

1999-2000 ENGINES

2.2L 4-Cylinder

ENGINE IDENTIFICATION

- NOTE:** For repair procedures not covered in this article, see **ENGINE OVERHAUL PROCEDURES** article in **GENERAL INFORMATION**.
- NOTE:** References to California models apply to California emission vehicles, which may be verified by underhood Emission Control label. California emissions may be available in other states.
- NOTE:** On Camry and Camry Solara models only, 2 balance shafts are located in balance shaft assembly at bottom of cylinder block, below crankshaft. The No. 1 balance shaft is driven by a drive gear on No. 3 crankshaft counterweight. Balance shaft assembly is used to reduce engine vibration.
- NOTE:** On 2000 Camry, a Compressed Natural Gas (CNG) version of this engine is used. Differences between gas and CNG engines will be noted in the text.

Engine serial number is stamped on flywheel/drive plate end of cylinder block, just below cylinder head surface.

ENGINE IDENTIFICATION CODE

Engine	Code
2.2L 4-Cylinder	5S-FE

ADJUSTMENTS

BALANCE SHAFT GEAR BACKLASH

Camry & Camry Solara

For on-vehicle checking of balance shaft gear backlash, see **PRELIMINARY INSPECTION** under **BALANCE SHAFTS (CAMRY)** under **REMOVAL & INSTALLATION**.

VALVE CLEARANCE ADJUSTMENT (EXCEPT CAMRY CNG)

- NOTE:** Adjust valve clearance with engine cold.

1. Disconnect PCV hose(s), cable brackets and necessary electrical connectors to access valve cover. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly reference, as grommets **MUST BE** installed in original location.

2000 Toyota Camry Solara SE

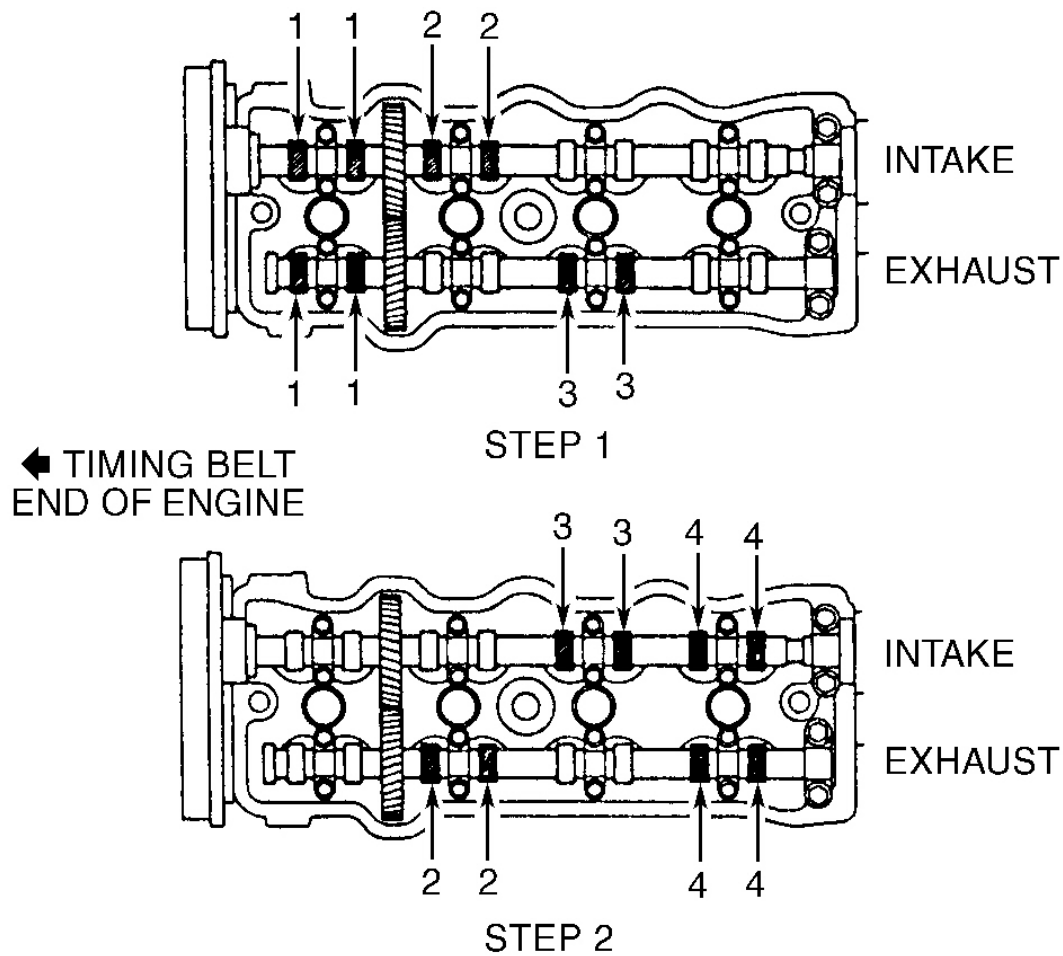
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2. Rotate crankshaft clockwise (viewed from timing belt end of engine) so cylinder No. 1 is at TDC on compression stroke, and timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Cylinder No. 1 is front cylinder at timing belt end of engine.
3. Ensure valve lifters are loose on cylinder No. 1 and tight on cylinder No. 4. If conditions are not as described, rotate crankshaft clockwise 1 complete revolution (360 degrees).
4. With piston No. 1 at TDC on compression stroke, check valve clearance on specified valves. See STEP 1 in illustration. See **Fig. 1**. Using feeler gauge, measure and record valve clearance between valve lifter and camshaft.
5. To check remaining valves, rotate crankshaft clockwise (viewed from timing belt end of engine) 1 complete revolution (360 degrees) until piston No. 4 is at TDC on compression stroke. Measure and record valve clearance on specified valves. See STEP 2 in illustration. See **Fig. 1**.
6. Ensure valve clearance is within specification. See **VALVE CLEARANCE SPECIFICATIONS** table.

VALVE CLEARANCE SPECIFICATIONS (ALL ENGINES) ⁽¹⁾

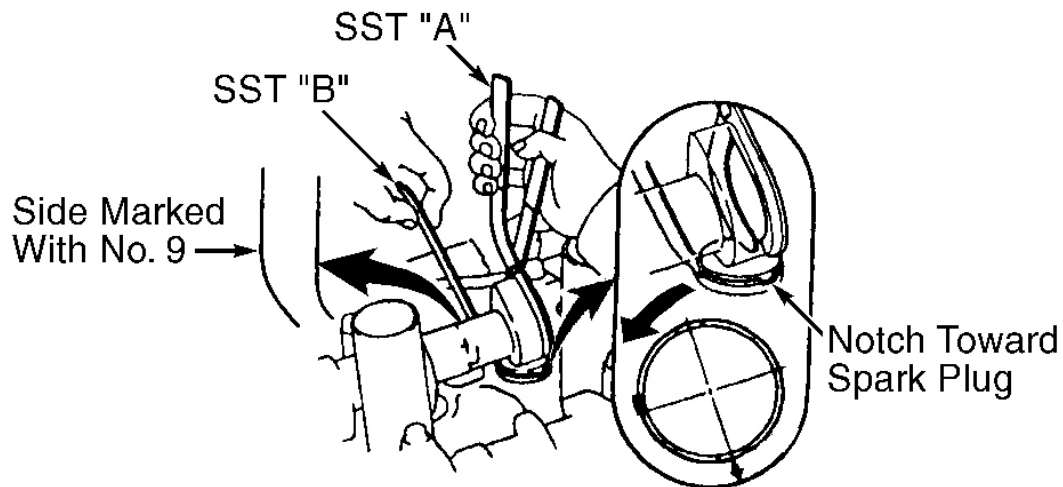
Application	In. (mm)
Intake Valve	.007-.011 (.18-.28)
Exhaust Valve	.011-.015 (.28-.38)
(1) Adjust valve clearance with engine cold.	

7. If valve clearance requires adjustment, rotate camshaft so lobe on valve faces upward, away from valve lifter. Rotate valve lifter so notch on valve lifter is toward spark plug.
8. Use Valve Clearance Adjuster (SST 09248-55040) to remove adjusting shim. Using SST "A" of valve clearance adjuster, push downward on valve lifter. Place SST "B" between camshaft and valve lifter with side marked with No. 9 at designated position. See **Fig. 2**. Remove SST "A".



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Fig. 1: Checking Valve Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 2: Adjusting Valve Clearance

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

9. Using small screwdriver and magnet, remove adjusting shim. Measure and record thickness of adjusting shim removed. Using measured valve clearance and adjusting shim thickness, select proper replacement adjusting shim. See [Fig. 3](#) and [Fig. 4](#) . Install replacement adjusting shim. Recheck valve clearance.

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EXAMPLE: A 0.1102" (2.800 mm) shim is installed and measured clearance is 0.0177" (0.450 mm). Replace 0.1102" (2.800 mm) shim with a No. 11 shim.

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2000 Toyota Camry Solara SE
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Fig. 3: Intake Valve Adjusting Shim Selection Chart (Except Camry CNG)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

2000 Toyota Camry Solara SE

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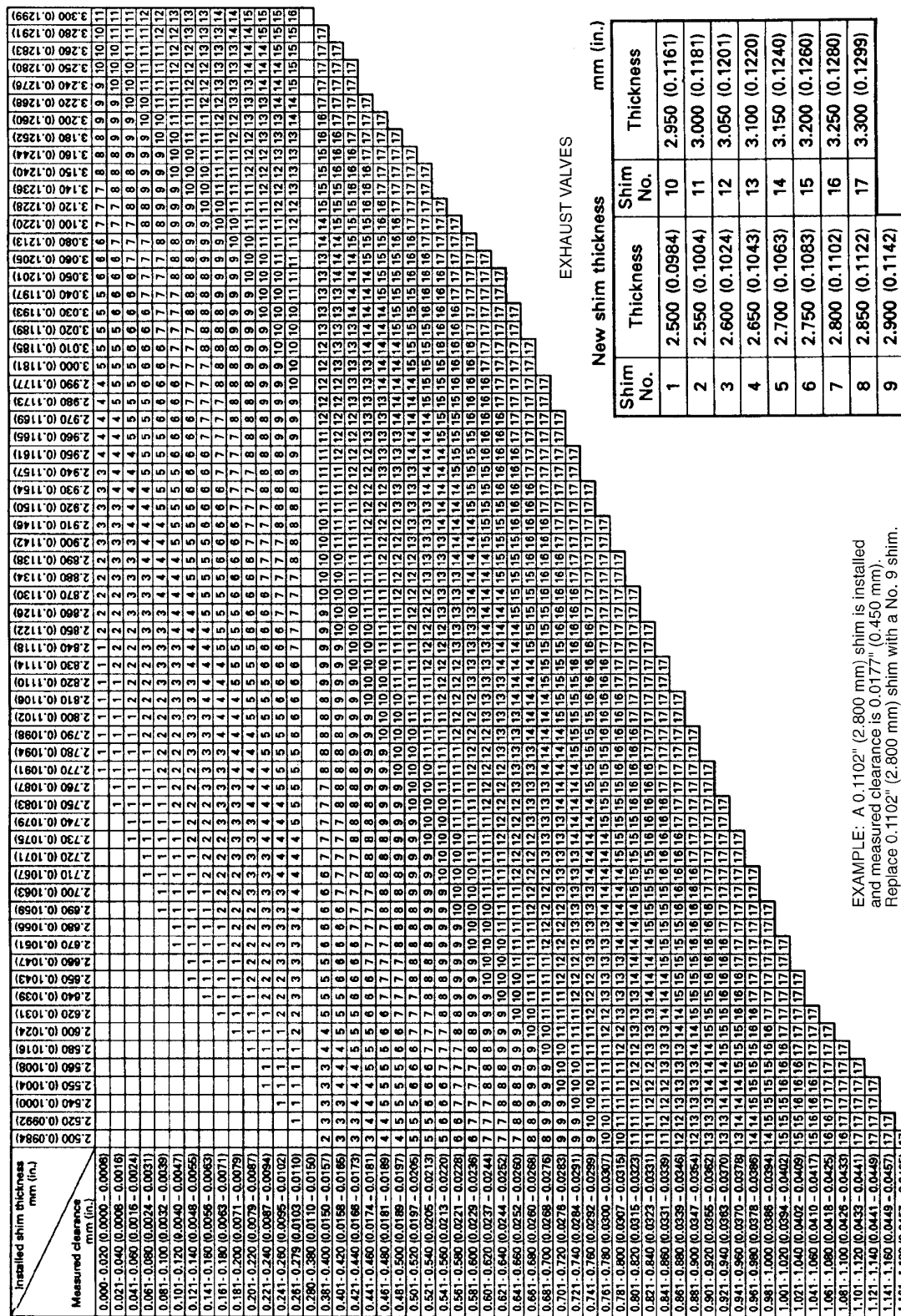


Fig. 4: Exhaust Valve Adjusting Shim Selection Chart (Except Camry CNG)

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

VALVE CLEARANCE ADJUSTMENT (CAMRY CNG)

1. Disconnect spark plug wires from clamps on valve cover. Remove spark plug wires. Disconnect PCV hose(s), cable brackets and necessary electrical connectors to access valve cover. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly reference, as grommets **MUST BE** installed in original location.
2. Rotate crankshaft clockwise (viewed from timing belt end of engine) so cylinder No. 1 is at TDC on compression stroke, and timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Cylinder No. 1 is front cylinder at timing belt end of engine.
3. Ensure valve lifters are loose on cylinder No. 1 and tight on cylinder No. 4. If conditions are not as described, rotate crankshaft clockwise 1 complete revolution (360 degrees).
4. With piston No. 1 at TDC on compression stroke, check valve clearance on specified valves. See STEP 1 in illustration. See **Fig. 1**. Using feeler gauge, measure and record valve clearance between valve lifter and camshaft.
5. To check remaining valves, rotate crankshaft clockwise (viewed from timing belt end of engine) 1 complete revolution (360 degrees) until piston No. 4 is at TDC on compression stroke. Measure and record valve clearance on specified valves. See STEP 2 in illustration. See **Fig. 1**.
6. Ensure valve clearance is within specification. See **VALVE CLEARANCE SPECIFICATIONS** table.
7. If valve clearance requires adjustment, remove timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove camshafts. See **CAMSHAFT** under REMOVAL & INSTALLATION. Remove valve lifter and adjusting shim.
8. Measure and record thickness of adjusting shim removed. Using measured valve clearance and adjusting shim thickness, select proper replacement adjusting shim. See **Fig. 5** and **Fig. 6**. Install replacement adjusting shim. Install valve lifter. Install camshafts. install timing belt. Recheck valve clearance.

Fig. 6: Exhaust Valve Adjusting Shim Selection Chart (Camry CNG)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

TROUBLE SHOOTING

To trouble shoot mechanical engine components, see appropriate table in TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

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.

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may exist until computer systems complete a relearn cycle.

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

FUEL PRESSURE RELEASE (EXCEPT CAMRY CNG)

1. Manufacturer recommends disconnecting electrical connector at electric fuel pump and operating engine until engine stalls before loosening fuel line connection. Remove rear seat cushion and floor panel cover for access to electrical connector for electric fuel pump. Disconnect electrical connector for electric fuel pump.
2. Start engine, and allow engine to idle until engine stalls. Turn ignition off. Disconnect negative battery cable. Place an approved gasoline container under fuel line connection. Cover fuel line connection with shop towel.
3. Slowly loosen fuel line connection to release any remaining fuel pressure. Once fuel pressure is released, service fuel system components. Reconnect electrical connector for electric fuel pump. Reinstall floor panel cover and rear seat cushion.

FUEL PRESSURE RELEASE (CAMRY CNG)

NOTE: CNG fuel system is pressurized up to 3600 psi (253 kg/cm²) upstream of pressure regulator, and up to 114 psi (8 kg/cm²), downstream of pressure regulator. Use caution when working around fuel system. Perform procedure in a well ventilated area.

Close manual shutoff valve. Start engine and let idle until it dies. Check that fuel gauge is on "E". If gauge is not on "E", restart engine and let it idle out. Crank engine and confirm a no start condition. Turn ignition off. Wait 5 seconds. Disconnect negative battery cable.

COOLING SYSTEM BLEEDING

No special cooling system bleeding procedure is required.

ENGINE

Removal (Camry & Camry Solara)

NOTE: Manufacturer does not provide a specific engine removal and installation procedure for Camry CNG models. Removal and installation is basically the same as gas engines, except for fuel delivery components. When removing fuel delivery components on CNG engines, see **REMOVAL, OVERHAUL & INSTALLATION - 4-CYLINDER** article in **ENGINE PERFORMANCE**.

1. Engine and transaxle are removed as an assembly. Release fuel pressure. See **FUEL PRESSURE RELEASE (EXCEPT CAMRY CNG)** or **FUEL PRESSURE RELEASE (CAMRY CNG)** . Remove hood. Remove battery and battery tray. Drain cooling system and engine oil. Remove front fender liners.
2. Disconnect control cables at throttle body. Remove air intake duct with air cleaner assembly and air cleaner case. Remove cruise control actuator. Disconnect electrical connectors, coolant hoses and transmission oil cooler lines for radiator removal. Remove radiator and cooling fan.
3. Remove bolts and nuts attaching front exhaust pipe support stay and support bracket. Remove support stay and support bracket. Remove bolts and nuts attaching front exhaust pipe to center exhaust pipe, and front exhaust pipe to exhaust manifold. Remove front exhaust pipe. Disconnect necessary electrical connectors, coolant hoses, vacuum hoses and fuel lines for engine removal. Remove A/C compressor and power steering pump with hoses attached, and secure aside. Remove lower instrument panel cover and glove box.
4. Disconnect connectors from ECM and engine wiring connectors near ECM. Remove grommet as necessary, and pull engine wiring out through firewall. Remove front axle shafts. See **AXLE SHAFTS - FWD** article in **DRIVE AXLES**.
5. On man. trans., remove starter and clutch release cylinder with hose attached, and secure aside. On auto. trans. models, disconnect oil cooler lines at transaxle. Remove bolts attaching transaxle to left engine mounting insulator. Remove 3 nuts attaching rear engine mounting bracket to front frame. Remove 3 bolts attaching front mounting insulator to frame. Attach engine sling. Remove 3 bolts, and remove engine moving control rod. On all models, disconnect control cables and electrical connectors at transaxle.
6. Lift engine out of vehicle slowly and carefully. Ensure engine is clear of all wiring, hoses and cables. Place engine and transaxle assembly onto stand. Remove front and rear engine mounting insulators and bolts from engine. Remove No. 2 right engine mounting bracket.
7. On A/T models, disconnect throttle cable from throttle body. Remove starter. On all models, Disconnect VSS connector. On M/T models, disconnect back-up light switch connector. On A/T models, disconnect PNP switch connector and 2 solenoid connectors. Remove No. 1 and No. 2 exhaust manifold stay. Remove left and right stiffener plates.
8. Remove exhaust pipe bracket, oil pan, insulator and No. 2 rear end plate. On A/T models, turn crankshaft pulley bolt to gain access to each bolt. Using wrench, hold crankshaft pulley bolt, and remove 6 bolts.
9. Remove 4 bolts, ground strap and wire bracket. Remove transaxle as an assembly with torque converter

clutch (A/T) from engine. On M/T models, remove clutch cover and disc. Remove flywheel. On A/T models, remove drive plate. On all models, remove No. 1 rear end plate.

Installation (Camry & Camry Solara)

1. To install, reverse removal procedure. Tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.
2. Before installing axle shafts, coat axle shaft splines and sliding surfaces with Dexron-III on A/T models or SAE 75W-90 GL-5 gear oil on M/T models. Install NEW snap ring on end of left axle shaft. Coat axle shaft seals in transaxle with grease. Position snap ring on end of left axle shaft with opening facing downward.
3. Install left axle shaft by lightly tapping axle shaft into transaxle. Ensure left axle shaft moves inward and outward approximately .079-.120" (2.01-3.05 mm), and cannot be pulled from transaxle. When installing right axle shaft, install NEW snap ring and NEW axle shaft bearing bolt. Tighten axle shaft bearing bolt to specification. See **TORQUE SPECIFICATIONS**.
4. To install remaining components, reverse removal procedure. Use NEW gasket and NEW nuts when installing front exhaust pipe. Tighten, bolts/nuts to specification. See **TORQUE SPECIFICATIONS**. Adjust fluid levels and control cables. Fill transaxle with Dexron-III ATF on A/T models or SAE 75W-90 GL-5 gear oil on M/T models.

Removal (Celica)

1. Engine and transaxle are removed as an assembly. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Remove hood. Remove engine under covers. Remove battery. Drain cooling system, engine oil and transaxle fluid.
2. Disconnect necessary clamps and connectors from air cleaner cap. Remove air intake duct with air cleaner assembly and air cleaner case. Disconnect control cables at throttle body. Remove cruise control actuator from bracket on the body.
3. Remove relay box located above radiator . Disconnect electrical connectors, coolant hoses and transmission oil cooler lines (on A/T models) for radiator removal. Remove radiator and cooling fan.
4. Disconnect necessary control cables, electrical connectors, fuel lines, coolant hoses and vacuum hoses for engine removal. Remove covers from fuse/relay box located at driver's side front corner of engine compartment. See **Fig. 7**. Disconnect 2 engine wiring electrical connectors from bottom of fuse/relay box. See **Fig. 7**.
5. Remove passenger's side kick panel. Remove scuff plate from passenger's side door opening, and remove carpet for access to wiring at Engine Control Module (ECM) located below instrument panel. See **Fig. 8**.
6. Remove engine wiring bracket from ECM. Disconnect necessary connectors so engine wiring may be pulled out through firewall. See **Fig. 8**.

