

1991 Toyota Tercel

1.5L 4-CYL - VIN [E] 1991 Engines - 1.5L 4-Cylinder

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ENGINE IDENTIFICATION

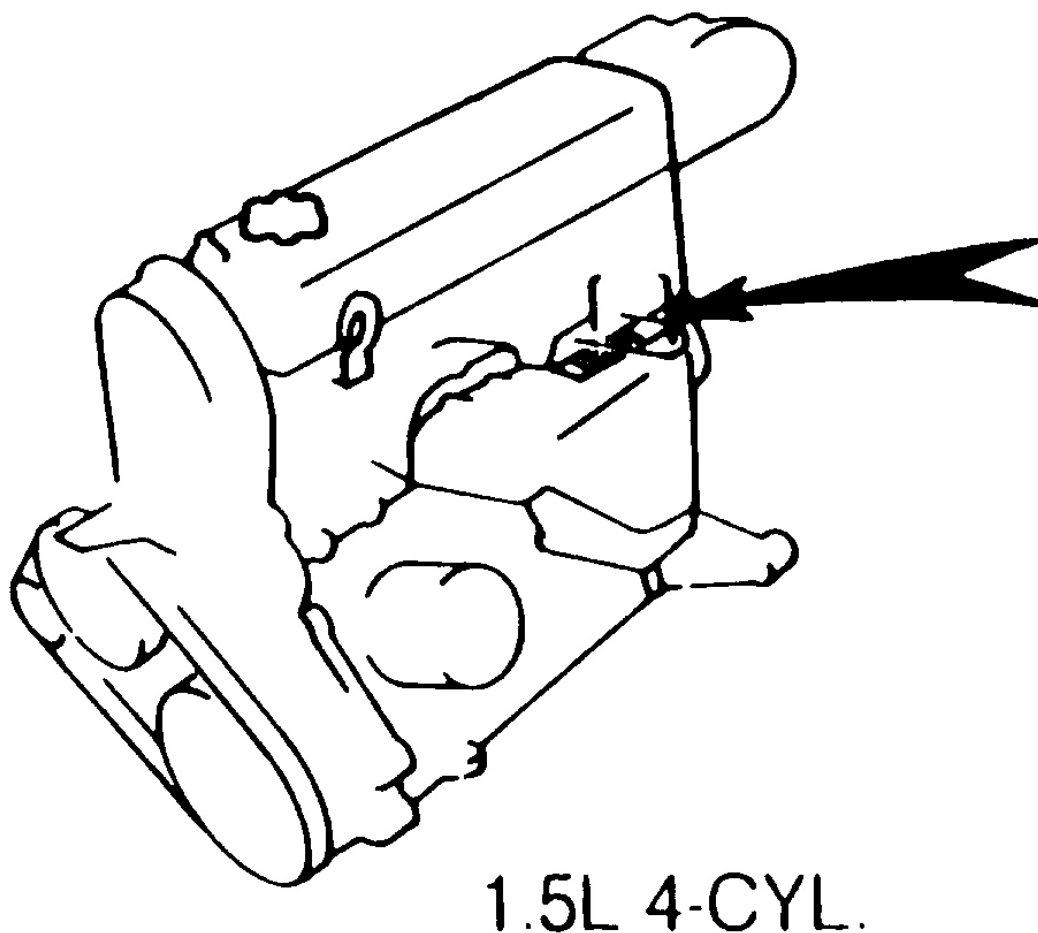
NOTE: For engine repair procedures not covered in this article, see **ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION** article in the **GENERAL INFORMATION** section.

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

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

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
1.5L 4-Cyl. PFI	3E-E	E



118443

Fig. 1: Locating Engine Identification Code

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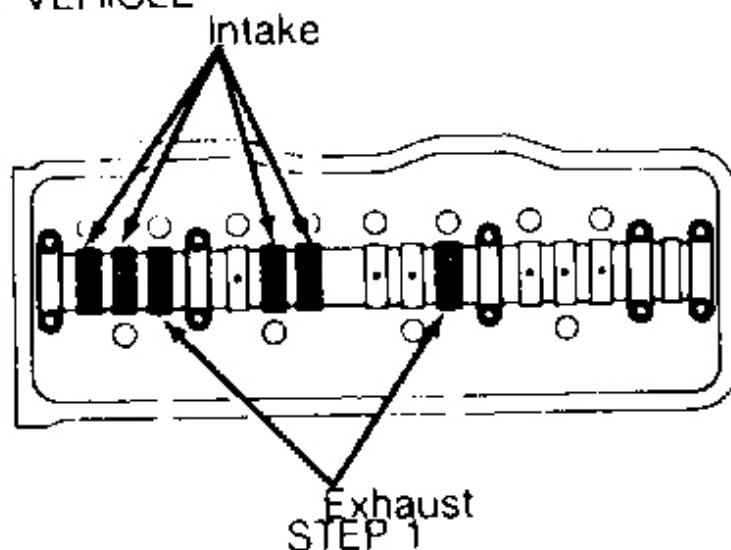
ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Valves should be adjusted with engine at normal operating temperature. Cold specification is provided for initial setting after assembly.

1. With engine at normal operating temperature, stop engine and remove valve cover. Turn crankshaft pulley and align timing marks on TDC.
2. Ensure No. 1 cylinder rocker arms are loose and No. 4 cylinder rocker arms are tight. Measure valve clearance on valves indicated in STEP 1. See **Fig. 2** .

● FRONT OF VEHICLE



● FRONT OF VEHICLE

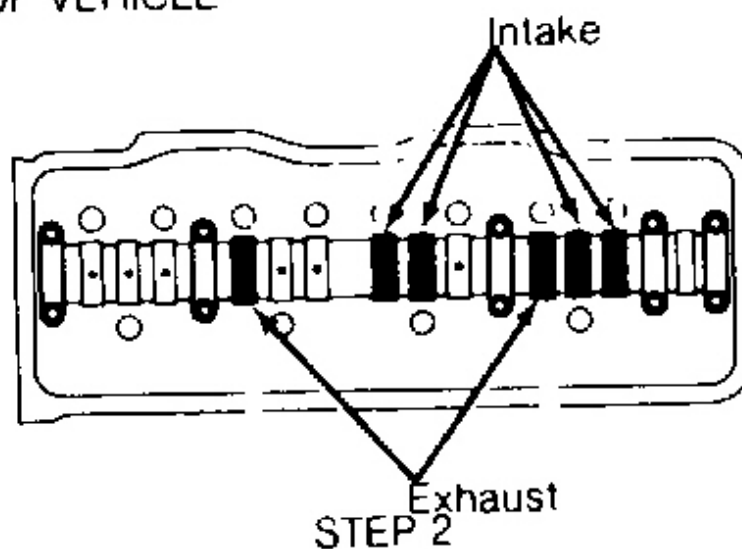


Fig. 2: Valve Clearance Adjustment Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

- Loosen rocker arm lock nut and turn adjusting screw to specified clearance. See **VALVE CLEARANCE SPECIFICATIONS** table. Tighten rocker arm lock nut and recheck clearance. Turn crankshaft 1 revolution and adjust valves in STEP 2. See **Fig. 2**.

VALVE CLEARANCE SPECIFICATIONS

Valve	Hot In. (mm)	Cold In. (mm)
Intake & Exhaust	.008 (.20)	⁽¹⁾ .007 (.18)

(1) Cold specification is provided for initial setting after assembly.

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.

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/component. Slowly loosen fitting, allowing pressurized fuel to spill into container. After fuel system has depressurized, disconnect and plug fitting.

ENGINE

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

Removal

1. Drain coolant and engine oil. Remove battery. Remove radiator reservoir tank. Remove hood. Remove engine under cover (splash) shields. Remove radiator.
2. Disconnect accelerator cable. On A/T models, disconnect throttle cable. On all models, remove PCV hoses. Remove air cleaner assembly with air intake connector. Remove air cleaner bracket. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION.
3. Disconnect fuel hoses. Remove charcoal canister. Disconnect all necessary electrical wiring from engine. Disconnect and mark all vacuum hoses for installation reference. Disconnect all coolant hoses.
4. Disconnect speedometer cable. Disconnect control cables from transaxle. On A/T models, remove control cable bracket. On M/T models, remove clutch release (slave) cylinder and wire out of way. **DO NOT** disconnect hydraulic line.
5. On all models, disconnect clamps attaching engine wire harness. Move wire harness out of way. Remove starter. Remove vacuum transmitting valves with bracket. On models with power steering, remove power steering pump and wire out of way. **DO NOT** disconnect power steering hoses.
6. On models with A/C, remove A/C compressor. **DO NOT** disconnect A/C hoses. Wire A/C compressor out of way. Remove A/C compressor mounting bracket. On all models, disconnect exhaust pipe.
7. Remove drive shafts. Attach hoist chain to engine hangers. Remove rear mount through bolt. Remove bolts and rear mount. Remove right mount through bolt. Remove bolts and right mount.
8. Disconnect ground strap. Remove left mount bracket. Carefully lift engine out of vehicle. Lower transaxle to clear battery carrier support.

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

Installation

To install, reverse removal procedures. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS** table. Add proper amount of engine oil, transmission fluid and coolant. Start engine and check for leaks.

