1992-93 ENGINES

1.8L & 2.4L 4-Cylinder

ENGINE IDENTIFICATION

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

Vehicle Identification Number (VIN) is stamped on a metal plate located at upper left corner of instrument panel, near windshield. The eighth character of VIN identifies engine, and tenth character identifies model year (letter "N" for 1992 & "P" for 1993).

Engine code and serial number are stamped on right side of cylinder block, near front. For specific location, see **CHRYSLER CORP./MITSUBISHI INTRODUCTION** article in ENGINE PERFORMANCE.

ENGINE IDENTIFICATION CODES

Application	Engine Code	VIN Code
Colt Vista, Expo, Summit & Summit Wagon		
VIN "N" 1992		
1.8L 4-Cylinder (SOHC 16 Valve)	4G93	D
2.4L 4-Cylinder (SOHC 8 Valve)	4G64	W
VIN "P" 1993		
1.8L 4-Cylinder (SOHC 16 Valve)	4G93	C
2.4L 4-Cylinder (SOHC 16 Valve)	4G64	G

ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: The 1.8L engine uses adjustable rocker arms to set valve clearance. Periodic valve adjustment is required. Hydraulic lash adjusters are used in the 2.4L engine. Valve adjustment is not required on 2.4L engine.

1.8L

1. Adjust valves when engine temperature is 176-203°F (80-95°C). Remove spark plugs and valve cover. Rotate crankshaft counterclockwise until "T" mark is lined up with notch on crankshaft pulley.

CAUTION: Always rotate engine in direction of normal rotation (counterclockwise as viewed from front of engine).

2. Ensure valve stem-to-rocker arm clearance is present at cylinder No. 1. If clearance is not present, rotate crankshaft another 360 degrees. Ensure "T" mark on timing indicator is lined up with notch on crankshaft

pulley. Adjust clearance on both valves for cylinder No. 1 and exhaust valve for cylinder No. 3. Adjust cylinder No. 2 intake valve. See **Fig. 1**. See **VALVE CLEARANCE SPECIFICATIONS (1.8L)** table.

3. Rotate crankshaft 360 degrees counterclockwise so piston No. 4 is at TDC of compression stroke. Ensure "T" mark on timing indicator is lined up with notch on crankshaft pulley. Adjust clearance on both valves for cylinder No. 4. Adjust cylinder No. 3 intake valve and cylinder No. 2 exhaust valve. See **Fig. 1**. Install new valve cover gasket. Install valve cover.

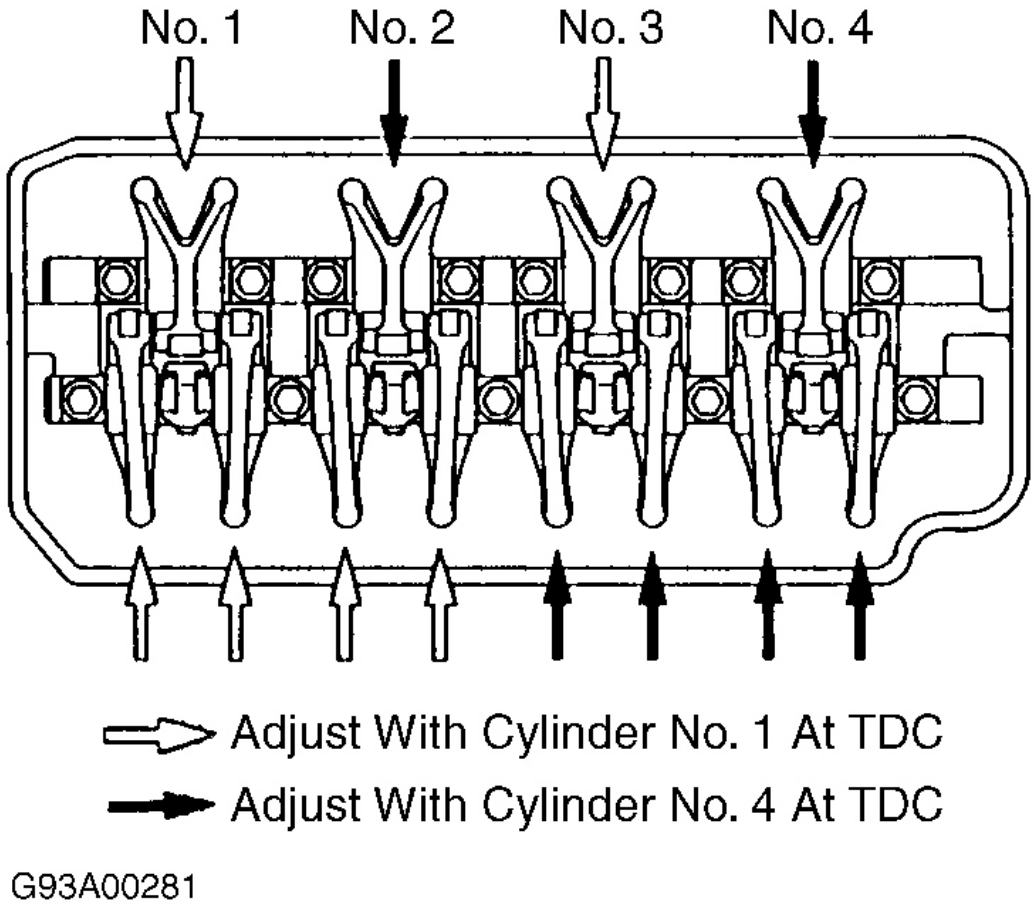


Fig. 1: Valve Clearance Adjusting Sequence (1.8L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

VALVE CLEARANCE SPECIFICATIONS (1.8L) table

Application	In. (mm)
Cold Engine	
Exhaust	.0035 (.09)
Intake	.0079 (.20)
Hot Engine	

Exhaust	.012 (.30)
Intake	.008 (.20)

TROUBLE SHOOTING

NOTE: For trouble shooting mechanical engine components, see ENGINE MECHANICAL in BASIC TROUBLE SHOOTING article in GENERAL INFORMATION.

REMOVAL & INSTALLATION

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

Disconnect fuel pump connector near fuel tank. Start engine, and allow it to idle until it stalls. Turn ignition off. Reconnect fuel pump connector. Disconnect negative battery cable before disconnecting fuel lines.

ENGINE

CAUTION: To prevent fire hazard, release residual pressure in fuel system before disconnecting fuel lines.

Removal (1.8L)

1. Release residual fuel pressure from fuel system. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Remove hood and air cleaner assembly.
2. Remove all necessary electrical connectors, vacuum hoses, fuel hoses, coolant hoses and cables. Remove accelerator cable. Drain cooling system. Drain engine oil and transaxle oil. Remove transaxle. For M/T models, see **CLUTCH** article in CLUTCHES. For A/T models, see **REMOVAL & INSTALLATION** article in TRANSMISSION SERVICING.
3. Remove radiator. Leaving hoses connected, remove power steering pump and A/C compressor, and support aside using wire. Remove all drive belts. Remove exhaust manifold heat shield. Disconnect exhaust pipe from exhaust manifold. Disconnect front and rear lower engine mounts.
4. Support engine using hoist. Remove engine mount brackets. Raise engine slightly. Ensure all cables, hoses and electrical harnesses are disconnected from engine. Lift engine assembly upward from vehicle to remove from engine compartment.

Installation (1.8L)

To install, reverse removal procedure. Ensure all wiring and hoses are cleared when lowering engine into engine compartment. With weight of engine on insulators, tighten mounting bolts and nuts to specification. See **TORQUE SPECIFICATIONS**. Replace all fluids. Adjust all cables and linkages.

Removal (2.4L)

1. Release residual fuel pressure from fuel system. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Remove hood and engine undercover assembly. Drain cooling system. Remove radiator.
2. Remove all necessary electrical connectors, vacuum hoses, fuel hoses, coolant hoses and cables. Remove A/C and power steering hoses. Remove alternator. Drain engine oil and transaxle oil. Remove transaxle. For M/T models, see **CLUTCH** article in CLUTCHES. For A/T models, see **REMOVAL & INSTALLATION** article in TRANSMISSION SERVICING.
3. Remove air cleaner and intake hose assembly. Remove condenser tank. Remove all drive belts. Remove exhaust manifold heat shield. Disconnect exhaust pipe from exhaust manifold. Disconnect front and rear lower engine mounts.
4. Support engine using hoist. Remove engine mount brackets. Raise engine slightly. Ensure all cables, hoses and electrical harnesses are disconnected from engine. Lift engine assembly upward from vehicle to remove from engine compartment.

Installation (2.4L)

To install, reverse removal procedure. Ensure all wiring and hoses are cleared when lowering engine assembly into engine compartment. With weight of engine on insulators, tighten mounting bolts and nuts to specification. See **TORQUE SPECIFICATIONS**. Replace all fluids, and adjust all cables and linkages.

INTAKE MANIFOLD

CAUTION: To prevent fire hazard, release residual pressure in fuel system before disconnecting fuel lines.

Removal (1.8L)

1. Release residual fuel pressure from fuel system. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION.
2. Disconnect negative battery cable. Drain cooling system. Disconnect air intake hose or turbo supply hose from throttle body inlet. Remove air cleaner assembly (if necessary).

CAUTION: DO NOT allow fuel injectors to fall out when removing fuel delivery pipe.

3. Disconnect all necessary electrical connectors, vacuum hoses, coolant hoses, fuel hoses and cables from intake manifold, injectors and throttle body. On all models, remove delivery pipe with fuel injectors and pressure regulator attached. See **Fig. 2**.

4. Remove support brace from below intake manifold. Remove intake manifold-to-cylinder head bolts. Remove intake manifold and gasket. If necessary, remove remaining components from intake manifold.

Installation (1.8L)

To install, reverse removal procedure. Use new gaskets, fuel injector insulators and "O" rings. Adjust all control cables. Fill cooling system.

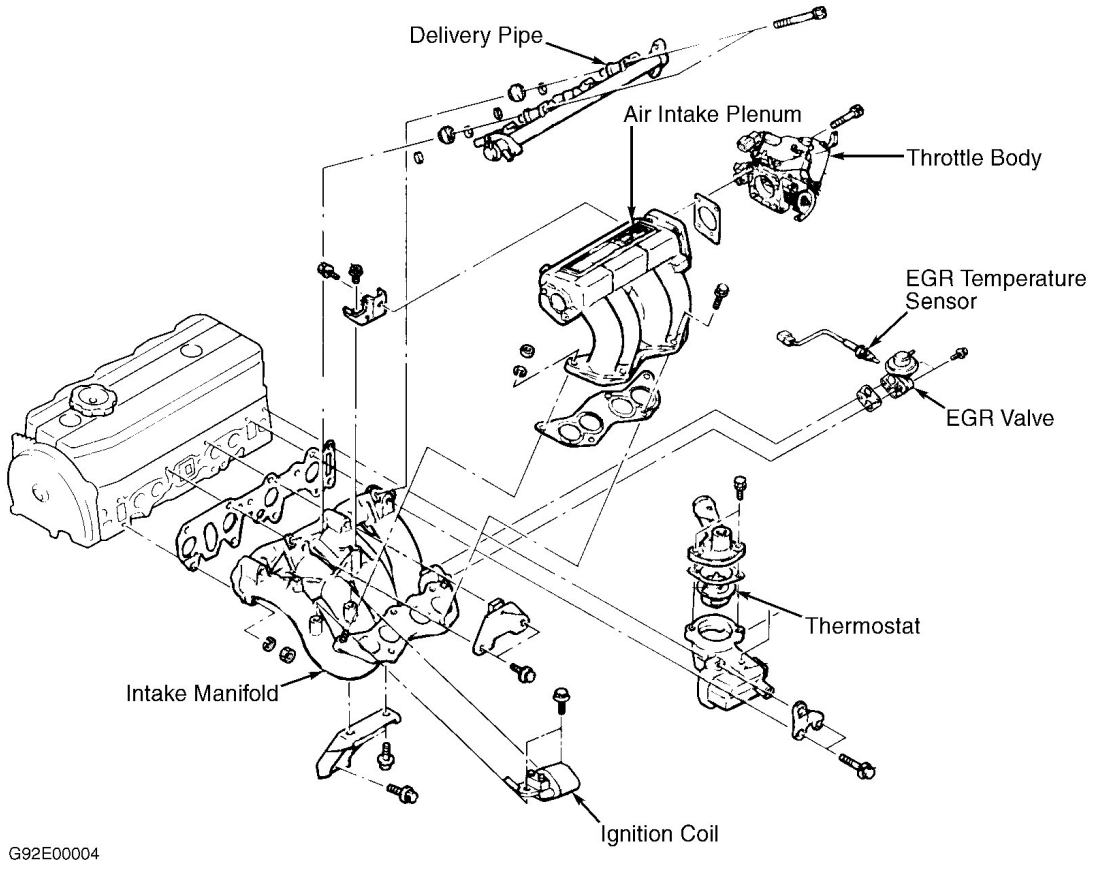


Fig. 2: View Of Intake Manifold & Related Components (1.8L Shown; 2.4L Models Similar)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Removal (2.4L)

1. Release residual fuel pressure from fuel system. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Disconnect negative battery cable. Disconnect air intake hose from air intake pipe.
2. Drain cooling system. Disconnect all necessary electrical connectors, vacuum hoses, coolant hoses, fuel hoses and cables from intake manifold, injectors and throttle body. See **Fig. 2**.
3. Remove air intake pipe and throttle body. Remove air intake plenum from intake manifold. Remove fuel delivery pipe with fuel injectors and pressure regulator attached. DO NOT allow fuel injectors to fall from delivery pipe during removal.

4. Remove distributor. Remove intake manifold-to-cylinder block support brace. Remove intake manifold-to-cylinder head bolts. Remove intake manifold and gasket. If necessary, remove remaining components from intake manifold.

Installation (2.4L)

To install, reverse removal procedure. Use new gaskets, fuel injector insulators and "O" rings. Adjust all control cables. Fill cooling system.

EXHAUST MANIFOLD

Removal (1.8L)

Disconnect exhaust pipe from manifold. Remove exhaust manifold outer heat shield and O2 sensor from manifold. Remove manifold bolts, manifold, gasket and manifold inner heat shield.

Installation (1.8L)

To install, reverse removal procedure. Use new gaskets and manifold nuts.

Removal (2.4L)

Remove exhaust manifold heat shield. Disconnect exhaust pipe and gasket from manifold. Remove O2 sensor. Remove exhaust manifold.

Installation (2.4L)

To install, reverse removal procedure. Use new gaskets and exhaust pipe-to-manifold nuts.

CYLINDER HEAD

CAUTION: Release residual pressure in fuel system before disconnecting fuel lines.

Removal (1.8L)

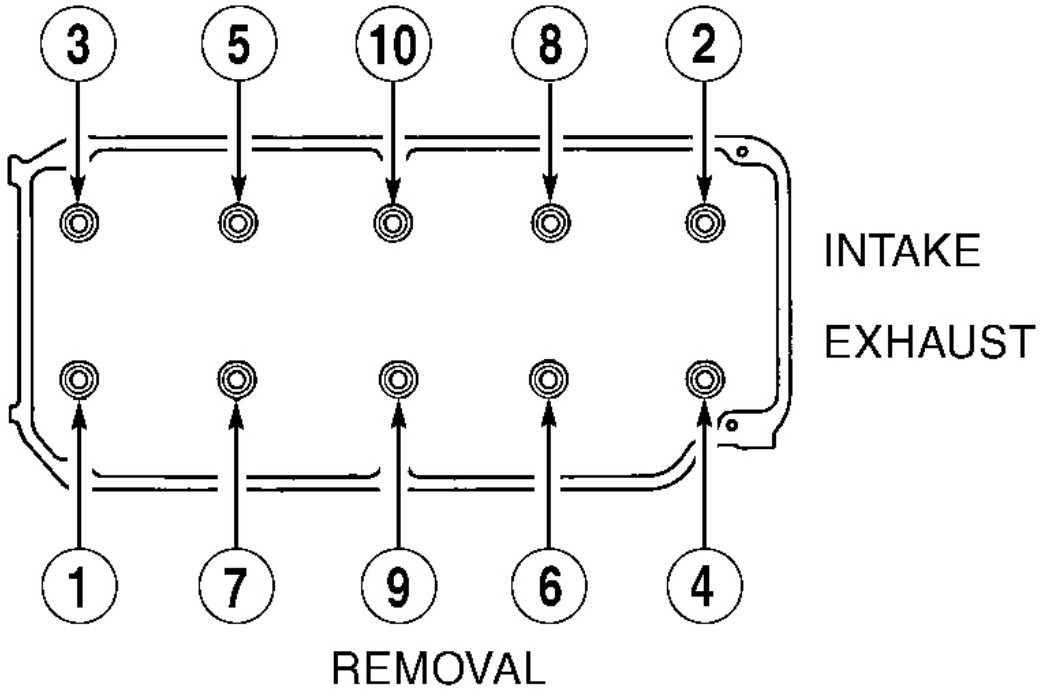
1. Release residual fuel pressure from fuel system. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION. Drain cooling system.
2. Disconnect all necessary electrical connectors, vacuum hoses, coolant hoses, fuel hoses and cables. Support timing belt end of engine from below. Remove engine mount at timing belt end of engine.

