2.0L 4-CYL

1997-98 ENGINES Toyota 2.0L 4-Cylinder

ENGINE IDENTIFICATION

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

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

ENGINE IDENTIFICATION CODE

Engine	Code
2.0L 4-Cylinder	3S-FE

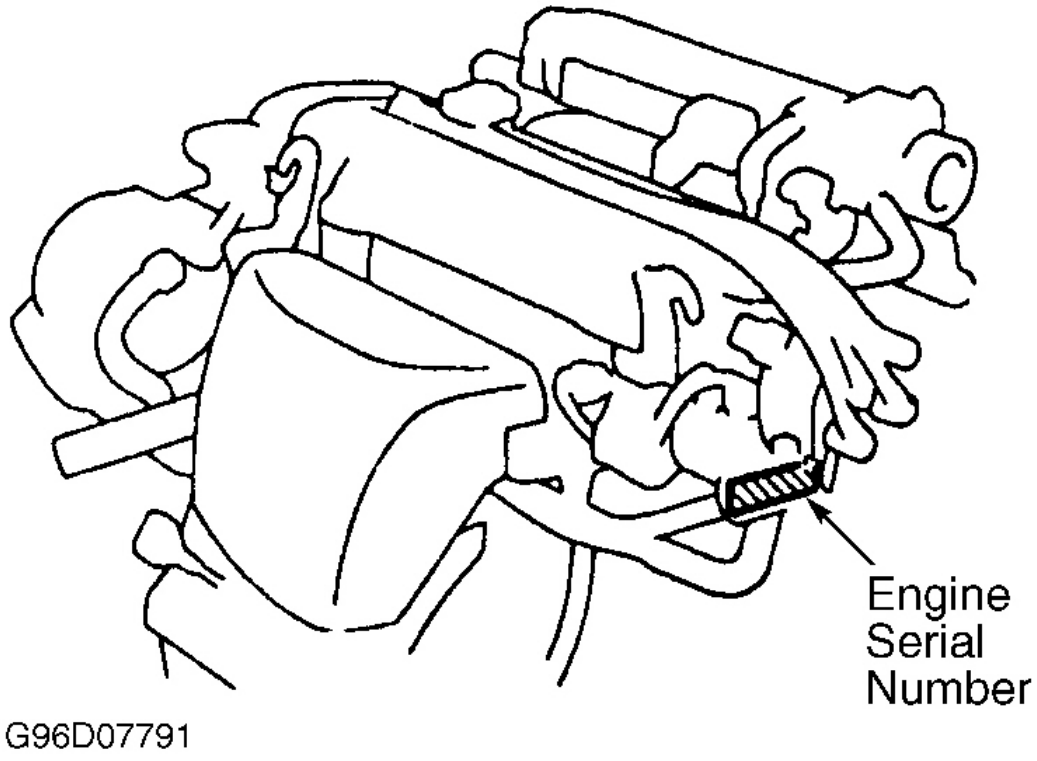


Fig. 1: Identifying Engine Serial Number
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine cold.

1. Disconnect power steering fluid reservoir, PCV hoses, cable brackets and control cables for access to valve cover. Disconnect spark plug wires from spark plugs.
2. Disconnect engine wiring harness protector at rear of timing belt cover for access to valve cover. When disconnecting engine wiring harness protector, remove bolt on intake manifold side of engine first, and then bolt on exhaust manifold side of engine.
3. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly reference, as grommets must be installed in original location.
4. 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.
5. Ensure valve lifters are loose on cylinder No. 1 and tight on cylinder No. 4. If conditions are not as described, rotate crankshaft clockwise one complete revolution (360 degrees).
6. With cylinder No. 1 at TDC on compression stroke, check valve clearance on specified valves. Perform STEP 1. See **Fig. 2** . Using feeler gauge, measure and record valve clearance between valve lifter and camshaft.
7. To check remaining valves, rotate crankshaft clockwise, viewed from timing belt end of engine, one complete revolution (360 degrees) until cylinder No. 4 cylinder is at TDC on compression stroke. Measure and record valve clearance on specified valves. Perform STEP 2. See0**Fig. 2** .
8. Ensure valve clearance is within specification. See **VALVE CLEARANCE SPECIFICATIONS** .

VALVE CLEARANCE SPECIFICATIONS (1)

Application	In. (mm)
Intake Valve	.007-.011 (.19-.29)
Exhaust Valve	.011-.015 (.29-.38)
(1) Adjust valve clearance with engine cold.	

9. If valve clearance requires adjustment, rotate camshaft so lobe on valve to be adjusted is facing upward, away from valve lifter. Rotate valve lifter so notch on valve lifter is toward spark plug.
10. 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. 3** . Remove SST "A".

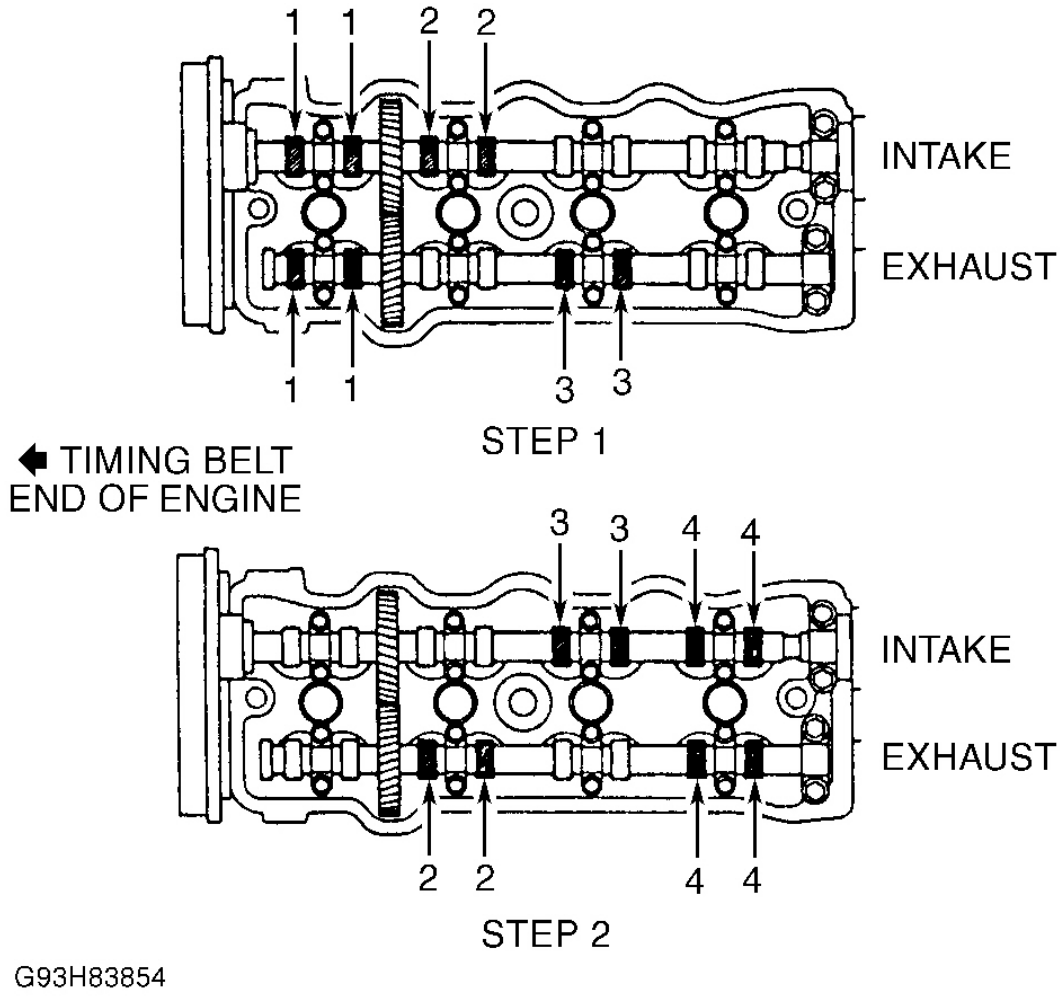


Fig. 2: Checking Valve Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

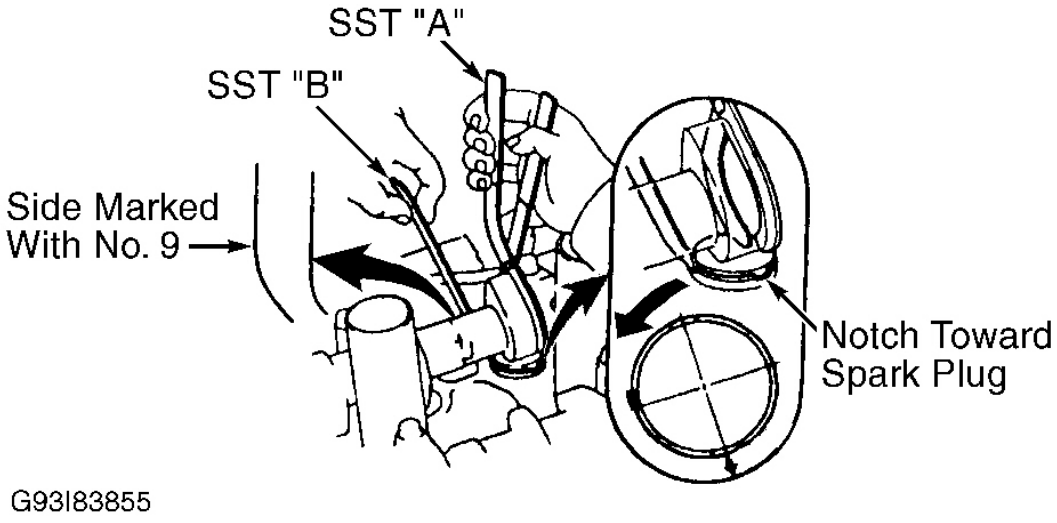


Fig. 3: Adjusting Valve Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

11. 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. 6** and **Fig. 7** .
12. Install replacement adjusting shim. Recheck valve clearance. Apply sealant at front and rear valve cover areas on cylinder head. See **Fig. 4** . Using NEW gasket, install valve cover.
13. Install grommets in original location with marking on grommet aligned in designated area. See **Fig. 5** . Install and tighten valve cover nuts to specification. See **TORQUE SPECIFICATIONS** .

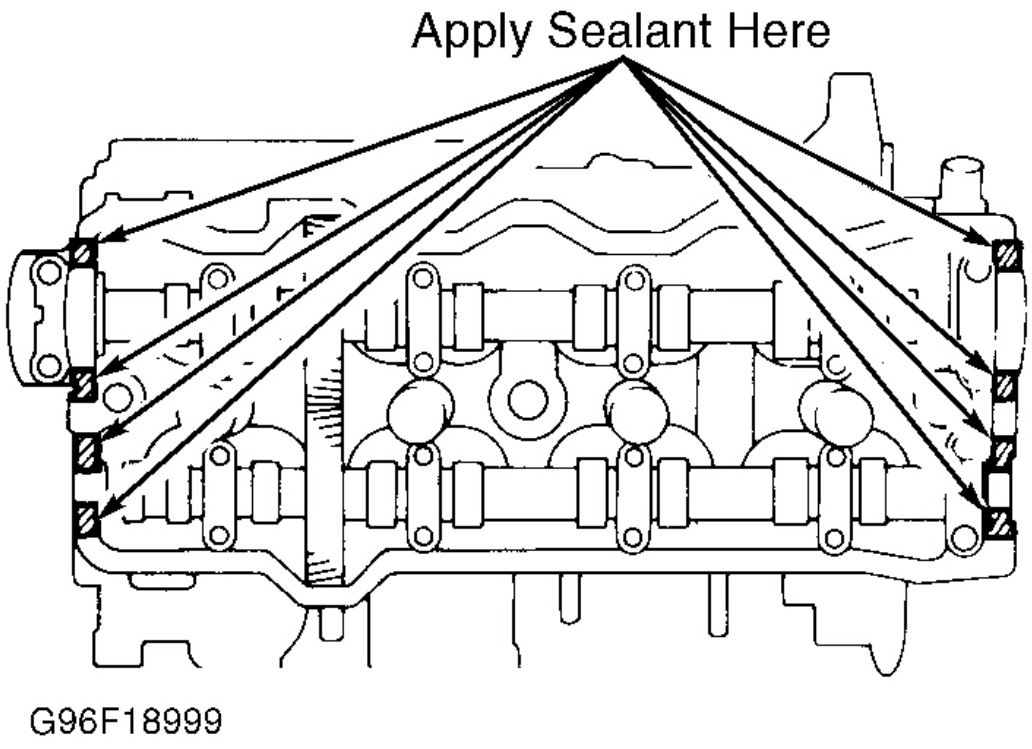


Fig. 4: Applying Sealant On Cylinder Head
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

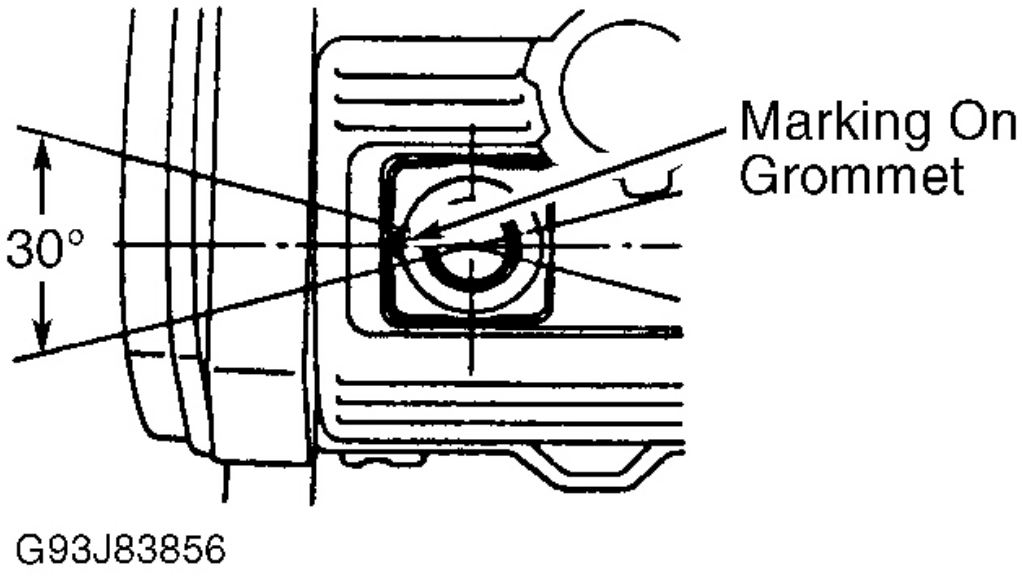
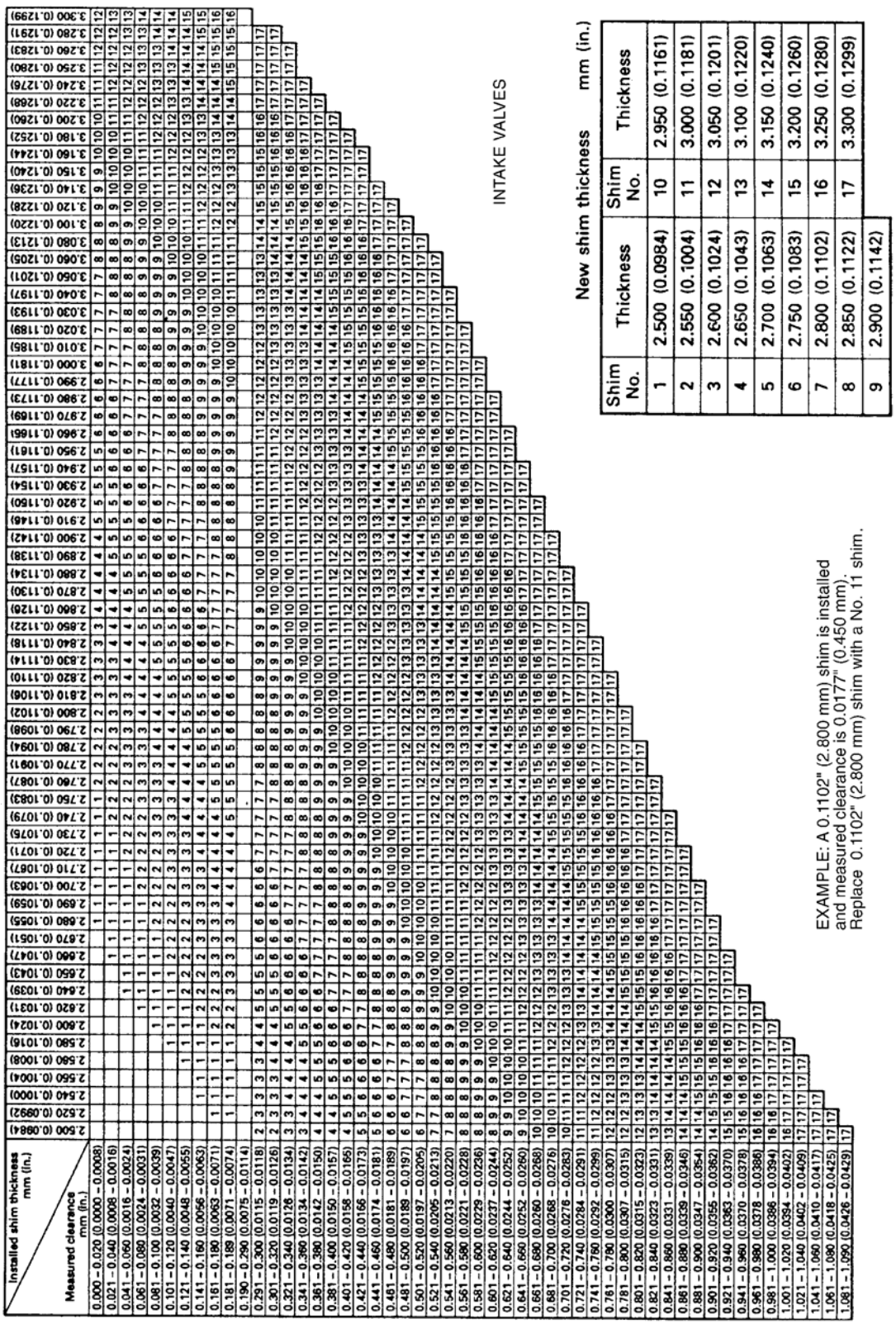


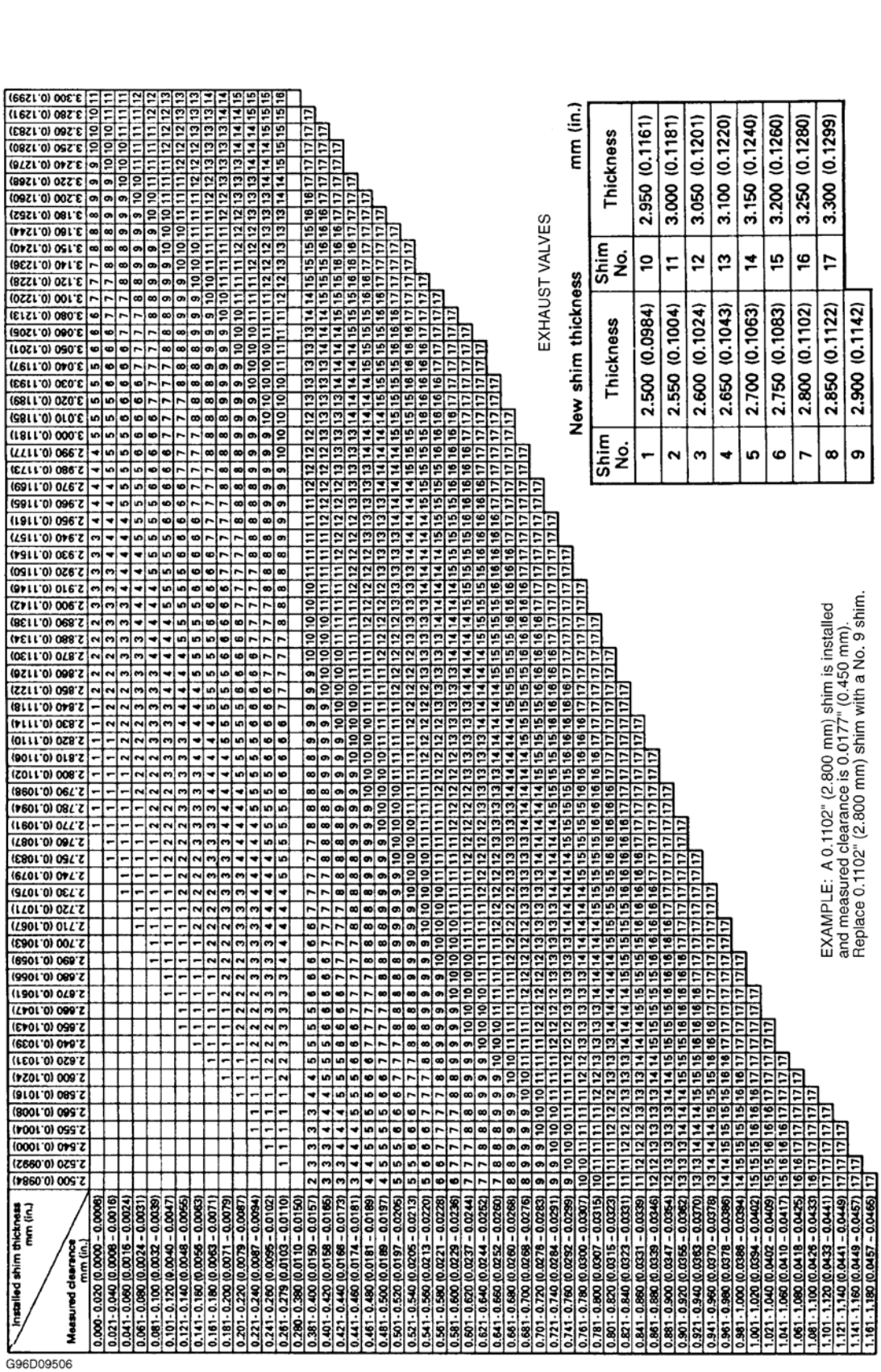
Fig. 5: Aligning Valve Cover Grommets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

Fig. 6: Intake Valve Adjusting Shim Selection Chart
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



New shim thickness		Shim No.	mm (in.) Thickness
Shim No.	Thickness		
1	2.500 (0.0984)	10	2.950 (0.1161)
2	2.550 (0.1004)	11	3.000 (0.1181)
3	2.600 (0.1024)	12	3.050 (0.1201)
4	2.650 (0.1043)	13	3.100 (0.1220)
5	2.700 (0.1063)	14	3.150 (0.1240)
6	2.750 (0.1083)	15	3.200 (0.1260)
7	2.800 (0.1102)	16	3.250 (0.1280)
8	2.850 (0.1122)	17	3.300 (0.1299)
9	2.900 (0.1142)		

Fig. 7: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

REMOVAL & INSTALLATION

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

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

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

FUEL PRESSURE RELEASE

1. Remove driver-side rear seat and floor panel cover for access to electrical connector for electric fuel pump.
2. Disconnect electrical connector for electric fuel pump. Start engine and allow engine to idle until engine stalls. Turn ignition off.
3. Reconnect electrical connector for electric fuel pump. Reinstall floor panel cover and driver-side rear seat.
4. Disconnect negative battery cable. Place an approved gasoline container under fuel line. Cover fuel line connection with shop towel.
5. Slowly loosen fuel line connection to release fuel pressure. Once fuel pressure is released, fuel system components may be serviced.

