

1.5L 4-CYL - VIN [E]

1994 Toyota Paseo

1994 ENGINES
Toyota 1.5L 4-Cylinder

Paseo

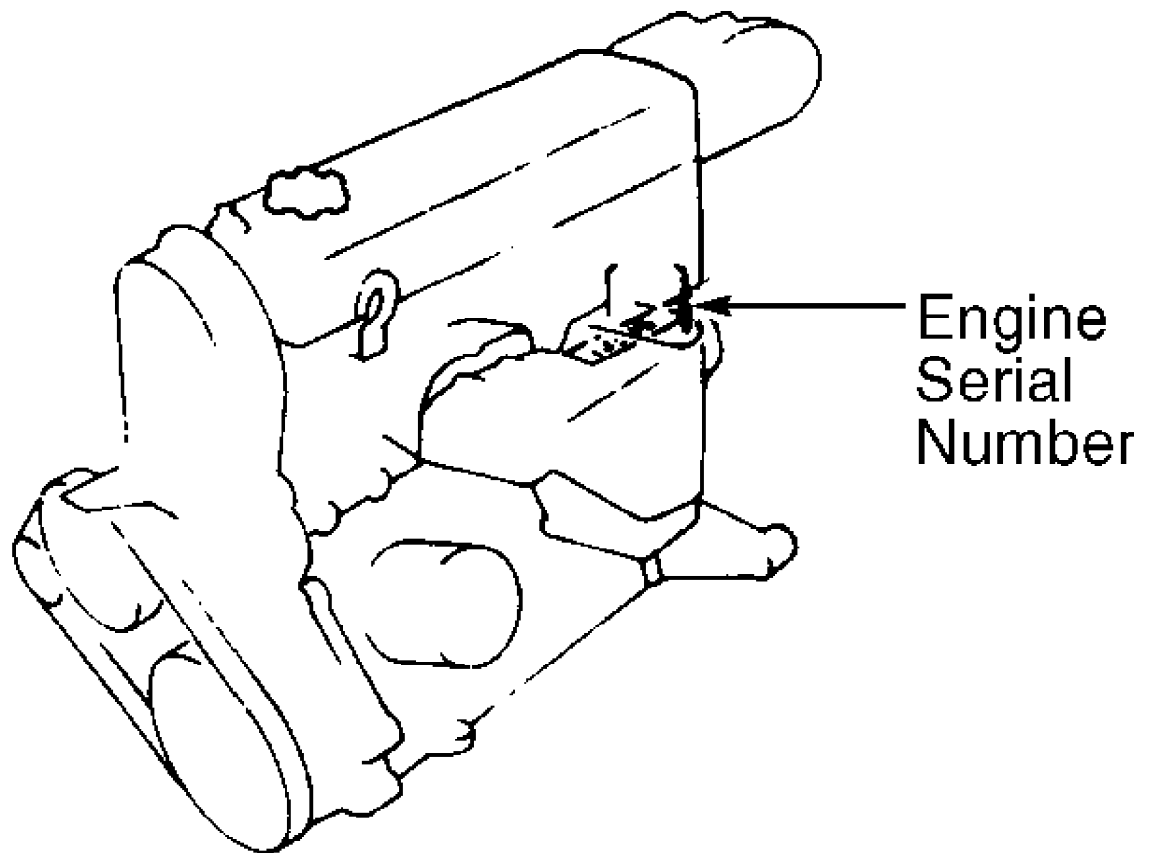
NOTE: For repair procedures not covered in this article, see
ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION
article in GENERAL INFORMATION.

ENGINE IDENTIFICATION

Engine serial number is stamped on left rear corner of
cylinder block. See Fig. 1.

ENGINE IDENTIFICATION CODE TABLE

Engine	Code
1.5L 4-Cylinder	5E-FE



93C00473

Fig. 1: Identifying Engine Serial Number
Courtesy of Toyota Motor Sales, U.S.A., Inc.

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine cold.

1) Disconnect PCV hose, necessary electrical connections and spark plug wires to access valve cover. Remove nuts, seal washers, valve cover and gasket.

2) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover.

3) Ensure valve lifters on cylinder No. 1 are loose and valve lifters on cylinder No. 4 are tight. If conditions are not as described, rotate crankshaft clockwise one complete revolution (360 degrees).

4) Using feeler gauge, measure valve clearance between valve lifter and camshaft on intake valves of cylinders No. 1 and 2, and exhaust valves of cylinders No. 1 and 3. Record valve clearance. Rotate crankshaft clockwise one complete revolution (360 degrees).

5) Measure and record valve clearance on intake valves of cylinders No. 3 and 4, and exhaust valves of cylinders No. 2 and 4. Ensure valve clearance is within specification. See VALVE CLEARANCE SPECIFICATIONS table.

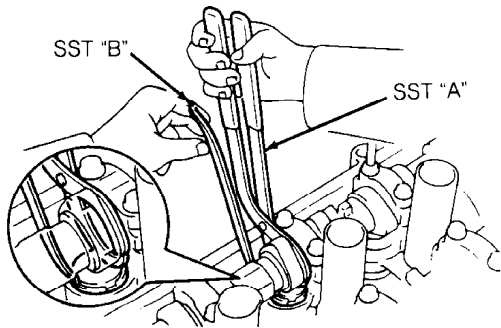
VALVE CLEARANCE SPECIFICATIONS TABLE (1)

Application	In. (mm)
Exhaust Valve .....	.012-.016 (.31-.41)
Intake Valve .....	.006-.010 (.15-.25)

(1) - Adjust valve clearance with engine cold.

6) If valve clearance requires adjustment, rotate camshaft so lobe on valve to be adjusted is facing upward, away from valve lifter. Position notch area on valve lifter toward inside of cylinder head. DO NOT align notch area with camshaft. Use Valve Clearance Adjuster (SST 09248-55040) to adjust valve clearance.

7) Using SST "A" of valve clearance adjuster, push downward on valve lifter. Place SST "B" between camshaft and valve lifter. See Fig. 2. Ensure enough clearance exists for adjusting shim removal. Remove SST "A".



93D00474
Fig. 2: Adjusting Valve Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Using small screwdriver and magnet, remove adjusting shim. Measure and record thickness of removed shim. Using measured clearance

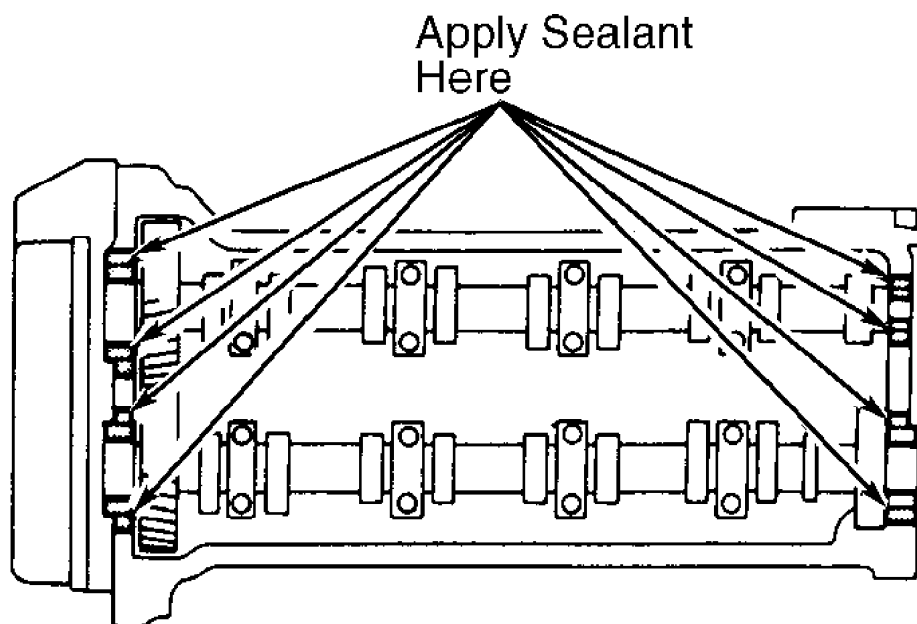
and adjusting shim thickness, select proper replacement adjusting shim. See Figs. 4 and 5.

9) Install replacement adjusting shim. Recheck valve clearance. Apply sealant at indicated valve cover sealing areas on cylinder head. See Fig. 3.

10) Using NEW gasket, install valve cover and sealing washers. Install and tighten nuts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

NEW SHIM THICKNESS TABLE

Shim No.	Thickness	Shim No.	Thickness mm (In.)
02	2.500 (0.0984)	20	2.950 (0.1161)
04	2.550 (0.1004)	22	3.000 (0.1181)
06	2.600 (0.1024)	24	3.050 (0.1201)
08	2.650 (0.1043)	26	3.100 (0.1220)
10	2.700 (0.1063)	28	3.150 (0.1240)
12	2.750 (0.1083)	30	3.200 (0.1260)
14	2.800 (0.1102)	32	3.250 (0.1280)
16	2.850 (0.1122)	34	3.300 (0.1299)
18	2.900 (0.1142)		



93E00475

Fig. 3: Identifying Cylinder Head Sealant Application Areas
Courtesy of Toyota Motor Sales, U.S.A., Inc.

EXHAUST VALVES

Measured clearance mm (in.)	Installed shim thickness mm (in.)	2.500 (0.0984)	2.525 (0.0994)	2.550 (0.1004)	2.575 (0.1014)	2.600 (0.1024)	2.620 (0.1031)	2.640 (0.1039)	2.660 (0.1043)	2.680 (0.1047)	2.680 (0.1055)	2.700 (0.1063)	2.720 (0.1071)	2.740 (0.1079)	2.750 (0.1083)	2.760 (0.1087)	2.780 (0.1094)	2.800 (0.1102)	2.820 (0.1110)	2.840 (0.1118)	2.860 (0.1122)	2.880 (0.1126)	2.880 (0.1134)	2.900 (0.1142)	2.920 (0.1150)	2.940 (0.1157)	2.960 (0.1161)	2.960 (0.1165)	2.980 (0.1173)	3.000 (0.1181)	3.020 (0.1189)	3.040 (0.1197)	3.060 (0.1201)	3.060 (0.1206)	3.080 (0.1213)	3.100 (0.1220)	3.120 (0.1228)	3.140 (0.1236)	3.150 (0.1240)	3.160 (0.1244)	3.180 (0.1252)	3.200 (0.1260)	3.225 (0.1270)	3.250 (0.1280)	3.275 (0.1289)	3.300 (0.1299)																																																																																																													
		0.000 - 0.020 (0.0000 - 0.0008)	0.021 - 0.040 (0.0008 - 0.0016)	0.041 - 0.060 (0.0016 - 0.0024)	0.061 - 0.080 (0.0024 - 0.0031)	0.081 - 0.100 (0.0032 - 0.0039)	0.101 - 0.120 (0.0040 - 0.0047)	0.121 - 0.140 (0.0048 - 0.0055)	0.141 - 0.160 (0.0056 - 0.0063)	0.161 - 0.180 (0.0063 - 0.0071)	0.181 - 0.200 (0.0071 - 0.0079)	0.201 - 0.220 (0.0079 - 0.0087)	0.221 - 0.240 (0.0087 - 0.0094)	0.241 - 0.260 (0.0095 - 0.0102)	0.261 - 0.280 (0.0103 - 0.0110)	0.281 - 0.300 (0.0111 - 0.0118)	0.301 - 0.309 (0.0119 - 0.0122)	0.310 - 0.410 (0.0122 - 0.0161)	0.411 - 0.430 (0.0162 - 0.0169)	0.431 - 0.450 (0.0170 - 0.0177)	0.451 - 0.470 (0.0178 - 0.0185)	0.471 - 0.490 (0.0185 - 0.0193)	0.491 - 0.510 (0.0193 - 0.0201)	0.511 - 0.530 (0.0201 - 0.0209)	0.531 - 0.550 (0.0209 - 0.0217)	0.551 - 0.570 (0.0217 - 0.0224)	0.571 - 0.590 (0.0225 - 0.0232)	0.591 - 0.610 (0.0233 - 0.0240)	0.611 - 0.630 (0.0241 - 0.0248)	0.631 - 0.650 (0.0248 - 0.0256)	0.651 - 0.670 (0.0256 - 0.0264)	0.671 - 0.690 (0.0264 - 0.0272)	0.691 - 0.710 (0.0272 - 0.0280)	0.711 - 0.730 (0.0280 - 0.0287)	0.731 - 0.750 (0.0288 - 0.0295)	0.751 - 0.770 (0.0296 - 0.0303)	0.771 - 0.790 (0.0304 - 0.0311)	0.791 - 0.810 (0.0311 - 0.0319)	0.811 - 0.830 (0.0319 - 0.0327)	0.831 - 0.850 (0.0327 - 0.0335)	0.851 - 0.870 (0.0335 - 0.0343)	0.871 - 0.890 (0.0343 - 0.0350)	0.891 - 0.910 (0.0351 - 0.0358)	0.911 - 0.930 (0.0359 - 0.0366)	0.931 - 0.950 (0.0367 - 0.0374)	0.951 - 0.970 (0.0374 - 0.0382)	0.971 - 0.990 (0.0382 - 0.0390)	0.991 - 1.010 (0.0390 - 0.0398)	1.011 - 1.030 (0.0398 - 0.0406)	1.031 - 1.050 (0.0406 - 0.0413)	1.051 - 1.070 (0.0414 - 0.0421)	1.071 - 1.090 (0.0422 - 0.0429)	1.091 - 1.110 (0.0430 - 0.0437)	1.111 - 1.130 (0.0437 - 0.0445)	1.131 - 1.150 (0.0445 - 0.0453)	1.151 - 1.170 (0.0453 - 0.0461)	1.171 - 1.190 (0.0461 - 0.0469)	1.191 - 1.210 (0.0469 - 0.0476)																																																																																																	
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Fig. 4: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

INTAKE VALVES

[illegible]

Fig. 5: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

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.

WARNING: To prevent air bag deployment, disconnect negative battery cable at least 90 seconds before working on vehicle.

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.

FUEL PRESSURE RELEASE

With ignition off, disconnect negative battery cable. Place suitable container under fuel line. Cover fuel line connection with shop towel. Slowly loosen fuel line connection to release fuel pressure. Once fuel pressure is released, fuel system components may be serviced.

ENGINE

NOTE: Remove engine and transaxle as an assembly.

Removal

1) Disconnect negative battery cable. Release fuel pressure. See FUEL PRESSURE RELEASE. Drain cooling system and engine oil. Remove hood, battery, coolant reservoir and radiator.

2) Remove air cleaner assembly with air intake connector and air cleaner bracket. Disconnect control cables at throttle body.

3) Remove charcoal canister and drain canister. Drain canister is connected to charcoal canister with a hose and is located near charcoal canister.

4) Disconnect necessary electrical connections, coolant hoses, fuel lines and vacuum hoses. Remove cruise control actuator (if equipped) from passenger-side front fender.

5) Remove bolt and vacuum switching valve assembly, located near front of timing belt cover, on passenger's side. Raise and support vehicle. Remove lower engine covers.

6) Disconnect necessary electrical connections, control cables, oil cooler lines and speedometer cable from transaxle. Disconnect oxygen sensor connector. Remove exhaust pipe-to-cylinder block support bracket bolts. Remove nuts, and separate exhaust pipe from exhaust manifold.

