





Intake ..... .0070-.0087 (.18-.22)  
Exhaust ..... .0091-.0106 (.23-.27)  
AA

## REMOVAL & INSTALLATION

\* PLEASE READ THIS FIRST \*

**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

#### 1995-97 Models

Disconnect fuel pump wiring connector located under rear seat. Start engine and let idle until it stalls. Crank engine for an additional 5 seconds. Turn ignition off.

#### 1998 Models

Disconnect fuel pump relay connector located under left side of dash. Start engine and run until it stalls. Crank engine for an additional 5 seconds. Turn ignition off.

### ENGINE

**NOTE:** Transaxle remains in vehicle with engine removal.

#### Removal

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Drain cooling system. Disconnect battery and remove from vehicle. Remove air intake duct/upper air cleaner cover assembly. Disconnect radiator and heater hoses. Disconnect A/T cooler lines (if equipped). Remove radiator.

2) Identify, mark and disconnect electrical connectors, vacuum hoses and fuel lines that interfere with engine removal. Discharge A/C system using approved refrigerant recovery/recycling equipment. Disconnect accelerator cable, cruise control cable (if equipped) and clutch cable/hill holder cable at clutch release fork (M/T).

3) Remove accessory drive belts. Remove power steering pump with hoses attached and set aside. Remove hoses from A/C compressor and set aside. Raise and support vehicle. Remove front exhaust pipe. Disconnect engine mount from front crossmember. Remove nuts attaching lower engine to transaxle.

4) Remove all brackets interfering with engine removal.

Remove flywheel access cover. Disconnect bolts securing drive plate to torque converter (A/T). Support engine using hoist. Support transaxle using floor jack. Remove bolts attaching upper side of engine to transmission. Remove engine.

#### Installation

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

### INTAKE MANIFOLD

#### Removal & Installation

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Remove "V" belt. Disconnect negative battery cable. Remove air intake duct/upper air cleaner cover assembly. Disconnect throttle cable. Disconnect cruise control cable (if equipped). Remove power steering belt. Remove power steering pump with hoses attached and set aside.

2) Disconnect PCV and ventilation hoses. Disconnect spark plug wires. Disconnect coolant hoses and air by-pass hose from throttle body. Disconnect electrical connectors and vacuum hoses interfering with intake manifold removal.

3) Remove EGR pipe. Disconnect fuel hoses from pipes. Remove intake manifold-to-cylinder head bolts. Remove intake manifold. To install, reverse removal procedure. Use NEW gaskets. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

### EXHAUST MANIFOLD

NOTE: Exhaust manifold is integral with cylinder head.

### CYLINDER HEAD

#### Removal

Release fuel pressure. See FUEL PRESSURE RELEASE. Drain engine coolant. Remove timing belt and camshaft sprocket. See TIMING BELT. Remove intake manifold and exhaust pipe. See INTAKE MANIFOLD. Remove cylinder head bolts in reverse order of tightening sequence. See Fig. 2. Remove cylinder head and gasket.

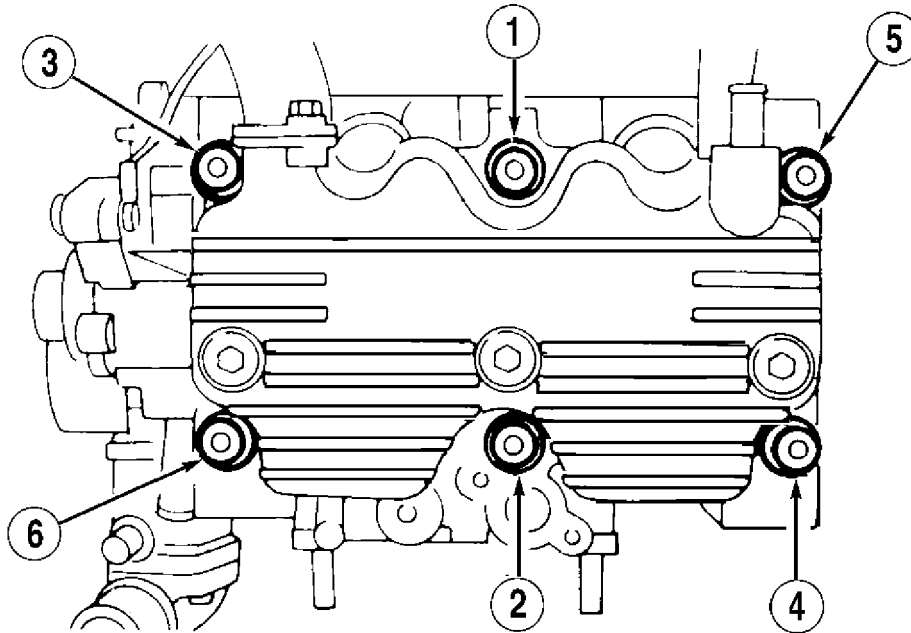
#### Inspection

Check cylinder head warpage and height. Resurface head if warpage exceeds specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. Replace cylinder head if height is not within specification.

#### Installation

Ensure mating surfaces are clean and dry. Install head

gasket. Coat head bolt threads with oil. Tighten bolts to specification in sequence. See Fig. 2. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedure.



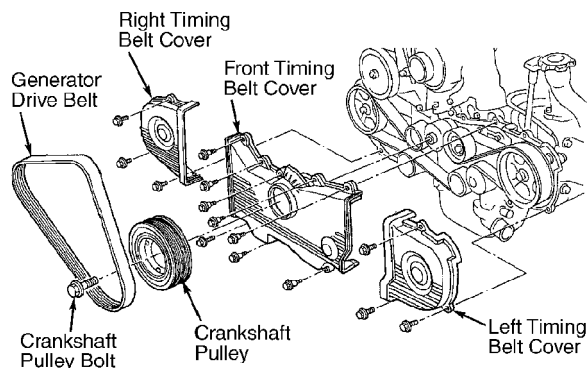
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**Fig. 2: Cylinder Head Bolt Tightening Sequence**  
 Courtesy of Subaru of America, Inc.

