2000-01 ENGINES

6.8L V10 - VIN S

ENGINE IDENTIFICATION

NOTE: This article also applies to Cab & Chassis.

Engine is identified by eighth character of Vehicle Identification Number (VIN). VIN is located on top of instrument panel, near lower left corner of windshield. VIN is also stamped on Vehicle Certification (VC) label mounted on left door pillar.

An engine code label is located in engine compartment, in front of radiator and on right valve cover. Label contains engine calibration number, engine build date, engine plant code and engine code.

Emission calibration number label is located on upper radiator shield. This label identifies engine calibration number, engine code number and revision level. Numbers from labels are required when ordering replacement parts.

ENGINE IDENTIFICATION CODES

Engine	Code
6.8L V10 (SOHC)	S

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

Hydraulic valve lash adjusters are used. No valve adjustment is required.

TROUBLE SHOOTING

NOTE: For trouble shooting mechanical engine components, see appropriate table in TROUBLE SHOOTING article 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. Place mating marks on engine hood and other major

assemblies before removal.

FUEL PRESSURE RELEASE & FUEL LINE CONNECTIONS

WARNING: Fuel system is under pressure. Release pressure before servicing fuel system components.

1. Remove fuel cap to release fuel tank pressure. Connect EFI Pressure Gauge (T80L-9974-B) to relief valve on right rear corner of fuel rail. Release pressure using valve on pressure gauge.
2. Before disconnecting fuel lines, disconnect negative battery cable. To disconnect fuel lines, remove retaining clip from outside of fuel line coupling.
3. Install Spring Lock Coupling Remover (D87L-9280-A) for 3/8" line, or (D87L-9280-B) for 1/2" line on fuel line coupling so it enters cage opening. See **Fig. 1**.
4. Push spring lock coupling remover into cage opening to release female fitting from garter spring. Pull couplings apart. Remove spring lock coupling remover.
5. When installing fuel lines, fit NEW fuel resistant "O" rings on fuel lines. Before installing, lightly coat "O" rings with clean engine oil. Clean fittings, and replace garter spring (if necessary).
6. Install female fitting to male fitting and push until garter spring snaps over flared end of female fitting. Ensure lines lock together and garter spring is over female fitting flared end.
7. Install retaining clip. Ensure horseshoe portion of clip is over coupling. DO NOT install retaining clip over rubber fuel line.

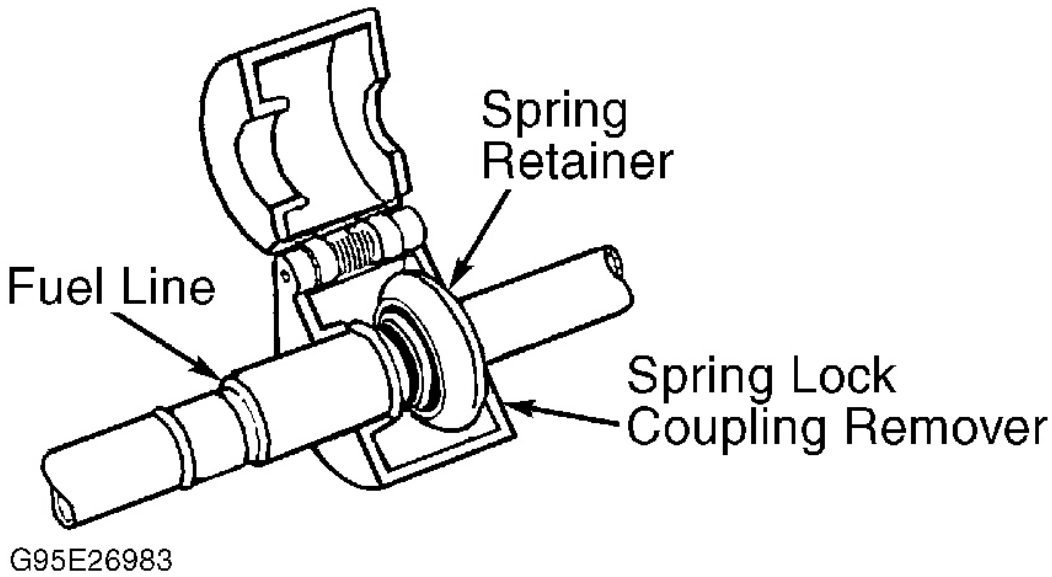

Fig. 1: Disconnecting Fuel Lines
Courtesy of FORD MOTOR CO.

ENGINE

Removal (Excursion & F250-F550 Super Duty)

1. Disconnect negative battery cable. Discharge A/C system using approved refrigerant recovery/recycling equipment. Release fuel pressure and disconnect fuel lines. See **FUEL PRESSURE RELEASE & FUEL LINE CONNECTIONS**.
2. Disconnect necessary harness and ground connections. Remove intake manifold. See **INTAKE MANIFOLD**. Remove air deflector, radiator grille, radiator grille opening panel and upper and lower core supports. Remove radiator, fan shroud and cooling fan. Remove headlights and side marker lights. Disconnect refrigerant lines, and remove A/C condenser core. Remove power steering pump bolts, and position pump aside.
3. Remove lower radiator hose. Disconnect A/C cycling switch connector at accumulator-drier. Disconnect suction hose from accumulator. Disconnect heater hose. Disconnect both oxygen sensor connectors. Raise and support vehicle. Remove exhaust manifold flange nuts.
4. Drain engine oil and remove filter. Loosen oil cooler threaded shaft, and position cooler aside. Remove starter. Remove transmission cooler line bracket. Remove ground strap. Remove flywheel inspection cover and access plug. Remove and discard torque converter bolts. Remove engine support isolator nuts.
5. Remove 4 lower engine-to-transmission bolts. Lower vehicle. Remove ground strap and transmission oil filler tube. Remove 3 upper engine-to-transmission bolts. Install Engine Lifting Bar (014-00073). Support transmission with suitable jack. Remove engine from vehicle.

Removal (E350 Econoline Van)

1. Disconnect negative battery cable(s). Discharge A/C system using approved refrigerant recovery/recycling equipment. Release fuel pressure and disconnect fuel lines. See **FUEL PRESSURE RELEASE & FUEL LINE CONNECTIONS**.
2. Disconnect necessary harness and ground connections. Remove intake manifold. See **INTAKE MANIFOLD**. Remove air deflector, radiator grille, radiator grille opening panel and upper and lower core supports. Remove radiator, fan shroud and cooling fan.
3. Remove headlight and side marker assemblies. Remove A/C condenser and plug openings. Remove accessory drive belt. Drain power steering fluid by disconnecting reservoir hose at power steering pump. Disconnect high pressure hose at power steering pump. Remove lower radiator hose. Disconnect suction hose at receiver-drier and plug openings.
4. Disconnect transmission harness and oxygen sensor connectors. Raise and support vehicle. Disconnect dual-converter "Y" pipe at exhaust manifold. Drain engine oil and remove oil filter. Remove oil cooler. Remove starter. Remove bolts, and position shift cable and bracket aside. Remove transmission-to-engine bolts.
5. Remove and discard torque converter nuts. Remove engine mount-to-subframe nuts. Lower vehicle. Remove transmission oil filler tube. Support transmission. Remove engine from vehicle.

Installation (All Models)

1. To install, reverse removal procedure. Replace torque converter nuts with new ones. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS**.
2. When installing fuel lines, fit NEW fuel resistant "O" rings on fuel lines. Lightly coat "O" rings with

clean engine oil before installing. Clean fittings, and replace garter spring (if necessary).

3. Adjust all control cables and fluid levels. Refill cooling system. Evacuate and charge A/C system.

INTAKE MANIFOLD

Removal (Excursion & F250-F550 Super Duty)

1. Disconnect negative battery cable. Release fuel pressure and disconnect fuel lines. See **FUEL PRESSURE RELEASE & FUEL LINE CONNECTIONS**. Drain cooling system. Disconnect radiator hose from thermostat housing.
2. Remove air cleaner outlet tube. Remove accelerator cable snow shield. Disconnect accelerator and speed control cables and return spring. Position accelerator cable bracket aside. Disconnect necessary vacuum and electrical connectors. Disconnect fuel injector electrical connectors from both sides of engine.
3. Disconnect heater hose. Disconnect EGR tube, and position aside. Remove 4 bolts and throttle body adapter. Remove generator. Remove ignition coils. Disconnect fuel injection supply manifold. Remove thermostat and housing. Remove upper intake manifold retaining bolts in reverse order of tightening sequence. See **Fig. 2**. Lift intake manifold assembly and remove intake manifold assembly from vehicle.
4. If separating upper and lower intake manifolds, remove lower intake manifold retaining bolts in reverse order of tightening sequence. See **Fig. 3**. Separate intake manifolds, and remove gasket.

Removal (E350 Econoline Van)

1. Disconnect negative battery cable(s). Remove engine cover. Release fuel pressure and disconnect fuel lines. See **FUEL PRESSURE RELEASE & FUEL LINE CONNECTIONS**.
2. Drain cooling system. Disconnect upper radiator hose from thermostat housing. Remove air cleaner and outlet tube assembly. Disconnect control cables from throttle body. Unbolt throttle body control cable bracket, and position aside. Remove throttle body.
3. Disconnect necessary vacuum and water connections. Disconnect necessary harness and ground connections. Disconnect EGR tube from exhaust manifold. Remove fuel injector electrical connectors. Remove spark plug wires. Remove ignition coils. Remove accessory drive belt. Remove generator.
4. Remove heater hose. Remove heater return tube. Remove thermostat. Remove upper intake manifold retaining bolts in reverse order of tightening sequence. See **Fig. 2**. Remove water return tube studs and return tube. Replace "O" rings on tube, if necessary. Lift intake manifold assembly and remove intake manifold assembly from vehicle.
5. If separating upper and lower intake manifolds, remove lower intake manifold retaining bolts in reverse order of tightening sequence. See **Fig. 3**. Separate intake manifolds, and remove gasket.

Installation (All Models)

1. To install, reverse removal procedure. Use NEW gaskets and "O" rings. Tighten intake manifold bolts to specification in sequence. See **Fig. 2** and **Fig. 3** . See **TORQUE SPECIFICATIONS**.
2. When installing fuel lines, fit NEW fuel resistant "O" rings on fuel lines. Lightly coat "O" rings with clean engine oil before installing. Clean fittings, and replace garter spring (if necessary).
3. To install remaining components, reverse removal procedure. Adjust all control cables and fluid levels. Refill cooling system. When installing spark plug wires, ensure wires are in correct position on coils.

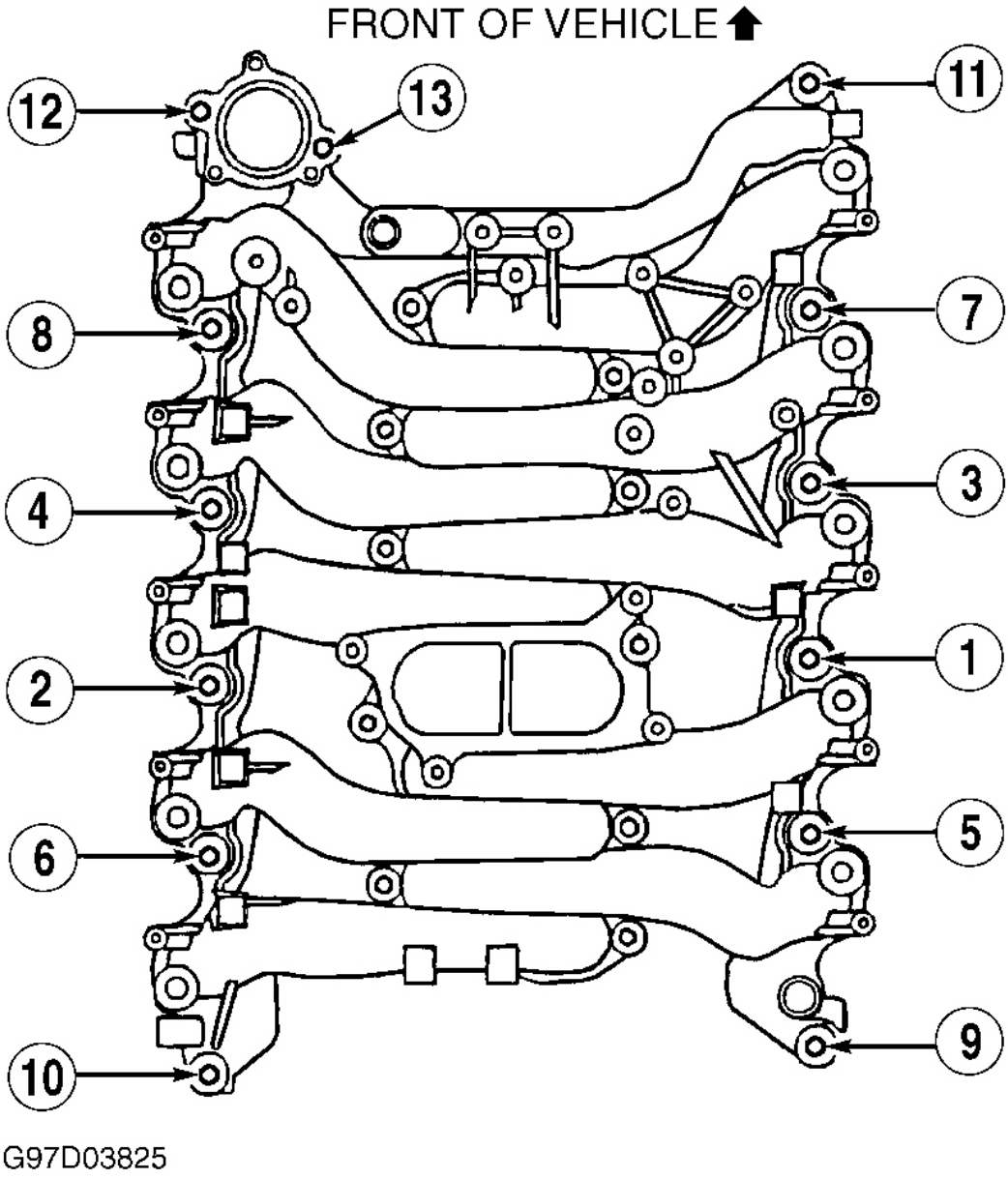

Fig. 2: Upper Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

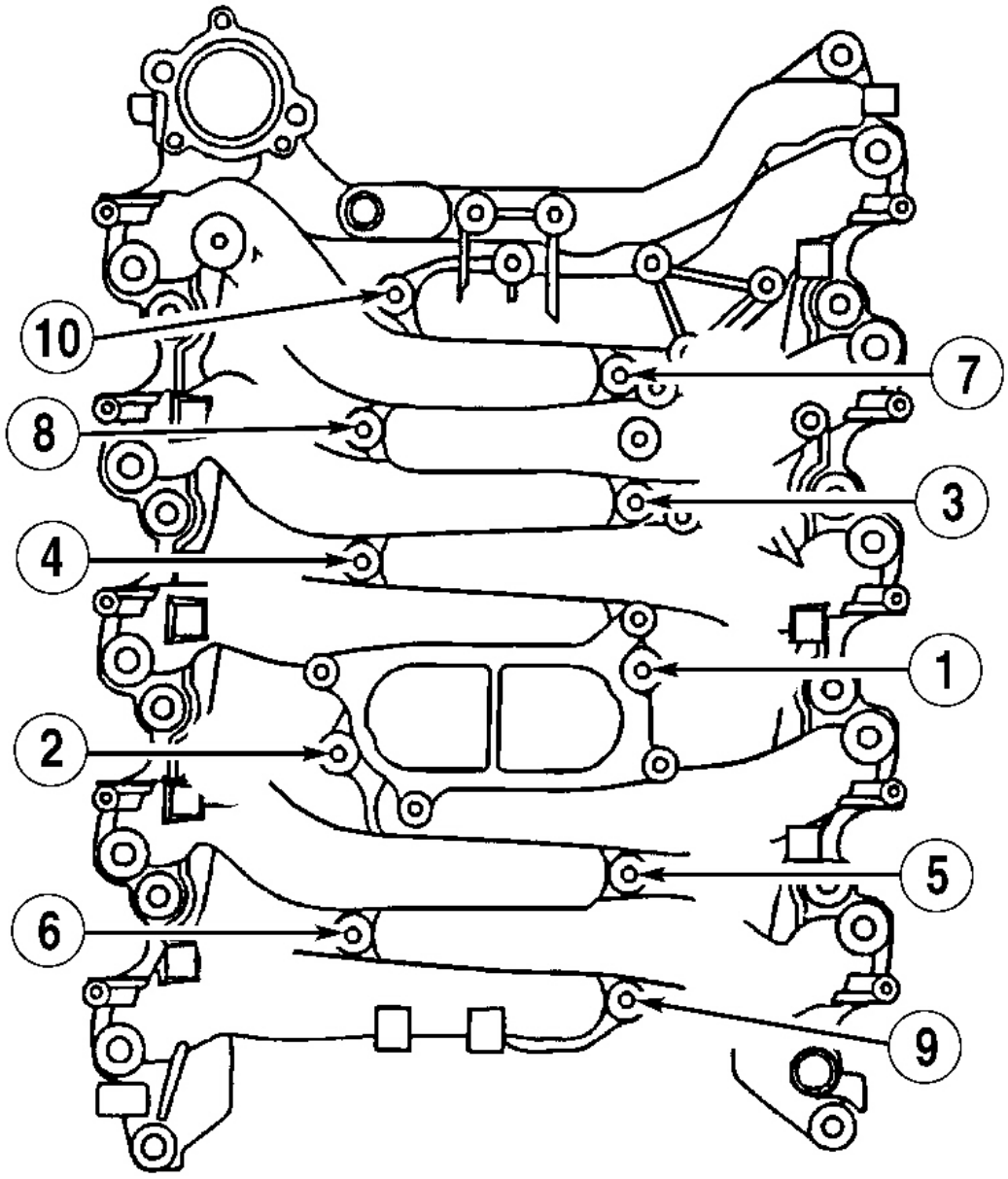

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Fig. 3: Lower Intake Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

EXHAUST MANIFOLD

Removal

Raise and support vehicle. Remove front fender splash shield. If removing left exhaust manifold, remove EGR manifold tube and brake vacuum booster hose bracket. On either side, disconnect exhaust manifold flange. Remove exhaust manifold retaining nuts in reverse order of tightening sequence. See **Fig. 4**. Remove exhaust manifold and gasket.

Installation

To install, reverse removal procedure. Tighten exhaust manifold nuts to specification in sequence. See **Fig. 4**. See **TORQUE SPECIFICATIONS**.

