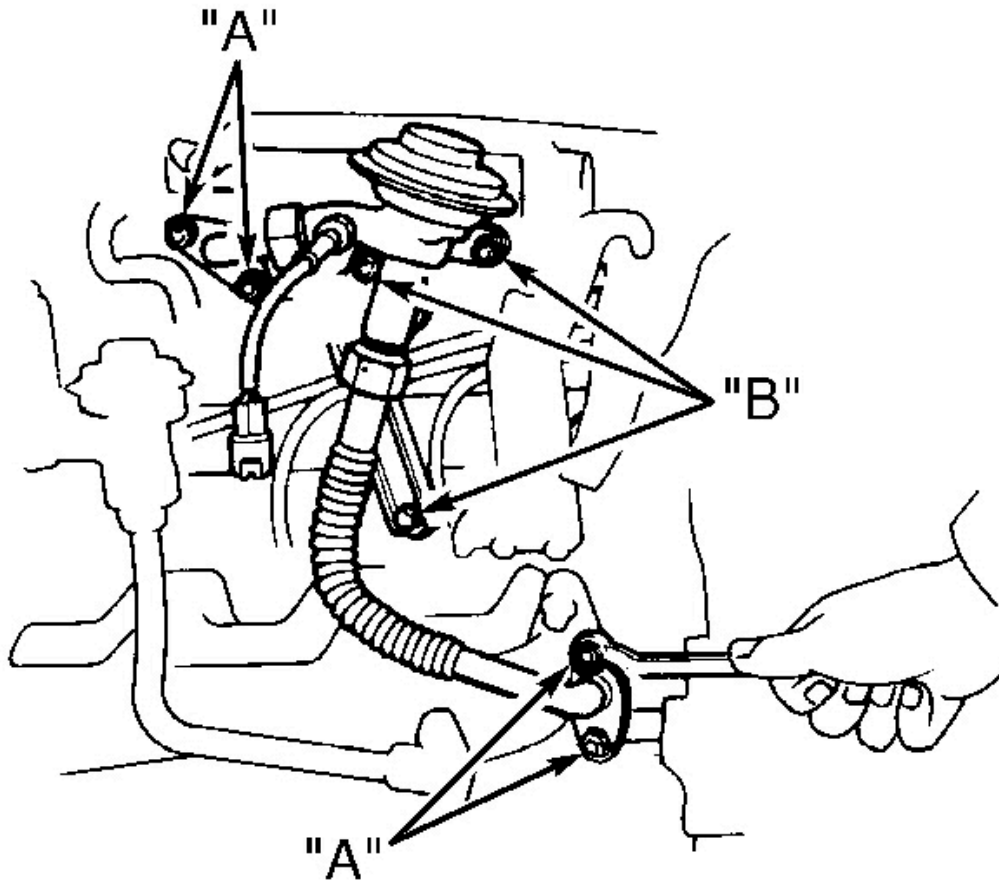


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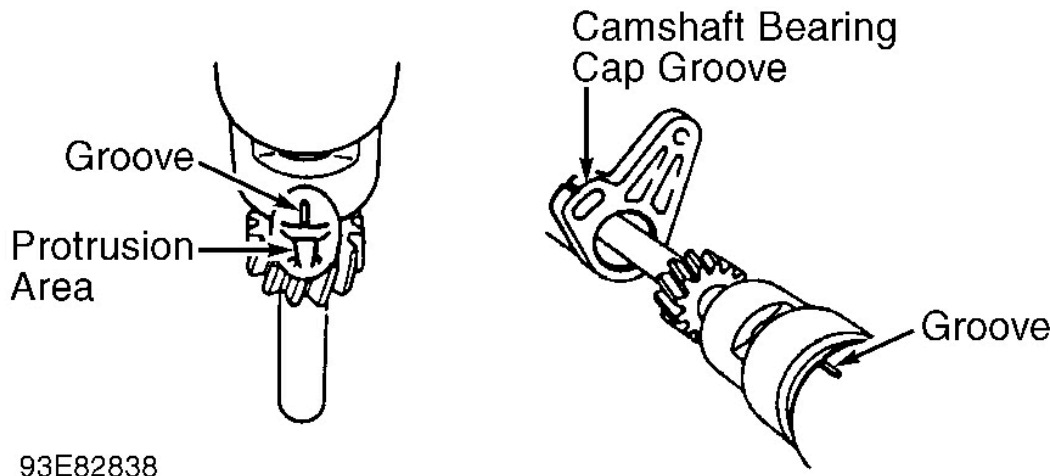
Tighten "A" To 22 Ft. Lbs. (30 N.m)
Tighten "B" To 13 Ft. Lbs. (18 N.m)

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Fig. 11: Tightening EGR Valve Bolt/Nuts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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Fig. 12: Installing Distributor

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKSHAFT FRONT SEAL

Removal & Installation (Oil Pump Removed)

Pry seal from oil pump body. Apply grease to seal lip of NEW seal. Using Seal Installer (SST 09309-37010), install seal until seal is even with oil pump body surface.

Removal & Installation (Oil Pump Installed)

1. Remove timing belt and crankshaft sprocket. See **TIMING BELT**. Using a knife, cut off seal lip. Pry seal from oil pump body. Use care not to damage sealing surfaces.
2. Apply grease seal lip of NEW seal. Using Seal Installer (SST 09309-37010), install seal until seal is even with oil pump body surface. To install remaining components, reverse removal procedure.