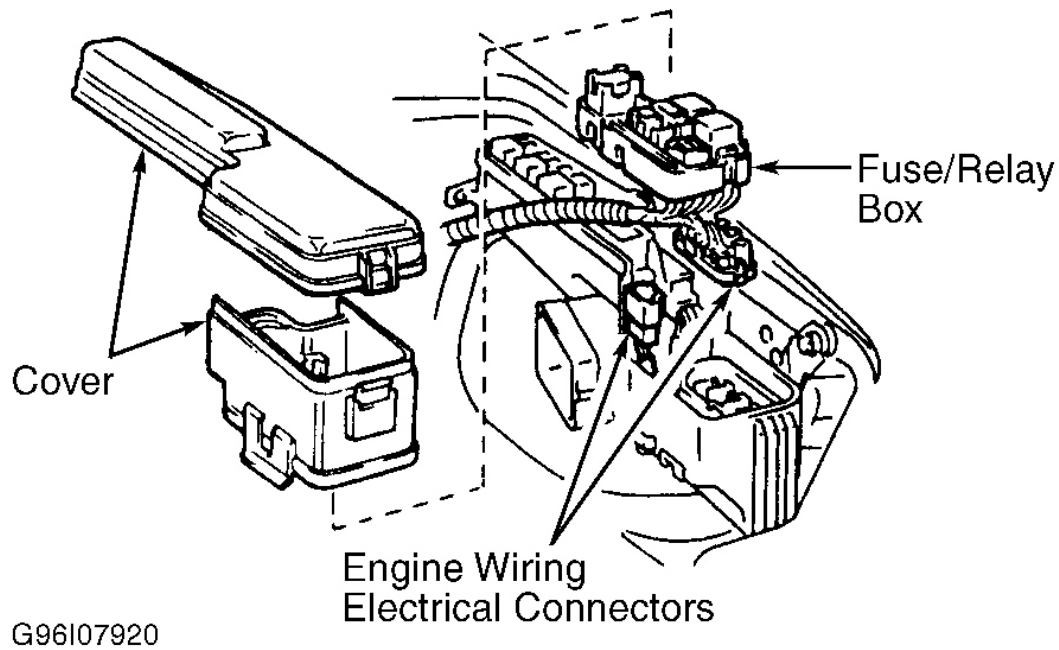


Fig. 7: Locating Fuse/Relay Box & Engine Wiring Connectors (Celica)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

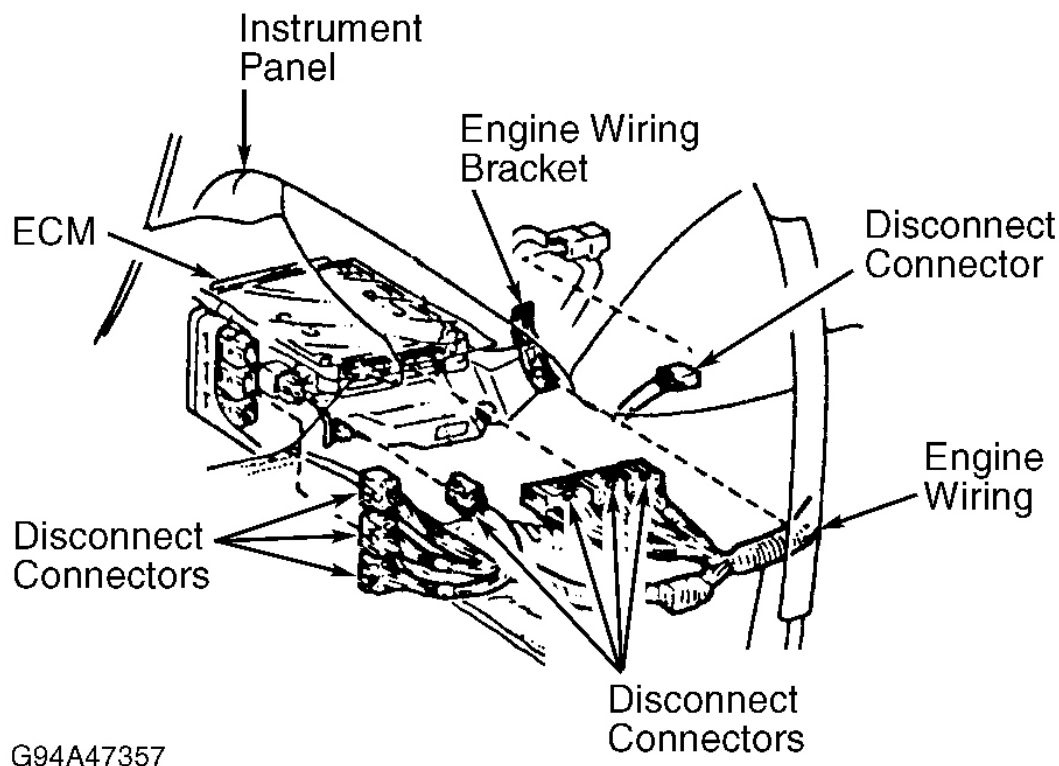


Fig. 8: Locating ECM & Engine Wiring Connectors (Celica)

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

7. Remove engine wiring-to-firewall retaining nuts located below wiper motor. Pull engine wiring out through the firewall. Remove front exhaust pipe-to-support bracket bolts. Remove exhaust pipe-to-rear catalytic converter bolts. Remove exhaust pipe-to-catalytic converter nuts and remove exhaust pipe. Remove A/C compressor and power steering pump with hoses attached, and secure aside.
8. On man. trans. models, remove starter. Remove clutch slave cylinder from transaxle. On all models, disconnect transaxle control cables from transaxle. Remove exhaust pipe support bracket.
9. Remove 2 dust covers from rear side of center member. Disconnect A/C pipe from bracket. Remove bolt and nut holding front engine mounting bracket to mounting insulator. Remove bolt holding rear engine mounting bracket to mounting insulator. Remove bolt and 2 nuts holding rear engine mounting insulator to front suspension member.
10. Remove 2 bolts (A/T) or 3 bolts (M/T) and rear engine mounting bracket. Remove 2 bolts holding center member to body, and remove center member and rear engine mounting insulator.
11. Attach engine chain hoist to engine hangers. Remove 2 nuts and bolt (M/T) or 2 bolts (A/T), and disconnect left engine mounting bracket from mounting insulator. Remove through bolt and engine mounting insulator. Disconnect ground strap connector. Remove bolt and 2 nuts. Disconnect right engine mounting bracket from mounting insulator.
12. Lift engine out of vehicle slowly and carefully. Ensure engine is clear of all wiring, hoses and cables.

Remove drive shaft bearing bracket.

13. On A/T models, disconnect throttle cable from throttle body, cable bracket and clamps on intake manifold. Disconnect connectors and cable. On A/T models, disconnect PNP switch connector and 2 solenoid connectors. On all models, disconnect ground cable and VSS connector.
14. On A/T models, disconnect starter connector. Remove nut, and disconnect starter cable. Remove 2 bolts. Disconnect oxygen sensor and engine wire brackets from starter. Remove starter.
15. Remove left exhaust manifold stay. Remove No. 2 intake manifold stay. Remove rear end plate stiffener. On A/T models, turn crankshaft pulley bolt to gain access to each bolt. Using wrench, hold crankshaft pulley bolt and remove 6 flywheel bolts.
16. Remove 6 bolts, and disconnect ground strap from transaxle. Remove transaxle as an assembly with torque converter clutch from engine. On M/T models, remove clutch cover and disc. Remove flywheel. On A/T models, remove flywheel and end plate.

Installation (Celica)

1. To install, reverse removal procedure. Install all bolts/nuts in engine mounts and engine mount crossmember before tightening to specification. Tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.
2. To install remaining components, reverse removal procedure. Use NEW gasket and NEW nuts when installing front exhaust pipe on catalytic converter. Tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.
3. Adjust fluid levels and control cables. Fill transaxle with Dexron-III ATF on A/T models or SAE 75W-90 GL-5 gear oil on M/T models.

CYLINDER HEAD & MANIFOLDS

Removal (Camry & Camry Solara)

1. Release fuel pressure. See **FUEL PRESSURE RELEASE (EXCEPT CAMRY CNG)** or **FUEL PRESSURE RELEASE (CAMRY CNG)**. Drain cooling system. Raise and support vehicle.
2. Remove air intake duct with air cleaner cap assembly. Remove generator and generator mounting bracket with engine hanger. Disconnect front exhaust pipe from exhaust manifold. Remove heat insulator from top of exhaust manifold.
3. Remove No. 1 and 2 exhaust manifold braces. Disconnect air/fuel sensor electrical connector (Calif. models) or oxygen sensor (except Calif. models) electrical connector at exhaust manifold. Remove nuts, exhaust manifold and gasket.
4. Disconnect electrical connectors, vacuum hoses and control cables at throttle body. Remove throttle body and gasket from intake manifold. Disconnect remaining coolant hoses and air hose from throttle body. Remove throttle body.
5. Disconnect electrical connectors at ignition coils. Ignition coils are mounted at end of cylinder head. Disconnect spark plug wires from spark plugs and clamp on top of valve cover.
6. Remove ignition coils along with intake manifold support brace and spark plug wire assembly from cylinder head. Disconnect necessary electrical connectors, coolant hoses and vacuum hoses for removal of intake manifold and cylinder head.
7. Remove coolant outlet and gasket from rear of cylinder head. Remove intake manifold brace. Remove

EGR Vacuum Switching Valve (VSV) and EGR valve with vacuum modulator. Disconnect engine wiring assembly from clamps on the side of intake manifold. Remove fuel pulsation damper with gaskets, and disconnect fuel inlet pipe from fuel delivery pipe.

8. Remove intake manifold and gasket. On Calif. models, remove air assist system hose. On all models, note location of electrical connectors on fuel injectors for reassembly reference. Disconnect electrical connectors from fuel injectors.

CAUTION: DO NOT allow fuel injectors to fall from fuel delivery pipe during when removing fuel delivery pipe.

9. On models with CNG, remove 2 nuts, and disconnect fuel inlet hose from pressure regulator. Remove "O" ring from pressure regulator. On all models, remove bolts and fuel delivery pipe with fuel injectors. Remove the 2 spacers for fuel delivery pipe from cylinder head.
10. On except California models, an insulator is located between bottom of each fuel injector and the cylinder head. Remove the 4 insulators from the cylinder head. On all models, remove fuel injectors from fuel delivery pipe (if necessary).

NOTE: **Manufacturer recommends removing timing belt only from camshaft sprocket when servicing cylinder head. After removing timing belt from camshaft sprocket, tension must be applied on timing belt so timing belt does not come off crankshaft sprocket. If timing belt comes off crankshaft sprocket, timing belt must be completely removed and reinstalled.**

11. Remove timing belt from camshaft sprocket. See **TIMING BELT**. Remove camshaft sprocket, No. 1 idler pulley and tension spring. See **TIMING BELT**.
12. Remove No. 3 timing belt cover from cylinder head. Remove camshafts from cylinder head. See **CAMSHAFT**.

NOTE: **Support timing belt, so meshing of crankshaft timing pulley and timing belt DOES NOT shift. Ensure NOT to drop anything inside timing belt cover. DO NOT allow belt to come into contact with oil, water or dust.**

CAUTION: To prevent cylinder head warpage, loosen cylinder head bolts in proper sequence

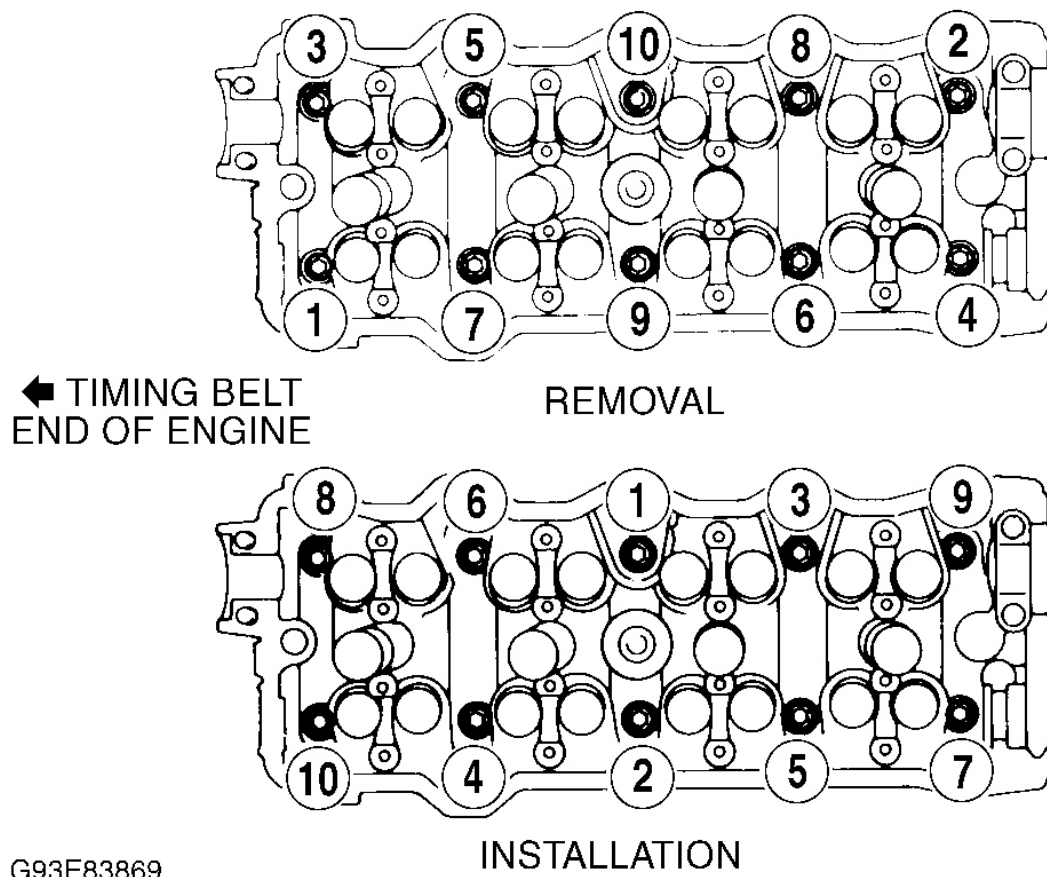


Fig. 9: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

13. Remove coolant by-pass pipe-to-cylinder head bolts. Disconnect electrical connector at camshaft position sensor. Camshaft position sensor is located at front of cylinder head.
14. Loosen cylinder head bolts in proper sequence using several steps. See **Fig. 9**. Remove cylinder head bolts, washers, cylinder head and gasket.
15. Remove camshaft position sensor from front of cylinder head (if necessary). Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

Inspection (Camry & Camry Solara)

1. Inspect cylinder head warpage at cylinder block, exhaust manifold and intake manifold surfaces. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Inspect cylinder block deck surface for warpage. Replace cylinder block if deck surface warpage exceeds specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

3. Inspect intake and exhaust manifold machined surfaces for warpage. Replace component if warpage exceeds .0031" (0.08 mm). Inspect camshaft and components. See **CAMSHAFT** under REMOVAL & INSTALLATION.
4. 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 (Camry & Camry Solara)

1. Place new cylinder head gasket on cylinder block. Place cylinder head on cylinder head gasket. Coat threads and bolt-to-cylinder contact surfaces on cylinder head bolts with engine oil. Install and tighten cylinder head bolts to specification in sequence. See **Fig. 9**. See **TORQUE SPECIFICATIONS**.
2. Reference mark front of cylinder head bolt. Retighten cylinder head bolts an additional 90 degrees. Install 2 bolts holding water bypass pipe to cylinder head. Connect camshaft position sensor connector.
3. Clean cylinder head spark plug tube holes of residual adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline. Screw threads of spark plug tube coated with adhesive into cylinder head. Using spark plug tube nut and 30 mm socket wrench, tighten spark plug tubes to specification. See **TORQUE SPECIFICATIONS**.
4. Install camshafts using proper procedure. See **CAMSHAFT**. Install No. 3 timing belt cover. Install and tighten to specification. See **TORQUE SPECIFICATIONS**.
5. To install remaining components, reverse removal procedure. If camshaft or cylinder head components are serviced, adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.
6. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. Using NEW gasket, install valve cover. Install grommets in original location with marking on grommet aligned in designated area. Install and tighten valve cover nuts to specification. See **TORQUE SPECIFICATIONS**.

NOTE: **On California models, an insulator, grommet and 2 "O" rings are used on the fuel injector. On all other models, grommet and "O" ring is used on fuel injector, and 4 insulators are used between bottom of fuel injectors and cylinder head.**

7. Replace "O" rings, grommet and insulator on fuel injector. Coat NEW "O" rings with gasoline. Using twisting motion, install fuel injectors into fuel delivery pipe.
8. Install 4 NEW insulators (except California models) on cylinder head. Install spacers and fuel delivery pipe with fuel injectors on cylinder head. Position electrical connector on fuel injector facing toward top of engine.
9. Install and slightly tighten fuel delivery pipe bolts. Ensure all fuel injectors rotate smoothly. If fuel injector fails to rotate smoothly, check for improperly installed or damaged "O" rings. Tighten fuel delivery pipe bolts to specification. See **TORQUE SPECIFICATIONS**.
10. On CNG engines, install NEW "O" ring into pressure regulator. Connect fuel inlet hose to pressure regulator and install and tighten 2 nuts. On all engines, install No. 1 idler pulley and camshaft sprocket. Install timing belt using proper procedure. See **TIMING BELT** under REMOVAL & INSTALLATION.
11. To install remaining components, reverse removal procedure. Tighten all bolts/nuts to specification. See

TORQUE SPECIFICATIONS.**Removal (Celica)**

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Drain cooling system. Raise and support vehicle. Remove lower engine covers.
2. Disconnect connectors, cord, cables and hoses from air cleaner cap. Disconnect 4 clamps and remove air cleaner cap. Disconnect air cleaner hose from throttle body. Remove air cleaner cap and hose assembly. Remove air cleaner case. Disconnect control cables at throttle body. Disconnect spark plug wires from valve cover clamp. Remove attaching bolt and remove distributor with plug wires. Remove "O" ring from distributor housing.
3. Remove generator. Disconnect oxygen sensor connectors. Remove exhaust manifold braces. Remove upper exhaust manifold heat insulator. Remove exhaust manifold and catalytic converter.
4. Remove 2 nuts, oxygen sensor (bank 1 sensor 1) and gasket. Remove oxygen sensor (bank 1 sensor 2) from converter. Remove 5 bolts and lower manifold heat insulator. Remove 8 bolts and 2 TWC heat insulators. Remove 3 bolts, 2 nuts and separate converter from manifold. Remove gasket, retainer and cushion.
5. Disconnect oil pressure switch connector. Remove water outlet. Disconnect necessary electrical connectors, coolant hoses and vacuum hoses for removal of throttle body, intake manifold and cylinder head. Remove water bypass pipe. Disconnect necessary hoses. Remove gasket and "O" ring.
6. Remove throttle body. Disconnect MAP vacuum hose from gas filter on manifold. Disconnect brake booster vacuum hose from intake manifold. Remove EGR valve and vacuum modulator from intake manifold. Remove Vacuum Switching Valve (VSV) assemblies and gasket from side of intake manifold.
7. Remove bolt, nut and intake manifold stay. Disconnect throttle cable from clamp on rear side of intake manifold. Disconnect 2 power steering air hoses from air tube and intake manifold. Disconnect air hose from fuel pressure regulator. Remove 2 bolts, hose bracket for EGR and air tube.
8. Disconnect knock sensor No. 1 connector. Remove bolt, and disconnect 2 ground wires from intake manifold. Disconnect EGR-VSV connector. Remove bolt and VSV.
9. Disconnect PCV hose from intake manifold. Remove 2 bolts, and disconnect cable bracket from intake manifold. Disconnect control cables from 4 clamps.
10. Disconnect engine wire protector from bracket on starter. Disconnect VSS sensor connector. Remove bolt, and disconnect engine wire protector from left side of intake manifold. Disconnect 4 injector connectors.
11. Disconnect engine wire protector from 2 brackets on front side of intake manifold. Disconnect engine wire protector from 2 mounting bolts of No. 2 timing belt cover.
12. Remove union bolt and 2 gaskets. Disconnect fuel inlet hose from delivery pipe. Disconnect fuel return hose from return pipe. Remove 6 bolts and 2 nuts. Disconnect engine wire between intake manifold and cylinder head. Remove intake manifold and gasket.
13. Remove air hose for air assist system (California). Remove 2 bolts and delivery pipe together with 4 injectors. Remove 4 insulators (except California) and 2 spacers from cylinder head. Pull out 4 injectors from delivery pipe. Remove 2 "O" rings, insulator and grommet from each injector (California). Remove "O" ring and grommet from each injector (except California).
14. Remove timing belt from camshaft timing pulley. Remove camshaft timing pulley. See **TIMING BELT**.
15. Remove No. 1 idler pulley and tension spring. Remove No. 3 timing belt cover from cylinder head.

Remove 3 bolts, generator bracket and engine hanger assemblies. Remove oil pressure switch. Remove valve cover. Mark valve cover grommets for installation reference. Remove camshafts. See **CAMSHAFT**.

16. Loosen cylinder head bolts in proper sequence using several steps. See **Fig. 9**.

Inspection (Celica)

1. Inspect cylinder head warpage at cylinder block, exhaust manifold and intake manifold surfaces. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Inspect cylinder block deck surface for warpage. Replace cylinder block if deck surface warpage exceeds specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
3. Inspect intake and exhaust manifold machined surfaces for warpage. Replace component if warpage exceeds .0031" (.079 mm). Inspect camshaft and components. See **CAMSHAFT** under REMOVAL & INSTALLATION.
4. 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 (Celica)

1. Install adjusting shims and valve lifters in original location on cylinder head (if removed). Ensure valve lifters rotate smoothly in cylinder head. Install NEW gasket for cylinder head on cylinder block. Ensure all holes in gasket align with holes in cylinder block.
2. Install cylinder head. Coat threads and bolt-to-cylinder contact surfaces on cylinder head bolts with engine oil. Install and tighten cylinder head bolts to specification in sequence. See **Fig. 9**. See **TORQUE SPECIFICATIONS**.
3. Clean cylinder head tube holes of any residual adhesive, oil or foreign particles. Remove any oil with kerosene or gasoline. Screw threads of spark plug tube coated with adhesive into cylinder head. Using spark plug tube nut and 30 mm socket wrench, tighten spark plug tubes to specification. See **TORQUE SPECIFICATIONS**.
4. Install camshafts using proper procedure. See **CAMSHAFT** under REMOVAL & INSTALLATION. To install remaining components, reverse removal procedure. If camshaft or cylinder head components are serviced, adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.
5. Install semi-circular plugs in cylinder head, (if removed). Install PCV valve, PCV hose and spark plug wire clamp to cylinder head. Using NEW gasket, install valve cover.
6. Install grommets in original location with marking on grommet positioned toward front of engine. Install and tighten valve cover nuts to specification. See **TORQUE SPECIFICATIONS**.
7. Install oil pressure switch. Install generator bracket and right engine hanger as an assembly. Install 3 bolts. Install left engine hanger and bolt. Install No. 3 timing belt cover. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Install No. 1 idler pulley and tension spring. Install camshaft pulley. Install timing belt to camshaft pulley.
8. If installing fuel injector in fuel delivery pipe, replace "O" ring(s), grommet and insulator (if used) on fuel injector. Coat NEW "O" ring(s) with gasoline. Using twisting motion, install fuel injectors into fuel delivery pipe.

NOTE: On California models, an insulator, grommet and 2 "O" rings are used on the fuel injector. On all other models, grommet and "O" ring is used on fuel injector. On all models except California, 4 insulators are used between bottom of fuel injectors and cylinder head.

9. When installing fuel delivery pipe, install 4 NEW insulators on cylinder head. Install spacers and fuel delivery pipe with fuel injectors on cylinder head. Position electrical connector on fuel injector facing toward top of engine.
10. Install and slightly tighten fuel delivery pipe bolts. Ensure all fuel injectors rotate smoothly. If fuel injector fails to rotate smoothly, check for improperly installed or damaged "O" rings. Tighten fuel delivery pipe bolts to specification. See **TORQUE SPECIFICATIONS**.

CAUTION: On models using bolts for throttle body, ensure to install longer bolts in 2 lower bolt holes.

11. Connect air hose to cylinder head port (only California models). Insert intake manifold between cylinder head and dash panel. Insert engine wire between cylinder head and intake manifold. Install new gasket and intake manifold. Install 6 bolts and 2 nuts. Tighten nuts/bolts to specification. See **TORQUE SPECIFICATIONS**.
12. Connect fuel inlet pipe to delivery pipe with 2 NEW gaskets and union bolt. Connect fuel return hose to return hose. Install engine wire protector to 2 mounting bolts of No. 2 timing belt cover. Install engine wire protector to 2 brackets on front side of intake manifold.

NOTE: The No. 1 and No. 3 injector connectors are Brown, and No. 2 and No. 4 injector connectors are Gray.

13. Connect 4 injector connectors. Install engine wire protector to left side of intake manifold with bolt. Connect VSS sensor connector. Install engine wire protector to bracket on starter.
14. Install throttle cable bracket to intake manifold and 2 bolts. Install control cables to 4 clamps. Install PCV hose to intake manifold. Install EGR-VSV and bolt. Install VSV connector.
15. Connect knock sensor 1 connector. Install 2 ground wires and bolt. Install air tube and hose bracket for EGR. Install 2 bolts.
16. Install connect 2 power steering air hoses to air tube and intake manifold. Connect vacuum sensing house to fuel pressure regulator. Install throttle control cable to clamp on rear side of intake manifold.
17. Install manifold stay. Install NEW gasket and EGR valve. Install union nut and 2 nuts. Install vacuum modulator to clamp on intake manifold. Connect 2 vacuum hoses to VSV for EGR. Install hose clamp-to- bracket on air tube. Connect EVAP hose to charcoal canister.
18. Connect MAP sensor vacuum hose to gas filter on intake manifold. Connect brake booster vacuum hose to intake manifold.
19. Install NEW throttle body gasket with protrusion on gasket facing toward bottom of throttle body. See **Fig. 10**. On models using bolts for throttle body, install 2 longer throttle body bolts in 2 lower bolt holes.
20. Install NEW "O" ring on coolant by-pass pipe. Apply soapy water solution on "O" ring before installing coolant by-pass pipe. Use NEW gasket when installing catalytic converter on exhaust manifold.
21. Connect IAC valve water bypass hose to water bypass pipe. Connect heater water hose to water bypass

- pipe. Connect 2 oil cooler water bypass hoses to oil cooler. Install oil cooler heat protector, 2 nuts and bolt.
22. Install NEW gasket and water outlet. Install 2 nuts. Connect radiator hose, water bypass pipe hose, heater water hose, vacuum hoses, and IAC valve water bypass hose to water outlet. Connect electrical connectors. Connect oil pressure switch.
 23. Install catalyst to exhaust manifold. Install 3 bolts and 2 nuts. Install lower manifold heat insulator and 5 bolts. Install 2 catalyst heat insulators. Install 8 bolts.
 24. Install NEW gasket and oxygen sensor. Install 2 nuts and oxygen sensor (Bank 1 Sensor 2) to front catalyst.
 25. Install gasket, manifold and catalyst assembly. Install 6 nuts and tighten to specification. See **TORQUE SPECIFICATIONS**. Install right exhaust manifold stay, 2 bolts and 2 nuts. Install upper manifold heat insulator and 5 bolts. Install left exhaust manifold stay, bolt and nut. Connect oxygen sensor connectors.
 26. Install front exhaust pipe. Install generator, distributor and air cleaner case and cap. Use NEW "O" ring for distributor. Fill engine with oil and coolant. Start engine and check for leaks. Recheck engine coolant level and oil level.

