3.2L & 3.5L V6
Article Text
1999 Isuzu VehiCROSS
For 1 1 1 1 1

Wednesday, May 18, 2005 12:13AM

ARTICLE BEGINNING

1999-2000 ENGINES
Acura/Honda/Isuzu 3.2L & 3.5L V6

Acura; SLX
Honda; Passport
Isuzu; Amigo, Rodeo, Trooper, VehiCROSS

*** PLEASE READ THIS FIRST ***

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

ENGINE IDENTIFICATION

Engine may be identified by using Vehicle Identification Number (VIN) stamped on a metal pad located near lower left corner of windshield. The eighth character identifies engine model.

Engine identification number, located on left side of cylinder block above starter, may be required when ordering replacement parts (if needed).

ENGINE IDENTIFICATION CODES

Engine	Code
3.2L DOHC	W
3.5L DOHC	X

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

DOHC
All valve adjustment must be done on a cold engine. DOHC engines have a tappet fit over valve spring with a shim on top of tappet. The shim is replaceable and available in assorted thicknesses. Shims are available in .0008" (.020 mm) intervals between .0945-.1260" (2.400-3.200 mm) thickness.

To measure clearance, rotate camshaft positioning heel of

lobe over tappet. Using feeler gauge, measure valve clearance between adjustment shim and camshaft lobe. Ensure valve clearance is within specification. See VALVE CLEARANCE ADJUSTMENT SPECIFICATION table. To adjust clearance, apply engine oil to camshaft lobe and adjustment shim. Using Valve Clearance Adjusting Tool (J-42689), rotate camshaft and push out adjustment shim with flat-blade screwdriver. Measure shim and replace with appropriate thickness adjustment shim to bring clearance within specification.

VALVE CLEARANCE ADJUSTMENT SPECIFICATION

Valve	Clearance In. (mm)
Exhaust	.010-.014 (.25-.35)
Intake	.009-.013 (.23-.33)

ACCELERATOR CABLE

Loosen lock nut. Pull outer cable while holding throttle valve closed. Temporarily tighten adjusting nut, and screw cap or lock nut. Loosen adjusting nut 3 turns and tighten screw cap or lock nut. Ensure valve lever returns to stopper screw. See Fig. 1.

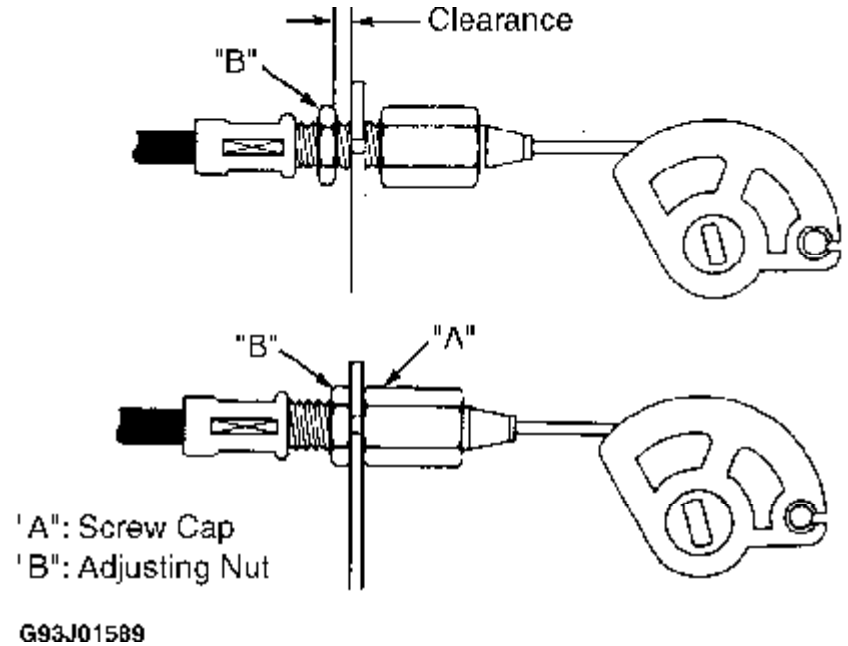

Fig. 1: Adjusting Accelerator Cable
Courtesy of Isuzu motor co.

TROUBLE SHOOTING

NOTE: See TROUBLE SHOOTING - BASIC PROCEDURES article in the GENERAL TROUBLE SHOOTING section.

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

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. Also place mating marks on engine hood and other major assemblies before removal.

FUEL PRESSURE RELEASE

Turn ignition off. Remove fuel filler cap. Remove fuel pump relay from underhood relay center. Start engine and allow it to stall. After engine stalls, crank engine for an additional 5 seconds. Disconnect negative battery cable. Reinstall fuel filler cap. Reinstall fuel pump relay.

ENGINE

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect battery cables. Mark hood and hood hinge for reassembly reference. Remove hood from vehicle.

2) Drain engine coolant. Disconnect throttle cable from throttle valve and upper intake manifold. Disconnect air intake duct from throttle valve. Remove air cleaner assembly. Disconnect canister vacuum hose. Disconnect brake booster vacuum hose.

3) Disconnect engine and starter harness connectors. Disconnect 2 battery ground cables. Disconnect bonding cable connector from left side of dash panel. Disconnect bonding cable terminal from back of left bank cylinder head.

4) Remove engine coolant hoses. Remove lower fan shroud and radiator. Remove power steering belt. Remove 2 bolts from power steering pump bracket. Without disconnecting power steering pump hoses, position pump and bracket aside.

5) Remove A/C compressor belt, if equipped. Remove 2 bolts attaching A/C compressor to engine. Without disconnecting A/C compressor lines, position A/C compressor aside. Remove heater hoses

from engine.

6) Remove transmission cooler lines from right-side engine mount. Remove transmission assembly. For M/T vehicles, see appropriate article in CLUTCHES. For A/T vehicles, see TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. Support engine and remove mount-to-chassis bolts for both engine mounts. Remove engine assembly.

Installation

To install, reverse removal procedure. Tighten all bolts and nuts to specification. See TORQUE SPECIFICATIONS. Adjust all control cables. Replenish fluid levels.

UPPER INTAKE MANIFOLD

Removal

1) Disconnect negative battery cable. Remove air cleaner assembly. Disconnect throttle cable from throttle valve and upper intake manifold. Disconnect necessary vacuum hoses and lines from upper intake manifold.

2) Disconnect necessary electrical connectors from sensors and valves. On SOHC, remove Direct Ignition System (DIS) assembly with bracket and spark plug wires. On both engines, remove throttle body assembly.

3) Remove EGR valve assembly. Remove upper intake manifold retaining bolts and nuts. Remove upper intake manifold.

Installation

To install, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Adjust accelerator cable. See Fig. 1. Loosen adjusting nut, and lock nut. Pull outer cable while holding throttle valve closed. Temporarily tighten adjusting nut, and screw cap or lock nut. Loosen adjusting nut 3 turns and tighten screw cap or lock nut. Ensure valve lever returns to stopper screw.

LOWER INTAKE MANIFOLD

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable. Remove air cleaner assembly. Remove upper intake manifold. See UPPER INTAKE MANIFOLD.

2) Remove fuel line bracket from valve cover. Disconnect fuel inlet and return hoses from fuel pipes. Disconnect electrical connectors at thermo sensor and fuel injectors. Remove lower intake manifold nuts and bolts. Remove lower intake manifold.

Installation

1) To install, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. Adjust accelerator cable. See Fig. 1.

