

## 3.3L 6-CYL - VIN [3]

1992 Subaru SVX

1992 SUBARU ENGINES  
3.3L 6-Cylinder

SVX

### \* PLEASE READ THIS FIRST \*

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

### ENGINE IDENTIFICATION

Engine can be identified by sixth character of Vehicle Identification Number (VIN). The VIN is stamped on a metal plate, located on front right side of engine compartment. Engine serial number is stamped on a machined pad on right rear of cylinder block.

#### ENGINE IDENTIFICATION CODES TABLE

Application	VIN Code
SVX 3.3L 6-Cylinder AWD .....	3

### ADJUSTMENTS

#### VALVE CLEARANCE ADJUSTMENT

Adjustment is not required. Hydraulic lifter preload is automatically adjusted.

### REMOVAL & INSTALLATION

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

#### FUEL PRESSURE RELEASE

Disconnect fuel pump wiring connector. Start engine, and operate it until it stalls. Crank engine for about 5 seconds. With ignition off, reconnect fuel pump wiring connector.

### ENGINE

#### Removal & Installation

1) Put vehicle on hoist. Open hood fully. Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable. Remove undercover, and drain cooling system. Remove coolant hoses and radiator.

2) Drain A/C system using approved refrigerant recovery/recycling equipment. Remove air intake system. Disconnect accelerator and cruise control cables. Mark and disconnect vacuum

hoses and electrical connectors.

3) Remove charcoal canister and bracket. Disconnect exhaust pipe at cylinder head and rear exhaust pipe, and remove exhaust pipe. Disconnect power steering and A/T cooler lines. Remove nuts connecting lower side of engine to transmission. Remove engine mount-to-frame nuts.

4) Remove torque converter bolts. Remove pitching stopper. Disconnect fuel lines. Attach engine to engine hoist. Support transmission. Remove upper engine-to-transmission bolts. Remove engine. To install, reverse removal procedure.

## INTAKE MANIFOLD

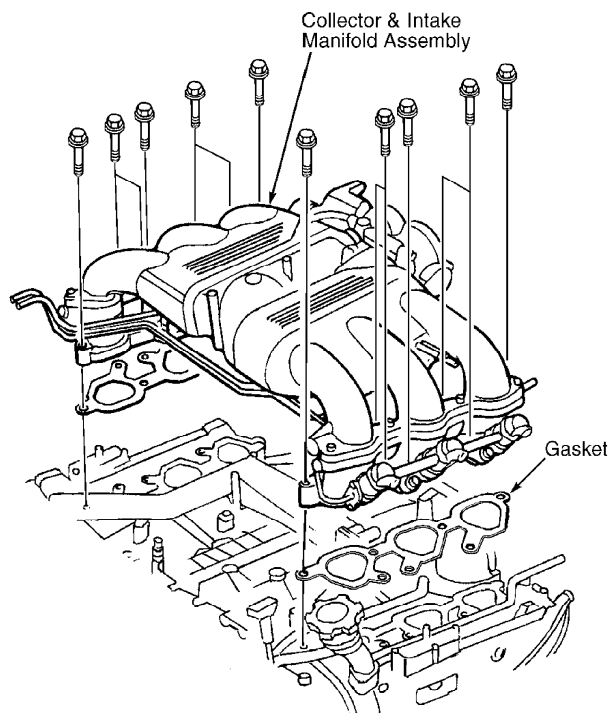
### Removal & Installation

1) Release fuel pressure. See FUEL PRESSURE RELEASE. Disconnect negative battery cable. Remove collector cover. Drain cooling system. Disconnect throttle and cruise control cable from throttle lever.

2) Remove air intake boots. Disconnect electrical connectors and hoses. Remove EGR pipe and cover. Disconnect fuel hoses from fuel pipes. Remove drive belt cover. Remove alternator/power steering drive belts. Remove A/C drive belt.

3) Remove alternator. Remove A/C idler pulley. Remove A/C compressor and bracket forward as a unit. Mark intake manifold components for installation reference. Remove collector and intake manifold. See Fig. 1.

4) To install, reverse removal procedure. Replace all "O" rings. Tighten bolts to specification. See TORQUE SPECIFICATIONS table at end of article.



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Fig. 1: Exploded View Of Intake Manifold & Components  
Courtesy of Subaru of America, Inc.

## EXHAUST MANIFOLD

### Removal & Installation

Disconnect oxygen sensor connector. Remove front undercover. Remove exhaust manifold covers. Disconnect front exhaust pipes. Disconnect EGR pipe from right exhaust manifold. Remove exhaust manifold. To install, reverse removal procedure.

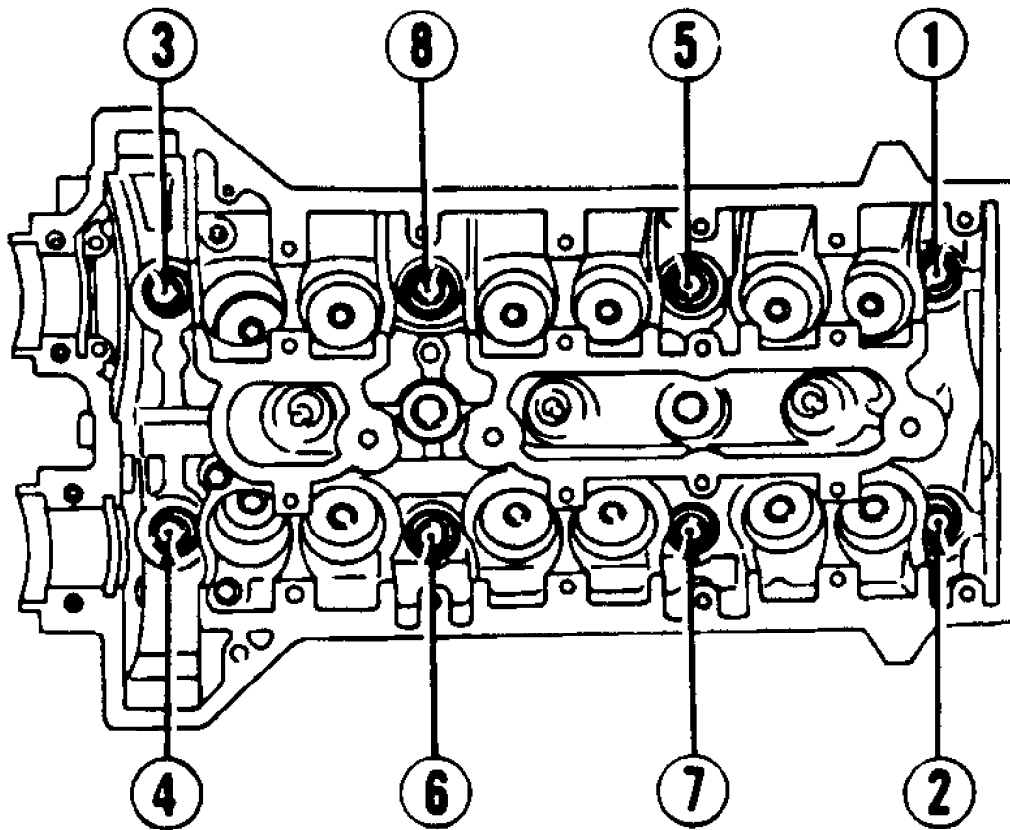
## CYLINDER HEAD

### Removal

1) Remove timing belts. See TIMING BELT. Remove camshafts and components. See CAMSHAFTS. Remove intake manifold and collector. See INTAKE MANIFOLD. See Fig. 1.

**CAUTION:** Loosen cylinder head bolts in 2 steps using proper sequence to prevent cylinder head warpage or cracking. Note bolt length and location.

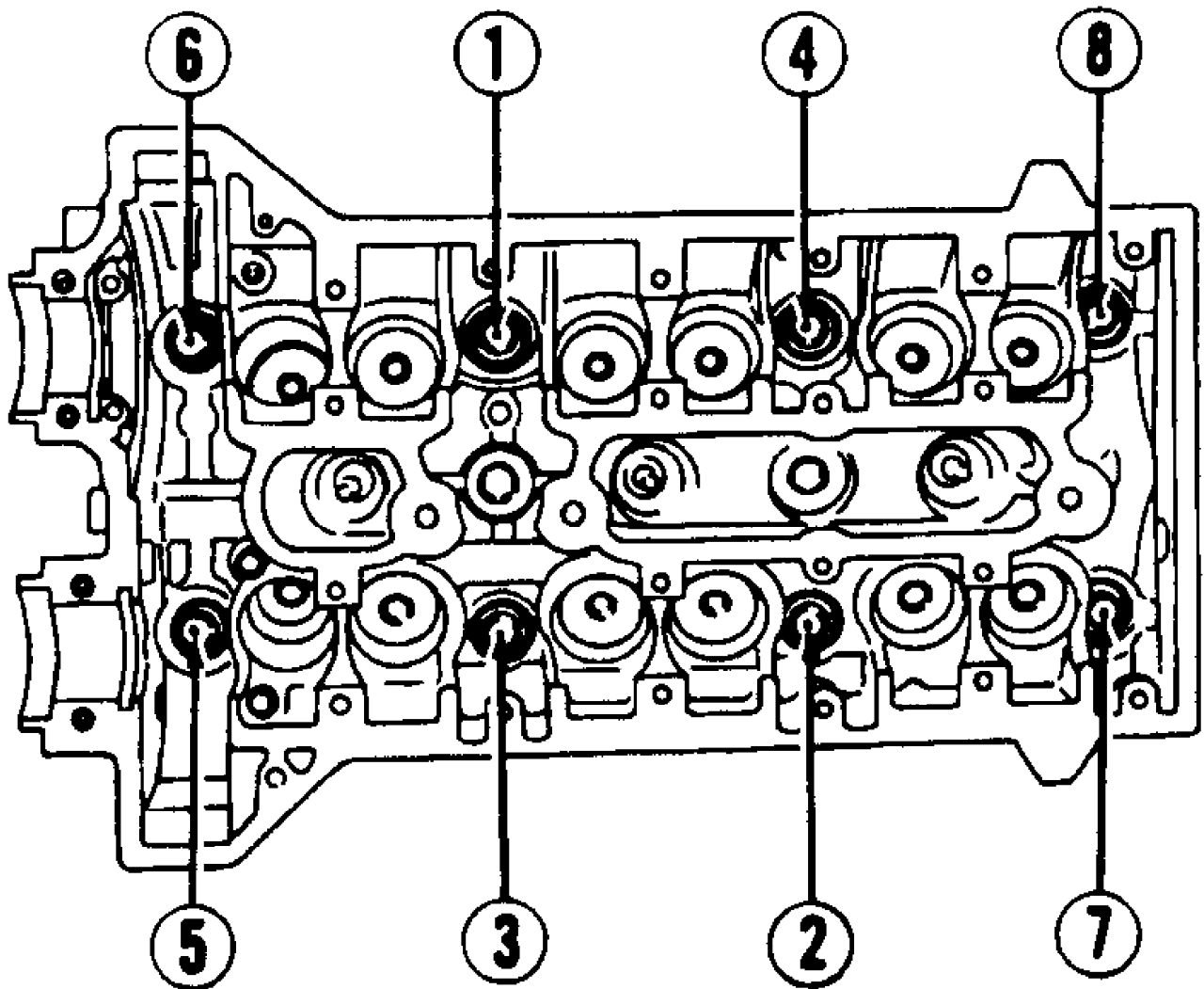
2) Remove oil level gauge guide. Remove heater pipe. Remove cylinder head bolts in proper sequence. See Figs. 2 and 3. To prevent head from falling, leave bolts No. 5 and 8 engaged by 3-4 threads. Break cylinder head loose and remove bolts No. 5 and 8. Remove cylinder head.



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REMOVAL

Fig. 2: Cylinder Head Bolt Removal Sequence (Removal)  
Courtesy of Subaru of America, Inc.



## 93G02224 INSTALLATION

Fig. 3: Cylinder Head Bolt Tightening Sequence (Installation)  
 Courtesy of Subaru of America, Inc.

