

3.0L V6 - VINS [B,C,S]

1991 Mitsubishi Montero

1991 ENGINES
Mitsubishi 3.0L V6
Montero, Pickup, 3000GT

* 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 the engine model.

Engine model number is stamped on front upper edge of cylinder block (below cylinder head) or on vehicle information plate on firewall. Engine serial number is stamped near the engine model number.

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Model	Engine Code
3.0L V6 SOHC		
Montero	6G72	S
Pickup	6G72	S
3.0L V6 DOHC		
3000GT		
Non-Turbo	6G72	B
Turbo	6G72	C

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: Hydraulic lash adjusters are set into rocker arms (SOHC) or cylinder head (DOHC). No adjustment is required.

REMOVAL & INSTALLATION

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

FUEL PRESSURE RELEASE

Perform these steps to release fuel system pressure:

- * Disconnect fuel pump harness connector at fuel tank.
- * Start engine. After it stalls, turn ignition switch to OFF position.
- * Disconnect battery (-) terminal, and reconnect fuel pump harness connector.

- * Wrap shop towels around fuel return and high pressure hoses to prevent fuel splashing on engine. Disconnect fuel return hose and high pressure fuel hose to drain any residual fuel.

ENGINE

Removal (Montero & Pickup)

- 1) Remove hood. Drain cooling system, and remove radiator. Remove skid plate and splash shields. Release fuel system pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Disconnect negative battery cable.
- 2) Remove air cleaner ducts. Remove accessory drive belts. Remove and support A/C compressor and power steering pump. DO NOT disconnect hoses from compressor or pump. Disconnect oil cooler hoses. Cover fuel hose using shop towel, and disconnect high pressure fuel hose and "O" ring. Remove fuel return hose.
- 3) Label and disconnect all vacuum hoses. Disconnect cooling system hoses. Label and disconnect all electrical connections from engine. Remove heat shield from motor mounts. Remove motor mount bolts. Ensure all hoses and wires are disconnected and set aside.
- 4) Disconnect exhaust pipe from exhaust manifolds. Remove starter. Attach engine hoist to engine. Support transmission. Disconnect engine from transmission. See appropriate article in CLUTCHES or TRANSMISSION SERVICING. Remove engine.

Installation (Montero & Pickup)

To install, reverse removal procedure. Install new "O" ring on fuel line. Install new exhaust gaskets and nuts. See TORQUE SPECIFICATIONS (MONTERO & PICKUP) table at end of article. Adjust fluid levels.

Removal (3000GT)

- 1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Remove hood. Remove cruise control vacuum pump and linkage. On turbo models, remove necessary turbo air intake hoses and pipes. On all other models, remove air cleaner hoses.
- 2) On all models, drain cooling system. Drain engine oil and transaxle oil. Remove heater hoses and radiator hoses. Remove transaxle assembly. See appropriate article in CLUTCHES or TRANSMISSION SERVICING.
- 3) Remove radiator. Label and disconnect all vacuum hoses. Label and disconnect all electrical connections and harnesses from engine. Remove accessory drive belts.
- 4) Remove and support A/C compressor and power steering pump. DO NOT disconnect hoses from compressor or pump. Cover fuel hose using shop towel, and disconnect high pressure fuel hose and "O" ring. Remove fuel return hose.
- 5) On turbo models, disconnect oil cooler and vacuum hoses. On all models, remove motor mount bolts and brackets. Ensure all hoses and wires are disconnected and set aside. Attach engine hoist to engine. Remove engine.

Installation

To install, reverse removal procedure. Install new "O" ring on fuel line. Install new exhaust gaskets and nuts. See TORQUE SPECIFICATIONS (3000GT) table at end of article. Adjust fluid levels.

UPPER INTAKE MANIFOLD

Removal (Montero & Pickup)

- 1) Remove air intake hose. See Fig. 1. Remove accelerator cable adjusting bolts. On models equipped with automatic transmission, remove throttle control cable. On all models, remove accelerator

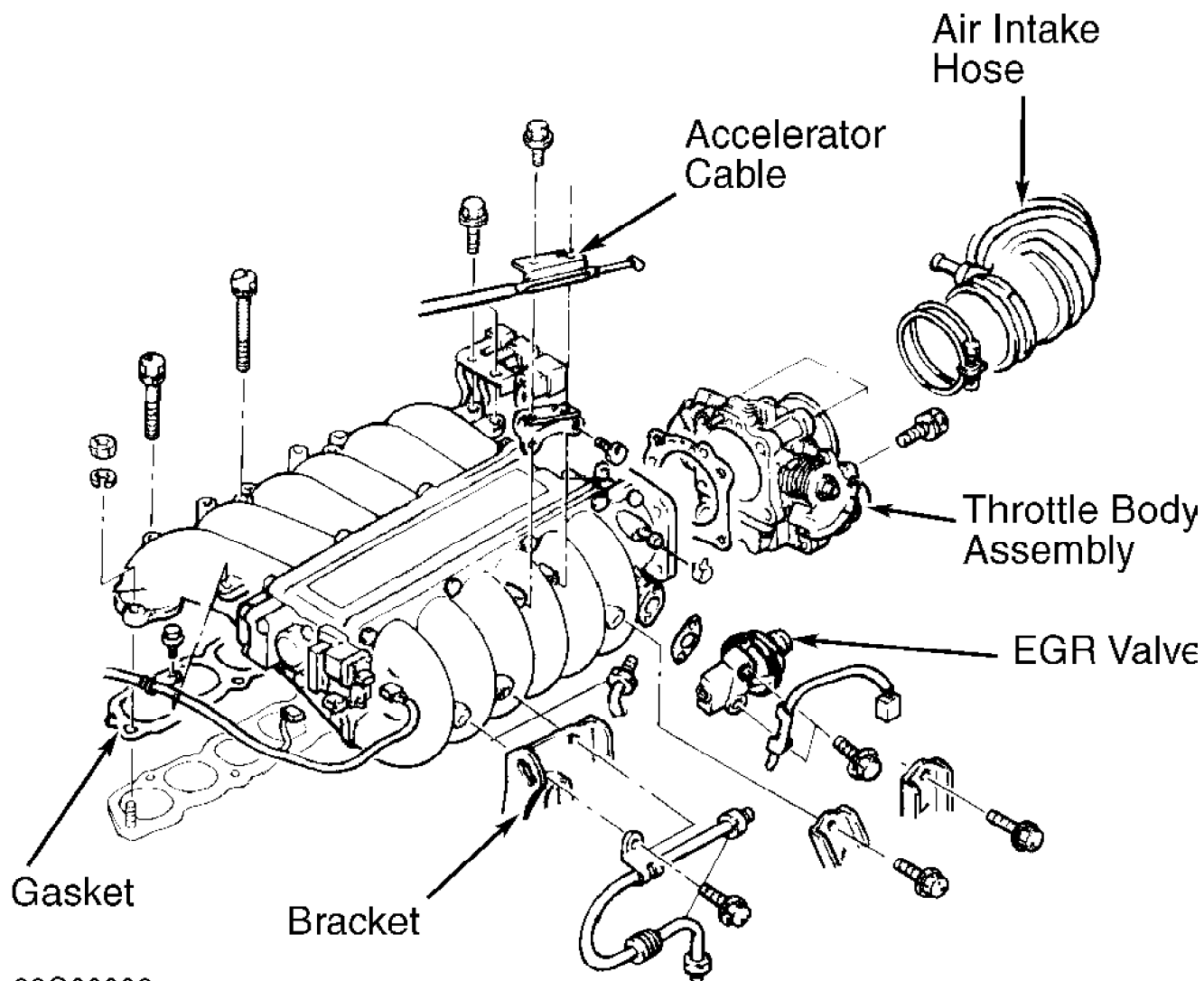
cable. Label and disconnect all vacuum hoses from throttle body and upper intake manifold.

2) Disconnect O2 sensor connector. Remove EGR pipe and gasket. Remove ignition coil. Remove engine oil filler neck bracket. Remove throttle body, leaving coolant hoses connected. Remove throttle body gasket. Remove upper intake manifold plenum mounting bolts and nuts.

3) If necessary, remove EGR valve and pipe. Remove upper intake manifold plenum brackets. Remove upper intake manifold and gasket.

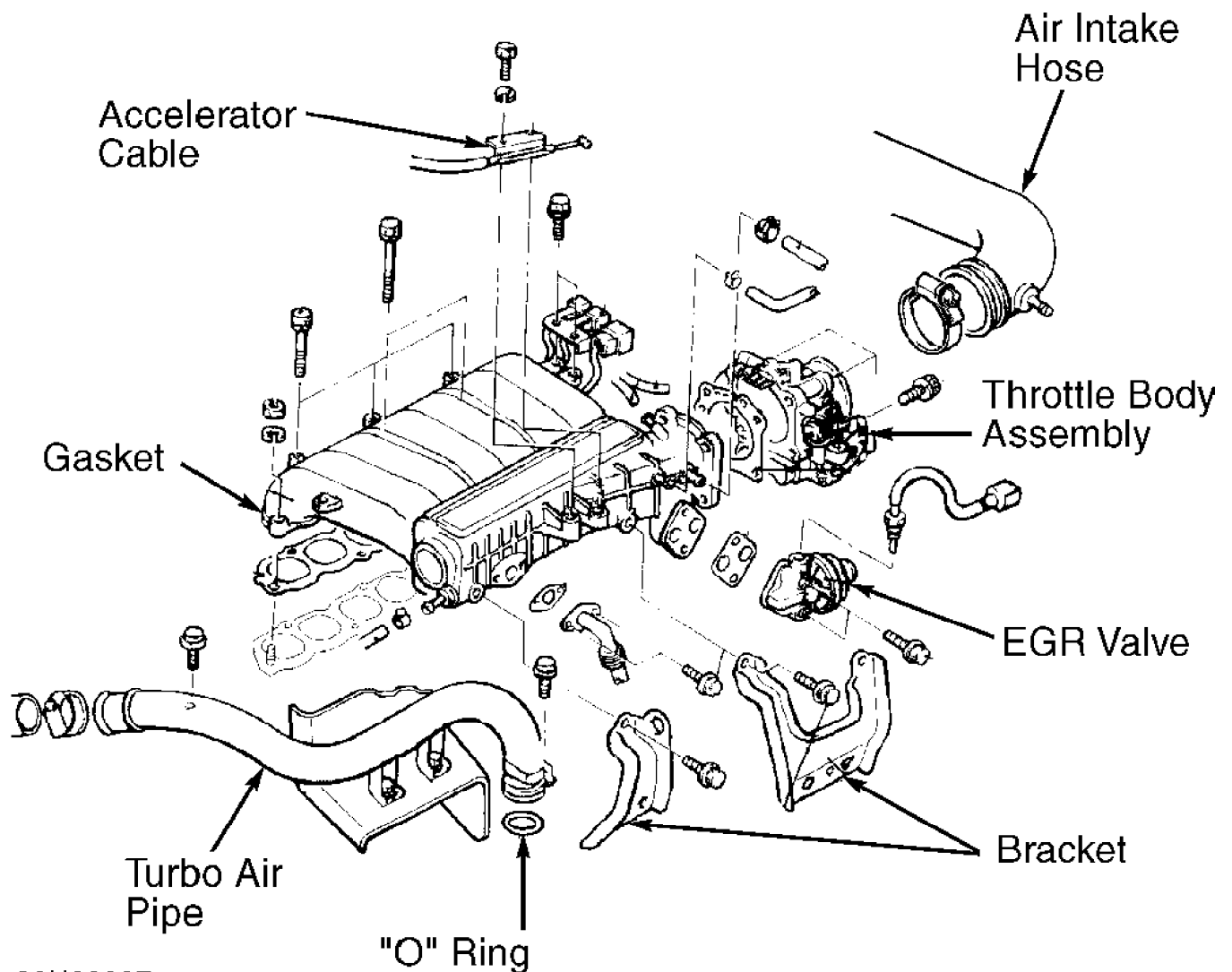
Inspection & Installation (Montero & Pickup)

Clean all gasket mating surfaces. Inspect for damage and cracks on all mounting surfaces. To install, reverse removal procedure using new gaskets. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS (MONTERO & PICKUP) table at end of article.



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Fig. 1: Exploded View of Upper Intake Manifold & Components (DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc



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Fig. 2: View of Upper Intake Manifold & Components (DOHC Turbo, SOHC)
 Courtesy of Mitsubishi Motor Sales of America, Inc

Removal (3000GT)

- 1) Remove air intake hose. Remove throttle body and gasket with control cables and coolant and vacuum hoses attached. See Fig. 2.
- 2) Remove EGR and EGR pipe (if equipped). Disconnect power brake hose. Label and disconnect vacuum hoses and electrical connections. Remove upper intake manifold plenum retaining bracket(s), mounting bolts and nuts. Remove upper intake manifold.

Inspection & Installation (3000 GT)

Clean all gasket mating surfaces. Inspect for damage and cracks on all mounting surfaces. To install, reverse removal procedure using new gaskets. Install throttle body gasket with projection on gasket facing upward beyond throttle body mounting surface. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS (3000GT) table at end of article.

LOWER INTAKE MANIFOLD

CAUTION: Fuel system is under pressure. Fuel pressure must be

released before disconnecting fuel lines.

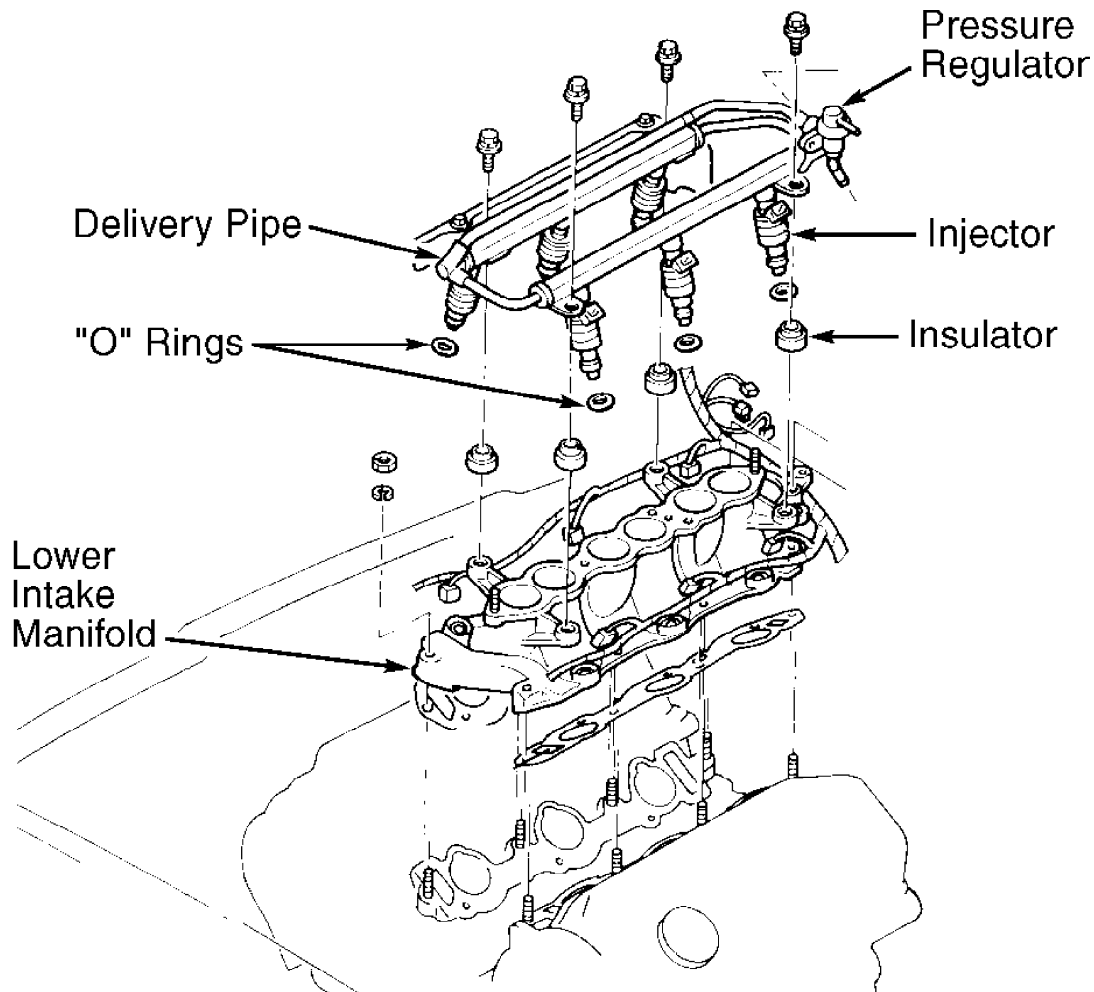
Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE under REMOVAL & INSTALLATION. Remove upper intake manifold. See UPPER INTAKE MANIFOLD under REMOVAL & INSTALLATION.