CYLINDER HEAD & MANIFOLDS**Removal & Installation**

1. Disconnect negative battery cable. Remove right side under cover (splash) shield. Drain coolant. Disconnect exhaust pipe. Disconnect accelerator cable.
2. On A/T models, disconnect throttle cable. On all models, remove PCV hoses. Remove air cleaner assembly with air intake connector. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION.
3. Disconnect fuel hoses. Disconnect all necessary electrical wiring from engine. Disconnect and mark all vacuum hoses for installation reference. Disconnect all coolant hoses.
4. On models with power steering, remove power steering pump. Remove power steering pump bracket. On models with A/C and without power steering, remove idler pulley bracket.
5. On all models, remove timing belt and camshaft timing gear. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove distributor. Remove water outlet housing. Remove bolts and outer exhaust manifold heat insulator. Remove 6 nuts, exhaust manifold, 2 gaskets and inner heat insulator.
6. Disconnect engine wiring harness from engine. Remove intake manifold bracket-to-cylinder block. Remove 5 bolts, 2 nuts and intake manifold with gasket.
7. Remove 2 bolts and fuel rail with fuel injectors. Use care not to drop fuel injectors. Pull out fuel injectors from fuel rail. Remove 2 spacers and 4 insulators from cylinder head.
8. Measure camshaft end play before removing cylinder head. End play should be within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS. If clearance is greater than maximum, replace cylinder head and/or camshaft. Remove camshaft. See **CAMSHAFT**.

CAUTION: Cylinder head warpage or cracking can result if cylinder head bolts are not removed in sequence.

9. Remove cylinder head. Loosen cylinder head bolts in 3 stages, in reverse of tightening sequence. See **Fig. 3**. Remove cylinder head. Use care not to damage cylinder head or engine block contact surfaces.

Installation

1. Ensure mating surfaces are clean and camshaft caps and rocker arm assembly are tightened. See **CAMSHAFT**. Apply engine oil to all moving parts. Install new cylinder head gasket and cylinder head. Apply light coat of engine oil to cylinder head bolts and cylinder block threads.
2. Tighten cylinder head bolts in 3 stages, in sequence. See **Fig. 3**. Tighten cylinder head bolts to proper specification. See **TORQUE SPECIFICATIONS** table.

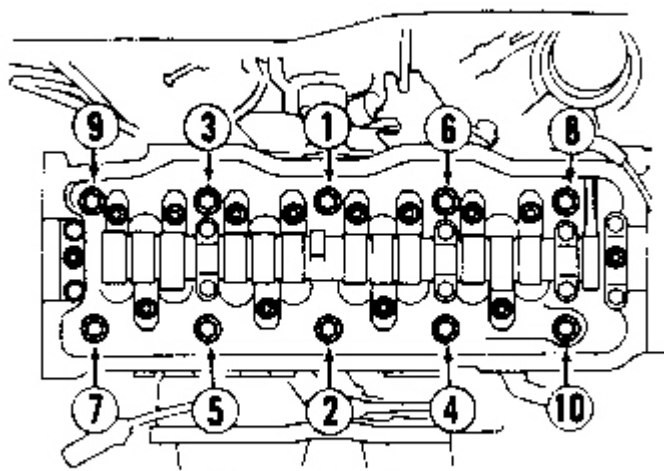


Fig. 3: Cylinder Head Bolt Tightening Sequence

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3. Install timing belt, check valve timing and timing belt tension. See **TIMING BELT** under REMOVAL & INSTALLATION. Install exhaust manifold gasket with "E" mark facing outward. To complete installation, reverse removal procedure.
4. Refill engine oil and cooling system. Set valve clearance. See **VALVE CLEARANCE ADJUSTMENT**. When installing valve cover, apply seal packing to cylinder head. See **Fig. 5**. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS** table. Set ignition timing and idle speed. Start engine and check for leaks.

FRONT COVER OIL SEAL

Removal & Installation

1. If oil pump is removed from cylinder block, pry out oil seal. Using Seal Installer (09309-37010), install oil seal until oil seal surface is flush with oil pump case edge. Apply multipurpose grease to oil seal lip.
2. If oil pump is installed to cylinder block, cut off 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 (09309-37010), install oil seal until oil seal surface is flush with oil pump case edge.

TIMING BELT

Removal

1. Disconnect negative battery cable. Remove right side engine under cover (splash) shield. Remove accessory drive belts. Disconnect accelerator cable. On A/T models, disconnect throttle cable.
2. On all models, disconnect PCV hoses. Remove bolt, ground strap and vacuum transmitting valves

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with bracket from right engine mount. Slightly raise engine and remove right engine mount. Remove valve cover. Remove spark plugs.

3. Set No. 1 cylinder at TDC on compression stroke. Turn crankshaft pulley and align groove on crankshaft with "0" mark on timing belt cover. Ensure rocker arms on No. 1 cylinder are loose. If not, turn crankshaft pulley 1 complete revolution.

NOTE: If reusing timing belt, mark location of belt for installation reference.

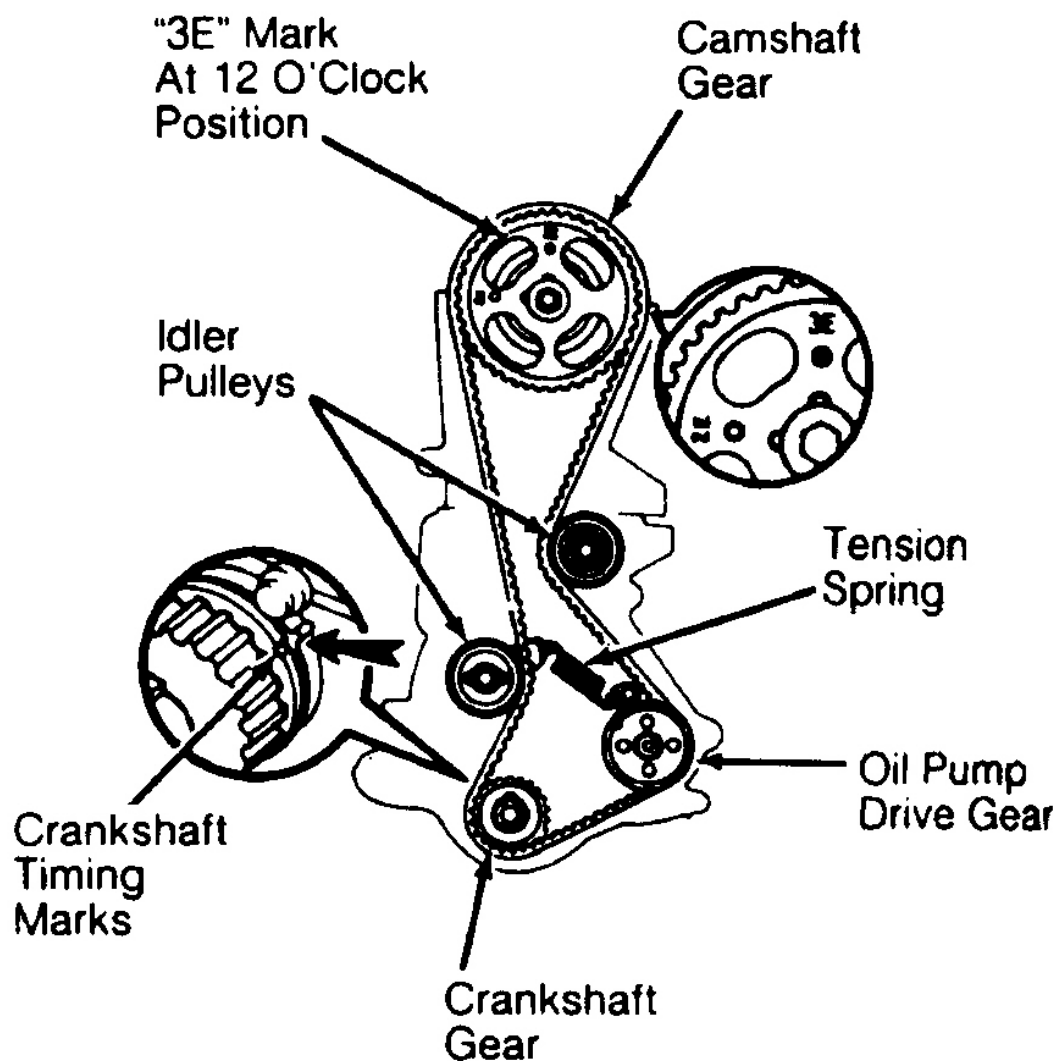
4. On models with A/C and/or power steering, remove pulley. Using Holder (09213-14010), hold crankshaft pulley. Loosen crankshaft pulley bolt. Remove holder. Remove crankshaft pulley bolt. Using Puller (09330-00021), remove crankshaft pulley.
5. Remove timing belt covers. Remove timing belt guide from front of crankshaft. Remove tension spring from idler pulley. Loosen idler pulley bolt and push pulley to left as far as it will go and tighten bolt. Remove timing belt.