## TIMING BELT

### Removal

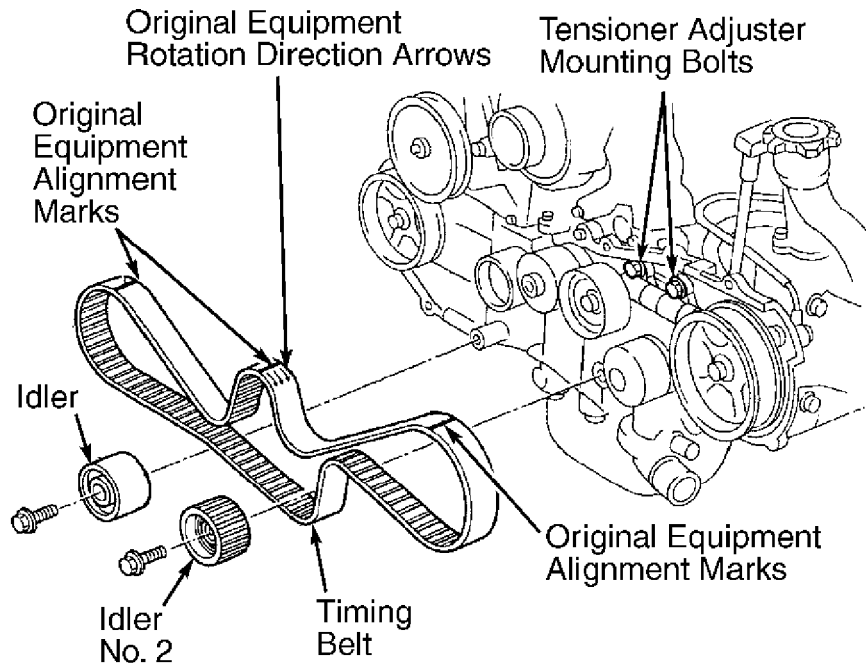
1) Remove generator drive belt. Remove A/C belt and tensioner, if equipped. Remove crankshaft pulley. If engine is removed from vehicle, crankshaft can be held using Crankshaft Pulley Wrench (499977000).



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**Fig. 3: Identifying Crankshaft Pulley & Timing Belt Covers**  
 Courtesy of Subaru of America, Inc.

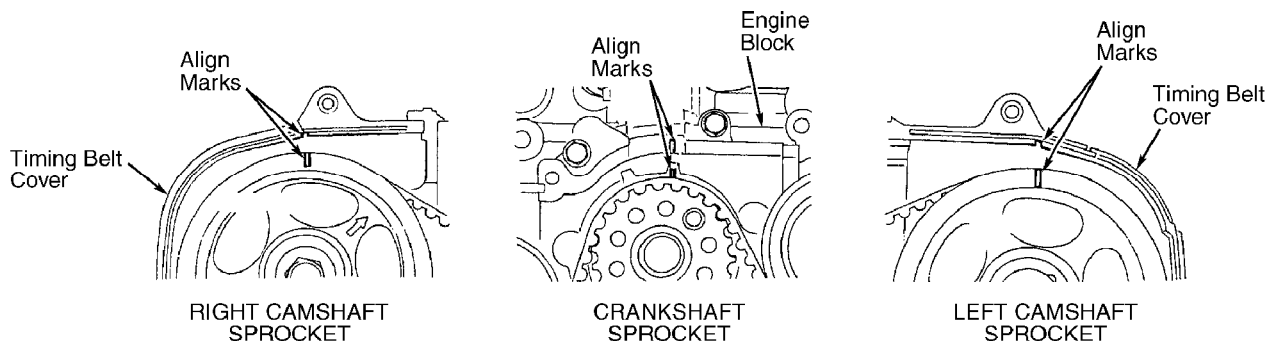
2) Remove left, right and front timing belt covers. See Fig. 3. If timing belt is to be reused, mark belt to indicate original direction of rotation before removal, if original marks are worn away or faded. Also mark belt to indicate belt-to-sprocket alignment, if original marks are worn away or faded. See Fig. 4.



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**Fig. 4: Identifying Timing Belt Components**  
Courtesy of Subaru of America, Inc.

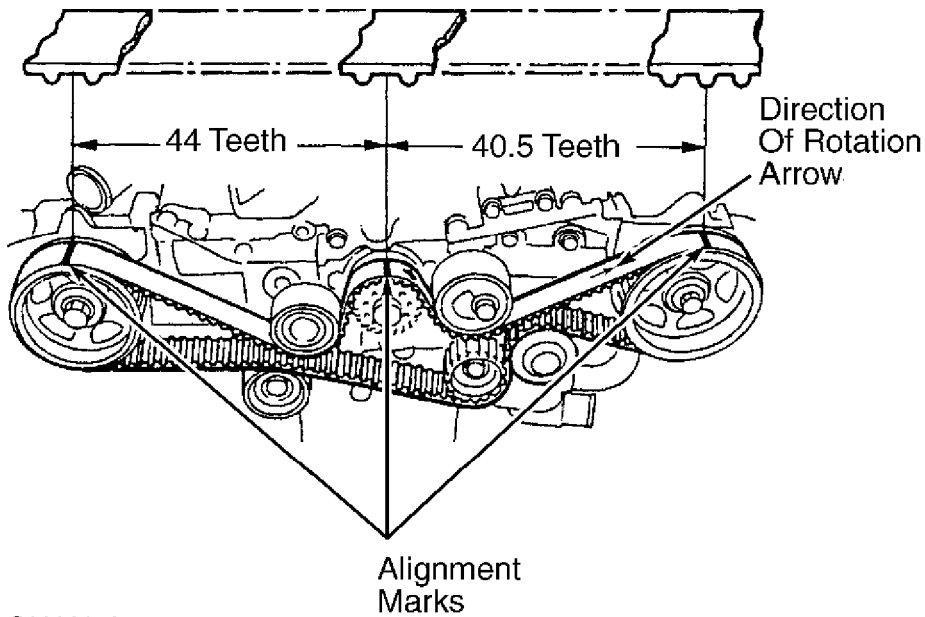
3) To mark belt, turn crankshaft with Crankshaft Socket (499987500) to align marks on crankshaft sprocket and left and right camshaft sprockets with notches on timing belt cover and engine block. See Fig. 5.



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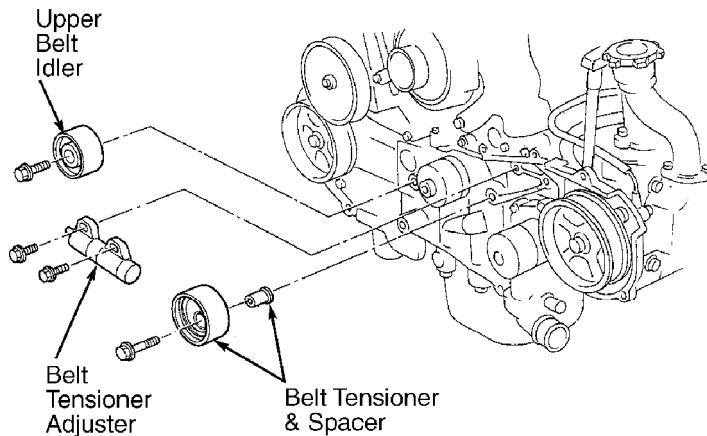
**Fig. 5: Aligning Crankshaft Sprocket & Left & Right Camshaft Sprocket Marks**  
Courtesy of Subaru of America, Inc.

4) Use White paint to mark direction of rotation and to mark timing belt in relation to sprocket timing marks. When marks are properly aligned, 44 teeth should be on right side of crankshaft sprocket and 40.5 teeth should be on left side of crankshaft sprocket. See Fig. 6.



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**Fig. 6: Aligning Timing Belt Before Removal (Impreza)**  
 Courtesy of Subaru of America, Inc.