ENGINE

Removal

1. Engine and transaxle are removed as an assembly from bottom of engine compartment. Release fuel pressure. See **FUEL PRESSURE RELEASE** . Remove hood, battery and battery tray. Drain cooling system and engine oil.
2. Disconnect control cables at throttle body. Remove air cleaner assembly and air cleaner case. Remove bolts, and disconnect relay box from body. Relay box is located near driver-side strut tower. See **Fig. 8** .
3. Remove upper cover from relay box. Disconnect electrical connector from relay box. See **Fig. 8** . Remove nuts, and disconnect engine wiring harness from relay box.
4. Remove charcoal canister. Remove accessory drive belt and generator. Disconnect upper and lower radiator hoses. Remove thermostat housing from front of engine.
5. Disconnect necessary electrical connectors, coolant hoses, vacuum hoses and fuel lines for engine

removal. Remove A/C compressor with hoses attached, and secure aside.

6. Remove scuff plate from passenger-side door opening and passenger-side kick panel. Remove center console trim panel from passenger-side of center console. See **Fig. 9** .
7. Disconnect 2 electrical connectors from Engine Control Module (ECM) and 2 electrical connectors on bracket. See **Fig. 9** . Disconnect electrical connector for relay box located behind passenger-side kick panel.
8. Disconnect engine wiring harness clamp located on engine wiring harness, near firewall. Pull engine wiring harness out through firewall.

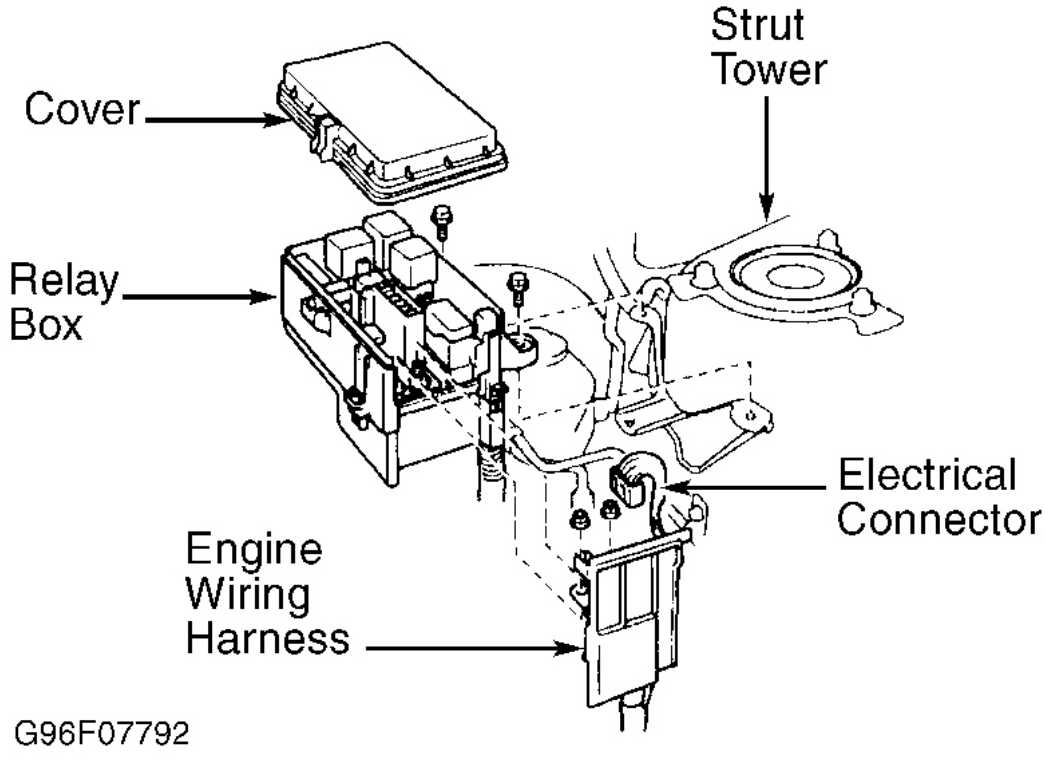


Fig. 8: Identifying Relay Box, Electrical Connector & Engine Wiring Harness
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

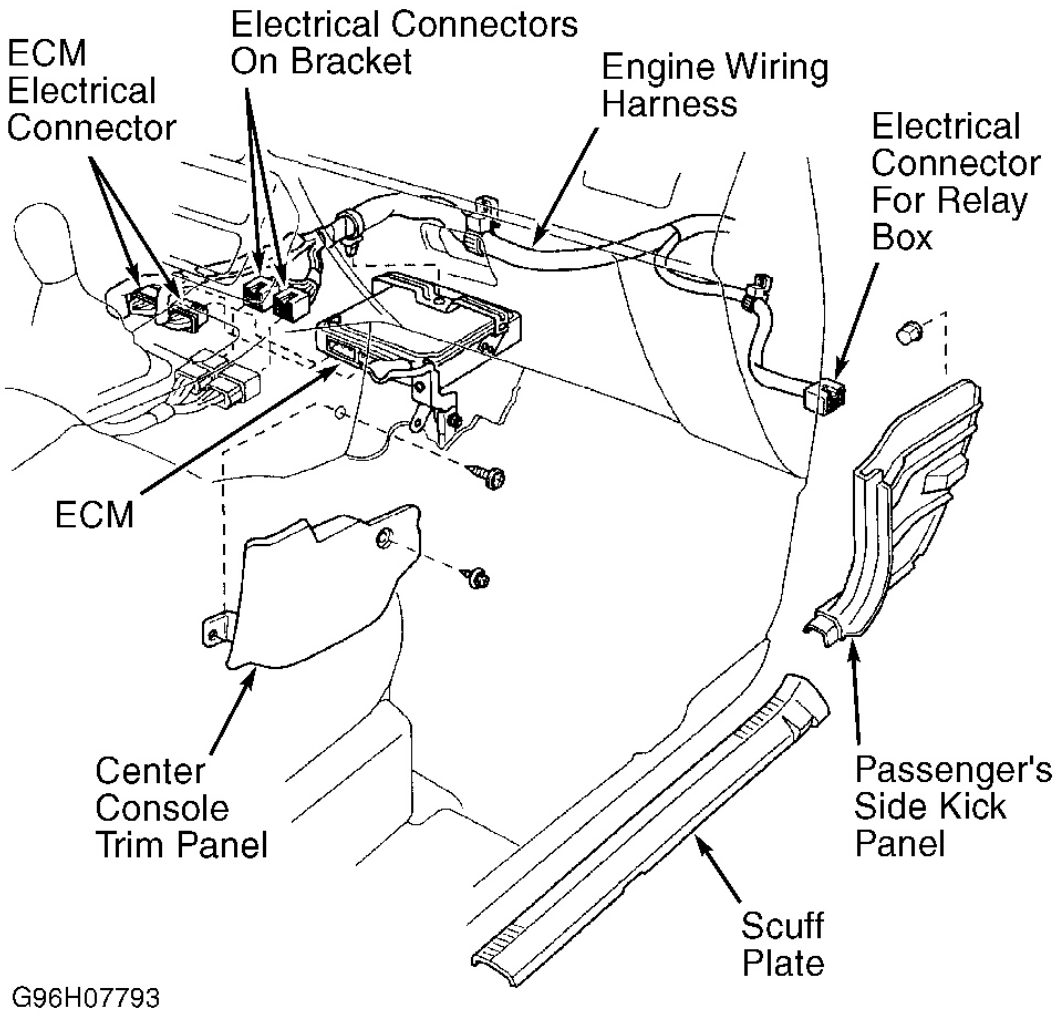


Fig. 9: Identifying ECM & Electrical Connectors
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. Raise and support vehicle. Remove lower engine covers. On M/T models, remove clutch release cylinder with hose attached, and secure aside. Remove starter. On 4WD models with M/T, disconnect oil cooler lines at transaxle.
10. On A/T models, disconnect oil cooler lines at transaxle. Disconnect shift cable bracket from engine mount crossmember.
11. On all models, disconnect control cables, oil cooler hoses and electrical connectors at transaxle. Remove front exhaust pipe from between front catalytic converter on exhaust manifold and rear exhaust pipe.
12. On 4WD models, place reference marks on drive shaft flanges for reassembly reference. Remove drive shaft flange bolts/nuts at rear axle. Remove drive shaft center support bearing bolts. Pull drive shaft from transaxle. Remove drive shaft.

13. On all models, remove front wheels. Drain transaxle fluid. On models with Anti-Lock Brake System (ABS), remove bolt and pull ABS speed sensor from front of axle carrier.
14. On all models, remove cotter pin and retainer from end of axle shaft. Loosen axle shaft nut while applying brakes. Remove axle shaft nut.
15. Remove nut, and separate tie rod from steering knuckle. Disconnect stabilizer bar link from lower control arm. Remove ball joint-to-lower control arm bolts/nuts.
16. Using soft-face hammer, tap axle shaft from hub assembly. Pull steering knuckle outward and separate axle shaft from hub assembly.
17. On 2WD A/T models, remove axle shaft bearing bracket bolts for right (passenger-side) axle shaft. See **Fig. 10** or **Fig. 11** . Remove right axle shaft assembly from transaxle and axle shaft bearing bracket.
18. On 2WD M/T models, remove snap ring and axle shaft retaining bolt from axle shaft bearing bracket for right (passenger-side) axle shaft. See **Fig. 10** or **Fig. 11** . Remove right axle shaft assembly from transaxle and axle shaft bearing bracket.
19. On 2WD models, use hammer and brass drift or a slide hammer and Drive Shaft Remover Attachment (09520-01010) to remove left (driver-side) axle shaft from transaxle. See **Fig. 12** .
20. On 4WD models use hammer and brass drift or a slide hammer and Drive Shaft Remover Attachment (09520-01010) to remove right (passenger-side) axle shaft from transaxle. See **Fig. 12** . Use pry bar to remove left (driver-side) axle shaft from transaxle. See **Fig. 13** .

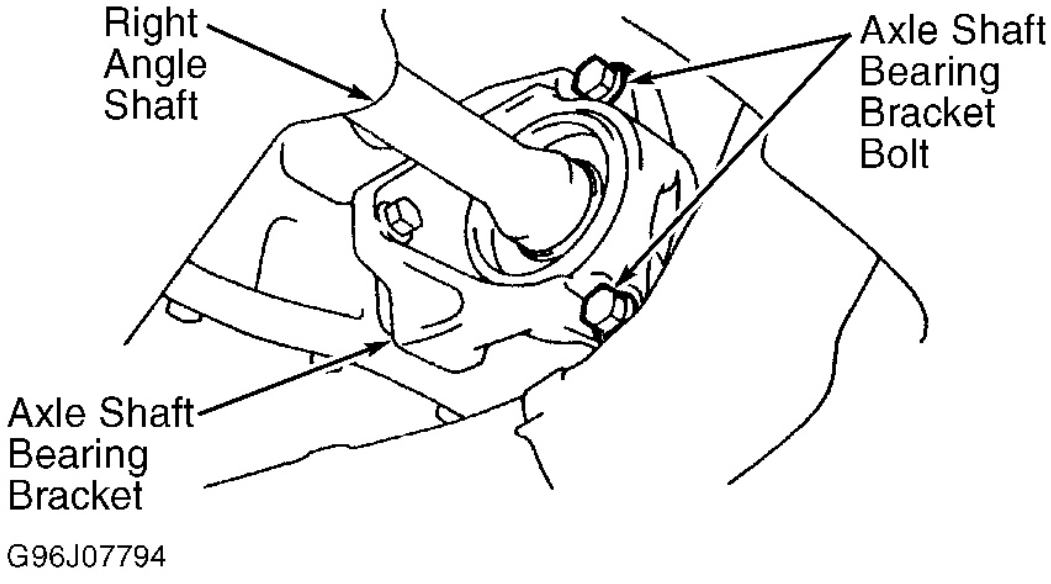


Fig. 10: Removing Right (Passenger-Side) Axle Shaft (2WD A/T Models)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

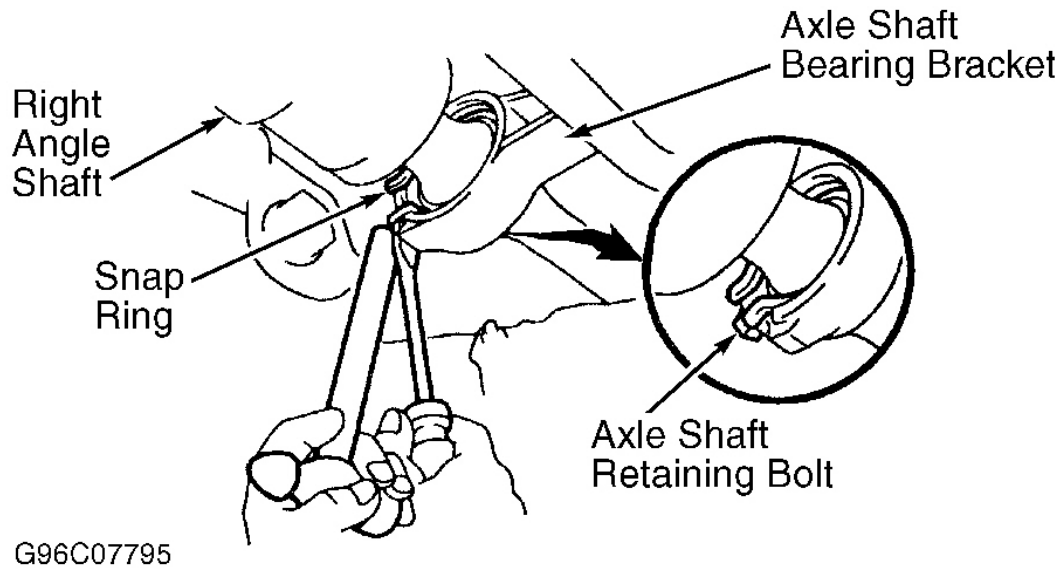


Fig. 11: Removing Right (Passenger-Side) Axle Shaft (2WD M/T Models)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

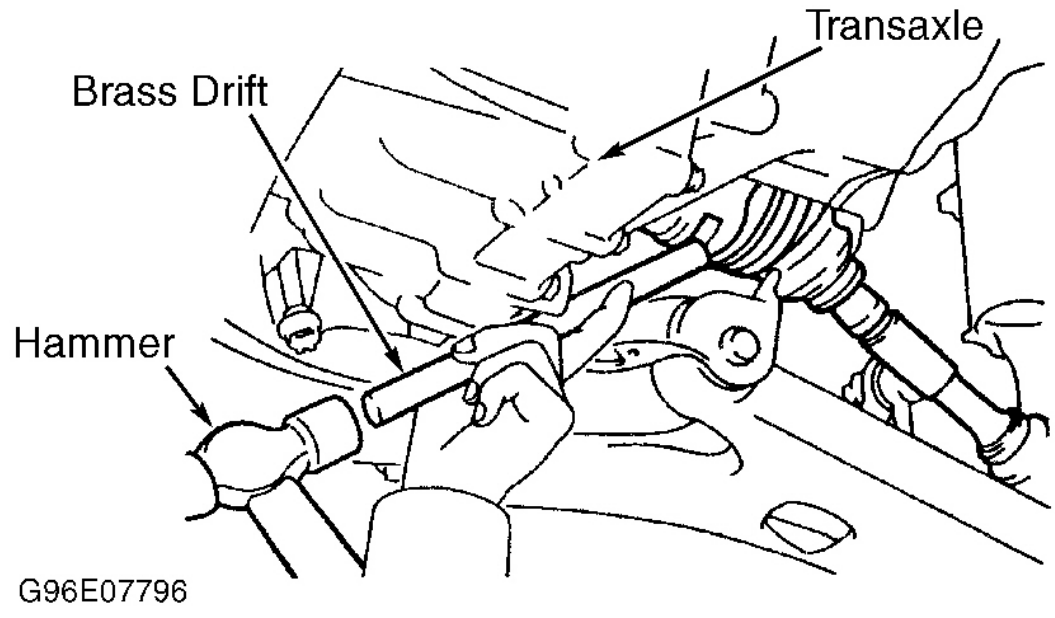


Fig. 12: Removing Left (Driver-Side) Axle Shaft (2WD Models) Or Right (Passenger-Side) Axle Shaft (4WD Models)

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

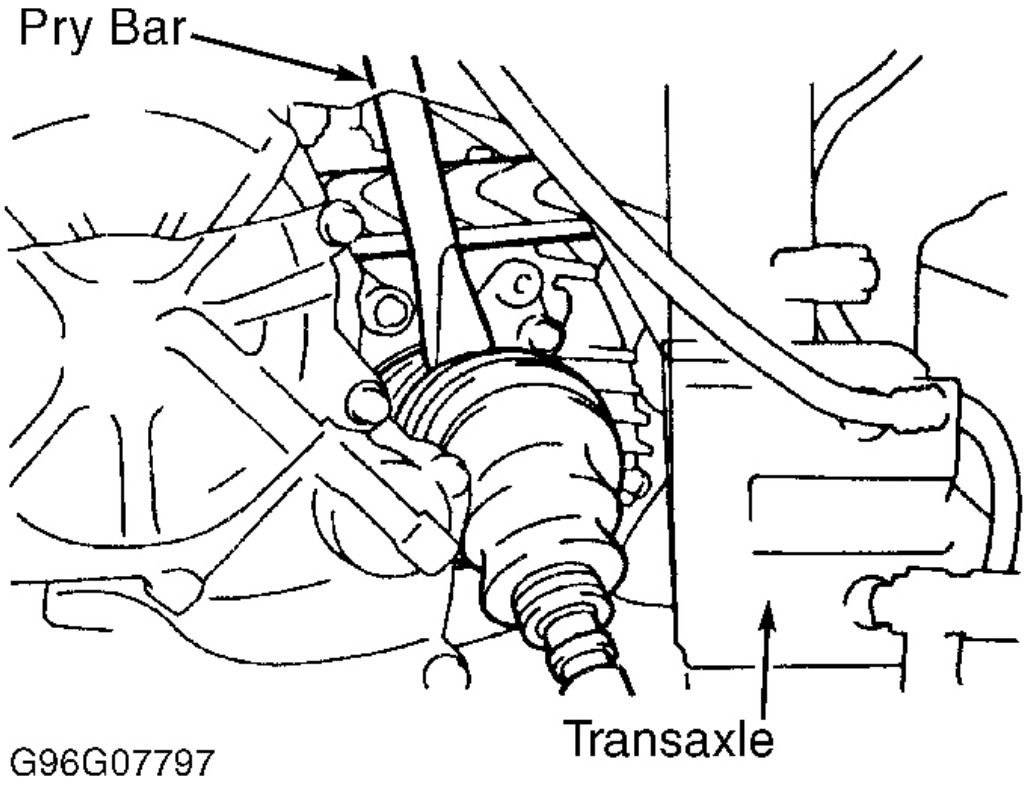


Fig. 13: Removing Left (Driver-Side) Axle Shaft (4WD Models)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

21. Remove stabilizer bar-to-frame mount bolts. Remove stabilizer bar with mounting brackets and insulators. Remove 2 steering gear assembly-to-front suspension crossmember bolts/nuts located at each end of steering gear assembly.
22. Support engine with hoist. Remove engine mount crossmember-to-front suspension crossmember nuts. Front suspension crossmember mounts between both lower control arms.
23. Support front suspension crossmember with floor jack. Remove front suspension crossmember bolts and front suspension crossmember.
24. Remove front (exhaust manifold side) engine mount-to-engine mount crossmember bolts. Remove engine mount crossmember-to-body bolts. Remove engine mount crossmember.
25. Remove power steering pump with hoses attached and secure aside. Remove left (transaxle side) engine mounting bracket-to-engine mount bolts/nuts. Remove right (timing belt side) engine mounting bracket-to-engine mount bolts/nuts. Lower engine from engine compartment.