TIMING BELT

Refer to REMOVAL & INSTALLATION in TIMING BELT REPLACEMENT - 3.0L V6 - 3V-ZE article.

NO. 2 IDLER PULLEY

Removal

1. Remove timing belt. See **TIMING BELT**. Remove necessary components for removal of No. 4 timing belt cover. See **Fig. 8**.

NOTE: If fuel pipes or fuel lines must be disconnected, ensure fuel pressure is released. See **FUEL PRESSURE RELEASE**.

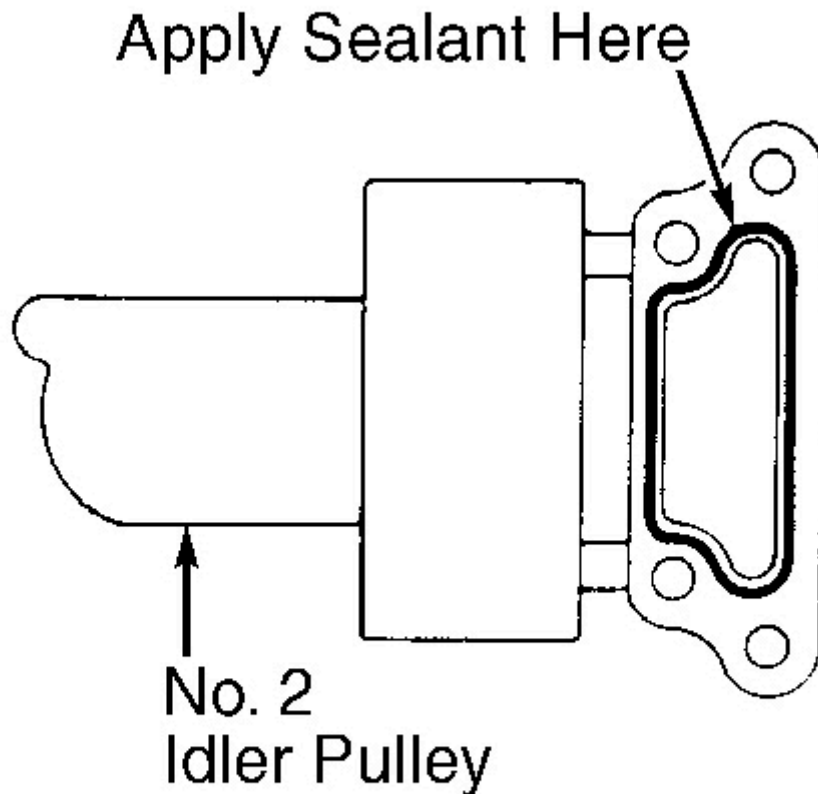
2. Remove bolts and No. 4 timing belt cover. See **Fig. 8**. Remove bolts and No. 2 idler pulley.

Inspection

Inspect No. 2 idler pulley for smooth rotation. Replace No. 2 idler pulley if defective.

Installation

Apply sealant in groove on sealing surface of No. 2 idler pulley. See **Fig. 13**. Install No. 2 idler pulley. Install and tighten bolts to specification in several steps. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.



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Fig. 13: Applying Sealant On No. 2 Idler Pulley
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE LIFTER

Removal

Remove camshaft. See **CAMSHAFT**. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head.

Inspection

Inspect components for damage. Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if oil clearance is not within specification. See **VALVE LIFTERS** table under ENGINE SPECIFICATIONS.

Installation

To install, reverse removal procedure. Ensure components are installed in original location and valve lifter rotates smoothly in cylinder head. If camshaft, adjusting shims or valve lifters are replaced, check valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

CAMSHAFT

Removal

1. Remove electrical connectors, vacuum lines, fuel lines and components necessary to access valve covers. Remove valve covers and gaskets.

NOTE: If fuel lines or pipes must be disconnected, ensure fuel pressure is released. See **FUEL PRESSURE RELEASE**.

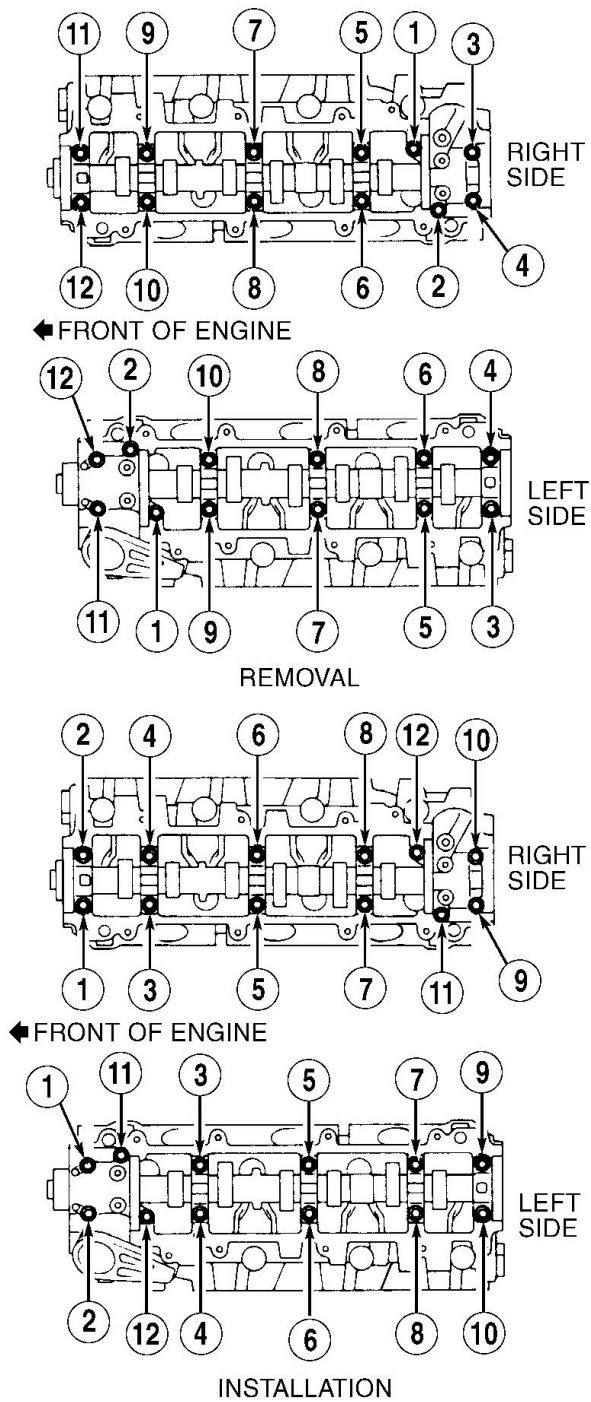
2. Remove timing belt and camshaft sprockets. See **TIMING BELT**. Remove No. 2 idler pulley. See **NO. 2 IDLER PULLEY**. Remove bolts, No. 3 and 4 timing belt covers. See **Fig. 8**.