Inspection

1. Check timing belt teeth for cracks or damage. If tooth damage is found, ensure camshaft, water pump and oil pump are okay. If wear or cracks on flat side of belt face are found, check for nicks on idler pulleys.
2. If wear or damage to only one side of belt is found, check belt guide and alignment of each pulley and sprocket. If noticeable wear is found on belt teeth, check timing cover gasket for damage or improper installation.
3. Ensure no foreign material is on sprocket teeth. Check idler pulley tension spring free length. Spring free length should be 1.51" (38.4 mm). If spring free length is not within specification, replace spring.

Installation

1. If reusing old timing belt, align marks made during removal. If installing new timing belt, turn camshaft pulley until "3E" mark on camshaft gear is at the 12 o'clock position. Turn crankshaft and align TDC mark on oil pump body with mark on crankshaft gear. See **Fig. 4**.



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Fig. 4: Aligning Timing Marks

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2. Remove idler pulley tension spring if not previously removed. Loosen idler pulley bolt and push pulley to the left as far as it will go and tighten bolt. Install timing belt. Loosen idler pulley bolt and install pulley tension spring.
3. Turn crankshaft 2 revolutions in the clockwise direction (TDC to TDC). Ensure camshaft and crankshaft marks are in proper alignment. See **Fig. 4** . Tighten idler pulley bolt to 13 ft. lbs. (18 N.m).
4. To complete the installation, reverse removal procedures. When installing valve cover, apply seal packing to cylinder head. See **Fig. 5** .

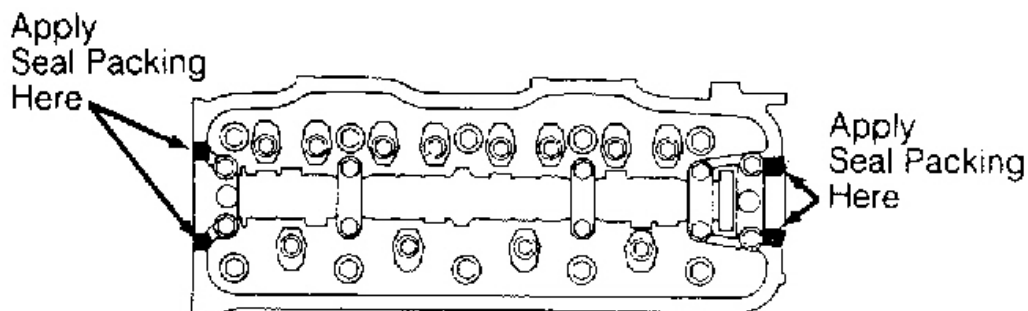


Fig. 5: Applying Seal Packing to Cylinder Head
 Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

ROCKER ARM & VALVE LASH ADJUSTER

Removal

1. Remove camshaft. See **CAMSHAFT** . Loosen rocker arm adjusting screw lock nuts. While lifting top of rocker arm spring, pry off spring. See **Fig. 6** .

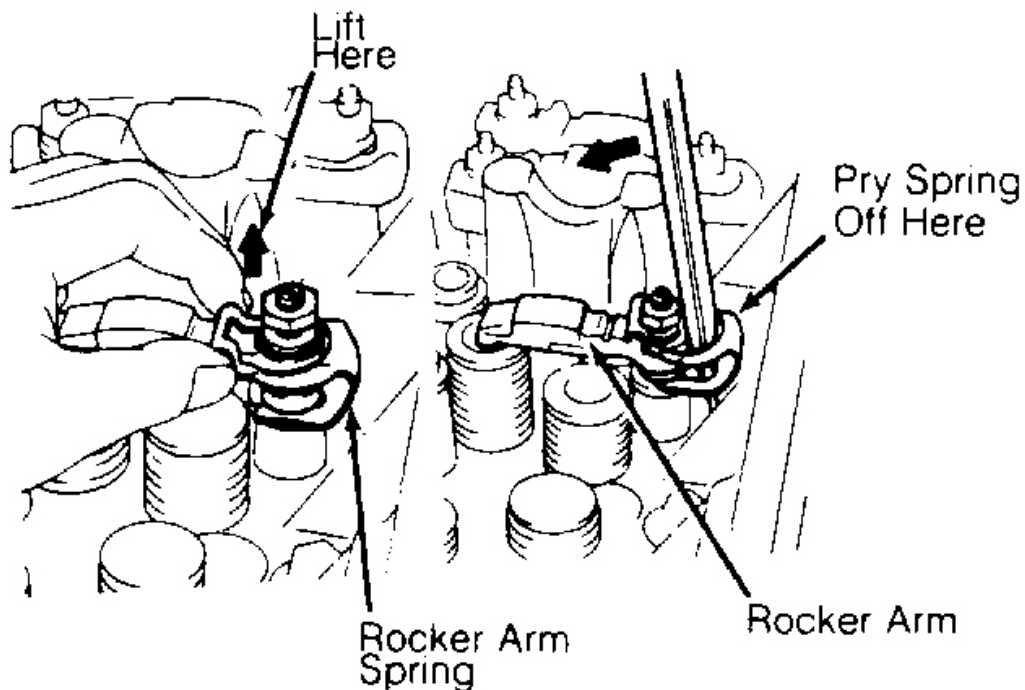


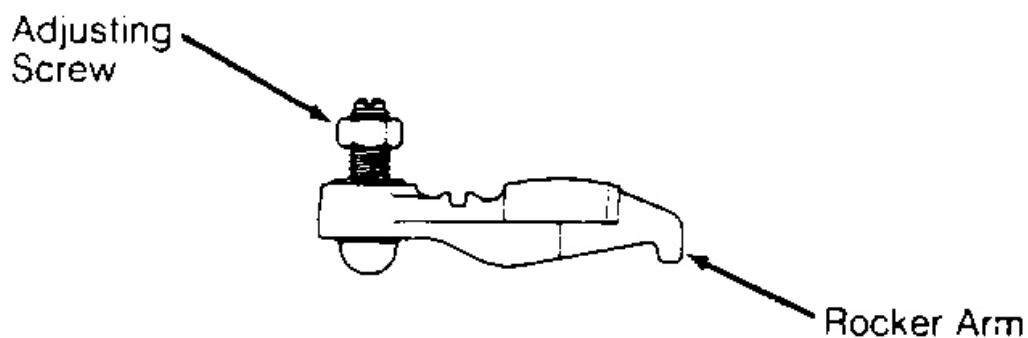
Fig. 6: Removing Rocker Arms

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

2. Remove rocker arms. Arrange rocker arms in order of removal for installation reference. Inspect contact surface of rocker arms, valve stem ends and camshaft lobes. If contact surfaces are excessively worn, replace as required.

Installation

1. Install rocker arms with adjusting screw fully extended. See **Fig. 7** .
2. Install new rocker arm springs. Press bottom lip of rocker arm spring until it fits into groove on rocker arm pivot. See **Fig. 8** .

**Fig. 7: Rocker Arm Adjusting Screw Installation Position**

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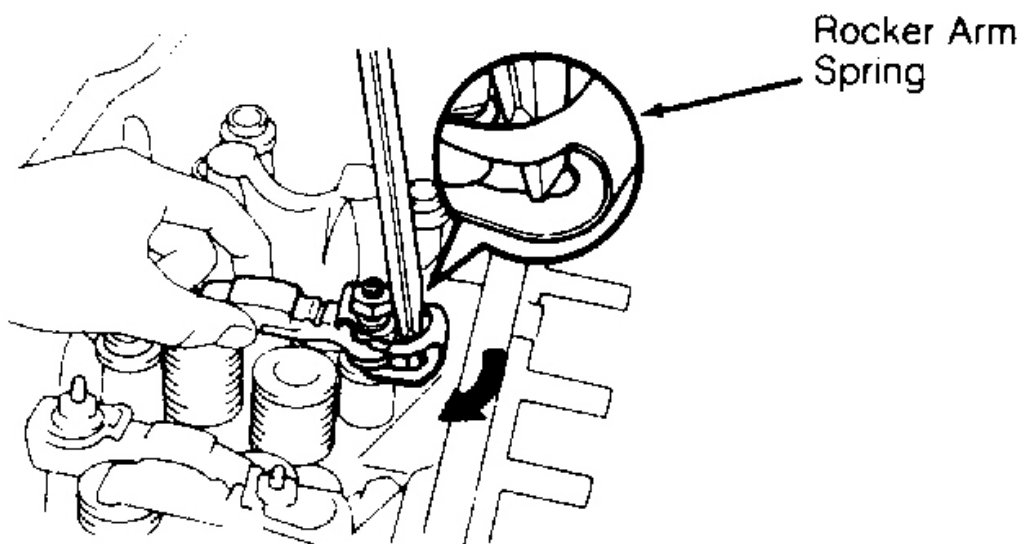


Fig. 8: Installing Rocker Arm

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3. Pull rocker arm up and down. Ensure there is spring tension on rocker arm and rocker arm does not rattle. To complete installation, reverse removal procedures. Adjust valves. See **VALVE CLEARANCE ADJUSTMENT**. When installing valve cover, apply seal packing to cylinder head. See **Fig. 5**.

CAMSHAFT

Removal

1. Mark and remove all wiring and vacuum hoses necessary for valve cover removal. Remove valve cover. Remove timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION.
2. Loosen camshaft bearing cap bolts in reverse of tightening sequence. See **Fig. 9**. Remove camshaft oil seal and camshaft bearing caps. **DO NOT** remove distributor bearing cap. Keep bearing caps in order for reassembly reference. Remove camshaft.

