

## 2.0L 4-CYL & 2.0L 4-CYL TURBO - VIN [S]

1988 Toyota Celica

1988 TOYOTA ENGINES  
2.0L & 2.0L Turbo 4-Cylinder  
Celica

### \* PLEASE READ THIS FIRST \*

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

## ENGINE CODING

### ENGINE IDENTIFICATION

Engine serial number is stamped onto a machined pad, located on the rear of the engine block.

NOTE: Two non-turbo engines are available for Celica. See ENGINE IDENTIFICATION CODE TABLE this section.

#### ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code	VIN Code
Celica		
2.0L 4-Cylinder		
2WD Non-Turbo .....	3S-FE .....	S
2WD Non-Turbo .....	3S-GE .....	S
4WD Turbo .....	3S-GTE .....	S

## ENGINE R & I

NOTE: Remove engine and transaxle as a unit.

### REMOVAL 2WD NON-TURBO

1) Disconnect negative battery cable. Drain coolant. Remove hood and battery. Disconnect accelerator cable from throttle body. On automatic transaxle models, disconnect throttle cable with bracket from throttle body. On all models, disconnect and remove radiator. Remove cruise control actuator (if equipped).

2) Remove battery and radiator reservoir tank. Remove suspension muffler brace. Remove air cleaner assembly with airflow meter. Label and disconnect all necessary wiring from alternator, distributor, and coolant temperature sending unit. Disconnect igniter, heater hoses, fuel lines and speedometer.

3) Label and disconnect vacuum hoses attaching A/C unit and cruise control to distribution block (if equipped). On manual transaxle models, remove clutch release cylinder without disconnecting tubing. Disconnect transaxle control cable. On automatic transaxle models, disconnect transaxle control cable.

4) Remove A/C compressor and power steering pump and lay aside (if equipped). Raise and support vehicle. Remove undercovers. Remove lower crossmember. Disconnect both front drive shafts. Remove exhaust pipe.

5) Attach engine hoist to lift brackets on engine. Remove

engine and transaxle mounts from brackets. Remove left transaxle mount bracket. Lift engine/transaxle assembly out of vehicle.

## INSTALLATION

1) Using an engine hoist, slowly lower engine/transaxle assembly into engine compartment. Tilt transaxle down while lowering to clear neutral start switch, engine mount brackets and power steering gear housing.

2) Install engine mounts, brackets and crossmember. To complete installation, reverse removal procedure. Reconnect all wiring, fuel and vacuum hoses. Adjust drive belts. Fill radiator with coolant and engine/transaxle with oil. Start engine and check for leaks.

## REMOVAL 4WD TURBO

1) Disconnect negative battery cable. Drain coolant. Drain intercooler coolant. Remove hood and disconnect accelerator cable from throttle body. Remove radiator. Remove heater, fuel and intercooler hoses. Remove cruise control actuator (if equipped).

2) Remove air cleaner assembly with airflow meter. Remove clutch slave and hose without discharging fluid. Remove A/C compressor and lay aside (if equipped). Raise and support vehicle. Label and disconnect all necessary wiring, vacuum lines and control cables. Raise and support vehicle. Disconnect speedometer cable and transaxle control cable.

CAUTION: Disconnect 3 connectors from the Toyota Computer Control System (TCCS) computer. Remove 2 retaining screws from cowl panel and pull out TCCS connectors before removing engine.

3) Drain engine oil. Remove engine undercovers. Remove lower crossmember. Disconnect both front drive shafts. Remove rear drive shaft. Remove power steering pump and lay aside without disconnecting hoses. Remove front exhaust pipe. Remove engine lower mounting center member. Lower vehicle. Attach engine hoist to lift brackets on engine. Remove engine and transaxle mounts from brackets. Remove left transaxle mount bracket. Lift engine/transaxle assembly out of vehicle.

## INSTALLATION

1) Using an engine hoist, slowly lower engine/transaxle assembly into engine compartment. Tilt transaxle down while lowering to clear neutral start switch, engine mount brackets and power steering gear housing.

2) Install engine mounts, brackets and crossmember. To complete installation, reverse removal procedure. Reconnect all wiring, fuel and vacuum hoses. Adjust drive belts. Fill radiator and intercooler with coolant. Fill engine/transaxle with oil. Start engine and check for leaks.

## INTAKE & EXHAUST MANIFOLDS R & I

### REMOVAL

1) On turbocharged models, disconnect oxygen sensor. Remove intercooler, alternator duct and bracket. Remove heat shield. Remove heat insulator. Remove turbo outlet elbow and bracket. Remove turbocharger.

2) On all models, remove intake manifold mounting bolts and

intake manifold. Remove exhaust manifold mounting bolts, heat insulator and exhaust manifold.

## INSPECTION

1) On turbocharged models, inspect turbo impeller wheel rotation and axial play. Impeller wheel should turn smoothly and easily, if not replace turbo. Maximum axial endplay is .006" (.13 mm). Inspect turbo vacuum switching valve for proper operation.

2) On all models, inspect air intake chamber. Check intake and exhaust manifold gasket surfaces for nicks, warpage or damage. Intake and exhaust manifold warpage limit is .012" (.30 mm).

3) Air intake chamber warpage limit is .012" (.30 mm). If warpage is beyond specification, resurface or replace.

## INSTALLATION

Use new gaskets when installing intake and exhaust manifolds. To install, reverse removal procedure.

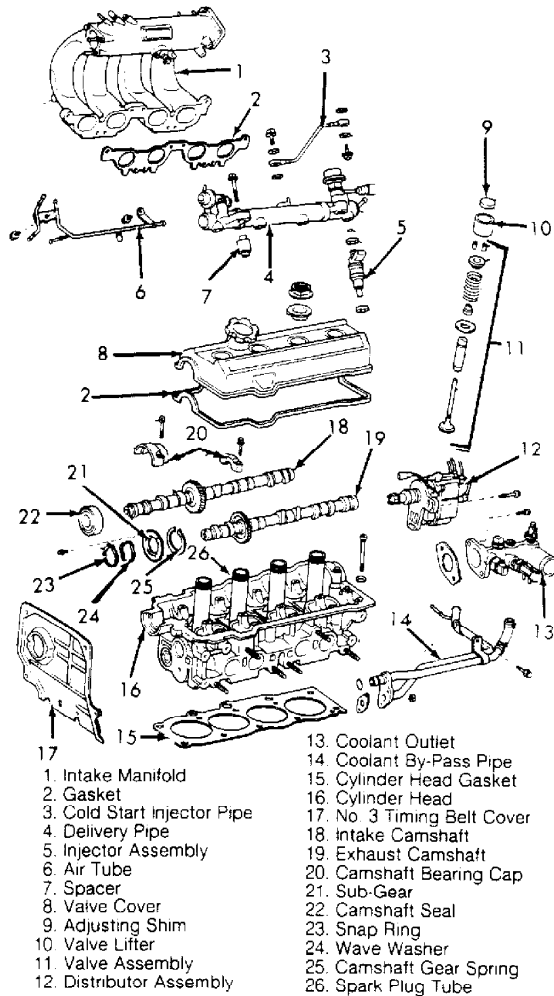


Fig. 1: Exploded View of 3S-FE Cylinder Head Components  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## CYLINDER HEAD R & I

## REMOVAL

1) Remove negative battery cable. Drain coolant. On turbo models, remove intercooler. Remove ignition coil connector and high tension wire. Remove upper brace from front suspension. On automatic transaxle vehicles, disconnect throttle cable and bracket from throttle body. Remove accelerator cable and bracket from throttle body and air intake chamber.

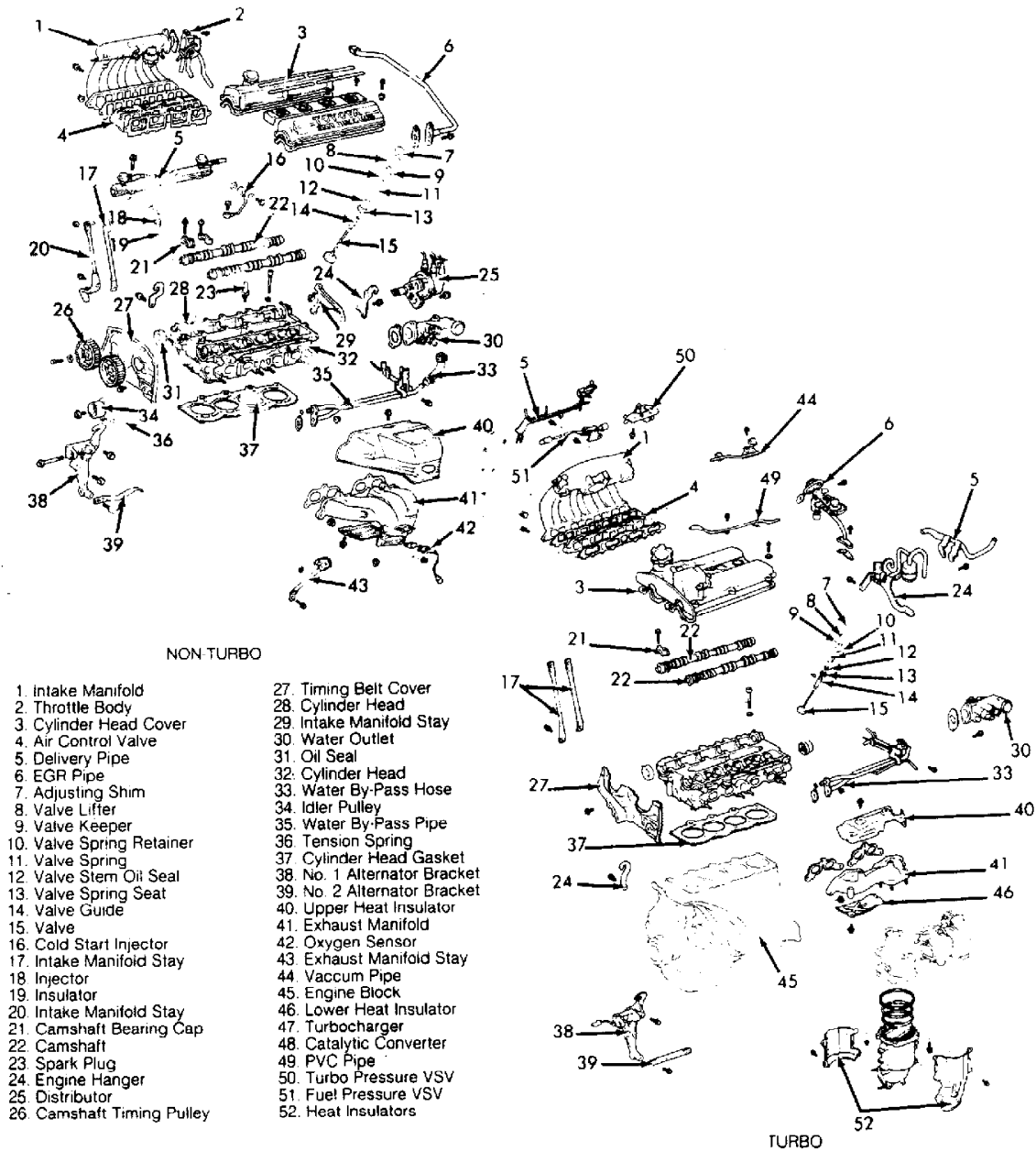


Fig. 2: Exploded View of 3S-GE & 3S-GTE Cylinder Head Components  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Remove radiator reservoir tank. Remove cruise control actuator and bracket (if equipped). Remove air cleaner assembly,

airflow meter and air cleaner hose. Remove alternator.

3) Remove oil pressure gauge, engine hangers and alternator upper bracket. Raise and support vehicle. Remove right-front wheel and cover from under right side of engine. Remove suspension lower crossmember.

4) On turbo models, remove catalytic converter. Remove alternator bracket and turbocharger. On non-turbo models, disconnect exhaust pipe from catalytic converter, remove oxygen sensor connector. Remove 6 bolts and manifold upper heat insulator. Remove 2 bolts and catalytic converter stay.

5) On all models, remove exhaust manifold and catalytic converter assembly. Disconnect oil, coolant and cold start injector switches. Remove distributor. Remove coolant temperature sender connector, cold start injector time switch connector, radiator upper hose, coolant hoses.

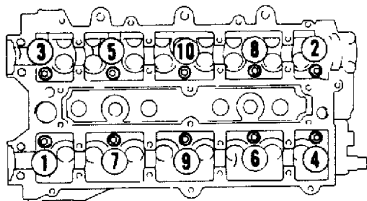
6) Remove emission control vacuum hoses and coolant outlet and gasket. Remove coolant by-pass pipe. Remove EGR valve and modulator. Remove throttle body and cold start injector tube.

7) Remove air intake chamber air hose, throttle body air hose, power steering pump air hoses and air tube. Remove 2 bolts and intake manifold stay. Remove vacuum sensing hose. Remove intake manifold and gasket. On 3S-GE engines, remove No. 1 and 3 intake manifold stays. Remove ground strap, 2 VSV connectors, and power steering hoses.

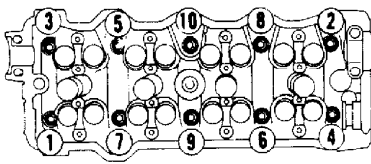
8) Remove delivery pipe and injectors, spark plugs and camshaft timing pulley. Remove No. 1 idler pulley and tension spring. On 3S-FE engines, remove 4 timing belt cover bolts. Support belt so meshing of crankshaft timing pulley and timing belt does not shift. Use care not to drop anything inside timing belt cover. Do not allow oil, coolant or dust to come in contact with timing belt.

9) Remove cylinder head cover nuts, grommets (if equipped), cover and gasket. Ensure grommets are arranged in correct order for reassembly reference. Remove camshafts as outlined under CAMSHAFT & TIMING BELT R & I in this article.

10) Loosen and remove cylinder head bolts gradually, in 3 stages. See Fig. 3. Failure to remove cylinder head bolts in proper order can cause severe head damage. Lift cylinder head from dowels on cylinder block and place on wooden work stand.



