

1983 Toyota Pickup

2.4L 4-CYL - VIN [R] 1983 Engines - 2.4L 4-Cylinder

2.4L 4-CYL - VIN [R]

1983 Engines - 2.4L 4-Cylinder

ENGINE CODING

ENGINE IDENTIFICATION

Engine serial number is stamped on left side of cylinder block, behind the alternator. Last group of characters designates engine type.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
Celica		
Carburetor	22R	R
Fuel Injection	22R-E	R
Pickup	22R	R

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

ENGINE, MANIFOLDS & CYLINDER HEAD

ENGINE

Removal

1. Remove engine hood, and disconnect negative battery cable. Drain cooling system. Remove air cleaner. Remove fan, radiator, shroud, hoses, and upper bracket. If equipped with air conditioning, remove compressor but **DO NOT** disconnect refrigerant hoses.
2. Disconnect heater hoses, fuel lines, and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses to ensure proper installation.
3. On fuel injected models, remove EGR modulator and air intake chamber with throttle body. Disconnect the actuator, accelerator, and throttle cables. Disconnect and label all fuel injection wiring and vacuum hoses. On other models, disconnect accelerator linkage from carburetor.
4. On all models equipped with automatic transmission, disconnect automatic transmission throttle cable. On vehicles with power steering, remove pump from engine. **DO NOT** disconnect hoses. Remove shift lever and clutch slave cylinder on manual transmission models.
5. Raise and support vehicle. Remove exhaust pipe at manifold. Remove engine undercover. Disconnect transmission shift linkage. If equipped with automatic transmission, disconnect cooler lines.
6. On Celica models, remove lower side engine shock absorber. Remove steering gear housing from crossmember and suspend under vehicle.
7. On all models, remove drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist

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to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose.

8. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install, reverse removal procedure. Be sure to check all fluid levels and linkage adjustments prior to starting engine.

INTAKE MANIFOLD

Removal

1. Remove air cleaner hose and disconnect accelerator cable from throttle body. If equipped with A/C, disconnect vacuum hose from idle compensating valve.
2. Disconnect electrical wires at glow plug current sensor connector, water temperature sensor connector, glow plug resistor wires and water temperature sender gauge connector.
3. Remove retaining clamps and 4 injector pipes. Remove fuel inlet pipe. Disconnect accelerator connecting rod from accelerator linkage. Remove EGR pipe. Remove 6 intake manifold bolts, 2 nuts and left side engine hanger. Remove intake manifold and gasket.

Inspection

Check and clean manifold-to-head contact surfaces. Inspect gasket surfaces for scratches, damage or warpage. Manifold warpage limit is .016" (0.4 mm). Replace manifold if warpage exceeds limit.

Installation

Always replace gaskets during intake manifold installation. Reverse remaining removal procedures.

EXHAUST MANIFOLD

Removal

Remove right side engine hanger. If equipped with A/C, remove A/C compressor bracket. Remove 4 bolts and 2 heat shield insulators. Remove exhaust pipe at manifold. Remove 6 manifold nuts and exhaust manifold with gasket.

Inspection

Check and clean manifold-to-head contact surfaces. Inspect gasket surfaces for scratches, damage or warpage. Manifold warpage is .016" (0.4 mm). Replace manifold if warpage exceeds limit.

Installation

Always replace gaskets during exhaust manifold installation. Reverse remaining removal procedures.

CYLINDER HEAD

Removal

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect exhaust pipe at manifold flange. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection), and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. Remove fuel pump from cylinder head (if equipped). Remove distributor with cap and wires.
3. If equipped, remove power steering pump and set aside. On fuel injected vehicles, remove EGR modulator with bracket and air intake chamber with throttle body. Disconnect and label all fuel injection wiring and linkages.
4. On all models, remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and fuel pump drive cam off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head.
6. Remove chain cover bolt in front of camshaft sprocket. Remove cylinder head bolts in reverse of tightening sequence. See **Fig. 1**.
7. Pry equally at front and rear of rocker arm assembly to clear locating dowels. Lift head carefully to clear locating dowels. **DO NOT** pry between head and block.

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and turn camshaft so dowel is at top.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

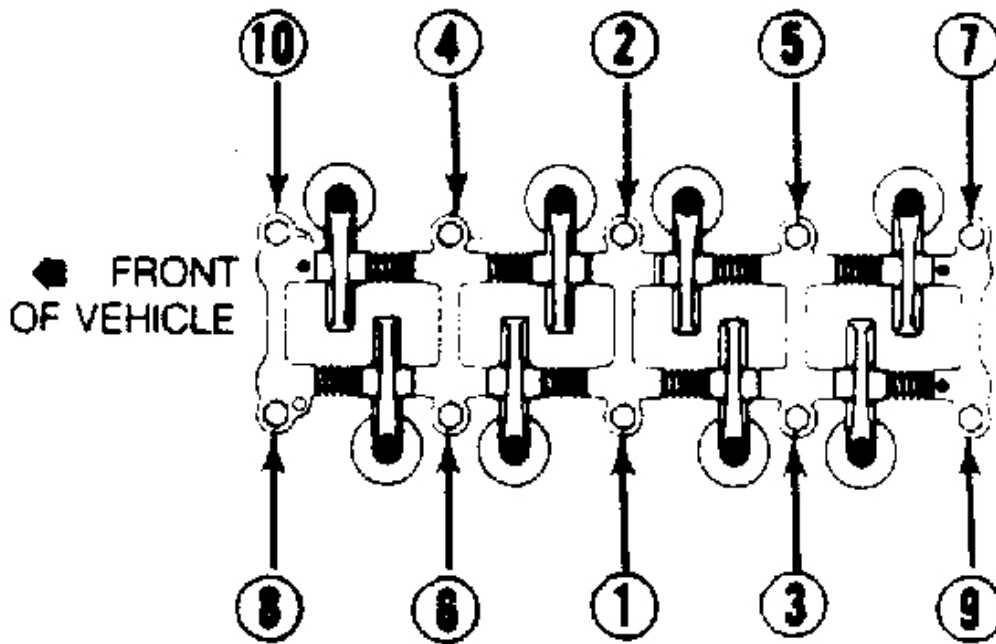


Fig. 1: Cylinder Head/Rocker Arm Bolt Tightening Sequence

TIMING CHAIN

Removal

1. Remove cylinder head and oil pan. Remove radiator, drive belts, air pump, and alternator bracket. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley and water by-pass tube bolts. Remove timing chain cover assembly.
2. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump drive and chain sprocket.

Inspection

1. Check chain, sprockets, tensioner, and chain dampers for wear. Replace chain tensioner if width is less than .43" (11 mm). Minimum size for left and right side chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance between 17 links should be 5.79" (147.0 mm). See **Fig. 2**.

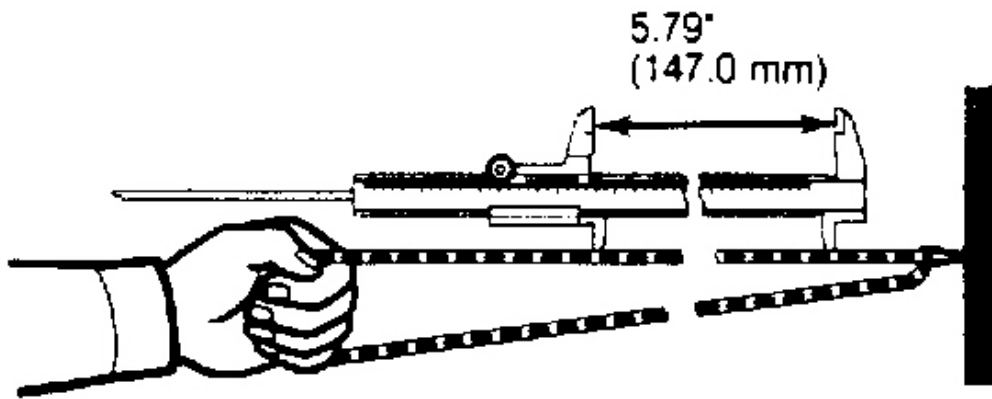


Fig. 2: Checking Timing Chain Stretch

CAMSHAFT

ENGINE FRONT COVER OIL SEAL

Removal & Installation

1. Seal is a press fit in oil pump body at front of crankshaft. Remove crankshaft pulley set bolt. Using gear puller, remove crankshaft pulley. Pry out seal with screwdriver.
2. Drive new seal into position using installer tool (09223-50010). Lubricate seal lip lightly with multi-purpose grease after installation. Tighten crankshaft pulley bolt to specification.
3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to the sprocket, measure the outer sides of the chain rollers. Using the same method, measure the crankshaft sprocket and chain.
4. The minimum dimension for crankshaft sprocket and chain is 2.339" (59.4 mm). The minimum dimension for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace chain and both sprockets.

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will be facing up). Position sprocket on crankshaft. Place chain on sprocket with single bright link aligned with the timing mark on sprocket.
2. Install cam sprocket in chain so that timing mark on sprocket is located between 2 chromed links. See **Fig. 3**. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.

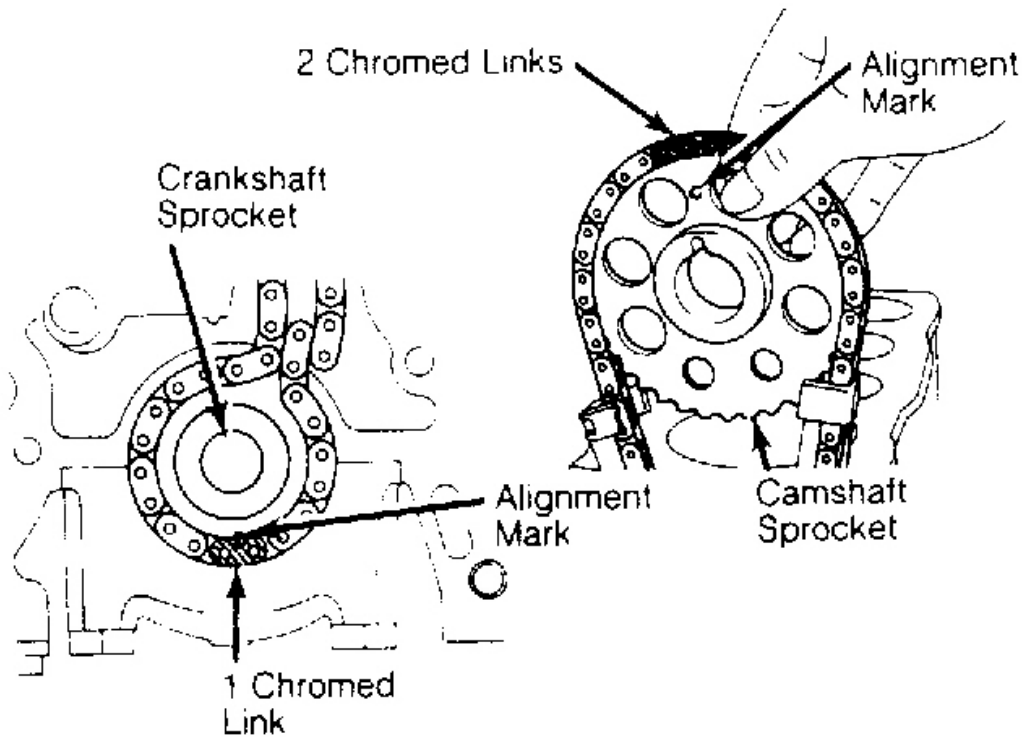


Fig. 3: Aligning Camshaft Sprocket and Timing Chain

NOTE: Camshaft dowel pin should be in 12 o'clock position.

3. Continue installation in reverse of removal procedure. Set camshaft timing as follows: With No. 1 cylinder at TDC on compression stroke, position camshaft so that dowel on sprocket flange is at 12 o'clock position.

VALVE TIMING

1. Turn crankshaft so No. 1 piston is at TDC of compression stroke (align mark on crankshaft with pointer on chain cover). Turn camshaft to locate dowel pin and stamped mark on camshaft at 12 o'clock position.
2. Timing mark on camshaft sprocket must be between 2 plated links on timing chain. Plated link on timing chain must be aligned with crankshaft sprocket timing mark.

CAMSHAFT

Removal

Remove cylinder head and rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

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Inspection

1. Camshaft bearing clearance may be checked using Plastigage method. If clearance exceeds specifications, replace cylinder head and/or camshaft. Measure journal diameter.
2. Maximum camshaft runout at center journal is .008" (.2 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678-1.682" (42.63-42.72 mm), or exhaust height is less than 1.681-1.684" (42.69-42.78 mm).

Installation

To install, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward the front. Adjust valves.

VALVES

VALVE ARRANGEMENT

Right Side - Intake valves.

Left Side - Exhaust valves.

ROCKER ARM ASSEMBLY

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.01-.05 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly, noting that all rocker arms are identical, but that all rocker stands are different. See **Fig. 4**.

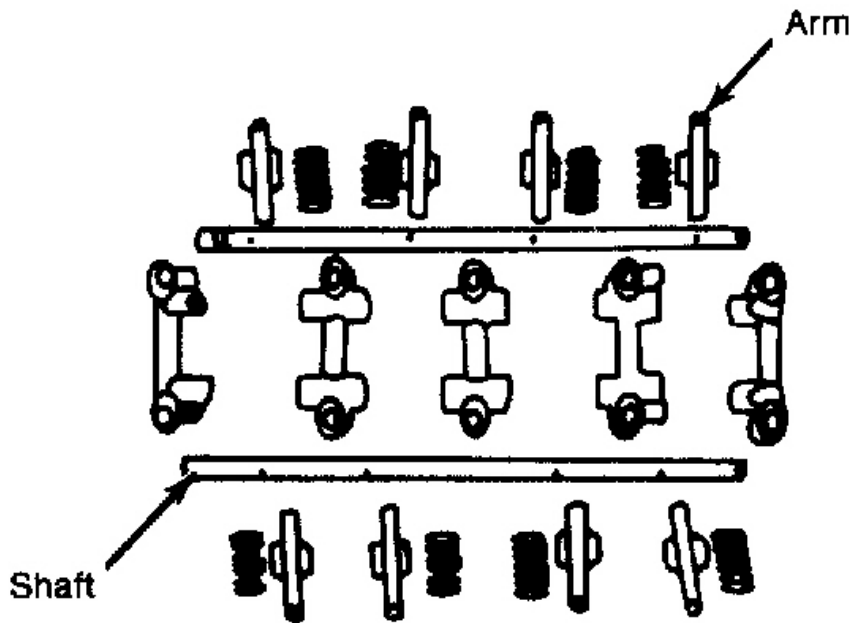


Fig. 4: Disassembled View of Rocker Arm Assembly

VALVE SPRINGS

Check valve spring free length and squareness. If less than 1.8" (45.8 mm) long or out of square more than .063" (1.6 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified.

VALVE STEM OIL SEALS

Removal & Installation

1. Using a spring compressor, remove valve keepers. Withdraw spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Slide a new oil seal over valve stem, using care not to damage seal as it passes over keeper grooves. Force seal over end of valve guide. Reverse removal procedure for remaining components.

VALVE GUIDE SERVICING

Removal & Installation

1. If valve stem oil clearance exceeds specifications, valve guides must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).

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2. Using driver (09201-60011), drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Guide should have .75" (19 mm) protrusion above cylinder head. Ream valve guide for proper stem clearance.

VALVE CLEARANCE ADJUSTMENT

1. Engine must be at normal operating temperature. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on the compression stroke. Measure clearance between rocker arm and valve stem. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves.
2. Rotate crankshaft one complete revolution (360°) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENT

Valve	In. (mm)
Intake	.008 (.20)
Exhaust	.012 (.30)

PISTONS, PINS, & RINGS

OIL PAN

Removal

1. Drain engine oil. Remove engine undercover. On Pickup models, detach steering idler arm bracket. Remove pitman arm and front crossmember. Remove oil pan.
2. On Celica, remove engine shock absorber and engine mount bolts. Jack engine up about 1" (25 mm). Remove oil pan bolts and nuts. Remove oil pan.

Installation

Place gasket on pan and apply sealer to 4 corners where front cover and rear seal retainer join cylinder block. Install pan. To complete installation, reverse removal procedure.

PISTON & ROD ASSEMBLY

Removal

1. Remove cylinder head and oil pan. Machine ring ridge from top of cylinder. Mark rods and caps for correct assembly, then remove rod caps.
2. Cover rod bolts with short length of hose to prevent crankshaft damage, then push piston/rod assembly out of block.

Installation

Lubricate piston, cylinder and journal with clean engine oil. Position rings, and install ring compressor. See **Fig. 5**. Stamped mark on ring must face upward. Install piston/rod assembly in proper position with notch on piston

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top facing forward.

FITTING PISTON

1. Measure cylinder bore at top, bottom, and center of piston travel. Measure in line with and at 90° to crankshaft. Standard bore in 3.6220-3.6232" (92.00-92.03 mm) with a wear limit of .008" (.20 mm). Maximum taper and out-of-round are .0008" (.200 mm).
2. Measure piston at right angle to pin and just below oil ring groove. If not within specifications, rebore cylinder and/or replace pistons. Pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON SIZE CHART

Application	In. (mm)
Standard	3.6196-3.6208 (91.938-91.968)
0.5 mm O/S	3.6393-3.6405 (92.438-92.468)
1.0 mm O/S	3.6590-3.6602 (92.938-92.968)

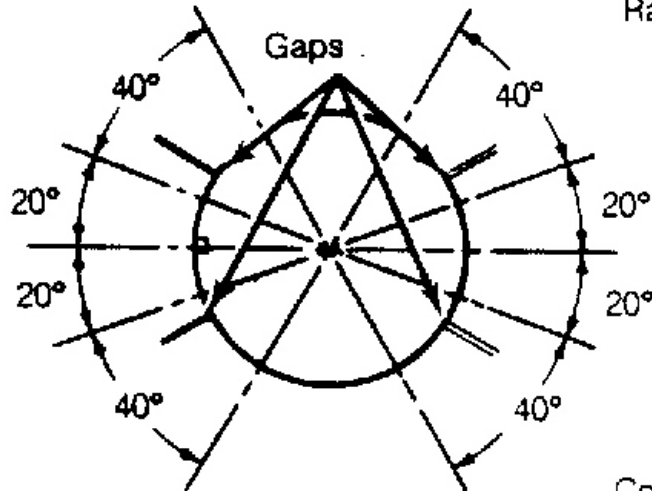
FITTING RINGS

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace the ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with code marks facing up. Position ring end gaps correctly. See **Fig. 5**.

Compression
Ring No. 1
& Expander

Lower
Side
Rail

Upper
Side
Rail



Compression
Ring No. 2

Fig. 5: Correct Piston Ring Gap Arrangement

NOTE: Stamped mark on ring must face upward.

PISTON PIN REPLACEMENT

Removal

Try to move piston back and forth on the piston pin. If any movement is felt, replace piston and pin. Heat piston to 176°F (80°C). Using hammer and driver, push piston pin out of piston and connecting rod.

Inspection

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater than .0006" (.015 mm).
2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. The maximum rod bend and twist limit is .002" (.05 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: Piston and pin are a matched set. Use new snap rings for reassembly.

Installation

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. Push piston pin into piston and rod assembly. Install snap rings.

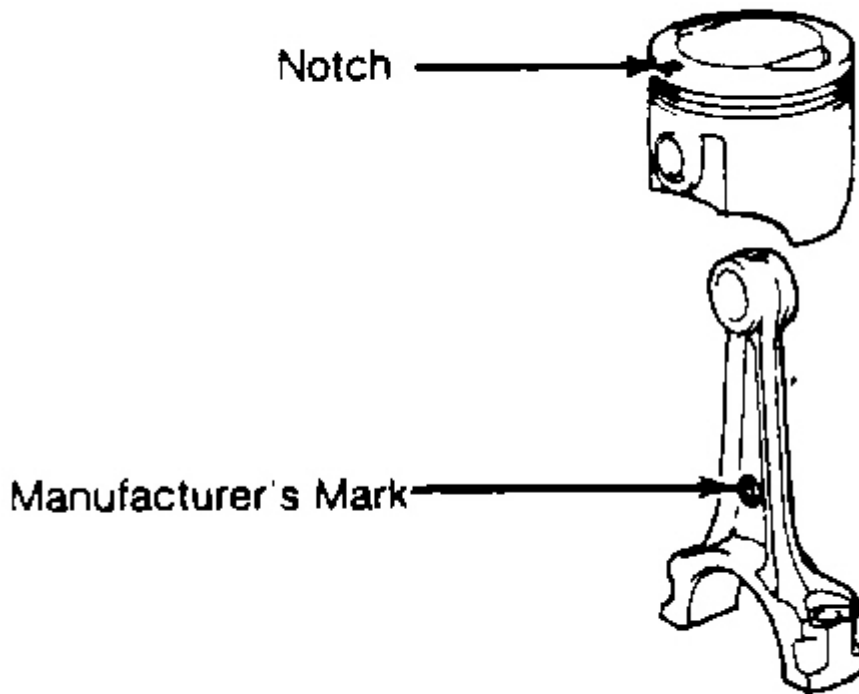


Fig. 6: Correct Alignment of Piston and Rod Assembly

NOTE: Mark on rod and indent on piston crown must face same direction.

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS

Main Bearings

1. Measure crankshaft runout at center bearing journal. If runout exceeds .004" (.1 mm), replace crankshaft.
2. Inspect all journals for wear or scoring. Out-of-round or taper limit is .004" (.1 mm). If crankshaft is worn excessively, grind journals for undersize bearings.
3. Measure bearing clearances using Plastigage method. If clearance exceeds specifications, grind journals for undersize bearings. Main bearings are available .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.70-59.71 mm).

Connecting Rod Bearings

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1. Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .004" (.10 mm).
2. Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.01 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.70-52.71 mm).

Thrust Bearing Alignment

Check crankshaft end play at thrust bearing using a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Thrust washers are available in .125" (3.2 mm) and .250" (6.3 mm) oversizes.

Rear Main Bearing Oil Seal

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Using tool (09223-41010), drive oil seal in place. After installing new seal, coat seal lip lightly with multi-purpose grease.

ENGINE OILING

CRANKCASE CAPACITY

4.9 qts. (4.6L) including filter.

OIL FILTER

Full-flow type with paper elements. Located at right side of engine.

OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

PRESSURE RELIEF VALVE

64 psi (4.5 kg/cm²) operating pressure.

ENGINE OILING SYSTEM

Oiling system is force fed, utilizing a gear and crescent type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full flow oil filter and then to oil galleries in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly.

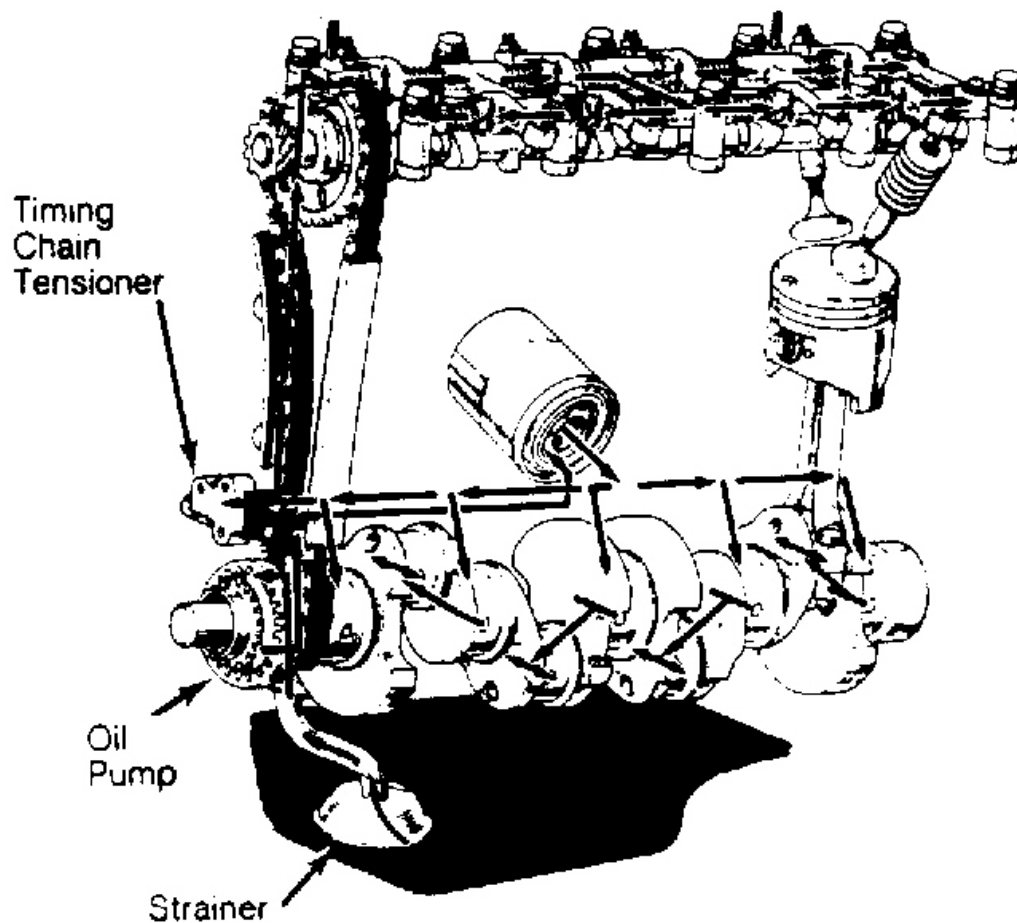


Fig. 7: Engine Oiling System

OIL PUMP

Removal

1. Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly.
2. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

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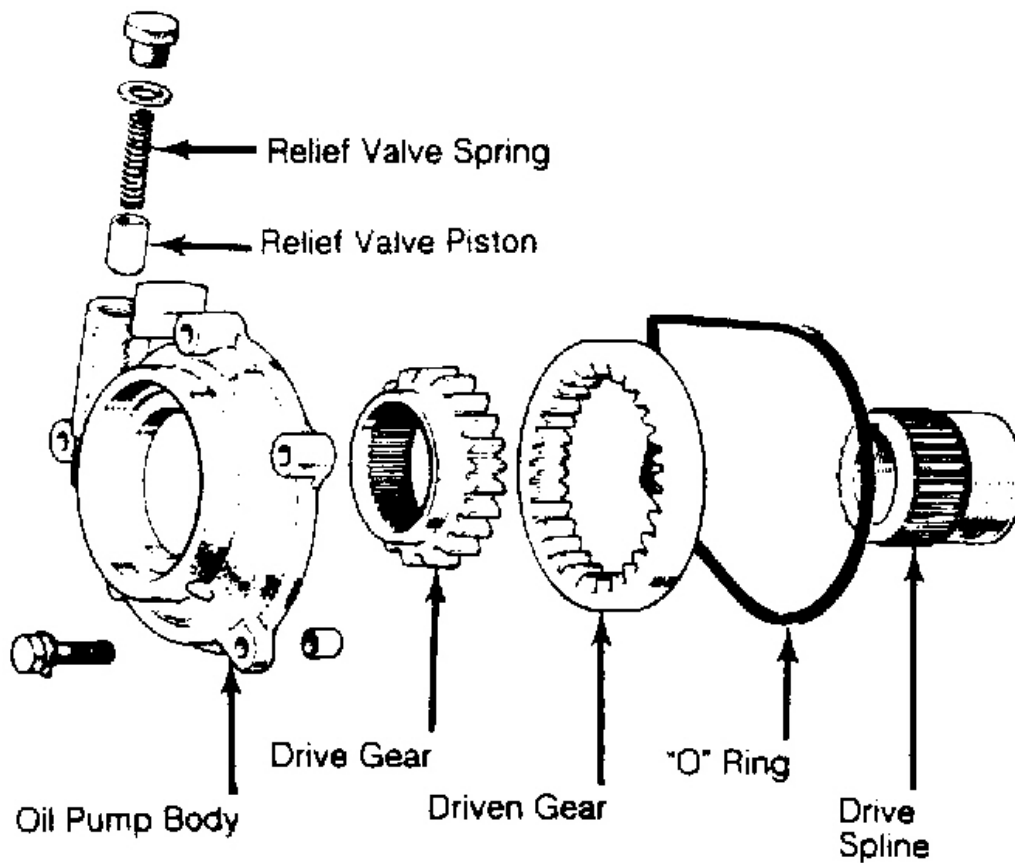


Fig. 8: Exploded View of Oil Pump

NOTE: Install new "O" ring in block and apply sealer to upper bolt.

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. Complete installation in reverse of removal procedure.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Drive Gear-to-Crescent	
Standard	.0087-.0098 (.220-.25)
Wear Limit	.012 (.30)
Driven Gear-to-Crescent	
Standard	.0059-.0083 (.15-.21)

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Wear Limit	.012 (.30)
Driven Gear-to-Body	
Standard	.0035-.0059 (.09-.15)
Wear Limit	.008 (.20)
Gear Faces-to-Body	
Standard	.0012-.0035 (.03-.09)
Wear Limit	.0059 (.15)

ENGINE COOLING

THERMOSTAT

On Federal models except Cab and Chassis Pickup, starts to open at 190°F (88°C) and is fully open at 212°F (100°C).

COOLING SYSTEM CAPACITY

8.9 qts. (8.4L).

RADIATOR CAP

11-15 psi (.75-1.05 kg/cm²).

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fluid coupling, pulley and fan belt. Remove 7 bolts and 2 nuts and take pump off engine.

Installation

To install, use new gasket on clean mating surfaces and reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	13-16 (18-22)
Camshaft Sprocket Bolt	51-65 (69-88)
Connecting Rod Cap Bolts	40-47 (54-64)
Crankshaft Pulley Bolt	102-130 (139-177)
Cylinder Head Bolts	53-63 (72-86)
Exhaust Manifold	29-36 (39-49)

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Flywheel Bolts	73-86 (99-117)
Intake Manifold	13-19 (18-26)
Main Bearing Cap Bolts	69-83 (94-113)
Timing Cover Bolts	
8 mm	9 (12)
10 mm	29 (39)

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

Application	In. (mm)
22R	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	2-Bbl.
HP @ RPM	95 @ 4800
Torque Ft. @ RPM	129 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-E	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	105 @ 4800
Torque Ft. @ RPM	137 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)

VALVE SPECIFICATIONS**VALVE SPECIFICATIONS**

Application	In. (mm)
Intake	
Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(1) 45°

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Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3138-.3144 (7.970-7.985)
Stem Clearance	.0008-.0024 (.002-.060)
Valve Lift	n/a
Exhaust	
Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3136-.3142 (7.965-7.980)
Stem Clearance	.0012-.0028 (.030-.070)
Valve Lift	n/a
(1) Correction angles are 30° and 65°.	

PISTONS, PINS, & RINGS SPECIFICATIONS**PISTONS, PINS, & RINGS SPECIFICATIONS**

Application	In. (mm)
2.4L	
Piston Clearance	.0020-.0028 (.050-.071)
Pins	
Piston Fit	Press Fit
Rod Fit	.0002-.0004 (.005-.011)
Rings	
Ring No. 1	
End Gap ⁽¹⁾	.0094-.0142 (.24-.36)
Side Clearance	.008 (.20)
Ring No. 2	
End Gap ⁽¹⁾	.0071-.0154 (.18-.39)
Side Clearance	.008 (.20)
Oil Ring	
End Gap	n/a
Side Clearance	n/a
(1) Specifications are for Pickup; Celica compression ring end gaps are .0071-.0142" (.18-.36 mm).	

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**

Application	In. (mm)
Main Bearings	

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Journal Diameter	2.3614-2.3622 (59.98-60.00)
Clearance	.0010-.0022 (.025-.055)
Thrust Bearing	Center
Crankshaft End Play	.0008-.0087 (.020-.22)
Connecting Rod Bearings	
Journal Diameter	2.0865-2.0866 (52.998-53.00)
Clearance	.0010-.0022 (.025-.055)
Side Play	.0063-.0102 (.160-.259)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
2.4L ⁽¹⁾	
Journal Diameter	1.2984-1.2992 (32.98-33.00)
Clearance	.0004-.0020 (.010-.050)
Lobe Lift	n/a
(1) End play is .0031-.0071" (.08-.18 mm).	

VALVE SPRING SPECIFICATIONS**VALVE SPRING SPECIFICATIONS**

Application	In. (mm)
Free Length	1.803 (45.80)
Pressure Lbs. @ In. (Kg @ mm)	
Valve Closed	55 @ 1.59 (25 @ 40.5)
Valve Open	n/a

1984 Toyota 4Runner

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ENGINE IDENTIFICATION

ENGINE CODING

Engine serial number is stamped on left side of cylinder block, behind the alternator. Last group of characters designates engine type.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
Celica		
Carburetor	22R	R
Fuel Injection	22R-E	R
Pickup & 4Runner	22R	R

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

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

1. Engine must be at normal operating temperature. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on the compression stroke. Measure clearance between rocker arm and valve stem. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves.
2. Rotate crankshaft one complete revolution (360°) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENT

Valve	In. (mm)
Intake	.008 (.20)
Exhaust	.012 (.30)

REMOVAL & INSTALLATION

ENGINE

Removal

1. Remove engine hood, and disconnect negative battery cable. Drain cooling system. Remove air cleaner. Remove fan, radiator, shroud, hoses, and upper bracket. If equipped with air conditioning, remove

compressor but **DO NOT** disconnect refrigerant hoses.

2. Disconnect heater hoses, fuel lines, and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses to ensure proper installation.
3. On fuel injected models, remove EGR modulator and air intake chamber with throttle body. Disconnect the actuator, accelerator, and throttle cables. Disconnect and label all fuel injection wiring and vacuum hoses. On other models, disconnect accelerator linkage from carburetor.
4. On all models equipped with automatic transmission, disconnect automatic transmission throttle cable. On vehicles with power steering, remove pump from engine. **DO NOT** disconnect hoses. Remove shift lever and clutch slave cylinder on manual transmission models.
5. Raise and support vehicle. Remove exhaust pipe at manifold. Remove engine undercover. Disconnect transmission shift linkage. If equipped with automatic transmission, disconnect cooler lines.
6. On Celica models, remove lower side engine shock absorber. Remove steering gear housing from crossmember and suspend under vehicle.
7. On all models, remove drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose.
8. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install, reverse removal procedure. Be sure to check all fluid levels and linkage adjustments prior to starting engine.

INTAKE MANIFOLD

Removal

1. Remove air cleaner hose and disconnect accelerator cable from throttle body. If equipped with A/C, disconnect vacuum hose from idle compensating valve.
2. Disconnect electrical wires at glow plug current sensor connector, water temperature sensor connector, glow plug resistor wires and water temperature sender gauge connector.
3. Remove retaining clamps and 4 injector pipes. Remove fuel inlet pipe. Disconnect accelerator connecting rod from accelerator linkage. Remove EGR pipe. Remove 6 intake manifold bolts, 2 nuts and left side engine hanger. Remove intake manifold and gasket.

Inspection

Check and clean manifold-to-head contact surfaces. Inspect gasket surfaces for scratches, damage or warpage. Manifold warpage limit is .016" (0.4 mm). Replace manifold if warpage exceeds limit.

Installation

Always replace gaskets during intake manifold installation. Reverse remaining removal procedures.

EXHAUST MANIFOLD

Removal

Remove right side engine hanger. If equipped with A/C, remove A/C compressor bracket. Remove 4 bolts and 2 heat shield insulators. Remove exhaust pipe at manifold. Remove 6 manifold nuts and exhaust manifold with gasket.

Inspection

Check and clean manifold-to-head contact surfaces. Inspect gasket surfaces for scratches, damage or warpage. Manifold warpage is .016" (0.4 mm). Replace manifold if warpage exceeds limit.

Installation

Always replace gaskets during exhaust manifold installation. Reverse remaining removal procedures.

CYLINDER HEAD**Removal**

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect exhaust pipe at manifold flange. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection), and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. Remove fuel pump from cylinder head (if equipped). Remove distributor with cap and wires.
3. If equipped, remove power steering pump and set aside. On fuel injected vehicles, remove EGR modulator with bracket and air intake chamber with throttle body. Disconnect and label all fuel injection wiring and linkages.
4. On all models, remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and fuel pump drive cam off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head.
6. Remove chain cover bolt in front of camshaft sprocket. Remove cylinder head bolts in reverse of tightening sequence. See **Fig. 1**.
7. Pry equally at front and rear of rocker arm assembly to clear locating dowels. Lift head carefully to clear locating dowels. **DO NOT** pry between head and block.

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and turn camshaft so dowel is at top.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

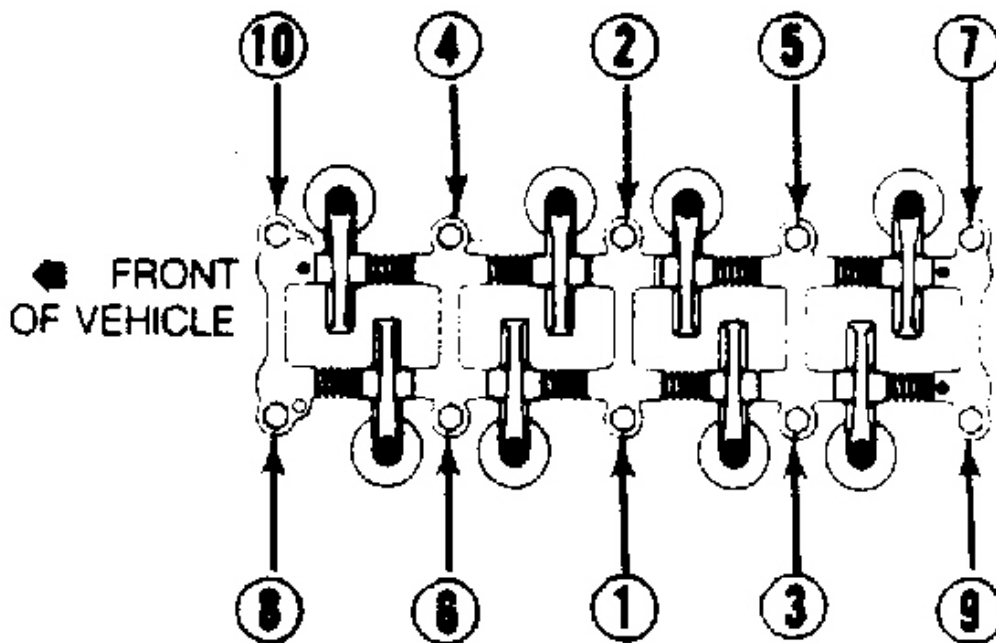


Fig. 1: Cylinder Head/Rocker Arm Bolt Tightening Sequence

NOTE: Loosen head bolts in reverse order.

ENGINE FRONT COVER OIL SEAL

Removal & Installation

1. Seal is a press fit in oil pump body at front of crankshaft. Remove crankshaft pulley set bolt. Using gear puller, remove crankshaft pulley. Pry out seal with screwdriver.
2. Drive new seal into position using installer tool (09223-50010). Lubricate seal lip lightly with multi-purpose grease after installation. Tighten crankshaft pulley bolt to specification.

TIMING CHAIN

Removal

1. Remove cylinder head and oil pan. Remove radiator, drive belts, air pump, and alternator bracket. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley and water by-pass tube bolts. Remove timing chain cover assembly.
2. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump

drive and chain sprocket.

Inspection

1. Check chain, sprockets, tensioner, and chain dampers for wear. Replace chain tensioner if width is less than .43" (11 mm). Minimum size for left and right side chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance between 17 links should be 5.79" (147.0 mm). See **Fig. 2**.

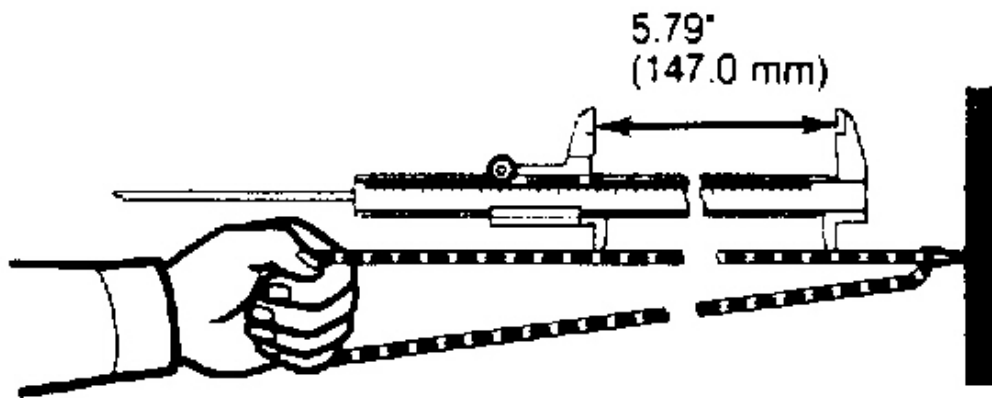


Fig. 2: Checking Timing Chain Stretch

NOTE: Check chain length between 17 links.

3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to the sprocket, measure the outer sides of the chain rollers. Using the same method, measure the crankshaft sprocket and chain.
4. The minimum dimension for crankshaft sprocket and chain is 2.339" (59.4 mm). The minimum dimension for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace chain and both sprockets.

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will be facing up). Position sprocket on crankshaft. Place chain on sprocket with single bright link aligned with the timing mark on sprocket.
2. Install cam sprocket in chain so that timing mark on sprocket is located between 2 chromed links. See **Fig. 3**. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.

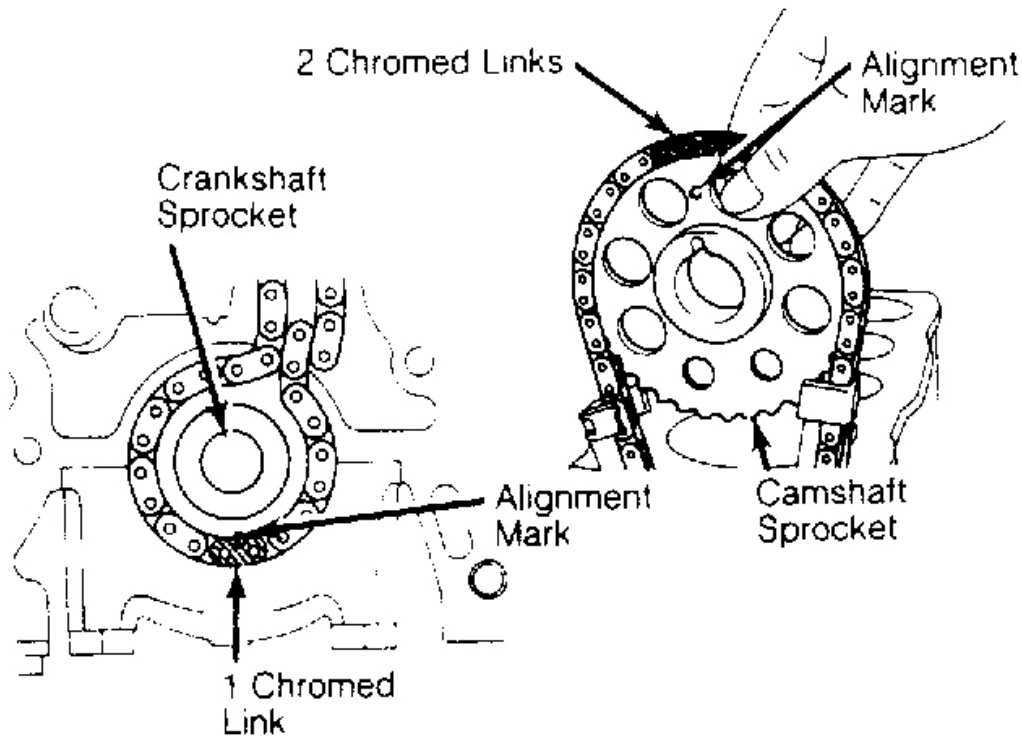


Fig. 3: Aligning Camshaft Sprocket & Timing Chain

NOTE: Camshaft dowel pin should be in 12 o'clock position.

3. Continue installation in reverse of removal procedure. Set camshaft timing as follows: With No. 1 cylinder at TDC on compression stroke, position camshaft so that dowel on sprocket flange is at 12 o'clock position.

VALVE TIMING

1. Turn crankshaft so No. 1 piston is at TDC of compression stroke (align mark on crankshaft with pointer on chain cover). Turn camshaft to locate dowel pin and stamped mark on camshaft at 12 o'clock position.
2. Timing mark on camshaft sprocket must be between 2 plated links on timing chain. Plated link on timing chain must be aligned with crankshaft sprocket timing mark.

CAMSHAFT

Removal

Remove cylinder head and rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

Inspection

1. Camshaft bearing clearance may be checked using Plastigage method. If clearance exceeds specifications, replace cylinder head and/or camshaft. Measure journal diameter.
2. Maximum camshaft runout at center journal is .008" (.2 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678-1.682" (42.63-42.72 mm), or exhaust height is less than 1.681-1.684" (42.69-42.78 mm).

Installation

To install, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward the front. Adjust valves.

VALVE ARRANGEMENT

Right Side - Intake valves.

Left Side - Exhaust valves.

ROCKER ARM ASSEMBLY

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.01-.05 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly, noting that all rocker arms are identical, but that all rocker stands are different. See **Fig. 4**.

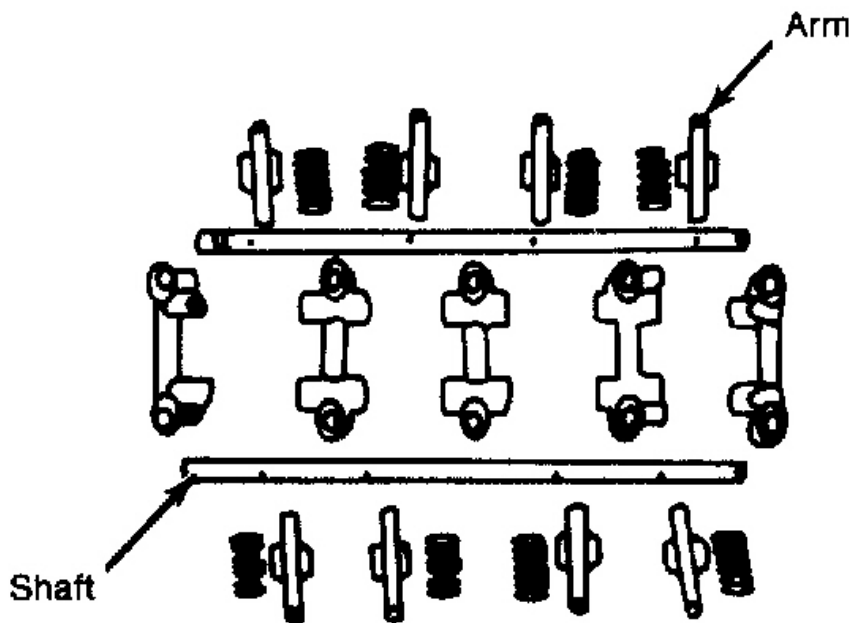


Fig. 4: Disassembled View Of Rocker Arm Assembly

VALVE SPRINGS

Check valve spring free length and squareness. If less than 1.8" (45.8 mm) long or out of square more than .063" (1.6 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified.

VALVE STEM OIL SEALS

Removal & Installation

1. Using a spring compressor, remove valve keepers. Withdraw spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Slide a new oil seal over valve stem, using care not to damage seal as it passes over keeper grooves. Force seal over end of valve guide. Reverse removal procedure for remaining components.

VALVE GUIDE SERVICING

Removal & Installation

1. If valve stem oil clearance exceeds specifications, valve guides must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

- Using driver (09201-60011), drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Guide should have .75" (19 mm) protrusion above cylinder head. Ream valve guide for proper stem clearance.

OVERHAUL

OIL PAN

Removal

- Drain engine oil. Remove engine undercover. On Pickup models, detach steering idler arm bracket. Remove pitman arm and front crossmember. Remove oil pan.
- On Celica, remove engine shock absorber and engine mount bolts. Jack engine up about 1" (25 mm). Remove oil pan bolts and nuts. Remove oil pan.

Installation

Place gasket on pan and apply sealer to 4 corners where front cover and rear seal retainer join cylinder block. Install pan. To complete installation, reverse removal procedure.

PISTON & ROD ASSEMBLY

Removal

- Remove cylinder head and oil pan. Machine ring ridge from top of cylinder. Mark rods and caps for correct assembly, then remove rod caps.
- Cover rod bolts with short length of hose to prevent crankshaft damage, then push piston/rod assembly out of block.

Installation

Lubricate piston, cylinder and journal with clean engine oil. Position rings, and install ring compressor. See **Fig. 5**. Stamped mark on ring must face upward. Install piston/rod assembly in proper position with notch on piston top facing forward.

FITTING PISTON

- Measure cylinder bore at top, bottom, and center of piston travel. Measure in line with and at 90° to crankshaft. Standard bore in 3.6220-3.6232" (92.00-92.03 mm) with a wear limit of .008" (.20 mm). Maximum taper and out-of-round are .0008" (.200 mm).
- Measure piston at right angle to pin and just below oil ring groove. If not within specifications, rebore cylinder and/or replace pistons. Pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON SIZE CHART

Application	In. (mm)
Standard	3.6196-3.6208 (91.938-91.968)

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

0.5 mm O/S	3.6393-3.6405 (92.438-92.468)
1.0 mm O/S	3.6590-3.6602 (92.938-92.968)

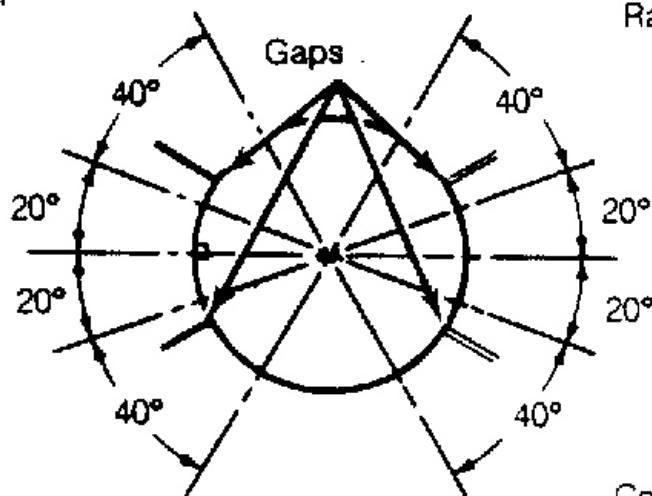
FITTING RINGS

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace the ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with code marks facing up. Position ring end gaps correctly. See **Fig. 5**.

Compression
Ring No. 1
& Expander

Lower
Side
Rail

Upper
Side
Rail



Compression
Ring No. 2

Fig. 5: Correct Piston Ring Gap Arrangement

PISTON PIN REPLACEMENT

Removal

Try to move piston back and forth on the piston pin. If any movement is felt, replace piston and pin. Heat piston to 176°F (80°C). Using hammer and driver, push piston pin out of piston and connecting rod.

Inspection

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater

than .0006" (.015 mm).

2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. The maximum rod bend and twist limit is .002" (.05 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: Piston and pin are a matched set. Use new snap rings for reassembly.

Installation

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. Push piston pin into piston and rod assembly. Install snap rings.

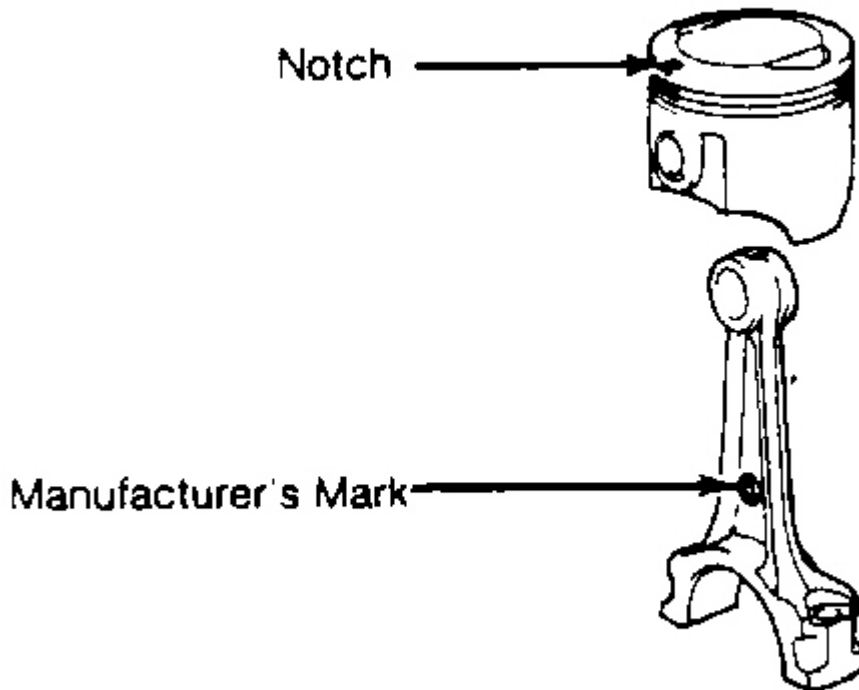


Fig. 6: Correct Alignment of Piston and Rod Assembly

MAIN BEARINGS

1. Measure crankshaft runout at center bearing journal. If runout exceeds .004" (.1 mm), replace crankshaft.
2. Inspect all journals for wear or scoring. Out-of-round or taper limit is .004" (.1 mm). If crankshaft is worn excessively, grind journals for undersize bearings.

3. Measure bearing clearances using Plastigage method. Observe correct tightening sequence. See **Fig. 7** . If clearance exceeds specifications, grind journals for undersize bearings.
4. Main bearings are available .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.70-59.71 mm).

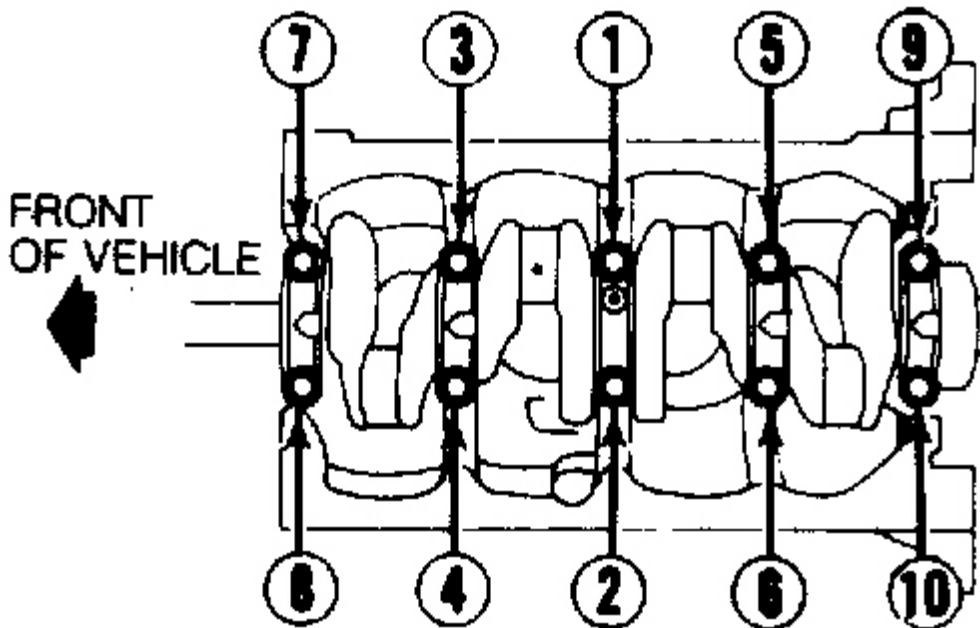


Fig. 7: Tightening Main Bearings

CONNECTING ROD BEARINGS

1. Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .004" (.10 mm).
2. Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.01 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.70-52.71 mm).

THRUST BEARING ALIGNMENT

Check crankshaft end play at thrust bearing using a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Oil grooves must be facing out.

THRUST WASHER SPECIFICATIONS

Size	Thickness In. (mm)
------	--------------------

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

Standard	.0787 (2.00)
0.124 O/S	.0811 (2.06)
0.250 O/S	.0839 (2.13)

REAR MAIN BEARING OIL SEAL

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Using tool (09223-41010), drive oil seal in place. After installing new seal, coat seal lip lightly with multi-purpose grease.

ENGINE LUBRICATION

CRANKCASE CAPACITY

4.9 qts. (4.6L) including filter.

OIL FILTER

Full-flow type with paper elements. Located at right side of engine.

OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

PRESSURE RELIEF VALVE

64 psi (4.5 kg/cm²) operating pressure.

ENGINE OILING SYSTEM

Oiling system is force fed, utilizing a gear and crescent type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full flow oil filter and then to oil galleries in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly.

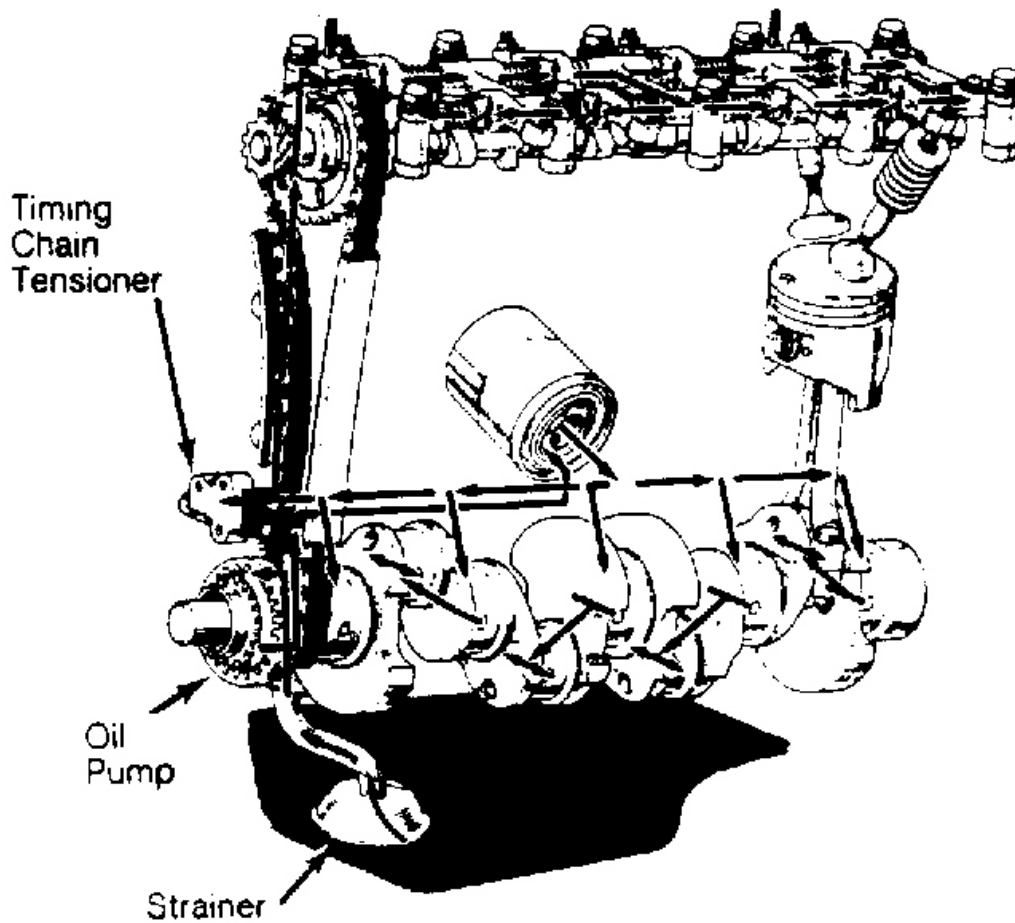


Fig. 8: Engine Oiling System

OIL PUMP

Removal

1. Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly.
2. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

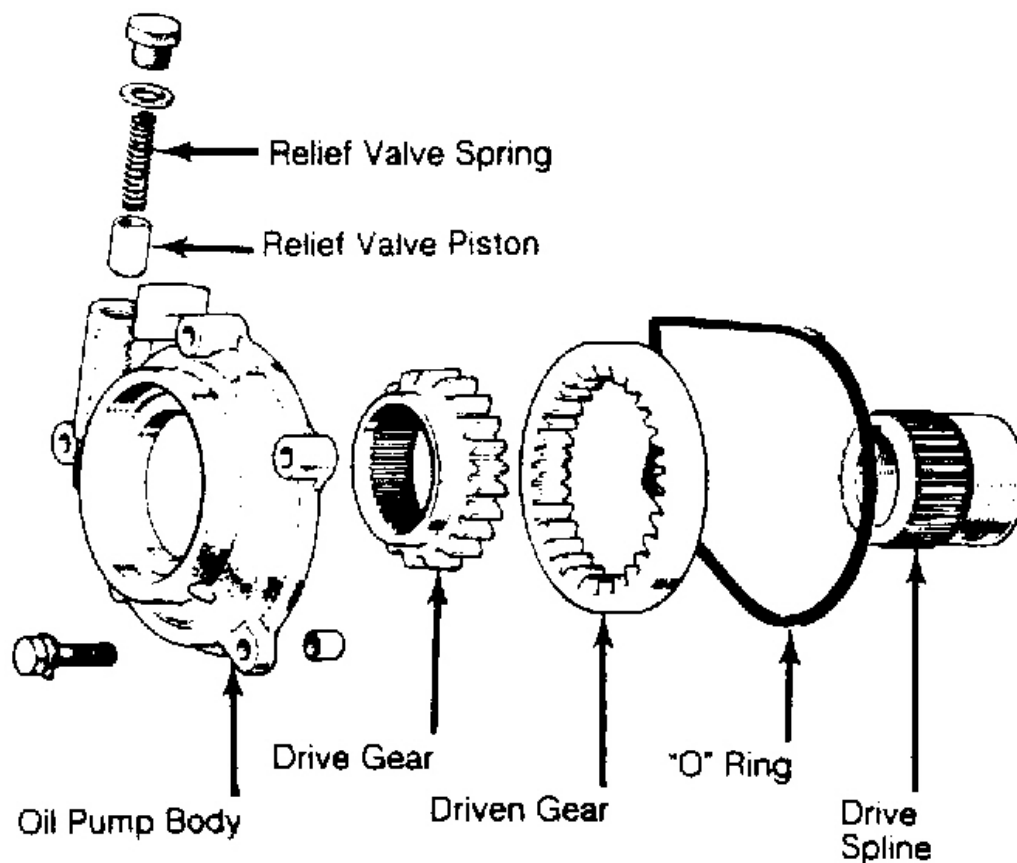


Fig. 9: Exploded View Of Oil Pump

NOTE: Install new "O" ring in block and apply sealer to upper bolt.

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. Complete installation in reverse of removal procedure.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Drive Gear-to-Crescent	
Standard	.0087-.0098 (.220-.25)
Wear Limit	.012 (.30)
Driven Gear-to-Crescent	
Standard	.0059-.0083 (.15-.21)

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

Wear Limit	.012 (.30)
Driven Gear-to-Body	
Standard	.0035-.0059 (.09-.15)
Wear Limit	.008 (.20)
Gear Faces-to-Body	
Standard	.0012-.0035 (.03-.09)
Wear Limit	.0059 (.15)

ENGINE COOLING

COOLING SYSTEM CAPACITY

8.9 qts. (8.4L).

RADIATOR CAP

11-15 psi (.75-1.05 kg/cm²).

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fluid coupling, pulley and fan belt. Remove 7 bolts and 2 nuts and take pump off engine.

Installation

To install, use new gasket on clean mating surfaces and reverse removal procedure.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	13-16 (18-22)
Camshaft Sprocket Bolt	51-65 (69-88)
Connecting Rod Cap Bolts	40-47 (54-64)
Crankshaft Pulley Bolt	102-130 (139-177)
Cylinder Head Bolts	53-63 (72-86)
Exhaust Manifold	29-36 (39-49)
Flywheel Bolts	73-86 (99-117)
Intake Manifold	13-19 (18-26)
Main Bearing Cap Bolts	69-83 (94-113)
Timing Cover Bolts	
8 mm	9 (12)

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

10 mm

29 (39)

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

Application	In. (mm)
22R	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	2-Bbl.
HP @ RPM	95 @ 4800
Torque Ft. @ RPM	129 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-E	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	105 @ 4800
Torque Ft. @ RPM	137 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)

VALVE SPECIFICATIONS**VALVE SPECIFICATIONS**

Application	In. (mm)
Intake	
Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3138-.3144 (7.970-7.985)
Stem Clearance	.0008-.0024 (.002-.060)
Valve Lift	n/a
Exhaust	

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3136-.3142 (7.965-7.980)
Stem Clearance	.0012-.0028 (.030-.070)
Valve Lift	n/a
(1) Correction angles are 30° and 65°.	

PISTONS, PINS, & RINGS SPECIFICATIONS**PISTONS, PINS, & RINGS SPECIFICATIONS**

Application	In. (mm)
2.4L	
Piston Clearance	.0020-.0028 (.050-.071)
Pins	
Piston Fit	Press Fit
Rod Fit	.0002-.0004 (.005-.011)
Rings	
Ring No. 1	
End Gap ⁽¹⁾	.0094-.0142 (.24-.36)
Side Clearance	.008 (.20)
Ring No. 2	
End Gap ⁽¹⁾	.0071-.0154 (.18-.39)
Side Clearance	.008 (.20)
Oil Ring	
End Gap	.0079-.0323 (.20-.82)
Side Clearance	n/a
(1) Specifications are for Pickup; Celica compression ring end gaps are .0071-.0142" (.18-.36 mm). No oil gaps are given.	

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**

Application	In. (mm)
Main Bearings	
Journal Diameter	2.3614-2.3622 (59.98-60.00)
Clearance	.0010-.0022 (.025-.055)
Thrust Bearing	Center
Crankshaft End Play	.0008-.0087 (.020-.22)
Connecting Rod Bearings	

1984 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1984 Engines - 2.4L 4-Cylinder

Journal Diameter	2.0865-2.0866 (52.998-53.00)
Clearance	.0010-.0022 (.025-.055)
Side Play	.0063-.0102 (.160-.259)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
2.4L ⁽¹⁾	
Journal Diameter	1.2984-1.2992 (32.98-33.00)
Clearance	.0004-.0020 (.010-.050)
Lobe Lift	n/a
(1) End play is .0031-.0071" (.08-.18 mm). Maximum is 0.0098" (.25 mm).	

VALVE SPRING SPECIFICATIONS**VALVE SPRING SPECIFICATIONS**

Application	In. (mm)
Free Length	1.803 (45.80)
Pressure Lbs. @ In. (Kg @ mm)	
Valve Closed	55 @ 1.59 (25 @ 40.5)
Valve Open	n/a

1985 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1985 Engines - 2.4L 4-Cylinder

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R]

1985 Engines - 2.4L 4-Cylinder

ENGINE IDENTIFICATION

Engine serial number is stamped on left side of cylinder block, behind the alternator. Last group of characters designates engine type.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
Celica		
Fuel Injection	22R-E	R
Pickup & 4Runner		
Carburetor	22R	R
Fuel Injection	22R-E	R
Turbocharger	22R-T	R

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

REMOVAL & INSTALLATION

ENGINE

Removal

1. Remove engine hood, and disconnect negative battery cable. Drain cooling system. Remove air cleaner. Remove fan, radiator, shroud, hoses, and upper bracket. If equipped with air conditioning, remove and support compressor without discharging system.
2. Disconnect heater hoses, fuel lines, and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses to ensure proper installation.
3. On 22R-E and 22R-TE, remove EGR modulator and air intake chamber with throttle body. Disconnect the actuator, accelerator, and throttle cables. Disconnect and label all fuel injection wiring and vacuum hoses. On 22-R, disconnect accelerator linkage from carburetor.
4. On all models equipped with automatic transmission, disconnect automatic transmission throttle cable. On vehicles with power steering, remove pump from engine. **DO NOT** disconnect hoses. Remove shift lever and clutch slave cylinder on manual transmission models.
5. Raise and support vehicle. Remove exhaust pipe at manifold. Remove engine undercover. Disconnect transmission shift linkage. If equipped with automatic transmission, disconnect cooler lines.
6. On Celica models, remove lower side engine shock absorber. Remove steering gear housing from crossmember and suspend under vehicle.
7. On all models, remove drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist

to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose.

8. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install, reverse removal procedure. Be sure to check all fluid levels and linkage adjustments prior to starting engine.

INTAKE MANIFOLD**Removal**

1. Remove air cleaner hose and disconnect accelerator cable from injection pump. If equipped with A/C, disconnect vacuum hose from idle compensating valve.
2. Disconnect electrical wires at glow plug current sensor connector, water temperature sensor connector, glow plug resistor wires and water temperature sender gauge connector.
3. Remove retaining clamps and 4 injector pipes. Remove fuel inlet pipe. On 2L-T, remove turbocharger oil pipe. On both engines, disconnect accelerator connecting rod from accelerator linkage. Remove EGR pipe. Remove 6 intake manifold bolts, 2 nuts and left side engine hanger. Remove intake manifold and gasket.

Inspection

Check and clean manifold-to-head contact surfaces. Inspect gasket surfaces for scratches, damage or warpage. Manifold warpage limit is .016" (0.4 mm). Replace manifold if warpage exceeds limit.

Installation

Always replace gaskets during intake manifold installation. Reverse remaining removal procedures.

EXHAUST MANIFOLD**Removal**

Remove right side engine hanger. If equipped with A/C, remove A/C compressor bracket. On 2L, remove 4 bolts and 2 heat shield insulators. On 2L-T, remove 4 bolts and 1 heat shield insulators. On both engines, remove exhaust pipe at manifold. Remove 6 manifold nuts and exhaust manifold with gasket.

Inspection

Check and clean manifold-to-head contact surfaces. Inspect gasket surfaces for scratches, damage or warpage. Manifold warpage is .016" (0.4 mm). Replace manifold if warpage exceeds limit.

Installation

Always replace gaskets during exhaust manifold installation. Reverse remaining removal procedures.

CYLINDER HEAD

Removal

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect exhaust pipe. On turbocharged models, remove turbocharger assembly. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection), and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. Remove fuel pump from cylinder head (if equipped). Remove distributor with cap and wires.
3. If equipped, remove power steering pump and set aside. On fuel injected vehicles, remove EGR modulator with bracket and air intake chamber with throttle body. Disconnect and label all fuel injection wiring and linkages.
4. On all models, remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and fuel pump drive cam off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head.
6. Remove chain cover bolt in front of camshaft sprocket. Remove cylinder head bolts in reverse of tightening sequence. See **Fig. 1**. Remove rocker arm assembly.
7. Pry equally at front and rear of rocker arm assembly to clear locating dowels. Lift head carefully to clear locating dowels. If difficult to remove, pry with flat bar between cylinder head and block projection. Remove EGR valve and intake and exhaust manifolds

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and turn camshaft so dowel is at top.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

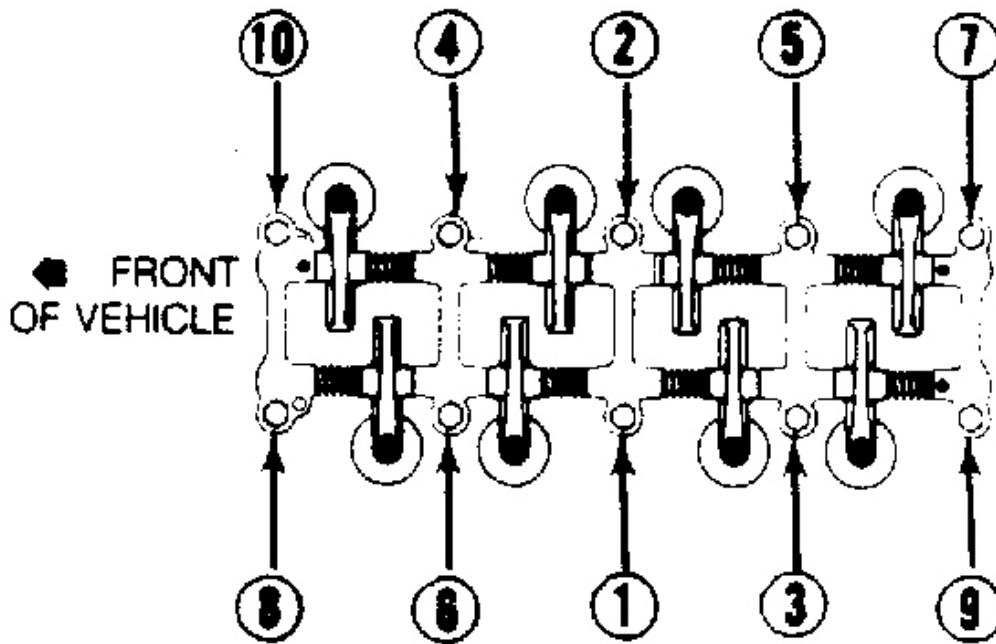


Fig. 1: Cylinder Head/Rocker Arm Bolt Tightening Sequence

NOTE: Loosen head bolts in reverse order.

ENGINE FRONT COVER OIL SEAL

Removal & Installation

1. Seal is a press fit in oil pump body at front of crankshaft. Remove crankshaft pulley set bolt. Using gear puller, remove crankshaft pulley. Pry out seal with screwdriver.
2. Drive new seal into position using installer tool (09223-50010). Lubricate seal lip lightly with multi-purpose grease after installation. Tighten crankshaft pulley bolt to specification.

TIMING CHAIN

Removal

1. Remove cylinder head and oil pan. Remove radiator, drive belts, air pump, and alternator bracket. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley and water by-pass tube bolts. Remove timing chain cover assembly.
2. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump

drive and chain sprocket.

Inspection

1. Check chain, sprockets, tensioner, and chain dampers for wear. Replace chain tensioner if width is less than .43" (11 mm). Minimum size for left and right side chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance between 17 links should be 5.79" (147.0 mm). See **Fig. 2**.

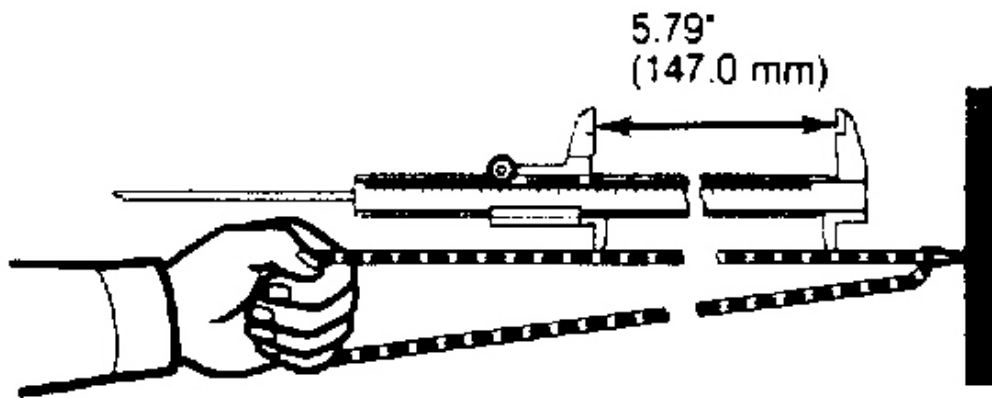


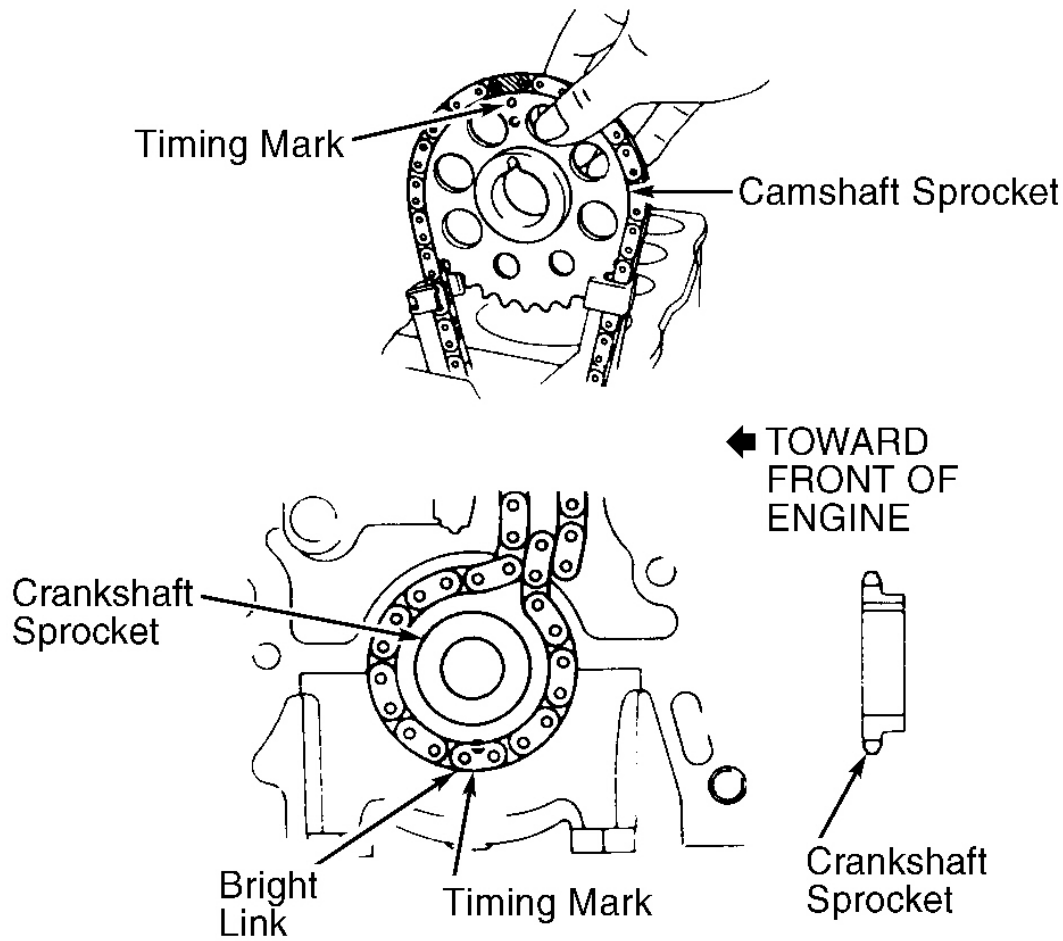
Fig. 2: Checking Timing Chain Stretch

NOTE: Check chain length between 17 links.

3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to the sprocket, measure the outer sides of the chain rollers. Using the same method, measure the crankshaft sprocket and chain.
4. The minimum dimension for crankshaft sprocket and chain is 2.339" (59.4 mm). The minimum dimension for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace chain and both sprockets.

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will be facing up). Position sprocket on crankshaft. Place chain on sprocket with single bright link aligned with the timing mark on sprocket.
2. Install cam sprocket in chain so that timing mark on sprocket is located between 2 chromed links. See **Fig. 3**. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.



93E00418

Fig. 3: Aligning Camshaft Sprocket & Timing Chain

NOTE: Camshaft dowel pin should be in 12 o'clock position.

- Continue installation in reverse of removal procedure. Set camshaft timing as follows: With No. 1 cylinder at TDC on compression stroke, position camshaft so that dowel on sprocket flange is at 12 o'clock position.

CAMSHAFT

Removal

Remove cylinder head and rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

Inspection

1. Camshaft bearing clearance may be checked using Plastigage method. If clearance exceeds specifications, replace cylinder head and/or camshaft. Measure journal diameter.
2. Maximum camshaft runout at center journal is .008" (.2 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678-1.682" (42.63-42.72 mm), or exhaust height is less than 1.681-1.684" (42.69-42.78 mm).

Installation

To install, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward the front. Adjust valves.

VALVE ARRANGEMENT

- Right Side - Intake valves.
- Left Side - Exhaust valves.

ROCKER ARM ASSEMBLY

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.01-.05 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly, noting that all rocker arms are identical, but that all rocker stands are different. See **Fig. 4**.

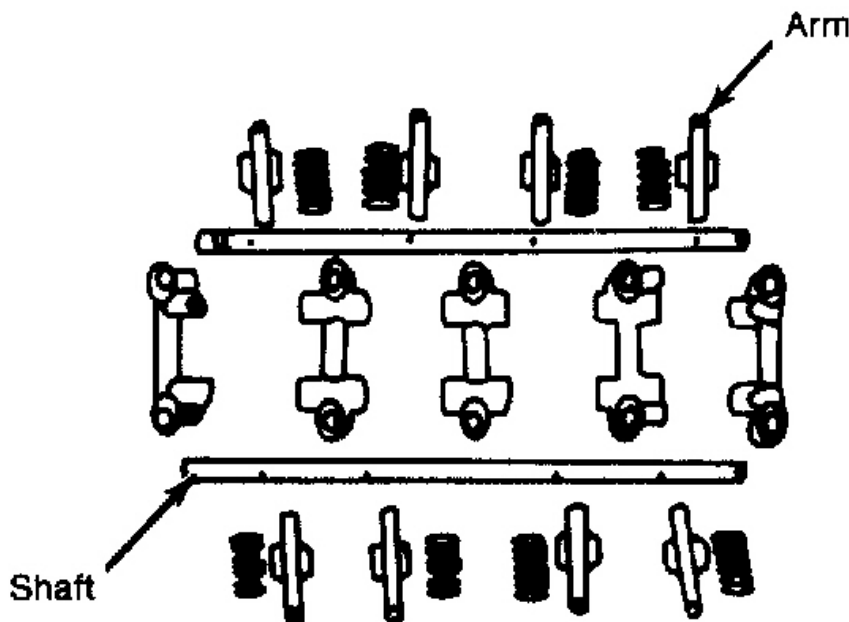


Fig. 4: Disassembled View Of Rocker Arm Assembly**VALVE TIMING**

1. Turn crankshaft so No. 1 piston is at TDC of compression stroke (align mark on crankshaft with pointer on chain cover). Turn camshaft to locate dowel pin and stamped mark on camshaft at 12 o'clock position.
2. Timing mark on camshaft sprocket must be between 2 plated links on timing chain. Plated link on timing chain must be aligned with crankshaft sprocket timing mark.

VALVE SPRINGS

Check valve spring free length and squareness. If less than 1.8" (45.8 mm) long or out of square more than .063" (1.6 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified.

VALVE STEM OIL SEALS**Removal & Installation**

1. Using a spring compressor, remove valve keepers. Withdraw spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Slide a new oil seal over valve stem, using care not to damage seal as it passes over keeper grooves. Force seal over end of valve guide. Reverse removal procedure for remaining components.

VALVE GUIDE SERVICING**Removal & Installation**

1. If valve stem oil clearance exceeds specifications, valve guides must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).
2. Using driver (09201-60011), drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Guide should have .75" (19 mm) protrusion above cylinder head. Ream valve guide for proper stem clearance.

VALVE CLEARANCE ADJUSTMENT

1. Engine must be at normal operating temperature. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on the compression stroke. Measure clearance between rocker arm and valve stem. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves.
2. Rotate crankshaft one complete revolution (360°) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENT

Valve	In. (mm)
Intake	.008 (.20)
Exhaust	.012 (.30)

PISTON & ROD ASSEMBLY

REMOVAL

1. Remove cylinder head and oil pan. Machine ring ridge from top of cylinder. Mark rods and caps for correct assembly, then remove rod caps.
2. Cover rod bolts with short length of hose to prevent crankshaft damage, then push piston/rod assembly out of block.

INSTALLATION

Lubricate piston, cylinder and journal with clean engine oil. Position rings, and install ring compressor. See **Fig. 5**. Stamped mark on ring must face upward. Install piston/rod assembly in proper position with notch on piston top facing forward.

FITTING PISTONS

1. Measure cylinder bore at top, bottom, and center of piston travel. Measure in line with and at 90° to crankshaft. Standard bore in 3.6220-3.6232" (92.00-92.03 mm) with a wear limit of .008" (.20 mm). Maximum taper and out-of-round are .0008" (.200 mm).
2. Measure piston at right angle to pin and just below oil ring groove. If not within specifications, rebore cylinder and/or replace pistons. Pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON SIZE CHART

Application	In. (mm)
22R & 22R-E	
Standard	3.6196-3.6208 (91.938-91.968)
.5 mm O/S	3.6393-3.6405 (92.438-92.468)
1.0 mm O/S	3.6590-3.6602 (92.938-92.968)
22R-TE	3.6195-3.6207 (91.935-91.965)

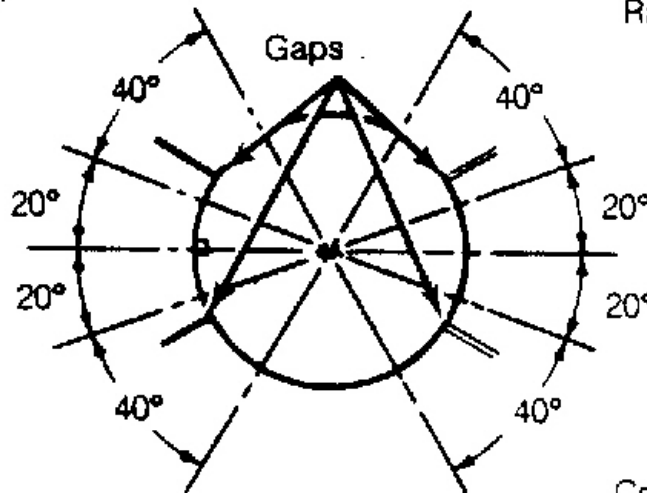
FITTING RINGS

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace the ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with code marks facing up. Position ring end gaps correctly. See **Fig. 5**.

Compression
Ring No. 1
& Expander

Lower
Side
Rail

Upper
Side
Rail



Compression
Ring No. 2

Fig. 5: Correct Piston Ring Gap Arrangement

NOTE: Stamped mark on ring must face upward.

PISTON PIN REPLACEMENT

REMOVAL

Try to move piston back and forth on the piston pin. If any movement is felt, replace piston and pin. Heat piston to 176°F (80°C). Using hammer and driver, push piston pin out of piston and connecting rod.

INSPECTION

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater than .0006" (.015 mm).
2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. The maximum rod bend and twist limit is .002" (.05 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: Piston and pin are a matched set. Use new snap rings for reassembly.

INSTALLATION

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. Push piston pin into piston and rod assembly. Install snap rings.

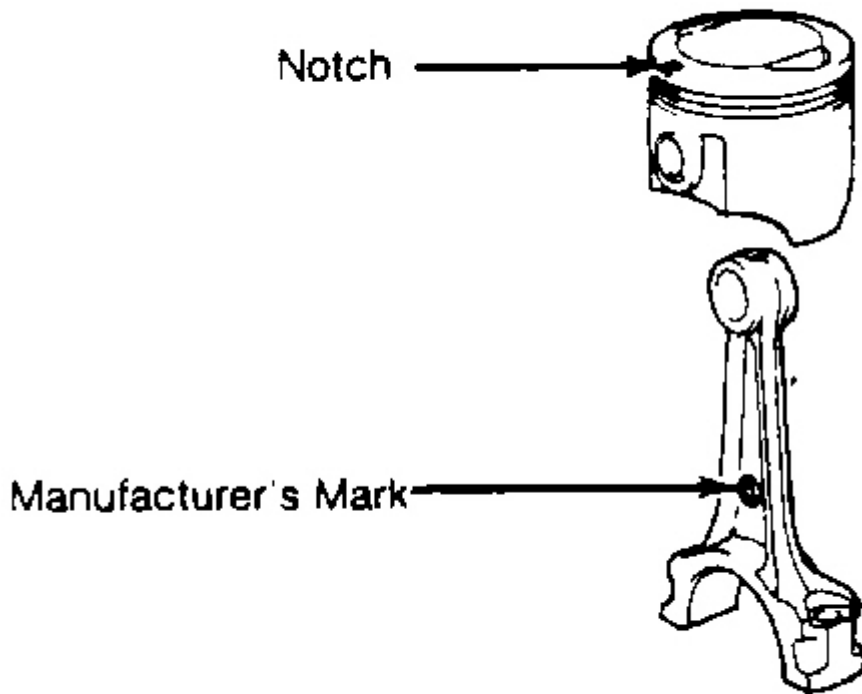


Fig. 6: Correct Alignment of Piston & Rod Assembly

NOTE: Mark on rod and indent on piston crown must face same direction.