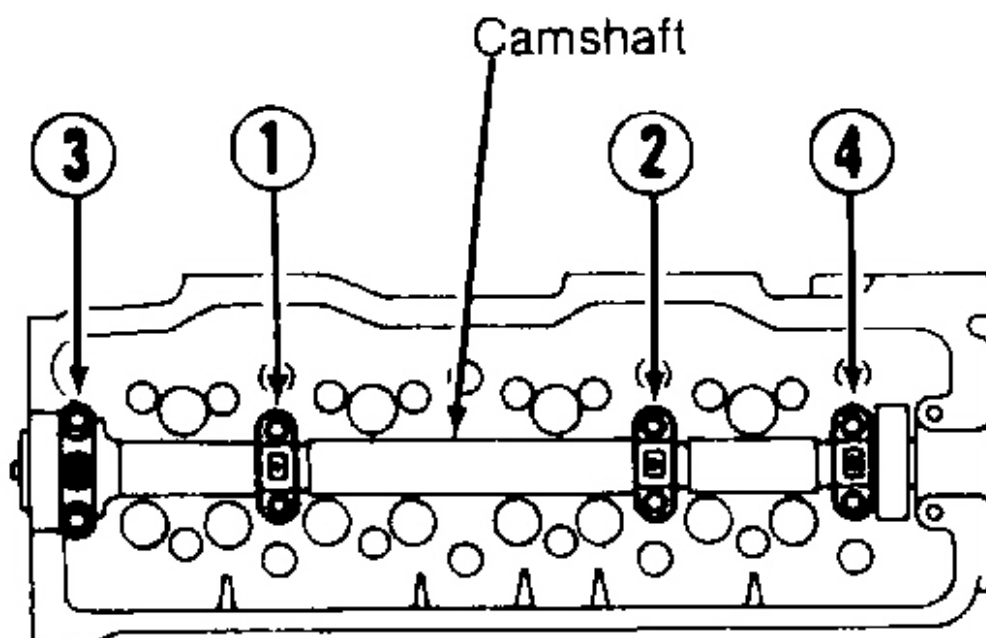


Fig. 9: Camshaft Bearing Cap Bolt Installation Sequence
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

Inspection

1. Inspect components for damage. Check camshaft journal diameter, lobe height and runout. See **Fig. 10**. Replace camshaft if not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.

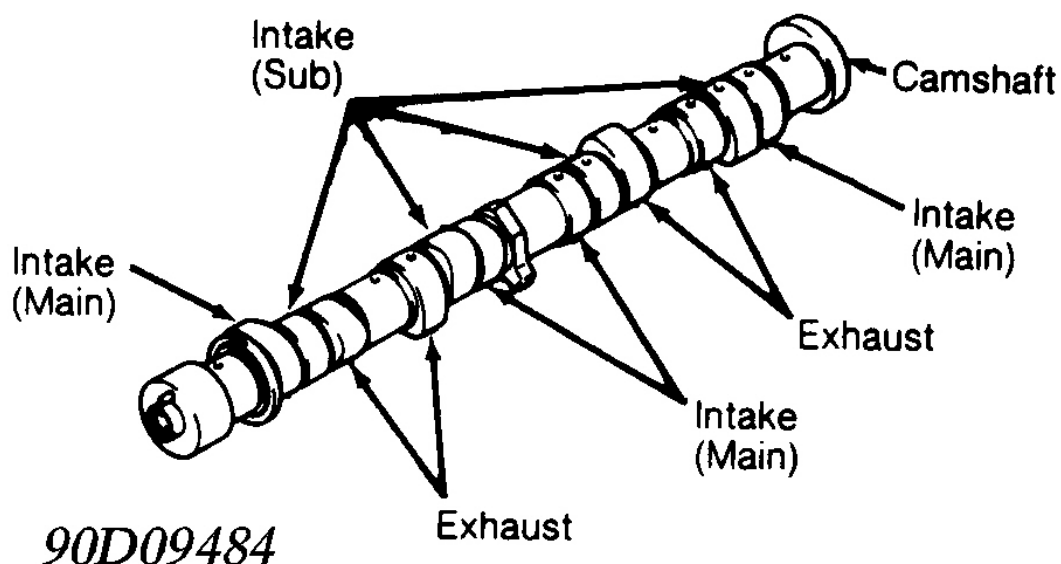


Fig. 10: Measuring Camshaft Lobe Height

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

Installation

1. Set No. 1 cylinder at TDC on compression stroke. Coat all bearing journals with engine oil. Position camshaft knock pin at the 12 o'clock position. See **Fig. 11**.

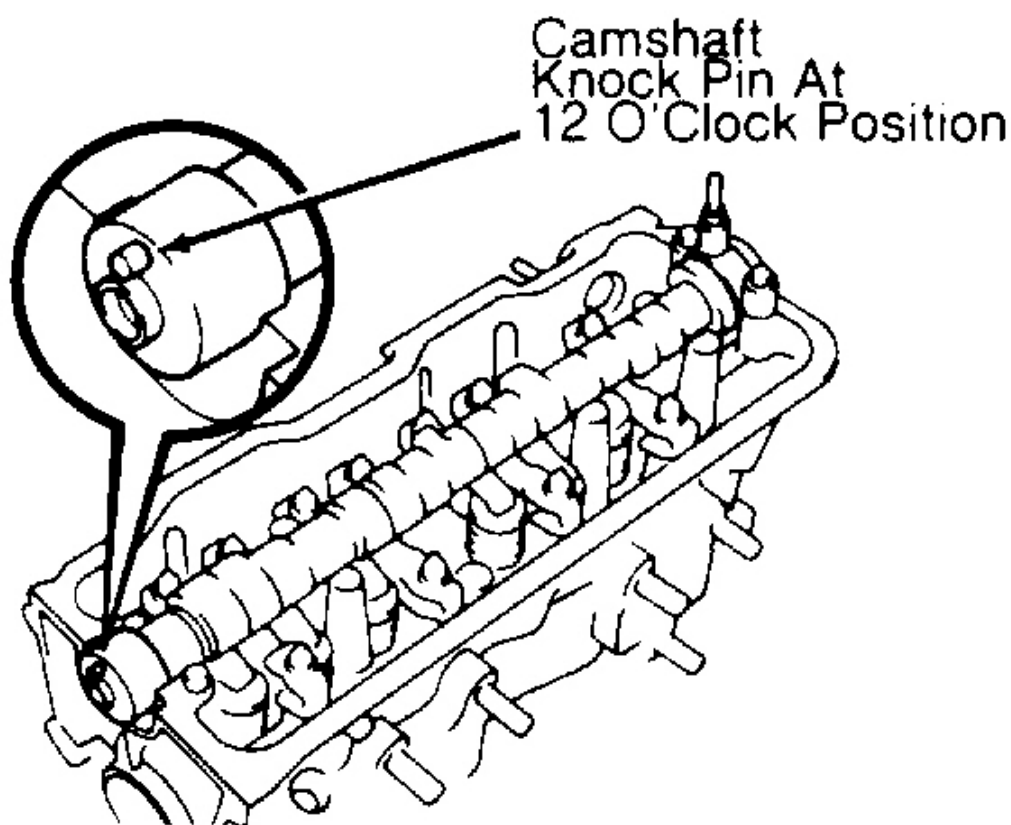


Fig. 11: Installing Camshaft

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2. Place bearing caps on each journal with arrows pointing to front of engine and bearing cap numbers in numerical sequence. Apply engine oil to lip of new camshaft oil seal. Install camshaft oil seal. Apply seal packing to No. 1 camshaft bearing cap. See **Fig. 12** .

NOTE: **Install No. 1 bearing cap immediately after applying seal packing.**

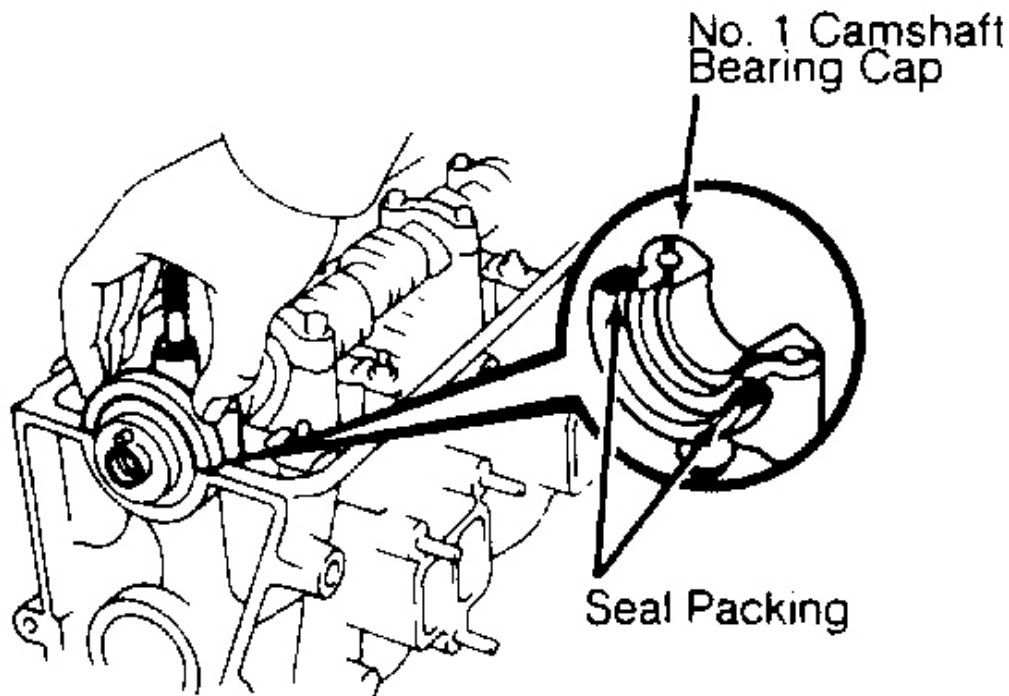


Fig. 12: Applying Seal Packing to No. 1 Camshaft Bearing Cap
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

3. Install No. 1 bearing cap. Tighten each bearing cap bolt in proper sequence. See **Fig. 9** . Tighten all bolts to specification. See **TORQUE SPECIFICATIONS** table.
4. To complete the installation, reverse removal procedure. When installing valve cover, apply seal packing to cylinder head. See **Fig. 5** .

