

2.2L 4-CYL - VIN [S]

1993 Toyota Celica

1993 TOYOTA ENGINES
2.2L 4-Cylinder

Camry, Celica, MR2

* 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.

NOTE: On Camry applications only, 2 balance shafts are located in balance shaft assembly at bottom of cylinder block, below crankshaft. The No. 1 balance shaft is driven by a drive gear on No. 3 crankshaft counterweight. Balance shaft assembly is used to reduce engine vibration.

ENGINE IDENTIFICATION

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

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code	VIN Code
Camry, Celica & MR2 2.2L 4-Cylinder	5S-FE	S

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine cold.

1) Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

2) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure valve lifters are loose on cylinder No. 1 and tight on cylinder No. 4. If conditions are not as described, rotate crankshaft one complete revolution (360 degrees).

3) With cylinder No. 1 at TDC on compression stroke, check valve clearance on specified valves. Perform STEP 1. See Fig. 1. Using feeler gauge, measure and record valve clearance between valve lifter and camshaft.

4) To check remaining valves, rotate crankshaft clockwise 360 degrees (one revolution) until cylinder No. 4 cylinder is at TDC on compression stroke. Measure and record valve clearance on specified valves. Perform STEP 2. See Fig. 1.

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

VALVE CLEARANCE SPECIFICATIONS (1) TABLE

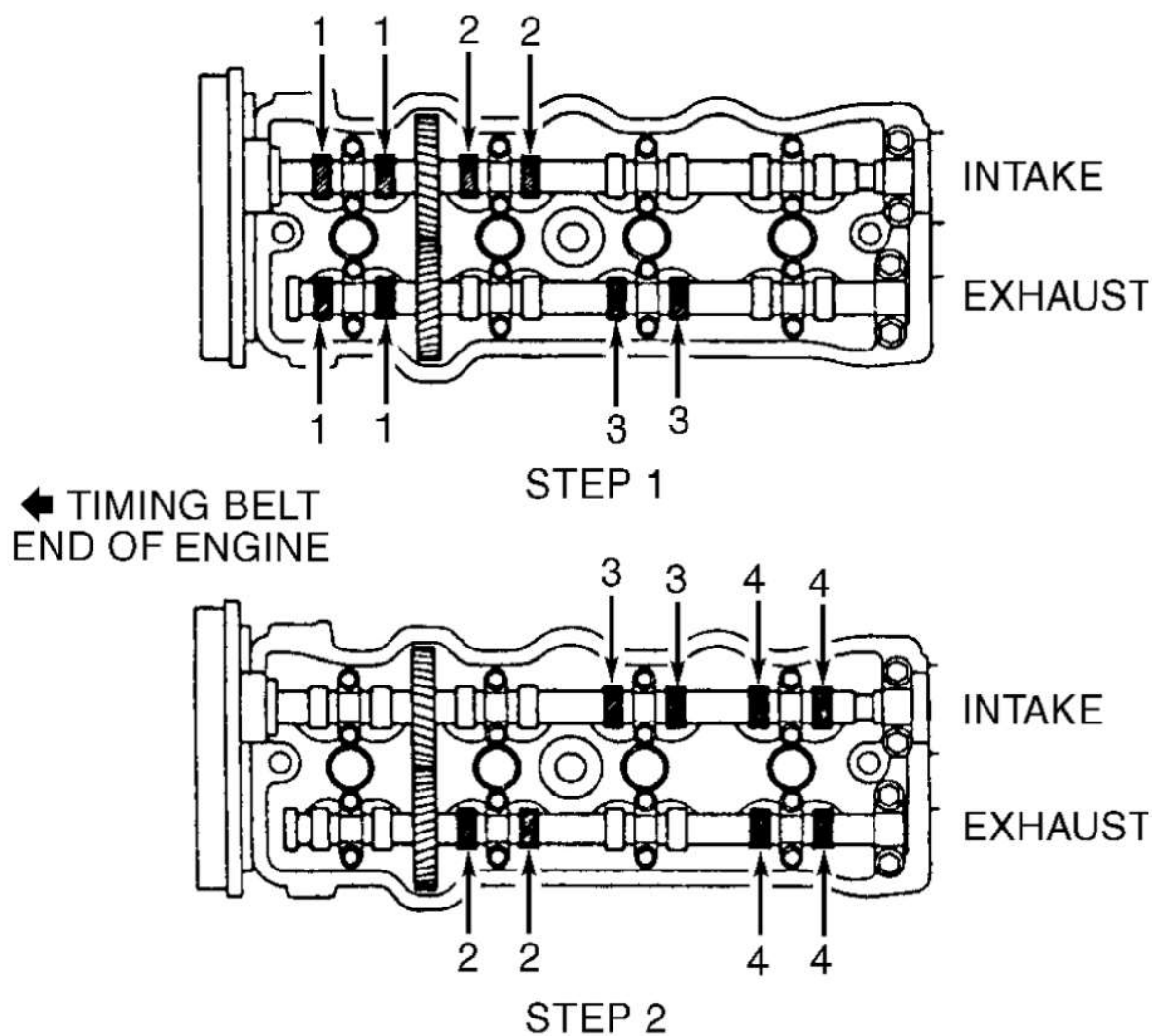
Application	In. (mm)
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Exhaust Valve	.011-.015 (.28-.38)
Intake Valve	.007-.011 (.19-.28)

(1) - Adjust valve clearance with engine cold.

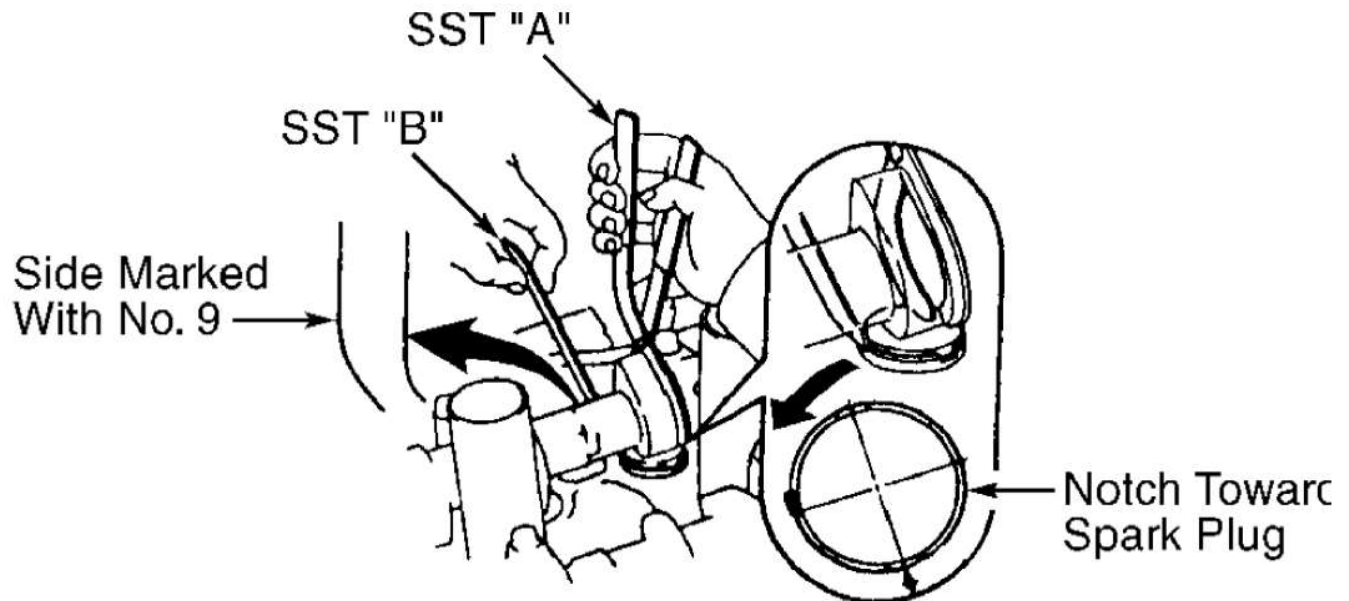
6) If valve clearance requires adjustment, rotate camshaft so lobe on valve to be adjusted is facing upward, away from valve lifter. Rotate valve lifter so notch on valve lifter is toward spark plug.

7) Use Valve Clearance Adjuster (SST 09248-55020) to remove adjusting shim. Using SST "A" of valve clearance adjuster, push downward on valve lifter. Place SST "B" between camshaft and valve lifter with side marked with No. 9 at designated position. See Fig. 2. Remove SST "A".



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Fig. 1: Checking Valve Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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

8) Using small screwdriver and magnet, remove adjusting shim. Measure and record thickness of adjusting shim removed. Using measured valve clearance and adjusting shim thickness, select proper replacement adjusting shim. See Figs. 5, 6, 7, 8, 9 and 10.

9) Install replacement adjusting shim. Recheck valve clearance. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See Fig. 3. Using NEW gasket, install valve cover.

10) Install grommets in original location with marking on grommet in aligned in designated area. See Fig. 4. Install and tighten valve cover nuts to specification. See TORQUE SPECIFICATIONS.

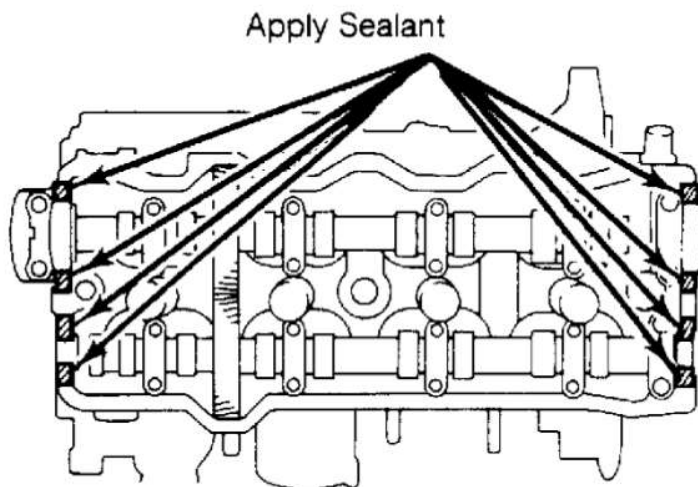
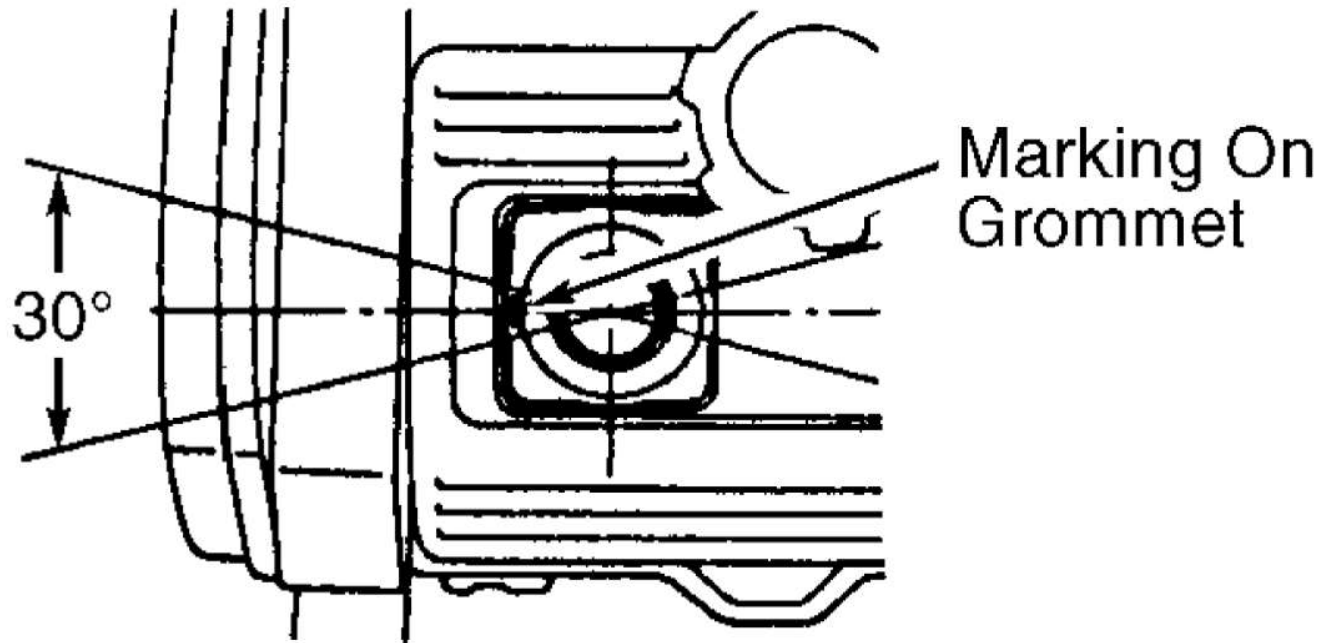


Fig. 3: Applying Sealant On Cylinder Head
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 4: Aligning Valve Cover Grommets
Courtesy of Toyota Motor Sales, U.S.A., Inc.

	Installed shim thickness mm (in.)	
	Measured clearance mm (in.)	
0.000 - 0.020 (0.0000 - 0.0008)	250 (0.0984)	
0.021 - 0.040 (0.0008 - 0.0016)	252 (0.0992)	
0.041 - 0.060 (0.0016 - 0.0024)	254 (0.1000)	
0.061 - 0.080 (0.0024 - 0.0031)	256 (0.1008)	
0.081 - 0.100 (0.0032 - 0.0039)	258 (0.1016)	
0.101 - 0.120 (0.0040 - 0.0047)	260 (0.1024)	
0.121 - 0.140 (0.0048 - 0.0055)	262 (0.1031)	
0.141 - 0.160 (0.0056 - 0.0063)	264 (0.1038)	
0.161 - 0.180 (0.0063 - 0.0071)	265 (0.1043)	
0.181 - 0.189 (0.0071 - 0.0074)	266 (0.1047)	
0.190 - 0.290 (0.0075 - 0.0114)	267 (0.1051)	
0.291 - 0.300 (0.0115 - 0.0118)	268 (0.1055)	
0.301 - 0.320 (0.0119 - 0.0126)	269 (0.1059)	
0.321 - 0.340 (0.0126 - 0.0134)	270 (0.1063)	
0.341 - 0.360 (0.0134 - 0.0142)	271 (0.1067)	
0.361 - 0.380 (0.0142 - 0.0150)	272 (0.1071)	
0.381 - 0.400 (0.0150 - 0.0157)	273 (0.1075)	
0.401 - 0.420 (0.0158 - 0.0165)	274 (0.1079)	
0.421 - 0.440 (0.0166 - 0.0173)	275 (0.1083)	
0.441 - 0.460 (0.0174 - 0.0181)	276 (0.1087)	
0.461 - 0.480 (0.0181 - 0.0189)	277 (0.1091)	
0.481 - 0.500 (0.0189 - 0.0197)	278 (0.1094)	
0.501 - 0.520 (0.0197 - 0.0205)	279 (0.1098)	
0.521 - 0.540 (0.0205 - 0.0213)	280 (0.1102)	
0.541 - 0.560 (0.0213 - 0.0220)	281 (0.1106)	
0.561 - 0.580 (0.0221 - 0.0228)	282 (0.1110)	
0.581 - 0.600 (0.0229 - 0.0236)	283 (0.1114)	
0.601 - 0.620 (0.0237 - 0.0244)	284 (0.1118)	
0.621 - 0.640 (0.0244 - 0.0252)	285 (0.1121)	
0.641 - 0.660 (0.0252 - 0.0260)	286 (0.1126)	
0.661 - 0.680 (0.0260 - 0.0268)	287 (0.1130)	
0.681 - 0.700 (0.0268 - 0.0276)	288 (0.1134)	
0.701 - 0.720 (0.0276 - 0.0283)	289 (0.1138)	
0.721 - 0.740 (0.0284 - 0.0291)	290 (0.1142)	
0.741 - 0.760 (0.0292 - 0.0299)	291 (0.1146)	
0.761 - 0.780 (0.0300 - 0.0307)	292 (0.1150)	
0.781 - 0.800 (0.0307 - 0.0315)	293 (0.1154)	
0.801 - 0.820 (0.0315 - 0.0323)	294 (0.1157)	
0.821 - 0.840 (0.0323 - 0.0331)	295 (0.1161)	
0.841 - 0.860 (0.0331 - 0.0339)	296 (0.1165)	
0.861 - 0.880 (0.0339 - 0.0346)	297 (0.1169)	
0.881 - 0.900 (0.0347 - 0.0354)	298 (0.1173)	
0.901 - 0.920 (0.0355 - 0.0362)	299 (0.1177)	
0.921 - 0.940 (0.0363 - 0.0370)	300 (0.1181)	
0.941 - 0.960 (0.0370 - 0.0378)	301 (0.1185)	
0.961 - 0.980 (0.0378 - 0.0386)		
0.981 - 1.000 (0.0386 - 0.0394)		
1.001 - 1.020 (0.0394 - 0.0402)		
1.021 - 1.040 (0.0402 - 0.0409)		
1.041 - 1.060 (0.0410 - 0.0417)		
1.061 - 1.080 (0.0418 - 0.0425)		
1.081 - 1.090 (0.0426 - 0.0429)		

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.50 (0.0984)	10	2.95 (0.1161)
2	2.55 (0.1004)	11	3.00 (0.1181)
3	2.60 (0.1024)	12	3.05 (0.1201)
4	2.65 (0.1043)	13	3.10 (0.1220)
5	2.70 (0.1063)	14	3.15 (0.1240)
6	2.75 (0.1083)	15	3.20 (0.1260)
7	2.80 (0.1102)	16	3.25 (0.1280)
8	2.85 (0.1122)	17	3.30 (0.1299)
9	2.90 (0.1142)		

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EXAMPLE: A 0.1102" (2.800 mm) shim is installed and measured clearance is 0.0177" (0.450 mm).

Replace 0.1102" (2.800 mm) shim with a No. 11 shim.

Fig. 6: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

INTAKE VALVES

Installed shim thickness mm (in.)	302 (0.1189)	303 (0.1193)	304 (0.1197)	305 (0.1201)	306 (0.1205)	308 (0.1213)	310 (0.1220)	312 (0.1228)	314 (0.1236)	315 (0.1240)	316 (0.1244)	318 (0.1252)	320 (0.1260)	322 (0.1268)	324 (0.1276)	325 (0.1280)	326 (0.1283)	328 (0.1291)	330 (0.1299)
Measured clearance mm (in.)																			
0.000 - 0.020 (0.0000 - 0.0008)	7	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12
0.021 - 0.040 (0.0008 - 0.0016)	7	7	8	8	8	8	9	9	10	10	10	10	11	11	12	12	12	12	13
0.041 - 0.060 (0.0016 - 0.0024)	8	8	8	8	8	9	9	10	10	10	10	11	11	12	12	12	12	13	13
0.061 - 0.080 (0.0024 - 0.0031)	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14
0.081 - 0.100 (0.0032 - 0.0039)	8	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14
0.101 - 0.120 (0.0040 - 0.0047)	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14
0.121 - 0.140 (0.0048 - 0.0055)	9	9	10	10	10	10	11	11	12	12	12	12	13	13	14	14	14	14	15
0.141 - 0.160 (0.0056 - 0.0063)	10	10	10	10	10	11	11	12	12	12	12	13	13	14	14	14	14	15	15
0.161 - 0.180 (0.0063 - 0.0071)	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15	16
0.181 - 0.189 (0.0071 - 0.0074)	10	10	11	11	11	11	12	12	13	13	13	13	14	14	15	15	15	15	16
0.190 - 0.290 (0.0075 - 0.0114)																			
0.291 - 0.300 (0.0115 - 0.0118)	13	13	13	13	13	14	14	15	15	15	15	16	16	17	17	17	17	17	
0.301 - 0.320 (0.0119 - 0.0126)	13	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17	
0.321 - 0.340 (0.0126 - 0.0134)	13	13	14	14	14	14	15	15	16	16	16	16	17	17	17	17	17		
0.341 - 0.360 (0.0134 - 0.0142)	14	14	14	14	14	15	15	16	16	16	16	17	17	17					
0.361 - 0.380 (0.0142 - 0.0150)	14	14	14	15	15	15	16	16	16	17	17	17	17						
0.381 - 0.400 (0.0150 - 0.0157)	14	15	15	15	15	16	16	16	17	17	17	17							
0.401 - 0.420 (0.0158 - 0.0165)	15	15	15	15	16	16	16	17	17	17	17								
0.421 - 0.440 (0.0166 - 0.0173)	15	15	16	16	16	16	17	17	17	17									
0.441 - 0.460 (0.0174 - 0.0181)	16	16	16	16	16	17	17	17											
0.461 - 0.480 (0.0181 - 0.0189)	16	16	16	17	17	17	17												
0.481 - 0.500 (0.0189 - 0.0197)	16	17	17	17	17	17													
0.501 - 0.520 (0.0197 - 0.0205)	17	17	17	17	17														
0.521 - 0.540 (0.0205 - 0.0213)	17	17	17	17															
0.541 - 0.560 (0.0213 - 0.0220)	17	17																	

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Fig. 7: Intake Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

New shim thickness mm (in.)

Shim No.	Thickness	Shim No.	Thickness
1	2.50 (0.0984)	10	2.95 (0.1161)
2	2.55 (0.1004)	11	3.00 (0.1181)
3	2.60 (0.1024)	12	3.05 (0.1201)
4	2.65 (0.1043)	13	3.10 (0.1220)
5	2.70 (0.1063)	14	3.15 (0.1240)
6	2.75 (0.1083)	15	3.20 (0.1260)
7	2.80 (0.1102)	16	3.25 (0.1280)
8	2.85 (0.1122)	17	3.30 (0.1299)
9	2.90 (0.1142)		

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EXAMPLE: A 0.1102" (2.800 mm) shim is installed and measured clearance is 0.0177" (0.450 mm).

Replace 0.1102" (2.800 mm) shim with a No. 9 shim.

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

EXHAUST VALVES

Installed shim thickness mm (in.) Measured clearance mm (in.)	298 (0.1173)	299 (0.1177)	300 (0.1181)	301 (0.1185)	302 (0.1189)	303 (0.1193)	304 (0.1197)	305 (0.1201)	306 (0.1205)	308 (0.1213)	310 (0.1220)	312 (0.1228)	314 (0.1236)	315 (0.1240)	316 (0.1244)	318 (0.1252)	320 (0.1260)	322 (0.1268)	324 (0.1276)	325 (0.1280)	326 (0.1283)	328 (0.1291)	330 (0.1299)
0.000 - 0.020 (0.0000 - 0.0008)	4	4	5	5	5	5	5	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11
0.021 - 0.040 (0.0008 - 0.0016)	5	5	5	5	5	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11
0.041 - 0.060 (0.0016 - 0.0024)	5	5	5	6	6	6	6	6	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11
0.061 - 0.080 (0.0024 - 0.0031)	5	6	6	6	6	6	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12
0.081 - 0.100 (0.0032 - 0.0039)	6	6	6	6	7	7	7	7	7	8	8	9	9	9	9	10	10	11	11	11	11	12	12
0.101 - 0.120 (0.0040 - 0.0047)	6	6	7	7	7	7	7	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13
0.121 - 0.140 (0.0048 - 0.0055)	7	7	7	7	7	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13
0.141 - 0.160 (0.0056 - 0.0063)	7	7	7	8	8	8	8	8	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13
0.161 - 0.180 (0.0063 - 0.0071)	7	8	8	8	8	8	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14
0.181 - 0.200 (0.0071 - 0.0079)	8	8	8	8	9	9	9	9	9	10	10	11	11	11	11	12	12	13	13	13	13	14	14
0.201 - 0.220 (0.0079 - 0.0087)	8	8	9	9	9	9	9	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15
0.221 - 0.240 (0.0087 - 0.0094)	9	9	9	9	9	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15
0.241 - 0.260 (0.0095 - 0.0102)	9	9	9	10	10	10	10	10	11	11	11	12	12	12	13	13	13	14	14	14	15	15	15
0.261 - 0.279 (0.0103 - 0.0110)	9	10	10	10	10	10	11	11	11	11	12	12	13	13	13	13	14	14	15	15	15	15	16
0.280 - 0.380 (0.0110 - 0.0150)																							
0.381 - 0.400 (0.0150 - 0.0157)	12	12	12	12	13	13	13	13	13	14	14	15	15	15	15	16	16	17	17	17	17	17	17
0.401 - 0.420 (0.0158 - 0.0165)	12	12	13	13	13	13	13	14	14	14	15	15	15	16	16	16	17	17	17	17	17	17	
0.421 - 0.440 (0.0166 - 0.0173)	13	13	13	13	13	14	14	14	14	15	15	15	16	16	16	17	17	17	17				
0.441 - 0.460 (0.0174 - 0.0181)	13	13	13	14	14	14	14	14	15	15	15	16	16	16	17	17	17	17					
0.461 - 0.480 (0.0181 - 0.0189)	13	14	14	14	14	14	15	15	15	15	16	16	17	17	17	17	17	17					
0.481 - 0.500 (0.0189 - 0.0197)	14	14	14	14	15	15	15	15	15	16	16	17	17	17	17	17	17						
0.501 - 0.520 (0.0197 - 0.0205)	14	14	15	15	15	15	15	16	16	16	17	17	17	17	17	17							
0.521 - 0.540 (0.0205 - 0.0213)	15	15	15	15	15	16	16	16	16	17	17	17	17	17									
0.541 - 0.560 (0.0213 - 0.0220)	15	15	16	16	16	16	16	16	17	17	17	17											
0.561 - 0.580 (0.0221 - 0.0228)	16	16	16	16	16	17	17	17	17	17													
0.581 - 0.600 (0.0229 - 0.0236)	16	16	16	17	17	17	17	17	17														
0.601 - 0.620 (0.0237 - 0.0244)	16	17	17	17	17	17	17	17															
0.621 - 0.640 (0.0244 - 0.0252)	17	17	17	17	17	17																	
0.641 - 0.660 (0.0252 - 0.0260)	17	17	17	17																			
0.661 - 0.680 (0.0260 - 0.0268)	17	17																					
0.681 - 0.700 (0.0268 - 0.0276)	17																						

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Fig. 10: Exhaust Valve Adjusting Shim Selection Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.