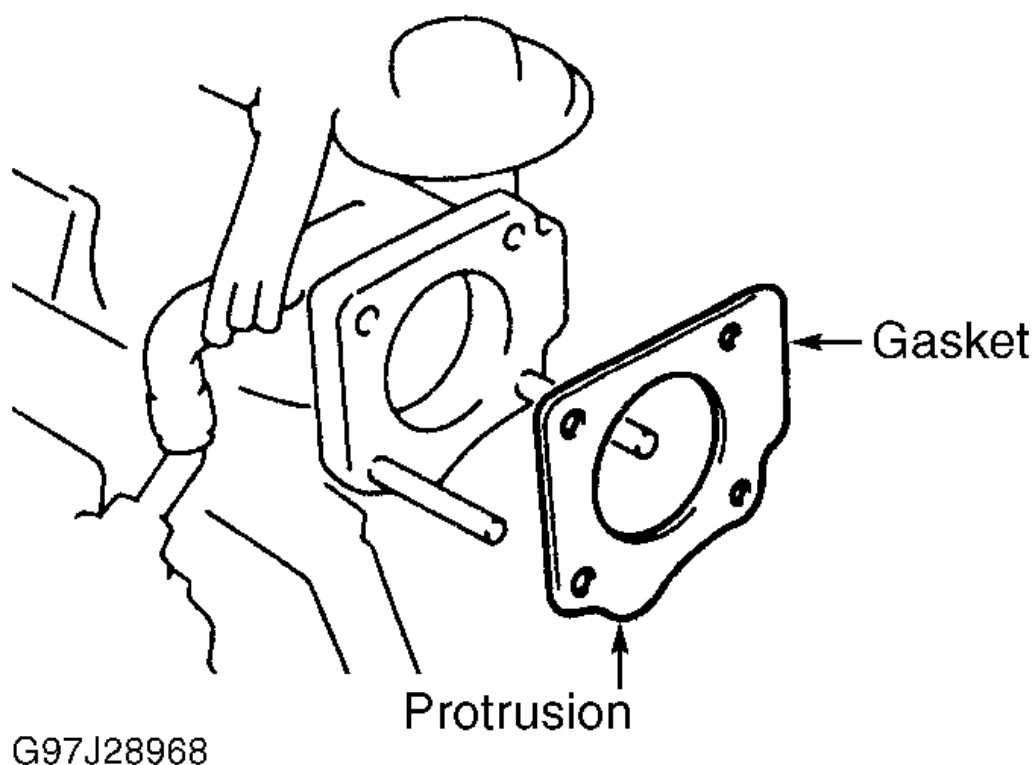


Fig. 10: Installing Throttle Body Gasket (Celica)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKSHAFT FRONT SEAL

Removal & Installation (Oil Pump Installed)

1. Remove timing belt and crankshaft sprocket. See **TIMING BELT** under REMOVAL & INSTALLATION. Using knife, cut lip from seal. Pry seal from oil pump housing. DO NOT damage sealing surfaces.
2. To install, apply grease to lip of NEW seal. Using hammer and Seal Installer (SST 09226-10010), install seal until seal surface is even with oil pump housing. To install remaining components, reverse removal procedure.

Removal & Installation (Oil Pump Removed)

Using hammer and drift, remove seal from oil pump housing. To install, use hammer and Seal Installer (SST 09226-10010). Install NEW seal until seal surface is even with oil pump housing. Apply grease to lip of seal.

TIMING BELT

Removal

1. Remove generator. Remove right front wheel. Remove right lower engine cover. Remove accessory drive belts.
2. Using floor jack, slightly raise engine to remove weight from engine mount for access to timing belt covers. Remove engine mount and bracket from front of engine. Disconnect ground strap connector.
3. On Camry and Camry Solara models, remove 3 bolts and control rod. On all models, remove bolt and nuts holding mounting insulator to mounting bracket. On Celica, disconnect power steering reservoir, bolt, nut and bracket. On all models, remove spark plug wires, spark plugs, No. 2 timing belt cover and gaskets.
4. Rotate crankshaft clockwise (viewed from timing belt end of engine) until cylinder No. 1 is at TDC on compression stroke and timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Cylinder No. 1 is front cylinder at timing belt end of engine.
5. Ensure hole in camshaft sprocket aligns with alignment mark on camshaft bearing cap. See **Fig. 11**. If hole in camshaft sprocket is not aligned with alignment mark, rotate crankshaft clockwise 1 complete revolution (360 degrees).

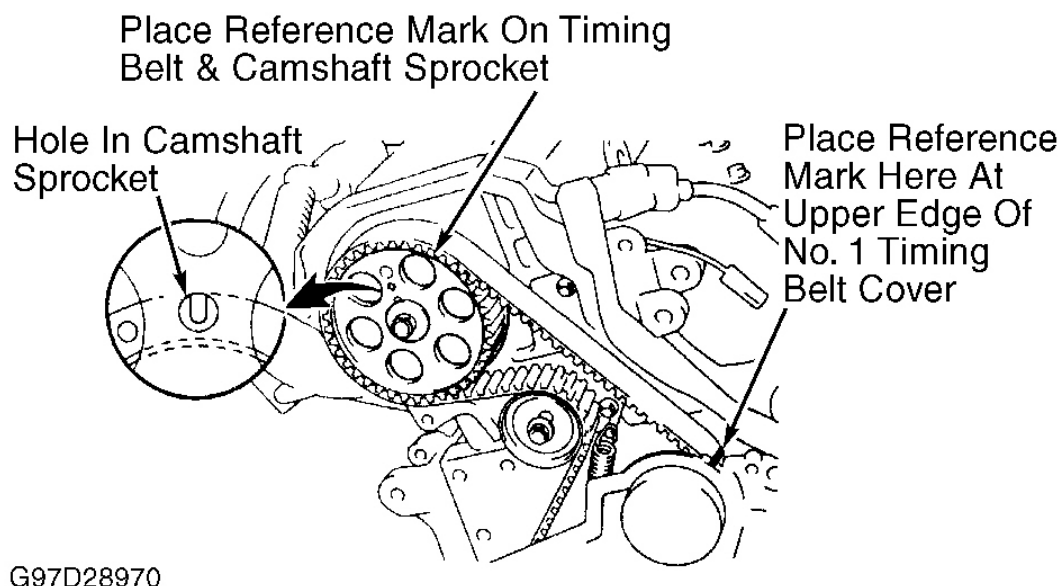


Fig. 11: Aligning Camshaft Timing Marks & Installing Reference Marks
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CAUTION: If reusing timing belt, mark direction of timing belt rotation and place reference mark on timing belt at camshaft sprocket for reassembly reference. Also place reference mark on timing belt at upper edge of No. 1 timing belt cover. See Fig. 11.

6. Loosen No. 1 idler pulley bolt. Move No. 1 idler pulley outward, away from timing belt as far as possible. Temporarily retighten No. 1 idler pulley bolt. Remove timing belt from camshaft sprocket.
7. If reusing timing belt, ensure reference mark placed on timing belt aligns with upper edge of No. 1 timing belt cover when timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover. If reference mark is aligned, proceed to step 12.
8. If reference mark is below surface of No. 1 timing belt cover, pull upward on water pump side of timing belt while rotating crankshaft pulley counterclockwise. Align reference mark with the upper edge of No. 1 timing belt cover.
9. Hold upward on water pump side of timing belt. Rotate crankshaft pulley clockwise so timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover.
10. If reference mark is above upper edge of No. 1 timing belt cover, pull upward on No. 1 idler pulley side of timing belt while rotating crankshaft pulley clockwise. Align reference mark with upper edge of No. 1 timing belt cover.
11. Hold upward on No. 1 idler pulley side of timing belt. Rotate crankshaft pulley counterclockwise so timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover.
12. Remove crankshaft pulley bolt. Using puller, remove crankshaft pulley. Disconnect crankshaft sensor wire from clamp on timing belt cover. Remove No. 1 timing belt cover and gasket. Note direction of

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

timing belt guide installation. Remove timing belt guide.

13. If reusing timing belt, mark direction of timing belt rotation and place reference marks on timing belt and crankshaft sprocket for reassembly reference. Remove timing belt from crankshaft sprocket.
14. Remove bolt, idler pulley and tension spring. Remove crankshaft timing pulley. Loosen pulley nut, then remove nut and pulley.

Inspection

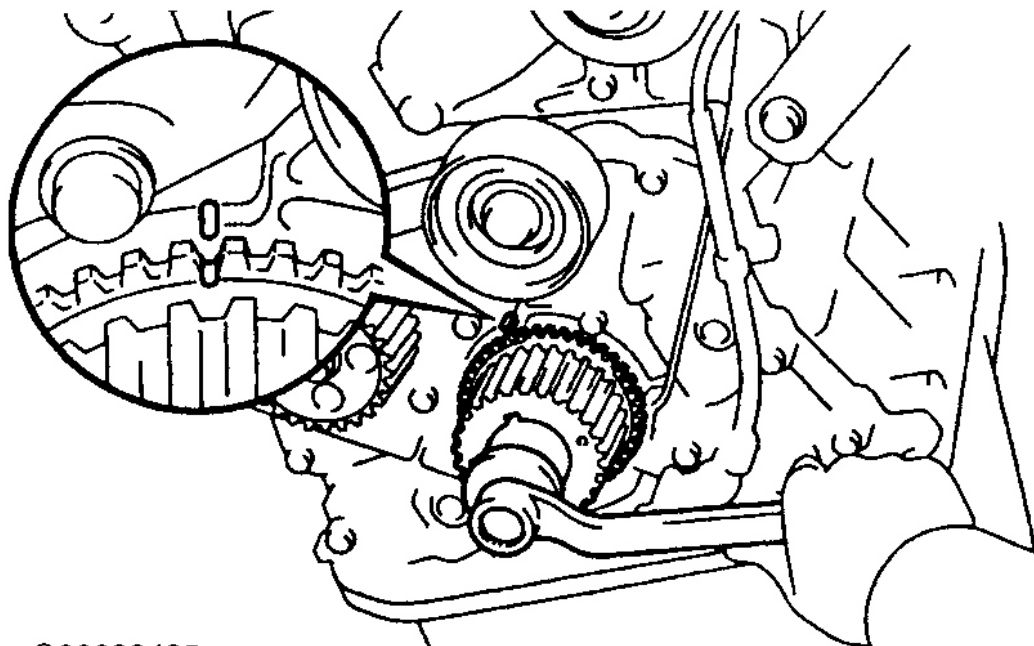
1. Inspect timing belt for damaged teeth, cracking or oil contamination. DO NOT bend timing belt inside out while inspecting timing belt. Replace timing belt if defective.
2. Ensure idler pulleys rotate freely and no signs of oil leakage exists at seal area on front of idler pulley. Replace idler pulley if idler pulley does not rotate smoothly or signs of oil leakage exists.
3. Inspect all sprockets for damage. Replace sprockets if damaged. Ensure free length of tension spring is within specification. See **TENSION SPRING SPECIFICATIONS** table.
4. Measure tension required to extend tension spring to specified installed length. Replace tension spring if tension is not within specification. See **TENSION SPRING SPECIFICATIONS** table.

TENSION SPRING SPECIFICATIONS

Application	Specification
Free Length	
Camry & Camry Solara	1.654" (42.01 mm)
Celica	1.811" (46.00 mm)
Tension At Spring Installed Length	
All Models	7.2-8.3 lbs. @ 1.988" (3.27-3.76 kg @ 50.50 mm)

Installation

1. Align cutouts of oil pump pulley and shaft. Slide on pulley. Install pulley nut. Align timing pulley set key with key groove of pulley. Slide on crankshaft timing pulley, facing angle sensor inward.
2. Install No. 2 idler pulley. Ensure 1.38" (35.0 mm) long bolt is used for the No. 2 idler pulley. Tighten bolt to specification. See **TORQUE SPECIFICATIONS**. Ensure No. 2 idler pulley is clean and rotates smoothly.
3. Install No. 1 idler pulley and tension spring. Ensure 1.65" (41.9 mm) long bolt is used for the No. 1 idler pulley. DO NOT tighten bolt at this time. Pry pulley as far left as possible and tighten pulley bolt. Ensure No. 1 idler pulley is clean and rotates smoothly.
4. Using crankshaft pulley bolt, turn crankshaft and align timing marks of crankshaft pulley and oil pump body. See **Fig. 12**. Ensure all idler pulleys are clean. Install timing belt on crankshaft sprocket, oil pump sprocket, No. 1 idler pulley, water pump sprocket and then No. 2 idler pulley.
5. 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.



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Fig. 12: Positioning Crankshaft Sprocket

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

CAUTION: If reusing timing belt, ensure reference mark on timing belt aligns with reference mark placed on crankshaft sprocket. Ensure timing belt is installed in original direction of rotation.

6. Align crankshaft pulley set key with key groove of pulley. Slide on pulley. Install pulley bolt. Align camshaft knock pin with knock pin groove of pulley. Slide on timing pulley. Using Crankshaft Pulley Holding Tool (09249-63010), install pulley bolt. Tighten to specification. See **TORQUE SPECIFICATIONS**.
7. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke and timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover. Rotate camshaft and align hole in camshaft timing pulley with alignment mark on camshaft bearing cap. See **Fig. 11**
8. If reusing timing belt, ensure reference mark on timing belt aligns with upper edge of No. 1 timing belt cover. If reference mark is not aligned, shift meshing of timing belt and crankshaft timing pulley until they align.
9. Loosen No. 1 idler pulley bolt 1/2 turn. Rotate crankshaft pulley clockwise 2 complete revolutions from TDC to TDC. DO NOT rotate crankshaft counterclockwise.
10. Ensure timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover and hole in camshaft sprocket aligns with alignment mark on camshaft bearing cap. See **Fig. 11**. If timing marks do not align, remove timing belt and reinstall

11. Rotate crankshaft clockwise $1 \frac{7}{8}$ revolutions and align timing mark on crankshaft pulley with 45-degree (BTDC) mark on No. 1 timing belt cover. See **Fig. 13**.

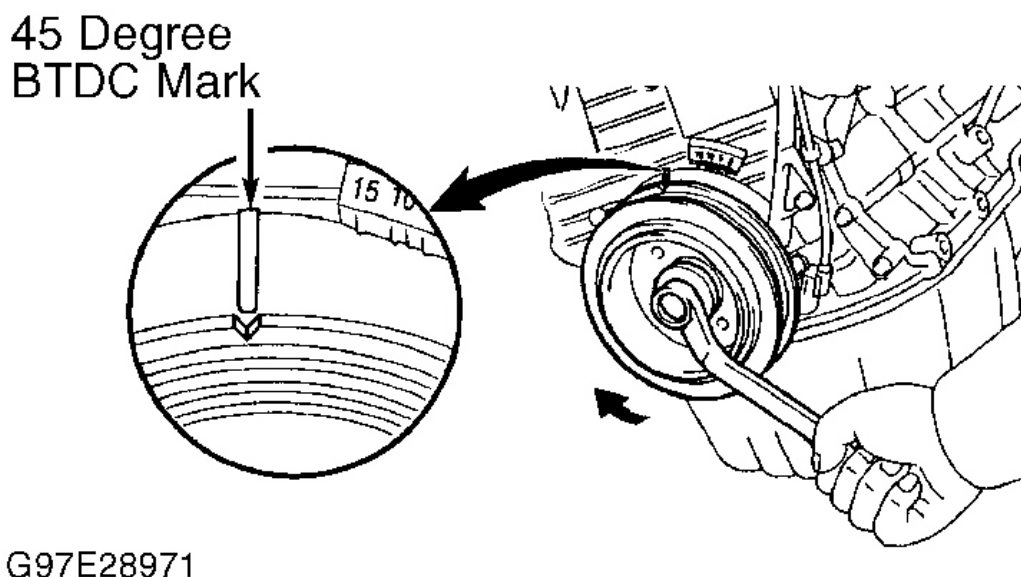


Fig. 13: Aligning Crankshaft Pulley With 45-Degree BTDC Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

12. Tighten No. 1 idler pulley bolt to specification. See **TORQUE SPECIFICATIONS**. Install No. 2 timing belt cover and gaskets. Install and tighten spark plugs to specification. See **TORQUE SPECIFICATIONS**.
13. Install 4 spark plugs. Connect spark plug wires to spark plugs. Connect plug wires to clamp on cylinder head cover. Install mounting bracket with 3 bolts.
14. On Camry and Camry Solara models, install No. 2 right engine mounting bracket. Temporarily install control rod with 3 bolts. Alternately tighten bolts in several passes. See **TORQUE SPECIFICATIONS**.
15. On Celica, attach mounting insulator to body and mounting bracket with 3 bolts and 2 nuts. Tighten bolts holding mounting insulator to body. Tighten to specification. See **TORQUE SPECIFICATIONS**.
16. On all models, connect ground strap connector. Install drive belt with 2 bolts. On Camry and Camry Solara, install right fender apron seal. On Celica install right engine cover. On all models, install right front wheel and generator.

VALVE LIFTER

Removal

Remove camshaft. See **CAMSHAFT** under REMOVAL & INSTALLATION. 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

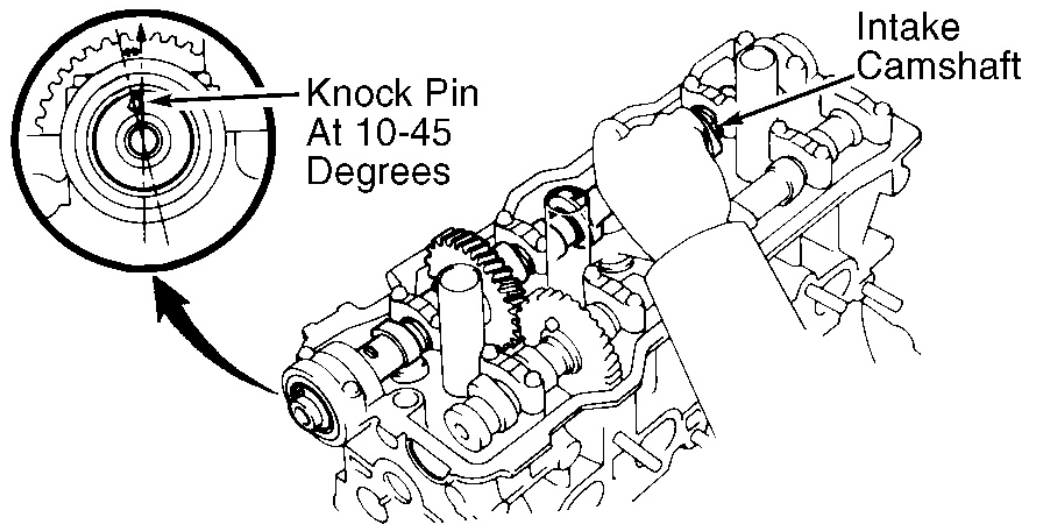
To install, reverse removal procedure. Ensure components are installed in original location and valve lifters rotate smoothly in cylinder head. If camshaft, adjusting shims or valve lifters are replaced, check valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

CAMSHAFT**Removal**

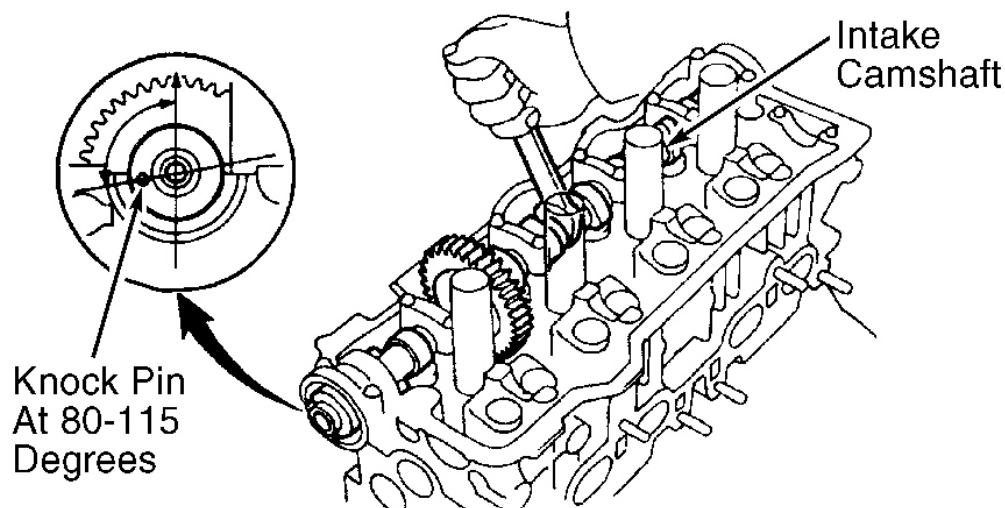
1. Remove timing belt. See **TIMING BELT**. Disconnect PCV hose(s), cable brackets and necessary electrical connectors to access valve cover.
2. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly reference, as grommets **MUST BE** installed in original location.

CAUTION: To prevent damage to cylinder head and camshaft, lift camshaft straight from cylinder head. DO NOT pry or force camshafts from cylinder head, or component damage will result.

3. For servicing of exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See **Fig. 14**. This aids in exhaust camshaft removal by using camshaft lobes on cylinders No. 2 and 4 to push on valve lifters.
4. Secure sub-gear to the main gear on exhaust camshaft with a 6 x 1.0 x 18 mm service bolt "B". See **Fig. 15**. Before removing camshaft bearing cap bolts, ensure torsional spring force of sub-gear is secured by service bolt "B".



SERVICING EXHAUST CAMSHAFT



SERVICING INTAKE CAMSHAFT

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Fig. 14: Positioning Camshafts

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

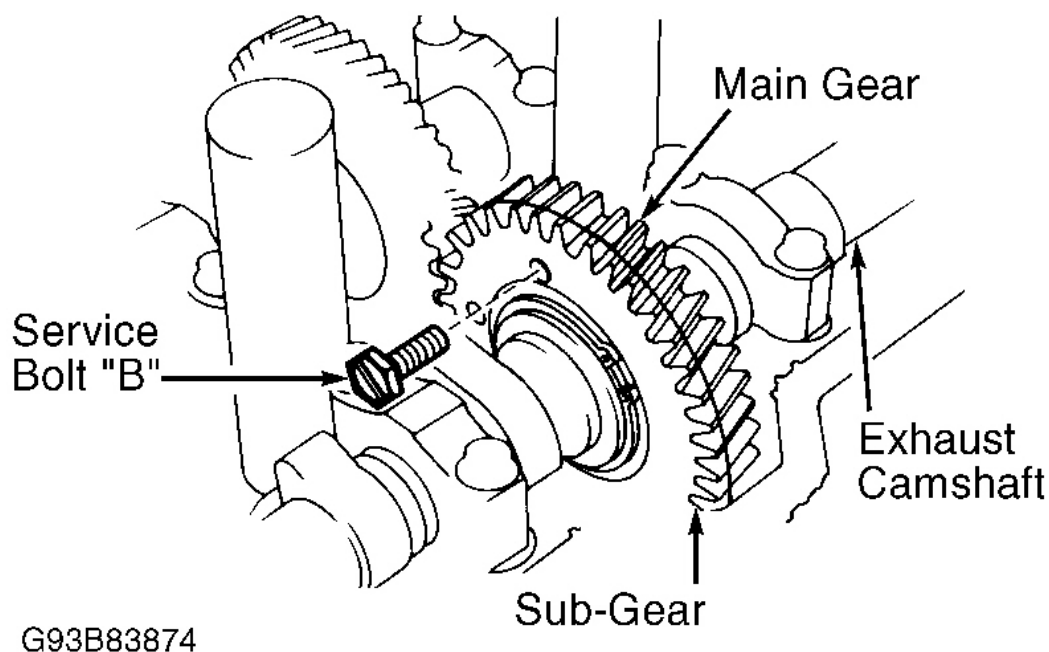


Fig. 15: Securing Sub-Gear-To-Main Gear
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Camshaft bearing caps are numbered for location with arrow on top of the cap. Front camshaft bearing cap on intake camshaft and rear camshaft bearing cap on exhaust camshaft are not numbered. All other camshaft bearing caps are numbered starting with No. 1 at timing belt end of engine. Arrow on top of camshaft bearing cap must point toward timing belt end of engine. See [Fig. 17](#).