2) Drain cooling system. Remove high pressure and return fuel lines. Cover fuel lines using shop towel during removal as some fuel may be retained. Remove vacuum hose from pressure regulator. Disconnect injector harness from injectors.

3) Remove fuel delivery pipe, fuel injectors and pressure regulator. See Fig. 3. DO NOT allow injectors to fall from delivery pipe during removal. Remove vacuum hose and pipe assembly.

4) On Montero & Pickup, disconnect coolant temperature sending unit, coolant temperature switch (A/C equipped), coolant temperature sensor and thermostatic switch (A/T equipped). Disconnect upper radiator and coolant by-pass hoses. Disconnect heater pipe. On all models, remove intake manifold and gasket.



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Fig. 3: Exploded View of Lower Intake Manifold & Components
Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection & Installation

1) Inspect for damage and cracks on all mounting surfaces. To

install, reverse removal procedure using new gaskets and "O" rings. Coat "O" ring with fuel before installation.

2) Install lower intake manifold gasket with adhesive side toward intake manifold and gasket protrusions facing outboard of engine. Tighten bolts and nuts to specification. See appropriate TORQUE SPECIFICATIONS table at end of article. Check for fuel leaks.

TURBOCHARGER

Removal (Front)

1) Drain coolant, and remove radiator. Disconnect exhaust pipe from turbo. Remove all air intake pipes. Note match marks and installation depth on air pipes and hoses for reinstallation. Remove serpentine drive belt. Remove alternator. Remove A/C compressor and bracket, and support aside.

2) Remove O2 sensor. Remove dipstick assembly and turbo heat shield. Disconnect turbo coolant feed and return lines. Disconnect turbo oil feed and return lines. Remove turbocharger assembly.

Removal (Rear)

1) Drain coolant. Remove battery. Disconnect accelerator cable at bracket and throttle body. Disconnect exhaust pipe from turbo. Remove all air intake pipes and heat shields. Disconnect accelerator cable at pedal.

2) Remove clutch booster vacuum hose. Remove O2 sensor. Remove EGR pipe and turbo heat shield. Disconnect turbo coolant feed and return lines. Disconnect turbo oil feed and return lines. Remove turbocharger assembly.

CAUTION: DO NOT allow foreign material into turbocharger air intakes or coolant and oil passages.

Inspection (Front & Rear)

1) Inspect turbocharger for oil leakage. Check turbine and compressor wheels for cracks and other damage. Both wheels should turn easily by hand.

2) Apply 6.8 psi (61 kPa) vacuum to wastegate diaphragm. Ensure wastegate operates and diaphragm holds vacuum pressure. Use care when cleaning gasket surfaces so no foreign material enters turbocharger oil, coolant and air passages.

Installation (Front & Rear)

Refill turbocharger with clean engine oil through oil pipe installation hole. To complete installation, reverse removal procedure. Align match marks, and install air pipes and hoses to proper depth.

EXHAUST MANIFOLDS

Removal (Montero & Pickup)

1) Remove splash shields. Remove O2 sensor. Remove exhaust pipe-to-manifold nuts. Lower exhaust pipe, and remove gasket. Remove heat protector. To remove right exhaust manifold, remove air duct, engine lift bracket and alternator bracket.

2) To remove left exhaust manifold, remove EGR pipe and gasket. Remove front intake manifold plenum bracket. Remove exhaust manifolds and gaskets.

Inspection (Montero & Pickup)

Clean all gasket mating surfaces. Inspect for damage and cracks on all mounting surfaces. Check mounting surfaces of manifold and cylinder head for warpage. Repair or replace components if warpage exceeds .012" (.30 mm).

Installation (Montero & Pickup)

To install, reverse removal procedure using new gaskets. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS (MONTERO & PICKUP) table at end of article.

Removal (3000GT)

1) Remove turbocharger(s) (if equipped). See TURBOCHARGER under REMOVAL & INSTALLATION. On front manifold, remove serpentine drive belt and alternator. Remove oil dipstick. On rear manifold, remove EGR pipe (if equipped).

NOTE: Note locations and direction of installation of exhaust manifold plain and spring washers for reinstallation reference. DO NOT mix these fasteners.

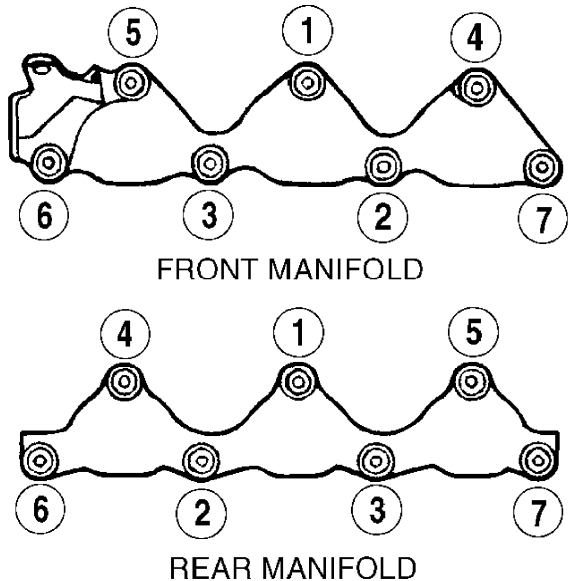
2) On all manifolds, remove exhaust pipe-to-manifold nuts. Lower exhaust pipe, and remove gasket. Remove heat protector. Remove exhaust manifold nuts and washers. Note locations and direction of installation of plain and spring washers for reinstallation reference. DO NOT mix these fasteners. Remove exhaust manifold and gasket.

Inspection (3000GT)

Clean all gasket mating surfaces. Inspect for damage and cracks on all mounting surfaces. Check mounting surfaces of manifold and cylinder head for warpage. Repair or replace components if warpage exceeds .012" (.30 mm).

Installation (3000GT)

To install, reverse removal procedure using new gaskets. Install new "O" ring on dipstick guide. Coat "O" ring with oil before installation. Install manifold nuts and washers in original locations. Tighten nuts to specification in sequence. See Fig. 4. See TORQUE SPECIFICATIONS (3000GT) table at end of article.



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Fig. 4: Exhaust Manifold Tightening Sequence (3000GT)
Courtesy of Mitsubishi Motor Sales of America, Inc.

CYLINDER HEADS

Removal (SOHC)

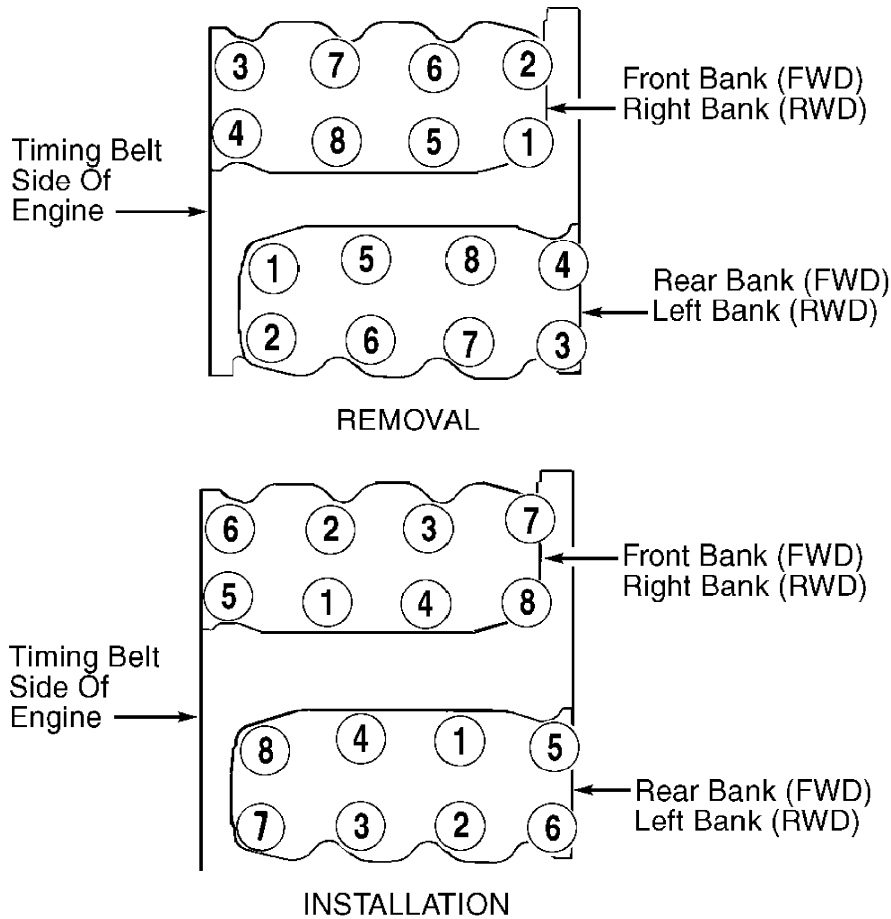
1) Drain cooling system. Remove upper and lower intake manifolds and brackets. See UPPER INTAKE MANIFOLD and LOWER INTAKE MANIFOLD under REMOVAL & INSTALLATION. Remove spark plug wires. Remove splash shields.

2) Disconnect O2 sensor. Disconnect exhaust pipe from exhaust manifold, and support to crossmember using wire. Remove heat shields and exhaust manifolds. See EXHAUST MANIFOLDS under REMOVAL & INSTALLATION.

3) Remove distributor (left or rear head). Remove timing belt outer covers, camshaft sprockets, timing belt and timing belt inner covers. See TIMING BELT under REMOVAL & INSTALLATION. Remove accessory bracket bolts from front of cylinder head. Remove rocker cover and gasket.

4) Using Socket (MD998051), loosen cylinder head bolts in 2-3 steps using proper sequence. See Fig. 5. Remove cylinder head and camshaft assemblies. Note direction of washer installation on head bolts.

NOTE: Cylinder head bolts must be loosened in 2-3 steps using proper sequence to prevent cylinder head warpage and cracking.



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Fig. 5: Cylinder Head Bolt Removal & Tightening Sequence
Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection (SOHC)

Check cylinder head height and warpage at gasket and manifold

surfaces. Resurface head if warpage exceeds specification. See CYLINDER HEAD (SOHC) table under ENGINE SPECIFICATIONS at end of article. Replace cylinder head if it is not within specification after resurfacing.

Installation (SOHC)

1) Ensure mating surfaces are clean and dry. Note identification mark located on front of head gasket. Identification marks are: "R" for SOHC, "2DN" for DOHC non-turbocharged and "2DT" for DOHC turbocharged engine. Install head gasket with identification mark toward timing belt side of engine and facing upward. Ensure all holes are aligned.

NOTE: Install head gasket with identification mark toward timing belt side of engine and facing upward. Ensure all holes align. Install washers on head bolts with chamfered side toward bolt head.

2) Install cylinder head and bolts. Ensure washers are installed on head bolts with chamfered side toward bolt head. Using proper sequence, tighten bolts to specification in 2-3 steps. See Fig. 5. See appropriate TORQUE SPECIFICATIONS table at end of article.

3) Apply sealant to rocker cover sealing surfaces before installation. See Fig. 6. Ensure rocker cover gasket projections are aligned with notches in rocker cover. Coat all "O" rings with oil, and install a new "O" ring on distributor adapter and oil dipstick tube.

4) Coat camshaft area with oil prior to installing distributor adapter. To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See appropriate TORQUE SPECIFICATIONS table. After engine reaches normal operating temperature, allow engine to cool, and retighten cylinder head bolts.

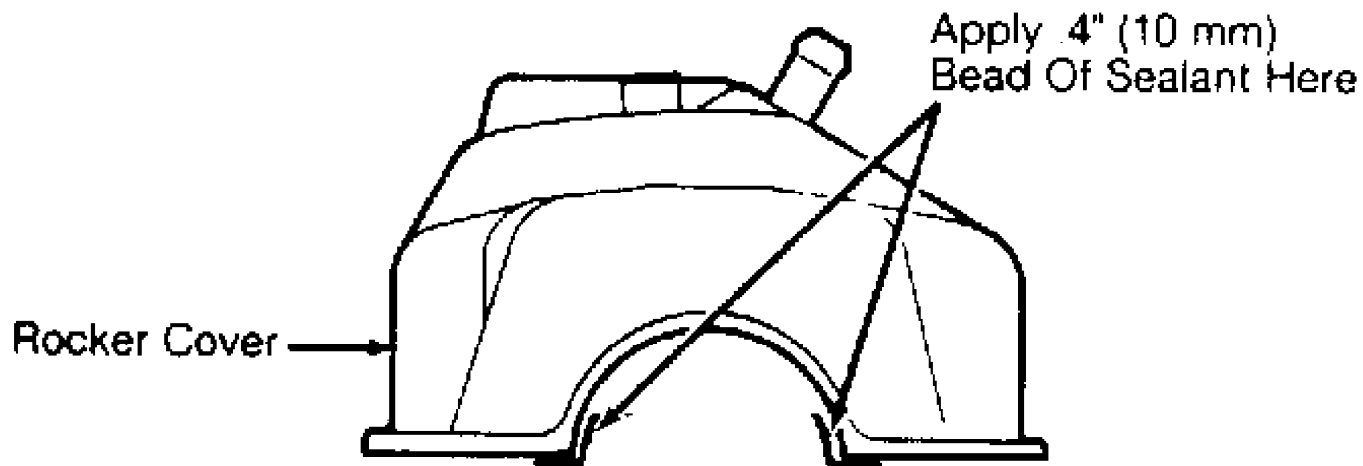


Fig. 6: Applying Sealant to Rocker Cover (SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Removal (DOHC)

1) Drain cooling system. Remove upper and lower intake manifolds and brackets. See UPPER INTAKE MANIFOLD and LOWER INTAKE MANIFOLD under REMOVAL & INSTALLATION.

2) Remove turbocharger(s) (if equipped). See TURBOCHARGER under REMOVAL & INSTALLATION. Remove heat shields from exhaust manifolds. Remove exhaust manifolds. See EXHAUST MANIFOLDS under REMOVAL & INSTALLATION.

3) Remove spark plug wires and ignition coils. Remove rocker cover and gasket. Remove timing belt and timing belt inner covers. See

TIMING BELT under REMOVAL & INSTALLATION. Remove intake camshaft sprockets.

4) Remove coolant manifold and coolant inlet pipe. Using Socket (MD998051), remove cylinder head bolts. Remove cylinder head and camshaft assemblies. Note direction of washer installation on head bolts.

Inspection (DOHC)

Check cylinder head height. Check warpage at gasket and manifold surfaces. Resurface head if warpage exceeds specification. See CYLINDER HEAD (DOHC) table under ENGINE SPECIFICATIONS at end of article. After resurfacing, recheck cylinder head height. Replace cylinder head if it is not within specification.

Installation (DOHC)

1) Ensure mating surfaces are clean and dry. Note identification mark located on front of head gasket. Identification marks are: "R" for SOHC, "2DN" for DOHC non-turbocharged and "2DT" for DOHC turbocharged engine. Install head gasket with identification mark toward timing belt side of engine and facing upward. Ensure all holes are aligned.

NOTE: Install head gasket with identification mark toward timing belt side of engine and facing upward. Ensure all holes align. Install washers on head bolts with chamfered side toward bolt head.

2) Install cylinder head and bolts. Ensure washers are installed on head bolts with chamfered side toward bolt head. Using proper sequence, tighten bolts to specification in 2-3 steps. See Fig. 5. See TORQUE SPECIFICATIONS (3000GT) table at end of article. On turbocharger equipped engines, back off head bolts once, and repeat tightening procedure.

3) To reinstall camshaft sprocket, hold hexagonal area of camshaft using wrench while tightening sprocket bolt. Tighten rocker cover bolts in a crisscross pattern. Start at 4 corners of rocker cover and move toward center.

NOTE: Rocker cover bolts are color coded. Front cylinder bank bolts are black; rear cylinder bank bolts are green.

4) To complete installation, reverse removal procedure. Tighten bolts and nuts to specification. See TORQUE SPECIFICATIONS (3000GT) table.