CAUTION: Note location and markings on top of camshaft bearing caps for reassembly reference. Camshaft bearing caps must be installed in correct location. See **Fig. 15**. Camshaft bearing cap No. 5 does not contain an arrow on top of bearing cap.

3. Loosen camshaft bearing cap bolts in sequence using several steps. See **Fig. 14**. Remove camshaft bearing caps, camshaft and oil seal.
4. Remove valve lifters and adjusting shims from cylinder head (if necessary). Ensure adjusting shims and valve lifters are marked for location in cylinder head. Remove camshaft housing rear cover and plug from rear of cylinder head (if necessary). See **Fig. 8**.

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Fig. 14: Camshaft Bearing Cap Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

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1. Inspect components for damage. Check camshaft journal diameter, lobe height and journal runout. Replace camshaft if not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
2. Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance. Tighten camshaft bearing cap bolts to specification in sequence when checking oil clearance. See **Fig. 14**. See **TORQUE SPECIFICATIONS**.

CAUTION: Ensure camshaft bearing caps are installed with arrows on camshaft bearings caps pointing toward front of engine (right side) and rear of engine (left side). See Fig. 15.

3. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
4. Check camshaft end play with camshaft bearing cap bolts tightened to specification in sequence. See **TORQUE SPECIFICATIONS**. See **Fig. 14**. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
5. Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if oil clearance is not within specification. See **VALVE LIFTERS** table under ENGINE SPECIFICATIONS.

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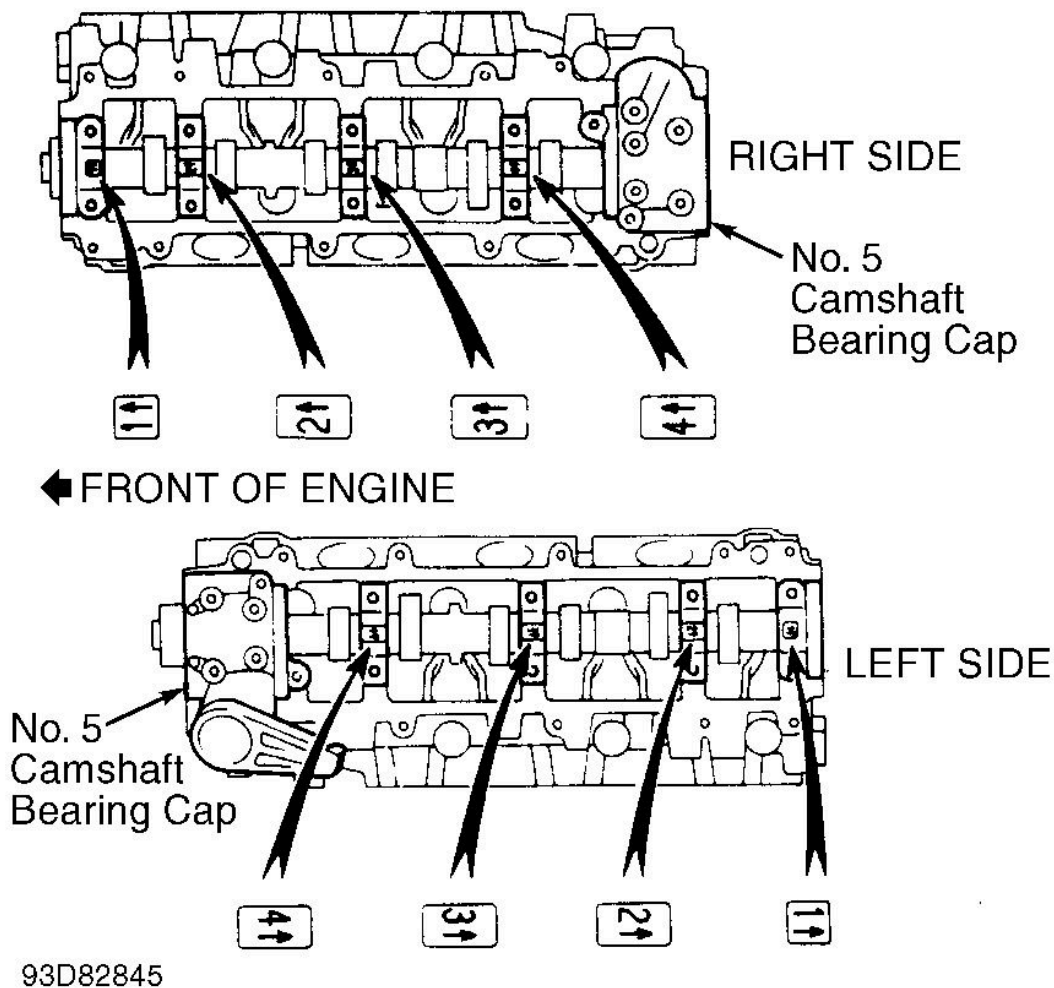


