

2.5L 5-CYL

Article Text

1993 Volkswagen EuroVan
For Volkswagen Technical Site
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Saturday, March 18, 2000 10:18PM

ARTICLE BEGINNING

1993 VOLKSWAGEN ENGINES
2.5L 5-Cylinder

EuroVan

* PLEASE READ THIS FIRST *

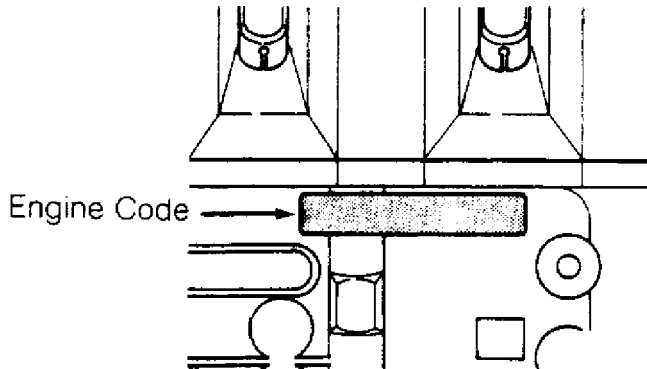
NOTE: For engine repair procedures not covered in this article, see ENGINE OVERHAUL PROCEDURES - GENERAL INFORMATION article in the GENERAL INFORMATION section.

ENGINE IDENTIFICATION

Engine identification number is stamped on a machined pad, between No. 3 and 5 cylinders. See Fig. 1. The engine code is also listed on a sticker attached to the timing belt cover.

ENGINE IDENTIFICATION CODES TABLE

Application	Engine Code
EuroVan	
2.5L 5-Cylinder 10-Valve	AAF



93F83001

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

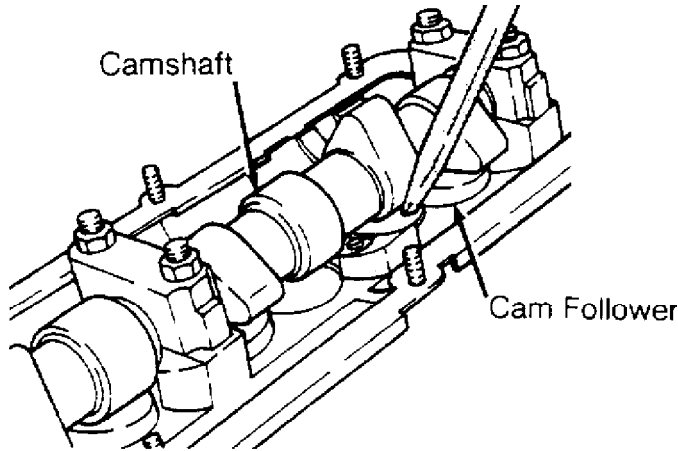
ADJUSTMENTS

HYDRAULIC LIFTER (CAM FOLLOWER) TEST

To determine weak or noisy lifter, position camshaft lobe high point upward. Using a piece of wood, push cam follower down. See

2.5L 5-CYL
Article Text (p. 2)
1993 Volkswagen EuroVan
For Volkswagen Technical Site
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Saturday, March 18, 2000 10:18PM

Fig. 2. If cam follower moves down more than .004" (.10 mm), replace cam follower. If cam follower moves less than .004" (.10 mm), cam follower is okay. Repeat procedure for remaining cam followers.



93G83002

Fig. 2: Measuring Cam Follower Clearance
Courtesy of Volkswagen United States, Inc.

REMOVAL & INSTALLATION

NOTE: The engine must be removed from below vehicle with transaxle attached. Match mark engine mounts to ensure original alignment position after installation.

FUEL PRESSURE RELEASE

Remove fuel pump relay (located in fuse/relay panel). Crank engine for 5 seconds. Reinstall fuel pump relay.

ENGINE

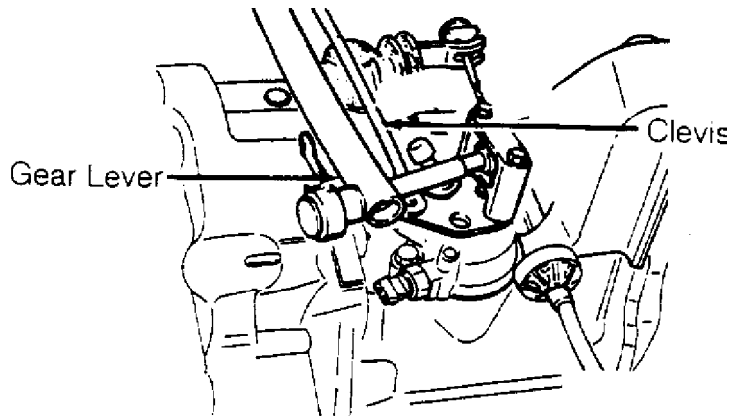
Removal

- 1) Obtain radio code. Disconnect negative battery cable. Support upper control arms with Wedge (3250). Drain cooling system. Disconnect cooling fan and thermostitch.
- 2) Label and disconnect electrical wiring and vacuum hoses. Disconnect throttle, cruise and kickdown linkage. Remove air duct from intake manifold. Remove shifting linkage clevis, and pry up on shift lever. See Fig. 3.
- 3) Disconnect shift rod. Disconnect power steering hoses and allow to drain. Remove left drive axle and disconnect right drive axle. See FWD AXLE SHAFTS article in DRIVE AXLES. Disconnect exhaust pipe from exhaust manifold.
- 4) Bolt Adapter Bracket (3227) to cylinder block. Raise transaxle slightly using Transaxle Jack (1383A). See Fig. 4. Remove 2 engine and transaxle mount bolts. Lower engine and transaxle out of

vehicle.