5) Loosen tensioner adjuster mounting bolts. Remove belt idler, and belt idler No. 2. Remove timing belt. Remove upper belt idler. Remove belt tensioner and spacer. Remove belt tensioner adjuster. See Fig. 7



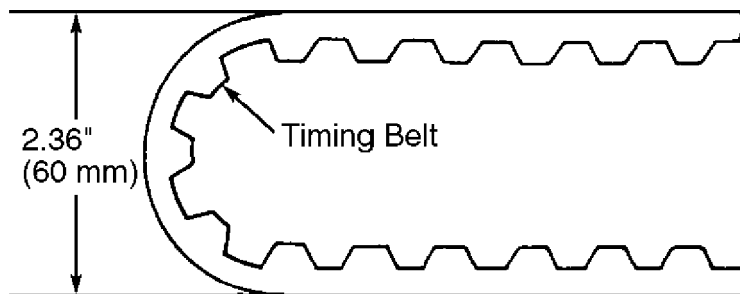
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**Fig. 7: Removing Timing Belt Tensioner Components**  
 Courtesy of Subaru of America, Inc.

### Inspection

1) Inspect timing belt for wear on rounded edges of drive teeth. Inspect belt for signs of oil contamination. Replace belt if it is damaged or contaminated. Inspect belt tensioner adjuster oil seals for leaks. Inspect rod ends for abnormal wear and scratches. Timing belt bend radius must be greater than 2.36" (60.0 mm). See Fig. 8.

2) Slight trace of oil at rod oil seal does not indicate a problem. While holding tensioner with both hands, push rod section against floor or wall using a force of 33-110 lbs. (15-50 kg) to ensure rod section does not move.

3) If rod section moves, replace tensioner adjuster with a NEW one. Measure extension of rod beyond body. Rod extension should be .606-.646" (15.40-16.40 mm). Replace belt tensioner adjuster if extension of rod is not as specified. Inspect belt tensioner and belt adjuster rod mating surface. Check spacer and tensioner bushing for wear.



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Fig. 8: Measuring Timing Belt Bend Radius  
Courtesy of Subaru of America, Inc.

### Installation

**CAUTION:** DO NOT allow press pressure to exceed 2205 lbs. (992 kg).  
DO NOT release pressure until stopper pin is completely installed.

1) Ensure timing marks are aligned. Using a press, push rod into body until holes in belt tensioner adjuster rod and adjuster body are aligned. Install .059" (1.50 mm) diameter stopper pin into holes in adjuster body and rod. See Fig. 9.

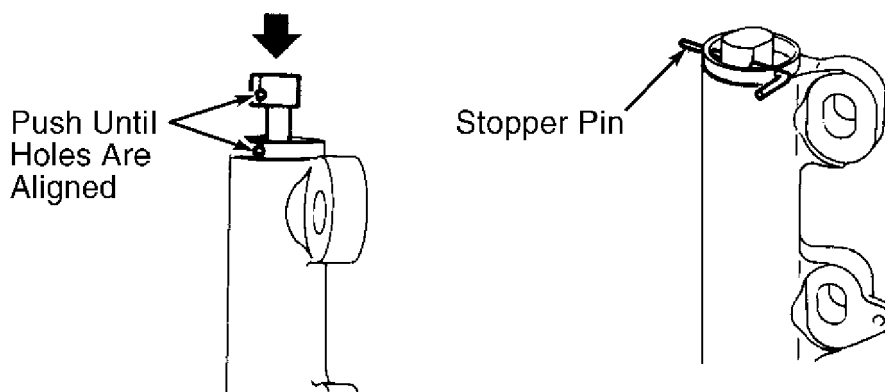
2) Install belt tensioner adjuster, and temporarily tighten mounting bolts while tensioner adjuster is pushed completely to the right. Install belt tensioner and spacer. Install upper belt idler. Ensure crankshaft and camshaft alignment marks are aligned. See Fig. 5

3) Install timing belt, being careful not to move sprockets. Ensure rotation direction of belt is correct and that all alignment marks are aligned when belt is installed. See Fig. 6. Install belt



idler No. 2 and belt idler. Loosen tensioner adjuster mounting bolts and push tensioner adjuster completely left. Tighten tensioner adjuster mounting bolts.

4) Ensure marks on timing belt and sprockets align. See Fig. 6. Remove stopper pin from tensioner adjuster. Install timing belt covers, crankshaft pulley and generator drive belt. Install A/C belt and tensioner, if equipped. Remove rocker covers, and ensure valve lash adjuster does not contain air.



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**Fig. 9: Installing Tension Adjuster Rod Stopper Pin**  
Courtesy of Subaru of America, Inc.

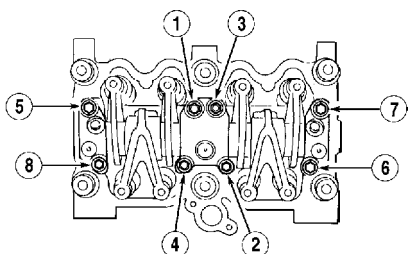
## ROCKER ARM ASSEMBLY

### Removal & Installation

1) Disconnect PCV hose, and remove rocker cover. Loosen, but DO NOT remove, bolt No. 1. See Fig. 10. Remove rocker bolts No. 2-4 in order. Remove bolts No. 5-8. Remove rocker arm assembly.

2) On models with hydraulic lash adjusters, ensure rocker arm assembly air vent remains facing upward or submerge rocker arm assembly in clean engine oil.

3) To install, reverse removal procedure. DO NOT allow rocker arm assembly to gouge dowel/alignment pins. Tighten bolts in reverse order of loosening sequence to specification. See Fig. 10. See TORQUE SPECIFICATIONS.



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**Fig. 10: Rocker Bolt Loosening Sequence**  
Courtesy of Subaru of America, Inc.

## CAMSHAFT

### Removal

Remove timing belt, valve covers and camshaft sprockets. See TIMING BELT.

NOTE: The following procedure is for removal of left camshaft. Procedure for right camshaft is similar.

Remove rocker arm assembly. See ROCKER ARM ASSEMBLY. Remove camshaft position sensor. Remove valve lash adjusters and submerge in clean engine oil (if equipped). Remove oil dipstick tube mounting bolt. Remove camshaft support and "O" ring. Remove camshaft. Remove oil seals only if necessary.

### Inspection

1) Place camshaft in "V" blocks. Measure bend. Bend limit is .001" (.025 mm). Check cam face condition. Remove minor burrs by grinding using oil stone. Check cam height and journal for damage or wear.

2) Measure outside diameter of camshaft journal and inside diameter of cylinder head journal to determine camshaft oil clearance. If clearance is not within specification, replace camshaft or cylinder head as necessary. See CAMSHAFT under ENGINE SPECIFICATIONS.

3) Measure camshaft end play. If end play is not within specification, replace camshaft support.

### Installation

1) Apply a coat of clean engine oil to camshaft journals. Install camshaft. Lubricate "O" ring and install to camshaft support. Install camshaft support.