CAUTION: DO NOT rotate engine counterclockwise (as viewed from timing belt end of engine).

3. Remove rocker cover. Remove timing belt upper front cover. Rotate crankshaft clockwise (as viewed from timing belt end of engine) until timing mark on camshaft sprocket aligns with timing mark on upper

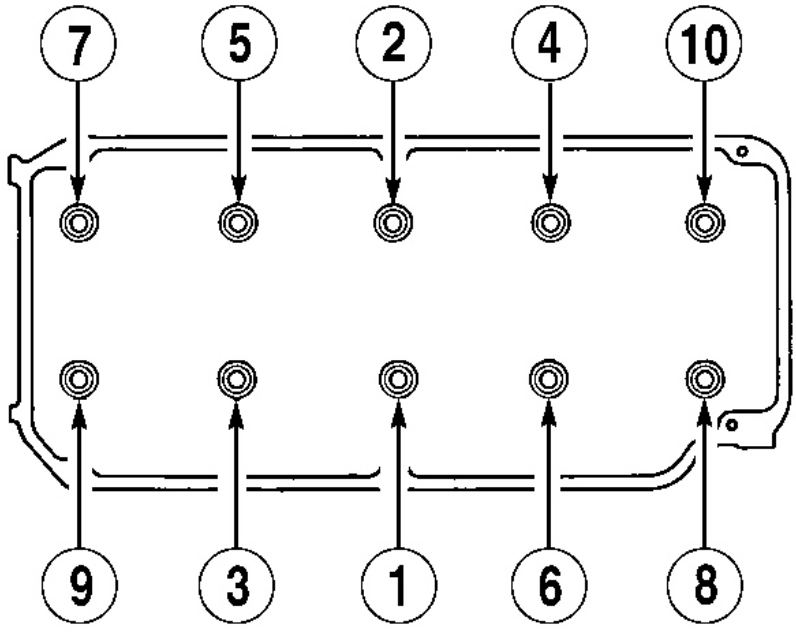
rear cover (1.8L). See **Fig. 9** or **Fig. 10** .

4. Wire timing belt and sprocket together to maintain correct position. Remove camshaft sprocket with timing belt attached, and allow it to rest on lower front cover. On 1.8L, remove timing belt upper rear cover. On all models, disconnect exhaust pipe from exhaust manifold.
5. Remove intake manifold support bracket. Using Cylinder Head Bolt Wrench (MD998051 for 1.8L or MD998360 for 2.0L), loosen cylinder head bolts (in 2-3 steps) in proper sequence. See **Fig. 3**. Remove cylinder head and gasket.



REMOVAL

FRONT OF ENGINE ➡



INSTALLATION

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Fig. 3: Cylinder Head Bolt Removal & Installation Sequence (1.8L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Inspection (1.8L)

Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Installation (1.8L)

1. Install cylinder head using new gasket. Ensure identification mark at timing belt end of gasket faces upward. DO NOT apply sealant to head gasket. Install and tighten cylinder head bolts to specification in proper sequence. See **Fig. 3**. See **ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS (1.8L & 2.4L)** table or **NON-ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS (2.4L)** table. Also see **TORQUE SPECIFICATIONS**.
2. To complete installation, reverse removal procedure. Apply sealant to contact surfaces of semi-circular packing. Apply gasoline to "O" ring on fuel line before installing fuel line in fuel delivery pipe. Adjust all control cables. Fill cooling system.

Removal (2.4L)

1. Release fuel pressure from fuel system. See **FUEL PRESSURE RELEASE** under REMOVAL & INSTALLATION.
2. Drain cooling system. Remove air intake hose and pipe from top of rocker cover. Disconnect all necessary electrical connectors, vacuum hoses, coolant hoses, fuel hoses and cables.
3. Remove power steering pump (with hoses connected if possible), and support aside using wire. Disconnect exhaust pipe from exhaust manifold. Remove upper front timing belt cover.
4. Turn crankshaft to TDC of compression stroke on cylinder No. 1 by aligning mark on cylinder head with mark on camshaft sprocket. See **Fig. 9** or **Fig. 10** . Remove rocker cover. Remove distributor cap.
5. Mark rotor-to-distributor position. Mark distributor-to-cylinder head position. Remove distributor. Mark timing belt in alignment with timing mark on camshaft sprocket. Wire timing belt to camshaft sprocket to maintain correct position. Remove camshaft sprocket bolt.
6. Slide camshaft sprocket (with belt attached) off camshaft. DO NOT turn crankshaft. Using Cylinder Head Bolt Wrench (MD998051), loosen cylinder head bolts (in 2-3 steps) in proper sequence. See **Fig. 4**. Remove cylinder head and gasket.

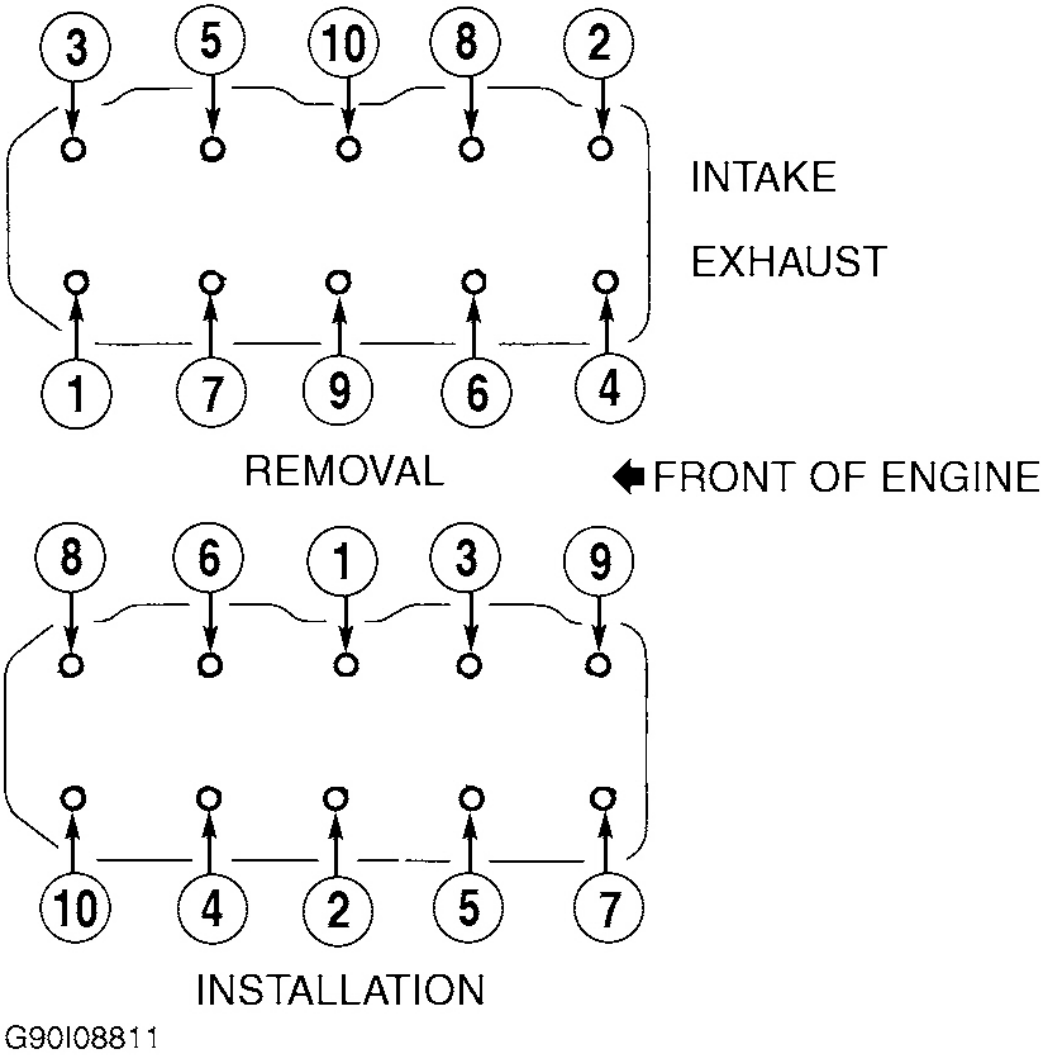


Fig. 4: Cylinder Head Bolt Removal & Installation Sequence (2.4L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Inspection (2.4L)

Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Installation (2.4L)

1. Install cylinder head using new gasket. Ensure identification mark at timing belt end of gasket faces upward. DO NOT apply sealant to head gasket. Install and tighten cylinder head bolts to specification in proper sequence. See **Fig. 4**. See **ELASTIC CYLINDER HEAD BOLT TIGHTENING**

SPECIFICATIONS (1.8L & 2.4L) table or **NON-ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS (2.4L)** table. Also see **TORQUE SPECIFICATIONS**.

2. To complete installation, reverse removal procedure. Apply sealant to contact surfaces of semi-circular packing. Adjust all control cables. Fill cooling system.

ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS (1.8L & 2.4L) (1) (2)

Procedure	FT.Lbs (N.m)
Cylinder Head Bolts (Cold)	
Step 1	Tighten to 55 ft.lbs (75 N.m)
Step 2	Fully loosen all bolts
Step 3	Tighten to 14 ft.lbs (20 N.m)
Step 4	Tighten 1/4 turn (90 degrees)
Step 5	Tighten 1/4 turn (90 degrees)

(1) Elastic head bolts are used on, 1992-93 1.8L and 1993 2.4L engines. These type bolts are tightened in a 5 step sequence. Follow head bolt tightening sequence. See **Fig. 3** and **Fig. 4**.

(2) Non-Elastic head bolts are used on, 1992 2.4L engine. These type bolts are tightened in a 3 step sequence. See **NON-ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS (2.4L)**.

NON-ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS (2.4L) (1), (2)

Application	FT. Lbs (N.m)
Cylinder Head Bolts (Cold)	
Step 1	29 (40)
Step 2	29 (40)
Step 3	80 (110)

(1) Non-Elastic head bolts are used on, 1992 2.4L engine. These type bolts are tightened in a 3 step sequence. Follow head bolt tightening sequence. See **Fig. 4**.

(2) Elastic head bolts are used on, 1992-93 1.8L and 1993 2.4L engines. These type bolts are tightened in a 5 step sequence. See **ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS**.

FRONT COVER OIL SEAL

NOTE: Front cover refers to cover at front of cylinder block. Cover contains oil pump and front cover oil seal (crankshaft front seal). Manufacturer lists oil seal removal procedure with front cover removed from engine. See OIL PUMP & FRONT COVER under ENGINE OILING.

TIMING BELT

CAUTION: To prevent engine damage, DO NOT rotate crankshaft counterclockwise (as viewed from timing belt end of engine).

NOTE: 1.8L models are not equipped with silent shaft. Silent shafts may also be referred to as balance shafts.

Removal (1.8L)

NOTE: Ensure timing marks are aligned. Mark direction of rotation of all timing belts.

1. Remove condenser tank. Remove A/C and power steering hose mounting bracket from upper engine mount at timing belt cover. Remove all drive belts. Using End Yoke Holder (MB990767) and Crankshaft Pulley Holder (MD998718), remove crankshaft pulley bolt and pulley.

CAUTION: DO NOT rotate crankshaft counterclockwise (as viewed from timing belt end of engine).

NOTE: Before removal of flange, take note of installation of flange. With a marker, mark flange to indicate side of flange facing outward (away from block). For aid in reassembly.

2. Remove upper and lower timing belt covers. Remove flange. Rotate crankshaft clockwise (as viewed from timing belt end of engine) until cylinder No. 1 is at TDC of compression stroke, and timing mark on camshaft sprocket and crankshaft sprocket align with timing mark on engine. See **Fig. 5**.
3. If timing belt is to be reused, mark direction of rotation before removing. Loosen timing belt tensioner bolt. Using a screwdriver, move tensioner away from timing belt. Tighten bolt to secure tensioner. Remove timing belt.

Inspection (1.8L)

Check belt teeth for cracks, damage and oil contamination. Inspect all sprockets for damage. Check belt tensioner for grease leakage or roughness in tensioner rotation. Check water pump for leakage, spin water pump pulley and check for roughness or binding. Replace components if damaged.

Installation (1.8L)

1. Install timing belt tensioner, leaving bolt loose. Using a screwdriver, push tensioner toward engine mount. Tighten timing belt tensioner bolt.
2. Align camshaft sprocket and crankshaft sprocket timing marks with timing marks on engine. Install timing belt. Loosen timing belt tensioner to apply spring pressure to timing belt. Ensure timing marks are still aligned.
3. Tighten timing belt tensioner bolt. Rotate camshaft in reverse direction and ensure that there is no slack in timing belt. Rotate crankshaft 2 complete revolutions clockwise (as viewed from timing belt end of engine) and ensure timing marks are still aligned.
4. Ensure timing belt teeth are properly seated in sprockets. Install flange, flange must be install properly. See **Fig. 6**. To complete installation, reverse removal procedure. Ensure proper length bolts are installed in designated areas in timing belt covers. See **Fig. 7**.

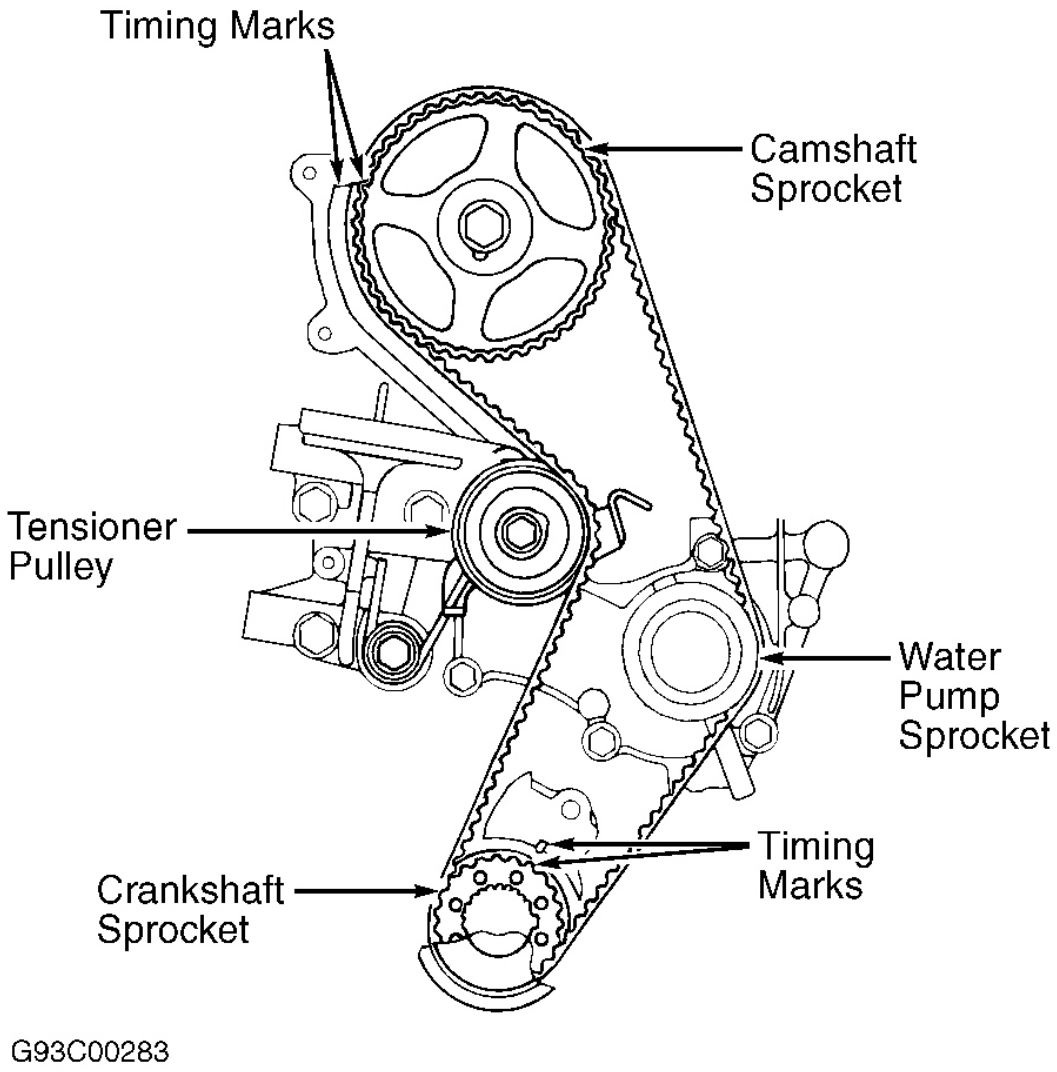


Fig. 5: Aligning Timing Marks (1.8L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