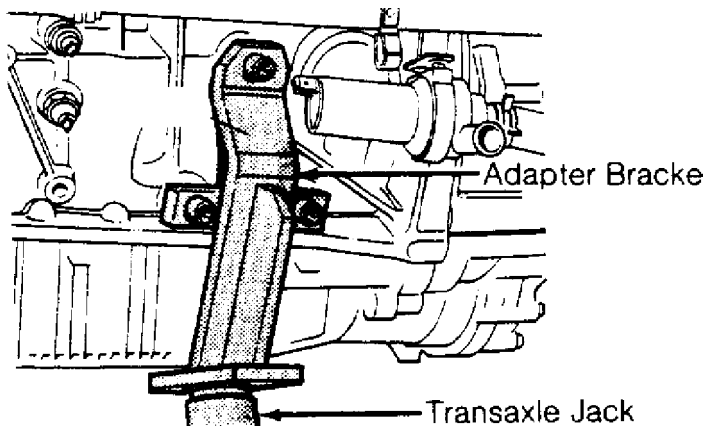
Installation

Reverse removal procedure to complete installation. Use **NEW** self-locking nuts. Ensure engine mounts are installed to original location. Tighten engine mount bolts to specification with engine running at idle. See **TORQUE SPECIFICATIONS** table.



93H83003

Fig. 3: Removing Shift Linkage
Courtesy of Volkswagen United States, Inc.



93I83004

Fig. 4: Raising Transaxle
Courtesy of Volkswagen United States, Inc.

INTAKE MANIFOLD

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

2.5L 5-CYL

Article Text (p. 4)

1993 Volkswagen EuroVan

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Saturday, March 18, 2000 10:18PM

EXHAUST MANIFOLD

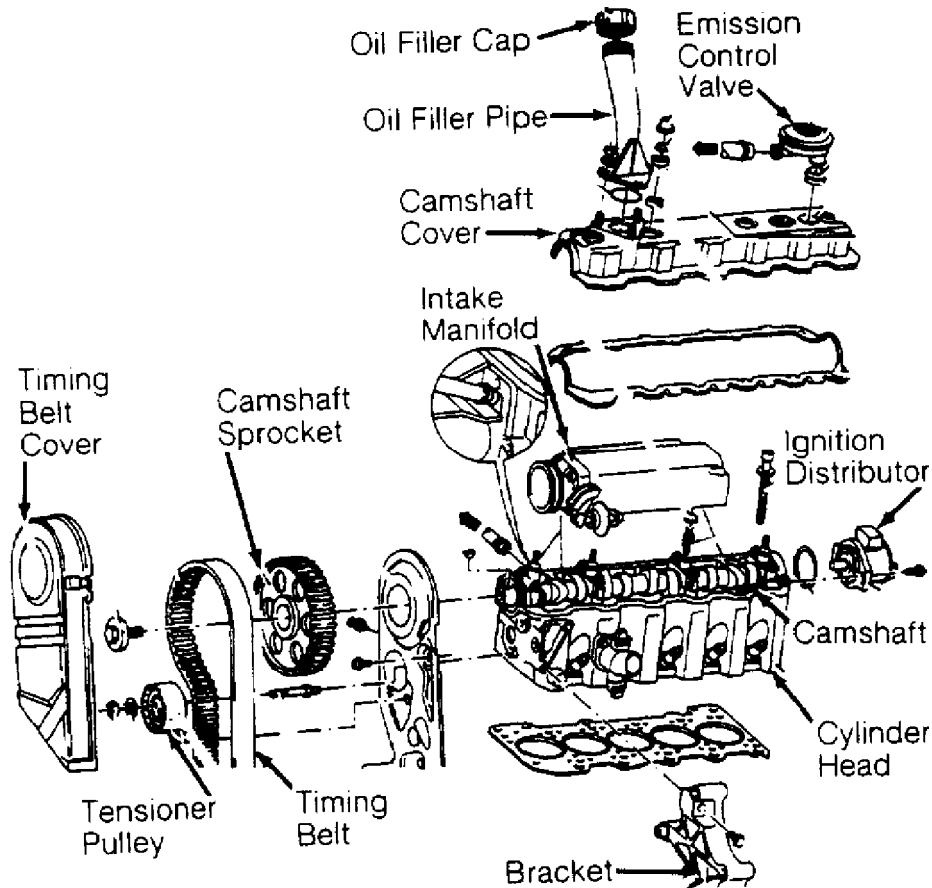
Removal and installation procedure is not available from manufacturer. See TORQUE SPECIFICATIONS table.

CYLINDER HEAD

Removal

1) Removal and installation procedure is not available from manufacturer. Cylinder head may be removed with engine in vehicle. Match mark all components for installation reference.

2) Remove timing belt. See TIMING BELT under REMOVAL & INSTALLATION. Remove cylinder head bolts in reverse sequence of installation. See Fig. 6. Replace cylinder head bolts after loosening or removing.



