2001-02 ENGINES

1.8L 4-Cylinder

ENGINE IDENTIFICATION

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

Vehicle Engine Code is stamped on left rear portion of cylinder block bellhousing. The first 3 characters of Engine Identification Code identifies engine type and size.

ENGINE IDENTIFICATION CODE

Application	VIN
Esteem	4

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Engine uses hydraulic lifters. Adjustment is not required.

TROUBLE SHOOTING

To trouble shoot mechanical engine components, see **ENGINE MECHANICAL** in GENERAL TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

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

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.

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

FUEL PRESSURE RELEASE

1. Ensure engine is cold. Place transmission in Neutral (M/T) or Park (A/T). Set parking brake, and block

drive wheels. Remove fuel pump relay. Fuel pump relay is located in relay box on left side of engine compartment. See Fig. 1.

2. Remove fuel tank filler cap to release pressure. Reinstall filler cap. Start engine, and idle until engine dies. Crank engine 2 or 3 times to ensure lines are empty. Turn ignition off.
3. Upon completion of service, reinstall fuel pump relay.

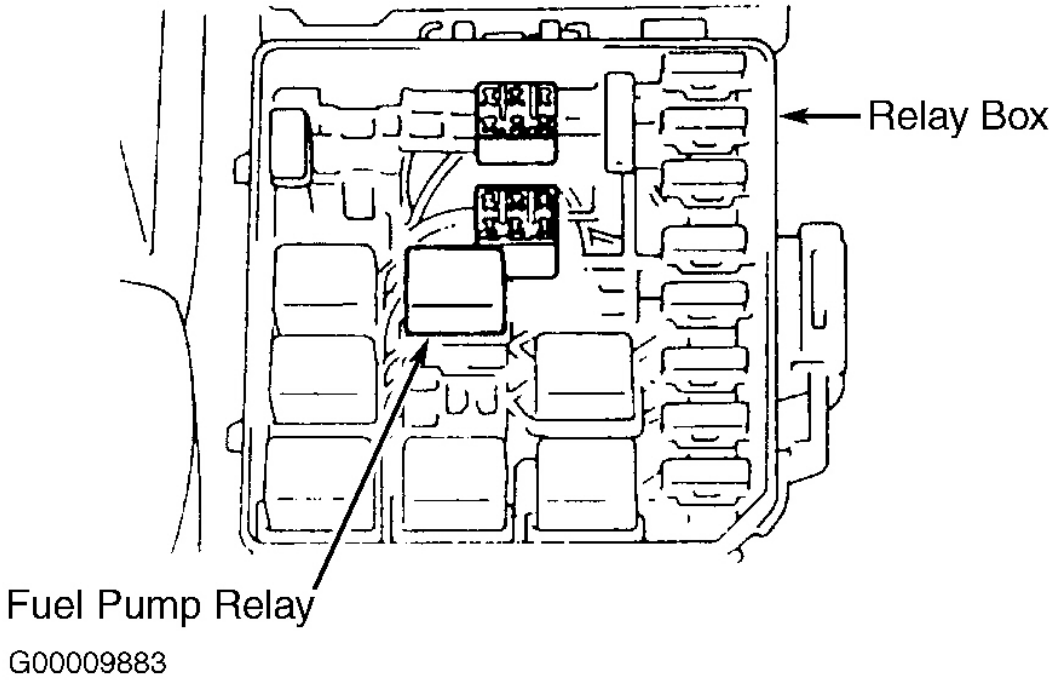


Fig. 1: Locating Fuel Pump Relay
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE

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

Removal

1. Relieve fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect negative battery cable. Disconnect windshield washer hose. Mark and remove hood. Remove air cleaner and duct hoses. Drain transmission oil, engine oil and cooling system. Remove radiator with cooling fan.
2. Disconnect accelerator cable at throttle body. On automatic transmission models, disconnect gear select cable from transmission. On manual transmission models, disconnect shift/select cable and clutch cable from transmission. Remove clutch slave cylinder from transmission, and wire aside.

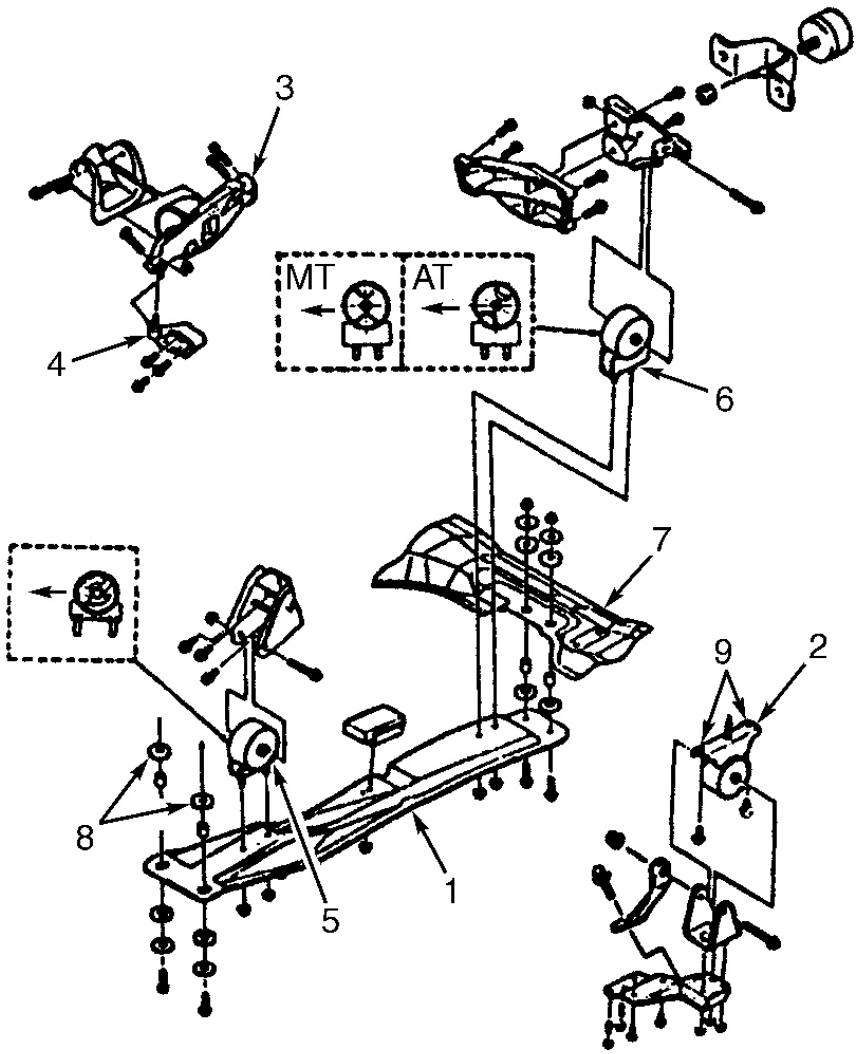
3. Mark and disconnect all wiring harness connectors from engine and transmission. Mark and remove fuel and vacuum hoses from engine. Remove coolant and heater hoses.
4. Remove engine undercovers. Disconnect exhaust pipe from exhaust manifold. Without disconnecting hoses, remove power steering pump and A/C compressor, and wire aside.
5. Remove axle shaft joints from transmission differential gear. Remove center bearing support.

NOTE: It is not necessary to remove axle shafts from steering knuckles if removing engine and transmission as a single unit.

6. Attach lifting device to engine. Remove mounting member from front member and suspension frame. See **Fig. 2**. Remove left and right engine mounts. Lower engine and transmission from vehicle.

Installation

Lift engine and transmission into engine compartment. Install left and right engine mounts. Install mounting member to front member and suspension frame. See **Fig. 2**. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. Remove lifting device. When installing axle shaft, push each axle shaft into differential so that snap ring engages with differential gear and center bearing support. To complete installation, reverse removal procedure. Refill cooling system, engine oil, and transmission with proper fluids.



1. Mounting Member
2. Left Mounting
3. Right Mounting
4. Right Mounting Bracket
5. Engine Front Torque Bush
6. Engine Rear Mounting
7. Suspension Frame
8. To Front Member
9. To Body

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Fig. 2: Exploded View Of Engine Mounting Frame
Courtesy of SUZUKI OF AMERICA

