

## 3.0L 6-CYL

1998 Toyota Supra

1997-98 ENGINES  
Toyota 3.0L & 3.0L Turbo 6-Cylinder  
Supra

### \* PLEASE READ THIS FIRST \*

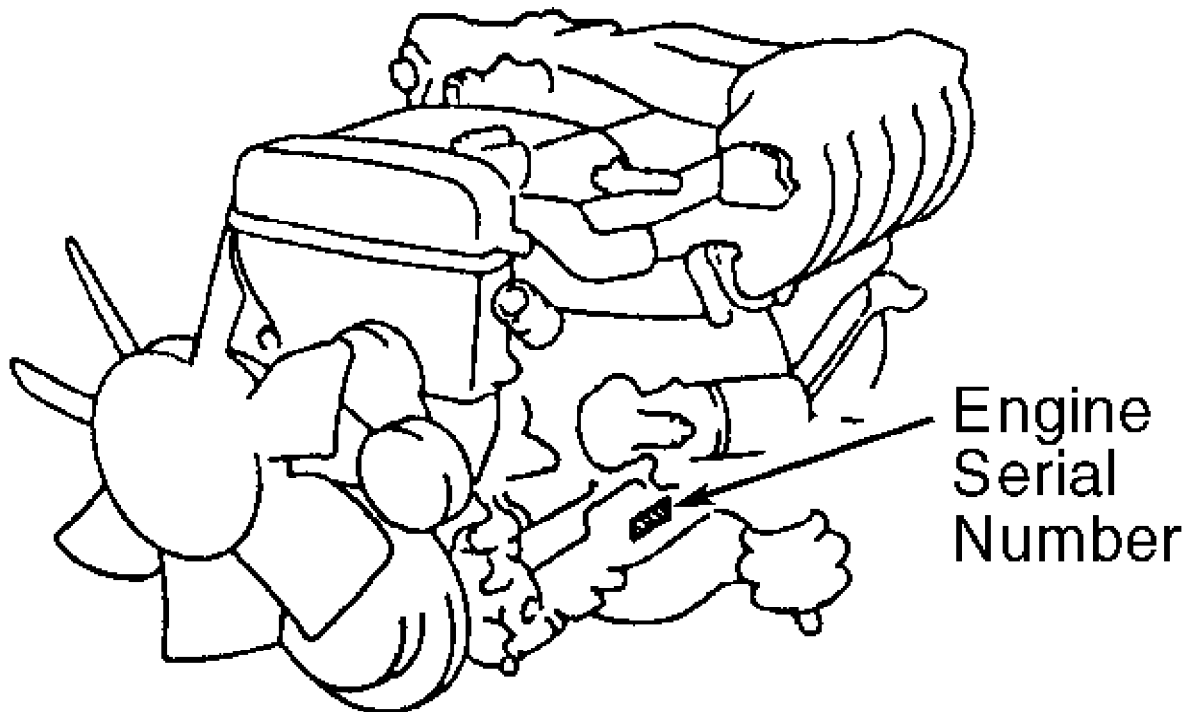
NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

### ENGINE IDENTIFICATION

Engine serial number is stamped on cylinder block, below oil filter. See Fig. 1.

#### ENGINE IDENTIFICATION CODES

Engine	Code
3.0L 6-Cylinder	
Non-Turbo .....	2JZ-GE
Turbo .....	2JZ-GTE



93D83041

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

### ADJUSTMENTS

## VALVE CLEARANCE ADJUSTMENT

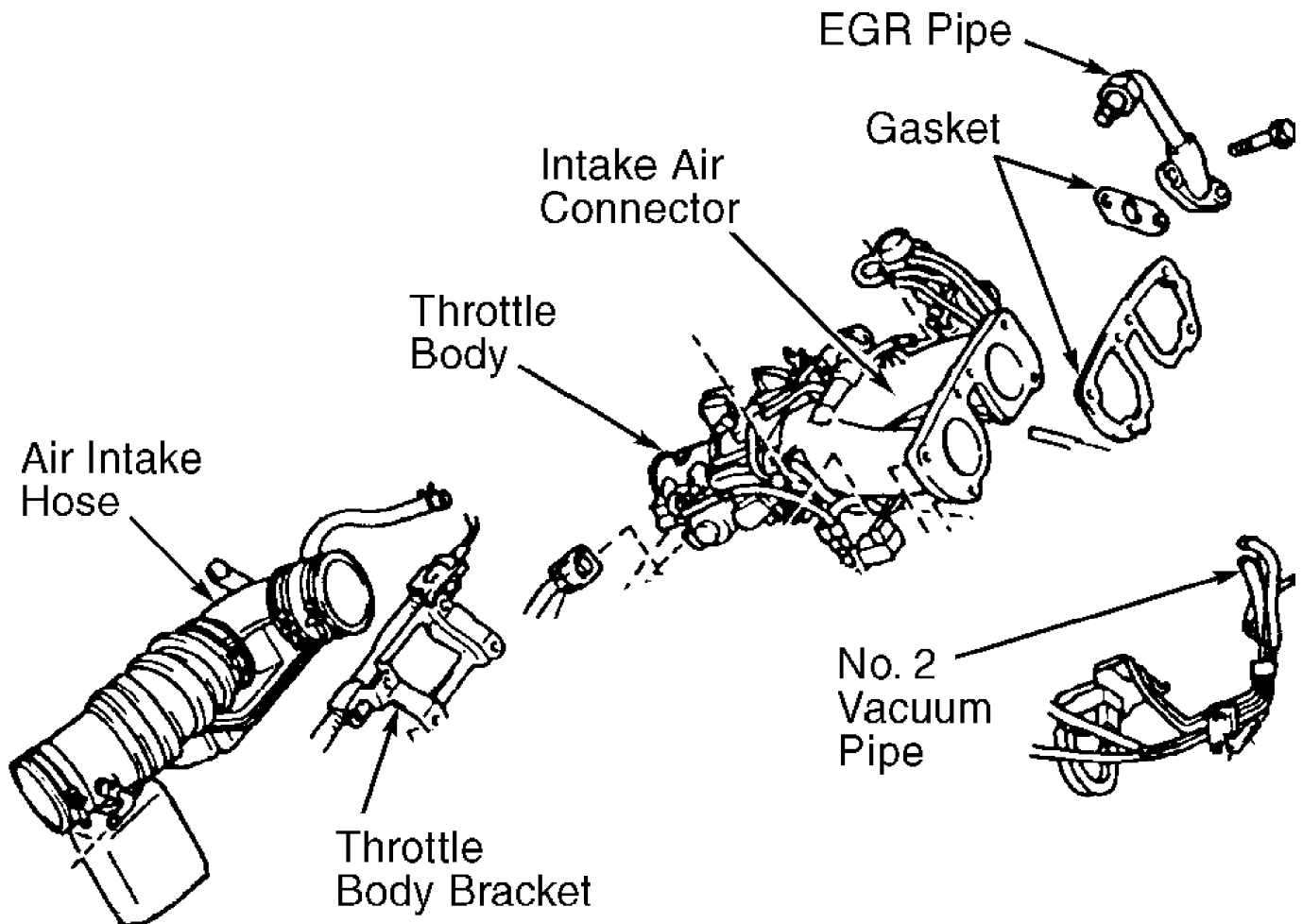
NOTE: Perform valve clearance adjustment with engine cold.

1997 Non-Turbo

1) Drain cooling system. Disconnect control cables from throttle body. Remove PCV hose from valve cover.

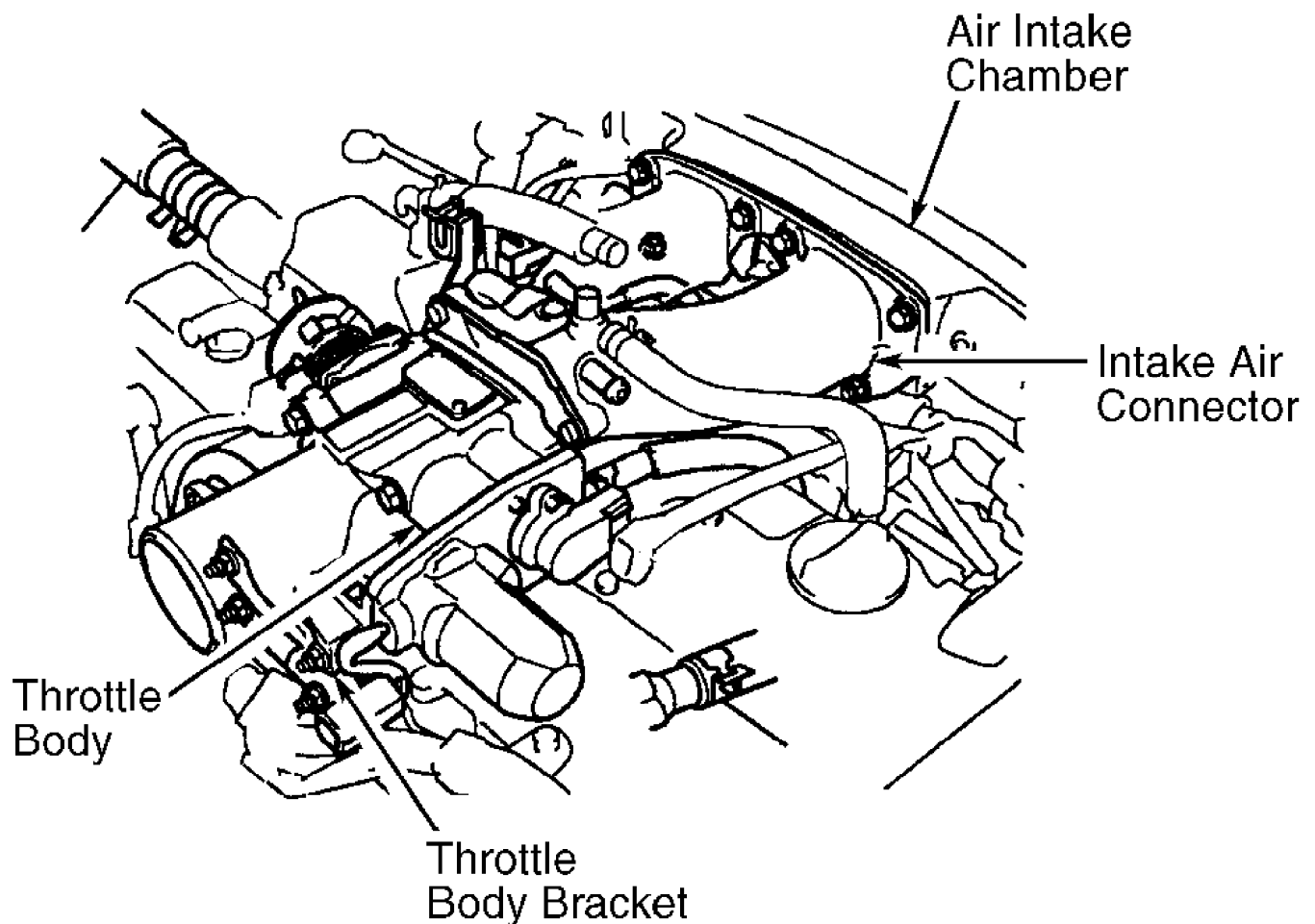
2) Remove air intake hose located between air filter and throttle body. See Fig. 2. On Calif. models, remove fuel pressure control Vacuum Switching Valve (VSV) bolted to front of air intake chamber.

3) On all models, remove EGR pipe and No. 2 vacuum pipe. Remove throttle body bracket located between throttle body and cylinder head. See Fig. 2.



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Fig. 2: Locating Intake Air Connector & Components (1997 Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



98C01393

Fig. 3: Locating Intake Air Connector & Components (1998 Non-Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Disconnect necessary vacuum hoses, coolant hoses and electrical connectors from throttle body. Remove intake air connector-to-air intake chamber bolts/nuts. Remove intake air connector and gasket along with throttle body.

5) Remove oil filler cap. Remove No. 3 (upper) timing belt cover located above timing belt. Remove cylinder head rear cover located at rear of valve covers. Disconnect spark plug wires from spark plugs and clips on valve cover.

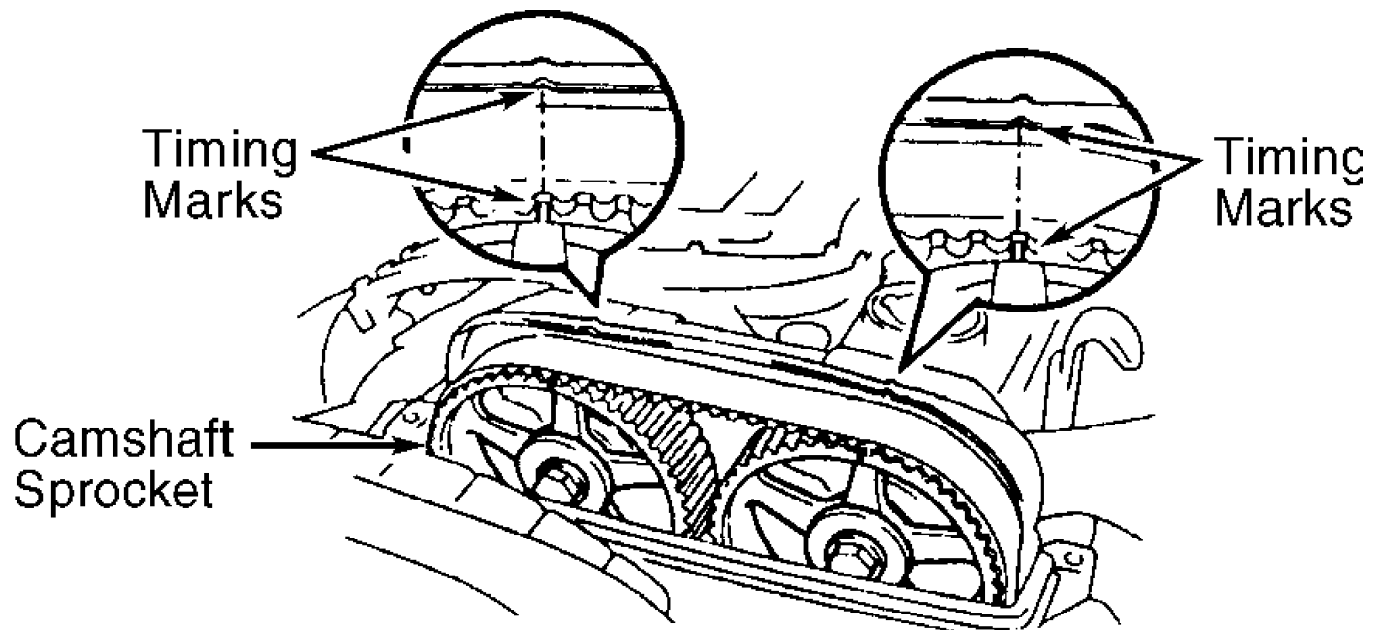
6) Remove No. 3 valve cover located above spark plugs, between No. 1 and 2 valve covers. Remove bolts/nuts, No. 1 and 2 valve covers and gaskets.

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

7) Rotate crankshaft pulley clockwise (viewed from front of engine) and align crankshaft pulley timing mark (groove) with "0" mark on timing belt cover so cylinder No. 1 (front cylinder) is at TDC on compression stroke.

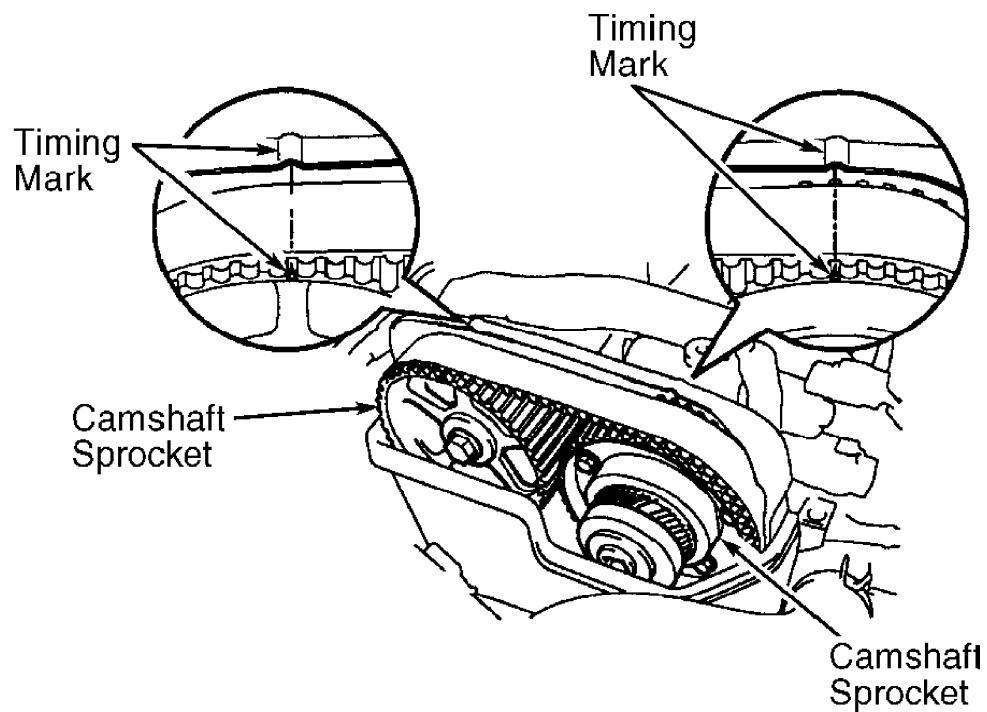
8) Ensure timing marks on camshaft sprockets are aligned with timing marks on timing belt cover. See Fig. 4. If timing marks are not aligned, rotate crankshaft clockwise one full revolution (360

degrees).



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Fig. 4: Aligning Camshaft Sprocket Timing Marks (1997 Non-Turbo & Turbo, & 1998 Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



98E01394

Fig. 5: Aligning Camshaft Sprocket Timing Marks (1998 Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

9) Using feeler gauge, measure and record valve clearance on intake valves on cylinders No. 1, 2 and 4 and exhaust valves on

cylinders No. 1, 3 and 5. Perform STEP 1. See Fig. 6.

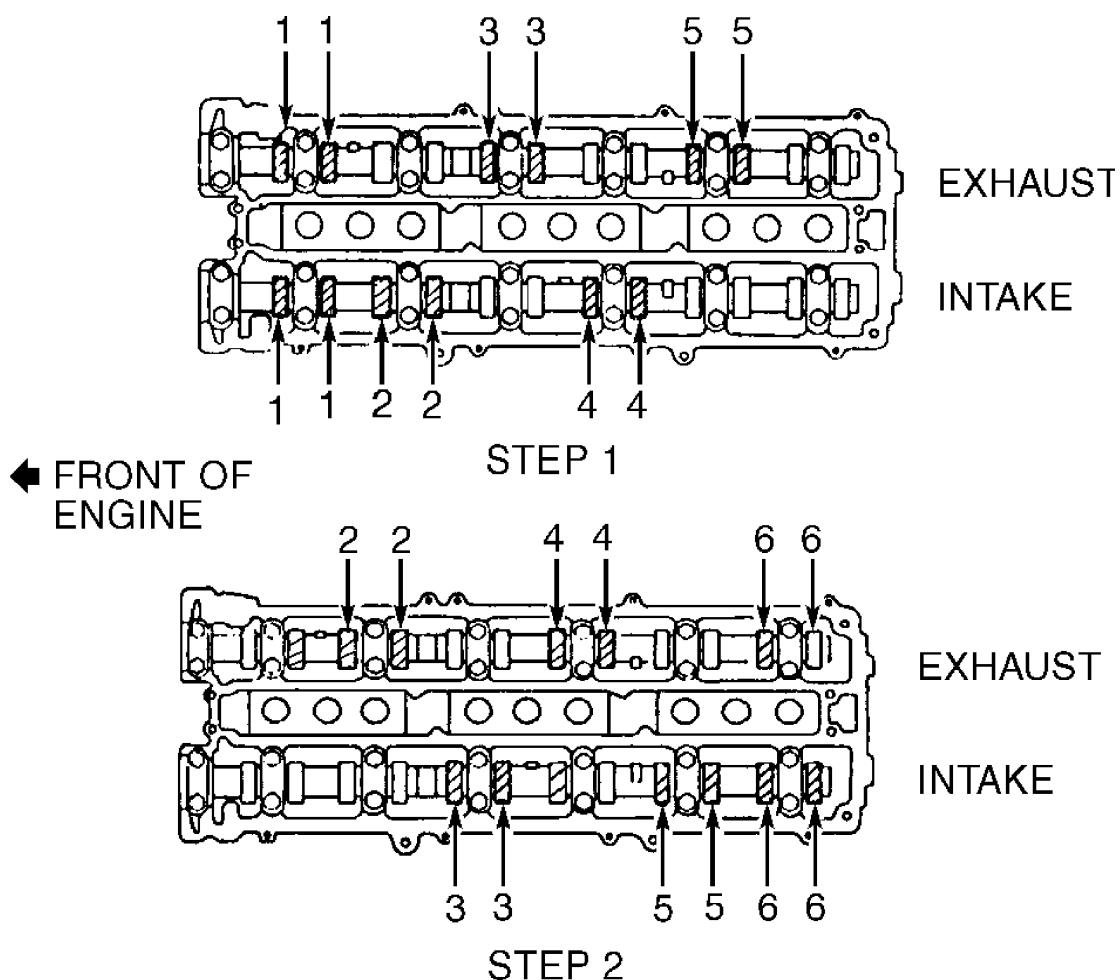
10) Rotate crankshaft pulley clockwise one full revolution (360 degrees) and realign crankshaft pulley timing mark (groove) with "0" mark on timing belt cover. Using feeler gauge, measure and record valve clearance on intake valves on cylinders No. 3, 5 and 6 and exhaust valves on cylinders No. 2, 4 and 6. Perform STEP 2. See Fig. 6

11) Ensure valve clearance is within specification. See VALVE CLEARANCE SPECIFICATIONS table.

#### VALVE CLEARANCE SPECIFICATIONS (1)

Application	In. (mm)
Intake Valve .....	.006-.010 (.15-.25)
Exhaust Valve .....	.010-.014 (.25-.35)

(1) - Adjust valve clearance with engine cold.



93G83044

Fig. 6: Identifying Cylinder Numbers & Valve Arrangement  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

12) If valve clearance adjustment is required, rotate crankshaft pulley so camshaft lobe is facing upward on valve to be

adjusted. Rotate valve lifter so notch area on valve lifter is at 90-degree angle to camshaft. This will place notch area perpendicular to camshaft.

13) Valve Clearance Adjuster (SST 09248-55040) is used for adjusting valve clearance. Using SST "A" of valve clearance adjuster, push downward on valve lifter. Install SST "B" between camshaft and valve lifter with side marked with No. 7 at designated position. See Fig. 7. Remove SST "A". Using small screwdriver and magnet, remove adjusting shim.

14) Using micrometer, measure thickness of removed adjusting shim. Using measured clearance and adjusting shim thickness, determine correct thickness of adjusting shim to be used. See Figs. 8 and 9.

15) Install proper adjusting shim with imprinted numbers on adjusting shim facing downward, toward valve lifter. Using SST "A", press downward on valve lifter. Remove SST "B". Recheck valve clearance.

16) Apply sealant at indicated No. 1 and 2 valve cover sealing areas on front of cylinder head. See Fig. 10. Using NEW gaskets, install all valve covers. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

17) To install remaining components, reverse removal procedure. Install NEW intake air connector gasket with protrusion in proper area. See Fig. 11. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.

#### 1998 Non-Turbo

1) Drain cooling system. Remove air intake hose for access to intake air connector with throttle body. See Fig. 3. Disconnect necessary electrical connectors, control cables, hoses and engine wire clamps for removal of intake air connector with throttle body.

2) Note location of throttle body bracket. See Fig. 3. Remove throttle body bracket nuts at the cylinder head. Remove intake air connector-to-air intake chamber bolts/nuts. Remove intake air connector with throttle body and gasket from air intake chamber.

3) Remove oil filler cap. Remove No. 3 (upper) timing belt cover with gasket. No. 3 (upper) timing belt cover is located above timing belt. Disconnect electrical connectors from ignition coils, located above the spark plugs, in between the valve covers. Remove bolts and ignition coils with spark plug wires. Remove spark plugs.

4) Disconnect engine wiring harness for access to valve covers. Remove bolts/nuts, No. 1 and 2 valve covers and gaskets.

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

5) Rotate crankshaft pulley clockwise (viewed from front of engine) so crankshaft pulley timing mark (groove) aligns with "0" mark on timing belt cover and cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing marks on camshaft sprockets are aligned with timing marks on timing belt cover. See Fig. 5. If timing marks are not aligned, rotate crankshaft pulley clockwise one full revolution (360 degrees).

6) Using feeler gauge, measure and record valve clearance of intake valves on cylinders No. 1, 2 and 4, and exhaust valves on cylinders No. 1, 3 and 5. Perform STEP 1. See Fig. 6.

7) Rotate crankshaft pulley clockwise one full revolution (360 degrees) and realign crankshaft pulley timing mark (groove) with "0" mark on timing belt cover. Using feeler gauge, measure and record valve clearance of intake valves on cylinders No. 3, 5 and 6, and exhaust valves on cylinders No. 2, 4 and 6. Perform STEP 2. See Fig. 5.

8) Ensure valve clearance is within specification. See VALVE CLEARANCE SPECIFICATIONS table.

## VALVE CLEARANCE SPECIFICATIONS

Application	(1) In. (mm)
Intake .....	.006-.010 (.15-.25)
Exhaust .....	.010-.014 (.25-.35)

(1) - Adjust valve clearance with engine cold.

9) If valve clearance adjustment is required, rotate crankshaft pulley so camshaft lobe is facing upward on valve to be adjusted. Rotate valve lifter so notch area on valve lifter is at 90-degree angle to camshaft. This will place notch area perpendicular to camshaft.

10) Valve Clearance Adjuster (SST 09248-55040) is used for adjusting valve clearance. Using SST "A" of valve clearance adjuster, push downward on valve lifter. See Fig. 6. Install SST "B" between camshaft and valve lifter with side marked with No. 7 at designated position. See Fig. 7. Remove SST "A".

NOTE: SST "B" may be marked with a No. 9 in place of the No. 7. When adjusting valve clearance on intake valve on cylinder No. 1, it may be necessary to remove No. 2 camshaft bearing cap so SST "B" may be installed between camshaft and valve lifter.

11) Using small screwdriver and magnet, remove adjusting shim. Using micrometer, measure thickness of removed adjusting shim. Using measured clearance and adjusting shim thickness, determine correct thickness of adjusting shim to be used. See Figs. 8 and 9.

12) Install proper adjusting shim with imprinted numbers on adjusting shim facing downward, toward valve lifter. Using SST "A", press downward on valve lifter and remove SST "B". Recheck valve clearance.

13) Install No. 2 camshaft bearing cap if removed. Tighten camshaft bearing cap bolts to specification. See TORQUE SPECIFICATIONS

14) Apply sealant at indicated No. 1 and 2 valve cover sealing areas on front of cylinder head. See Fig. 10. Using NEW gaskets, install all valve covers. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

15) To install remaining components, reverse removal procedure using NEW gasket for intake air connector gasket. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.

