

2.8L VR6 Article Text

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ARTICLE BEGINNING

1999-2000 ENGINES
Volkswagen 2.8L VR6 6-Cylinder

Golf, GTI, Jetta

* PLEASE READ THIS FIRST *

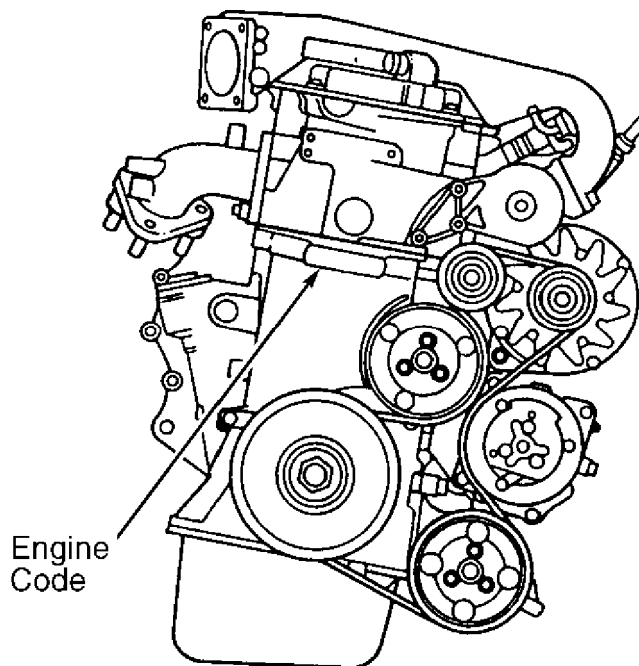
NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

ENGINE IDENTIFICATION

Engine identification number is stamped on a machined pad, on front of the cylinder block. See Fig. 1. The engine code is also listed on a sticker attached to the pulley side of the valve cover and the vehicle identification sticker located in the luggage compartment.

ENGINE CODES

| AA | |
|--|------|
| Application | Code |
| 2.8L VR6 | AAA |
| 2.8L VR6 | AFP |
| AA | |



G93H83102

Fig. 1: Locating Engine Identification Number
Courtesy of Volkswagen United States, Inc.

ADJUSTMENTS

VALVE CLEARANCE

Engine is equipped with hydraulic lifters. Adjustment is not necessary.

TROUBLE SHOOTING

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

REMOVAL & INSTALLATION

* PLEASE READ THIS FIRST *

NOTE: 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 other major assemblies before removal.

WARNING: Radio/cassette or radio/CD player is equipped with an anti-theft protection circuit. Whenever battery is disconnected, radio will go into anti-theft mode. When battery is reconnected, radio will display CODE, and will be inoperative until proper code number is entered. Obtain security code before disconnecting battery.

FUEL PRESSURE RELEASE

Remove fuel pump relay (lower right relay located in fuse/relay panel). Start engine and let idle until it stalls. Crank engine for an additional 5 seconds. Reinstall fuel pump relay.

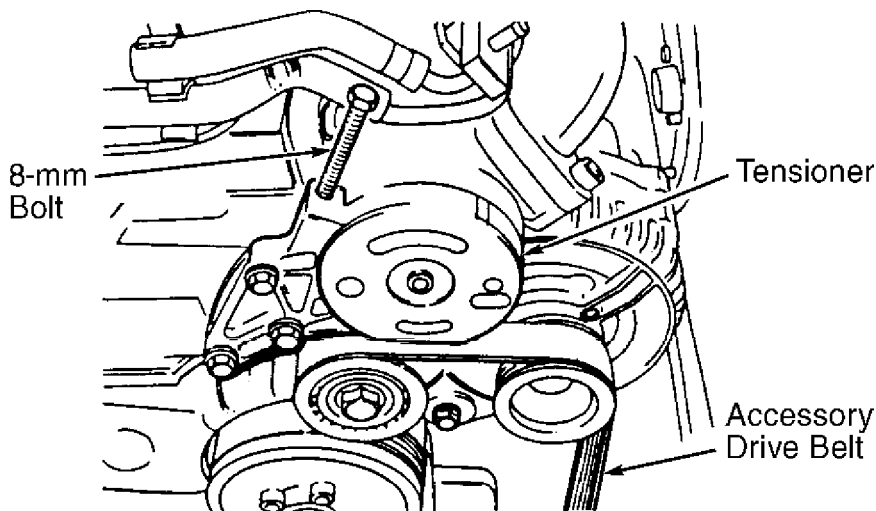
ENGINE

NOTE: Engine is removed with transaxle attached.

Removal

1) Obtain radio code. Turn ignition off and wait 20 seconds. Disconnect negative battery cable. Remove air cleaner assembly. Install 8-mm bolt in belt tensioner hole and remove accessory drive belt. See Fig. 2.

2) On manual transmission models, disconnect clutch slave cylinder. On all models, remove power steering pump and attach to body. DO NOT disconnect power steering hoses. Remove radiator, front lock support and front bumper. Drain cooling system. Disconnect cooling fan and thermostitch.



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Fig. 2: Releasing Accessory Drive Belt Tensioner
Courtesy of Volkswagen United States, Inc.

3) Label and disconnect all electrical wiring, control cables, coolant hoses and vacuum hoses from engine/transaxle assembly. Disconnect throttle, cruise and kickdown linkage (if equipped). Remove air duct from intake manifold.

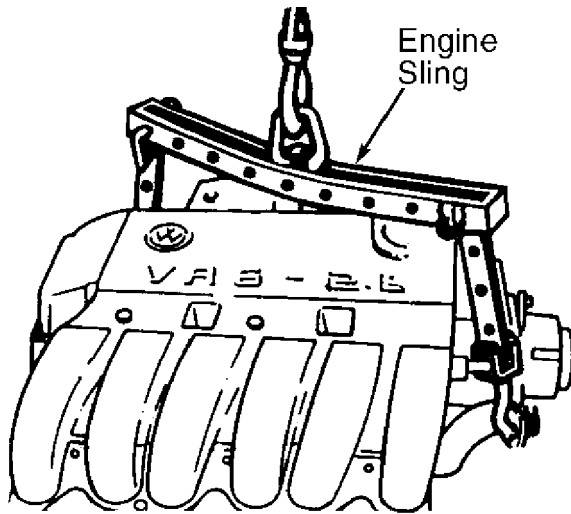
4) Disconnect drive axles from transaxle. See FWD AXLE SHAFTS

article in DRIVE AXLES. Disconnect exhaust pipe from exhaust manifold. Attach Engine Sling (2024A). See Fig. 3.

5) Disconnect left rear transaxle mount and right rear engine mount. Disconnect front engine mount. Release engine carrier. It may be necessary to pry spacer bracket from rubber bushings. Raise engine and transaxle out of vehicle.

Installation

To install, reverse removal procedure. Use NEW self-locking nuts and coolant. Ensure engine mounts are installed to original location. Align all engine supports with mount bushings before tightening mount bolts. Tighten bolts to specification. See TORQUE SPECIFICATIONS.



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Fig. 3: Attaching Engine Sling
Courtesy of Volkswagen United States, Inc.