2) Loosen adjusting nut, and lock nut. Pull outer cable while holding throttle valve closed. Temporarily tighten adjusting nut, and screw cap or lock nut. Loosen adjusting nut 3 turns and tighten screw cap or lock nut. Ensure valve lever returns to stopper screw.

EXHAUST MANIFOLD

Removal & Installation

Disconnect negative battery cable. On right manifold, remove torsion bar. On left manifold, disconnect O2 sensor connector. On both manifolds, remove front exhaust pipe. On right manifold, remove EGR pipe bolts and gasket from exhaust manifold. On both manifolds, remove exhaust manifold heat shield. Remove exhaust manifolds from engine. To install, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

CYLINDER HEAD COVERS

Removal & Installation

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable and battery. Drain engine coolant. Remove air cleaner assembly. Disconnect necessary electrical and vacuum connectors.

2) Remove upper and lower radiator hoses. Remove engine harness from cylinder head. Remove upper fan shroud. Remove fan clutch and cooling fan. Remove drive belt. Remove power steering pulley, fan pulley and bracket. Remove idler pulley and auto tensioner. Remove crankshaft pulley.

3) Remove timing belt covers. Remove ignition coil assemblies from spark plugs. Remove bolts and cylinder head cover(s). To install, apply RTV sealant to corners of end camshaft bearing towers. To complete installation, reverse removal procedure.

CYLINDER HEAD

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect battery cables. Mark hood and hood hinge for reassembly reference. Remove hood from vehicle.

2) Drain engine coolant and oil. Remove air cleaner assembly. Remove upper fan shroud and upper radiator hose. Remove radiator cooling fan assembly. Remove upper and lower intake manifolds. See

UPPER INTAKE MANIFOLD and
LOWER INTAKE MANIFOLD.

3) Remove thermostat housing. Remove all accessory drive belts. Remove power steering pump and cooling fan pulley assembly.

4) Using Puller (J-8614-01), remove crankshaft pulley bolt and pulley. Remove oil cooler hose from timing cover. Remove timing belt. See TIMING BELT. Remove cylinder head covers. See CYLINDER HEAD COVERS. Remove power steering bracket. Disconnect front exhaust pipes from both exhaust manifolds, if not already removed. Remove cylinder head bolts. Remove cylinder heads and gasket.

Inspection

1) Inspect cylinder head for warpage at cylinder block and manifold areas. Resurface cylinder head if warpage exists on head or manifold surfaces. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Inspect cylinder head for cracks, especially in area between valve seats and inside exhaust ports. Check head surface for corrosion and porosity.

CAUTION: DO NOT weld cylinder head to repair. Replace cylinder head.

2) Ensure cylinder head height is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Inspect cylinder block deck surface warpage. Resurface cylinder block if warpage exists. Replace cylinder block if warpage exceeds specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

Installation

1) To install, reverse removal procedure. Clean all gasket surfaces. DO NOT clean head using motorized wire brush. Tighten NEW cylinder head bolts in sequence. See Fig. 2. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS.

2) Before installing cylinder head cover, apply silicone sealant to corners of end camshaft towers and install NEW gasket. Adjust accelerator cable. See Fig. 1. See ACCELERATOR CABLE under ADJUSTMENTS.

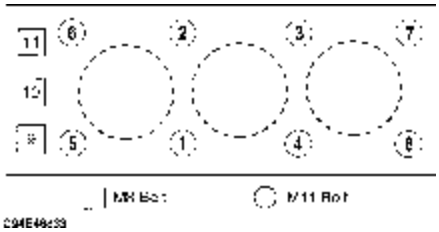

Fig. 2: Cylinder Head Bolt Tightening Sequence
Courtesy of Isuzu motor co.

CRANKSHAFT FRONT SEAL

Removal

Disconnect negative battery cable. Remove timing belt. See TIMING BELT. Remove crankshaft timing sprocket. Using inside puller, remove crankshaft front seal.

CAUTION: DO NOT damage oil pump and crankshaft sealing surfaces when removing seal.

Installation

To install, reverse removal procedure. Lubricate oil seal lip with engine oil. Install seal using seal driver.

TIMING BELT

Removal

1) Disconnect negative battery cable. Remove air cleaner assembly. Remove upper fan shroud. Remove cooling fan assembly. Remove all accessory drive belts.

2) Remove fan pulley assembly. Using Puller (J-8614-01), remove crankshaft pulley bolt and pulley. Remove timing belt cover. Align all timing marks prior to belt removal. See Figs. 3 and 4. Mark timing belt direction of rotation if reusing belt. Remove belt tensioner pusher and timing belt.

Installation

1) Ensuring all timing marks are aligned. Install belt over one pulley at a time, staring at crankshaft sprocket and working counterclockwise. Belt should go over tensioner last. Secure belt at each pulley during installation with pinch clips. See Fig. 5.

CAUTION: If reusing original belt, ensure direction of rotation marks are pointing in proper direction.

2) Compress timing belt tensioner pusher and insert pin to retain pusher. Apply pressure to tensioner against belt and install tensioner pusher. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

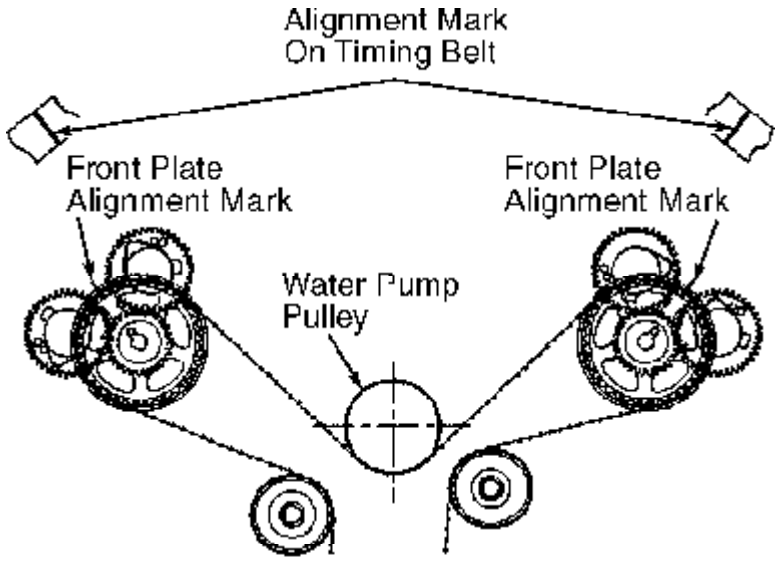

Fig. 3: Aligning Camshaft Timing Marks
Courtesy of Isuzu motor co.

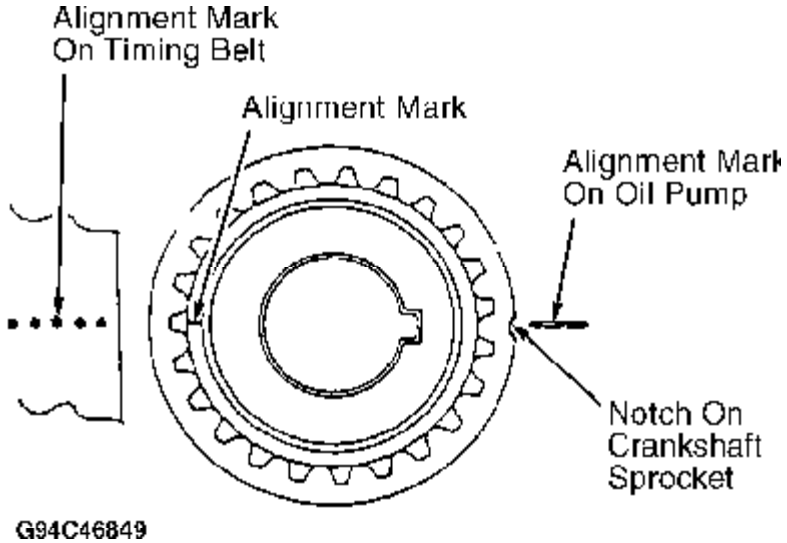

Fig. 4: Aligning Crankshaft Timing Marks
Courtesy of Isuzu motor co.