FRONT CRANKSHAFT OIL SEAL

Removal & Installation

Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Pry oil seal from oil pump. To install, coat seal lip with grease. Using Seal Installer (MD998717), install seal in oil pump. Install remaining components. See appropriate TORQUE SPECIFICATIONS table at end of article.

TIMING BELT

Removal (Montero & Pickup)

1) Drain cooling system. Disconnect upper radiator hose. Remove upper radiator shroud. Remove cooling fan and fan clutch assembly. Remove cooling fan pulley. Remove all drive belts. Remove power steering pump with pressure and return hoses connected, and set aside.

2) Remove power steering pump brackets. Remove A/C tensioner

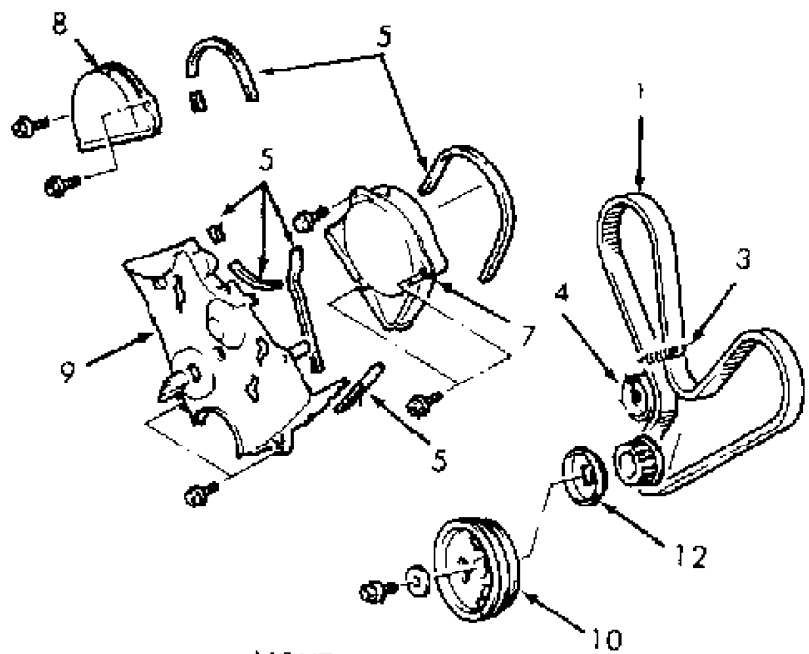
pulley and mounting bracket. Remove A/C compressor with hoses connected, and remove mounting bracket. Remove cooling fan bracket assembly. Note location and length of bolts for reassembly reference.

3) Remove No. 1 and No. 2 timing belt upper outer covers and gaskets. See Fig. 7. Remove timing belt lower outer cover and gaskets. Using Holder (MB998747) and a used "V" belt, remove crankshaft pulley bolt. Remove crankshaft pulley.

NOTE: "V" belt will be damaged by tool. DO NOT use engine "V" belt to hold crankshaft pulley unless replacing belt.

4) Remove flange. See Fig. 7. Rotate crankshaft and align all timing marks. See Fig. 8. Loosen belt tensioner bolt, and rotate belt tensioner counterclockwise to release belt tension.

5) If reusing timing belt, place arrow on belt to indicate direction of belt rotation. Remove timing belt and belt tensioner. If camshaft sprocket requires removal, install Holder (MB990775) on camshaft sprocket. Remove retaining bolt and camshaft sprocket. Remove rear timing belt cover (if required).



MONTERO & RAIDER

- | | |
|----------------------------|----------------------------|
| 1. Timing Belt | 8. No. 1 Upper Outer Cover |
| 2. Engine Support Bracket | 9. Lower Outer Cover |
| 3. Tensioner Spring | 10. Crankshaft Pulley |
| 4. Belt Tensioner Bolt | 11. Cover Cap |
| 5. Gasket | 12. Flange |
| 6. Belt Tensioner | 13. Cover |
| 7. No. 2 Upper Outer Cover | |

Fig. 7: Exploded View of Timing Belt Components (SOHC Is Similar)
 Courtesy of Mitsubishi Motor Sales of America, Inc.

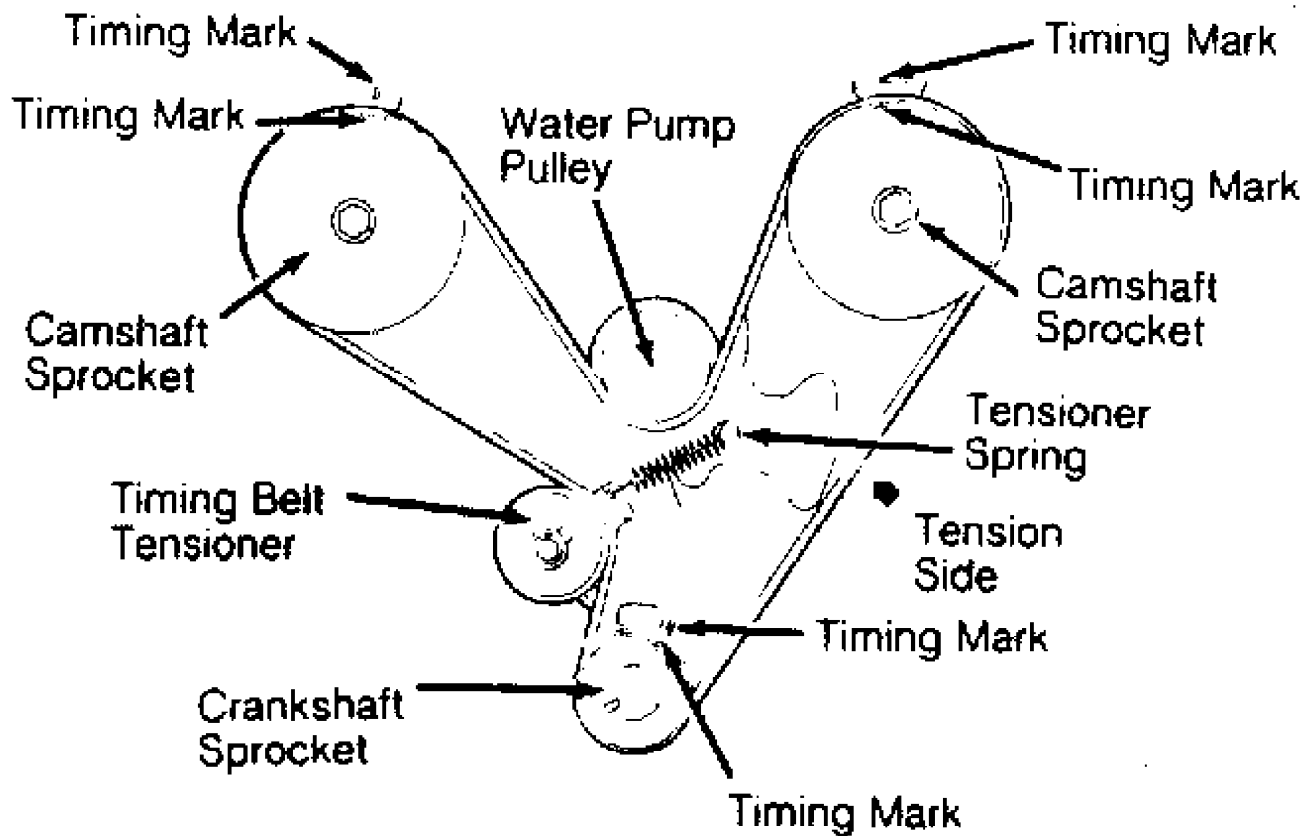


Fig. 8: Aligning Timing Marks (SOHC)
 Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection (Montero & Pickup)

Inspect timing belt for wear on edges of drive teeth. Inspect belt for oil contamination, cracks, separation, worn or missing teeth and hardened back surface. Replace belt if worn, damaged or contaminated. Inspect belt tensioner for smooth rotation. Replace if defective.

Installation (Montero & Pickup)

1) Install rear timing belt cover. Tighten bolts to specification. See TORQUE SPECIFICATIONS (MONTERO & PICKUP) table at end of article. Install camshaft sprockets (if removed). Using holder, hold camshaft and tighten retaining bolt to specification.

2) Install belt tensioner and spring. Ensure spring is secured on pin of water pump and engaged in hole of belt tensioner with hook of spring pointing from cylinder block.

3) Rotate belt tensioner counterclockwise as much as possible, and temporarily tighten bolt. Align all timing marks with No. 1 cylinder at TDC of compression stroke. See Fig. 8.

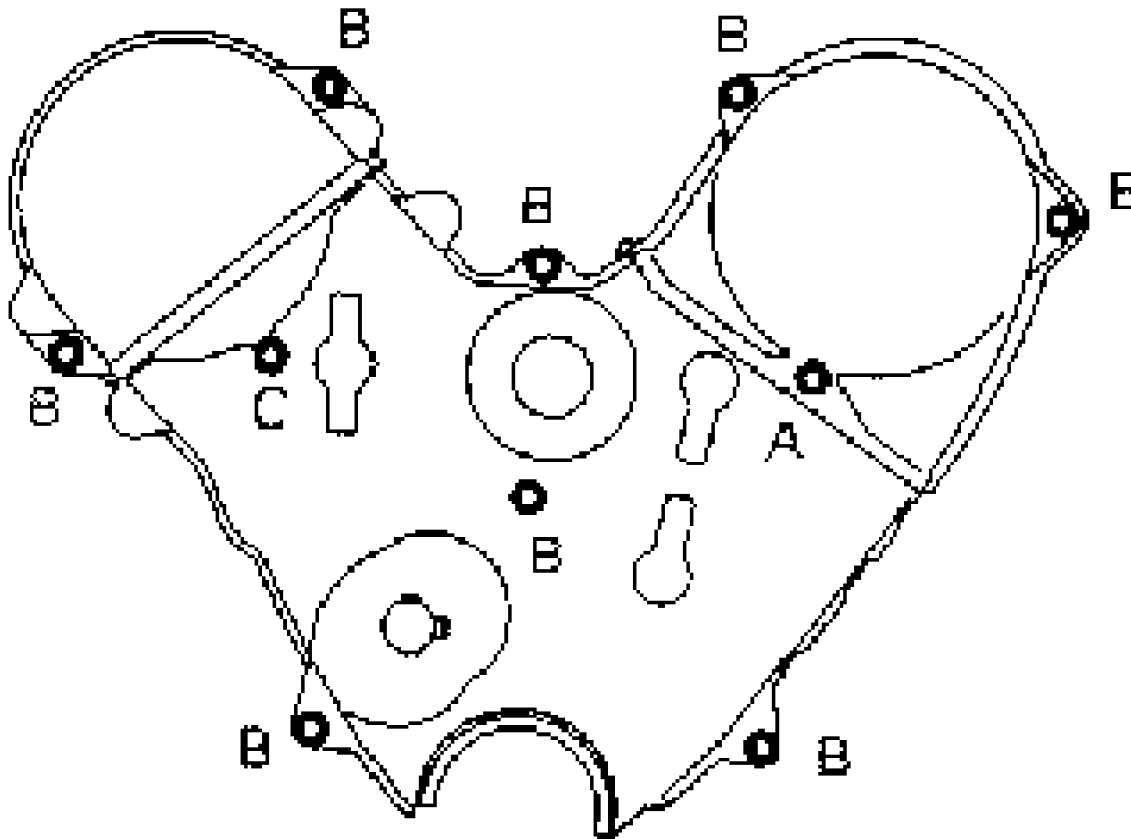
4) Install timing belt on crankshaft sprocket and then left camshaft sprocket with all slack removed from tension side of belt. Route timing belt onto water pump pulley, right camshaft sprocket and tensioner. Remove any slack from belt by rotating left and then right camshaft sprockets counterclockwise.

5) Ensure belt is installed in original direction of rotation and all timing marks are aligned. Install flange on crankshaft. Loosen belt tensioner bolts slightly, and allow tensioner to apply belt tension.

6) Using Crankshaft Socket (MD998716), rotate crankshaft 2

revolutions clockwise. DO NOT rotate counterclockwise. Realign all timing marks. Tighten belt tensioner bolts to specification. Using belt tension gauge, measure belt tension halfway between crankshaft sprocket and camshaft sprocket on side opposite belt tensioner.

7) Belt tension should be 57.3-83.8 lbs. (26-38 kg). To install remaining components, reverse removal procedure. Install proper length bolts in timing belt covers. See Fig. 9. Tighten bolts to specification. See TORQUE SPECIFICATIONS (MONTERO & PICKUP) table.



Note: Bolt measurements indicated in millimeters.

Thread Diameter & Length

A - 6x60mm

B - 6x20mm

C - 6x55mm

Fig. 9: Identifying Timing Belt Cover Bolt Lengths (MONTERO & PICKUP)
Courtesy of Mitsubishi Motor Sales of America, Inc.

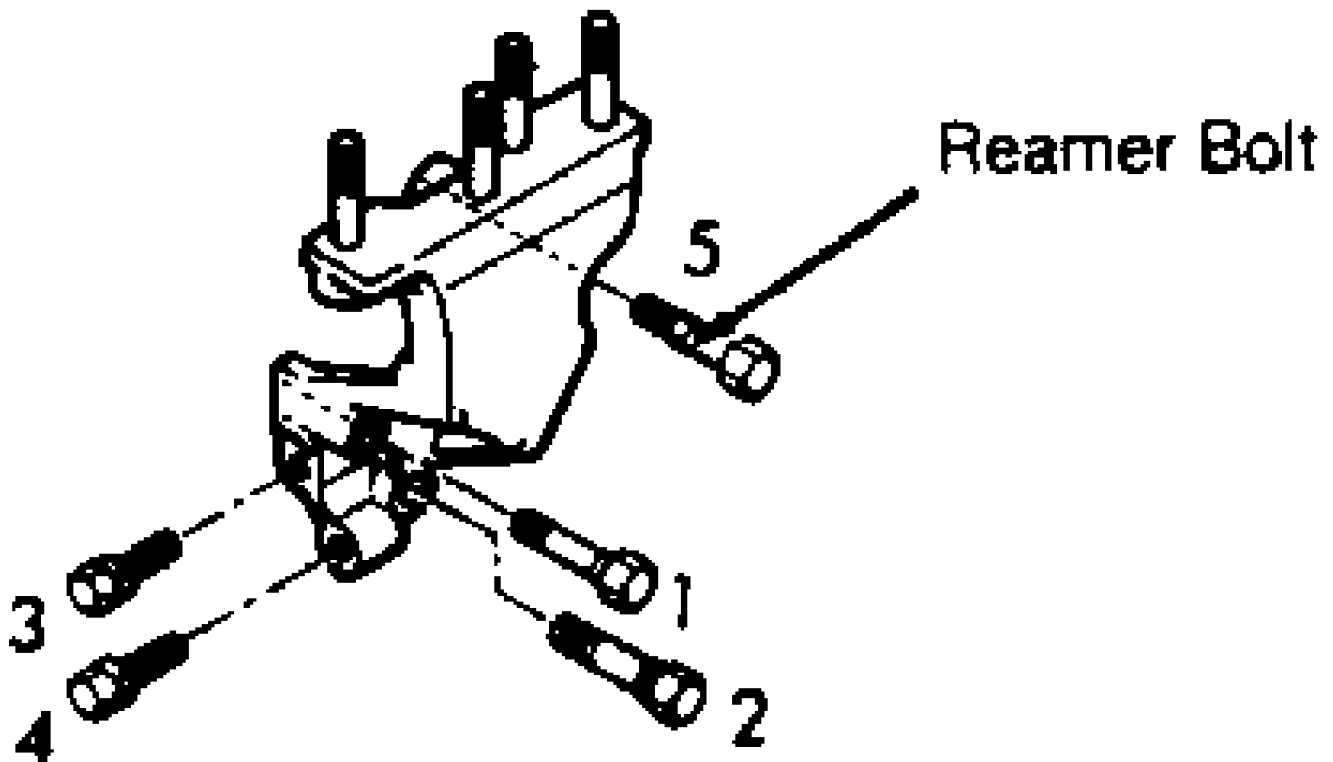


Fig. 10: Engine Support Bracket Bolt Removal Sequence (3000GT)
 Courtesy of Mitsubishi Motor Sales of America, Inc.

NOTE: Apply spray lubricant on reamer bolt during removal as bolt is sometimes seized in engine support bracket.

Removal (3000GT)

1) Remove lower splash shields. Remove cruise control actuator (if equipped). Remove all drive belts. Disconnect electrical connector at power steering pump. Remove A/C tensioner pulley and mounting bracket.