Installation

1. Install engine in engine compartment. Loosely install right (timing belt side) engine mounting bracket-to-engine mount bolts/nuts.
2. Install and tighten left (transaxle side) engine mounting bracket-to-engine mount bolts/nuts to specification. See **TORQUE SPECIFICATIONS** . Tighten right (timing belt side) engine mounting bracket-to-engine mount bolts/nuts to specification.
3. Install power steering pump. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
4. Install engine mount crossmember with front (exhaust manifold side) engine mount-to-engine mount crossmember bolts and engine mount crossmember-to-body bolts loosely installed. DO NOT tighten bolts at this time.
5. Install front suspension crossmember on body with bolts loosely installed. Loosely install engine mount crossmember-to-front suspension crossmember nuts and steering gear assembly-to-front suspension crossmember bolts/nuts. DO NOT tighten bolts/nuts at this time.
6. Install and tighten front suspension crossmember bolts to specification. See **TORQUE SPECIFICATIONS** .
7. Tighten steering gear assembly-to-front suspension crossmember bolts/nuts and then engine mount crossmember-to-front suspension crossmember nuts to specification. See **TORQUE SPECIFICATIONS** .
8. Tighten front (exhaust manifold side) engine mount-to-engine mount crossmember bolts and then engine mount crossmember-to-body bolts to specification. See **TORQUE SPECIFICATIONS** .
9. To install remaining components, reverse removal procedure. Before installing axle shafts coat axle shaft seals in transaxle with grease.

NOTE: All axle shafts except right (passenger-side) axle shaft on 2WD models, use a snap ring on end of axle shaft. Ensure NEW snap ring is installed.

10. On all axle shafts except right (passenger-side) axle shaft on 2WD models, install NEW snap ring on end of axle shaft. Position snap ring on end of axle shaft with opening facing downward.
11. Install axle shaft by lightly tapping axle shaft into transaxle. Ensure axle shaft moves inward and outward approximately .079-.120"(2.00-3.00 mm) and cannot be pulled from transaxle.
12. On 2WD M/T models, when installing right (passenger-side) axle shaft, install NEW axle shaft retaining bolt. Tighten axle shaft retaining bolt to specification. See **TORQUE SPECIFICATIONS** .
13. On 4WD models, ensure reference marks on drive shaft flanges are aligned. Ensure mounting bracket on drive shaft center support bearing is straight and perpendicular to drive shaft before tightening bolts to specification.
14. On all models, use NEW gasket and NEW nuts when installing front exhaust pipe on catalytic converter. Ensure all bolts/nuts are loosely installed before tightening to specification.
15. Adjust fluid levels and control cables. On 2WD models with A/T, use Dexron-II ATF. On 4WD models with A/T, use Type "T" ATF. On all M/T models, use SAE 75-90 GL-5 gear oil.

CYLINDER HEAD & MANIFOLDS

NOTE: On 4WD models, manufacturer recommends engine removal for servicing of cylinder head and manifolds. See ENGINE. Proceed to appropriate step in following procedure for servicing of cylinder head and manifolds.

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** . Drain cooling system. Raise and support vehicle. Remove right lower engine cover.
2. Disconnect control cables at throttle body. Remove air cleaner assembly and air cleaner case. Remove accessory drive belt and generator. On 1997 models, remove distributor with spark plug wires. On 1998 models, remove front exhaust pipe.
3. On 1997 models, disconnect electrical connectors for oxygen sensors and remove exhaust manifold and front catalytic converter. On 1998 models, disconnect oxygen sensor (except California) or Air/Fuel ratio (A/F) sensor (California) and remove exhaust manifold and heat shield. On all models, remove sensors from exhaust manifold and front catalytic converter, if equipped. See **Fig. 14** .
4. On 1997 models, separate exhaust manifold and front catalytic converter and disconnect oil pressure switch. On 1998 models, remove heat insulator from front exhaust pipe. Remove ignition coils with spark plug wires attached. Disconnect oil pressure switch. See **Fig. 14** .
5. On all models, disconnect necessary electrical connectors, coolant hoses and vacuum hoses from throttle body, cylinder head and intake manifold. Remove coolant outlet, coolant by-pass pipe and gaskets. See **Fig. 14** .
6. Remove throttle body and gasket. Remove union bolt and disconnect fuel line at fuel filter. Remove EGR valve and vacuum modulator. Remove EGR Vacuum Switching Valve (VSV) from side of cylinder head. See **Fig. 14** .
7. Remove intake manifold brace located between cylinder block and intake manifold. On A/T models, disconnect control cable bracket from side of intake manifold. On all models, disconnect power steering fluid reservoir, PCV hoses, cable brackets and control cables for access to valve cover.
8. Disconnect engine wiring harness protector at rear of timing belt cover for access to valve cover. When disconnecting engine wiring harness protector, remove bolt on intake manifold side of engine first, and then bolt on exhaust manifold side of engine.
9. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly reference, as grommets must be installed in original location.
10. Remove bolts and disconnect engine wiring harness protector from rear side of intake manifold. Disconnect electrical connectors at injectors, A/C compressor and crankshaft position sensor. Remove engine wiring harness clamps from timing belt cover and generator drive belt adjusting bar.
11. Disconnect engine wiring harness protector from brackets on front side of intake manifold. Remove scuff plate from passenger-side door opening and passenger-side kick panel. Remove center console trim panel from passenger-side of center console.
12. Disconnect 2 electrical connectors from Engine Control Module (ECM), and 2 electrical connectors on bracket. See **Fig. 9** . Disconnect electrical connector for relay box located behind passenger-side kick panel.
13. Disconnect engine wiring harness clamp located on engine wiring, near firewall. Pull engine wiring harness out through firewall. Remove engine wiring harness from between cylinder head and intake manifold.

NOTE: After removing timing belt from camshaft sprocket, manufacturer recommends supporting timing belt so belt does not come off crankshaft sprocket. If timing belt comes off crankshaft sprocket, timing belt must be completely removed and reinstalled.

14. Remove timing belt from camshaft sprocket. Remove camshaft sprocket, No. 1 idler pulley and tension spring. See **TIMING BELT** . Remove No. 3 timing belt cover from cylinder head. See **Fig. 14** . Remove camshafts. See **CAMSHAFTS** .

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

15. Loosen cylinder head bolts in proper sequence using several steps. See **Fig. 15** . Remove cylinder head bolts, washers, cylinder head with intake manifold. If cylinder head is difficult to remove, carefully pry between cylinder head and block using a screwdriver. Use care not to damage contact surfaces between cylinder head and block. Remove cylinder head gasket from cylinder block.
16. Remove air tube bolted onto side of intake manifold. Remove bolts/nuts, intake manifold and gasket from cylinder head.
17. Remove fuel delivery pipe-to-cylinder head bolts. Remove fuel delivery pipe from cylinder head. Remove fuel injectors and spacers from cylinder head. Remove oil pressure switch from side of cylinder head.
18. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

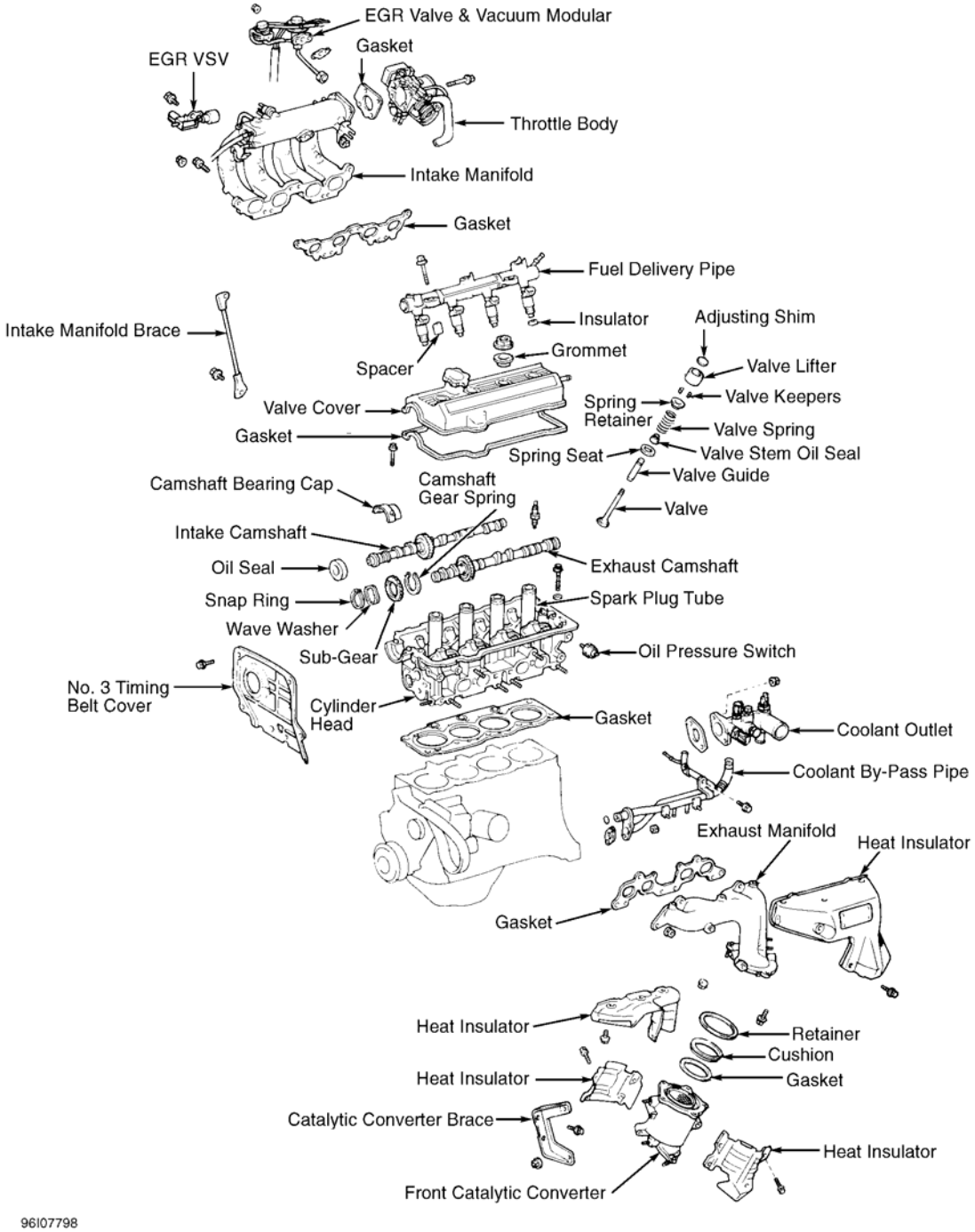


Fig. 14: Exploded View Of Typical Cylinder Head & Components (1997 Shown; 1998 Is Similar)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

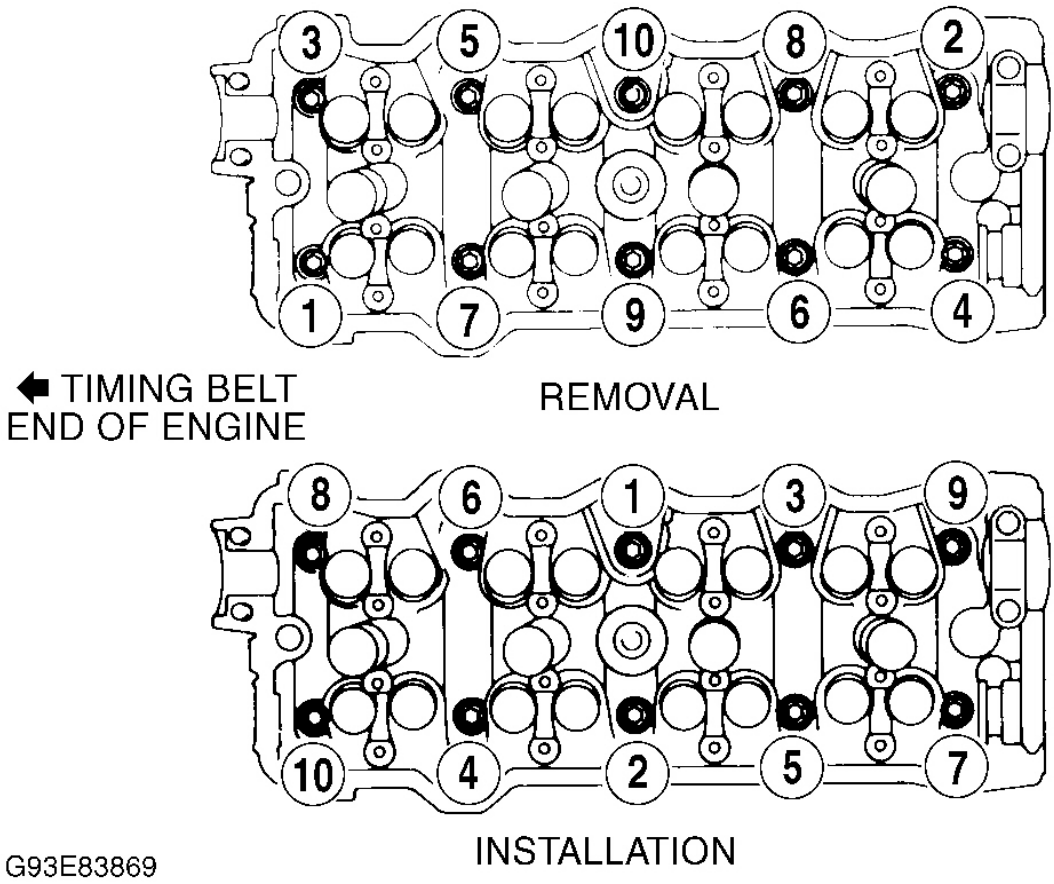


Fig. 15: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect cylinder head warpage at cylinder block, exhaust manifold and intake manifold surfaces. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS.
2. Inspect cylinder block deck surface for warpage. Replace cylinder block if deck surface warpage exceeds specification. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS.
3. Inspect intake and exhaust manifold machined surfaces for warpage. Replace component if warpage exceeds .0118" (.300 mm). Inspect camshaft and components. See **CAMSHAFTS** .
4. Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if not within specification. See **VALVE LIFTERS** under ENGINE SPECIFICATIONS.

Installation

1. Install NEW insulator at bottom of fuel injector and NEW grommet on top of fuel injector. Coat NEW "O" rings with gasoline and install on fuel injector.
2. Install 2 spacers on cylinder head. Install fuel injectors on cylinder head. Install fuel delivery pipe on fuel injectors. Using twisting motion, push fuel injectors into fuel delivery pipe.
3. Install and slightly tighten fuel delivery pipe-to-cylinder head bolts. Ensure all fuel injectors rotate smoothly. If fuel injector fails to rotate smoothly, check for improperly installed or damaged "O" rings.
4. Position electrical connector on fuel injector facing toward top of engine. Tighten fuel delivery pipe-to-cylinder head bolts to specification. See **TORQUE SPECIFICATIONS** .
5. Using NEW gasket, install intake manifold. Install and tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS** . Install air tube on side of intake manifold.
6. Install adjusting shims and valve lifters in original location on cylinder head (if removed). Ensure valve lifters rotate smoothly in cylinder head.
7. Install NEW gasket for cylinder head on cylinder block. Ensure all holes in gasket align with holes in cylinder block.
8. 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. 15** . See **TORQUE SPECIFICATIONS** .
9. Install camshafts using proper procedure. See CAMSHAFTS. Install No. 3 timing belt cover. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS** .
10. To install remaining components, reverse removal procedure. If camshaft or cylinder head components are serviced, adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.
11. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See **Fig. 4** . Using NEW gasket, install valve cover.
12. Install grommets in original location with marking on grommet aligned in designated area. See **Fig. 5** . Install and tighten valve cover nuts to specification. See **TORQUE SPECIFICATIONS** .
13. Install NEW throttle body gasket with protruding area on gasket facing toward bottom of throttle body. On throttle bodies using 4 mounting bolts, ensure longer bolts are installed in 2 lower bolt holes.
14. Install NEW "O" ring on coolant by-pass pipe and NEW gasket on water pump cover before installing 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.
15. Use NEW gasket and NEW nuts when installing front exhaust pipe on front catalytic converter. Ensure all bolts/nuts are loosely installed on front exhaust pipe before tightening to specification. See **TORQUE SPECIFICATIONS** .
16. Install NEW "O" ring on distributor. Coat "O" ring with engine oil. Rotate crankshaft clockwise, as 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.
17. Ensure slot area on intake camshaft is positioned vertically. Rotate drive coupling on distributor so cutout aligns with alignment mark on distributor housing. See **Fig. 16** .
18. Install distributor so center of flange on distributor is aligned with bolt hole on cylinder head. Install distributor hold-down bolt. Adjust control cables and ignition timing. Fill cooling system.

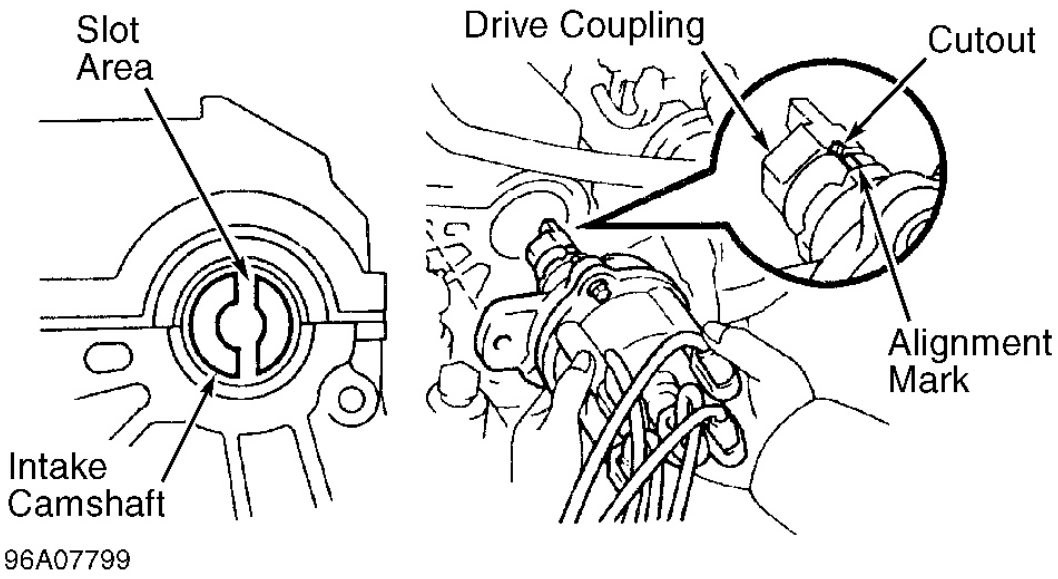


Fig. 16: Installing Distributor (1997)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKSHAFT FRONT SEAL

Removal & Installation (Oil Pump Installed)

1. Remove timing belt and crankshaft sprocket. See TIMING BELT. Using a knife, cut 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 seal until seal surface is even with oil pump housing. Apply grease to lip of NEW seal.

TIMING BELT

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. DO NOT bend, twist or turn timing belt inside out. DO NOT expose timing to oil, water or steam.