REMOVAL & INSTALLATION

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

CAUTION: When battery is disconnected, vehicle computer and memory systems may lose memory data. Driveability problems may

exist until computer systems have completed a relearn cycle.

CAUTION: To prevent air bag deployment, disconnect negative battery cable at least 30 seconds before working on vehicle.

FUEL PRESSURE RELEASE

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

COOLING SYSTEM BLEEDING

Camry & Celica

No special cooling system bleeding procedure is required.

MR2

1) Remove spare tire, front luggage compartment trim and upper radiator support seal. Connect air bleed hoses to heater and radiator air drain plugs. See Fig. 11. Attach and support opposite end of air bleed hoses to hood or hood support. Ensure air bleed hoses are not pinched.

2) Place heater control lever to the warmest position. Open heater and radiator air drain plugs at least 3 turns.

3) Slowly add coolant through coolant filler. See Fig. 11. Air will bleed from air bleed hoses on heater and radiator air drain plugs. Ensure coolant level in air bleed hoses and coolant filler are at the same level. See Fig. 11.

4) If coolant level in air bleed hoses is lower, air still exists in cooling system. Check for pinched or restriction in air bleed hoses and repeat step 3). When proper coolant level is obtained in air bleed hoses, close heater and radiator air drain plugs. Remove air bleed hoses.

5) Install radiator cap on coolant filler to the first stop point. DO NOT fully tighten radiator cap to the second stop point. Start engine and allow to idle for 3 minutes. Shut engine off. Recheck coolant level in coolant filler.

6) Add coolant if necessary and repeat step 5). Recheck coolant level. If proper coolant level exists, install radiator cap and fully tighten to the second stop point. Fill coolant reservoir tank to the FULL line. Reinstall upper radiator support seal.

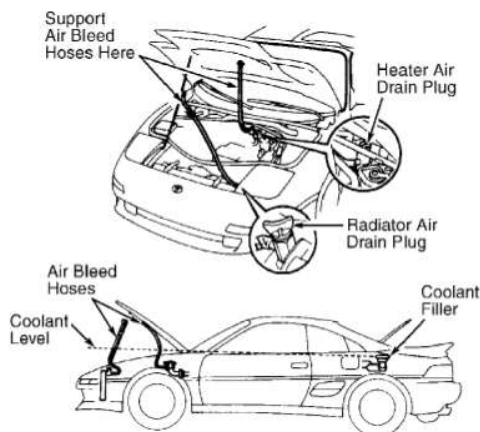


Fig. 11: Installing Air Bleed Hoses & Identifying Coolant Filler (MR2)

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

ENGINE

NOTE: Remove engine and transaxle as an assembly.

Removal (Camry)

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

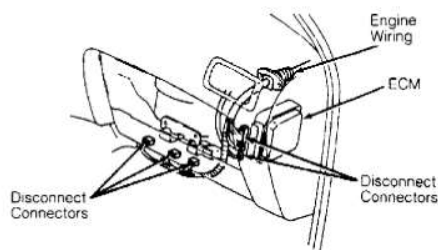
2) Disconnect control cables at throttle body. Remove air intake duct with air cleaner assembly and air cleaner case. Remove cruise control actuator (if equipped). Remove radiator and coolant reservoir tank.

3) Remove windshield washer fluid reservoir tank. Disconnect electrical connections at relay box, located near driver's side front corner of engine compartment. Disconnect electrical connections at ignitor and noise filter on driver's side front fender.

4) Disconnect necessary electrical connections, coolant hose, vacuum hoses and fuel lines. Remove A/C compressor (if equipped) and power steering pump with hoses attached and secure aside.

5) Remove lower instrument panel cover and glove box.

Disconnect connectors at Engine Control Module (ECM) and remaining engine wiring connectors. See Fig. 12. Remove nuts from firewall and pull engine wiring out through firewall.



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Fig. 12: Identifying ECM & Engine Wiring Connectors (Camry)

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

6) Raise and support vehicle. Remove lower engine covers. On M/T models, remove clutch release cylinder with hose attached and secure aside. Remove starter. On A/T models, disconnect oil cooler lines at transaxle.

7) On all models, disconnect control cables and electrical connections at transaxle. Disconnect front exhaust pipe from front catalytic converter or exhaust manifold.

NOTE: Front catalytic converter is bolted to exhaust manifold on California models only.

8) Remove front wheels. Remove cotter pin and retainer from end of axle shaft. Loosen axle shaft nut while applying the brakes. Remove axle shaft nut.

9) Remove inner fenderwell aprons for access to axle shaft. Drain transaxle fluid. Remove nut and separate tie rod from steering knuckle.

10) Disconnect stabilizer bar link from lower control arm. Remove ball joint-to-lower control arm bolts/nuts. Cover axle shaft boots with shop towel.

11) Using soft-faced hammer, tap axle shaft from hub assembly. Pull steering knuckle outward and separate axle shaft from hub assembly.

12) To remove left (driver's side) axle shaft, pry between transaxle case and axle shaft until axle shaft disengages from transaxle. See Figs. 13 & 14.

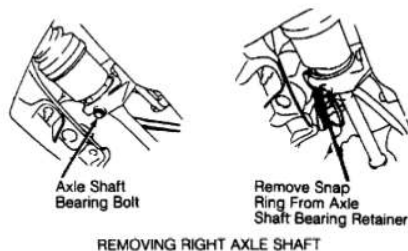
13) To remove right (passenger's side) axle shaft, remove axle shaft bearing bolt. See Figs. 13 & 14. Remove snap ring from axle shaft bearing retainer. See Fig. 13 & 14. Pull right axle shaft from transaxle.

14) Support engine with hoist. Disconnect engine and transaxle mounts. Lift engine and transaxle from vehicle.



93B83858

Fig. 13: Removing Left Axle Shafts (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93C83859

Fig. 14: Removing Right Axle Shaft (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) To install, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

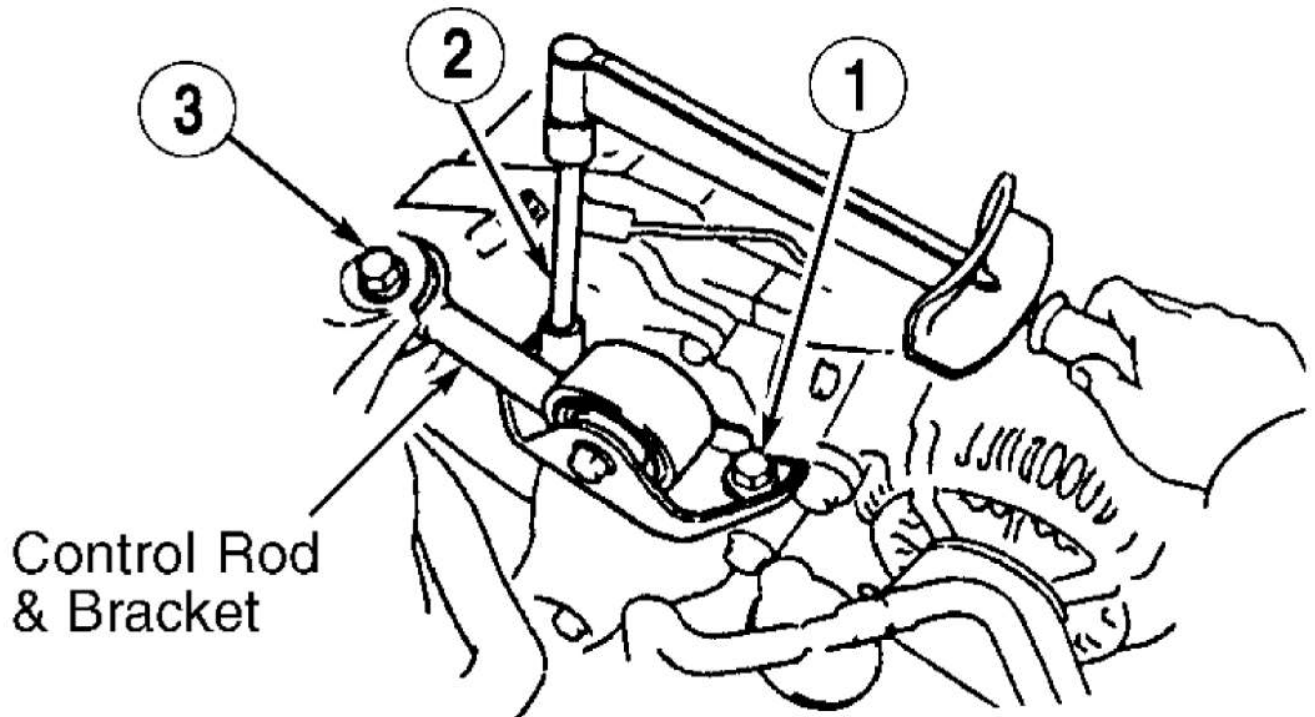
2) When installing control rod and bracket on strut tower and right (timing belt side) engine mount, tighten bolts to specification in sequence. See Figs. 15.

3) Before installing axle shafts, install NEW snap ring on end of left axle shaft. Coat axle shaft seals in transaxle with grease. Coat axle shaft splines and sliding surfaces with gear oil. Position snap ring on end of left axle shaft with opening facing downward.

4) Install left axle shaft by lightly tapping axle shaft into transaxle. Ensure left axle shaft will move inward and outward approximately .079-.120" (2.00-3.00 mm) and cannot be pulled from transaxle.

5) When installing right axle shaft, install NEW snap ring and NEW axle shaft bearing bolt. Tighten axle shaft bearing bolt to specification. See TORQUE SPECIFICATIONS.

6) To install remaining components, reverse removal procedure. Use NEW gasket when installing front exhaust pipe on catalytic converter. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Adjust fluid levels and control cables.



93F83860

Fig. 15: Control Rod & Bracket Bolt Installation Sequence (Camry)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Remove engine and transaxle as an assembly.

Removal (Celica)

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Remove hood and battery. Drain cooling system and engine oil.

2) Remove air intake duct with air cleaner assembly and air cleaner case. Remove relay box from bracket, located near battery. Remove lower cover from relay box. Disconnect fusible link assembly and other electrical connectors from relay box.

3) Remove A/C relay box from bracket, located near passenger's side front corner of engine compartment. Remove cruise control actuator and bracket (if equipped).

4) Remove radiator and coolant reservoir tank. Remove strut tower-to-firewall braces. Disconnect necessary control cables, electrical connections, fuel lines, coolant hoses and vacuum hoses.

5) Remove charcoal canister. Remove A/C compressor (if equipped) and power steering pump with hoses attached and secure aside. Disconnect connectors at Engine Control Module (ECM) and remaining engine wiring connectors. See Fig. 16. Remove nuts from firewall and pull engine wiring out through firewall.

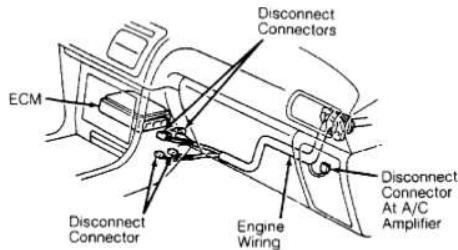
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Fig. 16: Identifying ECM & Engine Wiring Connectors (Celica)
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Raise and support vehicle. Remove lower engine covers. On M/T models, remove clutch release cylinder with hose attached and secure aside. Remove starter.

7) On A/T models, disconnect oil cooler lines at transaxle. On all models, disconnect control cables and electrical connections at transaxle.

8) Remove suspension crossmember bolted to both lower suspension arms. Remove front exhaust pipe, located between catalytic converter on exhaust manifold and center exhaust pipe.

9) Remove front wheels. Remove cotter pin and retainer from end of axle shaft. Loosen axle shaft nut while applying the brakes. Remove axle shaft nut.

10) Drain transaxle fluid. Remove brake caliper. Place reference mark on brake rotor and hub assembly for reassembly reference. Remove brake rotor. Remove nut and separate tie rod from steering knuckle.

11) Remove ball joint-to-lower control arm bolts/nuts. Cover axle shaft boots with shop towel. Using puller attached to hub assembly, press axle shaft from hub assembly.

12) Pull steering knuckle outward and separate axle shaft from hub assembly. To remove left (driver's side) axle shaft, pry between transaxle case and axle shaft until axle shaft disengages from transaxle. See Fig. 17 & 18.

13) To remove right (passenger's side) axle shaft, remove the 2 right axle shaft bearing retainer bracket bolts. See Fig. 17 & 18. Remove right axle shaft assembly.

14) Support engine with hoist. Remove engine mount crossmember located below engine. Mark direction of installation on all engine mounts for reassembly reference. Disconnect engine and transaxle mounts. Lift engine and transaxle from vehicle.

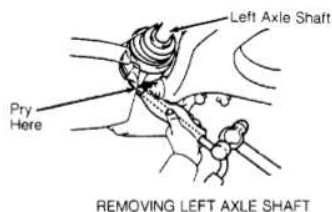
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Fig. 17: Removing Left Axle Shafts (Celica)
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



93183863

Fig. 18: Removing Right Axle Shafts (Celica)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) To install, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Install all bolts/nuts in engine and transaxle mounts before tightening to specification.

2) Before installing axle shafts, install NEW snap ring on end of left axle shaft. Coat axle shaft seals in transaxle with grease. Coat axle shaft splines and sliding surfaces with gear oil. Position snap ring on end of left axle shaft with opening facing downward.

3) Install left axle shaft by lightly tapping axle shaft into transaxle. Ensure axle shaft cannot be pulled from transaxle.

4) When installing right axle shaft, ensure pin on bearing aligns with hole on right axle shaft bearing retainer bracket. Install and tighten right axle shaft bearing retainer bracket bolts to specification. See TORQUE SPECIFICATIONS.

5) To install remaining components, reverse removal procedure. Ensure reference marks on brake rotor and hub assembly are aligned. Use NEW gasket when installing front exhaust pipe on catalytic converter. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. Adjust fluid levels and control cables.

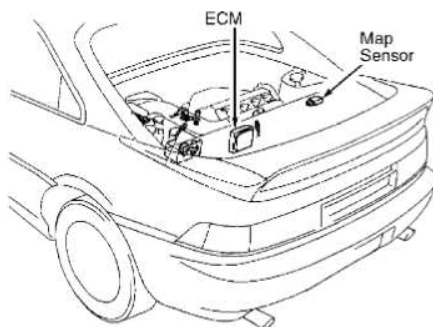
NOTE: Remove engine and transaxle as an assembly.

Removal (MR2)

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Drain cooling system, engine oil and transaxle oil.

2) Remove hood, hood side panels and lower engine covers. Disconnect throttle linkage at throttle body. Remove air intake duct with air cleaner assembly and air cleaner case. Remove cruise control actuator (if equipped).

3) Remove Manifold Absolute Pressure (MAP) sensor from the body. See Fig. 19. Remove data link connector, located near MAP sensor, from the body.



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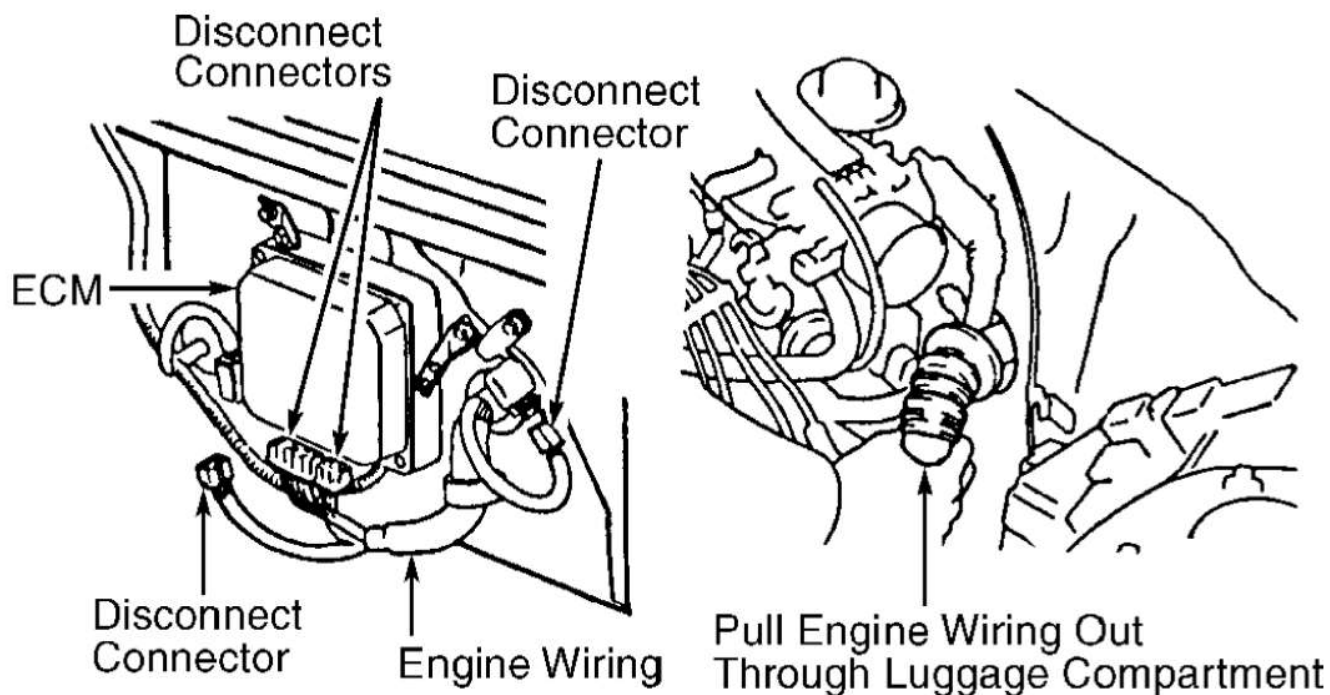
Fig. 19: Identifying ECM & MAP Sensor (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Disconnect necessary coolant hoses, fuel lines, vacuum hoses and electrical connections at engine. Remove A/C vacuum switching valve assembly, located near throttle body and mounted on side of the vehicle body.

5) Remove radiator cap and coolant filler. See Fig. 11. Remove charcoal canister. Remove bolts from relay box located near strut tower. Disconnect luggage compartment cable near relay box. Remove upper and lower covers from relay box.

6) Disconnect positive cable and electrical connections from relay box. Disconnect electrical connections from igniter, noise filter and coil wire from ignition coil.

7) Disconnect electrical connectors from Engine Control Module (ECM) located near luggage compartment. See Fig. 19. Disconnect remaining electrical connectors near ECM for removal of engine wiring. See Fig. 20. Pull engine wiring out through opening in luggage compartment.



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Fig. 20: Identifying Engine Wiring (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Raise and support vehicle. Disconnect control cables and electrical connections at transaxle. On A/T models, disconnect oil cooler hoses at transaxle. On all models, remove front exhaust pipe, located between muffler and catalytic converter on exhaust manifold.

9) Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove rear wheels. Remove cotter pin and retainer from end of axle shaft. Apply parking brake. Remove axle shaft nut. Release parking brake.

10) Remove brake caliper with hose attached and secure aside. Place reference marks on hub assembly and brake rotor for reassembly reference. Remove brake rotor.

11) Remove nut and disconnect stabilizer link from strut assembly. On models with Anti-Lock Brake System (ABS), remove bolt and pull ABS speed sensor from axle carrier.

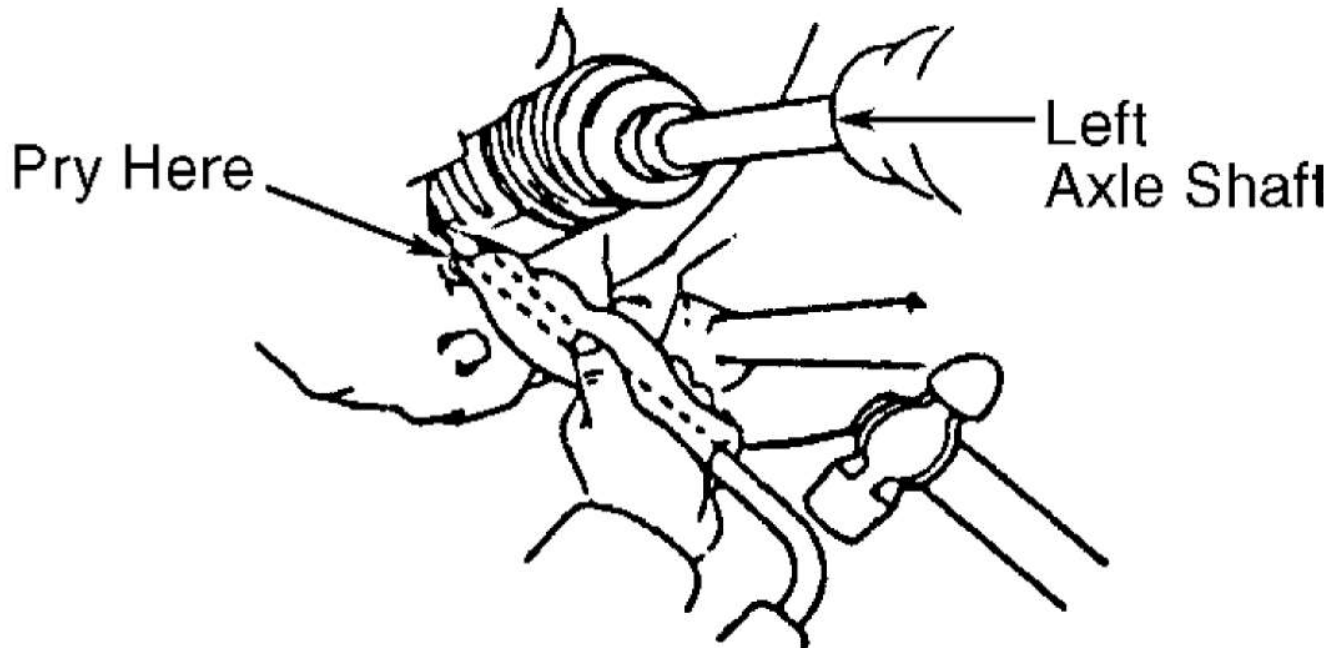
12) Remove ball joint-to-axle carrier bolts. Separate ball joint with lower control arm from axle carrier. Remove suspension rod-to-axle carrier bolt/nut. Separate suspension rod from axle carrier. Suspension rod is located at rear of axle carrier.

13) Cover axle shaft boot with shop towel. Using puller attached to hub assembly, press axle shaft from hub assembly. To remove left (driver's side) axle shaft, pry axle shaft from transaxle. See Figs. 21 & 22.

14) To remove right (passenger's side) axle shaft, use hammer and brass drift to tap axle shaft from transaxle. See Figs. 21 & 22. Support engine with hoist.

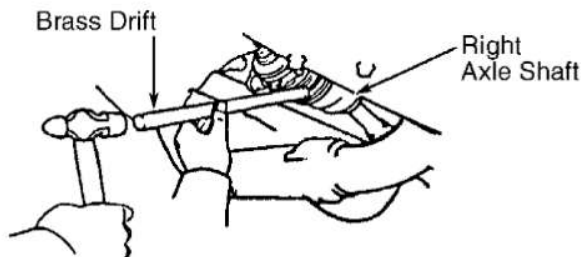
15) Remove engine mount through-bolt and bolts from front (exhaust manifold side) and rear (intake manifold side) engine mounts. Remove transaxle control cable bracket (A/T) or clutch release cylinder (M/T) with hose attached and secure aside.

16) Remove remaining engine mounts, support brackets and through-bolts. Lift engine and transaxle from vehicle.



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Fig. 21: Removing Left Axle Shafts (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 22: Removing Right Axle Shafts (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) Install engine and transaxle in engine compartment. Engine

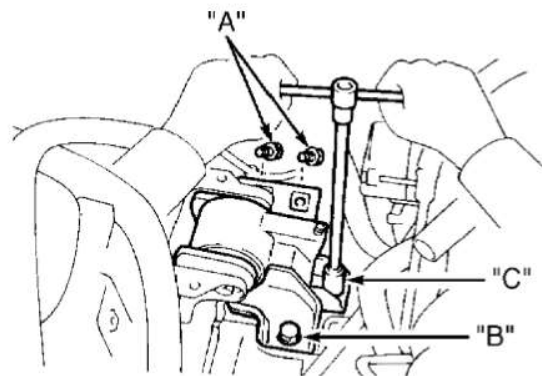
mounts must be installed and bolts/nuts tightened using the following procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

2) Install right (timing belt side) engine mount-to-body with through-bolt loosely installed. Secure right (timing belt side) engine mount-to-mounting bracket with nuts loosely installed.

