

## 1994 Suzuki Samurai JL

1.3L 4-CYL - VIN [3] 1994 SUZUKI ENGINES 1.3L 4-Cylinder

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#### 1994 SUZUKI ENGINES 1.3L 4-Cylinder

## ENGINE IDENTIFICATION

Engine code is stamped on rear portion of cylinder block at bellhousing, exhaust side. Vehicle Identification Number (VIN) is stamped on a metal tag attached to left side of instrument panel near pillar. The sixth character of VIN identifies engine model.

### ENGINE IDENTIFICATION CODE

Application	VIN
Samurai 1.3L SOHC	3

## ADJUSTMENTS

### VALVE CLEARANCE ADJUSTMENT

1. Remove rocker cover. Rotate crankshaft until TDC mark of timing belt cover is in line with timing mark on crankshaft pulley with cylinder No. 1 at TDC on compression stroke.
2. Remove distributor cap and ensure rotor is pointed upward at distributor hold-down bolt and to No. 1 terminal of distributor cap. If not correctly oriented, rotate crankshaft 360 degrees.
3. Measure clearance between adjustment screw and valve stem using thickness gauge. Check intake valve clearance of cylinders No. 1 and 2 and exhaust valve clearance of cylinders No. 1 and 3.
4. Turn crankshaft one complete revolution (360 degrees). Check intake valve clearance of cylinders No. 3 and 4 and exhaust valve clearance of cylinders No. 2 and 4. Ensure clearance is within specification. See VALVE CLEARANCE SPECIFICATIONS table.
5. If clearance adjustment is necessary, loosen lock nut and turn adjusting screw. After adjusting clearance, tighten adjusting screw lock nut to 11-14 ft. lbs. (15-19 N.m). Recheck clearance.

### VALVE CLEARANCE SPECIFICATIONS

Application	In. (mm)
Engine Cold	
Intake	.005-.007 (.13-.18)
Exhaust	.006-.008 (.15-.20)
Engine Hot	
Intake	.009-.011 (.23-.28)
Exhaust	.010-.011 (.25-.28)

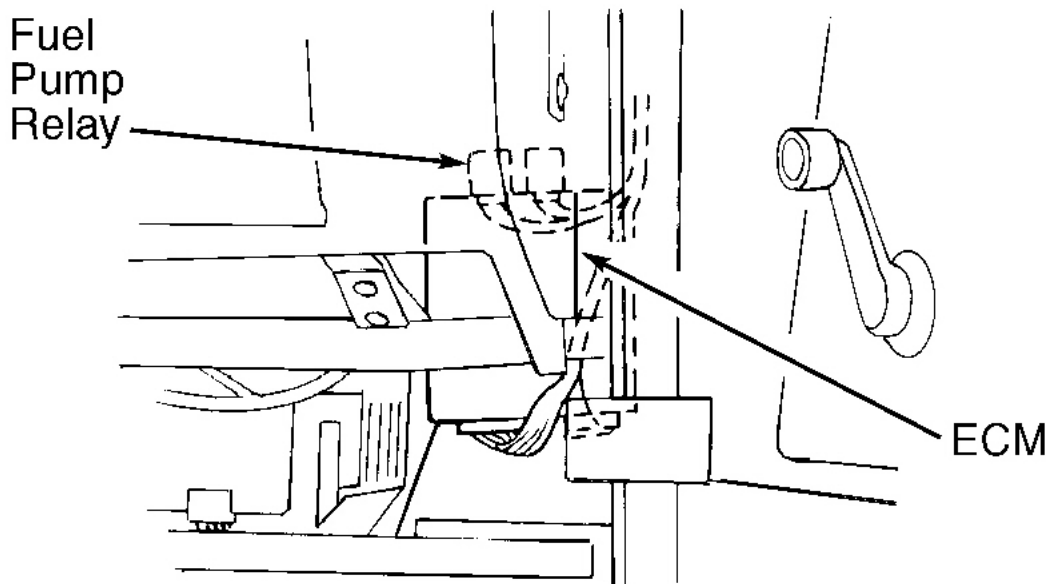
## REMOVAL & INSTALLATION

**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.

**WARNING:** ALWAYS relieve fuel pressure before disconnecting any fuel injection-related component. DO NOT allow fuel to contact engine or electrical components.

## FUEL PRESSURE RELEASE

1. Place transmission in Neutral (M/T) or Park (A/T). Set parking brake and block drive wheels.
2. Disconnect fuel pump relay connector. Fuel pump relay is located on right kick panel, above ECM. See **Fig. 1**.
3. Remove fuel filler cap to release pressure. Reinstall fuel filler cap. Start engine, and idle until engine dies. Crank engine 2 or 3 times to ensure lines are empty. Reconnect fuel pump relay connector.



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**Fig. 1: Locating Fuel Pump Relay**

Courtesy of SUZUKI OF AMERICA CORP.

## ENGINE

**CAUTION:** When raising or supporting engine or automatic transmission for any reason, DO NOT use a jack under oil pan. Damage to oil pump and pick-up strainer could result.

**NOTE:** Remove engine and transmission as an assembly.

**Removal**

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Disconnect battery cables. Mark and remove hood. Remove warm air hose. Disconnect breather hose from air cleaner case. Remove air cleaner case from throttle body and air inlet hose.
2. Mark all remaining connectors and disconnect from throttle body and intake manifold. Disconnect accelerator cable from throttle body. Disconnect and mark wires from starter motor and alternator terminals. Mark and disconnect vacuum hoses.
3. Disconnect fuel supply and return hoses from throttle body. Disconnect wire connector from oil pressure sending unit and oxygen sensor. Disconnect wire connector from back-up light switch and 5th gear switch.
4. Disconnect distributor primary wires at distributor. Remove high tension wire from ignition coil. Drain radiator. Disconnect hoses from thermostat cap and inlet pipe. Remove cooling fan and clutch.
5. Remove fan shroud and radiator. Disconnect brake booster vacuum hose. Remove 4 bolts fastening gearshift No. 2 lever boot, and move boot upward. Move gearshift No. 1 to upper side of shift lever.
6. Loosen 3 bolts on gearshift lever case, and remove shift lever from lever case. Raise vehicle. Disconnect exhaust pipe from exhaust manifold. Disengage clutch cable from clutch release lever. Drain transmission oil.
7. Remove drive shaft connecting transmission case to transfer case. Attach hoist to hooks provided on engine. One hook is mounted on each side of engine.
8. Remove exhaust center pipe mounting bracket and 4 transmission mount bolts. Remove pipe connected to chassis under transmission. Lower vehicle. Remove 4 bolts securing right and left engine mounting brackets.
9. Ensure all hoses, electrical wires and cables are disconnected. Remove engine. Remove lower clutch cover. Separate engine from transmission (if necessary).

**Installation**

Lower engine and transmission into vehicle. Install engine mountings to brackets. Install bolts into frame brackets. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Replace cooling system, engine and transmission fluids. To complete installation, reverse removal procedure.

**INTAKE MANIFOLD****Removal**

1. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Disconnect negative battery cable. Drain cooling system. Remove air intake hoses and air breather hoses.

**WARNING: To avoid severe burns, DO NOT remove radiator drain plug or cap while engine and radiator are still hot.**

2. Remove air cleaner assembly. Label and disconnect all electrical connections from intake manifold, injectors and throttle body. Label and disconnect vacuum hoses from intake manifold.
3. Disconnect coolant hoses from manifold and throttle body and remove upper radiator hose. Remove fuel

supply and return lines from delivery pipe. Disconnect all control cables.

4. Remove intake manifold-to-cylinder head bolts. Remove intake manifold and throttle body and gasket. Remove remaining components from intake manifold as required.

### Installation

To install, reverse removal procedure using NEW gaskets. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** . Adjust all control cables and fill cooling system.

## EXHAUST MANIFOLD

### Removal

1. Disconnect negative battery cable. Remove air cleaner assembly (if necessary). Disconnect oxygen sensor wire connector.
2. Disconnect exhaust pipe from exhaust manifold. Remove exhaust manifold cover. Remove exhaust manifold-to-cylinder head bolts. Remove exhaust manifold and gasket.

### Installation

To install, reverse removal procedure using NEW exhaust manifold gasket. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .

## CYLINDER HEAD

### Removal

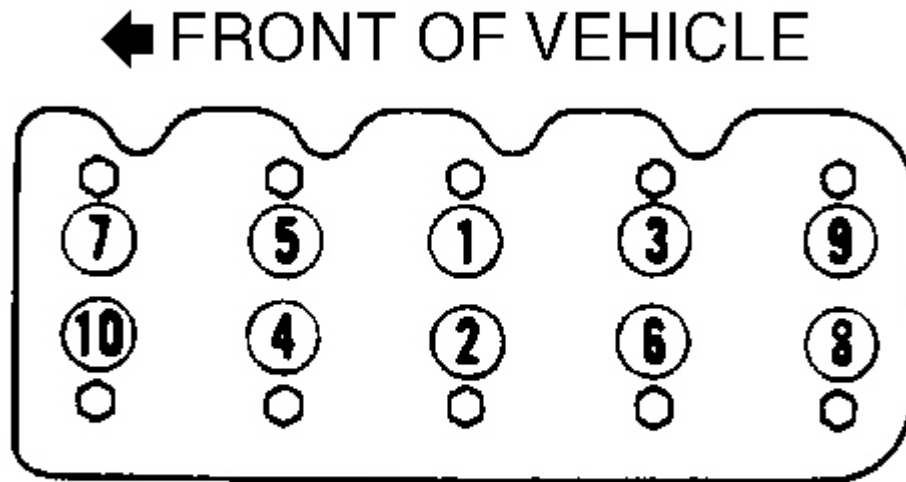
1. Release fuel pressure. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Remove intake and exhaust manifolds. See **INTAKE MANIFOLD** and **EXHAUST MANIFOLD** under REMOVAL & INSTALLATION.
2. Remove timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION. Loosen cylinder head bolts in reverse order of tightening sequence. See **Fig. 2** . Loosen head bolts in 2 or 3 steps to prevent cylinder head warpage. Remove bolts and cylinder head.

### Inspection

1. Check cylinder head for evidence of water leakage or damage. Remove carbon from combustion chambers. Check cylinder head for cracks in intake and exhaust ports, combustion chambers and head surface.
2. Check head warpage at 6 locations. If warpage exceeds specification, cylinder head should be machined or replaced. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS.
3. Check intake and exhaust manifold seating faces on cylinder head for warpage. Warpage limit for manifold seating faces is .004" (.10 mm). If warpage exceeds specification, machine or replace cylinder head.