3S-GE



3S-FE

Fig. 3: Cylinder Head Bolt Removal Sequence  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## INSPECTION

On 3S-FE cylinder head, maximum warpage on block side of head is .002" (.05 mm). On exhaust manifold side of head, maximum warpage is .0031" (.08 mm). On 3S-GE and 3S-GTE cylinder heads, maximum warpage on intake manifold side of head is .008" (.20 mm). On exhaust manifold side of head, maximum warpage is .012" (.30 mm). If warpage is greater than specification, cylinder head must be replaced.

## INSTALLATION

Position new cylinder head gasket on cylinder block. Install cylinder head on gasket. Put a light coat of oil on threads and under heads of cylinder head bolts. Install and tighten cylinder head bolts in reverse order of removal sequence. See Fig. 3. To install remaining components, reverse removal procedure. To install camshafts, see CAMSHAFT & TIMING BELT R & I section.

## CAMSHAFT ENGINE FRONT COVERS R & I

### 3S-FE

Remove negative battery cable. Remove right front wheel. Remove lower right engine cover. Remove cruise control actuator and bracket. Remove drive belts, alternator and bracket. Raise engine enough to remove weight from right engine mount. Remove right engine mount bolt and insulator. Remove spark plugs. Remove No. 2 timing belt cover.

### 3S-GE & 3S-GTE

Remove negative battery cable. Remove right front wheel. Remove right engine under cover. Remove spark plugs. Remove No. 2 timing belt cover with gasket. To install cover, reverse removal procedure.

## TIMING BELT R & I

### REMOVAL (3S-FE)

1) Remove negative battery cable. Remove right front wheel. Remove lower right engine cover. Remove cruise control actuator and bracket. Remove drive belts, alternator and bracket. Raise engine enough to remove weight from right engine mount. Remove right engine mount bolt and insulator. Remove spark plugs. Remove No. 2 timing belt cover.

2) Turn crankshaft pulley and align its groove with timing mark "0" on No. 1 timing belt cover. Ensure hole of camshaft timing pulley is aligned with alignment mark of bearing cap.

3) Remove timing belt from camshaft timing pulley. If timing belt is to be reused, place reference marks on belt and pulley. Loosen No. 1 idler pulley mount bolt and pull pulley as far left as possible and tighten pulley. Remove timing belt from camshaft timing pulley.

4) Using a Drive Shaft Holder (09278-54012) to hold camshaft pulley, remove bolt, plate washer and pulley from camshaft. Using a Crankshaft Pulley Holder (09213-54014) to hold crankshaft pulley, remove pulley mount bolt from crankshaft. Remove pulley.

5) Remove 4 bolts, No. 1 timing belt cover and gasket. Remove timing belt and belt guide. If timing belt is to be reused, place reference marks on belt and pulley. Remove No. 1 idler pulley and tension spring. Remove No. 2 idler pulley, crankshaft timing pulley and oil pump pulley.

## REMOVAL (3S-GE & 3S-GTE)

1) Remove negative battery cable. Remove right front wheel, lower engine cover, and radiator reservoir tank. Remove cruise control actuator with bracket (if equipped). Position power steering fluid reservoir tank out of way. Remove alternator drive belt, alternator and bracket. See Fig. 4.

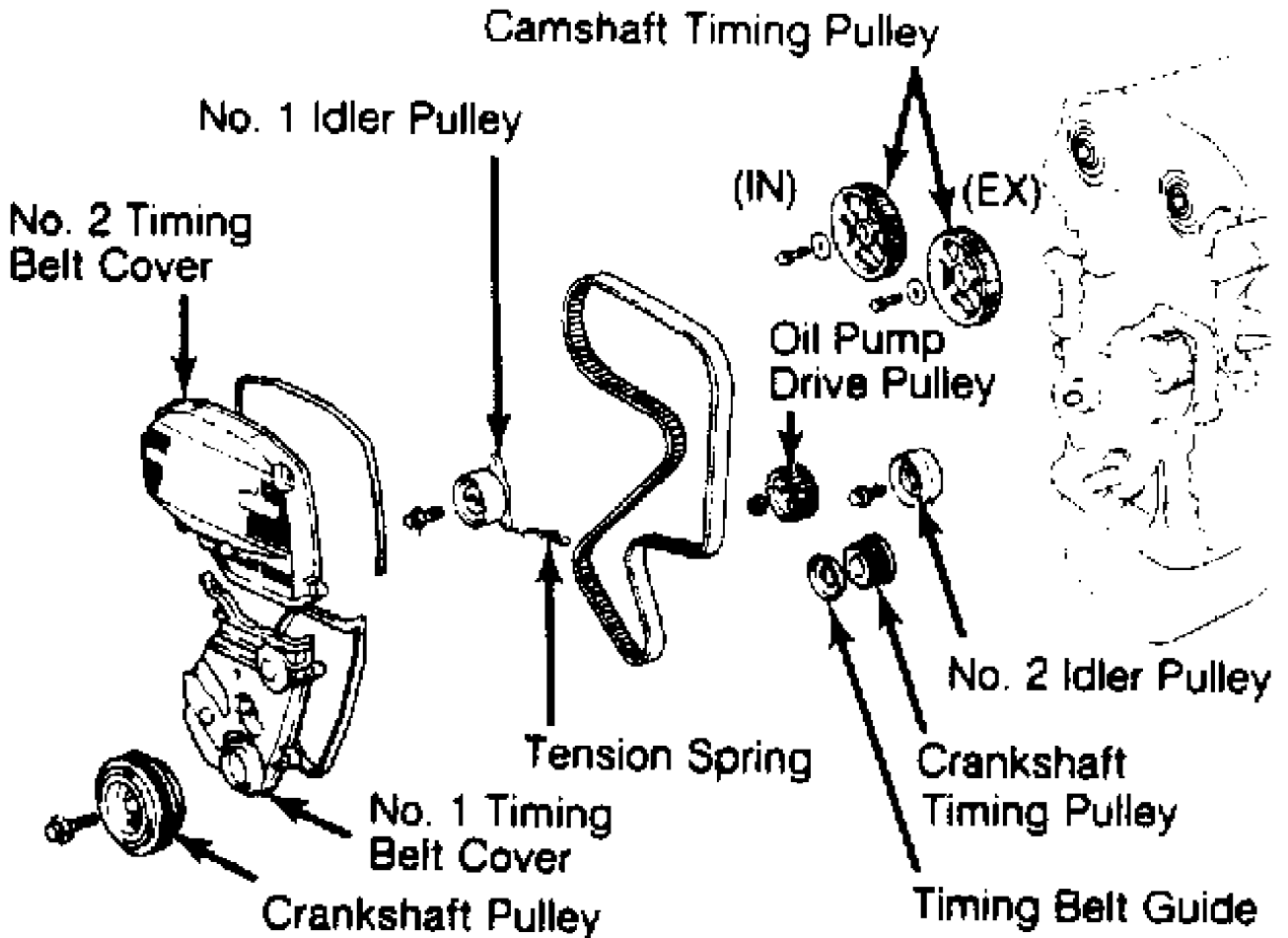


Fig. 4: Exploded View of 3S-GE & 3S-GTE Timing Belt Components  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

2) Remove power steering pump drive belt. Raise engine slightly. Remove right engine mounting insulator and bracket. Remove cylinder head covers with gaskets. Remove spark plugs. Remove No. 2 timing belt cover with gasket.

3) Turn crankshaft pulley and align groove with "0" mark on No. 1 timing belt cover. Ensure marks on camshaft timing pulleys and No. 3 timing belt are aligned. If marks are not aligned, turn crankshaft pulley one complete revolution.

4) Remove timing belt from camshaft timing pulleys. If old belt is to be reused, place reference marks for installation reference. Loosen No. 1 idler pulley bolt and move left as far as possible. Temporarily tighten set bolt and then relieve timing belt tension. Remove belt from camshaft timing pulley.

5) Support belt so meshing of crankshaft timing pulley and timing belt will not shift. Hold camshaft with wrench and remove pulley set bolts. Remove camshaft pulleys and pins. Using Crankshaft

Pulley Holder (SST 09213-14010) to hold crankshaft pulley, remove pulley bolt. Using Puller (SST 09213-31021), remove crankshaft pulley.

6) Remove 6 bolts, No. 1 timing belt cover and gasket. Remove timing belt guide and timing belt. If reusing old belt, mark location and rotation for reinstallation reference. Remove No. 1 idler pulley and tension spring. Remove No. 2 idler pulley, crankshaft timing pulley and oil pump pulley.

## INSPECTION

1) Check timing belt teeth for cracks or damage. If tooth damage is found, ensure camshaft, coolant pump or oil pump are not locked. If wear or cracks on flat belt face are found, check for nicks on one side of idler pulley lock.

2) If wear or damage to only one side of belt is found, check belt guide and alignment of each pulley and sprocket. If noticeable wear is found on belt teeth, check timing cover gasket for damage and proper installation. Ensure there is no foreign material on sprocket teeth.

3) Check idler pulleys for smooth rotation. Replace if roughness or noise is found. Inspect tension spring free length, installed tension and length. See TENSION SPRING SPECIFICATIONS table.

TENSION SPRING SPECIFICATIONS TABLE

Application	In. (mm)
Free Length	
3S-FE .....	1.815 (46.1)
3S-GE & 3S-GTE .....	1.724 (43.8)
Installed Length	
3S-FE .....	1.988 (50.5)
3S-GE & 3S-GTE .....	2.043 (51.9)
Lbs. (kg)	
Installed Tension	
3S-GE & 3S-GTE .....	16.6 (7.54)
3S-FE .....	13.2-15.4 (6.0-7.0)

## INSTALLATION (3S-FE)

1) Align cutouts of oil pump pulley and shaft, and install pulley. Install and tighten nut to 21 ft. lbs. (28 N.m). Align crankshaft pulley set key with key groove of pulley. Install and tighten bolt to 31 ft. lbs. (42 N.m).

2) Install No. 2 idler pulley and tighten bolt to 31 ft. lbs. (42 N.m). Ensure pulley is clean and rotates smoothly. Temporarily install No. 1 idler pulley and tension spring. Pry pulley left as far as possible. Temporarily install timing belt. Ensure marks made at disassembly are aligned.

CAUTION: Timing belt should not be installed on a warm engine.

3) Install timing belt guide, ensuring cup side faces outward. Install No. 1 timing belt cover. Align crankshaft pulley set key with key groove of pulley and install. Tighten bolt to 80 ft. lbs. (108 N.m). Align camshaft knock pin with pulley knock pin groove and install. Install plate washer and tighten bolt to 40 ft. lbs. (54 N.m).

4) Turn crankshaft pulley and align its groove with "0" timing mark on No. 1 timing belt cover. Turn camshaft and align hole of camshaft timing pulley with alignment mark on bearing cap. Ensure



marks made at disassembly are aligned and install timing belt.

5) Turn crankshaft pulley clockwise 2 turns from TDC to TDC. Tighten No. 1 idler pulley mount bolt to 31 ft. lbs. (42 N.m). Ensure belt tension is present as indicated. See Fig. 5. To complete installation, reverse removal procedure.

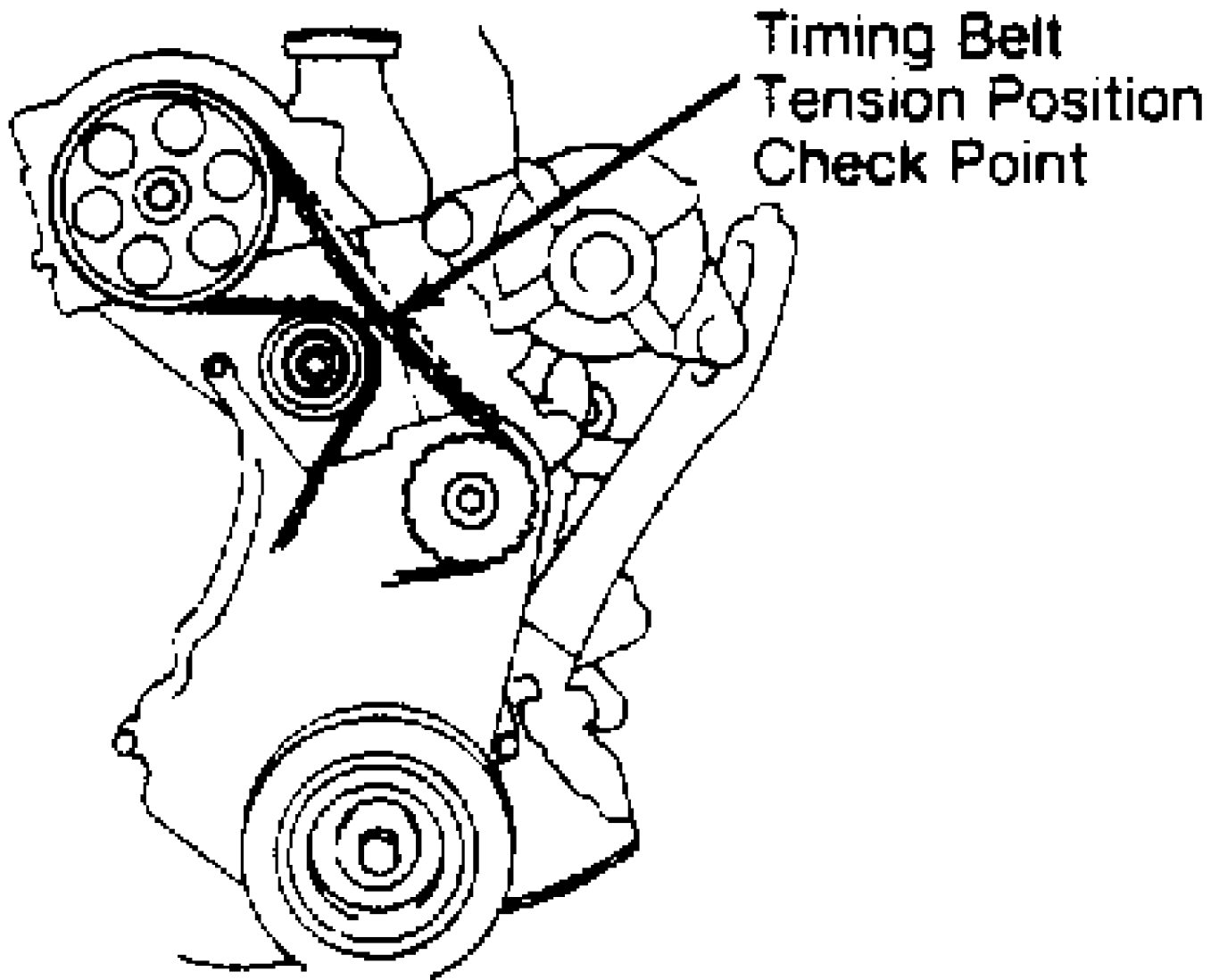
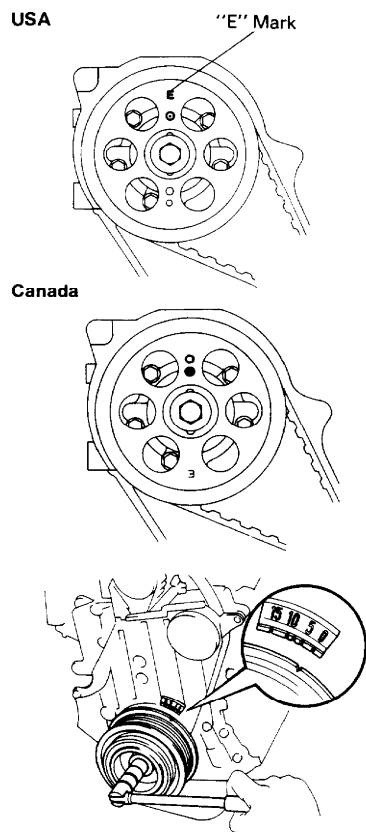


Fig. 5: Checking Timing Belt Tension  
Courtesy of Toyota Motor Sales, U.S.A., Inc.