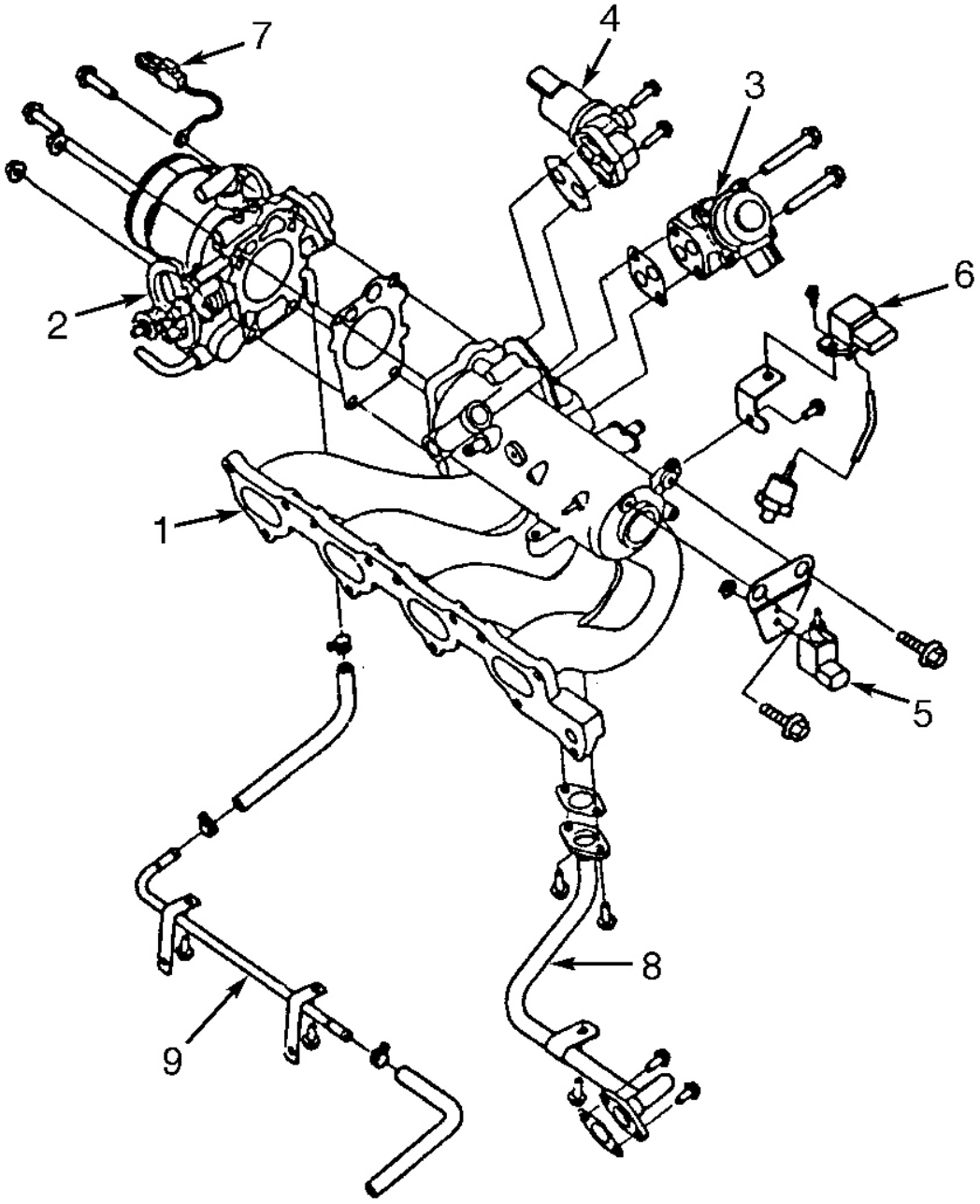
INTAKE MANIFOLD

Removal

1. Relieve fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect negative battery cable. Drain cooling system. Disconnect intake air temperature sensor. Remove air cleaner and intake and outlet hoses.
2. Disconnect accelerator cable. Label and disconnect all electrical connections from intake manifold, injectors and throttle body. Label and disconnect vacuum hoses from intake manifold.
3. Disconnect coolant pipe and hoses from intake manifold, throttle body and cylinder head. Remove fuel supply and return lines from fuel delivery pipe. Remove throttle body. Disconnect intake manifold front and rear stiffeners. See **Fig. 3**.
4. Remove EGR pipe. Remove intake manifold-to-cylinder head bolts. Remove intake manifold and gasket. Remove remaining components from intake manifold as required.

Installation

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



1. Intake Manifold
2. Throttle Body
3. EGR Valve
4. IAC Valve
5. EVAP Canister Purge Valve
6. MDP Sensor
7. Ground Terminal
8. EGR Pipe
9. Coolant Pipe

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Fig. 3: Exploded View Of Intake Manifold & Components
Courtesy of SUZUKI OF AMERICA CORP.

EXHAUST MANIFOLD

Removal

1. Disconnect negative battery cable. Disconnect oxygen sensor connector and remove from bracket. Remove exhaust manifold upper and lower covers. Remove oxygen sensor.
2. Remove right side engine undercover. Remove exhaust pipe-to-manifold bolts. Remove front and rear exhaust pipe stiffeners. Remove exhaust pipe from exhaust manifold. Remove air cleaner and intake/outlet hoses.
3. Detach power steering reservoir from inner fender. Disconnect A/C magnetic clutch and oxygen sensor connectors and detach wiring harness hold-down clamps. Support engine and remove right side engine mount and bracket. Remove exhaust manifold-to-cylinder head bolts. Remove exhaust manifold and gasket.

Installation

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

CYLINDER HEAD COVER

Removal & Installation

Disconnect negative battery cable. Remove ignition coil cover. Disconnect and remove ignition coils. Remove oil dipstick. Disconnect breather hose and PCV hose from cylinder head cover. Remove cylinder head cover. To install, reverse removal procedure. Apply sealant to cylinder head and cover. See **Fig. 4**.

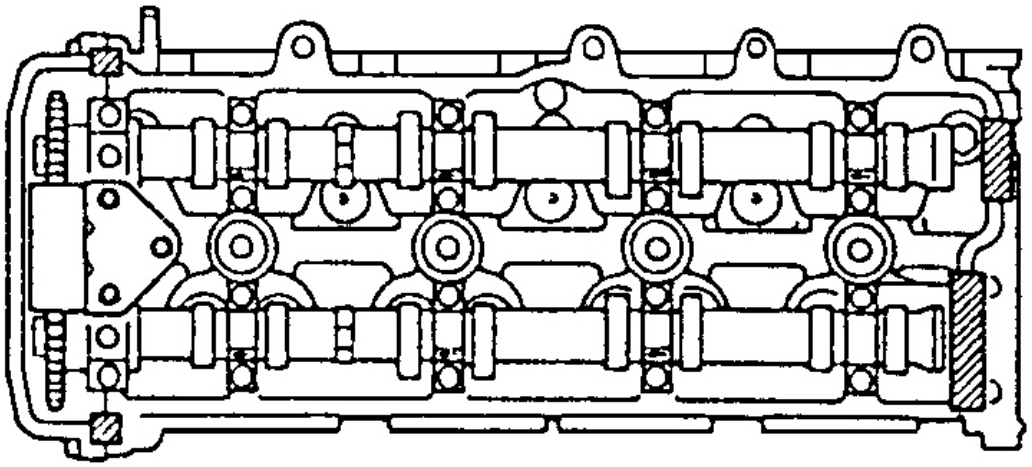

Fig. 4: Installing Cylinder Head Cover
Courtesy of SUZUKI OF AMERICA CORP.

CYLINDER HEAD

Removal

1. Relieve fuel pressure. See **FUEL PRESSURE RELEASE**. Disconnect negative battery cable. Drain cooling system and engine oil. Remove ignition coil cover. Remove air cleaner and intake and outlet hoses. Disconnect accelerator cable from throttle body and bracket. Label and remove all hoses, fuel lines and electrical connectors from cylinder head, intake manifold and exhaust manifold. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
2. Remove engine undercovers. Remove intake manifold rear stiffener. Disconnect coolant pipe from intake manifold. Remove timing chain cover. See **TIMING CHAIN COVER**. Remove first timing chain. See **1ST TIMING CHAIN & CHAIN TENSIONER**. Remove camshafts and valve lash adjusters. See **CAMSHAFTS & VALVE LASH ADJUSTERS**.
3. Disconnect exhaust pipe from exhaust manifold and remove stiffeners. Remove right side engine mount and bracket. Remove power steering pump and generator from power steering pump bracket. Remove power steering pump bracket. Loosen cylinder head bolts in sequence. Remove 6-mm bolt. See **Fig. 5**. Remove cylinder head with intake and exhaust manifolds attached.

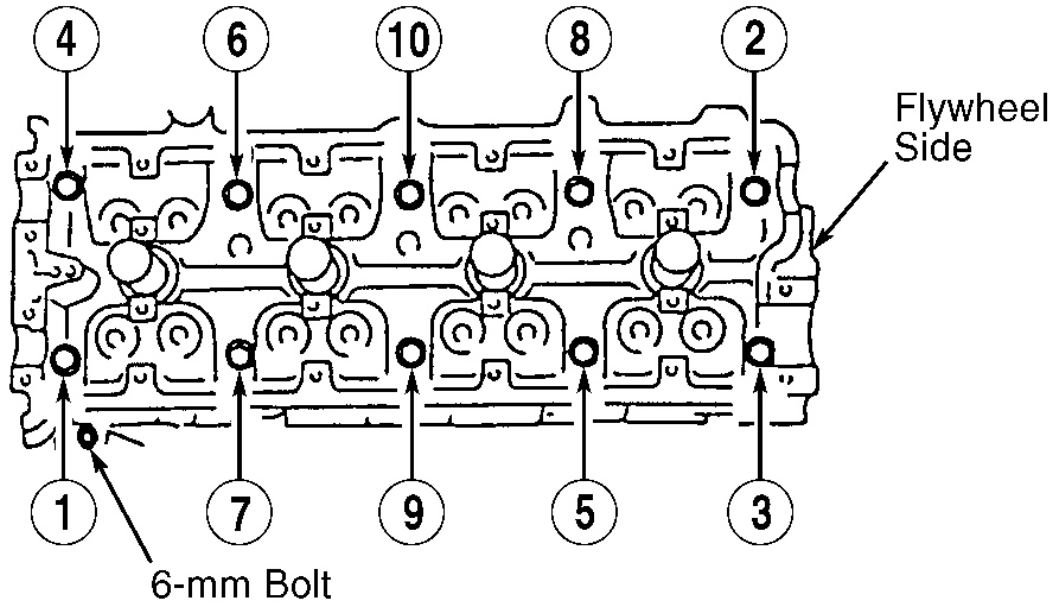

Fig. 5: Cylinder Head Bolt Removal Sequence
Courtesy of SUZUKI OF AMERICA CORP.

Inspection

1. Check cylinder head for evidence of water leakage or damage. Clean carbon from combustion chambers. Check cylinder head for cracks in intake and exhaust ports, combustion chambers and head surface.
2. Check for head warpage. 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 surfaces on cylinder head for warpage. Warpage limit for manifold seating surfaces is .004" (.10 mm). If warpage exceeds specification, machine or replace cylinder head.

Installation

1. To install, reverse removal procedure. Use NEW cylinder head and manifold gaskets. Tighten cylinder head bolts to 39 ft. lbs (53 N.m) in proper sequence. See **Fig. 6**.
2. Tighten cylinder head bolts to 61 ft. lbs (83 N.m) in proper sequence. Loosen all bolts in sequence, until torque is reduced to zero. See **Fig. 5**.
3. Retighten cylinder head bolts to 27 ft. lbs. (37 N.m) using proper sequence. See **Fig. 6**. Finish tightening cylinder head bolts to 76 ft. lbs. (103 N.m). Tighten 6-mm bolt on side of cylinder head to 97 INCH lbs. (11 N.m). To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