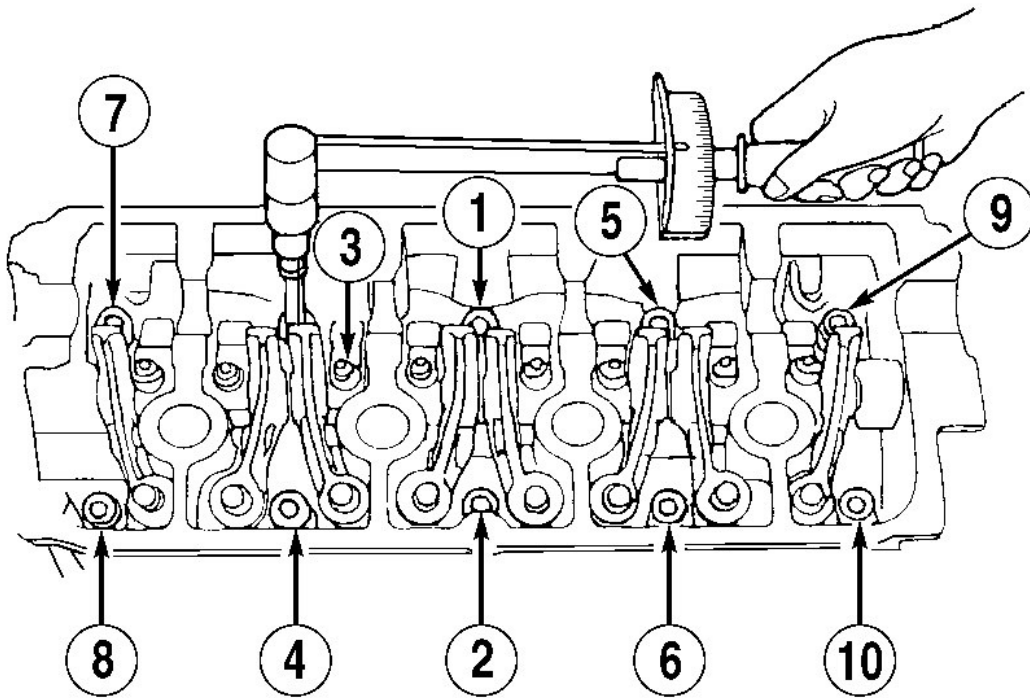
### Installation

To install cylinder head, reverse removal procedure. Use NEW head and manifold gaskets. Tighten cylinder head bolts to specification in 3 steps using proper sequence. See **Fig. 2** or **Fig. 3** . See **TORQUE SPECIFICATIONS** . Adjust valve clearance. See VALVE CLEARANCE ADJUSTMENT under ADJUSTMENTS.



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**Fig. 2: Cylinder Head Bolt Tightening Sequence (Except 1.6L 16-Valve)**  
Courtesy of SUZUKI OF AMERICA CORP.



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**Fig. 3: Cylinder Head Bolt Tightening Sequence (1.6L 16-Valve)**  
 Courtesy of SUZUKI OF AMERICA CORP.

## FRONT COVER OIL SEAL

### Removal

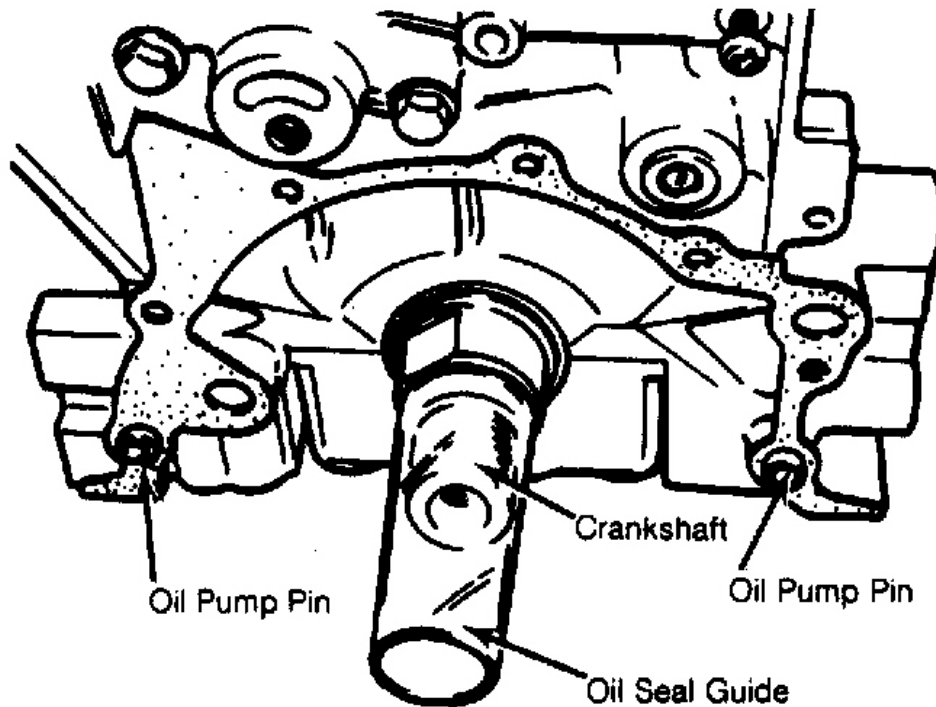
1. Remove water pump, crankshaft pulley and alternator. Remove timing belt cover and timing belt. See **TIMING BELT** under REMOVAL & INSTALLATION.
2. Drain engine oil. Remove oil dipstick and oil pan. Remove oil pump pick-up screen. Remove oil pump assembly. Remove oil pump rotor plate.
3. Using felt pen, mark outer gear for reassembly reference. Remove inner and outer oil pump gears. Remove plug, relief spring and relief valve. Drive out oil seal.

### Installation

1. Drive in NEW oil seal. Ensure gears are assembled in same direction as originally installed. Apply thin coat of engine oil to lip portion of oil seal and inside surfaces of oil pump case and plate. Install inner and outer rotors.
2. Install gear plate. Tighten 5 screws. Install 2 oil pump pins, NEW dipstick "O" ring, NEW seal for oil

pick-up tube and NEW oil pump gasket. Use Oil Seal Guide (09926-18210) to prevent damage to oil seal during installation of oil pump. See **Fig. 4**.

3. Apply engine oil to guide and install oil pump. Install dipstick guide with NEW seal. Install oil pan using silicone-type sealant. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.



**Fig. 4: Installing Oil Seal Guide**

Courtesy of SUZUKI OF AMERICA CORP.

## TIMING BELT

### Removal

1. Remove cooling fan and fan shroud. Discharge A/C system using approved refrigerant recovery/recycling equipment and disconnect compressor flexible suction hose from suction pipe (if equipped). Remove A/C compressor belt (if equipped).
2. Loosen alternator, and remove water pump pulley and belt.
3. Remove crankshaft pulley. Remove timing belt cover. Align all sprocket timing marks with timing marks on engine. See **Fig. 5**. Move up and secure timing belt tensioner.

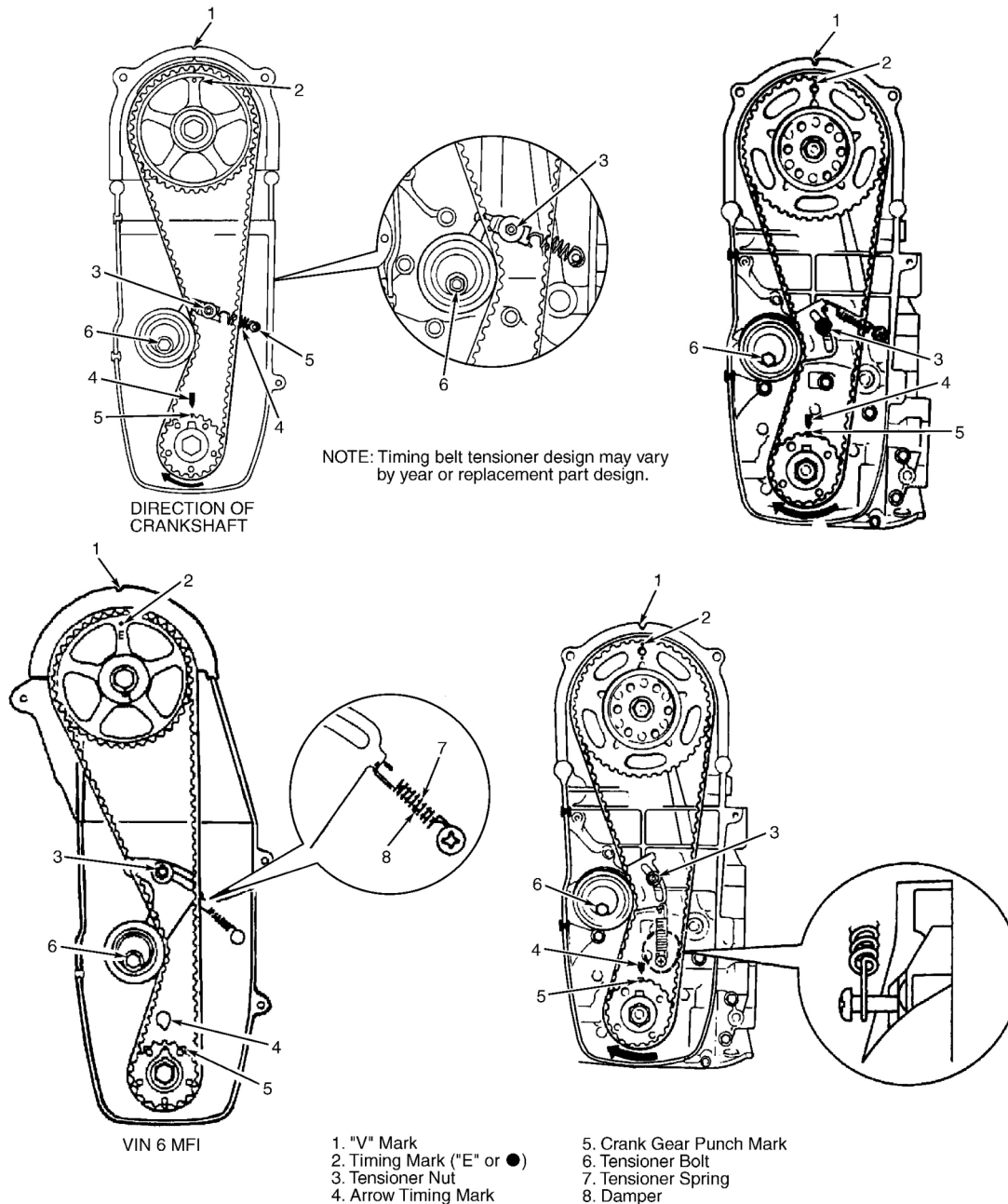
4. If timing belt is to be reused, mark belt with an arrow indicating direction of rotation. Remove timing belt from camshaft and crankshaft sprockets.