Fig. 15: Identifying Camshaft Bearing Cap Locations
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Installation

1. Install valve lifters and adjusting shims in original location (if removed). If installing plug on cylinder head, install NEW plug on rear of cylinder head with cup area facing inward (toward cylinder head). Install camshaft housing rear cover on cylinder head. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS**.
2. Coat camshaft journals with engine oil. Install camshaft on cylinder head. Apply sealant at specified areas on No. 1 and 5 camshaft bearing caps. See **Fig. 16**.
3. Install camshaft bearing caps in proper location. Ensure arrow on camshaft bearing cap points toward front of engine (right side) and rear of engine (left side). See **Fig. 15**.
4. Coat threads and bolt head-to-camshaft bearing cap contact surfaces on camshaft bearing cap bolts with

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engine oil. See **Fig. 14**. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See **TORQUE SPECIFICATIONS**.

5. Ensure camshaft end play is within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS. Apply grease to seal lip on oil seal for the camshaft.
6. Install oil seal on front edge of camshaft. Using Oil Seal Installer (SST 09214-60010), install oil seal in cylinder head.
7. Check and adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS. To install remaining components, reverse removal procedure.
8. Before installing valve cover and gasket, apply sealant at indicated areas on cylinder head. See **Fig. 3**. Tighten valve cover bolts to specification in sequence. See **TORQUE SPECIFICATIONS**. See **Fig. 4**.

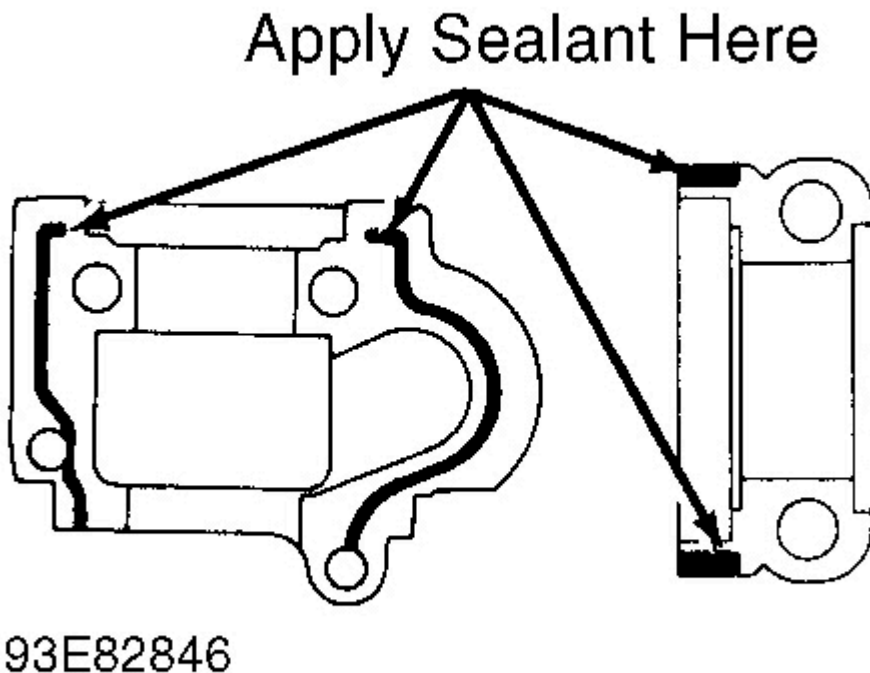


Fig. 16: Identifying Camshaft Bearing Caps No. 1 & 5 Sealant Application Areas
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transmission, clutch assembly (if equipped) and flywheel/drive plate. Using a knife, cut off seal lip.

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Pry oil seal from crankshaft rear oil seal retainer. Use care not to damage sealing surfaces.

Installation

1. Ensure all sealing surfaces are clean. Apply grease to seal lip of NEW oil seal. Using Oil Seal Installer (SST 09223-56010), install oil seal in crankshaft rear oil seal retainer until oil seal is even with surface of oil seal retainer.
2. Apply thread adhesive to flywheel/drive plate bolts. Install and tighten flywheel/drive plate bolts to specification in a crisscross pattern. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.