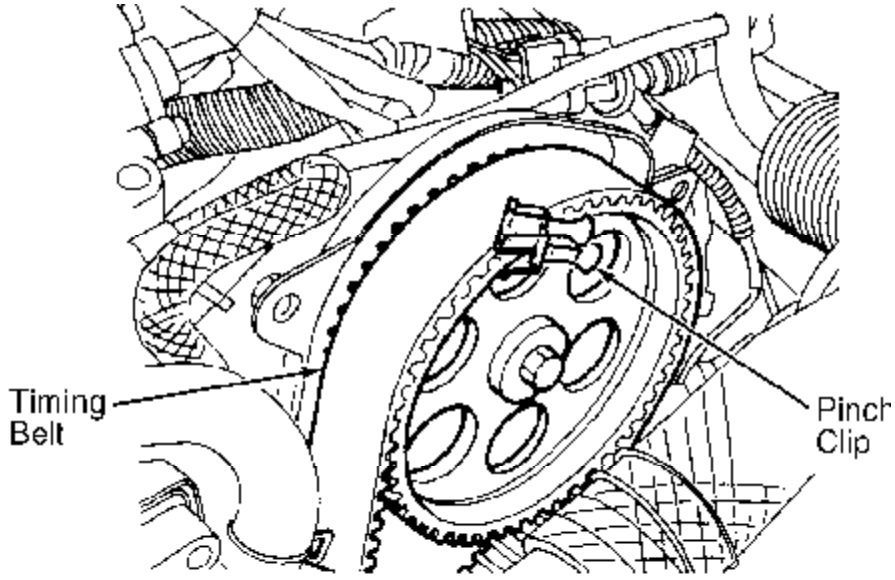

Fig. 5: Installing Pinch Clip On Timing Belt
Courtesy of Isuzu motor co.

3) Loosen tensioner pulley bolt. Apply pressure on belt by rotating tensioner. Tighten tensioner pulley bolt to specification. Remove pin from timing belt tensioner pusher.

4) Remove pinch clips from timing belt, if used. Install crankshaft pulley, tightening center bolt finger tight. Rotate crankshaft 2 turns clockwise to remove belt slack. Tighten tensioner pulley bolt to specification. See TORQUE SPECIFICATIONS.

5) Remove crankshaft pulley and install timing belt cover. To complete installation, reverse removal procedure. Tighten nuts and bolts to specification. See TORQUE SPECIFICATIONS.

CAMSHAFT

Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable. Remove fan shrouds and cooling fan assembly. Remove upper intake manifold. See UPPER INTAKE MANIFOLD.

2) Remove timing belt. See TIMING BELT. Remove cylinder head covers. See CYLINDER HEAD COVERS. Remove camshaft pulley bolt and pulley. Mark valve train components for reassembly reference. Remove camshaft towers and camshaft. Remove camshaft drive gear retainer.

Installation

To install, reverse removal procedure. Align mating marks on camshaft drive gears with sub-gear. Left bank has 2 dots and right bank has one dot. A M5 bolt in camshaft drive gear can be tightened to

hold camshaft in position. Ensure M5 bolt is released after camshafts timing is complete. See Fig. 6.

1) Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS. See Fig. 7. Ensure timing belt installation procedures are followed closely. See TIMING BELT.

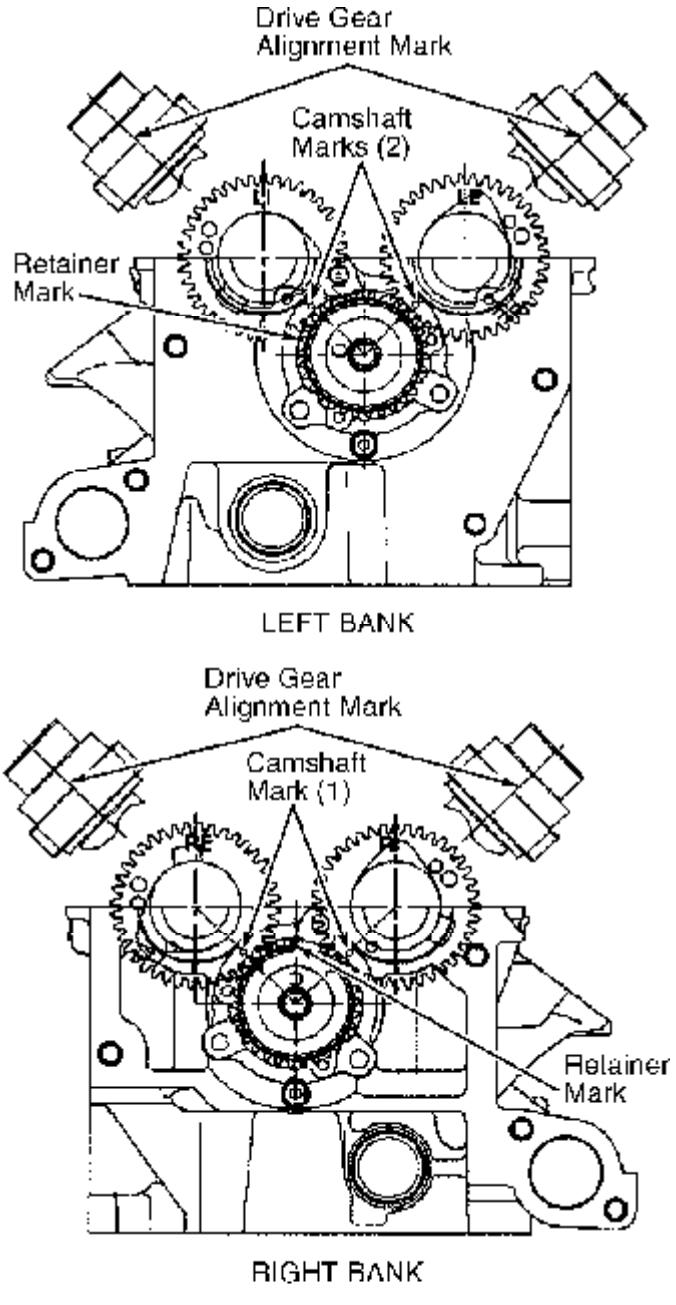

Fig. 6: Aligning Camshaft Timing Gears
Courtesy of Isuzu motor co.