REAR CRANKSHAFT OIL SEAL

NOTE: Rear main bearing oil seal is located on rear of engine block. Transmission must be removed to replace seal. When removing oil seal, use care to avoid damage to crankshaft seal surface.

Removal & Installation

1. Remove transmission and flywheel. See AUTOMATIC TRANS REMOVAL article in the TRANSMISSION SERVICING Section. Cut off seal lip. Use care not to damage crankshaft surface. Pry out oil seal.
2. Apply multipurpose grease to new seal lip. Using Seal Installer (09223-41020), install new oil seal until surface of seal is flush with rear of oil seal retainer edge. To complete installation, reverse removal procedure.

WATER PUMP

Removal

1. Disconnect negative battery cable. Drain engine coolant. Remove accessory drive belts. Remove alternator. Remove intake manifold bracket-to-cylinder block. Disconnect coolant hoses. Remove inlet water pump pipe and "O" ring.
2. Remove oil dipstick. Remove dipstick tube mounting bolt. Remove alternator adjusting bracket. Pull out dipstick tube. Plug dipstick tube installation hole. Remove "O" ring from dipstick tube. Remove bolt, 2 nuts and water pump.

Inspection

Ensure water pump bearing is not rough or noisy. Replace water pump assembly as required.

Installation

To install, reverse removal procedure. Install new "O" ring on water inlet pipe and oil dipstick tube. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS** table. Refill with coolant. Start engine and check for leaks.

CYLINDER HEAD OVERHAUL

CYLINDER HEAD

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. Check EGR passage for clogging. Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

VALVE SPRINGS

Inspect valve spring free length, tension and installed height. Using a square, check squareness of each valve spring. Replace if not within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS. Installed spring height is measured from spring seat to valve retainer. Install all valve springs with painted area toward rocker arm.

VALVE GUIDES

Measure diameter of valve stem and inside diameter of valve guide. Standard valve stem oil clearance should be within specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. If oil clearance is greater than maximum, replace valve guide.

VALVE GUIDE REPLACEMENT

1. Using Valve Guide Remover (09201-70010), remove valve guide bushing. Measure cylinder head valve guide bore inside diameter. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. If valve guide bore is not within specification, bushing bore may be machined to .4350-.4361" (11.050-11.077 mm).
2. Using Valve Guide Installer (09201-70010), install new valve guide until protrusion height is .52-.56" (13.3-14.1 mm). See **Fig. 13** . Using a 6 mm reamer, ream valve guide to obtain standard

specified clearance between valve guide and valve stem.

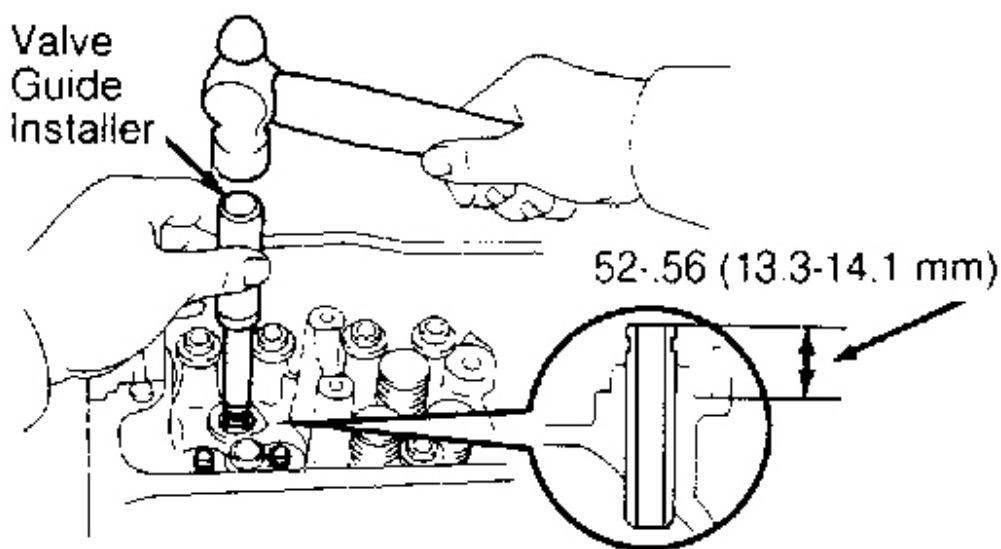


Fig. 13: Measuring Valve Guide Installed Height
Courtesy of TOYOTA MOTOR SALES, U.S.A., INC.

VALVE SEATS

No service procedure is given by manufacturer. Valve seats must be ground if valve guides are replaced.

VALVES

Inspect each valve for wear, damage and distortion of head and stem. If valve 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 service limit, replace valve.

VALVE TRAIN OVERHAUL

ROCKER ARM

Check contact surfaces of rocker arm for excessive wear or damage. Replace rocker arm if grooves or pitting is present.

CYLINDER BLOCK ASSEMBLY OVERHAUL

PISTON & ROD ASSEMBLY

1. Check connecting rod maximum bend and twist. Maximum bend and twist should be within

specification. See **CONNECTING RODS** table under ENGINE SPECIFICATIONS.

2. If maximum bend and twist are not within specification, replace connecting rod. Lubricate cylinder bore and rod journals with engine oil. Cover rod bolts with short piece of hose to protect crankshaft journals from damage.
3. Using piston ring compressor, push correctly numbered piston and connecting rod assembly into each cylinder with front mark of piston facing forward. See **Fig. 14**.

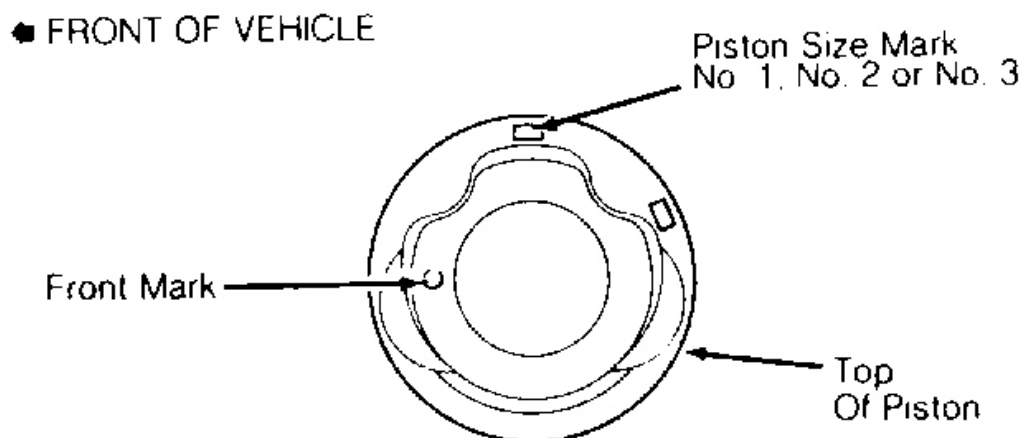


Fig. 14: Identifying Piston Marks

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

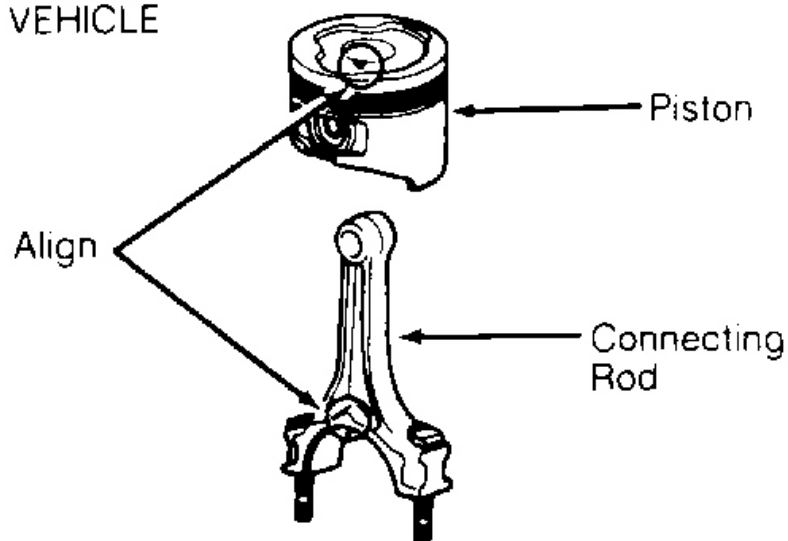
4. Install rod cap with front mark facing front of engine. Apply light coat of engine oil to rod bolt threads and nuts. Install and alternately tighten cap nuts in several stages to specification. See **TORQUE SPECIFICATIONS** table.
5. Ensure crankshaft turns smoothly. Check connecting rod side play. Connecting rod side play should be within specification. See **CONNECTING RODS** table under ENGINE SPECIFICATIONS. If clearance is greater than maximum, replace connecting rod assembly or crankshaft as required.

