1999-2000 ENGINES

2.0L 4-Cylinder

ENGINE IDENTIFICATION

ENGINE IDENTIFICATION CODES

Application	VIN
Vitara	5

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

Hydraulic lifters are used, no valve adjustments are required.

TROUBLE SHOOTING

NOTE: To trouble shoot engine mechanical components, see appropriate table in TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

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

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. See appropriate COMPUTER RELEARN PROCEDURES article in GENERAL INFORMATION before disconnecting battery.

FUEL PRESSURE RELEASE

CAUTION: Fuel system is under pressure. Fuel pressure must be released before servicing any fuel system components. Allow engine to cool prior to releasing fuel pressure to avoid possible fire hazard and/or damage to catalyst..

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 under driver-side dash, next to junction box. 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. Turn ignition off. Upon completion of repairs, reconnect fuel pump relay connector.

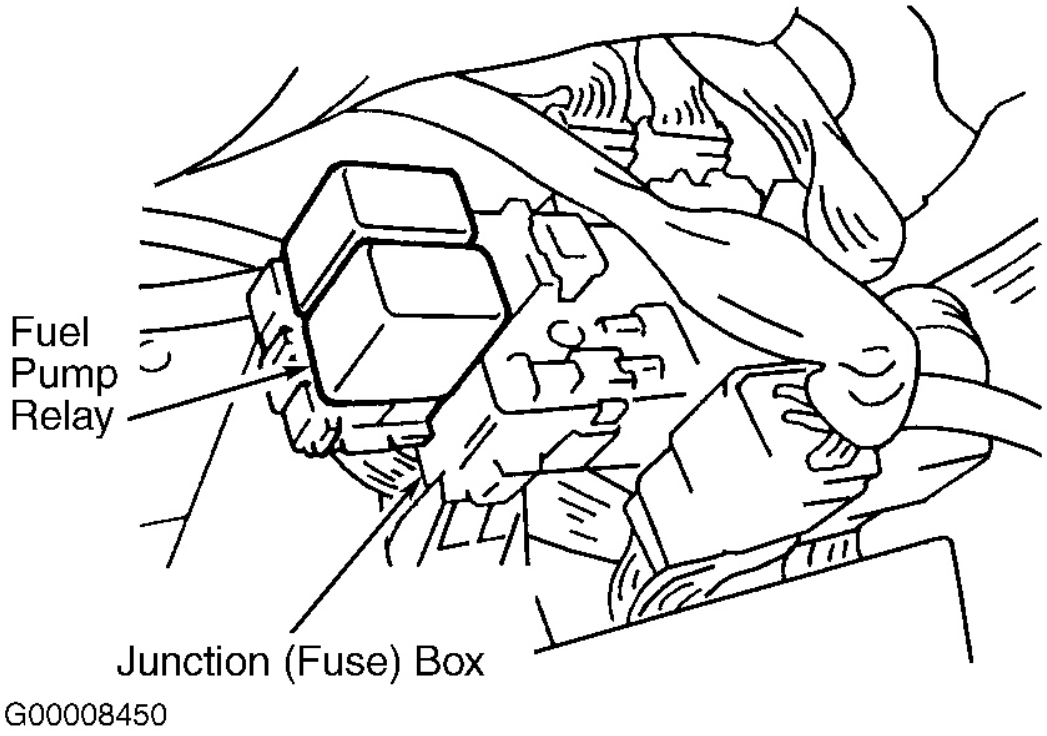

Fig. 1: Locating Fuel Pump Relay
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect battery cables. Mark and remove hood. Remove strut tower crossbrace. Drain coolant, and remove radiator hoses. Remove radiator, radiator fan shroud and cooling fan
2. Disconnect air cleaner outlet hose, fuel lines and heater hoses. Identify, mark and remove vacuum lines and hoses at engine. Remove EVAP canister from body.
3. Disconnect accelerator cable. On A/T models, remove throttle cable. On M/T models, disconnect clutch cable at transmission. On all models, label and disconnect all engine wiring. With hoses attached, remove power steering pump and A/C compressor from block (if equipped), and wire aside. Remove starter

motor.

4. Raise and support vehicle. Remove front differential housing with differential from chassis. See appropriate DIFFERENTIALS article in DRIVE AXLES. Remove exhaust pipe bolts, and remove exhaust pipe. Disconnect transmission cooler line clamps (A/T). Remove right side transmission stiffener, lower clutch housing plate (M/T) or lower torque converter housing cover (A/T). Remove torque converter bolts (A/T).
5. Lower vehicle. Support transmission. On A/T models, DO NOT place jack under A/T oil pan to support transmission. Remove transmission-to-block nuts and bolts. Install engine lifting device. Remove engine side mount bracket bolts/nuts. Ensure all hoses, wire harnesses and cables which may interfere with engine removal have been disconnected. Slowly remove engine from engine compartment, while separating engine from transmission.

Installation

Install engine into engine compartment. Install engine side mount brackets. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure. Adjust all control cables. Fill crankcase and cooling system. Check for leaks after starting engine.

INTAKE MANIFOLD

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect battery cables. Drain cooling system. Remove air intake hoses. Label and disconnect electrical connectors from intake manifold, injectors and throttle body.
2. Disconnect accelerator cable and A/T throttle cable. Label and disconnect vacuum hoses from intake manifold. Remove fuel rail (with injectors) from cylinder head. Remove intake manifold front and rear stiffener. Remove water pipe from intake manifold.
3. Remove intake manifold-to-cylinder head bolts. Remove intake manifold and gasket.

Installation

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

EXHAUST MANIFOLD

Removal

Disconnect negative battery cable. Disconnect oxygen sensor connector. Disconnect exhaust pipe from exhaust manifold. Remove exhaust manifold cover. Remove exhaust manifold stiffener. Remove exhaust manifold-to-cylinder head bolts. Remove exhaust manifold and gasket.

Installation

To install, reverse removal procedure. Use NEW gaskets. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

CYLINDER HEAD

Removal

1. Release fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect negative battery cable. Drain cooling system and remove necessary coolant hoses from cylinder head. Remove strut tower crossbrace. Label and remove hoses, lines and electrical connectors from cylinder head, intake manifold and exhaust manifold. Disconnect exhaust pipe from exhaust manifold, and remove brace.
2. Disconnect accelerator cable and A/T throttle cable. Remove intake manifold rear stiffener. Disconnect water pipe from intake manifold. Remove rocker arm cover. Remove oil pan. Remove timing chain cover, 2nd and 1st timing chains, camshafts and valve lash adjusters. See **TIMING CHAIN NO. 1**, **TIMING CHAIN NO. 2** and **CAMSHAFTS & VALVE LASH ADJUSTERS** .
3. Loosen cylinder head bolts in reverse order of tightening sequence. See **Fig. 2**. Loosen and remove head bolts in 2 or 3 steps to prevent cylinder head warpage. Remove M6 bolt. Remove cylinder head with intake and exhaust manifolds.

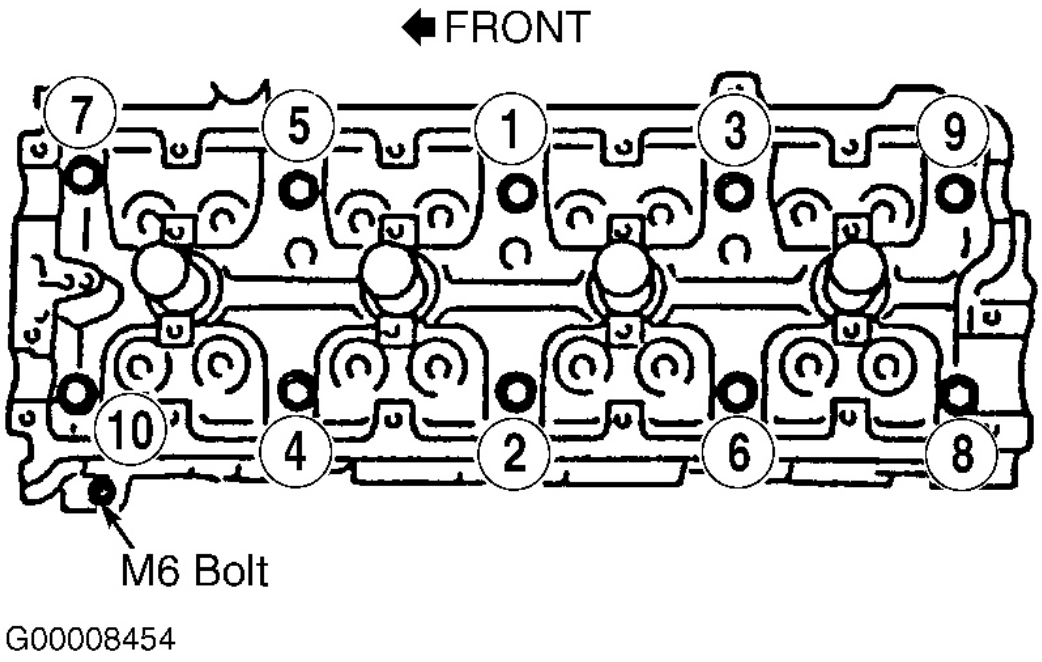

Fig. 2: Cylinder Head Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Inspection

1. Check cylinder head for evidence of water leakage or damage. Remove carbon from combustion chambers. Check cylinder head for cracks in combustion chambers, head surface, intake and exhaust ports.

2. Check head warpage at 6 locations. If warpage exceeds specification, cylinder head should be machined or replaced. See **CYLINDER HEAD** table 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. Loosely install all cylinder head bolts and M6 bolt. Tighten cylinder head bolts to specification in 3 steps using proper sequence. See Fig. 2. See **TORQUE SPECIFICATIONS**.

TIMING CHAIN COVER & FRONT SEAL

Removal

1. Disconnect negative battery cable. Drain coolant and engine oil. Remove oil pan and strainer. See **OIL PAN**. Remove rocker cover. Disconnect water by-pass pipe and hose.
2. Remove cooling fan, fan shroud, fan belt and pulley. Remove generator belt tensioner and idler pulley. Disconnect radiator hose from thermostat housing. With hoses attached, remove A/C compressor and bracket from block, and wire aside.
3. Hold crankshaft pulley using Special Tool (09917-8221). Remove crankshaft pulley bolt. Using appropriate puller, remove crankshaft pulley. Remove timing chain cover bolts and cover. Remove oil seal with suitable tool.