MAIN BEARINGS

1. Measure crankshaft runout at center bearing journal. If runout exceeds .004" (.1 mm), replace crankshaft.
2. Inspect all journals for wear or scoring. Out-of-round or taper limit is .004" (.1 mm). If crankshaft is worn excessively, grind journals for undersize bearings.
3. Measure bearing clearances using Plastigage method. Observe correct tightening sequence. See **Fig. 7**. If clearance exceeds specifications, grind journals for undersize bearings.
4. Main bearings are available .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.70-59.71 mm).

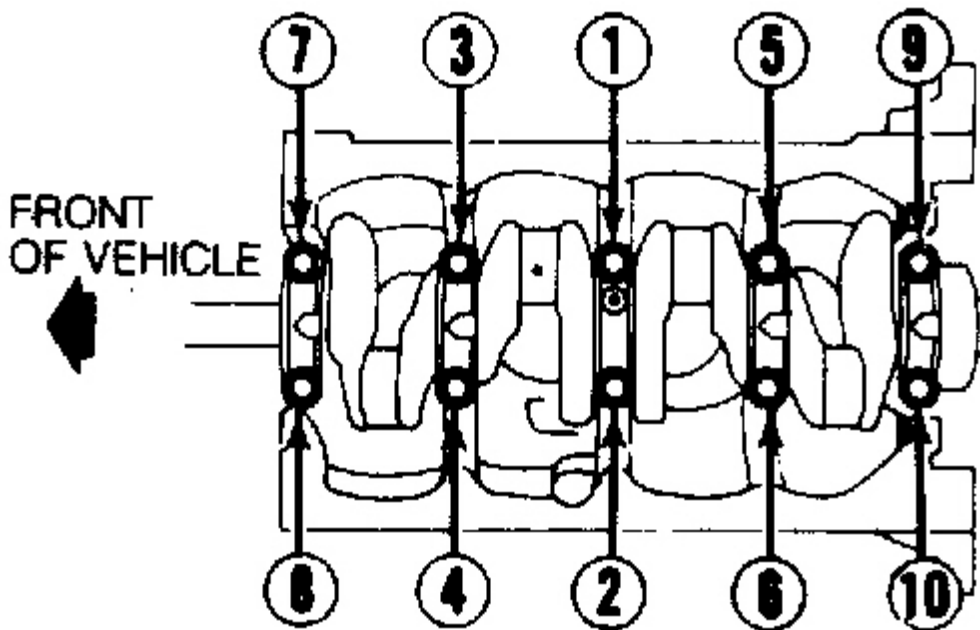


Fig. 7: Tightening Main Bearings

CONNECTING ROD BEARINGS

1. Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .004" (.10 mm).
2. Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.01 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.70-52.71 mm).

THRUST BEARING ALIGNMENT

Check crankshaft end play at thrust bearing using a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Oil grooves must be facing out.

THRUST WASHER SPECIFICATIONS

Size	Thickness In. (mm)
Standard	.1059-.1079 (2.690-2.740)
0.124 O/S	.1084-.1104 (2.753-2.803)
0.250 O/S	.1108-.1128 (2.815-2.865)

REAR MAIN BEARING OIL SEAL

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Using tool (09223-41010), drive oil seal in place. After installing new seal, coat seal lip lightly with multi-purpose grease.

ENGINE LUBRICATION

ENGINE OILING SYSTEM

Oiling system is force fed, utilizing a gear and crescent type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full flow oil filter and then to oil galleries in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly.

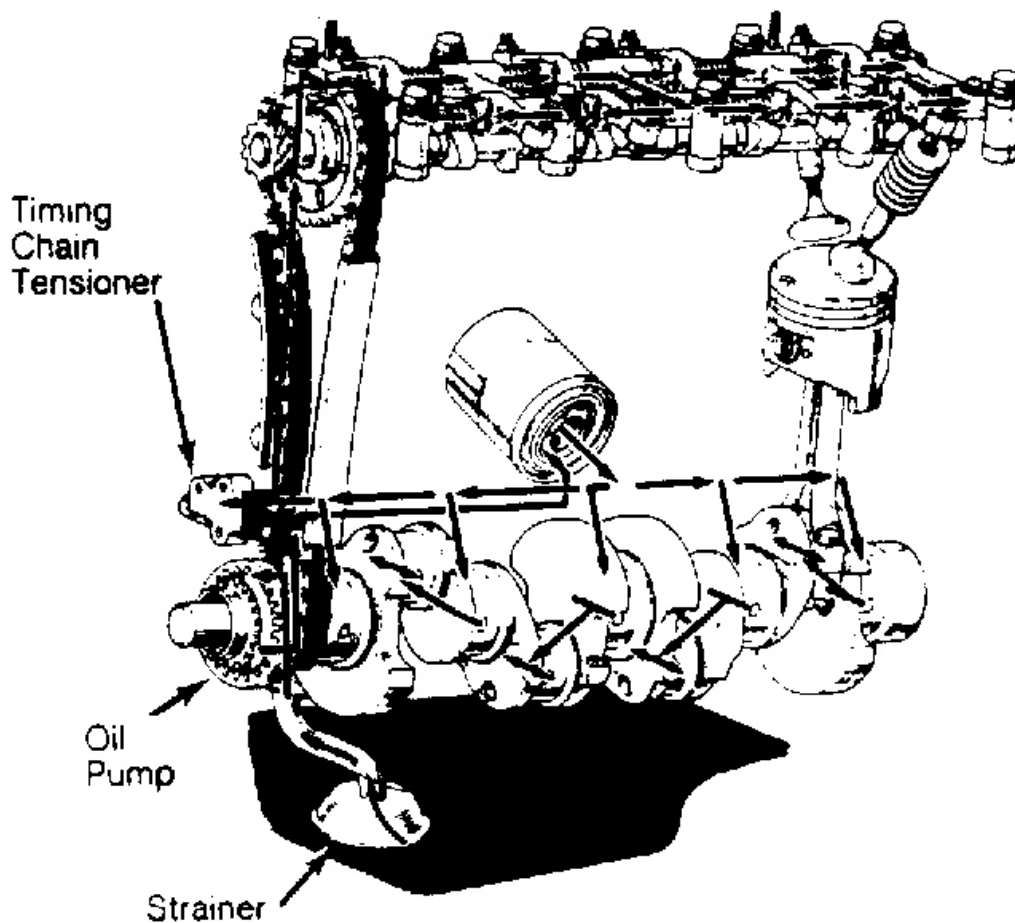


Fig. 8: Engine Oiling System

OIL PAN

Removal

1. Drain engine oil. Remove engine undercover. On Pickup models, detach steering idler arm bracket. Remove pitman arm and front crossmember. Remove oil pan.
2. On Celica, remove engine shock absorber and engine mount bolts. Jack engine up about 1" (25 mm). Remove oil pan bolts and nuts. Remove oil pan.

Installation

Place gasket on pan and apply sealer to 4 corners where front cover and rear seal retainer join cylinder block. Install pan. To complete installation, reverse removal procedure.

CRANKCASE CAPACITY

4.9 qts. (4.6L) including filter.

OIL FILTER

Full-flow type with paper elements. Located at right side of engine.

OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

PRESSURE RELIEF VALVE

64 psi (4.5 kg/cm²) operating pressure.

OIL PUMP

Removal

1. Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly.
2. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

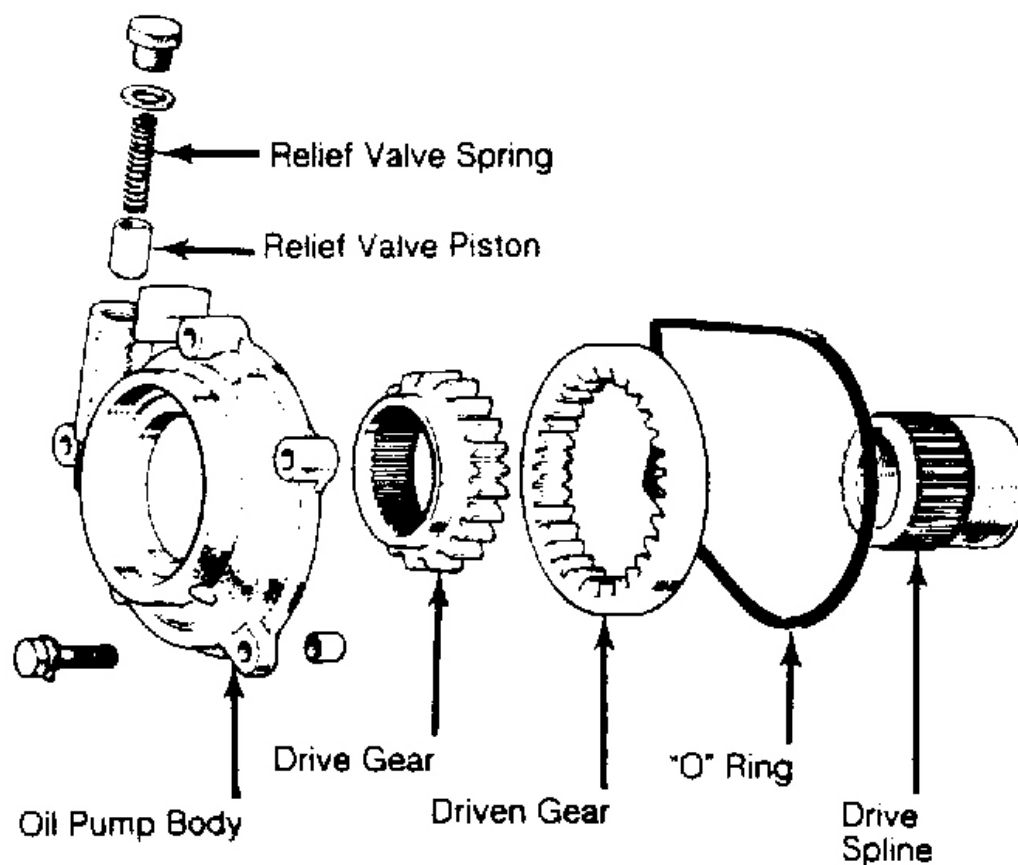


Fig. 9: Exploded View of Oil Pump

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. Complete installation in reverse of removal procedure.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Drive Gear-to-Crescent	
Standard	.0087-.0098 (.220-.25)
Wear Limit	.012 (.30)
Driven Gear-to-Crescent	
Standard	.0059-.0083 (.15-.21)
Wear Limit	.012 (.30)
Driven Gear-to-Body	

1985 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1985 Engines - 2.4L 4-Cylinder

Standard	.0035-.0059 (.09-.15)
Wear Limit	.008 (.20)
Gear Faces-to-Body	
Standard	.0012-.0035 (.03-.09)
Wear Limit	.0059 (.15)

ENGINE COOLING

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fluid coupling, pulley and fan belt. Remove 7 bolts and 2 nuts and take pump off engine.

Installation

To install, use new gasket on clean mating surfaces and reverse removal procedure.

COOLING SYSTEM CAPACITY

8.9 qts. (8.4L).

RADIATOR CAP

11-15 psi (.75-1.05 kg/cm²).

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	14 (20)
Camshaft Sprocket Bolt	58 (78)
Connecting Rod Cap Bolts	46 (62)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head Bolts	58 (78)
Exhaust Manifold	33 (44)
Flywheel Bolts	80 (108)
Intake Manifold	14 (20)
Main Bearing Cap Bolts	76 (103)
Timing Cover Bolts	
8 mm	9 (12)
10 mm	29 (39)

1985 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1985 Engines - 2.4L 4-Cylinder

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

Application	In. (mm)
22R	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	2-Bbl.
HP @ RPM	95 @ 4800
Torque Ft. @ RPM	129 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-E	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	116 @ 4800
Torque Ft. @ RPM	140 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-TE	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	135 @ 4800
Torque Ft. @ RPM	173 @ 2800
Compr. Ratio	8.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)

VALVE SPECIFICATIONS**VALVE SPECIFICATIONS**

Application	In. (mm)
Intake	

1985 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1985 Engines - 2.4L 4-Cylinder

Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3138-.3144 (7.970-7.985)
Stem Clearance	.0008-.0024 (.002-.060)
Exhaust	
Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3136-.3142 (7.965-7.980)
Stem Clearance	.0012-.0028 (.030-.070)
(1) Correction angles are 30° and 65°.	

PISTONS, PINS, & RINGS SPECIFICATIONS**PISTONS, PINS, & RINGS SPECIFICATIONS**

Application	In. (mm)
Piston Clearance	(1) .0020-.0028 (.050-.071)
Pins	
Piston Fit	n/a
Rod Fit	.0002-.0004 (.005-.011)
Rings	
Ring No. 1	
End Gap ⁽²⁾	.0094-.0142 (.24-.36)
Side Clearance	.008 (.20)
Ring No. 2	
End Gap ⁽²⁾	.0071-.0154 (.18-.39)
Side Clearance	.008 (.20)
Oil Ring	
End Gap	.0079-.0323 (.20-.82)
Side Clearance	n/a

(1) Specification is for 22R and 22R-E. 22R-TE is .0022-.0030" (.055-.075).

(2) Specifications are for Celica; Pickup compression ring end gaps are No. 1 .0138-.0224" (.349-.569 mm) and No. 2 .0098-.0185" (.25-.47 mm).

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**

Application	In. (mm)
Main Bearings	

1985 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1985 Engines - 2.4L 4-Cylinder

Journal Diameter	2.3614-2.3622 (59.98-60.00)
Clearance	.0010-.0022 (.025-.055)
Thrust Bearing	Center
Crankshaft End Play	.0008-.0087 (.020-.22)
Connecting Rod Bearings	
Journal Diameter	2.0865-2.0866 (52.998-53.00)
Clearance	.0010-.0022 (.025-.055)
Side Play	.0063-.0102 (.160-.259)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
Journal Diameter	1.2984-1.2992 (32.98-33.00)
Clearance	.0004-.0020 (.010-.050)
End play	
Nominal	.0031-.0071 (.08-.18)
Maximum	.0098 (.25)

VALVE SPRING SPECIFICATIONS**VALVE SPRING SPECIFICATIONS**

Application	In. (mm)
Free Length	1.909 (48.50)
Pressure Lbs. @ In. (Kg @ mm)	
Valve Closed	66.1 @ 1.59 (30 @ 40.5)
Valve Open	n/a

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R]

1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

ENGINE IDENTIFICATION

Engine serial number is stamped on left side of cylinder block, behind the alternator. The last group of characters designates engine type.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
Pickup & 4Runner		
Carburetor	22R	R
Fuel Injection	22R-E	R
Turbocharger	22R-TE	R

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

1. Engine must be at normal operating temperature. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on compression stroke. Measure clearance between rocker arm and valve stem. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves.
2. Rotate crankshaft one complete revolution (360 degrees) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENT

Valve	In. (mm)
Intake	.008 (.20)
Exhaust	.012 (.30)

REMOVAL & INSTALLATION

ENGINE

Removal

1. Disconnect negative battery cable. Remove hood and drain cooling system. Remove air cleaner. Remove fan, radiator, shroud, hoses and upper bracket. Remove and support air conditioning compressor without discharging system (if equipped).
2. Disconnect heater hoses, fuel lines and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses for reassembly reference. Remove alternator and distributor.
3. On 22R-E and 22R-TE engines, remove EGR modulator and air intake chamber with throttle body. Disconnect actuator, accelerator and throttle cables. Disconnect and label all fuel injection wiring and

vacuum hoses. On 22-R engines, disconnect accelerator linkage from carburetor.

4. On automatic transmission equipped models, disconnect transmission throttle cable and drain fluid. On power steering equipped models, remove pump from engine. **DO NOT** disconnect hoses. On manual transmission equipped models, remove shift lever and clutch slave cylinder.
5. Raise and support vehicle. Disconnect front exhaust pipe. Remove engine undercover. Disconnect transmission shift linkage. On automatic transmission equipped models, disconnect cooler lines.
6. Remove drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install engine, reverse removal procedure. Be sure to check all fluid levels and linkage adjustments prior to starting engine.

MANIFOLDS

Removal

Remove heater inlet pipe-to-cylinder head bolt. Remove No. 1 air pipe. Remove intake manifold with delivery pipe, injection nozzles and heater water inlet pipe as an assembly. Remove exhaust manifold bolts and exhaust manifold.

Installation

To install intake and exhaust manifolds, use new gaskets and reverse removal procedure.

CYLINDER HEAD

Removal

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect front exhaust pipe. On turbocharged models, remove turbocharger assembly. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection) and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. Remove fuel pump (22-R) from cylinder head. Remove distributor with cap and wires.
3. Remove power steering pump and set aside (if equipped). On fuel-injected vehicles, remove EGR modulator with bracket and air intake chamber with throttle body. Disconnect and label all fuel injection wiring and linkages for reassembly reference.
4. Remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and cam thrust plate off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head. Remove chain cover bolt in front of camshaft sprocket.
6. Loosen cylinder head bolts, in 2 or 3 stages, in reverse of tightening sequence. See **Fig. 1** . Remove rocker arm assembly. If necessary, pry equally at front and rear of rocker arm assembly to remove.

7. Lift head from dowels on block and set on wood blocks on work bench. If difficult to remove, pry with flat bar between cylinder head and block projection. Remove EGR valve, intake and exhaust manifolds.

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and turn camshaft so dowel is at top.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. See **Fig. 1** . Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

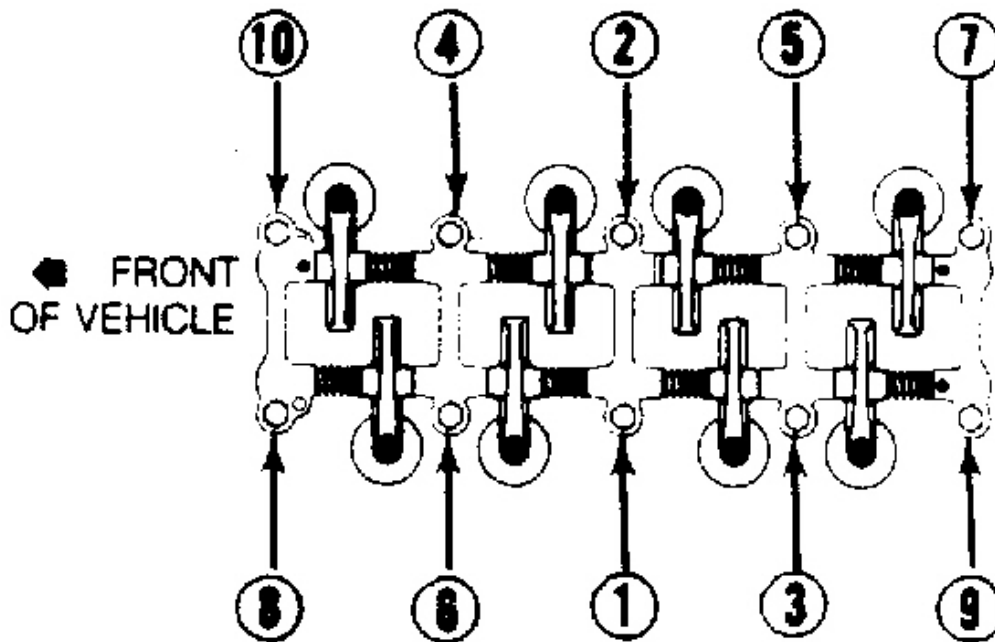


Fig. 1: Cylinder Head/Rocker Arm Bolt Tightening Sequence

ENGINE FRONT COVER OIL SEAL

Removal & Installation

1. Seal is a press fit in oil pump body at front of crankshaft. Remove crankshaft pulley bolt. Using gear puller, remove crankshaft pulley. Pry out seal with screwdriver.
2. Apply grease to lip of new oil seal and sealant to outside of seal. Drive new seal into position using Seal Installer (09223-50010). Tighten crankshaft pulley bolt to specification.

TIMING CHAIN

Removal

1. Remove cylinder head and oil pan. Remove radiator, drive belts, air pump and alternator bracket. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley, water by-pass tube bolts and heater tube. Remove timing chain cover assembly.
2. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump drive and chain sprocket.

Inspection

1. Check chain, sprockets, tensioner and chain dampers for wear. Replace chain tensioner if width is less than .43" (11 mm). Minimum size for left and right chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance between 17 links should be 5.79" (147.0 mm). See **Fig. 2**.

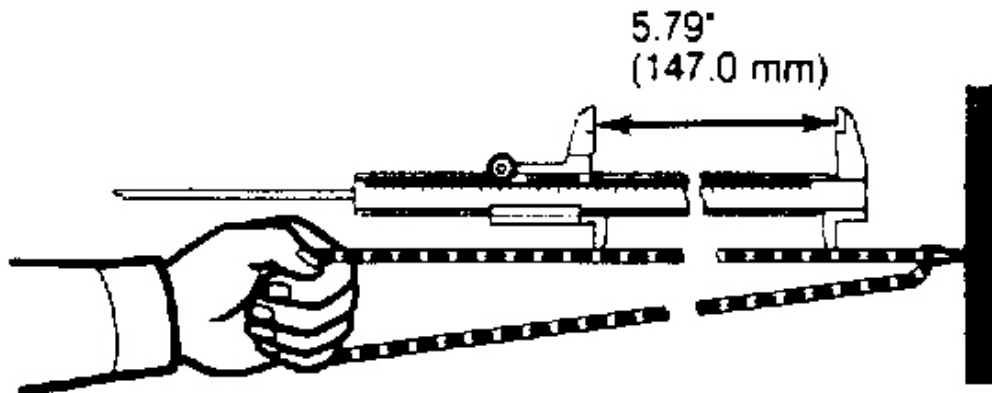


Fig. 2: Checking Timing Chain Stretch

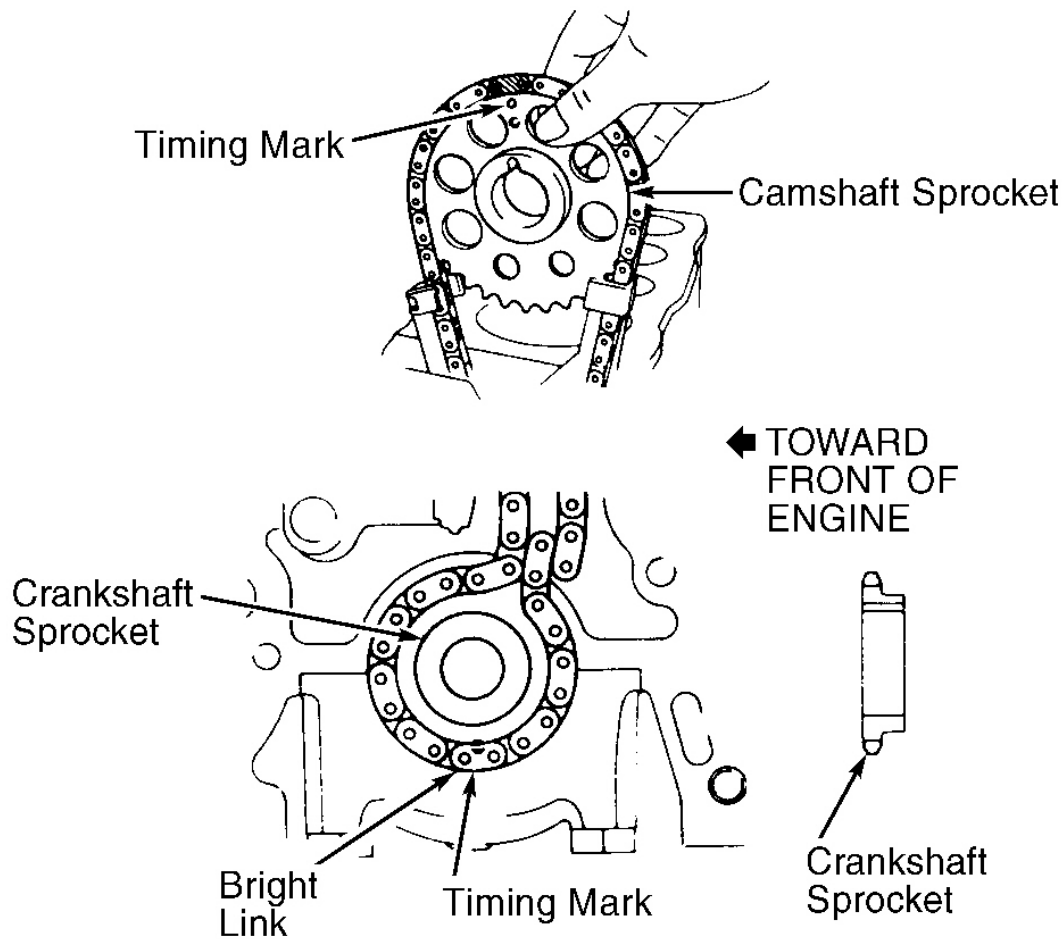
3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to sprocket, measure outer sides of chain rollers. Using same method, measure crankshaft sprocket and chain.
4. The minimum dimension for crankshaft sprocket and chain is 2.34" (59.4 mm). The minimum dimension for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace chain and both sprockets.

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will be facing up). Position sprocket on

crankshaft. Place chain on sprocket with single bright link aligned with timing mark on sprocket.

2. Install cam sprocket in chain so timing mark on sprocket is located between 2 chromed links. See **Fig. 3**. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.



93E00418

Fig. 3: Aligning Camshaft Sprocket & Timing Chain

3. Continue installation in reverse of removal procedure. Set camshaft timing by placing No. 1 cylinder at TDC on compression stroke and positioning camshaft so dowel on sprocket flange is in 12 o'clock position.

CAMSHAFT

Removal

Remove cylinder head and rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

Inspection

1. Camshaft journal oil clearance may be checked using Plastigage method. If clearance exceeds specification, replace cylinder head and/or camshaft. Maximum clearance is .004" (.10 mm).
2. Maximum camshaft runout at center journal is .008" (.20 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678-1.689" (42.62-42.90 mm), or exhaust lobe height is less than 1.681-1.684" (42.70-42.77 mm).

Installation

To install camshaft, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward front. Adjust valves.

VALVE ARRANGEMENT

Right Side: Intake valves.

Left Side: Exhaust valves.

ROCKER ARM ASSEMBLY

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.010-.050 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly. Note that rocker arms are identical. See **Fig. 4**.

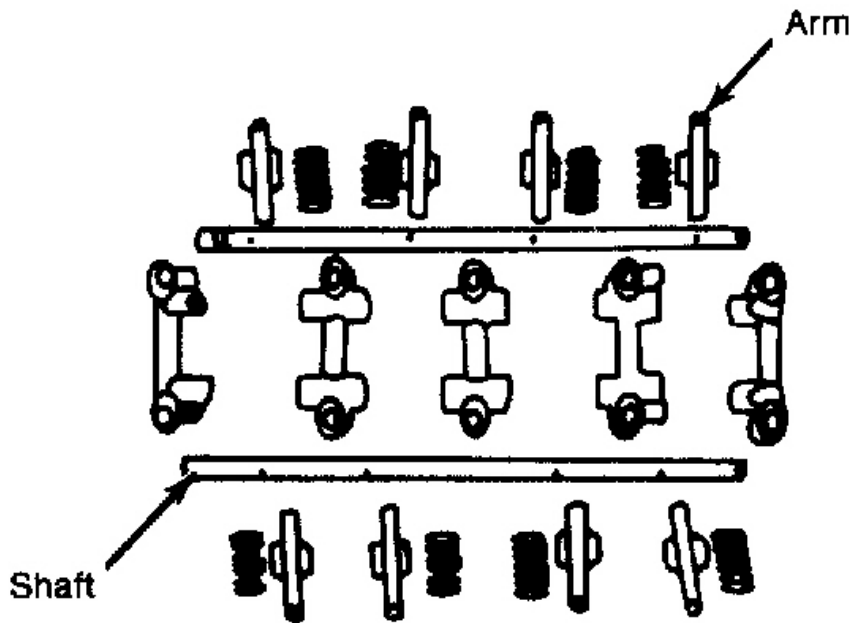


Fig. 4: Disassembled View of Rocker Arm Assembly

VALVE TIMING

1. Turn crankshaft so Woodruff key is on top. Slide crankshaft sprocket over key onto crankshaft. Place timing chain on sprocket with single plated link aligned with timing mark on sprocket.
2. Turn camshaft to locate dowel pin and stamped mark on camshaft at 12 o'clock position. Timing mark on camshaft sprocket must be between 2 plated links on timing chain. Single plated link on timing chain must be aligned with crankshaft sprocket timing mark.

VALVE SPRINGS

Check valve spring free length and squareness. If free length is less than 1.8" (45.8 mm) or out-of-square more than .067" (1.7 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified.

VALVE STEM OIL SEALS

Removal & Installation

1. Using a spring compressor, remove valve keepers. Remove spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Slide a new oil seal over valve stem, using care not to damage seal as it passes over keeper grooves. Force

seal over end of valve guide. To complete installation, reverse removal procedure.

VALVE GUIDE SERVICING

Removal & Installation

1. Measure diameter of valve guide and valve stem. Maximum clearance for exhaust valves is .0039" (.10 mm). Maximum clearance for intake valves is .0031" (.08 mm). If valve stem oil clearance exceeds specification, valve guides and valves must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).
2. Using Valve Guide Remover (09201-60011) and hammer, drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Ream valve guide with a .31" (8 mm) reamer for proper stem clearance.

OVERHAUL

PISTON & ROD ASSEMBLY

Removal

Remove cylinder head and oil pan. Remove ring ridge from top of cylinder. Mark rods and caps for correct assembly. Remove rod caps. Cover rod bolts with short length of hose to prevent crankshaft damage. Push piston/rod assembly out of block.

Installation

Lubricate piston, cylinder and journal with clean engine oil. Position rings, and install ring compressor. See **Fig. 5**. Stamped mark on ring must face upward. Install piston/rod assembly in proper position with notch on piston top facing forward.

FITTING PISTONS

1. Measure cylinder bore at top, bottom and center of piston travel. Measure in line with and at 90 degrees to crankshaft. Standard bore is 3.6220-3.6232" (91.998-92.029 mm) with a wear limit of .0008" (.020 mm). Maximum out-of-round is .0008" (.020 mm). Maximum taper is .0004" (.010 mm).
2. Measure piston at right angle to pin and just below oil ring groove. If not within specification, rebore cylinder and/or replace pistons. On 22R and 22R-E engines, pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON SIZE CHART

Application	In. (mm)
22R & 22R-E	
Standard	3.6196-3.6208 (91.938-91.968)
0.5 mm O/S	3.6393-3.6405 (92.438-92.468)

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

1.0 mm O/S	3.6590-3.6602 (92.938-92.968)
22R-TE	3.6195-3.6207 (91.935-91.965)

FITTING RINGS

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with code marks facing up. Position ring end gaps correctly. See **Fig. 5**.

Compression
Ring No. 1
& Expander

Lower
Side
Rail

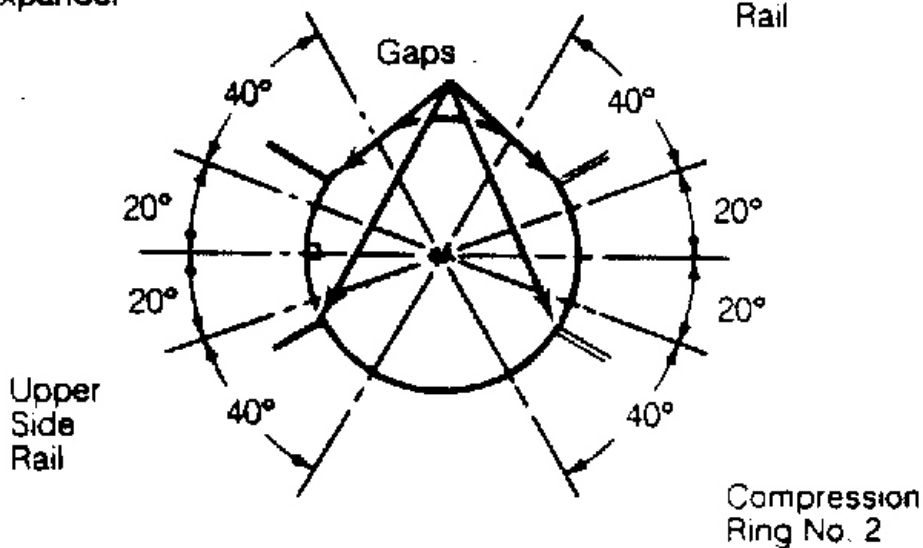


Fig. 5: Correct Piston Ring Gap Arrangement

PISTON PIN REPLACEMENT

Removal

Heat piston to 176°F (80°C). Using hammer and driver, push piston pin out of piston and connecting rod.

Inspection

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater

than .0006" (.015 mm).

2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. The maximum rod bend and twist limit is .002" (.05 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: Piston and pin are a matched set. Use new snap rings for reassembly.

Installation

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. Push piston pin into piston and rod assembly. Install snap rings.

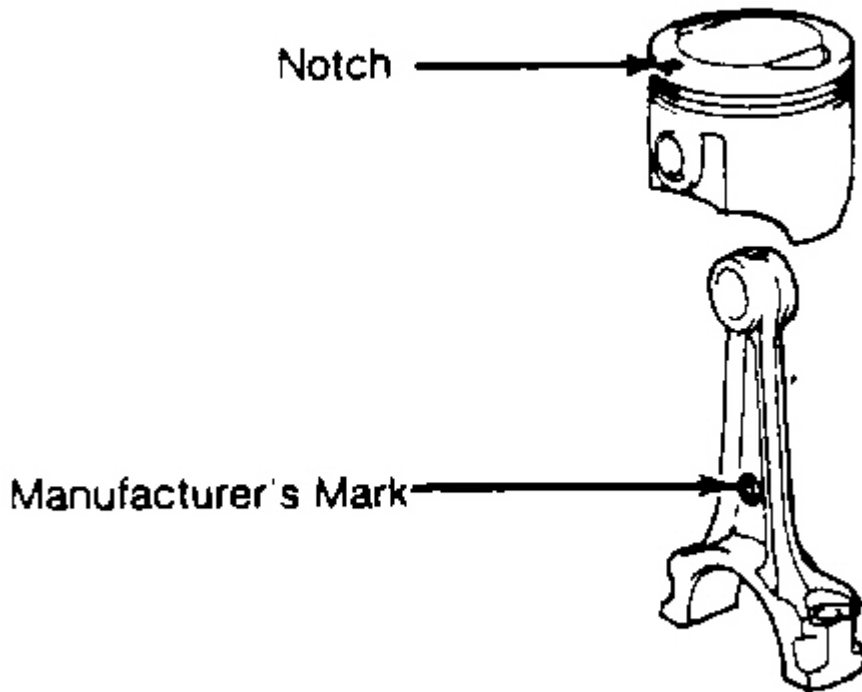


Fig. 6: Correct Alignment of Piston & Rod Assembly

MAIN BEARINGS

1. Measure crankshaft runout at center bearing journal. If runout exceeds .004" (.10 mm), replace crankshaft.
2. Inspect all journals for wear or scoring. Out-of-round or taper limit is .0004" (.010 mm). If crankshaft is

worn excessively, grind journals for undersize bearings.

3. Measure bearing clearances using Plastigage method. Observe correct tightening sequence. See **Fig. 7** . If clearance exceeds specification, grind journals for undersize bearings.
4. Maximum bearing clearance is .0031" (.078 mm). Main bearings are available in .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.700-59.710 mm).

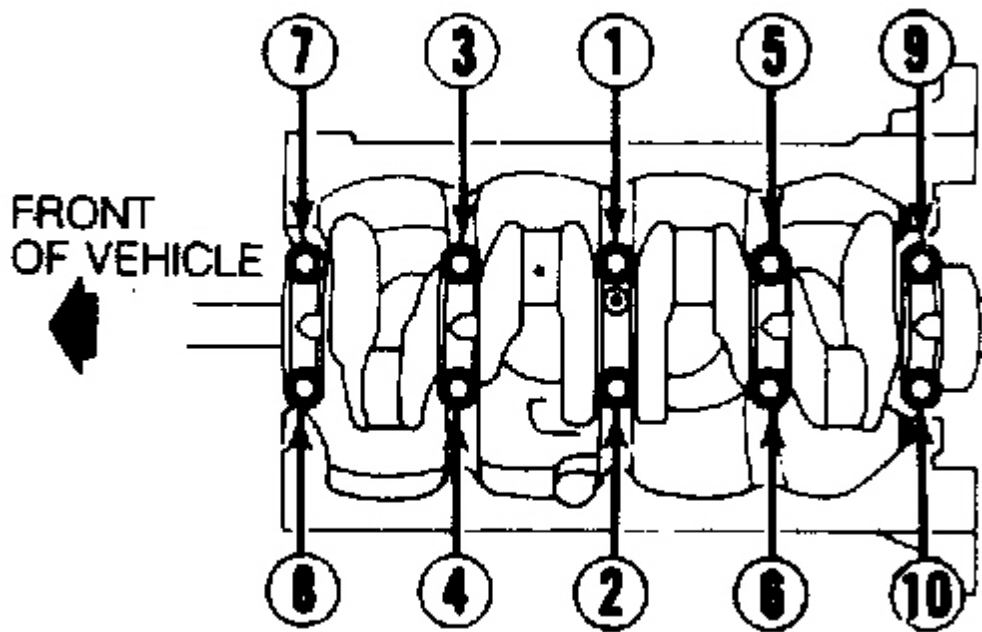


Fig. 7: Main Bearing Tightening Sequence

CONNECTING ROD BEARINGS

1. Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .0031" (.078 mm).
2. Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.010 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.699-52.710 mm).

THRUST BEARING ALIGNMENT

Check crankshaft end play at thrust bearing using a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Oil grooves must be facing out.

THRUST WASHER SPECIFICATIONS

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

Size	Thickness In. (mm)
Standard	.1059-.1079 (2.690-2.740)
0.125 O/S	.1084-.1104 (2.753-2.803)
0.250 O/S	.1108-.1128 (2.815-2.865)

REAR MAIN BEARING OIL SEAL

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Apply grease to lip of new oil seal. Using Seal Driver (09223-41010), drive oil seal in place.

ENGINE LUBRICATION

ENGINE OILING SYSTEM

Oiling system is force fed, utilizing a gear-type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full-flow oil filter and then to oil galleys in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly.

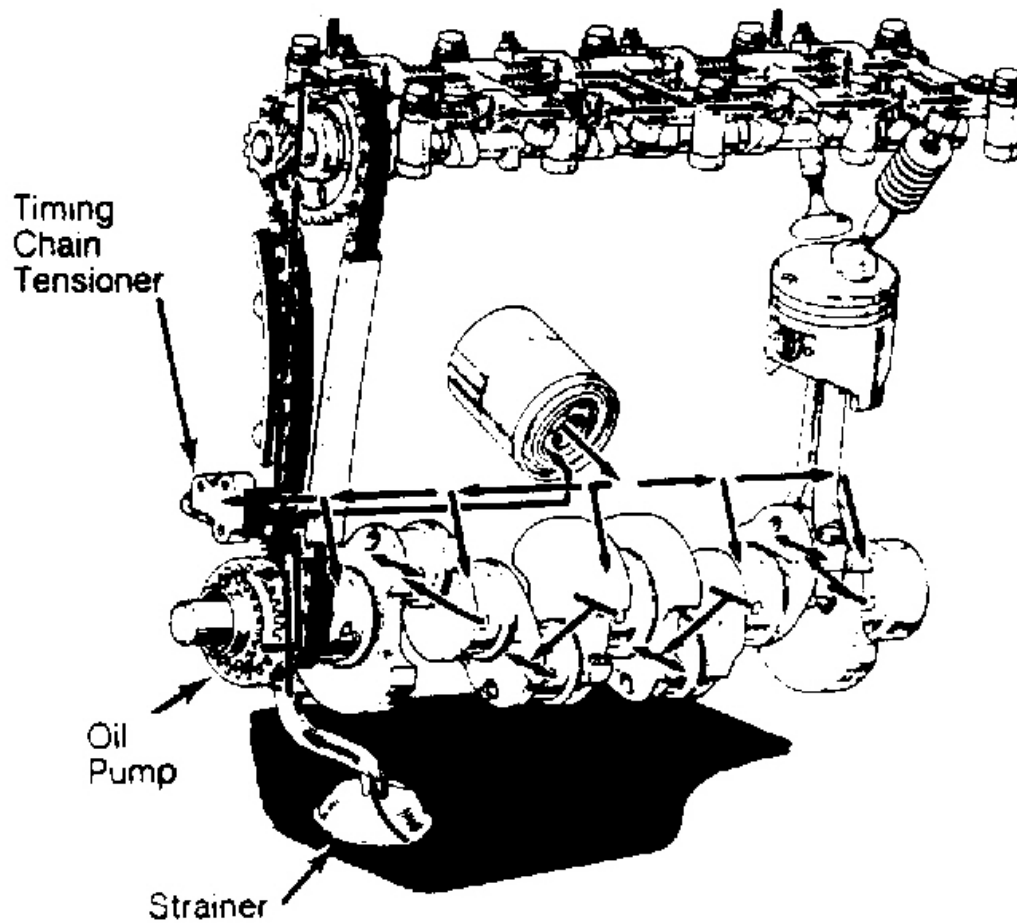


Fig. 8: Engine Oiling System

OIL PAN

Removal

Drain engine oil. Remove engine undercover. Detach steering idler arm bracket. Remove pitman arm and front crossmember. Remove oil pan.

Installation

Place gasket on pan and apply sealer to 4 corners where front cover and rear seal retainer join cylinder block. Install pan. To complete installation, reverse removal procedure.

CRANKCASE CAPACITY

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

The engine oil capacity is 4.9 qts. (4.6L) including oil filter.

OIL FILTER

Oil filter is a full-flow, disposable type. Filter is located at right side of engine.

OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

PRESSURE RELIEF VALVE

Relief valve is nonadjustable, with a 64 psi (4.5 kg/cm²) operating pressure.

OIL PUMP

Removal

1. Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly.
2. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. To complete installation, reverse removal procedure.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Drive Gear-to-Crescent	
Standard	.0087-.0098 (.221-.249)
Wear Limit	.012 (.30)
Driven Gear-to-Crescent	
Standard	.0059-.0083 (.149-.211)
Wear Limit	.012 (.30)
Driven Gear-to-Body	
Standard	.0035-.0059 (.088-.149)
Wear Limit	.008 (.20)
Gear Faces-to-Body	
Standard	.0012-.0035 (.030-.088)
Wear Limit	.0059 (.149)

ENGINE COOLING

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fan clutch, pulley and fan belt. Remove 6 bolts and 3 nuts. Remove pump from engine.

Installation

To install water pump, use new gasket on clean mating surfaces and reverse removal procedure.

NOTE: For further information on cooling systems, see **ENGINE COOLING SYSTEMS** in this section.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	In. (mm)
22R	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	2-Bbl.
HP @ RPM	95 @ 4800
Torque Ft. @ RPM	129 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-E	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	116 @ 4800
Torque Ft. @ RPM	140 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-TE	
Displacement	
Cu. In.	144.4

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	135 @ 4800
Torque Ft. @ RPM	173 @ 2800
Compr. Ratio	8.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)

VALVE SPECIFICATIONS**VALVE SPECIFICATIONS**

Application	In. (mm)
Intake	
Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3138-.3144 (7.970-7.985)
Stem Clearance	.0008-.0024 (.002-.060)
Valve Lift	n/a
Exhaust	
Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3136-.3142 (7.965-7.980)
Stem Clearance	.0012-.0028 (.030-.070)
Valve Lift	n/a
(1) Correction angles are 30° and 65°.	

PISTONS, PINS, & RINGS SPECIFICATIONS**PISTONS, PINS, & RINGS SPECIFICATIONS**

Application	In. (mm)
2.4L	
Piston Clearance	(1) .0020-.0028 (.050-.071)
Pins	
Piston Fit	n/a
Rod Fit	.0002-.0004 (.005-.011)
Rings	
Ring No. 1	

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

End Gap	.0138-.0224" (.349-.569 mm)
Side Clearance	.008 (.20)
Ring No. 2	
End Gap	.0098-.0185" (.25-.47 mm)
Side Clearance	.008 (.20)
Oil Ring	
End Gap	.0079-.0323 (.20-.82)
Side Clearance	n/a
(1) Specification is for 22R and 22R-E. 22R-TE is 0.0022-.0030" (.055-.075).	

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECS**CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECS**

Application	In. (mm)
2.4L	
Main Bearings	
Journal Diameter	2.3614-2.3622 (59.98-60.00)
Clearance	.0010-.0022 (.025-.055)
Thrust Bearing	Center
Crankshaft End Play	.0008-.0087 (.020-.22)
Connecting Rod Bearings	
Journal Diameter	2.0865-2.0866 (52.998-53.00)
Clearance	.0010-.0022 (.025-.055)
Side Play	.0063-.0102 (.160-.259)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
2.4L ⁽¹⁾	
Journal Diameter	1.2984-1.2992 (32.98-33.00)
Clearance	.0004-.0020 (.010-.050)
Lobe Lift	n/a
(1) End play is .0031-.0071" (.08-.18 mm). Maximum is .0098" (.25 mm).	

VALVE SPRING SPECIFICATIONS**VALVE SPRING SPECIFICATIONS**

Application	In. (mm)
Free Length	1.909 (48.50)
Pressure Lbs. @ In. (Kg @ mm)	

1986 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1986 ENGINES Toyota - 2.4L & 2.4L Turbo 4-Cylinder

Valve Closed	66.1 @ 1.59 (30 @ 40.5)
Valve Open	n/a

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	14 (20)
Camshaft Sprocket Bolt	58 (78)
Connecting Rod Cap Bolts	46 (62)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head Bolts	58 (78)
Exhaust Manifold	33 (44)
Flywheel Bolts	80 (108)
Intake Manifold	14 (20)
Main Bearing Cap Bolts	76 (103)
Timing Cover Bolts	
8 mm	9 (12)
10 mm	29 (39)

1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R]

1987 ENGINES Toyota - 2.4L 4-Cylinder

ENGINE IDENTIFICATION

Engine serial number is stamped on left side of cylinder block, behind the alternator. The last group of characters designates engine type.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
2.4L 4-Cylinder		
Carburetor	22R	R
Fuel Injection	22R-E	R
Turbocharger	22R-TE	R

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

ADJUSTMENT

CRANKSHAFT MAIN BEARINGS

1. Measure crankshaft runout at center journal. If runout exceeds .004" (.10 mm), replace crankshaft.
2. Inspect all journals for wear or scoring. Out-of-round or taper limit is .0004" (.010 mm). If crankshaft is worn excessively, grind journals for undersize bearings.
3. Measure bearing clearances using Plastigage method. Observe correct tightening sequence. See **Fig. 1** . If clearance exceeds specification, grind journals for undersize bearings.
4. Maximum bearing clearance is .0031" (.078 mm). Main bearings are available in .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.701-59.711 mm).

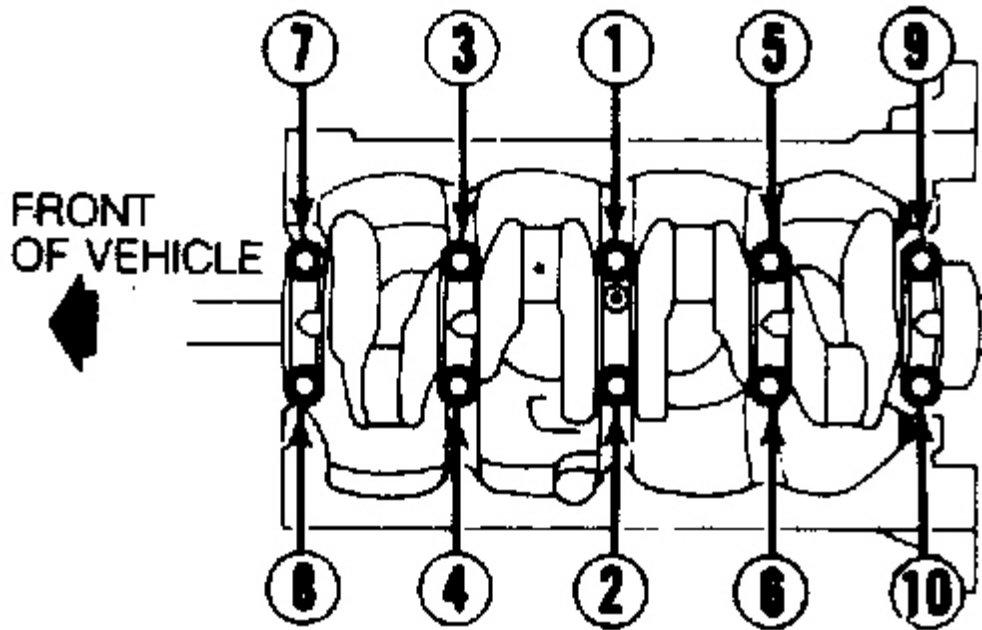


Fig. 1: Main Bearing Tightening Sequence

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

CONNECTING ROD BEARINGS

1. Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .0031" (.078 mm).
2. Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.010 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.699-52.710 mm).

THRUST BEARING ALIGNMENT

Check crankshaft end play at thrust bearing with a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Oil grooves must be facing out.

THRUST WASHER SPECIFICATIONS

Size	Thickness In. (mm)
Standard	.1059-.1079 (2.690-2.740)
0.125 O/S	.1084-.1104 (2.753-2.803)
0.250 O/S	.1108-.1128 (2.815-2.865)

REAR MAIN BEARING OIL SEAL

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Apply grease to lip of new oil seal. Using Seal Driver (09223-41010), drive oil seal in place.

REMOVAL & INSTALLATION

ENGINE

Removal

1. Disconnect the negative battery cable. Drain the cooling system. Disconnect the upper radiator hose from engine. On models with turbocharger, remove turbocharger assembly. On fuel injected engines, remove the air cleaner hose.
2. On all models, remove air cleaner. Disconnect exhaust pipe from exhaust manifold. Remove fan, radiator, shroud, hoses and upper bracket. Remove and support air conditioning compressor without discharging system (if equipped).
3. Disconnect heater hoses, fuel lines and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses for reassembly reference. Remove alternator and distributor.
4. On fuel injected engines, remove EGR modulator and air intake chamber with throttle body. Disconnect actuator, accelerator and throttle cables. Disconnect and label all fuel injection wiring and vacuum hoses. On carbureted engines, disconnect accelerator linkage.
5. On automatic transmission equipped models, disconnect transmission throttle cable and drain fluid. On power steering equipped models, remove pump from engine. **DO NOT** disconnect hoses. On manual transmission equipped models, remove shift lever and slave cylinder.
6. Raise and support vehicle. Disconnect front exhaust pipe. Remove engine undercover. Disconnect transmission shift linkage. On automatic transmission equipped models, disconnect cooler lines.
7. Remove drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install engine, reverse removal procedure. Be sure to check all fluid levels and linkage adjustments prior to starting engine.

MANIFOLDS

Removal

Remove heater inlet pipe-to-cylinder head bolt. Remove No. 1 air pipe. Remove intake manifold with delivery pipe, injection nozzles and heater water inlet pipe as an assembly. Remove exhaust manifold bolts and exhaust manifold.

Installation

1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

To install intake and exhaust manifolds, use new gaskets and reverse removal procedure.

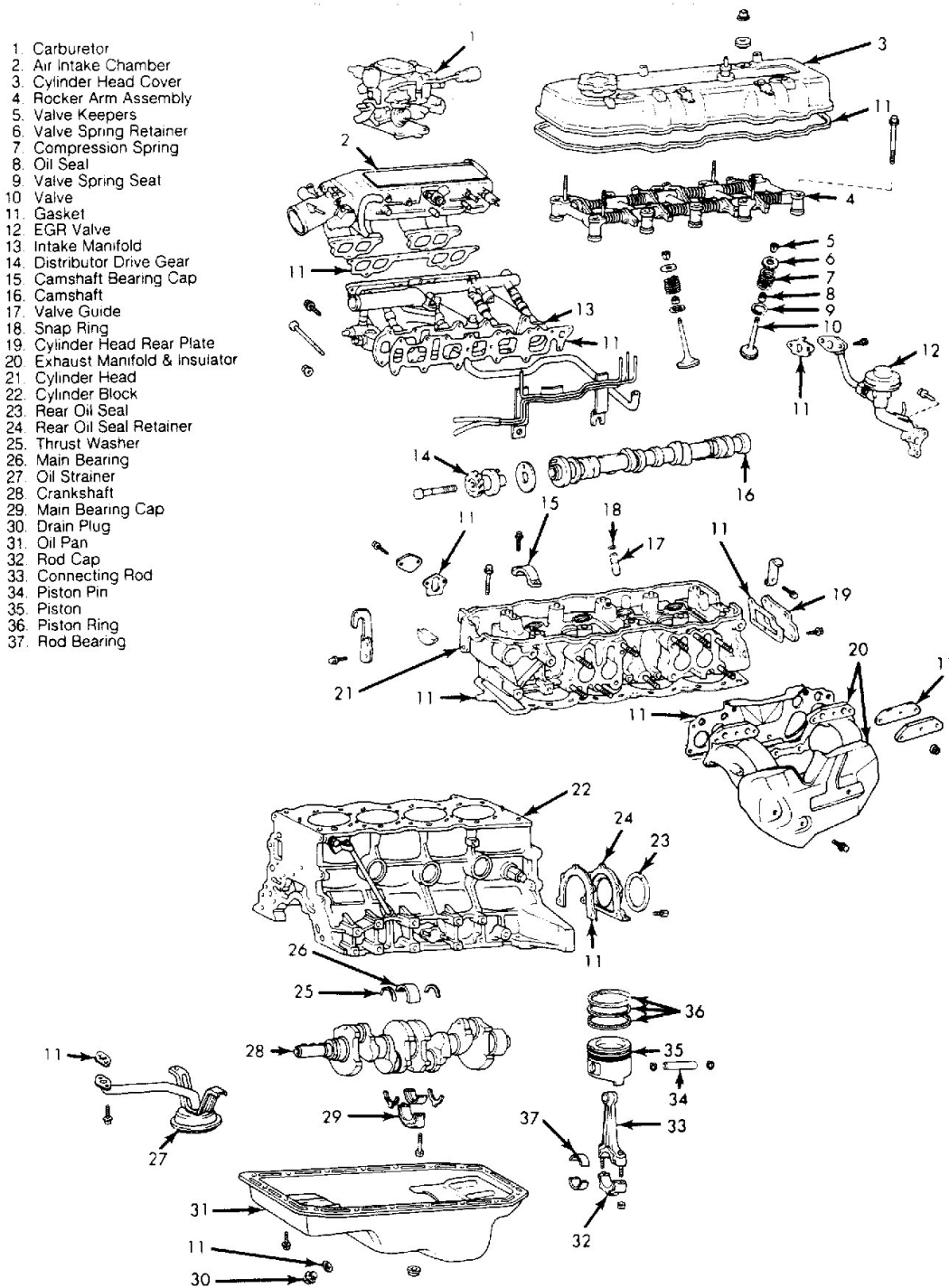


Fig. 2: Exploded View of Cylinder Head & Cylinder Block Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER HEAD

Removal

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect front exhaust pipe. On turbocharged models, remove turbocharger assembly. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection) and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. On carbureted models, remove fuel pump from cylinder head. Remove distributor with cap and wires.
3. Remove power steering pump and set aside (if equipped). On fuel injected vehicles, remove EGR modulator with bracket and air intake chamber with throttle body. See **Fig. 2** . Disconnect and label all fuel injection wiring and linkages for reassembly reference.
4. Remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and cam thrust plate off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head. Remove chain cover bolt in front of camshaft sprocket.
6. Loosen cylinder head bolts, in 3 steps, in reverse order of tightening sequence. See **Fig. 3** . Remove rocker arm assembly. If necessary, pry equally at front and rear of rocker arm assembly to remove.
7. Lift head from dowels on block and set on wood blocks on work bench. If difficult to remove, pry with flat bar between cylinder head and block projection. Remove EGR valve, intake and exhaust manifolds.

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and turn camshaft so dowel is at top.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. See **Fig. 3** . Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

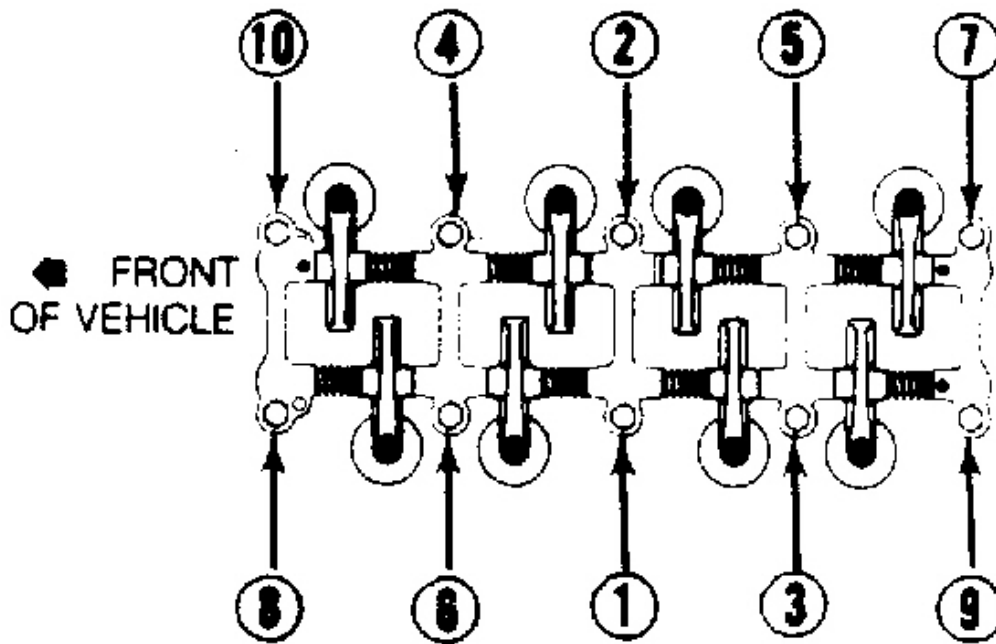


Fig. 3: Cylinder Head/Rocker Arm Bolt Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

FRONT COVER OIL SEAL

Removal & Installation

1. Seal press fits into oil pump body at front of crankshaft. Remove crankshaft pulley bolt. Using gear puller, remove crankshaft pulley. Pry out seal.
2. Apply grease to lip of new oil seal and sealant to outside of seal. Drive new seal into position using Seal Installer (09223-50010). Tighten crankshaft pulley bolt to specification.

TIMING CHAIN

Removal

1. Remove cylinder head. Remove radiator. Remove engine under cover and engine mounting bolts. Place a jack under transmission and raise engine about 1" (25.4mm). Remove 16 bolts and 2 nuts. Using Oil Pan Seal Cutter (09032-00100), remove oil pan.
2. Remove power steering belts (if equipped). Remove A/C belt, compressor and bracket (if equipped). Remove fluid coupling with fan and coolant pump pulley. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley. See **Fig. 4**.

3. Remove No. 1 coolant by-pass pipe. On carbureted and fuel injected models, remove 2 bolts and disconnect heater outlet pipe. On turbo models, remove 2 bolts and No. 3 turbo coolant pipe. Remove fan belt adjusting bar.
4. Remove timing chain cover assembly. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump drive spline and chain sprocket.

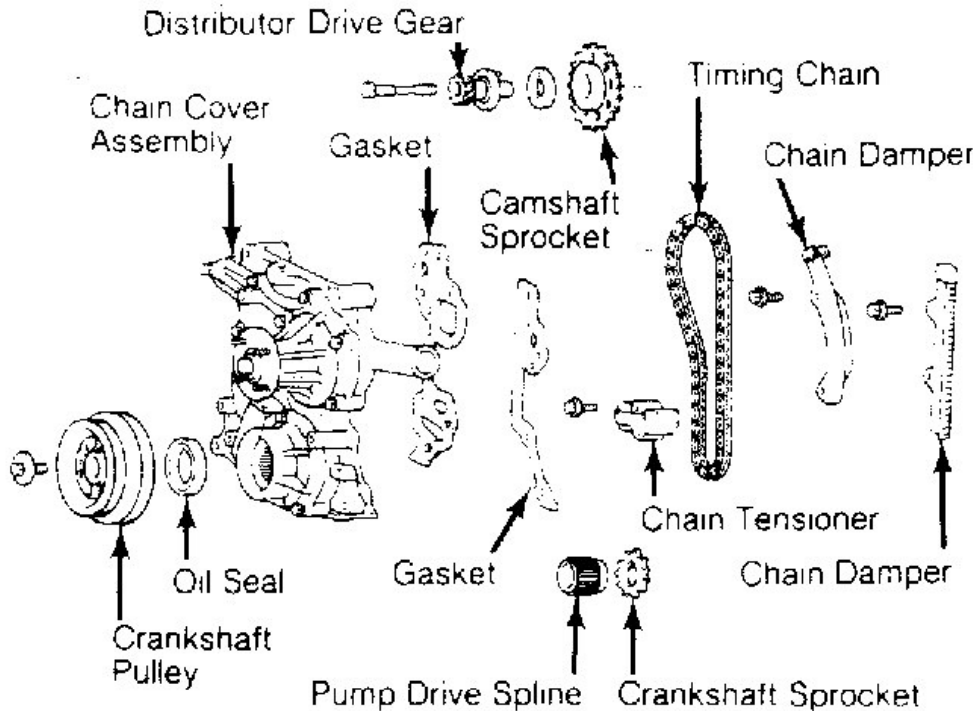


Fig. 4: Exploded View of Timing Chain Components

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

Inspection

1. Check chain, sprockets, tensioner and chain dampers for wear. Replace chain tensioner if width is less than .43" (11 mm). Minimum size for left and right chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance between 17 links should be 5.79" (147.0 mm). See **Fig. 5**.
3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to sprocket, measure outer sides of chain rollers. Using same method, measure crankshaft sprocket and chain.
4. The minimum dimension for crankshaft sprocket and chain is 2.34" (59.4 mm). The minimum dimension for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace

chain and both sprockets.

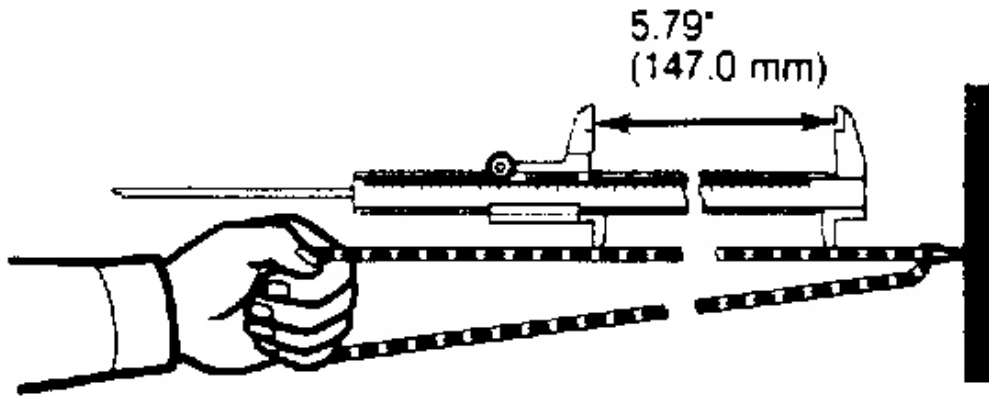
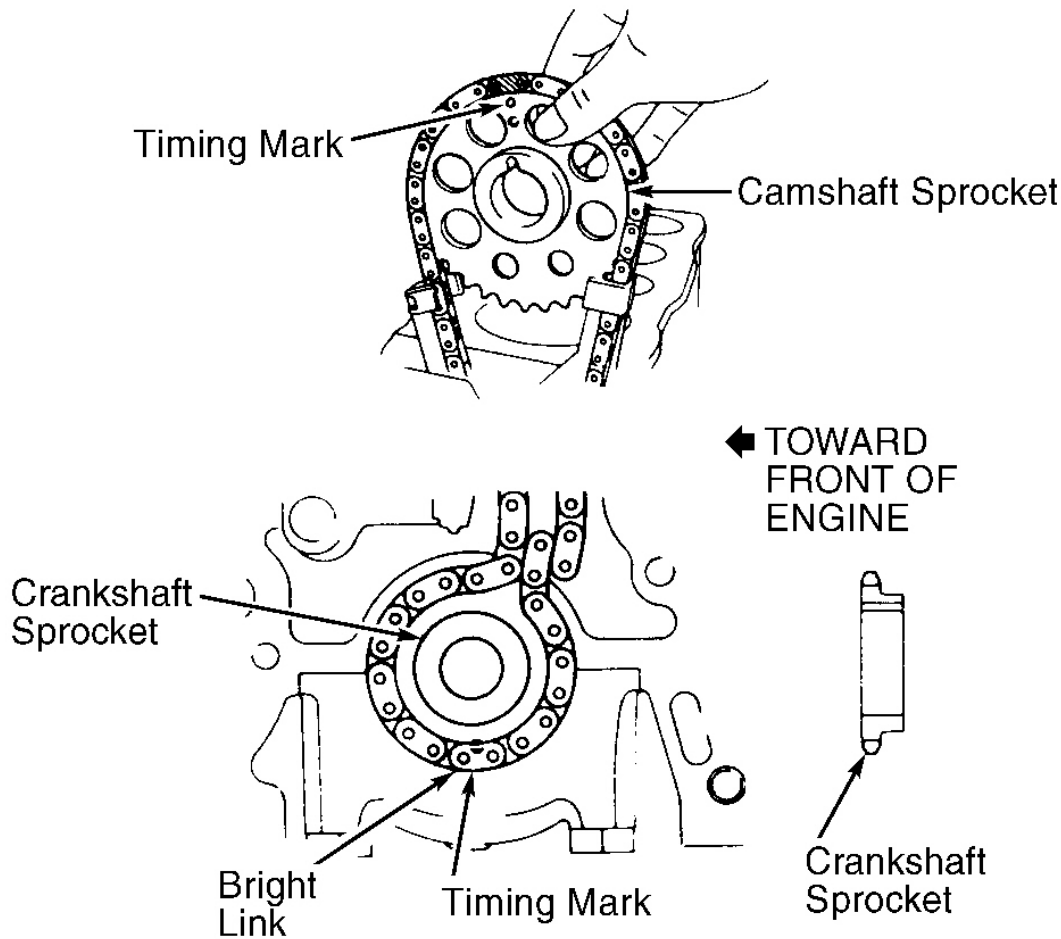


Fig. 5: Checking Timing Chain Stretch

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

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will be on top). Position sprocket on crankshaft. Place timing chain on sprocket with single bright link is aligned with timing mark on sprocket.
2. Install cam sprocket in timing chain so timing mark on sprocket is located between 2 chromed links. See **Fig. 6**. Ensure chain is positioned in dampers. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.
3. Continue installation in reverse of removal procedure. Set camshaft timing by placing No. 1 cylinder at TDC on compression stroke and positioning camshaft so dowel on sprocket flange is in 12 o'clock position.



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Fig. 6: Aligning Sprockets & Timing Chain
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CAMSHAFT

Removal

Remove cylinder head and rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

Inspection

1. Camshaft journal oil clearance may be checked using Plastigage method. If clearance exceeds specification, replace cylinder head and/or camshaft. Maximum clearance is .004" (.10 mm).
2. Maximum camshaft runout at center journal is .008" (.20 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678-1.689" (42.62-42.90 mm), or exhaust lobe height is less than 1.681-1.684" (42.70-42.77 mm).

Installation

To install camshaft, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward front. Adjust valves.

VALVE TIMING

1. Turn crankshaft so Woodruff key is on top. Slide crankshaft sprocket over key onto crankshaft. Place timing chain on sprocket with single plated link aligned with timing mark on sprocket.
2. Turn camshaft to locate dowel pin and stamped mark on camshaft at 12 o'clock position. Timing mark on camshaft sprocket must be between 2 plated links on timing chain. Single plated link on timing chain must be aligned with crankshaft sprocket timing mark.

VALVE ARRANGEMENT

Right Side: Intake valves.

Left Side: Exhaust valves.

ROCKER ARM ASSEMBLY

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.010-.050 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly. Note that rocker arms are identical. See **Fig. 7**.

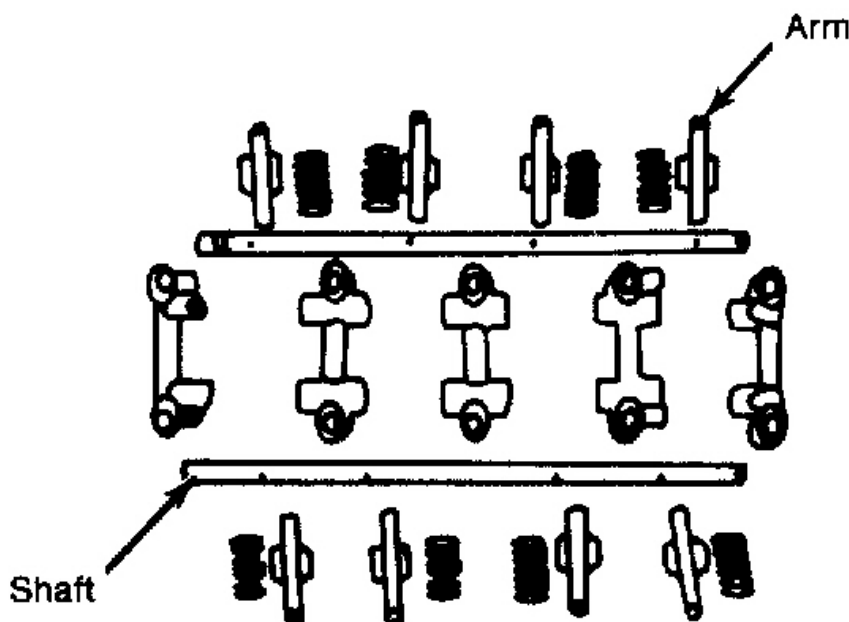


Fig. 7: Disassembled View of Rocker Arm Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE STEM OIL SEALS

Removal & Installation

1. Using a spring compressor, remove valve keepers. Remove spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Slide a new oil seal over valve stem, using care not to damage seal as it passes over keeper grooves. Force seal over end of valve guide. To complete installation, reverse removal procedure.

VALVE CLEARANCE ADJUSTMENTS

1. Engine must be at normal operating temperature. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on compression stroke. Measure clearance between rocker arm and valve stem.
2. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves. Rotate crankshaft one complete revolution (360 degrees) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENTS

Valve	In. (mm)
Intake	.008 (.20)

1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

Exhaust

.012 (.30)

VALVE GUIDES

Removal & Installation

1. Measure diameter of valve guide and valve stem. Maximum clearance for exhaust valves is .0039" (.10 mm). Maximum clearance for intake valves is .0031" (.08 mm). If valve stem oil clearance exceeds specification, valve guides and valves must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).
2. Using Valve Guide Remover (09201-60011) and hammer, drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Ream valve guide with a .31" (8 mm) reamer for proper stem clearance.

VALVE SPRINGS

Check valve spring free length and squareness. If free length is less than 1.91" (48.5 mm) or out-of-square more than .063" (1.6 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified.

OVERHAUL

PISTON & ROD ASSEMBLY

Removal

Remove cylinder head and oil pan. Remove ring ridge from top of cylinder. Mark rods and caps for correct assembly. Remove rod caps. Cover rod bolts with short length of hose to prevent crankshaft damage. Push piston/rod assembly out of block.

Installation

Lubricate piston, cylinder and journal with clean engine oil. Position rings, and install ring compressor. See **Fig. 8**. Stamped mark on ring must face upward. Install piston/rod assembly in proper position with notch on piston top facing forward.

FITTING PISTONS

1. Measure cylinder bore at top, bottom and center of piston travel. Measure in line with and at 90 degrees to crankshaft. Standard bore is 3.6220-3.6232" (91.998-92.029 mm) with a wear limit of .0008" (.020 mm). Maximum out-of-round is .0008" (.020 mm). Maximum taper is .0004" (.010 mm).
2. Measure piston at right angle to pin and just below oil ring groove. If not within specification, rebore cylinder and/or replace pistons. On 22R and 22R-E engines, pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON SIZE CHART

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1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

Application	In. (mm)
22R & 22R-E	
Standard	3.6209-3.6220 (91.970-92.000)
0.5 mm O/S	3.6405-3.6417 (92.470-92.500)
1.0 mm O/S	3.6602-3.6614 (92.970-93.000)
22R-TE	3.6195-3.6207 (91.935-91.965)

FITTING RINGS

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with code marks facing up. Position ring end gaps correctly. See **Fig. 8**.

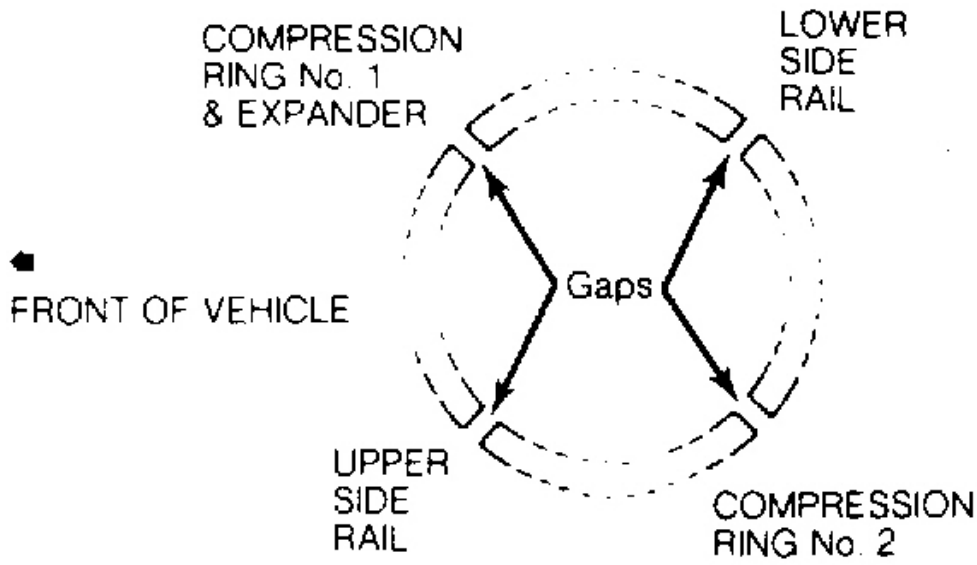


Fig. 8: Correct Piston Ring Gap Arrangement
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PISTON PIN REPLACEMENT

Removal

Heat piston to 176°F (80°C). Using hammer and driver, push piston pin out of piston and connecting rod.

Inspection

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater than .0006" (.015 mm).
2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. The maximum rod bend limit is .002" (.05 mm) per 3.94" (100 mm). The maximum rod twist limit is .0059" (.15 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: **Piston and pin are a matched set. Use new snap rings for reassembly.**

Installation

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. Push pin into piston and rod assembly. Install snap rings. See **Fig. 9**.

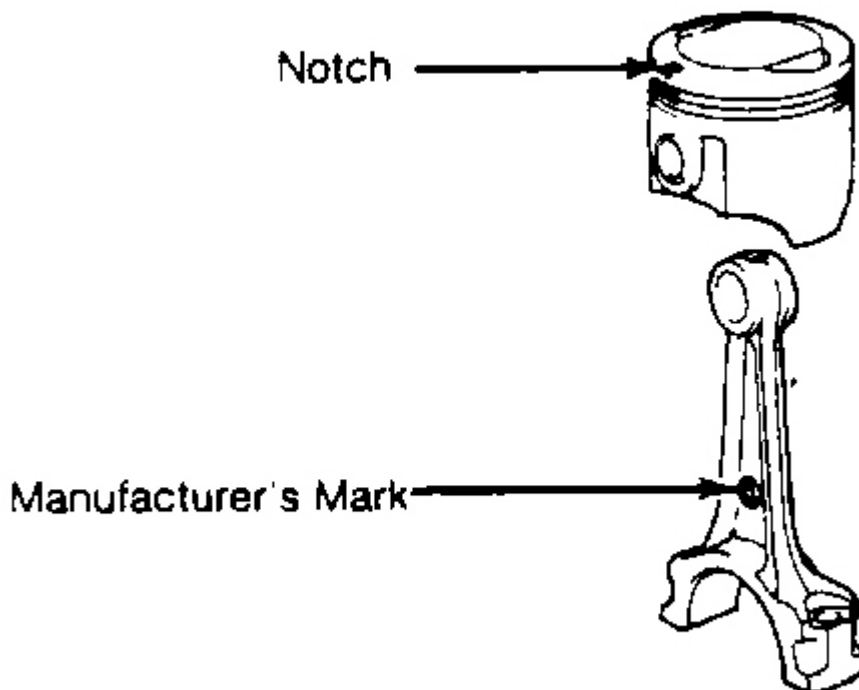


Fig. 9: Correct Alignment of Piston & Rod Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ENGINE LUBRICATION

OIL PAN

Removal

Drain engine oil. Remove engine undercover. Detach steering idler arm bracket. Remove pitman arm and front crossmember. Remove oil pan.

Installation

Place gasket on pan and apply sealer to 4 corners where front cover and rear seal retainer join cylinder block. Install pan. To complete installation, reverse removal procedure.

ENGINE OILING SYSTEM

Oiling system is force fed, utilizing a gear-type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full-flow oil filter and then to oil galleys in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly. See **Fig. 10** .

CRANKCASE CAPACITY

Engine oil capacity is 4.5 qts. (4.3L) including oil filter.

OIL FILTER

Oil filter is a full-flow, disposable type. Filter is located at right side of engine.

NORMAL OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

OIL PRESSURE RELIEF VALVE

Relief valve is nonadjustable, with a 64 psi (4.5 kg/cm²) operating pressure.

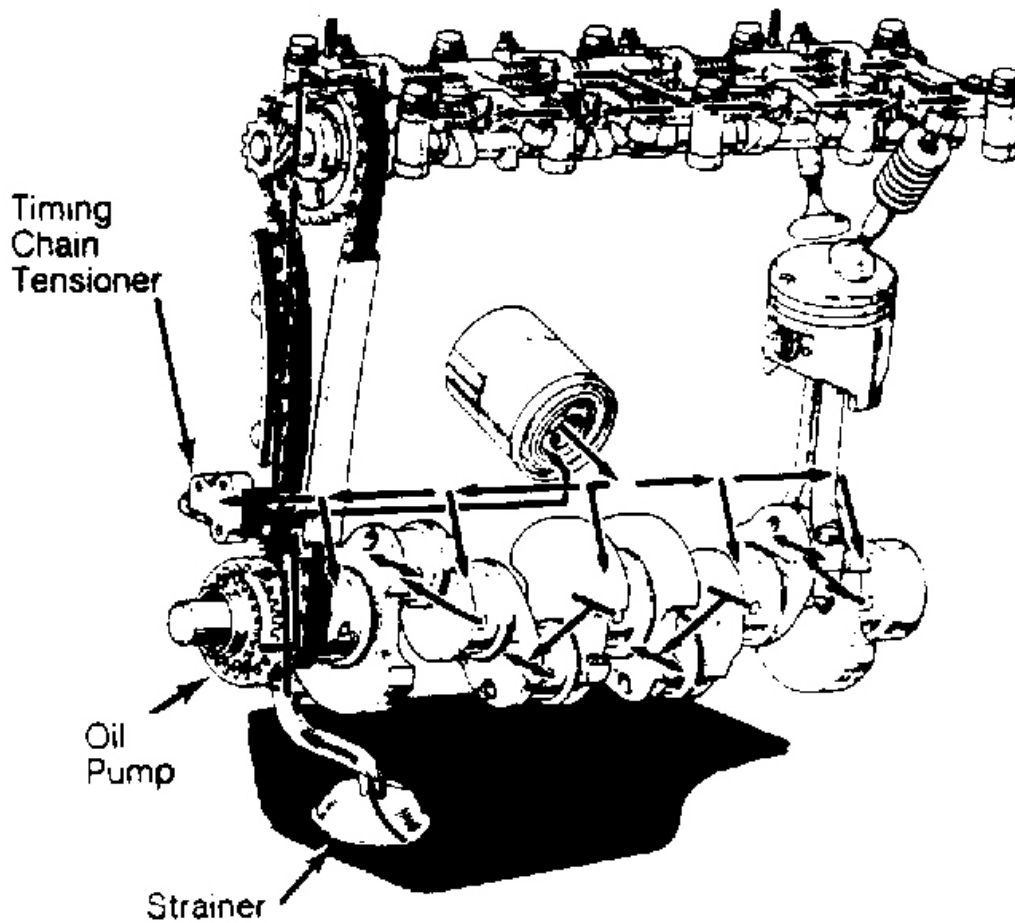


Fig. 10: Engine Oiling System

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

OIL PUMP

Removal

Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. To complete installation, reverse removal procedure.

1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Drive Gear-to-Crescent	
Standard	.0087-.0098 (.221-.249)
Wear Limit	.012 (.30)
Driven Gear-to-Crescent	
Standard	.0059-.0083 (.149-.211)
Wear Limit	.012 (.30)
Driven Gear-to-Body	
Standard	.0035-.0059 (.088-.149)
Wear Limit	.008 (.20)
Gear Faces-to-Body	
Standard	.0012-.0035 (.030-.088)
Wear Limit	.0059 (.149)

ENGINE COOLING

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fan clutch, pulley and fan belt. Remove 6 bolts and 3 nuts. Remove pump from engine.

Installation

To install water pump, use new gasket on clean mating surfaces and reverse removal procedure.

NOTE: For more information, see **ENGINE COOLING SYSTEMS** article.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	In. (mm)
22R	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	2-Bbl.
HP @ RPM	⁽¹⁾ 95 @ 4800
Torque Ft. @ RPM	129 @ 2800

1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-E	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	116 @ 4800
Torque Ft. @ RPM	140 @ 2800
Compr. Ratio	9.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
22R-TE	
Displacement	
Cu. In.	144.4
Liters	2.4
Fuel System	Fuel Inj.
HP @ RPM	135 @ 4800
Torque Ft. @ RPM	173 @ 2800
Compr. Ratio	8.0:1
Bore	3.62 (92.0)
Stroke	3.50 (89.0)
(1) Horsepower specification for Federal Pickup is 99 @ 4800.	

VALVE SPECIFICATIONS**VALVE SPECIFICATIONS**

Application	In. (mm)
Intake	
Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(1) 45°
Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3138-.3144 (7.970-7.985)
Stem Clearance	.0010-.0024 (.025-.061)
Valve Lift	n/a
Exhaust	
Head Diameter	n/a
Face Angle	44.5°
Seat Angle	(2) 45°

1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

Seat Width	.047-.063 (1.19-1.60)
Stem Diameter	.3136-.3142 (7.965-7.980)
Stem Clearance	.0012-.0026 (.030-.065)
Valve Lift	n/a
(1) Intake correction angles are 30° and 60°.	
(2) Exhaust correction angles are 30 and 65 degrees.	

PISTONS, PINS, & RINGS SPECIFICATIONS**PISTONS, PINS, & RINGS SPECIFICATIONS**

Application	In. (mm)
2.4L	
Piston Clearance	⁽¹⁾ .0008-.0016 (.020-.040)
Pins	
Piston Fit	n/a
Rod Fit	.0002-.0004 (.005-.011)
Rings	
Ring No. 1	
End Gap	.0098-.0185" (.349-.569 mm)
Side Clearance	.008 (.20)
Ring No. 2	
End Gap	.0236-.0323" (.60-.82 mm)
Side Clearance	.008 (.20)
Oil Ring	
End Gap	.0079-.0224 (.20-.57)
Side Clearance	n/a
(1) Specification is for 22R and 22R-E. 22R-TE is 0.0022-.0030" (0.055-.075).	

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**

Application	In. (mm)
2.4L	
Main Bearings	
Journal Diameter	2.3616-2.3622 (59.98-60.00)
Clearance	.0010-.0022 (.025-.055)
Thrust Bearing	Center
Crankshaft End Play	.0008-.0087 (.020-.22)
Connecting Rod Bearings	
Journal Diameter	2.0861-2.0866 (52.998-53.00)

1987 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1987 ENGINES Toyota - 2.4L 4-Cylinder

Clearance	.0010-.0022 (.025-.055)
Side Play	.0063-.0102 (.160-.259)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
2.4L ⁽¹⁾	
Journal Diameter	1.2984-1.2992 (32.98-33.00)
Clearance	.0004-.0020 (.010-.050)
Lobe Lift	n/a
(1) End play is .0031-.0071" (.08-.18 mm). Maximum is 0.0098" (.25 mm).	

VALVE SPRING SPECIFICATIONS**VALVE SPRING SPECIFICATIONS**

Application	In. (mm)
Free Length	1.909 (48.50)
Pressure: Lbs. @ In. (Kg @ mm)	
Valve Closed	66.1 @ 1.59 (30 @ 40.5)
Valve Open	n/a

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	14 (20)
Camshaft Sprocket Bolt	58 (78)
Connecting Rod Cap Bolts	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head Bolts	58 (78)
Exhaust Manifold	33 (44)
Flywheel Bolts	80 (108)
Intake Manifold-to-Cylinder Head	14 (19)
Main Bearing Cap Bolts	76 (103)
Oil Cooler (22R-TE)	33 (44)
Timing Cover Bolts	
8 mm	9 (12)
10 mm	29 (39)
	INCH Lbs.
Oil Pan	108 (13)

Rear Oil Seal Retainer	108 (13)
------------------------	----------

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R]

1988 Engines - 2.4L 4-Cylinder

ENGINE CODING

ENGINE IDENTIFICATION

Engine serial number is stamped on left side of cylinder block, behind the alternator. The last group of characters designates engine type.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
2.4L 4-Cylinder		
Carburetor	22R	R
Fuel Injection	22R-E	R
Turbocharger	22R-TE	R

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

REMOVAL & INSTALLATION

ENGINE

NOTE: Removal procedures between engines may vary slightly due to design differences.

Removal

1. Disconnect the negative battery cable. Drain the cooling system. Disconnect the upper radiator hose from engine. On models with turbocharger, remove turbocharger assembly. On fuel injected engines, remove the air cleaner hose.
2. On all models, remove air cleaner. Disconnect exhaust pipe from exhaust manifold. Remove fan, radiator, shroud, hoses and upper bracket. Remove and support air conditioning compressor without discharging system (if equipped).
3. Disconnect heater hoses, throttle control cable, fuel lines and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses for reassembly reference. Remove alternator and distributor.
4. On fuel injected engines, remove EGR vacuum modulator and air intake chamber with throttle body. Disconnect actuator, accelerator and throttle cables. Disconnect and label all fuel injection wiring and vacuum hoses. On carbureted engines, disconnect accelerator linkage.
5. On automatic transmission equipped models, disconnect transmission throttle cable and drain fluid. On

power steering equipped models, remove pump from engine without disconnecting hoses and set aside. On manual transmission equipped models, remove shift lever and slave cylinder.

6. Raise and support vehicle. Disconnect front exhaust pipe. Remove engine undercover. Disconnect transmission shift linkage. On automatic transmission equipped models, disconnect cooler lines.
7. Remove drive shaft. On 4WD models, remove undercover, stabilizer bar and front drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install engine, reverse removal procedure. Check all fluid levels and linkage adjustments prior to starting engine.