Removal

1. Disconnect negative battery cable. Remove power steering fluid reservoir with mounting bracket. Remove accessory drive belts. Remove generator and generator mounting bracket. Remove wiring brackets for access to timing belt covers.
2. On models with Anti-Lock Brake System (ABS), disconnect electrical connectors and brake lines from ABS actuator. ABS actuator is located in front of passenger-side strut tower. Remove ABS actuator mounting bracket-to-body bolts/nuts. Remove ABS actuator with mounting bracket.
3. On all models, raise and support vehicle. Remove passenger-side lower engine cover. Remove passenger-side front wheel.
4. Using floor jack, slightly raise engine to remove weight from right (timing belt side) engine mount at timing belt cover. Remove right (timing belt side) engine mount from body and mounting bracket on cylinder block for access to timing belt covers.
5. Remove spark plugs. Remove crankshaft pulley bolt. Using puller, remove crankshaft pulley. Remove right (timing belt side) engine mounting bracket from front of cylinder block.
6. Disconnect engine wiring harness protector from rear of No. 2 timing belt cover. When disconnecting engine wiring harness protector, remove bolt on intake manifold side of engine first and then bolt on exhaust manifold side of engine.
7. Remove No. 2 timing belt cover. See **Fig. 17** . Install crankshaft pulley on crankshaft. Temporarily install crankshaft pulley bolt.
8. 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.
9. Ensure hole in camshaft sprocket aligns with alignment mark on camshaft bearing cap. See **Fig. 18** . If hole in camshaft sprocket is not aligned with alignment mark, rotate crankshaft clockwise one full revolution.

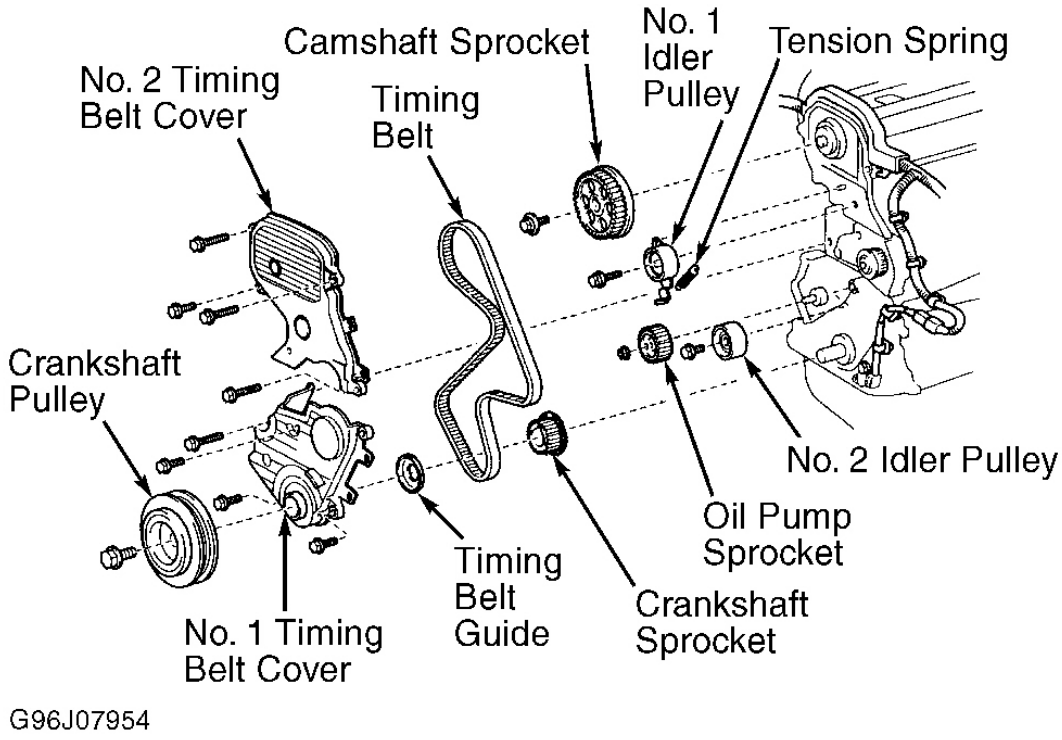


Fig. 17: Exploded View Of Timing Belt & Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

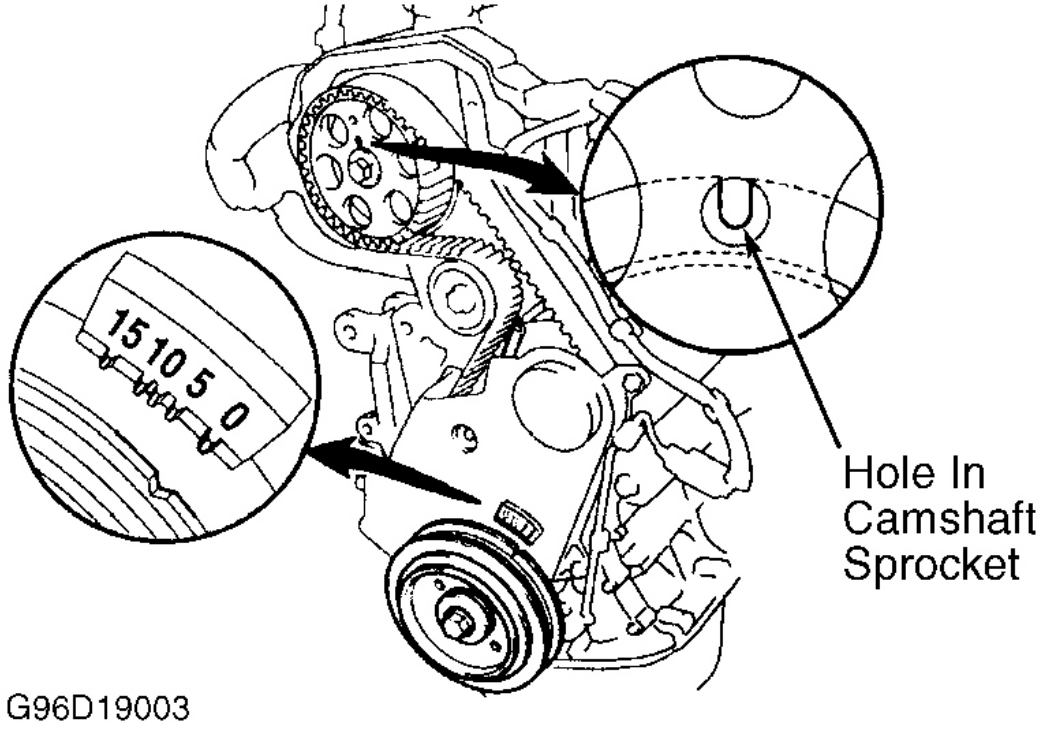


Fig. 18: Aligning Camshaft Timing Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

10. Loosen No. 1 idler pulley bolt. See **Fig. 17** . Move No. 1 idler pulley outward, as far as possible, away from timing belt. Temporarily retighten No. 1 idler pulley bolt.
11. Remove timing belt from camshaft sprocket. Hold crankshaft pulley and remove crankshaft pulley bolt. Using puller, remove crankshaft pulley. DO NOT allow crankshaft to rotate when removing crankshaft pulley.
12. Remove No. 1 timing belt cover. See **Fig. 17** . Note direction of timing belt guide installation. See **Fig. 17** . 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 idler pulleys (if necessary). If removing camshaft sprocket, use spanner wrench to hold camshaft sprocket and remove camshaft sprocket bolt. Remove camshaft sprocket.
15. If removing crankshaft sprocket, use puller to pull crankshaft sprocket from crankshaft. If removing oil pump sprocket, hold oil pump sprocket by installing spanner wrench in holes on front of oil pump sprocket. Remove oil pump sprocket nut. Remove spanner wrench and oil pump sprocket.

Inspection

1. Inspect timing belt for damaged teeth, cracking or oil contamination. Ensure idler pulleys rotate freely. Replace components if damaged or worn.
2. Ensure free length of tension spring is within specification. See **TENSION SPRING SPECIFICATIONS** . Measure tension required to extend tension spring to specified installed length. Replace tension spring if tension is not within specification. See **TENSION SPRING SPECIFICATIONS** .

TENSION SPRING SPECIFICATIONS

Application	Specification
Free Length	
1997	1.811" (46.00 mm)
1998	1.654" (42.00 mm)
Tension At Spring Installed Length (1)	
1997	5.0-6.1 lbs. (2.27-2.77 kg)
1998	7.0-8.5 lbs. (3.18-3.86 kg)
(1) Installed length of spring is 1.988" (50.5 mm).	

Installation

1. If installing oil pump sprocket, align cutout areas on oil pump sprocket with areas on oil pump shaft. Install oil pump sprocket. Install and tighten oil pump sprocket nut to specification while holding oil pump sprocket with spanner wrench. See **TORQUE SPECIFICATIONS** .
2. If installing crankshaft sprocket, align crankshaft sprocket with key in crankshaft. Install crankshaft sprocket with flange toward cylinder block. See **Fig. 17** .
3. Install No. 2 idler pulley (if removed). Install and tighten bolt to specification. See **TORQUE SPECIFICATIONS** . Ensure idler pulley is clean and rotates smoothly.
4. Install No. 1 idler pulley and tension spring (if removed). DO NOT tighten bolt at this time. Ensure pivot hole on No. 1 idler pulley mounting flange engages with pin on front of cylinder block.
5. Move idler pulley away from timing belt area as far as possible. Temporarily tighten No. 1 idler pulley bolt. Ensure idler pulley is clean and rotates smoothly.
6. If installing camshaft sprocket, align pin groove in camshaft sprocket with pin in camshaft. Install camshaft sprocket. Install and tighten camshaft sprocket bolt to specification. See **TORQUE SPECIFICATIONS** . Using crankshaft pulley bolt, rotate crankshaft so key on crankshaft is at 12 o'clock position.

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

7. Ensure all sprockets and idler pulleys are clean. Install timing belt on crankshaft sprocket, oil pump sprocket, water pump sprocket,No. 1 idler pulley and then No. 2 idler pulley.
8. Install timing belt guide with cupped side away from crankshaft sprocket and flat side toward timing belt. Install No. 1 timing belt cover.

9. Remove crankshaft pulley bolt. Align crankshaft pulley key groove with key in crankshaft. Install crankshaft pulley. Temporarily install and tighten crankshaft pulley bolt.
10. Rotate camshaft and align hole in camshaft sprocket with alignment mark on camshaft bearing cap. See **Fig. 18** .
11. If using NEW timing belt, go to step 16). 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 16).
12. 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 surface of No. 1 timing belt cover.
13. Pull 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.
14. If reference mark is above surface 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 surface of No. 1 timing belt cover.
15. Pull 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.
16. Install timing belt on camshaft sprocket. If reusing timing belt, ensure reference mark on timing belt aligns with reference mark placed on camshaft sprocket. Ensure tension exists on timing belt between crankshaft and camshaft sprockets.
17. Loosen No. 1 idler pulley bolt 1/2 turn. Rotate crankshaft pulley 2 full revolutions clockwise from TDC to TDC. DO NOT rotate crankshaft counterclockwise.
18. 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. 18** . If timing marks are not aligned, remove timing belt and reinstall.
19. Rotate crankshaft clockwise 1 7/8 revolutions and align crankshaft pulley "0" mark with 45-degree Before Top Dead Center (BTDC) mark on No. 1 timing belt cover. See **Fig. 19** .

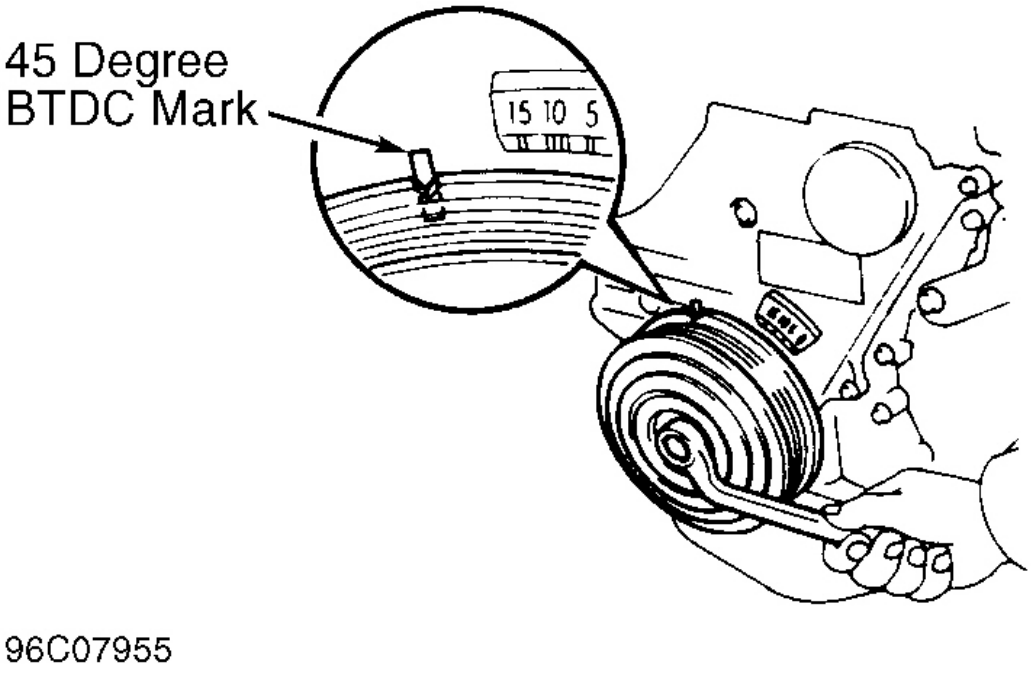


Fig. 19: Aligning Crankshaft Pulley With 45-Degree BTDC Mark
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

20. Tighten No. 1 idler pulley bolt to specification. See **TORQUE SPECIFICATIONS** . Install right (timing belt side) engine mounting bracket on front of cylinder block with bolts loosely installed. DO NOT tighten bolts at this time.
21. Install No. 2 timing belt cover. Install engine wire and engine wire protector on rear of No. 2 timing belt cover. When installing engine wire protector, install bolt on exhaust manifold side of engine first and then bolt on intake manifold side of engine.
22. Remove crankshaft pulley bolt and crankshaft pulley. Tighten right (timing belt side) engine mounting bracket-to-cylinder block bolts to specification. See **TORQUE SPECIFICATIONS** .
23. Reinstall crankshaft pulley. Install and tighten crankshaft pulley bolt to specification. See **TORQUE SPECIFICATIONS** .
24. Install right (timing belt side) engine mount on body and mounting bracket on cylinder block. Tighten right (timing belt side) engine mount-to-body bolts to specification. See **TORQUE SPECIFICATIONS** .
25. Tighten right (timing belt side) mounting bracket-to-engine mount bolts/nuts to specification. See **TORQUE SPECIFICATIONS** . To install remaining components, reverse removal procedure. On models with ABS, bleed brake system after install ABS actuator.

VALVE LIFTER

Removal

Remove camshaft. See **CAMSHAFTS** . 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** 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.

CAMSHAFTS

Removal (Exhaust Side)

1. Remove timing belt and camshaft sprocket. See **TIMING BELT** . Remove No. 3 timing belt cover.See **Fig. 14** .
2. Disconnect power steering fluid reservoir, PCV hoses, cable brackets and control cables for access valve cover. Disconnect spark plug wires from spark plugs. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly reference, as grommets must be installed in original location.

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

3. For servicing of exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See **Fig. 20** . 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 main gear on exhaust camshaft with a 6 x 1.0 x 18 mm service bolt "B". See **Fig. 21** . Before removing camshaft bearing cap bolts, ensure torsional spring force of sub-gear is secured by service bolt "B".

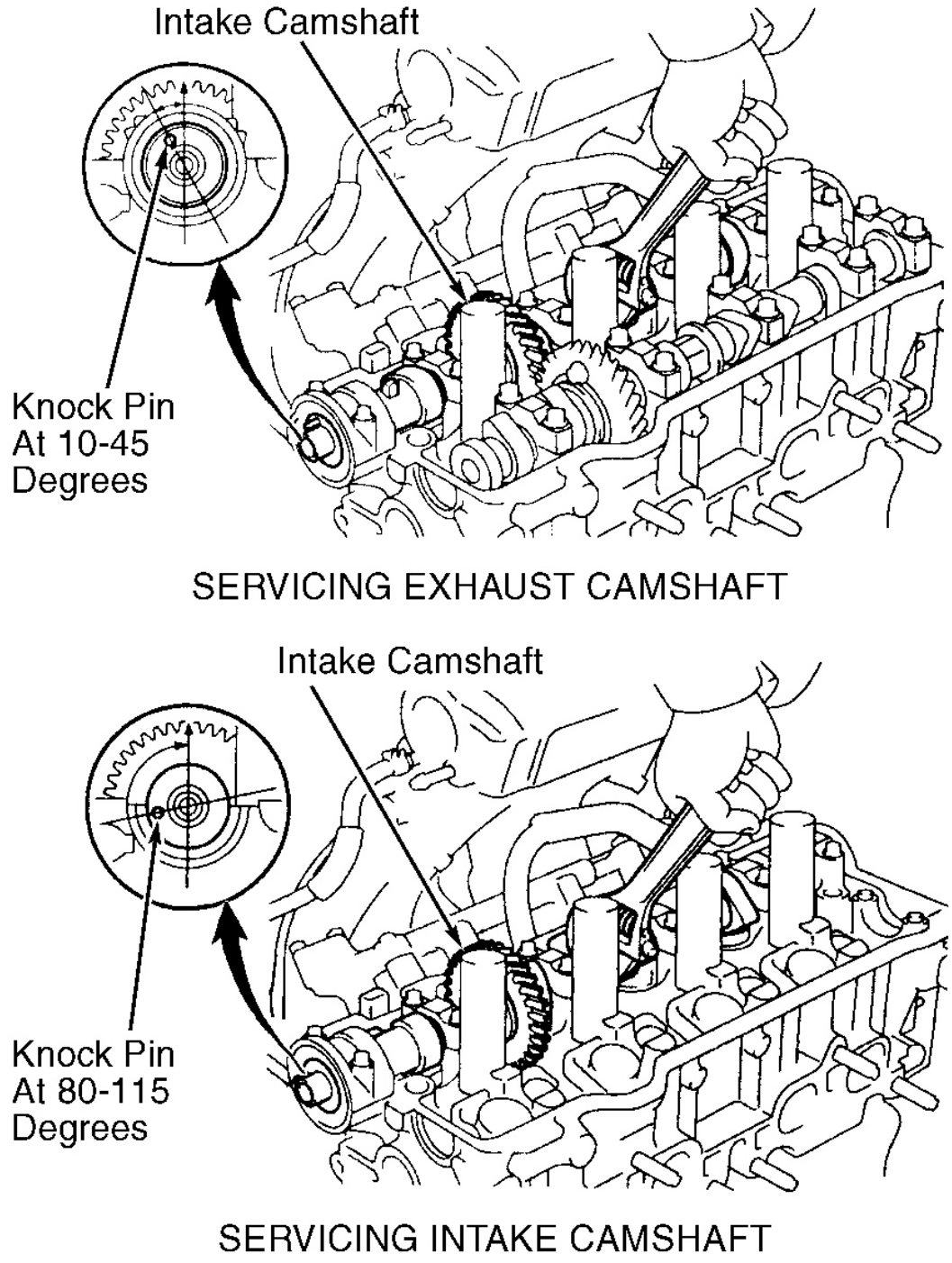


Fig. 20: Positioning Camshafts
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

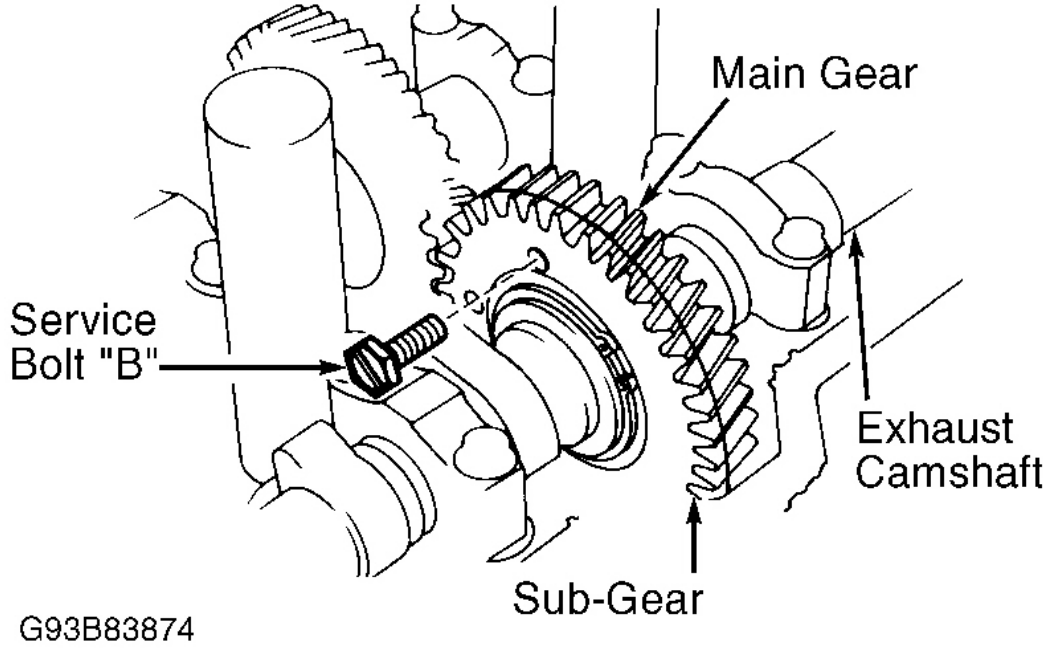


Fig. 21: Securing Sub-Gear-To-Main Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: Camshaft bearing caps are numbered for location with arrow on top of 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. 22 .