Installation

To install oil seal, use bearing installer or suitable tool. Apply sealant to front of block and cylinder head. See **Fig. 3**. Install timing chain cover. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

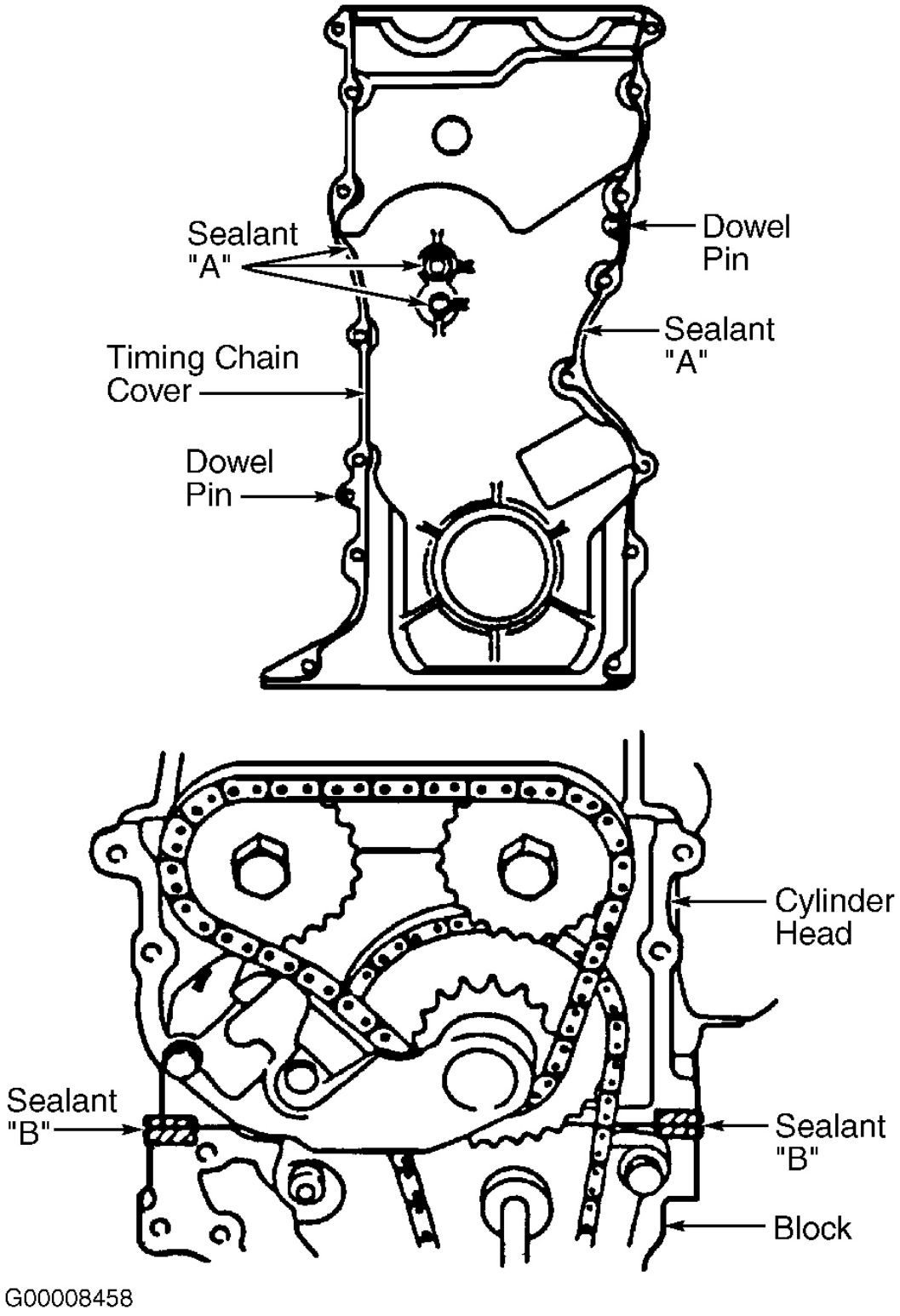

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Fig. 3: Applying Timing Chain Cover Sealant
Courtesy of SUZUKI OF AMERICA CORP.

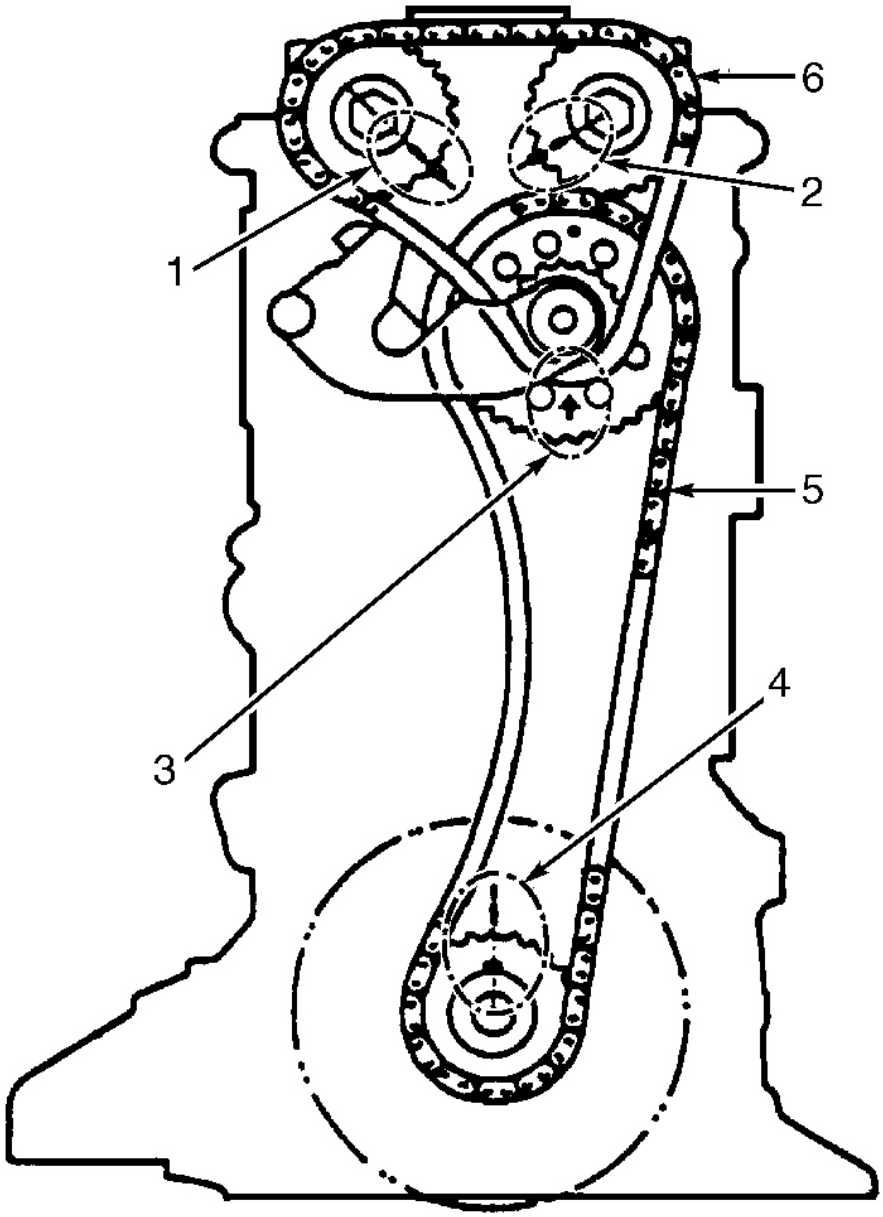
TIMING CHAIN NO. 2

NOTE: Upper timing chain is timing chain No. 2.

Removal

1. Disconnect negative cable. Drain coolant and engine oil. Remove oil pan and strainer. See **OIL PAN**. Remove rocker cover and timing chain cover. See **TIMING CHAIN COVER & FRONT SEAL**.
2. Align marks on all sprockets with marks on engine. See **Fig. 4**. Slacken timing chain No. 2 by turning intake camshaft counterclockwise while pushing back tensioner pad. Remove timing chain tensioner adjuster No. 2. Hold camshaft using a wrench on hexagonal portion at middle of camshaft. Remove intake and exhaust camshaft timing sprocket bolts. Remove camshaft timing sprockets and timing chain No. 2.

CAUTION: DO NOT turn crankshaft more than 90 degrees from aligned position, or intake and exhaust camshafts more than 15 degrees in either direction. Doing so could result in damage to piston(s) and/or valve (s) by interference.



1. Timing Marks Of Intake Camshaft Timing Sprocket
2. Timing Marks Of Exhaust Camshaft Timing Sprocket
3. Arrow Mark On Idler Sprocket
4. Timing Marks Of Crankshaft Timing Sprocket
5. Timing Chain No. 1
6. Timing Chain No. 2

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Fig. 4: Aligning Crankshaft & Camshaft Timing Marks
Courtesy of SUZUKI OF AMERICA CORP.

Inspection

Inspect chain for wear or damage. Inspect sprocket teeth, and check guide and tensioner pads for wear or damage.

Installation

1. To install, ensure all sprockets are aligned with marks on engine. Ensure arrow mark on idler sprocket points upward. See **Fig. 4**. Install timing chain No. 2 by aligning Yellow plate of timing chain with arrow mark on idler sprocket. Align Dark Blue plate of timing chain with arrow marks on intake and exhaust sprocket. Install camshaft sprocket bolts. Tighten to specifications. See **TORQUE SPECIFICATIONS**.
2. Push plunger into tensioner body and hold in place with a stopper pin insertyed into hole in tensioner body. Install timing chain tensioner adjuster No. 2 and gasket. Pull out stopper pin from timing chain tensioner adjuster No. 2.
3. Turn crankshaft 2 rotations clockwise, then align timing mark on crankshaft with timing mark on cylinder block . Ensure timing marks on all sprockets align with marks on block. See **Fig. 4**. Coat timing chains, guide rail, sprockets and tensioner with clean engine oil. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

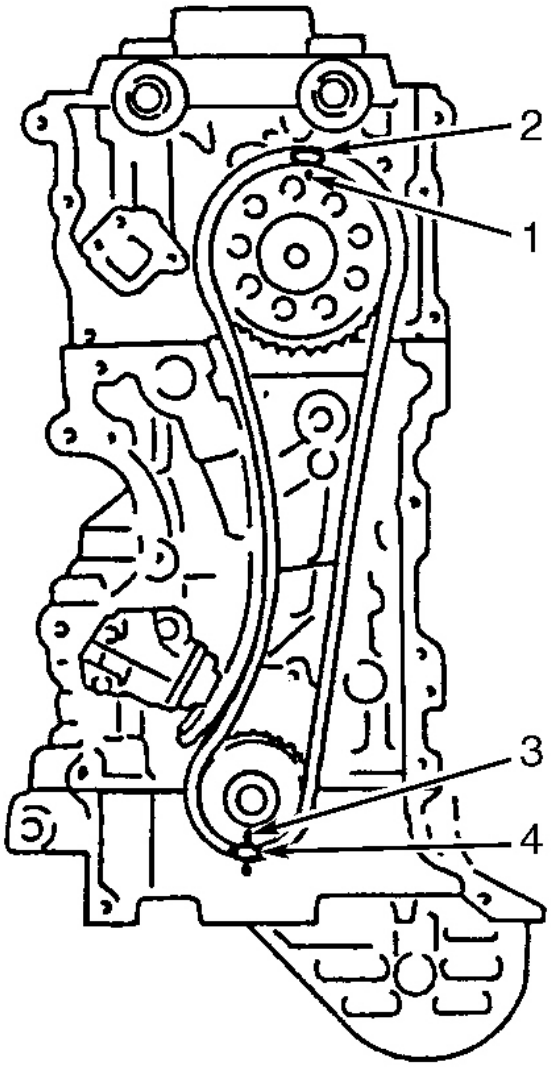
TIMING CHAIN NO. 1

Removal

Remove timing chain No. 2. See **TIMING CHAIN NO. 2**. Remove timing chain guide No. 1. Remove timing chain tensioner adjuster No. 1 and timing chain tensioner. Remove idler sprocket, timing chain No. 1 and crankshaft timing sprocket.