2) Remove power steering pump with hoses connected, and wire aside. Support engine. Remove front engine mount through bolt and front engine mount. Remove timing belt No. 1 upper outer cover and gaskets. See Fig. 7.

3) Remove engine support bracket bolts in proper sequence. See Fig. 10. Remove engine support bracket. Remove cover cap and timing belt No. 2 upper outer cover and gaskets. Using Holder (MB990767) and Adapter Bolts (MD998719), remove crankshaft pulley.

4) Remove lower outer cover, gaskets and flange. See Fig. 7. Rotate crankshaft and align all timing marks. See Fig. 8. Loosen belt tensioner bolt, and rotate belt tensioner counterclockwise to release belt tension.

5) If reusing timing belt, place arrow on belt to indicate direction of belt rotation. Remove timing belt and belt tensioner.

6) If camshaft sprocket requires removal, install Holder (MB990767) with Adapter Bolts (MD998719) on camshaft sprocket. Remove camshaft sprocket bolt and camshaft sprocket. Remove rear timing belt cover (if required).

Inspection (3000GT)

Inspect timing belt for wear on edges of drive teeth. Inspect belt for oil contamination. Replace belt if damaged or contaminated.

Inspect belt tensioner for smooth rotation. Replace if defective.

Installation

1) Install rear timing belt cover. Tighten bolts to specification. See TORQUE SPECIFICATIONS (3000GT) table at end of article. Install camshaft sprockets (if removed). Using holder, hold camshaft and tighten camshaft sprocket bolt to specification.

2) Install belt tensioner and spring. Ensure spring is secured on pin of water pump and engaged in hole of belt tensioner with hook of spring pointing from cylinder block.

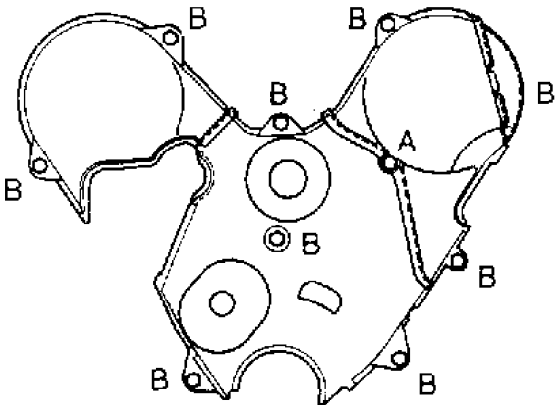
3) Rotate belt tensioner counterclockwise as much as possible, and temporarily tighten bolt. Align all timing marks with No. 1 cylinder at TDC of compression stroke. See Fig. 8.

4) Install timing belt on crankshaft sprocket, rear cylinder bank camshaft sprocket, water pump pulley, front cylinder bank camshaft sprocket and timing belt tensioner. Ensure belt is installed in original direction of rotation and all timing marks are aligned. Install flange on crankshaft. Loosen belt tensioner bolts slightly, and allow tensioner to apply belt tension.

5) Using Crankshaft Socket (MD998716), rotate crankshaft 2 revolutions clockwise. DO NOT rotate counterclockwise. Realign all timing marks. Tighten belt tensioner bolts to specification. See TORQUE SPECIFICATIONS (3000GT) table. Using belt tension gauge, measure belt tension halfway between crankshaft sprocket and camshaft sprocket on side opposite belt tensioner.

6) Belt tension should be 46.3-63.3 lbs. (21-29 kg). To install remaining components, reverse removal procedure. Install proper length bolts in timing belt covers and engine support bracket. See Figs. 9 and 10. Tighten bolts to specification. See TORQUE SPECIFICATIONS (3000GT) table.

NOTE: Engine support bracket reamer bolt must be tightened slowly while spraying lubricant on bolt.



Note: Bolt measurements indicated in millimeters.

Thread Diameter & Length

A - 6x55mm

B - 6x20mm

Fig. 11: Identifying Timing Belt Cover Bolt Length (SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

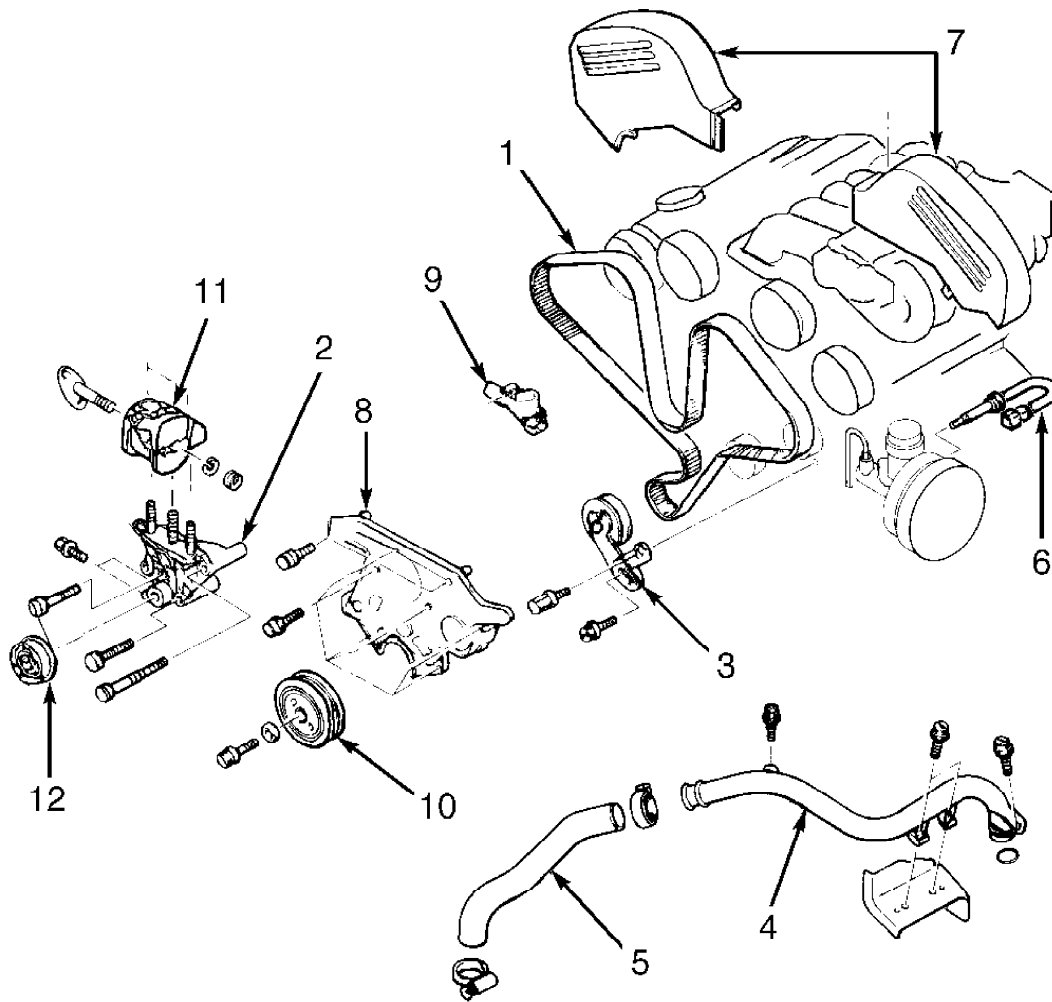
Removal (DOHC)

1) Remove lower splash shields. Remove cruise control

actuator (if equipped). Remove all drive belts. Remove alternator. Remove drive belt tensioner assembly.

2) Using Holder (MB990767) and Adapter Bolts (MD998754), remove crankshaft pulley. See Fig. 12. Disconnect brake fluid level sensor. Remove upper timing belt covers. Support engine. Remove front engine mount through bolt and front engine mount.

NOTE: Apply spray lubricant on reamer bolt during removal as bolt is sometimes seized in engine support bracket.



- | | |
|-----------------------------|-----------------------------|
| 1. Timing Belt | 7. Upper Timing Belt Covers |
| 2. Engine Support Bracket | 8. Lower Timing Belt Cover |
| 3. Belt Tensioner | 9. Automatic Tensioner |
| 4. Turbo Air Hose | 10. Crankshaft Pulley |
| 5. Turbo Air Pipe | 11. Engine Mount Bracket |
| 6. Brake Fluid Level Sensor | 12. Drive Belt Idler Pulley |

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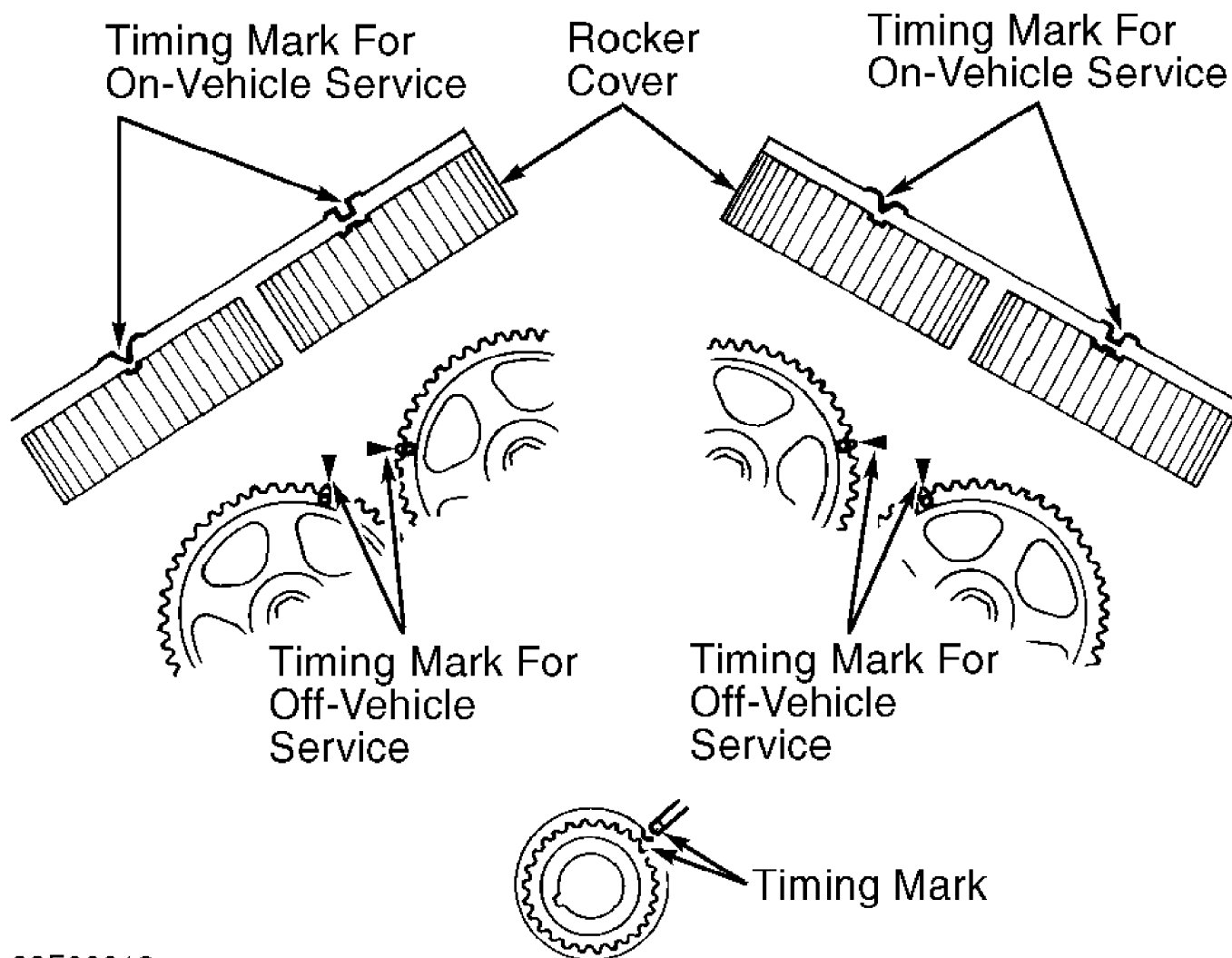
Fig. 12: Exploded View of Timing Belt Components (DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

3) Remove drive belt idler pulley. Remove engine support bracket bolts in proper sequence. See Fig. 10. Remove engine support

bracket. Remove timing belt upper lower cover, noting length and location of cover bolts.

4) If reusing timing belt, place arrow on belt to indicate direction of belt rotation. Remove timing belt and belt tensioner. Rotate crankshaft and align all timing marks. See Fig. 13. Loosen center tensioner bolt, and remove timing belt.

5) If camshaft sprocket requires removal, install wrench on hexagonal portion of camshaft. Hold camshaft while loosening camshaft sprocket bolt. Remove camshaft sprocket bolt and camshaft sprocket.



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Fig. 13: Aligning Timing Marks Initial Alignment (DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection (DOHC)

Inspect timing belt for wear on edges of drive teeth. Inspect belt for oil and coolant contamination. Replace belt if damaged or contaminated. Inspect belt tensioner for smooth rotation. Replace if defective.

Installation (DOHC)

1) Install camshaft sprockets (if removed). Using wrench, hold camshaft at hexagonal section and tighten camshaft sprocket bolt to specification. See TORQUE SPECIFICATIONS (3000GT) table at end of

article.

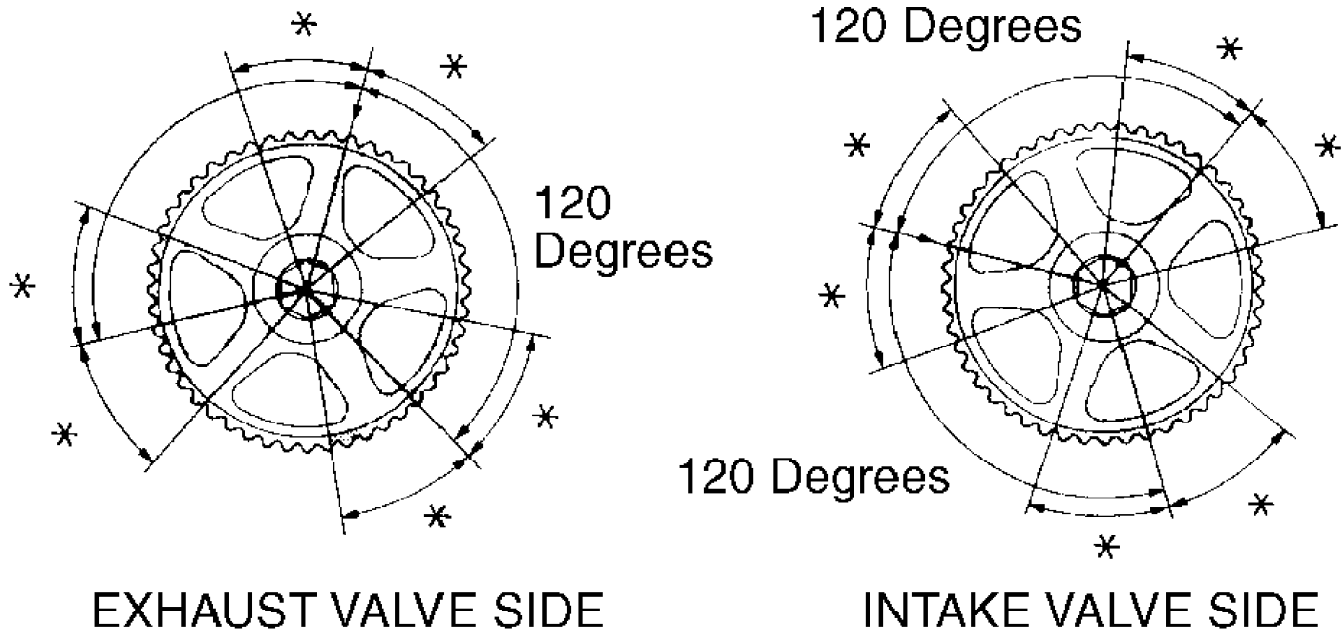
2) Place automatic tensioner assembly in a soft-faced vise. Squeeze rod back into automatic tensioner in small increments until both rod and housing holes are aligned. Install a .055" (1.39 mm) diameter wire through both holes.

3) Remove automatic tensioner from vise, and install assembly with wire installed. Install crankshaft sprocket (if removed). Align timing marks on crankshaft and camshaft sprockets. See Fig. 13.

CAUTION: Turning camshaft sprockets while No. 1 cylinder is at TDC may damage valve and piston. Use care when aligning timing marks.