93J83005

Fig. 5: Identifying 2.5L Cylinder Head (10-Valve)
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

2.5L 5-CYL

Article Text (p. 5)

1993 Volkswagen EuroVan
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cylinder head height and replace cylinder head (if necessary).

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

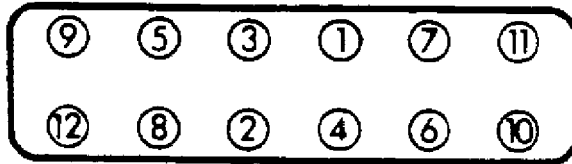
Installation

1) Ensure OBEN marking on cylinder head gasket faces up. Install Guide Pins (3070) into cylinder head bolts holes No. 9 and 10. See Fig. 6. Install gasket onto guide pins.

2) Install cylinder head onto cylinder block. Do not use any type of sealant. Install remaining head bolts and tighten by hand. Remove Guide Pins (3070) and install head bolts No. 9 and 10.

3) Tighten cylinder head bolts (in 3 steps) in sequence to specification. See Fig. 6. See the TORQUE SPECIFICATIONS table.

◆FRONT OF VEHICLE



REMOVE IN REVERSE ORDER

93A83006

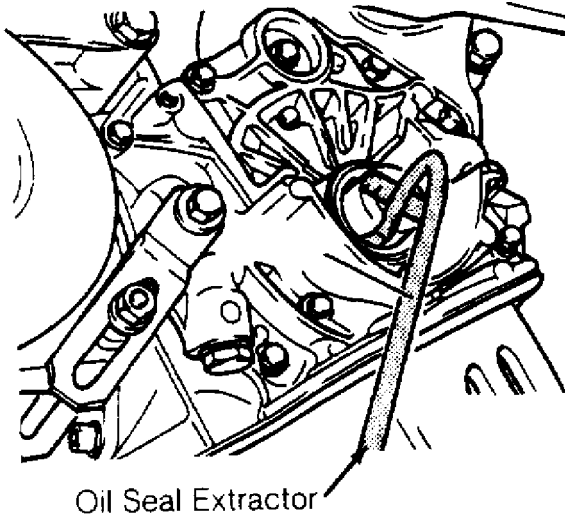
Fig. 6: Cylinder Head Bolts Tightening Sequence
Courtesy of Volkswagen United States, Inc.

FRONT COVER OIL SEAL

Removal

1) Remove timing belt. Remove vibration damper and crankshaft sprocket. Using Oil Seal Extractor (2086), remove front cover seal. See Fig. 7.

2) Lubricate threaded area of extractor and push in as far as possible. Loosen set screw and turn inner part of extractor until oil seal is removed.



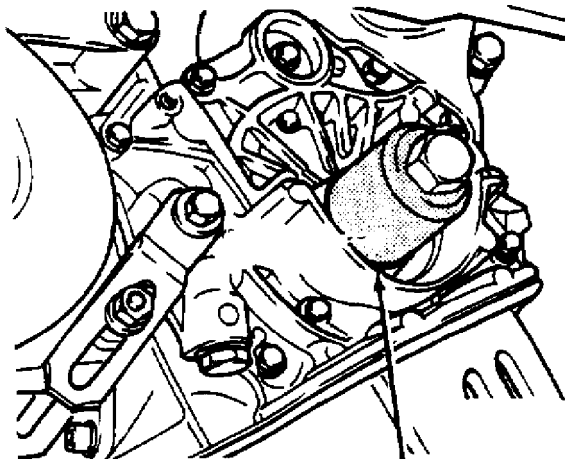
Oil Seal Extractor

93B83007

Fig. 7: Removing Front Cover Oil Seal
Courtesy of Volkswagen United States, Inc.

Installation

Lubricate outer edge and lip of new seal. Use bolt and Oil Seal Installer (2080A) to install oil seal. See Fig. 8. Insert bolt through oil seal installer and thread bolt all the way into crankshaft. Press seal completely into position. To complete installation, reverse removal procedure.