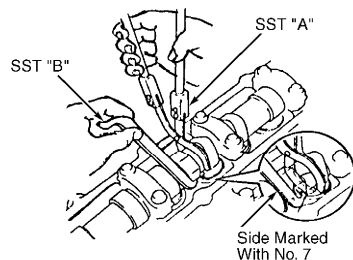


Fig. 7: Removing & Installing Valve Clearance Adjusting Shim  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

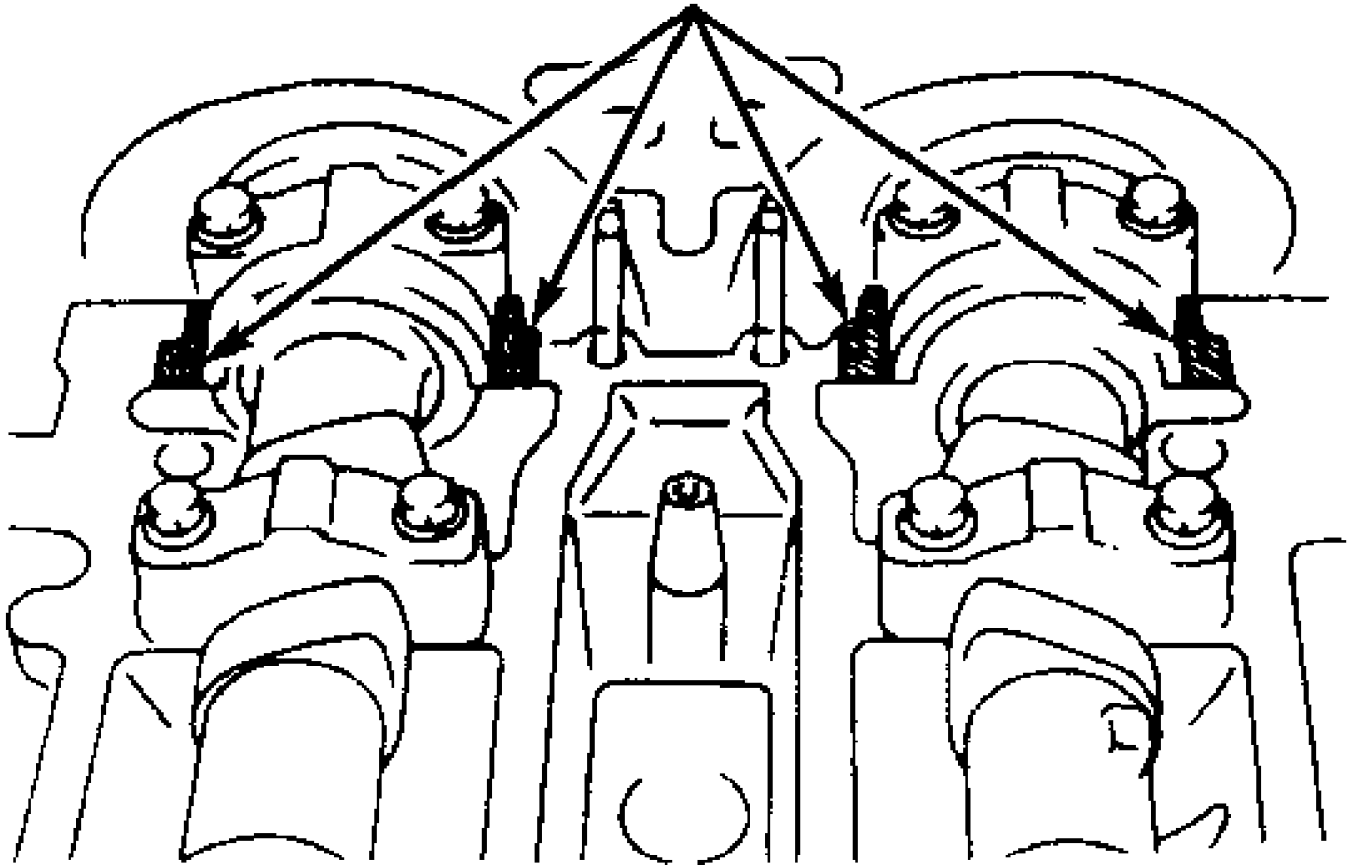




Measured Clearance mm (in.)	Installed Shim Thickness mm (in.)	Shim No.	Thickness	Shim No.	Thickness	New shim thickness mm (in.)	Shim No.	Thickness	Shim No.	Thickness
0.000 - 0.020 (0.000 - 0.008)	2.500 (0.0984)	1	2.500 (0.0984)	10	2.950 (0.1161)	2.500 (0.0984)	1	2.500 (0.0984)	10	2.950 (0.1161)
0.021 - 0.040 (0.008 - 0.016)	2.550 (0.1000)	2	2.550 (0.1004)	11	3.000 (0.1181)	2.550 (0.1000)	2	2.550 (0.1004)	11	3.000 (0.1181)
0.041 - 0.060 (0.016 - 0.024)	2.600 (0.1016)	3	2.600 (0.1024)	12	3.050 (0.1201)	2.600 (0.1016)	3	2.600 (0.1024)	12	3.050 (0.1201)
0.061 - 0.080 (0.024 - 0.032)	2.650 (0.1032)	4	2.650 (0.1043)	13	3.100 (0.1220)	2.650 (0.1032)	4	2.650 (0.1043)	13	3.100 (0.1220)
0.081 - 0.100 (0.032 - 0.040)	2.700 (0.1048)	5	2.700 (0.1063)	14	3.150 (0.1240)	2.700 (0.1048)	5	2.700 (0.1063)	14	3.150 (0.1240)
0.101 - 0.120 (0.040 - 0.047)	2.750 (0.1064)	6	2.750 (0.1083)	15	3.200 (0.1260)	2.750 (0.1064)	6	2.750 (0.1083)	15	3.200 (0.1260)
0.121 - 0.140 (0.047 - 0.055)	2.800 (0.1080)	7	2.800 (0.1102)	16	3.250 (0.1280)	2.800 (0.1080)	7	2.800 (0.1102)	16	3.250 (0.1280)
0.141 - 0.160 (0.055 - 0.063)	2.850 (0.1096)	8	2.850 (0.1122)	17	3.300 (0.1299)	2.850 (0.1096)	8	2.850 (0.1122)	17	3.300 (0.1299)
0.161 - 0.180 (0.063 - 0.071)	2.900 (0.1112)	9	2.900 (0.1142)			2.900 (0.1112)	9	2.900 (0.1142)		
0.181 - 0.200 (0.071 - 0.079)	2.950 (0.1128)					2.950 (0.1128)				
0.201 - 0.220 (0.079 - 0.087)	3.000 (0.1144)					3.000 (0.1144)				
0.221 - 0.240 (0.087 - 0.094)	3.050 (0.1160)					3.050 (0.1160)				
0.241 - 0.260 (0.094 - 0.102)	3.100 (0.1176)					3.100 (0.1176)				
0.261 - 0.280 (0.102 - 0.110)	3.150 (0.1192)					3.150 (0.1192)				
0.281 - 0.300 (0.110 - 0.118)	3.200 (0.1208)					3.200 (0.1208)				
0.301 - 0.320 (0.118 - 0.126)	3.250 (0.1224)					3.250 (0.1224)				
0.321 - 0.340 (0.126 - 0.134)	3.300 (0.1240)					3.300 (0.1240)				
0.341 - 0.360 (0.134 - 0.142)	3.350 (0.1256)					3.350 (0.1256)				
0.361 - 0.380 (0.142 - 0.150)	3.400 (0.1272)					3.400 (0.1272)				
0.381 - 0.400 (0.150 - 0.157)	3.450 (0.1288)					3.450 (0.1288)				
0.401 - 0.420 (0.157 - 0.165)	3.500 (0.1304)					3.500 (0.1304)				
0.421 - 0.440 (0.165 - 0.173)	3.550 (0.1320)					3.550 (0.1320)				
0.441 - 0.460 (0.173 - 0.181)	3.600 (0.1336)					3.600 (0.1336)				
0.461 - 0.480 (0.181 - 0.189)	3.650 (0.1352)					3.650 (0.1352)				
0.481 - 0.500 (0.189 - 0.197)	3.700 (0.1368)					3.700 (0.1368)				
0.501 - 0.520 (0.197 - 0.205)	3.750 (0.1384)					3.750 (0.1384)				
0.521 - 0.540 (0.205 - 0.213)	3.800 (0.1400)					3.800 (0.1400)				
0.541 - 0.560 (0.213 - 0.221)	3.850 (0.1416)					3.850 (0.1416)				
0.561 - 0.580 (0.221 - 0.229)	3.900 (0.1432)					3.900 (0.1432)				
0.581 - 0.600 (0.229 - 0.237)	3.950 (0.1448)					3.950 (0.1448)				
0.601 - 0.620 (0.237 - 0.245)	4.000 (0.1464)					4.000 (0.1464)				
0.621 - 0.640 (0.245 - 0.253)	4.050 (0.1480)					4.050 (0.1480)				
0.641 - 0.660 (0.253 - 0.261)	4.100 (0.1496)					4.100 (0.1496)				
0.661 - 0.680 (0.261 - 0.269)	4.150 (0.1512)					4.150 (0.1512)				
0.681 - 0.700 (0.269 - 0.277)	4.200 (0.1528)					4.200 (0.1528)				
0.701 - 0.720 (0.277 - 0.285)	4.250 (0.1544)					4.250 (0.1544)				
0.721 - 0.740 (0.285 - 0.293)	4.300 (0.1560)					4.300 (0.1560)				
0.741 - 0.760 (0.293 - 0.301)	4.350 (0.1576)					4.350 (0.1576)				
0.761 - 0.780 (0.301 - 0.309)	4.400 (0.1592)					4.400 (0.1592)				
0.781 - 0.800 (0.309 - 0.317)	4.450 (0.1608)					4.450 (0.1608)				
0.801 - 0.820 (0.317 - 0.325)	4.500 (0.1624)					4.500 (0.1624)				
0.821 - 0.840 (0.325 - 0.333)	4.550 (0.1640)					4.550 (0.1640)				
0.841 - 0.860 (0.333 - 0.341)	4.600 (0.1656)					4.600 (0.1656)				
0.861 - 0.880 (0.341 - 0.349)	4.650 (0.1672)					4.650 (0.1672)				
0.881 - 0.900 (0.349 - 0.357)	4.700 (0.1688)					4.700 (0.1688)				
0.901 - 0.920 (0.357 - 0.365)	4.750 (0.1704)					4.750 (0.1704)				
0.921 - 0.940 (0.365 - 0.373)	4.800 (0.1720)					4.800 (0.1720)				
0.941 - 0.960 (0.373 - 0.381)	4.850 (0.1736)					4.850 (0.1736)				
0.961 - 0.980 (0.381 - 0.389)	4.900 (0.1752)					4.900 (0.1752)				
0.981 - 1.000 (0.389 - 0.397)	4.950 (0.1768)					4.950 (0.1768)				
1.001 - 1.020 (0.397 - 0.405)	5.000 (0.1784)					5.000 (0.1784)				
1.021 - 1.040 (0.405 - 0.413)	5.050 (0.1800)					5.050 (0.1800)				
1.041 - 1.060 (0.413 - 0.421)	5.100 (0.1816)					5.100 (0.1816)				
1.061 - 1.080 (0.421 - 0.429)	5.150 (0.1832)					5.150 (0.1832)				
1.081 - 1.100 (0.429 - 0.437)	5.200 (0.1848)					5.200 (0.1848)				
1.101 - 1.120 (0.437 - 0.445)	5.250 (0.1864)					5.250 (0.1864)				
1.121 - 1.140 (0.445 - 0.453)	5.300 (0.1880)					5.300 (0.1880)				
1.141 - 1.160 (0.453 - 0.461)	5.350 (0.1896)					5.350 (0.1896)				

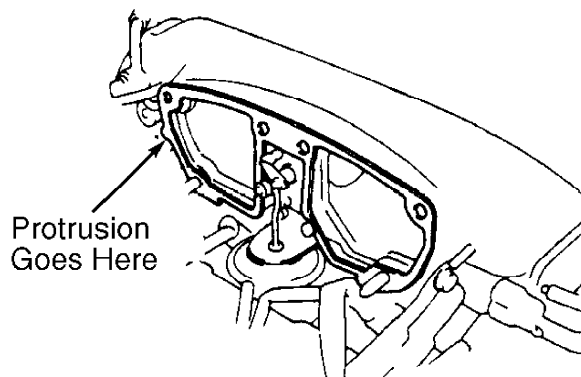
Fig. 9: Exhaust Valve Adjusting Shim Selection Chart  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

# Apply Sealant Here



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Fig. 10: Locating Typical Cylinder Head Sealant Application Areas  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 11: Installing Intake Air Connector Gasket (1997 Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

1997-98 Turbo

1) Remove oil filler cap. Remove No. 3 (upper) timing belt

cover located above timing belt. Disconnect PCV hoses.

2) Disconnect electrical connectors from ignition coils, located above the spark plugs, in between the No. 1 and 2 valve covers. Remove ignition coil bracket-to-valve cover bolts. Remove ignition coil assemblies.

3) Disconnect electrical wiring from clamps at front of engine, above No. 1 and 2 valve covers. Remove electrical wiring protector from front of No. 1 and 2 valve covers.

4) Disconnect ground straps and electrical wiring protector from firewall at rear of No. 1 and 2 valve covers. Disconnect hoses from Idle Air Control (IAC) valve pipe located at firewall, above rear of No. 1 and 2 valve covers. Remove IAC valve pipe from clamp on No. 1 valve cover.

5) Remove cable brackets and vacuum switching valve assemblies for access to No. 1 and 2 valve covers. Remove bolts/nuts, No. 1 and 2 valve covers and gaskets.

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

6) Rotate crankshaft pulley clockwise (viewed from front of engine) and align crankshaft pulley timing mark (groove) with "0" mark on timing belt cover so cylinder No. 1 (front cylinder) is at TDC on compression stroke.

7) Ensure timing marks on camshaft sprockets are aligned with timing marks on timing belt cover. See Fig. 4. If timing marks are not aligned, rotate crankshaft pulley clockwise one full revolution (360 degrees).

8) Using feeler gauge, measure and record valve clearance on intake valves on cylinders No. 1, 2 and 4 and exhaust valves on cylinders No. 1, 3 and 5. Perform STEP 1. See Fig. 6.

9) Rotate crankshaft pulley clockwise one full revolution (360 degrees) and realign crankshaft pulley timing mark (groove) with "0" mark on timing belt cover. Using feeler gauge, measure and record valve clearance on intake valves on cylinders No. 3, 5 and 6 and exhaust valves on cylinders No. 2, 4 and 6. Perform STEP 2. See Fig. 6.

10) Ensure valve clearance is within specification. See VALVE CLEARANCE SPECIFICATIONS table.

#### VALVE CLEARANCE SPECIFICATIONS (1)

Application	In. (mm)
Intake Valve .....	.006-.010 (.15-.25)
Exhaust Valve .....	.010-.014 (.25-.35)

(1) - Adjust valve clearance with engine cold.

11) If valve clearance adjustment is required, rotate crankshaft pulley so camshaft lobe is facing upward on valve to be adjusted. Rotate valve lifter so notch area on valve lifter is at 90-degree angle to camshaft. This will place notch area perpendicular to camshaft.

12) Valve Clearance Adjuster (SST 09248-55040) is used for adjusting valve clearance. Using SST "A" of valve clearance adjuster, push downward on valve lifter. See Fig. 6. Install SST "B" between camshaft and valve lifter with side marked with No. 7 at designated position. See Fig. 7. Remove SST "A".

13) Using small screwdriver and magnet, remove adjusting shim. Using micrometer, measure thickness of removed adjusting shim. Using measured clearance and adjusting shim thickness, determine

correct thickness of adjusting shim to be used. See Figs. 8 and 9.

14) Install proper adjusting shim with imprinted numbers on adjusting shim facing downward, toward valve lifter. Using SST "A", press downward on valve lifter and remove SST "B". Recheck valve clearance.

15) Apply sealant at indicated No. 1 and 2 valve cover sealing areas on front of cylinder head. See Fig. 10. Using NEW gaskets, install No. 1 and 2 valve covers. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

16) To install remaining components, reverse removal procedure. Tighten ignition coil bracket-to-valve cover bolts to specification. See TORQUE SPECIFICATIONS.

## REMOVAL & INSTALLATION

### \* PLEASE READ THIS FIRST \*

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

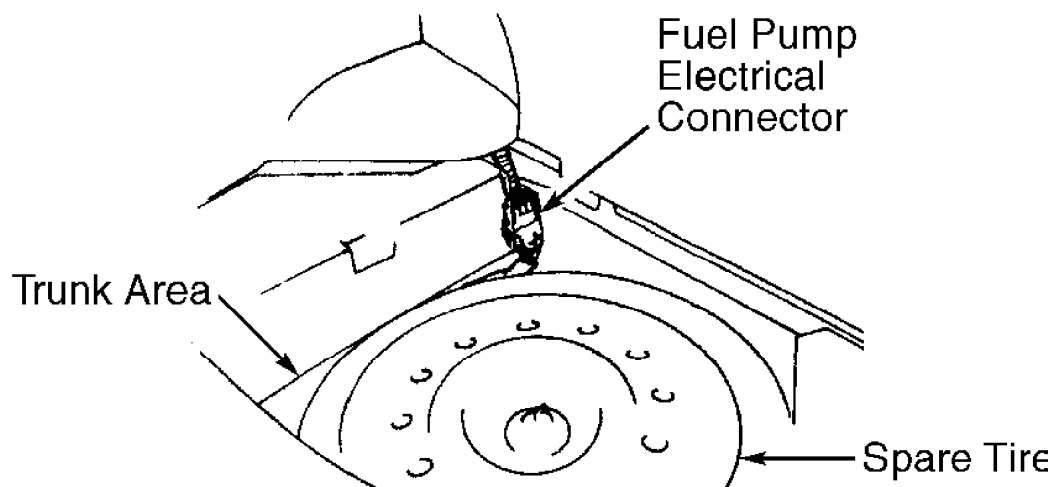
**NOTE:** For reassembly reference, label all electrical connectors, vacuum hoses and fuel lines before removal. Place mating marks on engine hood and other major assemblies before removal.

## FUEL PRESSURE RELEASE

1) Disconnect fuel pump electrical connector located in trunk area, near spare tire. See Fig. 12.

2) Start engine and allow engine to idle until engine stalls. Turn ignition off. Reinstall fuel pump electrical connector.

3) Disconnect negative battery cable. Place suitable container under fuel line connection. Cover fuel line connection with shop towel. Slowly loosen fuel line connection, allowing any fuel pressure to be released. Once fuel pressure is released, fuel system components may be serviced.



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Fig. 12: Locating Fuel Pump Electrical Connector  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## ENGINE

NOTE: Remove engine and transmission as an assembly.

#### Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Remove battery and battery tray. Drain cooling system and engine oil. Remove hood. Raise and support vehicle. Remove lower engine cover.

2) On turbo models, remove all air intake hoses to intake manifold and turbocharger. Remove No. 2 air tube located below radiator. On all models, disconnect control cables from throttle body. Remove air cleaner air duct located above radiator. Remove air cleaner and airflow meter with air cleaner hose attached.

3) Remove lower fan shroud from radiator. On 1997 models, remove left headlight beam angle gauge located near driver's side upper corner of radiator. On all models, remove radiator.

4) On turbo M/T models, remove drive belt tensioner damper, located between drive belt tensioner and stud on front of engine. See Fig. 20. On all models, rotate drive belt tensioner clockwise. Remove drive belt.

5) Place reference mark on fluid coupling, water pump pulley and stud on water pump for reassembly reference. Remove cooling fan, fluid coupling and water pump pulley.

6) On all 1997 models and 1998 turbo models, remove charcoal canister. On all models, disconnect necessary electrical connections and brackets, coolant hoses, fuel lines and vacuum hoses for engine removal. Remove power steering pump with hoses attached and secure aside.

7) Disconnect power steering line from brackets at lower front edge of engine. Remove A/C compressor with hoses attached and secure aside. Disconnect ground straps and electrical wiring protector from firewall at rear of No. 1 and 2 valve covers.

8) Remove passenger's side scuff plate from door opening that holds carpet down. Pull carpet upward on passenger's side of access to Engine Control Module (ECM) located on passenger-side floor panel. See Fig. 13.

9) Remove nuts and ECM protector located on top of ECM. Remove ECM retaining nuts. Lift ECM upward from floor panel. Disconnect electrical connector from ECM. On turbo models, also disconnect electrical connector from Traction Control System (TRAC) Electronic Control Unit (ECU). See Fig. 13.

10) On all models, disconnect necessary electrical connectors from engine wiring. Remove retaining bolts and pull engine wiring out through firewall. See Fig. 13.

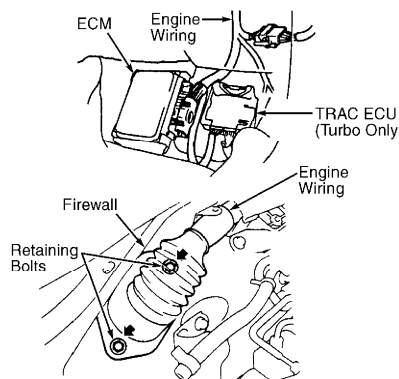


Fig. 13: Locating Typical ECM, TRAC ECU For Turbo Models & Retaining Bolts For Engine Wiring  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

11) On M/T models, remove shift lever knob. Using screwdriver, pry shift lever panel upward from center console for access to shift lever boot. See Fig. 14. Remove bolts and shift lever boot.

12) Remove clutch release cylinder with hose attached and secure aside. Remove shift lever-to-shift linkage bolt/nut at rear of transmission. See Fig. 14. Remove shift lever bolts and shift lever.

13) On A/T models, disconnect shift lever from control rod on transmission. On all models, disconnect necessary electrical connections at transmission.

14) On 1997 non-turbo models, disconnect rear exhaust pipe from front catalytic converter. Remove front catalytic converter and front exhaust pipe.

15) On 1998 non-turbo models, disconnect exhaust pipe at exhaust manifold. Manufacturer states to remove exhaust manifold before removing engine. Disconnect electrical connectors at oxygen sensors on exhaust manifold. Remove nuts, exhaust manifold and gaskets.

16) On 1997-98 turbo models, remove rear exhaust pipe and muffler. Remove front catalytic converter and front exhaust pipe. Remove front exhaust pipe heat insulator from body. Remove center floor crossmember brace located below drive shaft.

17) On all models, place reference marks on drive shaft companion flange at rear axle for reassembly reference. See Fig. 15. On turbo models, also place reference mark on drive shaft companion flange at transmission.

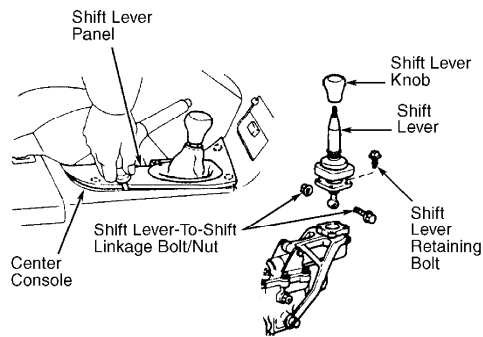
18) On all models, remove 3 drive shaft companion flange-to-rear axle companion flange bolts. DO NOT remove drive shaft-to-companion flange bolts. See Fig. 15. On turbo models, remove drive shaft companion flange bolts at transmission.

19) On all models, remove drive shaft center bearing bolts while holding drive shaft in a straight line. Note location of adjusting washers between center bearing and frame (if equipped) for installation reference.

20) Pull drive shaft toward front of vehicle until companion flange clears centering pin located in center of flange on rear axle. Remove drive shaft.

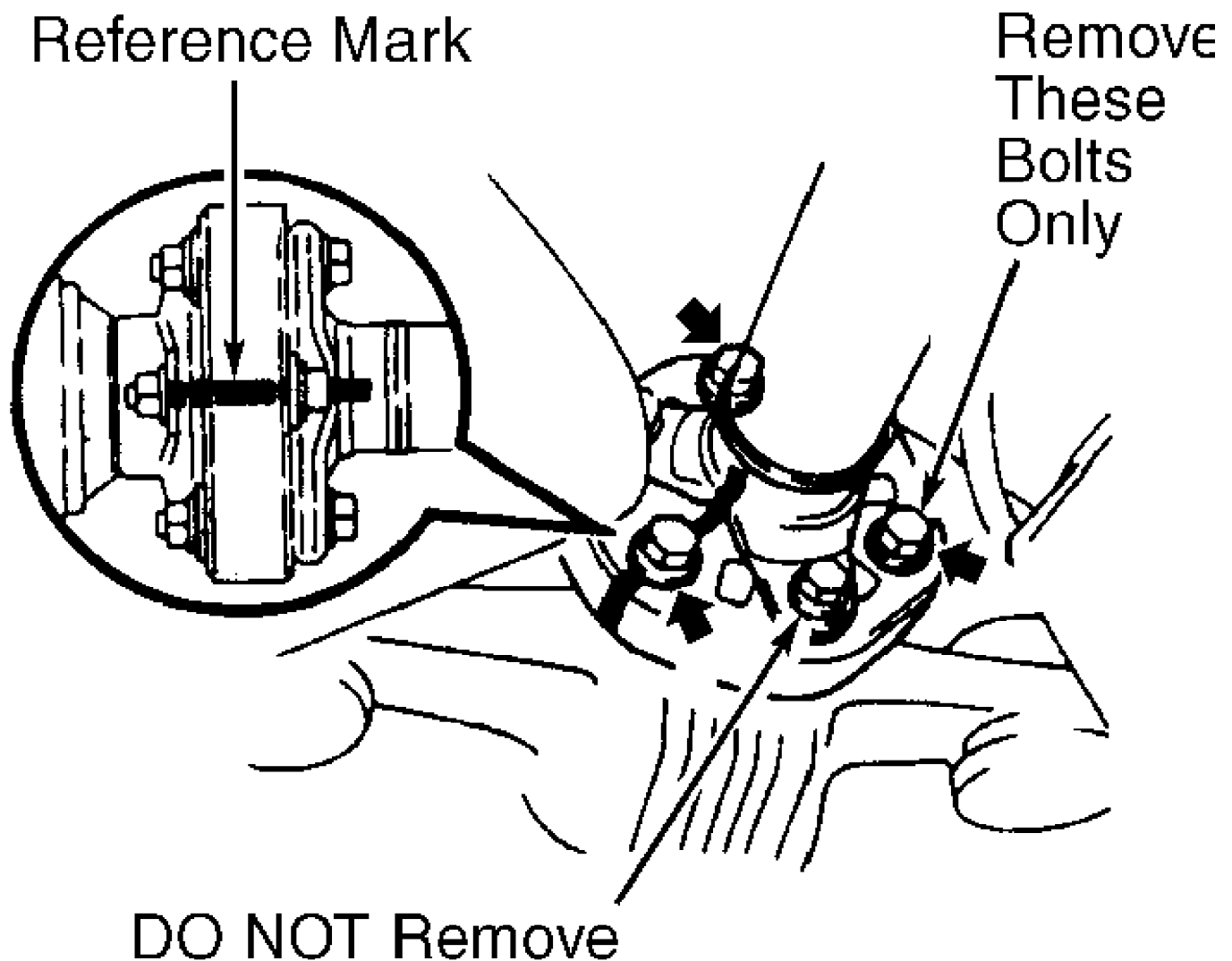
21) On non-turbo models, install Oil Plug (SST 09325-40010) for A/T or (SST 09325-20010) for M/T on output shaft of transmission to prevent fluid leakage.

22) On all models, support transmission with floor jack. Remove transmission mount-to-transmission crossmember nuts. Remove transmission crossmember. Support engine with hoist. Remove engine mount-to-crossmember nuts. Lift engine and transmission from vehicle.



93F83050

Fig. 14: Removing Shift Lever Panel & Shift Lever  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93G83051

Fig. 15: Installing Reference Mark & Removing Drive Shaft Companion Flange Bolts

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

NOTE: On turbo models with M/T, a special inspection procedure must be performed on flywheel, as flywheel consists of a primary and secondary flywheel. See CLUTCH ASSEMBLY under REMOVAL & INSTALLATION in CLUTCH article.

#### Installation

1) To install, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Before installing drive shaft, apply grease on center bushing located in companion flange on drive shaft. Ensure reference marks on drive shaft companion flanges are aligned.

CAUTION: Ensure center bearing on drive shaft is installed so bracket on center bearing is parallel to drive shaft.

2) On A/T models, before connecting shift lever to control

rod on transmission, move control rod fully backward (toward rear of vehicle). Move control rod forward 2 notches to Neutral position.

3) Ensure shift lever is in Neutral. Install control rod on shift lever. Install and tighten nut to specification. See TORQUE SPECIFICATIONS. On all models, adjust fluid levels.

## CYLINDER HEAD & MANIFOLDS

### Removal (Non-Turbo)

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Drain cooling system. Disconnect control cables from throttle body.

2) Raise and support vehicle. Remove lower engine cover. Remove air cleaner air duct located above radiator.

3) Rotate drive belt tensioner clockwise. Remove drive belt. Disconnect exhaust pipe at exhaust manifold. Disconnect electrical connectors at oxygen sensors on exhaust manifold. Remove nuts, exhaust manifolds and gaskets. Remove power steering pump with hoses attached and secure aside.

4) On 1997 models, go to next step. On 1998 models, go to step 8).

5) On 1997 models, remove PCV hose from valve cover. Remove air intake hose located between air filter and throttle body. See Fig. 2. On Calif. models, remove fuel pressure control Vacuum Switching Valve (VSV) bolted to front of air intake chamber.

6) Remove remove EGR pipe and No. 2 vacuum pipe. Remove throttle body bracket located between throttle body and cylinder head. See Fig. 2. Disconnect necessary vacuum hoses, coolant hoses and electrical connectors for removal of cylinder head. Remove intake air connector-to-air intake chamber bolts/nuts. Remove intake air connector and gasket along with throttle body.

7) Note location of No. 1 and 2 air intake chamber brace location for installation reference. See Fig. 16. Remove bolts/nuts, and No. 1 and 2 air intake chamber braces. Remove cylinder head rear cover located at rear of valve covers. Disconnect spark plug wires from spark plugs and clips on valve cover. Remove retaining nut and distributor with "O" ring. Go to step 11). Remove coolant outlet and by-pass hose. See Fig. 16.

8) On 1998 models, remove air intake hose for access to intake air connector with throttle body. See Fig. 3. Disconnect necessary electrical connectors, control cables, hoses and engine wire clamps for removal of intake air connector with throttle body.

9) Note location of throttle body bracket. See Fig. 3. Remove throttle body bracket nuts at the cylinder head. Remove intake air connector-to-air intake chamber bolts/nuts. Remove intake air connector with throttle body and gasket from air intake chamber.

10) Disconnect electrical connectors from ignition coils, located above the spark plugs, in between the valve covers. Remove bolts and ignition coils with spark plug wires. Go to next step.

11) On all models, remove coolant by-pass outlet and coolant by-pass outlet pipe. See Fig. 16 Remove engine oil dipstick and dipstick tube. Remove spark plugs. On A/T models, remove transmission dipstick and dipstick tube.

12) On all models, remove bolts/nuts, air intake chamber and gasket. See Fig. 16. Remove vacuum valve set and No. 2 vacuum pipe. Remove oil filler cap. Remove No. 3 (upper) timing belt cover located above timing belt.

CAUTION: Disconnect timing belt from camshaft sprockets and support timing belt when servicing cylinder head. DO NOT allow timing belt to become disengaged from crankshaft sprocket.

13) Remove timing belt and camshaft sprockets from camshafts.



Ensure timing belt does not become disengaged from crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION.

14) Disconnect electrical connections and remove engine wiring bracket located above intake manifold. Remove intake manifold support. Remove fuel pressure pulsation damper and gasket. Disconnect fuel inlet pipe from delivery pipe.

15) Disconnect electrical connectors from fuel injectors. Remove bolts/nuts, intake manifold and gasket along with delivery pipe and fuel injectors. If necessary, remove bolts, delivery pipe, fuel injectors, spacers and insulators from intake manifold. DO NOT allow fuel injectors to fall from delivery pipe when removing from intake manifold.

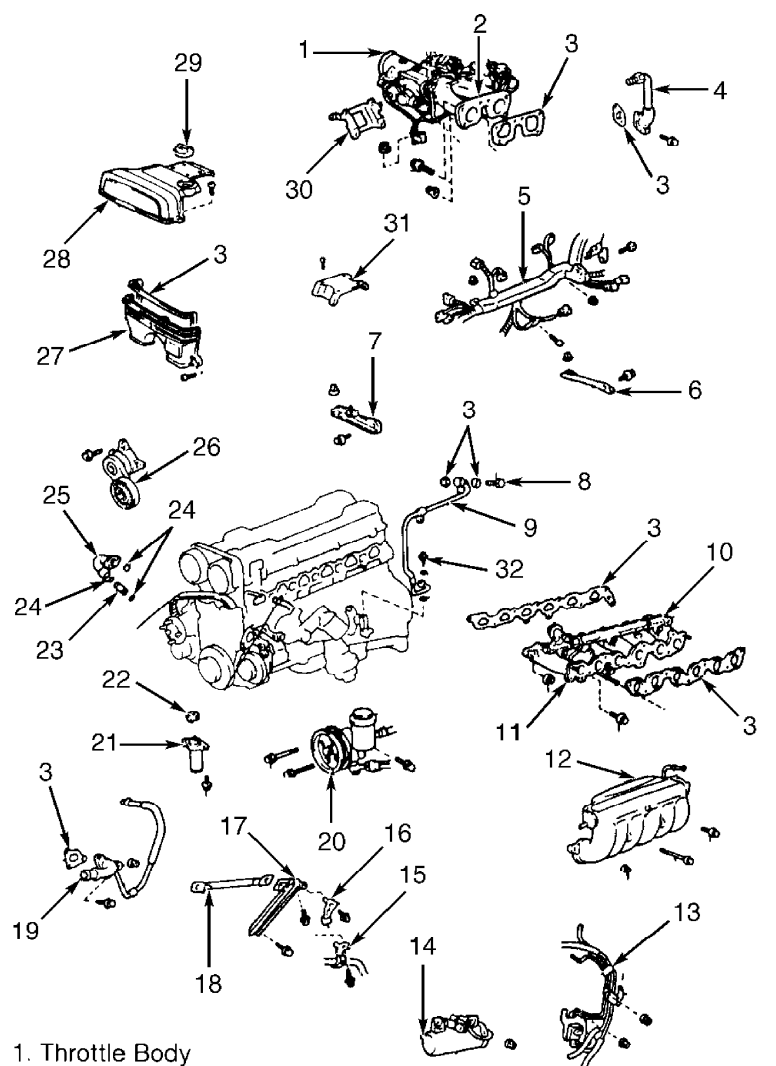
16) Remove No. 4 timing belt cover from cylinder head. See Fig. 17. Remove bolts/nuts, No. 1 and 2 valve covers and gaskets. Remove camshafts. See CAMSHAFTS under REMOVAL & INSTALLATION.