**CAUTION:** With timing belt removed, **DO NOT** turn camshaft sprocket more than 20 degrees in either direction from aligned position. **DO NOT** turn crankshaft more than 90 degrees in either direction from aligned position. Doing so could damage piston(s) and/or valve(s) by interference. Also, **DO NOT** bend timing belt.

### Installation

1. Loosen all valve adjusting screws fully before installing timing belt. Allow camshaft to rotate freely during belt tension adjustment. Align timing mark on camshaft sprocket with "V" mark on timing belt inner cover. See [Fig. 5](#) .
2. Turn crankshaft clockwise until punch mark on crankshaft sprocket is aligned with arrow mark on oil pump. With timing marks aligned, install timing belt. Ensure direction arrow mark on timing belt is pointed in direction of crankshaft rotation. Ensure drive side of belt is free of slack.
3. Move tensioner plate up with finger pressure, and loosely secure tensioner bolt. Turn crankshaft 2 revolutions clockwise to remove all slack from belt. Tighten tensioner nut and then tensioner bolt. See **TORQUE SPECIFICATIONS** .
4. Ensure timing marks are aligned. Install timing belt outer cover and tighten to specification. See **TORQUE SPECIFICATIONS** . Reverse removal procedure to complete installation. Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.





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**Fig. 5: Aligning Timing Belt & Tensioner (Typical SOHC)**  
Courtesy of SUZUKI OF AMERICA CORP.

### Removal

1. Remove negative battery cable. Remove air cleaner and airflow meter assembly. Raise vehicle and remove right fender apron extension by pushing center pin into clip. DO NOT push in too far, as pin may fall into fender. Remove water pump pulley and belt.
2. Remove crankshaft pulley 5-mm hexagon bolts. If engine is in vehicle, remove crankshaft pulley center

bolt. Remove crankshaft pulley. Loosen right engine mount bolt, and push air cleaner bracket aside. Remove timing belt covers.

3. Align all sprocket timing marks with timing marks on engine. See **Fig. 6** . Move timing belt tensioner up and secure. Mark timing belt for direction of rotation if it is to be reused. Remove timing belt from sprockets.

### Installation

1. Align timing marks. Bolts with flanged nuts may be wedged between cam sprocket teeth to hold camshaft on timing mark during belt installation (if necessary).

**CAUTION: While aligning timing marks, DO NOT turn camshaft sprockets more than 20 degrees in either direction from aligned position. DO NOT turn crankshaft more than 90 degrees in either direction from aligned position.**

2. Install timing belt so no slack exists on drive side of belt. Adjust tensioner to remove timing belt slack from other side of belt, and hand tighten tensioner bolt and nut. Turn crankshaft 2 revolutions to seat timing belt, and readjust tensioner.
3. Tighten tensioner bolt and nut. Ensure drive side of belt is free of slack. Ensure timing marks are aligned. Install timing belt outer covers and tighten to specification. See **TORQUE SPECIFICATIONS** . To complete installation, reverse removal procedure. Tighten bolts to specification.

## ROCKER ARM & VALVE LASH ADJUSTER

### Removal

1. Remove cylinder head valve cover. Remove distributor and distributor case.
2. Loosen all valve adjustment lock nuts and valve adjusting screws. Leave screws in place. Remove 10 rocker arm shaft retaining screws. Slide rocker arm shaft(s) out of rear side of head assembly. Remove rocker arms and springs.

### Installation

1. To install, reverse removal procedure. Intake rocker shaft has a .55" (14 mm) stepped end. Exhaust rocker shaft has a .59" (15 mm) stepped end. Ensure intake rocker shaft stepped end faces front of engine and exhaust rocker shaft stepped end faces rear of engine. Adjust valve clearance. See **VALVE CLEARANCE ADJUSTMENT** under ADJUSTMENTS.

## CAMSHAFT

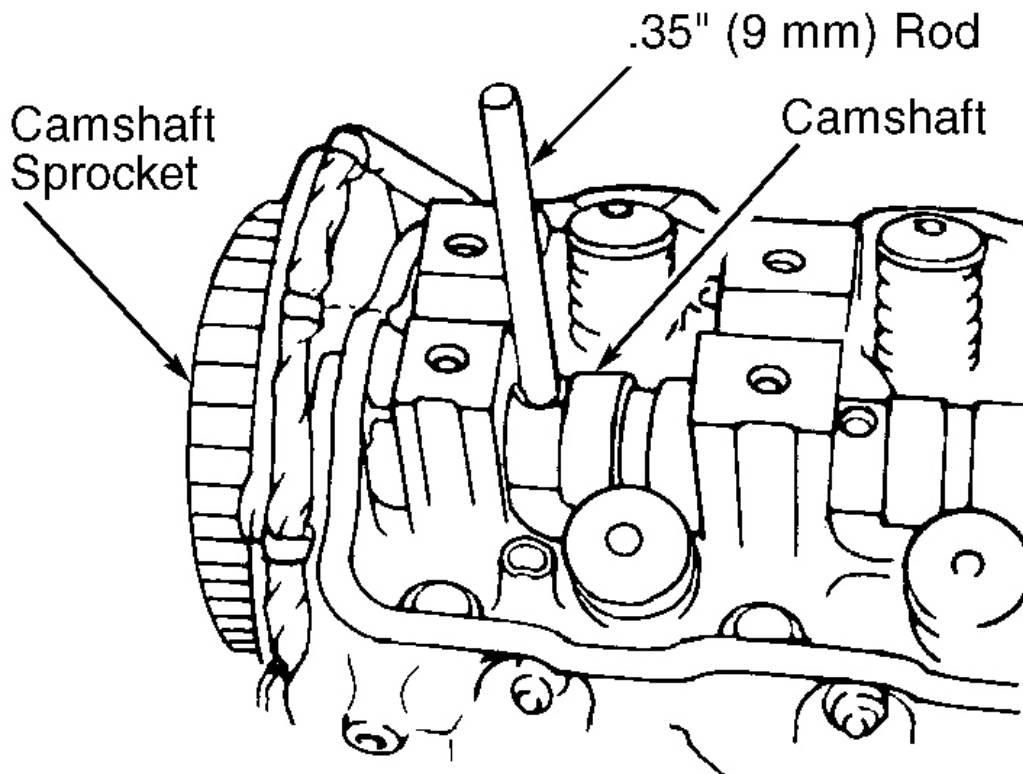
**NOTE:**        **Cylinder head removal is necessary to obtain enough clearance for camshaft removal.**

### Removal

1. Remove cylinder head. See **CYLINDER HEAD** under REMOVAL & INSTALLATION. Remove

rocker arms and shafts. See **ROCKER ARM & VALVE LASH ADJUSTER** under REMOVAL & INSTALLATION.

2. Use .35" (9 mm) rod to lock camshaft. See **Fig. 6** . Remove camshaft sprocket. Remove camshaft from rear of head. Remove oil seal.



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**Fig. 6: Locking Camshaft For Timing Belt Sprocket Removal**  
Courtesy of SUZUKI OF AMERICA CORP.

### Inspection

1. Check cam lobes and journals for wear and damage. Use Plastigage to check bearing clearance. If wear exceeds specification, repair or replace as necessary. See **CAMSHAFT** under ENGINE SPECIFICATIONS.
2. Use dial indicator and "V" blocks to measure camshaft runout at center of shaft. If wear exceeds specification, repair or replace as necessary. See **CAMSHAFT** .

### Installation

1. Lubricate camshaft lobes and camshaft bearing journals. Install camshaft and NEW oil seal in cylinder

head.

2. Install camshaft sprocket. Ensure camshaft sprocket timing marks align with timing marks on cylinder head. To complete installation, reverse removal procedure.

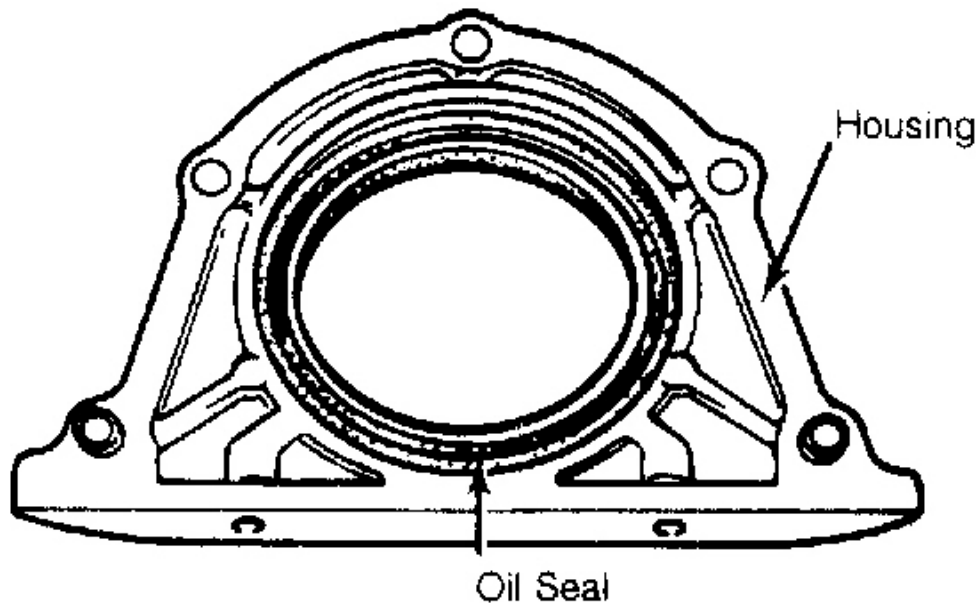
## REAR CRANKSHAFT OIL SEAL

### Removal

Remove engine or engine and transmission. See **ENGINE** under REMOVAL & INSTALLATION. Separate transmission from engine. Remove flywheel. Remove oil seal housing. Remove seal. Inspect oil seal housing for wear or damage. Repair or replace as necessary. See **Fig. 7**.