MANIFOLDS

Removal

Remove heater inlet pipe-to-cylinder head bolt. Remove No. 1 air pipe. Remove intake manifold with delivery pipe, injection nozzles and heater water inlet pipe as an assembly. Remove exhaust manifold bolts and exhaust manifold.

Installation

To install intake and exhaust manifolds, use new gaskets and reverse removal procedure.

CYLINDER HEAD

Removal

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect front exhaust pipe. On turbocharged models, remove turbocharger assembly. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection) and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. On carbureted models, remove fuel pump from cylinder head. Remove distributor with cap and wires.
3. Remove power steering pump and set aside (if equipped). On fuel injected vehicles, remove EGR modulator with bracket and air intake chamber with throttle body. See **Fig. 2**. Disconnect and label all fuel injection wiring and linkages for reassembly reference.
4. Remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and cam thrust plate off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head. Remove chain cover bolt in front of camshaft sprocket.
6. Loosen cylinder head bolts, in 3 steps, in reverse order of tightening sequence. See **Fig. 1**. Remove rocker arm assembly. If necessary, pry equally at front and rear of rocker arm assembly to remove.
7. Lift head from dowels on block and set on wood blocks on work bench. If difficult to remove, carefully

pry with flat bar between cylinder head and block projection. Remove EGR valve, intake and exhaust manifolds.

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and rotate camshaft so dowel pin is at facing upward.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. See **Fig. 1**. Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

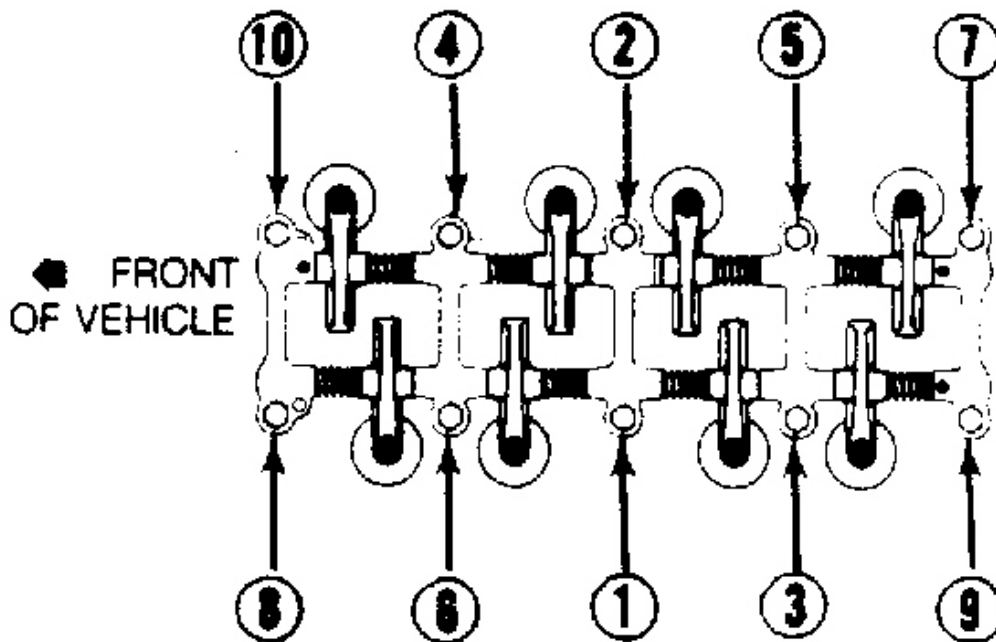


Fig. 1: Cylinder Head/Rocker Arm Bolt Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

FRONT COVER OIL SEAL

Removal & Installation

1. Oil seal press fits into oil pump body at front of crankshaft. Remove crankshaft pulley bolt. Using gear puller, remove crankshaft pulley. Pry out seal.
2. Apply grease to lip of new oil seal and sealant to outside of seal. Drive new seal into position using Seal Installer (09223-50010). Tighten crankshaft pulley bolt to specification.

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

1. Carburetor
2. Air Intake Chamber
3. Cylinder Head Cover
4. Rocker Arm Assembly
5. Valve Keepers
6. Valve Spring Retainer
7. Compression Spring
8. Oil Seal
9. Valve Spring Seat
10. Valve
11. Gasket
12. EGR Valve
13. Intake Manifold
14. Distributor Drive Gear
15. Camshaft Bearing Cap
16. Camshaft
17. Valve Guide
18. Snap Ring
19. Cylinder Head Rear Plate
20. Exhaust Manifold & insulator
21. Cylinder Head
22. Cylinder Block
23. Rear Oil Seal
24. Rear Oil Seal Retainer
25. Thrust Washer
26. Main Bearing
27. Oil Strainer
28. Crankshaft
29. Main Bearing Cap
30. Drain Plug
31. Oil Pan
32. Rod Cap
33. Connecting Rod
34. Piston Pin
35. Piston
36. Piston Ring
37. Rod Bearing

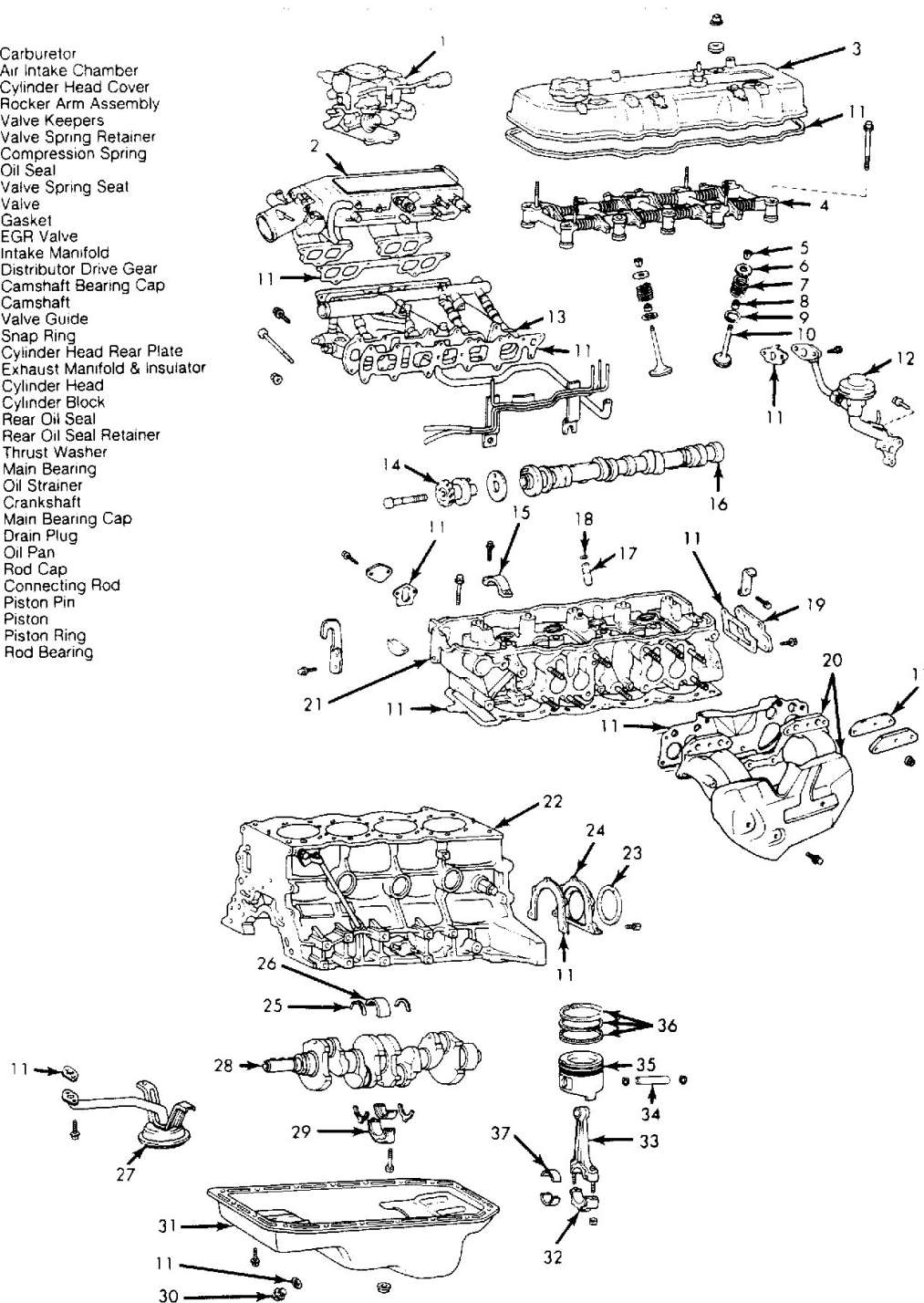


Fig. 2: Exploded View of Cylinder Head & Cylinder Block Components

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

TIMING CHAIN

Removal

1. Remove cylinder head. Remove radiator. Remove engine under cover and engine mounting bolts. Place a jack under transmission and raise engine about 1" (25.4mm). Remove 16 bolts and 2 nuts. Using Oil Pan Seal Cutter (09032-00100), remove oil pan.
2. Remove power steering belts (if equipped). Remove A/C belt, compressor and bracket (if equipped) and lay aside. Remove fluid coupling with fan and coolant pump pulley. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley. See **Fig. 3**.
3. Remove number one coolant by-pass pipe. On carbureted and fuel injected models, remove 2 bolts and disconnect heater outlet pipe. On turbo models, remove 2 bolts and No. 3 turbo coolant pipe. Remove fan belt adjusting bracket.
4. Remove timing chain cover assembly. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump drive spline and chain sprocket.

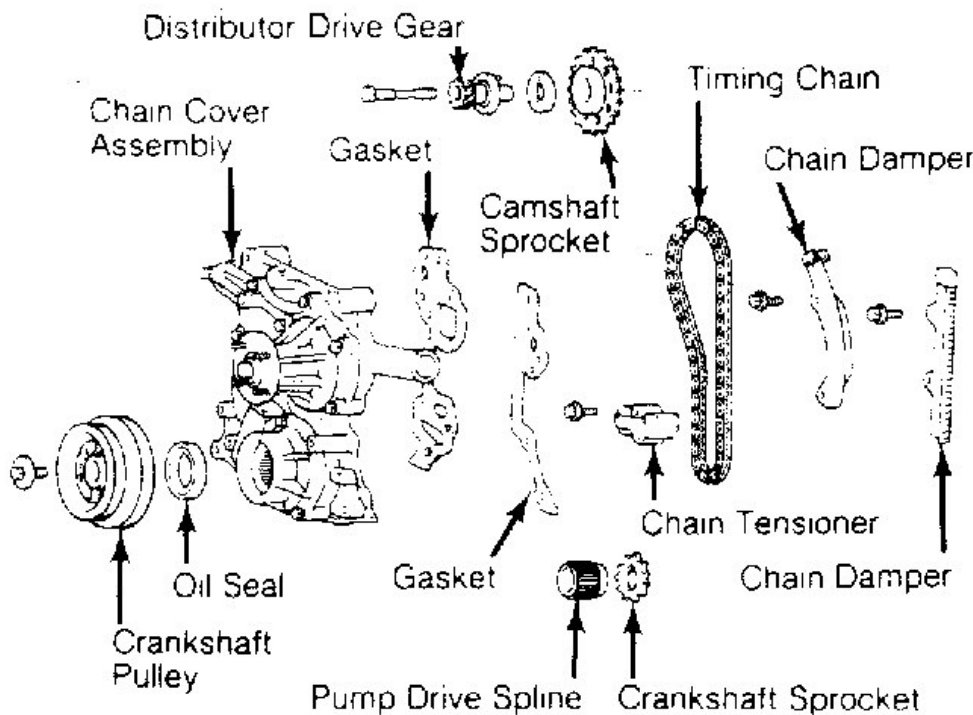


Fig. 3: Exploded View of Timing Chain Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Check chain, sprockets, tensioner and chain dampers for wear. Replace chain tensioner if width is less than .43" (11 mm). Minimum size for left and right chain dampers is .02" (.5 mm).

2. Measure length of timing chain with chain fully stretched. Maximum distance between 17 links should be 5.79" (147.0 mm). See **Fig. 4**.
3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to sprocket, measure outer sides of chain rollers. Using same method, measure crankshaft sprocket and chain.
4. The minimum dimension for crankshaft sprocket and chain is 2.34" (59.4 mm). The minimum dimension for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace timing chain and both sprockets.

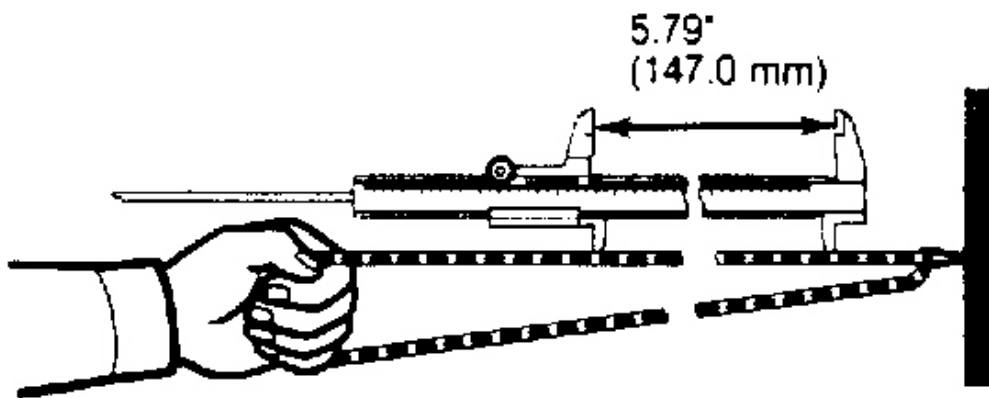
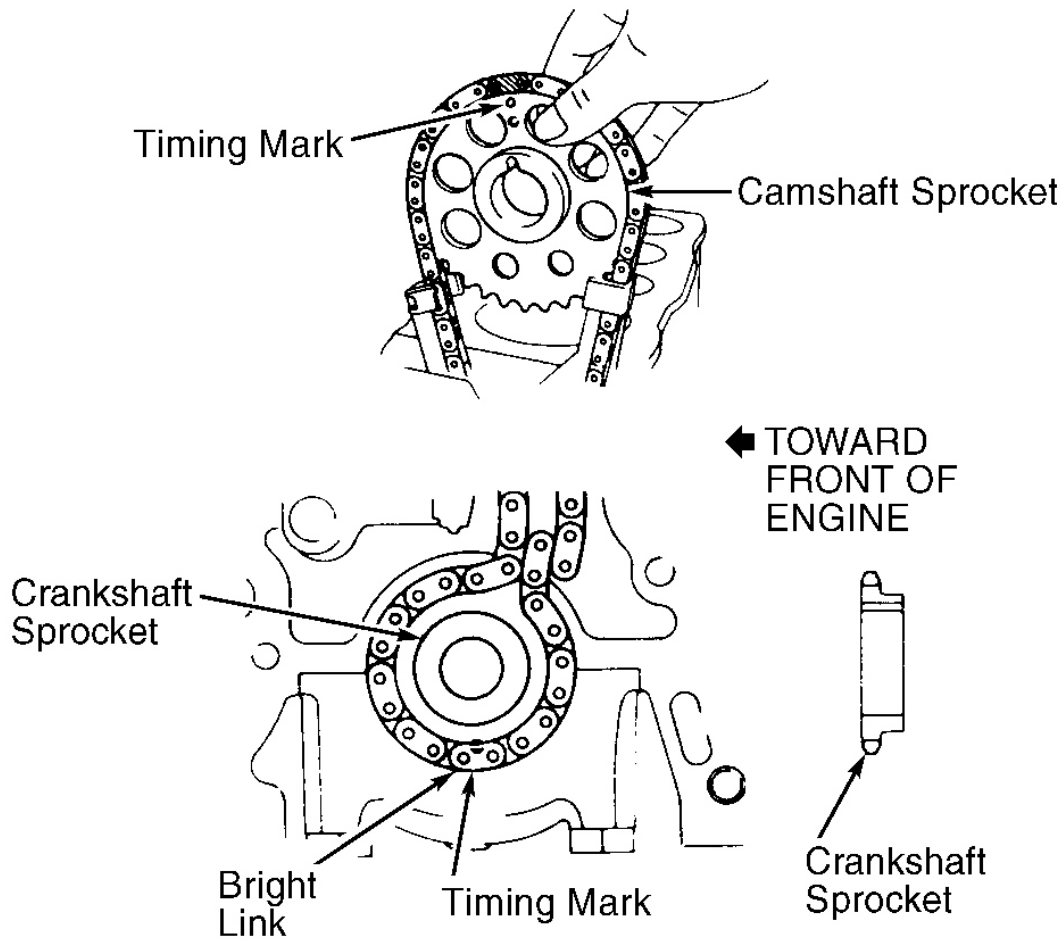


Fig. 4: Checking Timing Chain Stretch

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

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will positioned straight upward). Position sprocket on crankshaft. Place timing chain on sprocket with single bright link aligned with timing mark on sprocket.
2. Install cam sprocket in timing chain so timing mark on sprocket is located between 2 chromed links. See **Fig. 5**. Ensure chain is positioned in dampers. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.
3. Continue installation in reverse of removal procedure. Set camshaft timing by placing No. 1 cylinder at TDC on compression stroke and positioning camshaft so dowel on sprocket flange is in 12 o'clock position.



93E00418

Fig. 5: Aligning Sprockets & Timing Chain
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CAMSHAFT

Removal

Remove rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

Inspection

1. Camshaft journal oil clearance may be checked using Plastigage method. If clearance exceeds specification, replace cylinder head and/or camshaft. Maximum clearance is .004" (.10 mm).
2. Maximum camshaft runout at center journal is .008" (.20 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678-1.689" (42.62-42.90 mm), or exhaust lobe height is less than 1.681-1.684" (42.70-42.77 mm).

Installation

To install camshaft, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward front. Adjust valves.

VALVE TIMING

1. Turn crankshaft to TDC (Woodruff key on top). Slide crankshaft sprocket over key onto crankshaft. Place timing chain on sprocket with single plated link aligned with timing mark on sprocket.
2. Turn camshaft to locate dowel pin and stamped mark on camshaft at 12 o'clock position. Timing mark on camshaft sprocket must be between 2 plated links on timing chain. Single plated link on timing chain must be aligned with crankshaft sprocket timing mark.

VALVE ARRANGEMENT

Right Side - Intake Valves.

Left Side - Exhaust Valves.

ROCKER ARM ASSEMBLY

NOTE: **Label all rocker arm components for reassembly reference.**

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.010-.050 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly. Note that rocker arms are identical. See **Fig. 6** .

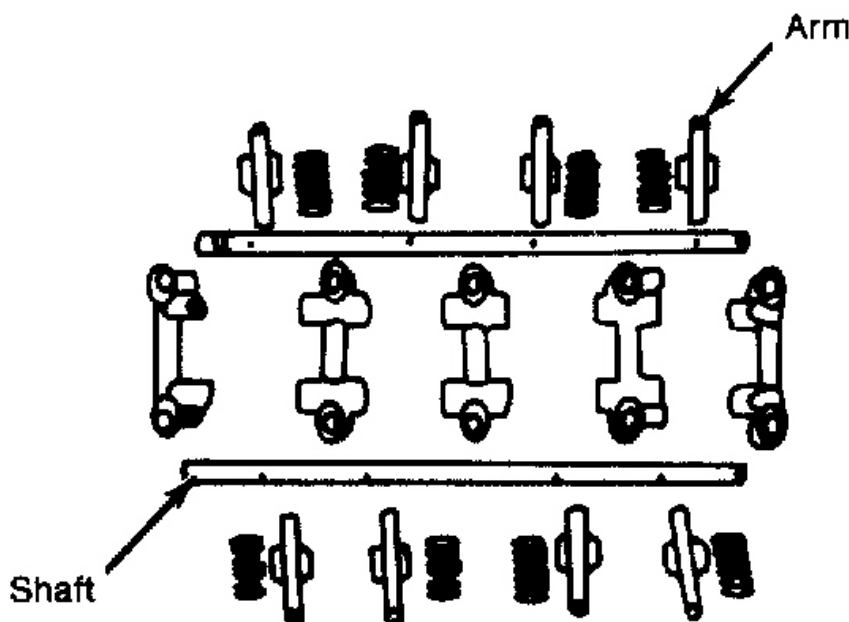


Fig. 6: Disassembled View of Rocker Arm Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE STEM OIL SEALS

1. Using a spring compressor, remove valve keepers. Remove spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Slide a new oil seal over valve stem, using care not to damage seal as it passes over keeper grooves. Force seal over end of valve guide. To complete installation, reverse removal procedure.

VALVE CLEARANCE ADJUSTMENTS

1. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on compression stroke. Measure clearance between rocker arm and valve stem.
2. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves. Rotate crankshaft one complete revolution (360 degrees) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENTS (COLD)

Valve	In. (mm)
Intake	.008 (.20)
Exhaust	.012 (.30)

VALVE GUIDES

1. Measure diameter of valve guide and valve stem. Maximum clearance for exhaust valves is .0039" (.10 mm). Maximum clearance for intake valves is .0031" (.08 mm). If valve stem oil clearance exceeds specification, valve guides and valves must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).
2. Using Valve Guide Remover (09201-60011) and hammer, drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Ream valve guide with a .31" (8 mm) reamer for proper stem clearance.

VALVE SPRINGS

Check valve spring free length and squareness. If free length is less than 1.91" (48.5 mm) or out-of-square more than .063" (1.6 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified.

OVERHAUL

PISTON & ROD ASSEMBLY

Removal

Remove cylinder head and oil pan. Remove ring ridge from top of cylinder. Mark rods and caps for correct assembly. Remove rod caps. Cover rod bolts with short length of hose to prevent crankshaft damage. Push piston/rod assembly out of block.

Installation

Lubricate piston, cylinder and journal with clean engine oil. Position rings, and install ring compressor. See **Fig. 7**. Stamped mark on ring must face upward. Install piston/rod assembly in proper position with notch on piston top facing forward.

FITTING PISTONS

1. Measure cylinder bore at top, bottom and center of piston travel. Measure in line with and at 90 degrees to crankshaft. Standard bore is 3.6232" (92.029 mm) with a wear limit of .0008" (.020 mm). Maximum out-of-round is .0008" (.020 mm). Maximum taper is .0004" (.010 mm).
2. Measure piston at right angle to pin and just below oil ring groove. If not within specification, rebore cylinder and/or replace pistons. On 22R and 22R-E engines, pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON SIZE CHART

Application	In. (mm)
22R & 22R-E	
Standard	3.6209-3.6220 (91.970-92.000)

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

0.50 mm O/S	3.6405-3.6417 (92.470-92.500)
1.00 mm O/S	3.6602-3.6614 (92.970-93.000)
22R-TE	
Standard	3.6195-3.6207 (91.935-91.965)
0.50 mm O/S	3.6392-3.6403 (92.435-92.465)
1.00 mm O/S	3.6589-3.6600 (92.935-92.965)

FITTING RINGS

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with "T OR N" marks facing upward. Position ring end gaps correctly. See **Fig. 7**.

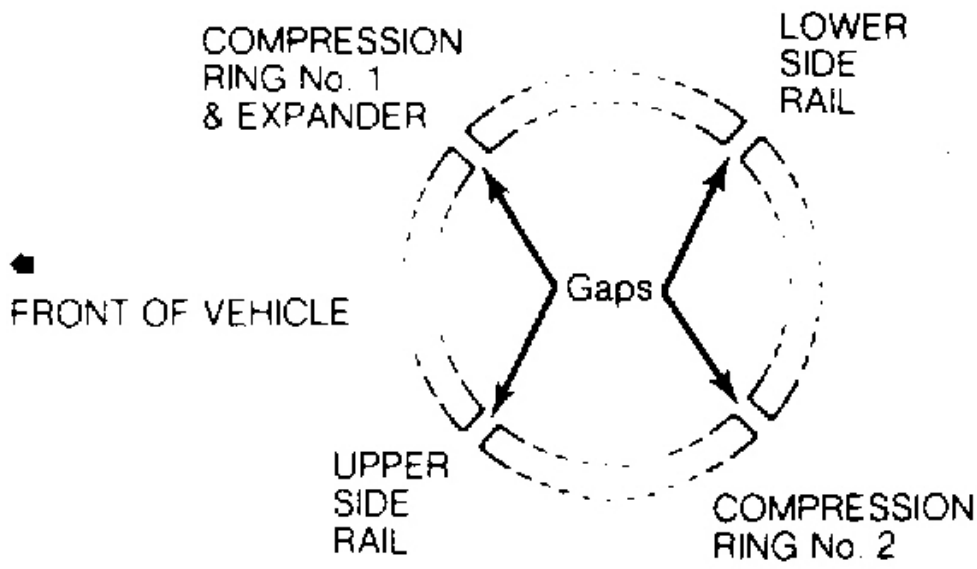


Fig. 7: Correct Piston Ring Gap Arrangement
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PISTON PIN REPLACEMENT

Removal

Remove piston pin snap ring. Heat piston in hot water to 140°F (60°C). Using hammer and driver, push piston pin out of piston and connecting rod.

Inspection

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater than .0006" (.015 mm).
2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. Inspect connecting rod for misalignment. The maximum rod bend limit is .002" (.05 mm) per 3.94" (100 mm). The maximum rod twist limit is .0059" (.15 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: **Piston and pin are a matched set. Use new snap rings for reassembly.**

Installation

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. Push pin into piston and rod assembly. Install snap rings. See **Fig. 8** .

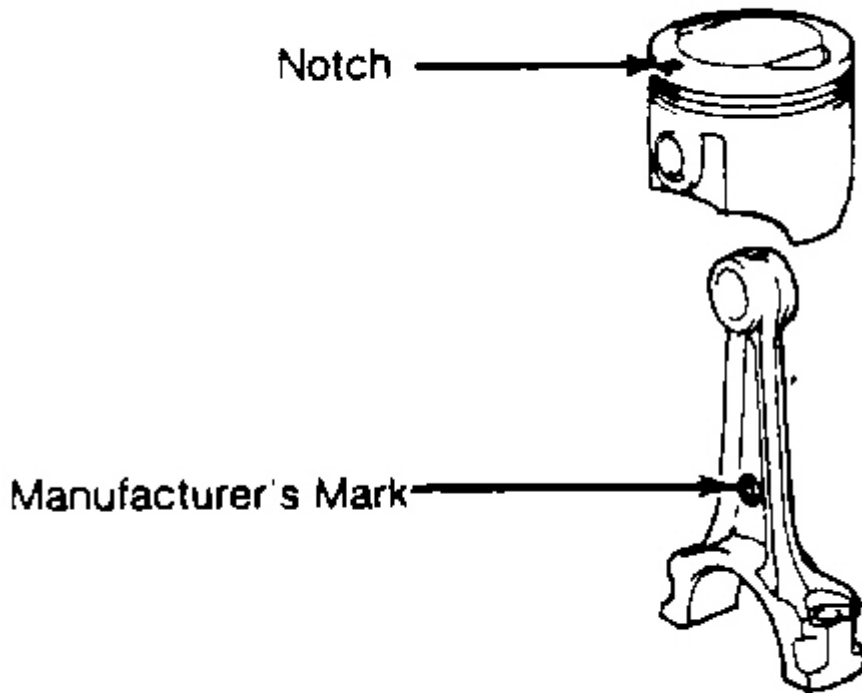


Fig. 8: Correct Alignment of Piston & Rod Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKSHAFT MAIN BEARINGS

NOTE: There are three sizes of standard main bearings, each size is marked with a 3, 4 or 5. Replacement main bearings should have the same number as the number stamped on the cylinder block. See Fig. 9 and **STANDARD MAIN BEARING SIZES** table.

1. Measure crankshaft runout at center journal. If runout exceeds .004" (.10 mm), replace crankshaft. Inspect all journals for wear or scoring. Out-of-round or taper limit is .0004" (.010 mm). If crankshaft is worn excessively, grind journals for undersize bearings.

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

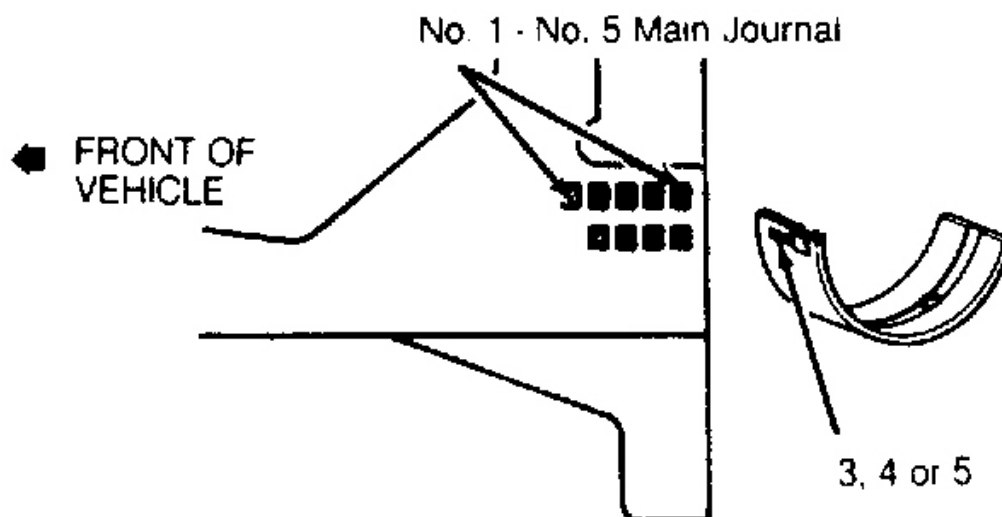


Fig. 9: Cylinder Block Main Bearing Size Identification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

STANDARD MAIN BEARING SIZES

Application	In. (mm)
Cylinder Block No. 3	
Bore Size	2.5198-2.5201 (64.004-64.010)
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Bearing Thickness	.0783-.0784 (1.988-1.992)
Cylinder Block No. 4	
Bore Size	2.5201-2.5203 (64.010-64.016)
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Bearing Thickness	.0784-.0786 (1.992-1.996)
Cylinder Block No. 5	
Bore Size	2.5203-2.5205 (64.016-64.022)
Journal Diameter	2.3616-2.3622 (59.984-60.000)

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Bearing Thickness	.0786-.0787 (1.996-2.000)
Cylinder Block No. .25 O/S	
Bore Size	2.5198-2.5205 (64.004-64.022)
Journal Diameter	2.3504-2.3508 (59.701-59.711)
Bearing Thickness	.0837-.0841 (2.126-2.136)

2. Measure bearing clearances using Plastigage method. Observe correct tightening sequence. See **Fig. 10** . If clearance exceeds specification, grind journals for undersize bearings.
3. Standard main bearing clearance is .0010-.0022" (.025-.055 mm). Maximum main bearing clearance is .0031" (.078 mm). Main bearings are available in .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.701-59.711 mm).

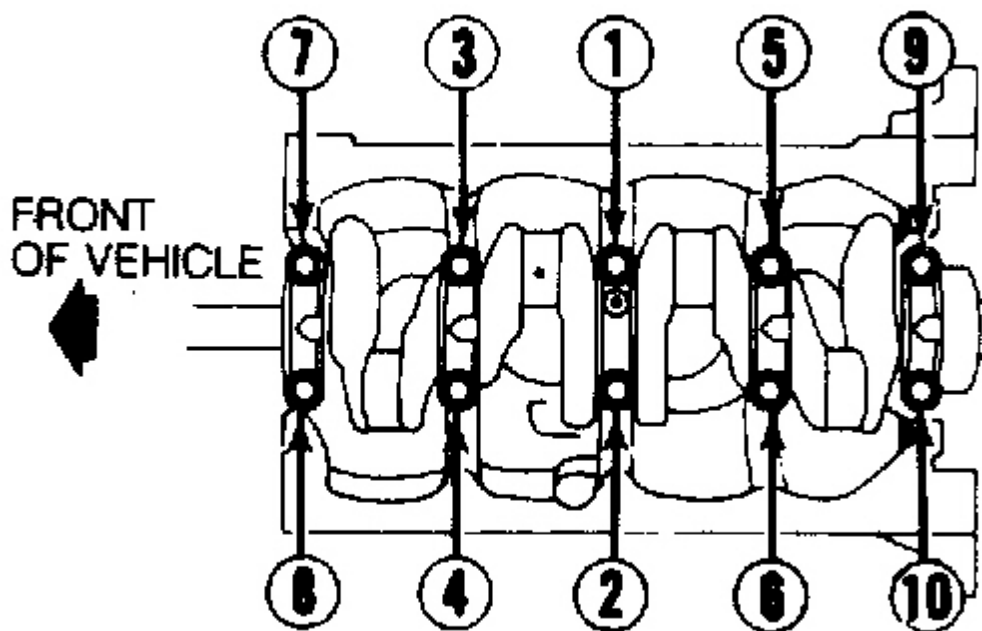


Fig. 10: Main Bearing Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CONNECTING ROD BEARINGS

NOTE: There are three sizes of standard connecting rod bearings, each size is marked with an A, B or C. Replacement connecting rod bearings should have the same letter as the letter stamped on the connecting rod cap. See [Fig. 11](#) and [STANDARD CONNECTING ROD BEARING SIZES](#) tables.

Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .0031" (.078 mm). Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.010 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.699-52.710 mm).

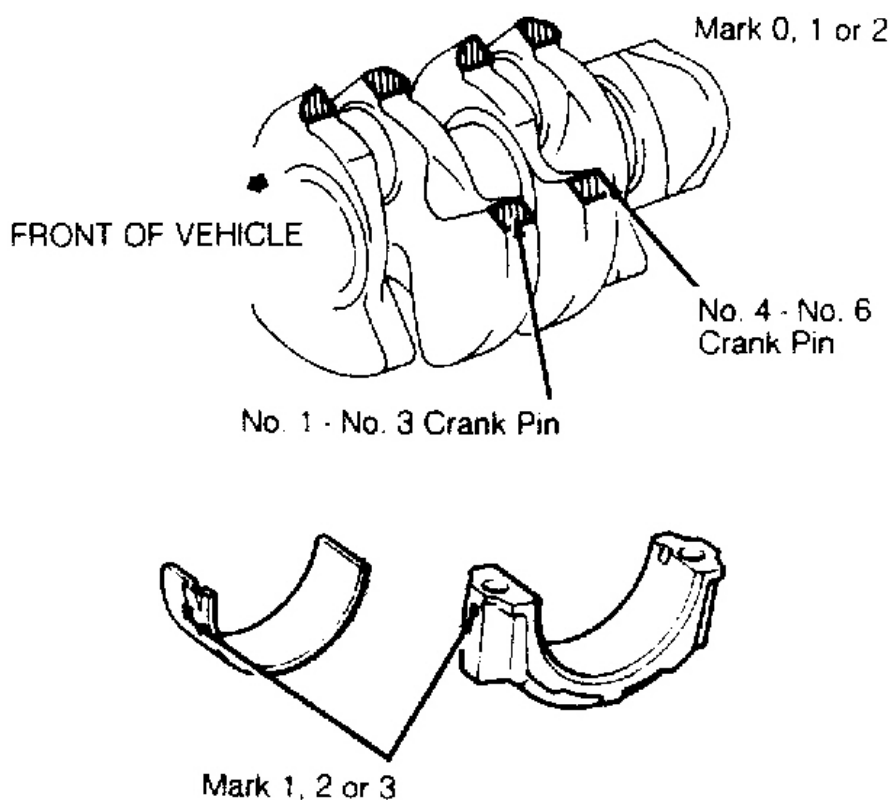


Fig. 11: Connecting Rod Bearing Size Identification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

STANDARD CONNECTING ROD BEARING SIZES

Application	In. (mm)
Connecting Rod Cap Letter A	
Big End Inside Diam.	2.2047-2.2050 (56.000-56.006)

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Crank Pin Diameter	2.0861-2.0866 (52.988-53.000)
Bearing Thickness	.0584-.0586 (1.484-1.488)
Connecting Rod Cap Letter B	
Big End Inside Diam.	2.2050-2.2052 (56.006-56.012)
Crank Pin Diameter	2.0861-2.0866 (52.988-53.000)
Bearing Thickness	.0586-.0587 (1.488-1.492)
Connecting Rod Cap Letter C	
Big End Inside Diam.	2.2052-2.2054 (56.012-56.018)
Crank Pin Diameter	2.0861-2.0866 (52.988-53.000)
Bearing Thickness	.0587-.0589 (1.492-1.496)
Connecting Rod Cap Letter .25 O/S	
Big End Inside Diam.	2.2047-2.2054 (56.000-56.018)
Crank Pin Diameter	2.0748-2.0752 (52.701-52.711)
Bearing Thickness	.0640-.0644 (1.626-1.636)

THRUST BEARING ALIGNMENT

Check crankshaft end play at thrust bearing with a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Oil grooves must be facing out.

THRUST WASHER SPECIFICATIONS

Thickness	Size In. (mm)
Standard	.1059-.1079 (2.690-2.740)
0.125 O/S	.1084-.1104 (2.753-2.803)
0.250 O/S	.1108-.1128 (2.815-2.865)

REAR MAIN BEARING OIL SEAL

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Apply grease to lip of new oil seal. Using Seal Driver (09223-41020), drive oil seal in place.

ENGINE LUBRICATION

OIL PAN

Removal

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Drain engine oil. Remove engine undercover. Detach necessary linkage components. Remove front crossmember. Remove oil pan.

Installation

Thoroughly clean pan rail mating surface. Apply a .20" (5.0 mm) bead of Seal Packing (08826-00080) to oil pan flange. Place gasket on pan and apply sealer to 4 corners of cylinder block where front cover and rear seal retainer meet cylinder block. Install pan. To complete installation, reverse removal procedure.

ENGINE OILING SYSTEM

Oiling system is force fed, utilizing a gear-type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full-flow oil filter and then to oil galleries in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly.

CRANKCASE CAPACITY

Engine oil capacity is 4.5 qts. (4.3L) when changing oil and oil filter. Oil capacity is 4.0 qts. (3.8L) when changing oil only.

OIL FILTER

Oil filter is a full-flow, disposable type. Filter is located at right side of engine.

NORMAL OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

OIL PRESSURE RELIEF VALVE

Relief valve is nonadjustable, with a 64 psi (4.5 kg/cm²) operating pressure.

OIL PUMP

Removal

Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. To complete installation, reverse removal procedure.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
-------------	--------------------

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Drive Gear-to-Crescent	
Standard	.0087-.0098 (.221-.249)
Wear Limit	.012 (.30)
Driven Gear-to-Crescent	
Standard	.0059-.0083 (.149-.211)
Wear Limit	.012 (.30)
Driven Gear-to-Body	
Standard	.0035-.0059 (.088-.149)
Wear Limit	.008 (.20)
Gear Faces-to-Body	
Standard	.0012-.0035 (.030-.088)
Wear Limit	.0059 (.149)

ENGINE COOLING

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fan clutch, pulley and fan belt. Remove 6 bolts and 3 nuts. Remove pump from engine.

Installation

To install water pump, use new gasket on clean mating surfaces and reverse removal procedure.

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

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	14 (19)
Camshaft Sprocket Bolt	58 (78)
Connecting Rod Cap Bolts	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head Bolts ⁽¹⁾	58 (78)
Exhaust Manifold	33 (44)
Flywheel Bolts	80 (108)
Intake Manifold-to-Cylinder Head	14 (19)
Main Bearing Cap Bolts ⁽²⁾	76 (103)
Timing Cover Bolts	

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

8 mm	9 (12)
10 mm	29 (39)
INCH Lbs. (N.m.)	
Oil Pan	108 (13)
Rear Oil Seal Retainer	108 (13)
(1) Tighten in sequence. See Fig. 1 .	
(2) Tighten in sequence. See Fig. 10 .	

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

Application	Specifications
Displacement	
Cubic Inches	144.4
Liters	2.4
Fuel System	
22R	2-Bbl.
22R-E	Fuel Inj.
HP @ RPM	
22R (Cal)	103 @ 4800
22R-E	116 @ 4800
Torque Ft. @ RPM	
22R	133 @ 2800
22R-E	140 @ 2800
Compression Ratio	
Bore	3.62 (92.0)
Stroke	3.50 (89.0)

PISTONS, PINS & RINGS SPECIFICATIONS**PISTONS, PINS & RINGS SPECIFICATIONS**

Application	In. (mm)
Piston Clearance	.0060-.0014 (.015-.035)
Piston Diameter ⁽¹⁾	
Mark "1"	3.6211-3.6214 (91.975-91.985)
Mark "2"	3.6214-3.6218 (91.985-91.995)
Mark "3"	3.6218-3.6222 (91.995-92.005)
Pins	
Diameter	n/a

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Piston Fit	(2)
Rod Fit	n/a
Rings	
Ring No. 1	
End Gap	.010-.019 (.25-.47)
Side Clearance ⁽²⁾	.001-.003 (.03-.07)
Ring No. 2	
End Gap	.024-.032 (.60-.82)
Side Clearance ⁽²⁾	.001-.003 (.03-.07)
Oil Ring	
End Gap	.008-.022 (.20-.55)
Side Clearance	n/a
(1) Three different piston sizes are used. Pistons are marked 1, 2, or 3.	
(2) At 176°F (80°C) piston pin should be push fit in piston. If pin can be installed at a lower temperature, replace piston/pin assembly.	

MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS**

Application	In. (mm)
Crankshaft	
Crankshaft End Play	.001-.009 (.02-.22)
Runout	.004 (.10)
Journal Taper	.0008 (.02)
Journal Out-Of-Round	.0008 (.02)
Main Bearings	
Journal Diameter	(1)
Oil Clearance ⁽²⁾	.001-.002 (.03-.06)
Connecting Rod Bearings	
Journal Diameter	(3)
Oil Clearance ⁽⁴⁾	.001-.002 (.03-.06)
(1) See MAIN BEARING DIMENSIONS table.	
(2) Standard listed. Limit is .003" (.08 mm).	
(3) See CONNECTING ROD BEARING DIMENSIONS table.	
(4) Standard listed. Limit is .004" (.10 mm).	

CONNECTING ROD SPECIFICATIONS**CONNECTING ROD SPECIFICATIONS**

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Application	In. (mm)
Side Play ⁽¹⁾	.0059-.0098 (.15-.25)
Maximum Bend & Twist ⁽²⁾	.002 & .006 (.05 & .15)
Pin Bore Diameter	n/a
Large Bore Diameter	(3)
Center-to-Center Length	n/a
(1) Standard listed. Limit is .012" (.3 mm).	
(2) Per 3.94".	
(3) See CONNECTING ROD BEARING DIMENSIONS table.	

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD SPECIFICATIONS**

Application	In. (mm)
Maximum Cylinder Head Warp ⁽¹⁾	.006 (.15)
Seat Angle	45°
Maximum Runout	n/a
Seat Width	.05-.06 (1.2-1.6)
Seat Bore Diameter	n/a
Valve Stem Oil Clearance	
Intake ⁽²⁾	.0010-.0024 (.025-.061)
Exhaust ⁽³⁾	.0012-.0026 (.031-.066)
Valve Guide Inside Diameter	.315-.316 (8.01-8.03)
Valve Guide Bore ⁽⁴⁾	.5118-.5125 (13.000-13.018)
(1) Over entire length and width.	
(2) Standard listed. Limit is .003" (.08 mm).	
(3) Standard listed. Limit is .004" (.10 mm).	
(4) Maximum rebore diameter is .5138-.5145" (13.05-13.068).	

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK SPECIFICATIONS**

Application	In. (mm)
Maximum Block Warp	.002 (.051)
Cylinder Bore	
Standard Diameter ⁽¹⁾	
Mark "1"	3.6220-3.6224 (92.00-92.01)
Mark "2"	3.6224-3.6228 (92.01-92.02)

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Mark "3"	3.6228-3.6232 (92.02-92.03)
Maximum Taper	.0008 (.02)
Maximum Out-of-Round	.0008 (.02)
(1) Three different bore sizes are used. Cylinders are marked 1, 2, or 3. See Fig. 9 .	

VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS SPECIFICATIONS**

Application	In. (mm)
Intake	
Head Diameter	n/a
Stem Diameter	.3138-.3144 (7.970-7.985)
Face Angle	44.5°
Minimum Margin	.024 (.60)
Maximum Refinish	n/a
Springs	
Free Length	1.91 (48.5)
Out-Of-Square	.063 (1.6)
Installed Height	1.594 (40.5)
Pressure Lbs. @ In. (Kg @ mm)	
Valve Closed	n/a
Valve Open	n/a
Exhaust	
Head Diameter	n/a
Stem Diameter	.3136-.3142 (7.965-7.980)
Face Angle	44.5°
Minimum Margin	.024 (.6)
Maximum Refinish	n/a
Springs	
Free Length	1.91 (48.5)
Out-Of-Square	.063 (1.6)
Installed Height	1.594 (40.5)
Pressure Lbs. @ In. (Kg @ mm)	
Valve Closed	n/a
Valve Open	n/a

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
Journal Diameter	1.298-1.299 (32.98-33.00)

1988 Toyota 4Runner

2.4L 4-CYL & 2.4L 4-CYL TURBO - VIN [R] 1988 Engines - 2.4L 4-Cylinder

Oil Clearance ⁽¹⁾	.0004-.0020 (.010-.050)
Bearing Bore	n/a
Maximum Runout	.008 (.20)
End Play	⁽²⁾ .003-.007 (.08-.18)
Lobe Lift	n/a
Lobe Height	
Intake	1.678-1.681 (42.63-42.72)
Exhaust	1.681-1.684 (42.69-42.78)

(1) Standard listed. Limit is .004" (.10 mm).

(2) Standard listed. Limit is .010" (.25 mm).

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

2.4L 4-CYL - VIN [R]

1989 Engines - 2.4L 4-Cylinder

ENGINE IDENTIFICATION

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

Engine serial number is stamped on left side of cylinder block, behind the alternator. The last group of characters designates engine type.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
2.4L 4-Cylinder		
Carburetor	22R	R
Fuel Injection	22R-E	R

REMOVAL & INSTALLATION

ENGINE

NOTE: Removal procedures between engines may vary slightly due to design differences.

Removal

1. Disconnect the negative battery cable. Drain the cooling system. Disconnect the upper radiator hose from engine. On fuel injected engines, remove the air cleaner hose.
2. On all models, remove air cleaner. Disconnect exhaust pipe from exhaust manifold. Remove fan, radiator, shroud, hoses and upper bracket. Remove and support air conditioning compressor without discharging system (if equipped).
3. Disconnect heater hoses, throttle control cable, fuel lines and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses for reassembly reference. Remove alternator and distributor.
4. On fuel injected engines, remove EGR vacuum modulator and air intake chamber with throttle body. Disconnect actuator, accelerator and throttle cables. Disconnect and label all fuel injection wiring and vacuum hoses. On carbureted engines, disconnect accelerator linkage.
5. On automatic transmission equipped models, disconnect transmission throttle cable and drain fluid. On power steering equipped models, remove pump from engine without disconnecting hoses and set aside. On manual transmission equipped models, remove shift lever and slave cylinder.
6. Raise and support vehicle. Disconnect front exhaust pipe. Remove engine undercover. Disconnect transmission shift linkage. On automatic transmission equipped models, disconnect cooler lines.

7. Remove drive shaft. On 4WD models, remove undercover, stabilizer bar and front drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install engine, reverse removal procedure. Check all fluid levels and linkage adjustments prior to starting engine.

MANIFOLDS**Removal**

Remove heater inlet pipe-to-cylinder head bolt. Remove No. 1 air pipe. Remove intake manifold with delivery pipe, injection nozzles and heater water inlet pipe as an assembly. Remove exhaust manifold bolts and exhaust manifold.

Installation

To install intake and exhaust manifolds, use new gaskets and reverse removal procedure.

CYLINDER HEAD**Removal**

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect front exhaust pipe. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection) and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. On carbureted models, remove fuel pump from cylinder head. Remove distributor with cap and wires.
3. Remove power steering pump and set aside (if equipped). On fuel injected vehicles, remove EGR modulator with bracket and air intake chamber with throttle body. See **Fig. 2** . Disconnect and label all fuel injection wiring and linkages for reassembly reference.
4. Remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and cam thrust plate off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head. Remove chain cover bolt in front of camshaft sprocket.
6. Loosen cylinder head bolts, in 3 steps, in reverse order of tightening sequence. See **Fig. 1** . Remove rocker arm assembly. If necessary, pry equally at front and rear of rocker arm assembly to remove.
7. Lift head from dowels on block and set on wood blocks on work bench. If difficult to remove, carefully pry with flat bar between cylinder head and block projection. Remove EGR valve, intake and exhaust manifolds.

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and rotate camshaft so dowel pin is at facing upward.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. See **Fig. 1** . Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

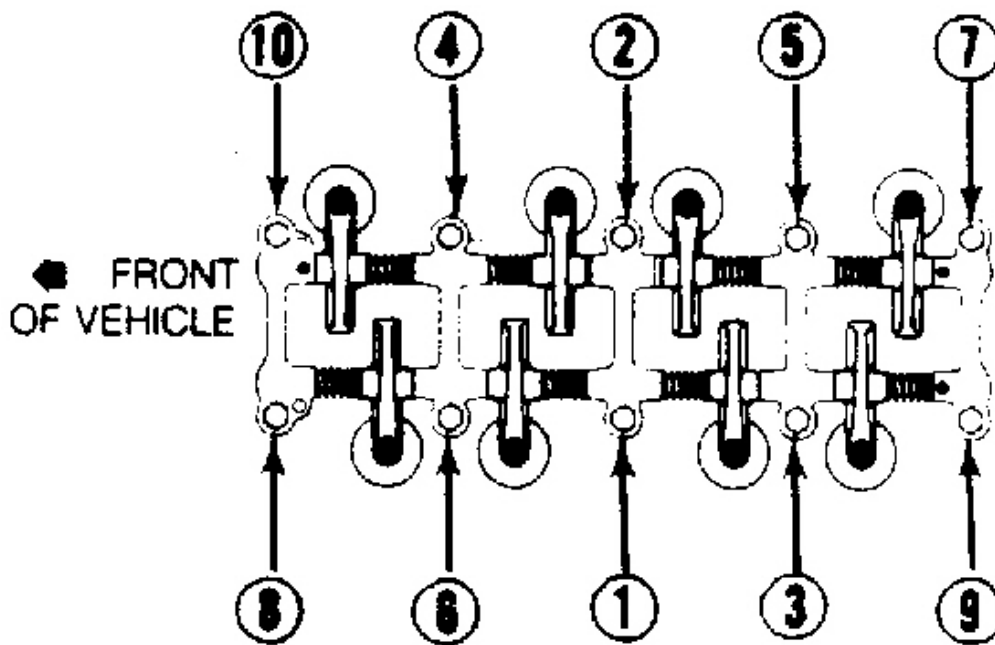


Fig. 1: Cylinder Head/Rocker Arm Bolt Tightening Sequence

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

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

1. Carburetor
2. Air Intake Chamber
3. Cylinder Head Cover
4. Rocker Arm Assembly
5. Valve Keepers
6. Valve Spring Retainer
7. Compression Spring
8. Oil Seal
9. Valve Spring Seat
10. Valve
11. Gasket
12. EGR Valve
13. Intake Manifold
14. Distributor Drive Gear
15. Camshaft Bearing Cap
16. Camshaft
17. Valve Guide
18. Snap Ring
19. Cylinder Head Rear Plate
20. Exhaust Manifold & insulator
21. Cylinder Head
22. Cylinder Block
23. Rear Oil Seal
24. Rear Oil Seal Retainer
25. Thrust Washer
26. Main Bearing
27. Oil Strainer
28. Crankshaft
29. Main Bearing Cap
30. Drain Plug
31. Oil Pan
32. Rod Cap
33. Connecting Rod
34. Piston Pin
35. Piston
36. Piston Ring
37. Rod Bearing

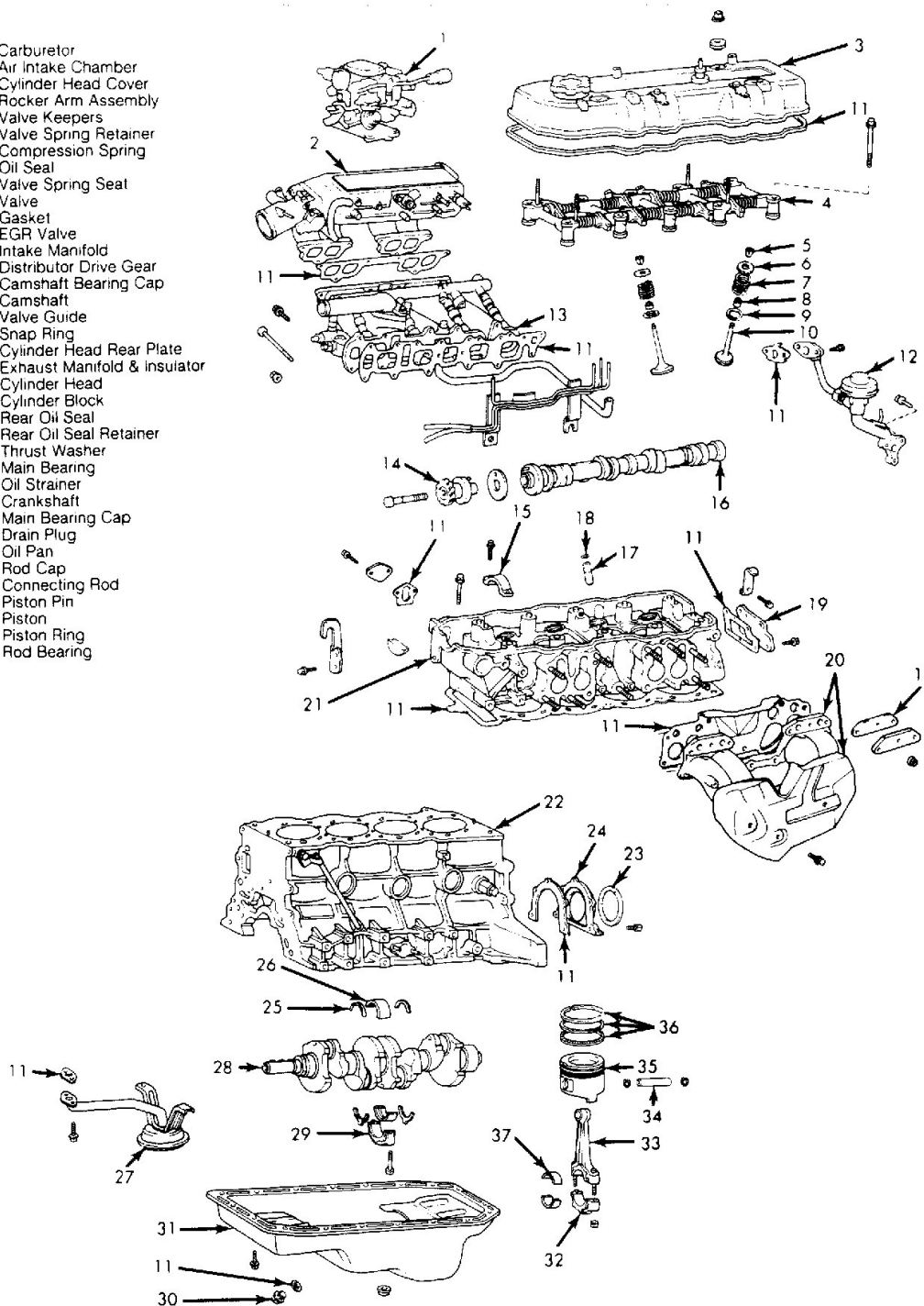


Fig. 2: Exploded View of 22R-E Engine

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

FRONT COVER OIL SEAL

Removal

Oil seal press fits into oil pump body at front of crankshaft. Remove crankshaft pulley bolt. Using gear puller, remove crankshaft pulley. Pry out seal.

Installation

Apply grease to lip of new oil seal and sealant to outside of seal. Drive new seal into position using Seal Installer (09223-50010). Tighten crankshaft pulley bolt to specification.

TIMING CHAIN**Removal**

1. Remove cylinder head. Remove radiator. Remove engine under cover and engine mounting bolts. Place a jack under transmission and raise engine about 1" (25.4 mm). Remove 16 bolts and 2 nuts. Using Oil Pan Seal Cutter (09032-00100), remove oil pan.
2. Remove power steering belts (if equipped). Remove A/C belt, compressor and bracket (if equipped) and lay aside. Remove fluid coupling with fan and coolant pump pulley. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley. See **Fig. 3**.
3. Remove number one coolant by-pass pipe. On carbureted and fuel injected models, remove 2 bolts and disconnect heater outlet pipe. Remove fan belt adjusting bracket.
4. Remove timing chain cover assembly. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump drive spline and chain sprocket.

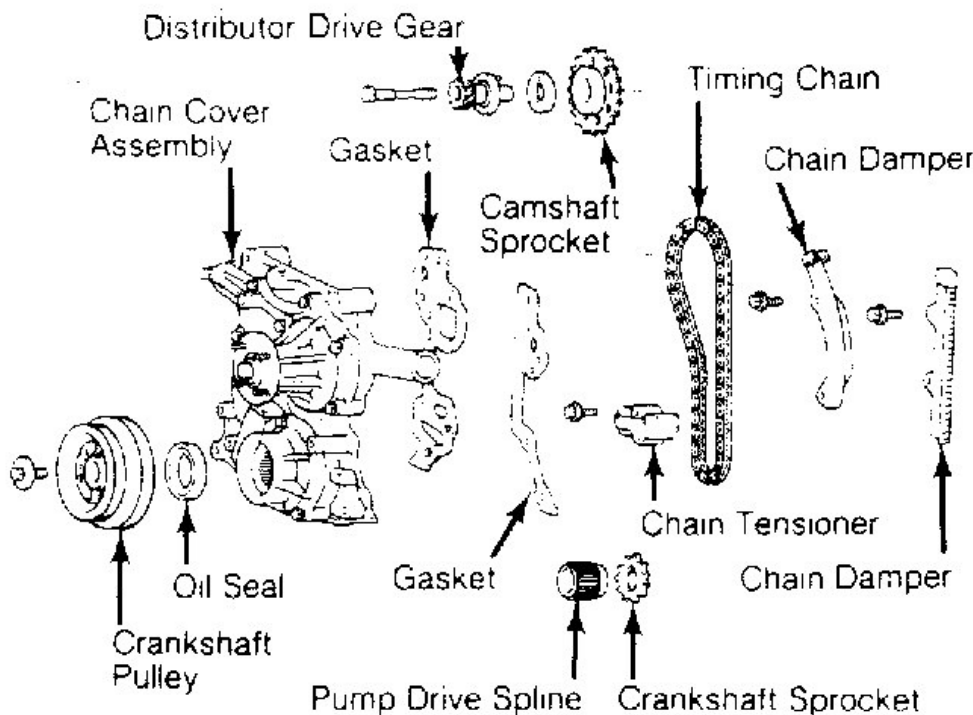


Fig. 3: Exploded View of Timing Chain Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Check chain, sprockets, tensioner and chain dampers for wear. Replace chain tensioner if width is less than .43" (11.0 mm). Minimum size for left and right chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance between 17 links should be 5.79" (147.0 mm). See **Fig. 4**.
3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to sprocket, measure outer sides of chain rollers. Using same method, measure crankshaft sprocket and chain.
4. The minimum dimension for crankshaft sprocket and chain is 2.34" (59.4 mm). The minimum dimension for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace timing chain and both sprockets.

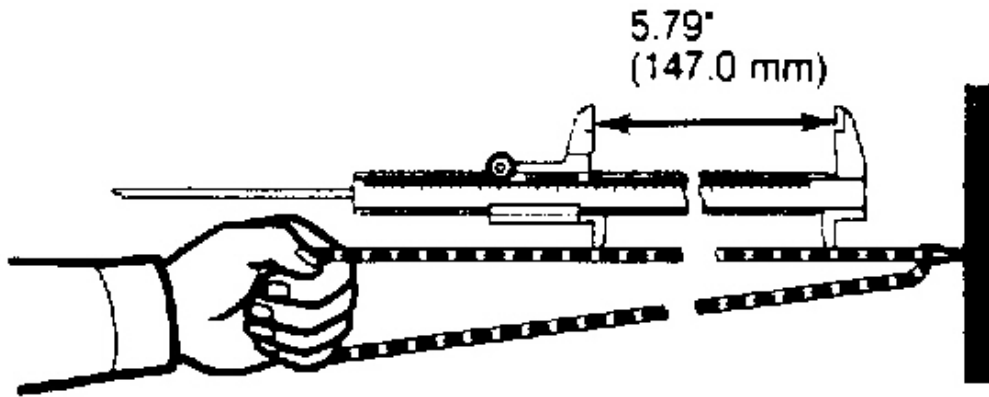
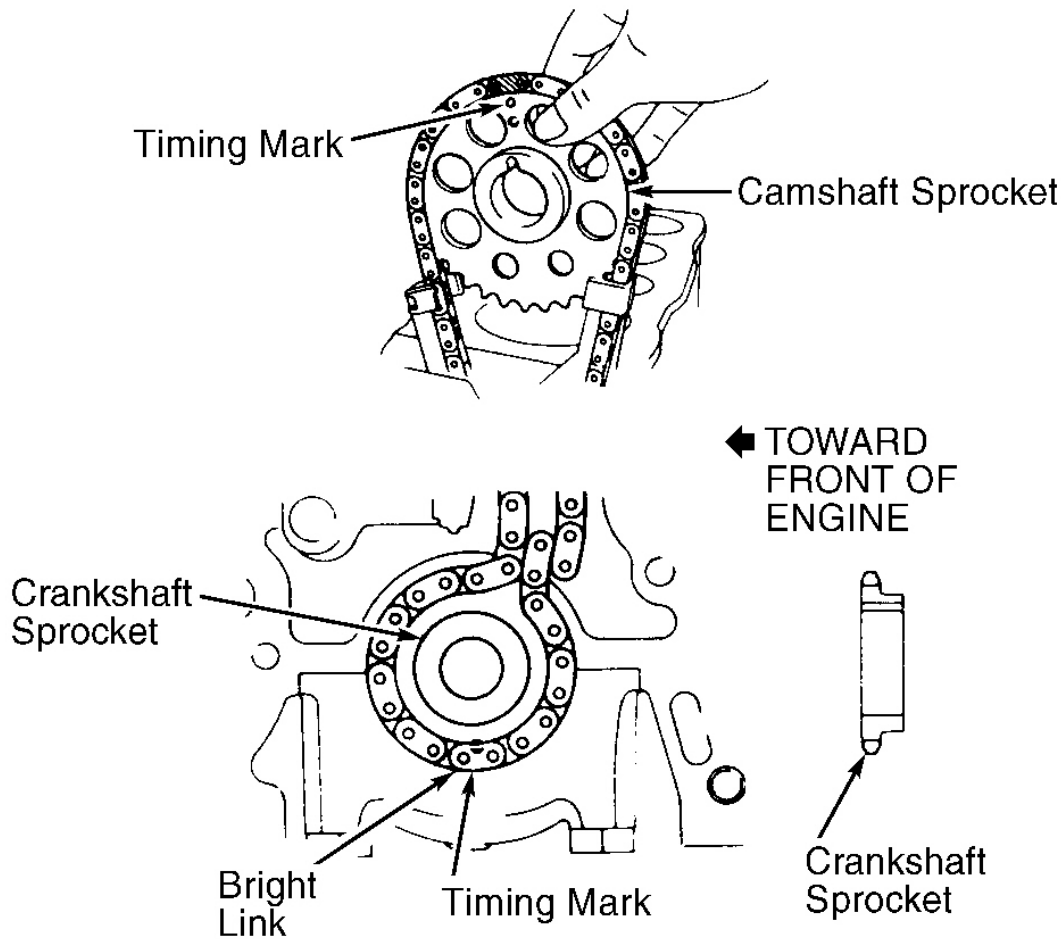


Fig. 4: Checking Timing Chain Stretch

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

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will positioned straight upward). Position sprocket on crankshaft. Place timing chain on sprocket with single bright link aligned with timing mark on sprocket.
2. Install cam sprocket in timing chain so timing mark on sprocket is located between 2 chromed links. See **Fig. 5** . Ensure chain is positioned in dampers. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.
3. Continue installation in reverse of removal procedure. Set camshaft timing by placing No. 1 cylinder at TDC on compression stroke and positioning camshaft so dowel on sprocket flange is in 12 o'clock position.



93E00418

Fig. 5: Aligning Sprockets & Timing Chain
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CAMSHAFT

Removal

Remove rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

Inspection

1. Camshaft journal oil clearance may be checked using Plastigage method. If clearance exceeds specification, replace cylinder head and/or camshaft. Maximum clearance is .004" (.10 mm).
2. Maximum camshaft runout at center journal is .008" (.20 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678" (42.62 mm), or exhaust lobe height is less than 1.681" (42.70 mm).

Installation

To install camshaft, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward front. Adjust valves.

VALVE TIMING

1. Turn crankshaft to TDC (Woodruff key on top). Slide crankshaft sprocket over key onto crankshaft. Place timing chain on sprocket with single plated link aligned with timing mark on sprocket.
2. Turn camshaft to locate dowel pin and stamped mark on camshaft at 12 o'clock position. Timing mark on camshaft sprocket must be between 2 plated links on timing chain. Single plated link on timing chain must be aligned with crankshaft sprocket timing mark.

VALVE ARRANGEMENT

Right Side - Intake Valves.

Left Side - Exhaust Valves.

ROCKER ARM ASSEMBLY

NOTE: **Label all rocker arm components for reassembly reference.**

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.010-.050 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly. Note that rocker arms are identical. See **Fig. 6** .

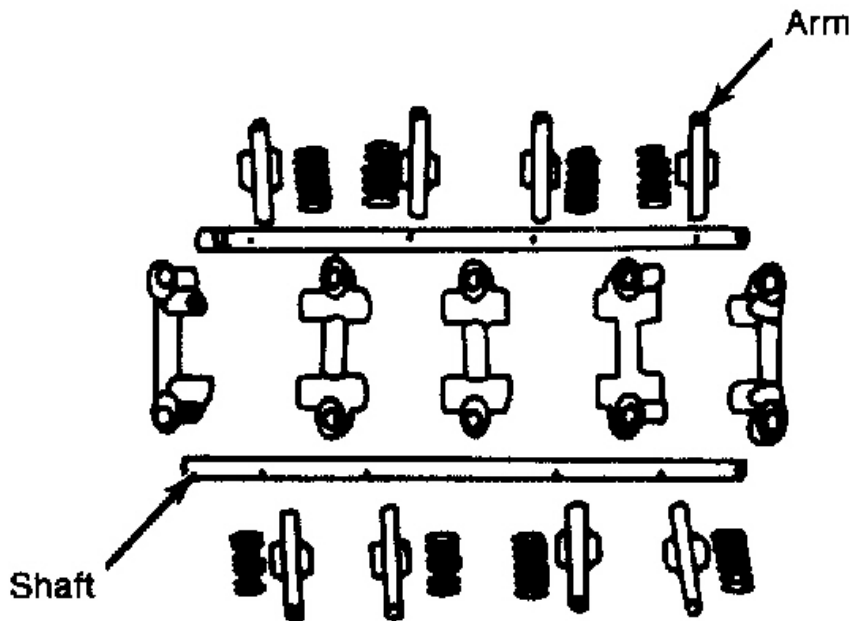


Fig. 6: Disassembled View of Rocker Arm Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE STEM OIL SEALS

Removal & Installation

1. Using a spring compressor, remove valve keepers. Remove spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Slide a new oil seal over valve stem, using care not to damage seal as it passes over keeper grooves. Force seal over end of valve guide. To complete installation, reverse removal procedure.

VALVE CLEARANCE ADJUSTMENTS

1. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on compression stroke. Measure clearance between rocker arm and valve stem.
2. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves. Rotate crankshaft one complete revolution (360 degrees) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENTS (COLD)

Valve	In. (mm)
Intake	.008 (.20)

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Exhaust

.012 (.30)

VALVE GUIDES

Removal & Installation

1. Measure diameter of valve guide and valve stem. Maximum clearance for exhaust valves is .0039" (.100 mm). Maximum clearance for intake valves is .0031" (.080 mm). If valve stem oil clearance exceeds specification, valve guides and valves must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).
2. Using Valve Guide Remover (09201-60011) and hammer, drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Ream valve guide with a .31" (8.0 mm) reamer for proper stem clearance.

VALVE SPRINGS

Check valve spring free length and squareness. If free length is less than 1.91" (48.5 mm) or out-of-square more than .063" (1.6 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified.

OVERHAUL

PISTON & ROD ASSEMBLY

Removal

Remove cylinder head and oil pan. Remove ring ridge from top of cylinder. Mark rods and caps for correct assembly. Remove rod caps. Cover rod bolts with short length of hose to prevent crankshaft damage. Push piston/rod assembly out of block.

Installation

Lubricate piston, cylinder and journal with clean engine oil. Position rings, and install ring compressor. See **Fig. 7**. Stamped mark on ring must face upward. Install piston/rod assembly in proper position with notch on piston top facing forward.

FITTING PISTONS

1. Measure cylinder bore at top, bottom and center of piston travel. Measure in line with and at 90 degrees to crankshaft. Standard bore is 3.6232" (92.029 mm) with a wear limit of .0008" (.020 mm). Maximum out-of-round is .0008" (.020 mm). Maximum taper is .0004" (.010 mm).
2. Measure piston at right angle to pin and just below oil ring groove. If not within specification, rebore cylinder and/or replace pistons. On 22R and 22R-E engines, pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON SIZE CHART

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1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Application	In. (mm)
Standard	3.6209-3.6220 (91.970-92.000)
0.50 mm O/S	3.6405-3.6417 (92.470-92.500)
1.00 mm O/S	3.6602-3.6614 (92.970-93.000)

FITTING RINGS

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with "T" or "N" marks facing upward. Position ring end gaps correctly. See **Fig. 7**.

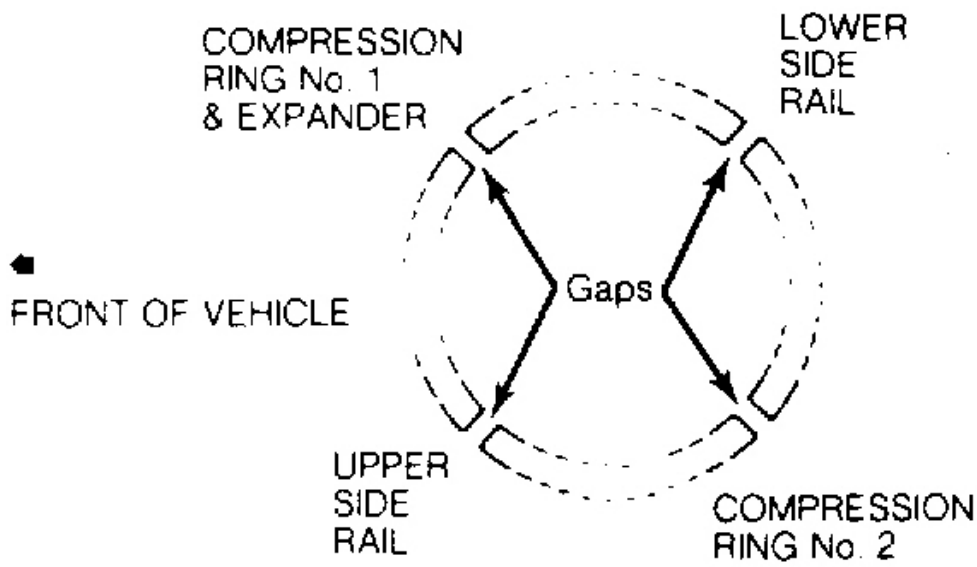


Fig. 7: Correct Piston Ring Gap Arrangement

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

PISTON PIN REPLACEMENT

Removal

Remove piston pin snap ring. Heat piston in hot water to 140°F (60°C). Using hammer and driver, push piston pin out of piston and connecting rod.

Inspection

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater than .0006" (.015 mm).
2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. Inspect connecting rod for misalignment. The maximum rod bend limit is .002" (.05 mm) per 3.94" (100 mm). The maximum rod twist limit is .0059" (.15 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: **Piston and pin are a matched set. Use new snap rings for reassembly.**

Installation

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. Push pin into piston and rod assembly. Install snap rings. See **Fig. 8**.

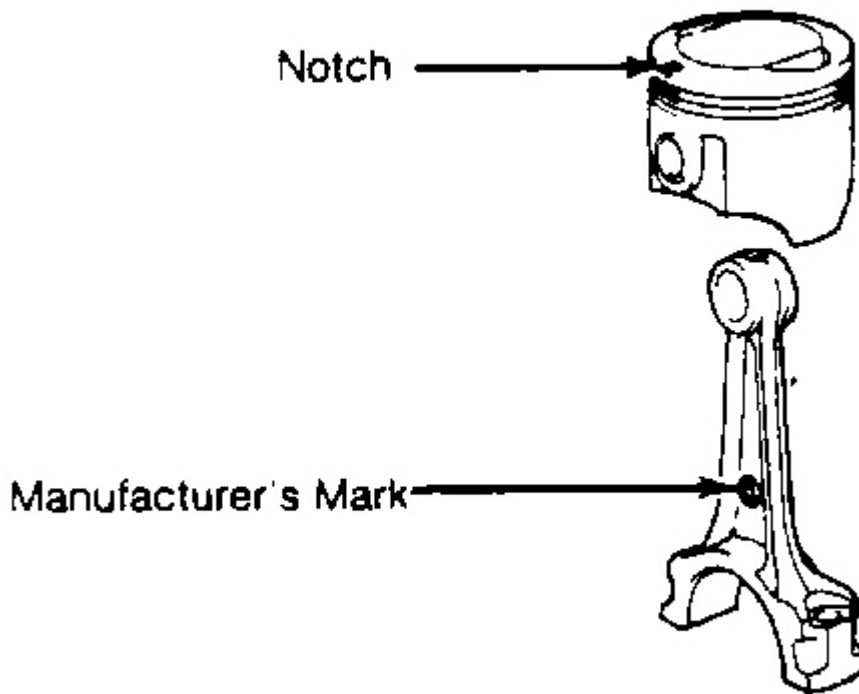


Fig. 8: Correct Alignment of Piston & Rod Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKSHAFT MAIN BEARINGS

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

NOTE: There are three sizes of standard main bearings. Each size is marked with a 3, 4 or 5. Replacement main bearings should have the same number as the number stamped on the cylinder block. See Fig. 9 and MAIN BEARING DIMENSIONS table.

1. Measure crankshaft runout at center journal. If runout exceeds .004" (.10 mm), replace crankshaft. Inspect all journals for wear or scoring. Out-of-round or taper limit is .0004" (.010 mm). If crankshaft is worn excessively, grind journals for undersize bearings.

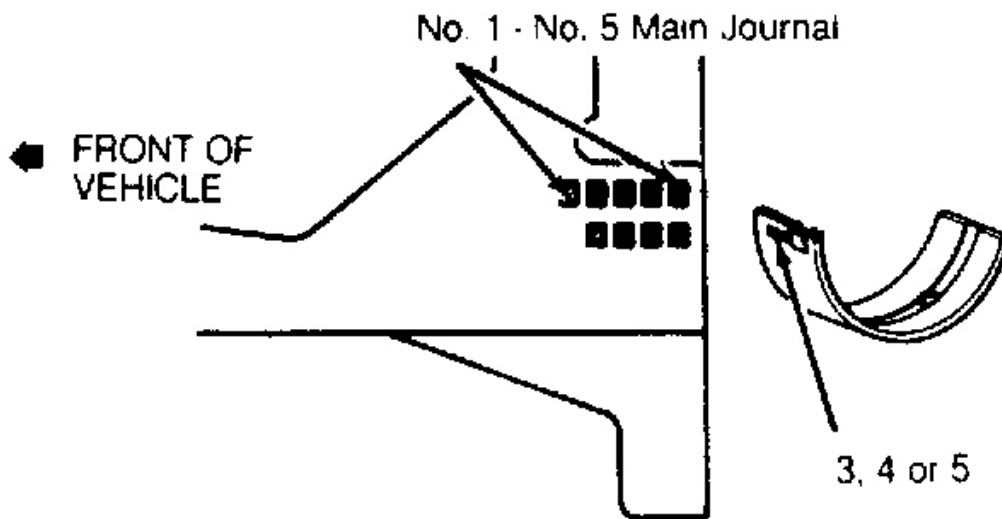


Fig. 9: Cylinder Block Main Bearing Identification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

MAIN BEARING DIMENSIONS

Application	In. (mm)
Cylinder Block	
Bore Size	
Mark 3	2.5198-2.5201 (64.004-64.010)
Mark 4	2.5201-2.5203 (64.010-64.016)
Mark 5	2.5203-2.5205 (64.016-64.022)
0.25 O/S	2.5198-2.5205 (64.004-64.022)

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Journal Diameter	
Mark 3, 4 & 5	2.3616-2.3622 (59.984-60.000)
0.25 O/S	2.3504-2.3508 (59.701-59.711)
Bearing Thickness	
Mark 3	.0783-.0784 (1.988-.1.992)
Mark 4	.0784-.0786 (1.992-.1.996)
Mark 5	.0786-.0787 (1.996-.2.000)
0.25 O/S	.0837-.0841 (2.126-.2.136)

2. Measure bearing clearances using Plastigage method. Observe correct tightening sequence. See **Fig. 10** . If clearance exceeds specification, grind journals for undersize bearings.
3. Standard main bearing clearance is .0010-.0022" (.025-.055 mm). Maximum main bearing clearance is .0031" (.078 mm). Main bearings are available in .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.701-59.711 mm).

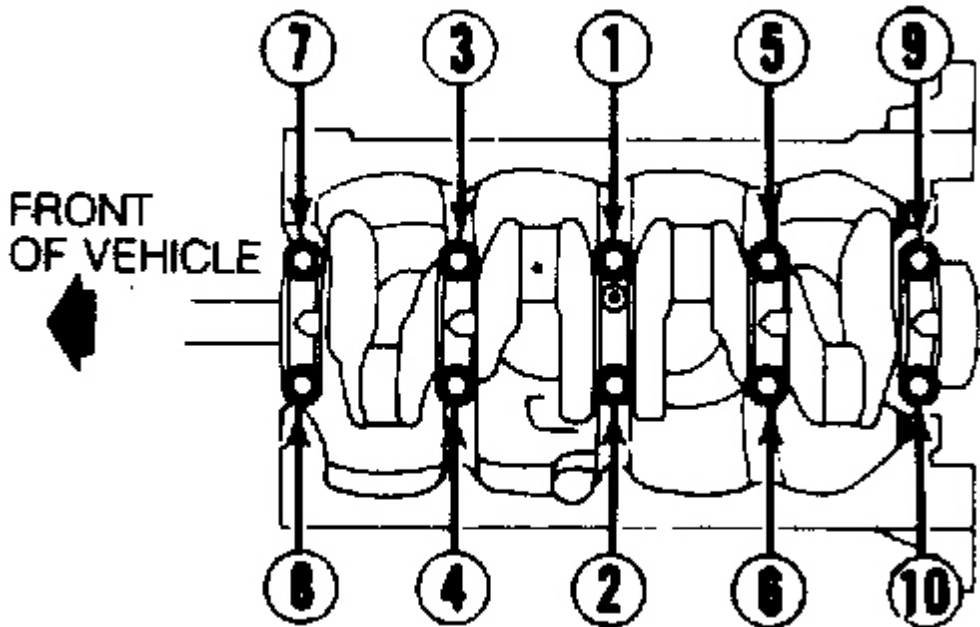


Fig. 10: Main Bearing Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CONNECTING ROD BEARINGS

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

NOTE: There are three sizes of standard connecting rod bearings. Each size is marked with an A, B or C. Replacement connecting rod bearings should have the same letter as the letter stamped on the connecting rod cap. See [Fig. 11](#) and [CONNECTING ROD BEARING DIMENSIONS](#) table.

Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .0031" (.078 mm). Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.010 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.699-52.710 mm).

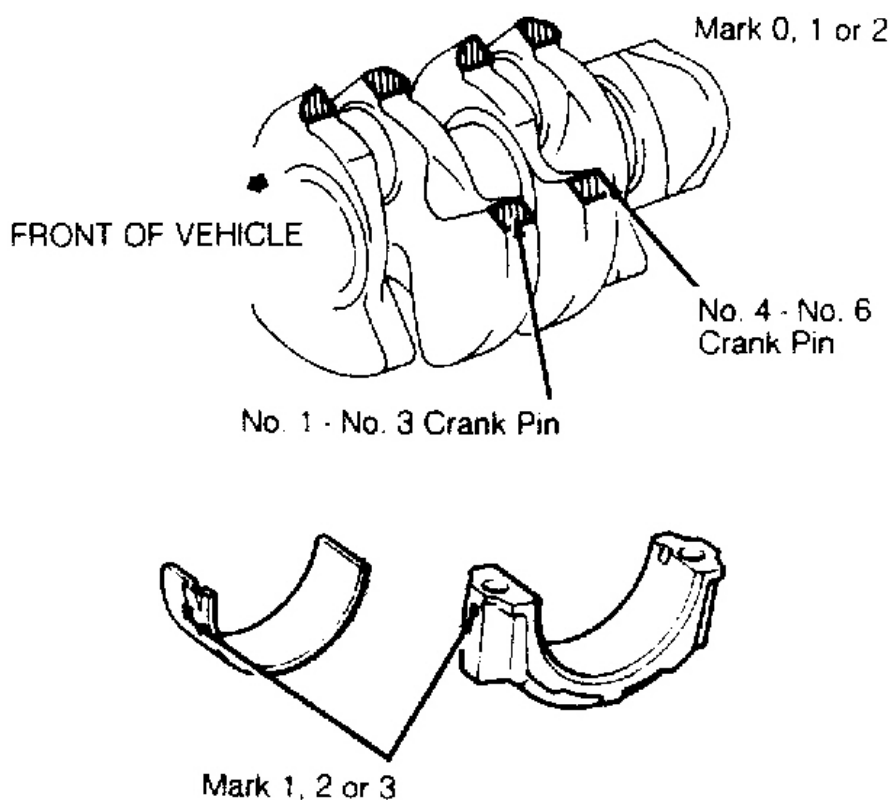


Fig. 11: Connecting Rod Bearing Size Identification
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CONNECTING ROD BEARING DIMENSIONS

Application	In. (mm)
Big End Inside Diameter	
Rod Cap Letter A	2.2047-2.2050 (56.000-56.006)

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Rod Cap Letter B	2.2050-2.2052 (56.006-56.012)
Rod Cap Letter C	2.2052-2.2054 (56.012-56.018)
0.25 O/S	2.2047-2.2054 (56.000-56.018)
Crank Pin Diameter	
Rod Cap Letter A, B & C	. 2.0861-2.0866 (52.988-53.000)
0.25 O/S	2.0748-2.0752 (52.701-52.711)
Bearing Thickness	
Rod Cap Letter A	.0584-.0586 (1.484-1.488)
Rod Cap Letter B	.0586-.0587 (1.488-1.492)
Rod Cap Letter C	.0587-.0589 (1.492-1.496)
0.25 O/S	.0640-.0644 (1.626-1.636)

THRUST BEARING ALIGNMENT

Check crankshaft end play at thrust bearing with a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Oil grooves must be facing out.

THRUST WASHER SPECIFICATIONS

Size	In. (mm)
Standard	.1059-.1079 (2.690-2.740)
0.125 O/S	.1084-.1104 (2.753-2.803)
0.250 O/S	.1108-.1128 (2.815-2.865)

REAR MAIN BEARING OIL SEAL

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Apply grease to lip of new oil seal. Using Seal Driver (09223-41020), drive oil seal in place.

ENGINE LUBRICATION

Oiling system is force fed, utilizing a gear-type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full-flow oil filter and then to oil galleries in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly.

OIL PAN

Removal

Drain engine oil. Remove engine undercover. Detach necessary linkage components. Remove front crossmember. Remove oil pan.

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Installation

Thoroughly clean pan rail mating surface. Apply a .20" (5.0 mm) bead of Seal Packing (08826-00080) to oil pan flange. Place gasket on pan and apply sealer to 4 corners of cylinder block where front cover and rear seal retainer meet cylinder block. Install pan. To complete installation, reverse removal procedure.

CRANKCASE CAPACITY

Engine oil capacity is 4.5 qts. (4.3L) when changing oil and oil filter. Oil capacity is 4.0 qts. (3.8L) when changing oil only.

NORMAL OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

OIL PRESSURE RELIEF VALVE

Relief valve is nonadjustable, with a 64 psi (4.5 kg/cm²) operating pressure.

OIL PUMP

Removal

Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. To complete installation, reverse removal procedure.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Drive Gear-to-Crescent	
Standard	0087-.0098 (.221-.249)
Wear Limit	012 (.30)
Driven Gear-to-Crescent	
Standard	0059-.0083 (.149-.211)
Wear Limit	012 (.30)
Driven Gear-to-Body	
Standard	0035-.0059 (.088-.149)
Wear Limit	008 (.20)
Gear Faces-to-Body	
Standard	0012-.0035 (.030-.088)

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Wear Limit

0059 (.149)

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fan clutch, pulley and fan belt. Remove 6 bolts and 3 nuts. Remove pump from engine.

Installation

To install water pump, use new gasket on clean mating surfaces and reverse removal procedure.

NOTE: For further information on cooling systems, see **ENGINE COOLING** article.

COOLING SPECIFICATIONS

BELT ADJUSTMENT ⁽¹⁾

Application	New Belt	Used Belt
Alternator	125 (56)	80 (36)
(1) Tension in Lbs.(kg) Using Burroughs Tension Gauge.		

PRESSURE CAP

Using radiator cap tester, apply pressure. Relief valve should open between 10 psi (0.75 kg/cm²) and 14.9 psi (1.05 kg/cm²).

COOLANT CAPACITY

For automatic transmission with 4 wheel drive: 9.6 qts. (9.1L), including heater. All others: 8.9 qts. (8.4L), including heater.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	14 (19)
Camshaft Sprocket Bolt	58 (78)
Connecting Rod Cap Bolts	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head Bolts ⁽¹⁾	58 (78)
Exhaust Manifold	33 (44)
Flywheel Bolts	80 (108)

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Intake Manifold-to-Cylinder Head	14 (19)
Main Bearing Cap Bolts ⁽²⁾	76 (103)
Timing Cover Bolts	
8 mm	9 (12)
10 mm	29 (39)
INCH Lbs. (N.m.)	
Oil Pan	108 (13)
Rear Oil Seal Retainer	108 (13)
(1) Tighten in sequence. See Fig. 1 .	
(2) Tighten in sequence. See Fig. 10 .	

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

Application	Specifications
Displacement	
Cubic Inches	144.4
Liters	2.4
Fuel System	
22R	2-Bbl.
22R-E	Fuel Inj.
HP @ RPM	
22R (Cal)	103 @ 4800
22R-E	116 @ 4800
Torque Ft. @ RPM	
22R	133 @ 2800
22R-E	140 @ 2800
Compression Ratio	n/a
Bore	3.62 (92.0)
Stroke	3.50 (89.0)

PISTONS, PINS & RINGS SPECIFICATIONS**PISTONS, PINS & RINGS SPECIFICATIONS**

Application	In. (mm)
Piston Clearance	.0060-.0014 (.015-.035)
Piston Diameter ⁽¹⁾	
Mark "1"	3.6211-3.6214 (91.975-91.985)
Mark "2"	3.6214-3.6218 (91.985-91.995)

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Mark "3"	3.6218-3.6222 (91.995-92.005)
Pins	
Diameter	n/a
Piston Fit	(2)
Rod Fit	n/a
Rings	
Ring No. 1	
End Gap	.010-.019 (.25-.47)
Side Clearance ⁽³⁾	.001-.003 (.03-.07)
Ring No. 2	
End Gap	.024-.032 (.60-.82)
Side Clearance ⁽³⁾	.001-.003 (.03-.07)
Oil Ring	
End Gap	.008-.022 (.20-.55)
Side Clearance	n/a
(1) Three different piston sizes are used. Pistons are marked 1, 2, or 3.	
(2) At 176°F (80°C) piston pin should be push fit in piston. If pin can be installed at a lower temp., replace piston/pin assembly.	
(3) Maximum is .008" (.2 mm).	

CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECS**CRANKSHAFT MAIN & CONNECTING ROD BEARINGS SPECS**

Application	In. (mm)
Crankshaft	
Crankshaft End Play	.001-.009 (.02-.22)
Runout	.004 (.10)
Journal Taper	.0008 (.02)
Journal Out-Of-Round	.0008 (.02)
Main Bearings	
Journal Diameter	(1)
Oil Clearance ⁽²⁾	.001-.002 (.03-.06)
Connecting Rod Bearings	
Journal Diameter	(3)
Oil Clearance ⁽⁴⁾	.001-.002 (.03-.06)
(1) See <u>MAIN BEARING DIMENSIONS</u>	
(2) Standard listed. Limit is .003" (.08 mm).	
(3) See <u>CONNECTING ROD BEARING DIMENSIONS</u>	

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

(4) Standard listed. Limit is .004" (.10 mm).

CONNECTING ROD SPECIFICATIONS**CONNECTING ROD SPECIFICATIONS**

Application	In. (mm)
Side Play ⁽¹⁾	.0059-.0098 (.15-.25)
Maximum Bend & Twist ⁽²⁾	.002 & .006 (.05 & .15)
Pin Bore Diameter	n/a
Large Bore Diameter	(3)
Center-to-Center Length	n/a

(1) Standard listed. Limit is .012" (.3 mm).

(2) Per 3.94".

(3) See **CONNECTING ROD BEARING DIMENSIONS**

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD SPECIFICATIONS**

Application	In. (mm)
Maximum Cylinder Head Warp ⁽¹⁾	.006 (.15)
Seat Angle	45°
Maximum Runout	n/a
Seat Width	.05-.06 (1.2-1.6)
Seat Bore Diameter	n/a
Valve Stem Oil Clearance	
Intake ⁽²⁾	.0010-.0024 (.025-.061)
Exhaust ⁽³⁾	.0012-.0026 (.031-.066)
Valve Guide Inside Diameter	.315-.316 (8.01-8.03)
Valve Guide Bore ⁽⁴⁾	.5118-.5125 (13.000-13.018)

(1) Over entire length and width.

(2) Standard listed. Limit is .003" (.08 mm).

(3) Standard listed. Limit is .004" (.10 mm).

(4) Maximum rebore diameter is .5138-.5145" (13.05-13.068).

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK SPECIFICATIONS**

Application	In. (mm)
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1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

Maximum Block Warp	.002 (.051)
Cylinder Bore	
Standard Diameter ⁽¹⁾	
Mark "1"	3.6220-3.6224 (92.00-92.01)
Mark "2"	3.6224-3.6228 (92.01-92.02)
Mark "3"	3.6228-3.6232 (92.02-92.03)
Maximum Taper	.0008 (.02)
Maximum Out-of-Round	.0008 (.02)
(1) Three different bore sizes are used. Cylinders are marked 1, 2, or 3. See Fig. 9 .	

VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS SPECIFICATIONS**

Application	In. (mm)
Intake	
Head Diameter	n/a
Stem Diameter	.3138-.3144 (7.970-7.985)
Face Angle	44.5°
Minimum Margin	.024 (.60)
Maximum Refinish	n/a
Springs	
Free Length	1.91 (48.5)
Out-Of-Square	.063 (1.6)
Installed Height	1.594 (40.5)
Pressure Lbs. @ In. (Kg @ mm)	
Valve Closed	n/a
Valve Open	n/a
Exhaust	
Head Diameter	n/a
Stem Diameter	.3136-.3142 (7.965-7.980)
Face Angle	44.5°
Minimum Margin	.024 (.6)
Maximum Refinish	n/a
Springs	
Free Length	1.91 (48.5)
Out-Of-Square	.063 (1.6)
Installed Height	1.594 (40.5)
Pressure Lbs. @ In. (Kg @ mm)	
Valve Closed	n/a
Valve Open	n/a

1989 Toyota 4Runner

2.4L 4-CYL - VIN [R] 1989 Engines - 2.4L 4-Cylinder

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
Journal Diameter	1.298-1.299 (32.98-33.00)
Oil Clearance ⁽¹⁾	.0004-.0020 (.010-.050)
Bearing Bore	n/a
Maximum Runout	.008 (.20)
End Play	⁽²⁾ .003-.007 (.08-.18)
Lobe Lift	n/a
Lobe Height	
Intake	1.678-1.681 (42.63-42.72)
Exhaust	1.681-1.684 (42.69-42.78)
(1) Standard listed. Limit is .004" (.10 mm).	
(2) Standard listed. Limit is .010" (.25 mm).	

1990 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

2.4L 4-CYL - VIN [R]

1990 ENGINES Toyota - 2.4L 4-Cylinder

ENGINE IDENTIFICATION

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

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
2.4L 4-Cylinder		
Carbureted	22R	R
Fuel Injection	22R-E	R

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENTS

1. Remove valve cover and rotate crankshaft until No. 1 piston is TDC on compression stroke. Measure clearance between rocker arm and valve stem.
2. Adjust No. 1 and No. 2 intake valves and No. 1 and No. 3 exhaust valves. Rotate crankshaft one complete revolution (360 degrees) and align timing mark at TDC. Adjust remaining valves.

VALVE CLEARANCE ADJUSTMENTS (COLD)

Valve	In. (mm)
Intake	.008 (.20)
Exhaust	.012 (.30)

REMOVAL & INSTALLATION

FUEL PRESSURE RELEASE

CAUTION: Fuel system is under pressure. Pressure must be released before disconnecting fuel system components.

To relieve fuel system pressure, start engine and disconnect fuel pump harness connector at rear of fuel tank. Run engine until it stalls. Attempt to restart engine several times.

ENGINE

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.

NOTE: Removal procedures may vary slightly due to engine design differences.

Removal

1. Disconnect negative battery cable. Drain cooling system. Disconnect the upper radiator hose from engine. On fuel injected engines, remove the air cleaner hose.
2. On all models, remove air cleaner. Disconnect exhaust pipe from exhaust manifold. Remove fan, radiator, shroud, hoses and upper bracket. Remove and support air conditioning compressor without discharging system (if equipped).
3. Disconnect heater hoses, throttle control cable, fuel lines and brake booster hose from intake manifold. Disconnect and label all electrical wiring and emission control hoses for reassembly reference. Remove alternator and distributor.
4. On fuel injected engines, remove EGR vacuum modulator and air intake chamber with throttle body. Disconnect actuator, accelerator and throttle cables. Disconnect and label all fuel injection wiring and vacuum hoses. On carbureted engines, disconnect accelerator linkage.
5. On automatic transmission equipped models, disconnect transmission throttle cable and drain fluid. On power steering equipped models, remove pump from engine without disconnecting hoses and set aside. On manual transmission equipped models, remove shift lever and slave cylinder.
6. Raise and support vehicle. Disconnect front exhaust pipe. Remove engine undercover. Disconnect transmission shift linkage. On automatic transmission equipped models, disconnect cooler lines.
7. Remove drive shaft. On 4WD models, remove undercover, stabilizer bar and front drive shaft. Remove motor mount bolts (above crossmember). Attach engine hoist to engine. Place jack under transmission. Place wood block between firewall and cylinder head to prevent damage to heater hose. Remove rear transmission mounting bracket. Lift engine and transmission from vehicle.

Installation

To install engine, reverse removal procedure. Check all fluid levels and linkage adjustments before starting engine.

MANIFOLDS

Removal

Remove heater inlet pipe-to-cylinder head bolt. Remove No. 1 air pipe. Remove intake manifold along with delivery pipe, injection nozzles and heater water inlet pipe as an assembly. Remove exhaust manifold bolts and exhaust manifold.

Installation

To install intake and exhaust manifolds, use new gaskets and reverse removal procedure.

CYLINDER HEAD

Removal

1. Disconnect negative battery cable. Drain engine oil and cooling system. Disconnect front exhaust pipe. Remove air cleaner. Remove and label all hoses and linkages to intake manifold, carburetor (or air intake chamber on fuel injection) and cylinder head.
2. Disconnect upper radiator and heater hoses from cylinder head. Remove water by-pass tube bolts. Disconnect and label all electrical wiring, fuel lines, and vacuum hoses from cylinder head. On carbureted models, remove fuel pump from cylinder head. Remove distributor with cap and wires.
3. Remove power steering pump and set aside (if equipped). On fuel injected vehicles, remove EGR modulator and bracket, and remove air intake chamber with throttle body. See **Fig. 2** . Disconnect and label all fuel injection wiring and linkages for reassembly reference.
4. Remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half-circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and cam thrust plate off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head. Remove chain cover bolt in front of camshaft sprocket.
6. Loosen cylinder head bolts, in 3 steps, in reverse order of tightening sequence. See **Fig. 1** . Remove rocker arm assembly. If necessary, pry equally at front and rear of rocker arm assembly to remove.
7. Lift head from dowels on block and set on wood blocks on work bench. If difficult to remove, carefully pry with flat bar between cylinder head and block projection. Remove EGR valve, intake and exhaust manifolds.

Inspection

Check for cracks, damage and coolant leakage. Remove scales, sealing compound and carbon deposits. Clean oil passages and blow compressed air through passages to ensure they are not clogged. Check EGR passage for clogging. Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See **CYLINDER HEAD SPECIFICATIONS** table.

Installation

1. Apply liquid sealer at 2 front corners of engine block and position head gasket over locating dowels. Place head in position and rotate camshaft so dowel pin is at facing upward.
2. Install rocker arm assembly over locating dowels and tighten head bolts in 3 steps. See **Fig. 1** . Continue installation in reverse of removal sequence. Ensure valve and ignition timing is properly set. Adjust valves.

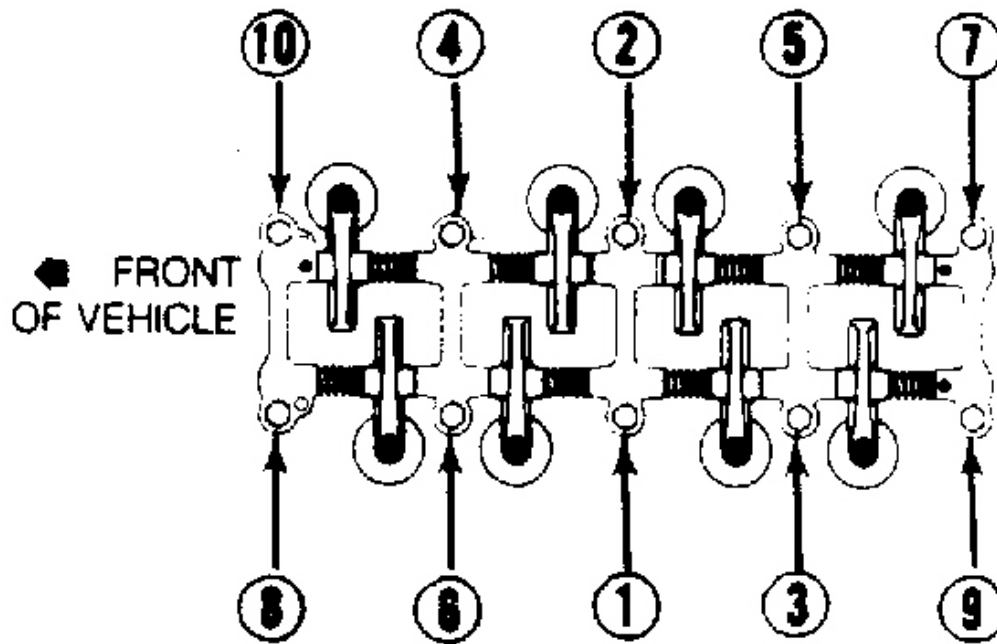


Fig. 1: Cylinder Head/Rocker Arm Bolt Tightening Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

1990 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

1. Carburetor
2. Air Intake Chamber
3. Cylinder Head Cover
4. Rocker Arm Assembly
5. Valve Keepers
6. Valve Spring Retainer
7. Compression Spring
8. Oil Seal
9. Valve Spring Seat
10. Valve
11. Gasket
12. EGR Valve
13. Intake Manifold
14. Distributor Drive Gear
15. Camshaft Bearing Cap
16. Camshaft
17. Valve Guide
18. Snap Ring
19. Cylinder Head Rear Plate
20. Exhaust Manifold & insulator
21. Cylinder Head
22. Cylinder Block
23. Rear Oil Seal
24. Rear Oil Seal Retainer
25. Thrust Washer
26. Main Bearing
27. Oil Strainer
28. Crankshaft
29. Main Bearing Cap
30. Drain Plug
31. Oil Pan
32. Rod Cap
33. Connecting Rod
34. Piston Pin
35. Piston
36. Piston Ring
37. Rod Bearing

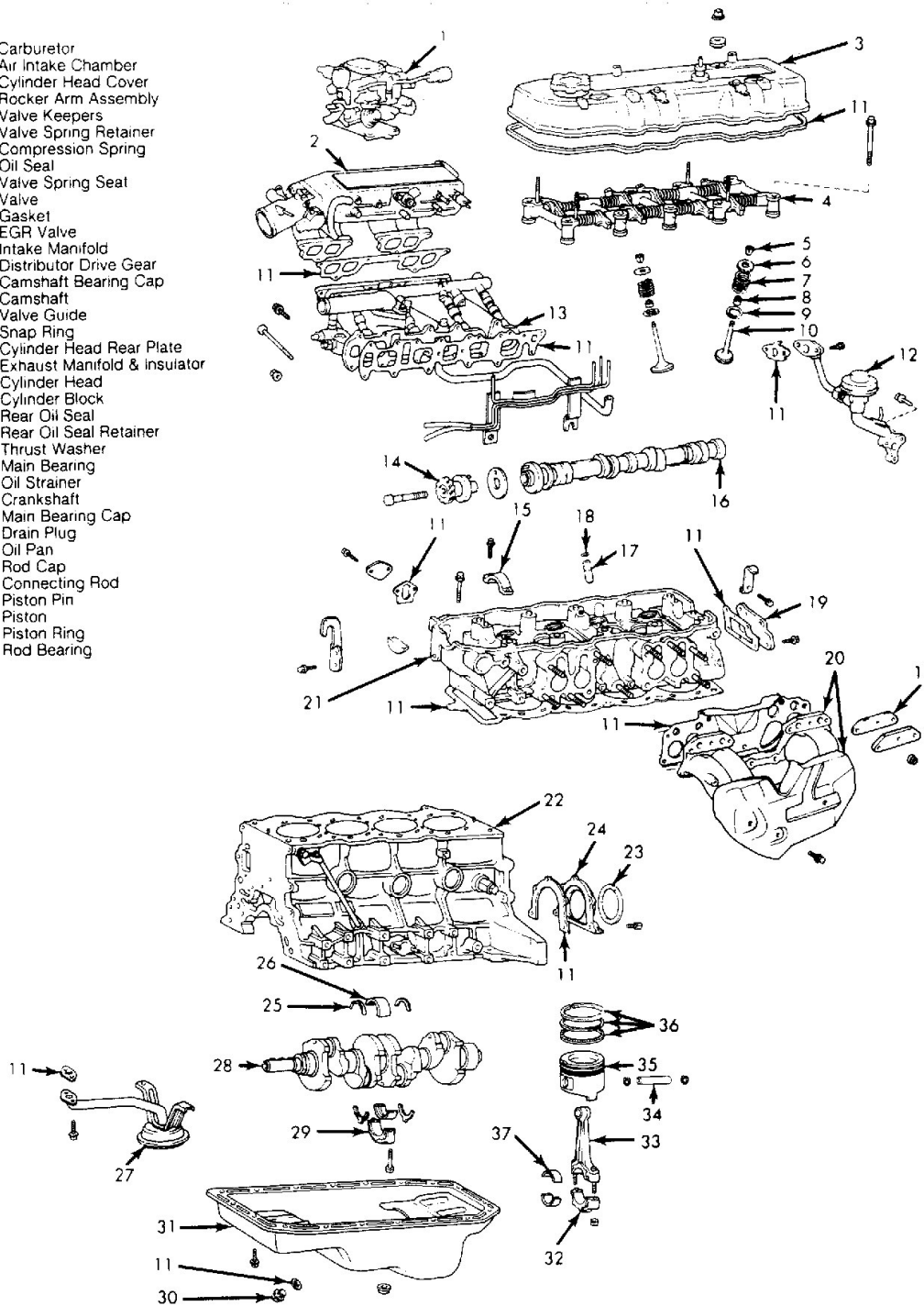


Fig. 2: Exploded View of 22R-E Cylinder Head & Cylinder Block Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER BLOCK SERVICE

Ensure all components are match marked during removal. Check cylinder block surface for warpage. Check each cylinder bore for wear, cracks and damage. If not within specification, machine or replace as necessary. See **CYLINDER BLOCK SPECIFICATIONS** table.

FRONT COVER OIL SEAL

Removal

Oil seal press fits into oil pump body at front of crankshaft. Remove crankshaft pulley bolt. Using gear puller, remove crankshaft pulley. Pry out seal.

Installation

Apply grease to lip of new oil seal and sealant to outside of seal. Drive new seal into position using Seal Installer (09223-50010). Tighten crankshaft pulley bolt to specification. Refer to **TORQUE SPECIFICATIONS** table.

TIMING CHAIN

Removal

1. Remove cylinder head. Remove radiator. Remove engine undercover and engine mounting bolts. Place a jack under transmission and raise engine about 1" (25.4mm). Remove 16 bolts and 2 nuts. Using Oil Pan Seal Cutter (09032-00100), remove oil pan.
2. Remove power steering belts (if equipped). Remove A/C belt, compressor and bracket (if equipped) and lay aside. Remove fluid coupling with fan and coolant pump pulley. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley. See **Fig. 3** .
3. Remove number one coolant by-pass pipe. On carbureted and fuel injected models, remove 2 bolts and disconnect heater outlet pipe. Remove fan belt adjusting bracket.
4. Remove timing chain cover assembly. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove both oil pump drive spline and chain sprocket.

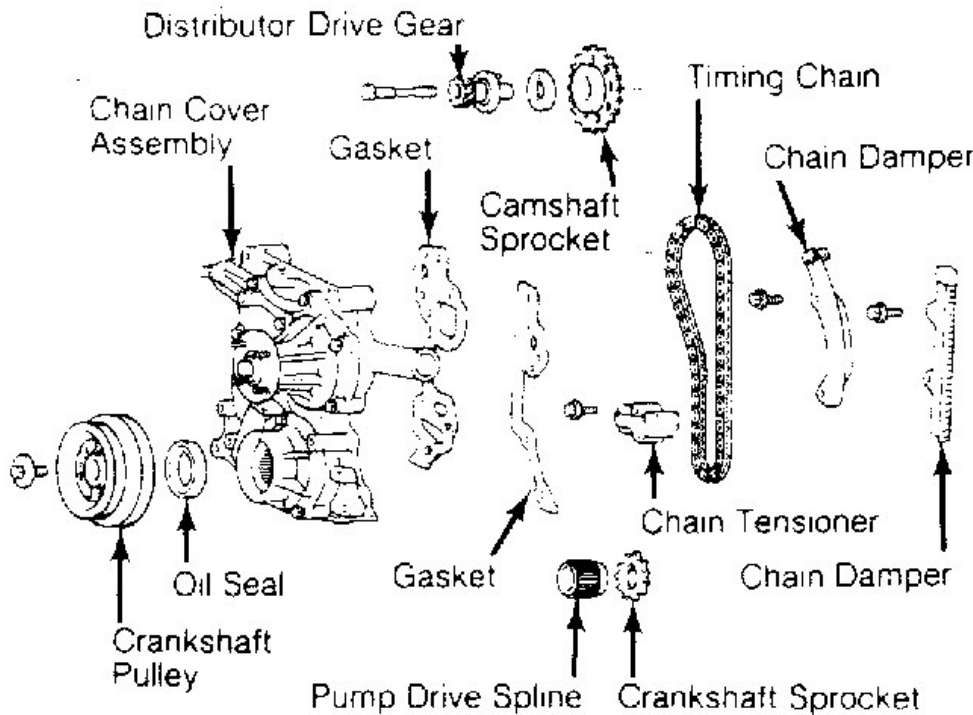


Fig. 3: Exploded View of Timing Chain Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Check chain, sprockets, tensioner and chain dampers for wear. Replace chain tensioner if width is less than .43" (11.0 mm). Minimum size for left and right chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance across 17 links should be 5.79" (147.0 mm). See **Fig. 4**.
3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to sprocket, measure outer sides of chain rollers. Using same method, measure diameter of crankshaft sprocket and chain.
4. The minimum diameter for crankshaft sprocket and chain is 2.34" (59.4 mm). The minimum diameter for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace timing chain and both sprockets.

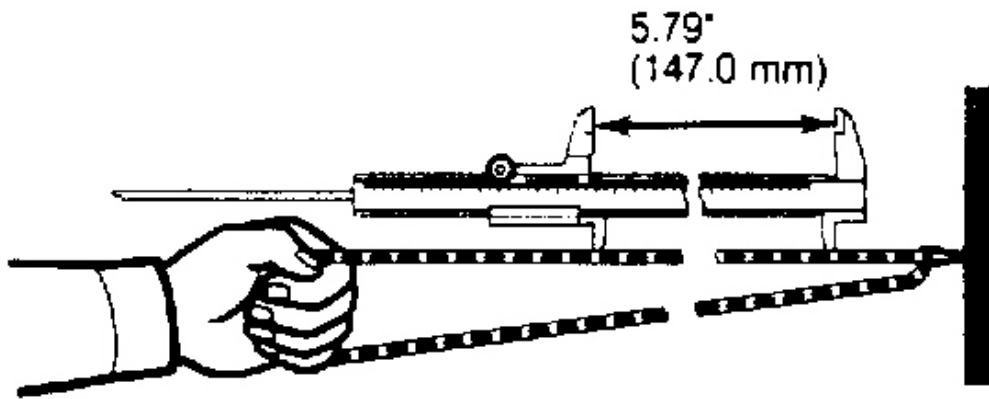
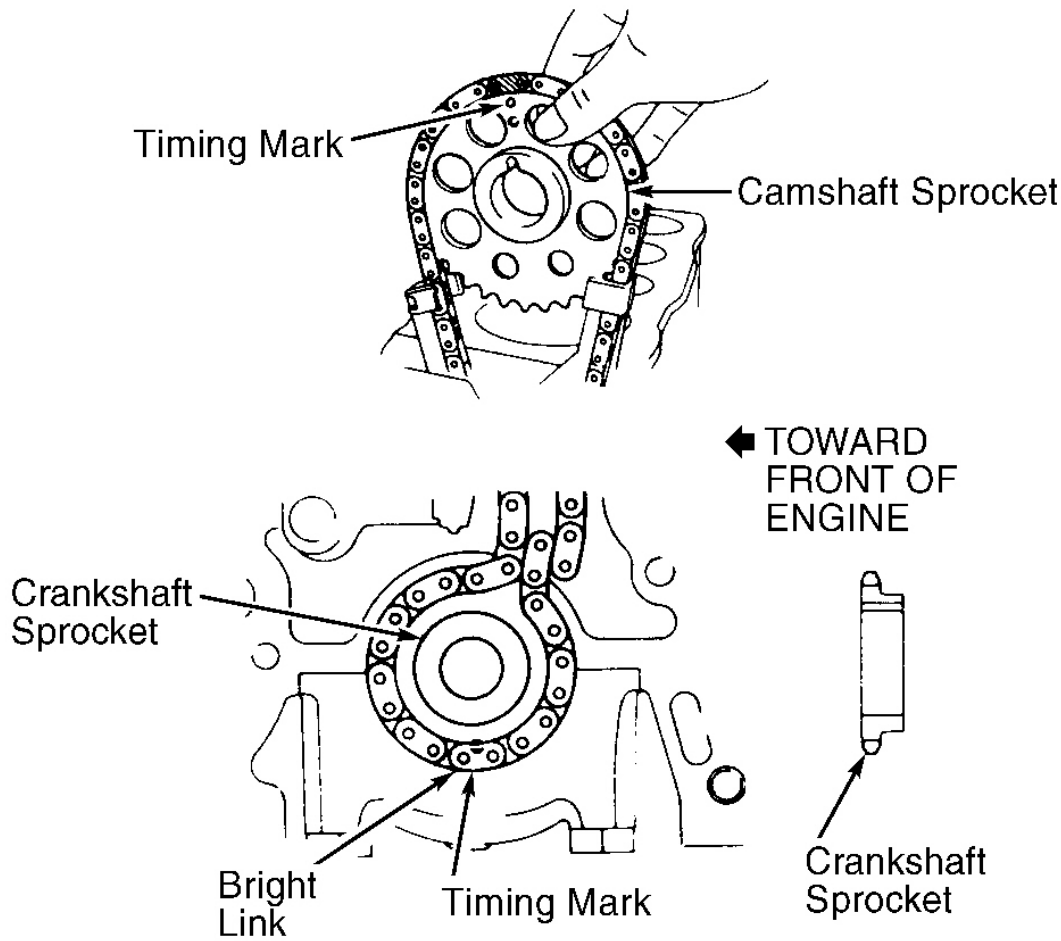


Fig. 4: Checking Timing Chain Stretch

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

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key will be positioned straight upward). Position sprocket on crankshaft. Place timing chain on sprocket with single bright link aligned with timing mark on sprocket.
2. Install cam sprocket in timing chain so timing mark on sprocket is located between 2 chrome links. See **Fig. 5**. Ensure chain is positioned in dampers. Slide oil pump drive spline over crankshaft key. Install cover assembly with new gasket over dowels and pump spline.
3. To complete installation, reverse removal procedure. Set camshaft timing by placing No. 1 cylinder at TDC on compression stroke and positioning camshaft so dowel on sprocket flange is in 12 o'clock position.



93E00418

Fig. 5: Aligning Sprockets & Timing Chain
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CAMSHAFT

Removal

Remove rocker arm assembly. Remove camshaft bearing caps and lift out camshaft.

Inspection

1. Camshaft journal oil clearance may be checked using Plastigage method. If clearance exceeds specification, replace cylinder head and/or camshaft. Maximum clearance is .004" (.10 mm).
2. Maximum camshaft runout at center journal is .008" (.20 mm). Replace camshaft if runout is beyond limit. Replace camshaft if intake lobe height is less than 1.678" (42.62 mm), or exhaust lobe height is less than 1.681" (42.70 mm).

Installation

To install camshaft, reverse removal procedure. Install bearing caps in numbered order with arrows pointing toward front of engine. Adjust valves.

VALVE ARRANGEMENT

Right Side: All intake.

Left Side: All exhaust.

ROCKER ARM SHAFT ASSEMBLY SERVICE

1. If rocker arms appear loose, disassemble rocker arm assembly and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.010-.050 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse of disassembly. Note that rocker arms are identical. See **Fig. 6**.

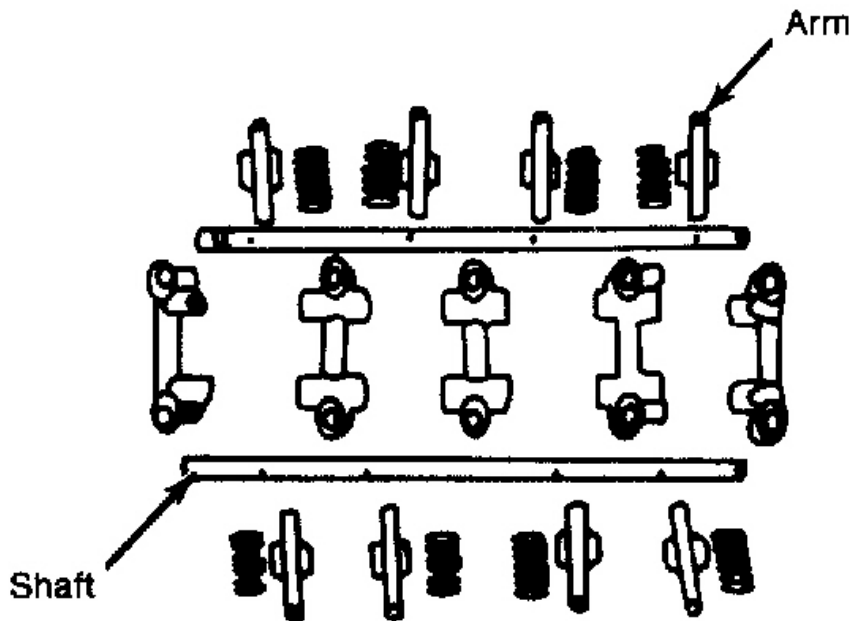


Fig. 6: Disassembled View of Rocker Arm Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE SPRINGS

Check valve spring free length and squareness. If free length is less than 1.91" (48.5 mm) or out-of-square more than .063" (1.6 mm), replace spring. Use a spring tester and measure tension at installed height. Replace spring if less than specified. See **VALVES & VALVE SPRINGS SPECIFICATIONS** table.

VALVE STEM OIL SEALS SERVICE

1. Using a spring compressor, remove valve keepers. Remove spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Carefully slide a new oil seal over valve stem without damaging seal as it passes over keeper grooves. Force seal over end of valve guide. To complete installation, reverse removal procedure.

VALVE GUIDES SERVICE

1. Measure diameter of valve guide and valve stem. Maximum clearance for exhaust valves is .0039" (.100 mm). Maximum clearance for intake valves is .0031" (.080 mm). If valve stem oil clearance exceeds specification, valve guides and valves must be replaced. Break off end of guide using punch and hammer. Heat cylinder head to about 194°F (90°C).
2. Using Valve Guide Remover (09201-60011) and hammer, drive old guide out through combustion chamber. Install new valve guide from top of head until snap ring contacts cylinder head. Ream valve guide with a .31" (8.0 mm) reamer for proper stem clearance.

VALVE SEAT SERVICE

Service procedure is not available. If replacing valve guides, valve seats must be ground.

VALVES SERVICE

Inspect each valve for ware, damage and distortion of head and stem. If stem end is pitted or worn, resurface as necessary. Resurfacing must be limited to a minimum. Resurface the valve face. If valve margin has decreased to less than the service limit, replace valve. See **VALVES & VALVE SPRINGS SPECIFICATIONS** table.

NOTE: **Label all rocker arm components for reassembly reference.**

OVERHAUL

PISTON & ROD ASSEMBLY SERVICE

Ensure rod and rod cap match cylinder number. Ensure piston and rod are installed in cylinder from which they were removed. Check piston and rod and replace if not within specifications. See **CONNECTING RODS SPECIFICATIONS** table and **PISTONS, PINS & RINGS SPECIFICATIONS** table.

FITTING PISTONS

1. Measure cylinder bore at top, bottom and center of piston travel. Measure in line with and at 90 degrees to crankshaft. Standard bore is 3.6232" (92.029 mm) with a wear limit of .0008" (.020 mm). Maximum out-of-round is .0008" (.020 mm). Maximum taper is .0004" (.010 mm).

2. Measure piston at right angle to pin and just below oil ring groove. If not within specification, rebore cylinder and/or replace pistons. On 22R and 22R-E engines, pistons are available in .50 mm and 1.00 mm oversize diameters.

PISTON RINGS SERVICE

1. Measure compression ring end gap at bottom of ring travel. If not within specification, replace ring. **DO NOT** file ring end. Check clearance of ring in land groove. If side clearance is greater than maximum, replace piston.
2. Position rings on piston with "T" or "N" marks facing upward. Position ring end gaps correctly. See **Fig. 7**.

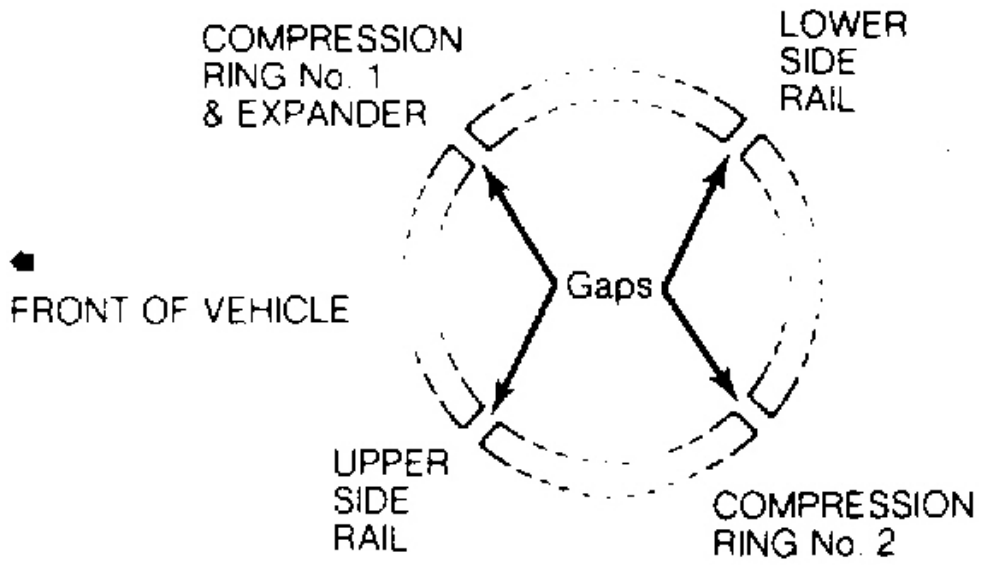


Fig. 7: Arranging Piston Ring Gaps

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

NOTE: There are three sizes of standard connecting rod bearings. Each size is marked with an A, B or C. Replacement connecting rod bearings should have the same letter as the letter stamped on the connecting rod cap. See **Fig. 11**.

PISTON PINS SERVICE

Removal

Remove piston pin snap ring. Heat piston in hot water to 140°F (60°C). Using hammer and driver, push piston

pin out of piston and connecting rod.

Inspection

1. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater than .0006" (.015 mm).
2. At 176°F (80°C), pin should push into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston. Inspect connecting rod for misalignment. The maximum rod bend limit is .002" (.05 mm) per 3.94" (100 mm). The maximum rod twist limit is .0059" (.15 mm) per 3.94" (100 mm). If rod is bent or twisted, replace rod.

NOTE: **Piston and pin are a matched set. Use new snap rings for reassembly.**

Installation

Heat piston to 176°F (80°C) and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. See **Fig. 8** . Push pin into piston and rod assembly. Install snap rings.

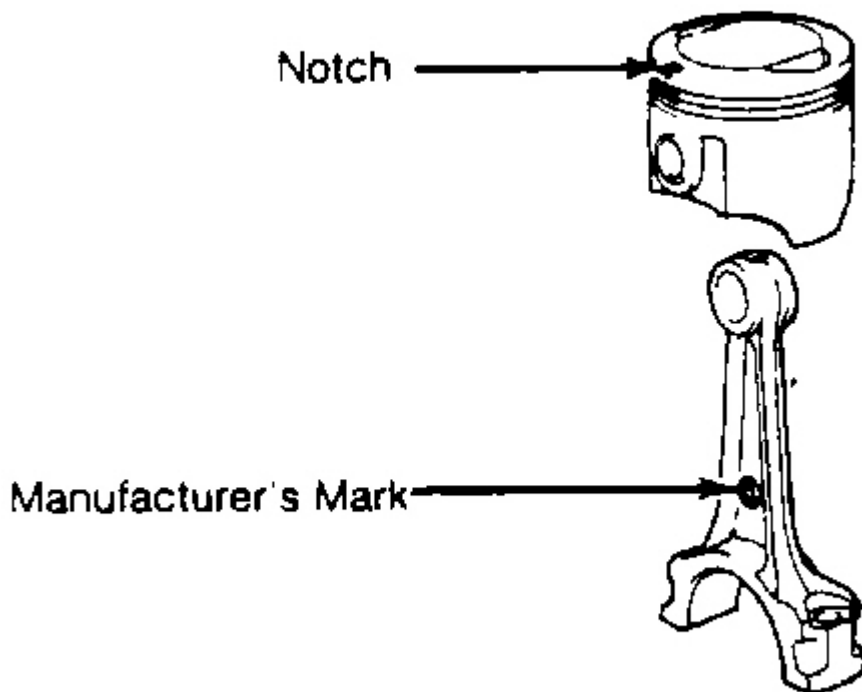


Fig. 8: Aligning Piston & Rod Assembly

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

MAIN BEARINGS SERVICE

1. Measure crankshaft runout at center journal. If runout exceeds .004" (.10 mm), replace crankshaft. Inspect all journals for wear or scoring. Out-of-round or taper limit is .0004" (.010 mm). If crankshaft is worn excessively, grind journals for undersize bearings.
2. Measure bearing clearances using Plastigage method. Observe correct tightening sequence. See **Fig. 10** . If clearance exceeds specification, grind journals for undersize bearings.
3. Standard main bearing clearance is .0010-.0022" (.025-.055 mm). Maximum main bearing clearance is .0031" (.078 mm). Main bearings are available in .25 mm undersize. Main journal finish diameter for undersize bearings is 2.3504-2.3508" (59.701-59.711 mm).

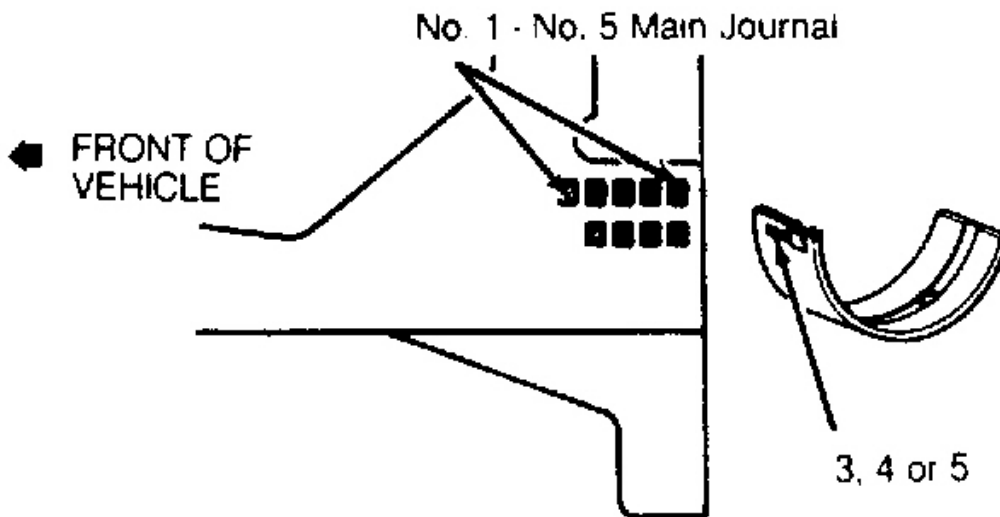


Fig. 9: Identifying Main Bearings

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

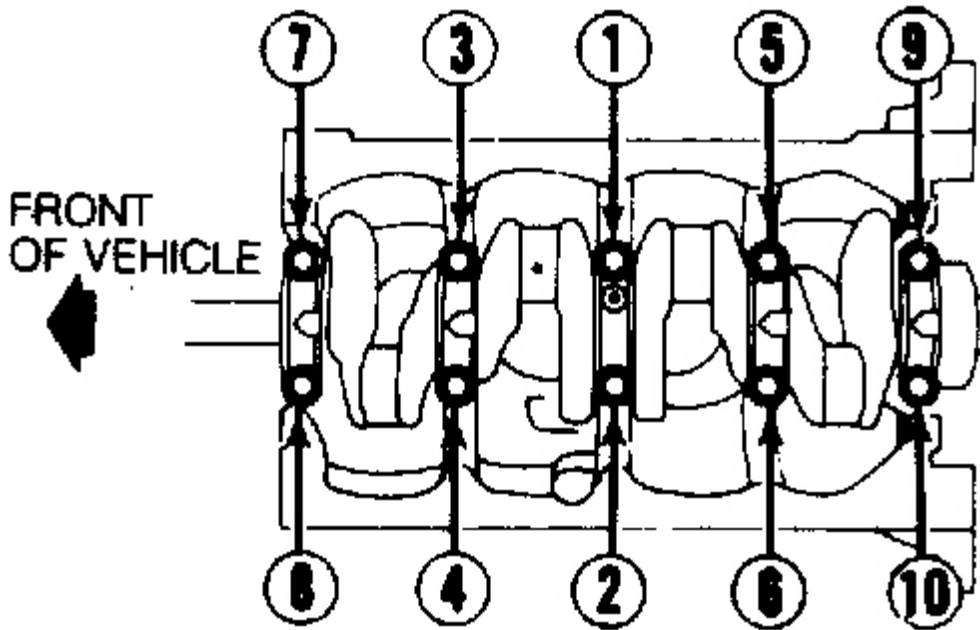


Fig. 10: Main Bearing Tightening Sequence

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

CONNECTING ROD BEARINGS

Measure connecting rod bearing clearance using Plastigage method. Replace bearings or grind crankshaft if clearance is greater than .0031" (.078 mm). Regrind crankshaft to .010" (.25 mm) undersize if taper or out-of-round is greater than .0004" (.010 mm). Connecting rod journal diameter for undersize is 2.0748-2.0752" (52.699-52.710 mm).

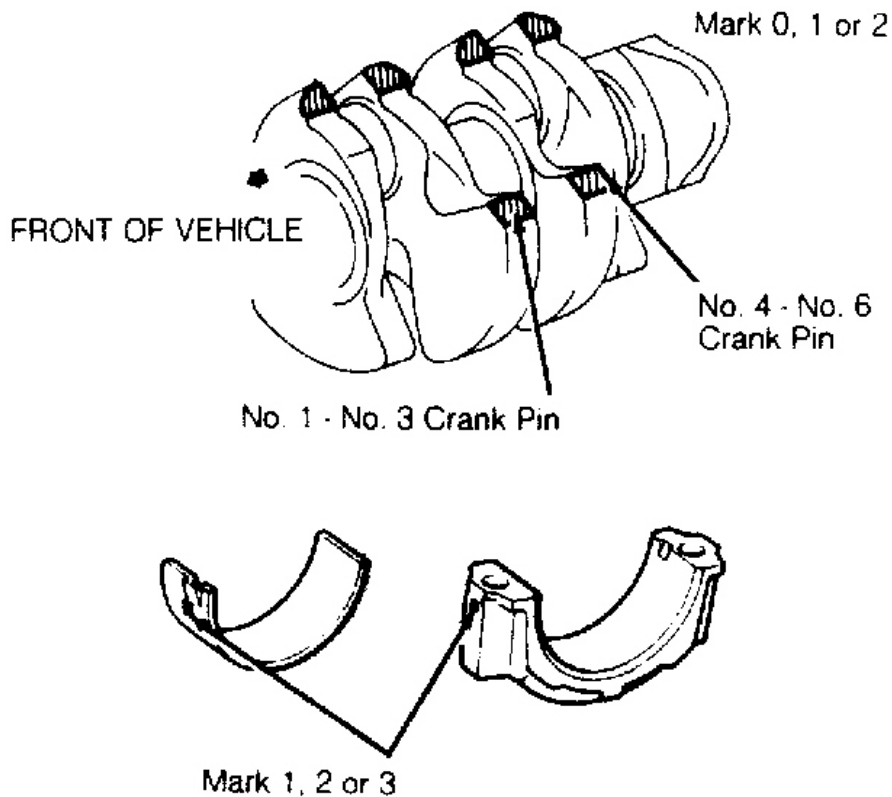


Fig. 11: Identifying Connecting Rod Bearing Sizes
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

NOTE: There are 3 sizes of standard main bearings. Each size is marked with a 3, 4 or 5. Replacement bearings should have the same number as the number stamped on the cylinder block. See [Fig. 9](#).

THRUST BEARING SERVICE

Check crankshaft end play at thrust bearing with a feeler gauge. If end play exceeds limit of .012" (.30 mm), replace thrust washers. Oil grooves must be facing out.

THRUST WASHER SPECIFICATIONS

Size	In. (mm)
Standard	.1059-.1079 (2.690-2.740)
0.125 Oversize	.1084-.1104 (2.753-2.803)
0.250 Oversize	.1108-.1128 (2.815-2.865)

REAR MAIN BEARING SEAL

Removal & Installation

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Apply grease to lip of new oil seal. Using Seal Driver (09223-41020), drive oil seal in place.

ENGINE LUBRICATION

Oiling system is force fed, using a gear-type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full-flow oil filter and then to oil galleys in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly. See **Fig. 12**.

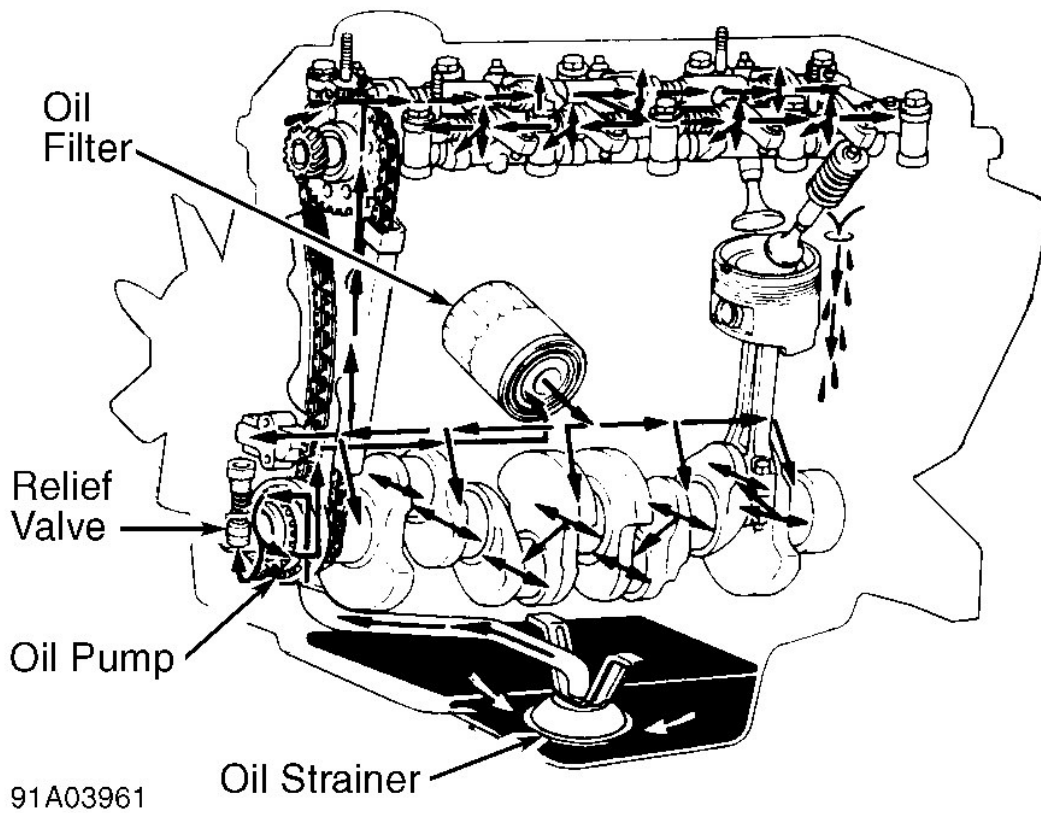


Fig. 12: Engine Oil Circuit

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

OIL PAN

Removal

1990 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

Drain engine oil. Remove engine undercover. Detach necessary linkage components. Remove front crossmember. Remove oil pan.

Installation

Thoroughly clean pan rail mating surface. Apply a .20" (5.0 mm) bead of Seal Packing (08826-00080) to oil pan flange. Place gasket on pan and apply sealer to 4 corners of cylinder block where front cover and rear seal retainer meet cylinder block. Install pan. To complete installation, reverse removal procedure.

OIL PUMP

Removal

Remove oil pan and strainer. Remove drive belts and crankshaft pulley. Remove 5 bolts and oil pump assembly. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

Installation

Reassemble pump and lubricate seal lip. Install new "O" ring in block and apply sealer to upper bolt. Install and tighten pump. To complete installation, reverse removal procedure.

OIL PUMP SPECIFICATIONS

Application	Clearance In. (mm)
Drive Gear-to-Crescent	
Standard	.0087-.0098 (.221-.249)
Wear Limit	.012 (.30)
Driven Gear-to-Crescent	
Standard	.0059-.0083 (.149-.211)
Wear Limit	.012 (.30)
Driven Gear-to-Body	
Standard	.0035-.0059 (.088-.149)
Wear Limit	.008 (.20)
Gear Faces-to-Body	
Standard	.0012-.0035 (.030-.088)
Wear Limit	.0059 (.149)

WATER PUMP

Removal

Drain cooling system and loosen alternator pivot adjusting bolts. Pivot alternator toward engine to loosen drive belt. Remove fan clutch, pulley and fan belt. Remove 6 bolts and 3 nuts. Remove pump from engine.

Installation

1990 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

To install water pump, use new gasket on clean mating surfaces and reverse removal procedure.

ENGINE SPECIFICATIONS**CRANKCASE CAPACITY**

Engine oil capacity is 4.5 qts. (4.3L) when changing oil and oil filter. Oil capacity is 4.0 qts. (3.8L) when changing oil only.

OIL PRESSURE

Oil pressure at idle speed is 4.3 psi (.3 kg/cm²) and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

GENERAL ENGINE SPECIFICATIONS**GENERAL ENGINE SPECIFICATIONS**

Application	Specification
Displacement	144.4 Cu. In. (2.4L)
Bore	3.62" (92.0 mm)
Stroke	3.50" (89.0 mm)
Compression Ratio	9.3:1
Fuel System	
22R	2-Bbl.
22R-E	PFI
HP @ RPM	
22R	102 @ 4800
22R-E	116 @ 4800
Torque: Ft. Lbs. @ RPM	
22R	132 @ 2800
22R-E	140 @ 2800

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

Application	In. (mm)
Crankshaft	
End Play	.0008-.0087 (.020-.220)
Runout	.004 (.10)
Main Bearings	
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Journal Out-of-Round	.0004 (.100)
Journal Taper	.0004 (.100)
Oil Clearance	.0010-.0022 (.025-.055)

1990 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

Bearing Center Wall Thickness	
Standard Bearing	
No. 3	.0783-.0784 (1.988-1.992)
No. 4	.0784-.0786 (1.992-1.996)
No. 5	.0786-.0787 (1.996-2.000)
0.25 Oversize	.0837-.0841 (2.216-2.136)
Thrust Washer Thickness	
Standard	.1059-.1079 (2.690-2.740)
1.25 Oversize	.1084-.1104 (2.573-2.803)
2.50 Oversize	.1108-.1128 (2.815-2.865)
Connecting Rod Bearings	
Journal Diameter	2.0861-2.0866 (52.988-53.000)
Journal Out-of-Round	.0004 (.100)
Journal Taper	.0004 (.100)
Oil Clearance	.0010-.0022 (.025-.055)
Bearing Center Wall Thickness	
Standard Bearing A	.0584-.0586 (1.484-1.488)
Standard Bearing B	.0586-.0587 (1.488-1.492)
Standard Bearing C	.0587-.0589 (1.492-1.496)
0.25 Oversize	.0640-.0644 (1.626-1.636)

CONNECTING RODS SPECIFICATIONS**CONNECTING RODS SPECIFICATIONS**

Application	In. (mm)
Bore Diameter	
Crankpin Bore	
Standard Bore A	2.2047-2.2050 (56.000-56.006)
Standard Bore B	2.2050-2.2052 (56.006-56.012)
Standard Bore C	2.2052-2.2054 (56.012-56.018)
0.25 Oversize	2.2047-2.2054 (56.000-56.018)
Maximum Bend	.0020 (.050)
Maximum Twist	.0059 (.150)
Side Play	.0063-.0102 (.160-.260)

PISTONS, PINS & RINGS SPECIFICATIONS**PISTONS, PINS & RINGS SPECIFICATIONS**

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1990 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

Application	In. (mm)
Piston Clearance	.0006-.0014 (.015-.035)
Piston Diameter	
Standard Size	
No. 1	3.6211-3.6214 (91.975-91.985)
No. 2	3.6214-3.6216 (91.985-91.995)
No. 3	3.6218-3.6222 (91.995-92.005)
Pins	
Piston Fit	Thumb Pressure @ 176°F (80°C)
Rod Fit	Thumb Pressure @ 176°F (80°C)
Oil Clearance	.0002-.0004 (.005-.011)
Rings	
No. 1	
End Gap	.0098-.0185 (.250-.470)
Side Clearance	.0012-.0028 (.030-.070)
No. 2	
End Gap	.0236-.0323 (.600-.820)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap	.0079-.0224 (.200-.570)
Side Clearance	.0012-.0028 (.030-.070)

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK SPECIFICATIONS**

Application	In. (mm)
Cylinder Bore	
Standard Diameter	
No. 1	3.6220-3.6224 (92.00-92.01)
No. 2	3.6224-3.6228 (92.01-92.02)
No. 3	3.6228-3.6232 (92.02-92.03)
Maximum Taper	.0008 (.020)
Maximum Out-of-Round	.0008 (.020)
Main Journal Bore	
Standard Bore	
No. 3	2.5198-2.5201 (64.004-64.010)
No. 4	2.5201-2.5203 (64.010-64.016)

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No. 5	2.5203-2.5205 (64.016-64.022)
0.25 Over Size	2.5198-2.5205 (64.004-64.022)
Maximum Deck Warpage	.002 (.05)

VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS SPECIFICATIONS**

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.039" (1.00 mm)
Standard Length	4.468" (113.30 mm)
Stem Diameter	.3138-.3144" (7.970-7.985 mm)
Valve Tip Maximum Refinish	.020" (.50 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.039" (1.00 mm)
Standard Length	4.425" (112.40 mm)
Stem Diameter	.3136-.3142" (7.965-7.980 mm)
Valve Tip Maximum Refinish	.020" (.50 mm)
Valve Springs	
Free Length	1.909" (48.50 mm)
Installed Height	1.594" (40.50 mm)
Out-of-Square	.063" (1.60 mm)
Pressure:	Lbs. @ In. (Kg @ mm)
Valve Closed	66.1 @ 1.595 (30.00 @ 40.50)

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD SPECIFICATIONS**

Application	Specification
Maximum Warpage	.0059" (.15 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)

1990 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

Valve Guides

Intake Valve	
Valve Guide I.D.	.3154-.3161" (8.010-8.030 mm)
Valve Guide O.D.	.5134-.5138" (13.040-13.051 mm)
Valve Stem-to-Guide Oil Clearance	.0010-.0024" (.025-.060 mm)
Exhaust Valve	
Valve Guide I.D.	.3154-.3161" (8.010-8.030 mm)
Valve Guide O.D.	.5134-.5138" (13.040-13.051 mm)
Valve Stem-to-Guide Oil Clearance	.0012-.0026" (.030-.065 mm)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
End Play	.0031-.0071 (.080-.180)
Journal Diameter	1.2984-1.2992 (32.98-33.00)
Journal Runout	.008 (.20)
Lobe Height	
Intake	1.6783-1.6891 (42.63-42.72)
Exhaust	1.6807-1.6842 (42.69-42.78)
Oil Clearance	.0004-.0020 (.010-.050)

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	14 (20)
Camshaft Sprocket Bolt	58 (78)
Chain Damper Bolts	16 (22)
Chain Tensioner Bolts	14 (19)
Connecting Rod Cap Bolts	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head Bolts	58 (78)
EGR Valve Bolt & Nut	9 (13)
Exhaust Manifold	33 (44)
Flywheel Bolts	80 (108)
Intake Manifold-to-Cylinder Head	14 (19)
Main Bearing Cap Bolts	76 (103)

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2.4L 4-CYL - VIN [R] 1990 ENGINES Toyota - 2.4L 4-Cylinder

Oil Cooler Relief Valve	51 (69)
Oil Pan Drain Plug	18 (25)
Rear Oil Seal Retainer Bolts	13 (18)
Timing Cover Bolts	
8 mm	9 (12)
10 mm	29 (39)
Valve Adjusting Screw	18 (25)
	INCH Lbs. (N.m.)
Oil Pan Bolts	108 (13)
Valve Cover Bolts	52 (5.9)

2.4L 4-CYL - VIN [R]

1991 ENGINES Toyota - 2.4L 4-Cylinder

ENGINE IDENTIFICATION

Engine may be identified by Vehicle Identification Number (VIN) stamped on a metal pad, located near lower left corner of windshield. The forth character of VIN identifies engine model. See ENGINE IDENTIFICATION CODES TABLE.

Engine identification number, located on cylinder block below cylinder head, may be needed when ordering replacement parts. See **Fig. 1** .

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
2.4L 4-Cylinder PFI	22R-E	E

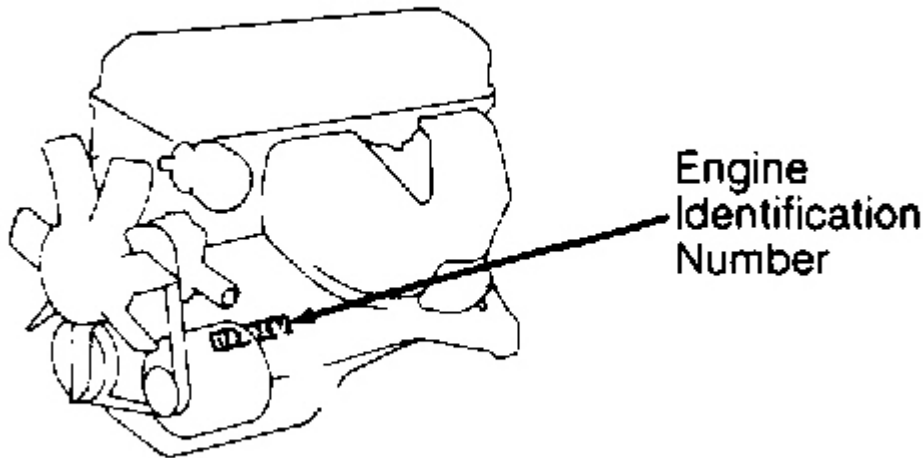


Fig. 1: Locating Engine Identification Number
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ADJUSTMENTS**VALVE CLEARANCE ADJUSTMENTS**

1. Check and adjust valve clearance with engine at normal operating temperature. Remove valve cover.

1991 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1991 ENGINES Toyota - 2.4L 4-Cylinder

Rotate crankshaft pulley and align pulley groove with "0" mark on timing belt cover to set No. 1 cylinder at TDC of compression stroke.

2. Ensure rocker arms on cylinder No. 1 are loose, and rocker arms on cylinder No. 4 are tight. This indicates TDC compression for cylinder No. 1. If rocker arms are not as described, rotate crankshaft 360 degrees and realign timing marks.
3. Check intake valve clearance on cylinders No. 1 and No. 2, and exhaust valve clearance on cylinders No. 1 and No. 3. Adjust clearance to specification if necessary. Refer to **VALVE CLEARANCE SPECIFICATIONS TABLE**.
4. Rotate crankshaft 360 degrees and realign timing marks. Adjust intake valve clearance on cylinders No. 3 and No. 4, and exhaust valve clearance on cylinders No. 2 and No. 4.

VALVE CLEARANCE SPECIFICATIONS

Valve ⁽¹⁾	In. (mm)
Exhaust	.012 (.30)
Intake	.008 (.20)
(1) Adjust valves with engine at normal operating temperature.	

REMOVAL & INSTALLATION

*** PLEASE READ FIRST ***

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

FUEL PRESSURE RELEASE

WARNING: High fuel pressure may be present in fuel lines and component parts. Relieve fuel pressure before opening fuel system. DO NOT allow fuel to flow onto engine or electrical parts.

Disconnect negative battery cable. Place container under fitting to be loosened. Use a rag to cover fuel line and component. Slowly loosen fitting, allowing pressurized fuel to flow into container. After fuel system has depressurized, disconnect and plug fitting.

ENGINE

NOTE: Engine and transaxle should be removed as an assembly.

Removal

1. Remove hood. Remove battery. Remove engine undercover (splash) shields. Drain coolant from radiator and cylinder block. Drain engine oil. Remove air cleaner case and intake air connector.
2. Remove radiator. Remove all accessory drive belts. Remove fan clutch along with fan. Remove fan

pulley. Disconnect all necessary electrical wiring from engine. Disconnect and mark all vacuum hoses for installation reference. Disconnect all coolant hoses. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Disconnect fuel lines.

3. Disconnect accelerator cable. Disconnect throttle cable and cruise control cable (if equipped). Disconnect ground straps from right side and rear side of engine. Remove drive shaft. Disconnect speedometer cable.
4. On models with power steering, remove power steering pump, and wire aside. DO NOT disconnect power steering hoses. Disconnect ground strap from power steering pump bracket.
5. On models with A/C, remove A/C compressor, and wire it aside. DO NOT disconnect A/C compressor hoses. On M/T models, remove shift lever(s) from inside vehicle. On 2WD A/T models, disconnect manual shift linkage from neutral start switch. On 4WD A/T models, disconnect transfer case shift linkage.
6. On all 4WD models, remove transfer case undercover (splash) shields. Remove stabilizer bar. Remove front drive shaft. Remove frame crossmember. On all models, disconnect oxygen sensor connector.
7. Disconnect exhaust pipe from exhaust manifold. Remove exhaust pipe clamp. Remove exhaust pipe from catalytic converter. On 2WD models, remove engine rear mount and bracket. On M/T models, remove clutch release (slave) cylinder with bracket.
8. On 4WD models, remove front floor heat insulator and brake tube heat insulator. Remove side frame crossmember. On all models, attach engine hoist chain to engine lift brackets. Remove engine mount nuts and bolts. Lift engine out of vehicle slowly and carefully. Ensure engine is clear of all wiring and hoses.

Installation

To install, reverse removal procedure. Check all fluid levels and linkage adjustments before starting engine. Tighten all nuts and bolts to specification. See **TORQUE SPECIFICATIONS TABLE** at end of article.

CYLINDER HEAD & MANIFOLDS

NOTE: See **Fig. 16** for exploded view of cylinder head and cylinder block components

Removal

1. Disconnect negative battery cable. Drain coolant from radiator and cylinder block. Remove intake air connector. Disconnect exhaust pipe from exhaust manifold.
2. Remove oil dipstick. Remove distributor and spark plugs. Disconnect all necessary electrical wiring from cylinder head. Disconnect and label all electrical wiring and vacuum hoses from cylinder head. Disconnect all coolant hoses from cylinder head.
3. Disconnect accelerator cable. Disconnect throttle cable (if equipped). Disconnect ground strap from rear of engine. Remove EGR vacuum modulator. Remove air intake chamber along with throttle body. See **Fig. 16**.
4. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Disconnect fuel lines. Remove power steering pump and bracket (if equipped). Remove valve cover. Set No. 1 piston to TDC on compression stroke. Paint mating marks on camshaft sprocket and timing chain. Remove rubber half-circle seal and cam sprocket retaining bolt.
5. Pull distributor drive gear and cam thrust plate off sprocket. Remove sprocket from camshaft. Allow sprocket and chain to rest in cylinder head. Remove chain cover bolt in front of camshaft sprocket.

6. Loosen cylinder head bolts in 3 stages, in reverse order of tightening sequence. See **Fig. 2** . Remove rocker arm assembly. If necessary, pry equally at front and rear of rocker arm assembly to remove.
7. Lift cylinder head from dowels on cylinder block. Set cylinder head on wood blocks on work bench. If cylinder head is hard to remove, carefully pry with flat bar between cylinder head and block projection.
8. Remove air injection manifold and reed valve from cylinder head. Remove heater inlet tube. Remove air pipe. Remove intake manifold as an assembly with fuel delivery pipe, injectors and heater water inlet pipe.
9. Remove EGR valve. Remove 3 bolts and exhaust manifold outer heat insulator. Remove 8 nuts, exhaust manifold and inner exhaust manifold heat insulator.

Installation

1. Apply liquid sealant at 2 front corners of engine block. Position head gasket over locating dowels. Place head in position, and rotate camshaft so dowel pin is facing up. Install rocker arm assembly over locating dowels.
2. Tighten cylinder head bolts in 3 stages in proper sequence. See **Fig. 2** . To complete installation, reverse removal procedure. Tighten all nuts and bolts to specification. Refer to **TORQUE SPECIFICATIONS TABLE** at end of article. Ensure valve and ignition timing are properly set. Adjust valves. See **VALVE CLEARANCE ADJUSTMENTS** .

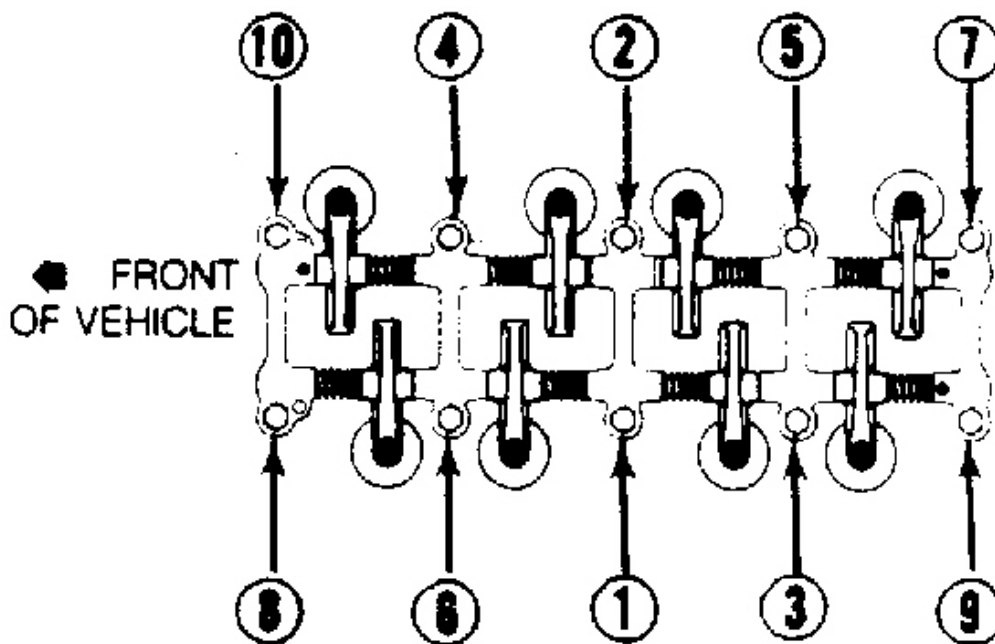


Fig. 2: Cylinder Head/Rocker Arm Bolt Tightening Sequence

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

FRONT COVER OIL SEAL

Removal & Installation

1. If oil pump is removed from cylinder block, pry out old oil seal. Using Seal Installer (09223-50010), install oil seal until oil seal surface is flush with timing chain cover. Apply multipurpose grease to oil seal lip.
2. If oil pump is installed to cylinder block, cut off old oil seal lip. Pry out oil seal. Use care not to damage crankshaft surface. Apply multipurpose grease to new oil seal lip. Using Seal Installer (09223-50010), install oil seal until oil seal surface is flush with timing chain cover edge.

TIMING CHAIN

Removal

1. Remove cylinder head. See **CYLINDER HEAD & MANIFOLDS** under REMOVAL & INSTALLATION. Remove radiator. On 4WD models, drain differential gear oil. Disconnect drive axles from side gear flanges. Index mark drive shaft and companion flange. Disconnect drive shaft.
2. Disconnect vacuum hoses and electrical connector (if equipped). Support differential assembly with jack. Remove differential assembly mounting bolts and nuts. Lower differential assembly from vehicle.
3. On 2WD models, place a jack under transmission, and raise engine about 1" (25.4 mm). On all models, remove 16 bolts and 2 nuts attaching oil pan. Using Oil Pan Seal Cutter (09032-00100), remove oil pan. DO NOT damage oil pan flange.
4. Remove power steering belt (if equipped). Remove A/C belt, compressor and bracket (if equipped), and lay them aside. Remove fan clutch along with fan. Remove water pump pulley. Set No. 1 cylinder to TDC of compression stroke. Remove crankshaft pulley. See **Fig. 3**.
5. Remove coolant by-pass pipe. Remove 2 bolts, and disconnect heater outlet pipe. Remove fan belt adjusting bracket.
6. Remove timing chain cover assembly. Remove chain from damper. Remove cam sprocket and chain. Using gear puller, remove oil pump drive spline and chain sprocket.

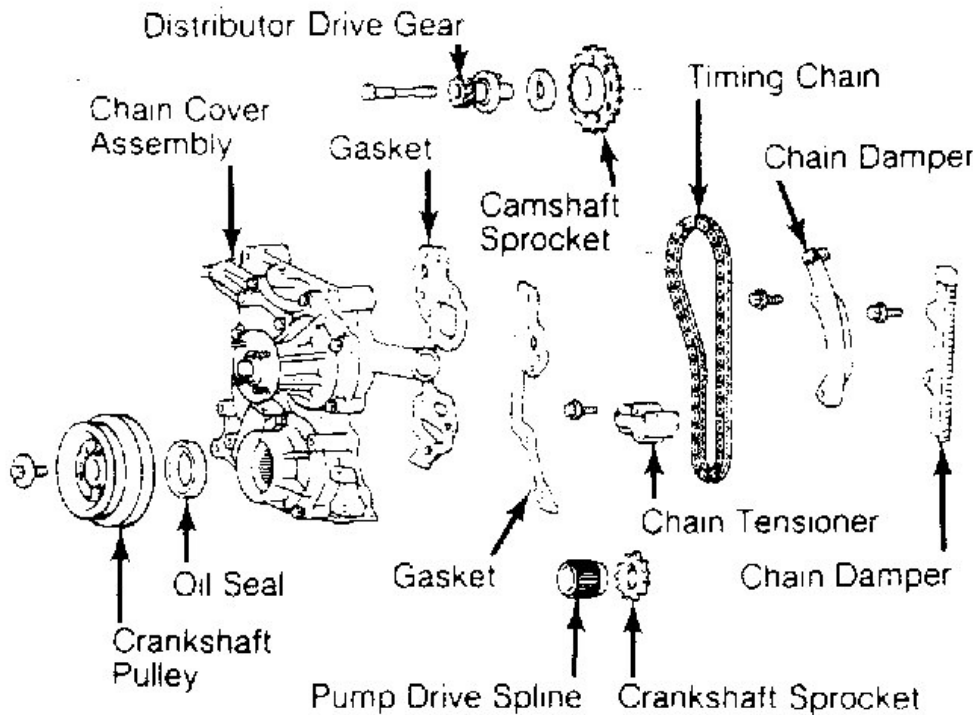


Fig. 3: Exploded View of Timing Chain Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Check timing chain, sprockets, tensioner and chain dampers for wear. Replace timing chain tensioner if width is less than .43" (11.0 mm). Minimum size for left and right chain dampers is .02" (.5 mm).
2. Measure length of timing chain with chain fully stretched. Maximum distance across 17 links should be 5.79" (147.0 mm). See **Fig. 4**.
3. Wrap timing chain completely around camshaft sprocket. Using a Vernier caliper held parallel to sprocket, measure outer sides of chain rollers. Using same method, measure diameter of crankshaft sprocket and chain.
4. Minimum diameter for crankshaft sprocket and chain is 2.34" (59.4 mm). Minimum diameter for camshaft sprocket and chain is 4.48" (113.8 mm). If either measurement is less than minimum, replace timing chain and both sprockets.

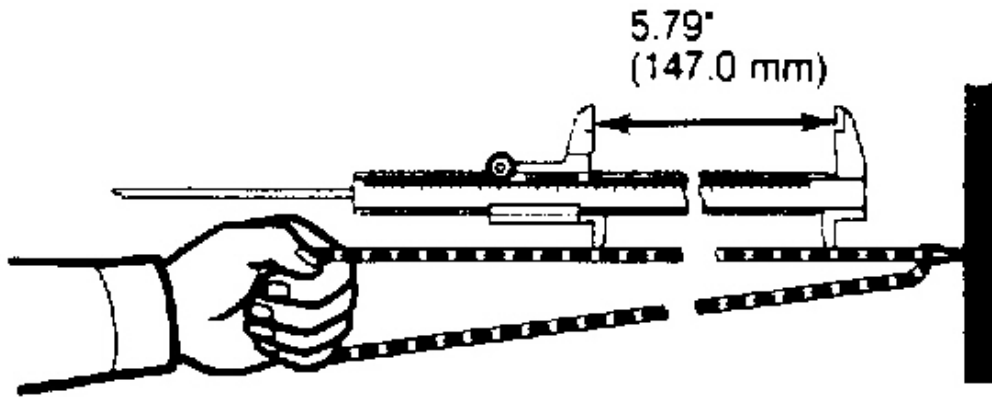
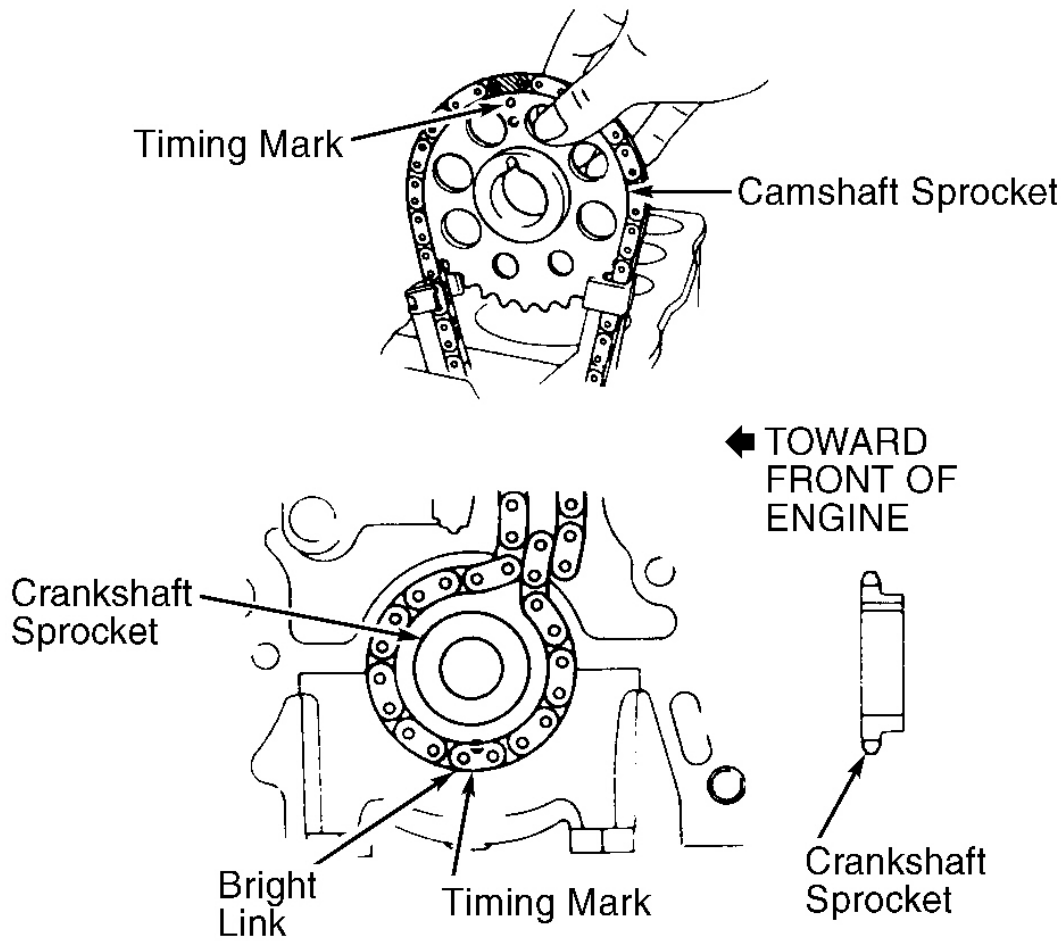


Fig. 4: Checking Timing Chain Stretch

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

Installation

1. Ensure No. 1 cylinder is at TDC (crankshaft Woodruff key is in 12 o'clock position). Position sprocket on crankshaft. Place timing chain on sprocket with single bright link aligned with timing mark on sprocket.
2. Install timing chain on camshaft sprocket so timing mark on sprocket is located between 2 chrome links. See **Fig. 5**. Ensure chain is positioned in dampers. Turn camshaft sprocket counterclockwise to remove slack from timing chain. Slide oil pump drive spline over crankshaft key.
3. Install cover assembly with new gasket over dowels and pump spline. To complete installation, reverse removal procedure. Tighten all nuts and bolts to specification. See **TORQUE SPECIFICATIONS** TABLE at end of article.



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Fig. 5: Aligning Sprockets & Timing Chain
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CAMSHAFT

Removal

1. Measure camshaft end play before removing camshaft. End play should be within specification. See **CAMSHAFT SPECIFICATIONS TABLE** under ENGINE SPECIFICATIONS at end of article. If end play is greater than maximum, replace cylinder head.
2. Remove cylinder head. See **CYLINDER HEAD & MANIFOLDS** under REMOVAL & INSTALLATION. Remove rocker arm assembly. Remove camshaft bearing caps. If necessary, pry equally at front and rear of rocker arm assembly to remove.

Inspection

1. Check camshaft journal oil clearance using Plastigage method. If clearance exceeds specification, replace cylinder head and/or camshaft. Maximum clearance is .004" (.10 mm).
2. Maximum camshaft runout at center journal is .008" (.20 mm). Replace camshaft if runout is beyond limit. Replace camshaft if lobe height is less than 1.663" (42.25 mm) for intake or 1.665" (42.30 mm) for exhaust.

Installation

1. To install camshaft, reverse removal procedure. Install camshaft bearing caps in numerical order with arrows pointing toward front of engine.
2. Tighten all nuts and bolts to specification. Refer to **TORQUE SPECIFICATIONS TABLE** at end of article. Ensure valve and ignition timing is properly set. Adjust valves. Refer to **VALVE CLEARANCE ADJUSTMENTS**.

REAR CRANKSHAFT OIL SEAL**Removal & Installation**

Rear main bearing oil seal may be replaced with engine in vehicle. Remove transmission. Pry out old seal from retainer. Apply grease to lip of new oil seal. Using Seal Driver (09223-41020), drive oil seal in place until oil seal surface is flush with rear oil seal retainer edge.

WATER PUMP**Removal & Installation**

1. Drain cooling system. Remove power steering pump and A/C compressor belts (if equipped). Remove fan clutch together with fan. Remove fan pulley.
2. Remove 6 bolts and 3 nuts attaching water pump. Remove water pump. To install water pump, reverse removal procedure. Use new gasket on clean mating surfaces.

OIL PAN**Removal**

Drain engine oil. Remove engine undercover (splash) shields. On 2WD models, place a jack under transmission, and raise engine about 1" (25.4 mm). On all models, remove 16 bolts and 2 nuts attaching oil pan. Using Oil Pan Seal Cutter (09032-00100), remove oil pan. DO NOT damage oil pan flange.

Installation

Thoroughly clean pan rail mating surface. Apply a .20" (5.0 mm) bead of Seal Packing (08826-00080) to oil pan flange. Place gasket on pan. Apply sealant to 4 corners of cylinder block, where front cover and rear seal retainer meet cylinder block. Install oil pan. To complete installation, reverse removal procedure.

OVERHAUL

NOTE: See Fig. 16 for exploded view of cylinder head and cylinder block components

CYLINDER HEAD OVERHAUL

1. Check for cracks, damage and coolant leakage. Remove scale, sealing compound and carbon deposits. Clean oil passages, and blow compressed air through passages to ensure they are not clogged.
2. Check EGR passage for clogging. Inspect cylinder head for warpage at deck surface. Replace cylinder if warpage exceeds specification. See CYLINDER HEAD SPECIFICATIONS TABLE under ENGINE SPECIFICATIONS at end of article.

VALVE SPRINGS

Inspect valve spring free length, tension and installed height. Using a square, check out-of-square of each spring. Replace valve spring if measurements are not within specification. See VALVES & VALVE SPRINGS SPECIFICATIONS TABLE under ENGINE SPECIFICATIONS at end of article.

VALVE STEM OIL SEALS

1. Using a spring compressor, remove valve keepers. Remove spring retainer and springs. Remove valve stem oil seal from end of valve guide.
2. Carefully slide new oil seal over valve stem without damaging seal as it passes over keeper grooves. Force seal over end of valve guide. To complete oil seal installation, reverse removal procedure.

VALVE GUIDES

With valves removed, measure I.D. of valve guide and O.D. of valve stem. Subtract valve stem O.D. from valve guide I.D. to obtain clearance. Replace valve and/or guide if clearance is not within specification. See CYLINDER HEAD SPECIFICATIONS TABLE under ENGINE SPECIFICATIONS at end of article.

VALVE GUIDE REPLACEMENT

1. Break valve guide off at snap ring. Gradually heat cylinder head to 194°F (90°C). Using Valve Guide Remover/Installer (09201-60011), remove valve guide(s).
2. To install valve guide(s), allow cylinder head to cool down. Measure valve guide bore of cylinder head. If bore exceeds .5125" (13.018 mm), machine bore to .5138-.5145" (13.050-13.068 mm) for oversize valve guide. If bore is less than .5125" (13.018 mm), use standard size guide.
3. Heat cylinder head to 194°F (90°C). Using remover/installer, install valve guide(s) until snap ring contacts cylinder head. Ream valve guide to obtain proper clearance for valve being installed.

VALVE SEATS

No service procedure is available. Valve seats must be ground if valve guides are replaced.

VALVES

Inspect each valve for wear, damage and distortion of head and stem. If stem end is pitted or worn, resurface as

necessary. This correction must be limited to a minimum. Resurface valve face. If valve margin has decreased to less than the service limit, replace valve. See **VALVES & VALVE SPRINGS SPECIFICATIONS TABLE** under ENGINE SPECIFICATIONS at end of article.

VALVE TRAIN OVERHAUL

NOTE: Label all rocker arm components for reassembly reference.

ROCKER ARM SHAFT ASSEMBLY

1. If rocker arms appear loose, disassemble rocker arm assembly, and measure rocker arm-to-shaft clearance. Clearance should be .0004-.0020" (.010-.050 mm), with a maximum limit of .0031" (.08 mm).
2. If clearance exceeds maximum limit, replace rocker arms and/or shafts. Reassemble in reverse order of disassembly. Note that rocker arms are identical. See **Fig. 6**.

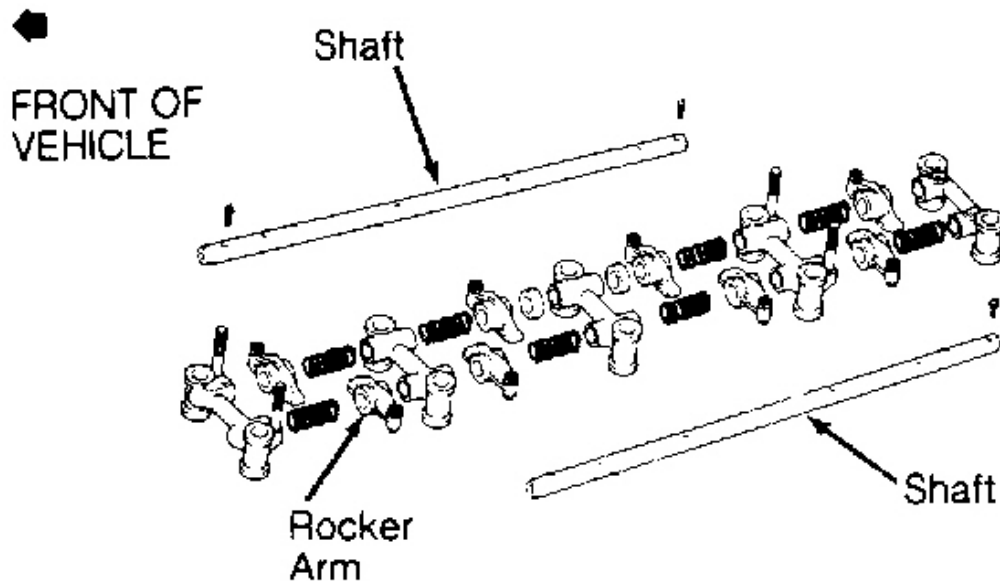


Fig. 6: Disassembled View of Rocker Arm Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER BLOCK ASSEMBLY OVERHAUL - PISTON & ROD ASSEMBLY

Ensure rod and rod cap are with matching cylinder number. Ensure piston and rod are installed in cylinder from which they were removed. Check piston and rod. Replace piston and rod if measurements are not as specified in **CONNECTING RODS SPECIFICATIONS TABLE** and **PISTONS, PINS & RINGS SPECIFICATIONS**

TABLE under ENGINE SPECIFICATIONS at end of article.

PISTON PINS

1. Remove piston pin snap ring. Heat piston in hot water to 140°F (60°C). Using hammer and driver, push piston pin out of piston and connecting rod.
2. Measure clearance between rod bushing and piston pin. Replace rod bushing if clearance is greater than .0006" (.015 mm).
3. At 176°F (80°C), it should be possible to push pin into piston with thumb pressure. If pin can be installed at lower temperature, replace pin and piston.
4. Inspect connecting rod for misalignment. Maximum rod bend limit is .002" (.05 mm) per 3.94" (100.0 mm). Maximum rod twist limit is .0059" (.150 mm) per 3.94" (100.0 mm). If rod is bent or twisted beyond maximum limit, replace rod.

NOTE: **Piston and pin are a matched set. Use new snap rings when reassembling.**

5. Heat piston to 176°F (80°C), and position piston and connecting rod so manufacturer's mark on rod and indent on piston crown face same direction. See **Fig. 7** . Push pin into piston and rod assembly. Install snap rings.

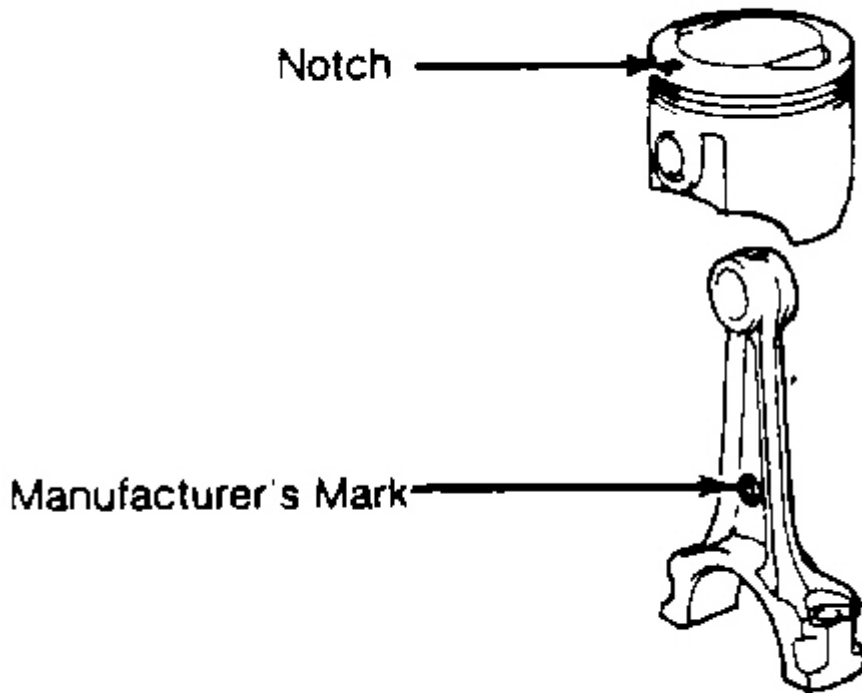


Fig. 7: Aligning Piston & Rod Assembly

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

FITTING PISTONS & RINGS

1. Remove carbon from top of piston. Clean piston and ring grooves. Measure piston clearance. Determine piston size by identification mark on top of piston. See **Fig. 8** . Refer to **PISTON SIZE IDENTIFICATION TABLE** . Measure piston diameter at right angles to piston pin center line. Measure 1.30" (33.0 mm) from piston head.
2. Determine cylinder bore size by identification mark on deck surface of cylinder block. See **Fig. 10** . Refer to **CYLINDER BORE SIZE IDENTIFICATION TABLE** . Measure cylinder bore diameter in thrust direction. See **Fig. 9** .
3. Subtract piston diameter measurement from cylinder bore diameter measurement. Ensure piston clearance is within specification. See **PISTONS** , PINS & RINGS SPECIFICATIONS TABLE under ENGINE SPECIFICATIONS at end of article. If piston clearance exceeds maximum specification, replace all pistons and/or rebore all cylinders.
4. Check end gap of ring in cylinder to which it will be installed. If end gap is greater than specification, try new set of rings. See **PISTONS** , PINS & RINGS SPECIFICATIONS TABLE. If end gap is still greater than specification, rebore cylinder and use oversize piston rings. Properly position rings on piston before

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installing piston. See **Fig. 11** .