NOTE: Piston and piston pin are a matched set. Keep pistons, pins, rings and rods in order for reassembly reference.

PISTON PIN

1. Check fit between piston and piston pin. If movement is felt, replace piston and pin. To remove piston pin, warm piston and rod to 68°F (20°C). Using Pin Remover/Installer (09221-25024), remove piston pin. Use care not to damage piston during removal.
2. Check piston pin and piston pin hole for signs of galling or excessive wear. Replace as required. To assemble, preheat piston and rod to 68°F (20°C). Align cavity on piston top with protrusion on rod.
3. Coat piston pin with oil. Insert pin into piston while holding parts in proper alignment. See **Fig. 15**. Using piston Pin Installer (09221-25024), install piston pin until centered in rod.

● FRONT OF VEHICLE

**Fig. 15: Assembling Piston & Connecting Rod**

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

NOTE: There are 3 different standard piston sizes and cylinder bore diameters being used. Pistons and cylinder bores are marked No. 1, No. 2 or No. 3. Mark is stamped on top of piston and cylinder block. See [Fig. 14](#) and [Fig. 16](#) .

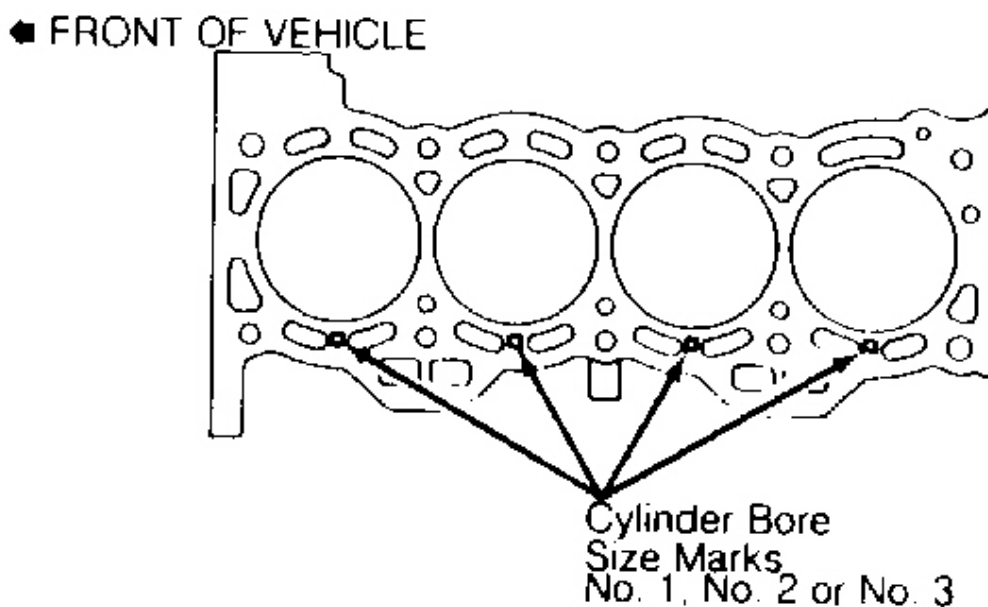


Fig. 16: Identifying Cylinder Bore Size Marks

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 being used. Measure piston diameter at right angles to piston pin center line. Measure .87" (22 mm) from top of piston head.
2. Measure cylinder bore diameter in thrust direction. See **Fig. 17** . Subtract piston diameter measurement from cylinder bore diameter measurement. Piston clearance should be within specification.

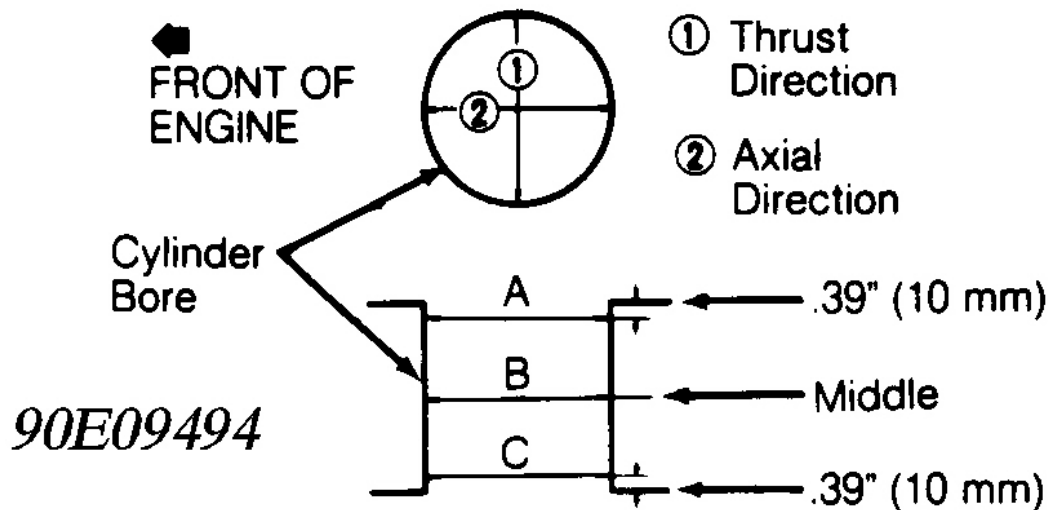


Fig. 17: Measuring Cylinder Bore Diameter

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

3. If piston clearance is greater than maximum, replace all 4 pistons and/or rebore all 4 cylinders. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.

CONNECTING ROD BEARINGS

1. Install replacement bearing. Ensure reference marks on rod cap and connecting rod are aligned. Check bearing clearance using Plastigage method.
2. Lubricate all components with engine oil before reassembling. Tighten nuts to specification. See **TORQUE SPECIFICATIONS** table. Ensure connecting rod moves freely on crankshaft. Check connecting rod side clearance.

CRANKSHAFT & MAIN BEARINGS

1. Place crankshaft on "V" blocks. Measure main and connecting rod journal taper and runout. See **ENGINE SPECIFICATIONS**. Regrind or replace crankshaft as necessary.
2. Clean all parts to be assembled. Apply engine oil to all moving parts. Install main bearings and bearing caps in order.

CAUTION: Ensure main bearing oil holes line up with oil hole in block.

3. Install upper thrust washers on center main bearing with oil grooves facing outward. Place crankshaft in cylinder block. Install main bearing caps in proper location.
4. Install thrust washers on No. 3 bearing cap with oil grooves facing outward. Install bearing caps in numerical order. Apply engine oil to threads of cap bolts. Tighten cap bolts in 2 or 3 stages and in proper sequence. See [Fig. 18](#).

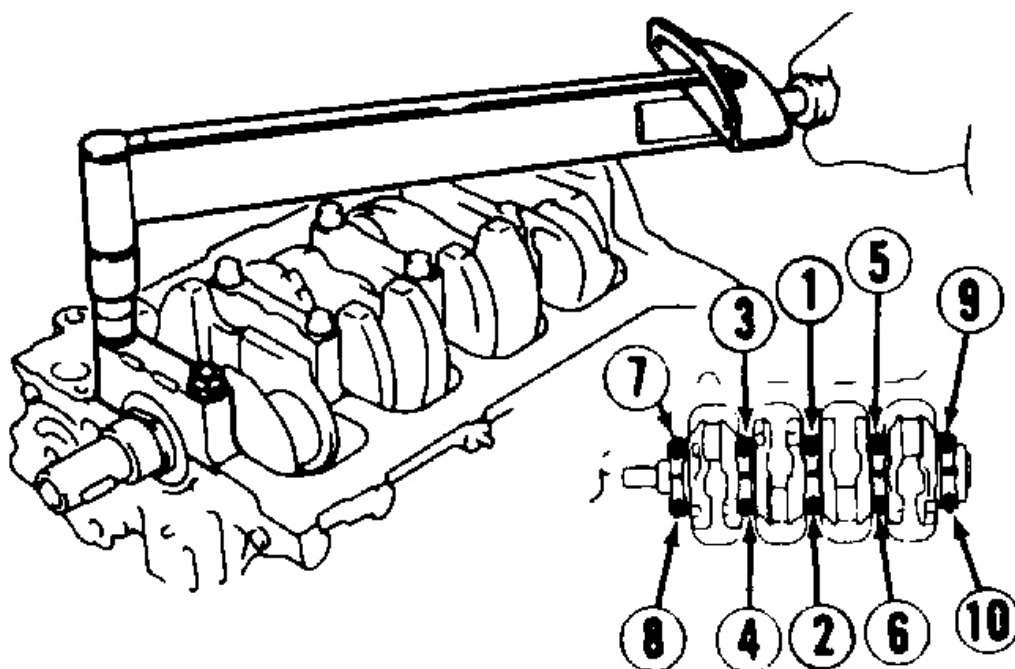


Fig. 18: Crankshaft Main Bearing Tightening Sequence

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

5. To complete installation, reverse removal procedure. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS** table.

ENGINE LUBRICATION

Oil from oil pan is pumped up by the oil pump. After it passes through oil filter, it is fed through various oil holes in crankshaft and cylinder block. After passing through cylinder block and performing its lubricating function, oil is returned by gravity to oil pan. See **Fig. 19**.