4) To lower No. 1 piston from TDC and prevent valve and piston contact, turn crankshaft back 3 sprocket teeth (measured at timing mark). Starting with front bank of cylinders, ensure intake and exhaust camshaft timing marks are not within shaded area of figure. See Fig. 14.

When camshaft sprocket timing marks are in indicated area, camshaft is under valve spring pressure and may rotate suddenly, pinching hand between sprockets. Use care when aligning timing marks.



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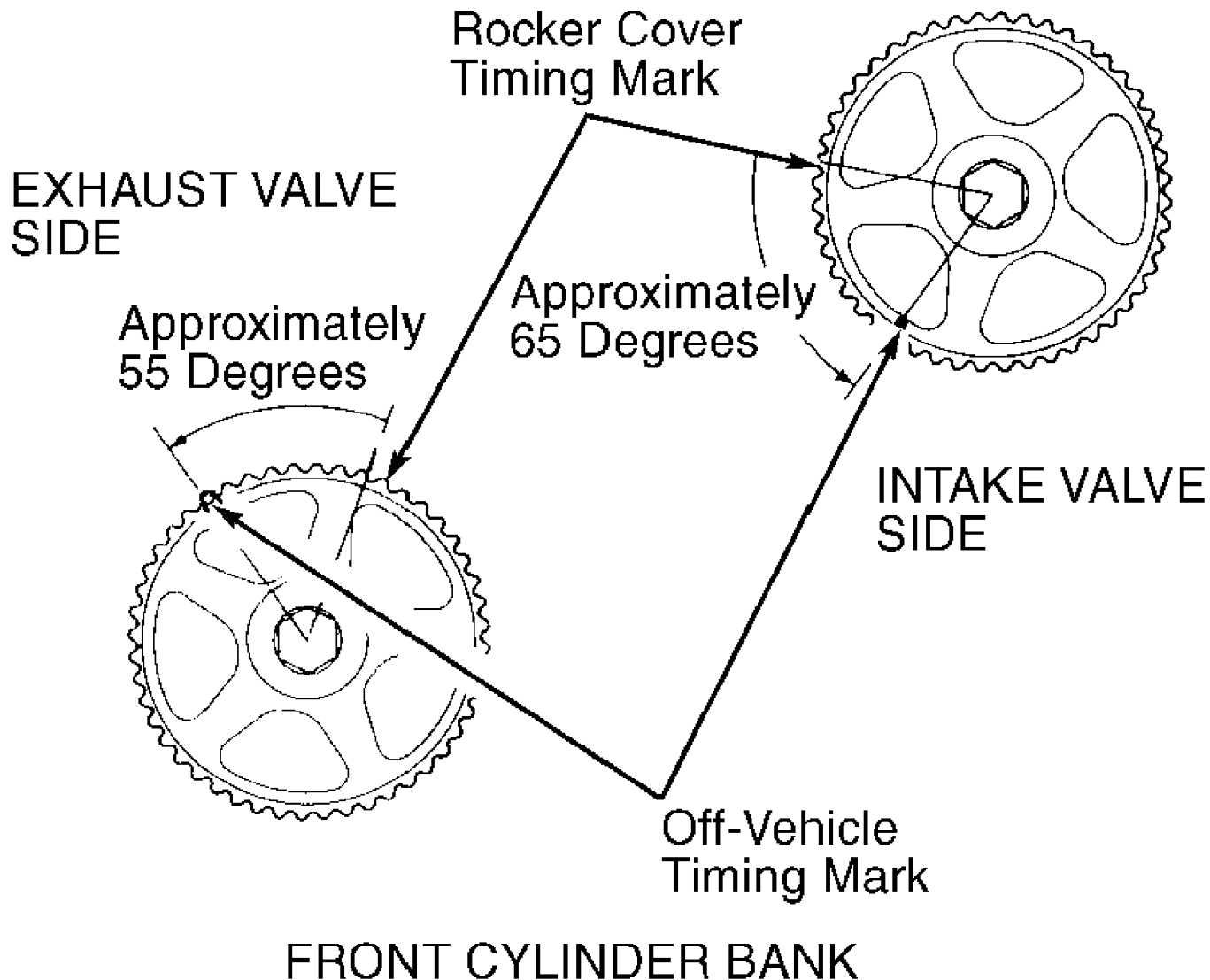
Fig. 14: Adjusting Timing Marks to Prevent Valve & Piston Damage (DOHC)

Courtesy of Mitsubishi Motor Sales of America, Inc.

5) If camshaft sprocket timing mark is within indicated area, carefully rotate camshaft sprocket until timing mark is located in nearest safe area. See Fig. 14.

6) Rotate either camshaft sprocket clockwise to align timing marks as shown in Fig. 15. If camshaft sprocket is turned past timing mark, turn it counterclockwise to realign it. Repeat procedure for

other front bank camshaft sprocket.

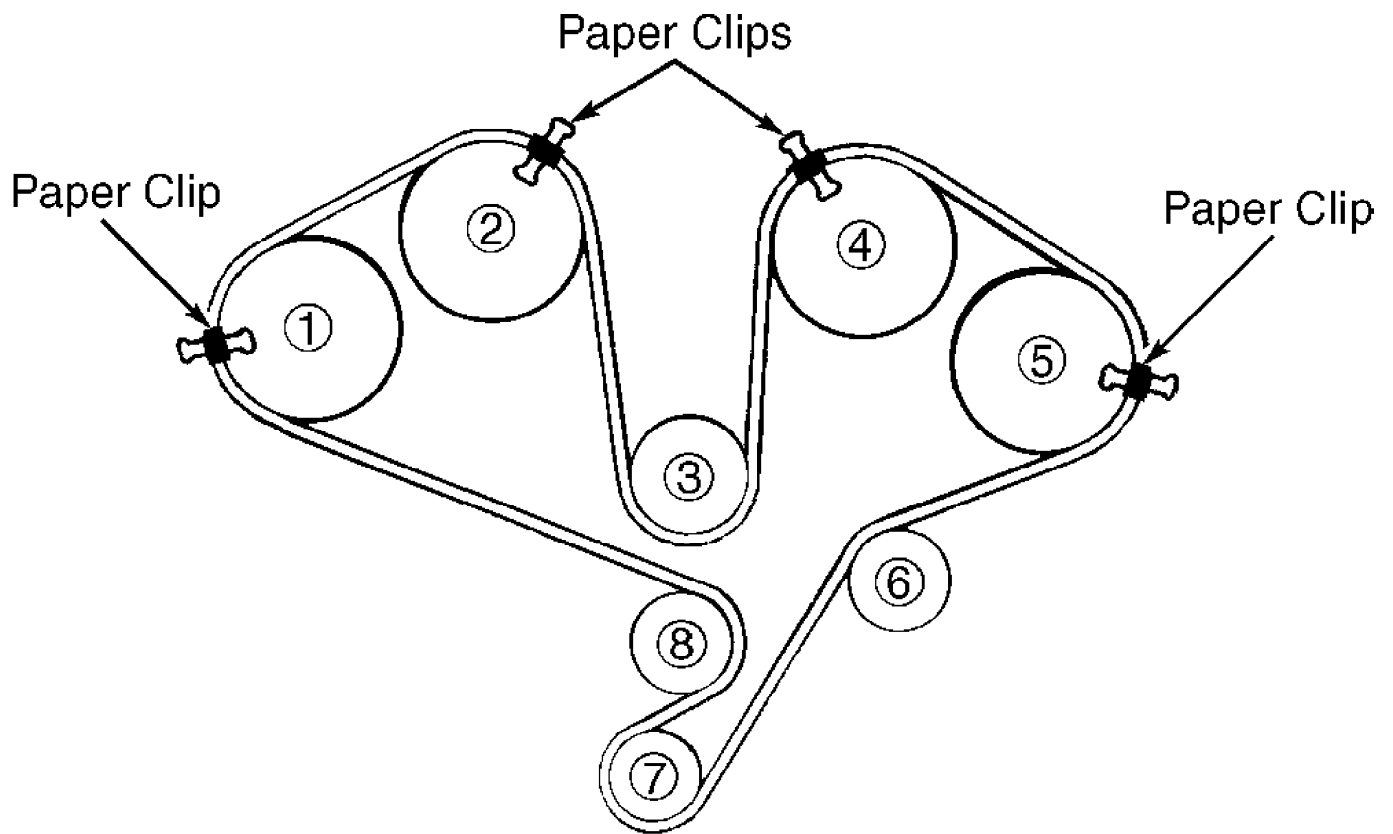


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Fig. 15: Aligning Timing Marks Final Alignment (DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

7) Repeat steps 4)-6) for rear cylinder bank camshafts. Align crankshaft timing mark. Install timing belt on sprockets in sequence. See Fig. 16. Use spring-type paper clips to secure belt on sprockets. Use offset box-end wrenches on camshaft sprocket bolts to keep camshafts from turning during belt installation.

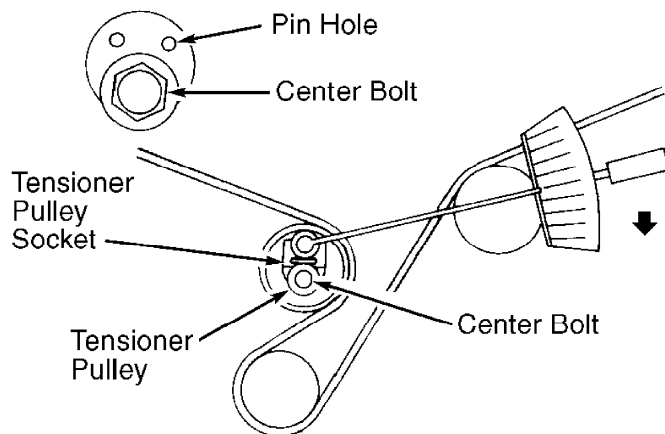
NOTE: If necessary, crankshaft sprocket may be turned one tooth counterclockwise to aid belt installation.



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Fig. 16: Installing Timing Belt (DOHC)
 Courtesy of Mitsubishi Motor Sales of America, Inc.

8) Rotate timing belt tensioner pulley until pin holes are located above center bolt. See Fig. 17. Push tensioner pulley against belt, and temporarily tighten center bolt. Ensure all timing marks are still aligned, and remove clips.



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Fig. 17: Adjusting Timing Belt Tensioner (DOHC)
 Courtesy of Mitsubishi Motor Sales of America, Inc.

9) Rotate crankshaft 1/4 revolution counterclockwise. Rotate crankshaft clockwise until timing marks are realigned. Loosen

tensioner center bolt. Using Tensioner Pulley Socket (MD998767) and torque wrench, apply 84 INCH lbs. (9.5 N.m). See Fig. 17. Retighten center bolt to specification. See TORQUE SPECIFICATIONS (3000GT) table at end of article. Ensure tensioner pulley does not rotate while tightening center bolt.

10) Ensure wire installed in automatic tensioner can be easily removed and installed. Rotate crankshaft 2 revolutions clockwise. Wait 5 minutes. Ensure wire can still be removed and installed easily or automatic tensioner rod projects from tensioner body .150-.177" (3.8-4.5 mm).

11) If rod projection is not to specification, repeat steps 9) and 10). To complete installation, reverse removal procedure. Install proper length bolts in timing belt covers. Install bolts into engine support bracket in reverse order of removal sequence. See Fig. 10. Tighten bolts to specification. See TORQUE SPECIFICATIONS (3000GT) table.

NOTE: Engine support bracket reamer bolt must be tightened slowly while spraying lubricant on bolt.

CAMSHAFT & ROCKER ARMS

Removal (SOHC)

1) Remove PCV valve and breather hoses. Remove timing belt, camshaft sprocket and rear timing belt cover. See TIMING BELT under REMOVAL & INSTALLATION. Remove rocker covers and gaskets. Remove circular packing from rear of camshafts.

2) Remove camshaft oil seal from front of cylinder head or distributor adapter. Remove distributor adapter and "O" ring. Install Valve Lash Adjuster Holder (MD998443) on rocker arm. See Fig. 18. Note arrow marks on bearing caps and cylinder head. See Fig. 19.

3) Bearing cap location number is stamped on front side of bearing cap. Remove bearing cap bolts. Keep components in order for reassembly reference. Remove rocker arm assembly. Remove camshaft from cylinder head.

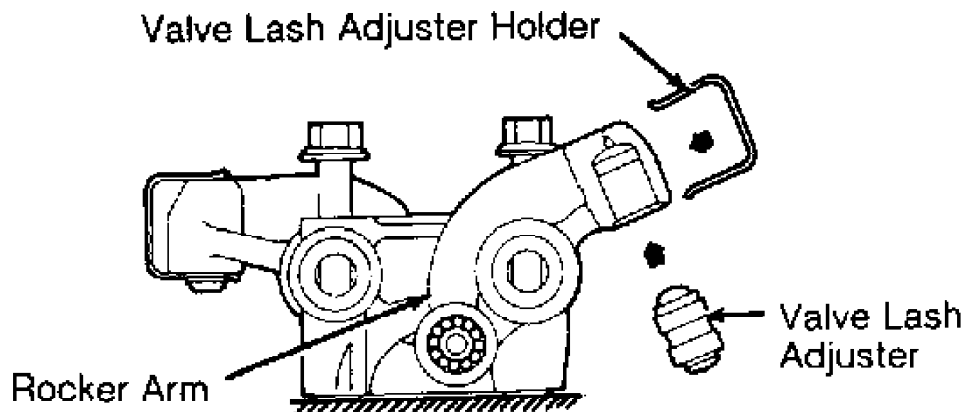


Fig. 18: Installing Valve Lash Adjuster Holder (SOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

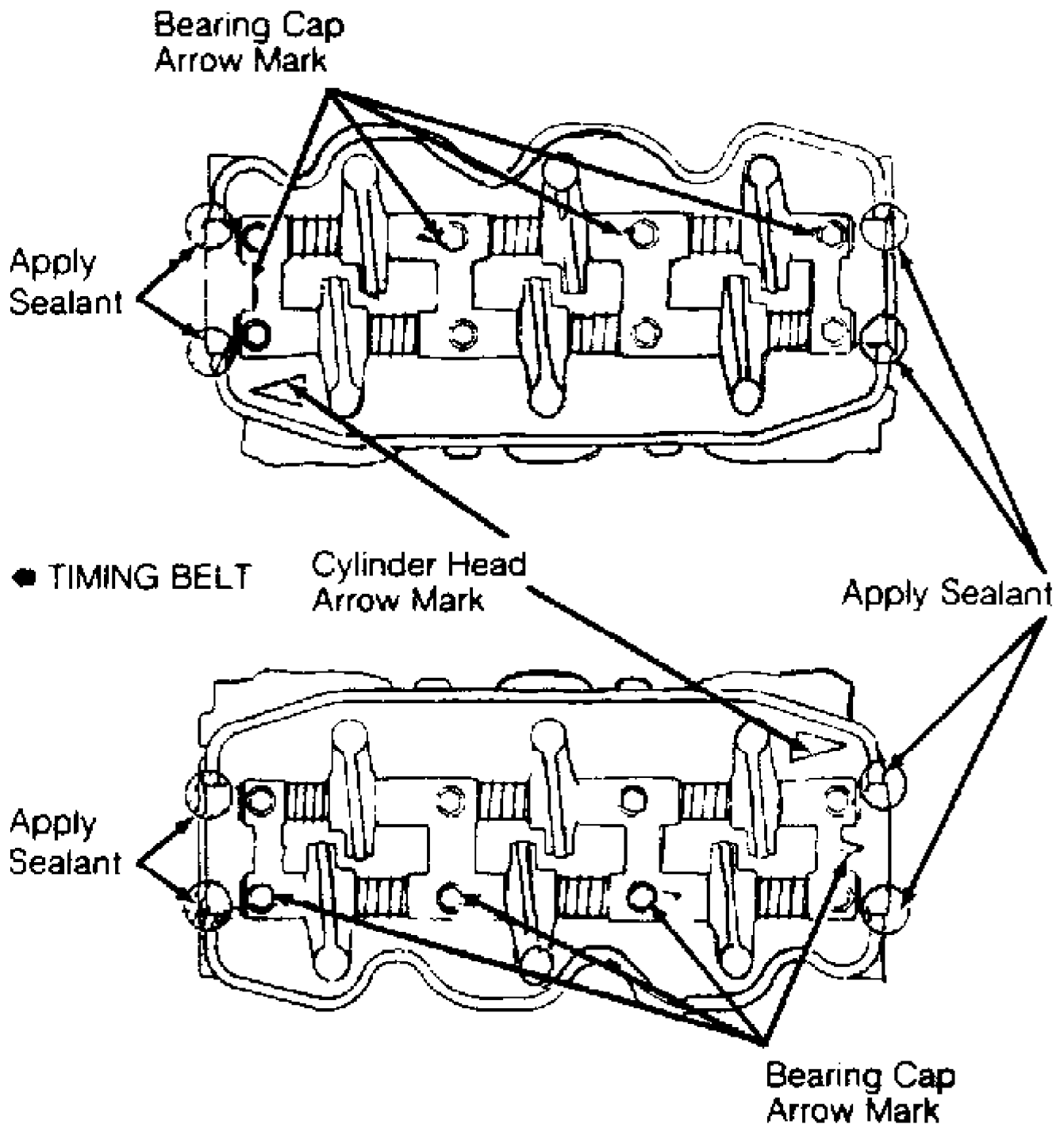


Fig. 19: Identifying Bearing Cap & Sealant Locations (SOHC)
 Courtesy of Mitsubishi Motor Sales of America, Inc.