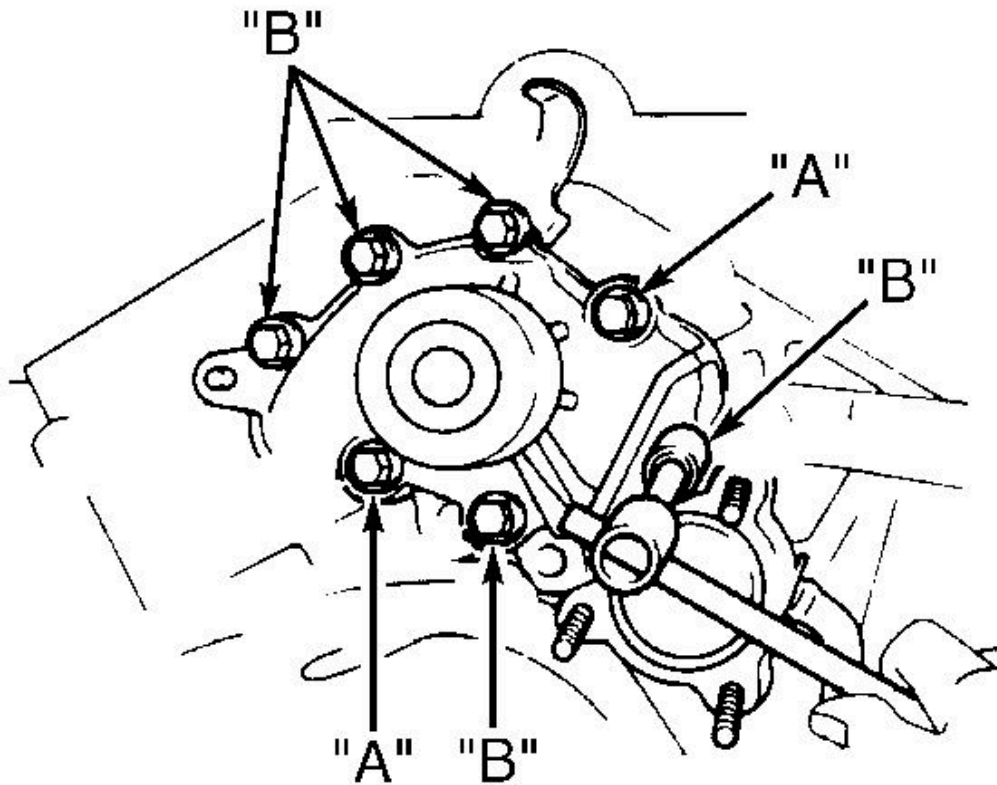
WATER PUMP

Removal

Drain cooling system. Remove timing belt. See **TIMING BELT**. Remove radiator hose at thermostat housing. Remove coolant inlet for thermostat, gasket and thermostat. Disconnect coolant hoses from water pump. Remove bolts and water pump.

Installation

1. Apply sealant on water pump sealing area. Install water pump. Install and tighten bolts to specification. See **Fig. 17**.
2. Install thermostat with jiggle pin facing upward (toward top of engine). Using NEW gasket, install coolant inlet. Install and tighten nuts to specification. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure. Fill cooling system.



Bolt "A" - 13 Ft. Lbs. (18 N.m)

Bolt "B" - 15 Ft. Lbs. (20 N.m)

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Fig. 17: Installing Water Pump Bolts

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OIL PAN

Removal

1. Remove lower engine covers. Drain engine oil. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges.
2. Place reference marks on drive shaft flanges for reassembly reference. Remove bolts and disconnect drive shaft from front differential.

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3. Disconnect necessary vacuum hoses and electrical connectors at front differential. Remove front differential crossmember, located below front differential (if equipped).
4. Support front differential assembly with floor jack. Remove front differential assembly mounting bolts. Lower front differential assembly from vehicle.
5. On all models, remove oil pan bolts/nuts. Install Seal Cutter (SST 09032-00100) between oil pan and cylinder block. Carefully tap seal cutter around oil pan to loosen seal. Use care not to damage sealing surfaces or oil pan flange. Remove oil pan.

Installation

1. Ensure sealing surfaces are clean. Apply a .12" (3.0 mm) diameter bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.
2. Install oil pan. Install and tighten oil pan bolts/nuts to specification. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.
3. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill front differential with gear oil. On 4WD models with manual hubs on front axle, use hypoid gear oil SAE 80W-90 with API rating of GL-5. On 4WD models without manual hubs on front axle, use hypoid gear oil SAE 75W-90 with API rating of GL-5.

OVERHAUL

CYLINDER HEAD OVERHAUL

Cylinder Head

1. Inspect cylinder head warpage at cylinder block and manifold surfaces. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See **Fig. 14**. See **TORQUE SPECIFICATIONS**. Measure camshaft end play with camshaft bearing cap bolts tightened to specification.
3. Replace camshaft and/or cylinder if camshaft oil clearance or end play is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS. Ensure valve lifter bore diameter is within specification. See **VALVE LIFTERS** table under ENGINE SPECIFICATIONS.