Oil Seal Installer

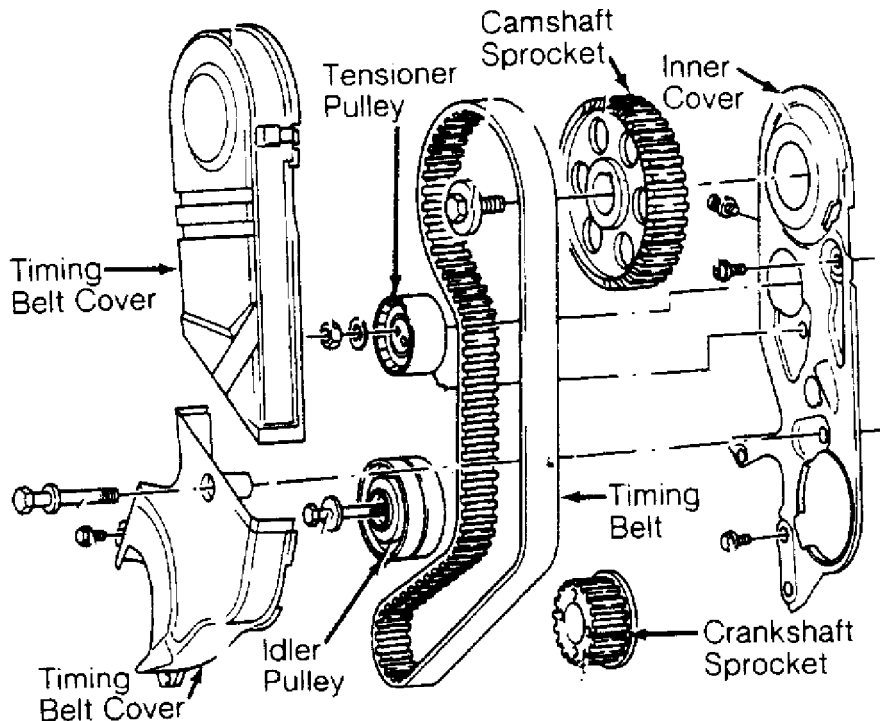
93C83008

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

Removal

1) Match mark all components to ensure reassembly in original position. Loosen tensioner and remove accessory drive belt. Remove vibration damper and timing belt cover.

2) Set crankshaft sprocket at TDC position and mark for reassembly reference. DO NOT turn crankshaft with belt removed. Loosen tensioner pulley and water pump. Remove timing belt. See Fig. 9.



93D83009

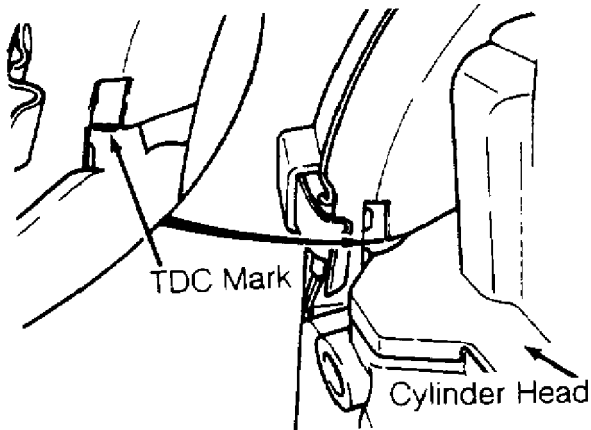
Fig. 9: Exploded View Of Timing Belt & Related Components
Courtesy of Volkswagen United States, Inc.

Installation

1) Ensure crankshaft is aligned at TDC. Align camshaft sprocket timing marks. See Fig. 10. Install timing belt on camshaft sprocket and crankshaft sprocket.

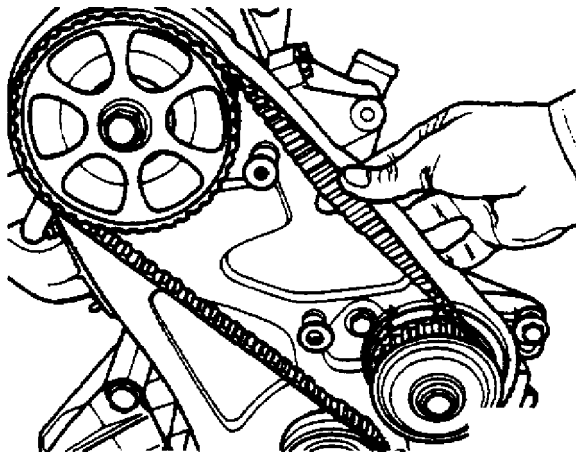
2) On models equipped with tensioner, loosen tensioner nut. Rotate tensioner clockwise to tighten belt and install lock nut. By hand, rotate crankshaft 2 turns and check timing mark alignment.

3) On models not equipped with tensioner, loosen water pump and move upward until slack in timing belt is eliminated. On all models, proper deflection is achieved when longest span of belt between sprockets can be twisted 90 degrees. See Fig. 11. To complete installation, reverse removal procedure.



93G83010

Fig. 10: Aligning Camshaft Timing Marks
Courtesy of Volkswagen United States, Inc.



93H83011

Fig. 11: Checking Timing Belt Tension
Courtesy of Volkswagen United States, Inc.

CAMSHAFT

Removal

1) Remove upper timing belt cover. Remove valve cover and camshaft cover. Place camshaft at TDC. See Fig. 10. Remove timing belt from camshaft sprocket.

2) Use puller to remove camshaft sprocket. Remove Woodruff key from camshaft. Remove distributor. Remove bearing caps No. 1 and 3. Loosen bearing caps No. 2 and 4 alternately in a diagonal sequence. Remove camshaft.

2.5L 5-CYL

Article Text (p. 9)

1993 Volkswagen EuroVan
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Saturday, March 18, 2000 10:18PM

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. Place camshaft in cylinder head with both high points of lobes for No. 1 cylinder facing upward. Install bearing caps.

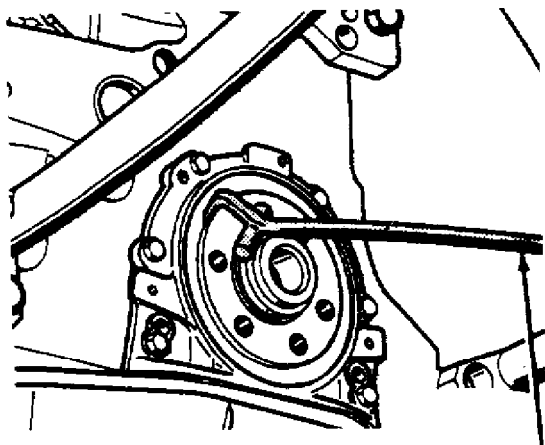
2) Tighten bearing caps No. 2 and 4 alternately in a diagonal sequence to 15 ft. lbs. (20 N.m). Repeat procedure for bearing caps No. 1 and 3. Install Woodruff key in camshaft.