2) Apply grease to oil seal lips. Using Oil Seal Guide (499597000) and Oil Seal Installer (499587100), install oil seal on camshaft support. To complete installation, install rocker cover, timing belt, camshaft sprockets and related parts. Perform necessary adjustments.

## OIL PAN

### Removal & Installation

Drain oil. Remove oil pan bolts. Remove oil pan and gasket. To install, reverse removal procedure using NEW gasket. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

## WATER PUMP

### Removal

1) Disconnect negative battery cable. Drain engine coolant.

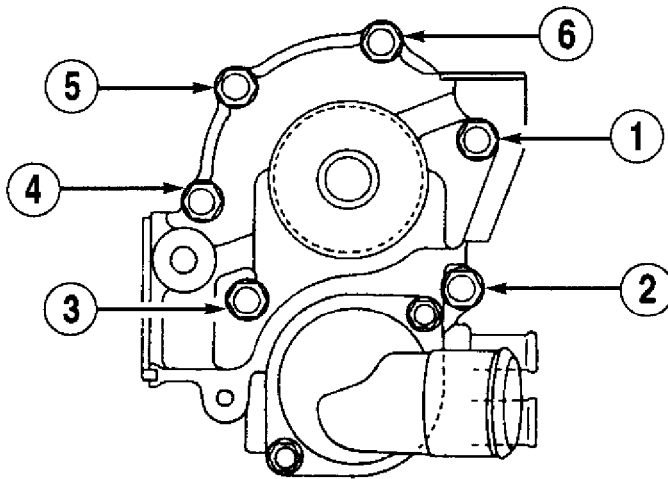
Disconnect radiator hose from water pump. Remove electric cooling fan.

2) Remove all accessory drive belts. Remove timing belt. See TIMING BELT. Remove belt tension adjuster and camshaft position sensor. Using Camshaft Sprocket Wrench (499207100), remove left-side camshaft pulley.

3) Remove left-side rear timing belt cover. Remove tensioner bracket. Disconnect heater hose from water pump. Remove water pump.

#### Installation

To install, reverse removal procedure using a NEW gasket. Tighten bolts to specification in sequence. See Fig. 11. See TORQUE SPECIFICATIONS.



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Fig. 11: Water Pump Bolt Tightening Sequence  
Courtesy of Subaru of America, Inc.

## OVERHAUL

### CYLINDER HEAD

#### Valve Springs

Measure free length of valve springs. Check spring tension at specified height. Replace springs if free length or tension is not within specification. Check valve spring for squareness. See VALVES & VALVE SPRINGS under ENGINE SPECIFICATIONS.

#### Valve Stem Oil Seals

With valves removed, remove oil seals from cylinder head. Intake valve stem seal is Black with White or Silver spring. Exhaust valve stem seal is Brown with White or Silver spring. Coat seals with oil. Using Valve Stem Oil Seal Guide (498857100), install valve stem oil seal.

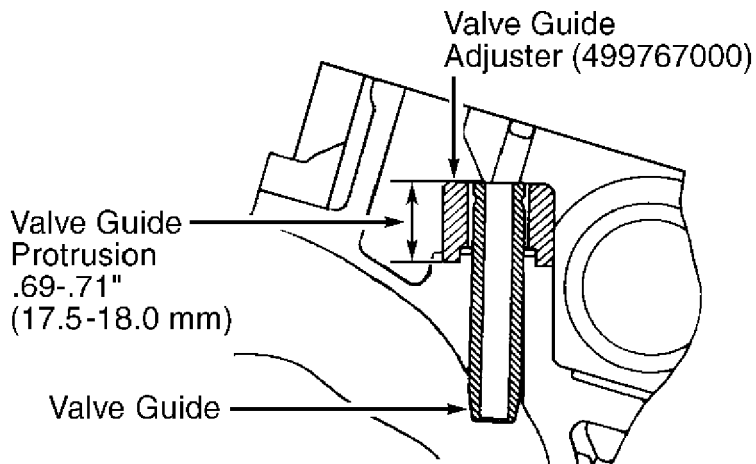
### Valve Guides

1) Check clearance between valve guide and stem. Clearance is checked by measuring outside diameter of valve stem and inside diameter of valve guide using an outside and inside micrometer.

2) If clearance is not within specification, replace valve guide. See CYLINDER HEAD under ENGINE SPECIFICATIONS. To replace valve guide, position cylinder head with combustion chamber facing upward. Insert Valve Guide Remover (499767200) into valve guide and press down to remove valve guide.

3) Invert cylinder head and place Valve Guide Adjuster (499767000) in position shown. See Fig. 12. Coat new valve guide with engine oil. Insert Valve Guide Remover (499767200) into valve guide. Press in until valve guide upper end is flush with upper surface of valve guide adjuster.

4) Check valve guide protrusion. Valve guide protrusion should be .69-.71" (17.5-18.0 mm). Ream inside of valve guide using Valve Guide Reamer (499767400). Ensure all chips and metal particles are cleaned from valve guide. Recheck contact between valve and valve seat after replacing valve guide.



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Fig. 12: Positioning Valve Guide Adjuster On Cylinder Head  
Courtesy of Subaru of America, Inc.

### Valve Seat

Inspect intake and exhaust valve seats. Correct contact surfaces with valve seat cutter if surfaces are defective or when valve guides are replaced. See CYLINDER HEAD under ENGINE SPECIFICATIONS.

### Valves

Measure valve stem diameter and valve margin. Replace valves if they are not within specification. See VALVES & VALVE SPRINGS under ENGINE SPECIFICATIONS. Recheck valve margin after grinding valves.

## VALVE TRAIN

### Rocker Arm Shaft Assembly

Check oil clearance between valve rocker arm and shaft. Clearance should be .0008-.0021" (.020-.054 mm) with a limit of .004" (.10 mm). Replace valve rocker or shaft if clearance is not as specified.

### Lash Adjuster Bleeding

1) Dip valve lash adjuster in engine oil. Push check ball in using .08" (2 mm) diameter rod. With check ball pushed in, manually move plunger up and down at one-second intervals until air bubbles disappear.

2) After air bubbles disappear, remove bar and quickly push plunger in to ensure it is locked. If plunger does not lock properly, replace valve lash adjuster. Always leave valve lash adjuster submerged in engine oil until it is ready for installation.

## CYLINDER BLOCK ASSEMBLY

### Cylinder Block Disassembly

1) Remove piston pin service hole cover and plugs. Rotate crankshaft until No. 1 and 2 pistons are at BDC. Remove piston pin circlips from No. 1 and 2 pistons through service hole.

2) Using Piston Pin Remover (499097500), remove piston pins. Rotate crankshaft until No. 3 and 4 pistons are at BDC. Remove circlips and piston pins.

3) Set up cylinder block so cylinders No. 1 and 3 are on upper side. Remove cylinder block connecting bolts. Separate left and right cylinder blocks. DO NOT allow connecting rods to fall and damage block.

4) Remove rear oil seal. Remove crankshaft together with connecting rods. Remove crankshaft bearings from cylinder block using hammer handle. Ensure bearings are marked for proper location.