Installation

1. Ensure crankshaft key is facing upward, matching mark on block. Install crankshaft sprocket. See **Fig. 4**. Install idler sprocket shaft. Coat sprocket shaft and sprocket bore with oil. Install idler sprocket. Install timing chain No. 1 by aligning Dark Blue plate of 1st timing chain and mark on idler sprocket. Match Yellow plate of timing chain with mark on crankshaft timing sprocket (facing downward). Install timing chain tensioner.
2. Push plunger into tensioner adjuster body and hold in place using a stopper pin inserted into tensioner body. Install timing chain tensioner adjuster No. 1. Pull stopper pin from adjuster No. 1. Install timing chain guide No. 1. Ensure Dark Blue and Yellow plate of timing chain match with marks on sprockets. See**Fig. 5**. To complete installation, reverse removal procedure. For installation of timing chain No. 2, see **TIMING CHAIN NO. 2**.



1. Match Mark On Idler Sprocket
2. Dark Blue Plate
3. Match Mark On Crank Timing Sprocket
4. Yellow Plate

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Fig. 5: Aligning Timing Chain Marks
Courtesy of SUZUKI OF AMERICA CORP.

CAMSHAFTS & VALVE LASH ADJUSTERS

Removal

1. Disconnect negative battery cable. Drain coolant and engine oil. Remove oil pan. See **OIL PAN**. Remove rocker cover. Remove timing chain cover. See **TIMING CHAIN COVER & OIL SEAL**. Remove 2nd timing chain. See **TIMING CHAIN NO. 2**. Remove camshaft position sensor. Rotate crankshaft 90 degrees clockwise as seen from in front of engine.
2. Loosen camshaft housing bolts in sequence. See **Fig. 6**. Remove camshaft housing and camshafts. Remove valve lash adjusters.

NOTE: DO NOT disassemble adjuster or apply force to body of adjuster. Immerse adjuster upright in oil until reassembly.

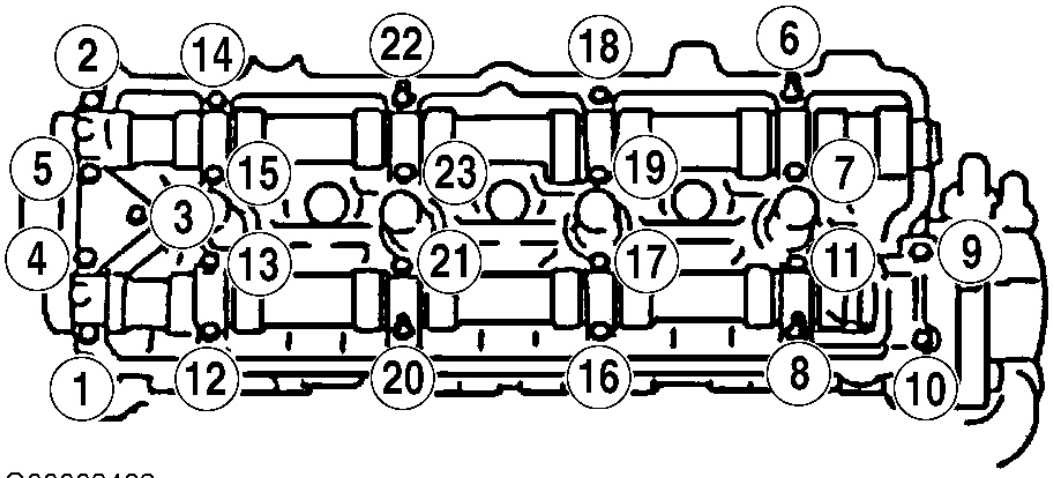

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Fig. 6: Camshaft Housing Bolt Removal Sequence
Courtesy of SUZUKI OF AMERICA CORP.

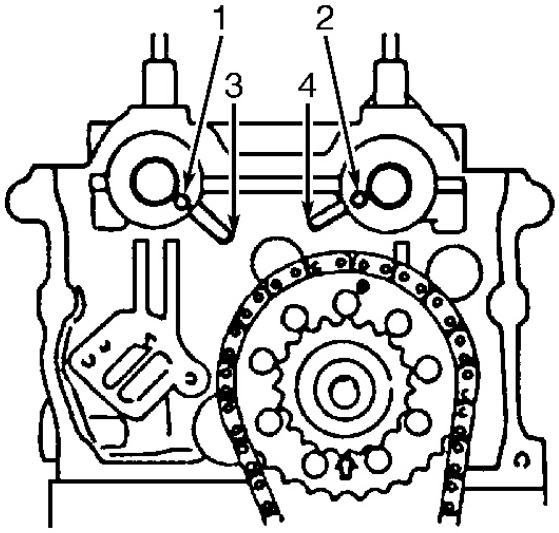
Inspection

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** table 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** table under ENGINE SPECIFICATIONS.

Installation

Lubricate valve lash adjuster bore in cylinder head with oil. Install adjuster in bore. Rotate crankshaft 90-degrees counterclockwise and seen from in front of engine, so crankshaft key is facing upward, aligning with mark on block. Lubricate camshaft journals and install camshafts. Ensure camshaft match marks align. See **Fig.**

7. Apply sealant to exhaust camshaft end housing. Install camshaft housings and tighten, in sequence, to specification. See **Fig. 8**. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure.



1. Intake Camshaft Knock Pin
2. Exhaust Camshaft Knock Pin
3. Intake Camshaft Match Mark
4. Exhaust Camshaft Match Mark

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Fig. 7: Aligning Camshafts
Courtesy of SUZUKI OF AMERICA CORP.

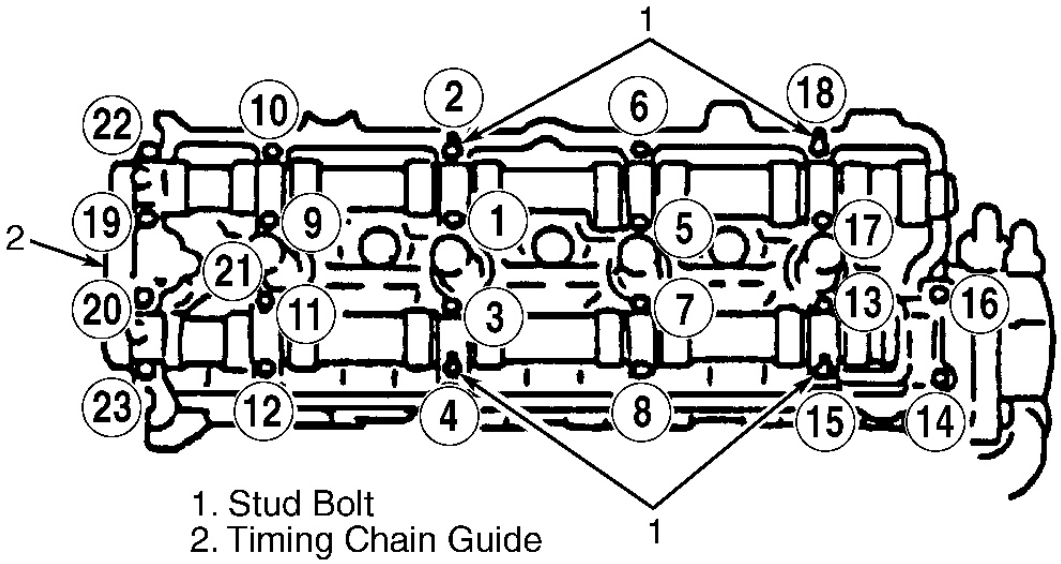

Fig. 8: Camshaft Housing Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

CRANKSHAFT REAR OIL SEAL

Removal

Remove transmission from vehicle. For A/T, see appropriate AUTOMATIC TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. For M/T, see appropriate article in CLUTCHES. Remove oil seal with suitable tool.

Installation

Install oil seal using Special Tools (09911-97710 & 09911-97810). To complete installation, reverse removal procedure.

WATER PUMP

Removal

Disconnect negative battery cable. Drain coolant. Remove radiator hose at thermostat housing. Remove drive belt and heater outlet pipe bolt. Remove water pump bolts and water pump assembly.

NOTE: DO NOT lose dowel pin when removing water pump.

Installation

Install NEW "O"ring to water pump. Install water pump with NEW bolts, and tighten to specification. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure. Fill with coolant.

OIL PAN

Removal

1. Remove oil dipstick. Raise and support vehicle. Remove front wheels. Remove rack and pinion steering gear. See appropriate article in STEERING. Remove front differential housing with differential from chassis. See appropriate DIFFERENTIALS article in DRIVE AXLES. Remove transmission stiffener and clutch (torque converter) housing lower plate.
2. Drain engine oil. Remove oil pan bolts, oil pan and oil pump strainer.

Installation

NOTE: To facilitate oil pan installation, motor mounts may be unbolted and engine hoisted no more than one inch.

Apply sealant to oil pan mating surface, inside of bolt holes. Install oil pump strainer, oil pan and oil pump bolts. To complete installation, reverse removal procedure.