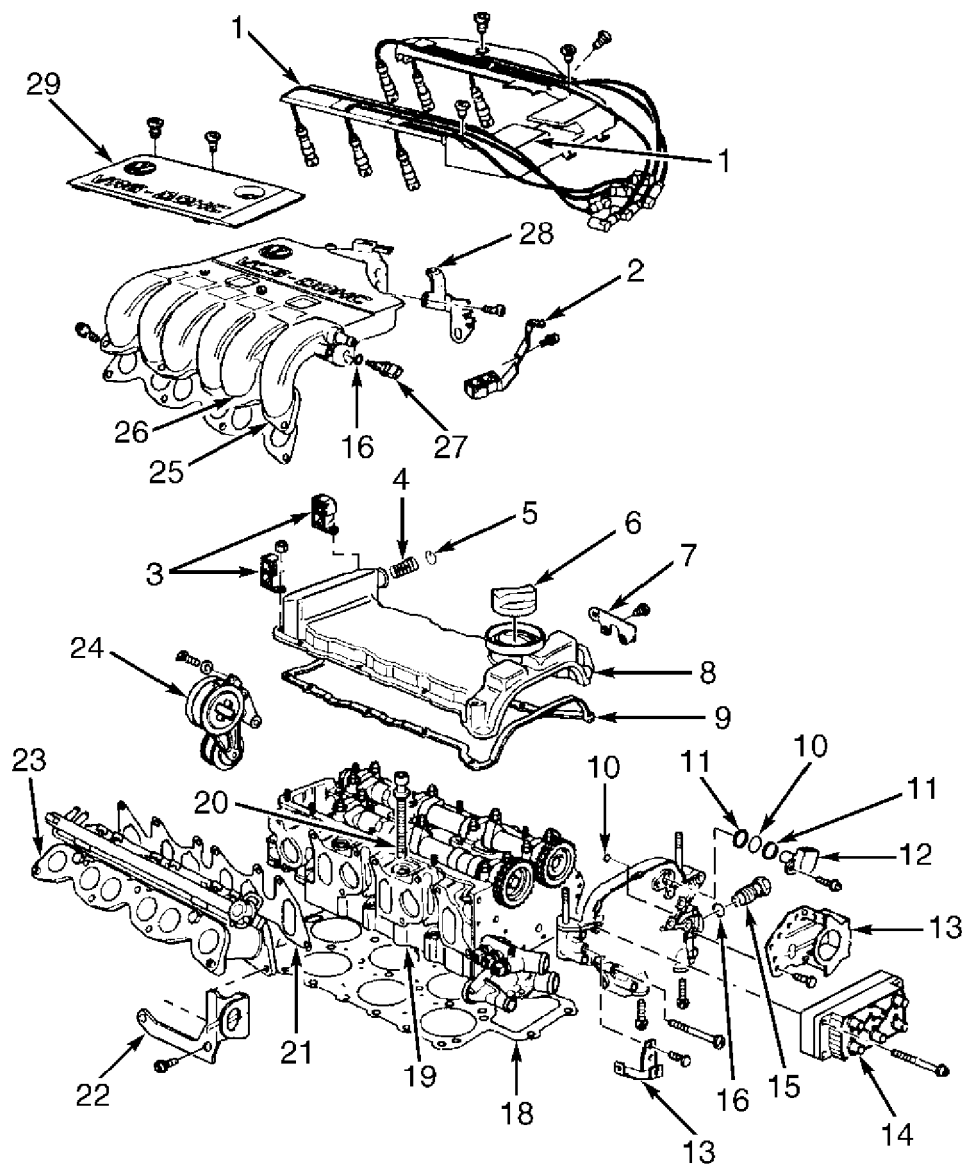
INTAKE & EXHAUST MANIFOLD

Removal and installation procedure is not available from manufacturer. See TORQUE SPECIFICATIONS.

CYLINDER HEAD

Removal (GTI & Jetta - AAA Engine)

1) Remove upper engine cover. Remove wire guide. Remove right rear support between upper intake manifold and cylinder head. Remove fuel line bracket, flame trap coil and circlip. Remove wire brackets. Remove valve cover and gasket. See Fig. 4.



- | | |
|------------------------------|-----------------------------------|
| 1. Wire Guide | 16. Seal |
| 2. Right Rear Support | 17. Camshaft Sprocket Cover |
| 3. Fuel Line Bracket | 18. Cylinder Head Gasket |
| 4. Flame Trap Coil | 19. Cylinder Head |
| 5. Circlip | 20. Cylinder Head Bolt |
| 6. Oil Filler Cap | 21. Lower Intake Manifold Gasket |
| 7. Wire Harness Bracket | 22. Lifting Eye |
| 8. Valve Cover | 23. Lower Intake Manifold |
| 9. Valve Cover Gasket | 24. Ribbed Belt Tensioner |
| 10 "O" Ring | 25. Upper Intake Manifold Gasket |
| 11. Spacer Ring | 26. Upper Intake Manifold |
| 12. Camshaft Position Sensor | 27. Intake Air Temperature Sensor |
| 13. Bracket | 28. Left Rear Support |
| 14. Ignition Coil | 29. Engine Cover |
| 15. Chain Tensioner | |

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Fig. 4: Identifying 2.8L VR6 Cylinder Head (GTI & Jetta - AAA Engine)
 Courtesy of Volkswagen United States, Inc.

2) Remove camshaft position sensor, "O" ring and spacer ring. Remove bracket for 42-pin connector and water pump. Remove ignition coil, chain tensioner and seal. Remove camshaft sprocket cover. Remove cylinder head bolts in reverse order of installation. See Fig. 7. Replace cylinder head bolts after loosening or removing.

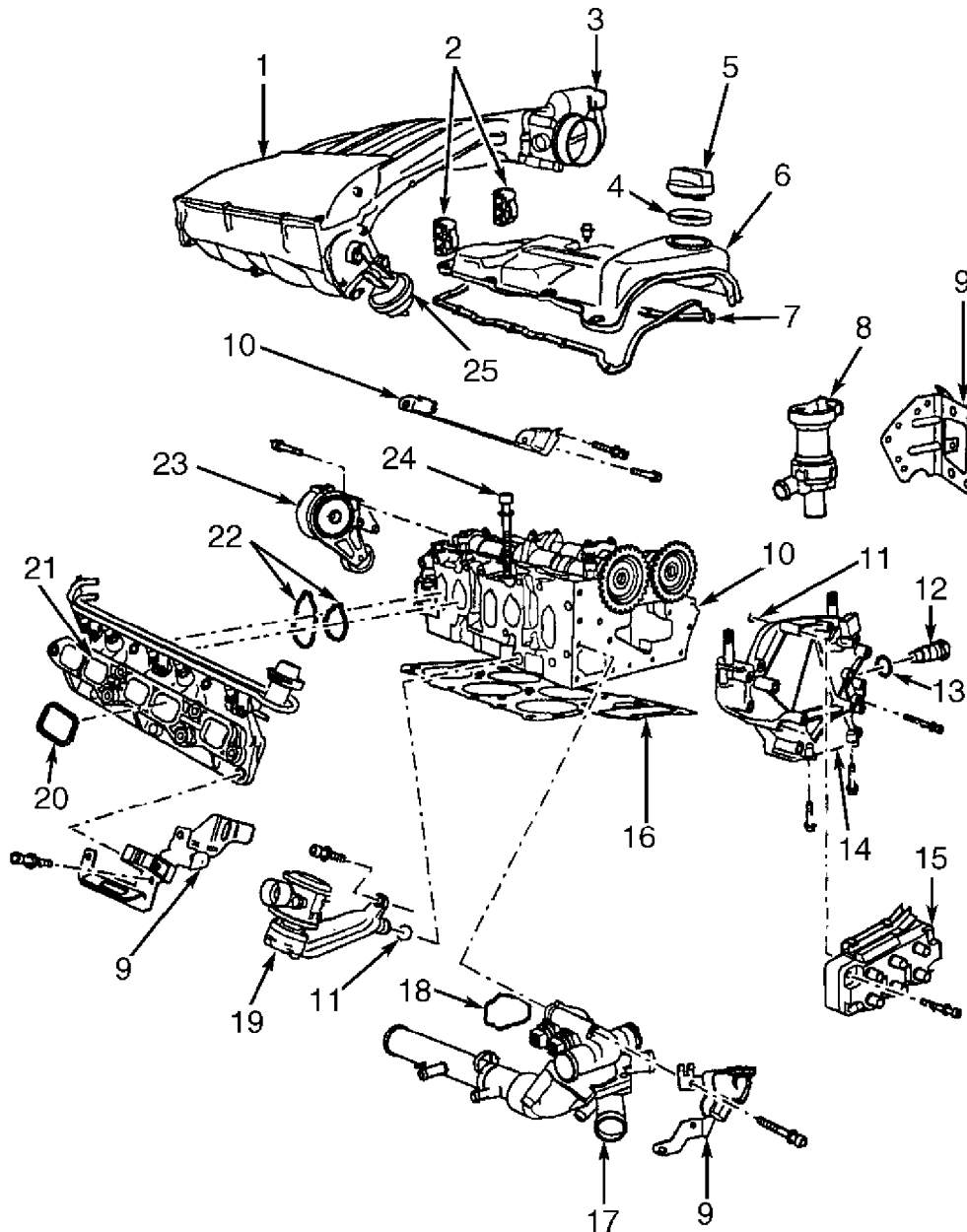
Removal (Golf & Jetta - AFP Engine)

1) Remove engine cover. Remove upper intake manifold, fuel line retainer, cylinder head and gasket. Remove Coolant Return Pump (V51) and retainer. See Fig. 5. Remove ignition coil bolt and ignition coil from cover.