### Installation

Install oil seal in housing. Apply oil to seal lip. Install oil seal housing with NEW gasket. Tighten housing bolts to specification. See **TORQUE SPECIFICATIONS**. Oil seal housing gasket will bulge after mounting bolts have been tightened. Trim excess gasket material even with oil pan gasket surface.



**Fig. 7: Identifying Rear Crankshaft Oil Seal & Housing**  
Courtesy of SUZUKI OF AMERICA CORP.

## WATER PUMP

**Removal**

1. Drain cooling system. Disconnect negative battery cable. Remove drive belts. Discharge A/C system using approved refrigerant recovery/recycling equipment and disconnect compressor flexible suction hose from suction pipe (if equipped). Remove cooling fan, fan shroud and fan clutch.
2. Remove pump pulley. Ensure No. 1 piston is at TDC of compression stroke. Remove crankshaft pulley bolts and crankshaft pulley. Remove timing belt cover, tensioner and timing belt. See **TIMING BELT** under **REMOVAL & INSTALLATION**. Remove dipstick and tube. Remove alternator mounting bracket. Remove water pump.

**Installation**

To install, reverse removal procedure. Ensure all mating surfaces are clean. Use NEW water pump gasket and NEW dipstick tube "O" ring.

**NOTE:** For further information on cooling systems, see appropriate **COOLING SYSTEM SPECIFICATIONS** article in **ENGINE COOLING**.

**OIL PAN****Removal**

1. Raise and support vehicle. Remove front differential assembly. See article in **DRIVE AXLES - FRONT & REAR**. Drain engine oil.
2. Remove clutch housing lower cover or torque convertor housing lower cover. Remove oil pan nuts and bolts. Remove oil pan then oil pump strainer.

**Installation**

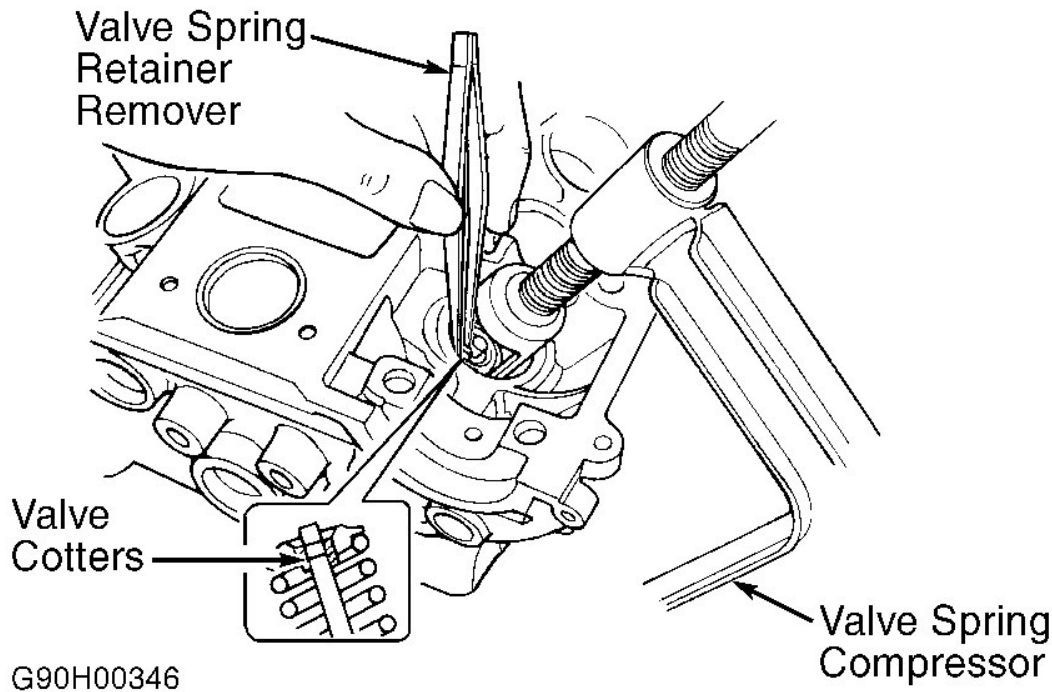
To install, reverse removal procedure. Install oil pan using silicone-type sealant. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

**OVERHAUL****CYLINDER HEAD****Cylinder Head Disassembly**

1. Remove cylinder head. See **CYLINDER HEAD** under **REMOVAL & INSTALLATION**. Remove manifolds and distributor assembly. Remove rocker arms and shafts. Remove camshaft. See **CAMSHAFT** under **REMOVAL & INSTALLATION**.
2. Use a Valve Spring Compressor (09916-14510) and Valve Lifter Attachment (09916-48210) to remove retainer locks. See **Fig. 8**. Remove retainers, springs, spring seats and valves. Keep all components in order for reassembly reference.

**Cylinder Head Reassembly**

To assemble, reverse disassembly procedure. Ensure valve springs are installed with close coiled (small pitch) end down, toward cylinder head.



**Fig. 8: Removing Valve Lock (SOHC Is Similar)**

Courtesy of SUZUKI OF AMERICA CORP.

#### Valve Springs

Check valve springs for damage. Use a square and flat surface plate to check spring squareness. Maximum out-of-square is .079" (2.00 mm). Using valve spring tester, check valve spring preload pressure. See **VALVES & VALVE SPRINGS** under ENGINE SPECIFICATIONS. Replace any weak or out of square springs.

**NOTE: DO NOT reuse old valve stem oil seals**

#### Valve Stem Oil Seals

Place NEW lubricated stem seal on valve guide. Use Valve Stem Seal Installer (09917-98210 on 8-valve SOHC). Press seal on valve guide using hand pressure only. When installer bottoms on head, seal is properly positioned. Avoid twisting seals during installation.

#### Valve Guides

1. Check valve stem-to-guide clearance. If clearance exceeds specification, replace with oversize valve

guide. See **CYLINDER HEAD** under ENGINE SPECIFICATIONS.

2. Ream guide bore in cylinder head with 12-mm Reamer (09916-37310) for 8-valve SOHC engines. Heat cylinder head to 176-212°F (80-100°C).
3. Using Valve Guide Installer Attachment (09917-88210 for 8-valve SOHC), drive in new oversized valve guide until valve guide installer contacts cylinder head.
4. Valve guide protrusion is .55" (14.0 mm) for 8-valve SOHC. Ream valve guide with 7-mm Reamer (09916-34520) for 8-valve SOHC.
5. Clean valve guide bore after reaming. Install valve and ensure valve stem oil clearance is correct. See **CYLINDER HEAD**.

### Valve Seat

1. Inspect valve seats for damage or wear. If exhaust valve seat rework is necessary, use 3 cutters to obtain required angles. The first cut should be 15 degrees. Second cut should be 75 degrees. Third cut should be 45 degrees to obtain correct seat angle.
2. For intake valves, procedure is the same, except second cut should be 60 degrees. After cutting valve seats to correct angles, lap valve seat.

### Valves

1. Remove carbon deposits. Inspect for wear, burns or distortion at face and stem. Replace as necessary. Measure valve head margin. Check valve stem end for pitting or wear.
2. Measure valve length. Valve stem end may be resurfaced if no more than .14" (3.6 mm) is removed from valve length. See **VALVES & VALVE SPRINGS** under ENGINE SPECIFICATIONS. Using "V" block and dial gauge, check valve head radial runout. Maximum limit is .003 (.08 mm). If runout exceeds limit, replace valve.

### Seat Correction Angles

On 8-valve SOHC exhaust valves, use 15-degree stone and 75-degree stone to narrow seat and 45-degree stone to widen seat. On 8-valve SOHC intake valves, use 15-degree stone and 60-degree stone to narrow seat and 45-degree stone to widen seat.

## VALVE TRAIN

### Rocker Arm Shaft Assembly

Check rocker arm-to-shaft oil clearance. Maximum clearance is .0035 (.09). Check rocker arm shaft runout. Rocker arm shaft runout limit is .008" (.20 mm) on 16-valve SOHC or .004" (.10 mm) on all others.

### Lash Adjusters

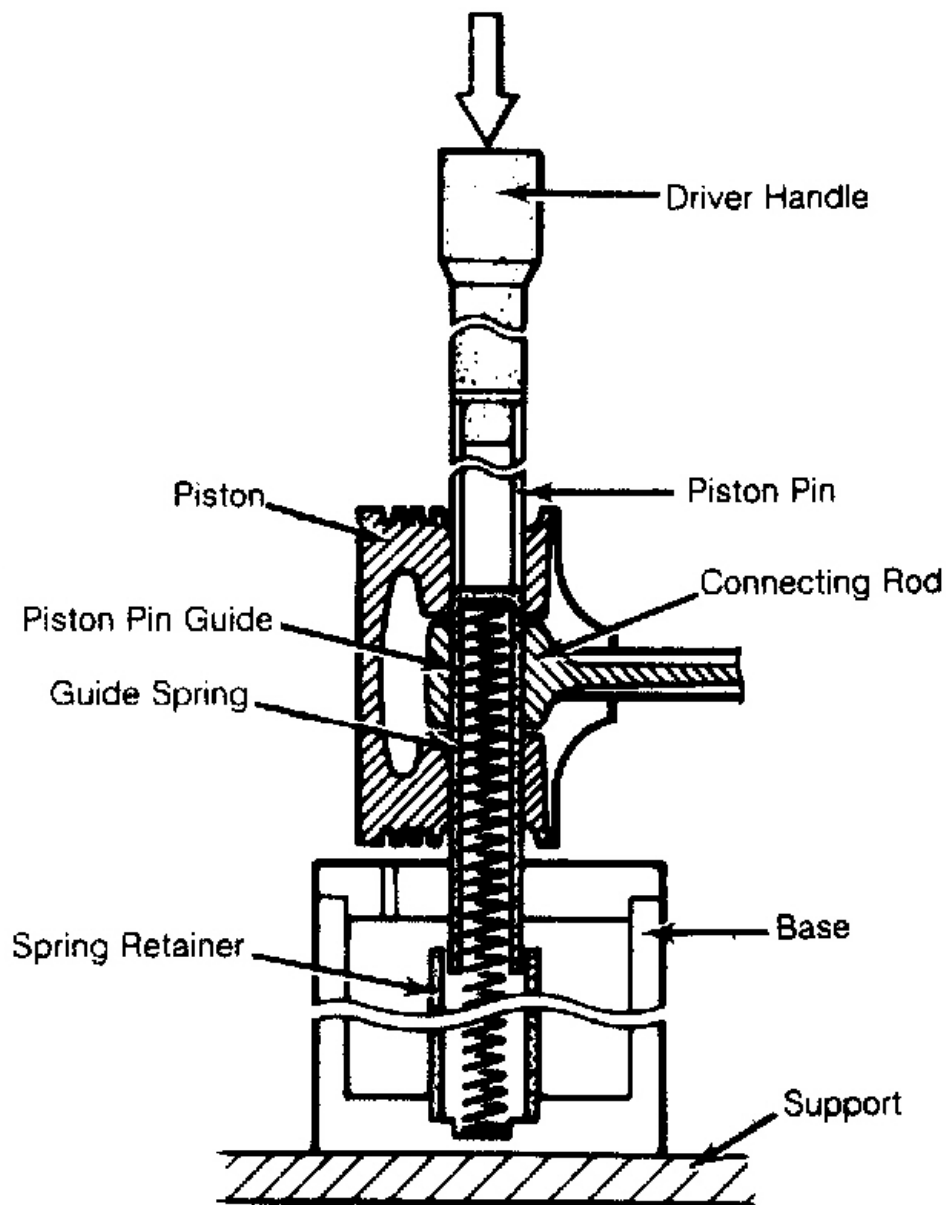
If tip of rocker arm adjusting screw is worn, replace screw. If cam riding face of rocker arm is badly worn, replace rocker arm.