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Fig. 6: Installing Engine Timing Belt and Sprockets

### INSTALLATION (3S-GE)

1) Using Wrench (SST 09616-30011), hold oil pump pulley and tighten nut. Install timing pulley over crankshaft key. Install and tighten No. 2 idler pulley. Install timing belt idler pulley and tension spring. Pry timing belt idler pulley left as far as possible and temporarily tighten.

CAUTION: Ensure no oil or coolant is present on idler pulley.

2) Temporarily install timing belt. Engine must not be warm. If old timing belt was reused, align reference marks made during removal. Install timing belt on crankshaft, oil pump, water pump, and No. 2 idler pulley. Install timing belt guide with cup side facing outward.

3) Install No. 1 timing belt cover gasket and belt cover. Use Crankshaft Pulley Holder (SST 09213-14010), to hold crankshaft pulley. Install and tighten pulley bolt. Ensure crankshaft pulley groove aligns with "0" mark on No. 1 timing cover. If "0" mark is not aligned, turn crankshaft pulley and align its groove with "0" mark on No. 1 timing belt cover.

NOTE: On 3S-GE engines, there are 2 types of camshafts available: one with 2 holes on timing pulley contact surface and one with 5 holes on timing pulley contact surface. All replacement camshafts have 5 holes.

4) To align 2-hole type camshafts on 3S-GE engines, use a wrench and turn camshafts so camshaft knock pin aligns with mark on

No. 3 timing belt cover. See Fig. 7. On 5-hole type camshafts, use a wrench and align camshaft knock pin and No. 1 bearing cap mark. See Fig. 8.

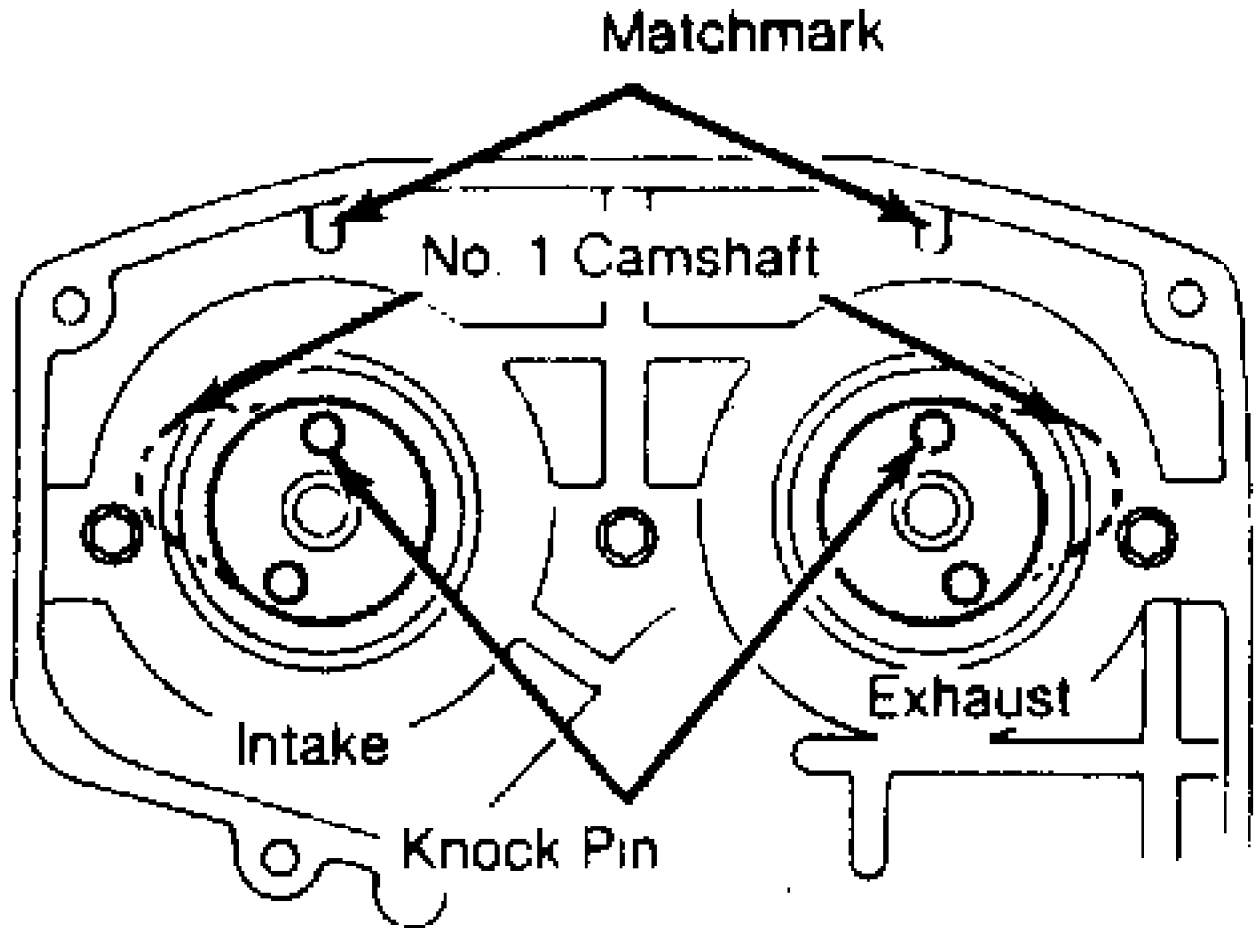


Fig. 7: 3S-GE Engine Two-Hole Type Camshaft Alignment Marks  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

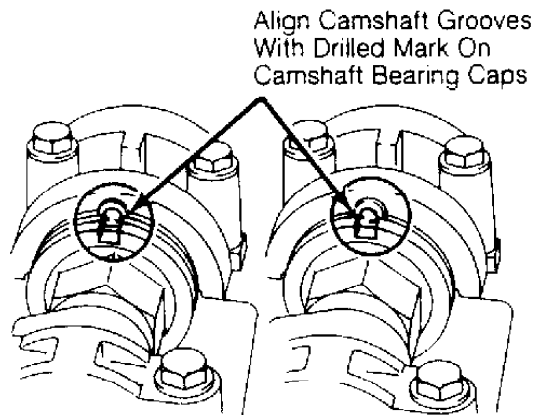


Fig. 8: 3S-GE Engine Five-Hole Type Camshaft Alignment Marks  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

NOTE: On 3S-GE engines, there are 2 types of camshaft timing pulleys available: one with 5 holes on the camshaft contact

surface and one with one hole on the camshaft surface. All replacement pulleys have 5 holes.

5) On both engines, install timing belt on pulleys. If reusing old belt, align marks made during removal. Be sure "S" mark on timing pulley faces outward. Align timing pulley mark with No. 3 timing belt cover mark. Install timing pulleys with belt. Match camshaft knock pin with camshaft timing pulley hole. See Fig. 9. Install knock pin.

One Hole Type

Matchmark

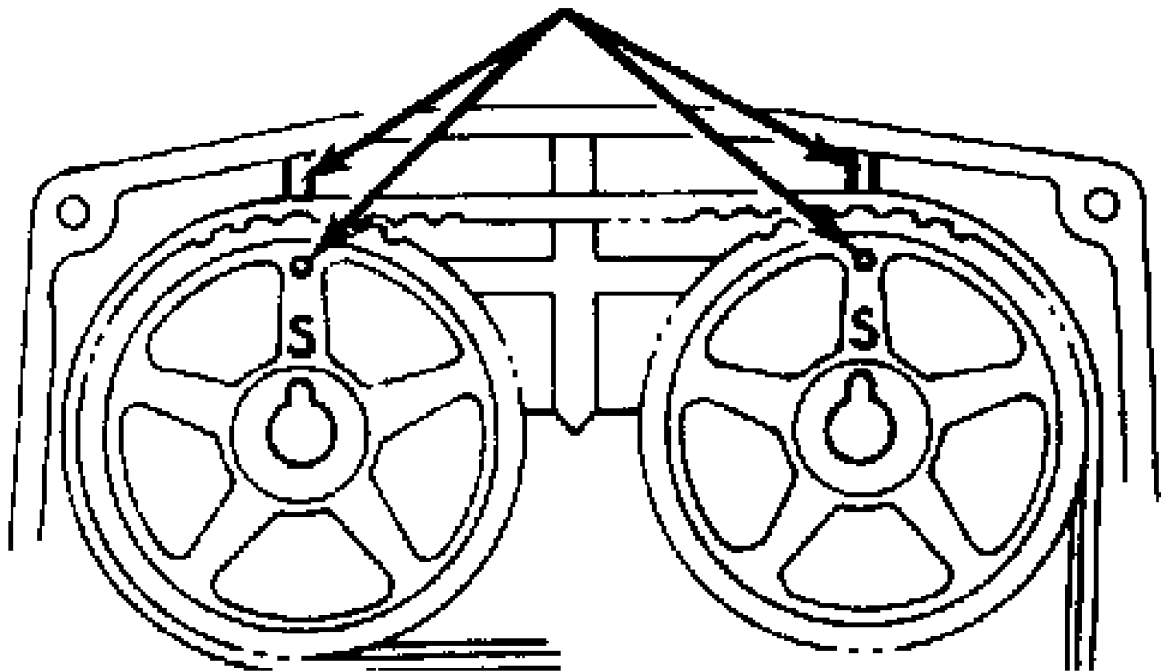


Fig. 9: One-Hole Type Camshaft Timing Pulley Alignment Marks  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) On 3S-GE engines with 5-hole type camshafts, install knock pin into whichever camshaft timing pulley and camshaft holes are aligned. See Fig. 10. If holes are not aligned, turn camshaft. On both engines, hold camshaft with wrench and tighten pulley bolts to specification. Loosen No. 1 idler pulley set bolt and stretch timing belt. Use care not to loosen set bolt further than point where idler returns.

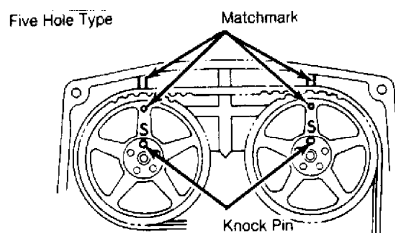


Fig. 10: Five-Hole Type Camshaft Timing Pulley Alignment Marks  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

7) Turn crankshaft pulley clockwise 2 revolutions from TDC to TDC. Tighten No. 1 idler pulley set bolt to 31 ft. lbs. (43 N.m).

Ensure belt has tension between crankshaft timing pulley and camshaft timing pulley on intake side. Check valve timing.

8) Install No. 2 timing belt cover, spark plugs, and cylinder head covers. Install right engine mounting insulator and bracket. Tighten bolts to specification. Lower engine and install power steering pump drive belt, alternator bracket, alternator and drive belt. Adjust drive belt tension. To complete installation, reverse removal procedure.

## CAMSHAFT & CAMSHAFT HOUSING R & I

**CAUTION:** Because camshaft thrust clearances are very small, camshafts must be held perfectly level while removing or installing. Failure to do so may result in cylinder and/or camshaft damage.

### REMOVAL (3S-FE)

1) Remove cylinder head cover and timing belts. Set knock pin of intake camshaft at 10-45 degrees BTDC of camshaft angle. See Fig. 11. This position will allow the camshaft to be lifted evenly by the valve lifters pushing the No. 2 and No. 4 cylinder cam lobes.

2) Secure exhaust camshaft sub-gear to main gear with a 6 X 1.0 X 18 mm service bolt. See Fig. 12. When removing camshaft, ensure torsional spring force of sub-gear has been eliminated by installation of service bolt.