Inspection (SOHC)

1) Remove bearing caps, rocker arms and springs from shafts. Mark component location for reassembly reference. Inspect rocker arm and shaft for damaged roller and flaking. Measure rocker arm I.D. and rocker arm shaft O.D. Determine oil clearance. Check spring free length. Replace components if not within specification. See **ROCKER ARM & SHAFT SPECIFICATIONS (SOHC)** table.

2) Inspect camshaft and distributor gear for damage. Measure camshaft end play, journal diameter and lobe height. Replace camshaft if it is not within specification. See CAMSHAFT (SOHC) table under ENGINE SPECIFICATIONS at end of article.

3) Coat components with oil. Reassemble rocker arms, springs and bearing caps. Install bearing caps with identification number toward camshaft sprocket. Ensure oil holes and notch of shafts are properly positioned. See Fig. 19.

ROCKER ARM & SHAFT SPECIFICATIONS TABLE (SOHC)

Application	In. (mm)
Oil Clearance	(1).0004-.0016 (.010-.041)
Rocker Arm I.D. ....	.7444 (18.91)
Rocker Arm Shaft O.D. ....	.7440 (18.90)
Spring Free Length	2.173 (55.19)

(1) - Maximum clearance is .0039" (.099 mm).

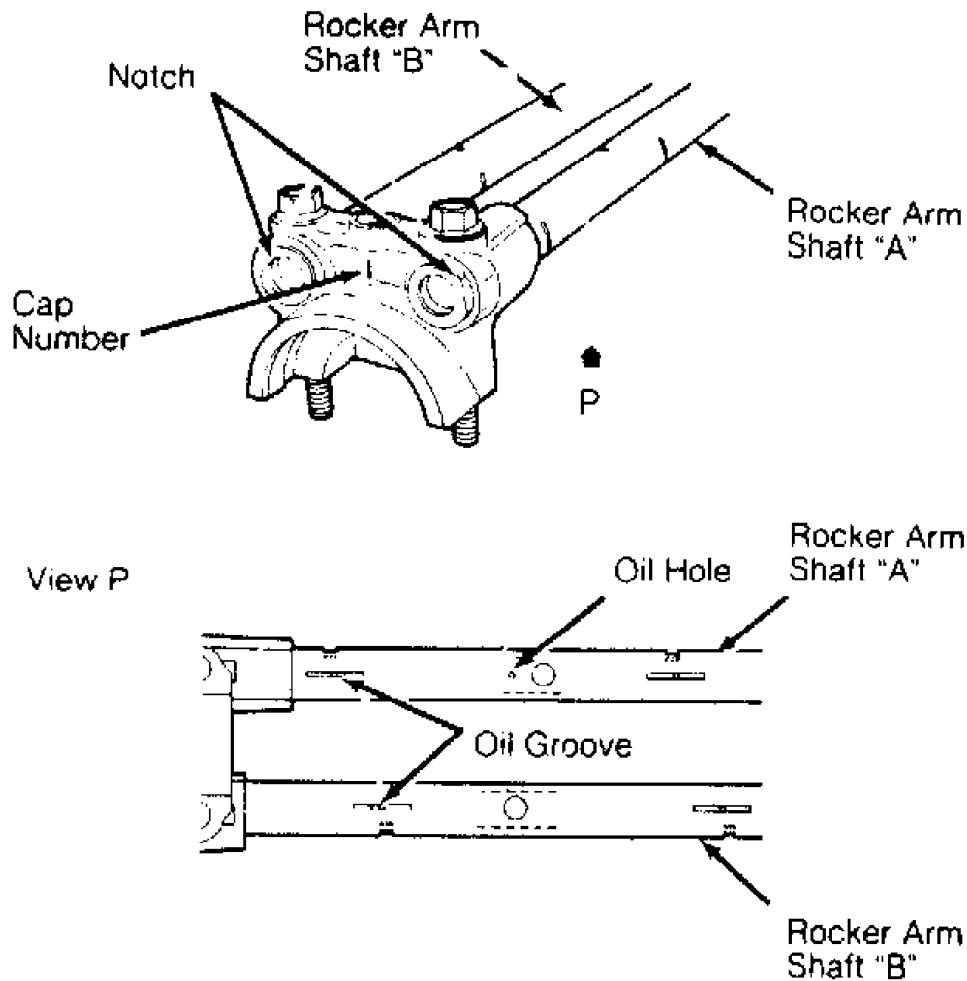


Fig. 20: Installing Rocker Arm Shafts (SOHC)
 Courtesy of Mitsubishi Motor Sales of America, Inc.

Installation

1) Coat camshaft with oil, and install in cylinder head.

Install valve lash adjusters and valve lash adjuster holders (if removed). See Fig. 18.

2) Apply 3M Sealant (4171) to designated areas of cylinder head. See Fig. 19. Use care so sealant does not get on camshaft or camshaft bearing journals. Install rocker arm assembly. Ensure arrow on bearing cap faces same direction as arrow on cylinder head. See Fig. 19. Tighten bearing cap bolts to specification. See appropriate TORQUE SPECIFICATIONS table at end of article. Remove valve lash adjuster holders.

3) Coat camshaft oil seal area with oil. Using Seal Installer (MD998713), install camshaft oil seal. Using Circular Packing Installer (MD998306), install circular packing to press-in depth of .02" (.5 mm).

4) Apply Three Bond (1212D) sealant to rocker cover sealing surfaces before installation. See Fig. 6. Coat new "O" ring with oil, and install on distributor adapter (if removed).

5) Coat camshaft area with oil before installing distributor adapter. To complete installation, reverse removal procedure. Tighten bolts to specification. See appropriate TORQUE SPECIFICATIONS table.

Removal (DOHC)

1) Remove UPPER INTAKE MANIFOLD and LOWER INTAKE MANIFOLD as necessary. See UPPER INTAKE MANIFOLD and LOWER INTAKE MANIFOLD under REMOVAL & INSTALLATION. Remove timing belt, camshaft sprockets and rear timing belt covers. See TIMING BELT under REMOVAL & INSTALLATION.

2) Remove center cover and spark plug wires. Remove PCV and breather hoses. Remove rocker covers and gaskets. Remove crank angle sensor adapter. Remove front and rear camshaft bearing caps along with seals and circular packings.

3) Remove remaining camshaft bearing caps in sequence: No. 2, No. 4 and No. 3. Remove camshaft, rocker arms and lash adjusters. Mark component location for reassembly reference.

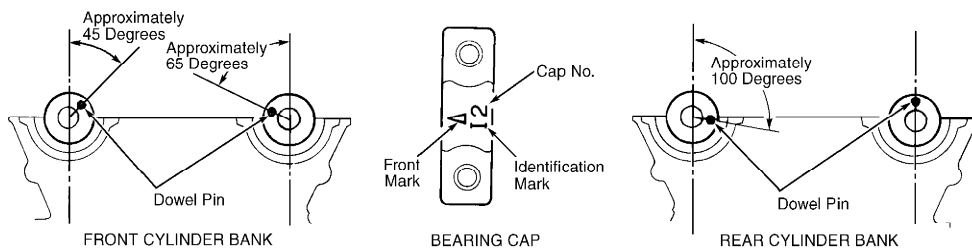
Inspection (DOHC)

Inspect rocker arm for damaged roller and flaking. Inspect camshaft for damage. Measure camshaft end play, journal diameter and lobe height. Replace camshaft if it is not within specification. See CAMSHAFT (DOHC) table in ENGINE SPECIFICATIONS at end of article.

Installation (DOHC)

1) Coat components with oil. Install lash adjusters and rocker arms. Bring No. 1 cylinder to TDC. Ensure intake and exhaust camshafts are installed correctly. Intake camshaft is marked with a "V" and exhaust camshaft is marked with a "C" on hexagon section. Position camshaft dowels as shown. See Fig. 21.

NOTE: If cylinder head is off vehicle, support cylinder head at least .39" (10 mm) above work surface to prevent valve damage while installing camshaft bearing caps.



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Fig. 21: Installing Camshafts & Bearing Caps (DOHC)
Courtesy of Mitsubishi Motor Sales of America, Inc.

2) Install camshaft bearing caps in sequence: No. 3, No. 4

and No. 2. Install bearing caps with front mark arrow facing the same direction as similar mark on cylinder head beside bearing journal. Note bearing cap number and identification mark ("I" for intake camshaft and "E" for exhaust). See Fig. 22.

3) Install front and rear bearing caps. Tighten bearing cap bolts to specification. See TORQUE SPECIFICATIONS (3000GT) table at end of article. Coat camshaft oil seal area with oil. Using Seal Installer (MD998761), install camshaft oil seal. Using Circular Packing Installer (MD998761), install circular packing.

4) Install crankshaft angle sensor adapter. To complete installation, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table.

REAR CRANKSHAFT OIL SEAL

Removal

Remove transaxle/transmission. See appropriate article in TRANSMISSION SERVICING or CLUTCHES. Remove flywheel or drive plate. Remove rear oil seal case. Pry seal from seal case.

Installation

To install, coat seal lip with oil. Using Seal Installer (MD998718), install seal in seal case. Apply sealant to sealing surface of seal case. Install seal case. Install flywheel or drive plate. Tighten bolts to specification. See appropriate TORQUE SPECIFICATIONS table at end of article. To complete installation, reverse removal procedure.

WATER PUMP

Removal

Drain cooling system. Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove coolant pipes to water pump (if required). Remove water pump bolts, noting length and location for reassembly reference. Remove water pump.

Installation

To install, reverse removal procedure using new gasket and "O" rings. Coat all "O" rings with water before installation. Install water pump and gasket. Tighten bolts to specification. See appropriate TORQUE SPECIFICATIONS table at end of article.

OIL PAN

Removal (Montero)

1) Remove hood. Remove skid plate and lower covers. Raise and support vehicle. Disconnect and remove exhaust pipe from exhaust manifolds. Drain engine oil. Remove starter cover and starter. Remove oil pressure sending unit connector. Remove front suspension crossmember.

2) Remove transmission stays. Remove ground cable and motor mount heat shields. Attach engine hoist. Remove motor mount bolts. Raise engine, and insert a 1" wood spacer between front insulator and mounts. Lower engine onto wood blocks.

3) Raise vehicle using a hoist. Remove oil pan bolts. Using Seal Cutter (MD998727), separate oil pan from cylinder block. Remove pan from vehicle.

Removal (Pickup)

1) Remove skid plate and lower covers. Raise and support vehicle. Drain engine oil. Using Steering Linkage Puller (C-3894-A or MB990635), disconnect relay rod from idler arm and steering box.

2) Remove oil pan bolts. Using Seal Cutter (MD998727),

separate oil pan from cylinder block. Remove pan from vehicle.

Removal (3000GT)

1) Raise and support vehicle. Remove engine undercovers. Drain engine oil. Disconnect O2 sensor connector. Remove front exhaust pipe from manifolds. On All-Wheel Drive (AWD) models, drain transfer assembly. Remove front air dam. Remove AWD drive shaft and transfer assembly.

2) On turbocharged models, remove oil return lines from oil pan. On all models, remove starter. Remove crossmember and transaxle stays. Remove bellhousing cover. Remove oil pan bolts. Using Seal Cutter (MD998727), separate oil pan from cylinder block. Remove pan from vehicle.

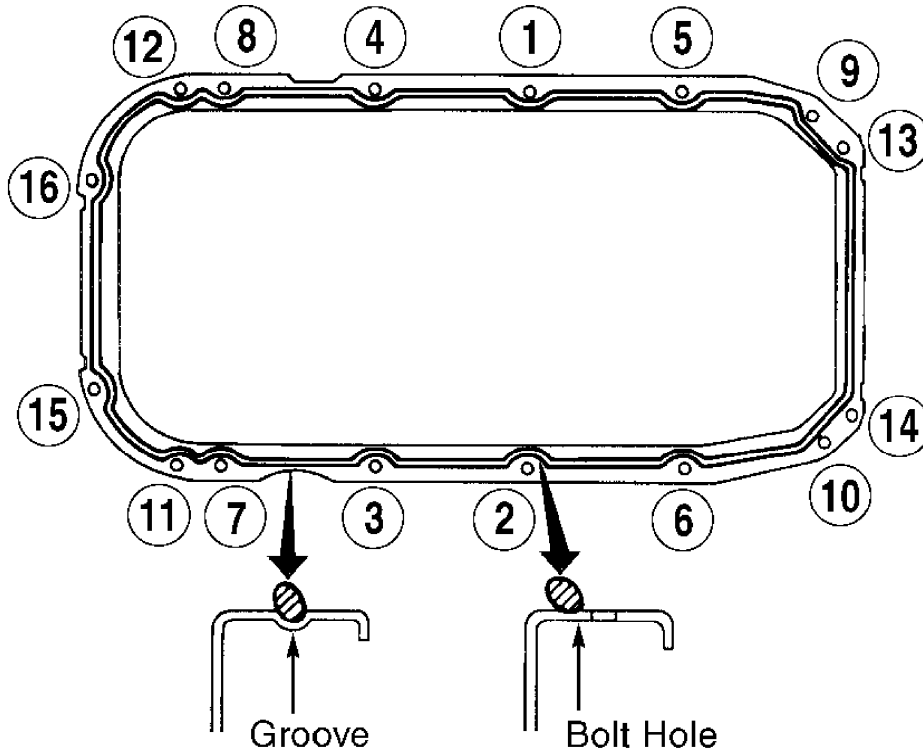
Inspection (All Models)

Clean sealant from oil pan mating surface on engine block and oil pan. Check oil pan for cracks and damage. Check sealing surface for damage and deformation. Inspect oil pick-up screen for damage.

Installation (All Models)

1) To install, reverse removal procedure. Apply sealant to oil pan flange in a continuous .16" (4 mm) diameter bead. See Fig. 22. Install oil pan within 15 minutes of applying sealant.

2) Tighten bolts to specification in proper sequence. See appropriate TORQUE SPECIFICATIONS table at end of article. Wait at least 30 minutes before adding oil and starting engine. On AWD models, refill transfer assembly with GL-4 hypoid gear oil. On all models, complete installation by reversing removal procedure.



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Fig. 22: Sealant Application & Oil Pan Bolt Tightening Sequence
Courtesy of Mitsubishi Motor Sales of America, Inc.

CYLINDER HEAD

Check cylinder head height and warpage at gasket and manifold surfaces. Resurface head if warpage exceeds specification. See appropriate CYLINDER HEAD table under ENGINE SPECIFICATIONS at end of article. Replace cylinder head if it is not within specification after resurfacing.

VALVE SPRINGS

Measure free length of valve springs. Check spring pressure at specified height. Replace springs if not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS at end of article. Check valve spring for squareness. Replace spring if out-of-square exceeds 4 degrees.

NOTE: Install valve springs with enamel-coated side toward valve spring retainer.

VALVE STEM OIL SEALS

With valves removed, remove oil seals from cylinder head. Coat new seals with oil. Using Valve Stem Oil Seal Installer (MD998377 for Montero, MD998729 for Pick-up or MD998763 for DOHC), install valve stem oil seal.

VALVE GUIDES

1) Measure valve stem-to-guide clearance. Replace valve guide if not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS at end of article.

2) Using rod of Valve Guide Remover/Installer (MD998115) for SOHC, drive out valve guide toward combustion chamber side of cylinder head. Note length of valve guides. On DOHC, use press and appropriately-sized rod to press valve guide toward combustion chamber side of head.