2) Remove "O" ring, chain tensioner and seal ring from cover. Remove cover bolts and cover from cylinder head. Remove thermostat

housing retainer, seal, thermostat housing, O-ring and combination valve from cylinder head.

3) Remove lower intake manifold bolts, both upper and lower seals, and lower intake manifold. Remove cylinder head bolts in reverse order of installation. See Fig. 7. Replace cylinder head bolt after loosening or removing.



- | | |
|--------------------------------------|--------------------------------|
| 1. Upper Intake Manifold | 13. Seal Ring |
| 2. Retainer | 14. Cover |
| 3. Throttle With Control Unit (J338) | 15. Ignition Coil (N52) |
| 4. Profile Gasket | 16. Cylinder Head Gasket |
| 5. Gasket Cover | 17. Thermostat Housing |
| 6. Cylinder Head Cover | 18. Seal |
| 7. Cylinder Head Cover Gasket | 19. Combination Valve |
| 8. Coolant Return Pump (V51) | 20. Upper Intake Manifold Seal |
| 9. Retainer | 21. Lower Intake Manifold |
| 10. Cylinder Head | 22. Lower Intake Manifold Seal |
| 11. "O" Ring | 23. Tensioner |
| 12. Chain Tensioner | 24. Cylinder Head Screw |
| | 25. Vacuum Actuator |

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Fig. 5: Identifying 2.8L VR6 Cylinder Head (Golf & Jetta - AFP Engine)

Courtesy of Volkswagen United States, Inc.

Inspection

Thoroughly clean all gasket mating surfaces. Check cylinder head for warpage. Maximum warpage is .004" (.10 mm). Check minimum cylinder head height and replace cylinder head (if necessary). See

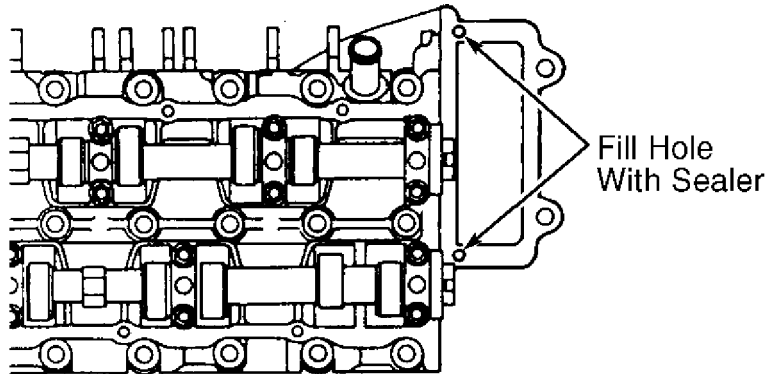
CYLINDER HEAD table under ENGINE SPECIFICATIONS.

NOTE: DO NOT reuse antifreeze after replacing cylinder block, cylinder head, head gasket, radiator and/or heater core.

Installation

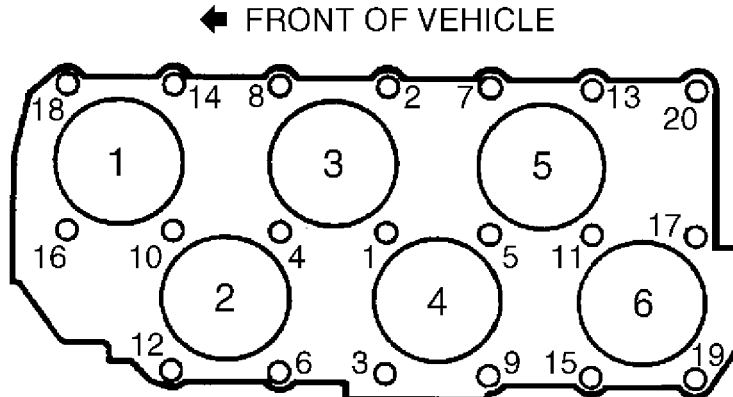
1) Remove sealer from the two 3-mm holes and replace with new sealer. See Fig. 6. Install gasket onto guide pins. Guide pins should be located near bolt holes No. 12 and 20. See Fig. 7.

2) Install cylinder head onto cylinder block. Do not use any type of sealant. Install head bolts and tighten by hand. Tighten cylinder head bolts in sequence (4 steps) to specification. See Fig. 7 . See TORQUE SPECIFICATIONS.



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Fig. 6: Sealing Cylinder Head 3-mm Holes
Courtesy of Volkswagen United States, Inc.



REMOVE IN REVERSE ORDER

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Fig. 7: Cylinder Head Bolts Tightening Sequence
Courtesy of Volkswagen United States, Inc.

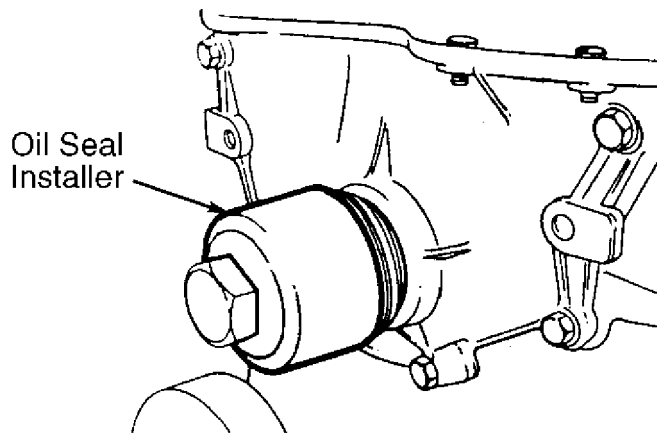
CRANKSHAFT OIL SEAL

Removal

Install 8-mm bolt in belt tensioner hole and remove accessory drive belt. See Fig. 2. Remove vibration damper. Loosen inner section of Oil Seal Extractor (3203) about 3 turns (4 mm) and lock in position with knurled screw. Turn inner section of oil seal extractor until seal is removed.

Installation

Place Guide Sleeve (3266/1) on crankshaft. Push oil seal over guide sleeve. Using Oil Seal Installer (3266) and vibration damper bolt, press oil seal in completely. See Fig. 8. Reverse removal procedure to complete installation.



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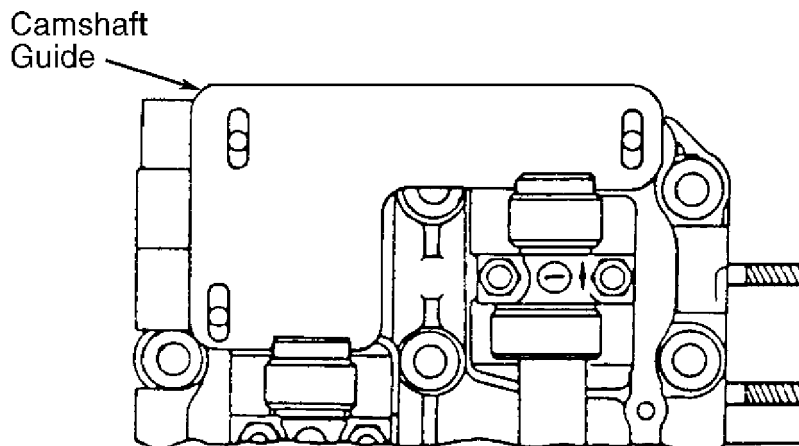
Fig. 8: Installing Crankshaft Oil Seal
 Courtesy of Volkswagen United States, Inc.