### Inspection

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

### Installation

1) Ensure mating surfaces are clean and dry. Install head gasket. Coat head bolt threads with oil. Ensure washers are installed on head bolts with chamfered edge against bolt.

**CAUTION:** Ensure washers are installed on bolts with chamfered edge against bolt and proper length bolts are installed in correct locations.

2) Ensure proper length bolts are installed in correct

locations. Tighten bolts to specification using proper sequence and steps. See Figs. 2 and 3. See TORQUE SPECIFICATIONS table at end of article. To install remaining components, reverse removal procedure. Tighten bolts to specification.

## FRONT CRANKSHAFT OIL SEAL

See OIL PUMP under ENGINE OILING.

## TIMING BELT

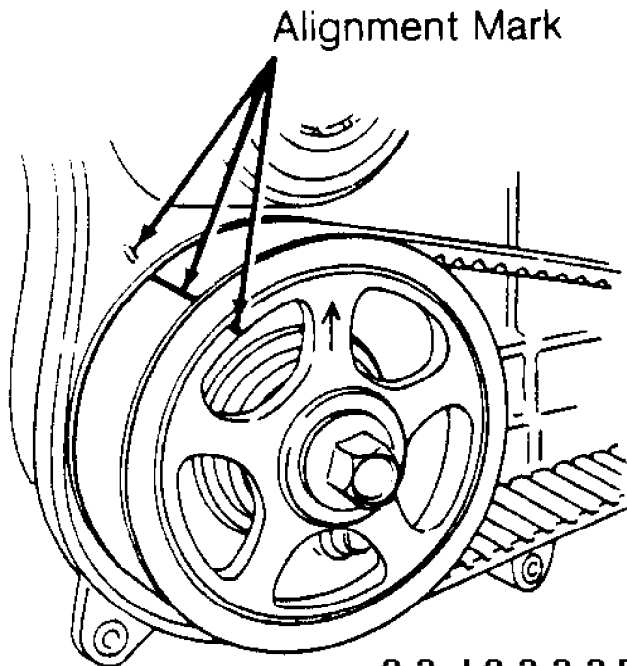
### Removal

1) Disconnect negative battery cable. Remove undercover. Disconnect power steering cooler hoses from body. Disconnect cooling fan connectors. Remove drive belt cover. Remove upper radiator brackets.

2) Remove radiator fan and sub-fan assemblies. Remove charcoal canister and bracket. Remove alternator/power steering drive belts and A/C drive belt. Remove alternator and drive belt cover bracket.

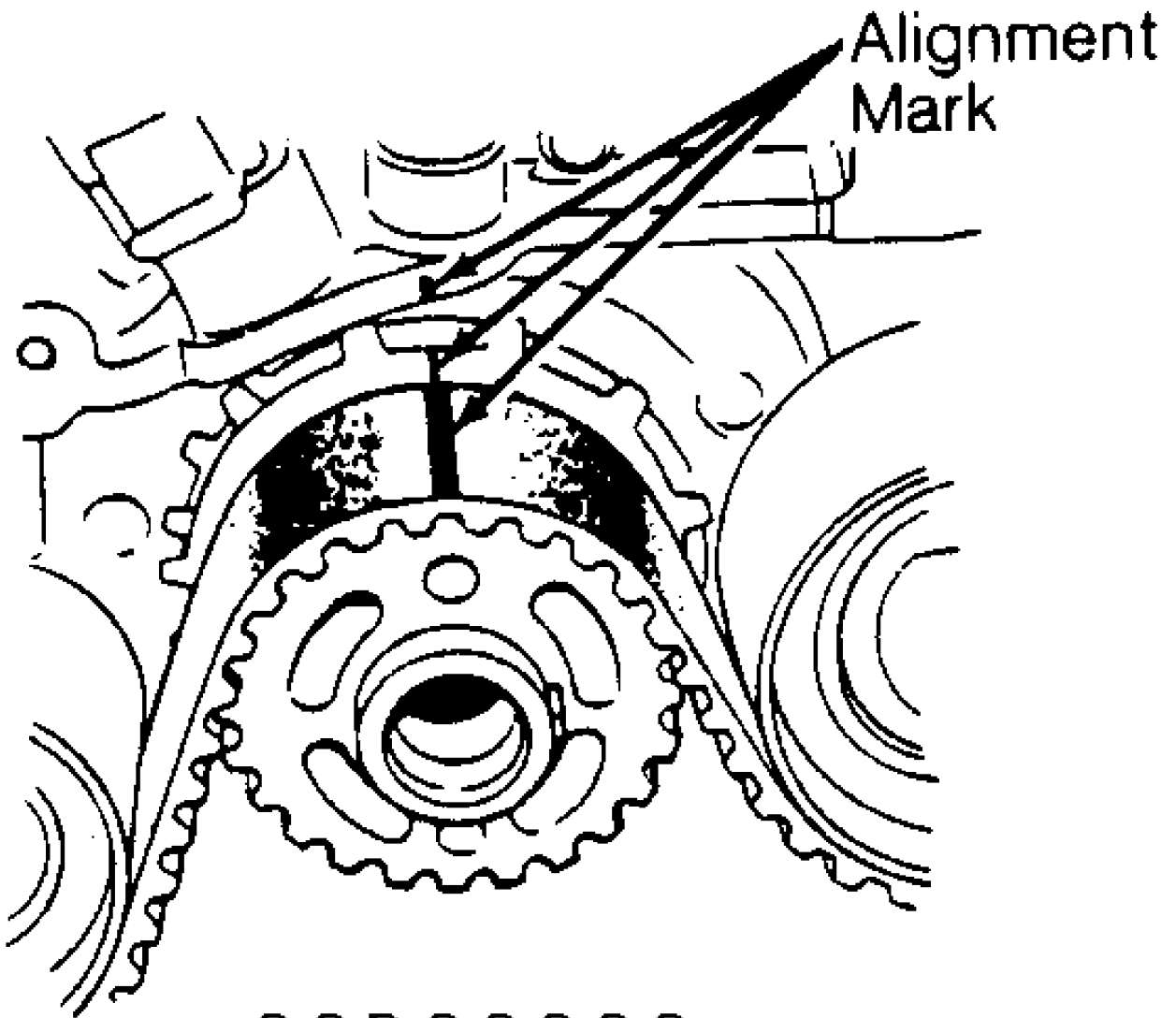
3) Remove A/C idler pulley. Remove power steering pump and bracket. Remove crankshaft pulley and front timing belt covers. To hold crankshaft, use Crankshaft Pulley Wrench (49997-7000). If rotation indicating marks on timing belt have rubbed off, remark timing belt before removing.

4) Turn crankshaft to align marks on crankshaft sprocket and camshaft sprockets with marks on cylinder block and timing belt cover. See Figs. 4-7. Using White paint, put alignment marks and/or arrows on timing belt in relation to sprockets. Loosen tensioner adjuster bolts. Remove timing belt idlers. See Fig. 7. Remove timing belt.



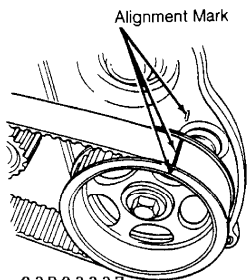
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Fig. 4: Timing Belt Alignment Marks Id (Right Crankshaft Sprocket)  
Courtesy of Subaru of America, Inc



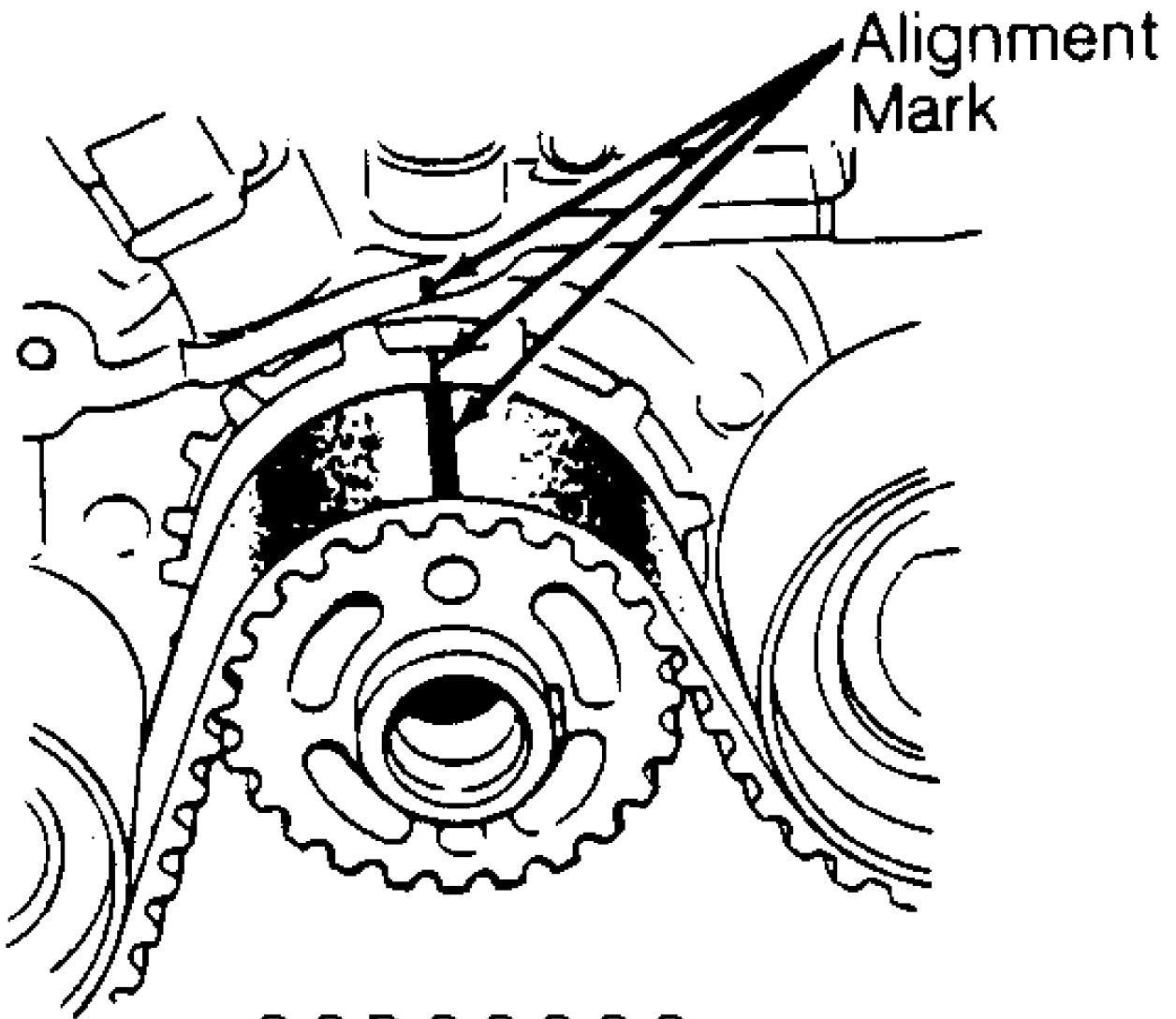
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Fig. 5: Timing Belt Alignment Marks Id (Crankshaft Sprocket)  
Courtesy of Subaru of America, Inc



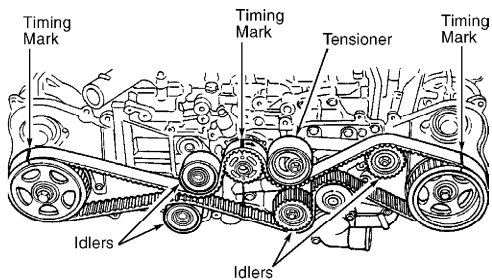
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Fig. 6: Timing Belt Alignment Marks Id (Left Crankshaft Sprocket)  
Courtesy of Subaru of America, Inc



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Fig. 7: Timing Belt Alignment Marks Id (Crankshaft Sprocket)  
 Courtesy of Subaru of America, Inc



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 Fig. 8: View Of Timing Belt 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.