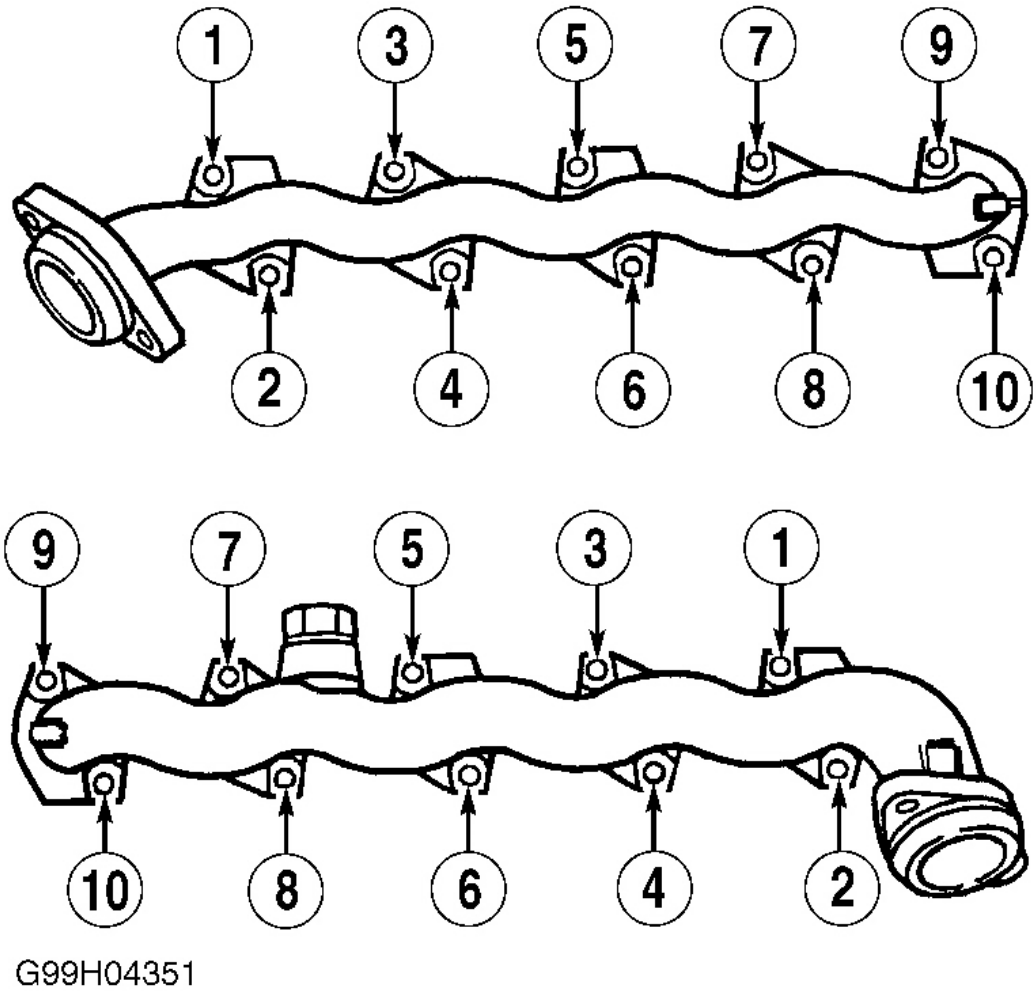

Fig. 4: Exhaust Manifold Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

CYLINDER HEAD

CAUTION: If cylinder head-to-block surface refinishing is necessary, DO NOT remove more than .010" (.25 mm) from cylinder head surface.

Removal

1. Disconnect negative battery cable(s). Remove intake manifold. See **INTAKE MANIFOLD**. Remove exhaust manifold. See **EXHAUST MANIFOLD**. Remove timing chains. See **TIMING CHAINS**. Disconnect heater hoses.
2. Remove cylinder head bolts in reverse order of tightening sequence. See **Fig. 5**. Remove cylinder head and gasket.

Inspection

Check cylinder head for warpage, cracks and damage. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Repair or replace cylinder head as necessary.

Installation

1. Ensure proper gaskets are installed. Right and left cylinder head gaskets are not interchangeable. Rotate crankshaft until keyway is in 12 o'clock position.
2. Install cylinder heads and retaining bolts. Torque bolts in sequence and to specification. See **Fig. 5**. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure. Tighten nuts and bolts to specification.

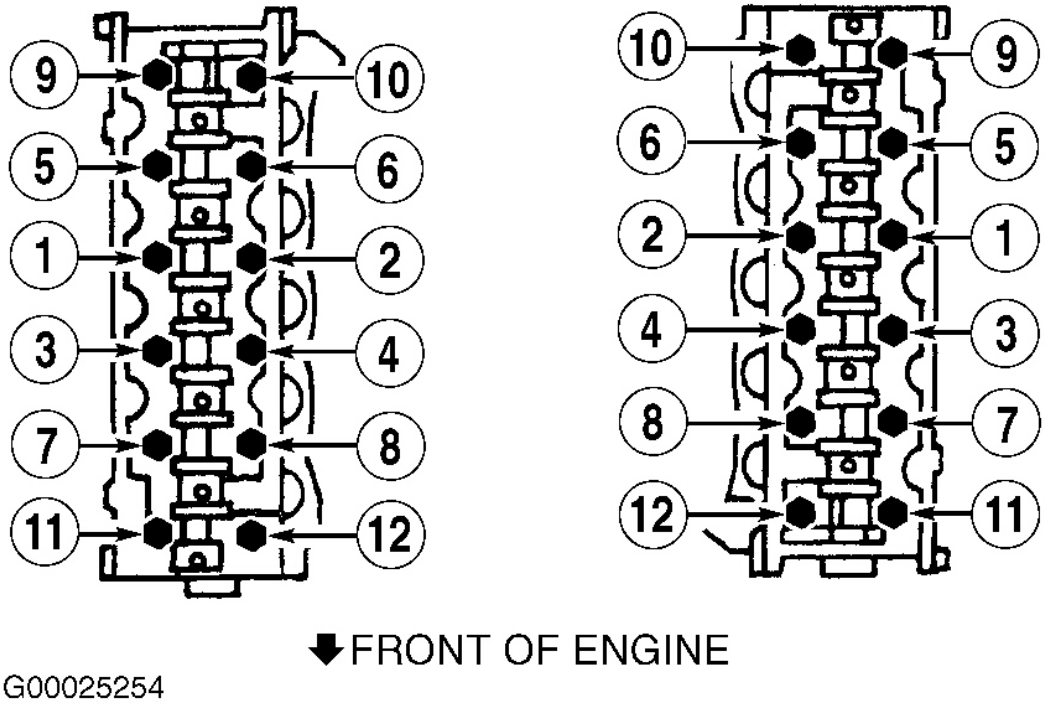

Fig. 5: Cylinder Head Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

VALVE COVERS

Removal (Excursion & F250-F550 Super Duty)

Disconnect negative battery cable. Remove air cleaner and outlet tube. Disconnect PCV hose. Disconnect fuel injector electrical connectors. On left side, disconnect fuel pressure regulator vacuum hose and lift fuel charging wiring off valve cover studs. On right valve cover, disconnect vapor vacuum hose and lift fuel charging wiring off valve cover studs. On both sides, remove valve cover attaching bolts and remove valve cover.

Removal (Van)

Disconnect negative battery cable(s). Remove engine cover. Remove intake manifold. See **INTAKE MANIFOLD**. If removing right valve cover, remove oil filler tube. On both sides, disconnect necessary harness connectors. Remove valve cover retaining bolts. Remove valve cover and gasket.

Installation (All Models)

1. Clean sealing surfaces on valve cover and cylinder head. Using gasket adhesive, glue valve cover gasket to valve cover. Apply a bead of silicone gasket adhesive to seam where cylinder head and front cover meet.

2. Install valve cover and tighten retaining bolts in sequence. See **Fig. 6**. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

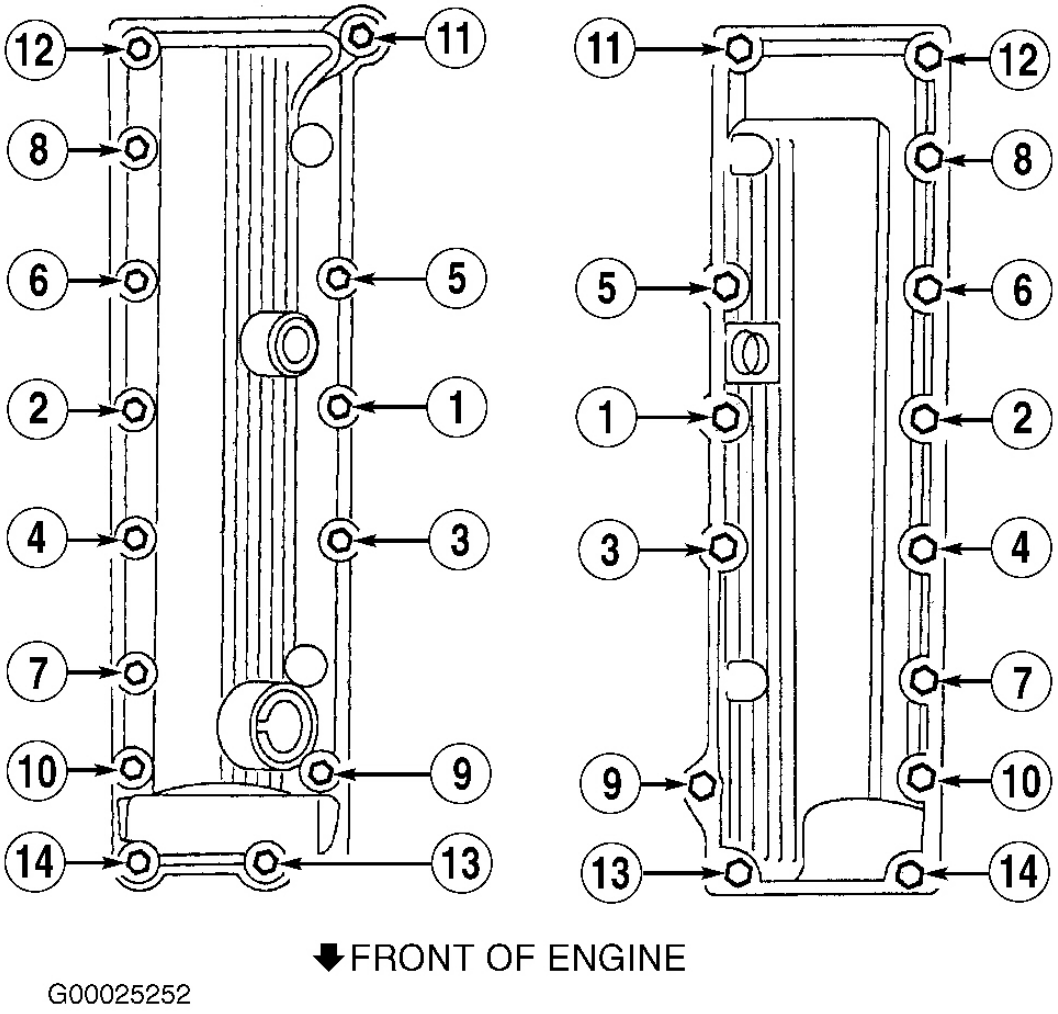

Fig. 6: Valve Cover Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

FRONT CRANKSHAFT OIL SEAL

Removal

Disconnect negative battery cable(s). Remove cooling fan and fan shroud. Remove accessory drive belt. Remove crankshaft pulley bolt. Using Crankshaft Damper Remover (T58P-6316-D), remove crankshaft damper. Using Front Crankshaft Seal Remover (T74P-6700-A), remove front crankshaft seal.

Installation

Lubricate oil seal bore and seal lip with engine oil before installing. Using Seal Installer (T88T-6701-A), install oil seal. Apply silicone sealant to keyway of crankshaft damper before installing. Using Crankshaft Damper Replacer (T74P-6316-B), install crankshaft damper. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

FRONT COVER

Removal

1. Disconnect negative battery cable(s). Remove valve covers. See **VALVE COVERS**. Remove radiator. Remove water pump. See **WATER PUMP**. Raise and support vehicle. Remove power steering pump retaining bolts, and position aside. Disconnect crankshaft and camshaft position sensor harness connectors. Drain engine oil. Remove oil pan-to-front cover bolts.
2. Lower vehicle. Remove front oil seal. See **FRONT CRANKSHAFT OIL SEAL**. Remove accessory drive belt and left side accessory drive belt idler pulley, if required. Remove front cover retaining bolts. Remove front cover and gasket.

Installation

To install, reverse removal procedure. Apply Sealant (E3AZ-19562-A) at front cover-to-oil pan, cylinder block and valve cover areas. Apply silicone sealant to keyway of crankshaft damper before installing. Tighten bolts to specification in sequence. See **Fig. 7**. Install oil pan-to-font cover bolts. Install and tighten outer bolt first. Install and tighten inner bolts. Tighten bolts in 2 stages to specification. See **TORQUE SPECIFICATIONS**.

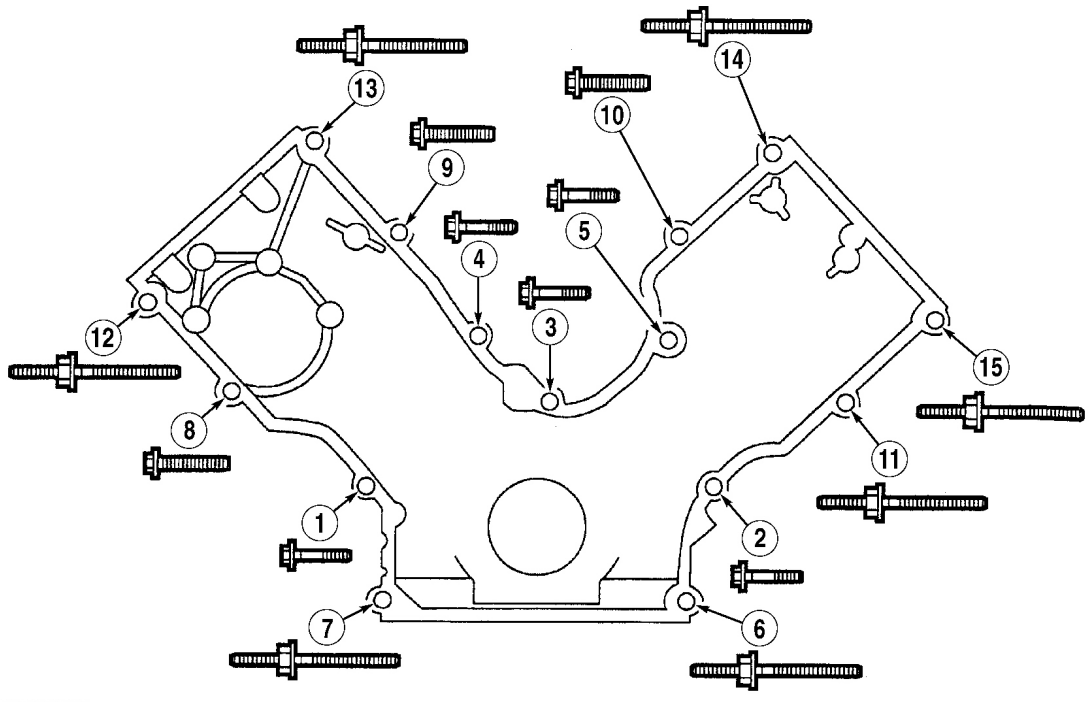

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Fig. 7: Front Cover Tightening Sequence

Courtesy of FORD MOTOR CO.

TIMING CHAINS

CAUTION: DO NOT rotate engine with timing chain removed. Damage to valves or pistons may result.

Special Tool(s)

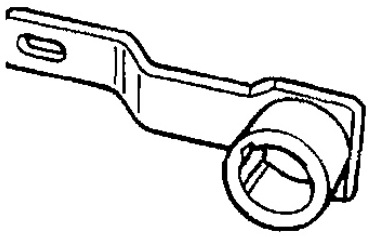
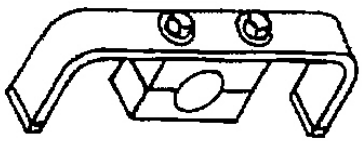
	Holding Tool, Crankshaft 303-448 (T93P-6303-A)
	Aligner, Camshaft Position 303-557 (T96T-6256-B) (2 Req'd)

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Fig. 8: Identifying Special Tools
Courtesy of FORD MOTOR CO.

Materials

Item	Specification
Super Premium SAE 5W-20 Engine Oil XO-5W20-QSP or equivalent	WSS-M2C153-H

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Fig. 9: Materials Specification
Courtesy of FORD MOTOR CO.

Removal

CAUTION: Since the engine is not free-wheeling, if the crankshaft or the camshafts are moved in any manner during removal and installation the crankshaft and camshaft must be resynchronized.

1. Remove the engine front cover. For additional information, refer to **FRONT COVER**.
2. Remove the crankshaft sensor ring from the crankshaft.

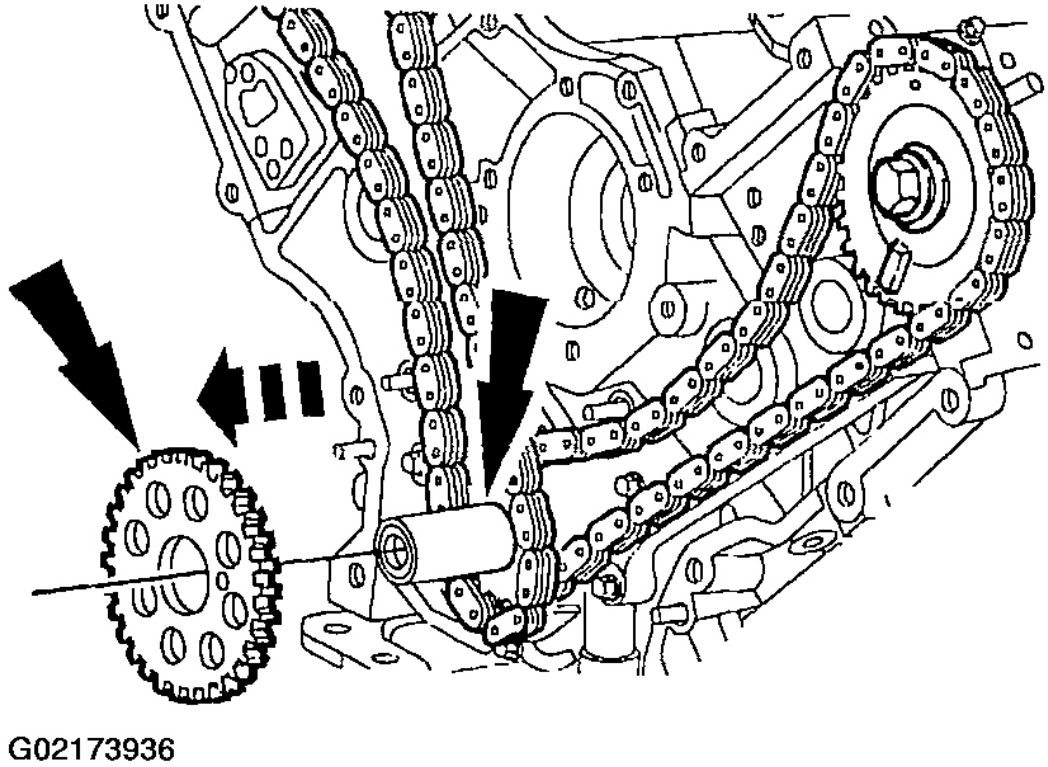

Fig. 10: Removing Crankshaft Sensor Ring From Crankshaft
Courtesy of FORD MOTOR CO.

3. Rotate the crankshaft until the timing mark on the RH camshaft sprocket is approximately at the 11 o'clock position and the timing mark on the LH camshaft sprocket is approximately at the 12 o'clock position.