5) Drive out each piston from cylinder block. Note piston position and location. Remove connecting rod caps. Remove connecting rod bearings. Note connecting rod cap and bearing locations.

6) Remove piston rings and oil ring. Mark rings for proper order/location. Remove remaining circlip from piston.

### Piston & Rod Assembly

1) Inspect pistons and pins for cracks or damage. Measure piston diameter at a 90-degree angle to piston pin, 1.575" (40.00 mm) from top of piston. See PISTONS, PINS & RINGS under ENGINE SPECIFICATIONS. Replace piston if defective.

2) Ensure piston-to-cylinder clearance is within specification. Ensure ring gap and side clearance are within specifications. Ensure piston pin can be inserted in piston with thumb

pressure at 68°F (20°C). See PISTONS, PINS & RINGS under ENGINE SPECIFICATIONS.

3) Inspect connecting rod thrust surfaces at both ends. Replace connecting rod if large or small end thrust surface is damaged. Measure connecting rod bend and twist. Replace connecting rod if bend or twist exceeds specification. See CONNECTING RODS under ENGINE SPECIFICATIONS.

4) Inspect connecting rod small end bushing. Measure piston pin-to-rod clearance. Replace connecting rod bushing if clearance exceeds specification. See PISTONS, PINS & RINGS under ENGINE SPECIFICATIONS.

5) Install connecting rod with bearing onto crankshaft. Measure side clearance. Replace connecting rod if clearance exceeds specification. See CONNECTING RODS under ENGINE SPECIFICATIONS.

6) Measure connecting rod bearing oil clearance using Plastigage. Replace bearing if oil clearance exceeds specification. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS under ENGINE SPECIFICATIONS.

#### Crankshaft & Main Bearings

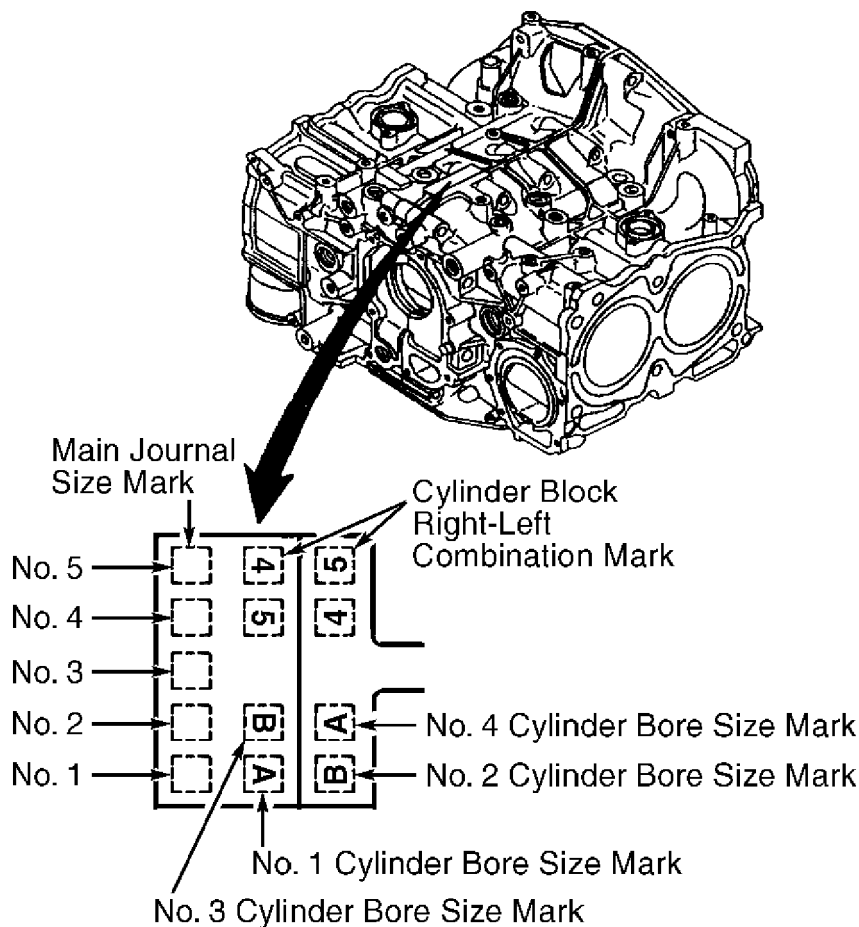
1) Inspect crankshaft for cracks. Measure crankshaft runout at center journal. Measure out-of-round and taper at each journal. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS under ENGINE SPECIFICATIONS. Grind crankshaft and replace bearing if out-of-round or taper exceeds specification.

2) Install main bearings in cylinder block. Install crankshaft in left side of cylinder block. Using feeler gauge, measure crankshaft end play at center journal. Replace center bearing if end play exceeds specified service limit.

3) Install right side cylinder block. Measure oil clearance at each bearing using Plastigage. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS under ENGINE SPECIFICATIONS. Grind crankshaft and replace bearing if oil clearance exceeds service limit.

#### Cylinder Block

Inspect cylinder block for cracks or damage. Measure warpage at deck surface. Surface cylinder block if warpage exceeds .002" (.05 mm). Cylinder bore size marks are stamped on front upper surface of block. See Fig. 13. Measure cylinder bore diameter 0.39" (10.0 mm), 1.77" (45.0 mm), 3.15" (80.0 mm) and 4.53" (115.0 mm) from deck surface. See CYLINDER BLOCK under ENGINE SPECIFICATIONS. Rebore cylinder if diameter, taper or out-of-round exceeds service limit.



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**Fig. 13: Identifying Cylinder Bore Size Marks**  
 Courtesy of Subaru of America, Inc.

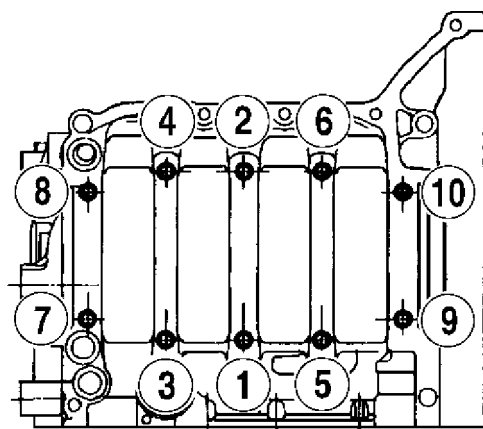
#### Crankshaft & Connecting Rod Installation

1) Lubricate and install bearings in connecting rod and connecting rod caps. Install connecting rod in proper crankshaft journal location, with identification mark toward front of crankshaft and matching numbers aligned.