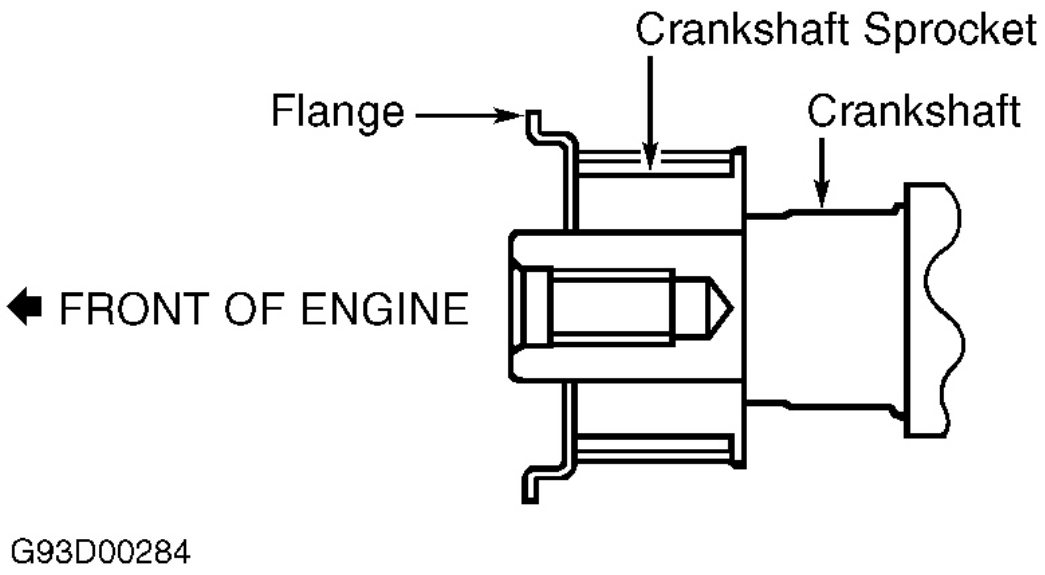


Fig. 6: Installing Flange (1.8L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

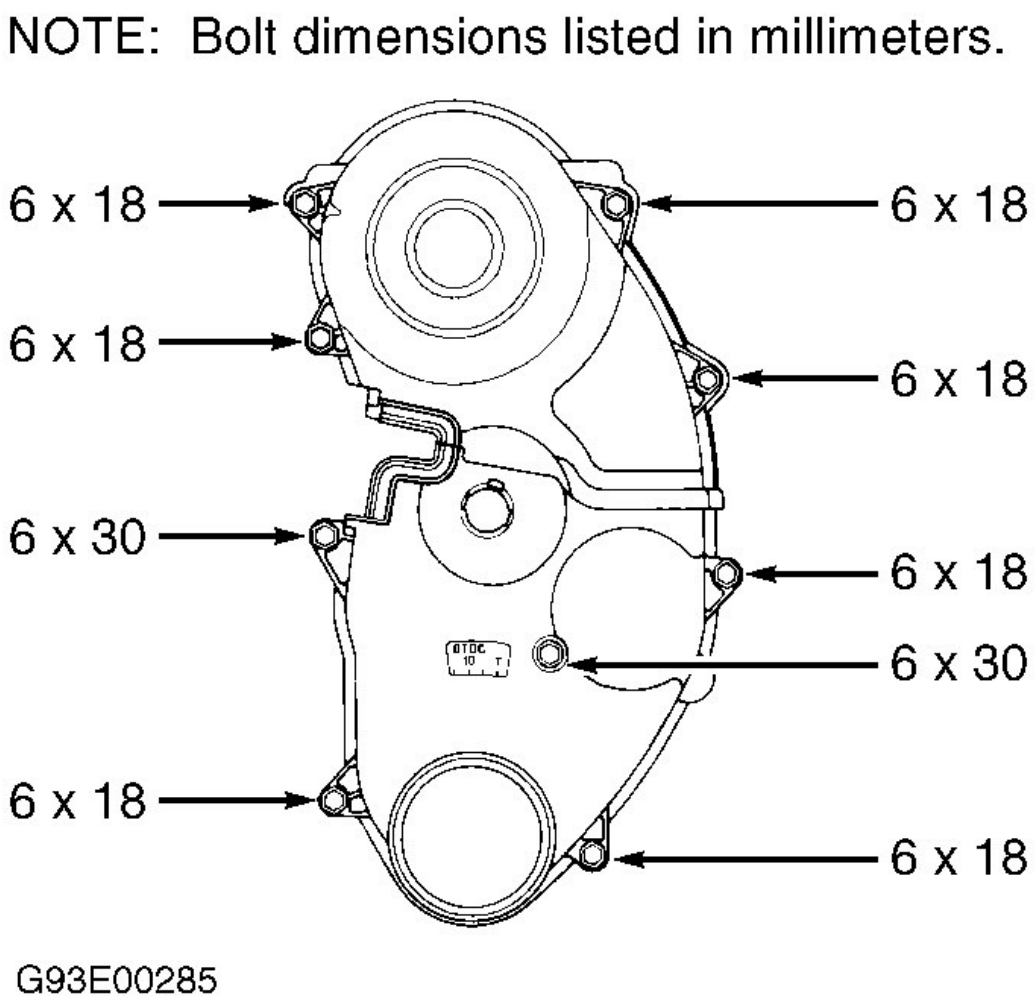


Fig. 7: Identifying Timing Belt Cover Bolt Locations (1.8L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Removal (2.4L)

CAUTION: To prevent engine damage, DO NOT rotate crankshaft counterclockwise (as viewed from timing belt end of engine).

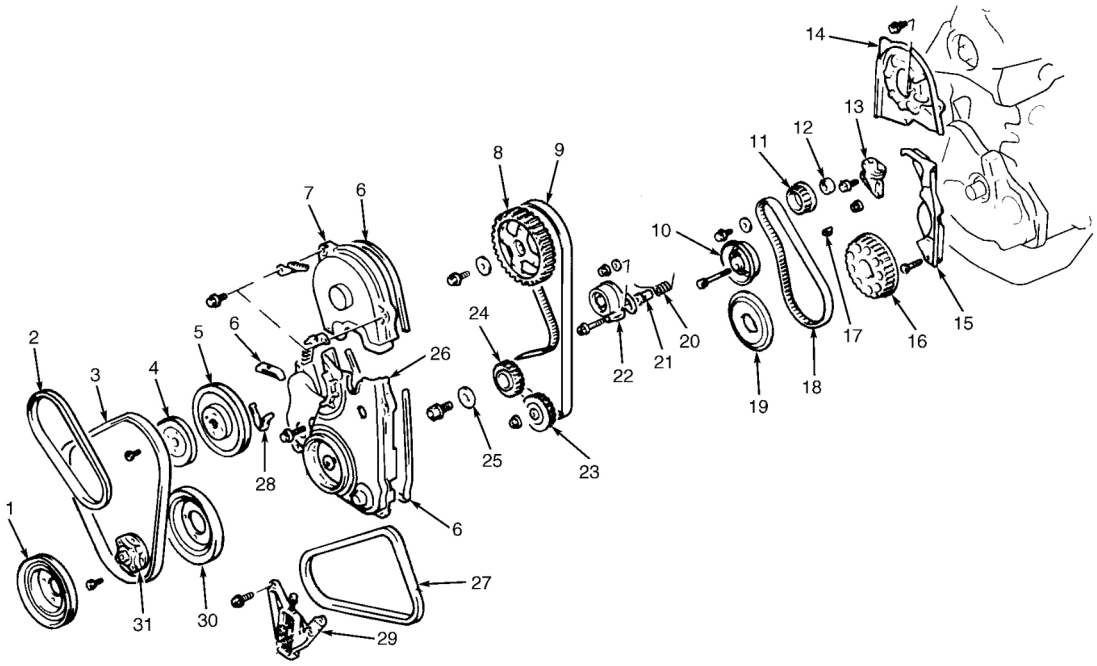
CAUTION: Ensure right silent shaft spacer is installed with chamfered side toward oil seal, or damage to oil seal will result.

NOTE:

1. Remove all drive belts and crankshaft pulleys. Remove upper timing belt covers and gaskets. Note bolt length and location.
2. Remove crankshaft sprocket bolt and washer. Rotate crankshaft clockwise (as viewed from timing belt end of engine) until cylinder No. 1 is at TDC of compression stroke. Align timing mark on camshaft sprocket with mark on cylinder head. See **Fig. 9** or **Fig. 10** .
3. For 16 valve engine, go to next step. On 8 valve engine, loosen timing belt tensioner adjustment bolts, and move tensioner toward water pump. Tighten bolt to secure tensioner. Remove front timing belt. DO NOT rotate crankshaft after timing belt has been removed.
4. On 16 valve engine, remove hydraulic timing belt tensioner bolts, and remove tensioner from engine. Remove front timing belt. DO NOT rotate crankshaft after timing belt has been removed. For installation of timing belt with hydraulic tensioner, see **INSTALLATION (2.4L 16 Valve)**.
5. Remove camshaft sprocket (if necessary). Remove oil pump sprocket access plug from cylinder block. See **Fig. 11**. Insert a.31" (8.0 mm) diameter Phillips® screwdriver to block left silent shaft.

NOTE: Before removal take note of direction and order of installation of flange and sprocket, mark flange to indicate side of flange facing outward (away from block).

6. Remove oil pump sprocket nut, and remove sprocket. Remove front crankshaft sprocket and flange.
7. Remove rear timing belt tensioner assembly. Remove rear timing belt. Remove right silent shaft sprocket with spacer (if necessary). Remove rear crankshaft sprocket with key.



1. Damper Pulley
2. Power Steering Belt
3. Alternator Belt
4. Power Steering Pulley
5. Water Pump Pulley
6. Gasket
7. Upper Timing Belt Cover
8. Camshaft Sprocket
9. Timing Belt "A"
10. Timing Belt "B" Tensioner
11. Right Silent Shaft Sprocket
12. Spacer
13. Engine Support Bracket
14. Rear Upper Timing Belt Cover
15. Rear Lower Timing Belt Cover
16. Crankshaft Sprocket "B"
17. Key
18. Timing Belt "B"
19. Flange
20. Tensioner Spring
21. Tensioner Spacer
22. Timing Belt "A" Tensioner
23. Oil Pump Sprocket
24. Crankshaft Sprocket "A"
25. Washer
26. Front Lower Timing Belt Cover
27. A/C Belt
28. Access Cover
29. Tensioner Pulley Bracket
30. Crankshaft Pulley
31. Adapter

Fig. 8: View Of Timing Belts & Related Components (2.4L 8 Valve Shown; 1.8L Engine Similar Without "B" Belt)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

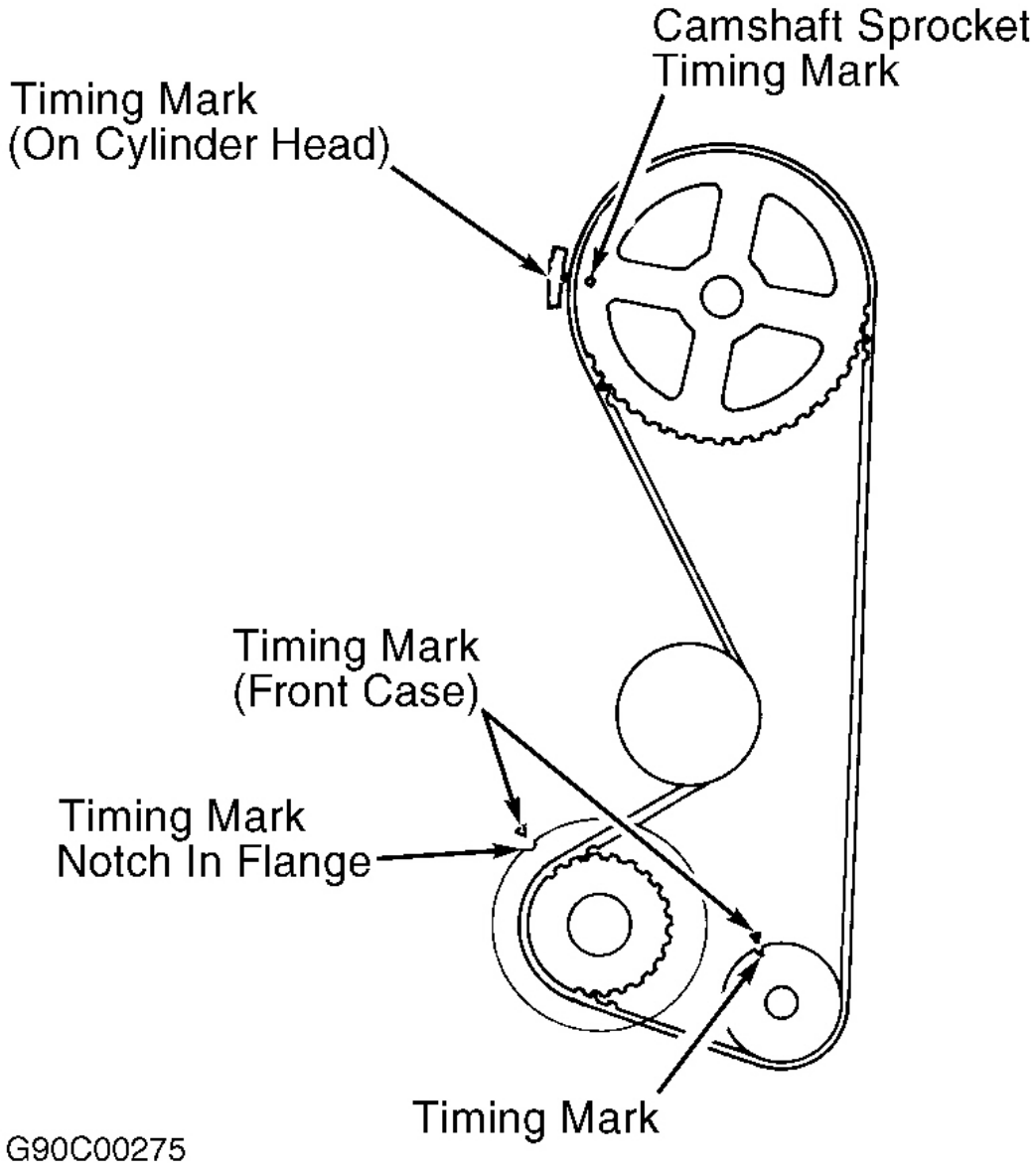


Fig. 9: Aligning Front Timing Belt (2.4L - 8 Valve)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