7) On M/T models, remove clutch release cylinder with hose attached and secure aside. On all models, remove power steering pump and A/C compressor (if equipped) with hoses attached and secure aside. Remove power steering pump adjusting bracket and A/C compressor mounting bracket (if equipped).

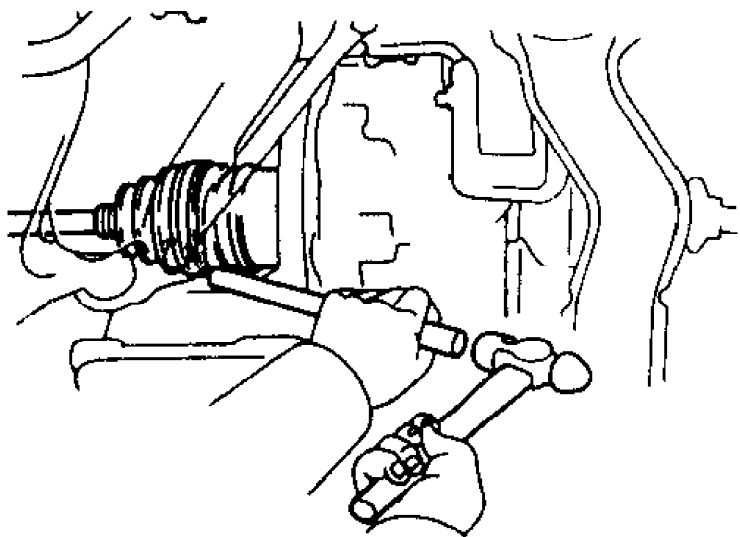
8) On A/C equipped models without power steering, remove A/C idler pulley. On all models, remove front wheels. Drain transaxle fluid. Remove cotter pin and retainer from end of axle shaft. Apply brakes and remove axle shaft nut.

9) Remove nut and separate tie rod from steering knuckle. Remove ball joint-to-lower control arm bolts/nuts. Separate lower control arm from ball joint.

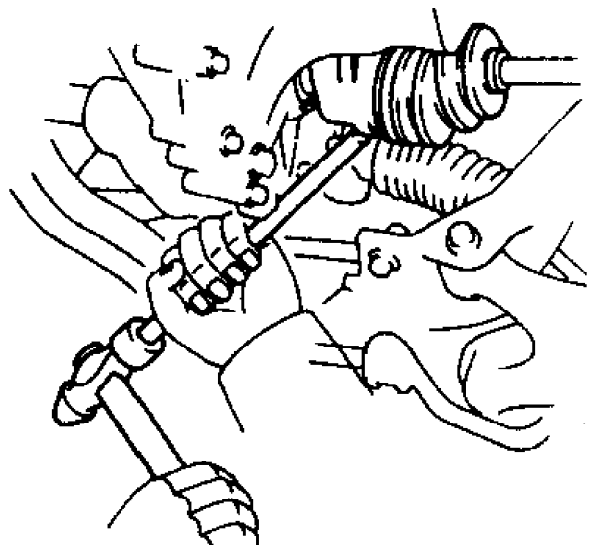
10) Cover axle shaft boot with shop towel. Attach Puller (SST 09950-20017) to front hub, and press axle shaft from hub assembly. Push hub assembly outward. Separate axle shaft from hub assembly.

11) Using hammer and brass drift, tap axle shaft from transaxle. See Fig. 6. Support engine with hoist. Remove through-bolt and rear (firewall side) engine mount bracket.

12) Remove through-bolt and right (timing belt side) engine mount. Remove left (transaxle side) engine mount bracket. Lift engine and transaxle from vehicle.

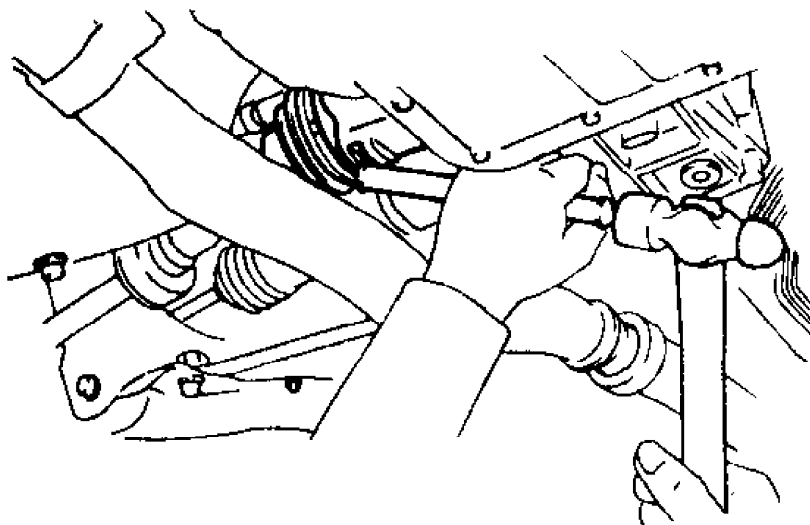


A/T MODELS



M/T MODELS

REMOVING LEFT AXLE SHAFT



REMOVING RIGHT AXLE SHAFT

93F00476

Fig. 6: Removing Axle Shaft

Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) Install engine and transaxle. Install right (timing belt side) engine mount and through-bolt. DO NOT tighten bolts/nuts at this time.

NOTE: Ensure ground strap is connected to left (transaxle side) engine mount bracket.

2) Install left (transaxle side) engine mount bracket. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Install rear (firewall side) engine mount bracket and through-bolt. Tighten bolts to specification.

3) With all other engine mount bolts tightened to specification, tighten right (timing belt side) engine mount bolts/nuts and through-bolt to specification. See TORQUE SPECIFICATIONS.

4) Install NEW snap ring on end of axle shaft. Coat lip of axle shaft seal with grease. Install axle shaft in transaxle with opening of snap ring facing downward.

5) Ensure axle shaft moves in and out .079-.120" (2.00-3.00 mm) after installation. Ensure axle shaft cannot be pulled from transaxle.

6) To install remaining components, reverse removal procedure. Install NEW exhaust pipe-to-exhaust manifold nuts. Tighten fasteners to specification. See TORQUE SPECIFICATIONS. Adjust fluid levels and control cables.

CYLINDER HEAD & MANIFOLDS

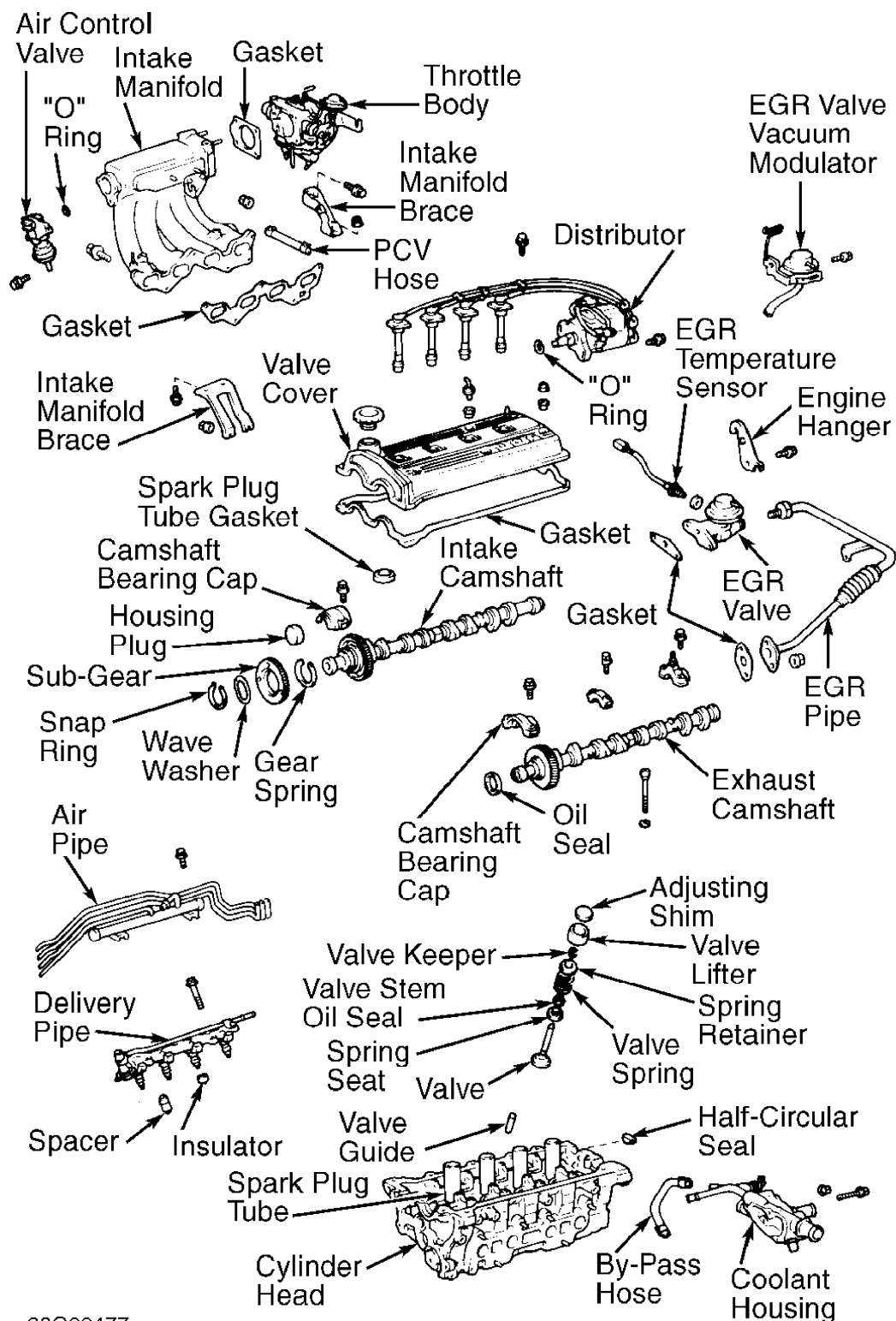
Removal

1) Disconnect negative battery cable. Release fuel pressure. See FUEL PRESSURE RELEASE. Drain cooling system. Disconnect control cables at throttle body.

2) Remove air cleaner assembly with air intake connector. Disconnect necessary electrical connections, coolant hoses, fuel lines, vacuum lines and PCV hose.

3) Remove A/C compressor and power steering pump (if equipped) with hoses attached and secure aside. Remove power steering pump bracket. On models equipped with A/C without power steering, remove A/C idler pulley.

4) On all models, remove distributor and spark plugs. Remove EGR pipe, EGR valve, EGR valve vacuum modulator, EGR temperature sensor (if equipped) and coolant housing. See Fig. 7. Raise and support vehicle. Remove right lower engine cover.



93G00477

Fig. 7: Exploded View Of Cylinder Head & Components
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

5) Disconnect oxygen sensor connector. Remove exhaust pipe-to-cylinder block support bracket bolts. Remove nuts, and separate

exhaust pipe from exhaust manifold.

6) Remove exhaust manifold heat insulator. Remove nuts, exhaust manifold and gasket. Remove air control valve and "O" ring from end of intake manifold and air pipe. See Fig. 7.

CAUTION: DO NOT allow injectors to fall from delivery pipe when removing from intake manifold.

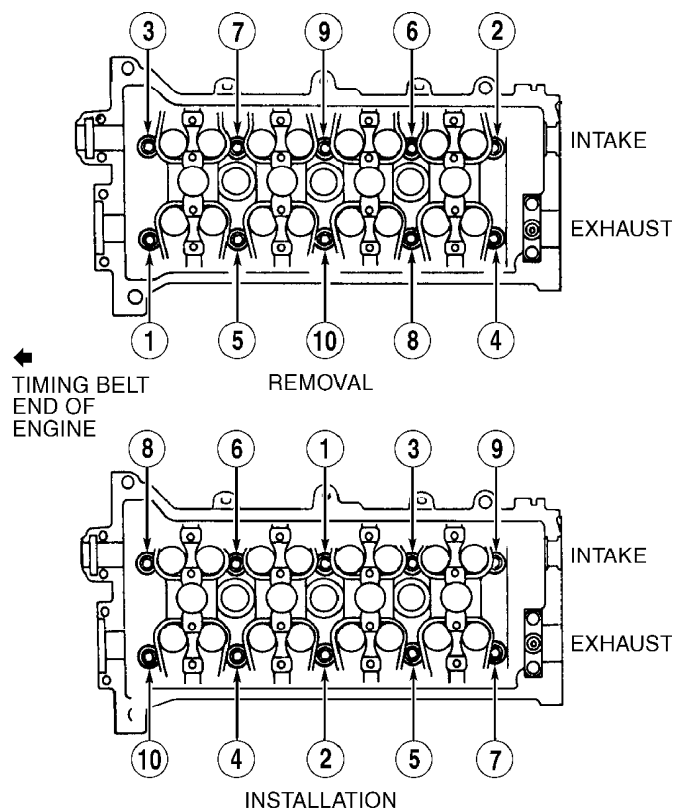
7) Remove throttle body and gasket from intake manifold (if necessary). Remove intake manifold braces. Disconnect fuel lines from delivery pipe and electrical connections from injectors. Remove bolts, delivery pipe with injectors, spacers and insulators. See Fig. 7.

8) Remove air pipe. See Fig. 7. Remove bolts/nuts, intake manifold and gasket. Remove nuts, seal washers, valve cover and gasket.

9) Remove timing belt from camshaft sprocket and No. 2 idler pulley. See TIMING BELT. Remove camshafts. See CAMSHAFT.

CAUTION: Cylinder head bolts must be loosened in proper sequence to prevent cylinder head warpage.

10) Loosen cylinder head bolts in sequence using several steps. See Fig. 8. Remove cylinder head bolts, cylinder head and cylinder head gasket.



NOTE: Long cylinder head bolts fit on exhaust side and short bolts on intake side.

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Fig. 8: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect cylinder head warpage at cylinder block and

manifold areas. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Inspect intake manifold-to-cylinder head surfaces for warpage. Replace intake manifold if warpage exceeds .0039" (.100 mm).

3) Inspect exhaust manifold-to-cylinder head surface warpage. Replace exhaust manifold if warpage exceeds .0079" (.200 mm).

4) Inspect cylinder block deck surface for warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Inspect camshaft and components. See CAMSHAFT.

Installation

1) Install NEW cylinder head gasket on cylinder block. Ensure all holes in cylinder head gasket align with holes in cylinder block. Install cylinder head. Apply engine oil on cylinder head bolt threads and cylinder head bolt-to-cylinder head contact surfaces.

2) Install and tighten cylinder head bolts to specification in sequence. See Fig. 8. See TORQUE SPECIFICATIONS. Install camshafts using proper procedure. See CAMSHAFT.

3) To install remaining components, reverse removal procedure using NEW gaskets and NEW "O" rings. If camshaft or cylinder head components are serviced, adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

4) If spark plug tube gasket in valve cover requires replacement, pry spark plug tube gasket from valve cover. Use care not to scratch valve cover sealing surface.