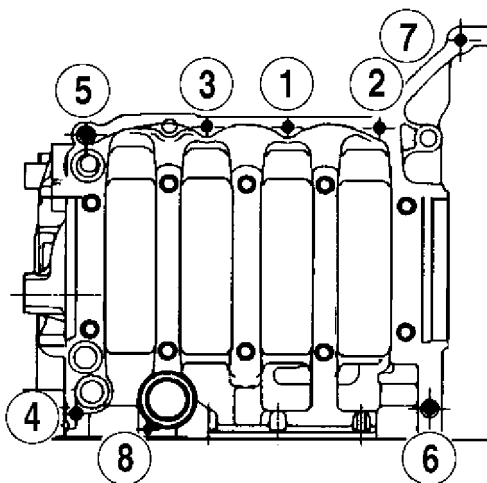
2) Use NEW connecting rod nuts. Apply oil to connecting rod bolt threads and tighten nuts to specification. See TORQUE SPECIFICATIONS. Lubricate and install main bearings in cylinder block. Install crankshaft in left side of cylinder block.

3) Apply Three Bond 1215 or equivalent to cylinder block mating surface. Install right side of cylinder block. Tighten 10 mm bolts in sequence to specification. Tighten 6 mm and 8 mm bolts in sequence to specification. See Fig. 14. See TORQUE SPECIFICATIONS.

4) Install rear oil seal using Oil Seal Guide (499597100) and Oil Seal Installer (499587200).



10-mm BOLTS



6-mm & 8-mm BOLTS

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**Fig. 14: Cylinder Block Bolt Tightening Sequence**  
 Courtesy of Subaru of America, Inc.

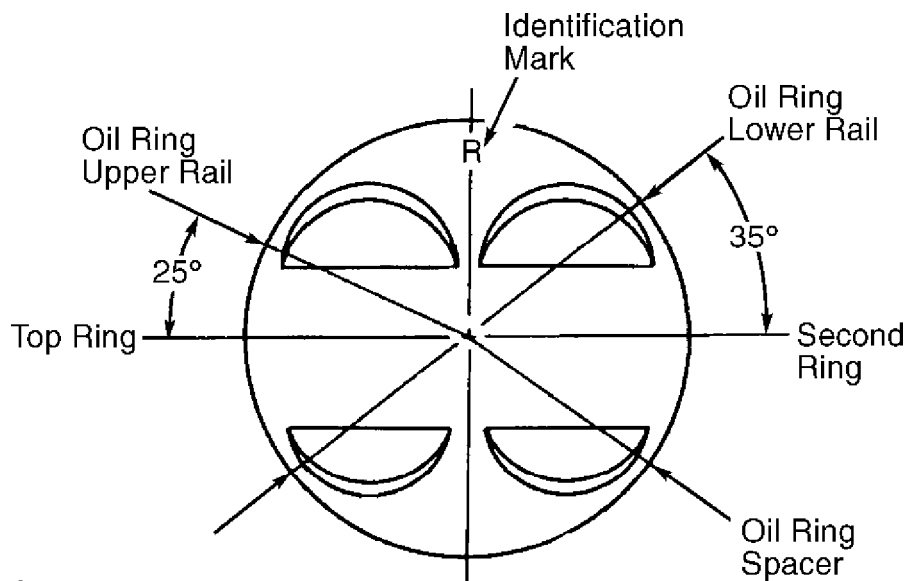
**Piston & Piston Pin Installation**

1) Install rings on piston with "R" mark toward top of piston. Properly space ring end gaps on piston. See Fig. 15. Ensure ring gaps are not in piston skirt area. Install one circlip in piston.

2) Rotate crankshaft so that connecting rods for pistons to be installed are at BDC. Lubricate piston, rings and cylinder bore with engine oil. Ensure identification mark on piston faces front of engine. Install piston into cylinder bore.

3) Coat Piston Pin Guide (499017100) with engine oil. Insert guide into service hole to align piston pin hole with connecting rod small end. Coat piston pin with engine oil. Insert piston pin into piston and connecting rod through service hole. Install remaining circlip. Install service hole plug and NEW gasket.





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**Fig. 15: Positioning Piston Ring Gaps**  
 Courtesy of Subaru of America, Inc.

## ENGINE OILING

### ENGINE LUBRICATION SYSTEM

Oil pressure is provided by a trochoid-type pump driven by timing belt. Pressure relief valve is located in oil pump body.

#### Crankcase Capacity

Crankcase capacity is 5.0 qts. (4.7L) with filter replacement.

#### Oil Pressure

With engine at normal operating temperature, pressure should be at least 14 psi (1.0 kg/cm<sup>2</sup>) at 600 RPM and at least 43 psi (3.0 kg/cm<sup>2</sup>) at 5000 RPM.

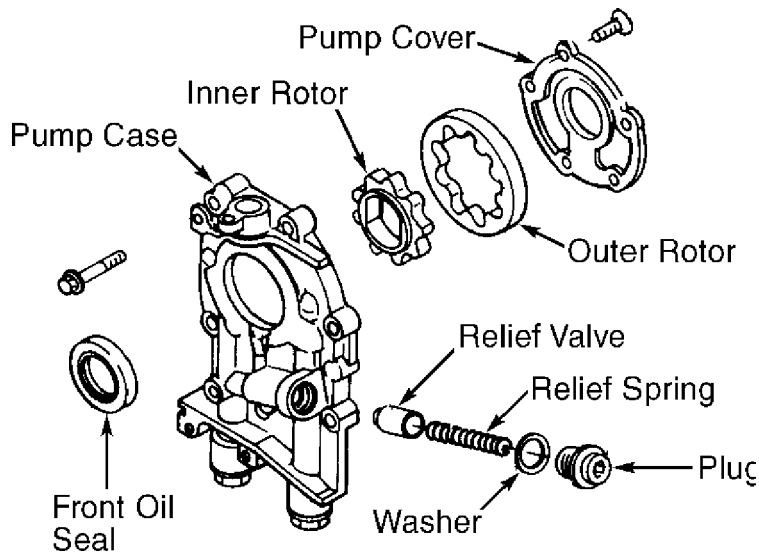
### OIL PUMP

#### Removal

Disconnect negative battery cable. Drain engine oil. Remove timing belt covers and timing belt. See TIMING BELT under REMOVAL & INSTALLATION. Remove belt tensioner bracket. Remove left camshaft sprocket. Remove water pump. Remove oil pump assembly and gasket.

#### Disassembly & Inspection

1) Disassemble pump. See Fig. 16. Measure tip clearance of rotors. See OIL PUMP SPECIFICATIONS. If clearance is not as specified, replace rotors as a matched set.



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**Fig. 16: Identifying Oil Pump Components**  
 Courtesy of Subaru of America, Inc.

**OIL PUMP SPECIFICATIONS**

Application In. (mm)

<b>Inner Rotor-To-Pump Cover Side</b>	
Clearance .....	.0008-.0028 (.020-.070)
<b>Inner Rotor Tip-To-Outer Rotor</b>	
Clearance .....	(1) .0016-.0055 (.040-.140)
Outer Rotor-To-Case Clearance .....	(2) .004-.007 (.10-.18)
<b>Relief Valve Spring (3)</b>	
Free Length .....	2.83 (71.8)
Installed Length .....	2.15 (54.7)

- (1) - Service limit is .007" (.18 mm).
- (2) - Service limit is .008" (.20 mm).
- (3) - Relief valve spring installed load is 17.33 lbs. (7.86 kg)

2) Measure clearance between outer rotor and oil pump cylinder block rotor housing. If case clearance is not as specified, replace rotor. See OIL PUMP SPECIFICATIONS.