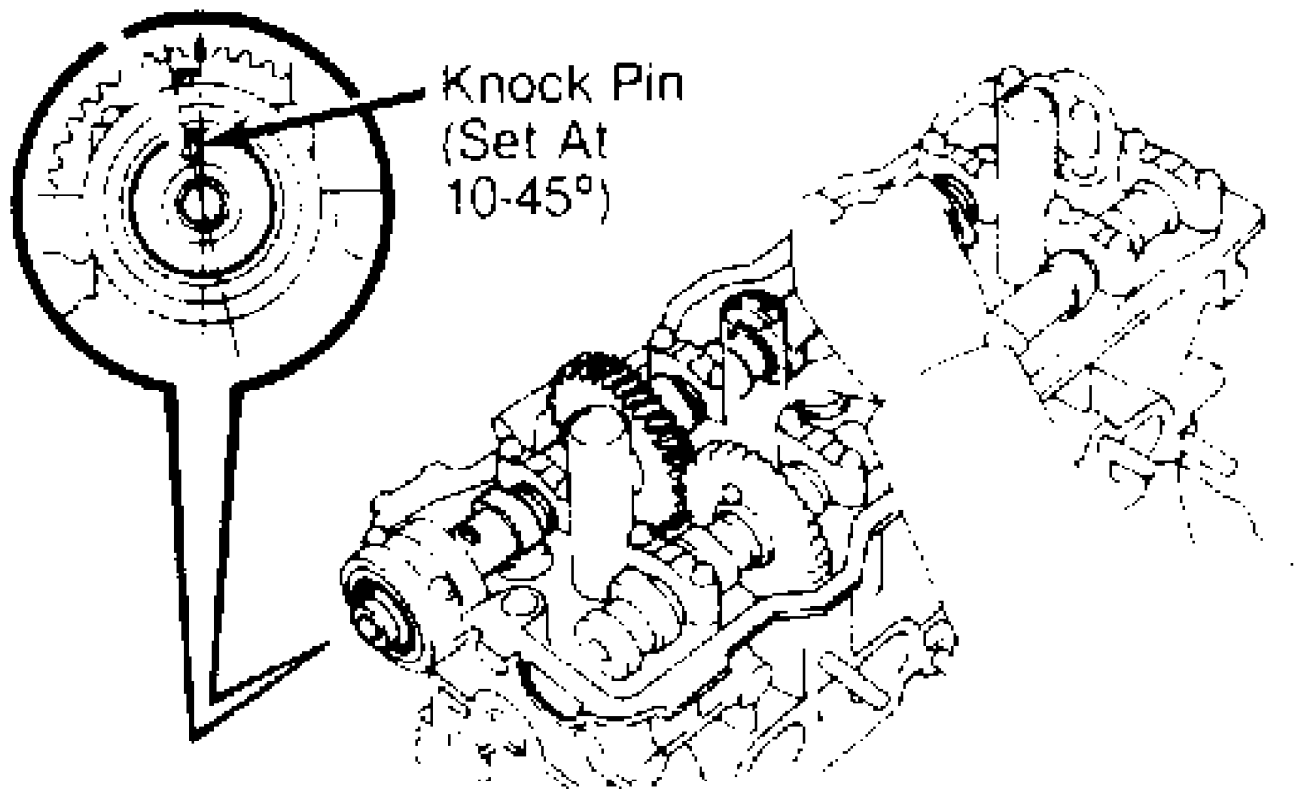


Fig. 11: Setting Camshaft Knock Pin  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

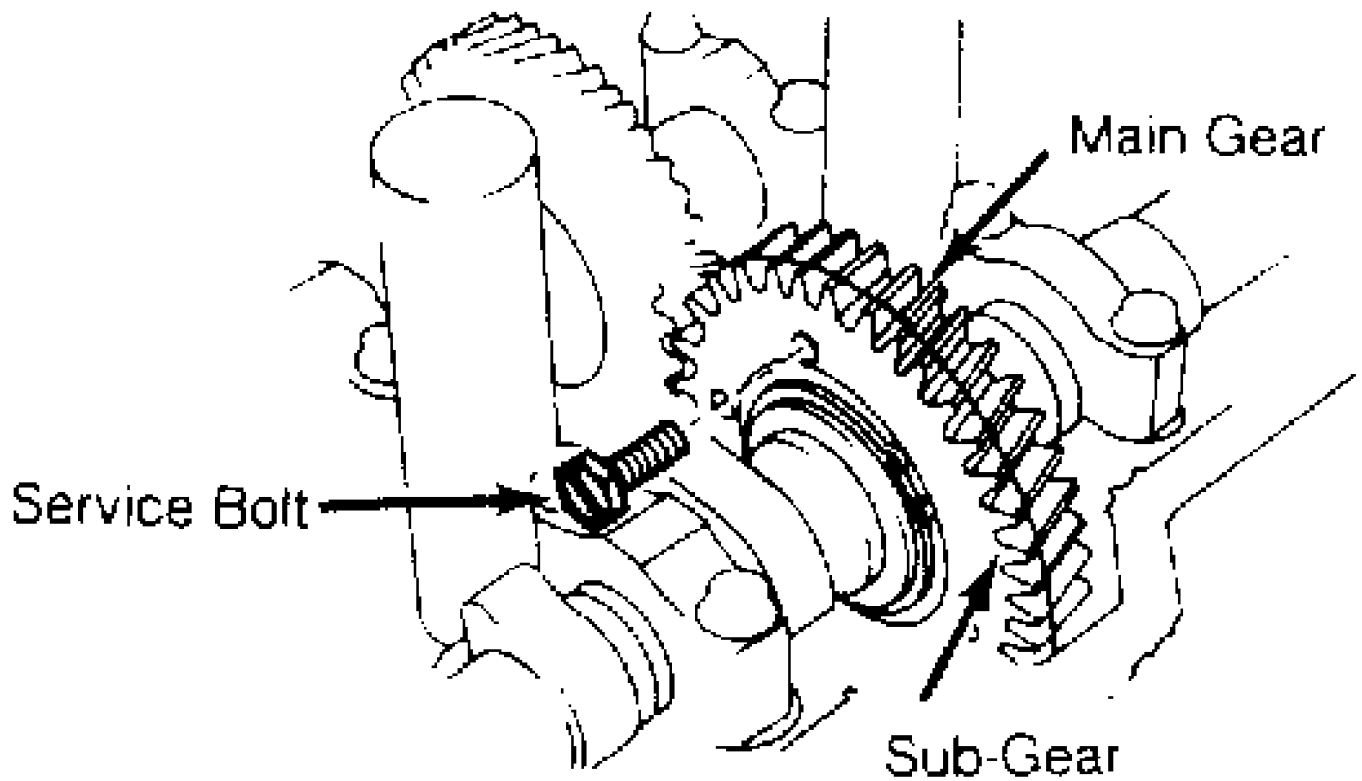


Fig. 12: Securing Exhaust Camshaft Sub-Gear  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

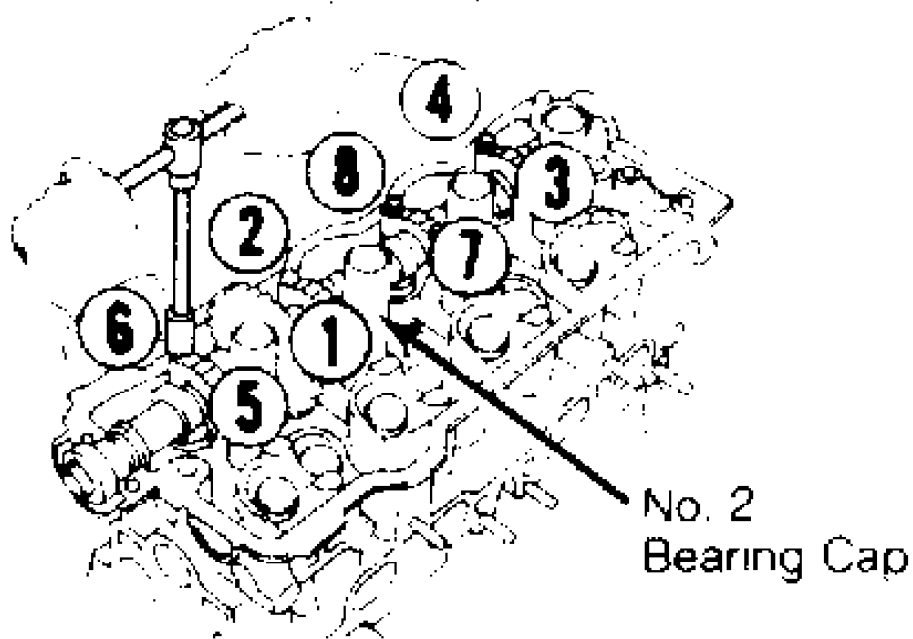


Fig. 13: Bearing Cap Bolt Numbers  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Remove camshaft rear bearing cap. Loosen and remove, in sequence, bearing cap bolts No. 3 to 8. See Fig. 13. Do not remove No.

3 bearing cap bolts at this time.

4) Remove No. 1, 2 and 4 bearing cap. Alternately loosen and remove No. 3 bearing cap bolts. As these bolts are loosened, ensure camshaft is lifted out straight and level.

5) If camshaft is not being lifted out straight and level, tighten bearing cap bolts No. 9 and 10, and reverse entire camshaft removal procedure. Reset knock pin of intake camshaft at 10-45 degrees BTDC. Remove No. 3 bearing cap and exhaust camshaft.

**CAUTION:** Never pry or force camshaft in any way. Serious damage to camshaft and/or cylinder head could occur.

6) To remove intake camshaft, set knock pin at 80-115 degrees BTDC of camshaft angle. This angle will allow No. 1 and 3 cylinder cam lobes of intake camshaft to be evenly pushed up by their valve lifters. Remove front bearing cap bolts No. 1 and 2. Remove front bearing cap and oil seal.

**CAUTION:** If front bearing cap cannot be removed by hand, do not attempt to force. Leave as is without bolts.

7) Uniformly loosen, in sequence, bearing cap bolts No. 3 to 8. Do not remove No. 2 bearing cap bolts at this time. Remove No. 1, 3 and 4 bearing caps. Alternately loosen and remove No. 2 bearing cap bolts. As bolts are loosened, ensure camshaft is lifted out straight and level.

8) If camshaft is not lifted straight and level, retighten No. 2 bearing cap bolts. Reposition knock pin of intake camshaft at 80-115 degrees BTDC and repeat entire camshaft removal procedure. Remove No. 2 bearing cap and camshaft.

**CAUTION:** Never pry or force camshaft in any way. Serious camshaft or cylinder head damage can occur.

### REMOVAL (3S-GE & 3S-GTE)

1) With cylinder head covers removed, remove spark plugs, No. 1 engine hanger, power steering oil reservoir tank and camshaft timing pulleys. Remove No. 1 idler pulley and tension spring. Remove No. 3 timing belt cover.

2) Loosen camshaft bearing cap bolts in sequence. See Fig. 14. Remove camshaft bearing caps, oil seals and camshafts.

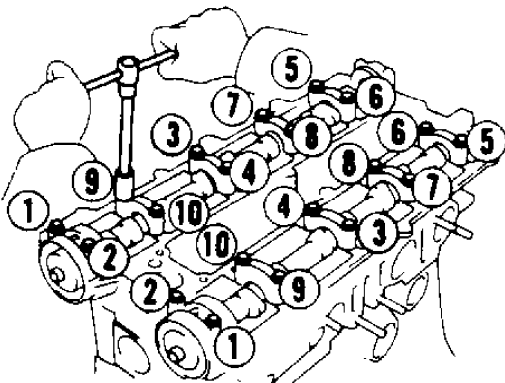


Fig. 14: Camshaft Bearing Cap Bolt Removal Sequence  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

### INSPECTION (3S-FE)

Check camshafts for proper specifications. See 3S-FE CAMSHAFT SPECIFICATIONS table.

### 3S-FE CAMSHAFT SPECIFICATIONS TABLE

Application	In. (mm)
<b>Gear Backlash</b>	
Standard	.008-.0079 (.203-.200)
Maximum	.188 (.30)
<b>Gear Spring End</b>	
Free Distance	.886-.902 (22.5-22.9)
Journal Diameter	1.0614-1.0620 (26.959-26.975)
<b>Journal Oil Clearance (1)</b>	
Standard	.025-.062 (.0010-.0024)
Maximum	.0039 (.10)
<b>Lobe Height</b>	
Standard	
Intake	1.3744-1.3783 (34.910-35.010)
Exhaust	1.4000-1.4039 (35.560-35.660)
Maximum	
Intake	1.3701 (34.80)
Exhaust	1.3957 (35.45)
Runout	.0016 (.04)
<b>Thrust Clearance</b>	
Standard	
Intake	.0018-.0039 (.045-.100)
Exhaust	.0012-.0033 (.030-.085)
Maximum	
Intake	.0047 (.12)
Exhaust	.0039 (.10)

(1) - Measure using Plastigage method.

### INSPECTION (3S-GE & 3S-GTE)

Check camshafts for proper specifications. See 3S-GE & 3S-GTE CAMSHAFT SPECIFICATIONS table.

### 3S-GE & 3S-GTE CAMSHAFT SPECIFICATIONS TABLE

Application	In. (mm)
<b>Bearing-to-Journal Clearance</b>	
Standard	.0010-.0024 (.025-.062)
Maximum	.003 (.08)
Journal Diameter	1.0614-1.0620 (26.959-26.975)
<b>Lobe Height</b>	
3S-GE	
Standard	1.3980-1.4020 (35.51-35.61)
Minimum	1.3937 (35.40)
3S-GTE	
Standard	1.3961-1.4000 (35.46-35.56)
Minimum	1.3937 (35.40)
Maximum Runout	.0024 (.062)
<b>Thrust Clearance</b>	
3S-GE	.0047-.0114 (.120-.290)
3S-GTE	.0039-.0094 (.100-.240)

### INSTALLATION (3S-FE)



1) Install hexagonal wrench head portion of camshaft in a vise. Install camshaft gear spring, sub-gear, wave washer and snap ring. See Fig. 15. Install bolt "A" into service hole of camshaft sub-gear. Using a screwdriver, align holes of camshaft main gear and sub-gear by turning camshaft sub-gear clockwise. Install bolt "B". See Fig. 16.

NOTE: Ensure camshaft is level during installation.

2) Apply multi-purpose grease to thrust portion of camshaft. Install intake camshaft at 80 degrees BTDC of camshaft angle on cylinder head. Apply Seal Packing (08826-00080) to No. 1 bearing cap. See Fig. 17.

3) Install bearing caps. Apply a light coat of engine oil on threads and under heads of bearing cap bolts. Install and tighten, in sequence, bearing cap bolts in 3 steps. See Fig. 18. Apply multi-purpose grease to new oil seal lip. Install oil seal.