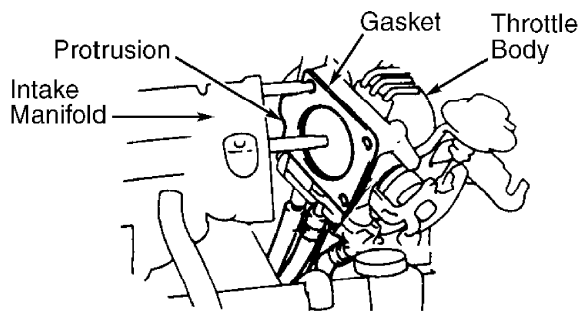
5) Using Handle (SST 09552-10010) and Gasket/Seal Installer (SST 09560-10010), install NEW spark plug tube gasket until it is even with upper edge of valve cover surface. Coat spark plug tube gasket sealing area with grease.

6) Before installing valve cover and gasket, apply sealant at indicated valve cover sealing areas on cylinder head. See Fig. 3. Using NEW gasket, install valve cover and sealing washers. Install and tighten nuts to specification. See TORQUE SPECIFICATIONS.

CAUTION: Install spacers below delivery pipe, with plastic end away from cylinder head and metal area toward cylinder head.

7) If injector was removed from delivery pipe, coat NEW "O" ring with gasoline. Install NEW "O" ring and NEW grommet on injector. Ensure injectors rotate smoothly after delivery pipe is installed. If injector does not rotate smoothly, check for damaged "O" rings.

8) When installing throttle body (if removed), ensure NEW throttle body gasket is positioned with protrusion in proper location. See Fig. 9.



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Fig. 9: Installing Throttle Body Gasket
Courtesy of Toyota Motor Sales, U.S.A., Inc.

9) Before installing air control valve, install NEW "O" ring on air control valve. Coat "O" ring with soapy water solution. Install

air control valve. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS.

10) Use NEW nuts when installing exhaust manifold. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

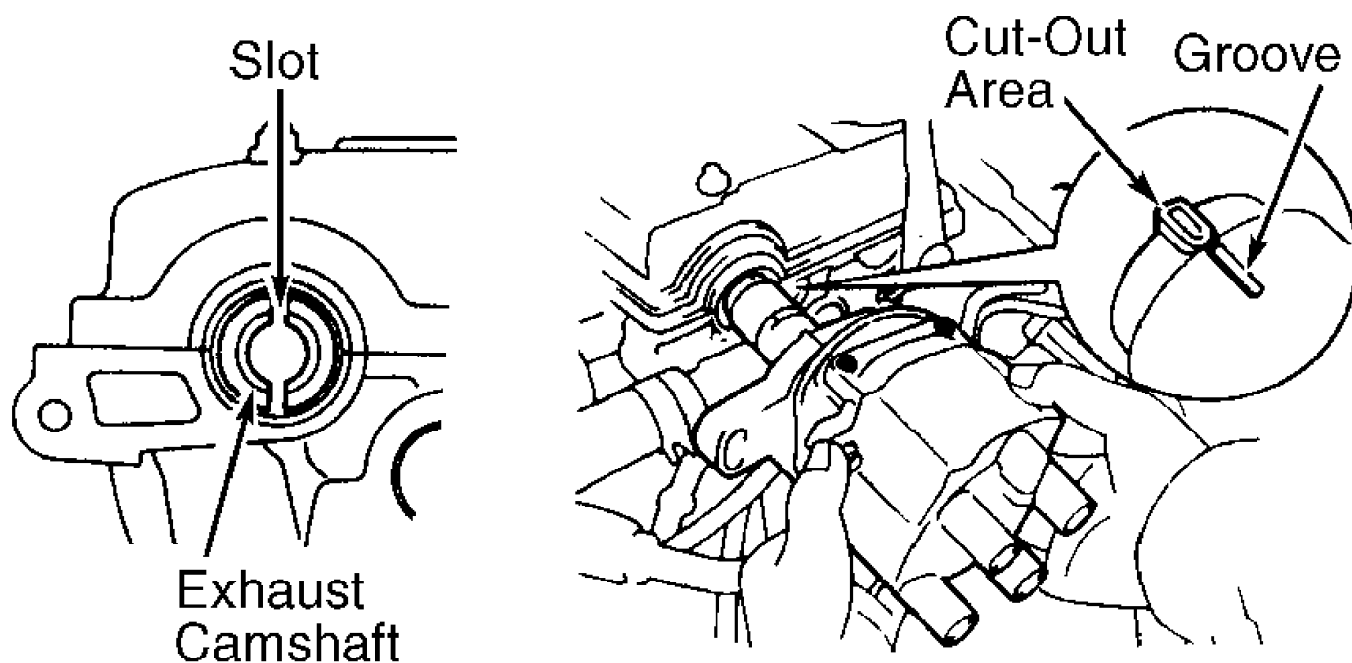
11) Before installing coolant housing, apply sealant in groove on rear of coolant housing. DO NOT apply excessive sealant on rear of coolant housing, as sealant may enter passages on cylinder head.

12) Install NEW "O" ring on distributor and coat with engine oil. When installing distributor, rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

13) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure slot area on exhaust camshaft is properly positioned. See Fig. 10.

14) Position cut-out area on coupling with groove on distributor housing. See Fig. 10. Install distributor. Position center of flange on distributor, with bolt hole on cylinder head. Install and tighten distributor hold-down bolts to specification. See TORQUE SPECIFICATIONS.

15) Install remaining components. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS. Adjust fluid levels, control cables and ignition timing.



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Fig. 10: Installing Distributor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CRANKSHAFT FRONT SEAL

Removal & Installation (Oil Pump Installed)

1) Remove timing belt and crankshaft sprocket. See TIMING BELT. Using a knife, cut seal lip from seal. Pry seal from oil pump body. Use care not to damage sealing surfaces.

2) To install, apply grease to seal lip of NEW seal. Using hammer and Seal Installer (SST 09309-37010), install seal until seal surface is even with oil pump body. To install remaining components,

reverse removal procedure.

Removal & Installation (Oil Pump Removed)

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

TIMING BELT

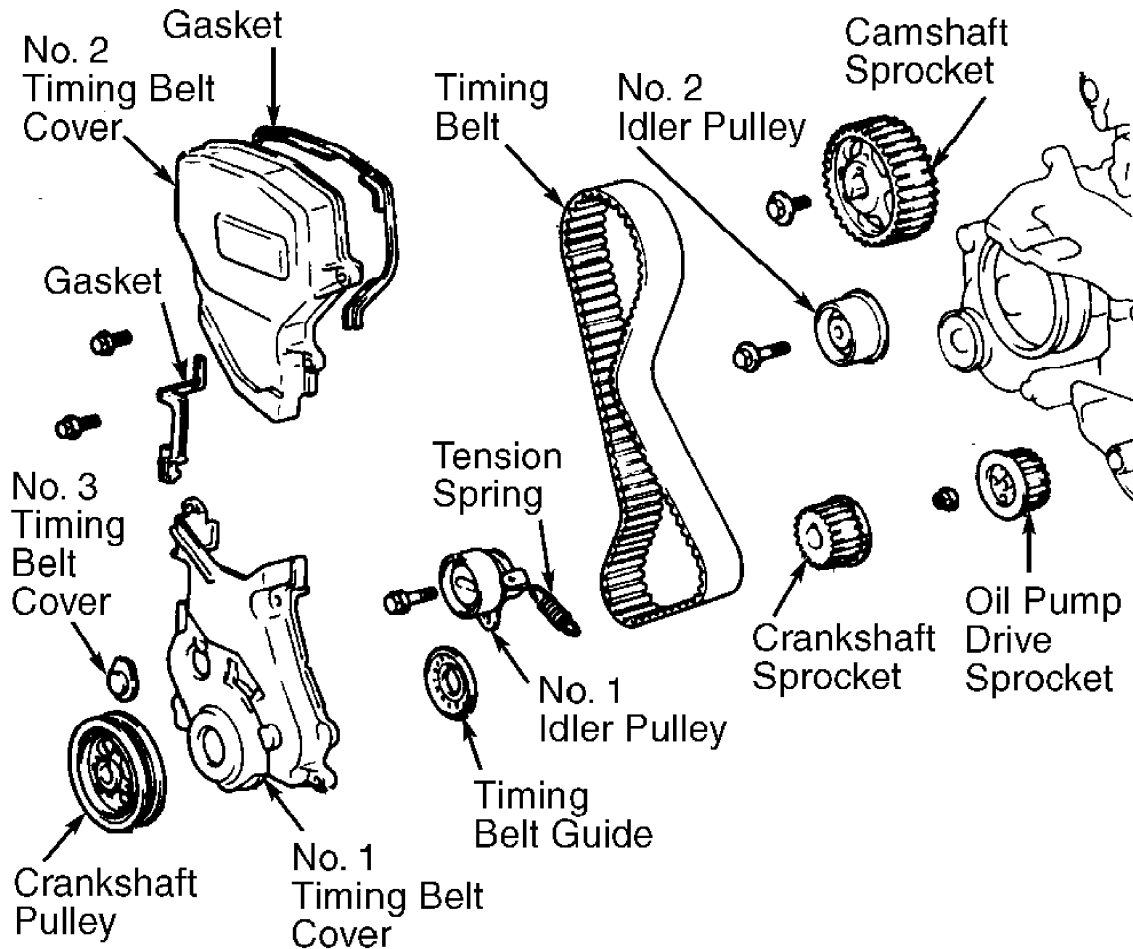
Removal

1) Disconnect negative battery cable. Remove accessory drive belts. Remove cruise control actuator (if equipped) from passenger-side front fender.

2) Remove bolt and vacuum switching valve assembly, located near front of timing belt cover on passenger's side. Raise and support vehicle. Remove right lower engine cover.

3) Slightly raise engine to remove weight from right (timing belt side) engine mount. Remove through-bolt and right engine mount.

4) Remove spark plugs. Remove nuts, seal washers, valve cover and gasket. Remove No. 2 timing belt cover and gasket. See Fig. 11.



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Fig. 11: Exploded View Of Timing Belt & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

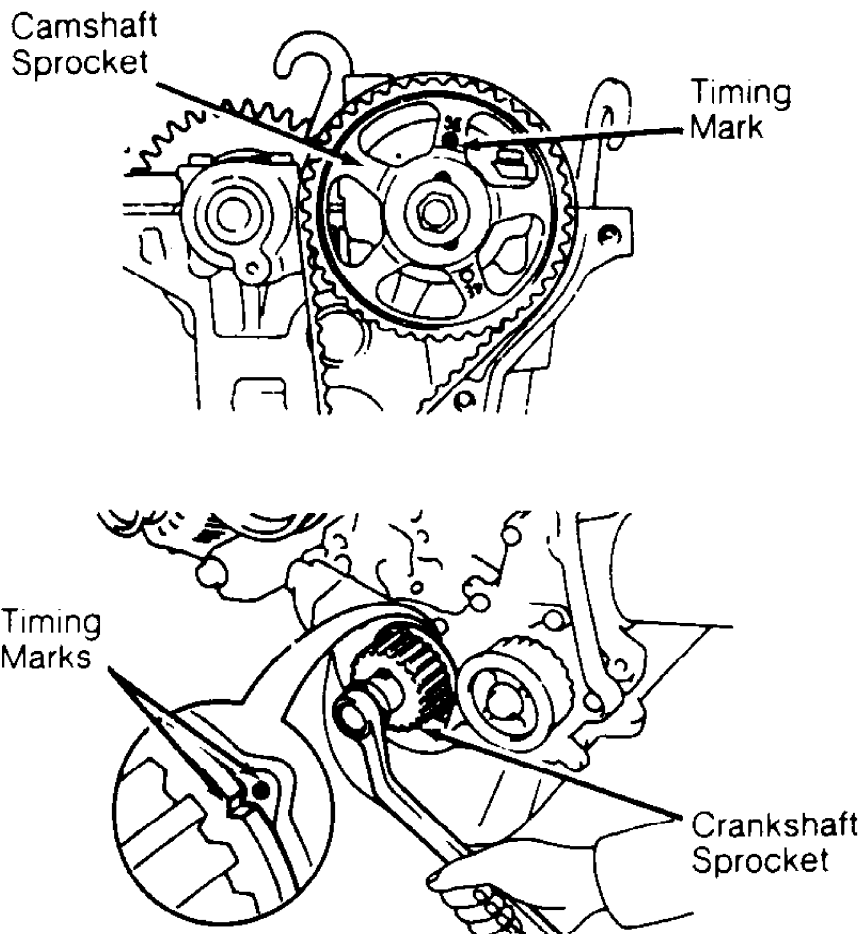
5) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt

end of engine. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover.

6) With cylinder No. 1 at TDC on compression stroke, ensure hole (5E timing mark) on camshaft sprocket aligns with timing mark on camshaft bearing cap. See Fig. 12. If timing mark is not aligned, rotate crankshaft clockwise one revolution (360 degrees).

7) Remove bolt and accessory drive belt pulley from front of crankshaft pulley. Using Pulley Holder (SST 09213-14010) and Handle (SST 09330-00021), hold crankshaft pulley, and remove crankshaft pulley bolt.

8) Using puller, remove crankshaft pulley. Remove No. 3 and then No. 1 timing belt cover and gasket. See Fig. 11. Note direction of timing belt guide installation for installation reference. See Fig. 12. Remove timing belt guide.



NOTE: Timing mark on camshaft sprocket is indicated by 5E stamped near hole in camshaft sprocket.

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Fig. 12: Aligning Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAUTION: If reusing timing belt, mark direction of timing belt rotation and place reference mark on timing belt at all

sprockets for reassembly reference.

9) Remove tension spring from No. 1 idler pulley.

See Fig. 11. Loosen No. 1 idler pulley bolt. Move No. 1 idler away from timing belt as far as possible and tighten bolt. Remove timing belt.

10) Remove bolt and No. 2 idler pulley (if necessary). If removing camshaft sprocket, hold camshaft on hexagon area using wrench. Use care not to damage cylinder head. Loosen camshaft sprocket bolt. Remove bolt and camshaft sprocket.

11) If removing crankshaft sprocket, place shop towels against oil pump body. Using 2 screwdrivers, pry crankshaft sprocket from crankshaft.

12) If removing oil pump drive sprocket, hold oil pump drive sprocket by installing Sprocket Holder (SST 09616-12011) in holes on front of oil pump drive sprocket. Remove oil pump drive sprocket nut. Remove sprocket holder and oil pump drive sprocket.

Inspection

1) Inspect timing belt for damaged teeth, cracking and oil contamination. Ensure No. 1 and 2 idler pulleys rotate freely. Inspect all sprockets for damage. Replace damaged components.

2) Measure free length of tension spring. Replace tension spring if free length is not 1.512" (38.40 mm). Measure tension required to extend tension spring to 1.866" (47.40 mm). Replace tension spring if tension is not 7.3 lbs. (3.3 kg).

Installation

1) If installing crankshaft sprocket, align crankshaft sprocket with key in crankshaft. Install crankshaft sprocket with flange toward cylinder block.

2) If installing oil pump drive sprocket, align flat area on oil pump drive sprocket with flat area on oil pump shaft. Install oil pump drive sprocket. Install and tighten nut to specification while holding oil pump drive sprocket with sprocket holder. See TORQUE SPECIFICATIONS.

3) If installing No. 2 idler pulley, install idler pulley. Install and tighten bolt to specification. See TORQUE SPECIFICATIONS. If installing camshaft sprocket, align pin groove in camshaft sprocket with pin in camshaft.

4) Install camshaft sprocket. Install and tighten camshaft sprocket bolt to specification while holding camshaft on hexagon area with wrench. See TORQUE SPECIFICATIONS.