PISTON SIZE IDENTIFICATION

Identification Mark	Diameter: In. (mm)
No. 1	3.6211-3.6214 (91.975-91.985)
No. 2	3.6214-3.6219 (91.985-91.995)
No. 3	3.6219-3.6222 (91.995-92.005)

CYLINDER BORE SIZE IDENTIFICATION

Identification Mark	Diameter: In. (mm)
No. 1	3.6220-3.6224 (92.000-92.010)
No. 2	3.6224-3.6228 (92.010-92.020)
No. 3	3.6228-3.6232 (92.020-92.030)

◆ FRONT OF VEHICLE

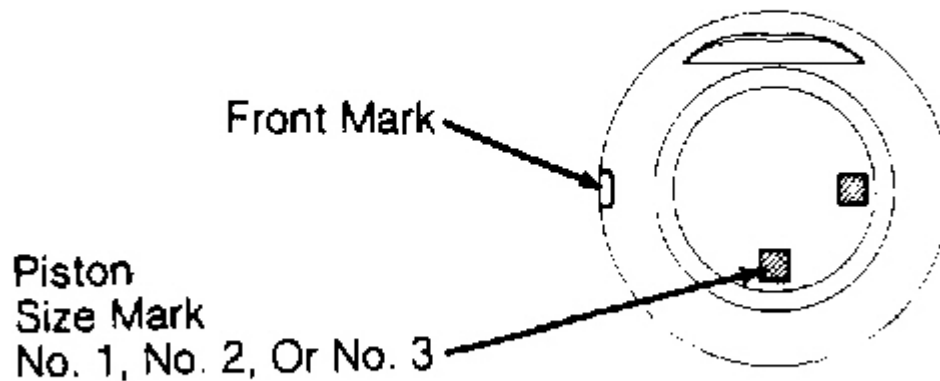
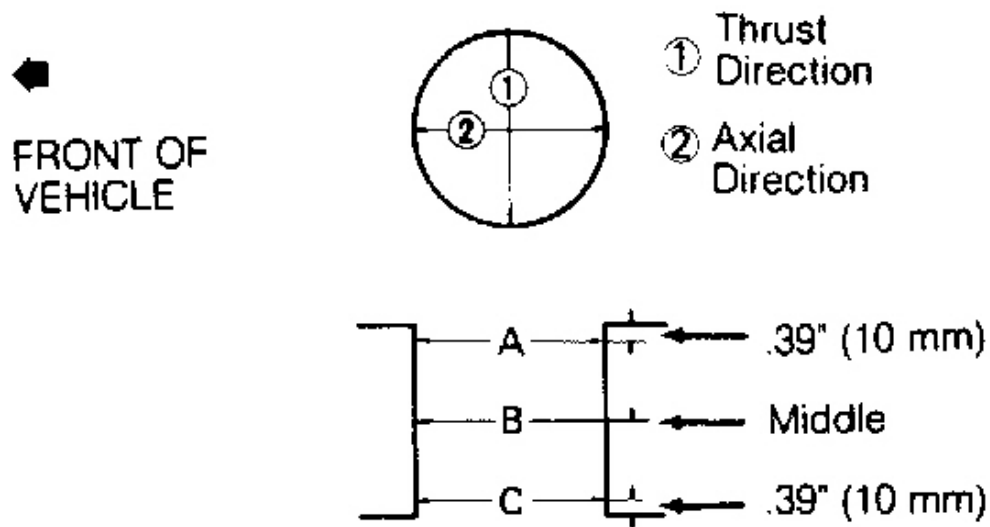


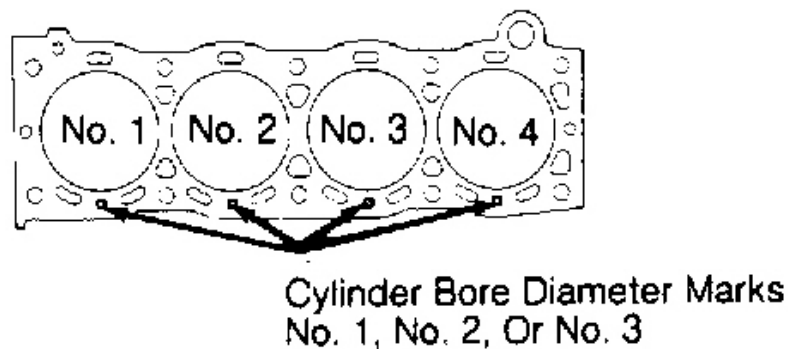
Fig. 8: Locating Piston Identification Marks

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

**Fig. 9: Measuring Cylinder Bore Diameter**

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

FRONT OF VEHICLE

**Fig. 10: Locating Cylinder Bore Identification Marks**

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

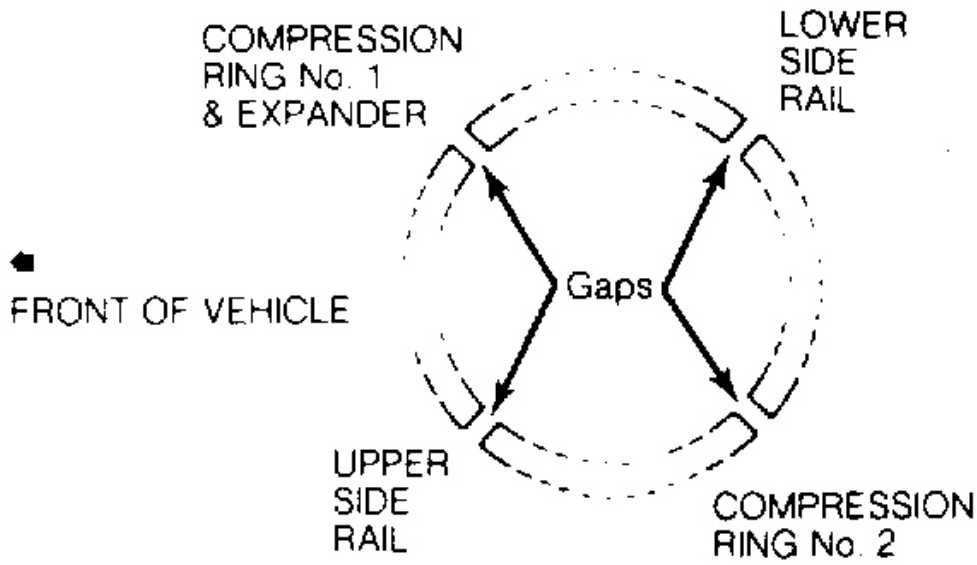


Fig. 11: Positioning Piston Ring Gaps

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

NOTE: There are 3 standard connecting rod bearing sizes. Connecting rod cap and bearing are marked with a letter "A", "B" or "C". See [Fig. 12](#) . If replacing rod bearing, ensure letter on replacement rod bearing is the same as letter on connecting rod cap.

ROD BEARINGS

Check crankshaft journal condition. Check rod bearing clearance. If clearance is not within specification, machine or replace as necessary. See [CRANKSHAFT](#) , MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS TABLE under ENGINE at end of article.

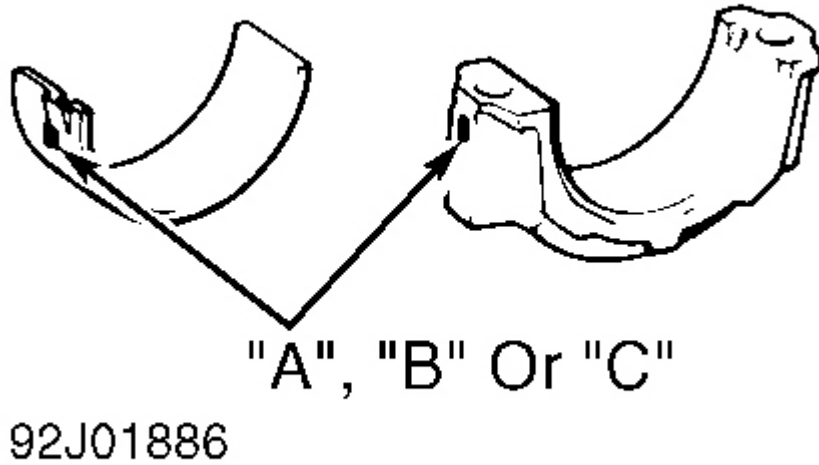


Fig. 12: Identifying Connecting Rod Bearing Identification Marks

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

NOTE: There are 3 sizes of standard main bearings. Cylinder block and main bearing are marked with a number "3", "4" or "5". See [Fig. 13](#) . If replacing bearing, ensure number on replacement bearing is the same as number on cylinder block.

CRANKSHAFT & MAIN BEARINGS

1. Remove main bearing caps evenly in 3 stages, in reverse order of tightening sequence. See [Fig. 14](#) . Check bearing clearance.
2. If bearing clearance is not within specification, machine or replace as necessary. See [CRANKSHAFT , MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS TABLE](#) under ENGINE SPECIFICATIONS at end of article.
3. Replacement main bearings must have same identification number as old main bearings. Install thrust washers on center bearing cap with oil grooves facing outward. Install bearing caps in numerical order with arrows facing forward.
4. Tighten main bearings to specification in sequence. See [TORQUE SPECIFICATIONS TABLE](#) at end of article. See [Fig. 14](#) .

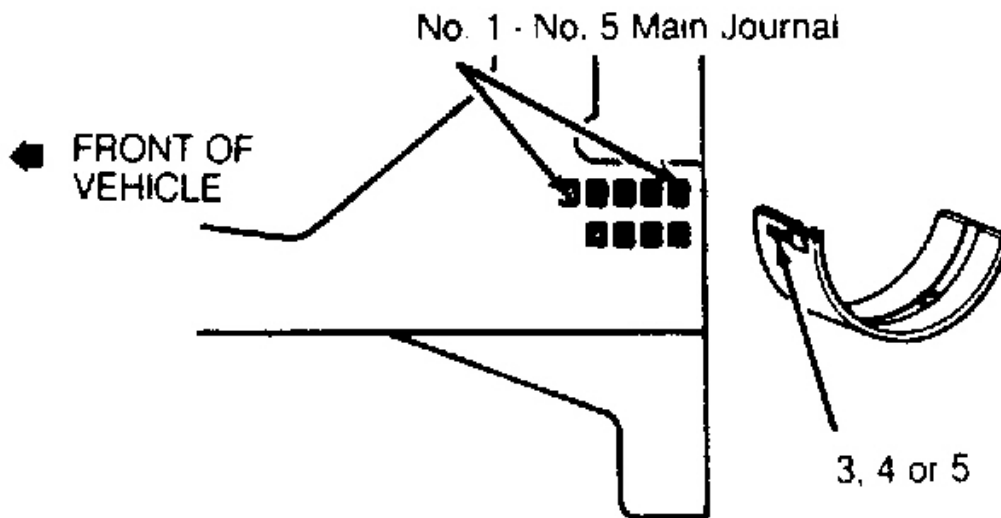


Fig. 13: Identifying Main Bearing Identification Marks
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

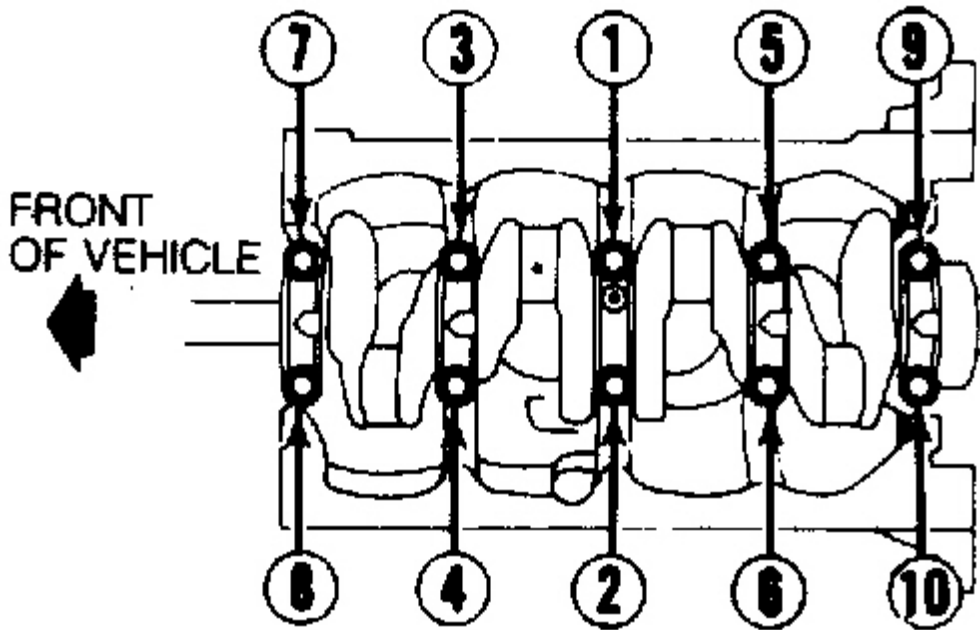


Fig. 14: Main Bearing Tightening Sequence

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

THRUST BEARING

Using dial indicator, measure thrust clearance. See **CRANKSHAFT**, MAIN & CONNECTING ROD BEARINGS TABLE under ENGINE SPECIFICATIONS at end of article. If clearance exceeds specification, replace thrust bearings as a set. See THRUST WASHER SPECIFICATIONS TABLE. If clearance is less than specification, remove and reinstall thrust bearing. Recheck thrust clearance.

THRUST WASHER SPECIFICATIONS

Size	In. (mm)
Standard	.1059-.1079 (2.690-2.740)
.125 Oversize	.1084-.1104 (2.753-2.803)
.250 Oversize	.1108-.1128 (2.815-2.865)

CYLINDER BLOCK

1. Check cylinder head surface of engine block for warpage using straightedge and feeler gauge. Cylinder block warpage must be within specification. See **CYLINDER BLOCK SPECIFICATIONS TABLE** under ENGINE SPECIFICATIONS at end of article.

2. Different cylinder bore sizes are used and can be identified by size marks on deck surface of cylinder block. See **Fig. 10** . Measure cylinder bore diameter at positions "A", "B" and "C" in thrust and axial directions. See **Fig. 9** . If diameter is greater than maximum specification, rebore cylinders or replace cylinder block. See **CYLINDER BLOCK SPECIFICATIONS TABLE** under ENGINE SPECIFICATIONS at end of article.

ENGINE OILING

ENGINE OILING LUBRICATION SYSTEM

Oiling system is force fed using a gear-type oil pump, driven from front of crankshaft. Oil from oil pan is pumped through a full-flow oil filter to the oil galleries in cylinder block. Oil is fed to crankshaft bearings, timing chain assembly, camshaft and rocker arm assembly. See **Fig. 15** for cross-sectional view of engine oil circuit.

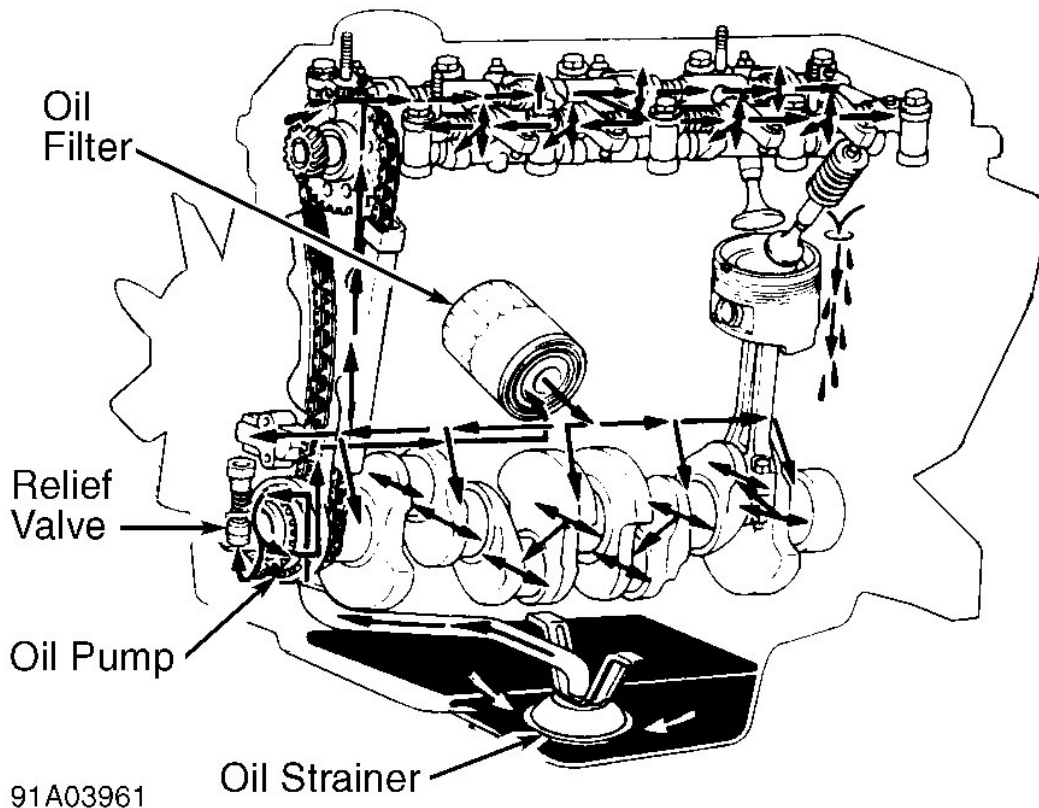


Fig. 15: Cross-Sectional View of Engine Oil Circuit
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CRANKCASE CAPACITY

Engine oil capacity is 4.5 qts. (4.3L) with oil filter change. Oil capacity without oil filter change is 4.0 qts.

(3.8L).

OIL PRESSURE

Oil pressure is 4.3 psi (.3 kg/cm²) at idle speed and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

OIL PUMP

NOTE: Manufacturer recommends cleaning oil pan and strainer when servicing oil pump.

Removal

1. Remove engine undercover (splash) shields. On 2WD models, place a jack under transmission, and raise engine about 1" (25.4 mm). On all models, remove 16 bolts and 2 nuts attaching oil pan.
2. Using Oil Pan Seal Cutter (09032-00100), remove oil pan. Remove oil strainer. Remove drive belts and crankshaft pulley. On models with A/C, remove A/C compressor and bracket. Wire A/C compressor aside. DO NOT disconnect A/C hoses.
3. On all models, loosen oil pump relief valve plug. See **Fig. 17**. Remove 5 bolts and oil pump assembly. Remove oil pump drive spline from crankshaft and "O" ring from engine block. Remove relief valve plug, spring and piston from pump body. Remove driven and drive gear from pump body.

Installation

Reassemble pump, and lubricate seal lip. Install new "O" ring in block, and apply sealant to upper bolt "A". See **Fig. 17**. Install and tighten pump. To complete installation, reverse removal procedure. Tighten oil pump bolts to specification. See **TORQUE SPECIFICATIONS** TABLE at end of article.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Driven Gear-To-Body Clearance	
Standard	.0035-.0059 (.090-.150)
Maximum	.008 (.20)
Gear Side Clearance	
Standard	.0012-.0035 (.030-.090)
Maximum	.006 (.15)
Tip-To-Crescent Clearance	
Standard	
Drive Gear	.0087-.0098 (.220-.250)
Driven Gear	.0059-.0083 (.150-.210)
Maximum	.012 (.30)

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2.4L 4-CYL - VIN [R] 1991 ENGINES Toyota - 2.4L 4-Cylinder

1. Carburetor
2. Air Intake Chamber
3. Cylinder Head Cover
4. Rocker Arm Assembly
5. Valve Keepers
6. Valve Spring Retainer
7. Compression Spring
8. Oil Seal
9. Valve Spring Seat
10. Valve
11. Gasket
12. EGR Valve
13. Intake Manifold
14. Distributor Drive Gear
15. Camshaft Bearing Cap
16. Camshaft
17. Valve Guide
18. Snap Ring
19. Cylinder Head Rear Plate
20. Exhaust Manifold & insulator
21. Cylinder Head
22. Cylinder Block
23. Rear Oil Seal
24. Rear Oil Seal Retainer
25. Thrust Washer
26. Main Bearing
27. Oil Strainer
28. Crankshaft
29. Main Bearing Cap
30. Drain Plug
31. Oil Pan
32. Rod Cap
33. Connecting Rod
34. Piston Pin
35. Piston
36. Piston Ring
37. Rod Bearing

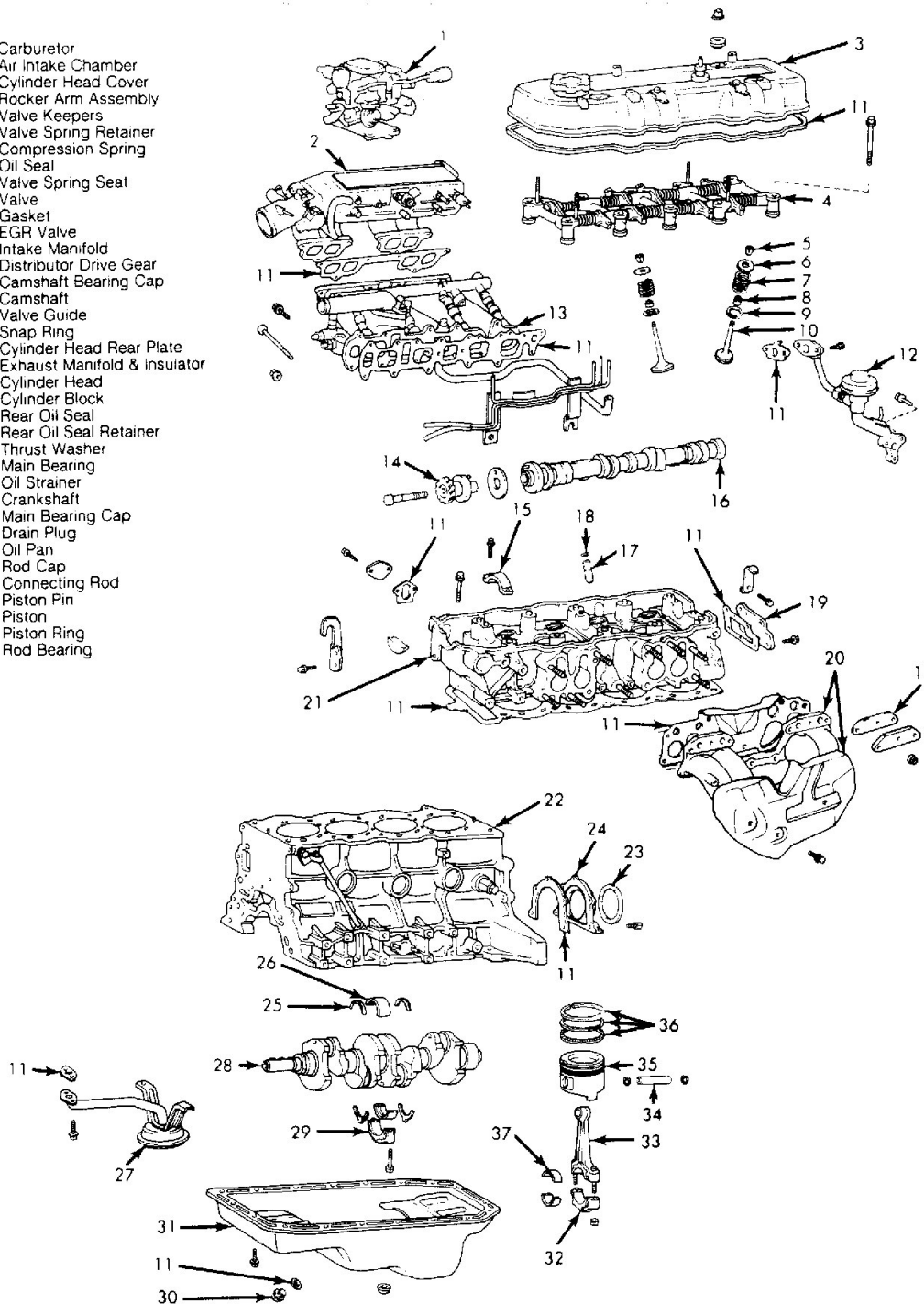


Fig. 16: Exploded View of Cylinder Head & Cylinder Block Components

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

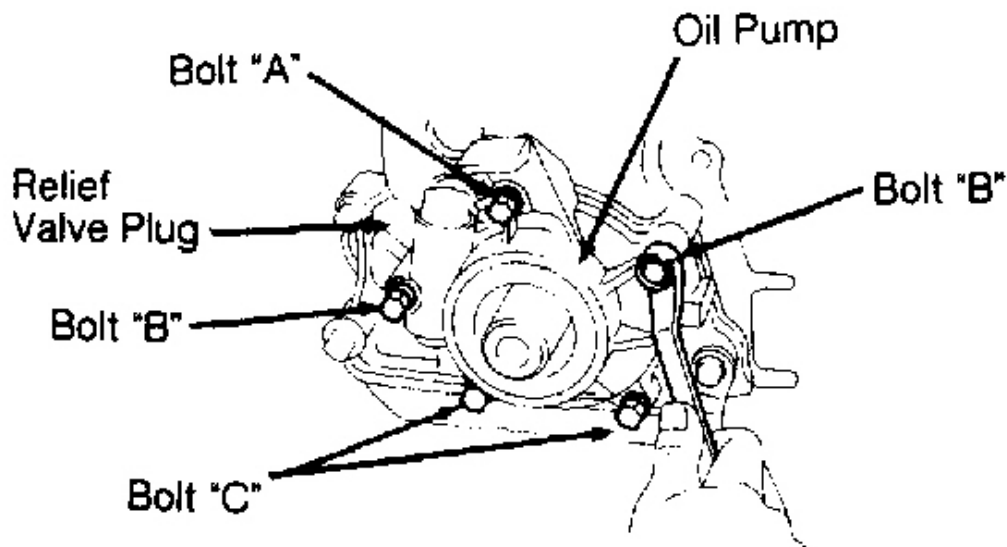


Fig. 17: Identifying Oil Pump Relief Valve Plug & Bolts
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

Application	Specification
Displacement	144.4 Cu. In. (2.4L)
Bore	3.62" (92.0 mm)
Stroke	3.50" (89.0 mm)
Compression Ratio	9.3:1
Fuel System	PFI
Horsepower @ RPM	116 @ 4800
Torque Ft. Lbs. @ RPM	140 @ 2800

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

Application	In. (mm)
Crankshaft	

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2.4L 4-CYL - VIN [R] 1991 ENGINES Toyota - 2.4L 4-Cylinder

End Play	.0008-.0087 (.020-.220)
Runout	.004 (.10)
Main Bearings	
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Journal Out-Of-Round	.0004 (.100)
Journal Taper	.0004 (.100)
Oil Clearance	.0010-.0022 (.025-.055)
Bearing Center Wall Thickness ⁽¹⁾	
Identification Mark "3"	.0783-.0784 (1.988-1.992)
Identification Mark "4"	.0784-.0786 (1.992-1.996)
Identification Mark "5"	.0786-.0787 (1.996-2.000)
Connecting Rod Bearings	
Journal Diameter	2.0861-2.0866 (52.988-53.000)
Journal Out-Of-Round	.0004 (.100)
Journal Taper	.0004 (.100)
Oil Clearance	.0010-.0022 (.025-.055)
Bearing Center Wall Thickness ⁽²⁾	
Identification Mark "A"	.0584-.0586 (1.484-1.488)
Identification Mark "B"	.0586-.0587 (1.488-1.492)
Identification Mark "C"	.0587-.0589 (1.492-1.496)
(1) Three standard main bearing sizes are used. Cylinder block is marked with a number "3", "4" or "5". See Fig. 13 .	
(2) Three standard rod bearing sizes are used. Connecting rod caps are marked with letter "A", "B" or "C". See Fig. 12 .	

CONNECTING RODS SPECIFICATIONS**CONNECTING RODS SPECIFICATIONS**

Application	In. (mm)
Bore Diameter	
Crankpin Bore ⁽¹⁾	
Standard Bore "A"	2.2047-2.2050 (56.000-56.006)
Standard Bore "B"	2.2050-2.2052 (56.006-56.012)
Standard Bore "C"	2.2052-2.2054 (56.012-56.018)
Maximum Bend	.0020 (.050)
Maximum Twist	.0059 (.150)
Side Play	.0063-.0102 (.160-.260)
(1) Three standard crankpin sizes are used. Connecting rod caps are marked with letter "A", "B", or "C".	

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2.4L 4-CYL - VIN [R] 1991 ENGINES Toyota - 2.4L 4-Cylinder

See **Fig. 12** .**PISTONS, PINS & RINGS SPECIFICATIONS****PISTONS, PINS & RINGS SPECIFICATIONS**

Application	In. (mm)
Pistons	
Clearance	.0006-.0014 (.015-.035)
Standard Diameter ⁽¹⁾	
Identification Mark No. 1	3.6211-3.6214 (91.975-91.985)
Identification Mark No. 2	3.6214-3.6219 (91.985-91.995)
Identification Mark No. 3	3.6219-3.6222 (91.995-92.005)
Pins	
Piston Fit	Thumb Pressure @ 176°F (80°C)
Rod Fit	Thumb Pressure @ 176°F (80°C)
Oil Clearance	.0002-.0004 (.005-.011)
Rings	
No. 1	
End Gap	.0098-.0185 (.250-.470)
Side Clearance	.0012-.0028 (.030-.070)
No. 2	
End Gap	.0236-.0323 (.600-.820)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap	.0079-.0224 (.200-.570)
Side Clearance	.0012-.0028 (.030-.070)
(1) Three piston sizes are used. Pistons are marked with No. 1, No. 2 or No. 3. See Fig. 8 .	

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK SPECIFICATIONS**

Application	In. (mm)
Cylinder Bore ⁽¹⁾	
Standard Diameter	
Identification Mark No. 1	3.6220-3.6224 (92.000-92.010)
Identification Mark No. 2	3.6224-3.6228 (92.010-92.020)

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2.4L 4-CYL - VIN [R] 1991 ENGINES Toyota - 2.4L 4-Cylinder

Identification Mark No. 3	3.6228-3.6232 (92.020-92.030)
Maximum Taper	.0008 (.020)
Maximum Out-Of-Round	.0008 (.020)
Main Journal Bore ⁽²⁾	
Identification Mark "3"	2.5198-2.5201 (64.004-64.010)
Identification Mark "4"	2.5201-2.5203 (64.010-64.016)
Identification Mark "5"	2.5203-2.5205 (64.016-64.022)
Maximum Deck Warpage	.002 (.05)
(1) Three cylinder bore sizes are used. Cylinders are marked with No. 1, No. 2 or No. 3. See Fig. 10 .	
(2) Three standard main journal sizes are used. Cylinder block is marked with number "3", "4" or "5". See Fig. 13 .	

VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS SPECIFICATIONS**

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.039" (1.00 mm)
Minimum Length	4.449" (113.00 mm)
Standard Length	4.468" (113.50 mm)
Stem Diameter	.3138-.3144" (7.970-7.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.039" (1.00 mm)
Minimum Length	4.406" (111.90 mm)
Standard Length	4.425" (112.40 mm)
Stem Diameter	.3136-.3142" (7.965-7.980 mm)
Valve Springs	
Free Length	1.909" (48.50 mm)
Installed Height	1.594" (40.50 mm)
Out-Of-Square	.063" (1.60 mm)
Pressure:	Lbs. @ In. (kg @ mm)
Valve Closed	66.1 @ 1.595 (30.00 @ 40.50)

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD SPECIFICATIONS**

Application	Specification
-------------	---------------

1991 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1991 ENGINES Toyota - 2.4L 4-Cylinder

Maximum Warpage	.0059" (.150 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Valve Guides	
Intake Valve	
Bore I.D.	.5118-.5125" (13.000-13.018 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 mm)
Valve Stem-To-Guide Oil Clearance	.0010-.0024" (.025-.060 mm)
Exhaust Valve	
Bore I.D.	.5118-.5125" (13.000-13.018 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 mm)
Valve Stem-To-Guide Oil Clearance	.0012-.0026" (.030-.065 mm)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
End Play	.0031-.0071 (.080-.180)
Journal Diameter	1.2984-1.2992 (32.980-33.000)
Journal Runout	.008 (.20)
Lobe Height	
Intake	1.6783-1.6891 (42.630-42.720)
Exhaust	1.6807-1.6842 (42.690-42.780)
Oil Clearance	.0004-.0020 (.010-.050)

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Camshaft Bearing Bolts	15 (20)
Camshaft Sprocket Bolt	58 (78)

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2.4L 4-CYL - VIN [R] 1991 ENGINES Toyota - 2.4L 4-Cylinder

Chain Damper Bolts	16 (22)
Chain Tensioner Bolts	14 (19)
Connecting Rod Cap Bolts	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head/Rocker Arm Bolts ⁽¹⁾	58 (78)
EGR Valve Bolt & Nut	10 (13)
Exhaust Manifold Bolts	32 (44)
Flywheel Bolts	
A/T	61 (83)
M/T	80 (108)
Intake Manifold Bolts	14 (19)
Main Bearing Cap Bolts ⁽²⁾	76 (103)
Oil Cooler Relief Valve	51 (69)
Oil Pan Drain Plug	18 (25)
Oil Pump ⁽³⁾	
Bolt "A"	18 (25)
Bolt "B"	14 (19)
Bolt "C"	10 (13)
Oil Pump Relief Valve Plug	27 (37)
Rear Oil Seal Retainer Bolts	13 (18)
Timing Chain Damper Bolt	16 (22)
Timing Chain Tensioner Bolt	14 (19)
Timing Cover Bolts	
8 mm	9 (12)
10 mm	29 (39)
Rocker Arm Adjusting Screw	18 (25)
INCH Lbs. (N.m.)	
Oil Pan Bolts	108 (12)
Oil Pump Strainer Bolts	108 (12)
Valve Cover Bolts	52 (5.9)

(1) Tighten in sequence. See **Fig. 2** .

(2) Tighten in sequence. See **Fig. 14** .

(3) See **Fig. 17** for bolt location.

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

2.4L 4-CYL - VIN [R]

1992 ENGINES Toyota - 2.4L 4-Cylinder

ENGINE IDENTIFICATION

Engine serial number is stamped behind the alternator on the cylinder block.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
2.4L 4-Cylinder	22R-E	R

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine at normal operating temperature.

1. Ensure engine is at normal operating temperature. Remove retaining nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 is at TDC of compression stroke. Ensure timing mark groove on crankshaft pulley aligns with "0" timing mark on front cover.
2. Ensure rocker arms on cylinder No. 1 are loose, and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft 360 degrees and realign timing marks.
3. Using feeler gauge, check valve clearance between rocker arm and valve stem on intake valves on cylinders No. 1 and 2 and on exhaust valves on cylinders No. 1 and 3.
4. Ensure valve clearance is within specification. Refer to **VALVE CLEARANCE SPECIFICATIONS** table. If necessary, loosen lock nut and rotate adjusting screw to obtain correct clearance. Tighten lock nut and recheck valve clearance.
5. Rotate crankshaft 360 degrees and realign timing marks. Check valve clearance on intake valves on cylinders No. 3 and 4, and exhaust valves on cylinders No. 2 and 4. Adjust valve clearance if necessary.
6. Before installing valve cover, ensure half-circular seals are installed at front and rear of cylinder head. Apply sealant at half-circular seals-to-cylinder head surfaces.
7. Install gasket, valve cover, seal and retaining nuts. Tighten retaining nuts to specification. See **TORQUE SPECIFICATIONS**.

VALVE CLEARANCE SPECIFICATIONS ⁽¹⁾

Application	In. (mm)
Exhaust Valve	.012 (.30)
Intake Valve	.008 (.20)

(1) Adjust valves with engine at normal operating temperature.

REMOVAL & INSTALLATION

*** PLEASE READ FIRST ***

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

FUEL PRESSURE RELEASE

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

ENGINE

NOTE: Remove engine and transmission as an assembly.

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** . Remove hood, battery and lower engine covers. Drain cooling system. Drain engine oil. Remove air cleaner case and intake air connector.
2. Remove radiator and accessory drive belts. Remove fan clutch along with fan and fan pulley. Disconnect necessary electrical connections, vacuum hoses, coolant hoses and fuel lines.
3. Disconnect accelerator cable, throttle cable (A/T models) and cruise control cable (if equipped). Disconnect necessary ground straps. Remove power steering pump and A/C compressor with hoses attached and secure aside (if equipped).
4. Place reference marks on drive shaft flanges for reassembly reference. Remove retaining bolts and all drive shaft(s).
5. On M/T models, remove shift lever(s) from inside vehicle. On 2WD A/T models, disconnect manual shift linkage from neutral start switch.
6. On 4WD A/T models, disconnect transfer case shift linkage from cross shaft at transfer case. Remove bolts and cross shaft.
7. On all 4WD models, remove transfer case protective plates located below transfer case. On all models, remove stabilizer bar (if equipped). Disconnect speedometer cable.

NOTE: DO NOT lose felt dust protector and washers from speedometer cable.

8. Disconnect oxygen sensor connector. Remove front exhaust pipe located between exhaust manifold and catalytic converter.
9. On 2WD models, support transmission and remove rear engine mount and bracket. On M/T models, remove clutch release cylinder with hoses attached and secure aside.
10. On 4WD models, remove front floor heat insulator and brake tube heat insulator. Support transmission with floor jack. Remove retaining bolts and crossmember located below transmission.
11. On all models, support engine with hoist. Remove engine mount bolts/nuts. Lift engine and transmission assembly from vehicle.

Installation

To install, reverse removal procedure. Ensure reference marks are aligned on drive shaft flanges. Adjust all fluid levels, control cables and shift linkages.

CYLINDER HEAD & MANIFOLDS**Removal**

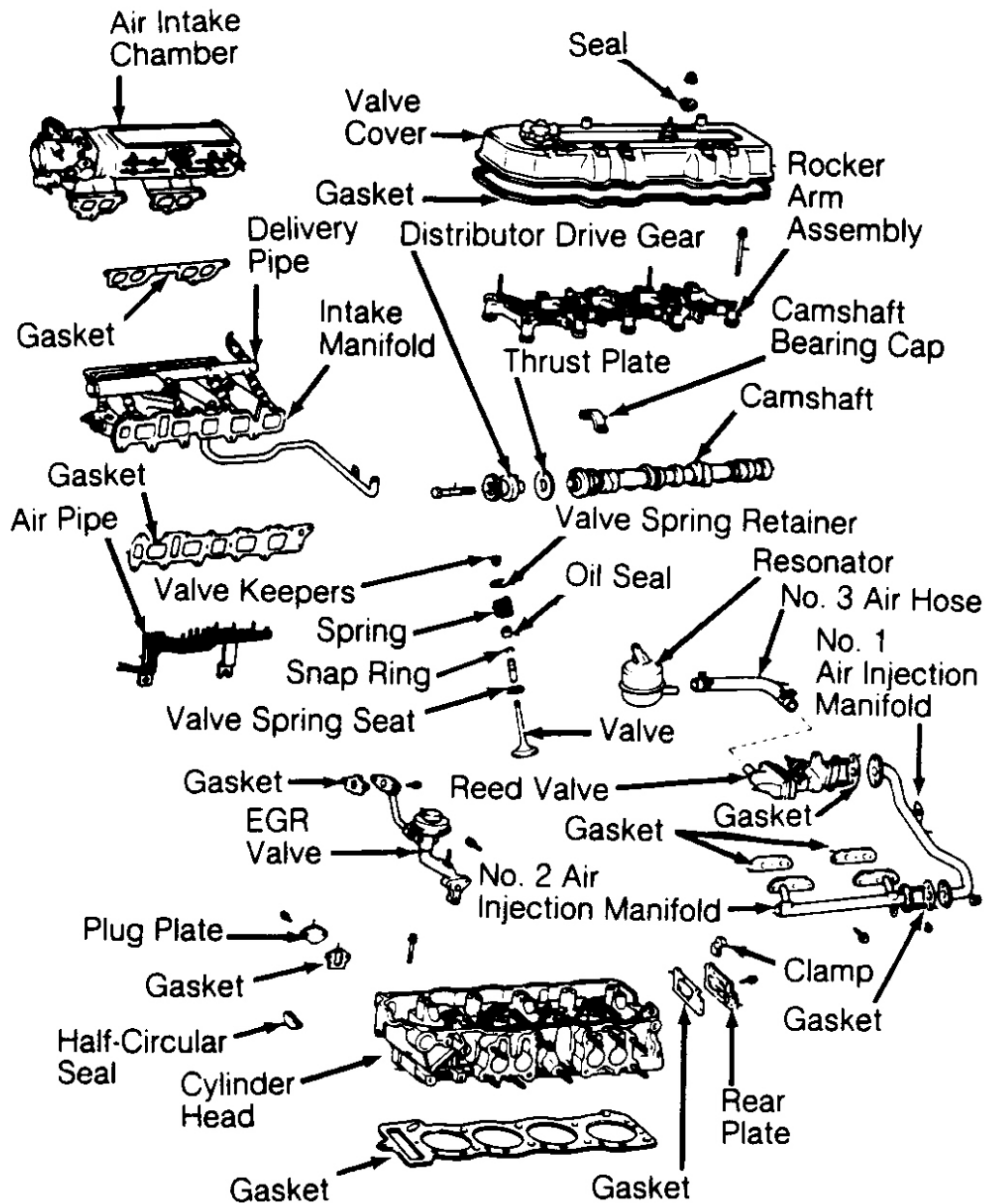
1. Disconnect negative battery cable. Drain cooling system. Remove air intake from air intake chamber. Disconnect exhaust pipe from exhaust manifold.
2. Remove oil dipstick. Remove distributor and spark plugs. Disconnect all necessary electrical connections, coolant hoses, vacuum hoses and control cables.
3. Remove EGR vacuum modulator. Remove air intake chamber along with throttle body. See **Fig. 1** . Release fuel pressure. Refer to **FUEL PRESSURE RELEASE** . Disconnect necessary fuel lines.
4. Remove power steering pump bracket-to-cylinder head bolts (if equipped). Remove retaining nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 is at TDC of compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
5. Ensure rocker arms on cylinder No. 1 are loose, and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft 360 degrees and realign timing marks.
6. Paint reference mark on camshaft sprocket and timing chain for reassembly reference. Remove half-circular seal and cam sprocket retaining bolt.
7. Remove distributor drive gear and thrust plate from camshaft sprocket. See **Fig. 1** . Remove camshaft sprocket and timing chain from camshaft. Allow camshaft sprocket and timing chain to rest in cylinder head.

CAUTION: DO NOT allow timing chain to become disengaged from crankshaft sprocket.

8. Remove cylinder head-to-front cover bolt, on cylinder head in front of camshaft sprocket area. Loosen cylinder head/rocker arm assembly bolts in sequence using several steps. See **Fig. 2** .
9. Remove rocker arm assembly. If necessary, pry equally at front and rear of rocker arm assembly to remove it. Remove cylinder head by lifting upward from dowels on cylinder block.

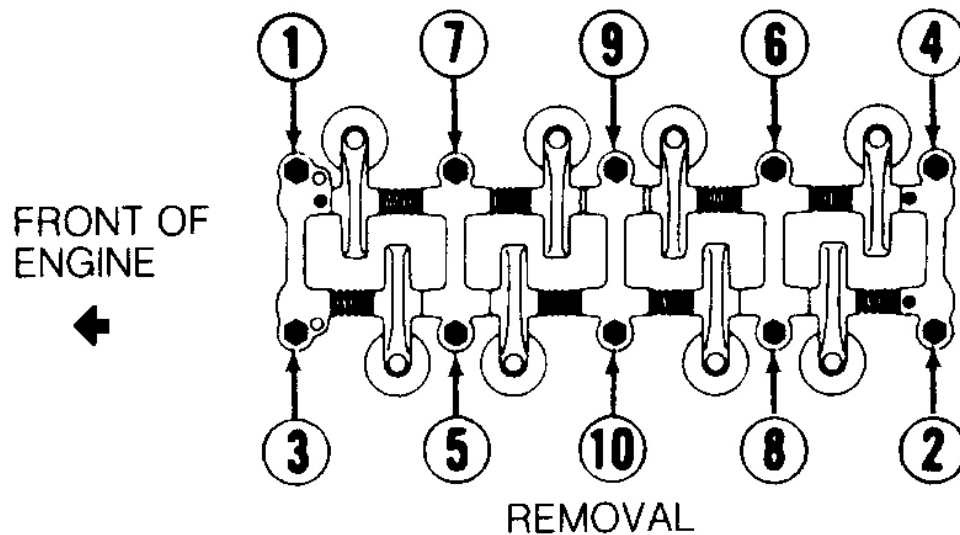
NOTE: If cylinder head removal is difficult, carefully pry with flat bar between cylinder head and projecting areas on cylinder block.

10. Remove retaining bolts/nuts, No. 1 air injection manifold gaskets and reed valve. See **Fig. 1** . Remove air pipe. Remove intake manifold as an assembly with delivery pipe, fuel injectors and heater coolant inlet pipe.
11. Remove EGR valve. Remove heat insulators, exhaust manifold and gasket. Remove rear plate and gasket. See **Fig. 1** .



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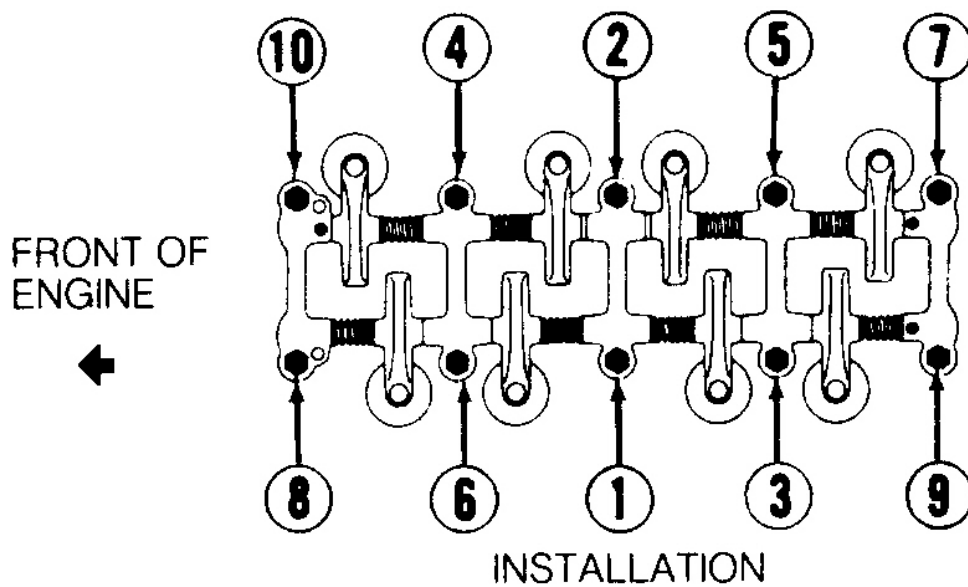
Fig. 1: Exploded View Of Cylinder Head & Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



92H02639

Fig. 2: Cylinder Head/Rocker Arm Assembly Bolt Removal Sequence

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



92J02640

Fig. 3: Cylinder Head/Rocker Arm Assembly Bolt Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect cylinder head warpage at cylinder block and manifold areas. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Inspect air intake chamber-to-intake manifold and intake manifold-to-cylinder head surfaces for warpage. Replace air intake chamber or intake manifold if warpage exceeds .008" (.20 mm).
3. Inspect exhaust manifold-to-cylinder head surface warpage. Replace exhaust manifold if warpage exceeds .028" (.70 mm).
4. Inspect cylinder block deck surface for warpage. Replace cylinder block if deck warpage exceeds specification. Refer to **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

Installation

1. Install components on cylinder head. Tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.

NOTE: Ensure EGR valve-to-cylinder head bolt hole threads are clean. Apply thread sealant on front bolt (closest to front of cylinder head) for EGR valve before installing it.

2. Apply liquid sealant at both front corners of cylinder block-to-front cover areas. Install cylinder head gasket. Ensure cylinder head gasket aligns with dowels in cylinder block.
3. Install cylinder head and rocker arm assembly. Ensure rocker arm assembly aligns with dowels in cylinder head. Install and tighten cylinder head/rocker arm assembly bolts to specification in sequence using 3 steps. See **Fig. 3**. Refer to **TORQUE SPECIFICATIONS**.
4. Install cylinder head-to-front cover bolt and tighten to specification. Ensure reference mark on camshaft sprocket and timing chain are aligned. Hold camshaft sprocket and timing chain upward.
5. If cylinder No. 1 is not at TDC of compression stroke, rotate crankshaft so engine is at TDC of compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
6. Install camshaft sprocket and timing chain on camshaft. It may be necessary to slightly rotate crankshaft back and forth while pulling upward on timing chain and camshaft sprocket.
7. Install thrust plate and distributor drive gear. Install camshaft sprocket bolt, and tighten it to specification. Refer to **TORQUE SPECIFICATIONS**. Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

NOTE: Adjust valve clearance initially with engine cold and then readjust with engine at normal operating temperature.

8. To install remaining components, reverse removal procedure. Before installing valve cover, ensure half-circular seals are installed at front and rear of cylinder head. Apply sealant at half-circular seals-to-cylinder head surfaces.

9. Install gasket, valve cover, seal and retaining nuts. Tighten retaining nuts to specification. See **TORQUE SPECIFICATIONS** . Adjust ignition timing.

FRONT COVER OIL SEAL

Removal & Installation (Front Cover Removed)

If front cover is removed from cylinder block, pry oil seal from front cover. Using Seal Installer (SST 09223-50010), install oil seal until oil seal surface is even with oil pump housing surface. Apply grease to oil seal lip.

Removal & Installation (Front Cover Installed)

1. Remove accessory drive belts. Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley, and remove retaining bolt.
2. Using puller, remove crankshaft pulley. Cut lip from oil seal. Pry oil seal from front cover. Use care not to damage sealing surfaces.
3. Apply grease on oil seal lip. Using Seal Installer (SST 09223-50010), install oil seal until oil seal surface is even with oil pump housing surface. To install remaining components, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

TIMING CHAIN

NOTE: **Cylinder head must be removed for servicing timing chain, as cylinder head gasket seals on front cover. On 4WD models, front differential must be removed for servicing timing chain.**

Removal

1. Remove cylinder head. See **CYLINDER HEAD & MANIFOLDS** . Remove radiator.
2. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges. Place reference marks on drive shaft flanges for reassembly reference. Remove retaining bolts and disconnect drive shaft front differential.
3. Disconnect necessary vacuum hoses and electrical connectors at differential (if equipped). Support differential assembly using floor jack. Remove differential assembly mounting bolts. Lower differential assembly from vehicle.
4. On all models, remove oil pan. See **OIL PAN** . Remove power steering belt (if equipped). Remove A/C compressor with hoses attached and mounting bracket (if equipped).
5. Remove fan clutch along with fan and fan pulley. Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley, and remove retaining bolt. Using puller, remove crankshaft pulley.
6. Disconnect coolant by-pass pipe on passenger's side from front cover. Remove alternator adjusting bracket. Disconnect heater outlet pipe, located near alternator, from front cover.
7. Remove front cover bolts. See **Fig. 4** . Remove front cover and gaskets. Remove timing chain from timing chain dampers. See **Fig. 5** . Remove camshaft sprocket and timing chain. Using gear puller, remove oil pump drive spline and crankshaft sprocket (if necessary). See **Fig. 5** .

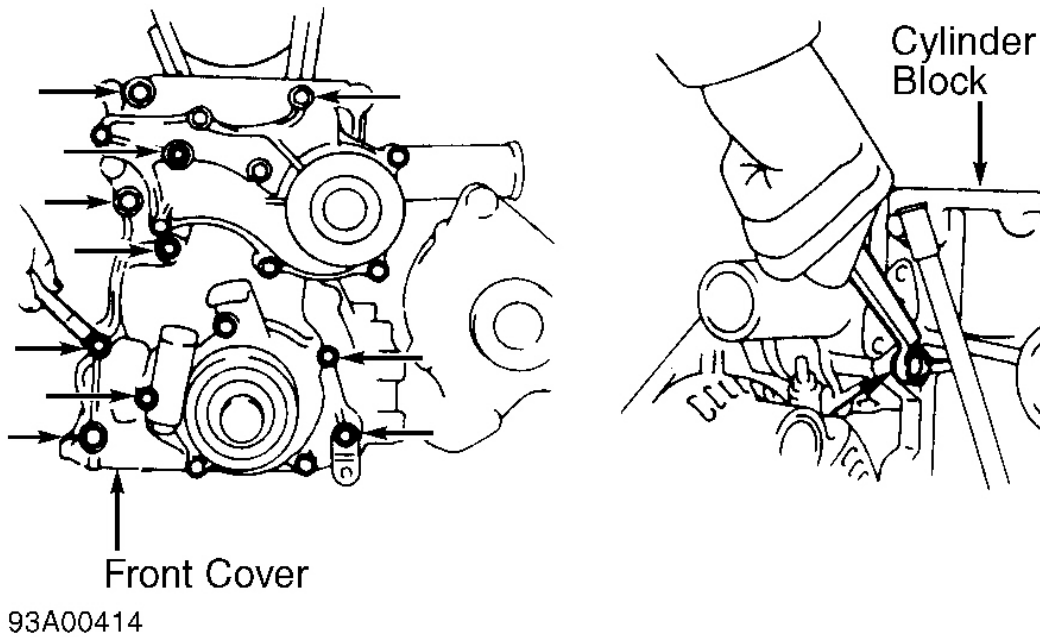
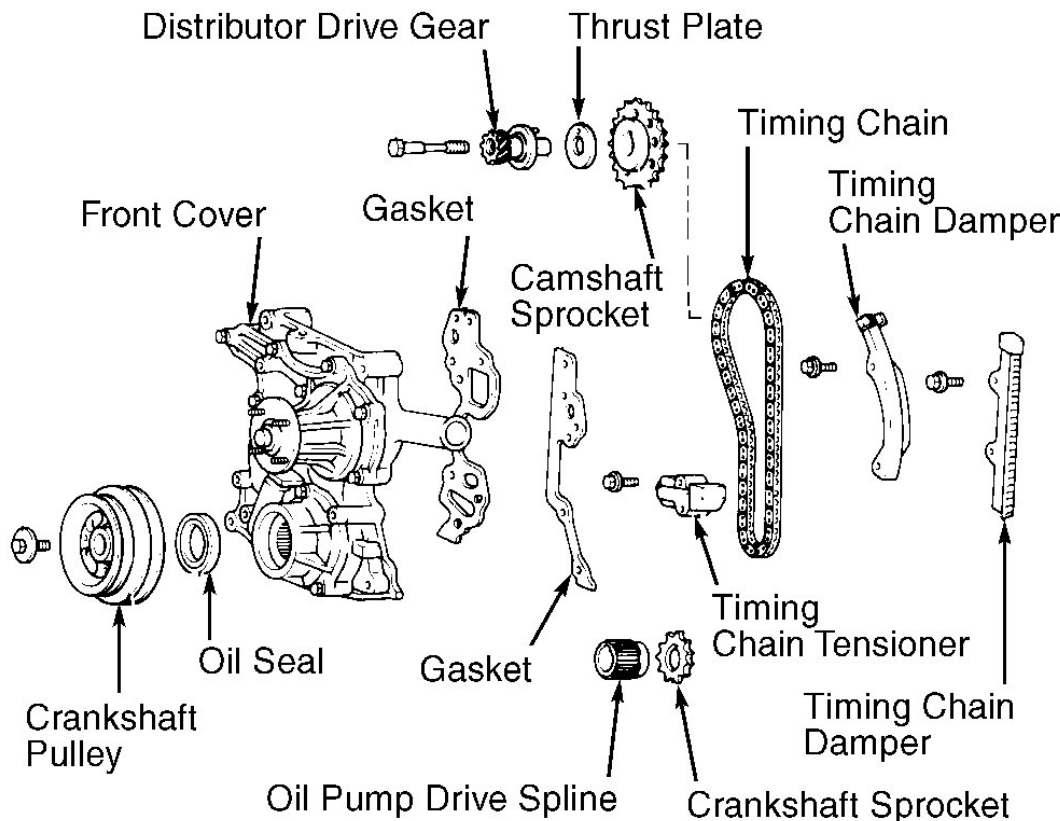


Fig. 4: Identifying Front Cover Bolts

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



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Fig. 5: Exploded View Of Timing Chain & Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect components for damage and wear. Measure timing chain tensioner width. See **Fig. 5** . Replace timing chain tensioner if width is less than .43" (11.0 mm).
2. Measure thickness of timing chain dampers. Replace timing chain dampers if thickness is .02" (.5 mm) or less. Using caliper, measure length of 17 links with timing chain fully stretched. See **Fig. 7** and **Fig. 8** . Repeat measurement in at least 3 areas. Replace timing chain if length of 17 links exceeds 5.79" (147.0 mm).
3. Wrap timing chain completely around camshaft sprocket. Using caliper, measure outside diameter of timing chain and camshaft sprocket. See **Fig. 7** and **Fig. 8** . Using same method, measure outside diameter of crankshaft sprocket and timing chain.
4. Replace timing chain and sprockets if outside diameter is less than specification. See **TIMING CHAIN & SPROCKET SPECIFICATIONS** table.

TIMING CHAIN & SPROCKET SPECIFICATIONS

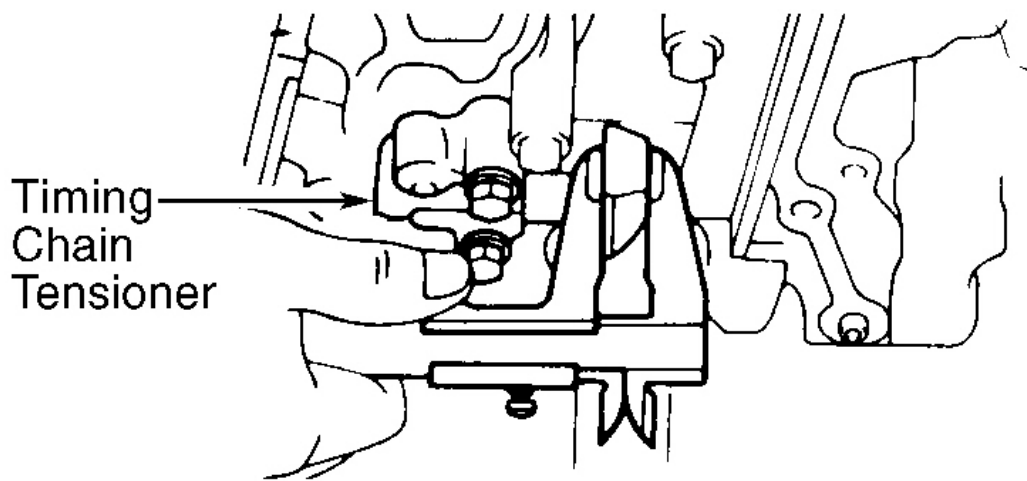
Application	In. (mm)
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1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

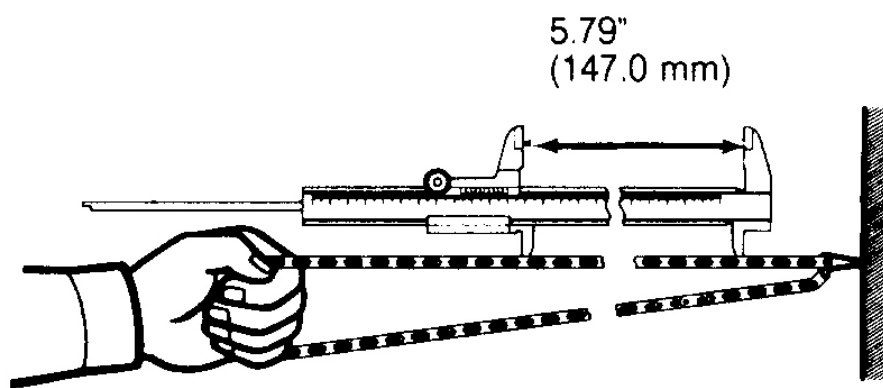
Timing Chain & Sprocket Outside Diameter

Timing Chain & Camshaft Sprocket	4.480 (113.79)
Timing Chain & Crankshaft Sprocket	2.339 (59.41)



93C00416

Fig. 6: Measuring Timing Chain Tensioner Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

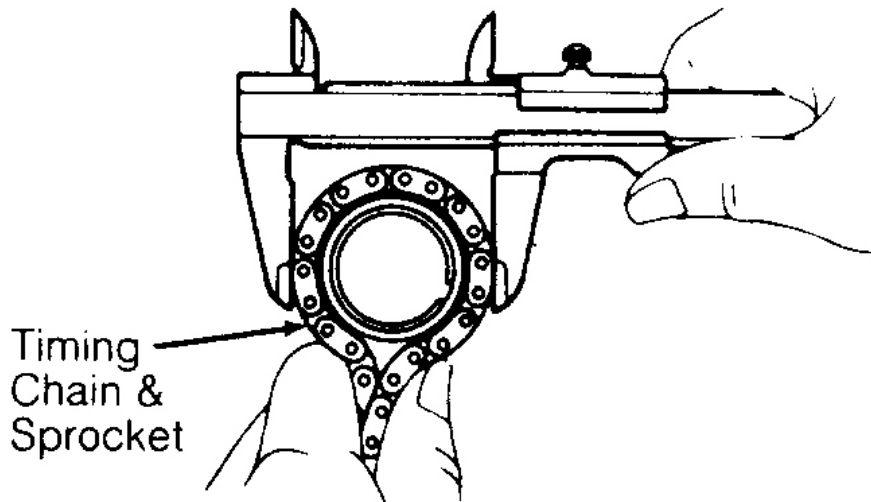


MEASURING TIMING CHAIN

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Fig. 7: Measuring Timing Chain

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

**MEASURING TIMING CHAIN & SPROCKET OUTSIDE DIAMETER****92D02642****Fig. 8: Measuring Timing Chain & Sprocket Outside Diameter**

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

Installation

1. Ensure crankshaft is positioned with keyway at 12 o'clock position. Install crankshaft sprocket on crankshaft.

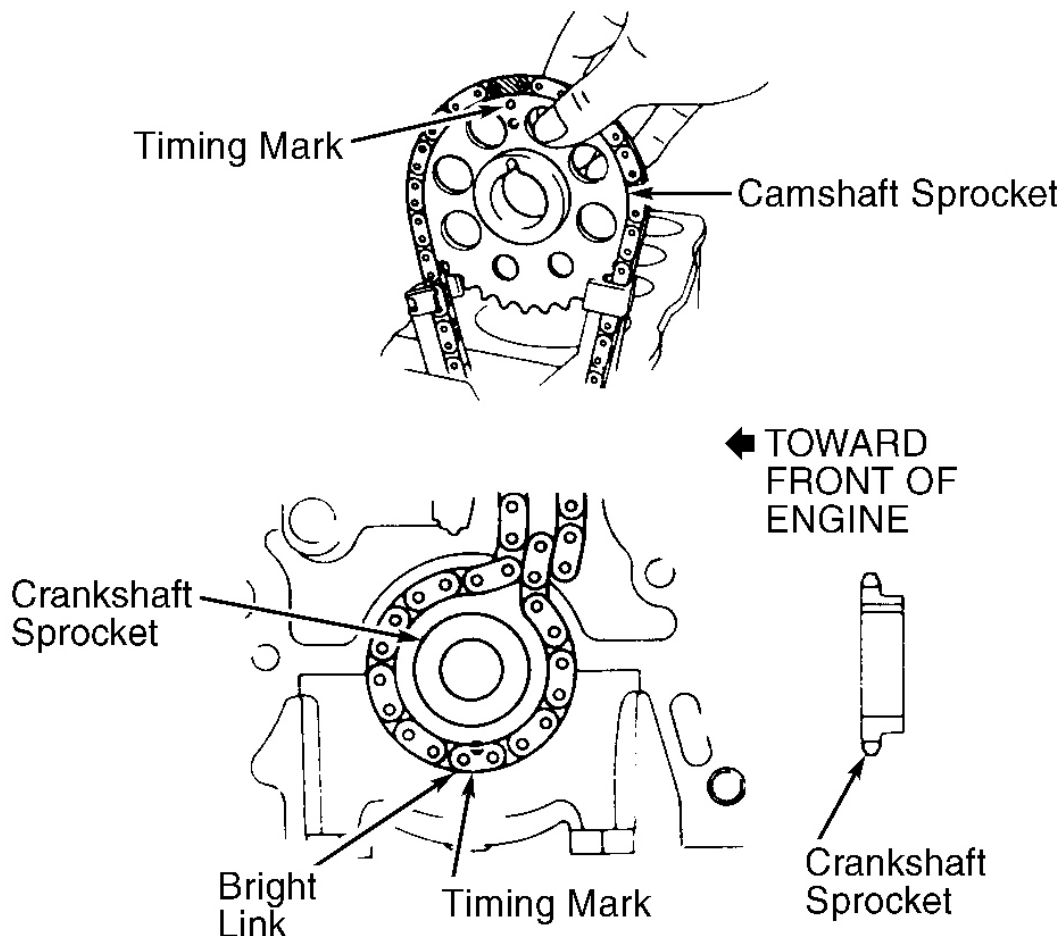
CAUTION: Install crankshaft sprocket with flat side toward front of engine. See **Fig. 9**.

2. Install timing chain on crankshaft sprocket with bright link aligned with timing mark. See **Fig. 9**. Install timing chain on camshaft sprocket with bright link aligned with timing mark. See **Fig. 9**. Ensure timing chain is positioned between timing chain dampers.
3. Rotate crankshaft counterclockwise (viewed from front of engine) to take slack out of timing chain. Install oil pump drive spline over crankshaft key.
4. Install front cover, gasket and retaining bolts. Tighten retaining bolts to specification. See **TORQUE SPECIFICATIONS**.

5. Ensure oil pan sealing surfaces are clean. Apply a .20" (5.0 mm) bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing area.

6. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing area.
7. Install oil pan, and tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS** . To install remaining components, reverse removal procedure.
8. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with hypoid gear oil SAE 80W-90 with API rating of GL-5.



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Fig. 9: Installing Timing Chain & Sprockets
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ROCKER ARM ASSEMBLY

Removal & Installation

Rocker arm assembly procedure is listed with cylinder head and manifold procedure. Rocker arm assembly is attached with cylinder head/rocker arm assembly bolts. See **CYLINDER HEAD & MANIFOLDS** .

CAMSHAFT

Removal

1. Measure camshaft end play before removing camshaft. End play should be within specification. See **CAMSHAFT SPECIFICATIONS** table under ENGINE SPECIFICATIONS. Replace cylinder head if camshaft end play exceeds specification.
2. Remove distributor. Remove rocker arm assembly and camshaft sprocket. Rocker arm assembly procedure is listed with cylinder head and manifold procedure. Rocker arm assembly is attached with cylinder head/rocker arm assembly bolts. Refer to **CYLINDER HEAD & MANIFOLDS** .
3. Note direction of camshaft bearing cap installation for reassembly reference. Camshaft bearing caps are numbered with No. 1 at front of engine. Ensure arrow on top of camshaft bearing cap points toward front of engine. Remove bolts, camshaft bearing caps and camshaft.

Inspection

1. Inspect components for damage. Check camshaft journal diameter, lobe height and runout. Replace camshaft if not within specification. See **CAMSHAFT SPECIFICATIONS** table under ENGINE SPECIFICATIONS.
2. Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification. See **TORQUE SPECIFICATIONS** .
3. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT SPECIFICATIONS** table under ENGINE SPECIFICATIONS.

Installation

1. To install, reverse removal procedure. Ensure camshaft bearing caps are installed in numerical order with arrows pointing toward front of engine.
2. Tighten bolts/nuts to specification. Refer to **TORQUE SPECIFICATIONS** . Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

REAR CRANKSHAFT OIL SEAL

Removal

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

Installation

1. Ensure all sealing surfaces are clean. Apply grease to seal lip of NEW oil seal. Using Seal Installer (SST 09223-41020), install oil seal in rear seal housing until oil seal is even with rear seal housing surface.
2. Install and tighten flywheel/drive plate bolts to specification. See **TORQUE SPECIFICATIONS** . To install remaining components, reverse removal procedure.

WATER PUMP

Removal & Installation

1. Drain cooling system. Remove power steering pump and A/C compressor belts (if equipped). Remove fan clutch along with fan and fan pulley.
2. Remove 6 bolts and 3 nuts retaining water pump. Remove water pump and gasket. To install, reverse removal procedure using NEW gasket. Fill cooling system.

OIL PAN

Removal

1. Drain engine oil. Remove lower engine covers. On 2WD models, place a jack under transmission and raise engine about 1.00" (25.4 mm) if necessary.
2. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges. Place reference marks on drive shaft flanges for reassembly reference. Remove retaining bolts and disconnect drive shaft front differential.
3. Disconnect necessary vacuum hoses and electrical connectors at differential (if equipped). Support differential assembly with floor jack. Remove differential assembly mounting bolts. Lower differential assembly from vehicle.
4. On all models, remove oil pan retaining bolts/nuts. Using Oil Pan Seal Cutter (SST 09032-00100), remove oil pan. DO NOT damage oil pan flange.

Installation

1. Ensure sealing surfaces are clean. Apply a .20" (5.0 mm) bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.
2. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing area.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing area.

3. Install oil pan, and tighten bolts/nuts to specification. See **TORQUE SPECIFICATIONS** .
4. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with hypoid gear oil SAE 80W-90 with API rating of GL-5. On all models, reverse removal procedure to install remaining components. Fill crankcase with oil.

OVERHAUL

CYLINDER HEAD

1. Inspect cylinder head warpage at cylinder block and manifold surfaces. 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. See **TORQUE SPECIFICATIONS**.
3. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT SPECIFICATIONS** table under ENGINE SPECIFICATIONS.

VALVE SPRINGS

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

VALVE STEM OIL SEALS

Lubricate valve stem oil seal with engine oil. Install valve stem oil seal and ensure valve stem oil seal is fully seated.

VALVE GUIDES

1. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.
2. To replace valve guide, hit top of valve guide using hammer and brass drift to break off old valve guide. Heat cylinder head to 194°F (90°C).
3. Using hammer and Valve Guide Remover/Installer (SST 09201-60011), drive valve guide from camshaft side of cylinder head.
4. Measure cylinder head valve guide bore inside diameter. If bore inside diameter is .5118-.5125" (13.000-13.018 mm), use standard valve guide.
5. If bore inside diameter is greater than .5125" (13.018 mm), machine valve guide bore to .5138-.5145" (13.050-13.068 mm) for oversize valve guide.
6. To install valve guide, heat cylinder head to 194°F (90°C). Using hammer and valve guide remover/installer, drive valve guide in from camshaft side of cylinder head until snap ring contacts cylinder head surface.
7. Using .236" (6.00 mm) reamer, ream valve guide to obtain specified 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.

VALVES

Ensure minimum refinish length, stem diameter and valve margin are within specification. See **VALVES &**

VALVE SPRINGS table under ENGINE SPECIFICATIONS.

SEAT CORRECTION ANGLES

Use 30-degree and 45-degree stones to lower valve seat contact area. Use 60-degree (intake valves), 65-degree (exhaust valves) and 45-degree stones to raise valve seat contact area.

VALVE TRAIN

CAUTION: Ensure rocker arm assembly components are marked for location. Components must be installed in original location.

Rocker Arm Assembly

1. If rocker arms appear loose on shaft, disassemble rocker arm assembly. Measure rocker arm inside diameter, shaft outside diameter and determine oil clearance. Replace components if not within specification. See **ROCKER ARM ASSEMBLY SPECIFICATIONS** table.

ROCKER ARM ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.051)
Wear Limit	.0031 (.79)
Rocker Arm Inside Diameter	.6299-.6306 (16.000-16.017)
Shaft Outside Diameter	.6287-.6295 (15.970-15.989)

2. To reassemble, reverse disassembly procedure. Note that rocker arms are identical, but rocker arm stands are different and must be installed in correct location. See **Fig. 10**.

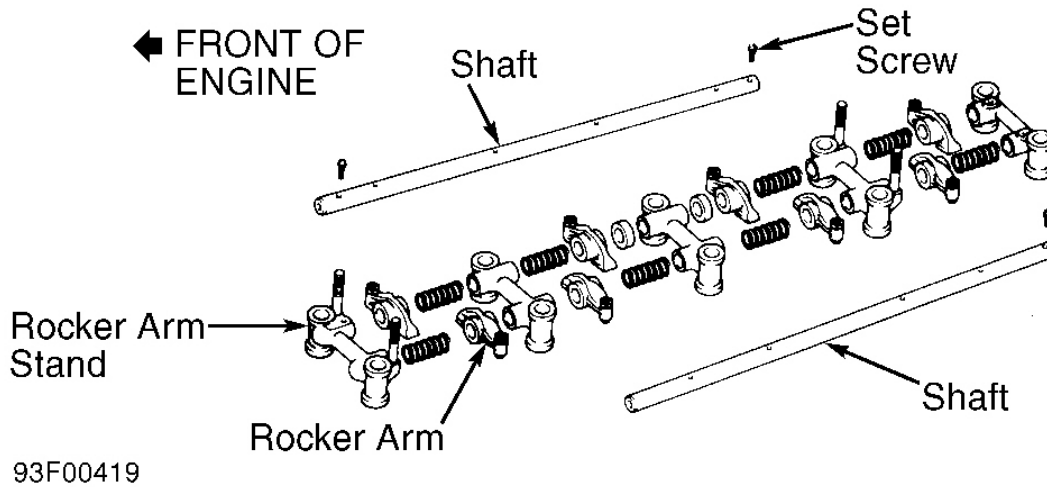


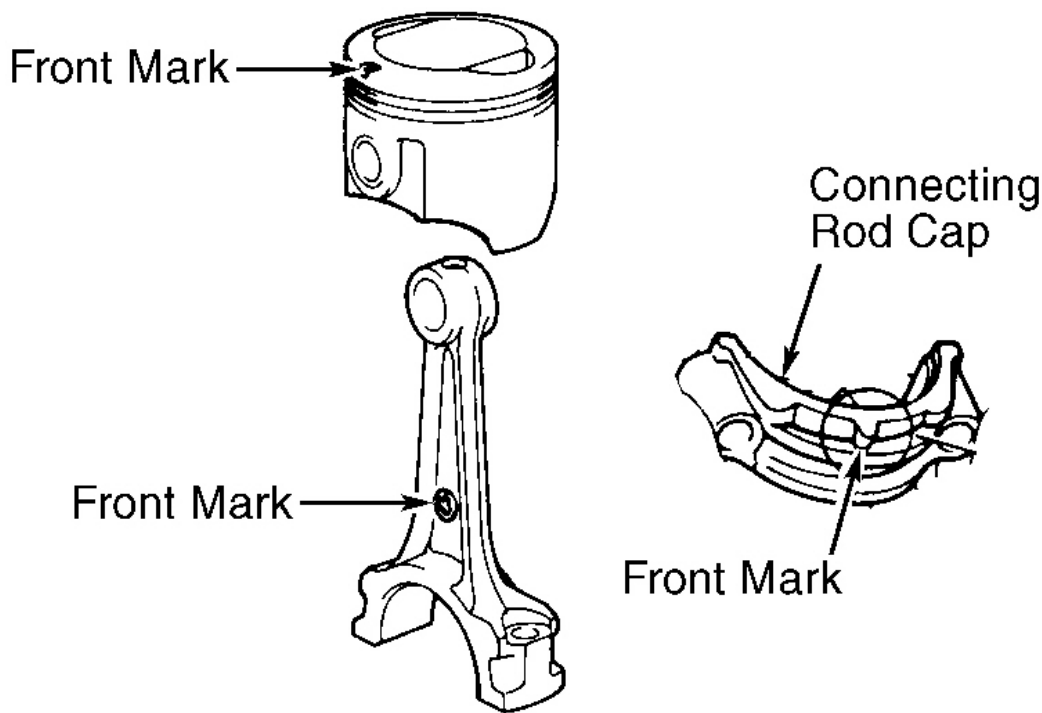
Fig. 10: Exploded View Of Rocker Arm Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PISTON & ROD ASSEMBLY

1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. When removing piston from connecting rod, remove snap ring from piston.
2. Heat piston to 176°F (80°C) in water. Remove piston pin. Separate piston from connecting rod. Measure piston pin outside diameter and connecting rod bushing inside diameter. Ensure piston pin-to-rod fit is within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
3. Bushing can be replaced in connecting rod if piston pin-to-rod fit exceeds specification. Ensure bushing oil holes align with connecting rod oil holes. Hone bushing to obtain correct piston pin-to-rod fit.

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

4. To reassemble, install piston with front mark on top of piston and connecting rod aligned. See **Fig. 11** . Install NEW snap ring in piston. Heat piston to 176°F (80°C) in water. Install piston pin and remaining snap ring.



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Fig. 11: Aligning Connecting Rod & Piston
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

FITTING PISTONS

1. To determine if piston-to-cylinder clearance is within specification, measure piston skirt diameter at 1.30" (33.0 mm) from top of piston, at 90-degree angle to piston pin.
2. Different piston sizes are used. Piston diameter is determined by size mark (No. "1", "2" or "3") stamped on top of piston. See **Fig. 12**. 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 cylinder bore and at middle of cylinder bore. Different cylinder bore sizes are used. Cylinder bore diameter can be identified by size mark (No. "1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 13**.
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 if piston clearance is not within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS. Cylinder block can be bored for .020" (.50 mm) or .040" (1.01 mm) oversize pistons.

◆ FRONT OF VEHICLE

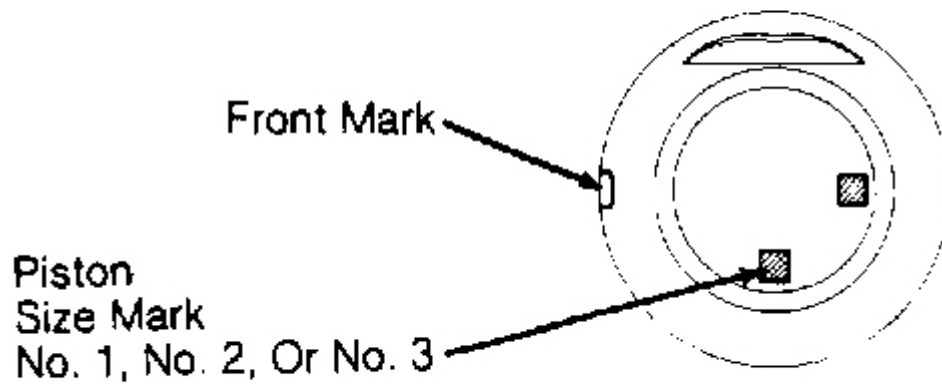
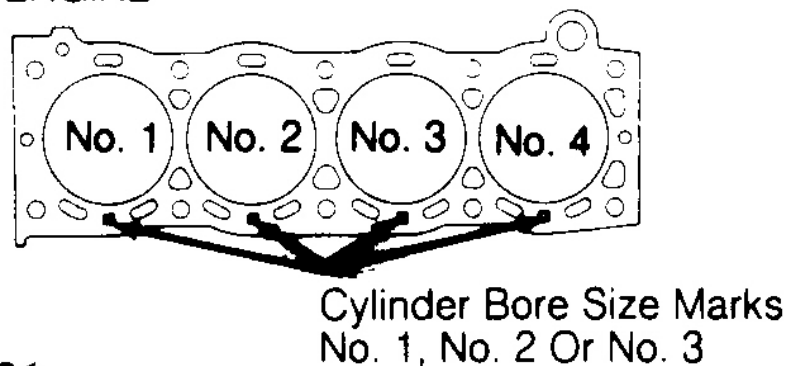


Fig. 12: Identifying Piston Size Marks

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

◆ FRONT OF ENGINE



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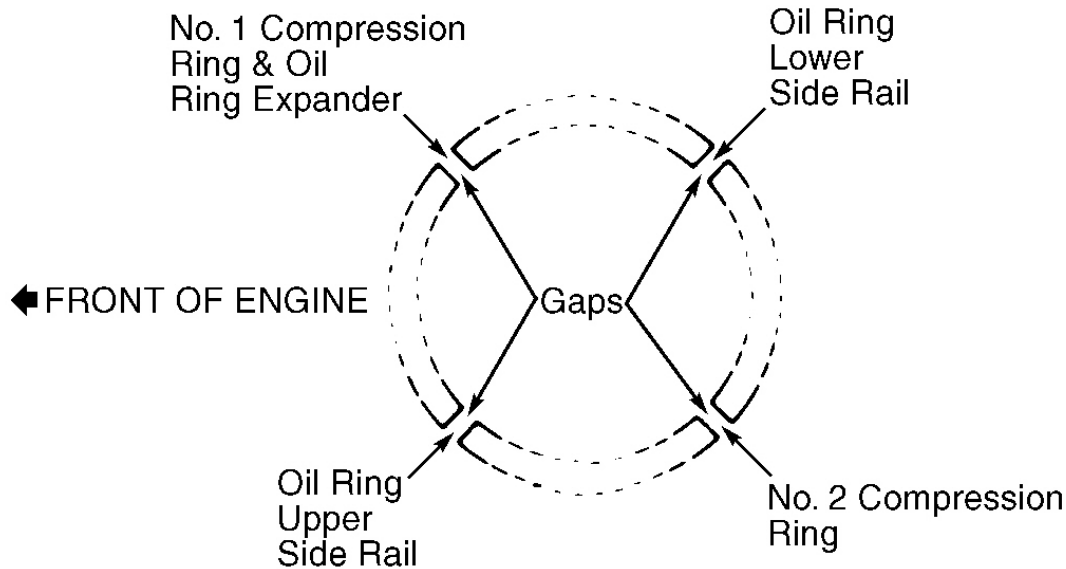
Fig. 13: Identifying Cylinder Bore Size Marks

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 gaps in proper areas, with identification mark on ring

toward top of piston. See **Fig. 14** .



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Fig. 14: 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. Install a connecting rod so front mark is toward front of engine. See **Fig. 11** .
2. Connecting rod cap and rod bearing are stamped with size mark "A", "B" or "C". See **Fig. 15** . Ensure size marks on connecting rod cap and rod bearing are the same. If size mark cannot be read, measure rod bearing thickness to determine bearing size. See **ROD BEARING SPECIFICATIONS** table.

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

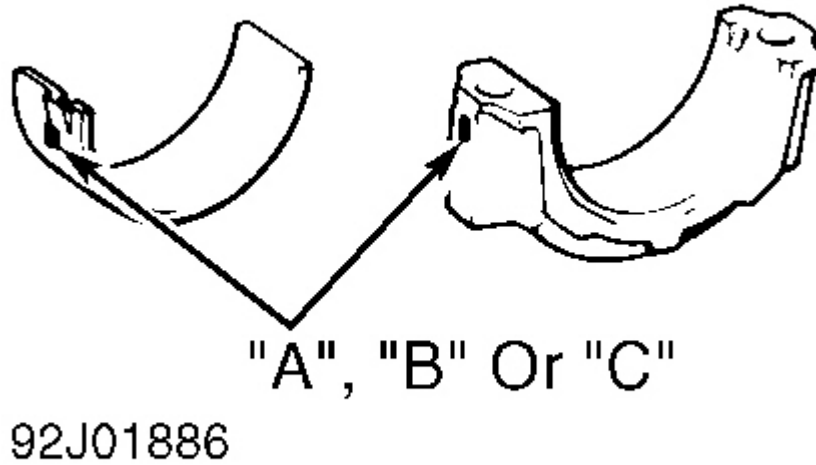


Fig. 15: Identifying Connecting Rod Cap & Bearing Size Marks

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

3. Ensure connecting rod caps are installed with front mark toward front of engine. See **Fig. 11** . Coat nut and threads of connecting rod bolts with engine oil before tightening to specification.
4. 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

Size Mark	Bearing Thickness: In. (mm)
A	.0584-.0586 (1.483-1.488)
B	.0586-.0587 (1.488-1.491)
C	.0587-.0589 (1.491-1.496)

CRANKSHAFT & MAIN BEARINGS

1. Main bearing caps are numbered on top of cap for location in cylinder block. No. 1 main bearing cap is at front of engine and No. 5 cap is at rear of engine. Note that arrow on top of main bearing cap points toward front of engine.
2. Remove main bearing cap bolts in sequence. See **Fig. 16** and **Fig. 17** . Cylinder block main bearing bore inside diameter is determined by size mark (No. "3", "4" or "5") stamped on cylinder block. See **Fig. 18** . Front size mark indicates No. 1 main journal and rear size mark indicates No. 5 main journal bore.
3. Ensure main bearing journal diameter, taper and out-of-round are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

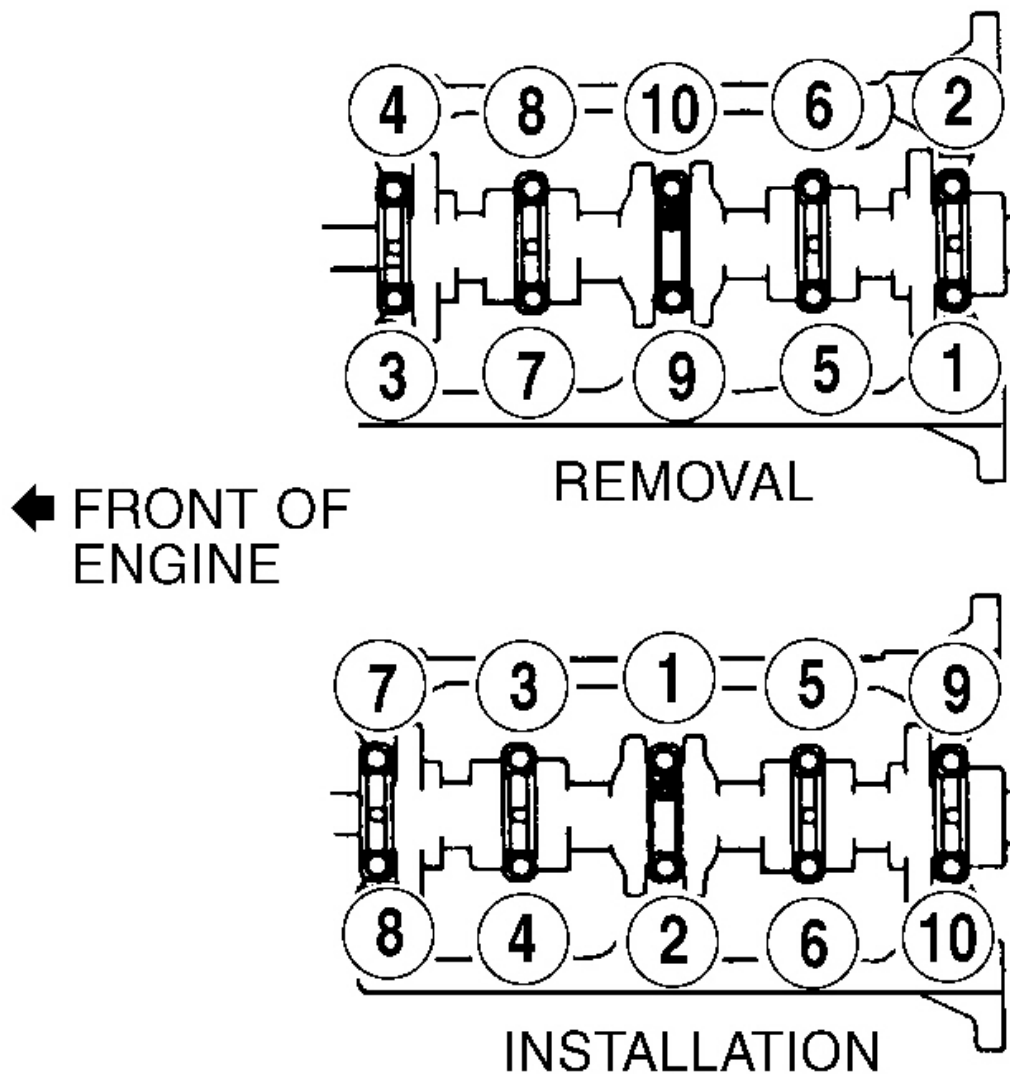
SPECIFICATIONS.