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

17) Loosen cylinder head bolts in sequence using several steps. See Fig. 18. Remove cylinder head bolts, washers, cylinder head and cylinder head gasket.

NOTE: If cylinder head removal is difficult, carefully pry between cylinder head and projected area near front of cylinder block. DO NOT damage sealing surfaces on cylinder block and cylinder head.

18) Remove EGR cooler and gasket from cylinder head (if necessary). See Fig. 16. Note location of adjusting shims and valve lifters for installation reference. Components must be installed in original location. Remove adjusting shims and valve lifters (if necessary).

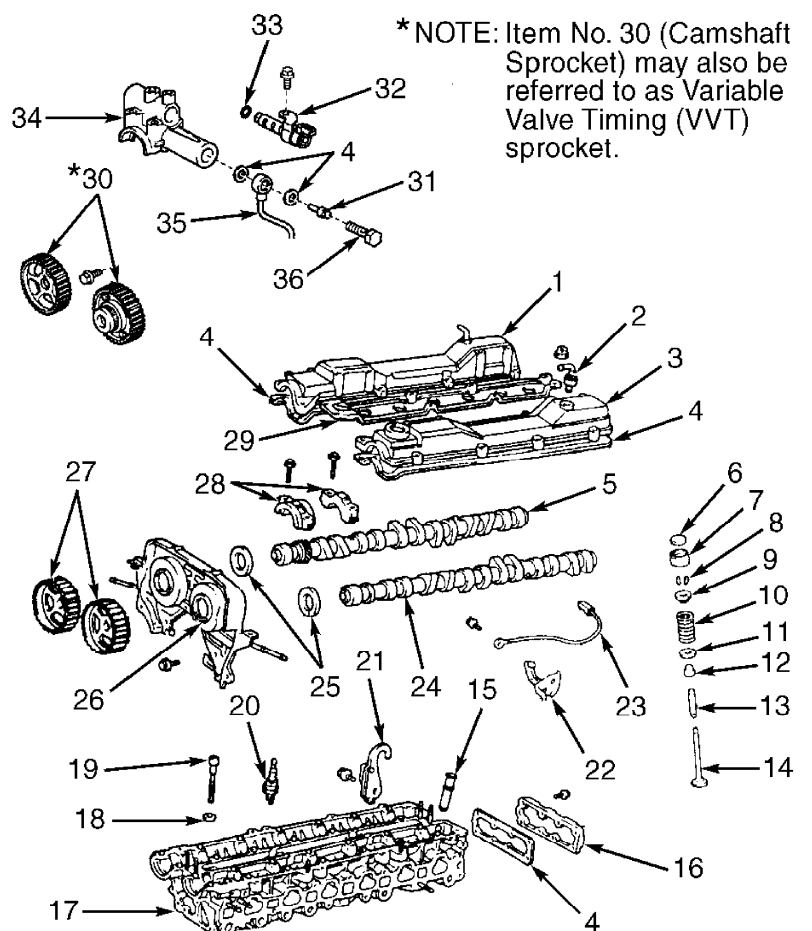


- |                                               |                                               |
|-----------------------------------------------|-----------------------------------------------|
| 1. Throttle Body                              | 18. Power Steering Pump Brace                 |
| 2. Intake Air Connector                       | 19. Coolant Outlet & By-Pass Hose (1997 Only) |
| 3. Gasket                                     | 20. Power Steering Pump                       |
| 4. EGR Pipe (1997 Only)                       | 21. Timing Belt Tensioner                     |
| 5. Engine Wiring Bracket                      | 22. Dust Boot                                 |
| 6. No. 2 Air Intake Chamber Brace (1997 Only) | 23. Coolant By-Pass Outlet Pipe               |
| 7. No. 1 Air Intake Chamber Brace (1997 Only) | 24. "O" Ring                                  |
| 8. Union Bolt                                 | 25. Coolant By-Pass Outlet                    |
| 9. Fuel Inlet Pipe                            | 26. Drive Belt Tensioner                      |
| 10. Delivery Pipe                             | 27. No. 2 Timing Belt Cover                   |
| 11. Intake Manifold                           | 28. No. 3 Timing Belt Cover                   |
| 12. Air Intake Chamber                        | 29. Oil Filler Cap                            |
| 13. No. 2 Vacuum Pipe                         | 30. Throttle Body Bracket                     |
| 14. Vacuum Valve Set                          | 31. Cylinder Head Rear Cover (1997 Only)      |
| 15. Wire Bracket                              | 32. Fuel Pressure Pulsation Damper            |
| 16. Hose Clamp                                |                                               |
| 17. Intake Manifold Support                   |                                               |

98E11761

Fig. 16: Exploded View Of Typical Intake Manifold & Components (Non-Turbo)

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

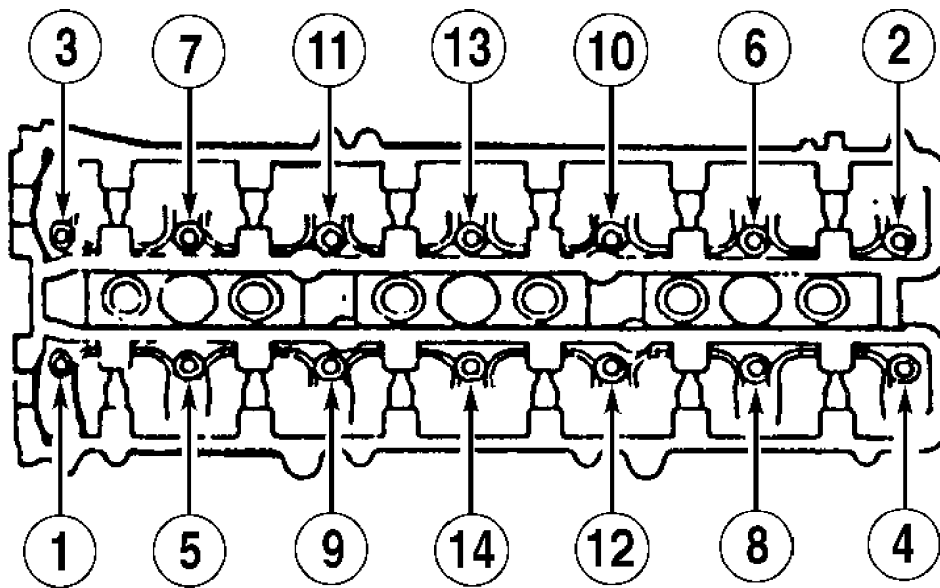


- |                            |                                                   |
|----------------------------|---------------------------------------------------|
| 1. No. 2 Valve Cover       | 20. Spark Plug                                    |
| 2. PCV Valve               | 21. Engine Hanger                                 |
| 3. No. 1 Valve Cover       | 22. Throttle Cable Bracket                        |
| 4. Gasket                  | 23. Ground Strap                                  |
| 5. Exhaust Camshaft        | 24. Intake Camshaft                               |
| 6. Adjusting Shim          | 25. Camshaft Oil Seal                             |
| 7. Valve Lifter            | 26. No. 4 Timing Belt Cover                       |
| 8. Valve Keepers           | 27. Camshaft Sprocket (1997)                      |
| 9. Spring Retainer         | 28. Camshaft Bearing Cap                          |
| 10. Valve Spring           | 29. No. 3 Valve Cover (1997 Only)                 |
| 11. Spring Seat            | 30. Camshaft Sprocket (1998)                      |
| 12. Valve Stem Oil Seal    | 31. Oil Control Valve Filter                      |
| 13. Valve Guide            | 32. Camshaft Timing Oil Control Valve (1998 Only) |
| 14. Valve                  | 33. "O" Ring (1998 Only)                          |
| 15. Heater Hose Union      | 34. No. 1 Camshaft Bearing Cap (1998 Only)        |
| 16. EGR Cooler (1997 Only) | 35. No. 1 Oil Pipe (1998 Only)                    |
| 17. Cylinder Head          | 36. Union Bolt (1998 Only)                        |
| 18. Washer                 |                                                   |
| 19. Cylinder Head Bolt     |                                                   |

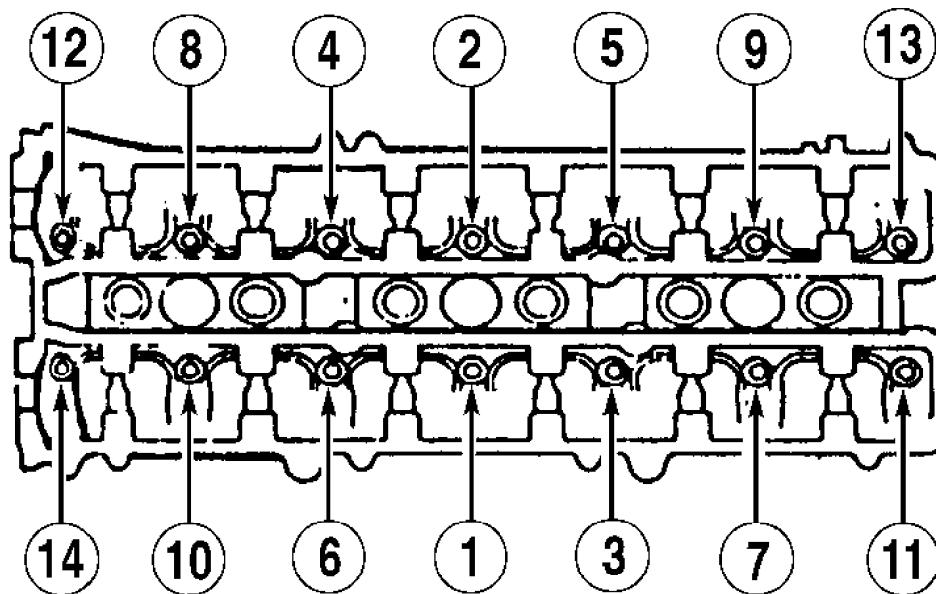
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Fig. 17: Exploded View Of Typical Cylinder Head & Components (Non-Turbo)

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



REMOVAL



INSTALLATION

◀ FRONT OF ENGINE

93J83054

Fig. 18: Cylinder Head Bolt Removal & Installation Sequence  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect cylinder head warpage at cylinder block and

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

2) Check intake manifold, air intake chamber and exhaust manifold machined surfaces for warpage. Replace component if warpage exceeds specification. See WARPAGE SPECIFICATIONS (NON-TURBO) table.

#### WARPAGE SPECIFICATIONS (NON-TURBO)

Application	In. (mm)
Air Intake Chamber .....	.0059 (.150)
Exhaust Manifold .....	.0196 (.500)
Intake Manifold .....	.0059 (.150)

3) Inspect cylinder block deck surface for warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Inspect camshaft and components. See CAMSHAFTS under REMOVAL & INSTALLATION.

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

5) Using caliper, measure cylinder head bolt outside diameter 2.0" (50 mm) down from bottom of bolt head. Replace cylinder head bolt if outside diameter is less than .421" (10.70 mm).

#### Installation

1) On 1997 models, use NEW gasket and install EGR cooler (if removed). Tighten bolts to specification. See TORQUE SPECIFICATIONS.

2) On all models, if installing heater hose union in cylinder head, apply Sealant (08833-00070) to heater hose union. Use hammer and wooden block, tap heater hose union into cylinder head. Install heater hose union into cylinder head until distance from top of heater hose union to surface of cylinder head is 1.89" (48.0 mm).

3) Install valve lifters and adjusting shims in original location (if removed). Ensure valve lifter rotates smoothly in cylinder head.

CAUTION: Ensure all holes in cylinder head gasket align with holes in cylinder block.

4) Install NEW cylinder head gasket on cylinder block. Install cylinder head. Apply light coat of engine oil to threads and underside of cylinder head bolts. Install washer on each cylinder head bolt. Install and tighten cylinder head bolts to specification in sequence using several steps. See Fig. 18. See TORQUE SPECIFICATIONS.

5) Install camshafts using proper procedure. See CAMSHAFTS under REMOVAL & INSTALLATION. Check and adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

6) Install No. 4 timing belt cover on front of cylinder head. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Install camshaft sprockets and timing belt using proper procedure. See TIMING BELT under REMOVAL & INSTALLATION.

7) To install remaining components, reverse removal procedure using NEW "O" rings and gaskets. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Before installing gaskets and No. 1 and 2 valve covers, apply sealant at indicated valve cover sealing areas on front of cylinder head. See Fig. 10.

8) If fuel injector was removed from delivery pipe, coat NEW "O" rings with gasoline. Install NEW "O" rings on fuel injectors. Install NEW grommets and insulators on fuel injectors.

9) Using twisting motion, install fuel injector in delivery

pipe. Ensure electrical connector on fuel injector is facing toward top of engine. Install spacers for delivery pipe on intake manifold. Install fuel injectors and delivery pipe on intake manifold.

10) Loosely install delivery pipe bolts. Ensure fuel injectors rotate smoothly with delivery pipe installed. If fuel injectors do not rotate smoothly, check for improper "O" ring installation.

11) Tighten delivery pipe bolts to specification. See TORQUE SPECIFICATIONS. When installing electrical connectors on fuel injectors, No. 1, 3 and 5 fuel injector electrical connectors are Dark Gray. For No. 2, 4 and 6 fuel injectors, electrical connectors are Gray or Brown. On 1997 models, go to next step. On 1998 models, go to step 17).

12) On 1997 models, No. 1 and 2 air intake chamber braces are marked with an "F" or "R". When installing No. 1 and 2 air intake chamber braces on air intake chamber, ensure No. 1 brace marked "F" goes to front (timing belt side) of engine and No. 2 brace marked "R" goes to rear of engine.

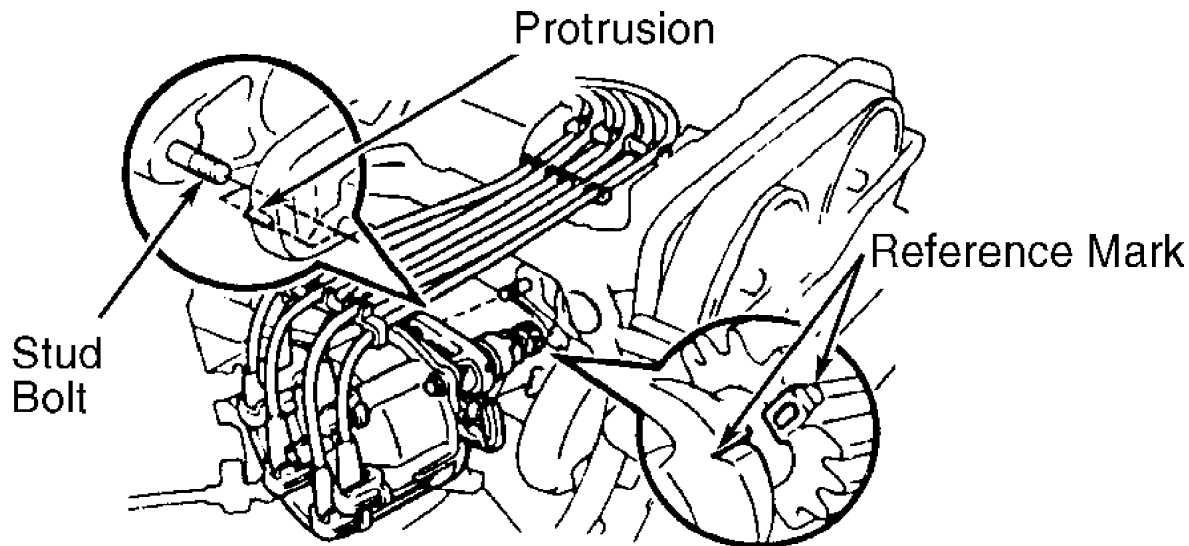
13) Ensure air intake connector gasket is installed with protrusion in proper area. See Fig. 11. Install NEW "O" ring on distributor. Coat "O" ring with engine oil.

14) When installing distributor, rotate crankshaft pulley clockwise (viewed from front of engine) and align crankshaft pulley timing mark (groove) with "0" mark on timing belt cover so cylinder No. 1 (front cylinder) is at TDC on compression stroke.

15) Ensure timing marks on camshaft sprockets are aligned with timing marks on timing belt cover. See Fig. 4. If timing marks are not aligned, rotate crankshaft clockwise one full revolution (360 degrees).

16) Align reference mark on distributor gear with reference mark on distributor housing. Install distributor so protrusion on distributor flange aligns with stud bolt on cylinder head. See Fig. 19. Install distributor retaining nut.

17) On all models, adjust fluid levels and control cables. On 1997 models, check and adjust ignition timing.



93A83055

Fig. 19: Installing Distributor (1997 Non-Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Removal (Turbo)

1) Release fuel pressure. See FUEL PRESSURE RELEASE under

REMOVAL & INSTALLATION. Drain cooling system.

2) Remove turbochargers. See TURBOCHARGERS under REMOVAL & INSTALLATION. Remove exhaust manifold and gasket. On M/T models, remove drive belt tensioner damper, located between drive belt tensioner and stud on front of engine. See Fig. 20. On all models, rotate drive belt tensioner clockwise. Remove drive belt.

3) Disconnect upper radiator hose from coolant outlet located above water pump. Remove bolts/nuts, coolant outlet and gasket. Remove No. 1 coolant by-pass pipe located between coolant outlet and water pump.

4) Remove power steering pump with hoses attached and secure aside. Disconnect necessary vacuum hoses, coolant hoses and electrical connectors for cylinder head removal.

5) Disconnect control cables at throttle body. Remove bolts/nuts, throttle body and gasket. Remove the oil dipstick and dipstick tube. On A/T models, remove transmission dipstick and dipstick tube.

6) On all models, remove air intake chamber support brace and control cable bracket from air intake chamber. Remove EGR pipe, coolant by-pass pipe and intake manifold support. See Fig. 20.

7) Remove retaining bolt holding engine wire protector to intake manifold. Remove bolts/nuts, air intake chamber and gasket. See Fig. 20.

8) Remove pressure tank and Vacuum Switching Valve (VSV) assembly located below intake manifold. See Fig. 20. Disconnect fuel inlet and return pipes from delivery pipe.

9) Disconnect electrical connectors from fuel injectors. Remove the bolts/nuts, intake manifold and gasket along with delivery pipe and fuel injectors.

10) If necessary, remove bolts, fuel injector holders, insulators, delivery pipe, fuel injectors, spacers and insulators from intake manifold. DO NOT allow fuel injectors to fall from delivery pipe when removing from intake manifold.

CAUTION: Disconnect timing belt from camshaft sprockets and support when servicing cylinder head. DO NOT allow timing belt to become disengaged from crankshaft sprocket.

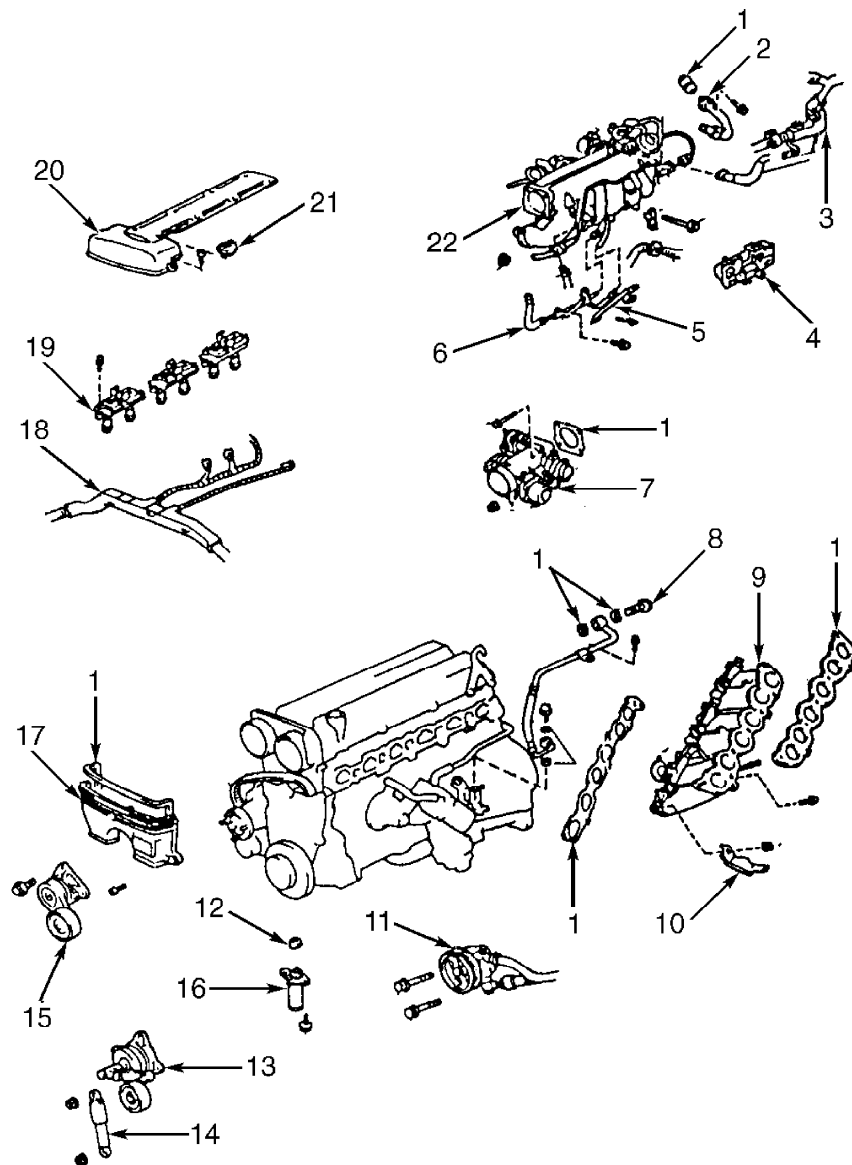
11) Remove timing belt and camshaft sprockets from camshafts. Ensure timing belt does not become disengaged from crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION.

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

12) Remove No. 4 timing belt cover from cylinder head. See Fig. 21. Remove camshafts. See CAMSHAFTS under REMOVAL & INSTALLATION. Loosen cylinder head bolts in sequence using several steps. See Fig. 18. Remove cylinder head bolts, washers, cylinder head and cylinder head gasket.

NOTE: If cylinder head removal is difficult, carefully pry between cylinder head and projected area near front of cylinder block. DO NOT damage sealing surfaces on cylinder block and cylinder head.

13) Remove EGR cooler, camshaft position sensors and gaskets from cylinder head (if necessary). See Fig. 21. Note location of adjusting shims and valve lifters for installation reference. Components must be installed in original location. Remove adjusting shims and valve lifters (if necessary).

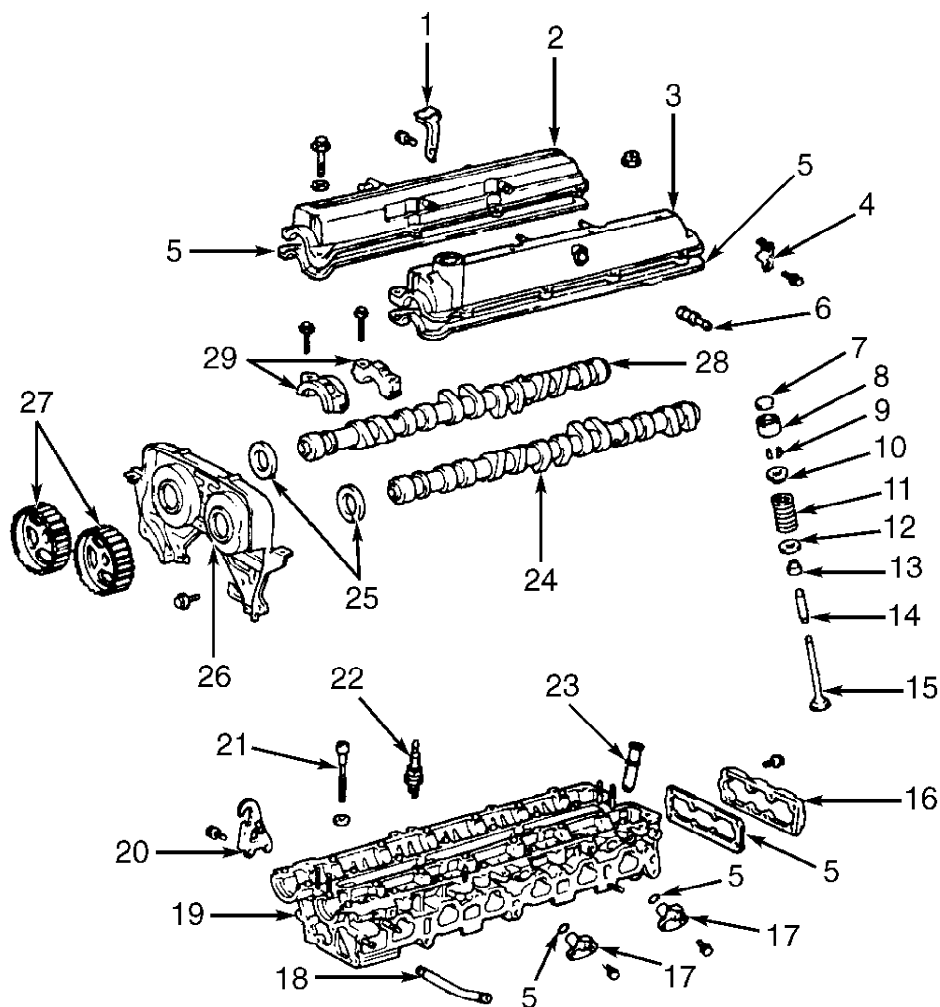


- |                                    |                                       |
|------------------------------------|---------------------------------------|
| 1. Gasket                          | 12. Dust Boot                         |
| 2. EGR Pipe                        | 13. Drive Belt Tensioner (M/T)        |
| 3. Engine Wire Protector           | 14. Drive Belt Tensioner Damper (M/T) |
| 4. Pressure Tank & VSV Assembly    | 15. Drive Belt Tensioner (A/T)        |
| 5. Intake Manifold Support         | 16. Timing Belt Tensioner             |
| 6. Coolant By-Pass Pipe            | 17. No. 2 Timing Belt Cover           |
| 7. Throttle Body                   | 18. Engine Wire                       |
| 8. Union Bolt                      | 19. Ignition Coil Assembly            |
| 9. Intake Manifold & Delivery Pipe | 20. No. 3 Timing Belt Cover           |
| 10. Engine Wire Bracket            | 21. Oil Filler Cap                    |
| 11. Power Steering Pump            | 22. Air Intake Chamber                |

93B83056

Fig. 20: Exploded View Of Intake Manifold & Components (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.





- |                         |                              |
|-------------------------|------------------------------|
| 1. Cable Bracket        | 16. EGR Cooler               |
| 2. No. 2 Valve Cover    | 17. Camshaft Position Sensor |
| 3. No. 1 Valve Cover    | 18. Coolant By-Pass Hose     |
| 4. Pipe Clamp           | 19. Cylinder Head            |
| 5. Gasket               | 20. Engine Hanger            |
| 6. PCV Valve            | 21. Cylinder Head Bolt       |
| 7. Adjusting Shim       | 22. Spark Plug               |
| 8. Valve Lifter         | 23. Heater Hose Union        |
| 9. Valve Keepers        | 24. Intake Camshaft          |
| 10. Spring Retainer     | 25. Camshaft Oil Seal        |
| 11. Valve Spring        | 26. No. 4 Timing Belt Cover  |
| 12. Spring Seat         | 27. Camshaft Sprocket        |
| 13. Valve Stem Oil Seal | 28. Exhaust Camshaft         |
| 14. Valve Guide         | 29. Camshaft Bearing Cap     |
| 15. Valve               |                              |

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Fig. 21: Exploded View Of Cylinder Head & Components (Turbo)  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect cylinder head warpage at cylinder block and

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

2) Check intake manifold, air intake chamber and exhaust manifold warpage. Replace component if warpage exceeds specification. See WARPAGE SPECIFICATIONS (TURBO) table.

#### WARPAGE SPECIFICATIONS (TURBO)

Application	In. (mm)
Air Intake Chamber .....	.0059 (.150)
Exhaust Manifold .....	.0315 (.800)
Intake Manifold .....	.0059 (.150)

3) Inspect cylinder block deck surface for warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Inspect camshaft and components. See CAMSHAFTS under REMOVAL & INSTALLATION.

4) Measure valve lifter diameter and bore diameter. Ensure oil clearance is within specification. Replace components if necessary. See VALVE LIFTERS table under ENGINE SPECIFICATIONS. Inspect turbochargers and components. See TURBOCHARGERS under REMOVAL & INSTALLATION.

5) Using caliper, measure cylinder head bolt outside diameter 2.0" (50 mm) down from bottom of bolt head. Replace cylinder head bolt if the outside diameter is less than .421" (10.70 mm).

#### Installation

1) Using NEW gasket, install EGR cooler and camshaft position sensors (if removed). Tighten bolts to specification. See TORQUE SPECIFICATIONS. If installing heater hose union in cylinder head, apply Sealant (08833-00070) to heater hose union.

2) Use hammer and wooden block, tap heater hose union into cylinder head. Install heater hose union into cylinder head until distance from top of heater hose union to surface of cylinder head is 2.87" (73.0 mm) on 1997 models or 1.89" (48.0 mm) for 1998 models.

3) Ensure valve lifters and adjusting shims are installed in original location (if removed). Ensure valve lifter rotates smoothly in cylinder head.

CAUTION: Ensure all holes in cylinder head gasket align with holes in cylinder block.

4) Install NEW cylinder head gasket on cylinder block. Install cylinder head. Apply light coat of oil to threads and underside of cylinder head bolts. Install washer on each cylinder head bolt. Install and tighten cylinder head bolts to specification in sequence using several steps. See Fig. 18. See TORQUE SPECIFICATIONS.

5) Install camshafts using proper procedure. See CAMSHAFTS under REMOVAL & INSTALLATION. Check and adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

6) Install No. 4 timing belt cover on front of cylinder head. Tighten bolts to specification. See TORQUE SPECIFICATIONS. Install camshaft sprockets and timing belt using proper procedure. See TIMING BELT under REMOVAL & INSTALLATION.

7) To install remaining components, reverse removal procedure using NEW "O" rings and gaskets. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Before installing gaskets and No. 1 and 2 valve covers, apply sealant at indicated valve cover sealing areas on front of cylinder head. See Fig. 10.

8) If fuel injector was removed from delivery pipe, coat NEW "O" rings with gasoline. Install 2 NEW "O" rings and insulator on fuel

injector. Push fuel injector into delivery pipe so electrical connector is facing correct direction.

**NOTE:** Electrical connector on fuel injector should face upward (toward top of engine) on all fuel injectors except front fuel injector at timing belt end of engine. Front fuel injector electrical connector should face downward, toward intake manifold.

9) Install spacers for delivery pipe on intake manifold. Install 6 NEW insulators on delivery pipe where delivery pipe fits into intake manifold. Install delivery pipe on intake manifold. Install and tighten delivery pipe bolts to specification. See **TORQUE SPECIFICATIONS**.