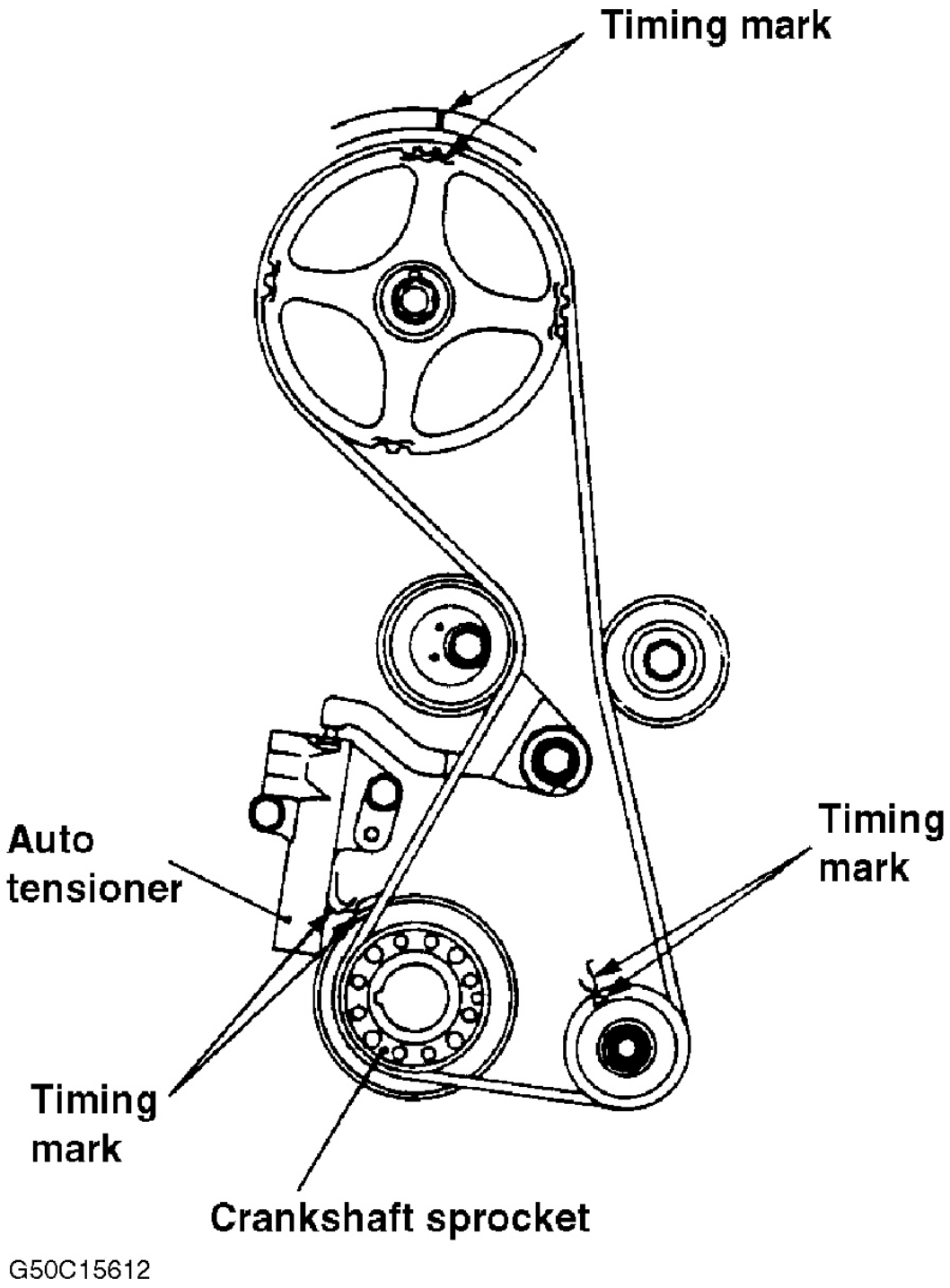
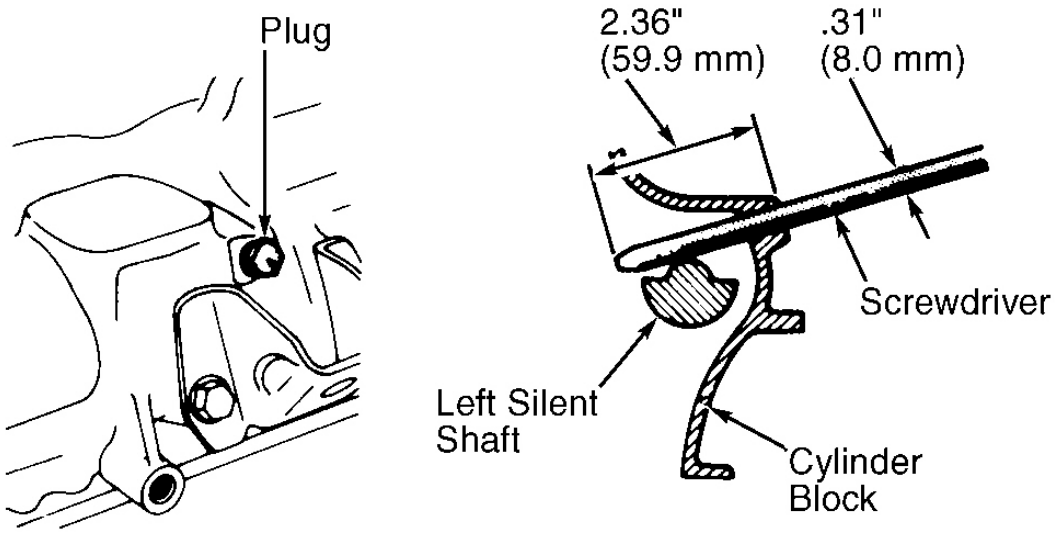


Fig. 10: Aligning Front Timing Belt (2.4L - 16 Valve)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



CAUTION: Ensure this alignment procedure is followed for left silent shaft. If balance weight is incorrectly positioned, excessive engine vibration will result. Weight must be in position, as illustrated, when timing marks are aligned.

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Fig. 11: Holding Silent Shaft In Stationary Position (2.4L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Inspection (General)

Check belt teeth for damage and oil contamination. Inspect belt for glossy, hardened or non-elastic surface. Ensure belt is not cracked, separated or showing canvas fiber. Inspect sprockets for damage. Check water pump for leakage, spin water pump pulley and check for roughness or binding. Replace components if damaged.

Inspection (Belt Tensioner)

Inspect automatic hydraulic tensioner, before reinstallation.

- Check rod end of hydraulic tensioner for wear. Measure distance from tensioner rod end to tensioner housing. Distance should be.47" (11.9 mm). If protrusion is out of specification, replace tensioner.
- Check hydraulic belt tensioner for leakage. If any hydraulic fluid is detected leaking from tensioner, replace tensioner.
- Press the rod of the tensioner down with the force of 22-24 lbs. (98-196 N.). If rod retracts more than.039" (1mm), replace tensioner.
- Replace hydraulic tensioner, if rod can be easily pushed into hydraulic tensioner.
- Check belt tensioner pulley, idler pulley and "B" belt tensioner pulley for leakage, roughness or binding in rotation. Replace components if damaged.

Installation (2.4L 8 Valve)

1. Install rear crankshaft sprocket. Install right silent shaft sprocket and spacer. Spacer should be installed with chamfered end into oil seal. Align "B" belt timing marks. Install "B" belt. See **Fig. 12**. Install flange. See **Fig. 13**.
2. Install "B" belt tensioner (pulley). Hold tensioner tightly against belt while tightening bolts. Ensure deflection is.20-.28" (5.0-7.1 mm). See **Fig. 14**. Tighten bolt to specification. See **TORQUE SPECIFICATIONS**.
3. Install front timing belt tensioner, tension spring and spacer. Ensure spring is properly engaged against water pump case. Rotate tensioner toward water pump, and temporarily tighten bolts. Ensure timing marks are aligned. See **Fig. 9** or **Fig. 10** . Install timing belt on crankshaft sprocket.
4. Apply thump pressure on timing belt at crankshaft sprocket to keep timing belt meshed with teeth on sprocket. Install belt (in this order) on crankshaft, oil pump and camshaft sprockets. Loosen tensioner bolts, allow tensioner spring pressure to be applied to timing belt (DO NOT tighten down tensioner at this time).
5. To apply tension to belt, rotate crankshaft clockwise at crankshaft until camshaft sprocket timing mark is offset by 2 teeth (this allows tensioner to remove slack from belt). Tighten tensioner bolt. Tighten tensioner spacer nut (DO NOT tighten tensioner spacer nut first, belt tension will be affected).
6. To check belt tension, apply slight thumb pressure and measure clearance between the timing belt out side surface and the rear timing belt cover (thump should be placed on belt at center of rear timing belt cover). Clearance should be.55" (14.0 mm). See **Fig. 15**.
7. Ensure oil pump drive sprocket nut has been tightened (if it has been removed), remove Phillips® screwdriver from block left silent shaft. Rotate crankshaft clockwise 4 complete turns, recheck belt tension. Check alignment of timing belt marks at the cam, crank, oil pump drive sprocket and "B" belt balance shaft sprocket. Reinstall Phillips® screwdriver into block at left silent shaft. Check to see Phillips® screwdriver will insert at least 60 mm (2.36 in). If insertion is only half of that, timing is off and procedure should be redone. If insertion is as specified, remove Phillips® screwdriver and reinstall plug into block. To complete installation, reverse removal procedure. Ensure proper length bolts are installed in designated areas in timing belt covers. See **Fig. 16**.

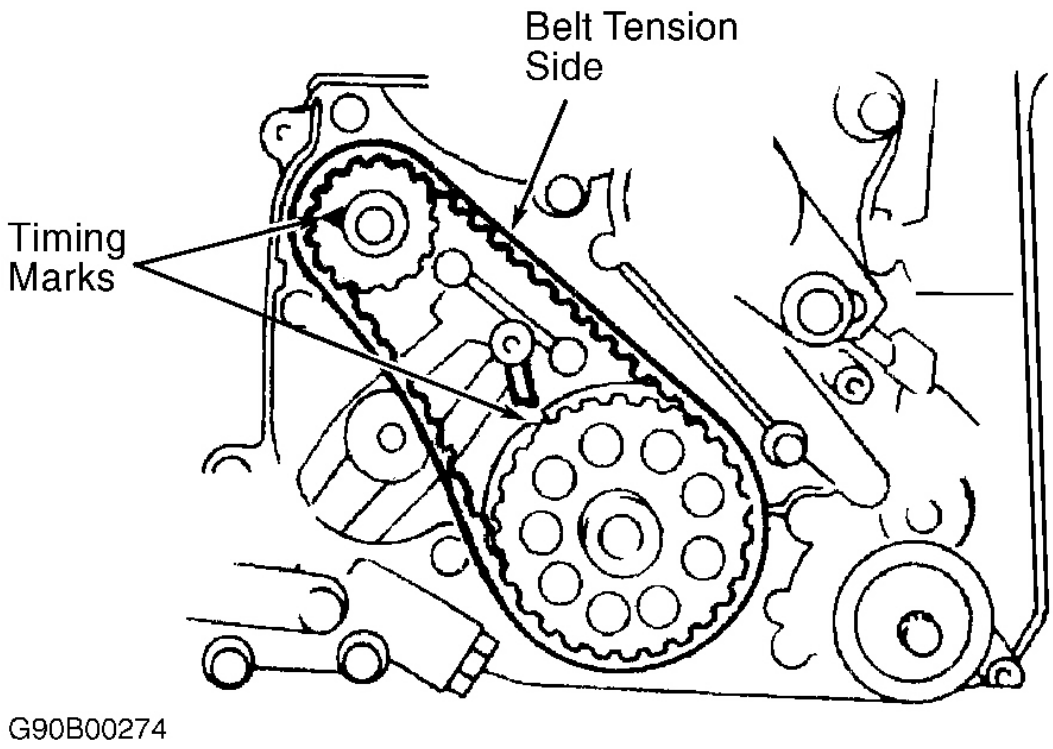


Fig. 12: Aligning Rear Balance "B" Belt (2.4L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

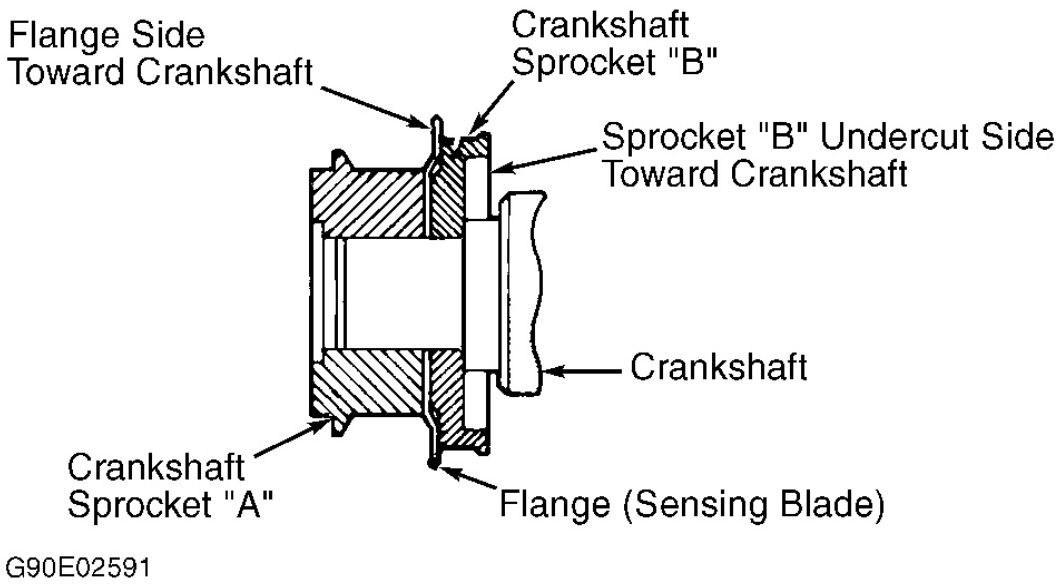


Fig. 13: Installing Crankshaft Sprockets & Flange
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

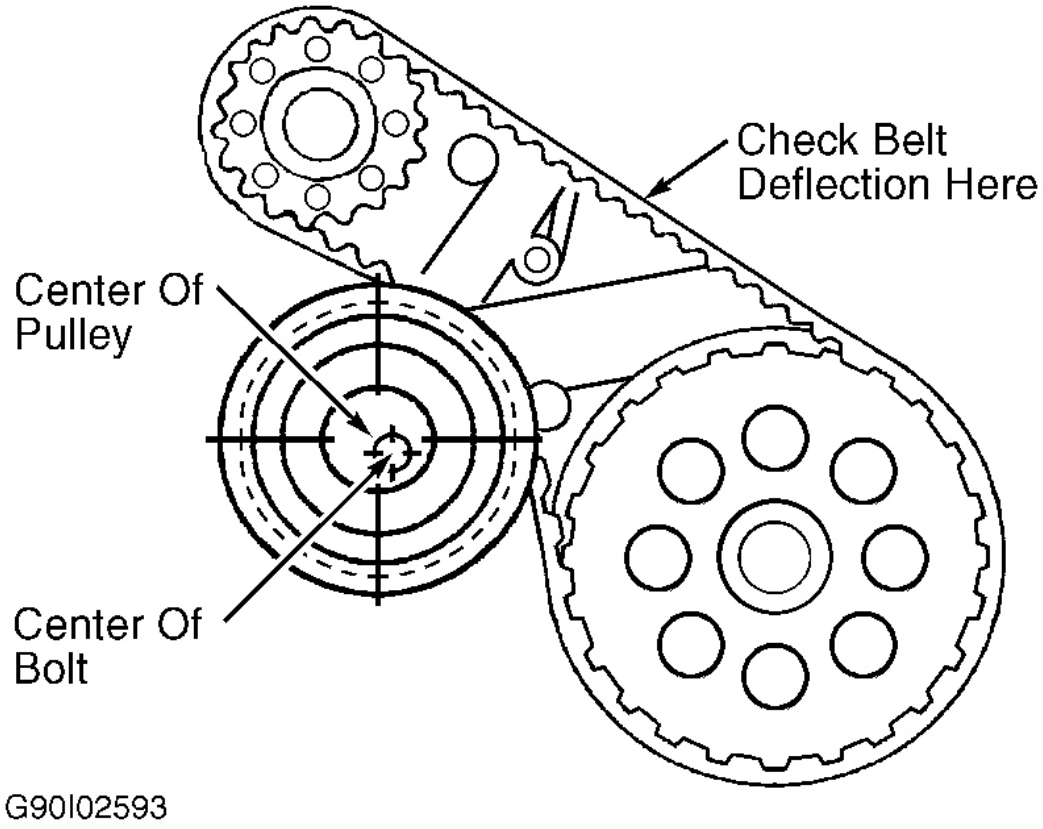


Fig. 14: Installing Timing Belt "B" Tensioner (2.4L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