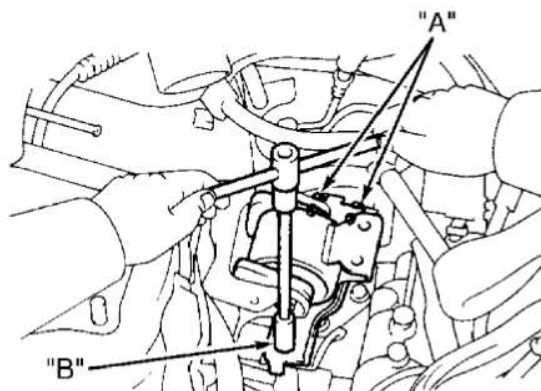
3) Install left (flywheel side) engine mount-to-body mount with through-bolt loosely installed. Install left (flywheel side) engine mount-to-bracket bolts and tighten to specification. See Fig. 23. Tighten left (flywheel side) engine mount through-bolt to specification.

4) Tighten right (timing belt side) engine mount-to-mounting bracket nuts and then the through-bolt to specification. Install support bracket on top of right (timing belt side) engine mount. Tighten support bracket bolt/nut to specification.

5) Install control rod and bracket on top of left (flywheel side) engine mount and at the body. On M/T models, install control rod support on top of control rod and bracket. On all models, install all bolts in control rod and bracket before tightening to specification.



A/T MODELS



M/T MODELS

Bolt "A" - 47 Ft. Lbs. (64 N.m)

Bolt "B" - 54 Ft. Lbs. (73 N.m)

Bolt "C" - 38 Ft. Lbs. (52 N.m)

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Fig. 23: Installing Left (Flywheel Side) Engine Mount Bolts (MR2)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Install transaxle control cable bracket (A/T models) or clutch release cylinder (M/T models). Install front (exhaust manifold

side) engine mount-to-body bolts. Tighten bolts to specification. Loosely install through-bolt in front (exhaust manifold side) engine mount.

7) Install rear (intake manifold side) engine mount bracket-to-body bolts. Tighten bolts to specification. Install rear (intake manifold side) engine mount-to-body bolts. Loosely install through-bolt.

8) Tighten rear (intake manifold side) engine mount-to-body bolts and then the through-bolt to specification. Tighten front (exhaust manifold side) engine mount through-bolt to specification.

9) To install remaining components, reverse removal procedure. Tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS.

10) Before installing axle shaft, install NEW snap ring on end of axle shaft. Coat axle shaft seals in transaxle with grease. Coat axle shaft splines and sliding surfaces with gear oil. Position snap ring on end of axle shaft with opening facing downward.

11) Install axle shaft by lightly tapping axle shaft into transaxle. Ensure axle shaft will move inward and outward approximately .079-.120" (2.00-3.00 mm) and cannot be pulled from transaxle.

12) Ensure reference marks on brake rotor and hub assembly are aligned. Tighten suspension rod-to-axle carrier bolt/nut to specification after vehicle is lowered to ground and bounced several times to stabilize suspension components.

13) Use NEW gasket when installing front exhaust pipe. Adjust control cables and fluid levels. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CYLINDER HEAD & MANIFOLDS

Removal

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

2) Disconnect control cables or linkages at throttle body. Remove air intake duct with air cleaner assembly. Remove cruise control actuator (if equipped). Remove alternator (if necessary). Remove distributor.

3) On MR2, remove hood side panels. Remove front exhaust pipe, located between muffler and catalytic converter on exhaust manifold. Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside.

4) On Celica, remove suspension crossmember bolted to both lower suspension arms. On Celica and Camry, remove front exhaust pipe, located between catalytic converter on exhaust manifold and center exhaust pipe.

NOTE: On Camry Calif. models, catalytic converter is bolted to exhaust manifold. Federal and Canada models do not use this catalytic converter on exhaust manifold.

5) On Camry Federal and Canada models, remove heat insulator and exhaust manifold. On all other models, remove heat insulator from top of exhaust manifold and catalytic converter braces. See Fig. 24. Remove nuts, exhaust manifold with catalytic converter and exhaust manifold gasket.

6) Remove catalytic converter, cushion, retainer and gasket from exhaust manifold (if necessary). See Fig. 24. Disconnect necessary electrical connections, coolant hoses and vacuum hoses from throttle body, cylinder head and intake manifold.

7) Remove coolant outlet, coolant by-pass pipe and gaskets. See Fig. 24. Remove throttle body and gasket. Remove EGR valve and

vacuum modulator, and EGR Vacuum Switching Valve (VSV). See Fig. 24.

8) On MR2, remove fuel pressure Vacuum Switching Valve (VSV) assembly from side of intake manifold. On Camry and Celica, remove air pipe. See Fig. 24.

9) On all models, remove intake manifold braces, intake manifold and gasket. Disconnect electrical connections from fuel injectors. Disconnect fuel lines from fuel delivery pipe.

10) Remove bolts and fuel delivery pipe. DO NOT allow fuel injectors to fall from fuel delivery pipe during removal. Remove insulators and spacers for fuel delivery pipe from cylinder head.

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

11) Remove timing belt from camshaft sprocket. Remove camshaft sprocket, No. 1 idler pulley and tension spring. See TIMING BELT under REMOVAL & INSTALLATION.

12) Remove No. 3 timing belt cover from cylinder head. See Fig. 24. Remove camshafts. See CAMSHAFT under REMOVAL & INSTALLATION.

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

13) Loosen cylinder head bolts in proper sequence using several steps. See Fig. 25. Remove cylinder head bolts, washers, cylinder head and cylinder head gasket. Note location of adjusting shims and valve lifters for reassembly reference. Remove adjusting shims and valve lifters from cylinder head (if necessary).

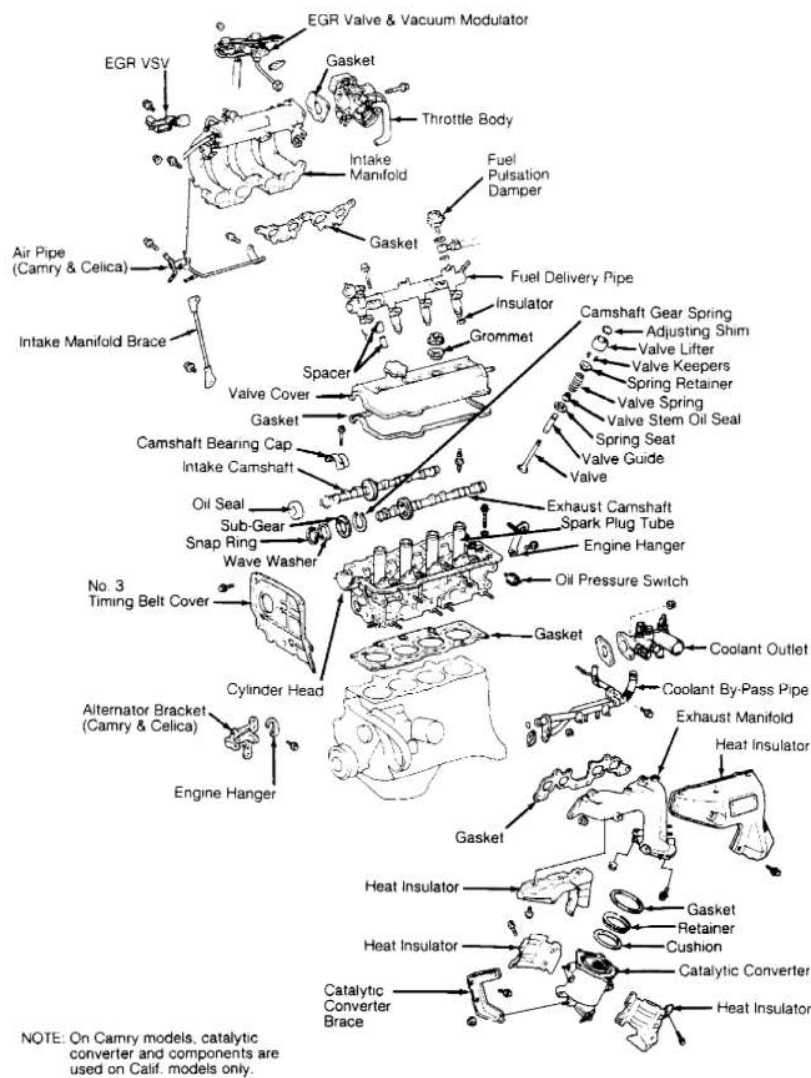


Fig. 24: Exploded View Of Typical Cylinder Head & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

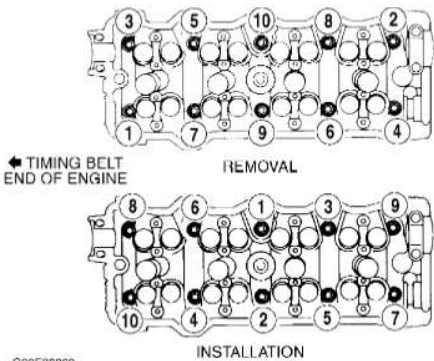


Fig. 25: Cylinder Head Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

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

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

3) Inspect intake and exhaust manifold machined surfaces for warpage. Replace component if warpage exceeds .0118" (.300 mm). Inspect camshaft and components. See CAMSHAFT under REMOVAL & INSTALLATION.

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

Installation

1) Install adjusting shims and valve lifters in original location on cylinder head (if removed). Install NEW cylinder head gasket on cylinder block. Ensure all holes in cylinder head gasket align with holes in cylinder block.

2) Install cylinder head. Apply engine oil on cylinder head bolt threads and cylinder head bolt-to-cylinder head contact surfaces. Install and tighten cylinder head bolts to specification in sequence. See Fig. 25. See TORQUE SPECIFICATIONS.

3) Install camshafts using proper procedure. See CAMSHAFT under REMOVAL & INSTALLATION. Install No. 3 timing belt cover. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS.

4) To install remaining components, reverse removal procedure. If camshaft or cylinder head components are serviced, adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

5) Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See Fig. 3. Using NEW gasket, install valve cover.

6) Install grommets in original location with marking on grommet in aligned in designated area. See Fig. 4. Install and tighten valve cover nuts to specification. See TORQUE SPECIFICATIONS.

7) If installing fuel injector in fuel delivery pipe, replace "O" ring and grommet on fuel injector. Coat NEW "O" ring with gasoline. Using twisting motion, install fuel injector into fuel delivery pipe.

8) When installing fuel delivery pipe, install NEW insulators on cylinder head. Install spacers and fuel delivery pipe with fuel injectors on cylinder head. Position electrical connector on fuel injector facing toward top of engine.

9) Install and slightly tighten fuel delivery pipe bolts. Ensure all fuel injectors rotates smoothly. If fuel injector fails to rotate smoothly, check for damaged "O" rings. Tighten fuel delivery pipe bolts to specification. See TORQUE SPECIFICATIONS.

10) Install NEW throttle body gasket with protruding area on gasket facing toward bottom of throttle body. Ensure longer throttle body bolts are installed in the 2 lower bolt holes.

11) Install NEW "O" ring on coolant by-pass pipe. Apply soapy water solution on "O" ring before installing coolant by-pass pipe. Use NEW gasket when installing catalytic converter on exhaust manifold.

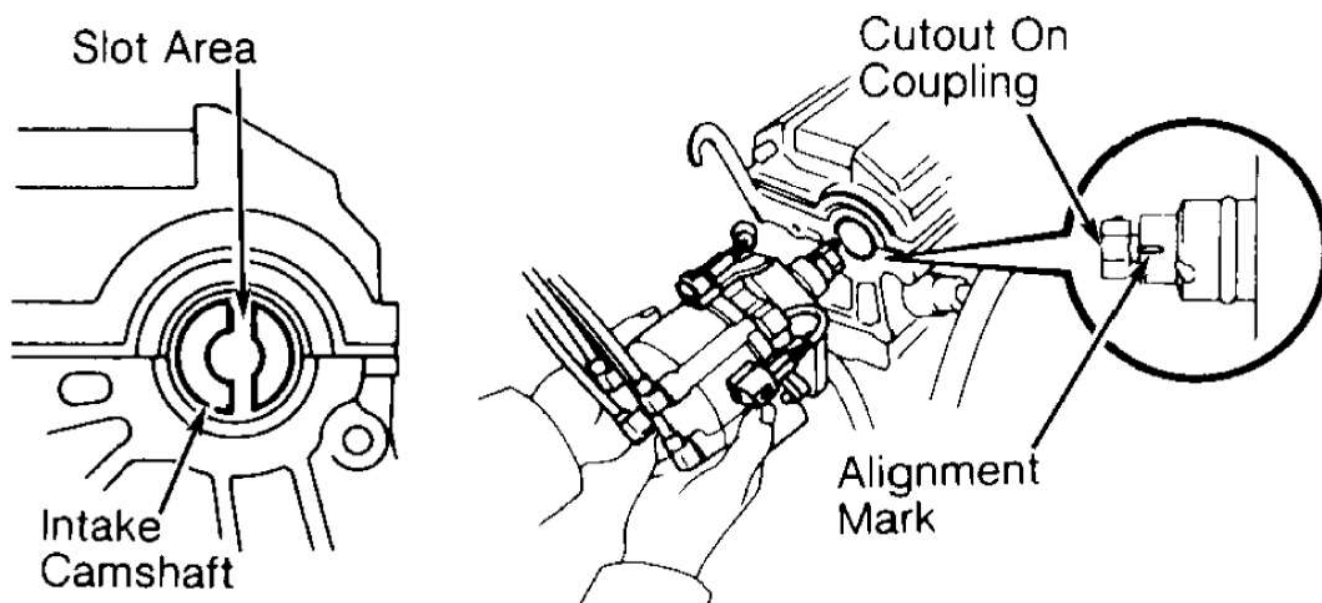
12) Install NEW "O" ring on distributor. Coat "O" ring with engine oil. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

13) Ensure slot area on intake camshaft is vertically positioned. Rotate cutout on coupling so it is aligned with alignment mark on distributor housing. See Fig. 26.

14) Install distributor so center of flange on distributor is aligned with bolt hole on cylinder head. Install distributor hold-down bolts.

15) To install remaining components, reverse removal procedure. Tighten all fasteners to specification. See TORQUE SPECIFICATIONS. Adjust control cables and ignition timing. Fill cooling system. On MR2, cooling system must be bled to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CAUTION: On MR2, ensure air is bled from cooling system to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.



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Fig. 26: Installing Distributor
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CRANKSHAFT FRONT SEAL

Removal & Installation (Oil Pump Installed)

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

2) To install, apply grease to lip of NEW seal. Using hammer and Seal Installer (SST 09226-10010), install seal until seal surface is even with oil pump housing. To install remaining components, reverse removal procedure.

Removal & Installation (Oil Pump Removed)

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

TIMING BELT

Removal

1) Disconnect negative battery cable. Raise and support vehicle. Remove lower engine covers.

2) On MR2, remove right hood side panel. Remove right rear wheel. On Celica and Camry, remove right front wheel and alternator. On Camry, remove coolant reservoir tank and windshield washer fluid reservoir.

3) On all models, remove cruise control actuator and bracket (if equipped). Remove accessory drive belts. Using floor jack, slightly raise engine to remove weight from right (timing belt side) engine mount at timing belt cover.

4) Remove right (timing belt side) engine mount and bracket from front of engine. Remove spark plugs. Remove No. 2 timing belt cover and gaskets. See Fig. 27.

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

6) Ensure timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover. Ensure hole in camshaft sprocket aligns with alignment mark on camshaft bearing cap. See Fig. 28. If hole in camshaft sprocket is not aligned with alignment mark, rotate crankshaft one full revolution.

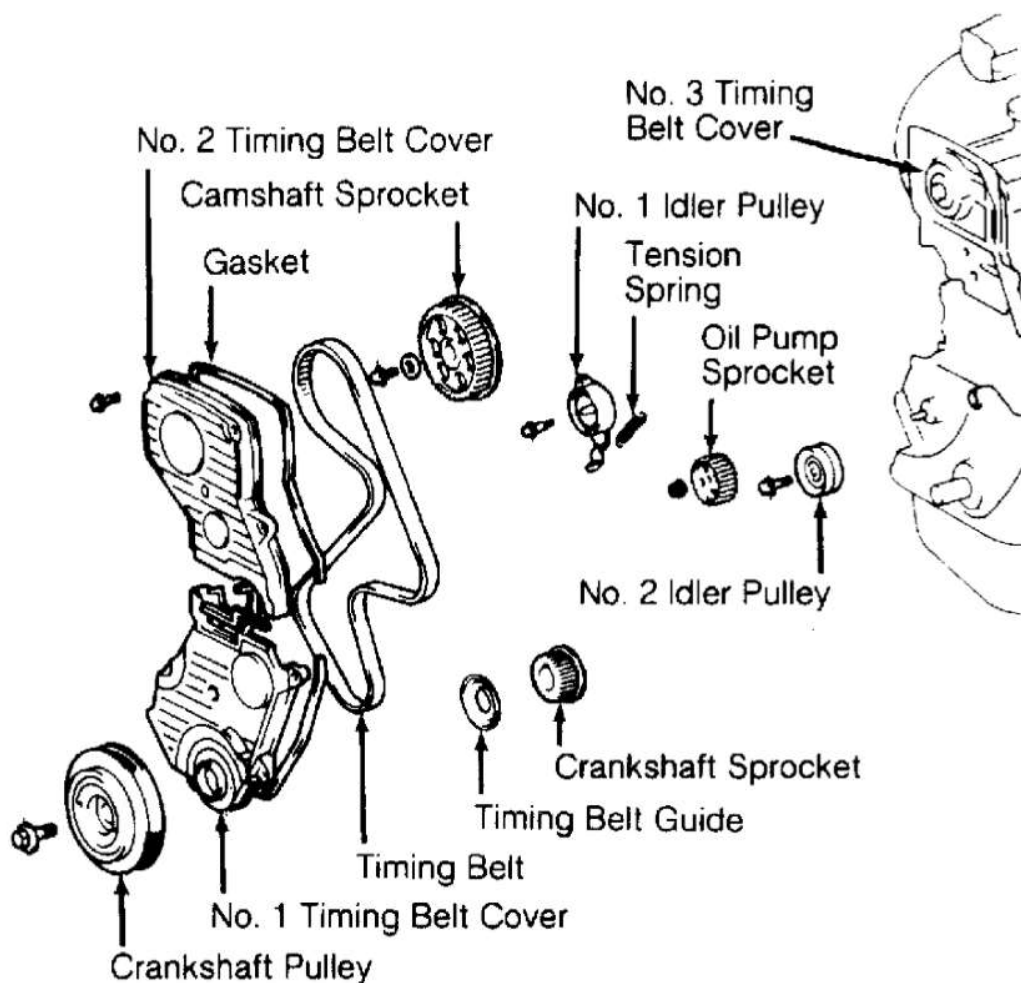
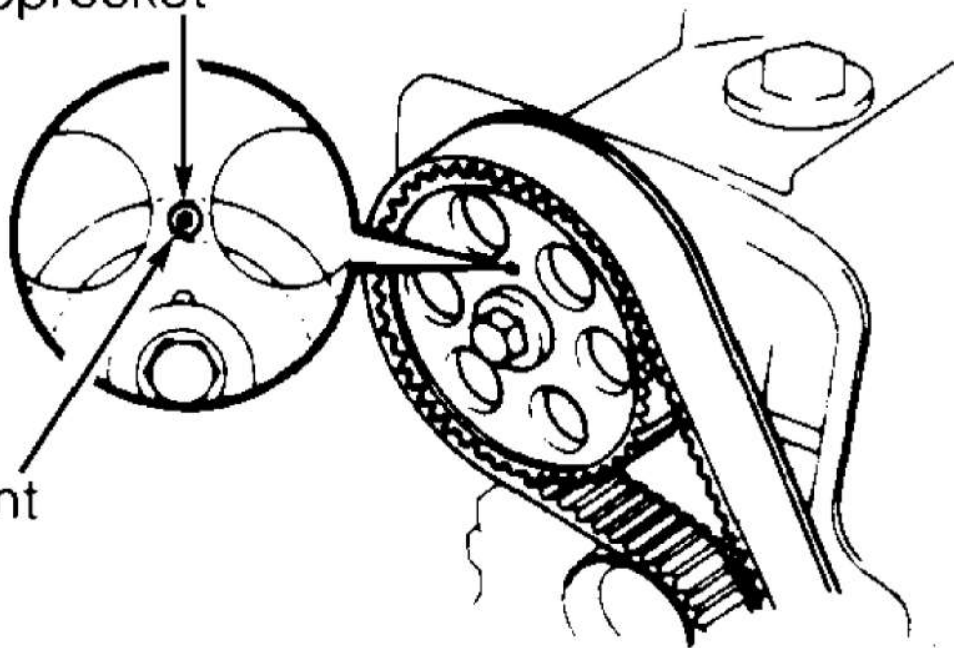


Fig. 27: Exploded View Of Timing Belt & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Hole In Camshaft Sprocket

Alignment
Mark



91B00530

Fig. 28: Aligning Camshaft Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

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

7) Loosen No. 1 idler pulley bolt. See Fig. 27. Move No. 1 idler pulley outward away from timing belt as far as possible. Temporarily retighten No. 1 idler pulley bolt. Remove timing belt from camshaft sprocket.

8) Using Pulley Holder (SST 09213-54015), hold crankshaft pulley. Remove crankshaft pulley bolt.

9) If reusing timing belt, ensure reference mark placed on timing belt aligns with upper edge of No. 1 timing belt cover when timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover. If reference mark is aligned, proceed to step 14).

10) If reference mark is below surface of No. 1 timing belt cover, pull upward on water pump side of timing belt while rotating crankshaft pulley counterclockwise. Align reference mark with surface of No. 1 timing belt cover.

11) Hold upward on water pump side of timing belt. Rotate crankshaft pulley clockwise so timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover.

12) If reference mark is below above surface of No. 1 timing belt cover, pull upward on No. 1 idler pulley side of timing belt while rotating crankshaft pulley clockwise. Align reference mark with surface of No. 1 timing belt cover.

13) Hold upward on No. 1 idler pulley side of timing belt. Rotate crankshaft pulley counterclockwise so timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover.

14) Using puller, remove crankshaft pulley. Remove No. 1 timing belt cover and gasket. If reusing timing belt, mark direction of timing belt rotation and place reference marks on timing belt and crankshaft sprocket for reassembly reference.

15) Note direction of timing belt guide installation. See Fig. 27. Remove timing belt guide. Remove timing belt from crankshaft sprocket. Remove idler pulleys (if necessary).

16) If removing camshaft sprocket, use Sprocket Holder (SST 09278-54012) to hold camshaft sprocket. Remove bolt and camshaft sprocket.

17) If removing crankshaft sprocket, place shop towels against oil pump housing. Using 2 screwdrivers, carefully pry sprocket from crankshaft. Use care not to damage oil pump housing.

18) If removing oil pump sprocket, hold oil pump sprocket by installing Sprocket Holder (SST 09616-30011) in holes on front of oil pump sprocket. Remove oil pump sprocket retaining nut. Remove sprocket holder and oil pump sprocket.

Inspection

1) Inspect timing belt for damaged teeth, cracking or oil contamination. Ensure idler pulleys rotate freely. Replace components if damaged or worn.

2) Ensure free length of tension spring is within specification. See TENSION SPRING SPECIFICATIONS table. Measure tension required to extend tension spring to specified installed length. Replace tension spring if tension is not within specification. See TENSION SPRING SPECIFICATIONS table.