TIMING CHAIN

Removal

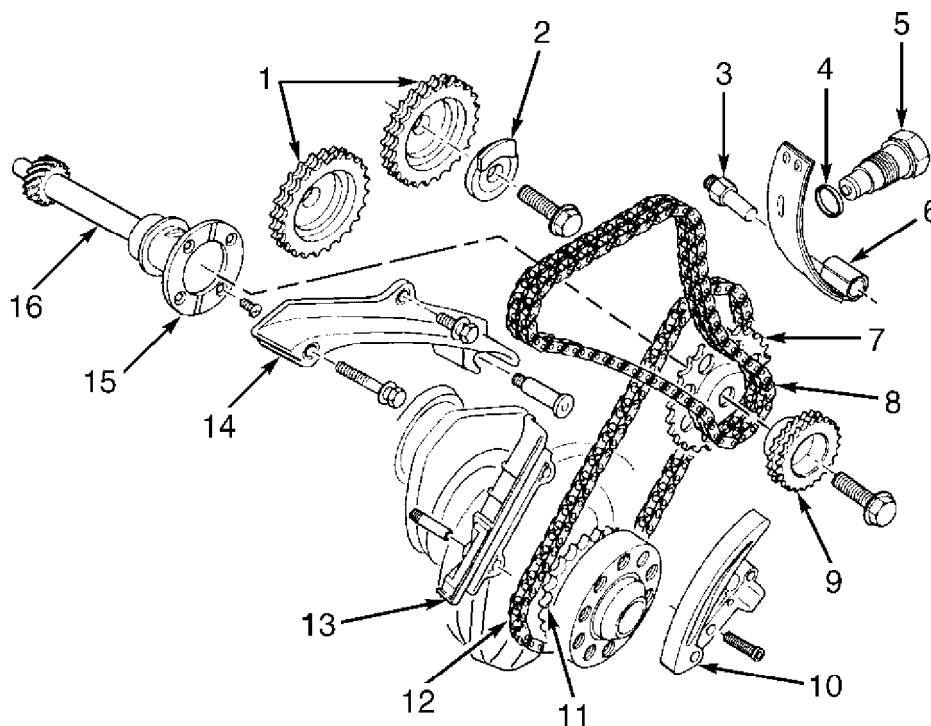
1) Removal and installation procedure is not available from manufacturer. Ensure crankshaft is aligned at TDC. Remove transaxle and bellhousing assembly. Remove torque converter or clutch assembly (as applicable). Remove valve cover. Remove camshaft sprocket cover and intermediate shaft cover. Match mark all components to ensure reassembly in original position.

2) Mark timing chains for direction of rotation. Align and install Camshaft Guide (3268) onto cylinder head bolts. See Fig. 9. Remove upper and lower chain tensioners. If necessary, remove intermediate sprocket and camshaft sprocket bolts. Remove the timing chain. See Fig. 10.



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Fig. 9: Installing Camshaft Guide Onto Cylinder Head
 Courtesy of Volkswagen United States, Inc.



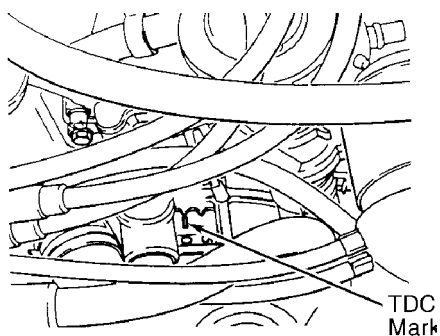
- | | |
|--------------------------|-----------------------------|
| 1. Camshaft Sprocket | 9. Double Chain Sprocket |
| 2. Sensor Wheel | 10. Single Chain |
| 3. Pivot Pin | Tensioning Plate |
| 4. Seal | 11. Crankshaft Sprocket |
| 5. Chain Tensioner | 12. Single Chain |
| 6. Double Chain | 13. Single Chain Guide Rail |
| Tensioning Plate | 14. Double Chain Guide Rail |
| 7. Single Chain Sprocket | 15. Thrust Washer |
| 8. Double Chain | 16. Intermediate Shaft |

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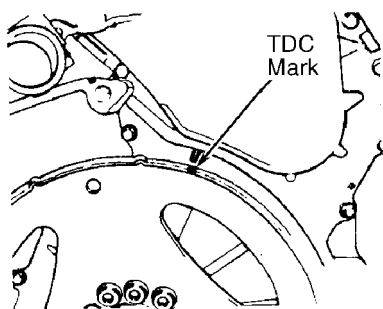
Fig. 10: Exploded View Of Timing Chain & Related Components
 Courtesy of Volkswagen United States, Inc.

Installation

Leave Camshaft Guide (3268) installed. Ensure crankshaft is aligned at TDC. See Figs. 11 or 12. Ensure intermediate shaft is correctly aligned. See Fig. 13. Install timing chain on sprockets. Reverse removal procedure to complete installation



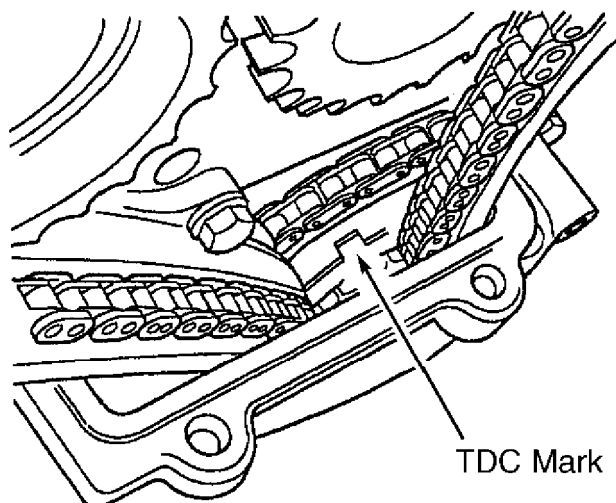
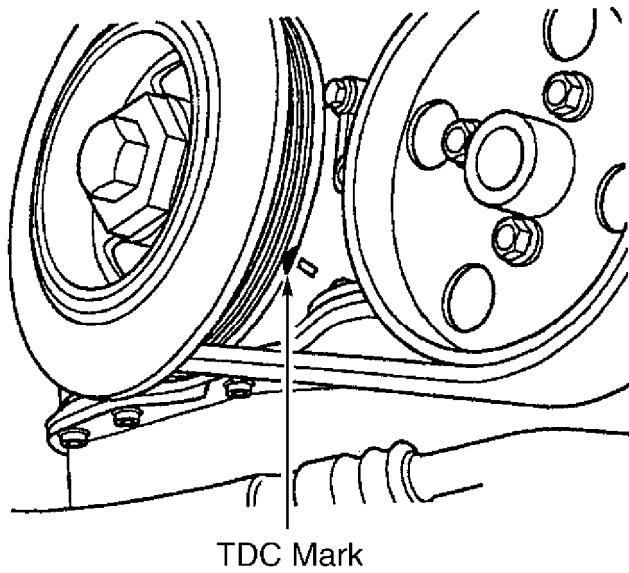
WITH TRANSAXLE INSTALLED