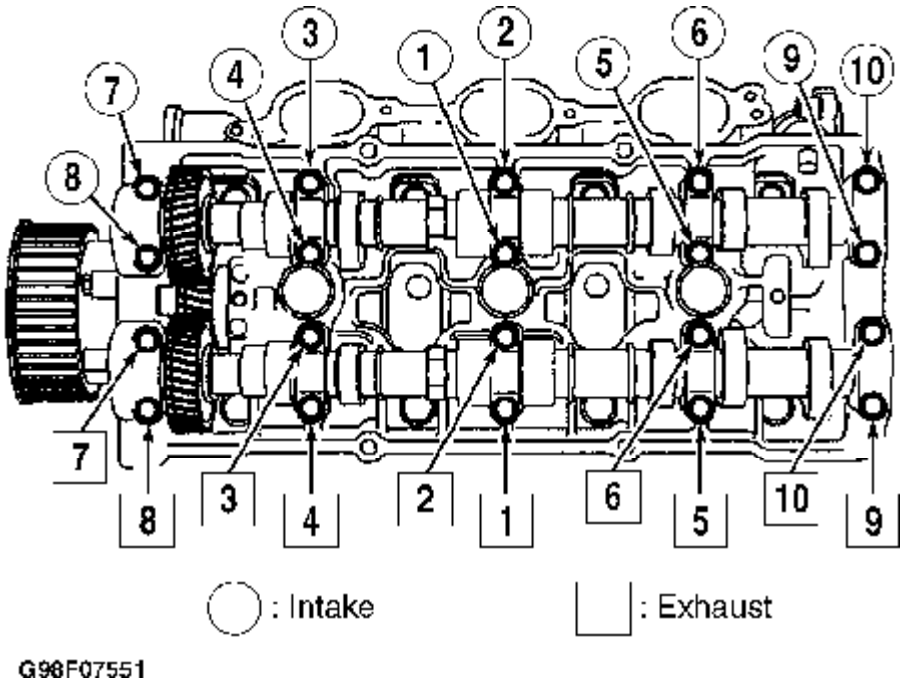

Fig. 7: Tightening Camshaft Bracket Housing Fixing Bolts
Courtesy of Isuzu motor co.

REAR MAIN SEAL

Removal

Remove transmission. For M/T vehicles, see appropriate article in CLUTCHES. For A/T vehicles, see TRANSMISSION REMOVAL & INSTALLATION article in TRANSMISSION SERVICING. On M/T, remove clutch assembly and flywheel. On A/T, remove flexplate. On all models, carefully remove seal from seal housing using a seal puller. DO NOT damage sealing surfaces on crankshaft.

Installation

1) Ensure all sealing surfaces are clean. Apply engine oil to lip of oil seal. Using Seal Installer (J-39201), install seal in seal housing. DO NOT reuse flywheel or flexplate bolts. Ensure no oil is present in threads of crankshaft.

2) Install flywheel. Tighten all bolts to specification. Tighten flywheel bolts in a diagonal pattern. See TORQUE SPECIFICATIONS. To install remaining components, reverse removal procedure.

WATER PUMP

Removal & Installation

1) Disconnect negative battery cable. Drain cooling system. Remove timing belt. See TIMING BELT. Remove idler pulley. Remove water

pump bolts, water pump and gasket.

2) To install, reverse removal procedure. Ensure gasket surfaces are clean. Tighten water pump bolts in sequence to specification. See TORQUE SPECIFICATIONS. See Fig. 8. Fill cooling system and check system for leaks.

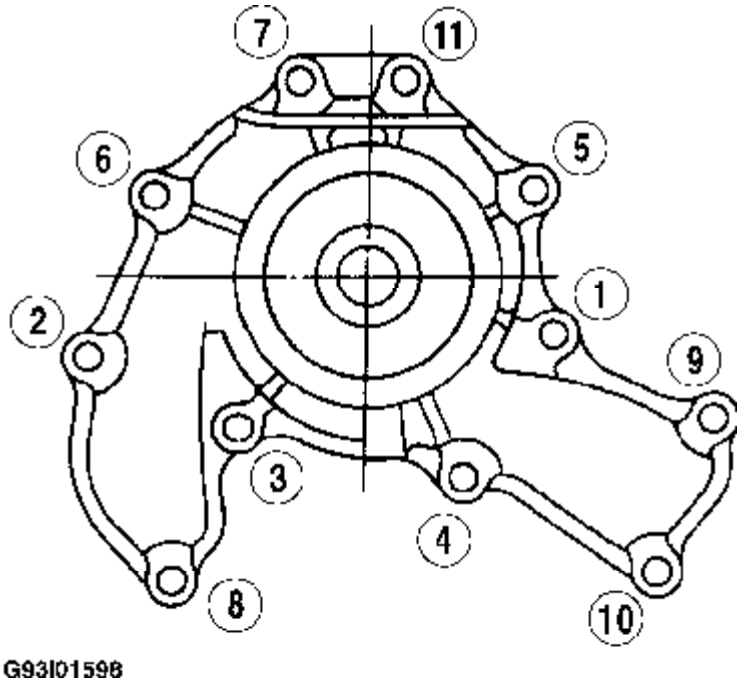

Fig. 8: Water Pump Bolt Tightening Sequence
Courtesy of Isuzu motor co.

OIL PAN

NOTE: Oil pan removal and installation information is not provided.

OVERHAUL

CYLINDER HEAD

Cylinder Head

1) Inspect cylinder head for warpage at cylinder block and manifold areas. Resurface cylinder head if warpage exists on head or manifold surfaces. Replace cylinder head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) Inspect cylinder head for cracks, especially in area between valve seats and inside exhaust ports. Check head surface for corrosion and porosity.

CAUTION: DO NOT weld cylinder head to repair. Replace cylinder head.

3) Ensure cylinder head height is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Springs

Ensure valve spring free length, out-of-square and pressure are within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS. Install valve springs with painted area of valve spring facing downward.

CAUTION: Ensure valve spring is installed with painted area toward cylinder head surface.

Valve Stem Oil Seals

Carefully install valve stem oil seal using Seal Installer (J-37281).

Valve Guides

1) Check valve stem-to-guide oil clearance. Ensure valve stem diameter is within specification. Replace valve guide if clearance exceeds specification. Manufacturer recommends replacing valve and valve guide as a set. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

2) To replace valve guide, use hammer and Valve Guide Remover/Installer (J-42899). Working from combustion side of cylinder head, drive valve guide out of top of head. Apply engine oil to outside of NEW valve guide.

3) Using hammer and valve guide remover/installer, drive valve guide into cylinder head from camshaft side. Measure valve guide installed height from top of valve guide to cylinder head surface. Ensure valve guide installed height is within specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Using reamer, ream valve guide to obtain specified valve stem-to-guide oil clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Seat

1) To measure valve seat margin, install a NEW valve in cylinder head. Measure valve installed height from spring seat to tip of valve stem. Replace valve seats if not within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

2) Measure valve seat width. See Fig. 9. Cut or replace valve seats to reach required width specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

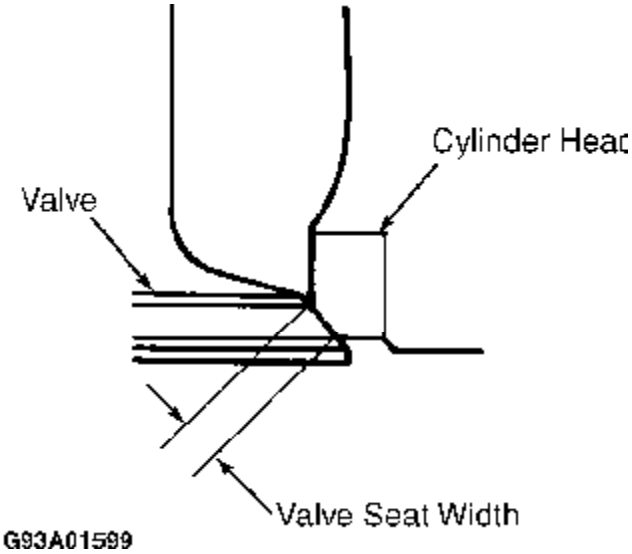

Fig. 9: Measuring Valve Seat Width
Courtesy of Isuzu motor co.