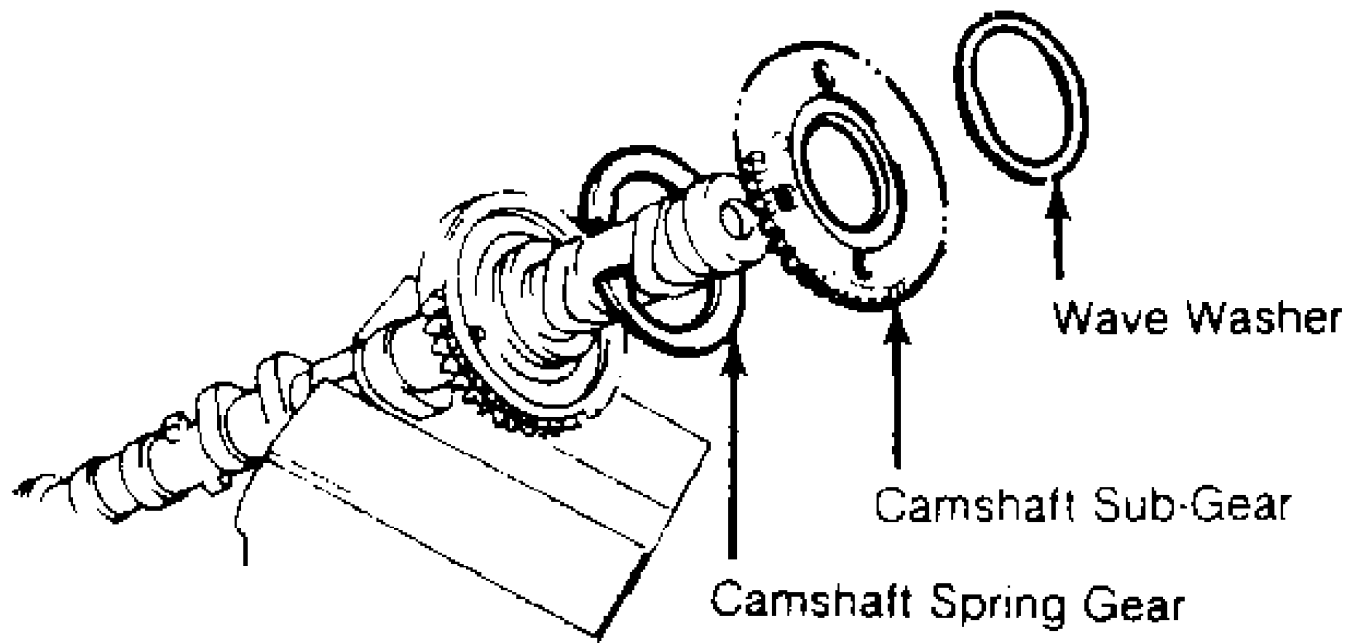


Fig. 15: Installing Camshaft Components  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

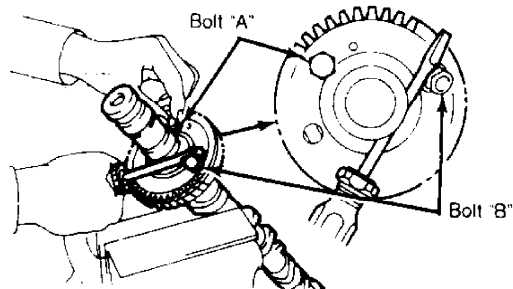


Fig. 16: Location of Bolts "A" & "B"  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

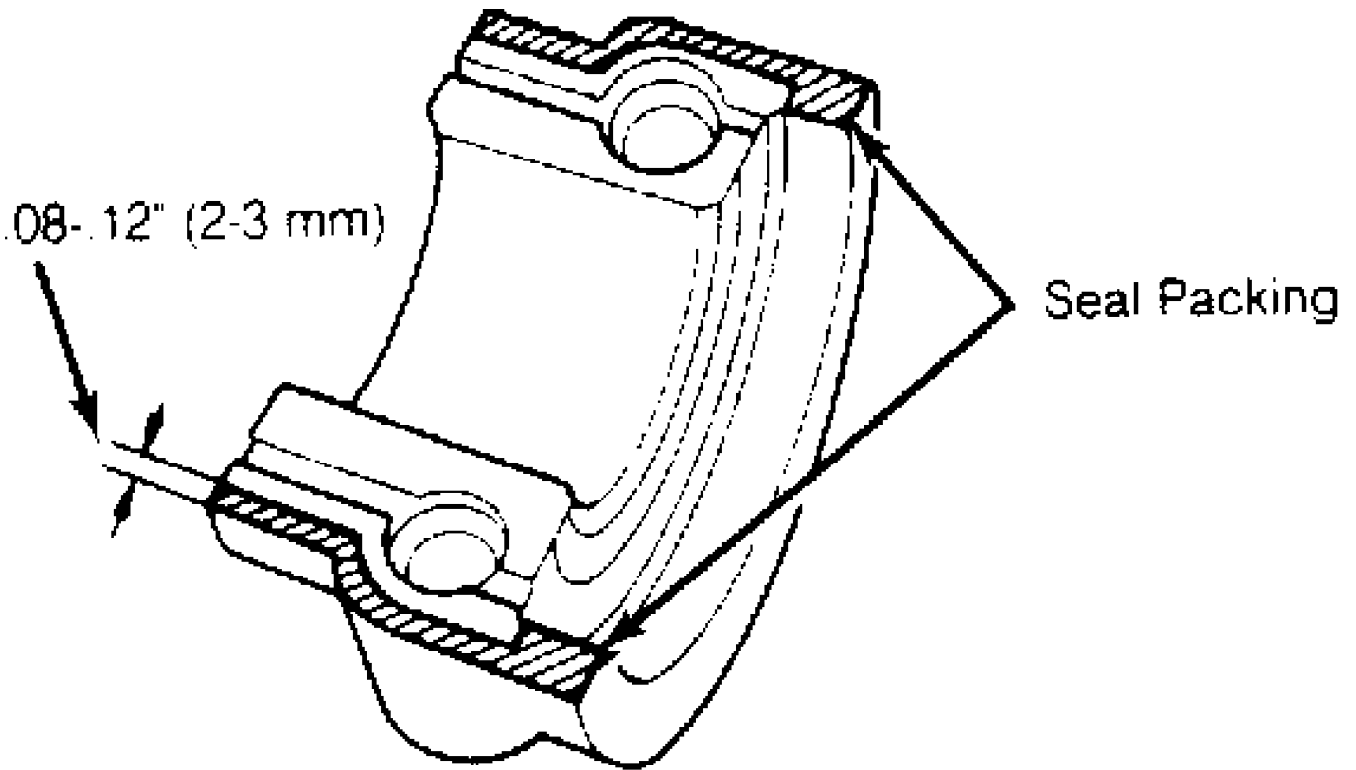


Fig. 17: Seal Packing Installation Location  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

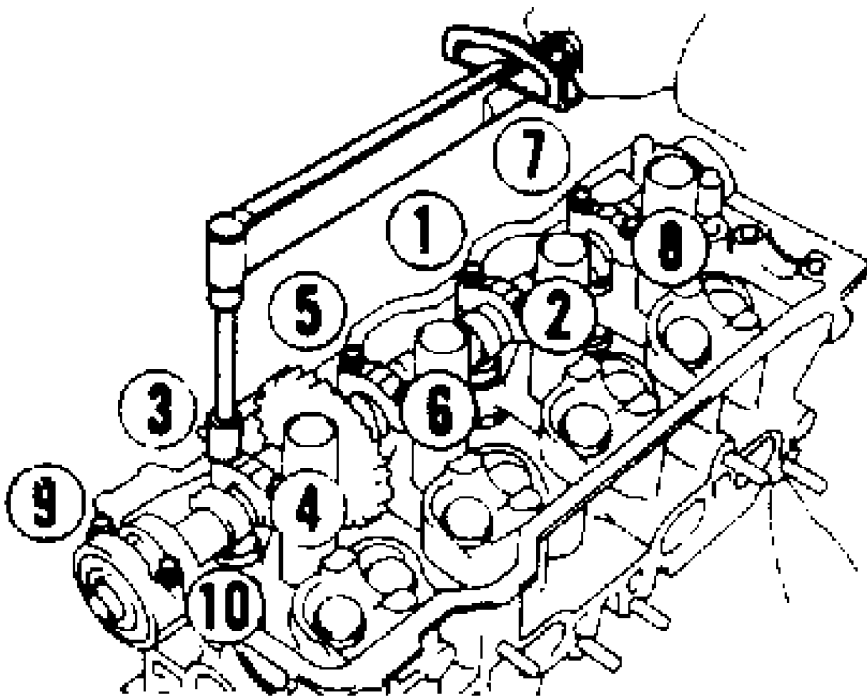


Fig. 18: Bearing Cap Bolt Tightening Sequence  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

4) Set knock pin of intake camshaft at 10 degrees BTDC of camshaft angle. Apply multi-purpose grease to thrust portion of

camshaft. Engage exhaust camshaft gear to intake camshaft gear by matching timing marks on each gear. Roll down exhaust camshaft onto bearing journals while engaging gears with each other.

**NOTE:** In addition to timing marks, assembly reference marks are present on each gear. Disregard these marks. See Fig. 19.

5) Turn intake camshaft in either direction, a little at a time, until exhaust camshaft sits in bearing journals evenly without rocking camshaft on bearing journals. Install bearing caps in proper location.

**CAUTION:** Camshaft must be evenly placed in bearing journals while tightening bearing caps.

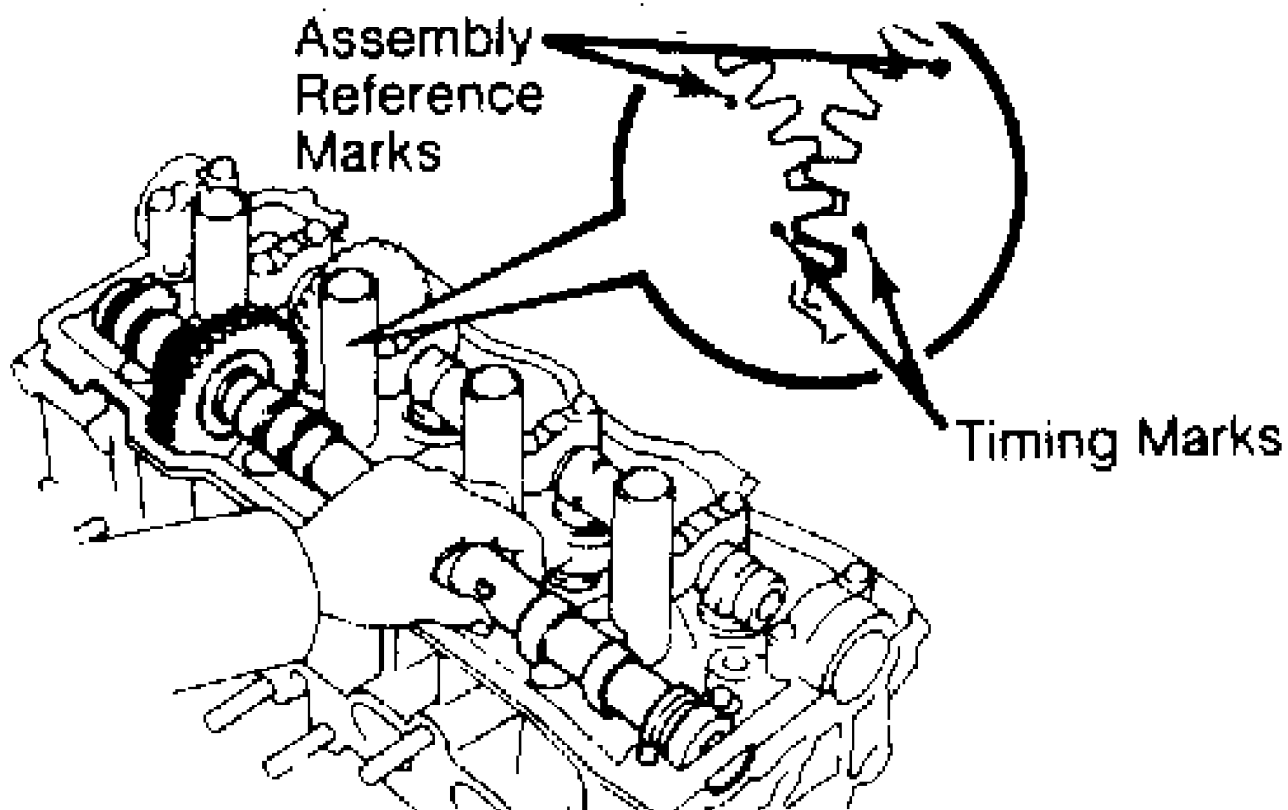


Fig. 19: Timing Reference Marks  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

6) Apply a light coat of engine oil on threads and under heads of bearing cap bolts. Install and tighten, in sequence, bearing cap bolts in reverse order of removal. Remove service bolt. Install seal packing to cylinder head. See Fig. 20. Install gasket to head cover.

7) Install and tighten head cover with 4 grommets and nuts. Ensure grommets are installed so markings are properly positioned. See Fig. 21.

8) Install No. 3 timing belt cover. Install No. 1 idler pulley and tension spring, camshaft timing pulley, spark plugs and injector and delivery pipe. Install intake manifold. To complete installation, reverse removal procedure.