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. 23** . 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 upward as No. 3 camshaft bearing cap bolts are loosened.
7. If exhaust camshaft is not lifted upward, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 10-45 degrees from vertical position. See **Fig. 20** . Repeat steps 5) and 6). Remove No. 3 camshaft bearing cap and exhaust camshaft.

Removal (Intake Side)

1. Remove distributor, if equipped. Rotate intake camshaft so knock pin is 80-115 degrees from vertical

position. See **Fig. 20** . This aids in intake camshaft removal by using camshaft lobes on cylinders No. 1 and 3 to push on valve lifters.

2. Remove 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. 24** . 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.

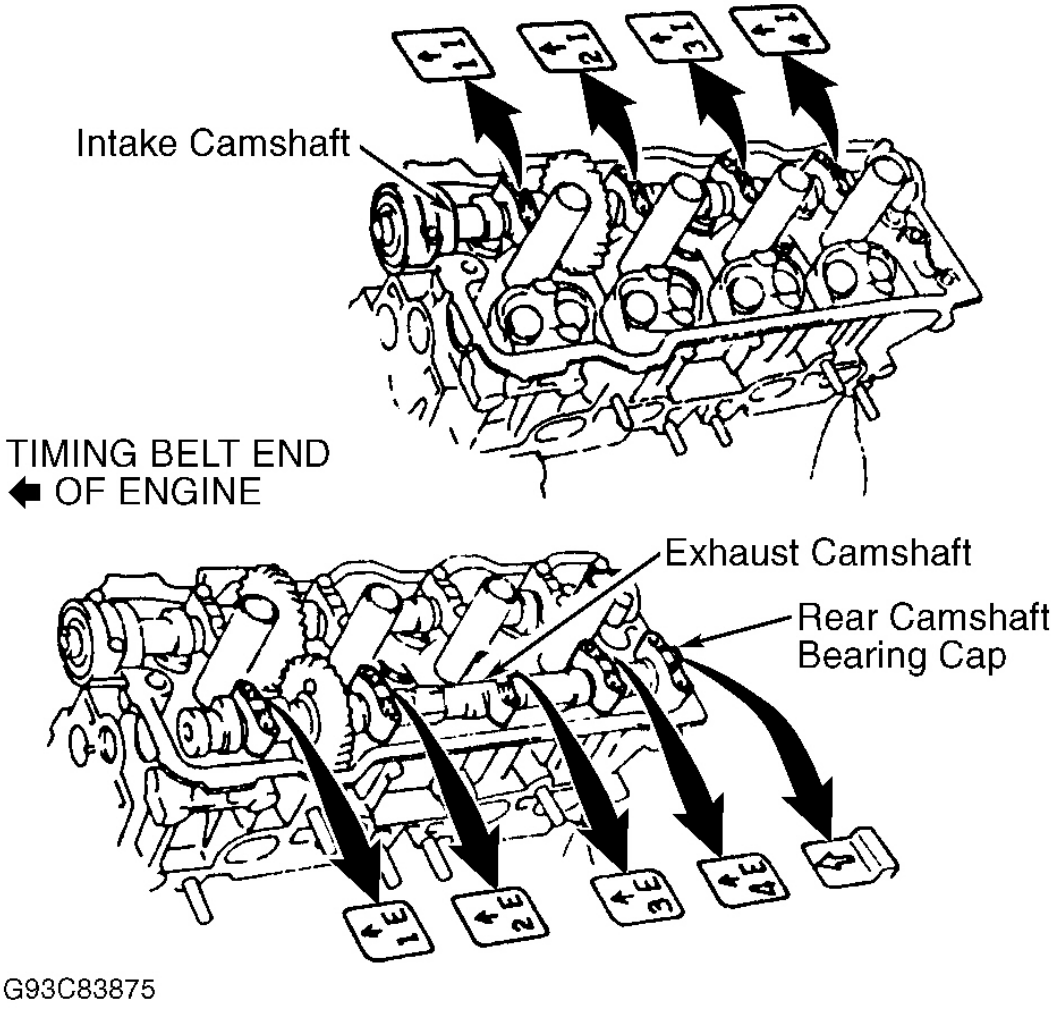


Fig. 22: Identifying Camshaft Bearing Caps
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

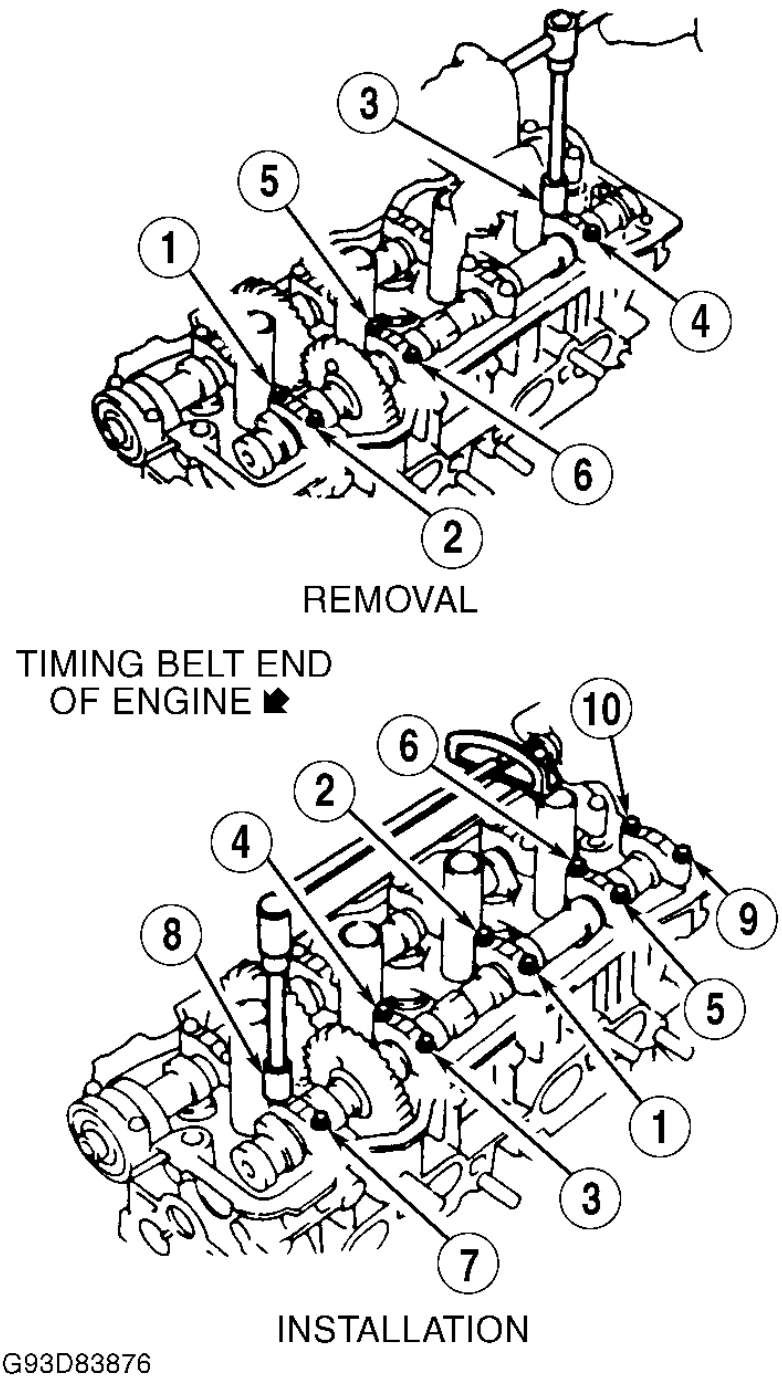


Fig. 23: Exhaust Camshaft Bearing Cap Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

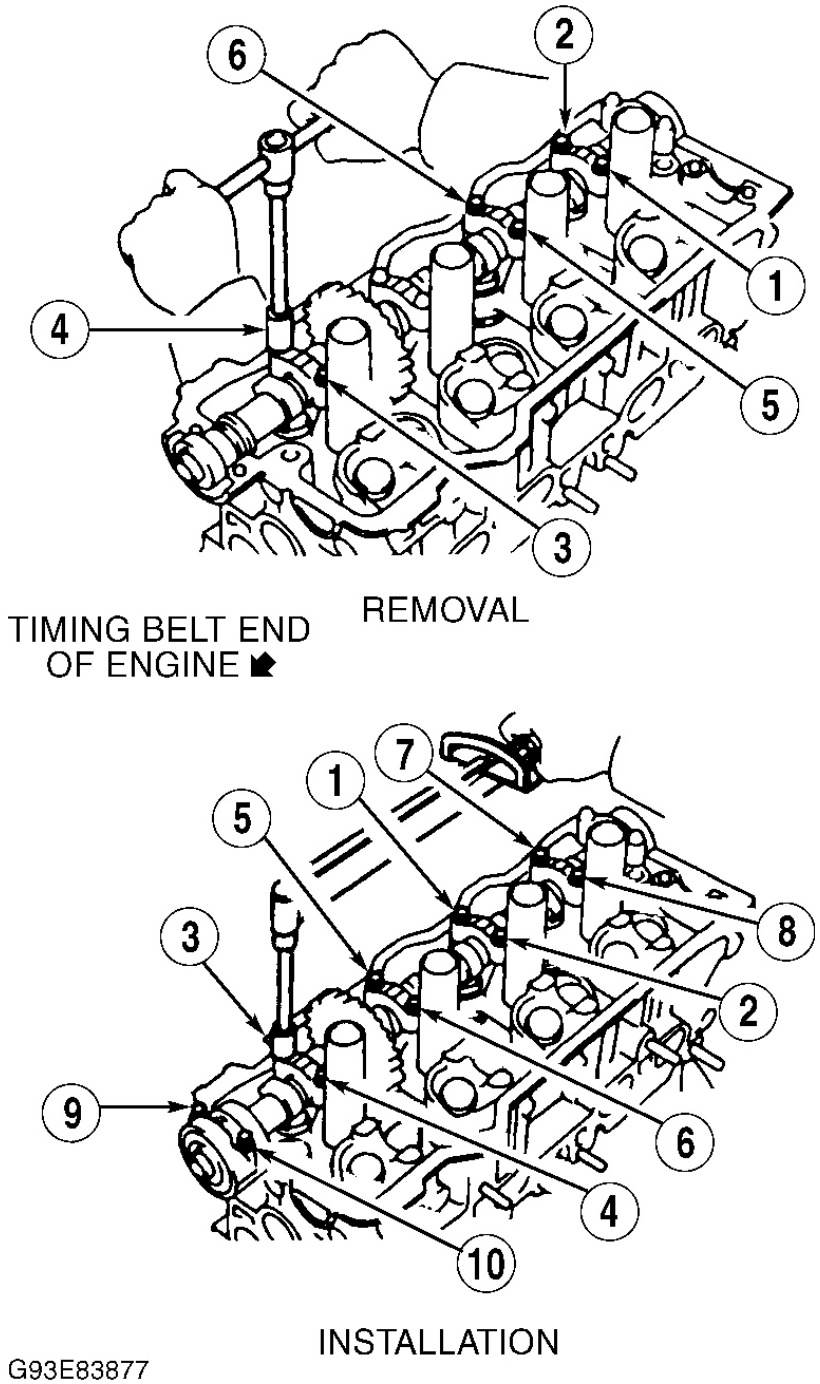


Fig. 24: Intake Camshaft Bearing Cap Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Alternately loosen bolts on No. 2 camshaft bearing cap on intake camshaft. Ensure intake camshaft is

lifted upward as No. 2 camshaft bearing cap bolts are loosened.

4. If intake camshaft is not lifted upward, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 80-115 degrees from vertical position. See **Fig. 20** . Repeat steps 9) and 10). Remove No. 2 camshaft bearing cap and intake camshaft.
5. If removing sub-gear from exhaust camshaft, mount camshaft in soft-jaw vise on hexagonal area of camshaft. Install service bolt "A" in camshaft. See **Fig. 25** .
6. Using screwdriver, rotate sub-gear clockwise and remove service bolt "B". Remove snap ring, wave washer, sub-gear and camshaft gear spring from exhaust camshaft. See **Fig. 14** .
7. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

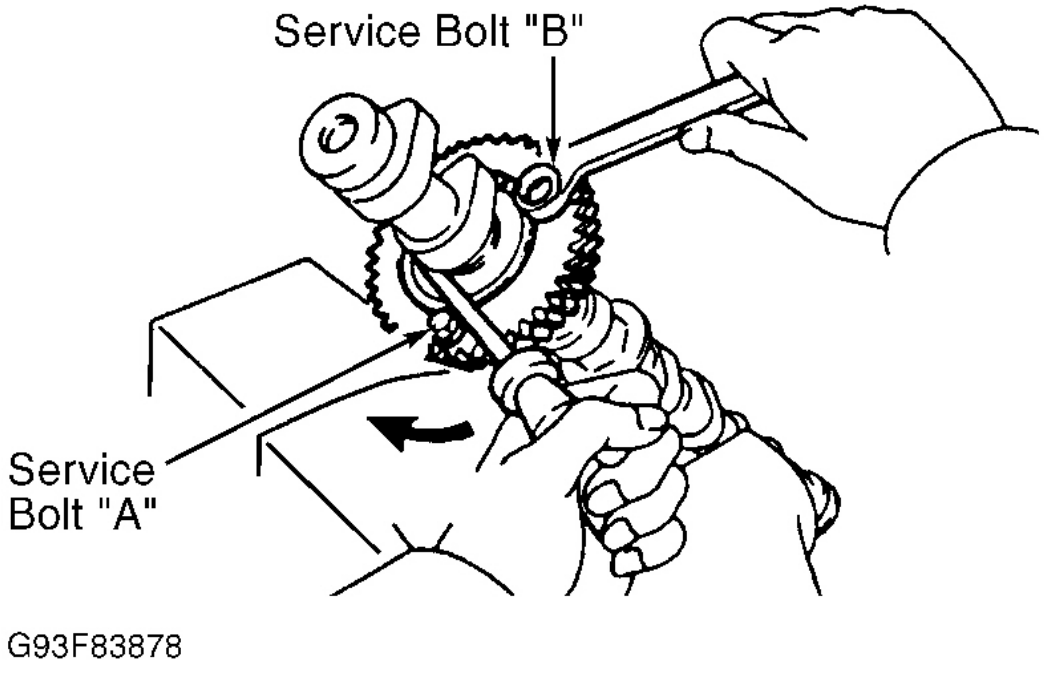


Fig. 25: Removing & Installing Sub-Gear On Main Gear
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect components for damage. Check camshaft journal diameter, lobe height and journal runout. Replace camshaft if not within specification. See **CAMSHAFT** 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. 23** and **Fig. 24** . See **TORQUE SPECIFICATIONS** .
3. Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft

and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** under ENGINE SPECIFICATIONS.

4. Install both camshafts in cylinder head without sub-gear installed on exhaust camshaft. Install and tighten camshaft bearing cap bolts to specification in sequence. See **Fig. 23** and **Fig. 24** . See **TORQUE SPECIFICATIONS** .
5. Using dial indicator, check gear backlash between gears on camshafts. Replace camshafts if gear backlash exceeds specification. See **CAMSHAFT** under ENGINE SPECIFICATIONS.
6. Measure distance between ends of camshaft gear spring. Replace camshaft gear spring if distance is not .886-.902" (22.50-22.90 mm). Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if not within specification. See **VALVE LIFTERS** 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. Install service bolt "A" on sub-gear. See **Fig. 25** . Using screwdriver, rotate sub-gear clockwise and align holes in sub-gear with hole on main gear. Install service bolt "B". Remove service bolt "A".
3. Install adjusting shims and valve lifters in original location on cylinder head (if removed). Ensure valve lifters rotate smoothly in cylinder head.
4. 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. 20** .
5. Coat seal lip of NEW oil seal for intake camshaft with grease. Install oil seal on front of intake camshaft until oil seal is fully seated in cylinder head. Apply sealant on front camshaft bearing cap for intake camshaft. See **Fig. 26** .

Fig. 26: Applying Sealant On Front Camshaft Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

6. 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. 22** .
7. Coat threads and bolt head-to-camshaft bearing cap contact surfaces of camshaft bearing cap bolts with engine oil. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See **Fig. 24** . See **TORQUE SPECIFICATIONS** .
8. To install exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See **Fig. 20** . Install exhaust camshaft so timing mark aligns with timing mark on intake camshaft. DO NOT use assembly reference marks. See **Fig. 27** . 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.

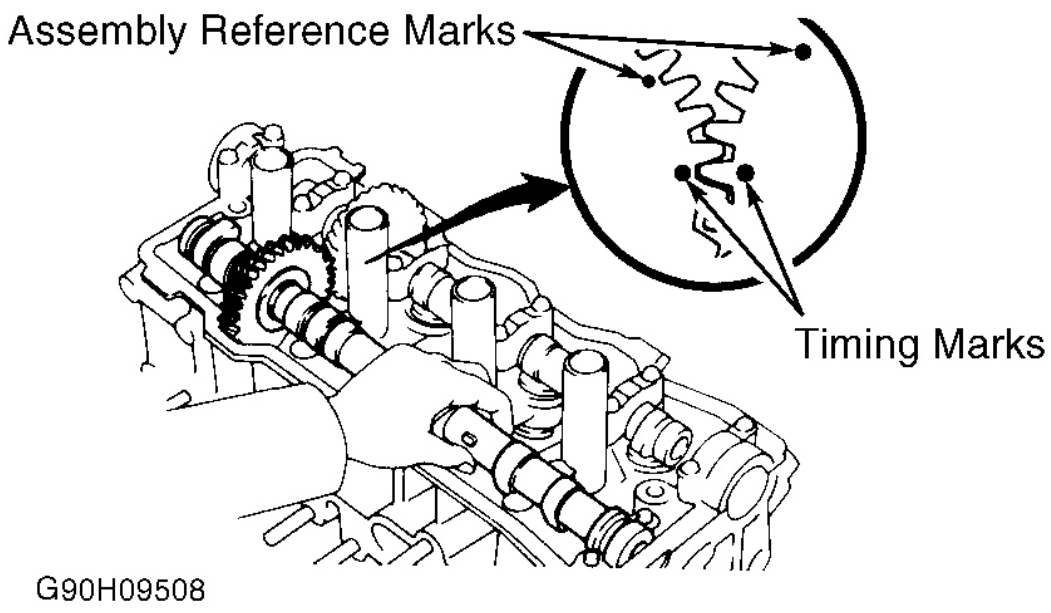


Fig. 27: Aligning Camshaft Timing Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

9. Install camshaft bearing caps for exhaust camshaft on cylinder head in numerical sequence with arrow pointing toward timing belt end of engine. See **Fig. 22** .
10. Coat threads and bolt head-to-camshaft bearing cap contact surfaces of camshaft bearing cap bolts with engine oil. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See **Fig. 23** . See **TORQUE SPECIFICATIONS** .
11. Remove service bolt "B" from camshaft gear. See **Fig. 25** . Install No. 3 timing belt cover. Install and tighten bolts to specification. See **TORQUE SPECIFICATIONS** . Install timing belt using proper procedure. See **TIMING BELT** .
12. 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.
13. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See **Fig. 4** .
14. Using NEW gasket, install valve cover. Install grommets in original location with marking on grommet aligned in designated area.See **Fig. 5** . Install and tighten valve cover nuts to specification. See **TORQUE SPECIFICATIONS** .
15. If installing distributor, install NEW "O" ring on distributor. Coat "O" ring with engine oil.
16. 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.

17. Ensure slot area on intake camshaft is vertically positioned. Rotate coupling on distributor so cutout aligns with alignment mark on distributor housing. See **Fig. 16** .
18. Install distributor so center of flange on distributor is aligned with bolt hole on cylinder head. Install distributor hold-down bolt(s). Adjust ignition timing.

CRANKSHAFT REAR OIL SEAL

NOTE: On 4WD models, manufacturer recommends removing engine with transaxle for transaxle removal. On 2WD models, transaxle may be removed with engine in vehicle.