2) Inspect tension adjuster for leaking oil seals and worn rod ends. Slight traces of oil at rod oil seal do not indicate problem. Ensure tension adjuster rod does not move with less than 33-110 lbs. (15-50 kg) of force applied.

3) Replace tension adjuster if rod moves. Measure tension adjuster rods extension beyond adjuster body. Distance should be .606-.646" (15.40-16.40 mm). Replace tension adjuster if distance is not correct. Inspect idler pulleys and tensioners for smooth rotation. Replace components if noise or excessive play is noted.

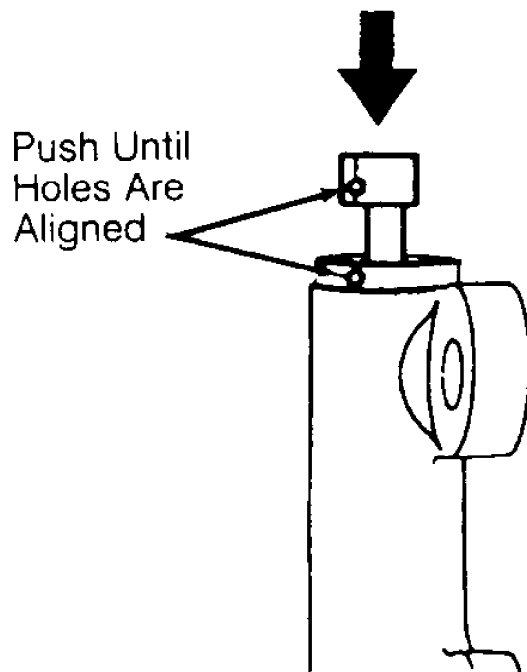
#### Installation

1) If tension adjuster was removed or replaced, use a press to push adjuster rod down far enough to install a stopper pin. See Figs. 9 and 10. Turn sprockets to align timing marks with marks on rear timing belt covers and oil pump. See Figs. 4-7.

2) While aligning marks on timing belt with marks on sprockets, position timing belt properly. Ensure belt rotating direction is correct. Install idler pulleys. Loosen tension adjuster attaching bolts and move adjuster fully left.

CAUTION: Readjust new alternator belt after 5 minutes of operation.

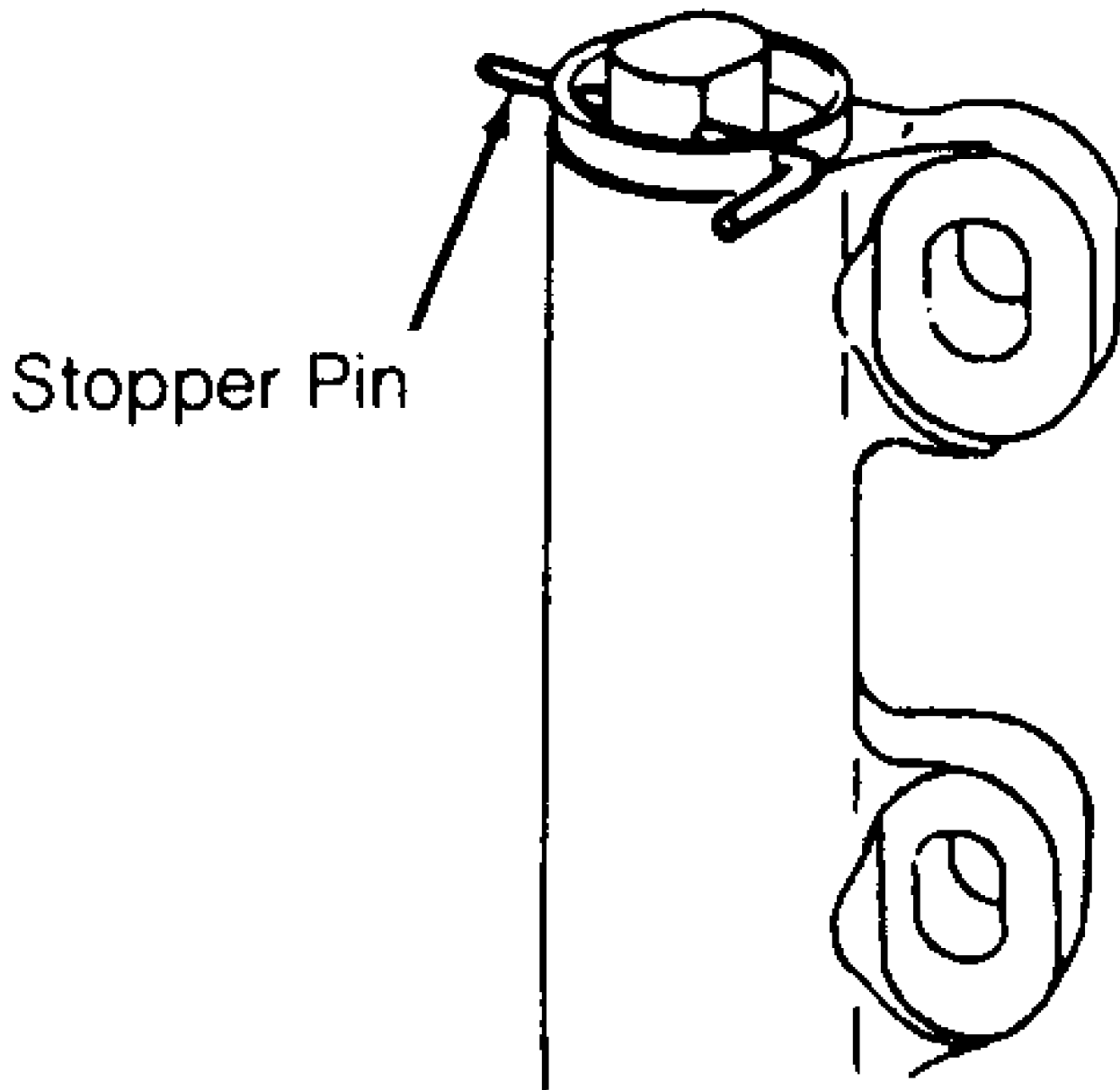
3) Tighten adjuster bolts. Once all timing marks are aligned, remove stopper pin from tension adjuster. Install front timing belt covers. To complete installation, reverse removal procedure. Tighten all nuts and bolts to specifications. See TORQUE SPECIFICATIONS table at end of article.



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Fig. 9: Setting Tension Adjuster  
Courtesy of Subaru of America, Inc.





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Fig. 10: Setting Tension Adjuster  
Courtesy of Subaru of America, Inc.

#### CAMSHAFTS

##### Removal (Left Camshafts)

1) Remove timing belt. See TIMING BELT. Remove camshaft sprockets and related parts. Disconnect cam angle sensor connector. Disconnect ignition coil connectors.

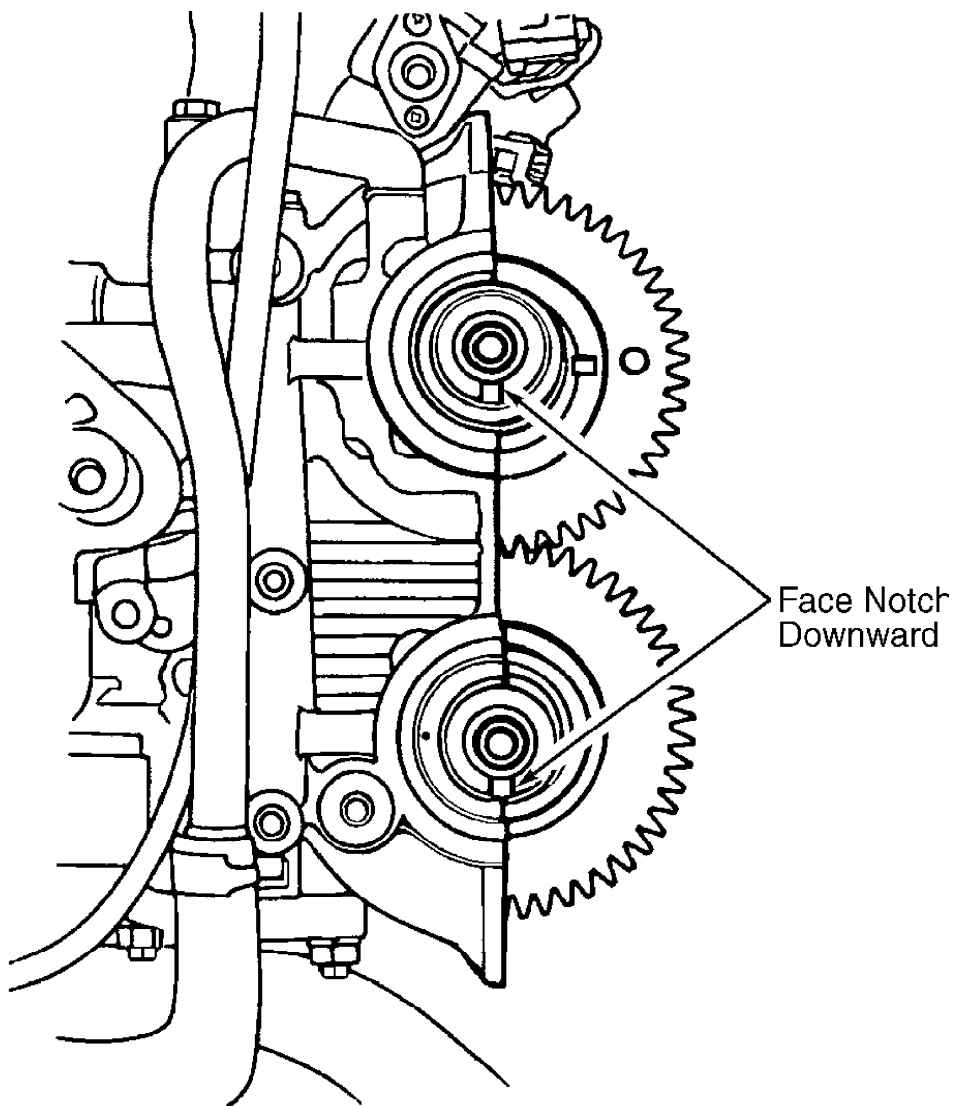
2) Remove cam angle sensor and ignition coils. Disconnect

necessary hoses. Remove valve covers. Remove front camshaft cap. Remove camshaft oil seal and plug.

NOTE: Camshaft thrust clearance is small. Camshaft must be removed by holding it parallel to cylinder head. If camshaft is not parallel to cylinder head, cylinder head thrust bearing portion may be damaged by camshaft.