5. Remove bolts and rear camshaft bearing cap from exhaust camshaft. Remove bolts from No. 1, 2 and 4 camshaft bearing caps on exhaust camshaft in proper sequence. See [Fig. 18](#). DO NOT remove bolts from No. 3 camshaft bearing cap at this time. Remove No. 1, 2 and 4 camshaft bearing caps from exhaust camshaft.
6. Alternately loosen bolts on No. 3 camshaft bearing cap on exhaust camshaft. Ensure exhaust camshaft is lifted up straight and level as No. 3 camshaft bearing cap bolts are loosened.
7. If exhaust camshaft is not lifted straight and level, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 10-45 degrees from vertical position. See [Fig. 14](#). Repeat steps 5 and 6. Remove No. 3 camshaft bearing cap and exhaust camshaft.
8. For servicing of intake camshaft, rotate intake camshaft so knock pin is 80-115 degrees from vertical position. See [Fig. 14](#). This aids in intake camshaft removal by using camshaft lobes on cylinders No. 1 and 3 to push on valve lifters.
9. Remove 2 bolts, front camshaft bearing cap and oil seal from intake camshaft. Remove bolts from No. 1,

- 3 and 4 camshaft bearing caps on intake camshaft in proper sequence. See **Fig. 19**. DO NOT remove bolts from No. 2 camshaft bearing cap at this time. Remove No. 1, 3 and 4 camshaft bearing caps from intake camshaft.
10. Alternately loosen bolts on No. 2 camshaft bearing cap on intake camshaft. Ensure intake camshaft is lifted up straight and level as No. 2 camshaft bearing cap bolts are loosened.
 11. If intake camshaft is not lifted straight and level, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 80-115 degrees from vertical position. See **Fig. 14**. Repeat steps 9 and 10. Remove No. 2 camshaft bearing cap and intake camshaft.
 12. If removing sub-gear from exhaust camshaft, mount camshaft in soft-jaw vise on hexagonal area of camshaft. Using spanner wrench, rotate sub-gear clockwise, and remove service bolt "B". See **Fig. 16**. Remove snap ring, wave washer, sub-gear and camshaft gear spring.
 13. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary). Remove semi-circular plugs from front and rear of cylinder head.

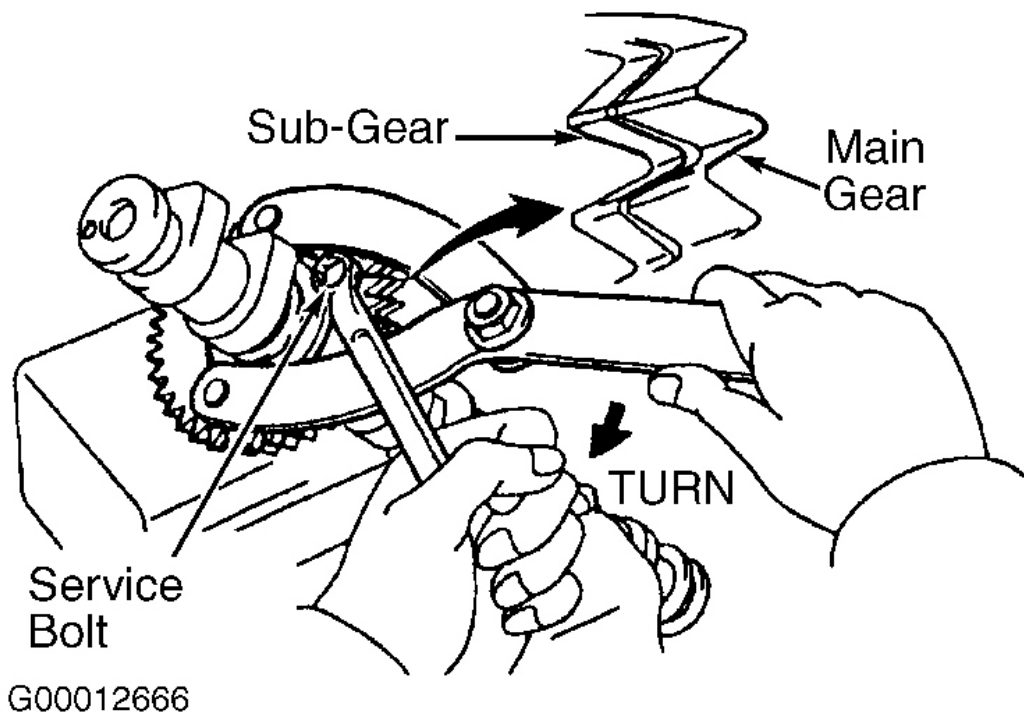


Fig. 16: Removing Exhaust Camshaft Drive Gear & Sub-Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

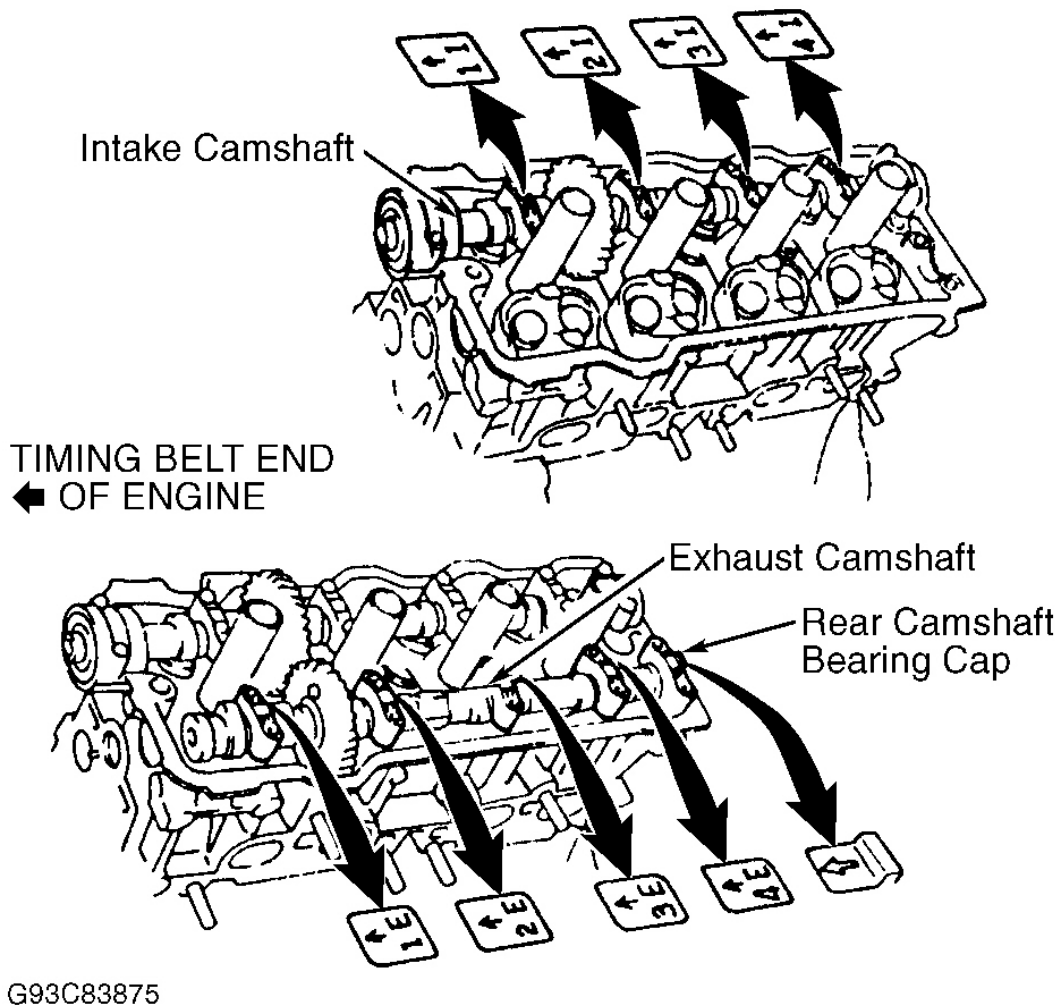
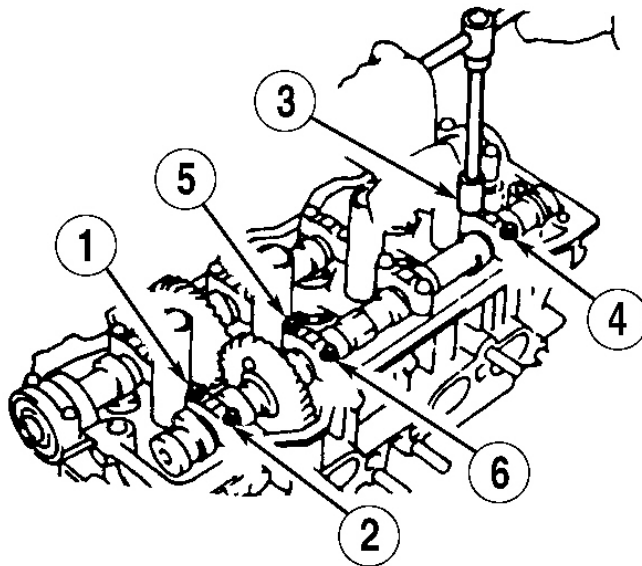
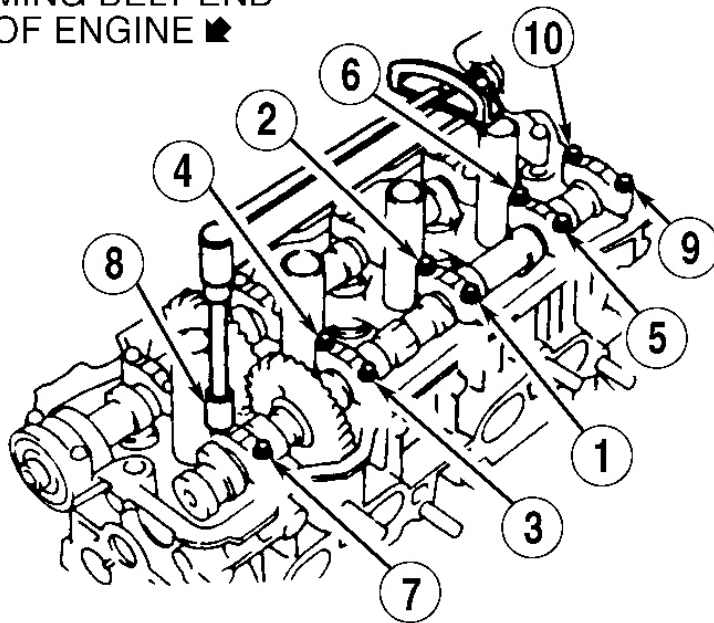


Fig. 17: Identifying Camshaft Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



REMOVAL

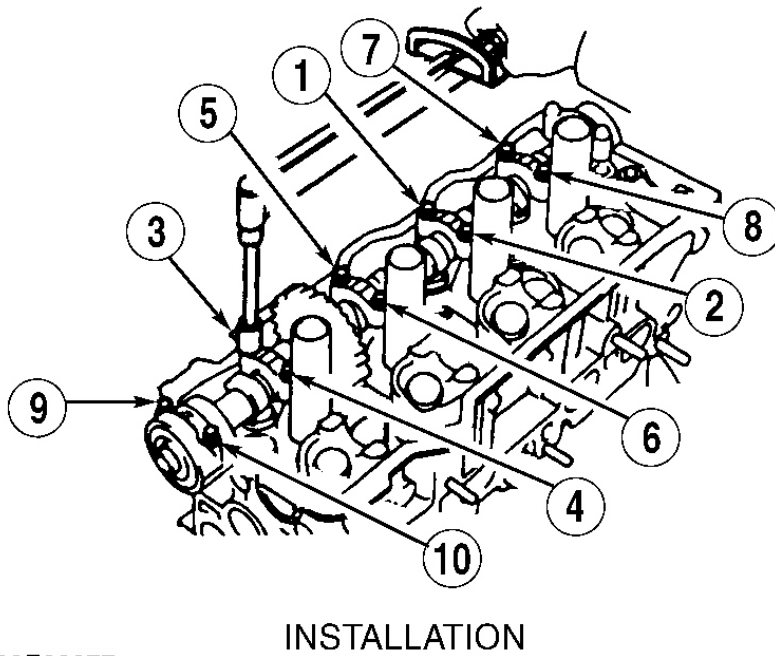
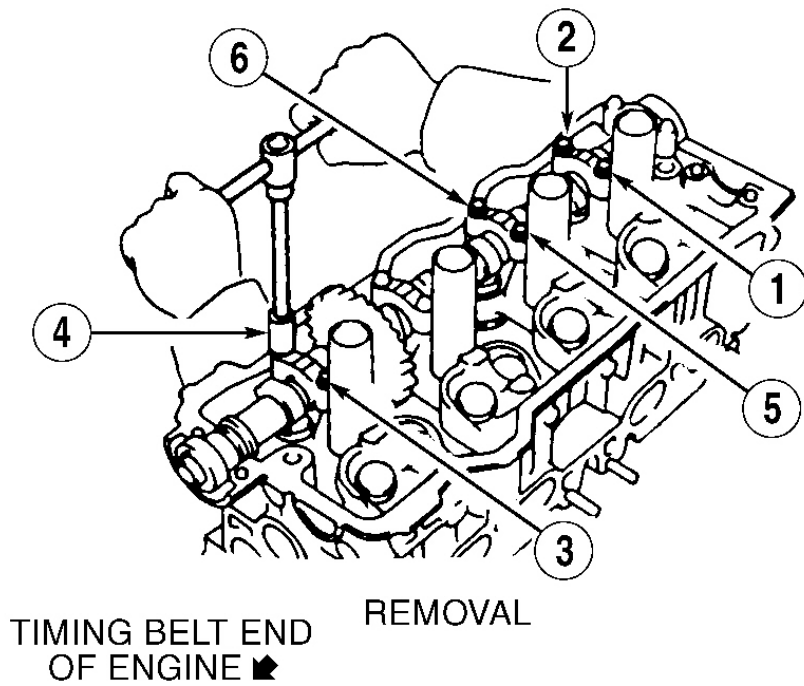
TIMING BELT END
OF ENGINE ➡



INSTALLATION

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Fig. 18: Exhaust Camshaft Bearing Cap Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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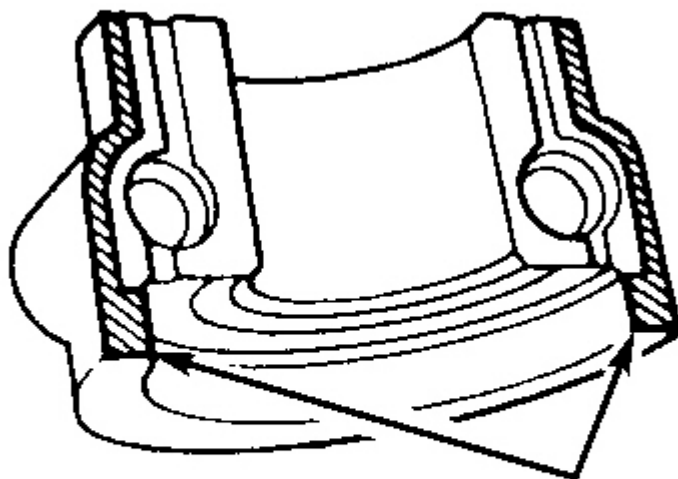
Fig. 19: Intake Camshaft Bearing Cap Bolt Removal & Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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. Install camshaft in cylinder head.
2. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See **Fig. 18** and **Fig. 19** . See **TORQUE SPECIFICATIONS**. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
3. Check camshaft end play with camshaft bearing cap bolts tightened to specification in sequence. See **Fig. 18** and **Fig. 19** . See **TORQUE SPECIFICATIONS**. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
4. Install both camshafts in cylinder head without sub-gear installed on exhaust camshaft and camshaft bearing cap bolts tightened to specification in sequence. See **Fig. 18** and **Fig. 19** . See **TORQUE SPECIFICATIONS**.
5. Using dial indicator, check gear backlash between gears on camshafts. Replace camshafts if gear backlash exceeds specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
6. Measure distance between ends of camshaft gear spring. Replace camshaft gear spring if distance is not .886-.902" (22.50-22.91 mm). 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

1. If installing sub-gear on exhaust camshaft, install camshaft gear spring, sub-gear, wave washer and snap ring on exhaust camshaft. Ensure pins on main gear and sub-gear engage with ends of camshaft gear spring.
2. Using spanner wrench, rotate sub-gear clockwise, and align holes so teeth of sub-gear and main gear align. Install and tighten service bolt "B". Install adjusting shims and valve lifters in original location on cylinder head (if removed). Ensure valve lifters rotate smoothly in cylinder head.
3. Coat thrust surfaces of camshafts with multipurpose grease. To install intake camshaft, rotate intake camshaft so knock pin is at 80-115 degrees from vertical position, and install in cylinder head. See **Fig. 14**. Apply sealant on front camshaft bearing cap for intake camshaft. See **Fig. 20**.



Apply Sealant Here

G93G83879

Fig. 20: Applying Sealant On Front Camshaft Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Install front camshaft bearing cap for intake camshaft on cylinder head. Install remaining camshaft bearing caps for intake camshaft on cylinder head in numerical sequence with arrow pointing toward timing belt end of engine. See [Fig. 17](#).
5. Coat threads and bolt head-to-camshaft bearing cap contact surfaces of camshaft bearing cap bolts with engine oil. Install and tighten intake camshaft bearing cap bolts to specification in sequence using several steps. See [Fig. 19](#). See **TORQUE SPECIFICATIONS**.
6. Coat seal lip of NEW oil seal for intake camshaft with grease. Using Oil Seal Installer (09223-46011), install oil seal into cylinder head.
7. To install exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See [Fig. 14](#). Install exhaust camshaft so timing mark aligns with timing mark on intake camshaft. DO NOT use assembly reference marks. See [Fig. 21](#). Ensure exhaust camshaft is fully seated in cylinder head.

NOTE: It may be necessary to slightly rotate intake camshaft so exhaust camshaft fully seats in cylinder head.

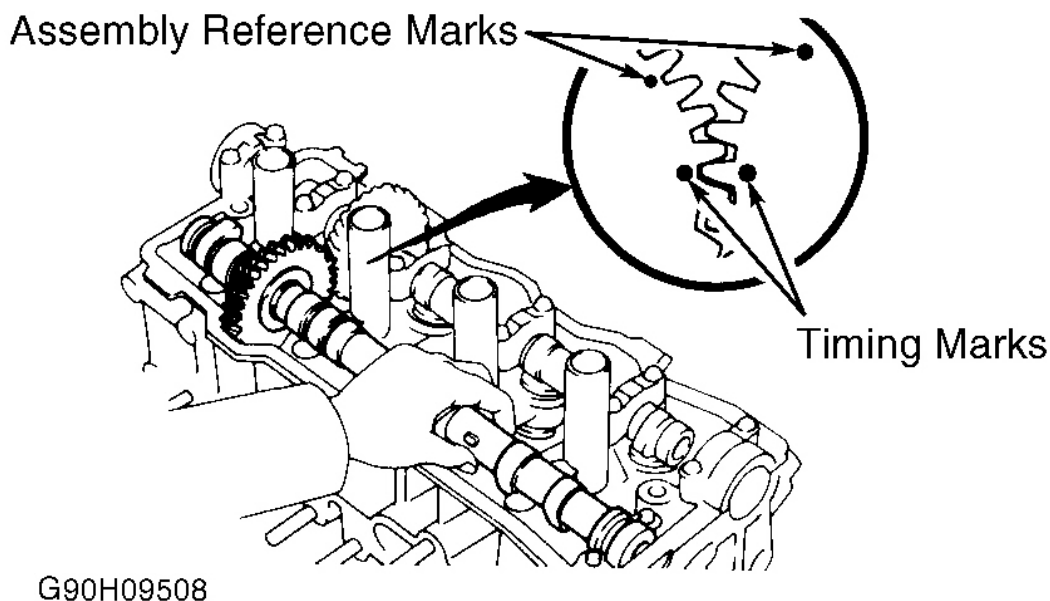


Fig. 21: Aligning Camshaft Timing Marks

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

8. Install camshaft bearing caps for exhaust camshaft on cylinder head in numerical sequence with arrow pointing toward timing belt end of engine. See **Fig. 17**.
9. Coat threads and bolt head-to-camshaft bearing cap contact surfaces of camshaft bearing cap bolts with engine oil. Install and tighten exhaust camshaft bearing cap bolts to specification in sequence using several steps. See **Fig. 18**. See **TORQUE SPECIFICATIONS**.
10. Remove service bolt "B" from camshaft gear. See **Fig. 15**. Install No. 3 timing belt cover. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Install timing belt using proper procedure. See **TIMING BELT** under REMOVAL & INSTALLATION.
11. Check valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS. Apply sealant in grooves on rear side of semi-circular plugs located on exhaust camshaft side of cylinder head. Install semi-circular plugs in cylinder head. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head.
12. Using NEW gasket, install valve cover. Install valve cover grommets in original location with marking on grommet aligned in designated area. Install and tighten valve cover nuts to specification. See **TORQUE SPECIFICATIONS**.