TENSION SPRING SPECIFICATIONS TABLE

Application	Specification
Free Length	1.811" (46.00 mm)
Tension At Spring Installed Length	
Celica & MR2	7.2-8.3 lbs. (3.25-3.75 kg) @ 1.988" (50.50 mm)
Camry	
Green Spring	7.2-8.3 lbs. (3.25-3.75 kg) @ 1.988" (50.50 mm)
Silver Spring	10.5-11.6 lbs. (4.75-5.25 kg) @ 1.988" (50.50 mm)

Installation

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

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

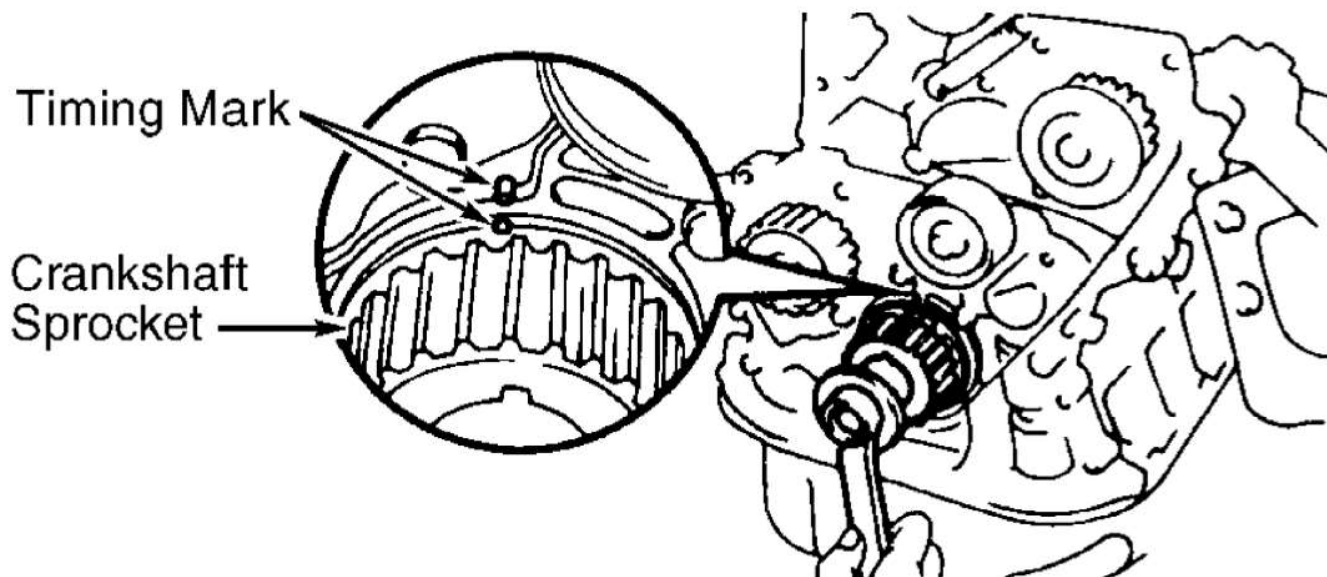
3) Install No. 2 idler pulley (if removed). Install and tighten bolt to specification. See TORQUE SPECIFICATIONS. Ensure idler pulley is clean and rotates smoothly.

4) Install No. 1 idler pulley and tension spring (if removed). Pry No. 1 idler pulley away from timing belt area as far as possible. Temporarily tighten No. 1 idler pulley bolt. Ensure idler pulley is clean and rotates smoothly.

5) If installing camshaft sprocket, align pin groove in camshaft sprocket with pin in camshaft. Install camshaft sprocket. Install washer and camshaft sprocket bolt. Tighten camshaft sprocket bolt to specification. See TORQUE SPECIFICATIONS.

6) Using crankshaft pulley bolt, rotate crankshaft so timing

mark on crankshaft sprocket aligns with timing mark on oil pump housing. See Fig. 29.



93H83870

Fig. 29: Aligning Crankshaft Sprocket Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

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

7) Ensure all sprockets and idler pulleys are clean. Install timing belt on crankshaft sprocket, oil pump sprocket, No. 1 idler pulley and then No. 2 idler pulley in sequence.

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

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

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

11) If reusing timing belt, ensure reference mark on timing belt aligns with upper edge of No. 1 timing belt cover. If reference mark is not aligned, perform procedure in steps 10) through 13) under removal procedure.

12) Rotate camshaft and align hole in camshaft sprocket with alignment mark on camshaft bearing cap. See Fig. 28.

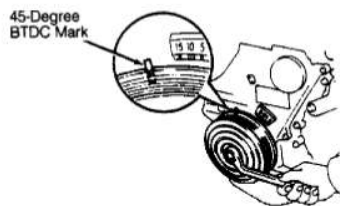
13) Install timing belt on camshaft sprocket. If reusing timing belt, ensure reference mark on timing belt is aligned with reference mark placed on camshaft sprocket. Ensure tension exists on timing belt between crankshaft and camshaft sprockets.

CAUTION: DO NOT rotate crankshaft counterclockwise.

14) Loosen No. 1 idler pulley bolt 1/2 turn. Rotate crankshaft clockwise pulley 2 full revolutions clockwise from TDC to TDC.

15) Ensure timing mark on crankshaft pulley aligns with "0" mark on No. 1 timing belt cover and hole in camshaft sprocket aligns with alignment mark on camshaft bearing cap. See Fig. 28. If timing marks are not aligned, remove timing belt and reinstall.

16) Rotate crankshaft clockwise 1 and 7/8 revolutions and align crankshaft pulley "0" mark with 45-degree Before Top Dead Center (BTDC) mark on No. 1 timing belt cover. See Fig. 30.



93183871

Fig. 30: Aligning Crankshaft Pulley With 45-Degree BTDC Mark
Courtesy of Toyota Motor Sales, U.S.A., Inc.

17) Tighten No. 1 idler pulley bolt to specification. See TORQUE SPECIFICATIONS. Install No. 2 timing belt cover and gaskets. Install and tighten spark plugs to specification. See TORQUE SPECIFICATIONS.

18) To install remaining components, reverse removal procedure. Install all bolts/nuts on right (timing belt side) engine mount before tightening to specification.

19) On Camry, when installing control rod and bracket on strut tower and right (timing belt side) engine mount, tighten bolts to specification in sequence. See Fig. 15.

VALVE LIFTER

Removal

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

Inspection

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

Installation

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

CAMSHAFT

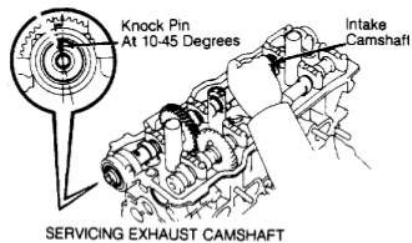
Removal

1) Remove timing belt and camshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove No. 3 timing belt cover. See Fig. 24. Remove nuts, grommets, valve cover and gasket. Note location of grommets for reassembly.

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

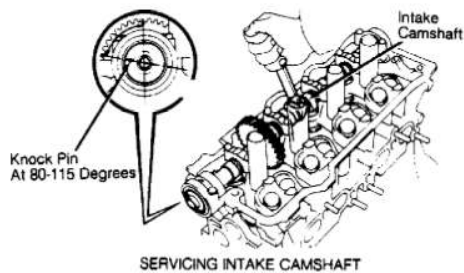
2) For servicing of exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See Figs. 31 & 32. This aids in exhaust camshaft removal by using camshaft lobes of cylinders No. 2 and 4 to push on valve lifters.

3) Secure sub-gear to the main gear on exhaust camshaft with a 6 x 1.0 x 18 mm service bolt "B". See Fig. 33. Before removing camshaft bearing cap bolts, ensure torsional spring force of sub-gear is secured by service bolt "B".



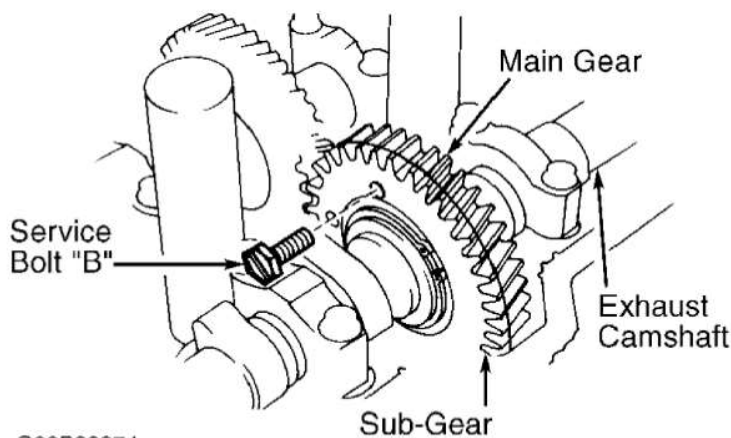
93J83872

Fig. 31: Servicing Exhaust Camshafts
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93A83873

Fig. 32: Servicing Intake Camshafts
Courtesy of Toyota Motor Sales, U.S.A., Inc.



G93B83874

Fig. 33: Securing Sub-Gear-To-Main Gear
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: Camshaft bearing caps are numbered for location with arrow on top of the cap. Front camshaft bearing cap on intake

camshaft and rear camshaft bearing cap on exhaust camshaft are not numbered. All other camshaft bearing caps are numbered starting with No. 1 at timing belt end of engine. Arrow on top of camshaft bearing cap must point toward timing belt end of engine. See Fig. 34.

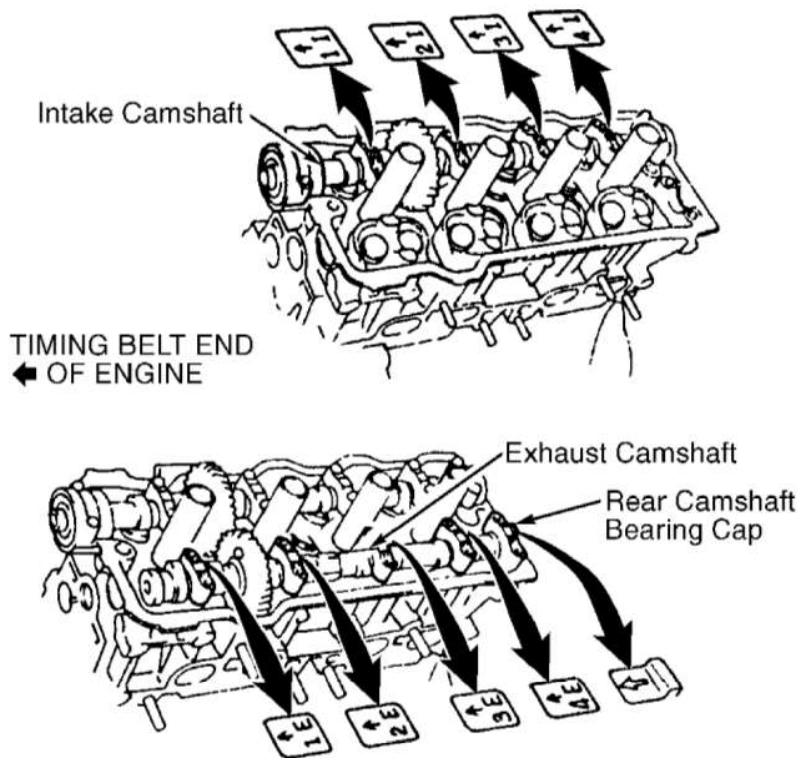
4) Remove bolts and rear camshaft bearing cap from exhaust camshaft. Remove bolts from No. 1, 2 and 4 camshaft bearing caps on exhaust camshaft in proper sequence. See Fig. 35. DO NOT remove bolts from No. 3 camshaft bearing cap at this time. Remove No. 1, 2 and 4 camshaft bearing caps from exhaust camshaft.

5) Alternately loosen bolts on No. 3 camshaft bearing cap on exhaust camshaft. Ensure exhaust camshaft is lifted upward as No. 3 camshaft bearing cap bolts are loosened.

6) If exhaust camshaft is not lifted upward, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 10-45 degrees from vertical position. See Fig. 32. Repeat steps 4) and 5). Remove No. 3 camshaft bearing cap and exhaust camshaft.

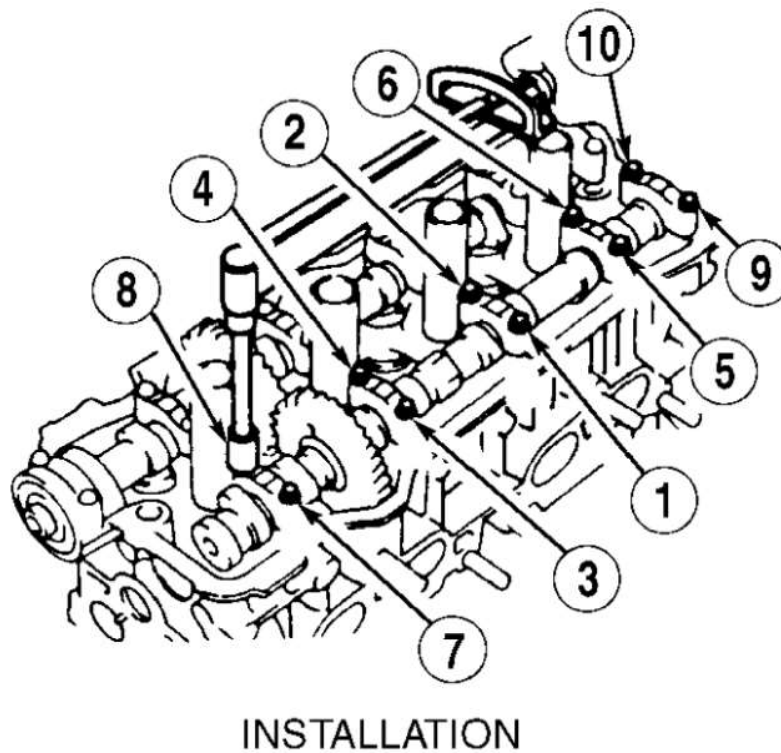
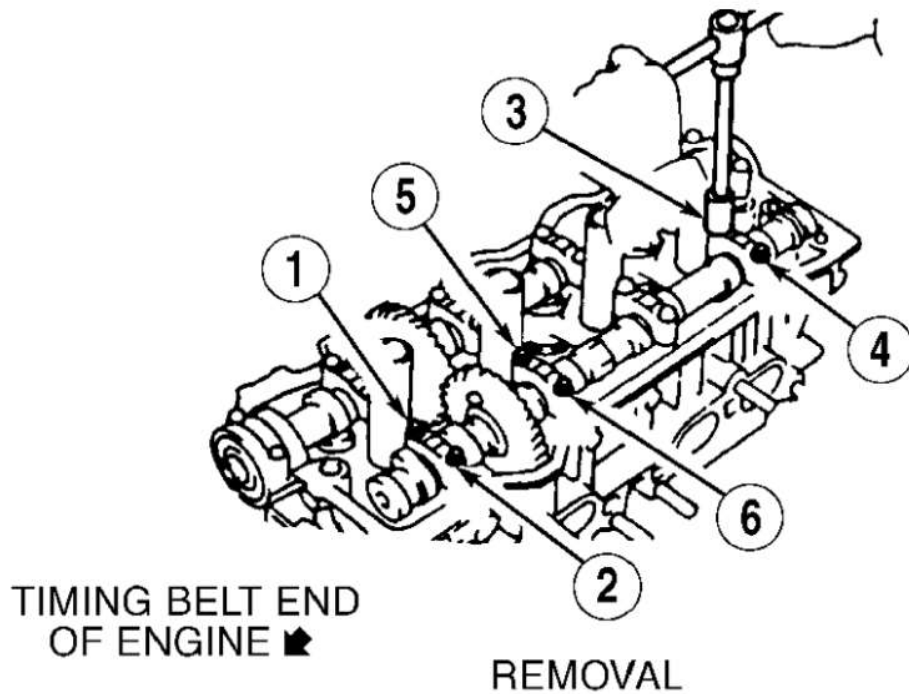
7) For servicing of intake camshaft, remove distributor. Rotate intake camshaft so knock pin is 80-115 degrees from vertical position. See Fig. 31. This aids in intake camshaft removal by using camshaft lobes of cylinders No. 1 and 3 to push on valve lifters.

8) Remove bolts, front camshaft bearing cap and oil seal from intake camshaft. Remove bolts from No. 1, 3 and 4 camshaft bearing caps on intake camshaft in proper sequence. See Fig. 36. DO NOT remove bolts from No. 2 camshaft bearing cap at this time. Remove No. 1, 3 and 4 camshaft bearing caps from intake camshaft.



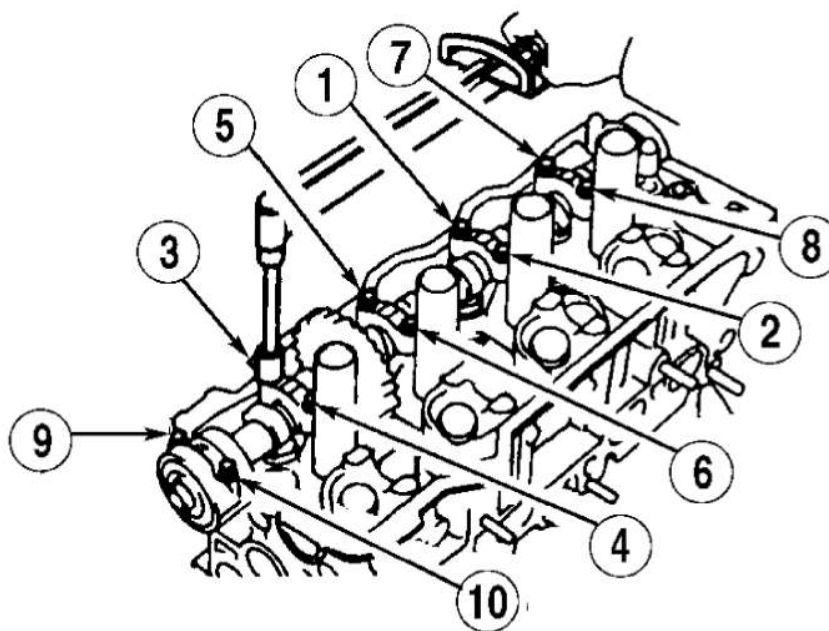
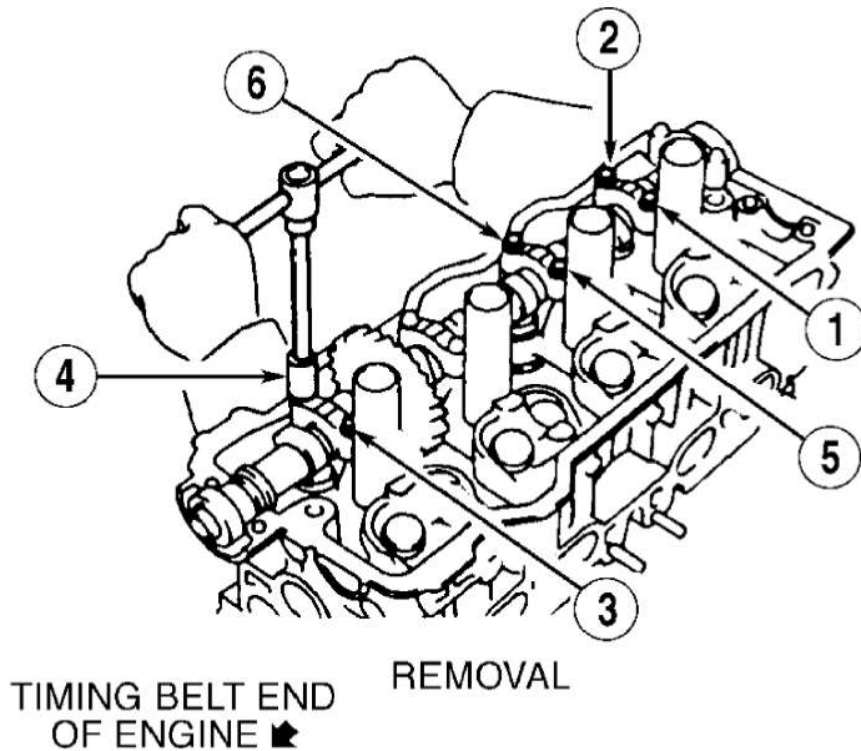
G93C83875

Fig. 34: Identifying Camshaft Bearing Caps
Courtesy of Toyota Motor Sales, U.S.A., Inc.



G93D83876

Fig. 35: Exhaust Camshaft Bearing Cap Bolt Removal & Installation Sequence
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



G93E83877

Fig. 36: Intake Camshaft Bearing Cap Bolt Removal & Installation
Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

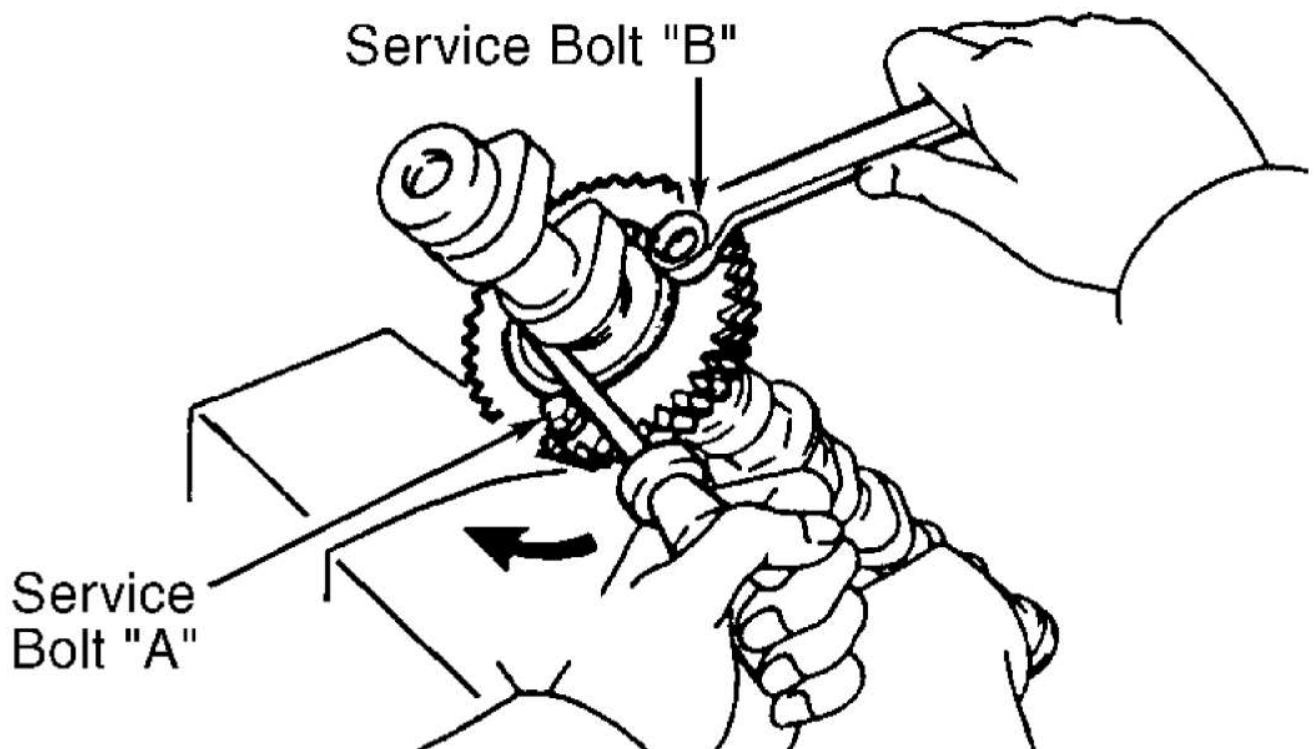
9) Alternately loosen bolts on No. 2 camshaft bearing cap on

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

10) If intake camshaft is not lifted upward, reinstall all camshaft bearing caps. Reposition intake camshaft so knock pin is 80-115 degrees from vertical position. See Fig. 32. Repeat steps 8) and 9). Remove No. 2 camshaft bearing cap and intake camshaft.

11) If removing sub-gear from exhaust camshaft, mount camshaft in soft-jawed vise on hexagonal area of camshaft. Install service bolts "A" and "B" in camshaft. See Fig. 37.

12) Using screwdriver, rotate sub-gear clockwise. Remove service bolt "B". Remove snap ring, wave washer, sub-gear and camshaft gear spring. See Fig. 24.



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Fig. 37: Disassembling Sub-Gear From Main Gear
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

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

2) Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See Figs. 35 and 36. See TORQUE SPECIFICATIONS.

3) Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

5) Install both camshafts in cylinder head without sub-gear

installed on exhaust camshaft. Install and tighten camshaft bearing cap bolts to specification in sequence. See Figs. 35 and 36. See TORQUE SPECIFICATIONS.

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

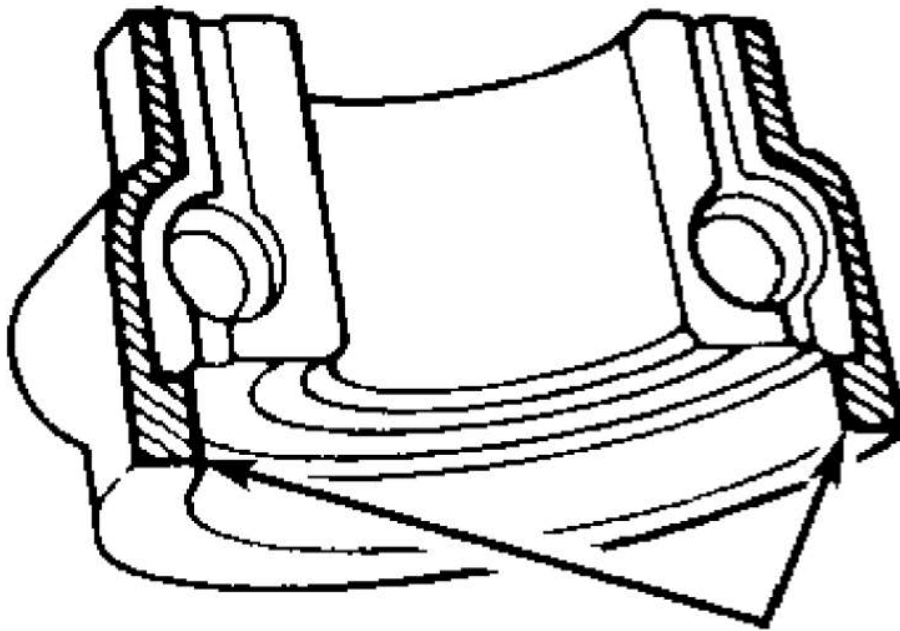
7) Measure distance between ends of camshaft gear spring. Replace camshaft gear spring if distance is not .886-.902" (22.50-22.90 mm).