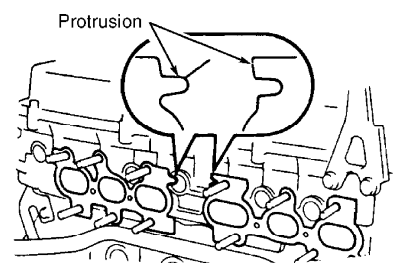
10) Ensure NEW insulator is installed on end of fuel injector. Install fuel injector holders on fuel injectors. Install and tighten fuel injector holder-to-delivery pipe bolts to specification. See **TORQUE SPECIFICATIONS**.

11) Install electrical connectors on fuel injectors. For No. 1, 3 and 5 fuel injectors, electrical connectors are Dark Gray. For No. 2, 4 and 6 fuel injectors, electrical connectors are Gray. Once fuel injectors are connected, secure fuel injector connector wiring loom in place.

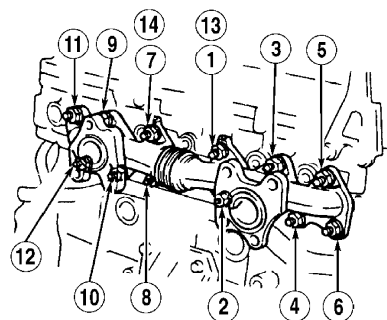
12) Apply soapy water solution to "O" rings on No. 1 coolant by-pass pipe before installing. Install exhaust manifold gaskets with protrusion areas in correct location. See Fig. 22.

13) Install exhaust manifold using NEW nuts. Tighten nuts to specification and sequence using several steps. See Fig. 22. See **TORQUE SPECIFICATIONS**.

14) Ensure proper procedure is used when installing turbochargers. See **TURBOCHARGERS** under **REMOVAL & INSTALLATION**. Fill cooling system.



INSTALLING EXHAUST MANIFOLD GASKETS



EXHAUST MANIFOLD NUT TIGHTENING SEQUENCE

96H18900

Fig. 22: Installing Exhaust Manifold (Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## TURBOCHARGERS

#### Removal

1) Drain cooling system. Raise and support vehicle. Remove lower engine cover. Disconnect cruise control actuator cable from throttle body.

2) Remove all air intake hoses to turbochargers. Remove air cleaner air duct located above radiator. Remove air cleaner and airflow meter with air cleaner hose attached.

3) Remove theft deterrent horn from passenger's side strut tower. Remove front lower arm bracket support and upper front crossmember extension. See Fig. 23.

4) Remove front catalytic converter and front exhaust pipe. Remove front exhaust pipe heat insulator from body. On A/T models, remove clamp brackets for transmission oil cooler lines at cylinder block and alternator.

5) On all models, remove bolts holding engine wiring protector to firewall. Disconnect necessary hoses, vacuum pipes, electrical connections and clamps for turbocharger removal. Remove Vacuum Switching Valve (VSV) assemblies for access to turbochargers.

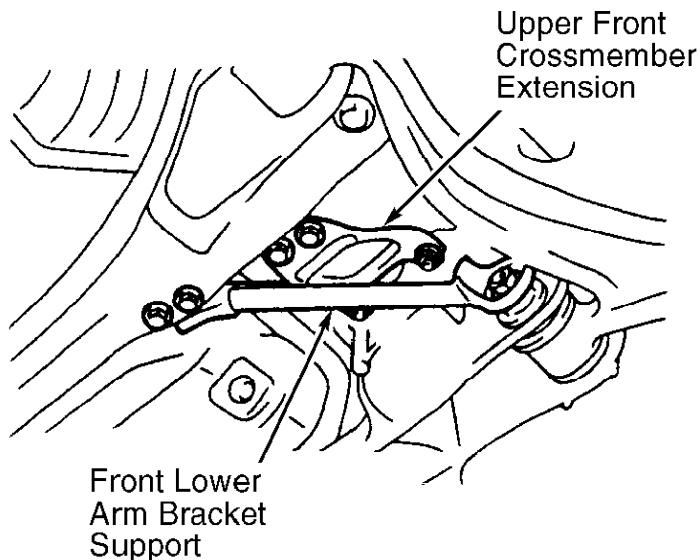
6) Remove bolts and separate No. 1 vacuum pipe and gasket from No. 1 turbocharger. See Fig. 24. Remove nuts and No. 4 air tube and air by-pass valve assembly and gasket from No. 1 turbocharger.

7) Remove nuts and intake air control valve with gasket from No. 2 turbocharger. Disconnect necessary hoses from No. 1 air tube. Remove No. 1 air tube.

8) Remove cable bracket and air inlet duct from above turbochargers. See Fig. 23. Remove heat insulator, exhaust by-pass pipe and gaskets from turbochargers.

9) Remove exhaust gas control valve brace. Remove main oxygen sensor and gasket from exhaust gas control valve. Remove exhaust gas control valve and gasket.

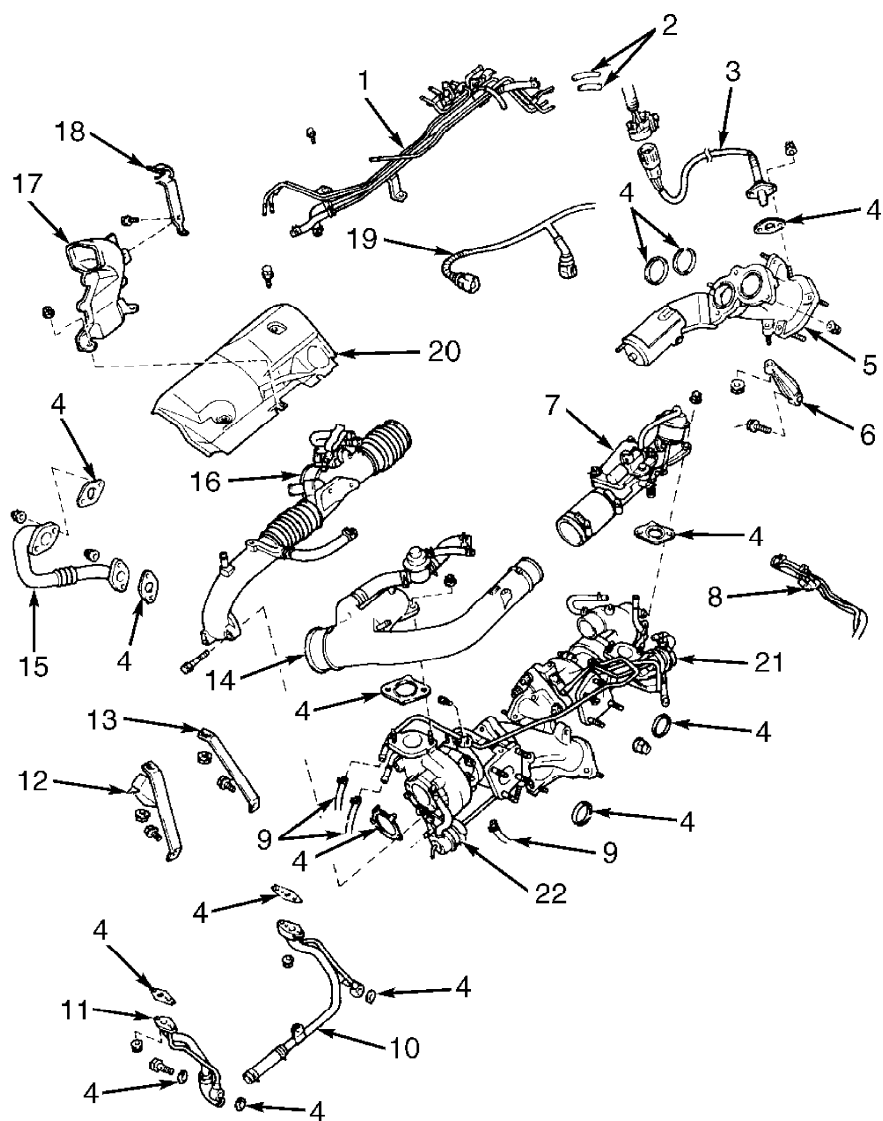
10) Remove No. 1 and 2 turbocharger supports. Remove No. 1 and 2 oil pipes and gaskets from turbochargers, No. 1 oil pan and cylinder block. See Fig. 24. Disconnect remaining coolant hoses. Remove turbocharger-to-exhaust manifold nuts. Remove turbochargers and gaskets from exhaust manifold.



93183061

Fig. 23: Locating Front Lower Arm Bracket Support & Upper Front Crossmember Extension

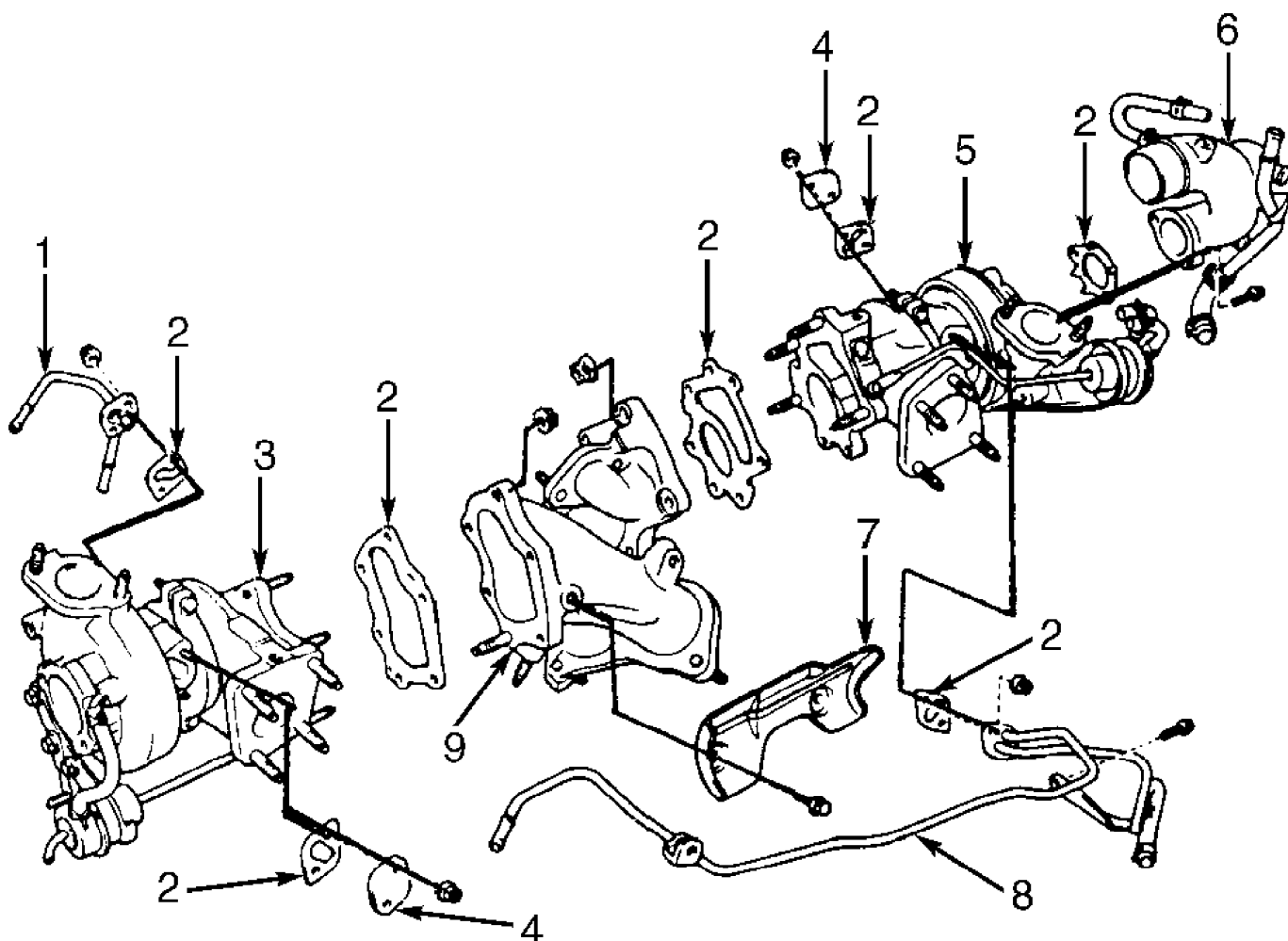
Courtesy of Toyota Motor Sales, U.S.A., Inc.



- |                                |                                |
|--------------------------------|--------------------------------|
| 1. No. 1 Vacuum Pipe           | 12. No. 1 Turbocharger Support |
| 2. Air Hose                    | 13. No. 2 Turbocharger Support |
| 3. Main Oxygen Sensor          | 14. No. 4 Air Tube & Air       |
| 4. Gasket                      | By-Pass Valve Assembly         |
| 5. Exhaust Gas Control Valve   | 15. Exhaust By-Pass Pipe       |
| 6. Exhaust Gas Control         | 16. No. 1 Air Tube             |
| Valve Brace                    | 17. Air Inlet Duct             |
| 7. Intake Air Control Valve    | 18. Cable Bracket              |
| 8. Idle Air Control Valve Pipe | 19. Engine Wire                |
| 9. Coolant By-Pass Hose        | 20. Heat Insulator             |
| 10. No. 2 Oil Pipe             | 21. No. 2 Turbocharger         |
| 11. No. 1 Oil Pipe             | 22. No. 1 Turbocharger         |

93J83062

Fig. 24: Identifying Turbochargers, Air Tubes & Components  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



- 1. No. 1 Coolant Pipe
- 2. Gasket
- 3. No. 1 Turbocharger
- 4. Bearing Housing Side Plate
- 5. No. 2 Turbocharger

- 6. No. 2 Air Tube & Coolant Pipe
- 7. Exhaust Manifold Plate (1997 Only)
- 8. No. 2 Coolant Pipe
- 9. Turbine Outlet Elbow

98H07887

Fig. 25: Exploded View Of Turbochargers & Turbine Outlet Elbow  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Disassembly

1) Remove No. 2 air tube and coolant pipe with gasket from No. 2 turbocharger. See Fig. 25. On 1997 models, remove exhaust manifold plate. On all models, remove No. 1 and 2 coolant pipes and gaskets from turbochargers.

2) Remove bearing housing side plates and gaskets from turbochargers. Remove turbocharger-to-turbine outlet elbow nuts. Separate turbochargers and gaskets from turbine outlet elbow.

#### Inspection

1) Rotate shaft and turbine wheel in each turbocharger.

Replace turbocharger if turbine wheel fails to rotate smoothly. Inspect impeller wheel and turbine wheel for damaged blades. Replace turbocharger if blades are damaged.

2) Turbine shaft end play and radial play must be checked. To check turbine shaft end play, attach dial indicator on turbocharger with stem resting against end of shaft at impeller wheel. See Fig. 26. Push turbine wheel all the way in one direction and zero dial indicator.

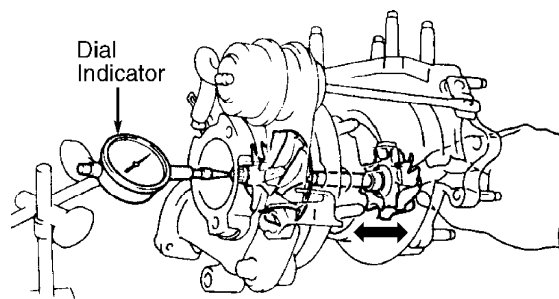
3) Pull turbine wheel back all the way and note end play reading on dial indicator. Replace turbocharger if turbine shaft end play exceeds specification. See TURBOCHARGER SPECIFICATIONS table.

4) To check turbine shaft radial play, attach dial indicator on turbocharger with stem resting through oil hole, against the shaft. See Fig. 26. Push shaft inward, toward inside of turbocharger and zero dial indicator.

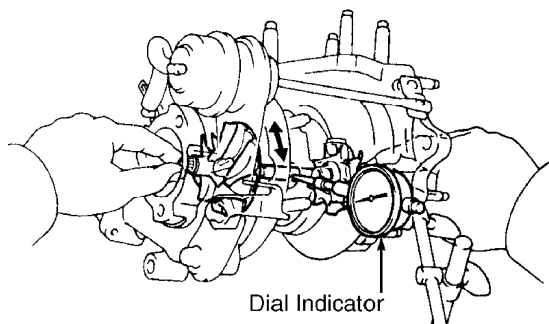
5) Pull shaft outward, toward outside of turbocharger and note turbine shaft radial play reading on dial indicator. Replace turbocharger if turbine shaft radial play exceeds specification. See TURBOCHARGER SPECIFICATIONS table.

#### TURBOCHARGER SPECIFICATIONS

Application	In. (mm)
Turbine Shaft End Play .....	.0043 (.110)
Turbine Shaft Radial Play	
1997 Models .....	.0064 (.162)
1998 Models .....	.0068 (.173)



CHECKING TURBINE SHAFT END PLAY



CHECKING TURBINE SHAFT RADIAL PLAY

97H06393  
Fig. 26: Checking Turbine Shaft End Play & Radial Play  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Reassembly

1) To ensure bearing is properly lubricated, pour 20 cc of

clean engine oil into oil inlet on turbocharger while rotating shaft and turbine wheel.

2) To reassemble, reverse disassembly procedure using NEW gaskets. Use NEW nuts when installing turbocharger on turbine outlet elbow. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

#### Installation

1) Using NEW gaskets, install turbochargers on exhaust manifold. Install NEW nuts and tighten to specification using several steps. See TORQUE SPECIFICATIONS.

2) To install remaining components, reverse removal procedure using NEW gaskets. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

3) Use NEW nuts when installing main oxygen sensor, exhaust by-pass pipe, exhaust control valve and front exhaust pipe at turbine outlet elbow. Fill cooling system.

### CRANKSHAFT FRONT SEAL

#### Removal & Installation (Oil Pump Installed)

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

2) To install, use hammer and Seal Installer (SST 09316-60011). Install seal until seal surface is even with oil pump body. Apply grease to sealing lip of seal. To install remaining components, reverse removal procedure.

#### Removal & Installation (Oil Pump Removed)

Pry seal from oil pump body. To install, use hammer and Seal Installer (SST 09316-60011). Install seal until seal surface is even with oil pump body. Apply grease to sealing lip of seal.

### TIMING BELT

#### Removal (1997 Non-Turbo & Turbo, & 1998 Turbo)

1) Remove battery and battery tray. Raise and support vehicle. Remove lower engine cover. Drain cooling system.

2) On turbo models, remove No. 2 air tube located below radiator. Remove air intake hose to air intake chamber for access to timing belt covers. On all models, remove air cleaner air duct located above radiator.

3) On 1997 models, remove left headlight beam angle gauge located near driver's side upper corner of radiator. On all models, remove lower fan shroud from radiator. Remove radiator.

4) On turbo M/T models, remove drive belt tensioner damper, located between drive belt tensioner and stud on front of engine. See Fig. 27. On all models, rotate drive belt tensioner clockwise. Remove drive belt.

5) Place reference mark on fluid coupling, water pump pulley and stud on water pump for reassembly reference. Remove cooling fan, fluid coupling and water pump pulley.

6) Remove front bracket for power steering pump for access to timing belt covers. It may be necessary to remove pulley from power steering pump. Remove oil filler cap and No. 3 timing belt cover. See Fig. 27. Remove No. 2 timing belt cover and gasket. Remove drive belt tensioner.

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

7) Rotate crankshaft pulley clockwise (viewed from front of



engine) and align crankshaft pulley timing mark (groove) with "0" mark on timing belt cover so cylinder No. 1 (front cylinder) is at TDC on compression stroke.

8) Ensure timing marks on camshaft sprockets are aligned with timing marks on timing belt cover. See Fig. 4. If timing marks are not aligned, rotate crankshaft clockwise one full revolution (360 degrees).

CAUTION: If reusing timing belt, place arrow on timing belt to indicate direction of rotation. Place reference mark on timing belt and each camshaft sprocket for installation reference.

9) Alternately loosen timing belt tensioner bolts. Remove bolts, timing belt tensioner and dust boot. See Fig. 27. Remove timing belt from camshaft sprockets.

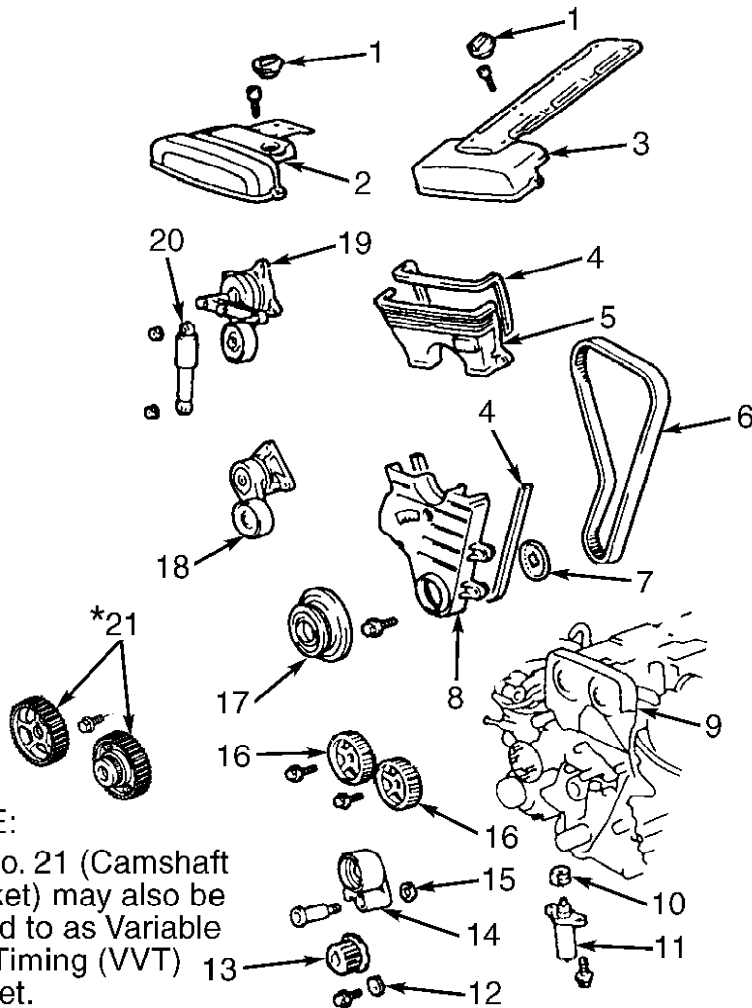
10) On A/T models, remove clamps securing oil cooler lines near crankshaft pulley. On all models, use Handle (SST 09330-00021) and Pulley Holder (SST 09213-70010) to hold crankshaft pulley. Remove crankshaft pulley bolt. Using puller, remove crankshaft pulley.

11) On all models, remove No. 1 timing belt cover and gaskets. See Fig. 27. Note direction of timing belt guide installation for installation reference. Remove timing belt guide.

CAUTION: If reusing timing belt, place reference mark on timing belt and crankshaft sprocket for installation reference.

12) Remove timing belt. Remove bolt, idler pulley and plate washer (if necessary). If removing camshaft sprockets, use spanner wrench to hold camshaft sprocket by using the holes on front of camshaft sprocket. Remove camshaft sprocket bolt and camshaft sprocket.

13) If removing crankshaft sprocket, remove bolt and timing belt plate. See Fig. 27. Use puller to pull crankshaft sprocket from crankshaft.



**\*NOTE:**

Item No. 21 (Camshaft Sprocket) may also be referred to as Variable Valve Timing (VVT) sprocket.

- |                                               |                                                         |
|-----------------------------------------------|---------------------------------------------------------|
| 1. Oil Filler Cap                             | 13. Crankshaft Sprocket                                 |
| 2. No. 3 Timing Belt Cover (Non-Turbo Models) | 14. Idler Pulley                                        |
| 3. No. 3 Timing Belt Cover (Turbo Models)     | 15. Plate Washer                                        |
| 4. Gasket                                     | 16. Camshaft Sprocket (Except 1998 Non-Turbo)           |
| 5. No. 2 Timing Belt Cover                    | 17. Crankshaft Pulley                                   |
| 6. Timing Belt                                | 18. Drive Belt Tensioner (Non-Turbo & Turbo A/T Models) |
| 7. Timing Belt Guide                          | 19. Drive Belt Tensioner (Turbo M/T Models)             |
| 8. No. 1 Timing Belt Cover                    | 20. Drive Belt Tensioner Damper (Turbo M/T Models)      |
| 9. No. 4 Timing Belt Cover                    | 21. Camshaft Sprocket (1998 Non-Turbo)                  |
| 10. Dust Boot                                 |                                                         |
| 11. Timing Belt Tensioner                     |                                                         |
| 12. Timing Belt Plate                         |                                                         |

98J07888

Fig. 27: Exploded View Of Typical Timing Belt & Components  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

**Inspection**

- 1) Inspect timing belt for damaged teeth, cracking and oil

contamination. DO NOT bend timing belt inside out while inspecting timing belt. If excessive wear or damage exists on face of timing belt, check for nicks on idler pulley. If excessive wear or damage exists only on one side of timing belt, check timing belt guide and alignment of all sprockets. If excessive wear exists on teeth of timing belt, check timing belt covers for damage and foreign material on sprockets. Replace timing belt if damaged.

2) Ensure idler pulley rotates smoothly. Replace idler pulley if idler pulley is defective or does not rotate smoothly. Inspect timing belt tensioner for signs of oil leakage. Replace timing belt tensioner if oil leakage exists.

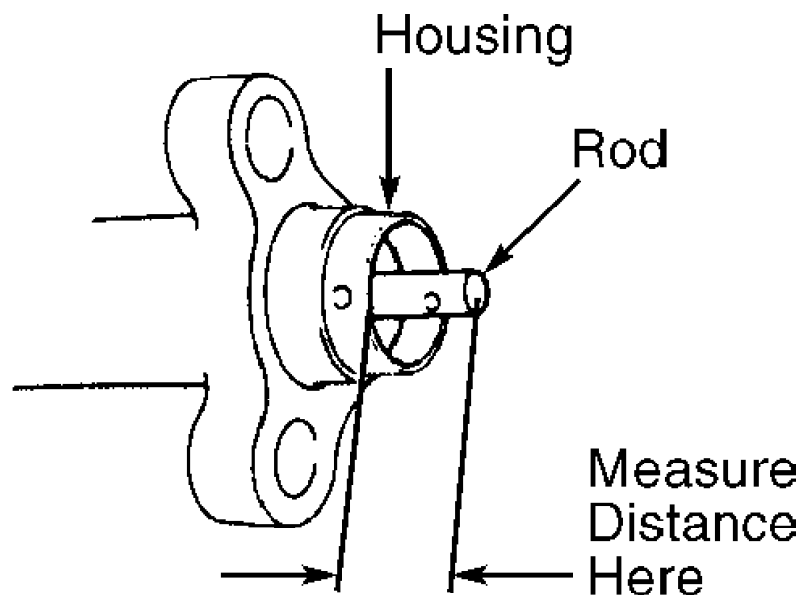
NOTE: Timing belt tensioner may indicate a small amount of oil on rod seal under normal conditions. If excessive amount of oil exists, replace timing belt tensioner.

3) Hold timing belt tensioner body. Press rod against solid surface. Replace timing belt tensioner if rod moves.

4) Measure timing belt tensioner rod protrusion from end of rod to edge of housing. See Fig. 28. Replace timing belt tensioner if distance is not .315-.346" (8.00-8.80 mm).

5) On turbo M/T models, compress and extend drive belt tensioner damper. Note that no abnormal resistance or unusual operating sound is heard. Replace drive belt tensioner damper if defective.

CAUTION: Before discarding drive belt tensioner damper, gas must be released from drive belt tensioner damper. To release gas from drive belt tensioner damper, fully extend damper. Drill small hole in side of drive belt tensioner, just above lower mounting stud hole. Use care, as gas will force metal chips to fly outward during drilling procedure.



**93A83071**

Fig. 28: Measuring Timing Belt Tensioner Rod Protrusion  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Installation

1) If installing crankshaft sprocket, align crankshaft

sprocket with key in crankshaft. Install crankshaft sprocket with flange toward cylinder block.

2) Install timing belt plate and bolt. Tighten bolt to specification. See TORQUE SPECIFICATIONS.

3) Install idler pulley and plate washer (if removed). Apply Loctite 242 on threads of idler pulley bolt. Install and tighten bolt to specification. See TORQUE SPECIFICATIONS. Ensure idler pulley is clean and rotates smoothly and idler pulley bracket moves freely.

CAUTION: If reusing timing belt, ensure reference marks on timing belt and crankshaft sprocket align and timing belt is installed in original direction of rotation.

4) Using crankshaft pulley bolt, rotate crankshaft and align timing mark on crankshaft sprocket with timing mark on oil pump body. See Fig. 29. Install timing belt on crankshaft sprocket and idler pulley.

5) Install timing belt guide with cupped side away from crankshaft sprocket. Flat side should be against timing belt. Install gaskets and No. 1 timing belt cover.

6) Align crankshaft pulley groove with crankshaft key. Install crankshaft pulley. Install and tighten crankshaft pulley bolt to specification while holding crankshaft pulley with handle and pulley holder. See TORQUE SPECIFICATIONS.

7) On A/T models, reinstall clamps for oil cooler lines near crankshaft pulley. On all models, if installing camshaft sprockets, align hole in camshaft sprocket with dowel pin in camshaft. Install camshaft sprocket. Install and tighten camshaft sprocket bolt to specification while holding camshaft sprocket with spanner wrench. See TORQUE SPECIFICATIONS.

CAUTION: Always rotate crankshaft clockwise. DO NOT rotate crankshaft counterclockwise.

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

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

9) Using spanner wrench, rotate camshaft sprockets so timing marks on camshaft sprockets align with timing marks on No. 4 timing belt cover. See Fig. 29. Install timing belt on camshaft sprockets. Ensure tension exists on timing belt between crankshaft sprocket and exhaust camshaft sprocket.

10) Using press, apply pressure on rod of timing belt tensioner until rod is retracted and holes in rod and housing are aligned. See Fig. 30.

11) Install hexagon wrench through holes in housing and rod to hold rod in retracted position. See Fig. 30. Release press. Install dust boot on timing belt tensioner.

12) Install timing belt tensioner. Install and alternately tighten timing belt tensioner bolts to specification. See TORQUE SPECIFICATIONS.

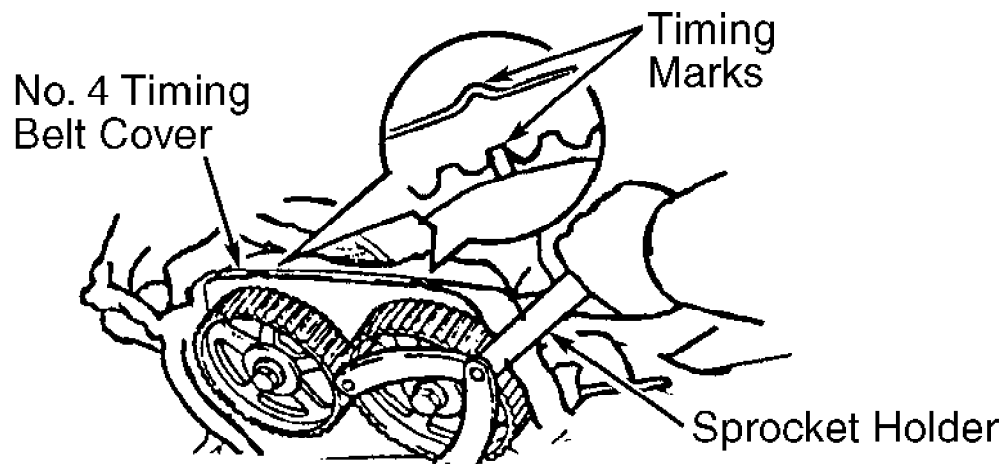
CAUTION: Always rotate crankshaft clockwise. DO NOT rotate crankshaft counterclockwise.