OVERHAUL

CYLINDER HEAD

Disassembly

1. Remove cylinder head. See **CYLINDER HEAD** under REMOVAL & INSTALLATION. Remove intake and exhaust manifolds. Remove camshaft and lash adjusters. See **CAMSHAFT & VALVE LASH ADJUSTER** under REMOVAL & INSTALLATION.
2. Using Valve Spring Compressor (09916-14510) and Adapters (09916-14910 & 0999-28610), compress valve spring. Using Valve Spring Retainer Remover (09916-84511) remove retainer locks. See **Fig. 9**. Remove retainers, springs, valve stem oil seals, spring seats and valves. Keep all components in order for reassembly reference.

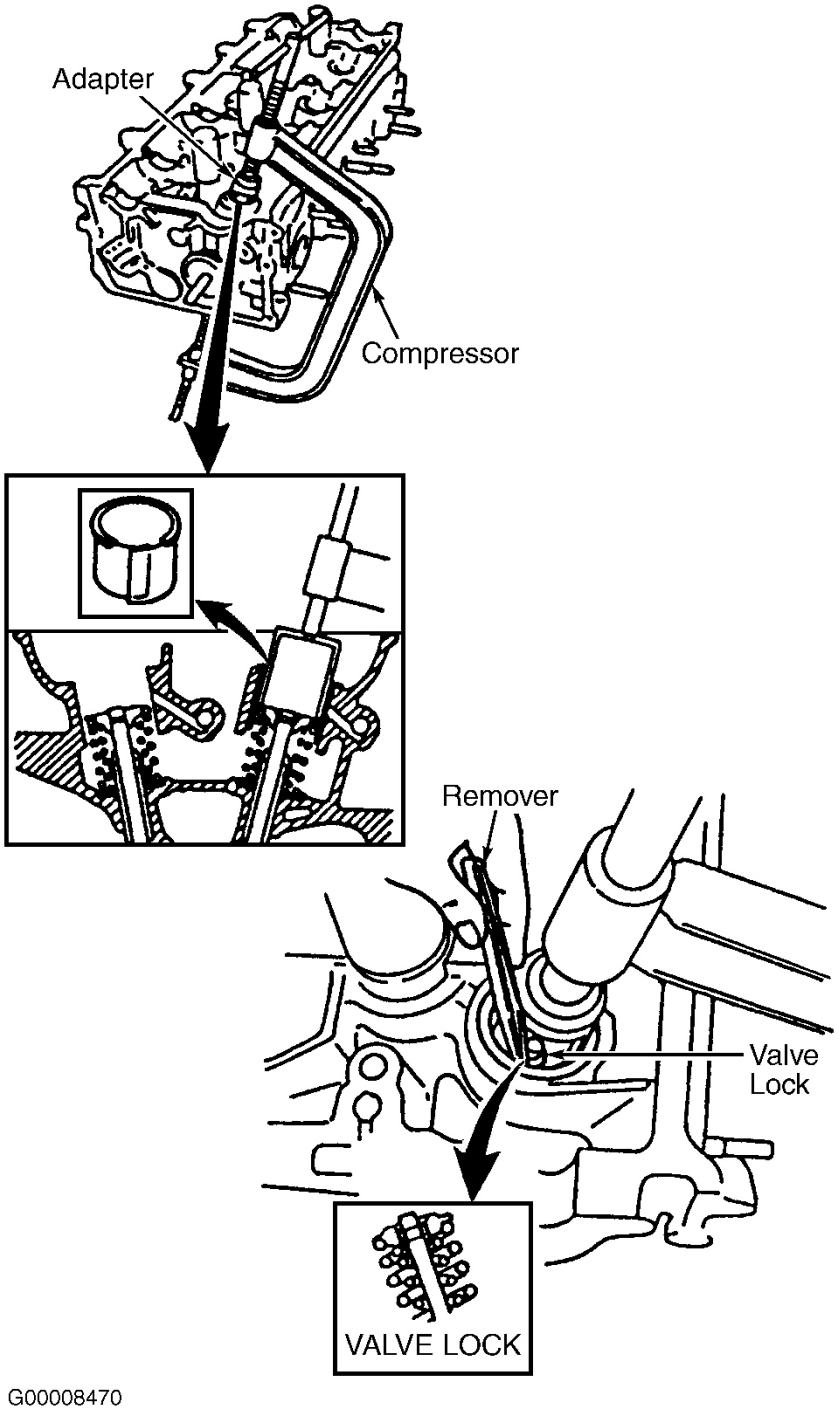

Fig. 9: Removing Valve Locks
Courtesy of SUZUKI OF AMERICA CORP.

Reassembly

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

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 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.

Valve Stem Oil Seals

NOTE: DO NOT reuse old valve stem oil seals

Place new lubricated stem seal on valve guide. Use Valve Stem Seal Installer Set (09917-98221 and 09916-58210). Press seal onto valve guide using hand pressure only. When installer bottoms on head, seal is properly positioned. DO NOT twist seals during installation.

Valve Guides

1. Check valve stem-to-guide clearance. If clearance exceeds specification, replace with oversize valve guide. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.
2. Using Valve Guide Remover (09916-44910), drive out old guide toward valve spring side of head. Ream guide bore in cylinder head with 11-mm Reamer (09916-38210 or 09916-56011). Uniformly heat cylinder head to 176-212°F (80-100°C).
3. Using Valve Guide Installer Set (09916-58210 & 09917-87810, or 09916-56011 & 09916-58210), drive in new oversize valve guide until valve guide installer contacts cylinder head.
4. Valve guide installed height is .53" (13.5 mm). Ream valve guide with 6-mm Reamer (09916-37810).
5. Clean valve guide bore after reaming. Install valve and ensure valve stem oil clearance is correct. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Install new valve stem oil seals. See **VALVE STEM OIL SEALS**.

Valve Seat

Inspect valve seats for damage or wear. If valve seat rework is necessary, use 2 or 3 cutters to obtain required seat angles. On intake valves (and exhaust valves for 2000), first cut shoud be 15 degrees. Second cut should be 45 degrees. On exhaust valves for 1999, first cut should be 15 degrees. Second cut should be 60 degrees and third cut should be 45 degrees. After cutting valve seats to correct angles, lap valve seat.

Valves

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. Valve may be reused if chamfer is still visible after resurfacing.

Valve Seat Correction Angles

On intake and exhaust valves, use 15-degree stone to narrow seat and 45-degree stone to widen seat. See **Valve**

Seat.

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. 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. Remove circlips and push piston pin out by hand. 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.
5. Position piston upward. Install circlip in pin bore. Align piston to rod, with arrow on top of piston and "86F" mark on connecting rod on the same side. Insert piston pin and insert remaining circlip. Position circlips with opening horizontal to piston top and facing oil hole in connecting rod.

Fitting Pistons

1. Check cylinder bore for damage, wear and taper. See **CYLINDER BLOCK ASSEMBLY**. Determine if block must be rebored. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.
2. Pistons are available in .0098" (.25 mm) and .0197" (.50 mm) oversize. Check outside diameter of piston. Measure at a point 1.04" (26.5 mm) from piston skirt end, in direction perpendicular to piston pin. Standard pistons are available in 2 sizes. Piston diameter is determined by numerical mark ("1" or "2") stamped on piston crown. See **Fig. 10**.
3. Cylinder bore diameter is determined by Red or Blue marks painted on cylinder block. See **Fig. 10**.
4. When installing piston into cylinder, ensure piston numerical mark matches cylinder painted mark. See **PISTON & CYLINDER DIAMETERS** table. Ensure correct piston-to-cylinder clearance. See **PISTONS & RINGS** table under ENGINE SPECIFICATIONS.

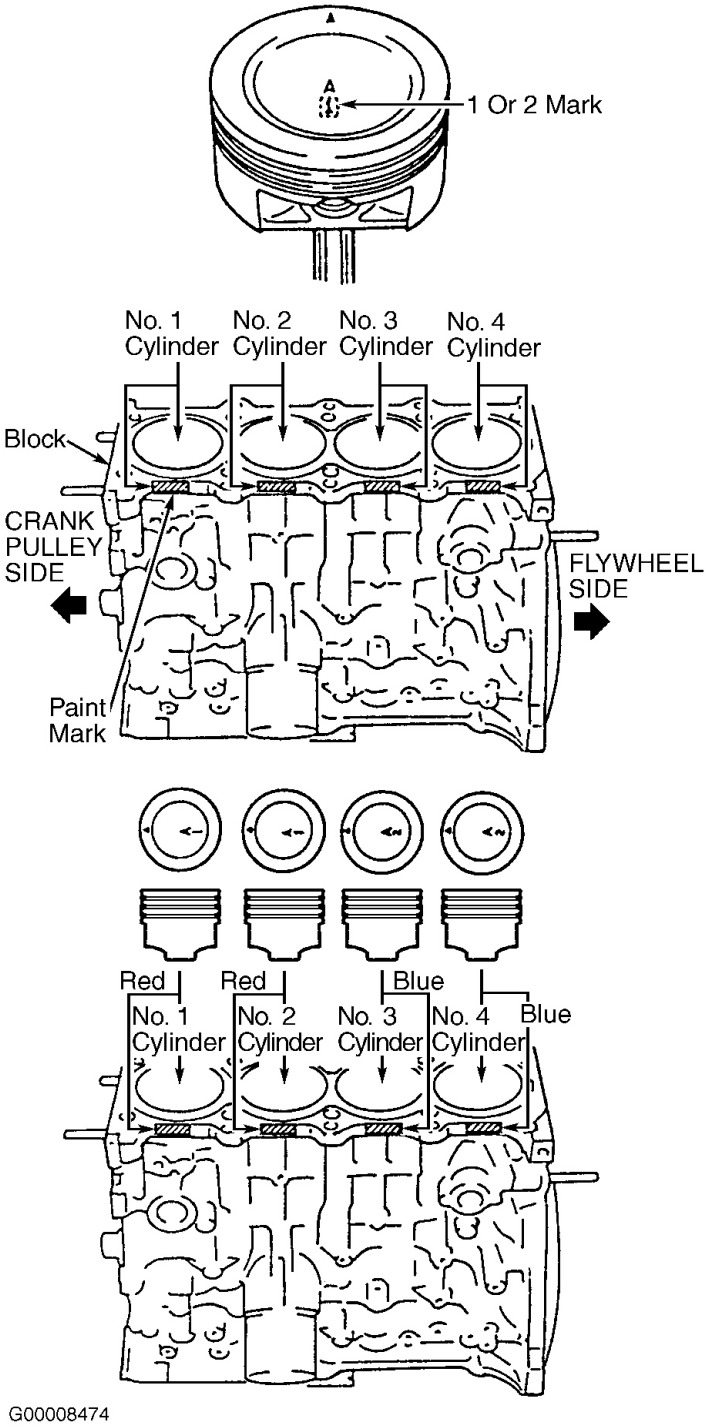

Fig. 10: Matching Pistons To Cylinder Block
Courtesy of SUZUKI OF AMERICA CORP.