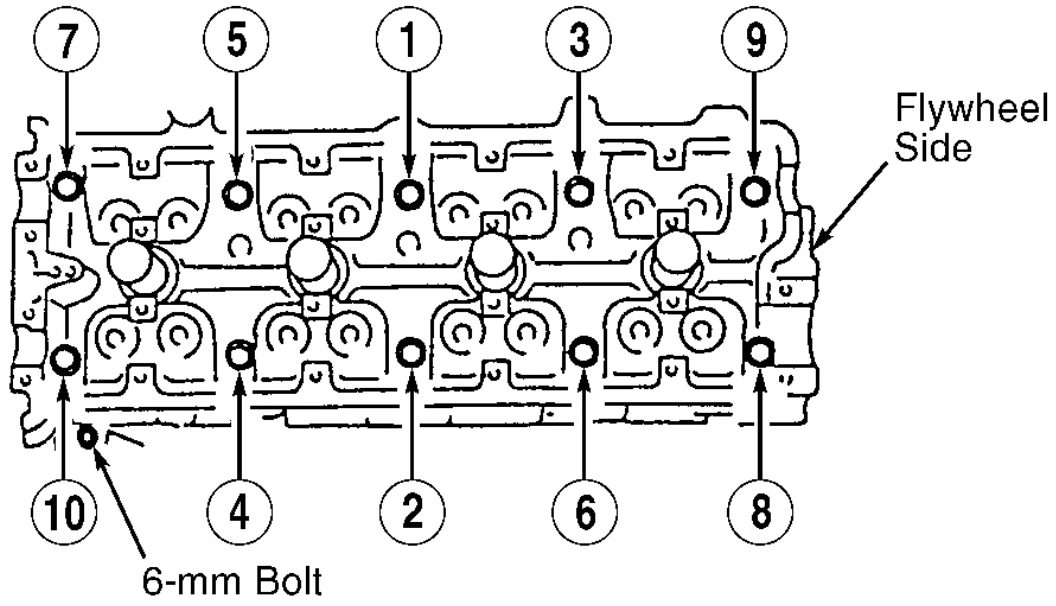

Fig. 6: Cylinder Head Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

TIMING CHAIN COVER

Removal

1. Disconnect negative battery cable. Drain engine oil and coolant. Remove air cleaner and intake and outlet hoses. Remove radiator hoses. Remove radiator cooling fan. Remove right side engine undercover. Remove generator belt.
2. Remove crankshaft pulley bolt. Using Puller (09944-36011) and Attachment (09926-58010) remove crankshaft pulley. Remove oil pan and oil pump screen. See **OIL PAN**. With lifting device, support engine. Remove engine front torque bushing, rear engine mount and rear mounting bracket. See **Fig. 2**
3. Without disconnecting refrigerant lines, remove A/C compressor and bracket, and suspend aside. Remove power steering fluid reservoir from inner fender and suspend aside. Disconnect oxygen sensor. Remove right side engine mount. With lifting device, raise engine to allow removal of water pump pulley, generator belt idler pulley, generator belt tensioner and timing chain cover.
4. Remove cylinder head cover. See **CYLINDER HEAD COVER**. Remove timing chain cover bolts and nut and remove timing chain cover.

Installation

To install, reverse removal procedure. Drive in NEW oil seal until flush with cover. Apply sealant to mating surface along edge of engine block and at cylinder block-to-cylinder head mating surfaces. Tighten bolts to

specification. See **TORQUE SPECIFICATIONS**.

2ND TIMING CHAIN & CHAIN TENSIONER

Removal

1. Disconnect negative battery cable. Drain engine oil and coolant. Remove oil pan and oil pump screen. See **OIL PAN**. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
2. Remove timing chain cover. See **TIMING CHAIN COVER**. Align sprocket timing marks with timing marks on block. See **Fig. 7**. Ensure key on crankshaft sprocket is pointing up.
3. Remove timing chain No. 2 tensioner adjuster by turning intake camshaft slightly counterclockwise while pushing back chain tensioner shoe. Remove intake and exhaust camshaft sprocket bolts. Remove camshaft sprockets and 2nd timing chain.

CAUTION: DO NOT turn camshafts more than 15 degrees, or crankshaft more than 90 degrees in either direction from aligned position after timing chain is removed. Doing so could damage pistons and/or valves.

Installation

1. Install camshaft sprockets, and align all sprocket timing marks with timing marks on block. See **Fig. 7**. Ensure key on crankshaft sprocket is pointing up, arrow on idler sprocket points up, and camshaft knock-pins are aligned with marks on cylinder head.
2. Install 2nd timing chain by aligning Yellow link on timing chain with arrow on idler sprocket. Align Dark Blue links on 2nd timing chain with marks on camshaft sprockets.
3. Push tensioner plunger back into tensioner body, and insert a push pin into timing chain tensioner to ensure plunger does not come out. Install timing chain tensioner with gasket and tighten to specification. See **TORQUE SPECIFICATIONS**.
4. Remove push pin from timing chain tensioner. Turn crankshaft clockwise 2 rotations, then align timing marks. Ensure timing marks are aligned. Apply oil to timing chains, tensioners, sprockets, and guides. To complete installation, reverse removal procedure.

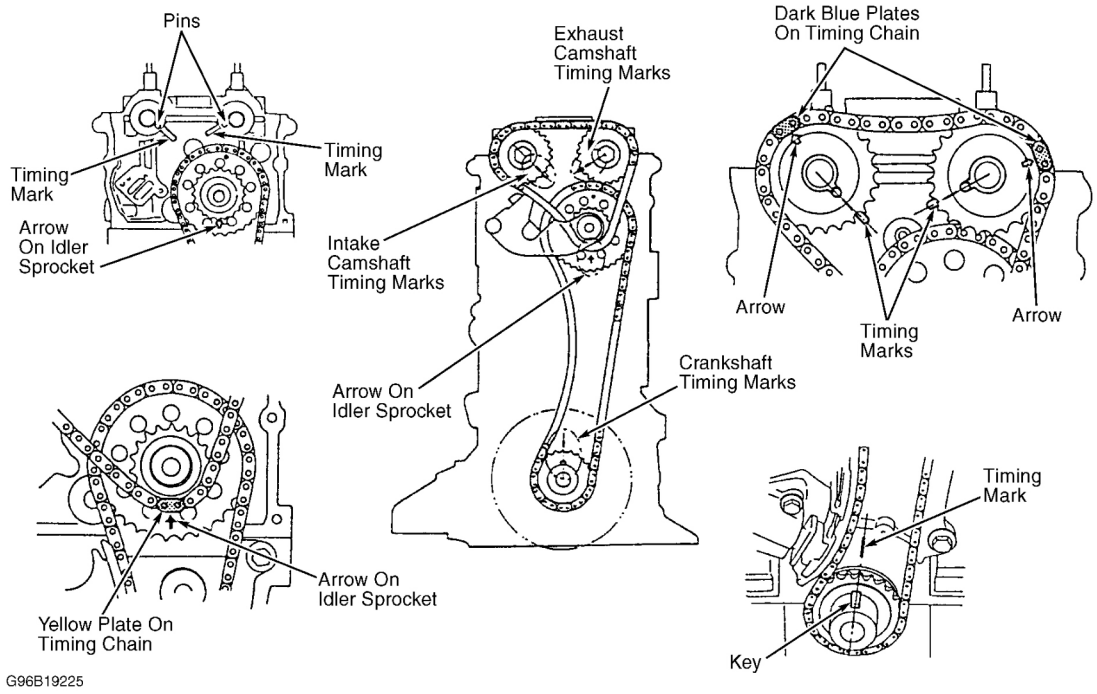

Fig. 7: Aligning 2nd Timing Chain & Sprockets
Courtesy of SUZUKI OF AMERICA CORP.

1ST TIMING CHAIN & CHAIN TENSIONER

Removal

1. Disconnect negative battery cable. Drain engine oil and coolant. Remove oil pan and oil pump screen. See **OIL PAN**. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
2. Remove timing chain cover. See **TIMING CHAIN COVER**. Align timing marks. See **Fig. 8**. Ensure key on crankshaft sprocket is pointing up.
3. Remove 2nd timing chain and chain tensioner. See **2ND TIMING CHAIN & CHAIN TENSIONER**. Remove 1st timing chain guide, timing chain tensioner adjuster, and timing chain tensioner. Remove idler sprocket and 1st timing chain. Remove crankshaft sprocket.

Installation

1. Install crankshaft sprocket, ensuring key on crankshaft is pointing up. See **Fig. 8**. Apply oil to idler sprocket shaft and bushing and install idler sprocket. Install first timing chain by aligning Dark Blue link on timing chain with mark on idler sprocket.
2. Align Yellow link on timing chain with mark on crankshaft sprocket. Install timing chain No. 1 tensioner. While holding release latch on tensioner adjuster, press plunger back into tensioner adjuster body, and insert a push pin to hold latch in place.
3. Install timing chain No. 1 tensioner adjuster, and tighten to specification. See **TORQUE SPECIFICATIONS**. Remove push pin from tensioner adjuster latch. Install timing chain guide. Ensure

Dark Blue link and Yellow link on timing chain are aligned with respective timing marks. To complete installation, reverse removal procedure.

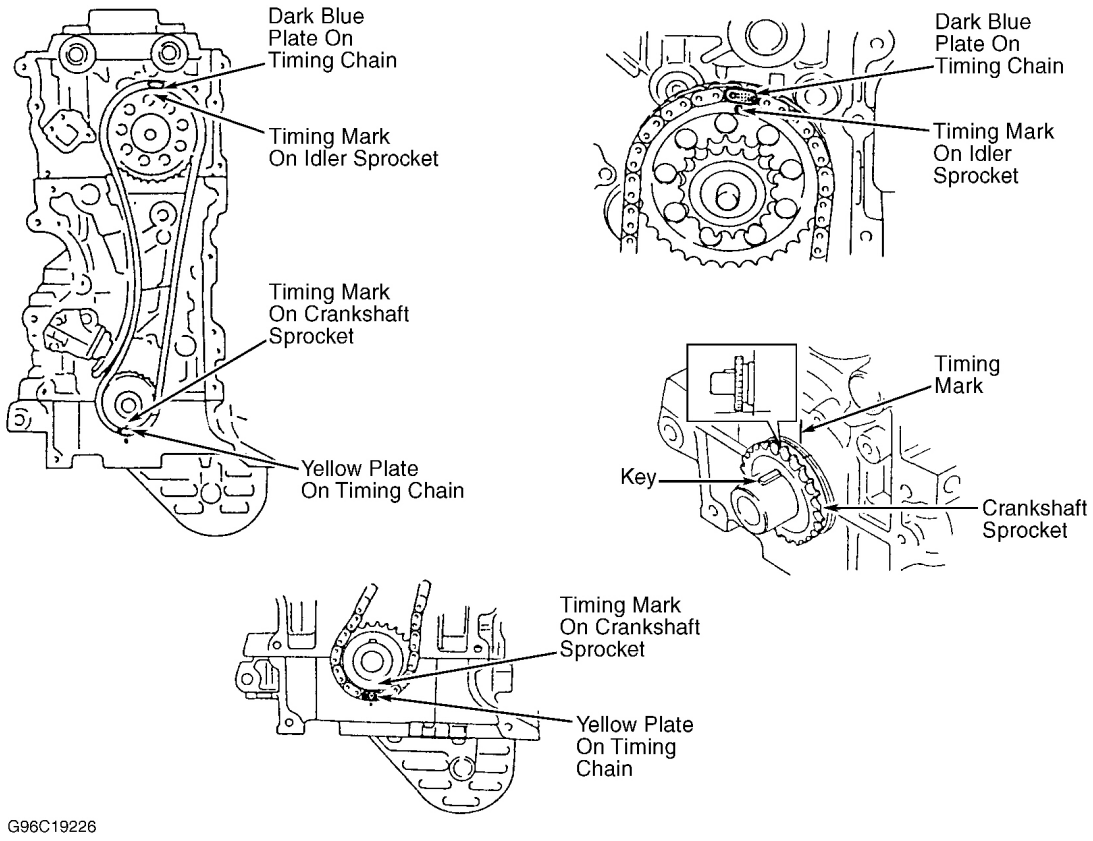

Fig. 8: Aligning 1st Timing Chain & Sprockets
Courtesy of SUZUKI OF AMERICA CORP.