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

4. Main bearing size mark (No. "3", "4" or "5") is located on side of main bearing. See **Fig. 18** . If replacing main bearing, ensure size mark on replacement bearing is same as size mark on original bearing.
5. If size mark cannot be read, measure main bearing thickness to determine bearing size. See **MAIN BEARING SPECIFICATIONS** table.
6. Coat main bearing cap bolt threads and seat area of bolt with engine oil before installing. Tighten main bearing cap bolts to specification in sequence using several steps. See **Fig. 16** and **Fig. 17** . See **TORQUE SPECIFICATIONS** .
7. Ensure bearing oil clearance and crankshaft end play is within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS. Replace thrust bearing if end play is not within specification.

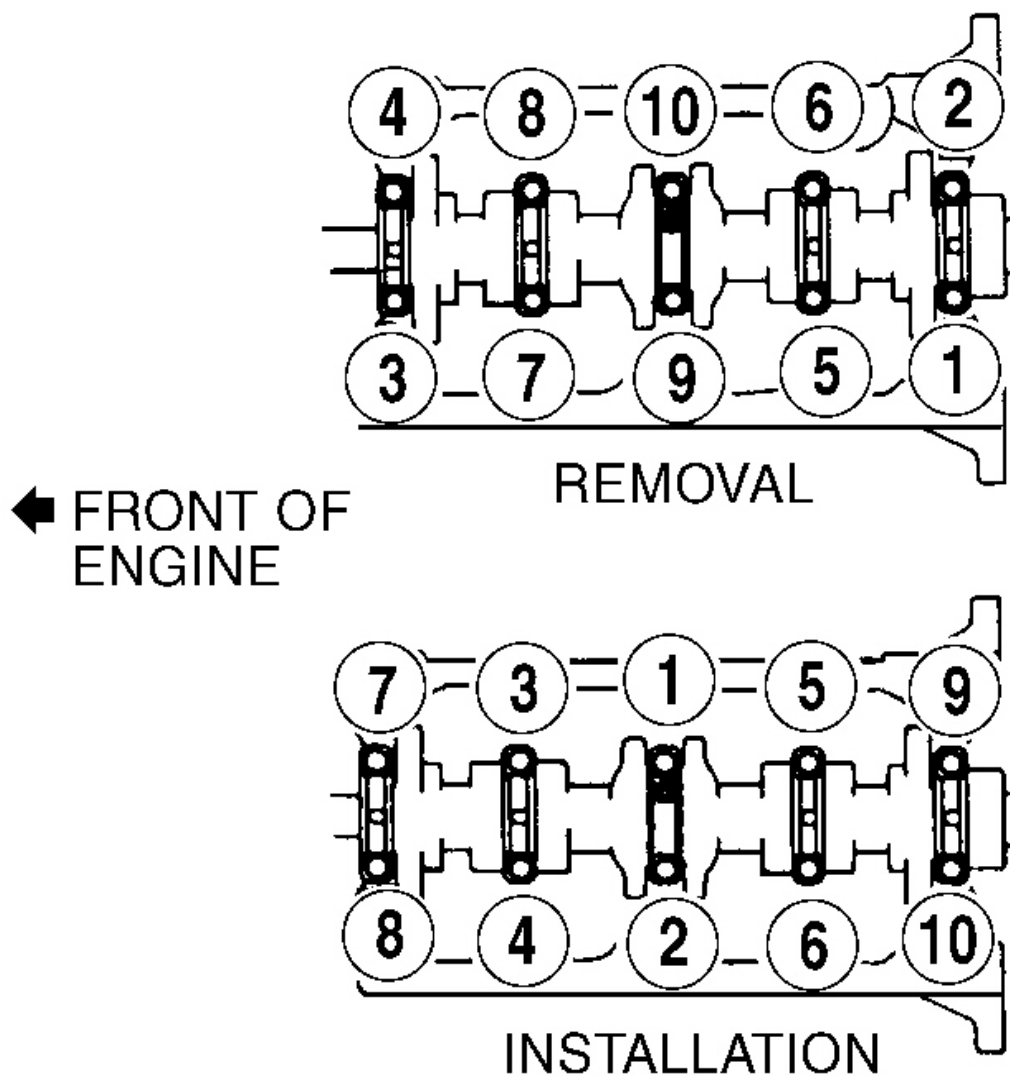
MAIN BEARING SPECIFICATIONS

Size Mark	Bearing Thickness: In. (mm)
3	.0783-.0784 (1.988-1.991)
4	.0784-.0786 (1.991-1.996)
5	.0786-.0787 (1.996-1.999)



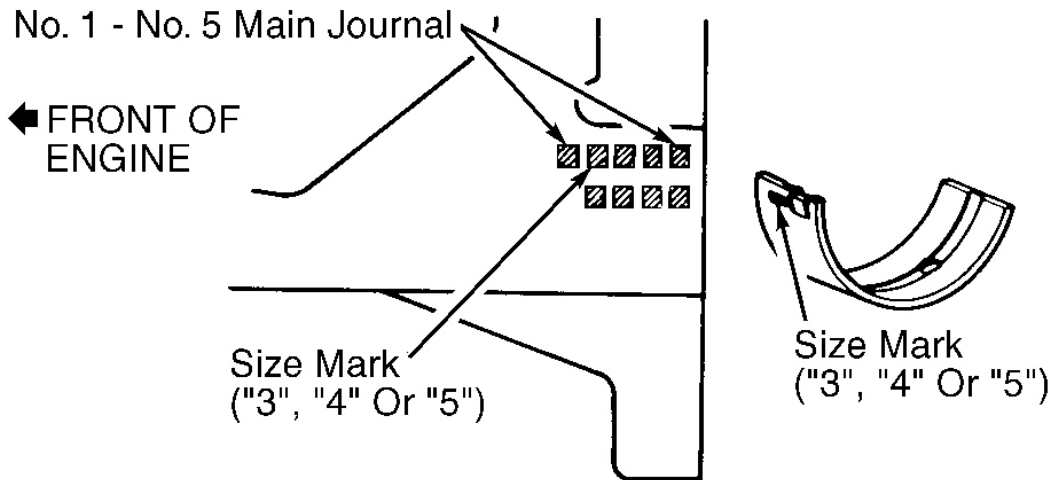
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Fig. 16: Main Bearing Cap Bolt Removal Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 17: Main Bearing Cap Bolt Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 18: Identifying 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. 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. Refer to **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
2. Different cylinder bore sizes are used and can be identified by size mark (No. "1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 13**. 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 if cylinder bore diameter exceeds specification. Cylinder block can be bored for .020" (.50 mm) or .040" (1.01 mm) oversize pistons.

NOTE: Main bearing bore inside diameter is determined by main bearing bore size mark (No. "3", "4" or "5") stamped on cylinder block. See **Fig. 18**.

4. Ensure main bearing bore inside diameter is within specification with main bearing caps installed and bolts tightened to specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

The crankshaft driven oil pump provides pressurized lubrication for engine lubrication. See **Fig. 19** .

Crankcase Capacity

Crankcase capacity with oil filter is 4.5 qts. (4.3L).

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.

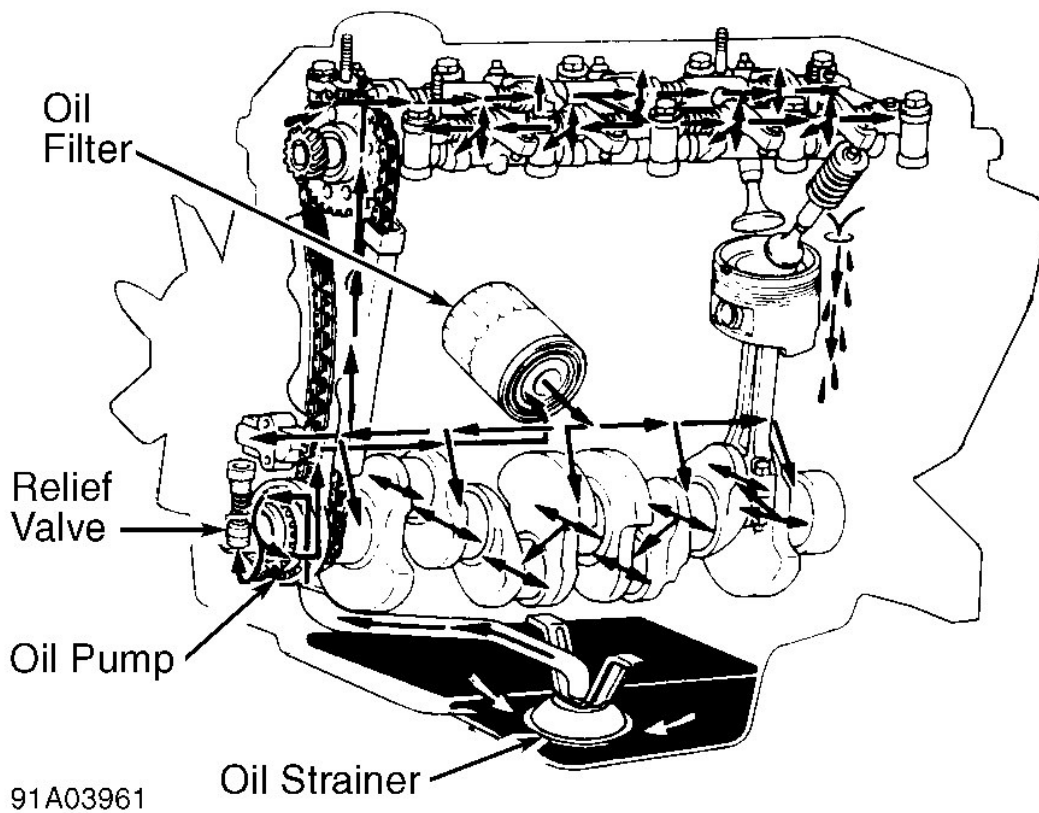


Fig. 19: Engine Oil Circuit

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

OIL PUMP

Removal & Disassembly

1. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. Remove retaining bolts and oil strainer. Remove accessory drive belt.
2. Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley, and remove retaining bolt. Using puller, remove crankshaft pulley.
3. Remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor bracket. On all models, remove retaining bolts, oil pump and "O"ring from front cover. Disassemble oil pump components. See [Fig. 20](#) .

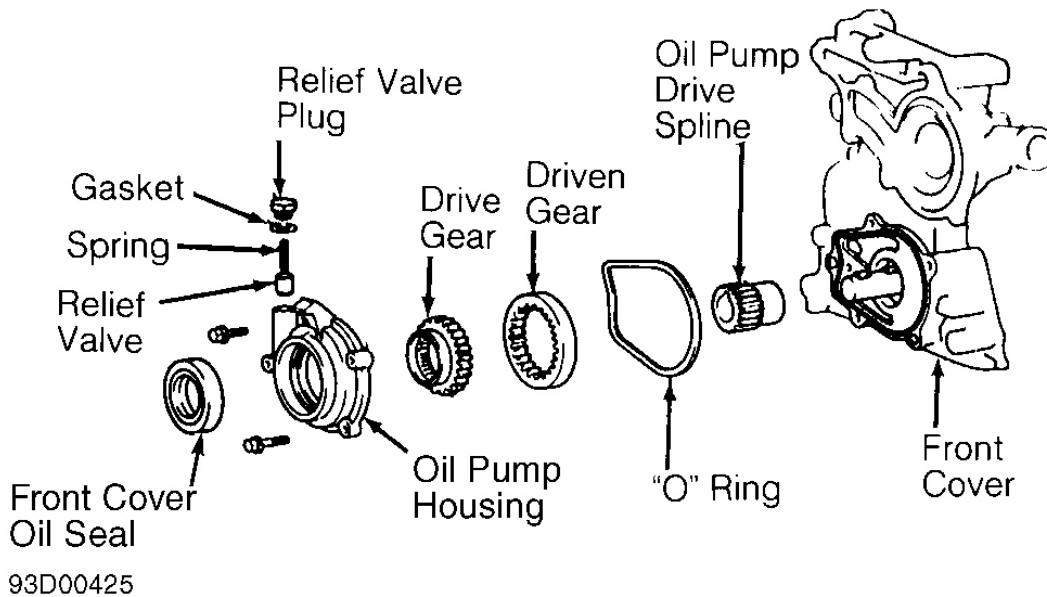


Fig. 20: Exploded View Of Oil Pump & Components

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

Inspection

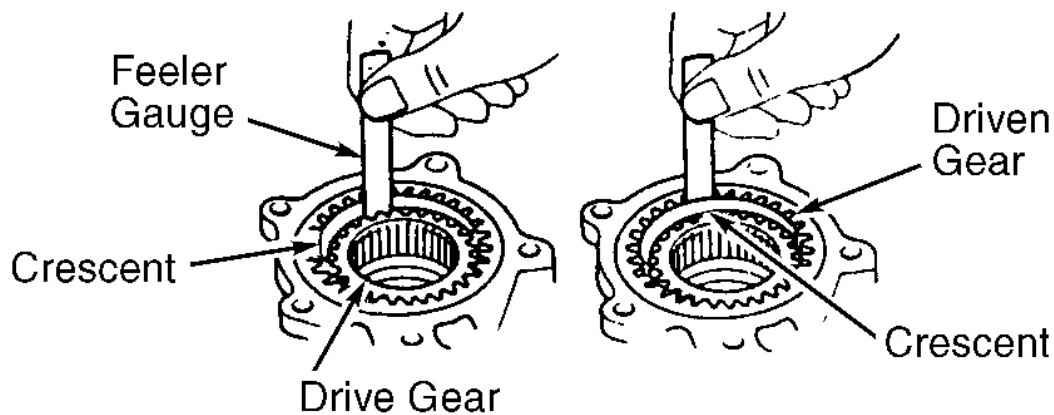
1. Inspect components for damage. Ensure relief valve slides freely in bore. Install drive and driven gears in oil pump housing.
2. Using feeler gauge, measure clearance between driven gear and oil pump housing. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.
3. Measure gear tip clearance between tip of gear and crescent in oil pump. See [Fig. 21](#) . Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.
4. Place straightedge across oil pump housing, above both gears. Measure gear end clearance between straightedge and gear surface. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.

OIL PUMP SPECIFICATIONS

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

Application	In. (mm)
Driven Gear-To-Housing Clearance	
Standard	.0035-.0059 (.089-.150)
Wear Limit	.008 (.20)
Gear End Clearance	
Standard	.0012-.0035 (.030-.089)
Maximum	.006 (.15)
Gear Tip-To-Crescent Clearance	
Drive Gear	
Standard	.0087-.0098 (.221-.249)
Wear Limit	.0120 (.300)
Driven Gear	
Standard	.0059-.0083 (.150-.211)
Wear Limit	.0120 (.300)

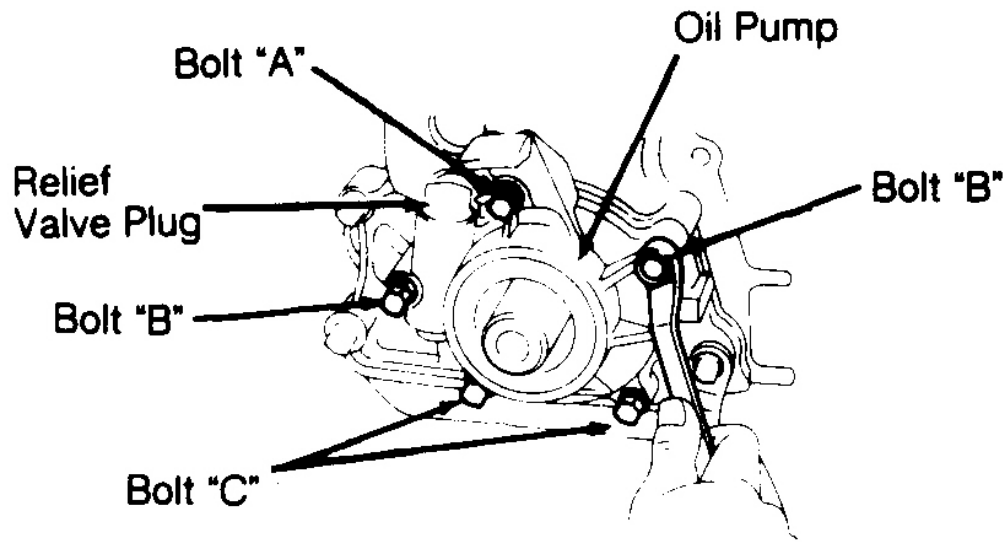


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Fig. 21: Measuring Oil Pump Gear Tip Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Reassembly & Installation

1. To reassemble, reverse disassembly procedure using NEW gasket on relief valve plug. Tighten relief valve plug to specification. See **TORQUE SPECIFICATIONS** .
2. Using Seal Installer (SST 09223-50010), install front cover oil seal (if removed) until seal surface is even with oil pump housing. Coat seal lip with grease.
3. Install NEW "O" ring and oil pump on front cover. Apply thread sealant to bolt "A" and install. See **Fig. 22** . Install remaining bolts and tighten to specification. See **Fig. 22** .



Bolt "A" - 18 Ft. Lbs. (24 N.m)
 Bolt "B" - 14 Ft. Lbs. (19 N.m)
 Bolt "C" - 108 INCH Lbs. (12 N.m)

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Fig. 22: Installing Oil Pump

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

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Air Intake Chamber-To-Intake Manifold Bolt	14 (19)
Camshaft Bearing Cap Bolt	14 (19)
Camshaft Sprocket Bolt	58 (79)
Connecting Rod Nut	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head/Rocker Arm Assembly Bolt ⁽¹⁾	58 (79)
Distributor Hold-Down Bolt	14 (19)
Drive Axle-To-Side Gear Flange Bolt	61 (83)
Exhaust Manifold Heat Insulator Bolt	14 (19)
Exhaust Manifold Nut	33 (45)
Flywheel/Drive Plate Bolt	
A/T	61 (83)

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

M/T	80 (109)
Front Cover Bolt	(2)
Front Differential Mount Bolts	
Left & Right Mount Bolt	123 (167)
Differential Cover Mount Bolt	108 (146)
Intake Manifold Bolt/Nut	14 (19)
Main Bearing Cap Bolt ⁽³⁾	76 (103)
Oil Cooler Relief Valve	51 (69)
Oil Pump Bolt	(4)
Rear Seal Housing Bolt	13 (18)
Relief Valve Plug	27 (37)
Spark Plug	13 (18)
Timing Chain Damper Bolt	16 (22)
Timing Chain Tensioner Bolt	14 (19)
INCH Lbs. (N.m)	
Cylinder Head Rear Plate Bolt	108 (12)
Cylinder Head-To-Front Cover Bolt	108 (12)
EGR Valve Bolt/Nut	108 (12)
No. 1 Air Injection Manifold Bolt/Nut	108 (12)
Oil Pan Bolt/Nut	108 (12)
Oil Strainer Bolt	108 (12)
Reed Valve Bolt	108 (12)
Valve Cover Nut	52 (6)
<p>(1) Tighten bolts to specification in sequence. See Fig. 2 -Fig. 3 .</p> <p>(2) Tighten 8-mm bolts to 108 INCH lbs. (12 N.m) and 10-mm bolts to 29 ft. lbs. (39 N.m).</p> <p>(3) Tighten bolts to specification in sequence. See Fig. 16 -Fig. 17 .</p> <p>(4) Tighten bolts as specified. See Fig. 22 .</p>	

ENGINE SPECIFICATIONS**GENERAL ENGINE SPECIFICATIONS**

Application	Specification
Displacement	146.4 Cu. In. (2.4L)
Bore	3.62" (91.9 mm)
Stroke	3.50" (88.9 mm)
Compression Ratio	9.3:1
Fuel System	PFI
Horsepower @ RPM	116 @ 4800
Torque Ft. Lbs. @ RPM	140 @ 2800

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.221)
Wear Limit	.012 (.30)
Runout	.004 (.10)
Main Bearings	
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0010-.0022 (.025-.056)
Wear Limit	.0031 (.079)
Connecting Rod Bearings	
Journal Diameter	2.0861-2.0866 (52.987-53.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0010-.0022 (.025-.056)
Wear Limit	.039 (.099)

CONNECTING RODS SPECIFICATIONS

Application	In. (mm)
Bore Diameter	
Crankpin Bore ⁽¹⁾	
Size Mark "A"	2.2047-2.2050 (56.000-56.007)
Size Mark "B"	2.2050-2.2052 (56.007-56.012)
Size Mark "C"	2.2052-2.2054 (56.012-56.017)
Maximum Bend	.0020 Per 3.94 (.050 Per 100.1)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	.0063-.0102 (.160-.259)
Wear Limit	.012 (.30)
(1) Crankpin bore diameter depends on size mark stamped on connecting rod cap. See Fig. 15 .	

PISTONS, PINS & RINGS SPECIFICATIONS

Application	In. (mm)
--------------------	-----------------

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

Pistons

Clearance	.0006-.0014 (.015-.036)
Diameter ⁽¹⁾	
Size Mark No. 1	3.6211-3.6214 (91.975-91.984)
Size Mark No. 2	3.6214-3.6218 (91.984-91.994)
Size Mark No. 3	3.6218-3.6222 (91.994-92.003)

Pins

Piston Fit	(2)
Rod Fit	.0002-.0004 (.005-.010)

Rings

No. 1	
End Gap	
Standard	.0098-.0185 (.249-.470)
Wear Limit	.0412 (1.069)

Side Clearance

Standard	.0012-.0028 (.030-.071)
Wear Limit	.008 (.20)

No. 2

End Gap	
Standard	.0236-.0323 (.599-.820)
Wear Limit	.0559 (1.420)

Side Clearance

Standard	.0012-.0028 (.030-.071)
Wear Limit	.008 (.20)

No. 3 (Oil)

End Gap	
Standard	.0079-.0224 (.201-.569)
Wear Limit	.0461 (1.171)

Side Clearance

Standard	.0012-.0028 (.030-.071)
Wear Limit	.008 (.20)

(1) Piston diameter is determined by size mark on top of piston. See **Fig. 12** .

(2) Piston pin should slide in piston using thumb pressure with piston heated to 176°F (80°C).

CYLINDER BLOCK SPECIFICATIONS

Application	In. (mm)
Cylinder Bore	
Standard Diameter ⁽¹⁾	
Size Mark No. 1	3.6220-3.6224 (91.999-92.009)

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

Size Mark No. 2	3.6224-3.6228 (92.009-92.019)
Size Mark No. 3	3.6228-3.6232 (92.019-92.029)
Main Bearing Bore Inside Diameter ⁽²⁾	
Size Mark No. 3	2.5198-2.5201 (64.003-64.011)
Size Mark No. 4	2.5201-2.5203 (64.011-64.016)
Size Mark No. 5	2.5203-2.5205 (64.016-64.021)
Maximum Deck Warpage	.002 (.05)
(1) Cylinder bore diameter depends on size mark on cylinder block deck surface. See Fig. 13 .	
(2) Main bearing bore inside diameter depends on size mark on cylinder block. See Fig. 18 .	

VALVES & VALVE SPRINGS SPECIFICATIONS

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.024" (.61 mm)
Minimum Refinish Length	4.448" (112.98 mm)
Stem Diameter	.3138-.3144" (7.971-7.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.024" (.61 mm)
Minimum Refinish Length	4.405" (111.89 mm)
Stem Diameter	.3136-.3142" (7.965-7.981 mm)
Valve Springs	
Free Length	1.909" (48.49 mm)
Out-Of-Square	.063" (1.60 mm)
Lbs. @ In. (kg @ mm)	
Pressure	
Valve Closed	66.1 @ 1.594 (29.9 @ 40.49)

CYLINDER HEAD SPECIFICATIONS

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.0059" (.150 mm)
Manifold Surface	.0079" (.201 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.19-1.60 mm)

1992 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1992 ENGINES Toyota - 2.4L 4-Cylinder

Exhaust Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.19-1.60 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	.5118-.5125" (13.000-13.018 mm)
Valve Guide I.D.	.3154-.3161" (8.011-8.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0010-.0024" (.025-.060 mm)
Wear Limit	.0031" (.079 mm)
Exhaust Valve	
Valve Guide Cylinder Head Bore I.D.	.5118-.5125" (13.000-13.018 mm)
Valve Guide I.D.	.3154-.3161" (8.011-8.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.031-.066 mm)
Wear Limit	.0039" (.099 mm)

CAMSHAFT SPECIFICATIONS

Application	In. (mm)
End Play	
Standard	.0031-.0071 (.079-.180)
Wear Limit	.0098" (.249 mm)
Journal Diameter	1.2984-1.2992 (32.980-33.000)
Journal Runout	.008 (.20)
Lobe Height	
Intake	
Standard	1.6783-1.6891 (42.630-42.720)
Wear Limit	1.6634" (42.250 mm)
Exhaust	
Standard	1.6807-1.6842 (42.690-42.780)
Wear Limit	1.6654" (42.301 mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.051)
Wear Limit	.004" (.10 mm)

1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

2.4L 4-CYL - VIN [R]

1993 TOYOTA ENGINES 2.4L 4-Cylinder

ENGINE IDENTIFICATION

Engine serial number is stamped the cylinder block, behind the alternator.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
2.4L 4-Cylinder	22R-E	R

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine at normal operating temperature.

1. Ensure engine is at normal operating temperature. Remove retaining nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing mark groove on crankshaft pulley aligns with "0" timing mark on front cover.
2. Ensure rocker arms on cylinder No. 1 are loose and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft 360 degrees and realign timing marks.
3. Using feeler gauge, check valve clearance between rocker arm and valve stem on intake valves on cylinders No. 1 and 2 and on exhaust valves on cylinders No. 1 and 3.
4. Ensure valve clearance is within specification. Refer to **VALVE CLEARANCE SPECIFICATIONS** table. If necessary, loosen rocker arm adjusting screw lock nut and rotate adjusting screw to obtain correct clearance. Tighten lock nut to specification. Refer to **TORQUE SPECIFICATIONS** . Recheck valve clearance.
5. Rotate crankshaft 360 degrees and realign timing marks. Check valve clearance on intake valves on cylinders No. 3 and 4, and exhaust valves on cylinders No. 2 and 4. Adjust valve clearance if necessary.
6. Using NEW gasket, install valve cover. Install and tighten retaining nuts to specification. See **TORQUE SPECIFICATIONS** .

VALVE CLEARANCE SPECIFICATIONS ⁽¹⁾

Application	In. (mm)
Exhaust Valve	.012 (.30)
Intake Valve	.008 (.20)

(1) Adjust valve clearance with engine at normal operating temperature.

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.

FUEL PRESSURE RELEASE

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

ENGINE

NOTE: Remove engine and transmission as an assembly.

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Remove hood, battery and lower engine covers. Drain cooling system and engine oil. Remove air cleaner case and intake air connector.
2. Remove radiator and accessory drive belts. Remove fan clutch along with fan and water pump pulley. Disconnect necessary electrical connections, vacuum hoses, coolant hoses and fuel lines.
3. Disconnect accelerator cable, throttle cable (A/T models) and cruise control cable (if equipped) at throttle body. Disconnect necessary ground straps. Remove power steering pump and A/C compressor with hoses attached and secure aside (if equipped).
4. Place reference marks on drive shaft flanges for reassembly reference. Remove retaining bolts and all drive shaft(s).
5. On M/T models, remove shift lever(s) from inside vehicle. On all models, disconnect necessary shift linkages, hoses and electrical connections at transmission and transfer case (if equipped).
6. On 4WD A/T models, disconnect transfer case shift linkage from cross shaft at transfer case. Remove bolts and cross shaft.
7. On all 4WD models, remove transfer case protective plates located below transfer case. On 4WD Pickup and all 4Runner models, remove stabilizer bar (if equipped). On all models, disconnect speedometer cable.

NOTE: DO NOT lose felt dust protector and washers from speedometer cable.

8. Disconnect oxygen sensor connector. Remove front exhaust pipe, located between exhaust manifold and catalytic converter.
9. On 2WD models, support transmission with floor jack. Remove rear engine mount and bracket at transmission. On M/T models, remove clutch release cylinder with hoses attached and secure aside.
10. On 4WD models, remove front floor heat insulator and brake tube heat insulator. Support transmission

with floor jack. Remove retaining bolts and crossmember located below transmission.

11. On all models, support engine with hoist. Remove engine mount bolts/nuts. Lift engine and transmission assembly from vehicle.

Installation

To install, reverse removal procedure. Ensure reference marks are aligned on drive shaft flanges. Adjust all fluid levels, control cables and shift linkages.

CYLINDER HEAD & MANIFOLDS

Removal

1. Disconnect negative battery cable. Drain cooling system. Remove air intake from air intake chamber. Disconnect exhaust pipe from exhaust manifold.
2. Remove oil dipstick. Remove distributor and spark plugs. Disconnect necessary electrical connections, coolant hoses, vacuum hoses and control cables.
3. Remove EGR vacuum modulator. Remove air intake chamber along with throttle body. See **Fig. 1** . Release fuel pressure. Refer to **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Disconnect necessary fuel lines.
4. Remove power steering pump bracket-to-cylinder head bolts (if equipped). Remove retaining nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
5. Ensure rocker arms on cylinder No. 1 are loose and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft 360 degrees and realign timing marks.
6. Paint reference mark on camshaft sprocket and timing chain for reassembly reference. Remove half-circular seal and camshaft sprocket retaining bolt.
7. Remove distributor drive gear and thrust plate from camshaft sprocket. See **Fig. 1** . Remove camshaft sprocket and timing chain from camshaft. Allow camshaft sprocket and timing chain to rest in cylinder head.

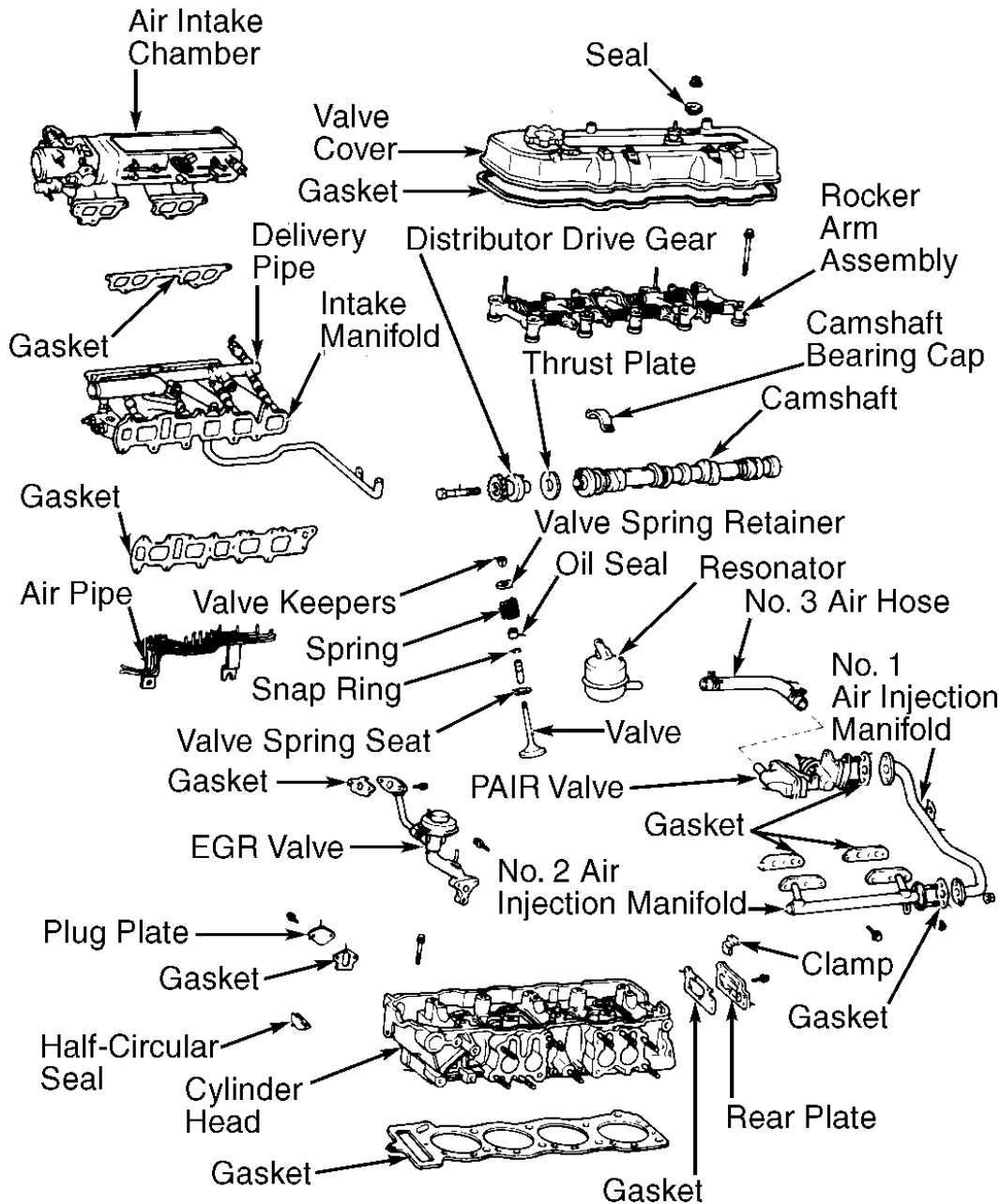
CAUTION: DO NOT allow timing chain to become disengaged from crankshaft sprocket.

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

8. Remove cylinder head-to-front cover bolt, located on cylinder head in front of camshaft sprocket area. Loosen cylinder head/rocker arm assembly bolts in sequence using several steps. See **Fig. 2** .
9. Remove rocker arm assembly. If necessary for removal, pry equally at front and rear of rocker arm assembly. Remove cylinder head by lifting upward from dowels on cylinder block.

NOTE: If cylinder head removal is difficult, carefully pry with flat bar between cylinder head and projecting areas on cylinder block.

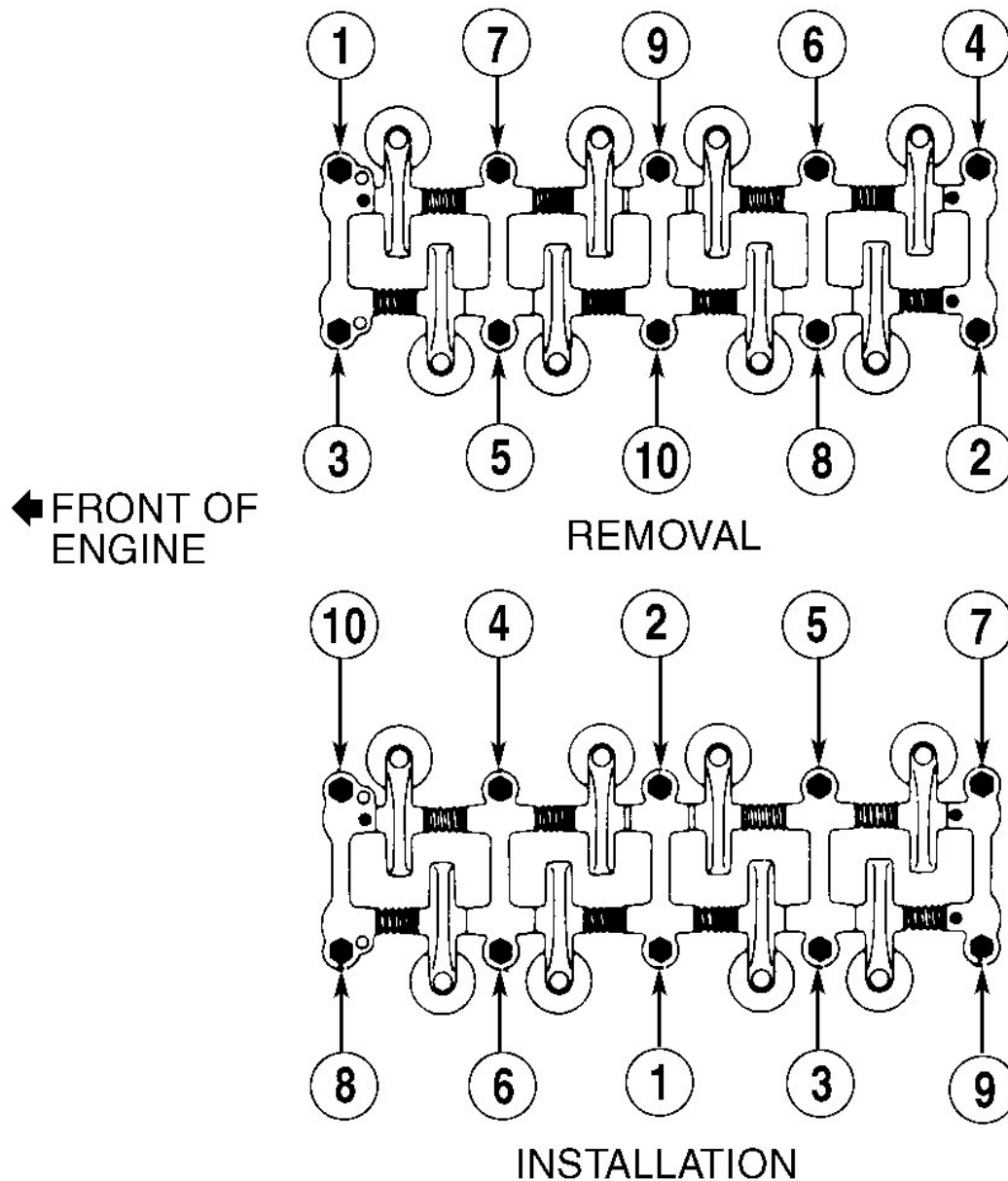
10. Remove retaining bolts/nuts, No. 1 air injection manifold gaskets and PAIR valve. See **Fig. 1** . Remove air pipe. Remove intake manifold as an assembly with delivery pipe, fuel injectors and heater coolant inlet pipe.
11. Remove EGR valve. Remove heat insulators, exhaust manifold and gasket. Remove rear plate and gasket. See **Fig. 1** .



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Fig. 1: Exploded View Of Cylinder Head & Components

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



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Fig. 2: Cylinder Head/Rocker Arm Assembly Bolt Removal & Installation Sequence

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

Inspection

1. Inspect cylinder head warpage at cylinder block and manifold areas. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Inspect air intake chamber-to-intake manifold and intake manifold-to-cylinder head surfaces for warpage. Replace air intake chamber or intake manifold if warpage exceeds .008" (.20 mm).
3. Inspect exhaust manifold-to-cylinder head surface for warpage. Replace exhaust manifold if warpage exceeds .028" (.70 mm).
4. Inspect cylinder block deck surface for warpage. Replace cylinder block if deck warpage exceeds specification. Refer to **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

Installation

1. Install components on cylinder head using NEW gaskets. Use NEW nuts when installing exhaust manifold. Tighten all bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.

NOTE: **Ensure EGR valve-to-cylinder head bolt hole threads are clean. Apply thread sealant on front bolt (closest to front of cylinder head) for EGR valve before installing bolt.**

2. Apply liquid sealant at both front corners of cylinder block-to-front cover areas. Install NEW cylinder head gasket. Ensure cylinder head gasket aligns with dowels in cylinder block.
3. Install cylinder head and rocker arm assembly. Ensure rocker arm assembly aligns with dowels in cylinder head. Install and tighten cylinder head/rocker arm assembly bolts to specification in sequence using 3 steps. See **Fig. 2**. Refer to **TORQUE SPECIFICATIONS**.
4. Install cylinder head-to-front cover bolt and tighten to specification. See **TORQUE SPECIFICATIONS**. Ensure reference mark on camshaft sprocket and timing chain are aligned. Hold camshaft sprocket and timing chain upward.
5. If cylinder No. 1 is not at TDC on compression stroke, rotate crankshaft so cylinder No. 1 is at TDC on compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
6. Install camshaft sprocket and timing chain on camshaft. It may be necessary to slightly rotate crankshaft back and forth while pulling upward on timing chain and camshaft sprocket.
7. Install thrust plate and distributor drive gear. Install and tighten camshaft sprocket bolt to specification. Refer to **TORQUE SPECIFICATIONS**. Adjust valve clearance. Refer to **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

NOTE: **Adjust valve clearance initially with engine cold and then readjust with engine at normal operating temperature.**

8. To install remaining components, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS**. Install NEW "O" ring on distributor before installing.
9. Before installing valve cover, ensure half-circular seals are installed at front and rear of cylinder head. Apply sealant at half-circular seals-to-cylinder head surfaces.
10. Install valve cover using NEW gasket. Install seals and retaining nuts. Tighten retaining nuts to specification. Refer to **TORQUE SPECIFICATIONS**. Adjust fluid levels, control cables and ignition

timing.

FRONT COVER OIL SEAL

Removal & Installation (Front Cover Removed)

Pry oil seal from oil pump housing, located on front cover. To install, use Oil Seal Installer (SST 09223-50010). Install oil seal until oil seal surface is even with oil pump housing surface. Apply grease to lip of oil seal.

Removal & Installation (Front Cover Installed)

1. Remove accessory drive belts. Remove accessory drive pulley from front of crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley. Remove crankshaft pulley retaining bolt.
2. Using puller, remove crankshaft pulley. Cut lip from oil seal. Pry oil seal from oil pump housing, located on front cover. Use care not to damage sealing surfaces.
3. To install, apply grease to lip of oil seal. Using Oil Seal Installer (SST 09223-50010), install oil seal until oil seal surface is even with oil pump housing surface.
4. To install remaining components, reverse removal procedure. Tighten crankshaft pulley retaining bolt to specification. See **TORQUE SPECIFICATIONS**.

TIMING CHAIN

NOTE: **Cylinder head must be removed for servicing timing chain, as cylinder head gasket seals on front cover. On 4WD models, front differential must be removed for servicing timing chain.**

Removal

1. Remove cylinder head. See **CYLINDER HEAD & MANIFOLDS** under REMOVAL & INSTALLATION. Remove radiator.
2. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges on front differential. Place reference marks on drive shaft flanges for reassembly reference. Remove retaining bolts from drive shaft flange. Disconnect drive shaft from front differential.
3. Disconnect necessary vacuum hoses and electrical connectors at front differential. Support front differential assembly with floor jack. Remove front differential assembly mounting bolts. Lower front differential assembly from vehicle.
4. On all models, remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. Remove power steering belt (if equipped). Remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor mounting bracket (if equipped).
5. Remove fan clutch along with fan and water pump pulley. Remove accessory drive pulley from crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley.
6. Remove crankshaft pulley retaining bolt. Using puller, remove crankshaft pulley. Disconnect coolant bypass pipe on passenger's side from front cover. Remove alternator adjusting bracket. Disconnect heater outlet pipe, located near alternator, from front cover.

7. Remove front cover bolts. See **Fig. 3** . Remove front cover and gaskets. Remove timing chain from timing chain dampers. See **Fig. 4** . Remove camshaft sprocket and timing chain. Using gear puller, remove oil pump drive spline and crankshaft sprocket (if necessary). See **Fig. 4** .

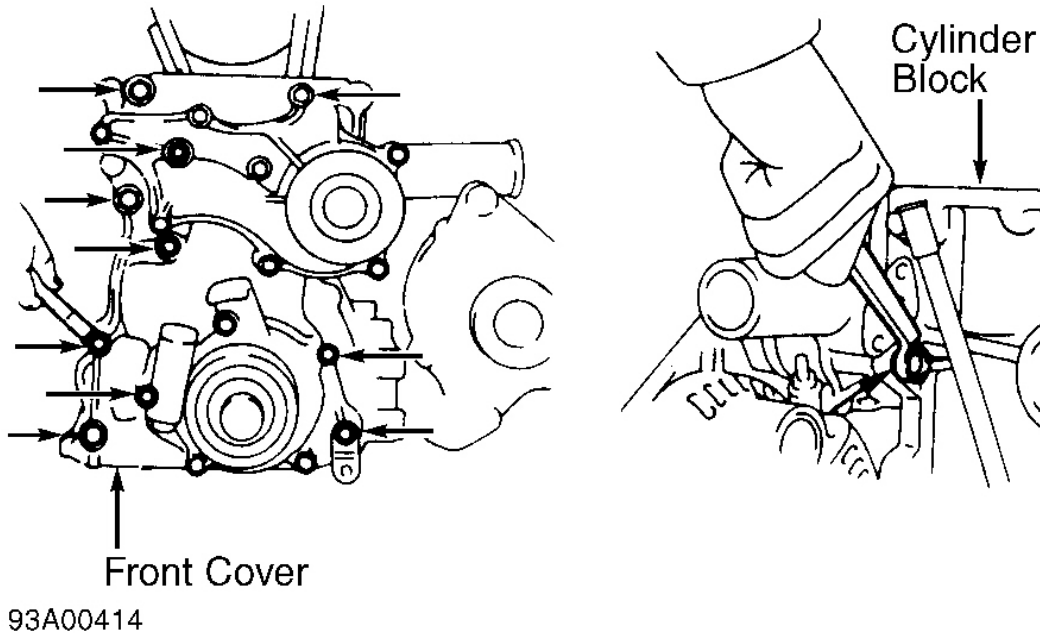
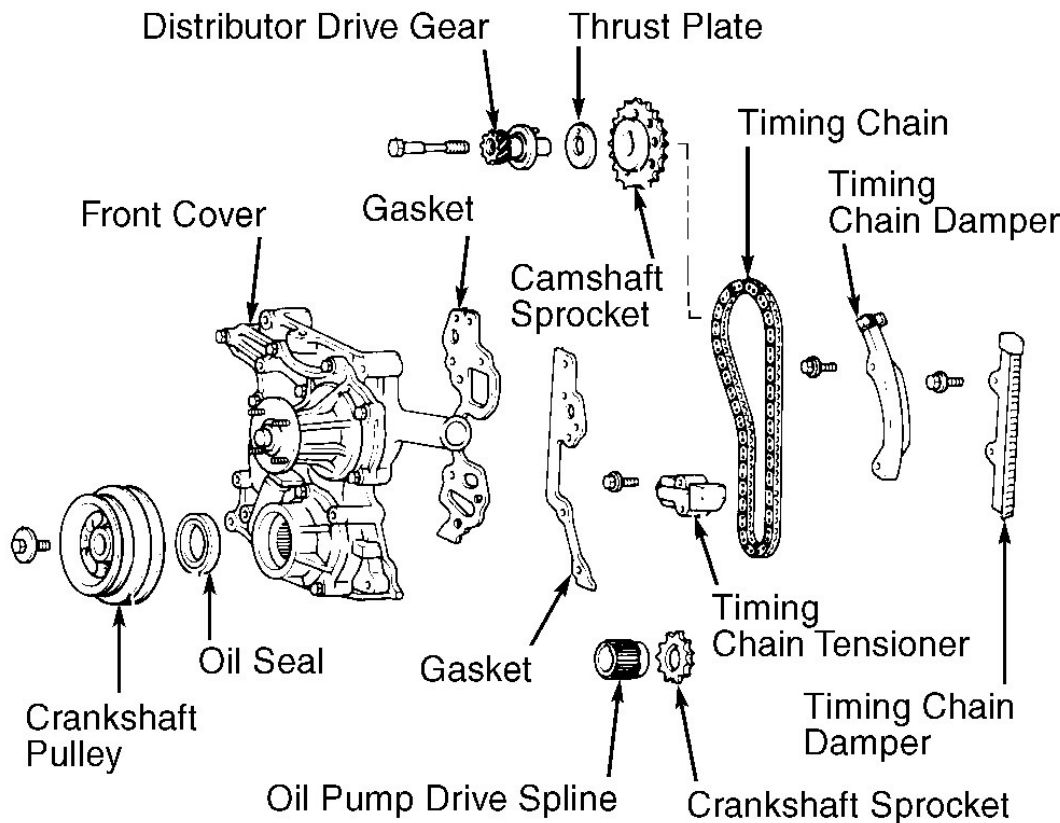


Fig. 3: Identifying Front Cover Bolts

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



93B00415

Fig. 4: Exploded View Of Timing Chain & Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect components for damage and wear. Using caliper, measure timing chain tensioner width. See **Fig. 5**. Replace timing chain tensioner if width is .433" (11.00 mm) or less.
2. Measure thickness of timing chain dampers. Replace timing chain dampers if thickness is .020" (.50 mm) or less. Using caliper, measure length of 17 links with timing chain fully stretched. See **Fig. 6**. Repeat measurement in at least 3 areas on timing chain. Replace timing chain if length of 17 links exceeds 5.79" (147.0 mm).
3. Wrap timing chain completely around camshaft sprocket. Using caliper, measure outside diameter of timing chain and camshaft sprocket. See **Fig. 6**. Using same method, measure outside diameter of crankshaft sprocket and timing chain.
4. Replace timing chain and sprockets if outside diameter is less than specified. See TIMING CHAIN & SPROCKET OUTSIDE DIAMETER SPECIFICATIONS table.

TIMING CHAIN & SPROCKET OUTSIDE DIAMETER SPECIFICATIONS

Application	In. (mm)
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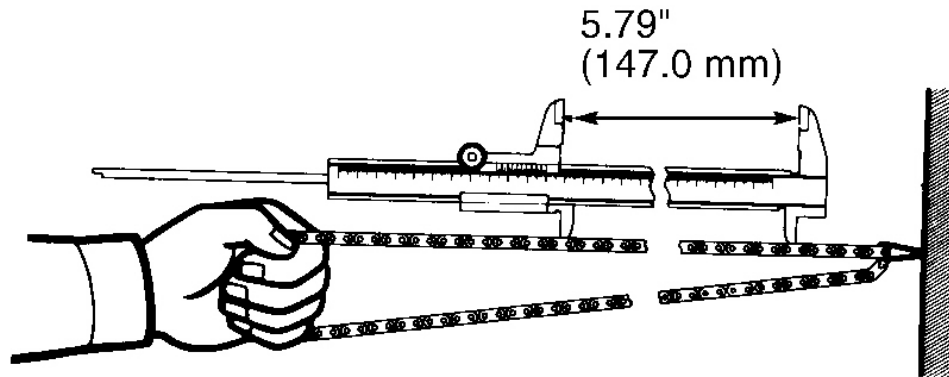
1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

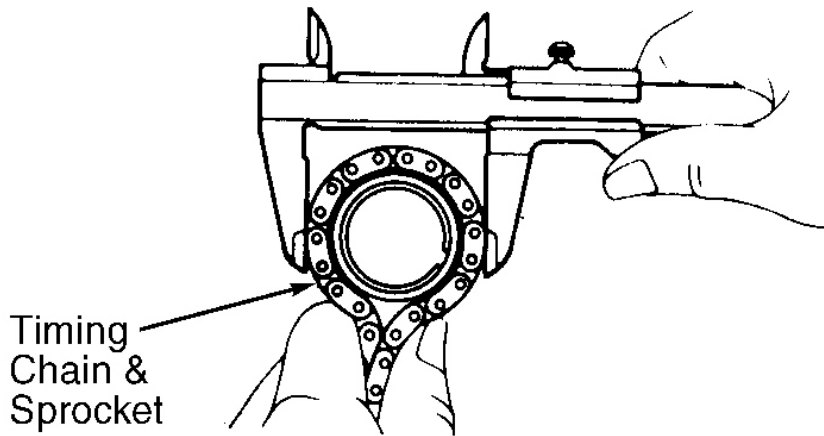
Timing Chain & Camshaft Sprocket	4.480 (113.80)
Timing Chain & Crankshaft Sprocket	2.339 (59.40)



Fig. 5: Measuring Timing Chain Tensioner Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



MEASURING TIMING CHAIN



MEASURING TIMING CHAIN & SPROCKET OUTSIDE DIAMETER

93D00417

Fig. 6: Measuring Timing Chain & Sprockets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Installation

1. Ensure crankshaft is positioned with keyway at 12 o'clock position. Install crankshaft sprocket on crankshaft with flat side toward front of engine.

CAUTION: Ensure crankshaft sprocket is installed with flat side toward front of engine. See Fig. 7 .

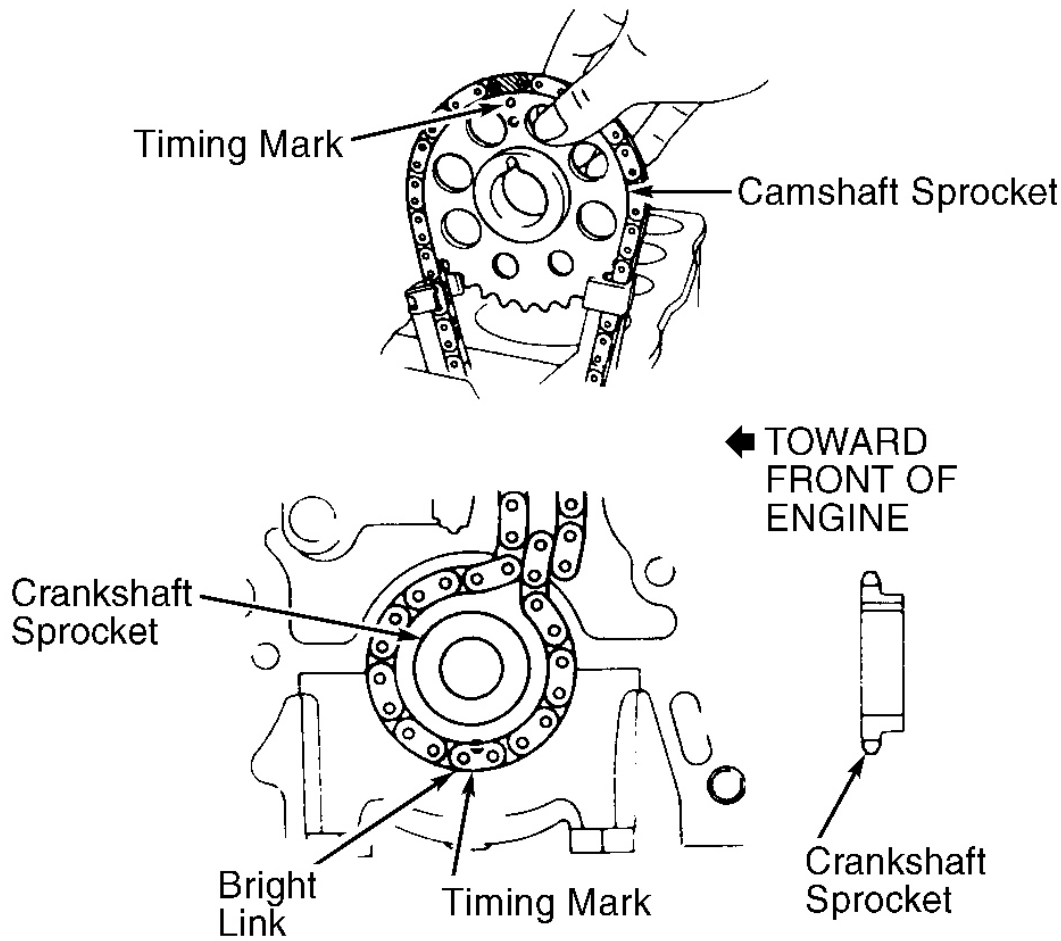
2. Install timing chain on crankshaft sprocket with bright link aligned with timing mark on crankshaft

sprocket. See **Fig. 7** . Install timing chain on camshaft sprocket with bright link aligned with timing mark on camshaft sprocket. See **Fig. 7** . Ensure timing chain is positioned between timing chain dampers.

3. Rotate crankshaft counterclockwise (viewed from front of engine) to take slack out of timing chain. Install oil pump drive spline over crankshaft key.
4. Using NEW gasket, install front cover. Install and tighten front cover retaining bolts to specification. Refer to **TORQUE SPECIFICATIONS** .
5. Ensure oil pan sealing surfaces are clean. Apply a .20" (5.0 mm) diameter bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing areas.

6. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing areas. Install oil pan. Install and tighten oil pan bolts/nuts to specification. Refer to **TORQUE SPECIFICATIONS** .
7. To install remaining components, reverse removal procedure. Tighten fasteners to specification. Refer to **TORQUE SPECIFICATIONS** .
8. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with gear oil.
9. On 4WD models with automatic disconnecting hubs on front axle, use hypoid gear oil SAE 75W-90 with API rating of GL-5. On 4WD models with manual hubs on front axle, use hypoid gear oil SAE 80W-90 with API rating of GL-5.



93E00418

Fig. 7: Installing Timing Chain & Sprockets
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ROCKER ARM ASSEMBLY

Removal & Installation

Rocker arm assembly procedure is listed with cylinder head and manifold procedure. Rocker arm assembly is attached with cylinder head/rocker arm assembly bolts. See **CYLINDER HEAD & MANIFOLDS** under REMOVAL & INSTALLATION.

CAMSHAFT

Removal

1. Remove distributor. Remove rocker arm assembly and camshaft sprocket. Rocker arm assembly is

attached with cylinder head/rocker arm assembly bolts. See **CYLINDER HEAD & MANIFOLDS** under REMOVAL & INSTALLATION.

2. Measure camshaft end play before removing camshaft. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
3. Note direction of camshaft bearing cap installation for reassembly reference. Camshaft bearing caps are numbered in sequence with No. 1 at front (timing chain end) of engine.
4. Ensure arrow on top of camshaft bearing cap points toward front of engine. Remove bolts, camshaft bearing caps and camshaft.

Inspection

1. Inspect components for damage. Check camshaft journal diameter, lobe height and 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. See **TORQUE SPECIFICATIONS**.
3. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.

Installation

1. To install, reverse removal procedure. Ensure camshaft bearing caps are installed in numerical order with No. 1 at front (timing chain end) of engine. Ensure arrow on top of camshaft bearing cap points toward front of engine.
2. Install and tighten camshaft bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**. Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transmission, clutch assembly (if equipped) and flywheel/drive plate. Using a knife, cut off seal lip from oil seal. 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. Using Oil Seal Installer (SST 09223-41020), install oil seal until oil seal is even with rear seal housing surface.
2. Install and tighten flywheel/drive plate bolts to specification. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.

WATER PUMP

Removal & Installation

1. Drain cooling system. Remove power steering pump and A/C compressor drive belts (if equipped). Remove fan clutch along with fan and water pump pulley.

2. Remove 6 bolts and 3 nuts retaining water pump. Remove water pump and gasket. To install, reverse removal procedure using NEW gasket. Fill cooling system.

OIL PAN

Removal

1. Drain engine oil. Raise and support vehicle. Remove lower engine covers. On 2WD models, remove engine mount bolts. Place a floor jack under transmission and raise engine about 1.00" (25.4 mm) if necessary.
2. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges on front differential. Place reference marks on drive shaft flanges for reassembly reference. Remove retaining bolts from drive shaft flange. Disconnect drive shaft from front differential.
3. Disconnect necessary vacuum hoses and electrical connectors at front differential. Support front differential assembly with floor jack. Remove front differential assembly mounting bolts. Lower front differential assembly from vehicle.
4. On all models, remove oil pan retaining bolts/nuts. Install Oil Pan Seal Cutter (SST 09032-00100), between cylinder block and oil pan. Tap oil cutter along sides of oil pan to remove oil pan. Use care not to damage sealing surfaces or oil pan flange.

Installation

1. Ensure sealing surfaces are clean. Apply a .20" (5.0 mm) diameter bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing areas.

2. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing areas. Install oil pan. Install and tighten oil pan bolts/nuts to specification. Refer to **TORQUE SPECIFICATIONS**.
3. To install remaining components, reverse removal procedure. Tighten fasteners to specification. Refer to **TORQUE SPECIFICATIONS**. Fill crankcase with oil.
4. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with gear oil. On 4WD models with automatic disconnecting hubs on front axle, use hypoid gear oil SAE 75W-90 with API rating of GL-5. On 4WD models with manual hubs on front axle, use hypoid gear oil SAE 80W-90 with API rating of GL-5.

OVERHAUL

CYLINDER HEAD

1. Inspect cylinder head warpage at cylinder block and manifold surfaces. 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. See **TORQUE SPECIFICATIONS**.

3. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
4. Measure camshaft end play. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** 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

Lubricate valve stem oil seal with engine oil. Install valve stem oil seal. Ensure valve stem oil seal is fully seated.

VALVE GUIDES

1. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.
2. To replace valve guide, hit top of valve guide to break off old valve guide, using hammer and brass drift. Heat cylinder head to 194°F (90°C).
3. Using hammer and Valve Guide Remover/Installer (SST 09201-60011), drive valve guide from camshaft side of cylinder head. Measure cylinder head valve guide bore inside diameter.
4. If bore inside diameter is .5118-.5125" (13.000-13.018 mm), use standard valve guide. If bore inside diameter is greater than .5125" (13.018 mm), machine valve guide bore to .5138-.5145" (13.050-13.068 mm) for oversize valve guide.
5. To install valve guide, heat cylinder head to 194°F (90°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 cylinder head surface.
6. Using .236" (6.00 mm) reamer, ream valve guide to obtain specified 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.

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 60-degree (intake valves), 65-degree

(exhaust valves) and 45-degree stones to raise valve seat contact area.

VALVE TRAIN

CAUTION: Ensure rocker arm assembly components are marked for location. Components must be installed in original location.

Rocker Arm Assembly

1. If rocker arms appear loose on shaft, disassemble rocker arm assembly. Measure rocker arm inside diameter, shaft outside diameter and determine oil clearance. Replace components if not within specification. See **ROCKER ARM ASSEMBLY SPECIFICATIONS** table.

ROCKER ARM ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.050)
Wear Limit	.0031 (.080)
Rocker Arm Inside Diameter	.6299-.6306 (16.000-16.018)
Shaft Outside Diameter	.6287-.6295 (15.970-15.990)

2. To reassemble, reverse disassembly procedure. Note that rocker arms are identical, but rocker arm stands are different and must be installed in correct location. See **Fig. 8**.

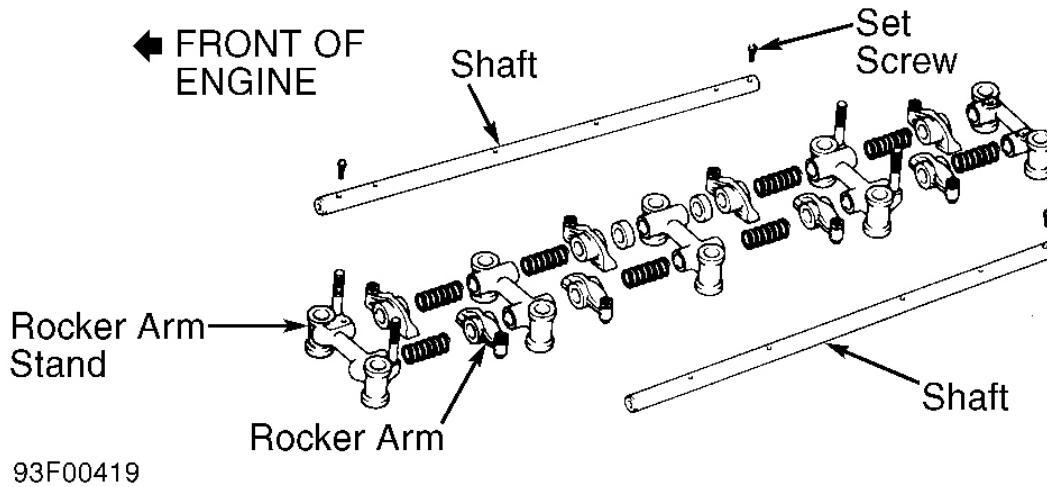


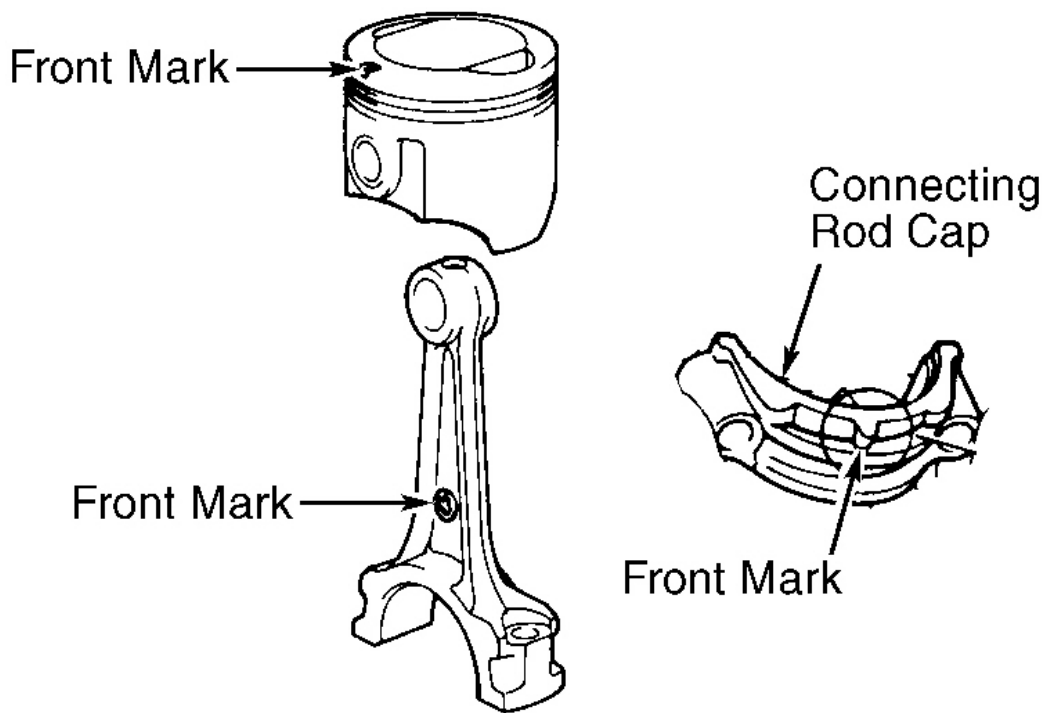
Fig. 8: Exploded View Of Rocker Arm Assembly
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

PISTON & ROD ASSEMBLY

1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. When removing piston from connecting rod, remove snap rings from piston.
2. Heat piston to 176°F (80°C) in water. Remove piston pin. Separate piston from connecting rod.
3. Measure piston pin outside diameter and connecting rod bushing inside diameter. Ensure piston pin-to-rod fit is within specification. See **PISTONS**, PINS & RINGS table under ENGINE SPECIFICATIONS.
4. Bushing can be replaced in connecting rod if piston pin-to-rod fit exceeds specification. Ensure bushing oil hole aligns with connecting rod oil hole. Bushing must be honed to obtain correct piston pin-to-rod clearance.

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

5. To reassemble, install piston on connecting rod so front mark on piston and connecting rod are aligned. See **Fig. 9**. Install NEW snap ring in piston. Heat piston to 176°F (80°C) in water. Install piston pin and remaining NEW snap ring.

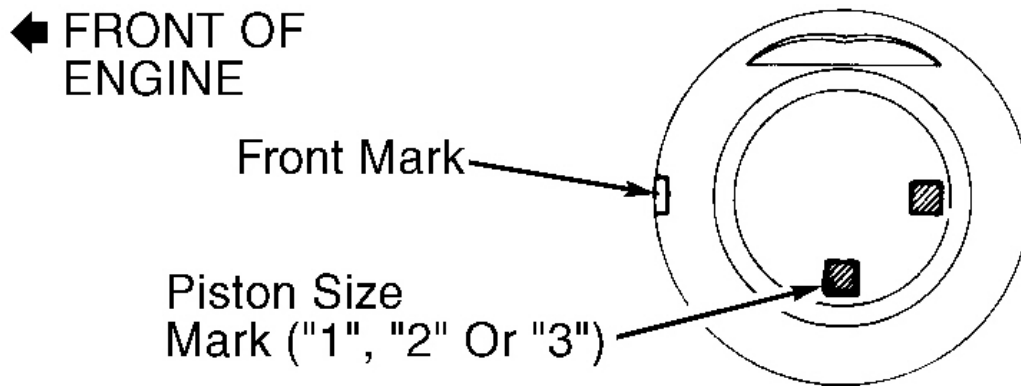


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Fig. 9: Aligning Connecting Rod & Piston
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

FITTING PISTONS

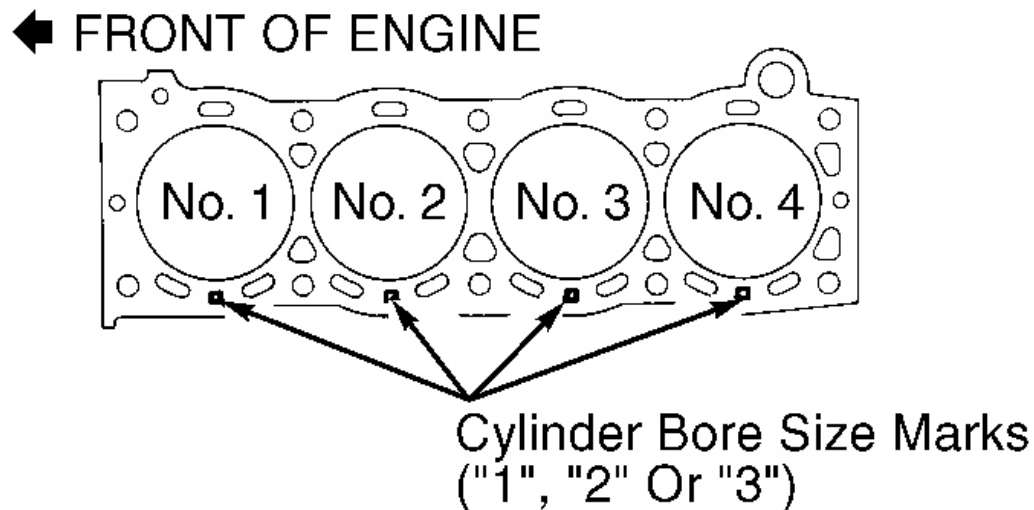
1. To determine if piston-to-cylinder clearance is within specification, measure piston skirt diameter at 1.30" (33.0 mm) from top of piston, at 90-degree angle to piston pin.
2. Different piston sizes are used. Piston diameter is determined by piston size mark ("1", "2" or "3") stamped on top of piston. See **Fig. 10** . 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 cylinder bore and at middle of cylinder bore. Different cylinder bore sizes are used. Cylinder bore diameter can be identified by cylinder bore size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 11** .
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 if piston clearance is not within specification. See **PISTONS** , **PINS & RINGS** table under ENGINE SPECIFICATIONS. Cylinder block can be bored for .020" (.50 mm) or .040" (1.00 mm) oversize pistons.



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Fig. 10: Identifying Piston Size Marks

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



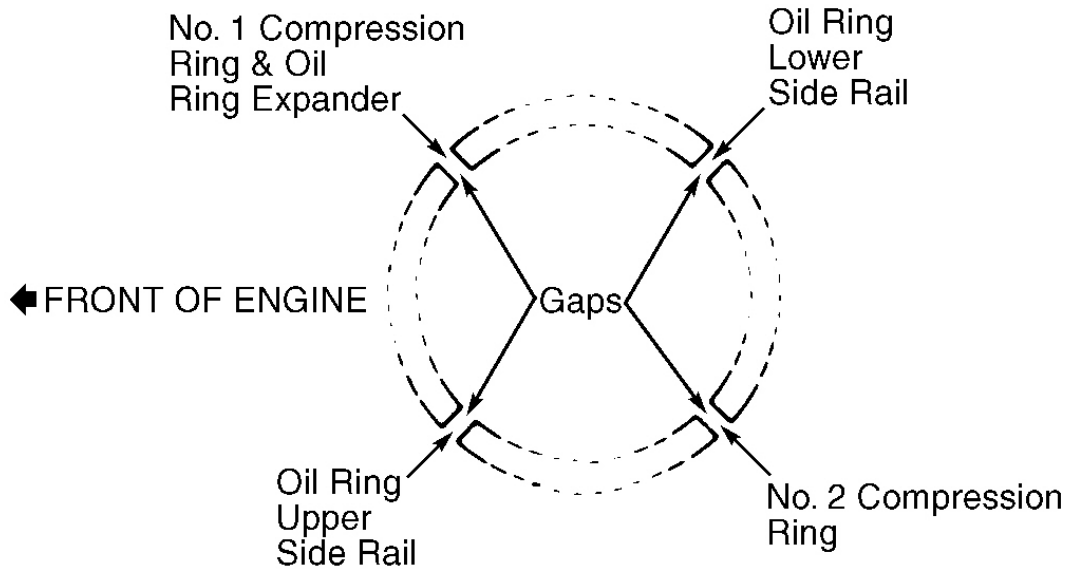
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Fig. 11: Identifying Cylinder Bore Size Marks

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 rings with ring end gaps in proper areas, with identification mark on piston ring toward top of piston. See **Fig. 12** .



93A00422

Fig. 12: 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 with front mark toward front of engine. See **Fig. 9** .
2. Connecting rod cap and rod bearing are stamped with size mark "A", "B" or "C". See **Fig. 13** . Ensure size marks on connecting rod cap and rod bearing are the same. Rod bearing thickness is determined by rod bearing size mark. See **ROD BEARING SPECIFICATIONS** table.

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

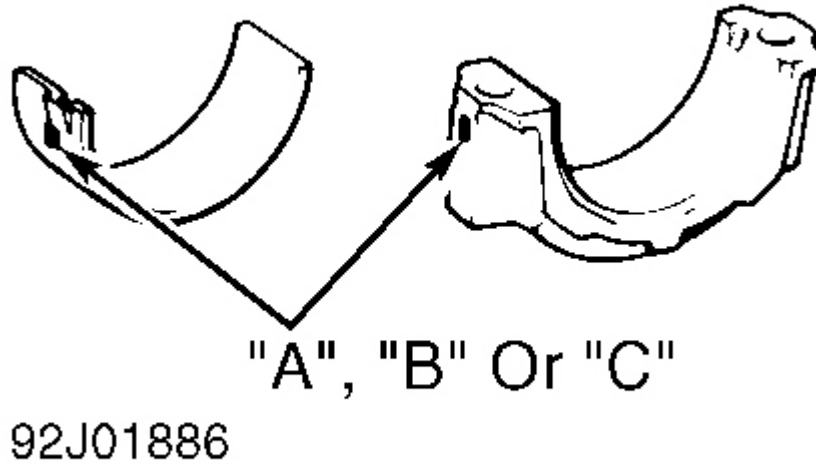


Fig. 13: Identifying Connecting Rod Cap & Bearing Size Marks

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

3. Ensure connecting rod and connecting rod cap are installed with front mark toward front of engine. See **Fig. 9** . Coat nut and threads of connecting rod bolts with engine oil before tightening to specification. See **TORQUE SPECIFICATIONS** .
4. Ensure bearing oil clearance and connecting rod side play are within specification. See **CRANKSHAFT** , **MAIN & CONNECTING ROD BEARINGS** and **CONNECTING RODS** tables under ENGINE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS

Bearing Size Mark	Bearing Thickness: In. (mm)
"A"	.0584-.0586 (1.484-1.488)
"B"	.0586-.0587 (1.488-1.492)
"C"	.0587-.0589 (1.492-1.496)

CRANKSHAFT & MAIN BEARINGS

1. Main bearing caps are numbered on top of main bearing cap for location in cylinder block. No. 1 main bearing cap is at front of engine and No. 5 main bearing cap is at rear of engine. Note that arrow on top of main bearing cap points toward front of engine.
2. Remove main bearing cap bolts in sequence. See **Fig. 14** . Cylinder block main bearing bore inside diameter is determined by size mark ("3", "4" or "5") stamped on cylinder block. See **Fig. 15** . Front size mark indicates No. 1 main journal and rear size mark indicates No. 5 main journal.
3. Ensure crankshaft main bearing journal diameter, taper and out-of-round are within specification. See

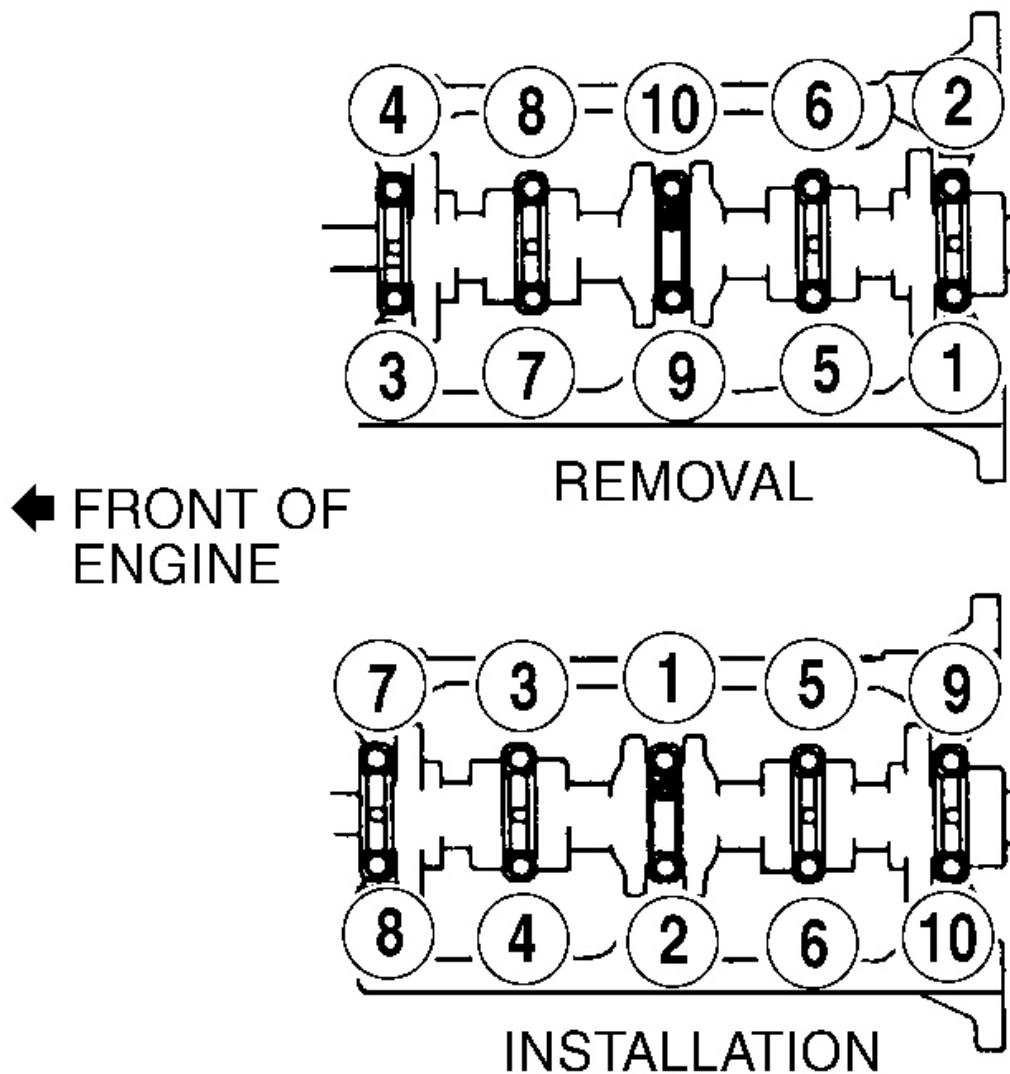
CRANKSHAFT , MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

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

4. Main bearing size mark ("3", "4" or "5") is located on side of main bearing. See **Fig. 15** . If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.
5. Main bearing thickness is determined by size mark on main bearing. See **MAIN BEARING SPECIFICATIONS** table. Install main bearings, crankshaft and main bearing caps.
6. Ensure main bearings caps are installed in correct location with No. 1 main bearing cap at front of engine and No. 5 main bearing cap at rear of engine. Ensure arrow on top of main bearing cap points toward front of engine.
7. Coat main bearing cap bolt threads and seat area of bolt with engine oil. Install and tighten main bearing cap bolts to specification in sequence using several steps. See **Fig. 14** . Refer to **TORQUE SPECIFICATIONS** .
8. Ensure bearing oil clearance and crankshaft end play is within specification. See **CRANKSHAFT** , MAIN & CONNECTING ROD BEARINGS table. Replace thrust bearing if end play is not within specification.

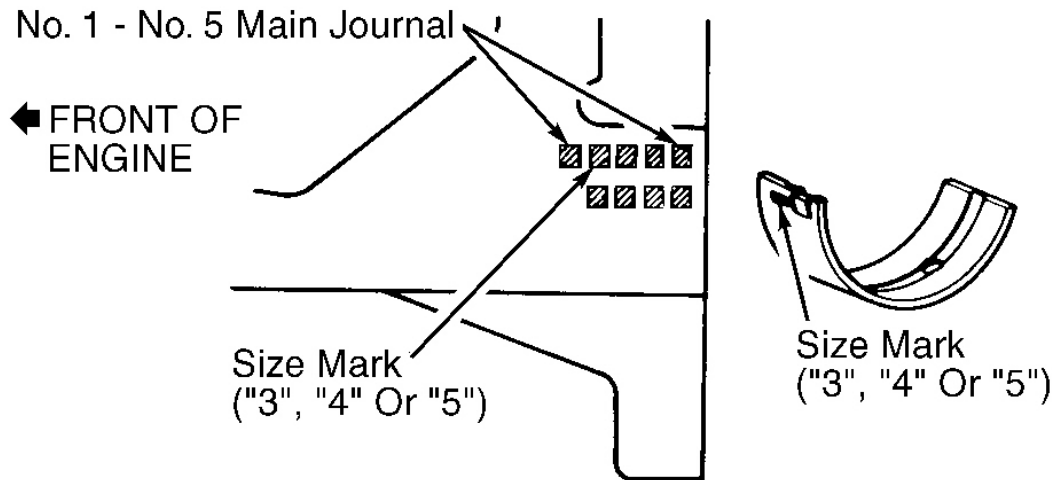
MAIN BEARING SPECIFICATIONS

Bearing Size Mark	Bearing Thickness: In. (mm)
"3"	.0783-.0784 (1.988-1.992)
"4"	.0784-.0786 (1.992-1.996)
"5"	.0786-.0787 (1.996-2.000)



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Fig. 14: Main Bearing Cap Bolt Removal & Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



93C00424

Fig. 15: Identifying Cylinder Block & 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 or 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 can be identified by cylinder bore size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 11**. 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 if cylinder bore diameter exceeds specification. Cylinder block can be bored for .020" (.50 mm) or .040" (1.00 mm) oversize pistons.
4. Install main bearing caps on cylinder block. Install and tighten main bearing cap bolts to specification in sequence using several steps. See **Fig. 14**. Refer to **TORQUE SPECIFICATIONS**.
5. Ensure cylinder block main bearing bore inside diameter is within specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS. Main bearing bore inside diameter is determined by main bearing bore size mark ("3", "4" or "5") stamped on cylinder block. See **Fig. 15**.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

The crankshaft driven oil pump provides pressurized lubrication for engine lubrication. See **Fig. 16** .

Crankcase Capacity

Crankcase capacity with oil filter is 4.5 qts. (4.3L).

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.

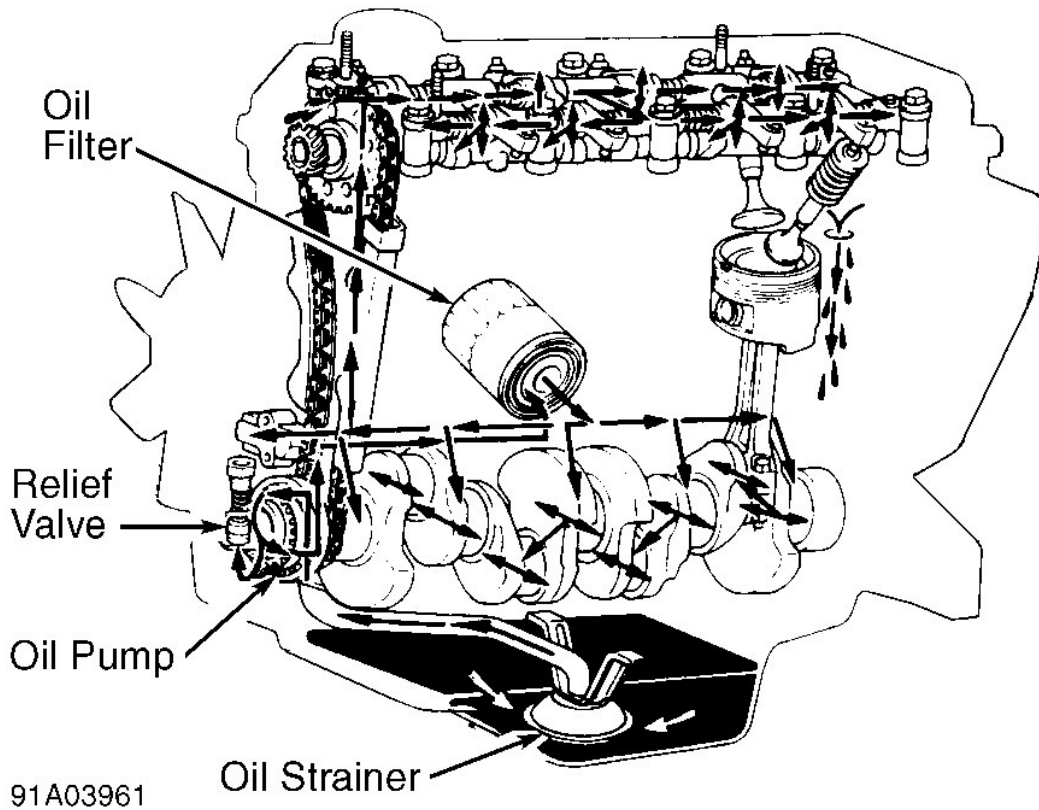


Fig. 16: Engine Oil Circuit

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

OIL PUMP

Removal & Disassembly

1. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. Remove retaining bolts and oil strainer. Remove accessory drive belt.
2. Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley. Remove crankshaft pulley retaining bolt. Using puller, remove crankshaft pulley.
3. Remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor bracket. Remove retaining bolts, oil pump and "O" ring from front cover. Disassemble oil pump components. See **Fig. 17**.