PISTON & CYLINDER DIAMETERS

Piston Number At Top	Piston Outer Diameter - In. (mm)	Cylinder Paint Color	Piston Bore Diameter - In. (mm)
1	3.3063-3.3066 (83.980-83.987)	Red	3.3075-3.3078 (84.010-84.018)
2	3.3059-3.3062 (83.969-83.977)	Blue	3.3071-3.3074 (84.000-84.008)

Piston Rings

Install rings with "R" or "RN" mark facing upward. Install oil ring spacer first, then rails. Position piston ring gaps. See **Fig. 11**. Lubricate pistons, piston rings and cylinder bores with engine oil before installation.

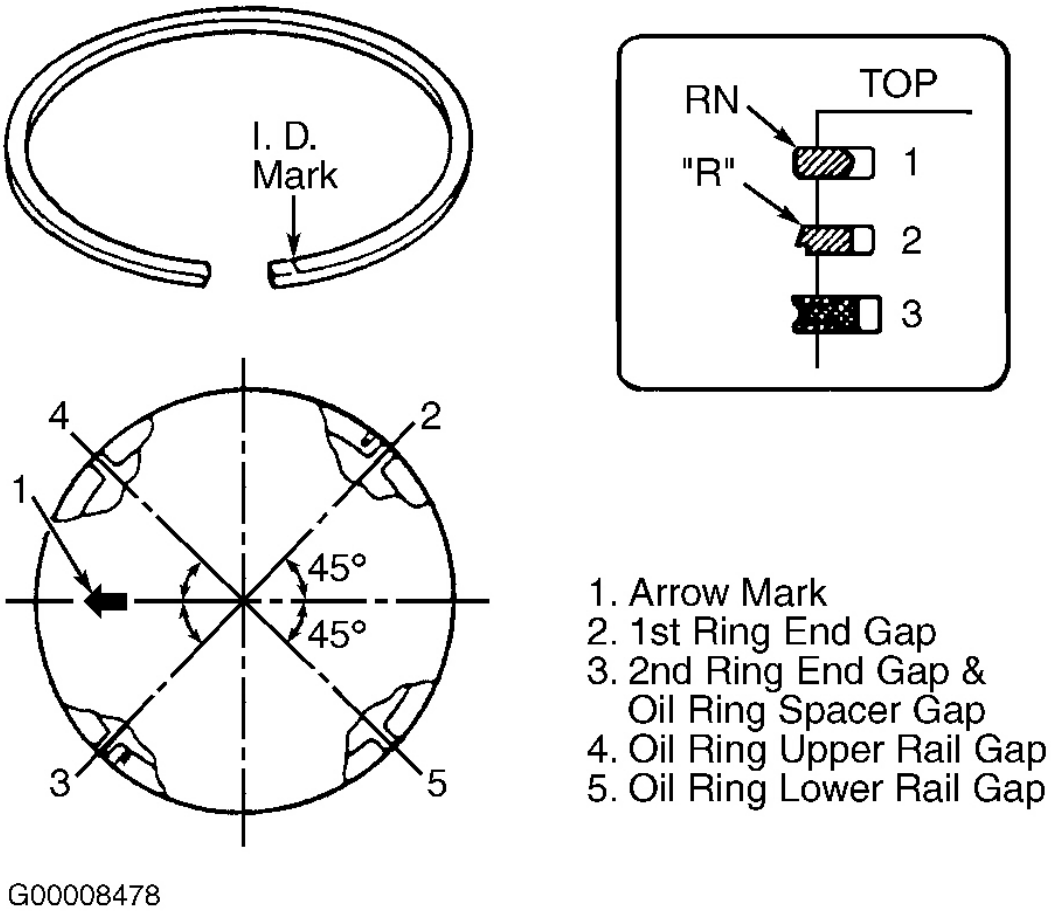

Fig. 11: Positioning Piston Rings
Courtesy of SUZUKI OF AMERICA CORP.

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** table under ENGINE SPECIFICATIONS.
2. Inspect bearing shells for signs of fusion, pitting, burning or flaking. Observe contact pattern. Two kinds of rod bearings are available. Standard size and .0098" (.25 mm) undersize. Undersize bearing has Red paint marks on front of shell.
3. Check bearing clearance using Plastigage. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
4. To install, reverse removal procedure. Tighten rod nuts to specification. See **TORQUE SPECIFICATIONS**.

Crankshaft & Main Bearings

1. Remove engine. See **ENGINE** under REMOVAL & INSTALLATION. Remove timing belt, sprockets, pulley and tensioner. See **TIMING CHAIN COVER** under REMOVAL & INSTALLATION. Remove flywheel and oil pan. Remove rear main oil seal. Remove connecting rod caps. Remove main bearing bolts. Remove lower crankcase. Remove crankshaft.
2. 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** table under ENGINE SPECIFICATIONS.
3. Main bearing journal diameter is determined by numerical mark ("1", "2" or "3") stamped on crank web No. 2. See **Fig. 12**.
4. Bearing cap bore diameter is stamped on lower crankcase main bearing cap. See **Fig. 13**. Letters represent bearing cap diameter. See **LOWER CRANKCASE BEARING CAP BORE DIAMETER** table.
5. Standard main bearings are color-coded. See **Fig. 14**. Five standard main bearings are available. See **COLOR CODE FOR STANDARD BEARINGS** table. Upper half of bearing has an oil groove.
6. From number stamped on crank web No. 2 and letters stamped on lower crankcase, determine new standard bearing to be installed to journal. See **STANDARD BEARING APPLICATION** table.

COLOR CODE FOR STANDARD BEARINGS

Paint Color	Bearing Thickness - In. (mm)
Green	.0785-.0786 (1.993-1.996)
Black	.0786-.0787 (1.996-1.999)
Colorless (No Paint)	.0787-.0788 (1.999-2.001)
Yellow	.0788-.0789 (2.001-2.004)
Blue	.0789-.0790 (2.004-2.007)

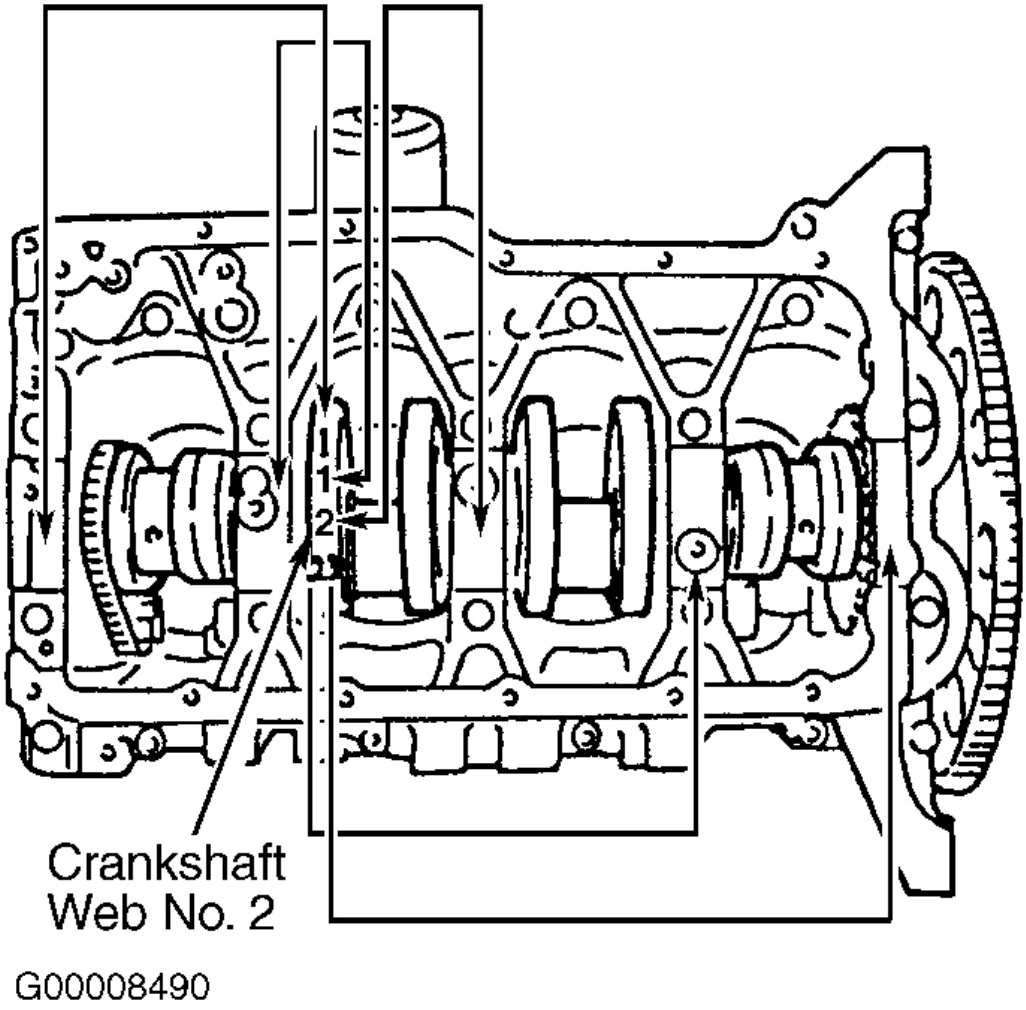

Fig. 12: Locating Main Bearing Mark
Courtesy of SUZUKI OF AMERICA CORP.