3) Replace valve seat if damaged. To remove valve seat, arc weld a welding rod to valve seat in several areas to shrink valve seat. Allow valve seat to cool. Gently tap on welding rod to remove valve seat. Ensure valve seat area in cylinder head is clean.

4) To install valve seat, heat valve seat area of cylinder head with steam. Cool valve seat with dry ice or refrigerate. Install valve seat in cylinder head. Valve seat-to-cylinder head interference fit should be .004-.006" (.11-.15 mm). Grind valve seat to specified seat width. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valves

Ensure valve stem diameter is within specification. Replace valves if not within specifications. Manufacturer recommends replacing valve and valve guide as a set. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS.

Valve Seat Correction Angles

After grinding seat, to lower seat, use a 30-degree stone to remove stock from top of valve seat on all valves. To raise seat, use a 75-degree stone to remove stock from bottom of seat on all valves.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

Ensure piston is installed in cylinder block with front mark arrow on top of piston toward front of engine. See Fig. 10. Install piston on connecting rod so front mark at center of connecting rod aligns with front mark on top of piston.

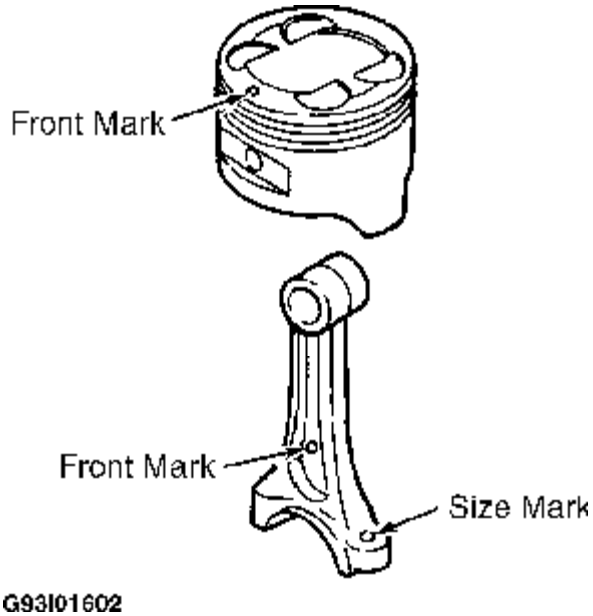

Fig. 10: Aligning Piston & Connecting Rod
Courtesy of Isuzu motor co.

Fitting Pistons

1) Determine if piston-to-cylinder clearance is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Measure piston skirt diameter at a 90-degree angle to piston pin 1.69" (43.0 mm) from top of piston. Different piston sizes are used. Piston size can be identified by letter (size mark) stamped on top of piston. See Fig. 11.

2) Size mark on piston is a letter corresponding to piston diameter. Ensure piston diameter is within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

3) Check cylinder bore to determine piston-to-cylinder clearance. Clearance should be within specification. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

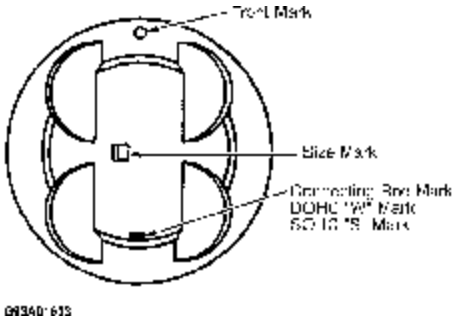

Fig. 11: Identifying Piston & Connecting Rod Size
Courtesy of Isuzu motor co.

Piston Pins

1) Measure piston pin outside diameter in 2 directions and 3 places. See Fig. 12. If outside diameter is not within specification at any one place, replace piston pin. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

2) Ensure piston pin to connecting rod interference fit is within specification. Measure inside diameter of connecting rod small end. If interference fit is not within specification, replace connecting rod and piston pin. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

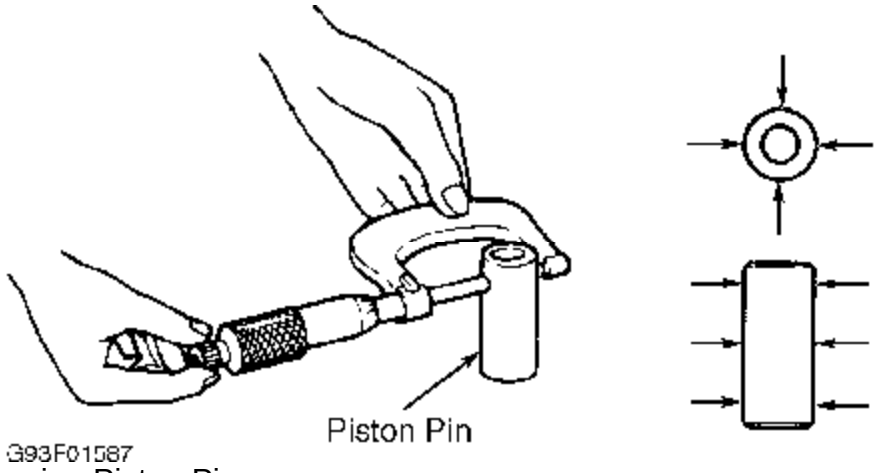

Fig. 12: Measuring Piston Pins
Courtesy of Isuzu motor co.

Piston Rings

1) Place NEW piston ring into cylinder bore. Using a piston, push ring into smallest part of cylinder bore. Measure ring end gap. If ring end gap is too large, use an oversize ring. If ring end gap is too small, file material from end of ring. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

2) Measure clearance between piston ring groove and piston ring. If clearance is not within specification, replace piston. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS. Position piston ring gaps in proper areas. See Fig. 13.

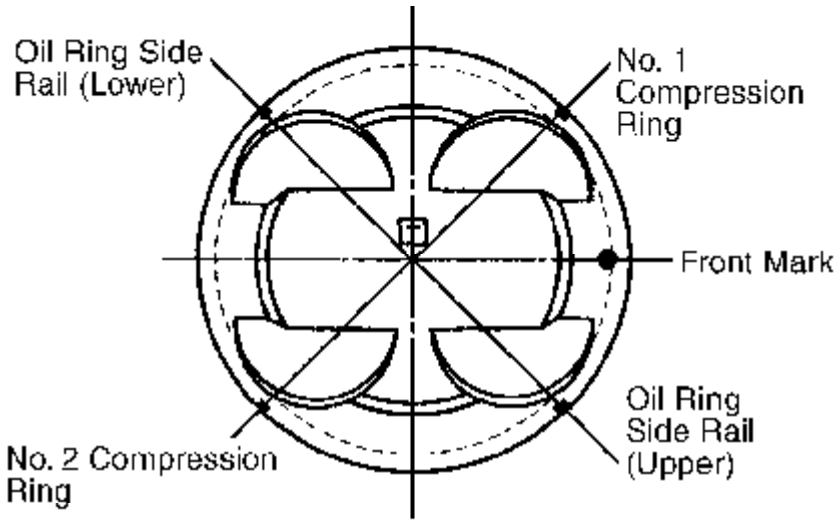

Fig. 13: Positioning Piston Rings
Courtesy of Isuzu motor co.

Rod Bearings

1) Note direction of connecting rod and cap installation. Ensure connecting rod is installed so front mark at center of connecting rod is toward front of engine. See Fig. 10.

2) Connecting rod big end bore diameter is indicated by an "A", "B" or "C" size mark stamped on one side of connecting rod. See Fig. 10. Ensure big end bore diameter is within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS.

3) Check rod bearing oil clearance using Plastigage. Ensure bearing oil clearance and side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS and CONNECTING RODS tables under ENGINE SPECIFICATIONS.