13) Remove hexagon wrench from timing belt tensioner. Rotate crankshaft 2 full revolutions clockwise from TDC to TDC. DO NOT rotate crankshaft counterclockwise.

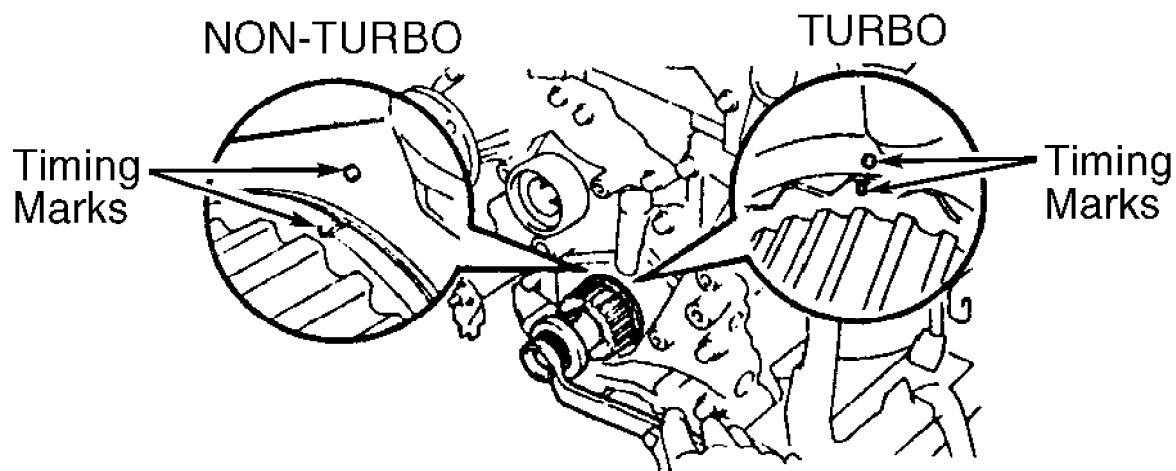
14) Ensure timing marks on camshaft sprockets align with timing marks on timing belt cover when timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. See Fig. 4-5. If timing marks are not aligned, remove timing belt and reinstall.

15) Install front bracket on power steering pump (if equipped). Install and tighten bolts to specification. See TORQUE SPECIFICATIONS.

16) To install remaining components, reverse removal procedure. Use care when installing drive belt tensioner bolts, as not to drop bolts into timing belt cover. Ensure reference mark on fluid coupling, water pump pulley and stud on water pump are aligned. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.



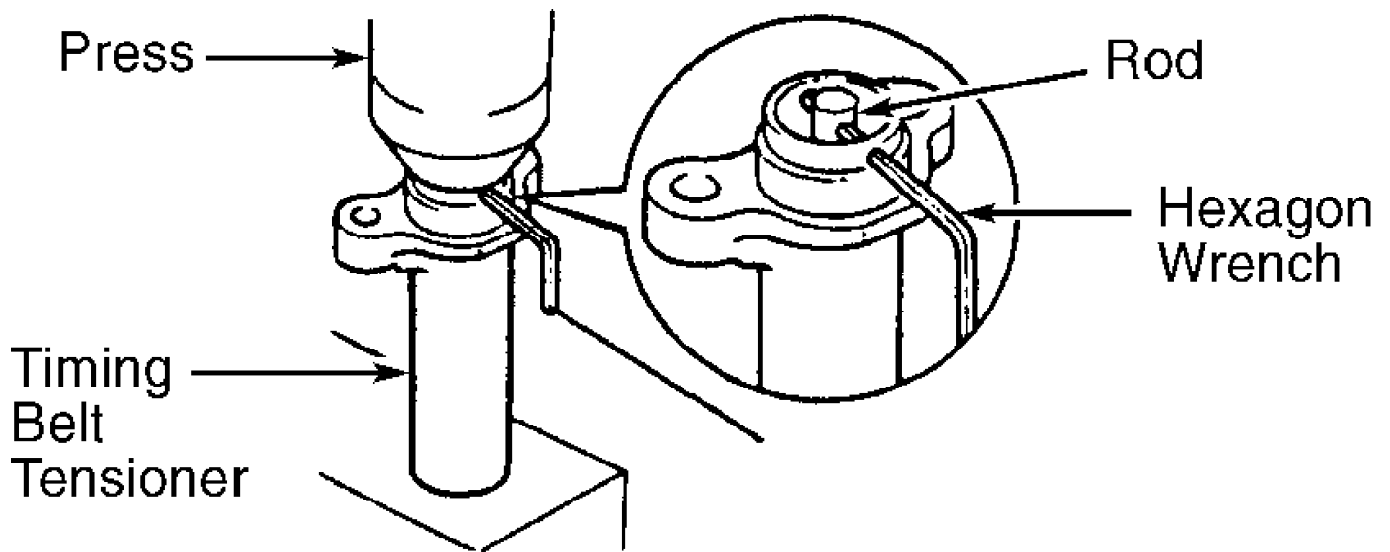
### ALIGNING CAMSHAFT SPROCKET TIMING MARKS



### ALIGNING CRANKSHAFT SPROCKET TIMING MARKS

96A19182

Fig. 29: Aligning Timing Marks (1997 Non-Turbo & Turbo, & 1998 Turbo)  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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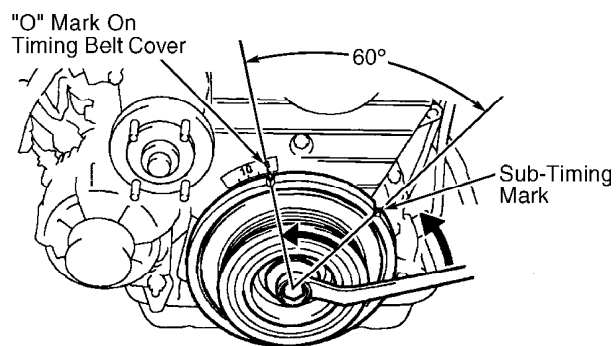
Fig. 30: Retracting Timing Belt Tensioner Rod  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Removal (1998 Non-Turbo)

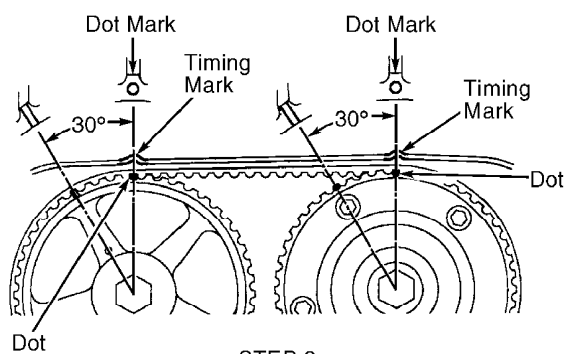
- 1) Remove battery and battery tray. Raise and support vehicle. Remove lower engine cover. Drain cooling system.
- 2) Remove air cleaner air duct located above radiator. Remove lower fan shroud from radiator. Remove radiator. Rotate drive belt tensioner clockwise. Remove drive belt.
- 3) Place reference mark on fluid coupling, water pump pulley and stud on water pump for reassembly reference. Remove cooling fan, fluid coupling and water pump pulley.
- 4) Remove power steering pump and front bracket for access to timing belt covers. Remove oil filler cap. Remove No. 2 and 3 timing belt covers and gaskets. See Fig. 27. Remove drive belt tensioner.
- 5) Use Handle (SST 09330-00021) and Pulley Holder (SST 09213-70010) to hold crankshaft pulley while loosening crankshaft pulley bolt. Rotate crankshaft pulley clockwise (viewed from front of engine) and align crankshaft pulley timing mark (groove) with "0" mark on timing belt cover so cylinder No. 1 (front cylinder) is at TDC on compression stroke.
- 6) Ensure timing marks on camshaft sprockets are aligned with timing marks on timing belt cover. See Fig. 5. If timing marks are not aligned, rotate crankshaft clockwise one full revolution (360 degrees).

**CAUTION:** Crankshaft must be properly positioned by aligning the sub-timing mark with "0" mark on timing belt cover to prevent valves from contacting the pistons.

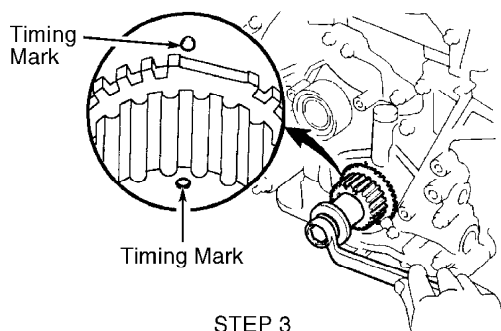
- 7) Rotate crankshaft pulley 60 degrees counterclockwise and align sub-timing mark with "0" mark on timing belt cover. Perform STEP 1. See Fig. 31. Ensure dots on camshaft sprockets are aligned with timing marks on timing belt cover. Perform STEP 2. See Fig. 31.



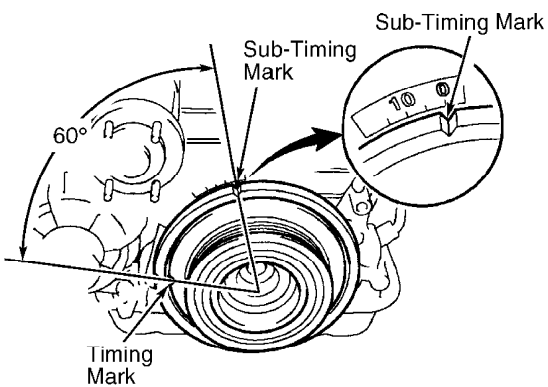
STEP 1



STEP 2



STEP 3



STEP 4

98F11069  
Fig. 31: Aligning Sub-Timing Mark, Camshaft Sprockets & Crankshaft Sprocket  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CAUTION: If reusing timing belt, place arrow on timing belt to

indicate direction of rotation. Place reference mark on timing belt and each camshaft sprocket for installation reference.

8) Alternately loosen timing belt tensioner bolts. Remove bolts, timing belt tensioner and dust boot. See Fig. 27. Remove timing belt from camshaft sprockets.

9) Remove crankshaft pulley bolt. DO NOT allow crankshaft to rotate when removing crankshaft pulley bolt or crankshaft pulley. Using puller, remove crankshaft pulley.

10) Remove No. 1 timing belt cover and gaskets. See Fig. 27. Note direction of timing belt guide installation for installation reference. Remove timing belt guide.

CAUTION: If reusing timing belt, place reference mark on timing belt and crankshaft sprocket for installation reference.

11) Remove timing belt. Remove bolt, idler pulley and plate washer (if necessary).

12) If removing crankshaft sprocket, remove bolt and timing belt plate. See Fig. 27. Use puller to pull crankshaft sprocket from crankshaft.

13) If removing camshaft sprocket from exhaust camshaft, use spanner wrench to hold camshaft sprocket by using the holes on front of camshaft sprocket. Remove camshaft sprocket bolt and camshaft sprocket.

NOTE: Camshaft sprocket on intake camshaft may also be referred to as Variable Valve Timing (VVT) sprocket.

14) If removing camshaft sprocket from intake camshaft, drain cooling system. Remove air intake hose for access to intake air connector with throttle body. See Fig. 3. Disconnect necessary electrical connectors, control cables, hoses and engine wire clamps for removal of intake air connector with throttle body.

15) Note location of throttle body bracket. See Fig. 3. Remove throttle body bracket nuts at the cylinder head. Remove intake air connector-to-air intake chamber bolts/nuts. Remove intake air connector with throttle body and gasket from air intake chamber.

16) Disconnect engine wiring harness for access to valve covers. Remove bolts/nuts, No. 1 valve cover and gasket. See Fig. 17.

17) Disconnect electrical connector at camshaft timing oil control valve located at No. 1 camshaft bearing cap. See Fig. 17. Remove bolt and camshaft timing oil control valve with "O" ring.

NOTE: When removing union bolt with oil control valve filter, use care not to damage the mesh screen area on the oil control valve filter.

18) Remove union bolt with oil control valve filter and gaskets, and disconnect No. 1 oil pipe from No. 1 camshaft bearing cap. See Fig. 17.

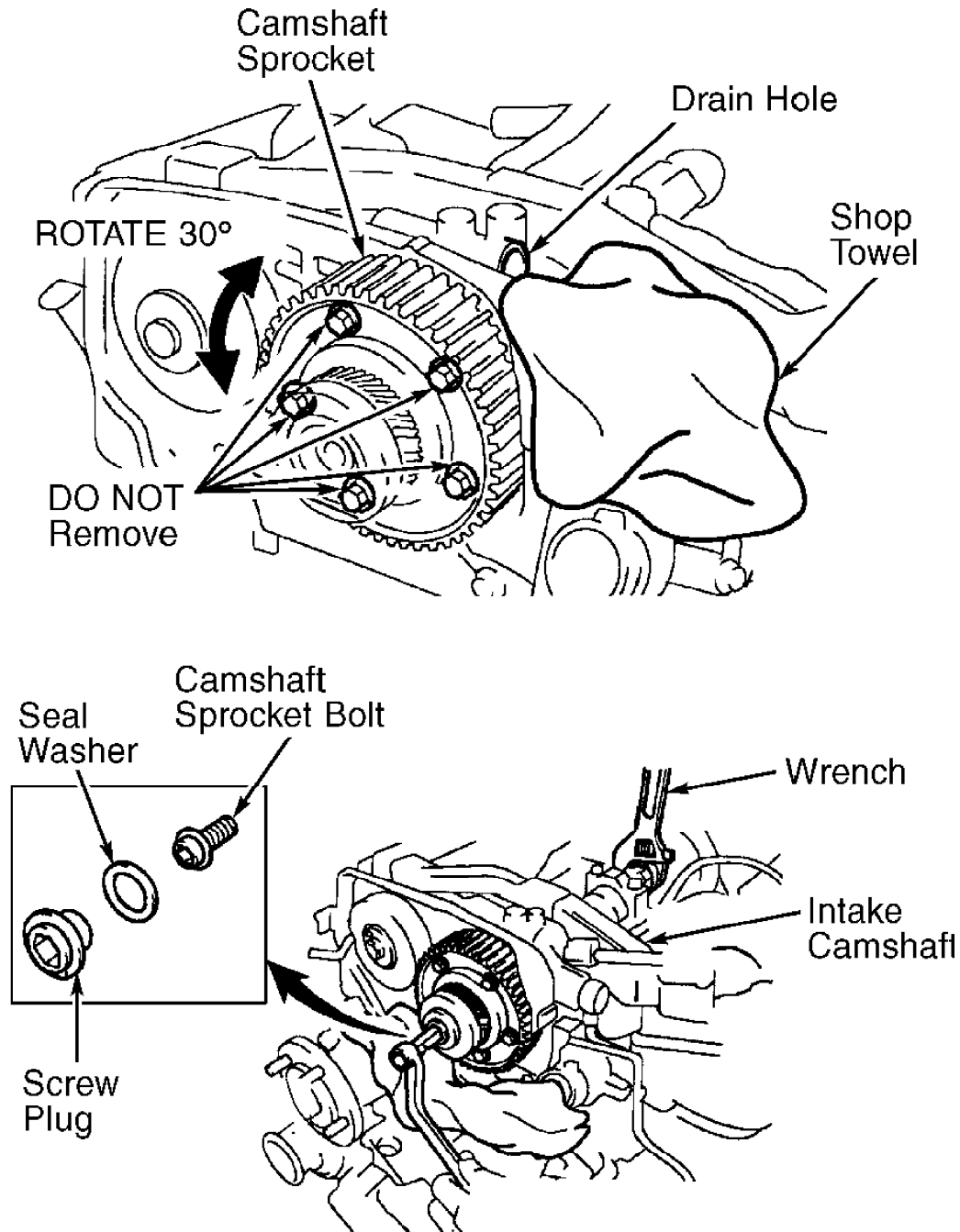
CAUTION: Note location of the 5 bolts at outer circumference of camshaft sprocket on intake camshaft sprocket. See Fig. 32. DO NOT remove these bolts, as these bolts determine gear backlash in the camshaft sprocket. If any of these bolts are removed, install NEW camshaft sprocket.

19) Place shop towel below drain hole on No. 1 camshaft bearing cap. See Fig. 32. Rotate camshaft sprocket back and forth within 30 degree angle 2-3 times to allow oil to exit out through drain hole where camshaft timing oil control valve was installed. See



Fig. 32.

20) Once all oil is drained from camshaft sprocket, use wrench to hold hexagonal area on intake camshaft while removing screw plug, gasket and camshaft sprocket bolt. See Fig. 32. Remove camshaft sprocket from intake camshaft.



98I11070

Fig. 32: Removing Camshaft Sprocket From Intake Camshaft  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect timing belt for damaged teeth, cracking and oil

contamination. DO NOT bend timing belt inside out while inspecting timing belt. If excessive wear or damage exists on face of timing belt, check for nicks on idler pulley. If excessive wear or damage exists only on one side of timing belt, check timing belt guide and alignment of all sprockets. If excessive wear exists on teeth of timing belt, check timing belt covers for damage and foreign material on sprockets. Replace timing belt if damaged.

2) Ensure idler pulley rotates smoothly. Replace idler pulley if defective or does not rotate smoothly. Inspect timing belt tensioner for signs of oil leakage. Replace timing belt tensioner if oil leakage exists.

NOTE: Timing belt tensioner may indicate a small amount of oil on rod seal under normal conditions. If excessive amount of oil exists, replace timing belt tensioner.

3) Hold timing belt tensioner body. Press rod against solid surface. Replace timing belt tensioner if rod moves.

4) Measure timing belt tensioner rod protrusion from end of rod to edge of housing. See Fig. 28. Replace timing belt tensioner if distance is not .315-.346" (8.00-8.80 mm).

#### Installation

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

2) Install timing belt plate and bolt. Tighten bolt to specification. See TORQUE SPECIFICATIONS.

3) Install idler pulley and plate washer (if removed). Apply Loctite 242 on threads of idler pulley bolt. Install and tighten bolt to specification. See TORQUE SPECIFICATIONS. Ensure idler pulley is clean and rotates smoothly and idler pulley bracket moves freely.

CAUTION: If reusing timing belt, ensure reference marks on timing belt and crankshaft sprocket align and timing belt is installed in original direction of rotation.

4) Using crankshaft pulley bolt, rotate crankshaft and align timing mark on crankshaft sprocket with timing mark on oil pump body. Perform STEP 3. See Fig. 31. Install timing belt on crankshaft sprocket and idler pulley.

5) Install timing belt guide with cupped side away from crankshaft sprocket. Flat side should be against timing belt. Install gaskets and No. 1 timing belt cover.

6) Align crankshaft pulley groove with crankshaft key. Install crankshaft pulley. Temporarily install crankshaft pulley bolt. Check that sub-timing mark is aligned with "0" mark on timing belt cover and timing mark is at 60 degree angle. Perform STEP 4. See Fig. 31.

7) If installing camshaft sprocket on exhaust camshaft, align hole in camshaft sprocket with dowel pin in camshaft. Install camshaft sprocket. Install and tighten camshaft sprocket bolt to specification while holding camshaft sprocket with spanner wrench. See TORQUE SPECIFICATIONS.

8) If installing camshaft sprocket on intake camshaft, align hole in camshaft sprocket with dowel pin in camshaft. Install camshaft sprocket until camshaft sprocket bottoms on camshaft. Check that outer circumference of camshaft sprocket rotates easily back and forth 30 degrees.

9) Install and tighten camshaft sprocket bolt and screw plug to specification while using wrench to hold hexagonal area on intake camshaft. See TORQUE SPECIFICATIONS.

10) Using NEW "O" ring, install camshaft timing oil control

valve. Tighten bolt to specification. See TORQUE SPECIFICATIONS. Using NEW gaskets, install No. 1 oil pipe-to-camshaft bearing cap union bolt with oil control valve filter. Tighten union bolt to specification. See TORQUE SPECIFICATIONS.

11) Apply sealant at indicated No. 1 valve cover sealing areas on front of cylinder head. See Fig. 10. Using NEW gaskets, install No. 1 valve cover. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

12) To install intake air connector, reverse removal procedure using NEW gasket. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

13) Rotate camshaft sprockets so dots on camshaft sprockets are aligned with timing marks on timing belt cover. Perform STEP 2. See Fig. 31.

**CAUTION:** If reusing timing belt, ensure reference marks on timing belt and camshaft sprockets align and timing belt is installed in original direction of rotation.

14) Install timing belt on camshaft sprockets. Ensure tension exists on timing belt between crankshaft sprocket and exhaust camshaft sprocket.

15) Using press, apply pressure on rod of timing belt tensioner until rod is retracted and holes in rod and housing are aligned. See Fig. 30.

16) Install hexagon wrench through holes in housing and rod to hold rod in retracted position. See Fig. 30. Release press. Install dust boot on timing belt tensioner.

17) Install timing belt tensioner. Install and alternately tighten timing belt tensioner bolts to specification. See TORQUE SPECIFICATIONS.

**CAUTION:** Always rotate crankshaft clockwise. DO NOT rotate crankshaft counterclockwise.

18) Remove hexagon wrench from timing belt tensioner. Rotate crankshaft 2 full revolutions clockwise from TDC to TDC and align crankshaft pulley timing mark (groove) with "0" mark on timing belt cover so cylinder No. 1 (front cylinder) is at TDC on compression stroke. DO NOT rotate crankshaft counterclockwise.

19) Ensure timing marks on camshaft sprockets align with timing marks on timing belt cover when timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. See Fig. 4-5. If timing marks are not aligned, remove timing belt and reinstall.

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

21) To install remaining components, reverse removal procedure. Use care when installing drive belt tensioner bolts, as not to drop bolts into timing belt cover. Ensure reference mark on fluid coupling, water pump pulley and stud on water pump are aligned. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.

## VALVE LIFTER

### Removal

Remove camshaft. See CAMSHAFTS under REMOVAL & INSTALLATION. Note location of adjusting shims and valve lifters for installation reference. Remove adjusting shims and valve lifters from cylinder head.

### Inspection

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

#### Installation

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

## CAMSHAFTS

#### Removal

1) Remove No. 1 and 2 valve covers for access to camshafts. For removal and installation of valve covers, see VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

CAUTION: Disconnect timing belt from camshaft sprockets and support timing belt when servicing camshaft. DO NOT allow timing belt to become disengaged from crankshaft sprocket.

2) Remove timing belt and camshaft sprockets. See TIMING BELT under REMOVAL & INSTALLATION. Remove No. 4 timing belt cover from front of cylinder head. See Fig. 27.

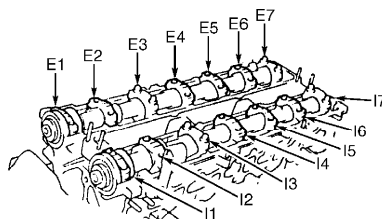
3) On 1997 non-turbo models, when removing exhaust camshaft, remove distributor. On all models, note location of camshaft bearing caps for installation reference.

NOTE: Camshaft bearing caps are numbered for location on top of bearing cap. Camshaft bearing cap is stamped with either an "I" for intake camshaft or an "E" for exhaust camshaft. See Fig. 33. On 1998 non-turbo models, No. 1 camshaft bearing cap is a wider type cap and contains camshaft timing oil control valve. See Fig. 17.

4) Remove bolts from No. 1 (front) camshaft bearing cap on each camshaft. Using screwdriver, carefully pry No. 1 camshaft bearing cap upward from cylinder head and remove. DO NOT damage sealing surfaces. Remove oil seal from camshaft.

CAUTION: Camshaft bearing caps bolts must be removed in proper sequence using several passes to prevent damage to cylinder head and camshaft thrust surfaces.

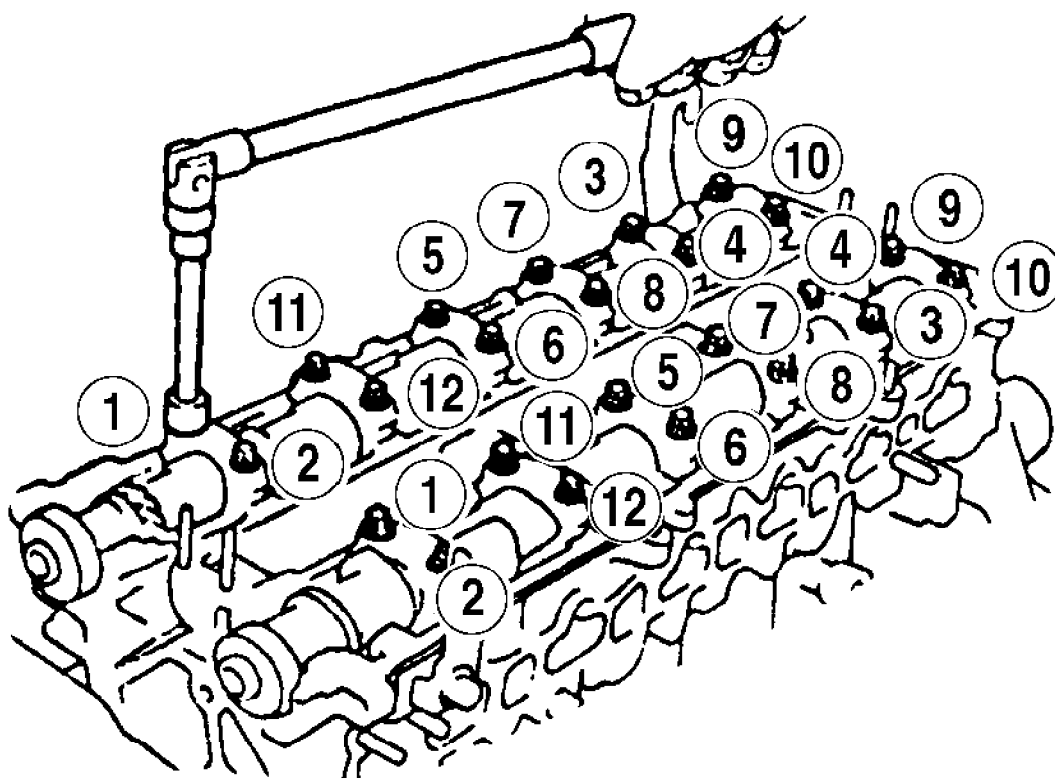
5) Remove camshaft bearing cap bolts in sequence using several steps. See Fig. 34. Remove camshaft bearing caps and camshaft. Note location of adjusting shims and valve lifters for installation reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).



♦FRONT OF ENGINE

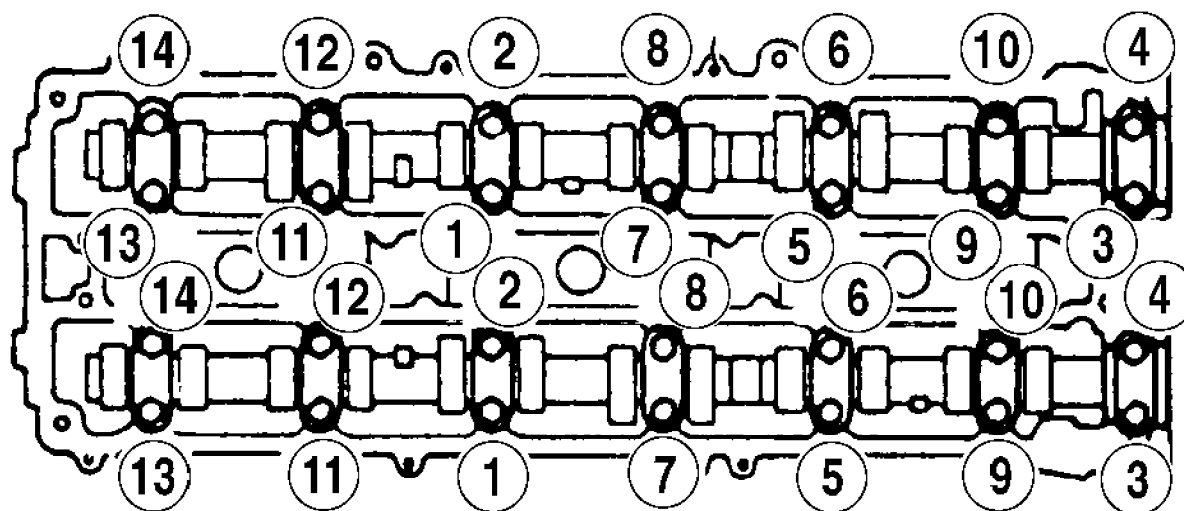
93H83078

Fig. 33: Identifying Typical Camshaft Bearing Caps  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



REMOVAL

◀ FRONT OF ENGINE



INSTALLATION

93183079

Fig. 34: Typical Camshaft Bearing Cap Bolt Removal & Initial  
Installation Sequence  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect components for damage. Check camshaft journal diameter, lobe height and journal runout. Replace camshaft if not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

2) To check camshaft oil clearance, install camshaft in cylinder head with camshaft dowel pins properly positioned and specified lobes facing upward. See Fig. 35. Install No. 3 and 7 camshaft bearing caps. Ensure proper camshaft bearing caps are installed. See Fig. 33.

3) Coat all camshaft bearing cap bolt threads and bolt-to-camshaft bearing cap surface with engine oil. Install camshaft bearing cap bolts in No. 3 and 7 camshaft bearing caps. Alternately tighten No. 3 and 7 camshaft bearing cap bolts until camshaft bearings caps are snug against cylinder head.

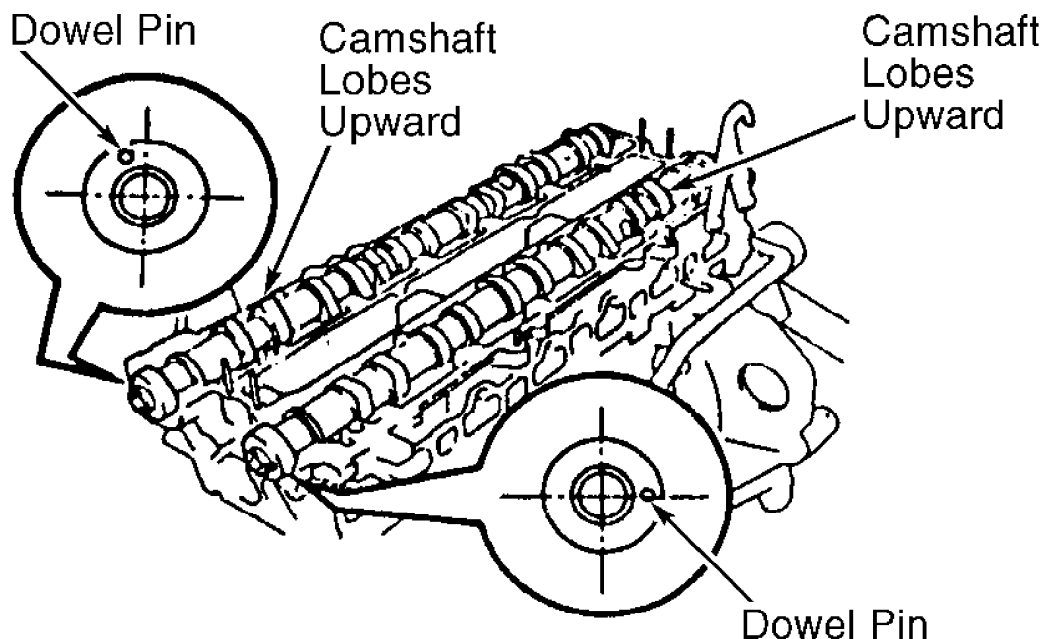
4) Install Plastigage on camshaft journal. Install remaining camshaft bearing caps. Ensure camshaft does not rotate. Tighten camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 34. See TORQUE SPECIFICATIONS.