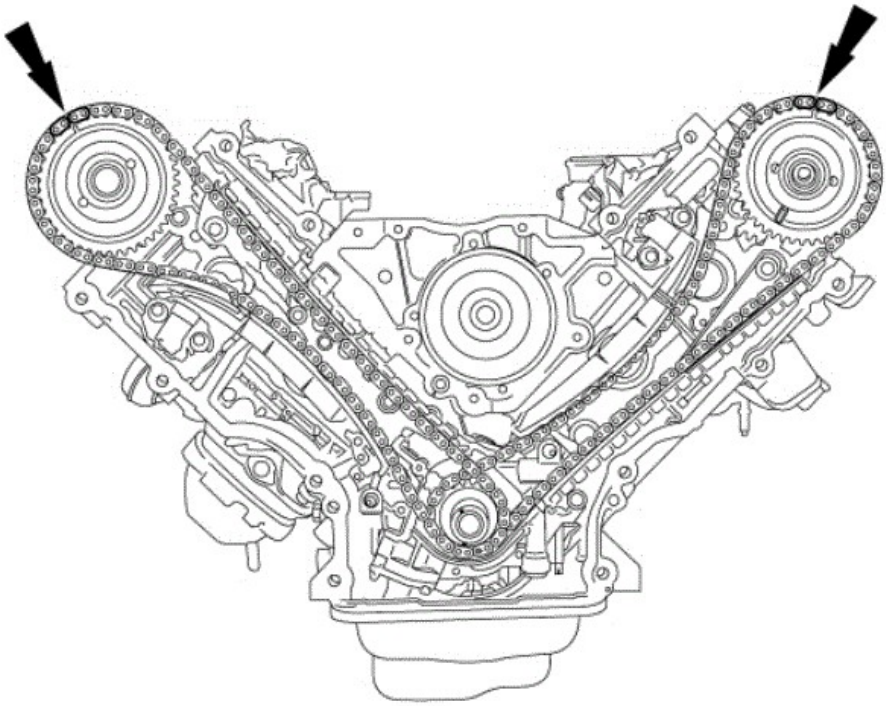

Fig. 11: Identifying Camshafts At 11:00 O'Clock Position
Courtesy of FORD MOTOR CO.

CAUTION: The caps must be marked for installation in their original location or damage to the engine may occur.

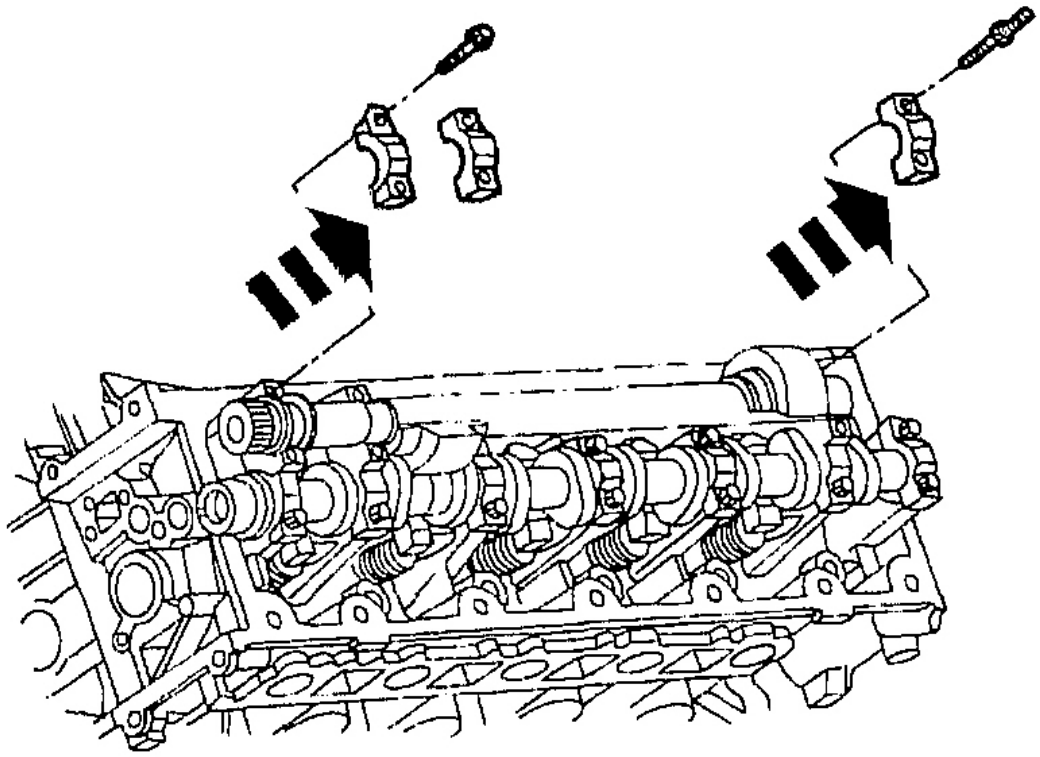

Fig. 12: Removing Balance Shaft Bearing Caps
Courtesy of FORD MOTOR CO.

4. Remove the six bolts and remove the balance shaft bearing caps.
5. Remove the balance shaft.

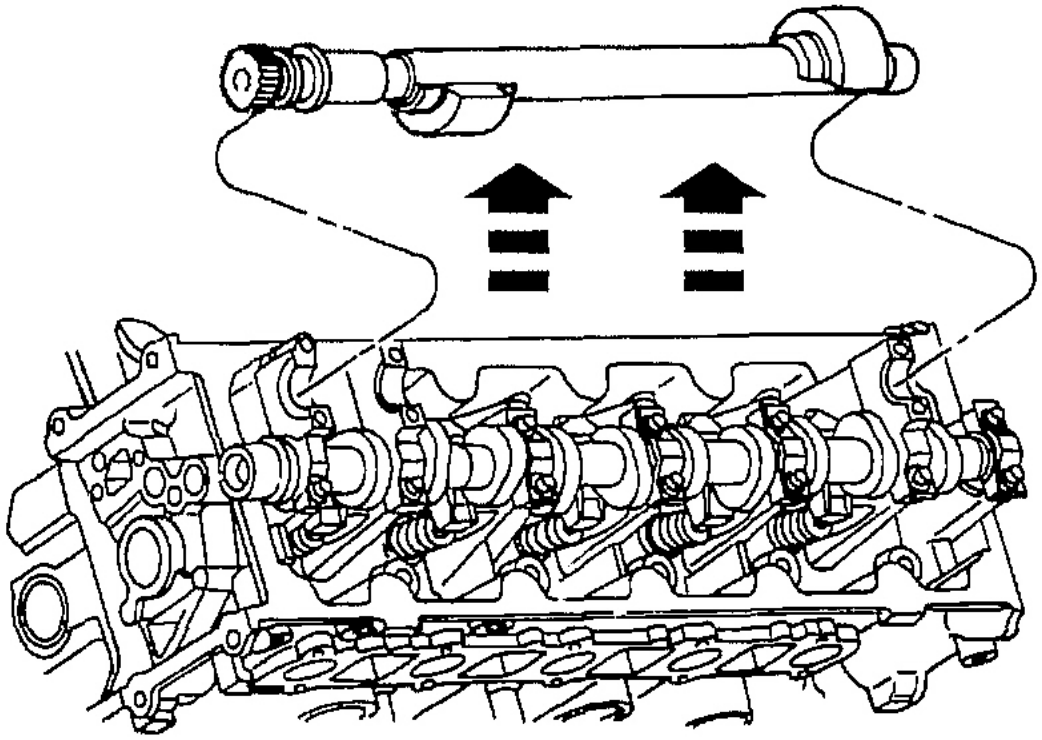

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Fig. 13: Removing Balance Shaft
Courtesy of FORD MOTOR CO.

CAUTION: Unless otherwise instructed, at no time when the timing chain (6268) are removed and the cylinder heads (6049) are installed may the crankshaft or camshaft (6250) be rotated. Severe piston (6108) and valve damage will occur.

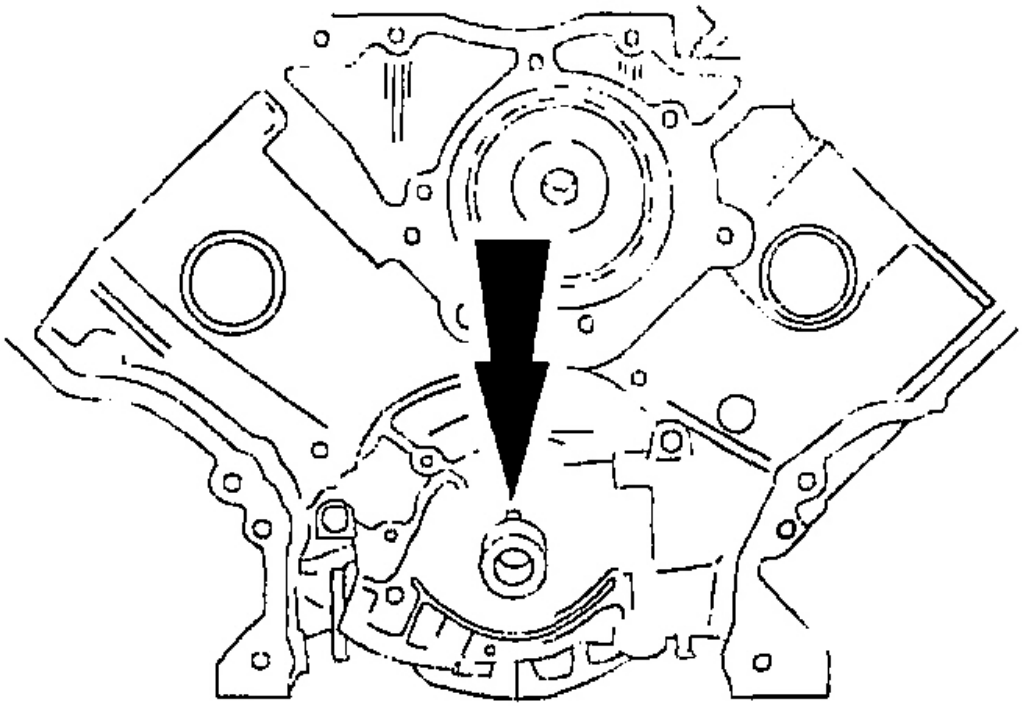

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Fig. 14: Identifying Crankshaft Keyway At 12 O'Clock Position
Courtesy of FORD MOTOR CO.

6. Position the crankshaft with the keyway at the 12 o'clock position.
7. Secure the crankshaft with the special tool.

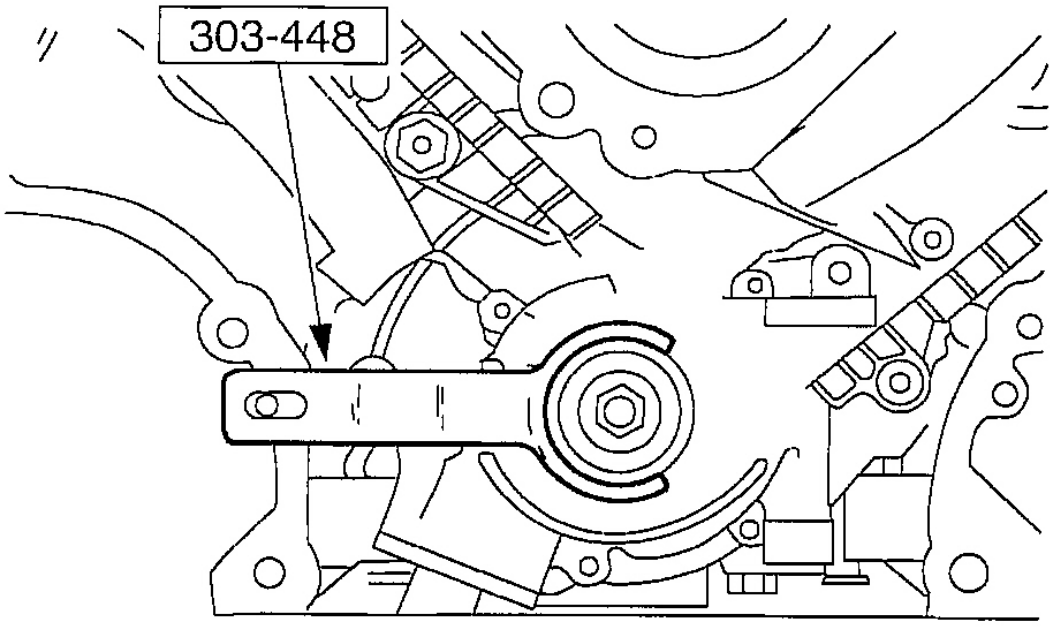

Fig. 15: Positioning Crankshaft With Special Tool
Courtesy of FORD MOTOR CO.

8. Install and carefully tighten the special tool on the camshafts.

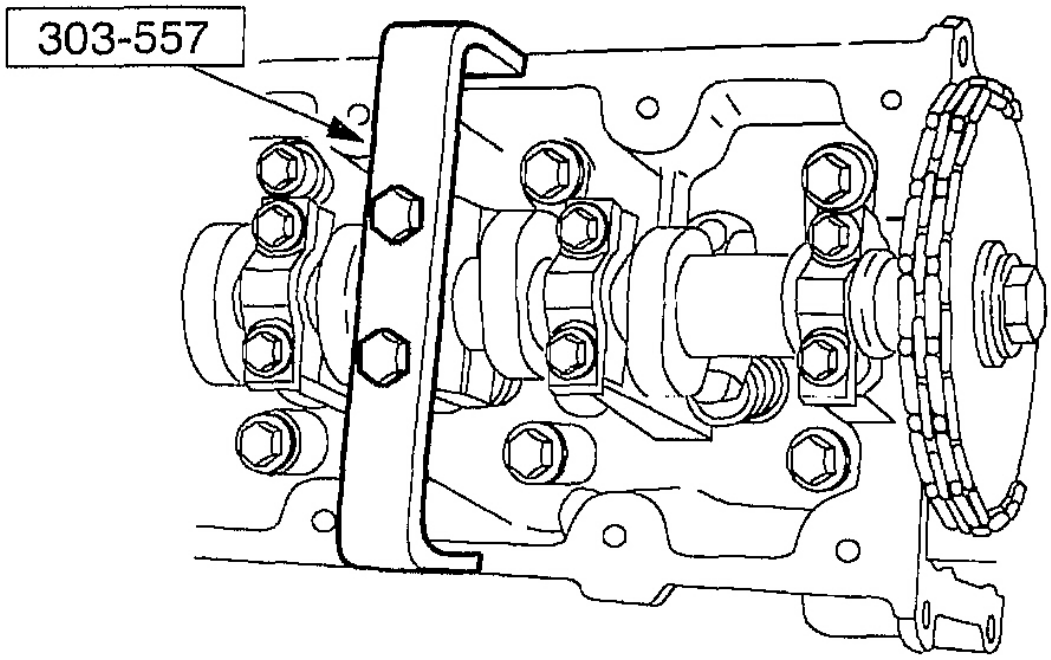

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Fig. 16: Installing Special Tool On Camshafts
Courtesy of FORD MOTOR CO.

9. Remove the timing chain tensioning system from both timing chains.
    1. Remove the bolts.
    2. Remove the timing chain tensioners.
    3. Remove the timing chain tensioner arms.

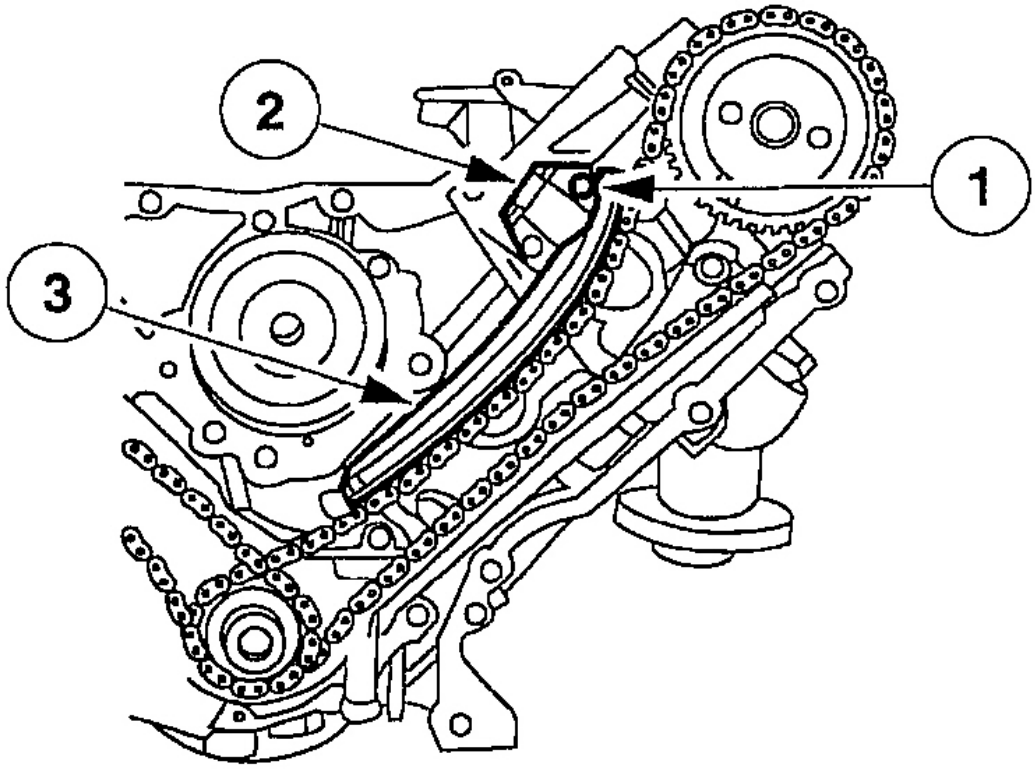

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Fig. 17: Removing Timing Chain Tensioning System From Timing Chains
Courtesy of FORD MOTOR CO.

10. Remove the LH and RH timing chain and the crankshaft sprockets.
    - Remove the RH timing chain from the camshaft sprocket.
    - Remove the RH timing chain from the crankshaft sprocket.
    - Remove the LH timing chain from the camshaft sprocket.
    - Remove the LH timing chain from the crankshaft sprocket.