3) To complete installation, reverse removal procedure. Ensure timing marks are properly aligned. Before starting engine, allow 30 minutes for cam followers to bleed down.

REAR CRANKSHAFT OIL SEAL

Removal & Installation

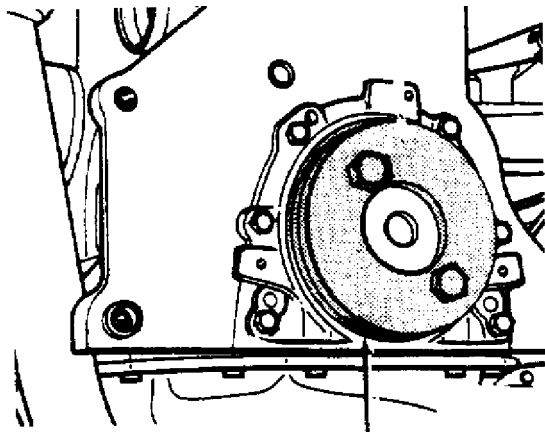
Remove flywheel/flexplate, and discard bolts. Remove retaining flange. Using Oil Seal Extractor (10-221), remove oil seal. See Fig. 12. Use Seal Installer (2003/1) to install seal. See Fig. 13. To complete installation, reverse removal procedure. Install new flywheel/flex plate bolts.



Oil Seal Extractor

93183012

Fig. 12: Removing Rear Crankshaft Oil Seal
Courtesy of Volkswagen United States, Inc.



Oil Seal Installer

93J83013

Fig. 13: Installing Crankshaft Rear Oil Seal
Courtesy of Volkswagen United States, Inc.

WATER PUMP

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

Removal & Installation

1) Disconnect negative battery cable. Turn heater control to hot. Drain cooling system. Remove accessories and brackets (as necessary).

2) Label and remove coolant hoses from water pump. Remove water pump pulley. Remove bolts and remove water pump assembly. To install, reverse removal procedure.

OIL PAN

Oil pan can be removed and installed with engine in vehicle. No further information is available from manufacturer.

OVERHAUL

CYLINDER HEAD

Cylinder Head

Clean all gasket mating surfaces. Check cylinder head for warpage. Ensure warpage does not exceed .004" (0.1 mm).

Valve Stem Oil Seals

Install seals using Valve Seal Replacer/Sleeve (10-204). DO NOT install valve seal without using sleeve.

Valve Guides

2.5L 5-CYL
Article Text (p. 11)
 1993 Volkswagen EuroVan
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 Saturday, March 18, 2000 10:18PM

- 1) Check valve-to-guide clearance specification. See CYLINDER HEAD table under ENGINE SPECIFICATIONS. To replace valve guide, press guide out from combustion chamber side.
- 2) Press guide 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 the valve and hold firmly against the valve seat. Measure valve stem tip-to-cylinder head distance. See Fig. 14.
- 2) Valve stem tip-to-cylinder head distance determines installed valve height. Subtract measured distance from minimum specification. See MINIMUM VALVE INSTALLED HEIGHT table.

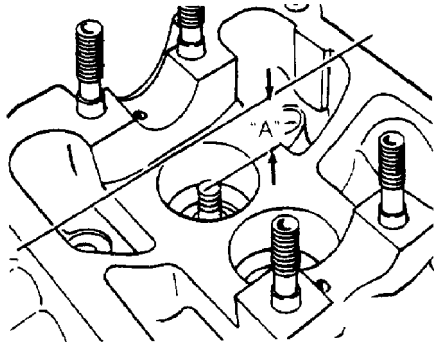
MINIMUM VALVE INSTALLED HEIGHT SPECIFICATIONS TABLE

Application	In. (mm)
Intake Valve	1.33 (33.8)
Exhaust Valve	1.34 (34.1)

- 3) The difference is maximum refacing allowable for valve and seat. If valve installed height is too high, replace cylinder head assembly. If valve installed height is too low or too high, cam followers will not work correctly.

Valves

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



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

93A83014

Fig. 14: Measuring Valve Installed Height
 Courtesy of Volkswagen United States, Inc.

2.5L 5-CYL

Article Text (p. 12)

1993 Volkswagen EuroVan

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Saturday, March 18, 2000 10:18PM

CYLINDER BLOCK ASSEMBLY

Piston & Rod Assembly

1) Make sure piston, rod and rod caps are marked with matching cylinder number prior to removal. Ensure arrow on top of piston points toward pulleys.

2) Ensure marks exists on rod and cap are positioned correctly. See Fig. 15. Rod cap bolts and nuts must be replaced after removing or loosening. Mark piston in relation to pin. Remove circlips from ends of pin bore.

3) Use Piston Pin Replacer/Installer (VW 222A) to remove and install piston pin. If pin is too tight, heat piston to 140°F (60°C). Ensure rod is properly positioned with piston. See Fig. 15.

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.