Installation

1) If reassembling sub-gear on exhaust camshaft, install camshaft gear spring so ends engage with pins on main gear on exhaust camshaft. Install sub-gear, wave washer and snap ring on exhaust camshaft.

2) Install service bolt "A" on sub-gear. See Fig. 37. Using screwdriver, rotate sub-gear clockwise and align holes in sub-gear with hole on main gear. Install service bolt "B". Remove service bolt "A".

3) Coat thrust surfaces of camshafts with multipurpose grease. To install intake camshaft, rotate camshaft so knock pin is at 80-115 degrees from vertical position and install in cylinder head. See Fig. 32. Apply sealant on front camshaft bearing cap for intake camshaft. See Fig. 38.



Apply Sealant Here

G93G83879

Fig. 38: Applying Sealant On Front Camshaft Bearing Cap
Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Install front camshaft bearing cap for intake camshaft on cylinder head. Install remaining camshaft bearing caps for intake

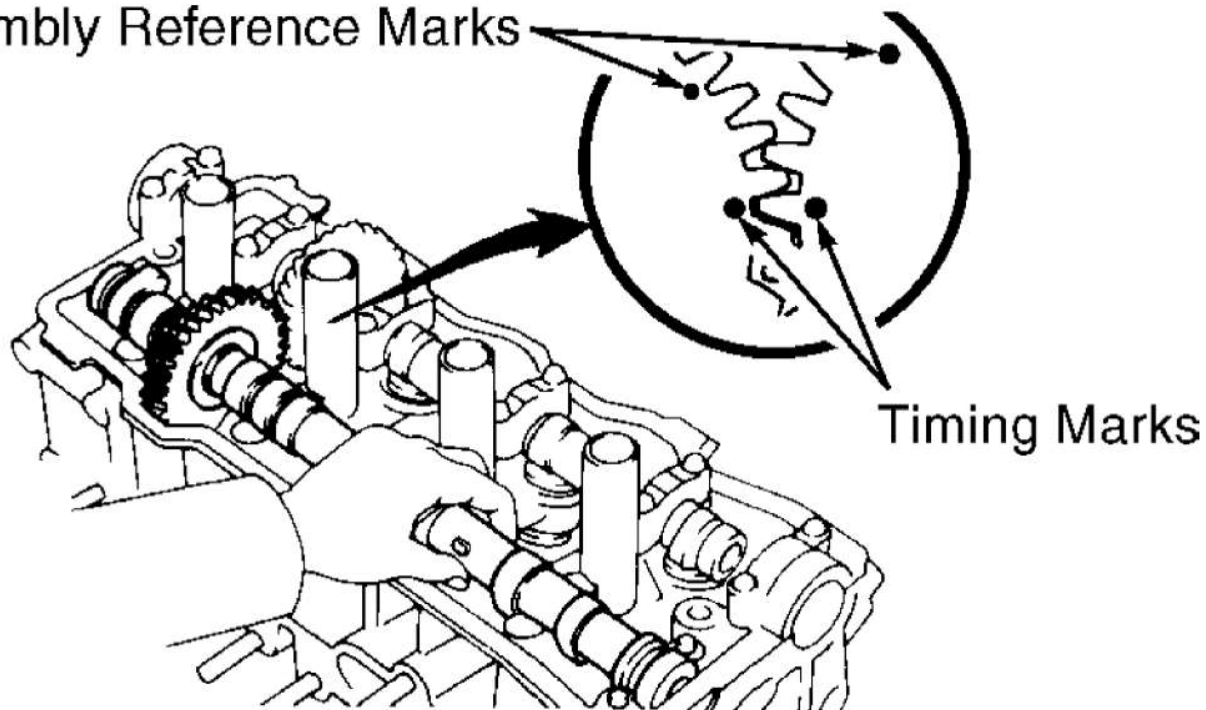
camshaft on cylinder head in numerical sequence with arrow pointing toward timing belt end of engine. See Fig. 34.

5) Apply engine oil to camshaft bearing cap bolt threads and below bolt head. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 36. See TORQUE SPECIFICATIONS.

6) Coat seal lip of NEW oil seal for intake camshaft with grease. Using Oil Seal Installer (SST 09223-46011), install oil seal into cylinder head.

7) To install exhaust camshaft, rotate intake camshaft so knock pin is 10-45 degrees from vertical position. See Fig. 32. Install exhaust camshaft so timing mark aligns with intake camshaft timing mark. DO NOT use assembly reference marks. See Fig. 39.

Assembly Reference Marks



G90H09508

Fig. 39: Aligning Camshaft Timing Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

8) Install camshaft bearing caps for exhaust camshaft on cylinder head in numerical sequence with arrow pointing toward timing belt end of engine. See Fig. 34.

9) Apply engine oil to camshaft bearing cap bolt threads and below bolt head. Install and tighten camshaft bearing cap bolts to specification in sequence using several steps. See Fig. 35. See TORQUE SPECIFICATIONS.

10) Remove service bolt "B" from camshaft gear. See Fig. 33. Install No. 3 timing belt cover. Install and tighten bolts to specification. See TORQUE SPECIFICATIONS. Install timing belt using proper procedure. See TIMING BELT under REMOVAL & INSTALLATION.

CAUTION: If cylinder head or camshaft were serviced or replaced, valve clearance must be checked. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.

11) Apply sealant on semi-circular plugs and install in each

end of cylinder head, located on exhaust camshaft side of cylinder head. Before installing gasket and valve cover, apply sealant at front and rear valve cover areas on cylinder head. See Fig. 3.

12) Using NEW gasket, install valve cover. Install grommets in original location with marking on grommet in aligned in designated area. See Fig. 4. Install and tighten valve cover nuts to specification. See TORQUE SPECIFICATIONS.

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

14) Ensure slot area on intake camshaft is vertically positioned. Rotate cutout on coupling so it is aligned with alignment mark on distributor housing. See Fig. 26.

15) Install distributor so center of flange on distributor is aligned with bolt hole on cylinder head. Install distributor hold-down bolts. Adjust ignition timing.

BALANCE SHAFTS (CAMRY)

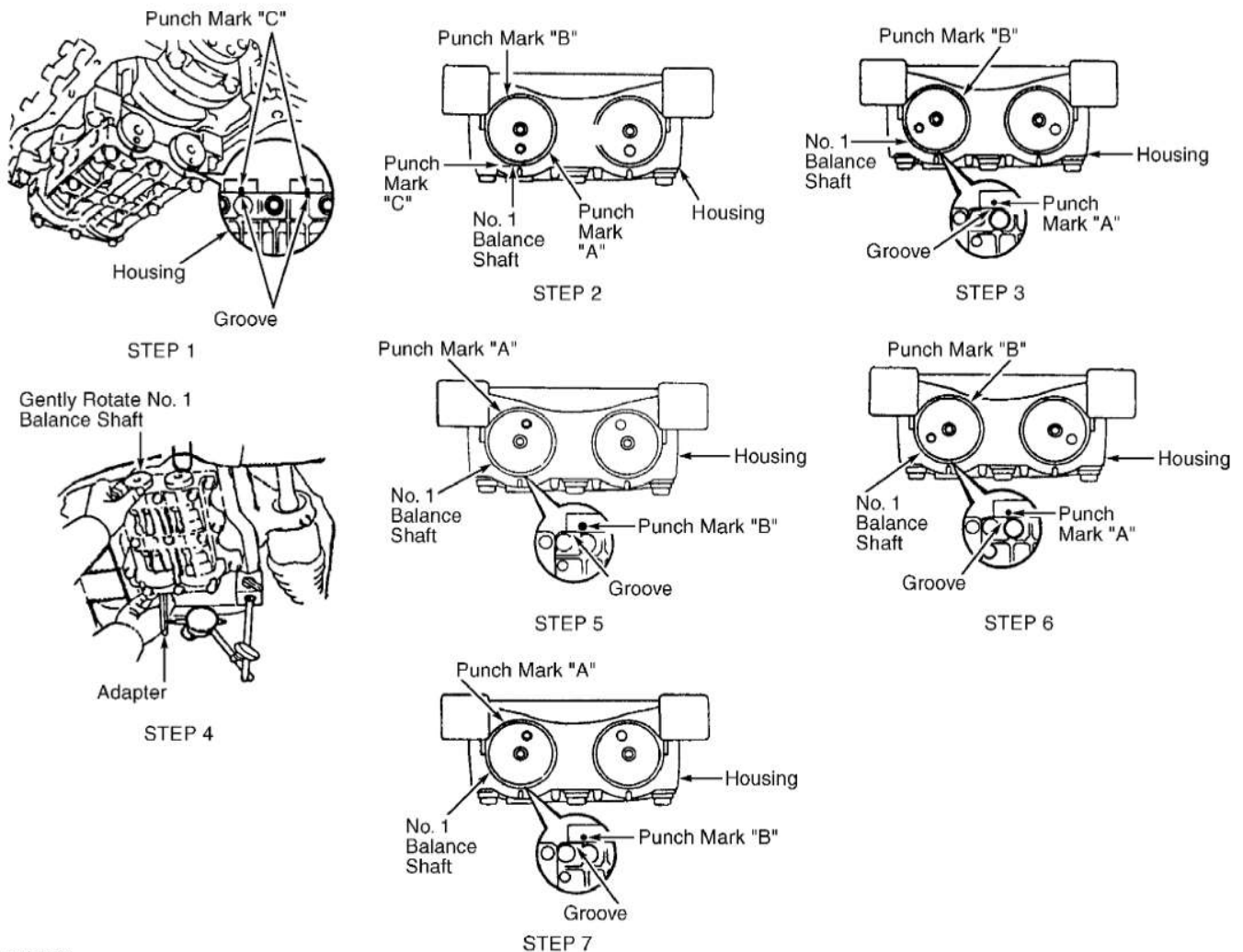
NOTE: Following procedure must be used when servicing balance shaft assembly with engine in the vehicle. Perform preliminary inspection before removing balance shaft assembly to ensure proper gear backlash exists. If balance shaft assembly is being serviced with engine removed from vehicle and cylinder block inverted (oil pan area facing upward) special procedure must be used. See BALANCE SHAFTS (CAMRY) under OVERHAUL.

Preliminary Inspection

1) Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION. Gear backlash between crankshaft gear and No. 1 balance shaft must be checked. Gear backlash varies with rotation of No. 1 balance shaft gear and crankshaft gear. Gear backlash must be checked with crankshaft gear and No. 1 balance shaft gear at 4 different points.

2) Rotate crankshaft 3 full revolutions to ensure proper seating of all gears. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

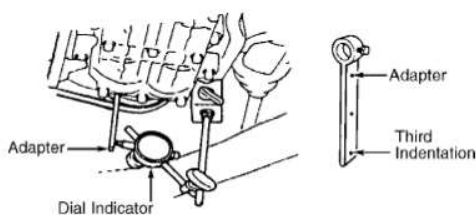
3) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. Perform STEP 1. See Fig. 40.



93J183880
Fig. 40: Checking Crankshaft Gear & No. 1 Balance Shaft Gear Backlash With Engine Installed
Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Ensure punch marks "A" and "B" on No. 1 balance shaft are at designated position. Perform STEP 2. See Fig. 40. Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 3. See Fig. 40.

5) Install dial indicator and Adapter (SST 09224-74010) on cylinder block and balance shaft assembly. See Fig. 41. Ensure dial indicator is perpendicular to adapter and dial indicator stem is in middle of third indentation on adapter. See Fig. 41.



93A83881
Fig. 41: Installing Dial Indicator & Adapter
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Gently rotate No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt and note gear backlash on dial indicator. Perform STEP 4. See Fig. 40. DO NOT use excessive force when rotating No. 1 balance shaft. It may be necessary to rotate No. 1 balance shaft several times to obtain a steady gear backlash reading. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

7) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 5. See Fig. 40.

8) Reinstall dial indicator. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

9) Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 6. See Fig. 40.

10) Reinstall dial indicator. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

11) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 7. See Fig. 40.

12) Reinstall dial indicator. Recheck gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt. Gear backlash should be .0024-.0039" (.060-.100 mm). Remove dial indicator and adapter.

13) If gear backlash is not within specification when performing all measurements, different thickness adjusting spacer must be installed between balance shaft assembly and cylinder block.

14) Remove balance shaft assembly and adjusting spacers from cylinder block using proper removal procedure. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.

15) Using gear backlash measured clearance and number stamped on installed adjusting spacer, determine replacement adjusting spacer. See Fig. 42. If gear backlash exceeds specification, use thinner adjusting spacer. If gear backlash is less than specified, use thicker adjusting spacer. Changing adjusting spacer thickness by .0008" (.020 mm) will change gear backlash about .0017" (.042 mm).

16) Use same thickness adjusting spacers on each side of balance shaft assembly. Reinstall adjusting shims and balance shaft assembly using proper procedure. Recheck gear backlash.

NEW SPACER THICKNESS mm (In.)

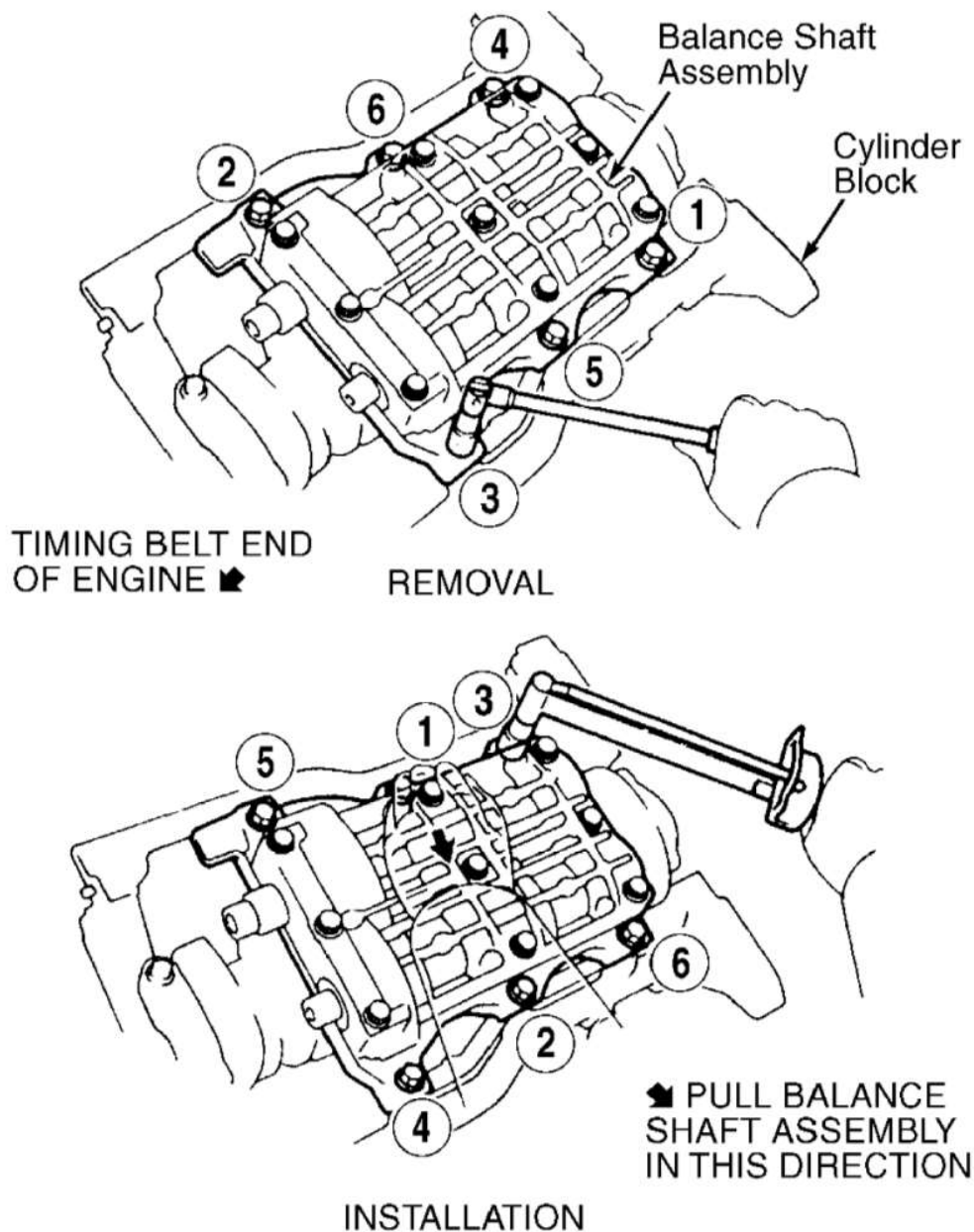
EXAMPLE: No. 25 adjusting spacers are installed and measured clearance is .0135" (.342 mm). Replace No. 25 adjusting spacers with No. 13 adjusting spacers.

Measured clearance	Installed spacer file		29	30	31	32	33	34	35	36	37	38	39	40
	mm (in.)													
0.000 - 0.017 (0.0000 - 0.0007)	33	33	35	35	37	37	37	39	39					
0.018 - 0.038 (0.0008 - 0.0015)	31	33	33	35	35	37	37	37	39	39				
0.039 - 0.059 (0.0016 - 0.0023)	31	31	33	33	35	35	37	37	39	39				
0.060 - 0.100 (0.0024 - 0.0039)														
0.101 - 0.121 (0.0040 - 0.0047)	27	29	29	31	31	33	33	35	35	37	37			
0.122 - 0.147 (0.0048 - 0.0056)	27	27	29	29	31	31	33	33	35	35	37	37		
0.143 - 0.163 (0.0057 - 0.0064)	25	27	27	29	29	31	31	33	33	35	35	37	37	
0.164 - 0.184 (0.0065 - 0.0072)	25	25	27	27	29	29	31	31	33	33	35	35	37	37
0.185 - 0.205 (0.0073 - 0.0081)	23	25	25	27	27	29	29	31	31	33	33	35	35	37
0.206 - 0.226 (0.0082 - 0.0089)	23	23	25	25	27	27	29	29	31	31	33	33	35	37
0.227 - 0.247 (0.0090 - 0.0097)	21	23	23	25	25	27	27	29	29	31	31	33	33	35
0.248 - 0.268 (0.0098 - 0.0105)	21	21	23	23	25	25	27	27	29	29	31	31	33	35
0.269 - 0.289 (0.0106 - 0.0114)	19	21	21	23	23	25	25	27	27	29	29	31	31	33
0.290 - 0.310 (0.0115 - 0.0122)	19	19	21	21	23	23	25	25	27	27	29	29	31	33
0.311 - 0.331 (0.0123 - 0.0130)	17	19	19	21	21	23	23	25	25	27	27	29	29	31
0.332 - 0.352 (0.0131 - 0.0138)	17	17	19	19	21	21	23	23	25	25	27	27	29	31
0.353 - 0.373 (0.0139 - 0.0147)	15	17	17	19	19	21	21	23	23	25	25	27	27	29
0.374 - 0.394 (0.0148 - 0.0155)	15	15	17	17	19	19	21	21	23	23	25	25	27	29
0.395 - 0.415 (0.0156 - 0.0163)	13	15	15	17	17	19	19	21	21	23	23	25	25	27
0.416 - 0.436 (0.0164 - 0.0171)	13	13	15	15	17	17	19	19	21	21	23	23	25	27
0.437 - 0.457 (0.0172 - 0.0179)	11	13	13	15	15	17	17	19	19	21	21	23	23	25
0.458 - 0.478 (0.0181 - 0.0188)	11	11	13	13	15	15	17	17	19	19	21	21	23	25
0.479 - 0.499 (0.0189 - 0.0196)	09	11	11	13	13	15	15	17	17	19	19	21	23	25
0.500 - 0.520 (0.0197 - 0.0205)	09	09	11	11	13	13	15	15	17	17	19	19	21	23
0.521 - 0.541 (0.0206 - 0.0213)	07	09	09	11	11	13	13	15	15	17	17	19	19	21
0.542 - 0.562 (0.0214 - 0.0221)	07	07	09	09	11	11	13	13	15	15	17	17	19	21
0.563 - 0.583 (0.0222 - 0.0230)	05	07	07	09	09	11	11	13	13	15	15	17	17	19
0.584 - 0.604 (0.0231 - 0.0238)	05	05	07	07	09	09	11	11	13	13	15	15	17	19
0.605 - 0.625 (0.0239 - 0.0246)	03	05	05	07	07	09	09	11	11	13	13	15	15	17
0.626 - 0.646 (0.0247 - 0.0254)	03	03	05	05	07	07	09	09	11					

Removal
1) Before removing balance shaft assembly, perform

preliminary inspection procedure to ensure proper thickness adjusting spacers are installed. See PRELIMINARY INSPECTION procedure under BALANCE SHAFTS (CAMRY).

2) Uniformly loosen and remove 6 outside bolts on balance shaft assembly in proper sequence. See Fig. 43. Remove balance shaft assembly and adjusting spacers. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.



93C83883

Fig. 43: Balance Shaft Assembly Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

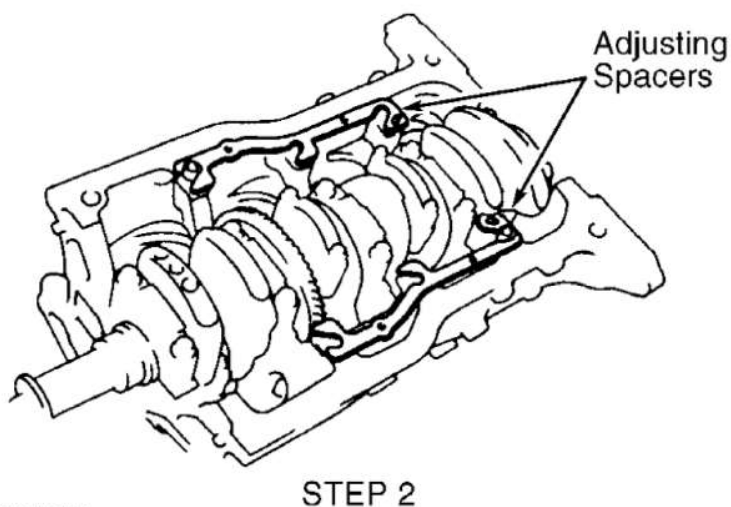
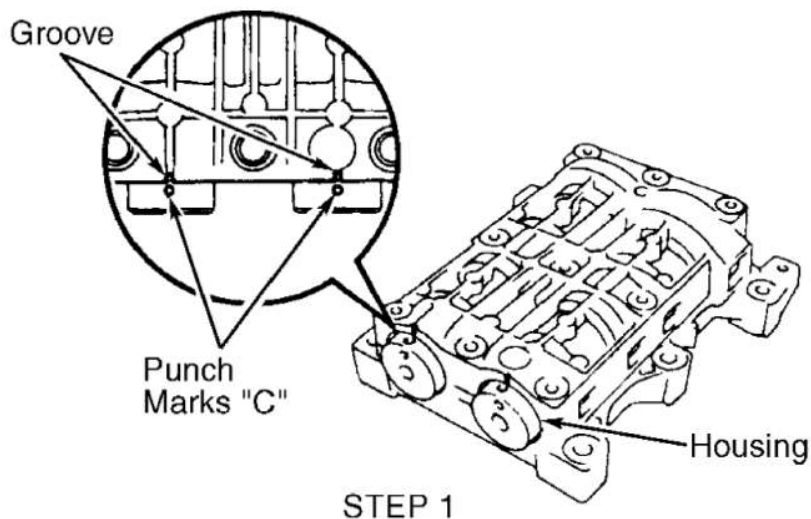
- 1) Rotate crankshaft clockwise so cylinder No. 1 is at TDC on

compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

2) Ensure timing mark on crankshaft pulley aligns with "0" mark on timing belt cover. Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. Perform STEP 1. See Fig. 44.

3) Ensure surfaces on cylinder block and adjusting spacers are clean. Install adjusting spacers on cylinder block. Perform STEP 2. See Fig. 44. Install balance shaft assembly on cylinder block with bolts loosely installed.

4) Ensure punch mark "C" on both balance shafts are still aligned with grooves on the housing of balance shaft assembly. Pull balance shaft assembly in proper direction and tighten bolts to specification in sequence. See Fig. 43. Recheck gear backlash. See PRELIMINARY INSPECTION procedure under BALANCE SHAFTS (CAMRY).



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Fig. 44: Aligning Balance Shaft Punch Marks & Installing Adjusting Spacers

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

CRANKSHAFT REAR OIL SEAL

Removal

Remove transaxle, clutch assembly (if equipped) and flywheel/drive plate. Using a knife, cut off oil seal lip. Pry oil seal from rear seal housing. Use care not to damage sealing surfaces.

Installation

1) Ensure all sealing surfaces are clean. Apply grease to seal lip of NEW oil seal. Use Oil Seal Installer (SST 09223-63010) for oil seal installation.

