4455 (87.465-87.515)
Pins	
Pin Diameter	0.8256-0.8261 (20.971-20.983)
Piston Pin Hole Diameter	0.8255-0.8260 (20.969-20.981)
Pin-To-Piston Clearance	-0.0002-0.0 (-0.0005-0.0)
Rings	
No. 1	
End Gap	0.0083-0.0173 (0.21-0.44)
Side Clearance	0.0016-0.0029 (0.041-0.074)
No. 2	
End Gap	0.0071-0.0173 (0.18-0.44)
Side Clearance	0.0012-0.0025 (0.030-0.064)
No. 3 (Oil)	
End Gap	0.0079-0.0299 (0.20-0.76)
Side Clearance	.0006-.0075 (.015-.19)

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK**

Application	In. (mm)
Cylinder Bore	
Grade No. 1	3.4252-3.4256 (87.000-87.010)
Grade No. 2	3.4256-3.4260 (87.010-87.020)
Grade No. 3	3.4260-3.4264 (87.020-87.030)
Maximum Taper	0.0006 (0.015)
Maximum Out-Of-Round	0.0006 (0.015)
Minimum Deck Height	8.9606-8.9645 (227.6-227.7)
Maximum Deck Warpage (Combined Head & Block)	0.008 (0.2)

ENGINE VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS**

Application	Specification
Intake Valves	
Face Angle	45°
Head Diameter	1.654-1.661" (42.0-42.2 mm)
Minimum Margin	0.0453-0.0571" (1.15-1.45 mm)
Minimum Refinish Length	4.933-4.957" (125.3-125.9 mm)
Stem Diameter	0.2742-0.2748" (6.965-6.980 mm)
Exhaust Valves	

1997 Mercury Villager GS

1997-98 ENGINES 3.0L SOHC V6 - VIN 1

Face Angle	45°
Head Diameter	1.378-1.386" (35.0-35.2 mm)
Minimum Margin	0.0531-0.0650" (1.35-1.65 mm)
Minimum Refinish Length	4.890-4.913" (124.2-124.8 mm)
Stem Diameter	0.3136-0.3138" (7.965-7.970 mm)
Valve Springs	
Outer	
Free Length	2.016" (51.2 mm)
Out-Of-Square	0.087" (2.2 mm)
Inner	
Free Length	1.736" (44.1 mm)
Out-Of-Square	0.075" (1.9 mm)
Lbs. @ In. (kg @ mm)	
Pressure	
Inner (Valve Open)	57.3 @ 0.984 (26 @ 25)
Outer (Valve Open)	117.7 @ 1.181 (53.4 @ 30)

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD**

Application	Specification
Cylinder Head Height	4.205-4.220" (106.8-107.2 mm)
Maximum Warp	0.004" (0.10 mm)
Valve Seat Angle	45°
Valve Seat Width	
Intake	0.0689" (1.75 mm)
Exhaust	0.067" (1.7 mm)
Valve Guides	
Intake Valve	
Guide I.D.	0.2756-0.2763" (7.000-7.018 mm)
Guide Installed Height	0.520-0.528" (13.2-13.4 mm)
Stem-To-Guide Oil Clearance	0.0008-0.0021" (0.020-0.053 mm)
Exhaust Valve	
Guide I.D.	0.3150-0.3154" (8.000-8.011 mm)
Guide Installed Height	0.520-0.528" (13.2-13.4 mm)
Stem-To-Guide Oil Clearance	0.0016-0.0029" (0.041-0.074 mm)

CAMSHAFT SPECIFICATIONS

1997 Mercury Villager GS

1997-98 ENGINES 3.0L SOHC V6 - VIN 1

CAMSHAFT

Application	In. (mm)
Bore Diameter	
Journal A	1.8504-1.8514 (47.000-47.026)
Journal B	1.6732-1.6742 (42.500-42.525)
Journal C	1.8898-1.8907 (48.000-48.024)
End Play	0.0012-0.0024 (0.03-0.06)
Journal Diameter	
Journal A	1.8472-1.8480 (46.920-46.940)
Journal B	1.6701-1.6709 (42.421-42.440)
Journal C	1.8866-1.8874 (47.920-47.940)
Journal Runout	0.004 (0.1)
Lobe Height	1.5331-1.5460 (38.941-39.268)
Oil Clearance	0.0059 (0.15)

VALVE LIFTERS SPECIFICATIONS**VALVE LIFTERS**

Application	In. (mm)
Bore Diameter	0.6299-0.6304 (16.000-16.012)
Lifter Diameter	0.6278-0.6282 (15.946-15.956)
Oil Clearance	
Standard	.0018-.0035 (.046-.089)
Limit	0.0017-0.0026 (0.043-0.066)