CAMSHAFT & VALVE LASH ADJUSTERS

Removal

1. Disconnect negative battery cable. Drain engine oil and coolant. Remove oil pan and oil pump screen. See **OIL PAN**. Remove cylinder head cover. See **CYLINDER HEAD COVER**.
2. Remove timing chain cover. See **TIMING CHAIN COVER**. Align timing marks. Remove 2nd timing chain and chain tensioner. See **2ND TIMING CHAIN & CHAIN TENSIONER**. Remove camshaft position sensor from end of camshaft.
3. To secure work for the following steps, reinstall frame mounting member, front torque bushing, rear engine mount and mounting bracket. Turn crankshaft clockwise 90 degrees so crankshaft key is pointing to 3 o'clock position.
4. Note position of camshaft bearing caps. Remove camshaft bearing cap bolts in reverse order of tightening sequence. See **Fig. 10**. Remove camshaft bearing caps and camshafts.
5. Remove valve lash adjusters. Completely immerse valve lash adjusters in clean engine oil to keep them

from collapsing. DO NOT apply force to body of adjuster. DO NOT place adjuster on its side or with bucket body facing up.

Installation

1. Fill valve lash adjuster pockets on cylinder head with clean engine oil. Ensure oil comes out of oil passages. Install valve lash adjusters into cylinder head.
2. Ensure key on crankshaft sprocket is pointing up and aligned with timing mark. Lubricate camshafts and install, ensuring knock out pins align with timing marks. See **Fig. 7**.
3. Apply sealant to exhaust camshaft rear bearing cap sealing surface. See **Fig. 9**. Check position of camshaft bearing caps and install. Bearing caps are marked with an "I" for intake camshaft and "E" for exhaust. Ensure arrow on caps point toward timing chain.
4. Lubricate camshaft bearing cap bolts and gradually tighten 2 or 3 times in sequence until specified torque is reached. See **Fig. 10** and **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure.

CAUTION: DO NOT turn camshafts or start engine for at least 30 minutes after installing valve lash adjusters and camshafts. Operating engine within 30 minutes may cause valve and/or piston damage.

NOTE: If air is trapped in valve lash adjuster, valve may make a tapping sound when engine is operated. To correct this condition, run engine for 30 minutes at 2000 RPM to purge air from valve lash adjuster. If condition is not corrected, replace defective valve lash adjuster(s).

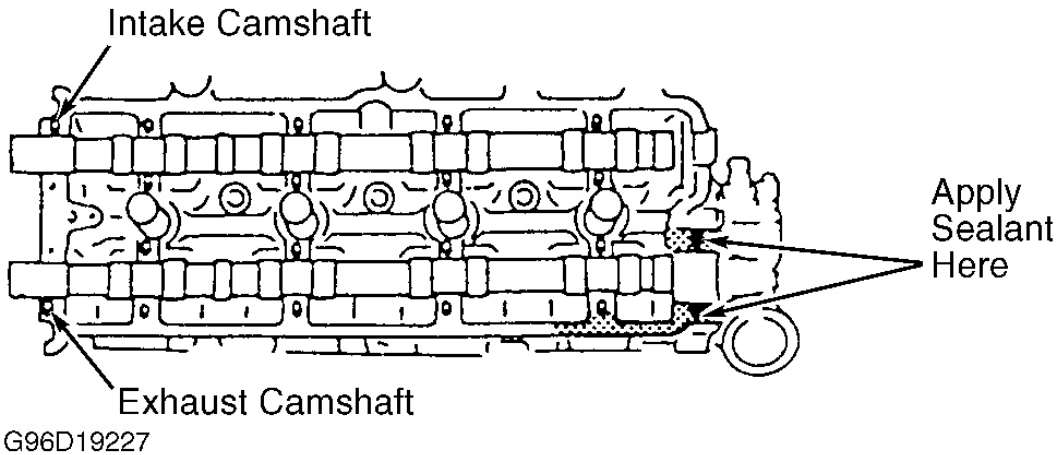

Fig. 9: Exhaust Camshaft Bearing Cap Sealing Surface
Courtesy of SUZUKI OF AMERICA CORP.

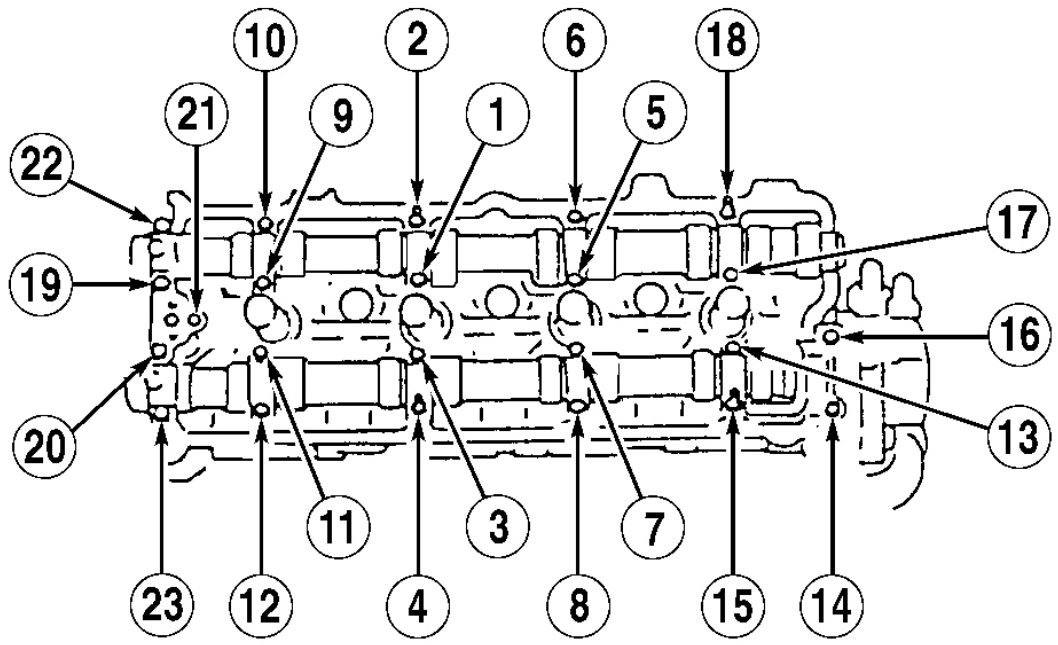

Fig. 10: Camshaft Bearing Cap Bolt Tightening Sequence
Courtesy of SUZUKI OF AMERICA CORP.

WATER PUMP

Removal

1. Disconnect negative battery cable. Drain cooling system. Remove radiator hose from thermostat housing. Remove heater outlet pipe bolt. Remove drive belts.
2. Remove radiator and cooling fan. Remove water pump pulley. Remove A/C compressor from bracket leaving hoses attached. Remove and discard 4 water pump attaching bolts. Remove water pump. DO NOT lose dowel pin when removing pump.

Installation

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

NOTE: For further information on cooling systems, see SPECIFICATIONS and ELECTRIC COOLING FANS articles in ENGINE COOLING.

OIL PAN

Removal

1. Remove oil dipstick. Raise and support vehicle. Drain engine oil. Remove engine under covers. Remove exhaust pipe from manifold. Attach lifting device and support engine. Remove frame mounting member. Remove flywheel lower cover.
2. Remove oil pan bolts and lower oil pan from vehicle. Remove oil pump screen.

Installation

Apply continuous bead of sealant to oil pan and install. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure.

OVERHAUL

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

CYLINDER HEAD

Disassembly

1. Remove cylinder head. See **CYLINDER HEAD** under REMOVAL & INSTALLATION. Remove fuel injectors. Remove intake and exhaust manifolds. Remove thermostat housing. Remove camshafts. See **CAMSHAFT & VALVE LASH ADJUSTERS** under REMOVAL & INSTALLATION.
2. Using Valve Spring Compressor (09916-14510) and Valve Lifter Attachment (09916-14910), compress valve springs and use tweezers to remove valve keepers. See **Fig. 11**. Remove valve spring retainers, springs, spring seats, valves and valve seals. Keep all components in order for reassembly reference.

Reassembly

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

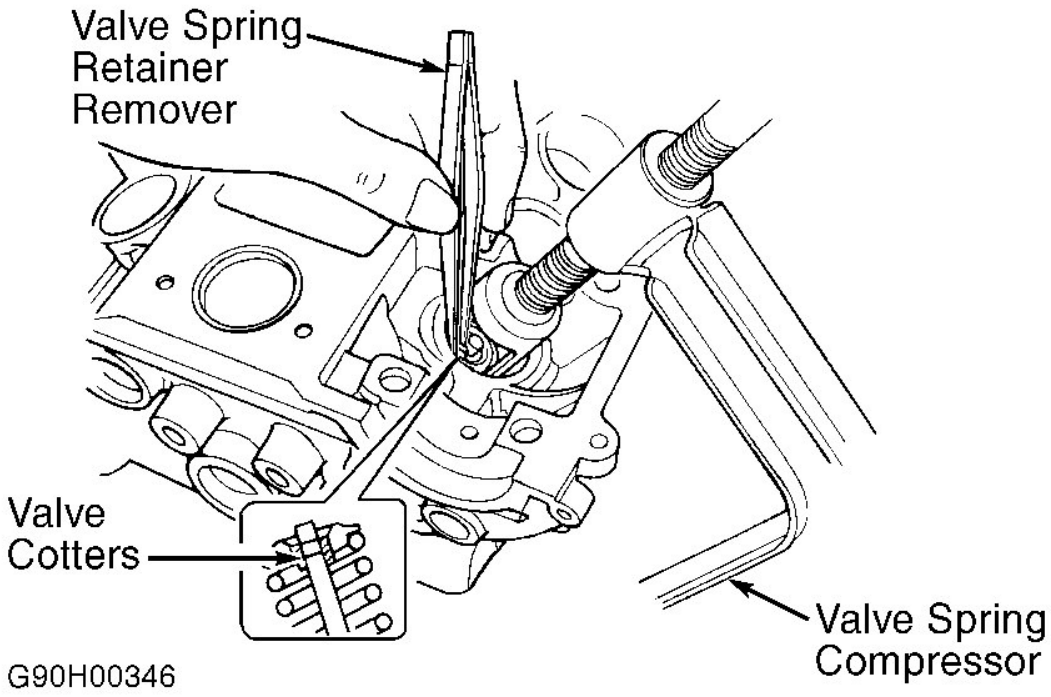

Fig. 11: Removing Valve Keepers
Courtesy of SUZUKI OF AMERICA CORP.

Valve Springs

Check valve springs for damage. Use a square, flat surface plate to check spring squareness. Using a valve spring tester, check valve spring preload pressure. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS. Replace any weak or out-of-square springs.