WITH TRANSAXLE REMOVED

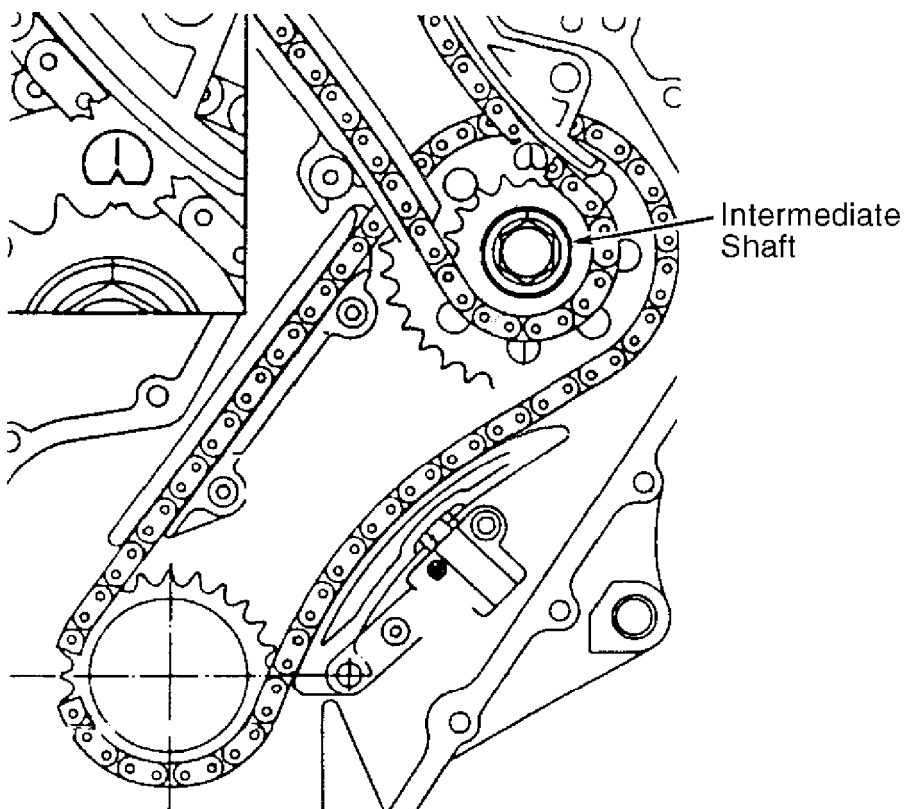
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Fig. 11: Aligning Crankshaft At TDC (GTI & Jetta - AAA Engine)
 Courtesy of Volkswagen United States, Inc.



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Fig. 12: Aligning Crankshaft At TDC (Golf & Jetta - AFP Engine)
 Courtesy of Volkswagen United States, Inc.



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Fig. 13: Aligning Intermediate Shaft At TDC
 Courtesy of Volkswagen United States, Inc.

Removal

Remove valve cover. Place crankshaft at TDC. Remove ignition coil. Remove double chain tensioner. Remove camshaft sprocket cover with camshaft position sensor attached. Remove camshaft sprockets. Mark timing chains for direction of rotation. If removing camshaft for cylinders No. 1, 3 and 5, remove bearing caps No. 1 and 7 first, then remove bearing caps No. 3 and 5. If removing camshaft for cylinders No. 2, 4 and 6, remove bearing cap No. 4 first, then remove bearing caps No. 2 and 6. Remove camshafts.

Inspection

Check camshaft bearing oil clearance. See CAMSHAFT table under ENGINE SPECIFICATIONS. If oil clearance exceeds specification, install new camshaft and recheck clearance. If clearance still exceeds specification, replace cylinder head.

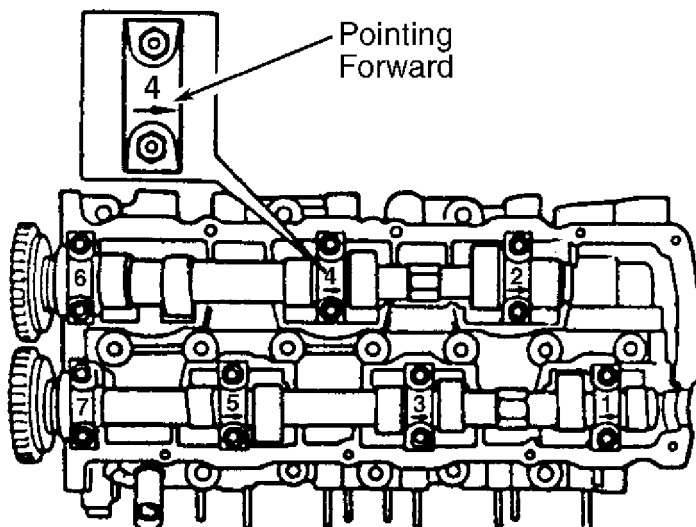
Installation

1) Lubricate all contact surfaces. When installing bearing caps, ensure identification mark on bearing cap is readable from exhaust manifold side and arrow points toward vibration damper. See Fig. 14.

2) If installing camshaft for cylinders No. 1, 3 and 5, tighten bearing caps No. 3 and 5 alternately in a diagonal sequence to 15 ft. lbs. (20 N.m). Repeat procedure for bearing caps No. 1 and 7.

3) If installing camshaft for cylinders No. 2, 4 and 6, tighten bearing caps No. 2 and 6 alternately in a diagonal sequence to 15 ft. lbs. (20 N.m). Repeat procedure for bearing cap No. 4.

4) To complete installation, reverse removal procedure. Ensure timing marks are properly aligned. If lifters are charged with oil, allow 30 minutes for lifters to bleed down before starting engine. Otherwise valves may come in contact with pistons.



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Fig. 14: Installing Camshafts Into Cylinder Head
Courtesy of Volkswagen United States, Inc.

VALVE LIFTERS

Removal & Installation

Remove camshaft. See CAMSHAFT. Remove valve lifters from cylinder head. Note position of each lifter. If lifters are reused, they MUST be installed in original position. If replacement lifters are charged with oil, allow 30 minutes for lifters to bleed down before starting engine. Otherwise, valves may come in contact with pistons. To complete installation, reverse removal procedure.

WATER PUMP

NOTE: Coolant/water mixture should be used at all times.

Removal (GTI & Jetta - AAA Engine)

1) Obtain radio security code. Turn ignition off and wait for 20 seconds. Disconnect negative battery cable. Drain cooling system. Disconnect front exhaust pipe from catalytic converter.

2) Install 8-mm bolt in belt tensioner hole and remove drive belt. See Fig. 2. Remove ignition cable guide. Disconnect front and rear motor mounts. Attach Engine Sling (2024A) to engine. See Fig. 3.

3) Lift engine enough to access water pump. Secure pulley using Spanner Wrench (VAG 1590). Remove water pump bolts. Push engine toward left side and remove water pump.

Installation

When installing motor mounts, ensure recess on engine bracket fits into mounting tab of bonded rubber bushing. Hand tighten motor mount bolts and light rock engine to ensure motor mounts are fully seated. To complete installation, reverse removal procedure.

Removal & Installation (Golf & Jetta - AFP Engine)

1) Obtain radio security code. Turn ignition off and wait for 20 seconds. Disconnect negative battery cable. Drain cooling system.

2) Remove accessory belt. Remove pulley retaining bolts and pulley from Coolant pump. Remove coolant pump bolts and coolant pump from engine block.

3) To install, reverse removal procedure. Tighten bolts to specification. See TORQUE SPECIFICATIONS.

OIL PAN

Removal & Installation

1) Remove center, left and right damping pans. Drain oil. Remove oil pan bolts. Remove oil pan using a rubber hammer if necessary. Remove sealant residue from cylinder block and oil pan. Ensure surfaces are free from grease and oil.

2) To install, apply 2-3 mm thick silicone bead around sealing surface of oil pan. Immediately install oil pan and lightly tighten all bolts. Ensure oil pan is flush with cylinder block. Tighten bolts to specification. See TORQUE SPECIFICATIONS. To complete installation, reverse removal procedures. Allow sealer to dry 30 minutes before installing engine oil.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Clean all gasket mating surfaces. Check cylinder head for warpage. Ensure warpage does not exceed .0039" (.100 mm).

Valve Stem Oil Seals

With valve springs removed, remove oil seals using Valve Seal Remover (3047A). To install new oil seal, slide plastic sleeve over valve stem. Lubricate new oil seal. Using Valve Seal Installer (3129), push oil seal on valve guide.