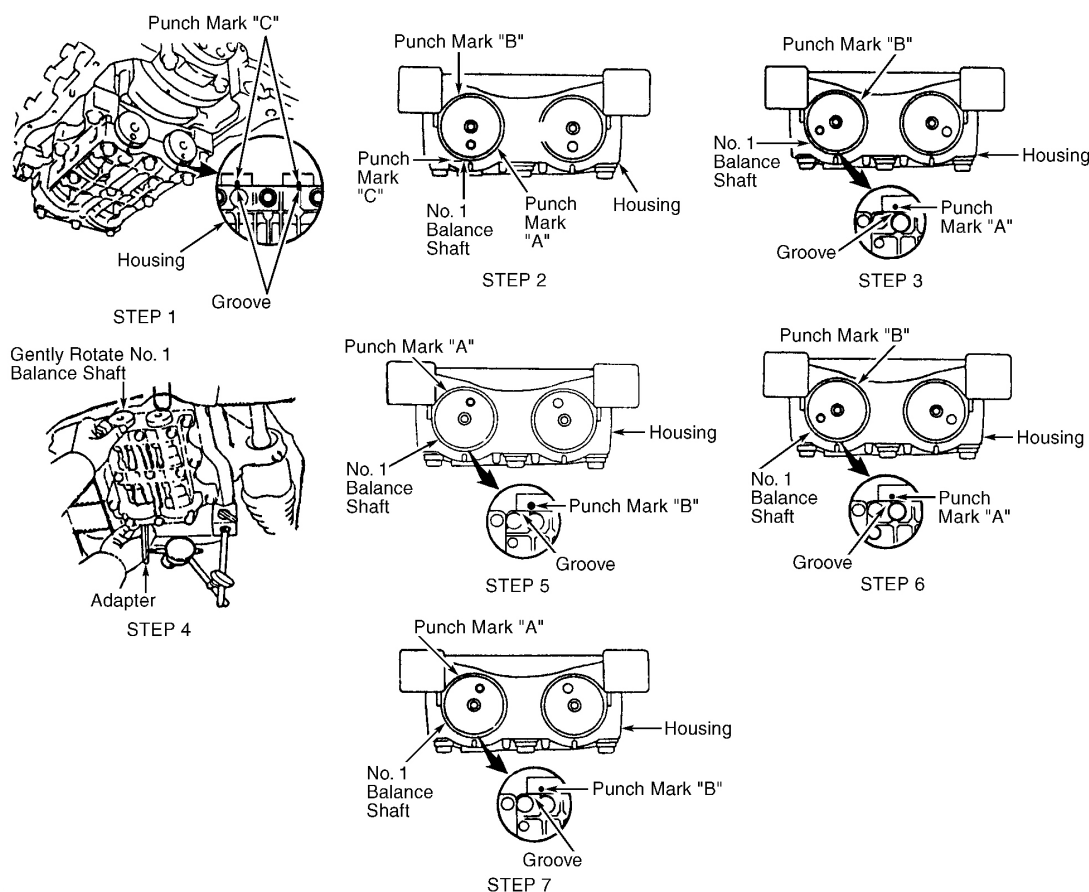
BALANCE SHAFTS (CAMRY & CAMRY SOLARA)

NOTE: Following procedure must be used when servicing balance shaft assembly with engine in the vehicle. Perform preliminary inspection before removing balance shaft assembly to ensure proper gear backlash exists. If balance shaft assembly is being serviced with engine removed from vehicle and cylinder

block inverted (oil pan area facing upward) special procedure must be used. See BALANCE SHAFTS (CAMRY & CAMRY SOLARA) under OVERHAUL.

Preliminary Inspection

1. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. Remove oil pump pick-up tube and gasket. Gear backlash between crankshaft gear and No. 1 balance shaft **MUST BE** checked. Gear backlash varies with rotation of No. 1 balance shaft gear and crankshaft gear. Gear backlash **MUST BE** checked with crankshaft gear and No. 1 balance shaft gear at 4 different points.
2. Rotate crankshaft clockwise 3 full revolutions to ensure proper seating of all gears. Rotate crankshaft clockwise until cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.
3. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. See STEP 1 in illustration. See **Fig. 22**.



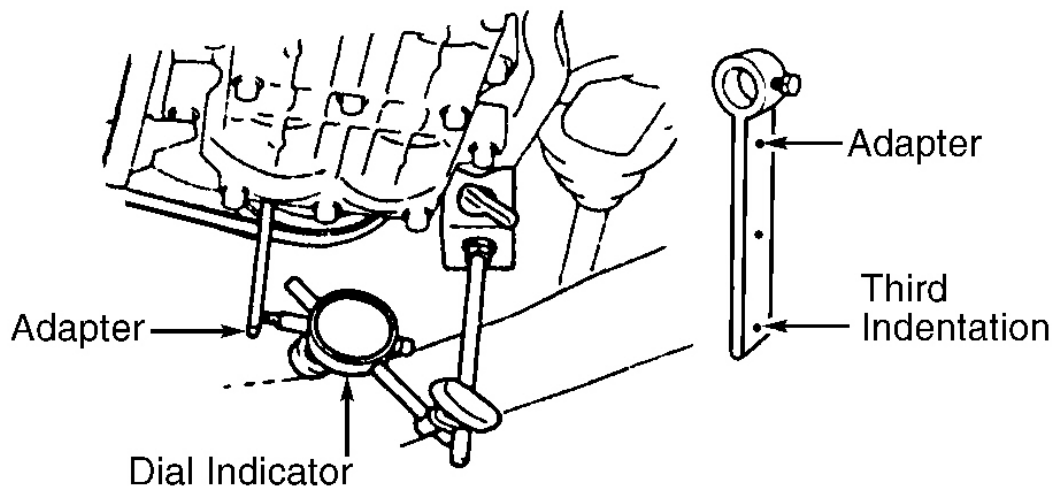
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Fig. 22: Checking Crankshaft Gear & No. 1 Balance Shaft Gear Backlash With Engine Installed
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

4. Ensure punch marks "A" and "B" on No. 1 balance shaft are at designated position. See STEP 2 in

illustration. See **Fig. 22**. Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on No. 2 balance shaft housing. See STEP 3 in illustration. See **Fig. 22**.

5. Install dial indicator and Adapter (SST 09224-74010) on cylinder block and balance shaft assembly. See **Fig. 23**. Ensure dial indicator is perpendicular to adapter and dial indicator stem is in middle of third indentation on adapter. See **Fig. 23**. Adapter just slides over the end of the balance shaft and secures to the shaft with a set screw.



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Fig. 23: Installing Dial Indicator & Adapter

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

6. Gently rotate No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt, and note gear backlash on dial indicator. See STEP 4 in illustration. See **Fig. 22**. DO NOT use excessive force when rotating No. 1 balance shaft. It may be necessary to rotate No. 1 balance shaft several times to obtain a steady gear backlash reading. Gear backlash should be .0010-.0026" (.025-.066 mm). Remove dial indicator and adapter.
7. Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. See STEP 5 in illustration. See **Fig. 22**.
8. Reinstall dial indicator and adapter. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0010-.0033" (.025-.084 mm). Remove dial indicator and adapter.
9. Rotate crankshaft clockwise, and align punch mark "A" on No. 1 balance shaft with groove on housing. See STEP 6 in illustration. See **Fig. 22**.
10. Reinstall dial indicator and adapter. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0010-.0026" (.025-.066 mm). Remove dial indicator and adapter.
11. Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. See STEP 7 in illustration. See **Fig. 22**.

12. Reinstall dial indicator and adapter. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0010-.0033" (.025-.084 mm). Remove dial indicator and adapter.
13. If any gear backlash measurement is not within specification, backlash **MUST BE** adjusted using different thickness adjusting spacers between balance shaft assembly and cylinder block.

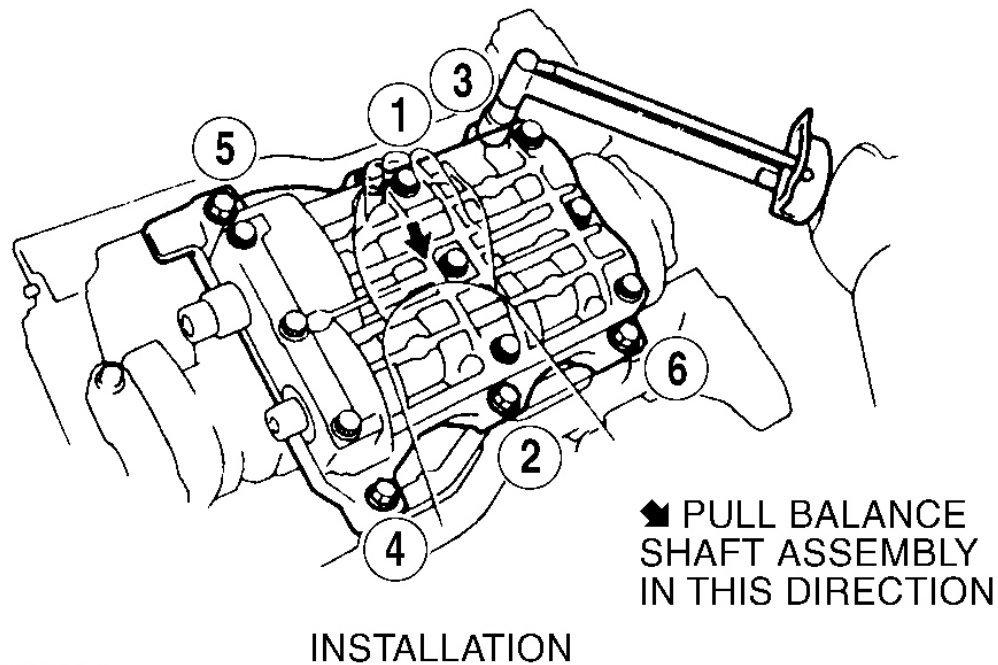
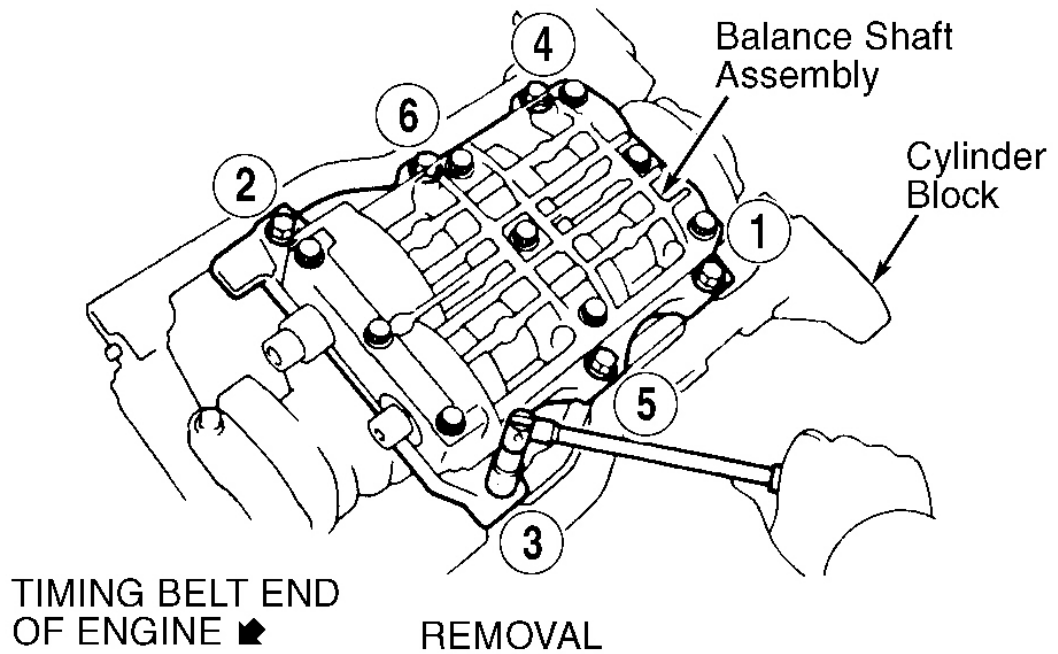
NOTE: **Adjusting spacers may possibly be removed by just loosening bolts for balance shaft assembly. It may be necessary to remove balance shaft assembly for removal of adjusting spacers.**

14. Remove balance shaft assembly (if necessary) and adjusting spacers from cylinder block using proper removal procedure. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.
15. Using gear backlash measured clearance and number stamped on installed adjusting spacer, determine replacement adjusting spacer. See **Fig. 24**. If gear backlash exceeds specification, use thinner adjusting spacer. If gear backlash is less than specified, use thicker adjusting spacer.
16. Use same thickness adjusting spacers on each side of balance shaft assembly. Reinstall adjusting spacers and balance shaft assembly using proper procedure. Recheck gear backlash.

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

Removal

1. Before removing balance shaft assembly, perform preliminary inspection procedure to ensure proper thickness adjusting spacers are installed. See **PRELIMINARY INSPECTION** procedure under **BALANCE SHAFTS (CAMRY & CAMRY SOLARA)**.
2. Evenly loosen, and remove 6 outside bolts on balance shaft assembly in proper sequence. See **Fig. 25**. Remove balance shaft assembly and adjusting spacers. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block. See **Fig. 26**.

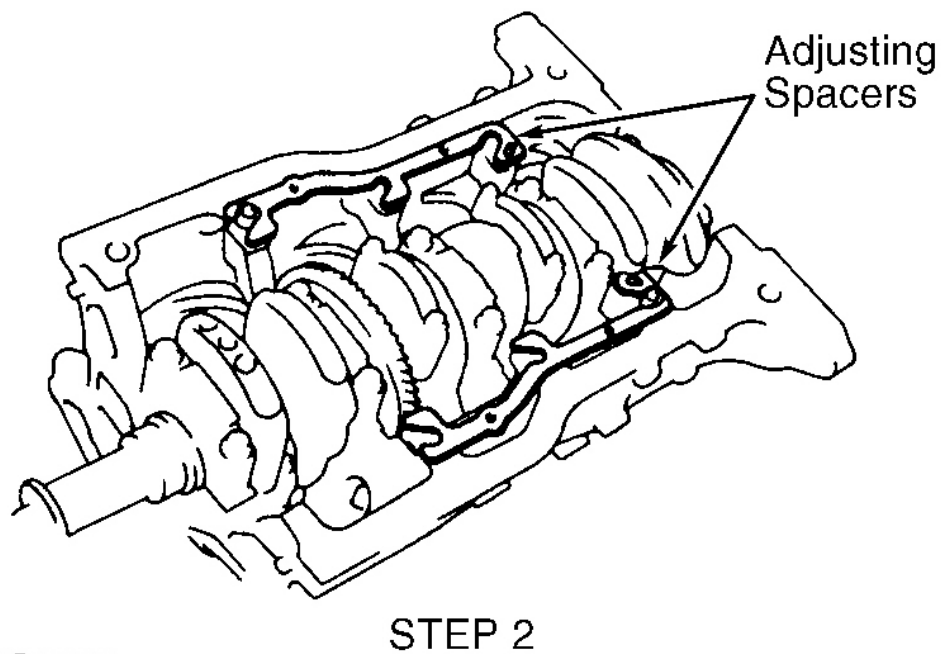
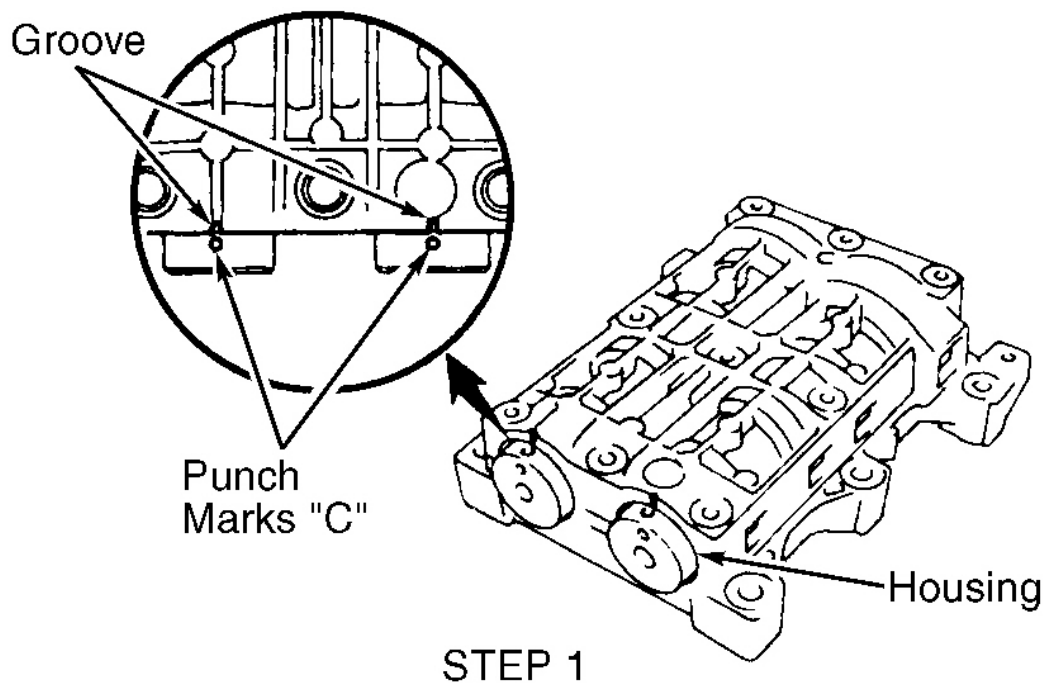


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Fig. 25: Balance Shaft Assembly Bolt Removal & Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Installation

1. 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.
2. Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. If crankshaft pulley is not installed, ensure key for crankshaft pulley is at 12 o'clock position at cylinder head side of cylinder block.
3. Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. See STEP 1 in illustration. See **Fig. 26**.
4. Ensure surfaces on cylinder block and adjusting spacers are clean and dry. Install adjusting spacers on cylinder block. See STEP 2 in illustration. See **Fig. 26**. Install balance shaft assembly on cylinder block with bolts loosely installed.
5. Ensure punch mark "C" on both balance shafts align with grooves housing of balance shaft assembly. Pull balance shaft assembly in proper direction, and tighten bolts to specification in sequence. See **Fig. 25**.
6. Recheck gear backlash. If checking gear backlash with engine in the vehicle, perform preliminary inspection. See **PRELIMINARY INSPECTION** procedure under **BALANCE SHAFTS (CAMRY & CAMRY SOLARA)**. If checking gear backlash with engine removed from vehicle and cylinder block inverted (oil pan area facing upward), see **BALANCE SHAFTS (CAMRY & CAMRY SOLARA)** under OVERHAUL.



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Fig. 26: Locating Adjuster Spacers & Aligning Balance Shaft Punch Marks
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKSHAFT REAR OIL SEAL

Removal

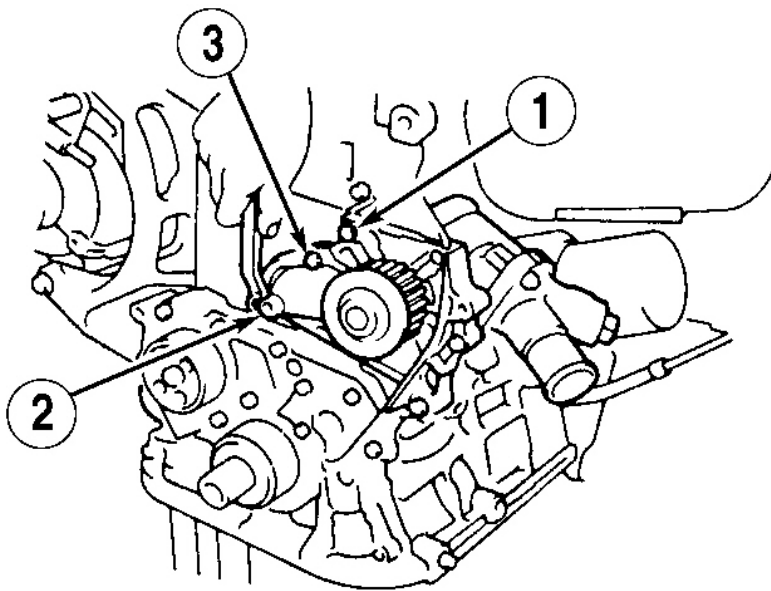
Remove transaxle, clutch assembly (if equipped) and flywheel/drive plate. See FWD article in CLUTCHES. Using knife, cut seal lip from oil seal. Pry oil seal from rear seal housing. DO NOT damage sealing surfaces.

Installation

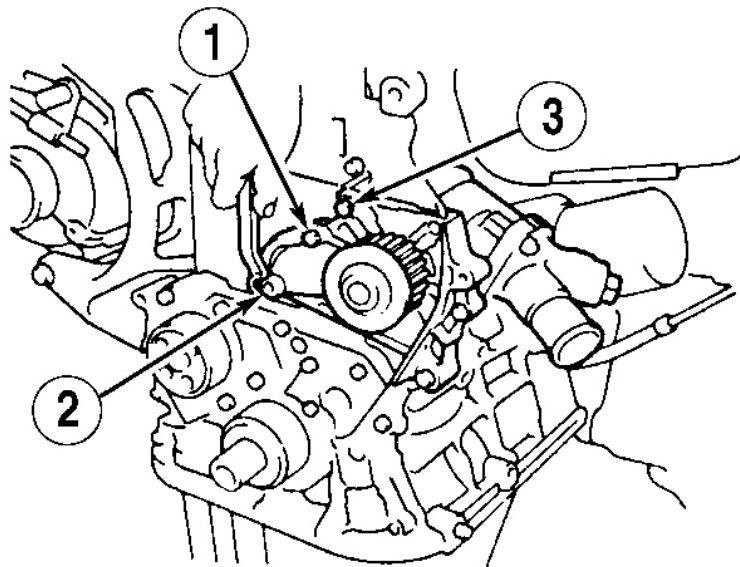
1. Ensure all sealing surfaces are clean. Apply grease to seal lip of new oil seal. Using oil seal installer, install oil seal in rear seal housing until oil seal is even with surface of rear seal housing.
2. Apply Loctite to flywheel/drive plate bolts. Install flywheel/drive plate. Install bolts, and tighten to specification using 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 timing belt and idler pulleys. See **TIMING BELT** under REMOVAL & INSTALLATION.
2. Disconnect lower radiator hose from water housing. Remove generator adjusting bar. Remove coolant by-pass pipe-to-water pump nuts.
3. Remove water pump bolts in sequence. See **Fig. 27**. Remove water pump, water pump cover and "O" rings. Remove water pump-to-water pump cover bolts. Remove water pump and gasket from water pump cover.



REMOVAL



INSTALLATION

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Fig. 27: Water Pump Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Installation

1. To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Apply soapy water solution on coolant by-pass pipe "O" ring before installing water pump.
2. Tighten water pump bolts to specification in sequence BEFORE tightening coolant by-pass pipe-to-water pump nuts. See **TORQUE SPECIFICATIONS**. See **Fig. 27**. To install remaining components, reverse removal procedure. Fill cooling system.

OIL PAN

Removal

1. Disconnect negative battery cable. Raise and support vehicle. Remove lower engine covers. Drain engine oil. Remove front exhaust pipe located below oil pan.
2. On Celica, remove engine mount crossmember below oil pan. Support engine with hoist. Remove engine mounts and engine crossmember as necessary for access to oil pan. Remove catalytic converter braces, catalytic converter, cushion, retainer and gasket to access oil pan (if necessary).
3. On all models, remove stiffener plate at rear of oil pan (if equipped) for access to oil pan. Remove dipstick. Remove bolts/nuts and oil pan.

Installation

1. Ensure sealing surfaces are clean. Apply bead of sealant at center of oil pan sealing surface, between bolt/nut holes and on inside of bolt/nut holes.
2. Install oil pan. Tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.
3. On Celica, ensure all engine mounts and engine crossmember bolts are installed before tightening to specification. Use a NEW gasket when installing catalytic converter (if removed). On all models, fill crankcase with oil.

OVERHAUL

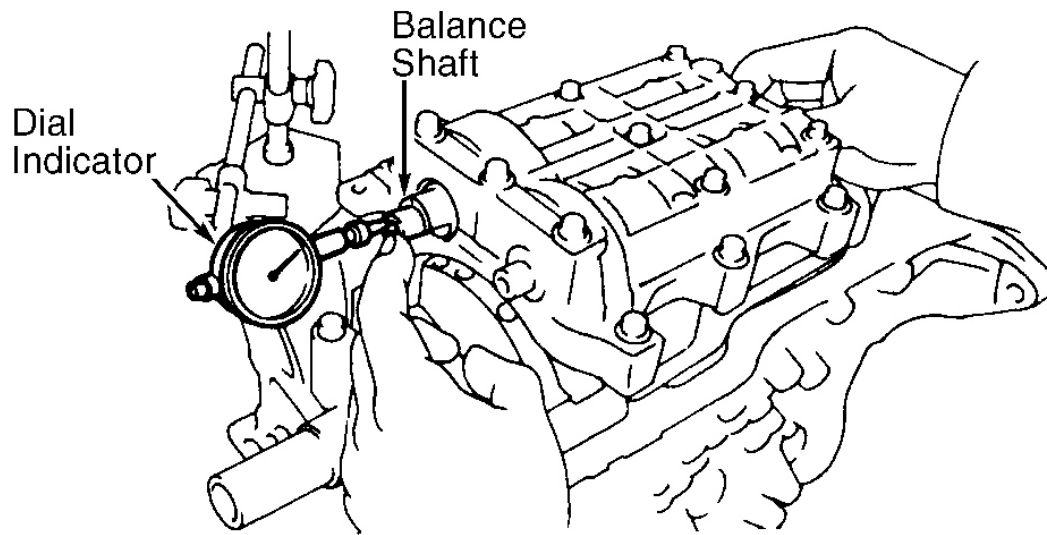
BALANCE SHAFTS (CAMRY & CAMRY SOLARA)

NOTE: Following procedure must be used when servicing balance shaft assembly with engine removed from vehicle and cylinder block inverted (oil pan area facing upward). Perform inspection procedure to ensure proper thrust clearance and gear backlash exists before removing or after installing balance shaft assembly. If balance shaft assembly is being serviced with engine in the vehicle, special procedure must be used. See **BALANCE SHAFTS (CAMRY & CAMRY SOLARA)** under **REMOVAL & INSTALLATION**. Manufacturer does not provide disassembly procedure for balance shaft assembly.