5) Install No. 1 idler pulley with bolt loosely installed. DO NOT tighten bolt at this time. Move No. 1 idler pulley away from timing belt area as far as possible. Temporarily tighten No. 1 idler pulley bolt.

6) Ensure all sprockets and idler pulleys are clean. Temporarily install crankshaft pulley bolt, and rotate crankshaft so timing mark on crankshaft sprocket aligns with timing mark on oil pump body. See Fig. 12.

CAUTION: If reusing timing belt, ensure reference marks on timing belt align with those placed on all sprockets and timing belt is installed in original direction of rotation.

7) Remove crankshaft pulley bolt. Install timing belt on crankshaft sprocket, oil pump drive sprocket, No. 1 idler pulley and then No. 2 idler pulley in sequence.

8) Install timing belt guide with cupped side away from crankshaft sprocket and flat side toward timing belt. Install No. 1 timing belt cover and gasket.

9) Align crankshaft pulley key groove with key in crankshaft.

Install crankshaft pulley. Install and tighten crankshaft pulley bolt to specification while holding crankshaft pulley with pulley holder and handle. See TORQUE SPECIFICATIONS.

10) Install accessory drive belt pulley on front of crankshaft pulley. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS.

11) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover.

CAUTION: If reusing timing belt, ensure reference on timing belt aligns with that on camshaft sprocket.

12) Rotate camshaft sprocket, and align hole (5E timing mark) on camshaft sprocket with timing mark on camshaft bearing cap. See Fig. 12. Install timing belt on camshaft sprocket. Ensure tension exists on timing belt between crankshaft sprocket, oil pump drive sprocket and camshaft sprocket.

CAUTION: Crankshaft must always be rotated clockwise. DO NOT rotate crankshaft counterclockwise.

13) Loosen No. 1 idler pulley bolt, allowing tension spring to move No. 1 idler pulley against timing belt. Rotate crankshaft clockwise 2 full revolutions from TDC to TDC.

14) Ensure hole (5E timing mark) on camshaft sprocket aligns with timing mark on camshaft bearing cap when timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. If timing marks are not aligned, remove and reinstall timing belt.

15) Tighten No. 1 idler pulley bolt to specification. See TORQUE SPECIFICATIONS. Install No. 2 and 3 timing belt covers and gaskets. Apply sealant at indicated valve cover sealing areas on cylinder head. See Fig. 3.

16) Using NEW gasket, install valve cover and sealing washers. Install and tighten nuts to specification. See TORQUE SPECIFICATIONS.

17) To install remaining components, reverse removal procedure. To ensure proper mount alignment, install all right (timing belt side) engine mount bolts/nuts before tightening to specification. See TORQUE SPECIFICATIONS.

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 not within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Installation

To install, reverse removal procedure. Ensure components are installed in original locations. If camshaft, adjusting shims or valve lifters are replaced, check valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

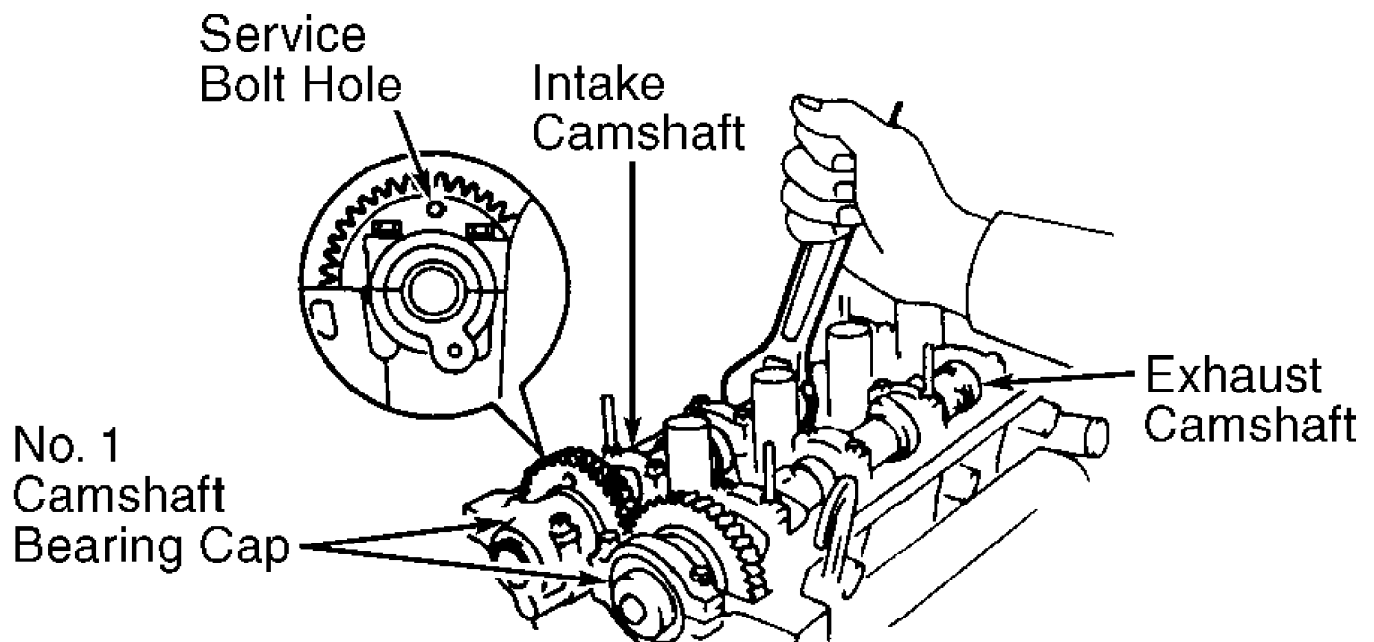
CAMSHAFT

Removal

1) Remove timing belt and camshaft sprocket. See TIMING BELT. When removing exhaust camshaft, remove bolts and distributor.

CAUTION: Camshafts must be properly positioned to lift camshaft straight from cylinder head to prevent damage to cylinder head and camshaft. DO NOT pry or force camshafts from cylinder head, or component damage will result.

2) Rotate intake camshaft so service bolt hole is positioned upward. See Fig. 13. Remove bolts and No. 1 (front) camshaft bearing cap from intake and exhaust camshafts.



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Fig. 13: Positioning Intake Camshaft Service Bolt Hole
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Remove oil seal and housing plug from front of cylinder head. See Fig. 7. Install service bolt "B" (6 x 1 x 18-mm) in service bolt hole of intake camshaft to secure sub-gear on intake camshaft to main gear.

NOTE: Note location of camshaft bearing caps. Camshaft bearing caps are numbered on top of camshaft bearing cap. Camshaft bearing caps are also stamped with either an "I" for intake camshaft or an "E" for exhaust camshaft. See Fig. 14. Ensure arrow on camshaft bearing cap points toward timing belt end of engine.

4) Before removing camshaft bearing cap bolts, ensure torsional spring force of sub-gear is held by service bolt "B".

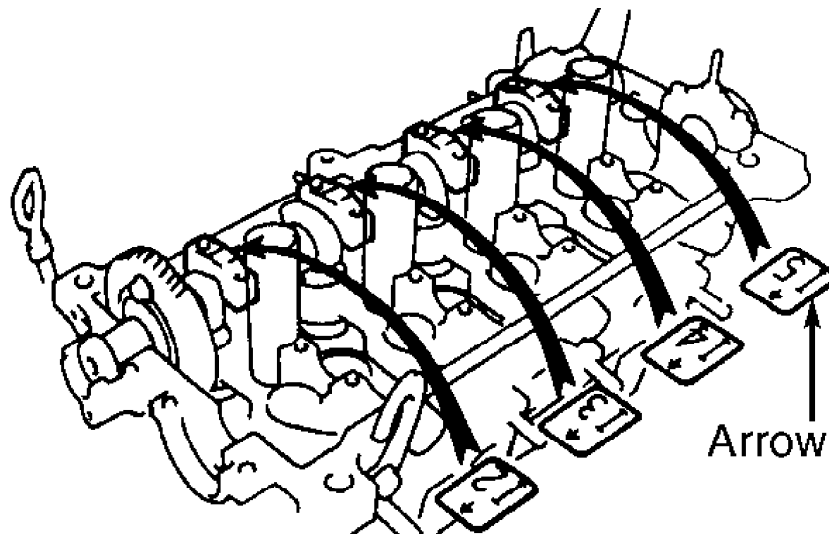
CAUTION: Ensure camshaft is lifted upward evenly from cylinder head when loosening camshaft bearing cap bolts.

5) Loosen and remove exhaust camshaft bearing cap bolts in sequence using several steps. See Fig. 15. Remove exhaust camshaft bearing caps and exhaust camshaft.

6) Loosen and remove intake camshaft bearing cap bolts in sequence using several steps. See Fig. 15. Remove intake camshaft

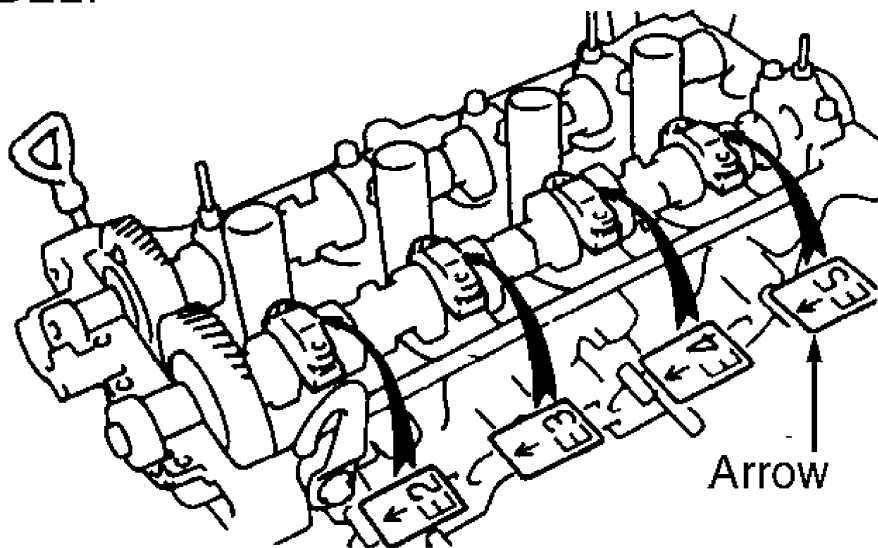
bearing caps and intake camshaft.

7) If disassembling intake camshaft, mount hexagonal area of camshaft in soft-jawed vise. Install service bolt "A" in sub-gear. See Fig. 16. Using screwdriver, rotate sub-gear clockwise and remove service bolt "B". Remove snap ring, wave washer, sub-gear and gear spring. See Fig. 7.



INTAKE CAMSHAFT BEARING CAPS

TIMING BELT
END OF
ENGINE



EXHAUST CAMSHAFT BEARING CAPS

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Fig. 14: Identifying Camshaft Bearing Caps
Courtesy of Toyota Motor Sales, U.S.A., Inc.

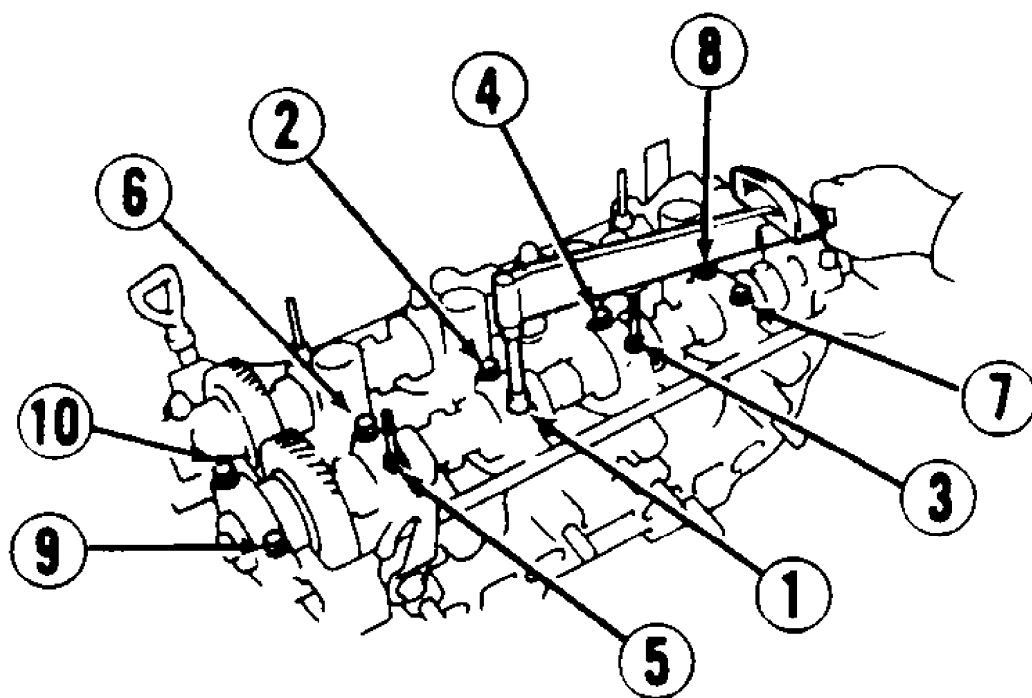
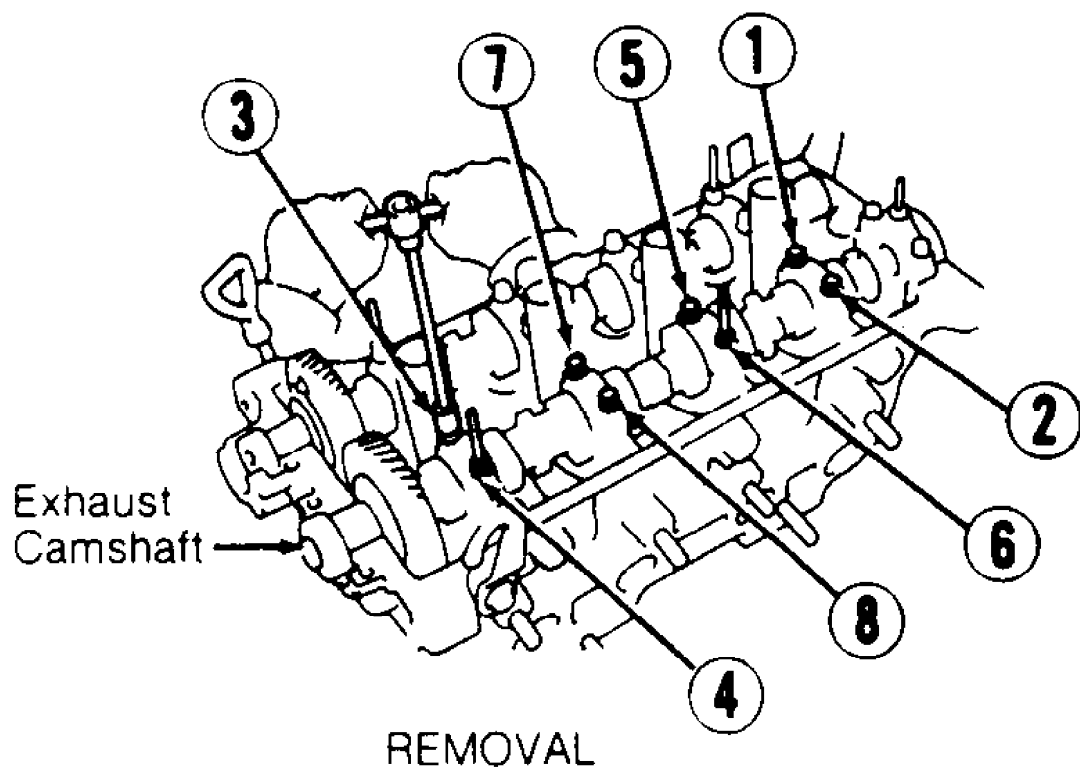
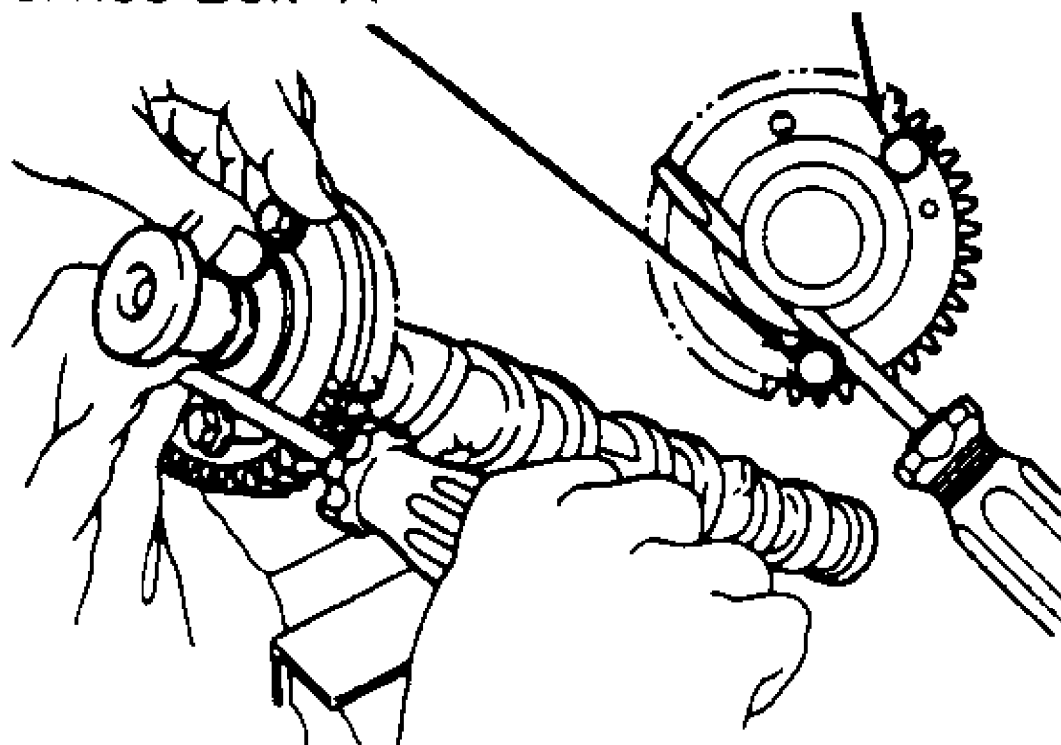