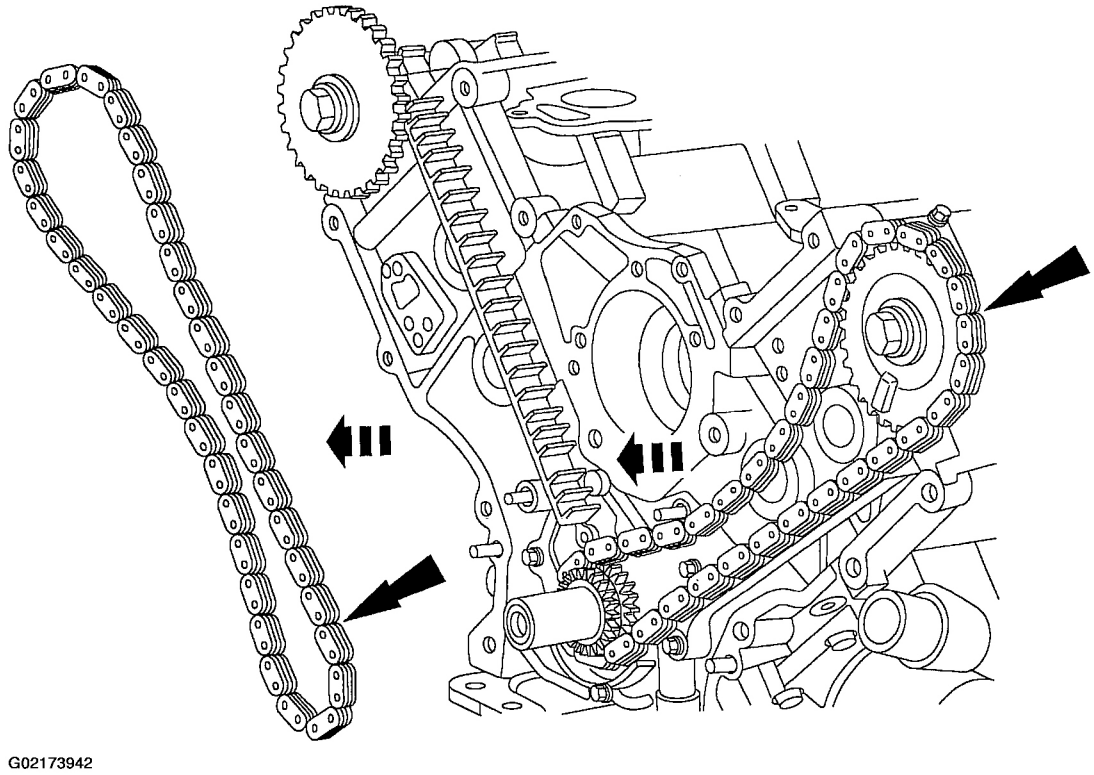

Fig. 18: Removing LH And RH Timing Chain And Crankshaft Sprockets
Courtesy of FORD MOTOR CO.

11. Remove the timing chain guides.
    - Remove the bolts.
    - Remove the timing chain guides.

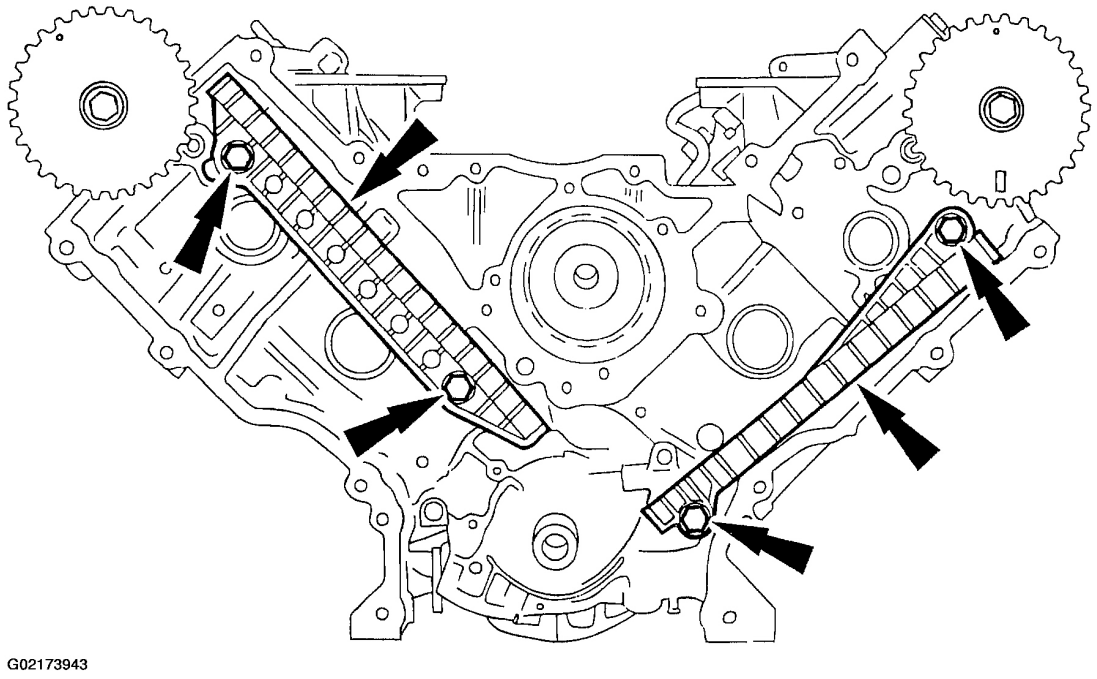

Fig. 19: Removing Timing Chain Guides
Courtesy of FORD MOTOR CO.

12. On Engines with bolt-on sprockets, remove the camshaft sprocket.
    - Remove the bolt.
    - Remove the camshaft sprocket.

Installation

CAUTION: Timing chain procedures must be followed exactly or damage to valves and pistons will result.

1. Compress the tensioner plunger, using a vise.

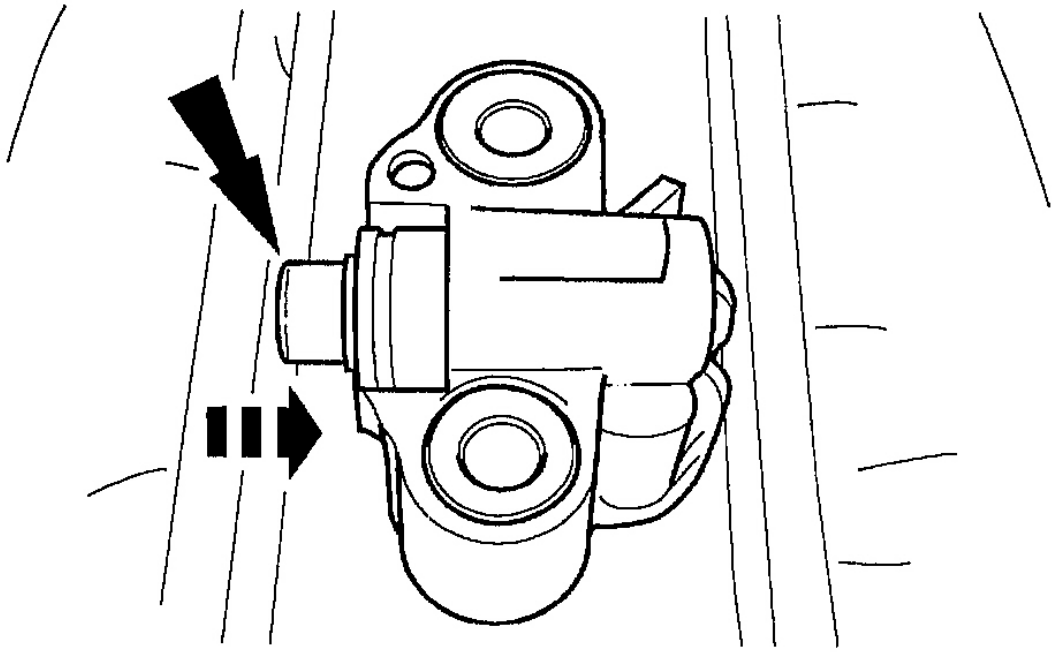

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Fig. 20: Compressing Tensioner Plunger
Courtesy of FORD MOTOR CO.

2. While holding the ratchet mechanism, push the ratchet arm back into the tensioner housing.

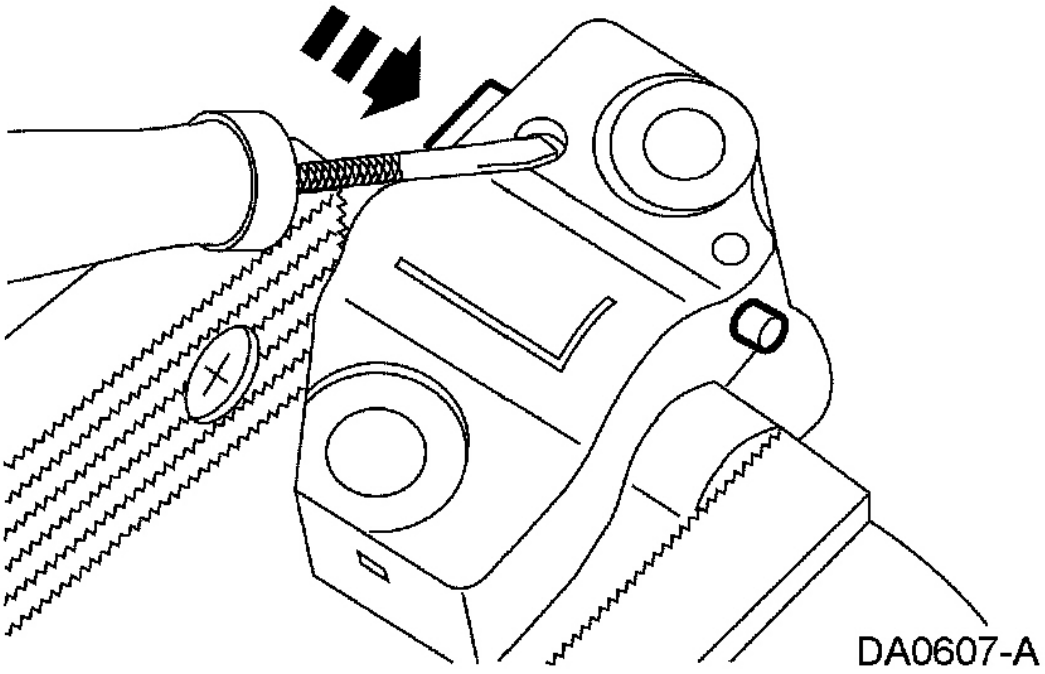

Fig. 21: Pushing Ratchet Arm Back Into Tensioner Housing
Courtesy of FORD MOTOR CO.

3. Depending on tensioner design, install a retaining clip on the tensioner to hold the plunger in during installation, or install a paper clip into the hole in the tensioner housing to hold the ratchet assembly.

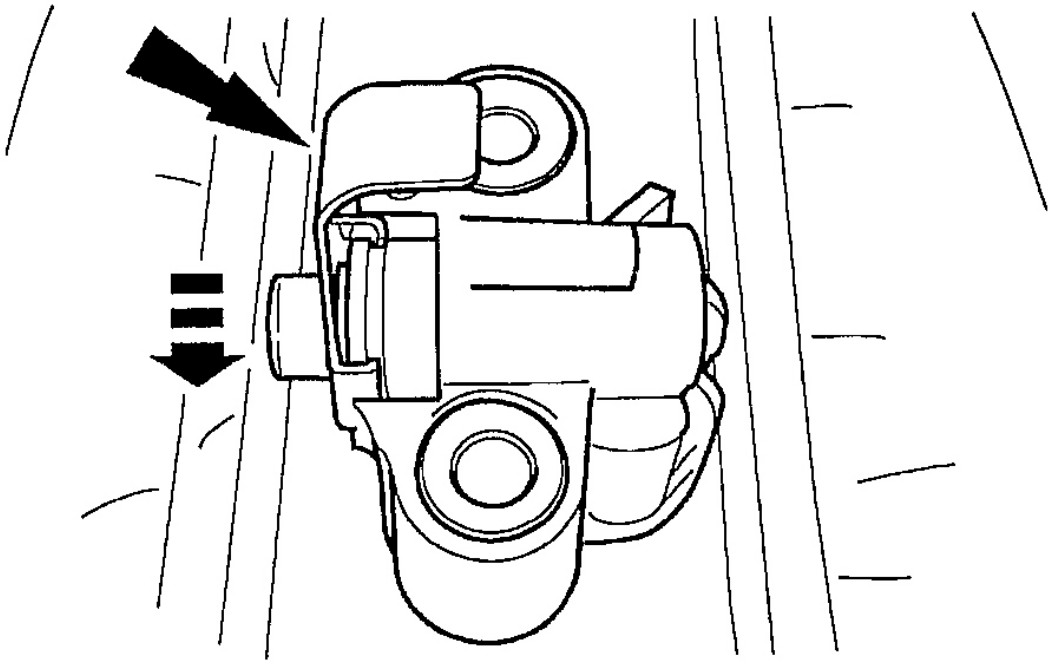

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Fig. 22: Installing Retaining Clip On Tensioner
Courtesy of FORD MOTOR CO.

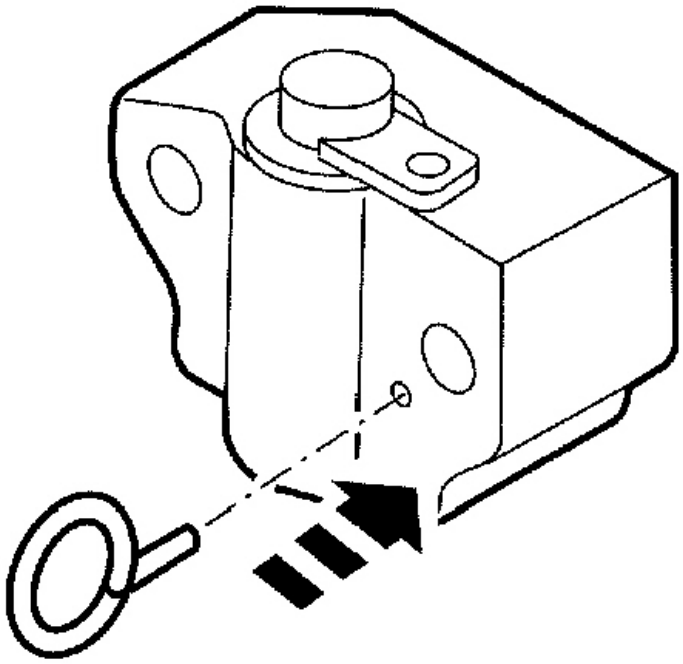

Fig. 23: Installing Paper Clip Into Hole Of Each Tensioner Housing
Courtesy of FORD MOTOR CO.

4. If copper links are not visible, mark two links on one end and one link on the other end, and use as timing marks.

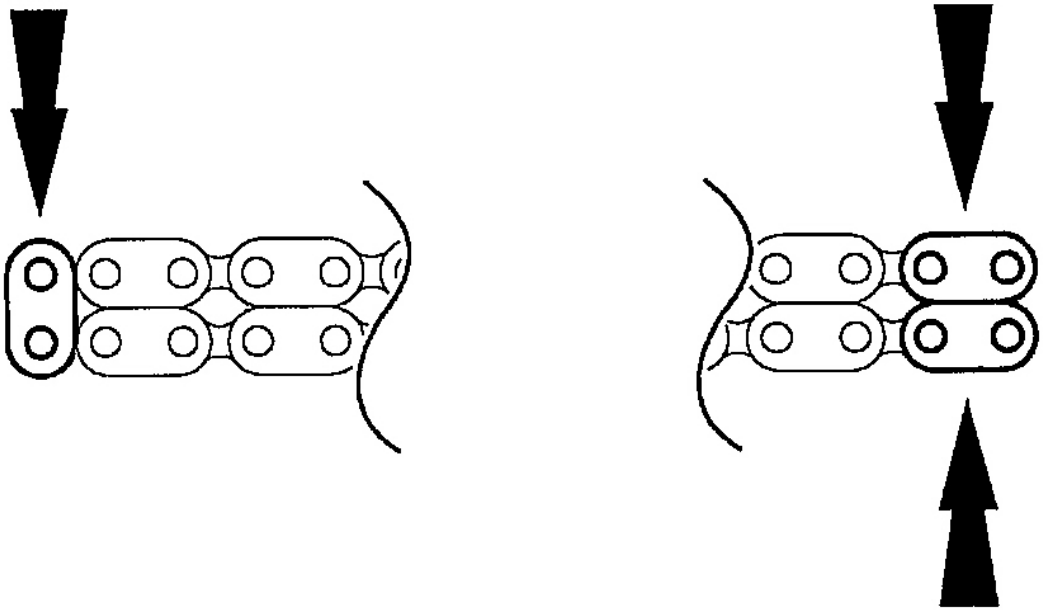

Fig. 24: Locating Link Timing Mark On Timing Chain
Courtesy of FORD MOTOR CO.

5. On engines equipped with bolt-on sprockets, install the camshaft sprocket.
    1. Install the bolt.
    2. Tighten the bolt.
        - M10 bolt: Tighten in 2 stages.
            - Stage 1: Tighten to 30 Ft. Lbs. (40 Nm).
            - Stage 2: Tighten an additional 90 degrees.
        - 12 bolt: Tighten to 120 Ft. Lbs. (120 Nm)
6. Install the timing chain guides.

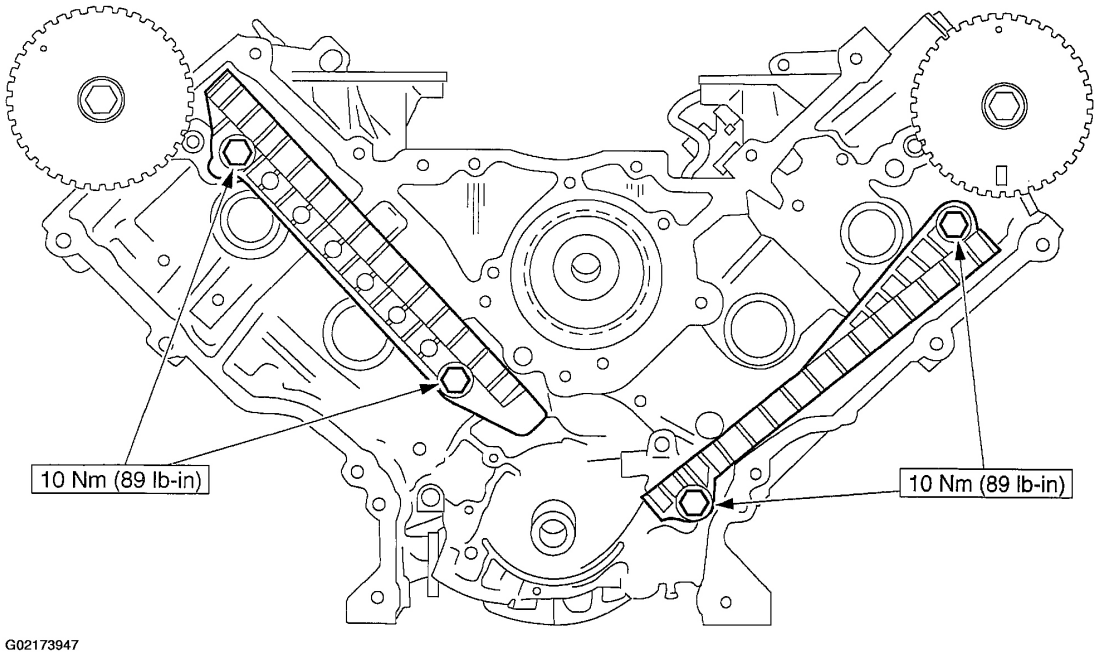

Fig. 25: Installing Timing Chain Guides
Courtesy of FORD MOTOR CO.

CAUTION: Rotate the crankshaft counterclockwise only. Do not rotate past the position shown or severe piston and/or valve damage can occur.