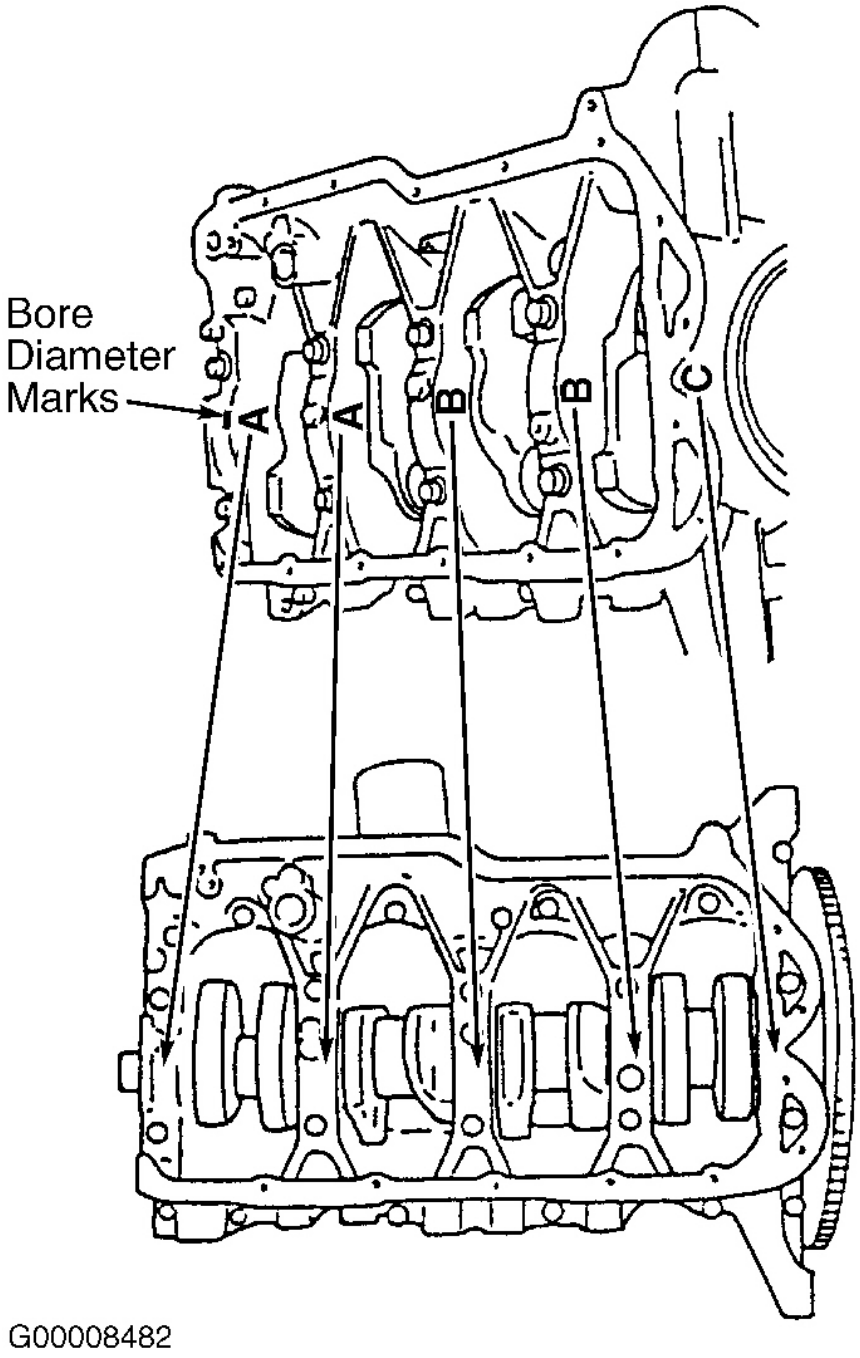

Fig. 13: Locating Lower Crankcase Bore Diameter
Courtesy of SUZUKI OF AMERICA CORP.

LOWER CRANKCASE BEARING CAP BORE DIAMETER

Stamped Letter	Diameter (Without Bearing) - In. (mm)
A	2.4409-2.4411 (62.000-62.004)
B	2.4412-2.4414 (62.006-62.011)
C	2.4414-2.4416 (62.011-62.016)

STANDARD BEARING APPLICATION

Letter Stamped On Lower Crankcase	Number 1 Stamped On Crank Web	Number 2 Stamped On Crank Web	Number 3 Stamped On Crank Web
A	Green	Black	Colorless
B	Black	Colorless	Yellow
C	Colorless	Yellow	Blue

Undersize Bearings

1. Bearings are available in .010" (.25 mm) undersize. Undersize bearing thickness is determined by 2 color marks on bearing shell. See **Fig. 15**. Five bearing sizes are available. See **COLOR CODE FOR UNDERSIZE BEARINGS** table.
2. Regrind journal to finished diameters, 2.2729-2.2736" (57.732-57.750 mm). Use journal diameter and letters stamped on lower crankcase to select an undersize bearing. See **UNDERSIZE BEARING APPLICATION** table.
3. To install, fit proper main bearings to block. Install "O" ring to block. Fit thrust bearings to block between No. 2 and No. 3 cylinders.
4. Place crankshaft in block. Apply sealant to lower crankcase mating surface. Install lower crankcase to cylinder block. Tighten bolts in sequence. See **Fig. 16**. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

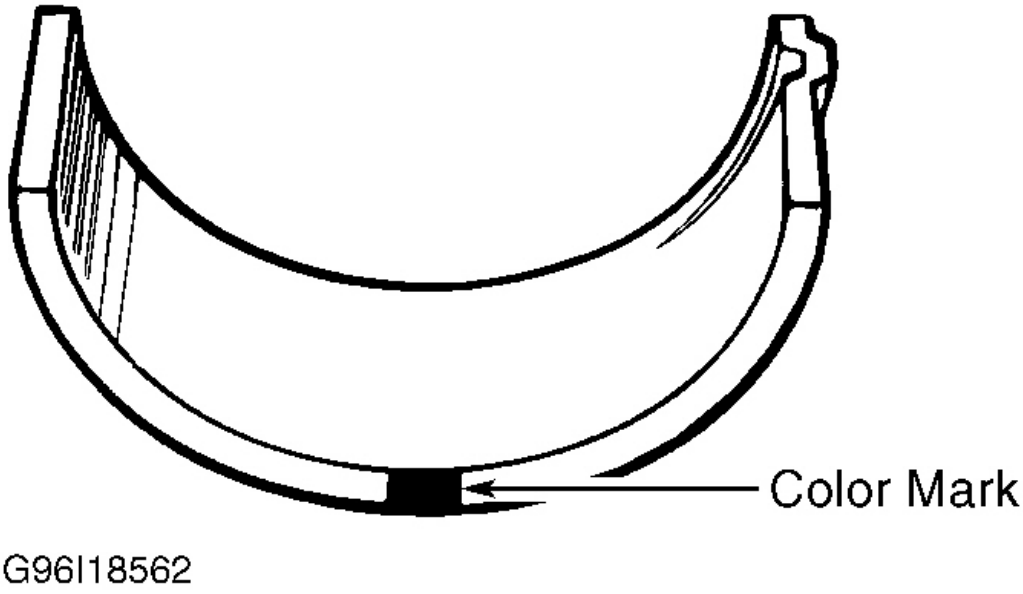

Fig. 14: Identifying Main Bearing Color Codes (Standard Bearing)
Courtesy of SUZUKI OF AMERICA CORP.

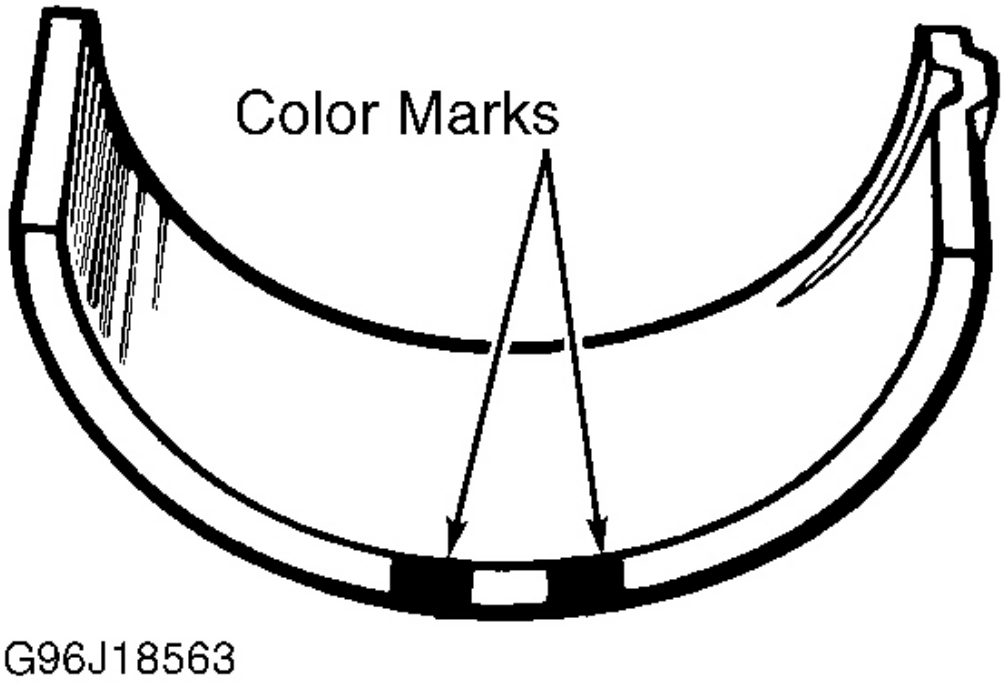

Fig. 15: Identifying Main Bearing Color Codes (Undersize Bearing)
Courtesy of SUZUKI OF AMERICA CORP.

COLOR CODE FOR UNDERSIZE BEARINGS

Paint Color	Bearing Thickness - In. (mm)
Green & Red	.0834-.0835 (2.118-2.121)
Black & Red	.0835-.0836 (2.121-2.123)
Red	.0836-.0837 (2.123-2.126)
Yellow & Red	.0837-.0838 (2.126-2.129)
Blue & Red	.0838-.0839 (2.129-2.131)

UNDERSIZE JOURNAL BEARING APPLICATION

Letter Stamped On Lower Crankcase	2.2734-2.2736 (57.744-57.750) Diameter Bearing Color	2.2731-2.2733 (57.737-57.742) Diameter Bearing Color	2.2729-2.2731 (57.732-57.737) Diameter Bearing Color
A	Green & Black	Black & Red	Red
B	Black & Red	Red	Yellow & Red
C	Red	Yellow & Red	Blue & Red