## CYLINDER BLOCK ASSEMBLY

**Piston & Rod Assembly**

1. Remove cylinder head. See **CYLINDER HEAD** under REMOVAL & INSTALLATION. Remove oil dipstick guide, oil pan and screen. See **OIL PAN** under REMOVAL & INSTALLATION.
2. Ensure pistons, connecting rods and rod caps are marked for reassembly reference. Remove carbon from top of cylinder bores. Remove connecting rod caps. Install protective hose over connecting rod bolts.
3. Remove connecting rod and piston assembly through top of cylinder block. Mark cylinder number on piston crown. Remove piston rings.
4. Use Piston Pin Remover/Installer (09910-38211) on 1.3L SOHC engines.
5. Check piston pin-to-bore fit. Pin should press in piston smoothly by hand at room temperature. When assembling, apply engine oil to outside of pin and to piston pin bore.
6. Position piston upward. Align piston, pin and rod with Piston Pin Remover/Installer (09910-38211) for 1.3L SOHC. Press pin into piston and rod using a hydraulic press. See **Fig. 9** .



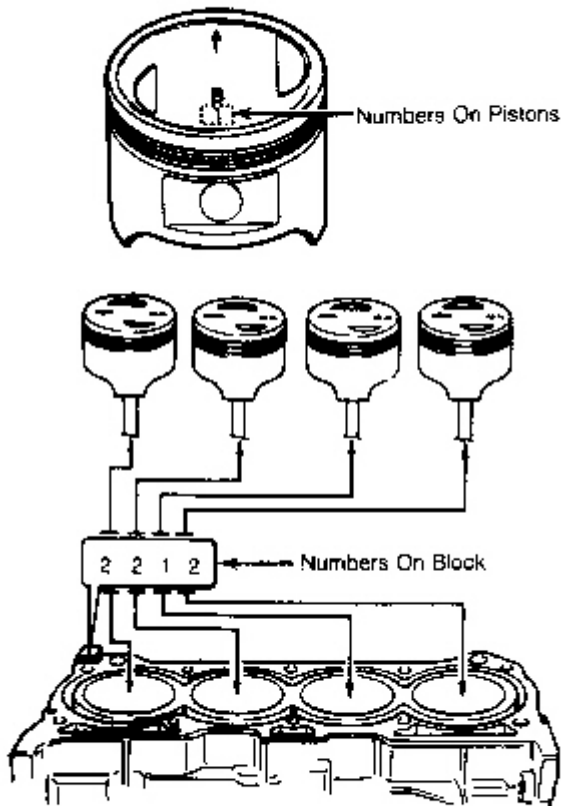


**Fig. 9: Installing Piston Pin (1.3L SOHC)**  
Courtesy of SUZUKI OF AMERICA CORP.

#### Fitting Pistons

1. Check cylinder bore for damage, wear and taper. See **CYLINDER BLOCK** under **CYLINDER BLOCK ASSEMBLY** under OVERHAUL. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS to determine if block must be rebored.

2. Pistons are available in .0098" (.25 mm) and .0197" (.50 mm) oversizes. Check outside diameter of piston. On 1.6L engine, measure at a point .63" (16.0 mm) from bottom of skirt and at 90 degrees to pin bore. On 1.3L engine, measure at a point .59" (15.0 mm) from bottom of skirt and at 90 degrees to pin bore.
3. Standard pistons are available in 2 sizes. Piston diameter is determined by numerical mark ("1" or "2") stamped on piston crown. See **Fig. 10** .
4. Cylinder bore diameter is determined by numerical mark ("1" or "2") stamped on cylinder block. Numerical marks on cylinder block, read left to right, indicate bore sizes of cylinders No. 1, 2, 3 and 4, respectively. See **Fig. 10** .
5. When installing piston into cylinder, ensure piston numerical mark matches cylinder bore numerical mark to provide correct piston-to-cylinder clearance.

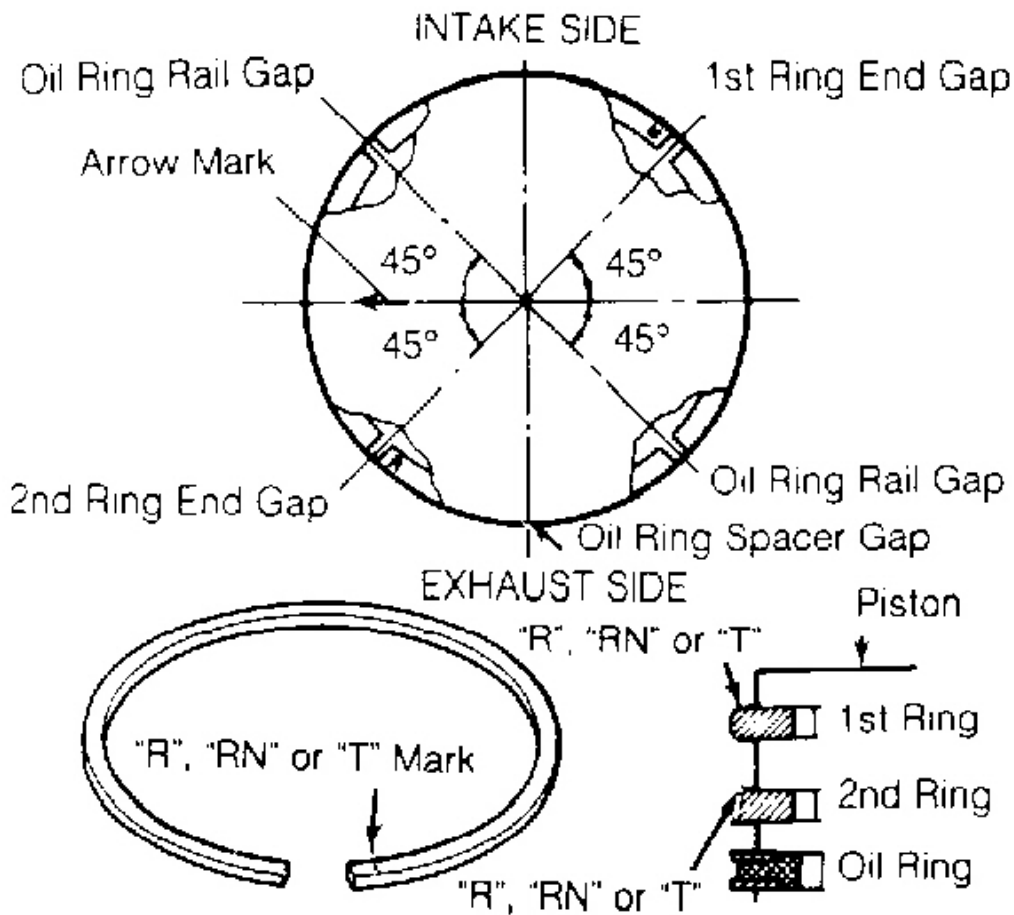


**Fig. 10: Matching Pistons To Cylinders**  
 Courtesy of SUZUKI OF AMERICA CORP.

#### Piston Rings

1. Install rings with "R", "RN" or "T" mark facing upward. Some Samurai top rings are unmarked and can be installed either side upward. Install oil ring spacer first, then rails. Position piston ring gaps. See **Fig. 11** . Lubricate all internal surfaces with engine oil before installation.
2. Ensure arrow on piston head faces front of engine. Ensure oil hole in connecting rod faces intake side of engine. Install cylinder head, oil pick-up screen and oil pan. To complete installation, reverse removal procedure.