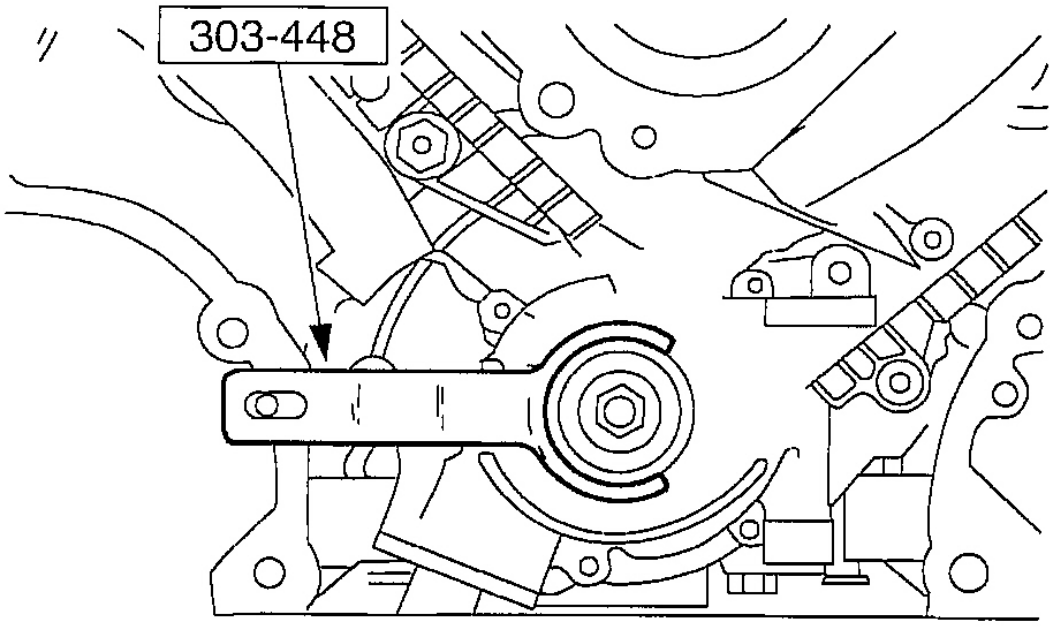

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Fig. 26: Positioning Crankshaft With Special Tool
Courtesy of FORD MOTOR CO.

7. Position the crankshaft with the special tool, remove the tool.

NOTE: Crankshaft sprockets are identical (2-piece design). They may only be installed one way. Refer to the following illustration for correct crankshaft sprocket installation.

8. If the crankshaft sprocket is a 2-piece design, install the the sprockets with the raised portion facing inward.

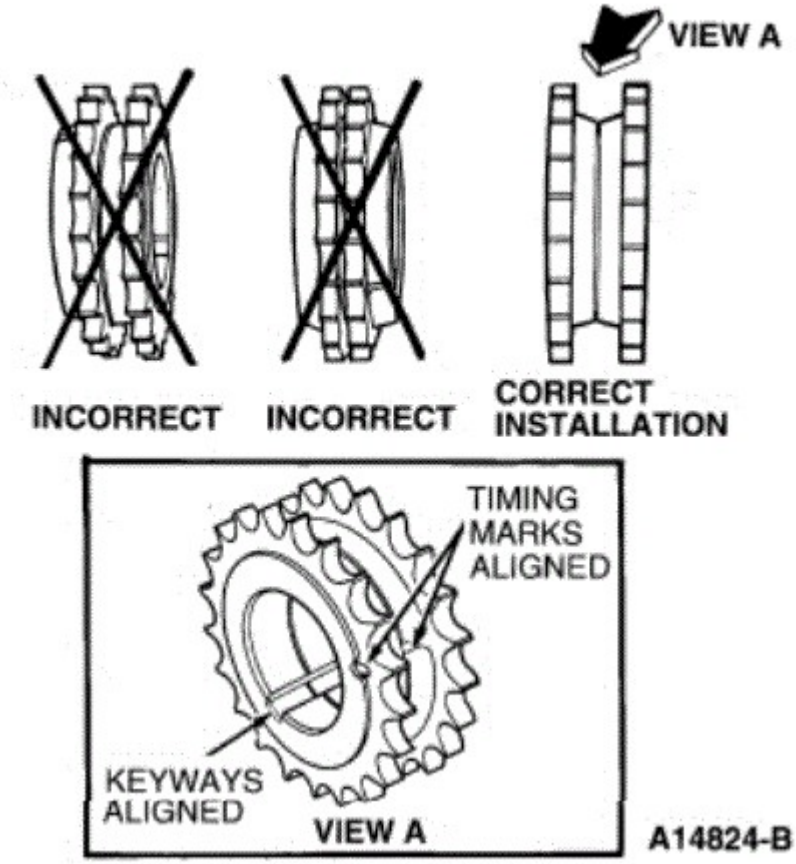

Fig. 27: Identifying Correct Installation Of Crankshaft Sprockets (2-Piece Design)
Courtesy of FORD MOTOR CO.

9. Install the crankshaft sprocket and lower end of the LH (inner) timing chain, aligning the timing marks.

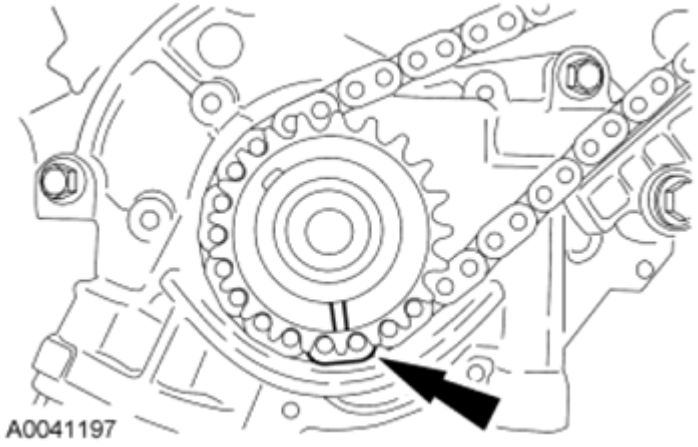

Fig. 28: Installing Crankshaft Sprocket And Lower End Of LH (Inner) Timing Chain
Courtesy of FORD MOTOR CO.

NOTE: Be sure the upper half of the timing chain is below the tensioner guide

dowel. If necessary, use the Camshaft Positioning Tool to adjust.

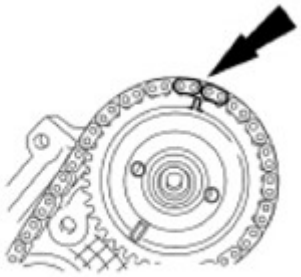

Fig. 29: Installing LH Timing Chain On Camshaft Sprocket
Courtesy of FORD MOTOR CO.

10. Install the LH timing chain on the camshaft sprocket with the two chain links and timing marks aligned.

CAUTION: The camshaft sprocket can jump time if the Camshaft Holding Tool is not secured.

NOTE: Be sure the chain link and crankshaft sprocket timing marks are aligned.

NOTE: The lower half of the timing chain must be positioned above the dowel.

11. Install the RH (outer) timing chain on the crankshaft sprocket.
12. Position the RH timing chain on the camshaft sprocket. Make sure the two copper-colored links align with the camshaft sprocket timing mark.

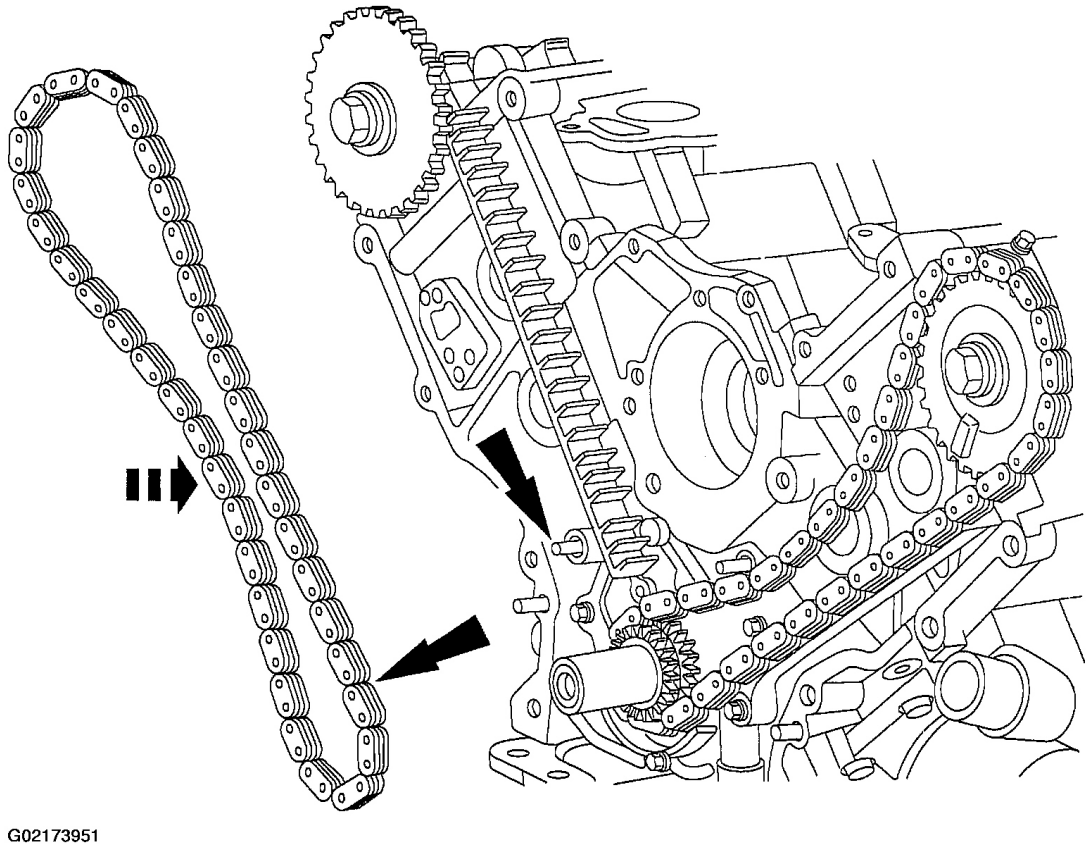

Fig. 30: Installing RH (Outer) Timing Chain On Crankshaft Sprocket
Courtesy of FORD MOTOR CO.

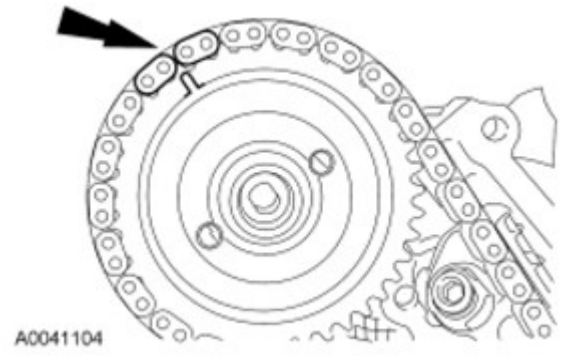

Fig. 31: Installing RH Timing Chain On Camshaft Sprocket
Courtesy of FORD MOTOR CO.

NOTE: The LH timing chain tensioner arm has a bump near the dowel hole, for identification.

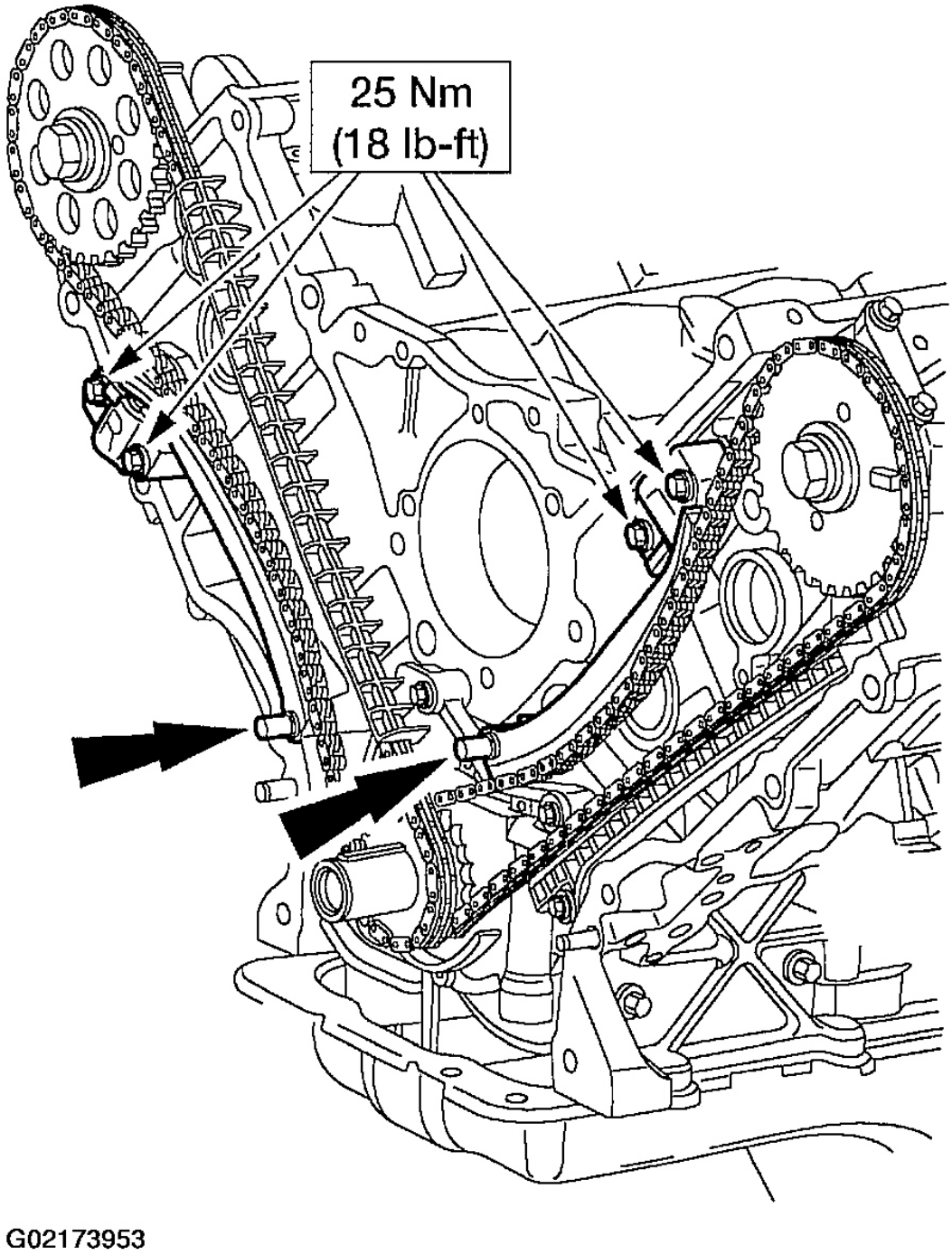

Fig. 32: Installing LH And RH Timing Chain Tensioner Arms And Timing Chain Tensioners
Courtesy of FORD MOTOR CO.

13. Position the LH and RH timing chain tensioner arms on the dowel pins. Position the timing chain

tensioners and install the bolts.

14. Remove the retaining clips or pins from the RH and LH timing chain tensioners.

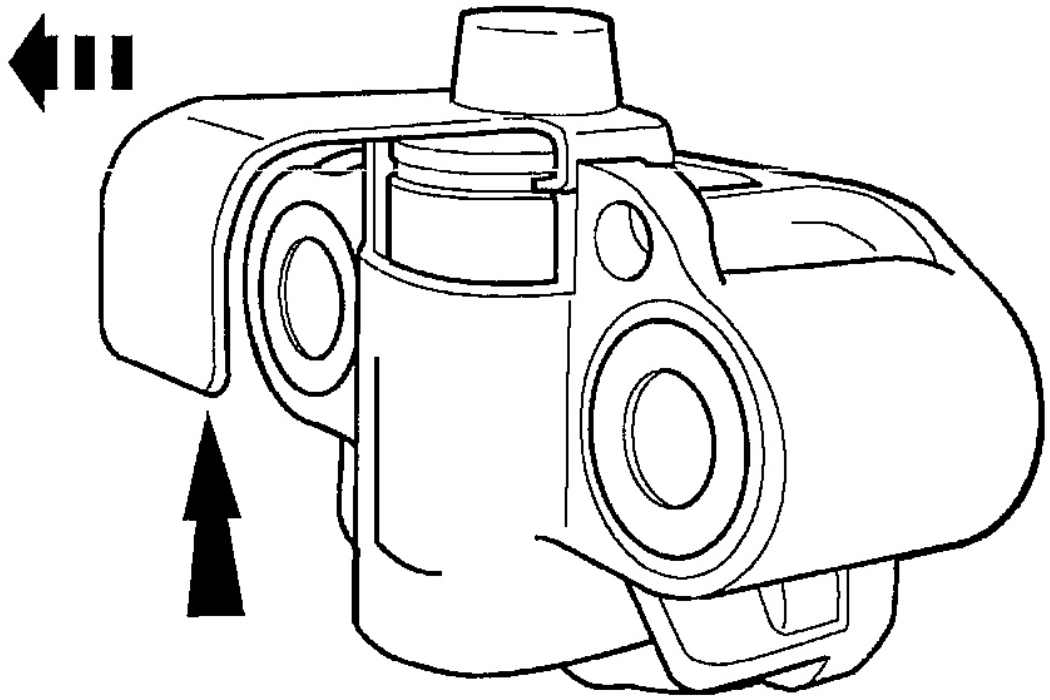

Fig. 33: Removing Retaining Clips From RH And LH Timing Chain Tensioners
Courtesy of FORD MOTOR CO.

15. Remove the special tools from the camshafts.

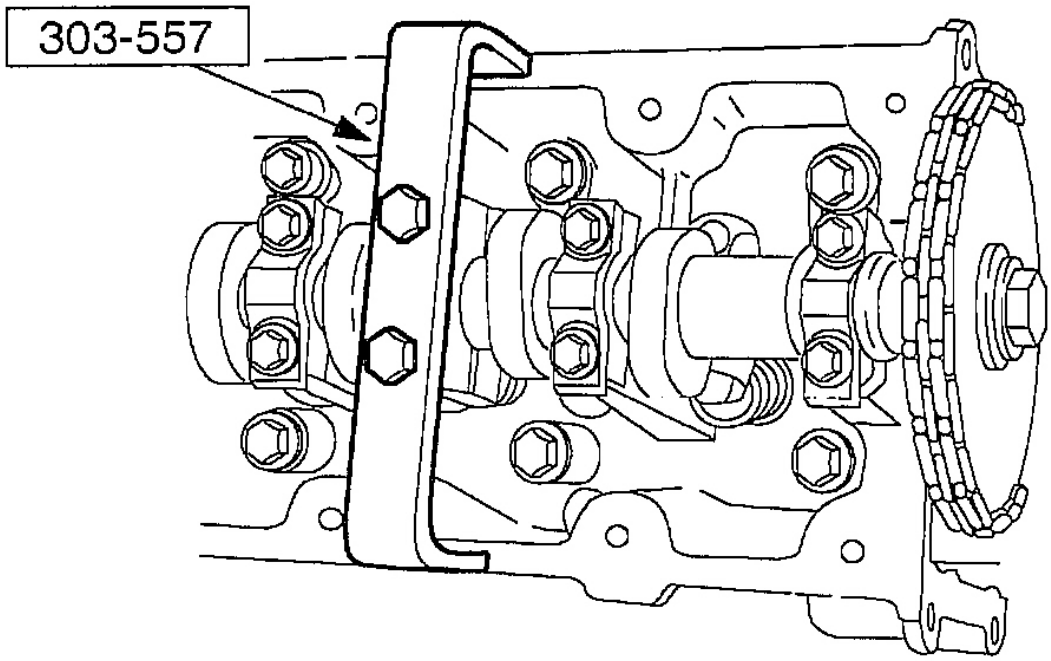

Fig. 34: Removing Special Tools From Camshafts
Courtesy of FORD MOTOR CO.