Removal

Remove transaxle, clutch assembly (if equipped) and flywheel/drive plate. Using a 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 (SST 09223-15030), 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 pulley(s) as needed for access to water pump. See **TIMING BELT** .
2. Disconnect lower radiator hose from thermostat housing. Remove generator adjusting bracket. Remove coolant by-pass pipe-to-water pump nuts. See **Fig. 28** .
3. Remove water pump bolts in sequence. See **Fig. 29** . Remove water pump, water pump cover and "O" rings. See **Fig. 28** . Remove water pump-to-water pump cover bolts. Remove water pump and gasket from water pump cover.

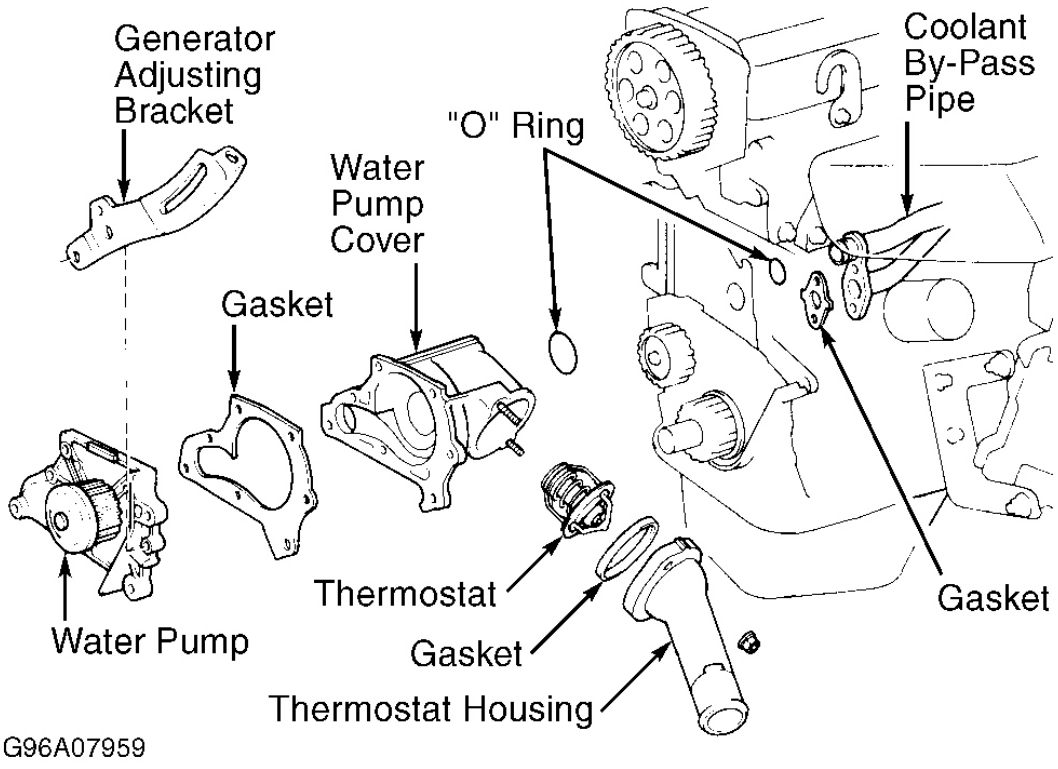
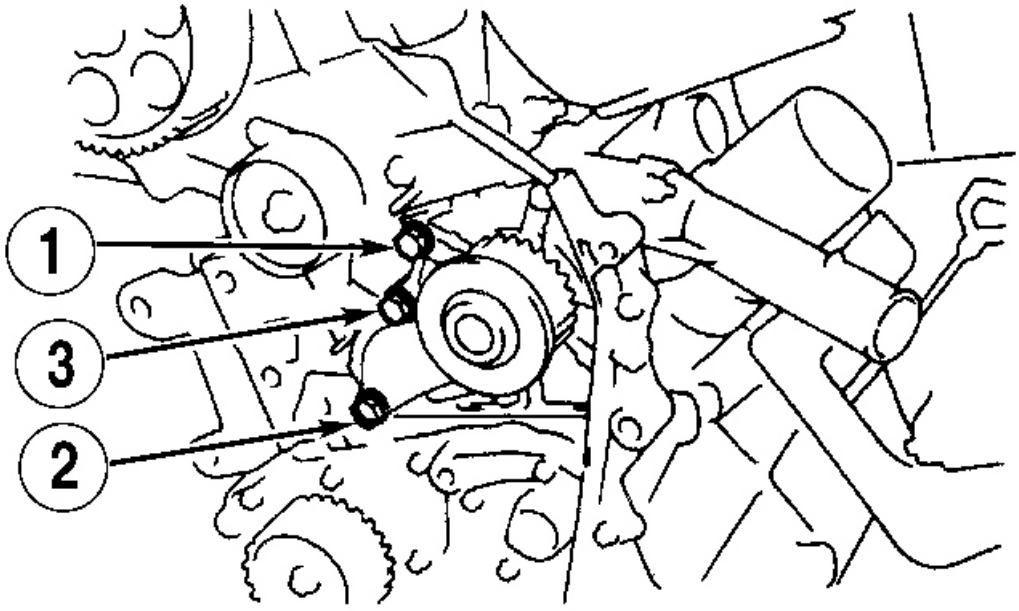
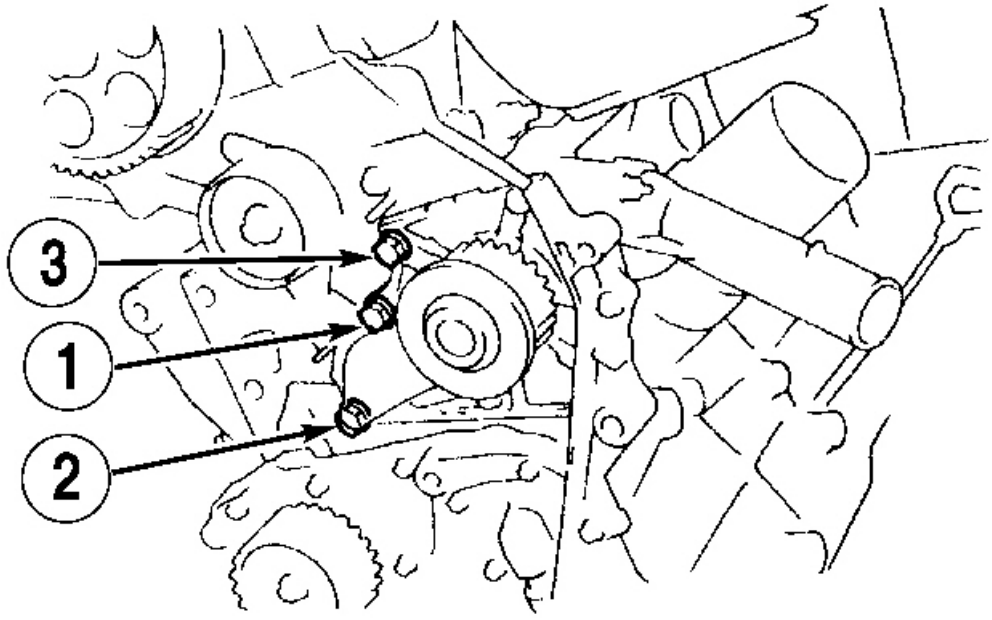


Fig. 28: Exploded View Of Typical Water Pump & Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



REMOVAL



INSTALLATION

G96F19005

Fig. 29: Water Pump Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Installation

1. To install, reverse removal procedure. Use 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 **Fig. 29** . See **TORQUE SPECIFICATIONS** . 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 oil dipstick. Remove front exhaust pipe that fits between front catalytic converter on exhaust manifold and rear exhaust pipe for access to oil pan.
2. Remove stiffener plate at rear of oil pan for access to oil pan. Stiffener plate fits between sides of cylinder block and front of transaxle. 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. Install and tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS** .
3. To install remaining components, reverse removal procedure. Use NEW gasket and NEW nuts when installing front exhaust pipe on catalytic converter. Ensure all bolts/nuts are loosely installed before tightening to specification. See **TORQUE SPECIFICATIONS** .

OVERHAUL

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** under ENGINE SPECIFICATIONS.
2. Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See **Fig. 23** and **Fig. 24** . See **TORQUE SPECIFICATIONS** .
3. Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft oil clearance or end play is not within specification. See **CAMSHAFT** under ENGINE SPECIFICATIONS.

4. Ensure valve lifter bore diameter in cylinder head is within specification. See **VALVE LIFTERS** under ENGINE SPECIFICATIONS.

Valve Springs

Ensure valve spring free length, pressure and out-of-square are within specification. See **VALVES & VALVE SPRINGS** 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 Brown and exhaust valve stem oil seal is Black. Ensure valve stem oil seal is installed in proper location.

Valve Stem Oil Seals

Intake valve stem oil seal is Brown and exhaust valve stem oil seal is Black. 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 (SST 09201-41020).

Valve Guides

1. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.
2. To replace valve guide, heat cylinder head to 176-212°F (80-100°C). Using a hammer and Valve Guide Remover/Installer set (SST 09201-01060), drive valve guide from camshaft side of cylinder head.
3. Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4325-.4335" (10.985-11.012 mm), use standard valve guide. If bore inside diameter is .4344-.4355" (11.035-11.062 mm), use oversize valve guide.
4. If bore inside diameter exceeds .4335" (11.012 mm), machine valve guide bore to .4344-.4355" (11.035-11.062 mm) for oversize valve guide. If bore inside diameter exceeds .4355" (11.062 mm), replace cylinder head.
5. Intake valve guide is 1.516" (38.50 mm) long and exhaust valve guide is 1.594" (40.50 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 until valve guide installed height is .315-.346" (8.00-8.80 mm). Valve guide installed height is measured from top of valve guide to cylinder head surface. See **Fig. 30** .
7. On all valve guide applications, use .236" (6.00 mm) reamer to ream valve guide to obtain correct valve stem-to-guide oil clearance. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS.

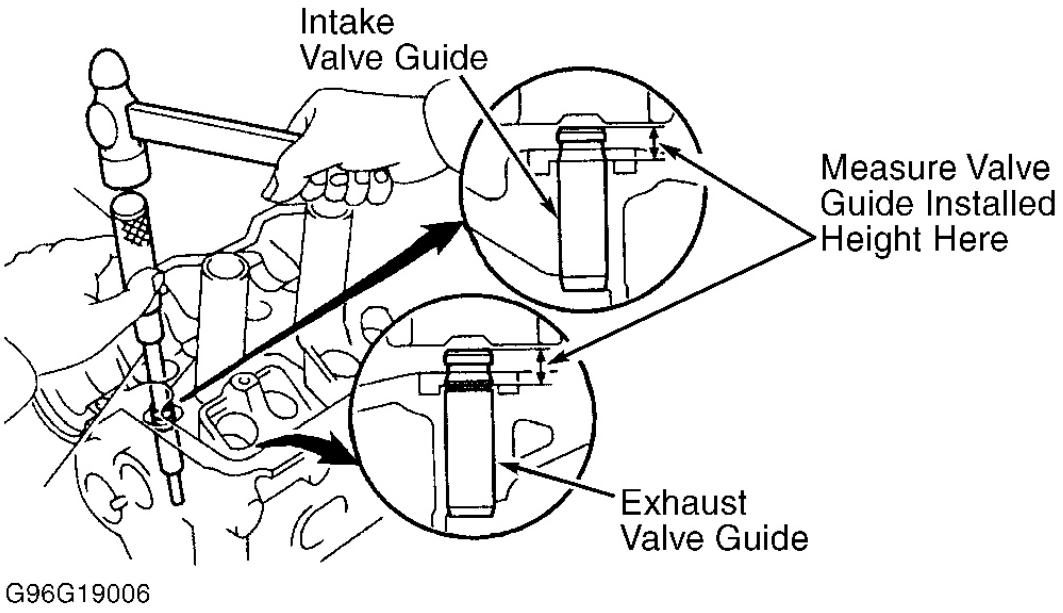


Fig. 30: Measuring Valve Guide Installed Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Valve Seat

Ensure valve seat angle and seat width are within specification. See **CYLINDER HEAD** 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** 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** under ENGINE SPECIFICATIONS.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly (1997)

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 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** under ENGINE SPECIFICATIONS. Ensure connecting rod bend, twist and piston pin bushing bore diameter are within specification. See **CONNECTING RODS** 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. Bushing must be honed to obtain correct piston pin-to-rod clearance. See **PISTONS, PINS & RINGS** 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 end of bolt. Standard connecting rod bolt outside diameter is .3094-.3150" (7.860-8.000 mm). Replace connecting rod bolt and nut assembly if bolt outside diameter is less than .2992" (7.600 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 1.024" (26.00 mm) from top of piston at 90-degree angle to piston pin. Ensure piston diameter is within specification. See **PISTONS, PINS & RINGS** 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 about 176-194°F (80-90°C) in hot water. Coat piston pin with engine oil. Install piston pin into piston and connecting rod using thumb pressure. Install remaining NEW snap ring.

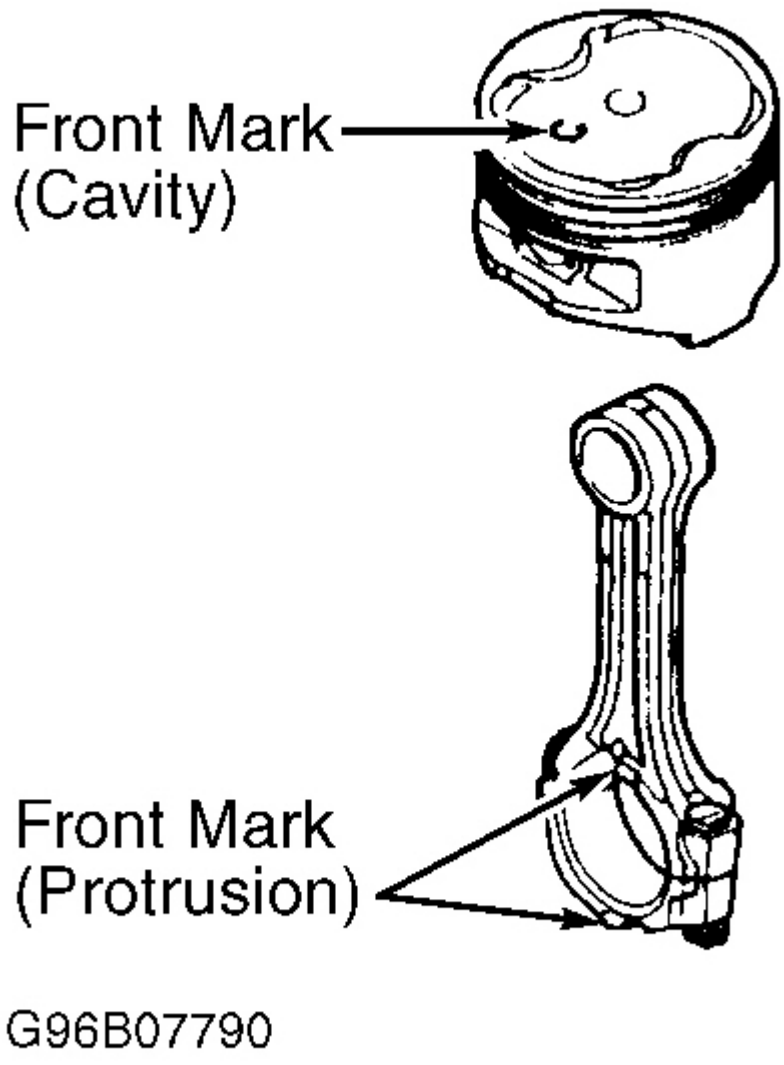


Fig. 31: Identifying Piston Front Marks (1997)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

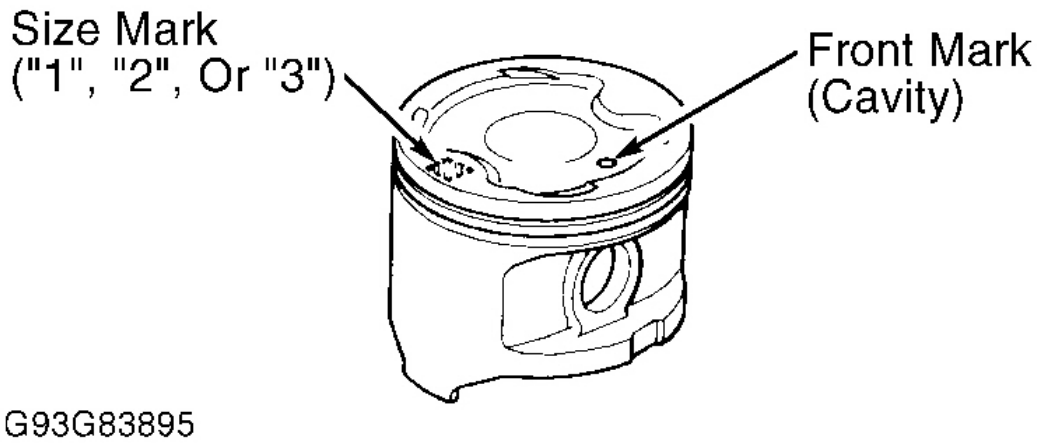


Fig. 32: Identifying Piston Size Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Piston & Rod Assembly (1998)

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 with front mark toward timing belt end of engine. See **Fig. 33** .
2. Before disassembling piston and connecting rod, try to move piston back and forth on piston pin. Replace piston and piston pin as a set, if any movement is felt.
3. Remove 2 compression rings using a piston ring expander. Remove 2 oil rings and oil ring expander by hand. Using Piston Pin Remover and Replacer (09221-25026), press piston pin from piston and remove connecting rod. See **Fig. 34** .
4. Ensure piston pin diameter is within specification. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS. Ensure connecting rod bend, twist and piston pin bore diameter (connecting rod small end) are within specification. See **CONNECTING RODS** under ENGINE SPECIFICATIONS.
5. If piston pin bore diameter is not within specification, replace connecting rod assembly. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS.
6. Using hand pressure, ensure nut rotates easily on connecting rod bolt. If nut fails to rotate easily, use caliper to measure connecting rod bolt outside diameter .59" (15.0 mm) from end of bolt. Standard connecting rod bolt outside diameter is .3094-.3150" (7.860-8.000 mm). Replace connecting rod bolt and nut assembly if bolt outside diameter is less than .2992" (7.600 mm).
7. Pistons with different diameters are used. Piston diameter is 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 1.024" (26.00 mm) from top of piston at 90-degree angle to piston pin. Ensure piston diameter is within size mark specification. See **PISTONS, PINS & RINGS** 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. 33** . Coat piston bore and piston pin with engine oil. Using Piston Pin Remover and Replacer (09221-25026), press piston pin into piston and connecting rod. See **Fig. 34** .