2) Install oil seal in rear seal housing until oil seal is even with surface of rear seal housing. Apply Loctite to flywheel/drive plate bolts. Install flywheel/drive plate. Install and tighten bolts to specification in a crisscross pattern. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

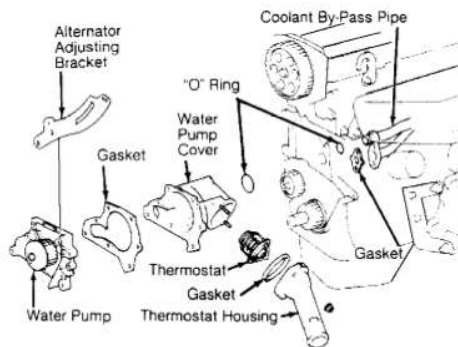
WATER PUMP

Removal (Camry & Celica)

1) Disconnect negative battery cable. Drain cooling system. Remove timing belt and idler pulleys. See TIMING BELT under REMOVAL & INSTALLATION.

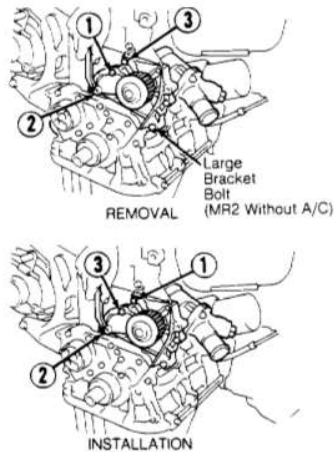
2) Disconnect lower radiator hose from thermostat housing. Remove alternator adjusting bracket. Remove coolant by-pass pipe nuts. See Fig. 45.

3) Remove water pump bolts in sequence. See Fig. 46. Remove water pump, water pump cover and "O" rings. See Fig. 45. Remove water pump-to-water pump cover bolts. Remove water pump and gasket from water pump cover.



93E83885

Fig. 45: Exploded View Of Water Pump & Components
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93F83886

Fig. 46: Water Pump Bolt Removal & Installation Sequence
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Installation

1) To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Apply soapy water solution on coolant by-pass pipe "O" ring before installing water pump. DO NOT tighten coolant by-pass pipe-to-water pump nuts until water pump bolts are tightened.

2) Tighten water pump bolts to specification in sequence. See Fig. 46. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure. Fill cooling system.

Removal (MR2)

1) Drain cooling system. Remove drive belt and idler pulley bracket. Remove A/C compressor with hoses attached and secure aside. Remove timing belt and No. 2 idler pulley. See TIMING BELT under REMOVAL & INSTALLATION.

2) Disconnect radiator hose at water pump. Remove the coolant by-pass pipe-to-water pump nuts. See Fig. 46. On models without A/C, remove large bracket bolt from lower right corner of water pump. See Fig. 46.

3) On all models, remove water pump bolts in sequence. See Fig. 46. Remove water pump, water pump cover and "O" rings. See Fig. 45. Remove water pump-to-water pump cover bolts. Remove water pump and gasket from water pump cover.

Installation

1) To install, reverse removal procedure using NEW gaskets and NEW "O" rings. Apply soapy water solution on coolant by-pass pipe "O" ring before installing water pump. DO NOT tighten coolant by-pass pipe-to-water pump nuts until water pump bolts are tightened.

2) Tighten water pump bolts to specification in sequence. See Fig. 46. See TORQUE SPECIFICATIONS. On models without A/C, install large bracket bolt and tighten to specification. See TORQUE SPECIFICATIONS.

3) To install remaining components, reverse removal procedure. Fill and bleed cooling system. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

CAUTION: On MR2, cooling system must be bled to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

OIL PAN

Removal

1) Disconnect negative battery cable. Raise and support vehicle. Remove lower engine covers. Drain engine oil. On all models, remove front exhaust pipe located below oil pan.

2) On Celica, remove suspension crossmember bolted to both lower suspension arm shafts. Support engine with hoist. Remove engine mount crossmember located below engine.

3) On MR2, remove catalytic converter braces, catalytic converter, cushion, retainer and gasket to access oil pan (if necessary). See Fig. 24.

4) Remove stiffener bracket at rear of oil pan. Remove dipstick. Remove bolts/nuts and oil pan.

Installation

1) Ensure sealing surfaces are clean. Apply bead of sealant at center of oil pan sealing surface, between bolt/nut holes and on inside of bolt/nut holes.

2) Install oil pan. Install and tighten bolts/nuts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

3) Use NEW nuts when installing exhaust pipe on catalytic converter. Use NEW gasket when installing catalytic converter (if removed). Fill crankcase with oil.

OVERHAUL

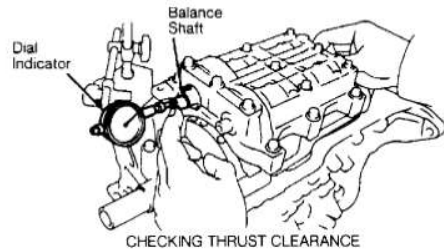
BALANCE SHAFTS (CAMRY)

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

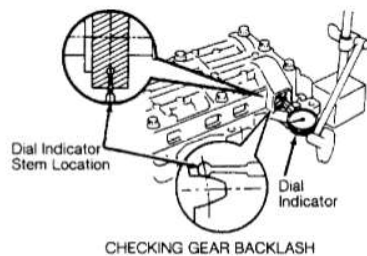
Inspection

1) Position cylinder block with oil pan area facing upward. To check thrust clearance, mount use dial indicator on cylinder block with stem against balance shaft. See Fig. 47.

2) Measure thrust clearance while manually moving balance shaft back and forth. See Fig. 47. Standard thrust clearance is .0026-.0043" (.065-.110 mm) with maximum thrust clearance of .0043" (.110 mm). Replace balance shaft assembly if thrust clearance exceeds specification.



93G83887
Fig. 47: Checking Thrust Clearance
Courtesy of Toyota Motor Sales, U.S.A., Inc.



93H83888
Fig. 48: Checking Gear Backlash
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Gear backlash between crankshaft gear and No. 1 varies with rotation of No. 1 balance shaft gear and crankshaft gear. Gear backlash must be checked with crankshaft gear and No. 1 balance shaft gear at 4 different points.

4) Rotate crankshaft 3 full revolutions to ensure proper seating of all gears. Rotate crankshaft clockwise so cylinder No. 1 is at TDC on compression stroke. Cylinder No. 1 is front cylinder at timing belt end of engine.

5) Ensure punch mark "C" on both balance shafts align with grooves on housing of balance shaft assembly. Perform STEP 1. See Fig. 49.

6) Ensure punch marks "A" and "B" on No. 1 balance shaft are at designated position. Perform STEP 2. See Fig. 49. Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 3. See Fig. 49.

7) Install lever-type dial indicator on cylinder block and balance shaft assembly so dial indicator is parallel to No. 1 balance shaft. See Fig. 48. Ensure dial indicator stem is located in center of tooth. See Fig. 48.

8) Gently rotate No. 1 balance shaft while pressing on end of No. 1 balance shaft until resistance is felt and note gear backlash on dial indicator. Perform STEP 4. See Fig. 49. DO NOT use excessive force when rotating No. 1 balance shaft. It may be necessary to rotate No. 1 balance shaft several times to obtain a steady gear backlash reading. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

9) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 5. See Fig. 49.

10) Reinstall dial indicator. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance

shaft. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

11) Rotate crankshaft clockwise and align punch mark "A" on No. 1 balance shaft with groove on housing. Perform STEP 6. See Fig. 49.

12) Reinstall dial indicator. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

13) Rotate crankshaft clockwise and align punch mark "B" on No. 1 balance shaft with groove on housing. Perform STEP 7. See Fig. 49.

14) Reinstall dial indicator. Check gear backlash by gently rotating No. 1 balance shaft while pressing on end of No. 1 balance shaft. Gear backlash should be 0-.0024" (0-.060 mm). Remove dial indicator.

15) If gear backlash is not within specification when performing all measurements, different thickness adjusting spacer must be installed between balance shaft assembly and cylinder block.

16) Remove balance shaft assembly and adjusting spacers from cylinder block. See BALANCE SHAFTS (CAMRY) under REMOVAL & INSTALLATION. Adjusting spacers are installed on each side of balance shaft assembly, between balance shaft assembly and cylinder block.

17) Using gear backlash measured clearance and number stamped on installed adjusting spacer, determine replacement adjusting spacer. See Fig. 50.

18) If gear backlash exceeds specification, use thinner adjusting spacer. If gear backlash is less than specified, use thicker adjusting spacer. Changing adjusting spacer thickness by .0008" (.020 mm) will change gear backlash about .0006" (.014 mm). Use same thickness adjusting spacers on each side of balance shaft assembly.

19) Reinstall adjusting shims and balance shaft assembly using proper procedure. See BALANCE SHAFTS (CAMRY) under REMOVAL & INSTALLATION. Recheck gear backlash.

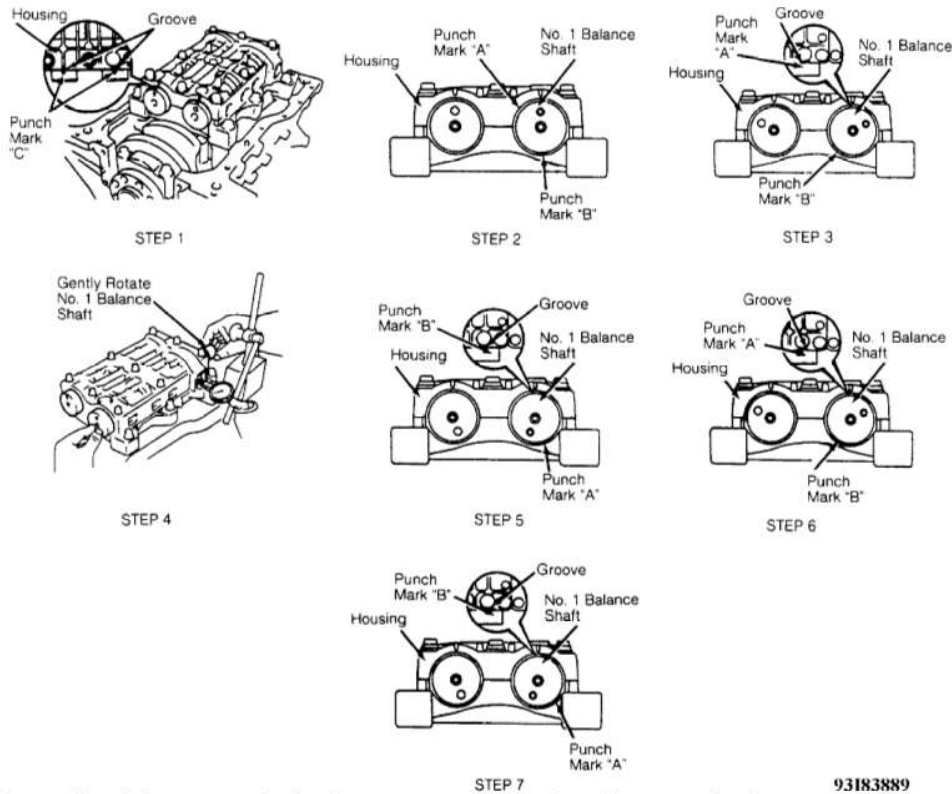


Fig. 49: Checking Crankshaft Gear & No. 1 Balance Shaft Gear Backlash With Engine Removed
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Measured clearance mm (in.)	Installed spacer No.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
0.000 - 0.060 (0.0000 - 0.0023)																													
0.061 - 0.067 (0.0023 - 0.0025)		01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.068 - 0.074 (0.0025 - 0.0027)			01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.075 - 0.081 (0.0027 - 0.0030)				01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.082 - 0.088 (0.0030 - 0.0033)					01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.089 - 0.095 (0.0033 - 0.0035)						01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.096 - 0.102 (0.0035 - 0.0038)							01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.103 - 0.109 (0.0038 - 0.0040)								01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.110 - 0.116 (0.0040 - 0.0043)									01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.117 - 0.123 (0.0043 - 0.0045)										01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.124 - 0.130 (0.0045 - 0.0048)											01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.131 - 0.137 (0.0048 - 0.0051)												01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.138 - 0.144 (0.0051 - 0.0053)													01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.145 - 0.151 (0.0054 - 0.0056)														01	01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.152 - 0.158 (0.0056 - 0.0058)															01	01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.159 - 0.165 (0.0058 - 0.0061)																01	01	01	01	01	01	01	01	01	01	01	01	01	01
0.166 - 0.172 (0.0061 - 0.0064)																	01	01	01	01	01	01	01	01	01	01	01	01	01
0.173 - 0.179 (0.0064 - 0.0066)																		01	01	01	01	01	01	01	01	01	01	01	01
0.180 - 0.186 (0.0067 - 0.0069)																			01	01	01	01	01	01	01	01	01	01	01
0.187 - 0.193 (0.0069 - 0.0071)																				01	01	01	01	01	01	01	01	01	01
0.194 - 0.200 (0.0072 - 0.0074)																					01	01	01	01	01	01	01	01	01
0.201 - 0.207 (0.0074 - 0.0077)																						01	01	01	01	01	01	01	01
0.208 - 0.214 (0.0077 - 0.0079)																							01	01	01	01	01	01	01
0.215 - 0.221 (0.0079 - 0.0082)																								01	01	01	01	01	01
0.222 - 0.228 (0.0082 - 0.0084)																									01	01	01	01	01
0.229 - 0.235 (0.0085 - 0.0087)																										01	01	01	01
0.236 - 0.242 (0.0087 - 0.0089)																											01	01	01
0.243 - 0.249 (0.0090 - 0.0092)																												01	01
0.250 - 0.256 (0.0092 - 0.0095)																													01
0.257 - 0.263 (0.0095 - 0.0097)																													01
0.264 - 0.270 (0.0098 - 0.0100)																													01
0.271 - 0.277 (0.0100 - 0.0102)																													01
0.278 - 0.284 (0.0103 - 0.0105)																													01
0.285 - 0.291 (0.0105 - 0.0108)																													01
0.292 - 0.298 (0.0108 - 0.0110)																													01
0.299 - 0.305 (0.0110 - 0.0113)																													01
0.306 - 0.312 (0.0113 - 0.0115)																													01
0.313 - 0.319 (0.0115 - 0.0118)																													01
0.320 - 0.326 (0.0118 - 0.0120)																													01
0.327 - 0.333 (0.0120 - 0.0123)																													01

EXAMPLE: No. 25 adjusting spacers are installed
and measured clearance is .0055" (.140 mm).
Replace No. 25 adjusting spacers with No. 9 adjusting spacers.

93B83890

Fig. 50: Adjusting Shim Selection Chart With Engine Removed
(Installed Spacer No. 01 Through 28)

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

Measured clearance mm (in.)	Installed spacer No.											
	29	30	31	32	33	34	35	36	37	38	39	40
0.000 - 0.080 (0.0000 - 0.0032)												
0.081 - 0.087 (0.0033 - 0.0035)	25	26	27	27	29	29	31	31	33	33	35	35
0.088 - 0.074 (0.0029 - 0.0027)	23	26	25	27	27	29	29	31	31	33	33	35
0.075 - 0.081 (0.0028 - 0.0030)	23	23	25	25	27	27	29	29	31	31	33	33
0.082 - 0.086 (0.0030 - 0.0033)	21	23	23	25	25	27	27	29	29	31	31	33
0.089 - 0.095 (0.0033 - 0.0036)	21	21	23	23	25	25	27	27	29	29	31	31
0.096 - 0.102 (0.0035 - 0.0038)	19	21	21	23	23	25	25	27	27	29	29	31
0.103 - 0.109 (0.0038 - 0.0040)	19	19	21	21	23	23	25	25	27	27	29	29
0.110 - 0.116 (0.0040 - 0.0043)	17	19	19	21	21	23	23	25	25	27	27	29
0.117 - 0.123 (0.0043 - 0.0045)	17	17	19	19	21	21	23	23	25	25	27	27
0.124 - 0.130 (0.0048 - 0.0048)	15	17	17	19	19	21	21	23	23	25	25	27
0.131 - 0.137 (0.0048 - 0.0051)	15	15	17	17	19	19	21	21	23	23	25	25
0.138 - 0.144 (0.0051 - 0.0053)	13	15	15	17	17	19	19	21	21	23	23	25
0.145 - 0.151 (0.0054 - 0.0056)	13	13	15	15	17	17	19	19	21	21	23	23
0.152 - 0.158 (0.0056 - 0.0058)	11	13	13	15	15	17	17	19	19	21	21	23
0.159 - 0.165 (0.0059 - 0.0061)	11	11	13	13	15	15	17	17	19	19	21	21
0.166 - 0.172 (0.0061 - 0.0064)	09	11	11	13	13	15	15	17	17	19	19	21
0.173 - 0.179 (0.0064 - 0.0066)	08	09	11	11	13	13	15	15	17	17	19	19
0.180 - 0.186 (0.0067 - 0.0069)	07	08	09	11	11	13	13	15	15	17	17	19
0.187 - 0.193 (0.0069 - 0.0071)	07	07	09	09	11	11	13	13	15	15	17	17
0.194 - 0.200 (0.0072 - 0.0074)	06	07	07	09	09	11	11	13	13	15	15	17
0.201 - 0.207 (0.0074 - 0.0077)	05	06	07	07	09	09	11	11	13	13	15	15
0.208 - 0.214 (0.0077 - 0.0079)	03	05	06	07	07	09	09	11	11	13	13	15
0.215 - 0.221 (0.0079 - 0.0082)	03	03	05	06	07	07	09	09	11	11	13	13
0.222 - 0.228 (0.0082 - 0.0084)	01	03	03	05	06	07	07	09	09	11	11	13
0.229 - 0.235 (0.0085 - 0.0087)	01	01	03	03	05	06	07	07	09	09	11	11
0.236 - 0.242 (0.0087 - 0.0089)	01	01	01	03	03	05	06	07	07	09	09	11
0.243 - 0.249 (0.0090 - 0.0092)	01	01	01	01	03	03	05	06	07	07	09	09
0.250 - 0.256 (0.0092 - 0.0095)	01	01	01	01	01	03	03	05	06	07	07	09
0.257 - 0.263 (0.0095 - 0.0097)	01	01	01	01	01	01	03	03	05	06	07	07
0.264 - 0.270 (0.0098 - 0.0100)		01	01	01	01	01	01	03	03	05	06	07
0.271 - 0.277 (0.0100 - 0.0102)			01	01	01	01	01	01	03	03	05	06
0.278 - 0.284 (0.0103 - 0.0106)					01	01	01	01	01	03	03	05
0.285 - 0.291 (0.0106 - 0.0108)						01	01	01	01	01	03	03
0.292 - 0.298 (0.0108 - 0.0110)							01	01	01	01	01	03
0.299 - 0.305 (0.0110 - 0.0113)								01	01	01	01	01
0.306 - 0.312 (0.0113 - 0.0115)									01	01	01	01
0.313 - 0.319 (0.0118 - 0.0118)										01	01	01
0.320 - 0.326 (0.0118 - 0.0120)											01	01
0.327 - 0.333 (0.0120 - 0.0123)												01

EXAMPLE: No. 25 adjusting spacers are installed
and measured clearance is .0055" (.140 mm).
Replace No. 25 adjusting spacers with No. 9 adjusting spacers.
93C83891

Fig. 51: Adjusting Shim Selection Chart With Engine Removed
(Installed Spacer No. 29 Through 40)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NEW SPACER THICKNESS							
No.	Thickness	No.	Thickness	No.	Thickness	No.	Thickness
01	1.74 (0.0685)	11	1.84 (0.0724)	21	1.94 (0.0764)	31	2.04 (0.0803)
03	1.76 (0.0693)	13	1.86 (0.0732)	23	1.96 (0.0772)	33	2.06 (0.0811)
05	1.78 (0.0701)	15	1.88 (0.0740)	25	1.98 (0.0780)	35	2.08 (0.0819)
07	1.80 (0.0709)	17	1.90 (0.0748)	27	2.00 (0.0787)	37	2.10 (0.0827)
09	1.82 (0.0717)	19	1.92 (0.0756)	29	2.02 (0.0795)	39	2.12 (0.0835)

EXAMPLE: No. 25 adjusting spacers are installed
and measured clearance is .0055" (.140 mm).
Replace No. 25 adjusting spacers with No. 9 adjusting spacers.
93D83892

Fig. 52: Adjusting Shim Selection Chart With Engine Removed
(New Spacer Thickness)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

CYLINDER HEAD

Cylinder Head

1) Inspect cylinder head warpage at cylinder block, exhaust manifold and intake manifold areas. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification in sequence. See Figs. 35 and 36. See TORQUE SPECIFICATIONS.

3) Replace camshaft and/or cylinder head if oil clearance is not within specification. See CAMSHAFT table under ENGINE SPECIFICATIONS.

4) Check camshaft end play with camshaft bearing cap bolts tightened to specification. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See CAMSHAFT table

under ENGINE SPECIFICATIONS.

5) Ensure valve lifter bore diameter in cylinder head is within specification. See VALVE LIFTERS table under ENGINE SPECIFICATIONS.

Valve Springs

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

Valve Stem Oil Seals

Intake valve stem oil seal is Brown or Gray and exhaust valve stem oil seal is Green. Ensure proper valve stem oil seal is installed. Lubricate valve stem oil seal with engine oil. Install valve stem oil seal using Oil Seal Installer (SST 09201-41020).

Valve Guides (Camry)

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

2) To replace valve guide, wrap tape around an old valve stem. Tape must be approximately .31" (8.0 mm) from small end of valve stem. From top of cylinder head, install old valve in valve guide until tape area rests on valve guide.

3) Using hammer, hit old valve to break off top of old valve guide. Remove snap ring from valve guide. Heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (SST 09201-70010), drive valve guide from camshaft side of cylinder head.

4) Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4331-.4342" (11.000-11.027 mm), use standard valve guide. If bore inside diameter is .4350-.4361" (11.050-11.077 mm), use oversize valve guide.

5) If bore inside diameter exceeds .4342" (11.027 mm), machine valve guide bore to .4350-.4361" (11.050-11.077 mm) for oversize valve guide. If bore inside diameter exceeds .4361" (11.077 mm), replace cylinder head.

6) To install valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head until snap ring on valve guide contacts the cylinder head.

7) Using .236" (6.00 mm) reamer, ream valve guide to obtain correct valve stem-to-guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Guides (Celica & MR2)

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

2) To replace valve guide, wrap tape around an old valve stem. Tape must be approximately .31" (8.0 mm) from small end of valve stem. From top of cylinder head, install old valve in valve guide until tape area rests on valve guide.

3) Using hammer, hit old valve to break off top of old valve guide. Remove snap ring from valve guide (if equipped). Heat cylinder head to 176-212°F (80-100°C). Using hammer and Valve Guide Remover/Installer (SST 09201-70010), drive valve guide from camshaft side of cylinder head.

4) Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .4325-.4335" (10.985-11.012 mm), use standard valve guide. If bore inside diameter is .4344-.4355" (11.035-11.062 mm), use oversize valve guide.

5) If bore inside diameter exceeds .4335" (11.012 mm), machine valve guide bore to .4344-.4355" (11.035-11.062 mm) for

oversize valve guide. If bore inside diameter exceeds .4355" (11.062 mm), replace cylinder head.

6) Intake valve guide is 1.516" (38.50 mm) long and exhaust valve guide is 1.594" (40.50 mm) long. Ensure proper valve guide is installed.

7) To install valve guide, heat cylinder head to 176-212°F (80-100°C). Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head.

8) On exhaust valve guides, install valve guide until snap ring contacts cylinder head. On intake valve guide, install valve guide until distance from top of intake valve guide to the cylinder head surface is .315-.346" (8.00-8.80 mm).

9) On all valve guides, use .236" (6.00 mm) reamer to ream valve guide to obtain correct valve stem-to-guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Seat

Ensure valve seat angle and seat width are within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Valve seat replacement information is not available from manufacturer.

Valves

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

Valve Seat Correction Angles

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

VALVE TRAIN

Valve Lifters

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

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Note that piston must be installed with front mark (cavity) on top of piston aligned with front mark (protrusion) on connecting rod. See Fig. 53.

2) Before disassembling piston and connecting rod, try to move piston back and forth on piston pin. Replace piston and piston pin if any movement is felt.

3) When removing piston from connecting rod, remove snap rings from piston. Heat piston to 176-194°F (80-90°C) in water. Remove piston pin. Separate piston from connecting rod.

4) Ensure piston pin diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Ensure connecting rod bend, twist and piston pin bushing bore diameter are within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

5) Bushing in connecting rod 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. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

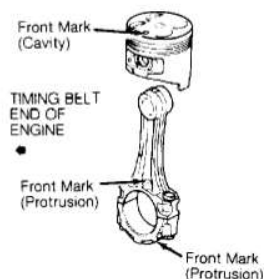
NOTE: With piston at 140°F (60°C), piston pin should be able to be

pressed into piston using thumb pressure.

6) Check that nut easily rotates on bolt of connecting rod. If nut fails to rotate easily, use caliper to measure connecting rod bolt outside diameter at .59" (15.0 mm) from end of bolt, just above threads. Replace connecting rod bolt and nut if outside diameter is less than .2992" (7.600 mm).