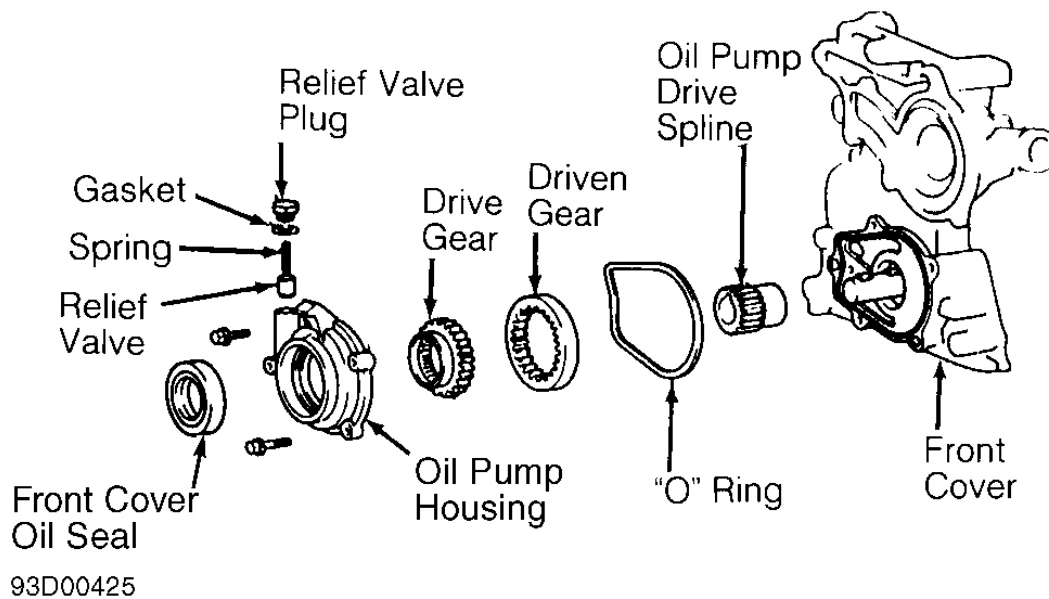


Fig. 17: Exploded View Of Oil Pump & Components

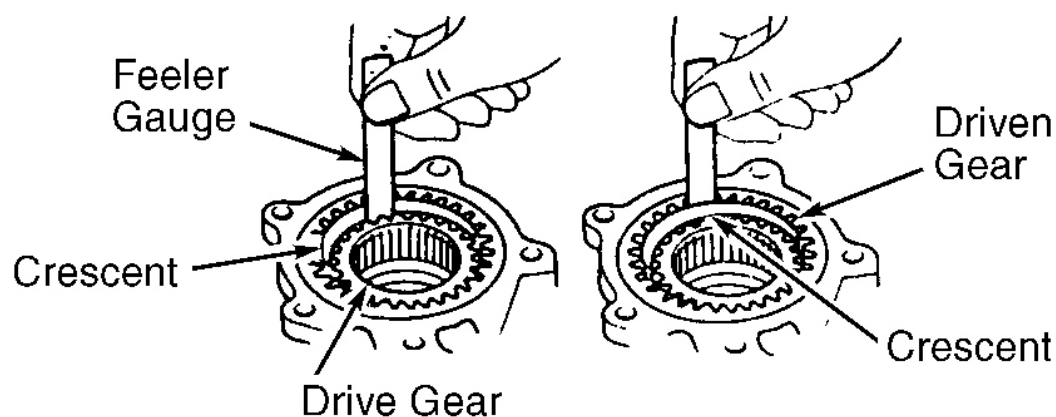
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect components for damage. Ensure relief valve slides freely in bore of oil pump housing. Install drive and driven gears in oil pump housing.
2. Using feeler gauge, measure driven gear-to-oil pump housing clearance. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.
3. Measure gear tip clearance between tip of gear and crescent in oil pump. See **Fig. 18**. Replace gear assembly or oil pump housing if clearance exceeds specification. Refer to **OIL PUMP SPECIFICATIONS** table.
4. Place straightedge across oil pump housing, above both gears. Measure gear end clearance between straightedge and gear surface. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Driven Gear-To-Oil Pump Housing Clearance	
Standard	.0035-.0059 (.090-.150)
Wear Limit	.008 (.20)
Gear End Clearance	
Standard	.0012-.0035 (.030-.090)
Maximum	.006 (.15)
Gear Tip-To-Crescent Clearance	
Drive Gear	
Standard	.0087-.0098 (.220-.250)
Wear Limit	.012 (.30)
Driven Gear	
Standard	.0059-.0083 (.150-.210)
Wear Limit	.012 (.30)

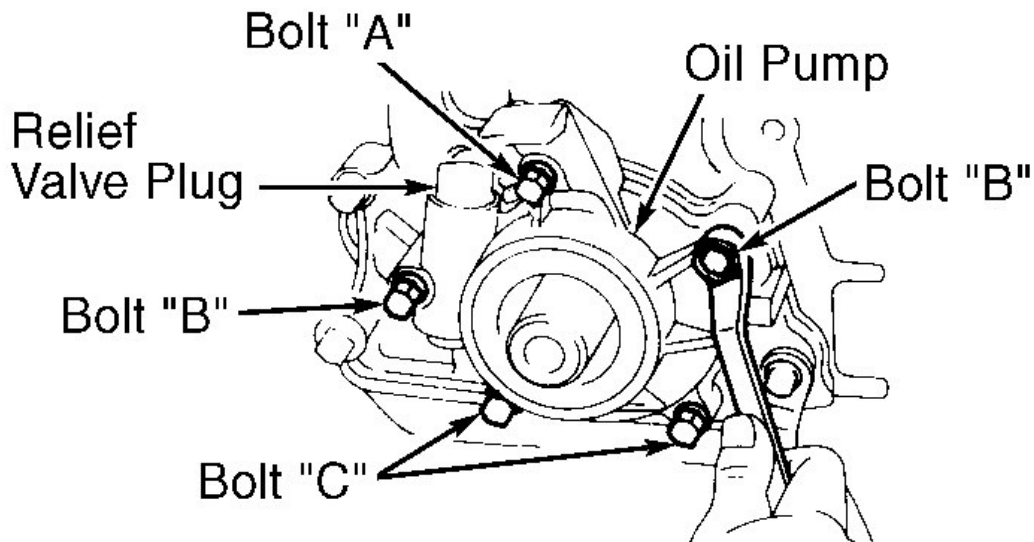


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Fig. 18: Measuring Oil Pump Gear Tip Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Reassembly & Installation

1. To reassemble, reverse disassembly procedure using NEW gasket on relief valve plug. Tighten relief valve plug to specification. See **TORQUE SPECIFICATIONS**.
2. Using Oil Seal Installer (SST 09223-50010), install front cover oil seal (if removed) until oil seal surface is even with oil pump housing. Coat seal lip with grease.
3. Using NEW "O" ring, install oil pump on front cover. Apply thread sealant to bolt "A" and install. See **Fig. 19**. Install remaining bolts. Tighten all bolts to specification. See **Fig. 19**.
4. To install remaining components, reverse removal procedure. Tighten fasteners to specification. Refer to

TORQUE SPECIFICATIONS .

Bolt "A" - 18 Ft. Lbs. (24 N.m)
 Bolt "B" - 14 Ft. Lbs. (19 N.m)
 Bolt "C" - 115 INCH Lbs. (13.0 N.m)

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Fig. 19: Installing Oil Pump

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

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

Application	Specification
Displacement	146.4 Cu. In. (2.4L)
Bore	3.62" (91.9 mm)
Stroke	3.50" (88.9 mm)
Compression Ratio	9.3:1
Fuel System	PFI
Horsepower @ RPM	116 @ 4800
Torque Ft. Lbs. @ RPM	140 @ 2800

1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

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

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.012 (.30)
Runout	.004 (.10)
Main Bearings	
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0010-.0022 (.025-.055)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	2.0861-2.0866 (52.988-53.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0010-.0022 (.025-.055)
Wear Limit	.039 (.099)

CONNECTING RODS SPECIFICATIONS**CONNECTING RODS SPECIFICATIONS**

Application	In. (mm)
Bore Diameter	
Crankpin Bore ⁽¹⁾	
Size Mark "A"	2.2047-2.2050 (56.000-56.006)
Size Mark "B"	2.2050-2.2052 (56.006-56.012)
Size Mark "C"	2.2052-2.2054 (56.012-56.018)
Maximum Bend	.0020 Per 3.94 (.050 Per 100.1)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	.0063-.0102 (.160-.260)
Wear Limit	.012 (.30)
(1) Crankpin bore diameter is determined by size mark stamped on connecting rod cap. See Fig. 13 .	

1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

PISTONS, PINS & RINGS SPECIFICATIONS**PISTONS, PINS & RINGS SPECIFICATIONS**

Application	In. (mm)
Pistons	
Clearance	.0006-.0014 (.015-.035)
Diameter ⁽¹⁾	
Size Mark "1"	3.6211-3.6214 (91.975-91.985)
Size Mark "2"	3.6214-3.6218 (91.985-91.995)
Size Mark "3"	3.6218-3.6222 (91.995-92.005)
Pins	
Piston Fit	(2)
Rod Fit	.0002-.0004 (.005-.010)
Rings	
No. 1	
End Gap	
Standard	.0098-.0185 (.250-.470)
Wear Limit	.0412 (1.070)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
No. 2	
End Gap	
Standard	.0236-.0323 (.600-.820)
Wear Limit	.0559 (1.420)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0224 (.200-.570)
Wear Limit	.0461 (1.170)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
(1) Piston diameter is determined by size mark on top of piston. See Fig. 10 .	
(2) Piston pin should slide in piston using thumb pressure with piston heated to 176°F (80°C).	

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK SPECIFICATIONS**

1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

Application	In. (mm)
Cylinder Bore	
Standard Diameter ⁽¹⁾	
Size Mark "1"	3.6220-3.6224 (92.000-92.010)
Size Mark "2"	3.6224-3.6228 (92.010-92.020)
Size Mark "3"	3.6228-3.6232 (92.020-92.030)
Main Bearing Bore Inside Diameter ⁽²⁾	
Size Mark "3"	2.5198-2.5201 (64.004-64.010)
Size Mark "4"	2.5201-2.5203 (64.010-64.016)
Size Mark "5"	2.5203-2.5205 (64.016-64.022)
Maximum Deck Warpage	.002 (.05)
(1) Cylinder bore diameter is determined by size mark on cylinder block deck surface. See Fig. 11 . Maximum cylinder bore wear is .008" (.20 mm).	
(2) Main bearing bore inside diameter is determined by size mark on cylinder block. See Fig. 15 .	

VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS SPECIFICATIONS**

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.024" (.60 mm)
Minimum Refinish Length	4.448" (112.98 mm)
Stem Diameter	.3138-.3144" (7.970-7.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.024" (.60 mm)
Minimum Refinish Length	4.405" (111.89 mm)
Stem Diameter	.3136-.3142" (7.965-7.980 mm)
Valve Springs	
Free Length	1.909" (48.50 mm)
Out-Of-Square	.063" (1.60 mm)
Pressure: Lbs. @ In. (kg @ mm)	
Valve Closed	62.8-66.1 @ 1.594 (28.5-29.9 @ 40.50)

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD SPECIFICATIONS**

1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.0059" (.150 mm)
Manifold Surface	.0079" (.200 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	.5118-.5125" (13.000-13.018 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 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.	.5118-.5125" (13.000-13.018 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Wear Limit	.0039" (.099 mm)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
End Play	
Standard	.0031-.0071 (.080-.180)
Wear Limit	.0098" (.250 mm)
Journal Diameter	1.2984-1.2992 (32.980-33.000)
Journal Runout	.008 (.20)
Lobe Height	
Intake	
Standard	1.6783-1.6891 (42.630-42.720)
Wear Limit	1.6634" (42.250 mm)
Exhaust	

1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

Standard	1.6807-1.6842 (42.690-42.780)
Wear Limit	1.6654" (42.300 mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.050)
Wear Limit	.004" (.10 mm)

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Accessory Drive Pulley-To-Crankshaft Pulley Bolt	14 (19)
Air Intake Chamber-To-Intake Manifold Bolt	14 (19)
Camshaft Bearing Cap Bolt	15 (20)
Camshaft Sprocket Bolt	58 (79)
Connecting Rod Nut	51 (69)
Crankshaft Pulley Bolt	116 (157)
Crossmember-To-Frame Bolt (4WD Models)	70 (95)
Cylinder Head/Rocker Arm Assembly Bolt ⁽¹⁾	58 (79)
Distributor Hold-Down Bolt	14 (19)
Drive Axle-To-Side Gear Flange Bolt	61 (83)
Drive Shaft Flange Bolt	55 (75)
Exhaust Manifold Heat Insulator Bolt	14 (19)
Exhaust Manifold Nut	33 (45)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	80 (109)
Front Cover Bolt	(2)
Front Differential Mount Bolts	
Differential Cover Mount Bolt	108 (146)
Left & Right Mount Bolt	123 (167)
Fuel Line-To-Delivery Pipe Union Bolt	32 (43)
Intake Manifold Bolt/Nut	14 (19)
Main Bearing Cap Bolt ⁽³⁾	76 (103)
Oil Pump Bolt	(4)
Power Steering Pump Bracket-To-Cylinder Head Bolt	32 (43)
Power Steering Pump Pulley Nut	32 (43)
Rocker Arm Adjusting Screw Lock Nut	18 (24)
Rear Seal Housing Bolt	13 (18)
Relief Valve Plug	27 (37)
Spark Plug	13 (18)

1993 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1993 TOYOTA ENGINES 2.4L 4-Cylinder

Stabilizer Bar-To-Frame Bracket Bolt	21 (29)
Timing Chain Damper Bolt	16 (22)
Timing Chain Tensioner Bolt	14 (19)
INCH Lbs. (N.m)	
Clutch Release Cylinder Bolt	106 (12.0)
Cylinder Head Rear Plate Bolt	115 (13.0)
Cylinder Head-To-Front Cover Bolt	115 (13.0)
EGR Valve Bolt/Nut	115 (13.0)
No. 1 Air Injection Manifold Bolt/Nut	115 (13.0)
Oil Pan Bolt/Nut	115 (13.0)
Oil Strainer Bolt	115 (13.0)
PAIR Valve Nut	115 (13.0)
Stabilizer Bar Link-To-Lower Control Arm Nut	115 (13.0)
Valve Cover Nut	52 (5.9)

- (1) Tighten bolts to specification in sequence. See **Fig. 2** .
- (2) Tighten 8-mm bolts to 115 INCH lbs. (13.0 N.m) and 10-mm bolts to 29 ft. lbs. (39 N.m).
- (3) Tighten bolts to specification in sequence. See **Fig. 14** .
- (4) Tighten bolts as specified. See **Fig. 19** .

1994 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

2.4L 4-CYL - VIN [R]

1994 ENGINES Toyota 2.4L 4-Cylinder

ENGINE IDENTIFICATION

Engine serial number is stamped on cylinder block, behind the alternator.

ENGINE IDENTIFICATION CODE

Engine	Code
2.4L 4-Cylinder	22R-E

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine at normal operating temperature.

1. Warm engine to normal operating temperature. Remove nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing mark groove on crankshaft pulley aligns with "0" timing mark on front cover.
2. Ensure rocker arms on cylinder No. 1 are loose and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft one revolution (360 degrees) and realign timing marks.
3. Using feeler gauge, check valve clearance between rocker arm and valve stem on intake valves of cylinders No. 1 and 2, and exhaust valves of cylinders No. 1 and 3.
4. Ensure valve clearance is within specification. Refer to **VALVE CLEARANCE SPECIFICATIONS** table. If valve clearance adjustment is required, loosen rocker arm adjusting screw lock nut and rotate adjusting screw to obtain correct valve clearance. Tighten rocker arm adjusting screw lock nut to specification. See **TORQUE SPECIFICATIONS**. Recheck valve clearance.
5. Rotate crankshaft one revolution (360 degrees) and realign timing marks. Check valve clearance on intake valves of cylinders No. 3 and 4, and exhaust valves of cylinders No. 2 and 4. Adjust valve clearance if necessary.
6. Using NEW gasket, install valve cover. Install and tighten nuts to specification. See **TORQUE SPECIFICATIONS**.

VALVE CLEARANCE SPECIFICATIONS ⁽¹⁾

Application	In. (mm)
Exhaust Valve	.012 (.30)
Intake Valve	.008 (.20)

(1) Adjust valve clearance with engine at normal operating temperature.

REMOVAL & INSTALLATION

*** PLEASE READ FIRST ***

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.

FUEL PRESSURE RELEASE

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

ENGINE

NOTE: Remove engine and transmission as an assembly.

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Remove hood, battery and lower engine covers. Drain cooling system and engine oil. Remove air cleaner case and intake air connector.
2. Remove radiator and accessory drive belts. Remove fan clutch along with fan and water pump pulley. Disconnect necessary electrical connections, vacuum hoses, coolant hoses and fuel lines.
3. Disconnect control cables at throttle body. Disconnect necessary ground straps. Remove power steering pump and A/C compressor with hoses attached and secure aside (if equipped).
4. Place reference marks on drive shaft flanges for reassembly reference. Remove bolts and all drive shaft(s).
5. On M/T models, remove shift lever(s) from inside vehicle. Disconnect necessary shift linkages, hoses and electrical connections at transmission and transfer case (if equipped).
6. On 4WD A/T models, disconnect transfer case shift linkage from cross shaft at transfer case. Remove bolts and cross shaft.
7. On all 4WD models, remove transfer case protective plates located below transfer case. On 4WD 4Runner models, remove stabilizer bar (if equipped). Disconnect speedometer cable.

NOTE: DO NOT separate felt dust protector and washers from speedometer cable.

8. Disconnect oxygen sensor connector. Remove front exhaust pipe, located between exhaust manifold and catalytic converter.
9. On 2WD models, support transmission with floor jack. Remove rear engine mount and bracket at transmission. On M/T models, remove clutch release cylinder with hoses attached and secure aside.
10. On 4WD models, remove front floor heat insulator and brake tube heat insulator. Support transmission

with floor jack. Remove bolts and transmission crossmember located below transmission.

11. Support engine with hoist. Remove engine mount bolts/nuts. Lift engine and transmission assembly from vehicle.

Installation

To install, reverse removal procedure. Ensure reference marks are aligned on drive shaft flanges. Adjust all fluid levels, control cables and shift linkages.

CYLINDER HEAD & MANIFOLDS

Removal

1. Disconnect negative battery cable. Drain cooling system. Remove air intake from air intake chamber. Disconnect exhaust pipe from exhaust manifold.
2. Remove oil dipstick, distributor and spark plugs. Disconnect necessary electrical connections, coolant hoses, vacuum hoses and control cables.
3. Remove EGR vacuum modulator. Remove air intake chamber along with throttle body. See **Fig. 1**. Release fuel pressure. Refer to **FUEL PRESSURE RELEASE**. Disconnect necessary fuel lines.
4. Remove power steering pump bracket-to-cylinder head bolts (if equipped). Remove nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
5. Ensure rocker arms on cylinder No. 1 are loose and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft one revolution (360 degrees) and realign timing marks.
6. Paint reference mark on camshaft sprocket and timing chain for reassembly reference. Remove half-circular seal and camshaft sprocket bolt.
7. Remove distributor drive gear and thrust plate from camshaft sprocket. See **Fig. 1**. Remove camshaft sprocket and timing chain from camshaft. Allow camshaft sprocket and timing chain to rest in cylinder head.

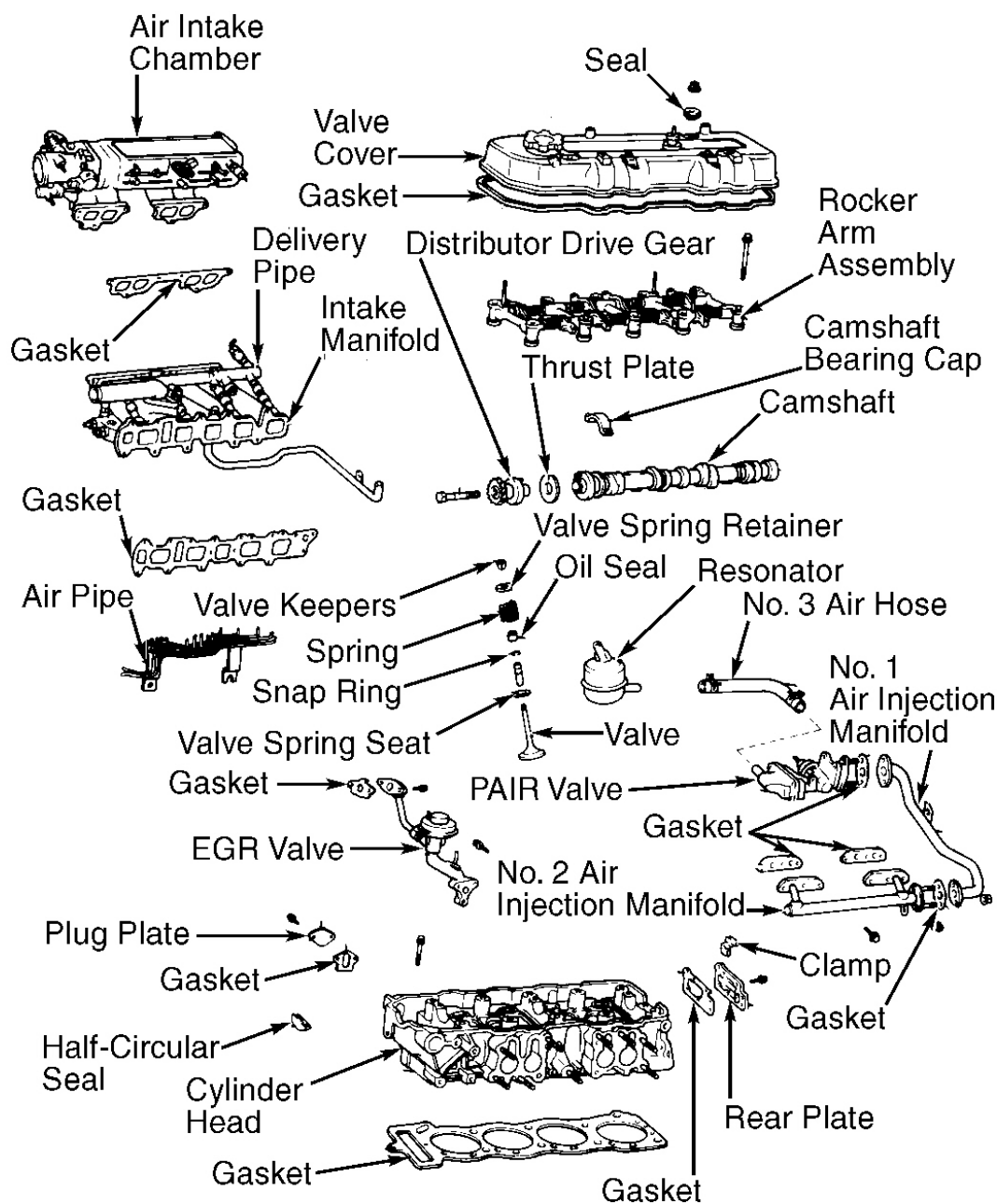
CAUTION: DO NOT allow timing chain to become disengaged from crankshaft sprocket.

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

8. Remove cylinder head-to-front cover bolt, located on cylinder head in front of camshaft sprocket area. Loosen cylinder head/rocker arm assembly bolts in sequence using several steps. See **Fig. 2**.
9. Remove rocker arm assembly. If necessary for removal, pry equally at front and rear of rocker arm assembly. Remove cylinder head by lifting upward from dowels on cylinder block. Remove cylinder head gasket.

NOTE: If cylinder head removal is difficult, carefully pry with flat bar between cylinder head and projecting areas on cylinder block.

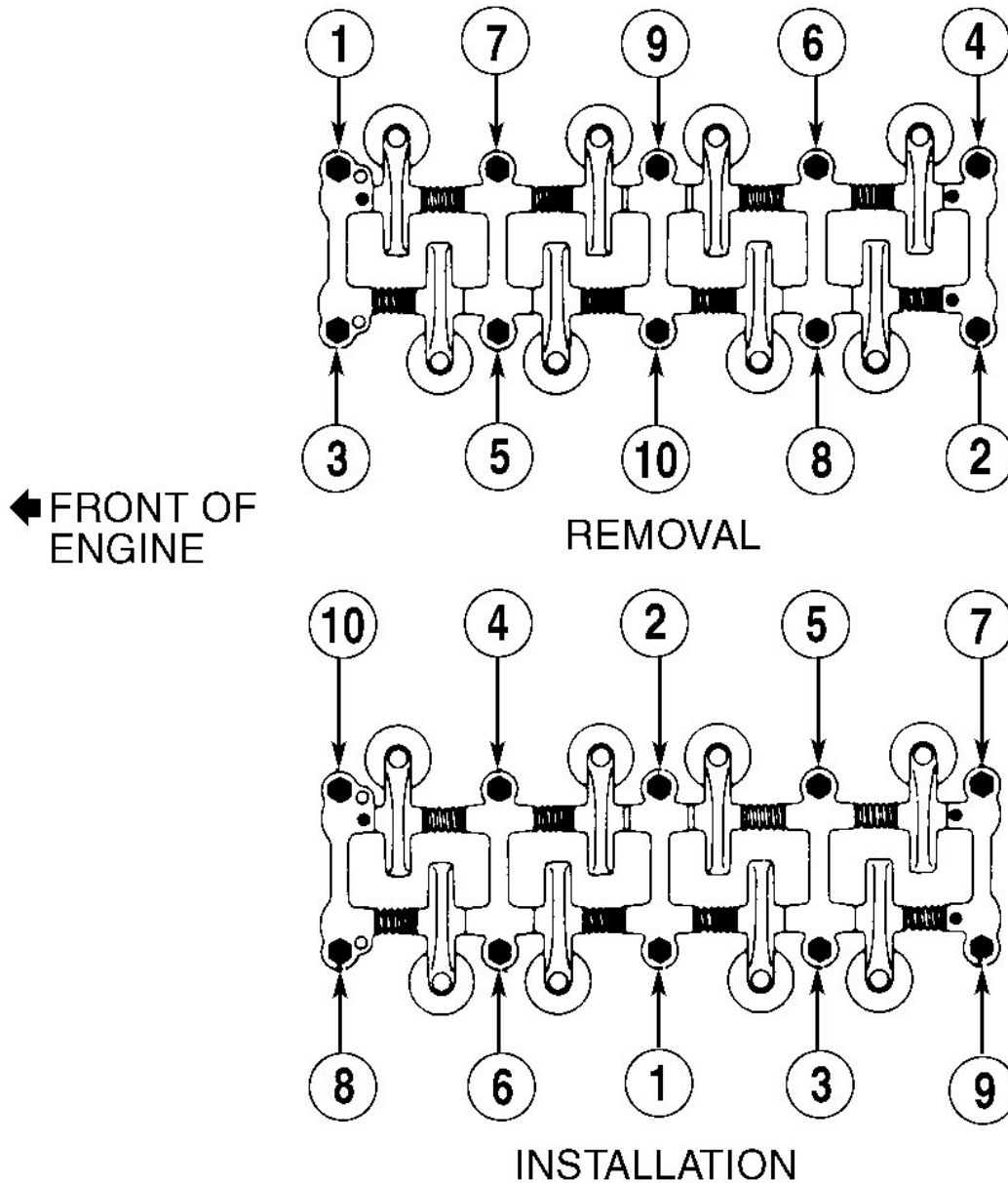
10. Remove bolts/nuts, No. 1 air injection manifold, gaskets and PAIR valve. See **Fig. 1**. Remove air pipe. Remove intake manifold as an assembly with delivery pipe, fuel injectors and heater coolant inlet pipe.
11. Remove EGR valve. Remove heat insulators, exhaust manifold and gasket. Remove rear plate and gasket. See **Fig. 1**.



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Fig. 1: Exploded View Of Cylinder Head & Components

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



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Fig. 2: Cylinder Head/Rocker Arm Assembly Bolt Removal & Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect cylinder head warpage at cylinder block and manifold areas. Replace cylinder head if warpage

exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

2. Inspect air intake chamber-to-intake manifold and intake manifold-to-cylinder head surfaces for warpage. Replace air intake chamber or intake manifold if warpage exceeds .008" (.20 mm).
3. Inspect exhaust manifold-to-cylinder head surface for warpage. Replace exhaust manifold if warpage exceeds .028" (.70 mm).
4. Inspect cylinder block deck surface for warpage. Replace cylinder block if deck warpage exceeds specification. Refer to **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS. Inspect camshaft and components. See CAMSHAFT.

Installation

1. Install components on cylinder head using NEW gaskets. Use NEW nuts when installing exhaust manifold. Tighten all bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.

NOTE: Ensure EGR valve-to-cylinder head bolt hole threads are clean. Apply thread sealant on front bolt (closest to front of cylinder head) for EGR valve before installing bolt.

2. Apply liquid sealant at both front corners of cylinder block-to-front cover areas. Install NEW cylinder head gasket. Ensure cylinder head gasket aligns with dowels in cylinder block.
3. Install cylinder head and rocker arm assembly. Ensure rocker arm assembly aligns with dowels in cylinder head. Install and tighten cylinder head/rocker arm assembly bolts to specification in sequence using 3 steps. Refer to **TORQUE SPECIFICATIONS**. Refer to Fig. **Fig. 2**.
4. Install and tighten cylinder head-to-front cover bolt to specification. See **TORQUE SPECIFICATIONS**. Ensure reference marks on camshaft sprocket and timing chain are aligned. Hold camshaft sprocket and timing chain upward.
5. If cylinder No. 1 is not at TDC on compression stroke, rotate crankshaft so cylinder No. 1 is at TDC on compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
6. Install camshaft sprocket and timing chain on camshaft. It may be necessary to rotate crankshaft back and forth slightly while pulling upward on timing chain and camshaft sprocket.
7. Install thrust plate and distributor drive gear. Install and tighten camshaft sprocket bolt to specification. Refer to **TORQUE SPECIFICATIONS**. Adjust valve clearance. Refer to **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

NOTE: Adjust valve clearance initially with engine cold and then readjust with engine at normal operating temperature.

8. To install remaining components, reverse removal procedure. Tighten fasteners to specification. Refer to **TORQUE SPECIFICATIONS**. Install NEW "O" ring on distributor before installing distributor.
9. Before installing valve cover, ensure half-circular seals are installed at front and rear of cylinder head. Apply sealant at half-circular seal-to-cylinder head surfaces.
10. Using NEW gasket, install valve cover. Install seals and nuts. Tighten nuts to specification. See **TORQUE SPECIFICATIONS**. Adjust fluid levels, control cables and ignition timing.

FRONT COVER OIL SEAL**Removal & Installation (Front Cover Removed)**

Pry oil seal from oil pump housing, located on front cover. To install, use Oil Seal Installer (SST 09223-50010). Install NEW oil seal until oil seal surface is even with oil pump housing surface. Apply grease to lip of oil seal.

Removal & Installation (Front Cover Installed)

1. Remove accessory drive belts. Remove accessory drive pulley from front of crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley. Remove crankshaft pulley bolt.
2. Using puller, remove crankshaft pulley. Cut lip from oil seal. Pry oil seal from oil pump housing, located on front cover. Use care not to damage sealing surfaces.
3. To install, apply grease to lip of NEW oil seal. Using Oil Seal Installer (SST 09223-50010), install oil seal until oil seal surface is even with oil pump housing surface.
4. To install remaining components, reverse removal procedure. Tighten crankshaft pulley and accessory drive pulley bolt to specification. See **TORQUE SPECIFICATIONS**.

TIMING CHAIN

NOTE: **Cylinder head must be removed for servicing timing chain. On 4WD models, front differential must also be removed for servicing timing chain.**

Removal

1. Remove cylinder head. See **CYLINDER HEAD & MANIFOLDS**. Remove radiator. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges on front differential. Place reference marks on drive shaft flanges for reassembly reference. Remove bolts from drive shaft flange. Disconnect drive shaft from front differential.
2. Disconnect necessary vacuum hoses and electrical connectors at front differential. Support front differential assembly with floor jack. Remove front differential assembly mount bolts. Lower front differential assembly from vehicle.
3. Remove oil pan. See **OIL PAN**. Remove all accessory drive belts. Remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor mounting bracket (if equipped).
4. Remove fan clutch along with fan and water pump pulley. Remove accessory drive pulley from crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley.
5. Remove crankshaft pulley bolt. Using puller, remove crankshaft pulley. Disconnect coolant by-pass pipe, on passenger's side, from front cover. Remove alternator adjusting bracket. Disconnect heater outlet pipe, located near alternator, from front cover.

CAUTION: When removing front cover bolts, ensure front cover bolt on rear of front cover block is removed. See **Fig. 3**.

6. Remove front cover bolts. See **Fig. 3**. Remove front cover and gaskets. Remove timing chain from timing chain dampers. See **Fig. 4**. Remove camshaft sprocket and timing chain. Using gear puller, remove oil pump drive spline and crankshaft sprocket (if necessary). See **Fig. 4**.

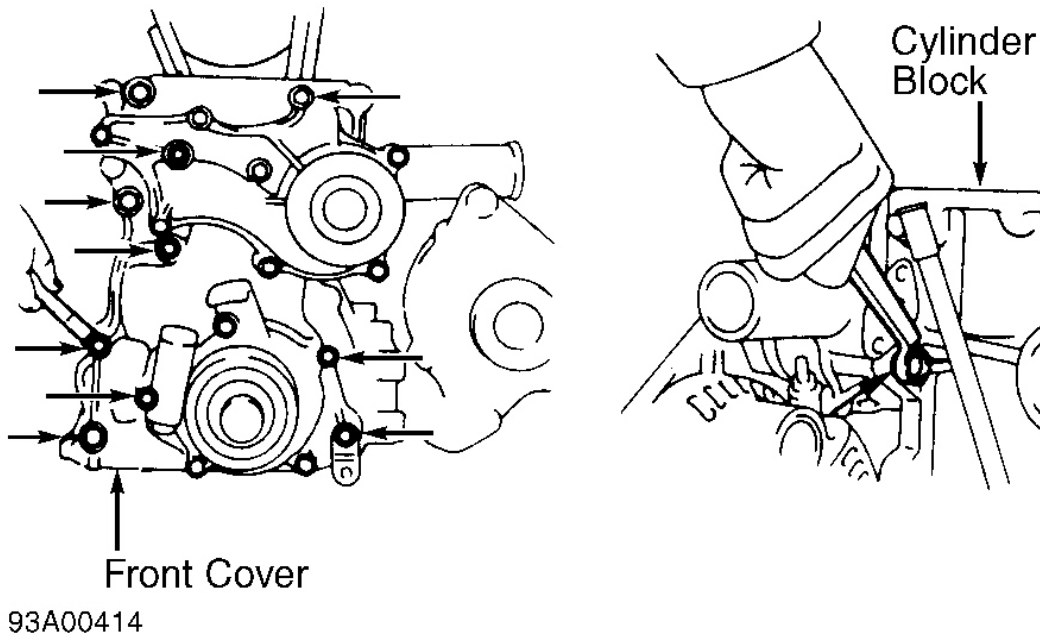
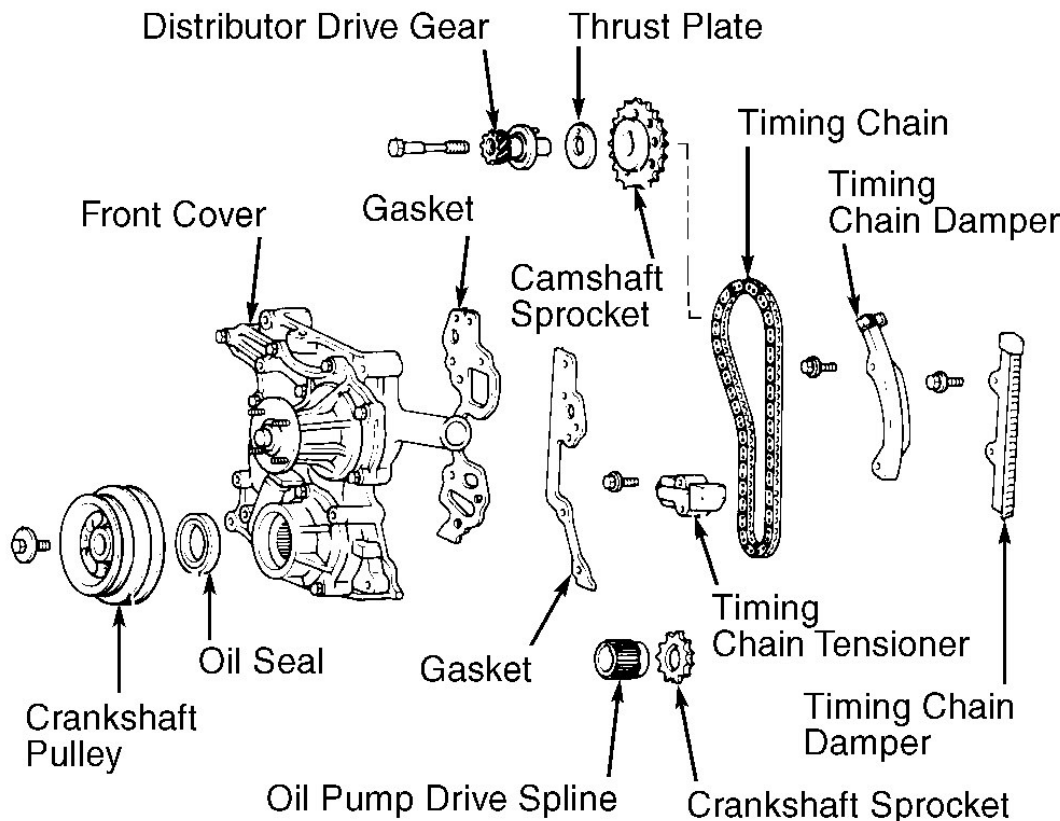


Fig. 3: Identifying Front Cover Bolts

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



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Fig. 4: Exploded View Of Timing Chain & Components
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect components for damage and wear. Using caliper, measure timing chain tensioner width. See **Fig. 5**. Replace timing chain tensioner if width is .433" (11.00 mm) or less.
2. Measure thickness of timing chain dampers. Replace timing chain dampers if thickness is .020" (.50 mm) or less. Using caliper, measure length of 17 links with timing chain fully stretched. See **Fig. 6**. Repeat measurement in at least 3 areas on timing chain. Replace timing chain if length of 17 links exceeds 5.79" (147.0 mm).
3. Wrap timing chain completely around camshaft sprocket. Using caliper, measure outside diameter of timing chain and camshaft sprocket. See **Fig. 6**. Using same method, measure outside diameter of crankshaft sprocket and timing chain.
4. Replace timing chain and sprockets if outside diameter is less than specified. See TIMING CHAIN & SPROCKET OUTSIDE DIAMETER SPECIFICATIONS table.

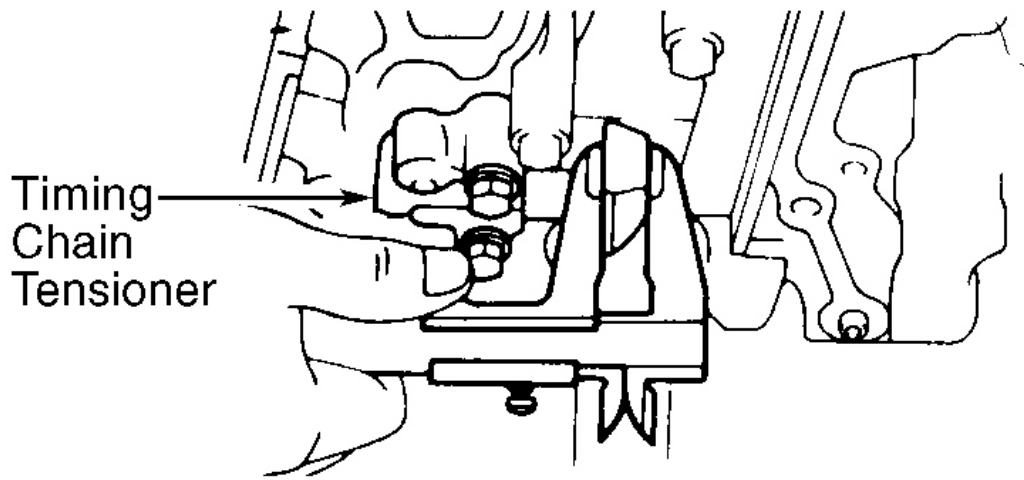
TIMING CHAIN & SPROCKET OUTSIDE DIAMETER SPECIFICATIONS

Application	In. (mm)
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1994 Toyota 4Runner SR5

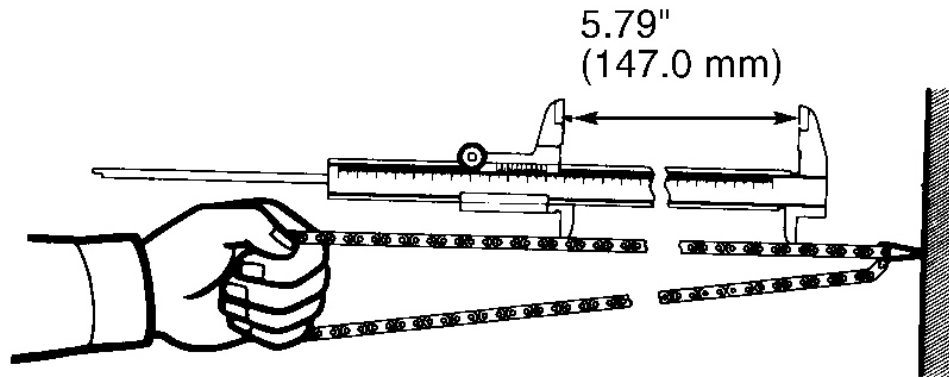
2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Timing Chain & Camshaft Sprocket	4.480 (113.80)
Timing Chain & Crankshaft Sprocket	2.339 (59.40)

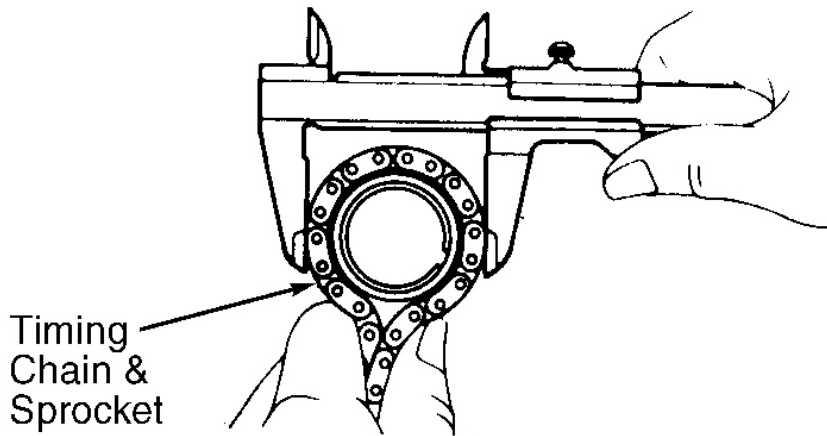


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Fig. 5: Measuring Timing Chain Tensioner Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



MEASURING TIMING CHAIN



MEASURING TIMING CHAIN & SPROCKET OUTSIDE DIAMETER

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Fig. 6: Measuring Timing Chain & Sprockets
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Installation

1. Ensure crankshaft is positioned with keyway at 12 o'clock position. Install crankshaft sprocket on crankshaft with flat side toward front of engine.

CAUTION: Ensure crankshaft sprocket is installed with flat side toward front of engine. See Fig. 7.

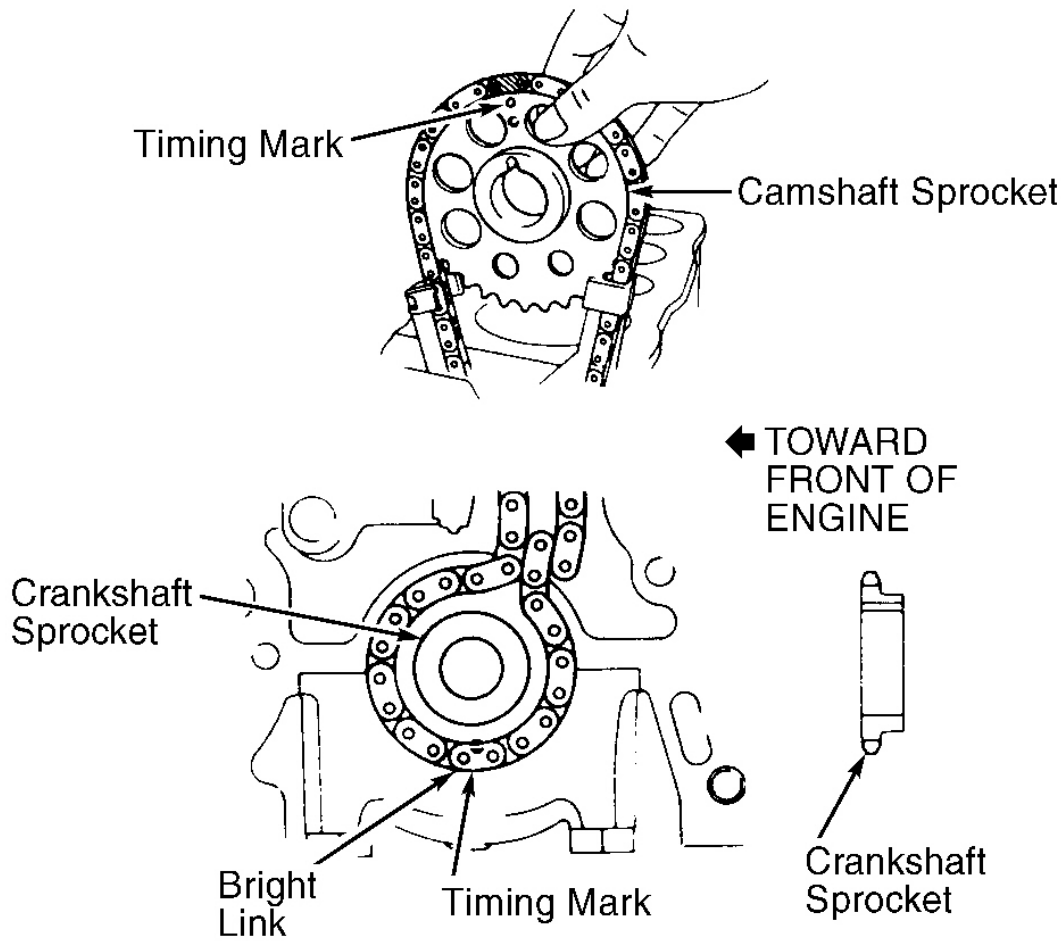
2. Install timing chain on crankshaft sprocket with bright link on timing chain aligned with timing mark on

crankshaft sprocket. See **Fig. 7**. Install timing chain on camshaft sprocket with bright link on timing chain aligned with timing mark on camshaft sprocket. Ensure timing chain is positioned between timing chain dampers.

3. Rotate camshaft sprocket counterclockwise to take slack out of timing chain. Install oil pump drive spline over crankshaft key.
4. Using NEW gasket, install front cover. Install and tighten front cover bolts to specification. See **TORQUE SPECIFICATIONS**.
5. Ensure oil pan sealing surfaces are clean. Apply a .20" (5.0 mm) diameter bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing areas.

6. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing areas. Install oil pan. Install and tighten oil pan bolts/nuts to specification. Refer to **TORQUE SPECIFICATIONS**.
7. To install remaining components, reverse removal procedure. Tighten fasteners to specification. Refer to **TORQUE SPECIFICATIONS**.
8. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with gear oil.
9. On 4WD models without manual hubs on front axle, use hypoid gear oil SAE 75W-90 with API rating of GL-5. On 4WD models with manual hubs on front axle, use hypoid gear oil SAE 80W-90 with API rating of GL-5.



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Fig. 7: Installing Timing Chain & Sprockets
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ROCKER ARM ASSEMBLY

Removal & Installation

Rocker arm assembly removal and installation procedure is listed with cylinder head and manifold removal and installation procedure. Rocker arm assembly is attached with cylinder head/rocker arm assembly bolts. See CYLINDER HEAD & MANIFOLDS.

CAMSHAFT

Removal

1. Remove distributor. Remove rocker arm assembly and camshaft sprocket. Rocker arm assembly is

attached with cylinder head/rocker arm assembly bolts. See **CYLINDER HEAD & MANIFOLDS** under REMOVAL & INSTALLATION.

2. Measure camshaft end play before removing camshaft. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.
3. Note direction of camshaft bearing cap installation for reassembly reference. Camshaft bearing caps are numbered in sequence with No. 1 at front of engine (timing chain end).
4. Ensure arrow on top of camshaft bearing cap points toward front of engine. Remove bolts, camshaft bearing caps and camshaft.

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

Installation

1. To install, reverse removal procedure. Ensure camshaft bearing caps are installed in numerical order with No. 1 at front of engine (timing chain end). Ensure arrow on top of each camshaft bearing cap points toward front of engine.
2. Install and tighten camshaft bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**. Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transmission, clutch assembly (if equipped) and flywheel/drive plate. Using a knife, cut off seal lip from oil seal. 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. Using Oil Seal Installer (SST 09223-41020), install oil seal until oil seal is even with rear seal housing surface.
2. Install and tighten flywheel/drive plate bolts to specification. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.

WATER PUMP

Removal & Installation

1. Drain cooling system. Remove power steering pump and A/C compressor drive belts (if equipped).

Remove fan clutch along with fan and water pump pulley.

2. Remove bolts/nuts, water pump and gasket. To install, reverse removal procedure using NEW gasket. Fill cooling system.

OIL PAN

Removal

1. Drain engine oil. Raise and support vehicle. Remove lower engine covers. On 2WD models, remove engine mount bolts. Place a floor jack under transmission, and raise engine about 1.00" (25.4 mm) if necessary.
2. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges on front differential. Place reference marks on drive shaft flanges for reassembly reference. Remove bolts from drive shaft flange. Disconnect drive shaft from front differential.
3. Disconnect necessary vacuum hoses and electrical connectors at front differential. Support front differential assembly with floor jack. Remove front differential assembly mount bolts. Lower front differential assembly from vehicle.
4. Remove oil pan bolts/nuts. Install Oil Pan Seal Cutter (SST 09032-00100) between cylinder block and oil pan. Tap oil cutter along sides of oil pan to remove oil pan. Use care not to damage sealing surfaces or oil pan flange.

Installation

1. Ensure sealing surfaces are clean. Apply a .20" (5.0 mm) diameter bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing areas.

2. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing areas. Install oil pan. Install and tighten oil pan bolts/nuts to specification. Refer to **TORQUE SPECIFICATIONS**.
3. To install remaining components, reverse removal procedure. Tighten fasteners to specification. Refer to **TORQUE SPECIFICATIONS**. Fill crankcase with oil.
4. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with gear oil. On 4WD models without manual hubs on front axle, use hypoid gear oil SAE 75W-90 with API rating of GL-5. On 4WD models with manual hubs on front axle, use hypoid gear oil SAE 80W-90 with API rating of GL-5.

OVERHAUL

CYLINDER HEAD

Cylinder Head

1. Inspect cylinder head warpage at cylinder block and manifold surfaces. 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. See **TORQUE SPECIFICATIONS**.
3. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT** table.
4. Measure camshaft end play. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** 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

Lubricate valve stem oil seal with engine oil. Install valve stem oil seal. Ensure valve stem oil seal is fully seated.

Valve Guides

1. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.
2. To replace valve guide, using hammer and brass drift, hit top of valve guide to break off old valve guide. Heat cylinder head to 194°F (90°C).
3. Using hammer and Valve Guide Remover/Installer (SST 09201-60011), drive valve guide from camshaft side of cylinder head. Measure cylinder head valve guide bore inside diameter.
4. If bore inside diameter is .5118-.5125" (13.000-13.018 mm), use standard valve guide. If bore inside diameter is greater than .5125" (13.018 mm), machine valve guide bore to .5138-.5145" (13.050-13.068 mm) for oversize valve guide.
5. To install valve guide, heat cylinder head to 194°F (90°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 cylinder head surface.
6. Using .31" (8.0 mm) reamer, ream valve guide to obtain specified valve stem-to-guide oil clearance. See **CYLINDER HEAD** table.

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.

Valves

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

1994 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Valve Seat Correction Angles

Use 30-degree and 45-degree stones to lower valve seat contact area. Use 60-degree (intake valves), 65-degree (exhaust valves) and 45-degree stones to raise valve seat contact area.

VALVE TRAIN

CAUTION: Ensure rocker arm assembly components are marked for location. Components must be installed in original location.

Rocker Arm Assembly

1. If rocker arms appear loose on shaft, disassemble rocker arm assembly. Measure rocker arm inside diameter and shaft outside diameter to determine oil clearance. Replace components if not within specification. See **ROCKER ARM ASSEMBLY SPECIFICATIONS** table.
2. To reassemble, reverse disassembly procedure. Note that rocker arms are identical, but rocker arm stands are different and must be installed in correct location. See **Fig. 8**.

ROCKER ARM ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.050)
Wear Limit	.0031 (.080)
Rocker Arm Inside Diameter	.6299-.6306 (16.000-16.018)
Shaft Outside Diameter	.6287-.6295 (15.970-15.990)

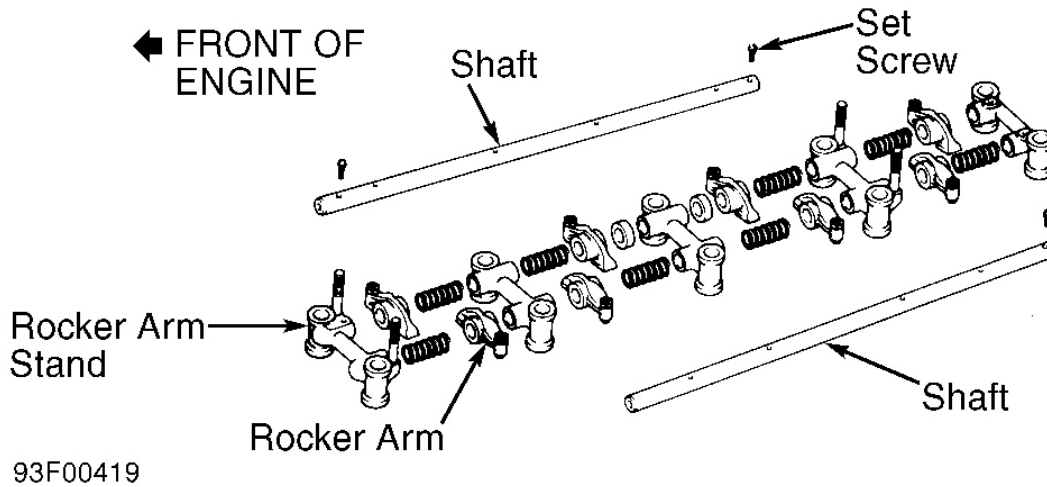


Fig. 8: Exploded View Of Rocker Arm Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. 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.
2. When removing piston from connecting rod, remove snap rings from piston. Heat piston to 176°F (80°C) in water. Remove piston pin. Separate piston from connecting rod.
3. Measure piston pin outside diameter and connecting rod bushing inside diameter. Ensure piston pin-to-rod fit is within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
4. Bushing can be replaced in connecting rod if piston pin-to-rod fit exceeds specification. Ensure bushing oil hole aligns with connecting rod oil hole. Bushing must be honed to obtain correct piston pin-to-rod clearance.

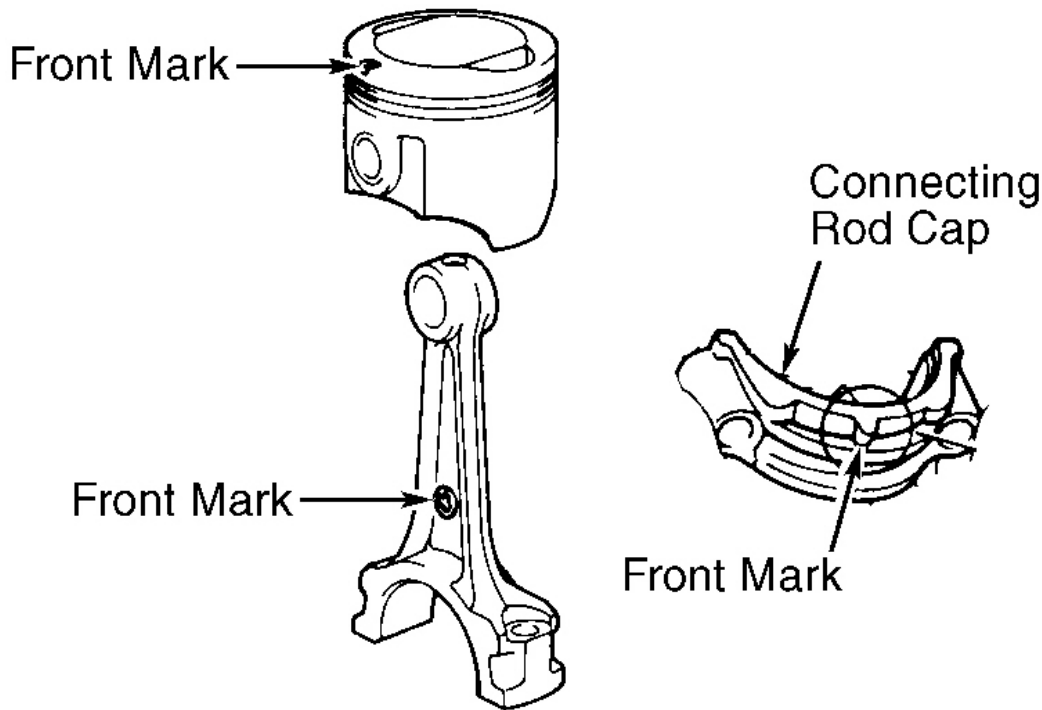
NOTE: With piston at 176°F (80°C), piston pin should be able to be pressed into piston using thumb pressure.

5. Ensure connecting rod bend, twist and crankpin bore diameter is within specification. See **CONNECTING RODS** table under ENGINE SPECIFICATIONS.

NOTE: Crankpin bore diameter is determined by size mark stamped on connecting rod cap. See **Fig. 13**.

6. To reassemble, install piston on connecting rod so front marks on piston and connecting rod align. See

Fig. 9. Install NEW snap ring in piston. Heat piston to 176°F (80°C) in water. Install piston pin and remaining NEW snap ring.



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Fig. 9: Identifying Front Marks & Aligning Connecting Rod With Piston
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

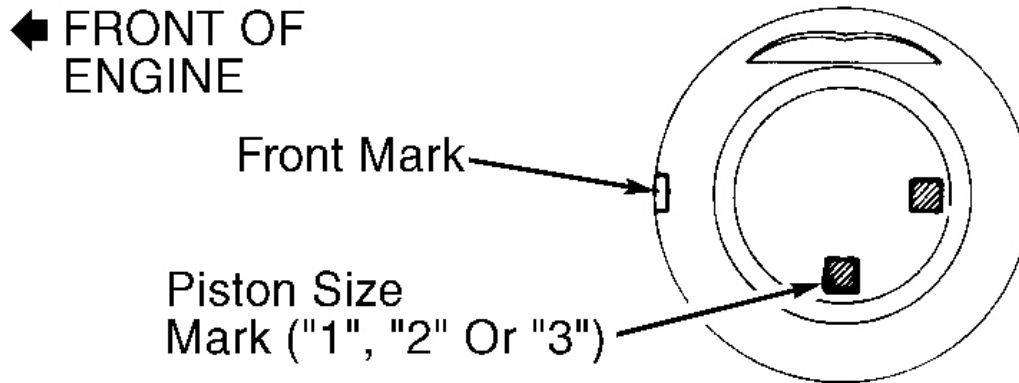
Fitting Pistons

1. To determine if piston-to-cylinder clearance is within specification, measure piston skirt diameter 1.30" (33.0 mm) from top of piston, at 90-degree angle to piston pin.
2. Different piston sizes are used. Piston diameter is determined by piston size mark ("1", "2" or "3") stamped on top of piston. See **Fig. 10**. Ensure piston diameter is within specification. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
3. Measure cylinder bore diameter .39" (10.0 mm) from top and bottom cylinder bore and at middle of cylinder bore. Different cylinder bore sizes are used. Cylinder bore diameter can be identified by cylinder bore size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 11**.
4. Ensure cylinder bore diameter is within specification. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS. Determine piston clearance.

CAUTION: If replacing piston, ensure replacement piston has same size mark as

cylinder bore size mark, located on cylinder block.

5. Replace piston, or bore cylinder block if piston clearance is not within specification. See **PISTONS, PINS & RINGS SPECIFICATIONS** table. Cylinder block can be bored for .020" (.50 mm) or .040" (1.00 mm) oversize pistons.

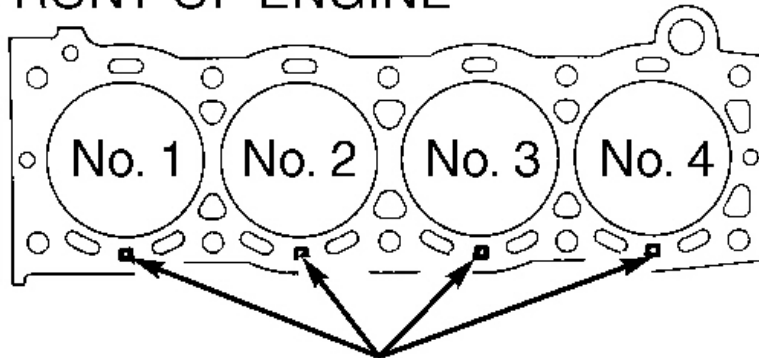


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Fig. 10: Identifying Piston Size Marks

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

← FRONT OF ENGINE

Cylinder Bore Size Marks
("1", "2" Or "3")

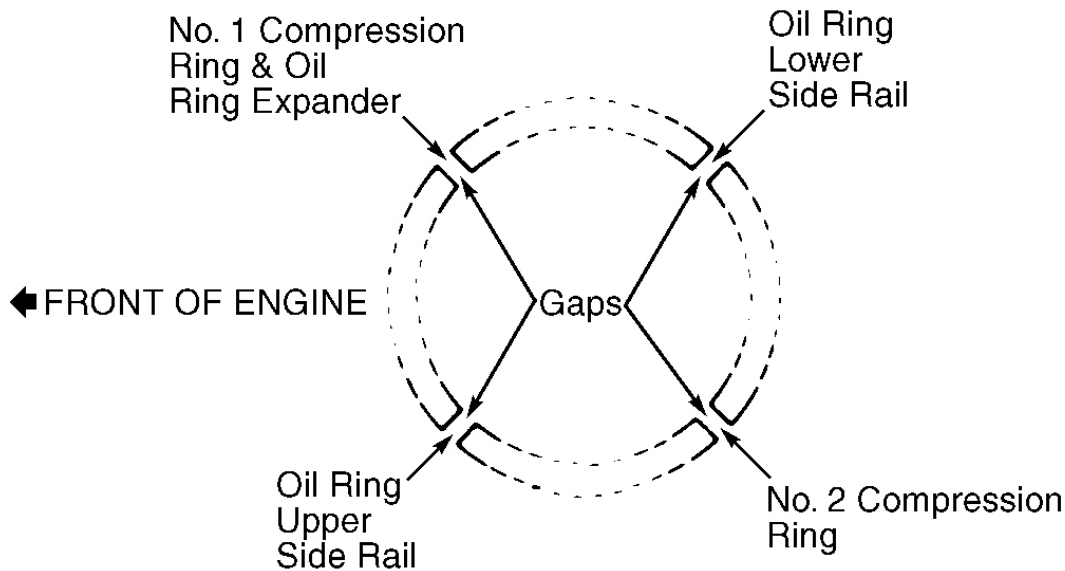
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Fig. 11: Identifying Cylinder Bore Size Marks

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 rings with ring end gaps in proper areas, with identification mark on piston ring toward top of piston. See **Fig. 12**.



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Fig. 12: 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 and connecting rod cap must be installed with front mark toward front of engine. See **Fig. 9**.
2. Connecting rod cap and rod bearing are stamped with size mark ("A", "B" or "C"). See **Fig. 13**. Ensure size marks on connecting rod cap and rod bearing are the same. Rod bearing thickness is determined by rod bearing size mark. See **ROD BEARING SPECIFICATIONS** table.

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

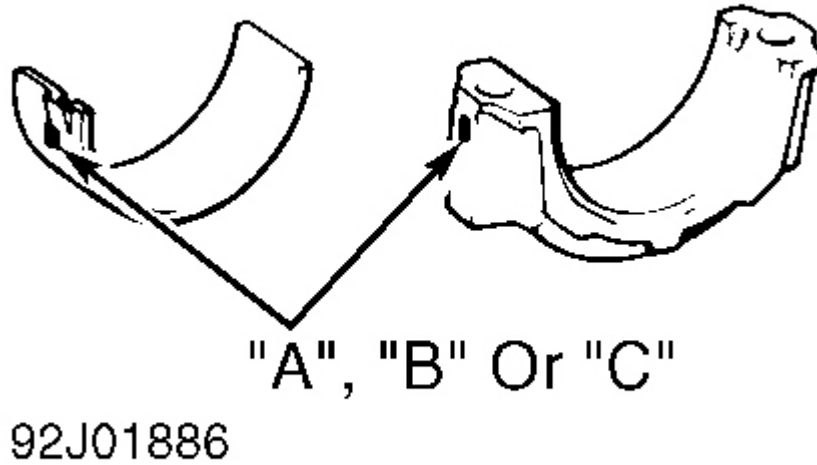


Fig. 13: Identifying Connecting Rod Cap & Bearing Size Marks

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

3. Ensure piston, connecting rod and connecting rod cap are installed with front mark toward front of engine. See **Fig. 9**. Coat nut and threads of connecting rod bolts with engine oil before tightening to specification. See **TORQUE SPECIFICATIONS**.
4. Ensure bearing oil clearance and connecting rod side play are within specification. See **CRANKSHAFT**, **MAIN & CONNECTING ROD BEARINGS** and **CONNECTING RODS** tables under **ENGINE SPECIFICATIONS**.

ROD BEARING SPECIFICATIONS

Bearing	Bearing Thickness	Size Mark	In. (mm)
"A"	.0584-.0586 (1.484-1.488) "B"	.0586-.0587 (1.488-1.492) "C"	.0587-.0589 (1.492-1.496)

Crankshaft & Main Bearings

1. Main bearing caps are numbered on top of main bearing cap for location in cylinder block. No. 1 main bearing cap is at front of engine, and No. 5 main bearing cap is at rear of engine. Note that arrow on top of main bearing cap points toward front of engine.
2. Remove main bearing cap bolts in sequence. See **Fig. 14**. Remove main bearing caps, crankshaft, thrust bearings and main bearings. Cylinder block main bearing bore inside diameter is determined by size mark ("3", "4" or "5") stamped on cylinder block. See **Fig. 15**. Front size mark indicates No. 1 main journal, and rear size mark indicates No. 5 main journal.
3. Ensure crankshaft journal diameter, taper and out-of-round are within specification. See **CRANKSHAFT**, **MAIN & CONNECTING ROD BEARINGS** table under **ENGINE**

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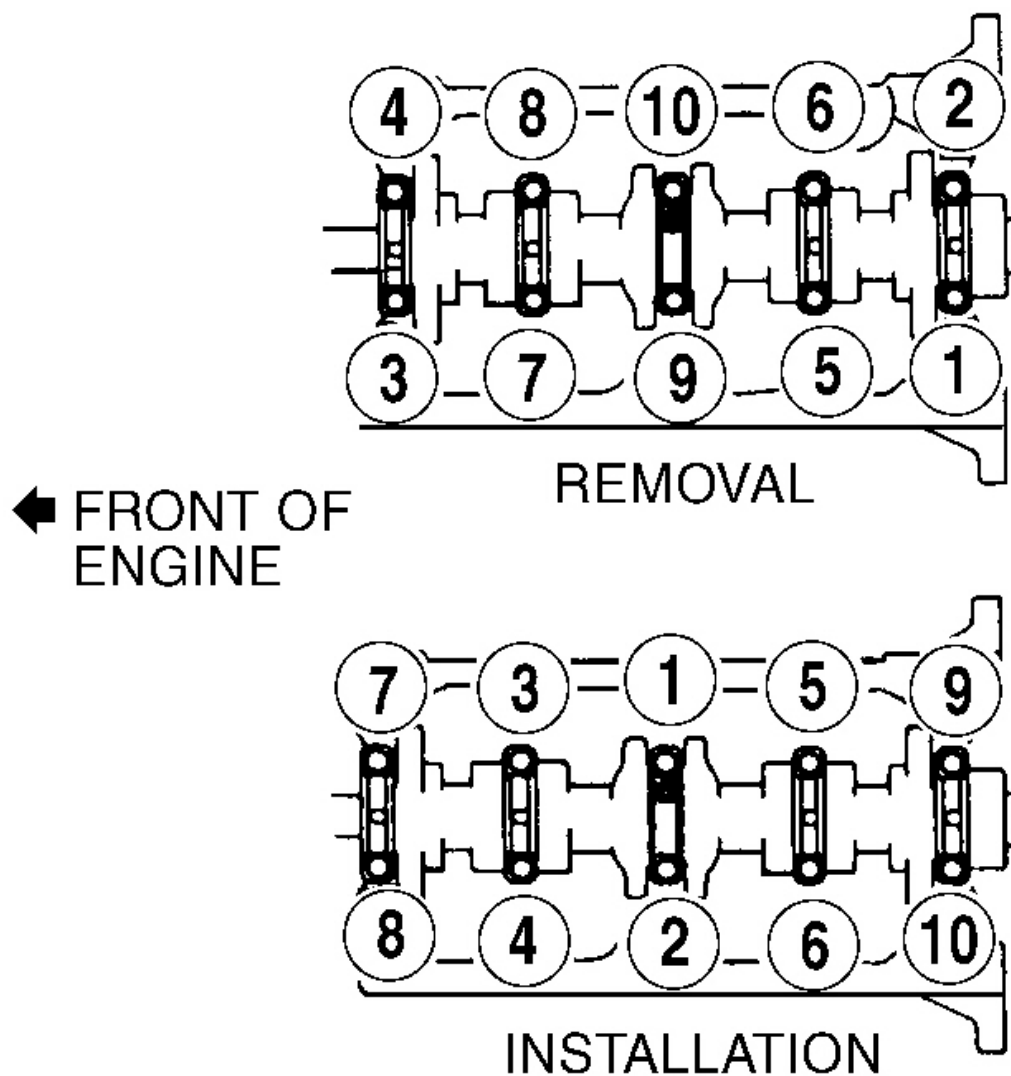
SPECIFICATIONS.

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

4. Main bearing size mark ("3", "4" or "5") is located on side of main bearing. See **Fig. 15**. If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.
5. Main bearing thickness is determined by size mark on main bearing. See **MAIN BEARING SPECIFICATIONS** table. Install main bearings, thrust bearings, crankshaft and main bearing caps.
6. Ensure main bearings caps are installed in correct location, with No. 1 main bearing cap at front of engine and No. 5 main bearing cap at rear of engine. Ensure arrow on top of each main bearing cap points toward front of engine.
7. Coat threads and bolt-to-main bearing cap contact area on main bearing cap bolts with engine oil. Install and tighten main bearing cap bolts to specification in sequence using several steps. Refer to **TORQUE SPECIFICATIONS**. Refer to Fig. **Fig. 14**.
8. Ensure bearing oil clearance and crankshaft end play is within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table. Replace thrust bearing if crankshaft end play is not within specification.

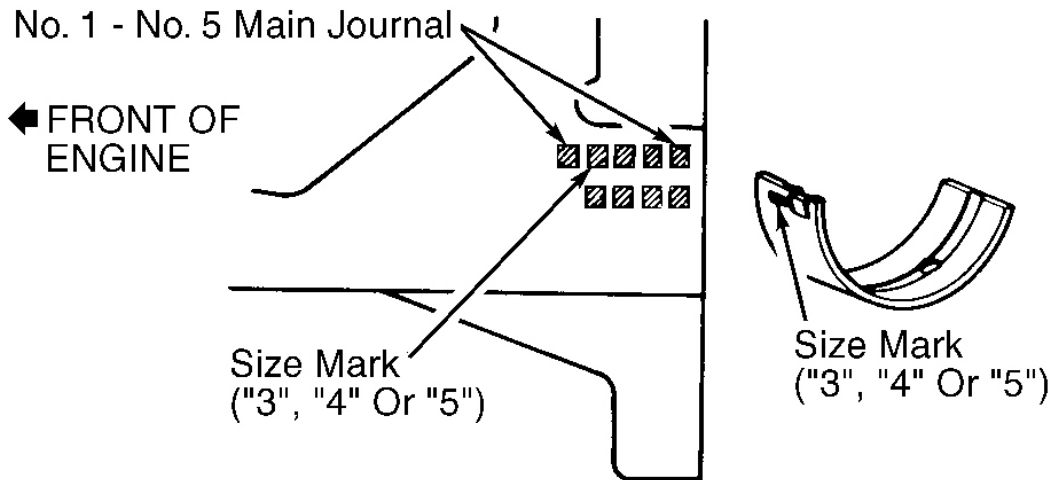
MAIN BEARING SPECIFICATIONS

Bearing	Bearing Thickness	Size Mark	In. (mm)
"3"	.0783-.0784 (1.988-1.992) "4"	.0784-.0786 (1.992-1.996) "5"	.0786-.0787 (1.996-2.000)



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Fig. 14: Main Bearing Cap Bolt Removal & Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 15: Identifying Cylinder Block & 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 or 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. Refer to **CYLINDER BLOCK SPECIFICATIONS** table under ENGINE SPECIFICATIONS.
2. Different cylinder bore sizes are used and can be identified by cylinder bore size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 11**. Measure cylinder bore diameter .39" (10.0 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 SPECIFICATIONS** table. Bore cylinder block if cylinder bore diameter exceeds specification. Cylinder block can be bored for .020" (.50 mm) or .040" (1.00 mm) oversize pistons.
4. Install main bearing caps on cylinder block. Ensure main bearing caps are installed in correct location, with No. 1 main bearing cap at front of engine and No. 5 main bearing cap at rear of engine. Ensure arrow on top of each main bearing cap points toward front of engine.
5. Coat threads and bolt-to-main bearing cap contact area on main bearing cap bolts with engine oil. Install and tighten main bearing cap bolts to specification in sequence using several steps. Refer to **TORQUE SPECIFICATIONS**. See **Fig. 14**.
6. Ensure cylinder block main bearing bore inside diameter is within specification. See **CYLINDER BLOCK** table. Main bearing bore inside diameter is determined by main bearing bore size mark ("3", "4"

or "5") stamped on cylinder block. See **Fig. 15**.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pump provides pressurized engine lubrication. See **Fig. 16**.

Crankcase Capacity

Crankcase capacity with oil filter is 4.5 qts. (4.3L).

Oil Pressure

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

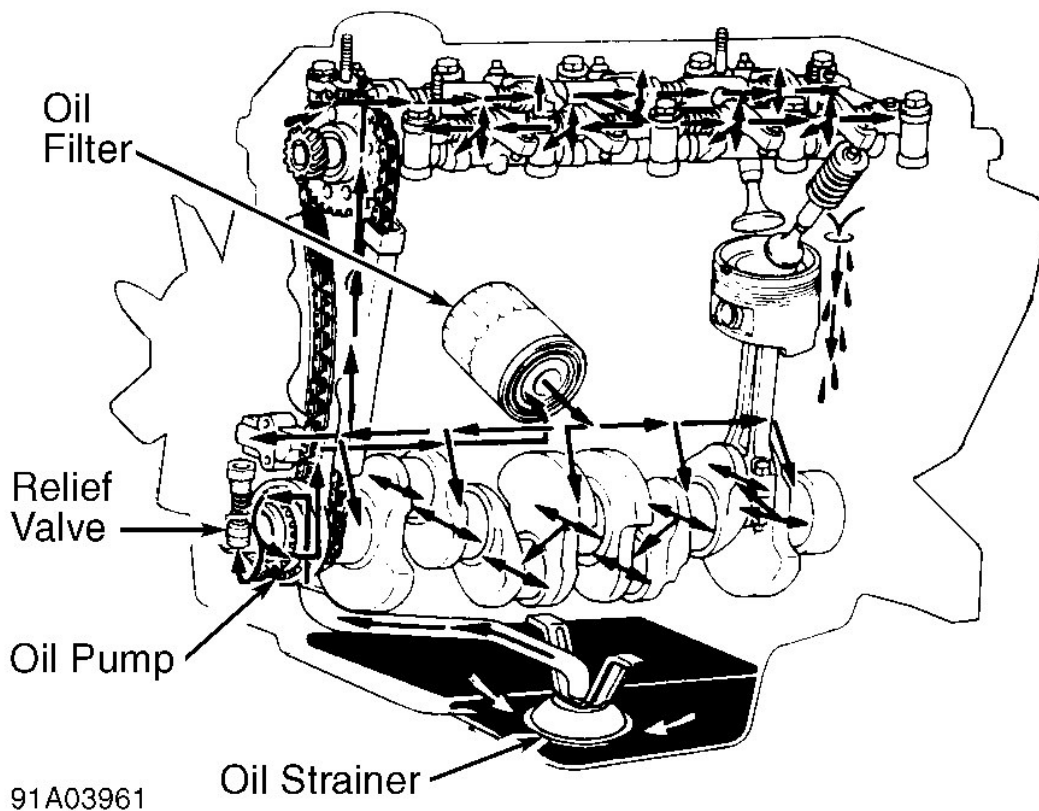


Fig. 16: Cross-Sectional View Of Engine Oil Circuit
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OIL PUMP

Removal & Disassembly

1. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. Remove bolts and oil strainer. Remove accessory drive belt.
2. Remove accessory drive pulley from front of crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley. Remove crankshaft pulley bolt. Using puller, remove crankshaft pulley.
3. Remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor bracket. Remove bolts, oil pump and "O" ring from front cover. Disassemble oil pump components. See **Fig. 17**.

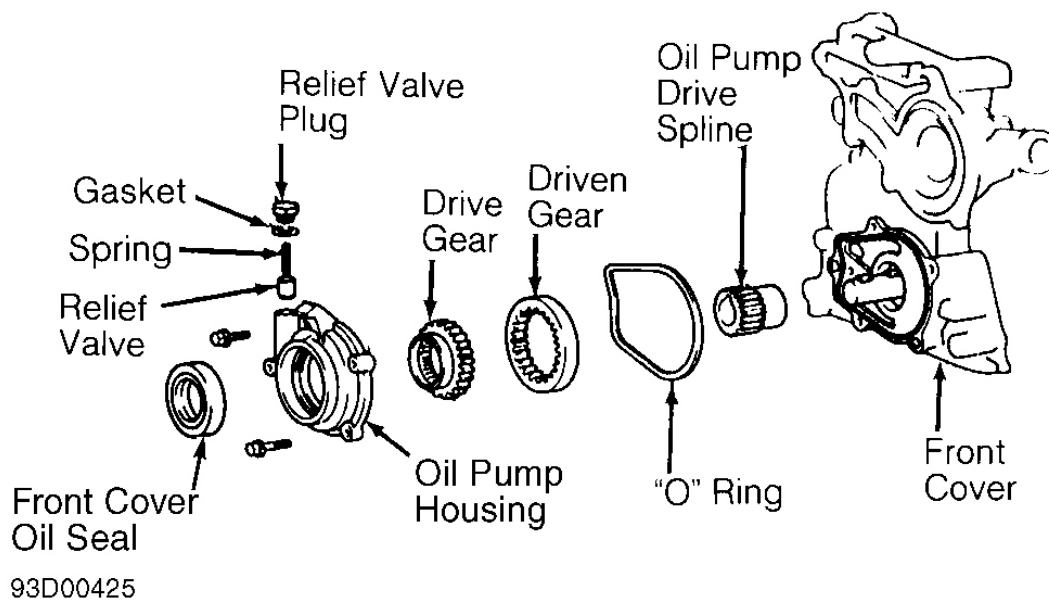


Fig. 17: Exploded View Of Oil Pump & Components

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

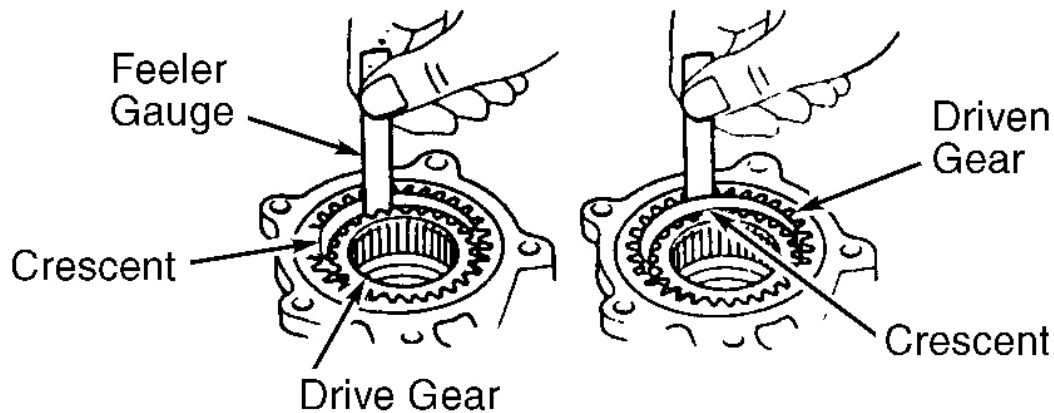
Inspection

1. Inspect components for damage. Coat relief valve with engine oil and ensure relief valve slides freely in bore of oil pump housing. Install drive and driven gears in oil pump housing.
2. Using feeler gauge, measure driven gear-to-oil pump housing clearance. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.
3. Measure gear tip clearance between tip of each gear and crescent in oil pump. See **Fig. 18**. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.
4. Place straightedge across oil pump housing, above both gears. Measure gear end clearance between

straightedge and gear surface. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS** table.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Driven Gear-To-Oil Pump Housing Clearance	
Standard	.0035-.0059 (.090-.150)
Wear Limit	.008 (.20)
Gear End Clearance	
Standard	.0012-.0035 (.030-.090)
Maximum	.006 (.15)
Gear Tip Clearance	
Drive Gear	
Standard	.0087-.0098 (.220-.250)
Wear Limit	.012 (.30)
Driven Gear	
Standard	.0059-.0083 (.150-.210)
Wear Limit	.012 (.30)



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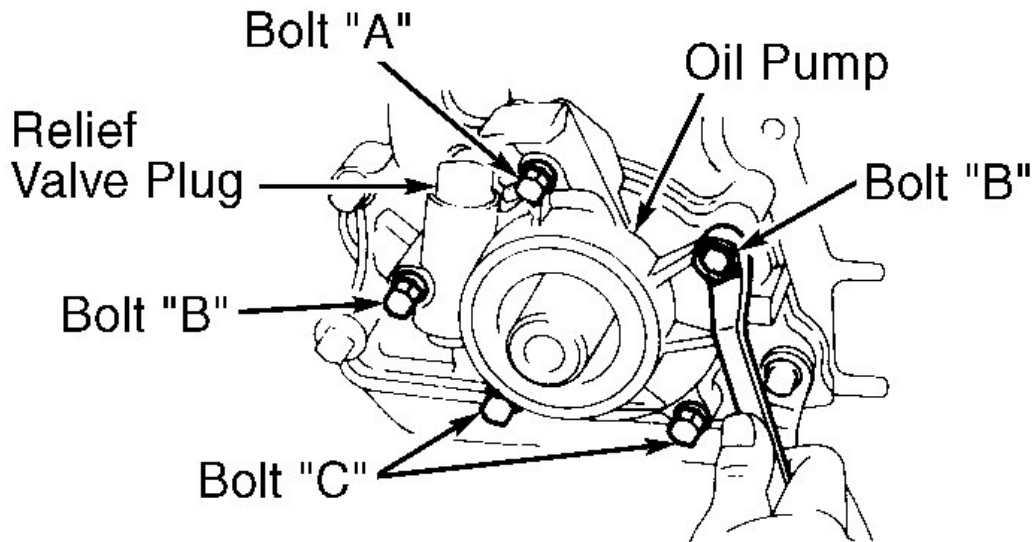
Fig. 18: Measuring Oil Pump Gear Tip Clearance
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Reassembly & Installation

1. To reassemble, reverse disassembly procedure using NEW gasket on relief valve plug. Tighten relief valve plug to specification. See **TORQUE SPECIFICATIONS**.
2. Using Oil Seal Installer (SST 09223-50010), install NEW front cover oil seal (if removed) until oil seal

surface is even with oil pump housing. Coat seal lip with grease.

3. Using NEW "O" ring, install oil pump on front cover. Apply thread sealant to bolt "A" and install. See **Fig. 19**. Install remaining bolts. Tighten all bolts to specification.
4. To install remaining components, reverse removal procedure. Tighten fasteners to specification. Refer to **TORQUE SPECIFICATIONS**.



Bolt "A" - 18 Ft. Lbs. (24 N.m)
 Bolt "B" - 14 Ft. Lbs. (19 N.m)
 Bolt "C" - 115 INCH Lbs. (13.0 N.m)

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Fig. 19: Installing Oil Pump

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TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt-To-Mounting Bracket Bolt	20 (27)
Accessory Drive Pulley-To-Crankshaft Pulley Bolt	14 (19)
Air Intake Chamber-To-Intake Manifold Bolt	14 (19)
Camshaft Bearing Cap Bolt	15 (20)
Camshaft Sprocket Bolt	58 (79)

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Connecting Rod Nut	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head/Rocker Arm Assembly Bolt ⁽¹⁾	58 (79)
Distributor Hold-Down Bolt	14 (19)
Drive Axle-To-Side Gear Flange Bolt	61 (83)
Drive Shaft Flange Bolt	55 (75)
Exhaust Manifold Heat Insulator Bolt	14 (19)
Exhaust Manifold Nut	33 (45)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	80 (109)
Front Cover Bolt	(2)
Front Differential Mount Bolts	
Differential Cover Mount Bolt	108 (146)
Left & Right Mount Bolt	123 (167)
Fuel Line-To-Delivery Pipe Union Bolt	32 (43)
Intake Manifold Bolt/Nut	14 (19)
Main Bearing Cap Bolt ⁽³⁾	76 (103)
Oil Pump Bolt	(4)
Power Steering Pump Bracket-To-Cylinder Head Bolt	32 (43)
Power Steering Pump Pulley Nut	32 (43)
Rocker Arm Adjusting Screw Lock Nut	18 (24)
Rear Seal Housing Bolt	13 (18)
Relief Valve Plug	27 (37)
Spark Plug	13 (18)
Stabilizer Bar-To-Frame Bracket Bolt	21 (29)
Stabilizer Bar Link-To-Lower Control Arm Nut	19 (26)
Timing Chain Damper Bolt	16 (22)
Timing Chain Tensioner Bolt	14 (19)
Transmission Crossmember-To-Body Bolt (4WD Models)	70 (95)
INCH Lbs. (N.m)	
Clutch Release Cylinder Bolt	106 (12.0)
Cylinder Head Rear Plate Bolt	115 (13.0)
Cylinder Head-To-Front Cover Bolt	115 (13.0)
EGR Valve Bolt/Nut	115 (13.0)
No. 1 Air Injection Manifold Bolt/Nut	115 (13.0)
Oil Pan Bolt/Nut	115 (13.0)
Oil Strainer Bolt	115 (13.0)
PAIR Valve Nut	115 (13.0)
Stabilizer Bar Link-To-Lower Control Arm Nut	115 (13.0)

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2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Valve Cover Nut	52 (5.9)
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- (1) Tighten bolts to specification in sequence. See **Fig. 2**.
- (2) Tighten 8-mm bolts to 115 INCH lbs. (13.0 N.m) and 10-mm bolts to 29 ft. lbs. (39 N.m).
- (3) Tighten bolts to specification in sequence. See **Fig. 14**.
- (4) Tighten bolts to specification as specified. See **Fig. 19**.