**CAUTION:** Install spacer gap more than 45 degrees from side rail gaps. Rails should turn smoothly when installed.



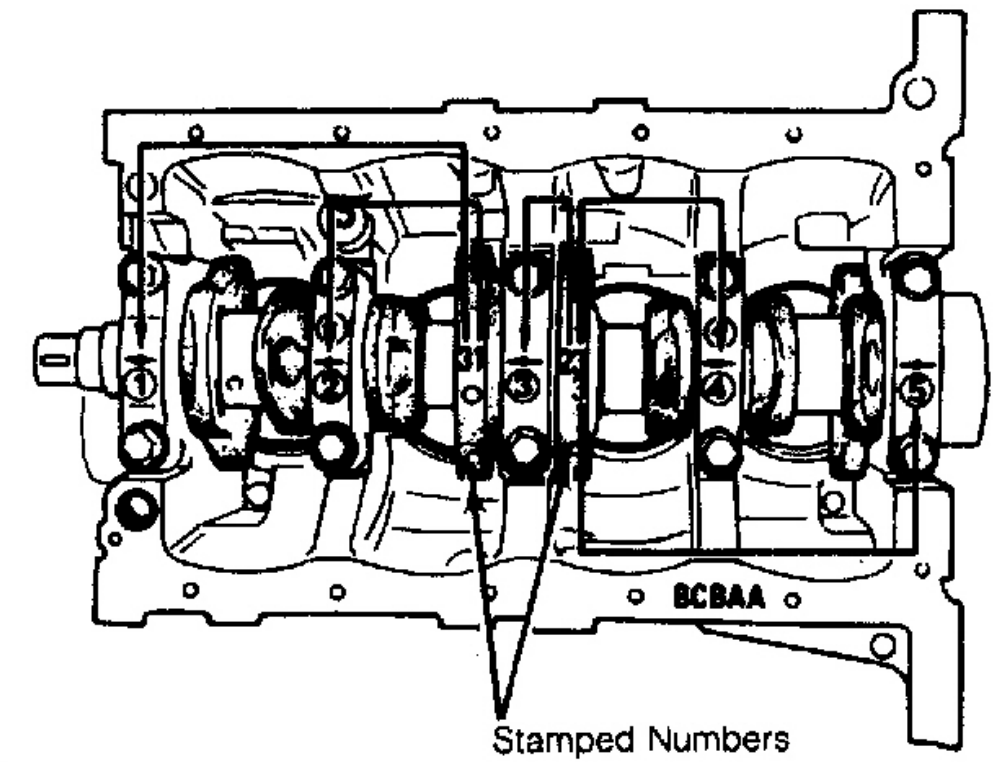
**Fig. 11: Positioning Piston Ring Gaps**  
Courtesy of SUZUKI OF AMERICA CORP.

#### Rod Bearings

1. Inspect journals for wear, taper and out-of-round. If specifications are exceeded, grind journals to undersize or replace crankshaft. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.
2. Inspect bearing shells for signs of fusion, pitting, burning or flaking. Observe contact pattern. Standard bearings are unmarked. Undersized bearings are stamped US025 on back of bearing to indicate .010" (.25 mm) undersize.
3. Check bearing clearance using Plastigage measuring method. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** . Standard connecting rod side play is .0039-.0078" (.10-.20mm), with a service limit of .0138" (.35 mm).
4. To install, reverse removal procedure. Tighten rod nuts to specification. See **TORQUE SPECIFICATIONS** .

### **Crankshaft & Main Bearings**

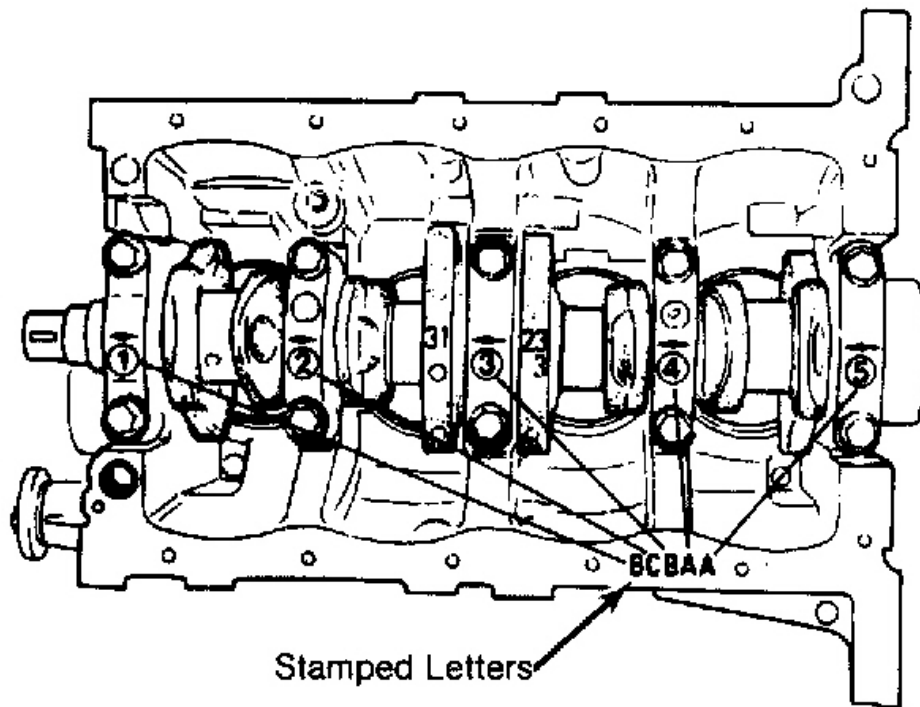
1. Remove engine, or engine and transmission. See **ENGINE** under REMOVAL & INSTALLATION. Separate transmission from engine. Remove timing belt, sprockets, pulley and tensioner. See **TIMING BELT** under REMOVAL & INSTALLATION.
2. Remove flywheel and oil pan. Remove rear main oil seal housing. Remove connecting rod caps. Remove main bearing caps. Remove crankshaft.
3. Inspect journals for wear, taper and out-of-round condition. If specifications are exceeded, grind journals to undersize or replace crankshaft. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.
4. Standard main bearings are color-coded. Upper half of bearing has an oil groove. An arrow mark and number are embossed on each main bearing cap.
5. Ensure arrow mark on main bearing cap faces toward crankshaft pulley. Bearing No. 1 is at crankshaft pulley end of engine. Bearing No. 5 is at flywheel end of engine.
6. Main bearing journal diameter is determined by numerical mark ("1", "2" or "3") stamped on crankshaft webs of cylinders No. 2 and 3. See **Fig. 12** .
7. The numerical marks on crankshaft web, read left to right, indicate journal diameters of bearings No. 1, 2, 3, 4 and 5, respectively.
8. Determine bearing cap bore diameter with bearing removed. Bearing cap bore diameter is determined by letter ("A", "B" or "C") stamped on cylinder block mating surface. See **BEARING CAP BORE DIAMETERS** .
9. The letters stamped on cylinder block mating surface, read left to right, indicate cap bore diameters of bearing caps No. 1, 2, 3, 4 and 5, respectively. Five standard main bearing sizes are available. Bearing thickness is determined by color code. See **COLOR CODE FOR STANDARD BEARINGS** .
10. Use numerical marks on crankshaft webs and letters stamped on cylinder block mating surface to determine correct replacement bearing. See **STANDARD BEARING APPLICATION** .



**Fig. 12: Locating Numerical Marks On Crankshaft Webs**  
 Courtesy of SUZUKI OF AMERICA CORP.

#### CRANKSHAFT JOURNAL DIAMETERS

Numbers Stamped On Webs	In. (mm)
"1"	1.7714-1.7716 (44.994-45.000)
"2"	1.7712-1.7714 (44.988-44.994)
"3"	1.7710-1.7712 (44.982-44.988)



**Fig. 13: Locating Letters Stamped On Cylinder Block**  
 Courtesy of SUZUKI OF AMERICA CORP.

#### BEARING CAP BORE DIAMETERS

Letters Stamped On Block	In. (mm)
"A"	1.9292-1.9294 (49.000-49.006)
"B"	1.9294-1.9296 (49.006-49.012)
"C"	1.9296-1.9298 (49.012-49.018)

#### COLOR CODE FOR STANDARD BEARINGS

Color Painted	Thickness - In. (mm)
Green	.0786-.0787 (1.996-2.000)
Black	.0787-.0788 (1.999-2.003)
No Paint	.0788-.0789 (2.002-2.006)
Yellow	.0789-.0790 (2.005-2.009)
Blue	.0790-.0791 (2.008-2.012)

#### STANDARD BEARING APPLICATION

	Number Stamped On	
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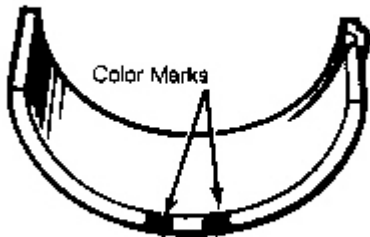
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Letter Stamped On Block	Crankshaft Webs	Color
"A"	"1"	Green
"A"	"2"	Black
"A"	"3"	No Paint
"B"	"1"	Black
"B"	"2"	No Paint
"B"	"3"	Yellow
"C"	"1"	No Paint
"C"	"2"	Yellow
"C"	"3"	Blue

**Undersize Bearings**

1. Bearings are available in .010" (.25 mm) undersize. Undersize bearing thickness is determined by 2 color marks. See **Fig. 14** . See **COLOR CODE FOR UNDERSIZE BEARINGS** .
2. Use journal finished diameters, 1.7611-1.7618" (44.732-44.750 mm), and letters stamped on cylinder block mating surface to determine correct undersize bearing for replacement. See appropriate **UNDERSIZE BEARING APPLICATION** .
3. Use Plastigage method to ensure correct clearance of installed undersize bearing. Lubricate bearings before installing. Tighten bolts to specification in 3 steps. Tighten main bearing caps in following order: center cap, No. 2 cap, No. 4 cap, front cap and rear cap. See **TORQUE SPECIFICATIONS** .



**Fig. 14: Identifying Undersize Main Bearing Color Marks**  
 Courtesy of SUZUKI OF AMERICA CORP.

**COLOR CODE FOR UNDERSIZE BEARINGS**

Color Painted	Thickness - In. (mm)
Green & Red	.0835-.0836 (2.121-2.125)
Black & Red	.0836-.0837 (2.124-2.128)
Red Only	.0837-.0838 (2.127-2.131)

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Yellow & Red	.0838-.0839 (2.130-2.134)
Blue & Red	.0839-.0840 (2.133-2.137)

### UNDERSIZE BEARING APPLICATION

Measured Journal Diameter - In. (mm)	Letter Stamped On Block	Color
1.7616-1.7618 (44.744-44.750)	"A"	Green & Red
1.7616-1.7618 (44.744-44.750)	"B"	Black & Red
1.7616-1.7618 (44.744-44.750)	"C"	Red Only
1.7614-1.7616 (44.738-44.744)	"A"	Black & Red
1.7614-1.7616 (44.738-44.744)	"B"	Red Only
1.7614-1.7616 (44.738-44.744)	"C"	Yellow & Red
1.7612-1.7614 (44.732-44.738)	"A"	Red Only
1.7612-1.7614 (44.732-44.738)	"B"	Yellow & Red
1.7612-1.7614 (44.732-44.738)	"C"	Blue & Red

### Thrust Bearing

1. With crankshaft bearing caps installed, check thrust clearance (end play) using dial gauge to read displacement in axial thrust direction of crankshaft.
2. Standard thickness of thrust bearing is .0984" (2.50 mm). Oversize thrust bearings are available in increments of .0049" (.125 mm). If clearance exceeds specification, replace thrust bearing. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** under ENGINE SPECIFICATIONS.