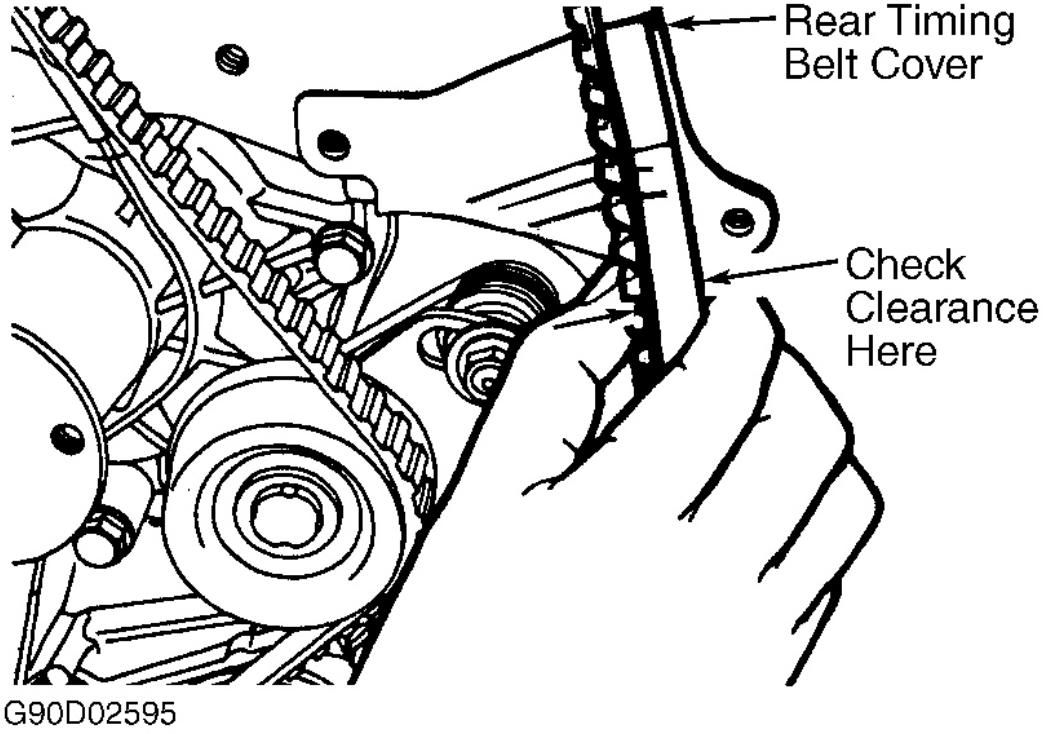


Fig. 15: Checking Timing Belt "A" Tension (1.8L Similar)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

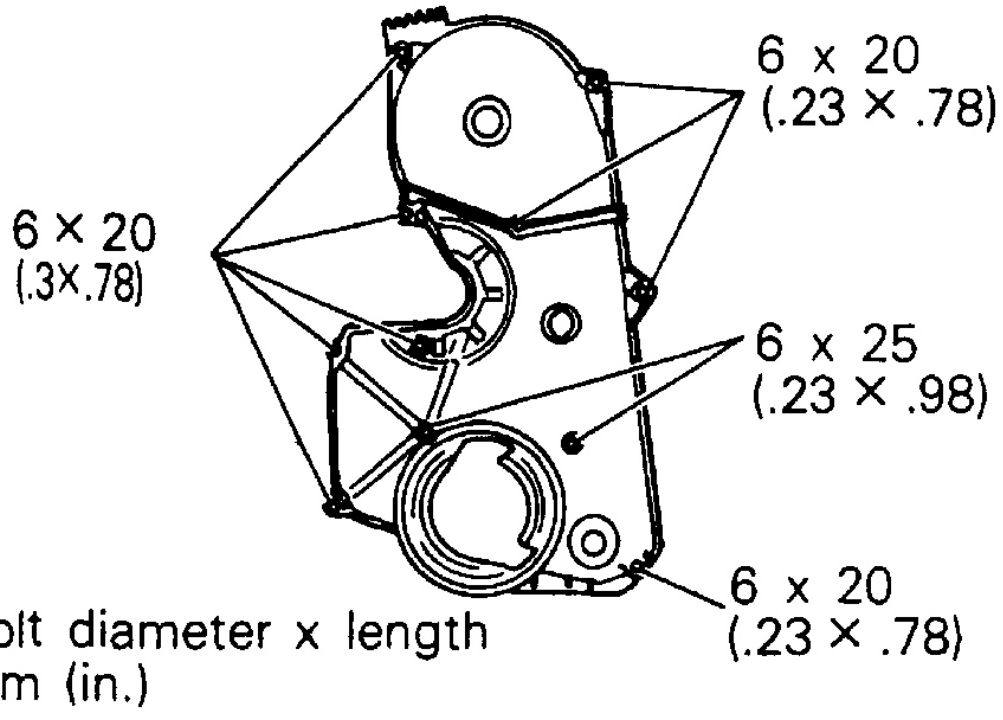


Fig. 16: Installation Of Timing Belt Lower & Upper Cover
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Installation (2.4L 16 Valve)

NOTE: 2.4L 16 valve engine incorporates the use of an automatic hydraulic tensioner to tension the timing belt. Check hydraulic belt tensioner for leakage. If any hydraulic fluid is detected leaking from tensioner, replace tensioner.

1. Install rear crankshaft sprocket. Install right silent shaft sprocket and spacer. Spacer should be installed with chamfered end into oil seal. Align "B" belt timing marks. Install "B" belt. See **Fig. 12**. Install flange. See.**Fig. 13**
2. Install "B" belt tensioner (pulley). Hold tensioner tightly against belt while tightening bolts. Ensure deflection is.20-.28" (5.0-7.1 mm). See **Fig. 14**. Install camshaft sprocket. Tighten camshaft sprocket bolt to specification. See **TORQUE SPECIFICATIONS**.

NOTE: Compressing the hydraulic tensioner to quickly may damage it's internal valving, compress slowly.

3. Timing belt hydraulic tensioner must be compressed before installation. If tensioner has a hex head set screw at base of tensioner, place a suitable size washer at base of tensioner to protect set screw (DO NOT

remove or turn set screw). Using a soft jaw vise, place tensioner in vise. SLOWLY compress hydraulic tensioner push rod until pin hole in push rod aligns with pin holes in tensioner body. Lock push rod in place, insert a suitable size hard wire (.055 in [1.4mm] diameter) through pin hole in body and push rod. See **Fig. 17**. Remove tensioner from vise.

4. Install front timing belt hydraulic tensioner. Tighten tensioner bolts. See **TORQUE SPECIFICATIONS (2.4L)**. Ensure all timing marks are still aligned. See **Fig. 10**. Install timing belt starting at crankshaft sprocket.
5. Apply thump pressure on timing belt at crankshaft sprocket to keep timing belt meshed with teeth on sprocket. Installing belt (in this order) on crankshaft, oil pump and camshaft sprockets. Reposition tensioner pulley by raising it up unit it comes in contact with the belt, with a slight pressure remove slack from belt. Holes in pulley should be at about the 9 o'clock position. See **Fig. 18**. Tighten pulley center bolts finger tight. (DO NOT torque down tensioner at this time). Turn crankshaft counter clockwise 1/4 turn. Reverse direction (clockwise) and ensure all timing marks are realigned. See **Fig. 10**.

NOTE: Engine may need to be raised or lowered to gain enough working room for tools.

6. Install 2 pin Adapter (MD998767) and a 1/4 inch drive torque wrench onto tensioner pulley. To apply tension to belt, loosen center bolt, rotate tensioner pulley clockwise. Apply 23-25 INCH lbs. (2.6-2.8 Nm) of torque to pulley. See **Fig. 19**. Holding tensioner in this position, Tighten center bolt so tensioner pulley will not back off from belt tension. Remove torque wrench, install a 1/4 inch drive breaker bar onto 2 pin adapter at tensioner pulley. Tighten pulley center bolt to specification. See **TORQUE SPECIFICATIONS (2.4L)**. DO NOT allow pulley to turn when tightening center bolt, belt tension will be affected.
7. Install Set Screw (MD998738) into rear timing belt cover. See **Fig. 20**. Screw in set screw until tensioner bracket arm makes contact with hydraulic tensioner push rod end. While pulling on the locking pin, turn set screw in till pressure is removed from pin. Remove locking pin from hydraulic tensioner. Remove set screw.
8. Ensure oil pump drive sprocket nut has been tightened (if it has been removed), remove Phillips® screwdriver from block left silent shaft. Rotate crankshaft clockwise 4 complete turns. Check alignment of timing belt marks at the cam, crank, oil pump drive sprocket and "B" belt balance shaft sprocket.
9. Let vehicle sit for 15 minutes. Measure hydraulic tensioner rod protrusion between hydraulic tensioner housing and point where it contacts tensioner arm (an appropriate size drill bit can be used). Protrusion should be.150-.177" (3.8-4.5 mm). See **Fig. 21**. If protrusion is not as specified, repeat timing belt tensioning procedure.
10. Reinstall Phillips® screwdriver into block at left silent shaft. See **Fig. 11**. Check Phillips® screwdriver will insert at least 2.36 in (60 mm). If insertion is as specified, remove Phillips® screwdriver and reinstall plug into block. If insertion is only half of that, timing is off and procedure should be redone. Remove timing belt and turn only the oil pump drive sprocket one complete rotation. Recheck Phillips® screwdriver will insert at least 2.36 in (60 mm). If insertion is as specified, proceed with reinstallation of timing belt. Go to step, 3. To complete installation, reverse removal procedure. Ensure proper length bolts are installed in designated areas in timing belt covers. See **Fig. 22**.

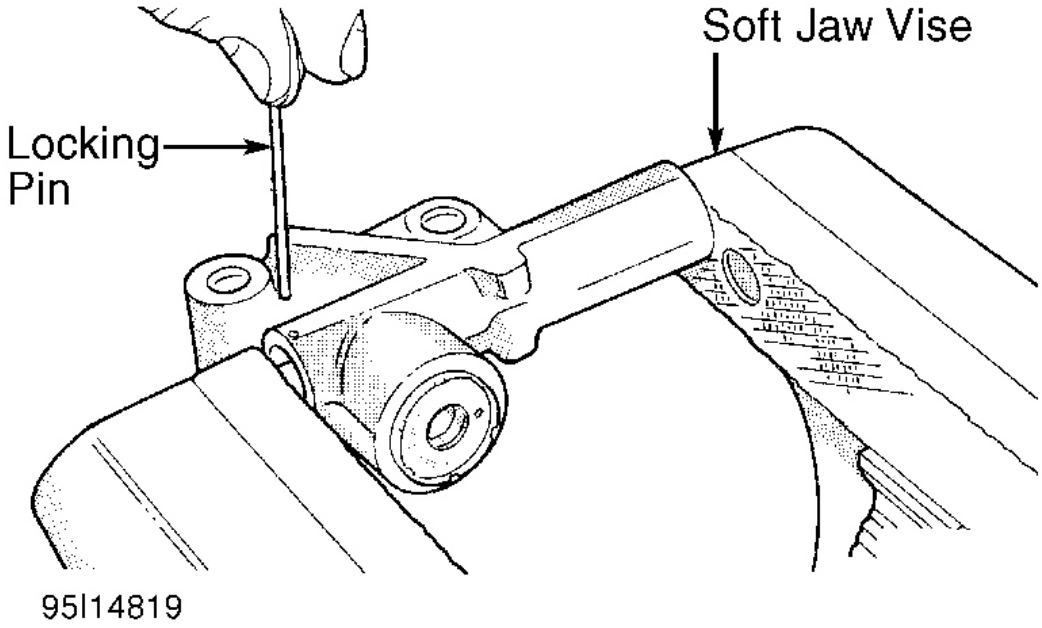


Fig. 17: Compressing Hydraulic Tensioner
Courtesy of CHRYSLER LLC

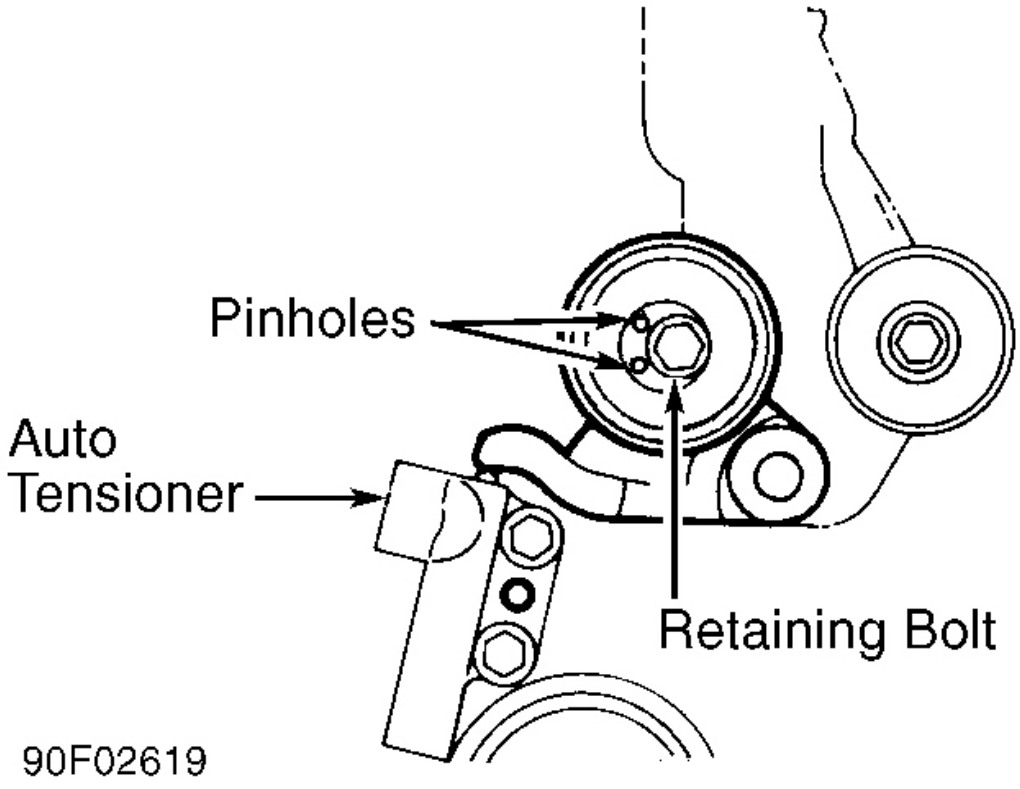


Fig. 18: Positioning Tensioner Pulley Pin Holes Installation
Courtesy of CHRYSLER LLC

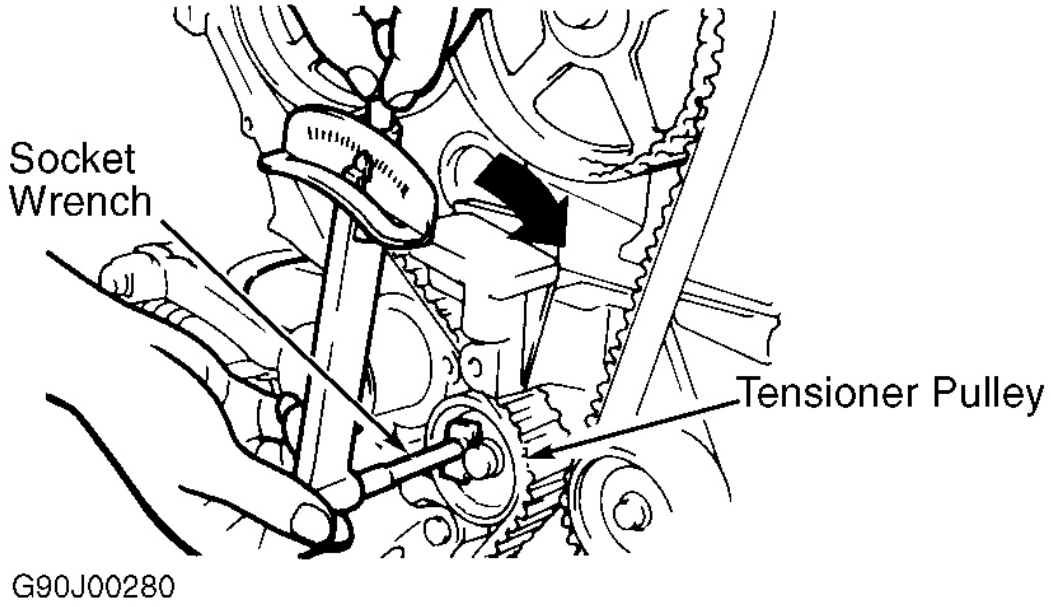


Fig. 19: Adjusting Timing Belt Tensioner Pulley (DOHC Shown; SOHC Similar)
Courtesy of CHRYSLER LLC

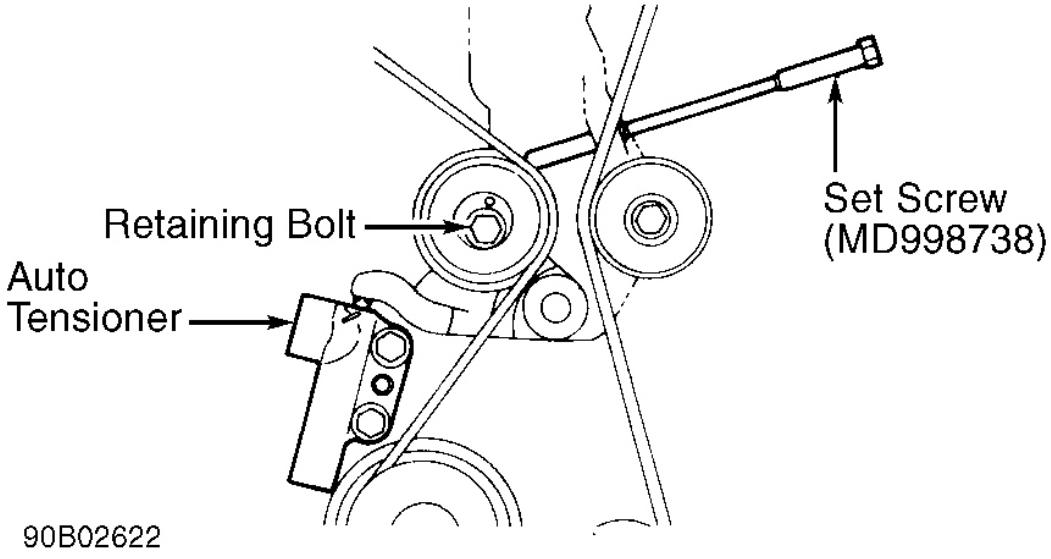


Fig. 20: Installing Set Screw To Retract Auto Tensioner Rod
Courtesy of CHRYSLER LLC