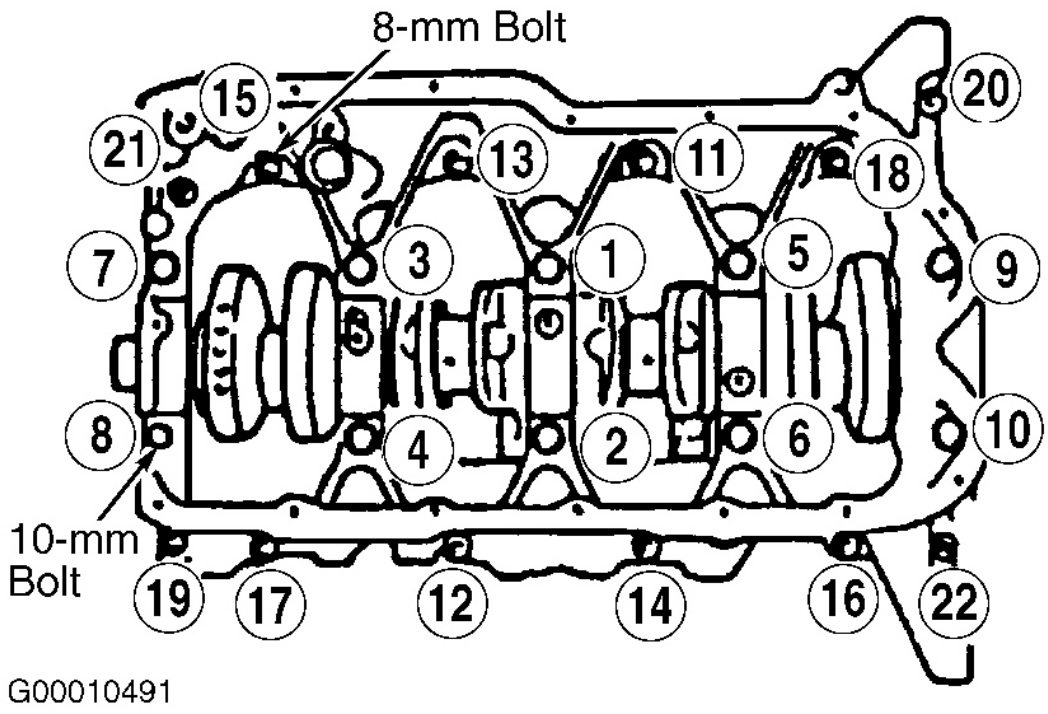

Fig. 16: Lower Crankcase Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Thrust Bearing

1. With lower crankcase installed, check thrust clearance (end play) using dial indicator to measure thrust clearance in axial direction.
2. Standard thickness of thrust bearing is .0984" (2.50 mm). If clearance exceeds specification, replace thrust bearing with new standard one or oversize one to obtain standard thrust clearance. Thickness of oversize thrust bearing is .1009" (2.563 mm).

Cylinder Block

1. Inspect block for distortion of deck surface. Inspect block for cracks, scratches and other defects. Measure cylinder bores at 3 separate levels for wear, taper and out-of-round condition.
2. If bore wear, taper or out-of-round exceeds specification, rebore cylinders. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pump is a trochoid type mounted under crankshaft. Force feed type lubrication system is used. See **Fig. 17**.

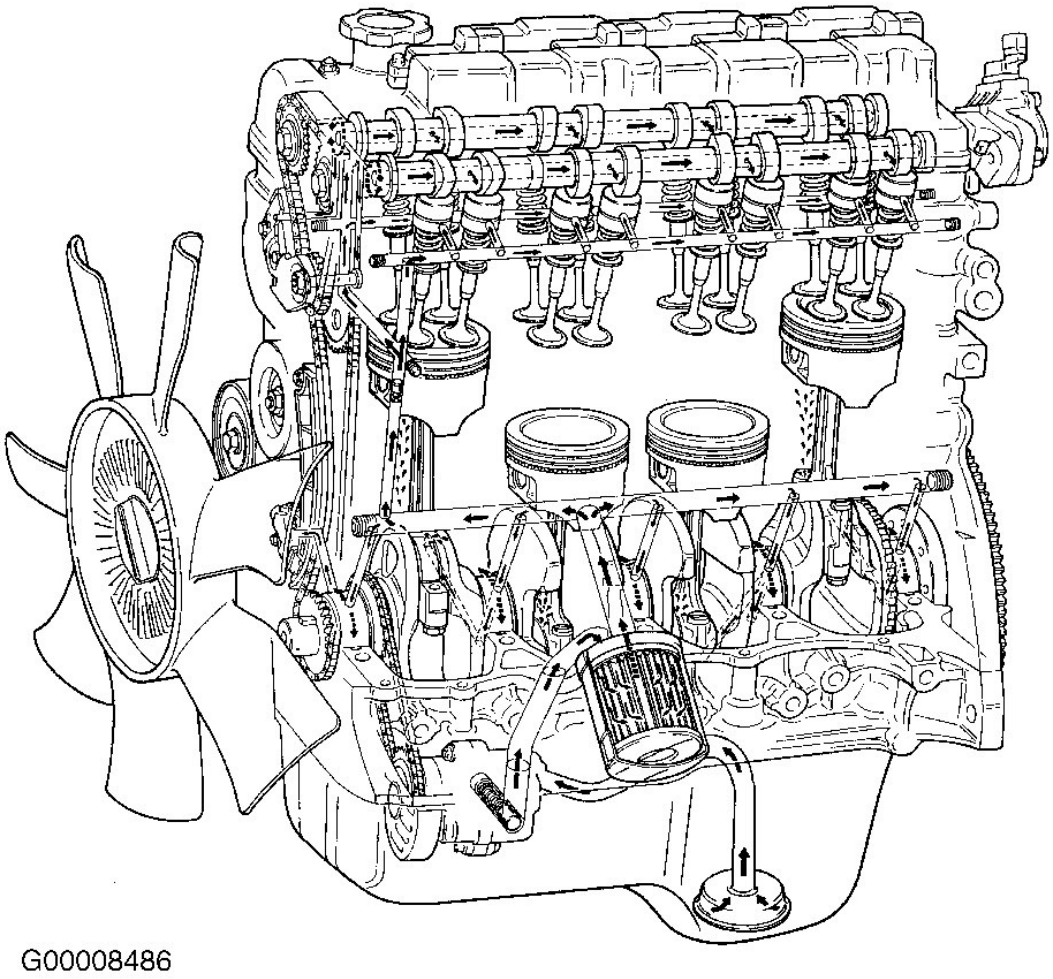

Fig. 17: Cross-Sectional View Of Engine Oiling Circuit
Courtesy of SUZUKI OF AMERICA CORP.

Crankcase Capacity

Oil capacity is 5.2 qts. (5L) with filter.

Oil Pressure

Oil pressure is 56-67 psi (3.9-4.7 kg/cm^2) at 4000 RPM.

OIL PUMP

Removal & Disassembly

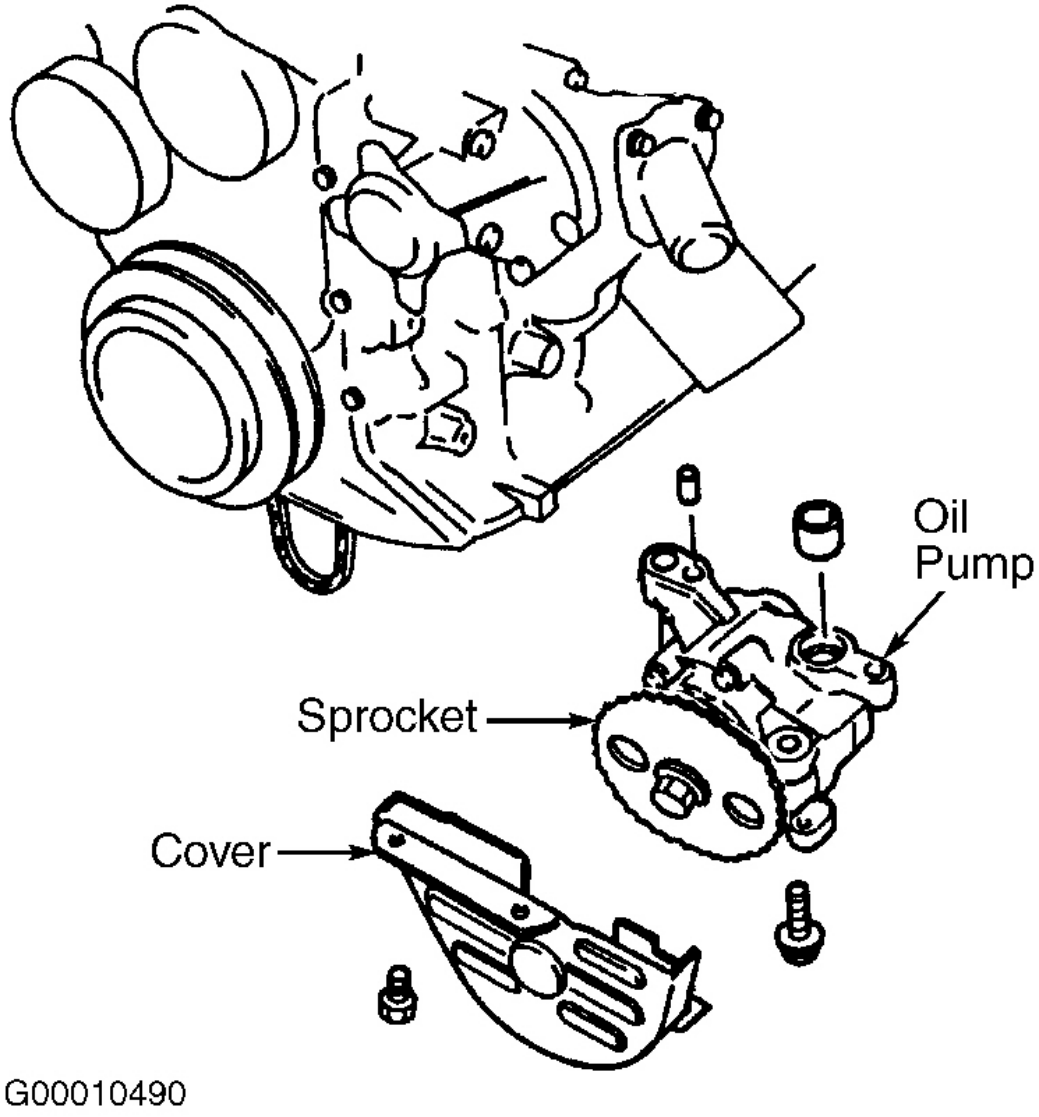

Fig. 18: Removing Oil Pump
Courtesy of SUZUKI OF AMERICA CORP.

Disconnect negative battery cable. Drain engine oil. Remove oil pan and strainer. See **OIL PAN** under REMOVAL & INSTALLATION. Remove oil pump sprocket cover. Remove oil pump from lower crankcase. See **Fig. 18**.

NOTE: DO NOT remove oil pump sprocket from oil pump shaft. If replacement is needed, replace oil pump.

Inspection

1. Disassemble oil pump. See **Fig. 19**. Inspect components for damage. Using straightedge and feeler gauge, measure side clearance between inner rotor and pump body. Check radial clearance between outer rotor and case using feeler gauge.
2. Measure free length and tension of oil relief spring. Replace components or entire assembly if not within specification. See **OIL PUMP SPECIFICATIONS** table.