5) Remove bolts and No. 1 camshaft bearing cap from each camshaft. Remove camshaft bearing cap bolts in sequence using several steps. See Fig. 34.

6) Measure width of Plastigage to check oil clearance. Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if oil clearance or camshaft end play is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

#### Installation

1) Install valve lifters and adjusting shims in original location (if removed). Ensure valve lifters rotate smoothly in cylinder head. Apply grease to thrust surfaces of camshafts. Install camshaft in cylinder head with camshaft dowel pins properly positioned and specified lobes facing upward. See Fig. 35.



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Fig. 35: Installing Camshafts  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Install No. 3 and 7 camshaft bearing caps. Ensure camshaft bearing caps are installed in correct positions. See Fig. 33. Coat all

camshaft bearing cap bolt threads and bolt-to-camshaft bearing cap surface with engine oil.

3) Install camshaft bearing cap bolts in No. 3 and 7 camshaft bearing caps. Alternately tighten No. 3 and 7 camshaft bearing cap bolts until camshaft bearing caps are snug against cylinder head.

CAUTION: Ensure sealant is applied on No. 1 camshaft bearing cap at bearing cap-to-cylinder head surface before installing.  
Ensure camshaft bearing caps are installed in proper location. See Fig. 33.

4) Coat lip of NEW oil seal with grease and install on front edge of camshaft. Apply sealant on No. 1 camshaft bearing cap at bearing cap-to-cylinder head surface. Install all remaining camshaft bearing caps.

5) Install camshaft bearing cap bolts. Tighten camshaft bearing cap bolts to specification in sequence. See Fig. 34. See TORQUE SPECIFICATIONS.

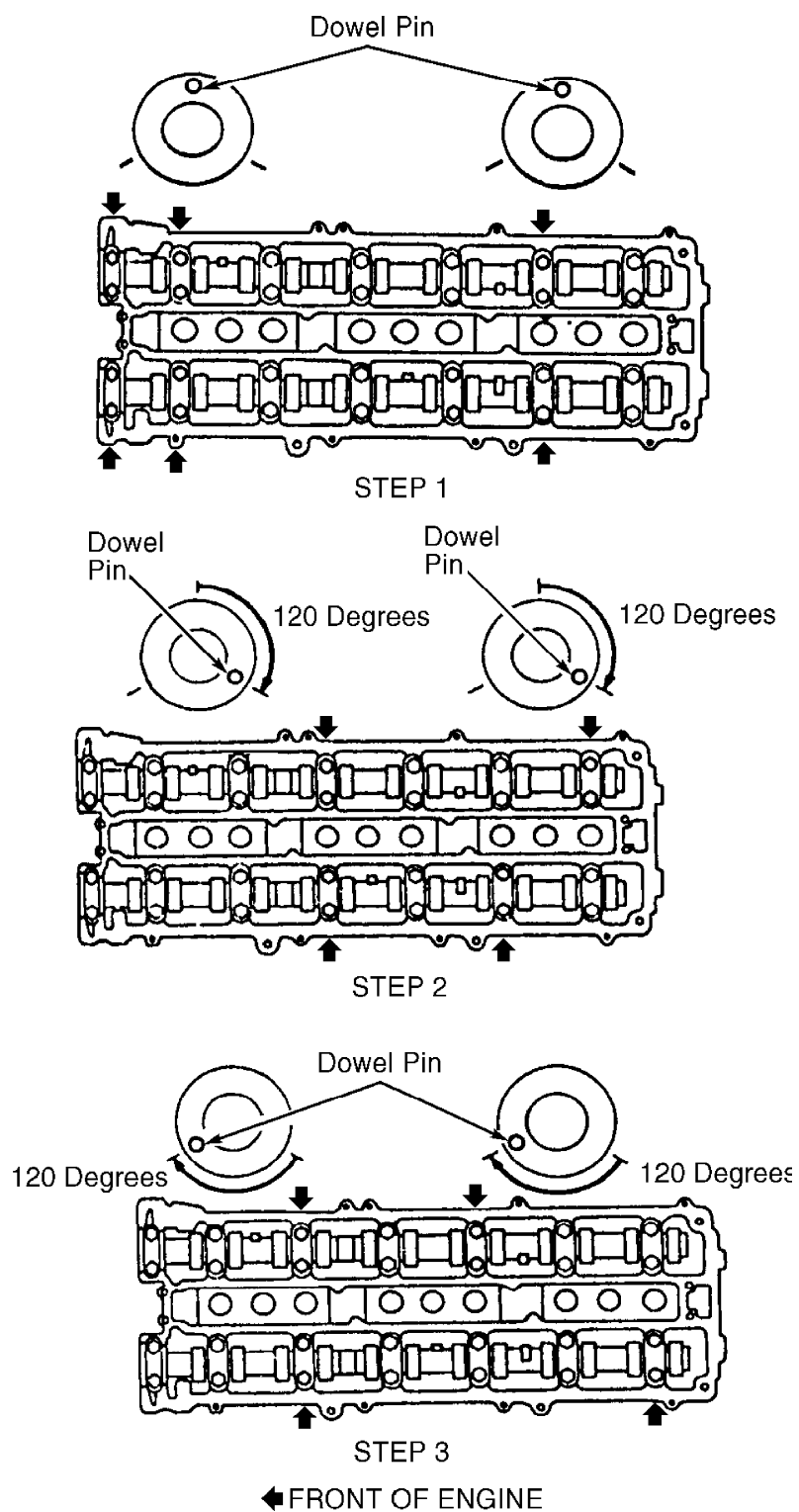
NOTE: This is initial tightening of camshaft bearing cap bolts. Bolts must eventually be retightened using specified procedure after oil seal is fully installed.

6) Using Oil Seal Installer (SST 09316-60011), push oil seal into No. 1 camshaft bearing cap as far as possible. Using wrench on hexagonal area of camshaft, rotate camshafts until dowel pin in each camshaft is at 12 o'clock position. Perform STEP 1. See Fig. 36.

7) Loosen camshaft bearing cap bolts on designated camshaft bearing caps until bolts can be turned by hand. Perform STEP 1. See Fig. 36. Retighten these camshaft bearing cap bolts evenly to specification using several steps. See TORQUE SPECIFICATIONS.

8) Rotate the camshafts clockwise until dowel pin moves an additional 1/3 turn (120 degrees). Loosen camshaft bearing cap bolts on designated camshaft bearing caps until bolts can be turned by hand. Perform STEP 2. See Fig. 36. Retighten these camshaft bearing cap bolts evenly to specification using several steps. See TORQUE SPECIFICATIONS.

9) Rotate the camshafts clockwise until dowel pin moves an additional 1/3 turn (120 degrees). Loosen camshaft bearing cap bolts on designated camshaft bearing caps until bolts can be turned by hand. Perform STEP 3. See Fig. 36. Retighten these camshaft bearing cap bolts evenly to specification using several steps. See TORQUE SPECIFICATIONS.



93C83081  
 Fig. 36: Typical Camshaft Bearing Cap Bolt Final Installation Sequence  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

10) Check and adjust valve clearance. See



VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS. Install No. 4 timing belt cover. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS. Install camshaft sprockets and timing belt using proper procedure. See TIMING BELT under REMOVAL & INSTALLATION.

11) To install remaining components, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Before installing gaskets and valve covers, apply sealant at indicated valve cover sealing areas on front of cylinder head. See Fig. 10.

12) On 1997 non-turbo models, ensure air intake connector gasket is installed with protrusion in proper area. See Fig. 11. Install NEW "O" ring on distributor. Coat "O" ring with engine oil.

13) When installing distributor, rotate crankshaft clockwise so cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing mark (groove) on crankshaft pulley aligns with "0" mark on timing belt cover.

14) Align reference mark on distributor gear with reference mark on distributor housing. Install distributor so protrusion on distributor flange aligns with stud bolt on cylinder head. See Fig. 19. Install distributor retaining nut. Adjust ignition timing.

## CRANKSHAFT REAR OIL SEAL

### Removal

Remove transmission, clutch assembly (if equipped) and flywheel/drive plate. For manual transmission, see CLUTCH article. For automatic transmission, see TRANSMISSION REMOVAL & INSTALLATION - A/T article in AUTOMATIC TRANSMISSION SERVICING. Using a knife, cut off seal lip. Carefully pry oil seal from rear oil seal housing. Use care not to damage sealing surfaces.

### Installation

1) Ensure all sealing surfaces are clean. Apply grease to seal lip of oil seal. Using Oil Seal Installer (SST 09223-15030) and Handle (SST 09950-70010), install NEW oil seal in rear oil seal housing until oil seal is even with housing surface.

2) Apply Loctite to flywheel/drive plate bolts. Install and tighten flywheel/drive plate bolts to specification in a crisscross pattern. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

## WATER PUMP

### Removal

1) Remove battery and battery tray. Remove air cleaner and airflow meter with air cleaner hose attached.

2) Raise and support vehicle. Remove lower engine cover. Drain cooling system. Remove lower radiator hose, thermostat housing, thermostat and gasket. Remove timing belt and idler pulley. See TIMING BELT under REMOVAL & INSTALLATION.

3) On non-turbo models, remove coolant by-pass outlet, coolant by-pass pipe and "O" rings. See Fig. 16. Remove bolt and disconnect engine wiring from bracket located near top of water pump. Remove bolts and separate generator from water pump. Remove nuts and disconnect coolant pipe from rear of water pump. Remove bolts, water pump, gasket and "O" ring.

4) On turbo models, remove generator and air intake hose to turbochargers. Disconnect upper radiator hose and turbocharger coolant hoses from coolant outlet above water pump. Remove bolts, coolant outlet and gasket. Remove No. 1 coolant by-pass pipe between coolant outlet and water pump. Disconnect turbo coolant hoses at water pump. Remove nuts and disconnect coolant pipe from rear of water pump. Remove bolts, water pump, gasket and "O" ring.

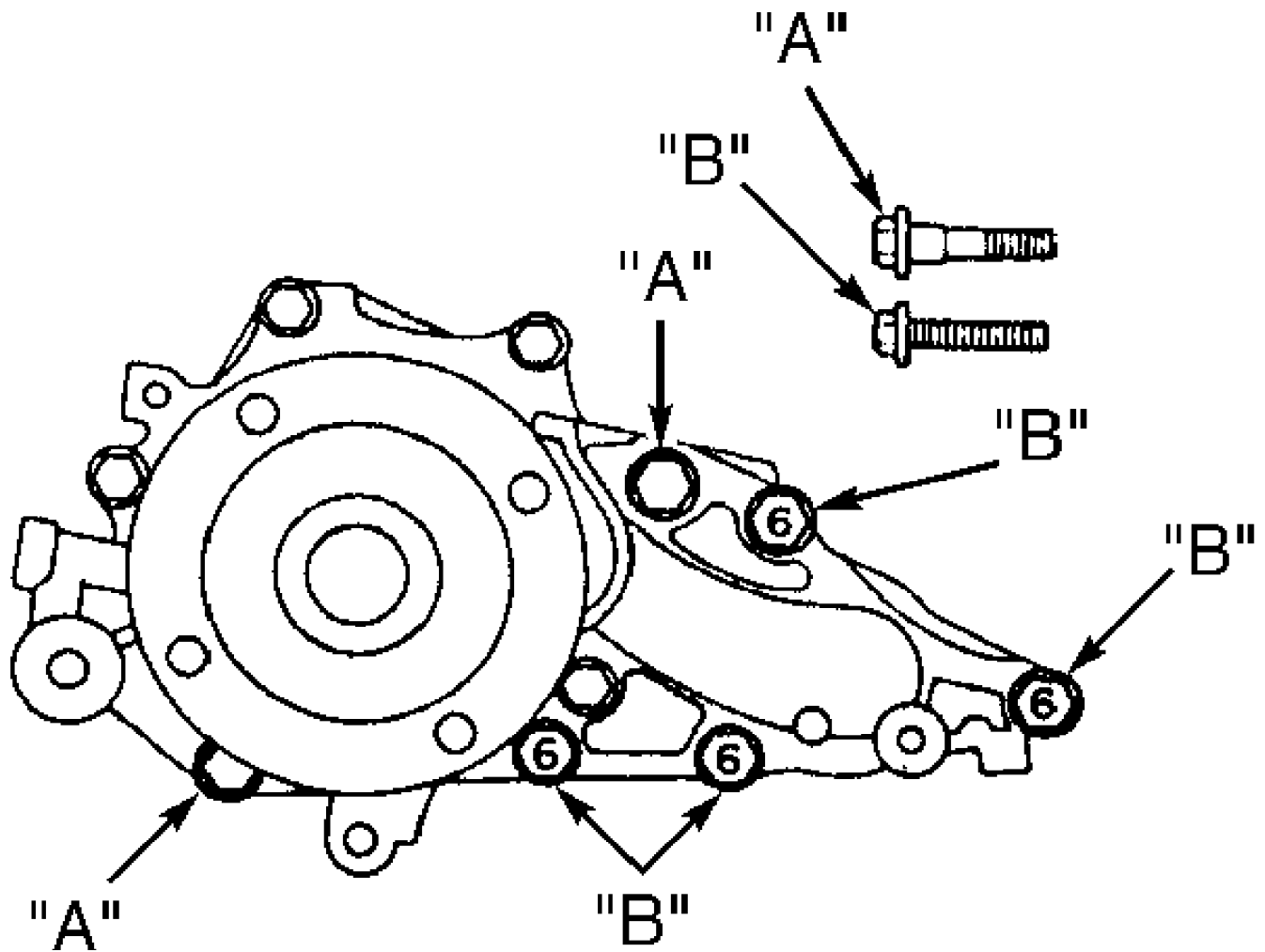
#### Installation

1) Using NEW gasket and NEW "O" ring, install water pump on cylinder block. DO NOT install coolant pipe nuts on rear of water pump at this time.

2) Install water pump bolts. Ensure proper bolt is installed in specified location. See Fig. 37. Hand-tighten water pump bolts "A" first and then tighten all bolts to specification. See TORQUE SPECIFICATIONS.

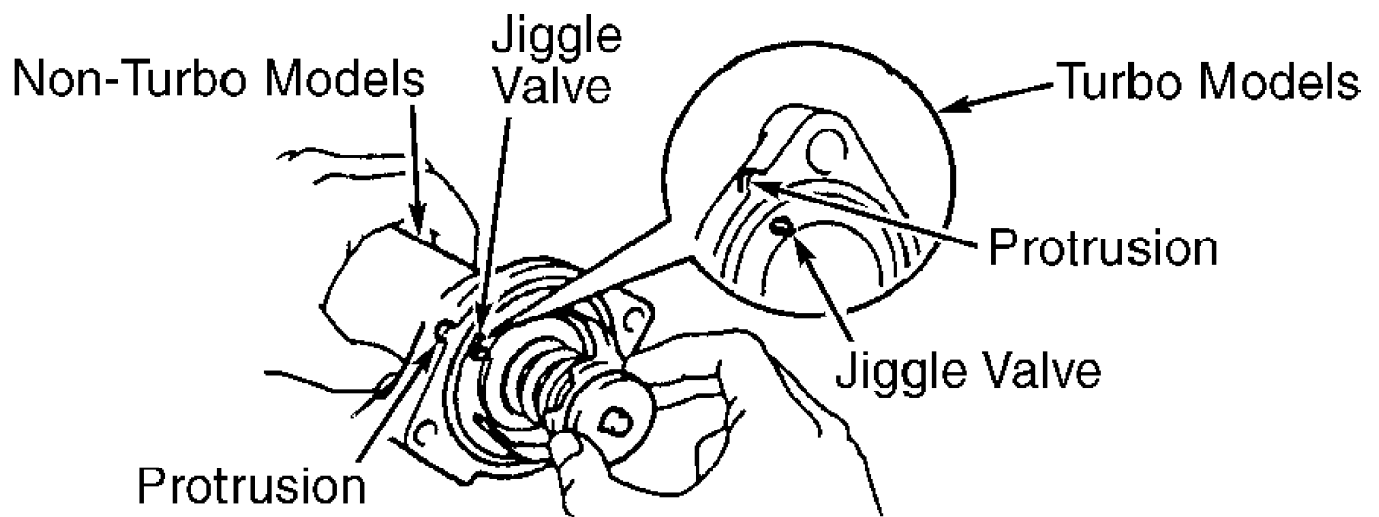
3) To install remaining components, reverse removal procedure. On turbo models, apply soapy water solution to NEW "O" rings on No. 1 coolant by-pass pipe before installing.

4) On all models, ensure jiggle valve on thermostat aligns with protrusion on thermostat housing. See Fig. 38. Tighten all bolts/nuts to specification. See TORQUE SPECIFICATIONS. Fill cooling system.



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Fig. 37: Installing Water Pump Bolts  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 38: Installing Thermostat  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## OIL PAN

NOTE: Manufacturer lists procedure with engine removed.

### Removal

1) Remove engine. See ENGINE under REMOVAL & INSTALLATION. Remove dipstick, bolt, dipstick tube and "O" ring. Remove bolts, oil level sensor and gasket. See Fig. 39.

2) Remove No. 2 oil pan bolts/nuts. See Fig. 39. Install Seal Cutter (SST 09032-00100) between No. 1 and No. 2 oil pans. Tap seal cutter around No. 2 oil pan to loosen seal. DO NOT damage sealing surfaces. Remove No. 2 oil pan.

3) Remove pick-up tube, gasket and oil pan baffle plate. On turbo models, disconnect oil hoses from turbocharger oil outlet pipe. Remove turbocharger oil outlet pipe and gasket. See Fig. 39.

4) On all models, note location of No. 1 oil pan bolts for installation reference. Remove bolts, No. 1 oil pan and "O" ring from cylinder block.

CAUTION: Ensure "O" ring is installed in cylinder block before installing No. 1 oil pan.

### Installation

To install, reverse removal procedure. Ensure sealing surfaces are clean. Apply a .16-.20" (4.0-5.0 mm) diameter bead of sealant at designated areas on the oil pans. See Fig. 40. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

Turbocharger Oil Hose  
(Turbo Models Only)

Gasket (Turbo Models Only)

"O" Ring

No. 1  
Oil Pan

Turbocharger  
Oil Outlet Pipe  
(Turbo Models  
Only)

Oil Pan  
Baffle Plate

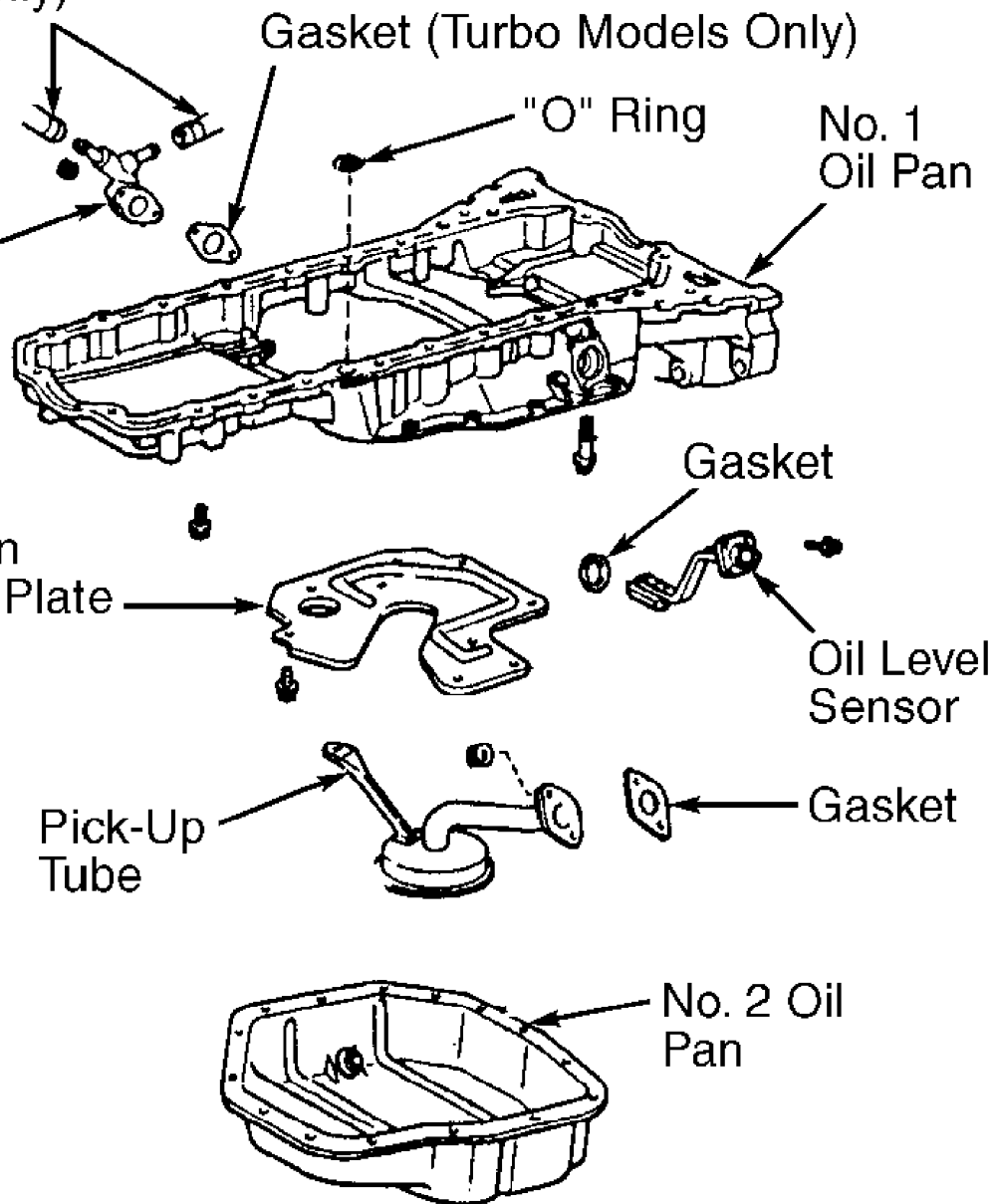
Gasket

Oil Level  
Sensor

Pick-Up  
Tube

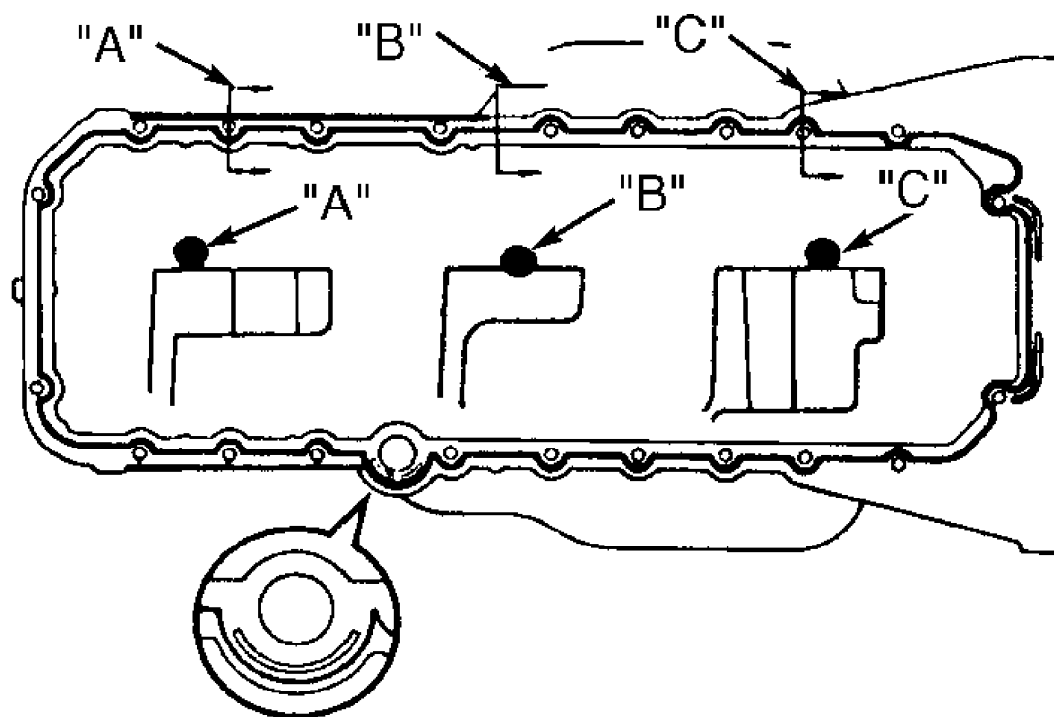
Gasket

No. 2 Oil  
Pan

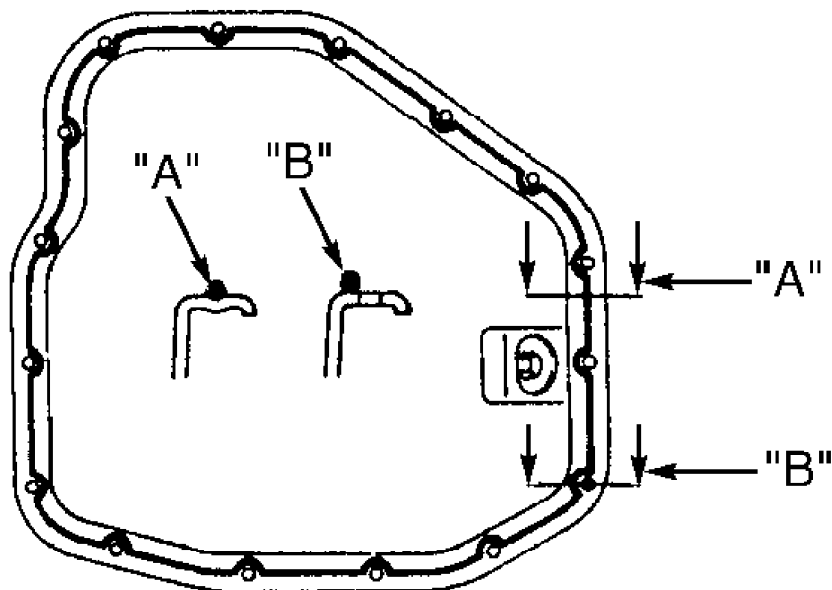


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Fig. 39: Exploded View Of Oil Pan & Components  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



NO. 1 OIL PAN SEALANT APPLICATION



NO. 2 OIL PAN SEALANT APPLICATION

96B19183

Fig. 40: Identifying Oil Pan Sealant Application Areas  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

OVERHAUL

## CYLINDER HEAD

### Cylinder Head

1) Inspect cylinder head warpage at cylinder block and manifold mating surfaces. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) To check camshaft oil clearance, install camshaft in cylinder head with camshaft dowel pins properly positioned and specified lobes facing upward. See Fig. 35. Install No. 3 and 7 camshaft bearing caps. Ensure proper camshaft bearing caps are installed. See Fig. 33.

3) Coat all camshaft bearing cap bolt threads and bolt-to-camshaft bearing cap surface with engine oil. Install camshaft bearing cap bolts in No. 3 and 7 camshaft bearing caps. Alternately tighten No. 3 and 7 camshaft bearing cap bolts until camshaft bearings caps are snug against cylinder head.

4) Install Plastigage on camshaft journal. Install remaining camshaft bearing caps. Ensure camshaft does not rotate. Tighten camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 34. See TORQUE SPECIFICATIONS.

5) Remove bolts and No. 1 camshaft bearing cap from each camshaft. Remove camshaft bearing cap bolts in sequence using several steps. See Fig. 34.

6) Measure width of Plastigage to check oil clearance. Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if oil clearance or end play is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

7) Ensure valve lifter diameter, bore diameter and oil clearance are within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS. When using replacement cylinder head, heater hose union (pipe that heater hose fits on) must be installed in cylinder head. See Figs. 17 and 21.

8) Apply Sealant (08833-00070) on heater hose union. On 1997 models, install and tap heater hose union into cylinder until distance from cylinder head surface to top of heater hose union is 1.89" (48.0 mm) for non-turbo models or 2.87" (73.0 mm) for turbo models. On 1998 models, install and tap heater hose union into cylinder until distance from cylinder head surface to top of heater hose union is 1.89" (48.0 mm).

### Valve Springs

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

**CAUTION:** On 1997 models and 1998 turbo models, ensure valve spring is installed with narrow-spaced coil end of valve spring facing downward, toward the cylinder head.

### Valve Stem Oil Seals

Lubricate valve stem oil seal with engine oil. Install valve stem oil seal on top of valve guide. Ensure valve stem oil seal is fully seated.

### Valve Guides

1) Ensure valve guide inside diameter is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.

2) To replace the valve guide, use hammer and Valve Guide Remover/Installer (SST 09201-01060) to drive valve guide out from camshaft side of cylinder head. Measure cylinder head valve guide bore

diameter.

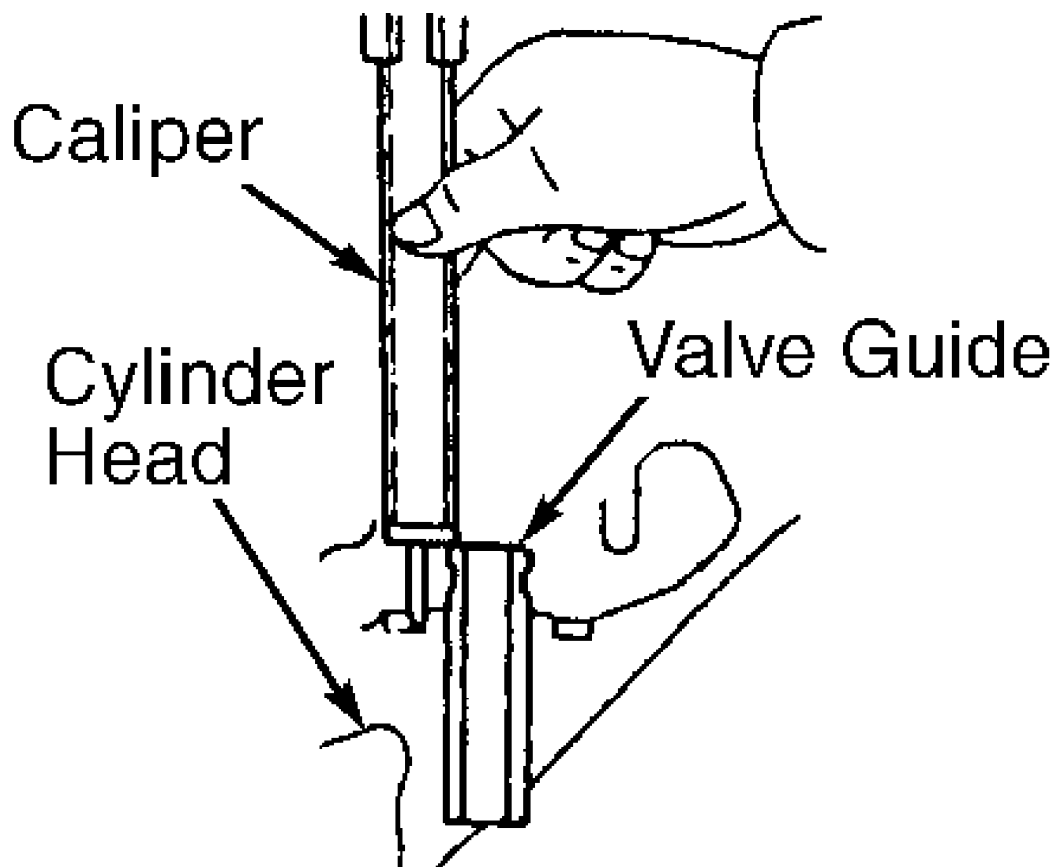
3) If bore diameter is .4325-.4333" (10.985-11.006 mm), use standard valve guide. If bore diameter exceeds .4333" (11.006 mm), machine valve guide bore to .4344-.4353" (11.035-11.056 mm) for oversize valve guide. Replace cylinder head if bore diameter exceeds .4353" (11.056 mm).