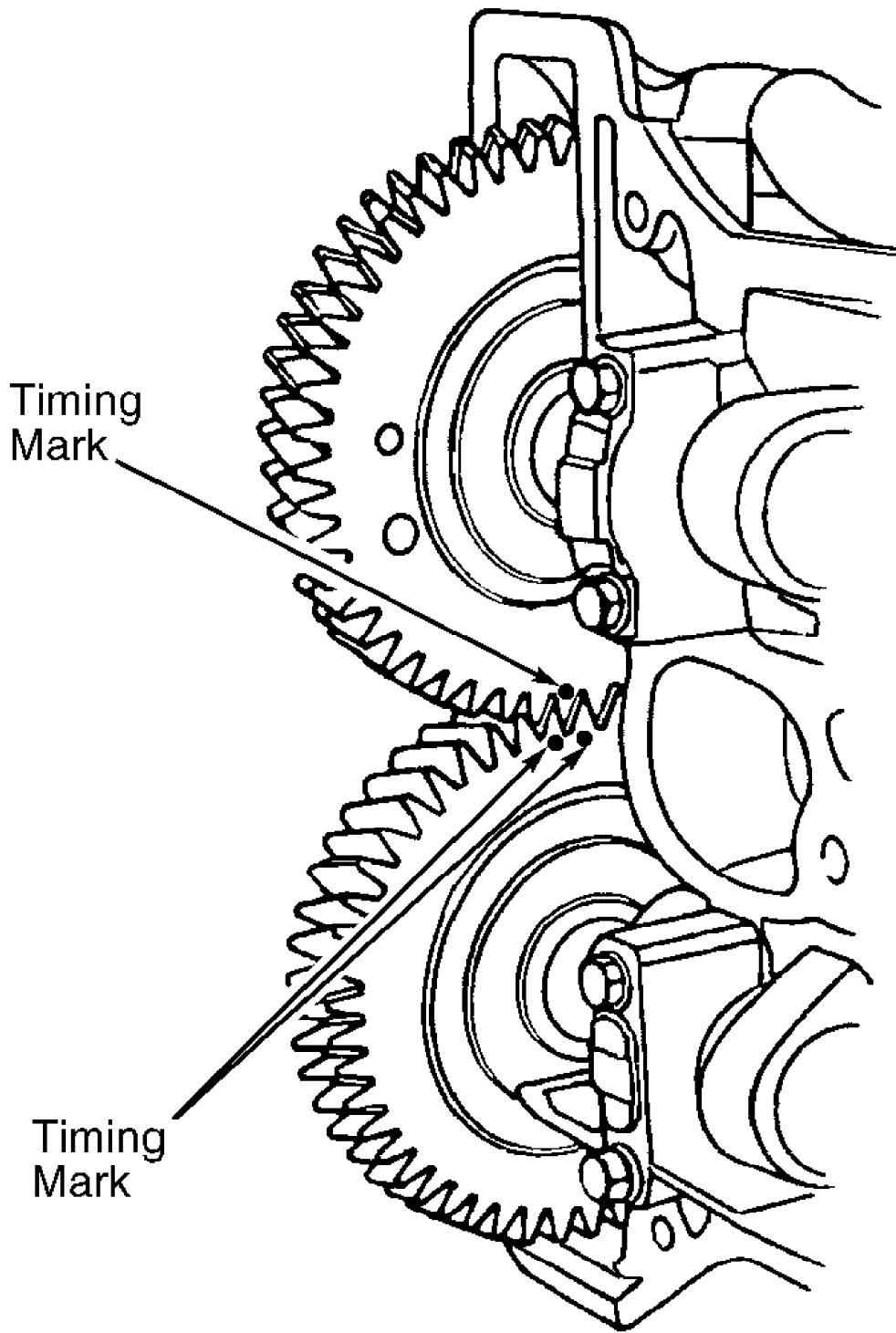
3) To avoid damage to cylinder head thrust bearing portion, rotate both left camshafts so notch on front of each camshaft points downward. See Fig. 11.

4) Ensure marks on rear side of both camshaft gears are aligned. See Fig. 12. Install a bolt through sub-gear to secure sub-gear to driven gear of intake camshaft. See Fig. 13.



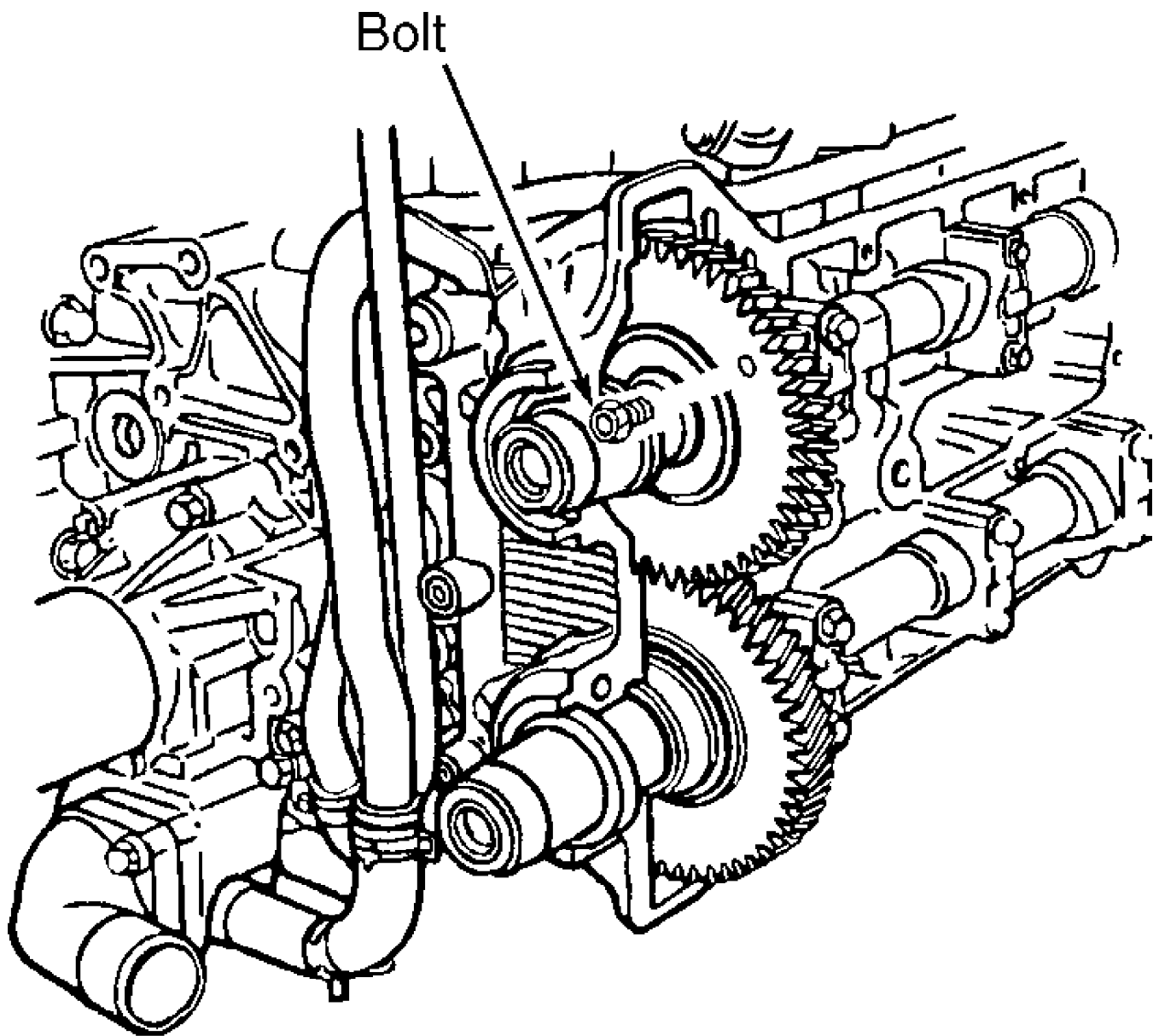
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Fig. 11: Removing Left Camshafts (1 Of 2)  
Courtesy of Subaru of America, Inc.



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Fig. 12: Removing Left Camshafts (2 Of 2)  
Courtesy of Subaru of America, Inc.



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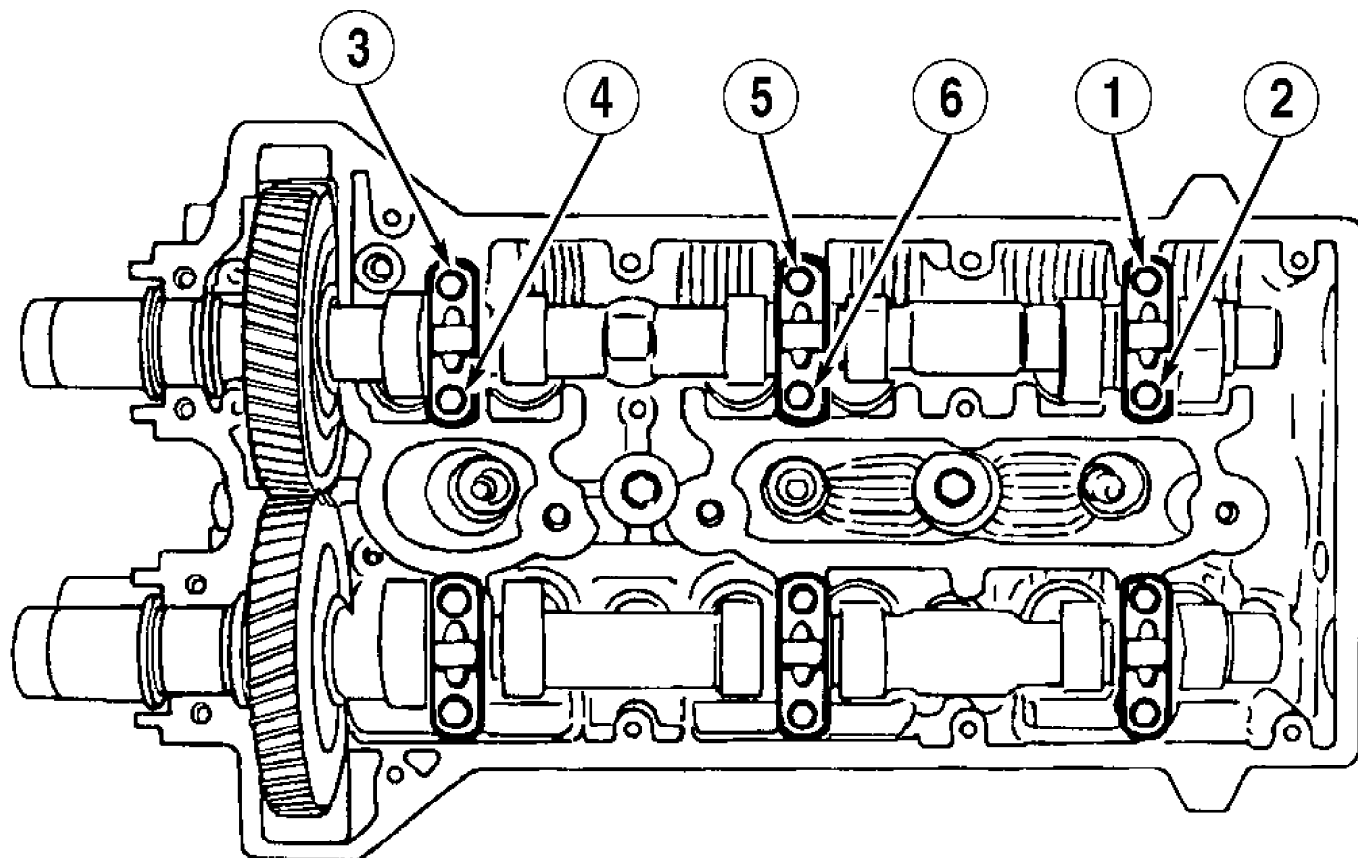
Fig. 13: Installing Bolt In Intake Camshaft Gear  
Courtesy of Subaru of America, Inc.

5) Loosen 6 bolts on 3 intake camshaft caps; loosen bolts equally, a little at a time, in proper sequence. See Fig. 14. Ensure that as bolts are loosened, clearance between camshaft journal and cylinder head journal bearing increases evenly at 3 places.

6) If clearance does not increase evenly in 3 places, tighten bolts by reversing numerical sequence. See Fig. 14. Loosen bolts in sequence again. Remove camshaft cap while holding intake camshaft using one hand. Remove camshaft.

7) If camshaft is difficult to remove, rotate exhaust camshaft clockwise. Repeat operation for exhaust camshaft. Loosening sequence is same as for intake camshaft. Arrange camshaft caps in

order. Remove lash adjusters and install them in original positions.



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Fig. 14: Removing Camshaft Cap Bolts In Sequence  
Courtesy of Subaru of America, Inc.

#### Removal (Right Camshafts)

1) Procedure for removing right camshafts is same as removing left camshafts, except when aligning camshaft gear marks.

2) On right camshafts, rotate camshafts so notches on front end of camshafts point upward. Ensure marks on rear of both camshaft gears are aligned. See Fig. 12. For camshaft cap loosening sequence, refer to illustration. See Fig. 14.

#### Disassembly (Intake Camshaft)

Place camshaft in a vise, being careful to protect lobes and journals. Turn sub-gear clockwise using Camshaft Gear Wrench (49920-7200). Remove sub-gear bolt. Remove snap ring. Remove all parts.

NOTE: For specifications, see CAMSHAFT table under ENGINE SPECIFICATIONS at end of article.

#### Inspection

1) Visually inspect camshaft for scratches, flaking and wear. Place camshaft journals No. 2 and 4 on "V" blocks. Measure camshaft runout at No. 3 journal.