Valve Guides

1) Check valve-to-guide clearance specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. If valve guides have previously been replaced, replace cylinder head.

2) To replace valve guide, press guide out from camshaft side. Lubricate guide and press in cold cylinder head (from camshaft side) until shoulder makes contact. DO NOT exceed one ton pressure. Ream guides to proper valve-to-guide clearance. See CYLINDER HEAD table under ENGINE SPECIFICATIONS.

Valve Seats

1) Check valve seats before any other cylinder head service. Insert valve and hold firmly against valve seat. Measure valve stem tip-to-cylinder head distance. See Fig. 15. This measurement determines installed valve height. Subtract measured distance from minimum specification. See MINIMUM VALVE INSTALLED HEIGHT table.

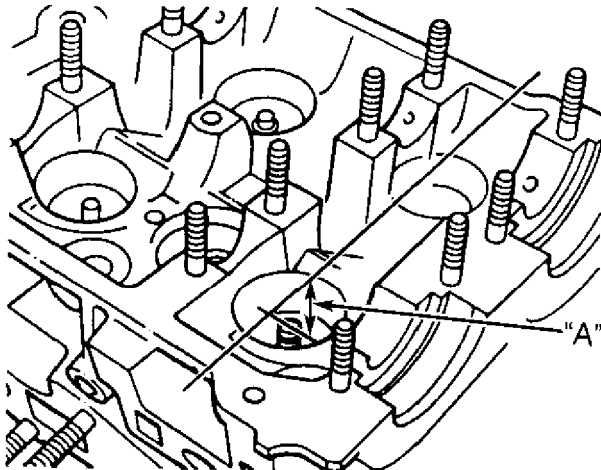
2) The difference is maximum refacing allowable for valve and seat. If valve installed height is too low or too high, lifters will not work correctly. Replace cylinder head assembly.

MINIMUM VALVE INSTALLED HEIGHT

AA

| Application | In. (mm) |
|---------------------|-------------|
| Intake Valve | 1.33 (33.9) |
| Exhaust Valve | 1.34 (34.1) |

AA



"A" = Valve Stem-To-Cylinder Head Measurement

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Fig. 15: Measuring Installed Valve Height
 Courtesy of Volkswagen United States, Inc.

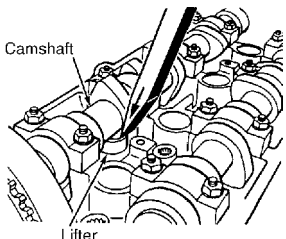
Valves

Measure valve length, stem diameter and valve margin. If not within specification, replace valves. Lap valves by hand or replace as necessary. See VALVES table under ENGINE SPECIFICATIONS.

HYDRAULIC LIFTER TEST

To determine weak or noisy lifter, position camshaft lobe high point upward. Using a piece of wood, push lifter down. See Fig. 16. If lifter moves down more than .004" (.10 mm), replace lifter. If lifter moves less than .004" (.10 mm), lifter is okay. Repeat procedure for remaining lifters.

CAUTION: If new lifters have been installed, engine must not be started for 30 minutes. Otherwise, valves may come in contact with pistons.



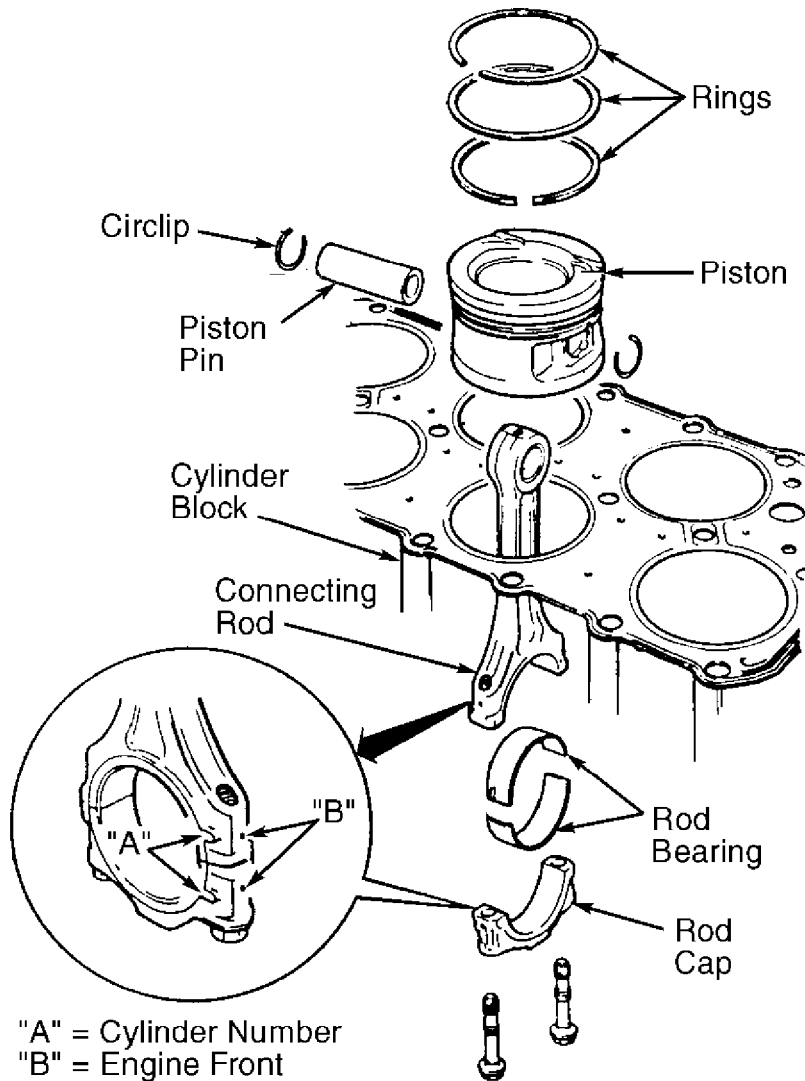
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Fig. 16: Depressing Lifter
 Courtesy of Volkswagen United States, Inc.

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Ensure piston, rod and rod caps are marked with matching cylinder number prior to removal. Ensure arrow on top of piston points toward pulleys. Ensure marks on rod and cap are positioned correctly. See Fig. 17. Rod cap bolts and nuts must be replaced after removing or loosening.



"A" = Cylinder Number
 "B" = Engine Front

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Fig. 17: Assembling Piston & Rod
 Courtesy of Volkswagen United States, Inc.

2) Mark piston in relation to pin. Remove circlips from ends of pin bore. Use Piston Pin Replacer/Installer (VW 222A) to remove and install piston pin. If pin is too tight, heat piston to 140øF (60øC). Ensure rod is properly positioned with piston.

Fitting Pistons

Measure clearances with cylinder block supported on work bench. Check clearance of piston-to-cylinder bore. Piston diameter is stamped on top of piston in millimeters.