Valve Springs

Ensure valve spring free length, pressure and out-of-square are within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Stem Oil Seals

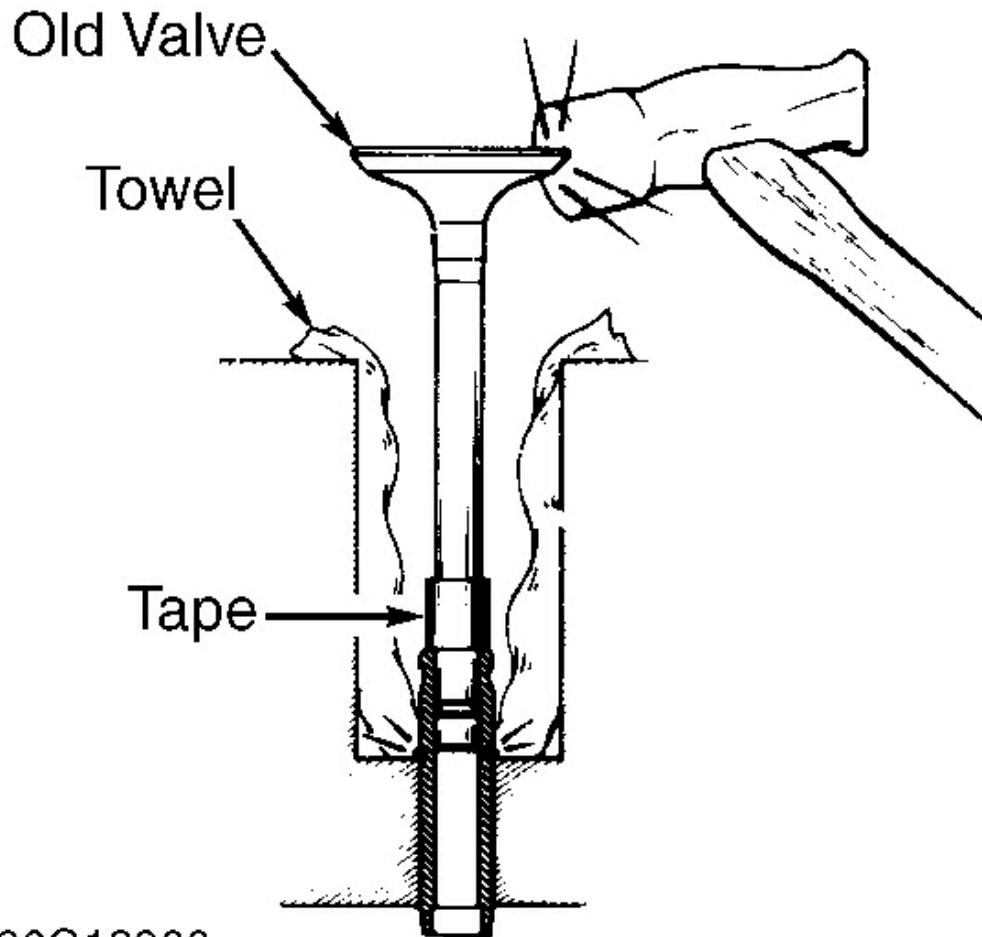
Valve stem oil seal for intake valve is Gray and exhaust valve is Brown. Ensure proper valve stem oil seal is installed. Lubricate valve stem oil seal with engine oil. Use Oil Seal Installer (SST 09201-41020) to install valve stem oil seal. Ensure valve stem oil seal is fully seated.

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Valve Guides

1. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.
2. To replace valve guide, remove snap ring from valve guide. Wrap tape around old valve stem at approximately .47" (12.0 mm) from end of valve stem. From top of cylinder head, install old valve in valve guide with tape area resting on valve guide. See **Fig. 18**.
3. Using hammer, hit old valve to break off old valve guide. Heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (SST 09201-60011), drive valve guide out from camshaft side of cylinder head.
4. Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .5118-.5129" (13.000-13.027 mm), use standard valve guide.
5. If bore inside diameter exceeds .5129" (13.027 mm), machine valve guide bore to .5138-.5148" (13.050-13.077 mm) for oversize valve guide. To install valve guide, heat cylinder head to 176-212°F (80-100°C).
6. Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head until snap ring on valve guide contacts cylinder head surface.
7. Using .31" (8.0 mm) reamer, ream valve guide to obtain specified valve stem-to-guide oil clearance. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.



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Fig. 18: Removing Valve Guide

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Valve Seat

Ensure valve seat angle and seat width are within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Valve seat replacement information is not available at time of publication.

Valves

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

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Valve Seat Correction Angles

Use 30-degree and 45-degree stones to lower valve seat contact area. Use 60-degree and 45-degree stones to raise valve seat contact area.

VALVE TRAIN

Valve Lifters

Ensure valve lifter diameter, bore diameter and oil clearance are within specification. See **VALVE LIFTERS** table under ENGINE SPECIFICATIONS.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