2) Measure journal diameter and lobe height. Replace camshaft if measurements exceed specifications. Visually inspect camshaft caps for scratches, flaking and wear. If camshaft caps are damaged, replace caps and cylinder head as a set.

3) Install camshaft, but DO NOT install lash adjusters. Measure camshaft end play. If end play exceeds specifications, replace camshaft caps and cylinder head as a set. If necessary, replace camshaft. Measure camshaft journal oil clearance using Plastigage.

4) If oil clearance exceeds specifications, replace camshaft. If necessary, replace caps and cylinder head. Install intake and exhaust camshafts, but DO NOT install lash adjusters.

5) DO NOT install intake camshaft sub-gear. Measure distributor gear backlash. If backlash exceeds specification, replace both camshafts as a set. Measure distance between ends of camshaft gear spring. Replace spring if distance exceeds 0.9795-1.1370" (24.88-28.88 mm).

#### Reassembly

1) Install camshaft gear spring, camshaft sub-gear, wave washer and snap ring. To set sub-gear tension, place camshaft in a vise. DO NOT clamp lobes or journals in vise.

2) Turn sub-gear clockwise and align holes in camshaft driven gear and sub-gear using Camshaft Gear Wrench (49920-7200). Install sub-gear bolt.

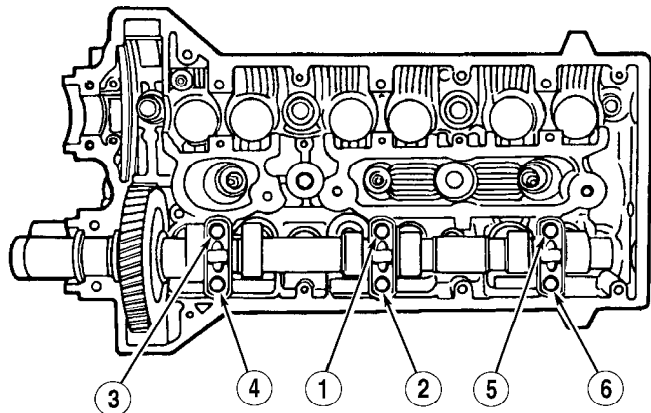
NOTE: Camshaft thrust clearance is small. When installing camshaft, hold it parallel to cylinder head or thrust bearing may be damaged.

#### Installation (Left Camshafts)

1) To install exhaust camshaft, apply engine oil to lash adjusters and install lash adjusters. Apply engine oil to camshaft journals. Place exhaust camshaft on cylinder head with notch on front end facing downward.

NOTE: As cap bolts are tightened, clearance between camshaft journal and cylinder head journal should decrease evenly at 3 places. If clearance does not decrease evenly, loosen bolts and repeat tightening procedure.

2) Install 3 camshaft caps, and hand-tighten cap bolts. Tighten cap bolts equally, a little at a time, in numerical sequence. See Fig. 15. Tighten each bolt to specification. See TORQUE SPECIFICATIONS table at end of article.



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Fig. 15: Tightening Camshaft Cap Bolts In Sequence  
Courtesy of Subaru of America, Inc.

3) To install intake camshaft, apply engine oil to lash adjusters and install lash adjusters. Apply engine oil to camshaft

journals. Place intake camshaft on cylinder head with notch on front end pointing downward.

4) Align timing marks located on backs of both camshaft gears. See Fig. 12. Install 3 camshaft caps, and hand-tighten bolts. Tighten cap bolts equally, a little at a time, in numerical sequence. See Fig. 15. Numerical tightening sequence is same for both camshafts.

5) Tighten cap bolts to specification. See TORQUE SPECIFICATIONS table. Remove sub-gear bolt from intake camshaft. To install front camshaft cap, apply silicone sealant to front camshaft cover mating surface.

6) Install front camshaft cover. Apply grease to oil seal lip, and install oil seal using Camshaft Oil Seal Guide (49959-7000) and Camshaft Oil Seal Installer (49958-7300). Install camshaft plug using Camshaft Plug Installer (49803-7100). Install valve covers. To install other components, reverse removal procedure.

#### Installation (Right Camshafts)

1) Installation of right camshafts is similar to left camshafts; however, a few differences exist. For camshaft cap tightening sequence, refer to illustration. See Fig. 15.

**NOTE:** As cap bolts are tightened, clearance between camshaft journal and cylinder head journal should decrease evenly at 3 places. If clearance does not decrease evenly, loosen bolts and repeat tightening procedure.

2) Notches on front end of camshaft should face upward. Align timing marks located on rear of camshaft gears. See Fig. 12. After properly installing camshafts, tighten cap bolts to specification. See TORQUE SPECIFICATIONS table at end of article. To complete installation, reverse removal procedures.

## LASH ADJUSTERS

#### Removal & Installation

Remove engine. See ENGINE. Remove camshafts. See CAMSHAFTS. Remove lash adjusters. Arrange lash adjusters so they can be installed in their original positions. To install, reverse removal procedures.

## REAR CRANKSHAFT OIL SEAL

Information is not available from manufacturer.

## WATER PUMP

#### Removal & Installation

1) Disconnect negative battery cable. Drain coolant completely. Disconnect radiator outlet hose. Disconnect cooling fan electrical connector.

2) Remove radiator bracket. Remove sub-cooling fan. Remove drive belts. Remove timing belt. See TIMING BELT. Remove tensioner adjuster. Remove cam angle sensor.

3) Remove left camshaft pulley. Hold camshaft pulley using Camshaft Sprocket Wrench (49920-7100). Remove left rear timing belt cover. Remove tensioner bracket. Disconnect hoses from water pump. Remove water pump. To install, reverse removal procedure.

## OIL PAN

#### Removal & Installation

Disconnect negative battery cable. Disconnect oxygen sensor connector. Remove bolts connecting oil level gauge to cylinder head.

Drain engine oil. Remove engine undercover. Remove left exhaust manifold cover, front exhaust pipe and exhaust manifold. Remove steering gear clamps. Disconnect oil level gauge guide from oil pan, and remove oil pan. To install, reverse removal procedure.

## OVERHAUL

### CYLINDER HEAD

#### Cylinder Head

Check for cracks and damage. Measure cylinder head warpage. Grind cylinder head if warpage exceeds specification.

#### Valve Springs

Measure free length of valve springs. Check spring tension at specified height. Check spring squareness by standing spring on a surface plate and measuring deflection at top using a square. Replace springs if they are not within specification. See VALVES & VALVE SPRINGS table under ENGINE SPECIFICATIONS at end of article.

#### Valve Stem Oil Seals

With valves removed, remove oil seals from cylinder head. Coat seals with oil. Rubber part of intake valve seal is black; rubber part of exhaust valve seal is brown. Using Valve Stem Oil Seal Installer (49885-7100), install valve stem oil seal.

#### Valve Guides

1) Measure outside diameter of valve stem and inside diameter of valve guide. If clearance is not to specification, replace guide. See VALVES & VALVE SPRINGS and CYLINDER HEAD tables under ENGINE SPECIFICATIONS at end of article.

2) To replace valve guide, drive valve guide out from combustion chamber side of cylinder head using Valve Guide Remover/Installer (49976-7200). Position cylinder head with combustion chamber facing downward.

3) Place Valve Guide Adjuster (49976-7600) over valve guide bore of cylinder head. Valve guide adjuster ensures correct valve guide height. Coat new valve guide with oil. Press guide into valve guide bore using valve guide remover/installer .

4) Top of valve guide should be flush with valve guide adjuster. For valve guide installed height specification, see CYLINDER HEAD table.

5) Use Valve Guide Reamer (49976-7400) to ream valve guide to obtain proper valve stem clearance. Coat face of valve with talcum powder and lightly rotate valve against valve seat to check for proper valve seating.

#### Valve Seat

Inspect valve seats. Correct seat angles during overhaul or when valve guides are replaced. For specifications, see CYLINDER HEAD table under ENGINE SPECIFICATIONS at end of article.

#### Valves

Measure valve stem diameter, valve margin and overall length. Replace valves if they are not within specification. See VALVES & VALVES SPRINGS table under ENGINE SPECIFICATIONS at end of article. Recheck valve margin after grinding valves.

### VALVE TRAIN

#### Lash Adjusters

1) To remove lash adjusters, see LASH ADJUSTERS under REMOVAL



& INSTALLATION. Inspect lash adjusters for wear and scratches. Replace adjusters as necessary. Measure lash adjuster outside diameter.

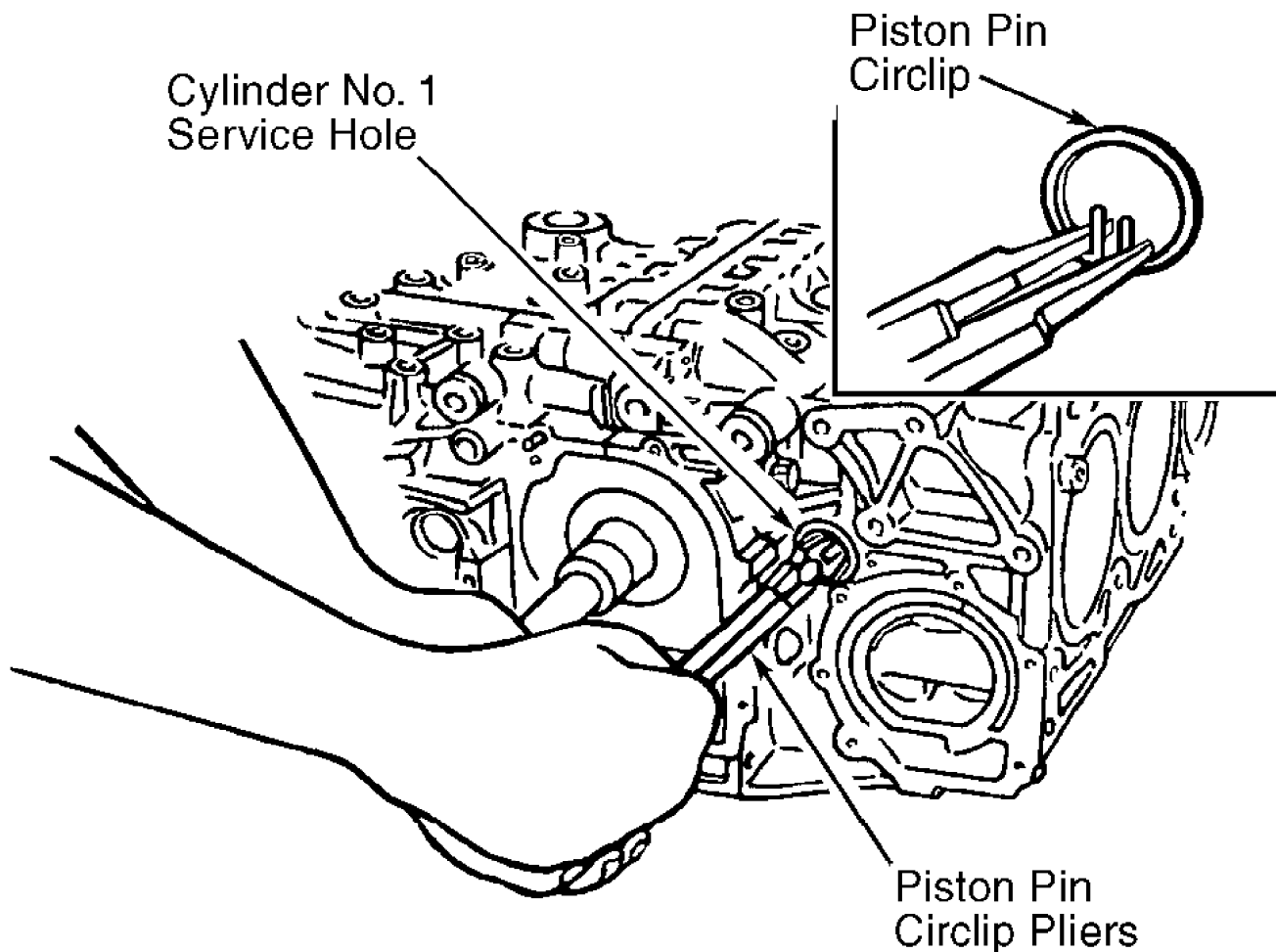
2) Measure inside diameter of lash adjuster bore in cylinder head. Using these measurements, determine lash adjuster oil clearance. Replace cylinder head if oil clearance is not within specification. See VALVE LASH ADJUSTERS table under ENGINE SPECIFICATIONS at end of article.