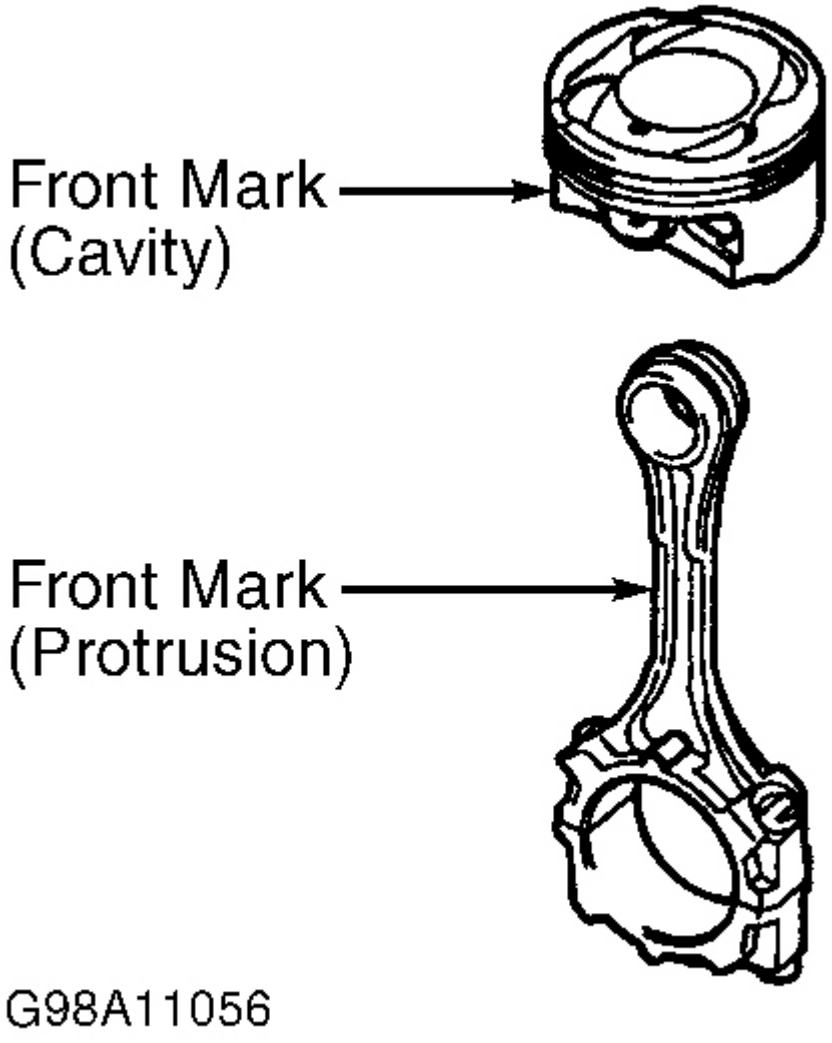


Fig. 33: Identifying Piston Front Marks (1998)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

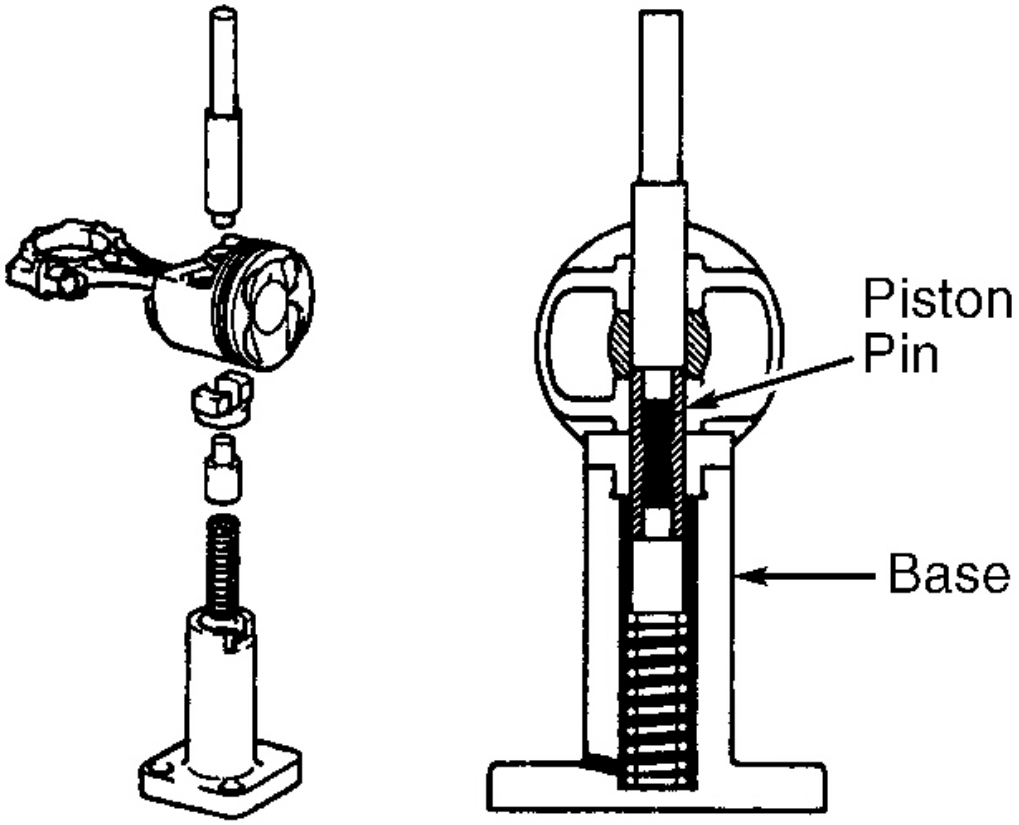


Fig. 34: Removing & Installing Piston Pin (1998)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Fitting Pistons

1. Different diameter pistons are used. Piston diameter is identified by size mark ("1", "2" or "3") stamped on top 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. 35** .
3. To determine piston-to-cylinder clearance, measure piston diameter and cylinder bore diameter. On 1997 models, measure piston skirt diameter 1.024" (26.00 mm) from top of piston, 90-degree to piston pin. On 1998 models, measure piston skirt diameter .91" (23.0 mm) from top of piston.
4. Measure cylinder bore diameter at 3 different positions, 90 degrees apart, .39" (10.0 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** under ENGINE

SPECIFICATIONS.

5. Calculate piston-to-cylinder clearance. Replace replace piston or bore cylinder block for oversize pistons if clearance is not within specification. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS. Pistons are available in .020" (.50 mm) oversize. If replacing piston, ensure replacement piston contains same size mark as size mark on cylinder block.

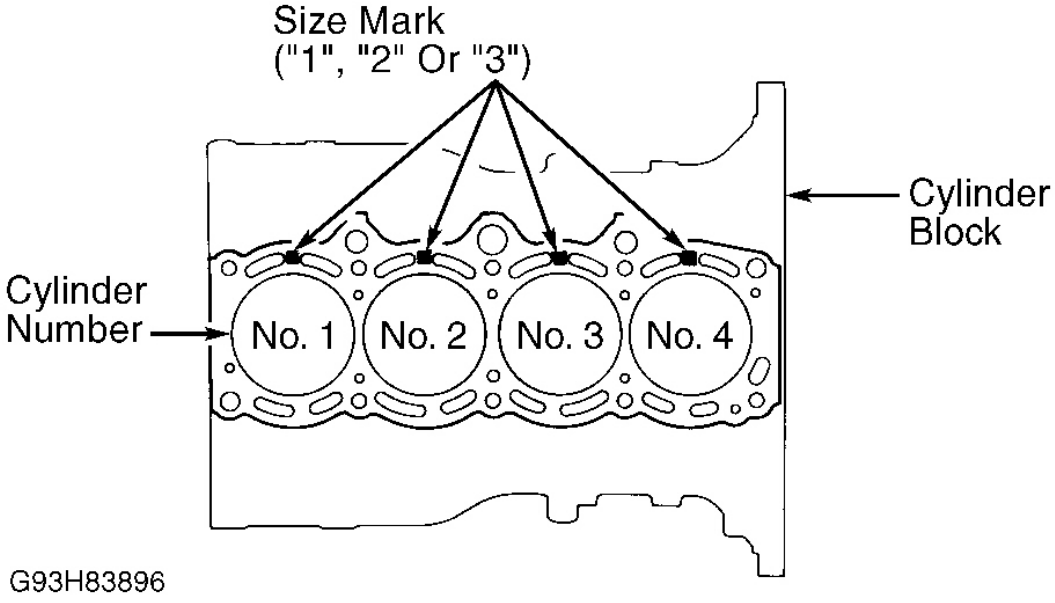


Fig. 35: Identifying Cylinder Bore Size Marks (Typical)
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Piston Rings

1. Ensure piston ring end gap and side clearance are within specification. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS.
2. Install oil ring expander and 2 side rails by hand. Using a piston ring expander, install No. 2 compression ring with 2N or 2T identification mark facing up. Using a piston ring expander, install No. 1 compression ring with 1N or "T" identification mark facing up. Ensure compression rings and oil side rails are positioned correctly. See **Fig. 36** .

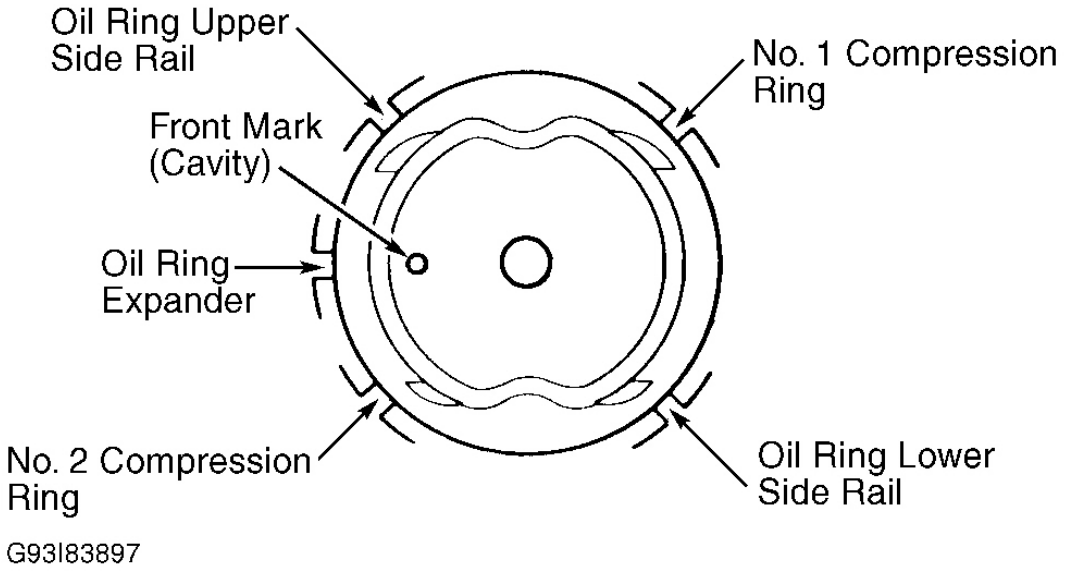


Fig. 36: Positioning Piston Rings
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Rod Bearings

1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Connecting rod must be installed so front mark (protrusion) at center of connecting rod is toward timing belt end of engine. Front mark (protrusion) on connecting rod cap must also face timing belt end of engine. See **Fig. 31** or **Fig. 33** .
2. Connecting rod cap and rod bearing are stamped with size mark ("1", "2" or "3"). See **Fig. 37** . Ensure size marks on connecting rod cap and rod bearing are same.

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

3. Rod bearing thickness is determined by size mark. See **ROD BEARING SPECIFICATIONS** .
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** or **Fig. 33** . 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** under ENGINE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS

Bearing Size Mark	Bearing Thickness - In. (mm)
"1"	.0584-.0586 (1.484-1.488)
"2"	.0586-.0587 (1.488-1.492)
"3"	.0587-.0589 (1.492-1.496)

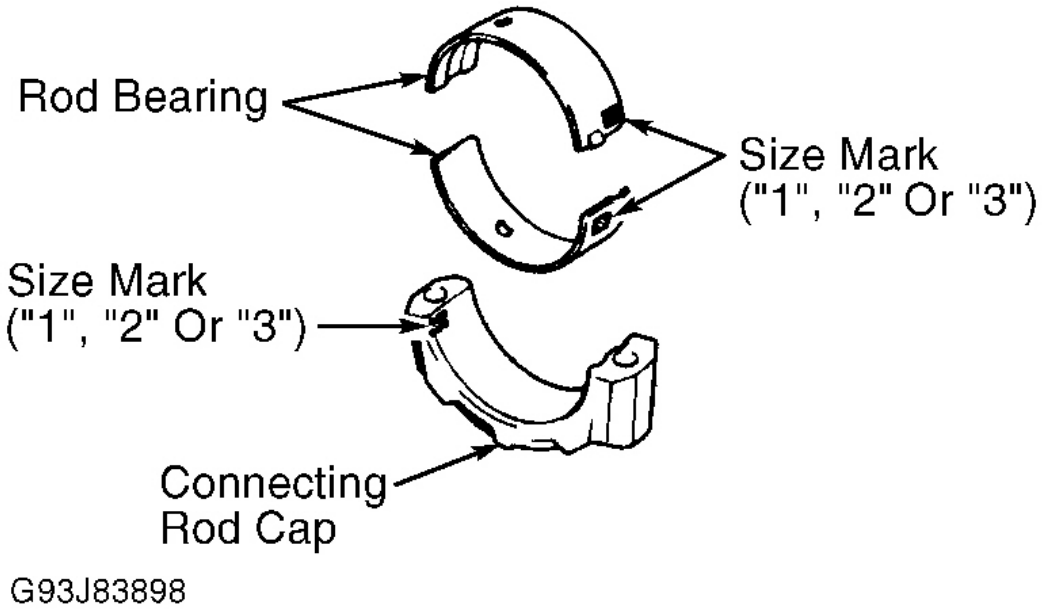


Fig. 37: Identifying Connecting Rod Cap & Rod Bearing Size Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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 of engine. 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. 38** . 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. 39** . 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. 39** .
5. Ensure crankshaft runout, journal diameter, taper and out-of-round are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.

6. Main bearing size mark ("1", "2", "3", "4" or "5") is located on side of main bearing. See **Fig. 39** . 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 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".

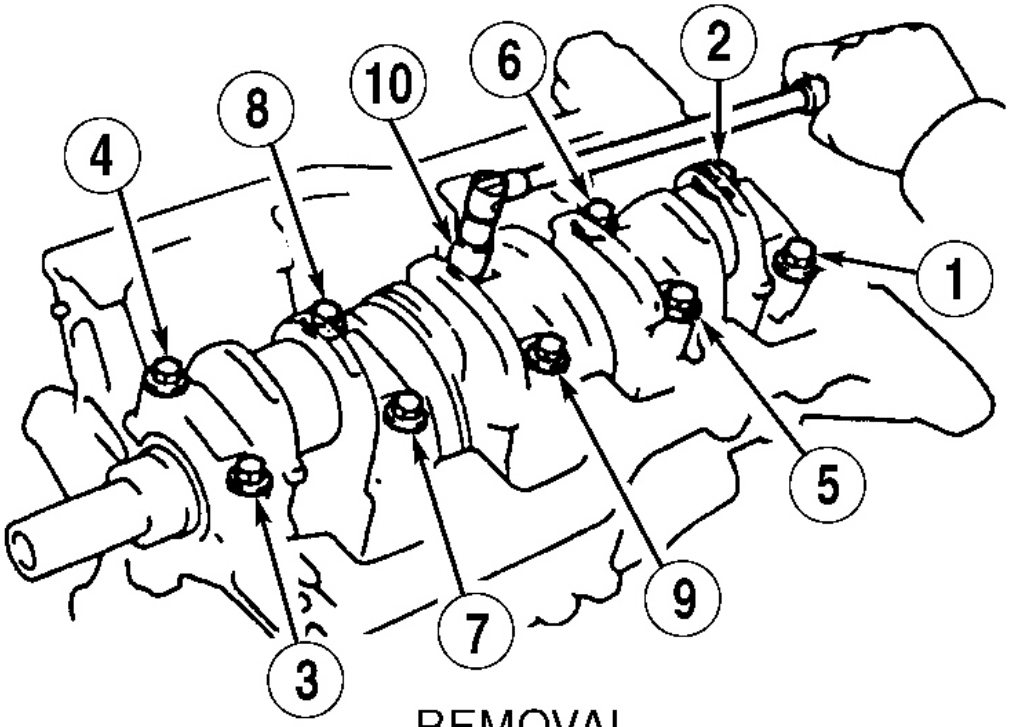
NOTE: Different width main bearings are used. Install wide main bearing on No. 3 journal and narrow main bearings on all other journals.

8. Main bearing thickness is determined by size mark. See **MAIN BEARING SPECIFICATIONS** . 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. 38** . See **TORQUE SPECIFICATIONS** .
11. Ensure crankshaft main bearing oil clearance and crankshaft end play are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS. Replace thrust bearing if end play is not within specification.

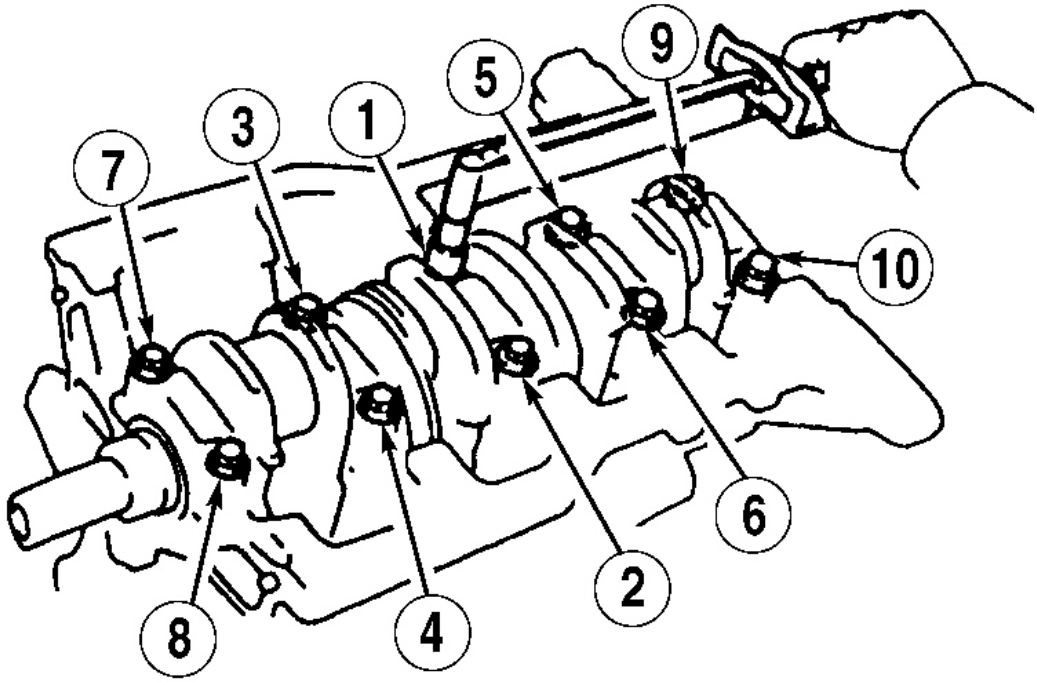
MAIN BEARING SPECIFICATIONS

Bearing Size Mark	Bearing Thickness - In. (mm)
No. 3 Main Bearing	
"1"	.07842-.07854 (1.9920-1.9950)
"2"	.07854-.07866 (1.9950-1.9980)
"3"	.07866-.07877 (1.9980-2.0010)
"4"	.07877-.07889 (2.0010-2.0040)
"5"	.07889-.07901 (2.0040-2.0070)
All Others	
"1"	.07862-.07874 (1.9970-2.0000)
"2"	.07874-.07885 (2.0000-2.0030)
"3"	.07885-.07897 (2.0030-2.0060)
"4"	.07897-.07909 (2.0060-2.0090)

"5"	.07909-.07921 (2.0090-2.0120)



REMOVAL



INSTALLATION

G93A83899

Fig. 38: Main Bearing Cap Bolt Removal & Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

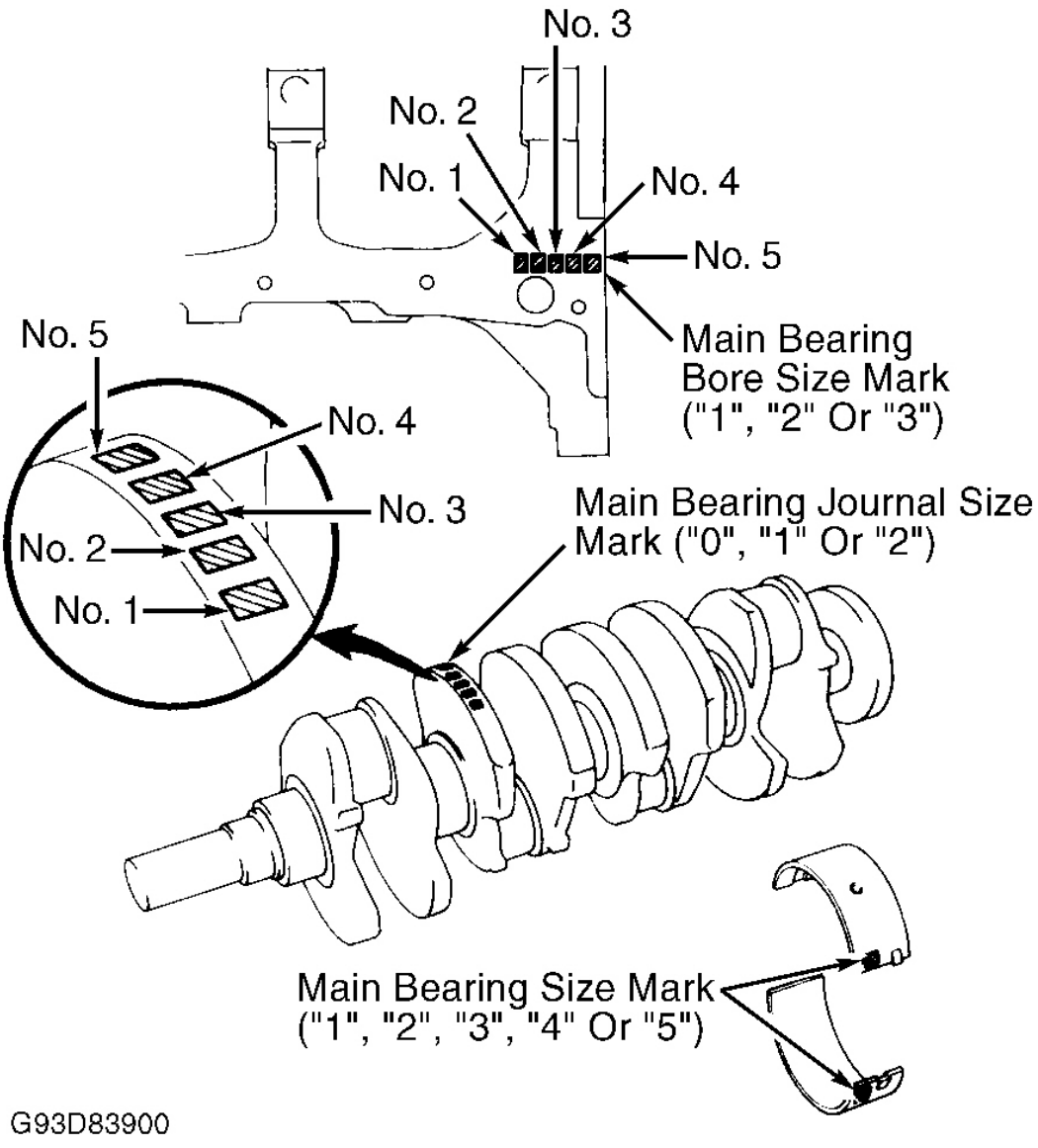


Fig. 39: Identifying Cylinder Block, Crankshaft & Main Bearing Size Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Thrust Bearing

Install thrust bearing on No. 3 main bearing with grooves facing toward crankshaft and away from cylinder block and main bearing cap. Replace thrust bearing if crankshaft end play is not within specification. See

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS under ENGINE SPECIFICATIONS.