7) To reassemble, position piston and connecting rod so front mark (cavity) on top of piston aligns with front mark (protrusion) on connecting rod. See Fig. 53.

8) Install one NEW snap ring in piston. Heat piston to 176-194°F (80-90°C) in water. Coat piston pin with engine oil. Install piston pin into piston and connecting rod using thumb pressure. Install remaining NEW snap ring.



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Fig. 53: Aligning Piston With Connecting Rod
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Fitting Pistons

1) To determine piston-to-cylinder clearance, measure piston skirt diameter .925" (23.50 mm) from top of piston at 90-degree angle to piston pin.

2) Different piston sizes are used. Piston size can be identified by size mark ("1", "2" or "3") stamped on top of piston. See Fig. 54. Ensure piston diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

3) Measure cylinder bore diameter at .39" (9.9 mm) from top and bottom of cylinder bore and at middle of cylinder bore. Different cylinder bore sizes are used. Cylinder bore diameter can be identified by size mark ("1", "2" or "3") stamped on cylinder block deck surface. See Fig. 55.

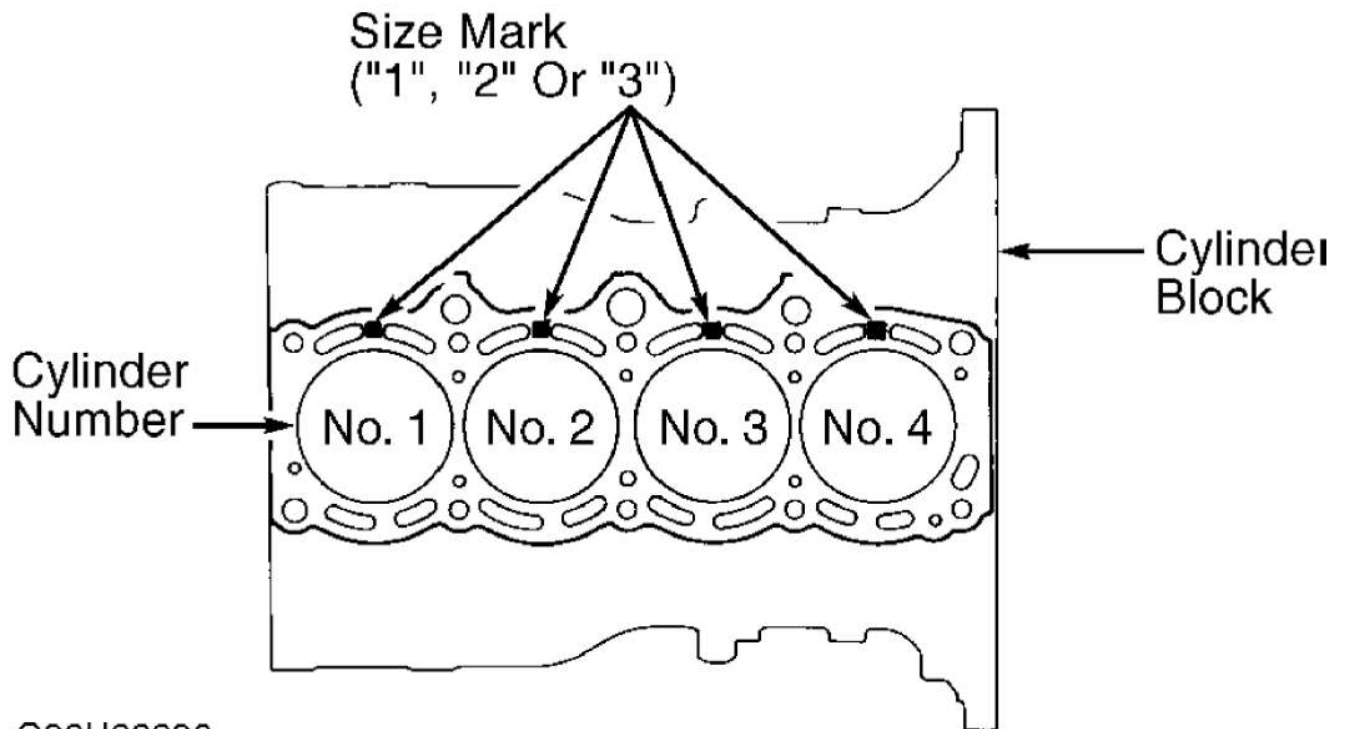
4) Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Determine piston clearance.

5) Replace piston or bore cylinder block for oversize pistons if clearance is not within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Pistons are available in .20" (.50 mm) oversize. If replacing piston, ensure replacement piston contains same size mark as size mark on cylinder block.



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Fig. 54: Identifying Piston Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

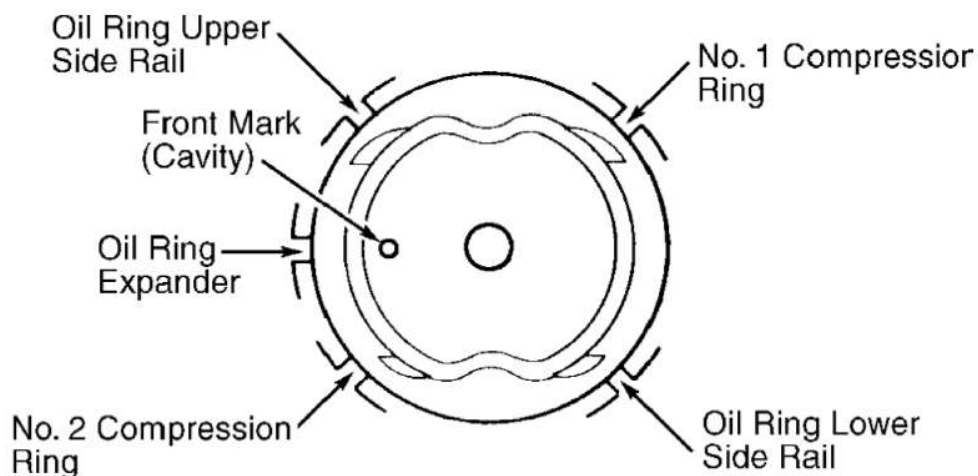


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Fig. 55: Identifying Cylinder Bore Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Piston Rings

Ensure piston ring end gap and side clearance are within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Position piston ring with ring end gaps in proper areas with identification mark on piston ring toward top of piston. See Fig. 56.



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Fig. 56: Positioning Piston Rings
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Rod Bearings

- 1) Mark direction of connecting rod cap and cylinder number

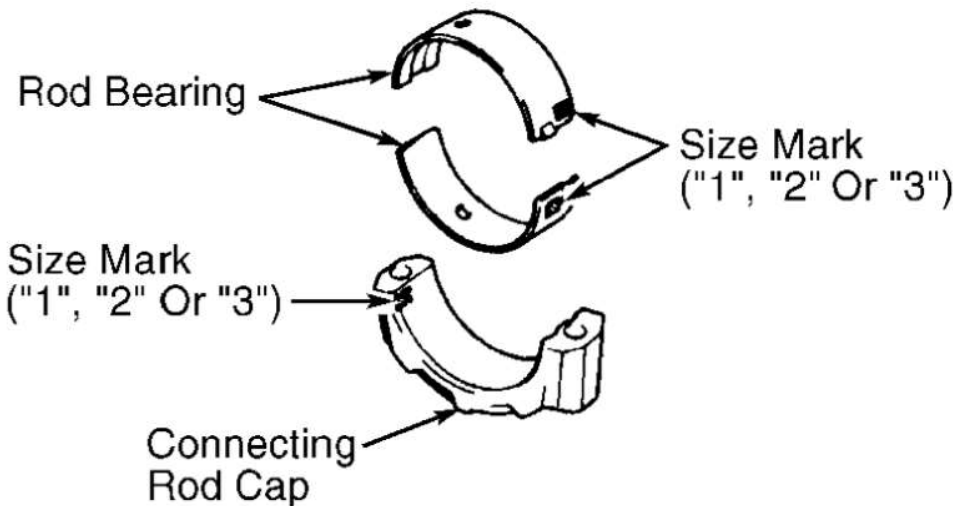
before disassembly. Connecting rod must be installed so front mark (protrusion) at center of connecting rod is toward timing belt end of engine. Front mark (protrusion) on connecting rod cap must face toward timing belt end of engine. See Fig. 53.

2) Connecting rod cap and rod bearing are stamped with size mark ("1", "2" or "3"). See Fig. 57. Ensure size marks on connecting rod cap and rod bearing are same.

- NOTE: If replacing rod bearing, ensure size mark on replacement rod bearing is same as size mark on original rod bearing.
- 3) Rod bearing thickness is determined by the size mark. See ROD BEARING SPECIFICATIONS table.
- 4) Check that nut easily rotates on bolt of connecting rod. If nut fails to rotate easily, use caliper to measure connecting rod bolt outside diameter at .59" (15.0 mm) from end of bolt, just above threads. Replace connecting rod bolt and nut if outside diameter is less than .2992" (7.600 mm).
- 5) Install connecting rod cap with front mark (protrusion) toward timing belt end of engine. See Fig. 53. Coat threads of connecting rod bolts and nut-to-connecting rod cap surface with engine oil before tightening nuts to specification. See TORQUE SPECIFICATIONS.
- 6) Ensure bearing oil clearance and connecting rod side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS and CONNECTING RODS tables under ENGINE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS TABLE

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



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Fig. 57: Identifying Connecting Rod Cap & Rod Bearing Size Marks
Courtesy of Toyota Motor Sales, U.S.A., Inc.

- Crankshaft & Main Bearings
- 1) Main bearing caps are numbered on top of cap for location

reference. No. 1 main bearing cap is at timing belt end of engine and No. 5 is at flywheel/drive plate end. Arrow on top of main bearing cap must point toward timing belt end of engine.

2) Remove main bearing cap bolts in sequence. See Fig. 58. Remove main bearing caps, crankshaft, thrust bearing and main bearings.

3) Cylinder block main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 59. Front size mark indicates No. 1 main bearing bore and rear size mark indicates No. 5 main bearing bore.

4) Crankshaft main bearing journal diameter is identified by main bearing journal size mark ("0", "1" or "2") located on crankshaft counterweight. See Fig. 59.

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

6) Main bearing size mark ("1", "2", "3", "4" or "5") is located on side of main bearing. See Fig. 59. If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.

7) If main bearing size mark cannot be obtained, add size marks on cylinder block and crankshaft to determine size mark of main bearing to be used. For example, if size mark on cylinder block is "2" and size mark on crankshaft is "1", use main bearing with size mark "3".

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

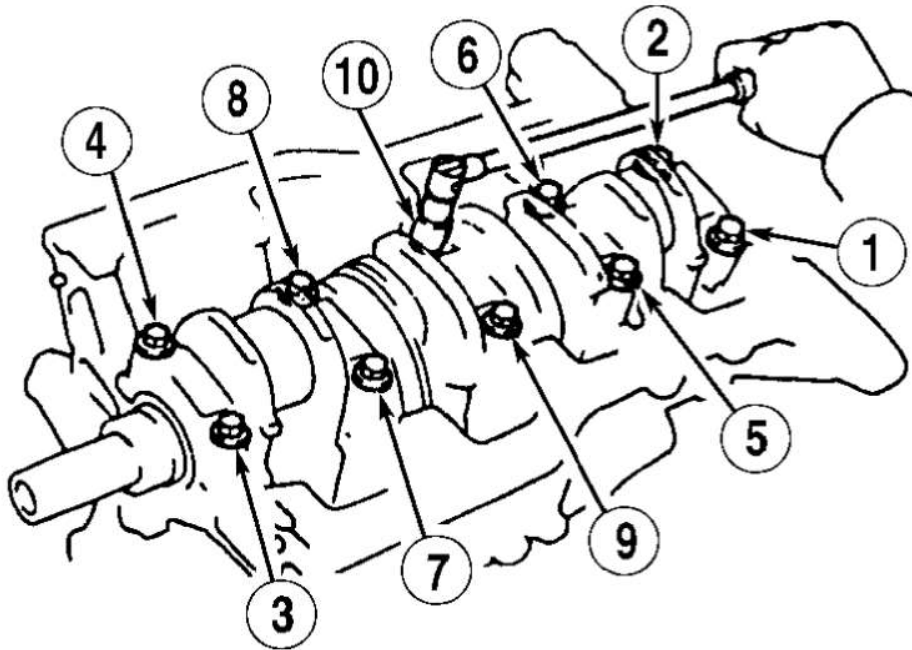
9) Ensure main bearings caps are properly installed in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel/drive plate end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.

10) Coat main bearing cap bolt threads and seat area of bolt with engine oil before installing. Install and tighten main bearing cap bolts to specification in sequence. See Fig. 58. See TORQUE SPECIFICATIONS.

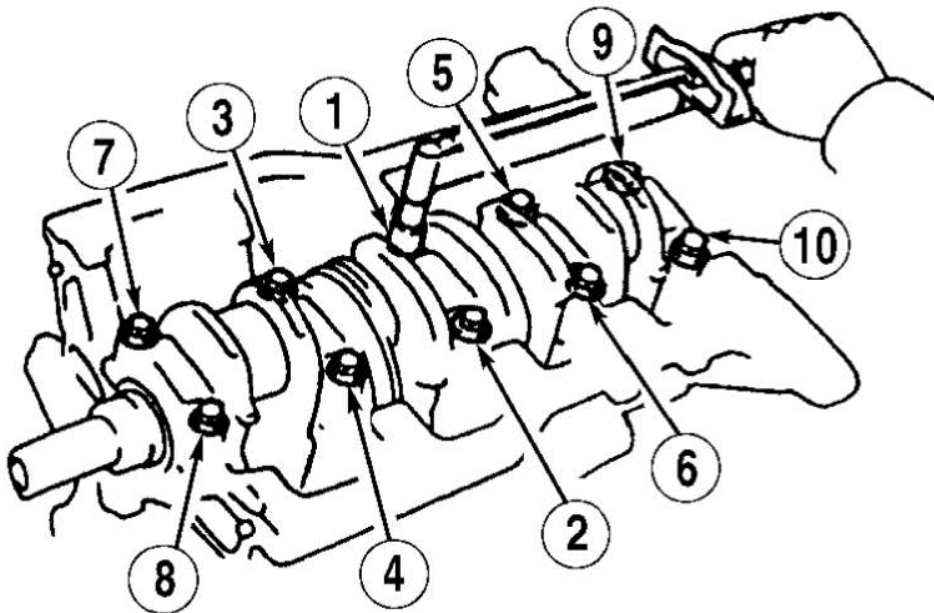
11) Ensure crankshaft main bearing oil clearance and crankshaft end play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Replace thrust bearing if crankshaft end play is not within specification.

MAIN BEARING SPECIFICATIONS TABLE

Bearing Size Mark		Bearing Thickness In. (mm)	
No. 3 Main Bearing			
"1"		.07842-.07854	(1.9920-1.9950)
"2"		.07854-.07866	(1.9950-1.9980)
"3"		.07866-.07877	(1.9980-2.0010)
"4"		.07877-.07889	(2.0010-2.0040)
"5"		.07889-.07901	(2.0040-2.0070)
All Others			
"1"		.07862-.07874	(1.9970-2.0000)
"2"		.07874-.07885	(2.0000-2.0030)
"3"		.07885-.07897	(2.0030-2.0060)
"4"		.07897-.07909	(2.0060-2.0090)
"5"		.07909-.07921	(2.0090-2.0120)



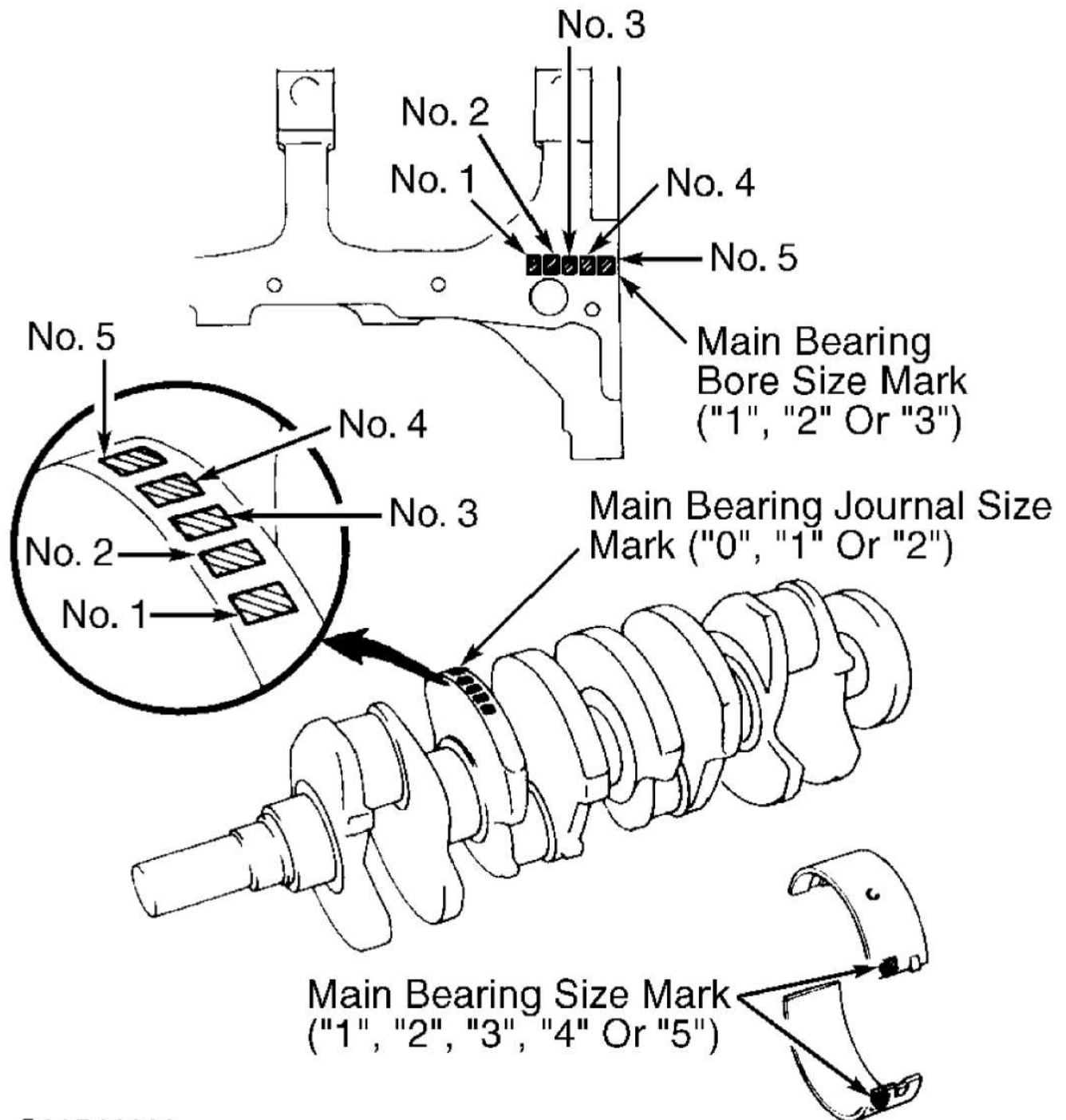
REMOVAL



INSTALLATION

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Fig. 58: Main Bearing Cap Bolt Removal & Installation Sequence
 Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 59: Identifying Cylinder Block, Crankshaft & Main Bearing Size Marks

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

Thrust Bearing

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

specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

- 1) Inspect cylinder block deck surface warpage. Replace cylinder block if deck warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.
- 2) Different cylinder bore sizes are used and are identified by size mark ("1", "2" or "3") on cylinder block deck surface. See Fig. 55. Measure cylinder bore diameter at .39" (9.9 mm) from top and bottom of cylinder bore and at middle of cylinder bore.
- 3) Ensure cylinder bore diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. Bore cylinder block for oversize pistons if clearance is not within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Pistons are available in .20" (.50 mm) oversize.
- 4) Install main bearing caps in numerical sequence with No. 1 at timing belt end and No. 5 at flywheel/drive plate end of engine. Ensure arrow on top of main bearing cap points toward timing belt end of engine.
- 5) Install and tighten main bearing cap bolts to specification in sequence. See Fig. 58. See TORQUE SPECIFICATIONS.
- 6) Ensure main bearing bore inside diameter is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

NOTE: Main bearing bore inside diameter is identified by main bearing bore size mark ("1", "2" or "3") stamped on cylinder block. See Fig. 59.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

The crankshaft-driven oil pump provides lubrication. See Fig. 60. Oil cooler may be installed between oil filter and cylinder block.

NOTE: Oil cooler is used on all Camry and MR2 models and may be optional on Celica models.

Crankcase Capacity

See CRANKCASE CAPACITIES table.

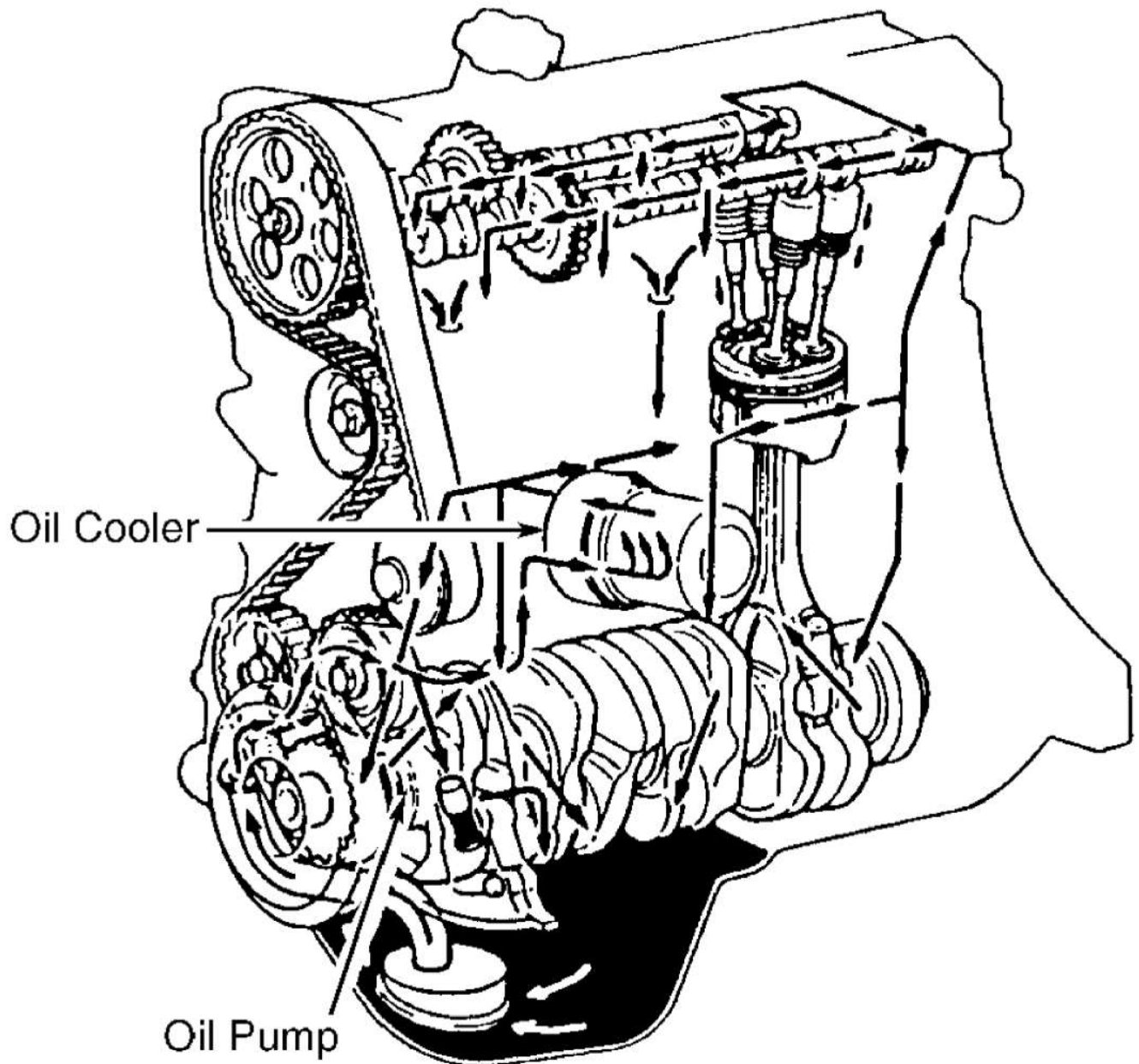
CRANKCASE CAPACITIES (1) TABLE

Application	Qts. (L)
Camry	3.8 (3.6)
Celica	
With Oil Cooler	4.4 (4.2)
Without Oil Cooler	4.3 (4.1)
MR2	4.4 (4.2)

(1) - Capacity listed is with oil filter.