Valve Stem Oil Seals

Use Handle (09916-58210) and Valve Stem Seal Installer (09917-98221) to install valve stem seals. Place new lubricated valve stem seal on valve stem seal installer and press seal onto 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** table under ENGINE SPECIFICATIONS.
2. Use Valve Guide Remover (09916-44910) to drive out old guide. Ream guide bore in cylinder head with 11-mm Reamer (09916-38210) and Handle (09916-34542). Heat cylinder head to 176-212°F (80-100°C).
3. Using Valve Guide Installer (09917-87810) and Handle (09916-58210), drive in new oversize valve guide until valve guide installer contacts cylinder head.

4. Check valve guide installed height. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS. Ream NEW valve guide with 6-mm Reamer (09916-37810) and Handle (09916-34542). Clean valve guide bore after reaming.

Valve Seats

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

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. Valve stem end may be resurfaced if not too much material is removed from valve length. Measure valve length. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1. Remove cylinder head. See **CYLINDER HEAD** under REMOVAL & INSTALLATION. Remove oil pump. See **OIL PUMP** under ENGINE OILING.
2. Ensure pistons, connecting rods and rod caps are marked for reassembly reference. Clean carbon from top of cylinder bores. Remove connecting rod caps. Install protective hose over connecting rod studs.
3. Push connecting rod and piston assembly out through top of cylinder block. Remove piston rings. Remove wrist-pin circlips and push piston wrist-pin out by hand.
4. Check piston wrist pin-to-bore fit. Wrist pin should push into piston smoothly by hand, at room temperature. When assembling, apply engine oil to outside of wrist pin and to wrist pin bore. Install piston wrist pin with opening in circlips facing down.

Fitting Pistons

1. Check cylinder bore for damage, wear and taper. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS to determine if block must be rebored.
2. Standard pistons are identified by numerical marks ("1" or "2") stamped on piston crown. Cylinder bore diameters are indicated by colored marks (Red or Blue) on cylinder block. See **Fig. 12**. To check outside diameter of piston, measure piston at a point 1.04" (26.4 mm) from bottom of skirt and at 90 degrees to pin bore.
3. Pistons are available in .0098" (.25 mm) and .0196" (.50 mm) oversizes. Select oversize piston according to cylinder wear. See **PISTONS, PINS & RINGS** table under ENGINE SPECIFICATIONS.
4. When installing piston into cylinder, ensure piston numerical mark corresponds with cylinder bore colored mark to provide correct piston-to-cylinder clearance. See **Fig. 12**. See **CYLINDER BLOCK**

table under ENGINE SPECIFICATIONS.

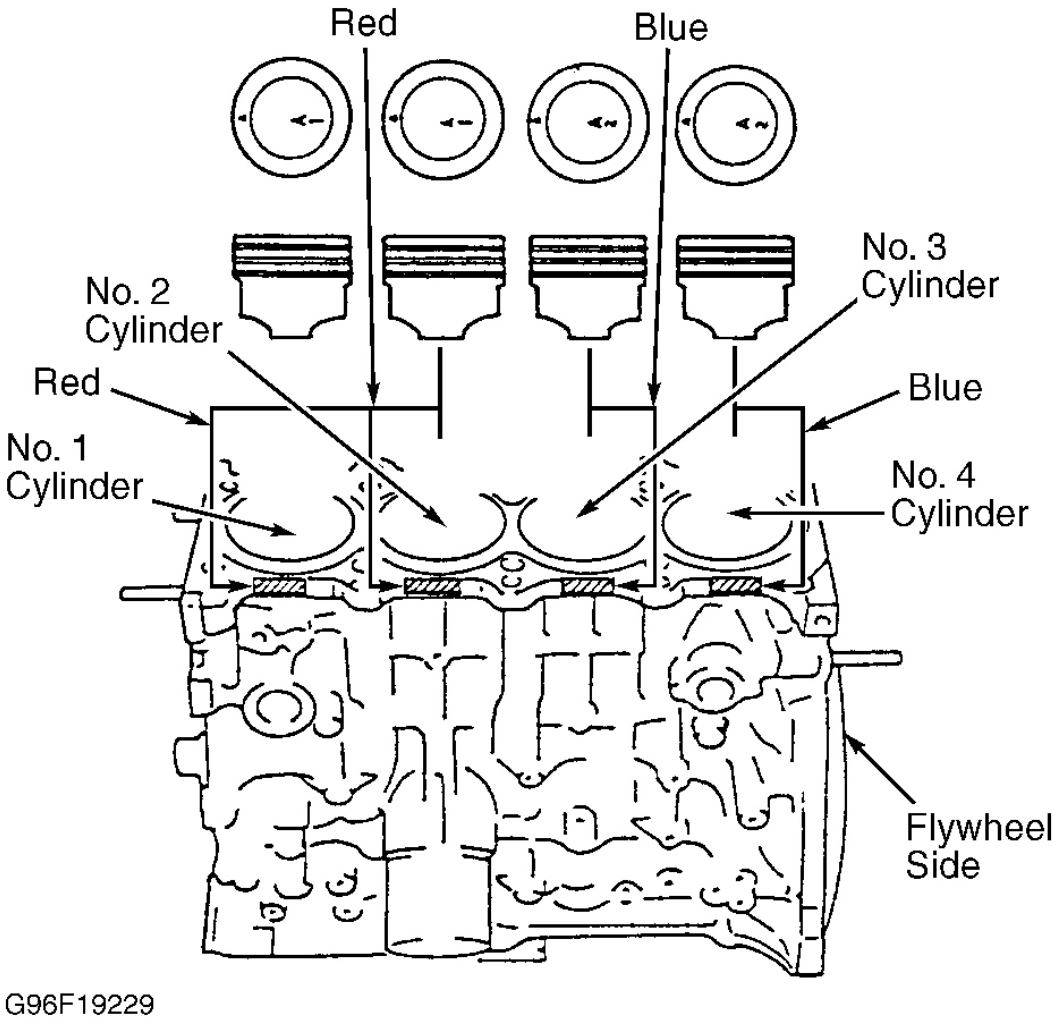

Fig. 12: Matching Pistons To Cylinders
Courtesy of SUZUKI OF AMERICA CORP.

Piston Rings

1. Install rings with "R" or "RN" mark facing up. Install oil ring spacer. Install rails, and position piston ring gaps 45 degrees apart. Lubricate all internal surfaces with engine oil before installation.
2. Ensure arrow on top of piston points to front of engine and that the "77E" mark on connecting rod faces front of engine. Using a ring compressor, install piston and rod assemblies.

Rod Bearings

1. Inspect crankshaft journals for wear, taper and out-of-round condition. If specifications are exceeded, use

undersize bearings, grind journals to undersize or replace crankshaft. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

2. Inspect rod bearing shells for signs of fusion, pitting, burning or flaking. Standard bearings are unmarked. Undersized bearings have a Red mark painted on edge of bearing. Undersize bearing thickness is .0632-.0635" (1.605-1.613 mm) at center of bearing. Check rod bearing clearance using Plastigage. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
3. Check connecting rod side clearance. Standard connecting rod side play is .010-.015" (.25-.38 mm), with a service limit of .0177" (.45 mm).

Crankshaft & Main Bearings

1. Loosen crankshaft lower crankcase bolts in proper sequence and remove crankshaft. See **Fig. 16**. Inspect journals for wear, taper and out-of-round condition. Use Plastigage to check bearing clearance. If specifications are exceeded, use undersize bearings, grind crankshaft journals to undersize or replace crankshaft. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.
2. Standard and undersize main bearings are available in 5 different sizes and are color-coded to indicate size. See **UNDERSIZE BEARINGS**. See **COLOR CODE FOR STANDARD MAIN BEARINGS** table. Upper bearing half has an oil groove and must be installed to cylinder block. Lower bearing half without oil groove is installed to lower crankcase housing. Bearing No. 1 is at crankshaft pulley end of engine. Bearing No. 5 is at flywheel end of engine.
3. Main bearing journal diameter is indicated by numerical marks ("1", "2" or "3") stamped on crankshaft web No. 2. See **Fig. 13**. The numerical marks on crankshaft web No. 2 read left to right, and indicate journal diameters of bearings No. 1, 2, 3, 4 and 5. See **CRANKSHAFT MAIN BEARING JOURNAL DIAMETERS** table.
4. Main bearing bore diameter, with bearing removed, is indicated by letters ("A", "B" or "C") stamped on corresponding bearing bore on lower crankcase housing. See **Fig. 14**. See **MAIN BEARING BORE DIAMETERS** table.
5. Determine NEW standard bearing by using numerical marks on crankshaft webs and letters stamped on lower crankcase mating surface. See **STANDARD MAIN BEARING APPLICATIONS** table.
6. Fit main bearings with oil groove into cylinder block, and bearings without oil grove into lower crankcase housing. Coat bearings with oil, and place crankshaft in cylinder block. Install NEW "O" ring to cylinder block, and apply sealant to lower crankcase mating surface as shown in illustration. See **Fig. 15**. Install lower crankcase housing to cylinder block and tighten bolts to specification and in sequence. See **Fig. 17**.

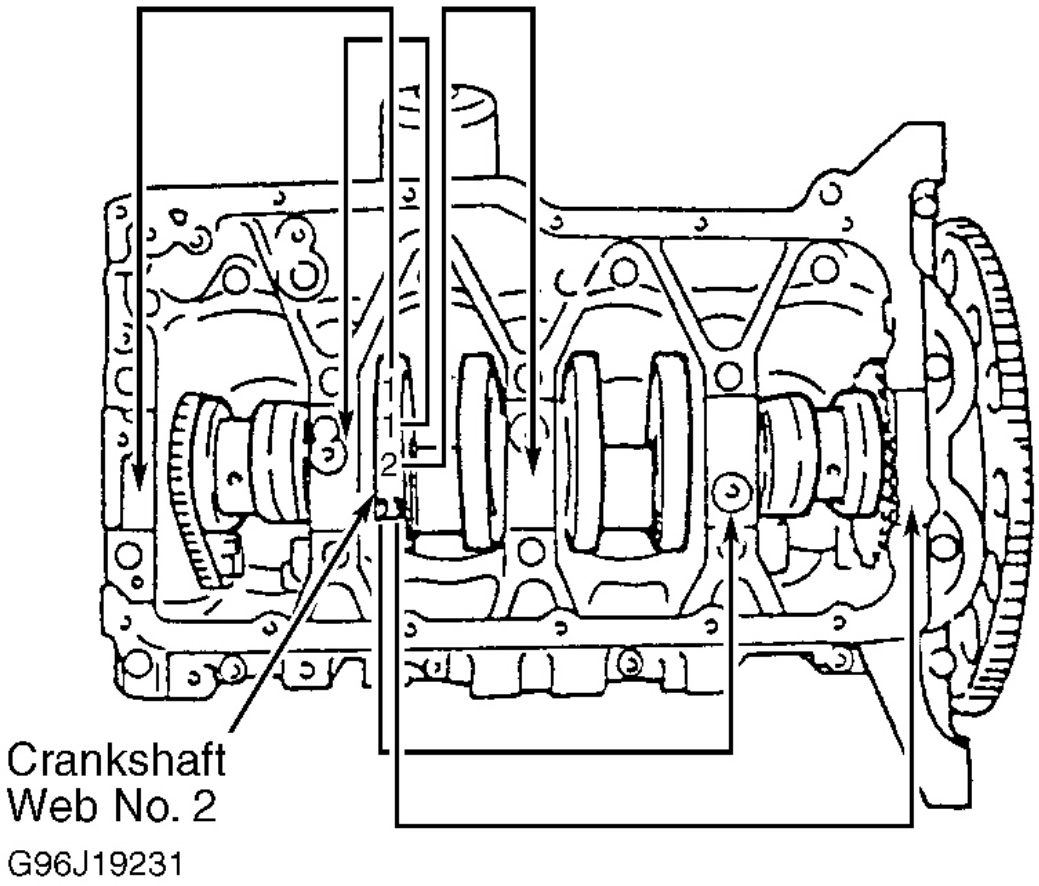

Fig. 13: Locating Main Bearing Journal Diameter On Crankshaft Web No. 2
Courtesy of SUZUKI OF AMERICA CORP.