## Apply Sealant

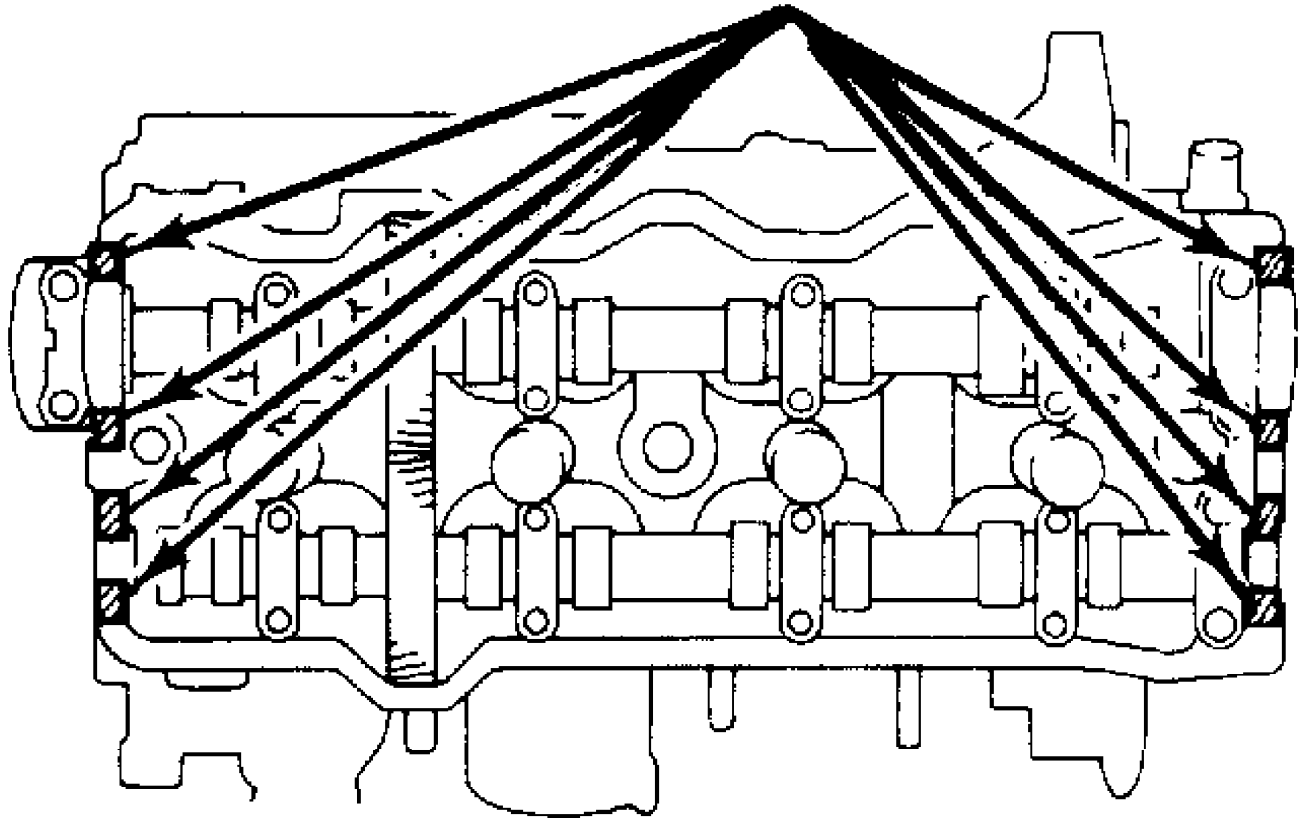


Fig. 20: Cylinder Head Seal Packing Installation  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

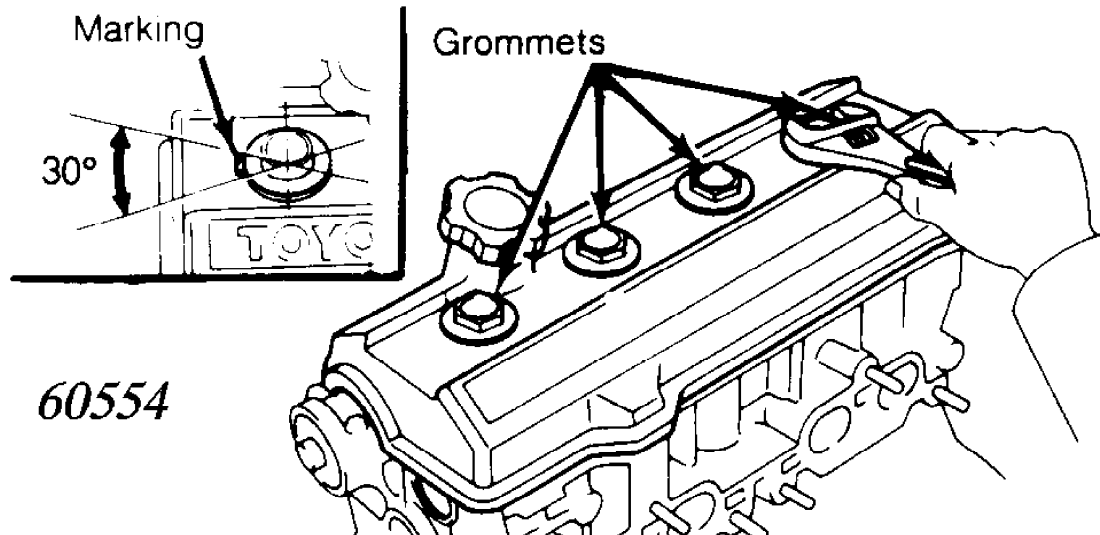


Fig. 21: Head Cover Grommet Installation  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

INSTALLATION (3S-GE & 3S-GTE)

Install bearing caps in numerical order from front. Ensure bearing cap arrows point toward front of engine. Install Seal Packing (08826-00080) to No. 1 bearing cap. Apply light coat of engine oil on threads and under heads of bearing cap bolts. Tighten bearing cap bolts in sequence to 14 ft. lbs. (19 N.m). To install remaining components, reverse removal procedure.

## **CAMSHAFT OIL SEAL R & I**

### **3S-FE**

Remove oil seal with screwdriver. To install, apply multi-purpose grease to oil seal lips. Drive in new seal.

### **3S-GE & 3S-GTE**

Remove camshaft bearing cap and oil seal. Apply grease to new oil seal lips. With camshaft bearing caps installed, install new seal using Driver (SST 09223-50010).

## **VALVE ARRANGEMENT**

Rear - Intake Valves.  
Front - Exhaust Valves.

## **VALVE SPRINGS**

### **INSPECTION**

1) Check squareness of valve springs. Spring must be less than .079" (2.0 mm) out of square. Check free length of spring and replace if not within specification.

2) Check tension of each spring at specified installed height. Installed tension is 36-42 lbs @ 1.366" (16.7-19.3 kg @ 34.77 mm).

### **VALVES**

1) On 3S-GE and 3S-GTE engines, standard overall valve length is 4.0492" (102.850 mm) for intake and 4.0118" (101.900 mm) for exhaust. Valve stem end surface grinding limit is .028" (.70 mm).

2) On 3S-FE engines, standard overall valve length is 3.9606" (100.60 mm) for intake and 3.9547" (100.45 mm) for exhaust. Valve stem end surface grinding limit is 3.941" (100.10 mm) for intake and 3.937" (100.00 mm) for exhaust.

## **VALVE GUIDES**

### **CLEARANCE CHECK**

Clean valve guides. Maximum valve stem-to-guide clearance is .0031" (.080 mm) for intake and .004" (.10 mm) for exhaust. If clearance is beyond limit and valve stem is not worn, replace guide.

### **REPLACEMENT**

1) Using hammer and drift, tap valve guide firmly enough to break guide off flush with cylinder head surface. Remove snap ring. Gradually heat head to 230-266°F (110-130°C) in an oil bath. Using

Valve Guide Driver (09201-60011), drive guide out toward block side. Measure cylinder head hole for valve guide. See VALVE GUIDE BORE SPECIFICATIONS table.

VALVE GUIDE BORE SPECIFICATIONS TABLE

Application	In. (mm)
Standard Diameter . . . . .	.4331-.4341 (11.00-11.028)
Maximum Rebores Diameter . . . . .	.4350-.4361 (11.050-11.078)

2) Drive in new guide using Valve Guide Remover and Installer (09201-60011) until snap ring comes in contact with cylinder head. See Fig. 22. Using an appropriate reamer, finish guide bore to specified clearance. Reface valve seat surface as necessary.

NOTE: Intake valve oil seal is Brown and exhaust valve oil seal is Black.

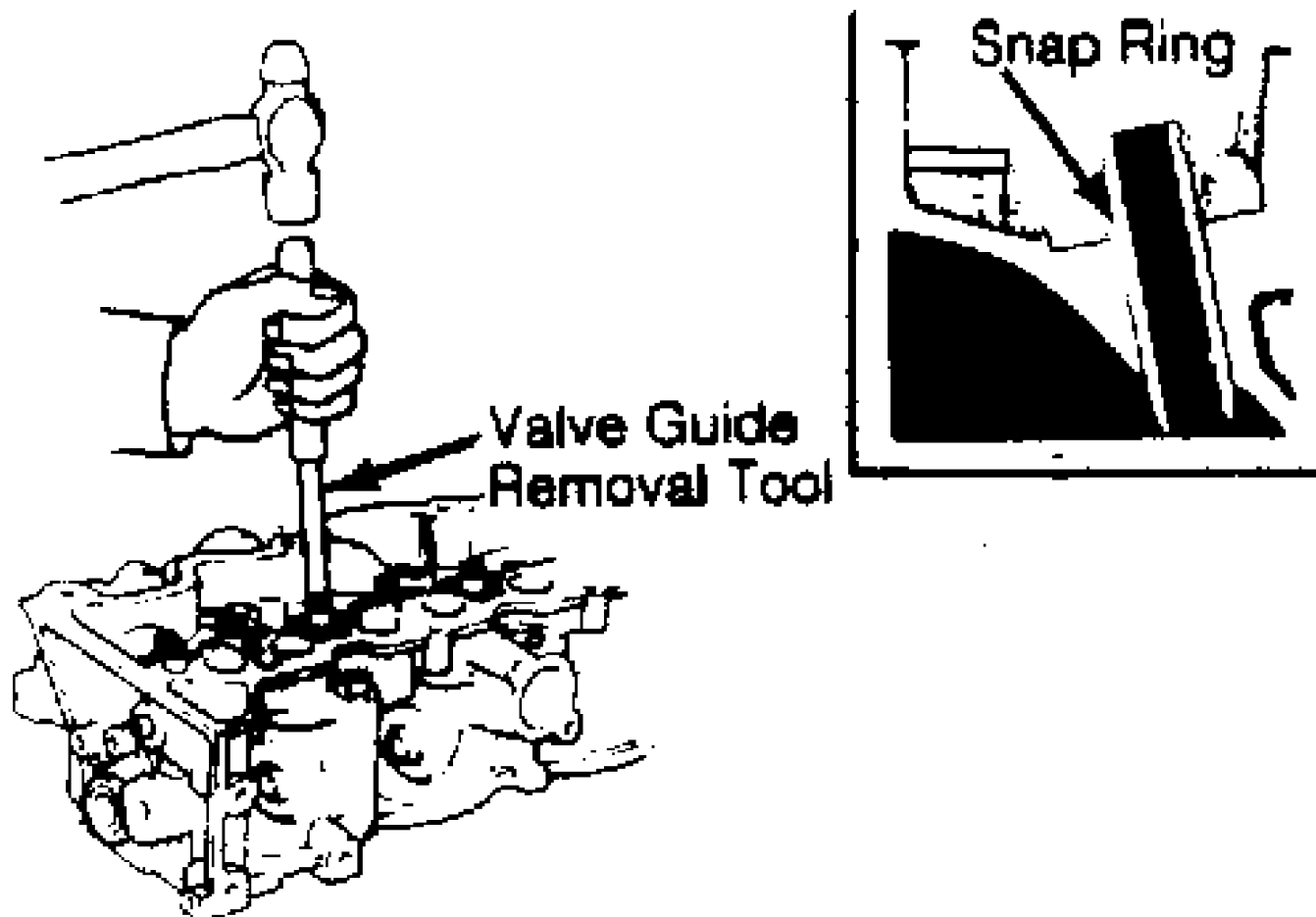


Fig. 22: Installing Oversize Valve Guide  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

**PISTON & ROD ASSEMBLY R & I**  
REMOVAL

1) With cylinder head and oil pan removed, remove connecting rod nuts. Remove rod cap with bearing half. Remove cylinder bore ridge (if present).

2) Remove piston and rod assembly through top of block. Rod caps must be kept with their respective piston and rod assembly. Connecting rod caps are not interchangeable.

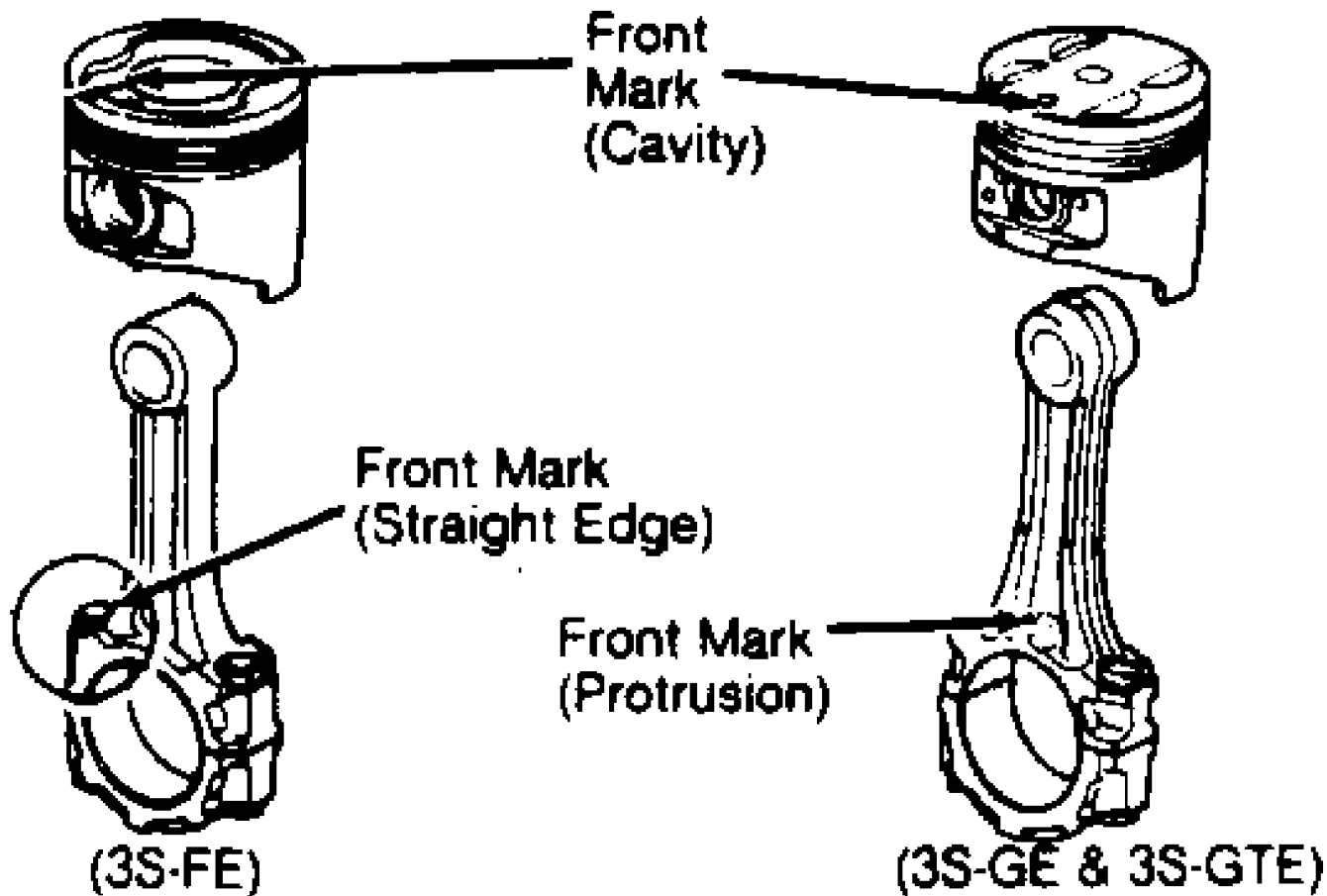


Fig. 23: Piston-to-Connecting Rod Alignment  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

### INSPECTION

1) Ensure connecting rods conform to specifications. See CONNECTING ROD SPECIFICATIONS table.