## CYLINDER BLOCK ASSEMBLY

NOTE: Be sure to install pistons and piston pins in original positions.

### Disassembly

1) Remove service hole covers and plugs. Rotate crankshaft to move pistons No. 1 and 2 to BDC. Using Piston Pin Circlip Pliers (49989-7200), remove piston pin circlip and piston pins from pistons No. 1 and 2 through service hole of cylinders No. 1 and 2. See Fig. 16.



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Fig. 16: Removing Piston Pin Circlip  
Courtesy of Subaru of America, Inc.

2) Rotate crankshaft to move pistons No. 3 and 4 to BDC. Remove piston pin circlip and piston pins through service hole of

cylinders No. 3 and 4. Rotate crankshaft to move pistons No. 5 and 6 to BDC. Remove piston pin circlip and piston pins through service hole of cylinders. 5 and 6.

NOTE: When separating block halves, ensure connecting rod does not fall onto cylinder wall.

3) Remove bolts connecting cylinder block on cylinders No. 1, 3 and 5 side. Loosen cylinder block bolts on opposite side 2-3 turns. Remove all cylinder block bolts. Separate block halves.

4) Remove rear oil seal. Remove crankshaft and connecting rod assembly. Remove main bearings and keep them separated. Remove pistons from block. Keep pistons in order. Remove connecting rods and bearings. Keep parts in order. Remove piston rings.

#### Connecting Rod

1) Replace connecting rod if thrust surface is damaged. Check for bend and twist using a connecting rod aligner. Install bearing on connecting rod, and place rod on crankshaft.

2) Check side clearance. Check oil clearance, bushing at rod small end and piston pin clearance. See appropriate tables under ENGINE SPECIFICATIONS at end of article. Replace connecting rods as necessary.

#### Piston, Piston Rings & Piston Pin

1) Check for wear, damage and cracks. Measure piston-to-cylinder clearance. If clearances are not correct, replace piston or bore cylinder and use oversized piston. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS at end of article. Ensure piston pin can be inserted into piston with thumb pressure at 68°F (20°C).

2) Replace pin if it is excessively worn or will not fit properly. Place top ring and oil ring 1.18" (30.0 mm) into cylinder bore. Measure ring end gap. Measure clearance between piston ring and ring groove.

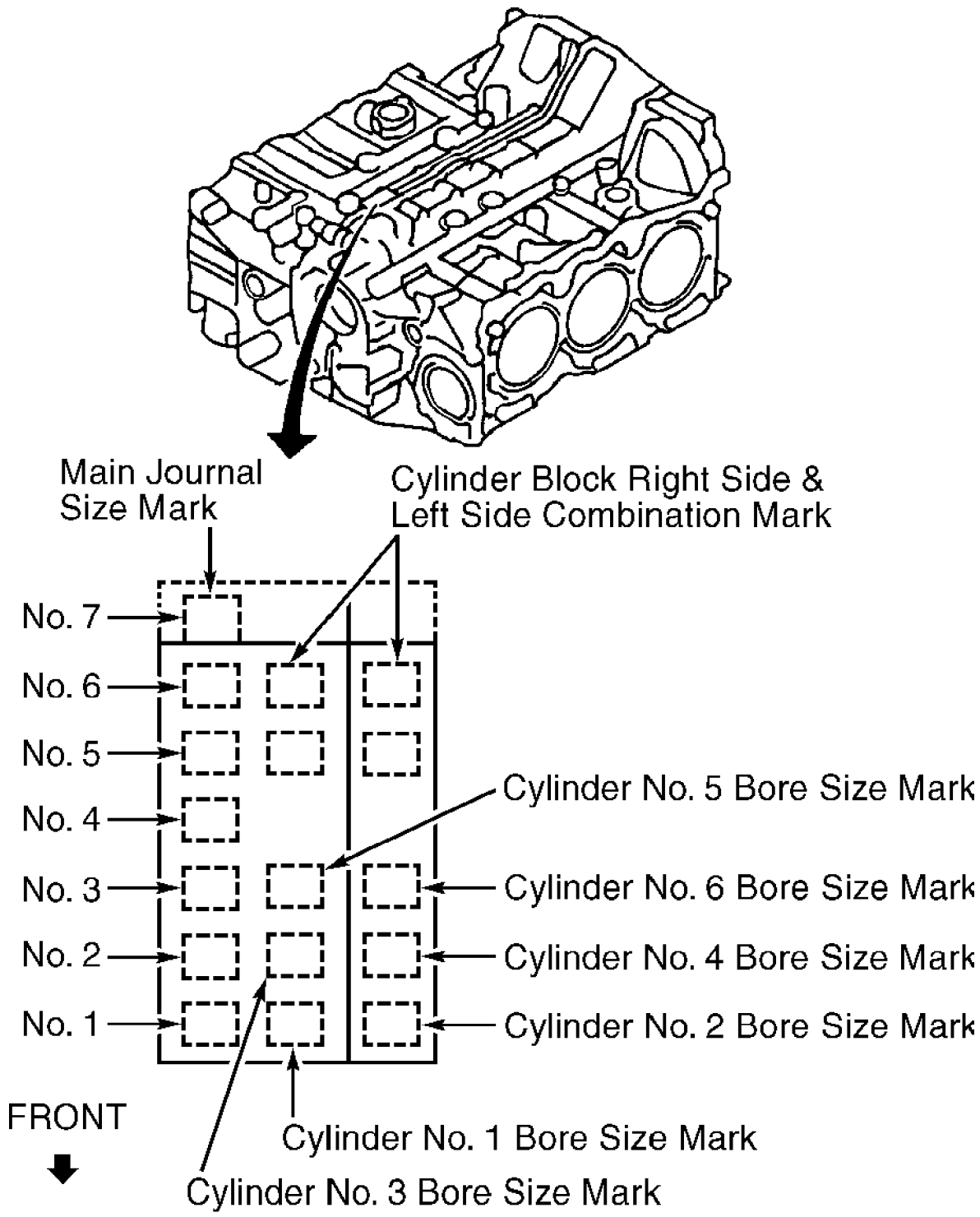
#### Crankshaft

Check for cracks. Measure crankshaft bend, journal, end play, main journal oil clearance and crankpin wear. Replace or recondition crankshaft as necessary. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS at end of article.

#### Cylinder Block

1) Check for cracks and damage. Measure block-to-head surface for warpage. If warpage exceeds specification, grind surface to specification. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS at end of article.

2) Measure cylinder bore in thrust area and piston pin area. Measure cylinder taper. Cylinder bore size is stamped on front upper surface of block. See Fig. 17.



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Fig. 17: Checking Cylinder Bore Size  
 Courtesy of Subaru of America, Inc.

3) If cylinder bore is excessively worn, bore cylinder to fit  
 oversize piston. If any cylinder needs boring, bore all cylinders.

Oversized pistons come in 3 sizes, which are designated by letters "A", "B" and "C". See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

NOTE: Immediately after boring, cylinder diameter may be different due to temperature rise and expansion.

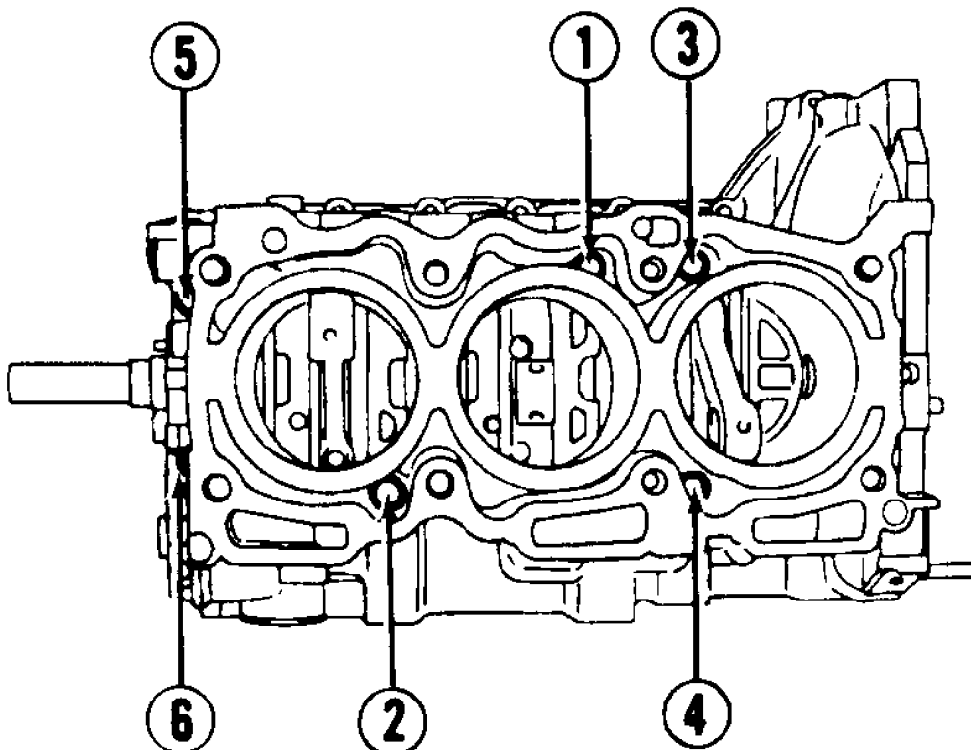
4) If cylinder bore exceeds specification after boring and honing, replace block. See CYLINDER BLOCK table.

#### Reassembly

1) Install connecting rod bearings on connecting rods and caps. Apply oil to face of bearings. Marked side of connecting rod and arrow on rod cap should be facing toward front of crankshaft. Install connecting rods onto crankshaft.

2) Apply oil to connecting rod nuts, and tighten nuts to specification. See TORQUE SPECIFICATIONS table at end of article. Install main bearings into block. Apply oil to crankshaft journal and face of main bearings.