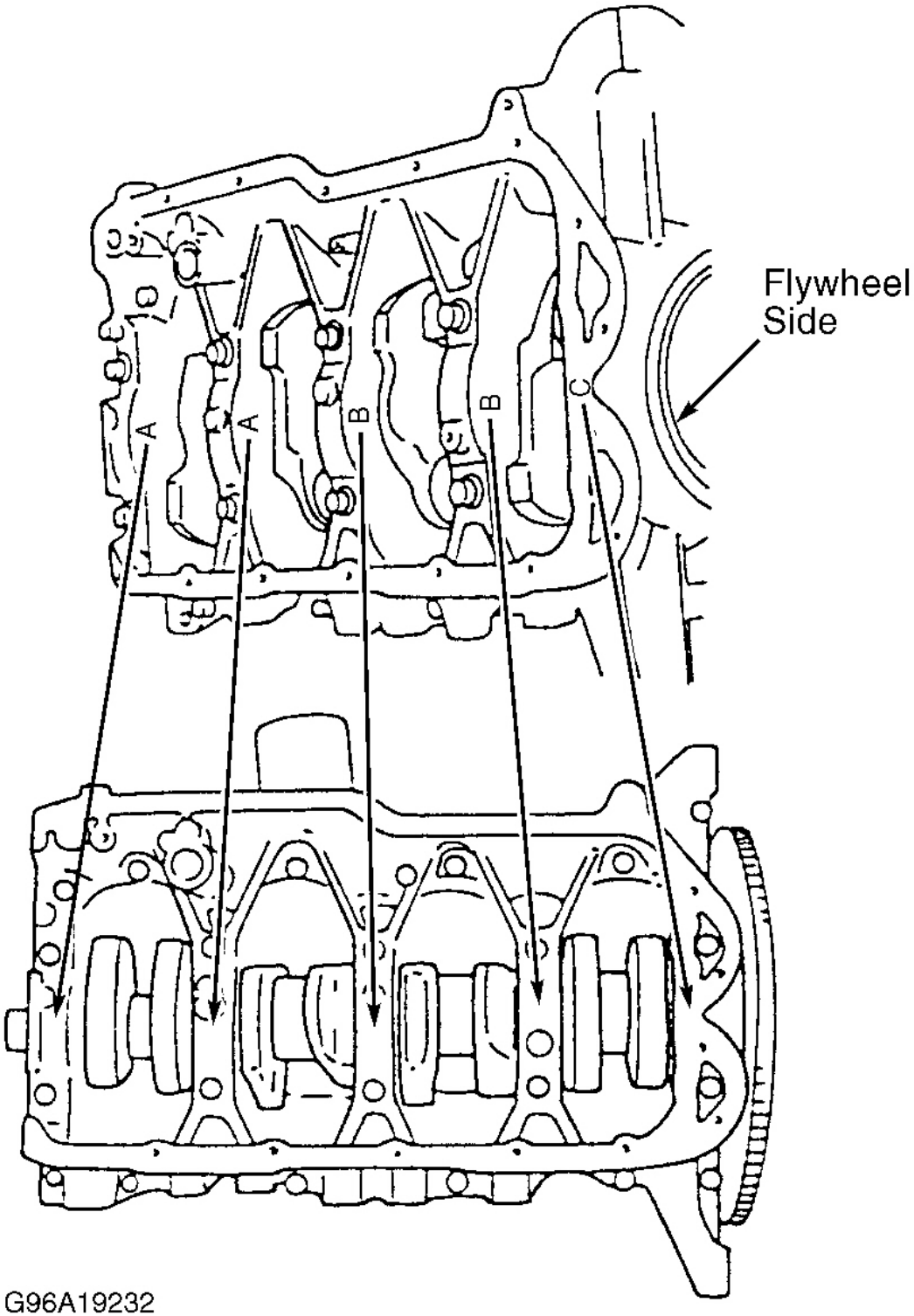

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Fig. 14: Locating Main Bearing Bore Diameter Letters Stamped On Lower Crankcase Housing
Courtesy of SUZUKI OF AMERICA CORP.

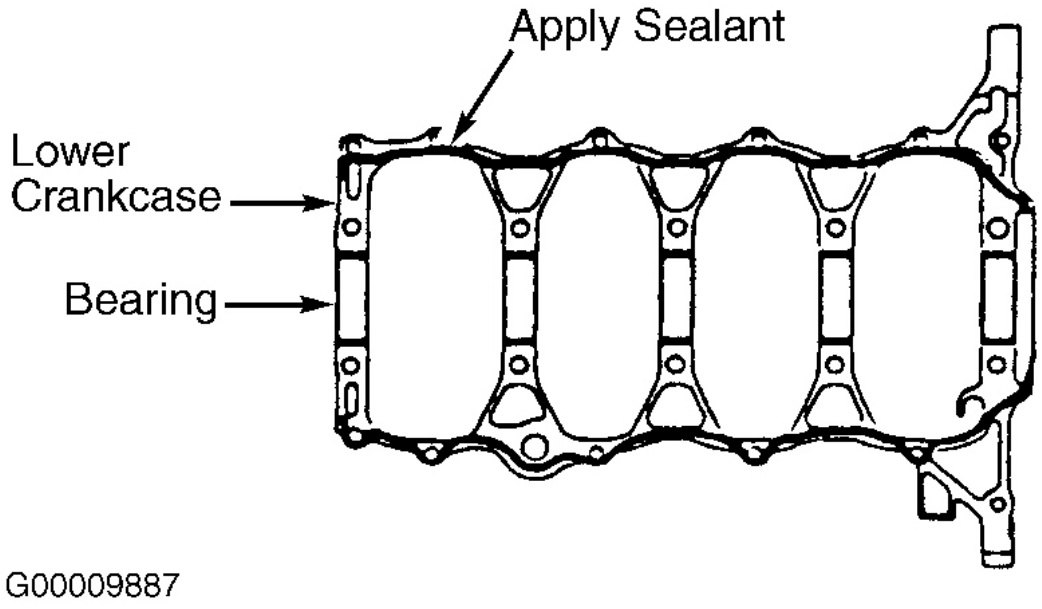

Fig. 15: Identifying Lower Crankcase Sealant Application Areas
Courtesy of SUZUKI OF AMERICA CORP.

CRANKSHAFT MAIN BEARING JOURNAL DIAMETERS

Numbers Stamped On Web No. 2	In. (mm)
"1"	2.2832-2.2834 (57.993-57.998)
"2"	2.2830-2.2832 (57.988-57.993)
"3"	2.2828-2.2829 (57.983-57.986)

MAIN BEARING BORE DIAMETERS

Letters Stamped On Block	In. (mm)
"A"	2.4409-2.4411 (62.000-62.004)
"B"	2.4412-2.4414 (62.006-62.012)
"C"	2.4414-2.4416 (62.012-62.017)

COLOR CODE FOR STANDARD MAIN BEARINGS

Paint Color	Thickness - In. (mm)
Green	.0783-.0785 (1.989-1.994)
Black	.0785-.0786 (1.994-1.996)
No Paint	.0786-.0787 (1.996-2.000)

Yellow	.0787-.0789 (2.000-2.004)
Blue	.0788-.0790 (2.002-2.007)

STANDARD MAIN BEARING APPLICATIONS

Letter Stamped On Lower Crankcase Housing (Cap Bore Diameter)	Number Stamped On Crank Web No.2 (Journal Diameter)	Standard Bearing Color to Use
"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

COLOR CODE FOR UNDERSIZE MAIN BEARINGS

Paint Color	Thickness - In. (mm)
Green & Red	.0833-.0834 (2.115-2.118)
Black & Red	.0834-.0835 (2.118-2.121)
Red Only	.0835-.0837 (2.121-2.126)
Yellow & Red	.0836-.0838 (2.123-2.129)
Blue & Red	.0837-.0839 (2.126-2.131)

UNDERSIZE MAIN BEARING APPLICATIONS

Letter Stamped on Lower Crankcase	2.2734-2.2736" (57.744-57.749 mm) Journal Diameter Bearing Color	2.2731-2.2733" (57.737-57.742 mm) Journal Diameter Bearing Color	2.2729-2.2731" (57.732-57.737 mm) Journal Diameter Bearing Color
"A"	Green & Red	Black & Red	Red Only
"B"	Black & Red	Red Only	Yellow & Red
"C"	Red Only	Yellow & Red	`Blue & Red

Undersize Bearings

1. Undersize main bearings are available in 5 different sizes and are color coded to indicate size. See **COLOR CODE FOR UNDERSIZE BEARINGS** table.
2. If regrinding crankshaft is necessary, ensure finished journal diameter is within a range of 2.2729-2.2736" (57.732-57.749 mm). Using micrometer, measure re-ground journal diameter. Using journal diameter and letters stamped on lower crankcase housing, select undersize bearing. See **UNDERSIZE MAIN BEARING APPLICATIONS** table. Use Plastigage to ensure correct clearance of installed undersize bearing.

Thrust Bearing

1. With lower crankcase housing installed, check crankshaft thrust clearance (end play) using a dial indicator.
2. Standard thrust bearing thickness is .984" (2.50 mm). Oversize thrust bearing thickness is .1009" (2.563 mm). If clearance exceeds specification, replace thrust bearing. See **CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS** table under ENGINE SPECIFICATIONS.