3) On all models, cylinder head must be bored to install oversized valve guide once guide is removed. DO NOT install valve guide of same dimension as old guide. Bore cylinder head to specification for oversize valve guide. See appropriate OVERSIZE VALVE GUIDE SPECIFICATIONS table.

4) On SOHC, install proper length valve guide. Intake guide is 1.73" (43.9 mm) long and exhaust guide is 1.89" (48.0 mm) long. On all models, position cylinder head with combustion chamber downward.

5) Using valve guide remover/installer, install valve guide. Remover/installer sets valve guide height on SOHC. On DOHC, install valve guide to .689" (17.5 mm), measured from cylinder head spring seating area to top of valve guide. On all models, ensure valve slides smoothly in valve guide. Recondition valve seat.

OVERSIZE VALVE GUIDE SPECIFICATIONS TABLE (SOHC)

Oversize In. (mm)	Size Mark	Bore Size In. (mm)
.002 (.05)	5	.5138-.5145 (13.050-13.068)
.010 (.25)	25	.5217-.5224 (13.251-13.269)
.020 (.51)	50	.5315-.5322 (13.500-13.518)

OVERSIZE VALVE GUIDE SPECIFICATIONS TABLE (DOHC)

Oversize In. (mm)	Size Mark	Bore Size In. (mm)
.002 (.05)	5 ...	.4744-.4751 (12.050-12.068)
.010 (.25)	25 ..	.4823-.4830 (12.251-12.269)
.020 (.51)	50 ..	.4921-.4928 (12.500-12.518)

VALVE SEAT (SOHC)

1) Valve seat sinkage should be checked after valve and valve seat have been reconditioned and lightly lapped. With valve assembly installed, measure installed height of valve spring between spring seat and retainer. Valve seat must be replaced if measurement exceeds 1.63" (41.4 mm).

2) Grind seat wall thickness until seat can be removed. Machine cylinder head to accommodate an oversize valve seat. See OVERSIZE VALVE SEAT SPECIFICATIONS (SOHC) table. Heat cylinder head to approximately 480°F (250°C), and install valve seat. Grind valve seat using 45-degree stone. Use 30-degree and 60-degree stones to set seat height.

OVERSIZE VALVE SEAT SPECIFICATIONS TABLE (SOHC)

Application	In. (mm)
Intake	
Bore Depth	
.012" (.3 mm) Oversize	.311-.319 (7.9-8.1)
.024" (.6 mm) Oversize	.323-.331 (8.2-8.4)
Bore Diameter	
.012" (.3 mm) Oversize	.. 1.7440-1.7451 (44.300-44.325)
.024" (.6 mm) Oversize	.. 1.7559-1.7569 (44.600-44.625)
Exhaust	
Bore Depth	
.012" (.3 mm) Oversize	.311-.319 (7.9-8.1)
.024" (.6 mm) Oversize	.323-.331 (8.2-8.4)
Bore Diameter	
.012" (.3 mm) Oversize	.. 1.5079-1.5089 (38.300-38.325)
.024" (.6 mm) Oversize	.. 1.5197-1.5207 (38.600-38.625)

VALVE SEAT (DOHC)

Grind seat wall thickness until seat can be removed. Machine cylinder head to accommodate an oversize valve seat. See OVERSIZE VALVE SEAT SPECIFICATIONS (DOHC) table. Chill cylinder head with liquid nitrogen, and install valve seat. Grind valve seat using 45-degree stone. Use 30-degree and 60-degree stones to adjust seat height.

OVERSIZE VALVE SEAT SPECIFICATIONS TABLE (DOHC)

Application	In. (mm)
Intake	
Bore Depth	
.012" (.3 mm) Oversize	.295-.303 (7.5-7.7)
.024" (.6 mm) Oversize	.307-.315 (7.8-8.0)
Bore Diameter	
.012" (.3 mm) Oversize	.. 1.4291-1.4301 (36.300-36.325)
.024" (.6 mm) Oversize	.. 1.4409-1.4419 (36.600-36.625)
Exhaust	
Bore Depth	

.012" (.3 mm) Oversize	.....	.311-.319 (7.9-8.1)
.024" (.6 mm) Oversize	.....	.323-.331 (8.2-8.4)
Bore Diameter		
.012" (.3 mm) Oversize	..	1.3110-1.3120 (33.300-33.325)
.024" (.6 mm) Oversize	..	1.3228-1.3238 (33.600-33.625)

VALVES

Disassemble cylinder head. Measure valve stem diameter, valve margin and overall length. Replace valves if not within specification. See appropriate VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS at end of article. Check valve for worn valve tip. Measure valve margin after grinding valves.

LASH ADJUSTERS

Before installation, submerge lash adjuster in diesel fuel. Using a small wire, hold down internal check valve. Pump plunger up and down 4 or 5 times to bleed air from lash adjuster.

CYLINDER BLOCK ASSEMBLY OVERHAUL

CYLINDER BLOCK

1) Inspect cylinder block for cracks, warpage, cylinder bore taper and out-of-round. Replace or repair cylinder block if it is not within specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS at end of article.

2) Measure cylinder bore and piston skirt diameter. Piston skirt diameter should be measured at 90-degree angle to piston pin. Clearance between piston and cylinder bore must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS at end of article.

PISTON & ROD ASSEMBLY

1) Remove cylinder heads, and remove oil pan. See CYLINDER HEADS and OIL PAN under REMOVAL & INSTALLATION. Ensure cylinder ridge is removed. Mark connecting rod and cap for cylinder identification.

2) Note front mark on piston and connecting rod. See Fig. 23. Mark is positioned toward timing belt side of engine. Remove rod cap and piston assembly.

3) Ensure piston ring end gap and side clearance are within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS at end of article. Install rings on piston with ring code identification marks toward top of piston. On DOHC, top ring is marked "T" and No. 2 ring is marked "T2". On SOHC, top ring is marked "T1" and No. 2 ring is marked "2R". Lubricate piston, rings and cylinder bore with engine oil.

4) Properly space ring end gaps on piston. See Fig. 23. Install piston and rod into cylinder bore. Ensure piston is installed with front mark toward timing belt side of engine.

NOTE: Front mark "R" on piston indicates installation in cylinders No. 1, 3 or 5 while front mark "L" indicates installation in cylinders No. 2, 4 or 6. Ensure front mark on piston and connecting rod are toward timing belt side of engine. See Fig. 23.

5) Check bearing clearance using Plastigage method. Tighten rod cap nuts to specification. See appropriate TORQUE SPECIFICATIONS

table at end of article. Ensure rod moves freely on crankshaft. Check connecting rod side play. Repair or replace connecting rod if not within specification. See CONNECTING RODS table under ENGINE SPECIFICATIONS at end of article.

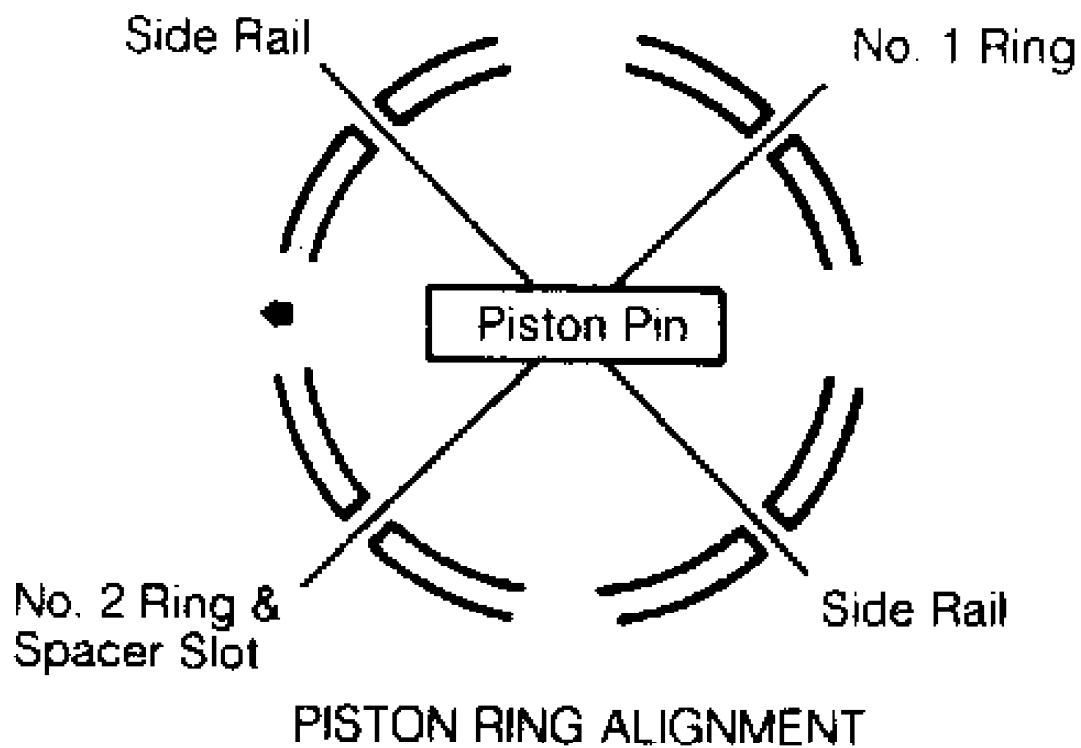
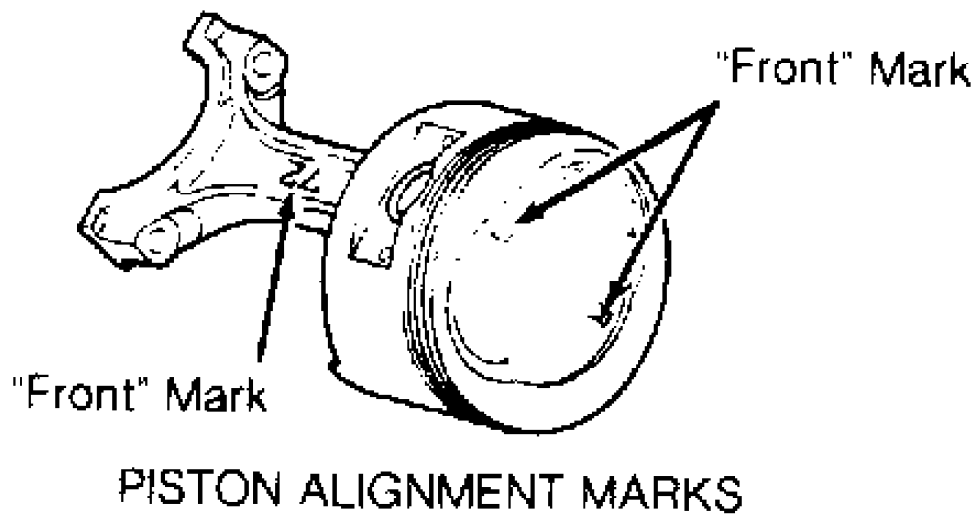


Fig. 23: Aligning Piston & Rings
Courtesy of Mitsubishi Motor Sales of America, Inc.

Measure cylinder bore and piston skirt diameter. Piston skirt diameter should be measured at 90-degree angle to piston pin. Clearance between piston and cylinder bore must be within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS at end of article.

PISTON PIN REPLACEMENT

- 1) Note reference mark on top of piston and connecting rod. See Fig. 23. Using press and Piston Pin Remover/Installer (MD998184 for SOHC or MD998765 for DOHC), remove pin.
- 2) Inspect piston for cracks and damage. Check ring side clearance. Replace piston if not within specification. See appropriate PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.
- 3) Check connecting rod for bend and twist. Replace connecting rod if twist exceeds .004" (.10 mm) or bend exceeds .002" (.05 mm). Pressure required to install pin in rod is 1686-3934 lbs. (7500-17,500 N).
- 4) Position piston on connecting rod. Ensure reference marks on top of piston and connecting rod are aligned. See Fig. 23. Lubricate all components with oil. To install, reverse removal procedure. Ensure piston pin is centered in piston.

NOTE: Install piston with reference mark aligned with connecting rod reference mark. See Fig. 23.

CRANKSHAFT & MAIN BEARINGS

- 1) Remove flywheel or drive plate. Remove transaxle/transmission mounting plate and rear seal case. Remove oil pump, oil pan and oil pick-up tube. Ensure connecting rods and main bearing cap are marked for location.
- 2) Remove connecting rod caps and bearings. Note direction of arrow on main bearing cap. Remove main bearing cap. See Fig. 24. Ensure all components are placed in correct order. Remove crankshaft. Remove main bearings from cylinder block. Mark bearings for location.
- 3) Inspect crankshaft for cracks and damaged gear or threads. Check crankshaft for taper and out-of-round. Replace or repair crankshaft if it is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS at end of article.
- 4) Install upper main bearings in cylinder block. Ensure oil hole is aligned and bearing is properly seated. Lubricate bearings with engine oil. Install thrust bearings on No. 3 main bearing journal with oil grooves toward crankshaft thrust surface.
- 5) Install crankshaft in block. Install thrust bearing on No. 3 main bearing cap with oil grooves toward crankshaft thrust surface. Install main bearing cap with arrow toward front of engine.
- 6) Check oil clearance using Plastigage method. Tighten bolts to specification in proper sequence. See Fig. 24. See appropriate TORQUE SPECIFICATIONS table at end of article. Remove main bearing cap. Clearance must be within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table. If oil clearance exceeds specification, replace bearings or crankshaft.
- 7) Ensure crankshaft rotates freely with main bearing cap installed. Check crankshaft end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table.
- 8) Install connecting rod caps and bearings. Ensure components are installed in original location. Tighten rod nuts to specification. See appropriate TORQUE SPECIFICATIONS table. Ensure connecting rods move freely on crankshaft. To complete installation, reverse removal procedure. Tighten bolts to specification.

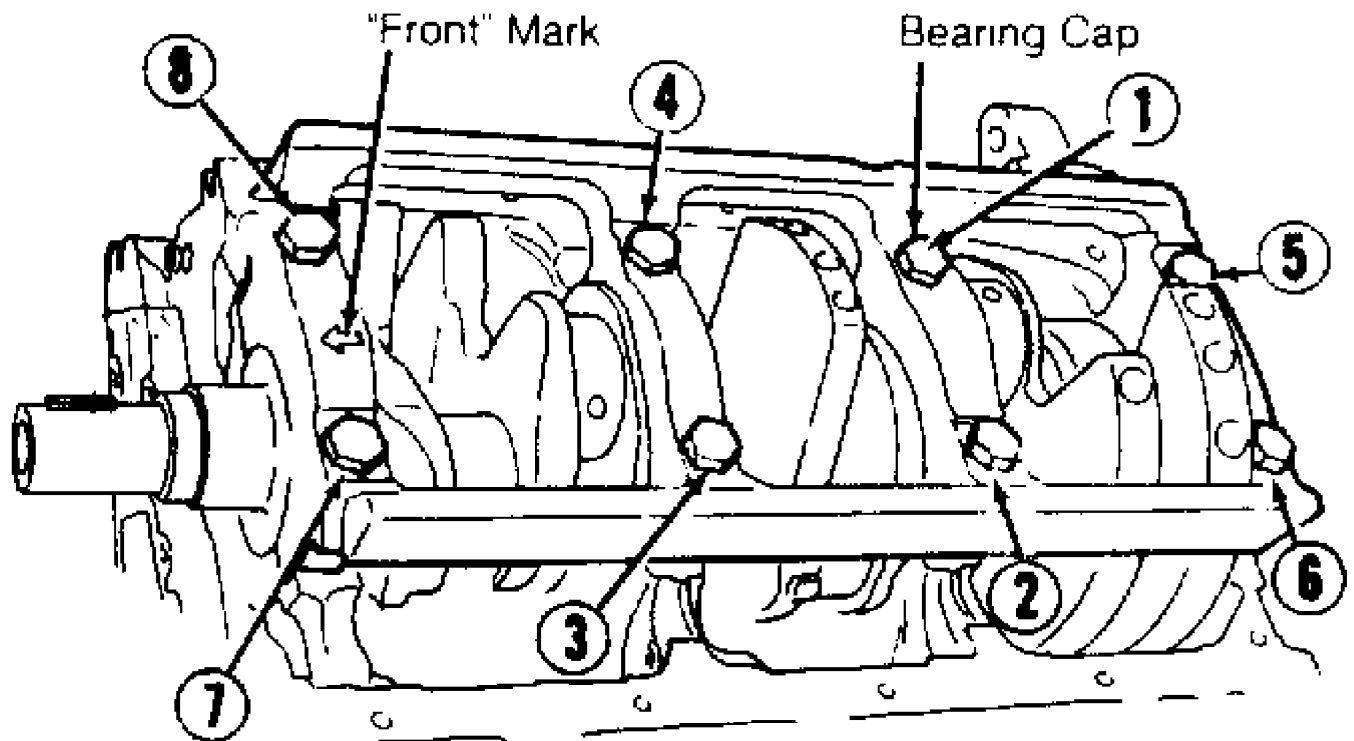


Fig. 24: Main Bearing Cap Bolt Tightening Sequence
 Courtesy of Mitsubishi Motor Sales of America, Inc.