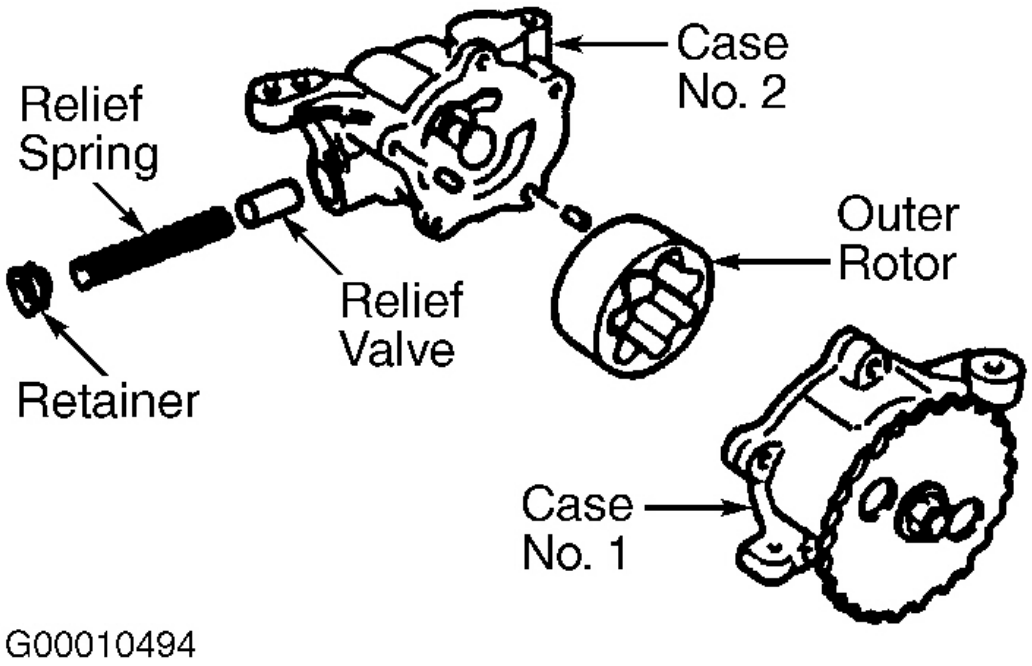

Fig. 19: Exploded View Of Oil Pump
Courtesy of SUZUKI OF AMERICA CORP.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Rotor	
Radial Clearance	.0059 (.15)
Side Clearance	.0043 (.11)
Relief Valve	
Relief Spring Free Length	2.5 (63.5)
Spring Preload	62.2 Lbs. @ 2.05" (8.6 Kg. @ 52 mm)

Reassembly & Installation

1. Ensure rotors are assembled in same direction as originally installed. Install relief valve, relief spring and

retainer to oil pump case. Install oil pump case pins to oil pump case.

2. Assemble oil pump. Ensure oil pump rotates freely after assembly. Install oil pump to lower crankcase. Install oil pump sprocket cover. Tighten bolts to specifications. See **TORQUE SPECIFICATIONS**.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Lbs. (N.m)
Camshaft Sprocket Bolt	58 (79)
Connecting Rod Nuts	33 (45)
Cylinder Head Bolt (1)	
Step 1	39 (53)
Step 2	61 (83)
Step 3	Loosen All Bolts
Step 4	39 (53)
Step 5	76 (103)
Crankshaft Pulley Bolt	109 (148)
Engine-To-Transmission Bolts	62 (84)
Exhaust Pipe Bolts	37 (50)
Flywheel/Drive Plate Bolts	51 (69)
Generator Idler Pulley Bolt	33 (45)
Lower Crankcase Bolts (2)	44 (60)
Oil Drain Plug	26 (35)
Oil Pressure Switch	11 (15)
Oil Pump-To-Crankcase Bolts	20 (27)
Relief Valve Retainer	21 (28)
Timing Chain Tensioner No.1 Nut	18 (25)
Timing Chain Tensioner No.2	
Bolts	(3)
Nuts	33 (45)
Torque Convertor Bolt	47 (64)
	INCH Lbs. (N.m.)
Camshaft Housing Bolts	97 (11)
Crankshaft Position Sensor	53 (6)
Cylinder Head Bolts (M6)	97 (11)
Oil Pan Bolts	97 (11)
Oil Pump Body Bolts	106 (12)
Oil Pump Sprocket Cover Bolts	97 (11)
Oil StrainerBolts	97 (11)
Timing Chain Cover Bolts	97 (11)
Timing Chain Guide No.1 Bolts	84 (9.5)

Timing Chain Tensioner No.1 Bolts	80 (9)
Valve Cover Bolts	97 (11)
(1) Tighten in sequence. See **Fig. 2**	
(2) Tighten in sequence. See **Fig. 16**	
(3) Tighten to 97 INCH lbs. (11 N.m.)	

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	122 Cu. In. (2.0L)
Bore	3.30" (84 mm)
Stroke	(1)
Compression Ratio	(1)
Fuel System	SFI
(1) Information not available from manufacturer	

CRANKSHAFT, MAIN BEARINGS & CONNECTING ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0039-.0138 (.10-.35)
Service Limit	.0165 (.42)
Runout	.0023 (.06)
Main Bearings	
Journal Diameter(1)	
"1"	2.2832-2.2834 (57.994-58.00)
"2"	2.2830-2.2832 (57.988-57.993)
"3"	2.2828-2.2829 (57.983-57.985)
Journal Out-Of-Round	.0004 (.01)
Journal Taper	.0004 (.01)
Oil Clearance	
Standard	.0010-.0018 (.025-.046)
Service Limit	.0023 (.058)
Main Bearing Cap Bore Diameter (2)	

"A"	2.4409-2.4411 (62.00-62.003)
"B"	2.4412-2.4414 (62.006-62.012)
"C"	2.4414-2.4416 (62.012-62.017)
Connecting Rod Bearings	
Journal Diameter	1.9678-1.9685 (49.982-50.00)
Journal Out-Of-Round	.0004 (.01)
Journal Taper	.0004 (.01)
Oil Clearance	
Standard	.0018-.0025 (.045-.063)
Service Limit	.0031 (.08)
(1) Journal diameters are stamped on crank web No. 2. See **Fig. 12**.	
(2) Bore diameters are stamped on lower crankcase. See **Fig. 13**.	

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS

Application	In. (mm)
Bore Diameter	
Pin Bore	.8269-.8272 (21.003-21.011)
Crankpin Bore	1.9678-1.9685 (49.982-50.00)
Maximum Bend	.0020 (.05)
Maximum Twist	.0039 (.10)
Side Play	
Standard	.0099-.0157 (.25-.40)
Service Limit	.0177 (.45)

PISTONS, PISTON PINS & PISTON RINGS SPECIFICATIONS

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	.0008-.0015 (.02-.04)
Diameter	3.3059-3.3066 (83.970-83.990)
Pins	
Diameter	.8266-.8267 (20.998-21.000)
Piston Fit	Slip
Rod Fit	Slip
Rings	
No. 1	
End Gap	
Standard	.0079-.0137 (.20-.35)

Limit	.0276 (.70)
Side Clearance	.0012-.0027 (.03-.07)
No. 2	
End Gap	
Standard	.0138-.0196 (.35-.50)
Limit	.0276 (.70)
Side Clearance	.0008-.0023 (.02-.06)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0275 (.20-.70)
Limit	.0709 (1.80)

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore(1)	
Red	3.3075-3.3078 (84.01-84.02)
Blue	
Standard	3.3071-3.3074 (84.00-84.01)
Diameter Limit	3.3090 (84.05)
Maximum Taper	.004 (.10)
Maximum Out-Of-Round	.004 (.10)
Maximum Deck Warpage	.0024 (.06)
(1) Cylinder diameter determined by color painted on block. See **Fig. 10**.	

ENGINE VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Face Angle	45°
Head Thickness	
Standard	.039 (1.0)
Limit	.024 (.60)
Face Width	.0433-.0512 (1.1-1.3)
Stem Diameter	.2348-.2354 (5.964-5.980)
Exhaust Valves	
Face Angle	45°
Head Thickness	
Standard	.047 (1.2)

Limit	.028 (.71)
Face Width	.0433-.0512 (1.1-1.3)
Stem Diameter	.2339-.2344 (5.941-5.953)
Valve Springs	
Free Length	
Inner	
Standard	1.4204 (36.08)
Limit	1.3780 (35.00)
Outer	
Standard	1.5921 (40.44)
Limit	1.5441 (39.22)
Out-Of-Square	.079 (2.0)
	Lbs. @ In. (kg @ mm)
Preload	
Inner	
Standard	15.2-17.4 @ 1.08 (6.9-7.9 @ 27.5)
Limit	13.6 @ 1.08 (6.2 @ 27.5)
Outer	
Standard	33.9-39.2 @ 1.25 (15.4-17.8 @ 31.7)
Limit	30.4 @ 1.25 (13.8 @ 31.7)

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD

Application	Specification
Maximum Warpage	
Head-To-Block	.002 (.05)
Manifold-To-Block	.004 (.10)
Valve Seats	
Seat Angle	45°
Seat Width	.0433-.0512 (1.10-1.30)
Valve Guides	
Valve Guide I.D.	.2362-.2366 (6.00-6.01)
Valve Guide Installed Height	.53 (13.5)
Valve Stem-To-Guide Oil Clearance	
Intake	
Standard	.0008-.0018 (.020-.045)
Limit	.0027 (.07)
Exhaust	
Standard	.0018-.0028 (.045-.071)
Limit	.0035 (.09)

CAMSHAFT SPECIFICATIONS

CAMSHAFT

Application	In. (mm)
Bore Diameter	1.0236-1.0249 (26.00-26.033)
Journal Diameter	1.0220-1.0228 (25.959-25.980)
Oil Clearance	.0008-.0029 (.020-.074)
Journal Runout	.0039 (.10)
Lobe Height	
Intake	
Standard	1.5906-1.5969 (40.402-40.561)
Limit	1.5827 (40.20)
Exhaust	
Standard	1.5717-1.5780 (39.921-40.081)
Limit	1.5638 (39.721)

VALVE LIFTERS SPECIFICATIONS

VALVE LIFTERS

Application	In. (mm)
Bore Diameter	1.2205-1.2214 (31.00-31.023)
Lifter Diameter	1.2189-1.2194 (30.960-30.972)
Oil Clearance	.0010-.0025 (.025-.063)