16. Check for correct alignment of all timing marks.

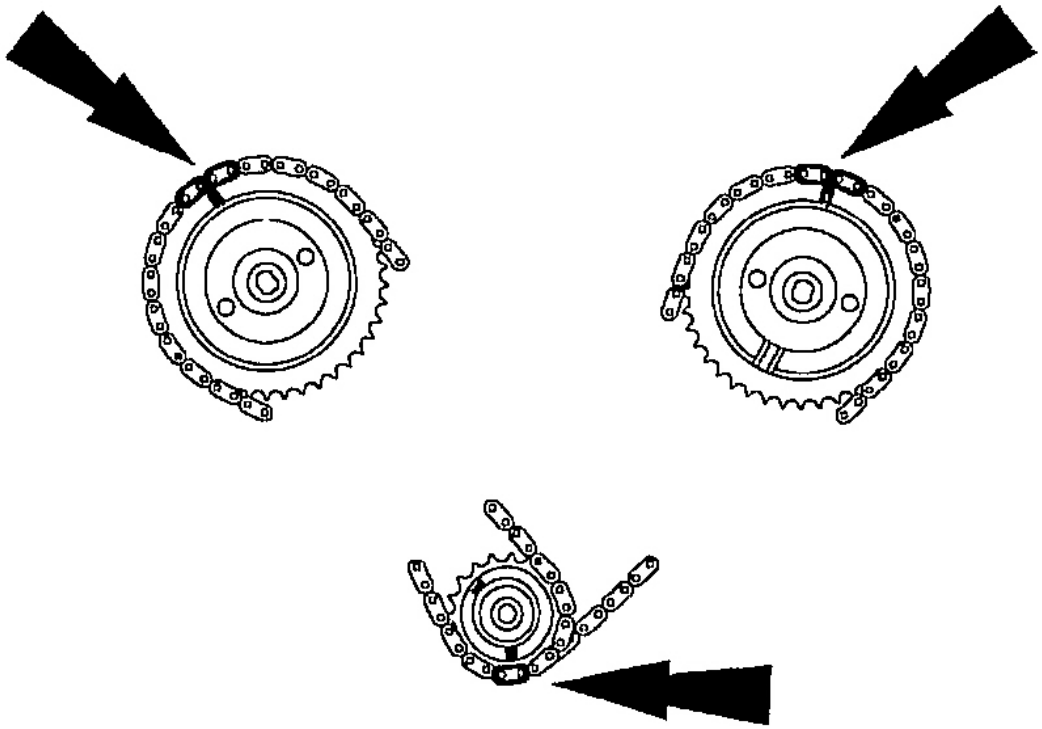

Fig. 35: Verifying Correct Alignment Of All Timing Marks
Courtesy of FORD MOTOR CO.

17. Install the crankshaft sensor ring on the crankshaft.

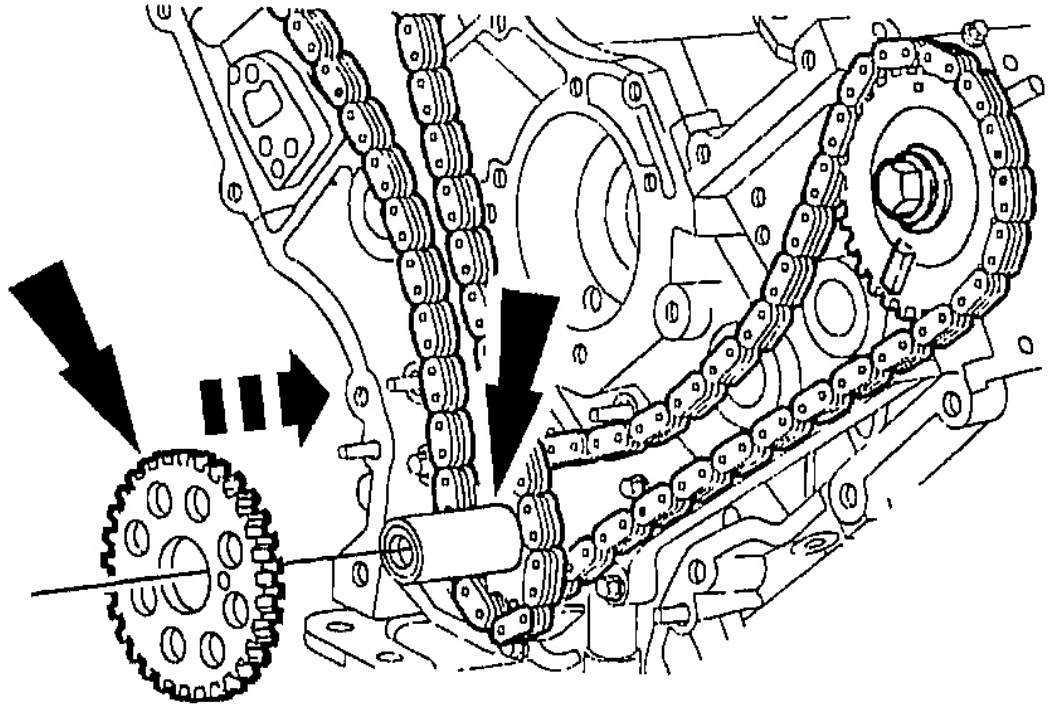

Fig. 36: Installing Crankshaft Sensor Ring On Crankshaft
Courtesy of FORD MOTOR CO.

18. Lubricate the balance shaft journals with clean engine oil.
19. Position the balance shaft on the journals.

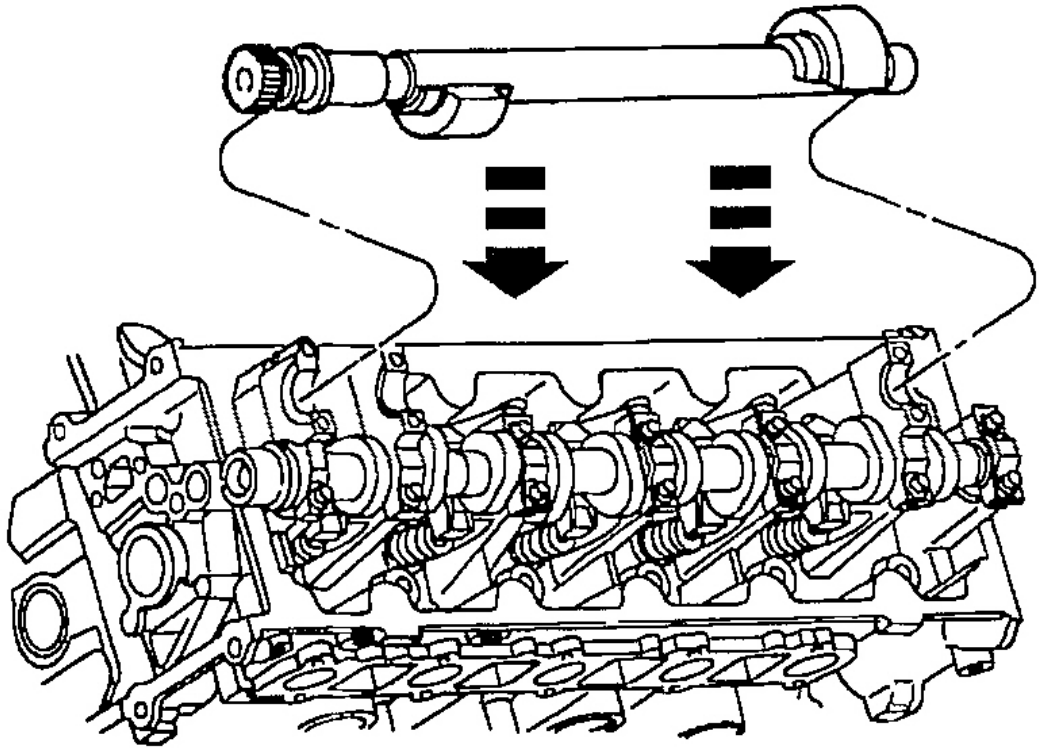

Fig. 37: Positioning Balance Shaft On Journals
Courtesy of FORD MOTOR CO.

20. Align the the balance shaft with the camshaft timing mark as shown.

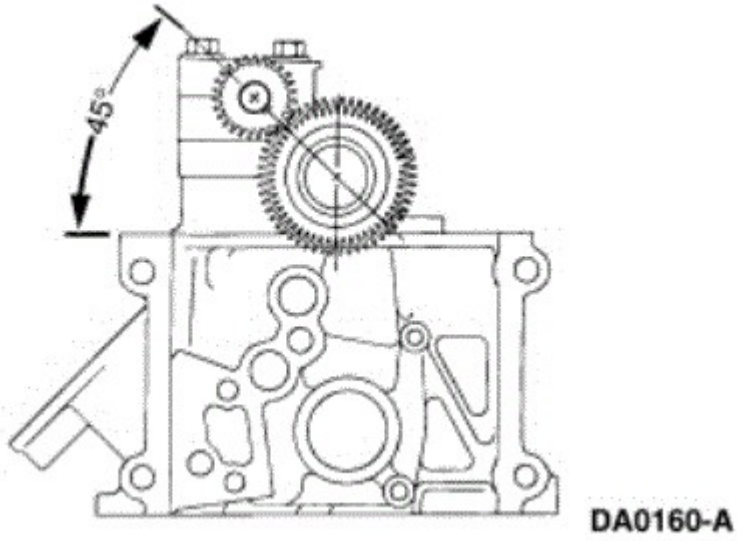

Fig. 38: Aligning Balance Shaft With Camshaft Timing Mark
Courtesy of FORD MOTOR CO.

21. Install the bearing caps in their original location. Install the bolts and tighten the bolts in the sequence shown.

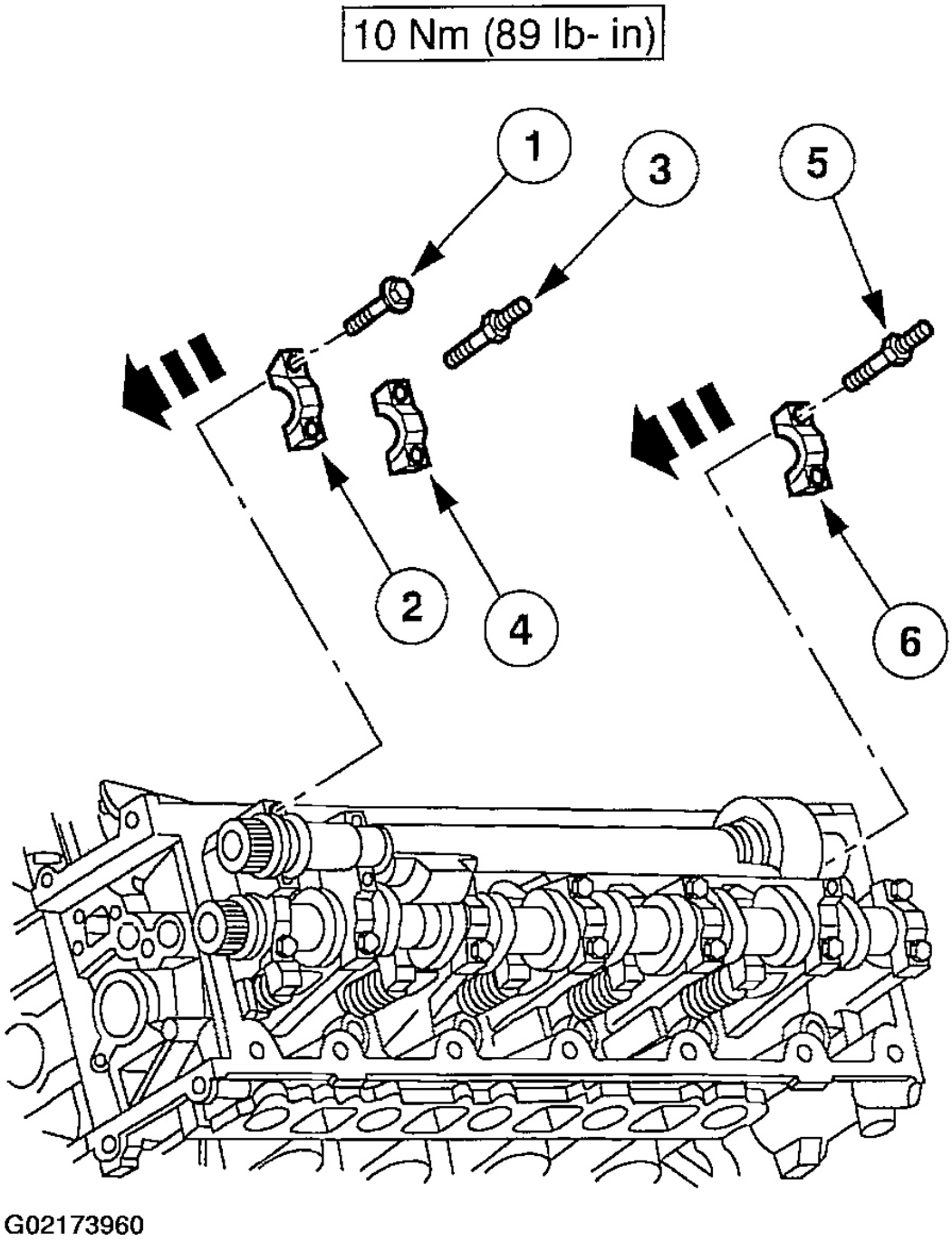

Fig. 39: Identifying Balance Shaft Bearing Caps Bolts Tightening Sequence With Torque Specifications
Courtesy of FORD MOTOR CO.

22. Install engine front cover. For additional information, refer to **FRONT COVER**.

CAMSHAFT FOLLOWER & LASH ADJUSTER

Removal

1. Remove intake manifold. See **INTAKE MANIFOLD**. Remove valve covers. See **VALVE COVERS**. Rotate crankshaft until piston in cylinder to be serviced is at bottom of its stroke, and camshaft lobe is at base circle.
2. Install Valve Spring Spacer (T91P-6565-AH) between valve spring coils to prevent valve stem oil seal damage. Using Valve Spring Compressor (T91P-6565-A), compress valve spring. Remove camshaft follower and lash adjuster.

Inspection

Inspect components for damage. Specifications are unavailable from manufacturer at this time.

CAUTION: Before installing, ensure lash adjuster is full of oil and plunger does not have more than .059" (1.49 mm) travel. Ensure piston is at bottom of stroke, and camshaft lobe is on base circle.

Installation

1. To install, reverse removal procedure. Coat components with engine oil before installing. Before installing valve cover, apply silicone sealant at front cover-to-cylinder block areas.
2. When installing fuel lines, fit NEW fuel resistant "O" rings on fuel lines. Lightly coat "O" rings with clean engine oil before installing. Clean fittings, and replace garter spring (if necessary).

CAMSHAFT

CAUTION: DO NOT remove camshaft before removing camshaft followers. Camshaft will bend and be damaged from side loading.

CAUTION: DO NOT rotate engine at any time when cylinder heads are installed and timing chains are removed. Severe piston and valve damage will occur.

Removal

Remove camshaft followers and lash adjusters. See **CAMSHAFT FOLLOWER & LASH ADJUSTER**. Remove timing chains. See **TIMING CHAINS**. Remove balance shaft. Remove camshaft cap bolts in reverse order of tightening sequence. See **Fig. 40**. Remove camshaft caps and camshaft.

Inspection

Measure camshaft bore I.D., journal O.D., oil clearance and lobe lift. Replace camshaft if measurements are not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.

Installation

1. Coat components with engine oil, and install components. Install and finger tighten all bolts for camshaft caps. Tighten bolts to 72-106 INCH lbs. (8-12 N.m) in sequence. See **Fig. 40**.

CAUTION: Ensure proper procedure is used when installing timing chains to prevent engine damage. See TIMING CHAINS.

2. Ensure camshaft end play is within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS. To install remaining components, reverse removal procedure. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS**.

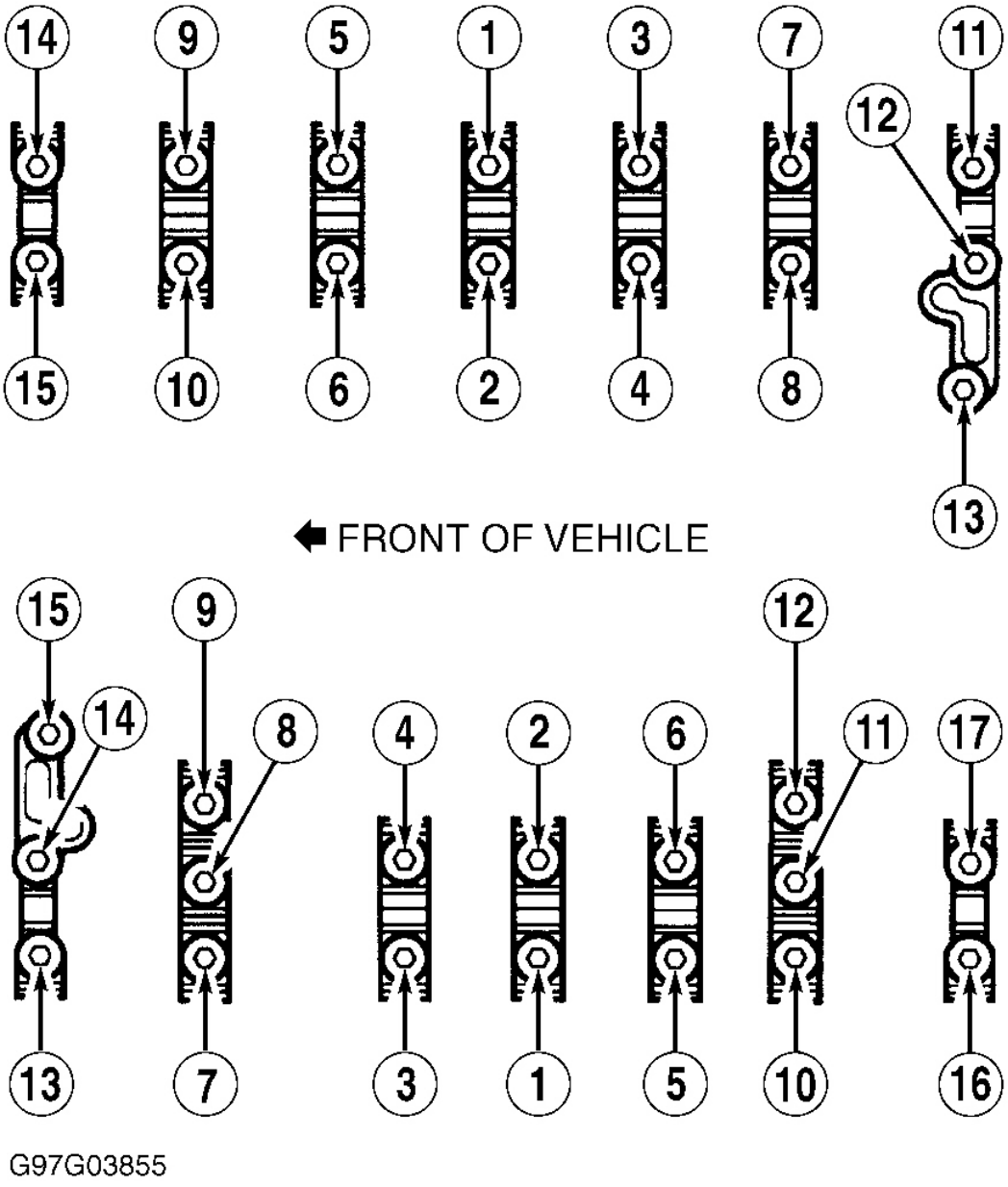

Fig. 40: Camshaft Cap Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

BALANCE SHAFT

Removal

Remove valve covers. See **VALVE COVERS**. Position cylinder No. 1 at TDC of compression stroke. Remove balance shaft caps in reverse order of tightening sequence. See Fig. 41. Remove balance shaft.