4) If rod bearing oil clearance is incorrect, it may be possible to obtain correct clearance using selective service rod bearings. Rod bearings are available in 3 standard service sizes, indicated by a color code on bearing. See ROD BEARING SPECIFICATIONS table. Coat nut and threads with engine oil before installing. Tighten nuts to specification. See TORQUE SPECIFICATIONS.

ROD BEARING SPECIFICATIONS

Color Code	Bearing Thickness - In. (mm)
Yellow	.0595-.0597 (1.512-1.516)
Green	.0594-.0595 (1.508-1.512)
Pink	.0592-.0594 (1.504-1.508)

Crankshaft & Main Bearings

1) Ensure main bearing caps are numbered for location. Mark bearing cap for reassembly reference. Remove main bearing cap bolts in proper sequence. See Fig. 14.

2) Cylinder block main bearing bore size is indicated by numerical size mark stamped on cylinder block. See Fig. 15. Main bearing journal size is determined by size marks, given in dashes (-), located on crankshaft front counterweight. See Fig. 16.

3) If color code on original bearing cannot be obtained, use size marks on cylinder block and crankshaft to determine proper color-coded main bearing. See MAIN BEARING SELECTION table.

4) When installing main bearing caps, ensure reassembly reference mark on cap points toward front of engine. Coat bolt threads with engine oil before installing.

5) Tighten bolts in sequence to specification. See Fig. 17. See TORQUE SPECIFICATIONS. Ensure crankshaft end play is within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

MAIN BEARING SELECTION

Cylinder Block Size Mark	Crankshaft Size Mark	Bearing Color Code
1	1 Or -	Brown
1	2 Or - -	Blue
2	1 Or -	Green
2	2 Or - -	Brown
3	1 Or -	Yellow
3	2 Or - -	Green

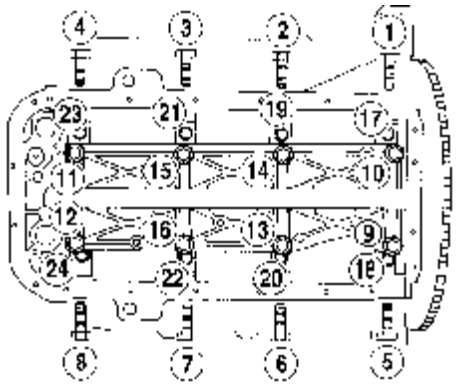

Fig. 14: Main Bearing Bolt Removal Sequence
Courtesy of Isuzu motor co.

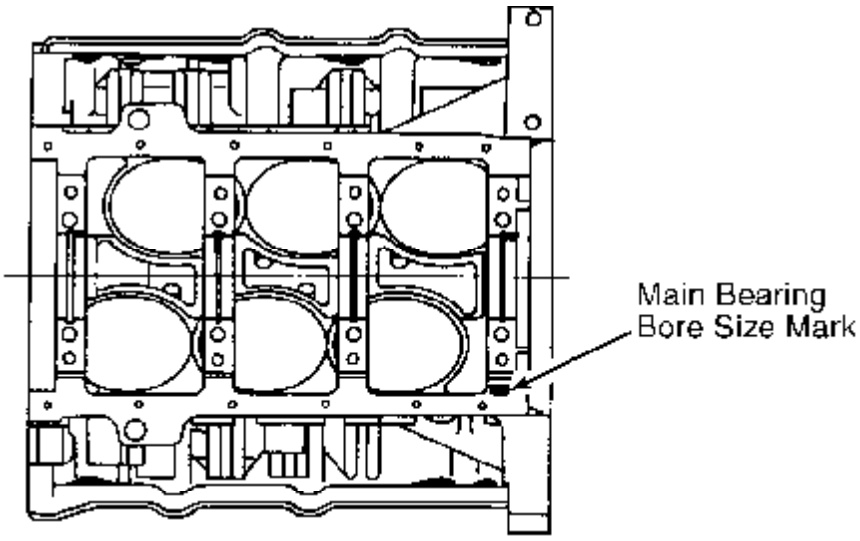

Fig. 15: Identifying Main Bearing Bore Size
Courtesy of Isuzu motor co.

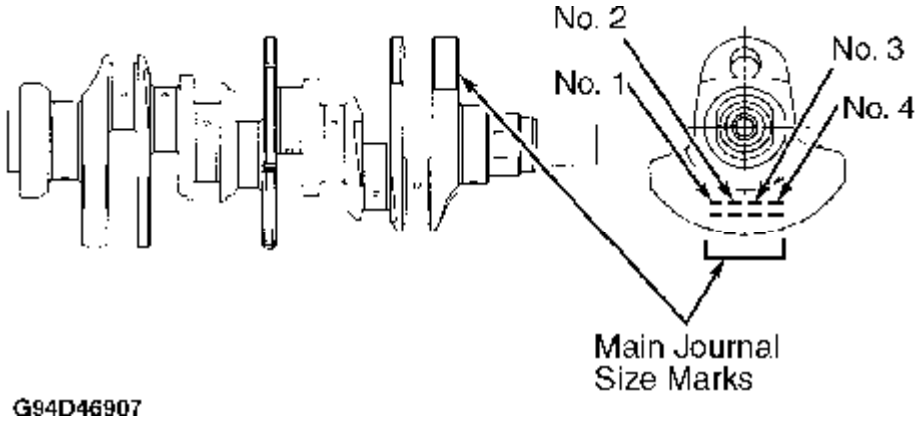

Fig. 16: Identifying Main Bearing Journal Size
Courtesy of Isuzu motor co.

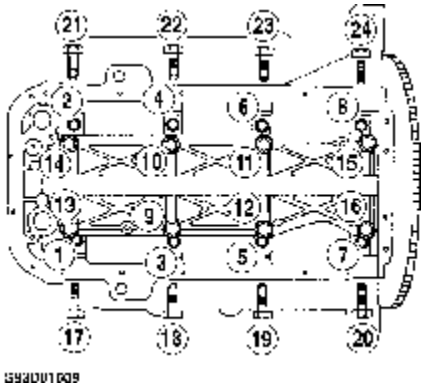

Fig. 17: Main Bearing Bolt Installation Sequence
Courtesy of Isuzu motor co.

Thrust Bearing

Install thrust bearing on No. 3 main bearing so grooves are toward crankshaft, away from cylinder block. Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

1) Using feeler gauge and straightedge, check cylinder block deck surface warpage. If warpage exceeds specification, resurface or replace cylinder block. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

2) Check diameter of cylinder bore. Measure cylinder in axial and thrust directions. Different cylinder bore sizes are used and can be identified by size marks on deck surface of cylinder block. See Fig. 18. Cylinder size marks are stamped in relation to cylinder layout.

3) Ensure diameter of cylinder bore is within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS. If diameter of cylinder bore exceeds maximum limit, replace cylinder block.