### Cylinder Block

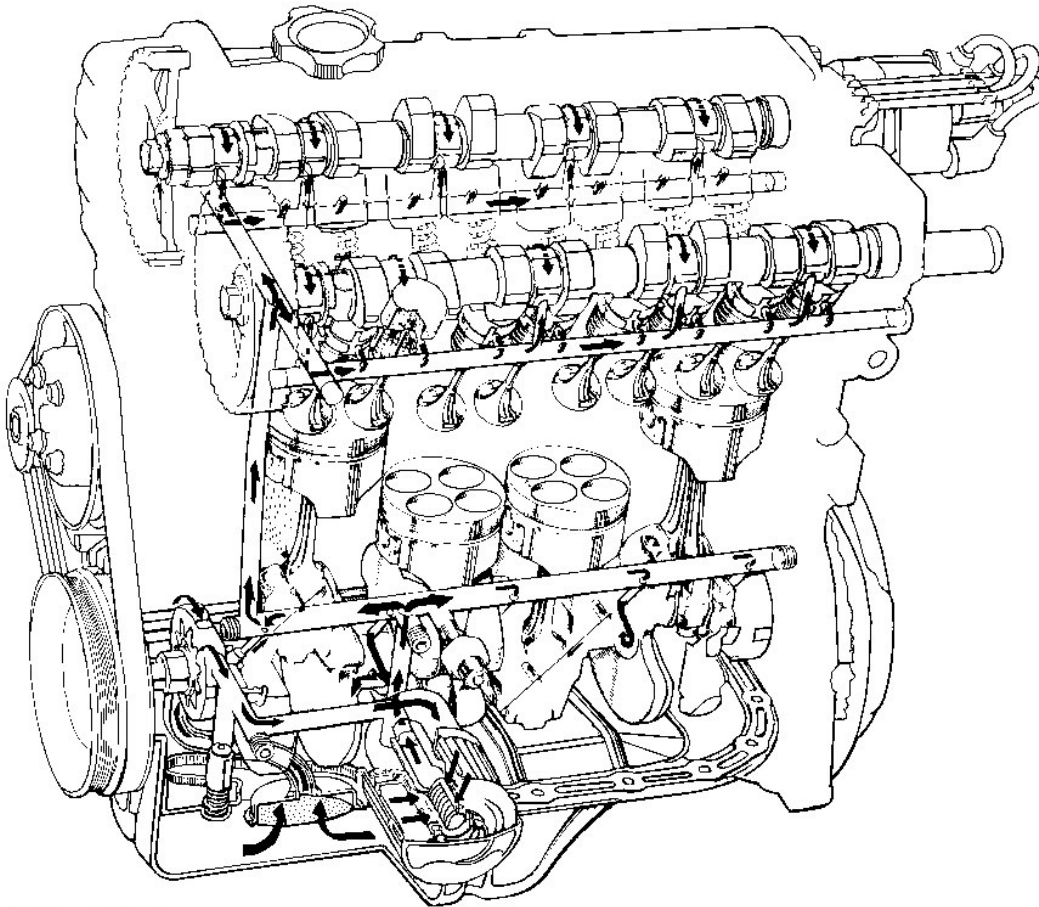
1. Inspect block for distortion of deck surface. Warp limit is .0012-.0024" (.03-.06 mm). Inspect block for cracks, scratches and other defects. Measure bores at 3 levels for wear, taper and out-of-round condition.
2. If bore wear, taper or out-of-round exceed specification, rebore cylinders. See **CYLINDER BLOCK** under ENGINE SPECIFICATIONS.

## ENGINE OILING

### ENGINE LUBRICATION SYSTEM

A force-feed type lubrication system is used. The oil pump is a trochoid-type pump mounted on the forward portion of the crankshaft. See **Fig. 15** .





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**Fig. 15: Cross-Sectional View Of Engine Oil Circuit (Typical)**  
Courtesy of SUZUKI OF AMERICA CORP.

#### **Crankcase Capacity**

Crankcase capacity, including filter, is 3.7 qts. (3.5L). Check dipstick to verify oil level is correct.

#### **Oil Pressure**

Normal oil pressure is 42.7-59.7 psi (3.0-4.2 kg/cm<sup>2</sup>) at 3000 RPM.

#### **OIL PUMP**

##### **Removal & Disassembly**

1. Disconnect negative battery cable. Remove radiator cooling fan, shroud, water pump pulley and drive

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belt. Remove timing belt cover, timing belt and tensioner. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove alternator and bracket and air conditioner compressor bracket bolts (if equipped).

2. Raise vehicle and drain engine oil and front differential oil (if equipped). Remove oil dipstick and oil pan. Remove oil pump pick-up screen. Lock crankshaft with Gear Stopper (09927-56010) installed at flywheel ring gear. With crankshaft locked, remove timing belt pulley. Remove oil pan and oil pump strainer/pickup. Remove oil pump assembly. Remove dip stick guide. Remove oil pump rotor plate.
3. Mark outer gear with felt pen for reassembly reference. Remove inner and outer oil pump gears. Remove plug, relief spring and relief valve.

### Inspection

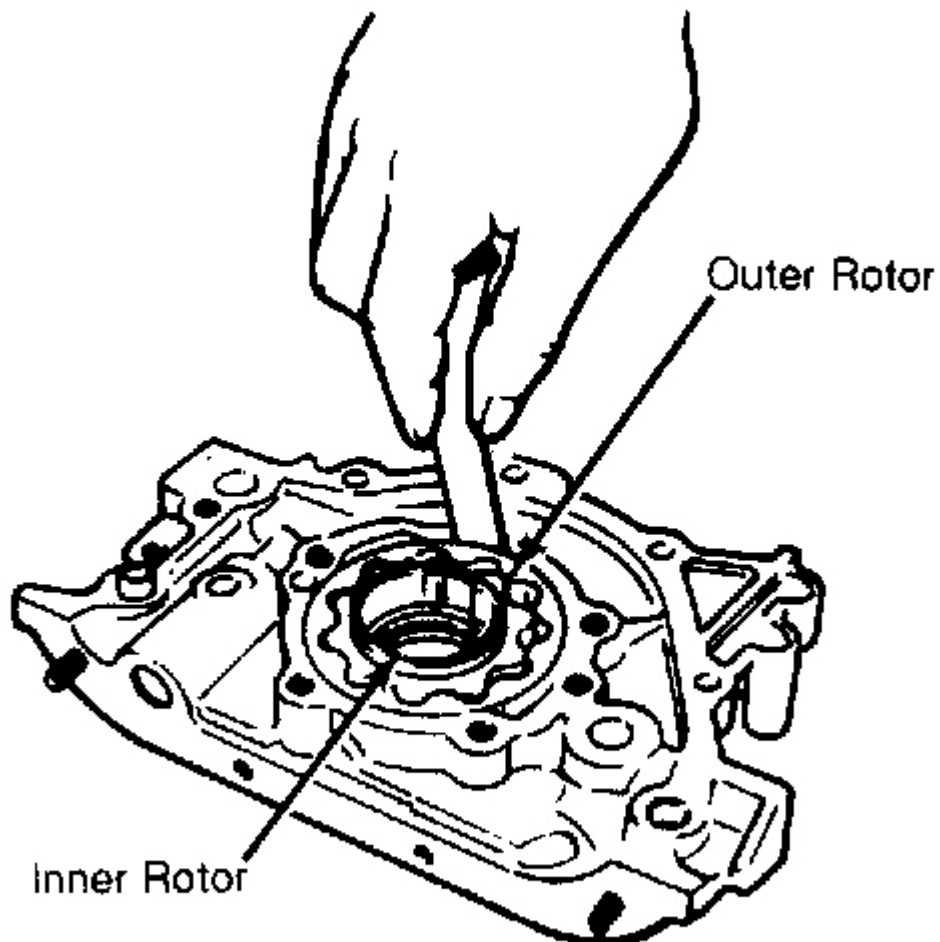
1. Inspect oil pump housing for cracks or damage. Inspect oil screen for clogging or damage. Inspect oil screen "O" ring. Ensure relief valve slides smoothly in bore. Inspect pressure relief spring for damaged coils.
2. Inspect oil pump gears for wear or damage. Using a feeler gauge, measure radial and side clearance. See **Fig. 16** and **Fig. 17** . If clearance exceeds specification, replace outer rotor or case. See OIL PUMP SPECIFICATIONS table.

### OIL PUMP SPECIFICATIONS

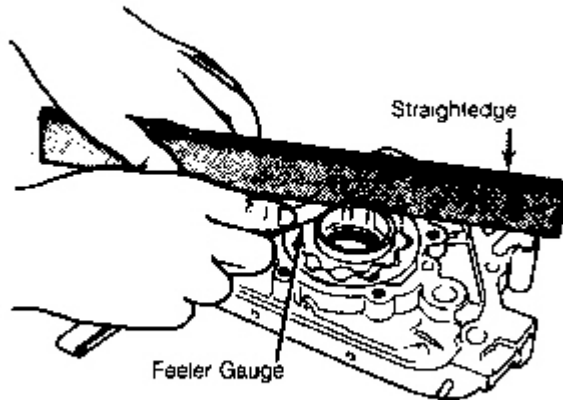
Application	Radial Clearance: In. (mm)	Side Clearance: In. (mm)
Samurai	.0122 (.310)	.0059 (.150)

### Reassembly & Installation

1. Ensure gears are assembled in same direction as originally installed. Apply thin coat of engine oil to inner and outer rotors, lip portion of oil seal and inside surfaces of oil pump case and plate. Install inner and outer rotors.
2. Install gear plate. Ensure gears turn freely by hand after gear plate is installed. Install oil pump pins, NEW dipstick "O" ring, NEW seal for oil pick-up tube and NEW oil pump gasket. Use Oil Seal Guide (09926-18210) to prevent damage to oil seal during installation of oil pump.
3. Apply engine oil to guide, and install pump. Install dipstick guide with NEW seal. Install oil pan using silicone-type sealant. Tighten bolts to specification. See **TORQUE SPECIFICATIONS** .