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

Application	Specification
Displacement	146.4 Cu. In. (2.4L)
Bore	3.62" (91.9 mm)
Stroke	3.50" (88.9 mm)
Compression Ratio	9.3:1
Fuel System	MFI
Horsepower @ RPM	116 @ 4800
Torque Ft. Lbs. @ RPM	140 @ 2800

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

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.012 (.30)
Runout	.004 (.10)
Main Bearings	
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0010-.0022 (.025-.055)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	2.0861-2.0866 (52.988-53.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)

1994 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Oil Clearance	
Standard	.0010-.0022 (.025-.055)
Wear Limit	.0039 (.100)

CONNECTING RODS SPECIFICATIONS**CONNECTING RODS SPECIFICATIONS**

Application	In. (mm)
Bore Diameter	
Crankpin Bore ⁽¹⁾	
Size Mark "A"	2.2047-2.2050 (56.000-56.006)
Size Mark "B"	2.2050-2.2052 (56.006-56.012)
Size Mark "C"	2.2052-2.2054 (56.012-56.018)
Maximum Bend	.0020 Per 3.94 (.050 Per 100.1)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	.0063-.0102 (.160-.260)
Wear Limit	.012 (.30)
(1) Crankpin bore diameter is determined by size mark stamped on connecting rod cap. See Fig. 13 .	

PISTONS, PINS & RINGS SPECIFICATIONS**PISTONS, PINS & RINGS SPECIFICATIONS**

Application	In. (mm)
Pistons	
Clearance	.0006-.0014 (.015-.035)
Diameter ⁽¹⁾	
Size Mark "1"	3.6211-3.6214 (91.975-91.985)
Size Mark "2"	3.6214-3.6218 (91.985-91.995)
Size Mark "3"	3.6218-3.6222 (91.995-92.005)
Pins	
Piston Fit	(2)
Rod Fit	
Standard	.0002-.0004 (.005-.011)
Wear Limit	.0006 (.015)
Rings	
No. 1	
End Gap	

1994 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Standard	.0098-.0185 (.250-.470)
Wear Limit	.0421 (1.070)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
No. 2	
End Gap	
Standard	.0236-.0323 (.600-.820)
Wear Limit	.0559 (1.420)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0224 (.200-.570)
Wear Limit	.0461 (1.170)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
(1) Piston diameter is determined by size mark on top of piston. See Fig. 10 .	
(2) Piston pin should slide in piston using thumb pressure with piston heated to 176°F (80°C).	

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK SPECIFICATIONS**

Application	In. (mm)
Cylinder Bore	
Standard Diameter ⁽¹⁾	
Size Mark "1"	3.6220-3.6224 (92.000-92.010)
Size Mark "2"	3.6224-3.6228 (92.010-92.020)
Size Mark "3"	3.6228-3.6232 (92.020-92.030)
Main Bearing Bore Inside Diameter ⁽²⁾	
Size Mark "3"	2.5198-2.5201 (64.004-64.010)
Size Mark "4"	2.5201-2.5203 (64.010-64.016)
Size Mark "5"	2.5203-2.5205 (64.016-64.022)

1994 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Maximum Deck Warpage	.002 (.05)
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(1) Cylinder bore diameter is determined by size mark on cylinder block deck surface. See **Fig. 11**.
Maximum cylinder bore diameter is 3.6311" (92.230 mm).

(2) Main bearing bore inside diameter is determined by size mark on cylinder block. See **Fig. 15**.

VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS SPECIFICATIONS**

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.024" (.60 mm)
Minimum Refinish Length	4.449" (113.00 mm)
Stem Diameter	.3138-.3144" (7.970-7.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.024" (.60 mm)
Minimum Refinish Length	4.406" (111.90 mm)
Stem Diameter	.3136-.3142" (7.965-7.980 mm)
Valve Springs	
Free Length	1.909" (48.50 mm)
Out-Of-Square	.063" (1.60 mm)
	Lbs. @ In. (kg @ mm)
Pressure	
Valve Closed	62.8-66.1 @ 1.594 (28.5-29.9 @ 40.50)

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD SPECIFICATIONS**

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.0059" (.150 mm)
Manifold Surface	.0079" (.200 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)

1994 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Valve Guides

Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.5118-.5125" (13.000-13.018 mm)
Oversize Valve Guide	.5138-.5145" (13.050-13.068 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 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.	
Standard Valve Guide	.5118-.5125" (13.000-13.018 mm)
Oversize Valve Guide	.5138-.5145" (13.050-13.068 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Wear Limit	.0039" (.100 mm)

CAMSHAFT SPECIFICATIONS**CAMSHAFT SPECIFICATIONS**

Application	In. (mm)
End Play	
Standard	.0031-.0071 (.080-.180)
Wear Limit	.0098" (.250 mm)
Journal Diameter	1.2984-1.2992 (32.980-33.000)
Journal Runout	.008 (.20)
Lobe Height	
Intake	
Standard	1.6783-1.6819 (42.630-42.720)
Wear Limit	1.6634" (42.250 mm)
Exhaust	
Standard	1.6807-1.6842 (42.690-42.780)

1994 Toyota 4Runner SR5

2.4L 4-CYL - VIN [R] 1994 ENGINES Toyota 2.4L 4-Cylinder

Wear Limit	1.6654" (42.300 mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.050)
Wear Limit	.0039" (.100 mm)

1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

2.4L 4-CYL VIN [R]

1995 ENGINES Toyota - 2.4L 4-Cylinder

ENGINE IDENTIFICATION

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

Engine may be identified by Vehicle Identification Number (VIN), stamped on a metal pad located near lower left corner of windshield on all models. On all models, fourth character of VIN identifies engine, and tenth character ("S" on 1995) identifies model year. Engine serial number is stamped on cylinder block, behind generator.

ENGINE IDENTIFICATION CODE

Engine	Code	VIN
2.4L 4-Cylinder	22R-E	"R"

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Adjust valve clearance with engine at normal operating temperature.

1. Warm engine to normal operating temperature. Remove nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing mark groove on crankshaft pulley aligns with "0" timing mark on front cover.
2. Ensure rocker arms on cylinder No. 1 are loose and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft one revolution (360 degrees) and realign timing marks.
3. Using feeler gauge, check valve clearance between rocker arm and valve stem on intake valves of cylinders No. 1 and 2, and exhaust valves of cylinders No. 1 and 3.
4. Ensure valve clearance is within specification. See **VALVE CLEARANCE SPECIFICATIONS** . If valve clearance adjustment is required, loosen rocker arm adjusting screw lock nut and rotate adjusting screw to obtain correct valve clearance. Tighten rocker arm adjusting screw lock nut to specification. See **TORQUE SPECIFICATIONS** . Recheck valve clearance.
5. Rotate crankshaft one revolution (360 degrees) and realign timing marks. Check valve clearance on intake valves of cylinders No. 3 and 4, and exhaust valves of cylinders No. 2 and 4. Adjust valve clearance if necessary.
6. Using NEW gasket, install valve cover. Install and tighten nuts to specification. See **TORQUE SPECIFICATIONS** .

VALVE CLEARANCE SPECIFICATIONS ⁽¹⁾

Application	In. (mm)
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1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

Exhaust Valve	.012 (.30)
Intake Valve	.008 (.20)
(1) Adjust valves with engine at normal operating temperature.	

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.

FUEL PRESSURE RELEASE

With ignition off, disconnect negative battery cable. Place an approved gasoline container under fuel line. Cover fuel line connection with shop towel. Slowly loosen fuel line connection to release fuel pressure. Once fuel pressure is released, fuel system components may be serviced.

ENGINE

NOTE: Remove engine and transmission as an assembly.

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** . Remove hood, battery and lower engine covers. Drain cooling system and engine oil. Remove air cleaner case and intake air connector.
2. Remove radiator and accessory drive belts. Remove fan clutch along with fan and water pump pulley. Disconnect necessary electrical connections, vacuum hoses, coolant hoses and fuel lines.
3. Disconnect control cables at throttle body. Disconnect necessary ground straps. Remove power steering pump and A/C compressor with hoses attached and secure aside (if equipped).
4. Place reference marks on drive shaft flanges for reassembly reference. Remove bolts and all drive shaft(s).
5. On M/T models, remove shift lever(s) from inside vehicle. On all models, disconnect necessary shift linkages, hoses and electrical connections at transmission and transfer case (if equipped).
6. On 4WD A/T models, disconnect transfer case shift linkage from cross shaft at transfer case. Remove bolts and cross shaft.
7. On all 4WD models, remove transfer case protective plates located below transfer case. Remove stabilizer bar (if equipped). Disconnect speedometer cable.

NOTE: DO NOT separate felt dust protector and washers from speedometer cable.

8. Disconnect oxygen sensor connector. Remove front exhaust pipe, located between exhaust manifold and catalytic converter.
9. On 2WD models, support transmission with floor jack. Remove rear engine mount and bracket at transmission. On M/T models, remove clutch release cylinder with hoses attached and secure aside.
10. On 4WD models, remove front floor heat insulator and brake tube heat insulator. Support transmission with floor jack. Remove bolts and transmission crossmember located below transmission.
11. On all models, support engine with hoist. Remove engine mount bolts/nuts. Lift engine and transmission assembly from vehicle.

Installation

To install, reverse removal procedure. Ensure reference marks are aligned on drive shaft flanges. Adjust all fluid levels, control cables and shift linkages.

CYLINDER HEAD & MANIFOLDS**Removal**

1. Disconnect negative battery cable. Drain cooling system. Remove air intake from air intake chamber. Disconnect exhaust pipe from exhaust manifold.
2. Remove oil dipstick, distributor and spark plugs. Disconnect necessary electrical connections, coolant hoses, vacuum hoses and control cables.
3. Remove EGR vacuum modulator. Remove air intake chamber along with throttle body. See **Fig. 1** . Release fuel pressure. See **FUEL PRESSURE RELEASE** . Disconnect necessary fuel lines.
4. Remove power steering pump bracket-to-cylinder head bolts (if equipped). Remove nuts, seals, valve cover and gasket. Rotate crankshaft so cylinder No. 1 (front cylinder) is at TDC on compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
5. Ensure rocker arms on cylinder No. 1 are loose and rocker arms on cylinder No. 4 are tight. If rocker arms are not as described, rotate crankshaft one revolution (360 degrees) and realign timing marks.
6. Paint reference mark on camshaft sprocket and timing chain for reassembly reference. Remove half-circular seal and camshaft sprocket bolt.
7. Remove distributor drive gear and thrust plate from camshaft sprocket. See **Fig. 1** . Remove camshaft sprocket and timing chain from camshaft. Allow camshaft sprocket and timing chain to rest in cylinder head.

CAUTION: DO NOT allow timing chain to become disengaged from crankshaft sprocket.

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

8. Remove cylinder head-to-front cover bolt, located on cylinder head in front of camshaft sprocket area. Loosen cylinder head/rocker arm assembly bolts in sequence using several steps. See **Fig. 2** .

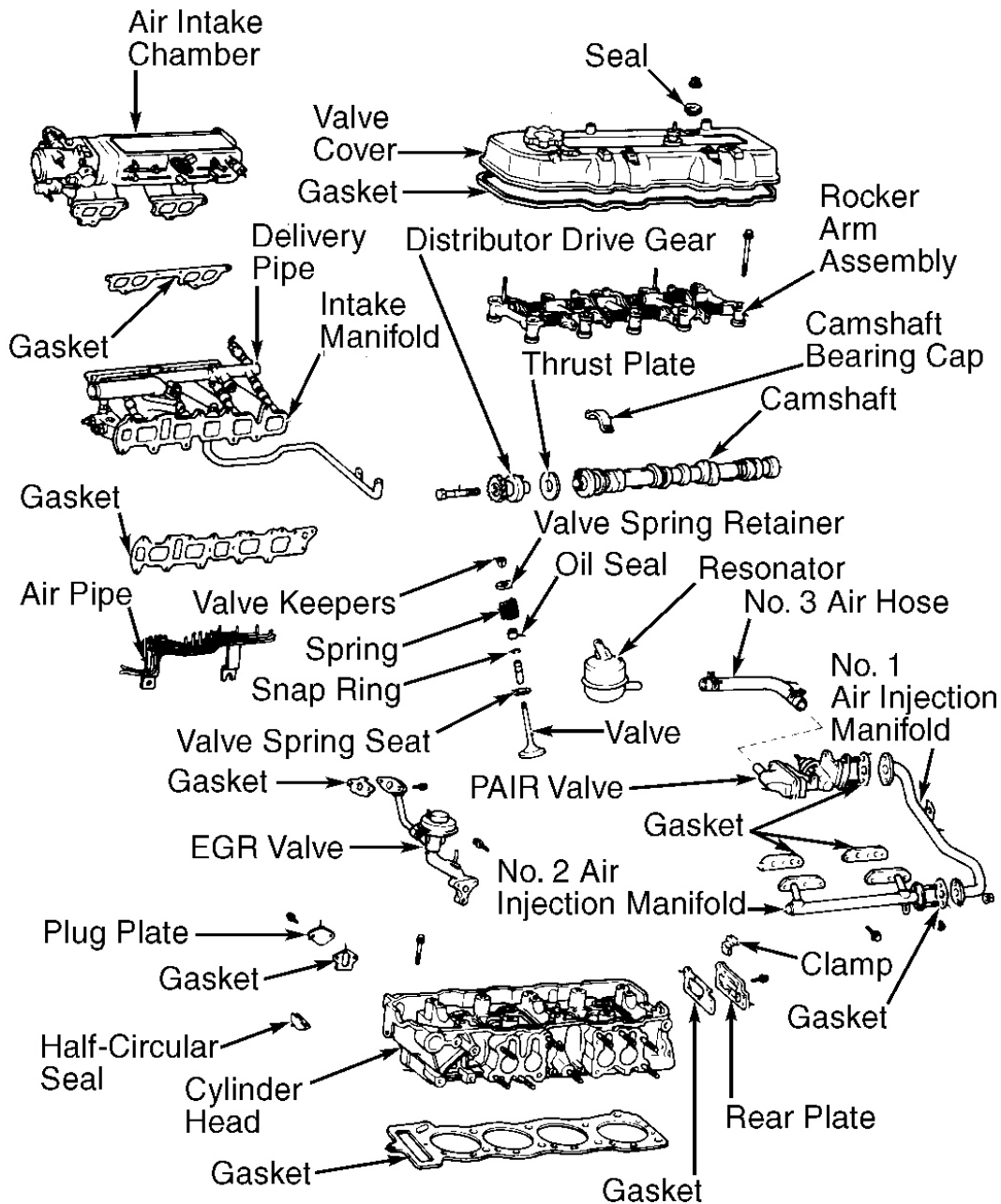
9. Remove rocker arm assembly. If necessary for removal, pry equally at front and rear of rocker arm assembly. Remove cylinder head by lifting upward from dowels on cylinder block. Remove cylinder headgasket.

NOTE: **If cylinder head removal is difficult, carefully pry with flat bar between cylinder head and projecting areas on cylinder block.**

10. Remove bolts/nuts, No. 1 air injection manifold, gaskets and PAIR valve. See **Fig. 1** . Remove air pipe. Remove intake manifold as an assembly with delivery pipe, fuel injectors and heater coolant inlet pipe.
11. Remove EGR valve. Remove heat insulators, exhaust manifold and gasket. Remove rear plate and gasket. See **Fig. 1** .

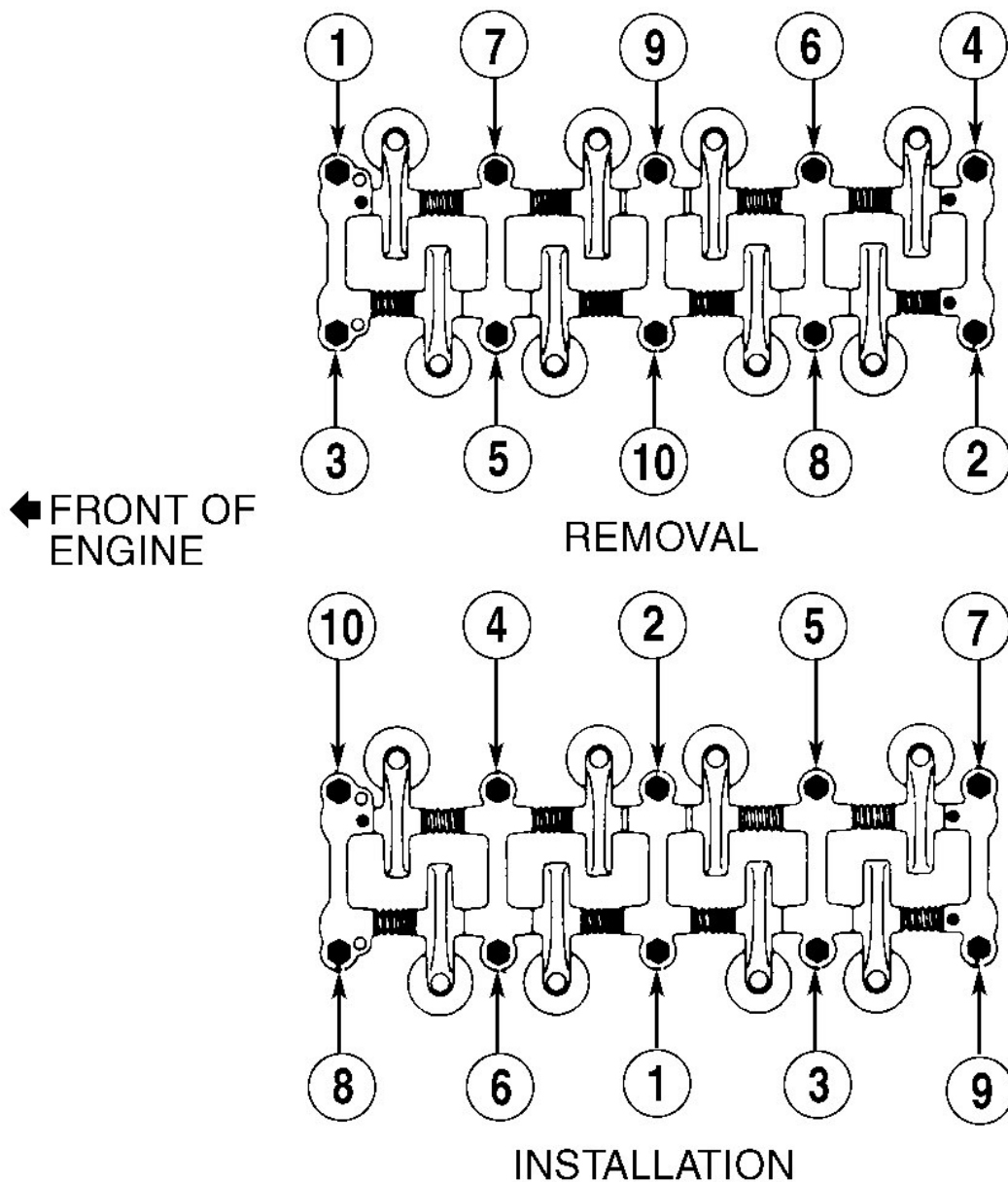
1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder



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Fig. 1: Exploded View Of Cylinder Head & Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 2: Cylinder Head/Rocker Arm Assembly Bolt Removal & Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect cylinder head warpage at cylinder block and manifold areas. Replace cylinder head if warpage exceeds specification. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS.
2. Inspect air intake chamber-to-intake manifold and intake manifold-to-cylinder head surfaces for warpage.

Replace air intake chamber or intake manifold if warpage exceeds .008" (.20 mm).

3. Inspect exhaust manifold-to-cylinder head surface for warpage. Replace exhaust manifold if warpage exceeds .028" (.70 mm).
4. Inspect cylinder block deck surface for warpage. Replace cylinder block if deck warpage exceeds specification. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS. Inspect camshaft and components. See **CAMSHAFT**.

Installation

1. Install components on cylinder head using NEW gaskets. Use NEW nuts when installing exhaust manifold. Tighten all bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.

NOTE: Ensure EGR valve-to-cylinder head bolt hole threads are clean. Apply thread sealant on front bolt (closest to front of cylinder head) for EGR valve before installing bolt.

2. Apply liquid sealant at both front corners of cylinder block-to-front cover areas. Install NEW cylinder head gasket. Ensure cylinder head gasket aligns with dowels in cylinder block.
3. Install cylinder head and rocker arm assembly. Ensure rocker arm assembly aligns with dowels in cylinder head. Install and tighten cylinder head/rocker arm assembly bolts to specification in sequence using 3 steps. See **Fig. 2**. See **TORQUE SPECIFICATIONS**.
4. Install and tighten cylinder head-to-front cover bolt to specification. See **TORQUE SPECIFICATIONS**. Ensure reference marks on camshaft sprocket and timing chain are aligned. Hold camshaft sprocket and timing chain upward.
5. If cylinder No. 1 is not at TDC on compression stroke, rotate crankshaft so cylinder No. 1 is at TDC on compression stroke. Ensure timing groove on crankshaft pulley aligns with "0" timing mark on front cover.
6. Install camshaft sprocket and timing chain on camshaft. It may be necessary to rotate crankshaft back and forth slightly while pulling upward on timing chain and camshaft sprocket.
7. Install thrust plate and distributor drive gear. Install and tighten camshaft sprocket bolt to specification. See **TORQUE SPECIFICATIONS**. Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

NOTE: Adjust valve clearance initially with engine cold and then readjust with engine at normal operating temperature.

8. To install remaining components, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS**. Install NEW "O" ring on distributor before installing distributor.
9. Before installing valve cover, ensure half-circular seals are installed at front and rear of cylinder head. Apply sealant at half-circular seal-to-cylinder head surfaces.
10. Using NEW gasket, install valve cover. Install seals and nuts. Tighten nuts to specification. See **TORQUE SPECIFICATIONS**. Adjust fluid levels, control cables and ignition timing.

FRONT COVER OIL SEAL

Removal & Installation (Front Cover Removed)

Pry oil seal from oil pump housing, located on front cover. To install, use Oil Seal Installer (SST 09223-50010). Install NEW oil seal until oil seal surface is even with oil pump housing surface. Apply grease to lip of oil seal.

Removal & Installation (Front Cover Installed)

1. Remove accessory drive belts. Remove accessory drive pulley from front of crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley. Remove crankshaft pulley bolt.
2. Using puller, remove crankshaft pulley. Cut lip from oil seal. Pry oil seal from oil pump housing, located on front cover. Use care not to damage sealing surfaces.
3. To install, apply grease to lip of NEW oil seal. Using Oil Seal Installer (SST 09223-50010), install oil seal until oil seal surface is even with oil pump housing surface.
4. To install remaining components, reverse removal procedure. Tighten crankshaft pulley and accessory drive pulley bolt to specification. See **TORQUE SPECIFICATIONS**.

TIMING CHAIN

NOTE: **Cylinder head must be removed for servicing timing chain. On 4WD models, front differential must also be removed for servicing timing chain.**

Removal

1. Remove cylinder head. See **CYLINDER HEAD & MANIFOLDS**. Remove radiator. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges on front differential. Place reference marks on drive shaft flanges for reassembly reference. Remove bolts from drive shaft flange. Disconnect drive shaft from front differential.
2. Disconnect necessary vacuum hoses and electrical connectors at front differential. Support front differential assembly with floor jack. Remove front differential assembly mount bolts. Lower front differential assembly from vehicle.
3. On all models, remove oil pan. See **OIL PAN**. Remove all accessory drive belts. Remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor mounting bracket (if equipped).
4. Remove fan clutch along with fan and water pump pulley. Remove accessory drive pulley from crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley.
5. Remove crankshaft pulley bolt. Using puller, remove crankshaft pulley. Disconnect coolant by-pass pipe, on passenger's side, from front cover. Remove generator adjusting bracket. Disconnect heater outlet pipe, located near generator, from front cover.

CAUTION: When removing front cover bolts, ensure front cover bolt on rear of front cover block is removed. See **Fig. 3**.

6. Remove front cover bolts. See **Fig. 3**. Remove front cover and gaskets. Remove timing chain from

timing chain dampers. See **Fig. 4** . Remove camshaft sprocket and timing chain. Using gear puller, remove oil pump drive spline and crankshaft sprocket (if necessary). See **Fig. 4** .

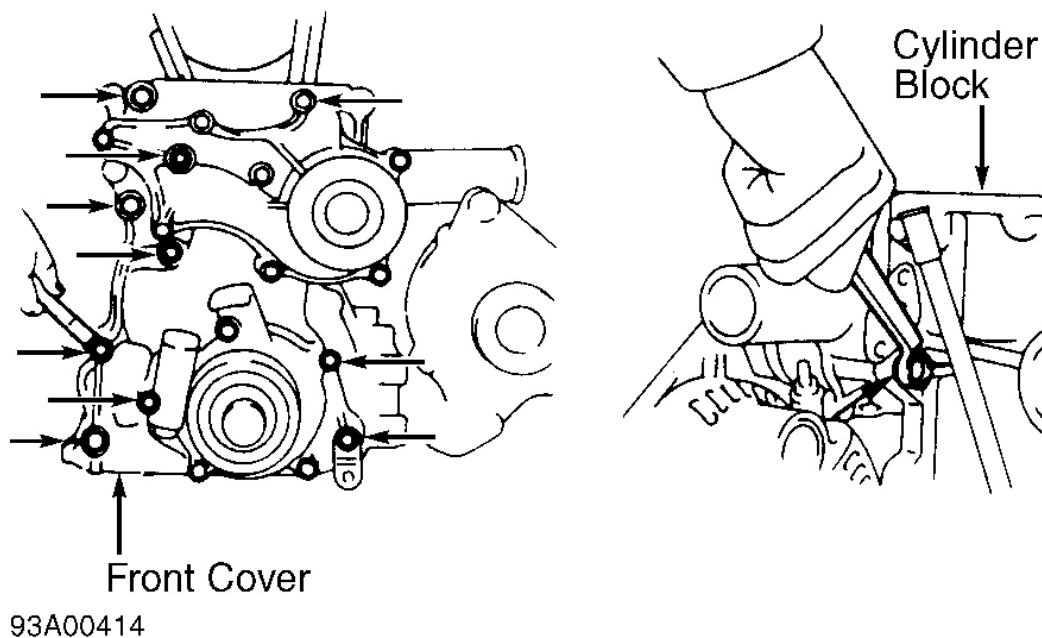
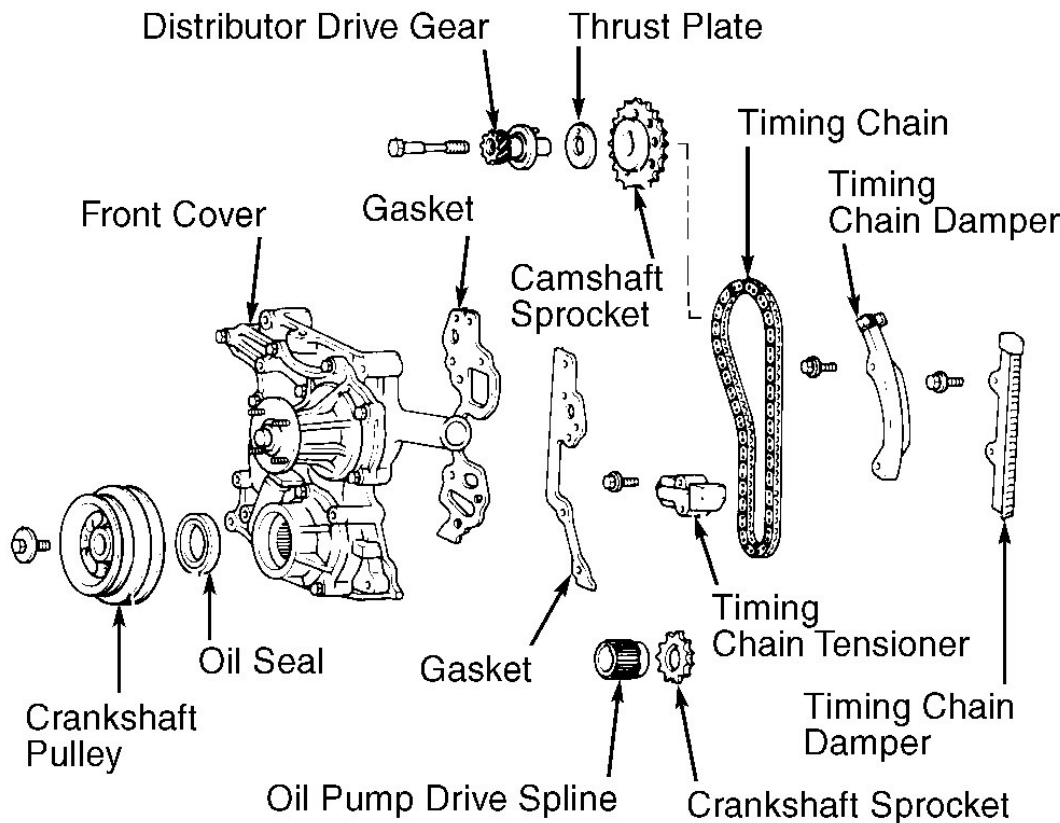


Fig. 3: Identifying Front Cover Bolts

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



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Fig. 4: Exploded View Of Timing Chain & Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect components for damage and wear. Using caliper, measure timing chain tensioner width. See **Fig. 5**. Replace timing chain tensioner if width is .433" (11.00 mm) or less.
2. Measure thickness of timing chain dampers. Replace timing chain dampers if thickness is .020" (.50 mm) or less. Using caliper, measure length of 17 links with timing chain fully stretched. See **Fig. 6**. Repeat measurement in at least 3 areas on timing chain. Replace timing chain if length of 17 links exceeds 5.79" (147.0 mm).
3. Wrap timing chain completely around camshaft sprocket. Using caliper, measure outside diameter of timing chain and camshaft sprocket. See **Fig. 6**. Using same method, measure outside diameter of crankshaft sprocket and timing chain.
4. Replace timing chain and sprockets if outside diameter is less than specified. See **TIMING CHAIN & SPROCKET OUTSIDE DIAMETER SPECIFICATIONS**.

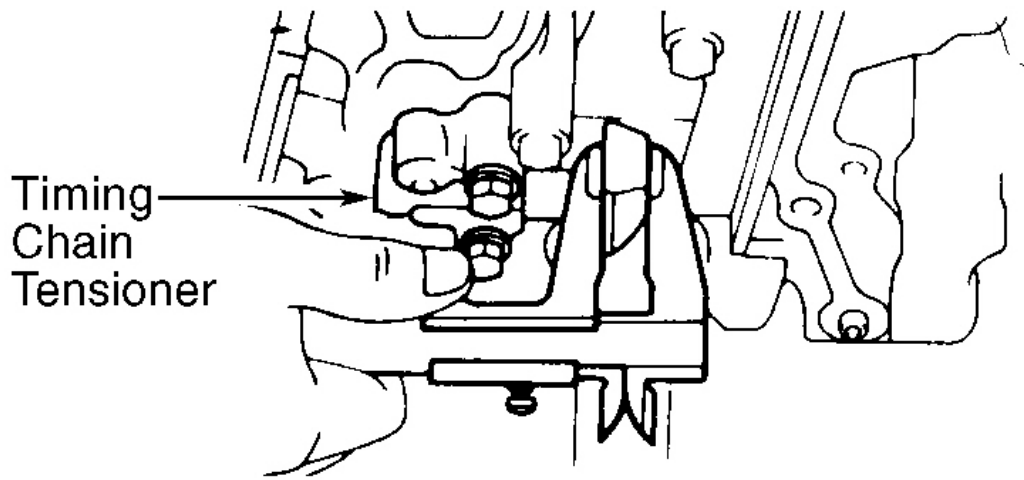
TIMING CHAIN & SPROCKET OUTSIDE DIAMETER SPECIFICATIONS

Application	In. (mm)
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1995 Toyota 4Runner SR5

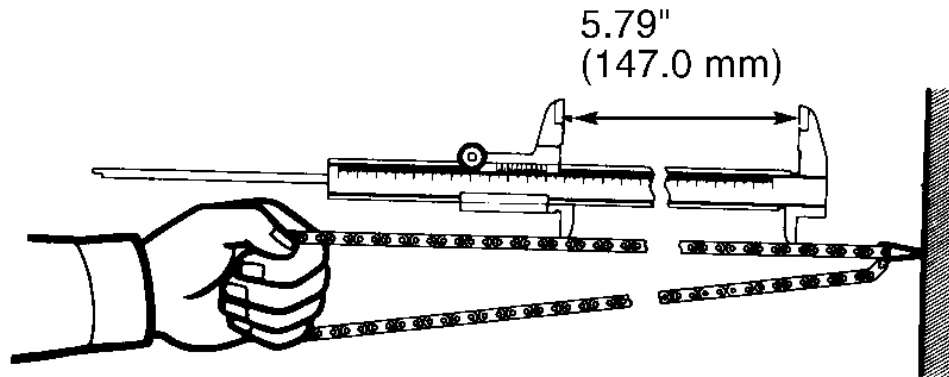
2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

Timing Chain & Camshaft Sprocket	4.480 (113.80)
Timing Chain & Crankshaft Sprocket	2.339 (59.40)

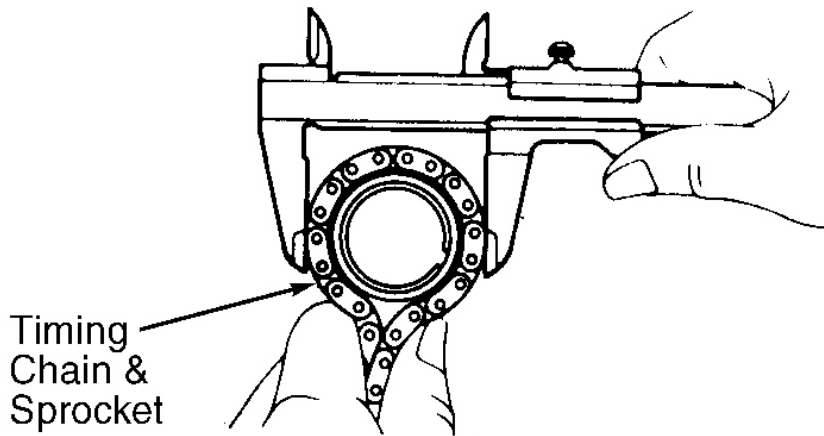


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Fig. 5: Measuring Timing Chain Tensioner Width
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



MEASURING TIMING CHAIN



MEASURING TIMING CHAIN & SPROCKET OUTSIDE DIAMETER

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Fig. 6: Measuring Timing Chain & Sprockets

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

Installation

1. Ensure crankshaft is positioned with keyway at 12 o'clock position. Install crankshaft sprocket on crankshaft with flat side toward front of engine.

CAUTION: Ensure crankshaft sprocket is installed with flat side toward front of engine. See Fig. 7 .

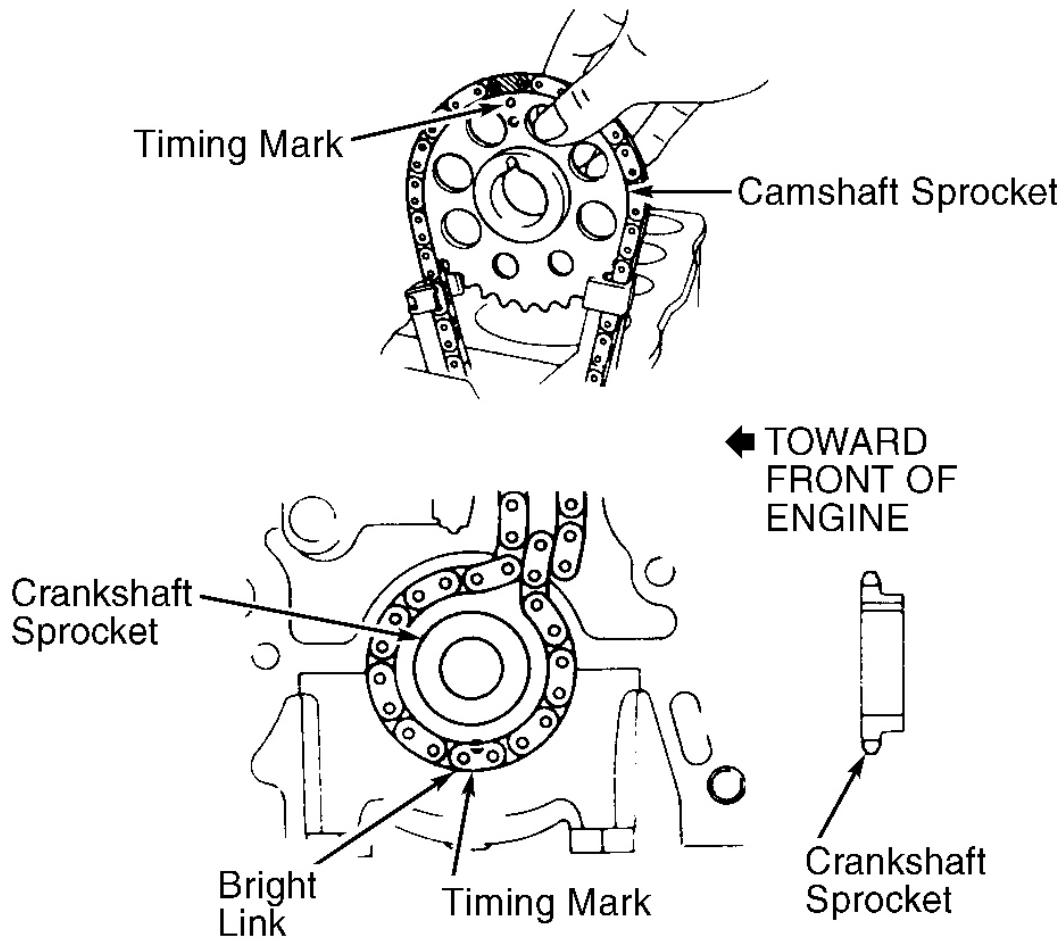
2. Install timing chain on crankshaft sprocket with bright link on timing chain aligned with timing mark on

crankshaft sprocket. See **Fig. 7** . Install timing chain on camshaft sprocket with bright link on timing chain aligned with timing mark on camshaft sprocket. Ensure timing chain is positioned between timing chain dampers.

3. Rotate camshaft sprocket counterclockwise to take slack out of timing chain. Install oil pump drive spline over crankshaft key.
4. Using NEW gasket, install front cover. Install and tighten front cover bolts to specification. See **TORQUE SPECIFICATIONS** .
5. Ensure oil pan sealing surfaces are clean. Apply a .20" (5.0 mm) diameter bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing areas.

6. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing areas. Install oil pan. Install and tighten oil pan bolts/nuts to specification. See **TORQUE SPECIFICATIONS** .
7. To install remaining components, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS** .
8. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with gear oil.
9. On 4WD models without manual hubs on front axle, use hypoid gear oil SAE 75W-90 with API rating of GL-5. On 4WD models with manual hubs on front axle, use hypoid gear oil SAE 80W-90 with API rating of GL-5.



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Fig. 7: Installing Timing Chain & Sprockets
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ROCKER ARM ASSEMBLY

Removal & Installation

Rocker arm assembly removal and installation procedure is listed with cylinder head and manifold removal and installation procedure. Rocker arm assembly is attached with cylinder head/rocker arm assembly bolts. See CYLINDER HEAD & MANIFOLDS .

CAMSHAFT

Removal

1. Remove distributor. Remove rocker arm assembly and camshaft sprocket. Rocker arm assembly is

attached with cylinder head/rocker arm assembly bolts. See **CYLINDER HEAD & MANIFOLDS** under REMOVAL & INSTALLATION.

2. Measure camshaft end play before removing camshaft. Replace camshaft and/or cylinder head if camshaft end play is not within specification. See **CAMSHAFT** under ENGINE SPECIFICATIONS.
3. Note direction of camshaft bearing cap installation for reassembly reference. Camshaft bearing caps are numbered in sequence with No. 1 at front of engine (timing chain end).
4. Ensure arrow on top of camshaft bearing cap points toward front of engine. Remove bolts, camshaft bearing caps and camshaft.

Inspection

1. Inspect components for damage. Check camshaft journal diameter, lobe height and journal runout. Replace camshaft if not within specification. See **CAMSHAFT** under ENGINE SPECIFICATIONS.
2. Install camshaft in cylinder head. Using Plastigage, check camshaft oil clearance with camshaft bearing cap bolts tightened to specification. See **TORQUE SPECIFICATIONS**.
3. Replace camshaft and/or cylinder head if oil clearance is not within specification. See **CAMSHAFT**.

Installation

1. To install, reverse removal procedure. Ensure camshaft bearing caps are installed in numerical order with No. 1 at front of engine (timing chain end). Ensure arrow on top of each camshaft bearing cap points toward front of engine.
2. Install and tighten camshaft bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**. Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transmission, clutch assembly (if equipped) and flywheel/drive plate. Using a knife, cut off seal lip from oil seal. 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. Using Oil Seal Installer (SST 09223-41020), install oil seal until oil seal is even with rear seal housing surface.
2. Install and tighten flywheel/drive plate bolts to specification. See **TORQUE SPECIFICATIONS**. To install remaining components, reverse removal procedure.

WATER PUMP

Removal & Installation

1. Drain cooling system. Remove power steering pump and A/C compressor drive belts (if equipped). Remove fan clutch along with fan and water pump pulley.
2. Remove bolts/nuts, water pump and gasket. To install, reverse removal procedure. Use a NEW gasket.

Fill cooling system.

OIL PAN

Removal

1. Drain engine oil. Raise and support vehicle. Remove lower engine covers. On 2WD models, remove engine mount bolts. Place a floor jack under transmission, and raise engine about 1.00" (25.4 mm) if necessary.
2. On 4WD models, drain front differential gear oil. Disconnect drive axles from side gear flanges on front differential. Place reference marks on drive shaft flanges for reassembly reference. Remove bolts from drive shaft flange. Disconnect drive shaft from front differential.
3. Disconnect necessary vacuum hoses and electrical connectors at front differential. Support front differential assembly with floor jack. Remove front differential assembly mount bolts. Lower front differential assembly from vehicle.
4. On all models, remove oil pan bolts/nuts. Install Oil Pan Seal Cutter (SST 09032-00100) between cylinder block and oil pan. Tap oil cutter along sides of oil pan to remove oil pan. Use care not to damage sealing surfaces or oil pan flange.

Installation

1. Ensure sealing surfaces are clean. Apply a .20" (5.0 mm) diameter bead of sealant on inside of bolt/nut holes and at center of oil pan sealing surface between bolt/nut holes.

CAUTION: Ensure sealant is applied where front cover and rear seal housing contact cylinder block at oil pan sealing areas.

2. Apply sealant where front cover and rear seal housing contact cylinder block at oil pan sealing areas. Install oil pan. Install and tighten oil pan bolts/nuts to specification. See **TORQUE SPECIFICATIONS**.
3. To install remaining components, reverse removal procedure. Tighten fasteners to specification. See **TORQUE SPECIFICATIONS**. Fill crankcase with oil.
4. On 4WD models, ensure reference marks are aligned on drive shaft flanges. Fill differential with gear oil. On 4WD models without manual hubs on front axle, use hypoid gear oil SAE 75W-90 with API rating of GL-5. On 4WD models with manual hubs on front axle, use hypoid gear oil SAE 80W-90 with API rating of GL-5.

OVERHAUL

CYLINDER HEAD

Cylinder Head

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

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

Valve Springs

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

Valve Stem Oil Seals

Lubricate valve stem oil seal with engine oil. Install valve stem oil seal. Ensure valve stem oil seal is fully seated.

Valve Guides

1. Ensure valve guide inside diameter is within specification. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS. Replace valve guide if inside diameter exceeds specification.
2. To replace valve guide, using hammer and brass drift, hit top of valve guide to break off old valve guide. Heat cylinder head to 194°F (90°C).
3. Using hammer and Valve Guide Remover/Installer (SST 09201-60011), drive valve guide from camshaft side of cylinder head. Measure cylinder head valve guide bore inside diameter.
4. If bore inside diameter is .5118-.5125" (13.000-13.018 mm), use standard valve guide. If bore inside diameter is greater than .5125" (13.018 mm), machine valve guide bore to .5138-.5145" (13.050-13.068 mm) for oversize valve guide.
5. To install valve guide, heat cylinder head to 194°F (90°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 cylinder head surface.
6. Using .31" (8.0 mm) reamer, ream valve guide to obtain specified valve stem-to-guide oil clearance. See **CYLINDER HEAD** .

Valve Seat

Ensure valve seat angle and seat width are within specification. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS. Valve seat replacement information is not available at time of publication.

Valves

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

Valve Seat Correction Angles

Use 30-degree and 45-degree stones to lower valve seat contact area. Use 60-degree (intake valves), 65-degree

(exhaust valves) and 45-degree stones to raise valve seat contact area.

VALVE TRAIN

CAUTION: Ensure rocker arm assembly components are marked for location. Components must be installed in original location.

Rocker Arm Assembly

1. If rocker arms appear loose on shaft, disassemble rocker arm assembly. Measure rocker arm inside diameter and shaft outside diameter to determine oil clearance. Replace components if not within specification. See **ROCKER ARM ASSEMBLY SPECIFICATIONS**.
2. To reassemble, reverse disassembly procedure. Note that rocker arms are identical, but rocker arm stands are different and must be installed in correct location. See **Fig. 8**.

ROCKER ARM ASSEMBLY SPECIFICATIONS

Application	In. (mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.050)
Wear Limit	.0031 (.080)
Rocker Arm Inside Diameter	.6299-.6306 (16.000-16.018)
Shaft Outside Diameter	.6287-.6295 (15.970-15.990)

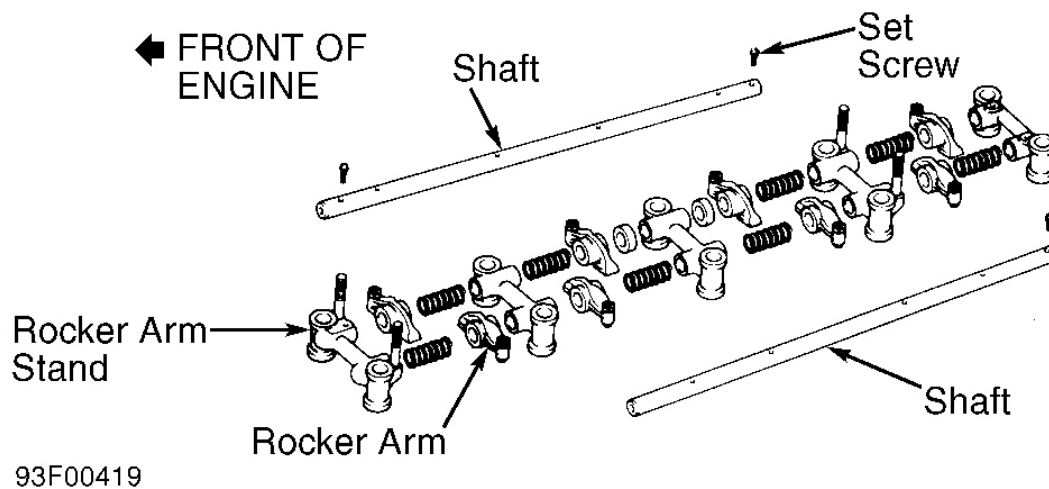


Fig. 8: Exploded View Of Rocker Arm Assembly
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

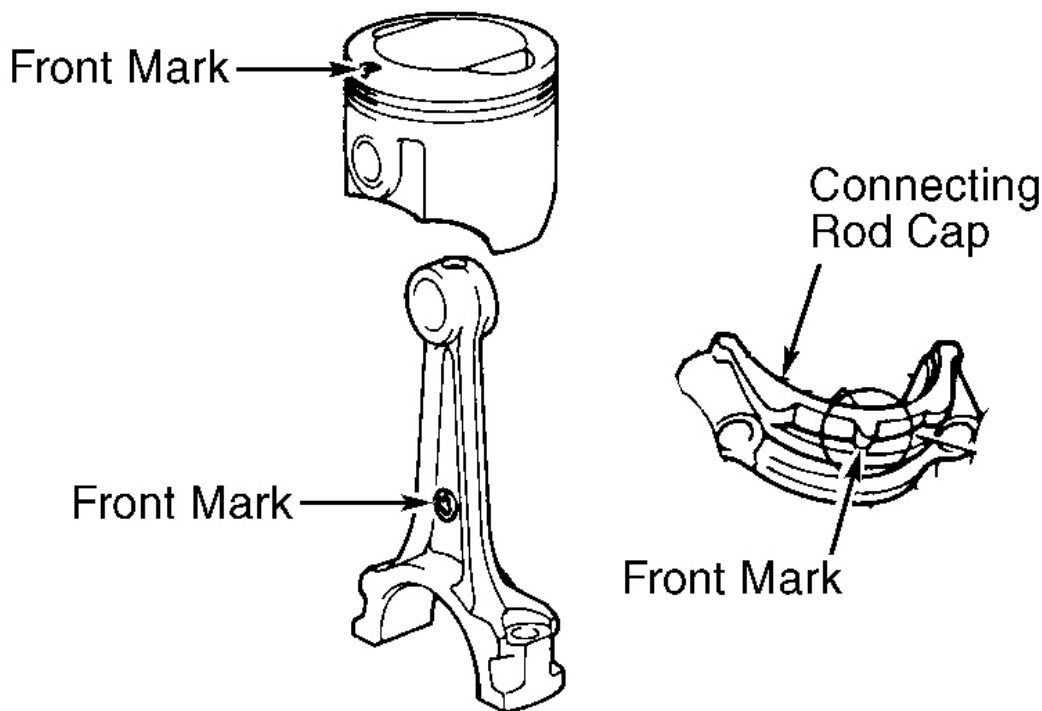
1. Ensure connecting rod and connecting rod cap are marked with matching cylinder number for reassembly reference. Before disassembling piston and connecting rod, try to move piston back and forth on piston pin. Replace piston and piston pin if any movement is felt.
2. When removing piston from connecting rod, remove snap rings from piston. Heat piston to 176°F (80°C) in water. Remove piston pin. Separate piston from connecting rod.
3. Measure piston pin outside diameter and connecting rod bushing inside diameter. Ensure piston pin-to-rod fit is within specification. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS.
4. Bushing can be replaced in connecting rod if piston pin-to-rod fit exceeds specification. Ensure bushing oil hole aligns with connecting rod oil hole. Bushing must be honed to obtain correct piston pin-to-rod clearance.

NOTE: **With piston at 176°F (80°C), piston pin should press into piston using thumb pressure.**

5. Ensure connecting rod bend, twist and crankpin bore diameter is within specification. See **CONNECTING RODS** under ENGINE SPECIFICATIONS.

NOTE: **Crankpin bore diameter is determined by size mark stamped on connecting rod cap. See Fig. 13 .**

6. To reassemble, install piston on connecting rod so front marks on piston and connecting rod align. See **Fig. 9** . Install NEW snap ring in piston. Heat piston to 176°F (80°C) in water. Install piston pin and remaining NEW snap ring.



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Fig. 9: Identifying Front Marks & Aligning Connecting Rod With Piston
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

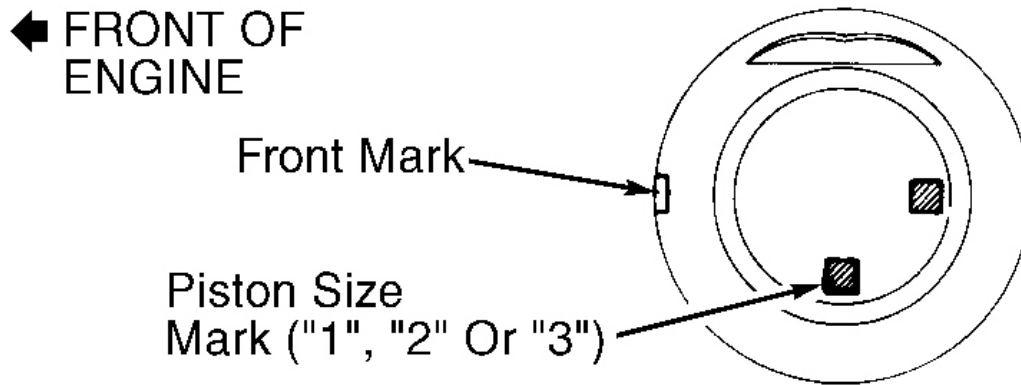
Fitting Pistons

1. To determine if piston-to-cylinder clearance is within specification, measure piston skirt diameter 1.30" (33.0 mm) from top of piston, at 90-degree angle to piston pin.
2. Different piston sizes are used. Piston diameter is determined by piston size mark ("1", "2" or "3") stamped on top of piston. See **Fig. 10** . Ensure piston diameter is within specification. See **PISTONS, PINS & RINGS** under ENGINE SPECIFICATIONS.
3. Measure cylinder bore diameter .39" (10.0 mm) from top and bottom cylinder bore and at middle of cylinder bore. Different cylinder bore sizes are used. Cylinder bore diameter can be identified by cylinder bore size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 11** .
4. Ensure cylinder bore diameter is within specification. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS. Determine piston clearance.

CAUTION: If replacing piston, ensure replacement piston has same size mark as cylinder bore size mark, located on cylinder block.

5. Replace piston, or bore cylinder block if piston clearance is not within specification. See **PISTONS**,

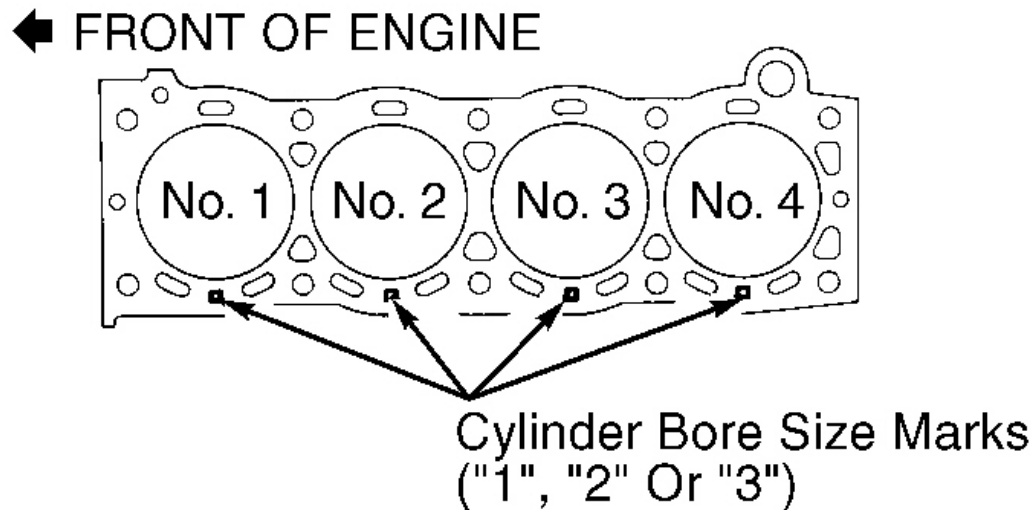
PINS & RINGS . Cylinder block can be bored for .020" (.50 mm) or .040" (1.00 mm) oversize pistons.



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Fig. 10: Identifying Piston Size Marks

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



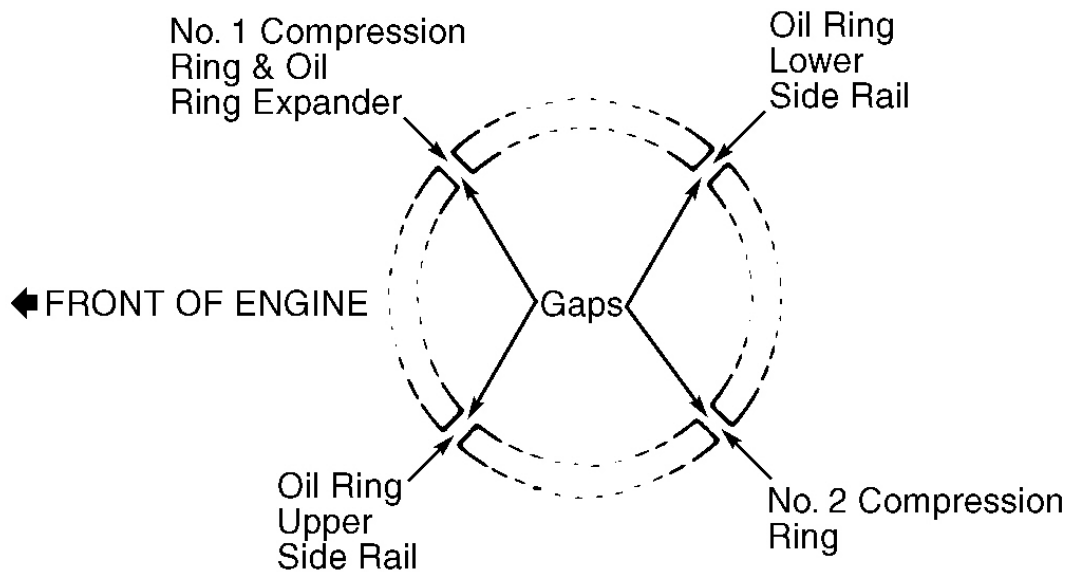
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Fig. 11: Identifying Cylinder Bore Size Marks

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** under ENGINE SPECIFICATIONS. Position piston rings with ring end gaps in proper areas, with identification mark on piston ring toward top of piston. See **Fig. 12**.



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Fig. 12: 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 and connecting rod cap must be installed with front mark toward front of engine. See **Fig. 9**.
2. Connecting rod cap and rod bearing are stamped with size mark ("A", "B" or "C"). See **Fig. 13**. Ensure size marks on connecting rod cap and rod bearing are the same. Rod bearing thickness is determined by rod bearing size mark. See **ROD BEARING SPECIFICATIONS**.

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

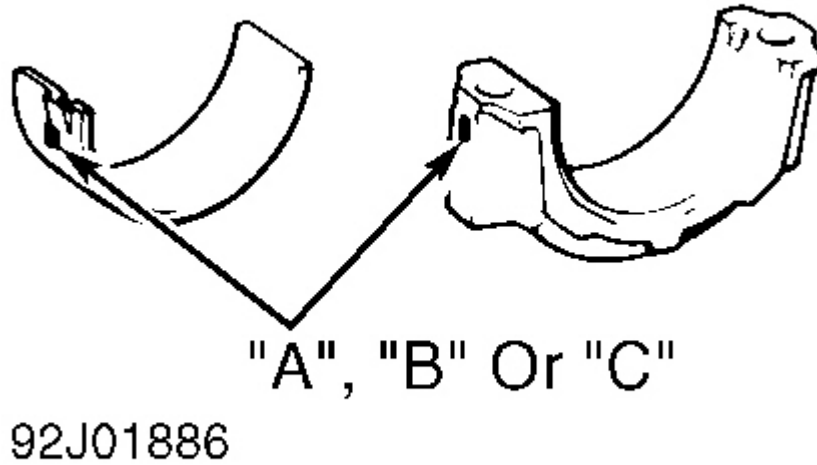


Fig. 13: Identifying Connecting Rod Cap & Bearing Size Marks

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

3. Ensure piston, connecting rod and connecting rod cap are installed with front mark toward front of engine. See **Fig. 9** . Coat nut and threads of connecting rod bolts with engine oil before tightening to specification. See **TORQUE SPECIFICATIONS** .
4. Ensure bearing oil clearance and connecting rod side play are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** and CONNECTING RODS tables under ENGINE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS

Bearing Size Mark	Bearing Thickness In. (mm)
"A"	.0584-.0586 (1.484-1.488)
"B"	.0586-.0587 (1.488-1.492)
"C"	.0587-.0589 (1.492-1.496)

Crankshaft & Main Bearings

1. Main bearing caps are numbered on top of main bearing cap for location in cylinder block. No. 1 main bearing cap is at front of engine, and No. 5 main bearing cap is at rear of engine. Note that arrow on top of main bearing cap points toward front of engine.
2. Remove main bearing cap bolts in sequence. See **Fig. 14** . Remove main bearing caps, crankshaft, thrust bearings and main bearings. Cylinder block main bearing bore inside diameter is determined by size mark ("3", "4" or "5") stamped on cylinder block. See **Fig. 15** . Front size mark indicates No. 1 main journal, and rear size mark indicates No. 5 main journal.

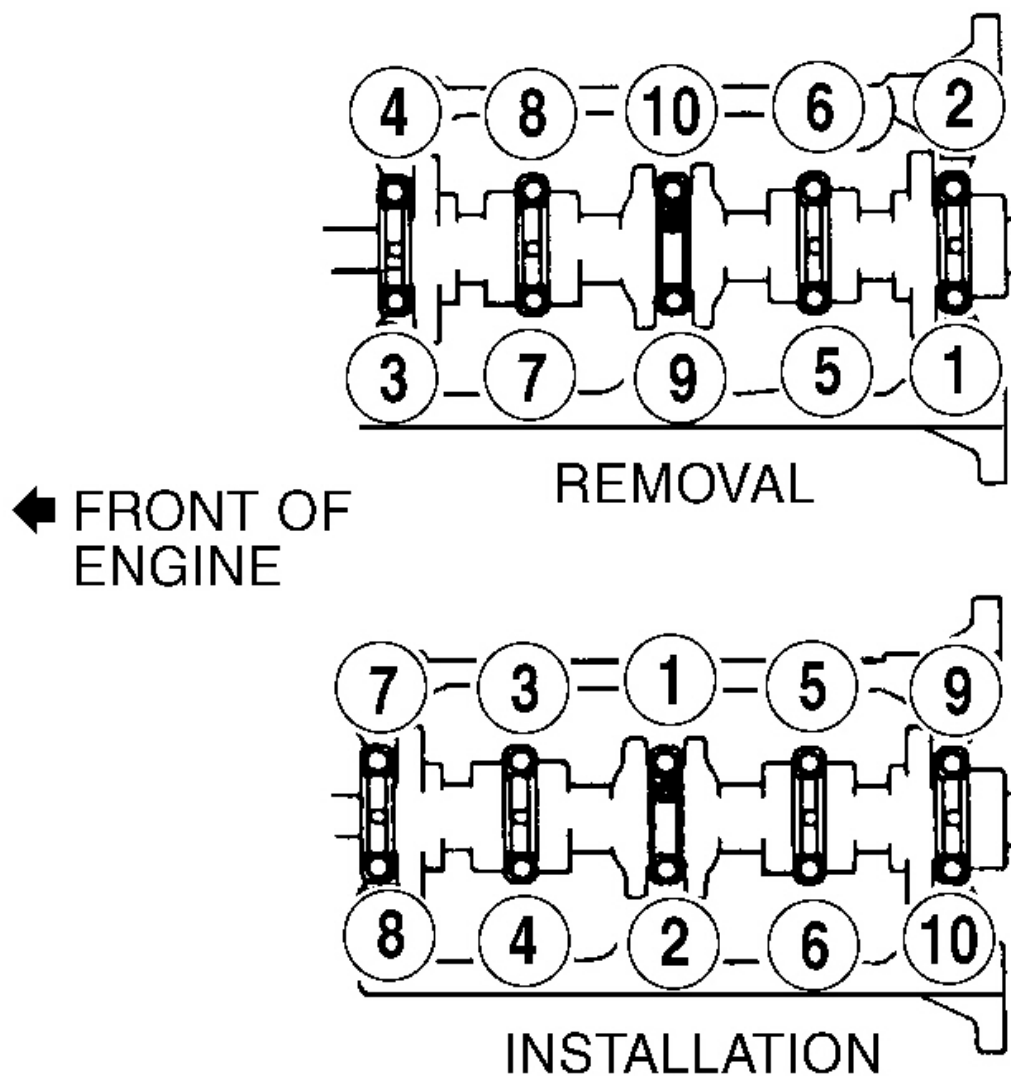
3. Ensure crankshaft journal diameter, taper and out-of-round are within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.

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

4. Main bearing size mark ("3", "4" or "5") is located on side of main bearing. See **Fig. 15** . If replacing main bearing, ensure size mark on replacement main bearing is same as size mark on original main bearing.
5. Main bearing thickness is determined by size mark on main bearing. See **MAIN BEARING SPECIFICATIONS** . Install main bearings, thrust bearings, crankshaft and main bearing caps.
6. Ensure main bearings caps are installed in correct location, with No. 1 main bearing cap at front of engine and No. 5 main bearing cap at rear of engine. Ensure arrow on top of each main bearing cap points toward front of engine.
7. Coat threads and bolt-to-main bearing cap contact area on main bearing cap bolts with engine oil. Install and tighten main bearing cap bolts to specification in sequence using several steps. See **Fig. 14** . See **TORQUE SPECIFICATIONS** .
8. Ensure bearing oil clearance and crankshaft end play is within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** . Replace thrust bearing if crankshaft end play is not within specification.

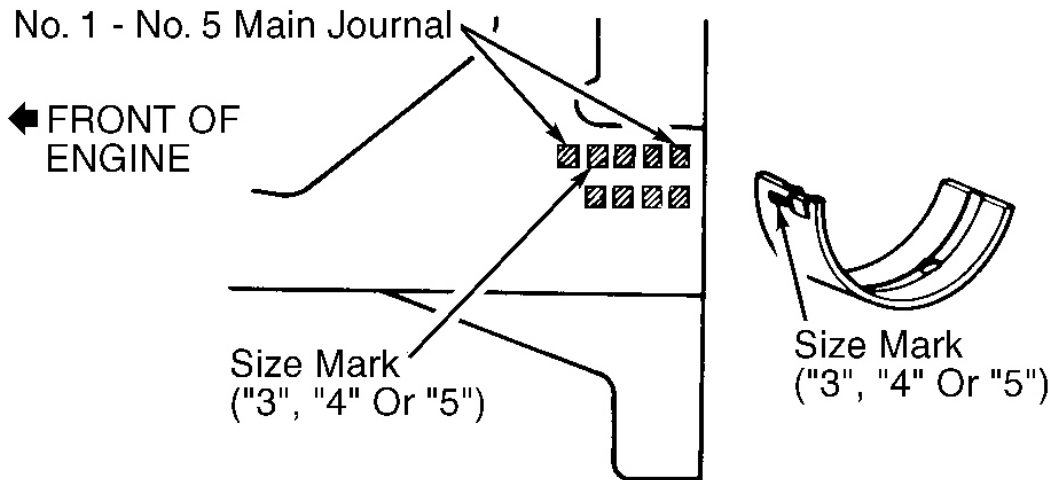
MAIN BEARING SPECIFICATIONS

Bearing Size Mark	Bearing Thickness In. (mm)
"3"	.0783-.0784 (1.988-1.992)
"4"	.0784-.0786 (1.992-1.996)
"5"	.0786-.0787 (1.996-2.000)



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Fig. 14: Main Bearing Cap Bolt Removal & Installation Sequence
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.



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Fig. 15: Identifying Cylinder Block & 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 or main bearing cap). Replace thrust bearing if crankshaft end play is not within specification. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.

Cylinder Block

1. Inspect cylinder block deck surface warpage. Replace cylinder block if deck warpage exceeds specification. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS.
2. Different cylinder bore sizes are used and can be identified by cylinder bore size mark ("1", "2" or "3") stamped on cylinder block deck surface. See **Fig. 11** . Measure cylinder bore diameter .39" (10.0 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** . Bore cylinder block if cylinder bore diameter exceeds specification. Cylinder block can be bored for .020" (.50 mm) or .040" (1.00 mm) oversize pistons.
4. Install main bearing caps on cylinder block. Ensure main bearing caps are installed in correct location, with No. 1 main bearing cap at front of engine and No. 5 main bearing cap at rear of engine. Ensure arrow on top of each main bearing cap points toward front of engine.
5. Coat threads and bolt-to-main bearing cap contact area on main bearing cap bolts with engine oil. Install and tighten main bearing cap bolts to specification in sequence using several steps. See **Fig. 14** . See **TORQUE SPECIFICATIONS** .
6. Ensure cylinder block main bearing bore inside diameter is within specification. See **CYLINDER BLOCK** . Main bearing bore inside diameter is determined by main bearing bore size mark ("3", "4" or "5") stamped on cylinder block. See **Fig. 15** .

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pump provides pressurized engine lubrication. See **Fig. 16** .

Crankcase Capacity

Crankcase capacity with oil filter is 4.5 qts. (4.3L).

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.

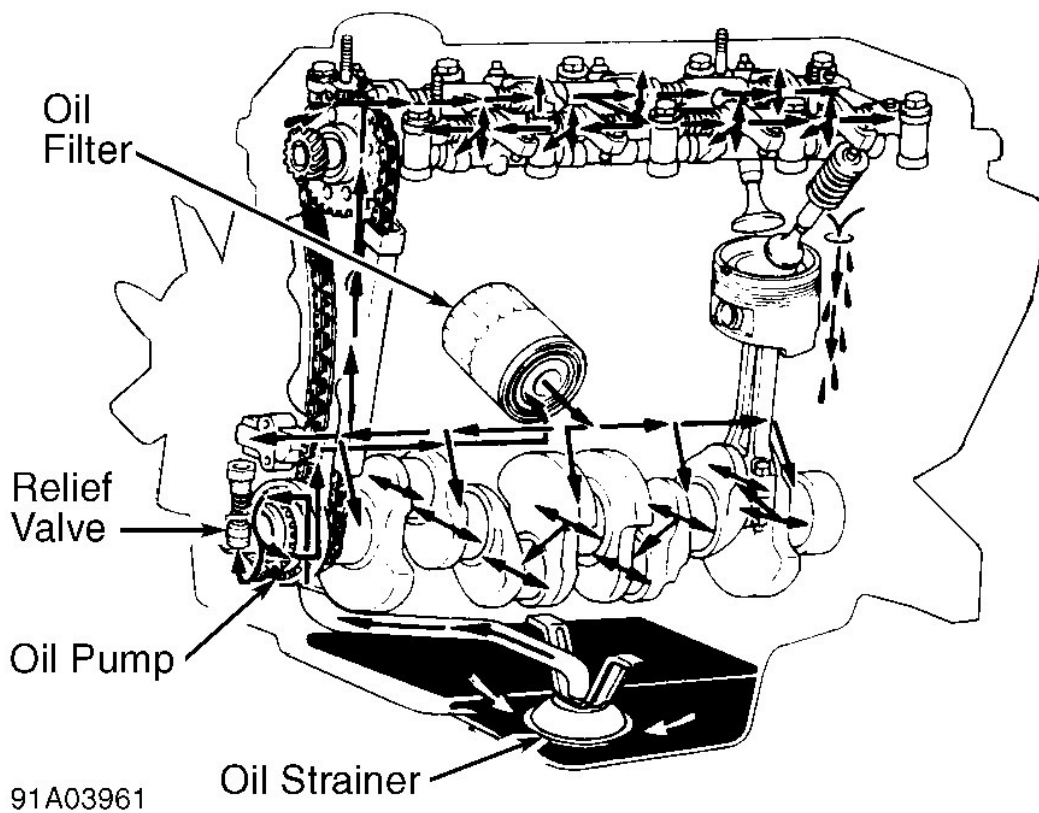


Fig. 16: Cross-Sectional View Of Engine Oil Circuit
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

OIL PUMP

Removal & Disassembly

1. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. Remove bolts and oil strainer. Remove accessory drive belt.
2. Remove accessory drive pulley from front of crankshaft pulley (if equipped). Using Pulley Holder (SST 09213-70010) and Handle (SST 09330-00021), hold crankshaft pulley. Remove crankshaft pulley bolt. Using puller, remove crankshaft pulley.
3. Remove A/C compressor with hoses attached and secure aside (if equipped). Remove A/C compressor bracket. Remove bolts, oil pump and "O" ring from front cover. Disassemble oil pump. See **Fig. 17**.

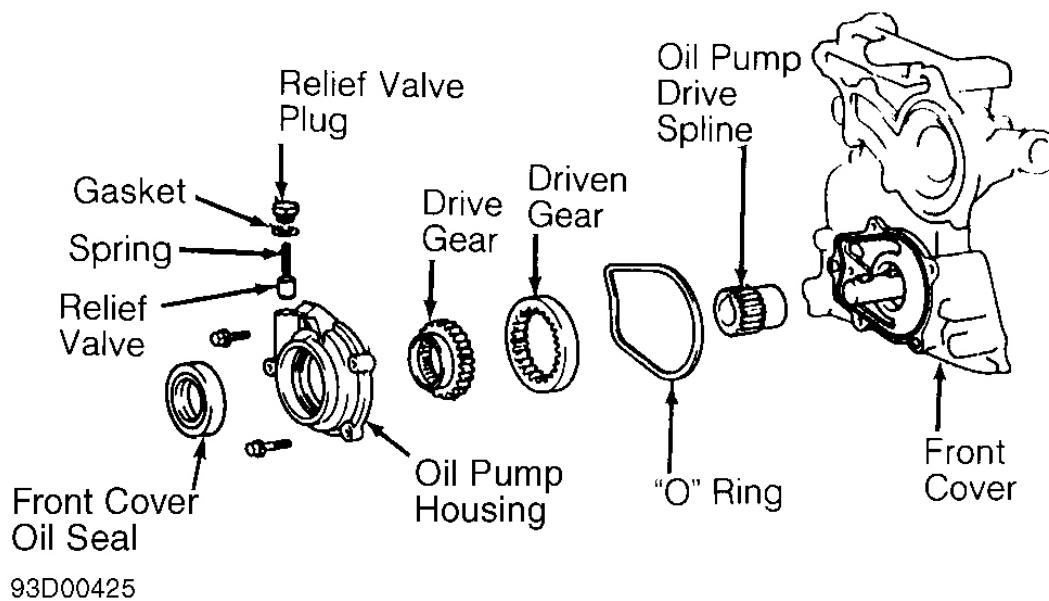


Fig. 17: Exploded View Of Oil Pump & Components
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

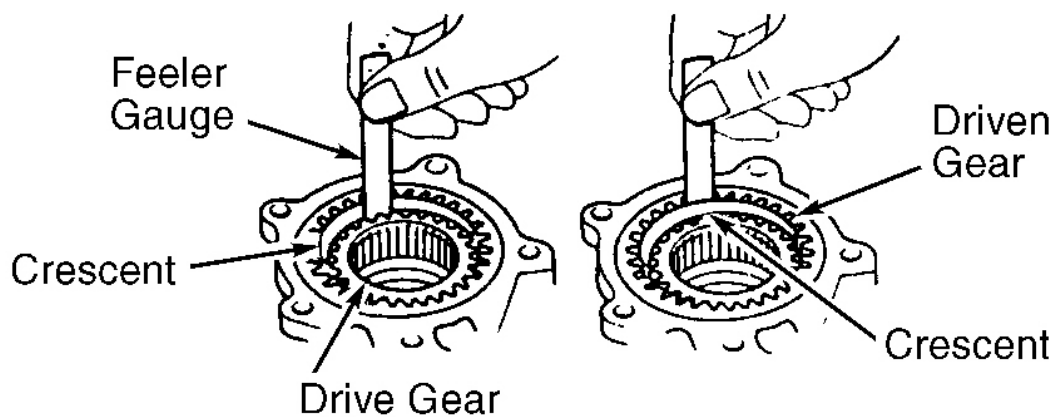
1. Inspect components for damage. Coat relief valve with engine oil and ensure relief valve slides freely in bore of oil pump housing. Install drive and driven gears in oil pump housing.
2. Using feeler gauge, measure driven gear-to-oil pump housing clearance. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS**.
3. Measure gear tip clearance between tip of each gear and crescent in oil pump. See **Fig. 18**. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS**.
4. Place straightedge across oil pump housing, above both gears. Measure gear end clearance between straightedge and gear surface. Replace gear assembly or oil pump housing if clearance exceeds specification. See **OIL PUMP SPECIFICATIONS**.

OIL PUMP SPECIFICATIONS

1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

Application	In. (mm)
Driven Gear-To-Oil Pump Housing Clearance	
Standard	.0035-.0059 (.090-.150)
Wear Limit	.008 (.20)
Gear End Clearance	
Standard	.0012-.0035 (.030-.090)
Maximum	.006 (.15)
Gear Tip Clearance	
Drive Gear	
Standard	.0087-.0098 (.220-.250)
Wear Limit	.012 (.30)
Driven Gear	
Standard	.0059-.0083 (.150-.210)
Wear Limit	.012 (.30)

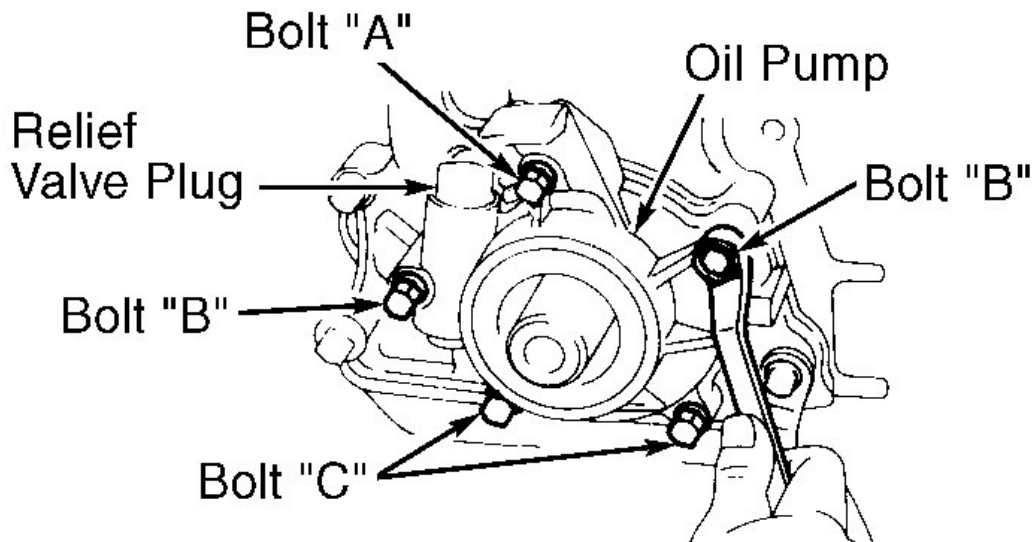


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Fig. 18: Measuring Oil Pump Gear Tip Clearance
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Reassembly & Installation

1. To reassemble, reverse disassembly procedure. Use a NEW gasket on relief valve plug. Tighten relief valve plug to specification. See **TORQUE SPECIFICATIONS**.
2. Using Oil Seal Installer (SST 09223-50010), install NEW front cover oil seal (if removed) until oil seal surface is even with oil pump housing. Coat seal lip with grease.
3. Using NEW "O" ring, install oil pump on front cover. Apply thread sealant to bolt "A" and install. See **Fig. 19**. Install remaining bolts. Tighten all bolts to specification.
4. To install remaining components, reverse removal procedure. Tighten fasteners to specification. See

TORQUE SPECIFICATIONS .

Bolt "A" - 18 Ft. Lbs. (24 N.m)
 Bolt "B" - 14 Ft. Lbs. (19 N.m)
 Bolt "C" - 115 INCH Lbs. (13.0 N.m)

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Fig. 19: Installing Oil Pump

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

TORQUE SPECIFICATIONS**TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
A/C Compressor Bolt-To-Mounting Bracket Bolt	20 (27)
Accessory Drive Pulley-To-Crankshaft Pulley Bolt	14 (19)
Air Intake Chamber-To-Intake Manifold Bolt	14 (19)
Camshaft Bearing Cap Bolt	15 (20)
Camshaft Sprocket Bolt	58 (79)
Connecting Rod Nut	51 (69)
Crankshaft Pulley Bolt	116 (157)
Cylinder Head/Rocker Arm Assembly Bolt ⁽¹⁾	58 (79)
Distributor Hold-Down Bolt	14 (19)

1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

Drive Axle-To-Side Gear Flange Bolt	61 (83)
Drive Shaft Flange Bolt	55 (75)
Exhaust Manifold Heat Insulator Bolt	14 (19)
Exhaust Manifold Nut	33 (45)
Flywheel/Drive Plate Bolt	
A/T	61 (83)
M/T	80 (109)
Front Cover Bolt	(2)
Front Differential Mount Bolts	
Differential Cover Mount Bolt	108 (146)
Left & Right Mount Bolt	123 (167)
Fuel Line-To-Delivery Pipe Union Bolt	32 (43)
Intake Manifold Bolt/Nut	14 (19)
Main Bearing Cap Bolt ⁽³⁾	76 (103)
Oil Pump Bolt	(4)
Power Steering Pump Bracket-To-Cylinder Head Bolt	32 (43)
Power Steering Pump Pulley Nut	32 (43)
Rocker Arm Adjusting Screw Lock Nut	18 (24)
Rear Seal Housing Bolt	13 (18)
Relief Valve Plug	27 (37)
Spark Plug	13 (18)
Stabilizer Bar-To-Frame Bracket Bolt	21 (29)
Stabilizer Bar Link-To-Lower Control Arm Nut	19 (26)
Timing Chain Damper Bolt	16 (22)
Timing Chain Tensioner Bolt	14 (19)
Transmission Crossmember-To-Body Bolt (4WD Models)	70 (95)
INCH Lbs. (N.m)	
Clutch Release Cylinder Bolt	106 (12.0)
Cylinder Head Rear Plate Bolt	115 (13.0)
Cylinder Head-To-Front Cover Bolt	115 (13.0)
EGR Valve Bolt/Nut	115 (13.0)
No. 1 Air Injection Manifold Bolt/Nut	115 (13.0)
Oil Pan Bolt/Nut	115 (13.0)
Oil Strainer Bolt	115 (13.0)
PAIR Valve Nut	115 (13.0)
Stabilizer Bar Link-To-Lower Control Arm Nut	115 (13.0)
Valve Cover Nut	52 (5.9)

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

(2) Tighten 8-mm bolts to 115 INCH lbs. (13.0 N.m) and 10-mm bolts to 29 ft. lbs. (39 N.m).

Tighten bolts to specification in sequence. See **Fig. 14** .

1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

(3)

(4) Tighten bolts to specification as specified. See **Fig. 19**.**ENGINE SPECIFICATIONS****GENERAL ENGINE SPECIFICATIONS****GENERAL ENGINE SPECIFICATIONS**

Application	Specification
Displacement	146.4 Cu. In. (2.4L)
Bore	3.62" (91.9 mm)
Stroke	3.50" (88.9 mm)
Compression Ratio	9.3:1
Fuel System	MFI
Horsepower @ RPM	116 @ 4800
Torque Ft. Lbs. @ RPM	140 @ 2800

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

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Wear Limit	.012 (.30)
Runout	.004 (.10)
Main Bearings	
Journal Diameter	2.3616-2.3622 (59.984-60.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0010-.0022 (.025-.055)
Wear Limit	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	2.0861-2.0866 (52.988-53.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	

1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

Standard	.0010-.0022 (.025-.055)
Wear Limit	.0039 (.100)

CONNECTING RODS SPECIFICATIONS**CONNECTING RODS**

Application	In. (mm)
Bore Diameter	
Crankpin Bore ⁽¹⁾	
Size Mark "A"	2.2047-2.2050 (56.000-56.006)
Size Mark "B"	2.2050-2.2052 (56.006-56.012)
Size Mark "C"	2.2052-2.2054 (56.012-56.018)
Maximum Bend	.0020 Per 3.94 (.050 Per 100.1)
Maximum Twist	.0059 Per 3.94 (.150 Per 100.1)
Side Play	
Standard	.0063-.0102 (.160- .260)
Wear Limit	.012 (.30)
(1) Crankpin bore diameter is determined by size mark stamped on connecting rod cap. See Fig. 13 .	

PISTONS, PINS & RINGS SPECIFICATIONS**PISTONS, PINS & RINGS**

Application	In. (mm)
Pistons	
Clearance	.0006-.0014 (.015- .035)
Diameter ⁽¹⁾	
Size Mark "1"	3.6211-3.6214 (91.975-91.985)
Size Mark "2"	3.6214-3.6218 (91.985-91.995)
Size Mark "3"	3.6218-3.6222 (91.995-92.005)
Pins	
Piston Fit	(2)

1995 Toyota 4Runner SR5

2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

Rod Fit	
Standard	.0002-.0004 (.005-.011)
Wear Limit	.0006 (.015)
Rings	
No. 1	
End Gap	
Standard	.0098-.0185 (.250-.470)
Wear Limit	.0421 (1.070)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
No. 2	
End Gap	
Standard	.0236-.0323 (.600-.820)
Wear Limit	.0559 (1.420)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0224 (.200-.570)
Wear Limit	.0461 (1.170)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.008 (.20)
(1) Piston diameter is determined by size mark on top of piston. See Fig. 10 .	
(2) Piston pin should slide in piston using thumb pressure with piston heated to 176°F (80°C).	

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK**

Application	In. (mm)
Cylinder Bore	
Standard Diameter ⁽¹⁾	

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Size Mark "1"	3.6220-3.6224 (92.000-92.010)
Size Mark "2"	3.6224-3.6228 (92.010-92.020)
Size Mark "3"	3.6228-3.6232 (92.020-92.030)
Main Bearing Bore Inside Diameter ⁽²⁾	
Size Mark "3"	2.5198-2.5201 (64.004-64.010)
Size Mark "4"	2.5201-2.5203 (64.010-64.016)
Size Mark "5"	2.5203-2.5205 (64.016-64.022)
Maximum Deck Warpage	.002 (.05)
(1) Cylinder bore diameter is determined by size mark on cylinder block deck surface. See Fig. 11 . Maximum cylinder bore diameter is 3.6311" (92.230 mm).	
(2) Main bearing bore inside diameter is determined by size mark on cylinder block. See Fig. 15 .	

VALVES & VALVE SPRINGS SPECIFICATIONS**VALVES & VALVE SPRINGS**

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.024" (.60 mm)
Minimum Refinish Length	4.449" (113.00 mm)
Stem Diameter	.3138-.3144" (7.970-7.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.024" (.60 mm)
Minimum Refinish Length	4.406" (111.90 mm)
Stem Diameter	.3136-.3142" (7.965-7.980 mm)
Valve Springs	
Free Length	1.909" (48.50 mm)
Out-Of-Square	.063" (1.60 mm)
Lbs. @ In. (kg @ mm)	
Pressure	
Valve Closed	62.8-66.1 @ 1.594 (28.5-29.9 @ 40.50)

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CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD**

Application	Specification
Maximum Warpage	
Cylinder Block Surface	.0059" (.150 mm)
Manifold Surface	.0079" (.200 mm)
Valve Seats	
Intake Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Exhaust Valve	
Seat Angle	45°
Seat Width	.047-.063" (1.20-1.60 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head Bore I.D.	
Standard Valve Guide	.5118-.5125" (13.000-13.018 mm)
Oversize Valve Guide	.5138-.5145" (13.050-13.068 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 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.	
Standard Valve Guide	.5118-.5125" (13.000-13.018 mm)
Oversize Valve Guide	.5138-.5145" (13.050-13.068 mm)
Valve Guide I.D.	.3154-.3161" (8.010-8.030 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Wear Limit	.0039" (.100 mm)

CAMSHAFT SPECIFICATIONS**CAMSHAFT**

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2.4L 4-CYL VIN [R] 1995 ENGINES Toyota - 2.4L 4-Cylinder

Application	In. (mm)
End Play	
Standard	.0031-.0071 (.080-.180)
Wear Limit	.0098" (.250 mm)
Journal Diameter	1.2984-1.2992 (32.980-33.000)
Journal Runout	.008 (.20)
Lobe Height	
Intake	
Standard	1.6783-1.6819 (42.630-42.720)
Wear Limit	1.6634" (42.250 mm)
Exhaust	
Standard	1.6807-1.6842 (42.690-42.780)
Wear Limit	1.6654" (42.300 mm)
Oil Clearance	
Standard	.0004-.0020 (.010-.050)
Wear Limit	.0039" (.100 mm)