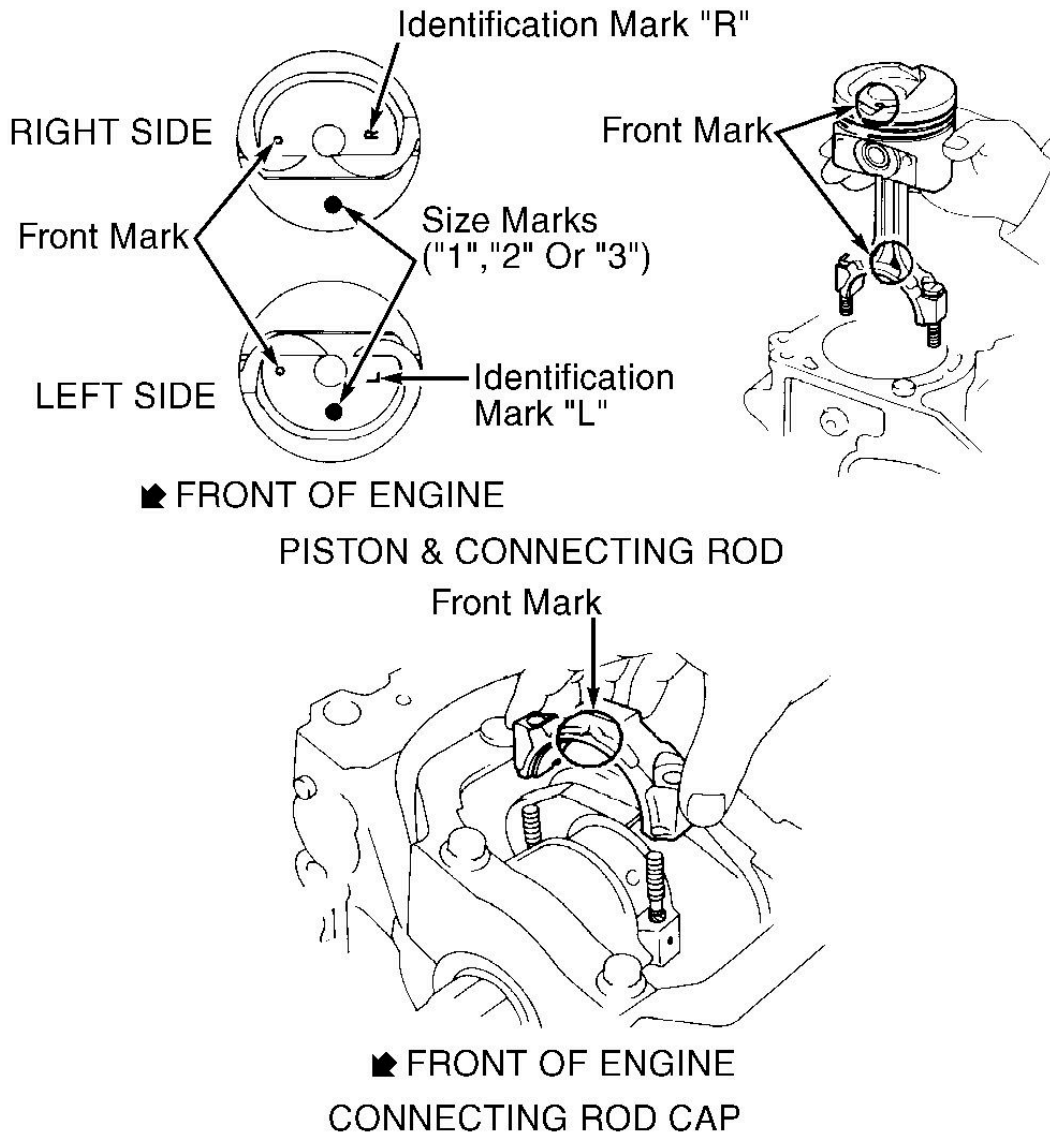
1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Piston, connecting rod and connecting rod cap must be installed with front mark toward front of engine. See [Fig. 19](#).

NOTE: Front mark on connecting rod may be a A1, B6, 1B, 8A, C3 or etc. stamped at center of connecting rod. See [Fig. 19](#).

2. Try to move piston back and forth on piston pin. Replace piston and piston pin as an assembly if any movement is felt. Press piston pin from piston. Separate piston from connecting rod.
3. Piston diameter is determined by size mark ("1", "2" or "3") stamped on top of piston. See [Fig. 19](#). Measure piston skirt diameter 1.02" (26.0 mm) from top of piston at 90-degree angle to piston. Ensure piston diameter is within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
4. Ensure connecting rod crankpin bore inside diameter, bend and twist are within specification. See **CONNECTING RODS** table under ENGINE SPECIFICATIONS. Crankpin bore inside diameter is determined by size mark ("1", "2" or "3") stamped on connecting rod cap. See [Fig. 22](#).
5. Ensure nut rotates easily on connecting rod bolt. If nut does not rotate easily, using caliper, measure outside diameter of connecting rod bolt on thread area at .646" (16.40 mm) from end of bolt. Replace bolt or connecting rod and cap as a set if outside diameter of bolt is less than .2992" (7.600 mm).
6. To reassemble, coat piston pin and piston pin holes on piston with engine oil before installing. Install piston on connecting rod so front mark on top of piston aligns with front mark on connecting rod. See [Fig. 19](#). Piston for the right side contains an identification mark "R" and piston for left side contains an identification mark "L". See [Fig. 19](#).