Cylinder Block

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

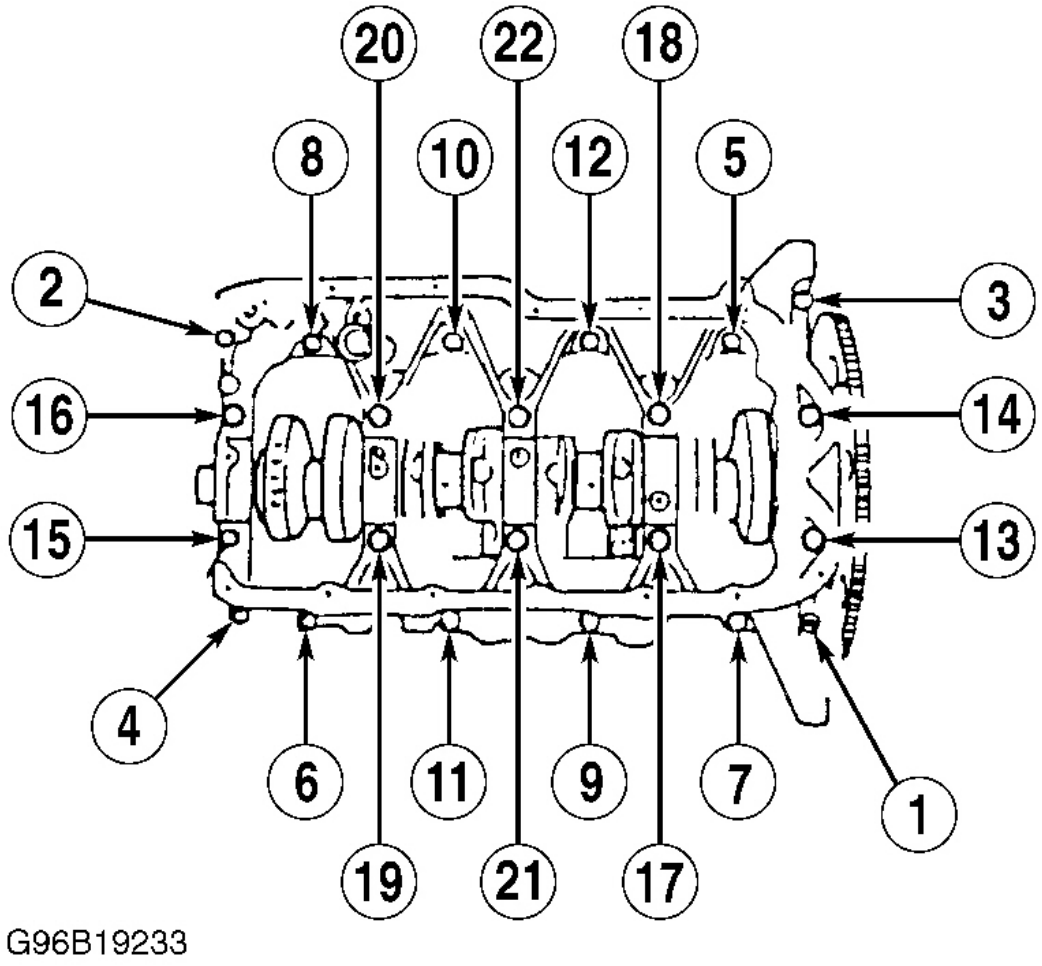

Fig. 16: Loosening Crankshaft Bearing Bolts
Courtesy of SUZUKI OF AMERICA CORP.

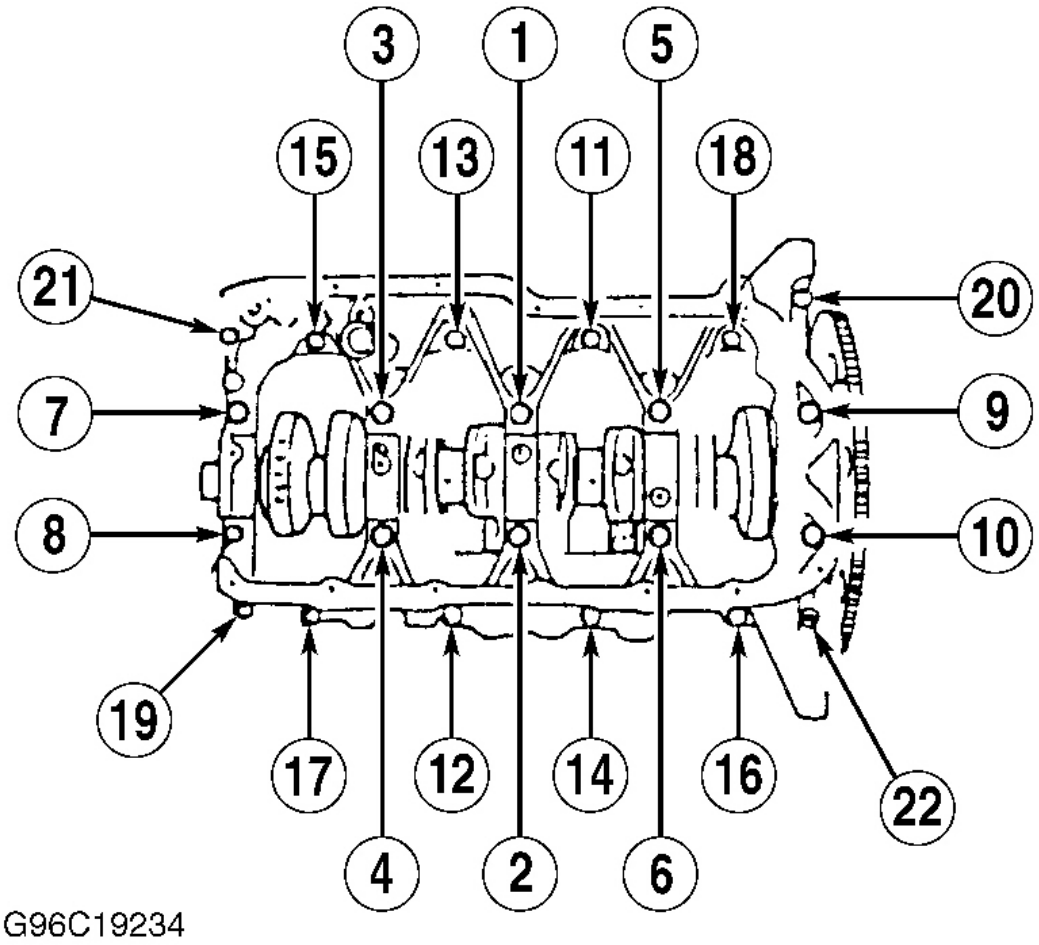

Fig. 17: Tightening Crankshaft Bearing Bolts
Courtesy of SUZUKI OF AMERICA CORP.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

A force-feed type lubrication system is used. The oil pump is a trochoid-type pump mounted on forward portion of crankshaft. Oil is drawn up through oil screen, passed through oil pump, and then oil filter. See **Fig. 18**. The filtered oil flows through 2 passages in cylinder block. One passage supplies oil to crankshaft and pistons, and the other passage supplies oil to cylinder head, valves and camshafts.

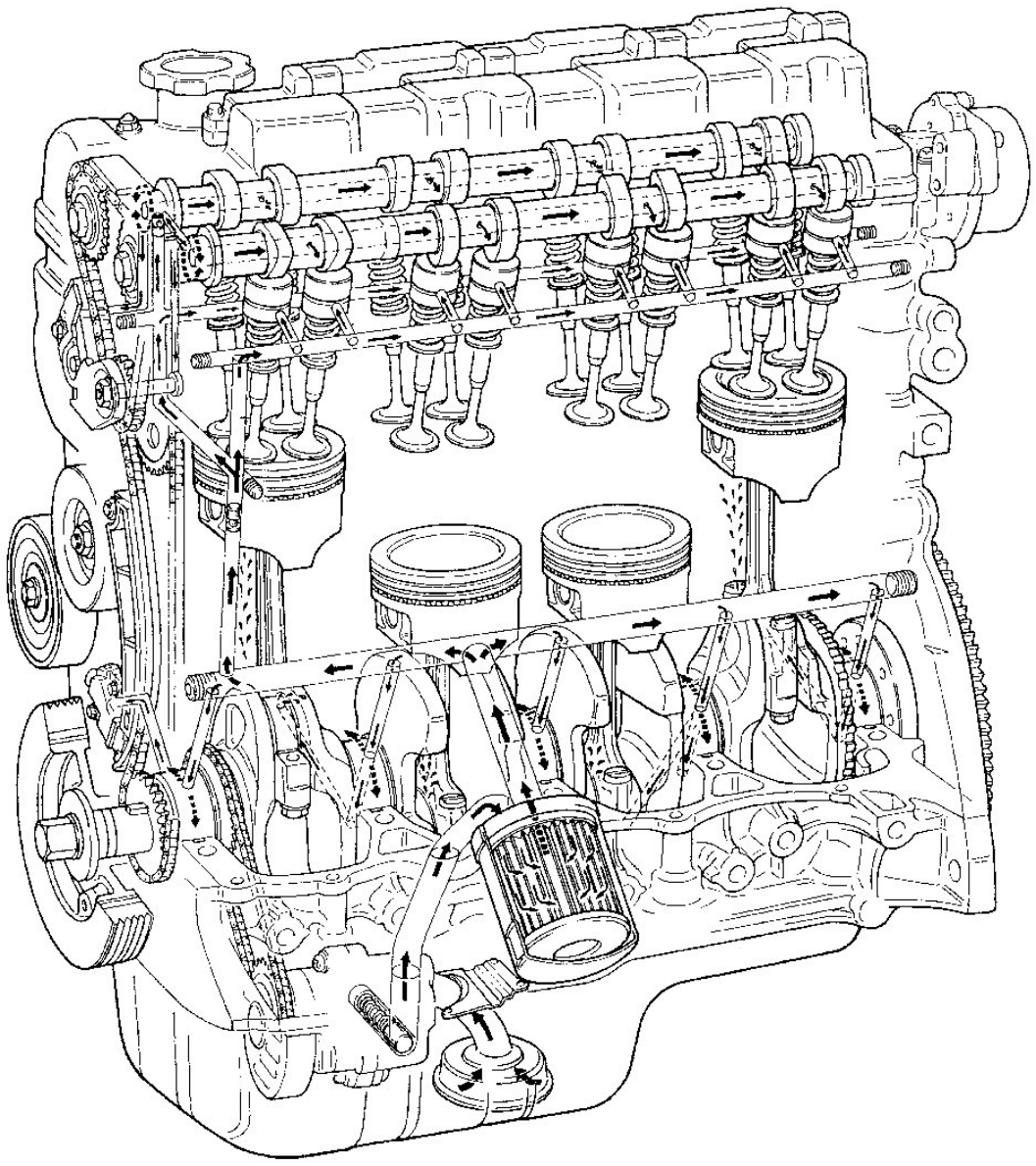

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Fig. 18: Cross Sectional View Of 1.8L Engine Oiling System
Courtesy of SUZUKI MOTOR CORPORATION

Crankcase Capacity

Total oil capacity, including filter, is 5.3 qts. (5L). Check dipstick to verify oil level is correct.