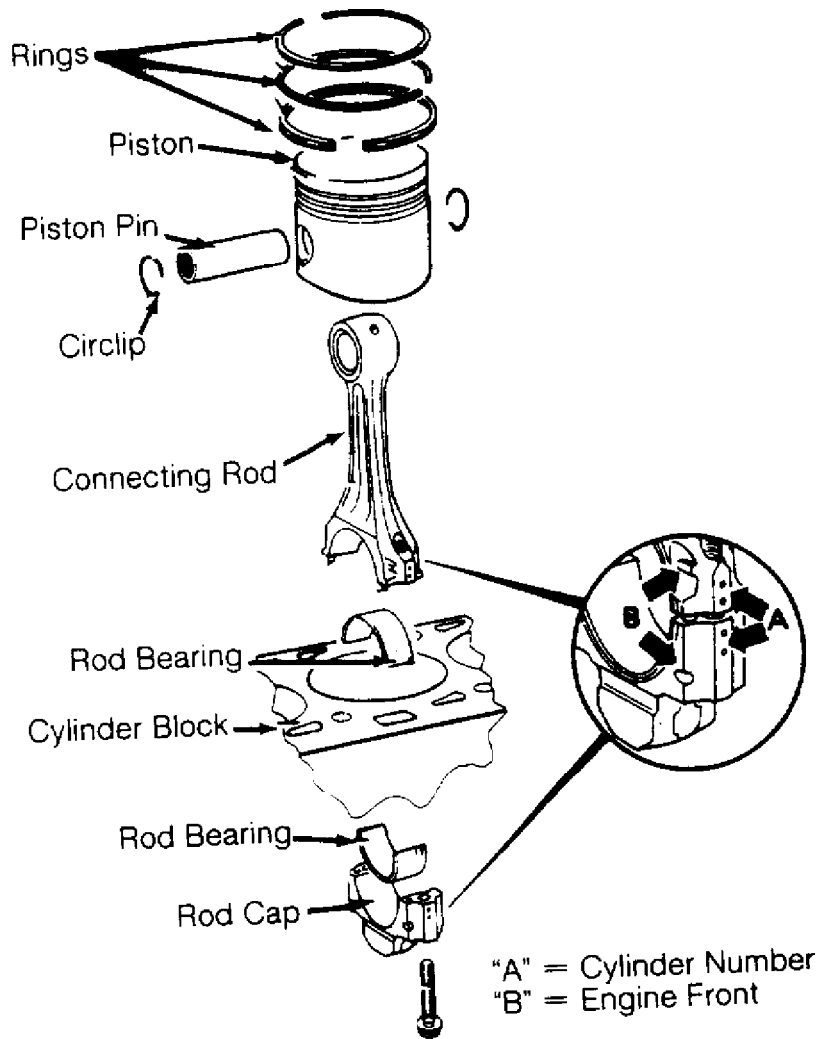
PISTON-TO-CYLINDER BORE DIMENSIONS TABLE

Size	Piston Diameter In. (mm)	Cylinder Bore In. (mm)
Standard	3.188 (80.98)	3.189 (81.01)
1st Over	3.198 (81.23)	3.199 (81.26)
2nd Over	3.208 (81.48)	3.209 (81.51)

Piston Rings

1) Measure ring end gap. Measure ring side clearance with piston. If not within specification, replace as necessary. See PISTONS, PINS & RINGS table under ENGINE SPECIFICATIONS.

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



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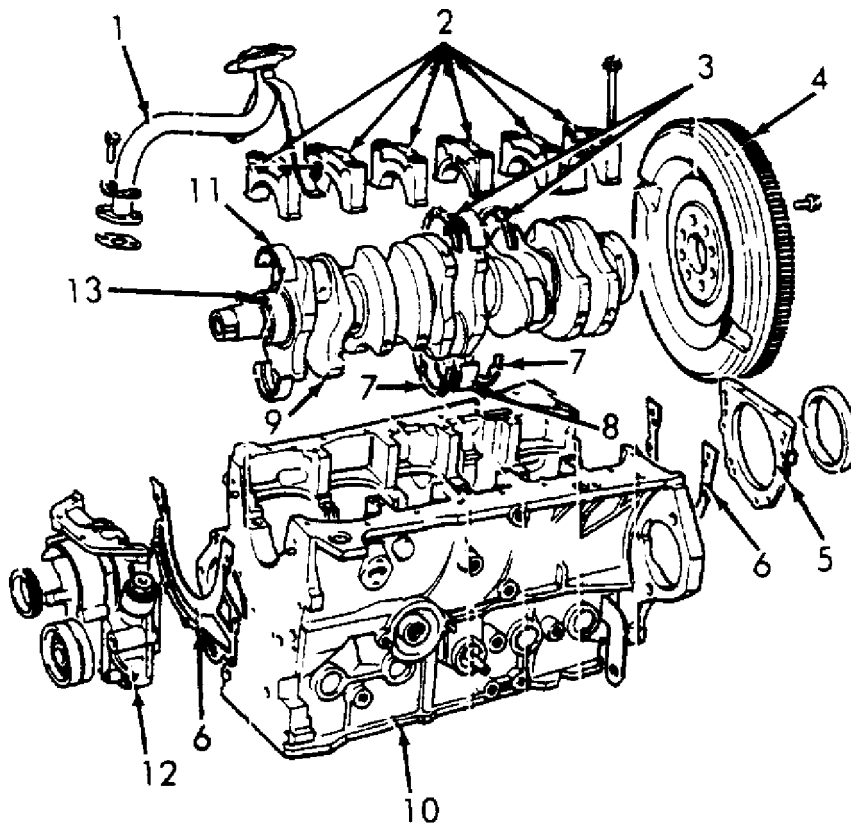
Fig. 15: Assembling Piston & Rod
Courtesy of Volkswagen United States, Inc.