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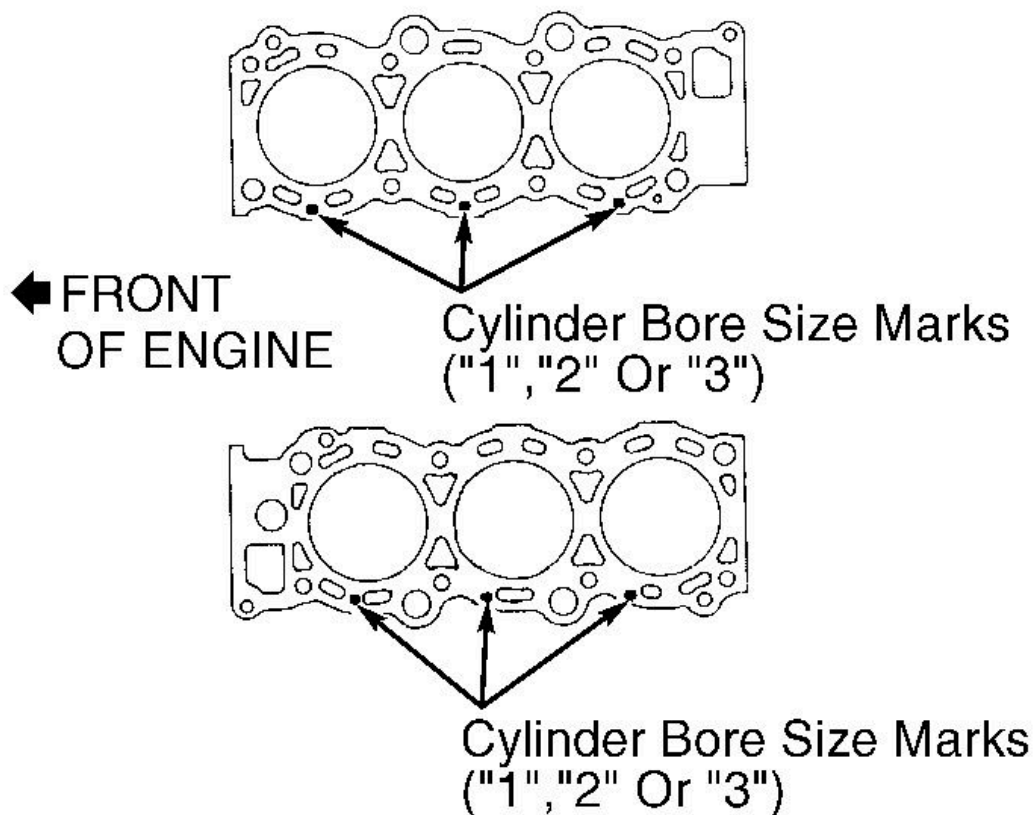
Fig. 19: Identifying Piston & Connecting Rod Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Fitting Pistons

1. Different piston sizes and cylinder bore sizes are used. Piston diameter is determined by size mark ("1", "2" or "3") stamped on top of piston. See **Fig. 19**. Cylinder bore diameter is determined by cylinder bore size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 20**. To determine piston-to-cylinder clearance, measure piston diameter and cylinder bore diameter.
2. Measure piston skirt diameter 1.02" (26.0 mm) from top of piston at 90-degree angle to piston. Ensure

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

3. Measure cylinder bore diameter at .39" (10.0 mm) from top and bottom of cylinder bore and at middle of cylinder bore. Ensure cylinder bore diameter is within specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
4. If clearance is not within specification, replace piston or bore cylinder block. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Cylinder block can be bored for .020" (.50 mm) oversize pistons.



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Fig. 20: Identifying Cylinder Bore Size Marks

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Piston Rings

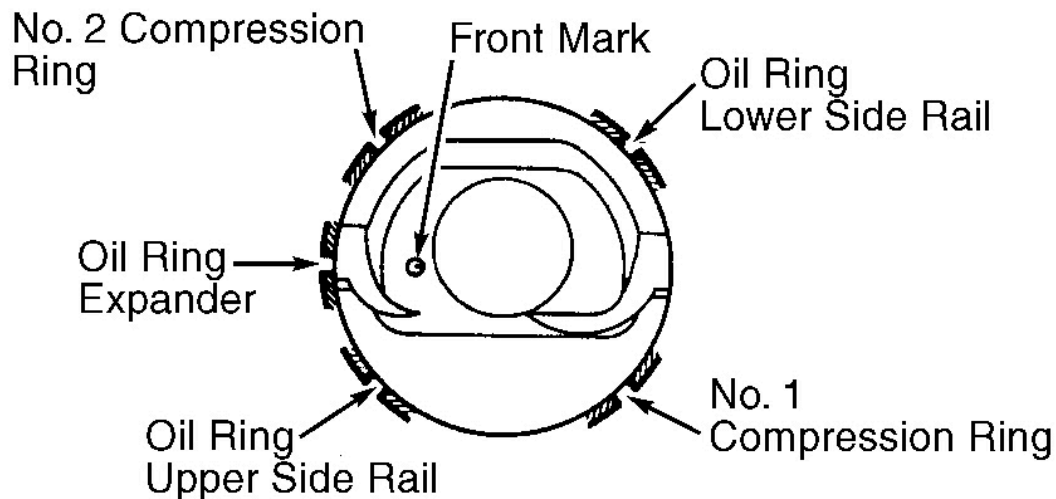
1. Ensure piston ring end gap and side clearance are within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

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NOTE: No. 1 compression ring may contain a 1R or "T" identification mark and No. 2 compression ring may contain a 2R or T2 identification mark. Ensure proper compression ring is installed in designated area.

2. Position piston rings with end gaps in proper areas and identification mark on piston ring toward top of piston. See **Fig. 21**.



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Fig. 21: Positioning Piston Rings

Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Rod Bearings

1. Mark direction of connecting rod cap installation and cylinder number before disassembly. Piston, connecting rod and connecting rod cap must be installed with front mark toward front of engine. See **Fig. 19**.
2. Connecting rod cap and rod bearing are stamped with a size mark ("1", "2" or "3"). See **Fig. 22**. Size marks on connecting rod cap and rod bearing must be same. Rod bearing thickness is determined by size mark. See **ROD BEARING SPECIFICATIONS** table.

NOTE: If replacing rod bearing, ensure size mark on replacement rod bearing is the same as size mark on original rod bearing.

3. Ensure nut rotates easily on connecting rod bolt. If nut does not rotate easily, using caliper, measure outside diameter of connecting rod bolt on thread area at .646" (16.40 mm) from end of bolt. Replace bolt or connecting rod and cap as a set if outside diameter of bolt is less than .2992" (7.600 mm).