#### CONNECTING ROD SPECIFICATIONS TABLE

Application	In. (mm)
Thrust Clearance .....	.014 (.35)
Torsion Twist/Bend	
In 3.94" (100 mm) Length	

Bend .....	.002 (.05)
Twist .....	.006 (.15)

---

2) Install connecting rod with bearings. Measure rod side thrust clearance. Maximum clearance at rod bearing cap must not exceed .014" (.35 mm). Replace rod if not within specification.

## INSTALLATION

1) Oil rings, piston and cylinder bore. Install piston and rod assembly. Ensure ring gaps are set 180 degrees apart and code marks face up. Do not set on thrust side of piston or in line with piston pin. Ensure bearing halves are properly seated in rod and cap.

2) Install ring compressor. Install piston in cylinder with cavity on piston top aligned with straight edge of rod and facing front of engine. With piston installed, ensure rod and bearings are seated against crankshaft journal.

3) Install rod caps to their respective piston and rod assembly. Tighten connecting rod cap bolts to specification. Install cylinder head. Install new gasket and oil pan. Tighten pan bolts to specification. Complete installation by reversing removal procedure.

## FITTING PISTONS & RINGS

1) Inspect cylinder block for cracks or flaws. If cylinder bore out-of-round or taper exceeds .0008" (.020 mm), refinish cylinder bore. When any one cylinder is bored, all cylinders must be bored. Maximum head contact surface warpage limit is .002" (.05 mm).

2) Determine piston oversize according to amount of wear in cylinder. Measure piston diameter at thrust face. Add piston-to-cylinder clearance. Finish hone of cylinder may then be determined. See PISTON & BORE SPECIFICATIONS table.

### PISTON & BORE SPECIFICATIONS TABLE

Application	Diameter In. (mm)
Piston Size	
3S-FE .....	3.3836-3.3848 (85.945-85.975)
3S-GE & 3S-GTE .....	3.3854-3.4138 (85.9660-85.990)
Bore Size	
Standard .....	3.3858-3.3870 (86.000-86.030)
Wear Limit .....	3.3949 (86.230)

---

3) After honing cylinder to final fit, measure piston-to-cylinder clearance with piston and cylinder at room temperature of 70°F (20°C). Maximum oil clearance is .0033" (.085 mm) for 3S-FE engines and .0028" (.070 mm) for 3S-GE and 3S-GTE engines. Ensure bore difference between cylinders is .002" (.05 mm) or less. If more than specification, cylinders must be bored.

## PISTON PINS

NOTE: Piston and pin are a matched set. Keep piston, pin, rings and rod together for each cylinder.

1) On 3S-FE engines, check fit between piston and pin by trying to move piston back and forth on piston pin. If movement is



felt, replace piston and pin. On 3S-GE and 3S-GTE engines, warm piston and rod assembly to 176°F (80°C). You should be able to insert piston pin into piston using thumb pressure. If piston pin can be inserted at a lower temperature, replace piston and pin.

2) To remove piston pin from piston on 3S-FE engines, press out piston pin using Piston Pin Installer/Remover (09221-25017). To remove piston pin from piston on 3S-GE engines, remove snap ring and gradually heat piston assemblies to 176-194°F (80-90°C). Using soft faced hammer and correct driver, tap out piston pin. Standard oil clearance on 3E-GE and 3S-GTE engines is .002-.004" (.005-.011 mm).

3) Inspect pin and piston pin hole for signs of gouging or excessive wear. To assemble piston and rod, reheat piston to 70°F (20°C). Align cavity on piston with straightedge on connecting rod.

4) Hold piston and rod in proper alignment. Coat pin with oil and insert into the piston using a piston pin installer/remover. Ensure there is no movement of piston on pin.

## CRANKSHAFT R & I

### REMOVAL

1) Remove engine from vehicle. Remove drive belts and front covers. Remove valve timing belt. Secure crankshaft and remove flywheel or drive plate. Remove oil pan, oil pump and cylinder head. Remove piston and rod assemblies. Using punch, mark rods and caps for installation reference.

2) Remove main bearing caps and arrange caps, inserts and thrust washers in order for installation reference. Remove rear oil seal retainer. Do not damage crankshaft sealing surface. Remove crankshaft. Remove upper main bearing halves.

NOTE: If replacing main or connecting rod bearings, replace with ones having the same number. There are 5 sizes of main bearings, marked "1", "2", "3", "4" or "5" and 3 sizes of connecting rod bearings marked "1", "2" or "3". See Fig. 23.

3) If the bearing number is unreadable, add the numbers on the crankshaft counterweight and the connecting rod cap for connecting rod bearings or the crankshaft counterweight the cylinder block pan rail for main bearing. See Fig. 24. Add these two figures and use the corresponding number in the MAIN BEARING SELECTION TABLE or CONNECTING ROD BEARING SELECTION TABLE. See Fig. 24.

#### MAIN BEARING SELECTION TABLE

Bearing Number	Bearing Thickness In. (mm)
Main Bearing No. 3	
1	.0784-.0785
1	(1.982-1.995)
2	.0785-.0787
2	(1.995-1.998)
3	.0787-.0788
3	(1.998-2.001)
4	.0788-.0789
4	(2.001-2.004)
5	.0789-.0790
5	(2.004-2.007)
All Other Main Bearings	
1	.0786-.0787

1	.....	(1.997-2.000)
2	.....	.0787-.0789
2	.....	(2.000-2.003)
3	.....	.0789-.0790
3	.....	(2.003-2.006)
4	.....	.0790-.0791
4	.....	(2.006-2.009)
5	.....	.0791-.0792
5	.....	(2.009-2.012)

CONNECTING ROD BEARING SELECTION TABLE

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

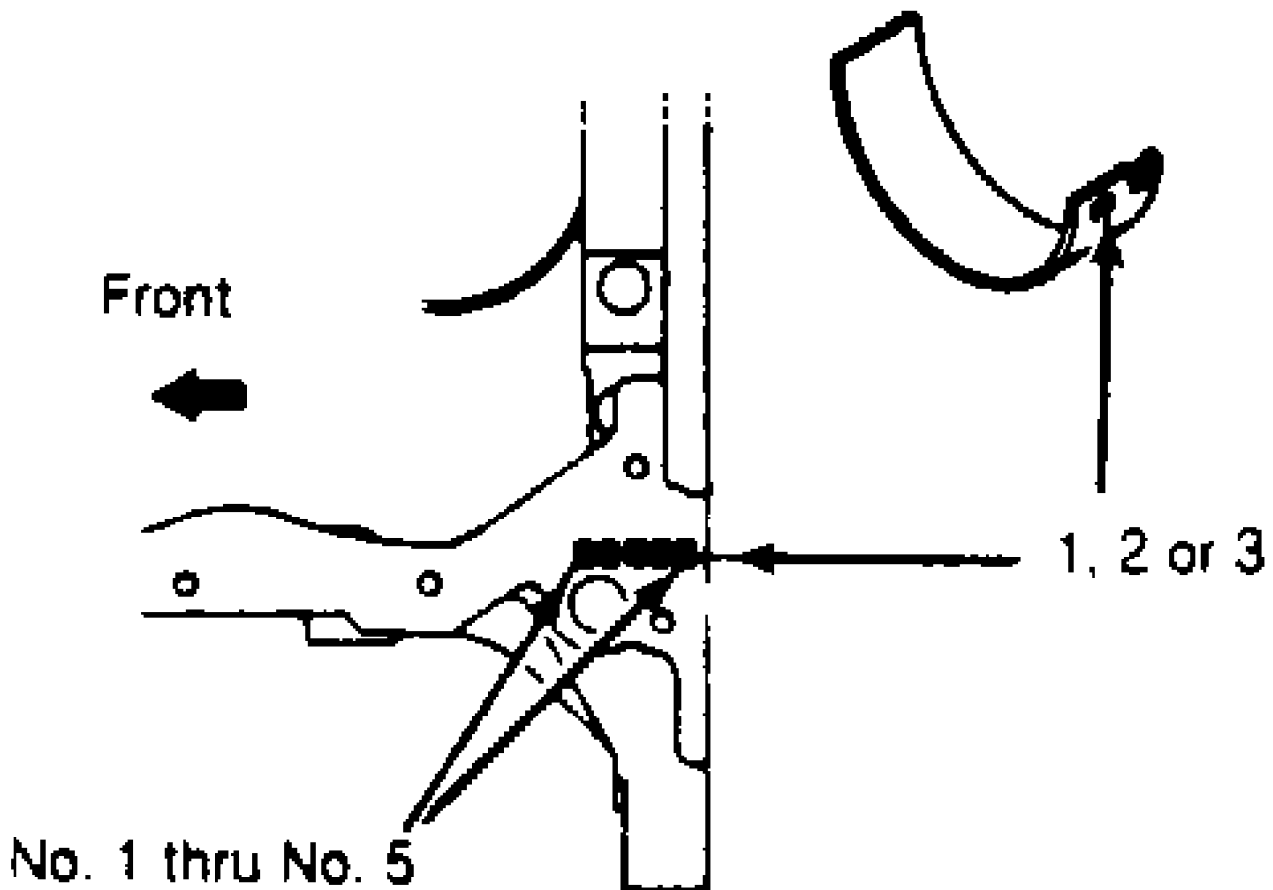


Fig. 24: Checking Standard Main Bearing Sizes  
 Courtesy of Toyota Motor Sales, U.S.A., Inc.

INSPECTION

1) Maximum taper and out-of-round is .0008" (.020 mm). Maximum allowable runout is .0024" (.060 mm). Maximum main bearing clearance is .003" (.08 mm).

2) If clearance is not to specification, main bearing inserts must be replaced with those having same number as marked on cylinder block. There are 3 sizes of standard main bearings, marked "1", "2" and "3".

3) Check bearing clearance using Plastigage method. Tighten rod caps to 36 ft. lbs. (49 N.m) on 3S-FE engines and 49 ft. lbs. (67 N.m) on 3S-GE and 3S-GTE engines. Maximum connecting rod bearing clearance is .0031" (.080 mm).

4) If not to specification, replace rod bearing inserts with ones having the same number as marked on bearing cap. Check flywheel surface for cracks, damage or wear. Measure friction surface runout using a dial indicator. Runout limit is .004" (.10 mm).

## INSTALLATION

1) Install main bearing halves in engine block. Ensure upper bearing halves have an oil hole and oil groove. Do not interchange inserts as crankshaft journal damage will result. Main bearing caps are numbered and must be installed with arrows facing front of engine.

2) Apply oil to main bearing surfaces. Install upper thrust washers on center bearing and lower thrust washers on No. 3 main bearing cap with oil grooves facing outward. Install crankshaft. Install main bearing caps with arrows facing front of engine.

3) Shift crankshaft toward front of engine. Tighten main bearing caps in 2 or 3 steps, starting at center bearing and working outward. Ensure crankshaft rotates smoothly. Check crankshaft end play. Maximum end play is .012" (.30 mm). Standard thrust washer thickness is .096-.098" (2.44-2.49 mm). If not within specification, replace No. 3 center main bearing thrust washers.

4) Install rear oil seal retainer. Install flywheel or drive plate tightening retaining bolts in proper sequence. See Fig. 25. Install piston and rod assemblies. To install remaining components, reverse removal procedure.

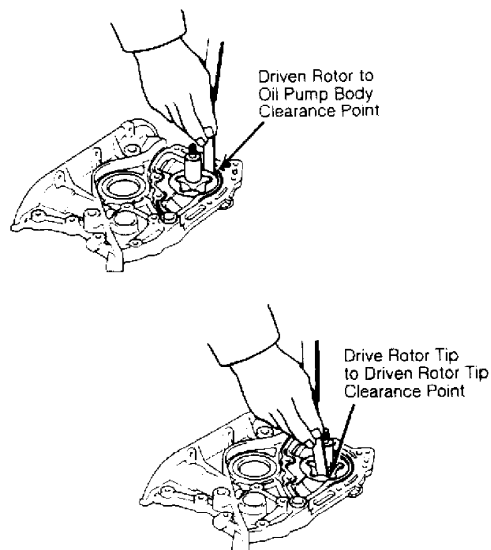


Fig. 25: Checking Oil Pump Clearance  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

## **OIL PUMP REMOVED**

Remove oil seal using hammer and drift. Do not damage oil seal contact surface of oil pump. Apply grease to new oil seal lip. Using Seal Installer (09226-10010), drive seal into oil pump housing until flush.