3) Using a straightedge and feeler gauge, measure side clearance between oil pump inner rotor and pump cover. If clearance is not as specified, replace rotor or pump body.

4) Check oil relief valve and relief spring for wear and damage. Check oil pump case for worn shaft hole, clogged oil passage,

worn rotor chamber and cracks. Check oil seal lips for deformation, hardening and wear. Replace components as necessary.

**Reassembly & Installation**

Install front oil seal using Oil Seal Installer (499587100). Install inner and outer rotors, oil relief valve, relief spring and oil pump cover. See Fig. 16. To complete installation, reverse removal procedure. Replace "O" ring.

**TORQUE SPECIFICATIONS**

**TORQUE SPECIFICATIONS**

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Application	Ft. Lbs. (N.m)
Camshaft Sprocket Bolt .....	54-61 (73-83)
Camshaft Support Bolt .....	12 (16)
Connecting Rod Cap Nut .....	31-34 (42-46)
Crankshaft Pulley Bolt .....	86-101 (117-137)
Cylinder Block Bolt	
6 mm Bolt .....	(1)
8 mm Bolt .....	17-20 (23-27)
10 mm Bolt .....	33-37 (44-50)
Cylinder Block Service Hole Plug .....	46-56 (62-76)
Cylinder Head Bolt	
Step 1 .....	(2) 21 (29)
Step 2 .....	(2) 51 (69)
Step 3 .....	(2) Loosen 180 Degrees
Step 4 .....	(2) Loosen 180 Degrees
Step 5 .....	(3)
Step 6 .....	(2) Tighten 80-90 Degrees
Step 7 .....	(2) Tighten 80-90 Degrees
Drive Plate Reinforcement Bolt .....	51-55 (69-75)
Flywheel Bolt .....	51-55 (69-75)
Timing Belt Idler Bolt .....	26-32 (35-43)
Timing Belt Tension Adjuster Bolt .....	17-20 (23-27)
Timing Belt Tensioner Bracket Bolt .....	17-20 (23-27)
Water Pump Bolt .....	7-10 (10.0-14.0)

**INCH Lbs. (N.m)**

Cylinder Block Service Hole Cover .....	57 (6.4)
Oil Pan Bolt .....	44 (5.0)
Oil Pump Bolt .....	57 (6.4)
Rocker Shaft Support Bolt	
Long .....	108 (12.2)
Short .....	44 (5.0)

Timing Belt Cover Bolt ..... 44 (5.0)  
 Valve Cover Bolt ..... 44 (5.0)

- (1) - Tighten bolts to 57 INCH lbs.(6.4 N.m)
- (2) - Tighten or loosen bolts in sequence. See Fig. 2.
- (3) - Tighten bolts No. 1 and 2 to 25 ft. lbs. (34 N.m), and  
 tighten bolts No. 3, 4, 5 and 6 to 11 ft. lbs. (15 N.m). See  
 Fig. 2.

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**ENGINE SPECIFICATIONS**

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

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Application Specification

1.8L  
 Displacement ..... 111 Cu. In. (1.8L)  
 Bore ..... 3.46" (87.8 mm)  
 Stroke ..... 2.95" (75.0 mm)  
 Compression Ratio ..... 9.7:1  
 Compression Pressure (1)  
   Standard ..... 156-185 psi (11-13 kg/cm<sup>2</sup>)  
   Service Limit ..... 128 psi (9 kg/cm<sup>2</sup>)  
   Maximum Variation ..... 28 psi (2 kg/cm<sup>2</sup>)  
 Fuel System ..... SFI  
 Horsepower @ RPM ..... 110 @ 5600  
 Torque Ft. Lbs. @ RPM ..... 110 @ 4400

2.2L  
 Displacement ..... 135 Cu. In. (2.2L)  
 Bore ..... 3.82" (97.0 mm)  
 Stroke ..... 2.95" (75.0 mm)  
 Compression Ratio ..... 9.7:1  
 Fuel System ..... SFI  
 Horsepower @ RPM ..... 137 @ 5400  
 Torque Ft. Lbs. @ RPM ..... 145 @ 4000

- (1) - Checked at 200-300 RPM or higher.
- AA

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

AA

Application In. (mm)

Crankshaft

End Play

Standard .....	.0012-.0045 (.030-.115)
Service Limit .....	.0098 (.250)
Runout .....	.0014 (.035)

Main Bearings

Journal Diameter

Standard .....	2.3619-2.3625 (59.992-60.008)
0.0012" (0.03 mm) Undersize	
Journals No. 1 & 5 .....	2.3607-2.3613 (59.962-59.978)
Journals No. 2, 3 & 4 .....	2.3604-2.3610 (59.954-59.970)
0.0020" (0.05 mm) Undersize	
All Journals .....	2.3596-2.3602 (59.934-59.950)
0.0098" (0.25 mm) Undersize	
Journals No. 1 & 5 .....	2.3520-2.3527 (59.742-59.758)
Journals No. 2, 3 & 4 .....	2.3517-2.3524 (59.734-59.750)

Journal Out-Of-Round .....	.0012 (.030)
Journal Taper .....	.0028 (.070)
Journal Grinding Limit .....	.0098 (.250)

Oil Clearance

Standard

Journals No. 1 & 5 .....	.0001-.0012 (.003-.030)
Journals No. 2, 3 & 4 .....	.0004-.0013 (.010-.033)

Service Limit

Journals No. 1, 3 & 5 .....	.0016 (.040)
Journals No. 2 & 4 .....	.0014 (.035)

Connecting Rod Bearings

Journal Diameter

Standard .....	2.0466-2.0472 (51.984-52.000)
0.0012" (0.03 mm) Undersize .....	2.0454-2.0461 (51.954-51.970)
0.0020" (0.05 mm) Undersize .....	2.0446-2.0453 (51.934-51.950)
0.0098" (0.25 mm) Undersize .....	2.0368-2.0374 (51.734-51.750)

Journal Out-Of-Round .....	.0012 (.030)
Journal Taper .....	.0028 (.070)
Journal Grinding Limit .....	.0098 (.250)

Oil Clearance

Standard .....	.00060-.00180 (.0152-.0457)
Service Limit .....	.002 (.05)

AA

CONNECTING RODS

CONNECTING RODS

AA

Application In. (mm)

Bore Diameter

Crankpin Bore	.....	2.1050-2.1060	(53.476-53.501)
Piston Pin Bore	.....	.9062-.9064	(23.017-23.023)
Maximum Bend	.....		(1)
Maximum Twist	.....		(1)
Side Play			
Standard	.....	.0028-.0130	(.070-.330)
Service Limit	.....	.016	(.40)