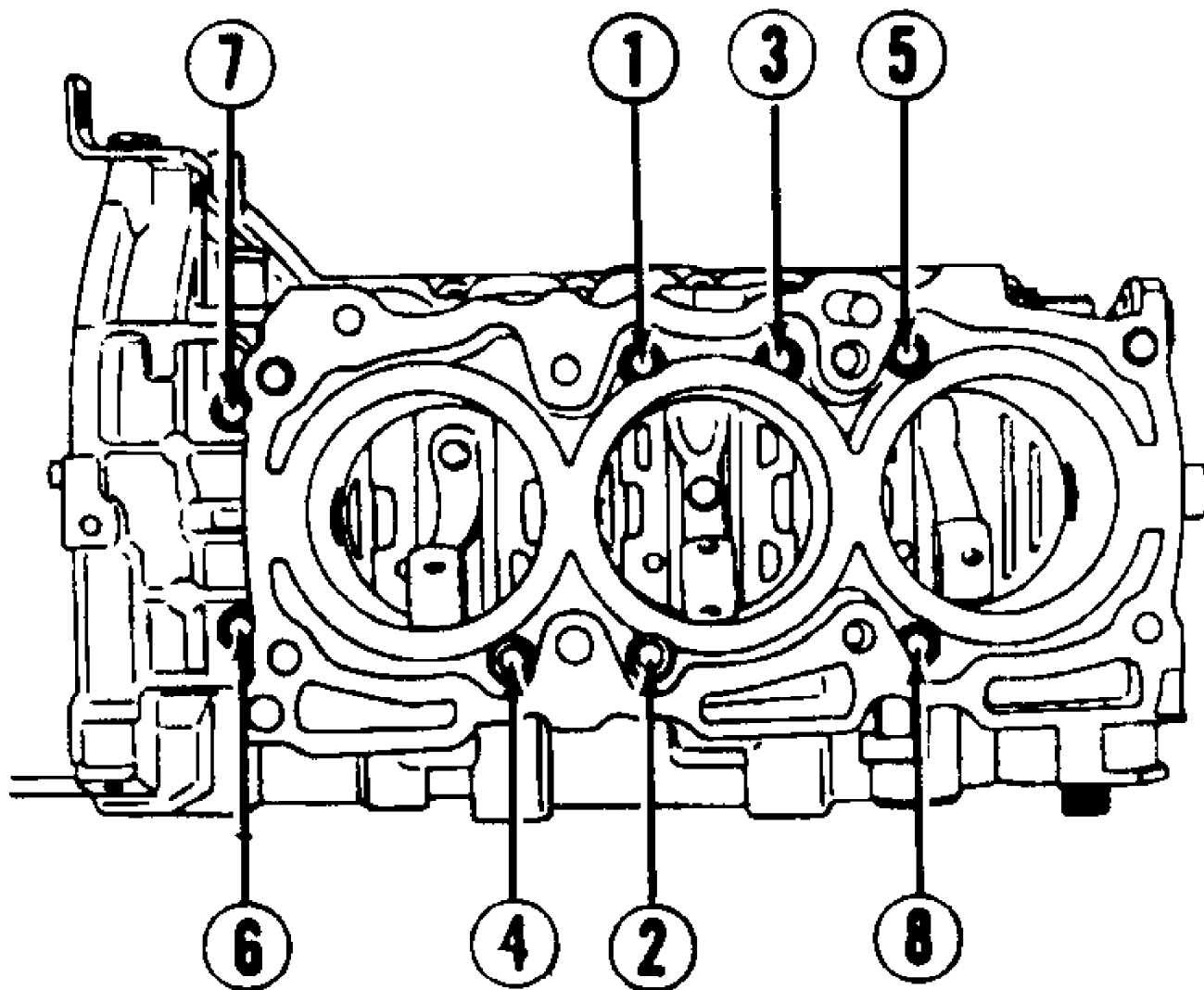
3) Position crankshaft into cylinders No. 1, 3 and 5 side of cylinder block. Install necessary "O" rings. Put sealant on block mating surfaces. Put cylinder block halves together. Tighten connecting bolts on cylinders No. 2, 4 and 6 side of block to 11 ft. lbs. (14.9 N.m), in numerical sequence. See Figs. 18 and 19.



CYLINDERS NO. 2, 4, & 6 SIDE

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Fig. 18: Tightening Cyl. Block Conn. Bolts (Cyl. No. 2, 4 & 6 Side)  
Courtesy of Subaru of America, Inc.



CYLINDERS NO. 1, 3, & 5 SIDE

**93D02411**

Fig. 19: Tightening Cyl. Block Conn. Bolts (Cyl. No. 1, 3 & 5 Side)  
 Courtesy of Subaru of America, Inc.

4) Tighten small bolt in crankcase. Tighten connecting bolts on cylinders No. 1, 3 and 5 side of block to 11 ft. lbs. (14.9 N.m), in numerical sequence. See Figs. 18 and 19.

5) Further tighten connecting bolts on cylinders No. 2, 4 and 6 side of block, 90° degrees and then 110° degrees, in numerical sequence. See Figs. 18 and 19. Do same for opposite side. See TORQUE SPECIFICATIONS table.

6) Use Oil Seal Installer (49958-7200) and Oil Seal Guide (49959-7100) to install rear oil seal. To install piston rings, install oil ring spacer, upper rail and lower rail, in that order, by hand. Install second and top rings using ring expander.

7) Insure ring gaps are positioned correctly. See Fig. 20. Install new piston pin circlips. To install pistons, start with

pistons No. 3 and 4. Turn crankshaft to move connecting rods No. 3 and 4 to BDC. Coat pistons and cylinder walls with engine oil.

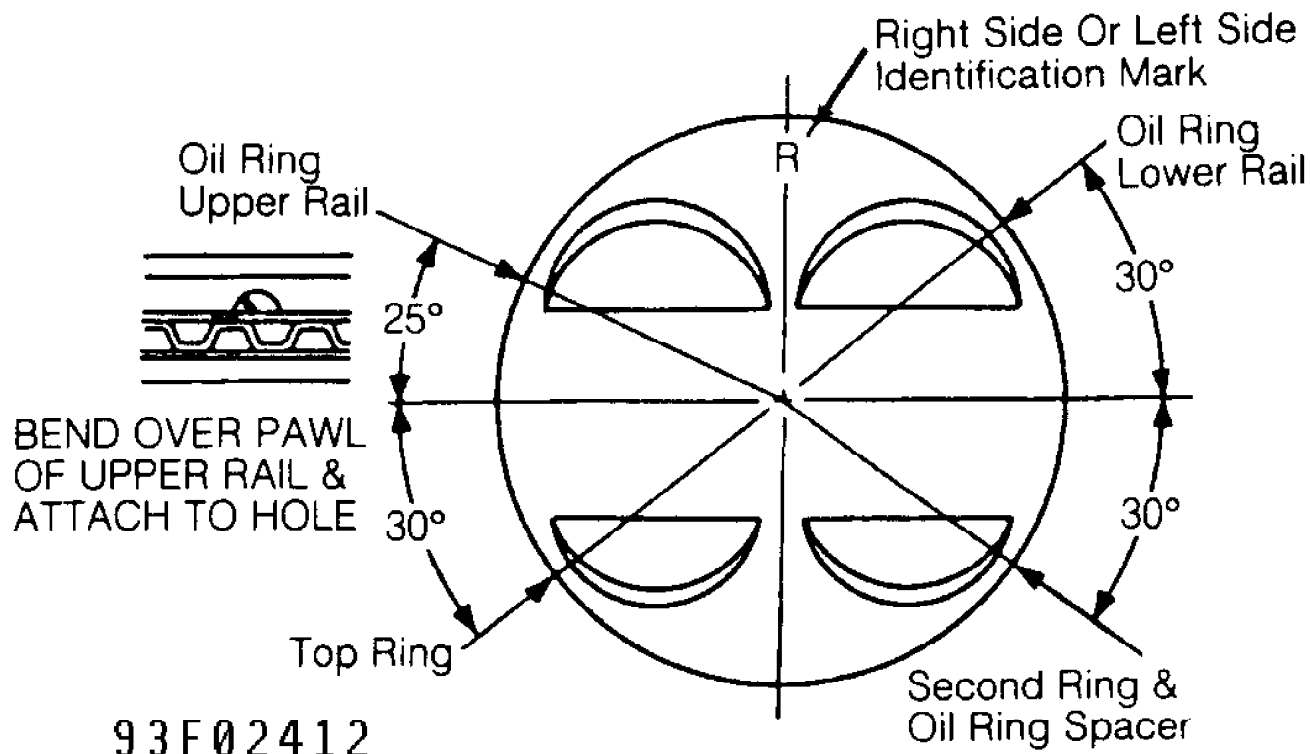


Fig. 20: Installing Piston Rings  
Courtesy of Subaru of America, Inc.

8) Place pistons No. 3 and 4 in cylinders. Insert Piston Pin Guide (49901-7100) into service hole to align piston pin holes in piston with holes in connecting rods.

9) Apply oil to piston pins, and insert pins into piston and connecting rod. Install new circlip using Piston Circlip Pliers (49989-7200). To install pistons No. 1 and 2, turn crankshaft to move connecting rods to BDC.

10) Repeat procedure as described for pistons No. 3 and 4. Install service hole plug and gasket. To install pistons No. 5 and 6, repeat procedures as for other pistons.

## ENGINE OILING

### ENGINE LUBRICATION SYSTEM

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

#### Crankcase Capacity

Crankcase capacity is 6.9 qts. (6.5L) with filter replacement.

#### Oil Pressure

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

## OIL PUMP

### Removal

1) Disconnect negative battery cable. Drain engine oil. Remove engine undercover. Remove power steering cooler. Remove cooling fan assemblies. Remove drive belts.

2) Remove A/C idler pulley. Remove power steering pump bracket. DO NOT remove power steering pump. Remove crank angle sensors and crankshaft pulley. Remove timing belt. See TIMING BELT under REMOVAL & INSTALLATION.

3) Remove crankshaft sprocket, timing belt idlers and belt tensioner. Remove oil pump.

### Disassembly & Inspection

1) Disassemble pump. See Fig. 21. Check pump case for worn shaft hole, worn rotor chamber and cracks. Replace components as necessary. Remove front oil seal using oil seal remover. Measure clearance between inner rotor and pump cover.

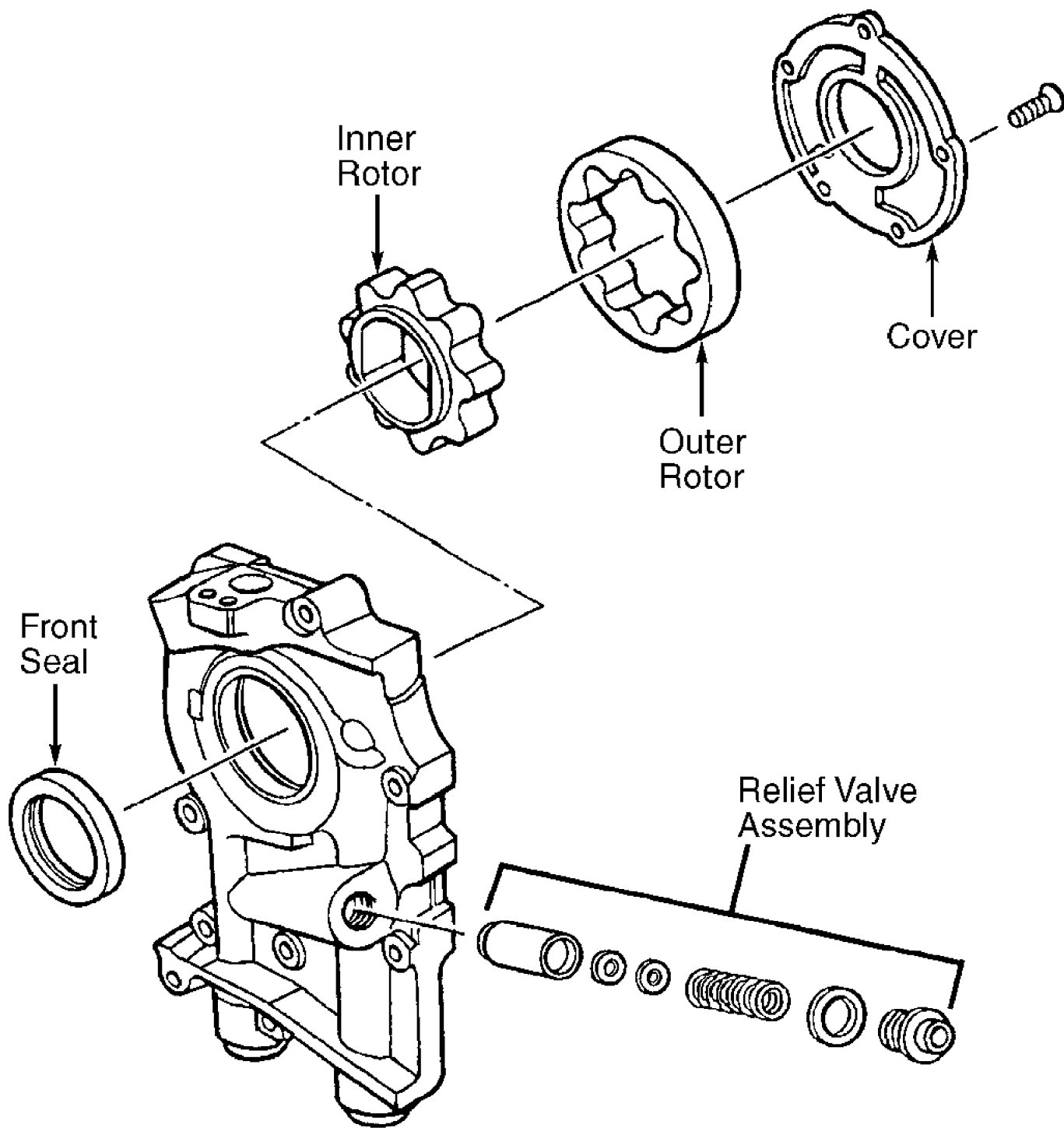
2) Measure clearance between tip of rotors. Measure clearance between outer rotor and rotor housing. Check relief valve spring length. If clearance on each measurement is not correct, replace worn part. See OIL PUMP SPECIFICATIONS table.