Cylinder Block

1. Inspect cylinder block deck surface warpage. Replace cylinder block if deck warpage exceeds specification. See **CYLINDER BLOCK** 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. 39** .
3. Measure cylinder bore diameter at 2 different places, 90 degrees apart at .39" (10.0 mm) from top and bottom of cylinder bore and at center of cylinder bore. Ensure cylinder bore diameter is within specification. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS.
4. Bore cylinder block for oversize pistons if cylinder bore diameter is not within specification. Pistons are available in .020" (.50 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. 38** . See **TORQUE SPECIFICATIONS** .
7. Ensure main bearing bore inside diameter is within specification. See **CYLINDER BLOCK** 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. 39 .

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Crankshaft driven oil pump provides pressurized engine lubrication. Oil cooler is installed between oil filter and cylinder block.

Crankcase Capacity

On 1997 models, drain and refill capacity with oil filter is approximately 4.1 qts. (3.9L). Dry fill capacity is approximately 4.7 qts. (4.4L). On 1998 models, drain and refill capacity with oil filter is approximately 4.3 qts. (4.1L). Dry fill capacity is approximately 4.8 qts. (4.6L).

Oil Pressure

With engine at normal operating temperature, oil pressure should be at least 4.3 psi (0.3 kg/cm^2) at idle and 36-71 psi (2.5-5.0 kg/cm^2) at 3000 RPM.

OIL PUMP

Removal & Disassembly

1. Remove timing belt, No. 2 idler pulley, crankshaft sprocket and oil pump sprocket. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION.
2. Remove oil pump pick-up tube, gasket and oil baffle plate. Disconnect electrical connector for crankshaft position sensor located on from of oil pump housing. Remove bolt and crankshaft position sensor from front of oil pump housing.
3. Remove oil pump-to-cylinder block bolts. Using soft-faced hammer, tap oil pump housing from cylinder block. To disassemble oil pump, remove oil pump body cover bolts, oil pump body cover and "O" ring. Disassemble oil pump components. See **Fig. 40** . Remove oil pump oil seal and crankshaft front oil seal (if necessary).

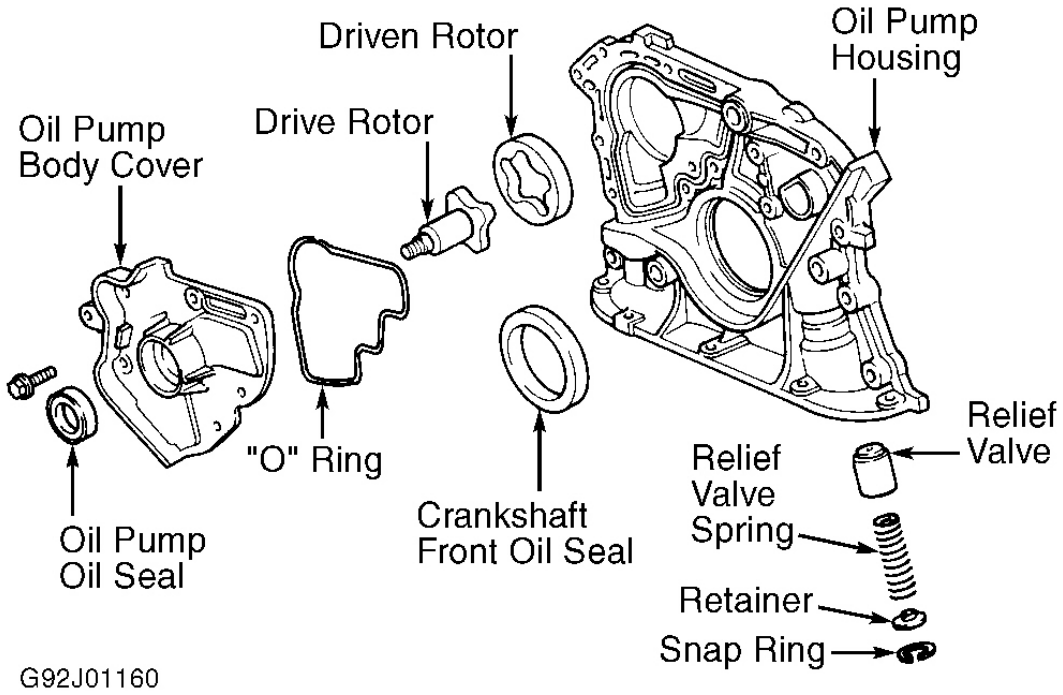


Fig. 40: Exploded View Of Oil Pump
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

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, measure driven rotor-to-oil pump housing clearance. Replace rotor assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** .
3. Using feeler gauge, measure rotor tip clearance between tip of drive rotor and tip of driven rotor. Tip of

drive rotor is on outside of rotor and tip of driven rotor is on inside of rotor. Replace rotor assembly if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** .

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Driven Rotor-To-Oil Pump Housing Clearance	
Standard	.0039-.0063 (.100-.160)
Wear Limit	.0079 (.200)
Rotor Tip Clearance	
Standard	.0016-.0063 (.040-.160)
Wear Limit	.0079 (.200)

Reassembly & Installation

1. To reassemble, reverse disassembly procedure. Ensure reference marks (dot area) on rotors face toward oil pump body cover, away from oil pump housing.
2. Using hammer and Oil Seal Installer (SST 09226-10010), 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. Install and tighten oil pump body cover bolts to specification. See **TORQUE SPECIFICATIONS** . Using NEW gasket, install oil pump on cylinder block using NEW gasket.
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 oil pump. Tighten oil pump-to-cylinder block bolts to specification. See **TORQUE SPECIFICATIONS** . To install remaining components, reverse removal procedure.

OIL COOLER

Removal

1. Oil cooler is mounted between oil filter and cylinder block. Disconnect negative battery cable. Drain cooling system.
2. Remove passenger-side lower engine cover. Remove front exhaust pipe that fits between front catalytic converter on exhaust manifold and rear exhaust pipe. Remove generator.
3. Remove exhaust manifold with catalytic converter and heat insulators for access to oil cooler. Remove oil filter. Disconnect coolant hoses from oil cooler. Remove oil cooler relief valve and plate washer from center of oil cooler housing. Remove oil cooler-to-cylinder block nut. Remove oil cooler, gasket and "O" ring.

Inspection

1. Inspect oil cooler for damage. Apply air pressure on coolant hose pipe on oil cooler. Ensure air flows through oil cooler and oil cooler is not restricted. Replace oil cooler if damage or restricted.

2. Using wooden stick, push inward on check valve located in center of oil cooler relief valve. Push inward from threaded end (opposite oil filter threads) on oil cooler relief valve. Replace oil cooler relief valve if check valve fails to move.

Installation

1. To install, reverse removal procedure. Use a NEW "O" ring and gasket. Coat "O" ring with engine oil. Coat threads and area below head of oil cooler relief valve with engine oil.
2. Install oil cooler with oil cooler-to-cylinder block nut and oil cooler relief valve loosely installed. Tighten oil cooler relief valve and then nut to specification. See **TORQUE SPECIFICATIONS** .
3. Use NEW gasket and NEW nuts when installing front exhaust pipe on catalytic converter. Ensure all bolts/nuts are loosely installed before tightening to specification. See **TORQUE SPECIFICATIONS** . Add engine oil as needed. Fill cooling system.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
ABS Actuator Mounting Bracket-To-Body Bolt/Nut	14 (19)
A/C Compressor Bolt/Nut	
Bolt	27 (37)
Nut	20 (27)
Stud Bolt	34 (46)
Axle Shaft Bearing Bracket Bolt	
2WD A/T Models	47 (64)
Axle Shaft Bearing Bracket-To-Cylinder Block Bolt	
2WD A/T & M/T Models	47 (64)
Axle Shaft Nut	159 (216)
Axle Shaft Retaining Bolt	
2WD M/T Models	24 (33)
Ball Joint-To-Lower Control Arm Bolt/Nut	94 (127)
Brake Line-To-ABS Actuator Nut	11 (15)
Camshaft Bearing Cap Bolt (1)	14 (19)
Camshaft Sprocket Bolt	40 (54)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Nut	11 (15)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (2)	
Step 1	36 (49)
Step 2	Additional 90 Degrees

Distributor Hold-Down Bolt	14 (19)
Drive Shaft Center Support Bearing Bolt	
4WD Models	27 (37)
Drive Shaft Flange Bolt/Nut	
4WD Models	54 (73)
EGR Valve	
Nut	(3)
Union Nut	43 (58)
Engine Mounts & Brackets	
Front (Exhaust Manifold Side) Engine Mount-To-Engine Mount Crossmember Bolt	59 (80)
Left (Transaxle Side) Engine Mounting Bracket-To-Engine Mount Bolt/Nut	47 (64)
Right (Timing Belt Side) Engine Mounting Bracket-To-Cylinder Block Bolt	38 (52)
Right (Timing Belt Side) Engine Mount-To-Body Bolt	47 (64)
Right (Timing Belt Side) Engine Mounting Bracket-To-Engine Mount Bolt/Nut	
Bolt	27 (37)
Nut	38 (52)
Engine Mount Crossmember-To-Body Bolt	26 (35)
Engine Mount Crossmember-To-Front Suspension Crossmember Nut	82 (111)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Front Catalytic Converter Brace Bolt/Nut	31 (42)
Front Catalytic Converter-To-Exhaust Manifold Bolt/Nut	21 (29)
Front Exhaust Pipe-To-Front Catalytic Converter Nut	46 (62)
Front Exhaust Pipe-To-Rear Exhaust Pipe Bolt/Nut	35 (47)
Front Suspension Crossmember Bolt	
Bolt At Body	152 (206)
Bolt At Lower Control Arm	101 (137)
Fuel Line-To-Fuel Filter Union Bolt	21 (29)
Fuel Pipe-To-Delivery Pipe Union Bolt	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)
Main Bearing Cap Bolt (4)	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)

Oil Cooler Relief Valve	58 (79)
Oil Pump Sprocket Nut	18 (24)
Oxygen Sensor-To-Exhaust Manifold Nut	15 (20)
Oxygen Sensor-To-Front Catalytic Converter	33 (45)
Power Steering Pump Bolt	32 (43)
Power Steering Pump Mounting Bracket-To-Cylinder Block Bolt	32 (43)
Spark Plug	13 (18)
Spark Plug Tube	39 (49)
Stabilizer Bar Link-To-Lower Control Arm Nut	
3-Door Vehicles	47 (64)
5-Door Vehicles	83 (113)
Stabilizer Bar-To-Frame Mount Bolt	22 (29)
Starter Bolt	29 (39)
Steering Gear Assembly-To-Front Suspension Crossmember Bolt/Nut	83 (113)
Stiffener Plate Bolt	27 (37)
Throttle Body Bolt/Nut	14 (19)
Tie Rod Nut	36 (49)
Valve Cover Nut	33 (44)
Wheel Lug Nut	76 (103)
	INCH Lbs. (N.m)
ABS Speed Sensor Bolt	71 (8.0)
Clutch Release Cylinder Bolt	106 (12.0)
Coolant By-Pass Pipe-To-Water Pump Nut	82 (9.3)
Crankshaft Position Sensor Bolt	71 (8.0)
Fuel Delivery Pipe-To-Cylinder Head Bolt	115 (13.0)
No. 3 Timing Belt Cover Bolt	69 (7.8)
Oil Baffle Plate-To-Cylinder Block Bolt/Nut	48 (5.4)
Oil Cooler-To-Cylinder Block Nut	78 (8.8)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	78 (8.8)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	115 (13.0)
Thermostat Housing Nut	78 (8.8)
Water Pump-To-Cylinder Block Bolt (5)	78 (8.8)
Water Pump-To-Water Pump Cover Bolt	78 (8.8)

(1) Tighten bolts to specification in sequence. See **Fig. 23** and **Fig. 24** .

(2) Tighten bolts to specification in sequence. See **Fig. 15** .

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

(4) Tighten bolts to specification in sequence. See **Fig. 38** .

(5) Tighten bolts to specification in sequence. See **Fig. 29** .

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	122 Cu. In. (2.0L)
Bore	3.39" (86.0 mm)
Stroke	3.39" (86.0 mm)
Compression Ratio	9.5:1
Fuel System	SFI
1997	
Horsepower @ RPM	120 @ 5400
Torque Ft. Lbs. @ RPM	125 @ 4600
1998	
California	
Horsepower @ RPM	125 @ 5400
Torque Ft. Lbs. @ RPM	130 @ 4600
Except California	
Horsepower @ RPM	127 @ 5400
Torque Ft. Lbs. @ RPM	132 @ 4600

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.0118 (.300)
Maximum Runout	.0024 (.060)
Main Bearings	
Journal Diameter (1)	
Size Mark "0"	2.1653-2.1655 (54.998-55.003)
Size Mark "1"	2.1651-2.1653 (54.993-54.998)
Size Mark "2"	2.1649-2.1651 (54.988-54.993)

Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft Journal	
No. 3 Journal	
Standard	.0010-.0017 (.025-.044)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0006-.0013 (.015-.034)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft Journal	
No. 3 Journal	
Standard	.0011-.0026 (.027-.067)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0007-.0023 (.019-.059)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	
Standard	2.0466-2.0472 (51.985-52.000)
Undersized .010" (.25 mm)	2.0372-2.0376 (51.745-51.755)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft Journal	
Standard	.0009-.0022 (.024-.055)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft Journal	
Standard	.0009-.0027 (.024-.069)
Wear Limit	.0031 (.080)
(1) Main bearing journal diameter is determined by size mark stamped on crankshaft. See **Fig. 39** .	

CONNECTING RODS

CONNECTING RODS

Application	**In. (mm)**
Piston Pin Bushing	
Bore Diameter	.8663-.8668 (22.005-22.017)
Piston Pin Oil Clearance (1)	
Standard	.0002-.0004 (.005-.010)

Wear Limit	.0020 (.050)
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 (.350)
(1) Piston pin oil clearance is the difference between the inside diameter of the connecting rod piston pin bushing bore and the outside diameter of the piston pin.	

PISTONS, PINS & RINGS

PISTONS, PINS & RINGS

Application	**In. (mm)**
Pistons	
Clearance	
1997	
Standard	.0047-.0055 (.120-.140)
Wear Limit	.0063 (.160)
1998	
Standard	.0056-.0064 (.143-.163)
Wear Limit	.0072 (.183)
Diameter (1)	
1997	
Size Mark "1"	3.3807-3.3811 (85.870-85.880)
Size Mark "2"	3.3811-3.3815 (85.880-85.890)
Size Mark "3"	3.3815-3.3819 (85.890-85.900)
Over Sized .1969" (.50 mm)	3.4004-3.4016 (86.370-86.400)
1998	
Size Mark "1"	3.3798-3.3802 (85.847-85.857)
Size Mark "2"	3.3802-3.3806 (85.857-85.867)
Size Mark "3"	3.3806-3.3810 (85.867-85.877)
Over Sized .1969" (.50 mm)	3.3995-3.4007 (86.347-86.377)
Pins	
1997	
Diameter	.8660-.8665 (21.997-22.009)
Piston Fit	(2)
Rod Fit (Oil Clearance)	
Standard	.0002-.0004 (.005-.011)
Wear Limit	.0020 (.050)
1998	

Diameter	.8660-.8665 (21.997-22.009)
Piston Fit	(3)
Rod Fit (Oil Clearance)	
Standard	.0002-.0004 (.005-.011)
Wear Limit	.0020 (.050)
Rings	
1997	
No. 1	
End Gap (4)	
Standard	.0106-.0197 (.270-.500)
Wear Limit	.0433 (1.100)
Side Clearance	.0012-.0028 (.030-.070)
No. 2	
End Gap (4)	
Standard	.0106-.0201 (.270-.510)
Wear Limit	.0437 (1.110)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap (4)	
Standard	.0079-.0217 (.200-.550)
Wear Limit	.0453 (1.150)
1998	
No. 1	
End Gap (4)	
Standard	.0106-.0185 (.270-.470)
Wear Limit	.0421 (1.070)
Side Clearance	.0012-.0028 (.030-.070)
No. 2	
End Gap (4)	
Standard	.0177-.0256 (.450-.650)
Wear Limit	.0492 (1.250)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap (4)	
Standard	.0039-.0177 (.100-.450)
Wear Limit	.0413 (1.050)

(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.

(3) On 1998 engine, piston pin has an interference fit and pin must be pressed into connecting rod and piston.

(4) Using a piston with rings removed, push ring into cylinder bore 4.33" (110 mm) from the top.

CYLINDER BLOCK

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore (1)	
Size Mark "1"	3.3858-3.3862 (86.000-86.010)
Size Mark "2"	3.3862-3.3866 (86.010-86.020)
Size Mark "3"	3.3866-3.3870 (86.020-86.030)
Maximum Standard Size	3.3949 (86.230)
.020" (.50 mm) Oversize	3.4146 (86.731)
Maximum Deck Warpage	.0020 (.050)
Main Bearing Bore I.D. (2)	
Size Mark "1"	2.3236-2.3239 (59.020-59.026)
Size Mark "2"	2.3239-2.3241 (59.026-59.032)
Size Mark "3"	2.3241-2.3243 (59.032-59.038)

(1) Cylinder bore diameter is determined by size mark on cylinder block deck surface. See **Fig. 37** .

(2) Main bearing bore I.D. is determined by main bearing bore size mark on cylinder block. See **Fig. 39** .

VALVES & VALVE SPRINGS

VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)
Minimum Refinish Length	3.823" (97.10 mm)
Stem Diameter	.2350-.2356" (5.970-5.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)

Minimum Refinish Length	3.858" (98.00 mm)
Stem Diameter	.2348-.2354" (5.965-5.980 mm)
Valve Springs	
Free Length	1.6520-1.6531" (41.96-41.99 mm)
Out-Of-Square Limit	.079" (2.00 mm)
Pressure	37-43 Lbs. @ 1.366 In. (16.7-19.5 kg @ 34.70 mm)

CYLINDER HEAD

CYLINDER HEAD

Application	**Specification**
Maximum Warpage	
Cylinder Block Surface	.0020" (.050 mm)
Intake & Exhaust Manifold Surface	.0031" (.080 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.039-.055" (1.00-1.40 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.039-.055" (1.00-1.40 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.4325-.4335" (10.985-11.012 mm)
Oversize Valve Guide	.4344-.4355" (11.035-11.062 mm)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed Height	.315-.346" (8.00-8.80 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0010-.0024" (.025-.060 mm)
Wear Limit	.0031" (.080 mm)
Exhaust Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.4325-.4335" (10.985-11.012 mm)
Oversize Valve Guide	.4344-.4355" (11.035-11.062 mm)

Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed Height	.315-.346" (8.00-8.80)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Wear Limit	.0039" (.100 mm)

CAMSHAFT

CAMSHAFT

Application	In. (mm)
End Play	
Intake Camshaft	
Standard	.0018-.0039 (.045-.100)
Wear Limit	.0047 (.120)
Exhaust Camshaft	
Standard	.0012-.0033 (.030-.085)
Wear Limit	.0039 (.100)
Gear Backlash	
Standard	.0008-.0079 (.020-.200)
Wear Limit	.0118 (.300)
Gear Spring End Free Distance	.886-.902 (22.50-22.91)
Journal Diameter	1.0614-1.0620 (26.959-26.975)
Journal Runout	.0016 (.040)
Lobe Height	
Intake Camshaft	
Standard	1.6539-1.6579 (42.010-42.110)
Wear Limit	1.6496 (41.900)
Exhaust Camshaft	
Standard	1.5772-1.5811 (40.060-40.160)
Wear Limit	1.5728 (39.950)
Oil Clearance	
Standard	.0010-.0024 (.025-.062)
Wear Limit	.0039 (.100)

VALVE LIFTERS

VALVE LIFTERS

Application	In. (mm)
Bore Diameter	1.2205-1.2212 (31.000-31.018)
Lifter Diameter	1.2191-1.2195 (30.966-30.976)

Oil Clearance	
Standard	.0009-.0020 (.024-.052)
Wear Limit	.0028 (.070)