Inspection

Measure balance bore I.D. and journal O.D. to determine oil clearance. Replace balance shaft if measurements are not within specification. See **BALANCE SHAFT** table under ENGINE SPECIFICATIONS.

Installation

Coat components with engine oil, and install components. Install all bolts for balance shaft caps, and tighten them finger tight. Tighten bolts to 72-106 INCH lbs. (8-12 N.m) in sequence. See **Fig. 41**.

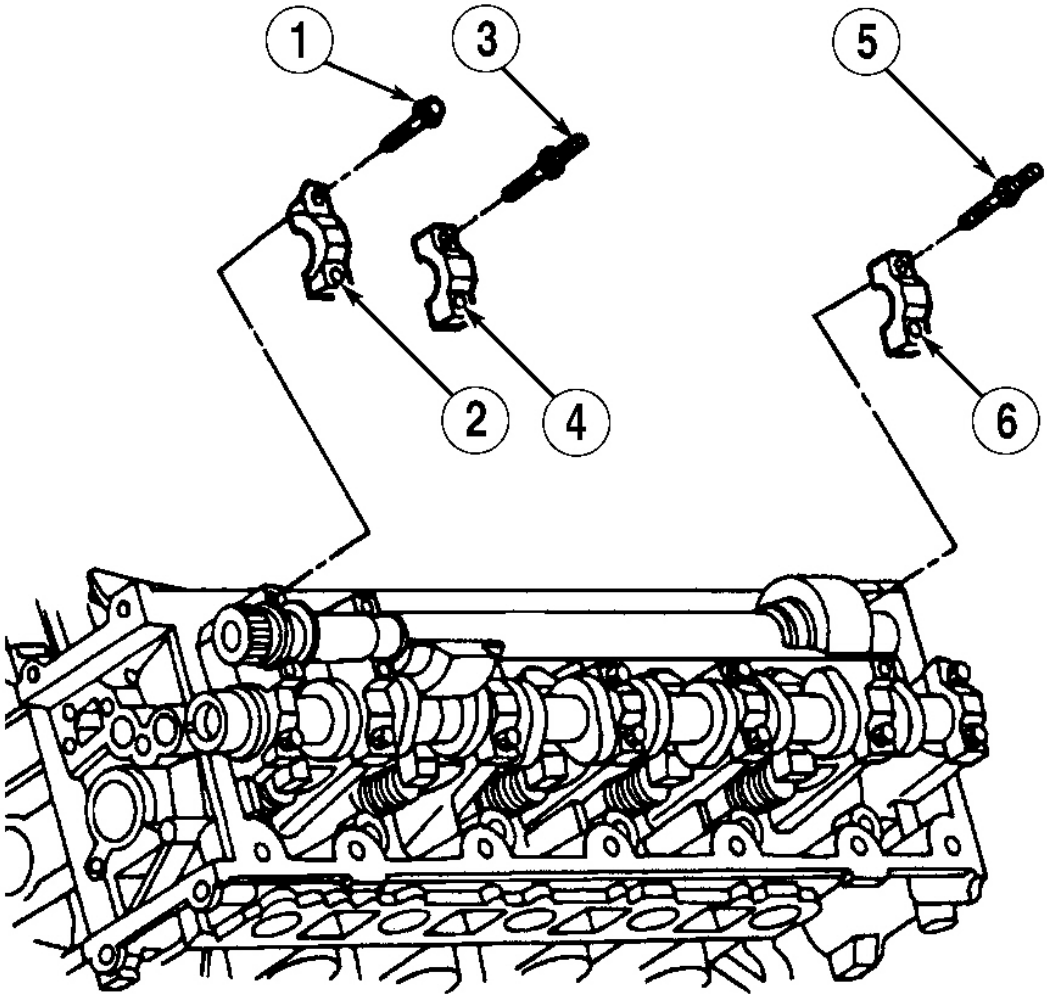

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Fig. 41: Balance Shaft Cap Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

CRANKSHAFT REAR OIL SEAL

Removal

1. Disconnect negative battery cable(s). Remove transmission. For A/T, see appropriate TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. For M/T, see appropriate article in CLUTCHES. Remove flywheel/flexplate.
2. Using Rear Crankshaft Slinger Remover (T95P-6701-AH) and Slide Hammer (T50T-100-A), remove crankshaft oil slinger. Using Rear Crankshaft Seal Remover (T95P-6701-BH) and Slide Hammer (T50-100-AR), remove rear crankshaft oil seal. If oil seal retainer plate is to be replaced, remove oil pan. See **OIL PAN**. Remove seal retainer plate bolts, and remove retainer.

Installation

Clean and inspect all mating surfaces. Using Rear Crankshaft Seal Replacer (T95P-6701-BH) and Rear Crankshaft Seal Adapter (T95P-6701-DH), install rear crankshaft seal. With rear crankshaft adapter still installed, use Rear Crankshaft Slinger Replacer (T95P-6701-CH) and seal replacer to install seal slinger. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

THERMOSTAT

Removal

1. Partially drain the cooling system. Disconnect the upper radiator hose. Remove the 2 thermostat housing bolts. Remove the thermostat housing. See **Fig. 42**.
2. Remove the thermostat and the "O" ring seal. See . Discard the "O" ring seal.

Installation

1. Use a new "O" ring seal to position the thermostat in the upper intake manifold. Install the thermostat housing and the bolts. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Connect the upper radiator hose. Fill and the cooling system.
2. Start the engine and allow to idle until normal operating temperature is reached. The engine coolant temperature gauge should maintain a stabilized reading in the middle of the NORMAL range and the upper radiator hose should feel hot to the touch. Shut the engine off and allow it to cool. Check the engine for coolant leaks. Check the engine coolant level and fill as necessary.

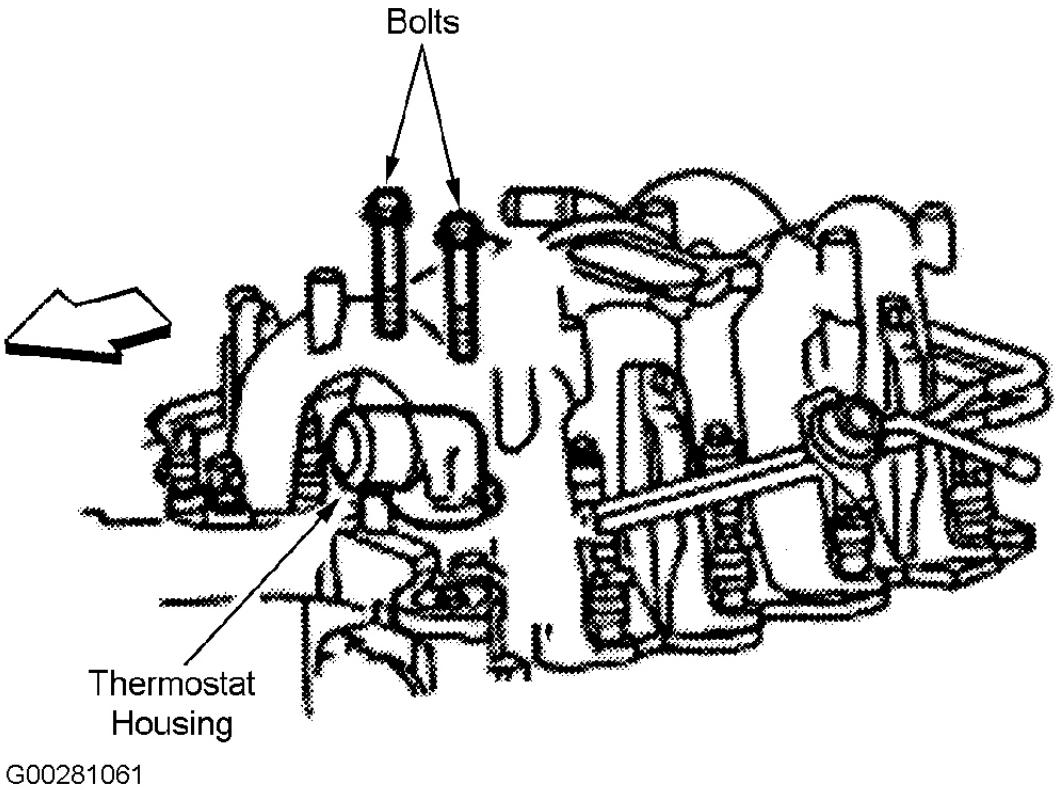

Fig. 42: Removing/Installing Thermostat Housing
Courtesy of FORD MOTOR CO.

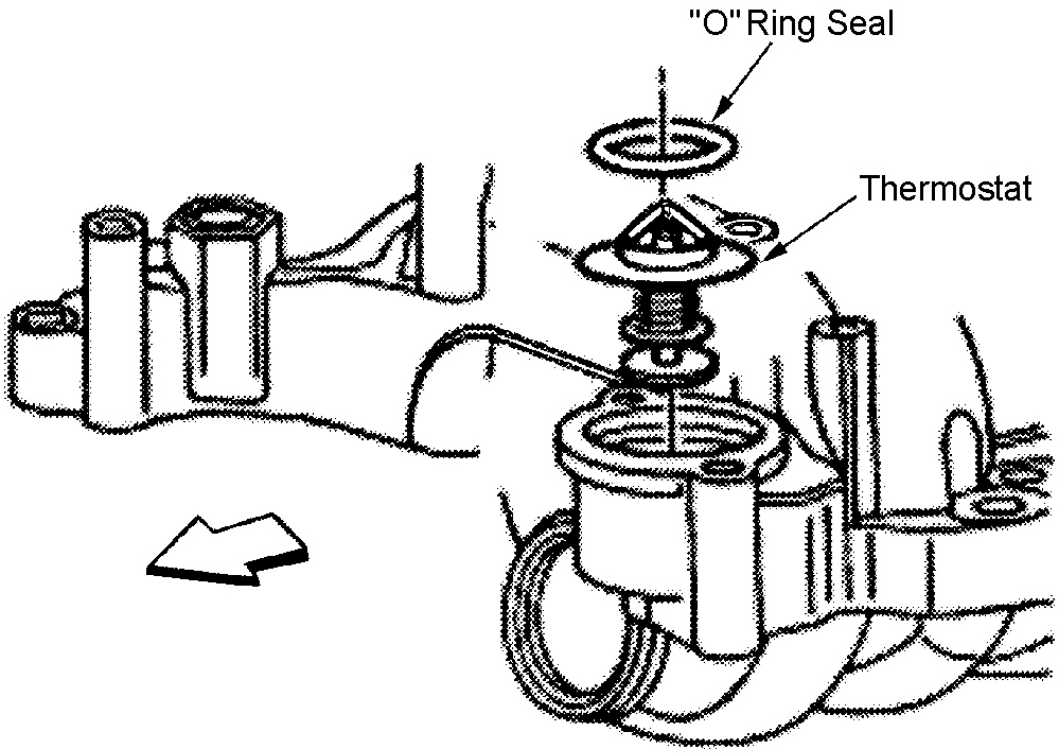

Fig. 43: Removing/Installing Thermostat
Courtesy of FORD MOTOR CO.

WATER PUMP

Removal & Installation

1. Drain cooling system. Remove cooling fan and fan shroud. Remove accessory drive belt. Remove water pump pulley. Remove water pump retaining bolts. Remove water pump and "O" ring.
2. To install, reverse removal procedure. Lubricate "O" ring with coolant before installing. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Fill cooling system.

OIL PAN

Removal (Excursion & F250-F550 Super Duty)

1. Disconnect negative battery cable(s). Remove air cleaner and outlet tube assembly. Drain cooling system and remove upper radiator hose. Remove accelerator cable snow shield. Disconnect accelerator and speed control cables and return spring. Position accelerator cable brackets aside.
2. Disconnect necessary vacuum and electrical connectors. Disconnect heater hose. Disconnect EGR tube and vacuum line. Remove throttle body adapter. Remove 2 screws at top of fan shroud, and move shroud

toward engine. Remove generator.

3. Instal engine support bracket into alternator mounting holes. Raise and support vehicle. Remove turbine shaft speed sensor and output shaft sensor, if equipped. Install plugs in sensor openings. Lower vehicle. Raise engine with floor jack. Support engine with suitable engine support. Raise and support vehicle. Drain engine oil and remove filter. Disconnect catalytic converter "Y" pipe.
4. Remove flywheel inspection plate. Support transmission with transmission jack. Remove drive shaft. Remove transmission mounting nuts. Raise transmission. Remove oil pan retaining bolts in reverse order of tightening sequence. See **Fig. 44**. Lower oil pan and remove oil pump pick-up tube. Remove oil pan with pick-up tube inside oil pan.

Removal (F350 Econoline Van)

1. Disconnect negative battery cable(s). Remove engine cover. Remove air cleaner and outlet tube assembly. Remove cooling fan and fan shroud. Remove oil indicator tube. Remove throttle body. Raise and support vehicle.
2. Drain engine oil. Drain cooling system. Remove upper radiator hose. Remove motor mount-to-subframe nuts. Remove flywheel inspection plate. Raise engine, and position blocks between motor mounts and subframe.
3. Remove oil pan retaining bolts in reverse order of tightening sequence. See **Fig. 44**. Lower oil pan and remove oil pump pick-up tube. Remove oil pan with pick-up tube inside oil pan.

Installation (All Models)

1. To install, reverse removal procedure. Apply silicone sealant on front cover and seal retainer-to-cylinder block areas before installing gasket and oil pan. Tighten all bolts to specification in sequence. See **Fig. 44**. See **TORQUE SPECIFICATIONS**.
2. When installing fuel lines, fit NEW fuel resistant "O" rings on fuel lines. Lightly coat "O" rings with clean engine oil before installing. Clean fittings, and replace garter spring (if necessary).

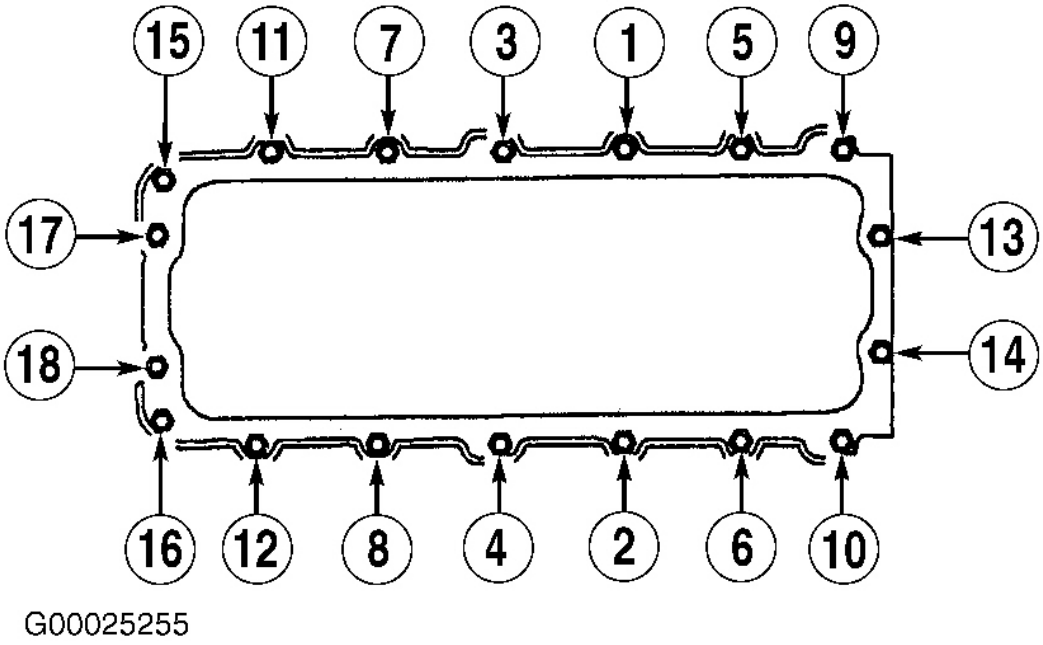

Fig. 44: Oil Pan Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Check cylinder head for cracks or damage. If maximum warpage exceeds .004" (.10 mm), replace cylinder head.

Valve Springs

Inspect valve spring free length, out-of-square and pressure. Replace valve spring if not as specified. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seals

Use Seal Installer (T91T-6571-A) to install oil seals.

NOTE: DO NOT ream valve guides from standard to maximum oversize in one step. Ream guides in gradual steps, so guides are reamed in true relation to valve seat. Valve seats must be ground when valve guide is reamed or replaced.

Valve Guides

1. Valve guides may be reamed for oversize valves if stem-to-guide oil clearance exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Valves are available in .015" (.38 mm) and .030" (.76 mm) oversize.
2. Valve guides may also be replaced with a NEW guide if oversize valves are not available or guide is damaged. Ream valve guides until proper stem-to-guide clearance exists.

Valve Seat

Ensure valve seat angle, seat width and seat runout are within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Valve seats must be ground when valve guide is reamed or replaced. Replacement information is not available.

Valves

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

CAUTION: DO NOT remove more than .010" (.25 mm) from valve stem when resurfacing tip.

Valve Seat Correction Angles

If seat width is too wide after grinding seat, use a 75-degree stone to remove stock from bottom of valve seat (raise seat), or a 30-degree stone to remove stock from top of seat (lower seat).

CYLINDER BLOCK ASSEMBLY

CAUTION: Connecting rod bearing caps are mechanically fractured during manufacturing and cannot be serviced or interchanged. Mark connecting rod and cap for reassembly reference. DO NOT attempt to repair connecting rods. Replace connecting rod if out of specification. Install NEW connecting rod bolts. DO NOT reuse bolts.

Piston & Rod Assembly

Note direction of connecting rod installation on piston. Install piston and connecting rod in engine, with arrow on top of piston toward front of engine.

Fitting Pistons

1. Standard service pistons are coded 1, 2 and 3 (or Red, Blue and Yellow) on dome of piston. Measure piston skirt diameter at 90-degree angle to piston pin, 1.62" (42.0 mm) below piston top. Replace piston if piston diameter is not within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
2. Measure cylinder bore at .50" (12.7 mm) below top of piston travel and .50" (12.7 mm) above bottom of

piston travel. Ensure piston clearance is within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

3. If piston clearance is not within specification, choose a selective fit piston to bring piston clearance within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS, for selective fit piston sizes.
4. If piston clearance cannot be corrected using a selective fit piston, bore all cylinders to nearest oversize.

Piston Rings

Ensure ring end gap and side clearance are within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Position oil control ring expander with gap positioned straight forward and rails with gaps 180 degrees apart, aligned with piston pin. Install compression rings with gaps staggered, so ring gaps do not align.

Rod Bearings

CAUTION: Mark connecting rod and cap for reassembly reference. Components are not marked at factory. Install NEW bolts in connecting rods. Do not reuse bolts.