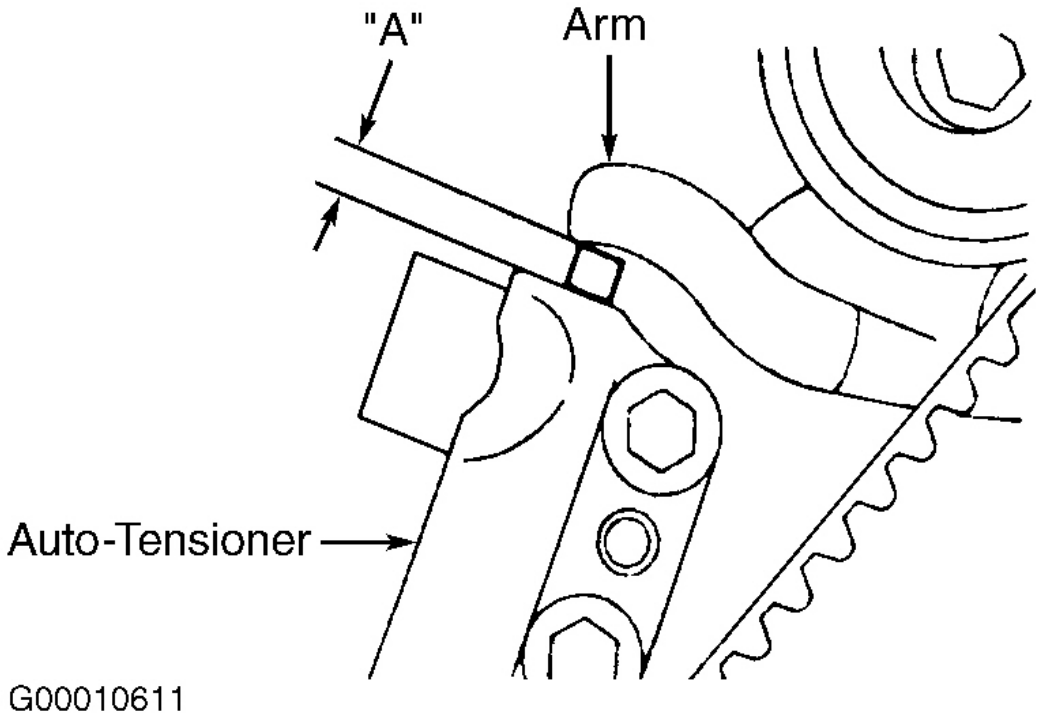
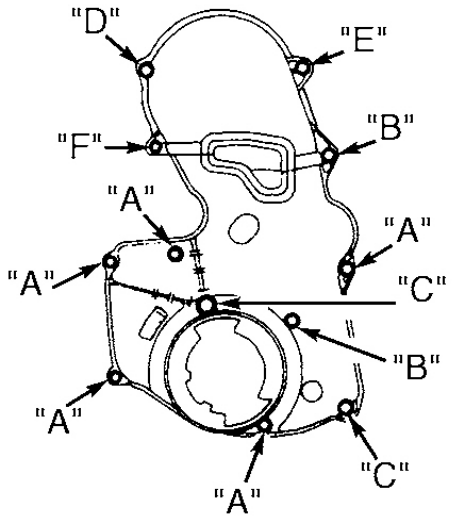


Fig. 21: Measuring Auto Tensioner Rod Protrusion
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.



Bolt	Size (mm)
"A"	6 x 18 (Flange Bolt)
"B"	6 x 25 (Flange Bolt)
"C"	6 x 25 (Loose Washer)
"D"	8 x 50 (Flange Bolt)
"E"	8 x 28 (Flange Bolt)
"F"	8 x 35 (Flange Bolt)

G96H18942

Fig. 22: Locating Timing Cover Bolt Installation Guide
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

ROCKER ARM & VALVE LASH ADJUSTER

CAUTION: DO NOT rotate crankshaft if timing belt has been removed. DO NOT rotate crankshaft counterclockwise (as viewed from timing belt end of engine).

Removal (2.4L)

1. Remove valve cover and semi-circular packing from rear of cylinder head. Remove upper front timing belt cover.
2. Rotate crankshaft clockwise (as viewed from timing belt end of engine) until cylinder No. 1 is at TDC of compression stroke and timing mark on camshaft sprocket aligns with timing mark on upper cover (1.8L) or cylinder head (2.4L). See **Fig. 9** or **Fig. 10** .
3. Mark timing belt in alignment with timing mark on camshaft sprocket. Wire belt to sprocket. Remove camshaft sprocket bolt. Slide camshaft sprocket and belt off camshaft.

NOTE: Check lash adjuster free play before rocker arm removal. See INSPECTION

procedure.

4. Install Lash Adjuster Retainer (MD998443) on rocker arm to prevent adjuster from falling out of rocker arm. See **Fig. 23**. Loosen rocker shaft mounting bolts uniformly, and remove rocker shaft assembly. Remove camshaft and oil seal. If removing lash adjusters from rocker arms, mark for installation reference.

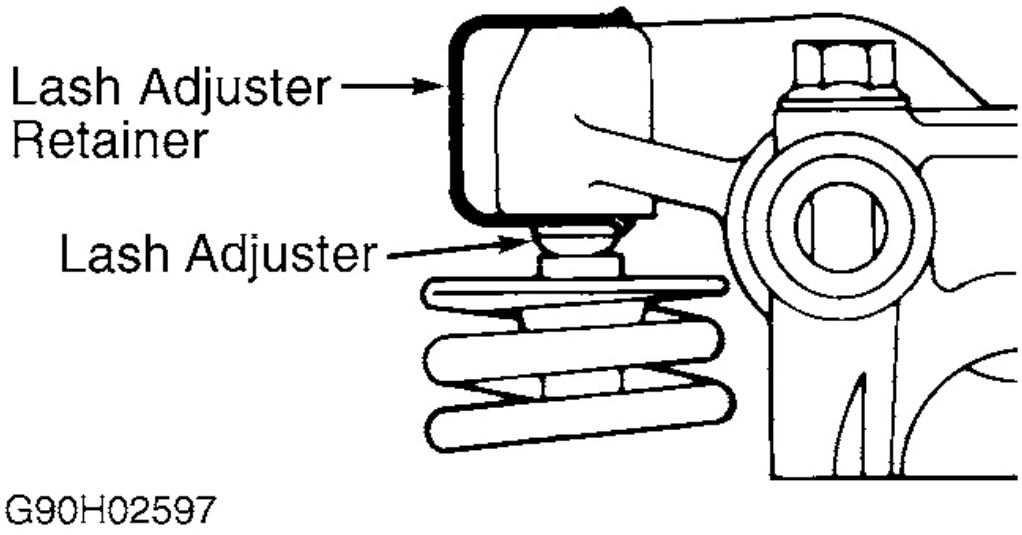


Fig. 23: Installing Lash Adjuster Retainers (2.4L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Inspection (2.4L)

1. Before removing rocker arms from engine, insert a small wire through rocker arm bleed hole and into lash adjuster. With wire lightly holding lash adjuster internal check ball down, move rocker arm up and down to check for free play. If no free play is present, replace adjuster.
2. Inspect rocker arms and shafts for wear and damage. Check distributor drive gear for tooth damage and wear. Replace components as necessary.
3. Check camshaft journal diameter and lobe height. Replace camshaft if journal diameter and lobe height are not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.

Installation (2.4L)

1. Lubricate camshaft lobes and camshaft bearing journals, and install camshaft into cylinder head. Install lash adjuster in rocker arm (if removed). Install lash adjuster retainer.
2. Ensure rocker arm components are installed in original location and wave washers are properly positioned. See **Fig. 24**. Rocker arms for cylinders No. 1 and 3 are marked 1-3. Rocker arms for cylinders

No. 2 and 4 are marked 2-4.

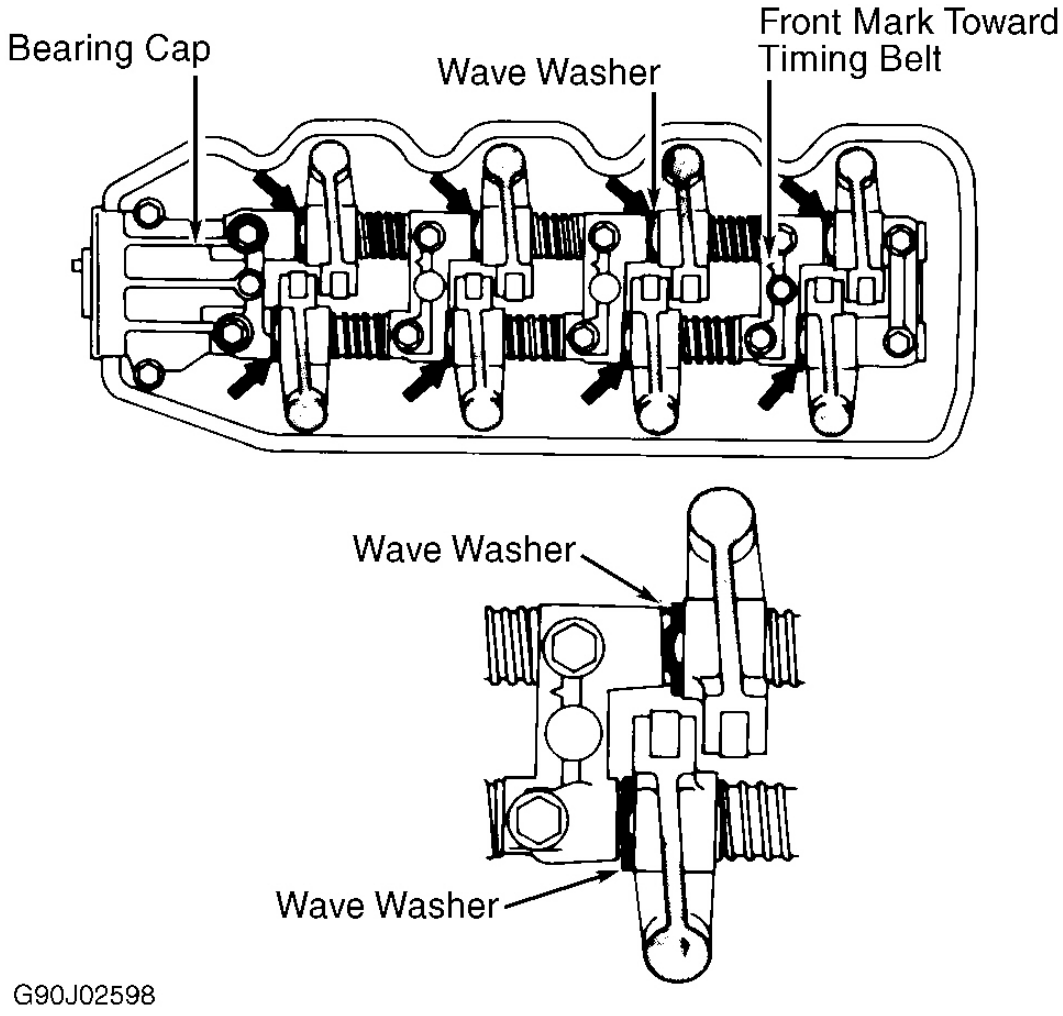


Fig. 24: Installing Rocker Arm Shaft Components (2.4L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

3. Install bearing cap No. 1 on rocker arm shafts so cut areas face away from camshaft area. See **Fig. 25**. Ensure front mark on each bearing cap faces timing belt. Ensure bearing caps are in correct numerical order. Tighten camshaft bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**.
4. Coat lip of camshaft oil seal with oil. Install seal into cylinder head using Seal Installer (MD998364) on 1.8L, and Seal Installer (MD998306) with Guide (MD998307) on 2.4L.
5. Remove lash adjuster retainers. Apply sealant to inside of semi-circular packing and cylinder head before installing. To complete installation, reverse removal procedure.

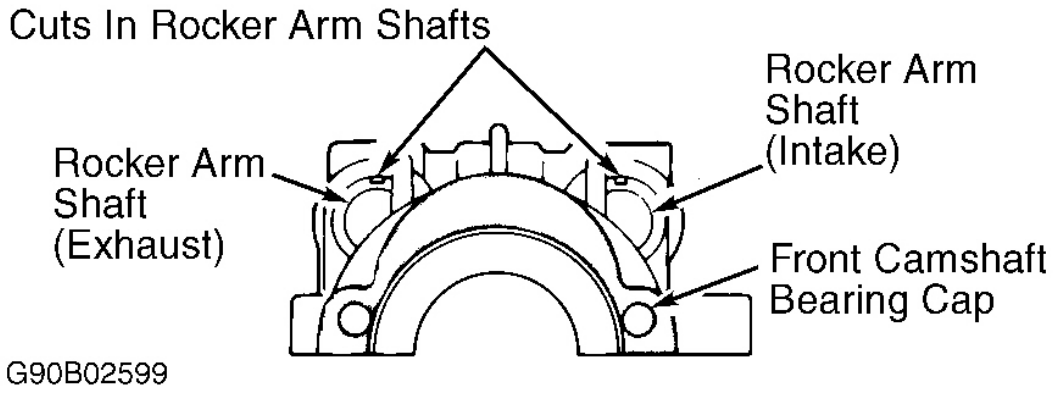


Fig. 25: Installing Rocker Arm Shaft & Bearing Cap (2.4L)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Removal (1.8L)

1. Remove valve cover and semi-circular packing from rear of cylinder head. Remove upper front timing belt cover. Rotate crankshaft clockwise (as viewed from timing belt end of engine) until cylinder No. 1 is at TDC of compression stroke.
2. Ensure timing mark on camshaft sprocket aligns with timing mark on upper cover. See **Fig. 5**. Mark timing belt in alignment with timing mark on camshaft sprocket. Wire belt to sprocket. Remove camshaft sprocket bolt.
3. Slide camshaft sprocket and belt off camshaft. Loosen rocker shaft mounting bolts uniformly, and remove rocker shaft assembly. Remove camshaft and oil seal.

Inspection (1.8L)

1. Inspect rocker arms and shafts for wear and damage. Check distributor drive gear for tooth damage and wear. Replace components as necessary.
2. Check camshaft journal diameter and lobe height. Replace camshaft if journal diameter and lobe height are not within specification. See **CAMSHAFT** table under ENGINE SPECIFICATIONS.

Installation (1.8L)

1. Lubricate camshaft lobes and camshaft bearing journals. Install camshaft into cylinder head.
2. Ensure rocker arms are installed in original location. Tighten camshaft bearing cap bolts to specification. See **TORQUE SPECIFICATIONS**.
3. Coat lip of camshaft oil seal with oil. Install seal into cylinder head using Seal Installer (MD998713-01). To complete installation, reverse removal procedure.

CAMSHAFT

NOTE: For removal and installation of camshaft, see ROCKER ARM & VALVE LASH ADJUSTER under REMOVAL & INSTALLATION.

SILENT SHAFTS & BEARINGS

NOTE: 1.8L models are not equipped with silent shaft. Silent shafts may also be referred to as balance shafts.

Removal

Remove front cover and oil pump. See **OIL PUMP & FRONT COVER** under ENGINE OILING. Remove silent shafts from cylinder block.

NOTE: Rear bearing(s) cannot be removed unless front bearings have been removed from block.

Inspection

1. Inspect silent shaft and bearings for damage. Ensure silent shaft journal O.D. and oil clearance is within specification. See **SILENT SHAFT SPECIFICATIONS** table. Replace components if not within specification.
2. If bearings need replacing, use indicated puller. See **SILENT SHAFT BEARING REMOVAL & INSTALLATION** table.

NOTE: Install rear bearings before installing front bearings.