## **OIL PUMP INSTALLED**

1) Use a knife to cut off oil seal lip. Pry out seal. Inspect seal lip contact surface of crankshaft for cracks or damage and replace if necessary.

2) Apply grease to new oil seal lip. Using Seal Installer (09226-10010), replace oil seal. Do not set seal more than .04" (1.0 mm) into oil pump body.

## **CRANKSHAFT REAR OIL SEAL R & I**

1) With engine/transaxle assembly removed from vehicle and separated, remove flywheel or drive plate. Remove rear oil seal retainer. Tap oil seal out using hammer and drift. Apply grease to new oil seal lip. Using Seal Installer (09223-63010), install new seal.

2) If rear oil seal retainer is left installed, use a knife to cut off lip of oil seal. Pry out seal.

3) Inspect seal lip contact surface of crankshaft for damage and replace as necessary. Apply grease to new oil seal lip. Using Seal Installer (09223-63010), install new oil seal.

## **ENGINE OILING SYSTEM**

Oil is circulated through engine by a timing belt-driven oil pump. Oil is drawn from oil pan, circulated through a full-flow filter, then directed to crankshaft bearings and connecting rod bearings. Oil then passes through a galley that feeds camshaft bearings and rocker arms.

## **CRANKCASE CAPACITY**

Crankcase capacity on 3S-FE and 3S-GE is 4.1 qts. (4.0L) with filter change. Crankcase capacity for the 3S-GTE engine is 3.8 (3.6L) with filter change.

## **OIL FILTER**

Oil filter is a full-flow, disposable type.

## **OIL PRESSURE**

Normal oil pressure is 4.3 psi (0.3 kg/cm<sup>2</sup>) at idle and 36-71 psi (2.5-5.0 kg/cm<sup>2</sup>) at 3000 RPM.

## **OIL PUMP R & I**

### **REMOVAL**

1) Raise and support vehicle. Drain engine oil. Remove lower right engine cover and oil dipstick. Remove oil pan without damaging

flange.

2) Remove oil strainer mount bolts, strainer and "O" ring. Remove timing belt. Remove oil pump housing mount bolts. Carefully tap housing with plastic hammer to dislodge.

## DISASSEMBLY

Remove oil pump body mount bolts, pump body, driven rotor and "O" ring. Hold sprocket in padded vise. Remove nut, sprocket, drive rotor and pump body. Remove snap ring, retainer, spring and relief valve piston.

## INSPECTION

1) Measure clearance between driven rotor and pump body. Standard clearance is .004-.007" (.10-.17 mm). Maximum clearance is .008" (.20 mm). See Fig. 25

2) Measure clearance between both rotor tips. Standard clearance is .0016-.0063" (.040-.160 mm). Maximum clearance is .008" (.20 mm). See Fig. 25.

3) Check relief valve components for wear or damage. Ensure relief valve operating pressure is within specification. Standard relief pressure is 51-63 psi (3.6-4.4 kg/cm<sup>2</sup>).

## REASSEMBLY

1) Install relief valve piston, spring, and retainer into pump body and secure with snap ring. Insert sprocket in drive rotor and install nut loosely. Hold sprocket in padded jaw vise and tighten nut to 16-23 ft. lbs. (22-31 N.m).

2) Place driven rotor into pump body with mark facing up. Install new "O" ring in body groove. Install pump body on pump housing.

## INSTALLATION

1) Using new gasket, install pump housing onto cylinder block. Install timing belt. Install oil strainer with new "O" ring.

2) Clean old packing material from oil pan and apply new seal packing to oil pan. See Fig. 26. Install oil pan as soon as seal packing is applied.

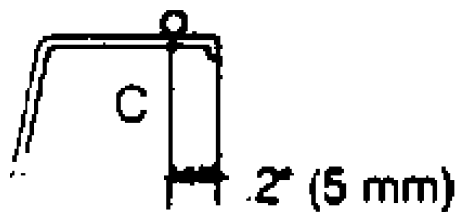
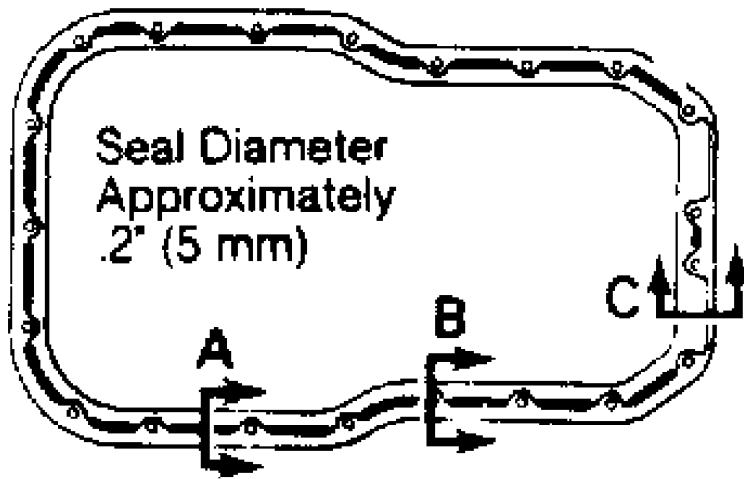


Fig. 26: Installing Oil Pan Gasket  
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) To install remaining components, reverse removal procedure. Fill crankcase with oil, start engine and check for leaks.

## WATER PUMP R & I

### REMOVAL

1) Drain coolant. Remove drive and timing belts. Remove alternator adjusting bar. Disconnect radiator inlet hose. Disconnect coolant temperature switch connector from coolant inlet housing.

2) Disconnect coolant by-pass hose from water pump. Remove heater pipe mount bolts, heater pipe and gasket. Remove 3 water pump assembly mounting bolts.

3) Remove remaining mounting bolts and tap water pump housing with plastic hammer to dislodge. Remove pump, "O" ring, and gasket.

### INSPECTION

Check water pump impeller and pump body for cracks and damage of contact surfaces. Check pump bearing for roughness or noise. Ensure there is no sign of coolant leakage from drain hole. Check thermostat and radiator to ensure proper cooling system function. Pressure test system.

### INSTALLATION

To install, reverse removal procedure.

NOTE: For further information on cooling systems, see ENGINE COOLING article at end of this section.

## TORQUE SPECS TABLE

### TIGHTENING SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
Air Control Valve .....	14 (19)
Camshaft Housing Mounting Bolts .....	14 (19)
Camshaft Sprocket Mount Bolt .....	40 (54)
Connecting Rod Cap Bolts	
3S-GE & 3S-GTE .....	47 (64)
3S-FE .....	36 (49)
Crankshaft Main Bearing Cap Bolts .....	43 (59)
Crankshaft Sprocket Mount Bolt .....	80 (108)
Cylinder Head Mounting Bolts (1)	
3S-FE .....	47 (64)
3S-GE & 3S-GTE .....	40 (54)
Engine Hanger No. 2 & Intake Manifold Stay No. 2 (3S-GE)	
12 mm Bolt .....	14 (19)
14 mm Bolt .....	29 (39)
Exhaust Manifold Bolts	
3S-FE .....	29 (39)
3S-GE & 3S-GTE .....	32 (43)
Flywheel Mounting Bolts .....	72 (98)
Intake Manifold Bolts	
Intake Manifold Side .....	14 (19)
Cylinder Block Side .....	19 (25)
No. 1 Idler	
Pulley-to-Cylinder Head Bolt .....	31 (42)
No. 2 Idler	
Pulley-to-Oil Pump Bolt .....	31 (42)

Oil Pump Pulley .....	31 (42)
Spark Plug .....	13 (18)
Throttle Body Bolts .....	14 (19)
Transaxle-to-Engine Mounting Bolts	
10 mm .....	25 (34)
12 mm .....	47 (64)
Turbocharger Elbow Mounting Bolts .....	47 (64)
Turbocharger Mounting Bolts .....	47 (64)
Turbo No. 1 Oil Line .....	10 (12)
Turbo No. 2 Oil Line .....	14 (19)
Turbo Support-to-Block .....	38 (52)
Turbo Support-to-Turbo .....	59 (79)
Turbo Water Lines .....	10 (12)
	INCH Lbs. (N.m)
Ignition Assembly-to-Camshaft Housing .....	108 (11)
Oil Pump Mouting Bolts .....	82 (9)
Oil Strainer Bolt .....	48 (5)
Water Pump Mounting Bolts .....	82 (9)

(1) - Tighten in sequence. See Fig. 3.

## ENGINE SPECIFICATIONS

### GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS TABLE

Application	In. (mm)
Displacement	
Cu. In. ....	122.0
Liters .....	2.0
Fuel System .....	Fuel Inj.
HP @ RPM .....	115 @ 5200
Torque Ft. @ RPM .....	125 @ 4400
Compr. Ratio .....	9.3:1
Bore .....	3.39 (86)
Stroke .....	3.39 (86)

### VALVE SPECIFICATIONS

VALVE SPECIFICATIONS TABLE

Application	In. (mm)
Intake	
Head Diam. ....	...
Face Angle .....	44.5°
Seat Angle .....	45°
Seat Width .....	.039-.055 (1.00-1.40)
Stem Diameter .....	.2350-.2356 (5.970-5.985)
Stem Clearance .....	.0010-.0024 (.025-.060)
Valve Lift .....	1.3744-1.3783 (34.910-35.010)
Exhaust	
Head Diam. ....	...
Face Angle .....	44.5°
Seat Angle .....	45°
Seat Width .....	.039-.055 (1.00-1.40)
Stem Diameter .....	.2348-.2354 (5.965-5.980)



Stem Clearance .....	.0012-.0026	(.030-.065)
Valve Lift .....	1.3961-1.4000	(35.460-35.560)

---

## PISTONS, PINS, & RINGS SPECIFICATIONS

PISTONS, PINS, & RINGS SPECIFICATIONS TABLE

Application	In. (mm)	
<b>2.0L 3S-FE</b>		
Pistons		
Clearance .....	.0018-.0026	(.045-.065)
Pins		
Piston Fit .....	.....	.....
Rod Fit .....	0002-.0004	(.005-.011)
Rings		
Ring No. 1		
End Gap .....	.0106-.0205	(.27-.52)
Side Clearance .....	.0012-.0028	(.030-.070)
Ring No. 2		
End Gap .....	.0106-.0209	(.27-.53)
Side Clearance .....	.0012-.0028	(.030-.070)
Oil Ring		
End Gap .....	.0079-.0323	(.20-.82)
Side Clearance .....	.0012-.0028	(.030-.070)
<b>2.0L 3S-GE</b>		
Pistons		
Clearance .....	.0012-.0020	(.030-.050)
Pins		
Piston Fit .....	.....	.....
Rod Fit .....	.....	Press Fit
Rings		
Ring No. 1		
End Gap .....	.0130-.0264	(.33-.67)
Side Clearance .....	.0012-.0028	(.030-.070)
Ring No. 2		
End Gap .....	.0177-.0323	(.45-.82)
Side Clearance .....	.0008-.0024	(.020-.060)
Oil Ring		
End Gap .....	.0079-.0283	(.20-.72)
Side Clearance .....	.....	.....
<b>2.0L Turbo</b>		
Pistons		
Clearance .....	0012-.0020	(.030-.050)
Pins		
Piston Fit .....	.....	.....
Rod Fit .....	.002-.0004	(.005-.011)
Rings		
Ring No. 1		
End Gap .....	.0130-.0224	(.330-.570)
Side Clearance .....	.0015-.0031	(.040-.080)
Ring No. 2		
End Gap .....	.0177-.0272	(.450-.690)
Side Clearance .....	.0012-.0028	(.030-.070)
Oil Ring		
End Gap .....	.0079-.0244	(.200-.620)
Side Clearance .....	.....	.....

## MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS

MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS TABLE

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Application	In. (mm)
<b>Main Bearings</b>	
Journal Diam. ....	2.1648-2.1653 (54.985-55.000)
Clearance .....	(1) .0007-.0015 (.018-.037)
Thrust Bearing .....	No. 3
Crankshaft End Play .....	.0008-.0087 (.020-.220)
<b>Connecting Rod Bearings</b>	
Journal Diam. ....	1.8892-1.8898 (47.985-48.000)
Clearance .....	.0009-.0022 (.023-.055)
Side Play .....	.0063-.0123 (.160-.312)

(1) - The main bearing clearance for journal No. 3 is .0011-.0019" (.028-.047 mm).

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## CAMSHAFT SPECIFICATIONS

CAMSHAFT SPECIFICATIONS TABLE

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Application	In. (mm)
<b>2.0L 3S-FE</b>	
<b>Intake</b>	
Journal Diam. ....	1.0614-1.0620 (26.95-26.97)
Clearance .....	.0010-.0024 (.025-.062)
Lobe Lift .....	1.374-1.378 (34.91-35.01)
<b>Exhaust</b>	
Journal Diam. ....	(.0614-1.0620 (26.95)-26.97)
Clearance .....	.0010-.0024 (.025-.062)
Lobe Lift .....	1.400-1.404 (34.56-35.66)
<b>2.0L 3S-GE (1)</b>	
<b>Intake</b>	
Journal Diam. ....	1.0614-1.0620 (26.95-26.97)
Clearance .....	.0010-.0024 (.025-.062)
Lobe Lift .....	1.398-1.402 (35.51-35.61)
<b>Exhaust</b>	
Journal Diam. ....	1.0614-1.0620 (26.95-26.97)
Clearance .....	.0010-.0024 (.025-.062)
Lobe Fit .....	1.398-1.402 (35.51-35.61)

(1) - The cam lobe lift for 2.0L turbo models is 1.3961-1.4000" (.35.460-35.560).

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## VALVE SPRING SPECIFICATIONS

VALVE SPRING SPECIFICATIONS TABLE

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Application	In. (mm)
<b>2.0L 3S-FE</b>	
Free Length .....	1.7720 (45.000)
	Pressure Lbs. @ In. (Kg @ mm)
Valve Closed .....	38.6 @ 1.366 (17.5 @ 34.7)
Valve Open .....	...
<b>2.0L 3S-GE</b>	
Free Length .....	1.6779 (42.620)
	Pressure Lbs. @ In. (Kg @ mm)
Valve Closed .....	38.6 @ 1.366 (17.5 @ 34.7)
Valve Open .....	...

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