1. Ensure piston and connecting rod are installed in engine with arrow on top of piston toward front of engine.
2. Check bearing clearances using Plastigage. Ensure bearing oil clearance and side play are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** and **CONNECTING RODS** tables under ENGINE SPECIFICATIONS. If oil clearance exceeds specification, grind crankshaft to fit undersize bearings. Tighten connecting rod bearing cap bolts to specification in 2 stages using proper sequence. See **Fig. 45**. See **TORQUE SPECIFICATIONS**.

NOTE: When checking bearing clearances using Plastigage, side bolts and side adjusting screws do not need to be installed.

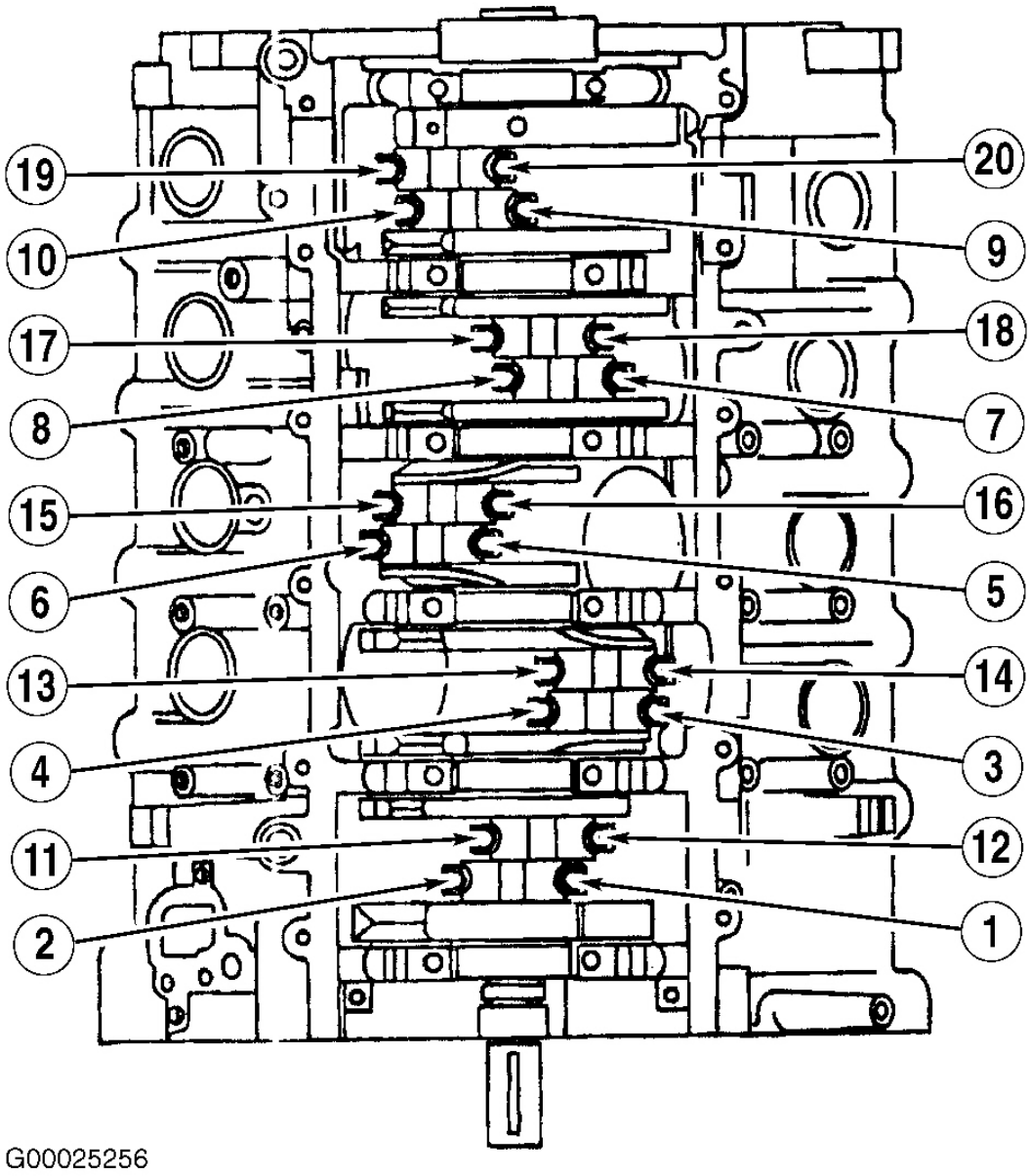

Fig. 45: Connecting Rod Bearing Cap Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

Crankshaft & Main Bearings

1. Measure main bearing clearances using Plastigage. Main bearing caps are marked for location, with No. 1 at front and No. 5 at rear of engine. Arrow on main bearing cap must point toward front of engine. Lubricate bearing shells with assembly lube or heavy oil before installation.
2. Install main bearing inserts in cylinder block. Lay crankshaft into cylinder block. Push crankshaft

rearward. Roll rear lower thrust washer into back of No. 6 main boss. Push crankshaft forward and install front lower thrust washer. Install upper thrust washer to back side of No. 6 bearing cap. Oil grooves face crankshaft surface.

CAUTION: Ensure side adjusting screws on main bearing caps are screwed inward completely before installing main cap. Using a brass hammer, tap main bearing caps into position on cylinder block before tightening bolts to specification. This must be done to ensure proper torque reading. DO NOT reuse main bearing cap bolts. Side bolts and side adjusting screws may be reused.

3. Install main bearing caps using NEW bolts, do not fully tighten. Tighten main bearing cap bolts to specification in 4 steps using proper sequence. See **Fig. 46**. See **TORQUE SPECIFICATIONS**.
4. Tighten side adjusting screws against cylinder block to specification in 2 steps using proper sequence. See **Fig. 46**. Side adjusting screws have left-hand threads. Tighten side bolts.

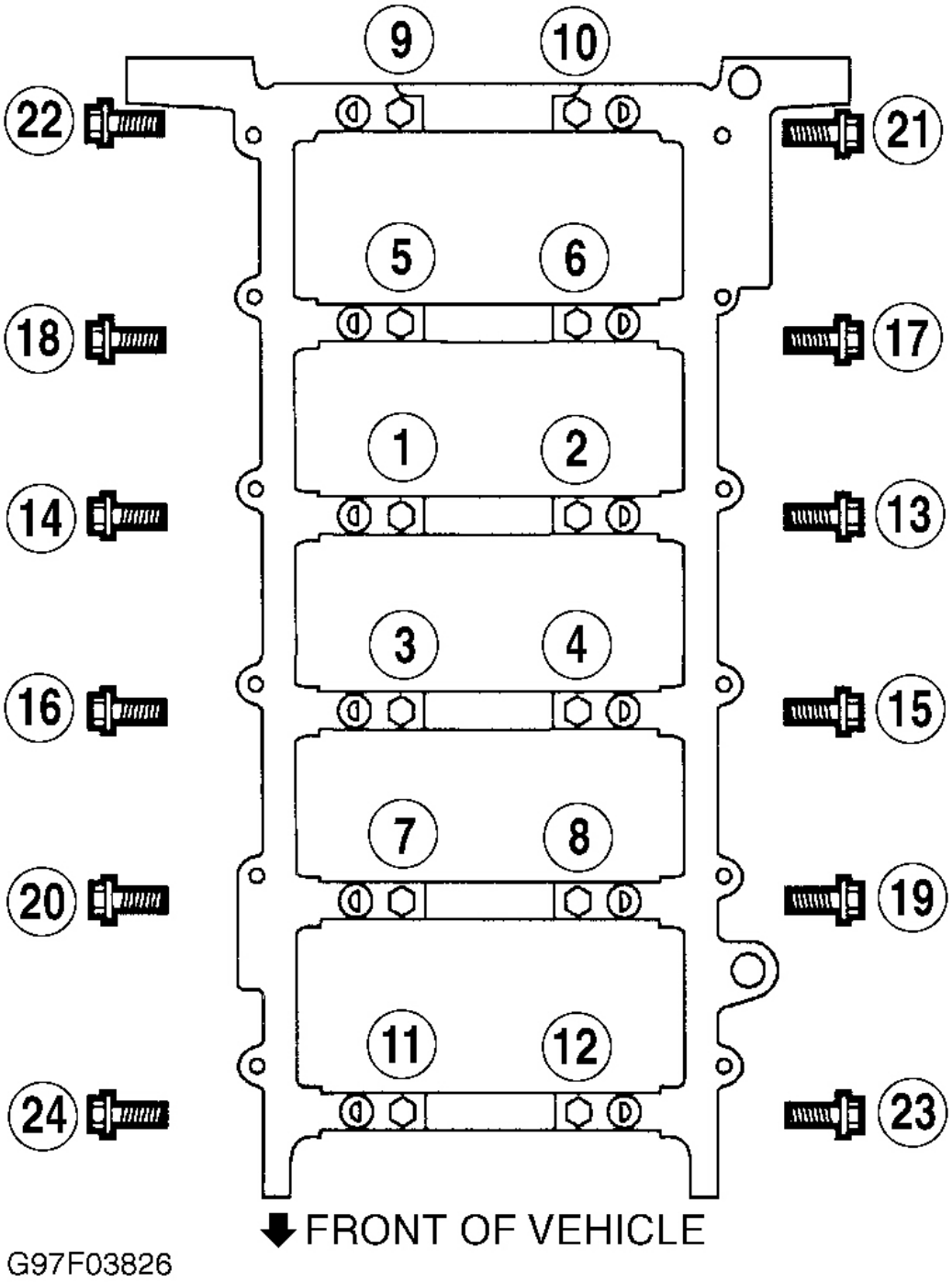

Fig. 46: Main Bearing Cap Bolt Tightening Sequence
Courtesy of FORD MOTOR CO.

CAUTION: Before boring cylinder block, install main bearing caps and tighten bolts to specification. See TORQUE SPECIFICATIONS. This prevents main bearing bores from being distorted when cylinder block is bored.

Cylinder Block

1. Using a feeler gauge and straightedge, inspect cylinder block deck for warpage. If not within specification, resurface or replace cylinder block. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

CAUTION: DO NOT machine more than .010" (.025 mm) from original cylinder block head surface.

2. Check cylinder bore diameter, out-of-round and taper. Cylinder bore is measured at .50" (12.7 mm) below top of cylinder block head surface and .50" (12.7 mm) above piston when at bottom of cylinder bore.
3. Bore cylinder block if measurements are not within specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Rotor-type pump is driven by crankshaft and delivers pressurized oil to main gallery.

Crankcase Capacity

Specification is unavailable from manufacturer at this time.

Oil Pressure

Specification is unavailable from manufacturer at this time.

OIL PUMP

NOTE: Disassembly and inspection procedures are not available.

Removal

Remove oil pan and pick-up tube. See **OIL PAN** under REMOVAL & INSTALLATION. Remove timing chains and crankshaft sprockets. See **TIMING CHAINS** under REMOVAL & INSTALLATION. Remove oil pump retaining bolts. Remove oil pump.

Installation

To install, reverse removal procedure. Ensure flat areas of oil pump rotor aligns with flat areas of crankshaft. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Connecting Rod Bolt (2000) (1)	
Step 1	29-33 (39-45)
Step 2	Additional 90-120 Degrees
Connecting Rod Bolt (2001) (1)	
Step 1	32 (43)
Step 2	Additional 90-120 Degrees
Crankshaft Damper Bolt	
Step 1	66 (90)
Step 2	Loosen 360 Degrees
Step 3	
2000	35-39 (47-53)
2001	37 (50)
Step 4	Additional 85-90 Degrees
Cylinder Head Bolt (1) (2)	
Step 1	
2000	27-32 (37-43)
2001	30 (40)
Step 2	Additional 85-95 Degrees
Step 3	Additional 85-95 Degrees
EGR Manifold Tube Fitting	22-32 (30-44)
Engine Mount Through-Bolt	50-68 (68-92)
Engine-To-Transmission Bolts	30-40 (41-54)
Exhaust Manifold Bolt (3)	
2000	17-20 (23-27)
2001	18 (25)
Exhaust Manifold-to-Exhaust Pipe Bolt	27-34 (34-46)
Flexplate-To-Crankshaft Bolt	54-64 (73-87)
Front Cover Bolt/Stud (4)	
2000	
Bolts 1-5	15-22 (20-30)
Bolts 6-15	30-41 (41-56)
2001	
Bolts 1-5	18 (25)
Bolts 6-15	35 (48)
Idler Pulley Bolt	15-22 (20-30)
Main Bearing Cap Bolts 1-12 (2000) (1) (5)	

Step 1	22-32 (34-43)
Step 2	Additional 85-95 Degrees
Main Bearing Cap Bolts 1-12 (2001) (1) (5)	
Step 1	30 (40)
Step 2	Additional 85 Degrees
Main Bearing Cap Side Bolts 13-24 (2000) (5)	
Step 1	20-24 (26-33)
Step 2	Additional 85-95 Degrees
Main Bearing Cap Side Bolts 13-24 (2001) (5)	
Step 1	22 (30)
Step 2	Additional 85 Degrees
Oil Pan Bolt (6)	
Step 1	(7)
Step 2	15 (20)
Step 3	Additional 60 Degrees
Oil Pan-To-Front Cover Bolts	
Step 1	15 (200
Step 2	Additional 60 Degrees
Power Steering Pump Bolts	15-22 (20-30)
Torque Converter Nut	25-34 (34-46)
Water Pump Bolt	
2000	15-22 (20-30)
2001	18 (25)
Water Pump Pulley Bolt	15-22 (20-30)
2000	15-22 (20-30)
2001	18 (25)
	INCH Lbs. (N.m)
Balance Shaft Bolt	
2000	71-106 (8-12)
2001	89 (10)
Camshaft Cap Bolt (8)	71-106 (8-12)
Camshaft Cover Bolt	71-106 (8-12)
Chain Guide Bolt	71-106 (8-12)
Crankshaft Seal Retainer Bolt	71-106 (8-12)
Intake Manifold	
Lower	
Step 1	18 (2)
Step 2	89 (10)
Upper	
Step 1	18 (2)

Step 2	(9)
Oil Pump-To-Cylinder Block Bolt	
2000	71-106 (8-12)
2001	89 (10)
Valve Cover Bolts	89 (10)

(1) Use new bolts. DO NOT reuse bolts.

(2) Tighten bolts in sequence. See **Fig. 5**.

(3) Tighten bolts in sequence. See **Fig. 4**.

(4) Tighten bolts in sequence. See **Fig. 7**.

(5) Tighten bolts in sequence. See **Fig. 46**.

(6) Tighten bolts in sequence. See **Fig. 44**.

(7) Tighten bolts to 18 INCH lbs. (2 N.m).

(8) Tighten bolts in sequence. See **Fig. 40**.

(9) On 2000 models, tighten bolts to 15-22 ft. lbs. (20-30 N.m). On 2001 models, tighten bolt to 18 ft. lbs.(25 N.m).

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	415 Cu. In. (6.8L)
Bore	3.55" (90.2 mm)
Stroke	4.17" (105.8 mm)
Fuel System	SFI

CRANKSHAFT, MAIN BEARINGS & CONNECTING ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft End Play	.003-.015 (.08-.37)
Main Bearings	
Journal Diameter	2.6567-2.6576 (67.482-67.503)
Journal Out-Of-Round	.0003 (.008)
Journal Taper	.0002 (.004)
Oil Clearance	.0009-.0019 (.024-.048)
Connecting Rod Bearings	
Journal Diameter	2.0859-2.0867 (52.983-53.003)

Journal Out-Of-Round	.0003 (.008)
Journal Taper	.0002 (.004)
Oil Clearance	.0010-.0025 (.025-.064)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS

Application	In. (mm)
Bore Diameter	
Piston Pin Bore	.8666-.8671 (22.012-22.024)
Crankpin Bore	2.0877-2.0885 (53.027-53.049)
Center-To-Center Length	6.657 (169.10)
Maximum Bend (1)	.0015 (.038)
Maximum Twist (1)	.0020 (.050)
Side Play	
Standard	.0059-.0263 (.150-.670)
Service Limit	.0263 (.670)
(1) Measured from bore-to-bore.	

PISTONS, PISTON PINS & PISTON RINGS SPECIFICATIONS

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	.0008-.0010 (.020-.025)
Diameter	
Code 1	(1)
Code 2	3.5502-3.5506 (90.175-90.185)
Code 3	(1)
Pins	
Diameter	.8664-.8666 (22.008-22.014)
Pin-To-Piston Clearance	.0002-.0005 (.005-.014)
Rod Fit	.0003-.0009 (.008-.023)
Rings	
No. 1	
End Gap	.005-.011 (.13-.28)
Side Clearance	(1)
No. 2	
End Gap	.010-.016 (.25-.40)
Side Clearance	

	(1)
No. 3 (Oil)	
End Gap (Steel Rail)	.006-.026 (.15-.66)
Side Clearance	(1)
(1) Information is unavailable from manufacturer.	

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter	
Grade 1	3.5512-3.5516 (90.200-90.210)
Grade 2	3.5516-3.5520 (90.210-90.220)
Grade 3	3.5520-3.5524 (90.220-90.230)
Maximum Taper	(1)
Maximum Out-Of-Round	(1)
Maximum Deck Warpage	(1)
(1) Information is unavailable from manufacturer.	

ENGINE VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS

Application	Specification
Valves	
Intake	
Face Angle	45.25-45.75°
Head Diameter	1.747-1.757" (44.37-44.63 mm)
Minimum Margin	(1)
Stem Diameter	.2746-.2754" (6.975-6.995 mm)
Valve Face Runout	.002" (.05 mm)
Exhaust	
Face Angle	45.25-45.75°
Head Diameter	1.334-1.343" (33.88-34.12 mm)
Minimum Margin	(1)
Stem Diameter	.2736-.2744" (6.949-6.970 mm)

Valve Face Runout	.002" (.05 mm)
Valve Springs	
Free Length	1.976" (50.19 mm)
Out-Of-Square	2.5(0)
	Lbs. @ In. (kg @ mm)
Pressure	
Valve Closed	65 @ 1.57" (29.5 @ 40.0 mm)
Valve Open	150 @ 1.10" (68.0 @ 28.0 mm)
(1) Information not available from manufacturer.	

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD

Application	Specification
Maximum Warpage	(1) .004" (.10 mm)
Intake & Exhaust Valve Seats	
Seat Angle	44.5-45.0°
Seat Width	.075-.083" (1.90-2.10 mm)
Maximum Seat Runout	.001" (.03 mm)
Valve Guides	
Valve Stem-To-Guide Oil Clearance	
Intake Valve	.0008-.0027" (.020-.069 mm)
Exhaust Valve	.0018-.0037" (.046-.094 mm)
(1) If maximum warpage is exceeded, replace cylinder head.	

BALANCE SHAFT SPECIFICATIONS

BALANCE SHAFT

Application	In. (mm)
Bearing Bore Diameter	1.0625-1.0635 (26.987-27.012)
End Play	.002-.007 (.04-.17)
Journal Diameter	1.0605-1.0615 (26.936-26.962)
Oil Clearance	.0010-.0030 (.025-.076)
Gear Backlash	.0003-.0051 (.008-.130)

CAMSHAFT SPECIFICATIONS

CAMSHAFT

Application	In. (mm)
Bearing Bore Diameter	(1)

End Play	.001-.007 (.03-.18)
Journal Diameter	1.0605-1.0615 (26.936-26.962)
Lobe Lift	
Intake	.259 (6.58)
Exhaust	.259 (6.58)
Oil Clearance	.001-.003 (.03-.08)
(1) Information not available from manufacturer.	