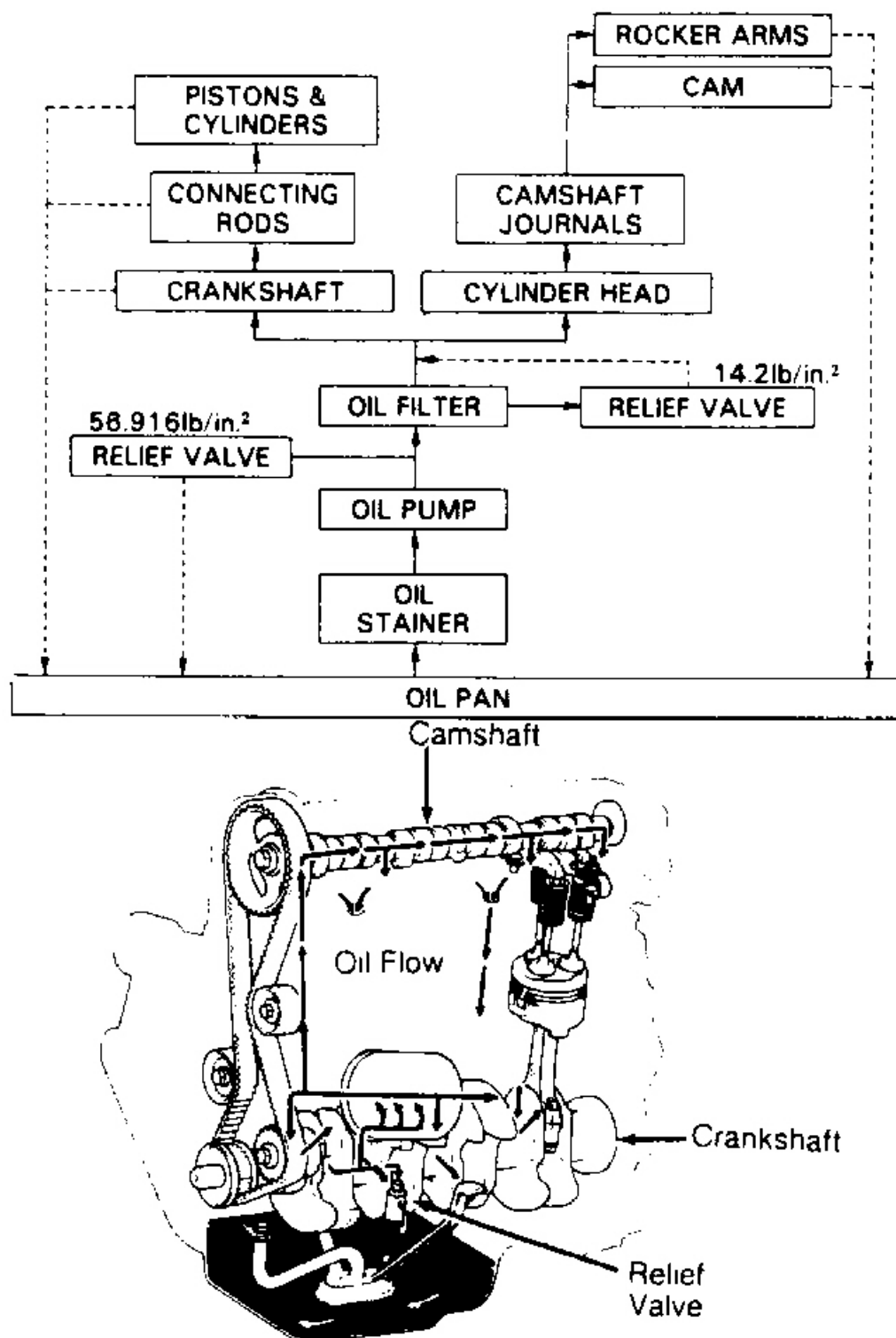


Fig. 19: Engine Oil Circuit

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

CRANKCASE CAPACITY

Crankcase oil capacity is 3.5 qts. (3.3L) with filter.

OIL PRESSURE

Oil pressure should be more than 4.3 psi (0.3 kg/cm²) at idle and 36-71 psi (2.5-5.0 kg/cm²) at 3000 RPM.

OIL PUMP

NOTE: When repairing oil pump, the oil pan and strainer should be removed and cleaned.

REMOVAL & INSTALLATION

1. Disconnect negative battery cable. Remove engine under cover (splash) shields. Disconnect exhaust pipe. Remove timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION . Remove oil filler cap. Drain engine oil. Remove oil dipstick, oil pan and oil strainer. Remove oil pressure regulator assembly. See **Fig. 20** .

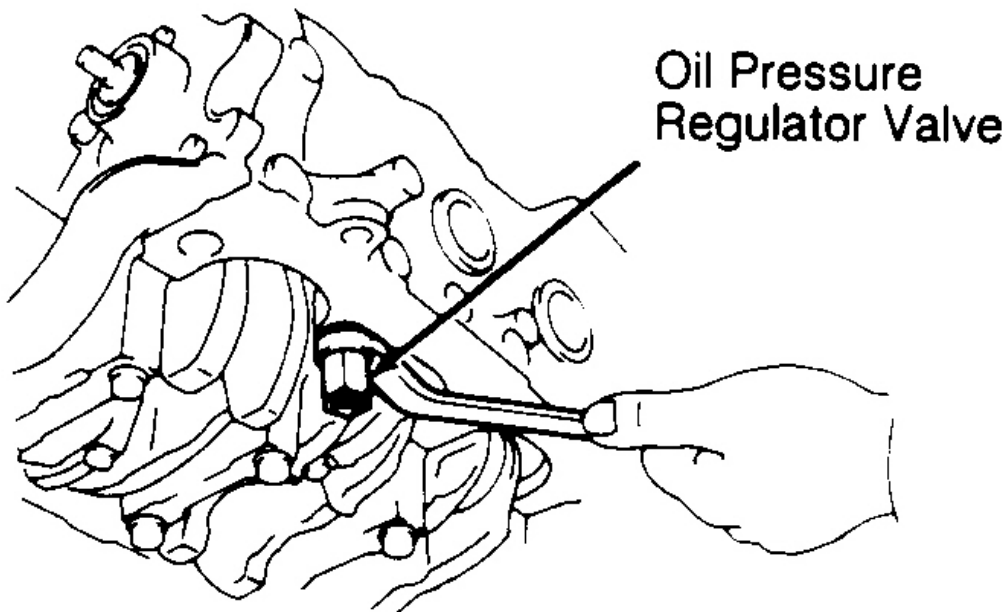
**90D09498**

Fig. 20: Removing Oil Pressure Regulator

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

2. Remove pulley tension spring bracket. Remove oil pump bolts attaching oil pump body to front of engine block. Remove oil pump body and "O" ring. See **Fig. 21** . To install, reverse removal

procedure. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS** table.

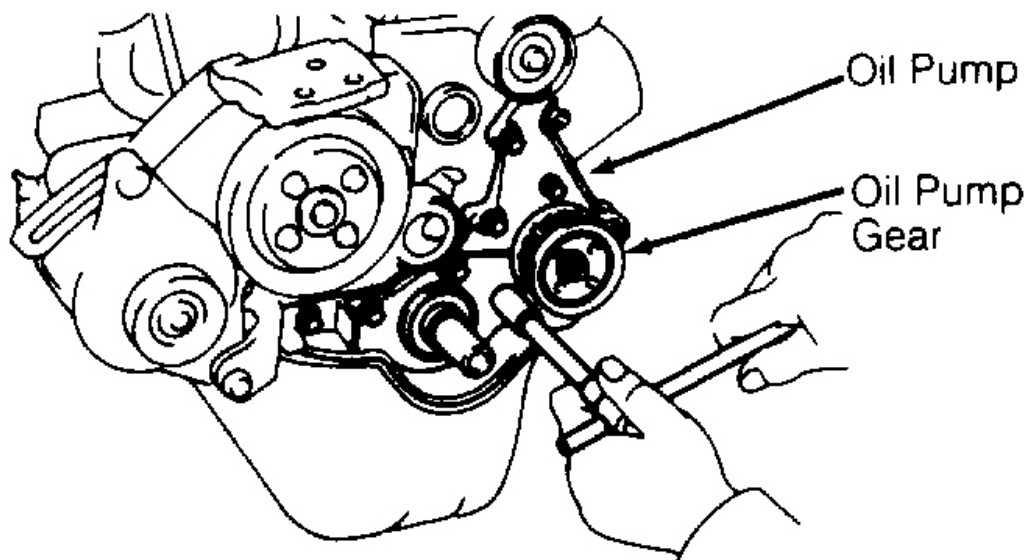


Fig. 21: Removing Oil Pump Assembly

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

INSPECTION

1. Disassemble pressure regulator. Remove snap ring, retainer, spring and pressure regulator valve piston. Coat valve piston with engine oil and check that it falls smoothly into valve hole by its own weight. Replace pressure regulator valve if a problem exists.
2. Reassemble pressure regulator valve. Measure oil pump body clearance, driven gear-to-body clearance, drive and driven gear tip-to-crescent clearance and gear side clearance. See **OIL PUMP SPECIFICATIONS** table. If oil pump is not within specification, replace oil pump rotor set and/or pump body.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Driven Gear-To-Body	
Clearance	(1) .0039-.0063 (.100-.160)
Drive & Driven Gear	
Tip-To-Crescent Clearance	(1) .0024-.0059 (.060-.150)
Gear Side Clearance	(2) .0012-.0035 (.030-.090)
(1) Standard clearance. Maximum clearance is .0079" (.200 mm).	
(2) Standard clearance. Maximum clearance is .0039" (.100 mm).	