Oil Pressure

Normal oil pressure is 55.5-66.8 psi (3.9-4.7 kg/cm^2) at 4000 RPM.

OIL PUMP

Removal & Disassembly

1. Disconnect negative battery cable. Drain engine oil. Remove oil pan and oil pump screen. See **OIL PAN** under REMOVAL & INSTALLATION. Remove oil pump sprocket cover. DO NOT remove oil pump sprocket from pump, as oil pump may be damaged. Remove oil pump with sprocket, from lower crankcase.
2. Remove pump assembly bolts, and remove inner and outer oil pump rotors. Remove retainer, relief spring and relief valve.

Inspection

1. Inspect inner and outer rotors and oil pump housing for cracks, wear or damage. Ensure relief valve slides smoothly in bore. Inspect pressure relief spring for damaged coils.
2. Using a feeler gauge, measure radial and side clearance of pump rotors and pump case. If clearance exceeds specification, replace outer rotor or case. See **OIL PUMP SPECIFICATIONS** table.

Reassembly & Installation

1. Ensure rotors are assembled in same direction as originally installed. Apply thin coat of engine oil to inner and outer rotors and inside surfaces of oil pump case. Install inner and outer rotors.
2. Ensure rotors turn freely by hand after pump is assembled. Install oil pump, and tighten bolts to specification. See **TORQUE SPECIFICATIONS**. To complete installation, reverse removal procedure.

OIL PUMP SPECIFICATIONS

Clearance	In. (mm)
Radial	.0059 (.150)
Side	.0043 (.109)

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
A/C Compressor Bracket Bolts	47 (64)
Camshaft Sprocket Bolts	57 (77)
Connecting Rod Cap Nut	33 (45)
Crankshaft Pulley Bolt	110 (150)
Cylinder Head Bolts	
Step 1	(1) 39 (53)
Step 2	61 (83)
Step 3	(2)

Step 4	27 (37)
Step 5	76 (103)
Step 6	(3)
Engine Side Mounting Bracket Bolts	40 (54)
Engine-To-Transmission Bolts	66 (89)
Exhaust Manifold Bolt	37 (50)
Exhaust Manifold Stiffener	(4) 37 (50)
Exhaust Pipe	37 (50)
Flex Plate/Flywheel Bolts	51 (69)
Generator Belt Idler Pulley Bolt	33 (45)
Generator Belt Tensioner Bolts	18 (24)
Intake Manifold Bolt	17 (23)
Intake Manifold Stiffener	(4) 37 (50)
Lower Crankcase-To-Cylinder Block (Main Bearing Cap) Bolts	
8-mm Bolt	20 (27)
10-mm Bolt	43 (58)
Oil Pan Drain Plug	26 (35)
Oil Pump Mounting Bolts	20 (27)
Oil Pump Relief Valve Plug	21 (28)
Timing Chain (1st) Tensioner Nut	18 (24)
Timing Chain (2nd) Tensioner Adjuster Nut	(5) 33 (45)
Torque Converter Bolts	14 (19)
Transmission Stiffener Bolts	37 (50)
	INCH Lbs. (N.m)
Camshaft Bearing Cap Bolts	97 (11)
Oil Pan Bolts	97 (11)
Oil Pump Sprocket Cover Bolts	97 (11)
Oil Strainer Bolts	97 (11)
Timing Chain Cover Bolts	97 (11)
Timing Chain (No.1) Guide	80 (9)
Throttle Body Bolts	115 (13)
Valve Cover Nuts	97 (11)

(1) Follow tightening procedure listed under CYLINDER HEAD under REMOVAL & INSTALLATION. See **Fig. 6**. Tighten 6-mm bolt to 96 INCH lbs. (11 N.m).

(2) Loosen bolts in sequence, until torque is reduced to zero (0). See **Fig. 5**.

(3) Tighten 6 mm bolt on side of cylinder head to 96 INCH lbs (11 N.m).

(4) Tighten smaller bolts to 18 ft. lbs. (25 N.m).

(5) Tighten smaller bolts to 96 INCH lbs. (11 N.m).

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
Displacement	109.8 Cu. In. (1.8L)
Compression Pressure (1)	
Standard	199 psi (14 kg/cm^2)
Minimum Limit	170 psi (12 kg/cm^2)
Maximum Variation	14.2 psi (1.0 kg/cm^2)
Fuel System	SFI
(1) Check while cranking engine at 250 RPM or more.	

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS

Application	In. (mm)
Pin Bore	.8269-.8272 (21.003-21.011)
Maximum Bend	.002 (.05)
Maximum Twist	.0039 (.099)
Side Play	
Standard	.0099-.0150 (.251-.381)
Service Limit	.0177 (.450)

CRANKSHAFT, MAIN BEARINGS & CONNECTING ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0039-.0138 (.009-.350)
Service Limit	.0149 (.378)
Runout	.0023 (.058)
Main Bearings	
Journal Diameter (1)	
"1"	2.2832-2.2834 (57.993-57.998)
"2"	2.2830-2.2832 (57.988-57.993)
"3"	2.2828-2.2829 (57.983-57.986)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)

Oil Clearance	
Standard	.0010-.0018 (.025-.046)
Service Limit	.0023 (.058)
Main Bearing Cap Bore Diameter (2)	
"A"	2.4409-2.4411 (62.000-62.004)
"B"	2.4412-2.4414 (62.006-62.012)
"C"	2.4414-2.4416 (62.012-62.017)
Connecting Rod Bearings	
Standard Journal Diameter	1.9768-1.9685 (50.210-50.000)
Undersize Journal Diameter	
.25 mm	1.9580-1.9586 (49.733-49.748)
Journal Out-Of-Round	.0004 (.010)
Journal Taper	.0004 (.010)
Oil Clearance	
Standard	.010-.0150 (.250-.381)
Service Limit	.0177 (.450)

(1) Main bearing journal diameter is indicated by numerical mark ("1", "2" or "3") stamped on crankshaft web No. 2. See **Fig. 13**.

(2) Main bearing cap bore diameter is indicated by letter ("A", "B" or "C") stamped on cylinder block. See **Fig. 14**.

PISTONS, PISTON PINS & PISTON RINGS SPECIFICATIONS

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	.0008-.0015 (.020-.038)
Standard Diameter (1)	
"1"	3.3063-3.3066 (83.980-83.988)
"2"	3.3059-3.3062 (83.970-83.977)
Oversize Diameter	
.0098" (.25 mm)	3.3157-3.3165 (84.219-84.239)
.0196" (.50 mm)	3.3256-3.3263 (84.470-84.488)
Pins	
Diameter	.8267-.8268 (20.998-21.001)
Piston Fit	Slip
Rod Fit	.0001-.0005 (.003-.013)
Rings	
No. 1	
End Gap	
Standard	.0079-.0137 (.201-.348)

Service Limit	.0276 (.701)
Side Clearance	.0012-.0027 (.030-.069)
No. 2	
End Gap	
Standard	.0138-.0196 (.351-.498)
Service Limit	.0276 (.701)
Side Clearance	.0008-.0023 (.020-.058)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0275 (.201-.700)
Service Limit	.0709 (1.801)
Side Clearance	.0024-.0059 (.061-.150)
(1) Piston diameter is determined by numerical mark ("1" or "2") stamped on top of piston.	

ENGINE VALVES & VALVE SPRINGS SPECIFICATIONS

VALVES & VALVE SPRINGS

Application	Specification
Intake Valves	
Seat Angle	45°
Valve Head Thickness	
Standard	.039" (.99 mm)
Service Limit	.024" (.61 mm)
Stem Diameter	.2348-.2354" (5.964-5.979 mm)
Exhaust Valves	
Seat Angle	45°
Valve Head Thickness	
Standard	.047" (1.19 mm)
Service Limit	.028" (.71 mm)
Stem Diameter	.2339-.2344" (5.941-5.954 mm)
Valve Springs	
Inner Spring Free Length	
Standard	1.4204" (36.078 mm)
Service Limit	1.3780" (35.001 mm)
Outer Spring Free Length	
Standard	1.5921" (40.439 mm)
Service Limit	1.5440" (39.218 mm)
Out-Of-Square	.079" (2.01 mm)
	Lbs. @ In. (kg @ mm)
Inner Valve Spring Preload	
Standard	15.2-17.4 @ 1.08 (6.9-7.9 @ 27.4)

Service Limit	13.6 @ 1.08 (6.2 @ 27.4)
Outer Valve Spring Preload	
Standard	33.9-39.2 @ 1.25 (15.4-17.8 @ 31.8)
Service Limit	30.4 @ 1.25 (13.8 @ 31.8)

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore	
Standard Diameter (1)	
Red	3.3075-3.3078 (84.011-84.018)
Blue	3.3071-3.3074 (84.000-84.008)
Maximum Taper	.004 (.10)
Maximum Out-Of-Round	.004 (.10)
Maximum Deck Warpage	.0024 (.061)
(1) Cylinder bore diameter is determined by color mark (Red or Blue) on cylinder block. See **Fig. 12**.	

CYLINDER HEAD SPECIFICATIONS

CYLINDER HEAD

Application	Specification
Maximum Warpage	
Head-To-Block	.002" (.05 mm)
Manifold-To-Head	.004" (.10 mm)
Valve Seats	
Seat Angle	45°
Seat Width	.0433-.0512" (1.1-1.3 mm)
Valve Guides	
Intake Valve	
Valve Guide I.D.	.2362-.2366" (6.000-6.010 mm)
Valve Guide Installed Height	.53" (13.5 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0008-.0018" (.020-.046 mm)
Service Limit	.0027" (.067 mm)
Exhaust Valve	
Valve Guide I.D.	.2362-.2366" (6.000-6.010 mm)
Valve Guide Installed Height	.53" (13.5 mm)
Valve Stem-To-Guide Oil Clearance	
Standard	.0018-.0028" (.046-.071 mm)
Service Limit	.0035" (.089 mm)

CAMSHAFT SPECIFICATIONS

CAMSHAFT

Application	In. (mm)
Bore Diameter	1.0236-1.0249 (26.000-26.032)
Journal Diameter	1.0220-1.0228 (25.959-25.979)
Journal Runout	.0039 (.099)
Lobe Height	
Intake	
Standard	1.5906-1.5969 (40.401-40.561)
Service Limit	1.5828 (40.203)
Exhaust	
Standard	1.5744-1.5780 (39.990-40.081)
Service Limit	1.5666 (39.792)
Oil Clearance	
Standard	.0008-.0029 (.020-.074)
Service Limit	.0047 (.119)