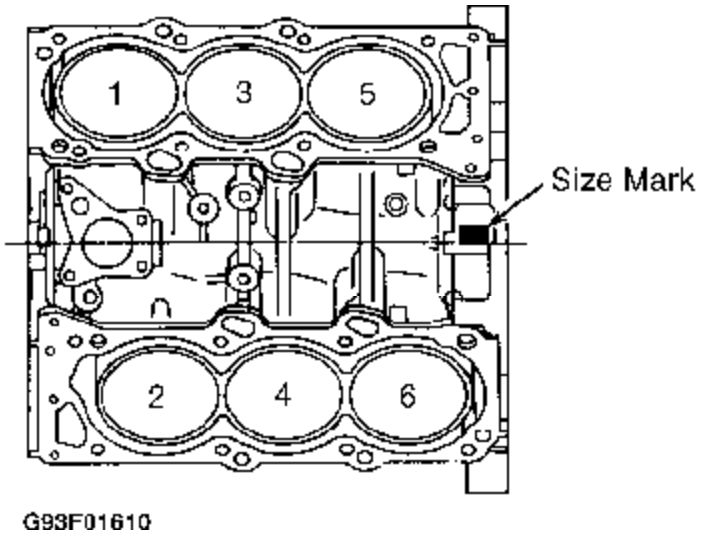

Fig. 18: Identifying Cylinder Bore Diameter
Courtesy of Isuzu motor co.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

A trochoid-type oil pump is used. Oil pump is driven by crankshaft. Oil pump delivers filtered oil through full-flow oil filter and water-cooled oil cooler to main oil gallery, feeding

crankshaft journals and cylinder head. Oil passages in crankshaft supply oil to connecting rod journals. Engine cylinder bore and piston pins are lubricated by oil sprayed from connecting rods.

Crankcase Capacity

Crankcase capacity is 5.6 qts. (5.3L) with oil filter change.

Oil Pressure

With engine at normal operating temperature, ensure oil pressure is 57-80 psi (3.9-5.6 kg/cm^2) at 3000 RPM.

OIL PUMP

Removal & Disassembly

1) Remove timing belt. See TIMING BELT under REMOVAL & INSTALLATION. Remove crankshaft sprocket from oil pump. Remove oil pan. Remove oil strainer and oil pipe.

2) Remove oil cooler assembly. Remove oil pump bolts and oil pump. See Fig. 19. Remove pressure relief valve. Remove oil pump cover. Mark oil pump gears for reassembly reference. Remove oil pump gears. Remove oil seal from oil pump housing.

NOTE: In colder climates, pressure relief valve may stick, creating excessive oil pressure and causing oil filter to deform and leak. If this condition exists, install NEW pressure relief valve and spring.

Inspection

1) Inspect components for damage. Install gears in oil pump housing. Place straightedge across oil pump housing surface.

2) Using feeler gauge, measure gear side clearance. Replace components if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

3) Using feeler gauge, measure side clearance between outside edge of outer gear and oil pump housing. Replace components if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

4) Assemble gears in oil pump housing. Using feeler gauge, measure clearance between tip of inner gear and tip of outer gear. Replace components if clearance exceeds specification. See OIL PUMP SPECIFICATIONS table.

OIL PUMP SPECIFICATIONS

Application	In. (mm)
Gear Side Clearance	

Standard ..... .001-.004 (.03-.10)
Wear Limit ..... .006 (.15)
Outer Gear-To-Oil Pump Housing Clearance
Standard ..... .004-.007 (.10-.18)
Wear Limit ..... .008 (.20)
Gear Tip Clearance
Standard ..... .004-.009 (.10-.23)
Wear Limit ..... .014 (.35)

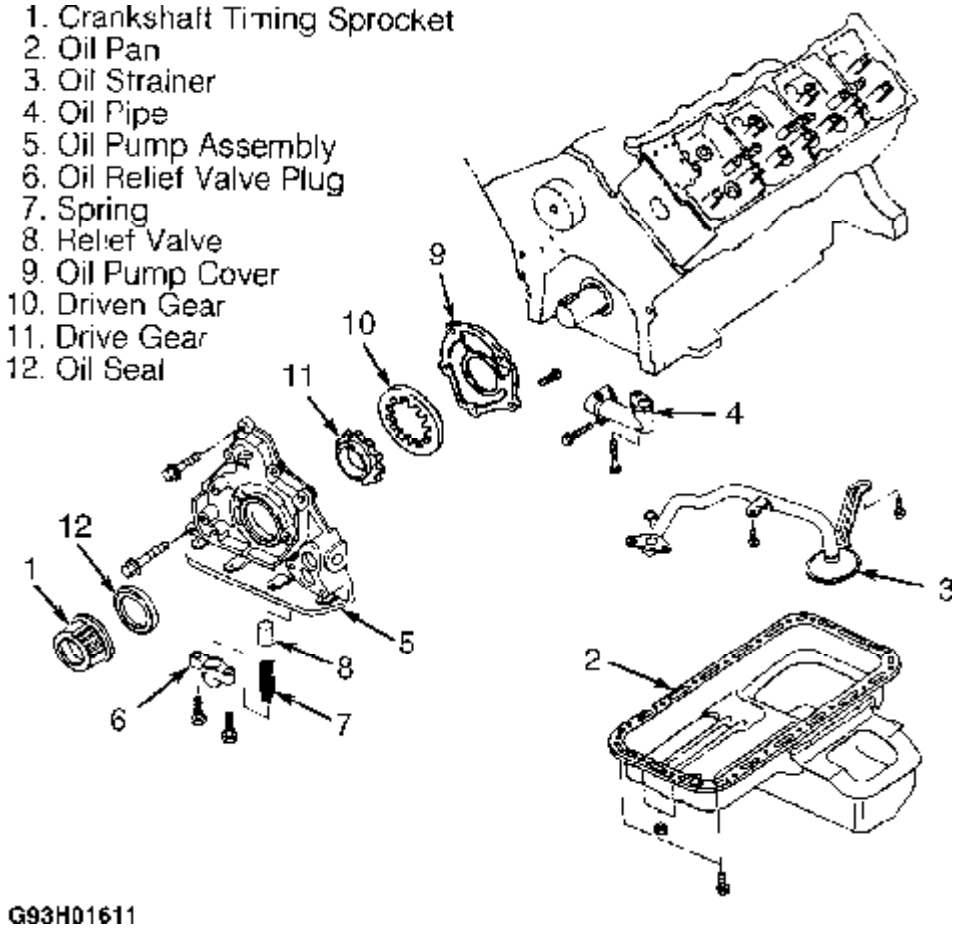

Fig. 19: Exploded View Of Engine Oiling System
Courtesy of Isuzu motor co.

Reassembly & Installation

1) To reassemble, reverse disassembly procedure. Lubricate all components with engine oil. Install oil seal using Seal Installer (J-39202). Tighten oil pump assembly bolts to specification. See TORQUE SPECIFICATIONS.

NOTE: Ensure oil pump gears rotate smoothly after oil pump cover bolts are tightened to specification.

2) To install, reverse removal procedure. Apply Sealant (TB-1207B) to oil pump gasket surface before installing oil pump. Tighten all bolts to specification. See TORQUE SPECIFICATIONS.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

Application	Ft. Lbs. (N.m)
Axle Housing Mounting Bolt	
Step 1	61 (83)
Step 2	112 (152)
Camshaft Idler Pulley Bolt	31 (42)
Camshaft Sprocket Bolt	41 (55)
Camshaft Timing Chain Tensioner Bolt	14 (19)
Common Chamber Duct Bolt	17 (23)
Connecting Rod Nut	40 (54)
Coolant Manifold Bolt	14 (19)
Crankshaft Pulley Bolt	123 (167)
Cylinder Head Bolt (1)	
M8	15 (20)
M11	47 (64)
DIS Module Assembly Bolt	14 (19)
Engine Hanger	
Bolt	15 (20)
Nut	42 (57)
Engine-To-Transmission Bolt	56 (76)
EGR Valve Bolt (Manifold Side)	21 (29)
Exhaust Manifold	
Bolt	21 (29)
Nut	42 (57)
Exhaust Pipe	
Bolt & Nut	32 (43)
Stud Nut	49 (67)
Fan Pulley Bolt	16 (22)
Flywheel Bolt	40 (54)
Front Plate Bolt (Timing Belt)	14 (19)
Heater Pipe Bolt	15 (20)
Idler Arm Retaining Bolt	33 (44)
Lock Plate Bolt	58-65 (79-88)
Lower Intake Manifold Bolt	18 (24)
Main Bearing Cap Bolt (2)	29 (39)
Main Bearing Cap Side Bolt (2)	29 (39)
Mount-To-Chassis Bolt	30 (41)