Oil Pressure

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



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Fig. 60: Cross-Sectional View Of Engine Oil Circuit
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

OIL PUMP

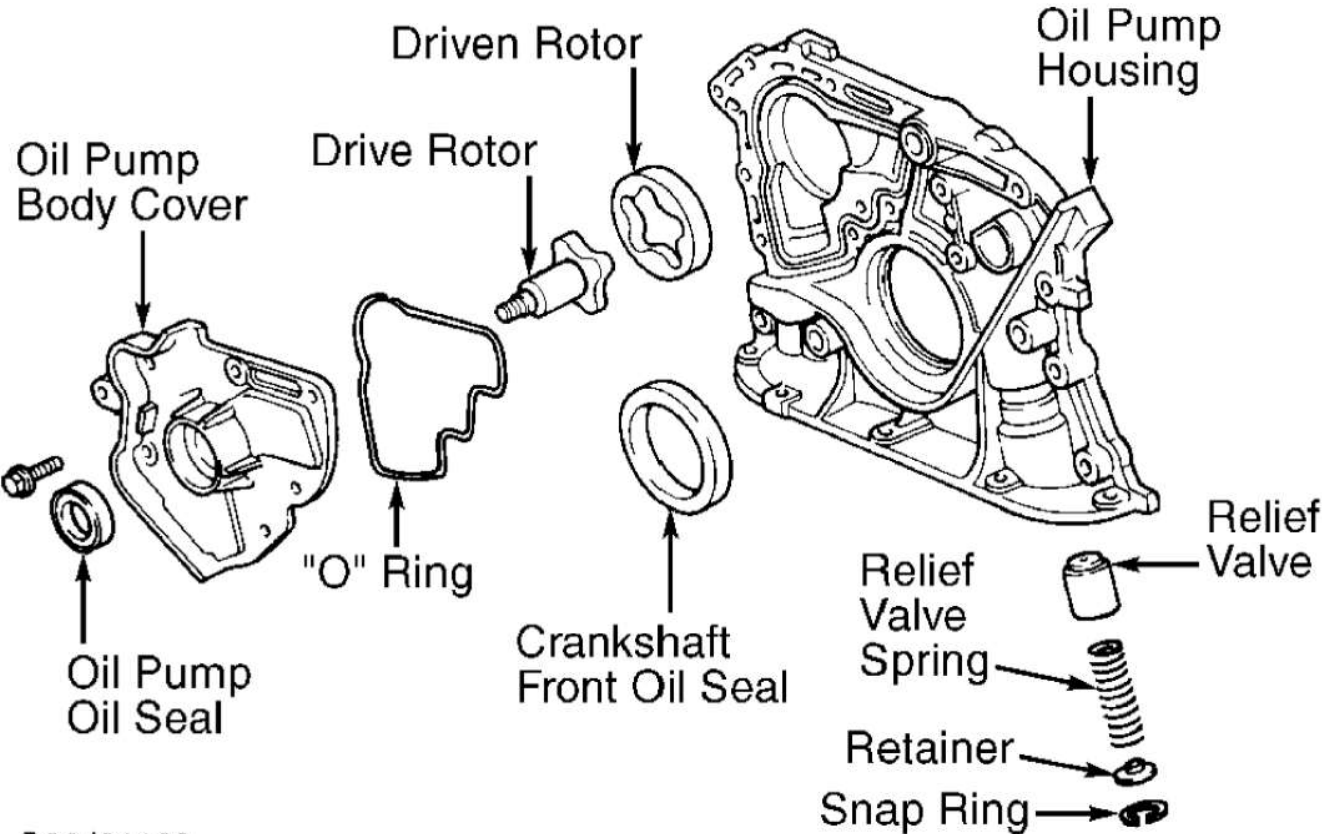
Removal & Disassembly

1) Remove timing belt, No. 2 idler pulley, crankshaft sprocket and oil pump sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION.

2) Remove oil pump pick-up tube and gasket. Remove oil pump bolts. Using soft-faced hammer, tap oil pump housing from cylinder

block.

3) To disassemble, remove oil pump body cover bolts, oil pump body cover and "O" ring. Disassemble oil pump components. See Fig. 61. Remove oil pump oil seal and crankshaft front seal from oil pump housing (if necessary).



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Fig. 61: Exploded View Of Oil Pump
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspection

1) Inspect components for damage. Ensure relief valve slides freely in bore of oil pump housing. Install rotors in oil pump housing.

2) Using feeler gauge, measure driven rotor-to-oil pump housing clearance. Replace rotor assembly or oil pump housing if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

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

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Driven Rotor-To-Oil Pump Housing Clearance	
Standard	.0039-.0063 (.099-.160)
Wear Limit	.0079 (.200)
Rotor Tip Clearance	
Standard	.0016-.0063 (.040-.160)
Wear Limit	.0079 (.200)

Reassembly & Installation

- 1) To reassemble, reverse disassembly procedure. Ensure reference marks (dot area) on rotors face toward outside of oil pump body (away from cylinder block surface).
- 2) Using Seal Installer (SST 09226-10010), install NEW crankshaft front seal (if removed) until seal surface is even with oil pump housing. Coat seal lip with grease.
- 3) Using Oil Seal Installer (SST 09627-30010) and Handle (SST 09631-00020), install NEW oil pump oil seal (if removed) until seal surface is even with oil pump body cover. Coat seal lip with grease.
- 4) Install oil pump body cover using NEW "O" ring. Install and tighten oil pump body cover bolts to specification. See TORQUE SPECIFICATIONS.
- 5) Install oil pump on cylinder block using NEW gasket. Ensure the 2 longest bolts are located in the lowest outside holes nearest to oil pan flange. Tighten bolts to specification. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

OIL COOLER

Removal

- 1) Oil cooler is mounted between oil filter and cylinder block. See Fig. 60. Disconnect negative battery cable. Drain cooling system.
- 2) Remove lower engine cover. It may be necessary to remove alternator. Remove front exhaust pipe. Remove exhaust manifold with catalytic converter for access to oil cooler (if necessary).
- 3) Remove oil filter. Disconnect coolant hoses from oil cooler. Remove relief valve and plate washer from center of oil cooler housing. Remove oil cooler-to-cylinder block nut. Remove oil cooler and "O" rings.

Inspection

- 1) Inspect oil cooler for damage or restriction. Replace oil cooler if damage or restricted.
- 2) Using wooden stick push inward on check valve located in center of relief valve. Push inward from threaded end (opposite oil filter threads) of relief valve. Replace relief valve if check valve fails to move.

Installation

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

CAUTION: On MR2, air must be bled from cooling system to prevent engine damage. See COOLING SYSTEM BLEEDING under REMOVAL & INSTALLATION.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS - CAMRY

TORQUE SPECIFICATIONS TABLE - CAMRY

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	20 (27)
Alternator Bracket Bolt	31 (42)
Axle Shaft Bearing Bolt	24 (33)
Axle Shaft Nut	217 (294)
Balance Shaft Assembly-To-Cylinder Block Bolt (1) ..	36 (49)
Ball Joint-To-Lower Control Arm Bolt/Nut	94 (127)
Camshaft Bearing Cap Bolt (2)	14 (19)
Camshaft Sprocket Bolt	40 (54)
Catalytic Converter Brace Bolt/Nut	31 (42)
Catalytic Converter-To-Exhaust Manifold Bolt/Nut ..	21 (29)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Bolt	11 (15)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (3)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Control Rod Bracket-To-Right (Timing Belt Side)	
Engine Mount Bracket Bolt (4)	47 (64)
Control Rod-To-Strut Tower Bolt	47 (64)
Front (Exhaust Manifold Side) Engine	
Mount-To-Cylinder Block Bolt	57 (77)
Front (Exhaust Manifold Side) Engine	
Mount-To-Frame Bolt	59 (80)
Rear (Intake Manifold Side) Engine	
Mount-To-Cylinder Block Bolt	57 (77)
Rear (Intake Manifold Side) Engine	
Mount Insulator-To-Frame Nut	49 (66)
Right (Timing Belt Side) Engine Mount	
Bracket-To-Cylinder Block Bolt	38 (52)
Transaxle Mount-To-Transaxle Bolt	47 (64)
EGR Valve	
Bolt	(5)
Union Nut	43 (58)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Fuel Line-To-Fuel Filter Union Bolt	21 (29)
Fuel Pulsation Damper	25 (34)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	
12-mm Bolt	16 (22)
14-mm Bolt	31 (42)
Knock Sensor	27 (37)
Main Bearing Cap Bolt (6)	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Relief Valve-To-Cylinder Block	58 (79)
Oil Pump Sprocket Nut	21 (29)
Power Steering Pump Bracket Bolt	32 (43)
Power Steering Pump-To-Bracket Bolt	32 (43)
Spark Plug	13 (18)
Stabilizer Bar Link-To-Lower Control Arm Nut	47 (64)
Stiffener Bracket Bolt	27 (37)
Throttle Body Bolt	14 (19)

Tie Rod Nut	36 (49)
Valve Cover Nut	17 (23)
Wheel Lug Nut	76 (103)

INCH Lbs. (N.m)

Coolant By-Pass Pipe-To-Water Pump Nut	78 (8.8)
Fuel Delivery Pipe Bolt	115 (13.0)
No. 3 Timing Belt Cover Bolt	69 (7.8)
Oil Cooler-To-Cylinder Block Nut	69 (7.8)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	82 (9.3)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Water Pump-To-Cylinder Block Bolt (7)	82 (9.3)
Water Pump-To-Water Pump Cover Bolt	82 (9.3)

- (1) - Tighten bolts to specification in sequence.
See Fig. 43.
- (2) - Tighten bolts to specification in sequence.
See Figs. 35 and 36.
- (3) - Tighten bolts to specification in sequence.
See Fig. 25.
- (4) - Tighten bolts to specification in sequence.
See Fig. 15.
- (5) - Tighten bolt 115 INCH lbs. (13.0 N.m).
- (6) - Tighten bolts to specification in sequence.
See Fig. 58.
- (7) - Tighten bolts to specification in sequence.
See Fig. 46.

TORQUE SPECIFICATIONS - CELICA

TORQUE SPECIFICATIONS TABLE - CELICA

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	20 (27)
Alternator Bracket Bolt	31 (42)
Axle Shaft Nut	166 (226)
Ball Joint-To-Lower Control Arm Bolt/Nut	94 (127)
Brake Caliper Bolt	79 (107)
Camshaft Bearing Cap Bolt (1)	14 (19)
Camshaft Sprocket Bolt	40 (54)
Catalytic Converter Brace Bolt/Nut	31 (42)
Catalytic Converter-To-Exhaust Manifold Bolt/Nut ..	21 (29)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Bolt	11 (15)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (2)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Front (Exhaust Manifold Side) Engine Mount	
Bracket-To-Cylinder Block Bolt	57 (77)
Front (Exhaust Manifold Side) Engine Mount	
Through-Bolt	64 (87)

Left (Transaxle Side) Engine Mount	
Bracket-To-Transaxle Bolt	38 (52)
Left (Transaxle Side) Engine Mount	
Support Brace Bolt/Nut	15 (20)
Left (Transaxle Side)	
Engine Mount-To-Bracket Bolt	47 (64)
Left (Transaxle Side)	
Engine Mount Through-Bolt	64 (87)
Rear (Intake Manifold Side) Engine Mount	
Bracket-To-Cylinder Block Bolt	57 (77)
Rear (Intake Manifold Side) Engine Mount	
Through-Bolt	64 (87)
Right (Timing Belt Side) Engine Mount	
Bracket-To-Cylinder Block Bolt	38 (52)
Right (Timing Belt Side) Engine Mount	
Support Brace Bolt/Nut	54 (73)
Right (Timing Belt Side)	
Engine Mount-To-Body Nut	38 (52)
Right (Timing Belt Side)	
Engine Mount Through-Bolt	64 (87)
Engine Mount Crossmember-To-Body Bolt	38 (52)
Engine Mount-To-Engine Crossmember Bolt	54 (73)
EGR Valve	
Bolt	(3)
Union Nut	43 (58)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Fuel Line-To-Fuel Filter Union Bolt	21 (29)
Fuel Pulsation Damper	25 (34)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	
12-mm Bolt	16 (22)
14-mm Bolt	31 (42)
Knock Sensor	27 (37)
Main Bearing Cap Bolt (4)	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Relief Valve-To-Cylinder Block	58 (79)
Oil Pump Sprocket Nut	21 (29)
Power Steering Pump Bracket Bolt	32 (43)
Power Steering Pump-To-Bracket Bolt	
Adjusting Bolt	29 (39)
All Others	32 (43)
Right Axle Shaft Bearing Retainer Bracket Bolt ...	47 (64)
Spark Plug	13 (18)
Stiffener Bracket Bolt	27 (37)
Strut Tower-To-Firewall Brace Bolt/Nut	
Bolt	15 (20)
Nut	47 (64)
Suspension Crossmember Bolt	112 (152)
Throttle Body Bolt	14 (19)
Tie Rod Nut	36 (49)
Valve Cover Nut	17 (23)
Wheel Lug Nut	76 (103)

INCH Lbs. (N.m)

Coolant By-Pass Pipe-To-Water Pump Nut	82 (9.3)
Fuel Delivery Pipe Bolt	115 (13.0)
No. 3 Timing Belt Cover Bolt	69 (7.8)
Oil Cooler-To-Cylinder Block Nut	69 (7.8)

Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Pick-Up Tube Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	78 (8.8)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Water Pump-To-Cylinder Block Bolt (5)	78 (8.8)
Water Pump-To-Water Pump Cover Bolt	78 (8.8)

- (1) - Tighten bolts to specification in sequence.
See Figs. 35 and 36.
- (2) - Tighten bolts to specification in sequence.
See Fig. 25.
- (3) - Tighten bolt 115 INCH lbs. (13.0 N.m).
- (4) - Tighten bolts to specification in sequence.
See Fig. 58.
- (5) - Tighten bolts to specification in sequence.
See Fig. 46.

TORQUE SPECIFICATIONS - MR2

TORQUE SPECIFICATIONS TABLE - MR2

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt	18 (24)
Axle Shaft Nut	166 (226)
Ball Joint-To-Axle Carrier Bolt	83 (113)
Brake Caliper Bolt	43 (58)
Camshaft Bearing Cap Bolt (1)	14 (19)
Camshaft Sprocket Bolt	40 (54)
Catalytic Converter Brace Bolt/Nut	31 (42)
Catalytic Converter-To-Exhaust Manifold Bolt/Nut ..	21 (29)
Connecting Rod Nut	
Step 1	18 (24)
Step 2	Additional 90 Degrees
Coolant Outlet Bolt	11 (15)
Crankshaft Pulley Bolt	80 (109)
Cylinder Head Bolt (2)	
Step 1	36 (49)
Step 2	Additional 90 Degrees
EGR Valve	
Nut	(3)
Union Nut	43 (58)
Engine Hanger Bolt	18 (24)
Engine Mounts & Brackets	
Control Rod & Bracket-To-Body Bolt	26 (35)
Control Rod & Bracket-To-Engine Mount Bolt	27 (37)
Control Rod Support Bolt	
Engine Mount Side	54 (73)
Transaxle Side	18 (24)
Engine Mount Bracket-To-Transaxle Case Bolt	38 (52)
Front (Exhaust Manifold Side) Engine	
Mount-To-Body Bolt	54 (73)
Front (Exhaust Manifold Side) Engine Mount	
Through-Bolt	64 (87)
Left (Flywheel Side) Engine Mount Through-Bolt ..	58 (79)
Left (Flywheel Side) Engine Mount-To-Bracket Bolt ...	(4)
Rear (Intake Manifold Side) Engine Mount	
Bracket-To-Body Bolt	57 (77)
Rear (Intake Manifold Side)	
Engine Mount-To-Body Bolt	47 (64)

Rear (Intake Manifold Side)	
Engine Mount Through-Bolt	64 (87)
Right (Timing Belt Side) Engine Mount Support	
Bracket Bolt/Nut	54 (73)
Right (Timing Belt Side) Engine Mount	
Bracket-To-Cylinder Block Bolt	45 (61)
Right (Timing Belt Side) Engine Mount-To-Mounting	
Bracket Nut	38 (52)
Right (Timing Belt Side) Engine Mount	
Through-Bolt	58 (79)
Exhaust Manifold Nut	36 (49)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	65 (88)
Idle Pulley Bracket-To-Cylinder Block Bolt	
12-mm Head	20 (27)
14-mm Head	27 (37)
Fuel Pulsation Damper	25 (34)
Intake Manifold Bolt/Nut	14 (19)
Intake Manifold Brace Bolt	
12-mm Bolt	16 (22)
14-mm Bolt	31 (42)
Knock Sensor	27 (37)
Main Bearing Cap Bolt (5)	43 (58)
No. 1 Idler Pulley Bolt	31 (42)
No. 2 Idler Pulley Bolt	31 (42)
Oil Cooler Relief Valve-To-Cylinder Block	58 (79)
Oil Pump Sprocket Nut	21 (29)
Spark Plug	13 (18)
Stabilizer Link Nut	36 (49)
Stiffener Bracket Bolt	27 (37)
Throttle Body Bolt	14 (19)
Suspension Rod-To-Axle Carrier Bolt/Nut	76 (103)
Transaxle Control Cable Bracket Bolt	57 (77)
Valve Cover Nut	17 (23)
Wheel Lug Nut	76 (103)

INCH Lbs. (N.m)

ABS Speed Sensor Bolt	65 (7.4)
Clutch Release Cylinder-To-Transaxle Bolt	106 (12.0)
Coolant By-Pass Pipe-To-Water Pump Nut	82 (9.3)
Fuel Delivery Pipe Bolt	115 (13.0)
No. 3 Timing Belt Cover Bolt	69 (7.8)
Oil Cooler-To-Cylinder Block Nut	69 (7.8)
Oil Pan Bolt/Nut	48 (5.4)
Oil Pump Body Cover Bolt	78 (8.8)
Oil Pump Pick-Up Tube Bolt/Nut	48 (5.4)
Oil Pump-To-Cylinder Block Bolt	78 (8.8)
Rear Plate-To-Cylinder Block Bolt	82 (9.3)
Rear Seal Housing Bolt	82 (9.3)
Water Pump-To-Cylinder Block Bolt	(6)
Water Pump-To-Water Pump Cover Bolt	78 (8.8)

- (1) - Tighten bolts to specification in sequence.
See Figs. 35 and 36.
- (2) - Tighten bolts to specification in sequence.
See Fig. 25.
- (3) - Tighten nut 115 INCH lbs. (13.0 N.m).
- (4) - Tighten bolts to specification. See Fig. 23.
- (5) - Tighten bolts to specification in sequence.
See Fig. 58.
- (6) - Tighten bolts to 78 (8.8) INCH lbs. in sequence.

See Fig. 46.

On models without A/C, tighten the large bracket bolt to 20 ft. lbs. (27 N.m).

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS TABLE

Application	Specification
Displacement	134 Cu. In. (2.2L)
Bore	3.43" (87.1 mm)
Stroke	3.58" (90.9 mm)
Compression Ratio	9.5:1
Fuel System	PFI
Horsepower @ RPM	135 @ 5400
Torque Ft. Lbs. @ RPM	145 @ 4400

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.0118 (.300)
Maximum Runout	.0024 (.060)
Main Bearings	
Journal Diameter (1)	
Size Mark "0"	2.1653-2.1655 (54.998-55.003)
Size Mark "1"	2.1651-2.1653 (54.993-54.998)
Size Mark "2"	2.1649-2.1651 (54.988-54.993)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft	
No. 3 Journal	
Standard	.0010-.0017 (.025-.044)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0006-.0013 (.015-.034)
Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft	
No. 3 Journal	
Standard	.0011-.0026 (.027-.067)
Wear Limit	.0031 (.080)
All Other Journals	
Standard	.0007-.0023 (.019-.059)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	2.0466-2.0472 (51.985-52.000)
Journal Out-Of-Round	.0008 (.020)
Journal Taper	.0008 (.020)
Oil Clearance	
Standard Crankshaft	
Standard	.0009-.0022 (.024-.055)

Wear Limit	.0031 (.080)
.010" (.25 mm) Undersize Crankshaft	
Standard	.0009-.0027 (.023-.069)
Wear Limit	.0031 (.080)

(1) - Main bearing journal diameter is determined by size mark stamped on crankshaft. See Fig. 59.

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS SPECIFICATIONS TABLE

Application	In. (mm)
Bore Diameter	
Pin Bore	.8663-.8668 (22.005-22.017)
Maximum Bend	.002 Per 3.94 (.05 Per 100.1)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	.0063-.0123 (.160-.312)
Wear Limit	.0138 (.350)

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE

Application	In. (mm)
Pistons	
Clearance	
Standard	.0055-.0063 (.140-.160)
Wear Limit	.0071 (.180)
Diameter (1)	
Size Mark "1"	3.4193-3.4197 (86.850-86.860)
Size Mark "2"	3.4197-3.4201 (86.860-86.870)
Size Mark "3"	3.4201-3.4205 (86.870-86.880)
Pins	
Diameter	.8660-.8665 (21.997-22.009)
Piston Fit	(2)
Rod Fit	
Standard	.0002-.0004 (.005-.011)
Wear Limit	.0020 (.050)
Rings	
No. 1	
End Gap	
Standard	.0106-.0197 (.270-.500)
Wear Limit	.0433 (1.100)
Side Clearance	.0016-.0031 (.040-.080)
No. 2	
End Gap	
Standard	.0138-.0236 (.350-.600)
Wear Limit	.0472 (1.200)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0217 (.200-.550)
Wear Limit	.0453 (1.150)

(1) - Piston diameter is determined by size mark stamped on top of piston. See Fig. 54.

(2) - With piston temperature at 140°F (60°C), piston pin

should slide through piston with thumb pressure.

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK SPECIFICATIONS TABLE

Application	In. (mm)
Cylinder Bore (1)	
Size Mark "1"	3.4252-3.4256 (87.000-87.010)
Size Mark "2"	3.4256-3.4260 (87.010-87.020)
Size Mark "3"	3.4260-3.4264 (87.020-87.030)
Maximum Deck Warpage	.002 (.05)
Main Bearing Bore I.D. (2)	
Size Mark "1"	2.3326-2.3239 (59.020-59.026)
Size Mark "2"	2.3239-2.3241 (59.026-59.032)
Size Mark "3"	2.3241-2.3243 (59.032-59.038)
(1) - Cylinder bore diameter is determined by size mark on cylinder block deck surface. See Fig. 55. Maximum bore diameter is 3.4342" (87.230 mm).	
(2) - Main bearing bore I.D. is determined by main bearing bore size mark on cylinder block. See Fig. 59.	

VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS SPECIFICATIONS TABLE

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)
Minimum Refinish Length	3.823" (97.10 mm)
Stem Diameter	.2350-.2356" (5.970-5.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.020" (.50 mm)
Minimum Refinish Length	3.858" (98.00 mm)
Stem Diameter	.2348-.2354" (5.965-5.980 mm)
Valve Springs	
Free Length	1.6520-1.6531" (41.96-41.99 mm)
Out-Of-Square Limit	.079" (2.00 mm)
	Lbs. @ In. (kg @ mm)
Pressure	37-43 @ 1.366 (16.7-19.5 @ 34.70)

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD SPECIFICATIONS TABLE

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.002" (.05 mm)
Intake & Exhaust Manifold Surface	.003" (.08 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.039-.055" (.99-1.40 mm)

Exhaust Valve	
Seat Angle	45 °
Seat Width	.039-.055" (.99-1.40 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Camry	
Standard Valve Guide	.4331-.4342 (11.000-11.027)
Oversize Valve Guide	.4350-.4361 (11.050-11.077)
Celica & MR2	
Standard Valve Guide	.4325-.4335 (10.985-11.012)
Oversize Valve Guide	.4344-.4355 (11.035-11.062)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 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.	
Camry	
Standard Valve Guide	.4331-.4342 (11.000-11.027)
Oversize Valve Guide	.4350-.4361 (11.050-11.077)
Celica & MR2	
Standard Valve Guide	.4325-.4335 (10.985-11.012)
Oversize Valve Guide	.4344-.4355 (11.035-11.062)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Wear Limit	.0039" (.099 mm)

CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

Application	In. (mm)
End Play	
Intake Camshaft	
Standard	.0018-.0039 (.046-.099)
Wear Limit	.0047 (.120)
Exhaust Camshaft	
Standard	.0012-.0033 (.030-.085)
Wear Limit	.0039 (.099)
Gear Backlash	
Standard	.0008-.0079 (.020-.200)
Wear Limit	.0118 (.300)
Journal Diameter	1.0614-1.0620 (26.959-26.975)
Journal Runout	.0016 (.040)
Lobe Height	
Intake Camshaft	
Standard	1.6539-1.6579 (42.010-42.110)
Wear Limit	1.6496 (41.900)
Exhaust Camshaft	
Standard	1.5772-1.5811 (40.060-40.160)
Wear Limit	1.5728 (39.950)
Oil Clearance	
Standard	.0010-.0024 (.025-.062)
Wear Limit	.0039 (.099)

VALVE LIFTERS SPECIFICATIONS

VALVE LIFTERS SPECIFICATIONS TABLE

Application		In. (mm)
Bore Diameter	 1.2205-1.2213	(31.000-31.018)
Lifter Diameter	 1.2191-1.2195	(30.966-30.976)
Oil Clearance		
Standard	0009-.0020	(.024-.052)
Wear Limit	0028	(.070)