(1) - Maximum bend or twist per 3.94" (100 mm) is .004" (.100 mm).  
 AA

PISTONS, PINS & RINGS

PISTONS, PINS & RINGS

AAA  
 Application In. (mm)

Pistons

Clearance ..... .0004-.0012 (.010-.030)

1.8L

Diameter

Standard

"A" ..... 3.4600-3.4604 (87.885-87.895)

"B" ..... 3.4596-3.4600 (87.875-87.885)

2.2L

Diameter

Standard

"A" ..... 3.8144-3.8148 (96.885-96.895)

"B" ..... 3.8140-3.8144 (96.875-96.885)

Pins

Diameter ..... .9053-.9055 (22.994-23.000)

Piston Fit ..... (1)

Piston-To-Pin Clearance ..... .0002-.0004 (.005-.010)

Pin-To-Rod Clearance ..... 0-.0009 (0-.022)

Rings

No. 1

End Gap

Standard ..... .0079-.0138 (.200-.350)

Service Limit ..... .039 (1.0)

Side Clearance

Standard ..... .0016-.0031 (.041-.080)

Service Limit ..... .0059 (.150)

No. 2

End Gap

Standard ..... .0079-.0197 (.200-.500)

Service Limit ..... .039 (1.0)

Side Clearance

Standard ..... .0012-.0028 (.030-.070)

Service Limit ..... .0059 (.150)  
 No. 3 (Oil)  
 End Gap  
 Standard ..... .008-.028 (.20-.70)  
 Service Limit ..... .059 (1.50)

(1) - Thumb press fit at 68°F (20°C).

AA

CYLINDER BLOCK

CYLINDER BLOCK

AA

Application In. (mm)

Cylinder Bore

1.8L

Standard Diameter

"A" ..... 3.4608-3.4612 (87.905-87.915)  
 "B" ..... 3.4604-3.4608 (87.895-87.905)

2.2L

Standard Diameter

"A" ..... 3.8151-3.8155 (96.905-96.915)  
 "B" ..... 3.8148-3.8151 (96.895-96.905)

Maximum Taper ..... .002 (.05)  
 Maximum Deck Warpage ..... .002 (.05)  
 Maximum Boring Limit ..... .020 (.50)  
 Maximum Surface Grinding Limit ..... .004 (.10)

Out-Of-Round

Standard ..... .0004 (.010)  
 Service Limit ..... .0020 (.050)

AA

VALVES & VALVE SPRINGS

VALVES & VALVE SPRINGS

AA

Application Specification

Intake Valves

Face Angle ..... 45°  
 Head Diameter ..... (1)  
 Margin  
 Standard ..... .039" (1.00 mm)  
 Service Limit ..... .031" (0.80 mm)  
 Stem Diameter  
 Standard ..... .2343-.2348" (5.950-5.965 mm)

Exhaust Valves

Face Angle ..... 45ø  
 Head Diameter ..... (1)  
 Margin  
     Standard ..... .047" (1.20 mm)  
     Service Limit ..... .031" (0.80 mm)  
 Stem Diameter  
     Standard ..... .2341-.2346" (5.945-5.960 mm)  
 Valve Springs  
     1995-96  
         1.8L  
             Free Length ..... 1.8173" (46.160 mm)  
             Out-Of-Square ..... .079" (2.00 mm)  
         2.2L  
             Free Length ..... 1.7342" (44.050 mm)  
             Out-Of-Square ..... .075" (1.90 mm)  
     1997-98  
         1.8L & 2.2L  
             Free Length ..... 1.7342" (44.050 mm)  
             Out-Of-Square ..... .075" (1.90 mm)  
 Pressure (2)  
     1995-96  
         1.8  
             Valve Closed ..... 42.8-49.4 @ 1.457 (19.4-22.4 @ 37.00)  
             Valve Open ..... 90.2-103.9 @ 1.150 (40.9-47.1 @ 29.20)  
         2.2 (1995-96)  
             Valve Closed ..... 39.2-45.0 @ 1.417 (17.8-20.4 @ 36.00)  
             Valve Open ..... 91.1-103.0 @ 1.110 (41.3-46.7 @ 28.20)  
     1997-98  
         1.8L & 2.2  
             Valve Closed ..... 39.2-45.0 @ 1.417 (17.8-20.4 @ 36.00)  
             Valve Open ..... 91.1-103.0 @ 1.110 (41.3-46.7 @ 28.20)

(1) - Information is not available from manufacturer.

(2) - Specification is Lbs. @ In. (kg @ mm).

AA

CYLINDER HEAD

CYLINDER HEAD

AA

Application Specification

Cylinder Head

Height ..... 3.870" (98.30 mm)

Maximum Warpage ..... (1) .002" (.05 mm)

Valve Seats

Intake Valve

Seat Angle ..... 45ø



Seat Width		
Standard	.....	.028" (.70 mm)
Service Limit	.....	.055" (1.40 mm)
Exhaust Valve		
Seat Angle	.....	45°
Seat Width		
Standard	.....	.055" (1.40 mm)
Service Limit	.....	.071" (1.80 mm)
Valve Guides		
Intake Valve		
Valve Guide I.D.	.....	.2362-.2367" (6.000-6.012 mm)
Valve Guide Installed Height	.....	.690-.710" (17.50-18.00 mm)
Valve Stem-To-Guide Oil Clearance		
Standard	.....	.0014-.0024" (.035-.062 mm)
Service Limit	.....	.006" (.15 mm)
Exhaust Valve		
Valve Guide I.D.	.....	.2362-.2367" (6.000-6.012 mm)
Valve Guide Installed Height	.....	.690-.710" (17.50-18.00 mm)
Valve Stem-To-Guide Oil Clearance		
Standard	.....	.0016-.0026" (.040-.067 mm)
Service Limit	.....	.006" (.15 mm)

(1) - Maximum resurface limit is .004" (0.10 mm) on 1995-97 models and .012" (0.30 mm) on 1998 models.

AA

CAMSHAFT

CAMSHAFT

AA

Application In. (mm)

End Play

Standard	.....	.0012-.0102 (.030-.260)
Service Limit	.....	.0138 (.350)

Journal Runout (Bend) ..... .0010 (.025)

Oil Clearance

Standard	.....	.0022-.0035 (.055-.090)
Service Limit	.....	.0039 (.100)

Lobe Height

1995-96

1.8L

Standard	.....	1.2742-1.2781 (32.364-32.464)
Service Limit	.....	1.2683 (32.214)

2.2L

Intake

Standard	.....	1.2596-1.2635 (31.994-32.094)
Service Limit	.....	1.2537 (31.844)

Exhaust

Standard ..... 1.2844-1.2883 (32.624-32.724)

Service Limit ..... 1.2785 (32.474)

1997-98

1.8L & 2.2L

Intake

Standard ..... 1.2694-1.2734 (32.244-32.344)

Service Limit ..... 1.2635 (32.094)

Exhaust

Standard ..... 1.2584-1.2624 (31.964-32.064)

Service Limit ..... 1.2525 (31.814)

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