TORQUE SPECIFICATIONS

1991 Toyota Tercel

1.5L 4-CYL - VIN [E] 1991 Engines - 1.5L 4-Cylinder

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Alternator Bracket Bolts	13 (18)
Camshaft	
Bearing Cap Bolts	10 (14)
Gear Bolt	37 (50)
Timing Gear Bolt	14 (19)
Connecting Rod	
Bearing Cap Bolts	29 (39)
Crankshaft	
Gear Bolt	112 (152)
Main Bearing Cap Bolts	42 (57)
Pulley Bolts	112 (152)
Cylinder Head Bolts ⁽¹⁾	
Step 1	22 (30)
Step 2	36 (49)
Step 3	(2)
Engine Mount	
Front Through Bolt	47 (64)
Front Bracket Bolts	19 (26)
Left Bracket Bolts	35 (47)
Rear Through Bolt	54 (73)
Rear Bracket Bolts	47 (64)
Right Bracket Bolts	32 (43)
Right Through Bolt	47 (64)
Exhaust Manifold Bolts	35 (47)
Exhaust Pipe	46 (62)
Fuel Pump	9 (12)
Intake Manifold Bolts	14 (19)
Spark Plugs	13 (18)
Oil Pump Gear Bolt	20 (27)
Timing Belt	
Left Idler Pulley Bolt	20 (27)
Right Idler Pulley Bolt	13 (18)
Water Outlet Housing Bolts	13 (18)
Water Pump Bolts	13 (18)
	INCH Lbs. (N.m)
Oil Pump Bolts	65 (7.3)
Rear Oil Seal Retainer Bolts	65 (7.3)
Valve Cover Bolts	61 (6.9)
Intake Manifold	
Upper Heat Insulator Bolts	69 (7.8)
(1) Tighten in sequence. See Fig. 3 .	

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1.5L 4-CYL - VIN [E] 1991 Engines - 1.5L 4-Cylinder

(2) Retighten an additional 90 degrees.

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

Application	Specification
Displacement	88.9 Cu. In. (1.5L)
Bore	2.88" (73.0 mm)
Stroke	3.43" (87.0 mm)
Compression Ratio	9.3:1
Fuel System	PFI
Horsepower @ RPM	82 @ 5200
Torque Ft. Lbs. @ RPM	90 @ 4400

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

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0008-.0087 (.020-.220)
Maximum	.012 (.30)
Runout	.0024 (.060)
Main Bearings	
Journal Diameter	1.9679-1.9685 (49.985-50.000)
Journal Out-Of-Round	.0028 (.070)
Journal Taper	.0031 (.080)
Oil Clearance	
Standard	.0006-.0014 (.016-.035)
Maximum	.0031 (.080)
Connecting Rod Bearings	
Journal Diameter	1.6923-1.6929 (42.985-43.000)
Journal Out-Of-Round	.0028 (.070)
Journal Taper	.0031 (.080)
Oil Clearance	
Standard	.0006-.0019 (.016-.048)
Maximum	.0031 (.080)

CONNECTING RODS SPECIFICATIONS**CONNECTING RODS**

Application	In. (mm)
Bore Diameter ⁽¹⁾	

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No. 1	1.8110-1.8113 (46.000-46.007)
No. 2	1.8113-1.8116 (46.007-46.014)
No. 3	1.8116-1.8118 (46.014-46.021)
Maximum Bend	.0012 (.030)
Maximum Twist	.0020 (.050)
Side Play	
Standard	.0059-.0138 (.150-.350)
Maximum	.0177 (.450)
(1) Three standard connecting rod bore diameters are used. Connecting rod bores are marked No. 1, No. 2 or No. 3 on rod cap.	

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

Application	In. (mm)
Piston Clearance	
Standard	.0028-.0035 (.070-.090)
Maximum	.0079 (.200)
Piston Diameter ⁽¹⁾	
No. 1	2.870-2.871 (72.92-72.93)
No. 2	2.871-2.872 (72.93-72.94)
No. 3	2.872-2.873 (72.94-72.95)
Pins	
Piston Fit	⁽²⁾ Press Fit
Rod Fit	⁽²⁾ Press Fit
Rings	
No. 1	
End Gap	.0102-.0189 (.260-.480)
Side Clearance	.0016-.0031 (.040-.080)
No. 2	
End Gap	.0118-.0224 (.300-.570)
Side Clearance	.0012-.0028 (.030-.070)
No. 3 (Oil)	
End Gap	.0059-.0205 (.150-.520)
(1) Three standard piston sizes are used. Pistons are marked No. 1, No. 2 or No. 3 on top of piston. See Fig. 14 .	
(2) Install piston pin at temperature of 68°F (20°C).	

CYLINDER BLOCK SPECIFICATIONS**CYLINDER BLOCK**

1991 Toyota Tercel

1.5L 4-CYL - VIN [E] 1991 Engines - 1.5L 4-Cylinder

Application	In. (mm)
Cylinder Bore	
Diameter ⁽¹⁾	
No. 1	2.8740-2.8744 (73.000-73.010)
No. 2	2.8744-2.8748 (73.010-73.020)
No. 3	2.8748-2.8752 (73.020-73.030)
Maximum Taper	.0008 (.020)
Maximum Out-Of-Round	.0008 (.020)
Maximum Deck Warpage	.002 (.05)
(1) Three standard cylinder bore diameters are used. Cylinder bores are marked No. 1, 2 or 3 on top of cylinder block. See Fig. 16 .	

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

Application	Specification
Intake Valves	
Face Angle	44.5°
Minimum Margin	.031" (.80 mm)
Minimum Refinish Length (Main)	3.6126" (91.760 mm)
Minimum Refinish Length (Sub)	3.5945" (91.300 mm)
Stem Diameter	.2350-.2356" (5.970-5.985 mm)
Exhaust Valves	
Face Angle	44.5°
Minimum Margin	.031" (.80 mm)
Minimum Refinish Length	3.6126" (91.760 mm)
Stem Diameter	.2348-.2354" (5.965-5.980 mm)
Valve Springs	
Free Length	1.6346" (41.520 mm)
Installed Height	1.3842" (35.160 mm)
Out-Of-Square	.079" (2.00 mm)
Pressure	Lbs. @ In. (kg @ mm)
Valve Closed	35.1 @ 1.3842 (15.91 @ 35.16)

CYLINDER HEAD SPECIFICATIONS**CYLINDER HEAD**

Application	Specification
Maximum Warpage	.002" (.05 mm)
Valve Seats	

1991 Toyota Tercel

1.5L 4-CYL - VIN [E] 1991 Engines - 1.5L 4-Cylinder

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 Cyl. Head	
Bore I.D.	.4331-.4341" (11.000-11.027 mm)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Installed Height	.52-.55" (13.3-14.1 mm)
Valve Stem-To-Guide	
Oil Clearance	
Standard	.0010-.0024" (.025-.060 mm)
Maximum	.0031 (.080)
Exhaust Valve	
Valve Guide Cyl. Head	
Bore I.D.	.4331-.4341" (11.000-11.027 mm)
Valve Guide I.D.	.2366-.2374" (6.010-6.030 mm)
Installed Height	.52-.55" (13.3-14.1 mm)
Valve Stem-To-Guide	
Oil Clearance	
Standard	.0012-.0026" (.030-.065 mm)
Maximum	.0039 (.100)

CAMSHAFT SPECIFICATIONS**CAMSHAFT**

Application	In. (mm)
End Play	.0031-.0071 (.080-.180)
Journal Diameter	1.0622-1.0628 (26.979-26.995)
Journal Runout	.0016 (.040)
Lobe Height	
Intake (Main)	1.3917-1.3957 (35.350-35.450)
Intake (Sub)	1.3744-1.3783 (34.910-35.010)
Exhaust	1.4106-1.4146 (35.830-35.930)
Oil Clearance	.0015-.0029 (.037-.073)