Installation

1. Coat bearing outer area with engine oil before installing. Mount rear silent shaft bearing on indicated installer. See **SILENT SHAFT BEARING REMOVAL & INSTALLATION** table.
2. Ensure oil hole in bearing aligns with oil hole in cylinder block. Note left rear bearing does not have oil hole. Install rear bearings in cylinder block.
3. Repeat procedure for front bearings. To install front silent shaft bearing on 1.8L, install guide pins provided with bearing installer in threaded holes at front of cylinder block.
4. Install front bearing on bearing installer. Ensure ratchet ball on bearing installer engages in oil hole of bearing. Coat outer area of bearing with engine oil.
5. Place bearing installer over guide pins, and drive bearing into cylinder block. On all models, install balance shafts in original location. To complete installation, reverse removal procedure.

SILENT SHAFT SPECIFICATIONS (2.4L)

Application	In. (mm)
Left Silent Shaft Journal O.D.	
Front	.728 (18.49)
Rear	1.61 (40.9)

Oil Clearance	
Front Journal	.0011-.0020 (.028-.051)
Rear Journal	.0020-.0036 (.051-.091)
Right Silent Shaft Journal O.D.	
Front	1.65 (42.0)
Rear	1.61 (40.9)
Oil Clearance	
Front Journal	.0011-.0024 (.028-.061)
Rear Journal	.0020-.0036 (.051-.091)

SILENT SHAFT BEARING REMOVAL & INSTALLATION (2.4L)

Application	Tool No.
Installer	MD990938
Front & Rear Bearing Adapter	MD998373
Left Rear Bearing Guide Plate	MD998374
Puller	MIT304204
Front Bearing Adapter	MD998371
Rear Bearing Adapter	MD998372
Left Rear Bearing Guide Plate	MD998374

REAR CRANKSHAFT OIL SEAL

Removal

1. Remove transaxle/transmission. For M/T models, see **CLUTCH** article in CLUTCHES. For A/T models, see **REMOVAL & INSTALLATION** article in TRANSMISSION SERVICING.
2. Remove flywheel or drive plate. Remove rear main oil seal case and gasket from rear of cylinder block. Remove oil separator and oil seal from seal case.

Installation

1. Coat seal lip with oil. Using Seal Installer (MD998011 for 1.8L Eclipse, MD998776 for 1.8L except Eclipse, or MD998376 for 2.4L), install seal in seal case until it bottoms.
2. Install oil separator in seal case with hole of separator at bottom of seal case (toward oil pan). Install seal case and gasket. Install flywheel or drive plate. To complete installation, reverse removal procedure.

WATER PUMP

CAUTION: Note length and location of bolts during removal. Different length bolts are used and must be installed in original location.

Removal

Drain cooling system. Remove necessary coolant hoses. Remove timing belt. See **TIMING BELT** under

REMOVAL & INSTALLATION. Remove water pump mounting bolts. Note bolt length and location. Remove water pump.

Installation

To install, reverse removal procedure using new gasket and "O" ring. Install "O" ring on coolant pipe, and apply water to "O" ring. DO NOT apply grease or oil to "O" ring. Ensure bolts are installed in original location.

OIL PAN

Removal

1. Drain engine oil. On Expo 4WD, Summit Wagon 4WD and Vista Wagon 4WD, remove transfer case. See appropriate axle shaft article in DRIVE AXLES.
2. On all models, remove oil pan bolts. Using Gasket Cutter (MD998727), cut gasket along sealing surface of cylinder block. Remove oil pan and gasket.

Installation

To install, apply sealant to oil pan flange at timing chain case and rear seal case areas. Install oil pan and gaskets. To complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Inspect cylinder head for warpage at deck surface. Resurface cylinder head if warpage exceeds specification. See **CYLINDER HEAD** table under ENGINE SPECIFICATIONS.

Valve Springs

Inspect valve spring free length, out-of-square and installed height. Replace valve spring if not within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS. Install all valve springs with painted area toward rocker arm.

Valve Stem Oil Seals

DO NOT reuse oil seals. Install valve spring seat before installing oil seals. To provide proper positioning of oil seal, install new oil seals using Valve Seal Installer (MD998774 for 1.8L, or MD998729 for 2.4L).

Valve Guides

Ensure valve stem diameter is within specification. Check valve stem clearance. Clearance should be within specification. See **VALVES & VALVE SPRINGS** and appropriate CYLINDER HEAD tables under **ENGINE SPECIFICATIONS**. If clearance exceeds service limits, replace valve guide with an oversized valve guide.

Valves

Ensure valve stem diameter and margin are within specification. See **VALVES & VALVE SPRINGS** table under ENGINE SPECIFICATIONS.

Valve Seat

See **ENGINE OVERHAUL PROCEDURES** article in the GENERAL INFORMATION.

Valve Seat Correction Angles

See **ENGINE OVERHAUL PROCEDURES** article in the GENERAL INFORMATION.

VALVE TRAIN

Rocker Arm Shaft Assembly

1. For reassembly reference, note location and order of assembly for all components. Remove bolts from shafts, and separate components. Note length of springs. Intake rocker arm shaft springs are longer than exhaust rocker arm shaft springs.
2. Inspect components for wear and damage. Install components in original location when reassembling shaft assembly. Tighten rocker arm assembly bolts to specification. See **TORQUE SPECIFICATIONS**.

Lash Adjusters

Before installing lash adjuster, submerge lash adjuster in oil. Use a small wire to hold down internal check valve. Pump plunger up and down 4 or 5 times to bleed air from lash adjuster.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1. Mark piston and rod assembly with corresponding cylinder number before removing. Center piston pin in piston. Measure and record piston pin installation depth. Use Piston Pin Removal & Installation Set (MD998780) with hydraulic press to remove piston pin.
2. Piston pin should be easily pushed into piston. If looseness or resistance is encountered, replace piston and pin as a set. Check connecting rod for damage and excessive bend and twist. See **CONNECTING RODS** table under ENGINE SPECIFICATIONS.
3. Position piston, piston pin and rod on press. Ensure front mark on piston will face timing belt side of engine when installed. Using piston pin removal and installation set, install piston pin into piston and rod to depth recorded in step 1). Ensure piston pin is centered in piston.

Fitting Pistons

1. Measure piston skirt diameter at 90-degree angle to piston pin. If piston diameter is not within specification, replace piston. See PISTONS, PINS & RINGS table under **ENGINE SPECIFICATIONS**.
2. Measure cylinder bore diameter at 3 places: near top of bore, bottom of bore and center of bore. If

cylinder bore diameter or taper is not within specification, machine cylinder bore. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS.

3. If piston-to-cylinder bore clearance is not within specification, replace piston and/or machine cylinder bore. See PISTONS, PINS & RINGS table under **ENGINE SPECIFICATIONS**.

Piston Rings

Ensure ring end gap and side clearance are within specification. See PISTONS, PINS & RINGS table under **ENGINE SPECIFICATIONS**. DO NOT use a ring expander to install oil ring side rails. Properly position ring end gaps around circumference of piston before installing. See **Fig. 26**.

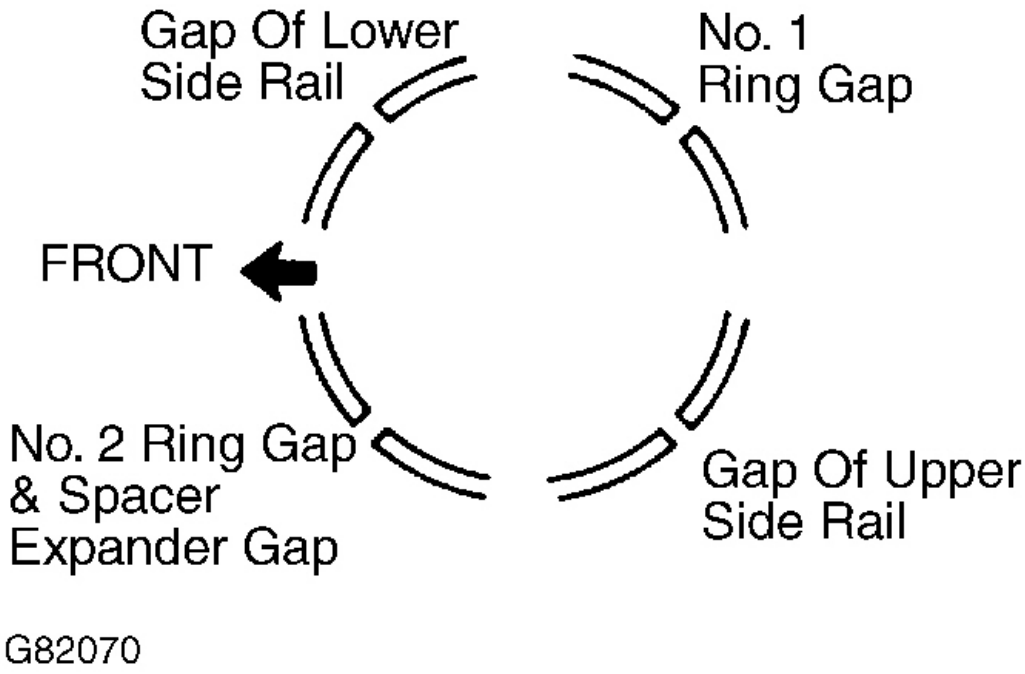


Fig. 26: Positioning Piston Ring Gaps
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

Rod Bearings

Note position of connecting rod in relation to bearing cap before removing. Ensure bearing oil clearance and side play are within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS and CONNECTING RODS tables under **ENGINE SPECIFICATIONS**.

Crankshaft & Main Bearings

Check diameter of crankshaft main bearing journals and connecting rod bearing journals. Check journals for

taper and out-of-round. Check crankshaft end play. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under **ENGINE SPECIFICATIONS**.

Thrust Bearing

Replace thrust bearing if crankshaft end play is not within specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under **ENGINE SPECIFICATIONS**.

Cylinder Block

1. Check cylinder block head surface warpage. If warpage exceeds specification, machine surface. See **CYLINDER BLOCK** table under ENGINE SPECIFICATIONS. DO NOT remove more than a combined total.008" (0.20 mm) material from original surfaces of cylinder head or cylinder block.
2. Check cylinder bore wear and taper. Measure cylinder bore diameter at 3 places: near top of bore, bottom of bore and center of bore. If cylinder bore diameter or taper is not within specification, machine cylinder bore. See **CYLINDER BLOCK** table.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Oil pressure is provided by a belt-driven oil pump mounted in front cover. Pressure relief valve is not adjustable, and is located either in front cover or oil filter bracket. See **Fig. 27**.

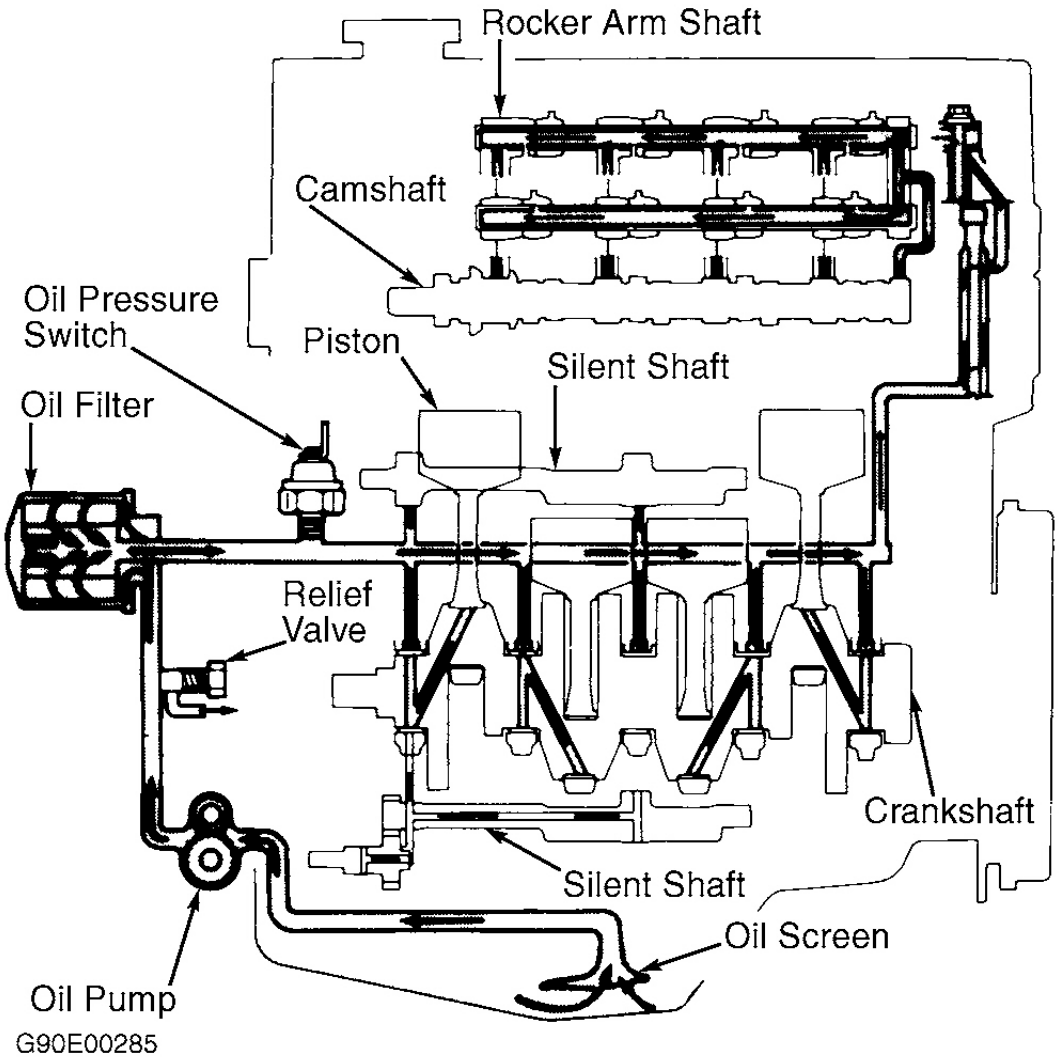


Fig. 27: Engine Oiling System (1.8L Shown; Others Are Similar)
Courtesy of MITSUBISHI MOTOR SALES OF AMERICA.

CRANKCASE CAPACITY SPECIFICATIONS

Application	(1) Qts. (L)
1.8L	4.0 (3.8)
2.4L	4.1 (3.9)
(1) Includes oil filter.	

Oil Pressure

Oil pressure should be at least 11.4 psi (.80 kg/cm^2) at curb idle, and oil temperature should be 167-194°F (75-

90°C).

OIL PUMP & FRONT COVER

Removal (1.8L)

1. Remove oil pan. See **OIL PAN** under REMOVAL & INSTALLATION. If necessary, remove oil filter bracket assembly. Remove oil pick-up assembly.
2. Remove timing belt and sprockets. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove oil pump drive gear. Remove oil pump cover and gasket. Remove front cover from cylinder block.
3. If front cover sticks to cylinder block, pry cover from cylinder block at screwdriver slot. Remove plug, spring and relief plunger. Remove silent shaft and crankshaft oil seal from front cover.

Inspection (1.8L)

1. Inspect components for damage. Install oil pump gears in front cover. Using feeler gauge, measure gear-to-front cover clearance between tip of teeth on each gear and front cover.
2. Place straightedge across front cover above gears. Using feeler gauge, check gear side clearance between straightedge and both oil pump gears. On Colt Vista, Expo and Summit Wagon, check clearance between gear (rotor) tips.
3. Check for ridge on oil pump cover in gear operating area. Ensure relief plunger slides freely in bore. Ensure spring free length is 1.85" (47.0 mm). Replace components if not within specification. See **OIL PUMP SPECIFICATIONS (1.8L)** table.

OIL PUMP SPECIFICATIONS (1.8L)

Application	Specification
Gear Side Clearance	.0015-.0039" (.040-.100 mm)
Gear Tip Clearance	.0024-.0071" (.060-.180 mm)
Gear-To-Front Cover Clearance	
Standard	.0039-.0071" (.100-.180 mm)
Limit	.0138" (.351 mm)

Installation (1.8L)

1. If crankshaft oil seal was removed, use Seal Installer (MD998304) to install seal in front cover. Install gears in oil pump case. Attach oil pump case cover and go to step 4.
2. Position Oil Seal Guide (MD998285) over front of crankshaft. Lubricate crankshaft oil seal and oil seal guide with engine oil.
3. Install front cover with new gasket. Ensure bolts of appropriate length are installed. Install oil pump gears with timing marks aligned. Lubricate gears with engine oil. Install oil pump cover gasket with rounded side toward oil pump cover.
4. On all models, to complete installation, reverse removal procedure. Tighten bolts to specification. See **TORQUE SPECIFICATIONS**.