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 table.

Crankshaft & Main Bearings

Main bearing caps are marked with matching journal for installation in original position. See Fig. 16. Measure crankshaft end play. See THRUST BEARING.



- | | |
|-----------------------------|------------------------|
| 1. Intake Tube | 8. Bearing Shell No. 4 |
| 2. Bearing Caps | 9. Crankshaft |
| 3. Thrust Washer | 10. Cylinder Block |
| 4. Flywheel | 11. Bearing Shells |
| 5. Oil Seal Mounting Flange | 12. Oil Pump |
| 6. Gasket | 13. Oil Pump Drive |
| 7. Thrust Washer | |

Fig. 16: Exploded View Of Crankshaft Assembly
Courtesy of Volkswagen United States, Inc.

93C83016

Thrust Bearing

Insert feeler gauge between No. 4 main bearing and crankshaft thrust face to measure end play. See Fig. 16. 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 TABLE

Model	With Filter Replacement	Without Filter Replacement
2.5L	5.8 Qts. (5.5L)	5.3 Qts. (5.0L)

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. See Fig. 17.

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. Repair or replace as necessary.

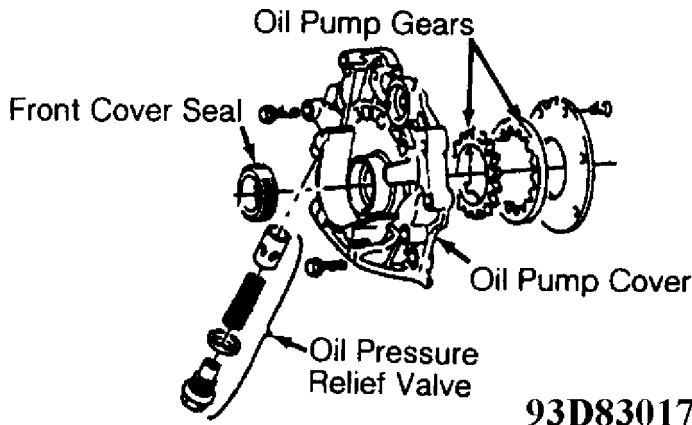


Fig. 17: Oil Pump Assembly
 Courtesy of Volkswagen United States, Inc.

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE

Application	Ft. Lbs. (N.m)
A/C Bracket-To-Engine Bolt	22 (30)

2.5L 5-CYL
Article Text (p. 16)
 1993 Volkswagen EuroVan
 For Volkswagen Technical Site
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 Saturday, March 18, 2000 10:18PM

Axle Shaft-To-Transaxle Drive Flange Bolt	33 (45)
Camshaft Bearing Cap Bolt	.....	11 (15)
Camshaft Drive Gear Bolt		
8.8	.....	63 (85)
10.9	.....	74 (100)
Clutch Cover Bolt	.....	15 (20)
Connecting Rod Bolt	..... 22 (30) + 1/4 Turn	
Crankshaft Main Bearing Cap Bolt	.....	50 (65)
Crankshaft Timing Sprocket Bolt	.....	66 (90)
Cylinder Head Nut		
Step 1	.....	30 (40)
Step 2	.....	44 (60)
Step 3	..... Additional 1/4 (90°) Turn	
Step 4	..... Additional 1/4 (90°) Turn	
Engine Bracket-To-Hydraulic Mount Bolt	.....	44 (60)
Engine-To-Transaxle 10-mm Bolt	.....	33 (45)
Engine-To-Transaxle 12-mm Bolt	.....	41 (55)
Exhaust Manifold-To-Cylinder Head Bolt & Nut	.....	18 (25)
Exhaust Pipe-To-Manifold Nut	.....	22 (30)
Exhaust Pipe-To-Support Bracket Bolt	.....	18 (25)
Flywheel or Pressure Plate-To-Crankshaft	.....	22 (30)
Front Exhaust Pipe-To-Manifold Bolt	.....	30 (40)
Intake Manifold	.....	18 (25)
Intermediate Shaft Sprocket Bolt	.....	59 (80)
Lower Pulley Bolt	.....	15 (20)
Oil Pan Bolt	.....	15 (20)
Oil Pan Drain Plug	.....	22 (30)
Oil Pump Cover Short Bolt	.....	7 (10)
Oil Pump Cover Long Bolt	.....	15 (20)
Rod Bearing Cap Nut	..... 22 (30) + 1/4 Turn	
Starter Mount Bolt	.....	18 (25)
Timing Belt Tensioner Nut	.....	15 (20)
Torque Converter-To-Carrier Plate Bolt	.....	22 (30)
Vibration Damper Bolt	.....	339 (460)
Water Pump Pulley Bolt	.....	15 (20)
Water Pump Housing-To-Engine Bolt	.....	15 (20)

INCH Lbs. (N.m)

Timing Belt Idler Bolt	.....	82 (10)
Transaxle/Engine Cover Plate Bolt	.....	89 (11)
Valve Cover Retaining Nut	.....	89 (11)
Water Pump-To-Housing	.....	89 (11)