Fig. 15: Removing & Installing Camshaft Bearing Cap Bolts
(Exhaust Camshaft Shown; Intake Camshaft Is Similar)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Service Bolt "A"

Service Bolt "B"



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Fig. 16: Disassembling & Reassembling Intake Camshaft
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

- 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 with camshaft bearing cap bolts tightened to specification in sequence. See Fig. 15. See TORQUE SPECIFICATIONS.
- 3) Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table.
- 4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table.
- 5) Install both camshafts in cylinder head without sub-gear installed on intake camshaft. Install and tighten camshaft bearing cap bolts to specification in sequence. See Fig. 15.
- 6) Using dial indicator, check gear backlash between gears on camshafts. Replace camshafts if gear backlash exceeds specification. See CAMSHAFT table.
- 7) Measure distance between ends of gear spring. Replace gear spring if distance is not .886-.902" (22.50-22.90 mm).

Installation

- 1) If reassembling intake camshaft, install gear spring on camshaft so end of gear spring is positioned against pin on main gear of camshaft. Install sub-gear, wave washer and snap ring on camshaft.
- 2) Install service bolt "A" on sub-gear. See Fig. 16. Using

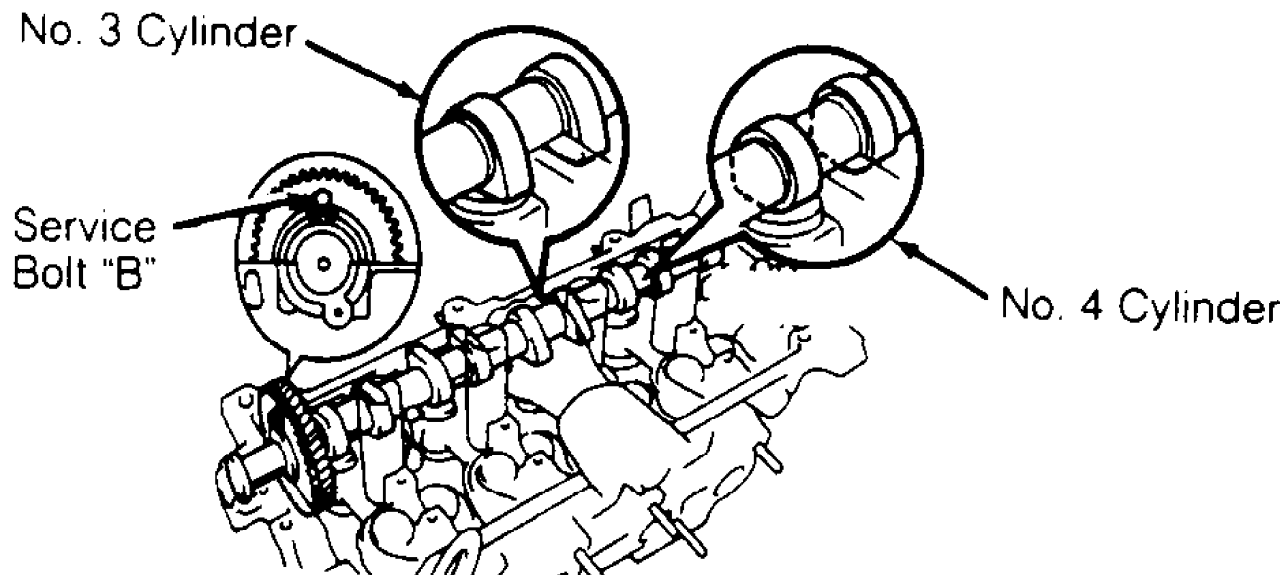
screwdriver, rotate sub-gear clockwise and align holes in sub-gear with holes on main gear. Install service bolt "B", and remove service bolt "A".

3) Apply engine oil to thrust surfaces of camshafts. Install intake camshaft in cylinder head, with lobes on cylinders No. 3 and 4 as shown. See Fig. 17.

4) Install No. 2 through 5 intake camshaft bearing caps with arrows pointing toward timing belt end of cylinder head. See Fig. 14. Install and slightly tighten intake camshaft bearing cap bolts to hold intake camshaft in place.

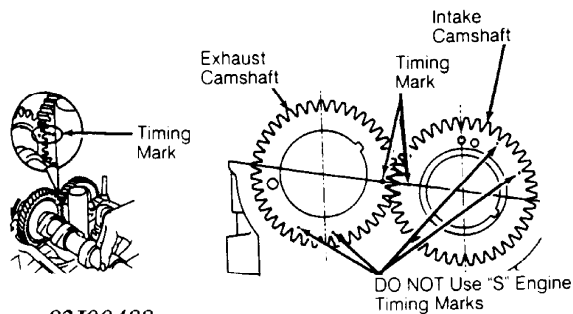
CAUTION: DO NOT use "S" engine timing marks when installing camshafts. Use proper timing marks. See Fig. 18.

5) Install exhaust camshaft so timing mark aligns with timing mark on intake camshaft. See Fig. 18. If necessary, rotate camshaft slightly during installation.



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Fig. 17: Installing Intake Camshaft
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93J00488

Fig. 18: Aligning Camshaft Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Install No. 2 through 5 exhaust camshaft bearing caps on exhaust camshaft with arrows pointing toward timing belt end of

cylinder head. See Fig. 14. Install and slightly tighten exhaust camshaft bearing cap bolts to hold camshaft in place. Remove service bolt "B" from intake camshaft.

7) Apply sealant on No. 1 (front) intake camshaft bearing cap-to-cylinder head surface and install on cylinder head. Ensure no clearance exists between No. 1 (front) camshaft bearing cap and cylinder head surface.

8) Install and slightly tighten No. 1 (front) intake camshaft bearing cap bolts. Install housing plug. Tighten all intake camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 15. See TORQUE SPECIFICATIONS.

9) Coat new oil seal lip of exhaust camshaft with grease. Install oil seal on front of exhaust camshaft until backside of oil seal contacts cylinder head.

10) Apply sealant on No. 1 (front) exhaust camshaft bearing cap-to-cylinder head surface and install on cylinder head. Ensure no clearance exists between No. 1 (front) camshaft bearing cap and cylinder head surface.

11) Install and slightly tighten No. 1 (front) exhaust camshaft bearing cap bolts. Tighten all exhaust camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 15. See TORQUE SPECIFICATIONS.

CAUTION: Ensure service bolt "B" is removed from sub-gear on intake camshaft. Ensure timing marks are still aligned. See Fig. 18.

12) Check and adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS. To install remaining components, reverse removal procedure.

13) Apply sealant at indicated valve cover sealing areas on cylinder head. See Fig. 3. Using NEW gasket, install valve cover and sealing washers. Install and tighten nuts to specification. See TORQUE SPECIFICATIONS.

14) Before installing distributor, install NEW "O" ring on distributor. Coat "O" ring with engine oil. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

15) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure slot on exhaust camshaft is properly positioned. See Fig. 10.

16) Position cut-out area on coupling with groove on distributor housing. See Fig. 10. Install distributor. Position center of flange on distributor with bolt hole on cylinder head. Install and tighten distributor hold-down bolts to specification. See TORQUE SPECIFICATIONS. Adjust ignition timing.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transaxle, clutch assembly (if equipped) and flywheel/drive plate. Using a knife, cut off seal lip. Pry oil seal from rear oil seal retainer on cylinder block. 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 09223-41020), install oil seal in rear oil seal retainer until oil seal is even with surface of rear oil seal retainer.

2) Apply Loctite 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

1) Disconnect negative battery cable. Drain cooling system. Remove drive belt and alternator. Remove intake manifold brace, located on lower side of intake manifold.

2) Disconnect coolant hoses from coolant inlet pipe at rear of water pump. Remove bolt, coolant inlet pipe and "O" ring from rear of water pump.

3) Remove oil dipstick, alternator adjusting bar, dipstick tube and "O" ring. Remove bolts/nuts and water pump.

Installation

1) Ensure sealing surfaces are clean. Apply bead of sealant in groove on rear of water pump. Install water pump. Install and tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

CAUTION: Install coolant inlet pipe evenly in water pump. DO NOT install coolant inlet pipe at an angle or use twisting motion during installation, as "O" ring will be damaged.

2) To install remaining components, reverse removal procedure using NEW "O" rings. Coat all "O" rings with soapy water solution before installing. Fill cooling system. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS.

OIL PAN

Removal

1) Disconnect negative battery cable. Raise and support vehicle. Drain engine oil.

2) Disconnect oxygen sensor connector. Remove exhaust pipe-to-cylinder block support bracket bolts. Remove nuts and separate exhaust pipe from exhaust manifold.

3) If necessary to access oil pan bolts, remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor mounting bracket (if equipped). Remove oil dipstick. Remove bolts/nuts and oil pan.

Installation

1) To install, ensure sealing surfaces are clean. Apply 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 bolts/nuts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Use NEW nuts when installing exhaust pipe on exhaust manifold. Fill crankcase with oil.

OVERHAUL

CYLINDER HEAD

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 caps installed and bolts tightened to specification in sequence. See Fig. 15. See TORQUE SPECIFICATIONS.

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. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table.

5) Install both camshafts in cylinder head without sub-gear installed on intake camshaft. Install and tighten camshaft bearing cap bolts to specification in sequence. See Fig. 15. See TORQUE SPECIFICATIONS.

6) Using dial indicator, check gear backlash between gears on camshafts. Replace camshafts if gear backlash exceeds specification. See CAMSHAFT table.

7) Ensure valve lifter bore diameter is within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

8) If installing spark plug tubes in NEW cylinder head, apply Three Bond Sealant (08833-00070) on spark plug tube surface of cylinder head.

9) Using a press, install spark plug tube in cylinder head until distance from top surface of spark plug tube to camshaft bearing cap surface on cylinder head is 2.185-2.228" (55.50-56.60 mm).

Valve Springs

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

CAUTION: Intake valve stem oil seal is Brown, and exhaust valve stem oil seal is Black. Ensure valve stem oil seal is installed in proper location.

Valve Stem Oil Seals

Intake valve stem oil seal is Brown, and exhaust valve stem oil seal is Black. Lubricate valve stem oil seal with engine oil. Install valve stem oil seal using suitable diameter socket.

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, use Valve Guide Remover/Installer (SST 09201-70010). Using hammer and valve guide remover/installer, drive valve guide from camshaft side of cylinder head.

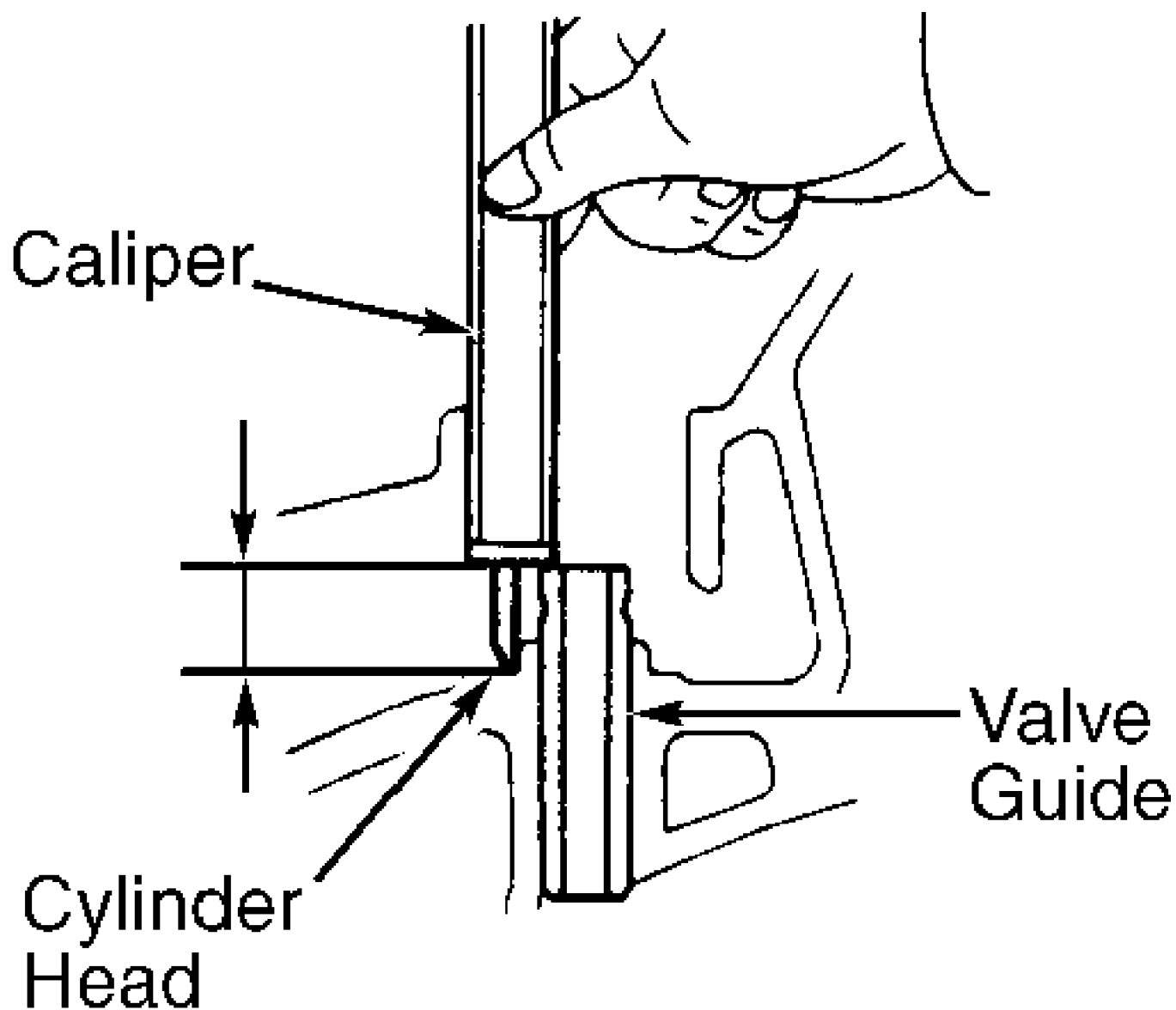
3) Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4331-.4341" (11.000-11.027 mm), use standard valve guide. If bore inside diameter is .4350-.4361" (11.050-11.077 mm), use oversize valve guide.