Removal & Disassembly (2.4L)

1. Remove timing belt and crankshaft sprocket. See **TIMING BELT** under REMOVAL & INSTALLATION. Remove oil filter, oil pressure switch, oil pan and oil screen.
2. Remove oil filter bracket, front cover and oil pump assembly. Remove plug cap located on front of front cover using Plug Cap Wrench (MD998162). Remove rear cover. Mark direction of gear installation for reassembly reference.

Inspection (2.4L)

1. Place straightedge across front cover housing and measure side play between each gear and straightedge. Check clearance between tip of gear teeth of both gears and front cover.
2. Ensure pressure relief valve moves without restriction in bore. Replace components if damaged or not within specification. See **OIL PUMP SPECIFICATIONS (2.4L)** table.

OIL PUMP SPECIFICATIONS (2.4L)

Application	Specification
Gear Side Clearance	
Drive Gear	
Standard	.0031-.0055" (.080-.140 mm)
Limit	.0098" (.250 mm)
Driven Gear	
Standard	.0024-.0047" (.060-.120 mm)
Limit	.0098" (.250 mm)
Gear-To-Front Cover Clearance	
Drive Gear	
Standard	.0063-.0083" (.160-.210 mm)
Limit	.0098" (.250 mm)
Driven Gear	
Standard	.0051-.0071" (.130-.180 mm)
Limit	.0098" (.250 mm)

Reassembly & Installation (2.4L)

1. Lubricate oil pump gears with engine oil, and install. Ensure timing marks are aligned. Install oil pump cover, and tighten bolts to specification. See **TORQUE SPECIFICATIONS**.
2. If crankshaft oil seal was removed, use Seal Installer (MD998375) to install seal in front cover. Use a socket of proper diameter to install silent shaft oil seals.
3. Position Oil Seal Guide (MD998285) over front of crankshaft. Lubricate crankshaft oil seal and oil seal guide with engine oil. Install front cover with new gasket, and temporarily tighten bolts. Install oil filter bracket. Ensure correct length bolts are installed.
4. To complete installation, reverse removal procedure. Install plug cap using new "O" ring, and tighten to specification. Apply thread sealant to oil pressure switch threads before installing. Tighten all bolts to specification. See **TORQUE SPECIFICATIONS**.

TORQUE SPECIFICATIONS

1.8L

TORQUE SPECIFICATIONS (1.8L)

Application	Ft. Lbs. (N.m)
A/C Tensioner Pulley Bracket Bolt	17-20 (23-27)
Air Intake Plenum Bolt	11-14 (15-19)
Camshaft Bearing Cap Bolt	
6 x 20-mm	14-15 (19-20)
8 x 65-mm	15-20 (20-27)
Camshaft Sprocket Bolt	58-72 (79-98)
Connecting Rod Nut	24-25 (33-34)
Crankshaft Pulley Bolt	11-13 (15-18)
Crankshaft Sprocket Bolt	80-94 (109-127)
Elastic Cylinder Head Bolt (Cold) (1)	
Step 1	55 (75)
Step 2	Fully Loosen
Step 3	14.5 (20)
Step 4	1/4 turn (90 degrees)
Step 5	1/4 turn (90 degrees)
Damper Pulley Bolt	11-13 (15-18)
Engine Support Bracket Bolt	36-47 (49-64)
Exhaust Manifold Nut	11-14 (15-19)
Flywheel/Drive Plate Bolt	94-101 (127-137)
Front Cover Bolt	11-13 (15-18)
Intake Manifold Bolt	12-14 (17-19)
Main Bearing Cap Bolt	37-39 (51-53)
Oil Filter Bracket Bolt	11-16 (15-22)
Oil Pick-Up Tube Nut	13-18 (18-24)
Oil Pump Cover Bolt	11-13 (15-18)
Oil Pump Sprocket Nut	26-29 (35-39)
Power Steering Pump Bolts	26-33 (35-45)
Oxygen Sensor	29-36 (39-49)
Rocker Arm Assembly Bolts	14-15 (19-20)
Silent Shaft Sprocket Bolt	25-29 (34-39)
Throttle Body Bolt	11-16 (15-22)
Timing Belt "A" Tensioner Bolt	16-22 (22-30)
Timing Belt "B" Tensioner Bolt	11-16 (15-22)
Water Pump Bolt	
Except 8 x 65-mm	10 (14)

8 x 65-mm	15-19 (20-26)
	INCH Lbs. (N.m.)
Fuel Rail Bolt	84-108 (9-12)
Oil Pan Bolt/Nut	48-60 (5-7)
Timing Belt Cover Bolt	84-108 (9-12)
Valve Cover Bolt	48-60 (5-7)
Water Pump Pulley Bolt	72-84 (8-9)
(1) Elastic head bolts are used on, 1992-93 1.8L engines. These type bolts are tightened in a 5 step sequence. Follow head bolt tightening sequence. See **Fig. 3**. Also see **ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS**	

2.4L

TORQUE SPECIFICATIONS (2.4L)

Application	**Ft. Lbs. (N.m)**
Balance Shaft Center Bolt ("B" Belt)	31-35 (42-48)
Balance Shaft Sprocket Nut (Oil Pump Drive)	36-42 (49-59)
Camshaft Bearing Cap Bolts	
8 x 25-mm	15-19 (20-26)
8 x 65-mm	14-15 (19-20)
Camshaft Sprocket Bolt	58-72 (79-98)
Connecting Rod Cap Nuts	37-38 (50-52)
Crankshaft Pulley Bolt	15-21 (20-28)
Crankshaft Sprocket Bolt	80-94 (109-127)
Elastic Cylinder Head Bolt (Cold) (1)	
Step 1	55 (75)
Step 2	Fully Loosen
Step 3	14.5 (20)
Step 4	1/4 turn (90 degrees)
Step 5	1/4 turn (90 degrees)
Non-Elastic Cylinder Head Bolts (Cold) (2)	
Step 1	29 (40)
Step 2	29 (40)
Step 3	80 (110)
Engine Support Bracket Bolts	29-36 (39-49)
Exhaust Manifold-To-Engine Bolt	11-14 (15-19)
Exhaust Pipe-To-Manifold Bolt	29-40 (39-54)
Flywheel/Drive Plate Bolt	94-101 (127-137)
Front Cover Bolt (Oil Pump)	15-19 (20-26)
Hydraulic Tensioner bolts	17 (24)
Intake Manifold Bolt	11-14 (15-19)

Intake Manifold Stay Bolt	13-18 (18-24)
Main Bearing Cap Bolt	37-39 (50-53)
Oil Filter Bracket Bolt	11-15 (15-20)
Oil Pan Drain Plug	26-32 (35-43)
Oil Pump Cover Bolt	11-13 (15-18)
Oil Pump Driven Gear Bolt	25-28 (34-38)
Oil Pump Relief Valve Plug	29-36 (39-49)
Oil Pump Sprocket Nut	36-43 (49-58)
Oil Screen Bolt	11-15 (15-20)
Oil Screen Stay Nut	11-15 (15-20)
Power Steering Pump Bolt	18-24 (24-33)
Rear Tensioner Bolt	11-15 (15-20)
Rocker Arm Assembly Bolts	14-15 (19-20)
Throttle Body Bolt	14 (19)
Timing Belt Hydraulic Tensioner Bolts	17 (24)
Timing Belt Tensioner Pulley Center Bolt	35 (48)
Timing Belt Idler Pulley Center Bolt	27 (37)
	INCH Lbs. (N.m.)
Cooling Fan Nut	84-108 (9-12)
Delivery Pipe Bolt	84-108 (9-12)
High Pressure Fuel Hose Bolt	12-24 (1.4-2.7)
Oil Pan Bolt	48-72 (5-8)
Oil Pressure Switch	72-108 (8-12)
Radiator Upper Shroud	24-48 (3-5)
Rear Oil Seal Case Bolt	84-108 (9-12)
Rocker Cover Bolt	48-60 (5-7)
Timing Belt Cover Bolts	84-108 (9-12)

(1) Elastic head bolts are used on, 1993 2.4L engine. These type bolts are tightened in a 5 step sequence. See **ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS**.

(2) Non-Elastic head bolts are used on, 1992 2.4L engine. These type bolts are tightened in a 3 step sequence. Follow head bolt tightening sequence. See **Fig. 4**. See **NON-ELASTIC CYLINDER HEAD BOLT TIGHTENING SPECIFICATIONS**

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

Application	Specification
1.8L	
Displacement	111 Cu. In. (1.8L)

Bore	3.19" (81.0 mm)
Stroke	3.50" (89.0 mm)
Compression Ratio	8.5:1
Fuel System	PFI
Horsepower @ RPM	(1)
Torque Ft. Lbs. @ RPM	(1)
2.4L	
Displacement	143.4 Cu. In. (2.4L)
Bore	3.41" (86.5 mm)
Stroke	3.94" (100.0 mm)
Compression Ratio	8.5:1
Fuel System	PFI
Horsepower @ RPM	116 @ 5000
Torque Ft. Lbs. @ RPM	136 @ 3500
(1) Information is not available from manufacturer.	

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECIFICATIONS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

Application	In. (mm)
Crankshaft End Play	
Standard	.0020-.0070 (.051-.178)
Wear Limit	.016 (.41)
Main Bearings	
Journal Diameter	2.244 (57.00)
Journal Out-Of-Round	.0006 (.015)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	.0008-.0016 (.020-.040)
Wear Limit	.004 (.10)
Connecting Rod Bearings	
Journal Diameter	1.771 (45.00)
Journal Out-Of-Round	.0006 (.015)
Journal Taper	.0002 (.005)
Oil Clearance	
Standard	.0008-.0020 (.020-.050)
Wear Limit	.004 (.10)

CONNECTING RODS SPECIFICATIONS

CONNECTING RODS

Application	In. (mm)
Maximum Bend	.0020 Per 3.937 (.051 Per 100.00)
Maximum Twist	.0039 Per 3.937 (.01 Per 100.00)
Side Play	
Standard	.0039-.0098 (.010-.250)
Wear Limit	.016 (.41)

PISTONS, PINS & RINGS SPECIFICATIONS (1.8L)

PISTONS, PINS & RINGS (1.8L)

Application	In. (mm)
Pistons	
Clearance	.0008-.0016 (.020-.040)
Diameter	3.1882-3.1886 (80.980-80.990)
Pin-to-Rod Fit	(1)
Rings	
No. 1	
End Gap	
Standard	.0098-.0157 (.250-.400)
Wear Limit	.031 (.79)
Side Clearance	
Standard	.0012-.0028 (.030-.070)
Wear Limit	.004 (.10)
No. 2	
End Gap	
Standard	.0157-.0217 (.400-.550)
Wear Limit	.031 (.79)
Side Clearance	
Standard	.0008-.0024 (.020-.060)
Wear Limit	.004 (.10)
Oil Ring Side Rail	.0079-.0236 (.200-.600)
(1) Press fit with load of 1653-3858 lbs. (750-1750 kg).	

PISTONS, PINS & RINGS SPECIFICATIONS (2.4L)

PISTONS, PINS & RINGS (2.4L)

Application	In. (mm)
Pistons	
Clearance	.0008-.0016 (.020-.041)
Diameter	3.406 (86.51)
Pin (Rod Fit)	(1)

Rings	
No. 1	
End Gap	
Standard	.0098-.0157 (.250-.400)
Wear Limit	.031 (.79)
Side Clearance	
Standard	.0012-.0028 (.030-.071)
Wear Limit	.004 (.10)
No. 2	
End Gap	
Standard	.0079-.0157 (.200-.400)
Wear Limit	.031 (.79)
Side Clearance	
Standard	.0008-.0024 (.020-.061)
Wear Limit	.004 (.10)
No. 3 (Oil)	
End Gap	
Standard	.0079-.0276 (.200-.700)
Wear Limit	.039 (.99)
(1) Press fit with load of 1653-3858 lbs. (750-1750 kg).	

CYLINDER BLOCK SPECIFICATIONS

CYLINDER BLOCK

Application	In. (mm)
Cylinder Bore (1.8L)	
Standard Diameter	3.1894-3.1898 (81.010-81.020)
Maximum Taper	.0004 (.010)
Maximum Out-Of-Round	.0004 (.010)
Deck Height	(2)
Maximum Deck Warpage	(1).0039 (.099)
Cylinder Bore (2.4L)	
Standard Diameter	3.406 (86.51)
Maximum Taper	.0008 (.020)
Maximum Out-Of-Round	.0008 (.020)
Deck Height	11.42 (290.1)
Maximum Deck Warpage	(1).002 (.05)
(1) Combined maximum total grind limit of cylinder head and cylinder block is.008" (.20 mm).	
(2) Information is not available from manufacturer.	

VALVES & VALVE SPRINGS SPECIFICATIONS (1.8L)

VALVES & VALVE SPRINGS (1.8L)

Application	Specification
Intake Valves	
Face Angle	45-45.5°
Minimum Margin	.019" (.48 mm)
Stem Diameter	.235" (5.97 mm)
Exhaust Valves	
Face Angle	45-45.5°
Minimum Margin	.039" (1.00 mm)
Stem Diameter	.234" (5.95 mm)
Valve Springs	
Free Length	1.965-2.004" (48.21-49.20 mm)
Installed Height	(1)
Out-Of-Square	
Standard	Less Than 2°
Wear Limit	4°
(1) Information is not available from manufacturer.	

VALVES & VALVE SPRINGS SPECIFICATIONS (2.4L)

VALVES & VALVE SPRINGS (2.4L)

Application	Specification
Intake Valves	
Face Angle	45-45.5°
Minimum Margin	
Standard	.047" (1.19 mm)
Wear Limit	.028" (.71 mm)
Stem Diameter	.31" (8.0 mm)
Valve Length	4.1953" (106.560 mm)
Exhaust Valves	
Face Angle	45-45.5°
Minimum Margin	
Standard	.079" (2.01 mm)
Wear Limit	.059" (1.50 mm)
Stem Diameter	.31" (8.0 mm)
Valve Length	4.1401" (105.159 mm)
Valve Springs	
Free Length	1.961" (49.81 mm)
Installed Height	1.591-1.630" (40.41-41.40 mm)

Out-Of-Square	
Standard	Less Than 2°
Wear Limit	4°

CYLINDER HEAD SPECIFICATIONS (1.8L)

CYLINDER HEAD (1.8L)

Application	Specification
Cylinder Head Height	4.720" (119.90 mm)
Maximum Warpage	(1).0012" (.030 mm)
Valve Seats	
Intake Valve	
Seat Angle	43.5-44.0°
Seat Width	.0354-.0512" (.899-1.300 mm)
Exhaust Valve	
Seat Angle	43.5-44.0°
Seat Width	.0354-.0512" (.899-1.300 mm)
Valve Guides	
Intake Valve	
Valve Stem-To-Guide Oil Clearance	
Standard	.0008-.0020" (.020-.050 mm)
Wear Limit	.004" (.10 mm)
Exhaust Valve	
Valve Stem-To-Guide Oil Clearance	
Standard	.0020-.0035" (.050-.090 mm)
Wear Limit	.006" (.15 mm)
(1) Combined maximum total grind limit of cylinder head and cylinder block is.008" (.20 mm).	

CYLINDER HEAD SPECIFICATIONS (2.4L)

CYLINDER HEAD (2.4L)

Application	Specification
Cylinder Head Height	3.544" (90.00 mm)
Maximum Warpage	(1).0020" (.051 mm)
Valve Seats	
Intake Valve	
Seat Angle	44-44.5°
Seat Width	.035-.051" (.89-1.30 mm)
Exhaust Valve	
Seat Angle	44-44.5°
Seat Width	.035-.051" (.89-1.30 mm)

Valve Guides	
Intake Valve	
Guide Length	1.85" (47.0 mm)
Valve Stem-To-Guide Oil Clearance	.0012-.0024" (.030-.061 mm)
Exhaust Valve	
Guide Length	2.05" (52.1 mm)
Valve Stem-To-Guide Oil Clearance	.0020-.0035" (.051-.089 mm)
(1) Combined maximum total grind limit of cylinder head and cylinder block is.008" (.20 mm).	

CAMSHAFT SPECIFICATIONS

CAMSHAFT

Application	In. (mm)
1.8L	
End Play	.004-.008 (.10-.20)
Journal Diameter	1.7689-1.7693 (44.930-44.940)
Lobe Height	
Intake	1.4677-1.4876 (37.280-37.780)
Exhaust	1.4799-1.4996 (37.590-38.090)
Oil Clearance	.0020-.0035 (.051-.089)
2.4L	
End Play	.004-.008 (.10-.20)
Journal Diameter	1.339 (34.01)
Lobe Height	1.6496-1.6693 (41.900-42.400)
Oil Clearance	.0020-.0035 (.051-.089)