Oil Cooler Bolt 19 (26)
Oil Gallery Retaining Bolt
Step 1 ..... 22 (30)
Step 2 ..... Additional 55-65 Degrees
Oil Pan Drain Plug 58 (78)
Oil Pump Assembly-To-Cylinder Block
Bolt 13 (18)
Oil Pump Strainer Bolt 16 (22)
Pitman Arm Nut 159 (216)
Power Steering Pump Bolt 34 (46)
Rear Crankshaft Seal Retainer Bolt 13 (18)
Spark Plug 13 (18)
Suspension Crossmember Bolt 58 (79)
Throttle Body Bolt 14 (19)
Timing Belt Cover Bolt 13 (18)
Timing Belt Tensioner Pulley Bolt 32 (43)
Timing Belt Tensioner Pusher Bolt 14 (19)
Upper Intake Manifold Bolt 18 (24)
Water Pump Bolt (3) 18 (24)

INCH Lbs. (N.m)

Camshaft Thrust Plate Bolt 87 (10)
Camshaft Tower Bolt 87 (10)
Cooling Fan Assembly Nut 69 (8)
Cylinder Head Cover Bolt 80 (9)
EGR Valve Bolt (Valve Side) 69 (8)
Ignition Coil 35 (4)
Oil Pan Bolt 87 (10)
Oil Pump Cover Bolt 87 (10)
Oil Pump Relief Valve Plug 69 (8)

(1) - Tighten bolts in sequence. See Fig. 3.
(2) - Tighten bolts in sequence. See Fig. 16.
(3) - Tighten bolts in sequence. See Fig. 8.
(4) - Tighten bolts to 13 ft. lbs. (18 N.m).

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

Application Specification

3.2L
Displacement ..... 193 Cu. In. (3.2L)
Bore ..... 3.68" (93.4 mm)
Stroke ..... 3.03" (77 mm)
Compression Ratio 9.0:1
Fuel System ..... SFI
3.5L
Displacement ..... 214 Cu. In. (3.5L)
Bore ..... 3.68" (93.4 mm)
Stroke ..... 3.35" (85 mm)
Compression Ratio 9.1:1
Fuel System ..... SFI

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft	
End Play	.012 (.30)
Runout	.002 (.04)
Main Bearings	
Journal Diameter	2.5165-2.5170 (63.918-63.933)
Journal Out-Of-Round	.0016 (.040)
Journal Taper	.0002 (.005)
Oil Clearance	.0010-.0019 (.025-.048)
Connecting Rod Bearings	
Journal Diameter	2.1229-2.1235 (53.922-53.937)
Journal Out-Of-Round	.0002 (.005)
Journal Taper	.0002 (.005)
Oil Clearance	.0010-.0023 (.025-.058)
Thrust Clearance	
Standard	.0024-.0094 (.061-.239)
Limit	.0118 (.300)

CONNECTING RODS

CONNECTING RODS

Application	In. (mm)
Big End Bore Diameter (1)	
Size Mark "A"	2.2439-2.2441 (56.994-57.000)

Size Mark "B" 2.2436-2.2439 (56.988-56.994)
Size Mark "C" 2.2434-2.2436 (56.982-56.988)
Maximum Bend (2) ..... .0059 (.15)
Maximum Twist (2) ..... .0078 (.20)
Side Play ..... .006-.014 (.16-.35)

(1) - Diameter is determined by size mark stamped on connecting rod. See Fig. 11.
(2) - Specification is per 3.937" (100 mm) of rod length.

PISTONS, PINS & RINGS

Application	In. (mm)
Pistons	
Clearance	.0008-.0031 (.020-.080)
Diameter	
3.2L & 3.5L	
Size Mark "A"	3.6756-3.6760 (93.360-93.370)
Size Mark "B"	3.6760-3.6764 (93.370-93.380)
Size Mark "C"	3.6764-3.6768 (93.380-93.390)
Pins	
Diameter	.8660-.8663 (21.997-22.005)
Pin/Rod Interference Fit	.0008-.0016 (.020-.041)
Pin/Piston Clearance	.0004-.0007 (.010-.017)
Rings	
3.2L & 3.5L	
No. 1	
End Gap	.0118-.0157 (.300-.400)
Side Clearance	.0006-.0015 (.015-.038)
No. 2	
End Gap	.0177-.0236 (.450-.600)
Side Clearance	.0006-.0015 (.015-.038)
No. 3 (Oil)	
End Gap	.0059-.0177 (.150-.450)

CYLINDER BLOCK

Application	In. (mm)

Cylinder Bore
Standard Diameter 3.6772-3.6783 (93.400-93.430)
Maximum Diameter 3.6823 (93.530)
Maximum Deck Warpage ..... .006 (.15)

VALVES & VALVE SPRINGS

VALVES & VALVE SPRINGS

Application	Specification
Face Angle	45°
Minimum Margin	
Intake & Exhaust	(1)
Stem Diameter	
Intake	
Standard	.2346-.2353" (5.959-5.977 mm)
Service Limit	.2323" (5.90 mm)
Exhaust	
Standard	.2343-.2350" (5.952-5.970 mm)
Service Limit	.2323" (5.90 mm)
Valve Installed Height (Maximum) (2)	
DOHC	
Intake	1.554" (39.47 mm)
Exhaust	1.553" (39.45 mm)
Valve Springs	
DOHC	
Free Length	
Standard	1.756" (44.66 mm)
Service Limit	1.717" (43.60 mm)
Installed Height	1.38" (35.0 mm)
Out-Of-Square	.079" (2.0 mm)
Pressure (Valve Closed)	196 Lbs. @ 1.38" (44 kg @ 35.0 mm)

(1) - Information not available from manufacturer.
(2) - With NEW valve installed. Replace valve seat if greater than specification.

CYLINDER HEAD

CYLINDER HEAD

Cylinder Head Height 5.236 (133.0)
Maximum Allowable Warpage ..... .002 (.05)
Resurface Limit ..... .008 (.20)
Valve Seats
Seat Angle ..... 45°
Minimum Seat Width ..... .067 (1.70)
Seat Margin
Intake Valve ..... (1)
Exhaust Valve ..... (1)
Valve Guides
Intake Valve
Valve Guide Installed Height ..... .512 (13.00)
Valve Stem-To-Guide Oil Clearance ..... .0009-.0022 (.023-.056)
Exhaust Valve
Valve Guide Installed Height ..... .512 (13.00)
Valve Stem-To-Guide Oil Clearance ..... .0012-.0025 (.030-.063)

(1) - Information not available from manufacturer.

CAMSHAFT

CAMSHAFT

Application	In. (mm)
Camshaft Runout	.004 (.10)
End Play (Maximum)	.005 (.12)
Journal Diameter	
Standard	1.0225-1.0233 (25.972-25.993)
Service Limit	1.0555 (26.810)
Journal Out-Of-Round (Maximum)	.004 (.10)
Oil Clearance	.0011-.0031 (.027-.078)
Lobe Height	1.7602 (44.709)
Thrust Clearance	
Standard	.003-.008 (.07-.20)
Service Limit	.01 (.25)

END OF ARTICLE