CAUTION: Exhaust valve guide is 1.594" (40.50 mm) long and intake valve guide is 1.516" (38.50 mm) long. Ensure proper length valve guide is installed.

4) To install the valve guide, use hammer and valve guide remover/installer. Drive valve guide in from camshaft side of cylinder head.

5) Using caliper, measure valve guide installed height from top of valve guide to cylinder head surface. See Fig. 41. Valve guide must be installed until valve guide installed height is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

6) Using .24" (6.0 mm) reamer, ream valve guide to obtain specified valve stem-to-guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.



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Fig. 41: Measuring Typical Valve Guide Installed Height  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Valve Seat

Ensure valve seat angle and seat width are within

specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.  
Valve seat replacement information is not available from manufacturer.

#### Valves

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

#### Valve Seat Correction Angles

Use 15-degree and 45-degree stones to lower valve seat contact area. On 1997 models, use 60-degree and 45-degree stones to raise valve seat contact area. On 1998 models, use 75-degree and 45-degree stones to raise valve seat contact area.

### VALVE TRAIN

#### Valve Lifters

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

### CYLINDER BLOCK ASSEMBLY

#### Piston & Rod Assembly

1) Ensure connecting rod and connecting rod cap are marked with matching cylinder number for installation reference. Piston and connecting rod must be installed in cylinder block with front mark toward front of engine. See Fig. 42.

2) Before removing piston from connecting rod, check for movement of piston back and forth on piston pin. Replace piston and piston pin as an assembly if movement exists.

3) Note direction of piston installation on connecting rod. See Fig. 42. When removing piston from connecting rod, remove snap rings from piston. Heat piston to 176°F (80°C) in water. Remove piston pin. Separate piston from connecting rod.

4) Using caliper, measure connecting rod bolt outside diameter .79" (20 mm) down from bottom of bolt head. Replace connecting rod bolt if outside diameter is less than .315" (8.00 mm).

5) Ensure piston and piston pin diameter are within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

6) Ensure connecting rod crankpin bore inside diameter, bend, twist and pin bushing bore diameter are within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS. Crankpin bore diameter is determined by size mark on connecting rod cap. See Fig. 44.

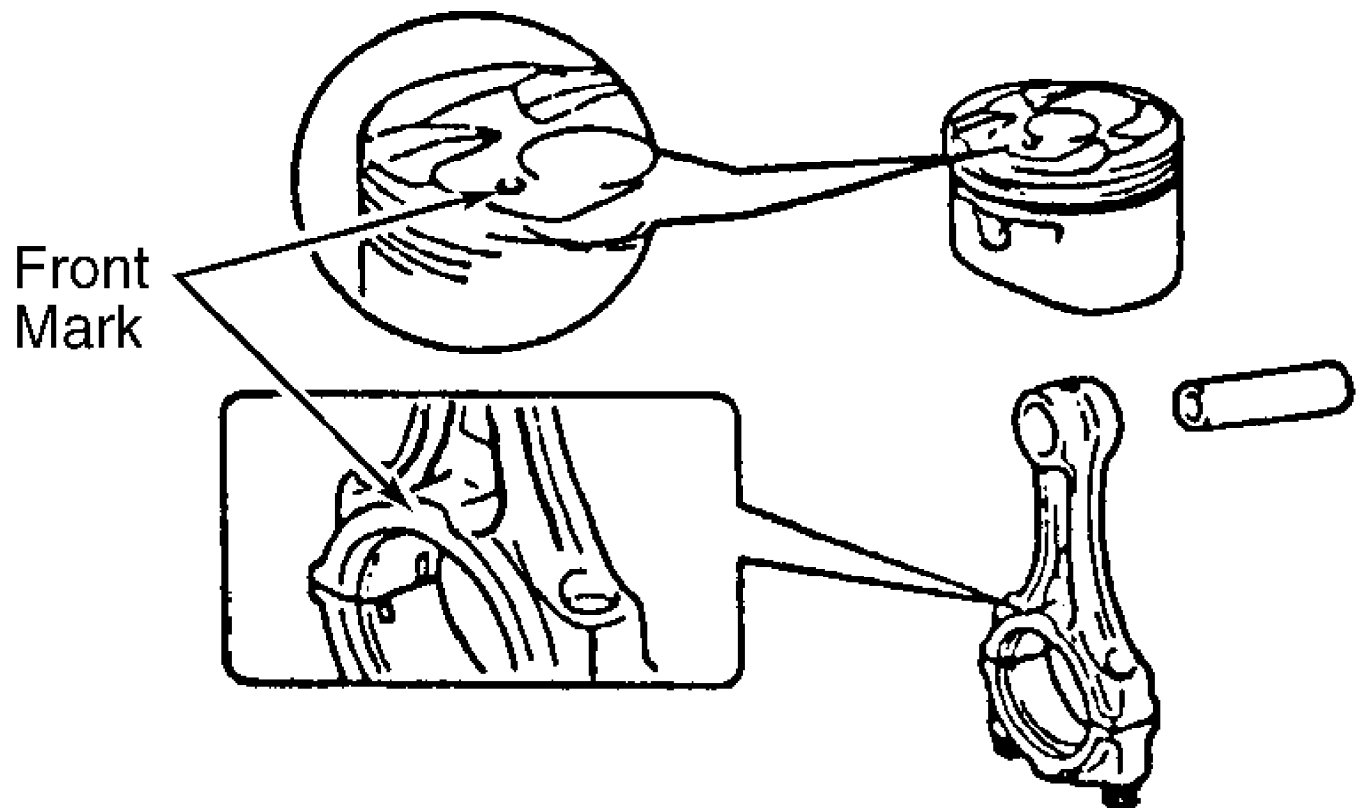
7) Bushing in connecting rod can be replaced if bore diameter is not within specification. Ensure bushing oil hole aligns with connecting rod oil hole. Bushing must be honed to obtain correct piston pin-to-rod clearance.

NOTE: With piston at 176°F (80°C), it should be possible to press piston pin into piston with thumb pressure. Replace piston if piston pin can be pressed into piston with piston at room temperature.

8) To reassemble, install piston with front mark on top of piston aligned with front mark on connecting rod. See Fig. 42. Install NEW snap ring in piston. Ensure ends of snap ring are not aligned with cut-out area on piston.

9) Heat piston to 176°F (80°C) in water. Coat piston pin with engine oil. Install piston pin and remaining NEW snap ring. Ensure ends of snap ring are not aligned with cut-out area on piston.





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Fig. 42: Locating Piston & Connecting Rod Front Marks  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Fitting Pistons

1) To determine piston-to-cylinder clearance, measure piston diameter and cylinder bore diameter. Measure piston skirt diameter 1.34" (34.0 mm) from top of piston at 90-degree angle to piston. Ensure piston diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

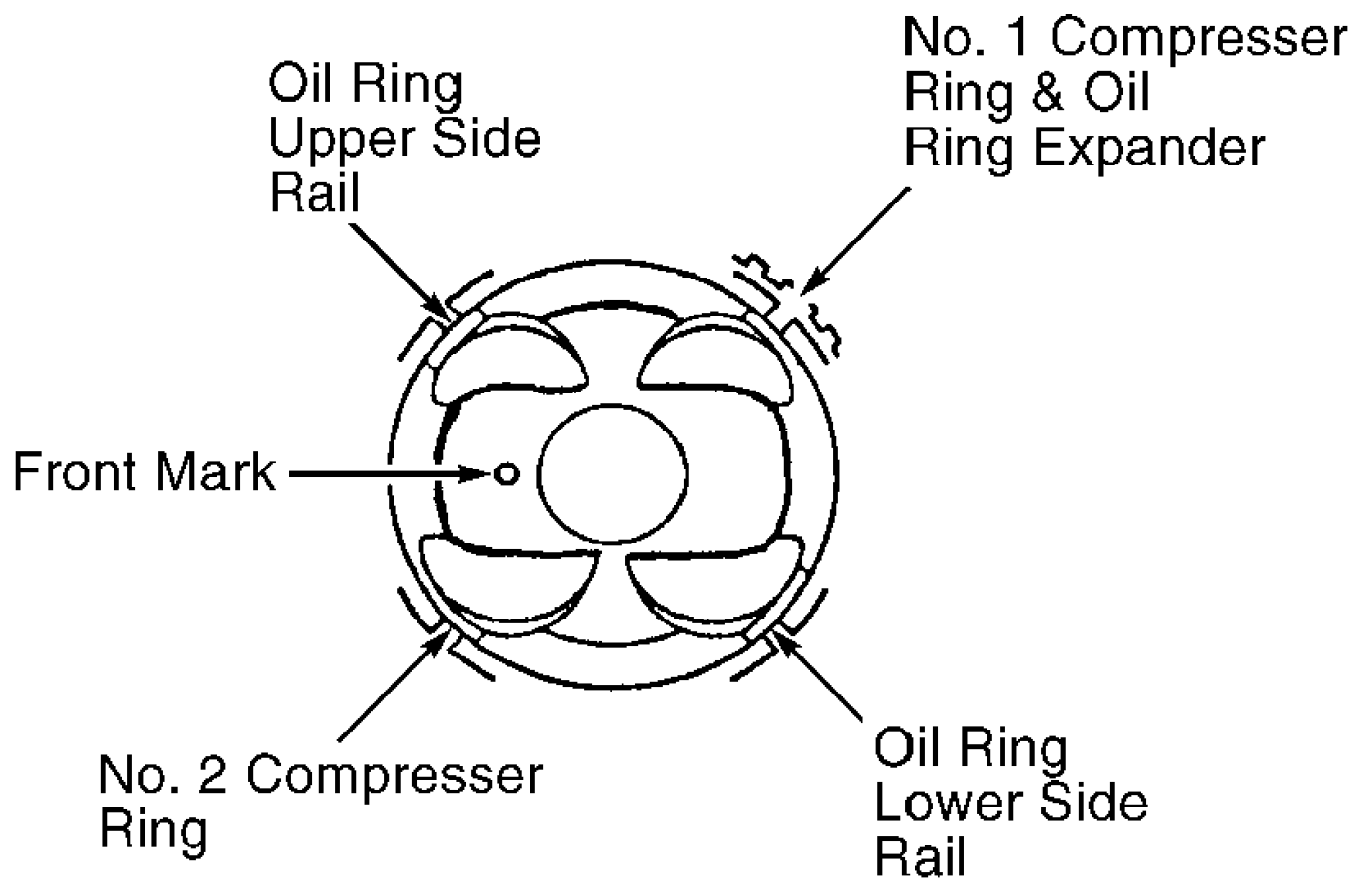
2) Measure cylinder bore diameter at .39" (10.0 mm) from top and bottom of cylinder bore and at middle of cylinder bore. Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Replace cylinder block if cylinder bore exceeds specification.

3) Determine piston clearance. Replace piston or cylinder block if clearance is not within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

#### Piston Rings

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

2) Install piston rings on piston with identification mark on compression rings toward top of piston. The No. 1 (top) compression ring contains identification mark 1T for non-turbo models and 1N for turbo models. The No. 2 (second) compression ring contains identification mark 2T for non-turbo models and 2N for turbo models. Ensure compression rings are installed in correct location. Position piston ring end gaps in proper areas. See Fig. 43.



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Fig. 43: 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 installation reference. Connecting rod must be installed with front mark toward front of engine. See Fig. 42.

2) Using caliper, measure connecting rod bolt outside diameter .79" (20.0 mm) down from bottom of bolt head. Replace connecting rod bolt if outside diameter is less than .315" (8.00 mm).

3) Connecting rod cap, rod bearing and crankshaft are stamped with a size mark. See Fig. 44. If replacing rod bearing, ensure size mark on replacement rod bearing is the same as size mark on original rod bearing.

4) If size mark on original rod bearing cannot be obtained, add size marks on crankshaft and connecting rod cap together to determine size mark of rod bearing. For example, if size mark on crankshaft is "2" and size mark on connecting rod cap is "1", use rod bearing with size mark "3".

5) Rod bearing thickness is determined by size mark. See ROD BEARING SPECIFICATIONS table. Ensure connecting rod is installed with front mark toward front of engine. See Fig. 42.

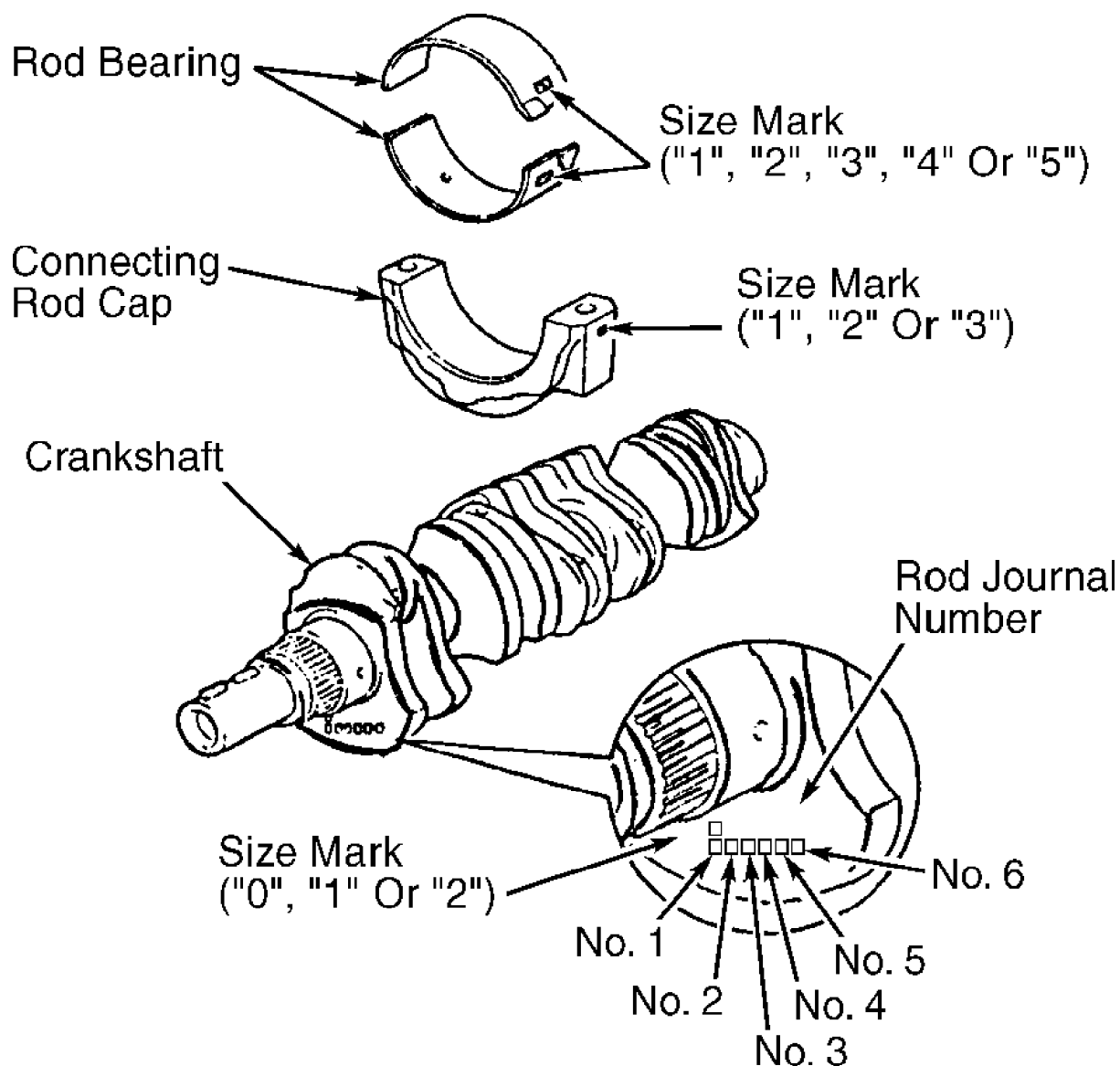
6) Before tightening connecting rod bolt to specification, coat bolt threads and bolt head-to-connecting rod cap surface with engine oil. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

7) Ensure bearing oil clearance and connecting rod side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD

BEARINGS and CONNECTING RODS table under ENGINE SPECIFICATIONS.

#### ROD BEARING SPECIFICATIONS

Bearing Size Mark		Thickness - In. (mm)	
1	.....	.0590-.0591	(1.498-1.501)
2	.....	.0591-.0592	(1.501-1.504)
3	.....	.0592-.0593	(1.504-1.507)
4	.....	.0593-.0594	(1.507-1.510)
5	.....	.0594-.0596	(1.510-1.513)



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Fig. 44: Locating Connecting Rod Journal, Rod Bearing & Connecting Rod Cap Size Marks  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

1) Main bearing caps are numbered on top of cap for location and arrow on cap points toward front of engine. No. 1 main bearing cap is at front of engine and No. 7 is at the flywheel/drive plate end.

2) Evenly loosen main bearing cap bolts in sequence using several steps. See Fig. 45. Remove main bearing caps, crankshaft, thrust bearings and main bearings.

3) Using caliper, measure main bearing cap bolt outside diameter 2.0" (50 mm) down from bottom of bolt head. Replace main bearing cap bolt if outside diameter is less than .382" (9.70 mm).

4) Cylinder block main bearing bore inside diameter is determined by size mark ("0", "1", "2", "3", "4", "5", "6" or "7") stamped on cylinder block. See Fig. 46. Left size mark indicates the front or No. 1 bore.

5) Crankshaft main bearing journal diameter is determined by size mark ("0", "1", "2", "3", "4", "5", "6" or "7") stamped on crankshaft counterweight. See Fig. 46. Ensure journal diameter, taper and out-of-round are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Replace crankshaft if not within specification.

6) Main bearing size mark ("1", "2", "3", "4" or "5") is stamped on side of main bearing. See Fig. 46. If replacing main bearing, ensure size mark on replacement main bearing is the same as size mark on original main bearing.

7) If size mark on original main bearing cannot be obtained, use size marks on cylinder block and crankshaft to determine size mark of main bearing. See Fig. 47. For example, if size mark on cylinder block is "3" and size mark on crankshaft is "4", use main bearing with size mark "3".

8) Main bearing thickness is determined by size mark. See MAIN BEARING SPECIFICATIONS table. Install main bearings, thrust bearings, crankshaft and main bearing caps in cylinder block.

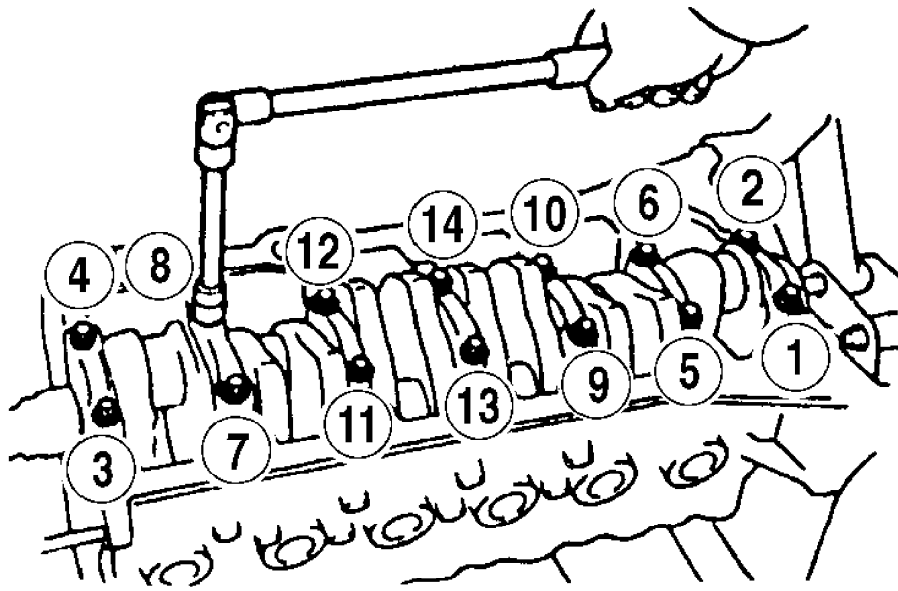
**CAUTION:** Main bearing caps must be installed with arrow on top of cap pointing toward front of engine. Ensure main bearing caps are installed in numerical order with No. 1 cap at front of engine and No. 7 cap at flywheel/drive plate end of engine.

9) Coat threads and bolt head-to-main bearing cap contact area of main bearing cap bolt with engine oil. Install and tighten main bearing cap bolts to specification in sequence using several steps. See Fig. 45. See TORQUE SPECIFICATIONS.

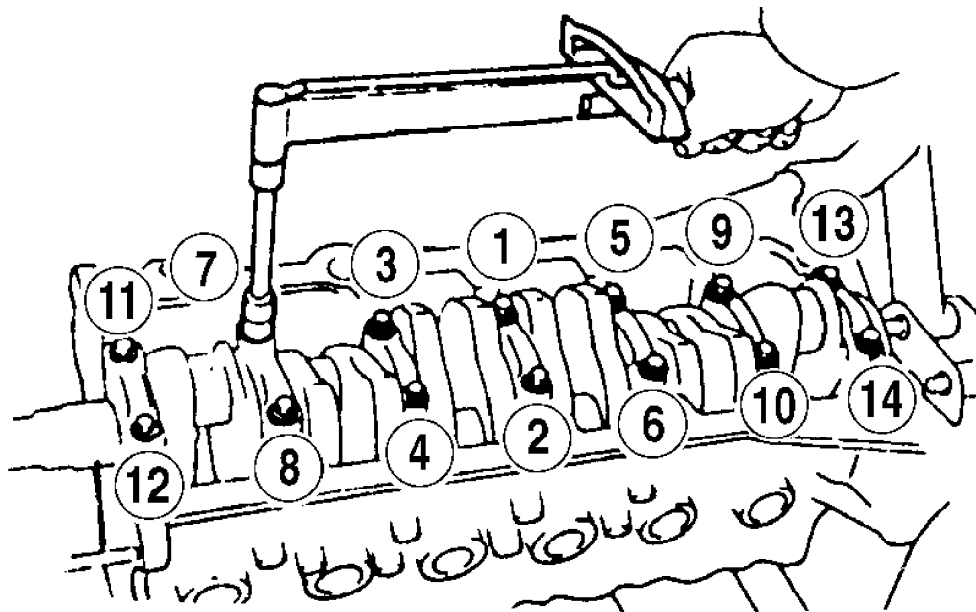
10) Ensure crankshaft end play and main bearing oil clearance are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Replace thrust bearing if end play is not within specification.

#### MAIN BEARING SPECIFICATIONS

Bearing Size Mark	Thickness - In. (mm)
1 .....	.0785-.0786 (1.994-1.997)
2 .....	.0786-.0787 (1.997-2.000)
3 .....	.0787-.0789 (2.000-2.003)
4 .....	.0789-.0790 (2.003-2.006)
5 .....	.0790-.0791 (2.006-2.009)



REMOVAL

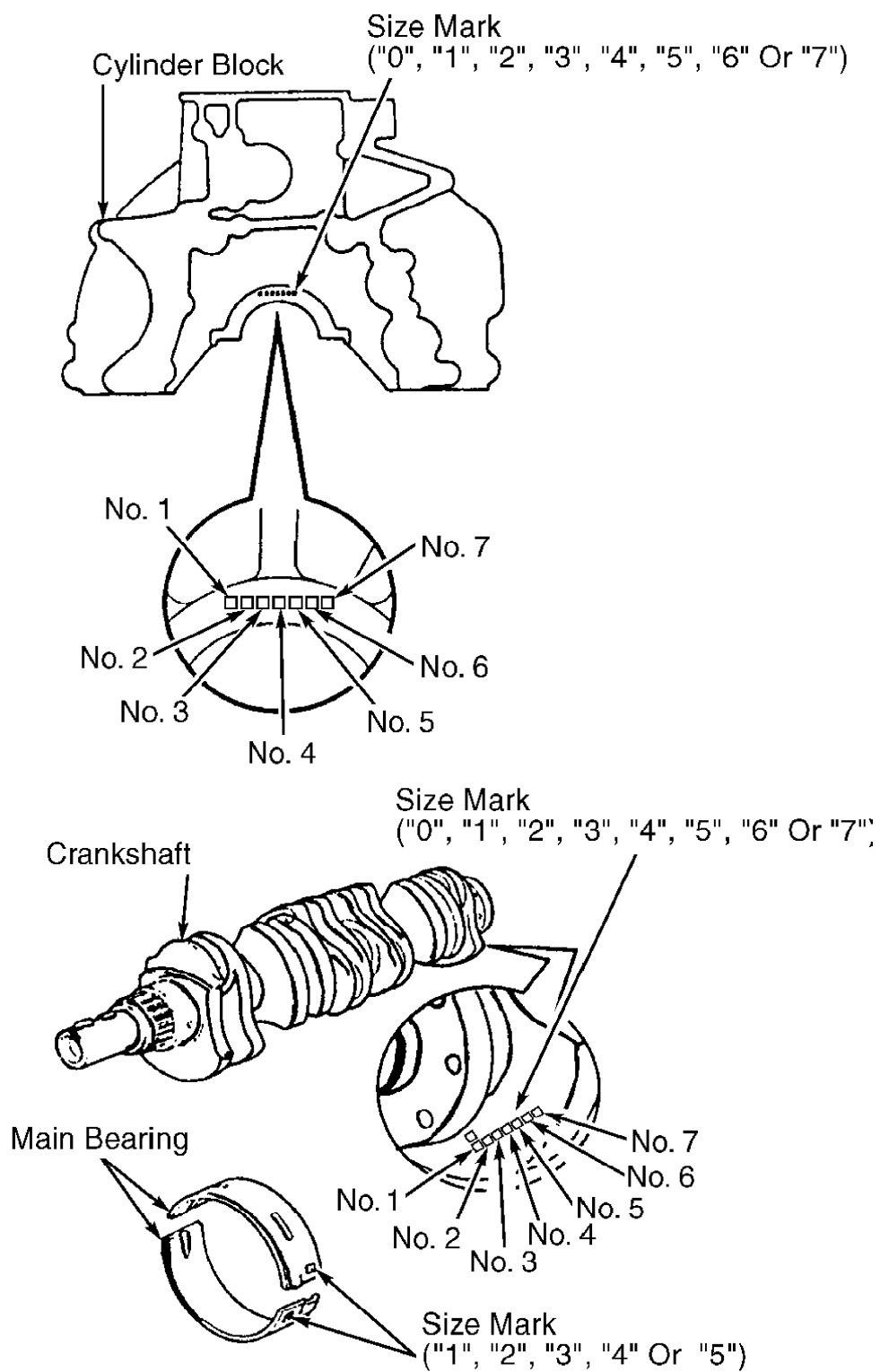


INSTALLATION

◀ FRONT OF ENGINE

93H83094

Fig. 45: Main Bearing Cap Bolt Removal & Installation Sequence  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



93I83095

Fig. 46: Locating Crankshaft Main Journal, Cylinder Block & Main Bearing Size Marks  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

Crankshaft Size Mark	Cylinder Block Size Mark							
	0	1	2	3	4	5	6	7
0	1	1	1	2	2	2	3	3
1	1	1	2	2	2	3	3	3
2	1	2	2	2	3	3	3	4
3	2	2	2	3	3	3	4	4
4	2	2	3	3	3	4	4	4
5	2	3	3	3	4	4	4	5
6	3	3	3	4	4	4	5	5
7	3	3	4	4	4	5	5	5

94C46781

Fig. 47: Determining Main Bearing Application  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### Thrust Bearing

Install thrust bearing on No. 4 main bearing with grooves toward crankshaft, away from cylinder block and main bearing cap. Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

#### Cylinder Block

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

2) Measure cylinder bore diameter at .39" (10.0 mm) from top and bottom cylinder bore and at middle of cylinder bore. Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

3) Install main bearing caps and tighten bolts to specification in sequence. See Fig. 45. Ensure main bearing bore inside diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

NOTE: Main bearing bore inside diameter is determined by size mark ("0", "1", "2", "3", "4", "5", "6" or "7") stamped on cylinder block. See Fig. 46.

## ENGINE OILING

### ENGINE LUBRICATION SYSTEM

Oil pump provides pressurized engine lubrication. See Fig. 48. On turbo models, oil spray nozzles, mounted in cylinder block are

used to cool pistons and oil cooler is mounted between oil filter and cylinder block. See Fig. 48.

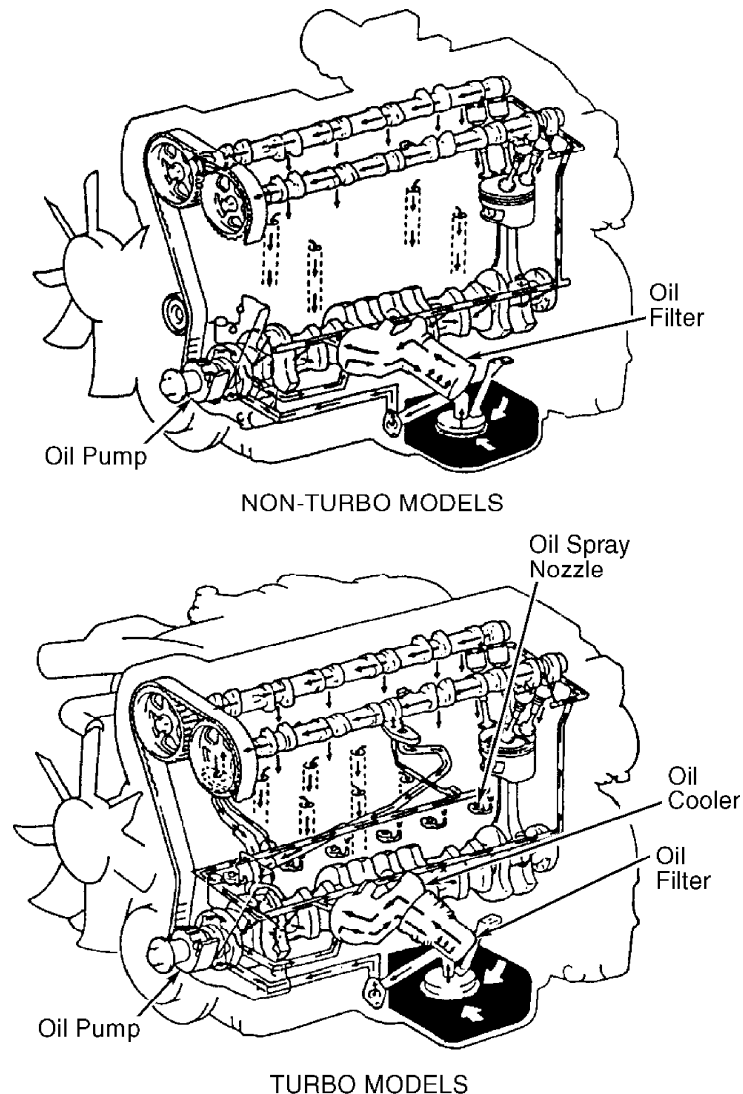
#### Crankcase Capacity

Crankcase capacity with oil filter is 5.5 qts. (5.2L) on non-turbo models or 5.3 qts. (5.0L) on turbo models.