### OIL PUMP SPECIFICATIONS TABLE

Application	In. (mm)
Inner Rotor-To-Pump Cover .... (1)	.0008-.0028 (.020-.070)
Outer Rotor-To-Rotor Housing .. (2)	.0039-.0069 (.100-.175)
Relief Valve Spring Length	
Free Length .....	2.902 (73.70)
Installed Length .....	2.154 (54.70)
Rotor Tip Clearance ..... (3)	.0016-.0055 (.040-.140)
(1) - Wear limit is .0047" (.120 mm)	
(2) - Wear limit is .0079" (.200 mm).	
(3) - Wear limit is .0071" (.180 mm).	

### Reassembly & Installation

Install front oil seal using Oil Seal Installer (49958-7100). Replace gaskets and "O" rings. To reassemble, reverse disassembly procedure. To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS table.



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Fig. 21: Exploded View Of Oil Pump Assembly  
 Courtesy of Subaru of America, Inc.

**TORQUE SPECIFICATIONS**

TORQUE SPECIFICATIONS TABLE



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Application	Ft. Lbs. (N.m)
Belt Idler Bolt .....	26-32 (35-43)
Belt Tension Adjuster Bolt .....	17-20 (23-27)
Camshaft Sprocket Bolt .....	80-94 (108-127)
Connecting Rod Nut .....	32-34 (43-46)
Crankshaft Pulley Bolt (1) .....	108-123 (147-167)
Cylinder Block (8-mm Bolt) .....	17-20 (23-27)
Cylinder Head Bolt	
Step 1 .....	22 (30)
Step 2 .....	51 (69)
Step 3 .....	Loosen 180 Degrees
Step 4 .....	Loosen 180 Degrees
Step 5 .....	20 (27)
Step 6 .....	(2) 33 (44)
Step 7 .....	(3) 33 (44)
Drive Plate Bolt .....	51-55 (69-75)
Intake Manifold Bolt .....	17-19 (23-26)
Oil Relief Plug .....	30-35 (40-48)
Service Hole Plug .....	46-56 (62-76)
Tensioner Bolt .....	26-32 (35-43)

INCH Lbs. (N.m)

Camshaft Cap Bolt .....	39-48 (4.4-5.4)
Oil Level Gauge Guide Bolt .....	51-61 (6.0-7.0)
Oil Pan Bolt .....	35-44 (4.0-5.0)
Oil Separator Cover Bolt .....	51-61 (6.0-7.0)
Timing Belt Cover Bolt .....	35-44 (4.0-5.0)
Valve Cover Bolt .....	35-44 (4.0-5.0)
Water Pump Pulley Bolt .....	84-120 (10.0-14.0)

- (1) - Coat bolt threads with oil before installation.  
(2) - Tighten bolts No. 1, 2, 3 and 4, 80-90 degrees in sequence. See Figs. 2 and 3.  
(3) - Tighten bolts No. 5, 6, 7 and 8, 80-90 degrees in sequence. See Figs. 2 and 3.
- 

## ENGINE SPECIFICATIONS

### GENERAL ENGINE SPECIFICATIONS

#### GENERAL SPECIFICATIONS TABLE

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Application	Specification
Displacement .....	202 Cu. In. (3.3L)
Bore .....	3.815" (96.90 mm)
Stroke .....	2.95" (75.0 mm)
Compression Ratio .....	10:1
Fuel System .....	PFI
Horsepower @ RPM .....	230 @ 5400
Torque Ft. Lbs. @ RPM .....	224 @ 4400

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### CRANKSHAFT, MAIN & CONNECTING

#### ROD BEARINGS SPECIFICATIONS

#### CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS TABLE

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Application	In. (mm)
<b>Crankshaft</b>	
End Play	
Standard	.0012-.0045 (.030-.115)
Limit	.0098 (.250)
Runout	.0014 (.036)
<b>Main Bearings</b>	
Journal Diameter	
Standard	2.3619-2.3625 (59.992-60.008)
Undersize (1)	2.3607-2.3613 (59.962-59.978)
Undersize (2)	2.3599-2.3605 (59.942-59.958)
Undersize (3)	2.3521-2.3527 (59.742-59.758)
Journal Out-Of-Round	.0012 (.030)
Journal Taper	.0028 (.070)
Grinding Limit	.0098 (.250)
Oil Clearance	
Standard	
Journals No. 1, 3 & 7	.0002-.0014 (.005-.035)
Journals No. 2, 4 & 6	.0005-.0015 (.013-.038)
Journal No. 5	.0005-.0013 (.013-.034)
Limit	
Journals No. 1, 2, 6 & 7	.0018 (.045)
Journals No. 3, 4 & 5	.0016 (.040)
<b>Connecting Rod Bearings</b>	
Journal Diameter	
Standard	2.0466-2.0472 (51.984-52.000)
Undersize (1)	2.0454-2.0461 (51.954-51.970)
Undersize (2)	2.0446-2.0453 (51.934-51.950)
Undersize (3)	2.0368-2.0374 (51.734-51.750)
Journal Out-Of-Round	.0012 (.030)
Journal Taper	.0028 (.070)
Oil Clearance	
Standard	.0008-.0018 (.020-.046)
Limit	.0020 (.050)

- (1) - .0012" (.030 mm) undersized.  
(2) - .0020" (.050 mm) undersized.  
(3) - .0098" (.250 mm) undersized.

## CONNECTING RODS SPECIFICATIONS

### CONNECTING RODS TABLE

Application	In. (mm)
Maximum Bend	(1) .0039 (.099)
Maximum Twist	.0039 (.099)
Side Play	
Standard	.0028-.0130 (.070-.330)
Limit	.0160 (.400)

- (1) - Limit of bend per 3.94" (100.0 mm).

## PISTONS, PINS & RINGS SPECIFICATIONS

### PISTONS, PINS & RINGS TABLE

Application	In. (mm)
Pistons	

Clearance			
Standard	.....	.0004-.0012	(.010-.030)
Limit	.....	.0024	(.600)
Diameter			
Standard			
"A"	.....	3.8144-3.8148	(96.885-96.895)
"B"	.....	3.8140-3.8144	(96.875-96.885)
"C"	.....	3.8136-3.8140	(96.865-96.875)
Oversize	.....	3.8238-3.8242	(97.125-97.135)
Oversize	.....	3.8337-3.8340	(97.375-97.385)
Pins			
Clearance	.....	.0002-.0003	(.004-.008)
Rings			
End Gap			
No. 1			
Standard	.....	.0079-.0118	(.200-.300)
Limit	.....	.0200	(.500)
Groove Clearance	..... (1)	.0016-.0035	(.040-.090)
No. 2			
Standard	.....	.0146-.0205	(.370-.520)
Limit	.....	.0390	(1.000)
Groove Clearance	..... (1)	.0012-.0028	(.030-.070)
No. 3 (Oil)			
Standard	.....	.0079-.0236	(.200-.600)
Limit	.....	.0590	(1.500)

(1) - Clearance between ring groove and ring.

## CYLINDER BLOCK SPECIFICATIONS

### CYLINDER BLOCK TABLE

Application	In. (mm)
Cylinder Bore	
Standard	
"A"	..... 3.8151-3.8155 (96.905-96.915)
"B"	..... 3.8148-3.8151 (96.895-96.905)
"C"	..... 3.8144-3.8148 (96.885-96.895)
Maximum Out-Of-Round & Taper	..... .002 (.05)
Boring Limit	..... .020 (.50)
Maximum Deck Grinding Limit	..... .016 (.41)
Maximum Deck Warp	..... .002 (.05)

## VALVES & VALVE SPRINGS SPECIFICATIONS

### VALVES & VALVE SPRINGS TABLE

Application	Specification
Intake Valves	
Face Angle	..... 45°
Margin	
Standard	..... .031" (.80 mm)
Limit	..... .024" (.60 mm)
Minimum Refinish Length	..... 3.5433" (90.000 mm)
Stem Diameter	..... .2344-.2350" (5.955-5.970 mm)
Oil Clearance	
Standard	..... .0012-.0022" (.030-.057 mm)
Limit	..... .0039" (.100)
Exhaust Valves	

Face Angle	.....	45 °
Margin		
Standard	.....	.039" (1.00 mm)
Limit	.....	.031" (0.80 mm)
Minimum Refinish Length	.....	3.5768" (90.850 mm)
Stem Diameter	.....	.2341-.2346" (5.945-5.960 mm)
Oil Clearance		
Standard	.....	.0016-.0026" (.040-.067 mm)
Limit	.....	.0039" (.100)
Valve Springs		
Free Length		
Inner Spring	.....	1.374" (34.90 mm)
Outer Spring	.....	1.433" (36.40 mm)
Out-Of-Square		
Inner Spring	.....	(1) .059" (1.50 mm)
Outer Spring	.....	(1) .063" (1.60 mm)
		Lbs. @ In. (kg @ mm)
Pressure		
Valve Closed		
Inner Spring	.....	13-15 @ 1.083 (6-7 @ 27.50)
Outer Spring	.....	28-32 @ 1.140 (12-14 @ 29.00)
Valve Open		
Inner Spring	.....	33-38 @ .772 (15-17.2 @ 19.60)
Outer Spring	.....	69-80 @ .831 (31-36 @ 21.00)

(1) - Maximum allowable deviation from 90° is 2.5°.

## CYLINDER HEAD SPECIFICATIONS

### CYLINDER HEAD TABLE

Application	Specification
Cylinder Head Height	..... 5.020" (127.50 mm)
Grinding Limit	..... .0118 (.300 mm)
Maximum Warpage	..... .002" (.05 mm)
Valve Seats	
Intake Valve	
Seat Angle	..... 90 °
Seat Width	
Standard	..... .039" (1.00 mm)
Limit	..... .067" (1.70 mm)
Exhaust Valve	
Seat Angle	..... 90 °
Seat Width	
Standard	..... .059" (1.50 mm)
Limit	..... .087" (2.20 mm)
Valve Guides	
I.D.	..... .2362-.2367" (6.000-6.012 mm)
Valve Guide Installed Height (1)	..... .335" (8.50 mm)

(1) - Protrusion above head.

## CAMSHAFT SPECIFICATIONS

### CAMSHAFT TABLE

Application	In. (mm)
Distributor Gear Backlash	

Standard	.....	.0011-.0069	(.029-.175)
Limit	.....	.0118	(.300)
End Play			
Intake			
Standard	.....	.0012-.0035	(.030-.090)
Limit	.....	.0051	(.130)
Exhaust			
Standard	.....	.0008-.0031	(.020-.080)
Limit	.....	.0047	(.120)
Journal Diameter			
No. 1	.....	1.2577-1.2584	(31.946-31.963)
No. 2, 3 & 4	.....	1.1002-1.1009	(27.946-27.963)
Lobe Height			
Intake			
Standard	.....	1.5374-1.5413	(39.050-39.150)
Limit	.....	1.5315	(38.900)
Exhaust			
Standard	.....	1.5689-1.5728	(39.850-39.950)
Limit	.....	1.5630	(39.700)
Oil Clearance			
Standard	.....	.0015-.0028	(.037-.072)
Limit	.....	.0039	(.100)

## VALVE LASH ADJUSTERS SPECIFICATIONS

### VALVE LASH ADJUSTERS TABLE

Application		In. (mm)
Bushing Inner Diameter	.....	1.2996-1.3004 (33.009-33.031)
Lash Adjuster Diameter	.....	1.2978-1.2982 (32.965-32.975)
Oil Clearance		
Standard	.....	.0011-.0031 (.028-.078)
Limit	.....	.0043 (.110)