CONNECTING ROD BEARINGS

- 1) Mark bearing cap and connecting rod for location. Remove connecting rod cap and bearing. Install replacement bearing.
- 2) Ensure reference marks on rod cap and connecting rod are aligned. Check bearing clearance using Plastigage method. Ensure connecting rod moves freely on crankshaft. Check connecting rod side play. See CONNECTING RODS table under ENGINE SPECIFICATIONS at end of article.

CRANKSHAFT END PLAY

If end play is not within specification, inspect thrust bearings and crankshaft. Replace thrust bearing or crankshaft to obtain correct end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS at end of article.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pressure is provided by a rotor-type pump driven by crankshaft. Pressure relief valve is located in oil pump body.

CRANKCASE CAPACITY

Montero & Pick-up oil capacity is 5.0 qts. (4.7L). Add .5 qt. (.4L) with filter replacement. Add .5 qt. (.4L) with oil cooler. 3000GT oil capacity is 4.2 qts. (4.0L). Add .5 qt. (.4L) with filter replacement. Add .5 qt. (.4L) with oil cooler.

OIL PRESSURE

Oil pressure should be at least 11.4 psi (.8 kg/cm²) at idle and engine oil temperature of 167-194°F (75-90°C).

OIL PUMP

Removal

Remove timing belt and crankshaft sprocket. See TIMING BELT under REMOVAL & INSTALLATION. Remove oil pan. See OIL PAN under REMOVAL & INSTALLATION. Remove oil filter and mounting bracket. Remove oil pump and gasket from cylinder block. Note bolt length and location for installation.

Disassembly & Inspection

1) Disassemble pump, and check for scoring and cracks.

Install rotors in pump body. Check clearance between driven rotor and pump body. See OIL PUMP SPECIFICATIONS table. Place straightedge across pump body to check rotor side clearance.

2) Check clearance between straightedge and both rotors.

Replace rotor set or pump assembly if not within specification. Ensure relief valve slides freely in pump body bore. Inspect relief valve spring for damage.

OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Driven Rotor-To-Pump Body .....	.0039-.0071 (.099-.180)
Rotor Side Clearance .....	.0016-.0037 (.041-.094)

Reassembly & Installation

1) Reassemble pump. Tighten pump rear cover bolts to specification. See appropriate TORQUE SPECIFICATIONS table in this article. Install oil pump and gasket. Ensure splined teeth of oil pump align with crankshaft. Install bolts, and tighten to specification.

2) If oil seal was removed, coat new seal with grease. Using Seal Installer (MD998717), install seal in oil pump until flush with case. Install remaining components.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE (MONTERO & PICKUP)

Application	Ft. Lbs. (N.m)
Air Intake Plenum Stay Bolts	11-14 (15-19)
Camshaft Bearing Cap Bolt	14-15 (19-20)
Camshaft Sprocket Bolt	58-72 (79-98)
Connecting Rod Nut	37-38 (50-52)
Crankshaft Pulley Bolt	
Montero	108-116 (146-157)
Pickup	130-137 (176-186)
Cylinder Head Bolt (1)	
Cold Engine	65-72 (88-98)
Drive Plate Bolt	53-55 (72-75)
Exhaust Manifold Nut	11-16 (15-22)
Flywheel Bolt	53-55 (72-75)
Intake Manifold Bolts	11-15 (15-20)
Left Engine Support Bracket Bolt	15-21 (20-30)

Main Bearing Cap Bolt	55-61	(75-83)
Oil Pick-Up Tube Bolt	11-15	(15-20)
Rear Engine Support		
Bracket-To-Engine Bolt	13-18	(18-25)
Relief Valve Plug	29-36	(39-49)
Right Engine Support Bracket Bolt		
10x22 mm	25-36	(34-49)
12x22 mm & 12x32 mm	47-61	(64-83)
Rocker Shaft	14-15	(19-20)
Timing Belt Tensioner Bolt	16-21	(22-29)
Water Pump Bolt	14-20	(19-27)

INCH Lbs. (N.m)

Delivery Pipe Bolt	84-108	(9-12)
Distributor Adapter Bolt	108-132	(12-15)
Oil Filter Bracket Bolt	108-120	(12-14)
Oil Pan Bolt	48-60	(5-7)
Oil Pump Cover Bolt	72-108	(8-12)
Oil Pump Mounting Bolt	108-120	(12-14)
Rear Seal Case Bolt	84-108	(9-12)
Rocker Cover Bolt	72-84	(8-9)
Throttle Body Bolt	84-108	(9-12)
Timing Belt Cover Bolt	84-108	(9-12)
Transmission Mounting Plate Bolt	84-108	(9-12)

(1) - Tighten in 2 steps using proper sequence.
See Fig. 4.

TORQUE SPECIFICATIONS TABLE (3000GT)

Application	Ft. Lbs. (N.m)	
Air Intake Plenum Stay Bolts	13	(18)
Automatic Tensioner Bolt	17	(23)
Camshaft Bearing Cap Bolt	15	(20)
Camshaft Sprocket Bolt	65	(88)
Connecting Rod Nut	38	(52)
Crankshaft Pulley Bolt		
SOHC	108-116	(146-157)
DOHC	130-137	(176-186)
Cylinder Head Bolt (1)		
SOHC	76-83	(103-113)
DOHC		
Non-Turbo	76-83	(103-113)
Turbo	87-94	(118-127)
Distributor Adapter Bolt	11	(15)
Drive Plate Bolt	55	(75)
Engine Support Bracket Bolt		
Except 10x40 mm	76-83	(103-113)
10x40 mm	47-54	(63-73)
Exhaust Manifold Nut	13	(18)
Flywheel Bolt	55	(75)
Intake Manifold Bolt		
Lower Manifold		
Non-Turbo	11-15	(15-20)
Turbo	9-11	(12-15)
Upper Manifold	13	(18)
Main Bearing Cap Bolt	58	(79)
Oil Filter Bracket Bolt	11	(15)
Oil Pick-Up Tube Bolt	14	(19)
Oil Pump Mounting Bolt	11	(15)

Rear Engine Support		
Bracket-To-Engine Bolt	13-18	(18-25)
Relief Valve Plug	33	(45)
Rocker Shaft	14-15	(19-20)
Roll Stopper Bracket Through Bolts	36-43	(49-58)
Turbocharger-To-Exhaust Fitting	40-47	(54-64)
Timing Belt Tensioner Bolt	31	(42)
Water Pump Bolt	17	(23)

INCH Lbs. (N.m)

Delivery Pipe Bolt	108	(12)
Oil Pan Bolt	48-60	(5-7)
Oil Pump Cover Bolt	96	(11)
Rear Seal Case Bolt	96	(11)
Rocker Cover Bolt		
SOHC	72-84	(8-9)
DOHC	26	(3)
Throttle Body Bolt	84-108	(9-12)
Timing Belt Cover Bolt	84-108	(9-12)
Transmission Mounting Plate Bolt	84-108	(9-12)

(1) - Tighten in 2 steps using proper sequence.
See Fig. 4.

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS TABLE

Application	Specification
3.0L V6 DOHC Non-Turbo	
Displacement	181.4 Cu. In. (3.0L)
Bore	3.587" (91.1 mm)
Stroke	2.992" (76.0 mm)
Compression Ratio	10.0:1
Fuel System	PFI
Horsepower @ RPM	222 @ 6000
Torque Ft. Lbs. @ RPM	201 @ 4500
3.0L V6 DOHC Turbo	
Displacement	181.4 Cu. In. (3.0L)
Bore	3.587" (91.1 mm)
Stroke	2.992" (76.0 mm)
Compression Ratio	8.0:1
Fuel System	PFI
Horsepower @ RPM	300 @ 6000
Torque Ft. Lbs. @ RPM	307 @ 2500
3.0L V6 SOHC	
Displacement	181.4 Cu. In. (3.0L)
Bore	3.587" (91.1 mm)
Stroke	2.992" (76.0 mm)
Compression Ratio	8.9:1
Fuel System	PFI
Horsepower @ RPM	143 @ 5000
Torque Ft. Lbs. @ RPM	168 @ 2500

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

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS TABLE

Application	In. (mm)
Crankshaft	
End Play	
Standard	.0020-.0098 (.050-.250)
Limit	.012 (.30)
Main Bearings	
Journal Diameter	2.36 (59.9)
Journal Out-Of-Round	
SOHC	.0002 (.005)
DOHC	.00012 (.003)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	
SOHC	.0008-.0019 (.020-.048)
DOHC	.0007-.0017 (.018-.043)
Limit	.004 (.10)
Connecting Rod Bearings	
Journal Diameter	1.965 (49.91)
Journal Out-Of-Round	
SOHC	.0002 (.005)
DOHC	.00012 (.003)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	.0006-.0018 (.015-.046)
Limit	.004 (.10)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS TABLE

Application	In. (mm)
Maximum Bend	.002 (.05)
Maximum Twist (Total Rod Length)	.004 (.10)
Side Play	
Standard	.0039-.0099 (.099-.251)
Limit	.016 (.41)

PISTONS, PINS & RINGS SPECIFICATIONS (SOHC)

PISTONS, PINS & RINGS TABLE (SOHC)

Application	In. (mm)
Pistons	
Clearance	.0008-.0016 (.020-.040)
Diameter	3.587 (91.11)
Pins	
Piston Fit	(1)
Rod Fit	(2)
Rings	
No. 1	
End Gap	
Standard	.0118-.0177 (.300-.450)
Limit	.031 (.79)

Side Clearance		
Standard	.0020-.0035	(.051-.089)
Limit	.004	(.10)
No. 2		
End Gap		
Standard	.0098-.0157	(.249-.399)
Limit	.031	(.79)
Side Clearance		
Standard	.0008-.0024	(.020-.060)
Limit	.004	(.10)
No. 3 (Oil)		
End Gap		
Standard	.008-.024	(.20-.60)
Limit	.039	(.99)

(1) - Slip.

(2) - At press load of 1686-3934 lbs. (7500-17500 N).

PISTONS, PINS & RINGS SPECIFICATIONS (DOHC)

PISTONS, PINS & RINGS TABLE (DOHC)

Application	In. (mm)
Pistons	
Clearance	.0012-.0020 (.030-.051)
Diameter	3.587 (91.11)
Pins	
Piston Fit	(1)
Rod Fit	(2)
Rings	
No. 1	
End Gap	.0118-.0177 (.300-.450)
Side Clearance	
Standard	.0012-.0028 (.030-.071)
Limit	.004 (.10)
No. 2	
End Gap	.0177-.0236 (.450-.599)
Side Clearance	
Standard	.0008-.0024 (.020-.060)
Limit	.004 (.10)
No. 3 (Oil)	
End Gap	
Standard	.008-.024 (.20-.60)
Limit	.039 (.99)

(1) - Slip.

(2) - At press load of 1686-3934 lbs. (7500-17500 N).

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK TABLE

Application	In. (mm)
Cylinder Bore	
Standard Diameter	3.586 (91.10)
Maximum Taper & Out-Of-Round	.0008 (.020)
Maximum Deck Warpage	
Standard	.002 (.05)
Limit	.0039 (.099)

VALVES & VALVE SPRINGS SPECIFICATIONS (SOHC)

VALVES & VALVE SPRINGS TABLE (SOHC)

Application	Specification
Intake Valves	
Face Angle	45-45.5°
Minimum Margin .....	.028" (.71 mm)
Standard Length	4.055" (103.00 mm)
Stem Diameter .....	.3134-.3140" (7.960-7.976 mm)
Exhaust Valves	
Face Angle	45-45.5°
Minimum Margin .....	.059" (1.50 mm)
Standard Length	4.043" (102.70 mm)
Stem Diameter .....	.3122-.3130" (7.930-7.950 mm)
Valve Springs	
Free Length	
Standard	1.988" (50.50 mm)
Limit	1.949" (49.50 mm)
Installed Height	1.591" (40.41 mm)
Out-Of-Square	
Standard	2°
Limit	4°
	Lbs. @ In. (kg @ mm)
Pressure	
Valve Closed	74@1.591 (33.6@40.41)

VALVES & VALVE SPRINGS SPECIFICATIONS (DOHC)

VALVES & VALVE SPRINGS TABLE (DOHC)

Application	Specification
Intake Valves	
Face Angle	45-45.5°
Minimum Margin .....	.019" (.48 mm)
Standard Length	4.185" (106.30 mm)
Stem Diameter .....	.260" (6.60 mm)
Exhaust Valves	
Face Angle	45-45.5°
Minimum Margin .....	.039" (.99 mm)
Standard Length	4.150" (105.41 mm)
Stem Diameter .....	.260" (6.60 mm)
Valve Springs	
Free Length	
Standard	1.846" (46.89 mm)
Limit	1.807" (45.90 mm)
Installed Height	1.492" (37.90 mm)
Out-Of-Square	
Standard	2°
Limit	4°
	Lbs. @ In. (kg @ mm)
Pressure	
Valve Closed	62@1.492 (28.1@37.90)

CYLINDER HEAD SPECIFICATIONS (SOHC)

CYLINDER HEAD TABLE (SOHC)

Application	Specification
Cylinder Head Height	3.307" (84.00 mm)
Maximum Warpage	.008" (.20 mm)
Valve Seats (Intake & Exhaust)	
Seat Angle	45°
Seat Width	.035-.051" (.90-1.30 mm)
Seat Bore Diameter	1.732-1.742" (44.00-44.25 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head	
Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide Length	1.732" (44 mm)
Stem-To-Guide Clearance	
Standard	.0012-.0024" (.030-.060 mm)
Limit	.004" (.10 mm)
Exhaust Valve	
Valve Guide Cylinder Head	
Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide Length	1.890" (48 mm)
Stem-To-Guide Clearance	
Standard	.0020-.0035" (.050-.090 mm)
Limit	.006" (.15 mm)

CYLINDER HEAD SPECIFICATIONS (DOHC)

CYLINDER HEAD TABLE (DOHC)

Application	Specification
Cylinder Head Height	5.20" (132.1 mm)
Maximum Warpage	.008" (.20 mm)
Valve Seats (Intake & Exhaust)	
Seat Angle	45°
Seat Width	.035-.051" (.90-1.30 mm)
Seat Bore Diameter	1.417-1.427" (35.99-36.25 mm)
Valve Guides	
Intake Valve	
Valve Guide Cylinder Head	
Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide	
Installed Height	.689" (17.50 mm)
Stem-To-Guide Clearance	
Standard	.0008-.0020" (.020-.051 mm)
Limit	.0039" (.099 mm)
Exhaust Valve	
Valve Guide Cylinder Head	
Bore I.D.	.5118-.5189" (13.00-13.18 mm)
Valve Guide	
Installed Height	.689" (17.50 mm)
Valve Stem-To-Guide	
Clearance	
Standard	.0020-.0035" (.051-.089 mm)
Limit	.0047" (.119 mm)

CAMSHAFT SPECIFICATIONS (SOHC)

CAMSHAFT TABLE (SOHC)

Application	In. (mm)
End Play	
Standard .....	.004-.008 (0.1-0.2)
Limit .....	.015 (0.4)
Journal Diameter	1.34 (34.0)
Lobe Height	
Standard	1.624 (41.25)
Limit	1.604 (40.75)
Oil Clearance .....	.0020-.0035 (.050-.090)

CAMSHAFT SPECIFICATIONS (DOHC)

CAMSHAFT TABLE (DOHC)

Application	In. (mm)
End Play	
Standard .....	.004-.008 (0.1-0.2)
Limit .....	.015 (0.4)
Journal Diameter	1.024 (26.0)
Lobe Height	
Intake	
Standard	1.397 (35.49)
Limit	1.378 (34.99)
Exhaust	
Standard	1.386 (35.20)
Limit	1.366 (34.70)
Oil Clearance .....	.0020-.0035 (.050-.090)