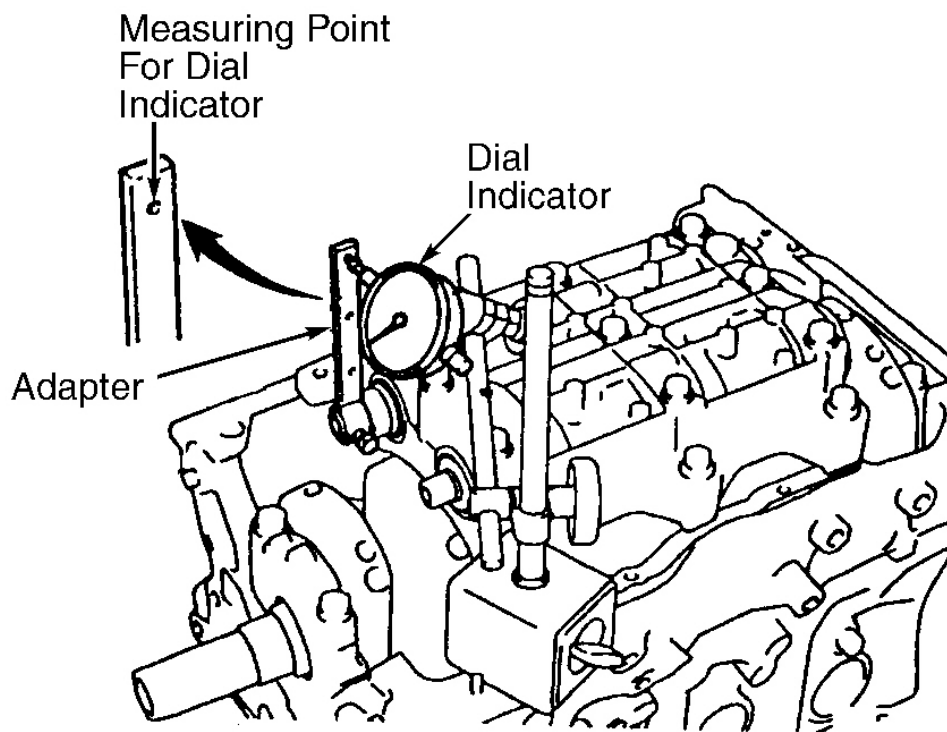
Inspection

1. Position cylinder block with oil pan area facing upward. To check thrust clearance, mount dial indicator on cylinder block with stem against balance shaft. See **Fig. 28**.

2. Measure thrust clearance while manually moving balance shaft back and forth. See **Fig. 28**. Standard thrust clearance is .0024-.0043" (.061-.109 mm). Replace balance shaft assembly if thrust clearance exceeds specification.



CHECKING THRUST CLEARANCE



CHECKING GEAR BACKLASH

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Fig. 28: Installing Dial Indicator For Checking Thrust Clearance & Gear Backlash
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

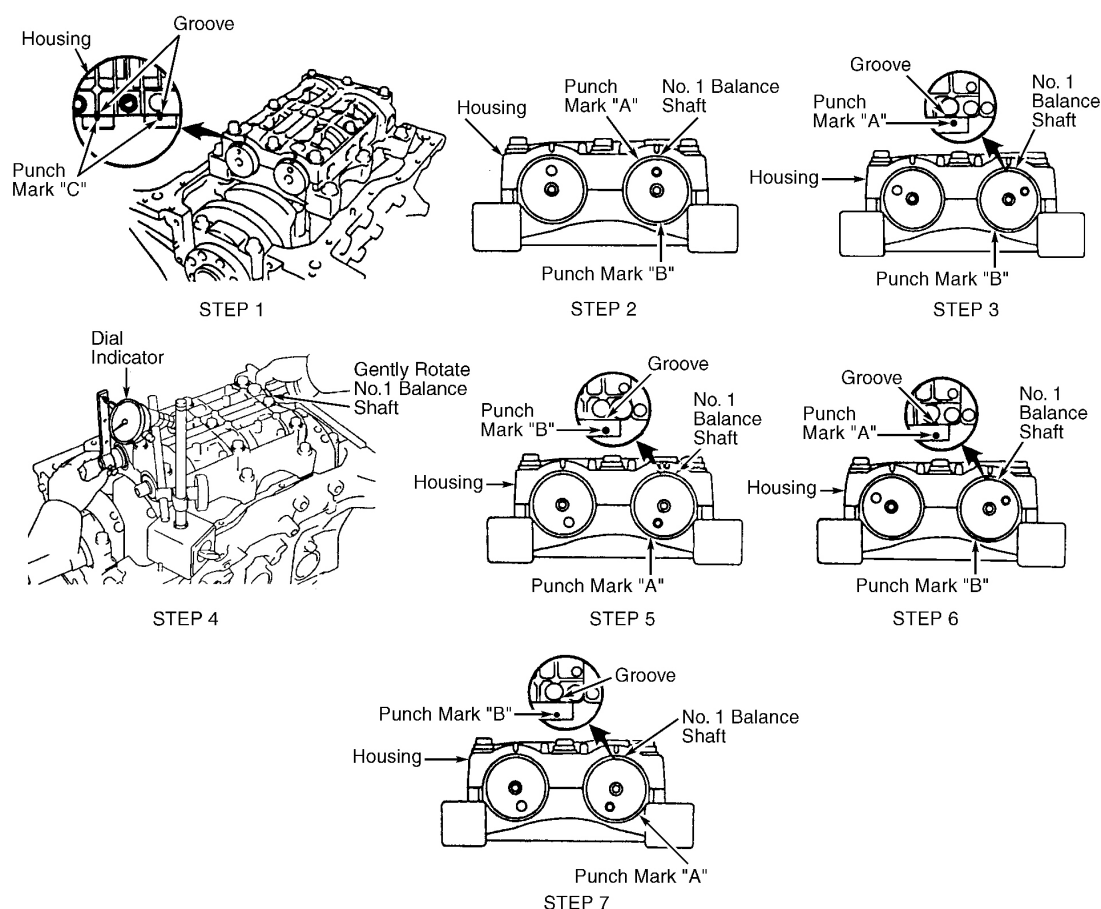
3. Gear backlash between crankshaft gear and No. 1 balance shaft gear varies with rotation of No. 1 balance shaft gear and crankshaft gear. Gear backlash MUST BE checked with crankshaft gear and No. 1 balance shaft gear at 4 different points.
4. Rotate crankshaft 3 full revolutions to ensure proper seating of all gears. 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.
5. Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. See STEP 1 in illustration. See **Fig. 29**.
6. Ensure punch marks "A" and "B" on No. 1 balance shaft are at designated position. See STEP 2 in illustration. See **Fig. 29**. Rotate crankshaft clockwise, and align punch mark "A" on No. 1 balance shaft with groove on housing. See STEP 3 in illustration. See **Fig. 29**.
7. Install dial indicator and Adapter (09224-74010) on cylinder block and balance shaft assembly for checking gear backlash. Ensure dial indicator is perpendicular to adapter and dial indicator stem is in middle of third indentation area on adapter. See **Fig. 28**. Adapter just slides over the end of the balance shaft and secures to the shaft with a set screw.
8. Gently rotate No. 1 balance shaft while pressing on end of No. 1 balance shaft, and note gear backlash on dial indicator. See STEP 4 in illustration. See **Fig. 29**. DO NOT use excessive force when rotating No. 1 balance shaft. It may be necessary to rotate No. 1 balance shaft several times to obtain a steady gear backlash reading. Gear backlash should be .0002-.0016" (.005-.040 mm). Remove dial indicator and adapter.
9. Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. See STEP 5 in illustration. See **Fig. 29**.
10. Reinstall dial indicator and adapter. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft. Gear backlash should be .0002-.0024" (.005-.061 mm). Remove dial indicator and adapter.
11. Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. See STEP 6 in illustration. See **Fig. 29**.
12. Reinstall dial indicator and adapter. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft. Gear backlash should be .0002-.0016" (.005-.040 mm). Remove dial indicator and adapter.
13. Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. See STEP 7 in illustration. See **Fig. 29**.
14. Reinstall dial indicator and adapter. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft. Gear backlash should be .0002-.0024" (.005-.060 mm). Remove dial indicator and adapter.
15. If gear backlash is not within specification when performing all measurements, different thickness adjusting spacer MUST BE installed between balance shaft assembly and cylinder block.

NOTE: To remove adjusting spacers loosen bolts for balance shaft assembly. It may be necessary to remove balance shaft assembly for removal of adjusting spacers.

16. Remove balance shaft assembly (if necessary) and adjusting spacers from cylinder block. See **BALANCE SHAFTS (CAMRY & CAMRY SOLARA)** under REMOVAL & INSTALLATION.

Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.

17. Using gear backlash measured clearance and number stamped on installed adjusting spacer, determine replacement adjusting spacer. See **Fig. 30**.
18. If gear backlash exceeds specification, install thinner adjusting spacer. If gear backlash is less than specified, install thicker adjusting spacer. Changing adjusting spacer thickness by .0008" (.020 mm) will change gear backlash about .0006" (.015 mm). Use same thickness adjusting spacers on each side of balance shaft assembly.
19. Reinstall adjusting spacers and balance shaft assembly using proper procedure. See **BALANCE SHAFTS (CAMRY)** under REMOVAL & INSTALLATION. Recheck gear backlash.



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Fig. 29: Checking Crankshaft Gear & No. 1 Balance Shaft Gear Backlash With Engine Removed
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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

CYLINDER HEAD

Cylinder Head

1. Inspect cylinder head warpage at cylinder block, exhaust manifold and intake manifold areas. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See **TORQUE SPECIFICATIONS**. See **Fig. 18** and **Fig. 19**. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
3. Check camshaft end play with camshaft bearing cap bolts tightened to specification in sequence. See **Fig. 18** and **Fig. 19**. See **TORQUE SPECIFICATIONS**. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
4. Ensure valve lifter bore diameter in cylinder head 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.

CAUTION: Valve stems oil seals are painted a different color on top of oil seal for specified valve application. Intake valve stem oil seal is Gray 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 Gray and exhaust valve stem oil seal is Black. Ensure proper valve stem oil seal is installed. Lubricate valve stem oil seal with engine oil. Install valve stem oil seal using Oil Seal Installer (09201-41020).

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, heat cylinder head to 173-212°F (78-100°C). Using hammer and Valve Guide Remover/Installer Set (09201-01060), drive valve guide from cylinder block side of cylinder head.
3. Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4325-.4335" (10.986-11.011 mm), use standard valve guide. If bore inside diameter is .4344-.4355" (11.034-11.062 mm), use oversize valve guide.
4. If bore inside diameter exceeds .4335" (11.011 mm), machine valve guide bore to .4344-.4355" (11.034-11.062 mm) for oversize valve guide. If bore inside diameter exceeds .4355" (11.062 mm), replace

cylinder head.

5. Intake valve guide is 1.516" (38.51 mm) long and exhaust valve guide is 1.594" (40.49 mm) long. Ensure proper valve guide is installed.
6. To install valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head.
7. On all intake valve guide applications, install valve guide until valve guide installed height is .315-.346" (8.00-8.79 mm). Valve guide installed height is measured from top of intake valve guide to the cylinder head surface next to valve guide.
8. On all valve guide applications, use .236" (5.99 mm) reamer to ream valve guide to obtain correct valve stem-to-guide oil clearance (if necessary). See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

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 45-degree and 75-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

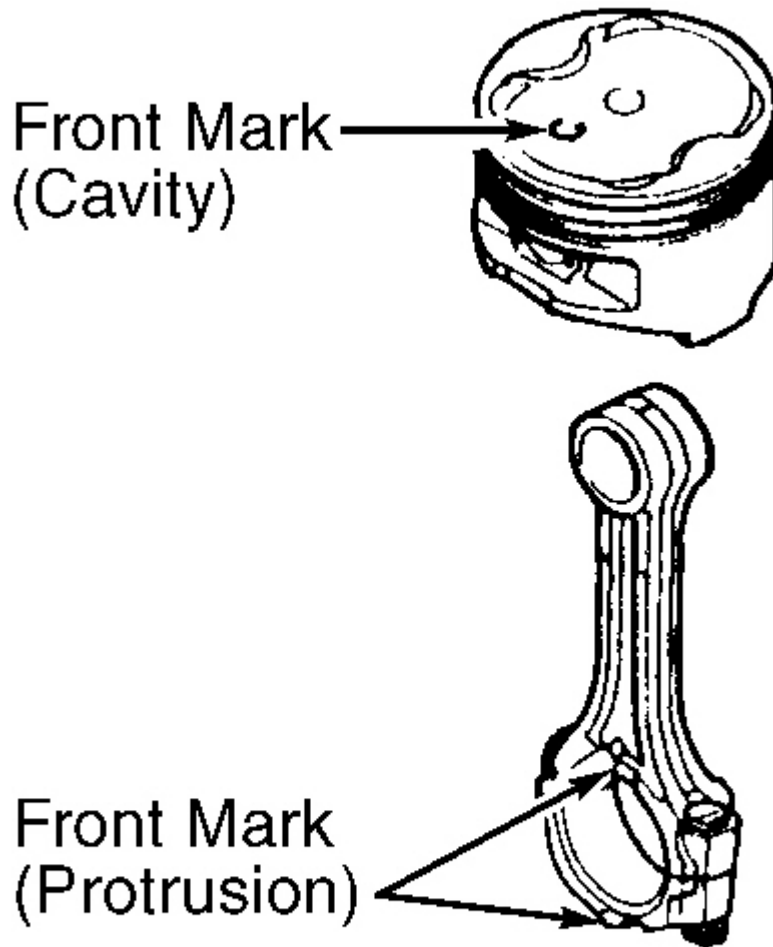
1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Piston, connecting rod and connecting rod cap MUST BE installed with front mark toward timing belt end of engine. See **Fig. 31**.
2. Before disassembling piston and connecting rod, try to move piston back and forth on piston pin. Replace piston and piston pin if any movement is felt.
3. When removing piston from connecting rod, remove snap rings from piston. Heat piston to 176-194°F (80-90°C) in water. Remove piston pin. Separate piston from connecting rod.
4. Ensure piston pin diameter is within specification. See **PISTONS, PINS & RINGS** table under ENGINE

SPECIFICATIONS. Ensure connecting rod bend, twist and piston pin bushing bore diameter are within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

5. Bushing in connecting rod may be replaced if bore diameter is not within specification. Ensure bushing oil hole aligns with connecting rod oil hole. Hone bushing to obtain correct piston pin-to-rod clearance. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
6. Ensure nut rotates easily on connecting rod bolt. If nut fails to rotate easily, use caliper to measure connecting rod bolt outside diameter at .59" (15.0 mm) from bottom of bolt. Replace connecting rod bolt and nut an assembly if bolt outside diameter is less than .299" (7.59 mm).

NOTE: **With piston at 140°F (60°C), piston pin should be able to be pressed into piston using thumb pressure.**

7. Different diameter pistons are used. Piston diameter may be identified by size mark ("1", "2" or "3") stamped on top of piston. See **Fig. 32**.
8. To determine piston diameter, measure piston skirt diameter at .925" (23.50 mm) from top of piston at 90-degree angle to piston pin. Ensure piston diameter is within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
9. To reassemble, position piston and connecting rod so front mark (cavity) on top of piston aligns with front mark (protrusion) on connecting rod. See **Fig. 31**.
10. Install one NEW snap ring in piston. Heat piston to 176-194°F (80-90°C) in water. Coat piston pin with engine oil. Install piston pin into piston and connecting rod using thumb pressure. Install other NEW snap ring.



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Fig. 31: Locating Front Marks

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

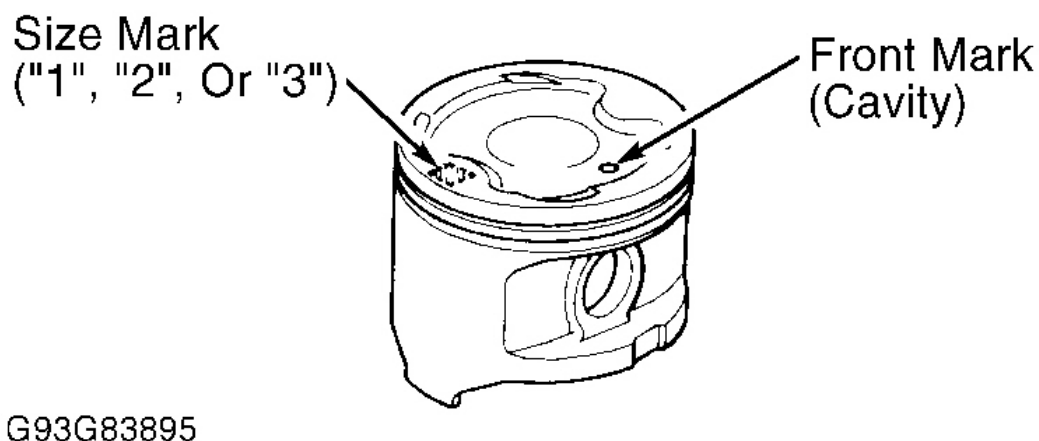
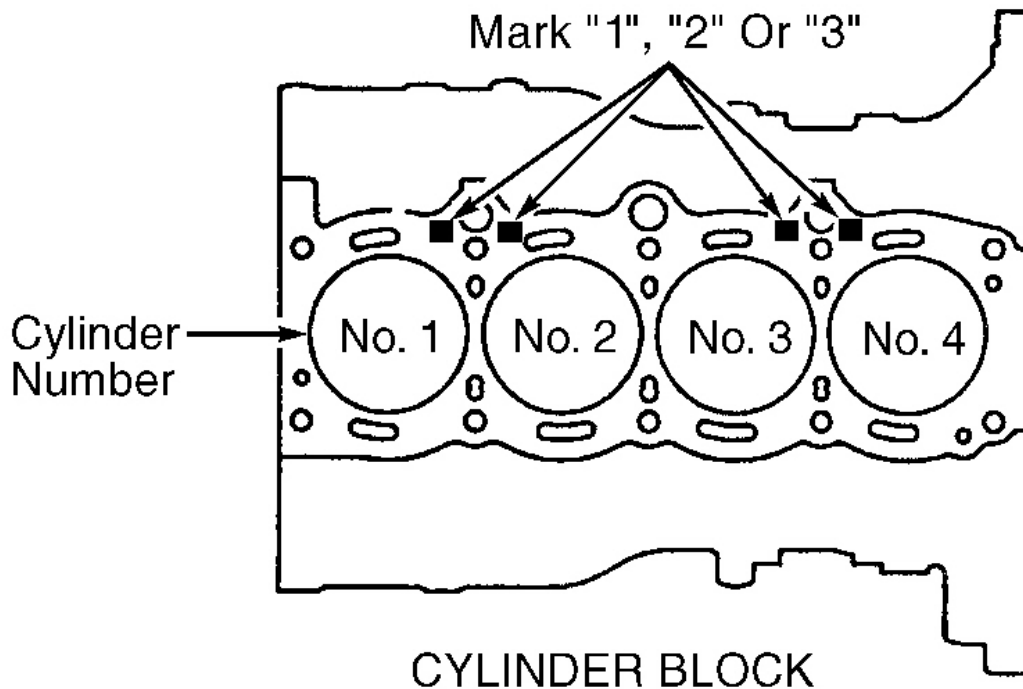


Fig. 32: Locating Piston Size Marks

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

Fitting Pistons

1. Different diameter pistons are used. Piston diameter may be identified by size mark ("1", "2" or "3") stamped on top of piston. On Camry CNG models, size mark is stamped in center of piston. On non-CNG models, size mark is stamped at edge of piston. See **Fig. 32**.
2. Different cylinder bore diameters are used. Cylinder bore diameter may be identified by size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 33**.
3. To determine piston-to-cylinder clearance, measure piston diameter and cylinder bore diameter. Measure piston skirt diameter at .925" (23.50 mm) from top of piston at 90-degree angle to piston pin.
4. Measure cylinder bore diameter at 2 different places, 90 degrees apart at .39" (9.9 mm) from top and bottom of cylinder bore and at center of cylinder bore. Ensure piston diameter and cylinder bore diameter are within specification. See **PISTONS, PINS & RINGS** and **CYLINDER BLOCK** tables under ENGINE SPECIFICATIONS.
5. Calculate piston-to-cylinder clearance. replace piston or bore cylinder block for oversize pistons if clearance is not within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Pistons are available in .020" (.51 mm) oversize. If replacing piston, ensure replacement piston contains same size mark as size mark on cylinder block.



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Fig. 33: Locating 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.
2. Position piston rings with ring end gaps in proper areas with identification mark on piston ring toward top of piston. See **Fig. 34**.
3. No. 1 compression ring may contain a 1N or "T" identification mark and No. 2 compression ring may contain a 2N or 2T identification mark. Ensure compression rings are installed in correct location.

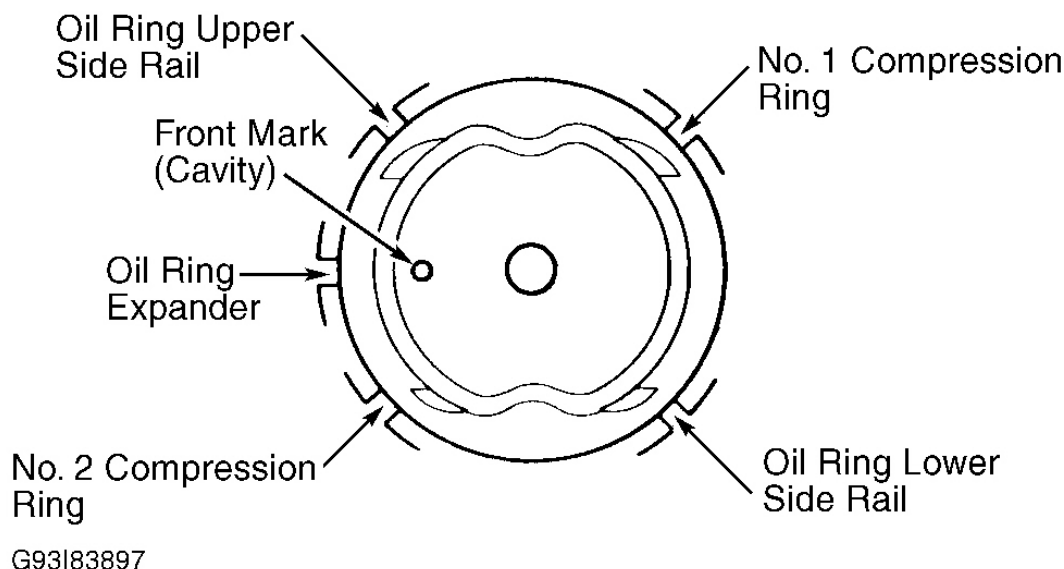


Fig. 34: Positioning Typical Piston Rings
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Rod Bearings

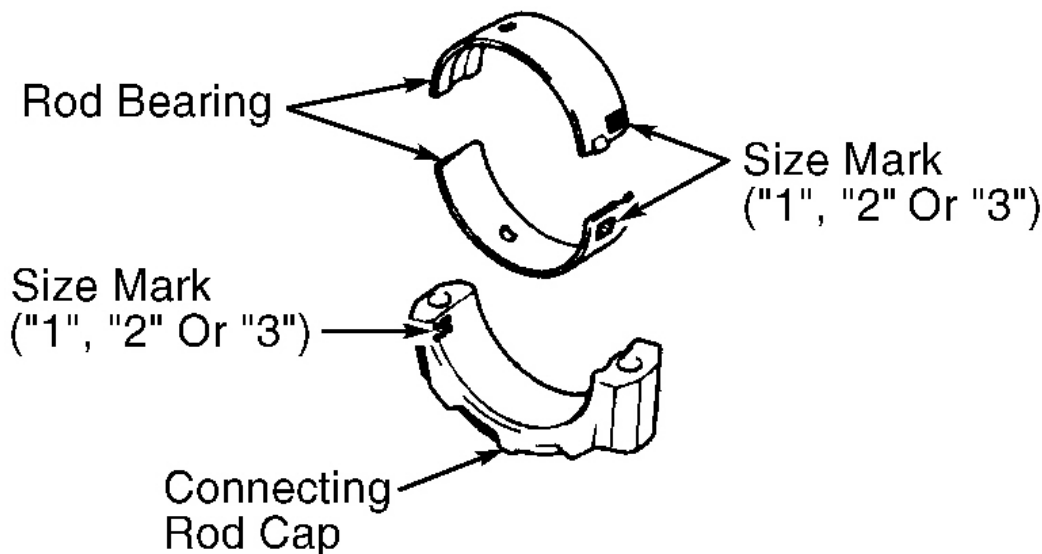
1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Piston, connecting rod and connecting rod **MUST BE** installed so front mark is toward timing belt end of engine. See **Fig. 31**.
2. Connecting rod cap and rod bearing are stamped with size mark ("1", "2" or "3"). See **Fig. 35**. Ensure size marks on connecting rod cap and rod bearing are the same.