PISTON-TO-CYLINDER BORE DIMENSIONS

| Size | Piston Diameter In. (mm) | Cylinder Bore In. (mm) |
|----------|--------------------------|------------------------|
| Standard | 3.188 (80.98) | 3.189 (81.01) |
| 1st Over | 3.208 (81.49) | 3.209 (81.51) |
| 2nd Over | 3.228 (81.98) | 3.229 (82.01) |

Piston Rings

1) Measure ring end gap. Measure ring side clearance between ring and piston. Replace if necessary. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

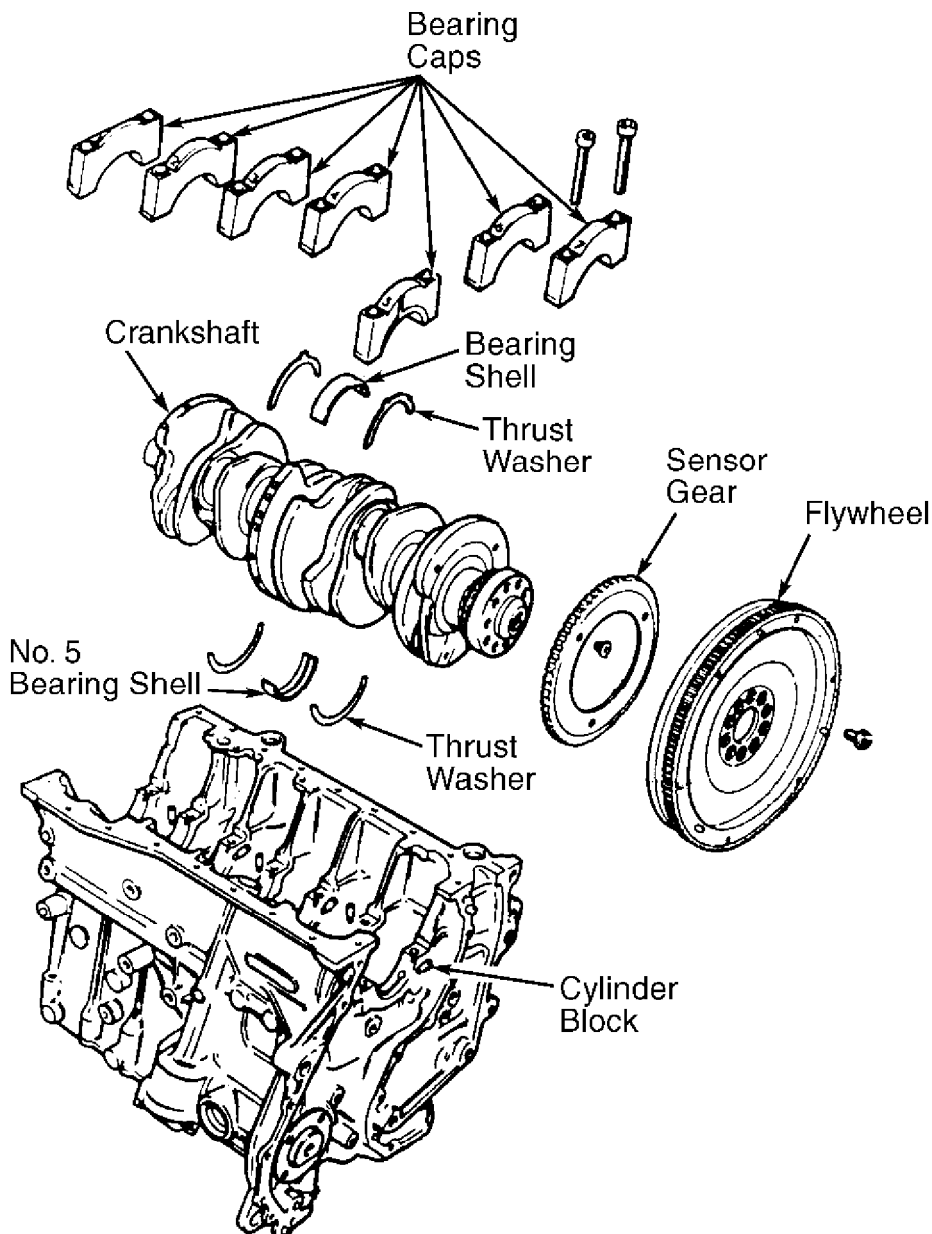
2) Install rings on piston with TOP mark facing upward. Recessed edge on outside of center ring must face piston pin (down). Position ring gaps on piston at 120-degree intervals.

Connecting Rod Bearings

Mark rod caps for reinstallation. Use Plastigage to measure bearing clearances. Measure connecting rod side play. Replace or machine as necessary. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS. Tighten evenly to specification in several steps. See TORQUE SPECIFICATIONS.

Crankshaft & Main Bearings

Main bearing caps are marked with matching journal for installation in original position. See Fig. 18. Measure crankshaft end play. See THRUST BEARING.



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Fig. 18: Exploded View Of Crankshaft Assembly
Courtesy of Volkswagen United States, Inc.

Thrust Bearing

Insert feeler gauge between No. 5 main bearing and crankshaft thrust face to measure end play. See Fig. 18. Replace thrust bearing as necessary. See CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS table under ENGINE SPECIFICATIONS.

Cylinder Block

Check cylinder bore for wear, out-of-round and taper. Check cylinder block for warpage. See CYLINDER BLOCK table under ENGINE SPECIFICATIONS.

ENGINE OILING

ENGINE LUBRICATION SYSTEM

Crankcase Capacity

See CRANKCASE CAPACITY table.

CRANKCASE CAPACITY

| Engine Code | With Filter Replacement | Without Filter Replacement |
|-------------|-------------------------|----------------------------|
| AAA | 5.8 Qts. (5.5L) | 5.3 Qts. (5.0L) |
| AFP | 6.4 Qts. (6.1L) | 5.9 Qts. (5.6L) |

Oil Pressure

Check oil pressure with engine at warm operating temperature. Minimum oil pressure at 2000 RPM is 29 psi (2.0 kg/cm²). If oil pressure is incorrect, check oil pump and oil pressure relief valve.

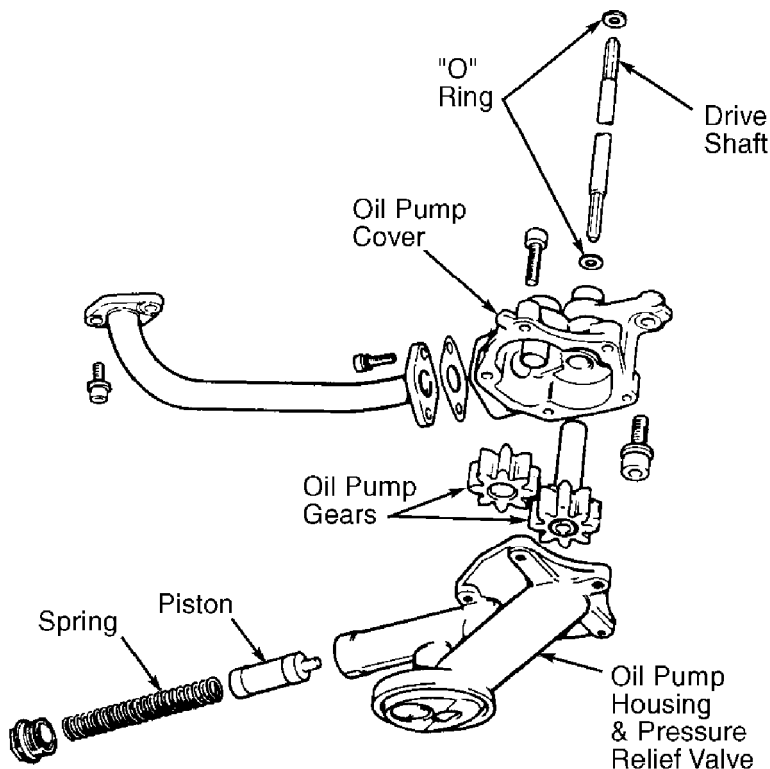
OIL PUMP

Removal & Installation

Remove oil pan. Remove oil pump attaching bolts and remove oil pump assembly. To install, reverse removal procedure.

Inspection

Check oil pump housing, gears and pressure relief valve for damage or excessive wear. See Fig. 19. Repair or replace as an assembly.