#### Oil Pressure

1) On 1997 models, with engine at normal operating temperature, oil pressure should be at least 7.1 psi (.5 kg/cm<sup>2</sup>) at idle and approximately 47-84 psi (3.3-5.9 kg/cm<sup>2</sup>) at 3000 RPM on non-turbo models or 4000 RPM on turbo models.

2) On 1998 models, with engine at normal operating temperature, oil pressure should be at least 7.1 psi (.5 kg/cm<sup>2</sup>) at idle and more than 47 psi (3.3 kg/cm<sup>2</sup>) at 3000 RPM.



96D18898

Fig. 48: Cross-Sectional View Of Typical Engine Oiling System  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

#### OIL PUMP



NOTE: Manufacturer lists procedure with engine removed.

#### Removal & Disassembly

1) Remove engine. See ENGINE under REMOVAL & INSTALLATION.  
Remove timing belt, idler pulley and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION.

2) On turbo M/T models, remove drive belt tensioner damper bracket from front of cylinder block, near crankshaft. On all models, remove No. 1 and 2 oil pans. See OIL PAN under REMOVAL & INSTALLATION. Remove bolts, oil pump and "O" rings. Note bolt location for installation reference.

3) Remove relief valve plug, gasket or "O" ring, spring and relief valve. See Fig. 49. Remove bolts, oil pump cover and rotors. Remove crankshaft front seal (if necessary).

#### Inspection

1) Inspect components for damage. Coat relief valve with engine oil and ensure relief valve slides freely in bore of oil pump body. Replace relief valve or oil pump body if relief valve does not slide freely.

2) Install drive and driven rotors in oil pump body with reference mark (triangle mark) toward oil pump cover. Using feeler gauge, measure driven rotor-to-oil pump body clearance. Replace rotor assembly and/or oil pump assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

3) Using feeler gauge, measure rotor tip clearance between tips of both rotors. Tip of drive rotor is on outside of rotor and tip of driven rotor is on inside of rotor. Replace the rotor assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

4) Place straightedge across oil pump body, above both rotors. Using feeler gauge, measure rotor end clearance between straightedge and surface of each rotor. Replace rotor assembly and/or oil pump assembly if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

#### OIL PUMP SPECIFICATIONS

Application	In. (mm)
Driven Rotor-To-Oil Pump Body Clearance	
Non-Turbo	
Standard	.0039-.0069 (.100-.175)
Wear Limit	.0079 (.200)
Turbo	
Standard	.0031-.0053 (.080-.135)
Wear Limit	.0063 (.160)
Rotor End Clearance	
Non-Turbo	
Standard	.0012-.0035 (.030-.090)
Wear Limit	.0047 (.120)
Turbo	
Standard	.0007-.0026 (.020-.065)
Wear Limit	.0039 (.100)
Rotor Tip Clearance	
Non-Turbo	
Standard	.0024-.0094 (.060-.240)
Wear Limit	.0118 (.300)
Turbo	
Standard	.0022-.0128 (.056-.326)
Wear Limit	.0157 (.400)

#### Reassembly & Installation

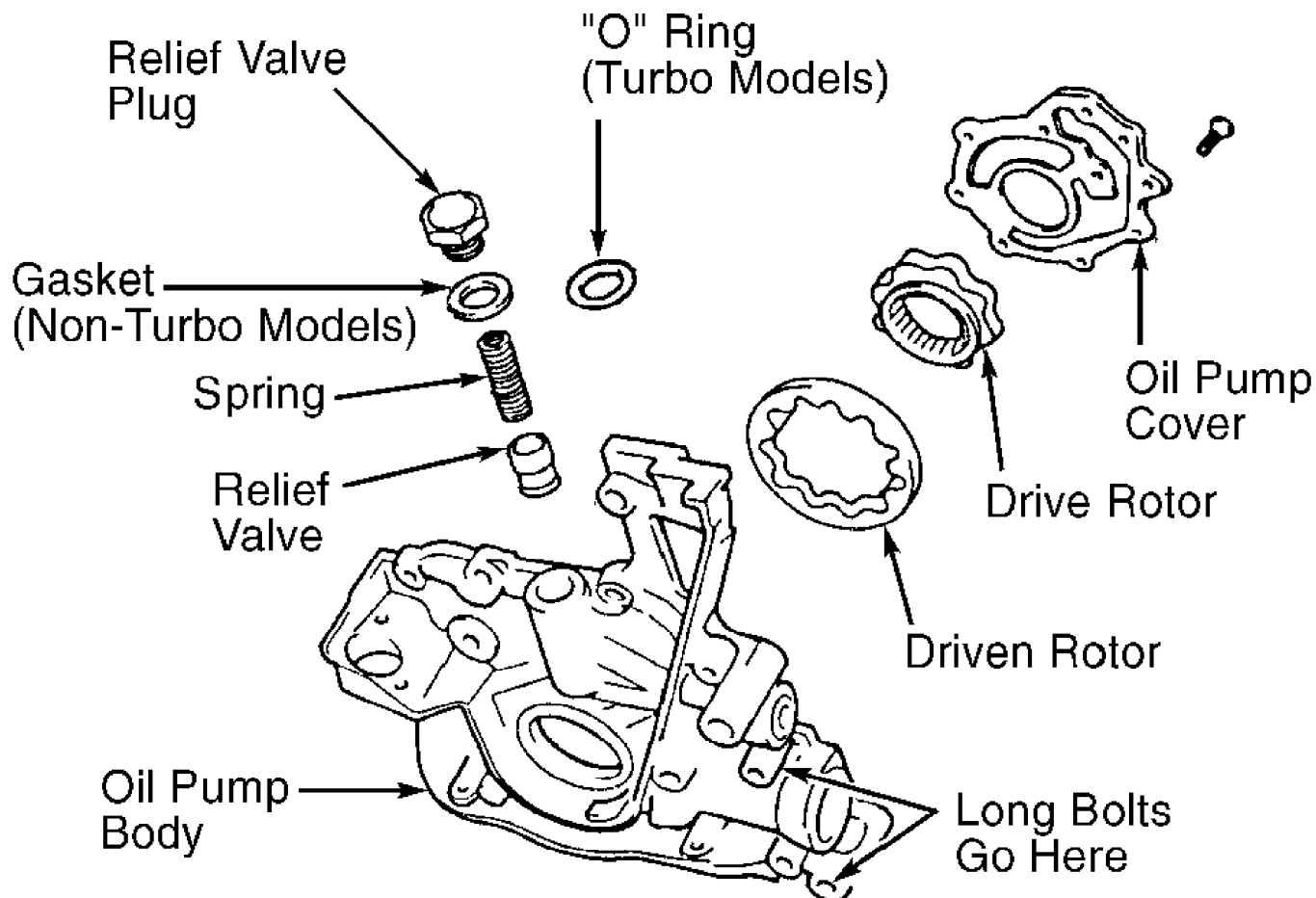
1) To reassemble, reverse disassembly procedure using NEW gasket or "O" ring. Ensure drive and driven rotors are installed in oil pump body with reference mark (triangle mark) toward oil pump cover. Tighten oil pump cover bolts and relief valve plug to specification. See TORQUE SPECIFICATIONS.

CAUTION: Ensure sealant does not enter oil passages on oil pump body when applying sealant on oil pump body.

2) To install, ensure sealing surfaces are clean. Install NEW "O" rings on cylinder block. Apply sealant on oil pump body.

3) Install oil pump and bolts. Ensure long bolts are installed in specified area. See Fig. 49. Tighten all bolts to specification. See TORQUE SPECIFICATIONS.

4) If installing crankshaft front seal, use hammer and Seal Installer (SST 09316-60011). Install seal until seal surface is even with oil pump body. Apply grease to sealing lip of seal. To install remaining components, reverse removal procedure.



93C83099

Fig. 49: Exploded View Of Oil Pump & Identifying Long Bolt Installation Area

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

## OIL COOLER

Removal (Turbo)

1) Drain cooling system. Remove power steering reservoir with

hoses attached and secure aside. Remove oil filter. Disconnect coolant hoses from oil cooler.

2) Remove oil cooler retaining stud and plate washer from center of oil cooler. The oil cooler retaining stud is the stud that the oil filter screws onto. A relief valve is located inside oil cooler retaining stud. Remove oil cooler and "O" rings.

#### Inspection

1) Inspect oil cooler for damage or restriction. Replace oil cooler if damaged or restricted.

2) Using small wooden object, ensure relief valve in oil cooler retaining stud moves when pressure is applied to relief valve from cylinder block threaded end (opposite end of oil filter retaining threads) of oil cooler retaining stud. Replace oil cooler retaining stud if relief valve fails to move.

#### Installation

1) To install, reverse removal procedure using NEW "O" rings. Apply engine oil to threads and bottom of head area on oil cooler retaining stud before installing.

2) Install and tighten oil cooler retaining stud to specification. See TORQUE SPECIFICATIONS. Fill cooling system and recheck engine oil level.

## OIL SPRAY NOZZLE

NOTE: Cylinder block has 6 oil spray nozzles, one for each piston. See Fig. 48. A relief valve check ball is located in each oil spray nozzle.

#### Removal (Turbo)

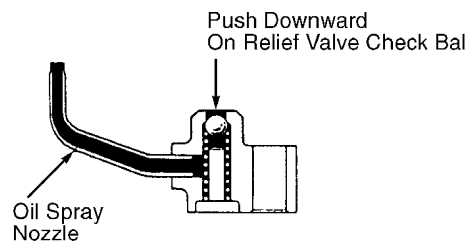
Remove crankshaft. See CYLINDER BLOCK under CYLINDER BLOCK ASSEMBLY under OVERHAUL. Remove oil spray nozzle-to-cylinder block bolt. Remove oil spray nozzle.

#### Inspection

Inspect oil spray nozzle for damage or restriction. Using small wooden object, ensure relief valve check ball in oil spray nozzle moves when pressure is applied against relief valve check ball. See Fig. 50. Replace oil spray nozzle if relief valve check ball fails to move.

#### Installation

Install oil spray nozzle in cylinder block. Ensure oil spray nozzle engages hole in cylinder block. Install and tighten oil spray nozzle-to-cylinder block bolt to specification. See TORQUE SPECIFICATIONS. Install crankshaft using proper procedure.



93F83100  
Fig. 50: Checking Oil Spray Nozzle Relief Valve Check Ball Operation  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## TORQUE SPECIFICATIONS

## TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt/Nut	
Bolt & Nut .....	38 (52)
Stud Bolt .....	19 (26)
Air Intake Chamber Bolt/Nut .....	20 (27)
Air Intake Chamber Support Brace Bolt .....	14 (19)
Camshaft Bearing Cap Bolt	
1997 Non-Turbo & Turbo (1) .....	15 (20)
1998 Non-Turbo .....	(2)
1998 Turbo (1) .....	15 (20)
Camshaft Sprocket Bolt	
1997 Models .....	58 (79)
1998 Models .....	60 (81)
Connecting Rod Bolt	
Step 1 .....	21 (29)
Step 2 .....	Additional 90 Degrees
Coolant Outlet Bolt/Nut .....	15 (20)
Coolant Pipe-To-Water Pump Nut .....	15 (20)
Cooling Fan & Fluid Coupling-To-Water Pump Nut .....	12 (16)
Crankshaft Pulley Bolt	
1997 Models .....	239 (324)
1998 Models .....	243 (330)
Cylinder Head Bolt (3)	
1997 Models	
Step 1 .....	25 (34)
Step 2 .....	Additional 90 Degrees
Step 3 .....	Additional 90 Degrees
1998 Models	
Step 1 .....	26 (35)
Step 2 .....	Additional 90 Degrees
Step 3 .....	Additional 90 Degrees
Delivery Pipe Bolt .....	15 (20)
Drive Belt Tensioner Bolt .....	15 (20)
Drive Belt Tensioner Damper Nut .....	15 (20)
Drive Shaft Center Bearing Bolt .....	36 (49)
Drive Shaft Companion Flange Bolt	
At Rear Axle Companion Flange .....	58 (79)
At Transmission Companion Flange .....	41 (56)
EGR Pipe	
1997 Non-Turbo	
Bolt .....	15 (20)
Union Nut .....	47 (64)
1997-98 Turbo	
Bolt .....	20 (27)
Union Nut .....	47 (64)
Engine Mount-To-Crossmember Nut .....	43 (58)
Exhaust By-Pass Pipe Nut .....	18 (24)
Exhaust Gas Control Valve Brace Bolt/Nut .....	32 (43)
Exhaust Gas Control Valve-To-Turbine Outlet Elbow Nut .....	51 (69)
Exhaust Manifold Nut	
Non-Turbo .....	29 (39)
Turbo (4) .....	29 (39)
Flywheel/Drive Plate Bolt	
A/T .....	61 (83)
M/T	
Step 1 .....	36 (49)
Step 2 .....	Additional 90 Degrees
Front Bracket Bolt	
At Oil Pump .....	38 (52)

At Power Steering Pump .....	43 (58)
Front Lower Arm Bracket Support Bolt/Nut	
Bolt .....	33 (45)
Nut .....	43 (58)
Fuel Inlet Pipe-To-Delivery Pipe Union Bolt .....	30 (41)
Fuel Pressure Pulsation Damper .....	30 (41)
Fuel Return Line Union Bolt .....	20 (27)
Idler Pulley Bolt .....	25 (34)
Intake Air Connector-To-Air Intake Chamber Bolt/Nut	
1997 Models .....	15 (20)
1998 Models .....	21 (29)
Intake Air Control Valve-To-No. 2 Turbocharger Nut .....	15 (20)
Intake Manifold Bolt/Nut .....	20 (27)
Intake Manifold Support Bolt/Nut	
1997 Models .....	29 (39)
1998 Models .....	30 (41)
Knock Sensor .....	33 (45)
Main Bearing Cap Bolt (5)	
Step 1 .....	33 (45)
Step 2 .....	Additional 90 Degrees
Main Oxygen Sensor Nut .....	15 (20)
No. 1 Air Tube-To-No. 1 Turbocharger Bolt .....	15 (20)
No. 1 Oil Pan Bolt	
12-mm Bolt Head .....	15 (20)
14-mm Bolt Head .....	29 (39)
No. 1 Oil Pipe-To-Camshaft Bearing Cap Union Bolt .....	41 (56)
No. 1 & 2 Air Intake Chamber Brace Bolt/Nut .....	13 (18)
No. 1 & 2 Oil Pipe-To-Cylinder Block Union Bolt	
1997 Models .....	29 (39)
1998 Models .....	33 (45)
No. 1 & 2 Oil Pipe-To-Turbocharger Nut .....	15 (20)
No. 1 & 2 Turbocharger Support Bolt/Nut .....	32 (43)
No. 2 Air Tube-To-Turbocharger Bolt .....	15 (20)
No. 2 Vacuum Pipe Nut .....	15 (20)
No. 4 Air Tube-To-No. 1 Turbocharger Nut .....	15 (20)
Oil Cooler Retaining Stud .....	58 (79)
Oil Filter Bracket-To-Cylinder Block Bolt .....	65 (88)
Oil Pump-To-Cylinder Block Bolt .....	15 (20)
Power Steering Pump Pulley Nut .....	32 (43)
Pressure Tank & VSV Assembly Bolt .....	15 (20)
Relief Valve Plug	
Non-Turbo .....	36 (49)
Turbo .....	21 (29)
Screw Plug .....	11 (15)
Shift Lever-To-Shift Linkage Bolt/Nut .....	14 (19)
Spark Plug .....	13 (18)
Thermostat Housing Nut	
Non-Turbo .....	( 6)
Turbo .....	15 (20)
Throttle Body Bolt/Nut .....	15 (20)
Throttle Body Bracket Nut .....	15 (20)
Timing Belt Tensioner Bolt .....	19 (26)
Torque Converter Bolt .....	24 (33)
Transmission Crossmember-To-Body Bolt .....	18 (24)
Turbocharger Oil Outlet Pipe Nut .....	20 (27)
Turbocharger-To-Exhaust Manifold Nut .....	40 (54)
Turbocharger-To-Turbine Outlet Elbow Nut .....	18 (24)
Upper Front Crossmember Extension Bolt/Nut	
Bolt .....	21 (29)
Nut .....	24 (33)
Vacuum Valve Set Nut .....	15 (20)
Water Pump Bolt .....	15 (20)

INCH Lbs. (N.m)

Bearing Housing Side Plate Nut	
1997 Models	78 (8.8)
1998 Models	80 (9.0)
Camshaft Position Sensor Bolt	
1997 Models	78 (8.8)
1998 Models	80 (9.0)
Camshaft Timing Oil Control Valve Bolt	71 (8.0)
Center Floor Crossmember Brace Bolt	115 (13.0)
Clutch Release Cylinder Bolt	115 (13.0)
Control Rod-To-Shift Lever Nut	115 (13.0)
Coolant By-Pass Outlet Bolt	78 (8.8)
EGR Cooler Bolt	
1997 Models	78 (8.8)
1998 Models	80 (9.0)
Fuel Injector Holder-To-Delivery Pipe Bolt	
1997 Models	69 (7.8)
1998 Models	71 (8.0)
Ignition Coil Bolt	71 (8.0)
Ignition Coil Bracket-To-Valve Cover Bolt	
1997 Models	78 (8.8)
1998 Models	80 (9.0)
No. 1 & 2 Coolant Pipe-To-Turbocharger Nut	
1997 Models	78 (8.8)
1998 Models	80 (9.0)
No. 1 & 2 Valve Cover Bolt/Nut	
Non-Turbo	
1997 Models	73 (8.2)
1998 Models	75 (8.5)
Turbo	48 (5.4)
No. 2 Oil Pan Bolt/Nut	
1997 Models	78 (8.8)
1998 Models	80 (9.0)
No. 3 Valve Cover Bolt	73 (8.3)
No. 4 Timing Belt Cover Bolt	
1997 Models	69 (7.8)
1998 Models	71 (8.0)
Oil Level Sensor Bolt	48 (5.4)
Oil Pan Baffle Plate Bolt/Nut	
1997 Models	78 (8.8)
1998 Models	80 (9.0)
Oil Pump Cover Bolt	89 (10.0)
Oil Spray Nozzle-To-Cylinder Block Bolt	
1997 Models	78 (8.8)
1998 Models	71 (8.0)
Pick-Up Tube Bolt/Nut	78 (8.8)
Rear Oil Seal Housing-To-Cylinder Block Bolt	52 (5.9)
Timing Belt Plate Bolt	
1997 Models	69 (7.8)
1998 Models	71 (8.0)
Transmission Mount-To-Transmission Crossmember Nut	115 (13.0)
Shift Lever Bolt	69 (7.8)

- (1) - Tighten camshaft bearing cap bolts using proper procedure listed. See CAMSHAFTS under REMOVAL & INSTALLATION.
- (2) - Tighten camshaft bearing cap bolts using proper procedure listed. See CAMSHAFTS under REMOVAL & INSTALLATION. Tighten bolts on all camshaft bearing caps except for No. 1 camshaft bearing cap on intake camshaft to 15 ft. lbs. (20 N.m). Tighten small bolts on No. 1 camshaft bearing cap on intake camshaft to 44 INCH lbs. (5.0 N.m) and large bolts to 15 ft. lbs. (20 N.m).
- (3) - Tighten bolts to specification in sequence. See Fig. 18.

- (4) - Tighten nuts to specification in sequence. See Fig. 22.
- (5) - Tighten bolts to specification in sequence. See Fig. 45.
- (6) - Tighten nuts to 78 INCH lbs. (8.8 N.m)

## ENGINE SPECIFICATIONS

### GENERAL SPECIFICATIONS

#### GENERAL SPECIFICATIONS

Application	Specification
Displacement .....	183 Cu. In. (3.0L)
Bore .....	3.39" (86.1 mm)
Stroke .....	3.39" (86.1 mm)
Compression Ratio	
Non-Turbo	
1997 Models .....	10.0:1
1998 Models .....	10.5:1
Turbo .....	8.5:1
Fuel System .....	SFI
Horsepower @ RPM	
Non-Turbo	
1997 Models .....	220 @ 5800
1998 Models .....	225 @ 6000
Turbo .....	320 @ 5600
Torque Ft. Lbs. @ RPM	
Non-Turbo	
1997 Models .....	210 @ 4800
1998 Models .....	220 @ 4000
Turbo .....	315 @ 4000

### 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)
Runout .....	.0024 (.060)
Main Bearings	
Journal Diameter (1)	
Size Mark "0" .....	2.44086-2.44094 (61.9980-62.0000)
Size Mark "1" .....	2.44078-2.44086 (61.9960-61.9980)
Size Mark "2" .....	2.44070-2.44078 (61.9940-61.9960)
Size Mark "3" .....	2.44063-2.44070 (61.9920-61.9940)
Size Mark "4" .....	2.44055-2.44063 (61.9900-61.9920)
Size Mark "5" .....	2.44047-2.44055 (61.9880-61.9900)
Size Mark "6" .....	2.44039-2.44047 (61.9860-61.9880)
Size Mark "7" .....	2.44031-2.44039 (61.9840-61.9860)
Journal Out-Of-Round .....	.0008 (.020)
Journal Taper .....	.0008 (.020)
Oil Clearance	
Standard Crankshaft Journal	
Standard .....	.0010-.0016 (.025-.040)
Wear Limit .....	.0024 (.060)
.010" (.25 mm) Undersize Crankshaft Journal	

Standard	.....	.0010-.0024	(.025-.060)
Wear Limit	.....	.0031	(.080)
Connecting Rod Bearings			
Journal Diameter (2)			
Size Mark "0"	.....	2.0470-2.0472	(51.994-52.000)
Size Mark "1"	.....	2.0468-2.0470	(51.988-51.994)
Size Mark "2"	.....	2.0465-2.0468	(51.982-51.988)
Journal Out-Of-Round	.....	.0008	(.020)
Journal Taper	.....	.0008	(.020)
Oil Clearance			
Standard Crankshaft Journal			
Standard	.....	.0009-.0016	(.023-.041)
Wear Limit	.....	.0028	(.070)
.010" (.25 mm) Undersize Crankshaft Journal			
Standard	.....	.0011-.0026	(.028-.066)
Wear Limit	.....	.0031	(.080)

- (1) - Main bearing journal diameter is determined by size mark stamped on crankshaft. See Fig. 46.
- (2) - Rod journal diameter is determined by size mark stamped on crankshaft. See Fig. 44.

## CONNECTING RODS

### CONNECTING RODS

Application	In. (mm)
Bore Diameter	
Pin Bushing Bore	..... .8663-.8667 (22.005-22.014)
Crankpin Bore (1)	
Size Mark "1"	..... 2.1663-2.1666 (55.025-55.031)
Size Mark "2"	..... 2.1666-2.1668 (55.031-55.037)
Size Mark "3"	..... 2.1668-2.1670 (55.037-55.043)
Maximum Bend	..... .0020 Per 3.94 (.050 Per 100.1)
Maximum Twist	..... .0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	..... .0098-.0158 (.250-.402)
Wear Limit	..... .0197 (.500)

- (1) - Bore diameter is determined by size mark stamped on connecting rod cap. See Fig. 44.

## PISTONS, PINS & RINGS

### PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	
Non-Turbo	
Standard	..... .0022-.0030 (.055-.078)
Wear Limit	..... .0039 (.100)
Turbo	
Standard	..... .0029-.0038 (.073-.096)
Wear Limit	..... .0047 (.120)
Diameter	
Non-Turbo	..... 3.3833-3.3837 (85.935-85.945)
Turbo	..... 3.3826-3.3830 (85.917-85.927)
Pins	



Diameter	.....	.8660-.8664	(21.997-22.006)
Piston Fit	.....		(1)
Rod Fit			
Standard	.....	.0002-.0004	(.005-.011)
Wear Limit	.....	.002	(.05)
Rings			
No. 1			
End Gap			
Non-Turbo			
Standard	.....	.0118-.0185	(.300-.470)
Wear Limit	.....	.0421	(1.070)
Turbo			
Standard	.....	.0118-.0157	(.300-.400)
Wear Limit	.....	.0394	(1.000)
Side Clearance			
Non-Turbo	.....	.0004-.0028	(.011-.070)
Turbo	.....	.0016-.0031	(.040-.080)
No. 2			
End Gap			
Non-Turbo			
Standard	.....	.0138-.0205	(.350-.520)
Wear Limit	.....	.0441	(1.120)
Turbo			
Standard	.....	.0138-.0178	(.350-.450)
Wear Limit	.....	.0413	(1.050)
Side Clearance			
Non-Turbo & Turbo	.....	.0012-.0028	(.030-.070)
No. 3 (Oil)			
End Gap			
Non-Turbo			
Standard	.....	.0051-.0177	(.130-.450)
Wear Limit	.....	.0413	(1.050)
Turbo			
Standard	.....	.0051-.0150	(.130-.380)
Wear Limit	.....	.0386	(.980)

(1) - With piston at 176°F (80°C), piston pin should be able to be pressed into piston using thumb pressure.

## CYLINDER BLOCK

### CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter	..... 3.3858-3.3863 (86.000-86.013)
Maximum Diameter	..... 3.3866 (86.020)
Main Bearing Bore Inside Diameter (1)	
Size Mark "0"	..... 2.59921-2.59929 (66.0200-66.0220)
Size Mark "1"	..... 2.59929-2.59936 (66.0220-66.0240)
Size Mark "2"	..... 2.59936-2.59944 (66.0240-66.0260)
Size Mark "3"	..... 2.59944-2.59952 (66.0260-66.0280)
Size Mark "4"	..... 2.59952-2.59960 (66.0280-66.0300)
Size Mark "5"	..... 2.59960-2.59968 (66.0300-66.0320)
Size Mark "6"	..... 2.59968-2.59976 (66.0320-66.0340)
Size Mark "7"	..... 2.59976-2.59984 (66.0340-66.0360)
Maximum Deck Warpage	..... .0028 (.070)

(1) - Cylinder block main bearing bore inside diameter is determined by size mark stamped on cylinder block. See Fig. 46.

## VALVES & VALVE SPRINGS

### VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Face Angle .....	44.5 °
Minimum Margin .....	.020" (.50 mm)
Minimum Refinish Length .....	3.8657" (98.190 mm)
Stem Diameter .....	.2350-.2356" (5.970-5.985 mm)
Exhaust Valves	
Face Angle .....	44.5 °
Minimum Margin .....	.020" (.50 mm)
Minimum Refinish Length .....	3.8874" (98.740 mm)
Stem Diameter .....	.2348-.2354" (5.965-5.980 mm)
Valve Springs	
Free Length	
1997 Models	
Non-Turbo & Turbo .....	1.6417" (41.700 mm)
1998 Models	
Non-Turbo	
Spring With Pink Paint Mark .....	1.7209" (43.710 mm)
Spring With Yellow Paint Mark .....	1.7362" (44.100 mm)
Turbo .....	1.6417" (41.700 mm)
Out-Of-Square .....	.079" (2.00 mm)
Pressure	
Intake & Exhaust ..	42-46 Lbs. @ 1.358 In. (19-21 kg @ 34.50 mm)

## CYLINDER HEAD

### CYLINDER HEAD

Application	Specification
Maximum Warpage	
Cylinder Block Surface .....	.0039" (.100 mm)
Manifold Surface .....	.0039" (.100 mm)
Valve Seats	
Intake Valve	
Seat Angle .....	45 °
Seat Width .....	.039-.055" (1.00-1.40 mm)
Exhaust Valve	
Seat Angle .....	45 °
Seat Width .....	.047-.063" (1.20-1.60 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide .....	.4325-.4333" (10.985-11.006 mm)
Oversize Valve Guide .....	.4344-.4353" (11.035-11.056 mm)
Valve Guide I.D. ....	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed Height .....	.484-.500" (12.30-12.70 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-.4333" (10.985-11.006 mm)
Oversize Valve Guide .....	.4344-.4353" (11.035-11.056 mm)
Valve Guide I.D. ....	.2366-.2374" (6.010-6.030 mm)
Valve Guide Installed Height .....	.449-.465" (11.40-11.80 mm)

Valve Stem-To-Guide Oil Clearance		
Standard	.....	.0012-.0026" (.030-.065 mm)
Wear Limit	.....	.0039" (.100 mm)

## CAMSHAFT

### CAMSHAFT

Application	In. (mm)
End Play	
Standard	..... .0031-.0075 (.080-.190)
Wear Limit	..... .0118 (.300)
Journal Diameter	..... 1.1397-1.1404 (28.949-28.965)
Journal Runout	..... .0031 (.080)
Lobe Height	
Intake	
1997 Models	
Standard	..... 1.7547-1.7587 (44.570-44.670)
Wear Limit	..... 1.7488 (44.420)
1998 Models	
Non-Turbo	
Standard	..... 1.7445-1.7465 (44.310-44.360)
Wear Limit	..... 1.7386 (44.160)
Turbo	
Standard	..... 1.7547-1.7587 (44.570-44.670)
Wear Limit	..... 1.7488 (44.420)
Exhaust	
1997 Models	
Standard	..... 1.7626-1.7665 (44.770-44.870)
Wear Limit	..... 1.7567 (44.620)
1998 Models	
Non-Turbo	
Standard	..... 1.7421-1.7461 (44.250-44.350)
Wear Limit	..... 1.7362 (44.100)
Turbo	
Standard	..... 1.7626-1.7665 (44.770-44.870)
Wear Limit	..... 1.7567 (44.620)
Oil Clearance	
Standard	..... .0014-.0028 (.035-.072)
Wear Limit	..... .0039 (.100)

## VALVE LIFTERS

### VALVE LIFTERS

Application	In. (mm)
Bore Diameter	..... 1.2205-1.2211 (31.000-31.016)
Lifter Diameter	..... 1.2191-1.2195 (30.966-30.976)
Oil Clearance	
Standard	..... .0009-.0020 (.024-.050)
Wear Limit	..... .0028 (.070)