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

3. Rod bearing thickness is determined by the size mark. See **ROD BEARING SPECIFICATIONS** table.
4. Ensure nut rotates easily on connecting rod bolt. If nut fails to rotate easily, use caliper to measure connecting rod bolt outside diameter at .59" (15.0 mm) from end of bolt. Replace connecting rod bolt and nut as an assembly if bolt outside diameter is less than .2992" (7.600 mm).
5. Install connecting rod cap with front mark (protrusion) toward timing belt end of engine. See **Fig. 31**. Coat threads of connecting rod bolts and nut-to-connecting rod cap surface with engine oil before tightening nuts to specification. See **TORQUE SPECIFICATIONS**.
6. 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

Bearing Size Mark	Bearing Thickness - In. (mm)
"1"	.0584-.0586 (1.483-1.488)
"2"	.0586-.0587 (1.488-1.491)
"3"	.0587-.0589 (1.491-1.496)



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Fig. 35: Locating Connecting Rod Cap & Rod Bearing Size Marks
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Crankshaft & Main Bearings

1. Main bearing caps are numbered on top of cap for location reference. No. 1 main bearing cap is at timing belt end of engine and No. 5 is at flywheel/drive plate end. Arrow on top of main bearing cap must point toward timing belt end of engine.
2. Remove main bearing cap bolts in sequence. See **Fig. 36**. Remove main bearing caps, crankshaft, thrust bearings and main bearings.
3. Cylinder block main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See **Fig. 37**. 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 main bearing journal size mark ("0", "1" or "2") located on crankshaft counterweight. See **Fig. 37**.
5. Ensure crankshaft runout, journal diameter, taper and out-of-round are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE

SPECIFICATIONS.

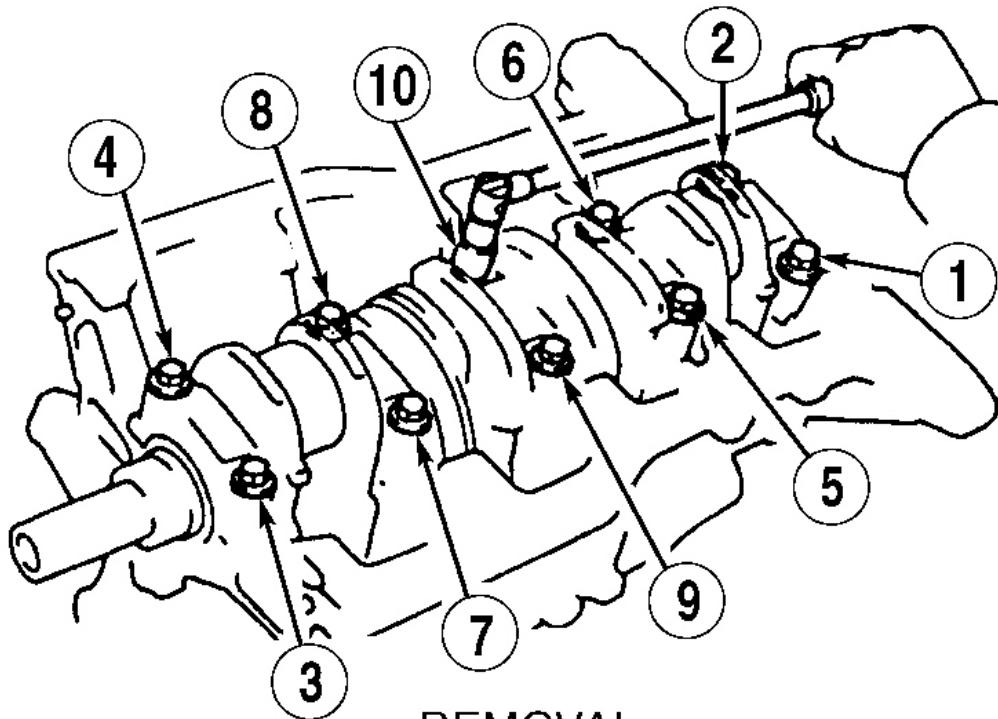
6. Main bearing size mark ("1", "2", "3", "4" or "5") is located on side of main bearing. See **Fig. 37**. If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.
7. If main bearing size mark cannot be obtained, add size marks on cylinder 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".

NOTE: Different width main bearings are used. Install wide main bearing on No. 3 journal and narrow main bearings on all other journals.

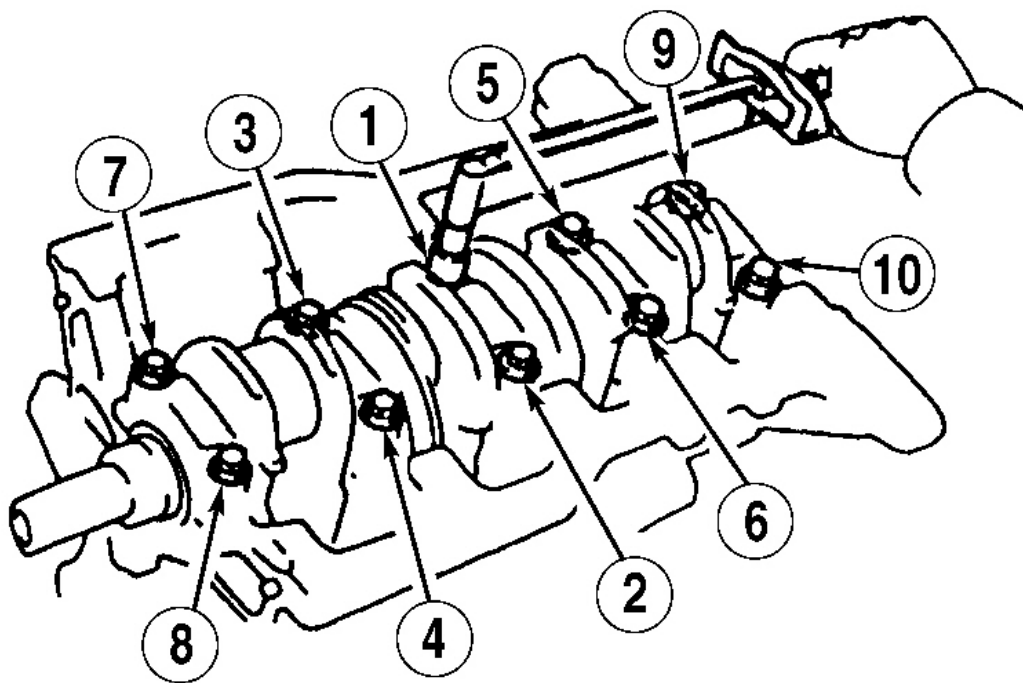
8. Main bearing thickness is determined by size mark. See **MAIN BEARING SPECIFICATIONS** table. Install main bearings, thrust bearings, crankshaft and main bearing caps.
9. Ensure main bearing caps are properly installed in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel/drive plate end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.
10. Coat threads and bolt-to-main bearing cap contact surfaces on main bearing cap bolts with engine oil. Install and tighten main bearing cap bolts to specification in sequence. See **Fig. 36**. See **TORQUE SPECIFICATIONS**.
11. Ensure crankshaft main bearing oil clearance and crankshaft end play are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. Replace thrust bearing if end play is not within specification.

MAIN BEARING SPECIFICATIONS

Bearing Size Mark	Bearing Thickness - In. (mm)
No. 3 Main Bearing	
"1"	.07842-.07854 (1.9919-1.9949)
"2"	.07854-.07866 (1.9949-1.9980)
"3"	.07866-.07877 (1.9980-2.0008)
"4"	.07877-.07889 (2.0008-2.0038)
"5"	.07889-.07901 (2.0038-2.0069)
All Others	
"1"	.07862-.07874 (1.9969-2.0000)
"2"	.07874-.07885 (2.0000-2.0028)
"3"	.07885-.07897 (2.0028-2.0058)
"4"	.07897-.07909 (2.0058-2.0089)
"5"	.07909-.07921 (2.0089-2.0119)



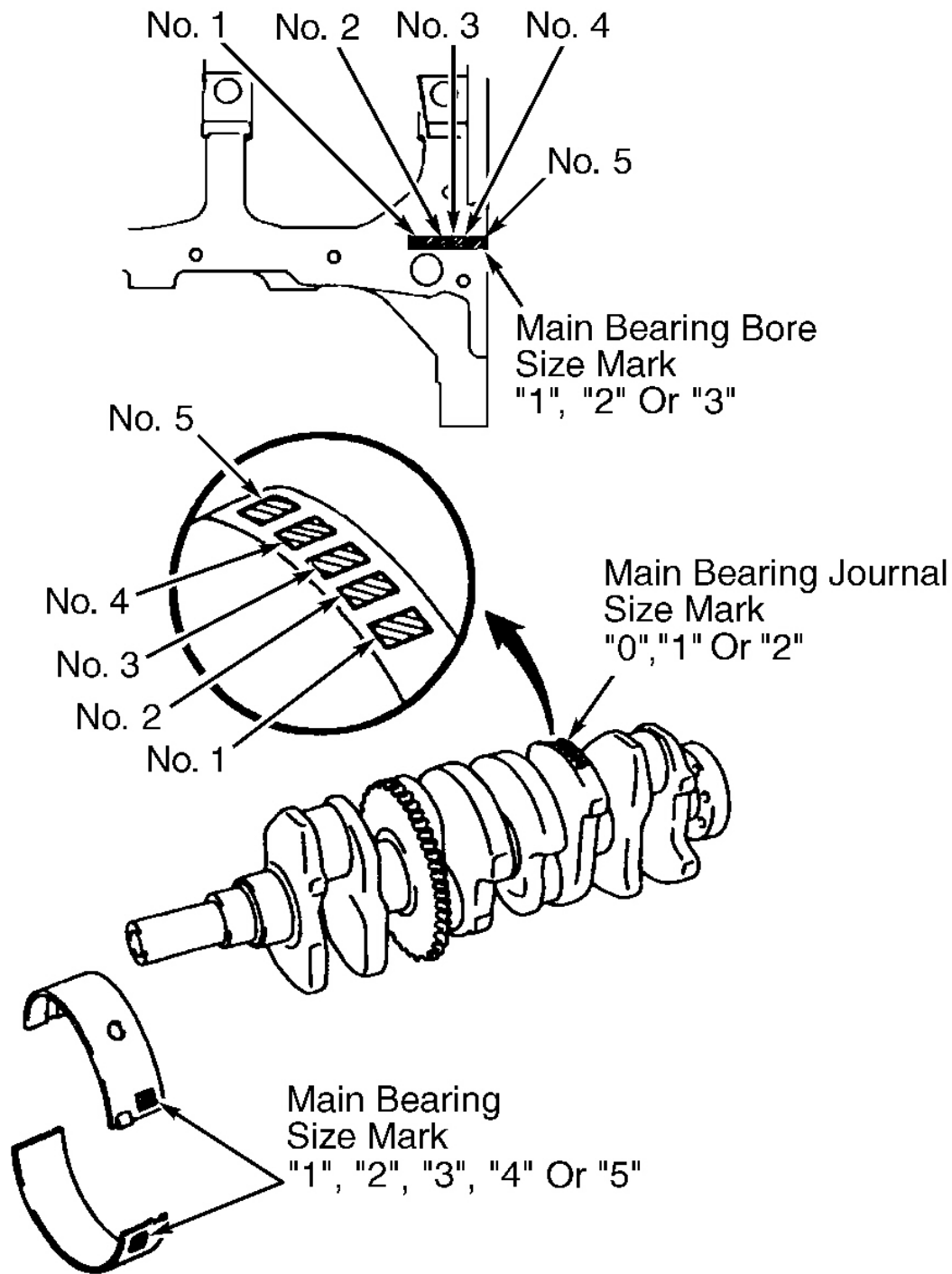
REMOVAL



INSTALLATION

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Fig. 36: Main Bearing Cap Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 37: Locating Cylinder Block, Crankshaft & Main Bearing Size Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Thrust Bearing

Install thrust bearings on No. 3 main bearing with grooves facing toward crankshaft and away from cylinder block and main bearing cap. Replace thrust bearings 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 surface warpage exceeds specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
2. Different cylinder bore diameters are used. Cylinder bore diameter may be identified by size mark ("1", "2" or "3") on cylinder block deck surface. See **Fig. 33**.
3. Measure cylinder bore diameter at 2 different places, 90 degrees apart at .39" (9.9 mm) from top and bottom of cylinder bore and at center of cylinder bore. Ensure cylinder bore diameter is within specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
4. Bore cylinder block for oversize pistons if cylinder bore diameter is not within specification. Pistons are available in .020" (.51 mm) oversize.
5. Install main bearing caps in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel/drive plate end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.
6. Install and tighten main bearing cap bolts to specification in sequence. See **Fig. 36**. See **TORQUE SPECIFICATIONS**.
7. Ensure main bearing bore inside diameter is within specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

NOTE: Main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See **Fig. 37**.

ENGINE OILING**ENGINE LUBRICATION SYSTEM**

Oil pump provides pressurized engine lubrication. See **Fig. 38**. Oil cooler is installed between oil filter and cylinder block.

Crankcase Capacity

For approximate crankcase capacity with oil filter, see **CRANKCASE CAPACITIES** table.

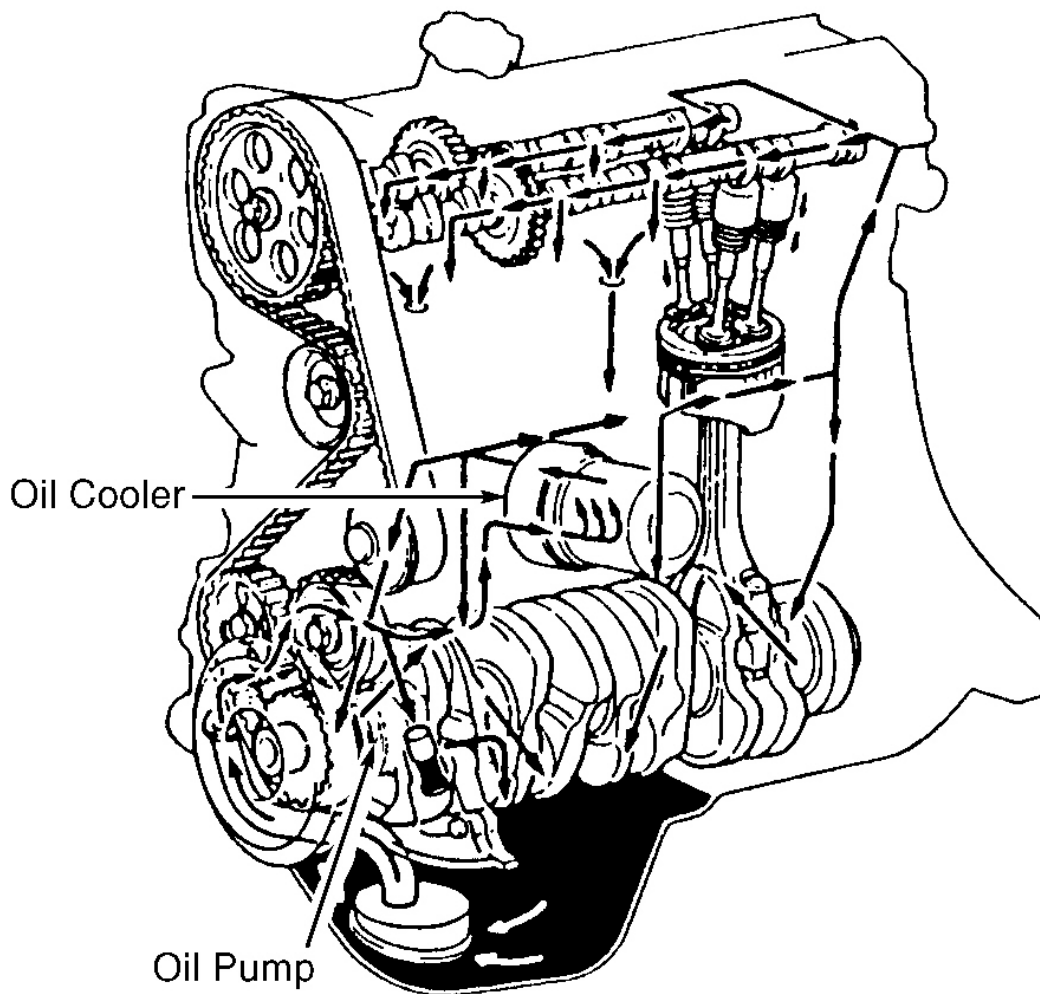
CRANKCASE CAPACITIES ⁽¹⁾

Application	Qts. (L)
Camry & Camry Solara	3.8 (3.6)
Celica	4.1 (3.9)

(1) Approximate capacity listed is with oil filter.

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.



G93E83901

Fig. 38: Typical Engine Oiling System

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

OIL PUMP

Removal & Disassembly

1. Drain engine oil, and remove engine under covers. Remove front exhaust pipe and engine mounting center member. See **ENGINE** under removal and installation.

2. Disconnect oxygen sensor connector, RH exhaust manifold stay, TWC, gasket, retainer and cushion. Remove end plate stiffener. Remove oil dipstick, 17 bolts and 2 nuts. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION.
3. Remove oil strainer and oil pan baffle plate. On Celica, suspend engine with sling. On all models, remove timing belt, No. 2 idler pulley, crankshaft timing pulley, oil pump pulley and oil pump. See **TIMING BELT** under REMOVAL & INSTALLATION
4. To disassemble oil pump, remove snap ring using snap ring pliers. Remove retainer, spring and relief valve. Remove 2 bolts, pump body cover, "O" ring, drive and driven rotors. Note direction of drive and driven rotor installation for reassembly reference. Disassemble oil pump components. See **Fig. 39**.

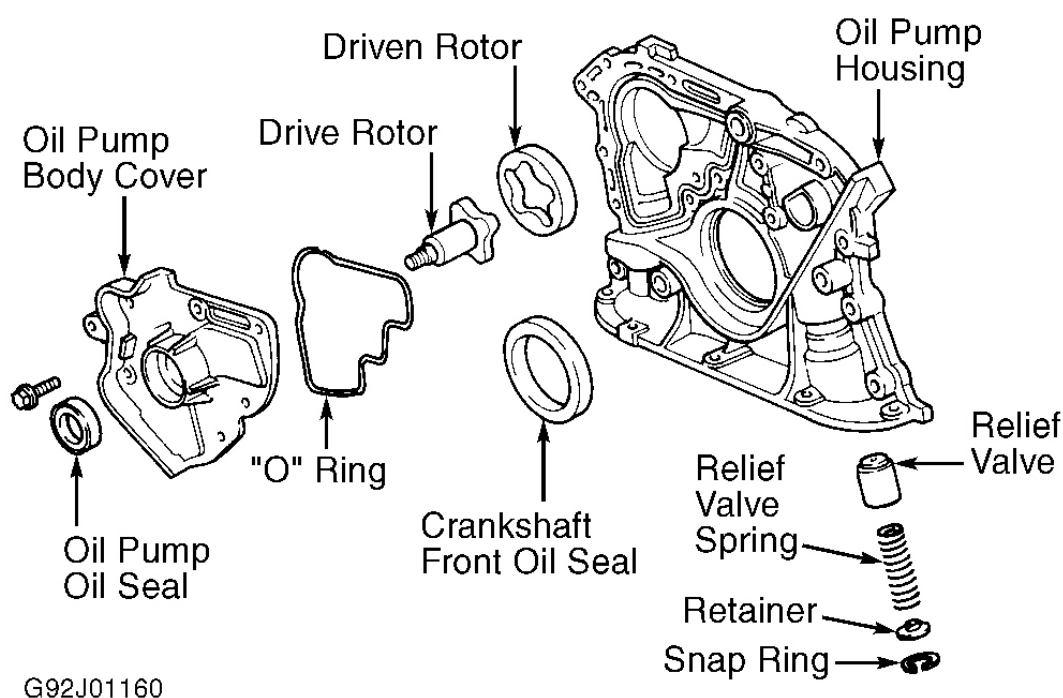


Fig. 39: Exploded View Of Oil Pump

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

Inspection

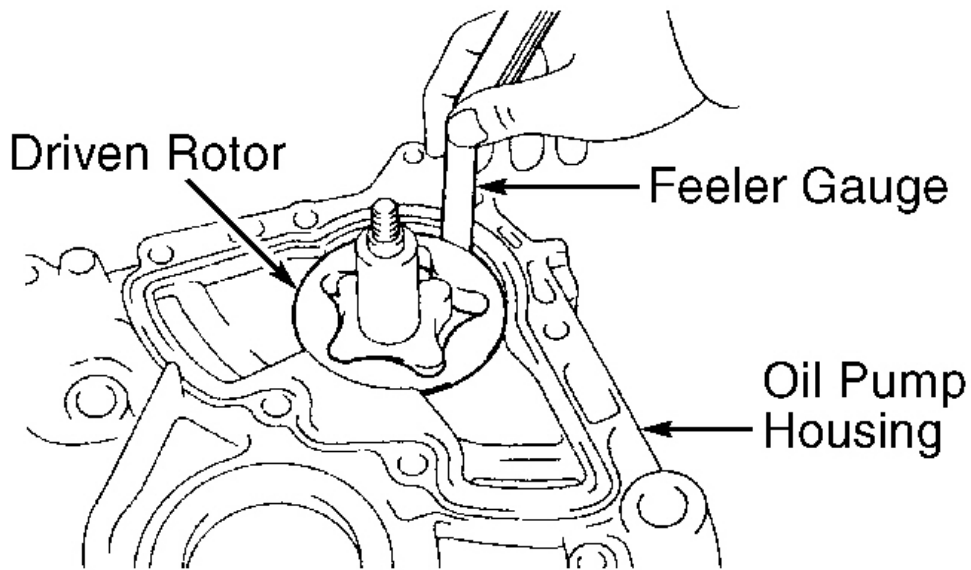
1. Inspect components for damage. Coat relief valve with engine oil and ensure relief valve slides freely in bore of oil pump housing. Replace relief valve and/or oil pump housing if relief fails to slide freely.
2. Install rotors in oil pump housing. Using feeler gauge, check driven rotor-to-oil pump housing clearance. See **Fig. 40**. Replace rotor assembly and/or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.
3. Using feeler gauge, check rotor tip clearance between tip of drive rotor and tip of driven rotor. See **Fig. 40**. Replace rotor assembly if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.