4) If bore inside diameter exceeds .4341" (11.027 mm), machine valve guide bore to .4350-.4361" (11.050-11.077 mm) for oversize valve guide. If bore inside diameter exceeds .4361" (11.077 mm), replace cylinder head.

CAUTION: Exhaust valve guide is 1.59" (40.5 mm) long, and intake valve guide is 1.52" (38.5 mm) long. Ensure proper length valve guide is installed.

5) To install valve guide, use hammer and valve guide remover/installer. Drive valve guide in from camshaft side of cylinder head until valve guide installed height is .500-.516" (12.70-13.10 mm). See Fig. 19.

6) Using .236" (6.00 mm) reamer, ream valve guide to obtain specified valve stem-to-guide oil clearance. See CYLINDER HEAD table.



93A00489

Fig. 19: Measuring Valve Guide Installed Height
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 from manufacturer.

Valves

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

Valve Seat Correction Angles

Use 30-degree and 45-degree stones to lower valve seat contact area. Use 75-degree and 45-degree stones to raise exhaust valve seat contact area. Use 75-degree, 60-degree and 45-degree stones to raise intake 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

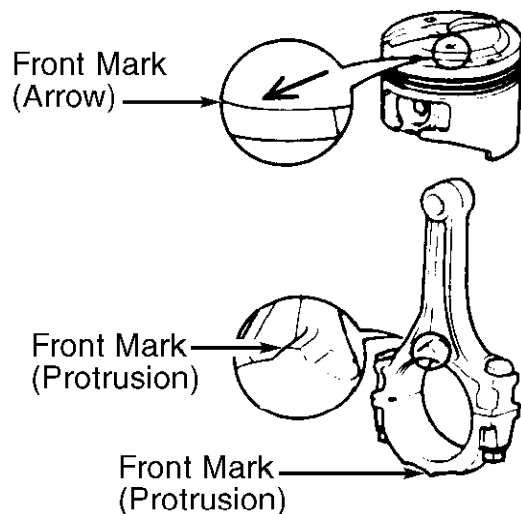
1) Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Before disassembling piston and connecting rod, try to move piston back and forth on piston pin. Replace piston and piston pin if any movement is felt.

2) When removing piston from connecting rod, press piston pin from piston. Ensure connecting rod bend, twist and crankpin bore diameter are within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

NOTE: Crankpin bore diameter is determined by size mark stamped on connecting rod cap. See Fig. 23.

3) To reassemble, install piston on connecting rod so front mark (arrow) on top of piston aligns with front mark (protrusion) on connecting rod. See Fig. 20. Coat piston pin and piston pin holes in piston with oil. Press piston pin into piston.

CAUTION: With connecting rod centered in piston, ensure same distance exists between end of piston pin and piston. If distance varies, relocate piston pin.



93D00490

Fig. 20: Aligning Connecting Rod & Piston Front Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fitting Pistons

1) Different piston and cylinder bore sizes are used. Piston

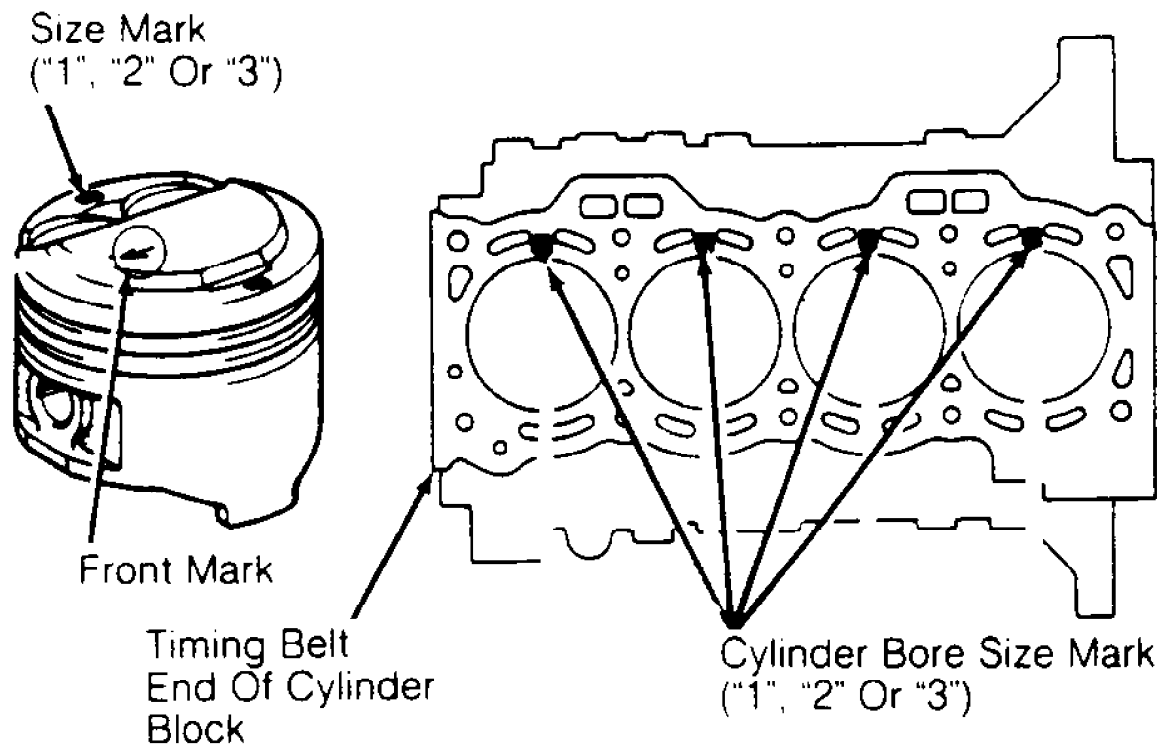
diameter and cylinder bore diameter are determined by size mark ("1", "2" or "3") stamped on top of piston and cylinder block deck surface, respectively. See Fig. 21.

2) To determine piston-to-cylinder clearance, measure piston diameter and cylinder bore diameter. Measure piston skirt diameter .91" (23.0 mm) from top of piston, at 90-degree angle to piston pin.

3) Measure cylinder bore diameter at .39" (10.0 mm) from top and bottom of cylinder bore and at middle of cylinder bore. Ensure piston diameter and cylinder bore diameter are within specification. See PISTONS, PINS & RINGS and CYLINDER BLOCK tables under ENGINE SPECIFICATIONS.

CAUTION: If replacing piston, ensure replacement piston contains same size mark as cylinder bore size mark on cylinder block.

4) Calculate piston-to-cylinder clearance. Replace piston or cylinder block if clearance is not within specification. See PISTONS, PINS & RINGS table.



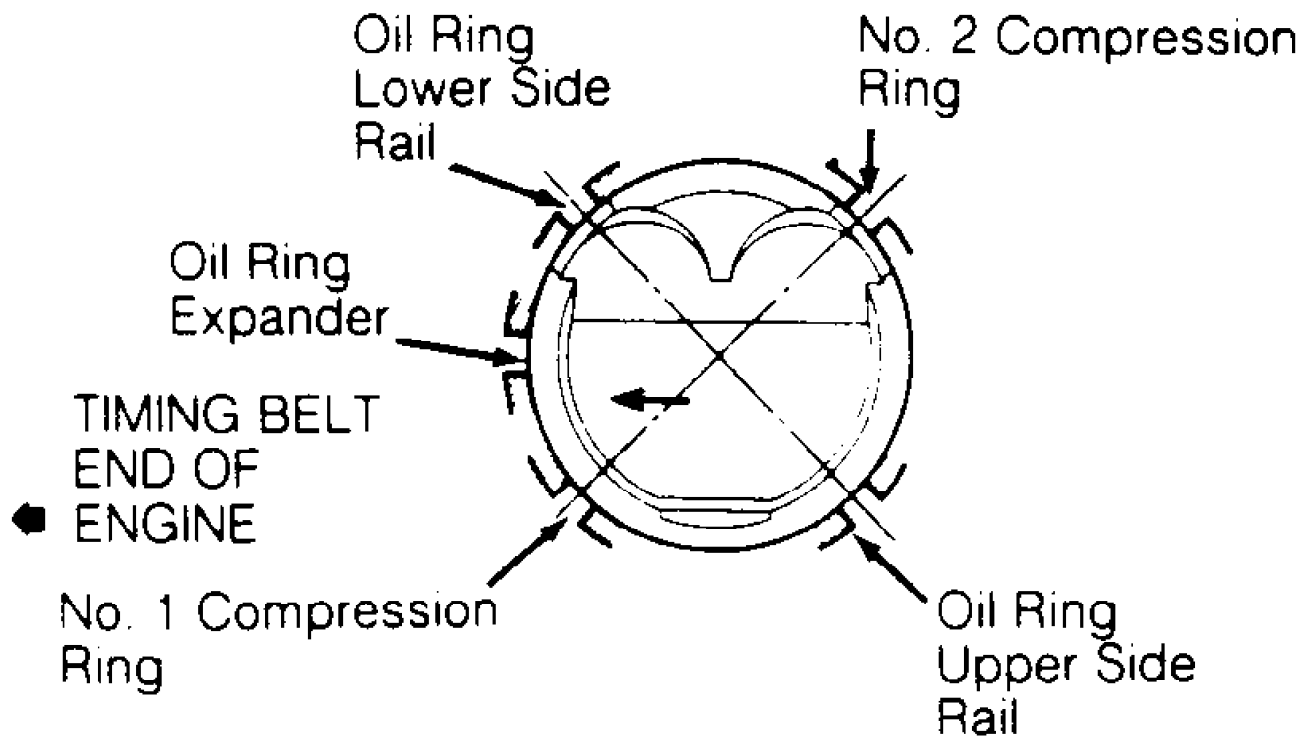
93E00491

Fig. 21: Identifying Piston & Cylinder Bore Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Piston Rings

Ensure piston ring end gap and side clearance are within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Position piston ring with ring end gaps in proper areas and identification mark on piston ring toward top of piston. See Fig. 22.

NOTE: No. 1 compression ring may contain a "T", "1N" or "1R" identification mark. No. 2 compression ring may contain a "2T", "2N" or "2R" identification mark.



93F00492

Fig. 22: Positioning Piston Rings
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Rod Bearings

1) Mark direction of connecting rod cap and cylinder number before disassembly. Connecting rod must be installed so front mark (protrusion) at center of connecting rod is toward timing belt end of engine. Front mark (protrusion) on connecting rod cap must also face timing belt end of engine. See Fig. 20.

2) Connecting rod cap and rod bearing are stamped with size mark "1", "2" or "3". See Fig. 23. Ensure size marks on connecting rod cap and rod bearing are same.

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

3) Rod bearing thickness is determined by size mark. See ROD BEARING SPECIFICATIONS table. Install connecting rod cap with front mark (protrusion) toward timing belt end of engine. See Fig. 20.

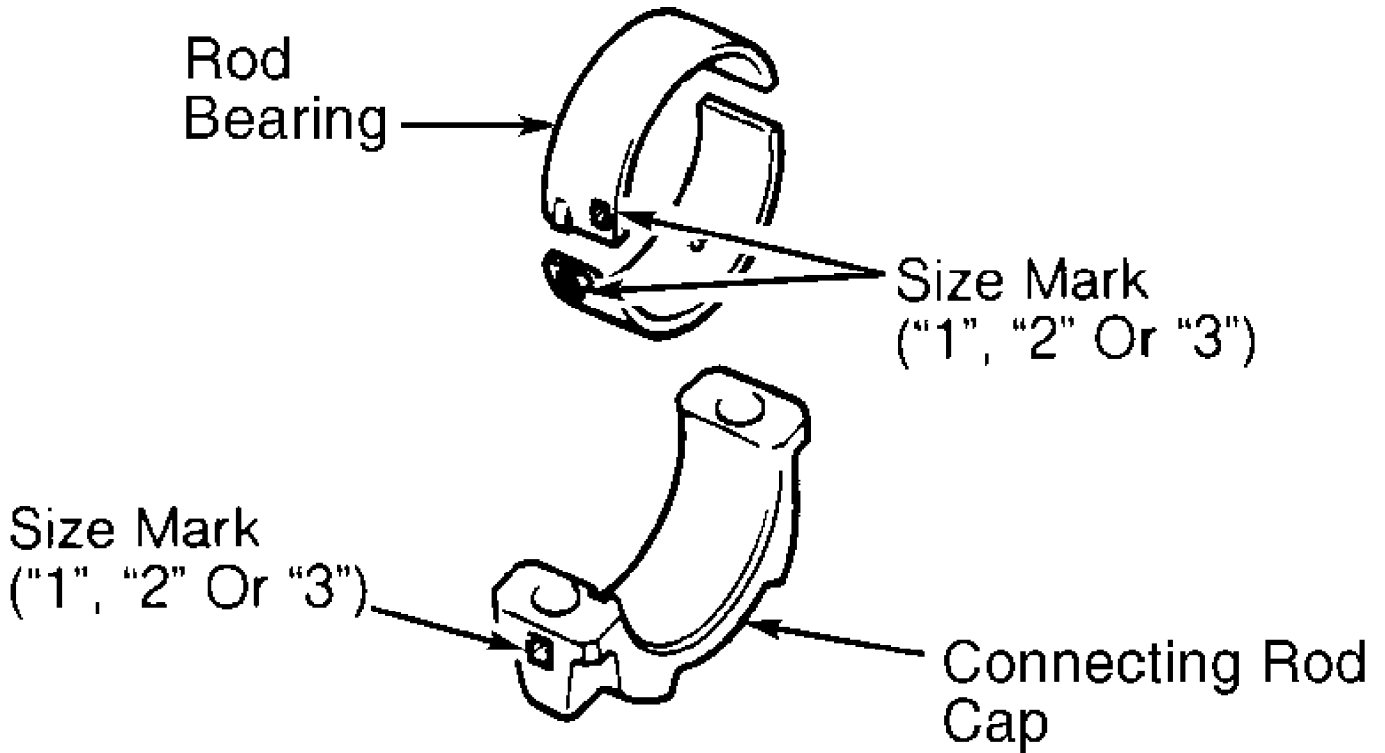
4) Coat threads of connecting rod bolt and connecting rod nut-to-connecting rod cap surface with engine oil before tightening nuts to specification. See TORQUE SPECIFICATIONS.