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Fig. 19: Oil Pump Assembly
 Courtesy of Volkswagen United States, Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

AA

| Application | Ft. Lbs. (N.m) |
|--|-----------------------------------|
| A/C Bracket-To-Engine Bolt | 18 (25) |
| Axle Shaft-To-Transaxle Drive Flange Bolt | 33 (45) |
| Camshaft Bearing Cap Bolt | 15 (20) |
| Camshaft Sprocket Bolt | 74 (100) |
| Connecting Rod Bolt | |
| Step 1 | 22 (30) |
| Step 2 | Additional 1/4 Turn (90 Degrees) |
| Crankshaft Main Bearing Cap Bolt | |
| Step 1 | 22 (30) |
| Step 2 | Additional 1/2 Turn (180 Degrees) |
| Cylinder Head Bolt (1) | |
| Step 1 | 30 (40) |
| Step 2 | 44 (60) |
| Step 3 | Additional 1/4 Turn (90 Degrees) |
| Step 4 | Additional 1/4 Turn (90 Degrees) |
| Engine Bracket (Front) | 44 (60) |
| Engine Bracket (To Body) | 44 (60) |
| Engine-To-Transaxle | |
| M12 Bolt | 59 (80) |
| M10 Bolt | 44 (60) |
| M7 Bolt | (2) |
| M6 Bolt | |
| Fig. 2 | |
| Exhaust Manifold-To-Cylinder Head Bolt & Nut | 18 (25) |
| Exhaust Pipe-To-Catalytic Converter Bolt | 18 (25) |
| Exhaust Pipe-To-Manifold Nut | 30 (40) |
| Flywheel-To-Crankshaft Bolt | |
| Step 1 | 44 (60) |
| Step 2 | Additional 1/4 Turn (90 Degrees) |
| Guide Rail Bolt | 15 (20) |
| Intake Manifold | 18 (25) |
| Intermediate Shaft Sprocket Bolt | 74 (100) |
| Oil Pan Bolt | 11 (15) |
| Oil Pan Drain Plug | 22 (30) |
| Oil Pressure Switch | 18 (25) |
| Oil Pump Cover Long Bolt | (2) |
| Oil Pump Cover Short Bolt | 18 (25) |
| Power Steering Pump Bracket Bolt | 18 (25) |
| Pressure Plate Bolt | 15 (20) |
| Starter Mount Bolt | 44 (60) |
| Timing Chain (Double Row) Tensioner Nut | 22 (30) |
| Torque Converter-To-Carrier Plate Bolt | 22 (30) |
| Vibration Damper Bolt | |
| Step 1 | 89 (120) |
| Step 2 | Additional 1/4 Turn (90 Degrees) |
| Water Pump Pulley Bolt | 18 (25) |
| Water Pump Housing-To-Engine Bolt | 15 (20) |

INCH Lbs. (N.m)

| | |
|--|----------------------------------|
| Fuel Rail Bolt (Lower) | 89 (10) |
| Intermediate Shaft Retainer Plate Bolt | 89 (10) |
| Sensor Wheel Bolt | |
| Step 1 | 89 (10) |
| Step 2 | Additional 1/4 Turn (90 Degrees) |
| Timing Chain (Single Row) Tensioner Bolt | 89 (10) |
| Valve Cover Retaining Nut | 89 (10) |

- (1) - Never reuse cylinder head bolt(s) when servicing.
- (2) - Tighten bolt to 89 INCH lbs. (10 N.m).

AA

ENGINE SPECIFICATIONS

GENERAL SPECIFICATIONS

GENERAL SPECIFICATIONS

AA

| Application | Specification |
|-------------------------|--------------------|
| Displacement | 170 Cu. In. (2.8L) |
| Bore | 3.19" (81.0 mm) |
| Stroke | 3.56" (90.3 mm) |
| Compression Ratio | 10.0:1 |
| Fuel System | Motronic SFI |

AA

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS

AA

| Application | In. (mm) |
|--------------------------------|-----------------------------|
| Crankshaft | |
| End Play | |
| Standard | .003-.009 (.07-.23) |
| Service Limit | .012 (.30) |
| Runout | .001 (.03) |
| Main Bearings | |
| Journal Diameter | 2.361-2.362 (59.958-59.978) |
| Journal Out-Of-Round | .001 (.03) |
| Journal Taper | .001 (.03) |
| Oil Clearance | |
| Standard | .0008-.0020 (.02-.06) |
| Service Limit | .0039 (.100) |
| Connecting Rod Bearings | |
| Journal Diameter | 2.124-2.125 (53.958-53.978) |
| Journal Out-Of-Round | .001 (.03) |
| Journal Taper | .001 (.03) |
| Oil Clearance | |
| Standard | .0004-.0020 (.01-.06) |
| Service Limit | .0039 (.100) |

AA

PISTONS, PINS & RINGS

PISTONS, PINS & RINGS

AA

| Application | In. (mm) |
|------------------|---------------------|
| Pistons | |
| Clearance | .0016 (.040) |
| Diameter | 3.188 (80.99) |
| Pins | |
| Diameter | (1) |
| Piston Fit | Interference Fit |
| Rod Fit | Interference Fit |
| Rings | |
| No. 1 | |
| End Gap | |
| Standard | .008-.016 (.20-.40) |

| | | |
|----------------|-------|---------------------|
| Service Limit | ..... | .0039 (.100) |
| Side Clearance | | |
| Standard | ..... | .001-.003 (.02-.07) |
| Service Limit | ..... | .006 (.15) |
| No. 2 | | |
| End Gap | | |
| Standard | ..... | .008-.016 (.20-.40) |
| Service Limit | ..... | .0039 (.100) |
| Side Clearance | | |
| Standard | ..... | .001-.003 (.02-.07) |
| Service Limit | ..... | .006 (.15) |
| No. 3 (Oil) | | |
| End Gap | | |
| Standard | ..... | .010-.020 (.25-.50) |
| Service Limit | ..... | .0039 (.100) |
| Side Clearance | ..... | .001-.002 (.02-.05) |

(1) - Information is not available from manufacturer.

AA

CYLINDER BLOCK

CYLINDER BLOCK

AA

Application In. (mm)

Cylinder Bore

| | | |
|----------------------|-------|---------------|
| Standard Diameter | ..... | 3.189 (81.01) |
| Maximum Taper | ..... | .0032 (.08) |
| Maximum Out-Of-Round | ..... | .001 (.03) |

AA

OIL PUMP

OIL PUMP

AA

Application Specification

Pump Gear Clearance

| | | |
|------------------|-------|------------------|
| Radial (Maximum) | ..... | .008" (.20 mm) |
| Axial (Maximum) | ..... | .0039" (.100 mm) |

AA

VALVES

VALVES

AA

Application Specification

Intake Valves

| | | |
|--------------------|-------|---------------------|
| Face Angle | ..... | 45ø |
| Head Diameter | ..... | 1.535" (39.00 mm) |
| Length | ..... | 4.1713" (105.95 mm) |
| Minimum Margin (1) | ..... | (2) |
| Stem Diameter | ..... | .2744" (6.97 mm) |

Exhaust Valves

| | | |
|--------------------|-------|---------------------|
| Face Angle | ..... | 45ø |
| Head Diameter | ..... | 1.346" (34.20 mm) |
| Length | ..... | 4.2106" (106.95 mm) |
| Minimum Margin (1) | ..... | (2) |
| Stem Diameter | ..... | .2736" (6.95 mm) |

(1) - DO NOT machine valves; hand lap only.

(2) - Information is not available from manufacturer.

AA

CYLINDER HEAD

CYLINDER HEAD

AA

Application Specification

Cylinder Head Height (Minimum) 5.492" (139.5 mm)
Maximum Warpage0039" (.100 mm)

Valve Seats

Intake Valve

Seat Angle 45ø
Seat Width055-.079" (1.4-2.0 mm)

Exhaust Valve

Seat Angle 45ø
Seat Width079-.098" (2.0-2.5 mm)

Valve Guides

Intake Valve

Valve Guide Installed Height (1)
Oil Clearance (2) .040" (1.0 mm)

Exhaust Valve

Valve Guide Installed Height (1)
Valve Stem-To-Guide Oil Clearance (2) .051" (1.30 mm)

- (1) - Valve guide shoulder flush with cylinder head.
(2) - New valve installed in cylinder head. Dial indicator used to measure valve rock in guide.

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CAMSHAFT

CAMSHAFT

AA

Application In. (mm)

End Play006 (.15)
Oil Clearance0039 (.100) Maximum
Runout0004 (.01) Maximum

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END OF ARTICLE