2000 Toyota Camry Solara SE

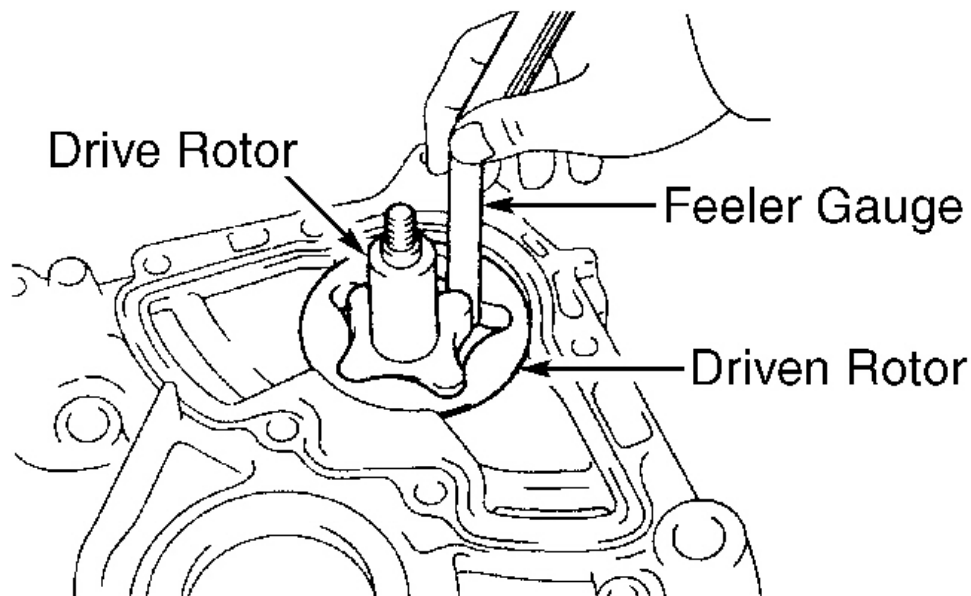
1999-2000 ENGINES 2.2L 4-Cylinder

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Driven Rotor-To-Oil Pump Housing Clearance	
Standard	.0039-.0063 (.099-.160)
Wear Limit	.0079 (.201)
Rotor Tip Clearance	
Standard	.0016-.0063 (.041-.160)
Wear Limit	.0079 (.201)



CHECKING DRIVEN ROTOR-TO-OIL PUMP HOUSING CLEARANCE



CHECKING ROTOR TIP CLEARANCE

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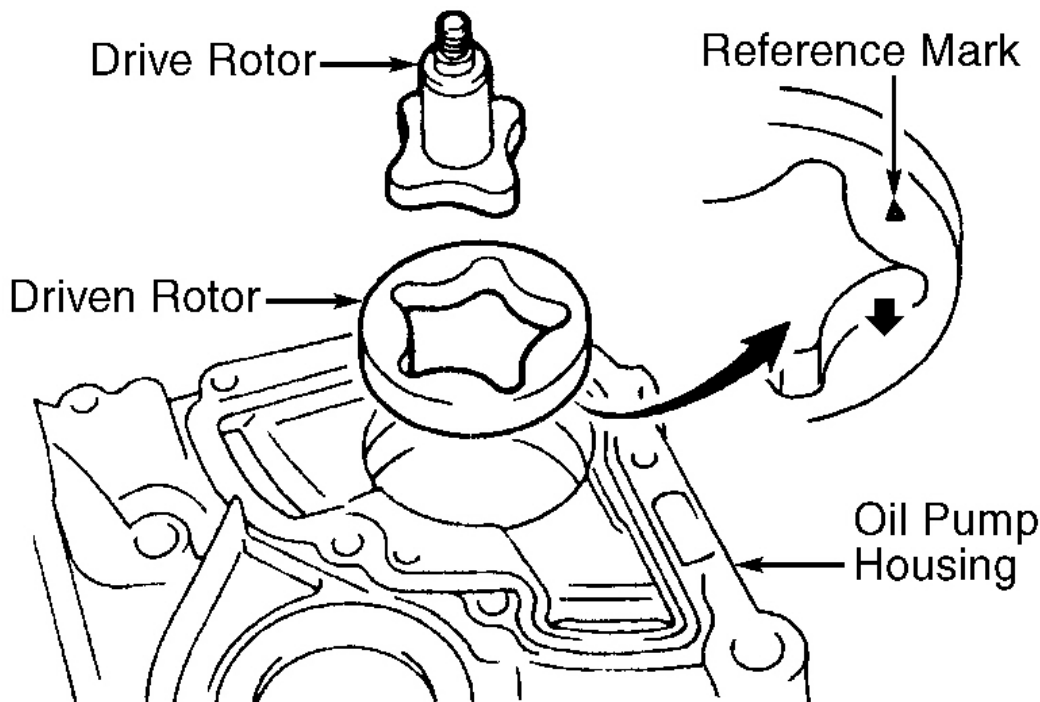
Fig. 40: Checking Driven Rotor-To-Oil Pump Housing Clearance & Rotor Tip Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Reassembly & Installation

1. To reassemble, reverse disassembly procedure using NEW "O" ring.

CAUTION: Install driven rotor in oil pump housing so reference mark faces oil pump housing. See Fig. 41.

2. Use hammer and Oil Seal Installer (09226-10010) to install NEW crankshaft front oil seal (if removed) until oil seal surface is even with oil pump housing. Coat lip of oil seal with grease.
3. Install NEW oil pump oil seal (if removed) until oil seal surface is even with oil pump body cover. Coat lip of oil seal with grease.
4. Install oil pump body cover using NEW "O" ring. Tighten oil pump body cover bolts to specification. See **TORQUE SPECIFICATIONS**. Using NEW gasket, install oil pump on cylinder block.
5. Ensure 2 longest oil pump-to-cylinder block bolts are located in lowest outside holes nearest to oil pan flange on each side of the oil pump. Tighten oil pump-to-cylinder block bolts to specification. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.



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Fig. 41: Installing Drive & Driven Rotors

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

OIL COOLER**Removal**

1. Oil cooler is mounted between oil filter and cylinder block. See **Fig. 38**. Disconnect negative battery cable. Drain cooling system.
2. On Celica, remove lower engine cover and generator. Remove front exhaust pipe and exhaust manifold with front catalyst assembly. Remove heat insulators.
3. On all models, remove oil filter. Disconnect coolant hoses from oil cooler. Remove oil cooler union bolt and plate washer from center of oil cooler housing. Remove oil cooler-to-cylinder block nut. Remove oil cooler and "O" ring from cylinder block.

Inspection

Inspect oil cooler for damage or restriction. Replace oil cooler if damage or restricted.

Installation

1. To install, reverse removal procedure using NEW "O" ring. Coat threads and area below head of oil cooler union bolt with engine oil.
2. Install oil cooler with oil cooler-to-cylinder block nut and oil cooler union bolt loosely installed. Tighten oil cooler union bolt, and then the nut to specification. See **TORQUE SPECIFICATIONS**.
3. Use NEW gasket when installing exhaust manifold and front exhaust pipe at catalytic converter (if removed). Add engine oil as needed. Fill cooling system.

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS (CAMRY & CAMRY SOLARA)****TORQUE SPECIFICATIONS (CAMRY & CAMRY SOLARA)**

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	19 (26)
Balance Shaft Assembly-To-Cylinder Block Bolt ⁽¹⁾	36 (49)
Ball Joint-To-Lower Control Arm Bolt/Nut	94 (127)
Camshaft Bearing Cap Bolt ⁽²⁾	14 (19)
Camshaft Sprocket Bolt	40 (54)
Clutch Release Cylinder Bolt	47 (64)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant By-Pass Pipe-To-Cylinder Head Bolt	14 (19)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Coolant Outlet Nut	11 (15)
Crankshaft Pulley Bolt	80 (108)
Cylinder Head Bolt ⁽³⁾	
Step 1	36 (49)
Step 2	Additional 90 Degrees
EGR Valve	
Nut	10 (14)
Union Nut	45 (61)
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Control Rod Bracket-To-Right (Timing Belt Side) Engine Mount Bracket Bolt	47 (64)
Control Rod-To-Strut Tower Bolt	47 (64)
Front (Exhaust Manifold Side) Engine Mount-To-Cylinder Block Bolt	47 (64)
Front (Exhaust Manifold Side) Engine Mount-To-Frame Bolt	
Toyota Motor Corporation (TMC) Models	59 (80)
Toyota Motor Manufacturing (TMM) Models	
Green Colored Bolt	49 (66)
Silver Colored Bolt	32 (43)
Rear (Intake Manifold Side) Engine Mount Insulator-To-Frame Nut	47 (64)
Rear (Intake Manifold Side) Engine Mount-To-Cylinder Block Bolt	47 (64)
Right (Timing Belt Side) Engine Mount Bracket-To-Cylinder Block Bolt	38 (52)
Transaxle Mount-To-Transaxle Bolt	47 (64)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Front Exhaust Pipe-To-Exhaust Manifold Nut	46 (62)
Front Exhaust Pipe-To-Rear Exhaust Pipe Bolt/Nut	41 (56)
Fuel Pulsation Damper	25 (34)
Generator Adjusting Bracket Bolt	20 (27)
Generator Mounting Bracket Bolt	31 (42)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	31 (42)
Ignition Coils & Intake Manifold Support Brace Bolt/Nut	
Small Bolt	15 (20)
Large Bolt	31 (42)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Knock Sensor	32 (43)
Main Bearing Cap Bolt ⁽⁴⁾	43 (58)
No. 1 Exhaust Manifold Brace Bolt	31 (42)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
No. 2 Exhaust Manifold Brace Bolt/Nut	
Toyota Motor Corporation (TMC) Models	
Cylinder Block Side	43 (58)
Exhaust Manifold Side	31 (42)
Toyota Motor Manufacturing (TMM) Models	
Cylinder Block Side	31 (42)
Exhaust Manifold Side	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Union Bolt	58 (79)
Oil Pump Sprocket Nut	18 (24)
Power Steering Pump Bracket Bolt	32 (43)
Power Steering Pump-To-Bracket Bolt	32 (43)
Spark Plug	13 (18)
Spark Plug Tube	36 (49)
Starter Bolt	27 (37)
Stiffener Plate Bolt (A/T)	27 (37)
M/T	29 (39)
Tension Spring Bolts	7-8 (9-11)
Throttle Body Bolt/Nut	14 (19)
Tie Rod Nut	36 (49)
Valve Cover Nut	33 (45)
Torque Converter Bolt	20 (27)
Water Outlet Bolts	11 (15)
Wheel Lug Nut	76 (103)
INCH Lbs. (N.m)	
Camshaft Position Sensor Bolt	84 (9)
Coolant By-Pass Pipe-To-Water Pump Nut	84 (9)
Fuel Delivery Pipe Bolt	115 (13)
Oil Cooler-To-Cylinder Block Nut	84 (9)
Oil Pan Bolt/Nut	48 (5)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump-To-Cylinder Block Bolt	78 (8.8)
Rear Plate-To-Cylinder Block Bolt	84 (9)
Water Pump-To-Cylinder Block Bolt ⁽⁵⁾	78 (8.8)
Water Pump-To-Water Pump Cover Bolt	78 (8.8)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

- (1) Tighten bolts to specification in sequence. See **Fig. 25**.
- (2) Tighten bolts to specification in sequence. See **Fig. 18** and **Fig. 19**.
- (3) Tighten bolts to specification in sequence. See **Fig. 9**.
- (4) Tighten bolts to specification in sequence. See **Fig. 36**.
- (5) Tighten bolts to specification in sequence. See **Fig. 27**.

TORQUE SPECIFICATIONS (CELICA)**TORQUE SPECIFICATIONS (CELICA)**

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	18 (24)
Axle Shaft Bearing Bracket Bolt	47 (64)
Camshaft Bearing Cap Bolt ⁽¹⁾	14 (19)
Camshaft Sprocket Bolt	40 (54)
Clutch Disc Cover Bolts	14 (19)
Clutch Release Cylinder Bolt	9 (12)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Nut	11 (15)
Crankshaft Pulley Bolt	18 (24)
Cylinder Head Bolt ⁽²⁾	
Step 1	36 (49)
Step 2	Additional 90 Degrees
Distributor Hold-Down Bolt	14 (19)
Drive Plate	61 (83)
Drive Shaft Bearing Bracket	47 (64)
EGR Valve	
Nut	9 (12)
Union Bolt	43 (58)
Engine Drain Plug	18 (24)
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Front (Exhaust Manifold Side) Engine Mount Through-Bolt	65 (88)
Left (Transaxle Side) Engine Mount Through-Bolt	54 (73)
Left (Transaxle Side) Engine Mount-To-Bracket Bolt/Nut	47 (64)
Rear (Intake Manifold Side) Engine Mount Bracket-To-Cylinder Block Bolt	58 (79)
Rear (Intake Manifold Side) Engine Mount Through-Bolt	65 (88)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Rear (Intake Manifold Side) Engine Mount-To-Engine Mount Crossmember Bolt/Nut	59 (80)
Right (Timing Belt Side) Engine Mount Bracket-To-Cylinder Block Bolt	38 (52)
Right (Timing Belt Side) Engine Mount-To-Bracket	
Bolt	27 (37)
Nut	38 (52)
Engine Mount Crossmember-To-Body Bolt	26 (35)
Exhaust Manifold	
Left Exhaust Manifold Stay	
Bolt	29 (39)
Nut	31 (42)
Right Exhaust Manifold Stay	
Bolt	31 (42)
Nut	31 (42)
Exhaust Manifold Nut	36 (49)
Exhaust Pipe Support Bracket Bolt	14 (19)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Front Exhaust Pipe-To-Catalytic Converter Nut	46 (62)
Front Exhaust Pipe-To-Exhaust Pipe Support Bracket Bolt	14 (19)
Front Exhaust Pipe-To-Rear Exhaust Pipe Bolt/Nut	32 (43)
Fuel Inlet Pipe-To-Fuel Delivery Pipe Union Bolt	25 (34)
Fuel Line-To-Fuel Filter Union Bolt	22 (29)
Generator Adjusting Bracket Bolt	20 (27)
Generator Mounting Bracket Bolt	18 (24)
Intake Manifold Bolt/Nut	(3) 14 (19)
Intake Manifold Brace Bolt/Nut	
Bolt	15 (20)
Nut	32 (43)
Knock Sensor	33 (45)
Main Bearing Cap Bolt ⁽⁴⁾	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Union Bolt	58 (79)
Oil Pump Sprocket Nut	18 (24)
Power Steering Pump Bracket Bolt	32 (43)
Power Steering Pump-To-Bracket Bolt	
Adjusting Bolt	29 (39)
All Others	32 (43)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Rear Oil Seal Retainer Bolt	9 (12)
Spark Plug	13 (18)
Spark Plug Tube	29 (39)
Stabilizer Bar Link-To-Lower Control Arm Nut	33 (45)
Starter Bolt	29 (39)
Stiffener Plate Bolt	
12-mm Bolt	15 (20)
14-mm Bolt	32 (43)
Tension Spring Bolt/Nut	7-8 (9-11)
Throttle Body Bolt/Nut	14 (19)
Tie Rod Nut	36 (49)
Torque Converter Bolt	18 (24)
Valve Cover Nut	33 (45)
Wheel Lug Nut	76 (103)
INCH Lbs. (N.m)	
Coolant By-Pass Pipe-To-Water Pump Nut	80 (9)
No. 3 Timing Belt Cover Bolt	69 (8)
Oil Cooler-To-Cylinder Block Nut	80 (9)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	80 (9)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	80 (9)
Rear Plate-To-Cylinder Block Bolt	80 (9)
Rear Seal Housing Bolt	115 (13.0)
Water Bypass Pipe Bolt	80 (9)
Water Pump-To-Cylinder Block Bolt ⁽⁵⁾	80 (9)
Water Pump-To-Water Pump Cover Bolt	80 (9)

(1) Tighten bolts to specification in sequence. See **Fig. 18** and **Fig. 19** .

(2) Tighten bolts to specification in sequence. See **Fig. 9**.

(3) Tighten nut to 115 INCH lbs. (13.0 N.m).

(4) Tighten bolts to specification in sequence. See **Fig. 36**.

(5) Tighten bolts to specification in sequence. See **Fig. 27**.

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

Application	Specification

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Displacement	134 Cu. In. (2.2L)
Bore	3.43" (87.1 mm)
Stroke	3.58" (91.0 mm)
Compression Ratio	9.5:1
Fuel System	SFI

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

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.221)
Wear Limit	.0118 (.300)
Maximum Runout	.0024 (.061)
Main Bearings	
Journal Diameter ⁽¹⁾	
Size Mark "0"	2.1653-2.1655 (54.999-55.004)
Size Mark "1"	2.1651-2.1653 (54.994-54.999)
Size Mark "2"	2.1649-2.1651 (54.988-54.994)
Journal Out-Of-Round	.0008 (.021)
Journal Taper	.0008 (.021)
Oil Clearance	
Standard Crankshaft Journal	
No. 3 Journal	
Standard	.0010-.0017 (.025-.043)
Wear Limit	.0031 (.079)
All Other Journals	
Standard	.0006-.0013 (.015-.033)
Wear Limit	.0031 (.079)
.010" (.25 mm) Undersize Crankshaft Journal	
No. 3 Journal	
Standard	.0011-.0026 (.028-.066)
Wear Limit	.0031 (.079)
All Other Journals	
Standard	.0007-.0023 (.018-.058)
Wear Limit	.0031 (.079)
Connecting Rod Bearings	
Journal Diameter	2.0466-2.0472 (51.984-52.999)
Journal Out-Of-Round	.0008 (.021)
Journal Taper	.0008 (.021)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Oil Clearance**Standard Crankshaft Journal**

Standard	.0009-.0022 (.023-.056)
----------	-------------------------

Wear Limit	.0031 (.079)
------------	--------------

.010" (.25 mm) Undersize Crankshaft Journal

Standard	.0009-.0027 (.023-.069)
----------	-------------------------

Wear Limit	.0031 (.079)
------------	--------------

(1) Main bearing journal diameter is determined by main bearing journal size mark stamped on crankshaft. See **Fig. 37**.

CONNECTING RODS**CONNECTING RODS**

Application	In. (mm)
Bore Diameter	
Pin Bushing Bore	.8663-.8668 (22.004-22.017)
Maximum Bend	.002 Per 3.94 (.05 Per 100.0)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.0)
Side Play	
Standard	.0063-.0123 (.160-.312)
Wear Limit	.0138 (.351)

PISTONS, PINS & PISTON RINGS**PISTONS, PINS & RINGS**

Application	In. (mm)
Pistons	
Clearance	
Camry & Camry Solara	
Standard	.0068-.0076 (.175-.195)
Wear Limit	.0085 (.215)
Celica	
Standard	.0055-.0063 (.140-.160)
Wear Limit	.0071 (.180)
Diameter ⁽¹⁾	
Camry & Camry Solara	
Size Mark "1"	3.4179-3.4183 (86.815-86.825)
Size Mark "2"	3.4183-3.4186 (86.825-86.835)
Size Mark "3"	3.4186-3.4190 (86.835-86.845)
Celica	
Size Mark "1"	3.4193-3.4197 (86.850-86.860)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Size Mark "2"	3.4197-3.4201 (86.860-86.871)
Size Mark "3"	3.4201-3.4205 (86.871-86.881)
Pins	
Diameter	.8660-.8665 (21.996-22.009)
Piston Fit	(2)
Rod Fit	
Standard	.0002-.0004 (.005-.010)
Wear Limit	.0020 (.051)
Rings	
No. 1	
Camry & Camry Solara	
End Gap	
Standard	.0106-.0192 (.269-.490)
Wear Limit	.0429 (1.090)
Side Clearance	.0012-.0028 (.030-.070)
Celica	
End Gap	
Standard	.0106-.0197 (.269-.500)
Wear Limit	.0433 (1.100)
Side Clearance	.0016-.0031 (.041-.079)
No. 2	
Camry & Camry Solara	
End Gap	
Standard	.0177-.0263 (.450-.670)
Wear Limit	.0499 (1.270)
Side Clearance	.0012-.0028 (.030-.070)
Celica	
End Gap	
Standard	.0138-.0236 (.351-.599)
Wear Limit	.0472 (1.199)
Side Clearance	.0012-.0028 (.030-.071)
No. 3 (Oil)	
Camry & Camry Solara	
End Gap	
Standard	.0039-.0185 (.100-.470)
Wear Limit	.0421 (1.070)
Celica	
End Gap	
Standard	.0079-.0217 (.201-.551)
Wear Limit	.0453 (1.151)

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1999-2000 ENGINES 2.2L 4-Cylinder

(1) Piston diameter is determined by size mark stamped on top of piston. See **Fig. 32**.

(2) With piston temperature at 140°F (60°C), piston pin should slide through piston with thumb pressure.

CYLINDER BLOCK

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter ⁽¹⁾	
Size Mark "1"	3.4252-3.4256 (87.000-87.010)
Size Mark "2"	3.4256-3.4260 (87.010-87.020)
Size Mark "3"	3.4260-3.4264 (87.020-87.031)
Maximum Deck Warpage	.0020 (.051)
Main Bearing Bore I.D. ⁽²⁾	
Size Mark "1"	2.3236-2.3239 (59.019-59.027)
Size Mark "2"	2.3239-2.3241 (59.027-59.032)
Size Mark "3"	2.3241-2.3243 (59.032-59.037)
(1) Cylinder bore diameter is determined by size mark on cylinder block deck surface. See Fig. 33 . Maximum bore diameter is 3.4342" (87.229 mm).	
(2) Main bearing bore I.D. is determined by main bearing bore size mark on cylinder block. See Fig. 37 .	

ENGINE VALVES & VALVE SPRINGS

VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.020" (.51 mm)
Minimum Refinish Length	3.823" (97.10 mm)
Stem Diameter	.2350-.2356" (5.969-5.984 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.020" (.51 mm)
Minimum Refinish Length	3.858" (97.99 mm)
Stem Diameter	.2348-.2354" (5.964-5.979 mm)
Valve Springs	
Free Length	1.6122-1.6850" (40.950-42.799 mm)
Out-Of-Square Limit	.079" (2.01 mm)

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Lbs. @ In. (kg @ mm)	
Pressure	36.8-42.5@ 1.366 (16.7-19.3 @ 34.70)

CYLINDER HEAD**CYLINDER HEAD**

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.0020" (.051 mm)
Intake & Exhaust Manifold Surface	.0118" (.300 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.039-.055" (.99-1.40 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.039-.055" (.99-1.40 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.4325-.4335" (10.986-11.011 mm)
Oversize Valve Guide	.4344-.435" (11.034-11.062 mm)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0010-.0024" (.025-.061 mm)
Wear Limit	.0031" (.079 mm)
Exhaust Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.4325-.4335" (10.986-11.011 mm)
Oversize Valve Guide	.4344-.4355" (11.034-11.062 mm)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.066 mm)
Wear Limit	.0039" (.099 mm)

CAMSHAFT**CAMSHAFT**

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Application	In. (mm)
End Play	
Intake Camshaft	
Standard	.0018-.0039 (.046-.099)
Wear Limit	.0047 (.119)
Exhaust Camshaft	
Standard	.0012-.0033 (.030-.084)
Wear Limit	.0039 (.099)
Gear Backlash	
Standard	.0008-.0079 (.020-.201)
Wear Limit	.0118 (.300)
Journal Diameter	1.0614-1.0620 (26.960-26.975)
Journal Runout	.0016 (.041)
Lobe Height	
Intake Camshaft	
Except Camry CNG Engine	
Standard	1.6539-1.6579 (42.009-42.111)
Wear Limit	1.6496 (41.900)
Camry CNG Engine	
Standard	1.6618-1.6657 (42.210-42.308)
Wear Limit	1.6575 (42.100)
Exhaust Camshaft	
Except Camry CNG Engine	
Standard	1.5772-1.5811 (40.061-40.160)
Wear Limit	1.5728 (39.949)
Camry CNG Engine	
Standard	1.5992-1.6013 (40.619-40.718)
Wear Limit	1.5949 (40.510)
Oil Clearance	
Standard	.0010-.0024 (.025-.061)
Wear Limit	.0039 (.099)

VALVE LIFTERS**VALVE LIFTERS**

Application	In. (mm)
Bore Diameter	1.2205-1.2212 (31.001-31.018)
Lifter Diameter	1.2191-1.2195 (30.965-30.975)

2000 Toyota Camry Solara SE

1999-2000 ENGINES 2.2L 4-Cylinder

Oil Clearance

Standard	.0009-.0020 (.023-.051)
Wear Limit	.0028 (.071)