**Fig. 16: Checking Oil Pump Radial Clearance**  
Courtesy of SUZUKI OF AMERICA CORP.



**Fig. 17: Checking Oil Pump Side Clearance**  
 Courtesy of SUZUKI OF AMERICA CORP.

## ENGINE SPECIFICATIONS

### GENERAL SPECIFICATIONS

#### GENERAL SPECIFICATIONS

Application	Specification
Displacement	79.2 Cu. In. (1.3L)
Bore	2.91" (74.0 mm)
Stroke	2.97" (75.5 mm)
Compression Ratio	9.5:1
Compression Pressure <sup>(1)</sup>	
Standard	199 psi (14 kg/cm <sup>2</sup> )
Service Limit	171 psi (12 kg/cm <sup>2</sup> )
Maximum Variation	14 psi (1 kg/cm <sup>2</sup> )
Fuel System	TBI
Horsepower HP @ RPM	66 @ 6000
Torque Ft. Lbs. @ RPM	76 @ 3500
Compression Ratio	8.9:1
Compression Pressure <sup>(1)</sup>	
Standard	199 psi (14 kg/cm <sup>2</sup> )
Limit	171 psi (12 kg/cm <sup>2</sup> )

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Maximum Variation	14.2 psi (1.0 kg/cm <sup>2</sup> )
Fuel System	TBI
Horsepower HP @ RPM	80 @ 5400
Torque Ft. Lbs. @ RPM	94 @ 3000
(1) Checked at 250 RPM or higher.	

**CONNECTING RODS****CONNECTING RODS**

Application	In. (mm)
Pin Bore	(1)
Maximum Bend	.0020 (.05)
Maximum Twist	.0039 (.10)
Side Play	
Standard	.0039-.0078 (.10-.20)
Service Limit	.0138 (.35)
(1) Information is not available.	

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

Application	In. (mm)
Crankshaft	
End Play	
Standard	.004-.012 (.11-.31)
Service Limit	.015 (.38)
Runout Limit	.002 (.06)
Main Bearings	
Journal Diameter <sup>(1)</sup>	
"1"	1.7714-1.7716 (44.994-45.000)
"2"	1.7712-1.7714 (44.988-44.994)
"3"	1.7710-1.7712 (44.982-44.988)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0008-.0016 (.020-.040)
Service Limit	.0024 (.060)
Main Bearing Cap Bore Diameters <sup>(2)</sup>	
"A"	1.9292-1.9294 (49.000-49.006)
"B"	1.9294-1.9296 (49.006-49.012)

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"C"	1.9296-1.9298 (49.012-49.018)
Connecting Rod Bearings	
Journal Diameter	1.6529-1.6535 (41.982-42.000)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.0012-.0020 (.030-.050)
Service Limit	.0031 (.080)
(1) Main bearing journal diameter is determined by numerical mark ("1", "2" or "3") stamped on crankshaft web.	
(2) Main bearing cap bore diameter is determined by letter ("A", "B" or "C") stamped on cylinder block mating surface. See <b>Fig. 13</b> .	

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

Application	In. (mm)
Pistons	
Clearance	.0008-.0016 (.02-.04)
Diameter <sup>(1)</sup>	
"1"	2.9126-2.9130 (73.980-73.990)
"2"	2.9122-2.9126 (73.970-73.980)
Pins	
Diameter	(2)
Piston Fit	Slip
Rod Fit	Interference
Rings	
No. 1	
End Gap	
Standard	.0079-.0118 (.20-.30)
Service Limit	.0276 (.70)
Side Clearance	.0012-.0027 (.030-.070)
No. 2	
End Gap	
Standard	.0079-.0118 (.20-.30)
Service Limit	.0276 (.70)
Side Clearance	.0008-.0024 (.02-.06)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0276 (.20-.70)
Service Limit	.0709 (1.8)

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(1) Piston diameter is determined by numerical mark ("1" or "2") stamped on piston. See **Fig. 10** .

(2) Information is not available.

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

<b>Application</b>	<b>Specification</b>
<b>Intake Valves</b>	
Seat Angle	45°
Valve Head Thickness	
Standard	.039" (1.0 mm)
Service Limit	.024" (.6 mm)
Stem Diameter	.2742-.2748" (6.965-6.980 mm)
Valve Tip Maximum Refinish	.0197" (.5 mm)
Maximum Head Radial Runout	.003" (.08 mm)
<b>Exhaust Valves</b>	
Seat Angle	45°
Valve Head Thickness	
Standard	.039" (1.0 mm)
Service Limit	.028" (.70 mm)
Stem Diameter	.2736-.2742" (6.950-6.964 mm)
Valve Tip Maximum Refinish	.0197" (.5 mm)
Maximum Head Radial Runout	.003" (.08 mm)
<b>Valve Springs</b>	
Free Length	
Standard	1.9409" (49.30 mm)
Out-Of-Square	.079" (2.0 mm)
Lbs. @ In. (kg @ mm)	
Valve Spring Preload	
Standard	54.7-64.3 @ 1.63 (24.8-29.2 @ 41.5)
Service Limit	50.2 @ 1.63 (22.8 @ 41.5)

**CYLINDER BLOCK****CYLINDER BLOCK**

<b>Application</b>	<b>In. (mm)</b>
Cylinder Bore	

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Standard Diameter <sup>(1)</sup>	
"1"	2.9138-2.9142 (74.010-74.020)
"2"	2.9134-2.9138 (74.000-74.010)
Maximum Taper	.0039 (.10)
Maximum Out-Of-Round	.0039 (.10)
Maximum Deck Warpage	.002 (.05)

(1) Cylinder bore diameter is determined by numerical mark ("1" or "2") stamped on cylinder block. See **Fig. 10**.

**CYLINDER HEAD****CYLINDER HEAD**

Application	Specification
Maximum Warpage	
Head-To-Block	.002" (.05 mm)
Manifold-To-Head	.004" (.10 mm)
Valve Seats	
Intake & Exhaust Valves	
Seat Angle	45°
Seat Width	.0512-.0591" (1.3-1.5 mm)
Valve Guides	
Valve Stem End Deflection Limit	
Intake	.006" (.14 mm)
Exhaust	.007" (.18 mm)
Intake Valve	
Valve Guide I.D.	.2756-.2762" (7.000-7.015 mm)
Valve Guide Installed Height	.55" (14.0 mm)
Valve Stem-To-Guide	
Oil Clearance	.0008-.0019" (.020-.050 mm)
Service Limit	.0035" (.09 mm)
Exhaust Valve	
Valve Guide I.D.	.2756-.2762" (7.000-7.015 mm)
Valve Guide Installed Height	.55" (14.0 mm)
Valve Stem-To-Guide Oil Clearance	.0014-.0026" (.035-.065 mm)

**CAMSHAFT****CAMSHAFT**

Application	In. (mm)
Bore Diameter <sup>(1)</sup>	



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No. 1	1.7402-1.7408 (44.200-44.216)
No. 2	1.7480-1.7487 (44.400-44.416)
No. 3	1.7560-1.7565 (44.600-44.616)
No. 4	1.7638-1.7644 (44.800-44.816)
No. 5	1.7717-1.7723 (45.000-45.016)
Journal Diameter <sup>(1)</sup>	
No. 1	1.7372-1.7382 (44.125-44.150)
No. 2	1.7451-1.7461 (44.325-44.350)
No. 3	1.7530-1.7539 (44.525-44.550)
No. 4	1.7608-1.7618 (44.725-44.750)
No. 5	1.7687-1.7697 (44.925-44.950)
Journal Runout	.0039 (.10)
Lobe Height	
Standard	1.4764 (37.500)
Service Limit	1.4724 (37.400)
Oil Clearance	
8-Valve Standard	.0020-.0036 (.050-.091)
8-Valve Service Limit	.0059 (.15)
(1) Journals are numbered from front of engine.	

**ROCKER ARM & ROCKER ARM SHAFT****ROCKER ARM & ROCKER ARM SHAFT**

Application	In. (mm)
Rocker Arm Inside Diameter	.6293-.6301 (15.985-16.005)
Rocker Arm Shaft Outside Diameter	.6287-.6293 (15.969-15.984)
Rocker Arm-To-Shaft Oil Clearance	
Standard	.0005-.0018 (.012-.045)
Service Limit	.0035 (.09)
Rocker Arm Shaft Runout	.005 (.12)

**TORQUE SPECIFICATIONS****TORQUE SPECIFICATIONS**

Application	Ft. Lbs. (N.m)
Alternator Mount & Adjusting Bolts	13-21 (18-28)
Alternator Pulley Bolt	37-48 (50-65)
Camshaft Sprocket Bolt	41-47 (56-64)

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Connecting Rod Cap Nut	24-27 (33-37)
Crankshaft Main Bearing Cap Bolt	37-42 (50-57)
Crankshaft Sprocket Bolt	77-85 (105-115)
Cylinder Head Bolt <sup>(1)</sup>	52-55 (70-75)
Engine-To-Transmission Bolt	16-26 (22-35)
Exhaust Manifold Bolt	13-21 (18-28)
Exhaust Pipe	26-36 (35-49)
Flywheel Bolt (Drive Plate For A/T)	42-48 (57-65)
Intake Manifold Bolt	13-21 (18-28)
Oil Pan Drain Plug	22-30 (30-40)
Oil Filter Mount	15-18 (20-25)
Rocker Arm Adjustent Lock Nut	11-14 (15-19)
Spark Plug	15-22 (20-30)
Timing Belt Tensioner Bolt	18-22 (24-30)
<b>INCH Lbs. (N.m)</b>	
Camshaft Bearing Cap Bolt	80-106 (9-12)
Cooling Fan Nut	71-106 (8-12)
Crankshaft Pulley Bolt	80-106 (9-12)
Distributor Case Bolt	71-106 (8-12)
Oil Pan Bolt	80-106 (9-12)
Oil Pressure Switch	106-133 (12-15)
Oil Pump Mounting Bolt	80-106 (9-12)
Oil Pump Rotor Plate Screw	80-106 (9-12)
Oil Pump Strainer Bolt	80-106 (9-12)
Oil Seal Housing Bolt	80-106 (9-12)
Rear Main Seal Bolt	89-115 (10-13)
Rocker Arm Shaft Screw	80-106 (9-12)
Rocker Cover Bolt	35-44 (4-5)
Timing Belt Outer Cover Bolt	80-106 (9-12)
Timing Belt Tensioner Stud Nut	80-106 (9-12)
Water Pump Mounting Bolt	80-106 (9-12)
Water Pump Pulley Bolt	89-115 (10-13)

(1) Tighten in sequence. See **Fig. 5** or **Fig. 6** .