5) Ensure bearing oil clearance and connecting rod side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS and CONNECTING RODS tables under ENGINE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS TABLE

Bearing Size Mark	Thickness In. (mm)
----------------------	-----------------------

"1"	.....	.0585-.0587	(1.487-1.491)
"2"	.....	.0587-.0589	(1.491-1.495)
"3"	.....	.0589-.0590	(1.495-1.499)



93G00493

Fig. 23: Identifying Connecting Rod & Rod Bearing Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Crankshaft & Main Bearings

1) Main bearing caps contain a location number and a front mark. See Fig. 24. No. 1 main bearing cap is located at timing belt end, and No. 5 is at flywheel/drive plate end.

2) Remove main bearing cap bolts in sequence. See Fig. 25. Remove main bearing caps, crankshaft, thrust bearing and main bearings.

3) Cylinder block main bearing bore inside diameter is identified by size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 26. Front size mark indicates No. 1 main bearing bore, and rear size mark indicates No. 5 main bearing bore.

4) Crankshaft main bearing journal diameter is identified by size mark ("0", "1" or "2") on crankshaft counterweight. See Fig. 26. Front size mark indicates No. 1 main bearing journal, and rear size mark indicates No. 5 main bearing journal.

5) Ensure journal diameter, taper and out-of-round are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

6) Main bearing size mark ("1", "2", "3", "4" or "5") is located on side of main bearing. See Fig. 26. If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.

7) If main bearing size mark cannot be obtained, add size marks on cylinder block and crankshaft together to determine size mark of main bearing to be used. For example, if size mark on cylinder

block is "2" and size mark on crankshaft is "1", use main bearing with size mark "3".

8) Main bearing thickness is determined by size mark. See MAIN BEARING SPECIFICATIONS table. Install main bearings, thrust bearing, crankshaft and main bearing caps. Ensure main bearing caps are properly installed in numerical sequence, with No. 1 at timing belt end and No. 5 at flywheel/drive plate end. Ensure front mark on each main bearing cap is pointing toward timing belt end of engine. See Fig. 24.

9) Coat threads and bolt-to-main bearing cap surfaces with engine oil. Install and tighten main bearing cap bolts to specification in sequence using several steps. See Fig. 25. See TORQUE SPECIFICATIONS.

10) Ensure crankshaft main bearing oil clearance and crankshaft end play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table. Replace thrust bearing if crankshaft end play is not within specification.

MAIN BEARING SPECIFICATIONS TABLE

Bearing			Thickness
Size Mark			In. (mm)
"1"	.....	.07862-.07874	(1.9970-2.0000)
"2"	.....	.07877-.07885	(2.0010-2.0030)
"3"	.....	.07889-.07897	(2.0040-2.0060)
"4"	.....	.07901-.07909	(2.0070-2.0090)
"5"	.....	.07913-.07921	(2.0100-2.0120)

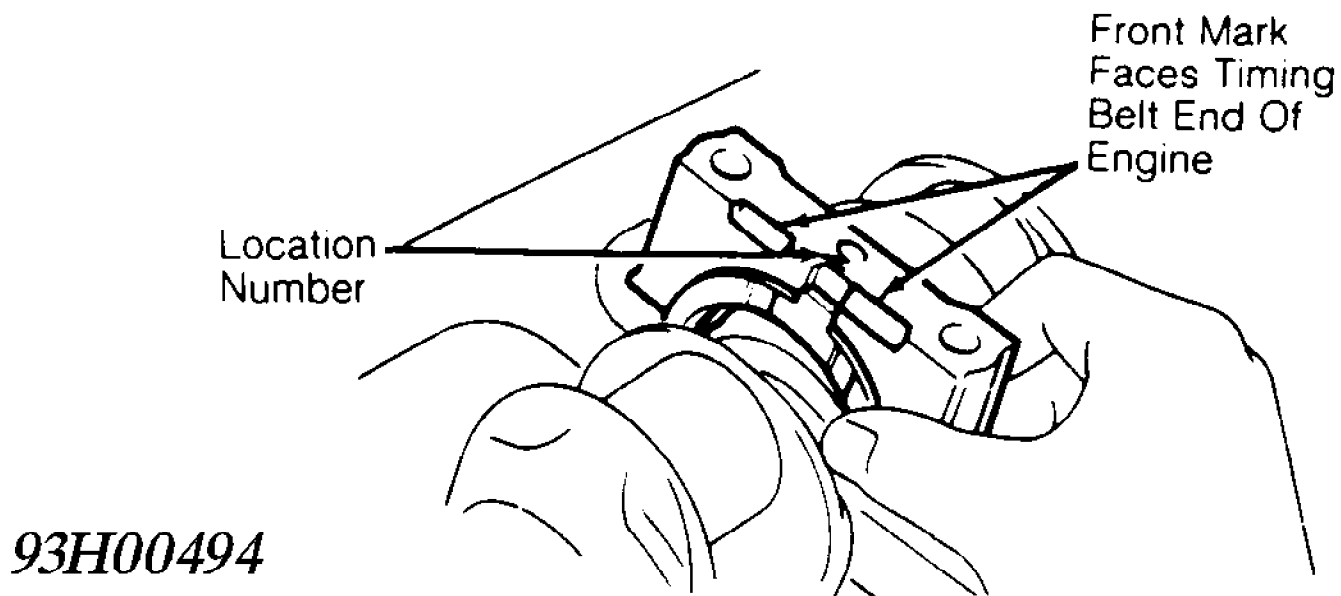
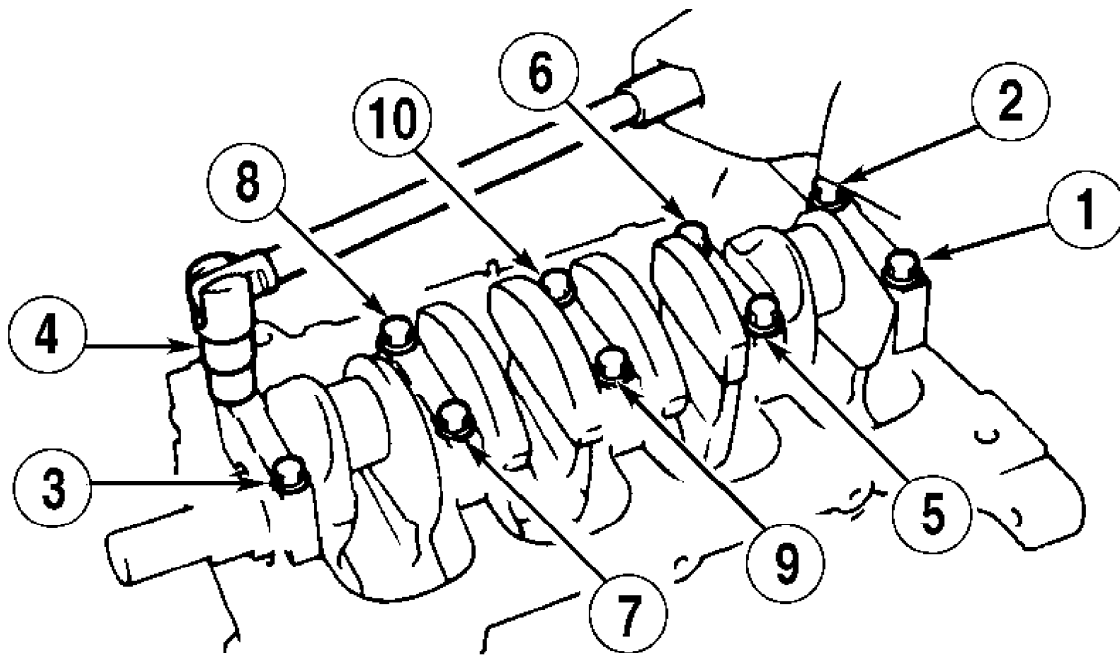
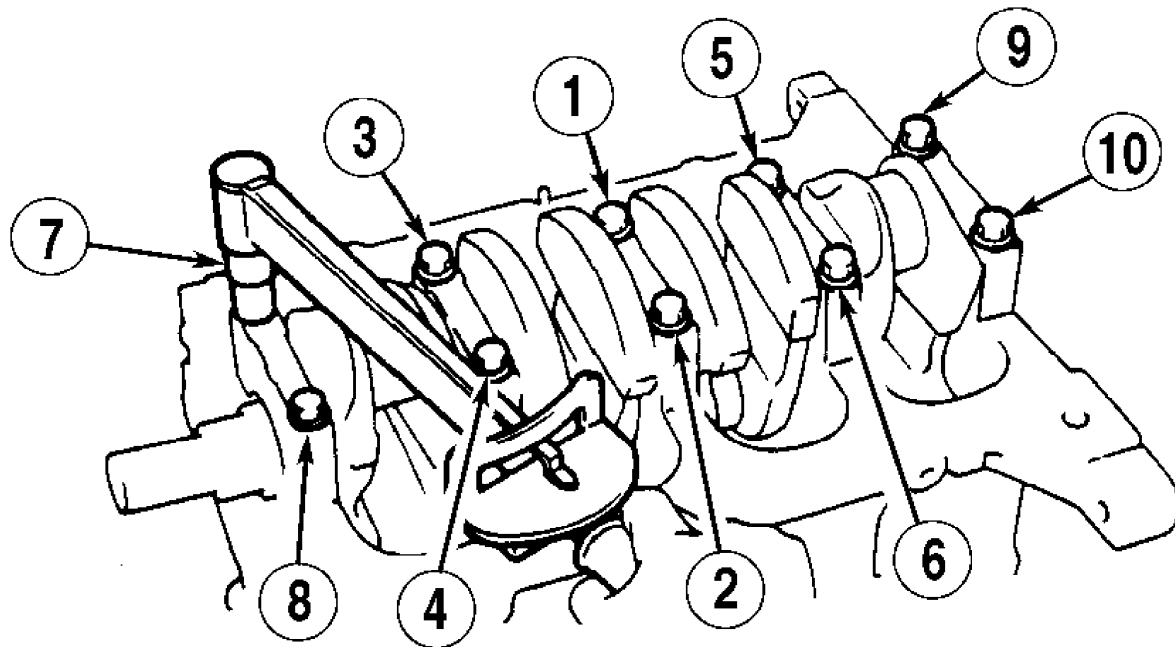


Fig. 24: Identifying Main Bearing Cap Location Number & Front Mark
Courtesy of Toyota Motor Sales, U.S.A., Inc.



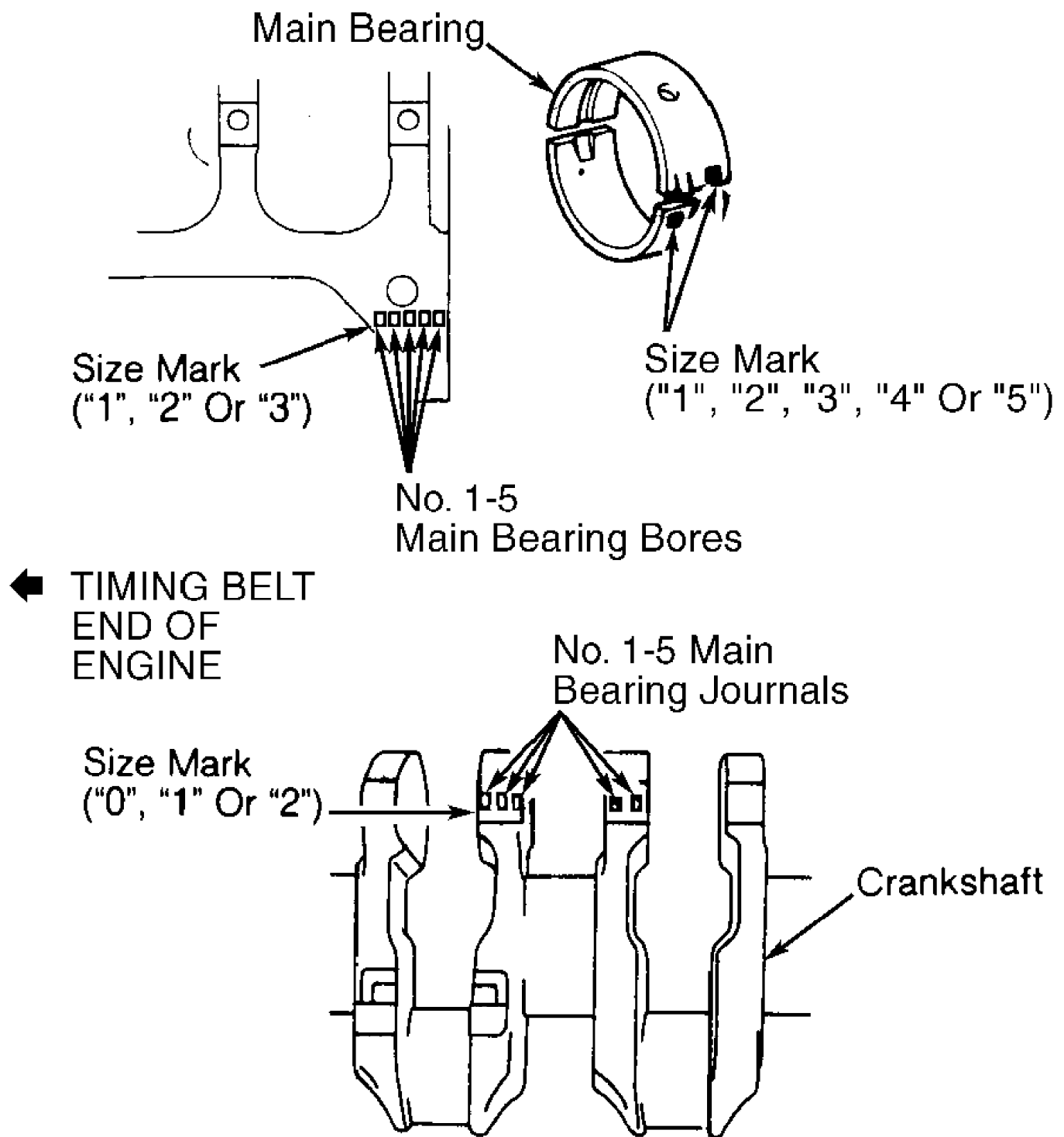
REMOVAL



INSTALLATION

93I00495

Fig. 25: Main Bearing Cap Bolt Removal & Installation Sequence
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



93J00496

Fig. 26: Identifying Cylinder Block, Crankshaft & Main Bearing Size Marks

Courtesy of Toyota Motor Sales, U.S.A., Inc.

Thrust Bearing

Install thrust bearing on No. 3 main bearing, with grooves toward crankshaft, away from cylinder block and main bearing cap.

Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

1) Inspect cylinder block deck surface warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

2) Different cylinder bore sizes are used. Cylinder bore size is identified by size mark ("1", "2" or "3") on cylinder block deck surface. See Fig. 21. Measure cylinder bore diameter at .39" (10.0 mm) from top and bottom of cylinder bore and at middle of cylinder bore.

3) Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table. Replace cylinder block if cylinder bore exceeds specification.

4) Install main bearing caps in numerical sequence, with No. 1 at timing belt end and No. 5 at flywheel/drive plate end. Ensure front mark on each main bearing cap points toward timing belt end of engine. See Fig. 24.

5) Install and tighten main bearing cap bolts to specification in sequence using several steps. See Fig. 25. See TORQUE SPECIFICATIONS. Ensure main bearing bore inside diameter is within specification. See CYLINDER BLOCK table.

NOTE: Main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 26.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Crankshaft-driven oil pump provides pressurized engine lubrication. See Fig. 27.

Crankcase Capacity

Crankcase capacity with oil filter is 2.9 qts. (2.7L).

Oil Pressure

With engine at normal operating temperature, oil pressure should be at least 4.3 psi (0.3 kg/cm²) at idle and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

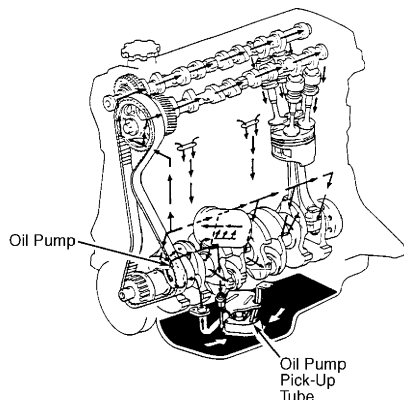


Fig. 27: ^{93A00497} Cross-Sectional View Of Engine Oil Circuit
Courtesy of Toyota Motor Sales, U.S.A., Inc.

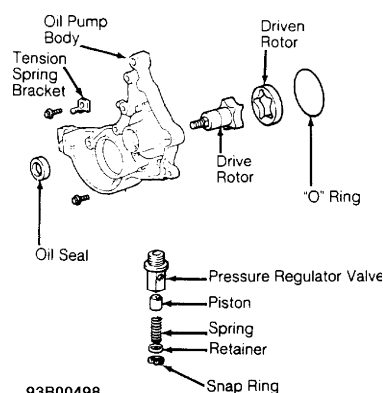
OIL PUMP

Removal & Disassembly

1) Remove timing belt, oil pump drive sprocket and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION.

2) Remove bolts, oil pump pick-up tube and "O" ring. Unscrew pressure regulator valve from oil pan flange area on cylinder block. Remove bolts, tension spring bracket, oil pump body and "O" ring. See Fig. 28.

3) Remove oil pump components. Remove oil seal and crankshaft front seal from oil pump body (if necessary). Remove snap ring, retainer, spring and piston from pressure regulator valve.



93B00498

Fig. 28: Exploded View Of Oil Pump

Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect components for damage. Coat piston with engine oil and ensure piston slides freely in pressure regulator valve. Install drive and driven rotors in oil pump body.

2) Using feeler gauge, measure driven rotor-to-oil pump body clearance between outer edge of driven rotor and oil pump body. Replace rotor assembly or oil pump body if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

3) Measure rotor tip clearance between tips of rotors. Replace rotor assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

4) Place straightedge across rotors, above oil pump body. Using feeler gauge, measure rotor end clearance between straightedge and oil pump body. Distance in which rotors protrude above oil pump body is rotor end clearance. Replace rotor assembly or oil pump body if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Driven Rotor-To-Oil Pump Body Clearance	
Standard	.0039-.0083 (.100-.210)
Wear Limit	.0079 (.200)
Rotor End Clearance	
Standard	.1146-.1169 (2.910-2.970)
Wear Limit	.1142 (2.900)
Rotor Tip Clearance	
Standard	.0024-.0059 (.060-.150)
Wear Limit	.0079 (.200)

Reassembly & Installation

1) To reassemble, reverse disassembly procedure. Ensure reference marks (dot area) on rotors face toward outside of oil pump body (away from cylinder block surface).

2) Using Seal Installer (SST 09309-37010), install NEW crankshaft front seal (if removed) until seal surface is even with oil pump body. Coat seal lip with grease.

3) Install NEW oil seal (if removed) in oil pump body using suitable size socket until seal surface is even with oil pump body. Coat seal lip with grease.

4) To install, apply sealant on rear of oil pump. Install NEW "O" ring in groove on oil pump body. Install oil pump on cylinder block. Install and tighten oil pump bolts and pressure regulator valve to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Accessory Drive Belt Pulley Bolt	14 (19)
A/C Compressor Bolt	18 (24)
A/C Compressor Mounting Bracket Bolt	20 (27)
A/C Idler Pulley Bolt	
12-mm Bolt	20 (27)
14-mm Bolt	27 (37)
Axle Shaft Nut	159 (216)
Ball Joint-To-Lower Control Arm Bolt/Nut	59 (80)
Camshaft Sprocket Bolt	37 (51)
Connecting Rod Nut	29 (39)
Coolant Housing Bolt/Nut	13 (18)
Crankshaft Pulley Bolt	112 (152)
Cylinder Head Bolt (1)	
Step 1	33 (45)
Step 2	Additional 90 Degrees
Delivery Pipe Bolt	14 (19)
Distributor Hold-Down Bolt	13 (18)
EGR Pipe	
Nut	22 (30)
Union Nut	29 (39)
EGR Temperature Sensor	15 (20)
EGR Valve Nut	13 (18)
Engine Mount	
Left (Transaxle Side)	
Bracket-To-Mount Insulator Bolt	35 (47)
Bracket-To-Transaxle Bolt	47 (64)
Rear (Firewall Side)	
Bracket-To-Transaxle Bolt	35 (47)
Through-Bolt	47 (64)
Right (Timing Belt Side)	
Mount-To-Cylinder Block Bolt/Nut	47 (64)
Through-Bolt	54 (73)
Exhaust Manifold Nut	35 (47)
Exhaust Pipe Support Bracket Bolt	14 (19)
Exhaust Pipe-To-Exhaust Manifold Nut	46 (62)
Flywheel/Drive Plate Bolt	65 (88)
Fuel Line Banjo Bolt	22 (30)
Idler Pulley Bolt	
No. 1 Idler Pulley	13 (18)
No. 2 Idler Pulley	20 (27)
Intake Manifold Bolt/Nut	14 (19)

Intake Manifold Brace Bolt/Nut	15 (20)
Main Bearing Cap Bolt (2)	42 (57)
Oil Pump Drive Sprocket Nut	27 (37)
Power Steering Pump Adjusting Bracket Bolt	15 (20)
Power Steering Pump Bolt	
Lower Bolt	29 (39)
Upper Bolt	32 (43)
Pressure Regulator Valve	22 (30)
Spark Plug	13 (18)
Throttle Body Bolt/Nut	14 (19)
Tie Rod Nut	36 (49)
Torque Converter Bolt	18 (24)
Water Pump Bolt/Nut	13 (18)
Wheel Lug Nut	76 (103)

INCH Lbs. (N.m)

Air Control Valve Bolt	69 (7.8)
Air Pipe Bolt	48 (5.4)
Camshaft Bearing Cap Bolt (3)	115 (13.0)
Clutch Release Cylinder Bolt	106 (12.0)
Coolant Inlet Pipe Bolt	65 (7.4)
Oil Pan Bolt/Nut	73 (8.3)
Oil Pump Bolt	65 (7.4)
Oil Pump Pick-Up Tube Bolt	89 (10.0)
Rear Oil Seal Retainer-To-Cylinder Block Bolt ...	65 (7.4)
Rear Plate-To-Cylinder Block Bolt	89 (10.0)
Valve Cover Nut	61 (6.9)

- (1) - Tighten bolts to specification in sequence.
See Fig. 8.
- (2) - Tighten bolts to specification in sequence.
See Fig. 25.
- (3) - Tighten bolts to specification in sequence.
See Fig. 15.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS TABLE

Application	Specification
Displacement	92 Cu. In. (1.5L)
Bore	2.91" (73.9 mm)
Stroke	3.43" (87.1 mm)
Compression Ratio	9.4:1
Fuel System	MFI
Horsepower @ RPM	100 @ 6400
Torque Ft. Lbs. @ RPM	91 @ 3200

CRANKSHAFT, MAIN & CONNECTING

ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS TABLE

Application	In. (mm)
Crankshaft	

End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.0118 (.300)
Runout	.0024 (.060)
Main Bearings	
Journal Diameter (1)	
Size Mark "0"	1.9683-1.9685 (49.995-50.000)
Size Mark "1"	1.9681-1.9683 (49.990-49.995)
Size Mark "2"	1.9679-1.9681 (49.985-49.990)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft	
Standard	.0006-.0014 (.016-.035)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft	
Standard	.0006-.0022 (.016-.055)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	1.6923-1.6929 (42.985-43.000)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft	
Standard	.0006-.0019 (.016-.048)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft	
Standard	.0006-.0023 (.016-.058)
Wear Limit	.0031 (.080)

(1) - Main bearing journal diameter is identified by size mark on the crankshaft. See Fig. 26.

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS TABLE

Application	In. (mm)
Bore Diameter	
Crankpin Bore (1)	
Size Mark "1"	1.8110-1.8113 (46.000-46.007)
Size Mark "2"	1.8113-1.8116 (46.007-46.014)
Size Mark "3"	1.8116-1.8118 (46.014-46.021)
Maximum Bend	.0012 Per 3.94 (.030 Per 100.1)
Maximum Twist	.0020 Per 3.94 (.050 Per 100.1)
Side Play	
Standard	.0059-.0138 (.150-.350)
Wear Limit	.0177 (.450)

(1) - Crankpin bore diameter is identified by size mark on connecting rod cap. See Fig. 23.

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS TABLE

Application	In. (mm)
Pistons	
Clearance	

Standard	.....	.0035-.0043	(.090-.110)
Wear Limit	.....	.0051	(.130)
Diameter (1)			
Size Mark "1"	.....	2.9094-2.9098	(73.900-73.910)
Size Mark "2"	.....	2.9098-2.9102	(73.910-73.920)
Size Mark "3"	.....	2.9102-2.9106	(73.920-73.930)
Rings			
No. 1			
End Gap			
Standard	.....	.0102-.0189	(.260-.480)
Wear Limit	.....	.0421	(1.070)
Side Clearance	.....	.0016-.0031	(.040-.080)
No. 2			
End Gap			
Standard	.....	.0118-.0224	(.300-.570)
Wear Limit	.....	.0402	(1.020)
Side Clearance	.....	.0012-.0028	(.030-.070)
No. 3 (Oil)			
End Gap			
Standard	.....	.0051-.0197	(.130-.500)
Wear Limit	.....	.0433	(1.100)

(1) - Piston diameter is identified by size mark on top of piston. See Fig. 21.

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK TABLE

Application	In. (mm)
Cylinder Bore	
Standard Diameter (1)	
Size Mark "1"	..... 2.9134-2.9138 (74.000-74.010)
Size Mark "2"	..... 2.9138-2.9142 (74.010-74.020)
Size Mark "3"	..... 2.9142-2.9146 (74.020-74.030)
Main Bearing Bore Inside Diameter (2)	
Size Mark "1"	..... 2.1267-2.1269 (54.018-54.024)
Size Mark "2"	..... 2.1270-2.1272 (54.025-54.030)
Size Mark "3"	..... 2.1272-2.1274 (54.030-54.036)
Maximum Deck Warpage	..... .002 (.05)

- (1) - Cylinder bore diameter is identified by cylinder bore size mark on cylinder block deck surface.
See Fig. 21. Maximum cylinder bore diameter is 2.9224" (74.230 mm).
- (2) - Main bearing bore inside diameter is identified by size mark on cylinder block. See Fig. 26.

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS TABLE

Application	Specification
Intake Valves	
Face Angle	..... 44.5 °
Minimum Margin	..... .020" (.50 mm)
Minimum Refinish Length	..... 3.6594" (92.950 mm)
Stem Diameter	..... .2350-.2356" (5.970-5.985 mm)
Exhaust Valves	

Face Angle	44.5 °
Minimum Margin .....	.020" (.50 mm)
Minimum Refinish Length	3.6768" (93.390 mm)
Stem Diameter .....	.2348-.2354" (5.965-5.980 mm)
Valve Springs	
Free Length	1.5669" (39.800 mm)
Out-Of-Square .....	.079" (2.00 mm)
	Lbs. @ In. (kg @ mm)
Pressure	
Valve Closed	33-37 @ 1.252 (15-17 @ 31.80)

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD TABLE

Application	Specification
Maximum Warpage	
Cylinder Block Surface .....	.002" (.05 mm)
Manifold Surface .....	.002" (.05 mm)
Valve Seats	
Intake Valve	
Seat Angle	45 °
Seat Width .....	.039-.055" (1.00-1.40 mm)
Exhaust Valve	
Seat Angle	45 °
Seat Width .....	.039-.055" (1.00-1.40 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide ...	.4331-.4341" (11.000-11.027 mm)
Oversize Valve Guide ...	.4350-.4361" (11.050-11.077 mm)
Valve Guide I.D. ....	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed Height ....	.500-.516 (12.70-13.10)
Valve Stem-To-Guide Oil Clearance	
Standard .....	.0010-.0024" (.025-.060 mm)
Wear Limit .....	.0031" (.080 mm)
Exhaust Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide ...	.4331-.4341" (11.000-11.027 mm)
Oversize Valve Guide ...	.4350-.4361" (11.050-11.077 mm)
Valve Guide I.D. ....	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed	
Height .....	.500-.516 (12.70-13.10)
Valve Stem-To-Guide Oil Clearance	
Standard .....	.0012-.0026" (.030-.065 mm)
Wear Limit .....	.0039" (.100 mm)

CAMSHAFT SPECIFICATIONS

CAMSHAFT TABLE

Application	In. (mm)
End Play	
Standard .....	.0018-.0039 (.045-.100)
Wear Limit .....	.0047 (.120)
Journal Diameter	
Exhaust Camshaft	
No. 1 Journal .....	.9822-.9829 (24.949-24.965)

All Others .....	.9035-.9041	(22.949-22.965)
Intake Camshaft		
All Journals .....	.9035-.9041	(22.949-22.965)
Journal Runout .....	.0016	(.040)
Lobe Height		
Intake		
Standard	1.6343-1.6382	(41.510-41.610)
Wear Limit	1.6283	(41.360)
Exhaust		
Standard	1.6264-1.6303	(41.310-41.410)
Wear Limit	1.6205	(41.160)
Oil Clearance		
Standard .....	.0014-.0028	(.035-.072)
Wear Limit .....	.0039	(.100)
Gear Backlash		
Standard .....	.0008-.0079	(.020-.200)
Wear Limit .....	.0118	(.300)

VALVE LIFTERS SPECIFICATIONS

VALVE LIFTERS TABLE

Application	In. (mm)
Bore Diameter	1.1024-1.1032 (28.000-28.021)
Lifter Diameter	1.1014-1.1018 (27.975-27.985)
Oil Clearance	
Standard .....	.0006-.0018 (.015-.046)
Wear Limit .....	.0039 (.100)