AA

ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS

GENERAL ENGINE SPECIFICATIONS TABLE

AA

Application	Specification
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2.5L 5-CYL
Article Text (p. 17)
 1993 Volkswagen EuroVan
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 Saturday, March 18, 2000 10:18PM

Displacement	153 Cu. In.
Bore	3.19" (81.0 mm)
Stroke	3.76" (95.5 mm)
Compression Ratio	8.5:1
Fuel System	Digifant II PFI
Horsepower @ RPM	121 @ 4500
Torque Ft. Lbs @ RPM	190 @ 2200

AA

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS

CRANKSHAFT, MAIN & CONNECTING ROD BEARINGS SPECS TABLE
 AA

Application	In. (mm)
Crankshaft	
End Play	
Standard	.003-.007 (.07-.17)
Service Limit	.010 (.25)
Runout	.001 (.03)
Main Bearings	
Journal Diameter	2.275-2.300 (57.78-58.42)
Journal Out-Of-Round	.001 (.03)
Journal Taper	.001 (.03)
Oil Clearance	
Standard	.001-.003 (.03-.08)
Service Limit	.007 (.17)
Connecting Rod Bearings	
Journal Diameter	1.880-1.881 (47.58-48.22)
Journal Out-Of-Round	.001 (.03)
Journal Taper	.001 (.03)
Oil Clearance	.0004-.002 (.01-.06)

AA

PISTONS, PINS & RINGS SPECIFICATIONS

PISTONS, PINS & RINGS SPECIFICATIONS TABLE
 AA

Application	In. (mm)
Pistons	
Clearance	.0016 (.040)
Diameter	3.189 (80.99)
Pins	
Diameter	(1)
Piston Fit	Interference
Rod Fit	Interference
Rings	
No. 1	
End Gap	
Standard	.008-.016 (.20-.40)

2.5L 5-CYL
Article Text (p. 18)
 1993 Volkswagen EuroVan
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 Saturday, March 18, 2000 10:18PM

Service Limit039 (1.0)
Side Clearance		
Standard001-.002 (.02-.05)
Service Limit	.....	.006 (.15)
No. 2		
End Gap		
Standard	.....	.008-.016 (.20-.40)
Service Limit	.....	.039 (1.0)
Side Clearance	.....	.001-.002 (.02-.05)
No. 3 (Oil)		
End Gap		
Standard	.....	.010-.020 (.25-.50)
Service Limit	.....	.039 (1.0)
Side Clearance001-.002 (.02-.05)

(1) - Information not available from manufacturer.
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**CYLINDER BLOCK SPECIFICATIONS**

CYLINDER BLOCK SPECIFICATIONS TABLE  
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Application	In. (mm)
Cylinder Bore	
Standard Diameter 3.189 (81.01)
Maximum Taper0032 (.08)
Maximum Out-of-Round001 (.03)

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**VALVES SPECIFICATIONS**

VALVES SPECIFICATIONS TABLE  
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Application	Specification
Intake Valves	
Face Angle 45°
Head Diameter 1.574" (40.00 mm)
Length	..... 3.583" (91.00 mm)
Minimum Margin (1)	..... (2)
Stem Diameter	..... .314" (7.97 mm)
Exhaust Valves	
Face Angle	..... 45°
Head Diameter	..... 1.299" (33.00 mm)
Length	..... 3.575" (90.80 mm)
Minimum Margin (1)	..... (2)
Stem Diameter	..... .313" (7.95 mm)

(1) - DO NOT machine valves; hand lap only.
 (2) - Information not available from manufacturer.
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**CYLINDER HEAD SPECIFICATIONS**

CYLINDER HEAD SPECIFICATIONS TABLE

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| Application                        | Specification       |
|------------------------------------|---------------------|
| Cylinder Head Height .....         | (1)                 |
| Maximum Warpage .....              | .039" (1.00 mm)     |
| Valve Seats                        |                     |
| Intake Valve                       |                     |
| Seat Angle .....                   | 45°                 |
| Seat Width .....                   | (2)                 |
| Exhaust Valve                      |                     |
| Seat Angle .....                   | 45°                 |
| Seat Width .....                   | (2)                 |
| Valve Guides                       |                     |
| Intake Valve                       |                     |
| Valve Guide Installed Height ..... | (3)                 |
| Oil Clearance .....                | (2) .039" (1.0 mm)  |
| Exhaust Valve                      |                     |
| Valve Guide Installed Height ..... | (1)                 |
| Valve Stem-to-Guide                |                     |
| Oil Clearance .....                | (4) .051" (1.30 mm) |

- (1) - Cylinder Head Height determined by measuring distance between valve stem tip and cylinder head surface. See CYLINDER HEAD under OVERHAUL.
- (2) - Information not available from manufacturer.
- (3) - Valve guide shoulder flush with cylinder head.
- (4) - New valve installed in cylinder head. Dial indicator used to measure valve rock in guide.

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**CAMSHAFT SPECIFICATIONS**

CAMSHAFT SPECIFICATIONS TABLE

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| Application         | In. (mm)           |
|---------------------|--------------------|
| End Play .....      | .006 (.15)         |
| Oil Clearance ..... | .004 (.10) Maximum |

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**END OF ARTICLE**